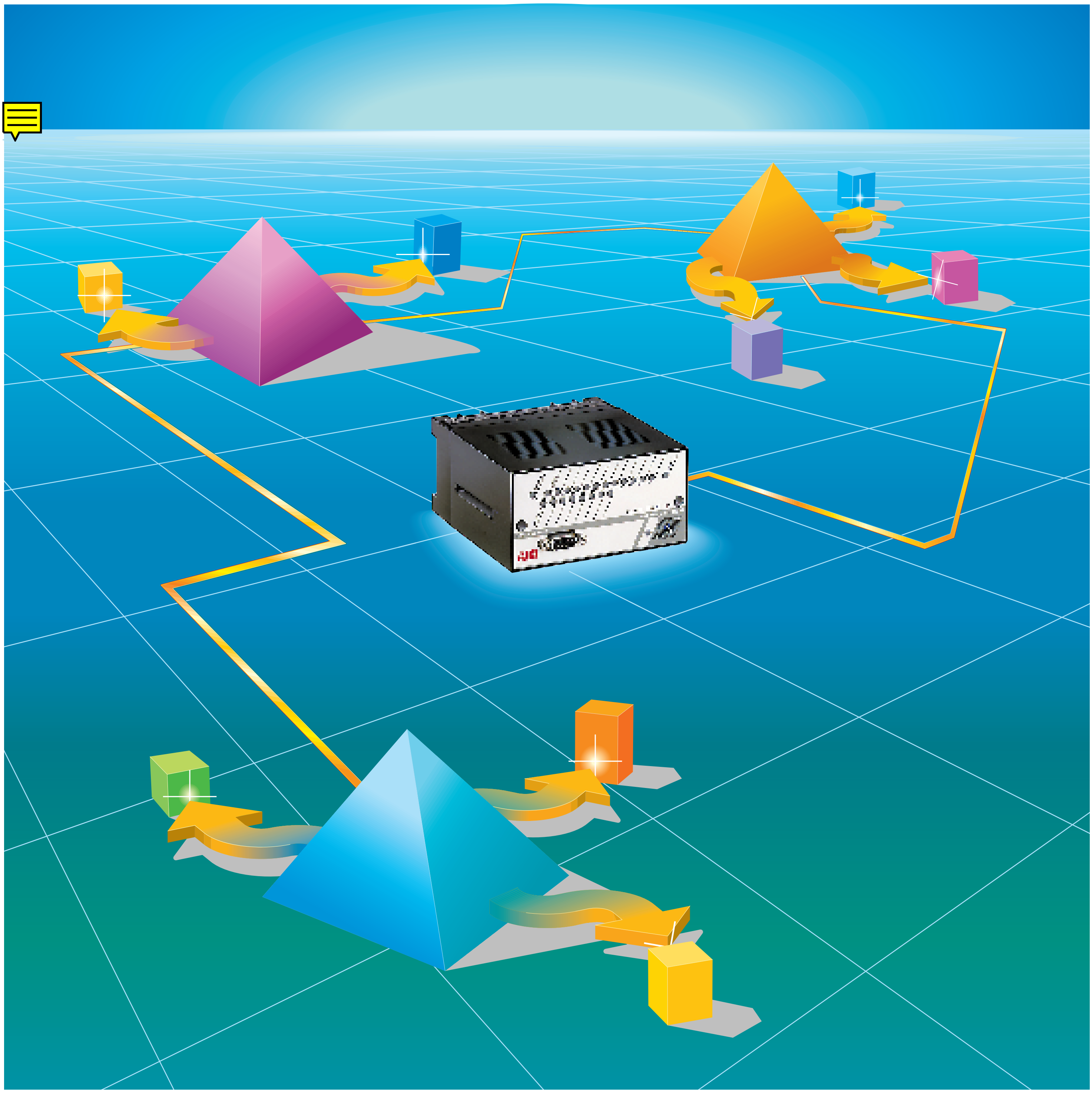
ABB Procontic CS 31

Intelligent decentralized automation system

FPTN 440 004 R2001 - d



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(1) Copy is not suitable.

ABB Procontic CS 31

Intelligent decentralized automation system

Main summary

Reply – Card

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ABB Procontic CS 31

Ref.: Technical documentation **FPTN 440 004 R2001-d**

Dear Sirs,

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(Visa)

ABB CS31

Intelligent decentralized automation system

General

ABB Control

Contents

FPTC 404 364 P2001-e

1 General

Machines and plant equipment, for reasons of competitiveness are becoming even more complex, the amount of information required from sensors and actuating devices is constantly expanding, causing heavier implementation and higher wiring costs.

The ABB Procontic CS 31 is designed to simplify implementation and wiring.

The CS 31 is a decentralized automation system.

The system is ideally suited to applications where modularity and cost reduction are key factors.

The CS 31 system comprises of the following :

– a central unit, enclosed within a compact case which can be screw or DIN rail mounted,
– remote input/output plug-in units, wich are easily removeable. The plug-in base can be screw or DIN rail mounted,
– a simple twisted pair wire arrangement (RS 485), which is utilized for connection of the central unit to the I/O units.

2 System description

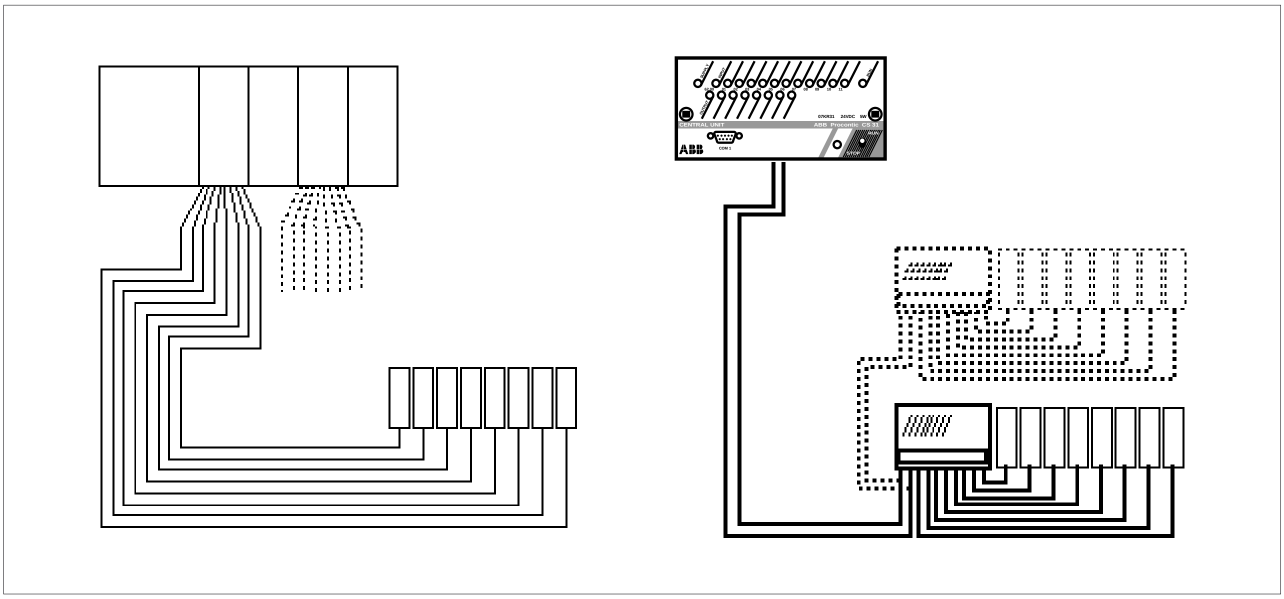
The decentralized architecture of the ABB Procontic CS 31 system offers a superior solution to control system requirements:

– The central unit can be mounted within the control panel.

– The input/output units can be mounted local to the sensors and actuators.

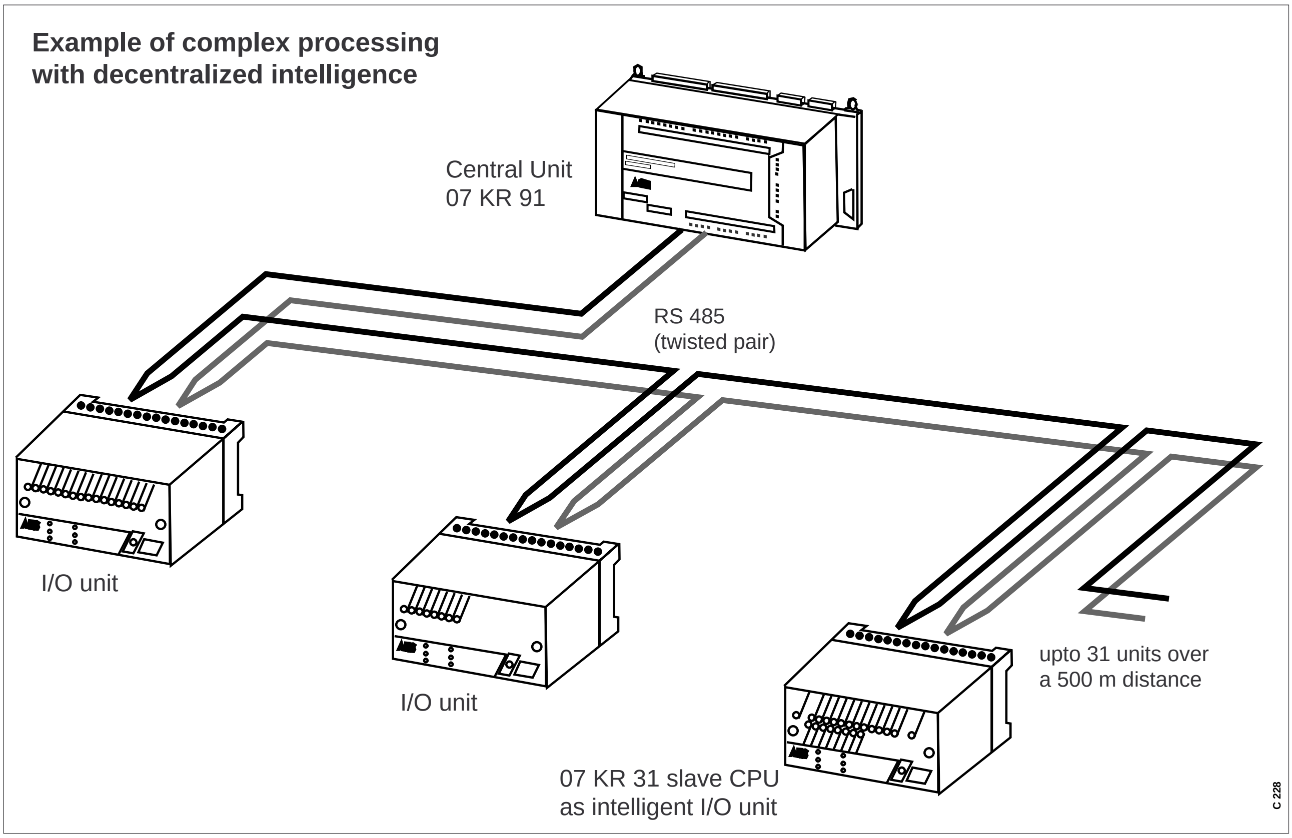
As an example the central unit may be connected to remote units distributed along a process line.

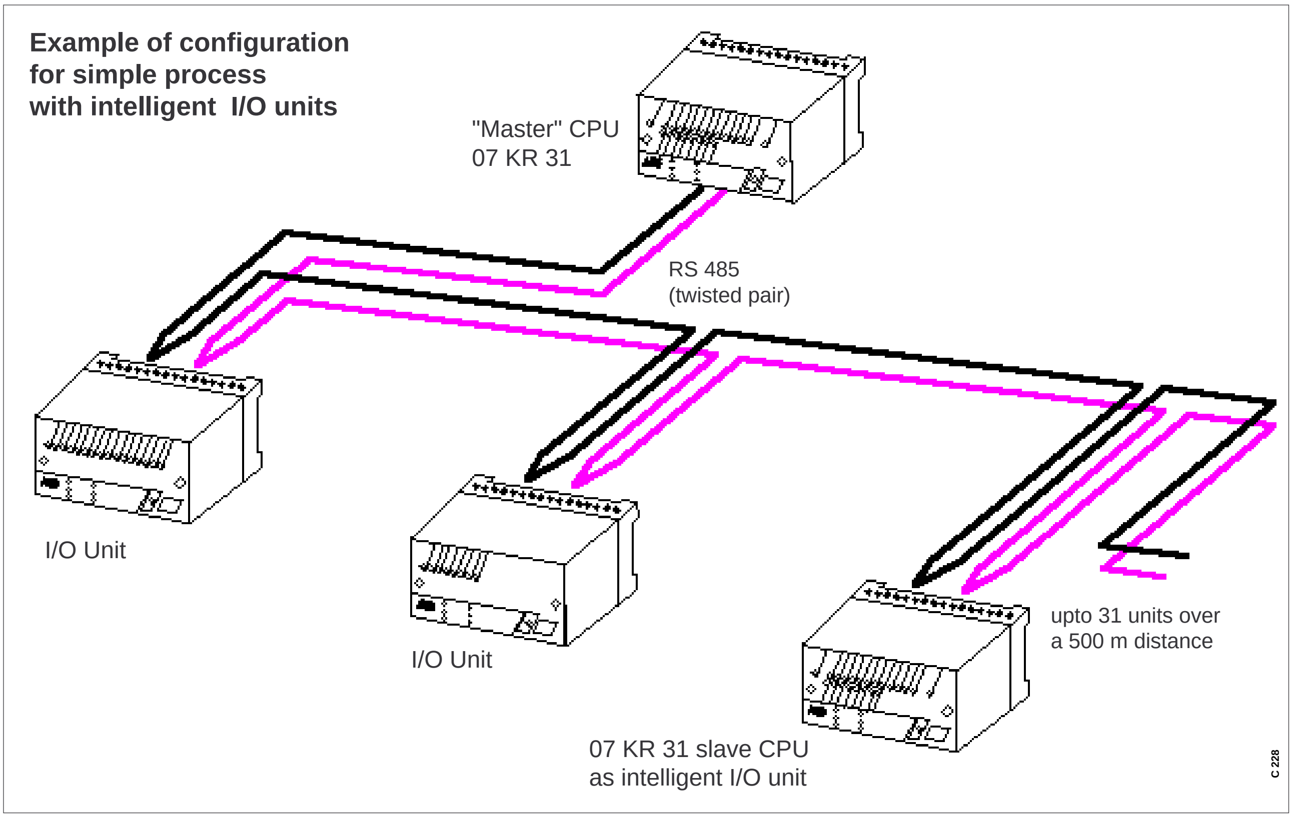
A cost reduction in wiring is possible upto 80% with the implementation of the CS 31 system.



Conventional wiring

Simplified wiring with the ABB Procontic CS 31 system


Example of complex processing
with decentralized intelligence
Central Unit
07 KR 91
RS 485
(twisted pair)
I/O unit
I/O unit
upto 31 units over
a 500 m distance
07 KR 31 slave CPU
as intelligent I/O unit
C 228


Example of configuration
for simple process
with intelligent I/O units
"Master" CPU
07 KR 31
RS 485
(twisted pair)
I/O Unit
I/O Unit
upto 31 units over
a 500 m distance
07 KR 31 slave CPU
as intelligent I/O unit
C 228

2.1 CS 31 benefits

– decentralized architecture as opposed to centralized system,

– reduction of wiring costs (design, materials and commissioning time),

– configurable input/output units,

– extensive diagnosis functions,

– freely expandable network. Additional units can be connected whilst the installation is operational,

– simple transparent programming. All remote I/O channels are handled as though they were centralized,

– remote I/O facility is integral feature and not an additional unit,

– programmable serial communications (RS 232) connection to modem, printer, operator display etc...

2.2 Modular system

The comprehensive range of units enhances the modularity of the system.

For example :

The low profile 16 channel user configurable input/output unit can be mounted on the control panel door, with inputs and outputs connected to pushbuttons and pilot lamps.

2.3 Versatile range

The CS 31 is based upon two types of central units, 07 KR 91, 07 KT 92/07 KT 93 and 07 KR 31/07 KT 31.

The system can be configured to comply with most control system requirements (See previous configuration examples).

- 07 KR 91, 07 KT 92/07 KT 93 is designed for complex applications with an higher level of functionality (Data manipulation, PID regulation, etc...).

- 07 KR 31/07 KT 31 incorporates all of the functions required for smaller decentralized applications, thus providing an excellent Price/Performance ratio.

2.4 Diagnosis

The CS 31 system incorporates extensive diagnosis functions.

All of the remote units contain a microprocessor which is dedicated to the management of inputs/outputs and diagnosis facilities.

The diagnosis are accessed using the "test" button on the front of each remote unit, the results are displayed on the I/O status led's.

The diagnosis results can be incorporated with the user program thus enabling effective fault management.

2.5 Use of the CS 31 system

All of the remote units are easily interchangeable, even with the process in operation, as they are plug-in base mounted.

The screw terminals of the plug-in bases are used for connection to the process inputs and outputs.

Bases are screw or DIN rail mounted.

The DIL switches on the bases are used for coding the address of units.
Any additional connected units are automatically recognized by the central unit.

NOTE : The system may comprise of remote units of varying supply and input voltages.

2.6 Emergency operation

A system may comprise of many central units, however one single master and the remainders slaves.

If the bus communication is interrupted or the master unit fails the individual slave units continue with their own operation.

2.7 ABB Procontic CS 31 equipment

Central processing units - CPU		
Type	**Description**	**Order code**
07 KR 31	CPU - 2 K word user memory (EEPROM), twelve 24 VDC inputs Eight 2A relay outputs Programmable RS 232 port RS 485 system bus real time clock high speed counter 10 kHz high order functions PI data handling, etc... Master/Slave MODBUS built-in	
	24 VDC power supply	**FPR 360 0227 R1202**
	120 VAC power supply	**FPR 360 0227 R0204**
	230 VAC power supply	**FPR 360 0227 R0206**
07 KT 31	CPU - 2 K word user program (EEPROM), twelve 24 VDC inputs Eight 24 VDC/0.5A transistor outputs Programmable RS 232 port RS 485 system bus real time clock high speed counter 10 kHz high order functions PI data handling, etc... Master/Slave MODBUS built-in	
	24 VDC power supply	**FPR 360 0228 R1202**
	120 VAC power supply	**FPR 360 0228 R0204**
	230 VAC power supply	**FPR 360 0228 R0206**
07 KR 91	CPU - 7 K FLASH EPROM, twenty 24 VDC inputs Twelve 2A relay outputs Programmable RS 232 port RS 485 system bus real time clock high speed counter 10 kHz high order functions PID data handling, etc...	
	24 VDC power supply	**GJR 525 0000 R0252**
	120 or 230 VAC power supply	**GJR 525 0000 R0202**
07 KT 92	CPU - 14 K FLASH EPROM, twelve 24 VDC inputs Eight 24 VDC/ 0.5A transistor outputs 4 analogue inputs 12 bits resolution 2 analogue output 12 bits resolution 2 programmable RS 232 port RS 485 system bus real time clock high speed counter 50 kHz high order functions PID data handling, etc...	
	24 VDC power supply	**GJR 525 0500 R0202**
07 KT 92	CPU - 14 K FLASH EPROM, twelve 24 VDC inputs Eight 24 VDC/ 0.5A transistor outputs 4 analogue inputs 12 bits resolution 2 analogue output 12 bits resolution 2 programmable RS 232 port RS 485 system bus real time clock high speed counter 50 kHz high order functions PID data handling, etc... ARCNET built-in	
	24 VDC power supply	**GJR 525 0500 R0262**

Central processing units - CPU (cont.)

Type	Description	Order code
07 KT 93	CPU - 14 K flash EPROM, twenty four 24 VDC inputs Sixteen 24 VDC/ 0.5A transistor outputs 2 programmable RS 232 port RS 485 system bus real time clock high speed counter 10 kHz high order functions PID data handling, etc... 24 VDC power supply	**GJR 525 1300 R0101**
07 KT 93	CPU - 14 K flash EPROM, twenty four 24 VDC inputs Sixteen 24 VDC/ 0.5A transistor outputs 2 programmable RS 232 port RS 485 system bus real time clock high speed counter 10 kHz high order functions PID data handling, etc... ARCNET built-in 24 VDC power supply	**GJR 525 1300 R0171**

Plug-in base

Type	Description	Order code
ECZ	Plug-in base for I/O units 07 KR 31/07 KT 31 DIN rail or screw fixing	**FPR 370 0001 R0001**

Binary input units

Type	Description	Order code
ICSI 08 D1	Input unit, eight 24 VDC inputs non-isolated configurable input delay: 2...32ms	
	24 VDC power supply	**FPR 331 5101 R1012**
	120 VAC power supply	**FPR 331 5101 R0014**
	230 VAC power supply	**FPR 331 5101 R0016**
ICSI 08 E1	Input unit, eight 24 V d.c. inputs isolated configurable input delay: 2...32ms	
	24 VDC power supply	**FPR 331 6101 R1012**
	120 VAC power supply	**FPR 331 6101 R0014**
	230 VAC power supply	**FPR 331 6101 R0016**
ICSI 16 D1	Input unit, sixteen 24 V d.c. inputs non-isolated configurable input delay: 2...32ms	
	24 VDC power supply	**FPR 331 5101 R1032**
	120 VAC power supply	**FPR 331 5101 R0034**
	230 VAC power supply	**FPR 331 5101 R0036**
ICSI 16 E1	Input unit, sixteen 24 VDC inputs isolated configurable input delay: 2...32ms	
	24 VAC power supply	**FPR 331 6101 R1032**
	120 VAC power supply	**FPR 331 6101 R0034**
	230 VAC power supply	**FPR 331 6101 R0036**
ICSI 08 E3	Input unit, eight 110 VAC isolated inputs	
	110 VAC power supply	**FPR 331 6301 R0014**
ICSI 08 E4	Input unit, eight 230 VAC isolated inputs	
	230 VAC power supply	**FPR 331 6401 R0016**

Binary output units

Type	Description	Order code
ICSO 08 R1	Output unit, eight relay outputs 250 VAC / 2A	
	24 VDC power supply	**FPR 331 2101 R1022**
	120 VAC power supply	**FPR 331 2101 R0024**
	230 VAC power supply	**FPR 331 2101 R0026**
ICSO 08 Y1	Output unit, eight transistor outputs 24 VDC / 2A max. 8A for eight outputs isolated short-circuit proof	
	24 VDC power supply	**FPR 331 1101 R1022**
	120 VAC power supply	**FPR 331 1101 R0024**
	230 VAC power supply	**FPR 331 1101 R0026**
ICSO 16 N1	Output unit, sixteen transistor outputs 24 VDC / 0.5A	
	24 VDC power supply	**FPR 331 3101 R1052**
	120 VDC power supply	**FPR 331 3101 R1054**
	230 VDC power supply	**FPR 331 3101 R1056**

Binary input/output units

Type	Description	Order code
ICSK 20 F1	Input/output unit, twelve 24 VDC inputs non-isolated inputs eight relay outputs 250 VAC / 2A	
	24 VDC power supply	**FPR 332 7101 R1202**
	120 VAC power supply	**FPR 332 7101 R0204**
	230 VAC power supply	**FPR 332 7101 R0206**
ICSK 20 N1	Input/output unit, twelve 24 VDC inputs non-isolated inputs eight transistor outputs 24 V ; 0.5 A	
	24 VDC power supply	**FPR 333 1001 R1202**
	120 VDC power supply	**FPR 333 1001 R1204**
	230 VDC power supply	**FPR 333 1001 R1206**
ICSC 08 L1	Input/output unit, eight user configurable channels for 24 VDC input signals or for 24 VDC / 0.5A output signals max. 2A for eight outputs short-circuit proof, non-isolated configurable input delay : 2...32ms	
	24 VDC power supply	**FPR 331 9101 R1082**
	120 VAC power supply	**FPR 331 9101 R0084**
	230 VAC power supply	**FPR 331 9101 R0086**
ICFC 16 L1	Input/output unit, sixteen user configurable channels for 24 VDC input signals or for 24 VDC / 0.5A output signals max. 4A for sixteen outputs short-circuit proof, non-isolated configurable input delay : 2...32ms low profile units 2 ECZ mounting bases are required	
	24 VDC power supply	**FPR 331 9101 R1162**
ICBG 32 L1	Input/output unit 16 inputs for 24 VDC input channels 8 transistor outputs 24 VDC 250 mA 8 user configurable input/output channels 24 VDC overload and short-circuit proof input signal delay : 7 ms	
	24 VDC power supply	**GJR 525 1400 R0101**

IP 65 remote units

Type	Description	Order code
ICPI 08 D1	Input unit, eight 24 VDC inputs Degree of protection IP 65 Protection against short circuit and overload 24 VDC power supply	**GJV 307 5614 R0101**
ICPI 16 D1	Input unit, sixteen 24 VDC inputs Degree of protection IP 65 Protection against short circuit and overload 24 VDC power supply	**GJV 307 5613 R0101**
ICPO 08 H1	Output unit, eight transistor outputs 24 VDC / 2A Degree of protection IP 65 Protection against short circuit and overload 24 VDC power supply	**GJV 307 5611 R0101**
ICPO 16 H1	Output unit, sisteen transistor outputs 24 VDC / 2A Degree of protection IP 65 Protection against short circuit and overload 24 VDC power supply	**GJV 307 5610 R0101**

Analogue input units

Type	Description	Order code
ICSE 08 A6	Eight analogue inputs 0 ...+ 10V, 0 ...20mA, 4 ...20mA 8 bits resolution	
	24 VDC power supply	**FPR 334 5601 R1012**
	120 VAC power supply	**FPR 334 5601 R0014**
	230 VAC power supply	**FPR 334 5601 R0016**
ICST 08 A8	Eight analogue inputs PT100 8 bits resolution range of temperature : -50 °C ... +150 °C (-58 °F ... +302 °F)	
	24 VDC power supply	**FPR 333 5801 R1012**
	120 VAC power supply	**FPR 333 5801 R0014**
	230 VAC power supply	**FPR 333 5801 R0016**
ICST 08 A9	Eight analogue inputs PT100 8 bits resolution range of temperature : 0 °C ... +300 °C (-32 °F ... +572 °F)	
	24 VDC power supply	**FPR 333 5901 R1012**
	120 VAC power supply	**FPR 333 5901 R0014**
	230 VAC power supply	**FPR 333 5901 R0016**
ICSE 08 B5	Eight analogue inputs -10V ...+10V, -20 ...+20mA, 4 ...20mA 12 bits resolution	
	24 VDC power supply	**FPR 334 6501 R1012**
	120 VAC power supply	**FPR 334 6501 R0014**
	230 VAC power supply	**FPR 334 6501 R0016**
ICDT 08 B5	Eight analogue inputs -10V ...+10 V, -5 ...+5 V, -500... + 500 mV, -50 ...+50 mV 0...20 mA, 4 ...20 mA 12 bits resolution configurable for temperature sensors or as voltage inputs	
	24 VDC power supply	**GJR 525 1666 R1001**

Analogue output unit

ICSA 04 B5	Four analogue outputs -10V ...+10V, 0 ...+20mA, 4 ...20mA 12 bits resolution	
	24 VDC power supply	**FPR 334 1501 R1042**
	120 VAC power supply	**FPR 334 1501 R0044**
	230 VAC power supply	**FPR 334 1501 R0046**

Analogue input/output units

ICSM 06 A6	Input/output unit, four inputs for 0 ...+ 10V, 0...20mA, 4...20mA signals 8 bits resolution, non-isolated two outputs for -10V ...+10V, 0...20mA, 4 ...20mA signals 8 bits resolution, non-isolated	
	24 VDC power supply	**FPR 335 0601 R1062**
	120 VAC power supply	**FPR 335 0601 R0064**
	230 VAC power supply	**FPR 335 0601 R0066**

High speed counter unit

Type	Description	Order code
ICSF 08 D1	encoder unit or 3 independant up/counter 2 threshold detections counter preset Max. frequency 50kHz 7 transistor outputs 24 V d.c. 300mA 4 binary inputs 24 V d.c. Integral 5V, 15V, 24V power supply for encoder	
	24 VDC power supply	**FPR 332 3101 R1012**
	120 VAC power supply	**FPR 332 3101 R0014**
	230 VAC power supply	**FPR 332 3101 R0016**

Remote display unit

Type	Description	Order code
TCAD	Display unit 2 lines, 32 characters 127 messages programmable + 1 backgroung message buzzer (programmable) key function embedded variables 24 VDC power supply	**FPR 320 3526 R1002**

CS31 Bus units

Type	Description	Order code
NCB	CS31 bus amplifier up to 2km 24 VDC power supply	**FPR 347 1200 R0006**
NCBR	CS31 bus amplifier with redondancy amplification up to 2km 24 VDC power supply	**FPR 347 1300 R0006**

Robot coupler unit

Type	Description	Order code
ICBG 32 L7	Robot coupler connect ABB S3 robot to CS 31 bus 16 inputs, 16 outputs for communication supply from robot rack	**FPR 333 0705 R0321**
ICBG 64 L7	Robot coupler connect ABB S3 robot to CS 31 bus 32 inputs, 32 outputs for communication supply from robot rack	**FPR 333 0705 R0641**

Communication units

Type	Description	Order code
07 KP 90	CS 31 RCOM coupler used with 07 KT 92, 07 KR 91 R 0252, 07 KT 93 1 serial interface EIA RS232 24 VDC power supply	**GJR 525 1000 R0202**
07 KP 92	CS 31 coupler used with 07 KT 92, 07 KR 91 R 0252, 07 KT 93 Freely programmable in C language, stored in flash EPROM 2 serial interfaces EIA R232, EJA RS422 or EIA RS485 24 VDC power supply	**GJR 525 1500 R101**

Accessories

Type	Description	Order code
NCC 232	RS 232/RS 232 isolated converter 24 VDC power supply	**FPR 347 1000 R0006**
NCC 485	RS 232/RS 485 isolated converter 24 VDC power supply	**FPR 347 1100 R0006**
TCZ	Handheld terminal	**FPR 320 0002 R1001**
TCZ - adapter	Adaptor "Off-line"	**FPTN 404 958 R0002**
Cable Sub D9	For programming and test	**FPTN 404 948 R0002**
Cable Sub D25	For programming and test	**FPTN 404 948 R0005**
Cable Sub D9	For ASCII or MODBUS communication	**FPTN 404 948 R0006**
Cable Sub D25	For ASCII or MODBUS communication	**FPTN 404 948 R0001**
Cable for communication	TCZ adaptor/printer 07 DR 12	**FPTN 404 948 R0004**

Spare parts

Lithium battery for UCZA	**FPTN 404 949 R0001**
Lithium battery for TCZ	**FPTN 404 949 R0002**
5V battery for external power supply of TCZ	**FPTN 404 949 R0003**
Spare cable to connect TCZ to 07 KR 91 or UCZA/UCZB or PCZB or CS 20	**FPTN 404 975 R0001**

2.8 General characteristics

The CS 31 system is developped according to the international standard IEC 1131-2.

• Operating conditions

– Temperature :

• operation	0 °C ... + 55 °C	32 ... 131 °F
• storage	- 40 °C ... + 75 °C	- 40 ... 167 °F
• transport	- 25 °C ... + 75 °C	- 13 ... 167 °F

– Humidity acc. to DIN 40040 class F without condensation :
- average over the year 75 %
- up to 30 days of a year 95 %
- on the other days withregard to the average of the year, occasionnally 85 %

– Air pressure :
- operation 800 hPA (2000 m)
- storage 660 hPA (3500 m)

• Mechanical data

– degree of protection	IP 20
– housing	UL94 V0 UL94 V1 for central units serie 90, coupler 07KPxx and units ICDxx
– vibration	each of three mutually perpendicular axes 10 Hz ...57 Hz continuous : 0.0375 mm amplitude occasional : 0.075 mm amplitude 57 Hz ... 150 Hz continuous : 0.5 g acceleration occasional : 1.0 g acceleration
– shocks	occasional excursion to 15 g, 11 ms, halfsine in each of three mutually perpendicular axes
– impact withstand test	for units with a power supply > 30 VAC. According to IEC 950 : a steel sphere with a mass of 500 g is to fall freely from a height of 1300 mm

• Mounting

– DIN rail	35 mm
– Screw mounting	screws Ø 4 mm (M4)

• Serial interfaces

– for connection of the central unit to the remote units	RS485, using screw terminals
– for programming and setting parameter	RS232-C 9 pole D connector (female)

• Termination

– on the plug-in base ECZ use 60 °C copper conductor only

Cross section :

– bus wiring terminal : twisted pair AWG 24 (0.22 mm^2) to AWG 18 (0.8 mm^2)

– earth terminal : rigid or stranded connector AWG 10 (5.2 mm^2)

– Others terminals :
- inputs : stranded connector AWG 18 (0.8 mm^2) to AWG 14 (2.1 mm^2)
- outputs : stranded connector AWG 14 (2.1 mm^2)
- power supply AWG 14 (2.1 mm^2)

– on removable terminal block (small section)	2.5 mm^2 (copper N$_o$ AWG14)
– on removable terminal block (small section)	1.5 mm^2 (copper N$_o$ AWG16)
– screws tightening torque (for guidance only)	7 ibs. inch (0.8 Nm)

• Supply connections

– 24 VDC (process and power supply	24 VDC (-20 %, +25 %, i.e. 19.2 ... 30V) incl. ripple
ripple factor	< 5 %
– 120 VAC power supply	120 VAC (-15%, +10%, i.e. 102 ... 132V) 50 Hz or 60 Hz (± 5 %)
– 230 VAC power supply	230 VAC (-15%, +10%, i.e. 195.5 ... 253V) 50 Hz or 60 Hz (± 5 %)

• Voltage drops and interruptions

– DC power supply	interruption time 10 ms time interval between two drops 1s
– AC power supply	interruption time 0.5 period time interval between two drops 1s

• Creepage distances and clearances

according to EN 61131-2 / IEC1131-2

• Insulation test voltages

the insulation test voltages are according to IEC 1131-2

- **Electromagnetic compatibility (EMC)**

– electrostatic discharge (ESD)	according to IEC 1000-4-2 (severity level 3)
test peak voltage :	
• at discharge thru air	8 kV
• at discharge thru relay's contact	6 kV
time between two discharges	> 1s
number of discharges on each selected point	10
– radiated electromagnetic field immunity test	according to IEC 1000-4-3
field strength	10 V/m (severity level 3)
frequency range	27 MHz to 1000 MHz
sweep speed	1.5 x 10E-3 decade/s
– fast transient burst test (FTT)	according to IEC 1000-4-4
interference voltage for :	
mains terminals 115/230 V	2 kV
mains terminals 24 V	2 kV
output terminals 24 V	1 kV
output terminals 115/230 V	2 kV
input terminals 24 V	1 kV
input terminals 115/230 V	2 kV
analogue input/output terminals	1 kV
CS 31 bus	2 kV
programming interface	0.5 kV
– surge immunity	according to IEC 1000-4-5
test voltage for assymetric coupling	common mode
power supply (115/230 VAC)	2 kV
power supply (24 VDC)	1 kV
digital inputs/outputs	1 kV
test voltage for symetric coupling	differential mode
power supply (115/230 VAC)	1 kV
power supply (24 VDC)	1 kV
digital inputs/outputs	1 kV

- **ABB Procontic CS 31 system bus**

The CS 31 bus is a shield twisted pair RS485

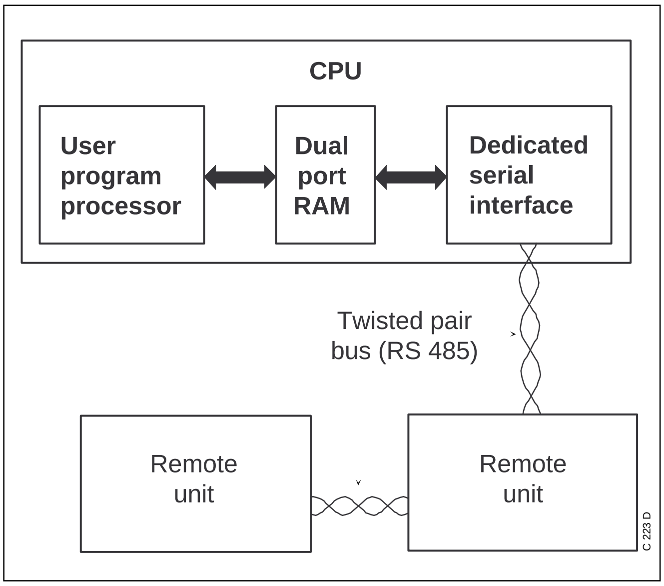
– cross	0.22 ... 0.8 mm2 (N° AWG 24 ... N° AWG 18)
– twists	> 10 per metre
– resistance	100 /km
– impedance characteristic	100 to 150
– capacitance	< 150 nF/km
– shield	
– termination	120 , 1/4 Watt resistor connected at the end of the bus
– number of points of connections	31 slaves + 1 master

3 General operation

3.1 CPU communication with remote units

Communication between the central units and the remote units requires no user intervention as it is carried out by a dedicated serial interface.

The dual port RAM of the central unit enables data transfer between the user program processor and the dedicated serial interface.



In the read cycle, data is taken from the remote unit and stored within the dual port RAM via the bus and dedicated serial interface, the user program processor then reads the data from the dual port RAM.

Similarly, data is transfered from the dual port RAM to the remote units via the dedicated serial interface and bus for the write cycle.

3.2 Addressing of the remote units

All system bus request telegrams have an address. The remote unit which has the same address as the telegram receives and responds to the data.

The address of the remote unit is set using the DIL switches of the plug-in base.

The inputs and outputs have the following address structure: yy, xx

yy represents the remote unit number,
xx represents the channel number.

Example

Address setting of DIL-switches : 03
Number of channels on remote unit : 08

The I/O channels are simply addressed from 03, 00 to 03, 07 within the user program of the central unit, as though they were centralized.

3.3 System bus

This is a simple 2-wire serial connection (RS 485).

Connection type	Serial RS 485
Mode	Half-Duplex
Baud rate	187.5 k bauds
Maximum length	500 metres
Isolation	opto-couplers
Material	twisted pair

NOTE : For the wiring precautions and characteristics see the "hardware" chapter.

• Installation of CS 31 system

Generalities

Some installation rules have to be respected. These rules concern the ground concept, the connection of the CS 31 bus and the different power supplies installations.
The following main principles must be applied :

Each type of signal has to be mounted separatly

– power supply 230 VAC
– analogue and low voltage signals

The ground and power supply wires must be connected in star

• Refer to the description of each remote unit for connection of inputs and outputs.

• Installation of the bus

The CS 31 bus is a RS 485 serial line and a schield twisted pair.

The CS 31 bus is a master slave bus. Only one master can be present on the bus.

The maximum length between the both extremities is 500 metres.

The master should be :
– a central unit : 07 KR 31, 07 KT 31, 07 KR 91, 07 KT 92, 07 KT 93, PCZB, UCZA/UCZB
– a PLC coupler : 07 CS 61 and 07 CS 91 for the ABB Procontic T 200 and T 300
– a PC board : 07 CM 90

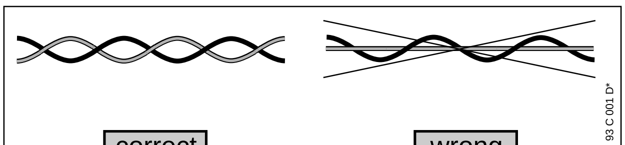
• Characteristics of the bus' cable

The CS 31 bus is a shield twisted pair RS 485

– cross	0.22 ... 0.8 mm2
– twists	> 10 per metre
– resistance	100/km
– impedance	
– characteristics	100 to 150
– capacitance	< 150 nF/km
– schield	
– termination	120 , 1/4 Watt resistor connected at the ends of the bus

Example of supplier :
– ALCATEL MCX-T
– DRAKKA dracoda 2903

The twisted pair has to be symetric



correct wrong

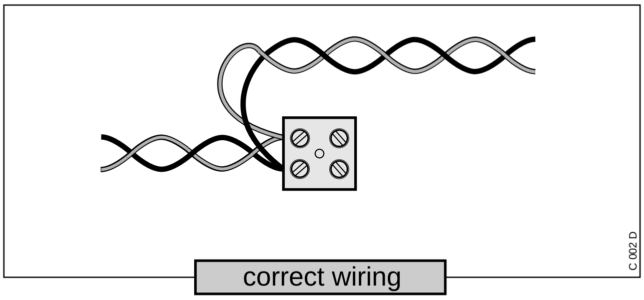
• Connections

The same type of cable should be used throughout the installation for the system bus (RS 485).

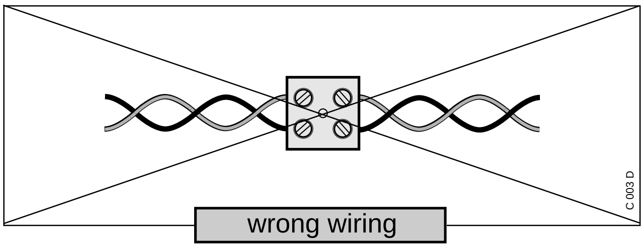
Avoid interruption of the bus, for example, when connecting cables at the marshalling cabinet.

Whenever interruption of the bus is absolutely necessary, it must be wired to the same side of the terminals.

Example :

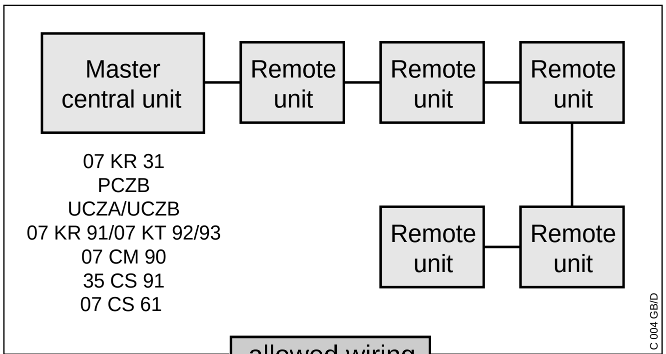


correct wiring

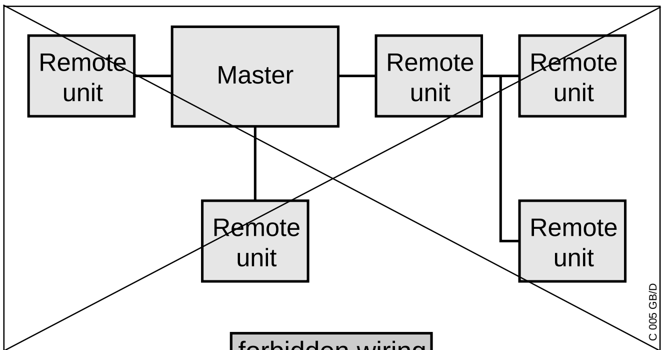


wrong wiring

"Star connection of the bus is forbidden !"

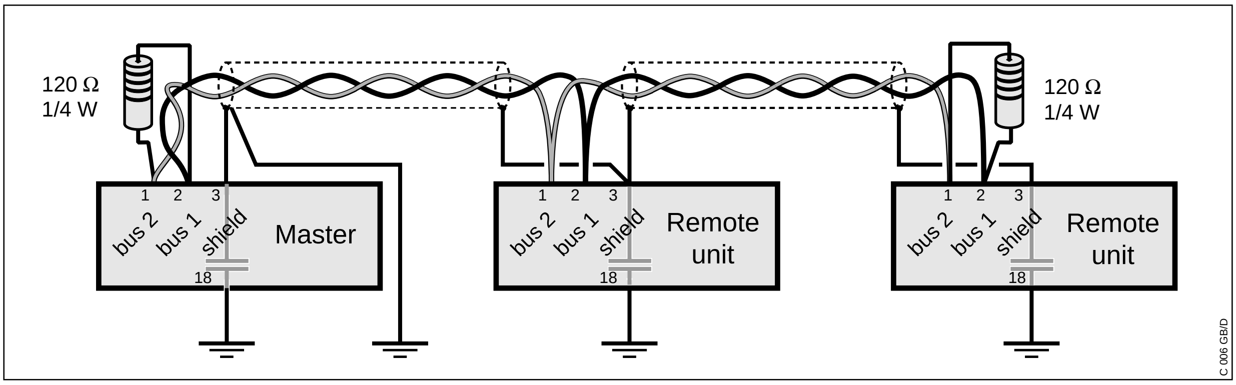


allowed wiring



forbidden wiring

- **Bus topology**

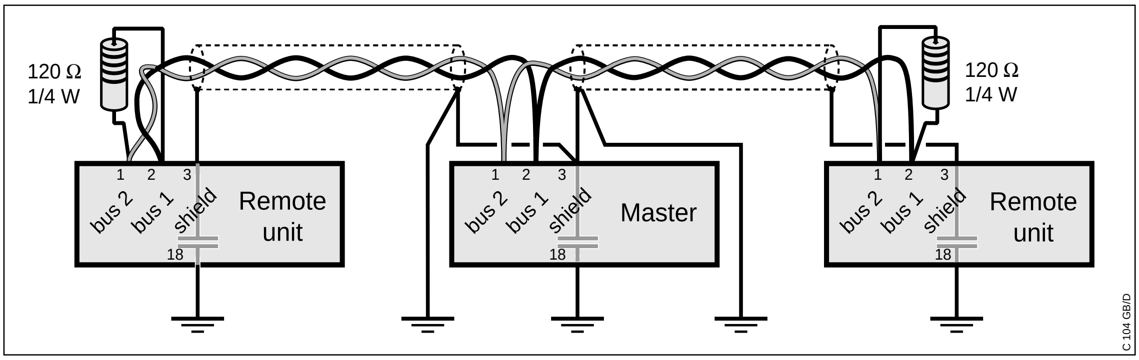


The bus must be terminated with a 120 , 1/4 Watt resistor, this must be connected at the ends of the bus.

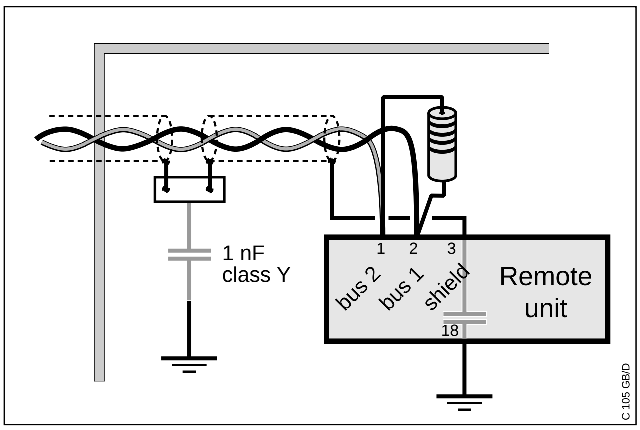
The central units UCZA/UCZB, the couplers 07 CS 61 and 35 CS 91 have to be connected at an end of the bus. The resistor 120 is integrated.

The other central units and the PC board should be connected everywhere on the bus.

The shield of the bus must be connected to the earth near the master.



When noisy elements are in the area of the cabinet, it is better to connect the bus' shield to the ground via a capacitor 1 nF class Y directly at the access of the cabinet according the following diagram.



The system bus CS 31 is opto-isolated from all units.

The shield is connected to the earth through a capacitor 1 nF class Y, mounted in the plug-in base.

The maximum bus length is 500 metres.

In case of use of a bus amplifier or redondy amplifier refer to their own descriptions.

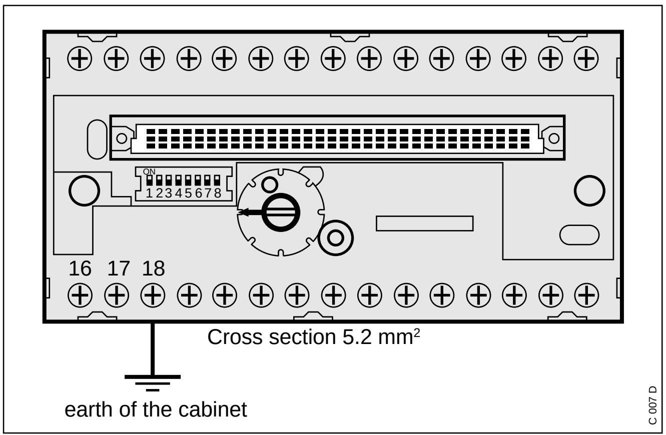
• Ground concept and power supplies

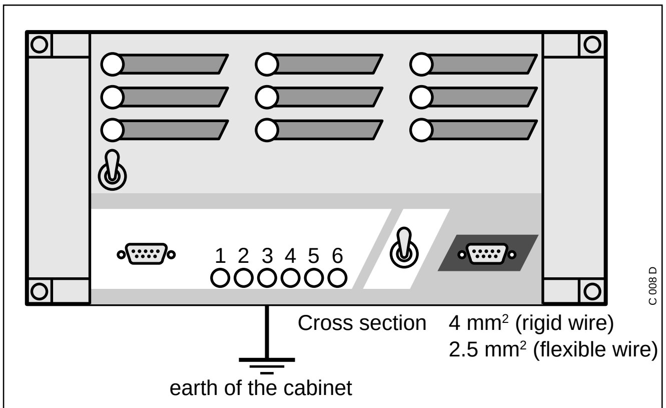
Ground concept

All CS 31 products in a cabinet must be connected to the same earth.

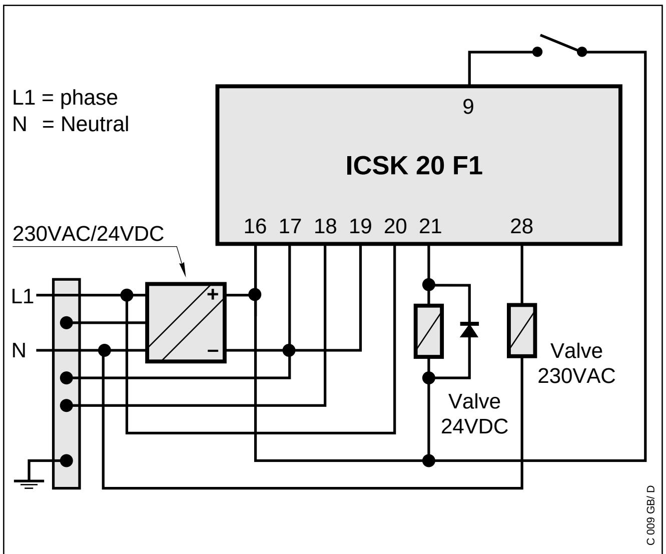
When the remote units are outside the cabinet, they must be connected to the nearest earth.

The connection to the earth has to be as short as possible (shorter than 25 cm).

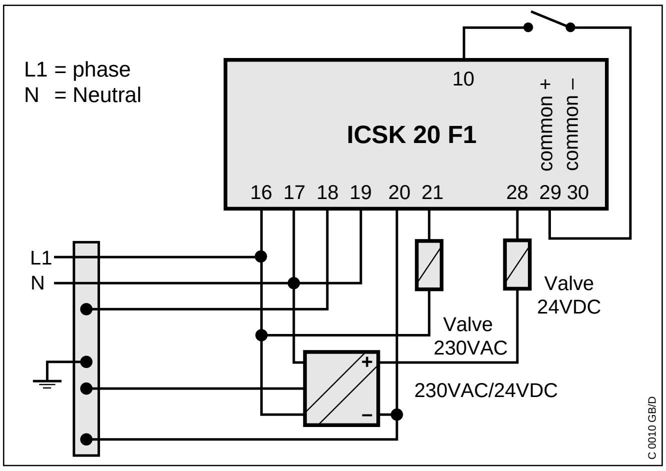




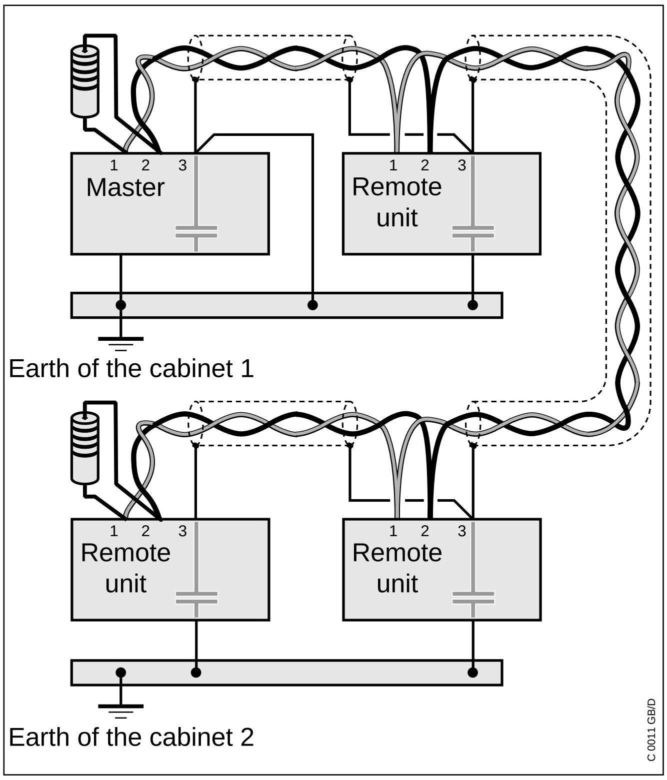
Example of connection with a 24 VDC power supply



Example of connection with a 230 VAC power supply



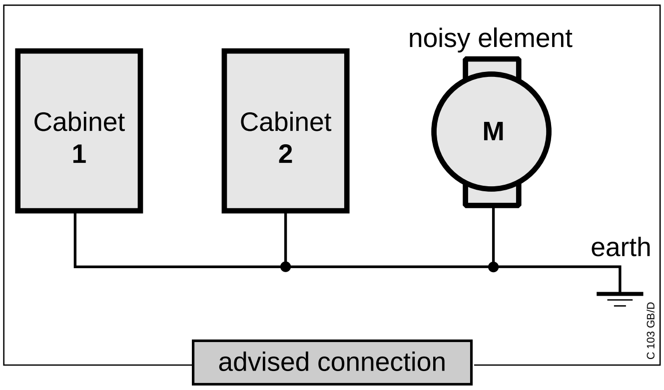
• Ground concept with different cabinets

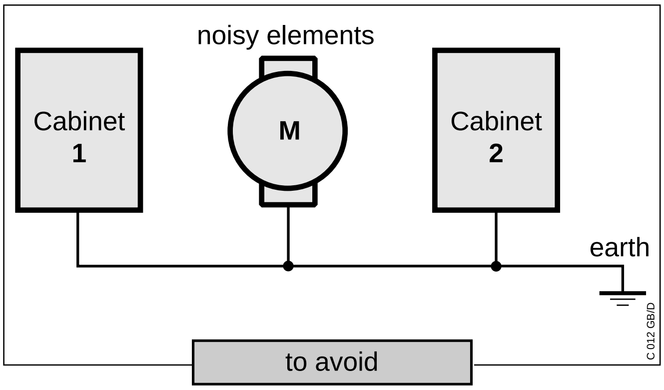


The capacitor is integrated in the plug-in base.

When the cabinets are close from each others, the different earths have to be connected together with a cable with a cross section of at least 16 mm².

The noisy elements (drives, motors, ...) haven't to be connected to the earth between two cabinets. The connection to the earth has to be near the noisier element.





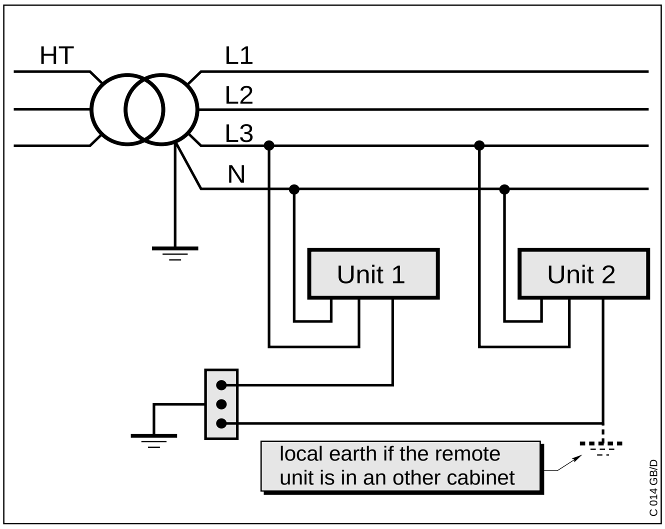
- **Types of power supplies**

Different types of power supplies are available.

The main difference is the connection of the neutral and the metallic parts to the earth.

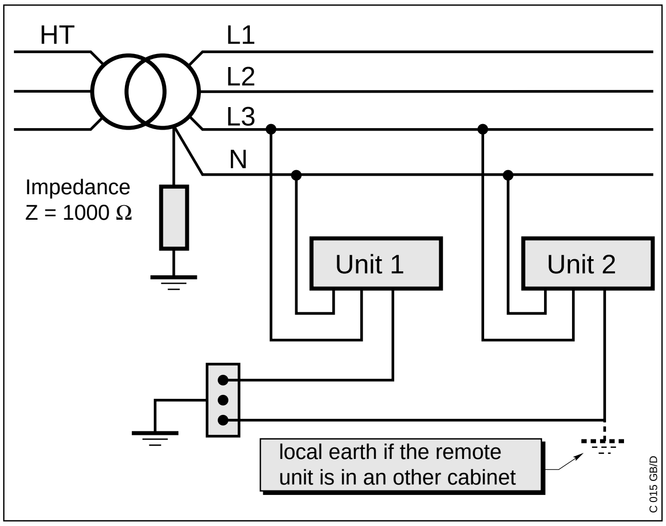
Power supply T-T

– The neutral is connected to the earth. All metallic parts are connected to the earth



Power supply I-T

- The neutral is isolated from the earth
- The metallic parts are connected to the earth



In a noisy environnement, an isolated transformer with a shield has used in each cabinet (even for 24 VDC version).

3.4 Transmission format

One single CPU is the master on the bus, all of the other remote units or CPU are considered to be slaves.
The master CPU manages up to a maximum of 31 remote units on one bus.
All messages are terminated with an error check (CRC8).

The format of the messages :

- request from the master CPU

Address	Data	CRC8

- response from the remote units

Start	Data	CRC8

During initialization, the central unit interrogates all of the remote units in succession, thus building an image of the system configuration.

On each cycle of the bus all of the remote units are interrogated.

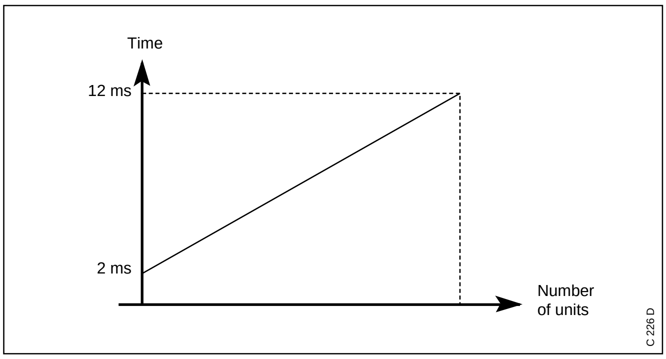
This updates all diagnosis information and recognizes additional remote units.

If the CPU or one of the remote units receives a message with a (CRC8) error, it is ignored.
After ten consecutive transmission errors, an error "Bus error" is generated on the remote units and within the diagnostics of the central unit.

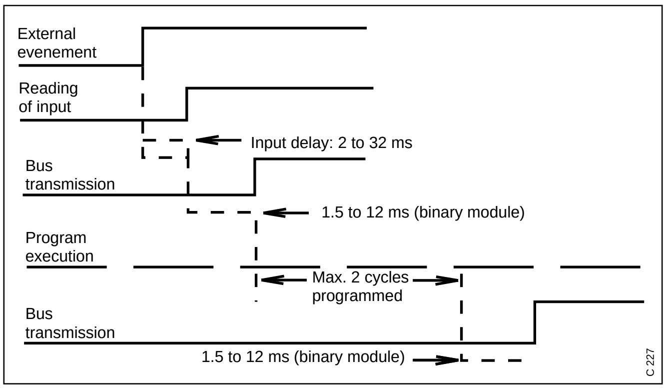
3.5 Bus refresh time

The refresh time depends on the configuration of the system, number and type of remote units.

The example below is for a system of remote units type ICSC 08 L1.



The user program and the bus refresh cycle are executed in serie with the 07 KR/KT 31, 07 KR 91 and 07 KT 92/93 central units. The time event diagram is shown below :



The bus transmission time is easily calculated from the configuration of the installation.

Communication time	
offset time Master CPU	2000 µs
Slave central units	
07 KR 31*	750 µs
07 KT 31*	750 µs
07 KR 91*	750 µs
07 KT 92*	750 µs
07 KT 93*	750 µs
* with factory setting	
time following the configuration :	
2 bytes in transmission 2 bytes in receiving	516 µs
4 bytes in transmission 4 bytes in receiving	750 µs
8 bytes in transmission 8 bytes in receiving	1300 µs
12 bytes in transmission 12 bytes in receiving	1850 µs
8 words in transmission 8 words in receiving	2500 µs
Binary input units	
ICSI 08 D1	323 µs
ICSI 08 E1	323 µs
ICSI 08 E3/E4	323 µs
ICSI 16 D1	387 µs
ICSI 16 E1	387 µs
Binary output units	
ICSO 08 R1	260 µs
ICSO 08 Y1	260 µs
ISCO 16 N1	340 µs
Binary input/output units	
ICSC 08 L1	387 µs
ICFC 16 L1	516 µs
ICSK 20 F1	452 µs
ICSK 20 N1	452 µs
ICDG 32 L1	516/590 µs following the configuration
IP65 binary input/output units	
ICPI 08 D1	323 µs
ICPI 16 D1	387 µs
ICPO 08 H1	260 µs
ICPO 16 H1	340 µs

Analogue units	
ICSM 06 A6 (input/output)	1162 µs
ICSE 08 A6 (input)	1355 µs
ICSE 08 B5 (input)	1355 µs
ICST 08 A7 (input)	1355 µs
ICST 08 A8 (input)	1355 µs
ICST 08 A9 (input)	1355 µs
ICDT 08 B5 (input)	1355 µs
ICSA 04 B5 (output)	700 µs
Robot coupler card	
ICBG 32 L7	516 µs
ICBG 64 L7	750 µs
High speed counter	
ICSF 08 D1	1300 µs

3.5.1 **Bus refresh time** (T rb)

This time is equal to :

– with a master central unit serie 90 :

T rb = T offset + T communication time

– with a master central unit serie 30 :

T rb = T offset + T communication time + n * 100 (µs)

with :

– T offset = 2 000 µs
– T communication time : see table
– n = number of slaves on the bus

Example of calculation

Configuration :

1 "Master" CPU .... 2 000 µs
1 ICSK 20 F1 .... 452 µs
1 ICSO 08 R1 .... 260 µs
1 ICSI 16 E1 .... 387 µs
1 ICFC 16 L1 .... 516 µs
1 ICSC 08 L1 .... 387 µs

– with a master central unit serie 90
T rb = 4 002 µs = 4 ms

– with a master central unit serie 30
T rb = 4 502 µs = 4,5 ms

3.5.2 Response time to energize an output from the activation of an input

See Part 3 page 5.3-1 for a master central unit serie 30.
See Part 4 pages 1-22 or 2-25 or 3-21 for a master central unit serie 90.

4 Programming and testing

There are 2 types of central units available for the CS 31 system :

– 07 KR 31, 07 KT 31/07 KR 91, 07 KT 92 and 07 KT 93.

Central units can be programmed by two methods :

– TCZ handheld terminal

– Software package (on IBM PC)

4.1 TCZ handheld terminal

The TCZ terminal can be used for the programming and testing of 07 KR 31 / 07 KT 31, 07 KR 91 /07 KT 92 / 07 KT 93, units.

The TCZ is powered from the central unit (9 PIN D - CONNECTOR).

An external power supply is available which allows "off line" editing of the program.

4.2 Programming software

All programming packages are used with an IBM AT compatible personal computer.
Expensive dedicated programming units are therefore not necessary as the computer is connected directly to the integral programming port of the central unit.

4.2.1 Software for 07 KR 91/ 07 KR 31 central unit

The higher level functions (data manipulation, communication and PID regulation etc...) of the 07 KR 91 central unit are programmed using the 907 PC 331 Package.

ABB CS31

Hardware

ABB Control

FPTC 404 365 P2001-e

Chapter	Description	Page
1.1	**General characteristics**	1.1-1
1.1.1	Technical data system	1.1-1
1.1.2	Installation of CS 31 System	1.1.2-1
1.2	**Transmission format**	1.2-1
1.3	**Bus refresh time**	1.3-1
1.4	**Dimensions**	1.4-1
1.5	**Approvals and classification societies**	1.5-1

1.1 General characteristics — Installation requirements

1.1.1 Technical data system

The CS 31 system is developped according to the international standard IEC 1131-2.

• Operating conditions

– Temperature :

• operation	0 °C ... + 55 °C	32 ... 131 °F
• storage	- 40 °C ... + 75 °C	- 40 ... 167 °F
• transport	- 25 °C ... + 75 °C	- 13 ... 167 °F

– Humidity acc. to DIN 40040 class F without condensation :
- average over the year ≤ 75 %
- up to 30 days of a year 95 %
- on the other days withregard to the average of the year, occasionnally 85 %

– Air pressure :
- operation ≥ 800 hPA (≤ 2000 m)
- storage ≥ 660 hPA (≤ 3500 m)

• Mechanical data

– degree of protection	IP 20
– housing	UL94 V0 UL94 V1 for central units serie 90, coupler 07KPxx and units ICDxx
– vibration	each of three mutually perpendicular axes 10 Hz ...57 Hz continuous : 0.0375 mm amplitude occasional : 0.075 mm amplitude 57 Hz ... 150 Hz continuous : 0.5 g acceleration occasional : 1.0 g acceleration
– shocks	occasional excursion to 15 g, 11 ms, halfsine in each of three mutually perpendicular axes
– impact withstand test	for units with a power supply > 30 VAC. According to IEC 950 : a steel sphere with a mass of 500 g is to fall freely from a height of 1300 mm

• Mounting

– DIN rail	35 mm
– Screw mounting	screws Ø 4 mm (M4)

• Serial interfaces

– for connection of the central unit to the remote units	RS485, using screw terminals
– for programming and setting parameter	RS232-C 9 pole D connector (female)

• Termination

– on the plug-in base ECZ use 60 °C copper conductor only

Cross section :

– bus wiring terminal : twisted pair AWG 24 (0.22 mm²) to AWG 18 (0.8 mm²)

– earth terminal : rigid or stranded connector AWG 10 (5.2 mm²)

– Others terminals :
- inputs : stranded connector AWG 18 (0.8 mm²) to AWG 14 (2.1 mm²)
- outputs : stranded connector AWG 14 (2.1 mm²)
- power supply AWG 14 (2.1 mm²)

– on removable terminal block (small section)	2.5 mm² (copper N° AWG14)
– on removable terminal block (small section)	1.5 mm² (copper N° AWG16)
– screws tightening torque (for guidance only)	7 ibs. inch (0.8 Nm)

• Supply connections

– 24 VDC (process and power supply	24 VDC (-20 %, +25 %, i.e. 19.2 ... 30V) incl. ripple
ripple factor	< 5 %
– 120 VAC power supply	120 VAC (-15%, +10%, i.e. 102 ... 132V) 50 Hz or 60 Hz (± 5 %)
– 230 VAC power supply	230 VAC (-15%, +10%, i.e. 195.5 ... 253V) 50 Hz or 60 Hz (± 5 %)

• Voltage drops and interruptions

– DC power supply	interruption time ≤ 10 ms time interval between two drops ≥ 1s

– AC power supply	interruption time ≤ 0.5 period time interval between two drops ≥ 1s

- **Creepage distances and clearances**

according to EN 61131-2 / IEC1131-2

- **Insulation test voltages**

the insulation test voltages are according to IEC 1131-2

- **Electromagnetic compatibility (EMC)**

– electrostatic discharge (ESD)	according to IEC 1000-4-2 (severity level 3)
test peak voltage :	
• at discharge thru air	8 kV
• at discharge thru relay's contact	6 kV
time between two discharges	> 1s
number of discharges on each selected point	10
– radiated electromagnetic field immunity test	according to IEC 1000-4-3
field strength	10 V/m (severity level 3)
frequency range	27 MHz to 1000 MHz
sweep speed	1.5 x 10E-3 decade/s
– fast transient burst test (FTT)	according to IEC 1000-4-4
interference voltage for :	
mains terminals 115/230 V	2 kV
mains terminals 24 V	2 kV
output terminals 24 V	1 kV
output terminals 115/230 V	2 kV
input terminals 24 V	1 kV
input terminals 115/230 V	2 kV
analogue input/output terminals	1 kV
CS 31 bus	2 kV
programming interface	0.5 kV
– surge immunity	according to IEC 1000-4-5
test voltage for assymetric coupling	common mode
power supply (115/230 VAC)	2 kV
power supply (24 VDC)	1 kV
digital inputs/outputs	1 kV
test voltage for symetric coupling	differential mode
power supply (115/230 VAC)	1 kV
power supply (24 VDC)	1 kV
digital inputs/outputs	1 kV

- **ABB Procontic CS 31 system bus**

The CS 31 bus is a shield twisted pair RS485

– cross	0.22 ... 0.8 mm2 (N∘ AWG 24 ... N∘ AWG 18)
– twists	> 10 per metre
– resistance	≤ 100 Ω/km
– impedance characteristic	100 to 150 Ω
– capacitance	< 150 nF/km
– shield	
– termination	120 Ω, 1/4 Watt resistor connected at the end of the bus
– number of points of connections	31 slaves + 1 master

1.1.2 Installation of CS 31 system

Generalities

Some installation rules have to be respected. These rules concern the ground concept, the connection of the CS 31 bus and the different power supplies installations.
The following main principles must be applied :

Each type of signal has to be mounted separatly

– power supply 230 VAC
– analogue and low voltage signals

The ground and power supply wires must be connected in star

- **Refer to the description of each remote unit for connection of inputs and outputs.**

- **Installation of the bus**

The CS 31 bus is a RS 485 serial line and a schield twisted pair.

The CS 31 bus is a master slave bus. Only one master can be present on the bus.

The maximum length between the both extremities is 500 metres.

The master should be :
– a central unit : 07 KR 31, 07 KR 91, 07 KT 92, 07 KT 93, PCZB, UCZA/UCZB
– a PLC coupler : 07 CS 61 and 07 CS 91 for the ABB Procontic T 200 and T 300
– a PC board : 07 CM 90

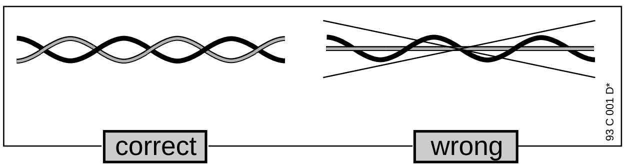
- **Characteristics of the bus' cable**

The CS 31 bus is a shield twisted pair RS 485

– cross	0.22 ... 0.8 mm2
– twists	> 10 per metre
– resistance	≤ 100/km
– impedance	
• **Characteristics**	100 to 150 Ω
– capacitance	< 150 nF/km
– schield	
– termination	120 Ω, 1/4 Watt resistor connected at the ends of the bus

Example of supplier :
– ALCATEL MCX-T
– DRAKKA dracoda 2903

The twisted pair has to be symetric



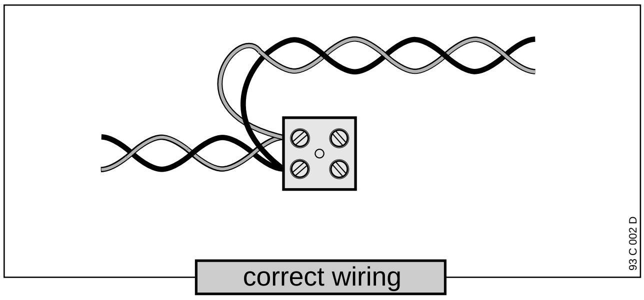
- **Connections**

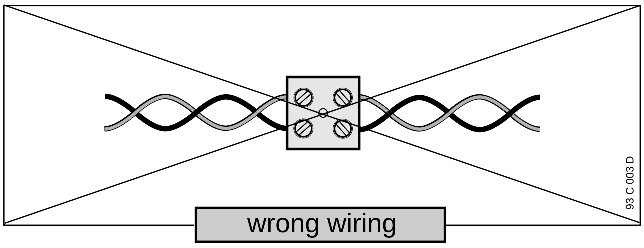
The same type of cable should be used throughout the installation for the system bus (RS 485).

Avoid interruption of the bus, for example, when connecting cables at the marshalling cabinet.

Whenever interruption of the bus is absolutely necessary, it must be wired to the same side of the terminals.

Example :





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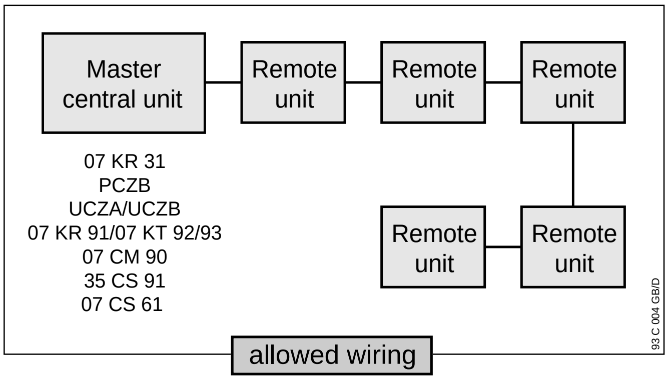
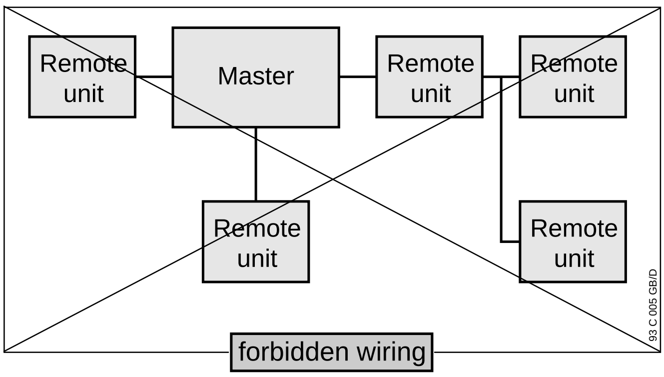
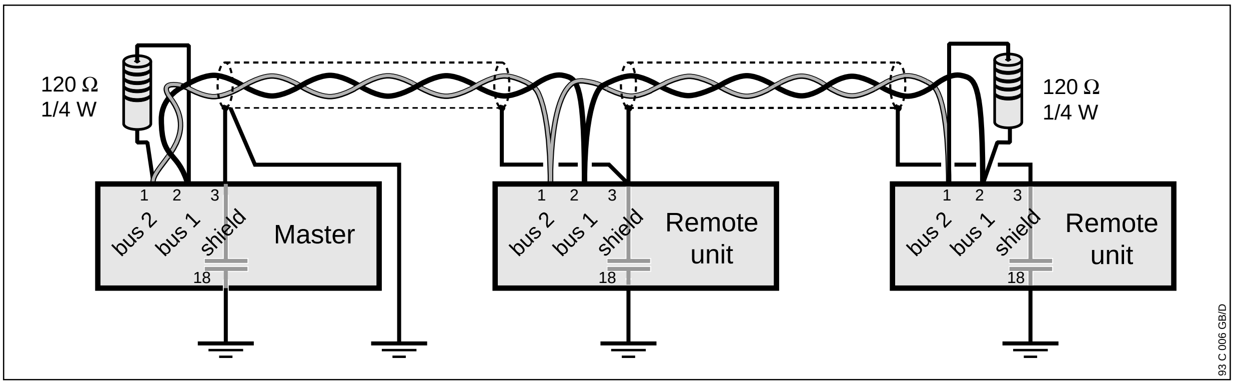




● **Bus topology**



The bus must be terminated with a 120 Ω, 1/4 Watt resistor, this must be connected at the ends of the bus.

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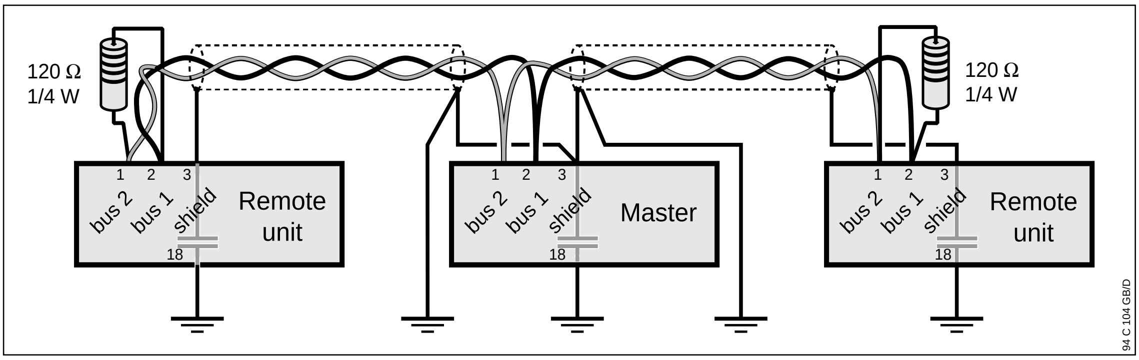
The shield of the bus must be connected to the earth near the master.



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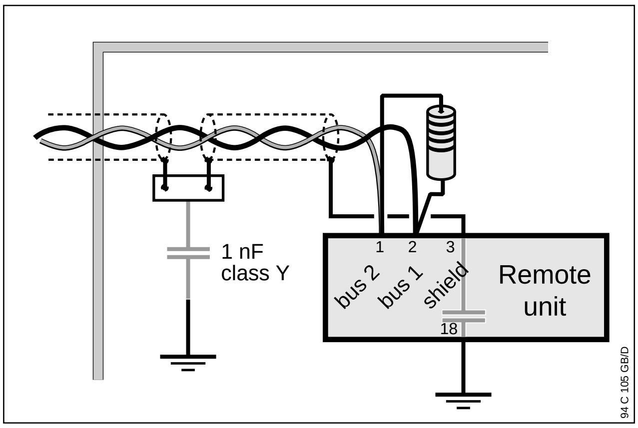

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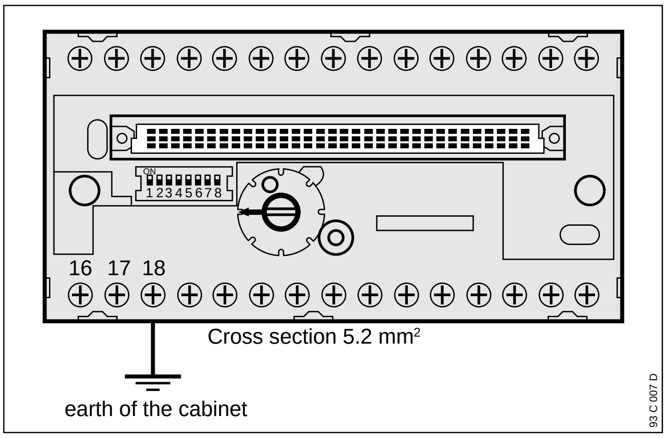
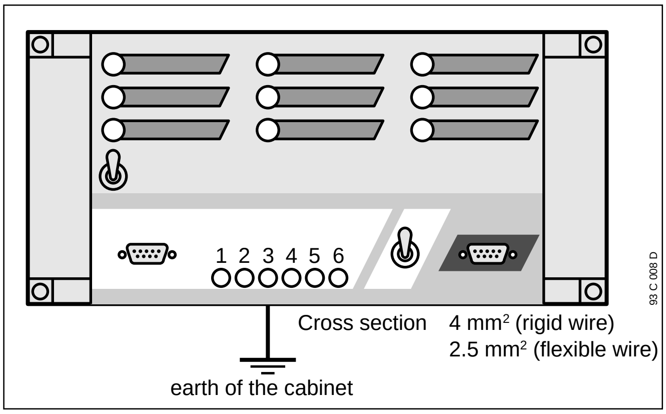
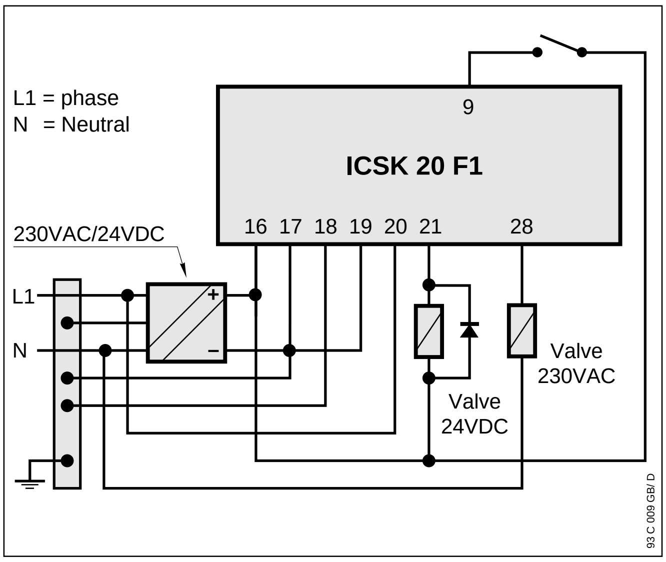
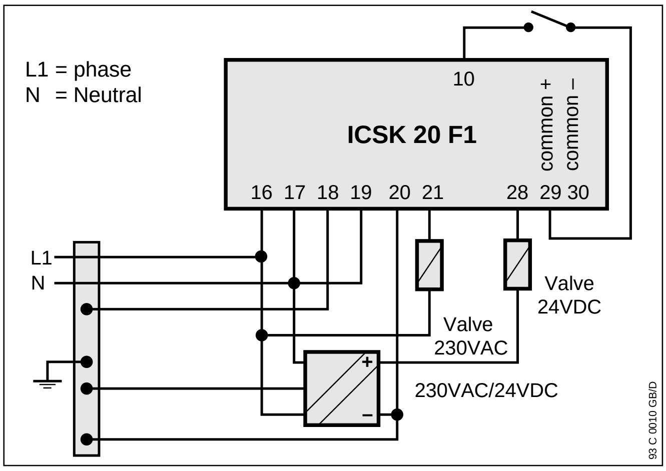




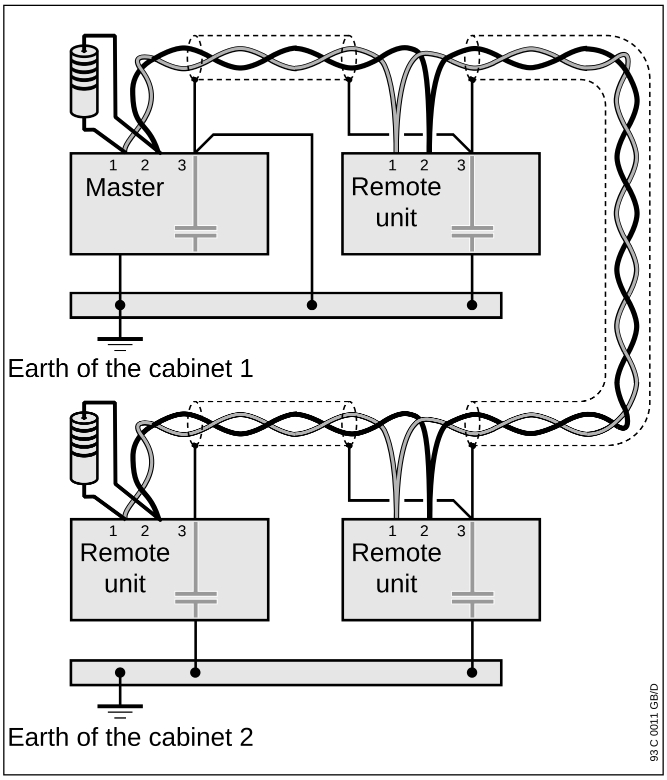
Example of connection with a 24 VDC power supply



Example of connection with a 230 VAC power supply



• Ground concept with different cabinets



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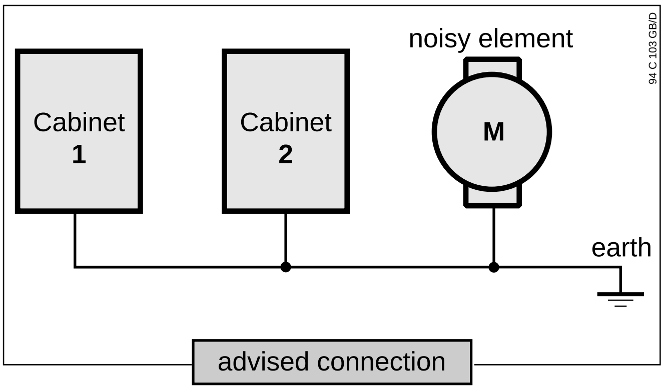

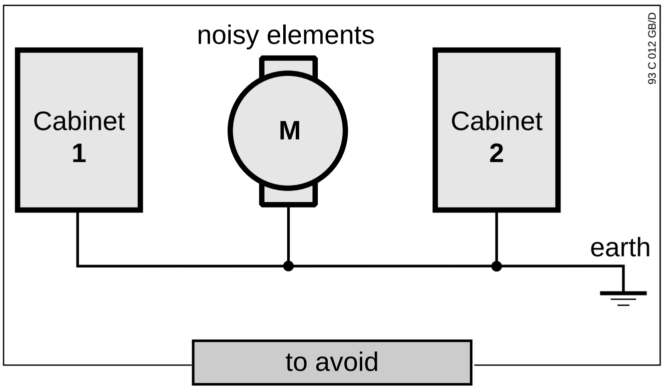

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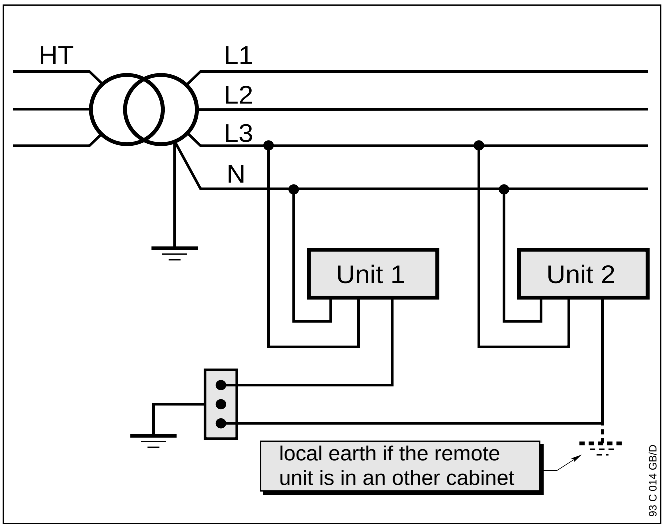
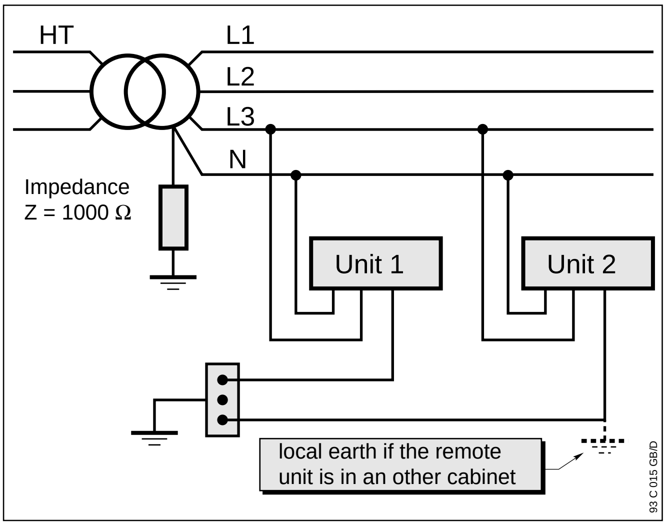


Power supply I-T

- The neutral is isolated from the earth
- The metallic parts are connected to the earth



In a noisy environnement, an isolated transformer with a shield has used in each cabinet (even for 24 VDC version).

1.2 Transmission format

One single CPU is the master on the bus, all of the other remote units or CPU are considered to be slaves.
The master CPU manages up to a maximum of 31 remote units on one bus.
All messages are terminated with an error check (CRC8).

The format of the messages :

- request from the master CPU

Address	Data	CRC8

- response from the remote units

Start	Data	CRC8

During initialization, the central unit interrogates all of the remote units in succession, thus building an image of the system configuration.

On each cycle of the bus all of the remote units are interrogated.

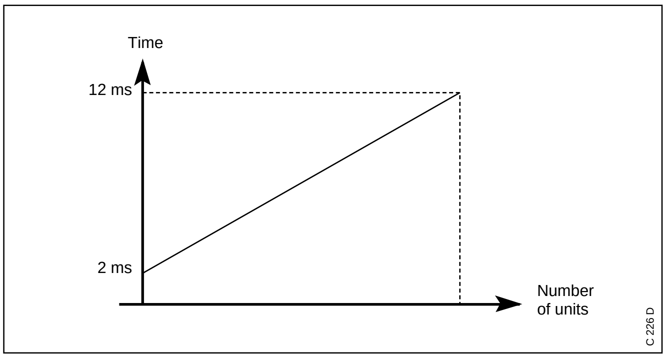
This updates all diagnosis information and recognizes additional remote units.

If the CPU or one of the remote units receives a message with a (CRC8) error, it is ignored.
After ten consecutive transmission errors, an error "Bus error" is generated on the remote units and within the diagnosis of the central unit.

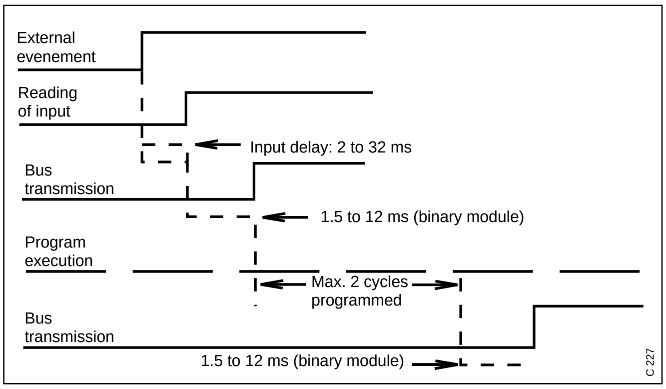
1.3 Bus refresh time

The refresh time depends on the configuration of the system, number and type of remote units.

The example below is for a system of remote units type ICSC 08 L1 :



The user program and the bus refresh cycle are executed in serie with the 07 KR/KT 31, 07 KR 91 and 07 KT 92/93 central units. The time event diagram is shown below :



● **Bus refresh time** (T rb)

The bus transmission time is easily calculated from the configuration of the installation.

This time is equal to :

– with a master central unit serie 90 :

T rb = T offset + T communication time

– with a master central unit serie 30 :

T rb = T offset + T communication time + n * 100 (µs)

with :

– T offset = 2 000 µs
– T communication time : see table on the next page
– n = number of slaves on the bus

Example of calculation

Configuration :

1 "Master" CPU .... 2 000 µs
1 ICSK 20 F1 .... 452 µs
1 ICSO 08 R1 .... 260 µs
1 ICSI 16 E1 .... 387 µs
1 ICFC 16 L1 .... 516 µs
1 ICSC 08 L1 .... 387 µs

– with a master central unit serie 90
T rb = 4 002 µs = 4 ms

– with a master central unit serie 30
T rb = 4 502 µs = 4,5 ms

● **Response time to energize an output from the activation of an input**

See Part 3 page 5.3-1 for a master central unit serie 30.

See Part 4 pages 1-22 or 2-25 or 3-21 for a master central unit serie 90.

Communication time	
offset time Master CPU	2000 µs

Slave central units	
07 KR 31*	750 µs
07 KT 31*	750 µs
07 KR 91*	750 µs
07 KT 92*	750 µs
07 KT 93*	750 µs
* with factory setting	
time following the configuration :	
2 bytes in transmission 2 bytes in receiving	516 µs
4 bytes in transmission 4 bytes in receiving	750 µs
8 bytes in transmission 8 bytes in receiving	1300 µs
12 bytes in transmission 12 bytes in receiving	1850 µs
8 words in transmission 8 words in receiving	2500 µs

Binary input units	
ICSI 08 D1	323 µs
ICSI 08 E1	323 µs
ICSI 08 E3/E4	323 µs
ICSI 16 D1	387 µs
ICSI 16 E1	387 µs

Binary output units	
ICSO 08 R1	260 µs
ICSO 08 Y1	260 µs
ISCO 16 N1	340 µs

Binary input/output units	
ICSC 08 L1	387 µs
ICFC 16 L1	516 µs
ICSK 20 F1	452 µs
ICSK 20 N1	452 µs
ICDG 32 L1	516/590 µs following the configuration

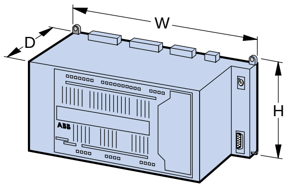
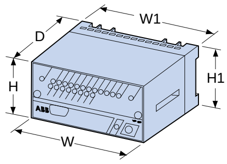
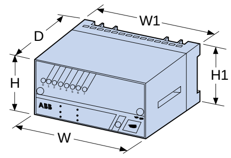
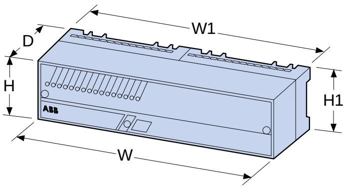
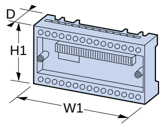
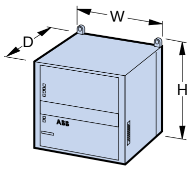
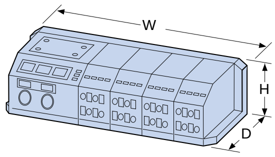
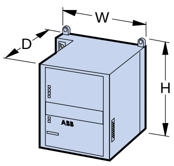
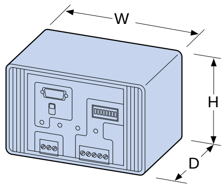
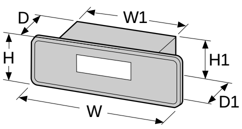
IP65 binary input/output units	
ICPI 08 D1	323 µs
ICPI 16 D1	387 µs
ICPO 08 H1	260 µs
ICPO 16 H1	340 µs

Analogue units	
ICSM 06 A6 (input/output)	1162 µs
ICSE 08 A6 (input)	1355 µs
ICSE 08 B5 (input)	1355 µs
ICST 08 A7 (input)	1355 µs
ICST 08 A8 (input)	1355 µs
ICST 08 A9 (input)	1355 µs
ICDT 08 B5 (input)	1355 µs
ICSA 04 B5 (output)	700 µs

Robot coupler card	
ICBG 32 L7	516 µs
ICBG 64 L7	750 µs

High speed counter	
ICSF 08 D1	1300 µs

1.4 Dimensions

Types	Short description		Dimensions in mm with unit carrier/terminal W/ x H/ x D W1 x H1 x D1
07 KR 91 **07 KT 92** **07 KT 93** **07 SA 93**	Central processing units Positioning unit		**240** x **140** x **85** – –
07 KR 31 **07 KT 31**	Central processing units		**120**/ x **60**/ x **115** 123 x 64
ICS..	Binary or analog units Input - Output - Input/Output High speed counter unit		**120**/ x **60**/ x **115** 123 x 64
ICFC 16 L1	Binary Input/Output unit		**244**/ x **60**/ x **80** 246 x 64
ECZ	Plug-in base		123 x 64 x 30
ICD..	Binary or analog remote units		**120** x **140** x **85** – –
ICPI 16 D1 **ICPO 16 H1**	Binary remote units (IP 65 protection)		**367** x **78** x **78.5** – –
ICPI 08 D1 **ICPO 08 H1**	Binary remote units (IP 65 protection)		**247** x **78** x **78.5** – –
07 KP 90 **07 KP 92** **07 MK 92**	Communication couplers		**120** x **140** x **85** – –
NCC 232 **NCC 485** **NCB** **NCBR**	Communication accessories		**120** x **80** x **85** – –
TCAD	Text display		**230** x **80** x **47** 198 x 67 x 42

The other products (type ICBG 32 L 7, type ICBG 64 L 7, type 07 CS 61, type 07 CM 90) are mounted in a rack.
Their dimensions depend on their ranges (Robot S3, ABB Procontic T 200 and PC).

1.5 Approvals and classification societies

The product listed in the catalogue is designed according to the relevant standards; it is manufactured and tested under our owwn reponsability.

The table below indicates for each unit the situation regarding the approvals for those countries or with regard to the classification societies where an approval is mandatory and confirms that products in standard version can be used worldwide thus avoiding double stocking.

All following units are developped, tested and produced according to the standard IEC 1131-2.

UL : only for 24 VDC and 120 VAC versions.
Ships classification societies agreements for : 24 VDC, 120 and 230 VAC versions.

■ : approved
△ : applied in 1996

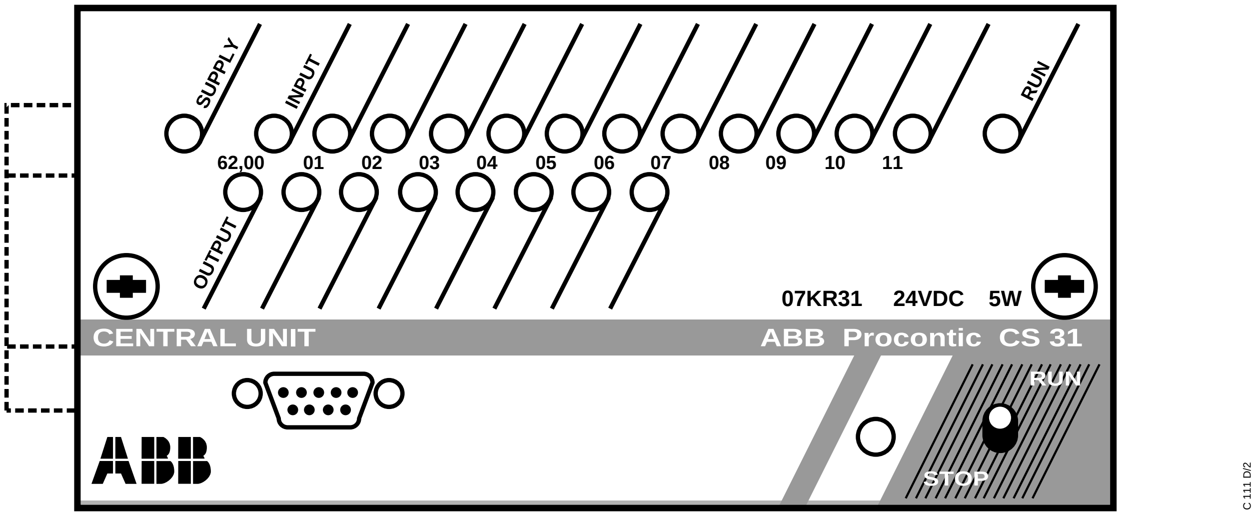
Unit type	Approvals		Ships classification societies agreements						
Test mark / Abbreviation	UL	CSA	BV	GL	LRS	MRS	RINa	DNV	ABS
Approved in	USA	Canada	France	German.	Gr.Brit.	Russia	Italy	Norway	USA
CS 31 CPU									
07 KR 31	■		■	■	■	■	■	■	■
07 KT 31	△		■	■	■	■	■	■	■
07 KR 91	■	■	■	■	■	■	■	■	■
07 KT 92	■	■	■	■	■	■	■	■	■
07 KT 93	■	■	■	■	■	■	■	■	■
CS 31 remote units									
ICSI 08 D1	■		■	■	■	■	■	■	■
ICSI 08 E1	■		■	■	■	■	■	■	■
ICSI 16 D1	■		■	■	■	■	■	■	■
ICSI 16 E1	■		■	■	■	■	■	■	■
ICSI 08 E3	■		■	■	■	■	■	■	■
ICSI 08 E4			■	■	■	■	■	■	■
ICSO 08 R1	■		■	■	■	■	■	■	■
ICSO 08 Y1									
ICSO 16 N1	△		■	■	■	■	■	■	■
ICSC 08 L1	△		■	■	■	■	■	■	■
ICFC 16 L1	△		■	■	■	■	■	■	■
ICSK 20 F1	■		■	■	■	■	■	■	■
ICSK 20 N1	△		■	■	■	■	■	■	■
ICDG 32 L1	■	■	■	■	■	■	■	■	■
ICSF 08 D1	■		■	■	■	■	■	■	■
ICPI 08 D1			■	■	■		■		
ICPI 16 D1			■	■	■		■		
ICPO 08 H1			■	■	■		■		
ICPO 16 H1			■	■	■		■		

All products have CE marking.

Unit type	Approvals		Ships classification societies agreements						
Test mark / Abbreviation	UL	CSA	BV	GL	LRS	MRS	RINa	DNV	ABS
Approved in	USA	Canada	France	German.	Gr.Brit.	Russia	Italy	Norway	USA
CS 31 remote units									
ICSE 08 A6	■		■	■	■	■	■	■	■
ICSE 08 B5	■		■	■	■	■	■	■	■
ICST 08 A7									
ICST 08 A8	■		■	■	■	■	■	■	■
ICST 08 A9	■		■	■	■	■	■	■	■
ICSA 04 B5	■		■	■	■	■	■	■	■
ICSM 06 A6	■		■	■	■	■	■	■	■
ICDT 08 B5	■	■	■	■	■	■	■	■	■
CS31 other units and accessories									
TCAD	△		■	■	■	■	■	■	■
NCB	△		■	■	■	■	■	■	■
NCBR	△		■	■	■	■	■	■	■
ICBG 32 L7									
ICBG 64 L7									
07 KP 90	■	■	■	■	■	■	■	■	■
07 KP 92	■	■	■	■	■	■	■	■	■
NCC 232	△		■	■	■	■	■	■	■
NCC 485	△		■	■	■	■	■	■	■
ECZ	■		■	■	■	■	■	■	■
CS 31 coupler for T200									
07 CS 61	■	■	■	■	■	■	■	■	■

2 Contents Central units

2.1 07 KR 31 Central unit
2 k instructions



Central unit 07 KR 31

The comprehensive description for this central unit is located in part 3 of this volume.

Brief description

The central unit 07 KR 31 works either as

- Bus master in the decentralized automation system ABB Procontic CS31 or as
- Slave (remote processor) in the decentralized automation system ABB Procontic CS 31 or as
- Stand-alone central unit.

The unit is provided in three versions with supply voltages of 24 V DC, 120 V AC or 230 V AC :

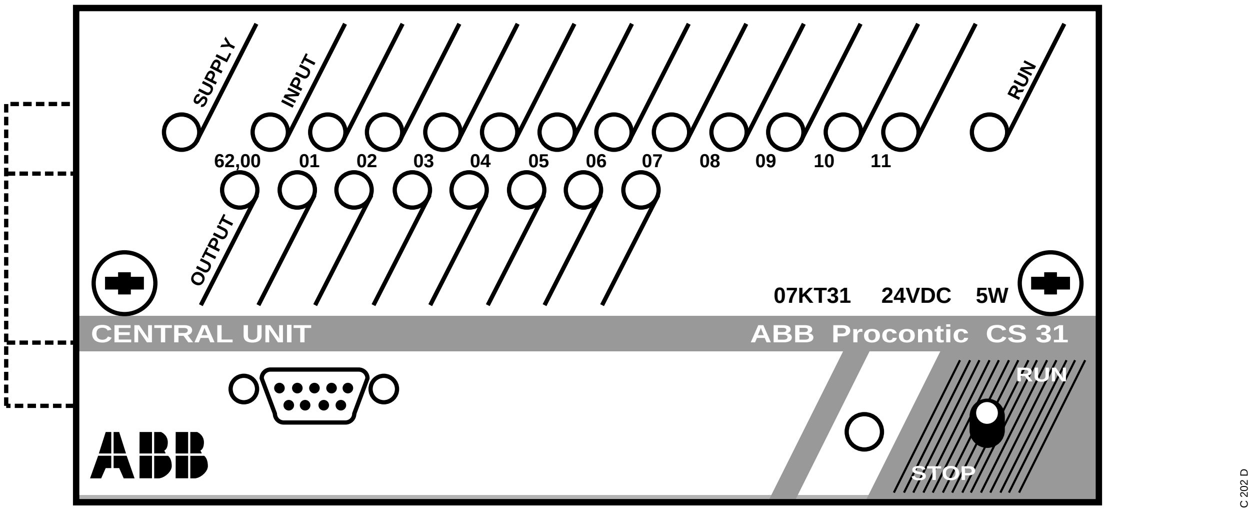
The central unit versions have the following main features :

- 12 binary inputs
- 8 binary relay outputs
- 1 counting input for couting frequencies up to 10 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  – is set as programming interface
  – can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
  – can be set as MODBUS interface
- has a built-in MODBUS protocol (master and slave)
- Real-time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Fastening by inserting in the plug-in base ECZ. The plug-in base can either be snapped on a DIN rail or fastened by screws.
- Built-in lithium battery for back-up of the RAM contents, its lifetime is 10 years.
- Reading and writing program protection by password
- Programming with the programming software 907 PC 331
- "On-Line" programming
- User program containing max. 2 k of instructions
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions

  – Self-diagnosis of the central unit
  – Diagnosis of the ABB Proncontic CS31 system bus and the connected units

2.2 07 KT 31 — Central unit

2 k instructions



Central unit 07 KT 31

The comprehensive description for this central unit is located in part 3 of this volume.

Brief description

The central unit 07 KT 31 works either as

- Bus master in the decentralized automation system ABB Procontic CS31 or as
- Slave (remote processor) in the decentralized automation system ABB Procontic CS 31 or as
- Stand-alone central unit.

The unit is provided in three versions with supply voltages of 24 V DC, 120 V AC or 230 V AC :

The central unit versions have the following main features :

- 12 binary inputs
- 8 binary transistor 24VDC/0.5A outputs
- 1 counting input for couting frequencies up to 10 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1

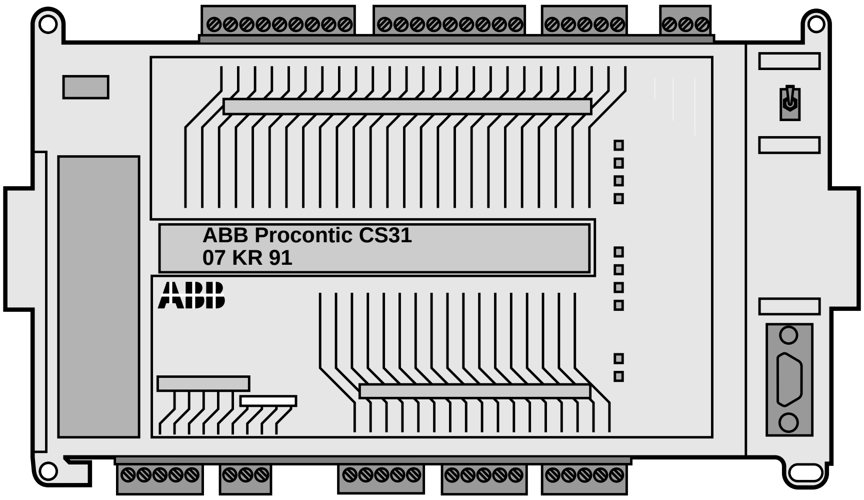
– is set as programming interface
– can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
– can be set as MODBUS interface

- has a built-in MODBUS protocol (master and slave)
- Real-time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Fastening by inserting in the plug-in base ECZ. The plug-in base can either be snapped on a DIN rail or fastened by screws.
- Built-in lithium battery for back-up of the RAM contents, its lifetime is 10 years.
- Reading and writing program protection by password
- Programming with the programming software 907 PC 331
- "On-Line" programming
- User program containing max. 2 k of instructions
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions

– Self-diagnosis of the central unit
– Diagnosis of the ABB Proncontic CS31 system bus and the connected units

2.3 07 KR 91 Central unit

7 k instructions



Central unit 07 KR 91

The comprehensive description for this central unit is located in part 4 of this volume.
The same description is available as an operating manual, order No. GATS 1316 01 R2001.

Brief description

The central unit 07 KR 91 works either as

- Bus master in the decentralized automation system ABB Procontic CS31 or as
- Slave (remote processor) in the decentralized automation system ABB Procontic CS 31 or as
- Stand-alone central unit.

The module is provided in two versions with supply voltages of 24 V DC and 115/230 V AC :

07 KR 91 R101 :
The device has a 115/230 V AC power supply voltage. It provides a 24 V output voltage for the supply of its own binary inputs.

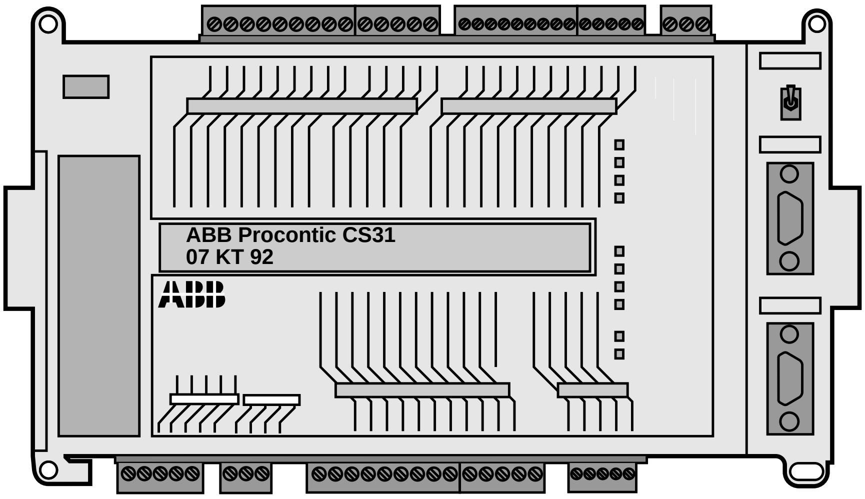
07 KR 91 R151 :

The device has a 24 V DC power supply voltage. It is provided with an additional interface for connecting communication modules (e.g. 07 KP 90).

Both module versions have the following main features :

- 20 binary inputs
- 12 binary relay outputs
- 1 counting input for couting frequencies up to 10 kHz
- Central unit for an user program containing ma. 7 k of instructions
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  - is set as programming interface
  - can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Real-time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw-type terminal blocks
- Detachable plastic sheet on the front side of the device ; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device on a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  - store and back-up the user program in the RAM
  - store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  - back-up the time and date (real-time clock)
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions
  - Self-diagnosis of the central unit
  - Diagnosis of the ABB Proncontic CS31 system bus and the connected modules

2.4 07 KT 92 Central unit
7 k instructions



Central unit 07 KT 92 R 101

The comprehensive description for this central unit is located in part 4 of this volume. The same description is available as an operating manual, order No. GATS 1316 02 R2001.

Brief description

The central unit 07 KT 92 works either as

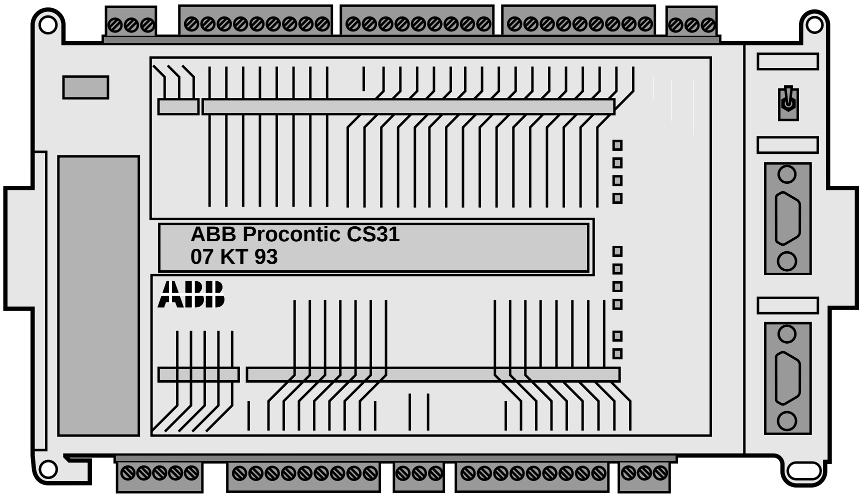
- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand-alone central unit.

Main features

- Power supply 24 V DC
- 12 binary inputs
- 8 binary transistor outputs
- 4 analog inputs
- 1 analog output
- 1 calibrated 10 V output
- 1 counting input for counting frequencies up to 10 kHz
- Central unit for a user program containing max. 7 k of instructions
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  – is set as programming interface
  – can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Serial interface COM2 as an MMC interface
- Additional interface for connecting communication modules (e.g. 07 KP 90)
- Real-time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw-type terminal blocks
- Detachable plastic sheet on the front side of the device ; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device on a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  – store and back-up the user program in the RAM
  – store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  – back-up the time and date (real-time clock)
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions
  – Self-diagnosis of the central unit
  – Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.5 07 KT 93 R101 Central unit

7 k instructions



Central unit 07 KT 93 R 101

The comprehensive description for this central unit is located in part 4 of this volume. The same description is available as an operating manual, order No GATS 1316 12 R2001

Brief description

The central unit 07 KT 93 works either as

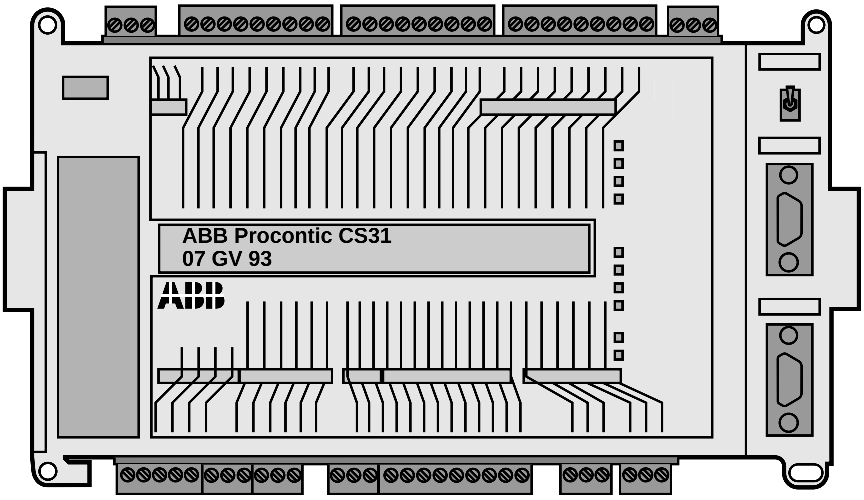
- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand-alone central uni

Main features

- Power supply 24 V DC
- 24 binary inputs
- 16 binary transistor ouputs
- 1 counting input for counting frequencies up to 10 kHz
- Central unit for a user program containing max. 7 k of instructions
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  – is set as programming interface
  – can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Serial interface COM2 as an MMC interface
- Additional interface for connecting communication modules (e.g. 07 KP 90)
- Real-time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw-type terminal blocks
- Detachable plastic sheet on the front side of the device ; can be labelled with the signal names in order to have the inputs and outputs directly assigried
- Fastening by screws or by snapping the device on a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  – store and back-up the user program in the RAM
  – store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  – back-up the time and date (real-time clock)
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions
  – Self-diagnosis of the central unit
  – Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.6 07 GV 93 Central unit

Positionning Module for 3 axes



Positioning module 07 GV 93 R 101

The comprehensive description for the positioning module is located in the 07 GV 93 operating manual in DIN A5 format, order No. GATS 1316 07 R2001.

Brief description

The positioning module 07 GV 93 is a subsystem within the decentralized automation system ABB Procontic CS31. It moves and positions three independent axes. The move sequences are programmed in a simple way by means of sets. Machine parametrers which can be freely chosen adapt the positioning module to the mechanical units of the machines or the installation.

When used as a stand-alone module, the 07 GV 93 positioning module automatically moves and positions the axes on the basis of the programmed positioning sets. Additional input/output modules, connected via the CS31 system bus, allow the external control of the positioning sets and positioning sequences programmed in 07 GV 93.

The positioning module 07 GV 93 can also be used as a slave on the CS31 system bus. In the case, the positioning sets and sequences programmed in 07 GV 93 are controlled by a central unit 07 KR 91/07 KT 92/07 KT 93. This configuration allows the connection of additionnal positioning modules, slave central units as well as input and output modules.

The main features of the 07 GV 93 positioning module are :

- 1…3 axes
- Speed setpoint ±10 V DC
- Connection to incremental encoders
- High traversing speed of up to 100 m/min
- Position control cycle 4 ms
- Internal numerical representation 32 bits
- Adjustable ramps per axis for both traverse directions
- Encoder error detection
- Power supply 24 DC
- LEDs for displaying the input and output signals as well as operating conditions and error messages
- Detachable screw-type terminal blocks
- Detachable plastic sheet on the front side of the device ; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- RUN/STOP switch for starting and aborting the program execution
- Diagnosis functions

Operating and programming

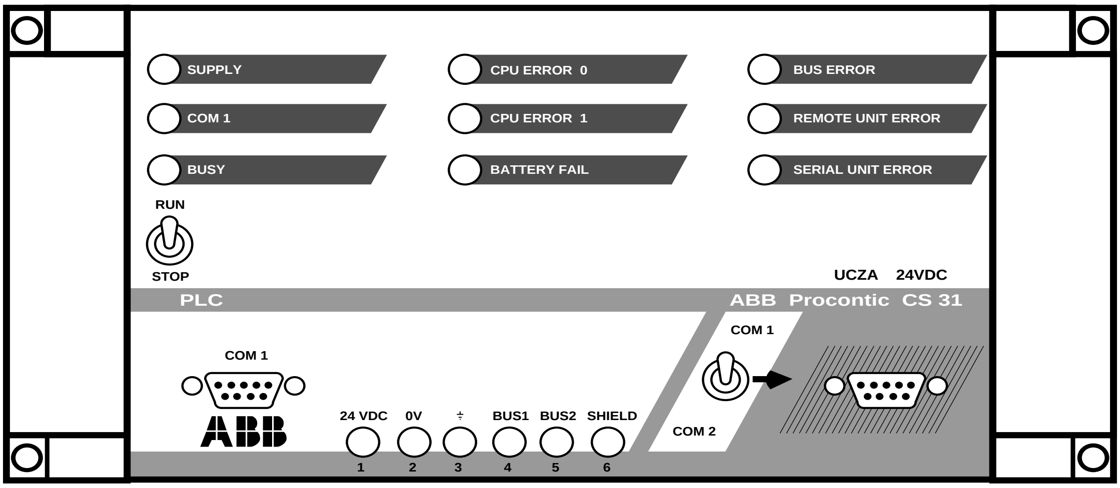
A means for operating and programming the positioning module 07 GV 93 is the operating station 35 BS 40. It is configured as a simple terminal when the power is switched on and no further programming is to be done. The control of the display which includes 2 lines of 40 characters each is performed completely by the module 07 GV 93. Entry is done via function keys and a numerical keypad.

The following functions are available for programming :

- Absolute and incremental dimensions
- Override 0…125 %
- 300 positioning sets per axis
- Machine data set for machine-specific parametrers
- Sofware limit switches
- 1-, 2- and 4 - fold evaluation of the positioning encoders
- Metric system
- Reference point drive
- Automatic single set and automatic next set
- Manual control (Feed, Jog, Pos)
- Error detection, diagnosis

2.7 UCZA/UCZB Central unit

8/16 k instructions



Central unit UCZA / UCZB

C 231 D

The comprehensive description for these central units is located in the part 5 of this volume.

Brief description

The central unit UCZA an UCZB work as bus master in the decentralized automation system ABB Procontic CS 31.

The units is provided in three versions with supply voltages of 24 VDC, 120 VAC or 230 VAC.

The central unit versions have the following main features :

- 1 CS 31 system bus interface for system expansion. A coupler SCZ allows an expansion to an other CS 31 bus.

- 1 serial interface COM1

– is set as programming interface

– can be set as an ASCII interface for connecting peripheral devices (e.g MMC devices)

- 1 serial interface COM2

For diagnosis and configuration

Real time clock

Leds for displaying the operating and error messages.

Programming with the programming software 907 PC 32.

User program containing max. 8 k instruction for UCZA and 16 k instruction for UCZB.

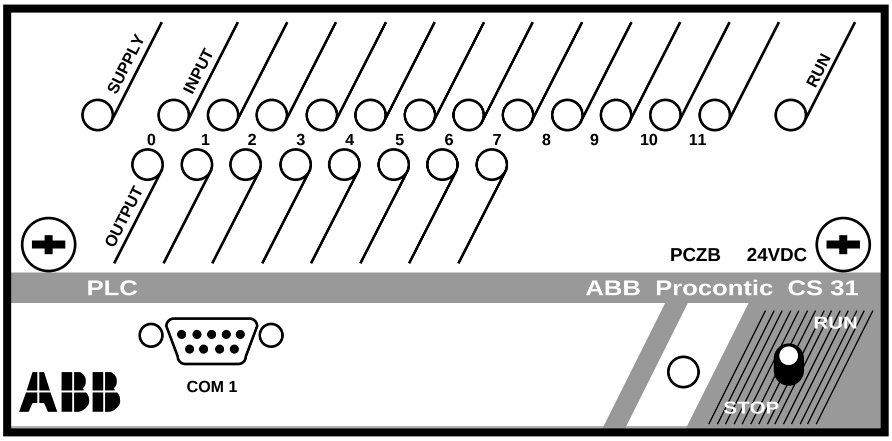
Fastening by screws or by snapping for starting or aborting the program execution.

Extensive diagnosis functions
– self-diagnosis of the central unit

– diagnosis of the ABB Procontic CS 31 and connected remote units.

2.8 PCZB — Central unit

2 k instructions



Central unit PCZB

C 149 D

The comprehensive description for this central unit is located in volume 5.

Brief description

The central unit PCZB works either as

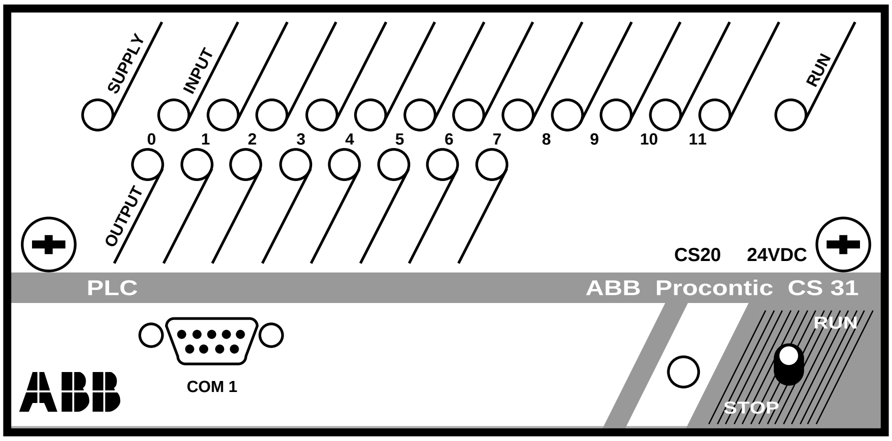
- Bus master in the dezentralized automation system ABB Procontic CS 31 or as
- Slave (remote processor) in the dezentralized automation system ABB Procontic CS 31 or as
- Stand-alone central unit.

Main features :

- Power supply
  24 VDC or 120 VAC or 230 VAC (3 versions)
- 12 binary inputs (one of them is a high-speed input)
- 8 binary relay outputs
- 1 integrated high-speed counter
- 1 CS 31 system bus interface for system expansion
- Serial interface COM1, EIA-232, for programming
- Real-time clock
- LEDs for displaying of the input and output signals as well as error messages and the RUN operating condition.
- Fastening by inserting in the plug-in base ECZ. The plug-in base can either be snapped on a DIN rail or fastened by screws.
- Built-in lithium battery for back-up of the RAM contents, its lifetime is 10 years.
- RUN/STOP switch for starting and aborting the program execution.
- Diagnosis functions.
- Programming with the programming software :
  907 PC 29
- User program containing max. 2 k instructions.

2.9 CS 20 — Central unit

2 k instructions



Central unit CS 20

The comprehensive description for this central unit is located in volume 5.

Brief description

The central unit CS 20 works as a

- Stand-alone central unit.

Main features :

- Power supply
  24 VDC or 120 VAC or 230 VAC (3 versions)
- 12 binary inputs (one of them is a high-speed input)
- 8 binary relay outputs
- 1 integrated high-speed counter
- Serial interface COM1, EIA-232, for programming
- Real-time clock
- LEDs for displaying of the input and output signals as well as error messages and the RUN operating condition.
- Fastening by inserting in the plug-in base ECZ. The plug-in base can either be snapped on a DIN rail or fastened by screws.
- Built-in lithium battery for back-up of the RAM contents, its lifetime is 10 years.
- RUN/STOP switch for starting and aborting the program execution.
- Diagnosis functions.
- Programming with the programming software :
  907 PC 29
- User program containing max. 2 k instructions.

3 Contents — Plug-in base

Chapter	Description	Page

The central units 07 KR 31, PCZB/CS20 and all of the remote units must be mounted on a plug-in base ECZ, with screw termination.

The plug-in base is suitable for rail mounting : (35 mm EN 50 022).

It consist of :

- 30 screw terminals for the connecting cables .... ①
- 8 dip switches to set the address of the unit .... ②
- 2 holes to allow screw fixing .... ③
- One 96 way connector for connection to the plug-in unit ④
- 1 voltage selector 24 VDC, 120 and 230 VAC .... ⑤
- Rail fixing .... ⑥

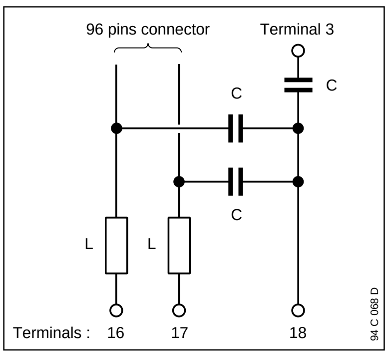
The following terminals are :

- Terminal 1 : bus 2
- Terminal 2 : bus 1
- Terminal 3 : shield of bus
- Terminal 16 : power supply 24 VDC or 120 VAC or 230 VAC
- Terminal 17 : power supply 0 VDC or 120 VAC or 230 VAC
- Terminal 18 : functional earth

- **Termination**
  - – on the plug-in base ECZ use 60 °C copper conductor only
  - Cross section :
  - – bus wiring terminal : twisted pair AWG 24 (0.22 mm^2) to AWG 18 (0.8 mm^2)
  - – earth terminal : rigid or stranded connector AWG 10 (5.2 mm^2)
  - – Others terminals :
    - inputs : stranded connector AWG 18 (0.8 mm^2) to AWG 14 (2.1 mm^2)
    - outputs : stranded connector AWG 14 (2.1 mm^2)
    - power supply AWG 14 (2.1 mm^2)

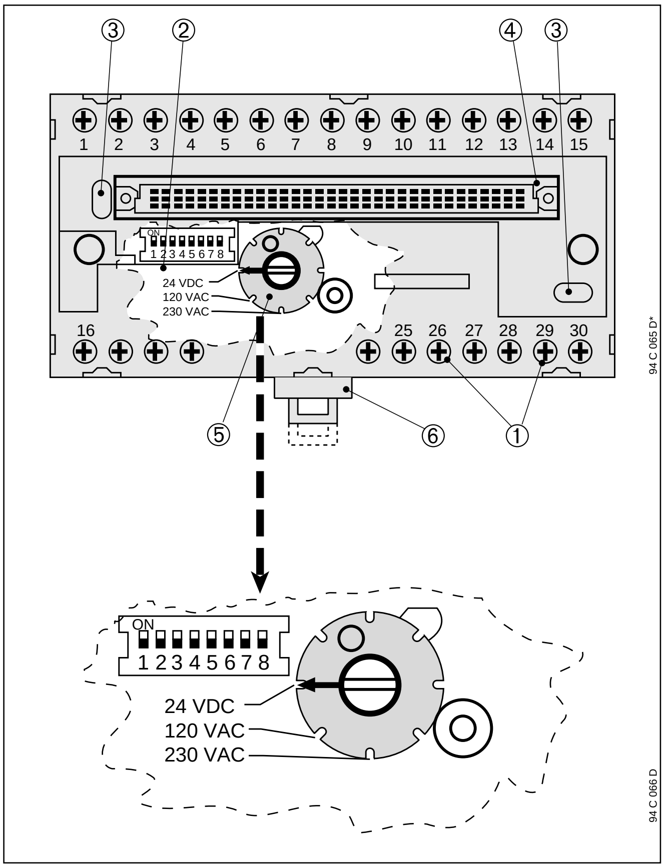
Screws thightening torque (for guidance only) 7 Lbs. in (0.8 N.m).

An LC filter is built into the base.



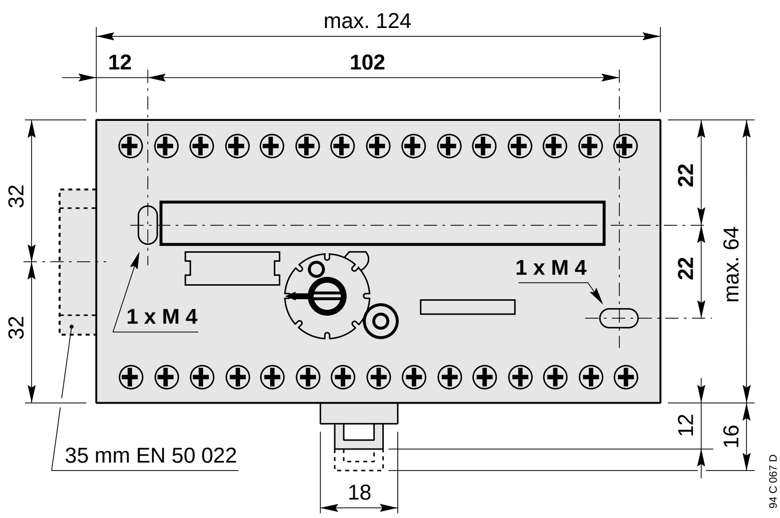
C : capacitor 1 nF class Y
L : self 3 , 330 µH

The insertion of a unit with the incorrect power supply is prevented by the voltage selector.



Dimensions in mm

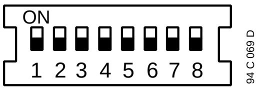
Details quoted in **heavy types** refer to screw fixing (2 x M4) dimensions.



Order number : FPR 370 0001 R0001
Weight (kg) : 0.200

3.2 Addressing

The address of the remote units is set by the dip switch on the plug-in base.

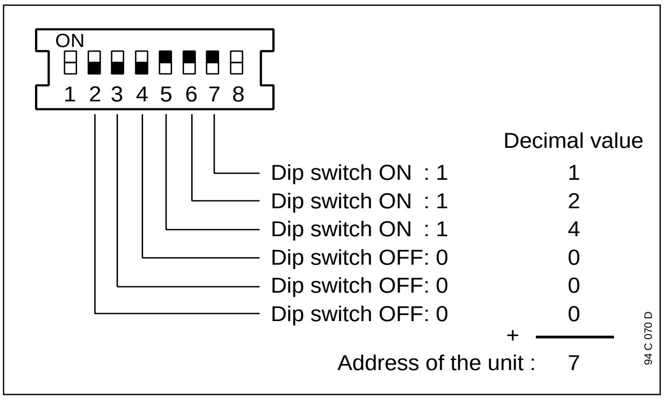


Dip switch	2	3	4	5	6	7
Decimal value	32	16	8	4	2	1

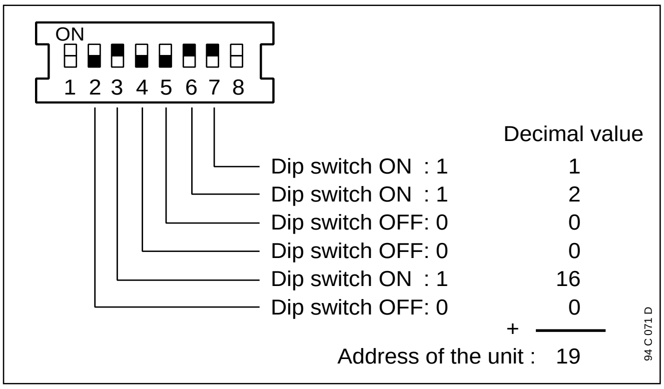
Dip switches 2 to 7 are used to set the address of the remote units on the bus.

The address of the unit is obtained by the addition of the binary values of the dip switches 2 to 7 when in the "ON position". The result obtained is the decimal address of the unit.

Example 1 : address 07



Example 2 : address 19



Dip switch N$_o$ 1 :

– For the user configurable I/O units
Examples : ICSC 08 L1, ICFC 16 L1

Position **«ON»** : All channels are set on outputs only.

Position **«OFF»** : The function of each of the channels is configurated by the user's programme.

– For the PCZB

Position **«ON»** : PCZB MASTER

Position **«OFF»** : PCZB SLAVE

Dip switch N$_o$ 8 :

This switch is used to set the address of the channels of I/O units.

xx = address of the remote unit

- Position **«OFF»** :

  xx, 00 to xx, 07 (channels 00 to 07)

  xx, 00 to xx, 15 (channels 00 to 15) with the central units 07 KR 31, 07 KR 91, 07 KT 92.

  xx, 00 to xx, 07 and xx+1, 00 to xx+1,07 with the central units UCZA/UCZB.

- Position **«ON»** :

  xx, 08 to xx, 15 (channels 08 to 15)

  xx, 08 to xx, 15 and xx+1,00 to xx+1,07 (channels 08 to 15 and channels 00 to 07) with the central units 07 KR 31, 07 KR 91, 07 KT 92.

  xx, 08 to xx, 15 and xx+1,08 to xx+1,15 with the central units UCZA/UCZB.

4.1.1 ICSI 08 D1 Binary Input remote unit

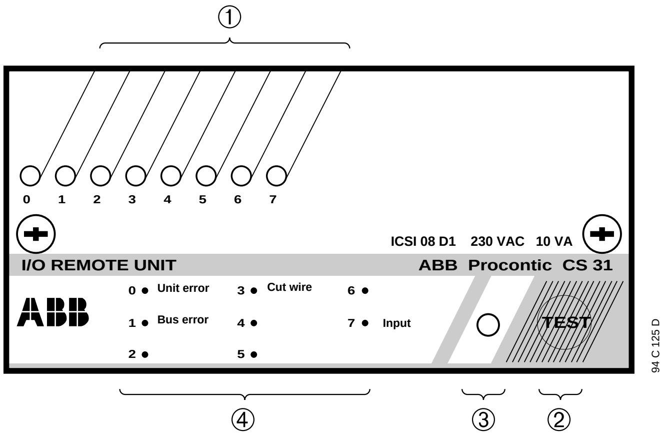
8 non isolated inputs 24 VDC

Binary non isolated input unit with 8 input channels for 24 VDC.

Description of the unit front :

- Eight yellow input status led's «0» to «7» .... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes .... ④

The unit has to be mounted on a plug-in base ECZ



8 inputs per unit

TECHNICAL CHARACTERISTICS

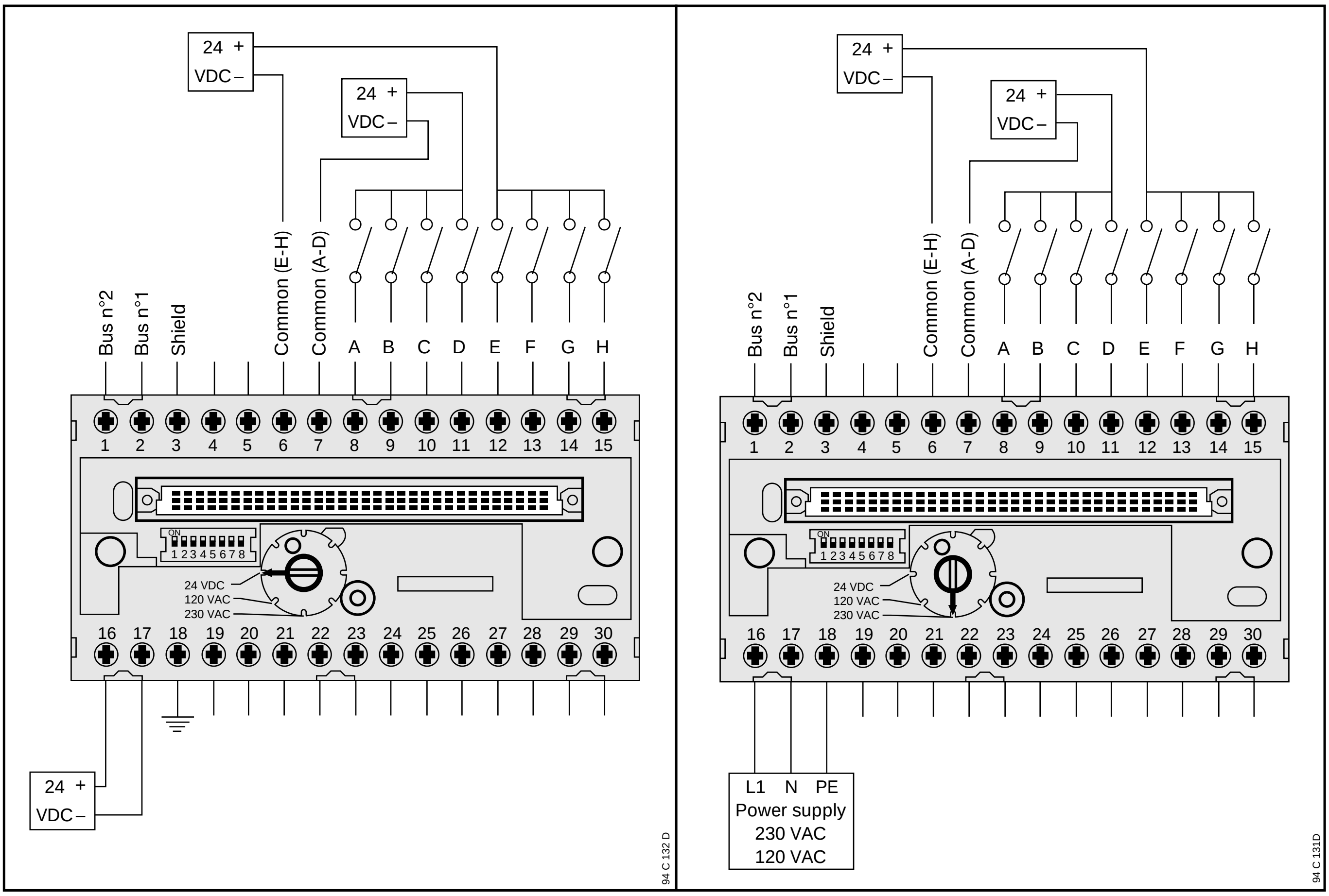
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	no	no
Supply output regulated 24 VDC (± 5 %)	-	100 mA
Signal level of the input, nominal value	24 VDC	24 VDC
Signal level of the input : 0 signal 1 signal	 –3 to +5V +15 to +30V	 –3 to +5V +15 to +30V
Open circuit detection	yes (**)	yes (**)
Input current for 24 VDC	6 mA	6 mA
Input delay (*)	2 to 32 ms	2 to 32 ms
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.5 W	8 W
Order number : FPR 331 5101	R1012	R0016/R0014
Weight (kg)	0.25	0.43

(*) This time can be changed, factory setting 8 ms.
(**) Open circuit will not be detected with factory setting. Enable with TCZ terminal (see Chapter 9, Volume 2 «**In case of failure**»).

● Electrical connection

The common "**+**" terminals are connected together.

Power supply 24 VDC	**Power supply 230 VAC and 120 VAC**
The common "**+**" must not be used.	The common "**+**" can supply the inputs with 24 VDC.



Note : In case of use of an external power supply 24 VDC for inputs, the "**0**" VDC has to be connected to the common "**–**".
Caution : The 24 VDC must never be connected to common "**+**".

● Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 8 inputs is displayed on the 8 led's.

- **Utilization**

VARIABLES USED IN THE CENTRAL UNIT						
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 61		00 … 63		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	ON	OFF	ON	OFF
Input	A	Exx, 00	Exx,08	Exx, 00	Exx, 08	Ixx00
	B	Exx, 01	Exx,09	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx,10	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx,11	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx,12	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx,13	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx,14	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx,15	Exx, 07	Exx, 15	Ixx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

The available configuration for each input :
– delay
– open circuit detection

- **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 3 : "**Cut wire**"

The status of an input channel is shown by :

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.1.2 ICSI 08 E1 Binary Input remote unit

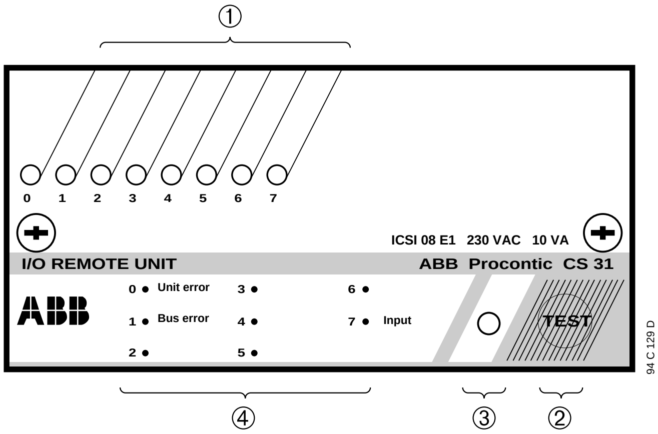
8 isolated inputs 24 VDC

Binary isolated input unit with 8 input channels for 24 VDC.

Description of the unit front :

- Eight yellow input status led's «0» to «7» .... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes .... ④

The unit has to be mounted on a plug-in base ECZ



8 inputs per unit

TECHNICAL CHARACTERISTICS

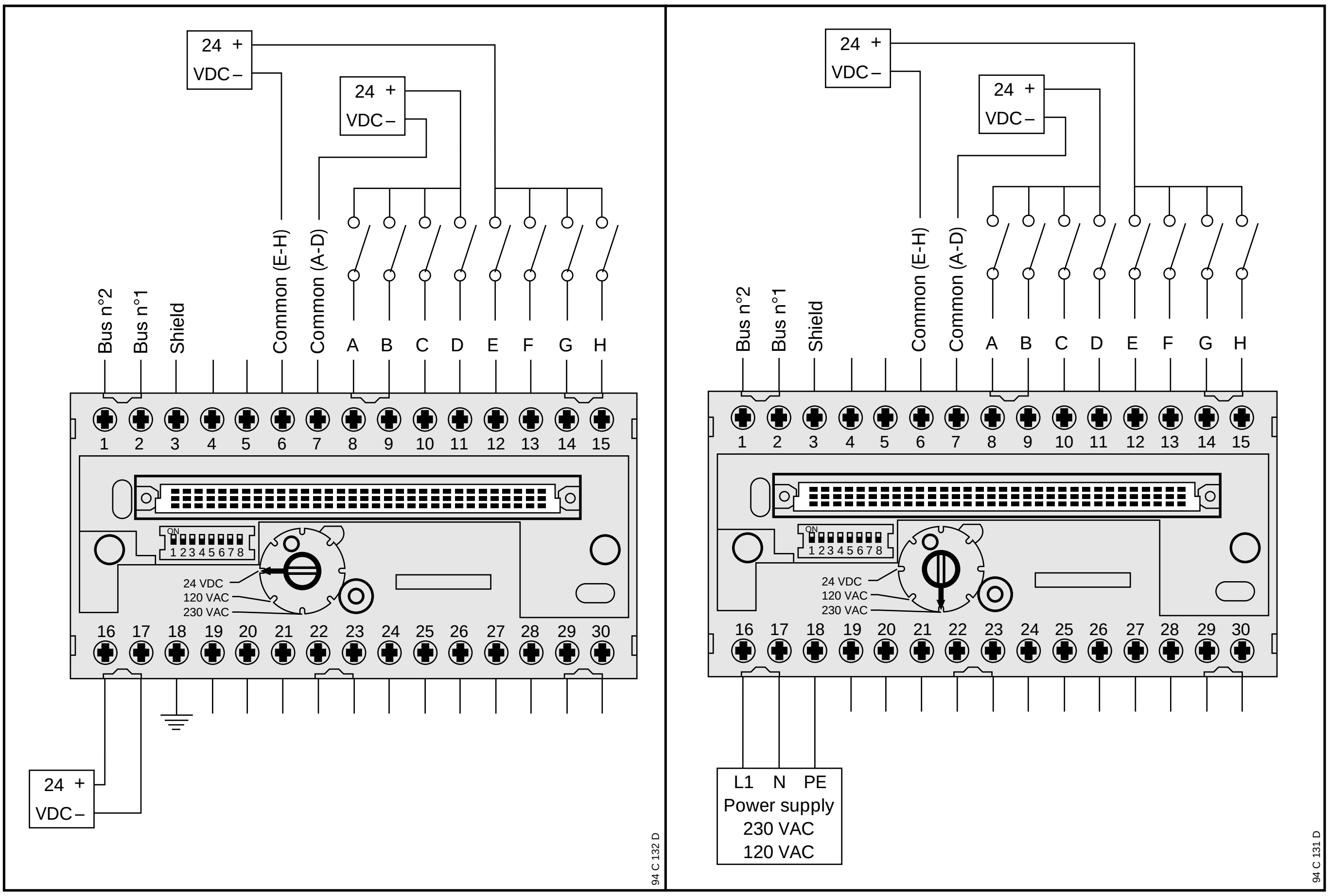
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	yes (1500VAC)	yes (1500 VAC)
Supply output regulated 24 VDC (± 5 %)	-	-
Signal level of the input, nominal value	24 VDC	24 VDC
Signal level of the input :		
0 signal	–3 to +5V	–3 to +5V
1 signal	+15 to +30V	+15 to +30V
Open circuit detection	-	-
Input current for 24 VDC	12 mA	12 mA
Input delay (*)	2 to 32 ms	2 to 32 ms
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.5 W	8 W
Order number : FPR 331 6101	R1012	R0016/R0014
Weight (kg)	0.25	0.43

(*) This time can be changed, factory setting 8 ms.

Note : After the input delay,the effective value is 5 ms higher than the selected value.

- **Electrical connection**

Power supply 24 VDC **Power supply 230 VAC and 120 VAC**



Note : In case of use of only one external power supply 24 VDC for inputs, the different communs have to be connected together and to the 0 VDC of the power supply.

- **Initialization**

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 8 inputs is displayed on the 8 led's.

● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT						
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 62		00 … 63		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	ON	OFF	ON	OFF
Input	A	Exx, 00	Exx,08	Exx, 00	Exx, 08	Ixx00
	B	Exx, 01	Exx,09	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx,10	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx,11	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx,12	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx,13	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx,14	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx,15	Exx, 07	Exx, 15	Ixx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 07 CS 91, refer to their own description

The available configuration for each input :
– delay

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"

The status of an input channel is shown by :

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.1.3 ICSI 08 E3/E4 Binary Input remote unit

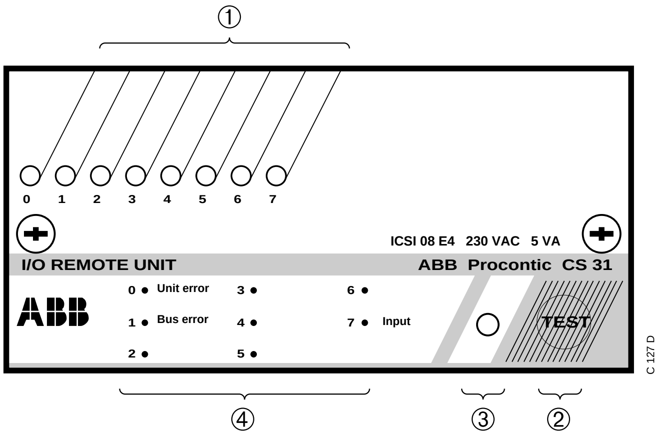
8 isolated inputs 120/230 VAC

Binary isolated input unit with 8 input channels for 120 VAC or 230 VAC.
Type E3 : isolated inputs 120 VAC
Type E4 : isolated inputs 230VAC

Description of the unit front :

- Eight yellow input status led's «0» to «7» .... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes.. ④

The unit has to be mounted on a plug-in base ECZ



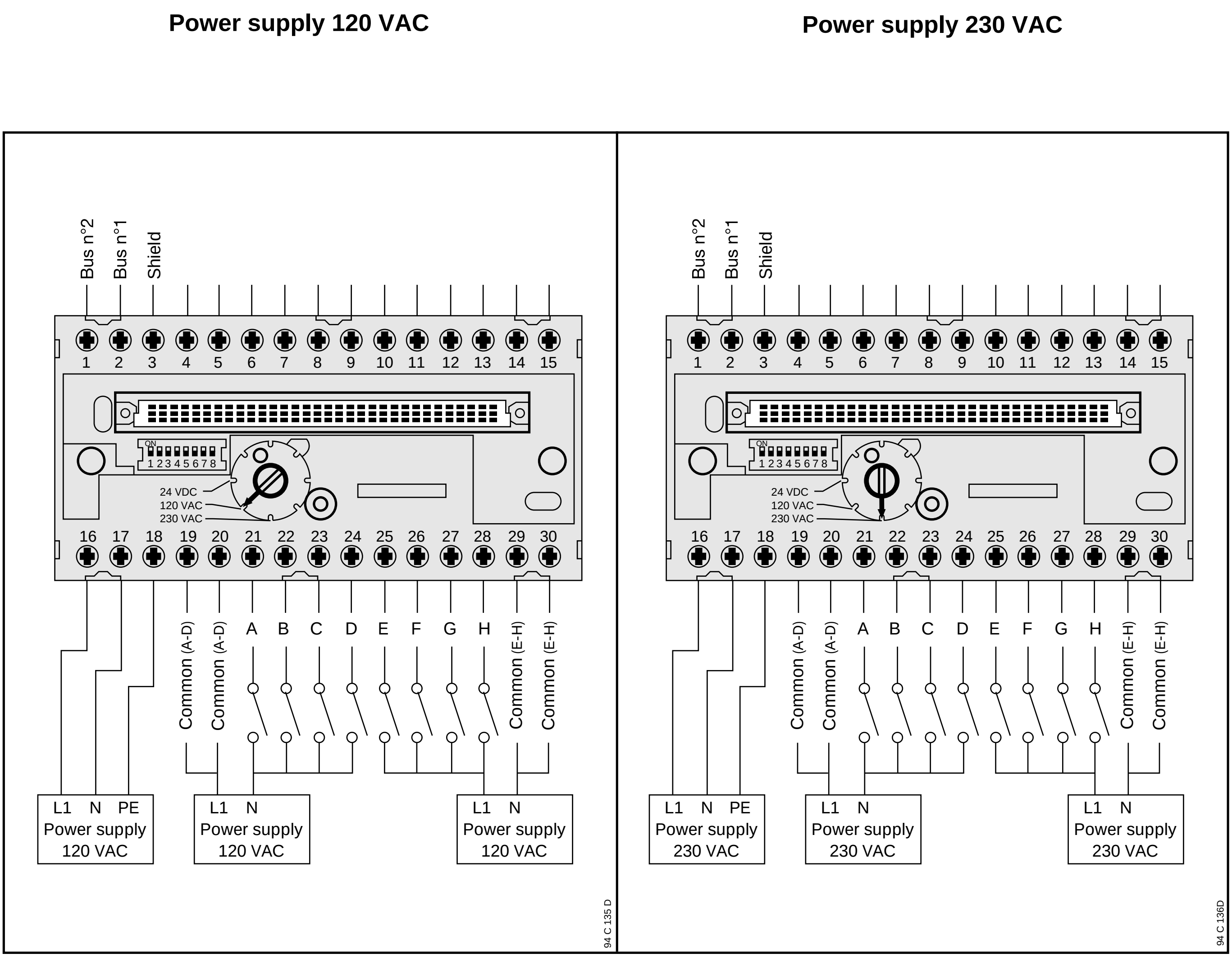
8 inputs per unit

TECHNICAL CHARACTERISTICS		
Power supply	120 VAC	230 VAC
Number of inputs per unit	8	8
Power supply isolation	yes(1500 VAC)	yes (1500 VAC)
Inputs opto-isolated	yes(1500 VAC)	yes(1500 VAC)
Supply output regulated 24 VDC (± 5 %)	-	-
Signal level of the input, nominal value	120 VAC	230 VAC
Signal level of the input :		
0 signal	0 to 20 V	0 to 40 V
1 signal	79 to 132 V	159 to 242 V
Open circuit detection	no	no
Input current	3.2 mA	6.5 mA
Input delay (*)	2 to 32 ms	2 to 32 ms
Maximum power consumption	5 VA	5VA
Maximum power dissipation	6 W	6W
Order number : FPR 331 6301	R0014	
FPR 331 6401		R0016
Weight (kg)	0.43	0.43

(*) This time can be changed, factory setting 10ms.

Note : After the input delay,the effective value is 10 ms higher than the selected value.

• Electrical connection



• Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 8 inputs is displayed on the 8 led's.

- **Utilization**

VARIABLES USED IN THE CENTRAL UNIT						
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 62		00 … 63		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	ON	OFF	ON	OFF
Input	A	Exx, 00	Exx,08	Exx, 00	Exx, 08	Ixx00
	B	Exx, 01	Exx,09	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx,10	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx,11	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx,12	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx,13	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx,14	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx,15	Exx, 07	Exx, 15	Ixx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

The available configuration for each input :
– delay

- **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"

The status of an input channel is shown by :

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.1.4 ICSI 16 D1 Binary Input remote unit

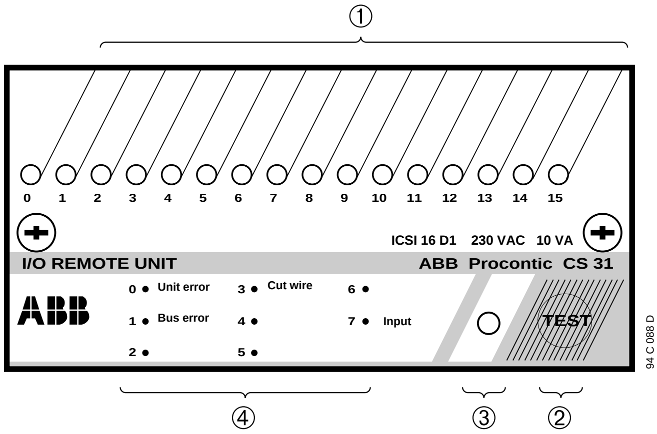
16 non isolated inputs 24 VDC

Binary non isolated input unit with 16 input channels for 24 VDC.

Description of the unit front :

- Sixteen yellow input status led's «0» to «15» .... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes .... ④

The unit has to be mounted on a plug-in base ECZ



16 inputs per unit

TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	16	16
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	no	no
Supply output regulated 24 VDC (± 5 %)	-	100 mA
Signal level of the input, nominal value	24 VDC	24 VDC
Signal level of the input : 0 signal 1 signal	 –3 to +5V +15 to +30V	 –3 to +5V +15 to +30V
Open circuit detection	yes (**)	yes (**)
Input current for 24 VDC	6 mA	6 mA
Input delay (*)	2 to 32 ms	2 to 32 ms
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.5 W	8 W
Order number : FPR 331 5101	R1032	R0036/R0034
Weight (kg)	0.25	0.43

(*) This time can be changed, factory setting 8 ms.
(**) Open circuit will not be detected with factory setting. Enable with TCZ terminal (see Chapter 9, Volume 2 «**In case of failure**»).

● Electrical connection

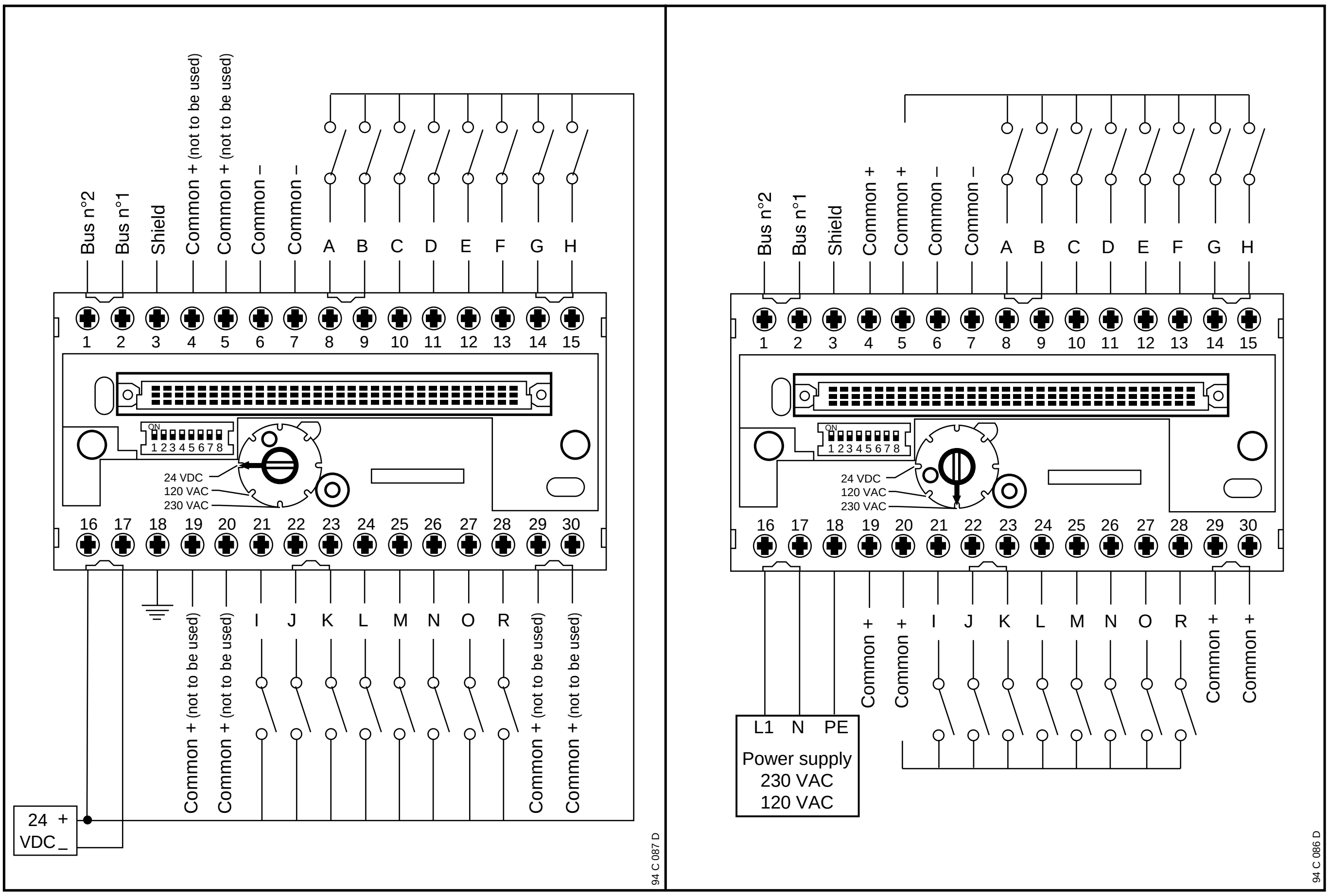
The common "**+**" terminals are connected together and never have to be connected to the 24 VDC.

Power supply 24 VDC

The common "**+**" must not be used.

Power supply 230 VAC and 120 VAC

The common "**+**" can supply the inputs with 24 VDC.



Note : In case of use of an external power supply 24 VDC for inputs, the "**0**" VDC has to be connected to the common "**–**".
Caution : the 24 VDC must never be connected to the common "**+**".

● Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 16 inputs is displayed on the 16 led's.

● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT					
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 61	00 … 62		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	OFF	ON	OFF
Input	A	Exx, 00	Exx, 00	Exx, 08	Ixx00
	B	Exx, 01	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx, 07	Exx, 15	Ixx07
	I	Exx, 08	Exx+1, 00	Exx+1, 08	Ixx08
	J	Exx, 09	Exx+1, 01	Exx+1, 09	Ixx09
	K	Exx, 10	Exx+1, 02	Exx+1, 10	Ixx10
	L	Exx, 11	Exx+1, 03	Exx+1, 11	Ixx11
	M	Exx, 12	Exx+1, 04	Exx+1, 12	Ixx12
	N	Exx, 13	Exx+1, 05	Exx+1, 13	Ixx13
	O	Exx, 14	Exx+1, 06	Exx+1, 14	Ixx14
	P	Exx, 15	Exx+1, 07	Exx+1, 15	Ixx15

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 07 CS 91, refer to their own description

The available configuration for each input :
– delay
– open circuit detection

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 3 : "**Cut wire**"

The status of an input channel is shown by :

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.1.5 ICSI 16 E1 Binary Input remote unit

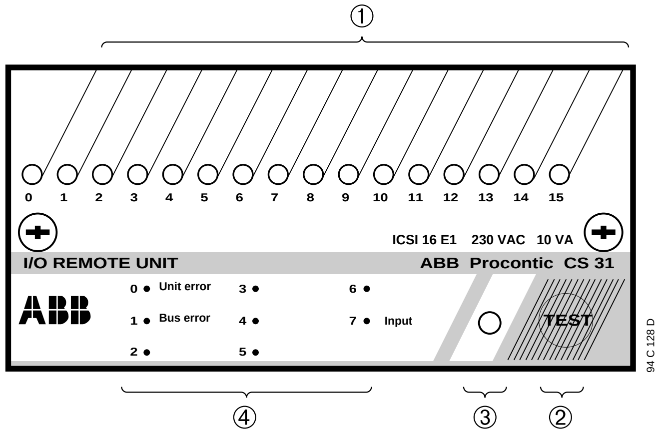
16 isolated inputs 24 VDC

Binary isolated input unit with16 input channels for 24 VDC.

Description of the unit front :

- Sixteen yellow input status led's «0» to «15» .... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes.. ④

The unit has to be mounted on a plug-in base ECZ



16 inputs per unit

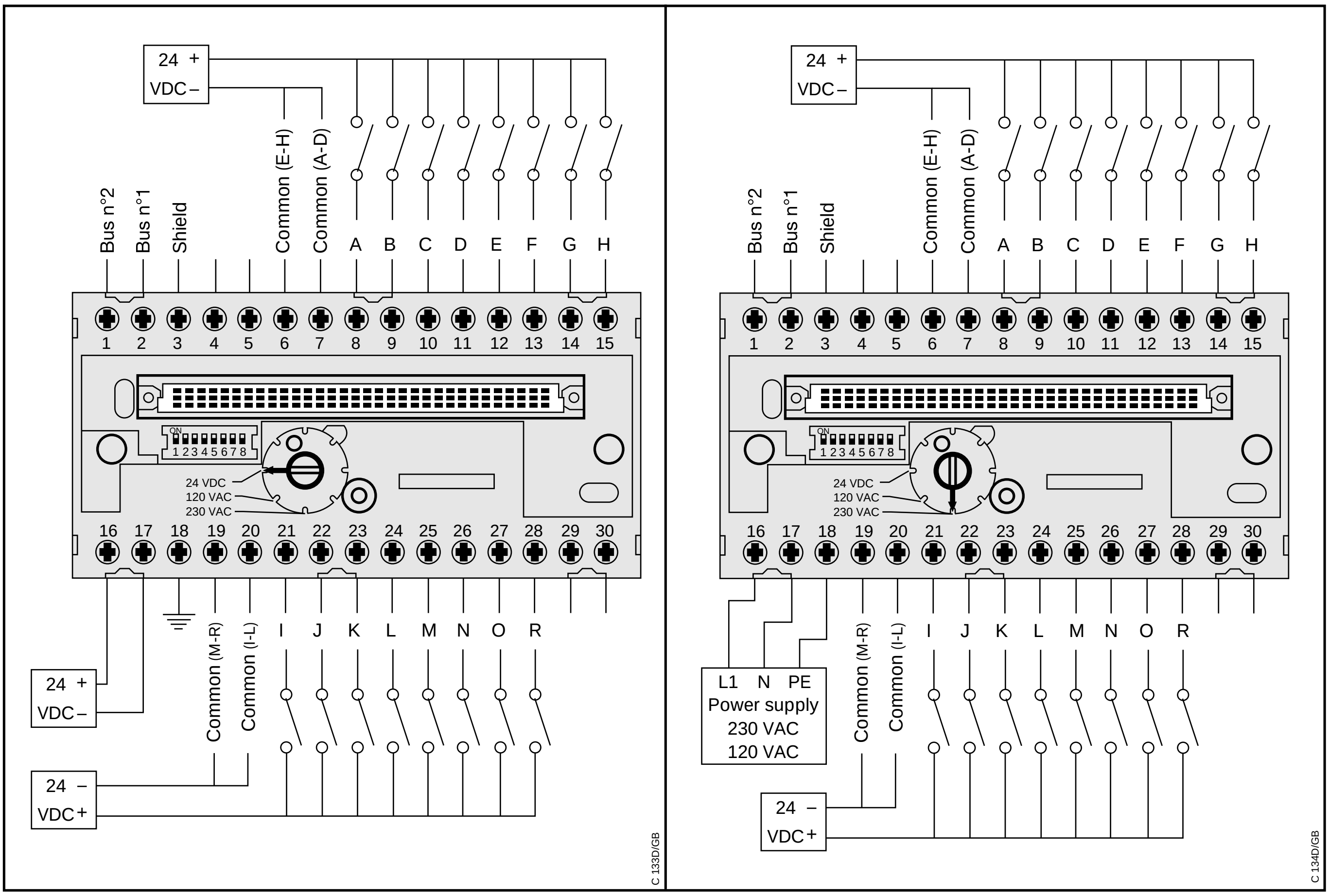
TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	16	16
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	yes(1500VAC)	yes(1500VAC)
Supply output regulated 24 VDC (± 5 %)	-	-
Signal level of the input, nominal value	24 VDC	24 VDC
Signal level of the input :		
0 signal	–3 to +5V	–3 to +5V
1 signal	+15 to +30V	+15 to +30V
Open circuit detection	-	-
Input current for 24 VDC	6 mA	6 mA
Input delay (*)	2 to 32 ms	2 to 32 ms
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.5 W	8 W
Order number : FPR 331 6101	R1032	R0036/R0034
Weight (kg)	0.25	0.43

(*) This time can be changed, factory setting 8 ms.

Note : After setting the input delay,the effective value is 5 ms higher than the selected value.

• Electrical connection

Power supply 24 VDC **Power supply 230 VAC and 120 VAC**



Note : In case of use of only one external power supply 24 VDC for inputs, the different communs have to be connected together and to the O VDC of the power supply.

• Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 16 inputs is displayed on the 16 led's.

● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT					
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 61	00 … 62		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	OFF	ON	OFF
Input	A	Exx, 00	Exx, 00	Exx, 08	Ixx00
	B	Exx, 01	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx, 07	Exx, 15	Ixx07
	I	Exx, 08	Exx+1, 00	Exx+1, 08	Ixx08
	J	Exx, 09	Exx+1, 01	Exx+1, 09	Ixx09
	K	Exx, 10	Exx+1, 02	Exx+1, 10	Ixx10
	L	Exx, 11	Exx+1, 03	Exx+1, 11	Ixx11
	M	Exx, 12	Exx+1, 04	Exx+1, 12	Ixx12
	N	Exx, 13	Exx+1, 05	Exx+1, 13	Ixx13
	O	Exx, 14	Exx+1, 06	Exx+1, 14	Ixx14
	P	Exx, 15	Exx+1, 07	Exx+1, 15	Ixx15

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

The available configuration for each input :
– delay

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"

The status of an input channel is shown by :

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.2.1 ICSO 08 R1 Binary Output remote unit

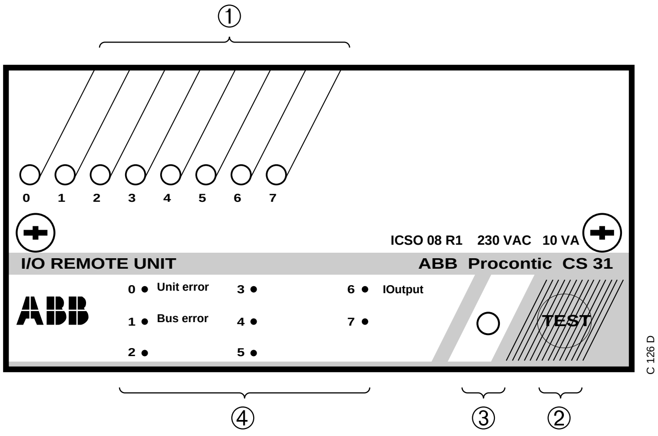
8 relay outputs 2A

Binary output unit with 8 relay output channels 2 A.

Description of the unit front :

- Eight yellow output status led's «0» to «7».............. ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes.. ④

The unit has to be mounted on a plug-in base ECZ



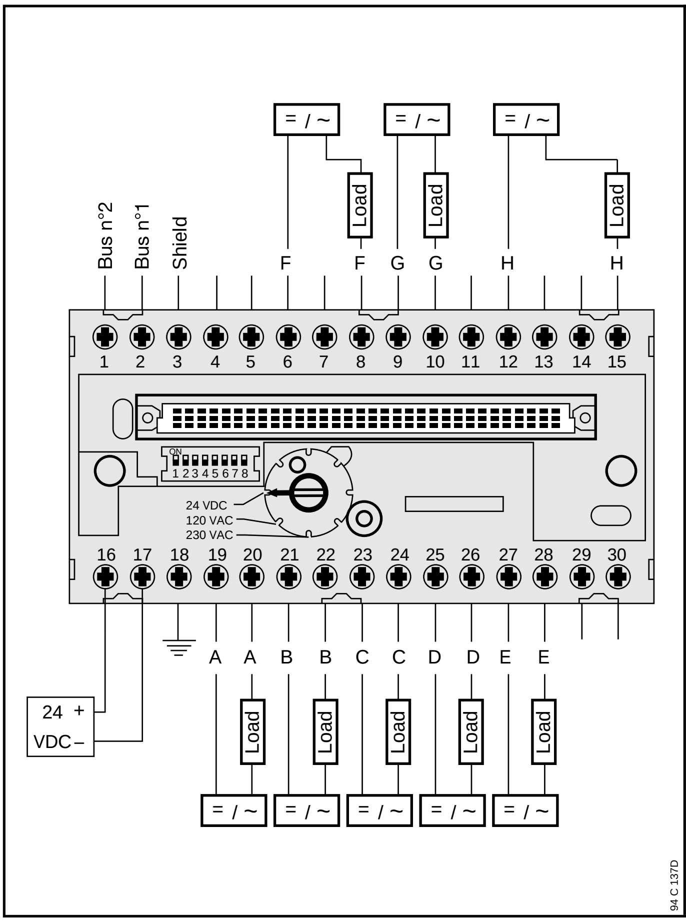
8 outputs per unit

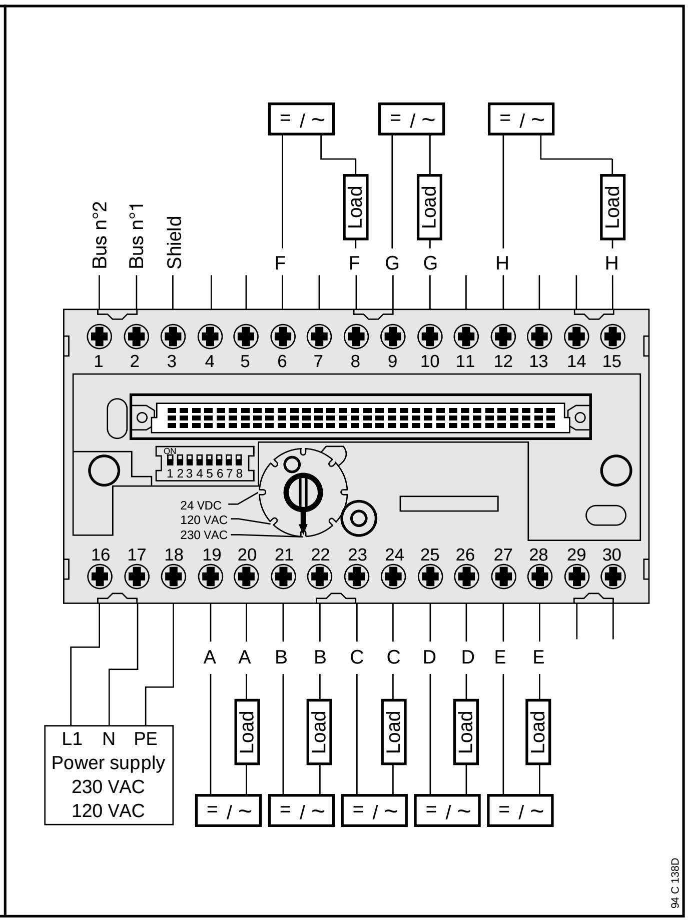
TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of outputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Outputs isolated	yes (1500 VAC)	yes (1500 VAC)
Switching capacity 120/230 AC DC	 2 A 60 W (2A)	 2 A 60 W (2A)
Load current,nominal value	2 A AC-1 1 A AC-3	2 A AC-1 1 A AC-3
Minimum values	12 VDC 10 mA	12 VDC 10 mA
Total current for 8 outputs	16 A	16 A
Short circuit shutdown	no	no
Limit of the inductive shutdown voltage	Varistor	Varistor
Maximum power consumption	0.2 A	6VA
Maximum power dissipation	5 W	5 W
Order number : FPR 331 2101	R1012	R0016/R0014
Weight (kg)	0.25	0.43

• Electrical connection

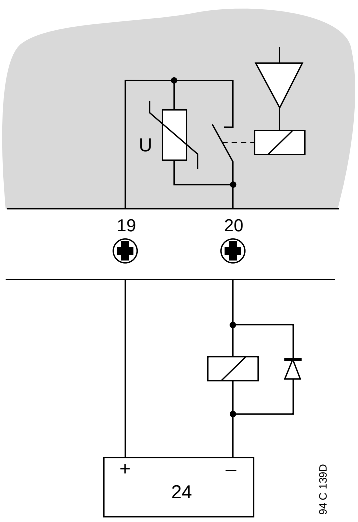
Power supply 24 VDC

Power supply 230 VAC and 120 VAC





Note : In case of inductive load with a DC current, a free wheele diode Has to be mounted in parallel of the load according the following example for the output A :



• Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 8 outputs is displayed on the 8 led's.

● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT						
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 62		00 … 63		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	ON	OFF	ON	OFF
Output	A	Axx, 00	Axx,08	Axx, 00	Axx, 08	Oxx00
	B	Axx, 01	Axx,09	Axx, 01	Axx, 09	Oxx01
	C	Axx, 02	Axx,10	Axx, 02	Axx, 10	Oxx02
	D	Axx, 03	Axx,11	Axx, 03	Axx, 11	Oxx03
	E	Axx, 04	Axx,12	Axx, 04	Axx, 12	Oxx04
	F	Axx, 05	Axx,13	Axx, 05	Axx, 13	Oxx05
	G	Axx, 06	Axx,14	Axx, 06	Axx, 14	Oxx06
	H	Axx, 07	Axx,15	Axx, 07	Axx, 15	Oxx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"

The status of an output channel is shown by :

Led 6 : "**Output**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.2.2 ICSO 08 Y1 — Binary Output remote unit

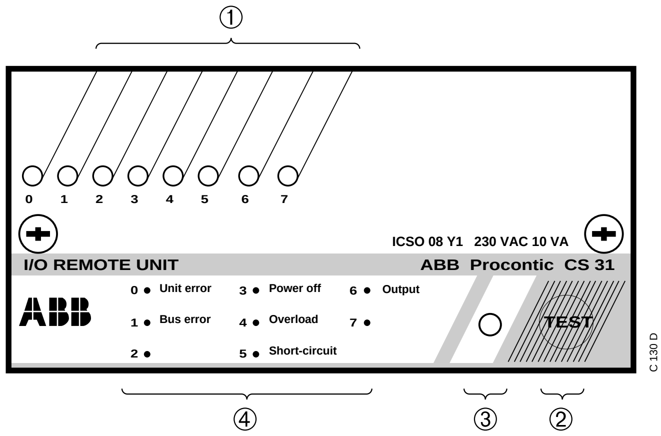
8 outputs 24 VDC 2A

Binary output unit with 8 transitor output channels 24 VDC 2 A.

Description of the unit front :

- Eight yellow output status led's «0» to «7» .... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes .... ④

The unit has to be mounted on a plug-in base ECZ

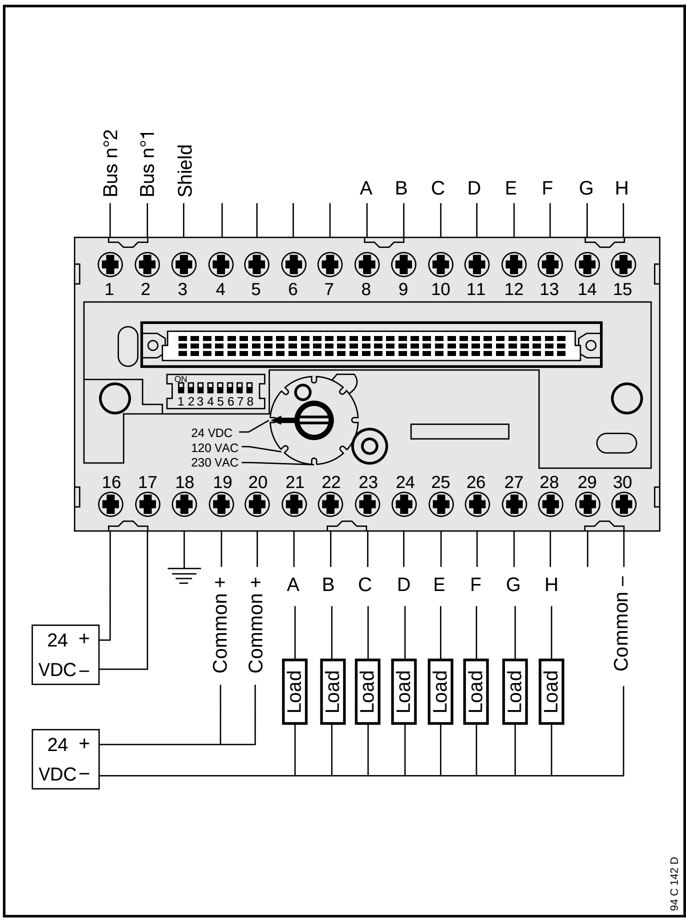


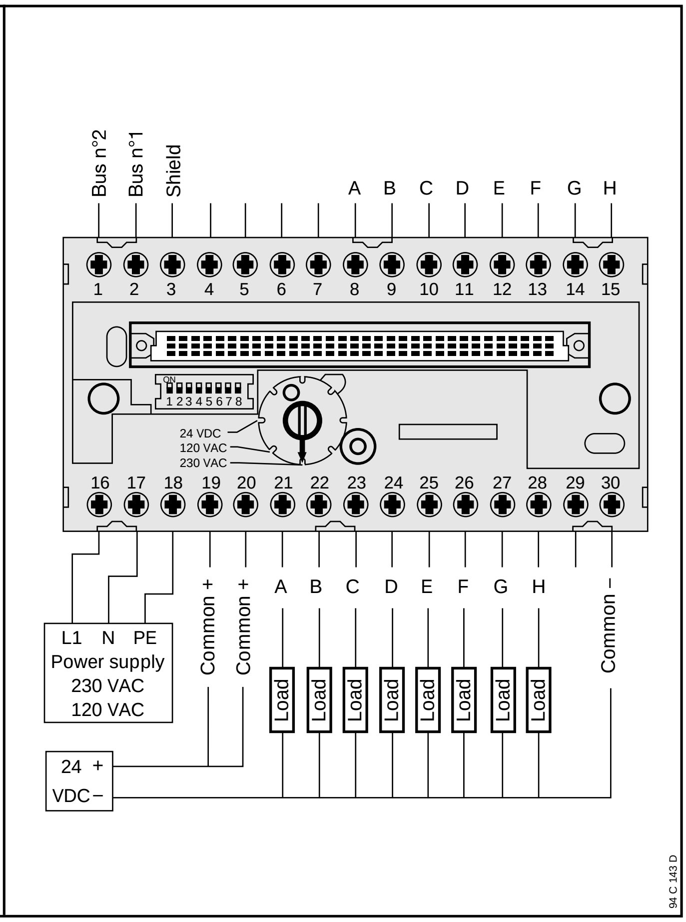
8 outputs per unit

TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of outputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Outputs opto-isolated	yes(1500VAC)	yes(1500 VAC)
Maximum current	2 A AC1	2 A AC1
Leackage current	4 mA	4 mA
Total current for the 8 outputs	8 A	8 A
Short circuit protection for each output	yes	yes
Overload thermal protection for each output	yes	yes
Maximum power consumption	0.2 A	6VA
Maximum power dissipation	6 W	8 W
Order number : FPR 331 1101	R1022	R0026/R0024
Weight (kg)	0.25	0.43

- **Electrical connection**

Power supply 24 VDC **Power supply 230 VAC and 120 VAC**





- **Initialization**

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 8 outputs is displayed on the 8 led's.

- **Utilization**

VARIABLES USED IN THE CENTRAL UNIT						
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 62		00 … 63		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	ON	OFF	ON	OFF
Output	A	Axx, 00	Axx,08	Axx, 00	Axx, 08	Oxx00
	B	Axx, 01	Axx,09	Axx, 01	Axx, 09	Oxx01
	C	Axx, 02	Axx,10	Axx, 02	Axx, 10	Oxx02
	D	Axx, 03	Axx,11	Axx, 03	Axx, 11	Oxx03
	E	Axx, 04	Axx,12	Axx, 04	Axx, 12	Oxx04
	F	Axx, 05	Axx,13	Axx, 05	Axx, 13	Oxx05
	G	Axx, 06	Axx,14	Axx, 06	Axx, 14	Oxx06
	H	Axx, 07	Axx,15	Axx, 07	Axx, 15	Oxx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

- **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 3 : "**Power off**"
Led 4 : "**Overload**"
Led 5 : "**Short-circuit**"

The status of an output channel is shown by :

Led 6 : "**Output**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.2.3 ICSO 16 N1 — Binary Output remote unit

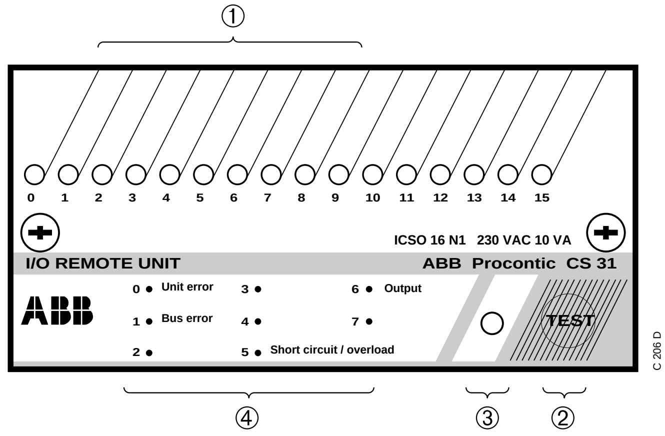
16 outputs 24 VDC 0.5A

Binary output unit with 16 transitor output channels 24 VDC 0.5A.

Description of the unit front :

- Sixteen yellow output status led's «0» to «15» .... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes .... ④

The unit has to be mounted on a plug-in base ECZ

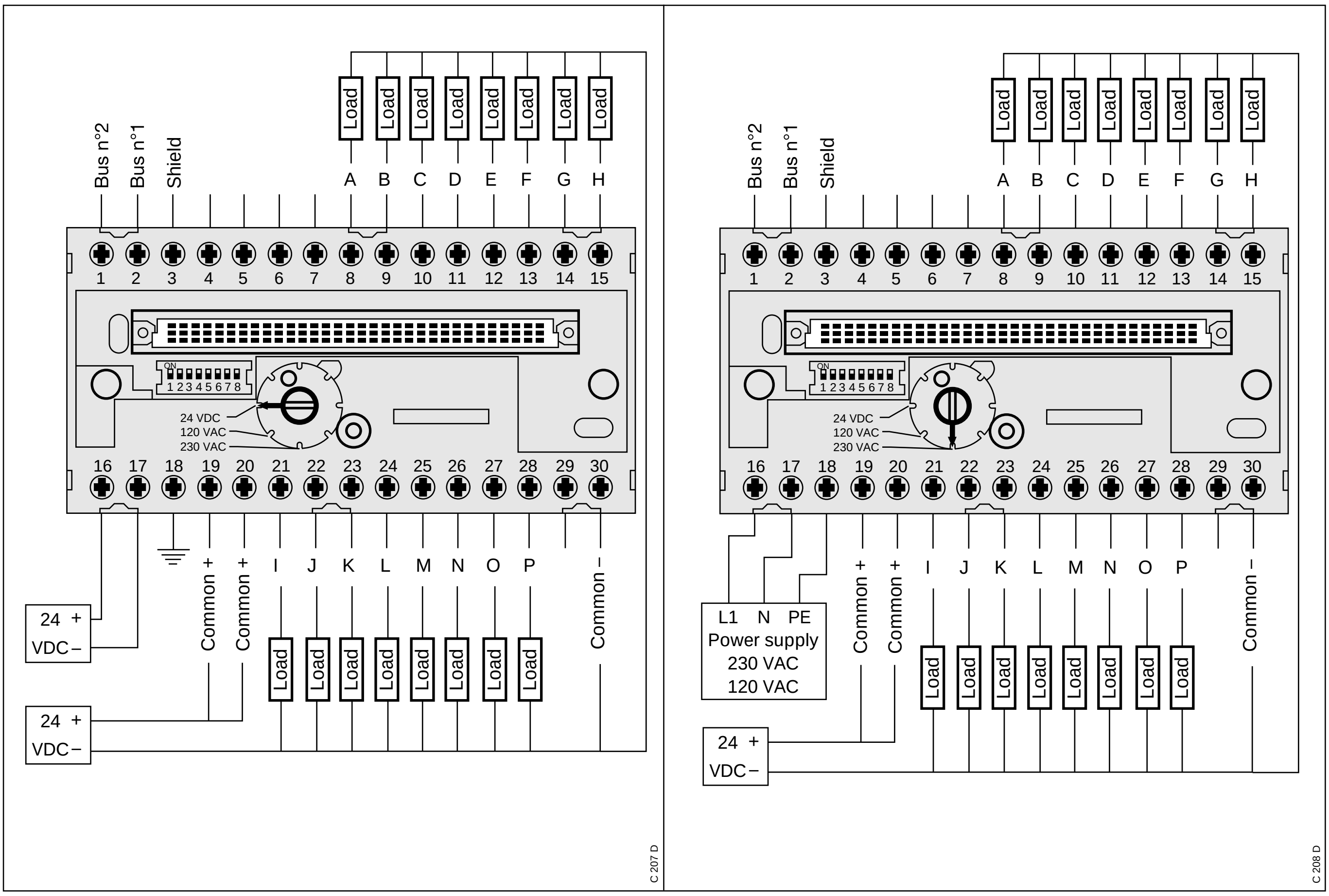


16 outputs per unit

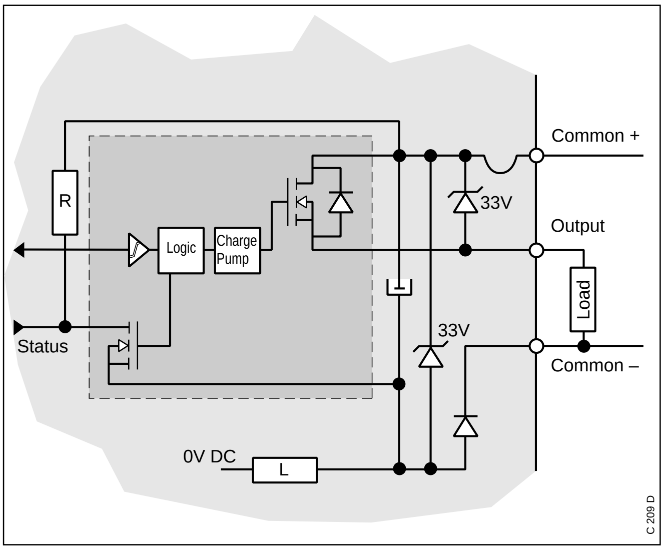
TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of outputs per unit	16	16
Power supply isolation	no	yes (1500 VAC)
Outputs opto-isolated	no	no
Maximum current	0.5 A	0.5 A
Total current for the 16 outputs	8 A	8 A
Short circuit protection for each output	yes	yes
Overload thermal protection for each output 2 A with 25 °C ambient 1.5 A with 55 °C ambient	yes	yes
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	6 W	8 W
Order number : FPR 331 3101	R1052	R0056/R0054
Weight (kg)	0.25	0.43

- **Electrical connection**

Power supply 24 VDC **Power supply 230 VAC and 120 VAC**



Electric schema for a transistor output



Note :

The both commun + terminals have to be connected to garanty a right diagnosis function.

If the common + terminals are not connected to an external power supply 24 VDC, the corresponding outputs are reset to 0.

– A free wheel diode is not necessary because the protection is integrated into the transistor component.

– An external thermal fuse max. 10 A has to be connected between the common + terminals and the 24 VDC to avoid damage in case of use of a lot of overload outputs.

- **Initialization**

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 16 outputs is displayed on the 16 led's.

• **Utilization**

VARIABLES USED IN THE CENTRAL UNIT					
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 61	00 … 63		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	OFF	ON	OFF
Output	A	Axx, 00	Axx, 00	Axx, 08	Oxx00
	B	Axx, 01	Axx, 01	Axx, 09	Oxx01
	C	Axx, 02	Axx, 02	Axx, 10	Oxx02
	D	Axx, 03	Axx, 03	Axx, 11	Oxx03
	E	Axx, 04	Axx, 04	Axx, 12	Oxx04
	F	Axx, 05	Axx, 05	Axx, 13	Oxx05
	G	Axx, 06	Axx, 06	Axx, 14	Oxx06
	H	Axx, 07	Axx, 07	Axx, 15	Oxx07
	I	Axx, 08	Axx + 1, 00	Axx + 1, 08	Oxx08
	J	Axx, 09	Axx + 1, 01	Axx + 1, 09	Oxx09
	K	Axx, 10	Axx + 1, 02	Axx + 1, 10	Oxx10
	L	Axx, 11	Axx + 1, 03	Axx + 1, 11	Oxx11
	M	Axx, 12	Axx + 1, 04	Axx + 1, 12	Oxx12
	N	Axx, 13	Axx + 1, 05	Axx + 1, 13	Oxx13
	O	Axx, 14	Axx + 1, 06	Axx + 1, 14	Oxx14
	P	Axx, 15	Axx + 1, 07	Axx + 1, 15	Oxx15

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

• **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 3 : "**Power off**"
Led 5 : "**Short-circuit or Overload**"

The status of an output channel is shown by :

Led 6 : "**Output**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.3.1 ICSK 20 F1 Binary Input/Output remote unit

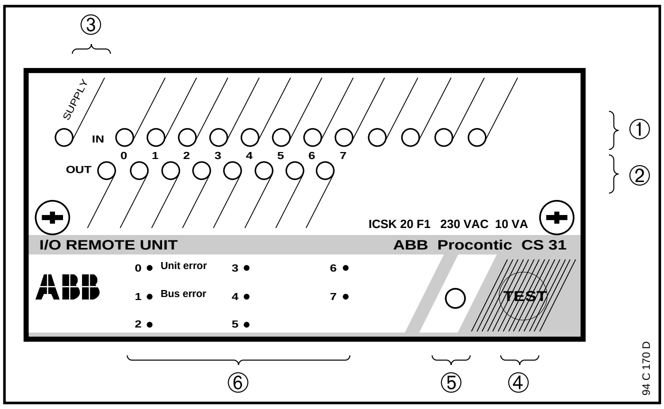
12 inputs 24 VDC / 8 relay outputs

Binary input/output unit with 12 input channels for 24 VDC and 8 relay output channels..

Description of the unit front :

- Twelwe yellow input status led's «0» to «11» .... ①
- Eight yellow output status led's «0» to «7» .... ②
- One green led labelled "Supply" to indicate the presence of the supply .... ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes .... ⑥

The unit has to be mounted on a plug-in base ECZ



12 inputs/8 relay outputs per unit

GENERAL CHARACTERISTICS

Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	12	12
Number of outputs per unit	8	8
Isolated power supply	no	yes (1500 VAC)
Maximum consumption	0.3 A	10 VA
Order number FPR 3327101	R 1202	R 0206/R 0204
Weight (kg)	0.25	0.43

INPUT CHARACTERISTICS

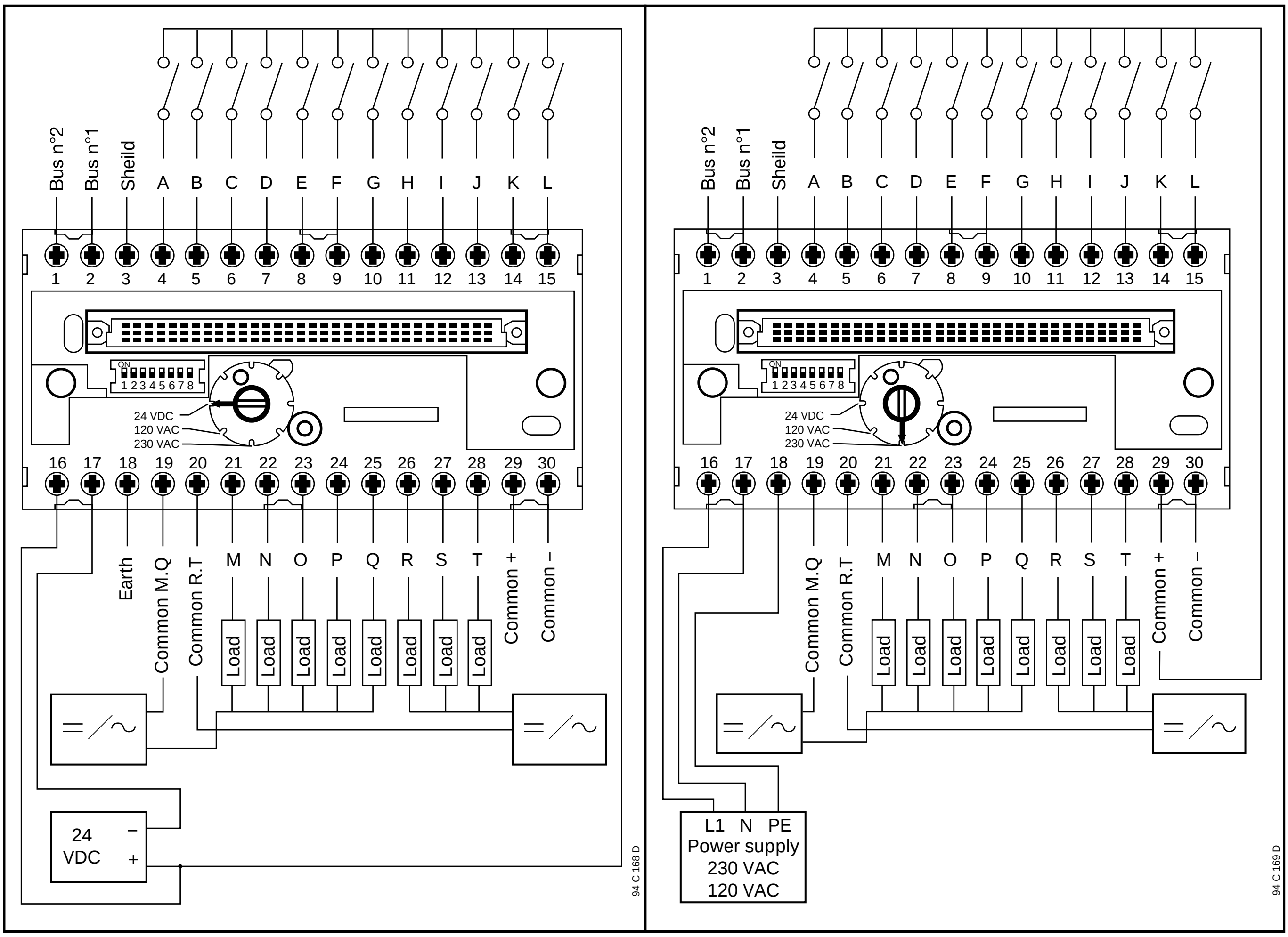
Signal level of the input, nominal value	24 VDC	24 VDC
Opto isolated inputs	no	no
Signal level of the inputs, nominal value	24 VDC	24 VDC
Signal level of the input 0 signal 1 signal	 –3 to +5V +15 to +30V	 –3 to +5V +15 to +30V
Input current for 24 VDC	5 mA	5 mA
Input delay (*)	5 ms	5 ms

(*) This delay can't be modified

OUTPUT CHARACTERISTICS		
Isolated	yes	yes
Switching capacity under 2 A (resistive or inductive load)		
120/230 VAC 50/60Hz	2 A	2 A
DC	60 W (2 A)	60 W (2 A)
Nominal current	2 A AC-1 1 A AC-3	2 A AC-1 1 A AC-3
Minimum power for the contacts	12 VDC	12 VDC
10 mA	10 mA	
Supply output 24 VDC 100 mA	no	yes
Total curent		
Common M-Q		
120/230 VAC 50/60Hz	6 A	6 A
24 VDC	6 A	6 A
Common R-T		
120/230 VAC 50/60Hz	4 A	4 A
24 VDC	4 A	4 A
Short-circuit protection	no	no
Over voltage protection	Varistor	Varistor

● **Electrical connection**

Power supply 24 VDC **Power supply 230 VAC and 120 VAC**



Note :
The internal 24 VDC (100 mA) power supply is only available for the 230 VAC/120 VAC versions. This power is used to power the inputs.

In case of the 24 VDC version, the 0 V of the second external power supply has to be connected to the common "–".

● **Initialization**

After configured and wired the unit :
– the unit initializes itself after power **On**.
– the error led goes out after initialization.
– the status of inputs/outputs is displayed on the 20 led's.

● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT					
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 61	00 … 62		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	OFF	ON	OFF
Input	A	Exx, 00	Exx, 00	Exx, 08	Ixx00
	B	Exx, 01	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx, 07	Exx, 15	Ixx07
	I	Exx, 08	Exx+1, 00	Exx+1, 08	Ixx08
	J	Exx, 09	Exx+1, 01	Exx+1, 09	Ixx09
	K	Exx, 10	Exx+1, 02	Exx+1, 10	Ixx10
	L	Exx, 11	Exx+1, 03	Exx+1, 11	Ixx11
Output					
	M	Axx, 00	Axx, 00	Axx, 08	Oxx00
	N	Axx, 01	Axx, 01	Axx, 09	Oxx01
	O	Axx, 02	Axx, 02	Axx, 10	Oxx02
	P	Axx, 03	Axx, 03	Axx, 11	Oxx03
	Q	Axx, 04	Axx, 04	Axx, 12	Oxx04
	R	Axx, 05	Axx, 05	Axx, 13	Oxx05
	S	Axx, 06	Axx, 06	Axx, 14	Oxx06
	T	Axx, 07	Axx, 07	Axx, 15	Oxx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

The available configuration for each chanel :
– none

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"

The status of an input channel is shown by :

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.3.2 ICSC 08 L1 Binary Input/Output remote unit

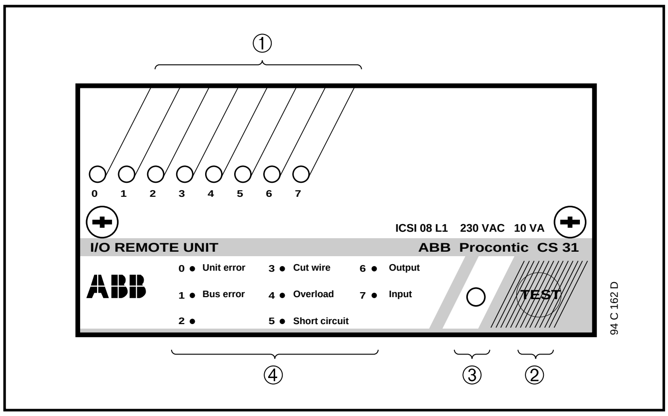
8 user configurable inputs/outputs

Binary input/output unit with 8 channels.
The function of each channel can be selected :
– as a 24 VDC input or
– as a 24 VDC 500 mA transistor output

Description of the unit front :

- Eight yellow input/output status led's «0» to «7» ..... ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes.. ④

The unit has to be mounted on a plug-in base ECZ



8 inputs/outputs per unit

TECHNICAL CHARACTERISTICS

Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8 max.	8 max.
Number of outputs per unit	8 max.	8 max.
Power supply isolation	no	1500 VAC
Maximum power consumption without load on the outputs	0.2 A	10 VA
Maximum power dissipation	6 W	8 W
Order number : FPR 331 9101	R1082	R0086/R0084
Weight (kg)	0.25	0.43

SPECIFICATIONS		
Specifications of the inputs		
Signal level, nominale value	24 VDC	24 VDC
Input opto-isolated	no	no
Signal level of the input 0 signal 1 signal	 – 3 V to + 5 V + 15 V to + 30 V	 – 3 V to + 5 V + 15 V to + 30 V
Open circuit detection	yes (**)	yes (**)
Input current, nominal value (under 24 VDC)	6 mA	6 mA
Input delay (*)	2 to 32 ms	2 to 32 ms
Specifications of outputs		
Process supply	24 VDC	24 VDC
Output opto-isolated	no	no
Maximum voltage drop under nominal load	3 V	3 V
Residual current for 0 signal	< 1 mA	< 1 mA
Switching frequency with inductive loads	max. 0.1 Hz	max. 0.1 Hz
Maximum current	0.5 A	0.5 A
Lamp loads	5 W	5 W
Total current for 8 outputs	max. 2 A	max. 2 A
Short-circuit protection (I > 2 A)	yes	yes
Overload protection (I > 0.6 A, t > 250 ms)	 yes	 yes
Open circuit detection (I < 50 mA)	yes (**)	yes (**)

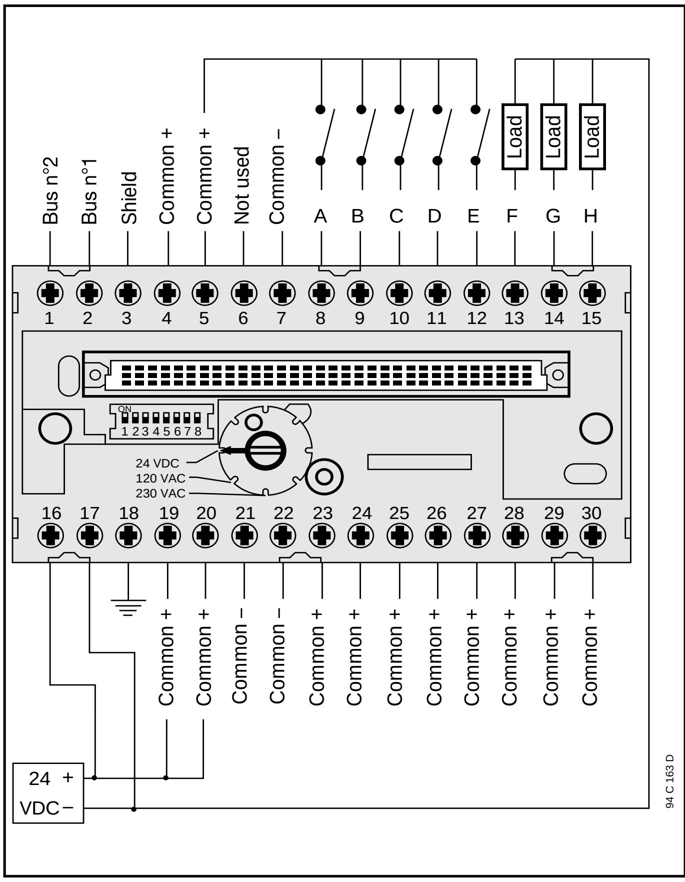
(*) This time can be changed, factory setting 8 ms.
(**) By factory setting, open circuit will not be detected.
Enable with TCZ terminal (see chapter 9, volume 2 «**In case of failure**»).

● **Electrical connection**

An external power supply is necessary if the outputs are used and in this case the **common + terminal musn't be disconnected** to the 24 VDC power supply.

Power supply 24 VDC

Example of electrical connections with 5 inputs and 3 outputs.

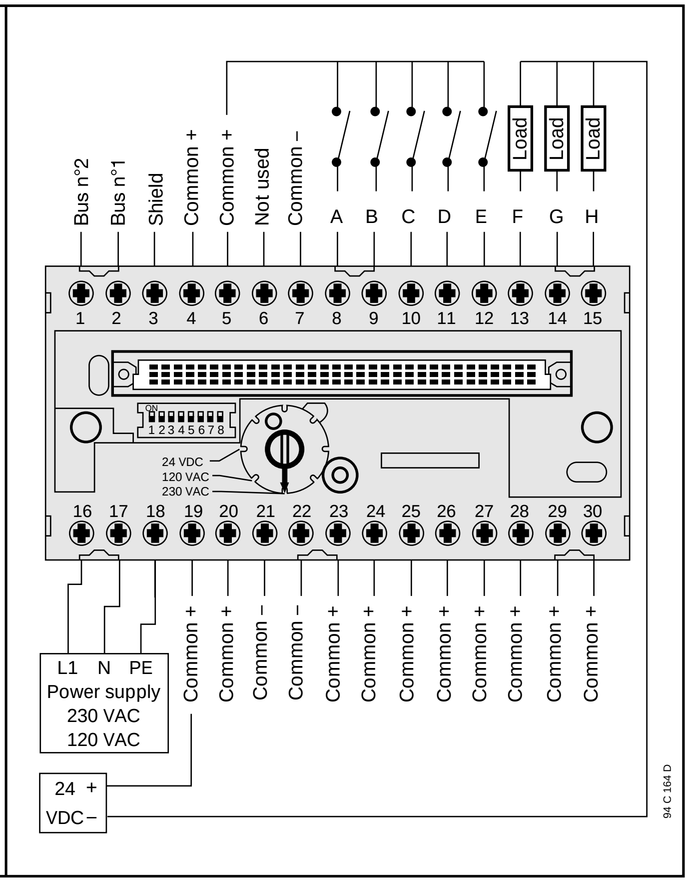


Note : Almost one common + has to be connected to the power supply. When switching high current loads, use many commun + terminal to avoid damage to the base.

Warning : For a version dated before 01/92, the terminals 4 and 5 have not be used.

Power supply 230 VAC and 120 VAC

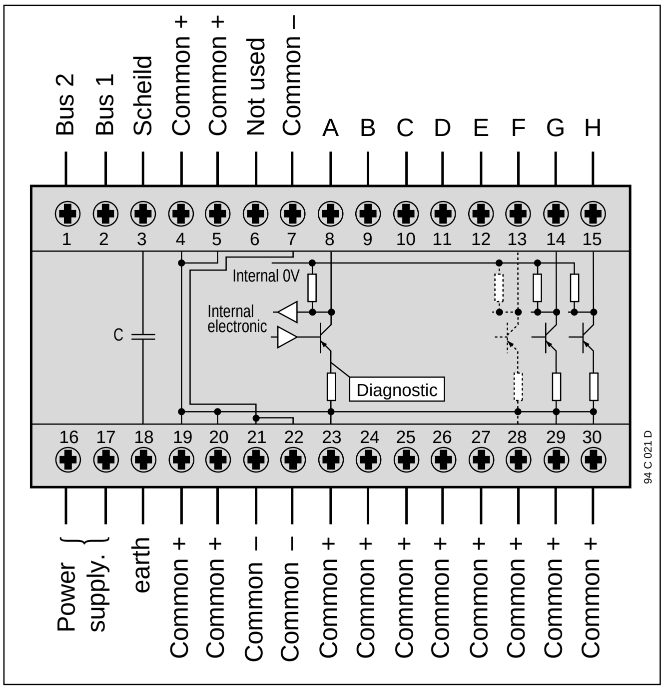
Example of electrical connections with 5 inputs and 3 outputs.



Note : In case of use of an external power supply 24 V DC for inputs, the "**24**" V DC has to be connected to the common "**+**".

Caution : if the 24 V DC is connected to common "**+**", the remote unit can be supplied by the external power supply even if the main power supply is **OFF**.

Internal connection



● Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 8 inputs is displayed on the 8 led's.

● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT						
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 61		00 … 62		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	OFF	OFF	ON	OFF
Input	A	Exx, 00	Exx,08	Exx, 00	Exx, 08	Ixx08
	B	Exx, 01	Exx,09	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx,10	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx,11	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx,12	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx,13	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx,14	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx,15	Exx, 07	Exx, 15	Ixx07
Output	A	Axx, 00	Axx,08	Axx, 00	Axx, 08	Oxx08
	B	Axx, 01	Axx,09	Axx, 01	Axx, 09	Oxx01
	C	Axx, 02	Axx,10	Axx, 02	Axx, 10	Oxx02
	D	Axx, 03	Axx,11	Axx, 03	Axx, 11	Oxx03
	A	Axx, 04	Axx,12	Axx, 04	Axx, 12	Oxx04
	F	Axx, 05	Axx,13	Axx, 05	Axx, 13	Oxx05
	G	Axx, 06	Axx,14	Axx, 06	Axx, 14	Oxx06
	H	Axx, 07	Axx,15	Axx, 07	Axx, 15	Oxx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

The available configuration for each input :

– delay

– open circuit detection

A channel can be used for an input or an output, depending upon the user program.

Note :

The inputs/outputs are configurated in outputs when the DIP switch N° 1 on the plug-in base ECZ is ON. This allows to use again the address coded for an input unit.

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 3 : "**Cut wire**"
Led 4 : "**Overload**"
Led 5 : "**Short Circuit**"

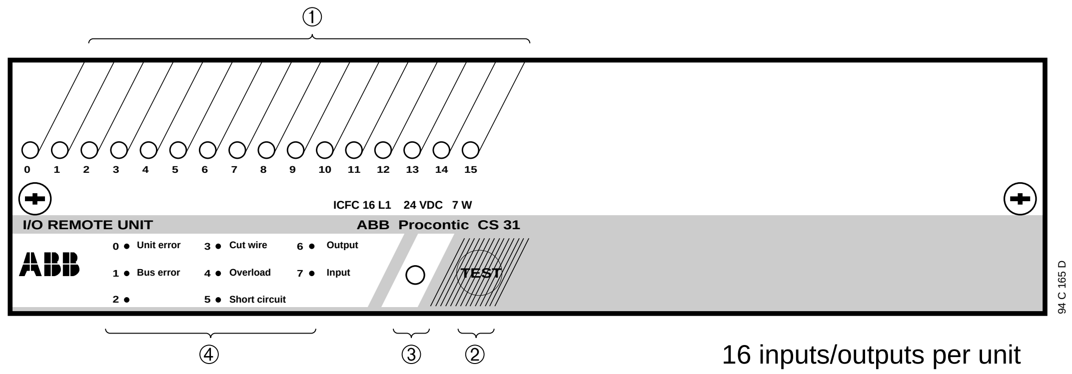
The status of an input channel is shown by :
Led 6 : "**Output**"

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.3.3 ICFC 16 L1 Binary Input/Output remote unit

16 user configurable inputs/outputs



16 inputs/outputs per unit

Binary input/output unit with 16 channels.
The function of each channel can be selected :
– as a 24 VDC input or
– as a 24 VDC 500 mA transistor output

Description of the unit front :

- Sixteen yellow input/output status led's «0» to «15» ①
- «TEST» push-button .... ②
- Red error led .... ③
- List of error codes.. ④

The unit has to be mounted on two plug-in bases ECZ

The unit has a special low-profile housing.

TECHNICAL CHARACTERISTICS	
Power supply	24 VDC
Number of inputs per unit	16 max.
Number of outputs per unit	16 max.
Power supply isolation	no
Maximum power consumption without load on the outputs	4 W
Maximum power dissipation	0.2 A
Order number : FPR 331 9101	R1162
Weight (kg)	0.37

SPECIFICATIONS	
Specifications of the inputs	
Signal level, nominale value	24 VDC
Input opto-isolated	no
Signal level of the input 0 signal 1 signal	 – 3 V to + 5 V + 15 V to + 30 V
Open circuit detection	yes (**)
Input current, nominal value	6 mA
Input delay (*)	2 to 32 ms
Specifications of outputs	
Process supply	24 V
Output opto-isolated	no
Maximum voltage drop under nominal load	3 V
Residual current for 0 signal	< 1 mA
Switching frequency with inductive loads	max. 0.1 Hz
Maximum current	0.5 A
Lamp loads	5 W
Total current for 16 outputs	max. 4 A
Short-circuit protection (I > 2 A)	yes
Overload protection (I > 0.6 A, t > 250 ms)	 yes
Open circuit detection (I < 50 mA)	yes (**)

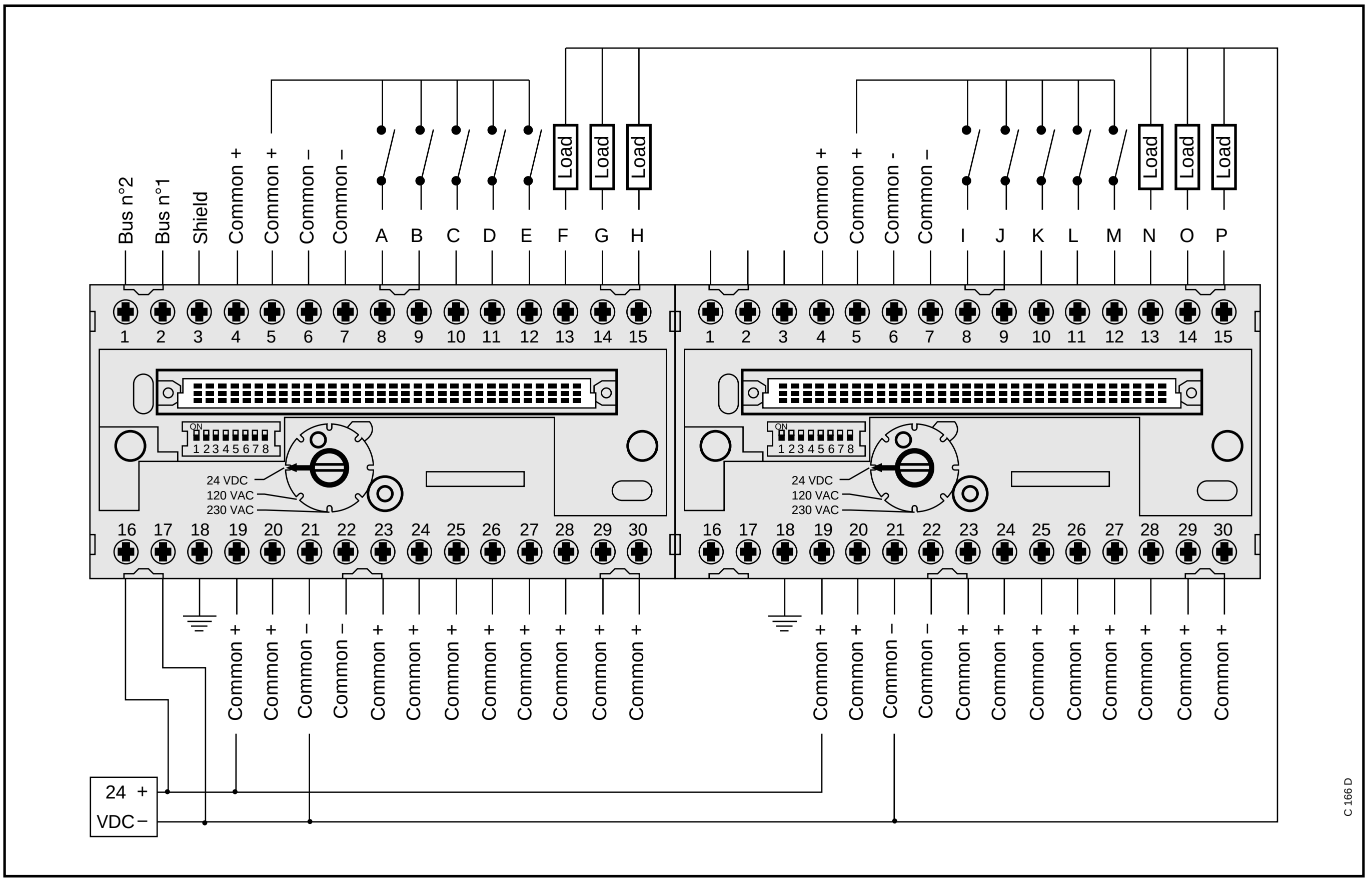
(*) This time can be changed, factory setting 8 ms.
(**) By factory setting, open circuit will not be detected.
Enable with TCZ terminal (see chapter 9, volume 2 «**In case of failure**»).

● **Electrical connection**

An external power supply is necessary if the outputs are used and in this case the **common + terminal musn't be disconnected** to the 24 VDC power supply.

Power supply 24 VDC

Example of electrical connections with 10 inputs and 6 outputs.



Note : Almost one common + and one commun – on each plug-in base ECZ have to be connected to the power supply.

When switching high current loads, use many commun + terminal to avoid damage to the base.

CAUTION : The common – is internaly connected to the earth terminal.

Note : In case of use of an external power supply 24 VDC for inputs, the "**24**" VDC has to be connected to the common "**+**".

Caution : if the 24 VDC is connected to common "**+**", the remote unit can be supplied by the external power supply even if the main power supply is **OFF**.

● **Initialization**

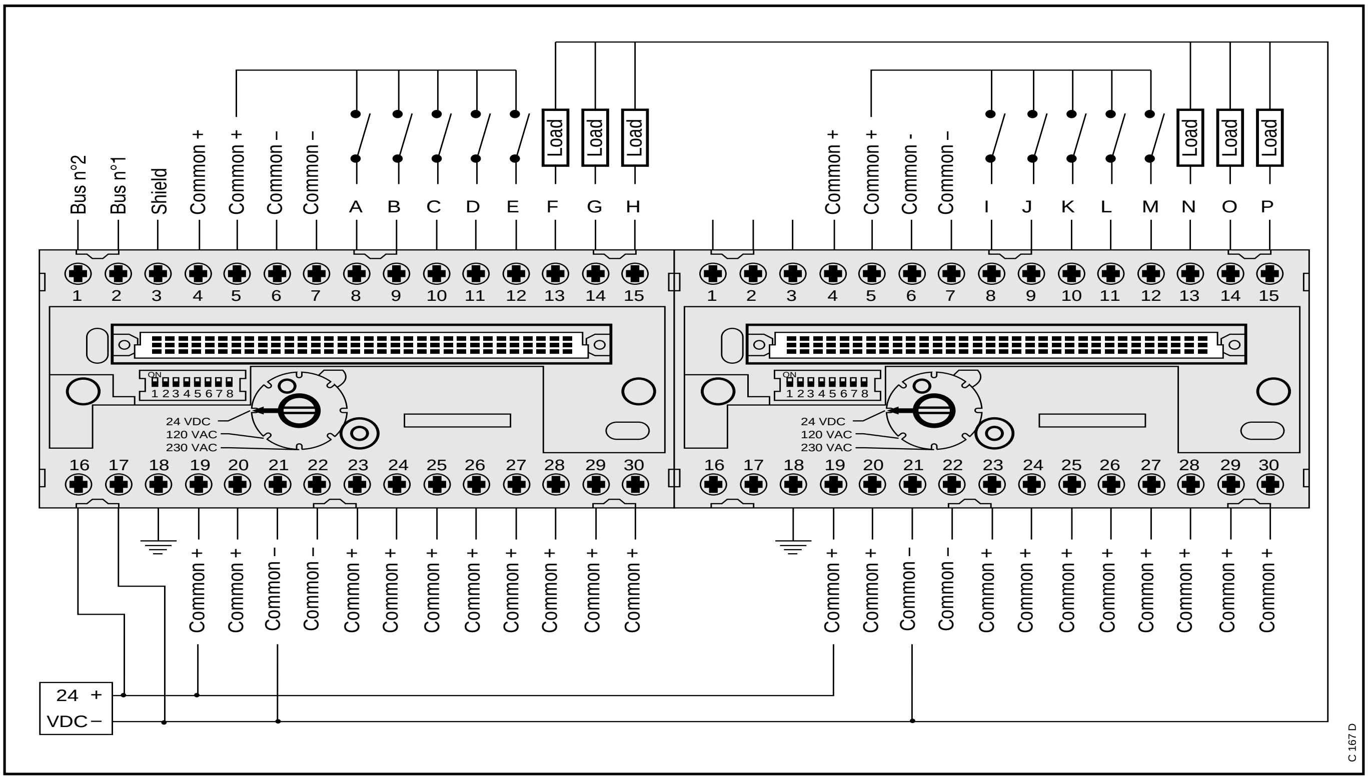
After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of 8 inputs is displayed on the 16 led's.

Internal connection



● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT					
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ on the left side		00 … 61	00 … 63		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	OFF	ON	OFF
Input	A	Exx, 00	Exx, 00	Exx, 08	Ixx08
	B	Exx, 01	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx, 07	Exx, 15	Ixx07
	I	Exx, 08	Exx+1,00	Exx+1,08	Ixx08
	J	Exx, 09	Exx+1,01	Exx+1,09	Ixx09
	K	Exx, 10	Exx+1,02	Exx+1,10	Ixx10
	L	Exx, 11	Exx+1,03	Exx+1,11	Ixx11
	M	Exx, 12	Exx+1,04	Exx+1,12	Ixx12
	N	Exx, 13	Exx+1,05	Exx+1,13	Ixx13
	O	Exx, 14	Exx+1,06	Exx+1,14	Ixx14
	P	Exx, 15	Exx+1,07	Exx+1,15	Ixx15
Output	A	Axx, 00	Axx, 00	Axx, 08	Oxx08
	B	Axx, 01	Axx, 01	Axx, 09	Oxx01
	C	Axx, 02	Axx, 02	Axx, 10	Oxx02
	D	Axx, 03	Axx, 03	Axx, 11	Oxx03
	A	Axx, 04	Axx, 04	Axx, 12	Oxx04
	F	Axx, 05	Axx, 05	Axx, 13	Oxx05
	G	Axx, 06	Axx, 06	Axx, 14	Oxx06
	H	Axx, 07	Axx, 07	Axx, 15	Oxx07
	I	Axx, 08	Axx, 08	Axx+1,08	Oxx08
	J	Axx, 09	Axx, 09	Axx+1,09	Oxx01
	K	Axx, 10	Axx, 10	Axx+1,10	Oxx02
	L	Axx, 11	Axx, 11	Axx+1,11	Oxx03
	M	Axx, 12	Axx, 12	Axx+1,12	Oxx04
	N	Axx, 13	Axx, 13	Axx+1,13	Oxx05
	O	Axx, 14	Axx, 14	Axx+1,14	Oxx06
	P	Axx, 15	Axx, 15	Axx+1,15	Oxx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

The available configuration for each input :

– delay

– open circuit detection

The available configuration for each output :

– open circuit detection

A channel can be used for an input or an output, depending upon the user program.

Note :

The inputs/outputs are configurated in outputs when the DIP switch N° 1 on the plug-in base ECZ is ON. This allows to use again the address coded for an input unit.

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 3 : "**Cut wire**"
Led 4 : "**Overload**"
Led 5 : "**Short Circuit**"

The status of an input channel is shown by :
Led 6 : "**Output**"
Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.3.4 Binary input/output module ICDG 32 L1

16 binary inputs, 8 binary outputs, 8 configurable inputs/outputs, 24 V DC, CS31 system bus connection electrically isolated

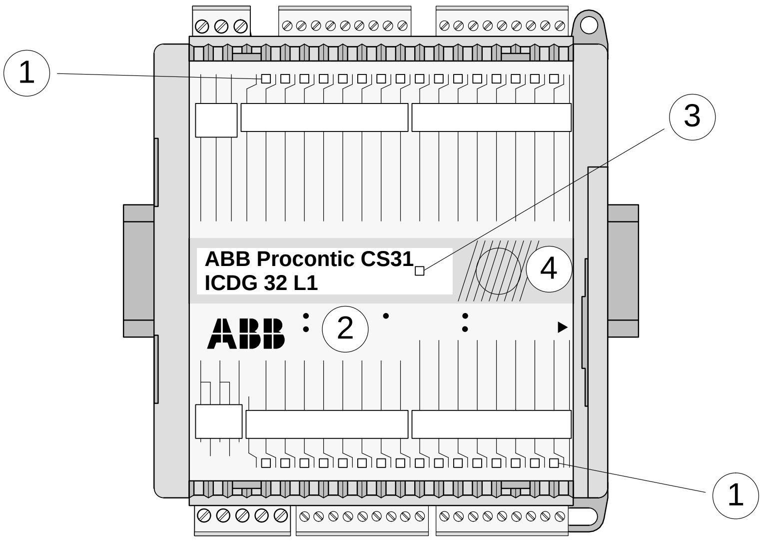


Fig. 4.3.4–1: Binary input/output module ICDG 32 L1

Contents

Intended purpose

The binary input/output module ICDG 32 L1 is a remote module on the CS31 system bus. It has 32 binary channels with the following features:

- 16 inputs, 24 V DC, in 2 groups
- 8 outputs, 24 V DC, in 1 group. The outputs
  - employ switching transistors,
  - have a rated load capability of 0.25 A and
  - are overload and short-circuit proof.
- 8 inputs/outputs, of which each can be addressed
  - as an input,
  - as an output
  - as a readable output (combined input/output).

  In this case the technical data are equal to the data of the other inputs and outputs.

The module is supplied with 24 V DC.

The CS31 system bus connection is electrically isolated from the remaining module components.

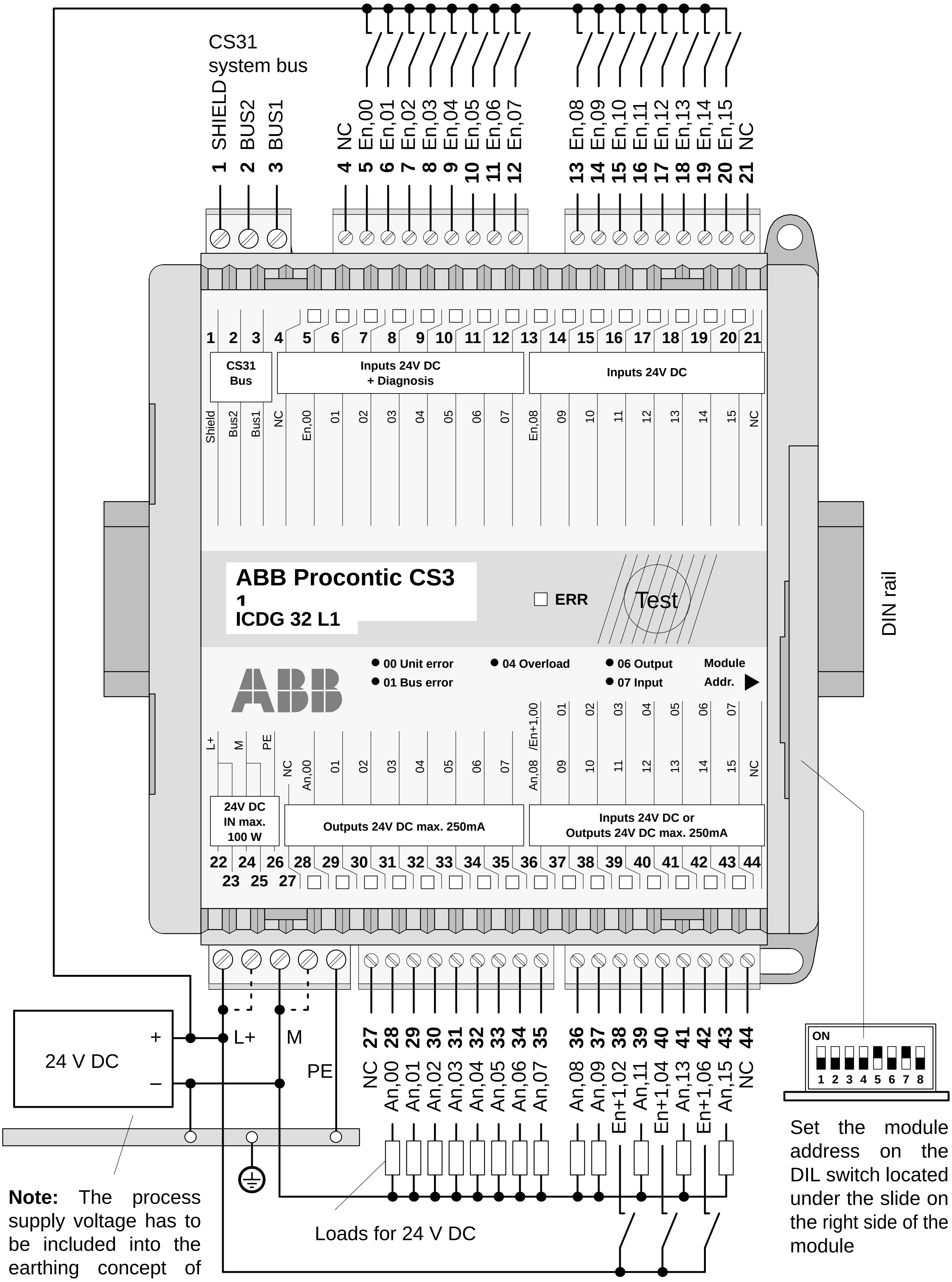
The module offers a number of diagnosis functions (see chapter ”Diagnosis and displays”).

Display and operating elements on the front panel

- ◯ 16 green LEDs for displaying the signal statuses of the inputs,
  16 yellow LEDs for displaying the signal statuses of the outputs or of the combined inputs/outputs
- ⊖ List of diagnosis information belonging to the LEDs, if they are used for diagnosis
- (.) Red LED for error message
- (0) Test button

Electrical connection

The module is mounted on a 15-mm-high DIN rail or fastened with 4 screws. The following figure shows the electrical connection of the input/output module.



Note: The process supply voltage has to be included into the earthing concept of the installation (e.g. by earthing the minus pole of the power supply unit).

Set the module address on the DIL switch located under the slide on the right side of the module

Fig. 4.3.4–2: Electrical connection of the binary input/output module ICDG 32 L1 R0101, the example shows 19 channels as inputs and 13 channels as outputs

Addressing

An address has to be set on each module, so that the central unit can access the inputs and outputs correctly.

A detailed description concerning the item ”Addressing” is contained in the chapters ”Addressing” of the central units and couplers.

The module address is set on the DIL switch located under the slide on the right side of the module.

If the central units 07 KR 91, 07 KT 92 and 07 KT 93 are used as bus masters, the following **operating modes** (address allocations) are valid, dependent on the position of the address DIL switch No. 1:

Central units 07 KR 91 / 07 KT 92 / 07 KT 93

For address DIL switch **No. 8** see separate description (this page, top right).

The address DIL switch **No. 1** set to **ON** means, that 16 inputs and 16 outputs are **unchangeably** allocated. All of the combined inputs/outputs are **outputs** only (see below).

Terminal/Input		Terminal/Output	
5	E n,00	28	A n,00
6	E n,01	29	A n,01
7	E n,02	30	A n,02
8	E n,03	31	A n,03
9	E n,04	32	A n,04
10	E n,05	33	A n,05
11	E n,06	34	A n,06
12	E n,07	35	A n,07
13	E n,08	36	A n,08
14	E n,09	37	A n,09
15	E n,10	38	A n,10
16	E n,11	39	A n,11
17	E n,12	40	A n,12
18	E n,13	41	A n,13
19	E n,14	42	A n,14
20	E n,15	43	A n,15

n: module address, is set on the address DIL switches No. 2...7.
Recommended module addresses with 07 KR 91 / 07 KT 92/93 as bus masters: 08, 10, 12......60 (even addresses)

With this setting, the module uses only **one** address on the CS31 system bus.
16 inputs and 16 outputs are available.

Fig. 4.3.4–3: Addresses of the channels, if DIL switch No. 1 is set to ON

Setting the address DIL switch No. 8

The address DIL switch is used to define whether the outputs should switch on again after overload or short-circuit automatically or by acknowledgement. Meaning of the switch positions:

OFF (factory setting): After the error has been eliminated, the outputs switch on again automatically.

ON: After the error has been eliminated, the outputs switch on again by pressing the test button or by acknowledgement via the PLC program (connection element CS31QU) or via the serial interface on the central unit.

Central units 07 KR 91 / 07 KT 92 / 07 KT 93

For address DIL switch **No. 8** see separate description (this page, top right).

The address DIL switch **No. 1** set to **OFF (factory setting)** means, that 16 inputs and 8 outputs are **unchangeably** allocated. The 8 combined inputs/outputs can be addressed **individually** as inputs or outputs (see below).

Term./Input		Term./Output		Input
5	E n,00	28	A n,00	
6	E n,01	29	A n,01	
7	E n,02	30	A n,02	
8	E n,03	31	A n,03	
9	E n,04	32	A n,04	
10	E n,05	33	A n,05	
11	E n,06	34	A n,06	
12	E n,07	35	A n,07	
13	E n,08	36	A n,08	E n+1,00
14	E n,09	37	A n,09	E n+1,01
15	E n,10	38	A n,10	E n+1,02
16	E n,11	39	A n,11	E n+1,03
17	E n,12	40	A n,12	E n+1,04
18	E n,13	41	A n,13	E n+1,05
19	E n,14	42	A n,14	E n+1,06
20	E n,15	43	A n,15	E n+1,07

n: module address, is set on the address DIL switches No. 2...7.
Recommended module addresses with 07 KR 91 / 07 KT 92/93 as bus masters: 08, 10, 12......60 (even addresses)

With this setting, the module uses **two** addresses on the CS31 system bus. 24 binary input and 16 binary output channels are occupied. The module has 16 inputs, 8 outputs and 8 combined inputs/outputs now. An+1,00...15 and En1,08...15 are not used. If needed, these addresses can be used for other modules.

Fig. 4.3.4–4: Addresses of the channels, if DIL switch No. 1 is set to OFF

Remark:
The module ICDG 32 L1 reads the positions of the DIL switches only once during initialization after power ON. If switch positions are changed during operation of the module, these alterations become effective not before the next initialization. Exception: The position of DIL switch No. 8 (defining whether the outputs should switch on again after overload or short-circuit automatically or by acknowledgement) is currently updated.

I/O configuration

The module ICDG 32 L1 does not store any configuration data. The 8 combined input/output channels are defined as inputs or outputs by the user program.

That means, that each of the combined inputs/outputs can be used as an input or an output (or readable output) by reading data from it or sending data to it, respectively. If used as an input, no signal ”1” may be sent to the respective output. For setting the DIL switches and address allocation see also figures 4.3.4–3 and 4.3.4–4 (one page above).

Normal operation

- The module initializes itself after power ON. During initialization all LEDs are ON.
- If the CS31 system bus does not run, the LED (3) flashes.
- The LED (3) goes out again, when the bus operation runs correctly and the module does not detect an error.
- The 16 green and the 16 yellow LEDs (1) show the signal statuses of the 32 channels.

Diagnosis and display

Diagnosis functions:

– Output short-circuit/overload (I > 0.7 A)
– Message of a short-circuit/overload to the central unit
– After storing this information, holding it ready for reading (error class and error location)
– Error in the module (Unit error)
– Error on the CS31 system bus (Bus error)

If one of these errors occurs, the red LED (3) lights up. **The error message is sent to the central unit (or coupler).** For more information see the chapters ”Diagnosis” in the descriptions of the central units and couplers.

By means of the test button (4) and the LEDs (1) the user is enabled to call diagnosis information directly from the module.

Pressing the test button the first time the channel En,**00** is selected: The LED of the selected channel flashes, all of the other LEDs are switched off during this test. When releasing the test button, the error information belonging to this channel is displayed by the green LEDs 00 to 07 for a period of ca. 3 seconds.

Meaning of the LEDs if lighting up:

00	Error in the module (Unit error)
01	Error on the CS31 system bus (Bus error)
02	not used
03	not used
04	Overload or short circuit, outputs only
05	not used
06	Configuration as an output
07	Configuration as an input

The meaning of the diagnosis LEDs (2) is labelled on the front panel of the module in English.

Pressing the test button further times, the test procedure repeats for all of the other inputs and outputs (and combined inputs/outputs).

After calling information from the last channel, a lamp test is carried out by pressing the test button the next time. All LEDs light up. After that, the positions of the address DIL switches stored during the initialization are displayed on the LEDs 00 to 07 for a period of ca. 3 seconds. LED 00 shows the position of switch No. 1 (LEDs 00 to 07 belong to the switches 1 to 8).

The error messages in the I/O module and in the central unit are reset again, when the errors have been eliminated, no new errors have occurred **and** the error elimination has been acknowledged. This also applies for the overload message independent of the position of the DIL switch No. 8.

Acknowledging an error after error elimination:

– by pressing the test button for a period of ca. 5 seconds

  or

– by means of the TCZ or a PC (see TCZ description in volume 7.3, Terminal mode, Mail command ”Acknowledging errors on remote modules”

  or

– via the PLC program in the central unit, connection element CS31QU, software 907 PC 331.

Remarks:

Using the LED display for overload/short-circuit, the user can find out which channels are involved.

The LEDs 06 and 07 indicate for the 8 configurable channels whether the selected channel is configured as output or as input/output. The unchangeable channels are indicated in the same way.

When the calling of the diagnosis information has been terminated, the 32 green and yellow LEDs show the binary signal statuses of the channels again.

Technical data ICDG 32 L1

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

General data of the module

Admissible temperature range, module in operation	0...65 °C
Rated supply voltage	24 V DC
Rated signal voltage at inputs and outputs	24 V DC
Max. current consumption, outputs unloaded	0.15 A
Max. total output current	4.0 A
Max. rated loadability for the supply terminals	4.0 A
Max. power dissipation in the module, outputs unloaded	5 W
Max. power dissipation in the module outputs under load	10 W
Overvoltage category	II according to IEC 65 A
Buffered voltage interruption time	
for the processor part	> 10 ms
for the outputs	none
Protection against reversed connection of supply voltage	yes
Conductor cross section for the removable terminal blocks	
supply voltage	max. 2.5 mm^2
CS31 system bus	max. 2.5 mm^2
input/output terminals	max. 1.5 mm^2
Number of binary inputs	16
Number of binary transistor outputs	8
Number of combined inputs/outputs	8
Reference potential for all inputs and outputs	terminals 24/25 (minus pole of the supply voltage, signal name M)
Number of interfaces	1 CS31 system bus interface
Electrical isolation	CS31 system bus interface versus the remaining module parts
Address setting	with a DIL switch located under the slide on the right side of the module
Diagnosis	see chapter ”Diagnosis and display”
Indication of operating statuses and errors	33 LEDs altogether
Mechanical dimensions	120 x 140 x 85 mm
Weight	450 g
Order number	GJR5 2514 00 R0101

Technical data for the binary inputs

Number of channels per module	16
Distribution of channels into groups	2 groups of 8 channels each, channels En,00...En,07 and En,08...En,15
Reference potential for all inputs	terminals 24/25 (minus pole of the supply voltage, signal name M)

Electrical isolation	versus the CS31 system bus interface
Input signal delay	typ. 7 ms
Signalling of input statuses	one green LED per channel, the LEDs correspond functionally to the input signals
Input signal voltage	
signal 0	–30 V...+ 5 V
signal 1	+13 V...+30 V
ripple when signal 0	within –30 V...+ 5 V
when signal 1	within +13 V...+30 V
Allowed input overvoltage	± 36 V, for 100 ms only
Input current per channel	
input voltage = +24 V	typ. 7.0 mA
input voltage = + 5 V	≥ 1.0 mA
input voltage = +13 V	≥ 2.0 mA
input voltage = +30 V	≤ 10.0 mA
Labelling for the inputs	Symbol names or short signal designations can be labelled on the front panel foil. The foil is **not removeable.**
Conductor cross section of the removable terminal blocks	max. 1.5 mm^2, terminal-to-terminal distance 3.81 mm

Technical data for the binary outputs

Number of channels per module	8 transistor outputs
Distribution of channels into groups	1 groups of 8 channels, channels An,00...An,07
Reference potential for all outputs	terminals 24/25 (minus pole of the supply voltage, signal name M)
Common voltage supply for all outputs	terminals 22/23 (plus pole of the supply voltage, signal name L+)
Electrical isolation	versus the CS31 system bus interface
Signalling of output statuses	one yellow LED per channel, the LEDs correspond functionally to the output signals
Output current	
rated value	250 mA with L+ = 24 V
maximum value	312 mA with L+ = 24 V + 25 %
leakage current with signal 0	< 0.5 mA
Demagnetization of inductive loads	internally with free-wheeling diode and Z-diode (Z-diode voltage is 12 V)
Switching frequency with inductive loads	max. 0.5 Hz
Switching frequency with lamp load	max. 11 Hz with max. 5 W
Short-circuit-proof/overload-proof	yes
Overload message (I ≥ 0,7 A)	yes, after ca. 100 ms
Limitation of output current	yes
Output is switched on again	after acknowledgement, if DIL switch No. 8 = ON automatically, if DIL switch No. 8 = OFF
Total load (together with the output currents of the combined inputs/outputs)	max. 4 A
Labelling for the outputs	Symbol names or short signal designations can be labelled on the front panel foil. The foil is **not removeable.**

Conductor cross section of the removable terminal blocks	max. 1.5 mm^2, terminal-to-terminal distance 3.81 mm

Technical data of the configurable inputs/outputs

The 8 combined input/output channels are defined individually as inputs or outputs by the user program. This is done by reading from or writing to the corresponding channel.

Number of channels per module	8 inputs/transistor outputs
Distribution of channels into groups	1 group of 8 channels
if the channels used as inputs	channels En+1,00...En+1,07
if the channels used as outputs	channels An,08...An,15
Signalling of input/output statuses	one yellow LED per channel, the LEDs correspond functionally to the binary signals
Other technical data	see binary inputs, see binary outputs

Connection to the ABB Procontic CS31 system bus

Interface standard	EIA RS–485
Electrical isolation	versus supply voltage, inputs/outputs
Conductor cross section of the removable terminal block	max. 2.5 mm^2, terminal-to-terminal distance 5.08 mm

Mechanical data

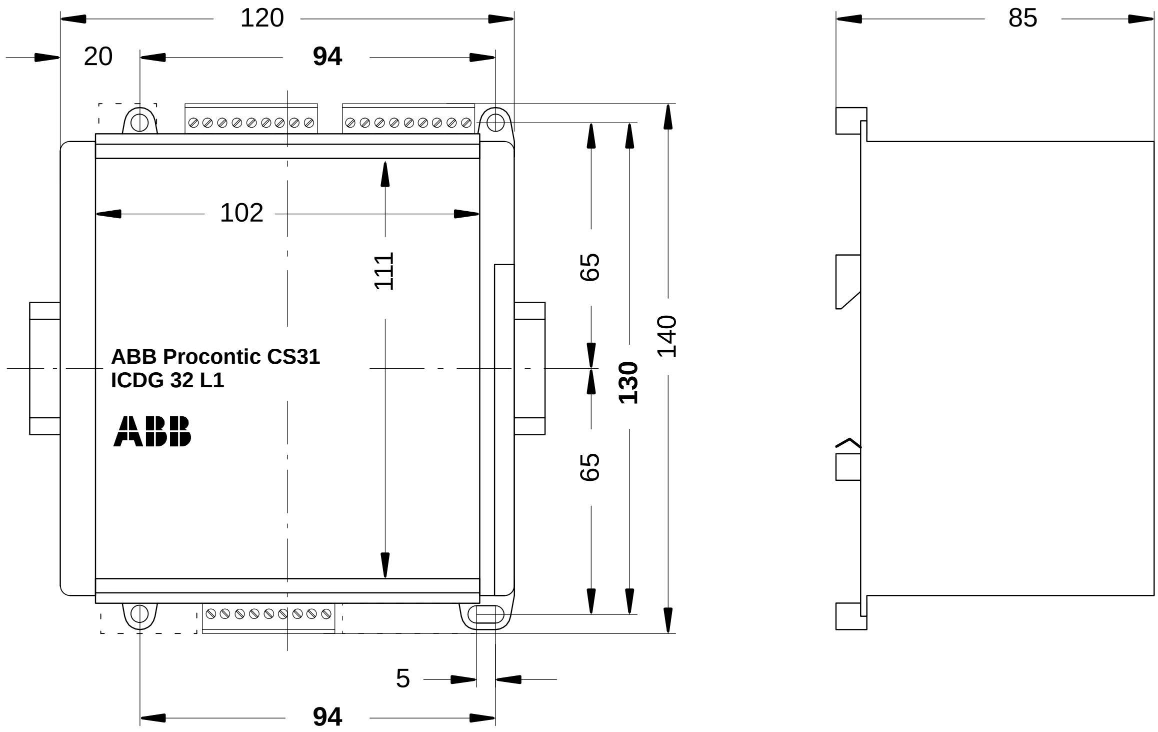
Mounting on DIN rail	according to DIN EN 50022–35, 15 mm deep. The DIN rail is located in the middle between the upper and the lower edges of the module.
Fastening by screws	using 4 M4 screws.
Width x height x depth	120 x 140 x 85 mm
Wiring method	by removable terminal blocks with screw-type terminals,
conductor cross section	max. 2.5 mm^2, terminal-to-terminal distance 5.08 mm max. 1.5 mm^2, terminal-to-terminal distance 3.81 mm
Weight	450 g
Outline dimensions (for mounting)	see the drawing on the next page

Mounting hints

Mounting position	vertical, terminals above and below
Cooling	The natural convection cooling must not hindered by cable ducts or other material mounted in the switch cabinet.

Ordering data

Module ICDG 32 L1 R0101	Order No. GJR5 2514 00 R0101
Scope of delivery	Binary input/output module ICDG 32 L1 1 5–pole terminal blocks (5.08 mm) 1 3–pole terminal block (5.08 mm) 4 9–pole terminal blocks (3.81 mm)



All dimensions in mm.

The module is 85 mm deep.
If a DIN rail is used, the mounting depth is increased by the overall depth of the rail.

Fig. 4.3.4–5:
ICDG 32 L1, outline dimensions, **the dimensions for assembly bore holes are printed in bold.**

4.3.5 ICSK 20 N1 Binary Input/Output remote unit

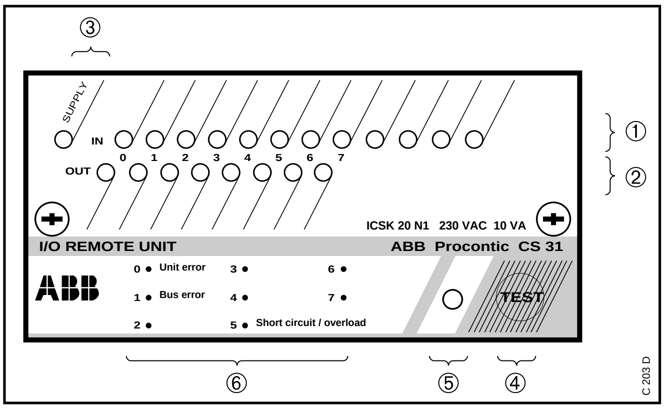
12 inputs 24 VDC / 8 transitor outputs

Binary input/output unit with12 input channels for 24 VDC and 8 transistor output 24VDC 0.5A channels.

Description of the unit front :

- Twelwe yellow input status led's «0» to «11» .... ①
- Eight yellow output status led's «0» to «7» .... ②
- One green led labelled "Supply" to indicate the presence of the supply .... ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes .... ⑥

The unit has to be mounted on a plug-in base ECZ



12 inputs/8 transistor outputs per unit

GENERAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	12	12
Number of outputs per unit	8	8
Isolated power supply	no	yes (1500 VAC)
Maximum consumption	0.3 A	10 VA
Order number FPR 3331001	R 1202	R 0206/R 0204
Weight (kg)	0.25	0.43

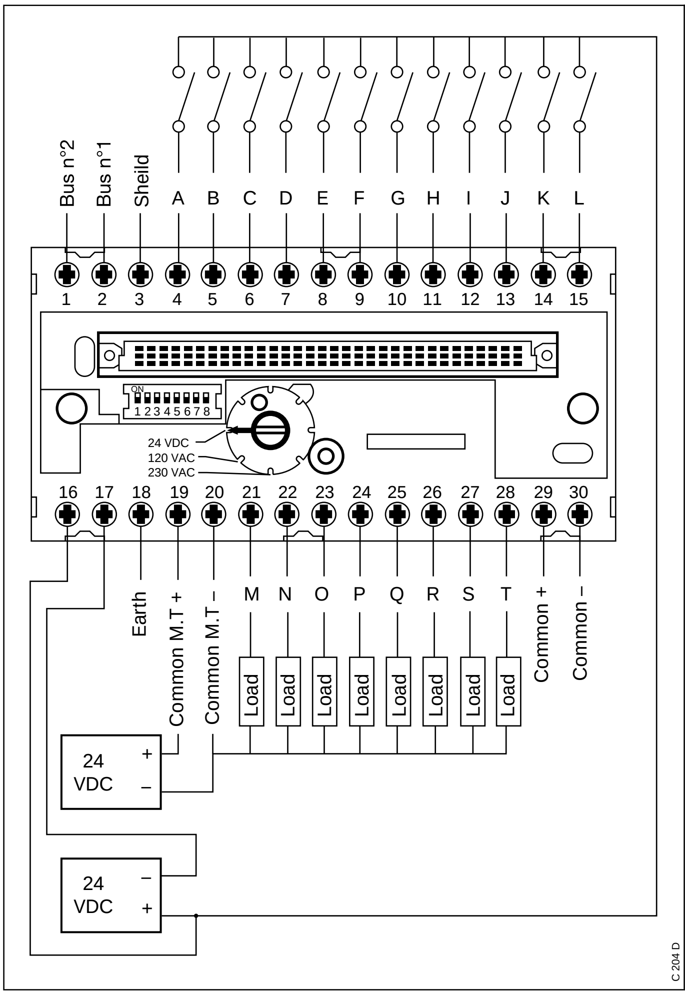
INPUT CHARACTERISTICS		
Signal level of the input, nominal value	24 VDC	24 VDC
Opto isolated inputs	no	no
Signal level of the inputs, nominal value	24 VDC	24 VDC
Signal level of the input 0 signal 1 signal	 –3 to +5V +15 to +30V	 –3 to +5V +15 to +30V
Input current for 24 VDC	5 mA	5 mA
Input delay (*)	5 ms	5 ms

(*) This delay can't be modified

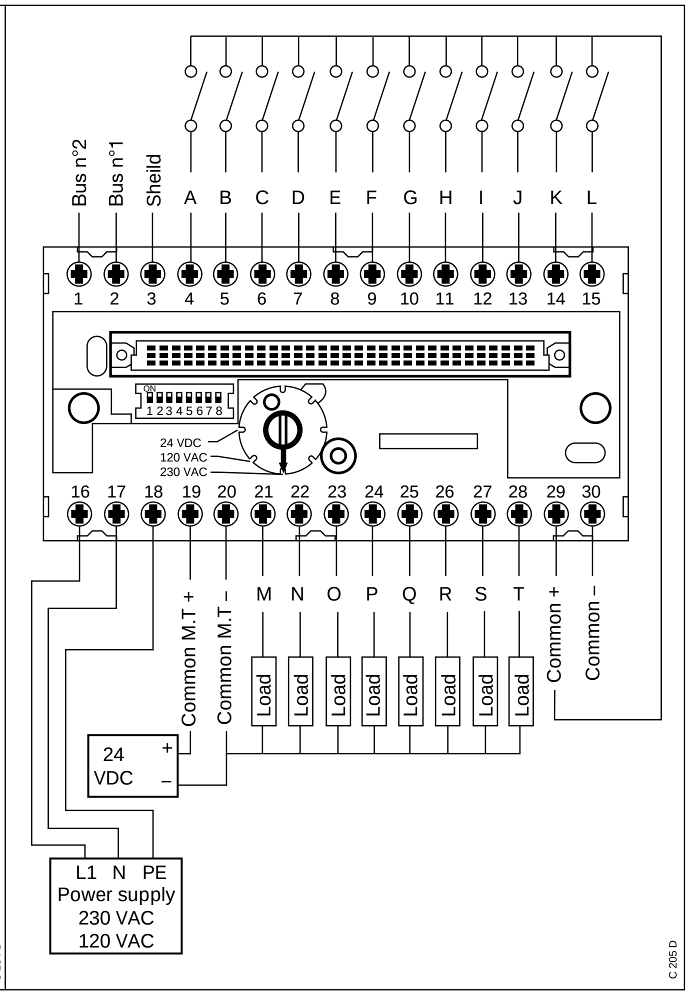
OUTPUT CHARACTERISTICS		
Isolated	no	no
Switching capacity under 0.5 A (resistive or inductive load) DC	 15W (0.5A)	 15 W (0.5A)
Nominal current	0.5 A	0.5 A
Supply output 24 VDC 100 mA	no	yes
Total curent for 8 outputs	4A	4A
Short-circuit protection for each output	yes	yes
Thermal protection for each output 2 A with 25 °C ambient 1.5 A with 55 °C ambient	yes	yes
Over voltage protection	yes	yes

● Electrical connection

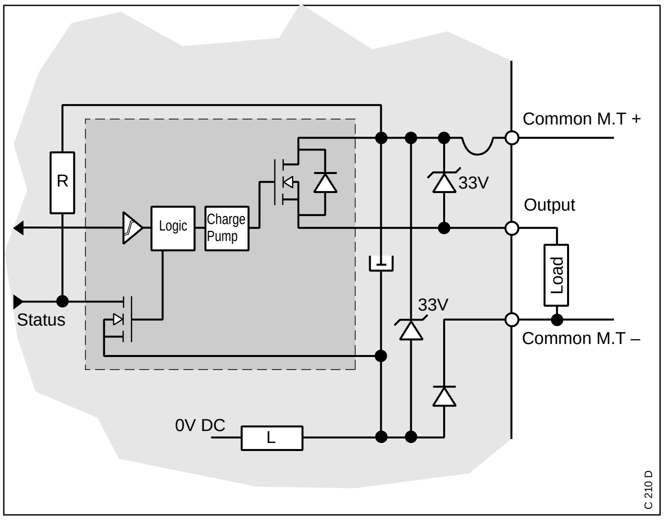
Power supply 24 VDC



Power supply 230 VAC and 120 VAC



Electrical schema for an output



Note :

The internal 24 VDC (100 mA) power supply is only available for the 230 VAC/120 VAC versions. This power is used to power the inputs.

In case of the 24 VDC version, the 0 V of the second external power supply for the inputs has to be connected to the common "–".

The 0 V of the 24 VDC power supply for the outputs has to be connected to the common M-T -.

If the 24 VDC of the external supply is not connected to the common M-P +, the outputs are reset to 0.

– A free wheel diode is not necessary because the protection is integrated into the transistor component.

– An external thermal fuse max. 5 A has to be connected between the common + terminals and the 24 VDC to avoid damage in case of use of a lot of overload outputs.

● Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the status of inputs/outputs is displayed on the 20 led's.

● **Utilization**

VARIABLES USED IN THE CENTRAL UNIT					
CENTRAL UNITS		07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 61	00 … 62		1 … 31
Switch N° 8 on the plug-in base ECZ		OFF	OFF	ON	OFF
Input	A	Exx, 00	Exx, 00	Exx, 08	Ixx00
	B	Exx, 01	Exx, 01	Exx, 09	Ixx01
	C	Exx, 02	Exx, 02	Exx, 10	Ixx02
	D	Exx, 03	Exx, 03	Exx, 11	Ixx03
	E	Exx, 04	Exx, 04	Exx, 12	Ixx04
	F	Exx, 05	Exx, 05	Exx, 13	Ixx05
	G	Exx, 06	Exx, 06	Exx, 14	Ixx06
	H	Exx, 07	Exx, 07	Exx, 15	Ixx07
	I	Exx, 08	Exx+1, 00	Exx+1, 08	Ixx08
	J	Exx, 09	Exx+1, 01	Exx+1, 09	Ixx09
	K	Exx, 10	Exx+1, 02	Exx+1, 10	Ixx10
	L	Exx, 11	Exx+1, 03	Exx+1, 11	Ixx11
Output					
	M	Axx, 00	Axx, 00	Axx, 08	Oxx00
	N	Axx, 01	Axx, 01	Axx, 09	Oxx01
	O	Axx, 02	Axx, 02	Axx, 10	Oxx02
	P	Axx, 03	Axx, 03	Axx, 11	Oxx03
	Q	Axx, 04	Axx, 04	Axx, 12	Oxx04
	R	Axx, 05	Axx, 05	Axx, 13	Oxx05
	S	Axx, 06	Axx, 06	Axx, 14	Oxx06
	T	Axx, 07	Axx, 07	Axx, 15	Oxx07

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

The available configuration for each chanel :
– none

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 5 : **"Short-circuit or overload"**

The status of an input channel is shown by :

Led 7 : "**Input**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).

4.4.1 Binary Output Module ICPO 16 H1

16 output channels 24 V DC/2A, **Degree of Protection IP65**
CS31 system bus connection electrically isolated

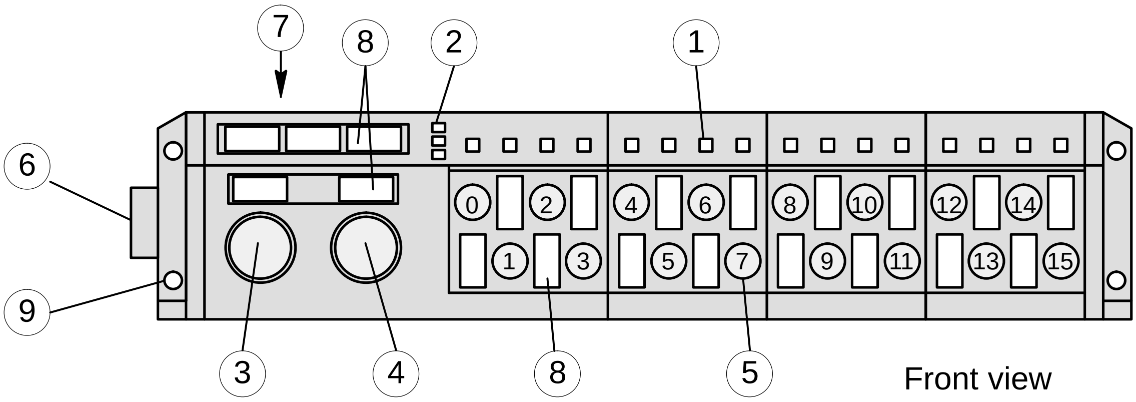


Fig. 4.4.1–1: Binary output module ICPO 16 H1

Contents

Intended purpose

The binary output module ICPO 16 H1 is a remote module on the CS31 system bus. It has 16 binary channels with the following features:

- Housing and termination system according to IP65 degree of protection
- The CS31 bus line is looped through from module to module. For this purpose, the module has two bus connectors as bus input and bus output.
- Each output has its own connector and thus can be unplugged individually.
- The 24 V DC supply voltage is connected via screw–type terminals inside the module housing.
- The outputs
  - employ switching transistors,
  - have a rated load capability of 2 A and
  - are overload and short–circuit proof.

The module is mounted with screws. There are bore holes available for both mounting on a rear wall or on a horizontal surface.

The CS31 system bus connection is electrically isolated from remaining module components.

The module offers diagnosis functions (see chapter ”Diagnosis and displays”).

Displays and connections at module housing

① 16 yellow LEDs for displaying the signal statuses of the outputs

② LEDs ”Bus Error”, ”Overload” and ”Supply” indicating of operating conditions and errors (see section ”Diagnosis and displays”)

③ CS31 bus connector (input)

④ CS31 bus connector (output)

⑤ 16 connectors for the outputs

⑥ PG11 cable gland for the 24 V DC power supply

⑦ The terminals for 24 V DC and PE are located under a removable cover. It is accessible from the top of the module. The DIL switch for setting the module address is also under the cover.

⑧ Labelling fields

⑨ Bore holes for mounting (see also ”Dimensioned drawing” at the end of this description)

Electrical connection

The following figure shows all details necessary for the electrical connection.

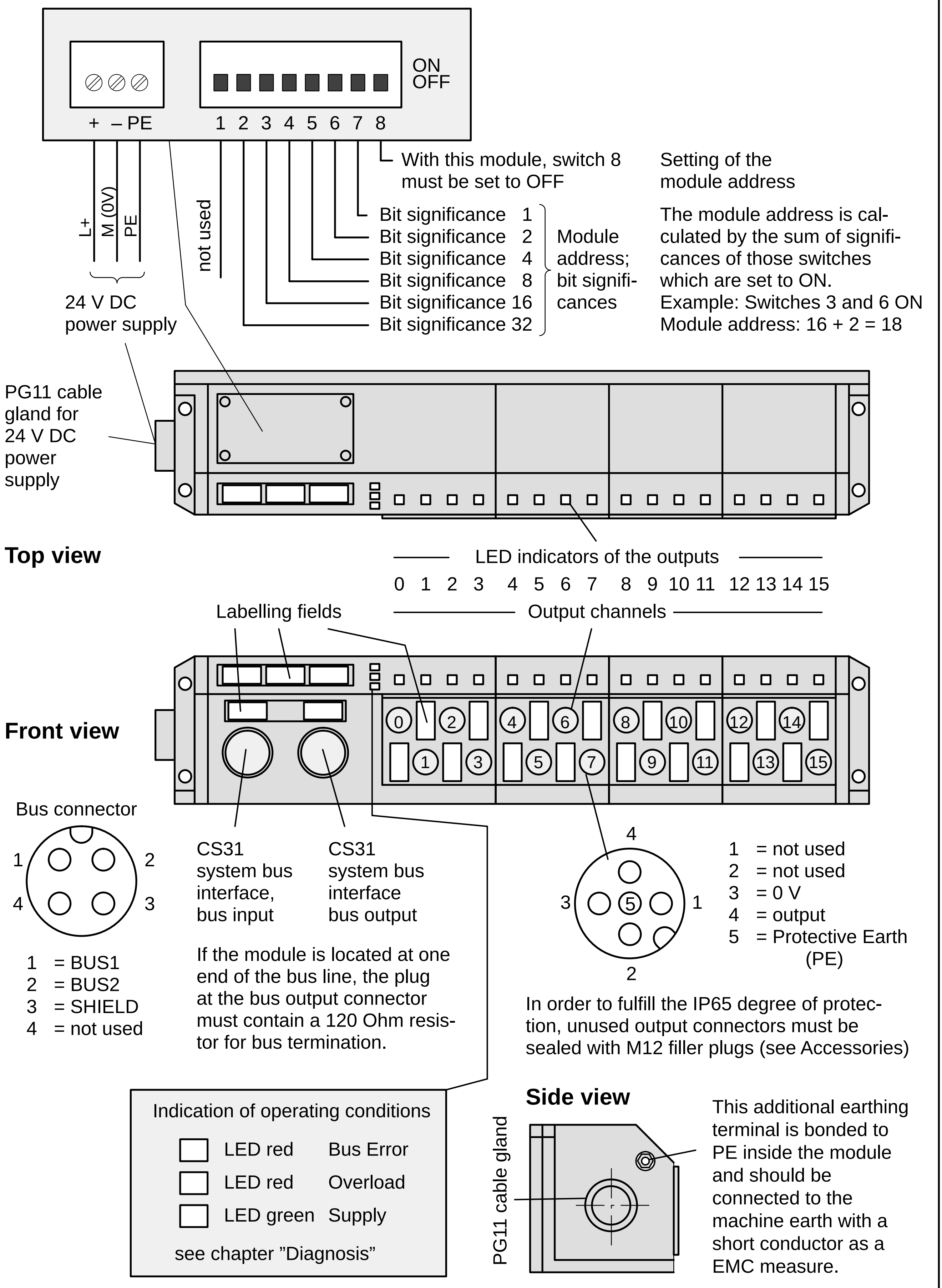


Fig. 4.4.1–2: Details for the electrical connection of the output module ICPO 16 H1

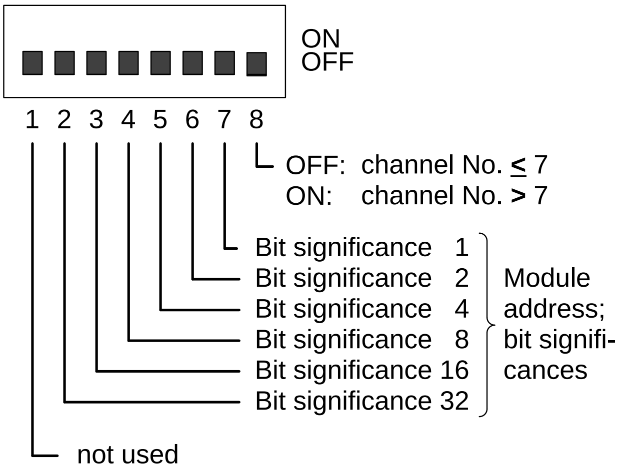
Addressing

An address has to be set on each module, so that the central unit can access the inputs and outputs correctly.

A detailed description concerning the item ”Addressing” is contained in the chapters ”Addressing” of the central units and couplers.

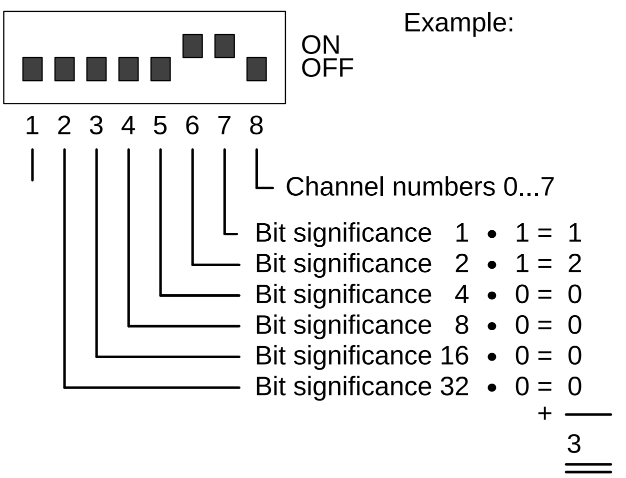
The module address is set on the DIL switch located under the cover at the top side of the module.

Meaning of the address switches:



Setting of the module address:

The module address is calculated by the sum of significances of those switches which are set to ON (see the following example).



When using the central units 07 KR 91, 07 KT 92 or 07 KT 93, the possible module addresses range from

0...61.

In connection with the central units 07 KR 91 and 07 KT 92/KT93 as bus masters, the following address allocations are valid:

Central units 07 KR 91 / 07 KT 92 / 93

The DIL switch No. 8 must be set to OFF.

Chan.		Chan.	
A0	A xx,00	A8	A xx,08
A1	A xx,01	A9	A xx,09
A2	A xx,02	A10	A xx,10
A3	A xx,03	A11	A xx,11
A4	A xx,04	A12	A xx,12
A5	A xx,05	A13	A xx,13
A6	A xx,06	A14	A xx,14
A7	A xx,07	A15	A xx,15

xx: Group number of the address, set on the DIL switch with the switches 2...7.

The module uses 16 outputs on the CS31 system bus.

I/O configuration

With this module, an I/O configuration is not necessary.

Normal operation

- The module initializes itself after power ON. During initialization all LEDs ⊖ are ON.
- After the initialization, the two red LEDs ⊖ go out again, if the bus is running correctly and the module does not detect any error. The green LED ”Supply” lights up.
- The16 yellow LEDs ○ indicate the signal statuses of the channels A0...A15.

Diagnosis and displays

Diagnosis functions:

– Bus Error (on the CS31 system bus)
– Overload (or short–circuit)
– Supply (power)

Diagnosis error table:

◩ LED flashes ■ LED ON □ LED OFF

Bus Error	Overload	Supply	Explanation
□	□	□	The module is not connected at all, or the 24 V DC power supply is OFF.
□	□	■	Power is ON, the bus is running, no error.
□	■	■	Power is ON, the bus is running, there is a short–circuit/overload on at least one output.
◩	■	■	Power is ON, there is a short–circuit/overload on at least one output, the bus does not run.
◩	□	■	Power is ON, the bus does not run.
■	■	■	Initialization phase after power ON.

Behaviour in case of short–circuit or overload:

If a short–circuit or an overload has occurred on an output channel, the involved channel will be switched off as a reaction on a high temperature of the switching transistor. In certain intervals, the module then tries to switch on the channel again. Before every switching–on trial, the signal at all channels will be interrupted for a period of ca. 20 µs. This is also valid for those channels which are not involved in the overload or short–circuit event.

After the short–circuit or overload has been eliminated, the involved channel can operate immediately again. The red LED ”Overload” goes out.

Error message to the master:

In case of a short–circuit or an overload, an error message is sent to the master, along with the error code No. 4. In each case, the channel No. 0 is given as faulty, independent of the really involved channel. The error message is kept up for a period of at least 5 seconds, even if the short–circuit or overload has been remedied in a shorter time.

Fur further information concerning diagnosis, see the descriptions of the central units and couplers used as bus masters.

Technical data ICPO 16 H1

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

Connectors and terminals

Power supply 24 V DC	Screw–type terminals 2.5 mm^2 inside the housing, PG11 gland for cable
CS31 bus line	2 x 4–pole M12 connector (female)
Outputs	16 x 5–pole M12 connector (female)

Power supply

Rated supply voltage L+	24 V DC
Current consumption, without output loads	max. 0.1 A
Max. supply current (incl. output loads)	20 A
Conductor cross section	max. 2.5 mm^2
Internal fuse (under the cover)	32 A, slow, 6 x 32 mm

Outputs

Number of outputs per module	16 (overload and short–circuit proof, electrically not isolated)
Signal level of the outputs, signal 1	like L+, max. transistor saturation voltage 0.5 V
Leakage current signal 0	$\leq$ 10 µA
Output load capability	
max. current per output	2 A continuously
lamp load per output	max. 50 W
total output current (all outputs together)	max. 20 A
Switching frequency with inductive load	max. 2 Hz
with resistive load	max. 100 Hz
Short–circuit and overload protection	electronically
Switch–off delay in case of a short–circuit	ca. 150 µs
Short–circuit indication	yes, with a red LED
Limitation of output voltage,	
if an inductive load is switched off	by an integrated suppressor diode
switch–off peak	max. –10 V

Interfaces

Transmission standard between the central unit and input/output modules	EIA RS–485 (ABB Procontic CS31 system bus)
Bus transmission time	387 µs

LED indicators

Output signals	1 yellow LED per channel
Bus Error	1 red LED
Overload (and short–circuit)	1 red LED (lights up, if at least one output is short–circuited or overloaded)
Supply	1 green LED (lights up, if the supply voltage is $\geq$ 18 V)

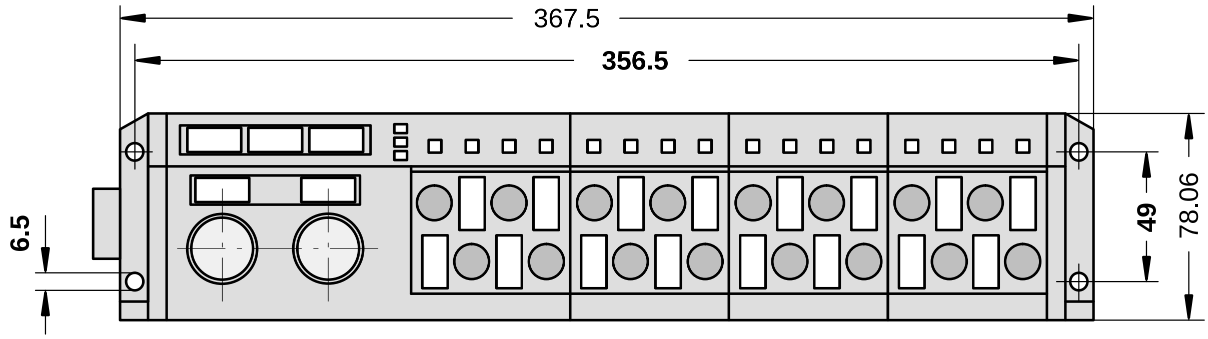
Mechanical data

Degree of protection according to DIN 40040, IEC 529	IP 65
Dimensions (length x width x height)	367.5 x 78.5 x 78.06 mm
Mounting dimensions	356.5 x 49 mm or 356.5 x 43 mm
Weight	ca. 1.15 kg

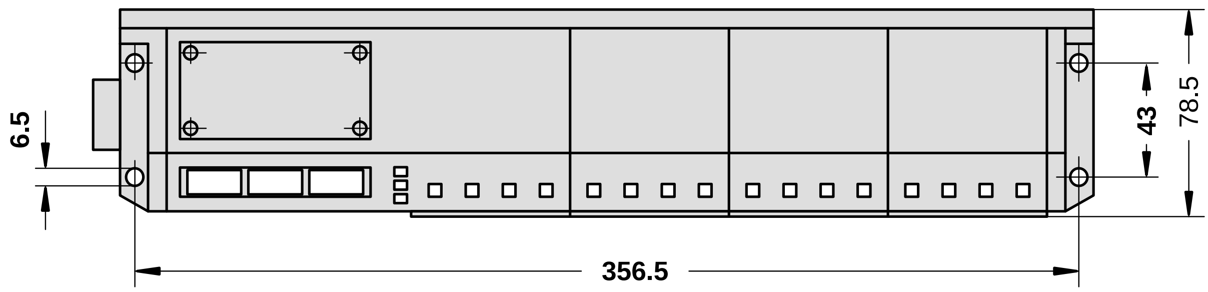
Ordering data	Order No.
Output module ICPO 16 H1	GJV 307 56 10 R0101
Accessories:	
5–pole M12 plug, male, ”straight”	GJV 307 56 17 R1
5–pole M12 plug, male, ”bended”	GJV 307 56 18 R1
4–pole M12 plug, male, ”straight”	GJV 307 56 21 R1
4–pole M12 plug, male, ”bended”	GJV 307 56 22 R1
M12 filler plug	GJV 307 56 19 R1

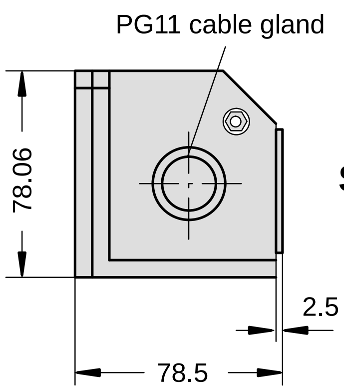
Note:
In order to meet the Degree of Protection IP65, suitable cables with certain diameters must be used at the cable glands (bus, I/O connectors, supply voltage): cable diameters for bus and I/O 4.5 mm to 6.5 mm, for supply voltage 5 mm to 10 mm. The electrical specifications for the bus cables can be found under the CS31 system data.

Front view



Top view





Side view

The dimensions for **assembly holes** are printed in **bold**, all dimensions are given in mm.

Fig. 4.4.1–3: Outline dimensions of the 16–channel output module ICPO 16 H1

4.4.2 Binary Output Module ICPO 08 H1

8 output channels 24 V DC/2A, **Degree of Protection IP65**
CS31 system bus connection electrically isolated

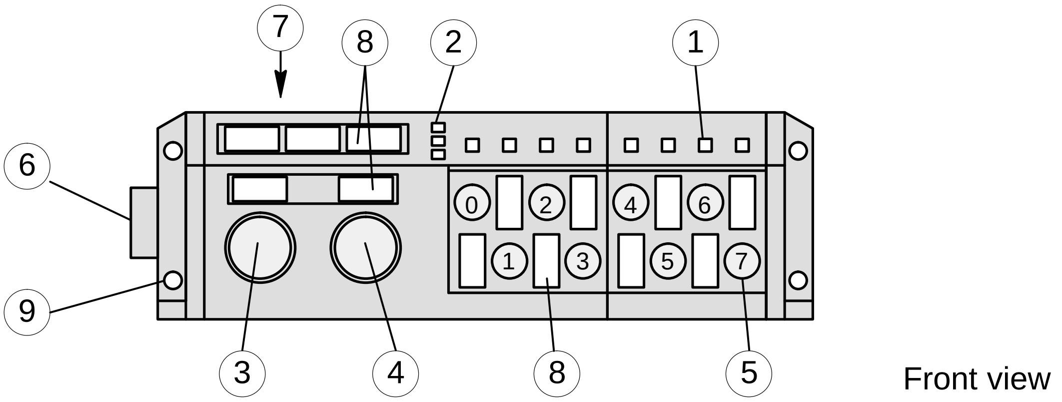


Fig. 4.4.2–1: Binary output module ICPO 08 H1

Contents

Intended purpose

The binary output module ICPO 08 H1 is a remote module on the CS31 system bus. It has 16 binary channels with the following features:

- Housing and termination system according to IP65 degree of protection
- The CS31 bus line is looped through from module to module. For this purpose, the module has two bus connectors as bus input and bus output.
- Each output has its own connector and thus can be unplugged individually.
- The 24 V DC supply voltage is connected via screw–type terminals inside the module housing.
- The outputs
  - employ switching transistors,
  - have a rated load capability of 2 A and
  - are overload and short–circuit proof.

The module is mounted with screws. There are bore holes available for both mounting on a rear wall or on a horizontal surface.

The CS31 system bus connection is electrically isolated from remaining module components.

The module offers diagnosis functions (see chapter ”Diagnosis and displays”).

Displays and connections at module housing

1. 8 yellow LEDs for displaying the signal statuses of the outputs
2. LEDs ”Bus Error”, ”Overload” and ”Supply” indicating of operating conditions and errors (see section ”Diagnosis and displays”)
3. CS31 bus connector (input)
4. CS31 bus connector (output)
5. 8 connectors for the outputs
6. PG11 cable gland for the 24 V DC power supply
7. The terminals for 24 V DC and PE are located under a removable cover. It is accessible from the top of the module. The DIL switch for setting the module address is also under the cover.
8. Labelling fields
9. Bore holes for mounting (see also ”Dimensioned drawing” at the end of this description)

Electrical connection

The following figure shows all details necessary for the electrical connection.

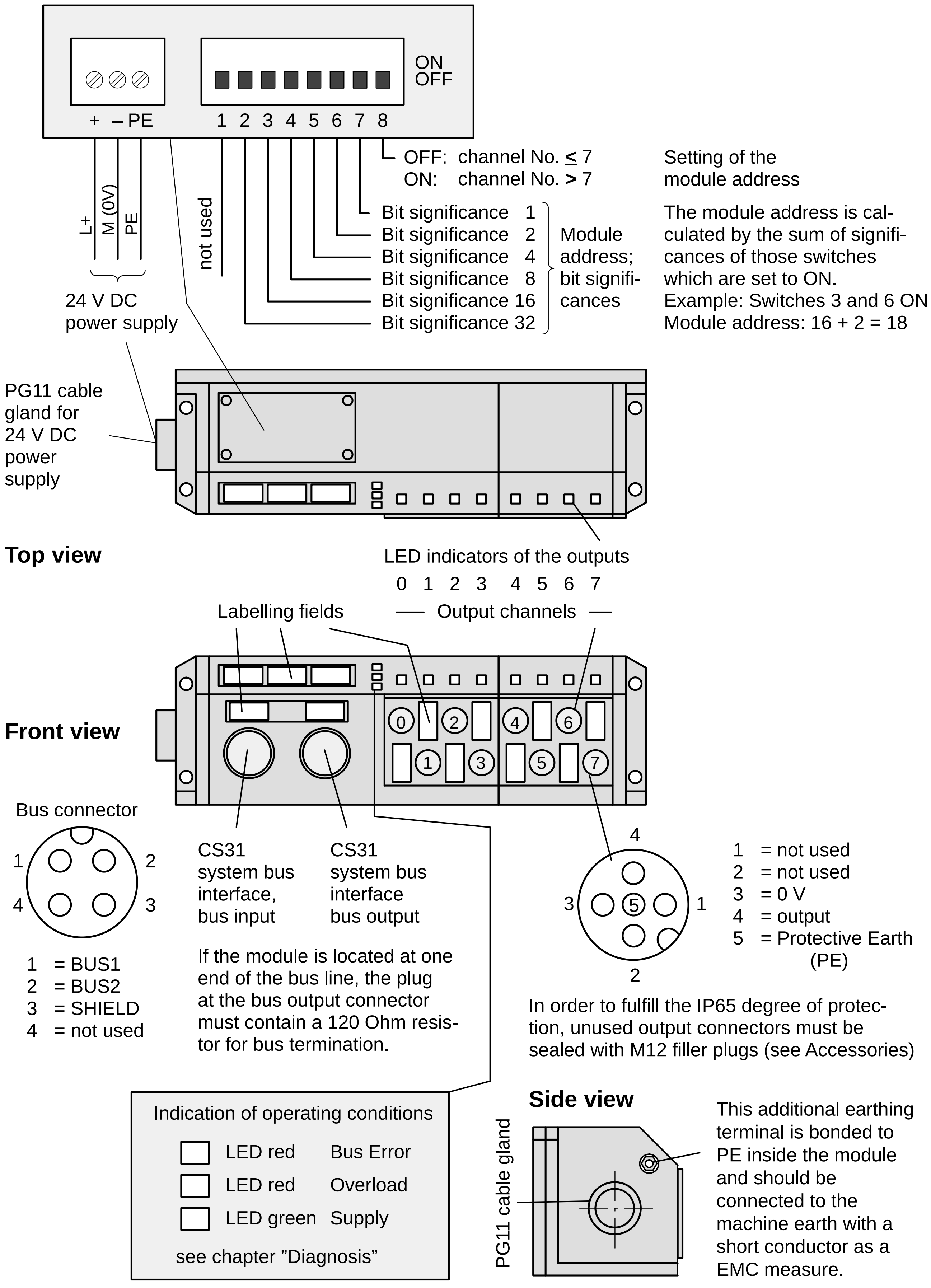


Fig. 4.4.2–2: Details for the electrical connection of the output module ICPO 08 H1

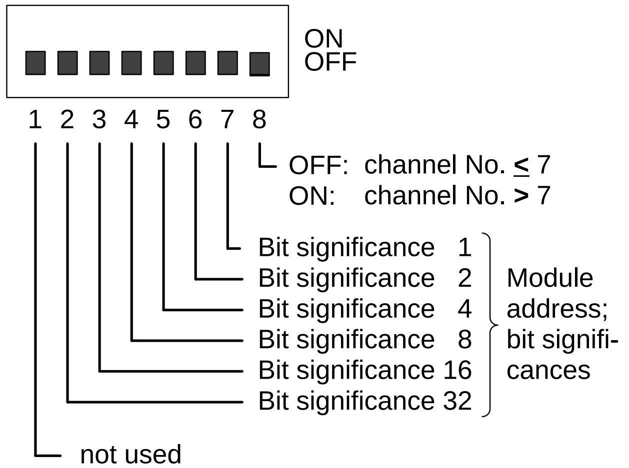
Addressing

An address has to be set on each module, so that the central unit can access the inputs and outputs correctly.

A detailed description concerning the item "Addressing" is contained in the chapters "Addressing" of the central units and couplers.

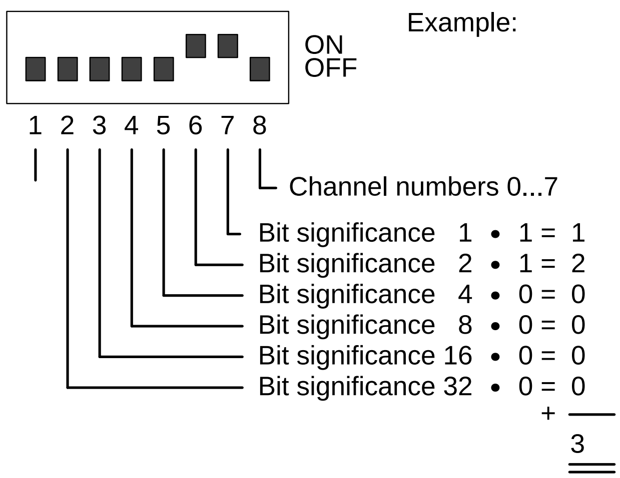
The module address is set on the DIL switch located under the cover at the top side of the module.

Meaning of the address switches:



Setting of the module address:

The module address is calculated by the sum of significances of those switches which are set to ON (see the following example).



When using the central units 07 KR 91, 07 KT 92 or 07 KT 93, the possible module addresses range from

0...61.

In connection with the central units 07 KR 91 and 07 KT 92/KT93 as bus masters, the following address allocations are valid:

Central units 07 KR 91 / 07 KT 92 / 93

The DIL switch No. 8 is set to:

Chan.	OFF	Chan.	ON
A0	A xx,00	A0	A xx,08
A1	A xx,01	A1	A xx,09
A2	A xx,02	A2	A xx,10
A3	A xx,03	A3	A xx,11
A4	A xx,04	A4	A xx,12
A5	A xx,05	A5	A xx,13
A6	A xx,06	A6	A xx,14
A7	A xx,07	A7	A xx,15

xx: Group number of the address, set on the DIL switch with the switches 2...7.

The module uses 8 outputs on the CS31 system bus.

I/O configuration

With this module, an I/O configuration is not necessary.

Normal operation

- The module initializes itself after power ON. During initialization all LEDs 2 are ON.
- After the initialization, the two red LEDs 2 go out again, if the bus is running correctly and the module does not detect any error. The green LED "Supply" lights up.
- The 8 yellow LEDs 1 indicate the signal statuses of the channels A0...A7.

Diagnosis and displays

Diagnosis functions:

– Bus Error (on the CS31 system bus)
– Overload (or short–circuit)
– Supply (power)

Diagnosis error table:

◩ LED flashes ■ LED ON □ LED OFF

Bus Error	Overload	Supply	Explanation
□	□	□	The module is not connected at all, or the 24 V DC power supply is OFF.
□	□	■	Power is ON, the bus is running, no error.
□	■	■	Power is ON, the bus is running, there is a short–circuit/overload on at least one output.
◩	■	■	Power is ON, there is a short–circuit/overload on at least one output, the bus does not run.
◩	□	■	Power is ON, the bus does not run.
■	■	■	Initialization phase after power ON.

Behaviour in case of short–circuit or overload:

If a short–circuit or an overload has occurred on an output channel, the involved channel will be switched off as a reaction on a high temperature of the switching transistor. In certain intervals, the module then tries to switch on the channel again. Before every switching–on trial, the signal at all channels will be interrupted for a period of ca. 20 µs. This is also valid for those channels which are not involved in the overload or short–circuit event.

After the short–circuit or overload has been eliminated, the involved channel can operate immediately again. The red LED ”Overload” goes out.

Error message to the master:

In case of a short–circuit or an overload, an error message is sent to the master, along with the error code No. 4. In each case, the channel No. 0 is given as faulty, independent of the really involved channel. The error message is kept up for a period of at least 5 seconds, even if the short–circuit or overload has been remedied in a shorter time.

Fur further information concerning diagnosis, see the descriptions of the central units and couplers used as bus masters.

Technical data ICPO 08 H1

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

Connectors and terminals

Power supply 24 V DC	Screw–type terminals 2.5 mm^2 inside the housing, PG11 gland for cable
CS31 bus line	2 x 4–pole M12 connector (female)
Outputs	8 x 5–pole M12 connector (female)

Power supply

Rated supply voltage	L+	24 V DC
Current consumption,	without output loads	max. 0.1 A
Max. supply current (incl. output loads)		16 A
Conductor cross section		max. 2.5 mm^2
Internal fuse (under the cover)		20 A, slow, 6 x 32 mm

Outputs

Number of outputs per module		8 (overload and short–circuit proof, electrically not isolated)
Signal level of the outputs,	signal 1	like L+, max. transistor saturation voltage 0.5 V
Leakage current	signal 0	$\leq$ 10 µA
Output load capability		
max. current per output		2 A continuously
lamp load per output		max. 50 W
total output current (all outputs together)		max. 16 A
Switching frequency	with inductive load	max. 2 Hz
	with resistive load	max. 100 Hz
Short–circuit and overload protection		electronically
Switch–off delay in case of a short–circuit		ca. 150 µs
Short–circuit indication		yes, with a red LED
Limitation of output voltage,		
if an inductive load is switched off		by an integrated suppressor diode
switch–off peak		max. –10 V

Interfaces

Transmission standard between the central unit and input/output modules	EIA RS–485 (ABB Procontic CS31 system bus)
Bus transmission time	323 µs

LED indicators

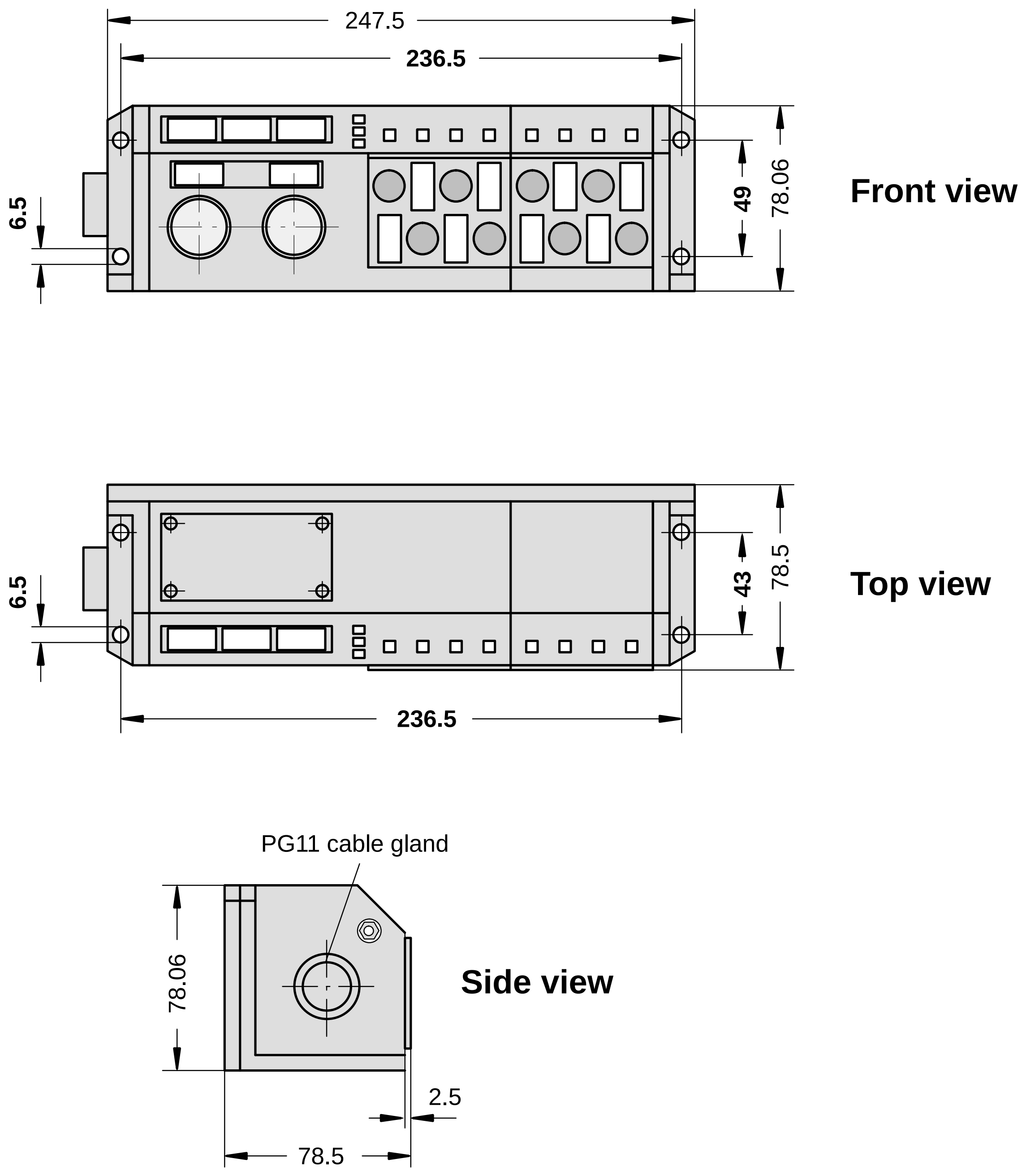
Output signals	1 yellow LED per channel
Bus Error	1 red LED
Overload (and short–circuit)	1 red LED (lights up, if at least one output is short–circuited or overloaded)
Supply	1 green LED (lights up, if the supply voltage is $\geq$ 18 V)

Mechanical data

Degree of protection according to DIN 40040, IEC 529	IP 65
Dimensions (length x width x height)	247.5 x 78.5 x 78.06 mm
Mounting dimensions	236.5 x 49 mm or 236.5 x 43 mm
Weight	ca. 0.75 kg

Ordering data	Order No.
Output module ICPO 08 H1	GJV 307 56 11 R0101
Accessories:	
5–pole M12 plug, male, ”straight”	GJV 307 56 17 R1
5–pole M12 plug, male, ”bended”	GJV 307 56 18 R1
4–pole M12 plug, male, ”straight”	GJV 307 56 21 R1
4–pole M12 plug, male, ”bended”	GJV 307 56 22 R1
M12 filler plug	GJV 307 56 19 R1

Note:
In order to meet the Degree of Protection IP65, suitable cables with certain diameters must be used at the cable glands (bus, I/O connectors, supply voltage): cable diameters for bus and I/O 4.5 mm to 6.5 mm, for supply voltage 5 mm to 10 mm. The electrical specifications for the bus cables can be found under the CS31 system data.



The dimensions for **assembly holes** are printed in **bold**, all dimensions are given in mm.

Fig. 4.4.2–3: Outline dimensions of the 8–channel output module ICPO 08 H1

4.4.3 Binary Input Module ICPI 16 D1

16 input channels 24 V DC, **Degree of Protection IP65**
CS31 system bus connection electrically isolated

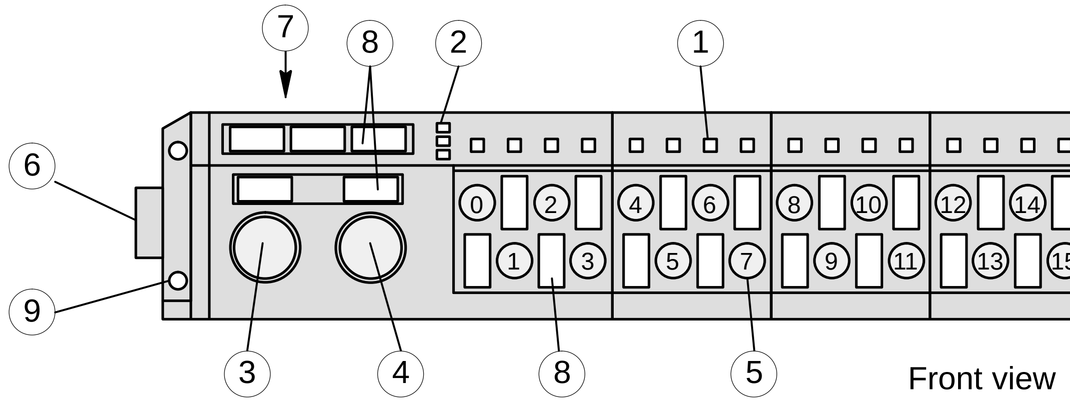


Fig. 4.4.3–1: Binary input module ICPI 16 D1

Contents

Intended purpose

The binary input module ICPI 16 D1 is a remote module on the CS31 system bus. It has 16 binary channels with the following features:

- Housing and termination system according to IP65 degree of protection
- The CS31 bus line is looped through from module to module. For this purpose, the module has two bus connectors as bus input and bus output.
- Each input has its own connector and thus can be unplugged individually.
- The 24 V DC supply voltage is connected via screw–type terminals inside the module housing.
- The inputs
  - allow you to connect sensors with 2–pole and 3–pole technique (switching contacts, initiators etc.)
  - provide a short–circuit/overload–proof supply voltage for the sensors, with can be loaded with 100 mA by each sensor
  - have a rated signal current of 15 mA each

The module is mounted with screws. There are bore holes available for both mounting on a rear wall or on a horizontal surface.

The CS31 system bus connection is electrically isolated from remaining module components.

The module offers diagnosis functions (see chapter ”Diagnosis and displays”).

Displays and connections at module housing

1 16 yellow LEDs for displaying the signal statuses of the inputs

2 LEDs ”Bus Error”, ”Overload” and ”Supply” indicating of operating conditions and errors (see section ”Diagnosis and displays”)

3 CS31 bus connector (input)

4 CS31 bus connector (output)

5 16 connectors for the inputs

6 PG11 cable gland for the 24 V DC power supply

7 The terminals for 24 V DC and PE are located under a removable cover. It is accessible from the top of the module. The DIL switch for setting the module address is also under the cover.

8 Labelling fields

9 Bore holes for mounting (see also ”Dimensioned drawing” at the end of this description)

Electrical connection

The following figure shows all details necessary for the electrical connection.

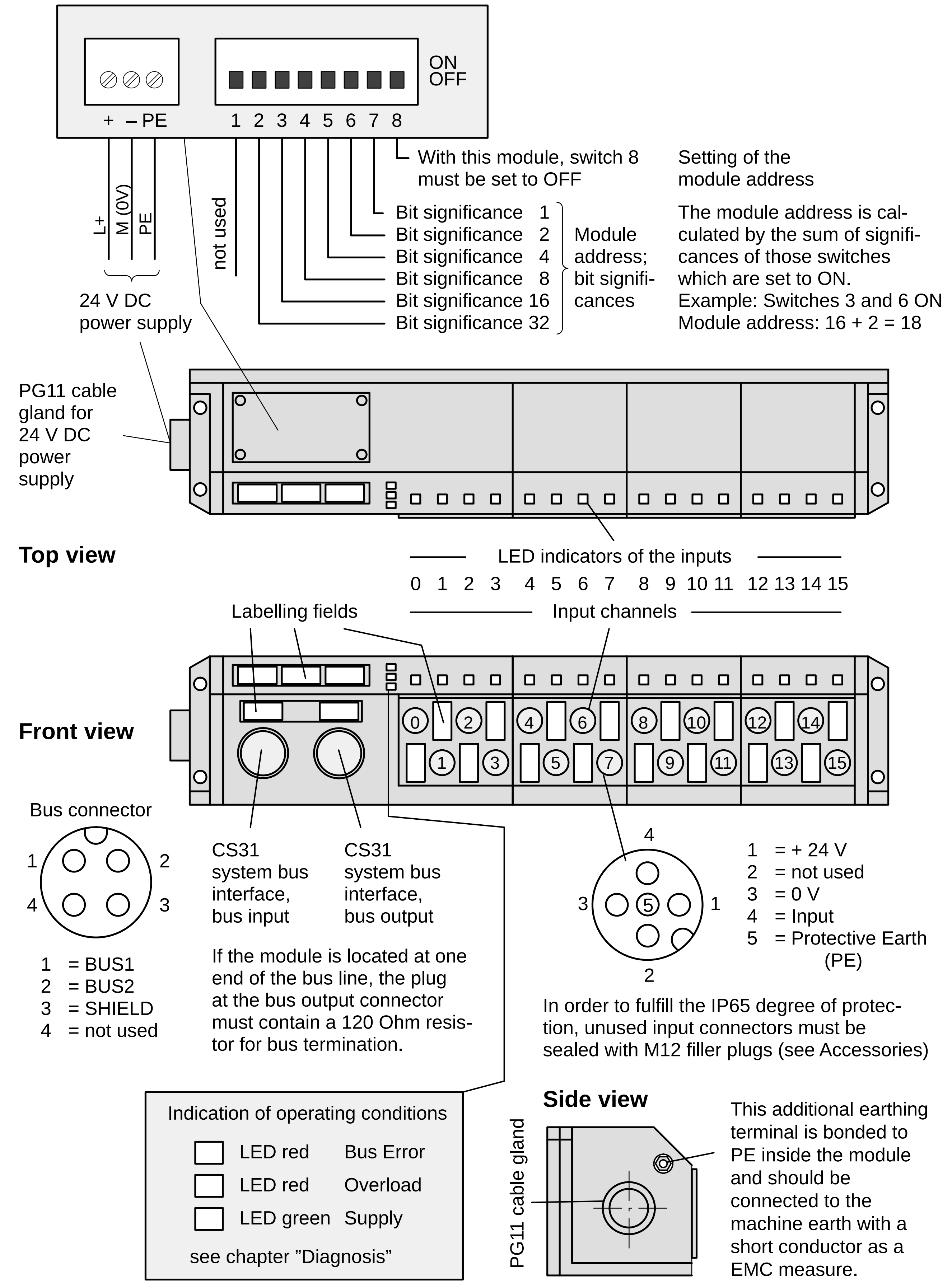


Fig. 4.4.3–2: Details for the electrical connection of the input module ICPI 16 D1

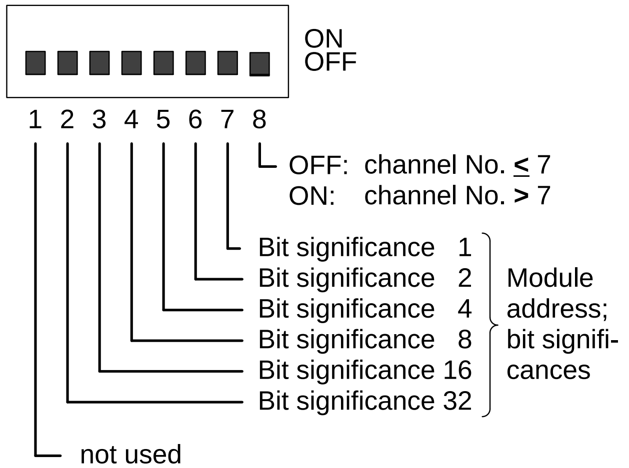
Addressing

An address has to be set on each module, so that the central unit can access the inputs and outputs correctly.

A detailed description concerning the item ”Addressing” is contained in the chapters ”Addressing” of the central units and couplers.

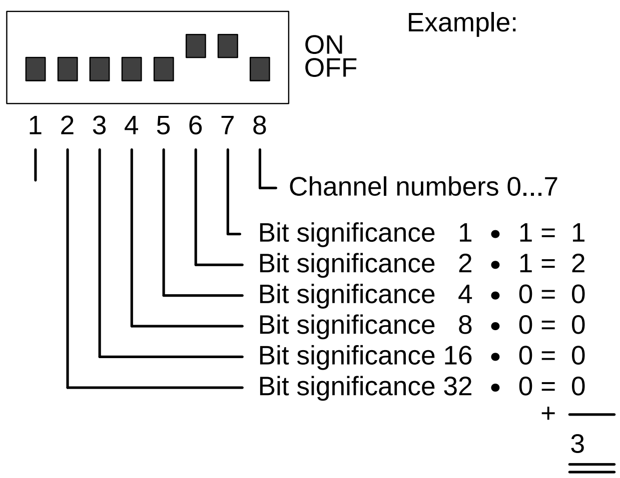
The module address is set on the DIL switch located under the cover at the top side of the module.

Meaning of the address switches:



Setting of the module address:

The module address is calculated by the sum of significances of those switches which are set to ON (see the following example).



When using the central units 07 KR 91, 07 KT 92 or 07 KT 93, the possible module addresses range from

0...61.

In connection with the central units 07 KR 91 and 07 KT 92/KT93 as bus masters, the following address allocations are valid:

Central units 07 KR 91 / 07 KT 92 / 93

The DIL switch No. 8 must be set to OFF.

Chan.		Chan.	
E0	E xx,00	E8	E xx,08
E1	E xx,01	E9	E xx,09
E2	E xx,02	E10	E xx,10
E3	E xx,03	E11	E xx,11
E4	E xx,04	E12	E xx,12
E5	E xx,05	E13	E xx,13
E6	E xx,06	E14	E xx,14
E7	E xx,07	E15	E xx,15

xx: Group number of the address, set on the DIL switch with the switches 2...7.

The module uses 16 inputs on the CS31 system bus.

I/O configuration

With this module, an I/O configuration is not necessary.

Normal operation

- The module initializes itself after power ON. During initialization all LEDs 2 are ON.
- After the initialization, the two red LEDs 2 go out again, if the bus is running correctly and the module does not detect any error. The green LED ”Supply” lights up.
- The16 yellow LEDs 1 indicate the signal statuses of the channels E0...E15.

Diagnosis and displays

Diagnosis functions:

– Bus Error (on the CS31 system bus)
– Overload (or short–circuit)
– Supply (power)

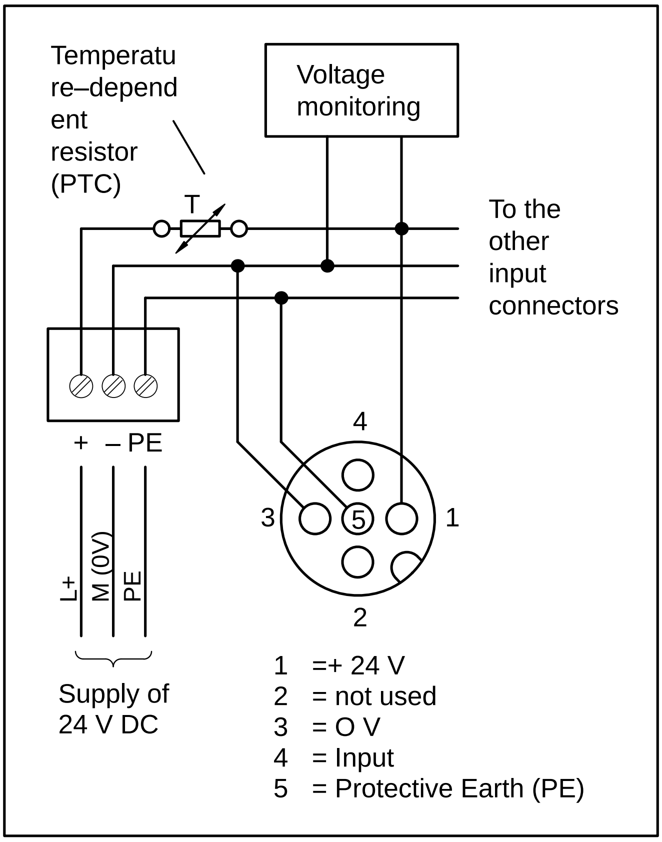
Diagnosis error table:

◪ LED flashes ■ LED ON □ LED OFF

Bus Error	Overload	Supply	Explanation
□	□	□	The module is not connected at all, or the 24 V DC power supply is OFF.
□	□	■	Power is ON, the bus is running, no error.
□	■	■	Power is ON, there is a short–circuit/overload on at least one +24 V DC power supply connection of an input, the bus is running.
◪	■	■	Power is ON, there is a short–circuit/overload on at least one +24 V DC power supply connection of an input, the bus is not running.
◪	□	■	Power is ON, the bus does not run.
■	■	■	Initialization phase after power ON.

Behaviour in case of short–circuit or overload at sensors:

The supply connections at the sensor input connectors are connected via a temperature–dependent resistor (PTC thermistor) to the +24 V DC input of the screw–type terminals. If an overload or a short–circuit occurs with a sensor, the PTC will work as an overload protection. A voltage monitoring circuitry generates an error message in case of undervoltage (the LED ”Overload” lights up). The following figure demonstrates the function.



After the short–circuit or overload has been eliminated, the module can operate correctly again. The red LED ”Overload” goes out.

Error message to the master:

In case of a short–circuit or an overload, an error message is sent to the master, along with the error code No. 4. In each case, the channel No. 0 is given as faulty, independent of the really involved channel. The error message is kept up for a period of at least 5 seconds, even if the short–circuit or overload has been remedied in a shorter time.

Fur further information concerning diagnosis, see the descriptions of the central units and couplers used as bus masters.

Technical data ICPI 16 D1

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

Connectors and terminals

Power supply 24 V DC	Screw–type terminals 2.5 mm^2 inside the housing, PG11 gland for cable
CS31 bus line	2 x 4–pole M12 connector (female)
Inputs	16 x 5–pole M12 connector (female)

Power supply

Rated supply voltage	L+	24 V DC
Current consumption,	without sensor loads	max. 50 mA
Supply voltage for the sensors		$\geq$ (L+ – 0.5 V)
Supply current for the sensors		max. 100 mA per sensor
Short–circuit protection		PTC thermistor, $I_{sc} \geq 1.6$ A
Short–circuit indication		yes, with a red LED
Conductor cross section		max. 2.5 mm^2

Inputs

Number of inputs per module		16
Signal level of the inputs	with signal 1 with signal 0	$\geq$ 13 V $\leq$ 7 V
Signal input current	with signal 1	ca. 15 mA
Input signal delay		ca. 6 ms

Interfaces

Transmission standard between the central unit and input/output modules	EIA RS–485 (ABB Procontic CS31 system bus)
Bus transmission time	387 µs

LED indicators

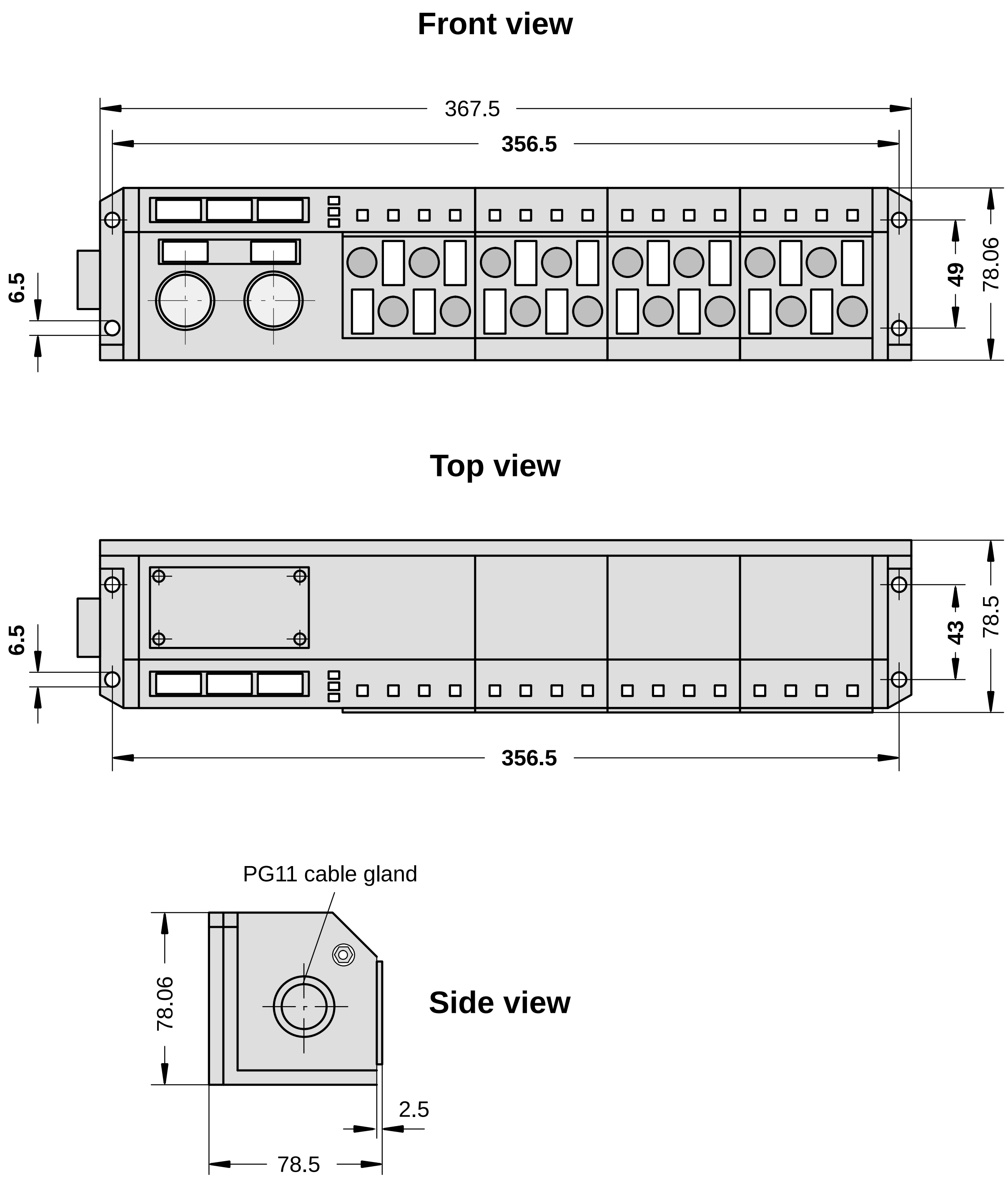
Input signals		1 yellow LED per channel
Bus Error		1 red LED
Overload	(and short–circuit)	1 red LED (lights up, if there is an overload or a short–circuit at the supply voltage on at least at one input channel)
Supply		1 green LED (lights up, if the supply voltage is $\geq$ 18 V)

Mechanical data

Degree of protection according to DIN 40040, IEC 529	IP 65
Dimensions (length x width x height)	367.5 x 78.5 x 78.06 mm
Mounting dimensions	356.5 x 49 mm or 356.5 x 43 mm
Weight	ca. 1.15 kg

Ordering data	Order No.
Input module ICPI 16 D1	GJV 307 56 13 R0101
Accessories:	
5–pole M12 plug, male, ”straight”	GJV 307 56 17 R1
5–pole M12 plug, male, ”bended”	GJV 307 56 18 R1
4–pole M12 plug, male, ”straight”	GJV 307 56 21 R1
4–pole M12 plug, male, ”bended”	GJV 307 56 22 R1
M12 filler plug	GJV 307 56 19 R1

Note:
In order to meet the Degree of Protection IP65, suitable cables with certain diameters must be used at the cable glands (bus, I/O connectors, supply voltage): cable diameters for bus and I/O 4.5 mm to 6.5 mm, for supply voltage 5 mm to 10 mm. The electrical specifications for the bus cables can be found under the CS31 system data.



The dimensions for **assembly holes** are printed in **bold**, all dimensions are given in mm.

Fig. 4.4.3–3: Outline dimensions of the 16–channel input module ICPI 16 D1

4.4.4 Binary Input Module ICPI 08 D1

8 input channels 24 V DC, **Degree of Protection IP65**
CS31 system bus connection electrically isolated

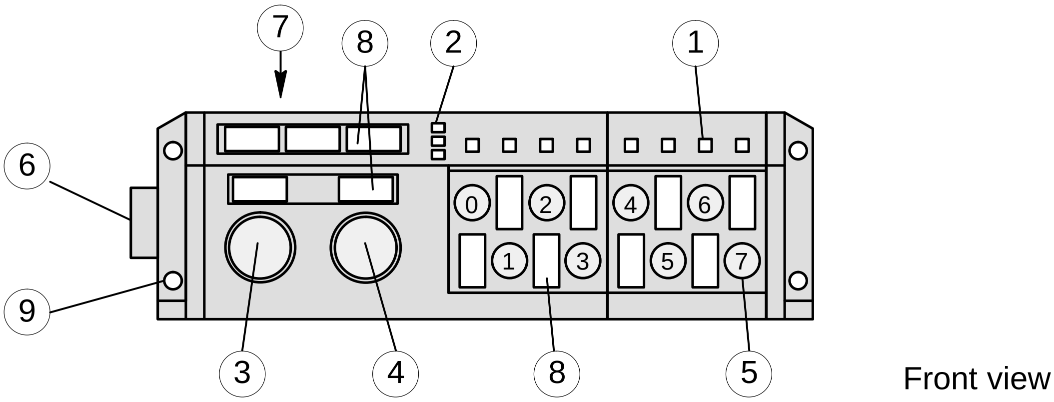


Fig. 4.4.4–1: Binary input module ICPI 08 D1

Contents

Intended purpose

The binary input module ICPI 08 D1 is a remote module on the CS31 system bus. It has 16 binary channels with the following features:

- Housing and termination system according to IP65 degree of protection
- The CS31 bus line is looped through from module to module. For this purpose, the module has two bus connectors as bus input and bus output.
- Each input has its own connector and thus can be unplugged individually.
- The 24 V DC supply voltage is connected via screw–type terminals inside the module housing.
- The inputs
  - allow you to connect sensors with 2–pole and 3–pole technique (switching contacts, initiators etc.)
  - provide a short–circuit/overload–proof supply voltage for the sensors, with can be loaded with 100 mA by each sensor
  - have a rated signal current of 15 mA each

The module is mounted with screws. There are bore holes available for both mounting on a rear wall or on a horizontal surface.

The CS31 system bus connection is electrically isolated from remaining module components.

The module offers diagnosis functions (see chapter ”Diagnosis and displays”).

Displays and connections at module housing

1 8 yellow LEDs for displaying the signal statuses of the inputs

2 LEDs ”Bus Error”, ”Overload” and ”Supply” indicating of operating conditions and errors (see section ”Diagnosis and displays”)

3 CS31 bus connector (input)

4 CS31 bus connector (output)

5 8 connectors for the inputs

6 PG11 cable gland for the 24 V DC power supply

7 The terminals for 24 V DC and PE are located under a removable cover. It is accessible from the top of the module. The DIL switch for setting the module address is also under the cover.

8 Labelling fields

9 Bore holes for mounting (see also ”Dimensioned drawing” at the end of this description)

Electrical connection

The following figure shows all details necessary for the electrical connection.

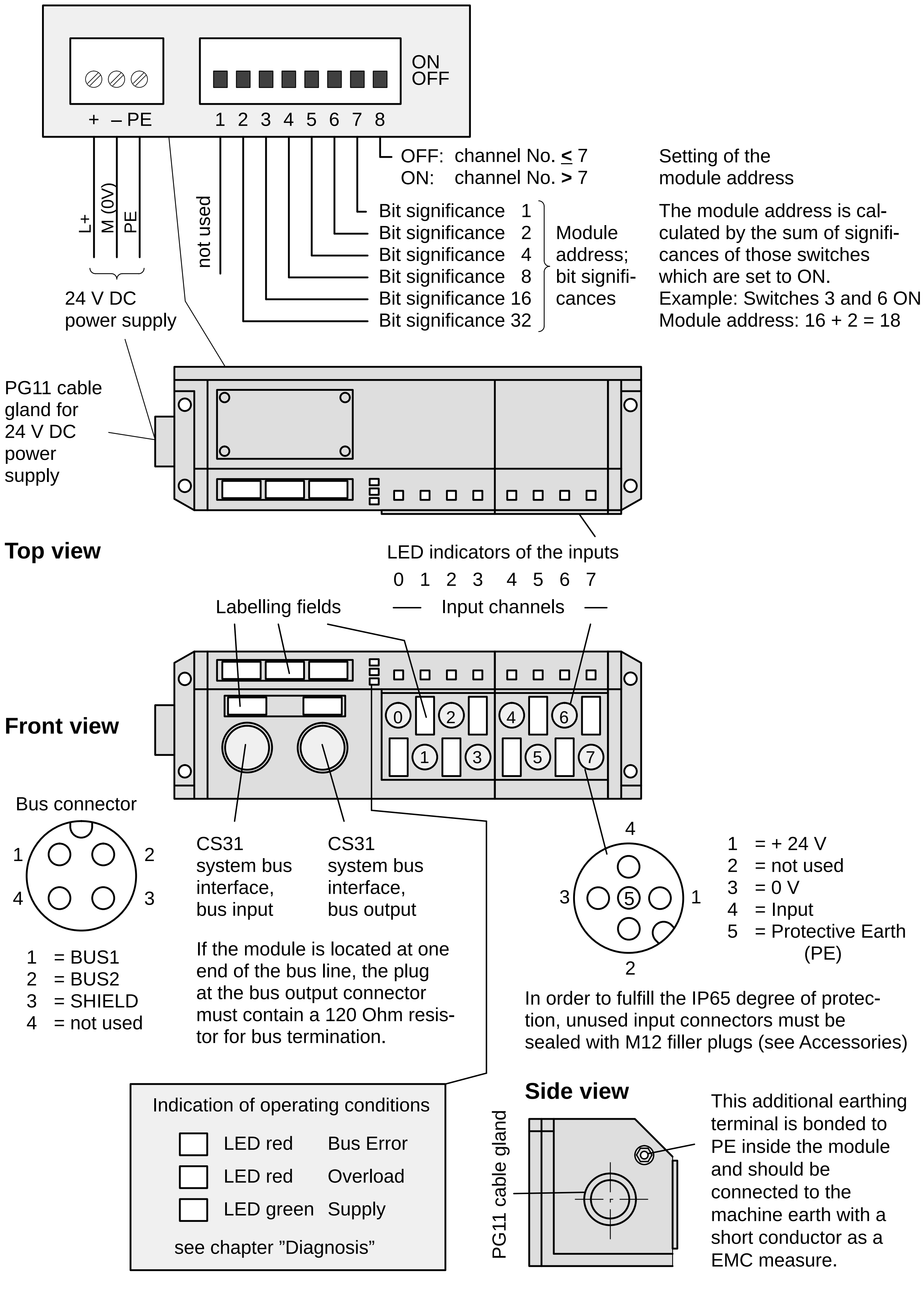


Fig. 4.4.4–2: Details for the electrical connection of the input module ICPI 08 D1

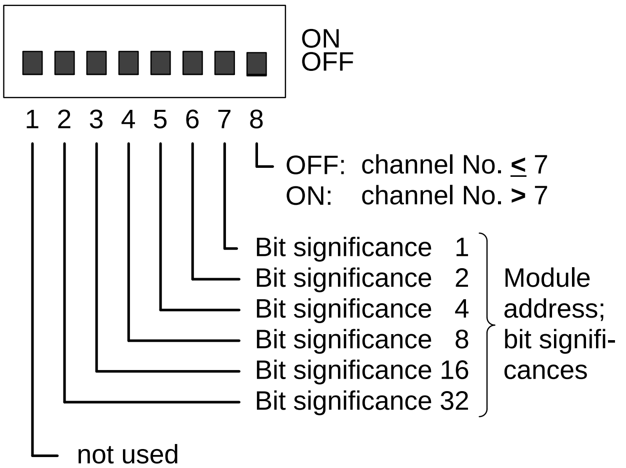
Addressing

An address has to be set on each module, so that the central unit can access the inputs and outputs correctly.

A detailed description concerning the item ”Addressing” is contained in the chapters ”Addressing” of the central units and couplers.

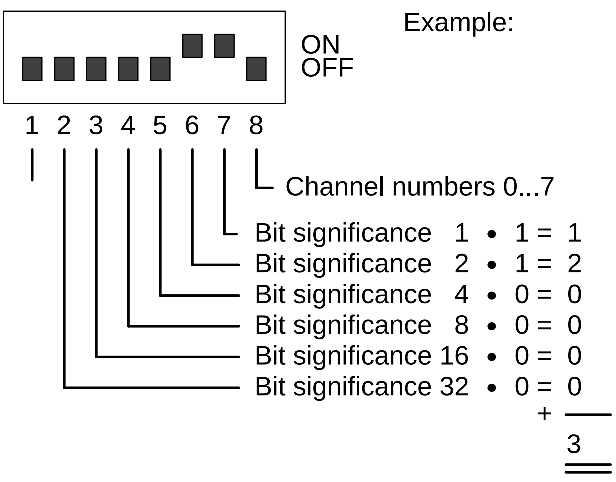
The module address is set on the DIL switch located under the cover at the top side of the module.

Meaning of the address switches:



Setting of the module address:

The module address is calculated by the sum of significances of those switches which are set to ON (see the following example).



When using the central units 07 KR 91, 07 KT 92 or 07 KT 93, the possible module addresses range from

0...61.

In connection with the central units 07 KR 91 and 07 KT 92/KT93 as bus masters, the following address allocations are valid:

Central units 07 KR 91 / 07 KT 92 / 93

The DIL switch No. 8 is set to:

Chan.	OFF	Chan.	ON
E0	E xx,00	E0	E xx,08
E1	E xx,01	E1	E xx,09
E2	E xx,02	E2	E xx,10
E3	E xx,03	E3	E xx,11
E4	E xx,04	E4	E xx,12
E5	E xx,05	E5	E xx,13
E6	E xx,06	E6	E xx,14
E7	E xx,07	E7	E xx,15

xx: Group number of the address, set on the DIL switch with the switches 2...7.

The module uses 8 inputs on the CS31 system bus.

I/O configuration

With this module, an I/O configuration is not necessary.

Normal operation

- The module initializes itself after power ON. During initialization all LEDs 2 are ON.
- After the initialization, the two red LEDs 2 go out again, if the bus is running correctly and the module does not detect any error. The green LED ”Supply” lights up.
- The 8 yellow LEDs 1 indicate the signal statuses of the channels E0...E7.

Diagnosis and displays

Diagnosis functions:

- Bus Error (on the CS31 system bus)
- Overload (or short–circuit)
- Supply (power)

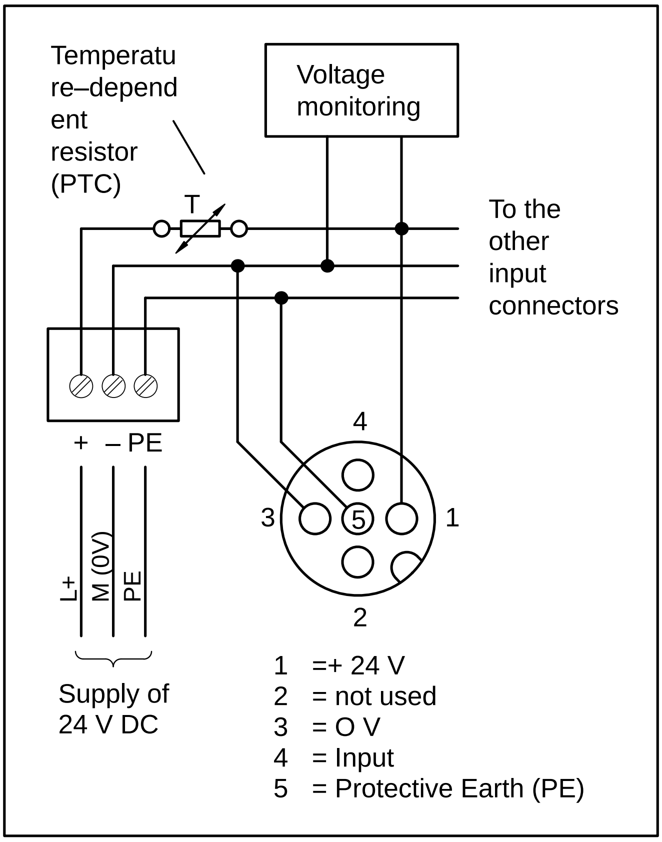
Diagnosis error table:

◩ LED flashes ■ LED ON □ LED OFF

Bus Error	Overload	Supply	Explanation
□	□	□	The module is not connected at all, or the 24 V DC power supply is OFF.
□	□	■	Power is ON, the bus is running, no error.
□	■	■	Power is ON, there is a short–circuit/overload on at least one +24 V DC power supply connection of an input, the bus is running.
◩	■	■	Power is ON, there is a short–circuit/overload on at least one +24 V DC power supply connection of an input, the bus is not running.
◩	□	■	Power is ON, the bus does not run.
■	■	■	Initialization phase after power ON.

Behaviour in case of short–circuit or overload at sensors:

The supply connections at the sensor input connectors are connected via a temperature–dependent resistor (PTC thermistor) to the +24 V DC input of the screw–type terminals. If an overload or a short–circuit occurs with a sensor, the PTC will work as an overload protection. A voltage monitoring circuitry generates an error message in case of undervoltage (the LED ”Overload” lights up). The following figure demonstrates the function.



After the short–circuit or overload has been eliminated, the module can operate correctly again. The red LED ”Overload” goes out.

Error message to the master:

In case of a short–circuit or an overload, an error message is sent to the master, along with the error code No. 4. In each case, the channel No. 0 is given as faulty, independent of the really involved channel. The error message is kept up for a period of at least 5 seconds, even if the short–circuit or overload has been remedied in a shorter time.

Fur further information concerning diagnosis, see the descriptions of the central units and couplers used as bus masters.

Technical data ICPI 08 D1

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

Connectors and terminals

Power supply 24 V DC	Screw–type terminals 2.5 mm^2 inside the housing, PG11 gland for cable
CS31 bus line	2 x 4–pole M12 connector (female)
Inputs	8 x 5–pole M12 connector (female)

Power supply

Rated supply voltage	L+	24 V DC
Current consumption,	without sensor loads	max. 50 mA
Supply voltage for the sensors		$\geq$ (L+ – 0.5 V)
Supply current for the sensors		max. 100 mA per sensor
Short–circuit protection		PTC thermistor, $I_{sc} \geq$ 1.6 A
Short–circuit indication		yes, with a red LED
Conductor cross section		max. 2.5 mm^2

Inputs

Number of inputs per module		8
Signal level of the inputs	with signal 1 with signal 0	$\geq$ 13 V $\leq$ 7 V
Signal input current	with signal 1	ca. 15 mA
Input signal delay		ca. 6 ms

Interfaces

Transmission standard between the central unit and input/output modules	EIA RS–485 (ABB Procontic CS31 system bus)
Bus transmission time	323 µs

LED indicators

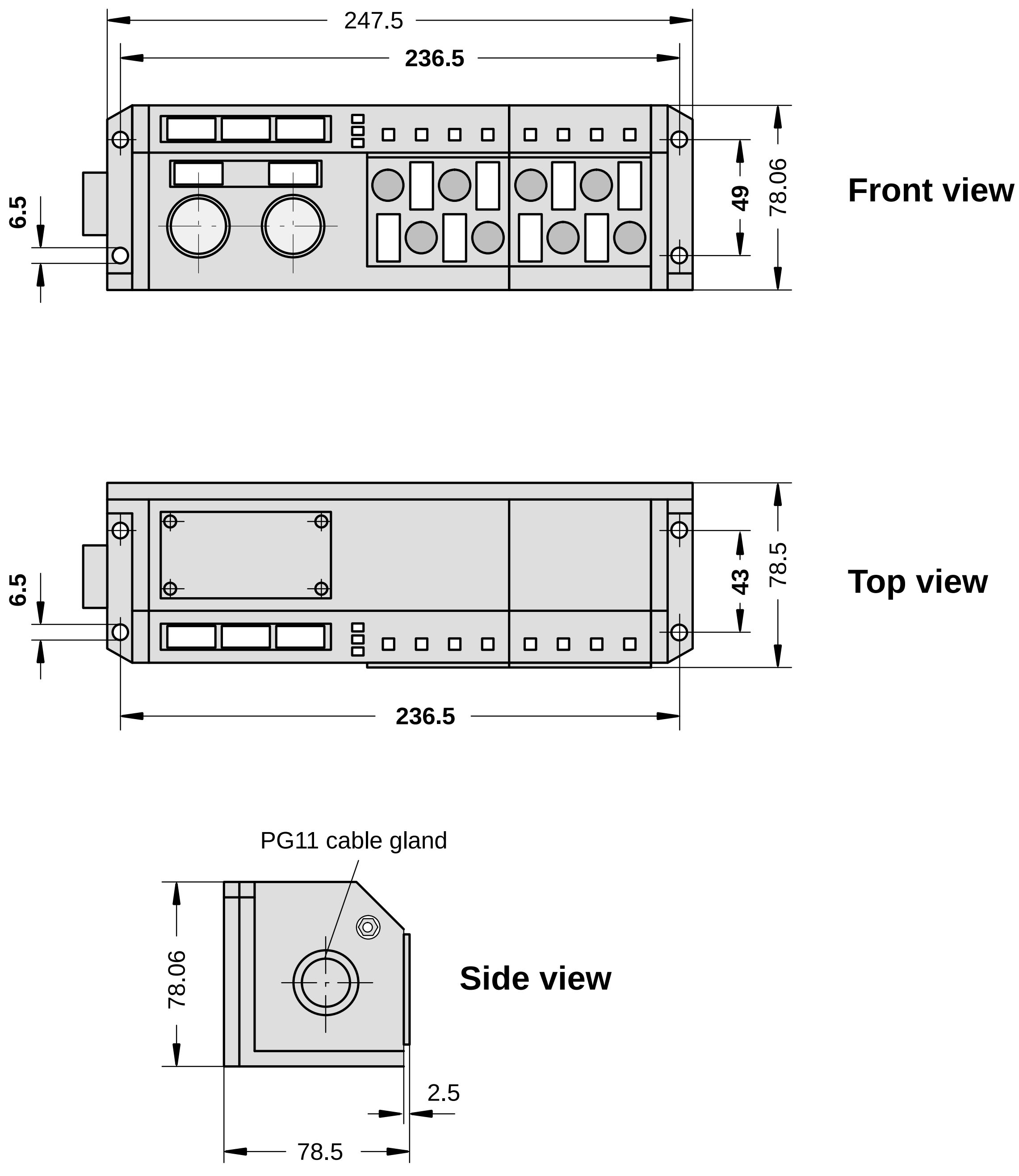
Input signals	1 yellow LED per channel
Bus Error	1 red LED
Overload (and short–circuit)	1 red LED (lights up, if there is an overload or a short–circuit at the supply voltage on at least at one input channel)
Supply	1 green LED (lights up, if the supply voltage is $\geq$ 18 V)

Mechanical data

Degree of protection according to DIN 40040, IEC 529	IP 65
Dimensions (length x width x height)	247.5 x 78.5 x 78.06 mm
Mounting dimensions	236.5 x 49 mm or 236.5 x 43 mm
Weight	ca. 0.75 kg

Ordering data	Order No.
Input module ICPI 08 D1	GJV 307 56 14 R0101
Accessories:	
5–pole M12 plug, male, ”straight”	GJV 307 56 17 R1
5–pole M12 plug, male, ”bended”	GJV 307 56 18 R1
4–pole M12 plug, male, ”straight”	GJV 307 56 21 R1
4–pole M12 plug, male, ”bended”	GJV 307 56 22 R1
M12 filler plug	GJV 307 56 19 R1

Note:
In order to meet the Degree of Protection IP65, suitable cables with certain diameters must be used at the cable glands (bus, I/O connectors, supply voltage): cable diameters for bus and I/O 4.5 mm to 6.5 mm, for supply voltage 5 mm to 10 mm. The electrical specifications for the bus cables can be found under the CS31 system data.



The dimensions for **assembly holes** are printed in **bold**, all dimensions are given in mm.

Fig. 4.4.4–3: Outline dimensions of the 8–channel input module ICPI 08 D1

The remote analogue input/output units are used to measure physical process values.
These units can convert analog values to numeric values for inputs or numeric values to analog values for outputs.

There are two available resolutions :

- 8 bits units:
  - ICSM 06 A6, 4 inputs, 2 outputs
  - ICSE 08 A6, 8 inputs
  - ICST 08 A8, 8 inputs PT 100
  - ICST 08 A9, 8 inputs PT 100
- 12 bits units :
  - ICSE 08 B5, 8 inputs
  - ICSA 04 B5, 4 outputs

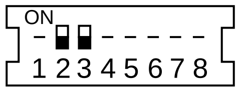
It is possible to use each channel of a unit for current or voltage processing.
The PT 100 channels are only used for temperature measurement.

	Inputs		Outputs	
	Voltage	Current	Voltage	Current
ICSM 06 A6	0…10 V 0…5 V	0…20 mA 4…20 mA	± 10 V	0…20 mA 4…20 mA
ICSE 08 A6	0…10 V 0…5 V	0…20 mA 4…20 mA		
ICSE 08 B5	± 10 V ± 5 V	± 20 mA 4...20 mA		
ICSA 04 B5			± 10 V ± 12.5 V	0…20 mA 4…20 mA

There are three possible configurations for the range of bits used within a word.
The range of bits used within a word is determined by the position of dip switches N∘2 and N∘3 of the plug-in base.

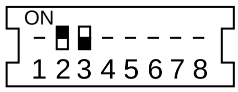
- **Configuration for UCZA/UCZB**

	2	3
ON		
OFF	X	X



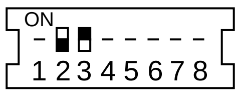
- **Configuration most significant byte (07 KT92)**

	2	3
ON	X	
OFF		X



- **Configuration least significant byte range**

	2	3
ON		X
OFF	X	



NOTE : Dip switch N∘1 is inoperationnal for the analog units.

Addresses allowed for the central units :

- UCZA/UCZB : even addresses.
- PCZB : addresses 1 to 8.
- 07 KR91/07 KT92/07 KT93 : addresses 0 to 5.
- 07 KR31 : addresses 0 to 5 and 8 to 15 (only for input units)

ANALOG INPUTS 8 BITS

Input range	0...10 V	0...5 V	0...20mA	4...20 mA
Resolution	39 mV	+ 20 mV	+ 0.08 mA	+ 0.062 mA
Maximum	+ 9.96 V	+ 4.98 V	+ 19.92 mA	+ 19.94 mA
Minimum	0 V	0 V	0 mA	+ 4 mA
Offset	0 V	0 V	0 mA	+ 4 mA

RANGE FOR UCZA/UCZB

Bits of analog word

B15	0 V	0 V	0 mA	0 mA (*)
B14	0 V	0 V	0 mA	0 mA (*)
B13	0 V	0 V	0 mA	0 mA (*)
B12	0 V	0 V	0 mA	0 mA (*)
B11	+ 5 V	+ 2.5 V	+ 10 mA	+ 8 mA
B10	+ 2.5 V	+ 1.25 V	+ 5 mA	+ 4 mA
B9	+ 1.25 V	+ 0.62 V	+ 2.5 mA	+ 2 mA
B8	+ 0.62 V	+ 0.31 V	+ 1.25 mA	+ 1 mA
B7	+ 0.31 V	+ 0.15 V	+ 0.62 mA	+ 0.5 mA
B6	+ 0.15 V	+ 0.08 V	+ 0.31 mA	+ 0.25 mA
B5	+ 0.08 V	+ 0.04 V	+ 0.15 mA	+ 0.125 mA
B4	+ 0.04 V	+ 0.02 V	+ 0.08 mA	+ 0.062 mA
B3	0 V	0 V	0 mA	0 mA
B2	0 V	0 V	0 mA	0 mA
B1	0 V	0 V	0 mA	0 mA
B0	0 V	0 V	0 mA	0 mA

RANGE FOR MOST SIGNIFICANT BYTE – 07 KT92

Bits of analog word

B15	0 V	0 V	0 mA	0 mA (*)
B14	+ 5 V	+ 2.5 V	+ 10 mA	+ 8 mA
B13	+ 2.5 V	+ 1.25 V	+ 5 mA	+ 4 mA
B12	+ 1.25 V	+ 0.62 V	+ 2.5 mA	+ 2 mA
B11	+ 0.62 V	+ 0.31 V	+ 1.25 mA	+ 1 mA
B10	+ 0.31 V	+ 0.15 V	+ 0.62 mA	+ 0.5 mA
B9	+ 0.15 V	+ 0.08 V	+ 0.31 mA	+ 0.25 mA
B8	+ 0.08 V	+ 0.04 V	+ 0.15 mA	+ 0.125 mA
B7	+ 0.04 V	+ 0.02 V	+ 0.08 mA	+ 0.062 mA
B6	0 V	0 V	0 mA	0 mA
B5	0 V	0 V	0 mA	0 mA
B4	0 V	0 V	0 mA	0 mA
B3	0 V	0 V	0 mA	0 mA
B2	0 V	0 V	0 mA	0 mA
B1	0 V	0 V	0 mA	0 mA
B0	0 V	0 V	0 mA	0 mA

RANGE FOR LEAST SIGNIFICANT BYTE				
B15	0 V	0 V	0 mA	0 mA (*)
B14	0 V	0 V	0 mA	0 mA (*)
B13	0 V	0 V	0 mA	0 mA (*)
B12	0 V	0 V	0 mA	0 mA (*)
B11	0 V	0 V	0 mA	0 mA (*)
B10	0 V	0 V	0 mA	0 mA (*)
B9	0 V	0 V	0 mA	0 mA (*)
B8	0 V	0 V	0 mA	0 mA (*)
B7	+ 5 V	+ 2.5 V	+ 10 mA	+ 8 mA
B6	+ 2.5 V	+ 1.25 V	+ 5 mA	+ 4 mA
B5	+ 1.25 V	+ 0.62 V	+ 2.5 mA	+ 2 mA
B4	+ 0.62 V	+ 0.31 V	+ 1.25 mA	+ 1 mA
B3	+ 0.31 V	+ 0.15 V	+ 0.62 mA	+ 0.5 mA
B2	+ 0.15 V	+ 0.08 V	+ 0.31 mA	+ 0.25 mA
B1	+ 0.08 V	+ 0.04 V	+ 0.15 mA	+ 0.125 mA
B0	+ 0.04 V	+ 0.02 V	+ 0.08 mA	+ 0.062 mA

(*) For input 4 … 20 mA :

- no significant bits = 0 if input current > 4 mA.
- no significant bits = 1 if input current < 4 mA.

ANALOG OUTPUTS 8 BITS			
Output range	± 10 V	0...20mA	4...20 mA
Resolution	+ 78 mV	+ 0.08 mA	+ 0.062 mA
Maximum	+ 9.92 V	+ 19.92 mA	+ 19.94 mA
Minimum	- 10V	0 mA	+ 4 mA
Offset	0 V	0 mA	+ 4 mA

RANGE FOR UCZA/UCZB (see diagram "a")			
Bits of analog word	±10 V	0...20 mA	4...20 mA
B15	- 80 V ([1])	- 160 mA ([2])	- 128 mA ([3])
B14	+ 40 V ([1])	+ 80 mA ([2])	+ 64 mA ([3])
B13	+ 20 V ([1])	+ 40 mA ([2])	+ 32 mA ([3])
B12	+ 10 V ([1])	+ 20 mA ([2])	+ 16 mA ([3])
B11	+ 5 V	+ 10 mA	+ 8 mA
B10	+ 2.5 V	+ 5 mA	+ 4 mA
B9	+ 1.25 V	+ 2.5 mA	+ 2 mA
B8	+ 0.62 V	+ 1.25 mA	+ 1 mA
B7	+ 0.31 V	+ 0.62 mA	+ 0.5 mA
B6	+ 0.15 V	+ 0.31 mA	+ 0.25 mA
B5	+ 0.08 V	+ 0.15 mA	+ 0.125 mA
B4	0 V	+ 0.08 mA	+ 0.062 mA
B3	0 V	0 mA	0 mA
B2	0 V	0 mA	0 mA
B1	0 V	0 mA	0 mA
B0	0 V	0 mA	0 mA

RANGE FOR MOST SIGNIFICANT BYTE – 07 KT92 (see diagram "b")			
Bits of analog word	±10 V	0...20 mA	4...20 mA
B15	- 10 V	- 20 mA	- 16 mA
B14	+ 5 V	+ 10 mA	+ 8 mA
B13	+ 2.5 V	+ 5 mA	+ 4 mA
B12	+ 1.25 V	+ 2.5 mA	+ 2 mA
B11	+ 0.62 V	+ 1.25 mA	+ 1 mA
B10	+ 0.31 V	+ 0.62 mA	+ 0.5 mA
B9	+ 0.15 V	+ 0.31 mA	+ 0.25 mA
B8	+ 0.08 V	+ 0.15 mA	+ 0.125 mA
B7	+ 0.04 V	+ 0.08 mA	+ 0.062 mA
B6	0 V	0 mA	0 mA
B5	0 V	0 mA	0 mA
B4	0 V	0 mA	0 mA
B3	0 V	0 mA	0 mA
B2	0 V	0 mA	0 mA
B1	0 V	0 mA	0 mA
B0	0 V	0 mA	0 mA

For UCZA/UCZB bits B12 to B15 represent the sign and the overflow outputs word of the analog outputs.

([1]) If B15 = 1 and B12, B13 or B14 = 0 the analog output is forced at the minimum value (-10 V).

([2]) If B15 = 1 the output is 0 mA
If B15 = 0 and B12, B13 or B14 = 1 the output is forced at + 20 mA

([3]) If B15 = 1 the output is forced at 4 mA
If B15 = 0 and B12, B13 or B14 = 1 the output is forced at + 20 mA

RANGE FOR LEAST SIGNIFICANT BYTE (see diagram "c")			
Bits of analog word	±10 V	0...20 mA	4...20 mA
B15	- 1280 V (4)	- 2560 mA (5)	- 2048 mA (6)
B14	+ 640 V (4)	+ 1280 mA (5)	+ 1024 mA (6)
B13	+ 320 V (4)	+ 640 mA (5)	+ 512 mA (6)
B12	+ 160 V (4)	+ 320 mA (5)	+ 256 mA (6)
B11	+ 80 V (4)	+ 160 mA (5)	+ 128 mA (6)
B10	+ 40 V (4)	+ 80 mA (5)	+ 64 mA (6)
B9	+ 20 V (4)	+ 40 mA (5)	+ 32 mA (6)
B8	+ 10 V (4)	+ 20 mA (5)	+ 16 mA (6)
B7	+ 5 V	+ 10 mA	+ 8 mA
B6	+ 2.5 V	+ 5 mA	+ 4 mA
B5	+ 1.25 V	+ 2.5 mA	+ 2 mA
B4	+ 0.62 V	+ 1.25 mA	+ 1.25 mA
B3	+ 0.31 V	+ 0.62 mA	+ 1 mA
B2	+ 0.15 V	+ 0.31 mA	+ 0.5 mA
B1	+ 0.08 V	+ 0.15 mA	+ 0.025 mA
B0	+ 0.04 V	+ 0.08 mA	+ 0.062 mA

(4) If B15 = 1 and B8, B9, B10, B11, B12, B13 or B14 = 0 the output is forced at -10V.
If B15 = 0 and B12, B13 or B14 =1 the output is forced at +10V.

(5) If B15 = 1 the output is forced at 0 mA.
If B15 = 0 and B8, B9, B10, B11, B12, B13 or B14 = 1 the output is forced at +20 mA.

(6) If B15 = 1 the output is forced at 4 mA.
If B15 = 0 and B8, B9, B10, B11, B12, B13 or B14 = 1 the output is forced at + 20 mA.

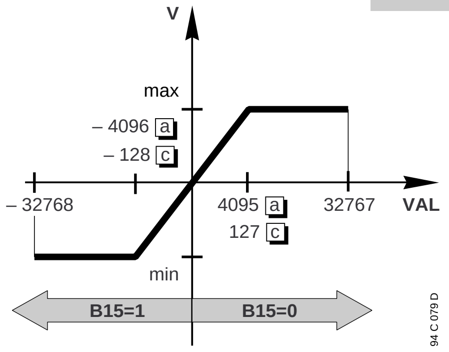
ANALOG OUTPUTS DIAGRAMS 8 BITS

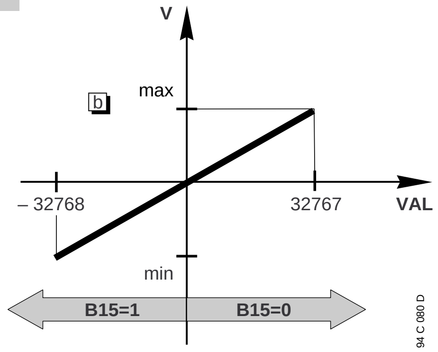
a *Analog unit dip switches are formated for using an UCZA/UCZB Central Unit*

b *Analog unit dip switches are formated for most significant byte*

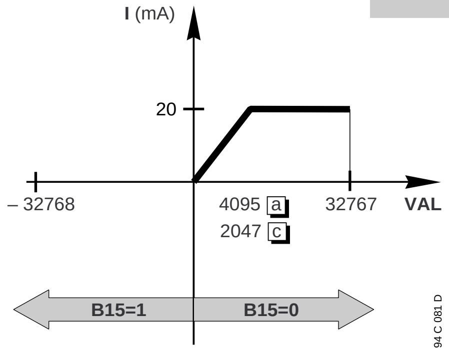
c *Analog unit dip switches are formated for least significant byte*

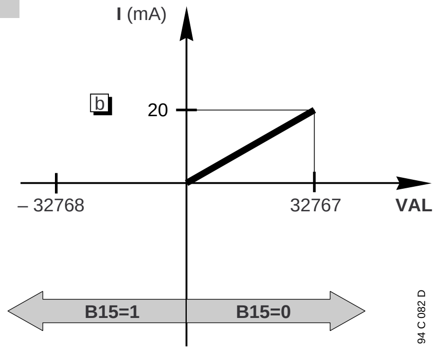
Voltage (± 10 V)



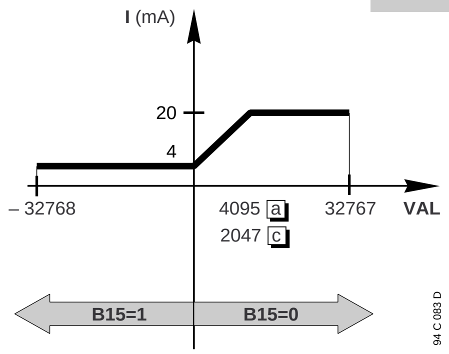


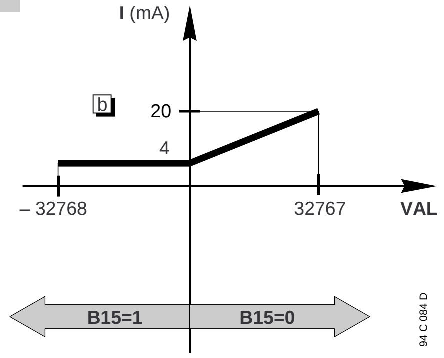
Current (0 … 20 mA)





Current (4 … 20 mA)





ANALOG INPUTS 12 BITS				
Input range	± 10 V	± 5 V	± 20 mA	4…20 mA
Resolution	+ 5 mV	+2.5 mV	+ 0.010 mA	+ 0.008 mA
Maximum	+10 V	+ 5 V	+ 20 mA	+ 20 mA
Minimum	- 10 V	- 5 V	- 20 mA	+ 4 mA
Offset	0 V	0 V	0 mA	+ 4 mA

RANGE FOR UCZA/UCZB				
Bits of analog word	± 10 V	± 5 V	± 20 mA	4…20mA
B15	- 10 V	- 5 V	- 20 mA	0 mA (*)
B14	x	x	x	0 mA (*)
B13	x	x	x	0 mA (*)
B12	x	x	x	0 mA (*)
B11	+ 5 V	+ 2.5 V	+ 10 mA	+ 8 mA
B10	+ 2.5 V	+ 1.25 V	+ 5 mA	+ 4 mA
B9	+ 1.25 V	+ 0.62 V	+ 2.5 mA	+ 2 mA
B8	+ 0.62 V	+ 0.31 V	+ 1.25 mA	+ 1 mA
B7	+ 0.31 V	+ 0.15 V	+ 0.62 mA	+ 0.5 mA
B6	+ 0.15 V	+ 0.08 V	+ 0.31 mA	+ 0.25 mA
B5	+ 0.08 V	+ 0.04 V	+ 0.15 mA	+ 0.125 mA
B4	+ 0.04 V	+ 0.02 V	+ 0.08 mA	+ 0.062 mA
B3	+ 0.02 V	+ 0.01 V	+ 0.04 mA	+ 0.031 mA
B2	+ 0.01 V	+ 0.005 V	+ 0.02 mA	+ 0.015 mA
B1	+ 0.005 V	+ 0.0025 V	+ 0.01 mA	+ 0.008 mA
B0	0 V	0 V	0 mA	0 mA

x = 0 positive value
x = 1 negative value

RANGE FOR MOST SIGNIFICANT BYTE – 07 KT92				
Bits of analog word	± 10 V	± 5 V	± 20 mA	4…20mA
B15	- 10 V	- 5 V	- 20 mA	0 mA (*)
B14	+ 5 V	+ 2.5 V	+ 10 mA	+ 8 mA
B13	+ 2.5 V	+ 1.25 V	+ 5 mA	+ 4 mA
B12	+ 1.25 V	+ 0.62 V	+ 2.5 mA	+ 2 mA
B11	+ 0.62 V	+ 0.31 V	+ 1.25 mA	+ 1 mA
B10	+ 0.31 V	+ 0.15 V	+ 0.62 mA	+ 0.5 mA
B9	+ 0.15 V	+ 0.08 V	+ 0.31 mA	+ 0.25 mA
B8	+ 0.08 V	+ 0.04 V	+ 0.15 mA	+ 0.125 mA
B7	+ 0.04 V	+ 0.02 V	+ 0.08 mA	+ 0.062 mA
B6	+ 0.02 V	+ 0.01 V	+ 0.04 mA	+ 0.031 mA
B5	+ 0.01 V	+ 0.005 V	+ 0.02 mA	+ 0.015 mA
B4	+ 0.005 V	+ 0.0025 V	+ 0.01 mA	+ 0.008 mA
B3	0 V	0 V	0 mA	0 mA
B2	0 V	0 V	0 mA	0 mA
B1	0 V	0 V	0 mA	0 mA
B0	0 V	0 V	0 mA	0 mA

RANGE FOR LEAST SIGNIFICANT BYTE				
Bits of analog word	± 10 V	± 5 V	± 20 mA	4…20mA
B15	- 10 V	- 5 V	- 20 mA	0 mA (*)
B14	x	x	x	0 mA (*)
B13	x	x	x	0 mA (*)
B12	x	x	x	0 mA (*)
B11	x	x	x	0 mA (*)
B10	+ 5 V	+ 2.5 V	+ 10 mA	+ 8 mA
B9	+ 2.5 V	+ 1.25 V	+ 5 mA	+ 4 mA
B8	+ 1.25 V	+ 0.62 V	+ 2.5 mA	+ 2 mA
B7	+ 0.62 V	+ 0.31 V	+ 1.25 mA	+ 1 mA
B6	+ 0.31 V	+ 0.15 V	+ 0.62 mA	+ 0.5 mA
B5	+ 0.15 V	+ 0.08 V	+ 0.31 mA	+ 0.25 mA
B4	+ 0.08 V	+ 0.04 V	+ 0.15 mA	+ 0.125 mA
B3	+ 0.04 V	+ 0.02 V	+ 0.08 mA	+ 0.062 mA
B2	+ 0.02 V	+ 0.01 V	+ 0.04 mA	+ 0.031 mA
B1	+ 0.01 V	+ 0.005 V	+ 0.02 mA	+ 0.015 mA
B0	+ 0.005 V	+ 0.0025 V	+ 0.01 mA	+ 0.008 mA

x = 0 positive value
x = 1 negative value

(*) For input 4 … 20 mA :

- No significant bits = 0 if input current > 4 mA
- No significant bits = 1 if input current < 4 mA

Bits (x) have the same status as 15.

ANALOG OUTPUTS 12 BITS

Output range	± 10 V	± 12.5 V	0…20mA	4…20 mA
Resolution	+ 5 mV	+ 5 mV	+ 0.01 mA	+ 0.008 mA
V maximum	+ 9.99 V	+ 12.49 V	+ 19.99 mA	+ 19.99 mA
V minimum	- 10V	- 12.5 V	0 mA	+ 4 mA
Offset	0 V	0 V	0 mA	+ 4 mA

RANGE FOR UCZA/UCZB (see diagram "a")

Bits of analog word	± 10 V	± 12.5 V	0…20 mA	4…20 mA
B15	([0])	([0])	([1])	([1])
B14	([0])	([0])	([1])	([1])
B13	([0])	([0])	([1])	([1])
B12	([0])	([0])	([1])	([1])
B11	+ 5 V	+ 6.25 V	+ 10 mA	+ 8 mA
B10	+ 2.5 V	+ 3.12 V	+ 5 mA	+ 4 mA
B9	+ 1.25 V	+ 1.56 V	+ 2.5 mA	+ 2 mA
B8	+ 0.62 V	+ 0.77 V	+ 1.25 mA	+ 1 mA
B7	+ 0.31 V	+ 0.39 V	+ 0.62 mA	+ 0.5 mA
B6	+ 0.15 V	+ 0.19 V	+ 0.31 mA	+ 0.25 mA
B5	+ 0.08 V	+ 0.1 V	+ 0.15 mA	+ 0.125 mA
B4	+ 0.04 V	+ 0.05 V	+ 0.08 mA	+ 0.062 mA
B3	+ 0.02 V	+ 0.025 V	+ 0.04 mA	+ 0.031 mA
B2	+ 0.01 V	+ 0.012 V	+ 0.02 mA	+ 0.015 mA
B1	+ 0.005 V	+ 0.006 V	+ 0.01 mA	+ 0.008 mA
B0	0 V	0 V	0 mA	0 mA

RANGE FOR MOST SIGNIFICANT BYTE – 07 KT92 (see diagram "b")

Bits of analog word	± 10 V	± 12.5 V	0…20 mA	4…20 mA
B15	- 10 V	- 12,5 V	0 mA ([2])	0 mA
B14	+ 5 V	+ 6.25 V	+ 10 mA	+ 8 mA
B13	+ 2.5 V	+ 3.12 V	+ 5 mA	+ 4 mA
B12	+ 1.25 V	+ 1.56 V	+ 2.5 mA	+ 2 mA
B11	+ 0.62 V	+ 0.77 V	+ 1.25 mA	+ 1 mA
B10	+ 0.31 V	+ 0.39 V	+ 0.62 mA	+ 0.5 mA
B9	+ 0.15 V	+ 0.19 V	+ 0.31 mA	+ 0.25 mA
B8	+ 0.08 V	+ 0.1 V	+ 0.15 mA	+ 0.125 mA
B7	+ 0.04 V	+ 0.05 V	+ 0.08 mA	+ 0.062 mA
B6	+ 0.02 V	+ 0.025 V	+ 0.04 mA	+ 0.031 mA
B5	+ 0.01 V	+ 0.012 V	+ 0.02 mA	+ 0.015 mA
B4	+ 0.005 V	+ 0.006 V	+ 0.01 mA	+ 0.008 mA
B3	0 V	0 V	0 mA	0 mA
B2	0 V	0 V	0 mA	0 mA
B1	0 V	0 V	0 mA	0 mA
B0	0 V	0 V	0 mA	0 mA

RANGE LEAST SIGNIFICANT BYTE (see diagram "c")				
Bits of analog word	± 10 V	± 5 V	± 20 mA	4…20mA
B15	(3)	(3)	(4)	(4)
B14	(3)	(3)	(4)	(4)
B13	(3)	(3)	(4)	(4)
B12	(3)	(3)	(4)	(4)
B11	(3)	(3)	(4)	(4)
B10	+ 5 V	+ 6.25 V	+ 10 mA	+ 8 mA
B9	+ 2.5 V	+ 3.12 V	+ 5 mA	+ 4 mA
B8	+ 1.25 V	+ 1.56 V	+ 2.5 mA	+ 2 mA
B7	+ 0.62 V	+ 0.77 V	+ 1.25 mA	+ 1 mA
B6	+ 0.31 V	+ 0.39 V	+ 0.62 mA	+ 0.5 mA
B5	+ 0.15 V	+ 0.19 V	+ 0.31 mA	+ 0.25 mA
B4	+ 0.08 V	+ 0.1 V	+ 0.15 mA	+ 0.125 mA
B3	+ 0.04 V	+ 0.05 V	+ 0.08 mA	+ 0.062 mA
B2	+ 0.02 V	+ 0.025 V	+ 0.04 mA	+ 0.031 mA
B1	+ 0.01 V	+ 0.012 V	+ 0.02 mA	+ 0.015 mA
B0	+ 0.005 V	+ 0.006 V	+ 0.01 mA	+ 0.008 mA

Bits B12 to B15 represent the sign and the overflow outputs word of analog outputs.

(0) If B15 = 1 and B12, B13 or B14 = 0 the analog output is forced at the minimum value.

If B15 = 0 and B12, B13 or B14 = 1 the output is at the maximum value.

(1) If B15 = 1 the output is 0 mA.
If B15 = 0 and B12, B13 and B14 <> 0 the output is + 20 mA.

If B15 = 1 the output is 0 mA.
If B15 = 0 and B12, B13 and B14 <> 0 the output is + 20 mA.

(2) If B15 = 1 the output is 0 mA.
If B15 = 0 the range of internal word is 0 . +32767.

(3) If B15 = 1 and B11, B12, B13 or B14 = 0 the output is at the minimum value.

If B15 = 0 and B11, B12, B13 or B14 = 1 the output is at the maximum value.

(4) If B15 = 1 the output is 0 mA.
If B15 = 0 and B11, B12, B13 and B14 <> 0 the output is + 20 mA.

If B15 = 1the output is 0 mA.
If B15 = 0 and B11, B12, B13 and B14 <>0 the output is + 20 mA.

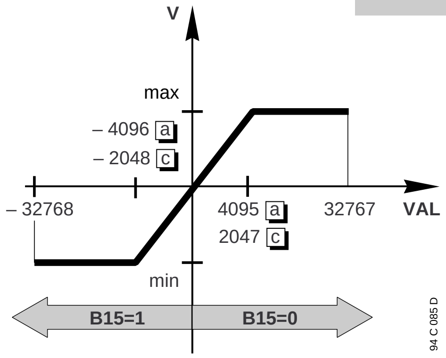
ANALOG OUTPUTS DIAGRAMS 12 BITS

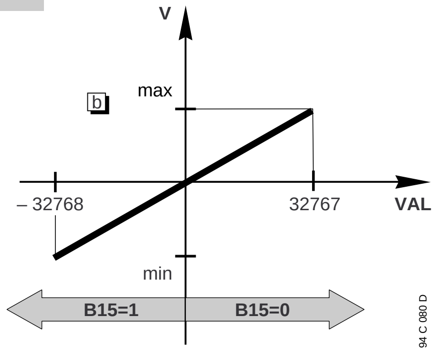
a *Analog unit dip switches are formated for using an UCZA/UCZB Central Unit*

b *Analog unit dip switches are formated for most significant byte*

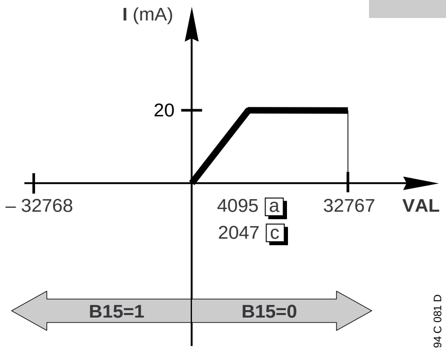
c *Analog unit dip switches are formated for least significant byte*

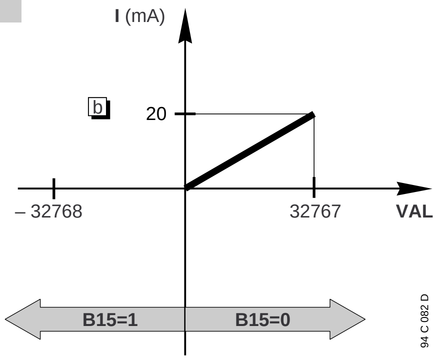
Voltage (±10 V, ± 12.5 V)



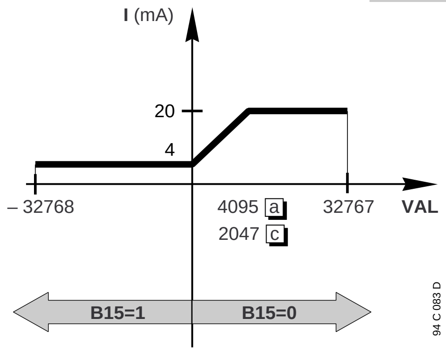


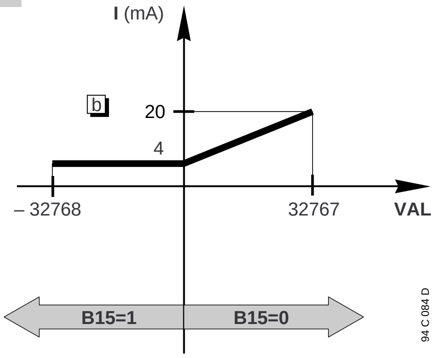
Current (0 … 20 mA)





Current (4 … 20 mA)





Data conversion table

This table shows the bit value of analog words in decimal and hexadecimal.

Bit of word	Decimal	Hexadecimal
	Maximum +32767 Minimum -32768 Resolution 1	Maximum 7FFF Minimum 8001 Resolution 1
B15	-32768	8000
B14	+16384	4000
B13	+8192	2000
B12	+4096	1000
B11	+2048	0800
B10	+1024	0400
B9	+512	0200
B8	+256	0100
B7	+128	0080
B6	+64	0040
B5	+32	0020
B4	+16	0010
B3	+8	0008
B2	+4	0004
B1	+2	0002
B0	+1	0001

Range of analog Input values within the central unit.				
		UCZA UCZB	Most significant byte	Least significant byte
8 bits	Max	0.996 (4080)	32512	255
	Min	0	0	0
12 bits	Max	0.999 (4092)	32752	2047
	Min	- 1.000 (- 4096)	- 32768	- 2048

5.2.1 ICSE 08 A6 Analog Input remote unit

8 inputs, 8 bits

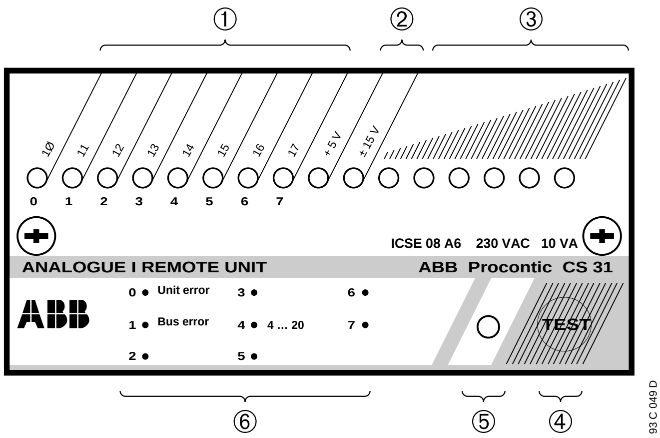
The analog input remote unit can be used for 0 … 10 V, 0 … 20 mA or 4 … 20 mA. The dip switches in the rear of the unit and the wiring on the plug-in base enable the choice of current or voltage input.

The unit is configured for 0 … 20 mA or 4 … 20 mA current ranges with an handheld programming unit (TCZ) or CS 31configuration functions (see chapter 2, in volume 2 «**Central Units**»).
The factory default setting is 0 … 20 mA.

Description of the unit front :

- Ten status led's:
  - Eight yellow input status led's «I0» to «I7»............ ①
  - Two green power supply led's «+ 5 V», «± 15 V» ..... ②
- Six yellow led's to display the signal value of inputs ... ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes.. ⑥

The unit has to be mounted on a plug-in base ECZ



8 analog inputs per unit

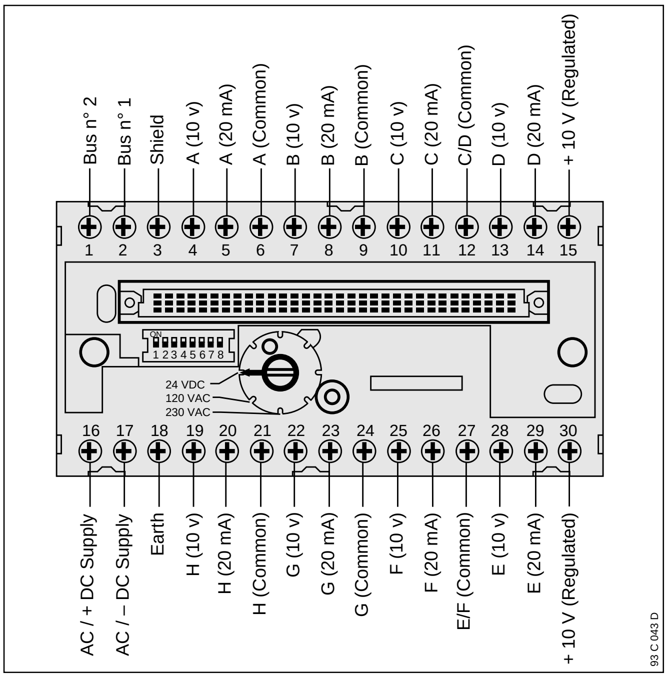
TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	no	no
Power supply output 10 VDC (± 1 %)	50 mA	50 mA
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.8 W	8 W
Order number : FPR 334 5601	R1012	R0016/R0014
Weight (kg)	0.25	0.43

INPUT SPECIFICATIONS			
Nominal range	0 … 10 V	0 … 20 mA	4 … 20 mA
Maximum value	30 V	20 mA	20 mA
Input resistance	100 k	250	250
Resolution : 8 bits	± 1/2 LSB (± 19.6 mV)	± 1/2 LSB (± 40 µA)	± 1/2 LSB (± 31 µA)
Linearity error	± 3/4 LSB (± 29.4 mV)	± 3/4 LSB (± 60 µA)	± 3/4 LSB (± 47 µA)
Error of maximum value	± 0.5 %	± 0.8 %	± 0.8 %
Amplification error between two channels	1 LSB (39 mV)	1 LSB (62 µA)	1 LSB (62 µA)
Temperature coefficient	100 ppm/K	150 ppm/K	150 ppm/K
Time constant of input filter	100 ms	20 ms	20 ms
Max refresh time	10 ms	10 ms	10 ms

CHANNEL POSSIBLE CONFIGURATIONS				
Dip switches in the rear of the unit	Configuration from the central unit		Terminal "current"	Terminal "voltage"
	0 … 20	4 … 20		
ON	X		0 … 20 mA	
OFF	X		0 … 5 V	0 … 10 V
ON		X	4 … 20 mA	
OFF		X	1 … 5 V*	2 … 10 V*

* For these special formats, the conversion tables are not available.

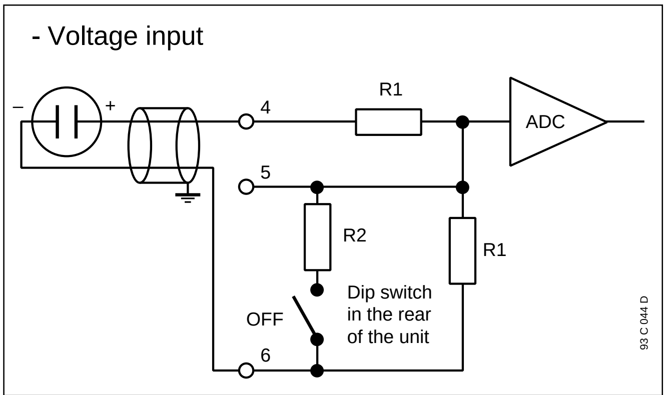
• Electrical connection

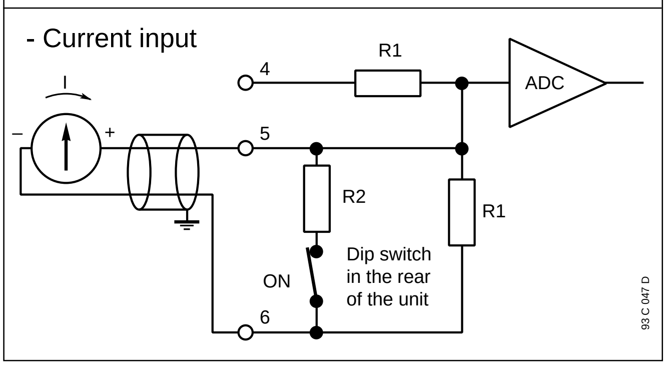


The function of each channel depends on the wired terminals.

NOTE : Terminals 15 and 30 (output + 10 V) are internally connected.
All common terminals are internally connected but it's better to use the terminal nearest the channel used.

• Connection of input A :



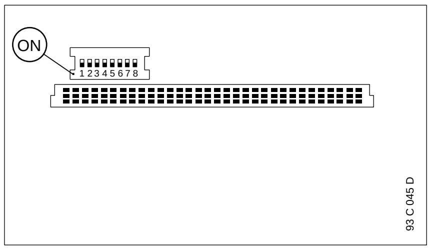


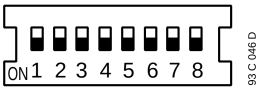
The wires for analogue inputs must be shielded and the shield has to be connected to the earth on the side of the remote unit.

• Initialization

The selection between current or voltage depends upon the dip switches in the rear of the unit. One dip switch for one channel :

Nₒ 1 : channel 00
Nₒ 2 : channel 01
Nₒ 3 : channel 02
Nₒ 4 : channel 03
Nₒ 5 : channel 04
Nₒ 6 : channel 05
Nₒ 7 : channel 06
Nₒ 8 : channel 07





Dip switches have to be in the **ON** position for current configuration.

Dip switches have to be in the **OFF** position for voltage configuration.

NOTE : The factory default setting is ± 10V.

In voltage configuration (dip switches OFF) the current input can be used in different ways :

- **In voltage input 0 … 5 V. If the unit is configured in 0 … 20 mA from the central unit.**
- **In voltage input 1 … 5 V. If the unit is configured in 4 … 20 mA from the central unit.**

After configured and wired the unit :

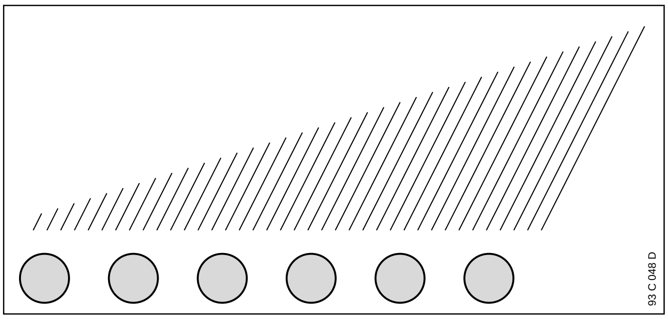
- The unit initializes itself after power on.
- The error led goes out after initialization.
- The value of the analog input IO is displayed on the 8 led's on the right and the led's "+ 5 and + 15" are illuminated.

• Utilization

VARIABLES USED IN THE CENTRAL UNIT							
CENTRAL UNITS		07 KR 31	07 KR 91 07 KT 92 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 05 08 ... 15	00 ... 05	even 00 … 14		1 … 8
Switch Nₒ 8 on the plug-in base		OFF	ON	OFF	ON	OFF
Input	A	EWxx, 00	EWxx, 08	EAxx, 00	EAxx, 08	IAx0
	B	EWxx, 01	EWxx, 09	EAxx, 01	EAxx, 09	IAx1
	C	EWxx, 02	EWxx, 10	EAxx, 02	EAxx, 10	IAx2
	D	EWxx, 03	EWxx, 11	EAxx, 03	EAxx, 11	IAx3
	E	EWxx, 04	EWxx, 12	EAxx, 04	EAxx, 12	IAx4
	F	EWxx, 05	EWxx, 13	EAxx, 05	EAxx, 13	IAx5
	G	EWxx, 06	EWxx, 14	EAxx, 06	EAxx, 14	IAx6
	H	EWxx, 07	EWxx, 15	EAxx, 07	EAxx, 15	IAx7

In the case of UCZA/UCZB, the addresses 08 … 14 are only allowed with SCZ unit.
For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description.

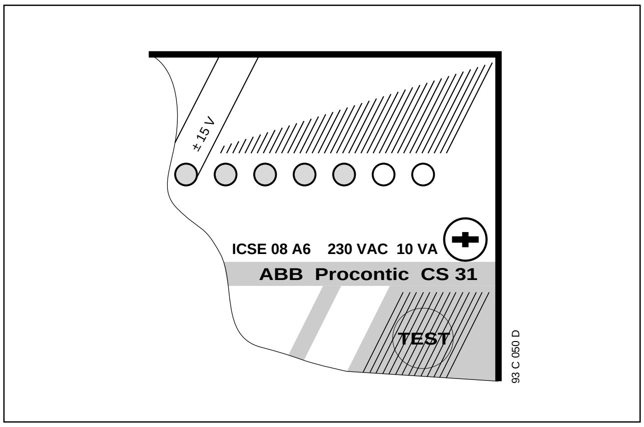
The value of the input selected by pressing the **"TEST"** button can be displayed on the 6 led's on the right.
These 6 led's have the following meaning :



no led ON ❍❍❍❍❍❍	3 led's ON ●●●❍❍❍	6 led's ON ●●●●●●	Configuration
0 V 0 V 0 mA	5 V 2.5 V 10 mA	10 V 5 V 20 mA	0 … 20 mA
2 V 1 V 4 mA	6 V 3 V 12 mA	10 V 5 V 20 mA	4 … 20 mA

Each channel can be displayed by pressing the "**TEST**" button.

The channel IO is always displayed after initialization until otherwise selected.



Fault indication:

Led 0 : **«Unit error»**
Led 1 : **«Bus error»**

The configuration of each channel is indicated by the led 4.

Led 4 : **«4 … 20»**
Current configuration 4 … 20 mA

Led 4 **«OFF»** : Channel in 0 … 20 mA or 0 … 10 V, depends upon the dip switches in the rear of the unit.

Led 4 **«ON »**: Channel in 4 … 20 mA or 2 … 10 V, depends upon the dip switches in the rear of the unit.
If an error occurs, (see chapter 9, volume 2 **«In case of failure»**).

5.2.2 ICSE 08 B5 — Analog Input remote unit

8 inputs, 12 bits

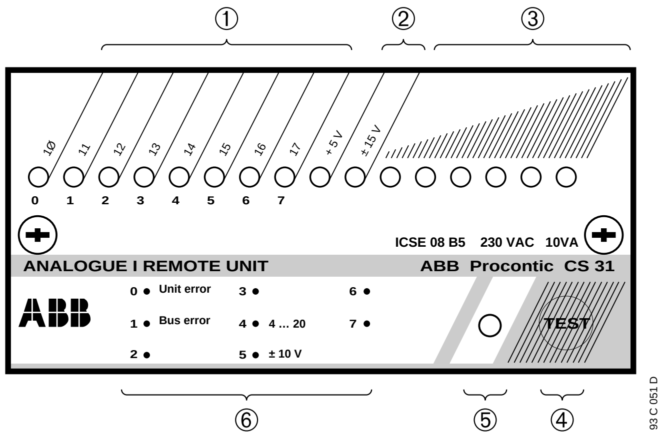
The analogue input remote unit can be used for ± 10 V, ± 5 V, ± 20 mA or 4 … 20 mA.
The dip switches in the rear of the unit enable the choice of current or voltage input.

The unit is configured for ± 20 mA or 4 … 20 mA current ranges with an handheld programming unit (TCZ) or CS 31configuration functions (see chapter 2, volume 2 «**Central Units**»).

Description of the unit front :

- Ten status led's:
  - Eight yellow input status led's «I0» to «I7»............ ①
  - Two green power supply led's «+ 5 V», «± 15 V» ..... ②
- Six yellow led's to display the signal value of inputs .... ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes.. ⑥

The unit has to be mounted on a plug-in base ECZ.



8 analog inputs per unit

TECHNICAL CHARACTERISTICS

Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Power supply output 10 VDC (± 1 %)	no	no
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.8 W	8 W
Order number : FPR 334 6501	R1012	R0016/R0014
Weight (kg)	0.25	0.43

INPUT SPECIFICATIONS			
Nominal range	± 10 V	± 20 mA	4 … 20 mA
Maximum value	+ 15 V	+ 25 mA	+ 25 mA
Minimum value	– 15 V	– 25 mA	– 25 mA
Input resistance	100 k	250	250
Resolution : 12 bits	± 1 LSB (± 5 mV)	± 2 LSB (± 20 µA)	± 2 LSB (± 20 µA)
Linearity error	± 1 LSB (± 5 mV)	± 2 LSB (± 20 µA)	± 2 LSB (± 20 µA)
Error of maximum value	± 0.3 %	± 0.5 %	± 0.5 %
Amplification error between two channels	1 LSB (5 mV)	2 LSB (20 µA)	2 LSB (20 µA)
Temperature coefficient	100 ppm/K	150 ppm/K	150 ppm/K
Time constant of input filter	0.5 ms	0.5 ms	0.5 ms
Max refresh time	10 ms	10 ms	10 ms

CONFIGURATION BY THE CENTRAL UNIT			
Dip switches in the rear of the unit	± 10 V	± 20 mA	4 … 20 mA
ON		± 20 mA	
OFF		± 5 V	
ON			4 … 20 mA
OFF			1 … 5 V
ON	± 40 mA*		
OFF	± 10 V		

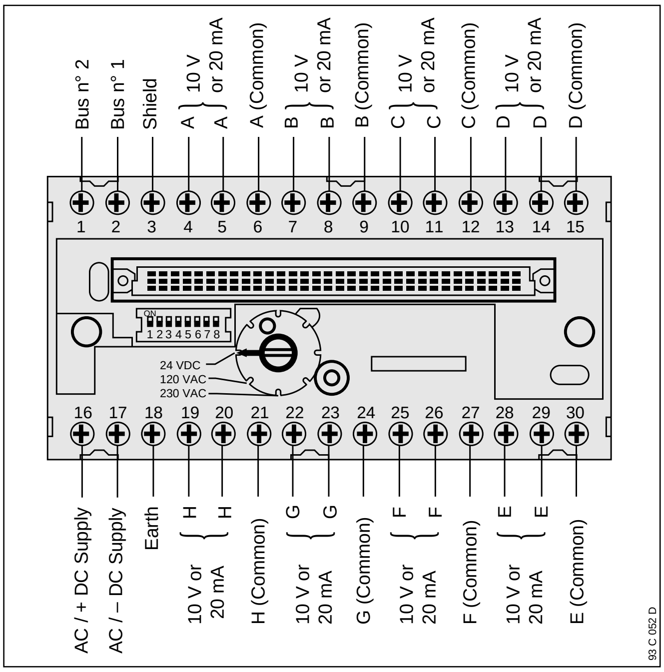
* Forbidden.

NOTE : The factory default setting is ± 10 V.

Configure a channel :

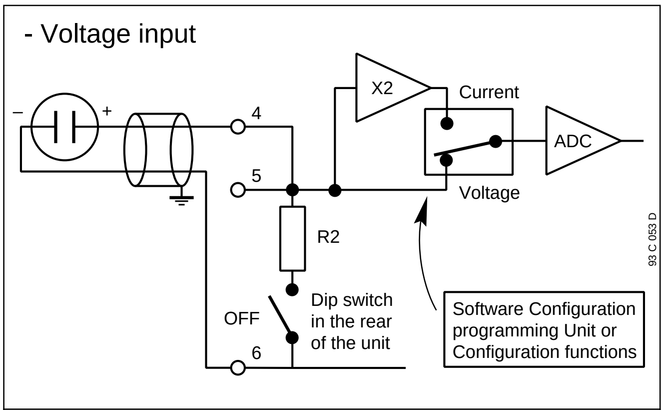
- **put the dip switch in the rear of the unit on the position ON or OFF**
- **configure the input by the central unit with the programming unit TCZ or with the user configurable functions in the user program.**

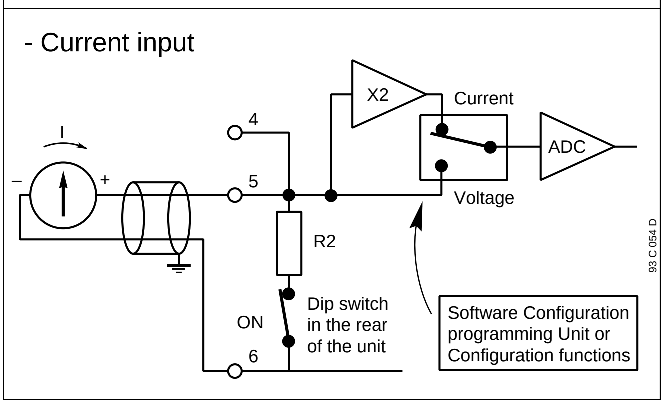
• Electrical connection



NOTE : All common terminals are internally connected but it's better to use the terminal nearest the channel used.

• Connection of input A :



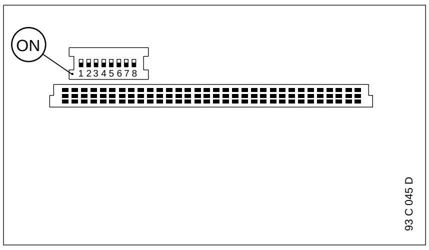


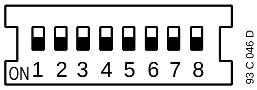
The wires for analogue inputs must be shielded and the shield has to be connected to the earth on the side of the remote unit.

• Initialization

The selection between current or voltage depends upon the dip switches in the rear of the unit. One dip switch for one channel :

N° 1 : channel 00
N° 2 : channel 01
N° 3 : channel 02
N° 4 : channel 03
N° 5 : channel 04
N° 6 : channel 05
N° 7 : channel 06
N° 8 : channel 07





Dip switches have to be in the **«ON»** position for current configuration.

Dip switches have to be in the **«OFF»** position for voltage configuration.

NOTE : the factory default setting is ± 10V.

After configured and wired the unit :

– The unit initializes itself after power on.

– The error led goes out after initialization.

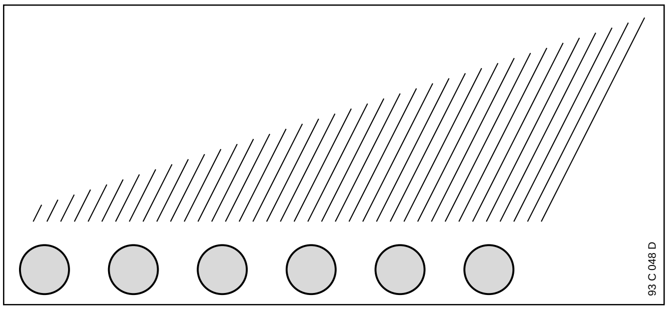
– The value of the analog input IO is displayed on the 6 led's on the right and the led's "+ 5 and ± 15" are illuminated.

• Utilization

VARIABLES USED IN THE CENTRAL UNIT						
CENTRAL UNITS		07 KR 31	07 KR 91 07 KT 92 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 05 08 ... 15	00 ... 05	even 00 … 14		1 … 8
Switch N₀ 8 on the plug-in base		OFF	ON	OFF	ON	OFF
Input	A	EWxx, 00	EWxx, 08	EAxx, 00	EAxx, 08	IAx0
	B	EWxx, 01	EWxx, 09	EAxx, 01	EAxx, 09	IAx1
	C	EWxx, 02	EWxx, 10	EAxx, 02	EAxx, 10	IAx2
	D	EWxx, 03	EWxx, 11	EAxx, 03	EAxx, 11	IAx3
	E	EWxx, 04	EWxx, 12	EAxx, 04	EAxx, 12	IAx4
	F	EWxx, 05	EWxx, 13	EAxx, 05	EAxx, 13	IAx5
	G	EWxx, 06	EWxx, 14	EAxx, 06	EAxx, 14	IAx6
	H	EWxx, 07	EWxx, 15	EAxx, 07	EAxx, 15	IAx7

In the case of UCZA/UCZB, the addresses 08 … 14 are only allowed with SCZ unit.
For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description.

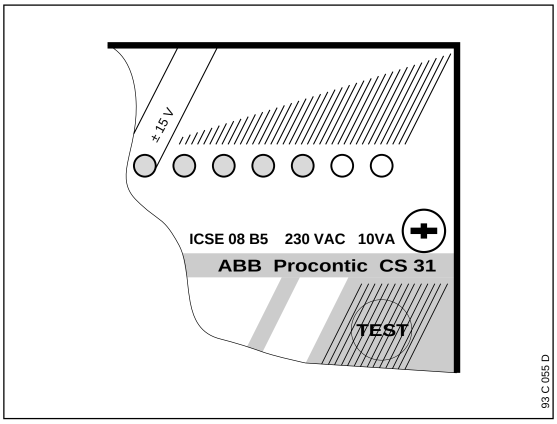
The value of the input selected by pressing the **"TEST"** button can be displayed on the 6 led's on the right.
These 6 led's have the following meaning :



no led ON ○○○○○○	3 led's ON ●●●○○○	6 led's ON ●●●●●●	Configuration
– 10 V	0 V	+ 10 V	± 10 V
– 20 mA – 5V	0 mA 0 V	+ 20 mA + 5 V	± 20 mA
- -	4 mA 1 V	20 mA 5 V	4 … 20 mA

Each channel can be displayed by pressing the **"TEST"** button.

The channel IO is always displayed after initialization until otherwise selected.



Fault indication:

Led 0 : **«Unit error»**
Led 1 : **«Bus error»**

The configuration of each channel is indicated by the led's 4 and 5.

Led 4 : **«4 … 20»**
Current configuration 4 … 20 mA

Led 4 and 5 **«OFF»** :
Configuration – 20 … 20 mA

If an error occurs, (see section 9 of chapter 2 **«In case of failure»**).

5.2.3 ICST 08 A8 — Analog Input remote unit

8 inputs PT100, 8 bits

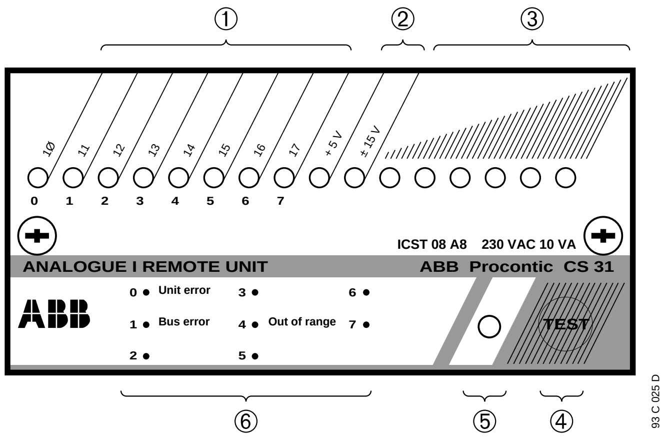
The analog input remote unit can be used for measurement of temperature.
The inputs have to be connected to the PT 100 sensors (2 or 3 wires) according the IEC 751 standard (class A and class B).

The range of temperature is : – 50 °C ... + 150 °C
(– 58 °F ... + 302 °F)

Description of the unit front :

- Ten status led's:
  - Eight yellow input status led's «I0» to «I7» .... ①
  - Two green power supply led's «+ 5 V», «± 15 V» ..... ②
- Six yellow led's to display the signal value of inputs ..... ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes .... ⑥

The unit has to be mounted on a plug-in base ECZ



8 analoge inputs per unit

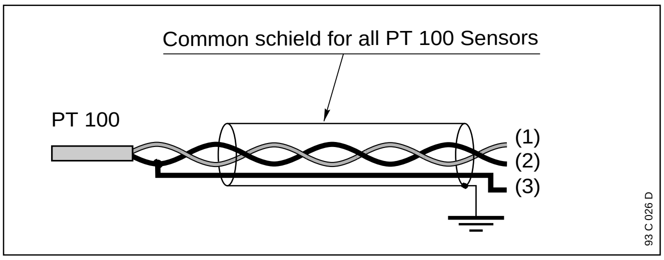
TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	no	no
Power supply output	no	no
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.8 W	8 W
Order number : FPR 333 5801	R1012	R0016/R0014
Weight (kg)	0.25	0.43

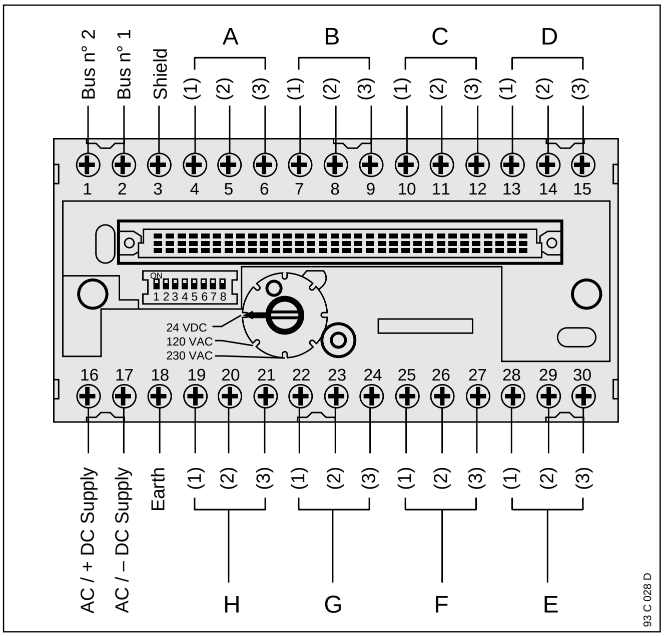
INPUT SPECIFICATIONS		
Nominal scale	– 50 … + 150 °C	(– 58 °F … + 302 °F)
Maximum value	+ 154.45 °C	(+ 310 °F)
Minimum value	– 52.47 °C	(– 62.45 °F)
Offset	0 °C	(0 °F)
Resolution : 8 bits	0.8 °C	(1.44 °F)
Accuracy on full scale (out of the allowance on sensor and for an ambient temperature of the unit for 0 °C … +55 °C (+32 °F ... +131 °F))	± 1.0 °C	(± 1.8 °F)
Allowance on sensor		
- type A (IEC 751)	± 0.5 °C on full scale	(± 0.9 °F)
- type B (IEC 751)	± 1 °C on full scale	(± 1.8 °F)
Ohmic value of the PT 100 sensor	80.31 … 157.31	
Temperature coefficient	100 ppm/ °C	
Max refresh time	300 ms for 8 channels	

* The different characteristics are available on the used range 0 °C … + 55 °C (+32 °F ... + 131 °F) of the remote unit.
* The no linearity of the sensor is compensated.

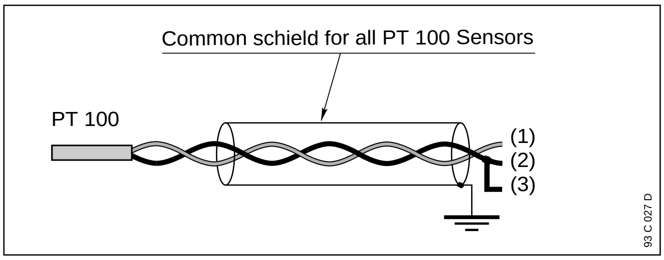
• Electrical connection

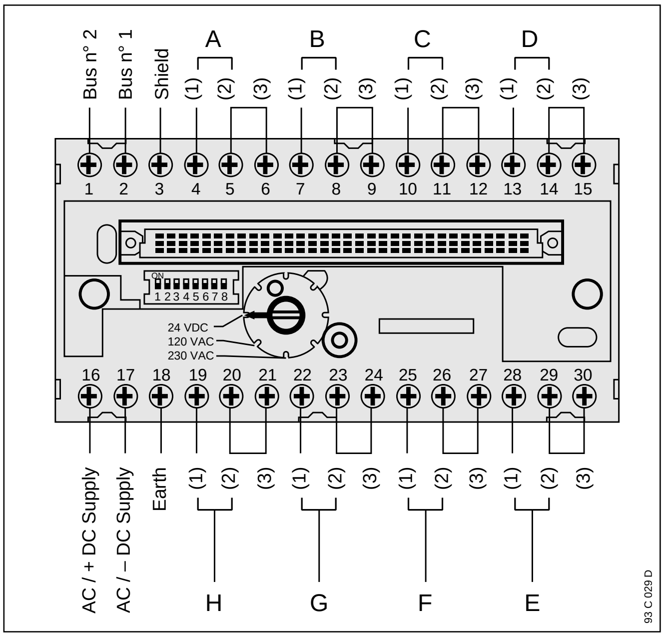
"3 wires" connection





"2 wires" connection





• Initialization

- The unit initializes itself after power ON.
- The error led goes out after initialization.

The value of the analog input I0 is displayed on the 6 led's on the right and the led's «+ 5 V» and «± 15 V» are illuminated.

• Utilization

VARIABLES USED IN THE CENTRAL UNIT

CENTRAL UNITS		07 KR 31	07 KR 91 07 KT 92 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 05 08 ... 15	00 ... 05	even 00 … 14		1 … 8
Switch N∘ 8 on the plug-in base		OFF	ON	OFF	ON	OFF
Input	A	EWxx, 00	EWxx, 08	EAxx, 00	EAxx, 08	IAx0
	B	EWxx, 01	EWxx, 09	EAxx, 01	EAxx, 09	IAx1
	C	EWxx, 02	EWxx, 10	EAxx, 02	EAxx, 10	IAx2
	D	EWxx, 03	EWxx, 11	EAxx, 03	EAxx, 11	IAx3
	E	EWxx, 04	EWxx, 12	EAxx, 04	EAxx, 12	IAx4
	F	EWxx, 05	EWxx, 13	EAxx, 05	EAxx, 13	IAx5
	G	EWxx, 06	EWxx, 14	EAxx, 06	EAxx, 14	IAx6
	H	EWxx, 07	EWxx, 15	EAxx, 07	EAxx, 15	IAx7

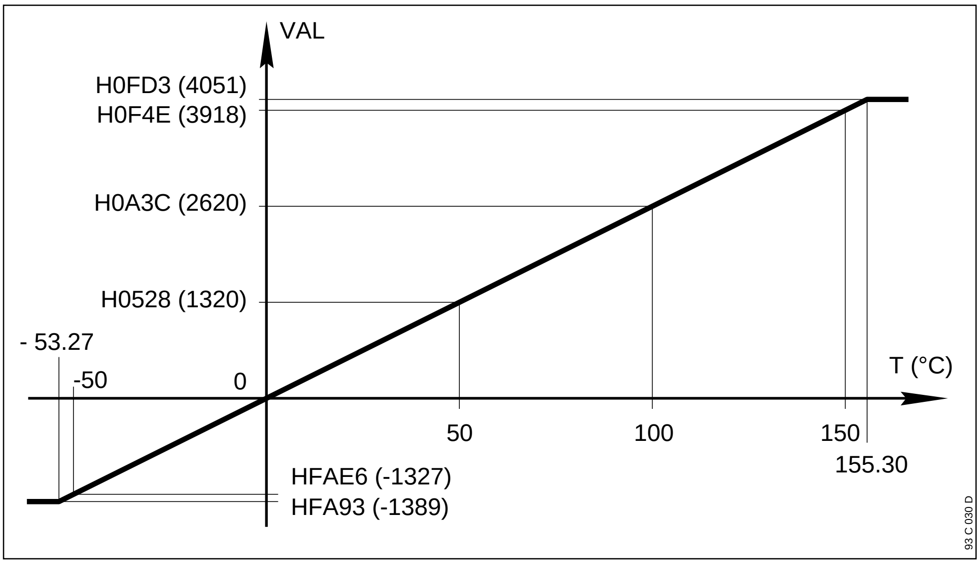
In the case of UCZA/UCZB, the addresses 08 ... 14 are only allowed with the SCZ unit.
For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description.

ANALOG INPUTS 8 BITS

Input range	– 50 °C … + 150 °C	(– 58 °F … + 302 °F)
Resolution	0.8 °C	(1.44 °F)
Maximum	154.45 °C	(310 °F)
Minimum	– 52.47 °C	(– 62.45 °F)

Bits of analog word	Range least significant byte and for central units UCZA/UCZB		Range most significant byte	
B15	– 157.00 °C	(– 250.60 °F)	– 157.00 °C	(– 250.60 °F)
B14	**	**	78.50 °C	(173.30 °F)
B13	**	**	39.25 °C	(102.65 °F)
B12	**	**	19.63 °C	(67.33 °F)
B11	78.50 °C	(173.30 °F)	9.81 °C	(49.66 °F)
B10	39.25 °C	(102.65 °F)	4.91 °C	(40.84 °F)
B9	19.63 °C	(67.33 °F)	2.45 °C	(36.41 °F)
B8	9.81 °C	(49.66 °F)	1.23 °C	(34.21 °F)
B7	4.91 °C	(40.84 °F)	0.61 °C	(33.10 °F)
B6	2.45 °C	(36.41 °F)	0.31 °C	(32.56 °F)
B5	1.23 °C	(34.21 °F)	0.15 °C	(32.27 °F)
B4	0.61 °C	(33.10 °F)	0.08 °C	(32.14 °F)
B3	0.31 °C	(32.56 °F)	0.04 °C	(32.07 °F)
B2	0.15 °C	(32.27 °F)	0	0
B1	0.08 °C	(32.14 °F)	0	0
B0	0.04 °C	(32.07 °F)	0	0

The choice of setting of the dip switches 2 and 3 on the plug-in base gives two different tables.
(See chapter 5.1, volume 2 "**General**")



Approximate function

T °C = 0.0383 VAL
VAL = 26.1096 T °C

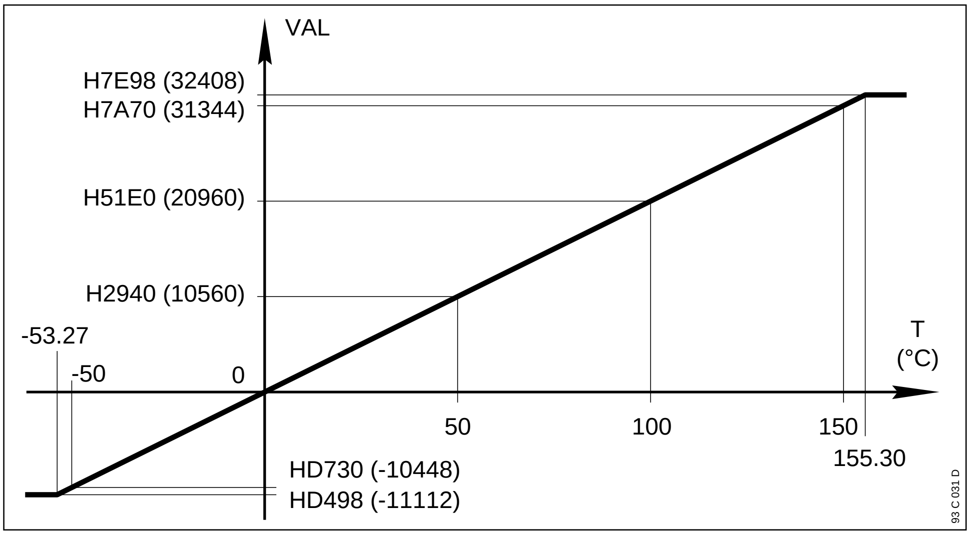
VAL : input word after conversion and linearity correction.

T °C : temperature in degree Celsius

Use the following formula to get the temperature in degree Fahrenheit :

$$°F = \frac{9}{5} °C + 32$$

Range least significant byte and UCZA/UCZB



Approximate function

T °C = 0.0048 VAL
VAL = 208.33 T °C

VAL : input word after conversion and linearity correction.

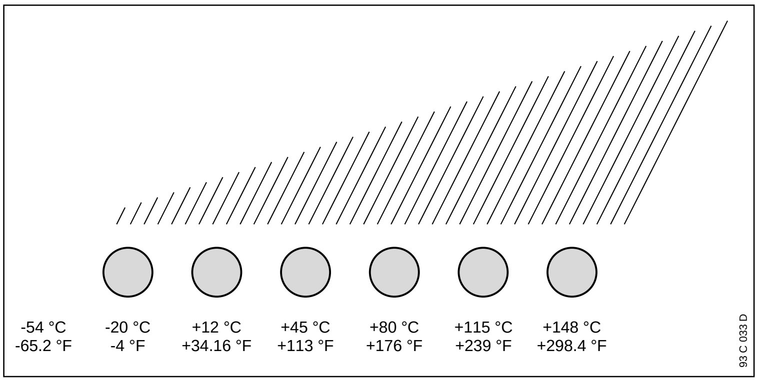
T °C : temperature in degree Celsius

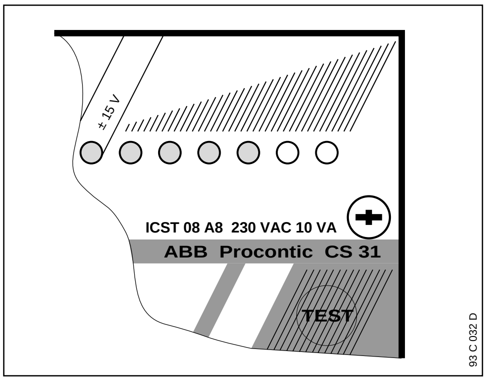
Use the following formula to get the temperature in degree Fahrenheit :

$$°F = \frac{9}{5}\,°C + 32$$

Range most significant byte

The value of input selected by pressing the «**TEST**» button can be displayed on the 6 led's on the right. These 6 led's have the following meaning :





Each channel can be selected by pressing the «**TEST**» button.

Channel I0 is always displayed after initialization until otherwise selected.

Fault indication:

Led 0 : «**Unit error**»
Led 1 : «**Bus error**»
Led 4 : «**Out of range**»

Led 4 «**OFF**» : the channel is wired and the temperature is in the due range.
Led 4 «**ON**» : measure out of range or short circuit detection (If VAL   VAL MIN), or open circuit detection (If VAL   VAL MAX).

If an error occurs, (see chapter 9, volume 2, «**In case of failure**»).

5.2.4 ICST 08 A9 — Analog Input remote unit

8 inputs PT 100, 8 bits

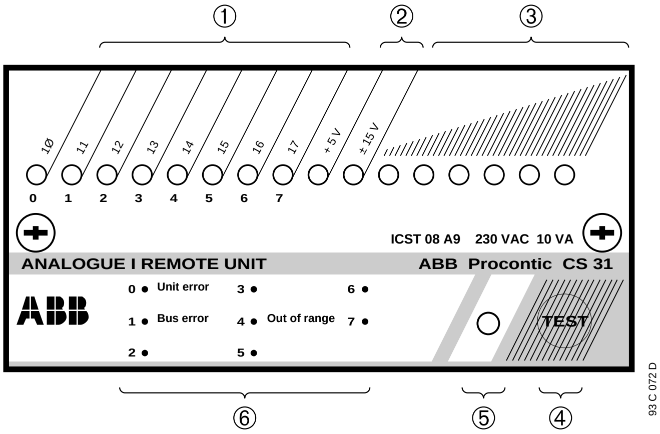
The analog input remote unit can be used for measurement of temperature.
The inputs have to be connected to the PT 100 sensors (2 or 3 wires) according the IEC 751 standard (class A and class B).

The range of temperature is : 0 °C … + 300 °C
(+ 32 °F … + 572 °F)

Description of the unit front :

- Ten status led's:
  - Eight yellow input status led's «I0» to «I7» .... ①
  - Two green power supply led's «+ 5 V», «± 15 V» .... ②
- Six yellow led's to display the signal value of inputs .... ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes .... ⑥

The unit has to be mounted on a plug-in base ECZ



8 analog inputs per unit

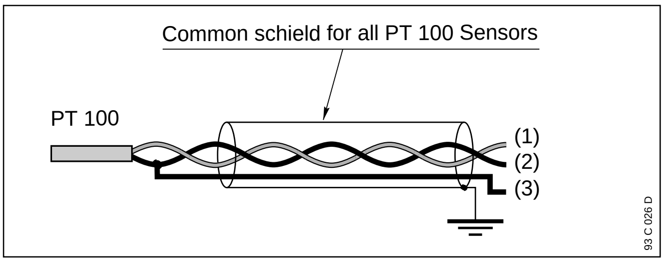
TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	no	no
Power supply output	no	no
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.8 W	8 W
Order number : FPR 333 5901	R1012	R0016/R0014
Weight (kg)	0.25	0.43

INPUT SPECIFICATIONS		
Nominal scale	0 °C … + 300 °C	(+ 32 °F … + 572 °F)
Maximum value	+ 300.5 °C	(+ 572.9 °F)
Minimum value	– 5 °C	(+ 23 °F)
Offset	0 °C	(0 °F)
Resolution : 8 bits	1.2 °C	(2.16 °F)
Accuracy on full scale (out of the allowance on sensor and for an ambient temperature of the unit for 0 °C … + 55 °C) (+ 32 °F … + 131 °F))	± 1.5 °C	(± 2.7 °F)
Allowance on sensor		
- type A (IEC 751)	± 0.75 °C on full scale	(± 1.35 °F)
- type B (IEC 751)	± 1.8 °C on full scale	(± 3.24 °F)
Ohmic value of the PT 100 sensor	100 … 212.02	
Temperature coefficient	100 ppm/ °C	
Max refresh time	300 ms for 8 channels	

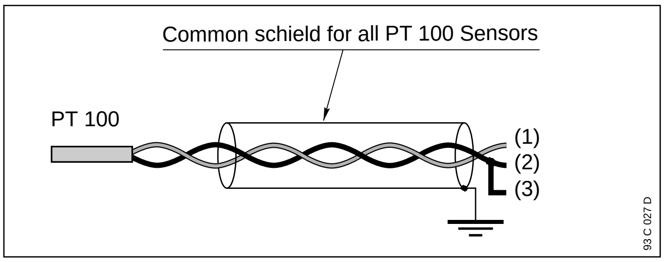
* The different characteristics are available on the used range 0 °C … 55 °C (+ 32 °F … + 131 °F) of the remote unit.
* The no linerarity of the sensor is compensated.

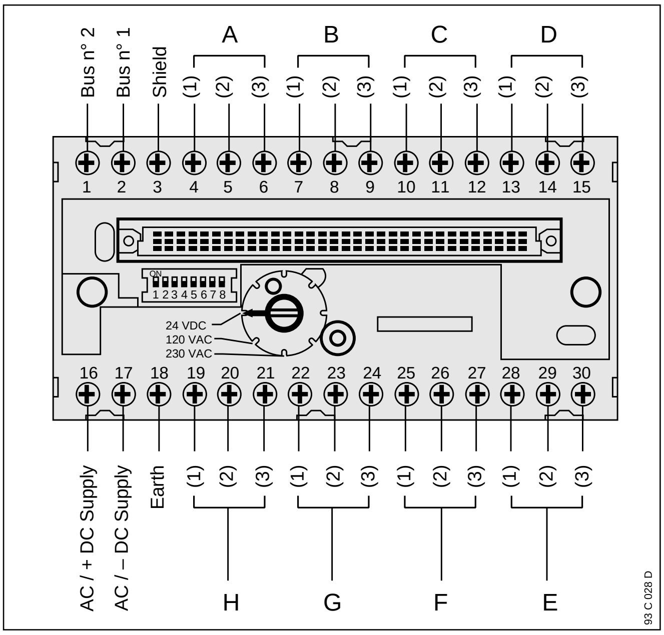
• Electrical connection

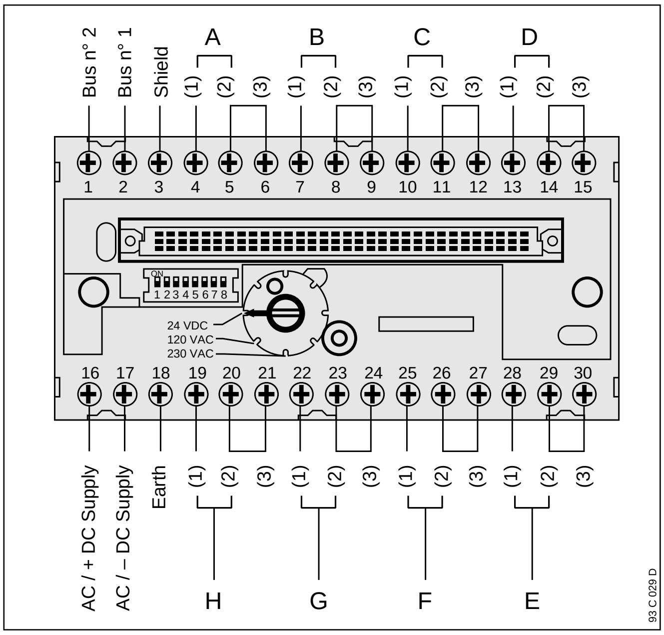
"3 wires" connection



"2 wires" connection







• Initialization

- The unit initializes itself after power ON.
- The error led goes out after initialization.

The value of the analog input I0 is displayed on the 6 led's on the right and the led's «+ 5 V» and «± 15 V» are illuminated.

• Utilization

VARIABLES USED IN THE CENTRAL UNIT

CENTRAL UNITS		07 KR 31	07 KR 91 07 KT 92 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 05 08 ... 15	00 ... 05	even 00 … 14		1 … 8
Switch N° 8 on the plug-in base		OFF	ON	OFF	ON	OFF
Input	A	EWxx, 00	EWxx, 08	EAxx, 00	EAxx, 08	IAx0
	B	EWxx, 01	EWxx, 09	EAxx, 01	EAxx, 09	IAx1
	C	EWxx, 02	EWxx, 10	EAxx, 02	EAxx, 10	IAx2
	D	EWxx, 03	EWxx, 11	EAxx, 03	EAxx, 11	IAx3
	E	EWxx, 04	EWxx, 12	EAxx, 04	EAxx, 12	IAx4
	F	EWxx, 05	EWxx, 13	EAxx, 05	EAxx, 13	IAx5
	G	EWxx, 06	EWxx, 14	EAxx, 06	EAxx, 14	IAx6
	H	EWxx, 07	EWxx, 15	EAxx, 07	EAxx, 15	IAx7

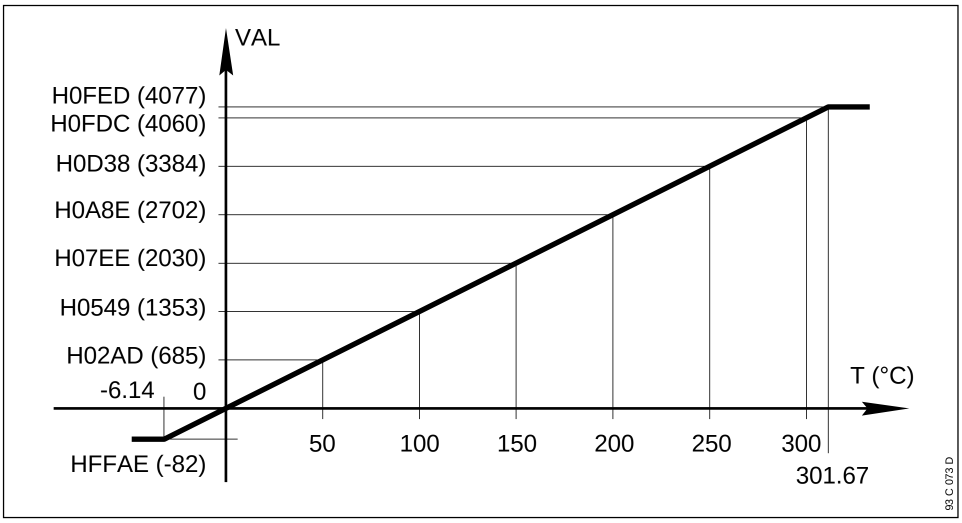
In the case of UCZA/UCZB, the adresses 08 ... 14 are only allowed with the SCZ unit.
For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description.

ANALOG INPUTS 8 BITS

Input range	0 °C … + 300 °C	(+ 32 °F … + 572 °F)
Resolution	1.2 °C	(2.16 °F)
Maximum	300.5 °C	(+ 572.9 °F)
Minimum	– 5 °C	(+ 23 °F)

Bits of analog word	Range least significant byte and for central units UCZA/UCZB		Range most significant byte	
B15	– 303.00 °C	(513.40 °F)	– 303.00 °C	(513.40 °F)
B14	**	**	151.50 °C	(304.70 °F)
B13	**	**	75.75 °C	(168.35 °F)
B12	**	**	37.88 °C	(100.18 °F)
B11	151.50 °C	(304.70 °F)	18.94 °C	(66.09 °F)
B10	75.75 °C	(168.35 °F)	9.47 °C	(49.04 °F)
B9	37.88 °C	(100.18 °F)	4.73 °C	(40.51 °F)
B8	18.94 °C	(66.09 °F)	2.37 °C	(36.26 °F)
B7	9.47 °C	(49.04 °F)	1.18 °C	(34.12 °F)
B6	4.73 °C	(40.51 °F)	0.59 °C	(33.06 °F)
B5	2.37 °C	(36.26 °F)	0.30 °C	(32.54 °F)
B4	1.18 °C	(34.12 °F)	0.15 °C	(32.27 °F)
B3	0.59 °C	(33.06 °F)	0.08 °C	(32.14 °F)
B2	0.30 °C	(33.54 °F)	0	0
B1	0.15 °C	(32.27 °F)	0	0
B0	0.08 °C	(32.14 °F)	0	0

The choice of setting of the dip switches 2 and 3 on the plug-in base gives two different tables.
(See chapter 5.1, volume 2 «**General**»)



Approximate function

T °C = 0.074 VAL
VAL = 13.5135 T °C

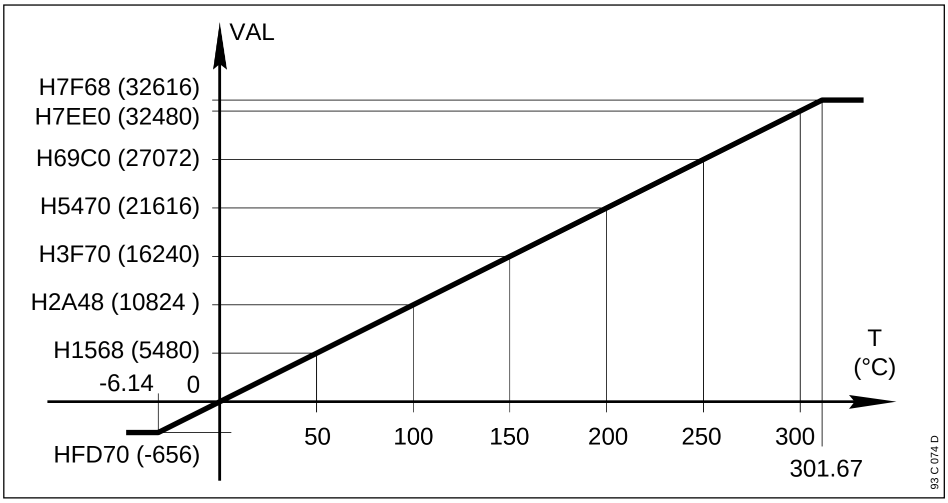
VAL : input word after conversion and linearity correction.

T °C : temperature in degree Celsius

Use the following formula to get the temperature in degree Fahrenheit :

$$°F = \frac{9}{5} °C + 32$$

Range least significant byte and UCZA/UCZB



Approximate function

T °C = 0.00925 VAL
VAL = 108.108 T °C

VAL : input word after conversion and linearity correction.

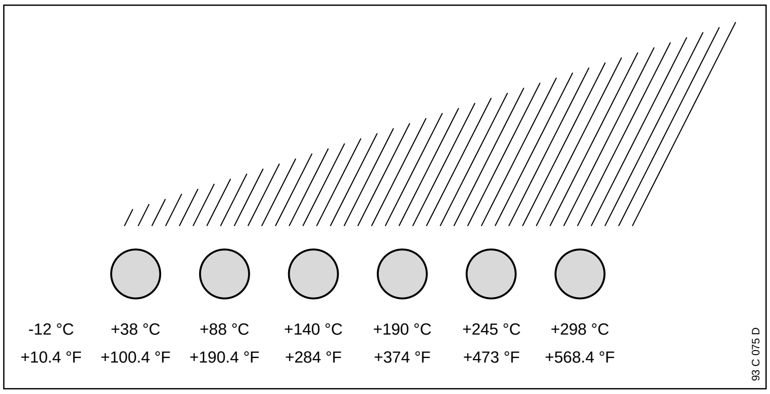
T °C : temperature in degree Celsius

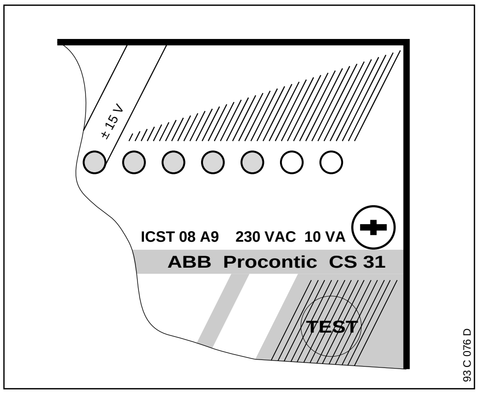
Use the following formula to get the temperature in degree Fahrenheit :

$$°F = \frac{9}{5}\,°C + 32$$

Range most significant byte

The value of input selected by pressing the **«TEST»** button can be displayed on the 6 led's on the right.
These 6 led's have the following meaning :





Each channel can be selected by pressing the **«TEST»** button.

Channel I0 is always displayed after initialization untill otherwise selected.

Fault indication:

Led 0 : **«Unit error»**
Led 1 : **«Bus error»**
Led 4 : **«Out of range»**

Led 4 **«OFF»** : the channel is wired and the temperature is in the due range.
Led 4 **«ON»** : measure out of range, or short circuit detection (if VAL VAL MIN), or open circuit detection (if VAL VAL MAX).

If an error occurs, (see chapter 9, volume 2 **«In case of failure»**).

5.2.5 Analog Input Module ICDT 08 B5

8 inputs, configurable for temperature sensors or as voltage inputs
24 V DC, CS31 system bus connection electrically isolated

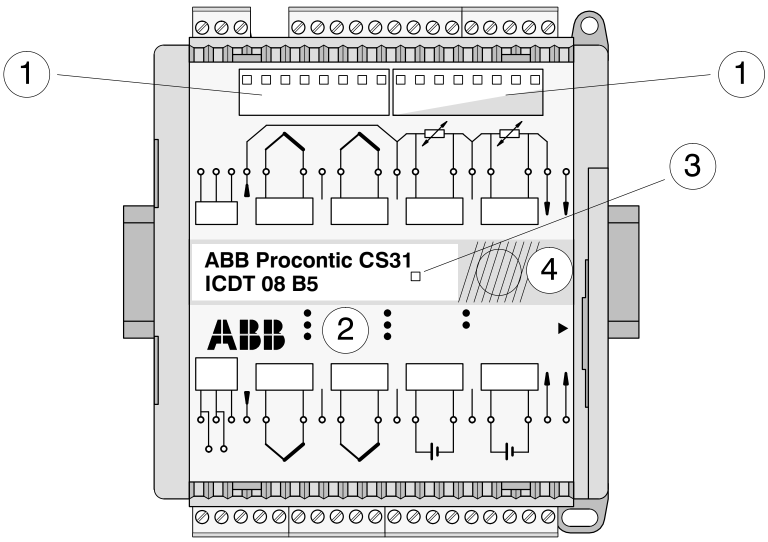


Fig. 5.2.5 – 1: Analog input module ICDT 08 B5

Contents

Intended purpose

The analog input module ICDT 08 B5 is a remote module on the CS31 system bus. It has 8 analog input channels with the following features:

- The channels are configured in pairs for the connection of the following temperature or voltage sensors:
  - $\pm$ 10 V / $\pm$ 5 V / $\pm$ 500 mV / $\pm$ 50 mV
  - 4...20 mA (with an external 250 Ω shunt)
  - Pt100 / Pt1000 with linearization
  - Thermocouples of types J, K and S with linearization
  - Only electrically isolated sensors may be used.
- The range of $\pm$ 5 V is also suitable for measuring 0...20 mA, if an external shunt of 250 Ω is used.

- The configuration of the input channels as well as the setting of the module address are performed at DIL switches.

The ICDT 08 B5 module uses **one** address in the word input range of 0...6. Each of the 8 channels needs 16 bits.

The module is supplied with 24 V DC. The CS31 system bus connection is electrically isolated from the remaining module components.

The module offers a number of diagnosis functions (see chapter ”Diagnosis and displays”). A self–calibration is carried out cyclically by the module’s internal control circuit.

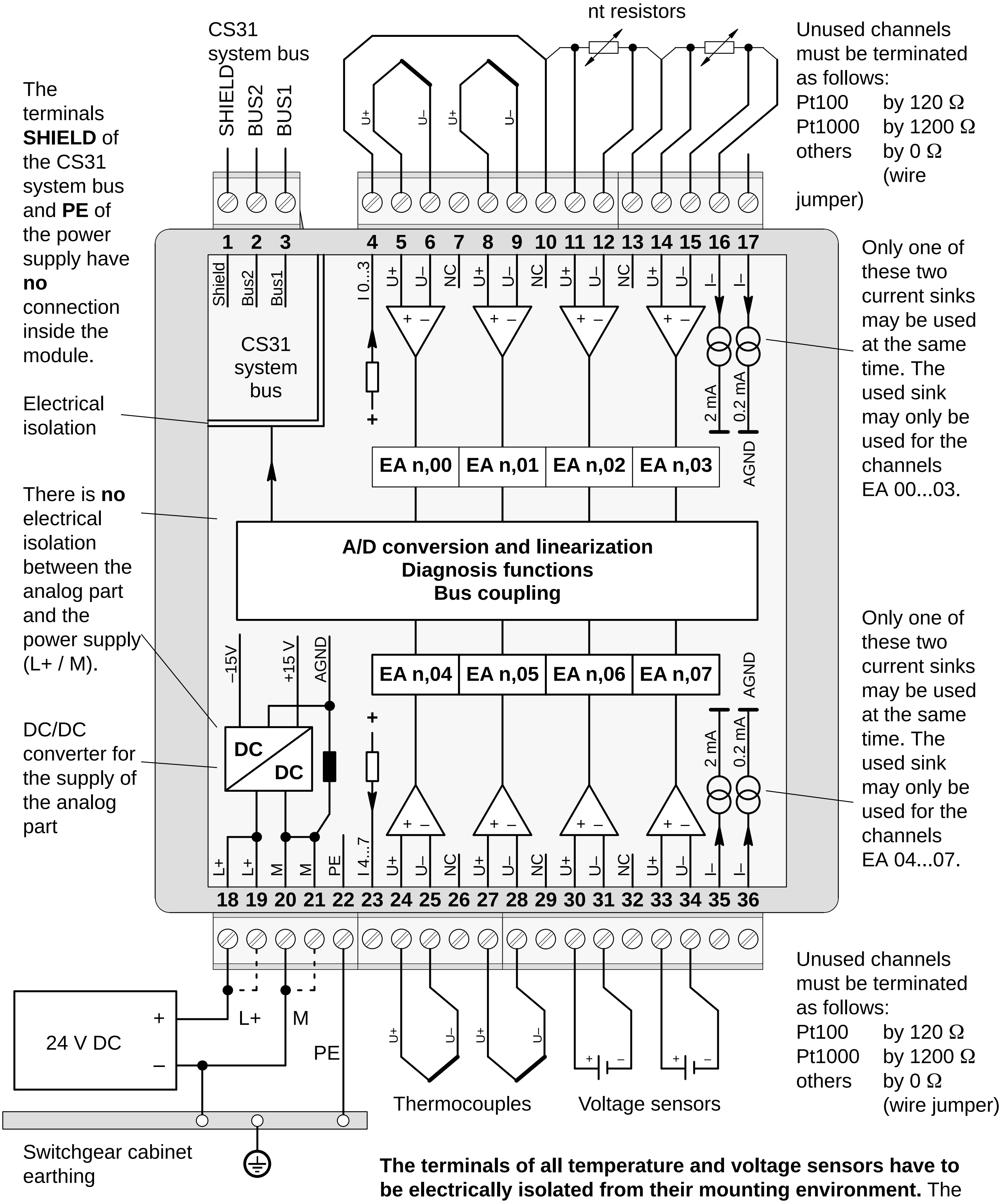
Display and operating elements on the front panel

1. 8 green LEDs for channel selection and diagnosis, 8 green LEDs for a rough display of an analog channel
2. List of diagnosis information belonging to the LEDs, if they are used for diagnosis
3. Red LED for error message
4. Test button

Electrical connection

The module is mounted on a 15-mm-high DIN rail or fastened with 4 screws. The following figure shows the electrical connection of the analog input module.

Connection examples for temperature sensors



Note: The process supply voltage has to be included into the earthing concept of the installation (e.g. by earthing the minus pole of the power supply unit).

The terminals of all temperature and voltage sensors have to be electrically isolated from their mounting environment. The cable shields of the sensor cables are connected to the switchgear cabinet earthing when the cables enter the switchgear cabinet.

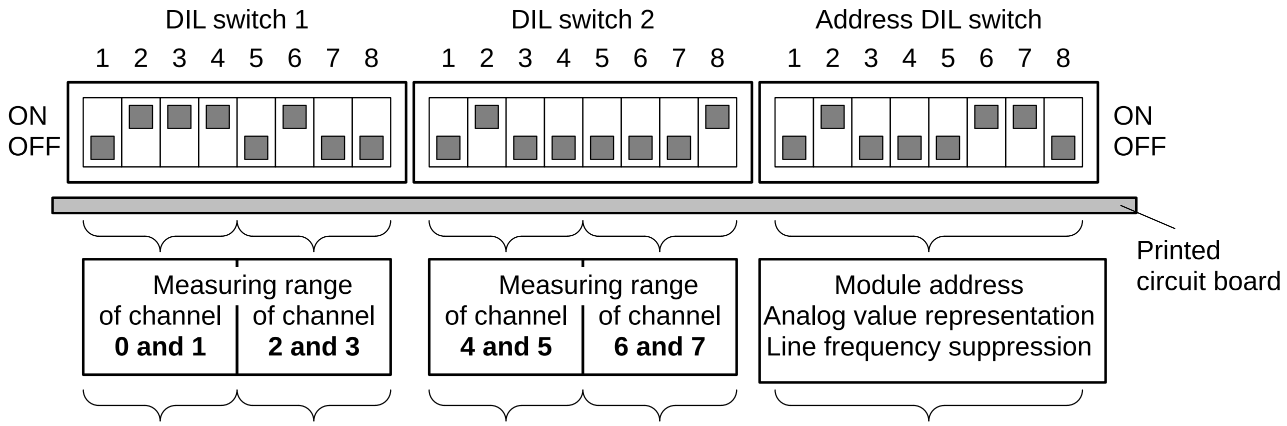
The configuration of the input channels as well as the setting of the module address are performed at DIL switches (see next page).

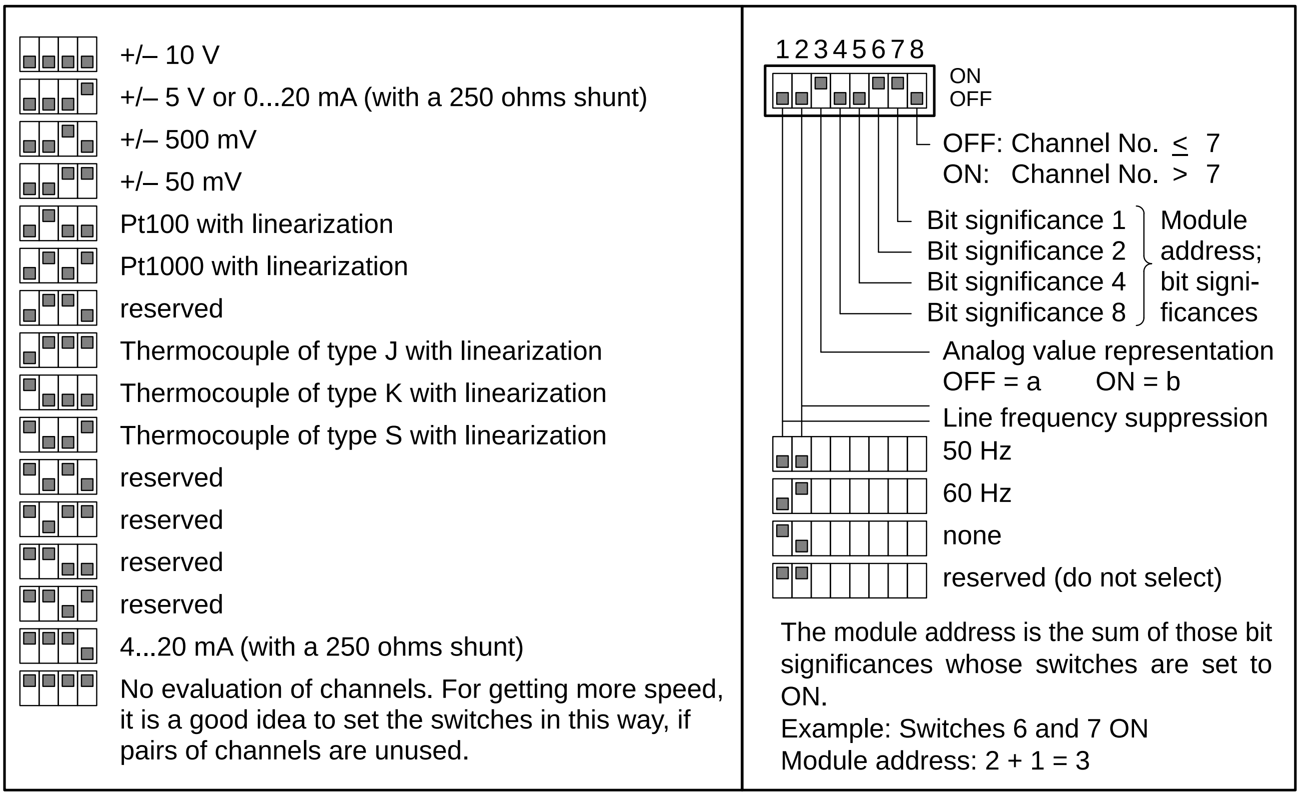
Fig. 5.2.5–2: Electrical connection of the analog input module ICDT 08 B5

Configuring the input channels and setting the module address on the CS31 system bus

The measuring ranges are set in pairs (i.e. always for two channels together) at the DIL switches 1 and 2. The setting on the address DIL switch determines the module address, the analog value representation and the type of line frequency suppression (50 Hz or 60 Hz or none).

The switches are under the cover on the right side of the module housing. The following drawing illustrates the setting modes.





Specifications of the platinum temperature sensors Pt100/Pt1000:

Pt100	=	Platinum 100 Ω at 0 °C	Measuring range	–50...400 °C	Current sink 2 mA
Pt1000	=	Platinum 1000 Ω at 0 °C	Measuring range	–50...400 °C	Current sink 0.2 mA

Specifications of the thermocouples of types J, K and S:

Type **J**	=	**Fe–CuNi**	0...1200 °C	Iron / Copper–Nickel	+ = Fe	– = CuNi
Type **K**	=	**NiCr–NiAl**	0...1372 °C	Nickel–Chromium / Nickel–Aluminium	+ = NiCr	– = NiAl
Type **S**	=	**Pt10Rh–Pt**	0...1600 °C	Platinum–10% Rhodium / Platinum	+ = Pt10Rh	– = Pt

Fig. 5.2.5–3: Configuration of the input channels and setting of the module address on the CS31 system bus

Measuring ranges of the input channels

All input signals are evaluated as differential signals. The sensor signals are connected double–pole to the inputs U+ and U– (for examples see Fig. 5.2.5–2). The relationship between the input signals and the output numerical values is shown in the figures 5.2.5–7 to 5.2.5–9. All unused channels have to be short–circuited (see also the termination of unused inputs configured as Pt100/Pt1000 channels).

± 10 V / ± 5 V / ± 500 mV / ± 50 mV

The set measuring range is converted into the numerical number range without linearization in the following way:

Analog representation **a:** –4095 ... 0.... +4095
Analog representation **b:** –32760 ... 0....+32760

If input voltages overflow the measuring range, the overflow number of +32767 is output. If the input voltage underflows the measuring range, the underflow number of –32767 is output. In both cases, an error message is sent via the CS31 system bus.

All unused channels have to be short–circuited.

4...20 mA / 0...20 mA

The following configurations can be set:

Measuring range	Setting
4...20 mA	4...20 mA
0...20 mA	± 5 V

The two input terminals have to be circuited in parallel with a 250 Ω shunt in both cases.

All unused channels have to be short–circuited.

Pt100 / Pt1000

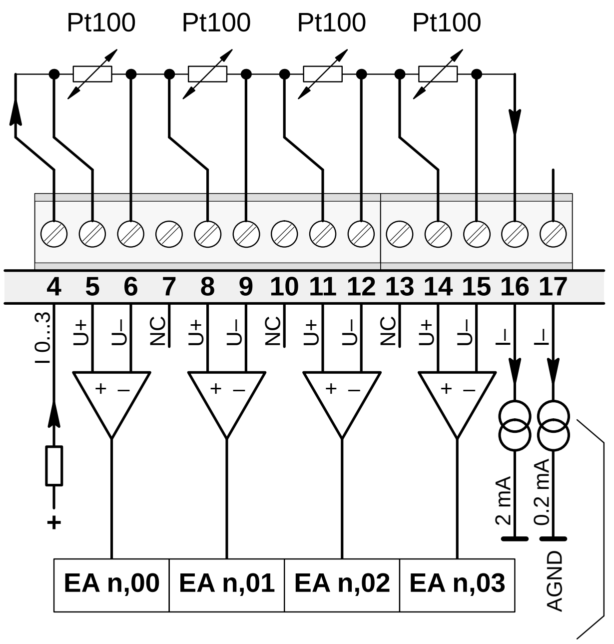
When resistance thermometers are used, a constant current must flow through their sensor resistors in order to build a voltage drop necessary for the evaluation in the module. The analog module provides two constant current sinks for this purpose.

The two following figures show configurations with Pt100 and Pt1000 resistance thermometers. The module linearizes the temperature-resistance curves if channels configured for Pt100/Pt1000. The accuracy of the integrated current sinks of 2 mA and 0.2 mA is also compensated in these measuring configurations.

The following three paragraphs describe the allocations of the integrated current sinks:

Resistance thermometers which are connected to the terminals 5 to 15 (channels EA n,00 to EA n,03), may use **only one of the two** sinks at the terminals 16 **or** 17 (2 mA **or** 0.2 mA).

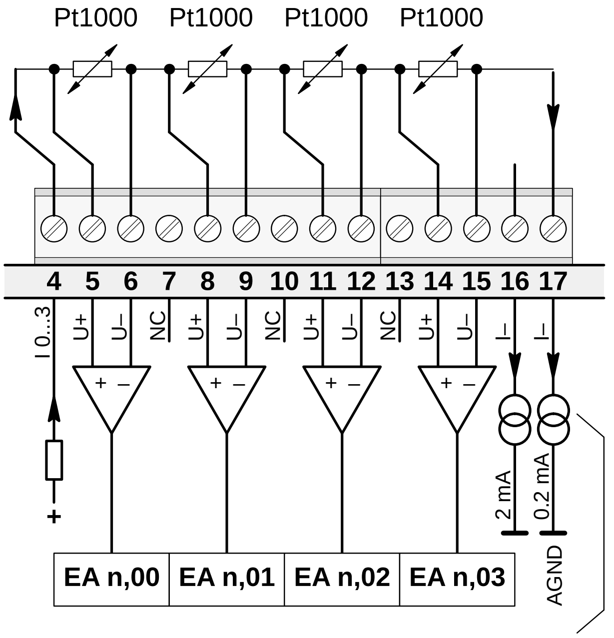
Setting for Pt100 with linearization:



Only one of these two current sinks may be used at the same time. The used sink may only be used for the channels EA 00...03.

Fig. 5.2.5–4: Connection of Pt100 sensors

Setting for Pt1000 with linearization



Only one of these two current sinks may be used at the same time. The used sink may only be used for the channels EA 00...03.

Fig. 5.2.5–5: Connection of Pt1000 sensors

Resistance thermometers which are connected to the terminals 24 to 34 (channels EA n,04 to EA n,07), may use **only one of the two** sinks at the terminals 35 **or** 36 (2 mA **or** 0.2 mA).

Use of Pt100 and Pt1000 sensors at the same time is possible. One group of the sensors (e.g. Pt100) can be connected to the upper terminals, the other group (e.g. Pt1000) to the lower terminals.

The terminals 7, 10, 13, 26, 29 and 32 (labelled with NC) can be used as connecting tags for the current loops (see also Fig. 5.2.4–2).

Independent of the analog representation **a** or **b**, the measuring range of **–50°C...400°C** is allocated linear to the number range of **–1022...+8190** (see also the figures 5.2.5–7 to 5.2.5–9).

If input voltages overflow the measuring range, the overflow number of +32767 is output. If the input voltage underflows the measuring range, the underflow number of –32767 is output. In both cases, an error message is sent via the CS31 system bus.

If a broken wire (open circuit) occurs in the current loop, the number –32767 is output. If a broken wire (open circuit) occurs in the sensor line, the number +32767 is output. In both cases, an error message is sent via the CS31 system bus.

If unused Pt100/Pt1000 channels would be connected to a wire jumper, its resistance of 0 Ω would pretend the measuring value of a very low temperature. As a result, the error message "Underflow" would be output. In order to prevent such error messages, unused Pt100/Pt1000 channels should be terminated as follows:

Pt 100	by a resistor of 120 Ω
Pt 100 0	by a resistor of 1200 Ω

Connection of other temperature–dependent resistors

In principle, all temperature–dependent resistors can be connected to the module instead of Pt100/Pt1000 sensors. As configurations, the settings ± 5 V, ± 500 mV and ± 50 mV are suitable. If necessary, the linearization of the temperature–resistance curve must be performed with the PLC program. The integrated current sinks can be used. In doing so, the following has to be observed:

– The voltage drop over all resistors circuited in series may not be greater than

  7 V (using the current sink of 0.2 mA),

  2.5 V (using the current sink of 2 mA).

– The tolerance of the integrated current sinks is ± 1,5 %. There is no compensation by the module in this application. This is a difference compared with the Pt100/Pt1000 settings.

Thermocouples of types J, K and S

The thermocouples are connected directly or via compensation wires to the terminals U+ and U–. The correct polarity must be observed by all means.

The reference junction temperature sensor is integrated in the module near the terminals. When evaluating the absolute temperature, the terminals are considered as the reference junction.

Configuration (see Fig. 5.2.5–3)

Type J with linearization

Type K with linearization

Type S with linearization

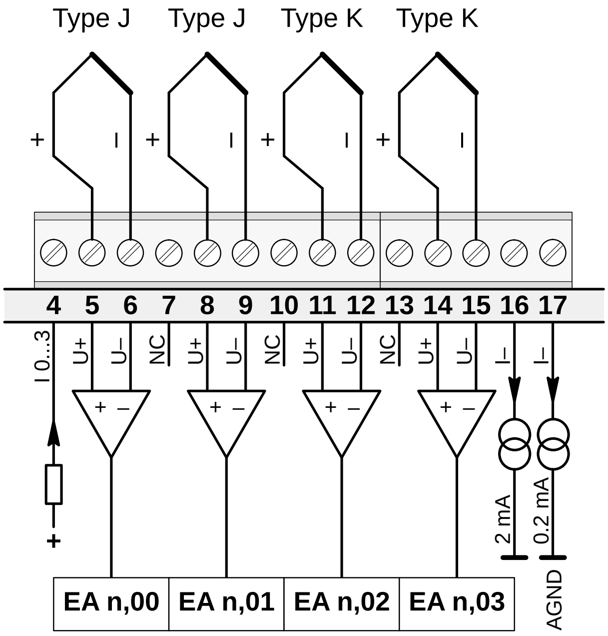


Fig. 5.2.5–6: Connection of 2 J–type and 2 K–type thermocouples

The thermoelectric voltage generated by the thermocouples is converted into binary values inside the module and then linearized according to the thermocouple type. In order to get the absolute temperature, the temperature of the reference junction is added.

Independent of the analog representation **a** or **b**, the measuring range is allocated linear to the number range as follows (see also the figures 5.2.5–7 to 5.2.5–9):

Type J:	**0°C...1200°C**	Number range	**0...24576**
Type K:	**0°C...1372°C**	Number range	**0...28096**
Type S:	**0°C...1600°C**	Number range	**0...32760**

If input voltages overflow the measuring range, the overflow number of +32767 is output. If the input voltage underflows the measuring range, the underflow number of –32767 is output. In both cases, an error message is sent via the CS31 system bus. Temperatures lower than 0°C are evaluated as ”Underflow”.

If a broken wire (open circuit) occurs, the number –32767 is output. In addition, an error message is sent via the CS31 system bus.

All unused channels must be short–circuited.

Note:

Since L type thermocouples (Iron/constantan, Fe–CuNi according to DIN 43710) are similar to J type thermocouples, they also can be used in the temperature range of 0...900 °C. The slightly greater thermal Emf generated by the L type thermocouple, however, pretends a little higher temperature. The following table illustrates this fact (all temperature data is referred to a reference temperature of 0 °C):

Temperature at the measuring point	Temperature evaluated by the module, if an L type thermocouple is used instead of a J type thermocouple
25 °C	25.63 °C
50 °C	51.23 °C
100 °C	101.89 °C
200 °C	203.13 °C
400 °C	405.69 °C
600 °C	609.78 °C
900 °C	920.41 °C

Configuration ”Unused channel”

If channels are unused in pairs, it is useful to omit them from the acquisition of the measured value and processing in the software. The other channels are processed faster then. Figure 5.2.5–3 shows how to set the configuration ”No evaluation of channels”.

Relationship between the measuring values and the arrangement of the bits in the 16–bit word according to the analog representations a and b

The measuring ranges for the analog channels are configured in pairs (i.e. always for 2 channels together), see Fig. 5.2.5–3. If an overflow or an underflow occurs, or if an open circuit is detected, the numbers +32767 or –32767 are output.

The following three figures illustrate the evaluation functions of the module.

Analog representation / measuring range **Bit No. in the 16–bit word**

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
a (T200)	–100 %	–100 %	–100 %	–100 %	50 %	25 %	12.5 %	6.25 %	3.13 %	1.56 %	0.78 %	0.39 %	0.20 %	0.10 %	0.05 %	0.02 %
±10V	–10V (sign)				5V	2.5V	1.25V	625mV	313mV	156mV	78mV	39mV	20mV	10mV	5 mV	2mV
± 5V	–5V (sign)				2.5V	1.25V	625mV	313mV	156mV	78mV	39mV	20mV	10mV	5mV	2mV	1mV
±0.5V	–500mV (sign)				250mV	125mV	63mV	31mV	16mV	7,8mV	3,9mV	2mV	1mV	0.5mV	0.2mV	0.1mV
±50mV	–50mV (sign)				25mV	12.5mV	6.3mV	3.1mV	1.6mV	0.8mV	0.4mV	0.2mV	0.1mV	0.05mV	0.02mV	0.01mV
Bit values	–4096 (sign)				2048	1024	512	256	128	64	32	16	8	4	2	1

Analog representation a, measuring ranges ± 10 V, ±5 V, ±500 mV, ±50 mV, 12 bits resolution plus sign the value range from –100...+100 % corresponds to the numbers $F001_H$...$0FFF_H$ (–4095...+4095), Overflow: $7FFF_H$ (32767), Underflow: 8001_H (–32767)

	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
b (CS31)	–100 %	50 %	25 %	12.5 %	6.25 %	3.13 %	1.56 %	0.78 %	0.39 %	0.20 %	0.10 %	0.05 %	0.02 %	0	0	0
	Sign															
±10V	–10V	5V	2.5V	1.25V	625mV	313mV	156mV	78mV	39mV	20mV	10mV	5 mV	2mV	0	0	0
± 5V	–5V	2.5V	1,25V	625mV	313mV	156mV	78mV	39mV	20mV	10mV	5mV	2mV	1mV	0	0	0
±0.5V	–500mV	250mV	125mV	63mV	31mV	16mV	7.8mV	3.9mV	2mV	1mV	0.5mV	0.2mV	0.1mV	0	0	0
±50mV	–50mV	25mV	12.5mV	6.3mV	3.1mV	1.6mV	0.8mV	0.4mV	0.2mV	0.1mV	0.05mV	0.02mV	0.01mV	0	0	0
Bit values	–32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

Analog representation b, measuring ranges ±10 V, ±5 V, ±500 mV, ±50 mV, 12 bits resolution plus sign, the value range from –100...+100 % corresponds to the numbers 8008_H...$7FF8_H$ (–32760...+32760), Overflow: $7FFF_H$ (32767), Underflow: 8001_H (–32767)

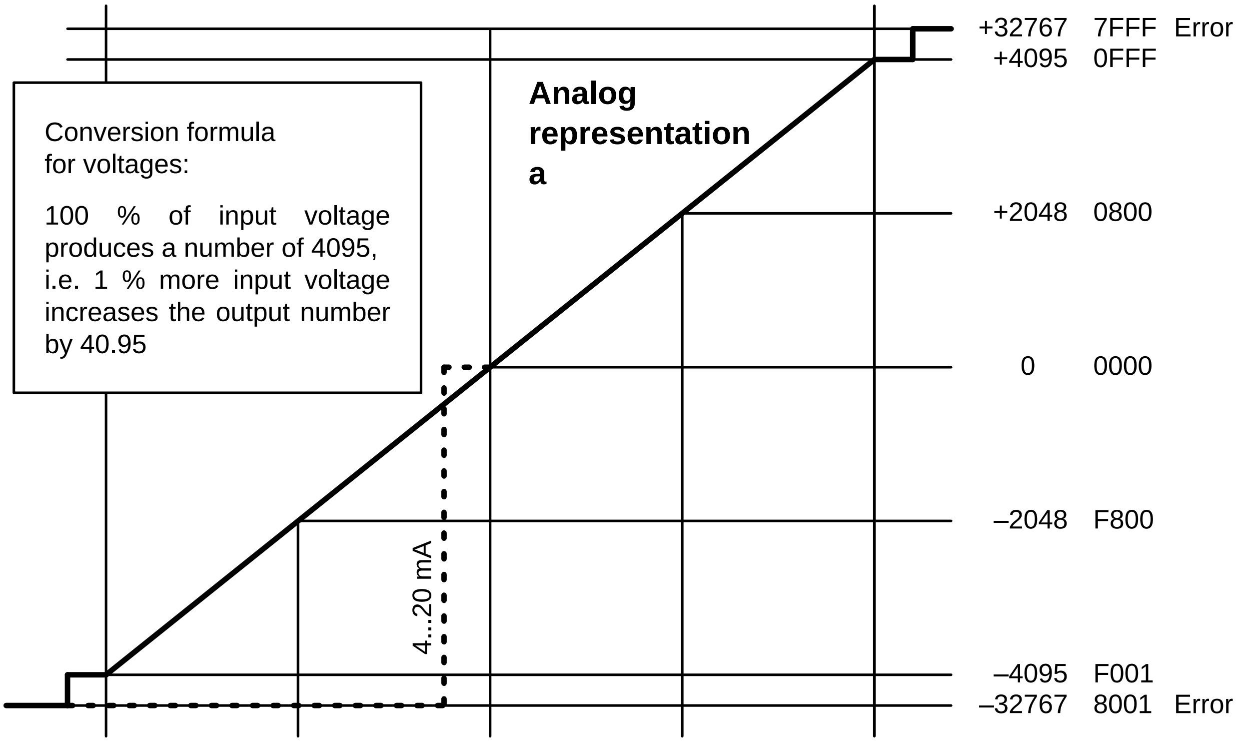
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
a or **b**	–100 %	50 %	25 %	12.5 %	6.25 %	3.13 %	1.56 %	0.78 %	0.39 %	0.20 %	0.10 %	0.05 %	0.02 %	0.01 %	0.005 %	0
	Sign															
Pt100 Pt1000	–1600°C	800°C	400°C	200°C	100°C	50°C	25°C	12.5°C	6.25°C	3.13°C	1.56°C	0.78°C	0.39°C	0.2°C	0.1°C	0
Thermo-couples	0	800°C	400°C	200°C	100°C	50°C	25°C	12.5°C	6.25°C	3.13°C	1.56°C	0.78°C	0.39°C	0	0	0
Bit values	–32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

Analog representation a/b, measuring ranges for Pt100/Pt1000 with 12 bits resolution plus sign, the value range from –50...+400°C corresponds to the numbers $FC02_H$...$1FFE_H$ (–1022...+8190), Overflow / open circuit in the sensor line: $7FFF_H$ (32767), Underflow / open circuit in the current loop: 8001_H (–32767)

Analog representation a/b, measuring ranges for thermocouples with 12 bits resolution without sign, the value range from 0...+1600°C corresponds to the numbers 0_H...$7FF8_H$ (0...+32760) Overflow: $7FFF_H$ (32767), Underflow / open circuit: 8001_H (–32767)

Fig. 5.2.5–7: Relationship between the measuring values and the arrangement of the bits in the 16–bit word according to the analog representations a and b

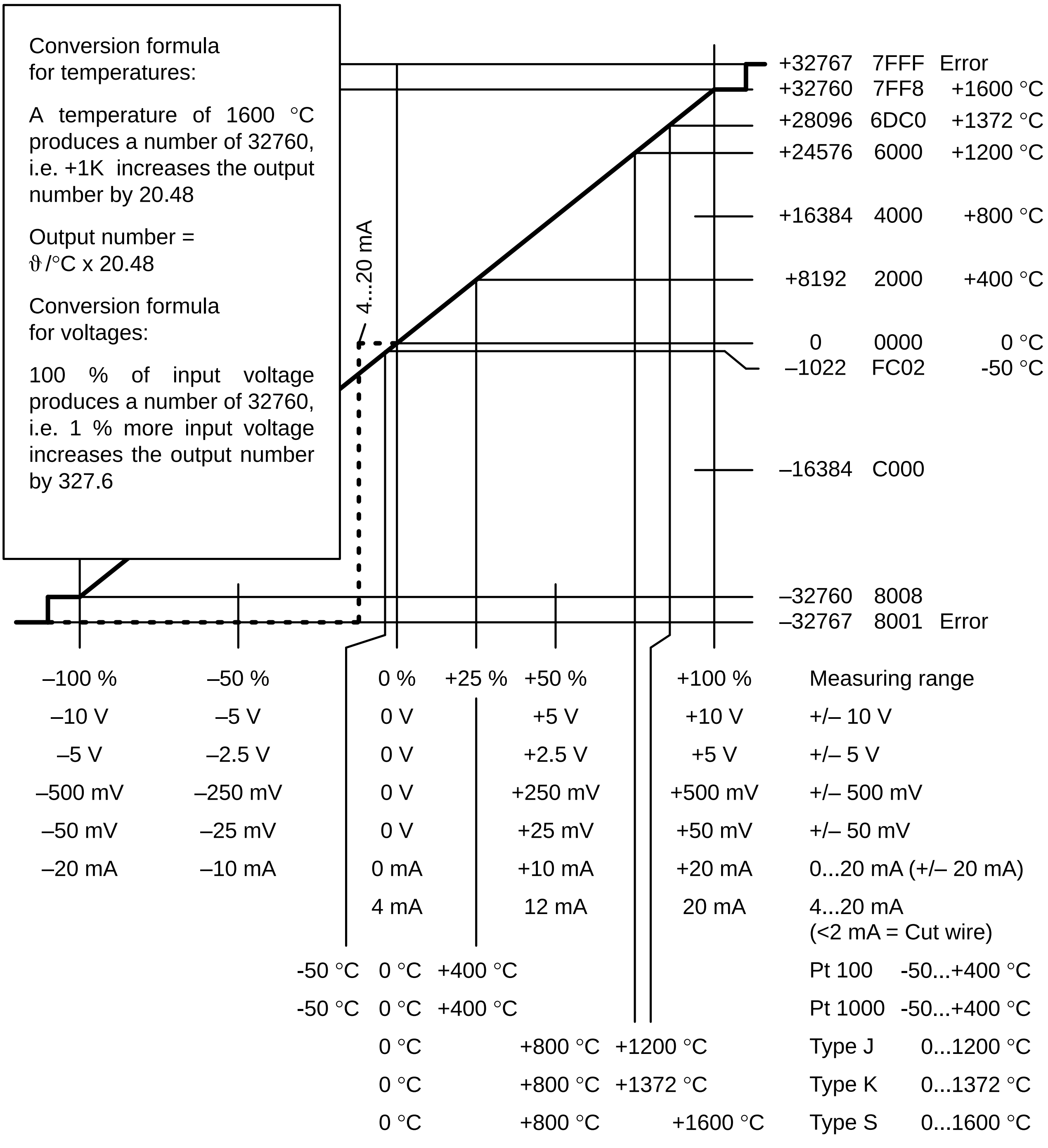
Relationship between the measuring value and the output number, Voltage input (analog representation a, T200)



–100 %	–50 %	0 %	+50 %	+100 %	Measuring range
–10 V	–5 V	0 V	+5 V	+10 V	+/– 10 V
–5 V	–2.5 V	0 V	+2.5 V	+5 V	+/– 5 V
–500 mV	–250 mV	0 V	+250 mV	+500 mV	+/– 500 mV
–50 mV	–25 mV	0 V	+25 mV	+50 mV	+/– 50 mV
–20 mA	–10 mA	0 mA	+10 mA	+20 mA	0...20 mA (+/– 20 mA)
		4 mA	12 mA	20 mA	4...20 mA (<2mA = Cut wire)

Fig. 5.2.5–8: Relationship between the measuring value and the output number (part 1)

Relationship between the measuring value and the output number, voltage input (analog representation b), temperature input (analog representation a or b)



Specifications of the platinum temperature sensors Pt100/Pt1000:

Pt100	=	Platinum 100 Ω at 0 °C	Measuring range	–50...400 °C	Current sink 2 mA
Pt1000	=	Platinum 1000 Ω at 0 °C	Measuring range	–50...400 °C	Current sink 0.2 mA

Specifications of the thermocouples of types J, K and S:

Type **J** =	**Fe–CuNi**	0...1200 °C	Iron / Copper–Nickel	+ = Fe	– = CuNi
Type **K** =	**NiCr–NiAl**	0...1372 °C	Nickel–Chromium / Nickel–Aluminium	+ = NiCr	– = NiAl
Type **S** =	**Pt10Rh–Pt**	0...1600 °C	Platinum–10% Rhodium / Platinum	+ = Pt10Rh	– = Pt

Fig. 5.2.5–9: Relationship between the measuring value and the output number (part 2)

Addressing

An address has to be set on each module, so that the central unit can access the inputs and outputs correctly.

A detailed description concerning the item ”Addressing” is contained in the chapters ”Addressing” of the central units and couplers. For setting the analog format (representation a and b) see Fig. 5.2.5–3.

The switches for setting the address are under the cover on the right side of the module housing (see Fig. 5.2.5–3). If the central units 07 KR 31, 07 KT 31, 07 KR 91, 07 KT 92 and 07 KT 93 are used as bus masters, the following address allocations are valid:

Central units 07 KR 31 / 07 KT 31 / 07 KR 91 / 07 KT 92 / 07 KT 93

The address DIL switch No. 8 is set to **OFF** (recommendation):

Chan.		Chan.	
E0 E1 E2 E3	EW xx,00 EW xx,01 EW xx,02 EW xx,03	E4 E5 E6 E7	EW xx,04 EW xx,05 EW xx,06 EW xx,07

The address DIL switch No. 8 is set to **ON**:

Chan.		Chan.	
E0 E1 E2 E3	EW xx,08 EW xx,09 EW xx,10 EW xx,11	E4 E5 E6 E7	EW xx,12 EW xx,13 EW xx,14 EW xx,15

xx: Group number of the address, set on the address DIL switch with the switches 4...7. Recommended addresses with 07 KR 31 / 07 KT 31 / 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master: 00....05

The module uses 8 analog inputs on the CS31 system bus.

Normal operation

- The module initializes itself after power ON. During initialization all LEDs are ON.
- If the CS31 system bus does not run, the LED 3 flashes. The error LED also light up, if an error occurs during initialization.

Diagnosis and displays

The module ICDT 08 B5 offers the following diagnosis functions:

- Detection of open circuit (broken wire), if Pt100/Pt1000 temperature sensors or thermocouples are used
- Storing and holding ready this information for interrogation (error type and error location)
- Detection of an error inside the module
- Detection of a transmission error

If one of these errors is detected, the red error LED lights up. **The error message is then sent to the central unit or to the coupler.**

- Open circuit (cut wire)

Error class 4	(FK4)		M 255,14
Error number:	09	–>	MW 255,08
Device type:	05	–>	MW 255,09)
Group number (address):		–>	MW 255,10
Channel number:		–>	MW 255,11

- Overflow (out of range)

Error class 4	(FK4)		M 255,14
Error number:	10 dec.	–>	MW 255,08
Device type:	05	–>	MW 255,09)
Group number (address):		–>	MW 255,10
Channel number:		–>	MW 255,11

By means of the test button all diagnosis functions can be selected for each channel. Pressing the test button the first time the channel 0 is selected: LED 0 flashes.

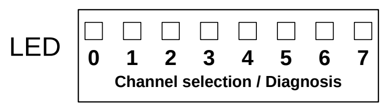


Fig. 5.2.5–10: LEDs for displaying channel selection and diagnosis

When releasing the test button, the error information belonging to this channel is displayed by the green LEDs 0 to 7 for a period of ca 3 seconds.

Meaning of the LEDs if lighting up:

0 Error inside the module (Unit error)
1 Error on the CS31 system bus (Bus error)
2 not used
3 Open circuit (Cut wire)
4 Overflow (Out of range)
5 not used
6 not used
7 not used

The meaning of the diagnosis LEDs is labelled on the front panel of the module in English.

The error messages on the module and in the central unit are reset again, when the errors have been eliminated, no new errors have occurred **and** the error elimination has been acknowledged.

Acknowledging an error after error elimination:

- by pressing the test button for a period of ca. 5 seconds or
- with the PC or
- with the PLC program in the central unit

Pressing and releasing the test button further times, the test procedure repeats for all of the other input channels.

After calling information from the last channel, a lamp test is carried out by pressing the test button the next time. All LEDs of the module must light up. After that, the positions of the address DIL switches (module address on the CS31 system bus) is displayed for a period of ca. 5 seconds. LED 0 shows the position of switch No. 1 (LEDs 0 to 7 belong to the switches 1 to 8).

Display of an analog value

When the test button is not pressed, 8 LEDs display the analog value of one selected channel roughly. Meaning of the LEDs:

all LEDs OFF –> minimum value
all LEDs ON –> maximum value

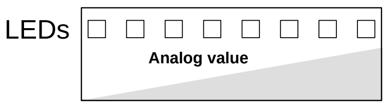


Fig. 5.2.5–11: Display of an analog value with LEDs

Minimum and maximum values are:

Configuration	Min. value all LEDs OFF	Max. value all LEDs ON
+/– 10 V	–10 V	+10 V
+/– 5 V	–5 V	+5 V
+/– 500 mV	–500 mV	+500 mV
+/– 50 mV	–50 mV	+50 mV
+/– 20 mA	–20 mA	+20 mA
0 V / 0 mA = 4 LEDs ON		
4...20 mA	4 mA	20 mA
12 mA = 4 LEDs ON		
Pt100	–50°C	–400°C
Pt1000	–50°C	–400°C
0°C = 1 LED ON		
Thermocouple type J	0°C	+1600°C
Thermocouple type K	0°C	+1600°C
Thermocouple type S	0°C	+1600°C
800°C = 4 LEDs ON		

Fig 5.2.5–12: Minimum and maximum values for the analog display

Technical data ICDT 08 B5

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

General data of the module

Admissible temperature range, module in operation	0...65 °C
Rated supply voltage	24 V DC
Current consumption	max. 0.15 A
Power dissipation	max. 3 W
Overvoltage category	II according to IEC 1133, part 2 (system data)
Protection against reversed connection of supply voltage	yes
Conductor cross section for the removable terminal blocks	max. 2 x 2.5 mm^2
Number of analog input channels	8
Electrical isolation	CS31 system bus interface from the remaining module components
Address setting and configuration	with DIL switches located under the cover on the right side of the module housing
Diagnosis	see chapter ”Diagnosis and displays”
Operating and error displays	17 LEDs altogether, see chapter ”Diagnosis and displays”
Mechanical dimensions	120 x 140 x 85 mm
Weight	450 g
Order No.	GJR5 2516 00 R101

Technical data of the analog inputs (applies for all settings)

Number of channels per module	8 (configurable in pairs)
Electrical isolation	versus the CS31 system bus interface
Line frequency suppression	configurable for 50 Hz or 60 Hz or none
Input signal delay	0 (no RC combination)
Line frequency suppression (software filter)	20.0 ms with 50 Hz line frequency 16.7 ms with 60 Hz line frequency
Permissible overvoltage at the inputs	max. +/– 30 V
Refresh time per channel incl. input delay and conversion time	
– line frequency suppression 50/60 Hz	typ. 100 ms
– no line frequency suppression	typ. 30 ms
– if thermocouples are used with line frequency suppression 50/60 Hz	typ. 150 ms

The total refresh time will be shorter if not all of the channels are used (for configuration see Fig. 5.2.5–3).

Voltage input

Input impedance	> 1 MΩ
Measuring ranges rated values	+/– 10 V, +/– 5 V, +/– 500 mV, +/– 50 mV
Permissible overvoltage at the inputs	max. +/– 30 V
Resolution	12 bits + sign
Total error	$\leq \pm$0.5 % of full scale
Unused channels	have to be short–circuited

Current input 0...20 mA / 4...20 mA

By terminating the input terminals with a shunt, the voltage input can also be used for input currents. The following specifications are valid:

Current measuring range	0...20 mA	4...20 mA
Selected measuring range	+/– 5 V	4...20 mA
Required external shunt	250 Ω	250 Ω
Permissible overvoltage at the inputs	max. +/– 30 V	max. +/– 30 V
Destruction limits of the shunt	depends on its own specifications	
Total error	$\leq \pm$0.5 % of full scale $\pm$ tolerance of the shunt	

Pt100/Pt1000 input

Evaluation range with linearization	–50°C...+400°C
Resistance of the sensors within the evaluation range	
Pt100	80.31 Ω...247.04 Ω
Pt1000	803.1 Ω...2470.4 Ω
Resolution	12 bits + sign (1 LSB = 0.1°C)
Permissible total line resistance of both current–carrying lines	max. 50 Ω per sensor (in 4–wire configuration)
Evaluation error within the range of –50...+400°C (linearity, linearization, temperature range, resolution, adjustment)	Pt100: +/– 0.5 % of full scale Pt1000: +/– 1.0 % of full scale
Constant current sinks for the sensors	
Pt100	2 mA
Pt1000	0.2 mA
Power dissipation in the sensor	
Pt100 temperature = 0°C	0.4 mW
temperature = 400°C	1.0 mW
Pt1000 temperature = 0°C	0.04 mW
temperature = 400°C	0.1 mW
No–load voltage of the current output	< +15 V
Permissible total voltage drop at the sensors and lines circuited in series	max. 7,0 V (current sink 0.2 mA is used) max. 2,5 V (current sink 2.0 mA is used)
Cable length, if cables have been laid in parallel	
shielded	max. 50 m
two-core shielded and cross section $\geq$ 0.5 mm^2	max. 200 m

Unused input channels:

If unused Pt100/Pt1000 channels would be connected to a wire jumper, its resistance of 0 Ω would pretend the measuring value of a very low temperature. As a result, the error message ”Underflow” would be output. In order to prevent such error messages, unused Pt100/Pt1000 channels should be terminated as follows:

Pt 100	by a resistor of 120 Ω
Pt 100 0	by a resistor of 1200 Ω

Connection of other temperature–dependent resistors:

In principle, all temperature–dependent resistors can be connected to the module instead of Pt100/Pt1000 sensors. As configurations, the settings ± 5 V, ± 500 mV and ± 50 mV are suitable. If necessary, the linearization of the temperature–resistance curve must be performed with the PLC program. The integrated current sinks can be used. In doing so, the following has to be observed:

– The voltage drop over all resistors circuited in series may not be greater than

  7 V (using the current sink of 0.2 mA),

  2.5 V (using the current sink of 2 mA).

– The tolerance of the integrated current sinks is ± 1,5 %. There is no compensation by the module in this application. This is a difference compared with the Pt100/Pt1000 settings.

Connection of thermocouples

Possible thermocouples types J, K and S

Evaluation range with linearization

Type J	Fe–CuNi	0°C...+1200°C	at	0....57.942 mV
Type K	NiCr–NiAl	0°C...+1372°C	at	0....41.269 mV
Type S	Pt10Rh–Pt	0°C...+1600°C	at	0.... 9.585 mV

The module has an internal reference junction. The temperature value of this junction is added to the temperature measured by the thermocouple.

Resolution	12 bits + sign (1 LSB = 0.4°C)
Evaluation error within the range of 0...+1600°C (linearity, linearization, temperature range, resolution, adjustment)	+/– 0.5 % of full scale
Cable length, if cables have been laid in parallel	
shielded	max. 50 m
two-core shielded and cross section ≥ 0.5 mm^2	max. 200 m
Unused channels	have to be short–circuited

Connection to the ABB Procontic CS31 system bus

Interface standard	EIA RS–485
Electrical isolation	versus supply voltage and inputs

Mechanical data

Mounting on DIN rail	according to DIN EN 50022–35, 15 mm deep. The DIN rail is located in the middle between the upper and the lower edges of the module.
Fastening by screws	using 4 M4 screws.
Width x height x depth	120 x 140 x 85 mm

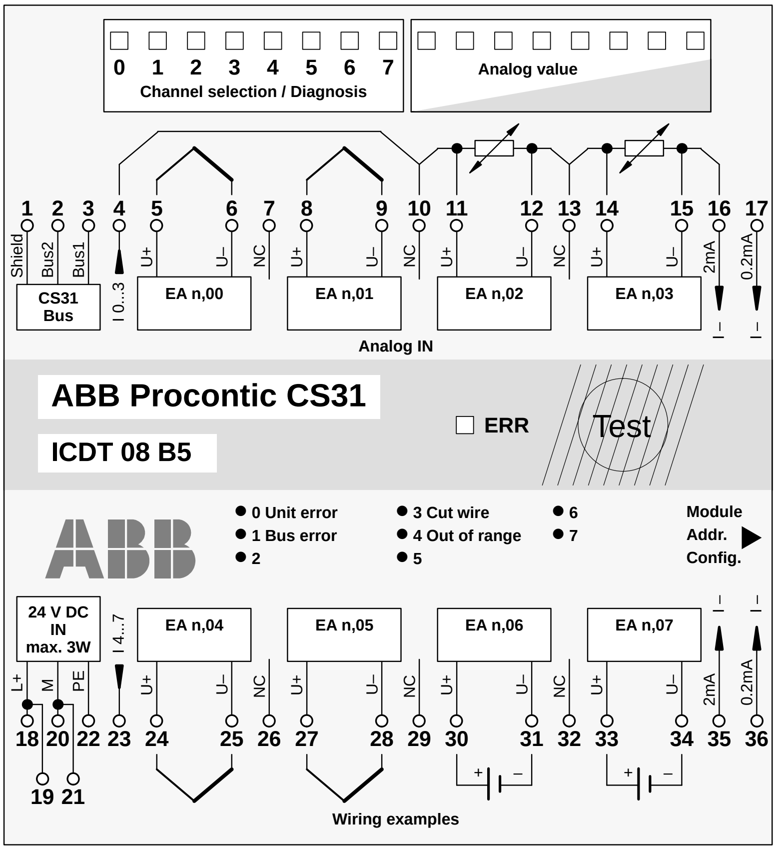
Wiring method	by removable terminal blocks with screw-type terminals,
conductor cross section	max. 2 x 2.5 mm^2
Weight	450 g
Outline dimensions (for mounting)	see the drawing on the next page

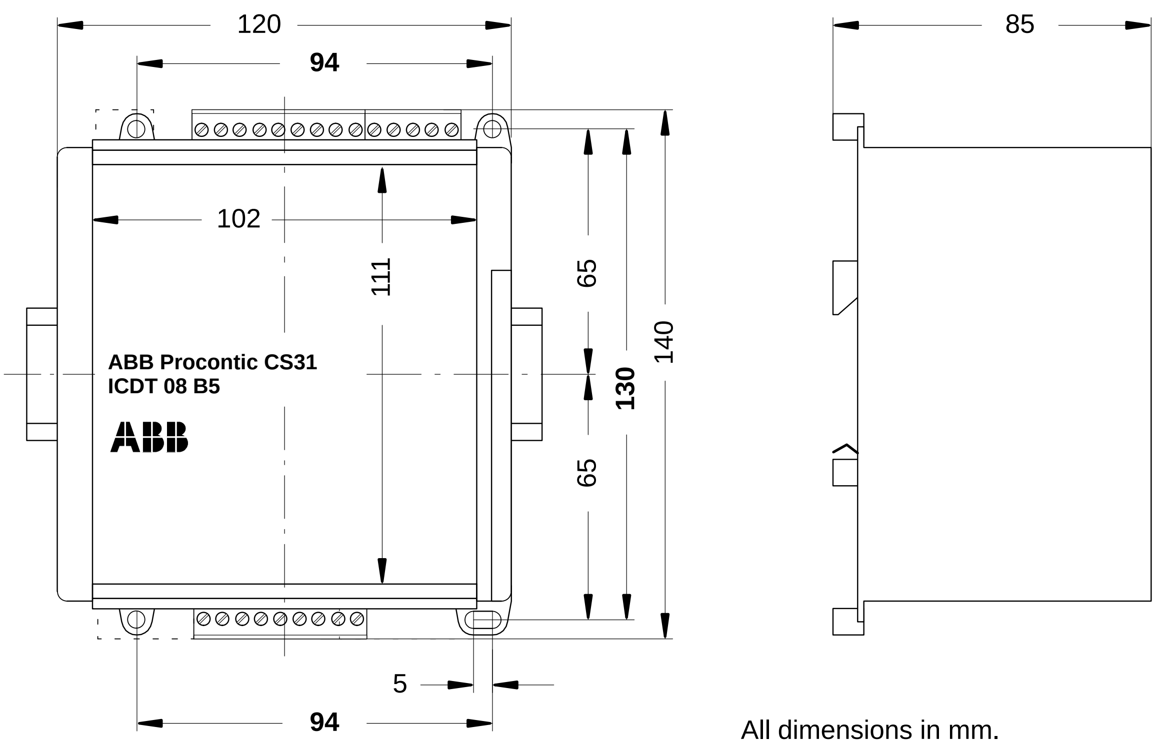
Mounting hints

Mounting position	vertical, terminals above and below
Cooling	The natural convection cooling must not be hindered by cable ducts or other material mounted in the switchgear cabinet.

Ordering data

Module ICDT 08 B5	Order No. GJR5 2516 00 R101
Scope of delivery	Analog input module ICDT 08 B5 1 3–pole terminal block 3 5–pole terminal blocks 2 9–pole terminal blocks





All dimensions in mm.

The module is 85 mm deep.
If a DIN rail is used, the mounting depth is increased by the overall depth of the rail.

Fig. 5.2.5–13: ICDT 08 B5, Front foil and outline dimensions, **the dimensions for assembly bore holes are printed in bold.**

5.2.6 ICST 08 A7 — Analog Input remote unit

8 inputs PT100, 8 bits

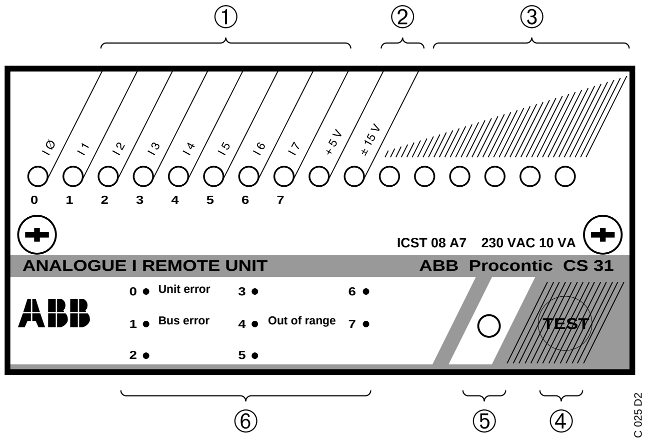
The analog input remote unit can be used for measurement of temperature.
The inputs have to be connected to the PT 100 sensors (2 or 3 wires) according the IEC 751 standard (class A and class B).

The range of temperature is : – 30 °C ... + 20 °C
(– 22 °F ... + 68 °F)

Description of the unit front :

- Ten status led's:
  - Eight yellow input status led's «I0» to «I7» .... ①
  - Two green power supply led's «+ 5 V», «± 15 V» ..... ②
- Six yellow led's to display the signal value of inputs ..... ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes .... ⑥

The unit has to be mounted on a plug-in base ECZ



8 analog inputs per unit

TECHNICAL CHARACTERISTICS

Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	8	8
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	no	no
Power supply output	no	no
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.8 W	8 W
Order number : FPR 333 5701	R1012	R0016/R0014
Weight (kg)	0.25	0.43

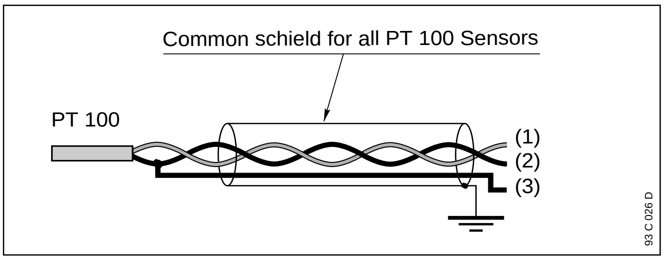
INPUT SPECIFICATIONS

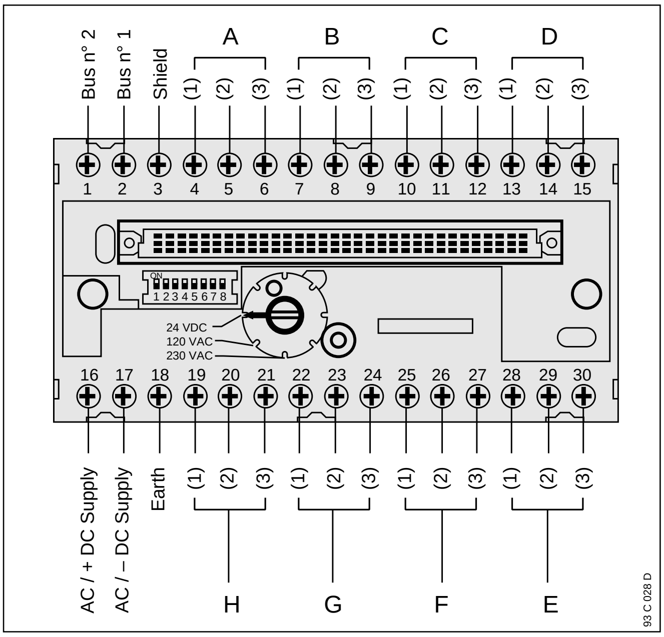
Nominal scale	– 30 °C … + 20 °C	(– 22 °F … + 68 °F)
Maximum value	+ 21.88 °C	
Minimum value	– 34.16 °C	
Offset	0 °C	
Resolution : 8 bits	0.11 °C	
Accuracy on full scale (out of the allowance on sensor and for an ambient temperature of the unit for 0 °C … +55 °C (+32 °F ... +131 °F))	± 1 °C	
Allowance on sensor		
- type A (IEC 751)	± 0.5 °C on full scale	
- type B (IEC 751)	± 1 °C on full scale	
Ohmic value of the PT 100 sensor	86.6 … 108.9	
Temperature coefficient	100 ppm/ °C	
Max refresh time	300 ms for 8 channels	

* The different characteristics are available on the used range 0 °C … + 55 °C (+32 °F ... + 131 °F) of the remote unit.
* The no linearity of the sensor is compensated.

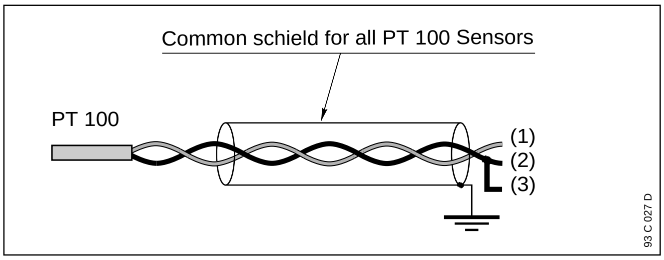
• Electrical connection

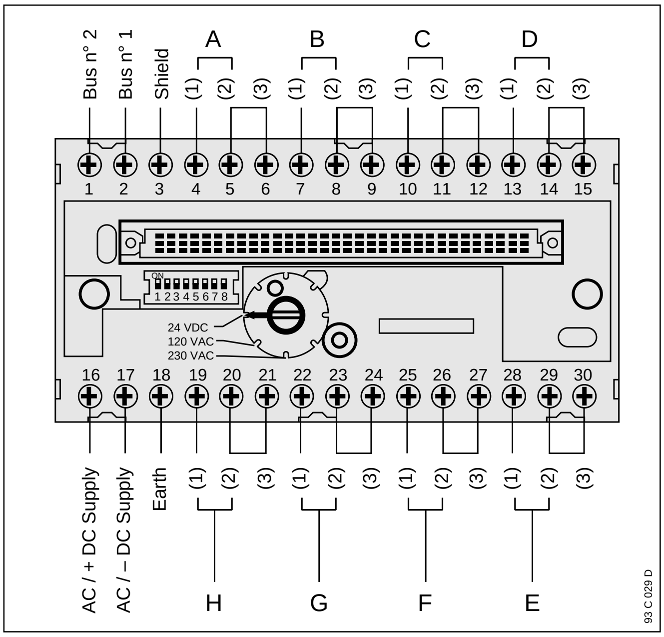
"3 wires" connection





"2 wires" connection





• Initialization

- The unit initializes itself after power ON.
- The error led goes out after initialization.

The value of the analog input I0 is displayed on the 6 led's on the right and the led's «+ 5 V» and «± 15 V» are illuminated.

• Utilization

VARIABLES USED IN THE CENTRAL UNIT

CENTRAL UNITS		07 KR 31	07 KR 91 07 KT 92 07 KT 93	UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 05 08 ... 15	00 ... 05	even 00 … 14		1 … 8
Switch N∘ 8 on the plug-in base		OFF	ON	OFF	ON	OFF
Input	A	EWxx, 00	EWxx, 08	EAxx, 00	EAxx, 08	IAx0
	B	EWxx, 01	EWxx, 09	EAxx, 01	EAxx, 09	IAx1
	C	EWxx, 02	EWxx, 10	EAxx, 02	EAxx, 10	IAx2
	D	EWxx, 03	EWxx, 11	EAxx, 03	EAxx, 11	IAx3
	E	EWxx, 04	EWxx, 12	EAxx, 04	EAxx, 12	IAx4
	F	EWxx, 05	EWxx, 13	EAxx, 05	EAxx, 13	IAx5
	G	EWxx, 06	EWxx, 14	EAxx, 06	EAxx, 14	IAx6
	H	EWxx, 07	EWxx, 15	EAxx, 07	EAxx, 15	IAx7

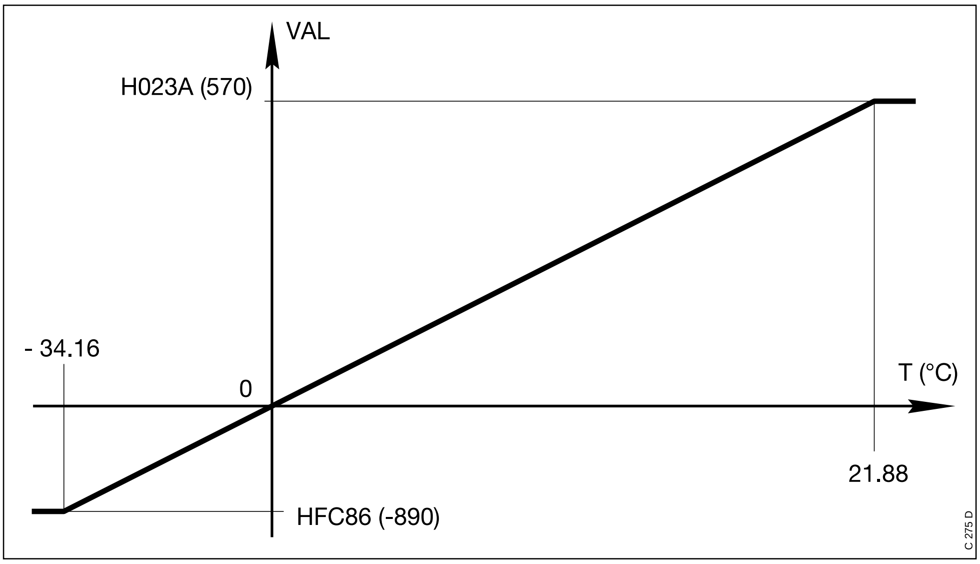
In the case of UCZA/UCZB, the addresses 08 ... 14 are only allowed with the SCZ unit.
For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description.

ANALOG INPUTS 8 BITS

Input range – 30 °C … + 20 °C (– 22 °F … + 68 °F)
Resolution 0.11 °C
Maximum 21.88 °C
Minimum – 34.16 °C

Bits of analog word	Range least significant byte and for central units UCZA/UCZB		Range most significant byte	
B15	– 157.00 °C	(– 250.60 °F)	– 157.00 °C	(– 250.60 °F)
B14	**	**	**	(173.30 °F)
B13	**	**	**	(102.65 °F)
B12	**	**	19.63 °C	(67.33 °F)
B11	**	(173.30 °F)	9.81 °C	(49.66 °F)
B10	**	(102.65 °F)	4.91 °C	(40.84 °F)
B9	19.63 °C	(67.33 °F)	2.45 °C	(36.41 °F)
B8	9.81 °C	(49.66 °F)	1.23 °C	(34.21 °F)
B7	4.91 °C	(40.84 °F)	0.61 °C	(33.10 °F)
B6	2.45 °C	(36.41 °F)	0.31 °C	(32.56 °F)
B5	1.23 °C	(34.21 °F)	0.15 °C	(32.27 °F)
B4	0.61 °C	(33.10 °F)	0.08 °C	(32.14 °F)
B3	0.31 °C	(32.56 °F)	0.04 °C	(32.07 °F)
B2	0.15 °C	(32.27 °F)	0	0
B1	0.08 °C	(32.14 °F)	0	0
B0	0.04 °C	(32.07 °F)	0	0

The choice of setting of the dip switches 2 and 3 on the plug-in base gives two different tables.
(See chapter 5.1, volume 2 "**General**")



Approximate function

T °C = 0.0383 VAL

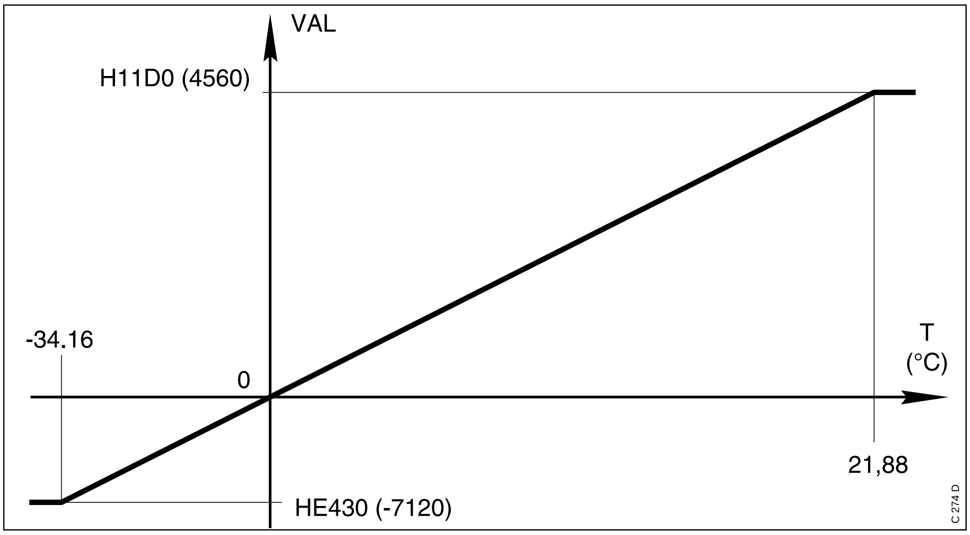
VAL : input word after conversion and linearity correction.

T °C : temperature in degree Celsius

Use the following formula to get the temperature in degree Fahrenheit :

$$°F = \frac{9}{5} °C + 32$$

Range least significant byte and UCZA/UCZB



Approximate function

T °C = 0.0048 VAL

VAL : input word after conversion and linearity correction.

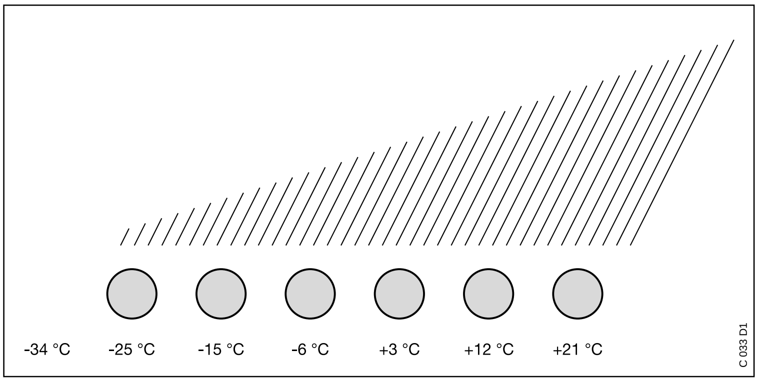
T °C : temperature in degree Celsius

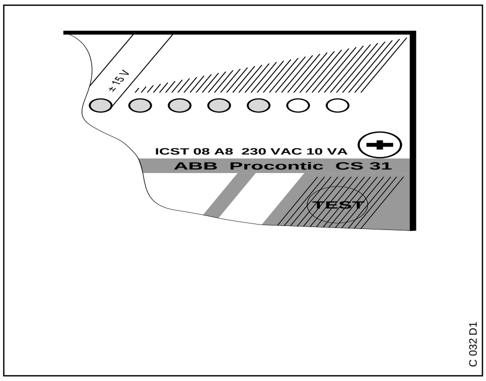
Use the following formula to get the temperature in degree Fahrenheit :

$$°F = \frac{9}{5} °C + 32$$

Range most significant byte

The value of input selected by pressing the «**TEST**» button can be displayed on the 6 led's on the right.
These 6 led's have the following meaning :





Each channel can be selected by pressing the «**TEST**» button.

Channel I0 is always displayed after initialization until otherwise selected.

Fault indication:

Led 0 : «**Unit error**»
Led 1 : «**Bus error**»
Led 4 : «**Out of range**»

Led 4 «**OFF**» : the channel is wired and the temperature is in the due range.
Led 4 «**ON**» : measure out of range or short circuit detection (If VAL   VAL MIN), or open circuit detection (If VAL   VAL MAX).

If an error occurs, (see chapter 9, volume 2, «**In case of failure**»).

5.3.1 ICSA 04 B5 — Analog Output remote unit
4 outputs, 12 bits

The analog output remote unit can be used for ± 10 V, ± 12.5 V, 0 … 20 mA or 4 … 20 mA.

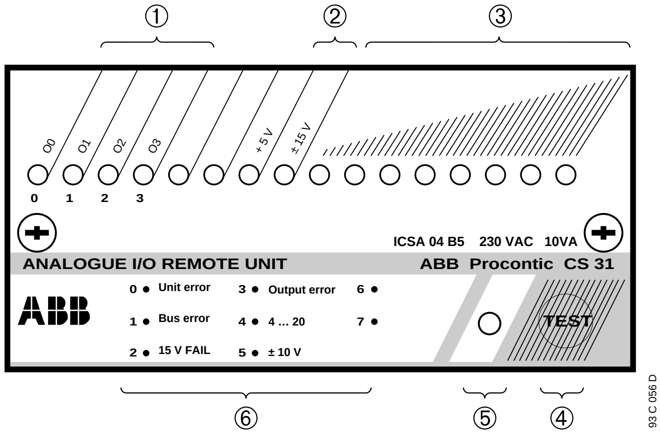
The wiring on the plug-in base ECZ is used to select the current or voltage input.

The unit is configured by the dip switches in the rear of the unit. The configuration by the central unit is not necessary.

Description of the unit front :

- Four yellow output status led's «O0» to «O3» .... ①
- Two inactive led's
- Two green power supply led's «+ 5 V», «± 15 V» .... ②
- Eight yellow led's to display the signal value of outputs ③
- «TEST» push-button .... ④
- Red error led .... ⑤
- List of error codes .... ⑥

The unit has to be mounted on a plug-in base ECZ.

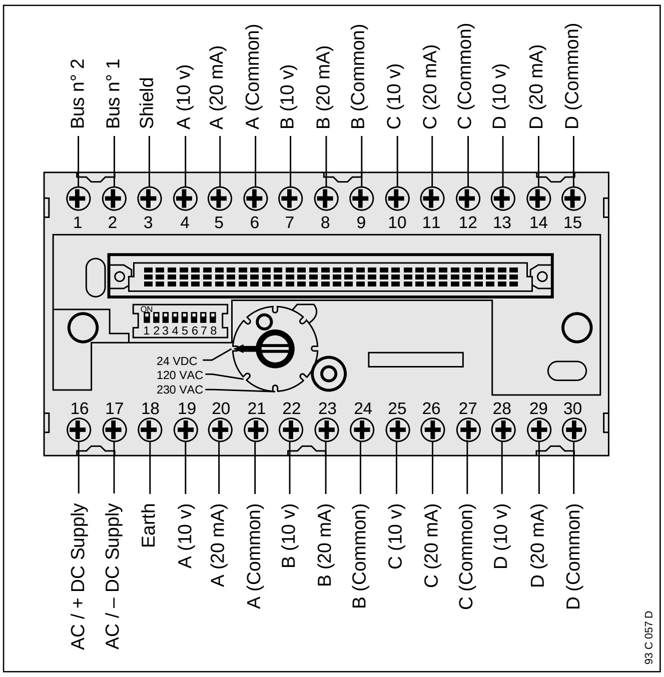


4 analog outputs per unit

TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Number of outputs per unit	4	4
Power supply isolation	no	yes (1500 VAC)
Outputs opto-isolated	no	no
Power supply outputs 10 VDC (± 1 %)	no	no
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.8 W	8 W
Order number : FPR 334 1501	R1042	R0046/R0044
Weight (kg)	0.25	0.43

OUTPUT SPECIFICATIONS				
Nominal range	± 10 V	± 12.5 V	0 … 20 mA	4 … 20 mA
Resolution : 12 bits	± 1 LSB (± 5 mV)	± 1 LSB (± 6 mV)	± 1 LSB (± 10 µA)	± 1 LSB (± 8 µA)
Linearity error	± 1 LSB (± 5 mV)	± 1 LSB (± 6 mV)	± 1 LSB (± 4.8 µA)	± 1 LSB (± 4 µA)
Error of maximum value	± 0.3 %	± 0.5 %	± 0.5 %	± 0.5 %
Temperature coefficient	100 ppm/K	100 ppm/K	100 ppm/K	100 ppm/K
Maximum load current	± 2 mA	± 2 mA	–	–
Resistance of the load circuit	–	–	500	500

• Electrical connection



The commons are internally connected.

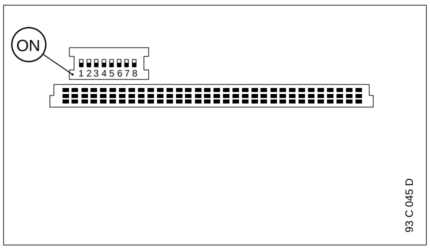
NOTE : Channels 19 to 30 are the same as 4 to 15.

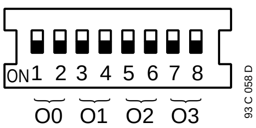
The wires for analogue outputs must be shielded and the shield has to be connected to the earth on the side of the remote unit.

• Initialization

The selection between current or voltage output is dependent upon the dip switches in the rear of the unit. Two switches for one channel :

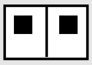
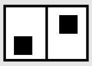
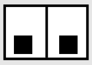
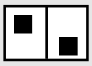
N° 1 : channel 00
N° 2 : channel 00
N° 3 : channel 01
N° 4 : channel 01
N° 5 : channel 02
N° 6 : channel 02
N° 7 : channel 03
N° 8 : channel 03





The factory default setting is ± 10V.

Possible configuration

dip switch		output current	output voltage
OFF ON		0 … 16 mA*	± 10 V
OFF ON		4 … 20 mA	± 10 V
OFF ON		4 … 25 mA*	± 12.5 V
OFF ON		0 … 20 mA	± 12.5 V

* For this special format the output conversion tables are not allowed.

The unit initializes itself after power on.
The error led goes out after initialization.
The value of the analog output O0 is displayed on the 8 led's on the right and the led's "+ 5 and ± 15" are illuminated.

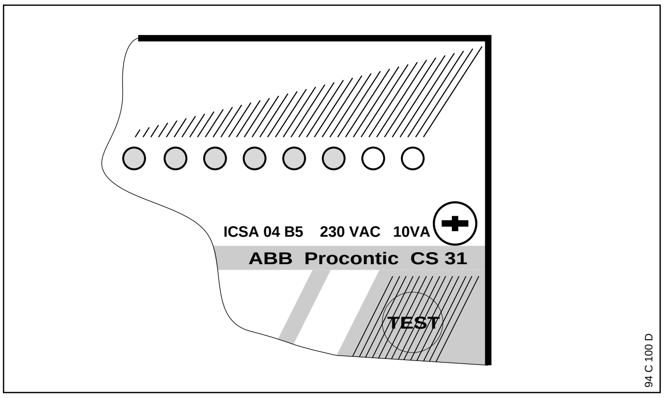
• Utilization

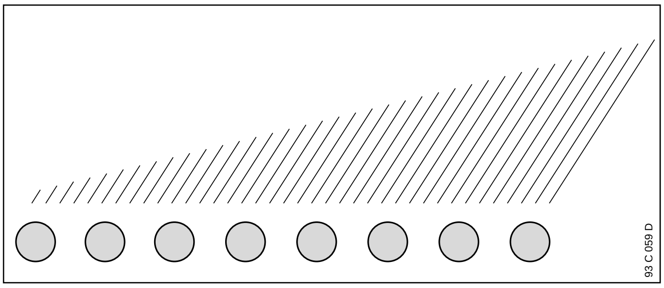
VARIABLES USED IN THE CENTRAL UNIT

CENTRAL UNITS		07 KR 31, 07 KR 91, 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 05		even 00 … 14		1 … 8
Switch N$_o$ 8 on the plug-in base		OFF	ON	OFF	ON	OFF
Output	A	AWxx, 00	AWxx, 08	AAxx, 00	AAxx, 08	OAx0
	B	AWxx, 01	AWxx, 09	AAxx, 01	AAxx, 09	OAx1
	C	AWxx, 02	AWxx, 10	AAxx, 02	AAxx, 10	OAx2
	D	AWxx, 03	AWxx, 11	AAxx, 03	AAxx, 11	OAx3

In the case of UCZA/UCZB, the addresses 08 … 14 are only allowed with the SCZ unit.
For the PC board 07 CM 90 and the coupler boards 07 CS 61 or 35 CS 91, refer to their own description.

The value of the output selected by pressing the **"TEST"** button can be displayed on the 8 leds on the right. These 8 led's have the following meaning :





no led ON ○○○○○○○○	4 led's ON ●●●●○○○○	8 led's ON ●●●●●●●●	Configuration
– 10 V	0 V	+ 10 V	± 10 V
– 12.5 V	0 V	+ 12.5 V	± 12.5 V
-	0 mA	20 mA	0 … 20 mA
-	0 mA	16 mA	0 … 16 mA
-	4 mA	20 mA	4 … 20 mA
-	4 mA	25 mA	4 … 25 mA

Each channel can be displayed by pressing the **"TEST"** button.

The channel O0 is always displayed after initialization until otherwise selected.

Fault indication:

Led 0 : **«Unit error»**
Led 1 : **«Bus error»**
Led 2 : **«15 V Fail»**
Led 3 : **«Output error»**

The configuration of each channel is indicated by the led's 4 and 5.

Led 4 : **«4 … 20»**
Current configuration 4 … 20 mA or ± 12.5 V

Led 4 **«OFF»** :
Channel 0 … 20 mA or ± 10 V, depends upon the dip switches in the rear of the unit.

Led 4 **«ON»** :
Channel 4 … 20 mA or ± 12.5 V, depends upon the dip switches in the rear of the unit.

Led 5 **«± 10 V»** :
± 10 V configuration.

Led 5 **«OFF»** :
Current or ± 12.5 V configuration.

Led 5 **«ON»** :
Channel ± 10 V.

If an error occurs, (see chapter 9, volume 2 **«In case of failure»**).

NOTE : The 4 … 20 mA configuration with an handheld programming unit TCZ or CS 31configuration functions (see chapter 2, volume 2 «**Central Unit**») is necessary for detecting error (open circuit detection),

5.4.1 ICSM 06 A6 — Analog Input/Output remote unit

4 inputs, 2 outputs, 8 bits

The analog output channels can be used for 0 … 10 V, 0 … 20 mA or 4 … 20 mA. The wiring on the plug-in base ECZ enables the choice of current or voltage channel.

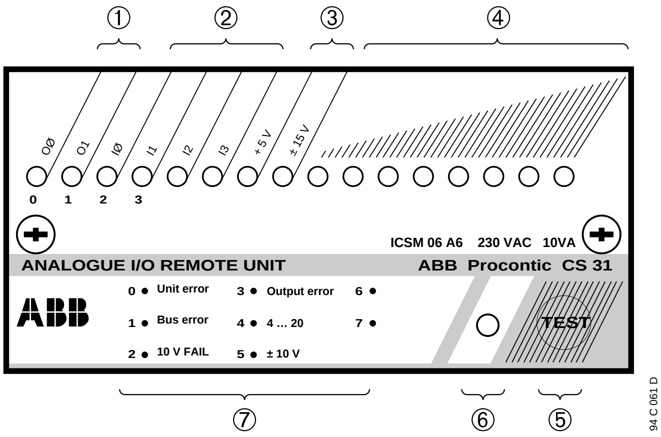
The unit is configured for 0 … 20 mA or 4 … 20 mA current ranges with an handheld programming unit (TCZ) or CS 31 configuration functions (see chapter 2, volume 2 «**Central Unit**»).

The factory default setting is 0 … 20 mA.

Description of the unit front :

- Eight status leds :
  - Two yellow input status leds «O0» and «O1» ..... ①
  - Four yellow input status leds «I0, I1, I2, I3, I4» ... ②
  - Two green power supply leds «+ 5 V», «± 15 V» .... ③
- Eight yellow leds to display the signal value of inputs or outputs .... ④
- «TEST» push-button .... ⑤
- Red error led .... ⑥
- List of error codes .... ⑦

The unit has to be mounted on a plug-in base ECZ.



4 analog inputs and 2 analog outputs per unit

TECHNICAL CHARACTERISTICS

Power supply	24 VDC	230 VAC/120 VAC
Number of inputs per unit	4	4
Power supply isolation	no	yes (1500 VAC)
Inputs opto-isolated	no	no
Power supply output 10 VDC (± 1 %)	50 mA	50 mA
Number of outputs per unit	2	2
Outputs electrically isolated	no	no
Maximum power consumption	0.2 A	10 VA
Maximum power dissipation	4.8 W	8 W
Order number : FPR 335 0601	R1062	R0066/R0064
Weight (kg)	0.25	0.43

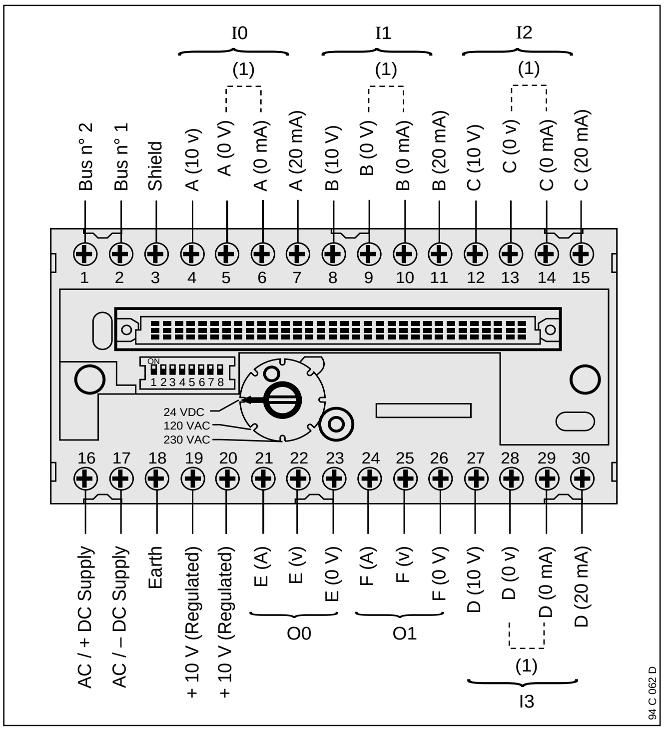
INPUT SPECIFICATIONS

Nominal range	0 … 10 V	0 … 20 mA	4 … 20 mA
Maximum value	12 V	25 mA	25 mA
Minimum value	– 5 V	– 10 mA	– 10 mA
Input resistance	100 k	250	250
Resolution : 8 bits	± 1/2 LSB (± 19.6 mV)	± 1/2 LSB (± 40 µA)	± 1/2 LSB (± 31 µA)
Linearity error	± 3/4 LSB (± 29.4 mV)	± 3/4 LSB (± 60 µA)	± 3/4 LSB (± 47 µA)
Error of maximum value	± 0.5 %	± 0.8 %	± 0.8 %
Amplification error between two channels	1 LSB (39 mV)	1 LSB (62 µA)	1 LSB (62 µA)
Temperature coefficient	100 ppm/K	150 ppm/K	150 ppm/K
Time constant of input filter	100 ms	20 ms	20 ms
Max refresh time	10 ms	10 ms	10 ms

OUTPUT SPECIFICATIONS

Nominal range	± 10 V	0 … 20 mA	4 … 20 mA
Resolution : 8 bits	± 1/2 LSB (± 40 mV)	± 1/2 LSB (± 40 µA)	± 1/2 LSB (± 31 µA)
Linearity error	± 1 LSB (± 80 mV)	± 1 LSB (± 80 µA)	± 1 LSB (± 62 µA)
Error of maximum value	± 1 %	± 1 %	± 1 %
Temperature coefficient	100 ppm/K	150 ppm/K	150 ppm/K
Maximum load current	± 2 mA	–	–
Resistance of the load circuit	–	500	500

• Electrical connection



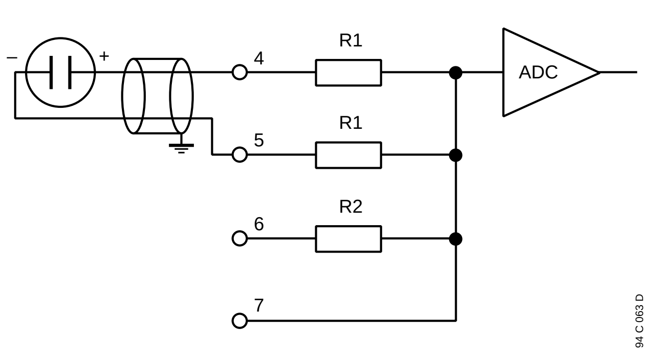
(1) For the current input unit, a jumper is required.

The commons 0 V are internally connected.

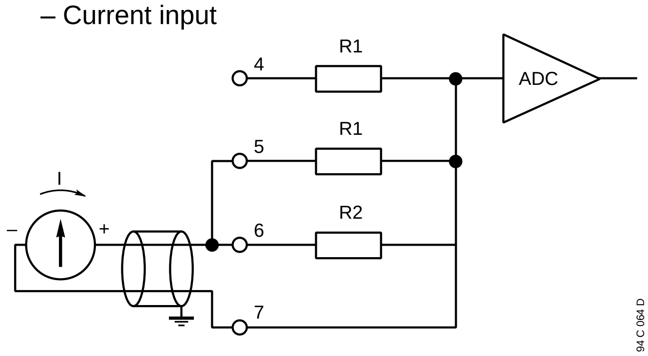
The function of each channel depends on the wired terminals.

• Connections of input A :

– Voltage input



– Current input



The wires for analogue inputs or output must be shielded and the shield has to be connected to the earth on the side of the remote unit.

• Selection current or voltage

The selection between current or voltage input is dependent upon the wiring on the plug-in base. When the unit is configured for 4 … 20 mA, the ranges available are shown in the table below. The analog outputs must be configured as the factory default setting is ± 10 V.

	Terminal	Configuration 0 … 20 mA	Configuration 4 … 20 mA
Inputs			
A	5 and 4 5 and 7 5 + 6 and 7	0 … 10 V 0 … 5 V (2) 0 … 20 mA	2 … 10 V 1 … 5 V 4 … 20 mA
B	9 and 8 9 and 11 9 + 10 and 11	0 … 10 V 0 … 5 V (2) 0 … 20 mA	2 … 10 V 1 … 5 V 4 … 20 mA
C	13 and 12 13 and 15 13 + 14 and 15	0 … 10 V 0 … 5 V (2) 0 … 20 mA	2 … 10 V 1 … 5 V 4 … 20 mA
D	28 and 27 28 and 30 28 + 29 and 30	0 … 10 V 0 … 5 V (2) 0 … 20 mA	2 … 10 V 1 … 5 V 4 … 20 mA
Outputs			
E	21 and 23 22 and 23	0 … 20 mA – 10/+ 10 V	4 … 20 mA – 6/+ 10 V
F	24 and 26 25 and 26	0 … 20 mA – 10/+ 10 V	4 … 20 mA – 6/+ 10 V

(2) Note : The range 0 … 5 V can be used for special application.

● Initialization

The unit initializes itself after power on.

The error led goes out after initialization. The value of the analog output 00 is displayed on the 8 led's on the right and the led's «+ 5V» and «± 15V» are illuminated.

● Utilization

VARIABLES USED IN THE CENTRAL UNIT

CENTRAL UNITS		07 KR 31, 07 KR 91, 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ		00 … 05		even 00 … 14		1 … 8
Switch N° 8 on the plug-in base		OFF	ON	OFF	ON	OFF
Input	A	EWxx, 00	EWxx, 08	EAxx, 00	EAxx, 08	IAx0
	B	EWxx, 01	EWxx, 09	EAxx, 01	EAxx, 09	IAx1
	C	EWxx, 02	EWxx, 10	EAxx, 02	EAxx, 10	IAx2
	D	EWxx, 03	EWxx, 11	EAxx, 03	EAxx, 11	IAx3
Output	A	AWxx, 00	AWxx, 08	AAxx, 00	AAxx, 08	OAx0
	B	AWxx, 01	AWxx, 09	AAxx, 01	AAxx, 09	OAx1

In the case of UCZA/UCZB, the addresses 08 … 14 are only allowed with the SCZ unit.
For the PC board 07 CM 90 and the coupler boards 07 CS 61 or 35 CS 91, refer to their own description.

● Specific configuration : ICSM 06 A6 as binary remote unit

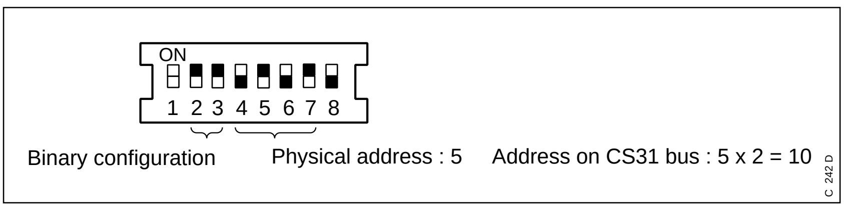
The ICSM 06 A6 remote unit can be used as a binary remote unit on the CS31 bus.
This specific configuration allows the connection of 31 analog remote units on CS31 bus instead of 12.

That means that all analog values can be sent or received by the central unit as binary values.
The analog/binary and binary/analog conversions are realized by the remote unit.

The setting of binary configuration is with the dip switches 2 and 3 of the plug-in base on ON position.

In this case (binary configuration), only the even addresses are allowed and the real address of the remote unit is obtained by the physical address multiplied by 2.

For example :



- **Utilization**

VARIABLES USED IN THE CENTRAL UNIT				
CENTRAL UNITS		07 KR 31, 07 KR 91, 07 KT 92, 07 KT 93	UCZA/UCZB	PCZB
Physical address y on the plug-in base ECZ		00 … 15	00 … 15	00 … 15
Address in the central unit xx = y x 2		00 ... 30	xx : 00 ... 30	xx : 00 ... 30
Switch N$_o$ 8 on the plug-in base		OFF	OFF	OFF
Input	A	Exx, 00 .... Exx, 07	Exx, 00 .... Exx, 07	Ixx 00 .... Ixx 07
	B	Exx, 08 .... Exx, 15	E(xx+1), 00 .... E(xx+1), 07	Ixx 08 .... Ixx 15
	C	E(xx+1), 00 .... E(xx+1), 07	E(xx+2), 00 .... E(xx+2), 07	I(xx+1) 00 ...... I(xx+1) 07
	D	E(xx+1), 08 .... E(xx+1), 15	E(xx+3), 00 .... E(xx+3), 07	I(xx+1) 08 ...... I(xx+1) 15
Output	A	Axx, 00 .... Axx, 07	Axx, 00 .... Axx, 07	Oxx 00 .... Oxx 07
	B	Axx, 08 .... Axx, 15	A(xx+1), 00 ..... A(xx+1), 07	Oxx 08 .... Oxx 15

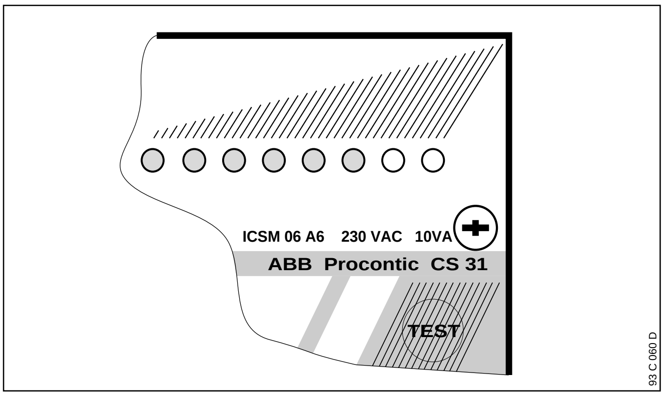
For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description.

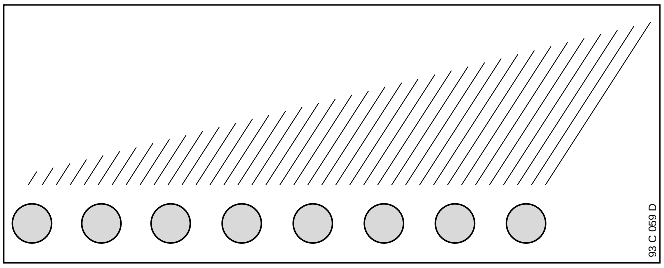
Note : This specific configuration allows a high number of remote units on CS31 bus with the 07 CS 61 coupler. The ICSM 06 A6 uses only 64 I/O points (instead of 128). The code for T200 configuration table is EA32.

The mode 4 - 20 mA has to be set in analog configuration by the central unit then, the switches 2 and 3 are moved in ON position.

In mode 4 - 20 mA, it is not possible to detect on opened circuit. The value is always 0 and never negative.

The value of the input or output selected by pressing the **"TEST"** button can be displayed on the 8 led's on the right. These 8 led's have the following meaning :





Analog inputs

no led ON ○○○○○○○○	4 led's ON ●●●●○○○○	8 led's ON ●●●●●●●●	Configuration
0 V 0 V 0 mA	5 V 2.5 V 10 mA	10 V 5 V 20 mA	0 … 20 mA
2 V 1 V 4 mA	6 V 3 V 12 mA	10 V 5 V 20 mA	4 … 20 mA

Analog outputs

no led ON ○○○○○○○○	4 led's ON ●●●●○○○○	8 led's ON ●●●●●●●●	Configuration
– 10 V	0 V	10 V	± 10 V
0 mA	10 mA	20 mA	0 … 20 mA
4 mA	12 mA	20 mA	4 … 20 mA

Each channel can be displayed by pressing the **"TEST"** button.

The channel O0 is always displayed after initialization until otherwise selected.

Fault indication:

Led 0 : **«Unit error»**
Led 1 : **«Bus error»**
Led 2 : **«10 V Fail»**
Led 3 : **«Output error»**

The configuration of each channel is indicated by the led's 4 and 5 :

Led 4 : **«4 … 20»**
Current configuration 4 … 20 mA

Led 5 **«± 10 V»** :
± 10 V Voltage configuration (only for outputs).

Led's 4 and 5 **«OFF»** :
0 … 20 mA configuration.

If an error occurs, (see chapter 9, volume 2 **«In case of failure»**).

Chapter	Description	Page
6.1	**ICSF 08 D1 : high speed counter**	6.1-1
6.2	**TCAD : Remote display**	6.2-1
6.3	**CS31 Bus units**	
6.3.1	NCB : CS31 Bus Amplifier	6.3.1-1
6.3.2	NCBR : CS31 Bus Amplifier with redondancy	6.3.2-1

6.1 ICSF 08 D1 Special remote unit

High speed counter

This unit can count three channels A, B and C at high speed.

Five modes of operation are possible :
– 32 bit counter incremental encoder input
– 32bit counter, incrementing on channel A and decrementing on channel B
– 32 bit counter, addition of channels A and B
– Three independant 16 bit counters for channel A, B and C
– Three 16 bit frequency meters for channels A,B and C

The mode of operation is selected by setting the DIP switches on the rear of the unit.

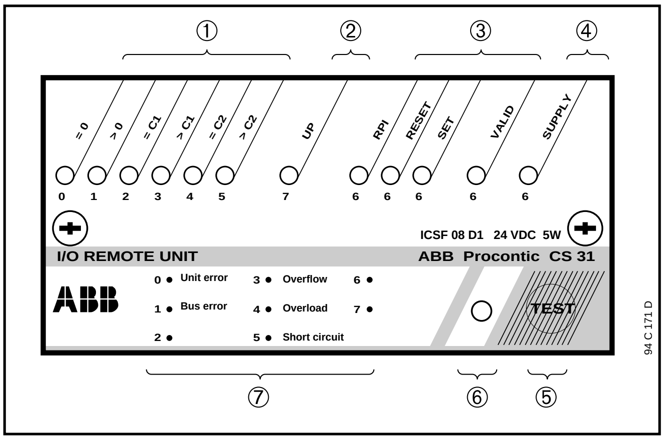
The counters can be set to detect rising, falling or rising and falling edges.
4 binary inputs for counter data setting and 7 binary static outputs are provided.

The status of the outputs is determined by the comparison of the counter(s) and setpoint values and the count direction.

The unit has to be mounted on a plug-in base ECZ.

Description of the unit front :

- Six yellow leds for outputs status .... ①
- One yellow led for "UP" for count direction .... ②
- Four yellow leds for inputs status .... ③
- One green led "SUPPLY" .... ④
- "TEST" push button .... ⑤
- One error red led .... ⑥
- List of the error codes .... ⑦



high speed counter

TECHNICAL CHARACTERISTICS		
Power supply	24 VDC	230 VAC/120 VAC
Max counting frequency	50 kHz	50 kHz
Number of counter inputs (depends on the selected mode)	1 or 3*	1 or 3*
Number of binary inputs	4	4
Number of binary outputs	7	7
Isolated power supply of the unit	no	yes (1500 VAC)
Isolated inputs/outputs	no	no
Isolated power supply output (max. 2 W) - 24 VDC (not regulated) - 15 VDC (± 5%) - 5 VDC (±5 %)	 no 50 mA 200 mA	 50 mA 50 mA } Max. 2 an total 200 mA
Max power consumption	5 W	10 VA
Order number FPR3323101	R1012	R0016/R0014
Weight (kg)	0.25	0.43

COUNTER INPUT CHARACTERISTICS

Differential mode (connection of a incremental encoder A$\overline{A}$, B$\overline{B}$, C$\overline{C}$)

Mini voltage	± 1 V
Max voltage	± 15 V

For all others modes (connection between 0 V and A, B, C)

Nominal voltage	15 V
Max voltage	+ 30 V
Min voltage	+ 8 V
Nominal voltage	5 V
Max voltage	+ 10 V
Min voltage	+ 3.2 V

TECHNICAL CHARACTERISTICS

Binary input characteristics

VALID	terminal 29	count enable
RPI	terminal 14	reference point initiator
RESET	terminal 15	reset the counter
SET	terminal 30	Set the counter with the set point

Nominal voltage	24 VDC
signal level of the inputs,nominal value	
Signal 0	- 3 to + 5 V
Signal 1	+ 15 to + 30 V
Current input for 24 VDC	6 mA
Input delay	1 ms

Binary output charateristics

= 0	terminal 21	Counter = 0
> 0	terminal 22	Counter > 0
= C1	terminal 23	Counter = threshold 1
> C1	terminal 24	Counter > threshold 1
= C2	terminal 25	Counter = threshold 2
> C2	terminal 26	Counter > threshold 2
UP	terminal 27	Direction of counter

Nominal voltage	24 VDC
Max current	300 mA
short circuit protection	yes

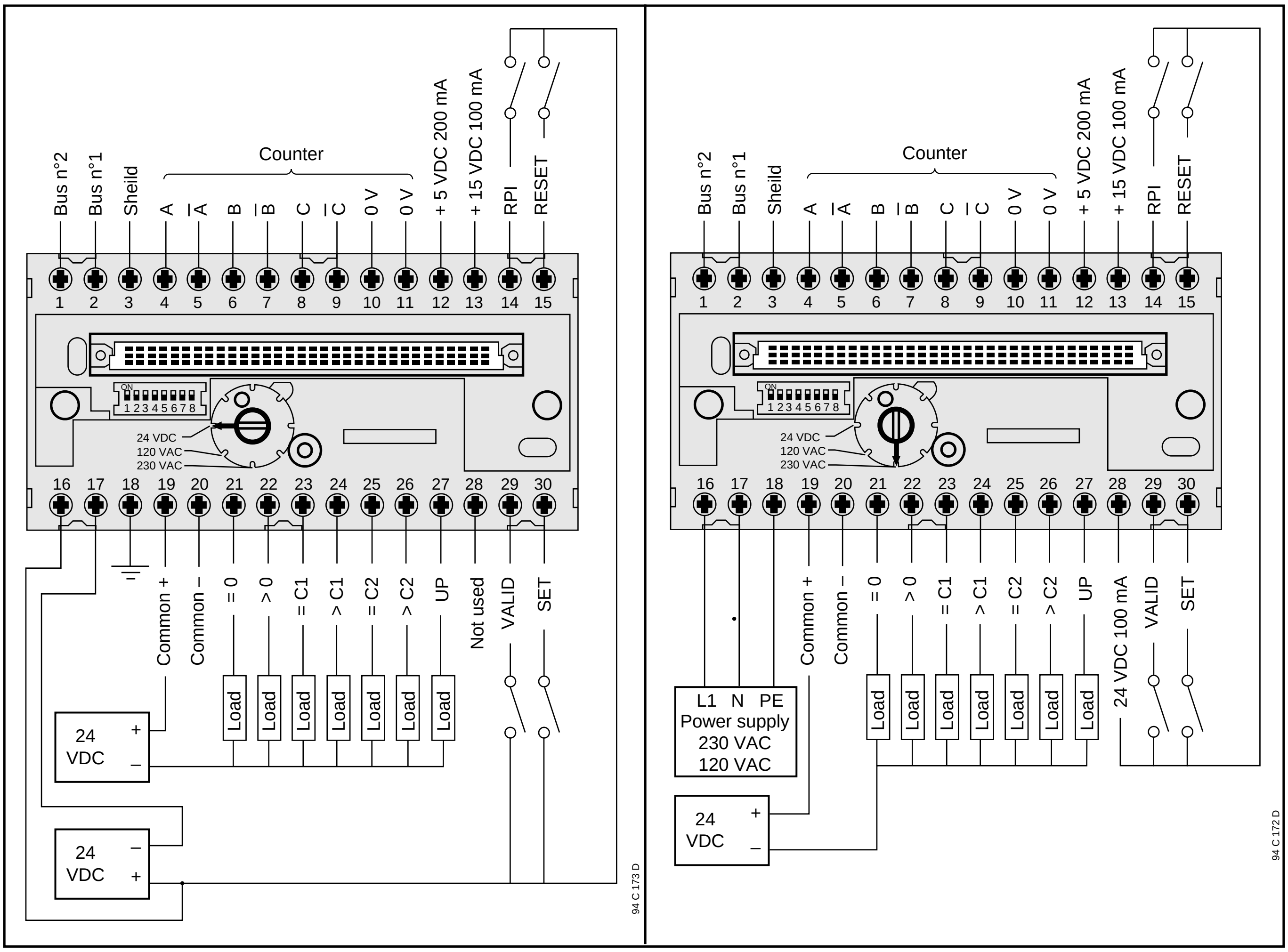
● Electrical connection

The common "**-**" terminals and the "0V" terminals are not internally connected.

Power supply 24 VDC

The common "**+**" must be connected to the 24VDC of the 24VDC power supply.

Power supply 230 VAC and 120 VAC



Note : When using the 230 VAC or 120 VAC versions, the internal 24 VDC supply can be used providing the load if it is not greater than 50 mA ; if it is, an external 24 VDC power supply must be used.

The 0 VDC of an external power supply used only to provide the outputs has not to be connected to the common –, if the outputs have to be reset to 0 with a power off of this supply.

If the load is inductive,the common – and the 0V terminals must be connected together to avoid overvoltage within the output circuitry an free weeling diode is built-in, this however increases the response time.

● Initialization

After configured and wired the unit :

– the unit initializes itself after power **On**.

– the error led goes out after initialization.

– the counters, the thresholds are reset to 0 and the target window to 2.

● **Utilization**

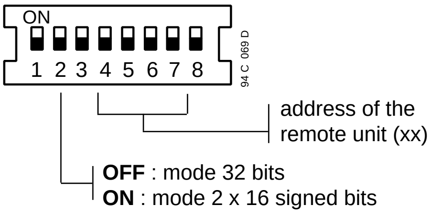
VARIABLES USED IN THE CENTRAL UNIT					
CENTRAL UNITS	07 KR 31, 07 KR 91 07 KT 92, 07 KT 93		UCZA/UCZB		PCZB
Address xx on the plug-in base ECZ	00 … 05		01, 03, 05		1 … 8
Switch N° 8 on the plug-in base ECZ	OFF	ON	OFF	ON	OFF
Inputs					
Counter (high word)	EWxx, 00	EWxx,08	EWxx, 00	EWxx, 08	IAx0
Counter (low word)	EWxx, 01	EWxx,09	EWxx, 01	EWxx, 09	IAx1
Counter (high word)	EWxx, 02	EWxx,10	EWxx, 02	EWxx, 10	IAx2
Status of binary I/O	EWxx, 03	EWxx,11	EWxx, 03	EWxx, 11	IAx3
Configuration & diagnosis	EWxx, 04	EWxx,12	EWxx, 04	EWxx, 12	IAx4
Outputs					
Command	AWxx, 00	AWxx,08	AWxx, 00	AWxx, 08	OAx0
Parameter 1	AWxx, 01	AWxx,09	AWxx, 01	AWxx, 09	OAx1
Parameter 2	AWxx, 02	AWxx,10	AWxx, 02	AWxx, 10	OAx2

In the case of UCZA/UCZB,the addresses 9,11,15 are only allowed with the SCZ unit.

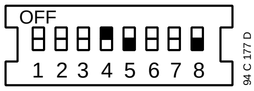
For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

Switches' configuration

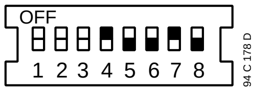
– Dip-switches on the plug-in base ECZ



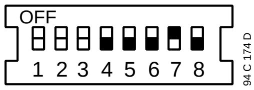
– Dip-switches on the rear of the remote unit



mode 3
(addition on channels A and B)



mode 4
(3 independant counters)



mode 5
(3 independant frequency meters)

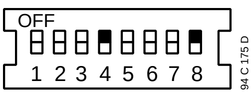
For the setting of switches 5, 6 and 7 refer to the description of different modes.

The possible configuration are :

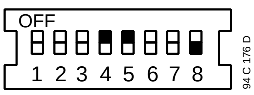
Dip-switches	OFF	ON
1	Input A set at 5V	Input A set at 12-30 V
2	Input B set at 5V	Input B set at 12-30 V
3	Input C set at 5V	Input C set at 12-30 V
4	Increment counter	Decrement counter
5 (*)	Counter x 2	Counter x 1
6 (*)	Count on rising edge	Count on falling edge
7	Count on all edges x 4	Allow n° 5 and 6
8	Incremental mode	Other modes

(*) Only if dip-switch n° 7 is on

Setting of different modes



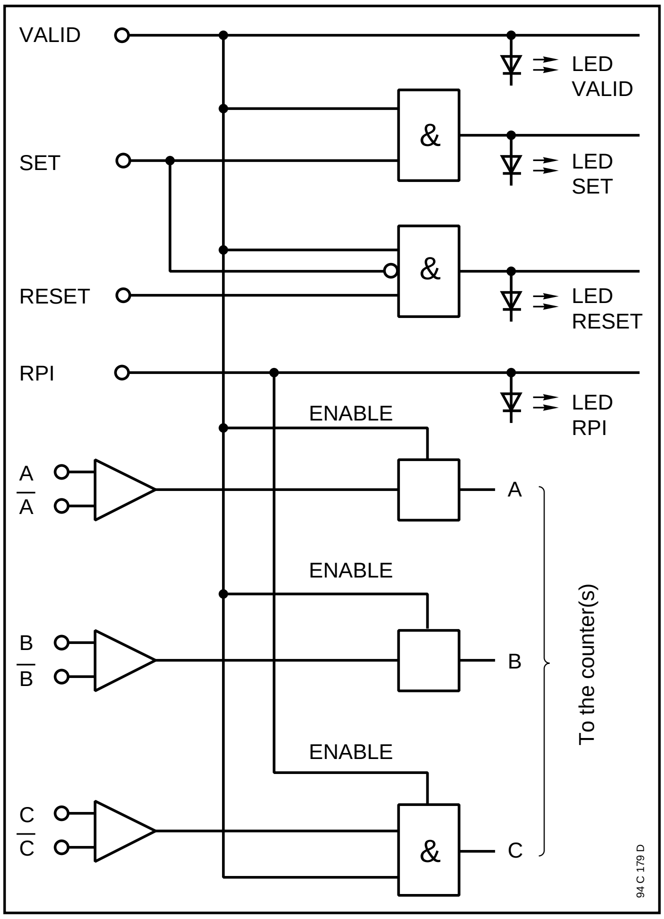
mode 1
(incremental encoder)



mode 2
(incrementing on channel A and decremeting on channel B)

INPUTS

Interdependance betwwen the inputs
A,B,C,VALID,SET,RESET and RPI.



The input RPI enables the input C only for the modes 1, 2 or 3.
The input RPI has not to be connected (OV) for the modes 4 and 5.

Status of binary Inputs and Outputs

The status of the binary inputs and outputs is written to the following word :

EW xx,03, EWxx,11, IAx3

where xx is the address of the remote unit selected on the plug-in base ECZ.

Composition of the word

B0	"Data transfer status"	0 = busy 1 = free
B1	SET	
B2	RESET	
B3	RPI	
B4	VALID	
B5	-	
B6	-	
B7	-	
B8	= 0	
B9	> 0	
B10	= C1	
B11	> C1	
B12	= C2	
B13	> C2	
B14	"UP"	0 = decrement 1 = increment
B15	-	

Bit B0 indicates the data transfer status and is checked to sending parameters and commands from the central unit to the counter unit.

Bits B1 to B4 indicate the status of the binary inputs.

Bits B8 to B14 indicate the status of the transistor outputs.

If the input valid is off, all binary outputs are reset to 0 but the internal status B8 - B14 is always available.

Configuration and diagnosis
The configuration and diagnosis are accessed with the following words.

EW xx,04, EWxx,12, IA y4

where xx is the address of the remote unit selected on the plug-in base ECZ.

Composition of the word

B0	short-circuit on the output "= 0"
B1	short-circuit on the output "> 0"
B2	short-circuit on the output "= C1"
B3	short-circuit on the output "> C1"
B4	short-circuit on the output "= C2"
B5	short-circuit on the output "> C2"
B6	short-circuit on the output "UP"
B7	"OVERLOAD"
B8	Mode 32 bits or 2 x 16 bits
B9	Dip-switch n°6
B10	Dip-switch n°7
B11	Dip-switch n°8
B12	Dip-switch n°5
B13	Dip-switch n°4
B14	-
B15	"OVERFLOW"

B7 : "OVERLOAD" is set when the temperature of the unit is too high. All of then outputs are reset to "O".

B15 : "OVERFLOW" indicate a counter error , when the counter value exceeds the maximun or when the counter frequency is too high.

B8 : indicate the mode operation for the counter (DIP-switch n°2 on the plug in base).

– B8 = 0 mode 32 bits (DIP switch n° 2 on "ON")
– B8 = 1 mode 2 x 16 signed bits(DIP switch n° 2 on "OFF")

In the mode 2 x 16 bit. The high word represents the number of positive or negative overflows of the low word.

The high word is incremented with a positive overflow on the transition from + 32767 à – 32768 of the low word.
In a similar manner the high word is decremented on the transition from – 32768 à + 32767of the low word.

Example :

High word = + 6 (6 positive overflows)
Low word = + 18000.

(6 x 32767) + 18000 = 214602 = value of counter

B9 to B13 : these bits indicate the positions of the dip-switches on the rear of the counter unit.
If the bit is 1, the dip-switch is on position "**ON**".

Transfer of command

The time required to transfer commands to the counter unit depends upon the configuration of the installation (n° of units on the bus).
It is necessary to have a short delay between two different transfert to ensure correct operation.

- First possibility

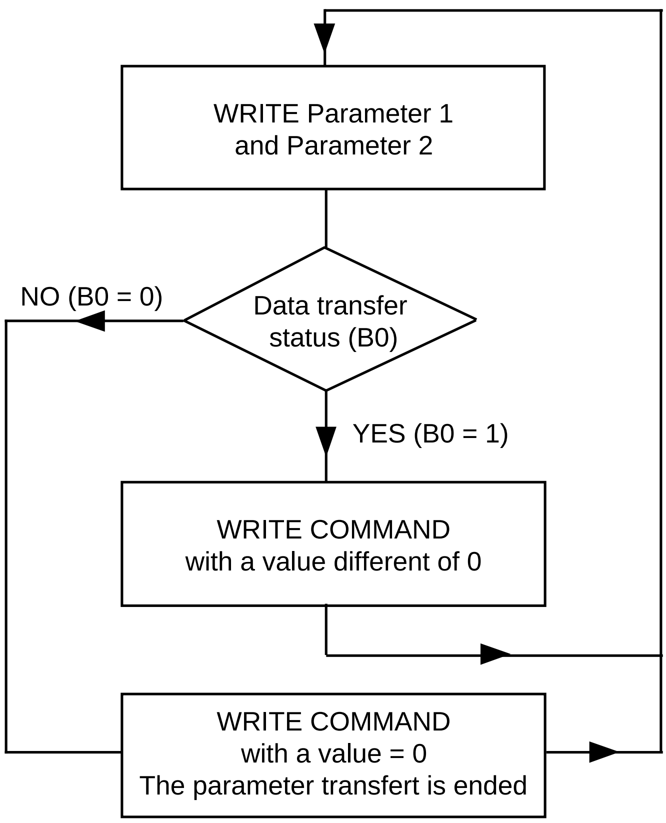
Start a timer for 50-100 milliseconds after each transfert and wait until the time is elapsed before transfering the next command.

- Second possibility

Use the internal protocol of the remote unit (Bit 0 of the binary input/output status word).

This bit is called the "Data transfer status".

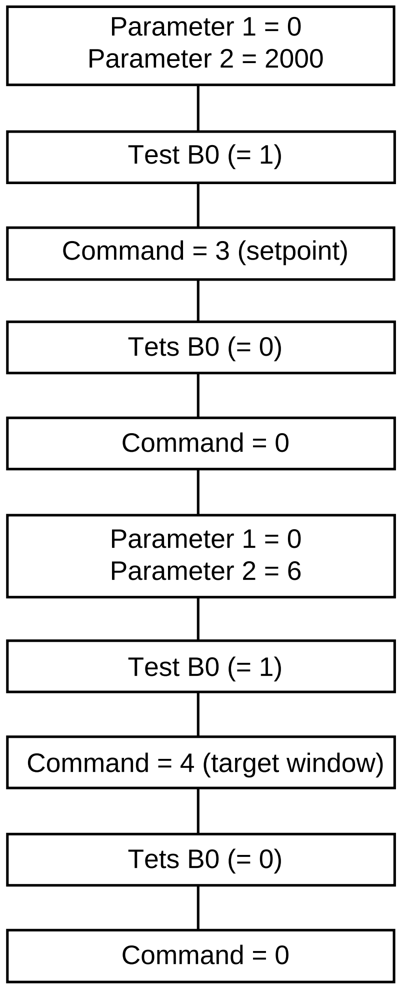
Data transfert status = "0" ➟ Executing command
Data transfert status = "1" ➟ Executing complete



Before using a new command (to send new parameters), the value 0 has to be loaded in the command word.

Example :

Transfert the setpoint 2000 then the target window 6.

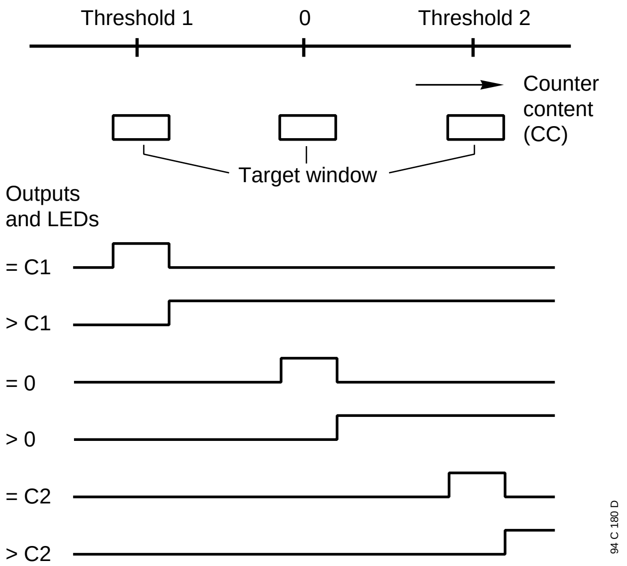


The different parameters for the modes 1, 2 or 3 are :

Command	Parameter 1	Parameter 2	
0	-	-	No command (used with the protocol for sending the command)
1	High word	Low word	Load threshold 1 with the highword lowword value
2	High word	Low word	Load threshold 2 with the highword lowword value
3	High word	Low word	Set point value, enabled by binary set input
4 (*)	-	0 to 255	Set the target window of the counter maximun value 255 (= ± 127)
5	-	-	Reset the counter value to "0" (independant of input VALID)
6	High word	Low word	Set the counter with the value (independant of input VALID)

(*) the counter content is continously compared to 0 and the two thresholds, one target window can be loaded via the bus, wich defines the width of the comparing windows. The following diagram shows an example.

The factory default is 2 (± 1).



Example : Threshold 1 is set to – 250
Threshold 2 is set to + 250
Target window is set to 20 (= ± 10)

Table of output signals (for the example) :

CC	Outputs = C1	> C1	CC	Outputs = 0	> 0	CC	Outputs = C2	> C2
– 261	0	0	– 11	0	0	+ 239	0	0
– 260	1	0	– 10	1	0	+ 240	1	0
– 259	1	0	– 9	1	0	+ 241	1	0
– 241	1	0	+ 9	1	0	+ 259	1	0
– 240	0	1	+ 10	0	1	+ 260	0	1
– 239	0	1	+ 11	0	1	+ 261	0	1

The different parameters for the mode 4 are :

Counter A

Command	Parameter 1	Parameter 2	
410	-	-	reset
411	-	data (16 bits)	set the counter to the value data
412	-	data (16 bits)	setpoint value, enabled by binary set and valid inputs
413	-	data (16 bits)	Load threshold A, result on outputs = C1 and > C1

Counter B

Command	Parameter 1	Parameter 2	
420	-	-	reset
421	-	data (16 bits)	set the counter to the value data
422	-	data (16 bits)	setpoint value, enabled by binary set and valid inputs
423	-	data (16 bits)	Load threshold B, result on outputs = C2 and > C2

Counter C

Command	Parameter 1	Parameter 2	
430	-	-	reset
431	-	data (16 bits)	set the counter to the value data
432	-	data (16 bits)	setpoint value, enabled by binary set and valid inputs
433	-	data (16 bits)	Load threshold C, result on outputs = 0 and > 0

The different parameters for the mode 5 are :

The different commands for the frequency meters are the same as the commands for the 3 counters(mode 4)

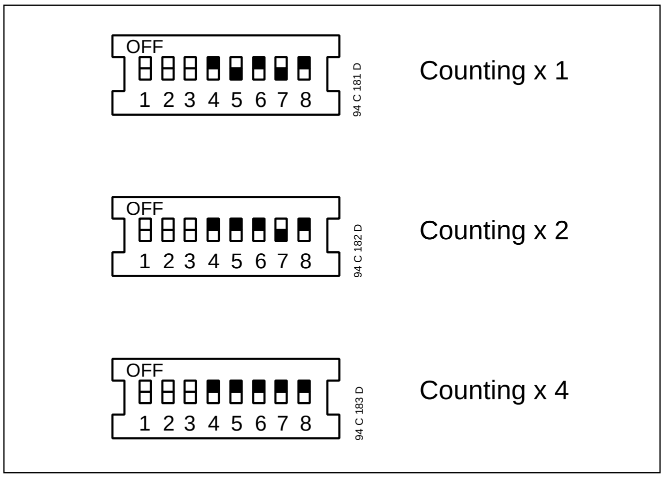
The period is loaded with the command = 400 and parameter 2 = data
(period = data* 100 ms)

precision:
3/100 for 100 ms
3/1000 for 1 s
3/10000 for 10 s
3/100000 for 100 s

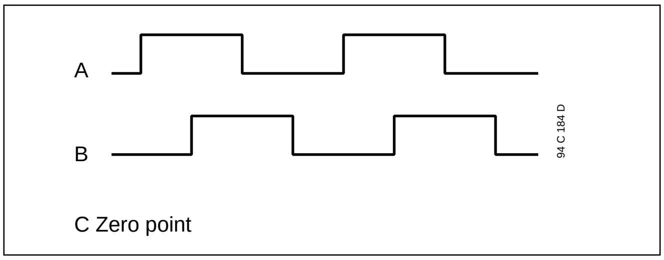
Mode 1 : 32 bit counter for incremental encoder

Configuration

Setting the DIP switches in the rear of the remote unit



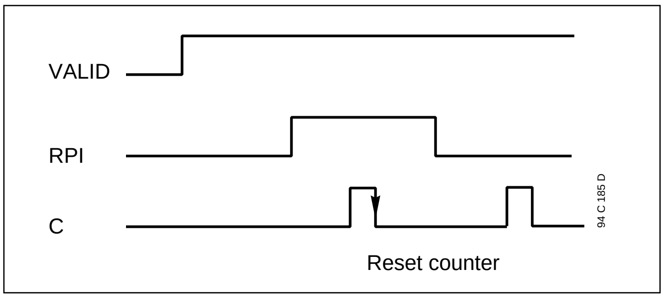
counting inputs A and B



The above shown pulse diagram results in counting upwards. The counting direction can be reversed by interchanging inputs A and B.

Relationship between RPI (reference point initiator) and C (zero point).

In order to reset the counter to 0 when crossing the machine zero point, the inputs RPI and C are used.



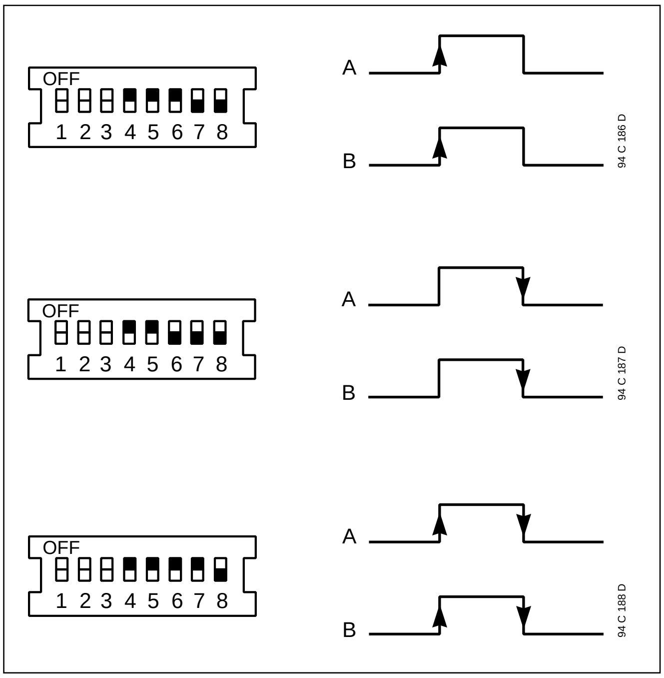
The falling edge of C resets the counter to 0 while RPI is ON. The signal C must not occur twice or more times within one period of RPI.

The VALID must be ON.

Mode 2 : 32 bit counter, incrementing one channel A and decrementing on channel B.

Configuration

Setting the DIP switches in the rear of the remote unit counting inputs A and B



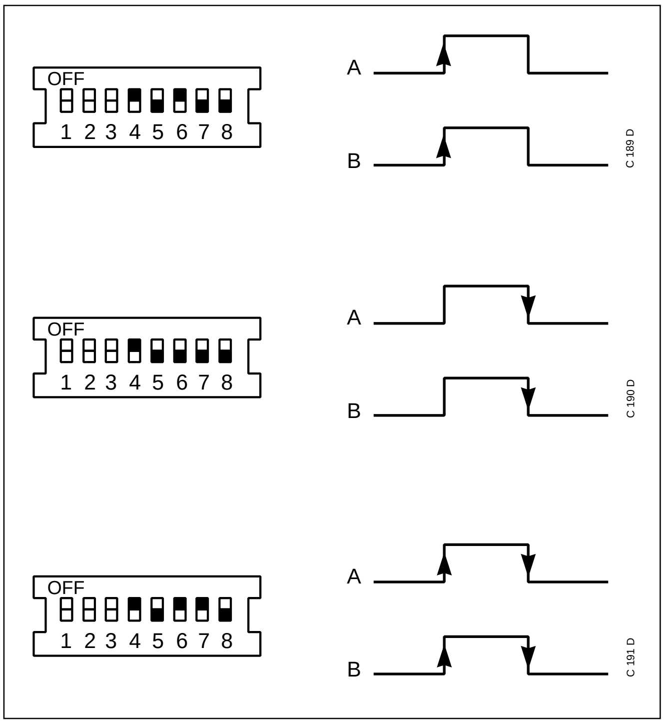
Impulses on input A count upwards,impulses on input b count downwards.Depending on the setting of the DIP switches, rising edges, falling edges or both edges trigger counting.

The inputs C and RPI have the effects as mode 1.

Mode 3 : 32 bit counter addition of channel A and B

Configuration

Setting the DIP switches in the rear of the remote unit



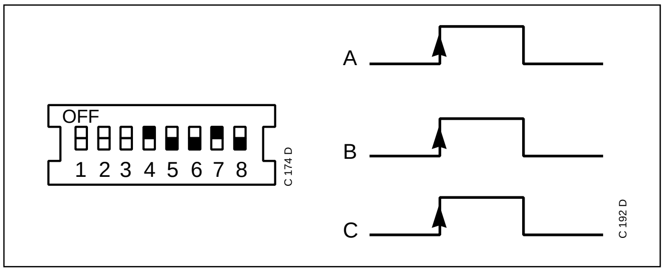
counting inputs A and B

Impulses on input A and B count upwards.Depending on the setting of the DIP switches, rising edges, falling edges or both edges trigger counting.

The inputs C and RPI have the effects as mode 1.

Mode 4 : 3 independant 16 bits counters on rising edge on channels A, B and C.

Configuration



Each counter counts from 0 or from the initial value.

When the counter counts from +32767 to –32768, the overflow error is not generated.

32767
↑
0
↑
– 32768

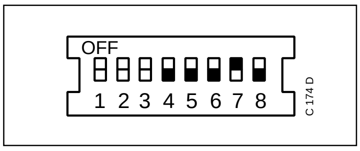
A hardware reset resets the 3 counters in one time.
A hardware set sets the 3 counters in one time.

The comparison between each counter and the corresponding threshold is signed.

The 3 counters are used with the following variables :
Counter A : EWxx,00
Counter B : EWxx,01
Counter C : EWxx,02

Mode 5 : 3 independant 16 bits frequency meters

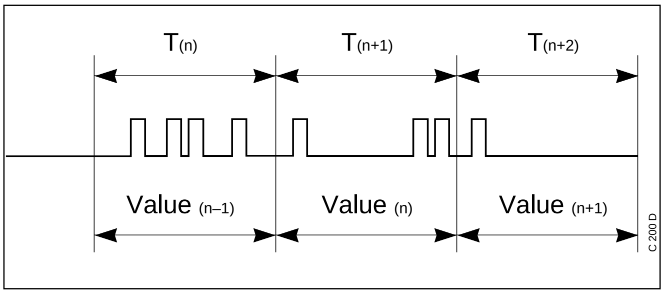
Configuration



The 3 frequency meters are independant and their functions are the same as mode 4.

The measurement period is the same for the 3 counters and the range is : 100 ms … 6563.5 seconds

The value of the frequency is determined in the following way :



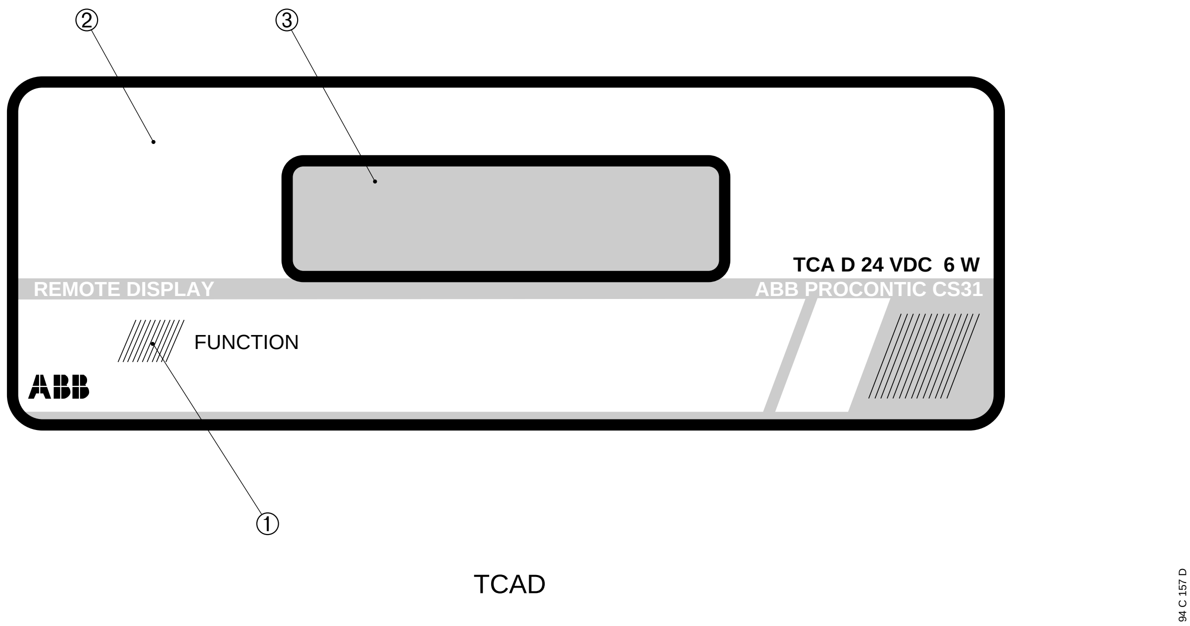
The 3 frequency meters are used with the following variables :
Frequency A : EWxx,00
Frequency B : EWxx,01
Frequency C : EWxx,02

● **Fault indication**

The led's indicate the following :

Led 0 : "**Unit error**"
Led 1 : "**Bus error**"
Led 3 : "**Overflow**" (the counter counts beyond its counting limits or thr counting frequency is too high)
Led 4 :"**Overload**" (temperature inside the unit is too high,all outputs are set to 0)
Led 5 :"**Short circuit**"

If an error occurs the red led error is **On** (see Chapter 9, Volume 2 «**In case of failure**»).



TCAD

Description of the unit front :

- Front plate IP 65 .... ①
- Display 2 lines, 32 characters .... ②
- "Key function" push-button .... ③

The remote display TCAD displays informations concerning machine and process status, concerning maintenance, etc.

It is directly connected to the CS 31 by a twisted pair. This allows the following **advantages** :
– reduction of the wiring and material costs.
– the serial port of central unit remains free.

- The messages stored in EEPROM in the remote display TCAD are called by their message number from the central unit.

- The various messages activated from the central unit are scrolled on the screen **every two seconds**.

- The activated messages can be desactivated **one by one** or **all at once**.

- The message is displayed on **2 lines of 16 supertwist 8 mm high characters**.

- **Two variable datas** can be embedded in each message. Each data has a maximum of 6 characters, one of which is for the sign.

- A buzzer (programmable) can be activated or desactivated.

- A **key function** is available on the front plate. It can be used in the user program as an input to acknowledge a message, the buzzer, etc.

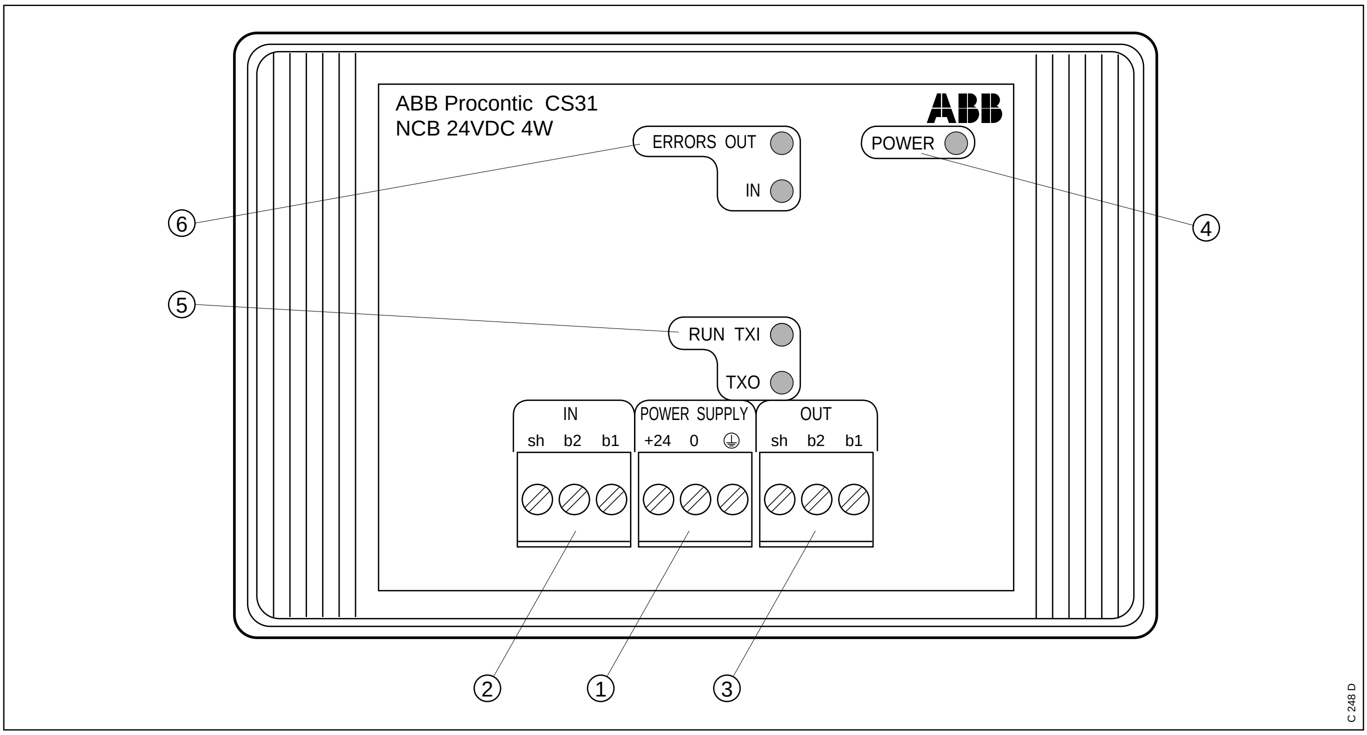
- The remote display TCAD is programmed with a **PC based programming software**.

TECHNICAL CHARACTERISTICS	
Power supply	24 VDC
Isolated power supply	yes
Internal buzzer	yes (programmable)
Number of serial interface	1 RS 232 C for programming 1 RS 485 (reserved for CS 31 bus)
Display	alphanumerical through 2 lines of 16 characters supertwist 8 mm high
Front unit protection	IP 65
Rear unit protection	IP 20
Memory	127 messages + 1 background message, both 32 characters in EEPROM
Operation temperature	0 °C to 55 °C
Power supply connection	rear removable terminal block
Programming interface connection	SUB D9 pins female
CS 31 interface connection	rear removable terminal block
Order number : FPR 3203 526	R1002
Weight	0.4 kg

For more details, refer to its own description

6.3.1 NCB — CS 31 Bus unit

CS 31 Bus Amplifier



The NCB is an amplifier for CS31 bus. It ensures a amplifier function whereas the maximum lenght on one bus can reached upto 2km with the installation of 3 NCB.

The use of NCB is totally transparent and a diagnosis is available on the unit and on the central unit if almost one of the different lines is faulty.

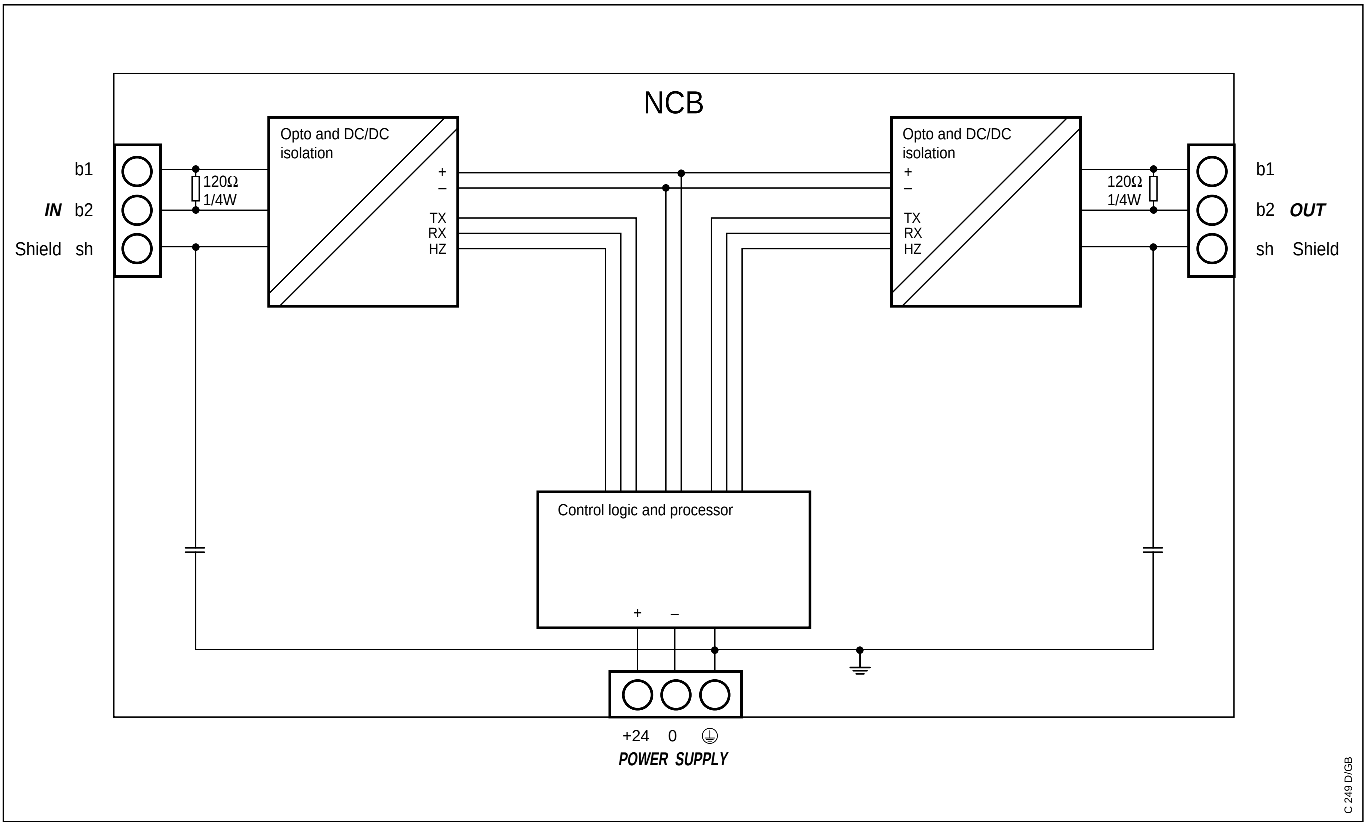
Description

- Removable connector for 24 VDC power supply ... ①
- Removable connector for CS31 bus input.............. ②
- Removable connector for CS31 bus output 1 .... ③
- 1 green led labelled "power" to indicate the presence of supply... √
- TX I : communication in progress from CS31 bus master to NCB.

  TX O : communication in progress from remote unit to NCB .... ⑤
- 2 red leds labelled "OUT" and "IN" to indicate the default on the CS31 bus .... ≈

TECHNICAL CHARACTERISTICS	
Power supply	24 VDC
Isolated power supply	no
Maximum consumption	4 W
Isolated RS485 CS31 bus IN/OUT and power supply	yes (1000 VAC)
Isolated RS485 CS31 bus OUT/IN and power supply	yes (1000 VAC)
Maximum delay between input/output signals	< 2 µs
Integrated resistor for end of line	yes (120 Ohm 1/4 W)
Mounting on DIL rail	yes
Widht x height x depth	120 x 80 x 85
Order number	FPR 347 1200 R1002
Weight	340g

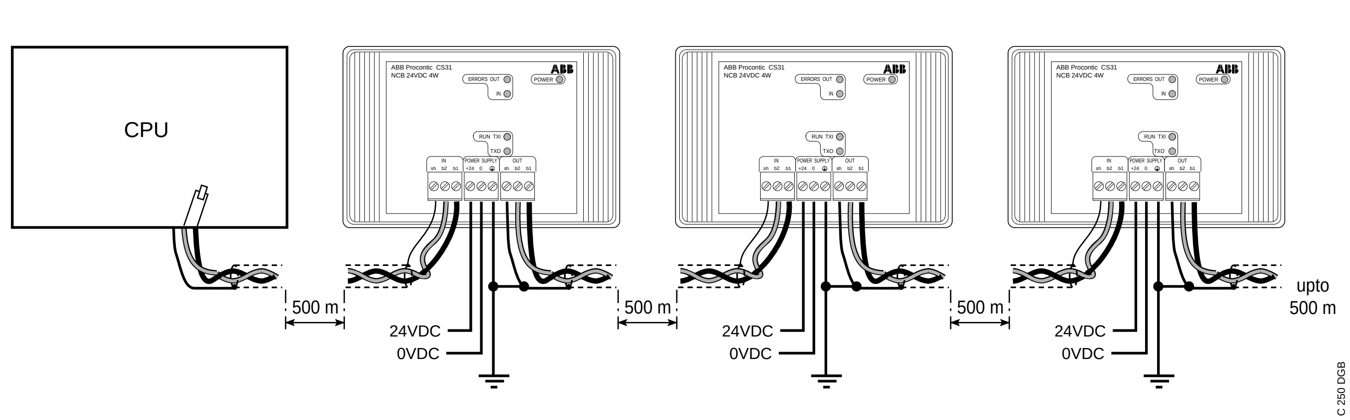
● **Electrical connections**



B2 : bus 1
B1 : bus 2

● **Installation**

All EMC protection rules have to be applied (see chapter 1.1.2 vol. 2)

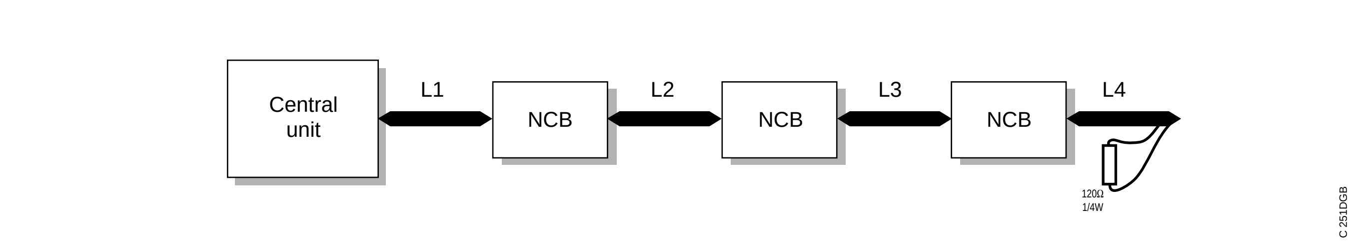


The resistance for end of line (120 Ω 1/4W) is already integrated into the NCB.

The terminals IN have to be connected to the above CS31 bus segment (CS31 master side) for the handling of diagnosis.

The choice of the CS31 bus cable is very important to reach long distance communication and to avoid disturbances in communication.

A typical configuration is :



The cable has to be chosen according on the following rule :

*L1 + L2 + L3 + L4 < 1200 m

The standard cable can be used (check general characteristics chapter 1)

*1200 m < L1 + L2 + L3 + L4 < 1500 m

Cable characteristics

– twisted pair (nb twists > 10 per meters)
– capacitance : C < 100 nF/km (100 pF/m)
– impedance characteristic :
  80 to 120 Ohms (= √L/C with L : inductance)
– **transmission velocity**
  (= 1/√LC) > 55 % light velocity (300 000 km/s)

*1200 m < L1 + L2 + L3 + L4 < 2000 m

Cable characteristics

– twisted pair (nb twists > 10 per meters)
– capacitance : C < 100 nF/km (100 pF/m)
– impedance characteristic :
  80 to 120 Ohms (= √L/C with L : inductance)
– **transmission velocity**
  (= 1/√LC) > 66 % light velocity (300 000 km/s)

Fault indication :

An open circuit and short circuit on the CS31 bus are detected by the NCB. In this case, the different CS31 bus segments below the default are out of order. The CS31 bus segment above the default runs properly.

The leds ERRORS "OUT" or "IN" are "ON" according on the CS31 bus in default.

This error is displayed on the central unit (FK3) as a remote unit error.

The access to the default is different according on the type of central unit :

07KR31 / 07KT31

– access to the default with the function block COPY to the memory address SEG : 0h and OFFSET : 8660h

  If the value is 2Ah, then almost one of the NCB's is on default. (The red led on central unit is OFF).

  The default is reset on the central unit when 0 is written at the address 0:8660h (with the function block COPY).

– access to the default as an FK3 error number 17d with the versions produced after April 96 (07KR31 index J and 07KT31 index B).

07KR91 / 07KT92 / 07KT93

– access to default with the function block COPY to the memory address SEG : C000h and OFFSET:0100h

  If the value is 2Ah, then almost one of the NCB's is on default. (The red led on central unit is ON).

  The default is reset on the central unit when 0 is written at the address 0C00/0100h (with the function block COPY).

07CS61 (for T200)

– Version index c R202

The default is seen as a bus error without any remote unit number.

– Version index d R202 and next

The default is set in the bit 4 of the word MW4104,03 for the first CS31 line, MW4105,11 for the second CS31 line, MW4107,03 for the third CS31 line and MW4108,11 of the fourth CS31 line.

07CS91 (for T300) and UCZA/UCZB

The diagnosis is not available.

How to solve the error ?

– Check the different connexions on the CS31 bus (the terminals b1 and b2 must not be inversed).

– Check the CS31 bus to find where is the error.

  In case of short-circuit, all remote units on the corresponding segment are in default.

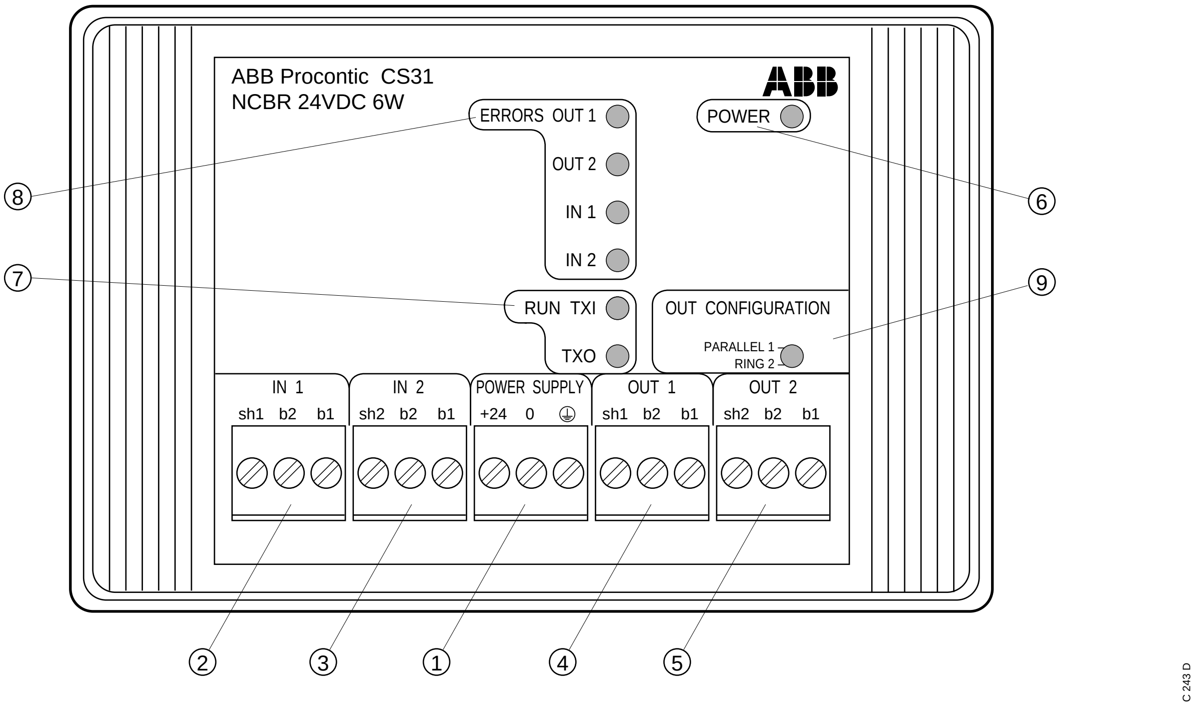
  The open circuit can be detected by the NCB only if this default happens between NCB and the first remote unit. For the cases, the central unit will detect a disconnected remote unit

When the failure disappears, the NCB quits the error by itself and the red leds go out.

A remote unit error is always normally detected by the central unit.

6.3.2 NCBR CS 31 Bus unit

CS 31 Bus Amplifier with redondancy



The NCBR is an amplifier for CS31 bus with integrated redundancy functions.

NCBR allows two types of configurations :

– Reliable installation
In this case, NCBR is used to built up a redondant data transmission medium.

– Extended installation
The NCBR is then used to built up star configuration and therefore to cover wide areas.

The redundancy functions is provided by 2 parallel buses between 2 NCBR or with one bus in ring configuration with only one NCBR.

It also ensures a amplifier function whereas the maximum lenght on one bus can reached upto 1800 m with the installation of 3 NCBR.

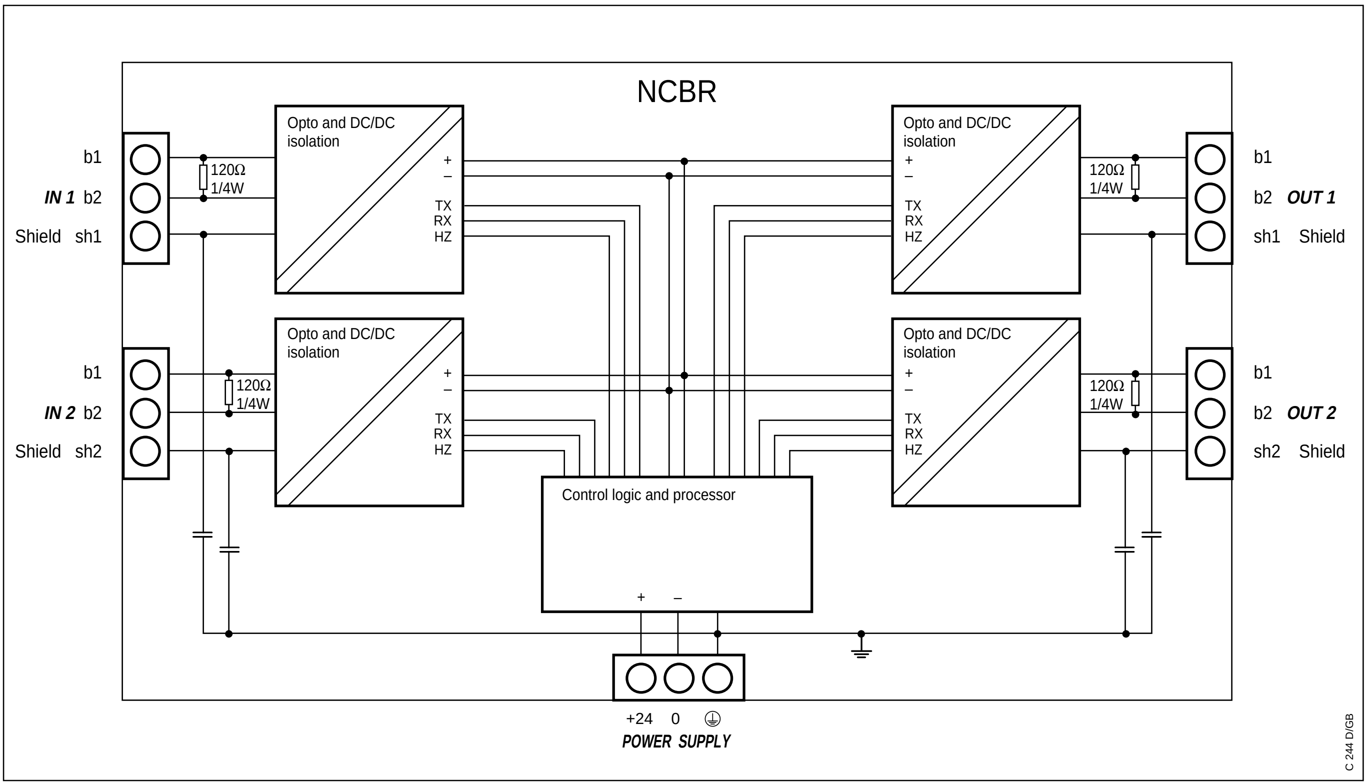
The use of NCBR is totally transparent and a diagnosis is available on the unit and on the central unit if almost one of the different lines is faulty.

Description

- Removable connector for 24 VDC power supply ... ①
- Removable connector for CS31 bus input 1........... ②
- Removable connector for CS31 bus input 2........... ③
- Removable connector for CS31 bus output 1 .... ④
- Removable connector for CS31 bus output 2 .... ⑤
- 1 green led labelled "power" to indicate the presence of supply.. ⑥
- 2 yellow leds labelled "TX I" and "TX O" to indicate the communication between central unit and NCBR .... ⑦
- 4 red leds labelled "OUT1", "OUT2", "IN1" and "IN2" to indicate the default on the different CS31 buses .... ⑧
- Parallel or ring configuration selection .... ⑨

TECHNICAL CHARACTERISTICS	
Power supply	24 VDC
Isolated power supply	no
Maximum consumption	6 W
Isolated RS485 CS31 bus IN1/IN2, OUT1, OUT2 and power supply	yes (1000 VAC)
Isolated RS485 CS31 bus IN2/IN1, OUT1, OUT2 and power supply	yes (1000 VAC)
Isolated RS485 CS31 bus OUT1/IN1, IN2, OUT2 and power supply	yes (1000 VAC)
Isolated RS485 CS31 bus OUT2/IN1, IN2, OUT1 and power supply	yes (1000 VAC)
Maximum delay between input/output signals	< 2 µs
Integrated resistor for end of line	yes (120 Ohm 1/4 W) on output (OUT) yes (1500 Ohm 1/4 W) on input (IN)
Mounting on DIL rail	yes
Widht x height x depth	120 x 80 x 85
Order number	FPR 347 1300 R1002
Weight	340g

● **Electrical connections**



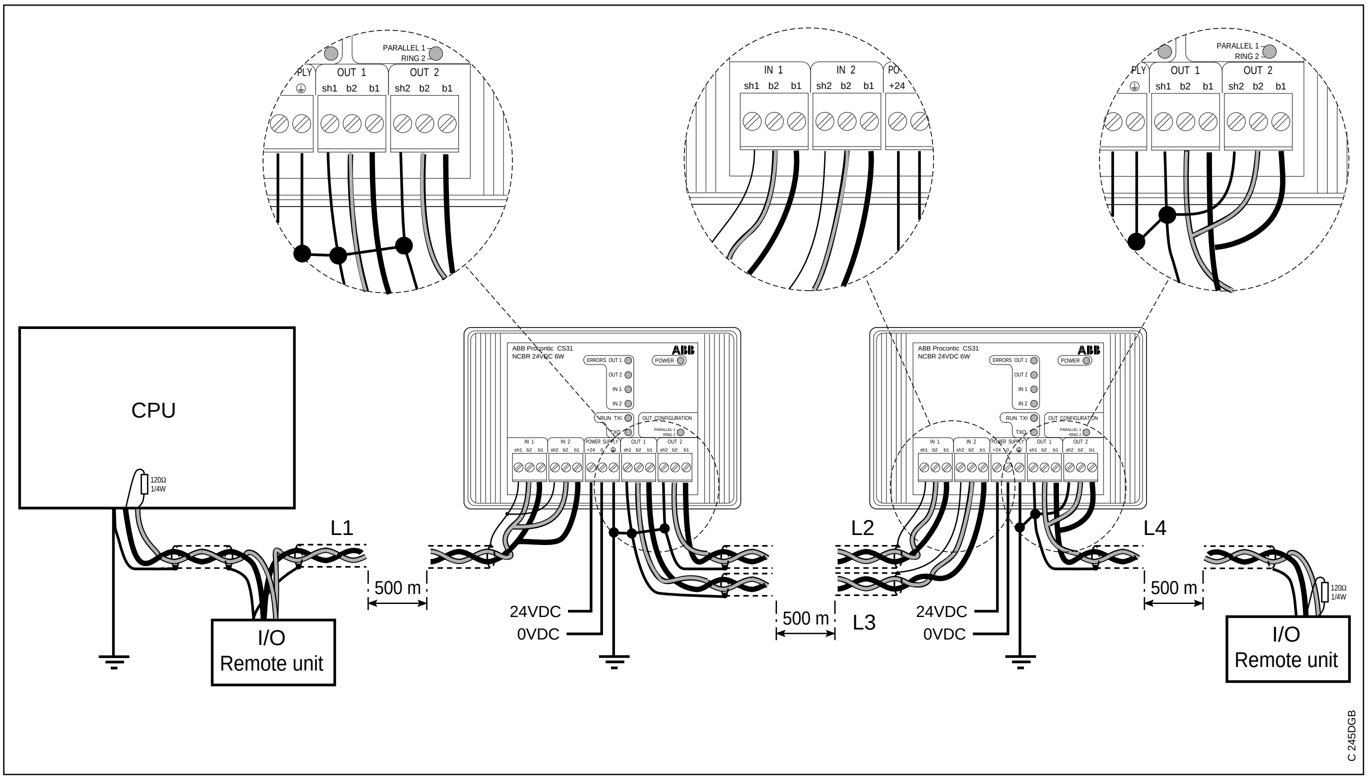
b2 : bus 1
b1 : bus 2

IN 1 and OUT 1 : segment 1
IN 2 and OUT 2 : segment 2

● **Installation**

All EMC protection rules have to be applied (see chapter 1.1.2 vol. 2)

Parallel configuration



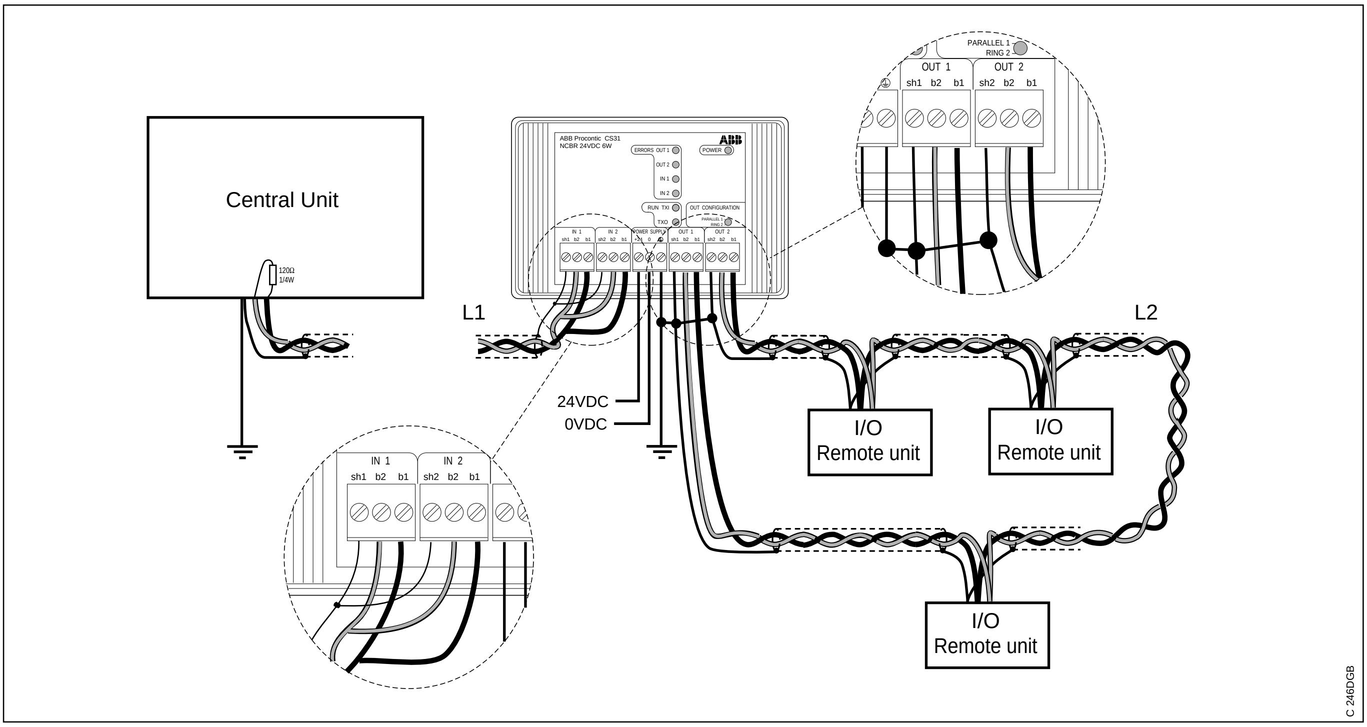
The resistor for end of line (120 Ω 1/4 W) is already integrated into the NCBR.

The maximum length of each segment is 500 m.

The maximum length in one direction (for example : L1 + L2 + L4) depends on the cable characteristics (check below for cable specifications).

In case on failure on L2 (resp. L3), the remote units connected on L2 (resp. L3) between the failure and the below NCBR lose the communication with the central unit.

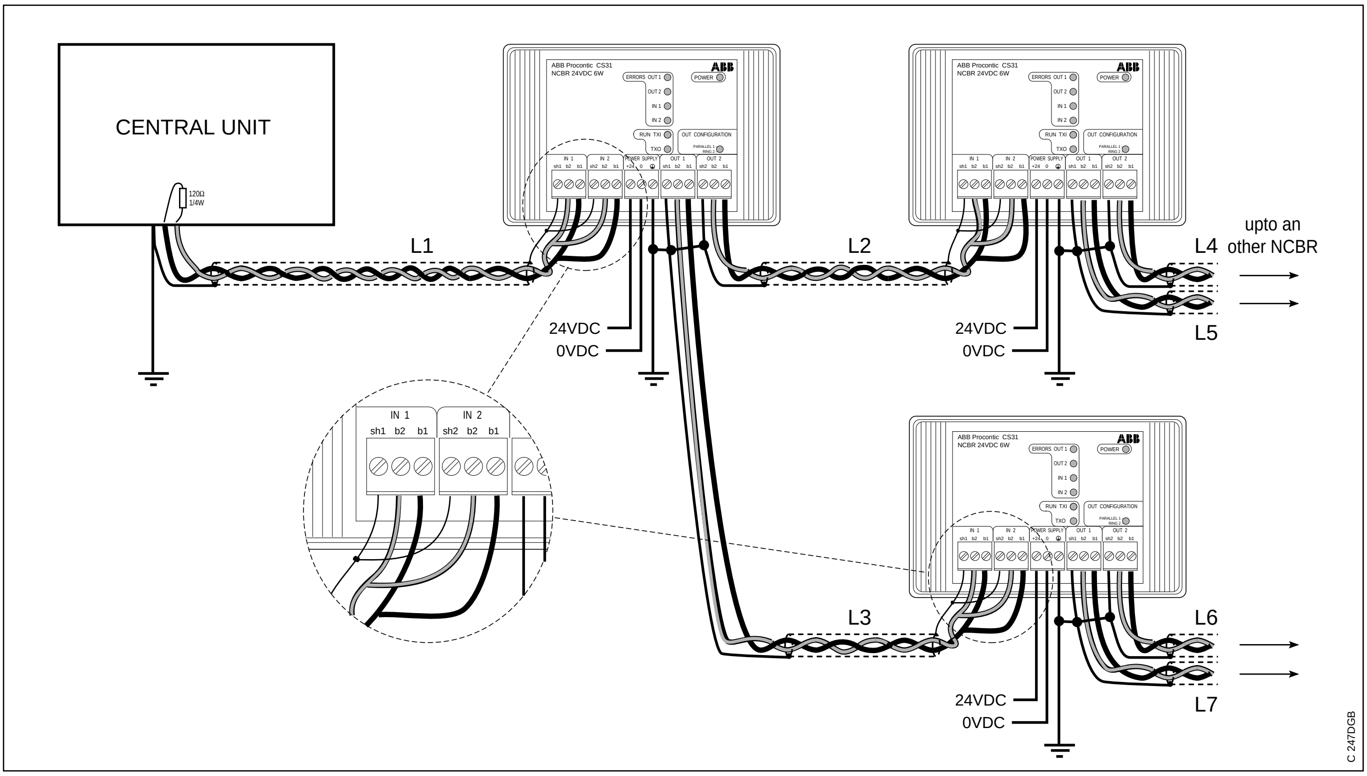
Ring configuration



The maximum length of each segment is 500 m.

The maximum length in one direction (for example : L1 + L2) depends on the cable characteristics (check below for cable specifications).

Star configuration



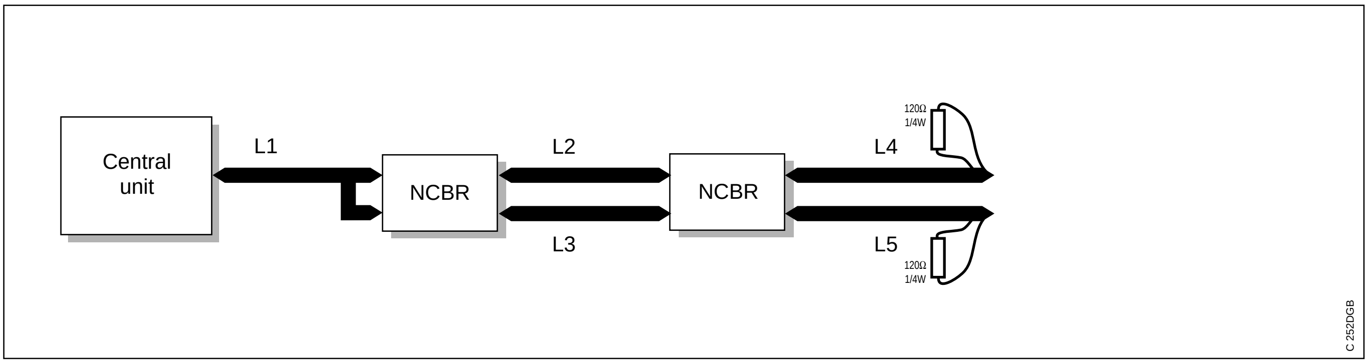
The maximum length of each segment is 500 m.

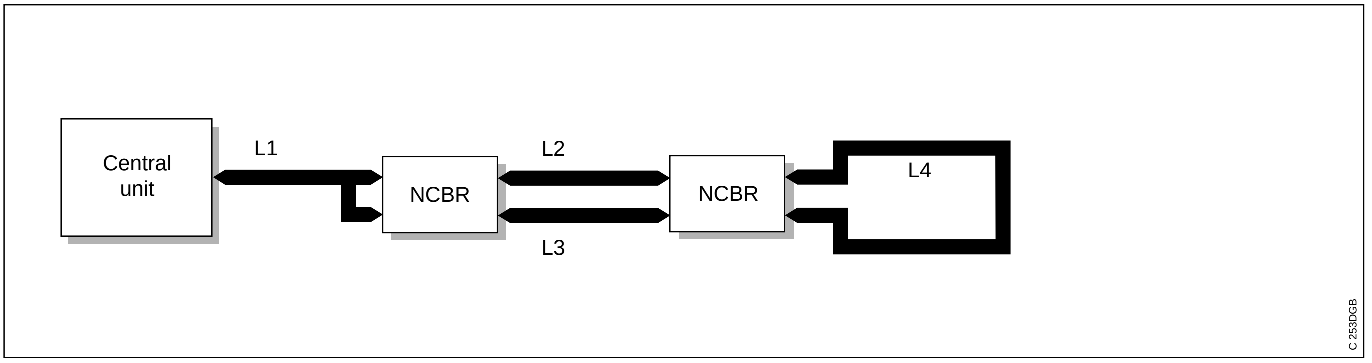
The maximum length in one direction (for example : L1 + L3 + L6) depends on the cable characteristics (check below for cable specifications).

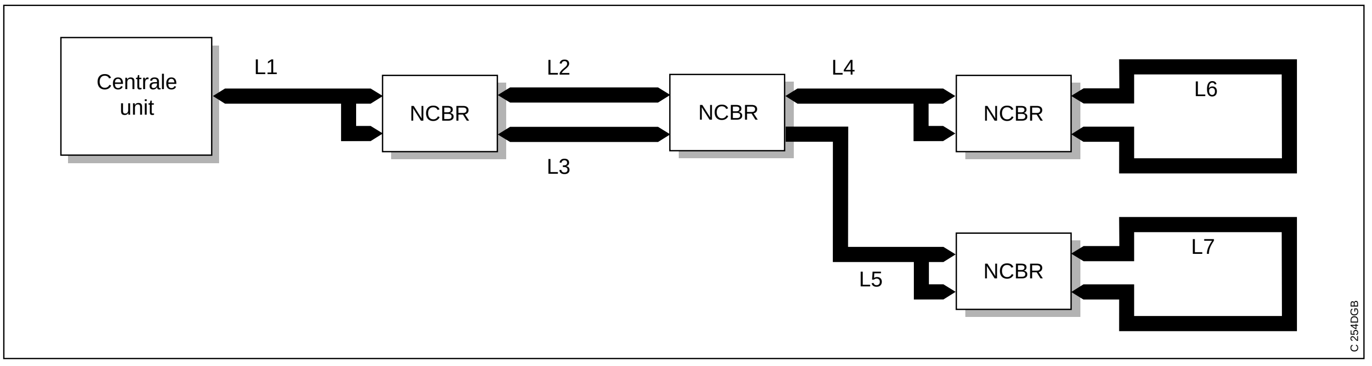
Upto 7 NCBR can be installed in this configuration.

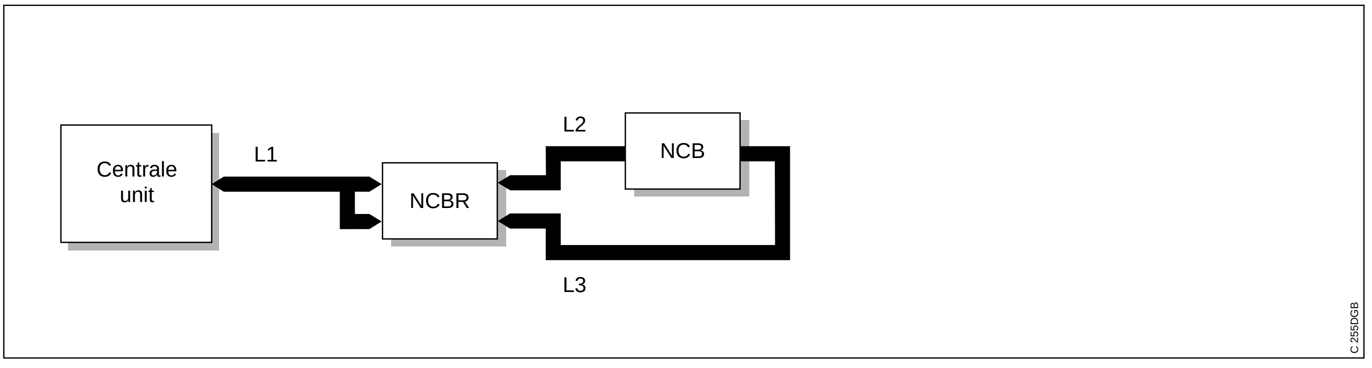
The 3 different configurations can be mixed together.
The limits are only 3 NCBR on one direction and only 31 remote units for the complete configuration (a NCBR unit doesn't use a CS31 bus address).

Example of others configurations :









with L2 + L3 < 800 m

The choice of the CS31 bus cable is very important to reach long distance communication and to avoid disturbances in this communication.

The maximum length for one direction depends on the cable specifications.

The maximum length for each segment is 500 m.

- **If the maximum length is lower than 1200 m** then the standard cable can be used (check general characteristics chapter 1).
- **If the maximum length is lower than 1500 m** then the cable characteristics are :
  - twisted pair (nb twists > 10 per meters)
  - capacitance : C < 100 nF/km (100 pF/m)
  - impedance characteristic : 80 to 120 Ohms (= √L/C with L : inductance)
  - **transmission velocity (= 1/√LC) > 55 % light velocity (300 000 km/s)**
- **If the maximum length is lower than 1800 m** then the cable characteristics are :
  - twisted pair (nb twists > 10 per meters)
  - capacitance : C < 100 nF/km (100 pF/m)
  - impedance characteristic : 80 to 120 Ohms (= √L/C with L : inductance)
  - **transmission velocity (= 1/√LC) > 66 % light velocity (300 000 km/s)**

● How is it running ?

The NCBR is waiting a character on the inputs IN1 and IN2.

When the first characters of a frame is received on one of the two buses, the corresponding line is valided and then the characters on the other bus are ignored.

After the end of the frame (delay > 20 µs) , the NCBR waits again a frame on the two input buses.

– Redondancy and star configuration

The switch "**OUT CONFIGURATION**" has to be on position **PARALLEL**.
The frame is sent in the same time on the two output buses.

– Ring configuration

The switch "**OUT CONFIGURATION**" has to be on position **RING**.
After the initialization, the electrical level on OUT 1 is modified and the NCBR checks if the electrical level on OUT 2 is also modified.

- If yes, the ring is closed and then the frame is sent only on OUT 1.

- If no, the ring is opened and the frame is sent on OUT 1 and OUT 2.

The red leds are alternatively ON).

The NCBR checks for each characters if the character arrives on OUT 2.

When the ring is again closed, the two frames are overlapted.

It could happen a transmission error, in this case the telegram is ignored and it will be sent again.

After power supply ON, the red leds go out and the yellow indicate the communication.

● Fault indication :

An open circuit and short circuit on the CS31 bus are detected by the NCBR.

This error is displayed on the central unit.

The leds ERRORS "OUT1", "OUT2", "IN1", or "IN2"are ON according on the CS31 bus in default.

The access to the default is different according on the type of central unit :

07KR31 / 07KT31

– access to the default with the function block COPY to the memory address SEG : 0h and OFFSET : 8660h

If the value is 2Ah, then almost one of the NCBR's is on default. (The red led on central unit is OFF).

The default is reset on the central unit when 0 is written at the address 0:8660h (with the function block COPY).

– access to the default as an FK3 error number 17d with the versions produced after April 96 (07KR31 index J and 07KT31 index B).

07KR91 / 07KT92 / 07KT93

– access to default with the function block COPY to the memory address SEG : C000h and OFFSET:0100h

If the value is 2Ah, then almost one of the NCBR's is on default. (The red led on central unit is ON).

The default is reset on the central unit when 0 is written at the address 0C00/0100h (with the function block COPY).

07CS61 (for T200)

– Version index c R202

The default is seen as a bus error without any remote unit number.

– Version index d R202 and next

The default is set in the bit 4 of the word MW4104,03 for the first CS31 line, MW4105,11 for the second CS31 line, MW4107,03 for the third CS31 line and MW4108,11 of the fourth CS31 line.

07CS91 (for T300) and UCZA/UCZB

The diagnosis is not available.

How to solve the error ?

– Check the different connexions on the CS31 bus (the terminals b1 and b2 must not be inversed).

– Check the presence and value of the resistance of end line

– Check the CS31 bus to find where is the error.

In case of short-circuit, all remote units on the corresponding segment are in default.

The open circuit can be detected by the NCBR only if this default happens between NCBR and the first remote unit of the last segment or on the segment between two NCBR (in parallel or ring configuration).

When the failure disappears, the NCBR quits the error by itself and the red leds go out.

A remote unit error is always normally detected by the central unit.

7 Contents Couplers

Chapter	Description	Page

7.1.1 ICBG 32 L7 Robot card

32 binary input/outputs

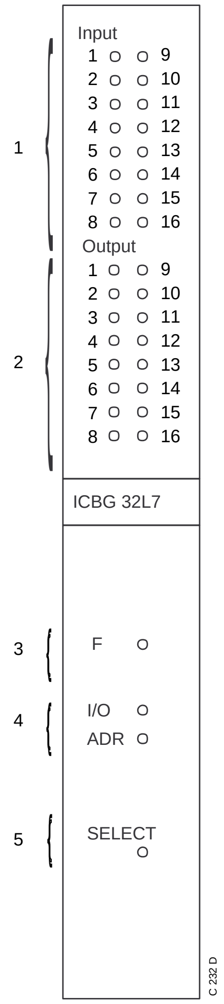
This card is a 32 channel binary inputs/ outputs card for communication between the CS31 system and ABB type S3 robots (it is mounted in the robot rack).

The power supply is taken from the robot rack.
The CS31 system bus is used for the communication.

The card is seen as a standard input/output unit by the robot and CS31 system.

Description of the front module :

- Sixteen yellow input status led's .... ①
- Sixteen yellow output status led's .... ②
- Red led to indicate errors .... ③
- Two yellow led's to significate the input/output led's ④
- "SELECT" push-button. .... ⑤



Robot coupler 32 Inputs/Outputs

SPECIFICATIONS	
Power supply (taken from the robot)	+ 5 V and + 15 VDC
Power supply isolation	no
Number of inputs	16
Number of outputs	16
Maximum consumption	4 W
Order number FPR3330705	R0321
Weight (kg)	0.3

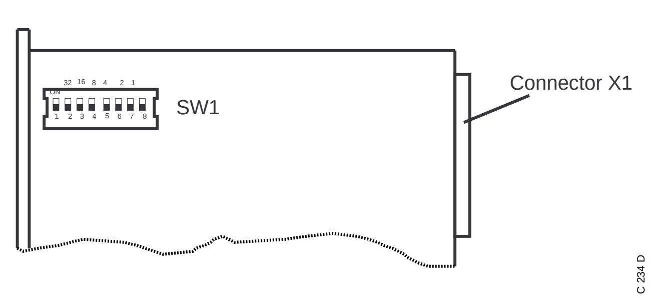
- **Connection**

The address of the card is set with the dil switch SW1 in the same manner as the plug-in base.

Connect the CS31 bus to the connector X1 of the card with the special cable (YB560105-DZ ABB Robotics)

Connect the wires of this cable to the CS31 bus.

– pin 30A : bus 1
– pin 30C : bus 2



Insert the card into a binary input/output slot of the robot rack (refer to robot documentation for user details).

- **Initialization**

– The card initializes itself after powered on the robot and the CS31. The input led's 1,2,8 et "F" are illuminated.

– After a correct initialization, the error led "F" switch off, The input led's take their function, the system is now ready to run.

- **Utilisation**

This card is used like a standard remote binary input/ output unit.
The usual instructions are used to read inputs and write outputs.
This card is used like one DSQC 223 by the robot.
Each output bit of the robot is an input bit of the CS31.
Each input bit of the robot is an output of the CS31.

Example : The robot sets output 5 to 1. This is read using the input (Exx,05 or Ixx 05).
In the same way input 7 of the robot can be set by writing to Axx,07 or Oxx,07 of the CS31.
The function of the led's on the front of the card can be selected by pressing the "SELECT" push-button on the card (I/O status or address and diagnosis).

– The "I/O" led is illuminated when the led's indicate the input/ouput status.
– The "ADR" led is illuminated when the led's indicate the setting of SW1.

If a fault occurs the "F" led is illuminated and the fault code is displayed on the led's:

Led 1 : "**Bus error**" No initialization on the CS31 bus.
Led 2 : "**Unit error**" No initialization on the robot
Led 4 : "**ROM error**"
Led 5 : "**External RAM error**"
Led 6 : "**Internal RAM error**"
Led 7 : "**Microprocessor error**"
Led 8 : "**Other error**"

If an error occurs, see chapter "**In case of failure**".

Example of addressing input/output card.
This card is inserted in the first binary input/output slot of the rack and the address is set by SW1 for the CS31 bus.

VARIABLES USED

Robot	07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB	PCZB
Address xx on the switch SW1	00 … 61	00 … 61	1 … 31
1 - 8 9 – 16	xx, 00 … xx,07 xx, 08 … xx,15	xx, 00 … xx, 07 xx+100 … xx+1,07	xx00 … xx007 xx08 … xx15

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

7.1.2 ICBG 64 L7 Robot card

64 binary inputs/outputs

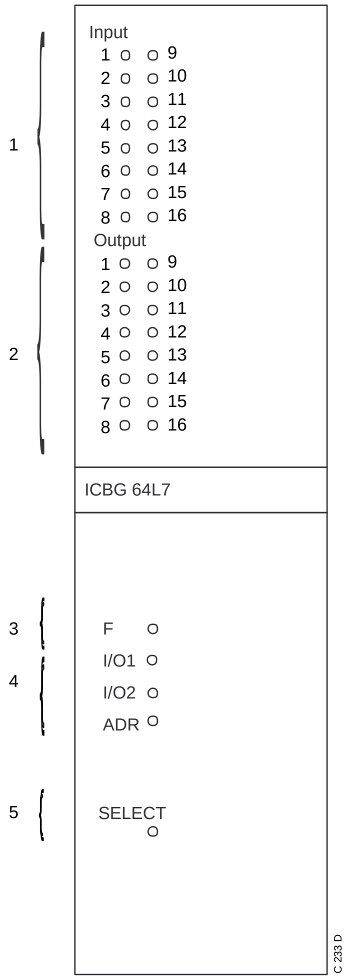
This card is a 64 channel binary inputs/outputs card for communication between the CS31 system and ABB type S3 robots (it takes two slots in the robot rack).

The power supply is taken from the robot rack.
The CS31 system bus is used for the communication.

The card is seen as a standard input/output module by the robot and CS31 system.

Description of the front module :

- Sixteen yellow input status led's .... ①
- Sixteen yellow output status led's .... ②
- Red led to indicate errors .... ③
- Two yellow led's to significate the input/output led's ④
- "SELECT" push-button. .... ⑤



Robot coupler 64 Inputs/Outputs

SPECIFICATIONS

Power supply (taken from the robot)	+ 5 V and + 15 VDC
Power supply isolation	no
Number of inputs	32
Number of outputs	32
Maximum consumption	4 W
Order number FPR3330705	R0641
Weight (Kg)	0.3

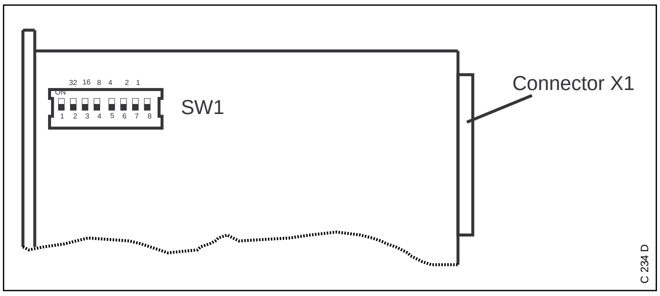
Connection

The address of the card is set with the dil switch SW1 in the same manner as the plug-in base.

Connect the CS31 bus to the connector X1 of the card with the special cable (YB560105-DZ ABB Robotics)

Connect the wires of this cable to the CS31 bus.

– pin 30A : bus 1
– pin 30C : bus 2



Insert the card into a binary input/output slot of the robot rack (refer to robot documentation for user details).

• Initialization

– The card initializes itself after powered on the robot and the CS31. The input led's 1,2,8 et "F" are illuminated.

– After a correct initialization, the error led "F" switch off, The input led's take their function, the system is now ready to run.

• Utilisation

This card is used like a standard remote binary input/ output unit.
The usual instructions are used to read inputs and write outputs.
This card is used like two DSQC 223 by the robot.

Each output bit of the robot is an input bit of the CS31.
Each input bit of the robot is an output of the CS31.

Example : The robot sets output 5 to 1. This is read using the input (Exx,05 or Ixx 05).
In the same way input 7 of the robot can be set by writing to Axx,07 or Oxx,07 of the CS31.
The function of the led's on the front of the card can be selected by pressing the "SELECT" push-button on the card (I/O status or address and diagnosis).

– The "I/O1" led is illuminated when the led's indicate the 16 first channels status.
– The "I/O2" led is illuminated when the led's indicate the 16 others channels status.
– The "ADR" led is illuminated when the led's indicate the setting of SW1.

If a fault occurs the "F" led is illuminated and the fault code is displayed on the led's:

Led 1 : "**Bus error**" No initialization on the CS31 bus.
Led 2 : "**Unit error**" No initialization on the robot
Led 4 : "**ROM error**"
Led 5 : "**External RAM error**"
Led 6 : "**Internal RAM error**"
Led 7 : "**Microprocessor error**"
Led 8 : "**Other error**"

If an error occurs, see chapter "**In case of failure**".

Example of addressing input/output card.
This card is inserted in the first binary input/output slot of the rack and the address is set by SW1 for the CS31 bus.

VARIABLES USED			
Robot	07 KR 31, 07 KR 91 07 KT 92, 07 KT 93	UCZA/UCZB	PCZB
Address xx on the switch SW1	00 … 60	00 … 60	1 … 30
1 - 8 9 – 16 17 - 24 25 – 32	xx, 00 … xx,07 xx, 08 … xx,15 xx+1,00 … xx+1,07 xx+1,08 … xx+1,15	xx, 00 … xx, 07 xx+1,00 … xx+1,07 xx+2,00 … xx+2,07 xx+3,00 … xx+3,07	xx00 … xx07 xx08 … xx15 xx100 … xx107 xx108 … xx115

For the PC board 07 CM 90 and the coupler boards 07 CS 61 and 35 CS 91, refer to their own description

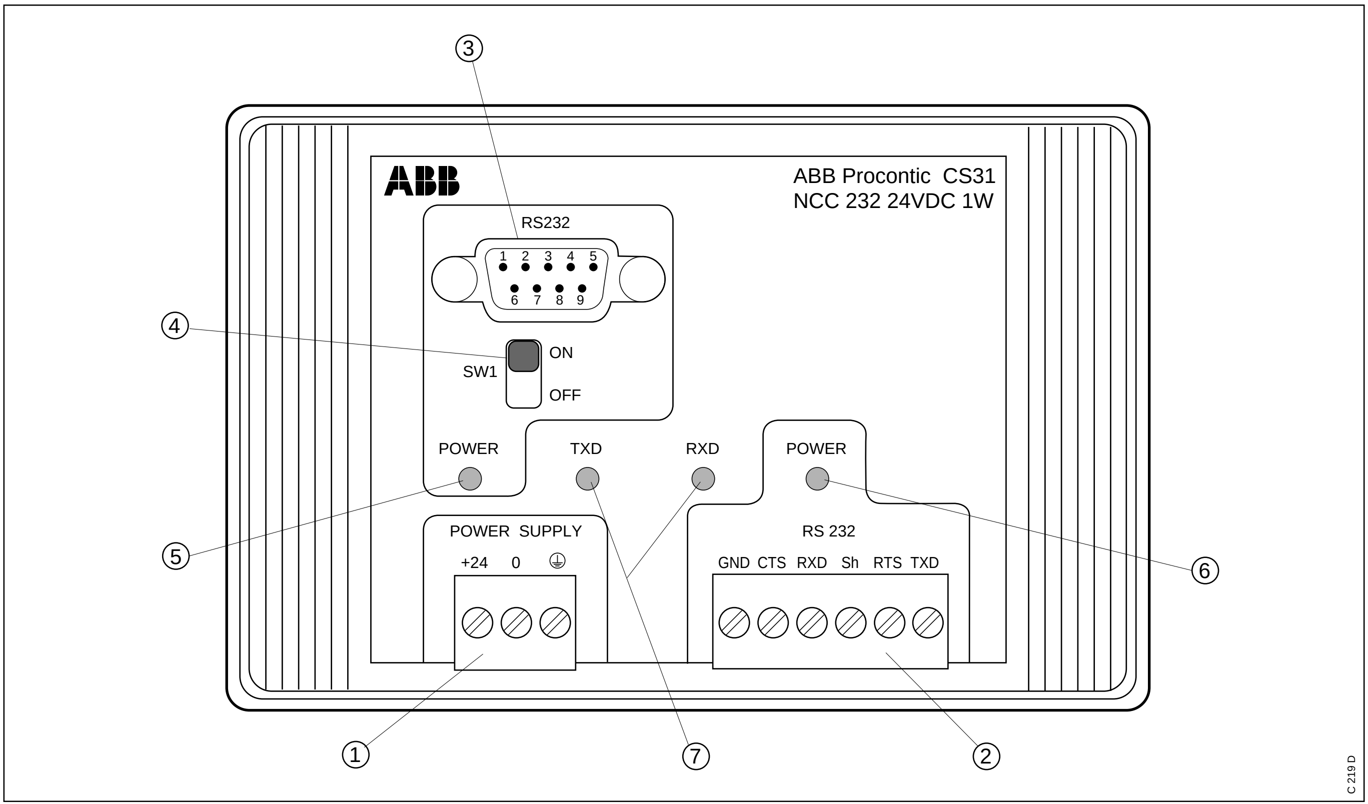
Any more available

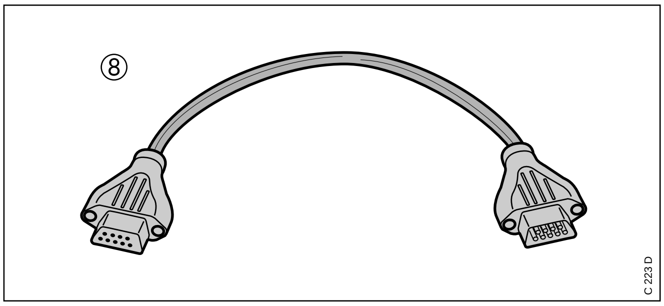
Any more available

8 Contents Accessories

8.1.1 NCC 232 — Serial line converters

RS232/RS232 isolated converter





The NCC 232 module is an RS232/RS232 interface converter. It is the solution of transmission problems in industrial data communications.

The NCC 232 allows a isolated connection between two RS232 interfaces.

In full duplex protocol, the NCC 232 allows long ranges transfers, the creation of point to point connection.

Description

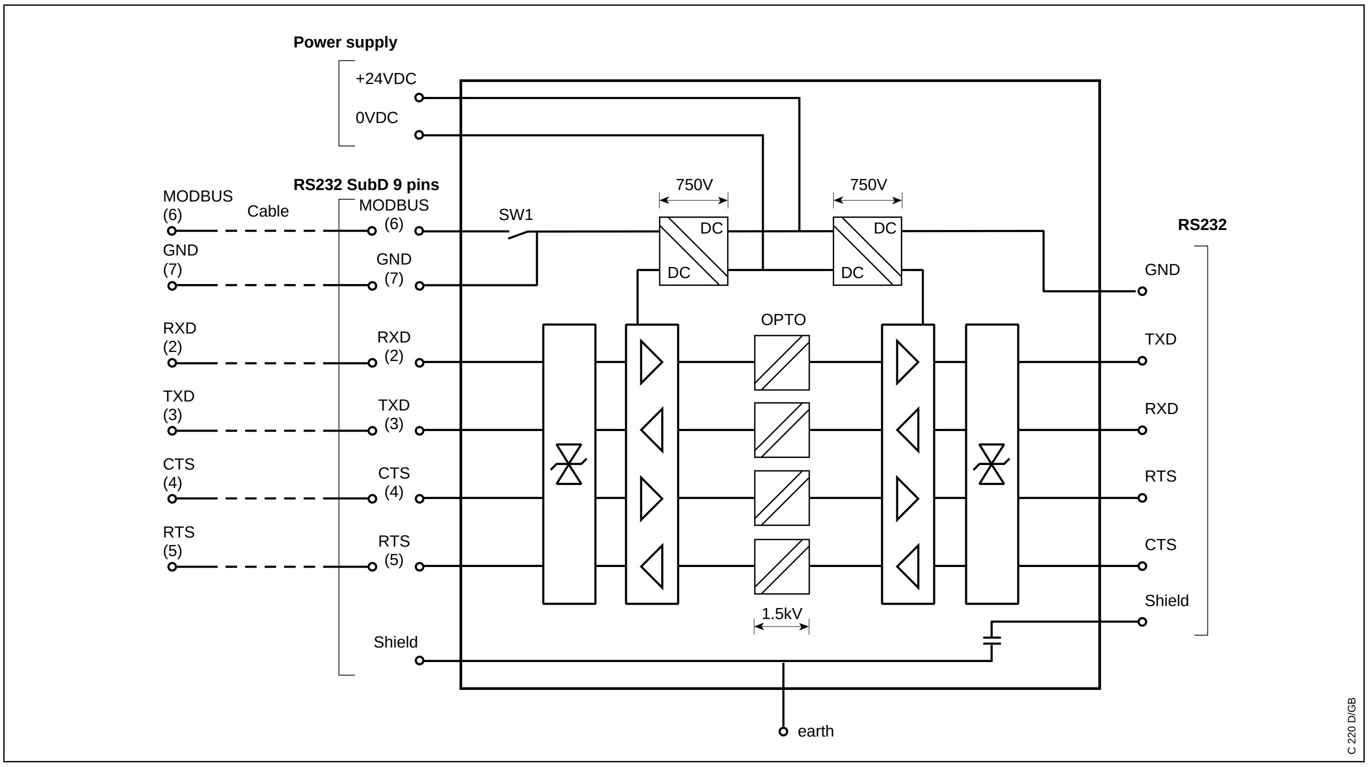
- Removable connector for 24VDC power supply .... ①
- Removable connector for RS232 interface .... ②
- SubD9 connector for RS232 interface .... ③
- Switch for MODBUS/ASCII or active modes.......... ④
- 1 green Led labelled "power" to indicate the presence of supply .... ⑤
- 1 green Led labelled "power" to indicate the presence of the isolated supply for RS232 interface .... ⑥
- 2 yellow Leds labelled "TXD" and "RXD" to indicate the data processing .... ⑦
- Cable for connection between the RS232 interface of NCC 232 and the RS232 interface of the CS31central units .... ⑧

TECHNICAL CHARACTERISTICS	
Power supply	24 VDC
Isolated power supply	yes
Maximum baud rate	19200
Maximum consumption	40 mA
Mechanical data :	
– Mounting on DIL rail	yes
– Width x height x depth	120x80x85
Order number	FPR3471000R0006
Weight	340g

RS232 SubD 9 interface characteristics	
Connector	SubD 9 male
Transfer signals	TxD, RxD
Handshake	RTS, CTS
Protocol	user specific

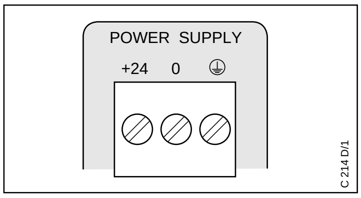
RS232 interface characterisitics	
Connector	removable
Isolated power supply	yes
Transfer signals	TxD, RxD
Handshake	RTS, CTS
Protocol	user specific
Range	max 15m
Cable :	
Connectors	subD 9 male-SubD 9 female
Lenght	33cm

● Electrical connections



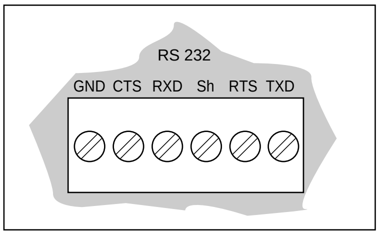
● Connectors assigment

Power supply

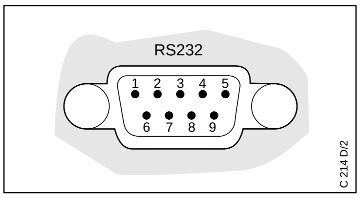


24VDC 0VDC Ground

RS232 interface



RS232 SubD 9 interface

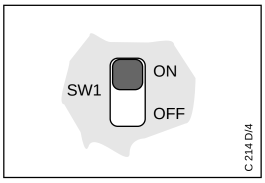


pin **1** : not used
pin **2** : RxD
pin **3** : TxD
pin **4** : CTS
pin **5** : RTS
pin **6** : MODBUS/ASCII (valid with switch SW1)
pin **7** : ground
pin **8** : not used
pin **9** : not used
(shield to the ground)

Cable

SubD 9 female .... SubD 9 male
1 1
2 2
3 3
4 4
5 5
6 6
7 7
8 8
9 9

● Configurations



SW1

– **OFF** : pin 6 is independant of pin 7

Active mode configuration for CS31 central units.

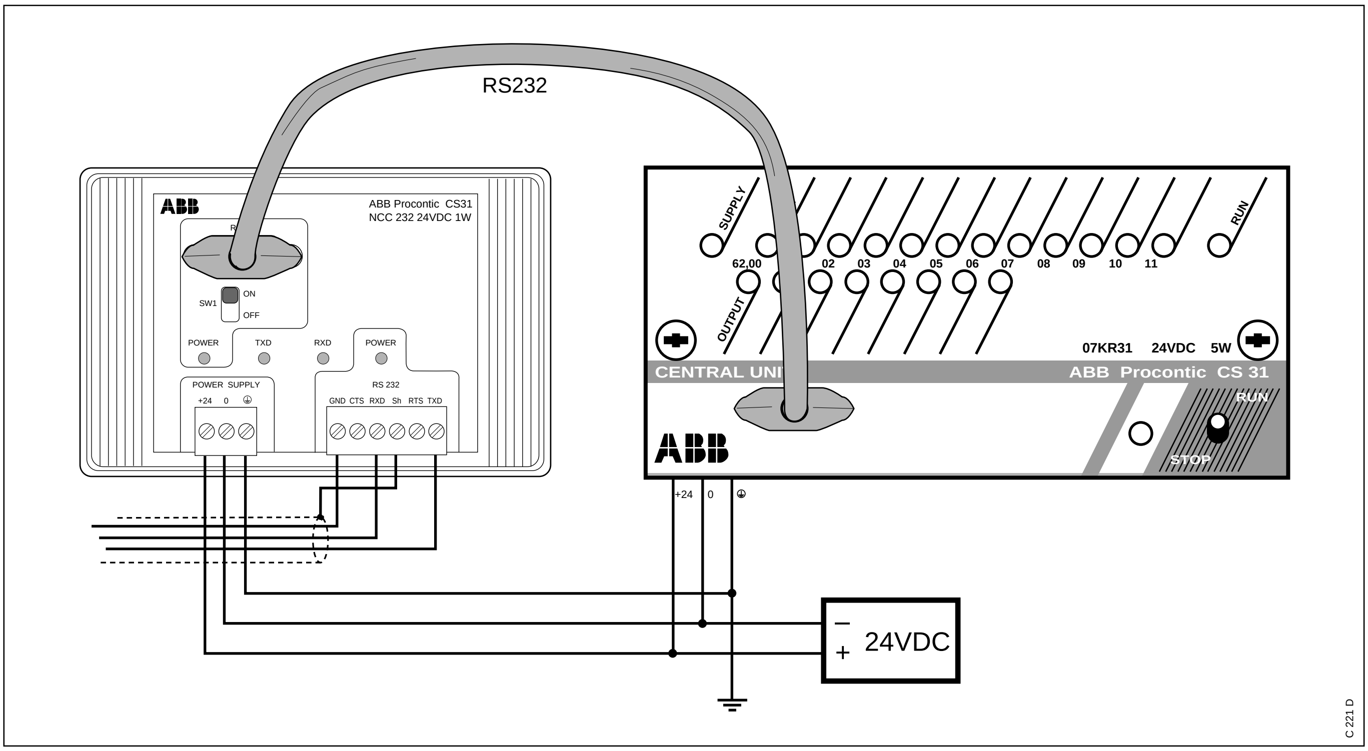
– **ON** : pin 6 is connected to pin 7

ASCII or MODBUS mode configuration according CS31 central units and value of the system constant KW00,06 (refer to central units descriptions).

● Installation

The NCC 232 has to be installed closed to the central unit with the specific cable or with a cable as short as possible.

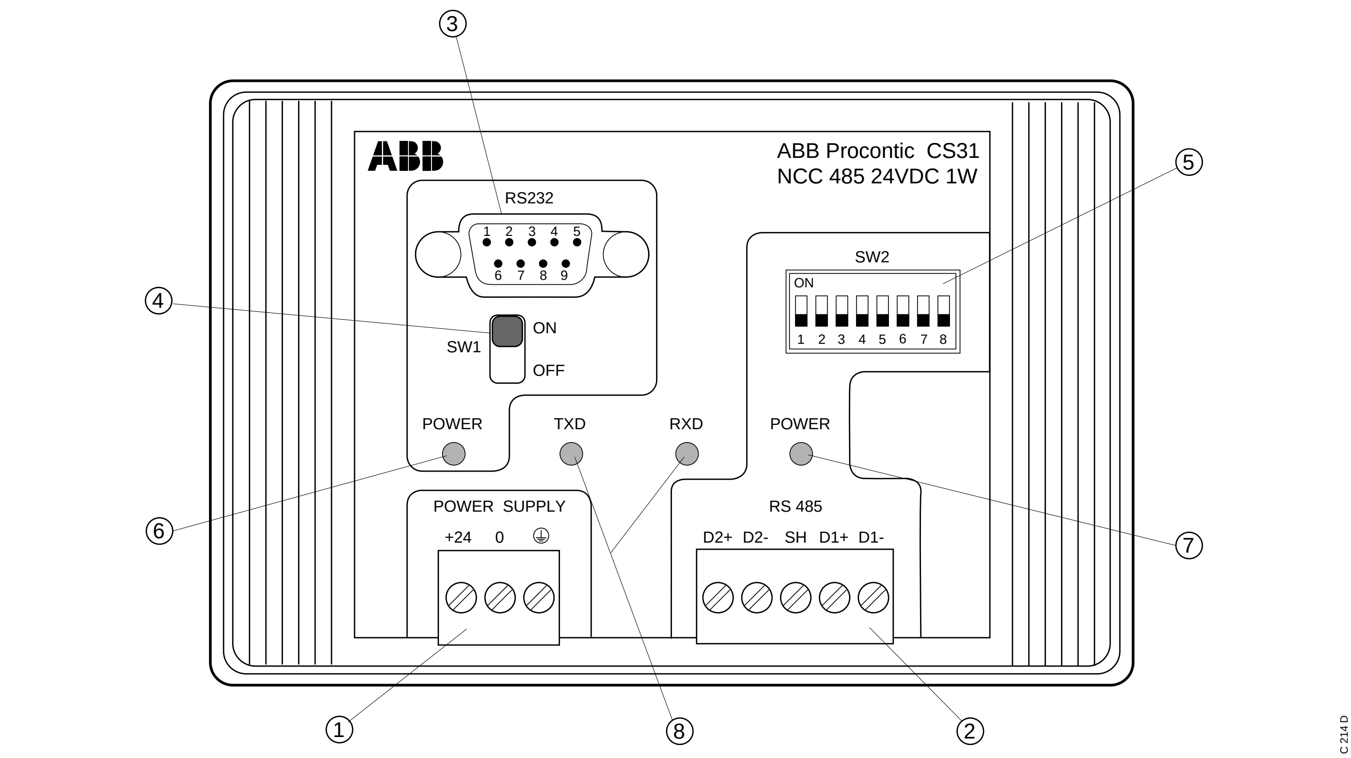
All EMC protection rules has to be applied (refer chapter 1.1.2 vol.2).



The 24 VDC power supply of the central unit can be used to supply only one unit NCC 232.

8.1.2 NCC 485 Serial line converters

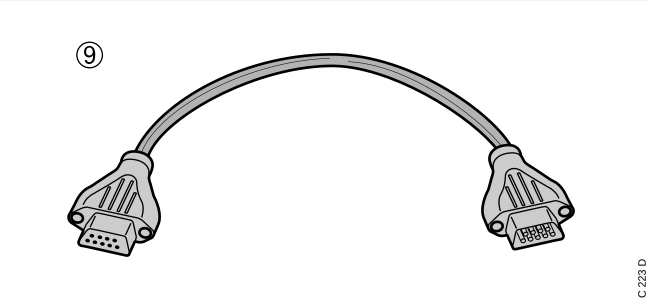
RS232/RS485 isolated converter



The NCC 485 module is an RS232/RS485 interface converter. It is the solution of transmission problems in industrial data communications.

The NCC 485 allows a isolated connection between two RS232 interface and an RS485 interface.
In half or full duplex protocol, the NCC 485 allows long ranges transfers, the creation of multiple point connection.

It is particulary adapted for the connection of the central units 07KR31 and 07KT31 to a MODBUS network.



Description

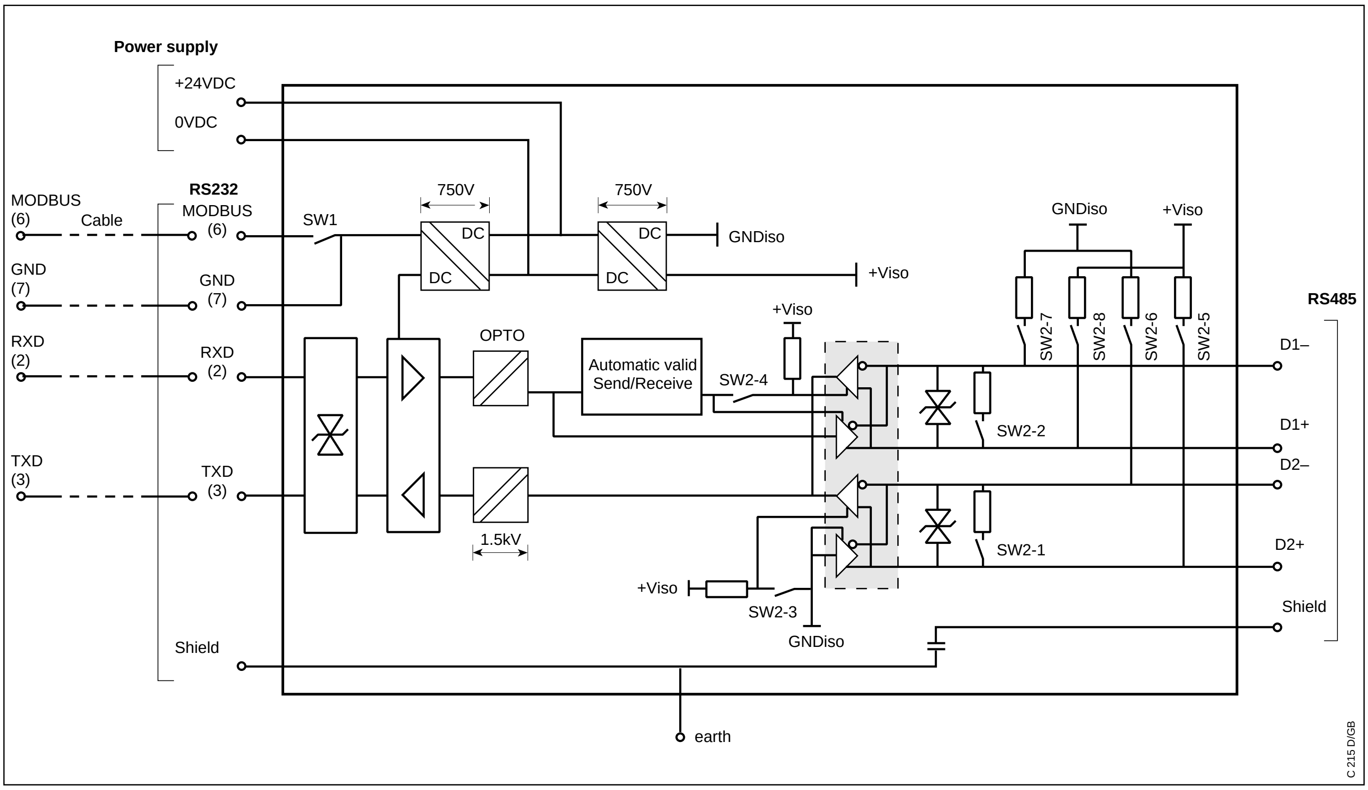
- Removable connector for 24VDC power supply .... ①
- Removable connector for RS485 interface .... ②
- SubD9 connector for RS232 interface ....③
- Switch for MODBUS/ASCII or active modes.......... ④
- Dip-switches for RS485 configuration.....................⑤
- 1 green Led labelled "power" to indicate the presence of supply ....⑥
- 1 green Led labelled "iso power" to indicate the presence of the isolated supply for RS485 interface ....⑦
- 2 yellow Leds labelled "TXD" and "RXD" to indicate the data processing ....⑧
- Cable for connection between the RS232 interface of NCC 485 and the RS232 interface of the CS31central units ....⑨

TECHNICAL CHARACTERISTICS	
Power supply	24 VDC
Isolated power supply	yes
Maximum baud rate	19200
Maximum consumption	40 mA
Mechanical data :	
– Mounting on DIL rail	yes
– Width x height x depth	120x80x85
Order number	FPR3471100R0006
Weight	340g

RS232 interface characteristics	
Connector	Sub D9 male
Transfer signals	TxD, RxD
Direction switching RS485	TxD
Delay	10µs at the begin of frame 2.2ms at the end
Protocol	user specific

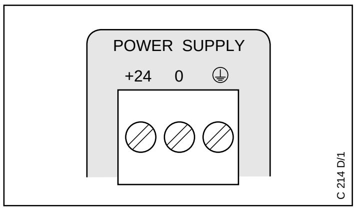
RS485 interface characteristics	
Isolated RS485 interface	yes
Half of full duplex communication	yes
Integrated resistance for impedance of end of line	yes
Maximum number of NCC 485 on RS485 line	32
Range	1200m twisted pair
Polarization line	yes per switch
Cable :	
Connectors	SubD 9 male-SubD 9 female
Lenght	33cm

● Electrical connections



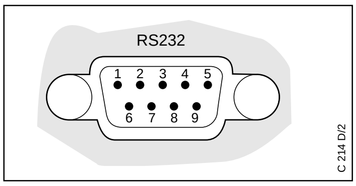
● Connectors assigment

Power supply



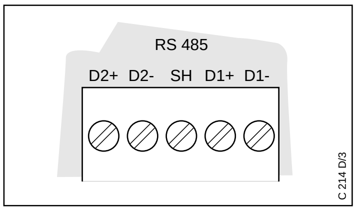
24VDC 0VDC Ground

RS232 interface



pin **1** : not used
pin **2** : RxD
pin **3** : TxD
pin **4** : not used
pin **5** : not used
pin **6** : MODBUS/ASCII (valid with switch SW1)
pin **7** : ground
pin **8** : not used
pin **9** : not used
(shield to the ground)

RS485 interface

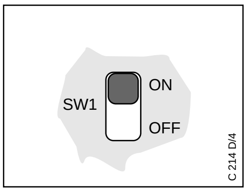


D1– : half/full duplex
D1+ : half/full duplex
SH : shield
D2– : full duplex
D2+ : full duplex

Cable

SubD 9 female	SubD 9 male
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

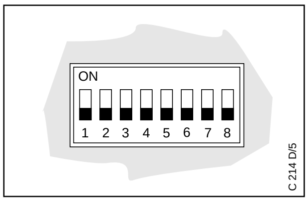
- **Configurations**



SW1

– **OFF** : pin 6 is independant of pin 7
Active mode configuration for CS31 central units.

– **ON** : pin 6 is connected to pin 7
ASCII or MODBUS mode configuration according CS31 central units and value of the system constant KW00,06 (refer to central units descriptions).



SW2

Dip-switch 1 :
– SW2-1 ON 120 Ohm resistor between D2+ and D2–
– SW2-1 has to be set to ON only if NCC 485 is installed at one of the ends of RS485 line.

Dip-switch 2 :
– SW2-2 ON 120 Ohm resistor between D1+ and D1–
– SW2-2 has to be set to ON only if NCC 485 is installed at one of the ends of RS485 line.

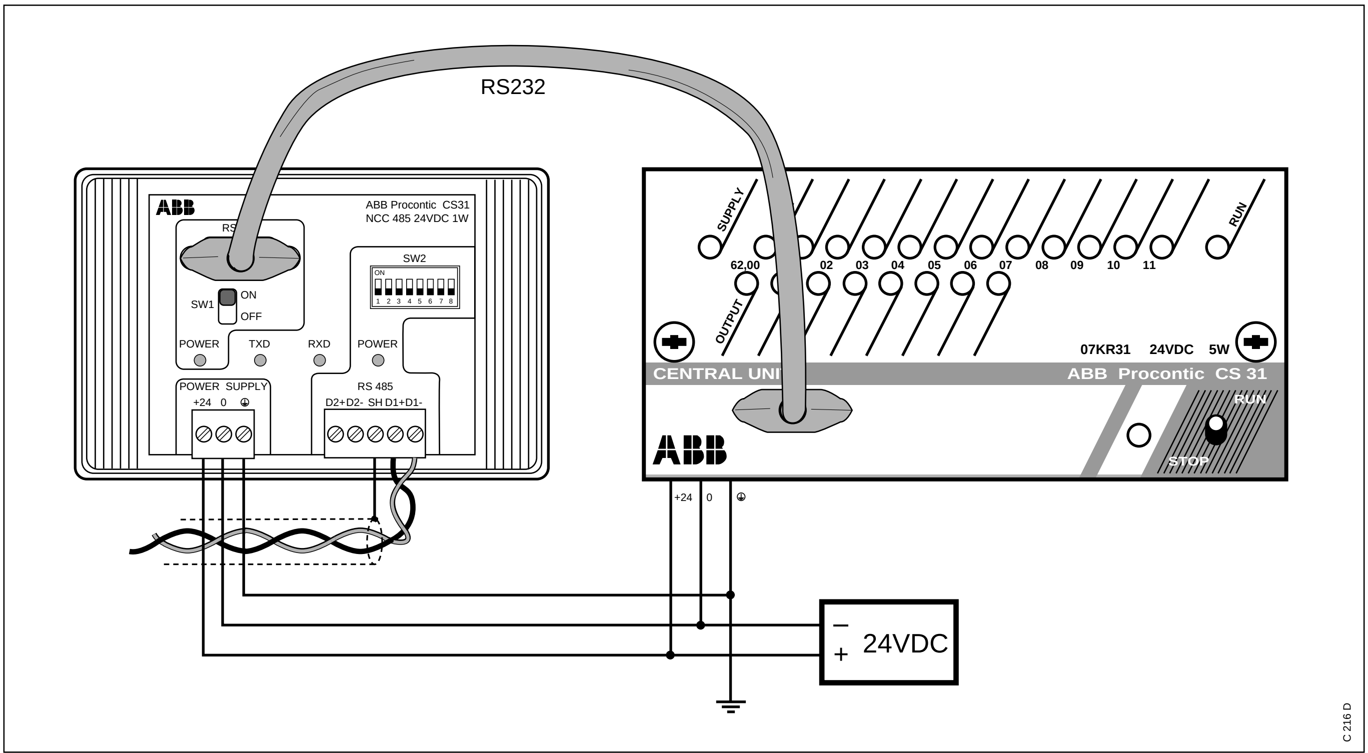
Dip-switch 3 : SW2-3	ON	OFF
Dip-switch 4 : SW2-4	OFF	ON
	full duplex	half duplex

Dip-switch 5 : SW2-5 ON polarization of D2+ line
Dip-switch 6 : SW2-6 ON polarization of D2– line
Dip-switch 7 : SW2-7 ON polarization of D1+ line
Dip-switch 8 : SW2-8 ON polarization of D1– line

Caution : The RS485 has to be polarized by only one of the participants.

● Installation

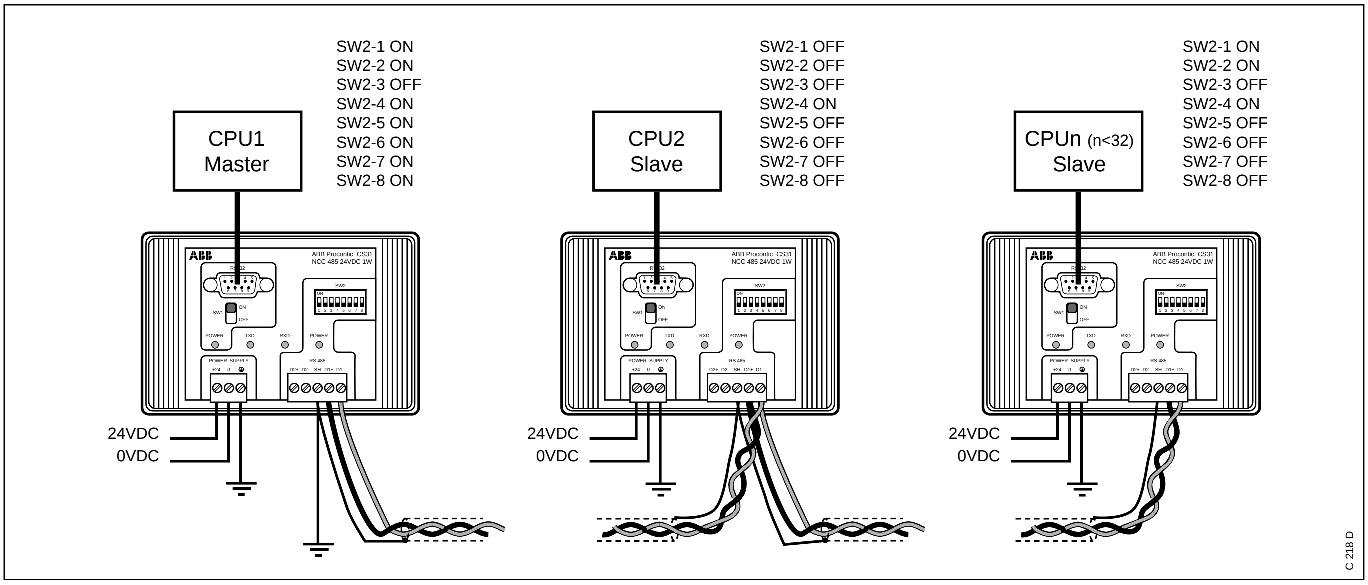
The NCC 485 has to be installed closed to the central unit with the specific cable or with a cable as short as possible. All EMC protection rules has to be applied (refer chapter 1.1.2 vol.2).



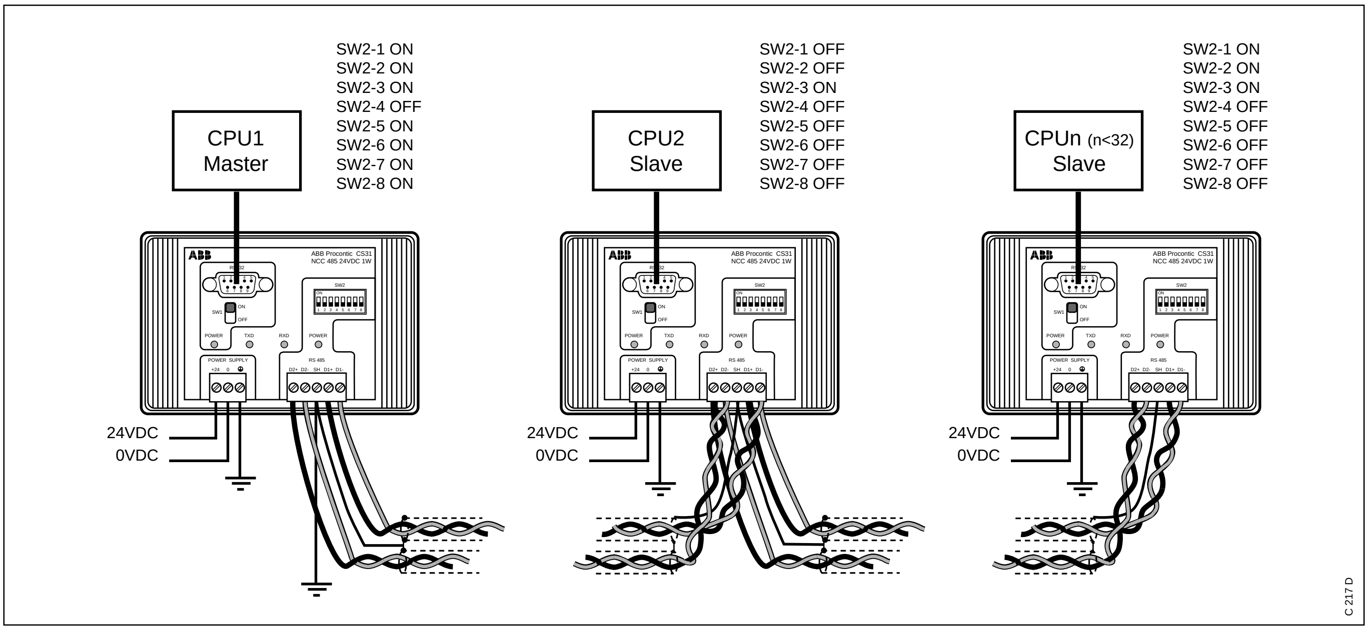
The 24 VDC power supply of the central unit can be used to supply only one unit NCC 485.

● **Configuration**

Half duplex configuration



Full duplex configuration



Handheld terminal TCZ

Order number FPR 3200002R1001

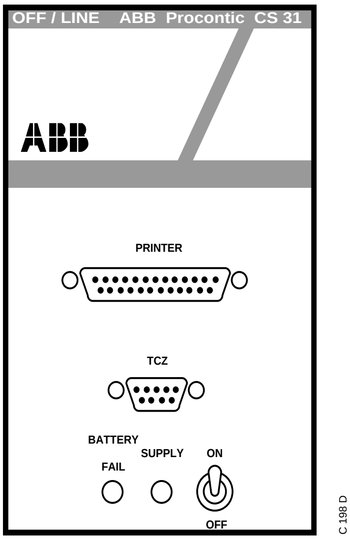
TCZ spare cable
Order number ABB : FPTN407548R0001

TCZ handheld teminal is used for programming and test of the central units type PCZB and CS20.

It can also be used for diagnosis configuration and setting of central units type UCZA/UCZB and 07KR31,07KR91 and 07KT92/93.

A back-up lithium battery is under a removable cover in the rear of TCZ.

8.3 TCZ adaptor "off-line" Material



TCZ adaptor "off-line"

Order number ABB : FPTN404958R0002

The TCZ adaptor supplies the supply voltage for the TCZ programming if it is running in the "off-line" mode (without connection to the central unit).

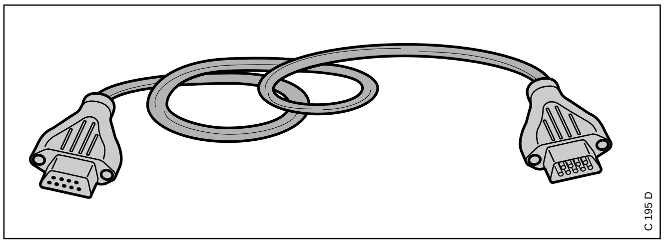
This adaptor is also used to connect the TCZ to a printer.

8.4.1 FPTN404948R0002

Programmation and test (Sub D9)

The system cable serves to connect all types of central units to a PC.AT for programming and test.

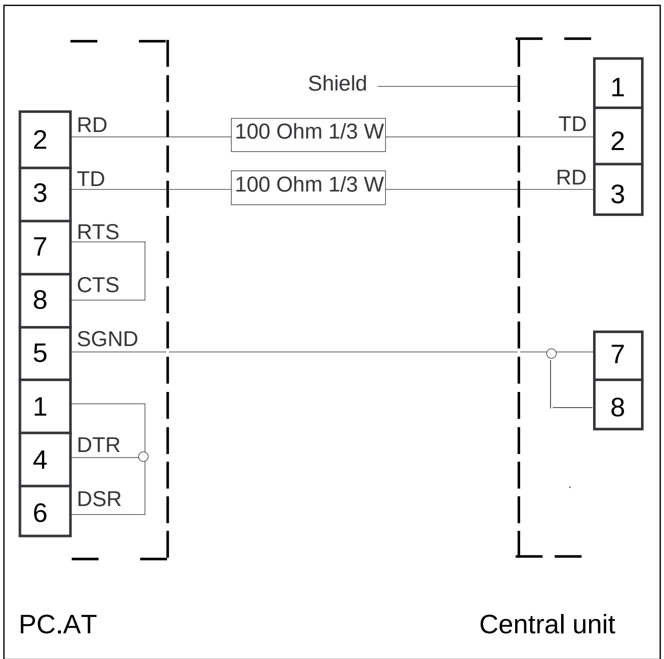
Connector :



– 9 pole sub. D connector pins central unit side.

– 9 pole sub. D connector sockets PC.AT side.

lenght : 2 meters

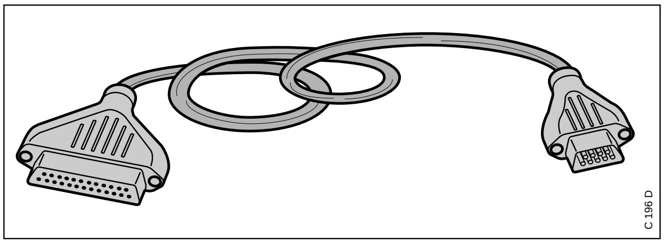


8.4.2 FPTN404948R0005

Programmation and test (SubD25)

The system cable serves to connect all types of CS31 central units to a PC.AT for programming and test.

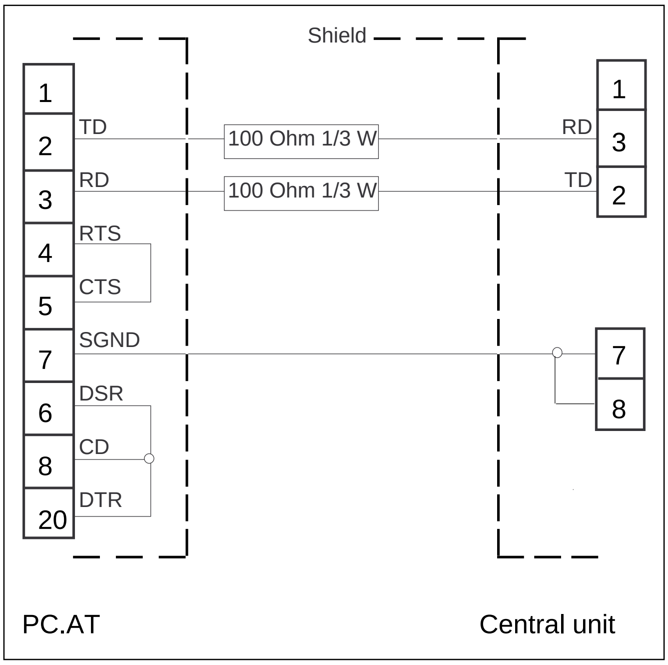
Connector :



– 9 pole sub. D connector pins central unit side.

– 25 pole sub. D connector sockets PC.AT side.

lenght : 2 meters

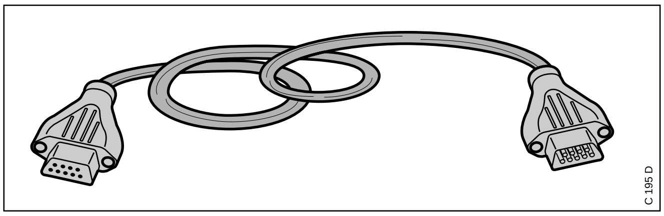


8.4.3 FPTN404948R0006

ASCII and MODBUS communication (Sub D9)

The system cable serves to connect all types of CS31 central units to 9 DB connector of an external device for ASCII communication (terminal, printer, etc...) or PC.AT. It must be used for MODBUS communication with 07 KR 31

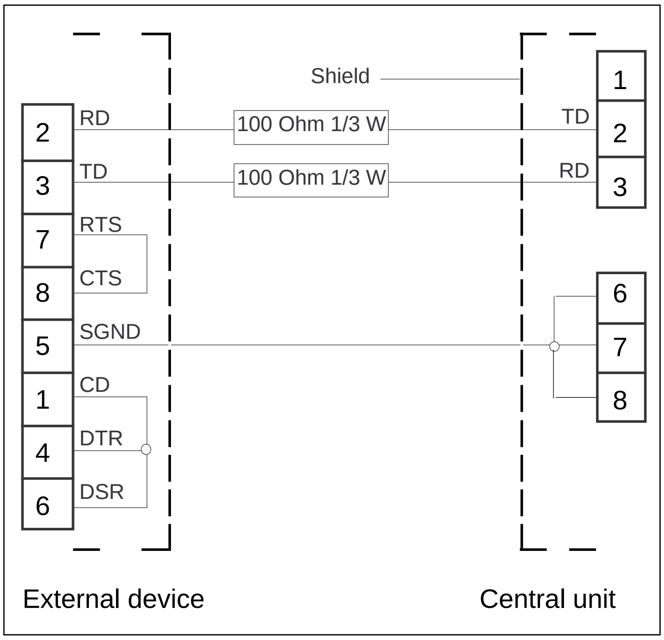
Connector :



– 9 pole sub. D connector pins central unit side.

– 9 pole sub. D connector sockets external device side.

lenght : 2 meters

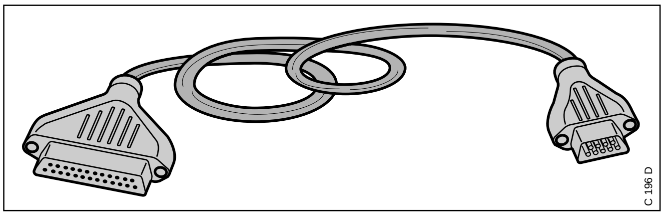


8.4.4 FPTN404948R0001

ASCII and MODBUS communication(SubD25)

The system cable serves to connect all types of CS31 central units to 25 DB connector of an external device for ASCII communication (terminal, printer, etc...) or PC.AT. It must be used for MODBUS communication with 07 KR 31

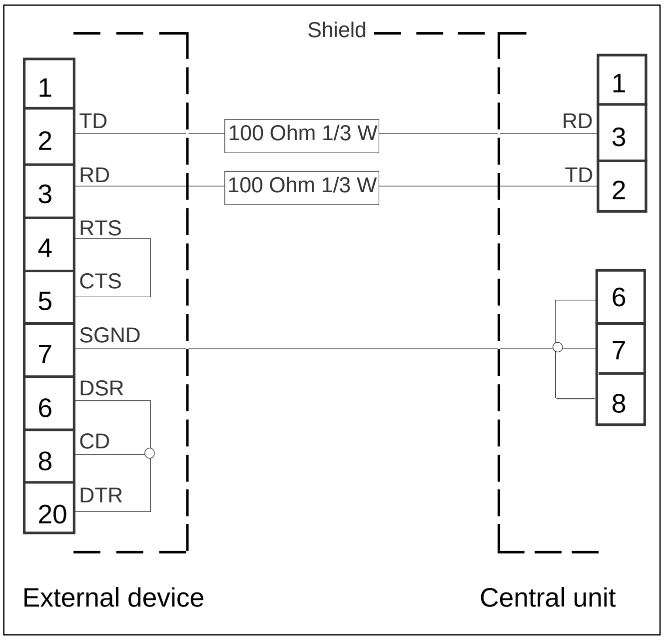
Connector :



– 9 pole sub. D connector pins central unit side.

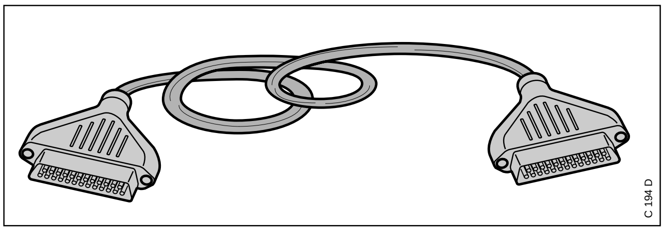
– 25 pole sub. D connector sockets external device side.

lenght : 2 meters



8.4.5 FPTN404948R0004
Communication TCZ adaptor-printer 07DR12.

25 pole sub. D connector pins printer side.
25 pole sub. D connector pins TCZ adaptor side.



1	1
2	2
3	3
7	7
20	20

External device Central unit

8.5 Batteries — Material

– Lithium battery for UCZA/UCZB :
  Order number ABB : FPTN404949R001

– Lithium battery for TCZ :
  Order number ABB : FPTN404949R002

– Spare battery (5 V) for the battery module for TCZ :
  Order number ABB : FPTN404949R003

Chapter	Description	Page

9.1 Internal diagnosis

9.1.1 General

All modules execute automatic diagnosis tests, which are specific to the unit type.

On the occurence of a fault, the red led next to the test button is illuminated.

– Led constant : fault stored
– Led flashing : remote unit not initialized (occurs during power on).

The fault codes are displayed on the led's of the unit.

9.1.2 Use of "TEST" push-button

The "TEST" push-button enables the type of fault and the channel on which it occurred to be displayed by a code on the I/O status led's.

Faults can be deleted with the "TEST" push-button if the fault condition no longer exists.

Use of test function:

– Press the push-button, the led of the selected channel will flash (channel 0, 1, etc...).

– On releasing the "TEST" push-button the diagnosis information for the selected channel is displayed.

– Press the "TEST" push-button again to obtain the information for the same test on the next channel.

– Press the "TEST" push-button after the last channel to test all the led indicators.

On releasing the "TEST" push-button the dil switch setting of the plug-in base is displayed on the led's 0-7 (ICSM06A6 and ICSA04B5 led's 0 to 5).

– Pressing the "TEST" push-button for more than 10 seconds clears all of the stored faults.

9.1.3 Sum up the diagnosis

The units can execut the diagnosis functions displayed:

A - Binary input/output units

Led 0 - Unit error
Led 1 - Bus error
Led 2 -
Led 3 - Cut wire
Led 4 - Overload
Led 5 - Short circuit
Led 6 - OUTPUT Output channel
Led 7 - INPUT Input channel

Units	Led 0	Led 1	Led 2	Led 3	Led 4	Led 5	Led 6	Led 7
ICSI 08 D1	X	X		X				X
ICSI 16 D1	X	X		X				X
ICSI 08 E1	X	X						X
ICSI 16 E1	X	X						X
ICSI 08 E3/E4	X	X						X
ICSC 08 L1	X	X		X	X	X	X	X
ICFC 16 L1	X	X		X	X	X	X	X
ICSK 20 F1	X	X						X
ICSO 08 R1	X	X					X	
ICSO 08 Y1	X	X		X*	X	X	X	
ICSO 16 N1	X	X			X			

* no power supply in 24 VDC for the outputs

B - Analogue units

Led 0 - Unit error
Led 1 - Bus error
Led 2 - 10 V fail
Led 3 - Output error
Led 4 - 4-20 In case of ICST 08 A8/A9
Led 5 - ± 10 V Led 4 : out of range
Led 6 -
Led 7 -

Units	Led 0	Led 1	Led 2	Led 3	Led 4	Led 5	Led 6	Led 7
ICSM 06 A6	X	X	X	X	X	X		
ICSE 08 A6	X	X			X			
ICSE 08 B5	X	X			X	X		
ICSA 04 B5	X	X		X	X	X		
ICST 08 A8	X	X			X			
ICST 08 A9	X	X			X			

C - High speed counter

Led 0 - Unit error
Led 1 - Bus error
Led 2 -
Led 3 - Overflow
Led 4 - Overload
Led 5 - Short circuit
Led 6 -
Led 7 -

Units	Led 0	Led 1	Led 2	Led 3	Led 4	Led 5	Led 6	Led 7
ICSF 08 D1	X	X		X	X	X		

D - Robot coupler card

Led 1 - Bus error	No initialization on CS31 bus
Led 2 - Unit error	No initialization on robot

Led 3 -
Led 4 - ROM error
Led 5 - External RAM error
Led 6 - Internal RAM error
Led 7 - Microprocessor error
Led 8 - Other error

Cards	Led 1	Led 2	Led 3	Led 4	Led 5	Led 6	Led 7	Led 8
ICBG 32 L7	X	X		X	X	X	X	X
ICBG 64 L7	X	X		X	X	X	X	X
ICBG 32 M7	X	X		X	X	X	X	X
ICBG 64 M7	X	X		X	X	X	X	X

E - Remote display TCDA

No led
A message on the remote display TCDA appear in of case deconnection on the CS 31 bus

F - CS 31 bus units

9.2 Open circuit detection

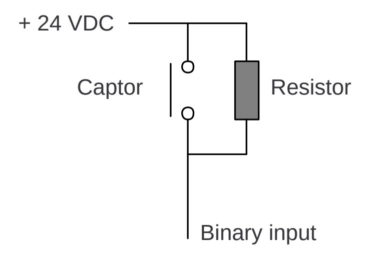
Open circuit detection is configurated by user program or TCZ.

9.2.1 Detection for inputs

A resistor has to be mounted in parrallele of the input captor.

With an inductive captor, the minimal current is 1mA.

Resistor : from 20 kOhm to 30 kOhm



Open circuit detection

9.2.2 Detection for outputs

The detection is done by analysing the current consumption.

9.3 Overload and short-circuit

A - Overload

Detection for I>I overload for a time T, output is momentanely opened (The value is written in the technical description of each module).

B - Short-circuit

When I>I short-circuit, the output is reset to "0" up to a quit of the fault (The value is written in the technical description of each module).

9.4 Diagnosis of the various central units

All details of the failures described above can be reached in the central units by the fonction MAILBOX or in specific diagnosis variables (cf central units descriptions).

ABB CS31

Intelligent decentralized automation system

Central processing units 07 KR 31 / 07 KT 31

ABB Control

Contents

07 KR 31 / 07 KT 31
Central processing units

FPTC 404 396 P0001-e

MODBUS® is a registered trademark of GOULD Inc.

The central units 07 KR 31 and 07 KT 31 work either as:

- **Bus master** in the decentralized automation system ABB Procontic CS31 or as
- **Intelligent I/O** (Slave remote processor) in the decentralized automation system ABB Procontic CS31 or as
- **Stand-alone central unit.**

The 07 KR 31 and 07 KT 31 have a 24 V d.c. or 120 V a.c. or 230 V a.c. power supply voltage.

Main features :

- **12 binary inputs**
- **8 binary relay outputs for the 07 KR 31 unit**
  8 binary transistor outputs for the 07 KT 31 unit
- **1 supply output regulated 24V d.c.** for the versions 120V a.c. and 230V a.c.
- **1 counting input for counting frequencies up to 10 kHz**
- **1 CS31 system bus interface for system expansion**
- **Serial interface COM1 :**
  - is set as programming interface
  - can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
  - can be set as a MODBUS interface : master and slave.
- **Real-time clock**
- **LED's** for displaying the binary input and output signals as well as operating conditions and error messages.
- **Wiring on the plug-in base ECZ**
- **Password for user program**
- **Store and back-up datas** which is additionally contained in the RAM, e.g. the status of flags
  - back-up the time and date (real-time clock)
- **RUN/STOP** switch for starting and aborting the program execution
- **Extensive diagnosis functions**
  - Self-diagnosis of the central unit
  - Diagnosis of the ABB Procontic CS31 system bus and the connected remote units.

The following has to be observed for project planning and start-up :

- **Programming** is performed using ABB Procontic programming software, which can be run on commercially available IBM compatible PCs (see documentation for programming system 907 PC 331).

- **Diagnosis and service device TCZ** (terminal mode) (see volume 7.3, see chapter 9 "**Programming and test**" and chapter 3.5 "**serial interface**")

  The processor processes the user program contained in the RAM. It is loaded into the RAM via the serial interface COM1 and can also be changed there. An additional save command is used to save the program in the EEPROM.

NOTE : In the course of the following operations

- Power "**ON**"
- **RUN/STOP** switch from **STOP** —> **RUN**
- Program start-up with programming system
- Cold start of the PLC

The RAM is overwritten by the contents of the EEPROM.

- **On-line program modification**
  The two existing RAMs allow a quick modification of the user program to be performed without interrupting the operation (see chapter 9.1 ON-LINE modifications or see ABB programming system 907 PC 331).

- **Change-over between the application modes**
  - Stand-alone central unit
  - Bus master central unit and
  - Intelligent I/O remote unit (Slave central unit)

  The central unit is set to "Stand-alone" upon delivery. Changing the application mode is carried out in the following three steps :

  1. Change the system constant KW 0,0 in the PLC, (see chapter 1.4 "**Operands**" § System constants).

  2. Save the user program in the EEPROM.

  3. Activate new application mode by :
     - calling up the menu item of "Enable PLC mode" in the ABB programming and test system or
     - performing a warm start or
     - performing a cold start.

- **Setting the cycle time**
  (see chapter 5 "**Processing times**")

- **Addressing when remote units are connected**
  (see chapter 6 "**Addressing**")

- **Initialisation of data storage areas**

  System constants can be used to determine which data areas are to be initialised with the value of "0" *during program start-up*. A specific initialization is possible for the following areas. It is also possible to initialize partial areas only :
  - Binary flags
  - Word flags
  - Double word flags
  - Step chains
  - Historical values
    (see chapter 1.4 "**Operands**" § System constants)

- **Reactions on errors of error class 3**

  The user can configure whether or not the user program is to be aborted automatically, if an class 3 error occurs, (see chapter 1.4 "**Operands**" § System constants).

- **Starting-up the CS31 system after power ON**

  The user can enter a number of *n* remote units in system constant KW 0.9. The user program starts only i.e. it handles process inputs and ouputs only, if at least *n* remote units have been adopted into the CS31 system bus cycle, (see chapter 1.4 "**Operands**" § System constants).

1.2 07 KR 31 / 07 KT 31 Technical characteristics
Central processing units

GENERAL CHARACTERISTICS		
Power supply of 07 KR 31 / 07 KT 31	24 VDC	230 VAC / 120 VAC
Number of inputs per unit	12	12
Number of outputs per unit	8	8
Isolated power supply	no	yes (1500 VAC)
Maximum consumption	0.3 A	10 VA
Order numbers : FPR3600227 for 07 KR 31	R1202	R0206/R0204
FPR3600228 for 07 KT 31	R1202	R0206/R0204
Weight (kg)	0.25	0.43

INPUT CHARACTERISTICS		
Opto isolated inputs	no	no
Signal level of the inputs, nominal value	24 VDC	24 VDC
Signal level of the input		
0 signal	-3 to +5V	-3 to +5V
1 signal	+15 to +30V	+15 to +30V
Input current for 24 VDC	5 mA	5 mA
Input delay (*)	5 ms	5 ms

(*) This delay can't be modified

OUTPUT CHARACTERISTICS FOR 07 KR 31

Isolated	yes	yes
Switching capacity under 2 A (resistive or inductive load)		
120/230 VAC 50/60Hz	2 A	2 A
DC	60 W (2A)	60 W (2A)
Nominal current	2 A AC-1 1 A AC-3	2 A AC-1 1 A AC-3
Minimum power for the contacts	12 VDC	12 VDC
10 mA	10 mA	
Supply output 24 VDC 100 mA	no	yes
Total curent		
Common M-Q		
120/230 VAC 50/60Hz	6 A	6 A
24 VDC	6 A	6 A
Common R-T		
120/230 VAC 50/60Hz	4 A	4 A
24 VDC	4 A	4 A
Short-circuit protection	no	no
Over voltage protection	Varistor	Varistor

OUTPUT CHARACTERISTICS FOR 07 KT 31

Isolated	no	no
Switching capacity under 0,5 A (resistive or inductive load)	0,5 A	0,5 A
24 VDC	15 W (0,5 A)	15 W (0,5 A)
Nominal current	0,5 A	0,5 A
Supply output regulated 24 VDC (± 5 %) 100 mA	no	yes
Total curent for 8 outputs	4 A	4 A
Short-circuit protection for each output	Yes	Yes
Thermal protection for each outpout	Yes	Yes
2 A with 25 °C ambient		
1.5 A with 55 °C ambient		
Over voltage protection	Yes	Yes

1.3 07 KR 31 / 07 KT 31 Central processing units — Overview of possibilities

Program memory	EEPROM Typ. 2 kinst. (8 kbytes)
Cycle time	6 ms/kinst. bits 30 ms/kinst. words
Binary inputs	12 integrated 744 external
Binary outputs	8 integrated outputs 496 external
Analog inputs	224
Analog outputs	48
Serial interface	1 RS232C 1 RS485 (reserved for CS31 bus)
High speed counter	1 (10 kHz) (using the first binary input of the central unit)
Real time clock	1
Password	yes
On-line programmation	yes
Communication protocol	ASCII MODBUS : master and slave
Binary flags	512
Word flags	256
Double word flags	32
Word constants	128
Double word constants	32
Sequencers (steps)	256
Diagnosis bit	16
Diagnosis words	32
Timers	illimited (only 42 running at the same time)
Counters	illimited
Boolean and arithmetic functions	yes
Software functions	more than 30 (see chapter 1.5 "**Software functions**")

NOTE : The number of inputs/outputs is the number of available I/O in the central unit. The number of physical inputs/outputs depends on the type of remote units (maxi 31 units).

1.4 07 KR 31 / 07 KT 31 Central processing units — Operands (variables and constants)

● Available variables and constants

– Inputs

E 00,00…E 61,15	:	Binary inputs, CS31 remote units
E 62,00…E 62,11	:	Binary inputs of the central unit 07 KR 31 or 07 KT 31
E 63,14	:	High-speed binary inputs (T_D = 0.02 ms), signal is identical to E 62,00
E 63,13	:	High-speed counter, interrogation of "Zero crossing"
EW 00,00…EW 05,15	:	Analog inputs, CS31 remote units
EW 08,00…EW 15,15	:	Analog inputs, CS31 remote units
EW 06,15	:	High-speed counter, interrogation of the counter content
EW 07,00…EW 07,07	:	Reserved
EW 07,08…EW 07,14	:	Reading of the real-time clock
EW 07,15	:	Status for CS31 system bus

– Outputs

A 00,00…A 61,15	:	Binary outputs, CS31 remote units
A 62,00…A 62,07	:	Binary outputs of the central unit 07 KR 31 or 07 KT 31
A 63,15	:	High-speed counter, adoption of start value
AW 00,00…AW 05,15	:	Analog outputs, CS31 remote units
AW 06,15	:	High-speed counter, "Start value"

– Internal operands

M 00,00…M 21,15 M 230,00…M 239,15	:	Binary flags
M 255,00…M 255,15	:	Diagnosis flags
S 00,00…S 15,15	:	Steps
K 00,00…K 00,01	:	Binary constants
MW 00,00…MW 5,15 MW 230,00…MW 239,15	:	Word flags
MW 254,00…MW 255,15	:	Diagnosis words
KW 00,00…KW 07,15	:	Word constants
MD 00,00…MD 01,15	:	Double word flags
KD 00,00…KD 01,15	:	Double word constants

– Time values for time functions

KD yy,xx : Time values for time functions such as ESV, ASV etc. are configured as *double word constants* or
MD yy,xx : *as double word flags*. Only integral multiples of 5 ms are permitted.

● System constants / diagnosis flags / CS31 status (overview)

– Setting the operating modes

The constants KW 00,00…KW 00,15 are reserved as system constants. Even the constants KW 00,12…KW 00,15 which are not used yet may *under no circumstances* be used for other purposes.

KW 00,00	:	Setting the central unit operating modes, (Stand-alone central unit, Master central unit, Slave central unit)
KW 00,01	:	Initialization : bit flag area
KW 00,02	:	Initialization : word flag area
KW 00,03	:	Initialization : double word flag area

KW 00,04	:	Initialization : step chain flag area
KW 00,05	:	Initialization : historical values
KW 00,06	:	Application modes of the serial interface COM 1
KW 00,07	:	Central unit reaction to class 3 errors
KW 00,08	:	Not used
KW 00,09	:	Initialization of the CS31 system after power ON, warm start or cold start
KW 00,10	:	Size of the transmitting area of the slave central unit
KW 00,11	:	Size of the receiving area of the slave central unit

– Setting the cycle time

KD 00,00 : The cycle time of the central unit program is preset with this constant. The cycle time is given in the unit of measurement milliseconds. Only integral multiples of 5 ms are permitted. The maximal value allowed in master configuration is 100 ms and in slave configuration 250 ms.

– Error diagnosis

Summation error display		:	M 255,10 indicates, that the central unit has detected an error
Fatal error,	FK1	:	M 255,11 = 1 i.e. error detected, detailed information in MW 254,00…MW 254,07
Serious error,	FK2	:	M 255,12 = 1 i.e. error detected, detailed information in MW 254,08…MW 254,15
Light error,	FK3	:	M 255,13 = 1 i.e. error detected, detailed information in MW 255,00…MW 255,07
Warning,	FK4	:	M 255,14 = 1 i.e. error detected, detailed information in MW 255,08…MW 255,15

– First-cycle detection

M 255,15

This binary flag can be used for detection of the *first* program cycle after a program start. It is always set to "zero" after each program start, independent of the initialization instructions given by the system constants. If this flag is read by the user program and then set to "1", it can be found out whether or not the user program was started once more.

– CS31 status word

EW 07,15

Bit 0 = 1	:	No class 2 error present.
Bit 1 = 1	:	Central unit has been adopted into the CS31 bus cycle (only relevant if used as a slave).
Bit 2	:	Not used.
Bit 3 = 0	:	Battery failure.
Bits 4…7	:	Not used.
Bits 8…15	:	Maximum number of modules on the CS31 system bus, found out until now (only relevant if used as a master).

– Real time clock

EW 07,08	second (0..59)
EW 07,09	minute (0..59)
EW 07,10	hour (0..23)
EW 07,11	day of the week (1..7)
EW 07,12	day
EW 07,13	month (1..12)
EW 07,14	year (0..99)

Time and date are set by using the UHRS command in the terminal mode or by using the function block UHR in a program.

● System constants / Setting of operating modes

– Definitions

At first, the definitions used with the setting of operating modes are explained :

– Cold start
– Warm start

1°) Cold start

– All of the RAM memories are tested and deleted.

– If there is *no user program* in the EEPROM, the default values are set to all of the system constants (identical to the factory settings).

– The operating modes given by the system constants are set.

– The CS31 system bus is initialized again (only when used as a master on the CS31 system bus).

Performing a cold start

– Command KALT <CR> in terminal mode (see volume 7.3) or

– Menu field "Cold start" in the programming system.

2°) Warm start

– All of the RAM memories, with the exception of the program memory and the operand memory (flags), are tested and deleted.

– If there is a *user program* in the EEPROM, this program is loaded into the RAM including the system constants.

– The operating modes given by the system constants are set.

– The CS31 system bus is initialized again (only when used as a master on the CS31 system bus).

Performing a warm start

– Power OFF/ON, or

– Command WARM <CR> in terminal mode (see volume 7.3) or

– Menu field "Enable PLC mode" in the programming system.

● Operating mode : Master central unit, Slave central unit or Stand-alone central unit

– Absolute identifier : KW 0,0

– Symbolic identifier : MAST_SLV

– Meaning of the values of the constant :
- Master central unit at the CS31 system bus –1 ($FFFF_H$)
- Stand-alone central unit –2 ($FFFE_H$)
- Slave central unit at CS31 system bus : CS31 unit addresses 0…61,100

If the value = 100 : the address is given by the switches of ECZ.

– Range of values : –2, –1, 0…61,100

– Default value : –2 (Stand-alone)

Important !

The change of the central unit operation mode is carried out in three steps :

1. Change system constant KW 0,0 in the central unit.
2. Save user program in the EEPROM.
3. Activate new central unit operating mode with the following steps :

– Call menu point "Enable PLC mode" in the ABB programming and test system or

– perform a warm start or

– perform a cold start.

● Back-up of data areas

Back-up of data areas, i.e. saving of data during power OFF/ON, is onlyfeasible with built-in battery. The following data can be backed, completely or partly :

– Binary flags
– Words flags
– Double word flags
– Step chains
– Historical values

In order to back-up certain data, they have to be excluded from initialization to 0.

● Initialization of data areas

During program start, that data areas are initialized to 0 partly or completely, that are defined by system constants. The initialization works as shown in the following table.

An external battery is not necessary (see §3.4 Battery).

Conditions, --> Action	Flags, step chains, and historical values which are initialized (set to 0)
Menu item --> Abort -->Cold start	all
RUN/STOP switch to RUN, --> Power ON	according to the values of the system constants (see below)
RUN/STOP switch, --> RUN	
Menu item --> Abort --> Start	

- **Initialization : Binary flags**
  - Absolute identifier : KW 0,1
  - Symbolic identifier : INIT_M

Value n of the system constant KW 00,01	Binary flag areas which are initialized (set to 0)
n = 0 (default)	M 000,00...M 021,15 M 230,00...M 239,15 M 255,00...M 255,15
n = 1...21	M n,00...M 021,15 M 230,00...M 239,15 M 255,00...M 255,15
n = 22...229	M 230,00...M 239,15 M 255,00...M 255,15
n = 230...239	M n,00...M 239,15 M 255,00...M 255,15
n = 240...255	M 255,00...M 255,15
n < 0, n > 255	M 255,10...M 255,15

- Example : KW 00,01 = 20
  Bits initialized : M 020,00...M 021,15
  M 230,00...M 239,00
  M 255,00...M 255,15
  Bits backed : M 000,00...M 019,15

- **Initialization : Word flags**
  - Absolute identifier : KW 0,2
  - Symbolic identifier : INIT_MW

Value n of the system constant KW 00,02	Word flag areas which are initialized (set to 0)
n = 0 (default)	MW 000,00...MW 005,15 MW 230,00...MW 239,15 MW 254,00...MW 255,15
n = 1...5	MW n,00...MW 005,15 MW 230,00...MW 239,15 MW 254,00...MW 255,15
n = 230...239	MW n,00...MW 239,15 MW 254,00...MW 255,15
n = 240...253	MW 254,00...MW 255,15
n = 254...255	MW n,00...MW 255,15
n < 0, n > 255	no initialization

- **Initialization : Double word flags**
  - Absolute identifier : KW 0,3
  - Symbolic identifier : INIT_MD

Value n of the system constant KW 00,03	Double word flag areas which are initialized (set to 0)
n = 0 (default)	MD 000,00...MD 01,15
n = 1	MD n,00...MD 01,15
n < 0, n > 1	no initialization

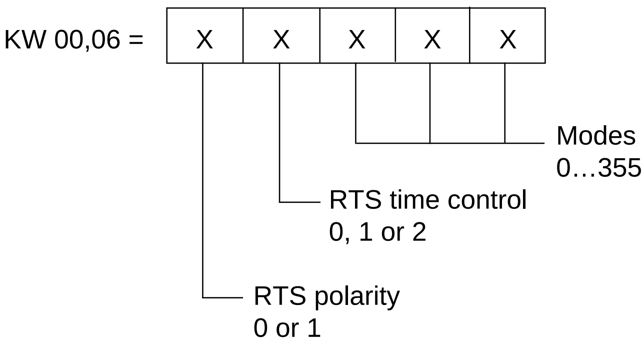
- **Initialization : Step chains**
  - Absolute identifier : KW 0,4
  - Symbolic identifier : INIT_S

Value n of the system constant KW 00,04	Step chain areas which are initialized (set to 0)
n = 0 (default)	S 000,00...S 15,15
n = 1...15	S n,00...S 15,15
n < 0, n > 15	no initialization

- **Initialization : Historical values**
  - Absolute identifier : KW 0,5
  - Symbolic identifier : INIT_VW

Value n of the system constant KW 00,05	Historical values which are initialized (set to 0)
n = 0 (default)	Initialization of all historical values
n < 0, n > 0	no initialization

- **Application mode : Serial interface COM1**
  - Absolute identifier : KW 00,06
  - Symbolic identifier : MODE_SST
  - Meaning of the values of the constant :



- Modes :

Active mode :	1
Passive mode (MMC) :	2
The status of pin 6 applies :	<0, =0, >2
MODBUS slave mode :	101…355
pin 6 applies	
MODBUS address :	1…255
MODBUS master mode :	100
pin 6 applies	

- Delay modification on RTS signal : 1000...1355
  2000…2355

- RTS signal inverted : 10000...12355

– Range of values : 0, 1, 2, 100…355
  (modulo 1000 or 10000)

– Default value : 0
  i.e. the application mode of the serial interface is determinated by the status of pin 6 of the interface connector.

A change of this system constant becomes effective :

– immediately.

● **PLC reaction to class 3 errors**

– Absolute identifier : KW 0,7

– Symbolic identifier : FK3_REAK

– Meaning of the values of the constant :
  Just output error : 0
  Output error and
  abord PLC program <0, >0

– Range of values : <0, =0, >0

– Default value : 0
  i.e. just output error.

A change of this system constant becomes effective :

– immediately.

● **Initialization of the CS31 system after power ON, warm start or cold start**

– Absolute identifier : KW 0,9

– Symbolic identifier : HOCHFAHR

– This system constant is only effective if the central unit is configured as a bus master.

– Meaning of the values of the constant :

  The user program is started.
  The central unit takes no notice of initialization of the CS31 remote units and their adoption into the CS31 bus cycle : =0

  The user program is not started until at least *n* remote units have been initialized and adopted into the CS31 bus cycle : =+n

– Range of values : 0…+31

– Default value : 0
  i.e. the user program is started immediately.

A change of this system constant becomes effective :

– with the next warm start or

– with the next cold start.

● **Size of the transmitting area of the slave central unit**

– Absolute identifier : KW 00,10

– Symbolic identifier : SLV_SEND

– Meaning of the values of the constant :

  The slave central unit can be used at the CS31 system bus *either* in the binary area *or* in the word area. The binary values are transferred byte by byte. It is possible to set the number of bytes (or words) which are to be sent from the slave central unit to the master central unit.

  – For use in the binary area :
    Transmitting : 2…15 bytes 2…15

  – For use in the word area :
    Transmitting : 1…8 words 101…108

– Default value : 4

– Range of values : 2…15 and 101…108

A change of this system constant becomes effective :

– with the next warm start or

– with the next cold start.

Note :

The default setting
– in the binary area is :
  - transmit 4 bytes and
  - receive 4 bytes.

This is defined by the default combination
KW 00,10 = KW 00,11 = 0.
The configured combination
KW 00,10 = KW 00,11 = 4 has the same result as the default combination.

The combination
KW 00,10 = KW 00,11 = 100
is inadmissible ! It would mean :
Transmit 0 words and receive 0 words.

When employed in the word area, the unused higher 8 channels of the address can be used by an analogue unit (no KR/KT).

A change of this system constant becomes effective :

– immediately.

● **Size of the receiving area of the slave central unit**

– Absolute identifier : KW 00,11

– Symbolic identifier : SLV_REC

– Meaning of the values of the constant :

The slave central unit can be used at the CS31 system bus *either* in the binary area *or* in the word area. It is possible to set the number of bytes (or words) which are to be received by the slave central unit from the master central unit.

– For use in the binary area :
Receiving : 2…15 bytes 2…15

– For use in the word area :
Receiving : 1…8 words 101…108

– Default value : 0

– Range of values : 2…15 and 101…108

A change of this system constant becomes effective :

– with the next warm start or

– with the next cold start.

Note :

The default setting
– in the binary area is :
- transmit 4 bytes and
- receive 4 bytes.

This is defined by the default combination
KW 00,10 = KW 00,11 = 0.

The configured combination
KW 00,10 = KW 00,11 = 4 has the same result as the default combination.

The combination
KW 00,10 = KW 00,11 = 100
is inadmissible ! It would mean :
Transmit 0 words and receive 0 words.

When employed in the word area, the unused higher 8 channels of the address can be used by an analogue unit (no KR/KT).

A change of this system constant becomes effective :

– immediately.

● **Central unit cycle time**

– Absolute identifier : KD 0,0

– Symbolic identifier : ZYKL_ZEIT

– Meaning of the values of the constant :
The central unit program is processed cyclically in the time intervals stated by the set cycle time.
The entries are made in the unit of measurement (ms).
The smallest cycle time that can be entered is 5 ms.
Only integral multiples of 5 ms are permissible.

– Range of values : 5…100 for a master CPU
5...250 for a slave CPU

– Default value : 10

A change of this system constant becomes effective :

– with the next program start.

- **Mapping**

System mapping

FFFF – D800	Compiled program 1
D7FF – B000	Compiled program 2
AFFF – AF00	Reserved
AEFF – AC00	I/O Datas
ABFF – A800	Reserved
A7FF – 8981	Micro-code in RAM
8980 – 8800	Constants
87FF – 8000	RAM non safeguarded
7FFF – 5000	Reserved
4FFF – 4000	Datas
3FFF – 2000	UART
1FFF – 1000	ASIC 2 - input ASIC
0FFF – 0000	ASIC 1 - output ASIC

Data mapping

Address	Data
AEFF – AD00	EW 15,15 – EW 00,00
ACFF – AC80	E 63,15 – E 00,00
AC7F – AC00	A 63,15 – A 00,00
8980	K 00,00; K 00,01
897F – 8900	KD 01,15 – KD 00,00
88FF – 8800	KW 07,15 – KW 00,00
85FF – 8500	AW 07,15 – AW 00,00
47D1 – 47B2	S 015,15 – S 000,00
467F – 4600	MD 001,15 – MD 000,00
4581 – 4542	MW 255,15 – MW 254,00
4541 – 4402	MW 239,15 – MW 230,00
4401 – 4342	MW 005,15 – MW 000,00
4341 – 4340	M 255,15 – M 255,00
433F – 432C	M 239,15 – M 230,00
432B – 4300	M 021,15 – M 000,00
42FF – 4100	Historical values
40FF – 4000	Timers

1.6 07 KR 31 / 07 KT 31 Central processing units — Software functions

● **Name of function** (CEs arranged according to function groups)	Call in FBD/LD ext.IL / IL (1)	

● **Binary functions**

AND	&	(2)
OR	/	(2)
Exclusive OR	=1	(2)
Allocation	=	(2)

● **Latch functions**

Allocation,set memory	=S	(2)
Allocation,reset memory	=R	(2)
Set memory,dominating	RS	(2)
Reset memory,dominating	SR	(2)

● **Arithmetic functions, word**

Addition	+	(2)
Subtraction	-	(2)
Multiplication	*	(2)
Division	:	(2)
Multiplication with division	*: / MULDI	
Multiplication by 2 to the power of n	MUL2N	
Absolute value generator	BETR	
Allocation Word	=W	(2)
Allocation direct constant to word variable	ZUDKW	

● **Comparison functions**

Greater than	>	(2)
Greater than or equal to	>=	(2)
Equal	=?	(2)
Unequal	><	(2)
Less than	<	(2)
Less than or equal to	<=	(2)

● **Timer functions**

On delay	ESV
Off delay	ASV
Monostable element «abort»	MOA
Monostable element «constant»	MOK

● **Counter functions**

Up-down counter	VRZ

● **Program control functions**

Conditional jump to label	SPBM /SPRUNG	
Target label	MRK / MR	
Program end	PE	
Conditional program end	=PE	(2)
Soubroutine call for an assembler program	CALLUP	

● **Format conversion**

BCD to binary conversion	BCDDUAL / BCDBIN
Binary to BCD conversion	DUALBCD / BINBCD
Pack binary variables in word	PACK
Unpacking a word into binary variables	UNPACK
Word to double word conversion	WDW
Double word to word conversion	DWW

● **Pulse**

Puls(rising edge)	I+	(2)
Puls(falling edge)	I-	(2)

● **Logical functions with word values**

AND combination,word	WAND
OR combination,word	WOR
Exclusive OR combination, word	WXOR

● **Access to physical addresses**

Copying memory areas	COPY
Read word with enabling	WOL

● **Higher order functions**

Binary selection gate	AWTB
Selection gate,word	AWT
Maximum value generator	MAX
Minimum value generator	MIN
Limiter	BEG
List allocator	LIZU
Binary value change annunciator	BMELD
Read word variable, indexed	IDLm / IDL
Write word variable, indexed	IDSm / IDS
Clock	UHR

● **Automatic control engineering functions**

Proportional-integral-controller	PI
Pulse duration modulator	PDM

---

(1) If a different call exists for IL compared to FBD/LD and extended IL.It is additionally given and separated by a /.

(2) This function is generated in the IL by a sequence of commands and/or blocks.

● **Communication through serial interface**

Initialization and configuration to the serial interface	SINIT
Output of ASCII characters and HEX values through a serial interface	DRUCK
Reception of characters	EMAS
Modbus master	MODBUS

● **CS31 functions**

Configure CS31 unit	CS31CO
Acknowledge CS31 error	CS31QU

1.7 07 KR 31 / 07 KT 31 Central processing units — Terminal mode : available functions

The terminal mode is used with the active mode of the central unit 07 KR 31 or 07 KT 31.

The central unit can be programed,tested and all operative functions are availables.

The communication is in ASCII protocol.

This terminal mode can be used with the aid of a terminal,the TCZ service device or the ABB Procontic programming software 907PC331.

For a complete description refer to Vol 7 part 3.

The list of the different commands can be displayed with the command H <CR>. The descripton of the commands is only in english language.

● Command for creating the user program

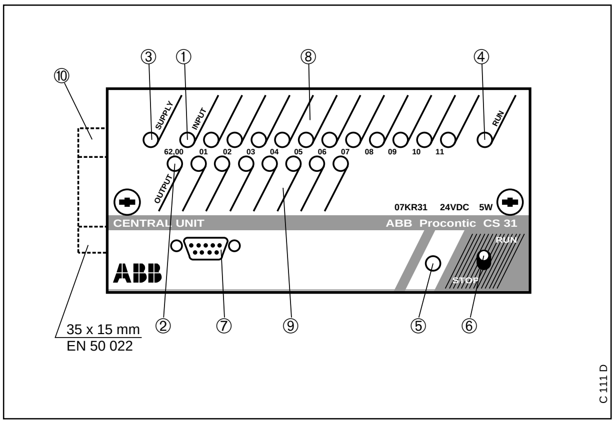
AEND	Preapare a program change on a running central unit program
ALT	Reactive the user program stored in EEPROM
AL	Display central unit capacity utilization normally less than 100%
D	Display program
DEEP	Erase user program in EEPROM
FREI	Enable a program change on a running user program
IDA	Display program identification
IDR	Delete program identification
IDS	Enter program identification
K	Enter/edit values of indirect constants
NOP	Delete program part, i.e. overwrite program part with NOPs
O	Optimise the program all NOPs are deleted;syntax:O<CR>
P	Display free program memory area
S	Enter/edit user program (substitute)
SP	Save user program in EEPROM
V	Move user program (only towards to the end)

● Command for testing the user program

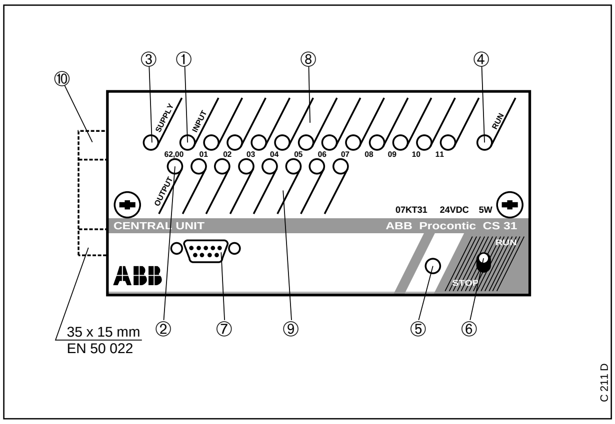
A	Abort user program
FEHLER	Display contents of the error register
FORC	Enter Force values (max.7 words and 31 bits)
FORCA	Display Force values
FORCR	Delete forcing
G	start user program
KALT	Perform cold start
PS	Display program status
ST	Display central unit status
WARM	Perform a warm start
Y	Overwrite value of a variable with a value to be entered
Z	Display status of variables
ZD	Display and continually update status of variables
ZZ	Display only the values of variables

● Commands for configurating

KONFS	Display/change operating modes English/ German (The german language has to be used with the ABB Procontic software 907 PC 331)
MAIL	Configuration and diagnosis of CS31 remote units
PASS :	Passeword → PASS → VALUE → <CR> → enable or disable the password value : 4 hexanumbers The value 0000 is not allowed The user can't have a access to the following commands AEND, D, DEEP, FREI, N, NOP, O, S, V (display or modification of program) when the program is protected by a password.
UHR	Display time and date
UHRS	Set time and date (without syntax control)



Central unit 07 KR 31



Central unit 07 KT 31

① 12 yellow led's labelled "**Input**" to indicate status of the inputs.

② 8 yellow led's labelled "**Output**" to indicate the presence of the outputs.

③ 1 green led labelled "**Supply**" to indicate the presence of the supply

④ 1 green led "**RUN**"

⑤ 1 red led for the error status

⑥ 1 "**RUN/STOP**" switch to start and stop the program execution

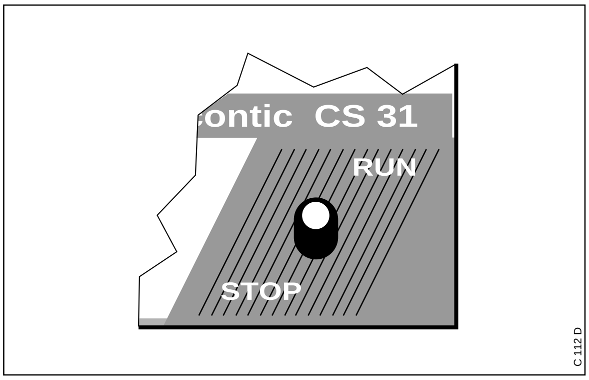
⑦ 1 serial interface RS 232 C

⑧ Assignment of the indentifiers for the inputs

⑨ Assignment of the identifiers for the outputs

⑩ The central unit has to be plugged on the plug-in base ECZ.

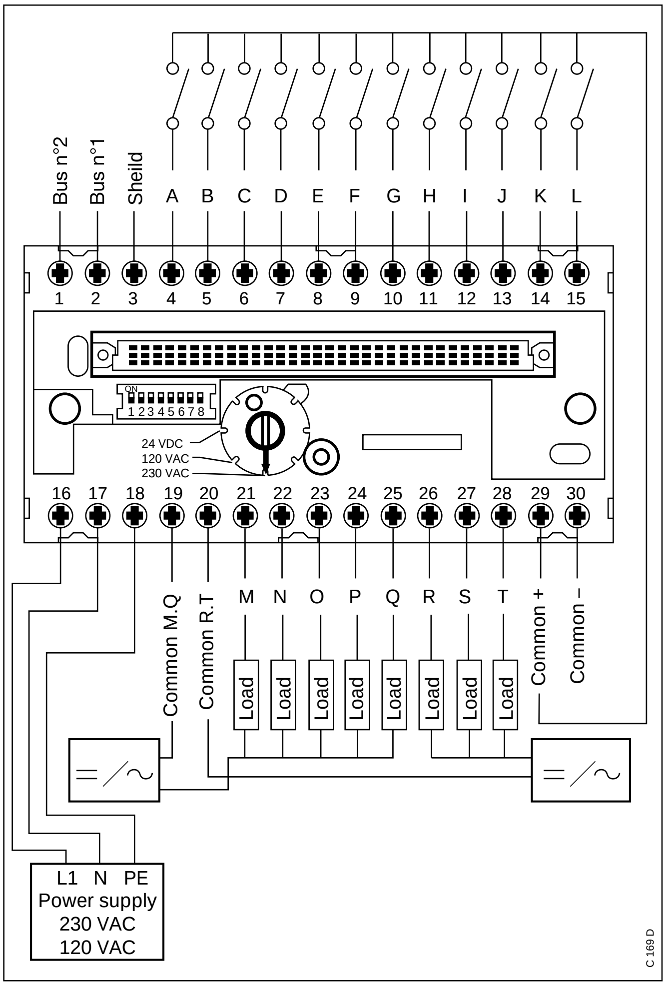
The plug-in base ECZ can be mounted on a DIN rail 35 x 15 mm - EN 50022.



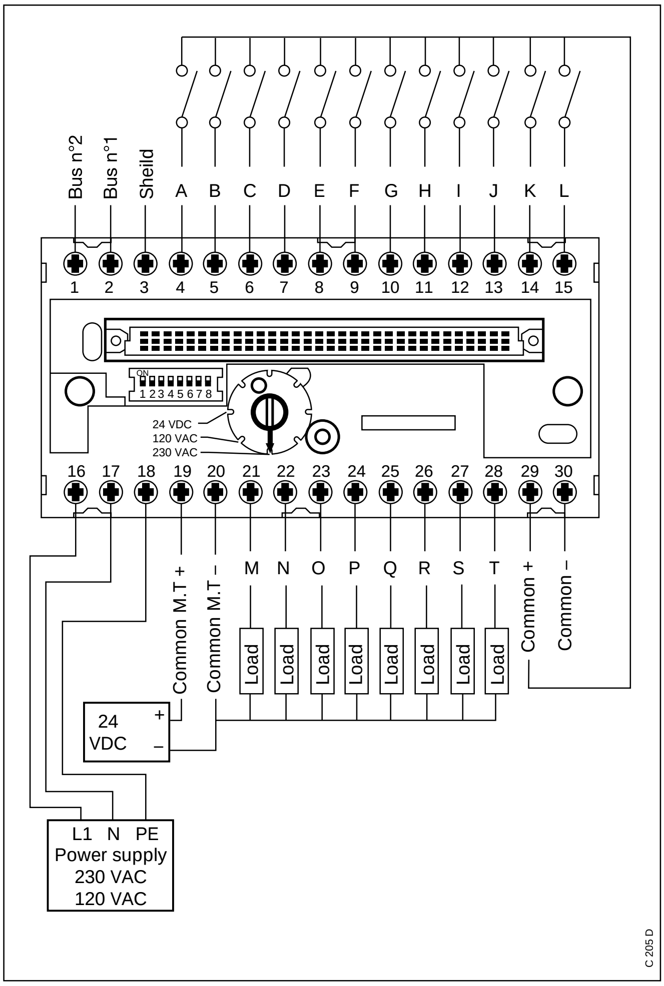
The **RUN/STOP** switch is used to start or abort the processing of the user program.

The central units 07 KR 31 and 07 KT 31 have to be mounted on the plug-in base ECZ.
The terminals are connected on the plug-in base ECZ.

07 KR 31 - 120 VAC / 230 VAC versions

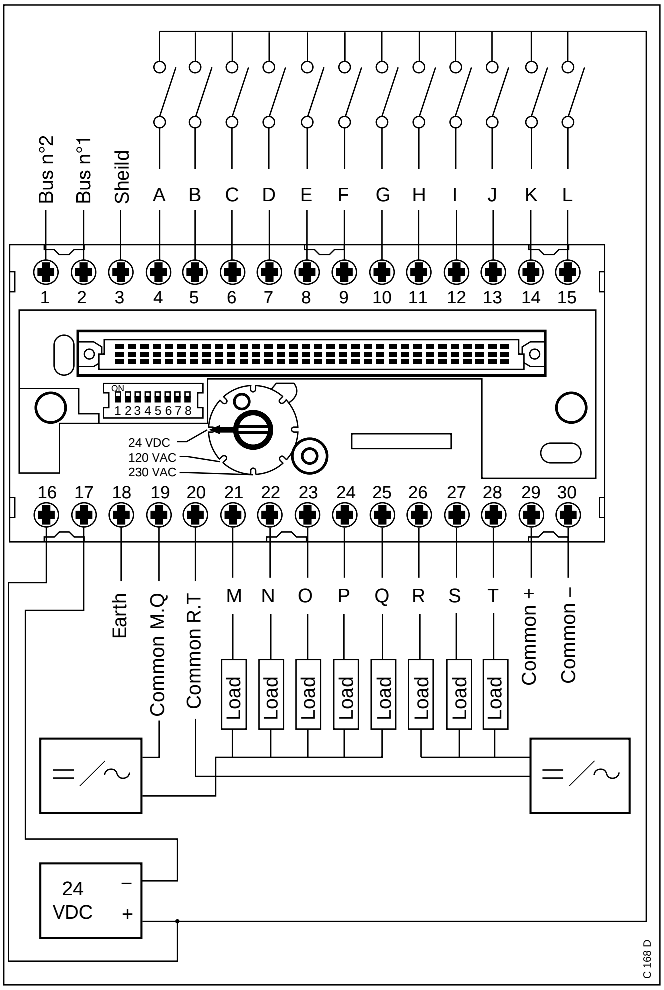


07 KT 31 - 120 VAC / 230 VAC versions

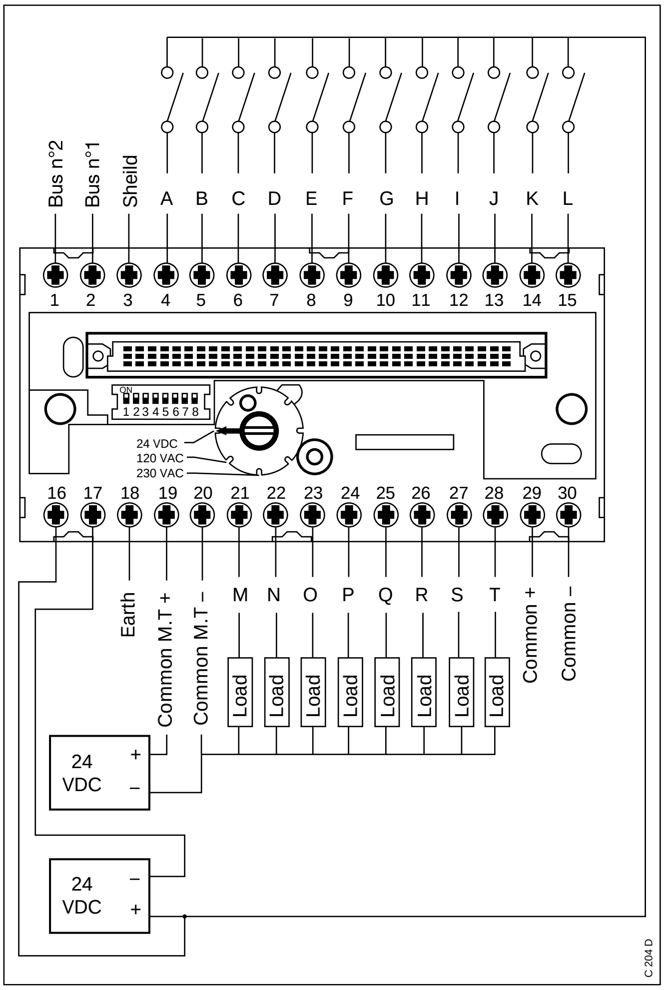


The internal 24 VDC (100 mA) power supply is only available for the 230VAC/120VAC versions. This power is used to power the inputs.

07 KR 31 - 24 VDC version



07 KT 31 - 24 VDC version



Please observe in particular :

- The earthing measures
- The handling of the electrically isolated input groups
- The handling of the electrically isolated output groups
- The connection of analog-value receiver and analog-value sensor
- The earthing of the switch cabinet mains socket

Variables used in the central unit			
Input	Channel	Output	Channel
A	E62,00	M	A62,00
B	E62,01	N	A62,01
C	E62,02	O	A62,02
D	E62,03	P	A62,03
E	E62,04	Q	A62,04
F	E62,05	R	A62,05
G	E62,06	S	A62,06
H	E62,07	T	A62,07
I	E62,08		
J	E62,09		
K	E62,10		
L	E62,11		

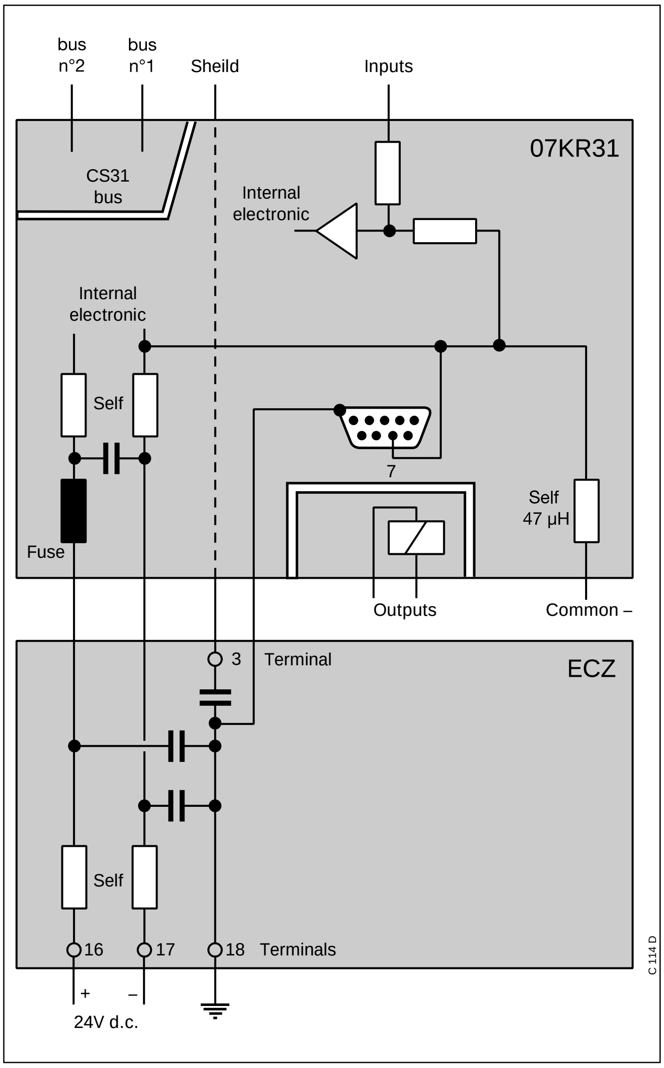
For 07 KT 31

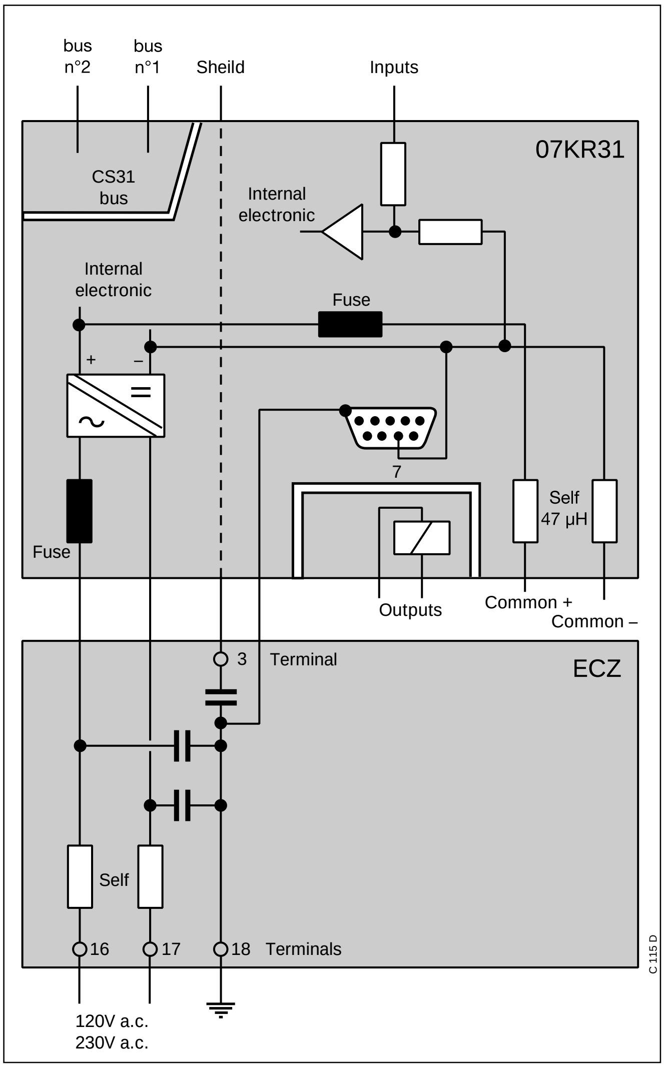
- A free wheel diode is not necessary because the protection is integrated into the transistor component.
- An external thermal fuse max. 5A has to be connected between the common + terminals and the 24 VDC to avoid damage in case of use of a lot of overload outputs.

The following illustration shows the parts of the device's circuit which are electrically isolated from each other as well as the internal connections which exist. Both the creepage distances and clearances as well as the test voltages used correspond to DIN/VDE 0160.

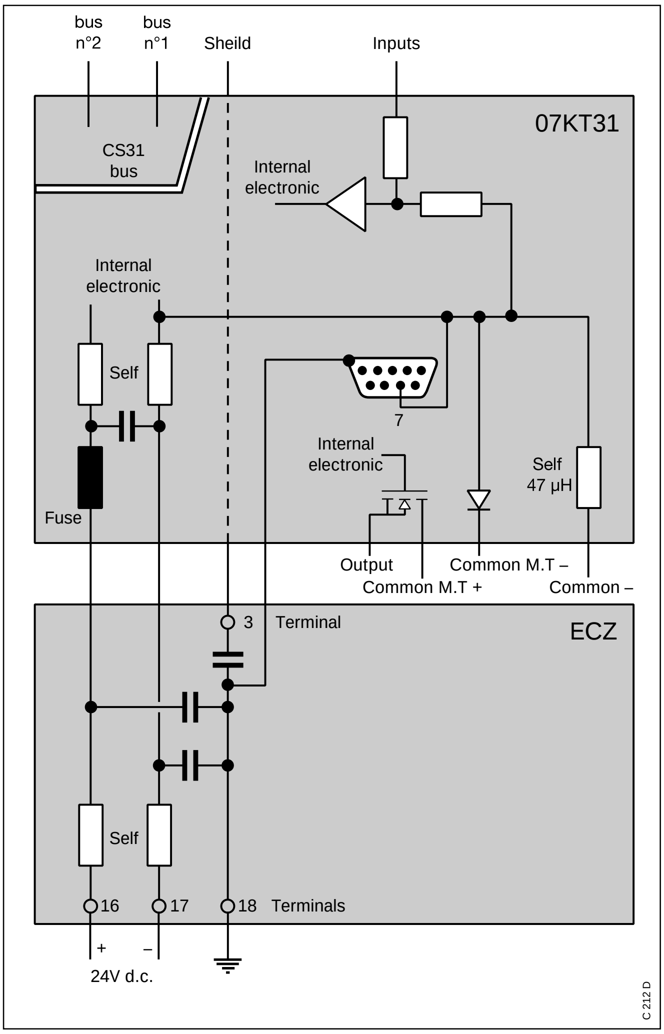
The earth on the plug-in base ECZ has to be connected directly and on the shortest possible way to the switch cabinet earthing using a wire with a cross section of 6 mm² in order to ensure safe earthing and as an EMC measure.

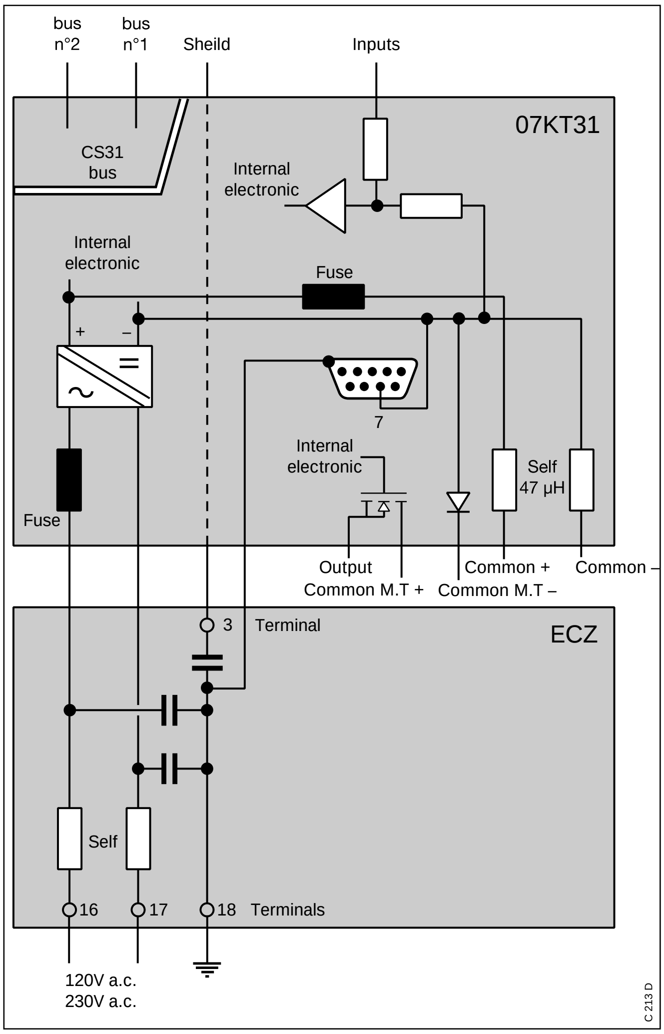
For the 07 KR 31 :

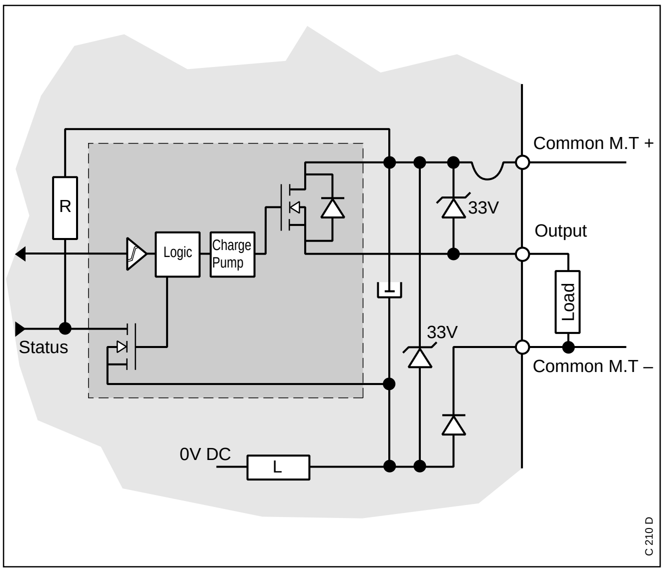




For the 07 KT 31 :







Connection for ABB Procontic CS31 system bus

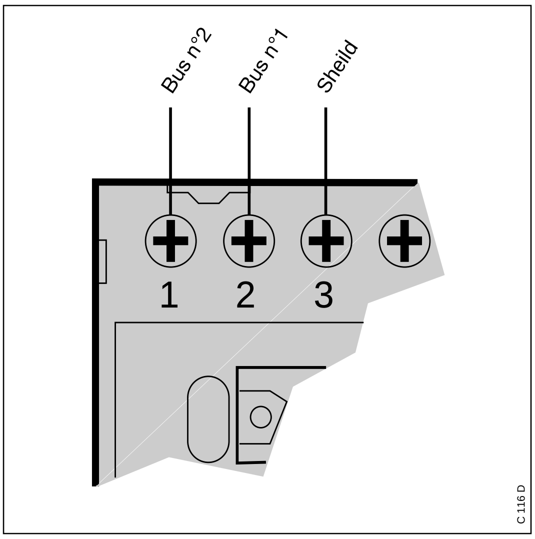
Please observe :

– All of the CS31 devices, no matter whether they are master or slave devices, are connected with the twisted-pair bus line as follow :
  - One core of the bus line is looped through via the bus n°2 terminals of the CS31 system bus.
  - The other core of the bus line is looped through via the BUS 2 terminals of all devices to be connected to the CS31 system bus.

– If the central unit 07 KR 31 / 07 KT 31 is located at the beginning or at the end of the bus line, the bus terminating resistor (120 1/4W) has to be connected additionally between the bus n°1 and the bus n°2 terminals.

– The shield of the twisted-pair bus line is looped through via the shield terminals of all the devices to be connected to the CS31 system bus.

– The handling of the CS31 system bus is described in detail in volume 2, System data.

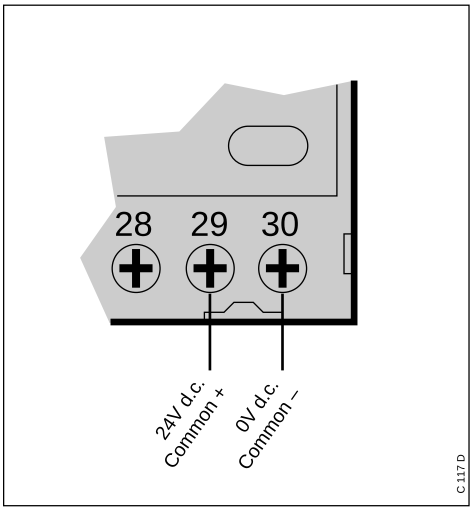


24V output voltage for the signal supply of the inputs

The central units 07 KR 31 / 07 KT 31 provide a 24VDC (100mA) voltage output for the 12 binary input signals (for this purpose only).

This 24V output voltage is only available for the 230 / 120VAC version.

The internal 24V power supply is overload-proof. The 24V output voltage is ready for operation again approx. 2 minutes after an overload has been eliminated.



All data (flags, words, historical datas, real-time clock) can be stored in a zeropower RAM (battery included into the RAM).

The battery lifetime is 5 years. The battery lifetime is the time during which the device remains operable in order to backup data while the supply voltage of the central is switched off. As long as there is a supply voltage available, there is no more load on the battery other than its own leakage current.

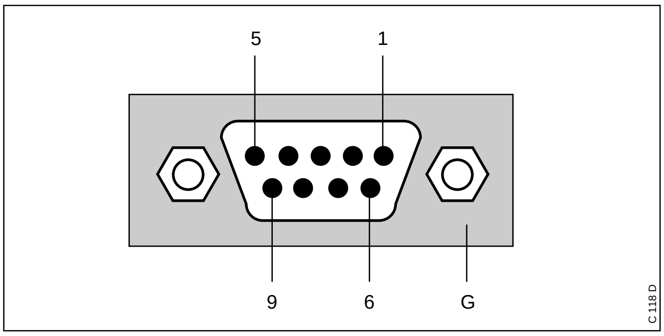
The battery can not be changed.

A battery failure is detected with the bit 3 of the status word EW 07,15 :
Bit 3 = 0 : battery failure
Bit 3 = 1 : no battery failure.

Interface standard : EIA 232

● **Assignment of the serial interface**

The serial interface has the following pin assignment :



G : Housing .... Protective Ground (Shield)
1 : not used
2 : TxD .... Transmit Data (Output)
3 : RxD .... Receive Data (Input)
4 : RTS .... Request To Send (Output)
5 : CTS .... Clear To Send (Input)
6 : PROG*****
7 : SGND .... Signal Ground (0V)
8 : not used
9 : +5V out .... Supply for the TCZ service device******

* 1 = Active mode (Programming/test)
0 = - Passive mode (DRUCK/EMAS applications), Pin 6 shorted to 0V
- MODE MODBUS Pin 6 shorted to 0V out

** 5V output (only for supplying the TCZ service device) :
The connected service device receives its voltage supply via the interface cable.

● **Operating modes of the serial interface**

The operating mode of the interface has to be set according to the application in each case :
– Programming and test or
– Man-machine-communication MMC
– MODBUS protocol (master and slave)

Active mode : The active mode is used for programming and testing the central unit, i.e. it gives the user access to all the programming and test functions of the central unit.

Passive mode : The passive mode is used to perform a communication configured with the DRUCK and EMAS blocks between the user program and a device connected to the serial interface.

MODBUS protocol : The MODBUS protocol is used to perform a communication between the central unit and a device connected to the serial interface.

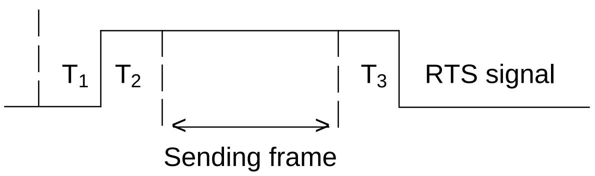
● **Conditions for setting the operating modes of the serial interface.**

– Modes

System constant KW00,06*	RUN/STOP switch	System cable/device	Mode set by this
0,<0,>2,<100	STOP	X	active
>355	RUN	07 SK 90 FPTN404948R0002	active
		07 SK 91, TCZ FPTN404948R0006	passive
1	X	X	active
2	STOP	X	active
	RUN		passive
>99, <356	X	07 SK 91 FPTN404948R0006 (Pin 6 shorted to 0V)	MODBUS
		07 SK 90 FPTN404948R0002	active

X : Without effect
* : KW 00,06 modulo 1000 or 10000

– Delay on RTS signal



System constant KW 00,06	T_1 - T_2 - T_3
0 - 99 or 10000 - 10099 (active or passive modes)	The RTS signal depends on the number of characters in the received buffer. When the buffer is full, the RTS signal is modified.
100 - 355 or 10100 - 10355 (MODBUS mode)	$T_1 = 0$ $T_2 = 0$ $T_3 = 0$
1000 - 1099 11000 - 11099 (active or passive modes)	$T_1 = T_2 = T_3 = 1$ character (i.e. : at baud rate = 9600 bauds, time for 1 character : T = 1,15 ms)
1100 - 1355 2100 - 2355 11100 - 11355 12100 - 12355 (MODBUS mode)	$T_2 = 5$ ms $T_1 = T_3 = 0$
2000 - 2099 12000 - 12099 (active or passive modes)	$T_1 = T_2 = T_3 = 3$ characters (i.e. : at baud rate = 9600 bauds, time for 3 characters : T = 3,45 ms)

● Interface parameters

Active mode : The setting of the interface parameters cannot be changed

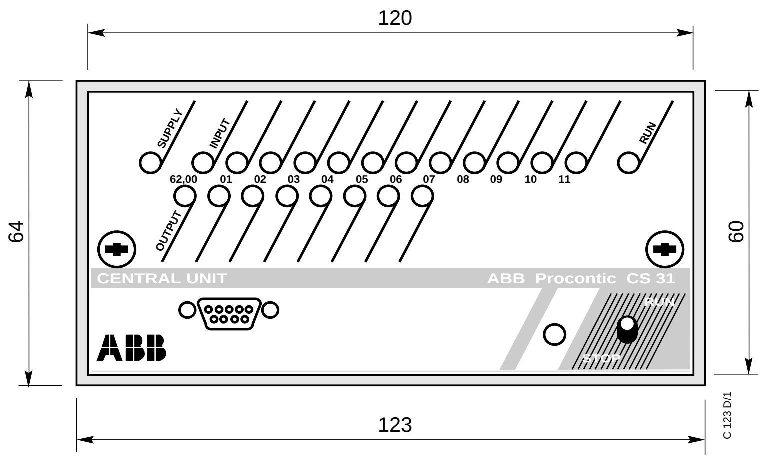
Data bits : 8
Stop bits : 1
Parity bits : .... none
Baud rate : 9600
Synchronization : .... RTS/CTS

MODBUS mode : .... Default setting
Data bits : 8
Stop bits : 1
Parity bits : .... none
Baud rate : 9600

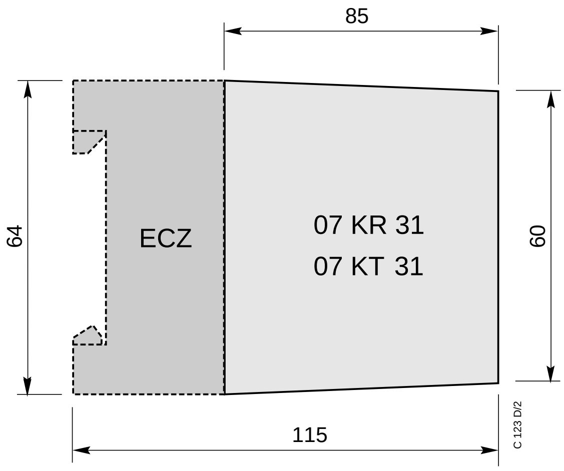
Passive mode :
Interface identifier COM1 : 1
The function block SINIT has to be used to set up the parameters.

● Signal level

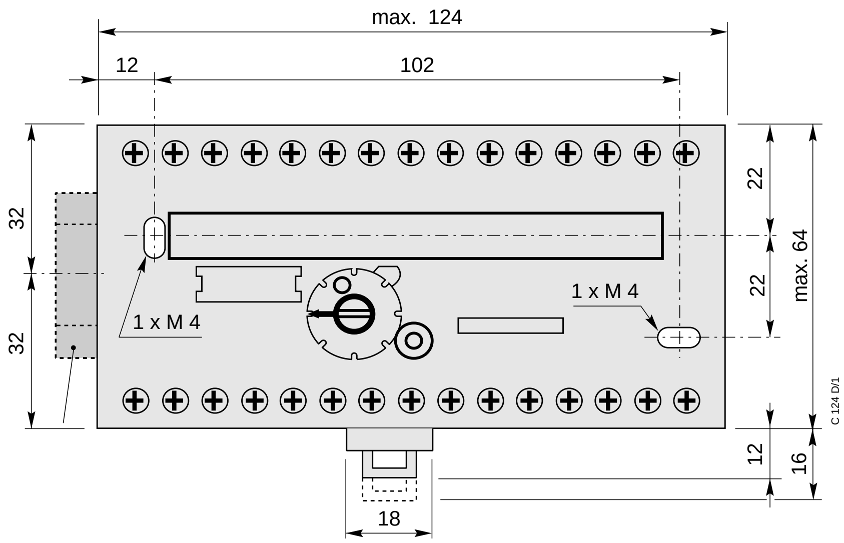
System constant KW 00,06	Actif RTS signal level
00000 - 02355	– 10V
10000 - 12355	+10V

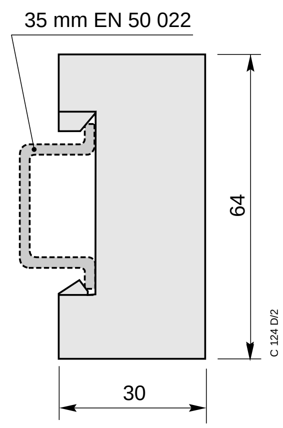


07 KR 31 / 07 KT 31



07 KR 31 / 07 KT 31 c/w plug-in base ECZ





Plug-in base ECZ

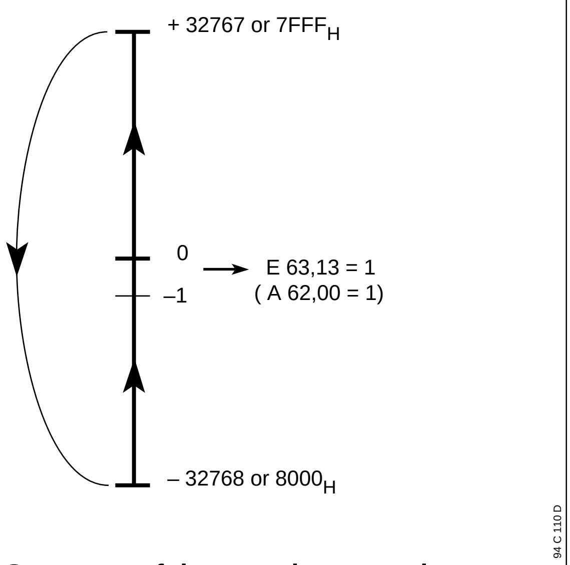
● **Features**

The high-speed counter used in the central units 07 KR 31 or 07 KT 31 works independently of the user program. Its features are as follows :

– The counting frequency is max. 10 kHz. The counter counts the 0–>1 edges at terminal 04 on the plug-in base ECZ (also designated as E 62,00).

– The counter counts upwards from –32768 to +32767 (8000_H…$7FFF_H$). If +32767 is exceeded, the counter skips to –32768.

– Sequence of the counting procedure :



Sequence of the counting procedure

– Setting the counter in the user program :

- to the value contained in the internal word variable AW 06,15

- using the internal variable A 63,15 = 1.

NOTE : If the internal variable A 63,15 = 1 is present during several processing cycles, the processor sets the counter at the program end in each case. During the remaining time of the processing cycle, the counter counts pulses at terminal 04.

– The counter content can be read via the internal variable EW 06,15.

– Zero-crossing message (signal changes from 0 to 1 when the counter contents changes from –1 to 0) :

- always via the internal variable E 63,13.

The zero-crossing message is cancelled when the counter is set.

– Fast input of binary signals into the user program with a delay of < 0,02 ms :

– Terminal 04 (also designated as E 62,00) : Internal variable E 63,14.

● **Preset start values**

You can preset both *positive* and *negative* start values for the counter.
The counting operation starts at the start value and is continued in correspondence with the arrows in the diagram until the enabling is stopped or a start value is loaded again.

● **Negative start value**

The minimum negative start value is – 32768 (8000_H).
By presetting a negative start value it is thus possible to count a maximum of 32768 pulses up to the zero crossing of the counter.

● **Positive start value**

If a positive start value is preset, the counter counts up to the value of +32767 ($7FFF_H$), continues the counting operation at the value of –32768 (8000_H) and then signals the zero crossing when reaching the transition from –1 to 0.

The minimum positive start value is 1. If you preset this value, 65535 pulses will be counted up to the zero crossing.

In order to count more than 32767 pulses up to the zero crossing, the start value has to be calculated according to the following equation :

Start value = 32767 – (number of pulses – 32768)

Example :

40 000 pulses are to be counted.
The start value is in the positive range, because more than 32768 pulses have to be counted.

Calculation :

Start value = 32767 – (number of pulses – 32768)
= 32767 – (40 000 – 32768)
= 25535

The most important times for the application of the central units 07 KR 31 / 07 KT 31 with or without connected remote units are :

- The **reaction time t_{kk}** is the time between a signal transition at the input terminal and the signal response at the output terminal.

  In case of binary signals, the reaction time consists of the input delay t_D, the cycle time t_{UP} of the program processing and the bus transmission time, if the system is expanded by remote units.

- The **cycle time t_C** determines the time intervals after which the processor starts the execution of the user program again.

  The cycle time has to be specified by the user. It should be greater than the program processing time t_{UP} of the user program, the CS31 bus transmission time and the related waiting times.

  The cycle time is also the time base for some time-controlled functions, such as for the timers.

- The **program processing time t_{UP}** is the net time for processing the user program.

  For the configuration and for determining the reaction time t_{kk}, the following steps are necessary :

  – Determining the program processing time t_{UP}

  – Determining the bus cycle time t_b, if there are any remote units connected to the central unit.

  – Addition of the other times which are within the cycle time t_C.

  – Specification of the cycle time t_C.

  – Reaction time t_{kk} as the sum of the input delay t_D and 2 x cycle time t_C and output delay t_{DO}.

In addition to calculating the cycle time t_C in accordance with chapter 5.2 it is possible to measure the capacity utilization on the programmed central unit – with the RUN/STOP switch set to RUN. The menu item of "Display central unit status" in the programming software 907 PC 331 can be used for this purpose. Increase the cycle time t_C until the capacity utilization is below 80 %.

The capacity utilization could be greater than 100 %. In this case, a FK3 error is generated (code 200_D), M 255,13 is set to 1.

The central unit is always processing. This capacity utilization allows to reduce the cycle time even if the initialization is too long.

Program processing time t_{UP}

- **Binary instructions of the type :**

  !M / M &M = M
  !NM /NM &NM = NM
  Processing time for 1000 instructions : 6 ms

  !M /M &M = SM
  !NM /NM &NM = RM
  Processing time for 1000 instructions : 6 ms

- **Word instructions of the type :**

  !MW +MW –MW = MW
  !–MW –MW +MW = –MW
  Processing time for 1000 instructions : 18 ms

  !MW *MW *MW = MW
  Processing time for 1000 instructions : 120 ms
  !–MW : MW :–MW = –MW
  Processing time for 1000 instructions : 750 ms

- **Mixed instructions**

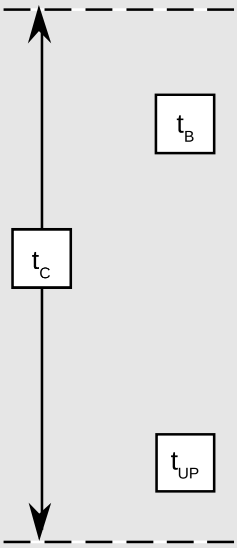
  – 65 % binary : !, /, &, =
  – 20 % word : !, +, –, =
  – 15 % word : !, *, =

  Processing time for 1000 instructions : 25,5 ms

- The program processing times of all the function blocks are specified in the documentation of the programming software 907 PC 331.

Set cycle time t_C

TIMES TO BE TAKEN INTO CONSIDERATION
WHEN THE CENTRAL UNITS 07 KR 31 / 07 KT 31 ARE USED AS :



Stand alone	Slave	Bus master inputs and outputs remote units	Explanation
–	$500\mu s \leq t_B \leq 2200\mu s$	$t_B \geq 3$ ms	– Communication time on the CS31 bus. – For a slave t_B has to be added to t_{UP} each t_B cycle time of the master. The worst case is only one slave on CS31 bus with a short cycle time in the master.
t_{UP}	t_{UP}	t_{UP}	Program processing time

The cycle time t_C has to be preset by the user taking the following equation into consideration :

$$\boxed{t_C \geq t_B + t_{UP}}$$

This equation assumes that the processor always gets access in the most unfavourable moment.

– For a slave, the bus transmission time is :

T_B slave = 66 µs + number of sent/received bytes

The cycle time t_C is stored in KD 00,00 and can be selected in 5 ms time steps. If the selected cycle time is too short, the processor will come in default then.

If this lack of time is getting too large over 16 successive cycles, the processor will generate an error (FK3) and continue the program execution (according the value of the system constant KW 00,07).

Using some function blocks, such as the PI controller, the error-free execution depends on an exact timing sequence. Make sure that there is a larger time reserve.

The correct setting of the cycle time can be checked by the following procedure :

– Loading the user program into the central unit.

– If the operating mode has been switched over from stand-alone to bus master : Power ON or menu item "Enable PLC mode" in the programming software.

– Interrogation of the capacity utilization using the menu item of "Display PLC status".

– Changing the cycle time t_C until the capacity utilization is below 80 %.

5.3 07 KR 31 / 07 KT 31 Central processing units — Reaction time in case of binary signals

TIMES TO BE TAKEN INTO CONSERATION
WHEN THE CENTRAL UNITS 07 KR 31 / 07 KT 31 ARE USED AS :

	Stand alone inputs and outputs of its own	Slave inputs and outputs of its own	Bus master inputs and outputs via remote units	Explanation
Inputs of remote unit or central units t_D	t_D = 5 ms	t_D = 5 ms	t_D = (8 ms)	Inputs signal delay t_D of binary remote units normally typ. 8 ms or of central unit type 5 ms.
Cycle time t_C	$t_C \geq 5$ ms	$t_C \geq 5$ ms	$t_C \geq 5$ ms	Cycle time t_C, to be set by the user.
Outputs of remote units or outputs of the central unit t_{do}	–	–	t_{do} (< 1 ms)	Output signal delay time of binary remote units : normally < 1 ms for a transistor output and < 5 ms for a relay output.

- The maximum reaction time t_{kk} (input terminal to output terminal) results from the asynchronicity of the operations.

- Bus master central unit via inputs and outputs of remote units :

$$\boxed{t_{kk} = t_D + 2 \bullet t_C + t_{do} + t_B + n * 100 \ \mu s}$$

with $\boxed{t_C \geq t_{UP} + t_B}$

t_{UP} : program processing time
t_B : bus CS31 cycle time
n : number of units on the bus

In case of analog signals, the refresh times are to be entered in the formula instead of the delay times.

Example : Bus master central unit + 1 binary input module + 1 binary output unit + 2 analog input units, reaction time for binary signals via the remote units :

input delay time : t_D = 8 ms

bus CS31 cycle time : t_B = 3 ms + 387 µs + 323 µs + 1355 µs + 1355 µs

t_B = 5,4 ms

cycle time : t_C = 15 ms ($t_C > t_B + t_{UP}$)

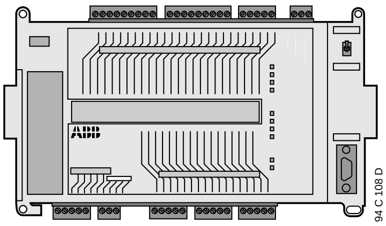
output delay time : t_{do} = 1 ms

terminal-to-terminal reaction time c.a. : t_{kk} = 44,8 ms

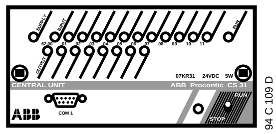
The cycle time t_b of the CS31 bus depends on number and type of the remote units (see vol. 2 refresh time).

Structure examples with 07 KR 31 / 07 KT 31 / 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master

Example 1 : 07 KR 31, 07 KT 31, 07 KR 91, 07 KT 92 or 07 KT 93 used as stand-alone central unit

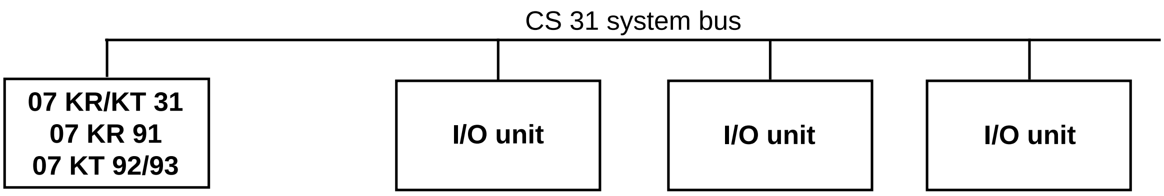


07 KR 91
07 KT 92 / 07 KT 93

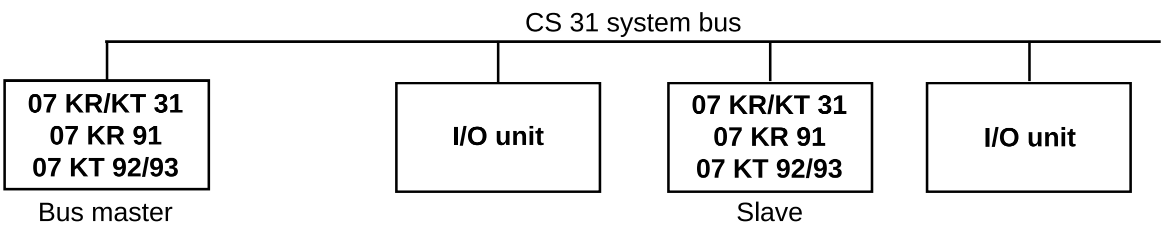


07 KR 31 / 07 KT 31

Example 2 : 07 KR 31, 07 KT 31, 07 KR 91, 07 KT 92 or 07 KT 93 used as bus master on the CS31 system bus, as remote units only I/O units are used.



Example 3 : 07 KR 31, 07 KT 31, 07 KR 91, 07 KT 92 or 07 KT 93 as bus master and as slave on the CS 31 system bus, in addition I/O units.



Without regard to the address ranges, the following units can be connected to a CS31 system bus :
– max. 1 bus master
– max. 31 remote units/slaves

Further restrictions result from the address range of the central units :

07 KR 31/07 KT 31:
– max. 28 analog input units;
– max. 12 analog output units
– max. 31 binary input units
– max. 31 binary output units

07 KR 91/07 KT 92/07 KT 93 :
- max. 12 analog input units
- max. 12 analog output units
- max. 31 binary input units
- max. 31 binary output units

There may be further restrictions according to the structure of the installation and the type of remote units. For the recommended addresses, (see chapter 6.1"**Recommended unit adresses on the CS31 bus**").

Structure of the input and output addresses in the remote units

The binary input unit ICSI 08 D1 will be explained here as an example.

The bus master central unit reads the input signals as operands. The complete address of an input signal has the following structure :

E 10 ,05

Channel number of the input,
here : input 05

Unit address (group number)
here : unit address 10 choosen by the DIL switch on the plug-in base ECZ
(see vol. 2).

Operand identifier,
here : binary input

Recommended unit addresses on the CS31 bus

The standard addressing has the purpose of :

– simplifying and schematizing the setting of addresses on the CS31 system bus

– simplifying diagnosis and troubleshooting.

The standard addressing makes sure that there will be no address overlapping even for units with a bigger amount of data.

Recommendations :

- Assign a specific unit address for each unit/each slave central unit; binary and analog units can be set to the same address.

- Unit addresses for binary remote units and central units : 0, 2…, 58, 60 (all even numbers), (see also chapter 6.5 "**Intelligent I/O remote units** (slave central units")).

- Unit addresses for analog remote unit :
  0…5 and 8...15 : analog input remote units
  0…5 : analog output remote units.

- Address switch No. 8 on the plug-in base ECZ always set to OFF (≤ 7) for the binary remote units.

Address setting for the units

● **Input and output units connected as slaves to the CS31 system bus**

The remote units are mounted on the plug-in base ECZ. This plug-in base is equipped with an address switch (DIP switch) for setting the unit address.

The combination of unit type, unit address and channel number results in the variable address used by the bus master central unit.

● **Setting the address switch for binary units**

The possible range of unit addresses when using the central units 07 KR 31 / 07 KT 31 is :

– 0…61

● **Setting the address switch for analog units**

The possible range of unit addresses when using the central units 07 KR 31 / 07 KT 31 is :

– 0…5 and 8...15 : analog input remote units
– 0…5 : analog output remote units

6.3 07 KR 31 / 07 KT 31 Central processing units — 07 KR 31 / 07 KT 31 used as a stand-alone central unit

If the central units 07 KR 31 / 07 KT 31 are used without the CS31 system bus connected, perform the following setting when programming in the user program :

System constant KW 00,00 = –2

This value is the factory setting.

6.4 07 KR 31 / 07 KT 31 Central processing units — 07 KR 31 / 07 KT 31 used as a bus master central unit

If remote units (slaves) are connected to the central unit 07 KR 31 or 07 KT 31 via the CS31 system bus, proceed as follows :

1. Change the system constant : KW 00,00 = –1
2. Save the user program in the EEPROM.
3. Activate the new PLC mode by :
   - calling the menu item "Enable PLC mode" in the ABB programming and test system, or
   - entering the command WARM <CR> in terminal mode or
   - power ON or
   - cold start.

6.5 07 KR 31 / 07 KT 31 Central processing units — Intelligent I/O remote units (Slave central units)

The central units 07 KR 31, 07 KT 31, 07 KR 91, 07 KT 92 and 07 KT 93 can also be used as slaves at the CS31 system bus, (see chapter 6 "**Addressing**" example 3). The central units 07 KR 31 / 07 KT 31 / 07 KR 91 / 07 KT 92 / 07 KT 93 may be used both in the binary range and in the word range.

The address can be set to a value from 0 to 61. The maximum permissible address depends on the size of the set transmit and receive range. The larger you choose the transmit or the receive range, the smaller is the maximum permissible address (see examples 1…3).

If you want to switch over to the "slave mode", proceed as follows :

1. Change the system constant : KW 00,00 = 0…61
   Only for 07 KR 31 and 07 KT 31 : if KW 00,00 = 100, the address of the slave is choosen by the dil switches of the plug-in base ECZ as a standard remote unit address range : 0…61.

2. Save the user program in the EEPROM.

3. Activate the new PLC mode by :
   - calling the menu item "Enable PLC mode" in the ABB programming and test system or
   - entering the command WARM <CR> in terminal mode or
   - power ON or
   - cold start.

There is no direct access to the inputs and outputs of the slave central unit via the CS31 system bus. The communication between master and slave is performed using input and output operands.

All the master data are consistently transferred to the slave, and all the slave datas are consistently transferred to the master.

The slave central unit can be used *either* in the binary range *or* in the word range of the CS31 system bus. The transmit and receive ranges of the slave can be adapted to the application-specific requirements by means of the two system constants KW 00,10 and KW 00,11 (see also chapter 1.4 "**Operands**" § System constants).

You can set :
- The size of the transmit and receive ranges and
- the mode of employment of the slave (in the binary or the word range).

Default condition :

If the central units 07 KR 31 / 07 KT 31 / 07 KR 91 / 07 KT 92 / 07 KT 93 are switched over to the "slave mode", they behave like binary input and output units with 32 inputs and 32 outputs when connected to the CS31 system bus.

This means that the default setting of the transmit and receive ranges is within the binary range of the master. Their size is 32 bits each (4 bytes).

Example 1 :

Default configuration of the slave (binary range) :
KW 00,10 = 0 : Slave transmit range : 4 bytes
(4 bytes * 8 channels = 32 binary O)
KW 00,11 = 0 : Slave receive range : 4 bytes
(4 bytes * 8 channels = 32 binary I)

Note :
The default configuration is the same as the configuration KW 00,10 = KW 00,11 = 4.

07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master	↔	07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as slave with : KW 00,10 = 0 or 4 KW 00,11 = 0 or 4
Receive or transmit using E/A operands (I/O operands)		Transmit or receive using E/A operands (I/O operands)
E n ,00	←	A 00,00
:		:
E n ,15		A 00,15
E n +1,00		A 01,00
:		:
E n +1,15		A 01,15
A n ,00	→	E 00,00
:		:
A n ,15		E 00,15
A n +1,00		E 01,00
:		:
A n +1,15		E 01,15

n : Unit address of the slave central unit
for this example : 0 ≤ n ≤ 60

For the slave address of n = 12 the following applies, for example :
The output signal A 00,00 of the 07 KR 31 used as slave is the input signal E 12,00 for the 07 KR 31 used as bus master.

Example 2 :

Configuration of the slave for the binary range :

KW 00,10 = 15 : Slave transmit range : 15 bytes
(15 bytes * 8 channels = 120 binary O)
KW 00,11 = 06 : Slave receive range : 6 bytes
(6 bytes * 8 channels = 48 binary I)

07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master	⟷	07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as slave with : KW 00,10 = 15 KW 00,11 = 6
Receive or transmit using E/A operands (I/O operands)		Transmit or receive using E/A operands (I/O operands)
E n ,00	←	A 00,00
:		:
E n ,15		A 00,15
:		
E n +7,00		A 07,00
:		:
E n +7,07		A 07,07
A n ,00	→	E 00,00
:		:
A n ,15		E 00,15
:		:
A n +2,00		E 02,00
:		:
A n +2,15		E 02,15

Notes :

The upper 8 input channels of the address n+7
E n+7,08…E n+7,15

can be assigned to another binary *8 bit input unit (excluding KR/KT)* on the CS31 system bus.

The output channels starting from the address n+3

A n+3,00…A n+7,15

can be assigned to other *output devices* on the CS31 system bus.

n : Unit address of the slave central unit
for this example : 0 ≤ n ≤ 54

For the slave address of n = 12 the following applies, for example :
The output signal A 00,00 of the 07 KR 31 used as slave is the input signal E 12,00 for the 07 KR 31 used as bus master.

Example 3 :

Configuration of the slave for the word range :

KW 00,10 = 101 : Slave transmit range : 1 word
(1 word = 1 word output)
KW 00,11 = 108 : Slave receive range : 8 words
(8 words = 8 words inputs)

07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master	⟷	07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as slave with : KW 00,10 = 101 KW 00,11 = 108
Receive or transmit using EW/AW operands		Transmit or receive using EW/AW operands
EW n,00	←	AW 00,00
AW n,00	→	EW 00,00
:		:
AW n,07		EW 00,07

Notes :

If a slave KR/KT is configured for the word range, only the lower 8 channels of the address n are assigned to it on the CS31 system bus.

(EW n,00…EW n,07 and AW n,00… AW n,07).

The upper 8 channels of the address n

EW n,08…EW n,15 and
AW n,08…AW n,15

can be assigned to *analogue unit (excluding KR/KT)* on the CS31 system bus, for example.

n : Unit address of the slave central unit
(see chapter 6.2 "**Adress setting for the units**").

For the slave address of n = 4 the following applies, for example :
The output signal AW 00,00 of the 07 KR 31 used as slave is the input signal EW 04,00 for the 07 KR 31 used as bus master.

Purpose of the I/O configuration

Dependent on the type of I/O units the following can be configured :

- in case of binary I/O units, an input delay different from the factory setting,
- in case of binary units with combined I/O channels, these channels can also be defined as input only or output only,
- in case of binary units, open-circuit monitoring at inputs and outputs,
- in case of analog units, measuring or output ranges which differ from the factory setting.

Switching over of inputs and outputs, switching on the diagnosis functions and changing the measuring and output ranges are performed as follows, depending on the unit type :

- Performing the I/O configuration via the CS31 system bus, either by means of the user program of the bus master central unit or by means of a terminal.
- Setting of switches on the plug-in base ECZ or on the rear side of the input/output unit.
- External wiring on the input/output unit terminals.

In some cases, there is a relation between the settings made on the remote unit and the information and diagnosis messages which can be interrogated at the remote unit or via the CS31 system bus. This relation will be explained in the following chapters.

There is no need for you to perform an I/O configuration via the CS31 system bus if the factory setting is sufficient. Once an I/O configuration has been performed, it will remain stored in the corresponding I/O unit until it is changed again. Even in case of power OFF it will not be deleted.

All possibilities of the I/O configuration are described in the volume 2 "**Hardware description**".

Performing and reading the I/O configuration

There are the following possibilities for system structures when using 07 KR 31 or 07 KT 31 as bus master :

- Performing and reading the I/O configuration via the user program of the bus master central unit 07 KR 31 or 07 KT 31
- Performing and reading the I/O configuration by means of the terminal or
- Reading the I/O configuration from the remote units.

Performing and reading the I/O configuration via the user program

The function block CS31CO is available for the I/O configuration of the units. This function block is part of the programming software 907 PC 331 and is described in the corresponding documentation.

Performing and reading the I/O configuration by means of the terminal or TCZ

This method is based on the fact that the central units 07 KR 31 / 07 KT 31 use a dialogue language at the programming interface which allows the I/O configuration to be performed and interrogated by means of simple protocols (see volume 7.3, chapter 3 "**MAIL command**").

07 KR 31 and 07 KT 31 are equipped with the special function for I/O configuration.

The following devices can be used as terminal :

- A commercially available terminal equipped with an EIA-232 interface, such as VT100.
- A PC equipped with the programming software 907 PC 331. All the interface data are correctly set under the main menu item of "PLC communication 2", sub-item "Terminal emulation".
- The service device TCZ in the operating mode 1 = TERMINAL, 2 = CHAR.MODE, N = transmission speed unchanged, 9600 Baud.

Reading I/O configuration and diagnosis data at the remote unit

(See vol. 2. "**Hardware description**").

The diagnosis system of the 07 KR 31 and 07 KT 31 is designed to ensure a quick and efficient troubleshooting. For this purpose, it is classified :

– "**vertically**" in diagnosis, error flags, reactions, LED display and acknowledgement, (see chapter 8.2 "**Acknowledgement of error messages in the remote units**").

  There are interrelations between the bus master central unit and the remote units. The central unit reads the diagnosis data which the remote units have found out. An acknowledgement in the central unit also causes the stored error messages in the remote units to be deleted.

– "**horizontally**" in 4 error classes, in correspondence with the severity of the error, (see chapter 8.2 "**Acknowledgement of error messages in the remote units**").

This concept is based on a system structure consisting of a bus master central unit and several remote units, and remote processors as well. The diagnosis system detects the following errors :

– Errors in the bus master central unit

– Errors on the CS31 system bus

– Errors in the remote units

– Errors in the wiring of the remote units on the process side

The troubleshooting is performed as follows :

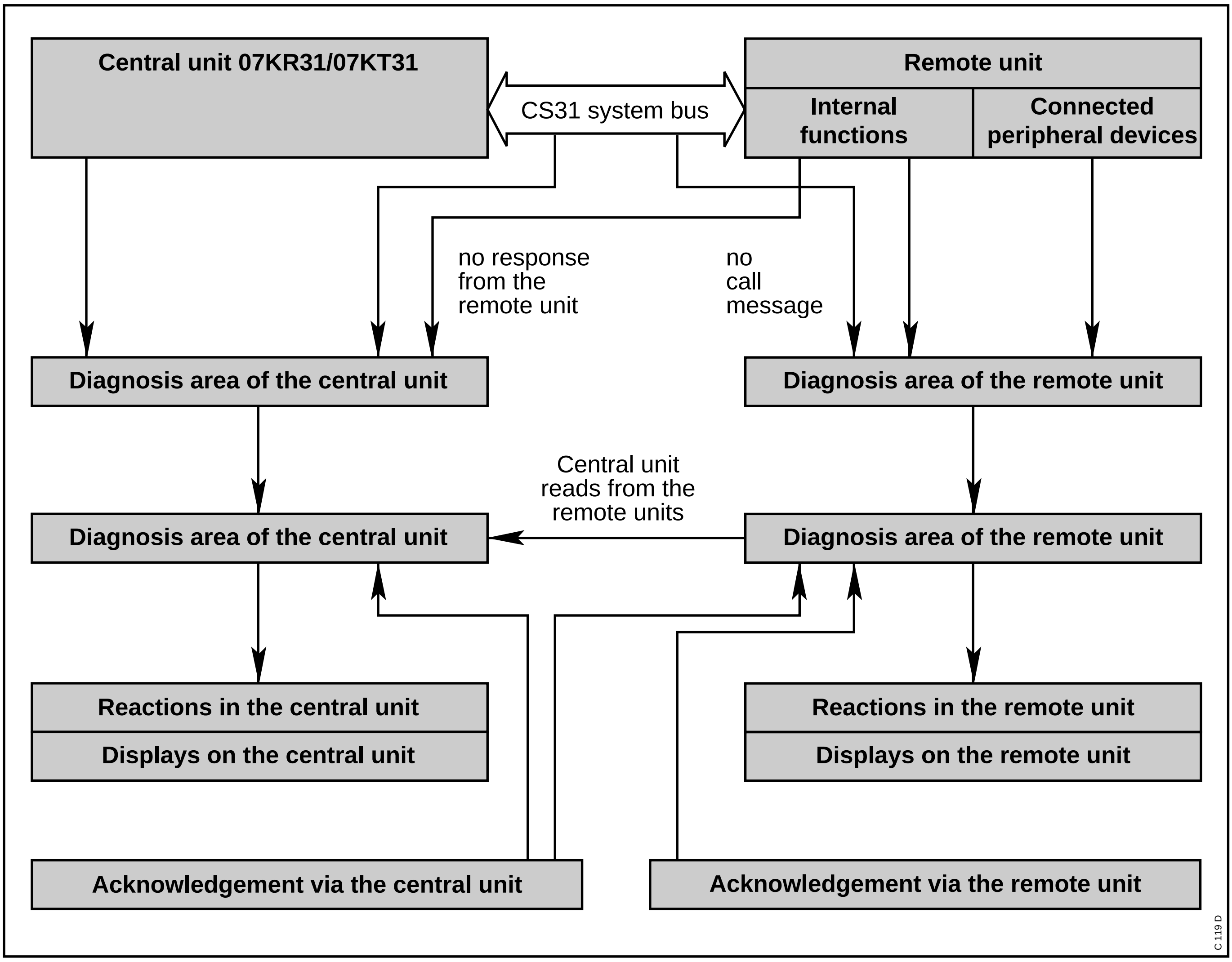
– The red LED on the central unit 07 KR 31 gives first hints. The errors detected by the remote units are also displayed here.

– If these hints are not sufficient, the error flags have to be read out. For the meaning of the error flags, (see chapters 8.6 "**Meaning of the contents of the error word flags**" and 8.7 "**Reaction on the bus master central unit and the remote units in case of errors**").

– The status register EW 07,15 in the central unit supplies additional information to be used for the diagnosis (see chapter 8.2 "**Acknowledgement of error messages in the remote units**").

– The remote units indicate errors occuring in their area. Detailed information can be obtained by pressing the test key on the units, (see chapter 8.3 "**Error flags in the central unit, error classification**").

8.1 07 KR 31 / 07 KT 31 Central processing units — Structure of the diagnosis



Acknowledgement of error messages in the remote units

The remote units store and display the error messages detected independently of the central unit. The error messages can be acknowledged :

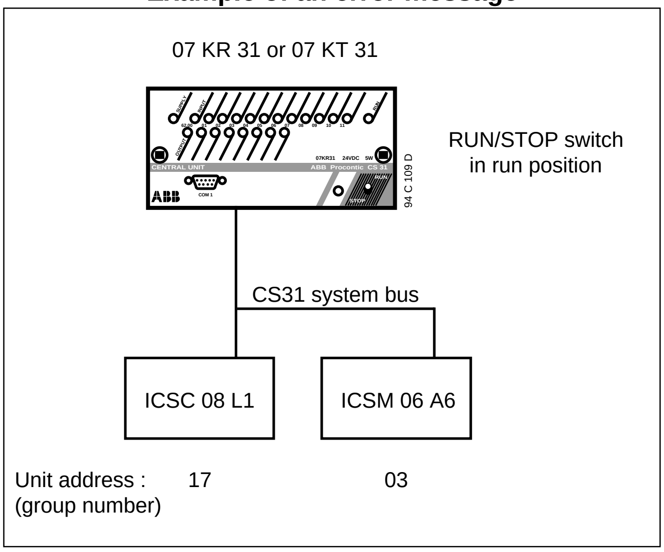
– on the remote units by pressing the test button

– in the user program by means of the function block CS31QU (this also deletes the error message stored in the central unit)

– in the terminal mode by means of the command MAIL (see volume 7.3 chapter 3 "**MAIL command**").

If the error has not been eliminated, the error message appears again.

Example of an error message



Errors which occured :

The bus line to the remote unit having the unit address 3 has been broken during operation.

Error flags in the central unit 07 KR 31 or 07 KT 31

It is assumed that the error flags have been set to 0 by acknowledgement/deletion before the error occured. In the following, only those error flags will be listed the contents of which changes.

M 255,10	=	1	Summation error message
M 255,13	=	1	Error class message (FK3 error)
MW 255,00	=	15	Error detection : remote unit is disconnected
MW 255,01	=	05	Unit type : analogue input and ouput
MW 255,02	=	03	Group number (unit address)
MW 255,03	=	0	not concerned, as well as all the other error flags which have not been mentioned
MW 255,04	=	0	
MW 255,05	=	0	
MW 55,06	=	0	
MW 255,07	=	0	

LED displays on the bus master central unit 07 KR 31 or 07 KT 31

Run led lights : up
Red led : error

Reaction of the bus master central unit 07 KR 31 or 07 KT 31

The processing program and the bus operation continue running (if KW 0,7 = 0).

Reaction of the remote unit ICSM 06 A6 : All of the outputs turn to 0.

Reaction of the remote unit ICSC 08 L1 : Data exchange with the bus master central unit 07 KR 31 or 07 KT 31.

Status word EW 07,15 in the central unit 07 KR 31 or 07 KT 31

– Bit 0 = 1 no class 2 error

– Bit 1 = 0 only applicable for 07KR31 or 07KT31 used as a slave

– Bit 2 not used.

– Bit 3 = 1 no battery failure.

– Bits 4…7 not used

– Bits 8...15 = 2 max. number of units connected to the CS31 system bus which have been found since the last power-on operation. Will not be altered by the error which has occured in the meantime.

Acknowledgement of the error flags in the central unit 07 KR 31 or 07 KT 31

Eliminate the error before acknowledgement. Otherwise the error message will appear again.

The bit flags M 255,10 and M 255,13 can be acknowledged by :

- power ON
- program "Start" (on-line in the programming software 907 PC 331)
- cold start (menu item in 907 PC 331)
- setting the RUN/STOP switch to RUN
- overwriting the flag M 255,13 with "0" in the user program
- overwriting the flag M 255,13 with "0" by means of the operating function "Overwrite" (see volume 7.3 chapter 3).
- using the function block CS31QU in the user program. The block is applicable only for errors which concern the CS31 system bus. It also deletes the error message in the remote units.

The error LED turns off upon the acknowledgement.

The word flags MW 255,00…MW 255,07 can only be deleted by overwriting them. They are overwritten by newly occuring errors.

Acknowledgement of error flags in the remote unit ICSM 06 A6

- on the unit by pressing the test button for a longer time
- in the user program of the central unit using the CS31QU block
- in the terminal mode by means of the MAIL command (see volume 7.3 chapter 3).

8.3 07 KR 31 / 07 KT 31 Central processing units — Error flags in the central unit, error classification

The central unit offers error messages for the user program which are classified into 4 error classes (FK1…FK4) according to their severity. The error messages are stored in error flags and can be used in the user program and be read by the programming system.

The following table gives you an overview of the error flags.

Error class	FK1 = fatal error	FK2 = serious error	FK3 = light error	FK4 = warning
General feature of the error class, examples	Save operation of the operating system is no longer ensured. *Error example :* – Checksum error in the operating system EPROM	The operating system works correctly, but the error-free processing of the user program is not guaranteed. *Error example :* – Write/read error when testing the user RAM	The choice whether the user program has to be aborted by the operating system or not depends on the application. The user decides which reactions are to be initiated. *Error example :* – Remote module has failed	Errors which occur on peripheral devices or which will show their effect only in the future. The user decides which reactions are to be initiated. *Error example :* – Short circuit on a remote module
Summation error message (1)	M 255,10			
Error class message (if 1, an error exists)	M 255,11	M 255,12	M 255,13	M 255,14
Error detection (word) (2) Detailed info 1 (word) (2) Detailed info 2 (word) (2) Detailed info 3 (word) (2) Detailed info 4 (word) (2) Detailed info 5 (word) (2) Detailed info 6 (word) (2) Detailed info 7 (word) (2)	MW 254,00 MW 254,01 MW 254,02 MW 254,03 MW 254,04 MW 254,05 MW 254,06 MW 254,07	MW 254,08 MW 254,09 MW 254,10 MW 254,11 MW 254,12 MW 254,13 MW 254,14 MW 254,15	MW 255,00 MW 255,01 MW 255,02 MW 255,03 MW 255,04 MW 255,05 MW 255,06 MW 255,07	MW 255,08 MW 255,09 MW 255,10 MW 255,11 MW 255,12 MW 255,13 MW 255,14 MW 255,15
Led displays after initialization	Red led or LED RUN does not go on, if RUN/STOP switch is set to RUN	Red led or LED RUN does not go on, if RUN/STOP switch is set to RUN	Red led	Red led
Reaction when switching on the central unit / Reaction during operation	All the outputs remain set to 0 or are set to 0. The programming system does not have access. The central units is in reset while the error is present.	All the outputs remain set to 0 or are set to 0. The programming system can get access. The user program is not started or is aborted.	You can choose in case of an error : – Just report the error : Evaluate the error flag M 255,13 – Abort the user program : Set system constant KW 0,7 = 1 (FK3_REAK)	Evaluation of the error messages using the user program
Acknowledgement of the summation error message/ of the error class message	– Power ON – Cold start	– Power ON – Cold start	– Power ON / cold start – Set the RUN/STOP switch to RUN – Start the program using 907 PC 331 – Set M 255,13 or M 255,14 to 0 – In case of CS31 error : function block CS31QU – Spontaneous if error FK4 diseappers and code ≤ 15	

(1) The summation error flag M 255,10 becomes 1, if at least one of the error class flags is set to 1. If M 255,10 = 0, the central unit has not found any error. The summation error flag is deleted automatically when the error class flags are acknowledged.

(2) The central unit enters the last found error into the relevant error flag record for each error class. The entry is made at the end of the program cycle and remains unchanged during the next running program cycle. The word flags can only be acknowledged by overwriting them with "0".

Acknowledgement of error messages in the central unit

Error messages remain stored and will be displayed until they are acknowledged. The following applies :

– The summation error message, the error class messages (bit flags) and the relevant red LED is reset with power ON, for example. For other possibilities for resetting/acknowledging them, (see chapters 8.2 "**Acknowledgement of error messages in the remote units**" and 8.3 "**Errors flags in the central unit, error classification**").

– The error identifiers and the detailed information (word flags) have to be reset by means of the user program or by means of the operating function "Overwrite" (see volume 7.3 chapter 3). They are also reset when a cold start is performed or by a power-fail.

The error message will appear again, if the error has not been eliminated.

Status word EW 07,15

The following data are continuously updated in the status word EW 07,15 :

– Bit 0 : this bit is valid for the stand-alone central unit, for the master central unit and for the slave central unit.
  Bit 0 = 1, there is *no error* of class 2.
  Bit 0 = 0, there is *an error* of class 2.

– Bit 1 : this bit is valid only for the slave central unit.
  Bit 1 = 1, the slave central unit is adopted into the bus cycle of the master central unit.
  Bit 1 = 0, the slave central unit is *not* adopted into the bus cycle of the master central unit.

– Bit 2 is not used.

– Bit 3 : this bit detects a battery failure.
  Bit 3 = 1, there is no battery failure.
  Bit 3 = 0, there is a battery failure.

– Bit 4…7 are not used.

– Bit 8…15 : *Maximum* number of remote units which have been existing in the CS31 bus cycle of the master central unit since the last power-ON or since the last cold start. Their number may be larger than the number of the remote units which are *currently* existing in the CS31 bus cycle.

Explanation of the following table :

– Address = Memory address at which the error was detected.

– Group number = Unit address of the remote unit

– Channel number = Number of the faulty channel

– Unit type Meaning

000 .... Binary input
001 .... Analog input
002 .... Binary output
003 .... Analog output
004 .... Binary input/output
005 .... Analog input/output
255 .... Bus master or slave central unit in which the error has occured and is stored.

Error class	Error description	Error identifier in MW 254,00 Dec Hex	Detailed info 1 in MW 254,01	Detailed info 2 in MW 254,02	Detailed info 3 in MW 254,03	Further detailed infos in MW 254,04 … MW 254,07
FK1 Fatal error	Checksum error of the system EPROM			–	–	–

Error class	Error description	Error identifier in MW 254,08 Dec Hex	Detailed info 1 in MW 254,09	Detailed info 2 in MW 254,10	Detailed info 3 in MW 254,11	Further detailed info in MW 254,12 … MW 254,15
FK2 Serious error	RAM defective (user program or operand memory)	128_D 80_H	Address	–	–	–
	Illegal master-slave identifier	129_D 81_H	–	–	–	–
	More timers than available in the central unit were required during the execution time.	255_D FF_H	–	–	–	–

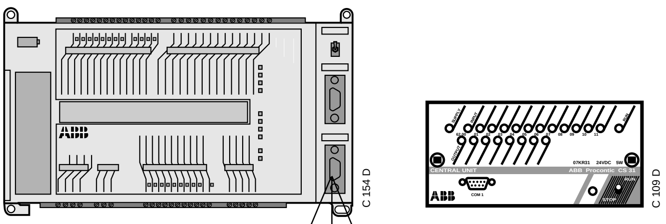
Error class	Error description	Error identifier in MW 255,00 Dec	Hex	Detailed info 1 in MW 255,01	Detailed info 2 in MW 255,02	Detailed info 3 in MW 255,03	Further detailed info in MW 255,04 … MW 255,07
FK3 Light error	Remote unit disconnected	15_D	F_H	Unit type	Group number	–	–
	CS31 bus error (there is no remote unit on the bus) **Note :** If there are only analog units connected to the CS31 system bus, this error message may occur when the supply voltage is switched on although the analog units have been correctly adopted into the CS31 bus cycle after a certain time. **Reason :** The analog units have a long initialization time. After this time is over, they only now appear at the CS31 bus as remote units. During the initialization time the master central unit cannot recognize them.	16_D	10_H	–	–	–	–
	NCB or NCBR error **Note :** One of the different CS31 buses is on default. Check red leds on NCB or NCBR to find on which line the error is.	17_D	11_H	–	–	–	–
	Cycle time KD 00,00 too short	200_D	$C8_H$	–	–	–	–

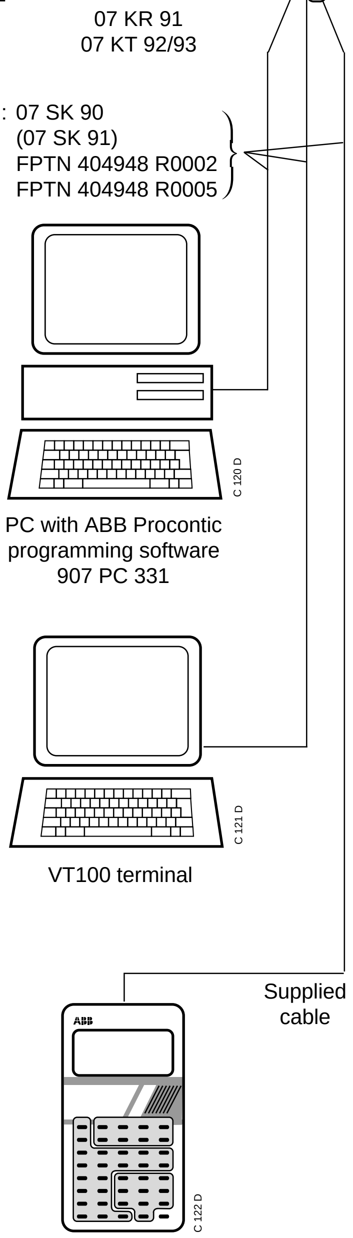
Error class	Error description	Error identifier in MW 255,08 Dec	Hex	Detailed info 1 in MW 255,09	Detailed info 2 in MW 255,10	Detailed info 3 in MW 255,11	Further detailed info in MW 255,12 … MW 255,15
FK4 Warning	Internal error of a remote unit	1_D	1_H	Unit type	Group number	Channel number	–
	Cut wire (open circuit)	2_D	2_H	Unit type	Group number	Channel number	–
	Wrong level of an analog output	3_D	3_H	Unit type	Group number	Channel number	–
	Overload	4_D	4_H	Unit type	Group number	Channel number	–
	10V FAIL	5_D	5_H	Unit type	Group number	Channel number	–
	Overload + cut wire	6_D	6_H	Unit type	Group number	Channel number	–
	Short circuit	8_D	8_H	Unit type	Group number	Channel number	–
	Short circuit + cut wire	10_D	A_H	Unit type	Group number	Channel number	–
	Overload + short circuit	12_D	C_H	Unit type	Group number	Channel number	–
	Short circuit + overload + cut wire	14_D	E_H	Unit type	Group number	Channel number	–
	During start-up, the system detects that the program end is missing	129_D	81_H	–	–	–	–
	During start-up, the system detects a syntax error in the user program	131_D	83_H	Program address	–	–	–
	During start-up, the system detects that the historical value memory is too small	132_D	84_H	–	–	–	–
	During start-up, the system detects that no cycle time has been set	133_D	85_H	–	–	–	–
	During start-up, the system detects that there are bracketing errors in the user program	134_D	86_H	Program address	–	–	–
	During start-up, the system detects that the target label for a conditional jump is missing	135_D	87_H	Program address	–	–	–
	The user program is not started because the number of remote units which are adopted into the CS31 bus cycle is smaller than the number configured in KW 00,09.	138_D	$8A_H$	Configured number of remote units (KW 00,09)	Actual number of remote units con-nected to the CS31 bus cycle	–	–
	User program too large for memory size	140_D	$8C_H$	–	–	–	–
	Compiled code	141_D	$8D_H$	–	–	–	–

N°	Error	Display/reaction of the bus master central unit	Display/reaction of the input/output remote units	Display/reaction of the slave central units
1	Bus master central unit has falled, e.g. because of power failure	No display, all outputs are off.	Error red LED lights up. All the outputs are turned to 0	07 KR 91 / 07 KT 92/93 : – LED BA is on LED RE flashes – Bit 1 = 0 in the status word EW 07,15
3a	CS31 system bus is disconnected (all the remote units are disconnected) or	Displays : red LED Flags : M 255,10 = 1 M 255,13 = 1 for further flags see 8.3		07 KR 31 / 07 KT 31 – red LED flashes – Bit 1 = 0 in the status word EW 7,15
3b	CS31 system bus is short-circuited			
4a	CS31 system bus is disconnected (the remote units are only disconnected in part)	Displays : red LED	Remote units without connection to the bus master central unit : same as 1	Slave central units without connection to the bus master central unit : same as 1
4b		Flags : M 255,10 = 1 M 255,13 = 1 for further flags see 8.3	Remote units with connection to the bus master central unit : no display/reaction	Slave central units with connection to the bus master central unit : no display/reaction
5a	A remote unit has been been lost on the CS31 system bus. Cause :	Displays : red LED Flags : M 255,10 = 1 M 255,13 = 1 for further flags see 8.3	Remote units with connection to the bus master central unit : no display/reaction	Slave central units with connection to the bus master central unit : no display/reaction
5b	No connection to the CS31 system bus		Remote units without connection to the bus master central unit : same as 1	Slave central unit without connection to the bus master central unit : same as 1
5c	defective remote unit			07 KR 31 / 07 KT 31 / 07 KR 91 / 07 KT 92/93 Error class FK1 / FK2, all outputs turn to 0.
5d	Power failure		all outputs turned to 0	all outputs turned to 0
6a	An error has occured at the inputs or outputs of a remote unit e.g. a short circuit.	Displays : red LED Flags : M 255,10 = 1 M 255,14 = 1 for further flags see 8.3	Concerned remote unit : error LED red lights up the LEDs of status of inputs/outputs by means of the test button detailed infos.	Concerned 07 KT 92/93 : Display : K = short circuit Concerned 07 KT 31 Display : red led Flags : M 255,10 = 1 M 255,14 = 1 for further flags see 8.3 07 KR 31 : not concerned
6b			0ther remote unit : no display/reaction	Other slave central units : no display/reaction

Reaction on the bus master central unit and the remote units in case of errors (continued)

N°	Error	Display/reaction of the bus master central unit	Display/reaction of the input/output remote units	Display/reaction of the slave central units
7a	Two remote input units of the same type have been set to the same address	The error is detected only when the signal statuses of the two units become different. The message is faulty in this case, and the units are considered to be disconnected. Display : Red error LED Flags : M 255,10 = 1 M 255,13 = 1 for other flags see 8.3 / 8.6	Concerned units same as 1 Other units : no display/reaction	same as 1
7b	Two remote units of the same type have been set to the same address.	No reaction, unless there is a large distance between the remote units.	Faultless operation of the two units, unless they are far apart from each other.	Not applicable because inputs and outputs are always present.
7c	Two remote units of different types, but with overlapping ranges have been set to the same address, e.g. ICSI 16 D1 and ICSK 20 F1.	The error is already detected during the initialization. The two remote units are not adopted into the bus cycle. The error is not detected.	Concerned units : same as 1 Other units : no display/reaction	Concerned units : same as 1 Other units : no display/reaction
7d	Address 62 or 63 has been set to a binary remote unit.	Is not detected.	– Output of the signals in parallel to the bus master – Input signals are ignored.	–
7e	An address higher than 5 has been set to an analog remote unit.	Is not detected.	same as 1	





● **Creation of the user program**

Using the programming languages :

– Extended instruction list (ext. IL)
– Function block diagram (FBD) and
– Ladder diagram (LD)

● **Test in terminal mode**

e.g. in the programming software 907 PC 331 (main menu "PLC commun.2" submenu "Terminal emulation")

● **Test**

The terminal interface has to be set to 9600 baud, 8 data bits, no parity bit and 1 stop bit.

● **Test**

Press the following <keys> in order to activate the terminal mode :

<CR>,
<1> for TERMINAL,
<2> for CHAR, MODE and
<N> for data rate unchanged.

For the interfacing to the all of the central units see the following :

In order to establish the connection between the programming and test tools *and* the all central unit, the serial interface COM1 of the central unit 07 KR 31 / 07 KT 31 / 07 KR 91 / 07 KT 92 / 07 KT 93 has to be set to "Active mode" in all cases, (see chapter 3.5 "**Serial interface**").

● **Historical values**

Some functions use historical values :

- ASV	:	1 word
- BMELD	:	(2 + #n / 2) words if n is even
		(2 + #n+1 / 2) words if n is odd
- CALLUP	:	#VGW words
- DRUCK	:	1 word
- EMAS	:	1 word
- MOA	:	1 word
- MODBUS	:	1 word
- MOK	:	1 word
- PI	:	4 words
- SINIT	:	1 word
- UHR	:	1 word
- VRZ	:	2 words

A maximum of 128 historical values can be used in a program. The number of timers in the program is illimited; a maximum of 42 timers can run at the same time.

If KW 00,05 is different from 0 and if a function block using historical values is activated, its historical values are stored in a file and restored after a STOP/RUN or a power supply.

● **On-line modifications**

- Insertion of a function block using historical values when the central unit is running :

If a function block using historical values is inserted in the program when the central unit is running, its historical values are not shifted in the file of historical values. In this case, all datas used in the function blocks with historical values are wrong.

Program	File
Function block 1 Function block 2 Function block 3	Historical value 1 Historical value 2 Historical value 3

If the function block 4 is inserted between the blocks 2 and 3, the historical values are not shifted in the right order.

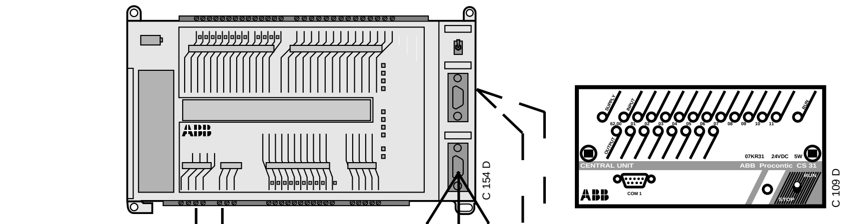
Modified program	File
Function block 1 Function block 4 Function block 2 Function block 3	Historical value 1 Historical value 2 Historical value 3 New historical value

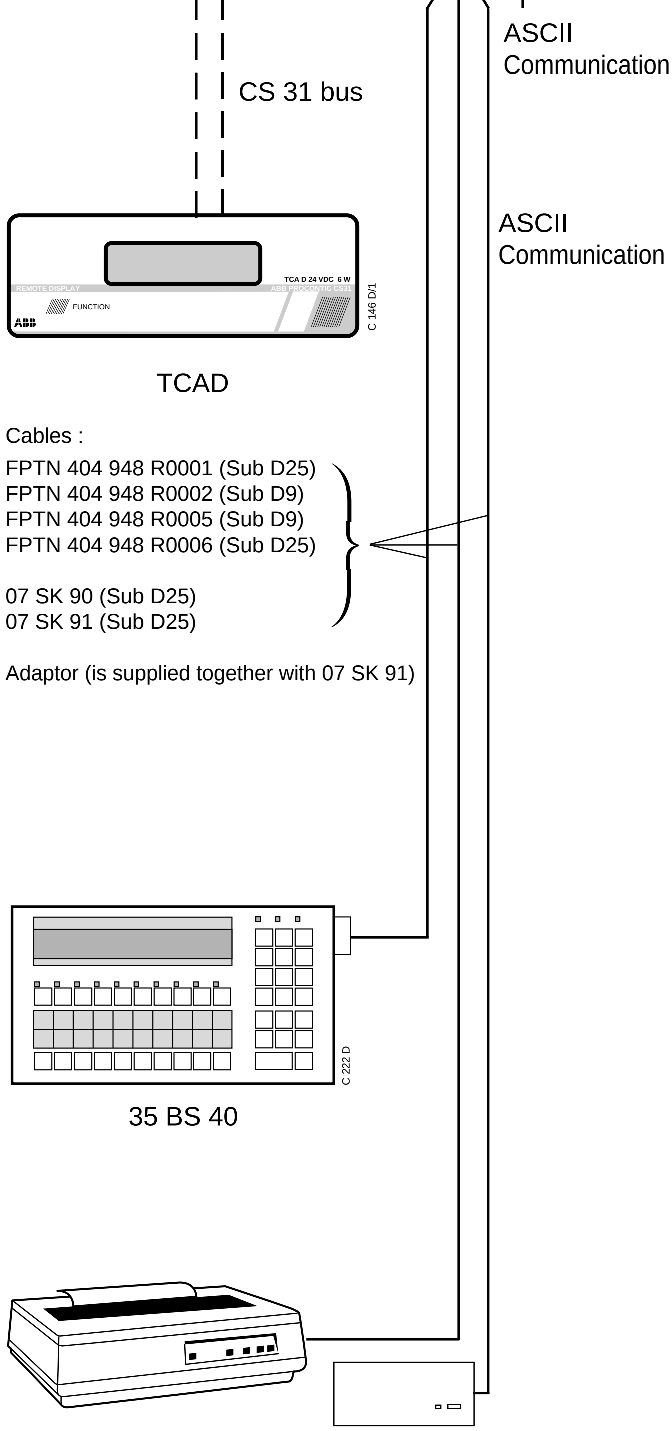
- In case of a too long coded program :

In case of a too long coded program (2 kInst with a lot of instructions which are coded on 6, 7 or 8 bytes), the status of central unit displays :
On-line : not available.
The central unit has to be in stop mode for a transfer of the program.

Note : in stop mode, the status always displays :
On-line : not available.

Central unit





- **TCAD**
  - Display of 127 messages + 1 background message on 2 lines of 16 characters.
  - Two variable datas can be embedded in a message.
  - A buzzer can be activated or dasactivated.
  - A key function is available on the front plate.

- **35 BS 40**
  - Control via the serial interface COM1 of the central unit in passive mode (see page 3.5-1 "Serial interface").
  - Control via the serial interface COM2 is only possible in passive mode, (see 07KT92 / 07KT93).
  - Display of texts. 999 two-line texts can be stored and called by the central unit.
  - Display of variables coming from the central unit.
  - Entry of commands and values via the keyboard.
  - Programming using the editor 935 BS 40.

- **Other control panels** with ASCII communication.

- **Other devices**, e.g. printer, modem
  - Control via the serial interface of the central unit in passive mode or active mode (see page 3.5-1 "Serial interface").
  - Control via the serial interface COM2 is only possible in passive mode (see 07KT92 / 07KT93).

The central units 07 KR 31 and 07 KT 31 have a built-in MODBUS interface used as a master or a slave on a MODBUS network.

The communication is in binary format (RTU) with an CRC16 checksum.

● Central unit used as **a MODBUS slave :**
All datas (inputs, outputs, internal memories, ...) can be read or write without any user program when using 07 KR 31 or 07 KT 31 as a slave on the MODBUS network.

● Central unit used as **a MODBUS master :**
The function block MODBUS has to be used in the user program. It allows the writing and the reading of datas in the MODBUS slaves.

The function block **SINIT** is necessary only if the user wants to change the factory setting parameters of the communication (baud rate, parity, ...).

NOTE : The central units 07 KR 31 and 07 KT 31 can be used as a master or a slave on the CS31 bus.

● The MODBUS **status** (master or slave) of the 07 KR 31/ 07 KT 31 is in the system constant **KW00,06**.

The value of the system constant KW00,06 and the pin 6 assignment on the cable determine the protocol of the serial interface RS232C (programming and test, man machine communication or MODBUS).

The central units 07 KR 31 and 07 KT 31 are able to recognize the number of the slave asked by the master and to interpret the «diffusion messages» (slave number requiered = zero).

● The 07 KR 31 and 07 KT 31 are able to identify the following function codes :

- Reading of n bits Code 01 or 02
- Reading of n words Code 03 or 04
- Writing of one bit Code 05
- Writing of one word Code 06
- Quick reading of 8 bits Code 07
- Writing of n bits Code 0F
- Writing of n words Code 10

The following error codes can be generated :

Error code 01 = unknown function code
Error code 02 = address error
Error code 03 = data error

11.1 07 KR 31 / 07 KT 31 MODBUS protocol
Central processing units

The MODBUS protocol is a request/reply type : the master MODBUS sends a request, then waits passively an answer from the slave.

The communication frames are set up on the same way :

- – Slave number (1 byte)
- – Function code (1 byte)
- – Message text (N bytes)
- – CRC16 check (2 bytes)

● Read n bits (0 < n < 255)

Function code : 01 or 02

send :

SLAVE	FCT	ADH	ADL	NB OF	BITS	CRCH	CRCL

receive :

SLAVE	FCT	NBYTE	.. DATA ..	CRCH	CRCL

DATA : 7th 1st 15th 8th

Example :

Read 16 bits at the address 0000H

send :

01 01 00 00 00 10 3D C6

receive :

01 01 02 00 00 B9 FC

● Read n words (0 < n < 100)

Function code : 03 or 04

send :

SLAVE	FCT	ADH	ADL	NB OF WORDS	CRCH	CRCL

receive :

SLAVE	FCT	NBYTE	.. DATA ..	CRCH	CRCL

DATA : 1st 2nd ...

Example :

Read 10 words at the address 0060H

send :

01 03 00 60 00 0A C5 D3

receive :

01 03 14 0000 0000 0000 0000 0000
0000 0000 0000 0000 0000
A367

with 14H = 20 bytes

● Write 1 bit

Function code : 05

send :

SLAVE	FCT	ADH	ADL	DATA	DATA	CRCH	CRCL

receive :

SLAVE	FCT	ADH	ADL	DATA	DATA	CRCH	CRCL

DATA : bit = 0 → 00 00
bit = 1 → FF 00

Example :

Write 1 at the address 2000H

send :

01 05 20 00 FF 00 87 FA

receive :

01 05 20 00 FF 00 87 FA

● Write 1 word

Function code : 06

send :

SLAVE	FCT	ADH	ADL	DATA	DATA	CRCH	CRCL

receive :

SLAVE	FCT	ADH	ADL	DATA	DATA	CRCH	CRCL

DATA : HI(WORD) LO(WORD)

Example :

write 1234H at the address 2000H

send :

01 06 20 00 12 34 8F 7D

receive :

01 06 20 00 12 34 8F 7D

● **Write of n bits (1 < n < 255)**

Function code: 0F

send :

SLAVE	FCT	ADH ADL	NB OF BITS	NBYTE	..DATA..	CRCH CRCL

DATA : 7th 1st 15th 8th

receive :

SLAVE	FCT	ADH ADL	NB OF BITS	CRCH CRCL

Example :
Write 5 bits (set to 1) at the address 2000H

send :
01 0F 20 00 00 05 01 1F 29 FE

receive :
01 0F 20 00 00 05 9E 08

with : 05H=NB OF BITS
01H=NBYTE
1FH=0001 1111B data
02H=NBYTES*2(1H*2)

● **Write of n words (1< n < 100)**

Function code : 10

send :

SLAVE	FCT	ADH ADL	NB OF WORDS	NBYTE	..DATA..	CRCH CRCL

DATA : 1st 2nd

receive :

SLAVE	FCT	ADH ADL	NB OF WORDS	CRCH CRCL

Example :

write : 1H at the address 2000H
2H at the address 2001H
3H at the address 2002H

send :
01 10 20 00 0003 06 0001 0002 0003 91 41

receive :
01 10 20 00 00 03 8B C8

● **Error code :**

receive :

SLAVE	FCT v 80H	ERR	CRCH	CRCL

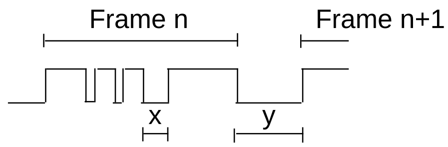
Error code 01 = unknown function code
Error code 02 = address error
Error code 03 = data error

Example : address error

receive after reading n words (code 03H)
01 83 02 C0 C0

with 83H=80H+03H

● **Timing**



Time between characters (x) :
At 9600 Bauds : 1 ms

The time between two characters must be lower than x

Time between frames (y) :

Rate (Bauds)	Time y (ms)
19200	4
9600	5,5
4800	11
2400	21
1200	42
600	83
300	166
150	330

A new frame is detected only if the delay after the previous frame is higher than y. If the delay is lower, a CRC error happens on the previous frame.

11.2 07 KR 31 / 07 KT 31 Central processing units — MODBUS configuration

The mode MODBUS protocol in the 07 KR 31 and 07 KT 31 depends on the value of the system constant KW00,06 and the connection between the pin 6 and pin 7 on the cable.

The mode MODBUS protocol, when it is selected, is always available even if the central unit is in STOP mode.

The programming mode is again available when there is no connection between pin 6 and pin 7 ; the program can be tested or modified by the programming software 907 PC 331.

● Master and slave configuration

The system constant KW 00,06 selects the status of the central unit on the MODBUS network.

The value has to be greater than 100.

The slave number is the value of KW 00,06 minus 100.

The MODBUS slave numbers are between 01 and 255 so the value of KW 00,06 for a MODBUS slave configuration is from 101 up to 355.

The number 00 is for the diffusion of messages (all slaves on the MODBUS network read the message).

The value of KW 00,06 for a MODBUS master configuration is 100.

● Communication parameters

The factory setting is :

- 9600 bauds
- parity : none
- data bits : 8
- stop bits : 1

These parameters can be changed with the function block SINIT in the user program.

Refer to the documentation of the function block.

SINIT : FREI
SSK
BAUD
Stop
ZL
PTY
E/O
Echo
SBRK
FEND
ENDS
ENDE

The following parameters have no influence on the configuration on the serial line in MODBUS protocol :

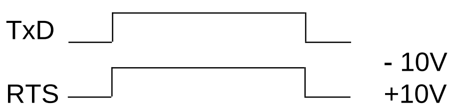
Echo
SBRK
FEND
ENDS
ENDE

● Serial line connection RS232C

07KR31 (Sub D9 female)	MODBUS
TXD 2	RXD
RXD 3	TXD
SGND 7	SGND
6 (bridged to 7)	
RTS 4	CTS
CTS 5	RTS
	DTR, DCD, DSR (bridged together)

It is not necessary to connect the CTS/RTS pins on 07 KR 31 or 07 KT 31.

Signal level on the Modbus slave :



The following cables are available :

- FPTN 404948R0001 (SubD25-SubD9)
- FPTN 404948R0006 (SubD9-SubD9)

Cross reference list MODBUS / 07 KR 31 or 07 KT 31

● **List of accessible parameters by the master MODBUS**

All following parameters of 07 KR 31 / 07 KT 31 can be read or written by the master MODBUS :

Bits : E 00,00 upto E 63,15
A 00,00 upto A 63,15
M 000,00 upto M 21,15 and
M 230,00 upto M 239,15 and
M 255,00 upto M 255,15
S 000,00 upto S 15,15
– in reading n bits (Function codes 01 or 02)
– in quick read of 8 bits (Function code 07)
– in writing n bits (Function codes 05 or 0F)

Words : EW 00,00 upto EW 07,15
AW 00,00 upto AW 07,15
MW 00,00 upto MW 05,15 and
MW 230,00 upto MW 239,15 and
MW 254,00 upto MW 255,15
KW 00,00 upto KW 07,15
– in reading n words
(Function codes 03 or 04)
– in writing n words
(Function codes 06 or 10)

It is possible to write inputs with MODBUS.The setting is only available for one central unit cycle.The result in the user program is a rising or falling edge on the binary input and a set point for one cycle for the analogue input.

● **BITS**

– INPUTS

in reading with the functions : 1 or 2 (from 1 to 255 Bits)
in writing : 5 or F (from 1 to 255 Bits)

Address 07KR31 or 07KT31	Address MODBUS	
E 00,00	0000_H	0000_D
E 00,01	0001_H	0001_D
.	.	
.	.	
E 00,15	$000F_H$	0015_D
E 01,00	0010_H	0016_D
.	.	
.	.	
E 01,15	$001F_H$	0031_D
.	.	
.	.	
E 62,00	$03E0_H$	0992_D
.	.	
E 63,15	$03FF_H$	1023_D

– OUTPUTS

in reading with the functions : 1 or 2 (from 1 to 255 Bits)
in writing : 5 or F (from 1 to 255 Bits)

Address 07KR31 or 07KT31	Address MODBUS	
A 00,00	1000_H	4096_D
A 00,01	1001_H	4097_D
.	.	
A 00,15	$100F_H$	4111_D
A 01,00	1010_H	4112_D
.	.	
A 01,15	$101F_H$	4127_D
.	.	
A 62,00	$13E0_H$	5088_D
A 63,15	$13FF_H$	5119_D

– Flags

in reading with the functions : 1 or 2 (from 1 to 255 bits)
in writing : 5 or F (from 1 to 255 bits)
in quick read with the function : 7 (bits M001,00 to M001,07)

Address 07KR31 or 07KT31	Address MODBUS	
M 000,00	2000_H	8192_D
M 000,01	2001_H	8193_D
.	.	
M 001,00	2010_H	8208_D
M 021,15	$215F_H$	8543_D
.		
M 230,00	$2E60_H$	11872_D
.	.	
M 239,15	$2EFF_H$	12031_D
M 255,00	$2FF0_H$	12272_D
M 255,15	$2FFF_H$	12287_D

– Sequencers

in reading with the functions : 1 or 2 (from 1 to 255 bits)
in writing : 6 (bit to bit)
(Only set to 1 is allowed)

Address 07KR31 or 07KT31	Address MODBUS	
S 00,00	3000_H	12288_D
S 00,01	3001_H	12289_D
.	.	
S 01,15	$301F_H$	12319_D
S 02,00	3020_H	12320_D
.	.	
S 15,15	$30FF_H$	12543_D

- **WORDS**

– INPUTS

in reading with the functions : 3 or 4 (from 1 to100 words)
in writing : 6 or 10 (from 1 to 100 words)

Address 07KR31 or 07KT31	Address MODBUS	
EW 00,00	0000_H	000_D
EW 00,00	0001_H	001_D
.	.	
EW 00,15	$000F_H$	015_D
EW 01,00	0010_H	016_D
.	.	
EW 01,15	$001F_H$	031_D
.	.	
EW 07,15	$007F_H$	127_D

– OUTPUTS

in reading with the functions : 3 or 4 (from 1 to 100 words)
in writing : 6 or 10 (from 1 to 100 words)

Address 07KR31 or 07KT31	Address MODBUS	
AW 00,00	1000_H	4096_D
AW 00,01	1001_H	4097_D
.	.	
AW 00,15	$100F_H$	4111_D
AW 01,00	1010_H	4112_D
.	.	
AW 01,15	$101F_H$	4127_D
.	.	
AW 07,15	$107F_H$	4223_D

– Internal words

in reading with the functions : 3 or 4 (from 1 to 100 words)
in writing : 6 or 10 (from 1 to 100 words)

Address 07KR31 or 07KT31	Address MODBUS	
MW 000,00	2000_H	8192_D
MW 000,01	2001_H	8193_D
.	.	
MW 005,15	$205F_H$	8543_D
MW 230,00	$2E60_H$	11872_D
.	.	
MW 239,15	$2EFF_H$	12031_D
.	.	
MW 254,00	$2FE0_H$	12271_D
.	.	
MW 255,15	$2FFF_H$	12287_D

– Indirect constants

in reading with the functions : 3 or 4 (from 1 to 100 words)

Address 07KR31 or 07KT31	Address MODBUS	
KW 00,00	3000_H	12288_D
KW 00,01	3001_H	12289_D
.	.	
KW 01,15	$301F_H$	12319_D
KW 02,00	3020_H	12320_D
.	.	
KW 07,15	$307F_H$	12415_D

The traitment time depends on :

– the baud rate
– the number of bytes of the frame
– the cycle time of the central unit
– the central unit load

The central unit has a buffer of 256 bytes.The traitement by the central unit of the frame starts after the time of 3/2 character after the last received character.

● For a Modbus slave 07 KR 31 / 07 KT 31

The transmission time (sending+receiving) is :
(Nb bytes*11/baud)*1000 ms.

The basic time in the central unit is :

reading n bits	: 0.827 ms + nb bits*0.246 ms
reading n words	: 0.731 ms + nb words*0.182 ms
write 1 bit	: 1.062 ms
write 1 word	: 1.025 ms
write n bits	: 1.113 ms + nb bits*0.039 ms
write n words	: 1.099 ms + nb words*0.182 ms
quick reading of 8 bits	: 0.265 ms

The traitment time in the central unit is:
Cycle time + (INT(basictime / ((1-load)*cycle time)))*cycle time

The total response time is :
sending time + traitment time in the central unit
+ receiving time

Example :

Read 10 words
9600 bauds
cycle time : 30ms
central unit load : 60%

Sending frame :

01 03 00 60 00 0A C5 D5
8*11/9600*1000 = 9.17ms

Receiving frame :

01 03 14 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 A3 67
25*11/9600*1000 = 28.64ms

Basic time :

0.731 + 10*0.182 = 2.551ms

Traitment time :

30 + INT(2.551 /30*(1-0.6))*30= 30ms

The total response time is :

9.17 + 28.64 + 30 = 67.81 ms
This time is a medium time.

Measurement of response time :

Nb variables	Bit read	Bit write	Word read	Word write
1	10 - 60	50	10 - 60	60
10	10 - 60	60	10 - 60	110
50	10 - 60	110	110 - 170	220
100	50 - 60	110	220 - 280	390
150	50 - 110		-	-
255	50 - 110		-	-

(T min - Tmax)ms

- Cycle time : 10 ms
- Central unit load : 80 %
- Baud rate : 9600
- 07 KR 31 / 07 KT 31 master

● For a Modbus master 07 KR 31 / 07 KT 31

The transmission times are always the same.

● **Capacities**

The central units 07 KR 91, 07 KT 92, 07 KT 93 have a very high powerfull treatment. A large number of software functions and a high velocity allows complexe applications.

The central units 07 KR 31 and 07 KT 31 are used for smaller applications or as slave in a complexe application.

	Velocity	Memory
07 KR 31, 07 KT 31	6ms/1kinst	EEPROM 2kinst (8kbytes)
07 KR 91, 07 KT 92/93	2ms/1kinst	Flash EPROM 7kinst (32kbytes)

The user program has to be stored in EEPROM in the 07 KR 31 and 07 KT 31.

The user program can be stored in RAM in the 07 KR 91/ 07 KT 92 (only if the flash EPROM is erased and the battery is mounted).

● **Range of variables**

The range of different variables in the 07 KR 31 / 07 KT 31 is smaller than the range in the 07 KR 91 / 07 KT 92 / 07 KT 93 (see chapter 1.4 "**Operands**").

● **Refresh variables**

All variables (inputs and outputs) are refreshed in the 07 KR 31 / 07 KT 31 even if these variables are not written in the user program.

In case of a data acquisition application where the 07 KR 31/ 07 KT 31 is connected to a supervisor, it is not necessary to write in the user program the inputs or outputs (binary or analog).

● **Cycle time**

07 KR 31, 07 KT 31 :

The CS 31 bus cycle time is included in the cycle time KD00,00.

The maximum cycle time (KD00,00) is 100ms for a master configuration and 250ms for a slave configuration.

An error FK3 (code 200) is generated if the cycle time is greater than the time in KD00,00 :

- the central unit aborts or continues the execution of the program according to the value of the system constant KW00,07.

07 KR 91, 07 KT 92, 07 KT 93 :

The CS 31 bus cycle time is not included in the cycle time KD00,00.

The value of the cycle time is not limited.

An error FK2 (code 131) is generated if the cycle time is greater than the time in KD00,00 :

- the central unit aborts the execution of the program.

Slave central unit

07 KR 91, 07 KT 92, 07 KT 93 :

The cycle time t_C is independant of the master or slave functions.

07 KR 31, 07 KT 31 :

The cycle time t_C depends on the configuration of the CS 31 bus and the cycle time of the master.

● **Timers and historical values**

	Timers running in the same time	Error in case of more timers	Historical values
07 KR 31 07 KT 31	42	FK2(255)	128 (excepted timer)
07 KR 91 07 KT 92 07 KT 93	80	FK2(257)	1000 (included timers)

● **Modification of a timer value online**

The new value of KD or MD is taken into account :
- immediately in a central unit serie 30;
- at the next timer in a central unit serie 90.

● **Address of a slave central unit**

The address is determined by	System constant KW00,00	Plug-in base ECZ
07 KR 31 07 KT 31	0 ... 61	switch if KW0,0 = 100
07 KR 91 07 KT 92 07 KT 93	0 ... 61	no

● **Diagnosis**

A user program too large (memory size too small) is detected in the 07 KR 31/07 KT 31. An error FK4(140) is generated.

The overlapping ranges are not detected by the 07 KR 31 or the 07 KT 31.

● **Forced variables**

Maximum number of I/O signals to be forced

	07KR91, 07KT92/93	07KR/KT31
binary inputs binary outputs	64 64	31
word inputs word outputs	16 16	7

● **Brackets**

	07KR91, 07KT92/93	07KR/KT31
nesting depth	15	8

● **Analog remote modules**

With the 07 KR 91, 07 KT 92 or 07 KT 93, a maximum of 12 analog input units can be connected on the CS31 bus.

With the 07 KR 31 or 07 KT 31, a maximum of 28 analog input units can be connected on the CS31 bus.

● **Modbus**

The central units 07 KR 31 and 07 KT 31 have a built-in MODBUS interface used as a master or a slave on a MODBUS network.

The central units 07 KR 91, 07 KT 92 or 07 KT 93 can be coupled to the 07 MK 92 coupler to be used as a MODBUS master or slave on a MODBUS network.

● **Password**

A password can be used in the 07 KR 31 or 07 KT 31 to lock the program access in reading or writing.

● **KW 00,08**

The KW 00,08 constant is used in the 07 KT 92 / 07 KT 93 central units to detect an output short circuit.

The KW 00,08 constant is not used in the 07 KT 31.

● **Battery**

A battery failure is detected with the bit 3 of the status word EW 07,15.

The battery can not be changed in the 07 KR 31 or 07 KT 31. In the 07 KR 91, 07 KT 92 or 07 KT 93, a led is lighted in case of battery failure and the battery can be changed.

● **FK4 errors**

A FK4 error (which code value is lower or equal than 15) is automatically reset in the 07 KR 31 or 07 KT 31 if it is reset in the remote unit.

FK4 errors	07KR31/07KT31	07KR91/07KT92/07KT93
< 15	red led	Leds BE and RE
> 15	red led	No led

● **Reset of MW254,00...MW255,15**

	07KR31/07KT31	07KR91/07KT92/07KT93
Reset	- overwrite - power supply OFF without back up	- overwrite

13 07 KR 31 / 07 KT 31 Ordering data
Central processing units

● **Central unit 07 KR 31**

230 VAC .... Order No. FPR 360 0227 R0206
120 VAC .... Order No. FPR 360 0227 R0204
24 VDC .... Order No. FPR 360 0227 R1202

● **Central unit 07 KT 31**

230 VAC .... Order No. FPR 360 0228 R0206
120 VAC .... Order No. FPR 360 0228 R0204
24 VDC .... Order No. FPR 360 0228 R1202

● **Plug-in base ECZ**. .... Order No. FPR 370 0001 R0001

● **Accessories**

Programming cable 9 pins .... Order No. FPTN 404 948 R0002
Programming cable 25 pins .... Order No. FPTN 404 948 R0005

MODBUS or MMC cable 9 pins .... Order No. FPTN 404 948 R0006
MODBUS or MMC cable 25 pins .... Order No. FPTN 404 948 R0001

System cable 07 SK 90 .... Order No. GJR5 2502 00 R0001
System cable 07 SK 91 .... Order No. GJR5 2503 00 R0001
System cable 07 SK 92 .... Order No. GJR5 2504 00 R0001

Operation station 35 BS 40 .... Order No. GJV3 0753 04 R0001
Operation station 35 BS 93 .... Order No. GJV3 0729 01 R0003

● **Programming and test software and operating manual**
(both 907 PC 33 and 907 PC 331 are required)

907 PC 33 German(1) .... Order No. GJP5 2039 00 R0102
907 PC 33 English(1) .... Order No. GJP5 2040 00 R0102

907 PC 331 German(2) .... Order No. GJP5 2045 00 R0102
907 PC 331 English(2) .... Order No. GJP5 2046 00 R0102

● **Further litterature**

System description ABB Procontic CS31 English .... Order No. FPTN 440 004 R2001
System description ABB Procontic T200 English .... Order No. GATS 1314 99 R2001
System description ABB Procontic T300 English .... Order No. GATS 1315 99 R2002

System description ABB Procontic CS31 German .... Order No. GATS 1316 99 R1002
System description ABB Procontic T200 German .... Order No. GATS 1314 99 R1001
System description ABB Procontic T300 German .... Order No. GATS 1315 99 R1002

1) Description General Part
2) Description 07 KR 31 / 07 KR 91 / 07 KT 92 - Specific Part + Software diskettes

Operating Manual

ABB Procontic CS31

Intelligent Decentralized Automation System

Central Units 07 KR 91, 07 KT 92 and 07 KT 93

Order No.
GATS 1316 23 R2001

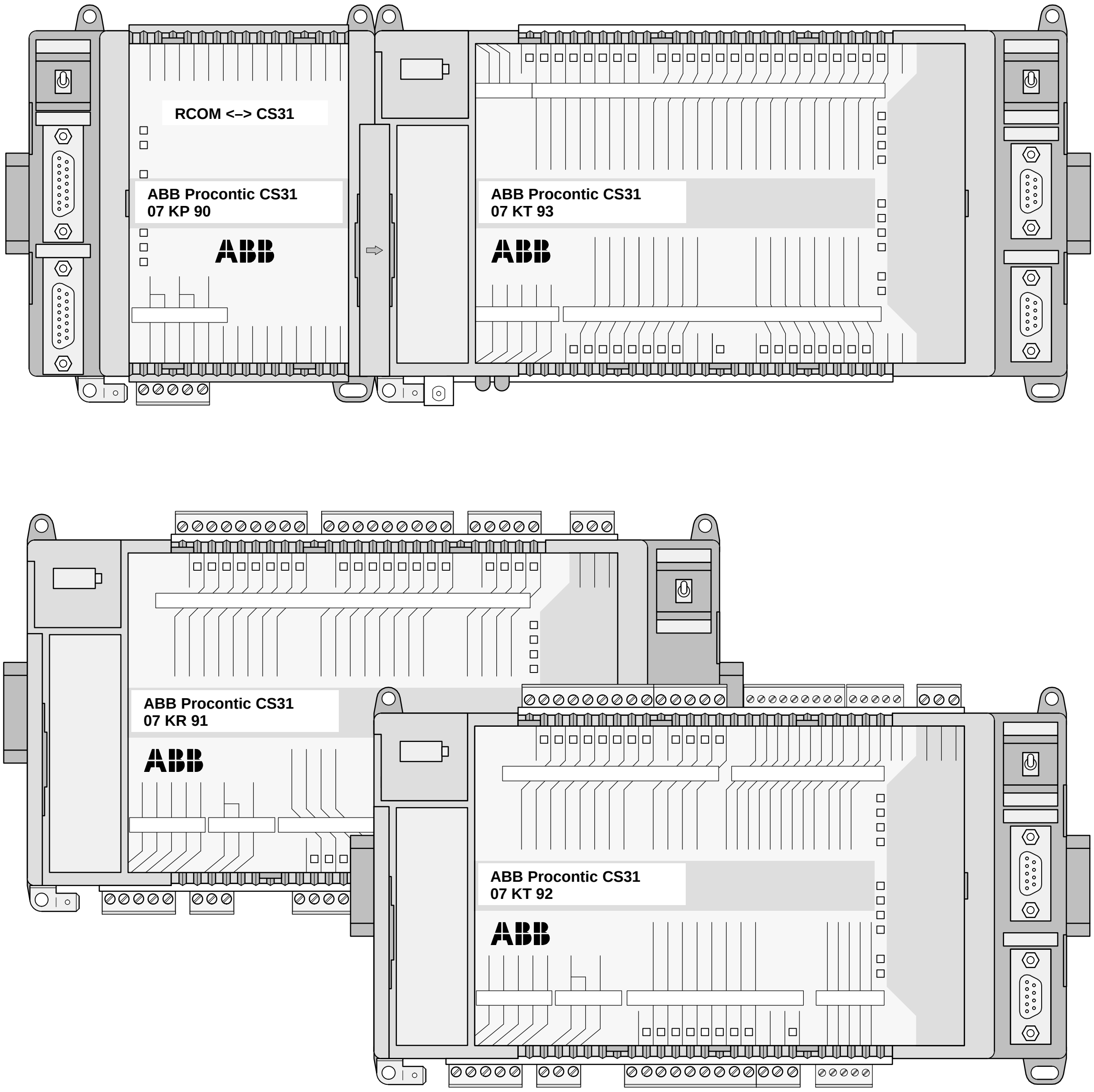


ABB Schalt–
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Regulations
Concerning the Setting up of Installations

Apart from the basic ”Regulations for the Setting up of Power Installations” DIN VDE* 0100 and for ”The Rating of Creepage Distances and Clearances” DIN VDE 0110 Part 1 and Part 2 the regulations ”The Equipment of Power Installations with Electrical Components” DIN VDE 0160 in conjunction with DIN VDE 0660 Part 500 have to be taken into due consideration.

Further attention has to be paid to DIN VDE 0113 Part 1 and Part 200 in case of the control of working and processing machines. If operating elements are to be mounted near parts with dangerous contact voltage DIN VDE 0106 Part 100 is additionally relevant.

If the protection against direct contact according to DIN VDE 0160 is required, this has to be ensured by the user (e.g. by incorporating the elements in a switch-gear cabinet). The devices are designed for pollution severity 2 in accordance with DIN VDE 0110 Part 1. If higher pollution is expected, the devices must be installed in appropriate housings.

The user has to guarantee that the devices and the components belonging to them are mounted following these regulations. For operating the machines and installations, other national and international relevant regulations, concerning prevention of accidents and using technical working means, also have to be met.

The ABB Procontic devices are designed according to IEC 1131 Part 2. Meeting this regulation, they are classified in overvoltage category II which is in conformance with DIN VDE 0110 Part 2.

For the direct connection of ABB Procontic devices, which are powered with or coupled to AC line voltages of overvoltage category III, appropriate protection measures corresponding to overvoltage category II according to IEC–Report 664/1980 and DIN VDE 0110 Part 1 are to install.

Equivalent standards:

DIN VDE 0110 Part 1 ≙ IEC 664
DIN VDE 0113 Part 1 ≙ EN 60204 Part 1
DIN VDE 0660 Part 500 ≙ EN 60439–1 ≙ IEC 439–1

* VDE stands for ”Association of German Electrical Engineers”.

ABB Schalt– und Steuerungstechnik GmbH Heidelberg

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Intelligent Decentralized
Automation System

Central Units
07 KR 91 R202 and R252

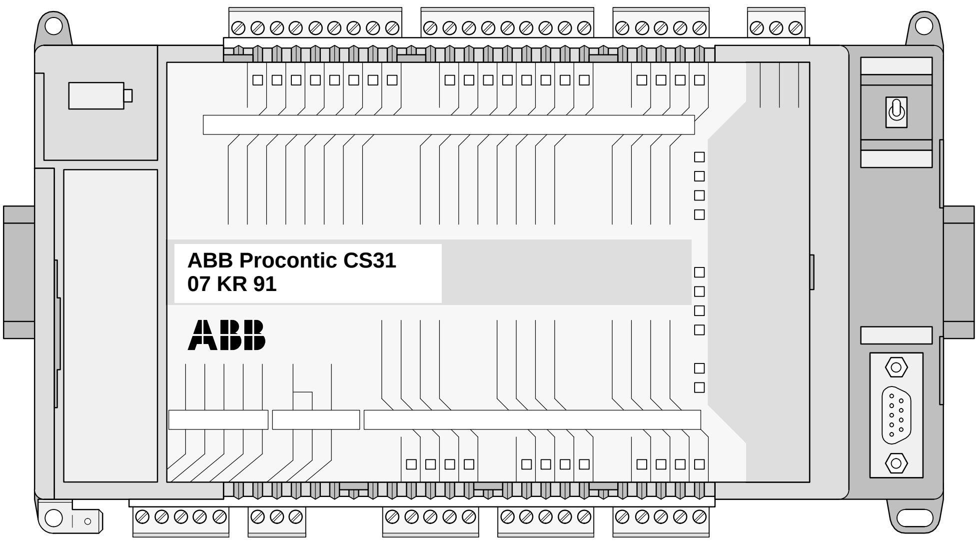

**ABB Schalt–
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DIN VDE 0660 Part 500 ≙ EN 60439–1 ≙ IEC 439–1

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1 Central unit 07 KR 91

Central unit with max. 28 kB user program

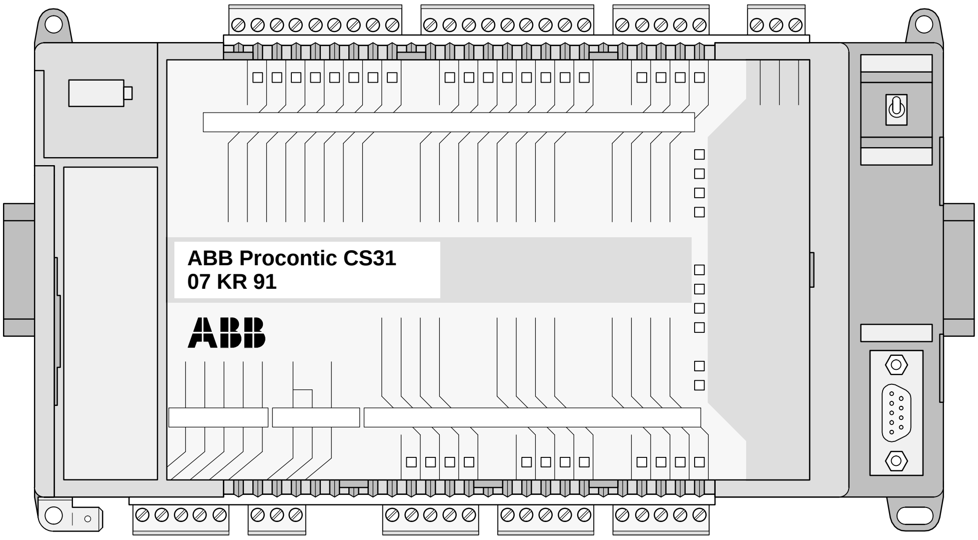


Fig. 1–1: Central unit 07 KR 91

Contents

1.1 Brief description

The central unit 07 KR 91 works either as

- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand–alone central unit.

The module is provided in two versions with supply voltages of 24 V DC and 115/ 230 V AC:

07 KR 91 R202:

The device has a 115/230 V AC power supply voltage. It provides a 24 V output voltage for the supply of its own binary inputs.

07 KR 91 R252:

The device has a 24 V DC power supply voltage. It is provided with an additional interface for connecting communication modules (e.g. 07 KP 90).

Both module versions have the following main features:

1.1.1 Main features

- 20 binary inputs
- 12 binary relay outputs
- 1 counting input for counting frequencies up to 10 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  - is set as programming interface
  - can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw–type terminal blocks
- Detachable plastic sheet on the front side of the device; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  - store and back-up the user program in the RAM
  - store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  - back-up the time and date (real–time clock)
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions
  - Self–diagnosis of the central unit
  - Diagnosis of the ABB Procontic CS31 system bus and the connected modules

1.1.2 Project planning / start–up

The following has to be observed for project planning and start–up:

- Programming
  is performed using ABB Procontic programming software, which can be run on commercially available IBM compatible PCs (see documentation for the programming system 907 PC 331)
- Diagnosis and service device TCZ (terminal mode)
  (see volume 7.3, see chapter A5 (Appendix), Programming and test, see 1.3.9 Serial interface COM1)
- The processor processes the user program contained in the RAM. It is loaded into the RAM via the serial interface COM1 and can also be changed there. An additional save command is used to save the program in the Flash EPROM.

  Note: In the course of the following operations

  - Power ’ON’
  - RUN/STOP switch from STOP —> RUN
  - Program start-up with programming system
  - Cold start of the PLC

  the RAM is overwritten by the contents of the Flash EPROM, if a user program is contained in the Flash EPROM.
- On-line program modification
  The two existing RAMs allow a quick modification of the user program to be performed without interrupting the operation (see ABB programming system 907 PC 331).
- Change-over between the application modes
  - Stand–alone central unit
  - Bus master central unit and
  - Slave central unit

  The central unit is set to ”Stand-alone” upon delivery. Changing the application mode is carried out in the following three steps:

  1. Change the system constant KW 00,00 in the PLC, see chapter A7.3 (Appendix), System constants

2. Save the user program in the Flash EPROM

3. Activate new application mode by:

   – calling up the menu item of ”Enable PLC mode” in the ABB programming and test system or

   – performing a warm start or

   – performing a cold start.

- Setting the cycle time
  see chapter A1 (Appendix), Processing times

- Addressing when remote modules are connected
  see chapter A2 (Appendix), Addressing

- Back-up of data areas
  Back-up of data areas, i.e. saving of data during power OFF/ON, is only feasible with built-in battery. The following data can be backed, completely or partly:

  – Binary flags
  – Word flags
  – Double word flags
  – Step chains
  – Historical values

  In order to back-up certain data, they have to be excluded from initialization to 0.

- Initialization of data areas
  During *program start,* that data areas are initialized to 0 partly or completely, that are defined by system constants, see chapter A7.3 (Appendix), System constants.

  If no battery is effective or if the system constants are in their default values (factory settings), all of the above mentioned data areas are completely set to 0 after power OFF/ON.

- Reactions on errors of error class 3
  The user can configure whether or not the user program is to be aborted automatically, if an class 3 error occurs, see chapter A7.3 (Appendix), System constants.

- Starting-up the CS31 system after power ON
  The user can enter a number of *n* remote modules in KW 00,09. The user program starts only, i.e. it handles process inputs and outputs only, if at least *n* remote modules have been adopted into the CS31 system bus cycle, see chapter A7.3 (Appendix), System constants.

1.2 Structure of the front panel

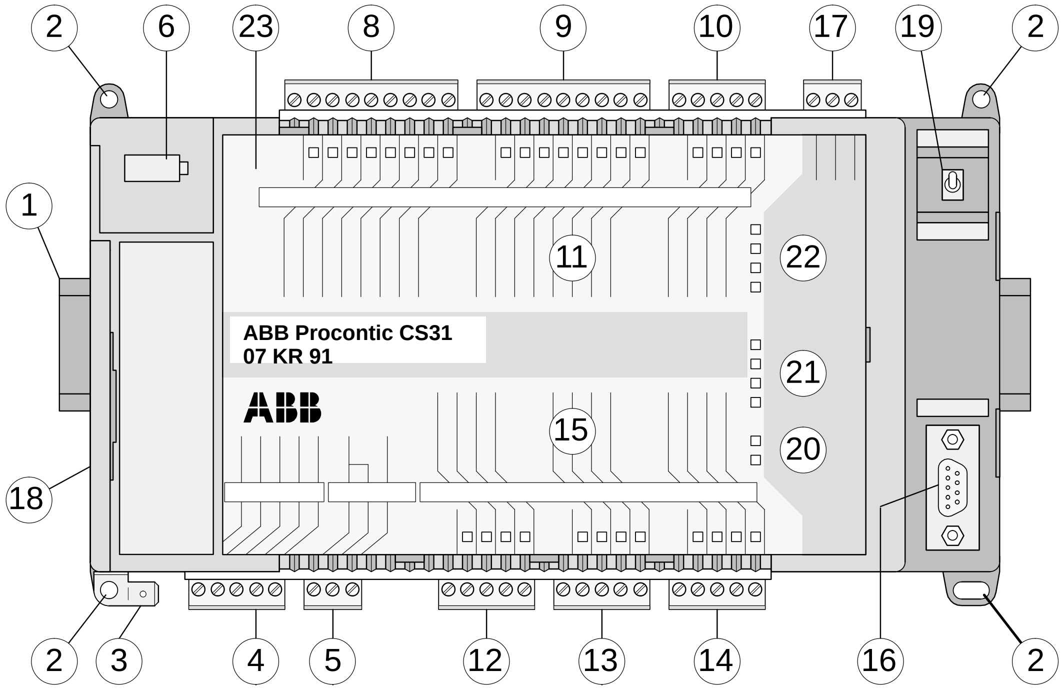
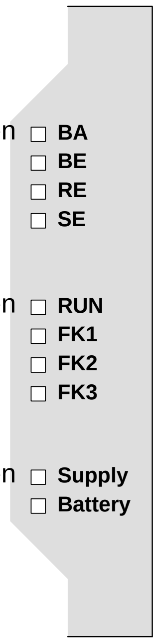


Fig. 1–2: Central unit 07 KR 91 with reference points

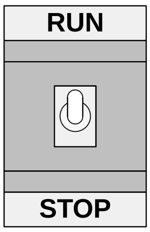
1	Fastening of the device on DIN rail
2	Fastening of the device by screws
3	Faston earthing terminal 6.3 mm
4	Supply voltage connection
5	24 V output voltage for input supply
6	Battery compartment
8 – 10	20 binary inputs in three groups
11	Assignment of the identifiers for the inputs
12 – 14	12 binary relay outputs in 3 groups
15	Assignment of the identifiers for the outputs
16	Serial interface COM1 (programming, MMC)
17	Connection for ABB Procontic CS31 system bus
18	Cover of the interface for the connection of communication modules (may only be removed for connecting communication modules)
19	Switch for RUN/STOP operation
20	LEDs for supply voltage and battery
21	LEDs for RUN and error class
22	LEDs for CS31 system bus
23	Plastic sheet (detachable for labelling)



22		
green	**BA**	Bus active
red	**BE**	Bus error
red	**RE**	Remote unit error
red	**SE**	Serial unit error
21		
green	**RUN**	User program is running
red	**FK1**	Fatal error
red	**FK2**	Serious error
red	**FK3**	Light error
20		
green	**Supply**	Supply voltage available
red	**Battery**	Battery not effective

For further information see chapter A4.3 (Appendix), Troubleshooting by means of LED displays on the central unit

19



The RUN/STOP switch is used to start or abort the processing of the user program.

1.2.1 Terminal assignment overview

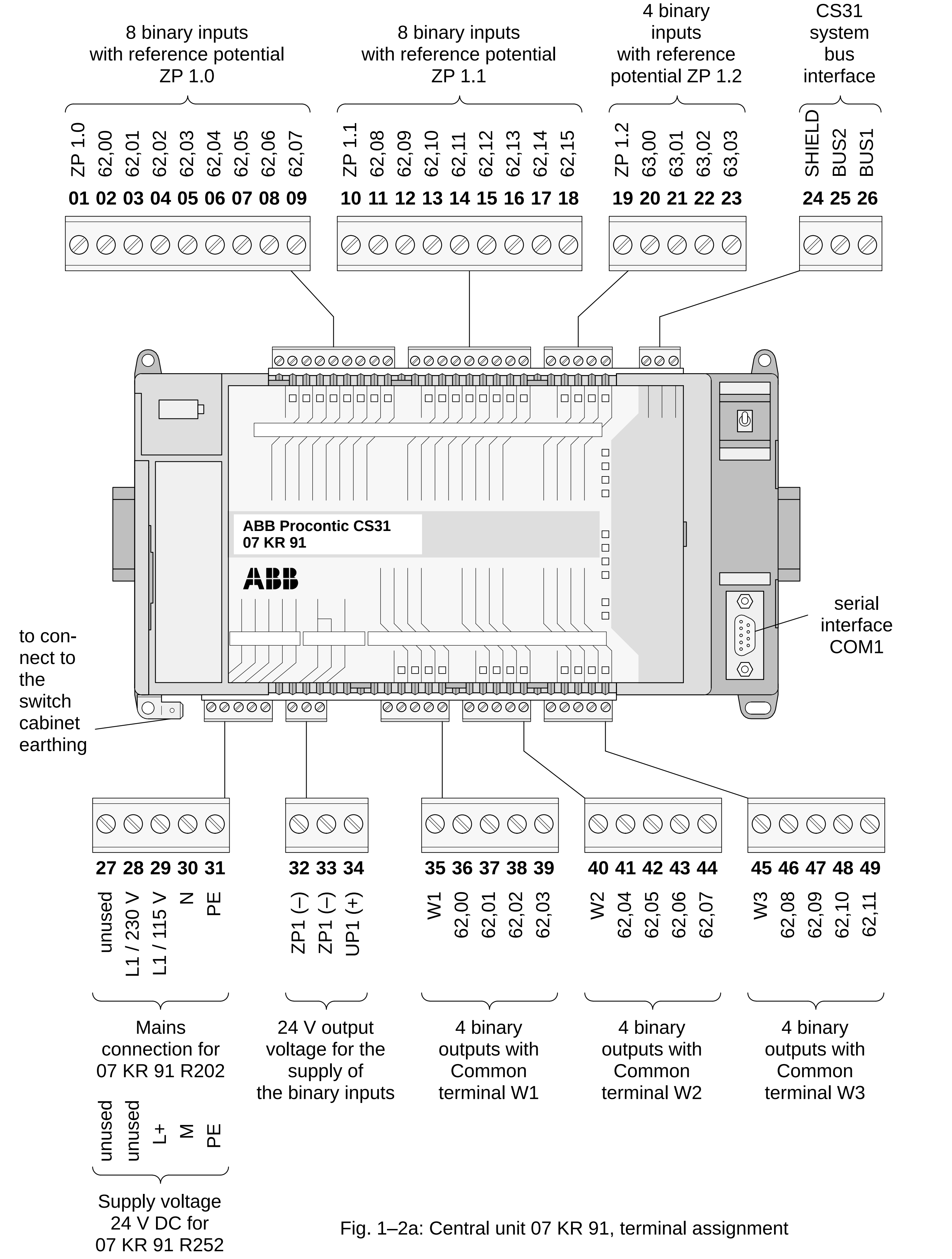


Fig. 1–2a: Central unit 07 KR 91, terminal assignment

1.3 Electrical connection

1.3.1 Application examples for input and output wiring

The following two illustrations show application examples for 07 KR 91 R202 and R252 in which different possibilities for wiring inputs and outputs are used. Please observe in particular:

- The earthing measures, see also the earthing of the switch cabinet mains socket
- The handling of the electrically isolated input groups
- The handling of the electrically isolated output groups at three different voltage sources
- The demagnetization (diode) of a 24 V DC valve

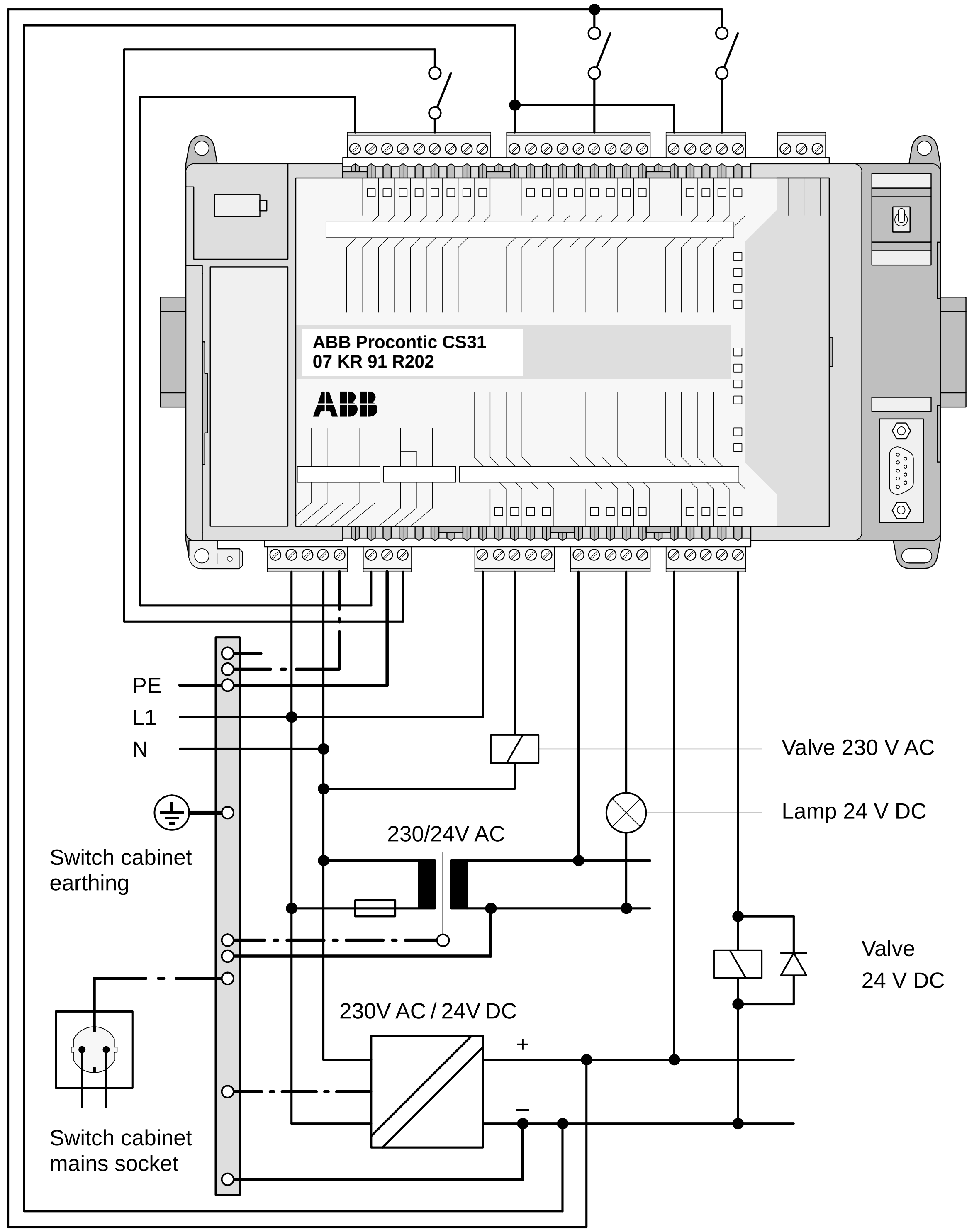


Fig. 1–3: Application example for the central unit 07 KR 91 R202 (supply voltage 230 V AC)

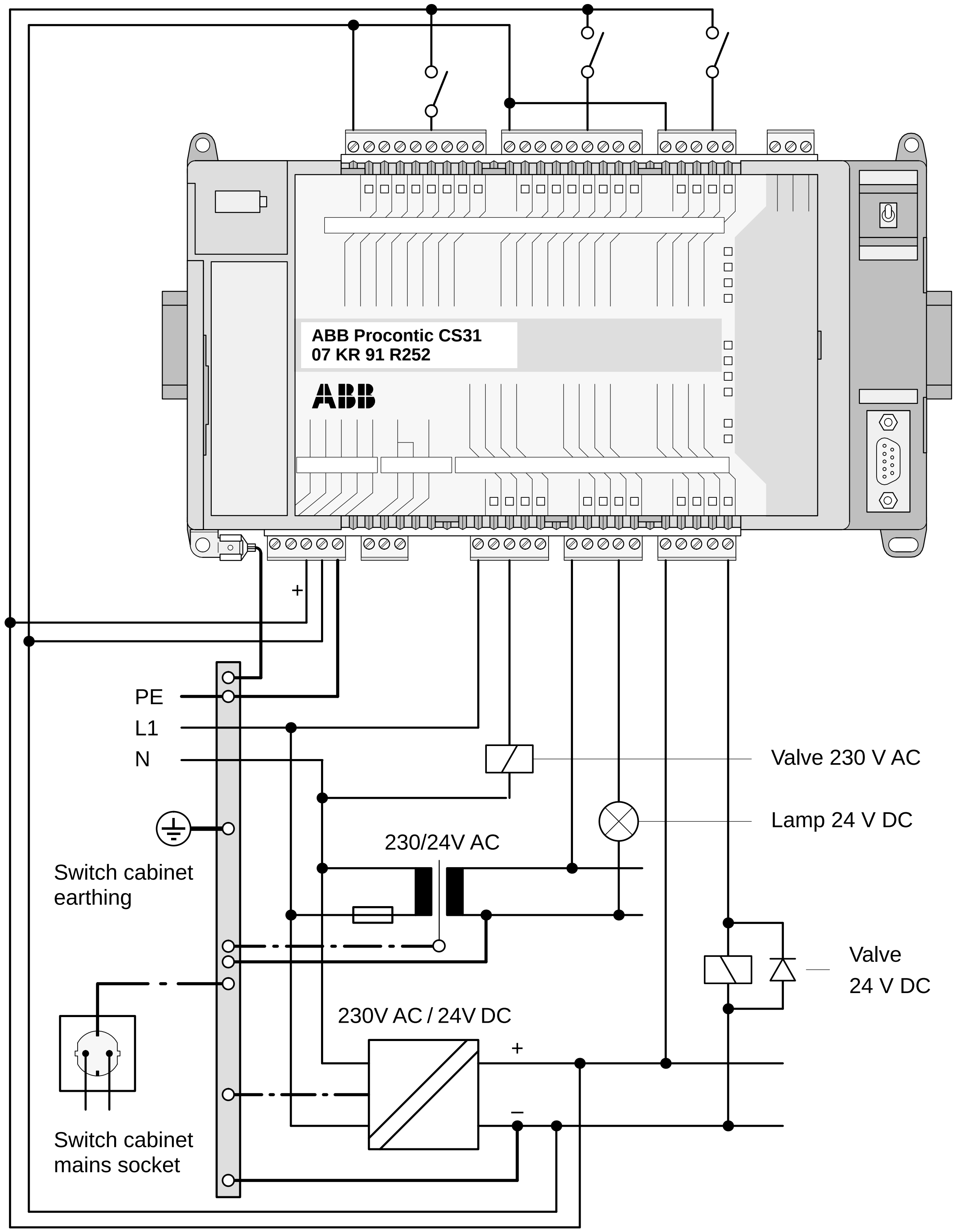


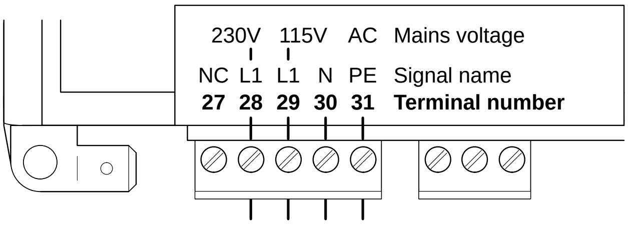
Fig. 1–3a: Application example for the central unit 07 KR 91 R252 (supply voltage 24 V DC)

1.3.2 Connecting the supply voltage

07 KR 91 R202: Supply voltage 115 V AC, 230 V AC

The mains supply voltage is connected via a 5-pole detachable terminal block.

Attention: Plug and unplug terminal block only with power is off!



Terminal assignment:

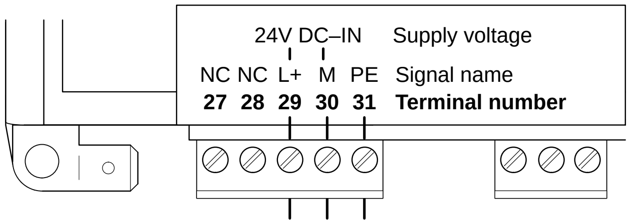
27	NC	This terminal is not used (NC = Not connected)
28	L1/230V	Connection of the phase conductor 230 V, 50/60 Hz
29	L1/115V	Connection of the phase conductor 115 V, 50/60 Hz
30	N	Connection of the neutral cond.
31	PE	Protective Earth terminal, connected with the Faston terminal inside the device. Do not cause earth loops! Connect PE and Faston to the same earthing potential!

Fig. 1–4: Assignment of the terminal block for the 115/230 V AC mains voltage

07 KR 91 R252: Supply voltage 24 V DC

The supply voltage of 24 V DC is connected via a 5-pole detachable terminal block.

Attention: Plug and unplug terminal block only with power is off!



Terminal assignment:

27	NC	This terminal is not used. (NC = Not connected)
28	NC	This terminal is not used. (NC = Not connected)
29	L+	Supply voltage +24 V DC
30	M	Reference potential (0V)
31	PE	Protective Earth terminal, connected with the Faston terminal inside the device. Do not cause earth loops! Connect PE and Faston to the same earthing potential!

Fig. 1–5: Assignment of the terminal block for the *24 V DC–IN* supply voltage

1.3.3 Electrical isolation and notes on earthing

The following illustrations show the parts of the devices' circuit which are electrically isolated from each other as well as the internal connections which exist. Both the creepage distances and clearances as well as the test voltages used correspond to DIN/VDE 0160.

The 6.3 mm Faston terminal in the lower left corner has to be connected directly and on the shortest possible way to the switch cabinet earthing using a wire with a cross section of 6 mm^2 in order to ensure safe earthing and as an EMC measure.

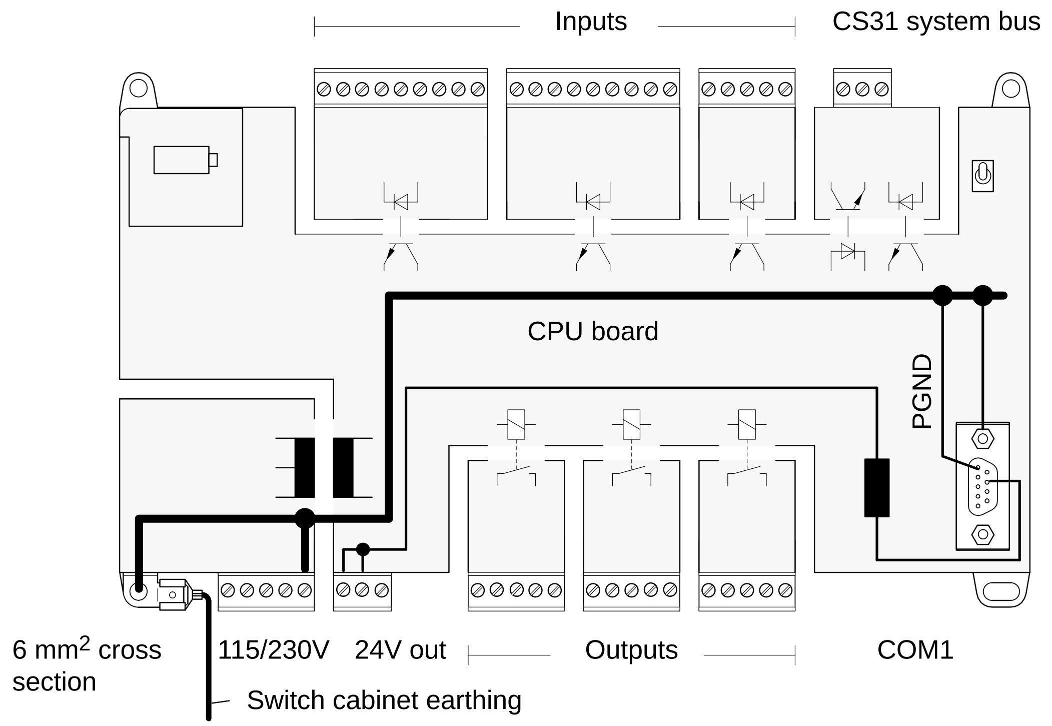


Fig. 1–6: Electrical isolation and connections inside the central unit 07 KR 91 R202

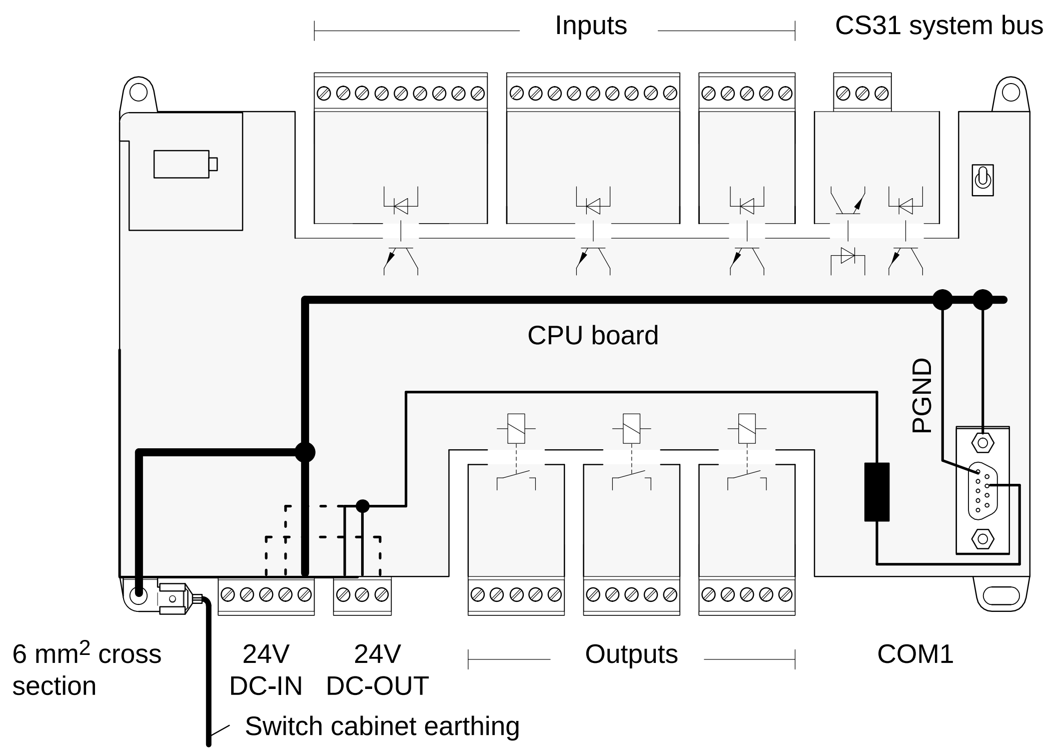
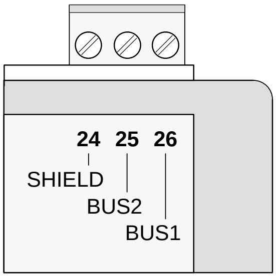


Fig. 1–7: Electrical isolation and connections inside the central unit 07 KR 91 R252

1.3.4 Connection for ABB Procontic CS31 system bus

The connection to the ABB Procontic CS31 system bus is made by means of a 3-pole detachable terminal block. Please observe:

- All of the CS31 devices, no matter whether they are master or slave devices, are connected with the twisted-pair bus line as follows:
  - One core of the bus line is looped through via the BUS1 terminals of all devices to be connected to the CS31 system bus.
  - The other core of the bus line is looped through via the BUS2 terminals of all devices to be connected to the CS31 system bus.
- If the central unit 07 KR 91 is located at the beginning or at the end of the bus line, the bus terminating resistor (120 Ω) has to be connected additionally between the BUS1 and BUS2 terminals.
- The shield of the twisted-pair bus line is looped through via the SHIELD terminals of all the devices to be connected to the CS31 system bus.
- The handling of the CS31 system bus is described in detail in volume 2, System data.



Terminal assignment

24 SHIELD
25 BUS2
26 BUS1

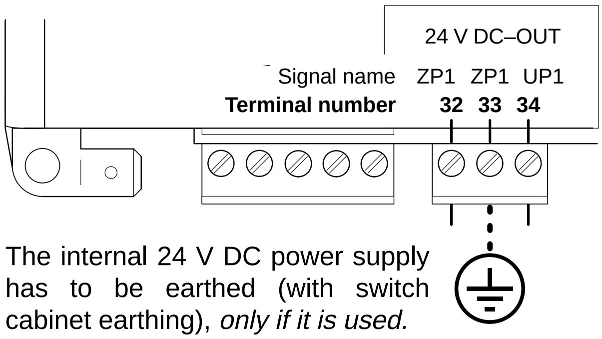
Fig. 1–8: Assignment of the ABB Procontic CS31 system bus interface

1.3.5 24 V output voltage for the signal supply of the inputs

The central unit 07 KR 91 provides a separate 24 V DC voltage output for the supply of the 20 binary input signals (for this purpose only).

This 24 V output voltage is used only if an external 24 V DC power supply unit is not available.

The internal 24 V power supply is overload-proof. The 24 V output voltage is ready for operation again approx. 2 minutes after an overload has been eliminated.



The internal 24 V DC power supply has to be earthed (with switch cabinet earthing), *only if it is used.*

Terminal assignment:

32	ZP1	Reference potential (OV), negative pole of the power source
33	ZP1	identical to terminal 32 (internally shorted)
34	UP1	+24 V, positive pole of power source

Fig.1–9 Assignment of the terminal block for the output voltage

1.3.6 Connection of the binary input

The following illustration shows the configuration of the 20 binary inputs in three groups which are electrically isolated from each other. The inputs work with 24 V DC signals in positive logic (1 ≙ +24 V).

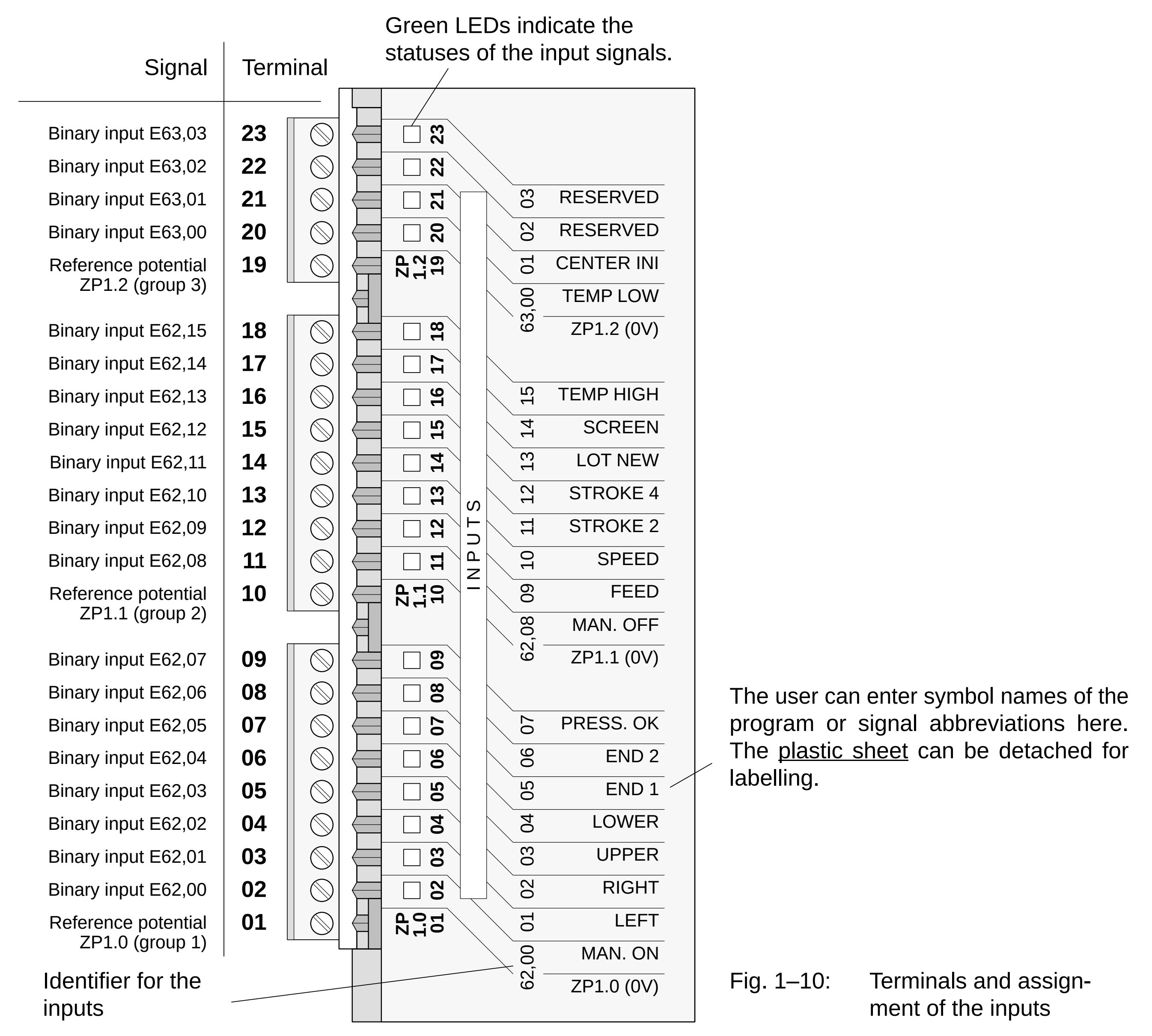


Fig. 1–10: Terminals and assignment of the inputs

Input signals at the terminals 2 and 3

Terminal 2

– **Use as normal input signal:**

The signal is available in the user program in the operand E 62,00. The signal delay time is 7 ms.

The updating of the operand E 62,00 is performed before the start of each program cycle.

– **Use as high-speed input signal:**

The signal is available in the user program in the operand E 63,14. The signal delay time is 0.02 ms.

The updating of the operand E 63,14 is performed before the start of each program cycle.

In the Dual Port RAM (DPR) this signal is updated after each CS31 bus telegram. With the aid of the function block WOL this signal can be read in the Dual Port RAM (word address C000:1FE$_H$, Bit 14).

– **Use for the high-speed counter:**

The signal is used as counting input (10 kHz) for the high-speed counter.

Terminal 3

– **Use as normal input signal:**

The signal is available in the user program in the operand E 62,01. The signal delay time is 7 ms.

The updating of the operand E 62,01 is performed before the start of each program cycle.

– **Use as high-speed input signal:**

The signal is available in the user program in the operand E 63,15. The signal delay time is 0.02 ms.

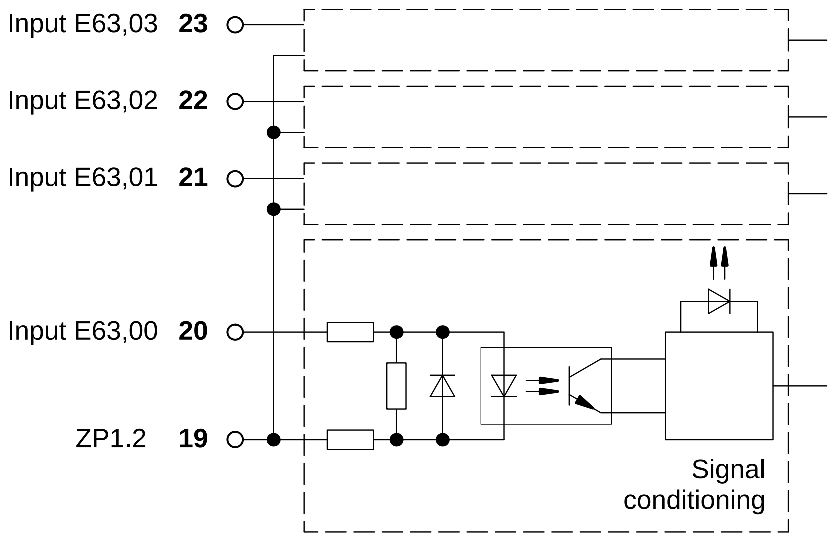
The updating of the operand E 63,15 is performed before the start of each program cycle.

In the Dual Port RAM (DPR) this signal is updated after each CS31 bus telegram. With the aid of the function block WOL this signal can be read in the Dual Port RAM (word address C000:1FE$_H$, Bit 15).

– **Use for the high-speed counter:**

The signal is used as enable input for the high-speed counter.

Circuit configuration of the binary inputs of the third group as an example (E63,00...E 62,03)



The three groups are electrically isolated from each other. ZP1.0, ZP1.1 and ZP1.2 are *not* connected with each other internally.

The input signals have a delay time of typ. 7 ms.

Fig. 1–11: Circuit configuration of the binary inputs of the third group as an example

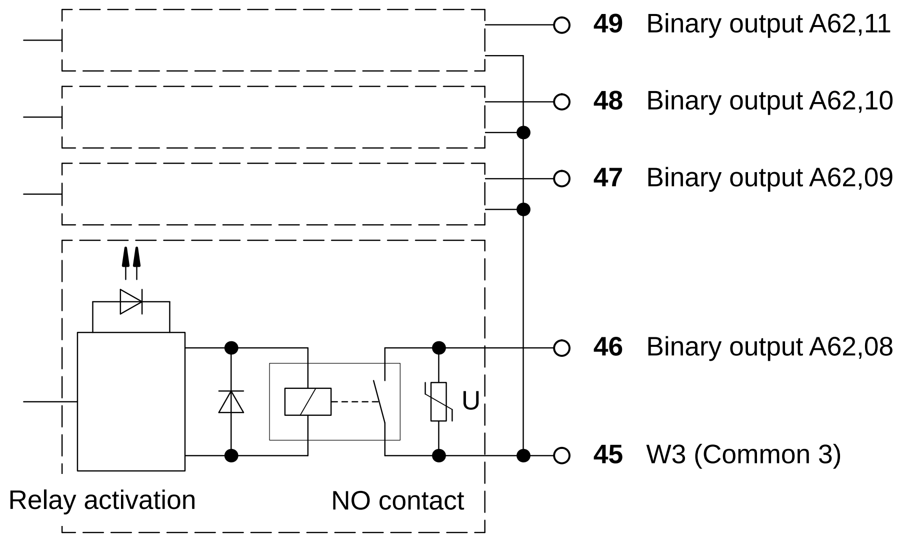
1.3.7 Connection of the binary outputs

The following illustration shows the circuit configuration of the binary outputs of the third group as an example.

The three groups (see the terminal configuration in the illustration on the next page) are electrically isolated from each other. The outputs work with relays. Each four relays from one group have a common voltage supply (Common terminal). These Common terminals can be supplied from different voltage sources.

Caution! If outputs are operated with dangerous contact voltages, the terminal block must be plugged in or unplugged only with their voltage switched off!

In order to suppress switching sparks when switching inductive AC loads, the relay contacts are equipped with varistors. If, however, **inductive DC loads** are switched, **one free-wheeling diode must be mounted in parallel to each of the loads** for demagnetization (see also Figures 1–3 and 1–4).



The three groups are electrically isolated from each other. W1, W2 and W3 may be supplied from different voltage sources.

Fig. 1–12: Circuit configuration of the relay outputs

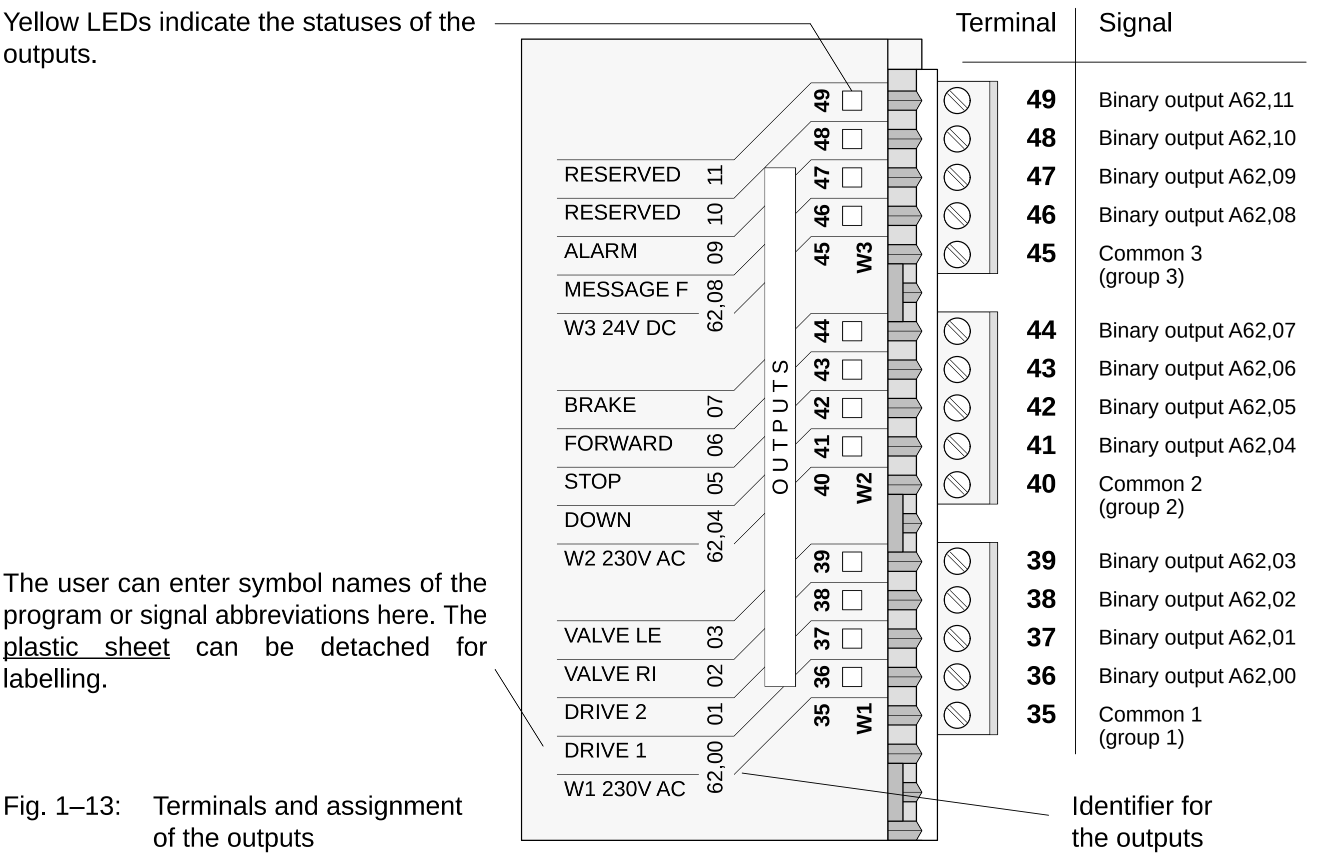
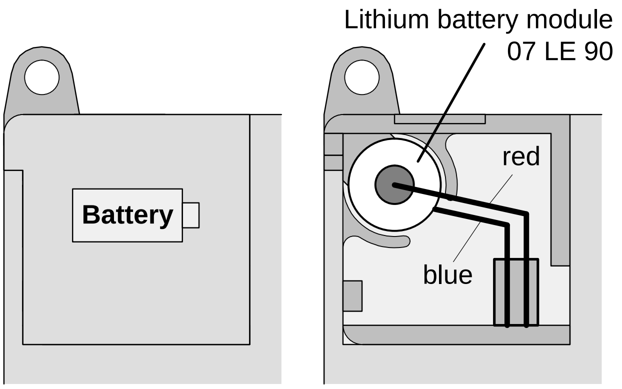


Fig. 1–13: Terminals and assignment of the outputs

1.3.8 Battery and battery replacement



Battery compartment closed

Built-in battery module (cover of the battery compartment is open)

Fig. 1–14: Battery and battery replacement

- The lithium battery 07 LE 90 can be inserted into the battery compartment in order to
  - backup data of user program in RAM
  - backup data of additionally in RAM contained information, e.g. flag statuses
  - backup of time and date (real-time clock).

The battery lifetime is 1.5 years (typ. 3 years) at 25°C. The battery lifetime is the time during which the device remains operable in order to backup data while the supply voltage of the central unit is switched off. As long as there is a supply voltage available, there is no more load on the battery other than its own leakage current.

The following handling notes have to be observed:

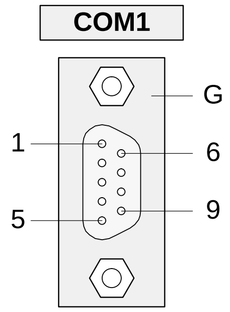
- Use only lithium batteries approved by ABB.
- Replace the battery by a new one at the end of its life.
- **Never short-circuit the battery!**
  There is danger of overheating and explosion. Avoid accidental short-circuits, therefore do not store batteries in metallic containers or boxes and do not bring it into contact with metallic surfaces.
- **Never try to charge the battery!**
  Danger of overheating and explosion!
- **Replace the battery only with the supply voltage switched on!**
  Otherwise you risk data being lost.
- **Dispose of battery environmentally consciously!**
- If no battery is built-in or if the battery is exhausted, the red LED ’Battery’ lights up.

1.3.9 Serial interface COM 1

Interface standard: EIA–232

Assignment of the serial interface COM1

The serial interface has the following pin assignment:



G	Housing	Protective Ground	(Shield)
1	PGND	Protective Ground	(Shield)
2	TxD	Transmit Data	(Output)
3	RxD	Receive Data	(Input)
4	RTS	Request To Send	(Output)
5	CTS	Clear To Send	(Input)
6	PROG *****		(Input)
7	SGND	Signal Ground	(0V)
8	0V out		(0V)
9	+5 V out	Supply for the TCZ service device ******	

***** 1 = Active mode (Programming/test), Pin 6 open
0 = Passive mode (DRUCK/EMAS applications), Pin 6 shorted to 0V out

****** 5V output (only for supplying the TCZ service device):
The connected service device receives its voltage supply via the interface cable.

Fig. 1–15: Assignment of the serial interface COM1

Operating modes of the serial interface COM1

The operating mode of the interface has to be set according to the application in each case:

– Programming and test or
– Man–machine–communication MMC

Active mode: The active mode is used for programming and testing the central unit, i.e. it gives the user access to all the programming and test functions of the central unit.

Passive mode: The passive mode is used to perform a communication configured with the DRUCK and EMAS blocks between the user program and a device connected to the serial interface.

Conditions for setting the operating modes of the interface COM1

RUN/ STOP switch	System constant KW00,06	System cable/ device	Mode set by this
STOP	x	x	Active
RUN	1	x	Active
	2	x	Passive
	0, <0, >2	07 SK 90	Active
		07 SK 91, TCZ	Passive

x: without effect

Temporary interruption of the passive mode

While a communication between the DRUCK or EMAS blocks and a device connected to COM1 is being executed, it may be come necessary to modify the program, for example. For this purpose, you must switch over COM1 from the passive mode into the active mode.

Switch-over: Passive mode ––> Active mode

There are three possibilities for switching over:

- Set the RUN/STOP switch to the ”STOP” position
- Replace cable 07 SK 91 by cable 07 SK 90 (if KW 00,06 is set to ≤0 or >2)
- Send the following special command to the PLC: <DEL><DEL><DEL>

The latter option has the advantage that the switch-over can also be controlled remotely, e.g. via telephone line and suitable dial-up modems. The ASCII character <DEL> has the decimal code of 127 and the hexadecimal code of $7F_H$. You can generate this character by simultaneously pressing the control key <CTRL> and the delete key <—.

Notes:

On German keyboards, the control key is labelled by <Strg> instead of <CTRL>.

If the switch-over to the active mode was performed using the special command <DEL><DEL><DEL>, please observe the following:

> *During the execution* of the PLC program, the system constant KW 00,06 must **not** be sent to the PLC because this would cause the system to be switched back to the passive mode.

The special command assigns the value of ”1” to the image of the system constant KW 00,06 located in the operand memory. The PLC evaluates the value of this image and sets the kind of application of COM1 correspondingly.

Switching back: Active mode ––> Passive mode

There are three possibilities for switching back:

- Return RUN/STOP switch to the "RUN" position
- Replace cable 07 SK 90 by cable 07 SK 91 again.
- Cancel the special command <DEL><DEL><DEL> as follows:

– If the PLC program is in the "aborted" condition:

Start the PLC program.

– If the PLC program is in the "running" condition:

send the original value of the system constant KW 00,06 to the PLC again (907 PC 33 menu item "Send constants")

or

overwrite the system constant KW 00,06 by the original value (907 PC 33 menu item "overwriting")

Interface parameters

Active mode: The settings of the interface parameters cannot be changed

Data bits:	8
Stop bits:	1
Parity bits:	none
Baud rate:	9600
Synchronization:	RTS/CTS

Passive mode: Default setting

Synchronization:	RTS/CTS
Interface identifier COM1:	1
Baud rate:	9600
Stop bits	1
Data bits:	8
Parity bits:	none
Echo:	off
Send Break Character:	0
Enabling End-of-text character for sending direction:	no [1])
Sending End-of-text character:	<CR> [1])
Receiving End-of-text character:	<CR> [2])

[1]) The default End-of-text character for the sending direction (CR) is not sent. Nevertheless, this default End-of-text character (CR) must not appear in the message text of the assigned DRUCK block.

[2]) For the direction of reception, an End-of-text character is always necessary. This default End-of-text character (CR) must not appear neither in the message text nor in the user data of the assigned EMAS block.

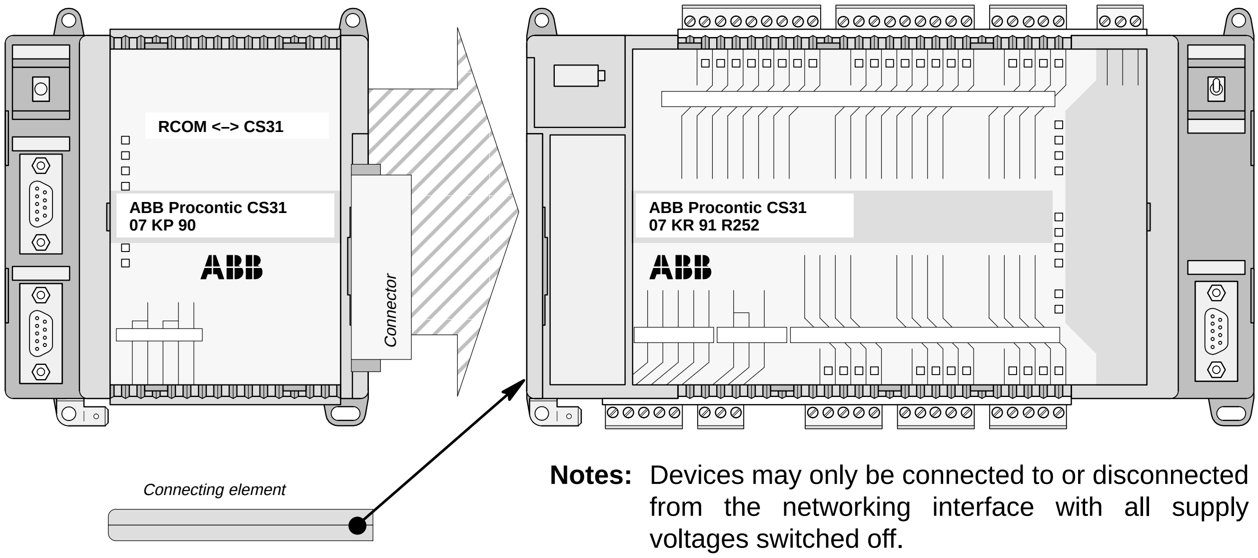
For the passive mode of COM1, the interface parameters can be changed using the SINIT function block. If the changed values are not plausible, the COM1 interface uses the default values.

The interface is newly initialized each time the operating mode is switched over.

The active-mode parameters are set in the active mode, whereas in the passive mode the parameters established by the SINIT block or the default values are set.

1.3.10 Networking interface

The 07 KR 91 **R252** central unit is equipped with a special parallel interface. It is thus possible to network it with another bus system using an additional communication processor module. The additional communication processor has its own housing.
Both housings (of the 07 KR 91 **R252** and of the communication processor) are assembled by means of a snap-on connection.



Notes: Devices may only be connected to or disconnected from the networking interface with all supply voltages switched off.

Fig. 1–16: Mounting of 07 KR 91 **R252** with expansion (e.g. communication processor 07 KP 90)

1.4 High-speed counter

Features

The high-speed counter used in the central units 07 KR 91, 07 KT 92 and 07 KT 93 works independently of the user program and is therefore able to response quickly to external signals. Its features are as follows:

- The counting frequency is max. 10 kHz. The counter counts the 0–>1 edges at terminal 02 (also designated as E 62,00).
- The counter counts upwards from –32768 to +32767 (8000_H...$7FFF_H$). If +32767 is exceeded, the counter skips to –32768.

  Sequence of the counting procedure:

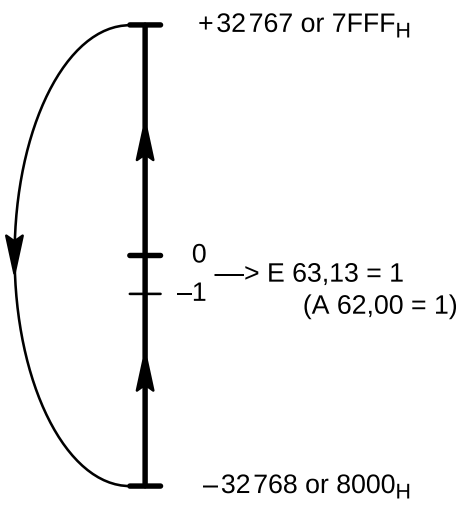


Fig. 1–17:
Sequence of the counting procedure

- Enabling/disabling of the counting procedure using the internal variable A 63,14 in the user program:
  - A 63,14 = 0:
    The internal variable A 63,13 = 1 enables the counting procedure, whereas A 63,13 = 0 disables it.
  - A 63,14 = 1:
    Signal 1 at terminal 03 (also designated as E 62,01) enables the counting procedure, whereas signal 0 disables it. A 63,13 is without effect.
    Note: The dead time may be 0...1.5 ms.

- Setting the counter in the user program:
  - to the value contained in the internal word variable AW 06,15
  - using the internal variable A 63,15 = 1.

  Note: If the internal variable A 63,15 = 1 is present during several processing cycles, the processor sets the counter at the program end in each case.
  During the remaining time of the processing cycle, the counter counts pulses at terminal 02.

- The counter content can be read via the internal variable EW 06,15.

- Zero-crossing message (signal changes from 0 to 1 when the counter contents changes from –1 to 0):
  - always via the internal variable E 63,13,
  - at the terminal 36 (also designated as A 62,00) only, if the internal variable A 63,14 = 1 is set.
    Note: The reaction time may be 0...1.5 ms. The direct control of the output A 62,00 from the user program is disabled by A 63,14 = 1.

  The zero-crossing message is cancelled when the counter is set.

- Fast input of binary signals into the user program with a delay of < 0.02 ms:
  - Terminal 02 (also designated as E 62,00):
    Internal variable E 63,14
  - Terminal 03 (also designated as E 62,01):
    Internal variable E 63,15

Block diagram

see next page

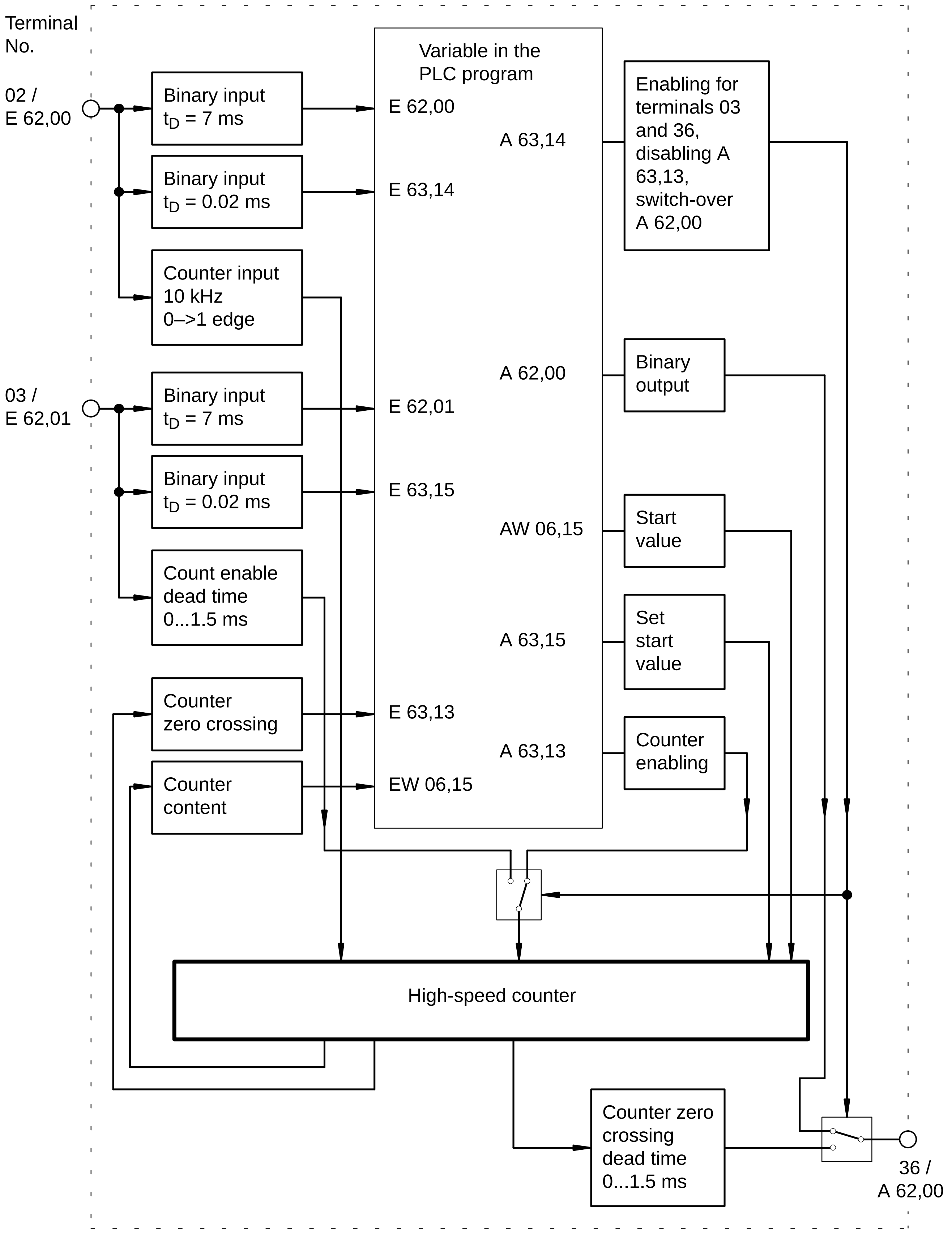


Fig. 1–18: 07 KR 91, High-speed counter, block diagram

Configuration example

- **Task:**
  - 180 pieces each of a unit load have to be filled into a packing.
  - Each filled-in piece generates one pulse.
  - When the packing is full, the counter is immediately prepared for the next filling operation.
  - The enabling signal for the filling operation is sent by the packaging machine.
  - The end of the counting operation has to be signalled to the packaging machine immediately.
- **Wiring**
  - Connect the signal line for the counting pulses to terminal 02.
  - Connect the signal line for the enabling of the counting operation to terminal 03.
  - Connect the signal line for ”zero crossing” of the counter to terminal 36.
- **Configuration steps: PLC program**

1) Activate terminals 03 and 36

– The terminals 03 and 36 are activated using the operand A 63,14.

IL (instruction list):
! K 00,01
= A 63,14 (with K 00,01 = 1)

2) Preset start value for the counter

The start value (AW 06,15) is set to the value of –180. The counter will then count starting from –180 in positive direction. The transition from –1 to 0 will be signalled.

IL (instruction list):
! KW 01,00
= AW 06,15 (with KW 01,00 = –180)

3) Adopt start value into the counter

After each counting operation, the start value is immediately set again into the counter by means of the ”zero crossing” signal (E 63,13). Operand A 63,15 = 1 has to be set for this purpose. At program start, the start value is loaded once into the counter by means of the initialization flag M 255,15 (M 255,15 has the value of 0 after program start).

IL (instruction list):
! NM 255,15
/ E 63,13
= A 63,15
:
:
other PLC program parts
:
:
! K 00,01
= M 255,15 (set M 255,15 = 1)
! PE   (program end)

Preset start values

You can preset both *positive* and *negative* start values for the counter.
The counting operation starts at the start value and is continued in correspondence with the arrows in the diagram until the enabling is stopped or a start value is loaded again.

Negative start value

The minimum negative start value is
–32768 (8000_H).
By presetting a negative start value it is thus possible to count a maximum of 32768 pulses up to the zero crossing of the counter.

Positive start value

If a positive start value is preset, the counter counts up to the value of +32767 ($7FFF_H$), continues the counting operation at the value of–32768 (8000_H) and then signals the zero crossing when reaching the transition from –1 to 0.
The minimum positive start value is 1. If you preset this value, 65535 pulses will be counted up to the zero crossing.

In order to count more than 32767 pulses up to the zero crossing, the start value has to be calculated according to the following equation:

Start value = 32767 – (number of pulses – 32768)

Example:
40 000 pulses are to be counted.
The start value is in the positive range, because more than 32768 pulses have to be counted.

Calculation:

Start value = 32767 – (number of pulses – 32768)
= 32767 – (40 000 – 32768)
= 25535

1.5 Technical data 07 KR 91

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

1.5.1 General data

Number of binary inputs	20
Number of binary relay outputs	12
I/O expansion via CS31 system bus by up to	744 binary inputs 496 binary outputs 96 analog input channels 48 analog output channels max. 31 remote modules altogether
Number of serial interfaces	1 (for programming or connection to man-machine communication)
Number of parallel interfaces (only 07 KR 91 **R252**)	1 special interface for connection of a communication processor (for networking with other bus systems)
Integrated memory, **07 KR 91 R202 / R252:**	Flash EPROM 32 kB (30 kB program) RAM 256 kB (30 kB program with online programming)
Resolution of the integrated real-time clock	1 second
Data of the integrated high-speed hardware counter counting range 0...65,535 (16 bits) counting frequency	 max. 10 kHz
Processing time, binary operation 65 % bits, 35 % words	typ. 0.4...0.6 ms/kB program typ. 0.7 ms/kB program
Number of software timers delay time of the timers	any (max. 80 simultaneously active) 5 ms...24.8 days
Number of up/down counter SW blocks	any
Number of bit flags	4096
Number of word flags	4096
Number of double word flags	512
Diagnosis	cycle time monitoring, battery monitoring, detection of syntax errors and checksum monitoring
Indication of operating statuses and errors	42 LEDs altogether

1.5.2 Power supply 07 KR 91 R202

Mains voltage (rated value)	115 V AC
or	230 V AC
Power dissipation	max. 20 W

1.5.3 Power supply 07 KR 91 R252

Rated supply voltage	24 V DC
Current consumption	max. 0.4 A plus output current through terminal 34 (output voltage for the supply of the binary inputs)
Protection against reversed terminal connection	yes

1.5.4 24 V output voltage for the supply of inputs

Rated voltage	24 V DC
Load capability	max. 160 mA
Protection against overload	with a PTC resistor
Conductor cross section of the removable 3-pole terminal block	max. 2.5 mm^2

1.5.5 Lithium battery

Battery for back-up of RAM contents	07 LE 90 battery module
Lifetime at 25°C	1.5 years (typ. 3 years)

1.5.6 Binary inputs

Number of channels per module	20
Distribution of channels into groups	2 groups of 8 channels each, 1 group of 4 channels
Common reference potential	
for group 1 (8 channels)	ZP1.0 (channels 62,00...62,07)
for group 2 (8 channels)	ZP1.1 (channels 62,08...62,15)
for group 3 (4 channels)	ZP1.2 (channels 63,00...63,03)
Electrical isolation	between the groups, between groups and other circuitry (see also Figures 1–6 and 1–7)
Signal coupling of input signals	with optocoupler
Input signal delay of	
channels E 62,00...E 63,03	typ. 7 ms
channels E 63,14 and 63,15	typ. 0.02 ms
for counter control	typ. 0.02 ms
Signalling of input statuses	one green LED per channel, the LEDs correspond functionally to the input signals
Input signal voltage	
signal 0	–30 V...+ 5 V
signal 1	+13 V...+30 V
ripple when signal 0	within –30 V...+ 5 V
when signal 1	within +13 V...+30 V
Allowed input overvoltage	± 36 V, for 100 ms only
Input current per channel	
input voltage = +24 V	typ. 8.0 mA
input voltage = + 5 V	≥ 0.2 mA
input voltage = +13 V	≥ 2.0 mA
input voltage = +30 V	≤ 10.0 mA
Labelling for the inputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Max. cable length unshielded	600 m
Max. cable length shielded	1000 m
Conductor cross section of the removable terminal blocks	max. 2.5 mm^2

1.5.7 Binary outputs

Number of channels per module	12 relay outputs
Distribution of channels into groups	3 groups of 4 channels each
Common supply voltage	
for group 1 (common 1)	W1 (channels 62,00...62,03)
for group 2 (common 2)	W2 (channels 62,04...62,07)
for group 3 (common 3)	W3 (channels 62,08...62,11)
Electrical isolation	between the groups, between groups and other circuitry (see also Figures 1–6 and 1–7)
Signalling of output statuses	one yellow LED per channel, the LEDs correspond functionally to the output signals
Switching voltage	12 V AC/DC...250 V AC/DC
Switching current per relay	
115/230 V AC, 50/60 Hz	$\cos\varphi = 1.0$; $I_{max} = 2$ A
115/230 V AC, 50/60 Hz	$\cos\varphi = 0.4$; $I_{max} = 1$ A
220 V DC	$I_{max} = 0.2$ A
24 V DC	$I_{max} = 2.0$ A
Total load per common potential (W1...W3)	max. 4 A
Leakage current per contact, contact open	max. 1 mA
Switching power	
in case of AC	max. 460 W
in case of DC	max. 50 W
Permissible lamp load	
in case of AC	max. 0.5 A, max. 100 W
in case of DC	max. 0.5 A, max. 25 W
Switching frequency	
with lamp load	max. 8 Hz (+30 %)
with inductive loads (full load)	max. 2 Hz
ON delay	$\leq$ 10 ms
OFF delay	$\leq$ 8 ms
Minimum switching power	2 W or 2 VA
Protection for relay contacts when switching inductive loads	
in case of AC	built-in varistor
in case of DC	a free-wheeling diode must be circuited in parallel to the load
Contact life time	
mechanical	> 4 x 10^7 cycles
230 V AC, load = 2 A (resistive load)	> 4 x 10^5 cycles
Labelling for the outputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Conductor cross section of the removable terminal blocks	max. 2.5 mm^2

1.5.8 Connection of serial interface COM1

Interface standard		EIA RS–232
Programming with 907 PC 33		by means of IBM PC (or compatible)
Man–machine communication		yes, e.g. with ABB Procontic Operating Station 35 BS 40
Display and updating of timers, counters and parameters		yes, e.g. with TCZ Service Device
Electrical isolation	07 KR 91 **R202**	versus mains, versus binary inputs and outputs, versus CS31 system bus interface (see also Fig. 1–6)
	07 KR 91 **R252**	versus binary inputs and outputs, versus CS31 system bus interface (see also Fig. 1–7)
Potential differences		In order to avoid potential differences between the 07 KR 91 central unit and the peripheral device connected to the COM1 interface, this device is supplied from the switch cabinet socket (see also the earthing connections in Figures 1–3 and 1–4).
Pin configuration and description of the COM1 interface		see chapter 1.3.9

1.5.9 Connection to the ABB Procontic CS31 system bus

Interface standard		EIA RS–485
Connection	as a Master PLC	yes, transmitting and receiving area are configurable
	as a Slave PLC	yes, see chapter ”system constants”
Setting of the CS31 module address		yes, by system constant, stored in the Flash EPROM of the Slave PLC
Electrical isolation		versus supply voltage, inputs/outputs, versus COM1 interface (see also Figures 1–6 and 1–7)
Terminal assignment and description of the CS31 bus interface		see chapter 1.3.4
Conductor cross section of the removable 3-pole terminal block		max. 2.5 mm^2

1.5.10 LED displays

LEDs for indication of:

– statuses of binary inputs	1 green LED per channel
– statuses of binary outputs	1 yellow LED per channel
– power supply exists 1 green LED	
– battery	1 red LED
– program runs (RUN)	1 green LED
– error classes (FK1, FK2, FK3)	1 red LED per error class
– CS31 system bus runs (BA)	1 green LED
– bus specific errors (BE, RE, SE)	3 red LEDs

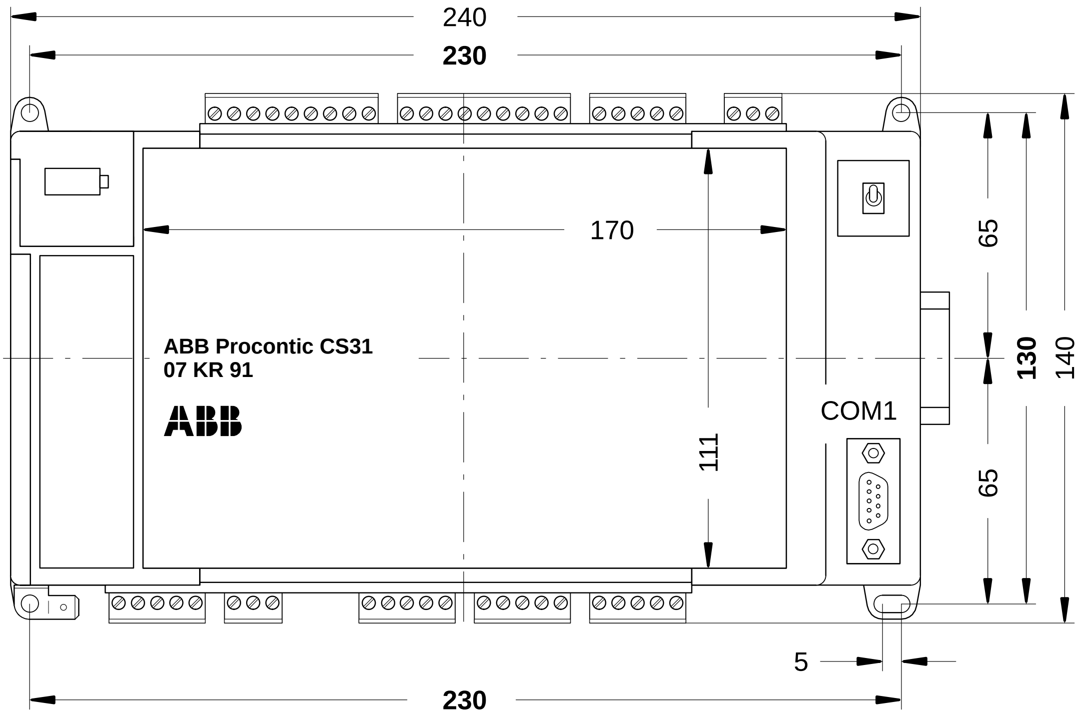
1.5.11 High-speed hardware counter

Data of the integrated high–speed hardware counter

counting range	0...65,535 (16 bits)	
counting frequency		max. 10 kHz
used inputs		62,00 and 62,01 (the signal delay of these inputs is set to 0.02 ms for the counter)
used outputs		62,00

1.5.12 Mechanical data

Mounting on DIN rail	according to DIN EN 50022–35, 15 mm deep. The DIN rail is located in the middle between the upper and the lower edges of the module.
Fastening by screws	using 4 M4 screws.
Width x height x depth	240 x 140 x 85 mm
Wiring method	by removable terminal blocks with screw-type terminals, conductor cross section max. 2.5 mm^2
Weight	1.6 kg
Dimensions (for mounting)	see the following drawing



All dimensions in mm.

The device is 85 mm deep. The interface connector COM1 is set deeper so that the mounting depth required does not become any larger even with detachable interface cables. If, however, a DIN rail is used, the mounting depth is increased by the overall depth of the rail.

The dimensions for assembly bore holes are printed in bold.

1.5.13 Mounting hints

Mounting position	vertical, terminals above and below
Cooling	The natural convection cooling must not hindered by cable ducts or other material mounted in the switch cabinet.

1.5.14 Ordering data

Central unit 07 KR 91 R202	Order No. GJR5 2500 00 R202
Central unit 07 KR 91 R252	Order No. GJR5 2500 00 R252
Scope of delivery	Central unit 07 KR 91 R202 or R252 2 9–pole terminal blocks 5 5–pole terminal blocks 2 3–pole terminal blocks Safety and mounting instructions

Accessories

System cable 07 SK 90	Order No. GJR5 2502 00 R1
System cable 07 SK 91	Order No. GJR5 2503 00 R1
System cable 07 SK 92	Order No. GJR5 2504 00 R1
Battery module 07 LE 90	Order No. GJR5 2507 00 R1
Bus termination resistor	
Simulation device 07 SG 90 (includes a number of switches and push-buttons to enter binary input signals)	Order No. GJR5 2506 00 R1

Programming and test software and operating manual

(both 907 PC 33 **and** 907 PC 331 are required)

907 PC 33	German	[1])	Order No. GJP5 2039 00 R202
907 PC 33	English	[1])	Order No. GJP5 2040 00 R202
907 PC 331	German	[2])	Order No. GJP5 2045 00 R202
907 PC 331	English	[2])	Order No. GJP5 2046 00 R202

Further Literature

System description ABB Procontic CS31	English	Order No. FPTN 440 004 R2001
System description ABB Procontic T200	English	Order No. GATS 1314 99 R2001
System description ABB Procontic T300	English	Order No. GATS 1315 99 R2002
System description ABB Procontic CS31	German	Order No. GATS 1316 99 R1002
System description ABB Procontic T200	German	Order No. GATS 1314 99 R1001
System description ABB Procontic T300	German	Order No. GATS 1315 99 R1002

[1]) Description General Part
[2]) Description 07 KR 91 / 07 KT 92/93–Specific Part + Software Diskettes

Operating Manual

ABB Procontic CS31
Intelligent Decentralized
Automation System

Central Units
07 KT 92 R202 and R262

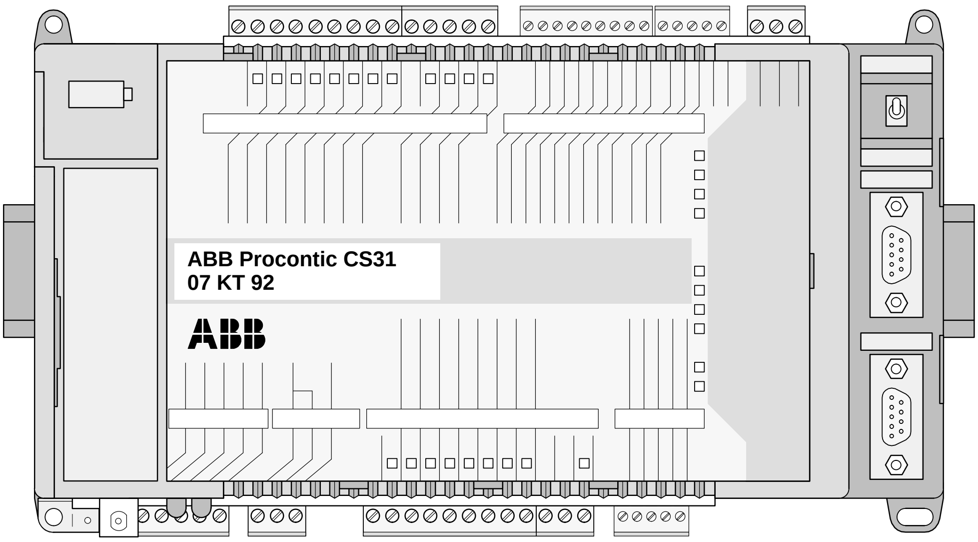


**ABB Schalt–
und Steuerungstechnik**

Regulations
Concerning the Setting up of Installations

Apart from the basic ”Regulations for the Setting up of Power Installations” DIN VDE* 0100 and for ”The Rating of Creepage Distances and Clearances” DIN VDE 0110 Part 1 and Part 2 the regulations ”The Equipment of Power Installations with Electrical Components” DIN VDE 0160 in conjunction with DIN VDE 0660 Part 500 have to be taken into due consideration.

Further attention has to be paid to DIN VDE 0113 Part 1 and Part 200 in case of the control of working and processing machines. If operating elements are to be mounted near parts with dangerous contact voltage DIN VDE 0106 Part 100 is additionally relevant.

If the protection against direct contact according to DIN VDE 0160 is required, this has to be ensured by the user (e.g. by incorporating the elements in a switch-gear cabinet). The devices are designed for pollution severity 2 in accordance with DIN VDE 0110 Part 1. If higher pollution is expected, the devices must be installed in appropriate housings.

The user has to guarantee that the devices and the components belonging to them are mounted following these regulations. For operating the machines and installations, other national and international relevant regulations, concerning prevention of accidents and using technical working means, also have to be met.

The ABB Procontic devices are designed according to IEC 1131 Part 2. Meeting this regulation, they are classified in overvoltage category II which is in conformance with DIN VDE 0110 Part 2.

For the direct connection of ABB Procontic devices, which are powered with or coupled to AC line voltages of overvoltage category III, appropriate protection measures corresponding to overvoltage category II according to IEC–Report 664/1980 and DIN VDE 0110 Part 1 are to install.

Equivalent standards:

DIN VDE 0110 Part 1 ≙ IEC 664
DIN VDE 0113 Part 1 ≙ EN 60204 Part 1
DIN VDE 0660 Part 500 ≙ EN 60439–1 ≙ IEC 439–1

* VDE stands for ”Association of German Electrical Engineers”.

ABB Schalt– und Steuerungstechnik GmbH Heidelberg

2 Central unit 07 KT 92

Central unit with max. 56 kB user program + 30 kB user data

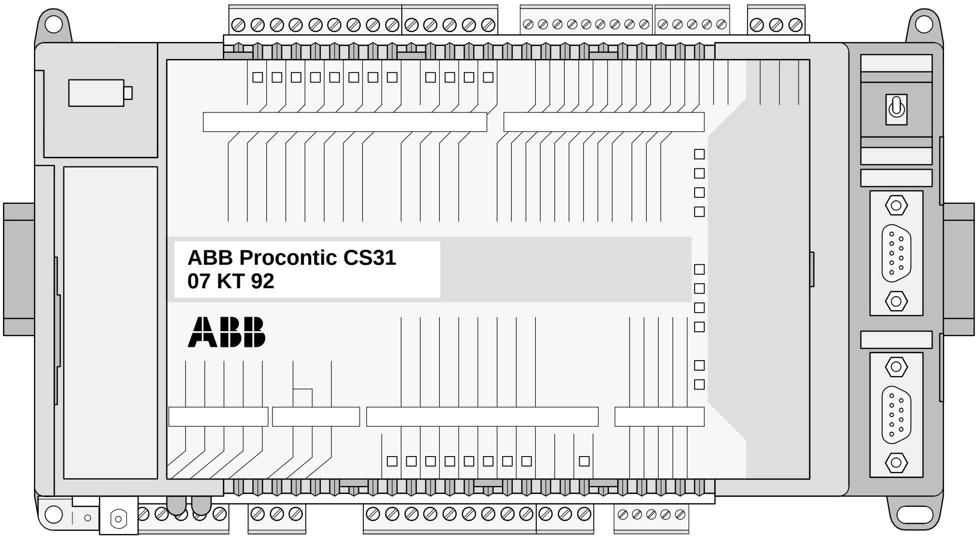


Fig. 2–1: Central unit 07 KT 92

Contents

2.1 Brief description

The central unit 07 KT 92 works either as

- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand–alone central unit.

The device has a 24 V DC power supply voltage. It is provided with an additional interface for connecting communication modules (e.g. 07 KP 90).

The central unit 07 KT 92 **R262** is equipped with **an integrated ARCnet coupler** (and an ARCnet interface).

2.1.1 Main features

- 12 binary inputs
- 8 binary transistor outputs
- 4 analog inputs
- 2 analog outputs
- 1 counting input for counting frequencies up to 50 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  – is set as programming interface
  – can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Serial interface COM2 as an MMC interface
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw–type terminal blocks
- Detachable plastic sheet on the front side of the device; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  – store and back-up the user program in the RAM
  – store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  – back-up the time and date (real–time clock)
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions
  – Self–diagnosis of the central unit
  – Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.1.2 Project planning / start–up

The following has to be observed for project planning and start–up:

- Programming
  is performed using ABB Procontic programming software, which can be run on commercially available IBM compatible PCs (see documentation for the programming system 907 PC 331)
- Diagnosis and service device TCZ (terminal mode) (see volume 7.3, see chapter A5 (Appendix), Programming and test, see 2.3.14 Serial interface COM1)
- The processor processes the user program contained in the RAM. It is loaded into the RAM via the serial interface COM1 and can also be changed there. An additional save command is used to save the program in the Flash EPROM.

  Note: In the course of the following operations

  – Power ’ON’
  – RUN/STOP switch from STOP —> RUN
  – Program start-up with programming system
  – Cold start of the PLC

  the RAM is overwritten by the contents of the Flash EPROM, if a user program is contained in the Flash EPROM.

Important note:

If a PLC is used with an ARCnet interface, a certain section of the PLC TURBO program memory No. 2 is reserved for ARCnet.

If programs with more than 2 k instructions are executed, the system-dependent capacity utilization can possibly be increased by reason of the reduced TURBO memory No. 2 when *changes* are made *to a running program.*

There are *no* problems, if
– the capacity utilization is less than 80 % *before* making changes to a running program or if
– the program length is less than 2 k instructions.

- On-line program modification
  The two existing RAMs allow a quick modification of the user program to be performed without interrupting the operation (see ABB programming system 907 PC 331).
- Change-over between the application modes
  – Stand–alone central unit
  – Bus master central unit and
  – Slave central unit

The central unit is set to ”Stand-alone” upon delivery. Changing the application mode is carried out in the following three steps:

1. Change the system constant KW 00,00 in the PLC, see chapter A7.3 (Appendix), System constants
2. Save the user program in the Flash EPROM
3. Activate new application mode by:
   – calling up the menu item of ”Enable PLC mode” in the ABB programming and test system or
   – performing a warm start or
   – performing a cold start.

- Setting the cycle time
  see chapter A1 (Appendix), Processing times
- Addressing when remote modules are connected
  see chapter A2 (Appendix), Addressing
- Back-up of data areas
  Back-up of data areas, i.e. saving of data during power OFF/ON, is only feasible with built-in battery. The following data can be backed, completely or partly:

  – Binary flags
  – Word flags
  – Double word flags
  – Step chains
  – Historical values

  In order to back-up certain data, they have to be excluded from initialization to 0.

- Initialization of data areas
  During *program start,* that data areas are initialized to 0 partly or completely, that are defined by system constants, see chapter A7.3 (Appendix), System constants.

  If no battery is effective or if the system constants are in their default values (factory settings), all of the above mentioned data areas are completely set to 0 after power OFF/ON.

- Reactions on errors of error class 3
  The user can configure whether or not the user program is to be aborted automatically, if an class 3 error occurs, see chapter A7.3 (Appendix), System constants.

- Starting-up the CS31 system after power ON

  The user can enter a number of *n* remote modules in KW 00,09. The user program starts only, i.e. it handles process inputs and outputs only, if at least *n* remote modules have been adopted into the CS31 system bus cycle, see chapter A7.3 (Appendix), System constants.

2.2 Structure of the front panel

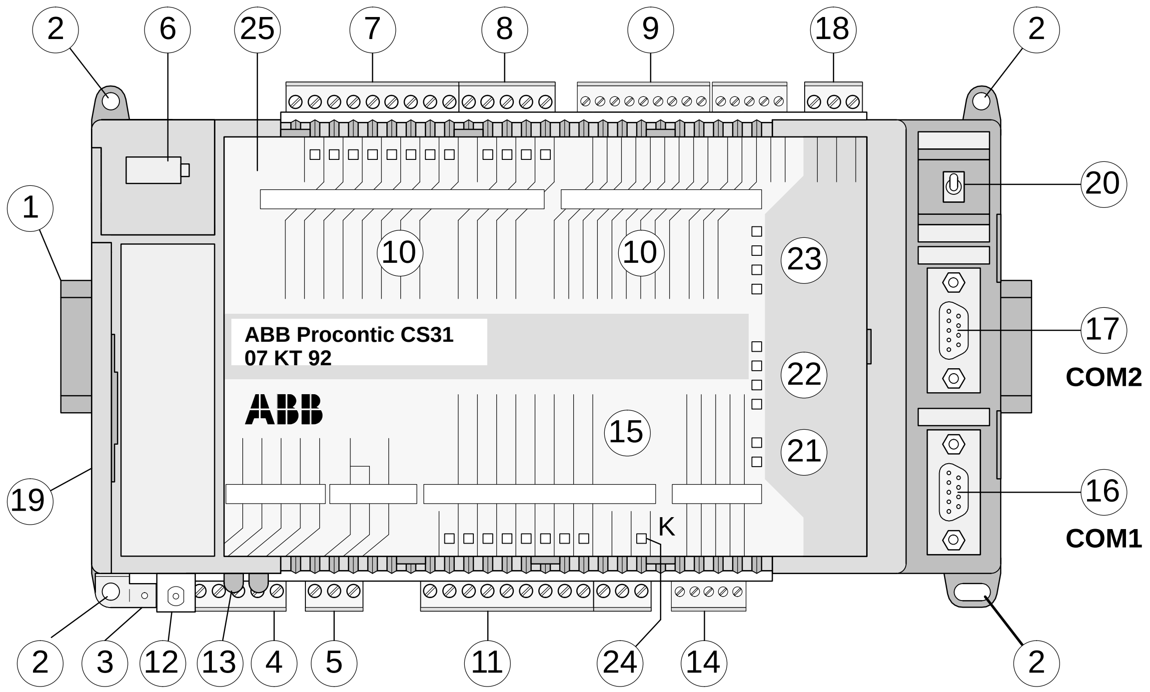


Fig. 2–2: Central unit 07 KT 92 with reference points

1 Fastening of the device on DIN rail

2 Fastening of the device by screws

3 Faston earthing terminal 6.3 mm

4 Supply voltage connection 24 V DC

5 24 V output voltage for input supply

6 Battery compartment

7 - 8 12 binary inputs in two groups

9 4 analog inputs in one group

10 Assignment of the identifiers for the inputs

11 8 binary transistor outputs in one group

12 ARCnet BNC connector (version R262 only)

13 2 LEDs for ARCnet operation (version R262)

14 2 analog outputs ±10 V

15 Assignment of the identifiers for the outputs

16 Serial interface COM1 (programming, MMC)

17 Serial interface COM2 (MMC)

18 Connection for ABB Procontic CS31 system bus

19 Cover of the interface for the connection of communication modules (may only be removed for connecting communication modules)

20 Switch for RUN/STOP operation

21 LEDs for supply voltage and battery

22 LEDs for RUN and error class

– LEDs for CS31 system bus

. LED for overload/short-circuit (LED K)

0 Plastic sheet (detachable for labelling)1

23

green ☐ **BA** Bus active
red ☐ **BE** Bus error
red ☐ **RE** Remote unit error
red ☐ **SE** Serial unit error

22

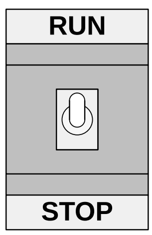
green ☐ **RUN** User program is running
red ☐ **FK1** Fatal error
red ☐ **FK2** Serious error
red ☐ **FK3** Light error

21

green ☐ **Supply** Supply voltage available
red ☐ **Battery** Battery not effective

For further information see chapter A4.3 (App.) Troubleshooting by means of LED displays on the central unit

20



The RUN/STOP switch is used to start or abort the processing of the user program.

2.2.1 Terminal assignment overview

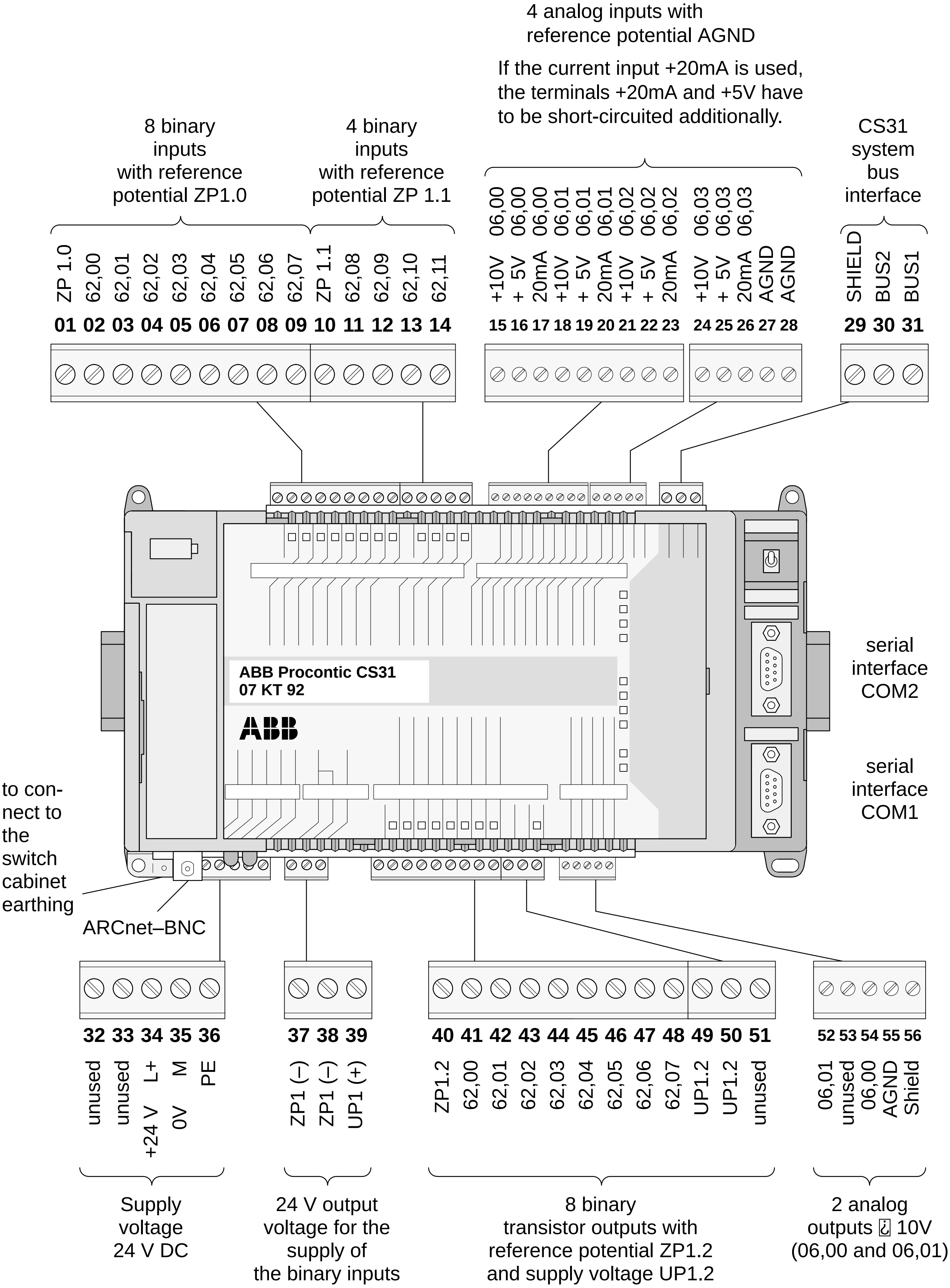


Fig. 2–2a: Central unit 07 KT 92, terminal assignment

2.3 Electrical connection

2.3.1 Application examples for input and output wiring

The following illustration shows an application example in which different possibilities for wiring inputs and outputs are used.

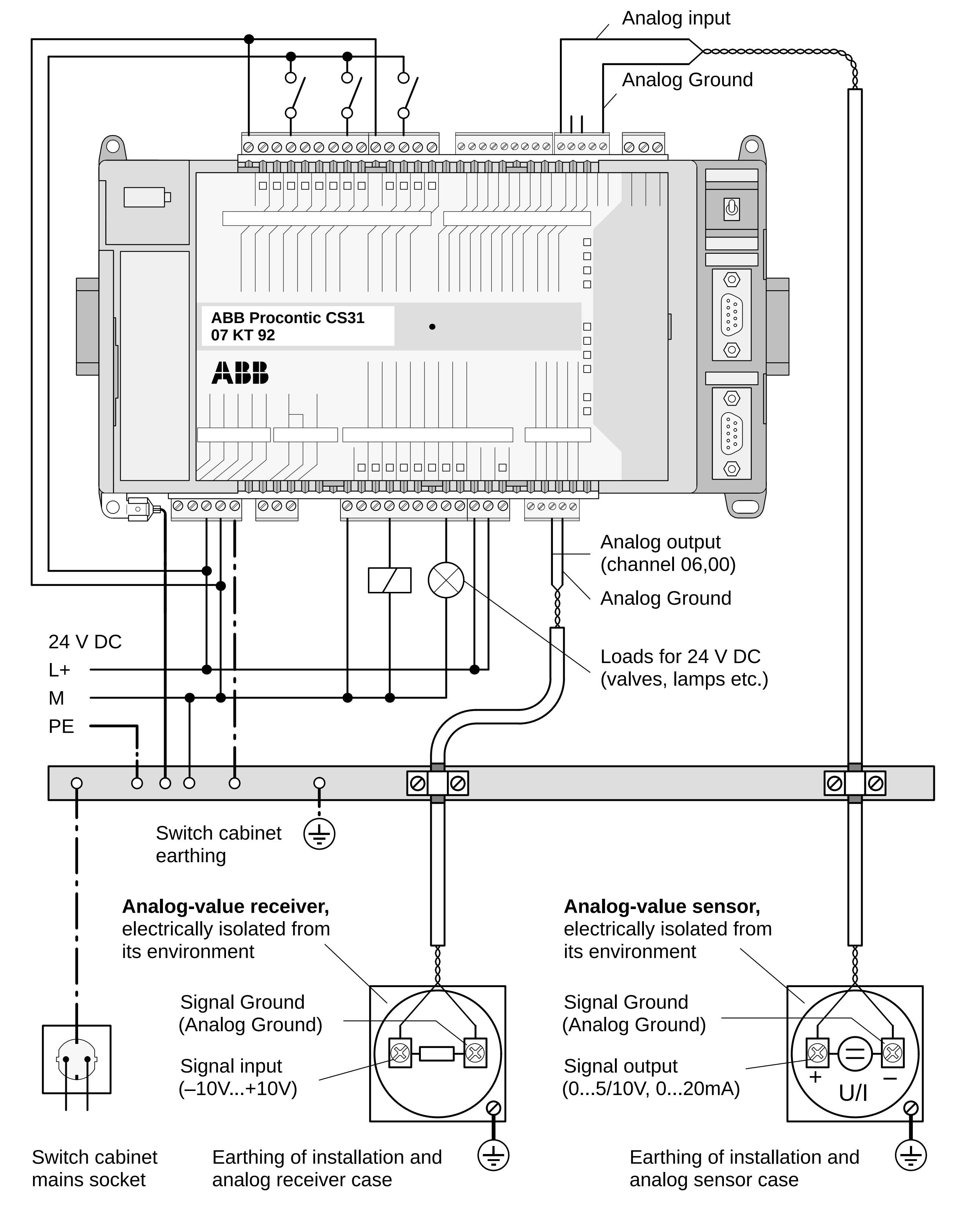


Fig. 2–3: Application example for central unit 07 KT 92

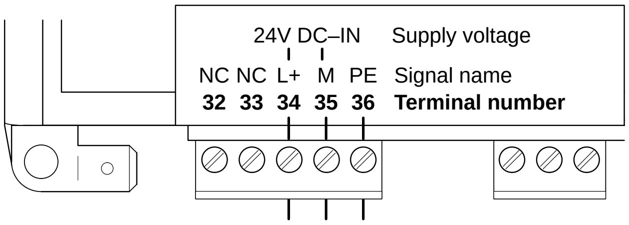
Please observe in particular:

- The earthing measures
- The handling of the electrically isolated input groups
- The handling of the electrically isolated output group
- The connection of analog-value receiver and analog-value sensor
- The earthing of the switch cabinet mains socket

2.3.2 Connecting the supply voltage

The 24 V DC supply voltage is connected via a 5-pole detachable terminal block.

Attention: Plug and unplug terminal block only with power is off!



Terminal assignment:

32	NC	This terminal is not used. (NC = Not connected)
33	NC	This terminal is not used. (NC = Not connected)
34	L+	Supply voltage +24 V DC
35	M	Reference potential (0V)
36	PE	Protective Earth terminal, connected with the Faston terminal inside the device. Do not cause earth loops! Connect PE and Faston to the same earthing potential!

Fig. 2–4: Assignment of the terminal block for the *24 V DC–IN* supply voltage

2.3.3 Electrical isolation and notes on earthing

The following illustration shows the parts of the device's circuit which are electrically isolated from each other as well as the internal connections which exist. Both the creepage distances and clearances as well as the test voltages used correspond to DIN/VDE 0160.

The 6.3 mm Faston terminal in the lower left corner has to be connected directly and on the shortest possible way to the switch cabinet earthing using a wire with a cross section of 6 mm^2 in order to ensure safe earthing and as an EMC measure.

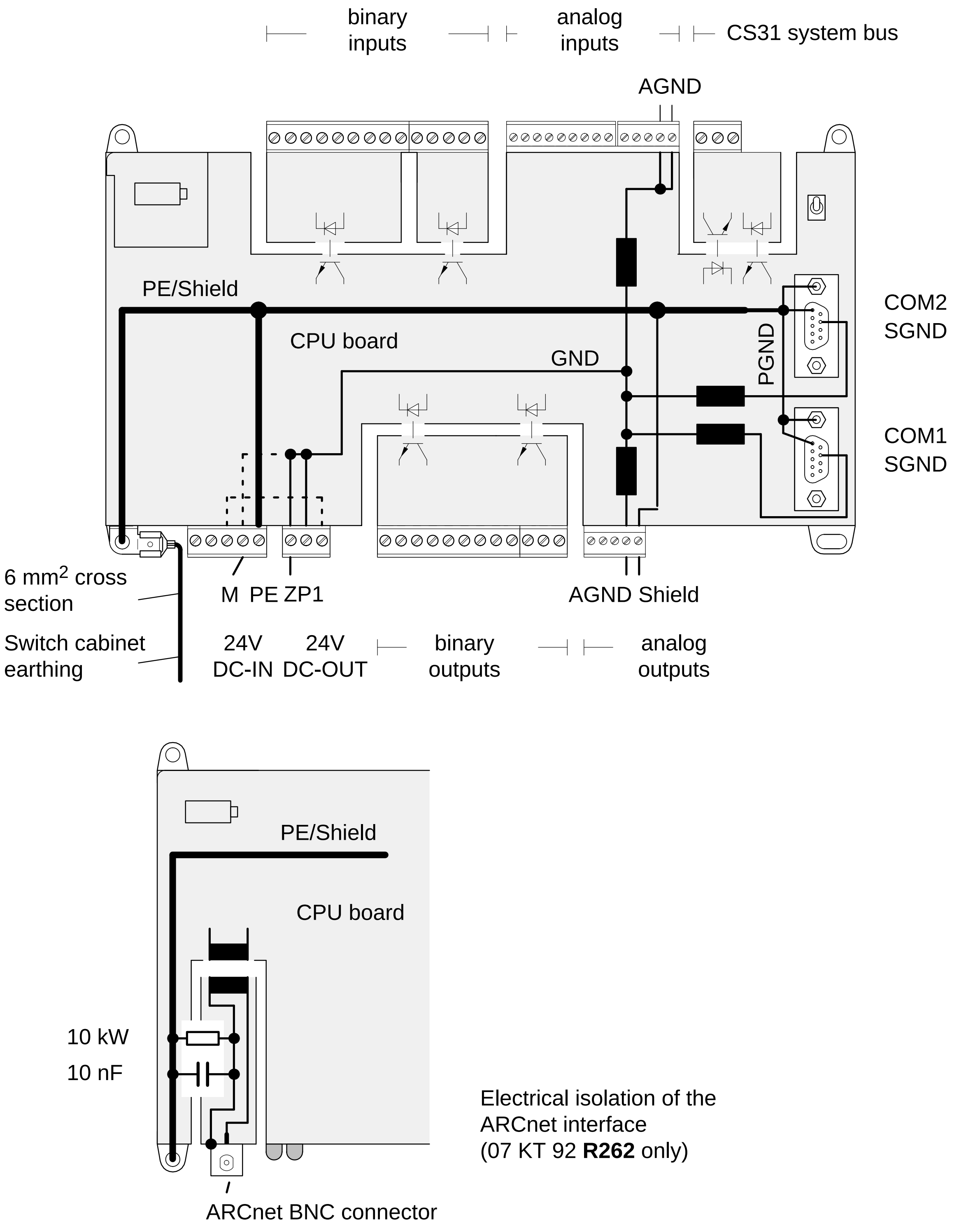


Fig. 2–5: Electrical isolation and connections inside the central unit 07 KT 92

2.3.4 ARCnet interface,
see also chapter A8 (Appendix)

- The ARCnet coupler is integrated in the central unit 07 KT 92 **R262**. The DIL switch for setting the ARCnet address is accessible through the cutout of the external networking interface.

- The ARCnet coupler is supplied from the internal 24 V DC power supply.

Important note:
If a PLC is used with an ARCnet interface, a certain section of the PLC TURBO program memory No. 2 is reserved for ARCnet.
If programs with more than 2 k instructions are executed, the system-dependent capacity utilization can possibly be increased by reason of the reduced TURBO memory No. 2 when *changes* are made *to a running program.*
There are *no* problems, if
- the capacity utilization is less than 80 % *before* making changes to a running program or if
- the program length is less than 2 k instructions.

- The function blocks AINIT, ASEND, AREC and APOLL are available for the ARCnet coupling.

- The data packages are read from the ARCnet controller interrupt-controlled. The interrupt routine stores the data package in the storage buffer. The APOLL block serves for the sending direction. It transfers data packages from the storage buffer to the ARCnet controller for sending them off.

- The ARCnet coupler interface is designed as a bus with BNC connector for coaxial cable. The ARCnet bus is earthed inside the module via a capacitor. As an EMC measure and for protection against dangerous contact voltages, the bus has to be earthed directly at a central place.

- Using the simplest configuration, called Linear ARCnet, a coaxial cable (RG62, 93 W) is layed from station to station and connected with T plugs at all stations. At both ends of the cable, termination resistors with 93 W each have to be installed, for more information see chapter A8.1 (Appendix). In a Linear ARCnet, a maximum of 8 stations is possible at a cable length of 300 m.

- The parallel networking interface is used for the ARCnet coupler inside the module. However, it is still available from outside as an external networking interface. The serial interface module 07 KP 92 can be connected here, for instance.

Setting the ARCnet Node Number (station address) of the central unit

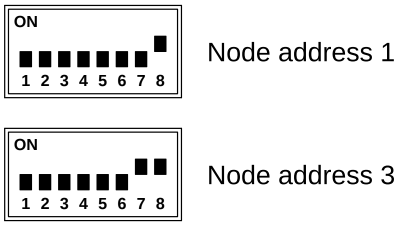
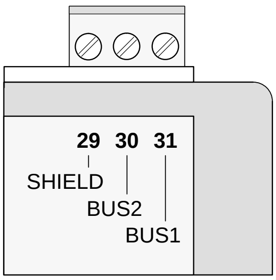


Fig. 2–5a: Setting the ARCnet Node Number (station address) of the central unit 07 KT 92 R262

2.3.5 Connection for ABB Procontic CS31 system bus



Terminal assignment

29 SHIELD
30 BUS2
31 BUS1

Fig. 2–6: Assignment of the ABB Procontic CS31 system bus interface

The connection to the ABB Procontic CS31 system bus is made by means of a 3-pole detachable terminal block. Please observe:

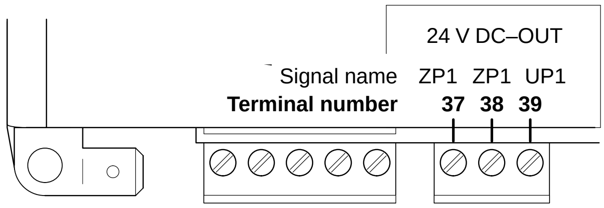
- All of the CS31 devices, no matter whether they are master or slave devices, are connected with the twisted-pair bus line as follows:
  - One core of the bus line is looped through via the BUS1 terminals of all devices to be connected to the CS31 system bus.
  - The other core of the bus line is looped through via the BUS2 terminals of all devices to be connected to the CS31 system bus.
- If the central unit 07 KT 92 is located at the beginning or at the end of the bus line, the bus terminating resistor (120 W) has to be connected additionally between the BUS1 and BUS2 terminals.
- The shield of the twisted-pair bus line is looped through via the SHIELD terminals of all the devices to be connected to the CS31 system bus.
- The handling of the CS31 system bus is described in detail in volume 2, System data.

2.3.6 24 V output voltage for the signal supply of the inputs

The central unit 07 KT 92 provides a separate 24 V DC voltage output for the supply of the 12 binary input signals (for this purpose only).

This 24 V output voltage is used only if an external 24 V DC power supply unit is not available.

The internal 24 V power supply is overload-proof. The 24 V output voltage is ready for operation again approx. 2 minutes after an overload has been eliminated.



Terminal assignment:

37	ZP1	Reference potential (OV), negative pole of the power source
38	ZP1	identical to terminal 37 (internally shorted)
39	UP1	+24 V, positive pole of power source

Fig. 2–7: Assignment of the terminal block for the output voltage

2.3.7 Connection of the binary inputs

The following illustration shows the circuit configuration of the binary inputs of the first group as an example.

Features:

- The 12 binary inputs are arranged in two groups.
- The two groups E 62,00...E 62,07 and E 62,08...E 62,11 are electrically isolated from each other (see Fig. 2–5).
- The inputs use 24 V signals in positive logic (1 ≙ +24 V).

Input signals at the terminals 2 and 3

Terminal 2

- **Use as normal input signal:**

  The signal is available in the user program in the operand E 62,00. The signal delay time is 7 ms.

  The updating of the operand E 62,00 is performed before the start of each program cycle.

- **Use as high-speed input signal:**

  The signal is available in the user program in the operand E 63,14. The signal delay time is 8 ms.

  The updating of the operand E 63,14 is performed before the start of each program cycle.

  In the Dual Port RAM (DPR) this signal is updated after each CS31 bus telegram. With the aid of the function block WOL this signal can be read in the Dual Port RAM (word address $C000:1FE_H$, Bit 14).

- **Use for the high-speed counter:**

  The signal is used as counting input (50 kHz) for the high-speed counter.

Terminal 3

- **Use as normal input signal:**

  The signal is available in the user program in the operand E 62,01. The signal delay time is 7 ms.

  The updating of the operand E 62,01 is performed before the start of each program cycle.

- **Use as high-speed input signal:**

  The signal is available in the user program in the operand E 63,15. The signal delay time is 8 ms.

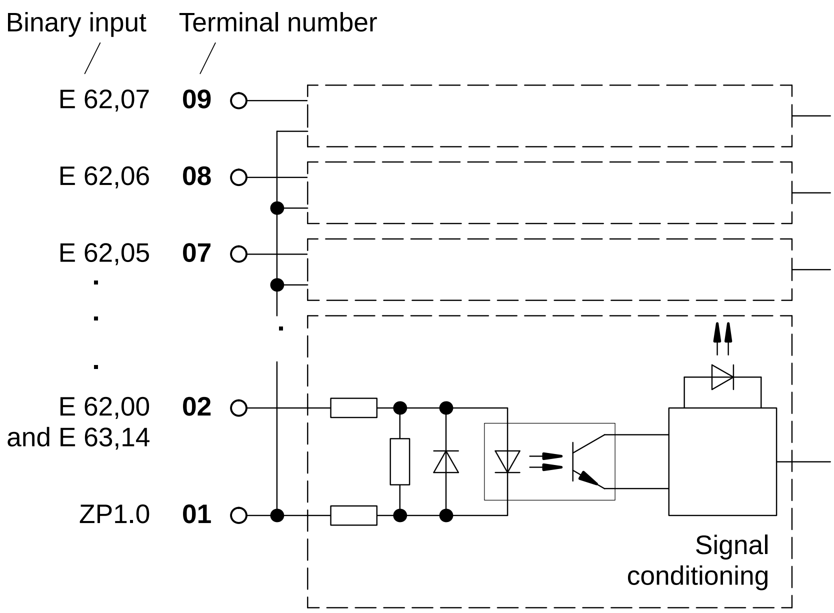
  The updating of the operand E 63,15 is performed before the start of each program cycle.

  In the Dual Port RAM (DPR) this signal is updated after each CS31 bus telegram. With the aid of the function block WOL this signal can be read in the Dual Port RAM (word address $C000:1FE_H$, Bit 15).

- **Use for the high-speed counter:**

  The signal is used as enable input for the high-speed counter.

Circuit configuration of the binary inputs of the first group as an example (E62,00...E 62,07)



The two groups are electrically isolated from each other. ZP1.0 and ZP1.1 are *not* connected with each other internally.

The input signals have a delay time of typ. 7 ms.

Fig. 2–8: Circuit configuration of the binary inputs of the first group as an example

2.3.8 Connection of the analog inputs,
with signal ranges either 0...10 V, 0...5 V or 0...20 mA

The following illustration shows the circuit configuration of the analog inputs of the first channel as an example.

Features:

– The 4 analog inputs are not separated electrically.

– The A/D converter has a resolution of 12 bits.

– The analog inputs are able to evaluate the following signal ranges each as required:

0...10 V	resolution ca. 2.5 mV
0... 5 V	resolution ca. 1.25 mV
0...20 mA	resolution ca. 5 µA

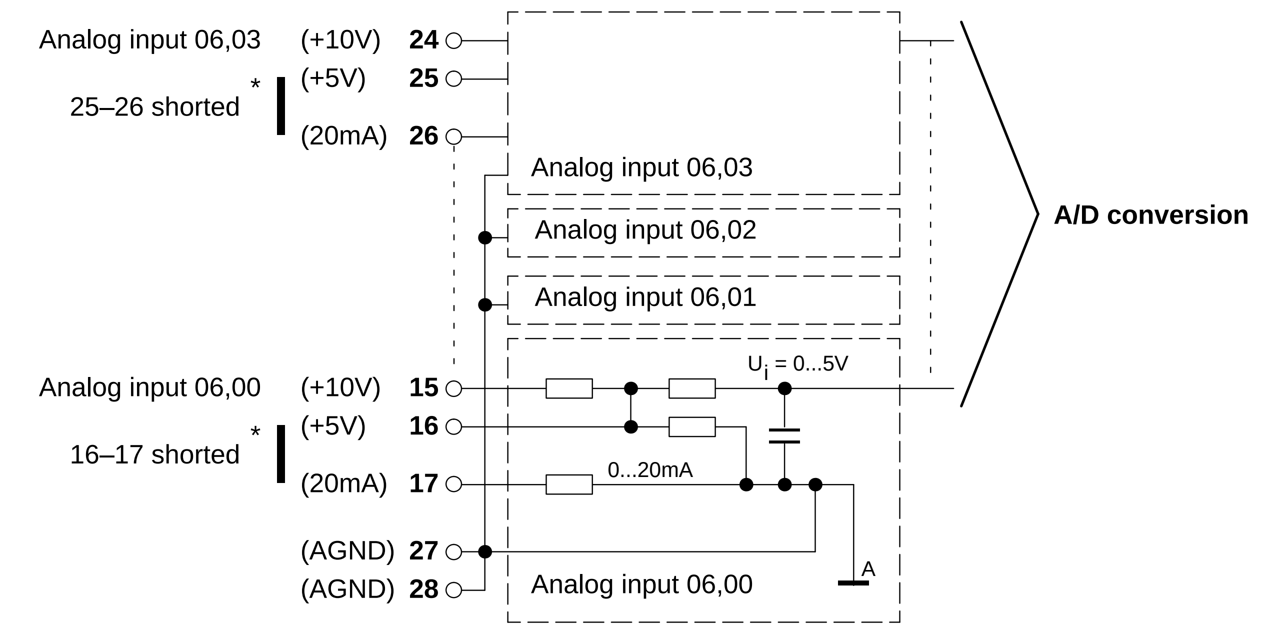
– Resolution in the PLC:
The smallest detectable changes on the analog side (2.5 mV, 1.25 mV, 5 µA) cause the numerical value in the PLC program to be changed by the amount of 8.

– Relationship between the analog value at the analog input and the numerical value in the PLC program:

selected range	numerical values
0...10 V	$0...32760_D$ or $0000...7FF8_H$
0... 5 V	$0...32760_D$ or $0000...7FF8_H$
0...20 mA	$0...32760_D$ or $0000...7FF8_H$

For further information see volume 2, chapter 5.1 General information on using the analog input and output modules.
For 07 KT 92 ”Assignment **b**” is valid.

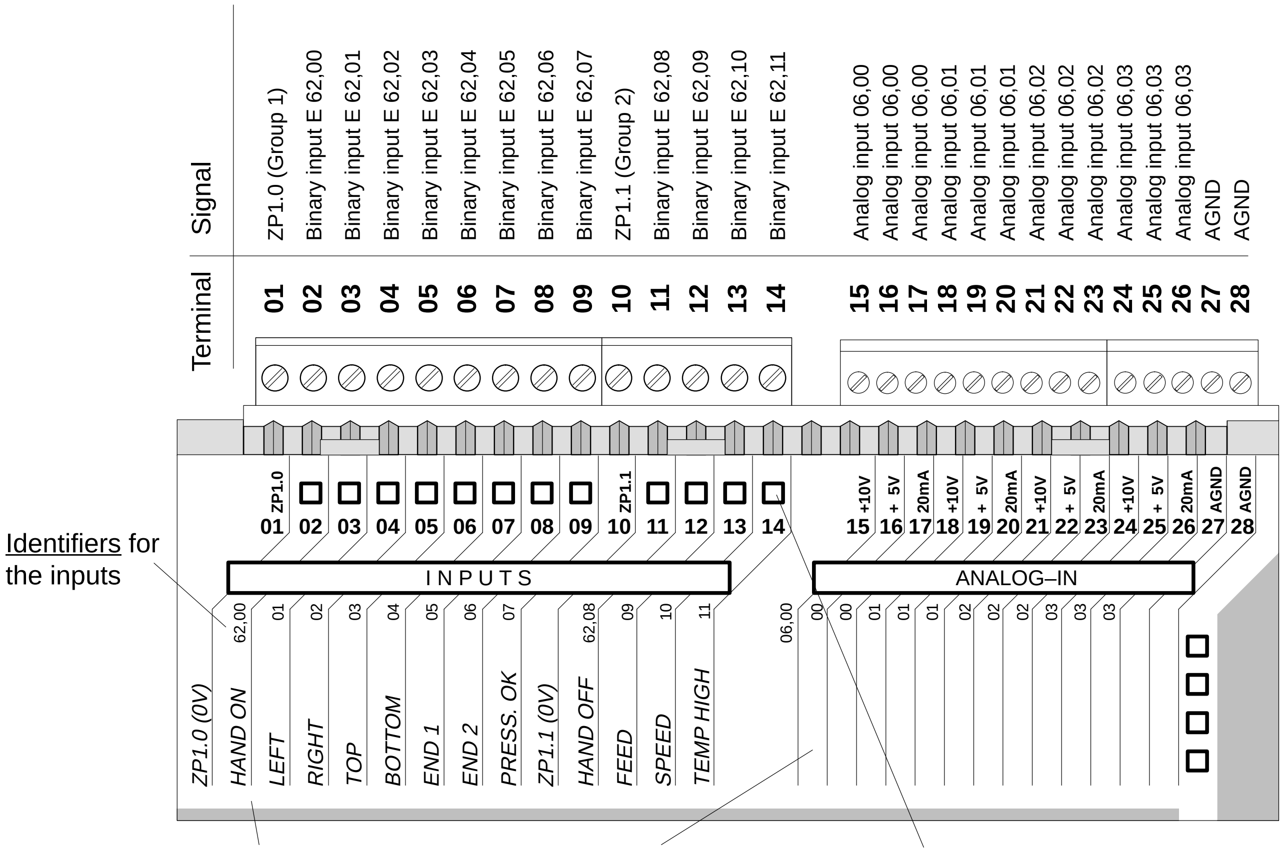
Circuit configuration of the analog inputs of the first channel as an example



* Connection is required for 20mA operation only

Fig. 2–9: Circuit configuration of the analog inputs

2.3.9 Identifier assignment for binary and analog inputs



The user can enter symbol names of the program or signal abbreviations here. The plastic sheet can be detached for labelling.

Green LEDs indicate the statuses of the input signals.

Fig. 2–10: Terminals and assignments of binary and analog inputs

2.3.10 Connection of the binary outputs

The following illustration shows the circuit configuration of the binary outputs.

Features of the outputs:

– The 8 outputs are arranged in one group and are electrically connected with each other.

– The outputs can be loaded with a rated current of 500 mA.

– The group as a whole is electrically isolated from the rest of the device.

– The outputs use transistors and are short-circuit-proof.

– The eight transistors of the group have a common power supply.

– The outputs are automatically switched off in case of overload or short-circuit.

– A overall error message indicates a short-circuit or an overload which has occurred on one or on several outputs.

– An overload is displayed by the red LED K and via error flags in the PLC.

– The user can set by means of a system constant whether the overloaded output is to be switched on again automatically by the PLC or whether it is to be switched on again by configuring within the PLC program, e.g. by means of the function blocks CS31QU or CS31CO. The default setting is the automatic reset of the outputs.

– The red LED K goes out when the overloaded output is switched on again after eliminating the overload.

– The acknowledgement of the error message, i.e. the resetting of the error flags, is done in correspondence with chapter A4.8 (Appendix), Acknowledgement of error messages in the central unit.

Circuit configuration of the binary outputs A 62,00...A 62,07

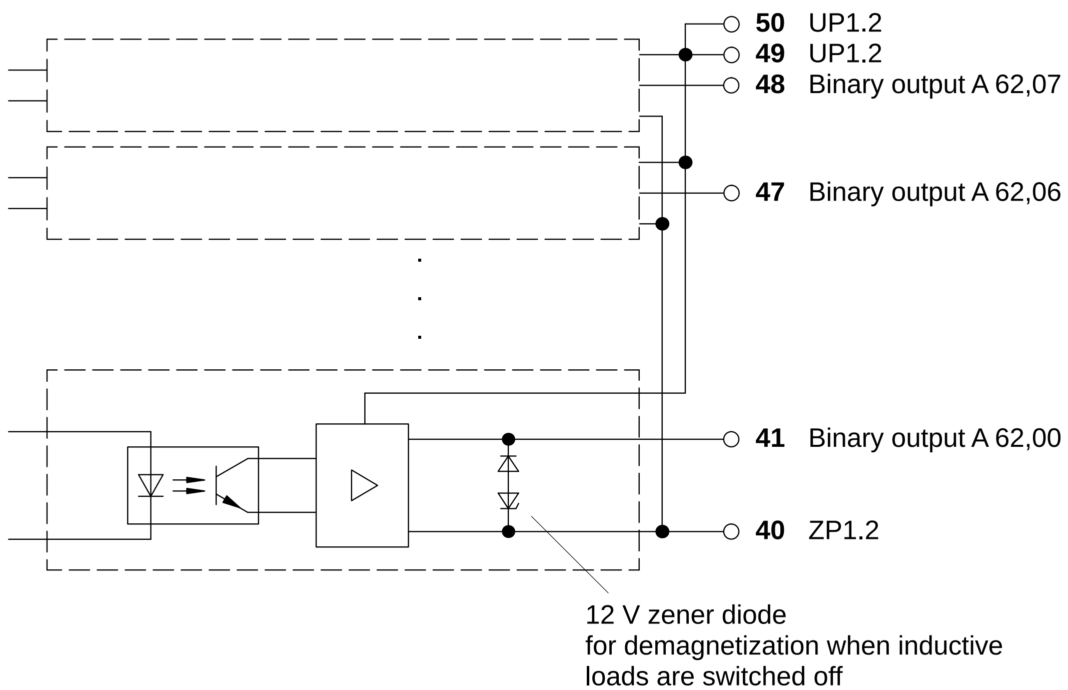


Fig. 2–11: Circuit configuration of the 8 transistor outputs

2.3.11 Connection of the analog outputs

The following illustration shows the circuit configuration of the analog outputs.

Features of the analog outputs:

– The analog outputs are not separated electrically.

– Load capability of the outputs max. $\pm$ 5 mA

– Resolution of the D/A converter: 12 bits

– Range of conversion: –10 V ... +10 V

– Resolution 5 mV

– If the numerical value in the PLC is changed by the amount of 16, the voltage at the outputs is changed by 5 mV.

– Relationship between the numerical value in the PLC program and the analog value at the analog outputs:

–32768 (8000_H) ... –32761 ($800F_H$) –>–10 V
–00016 ($FFF0_H$) ... –00001 ($FFFF_H$) –>–5 mV
00000 (0000_H) ... +00015 ($000F_H$) –> 0 V
+32752 ($7FF0_H$) ... +32767 ($7FFF_H$) –>+10 V

For further information see volume 2, chapter 5.1 General information on using the analog input and output modules.
For 07 KT 92 ”Assignment **b**” is valid.

Output 06,01 (analog output instead of the calibrated 10 V output)

With the module 07 KT 92 **R101,** the terminal 52 was assigned with a fixed and calibrated output voltage of +10 V. Instead of this fixed voltage, the terminal 52 of the module 07 KT 92 **R202/262** is assigned with a second analog output (channel No. 06,01). It has the same specifications as channel No. 06,00.

If the output 06,01 must have a voltage of +10 V, the user program has to be added by the following instruction:

!KW XX,YY = AW 06,01
with
KW XX,YY = 32767

When replacing older modules with newer ones it has to be kept in mind that the output AW 06,01 only provides the +10 V voltage while the program is running.

Circuit configuration of the analog outputs AW 06,00 and AW 06,01

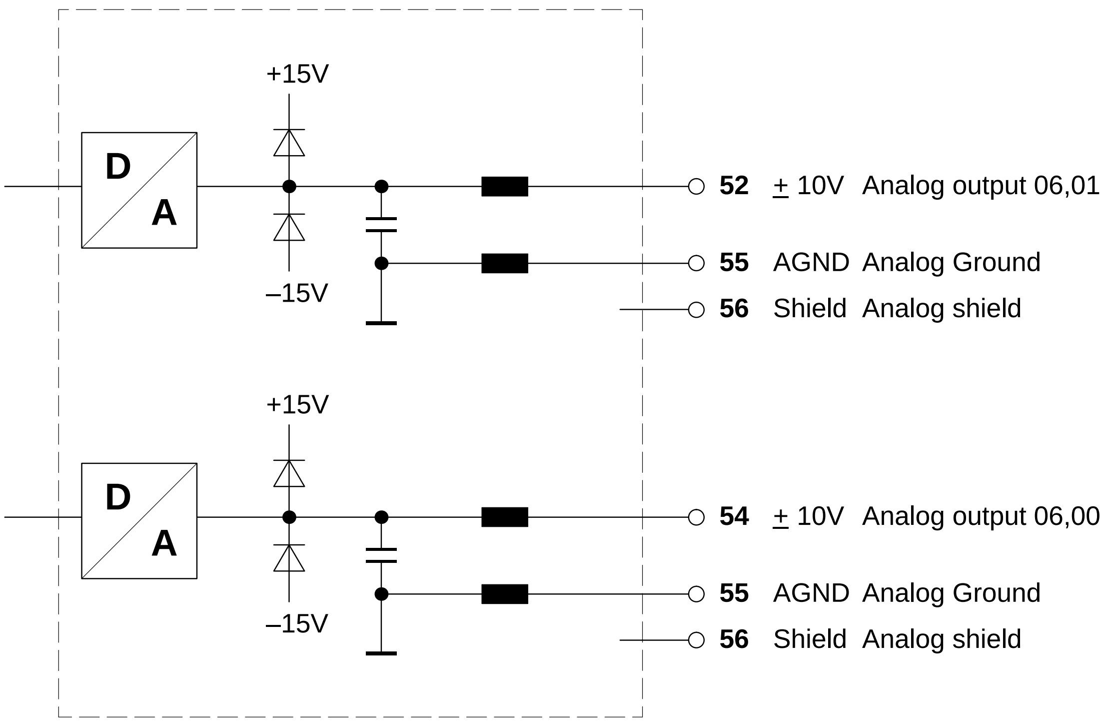


Fig. 2–12: Circuit configuration of the analog outputs

2.3.12 Identifier assignment for the outputs (binary and analog)

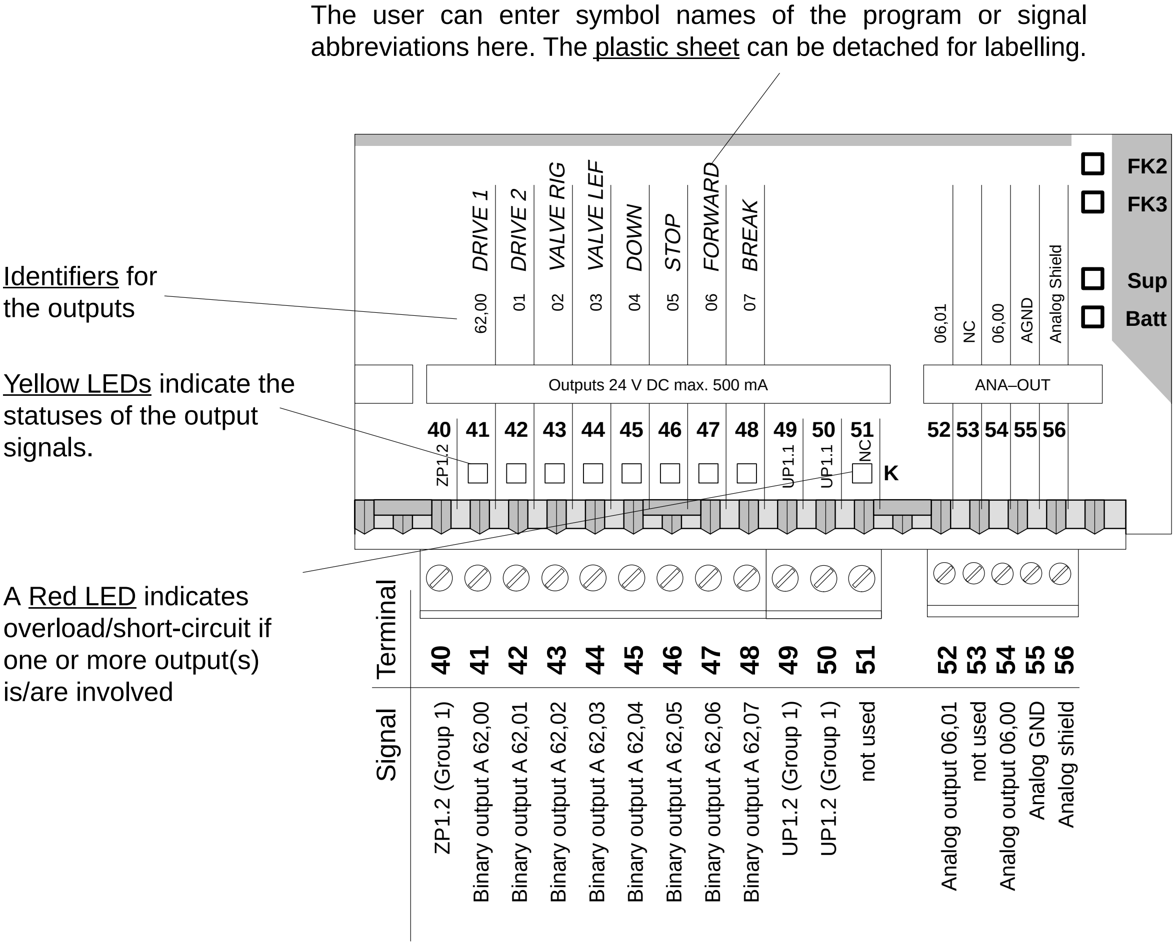


Fig. 2–13: Terminals and assignments of the outputs

2.3.13 Battery and battery replacement

- The lithium battery 07 LE 90 can be inserted into the battery compartment in order to
  - backup data of user program in RAM
  - backup data of additionally in RAM contained information, e.g. flag statuses
  - backup of time and date (real-time clock).

The battery lifetime is 1.5 years at 25¿C (typ. 3 years). The battery lifetime is the time during which the device remains operable in order to backup data while the supply voltage of the central unit is switched off. As long as there is a supply voltage available, there is no more load on the battery other than its own leakage current.

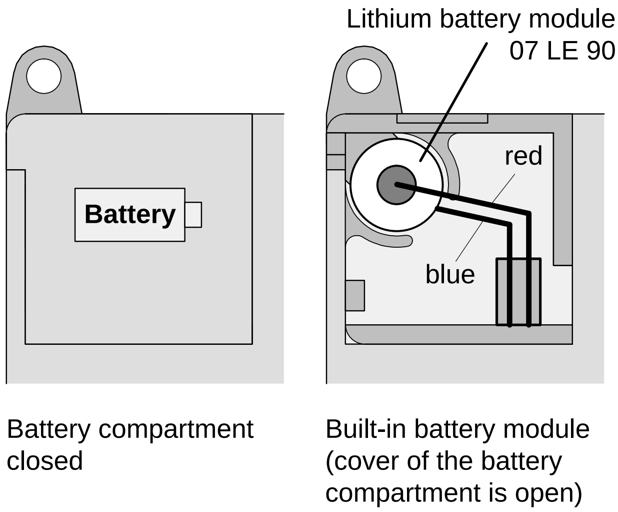


Fig. 2–14: Battery and battery replacement

The following handling notes have to be observed:

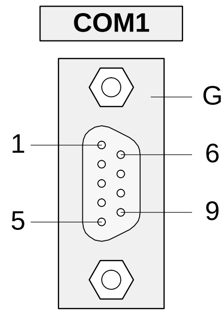
- Use only lithium batteries approved by ABB.
- Replace the battery by a new one at the end of its life.
- **Never short-circuit the battery!**
  There is danger of overheating and explosion. Avoid accidental short-circuits, therefore do not store batteries in metallic containers or boxes and do not bring it into contact with metallic surfaces.
- **Never try to charge the battery!**
  Danger of overheating and explosion!
- **Replace the battery only with the supply voltage switched on!**
  Otherwise you risk data being lost.
- **Dispose of battery environmentally consciously!**
- If no battery is built-in or if the battery is exhausted, the red LED ’Battery’ lights up.

2.3.14 Serial interface COM 1

Interface standard: EIA–232

Assignment of the serial interface COM1

The serial interface has the following pin assignment:



G	Housing	Protective Ground	(Shield)
1	PGND	Protective Ground	(Shield)
2	TxD	Transmit Data	(Output)
3	RxD	Receive Data	(Input)
4	RTS	Request To Send	(Output)
5	CTS	Clear To Send	(Input)
6	PROG *****		(Input)
7	SGND	Signal Ground	(0V)
8	0V out		(0V)
9	+5 V out	Supply for the TCZ service device ******	

***** 1 = Active mode (Programming/test), Pin 6 open
0 = Passive mode (DRUCK/EMAS applications), Pin 6 shorted to 0V out

****** 5V output (only for supplying the TCZ service device):
The connected service device receives its voltage supply via the interface cable.

Fig. 2–15: Assignment of the serial interface COM1

Operating modes of the serial interface COM1

The operating mode of the interface has to be set according to the application in each case:

– Programming and test or
– Man–machine–communication MMC

Active mode: The active mode is used for programming and testing the central unit, i.e. it gives the user access to all the programming and test functions of the central unit.

Passive mode: The passive mode is used to perform a communication configured with the DRUCK and EMAS blocks between the user program and a device connected to the serial interface.

Conditions for setting the operating modes of the interface COM1

RUN/ STOP switch	System constant KW00,06	System cable/ device	Mode set by this
STOP	x	x	Active
RUN	1	x	Active
	2	x	Passive
	0, <0, >2	07 SK 90	Active
		07 SK 91, TCZ	Passive

x: without effect

Temporary interruption of the passive mode

While a communication between the DRUCK or EMAS blocks and a device connected to COM1 is being executed, it may be come necessary to modify the program, for example. For this purpose, you must switch over COM1 from the passive mode into the active mode.

Switch-over: Passive mode ––> Active mode

There are three possibilities for switching over:

- Set the RUN/STOP switch to the ”STOP” position
- Replace cable 07 SK 91 by cable 07 SK 90 (if KW 00,06 is set to ≤0 or >2)
- Send the following special command to the PLC: <DEL><DEL><DEL>

The latter option has the advantage that the switch-over can also be controlled remotely, e.g. via telephone line and suitable dial-up modems. The ASCII character <DEL> has the decimal code of 127 and the hexadecimal code of $7F_H$. You can generate this character by simultaneously pressing the control key <CTRL> and the delete key <—.

Notes:

On German keyboards, the control key is labelled by <Strg> instead of <CTRL>.

If the switch-over to the active mode was performed using the special command <DEL><DEL><DEL>, please observe the following:

> *During the execution* of the PLC program, the system constant KW 00,06 must **not** be sent to the PLC because this would cause the system to be switched back to the passive mode.

The special command assigns the value of ”1” to the image of the system constant KW 00,06 located in the operand memory. The PLC evaluates the value of this image and sets the kind of application of COM1 correspondingly.

Switching back: Active mode ––> Passive mode

There are three possibilities for switching back:

- Return RUN/STOP switch to the ”RUN” position
- Replace cable 07 SK 90 by cable 07 SK 91 again.
- Cancel the special command <DEL><DEL><DEL> as follows:

– If the PLC program is in the ”aborted” condition:

> *Start the PLC program.*

– If the PLC program is in the ”running” condition:

> *send the original value of the system constant KW 00,06 to the PLC again (907 PC 33 menu item ”Send constants”)*
>
> or
>
> *overwrite the system constant KW 00,06 by the original value (907 PC 33 menu item ”overwriting”)*

Interface parameters

Active mode: The settings of the interface parameters cannot be changed

Data bits:	8
Stop bits:	1
Parity bits:	none
Baud rate:	9600
Synchronization:	RTS/CTS

Passive mode: Default setting

Synchronization:	RTS/CTS
Interface identifier COM1:	1
Baud rate:	9600
Stop bits	1
Data bits:	8
Parity bits:	none
Echo:	off
Send Break Character:	0
Enabling End-of-text character for sending direction:	no [1])
Sending End-of-text character:	<CR> [1])
Receiving End-of-text character:	<CR> [2])

[1]) The default End-of-text character for the sending direction (CR) is not sent. Nevertheless, this default End-of-text character (CR) must not appear in the message text of the assigned DRUCK block.

[2]) For the direction of reception, an End-of-text character is always necessary. This default End-of-text character (CR) must not appear neither in the message text nor in the user data of the assigned EMAS block.

For the passive mode of COM1, the interface parameters can be changed using the SINIT function block. If the changed values are not plausible, the COM1 interface uses the default values.

The interface is newly initialized each time the operating mode is switched over.

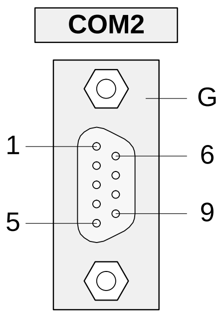
The active-mode parameters are set in the active mode, whereas in the passive mode the parameters established by the SINIT block or the default values are set.

2.3.15 Serial interface COM 2

Interface standard: EIA–232

Assignment of the serial interface COM2

The serial interface has the following pin assignment:



G	Housing	Protective Ground	(Shield)
1	PGND	Protective Ground	(Shield)
2	TxD	Transmit Data	(Output)
3	RxD	Receive Data	(Input)
4	RTS	Request To Send	(Output)
5	CTS	Clear To Send	(Input)
6	NC		(unused)
7	SGND	Signal Ground	(0V)
8	0V out		(0V)
9	+5 V out	Supply for the TCZ service device **	

** 5V output (only for supplying the TCZ service device):
The connected service device receives its voltage supply via the interface cable.

Fig. 2–16: Assignment of the serial interface COM2

Operating modes of the COM2 interface

The serial interface COM2 is fixedly set to the **passive mode** (MMC interface).

The passive mode is used to perform a communication configured with the aid of the DRUCK and EMAS blocks between the user program and a device connected to the serial interface.

The application-specific initialization of COM2 can be performed using the SINIT function block.

Interface parameter

Passive mode: Default setting

Synchronization:	RTS/CTS
Interface identifier COM2:	2
Baud rate:	9600
Stop bits	1
Data bits:	8
Parity bits:	none
Echo:	off
Send Break Character:	0
Enabling End-of-text character for sending direction:	no [1])
Sending End-of-text character:	<CR> [1])
Receiving End-of-text character:	<CR> [2])

[1]) The default End-of-text character for the sending direction (CR) is not sent. Nevertheless, this default End-of-text character (CR) must not appear in the message text of the assigned DRUCK block.

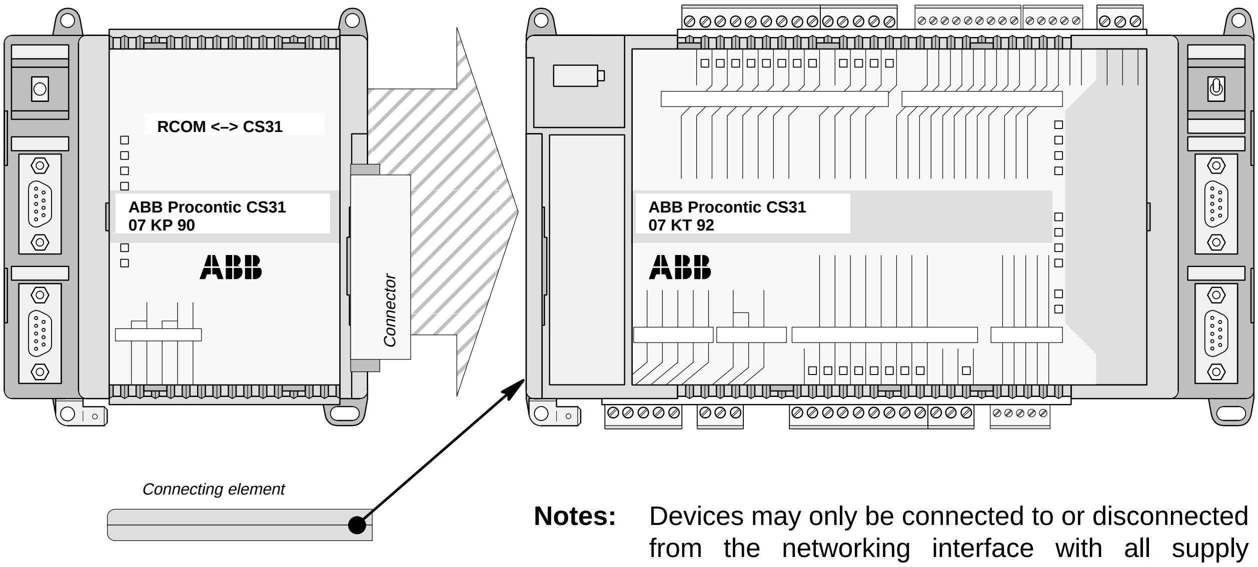
[2]) For the direction of reception, an End-of-text character is always necessary. This default End-of-text character (CR) must not appear neither in the message text nor in the user data of the assigned EMAS block.

For the passive mode of COM2, the interface parameters can be changed using the SINIT function block. If the changed values are not plausible, the COM2 interface uses the default values.

In the passive mode the parameters established by the SINIT block or the default values are set.

2.3.16 Networking interface

The 07 KT 92 central unit is equipped with a special parallel interface. It is thus possible to network it with another bus system using an additional communication processor module. The additional communication processor has its own housing. Both housings (of the 07 KT 92 and of the communication processor) are assembled by means of a snap-on connection.



Notes: Devices may only be connected to or disconnected from the networking interface with all supply voltages switched off.

In order to assemble the two devices with each other, they must be put together on a level ground and then be fastened using the connecting element.

Fig. 2–17: Mounting of 07 KT 92 with expansion (e.g. communication processor 07 KP 90)

2.4 High-speed counter

Features

The high-speed counter used in the central units 07 KR 91, 07 KT 92 and 07 KT 93 works independently of the user program and is therefore able to response quickly to external signals. Its features are as follows:

- The counting frequency is max. 50 kHz. The counter counts the 0–>1 edges at terminal 02 (also designated as E 62,00).
- The counter counts upwards from –32768 to +32767 (8000_H...$7FFF_H$). If +32767 is exceeded, the counter skips to –32768.

  Sequence of the counting procedure:

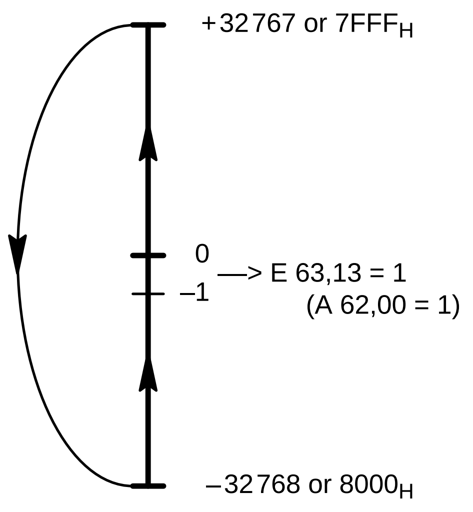


Fig. 2–18:
Sequence of the counting procedure

- Enabling/disabling of the counting procedure using the internal variable A 63,14 in the user program:
  - A 63,14 = 0:
    The internal variable A 63,13 = 1 enables the counting procedure, whereas A 63,13 = 0 disables it.
  - A 63,14 = 1:
    Signal 1 at terminal 03 (also designated as E 62,01) enables the counting procedure, whereas signal 0 disables it. A 63,13 is without effect.
    Note: The dead time may be 0...1.5 ms.

- Setting the counter in the user program:
  - to the value contained in the internal word variable AW 06,15
  - using the internal variable A 63,15 = 1.

  Note: If the internal variable A 63,15 = 1 is present during several processing cycles, the processor sets the counter at the program end in each case.
  During the remaining time of the processing cycle, the counter counts pulses at terminal 02.

- The counter content can be read via the internal variable EW 06,15.

- Zero-crossing message (signal changes from 0 to 1 when the counter contents changes from –1 to 0):
  - always via the internal variable E 63,13,
  - at the terminal 41 (also designated as A 62,00) only, if the internal variable A 63,14 = 1 is set.
    Note: The reaction time may be 0...1.5 ms. The direct control of the output A 62,00 from the user program is disabled by A 63,14 = 1.

  The zero-crossing message is cancelled when the counter is set.

- Fast input of binary signals into the user program with a delay of 8 ms:
  - Terminal 02 (also designated as E 62,00):
    Internal variable E 63,14
  - Terminal 03 (also designated as E 62,01):
    Internal variable E 63,15

Block diagram

see next page

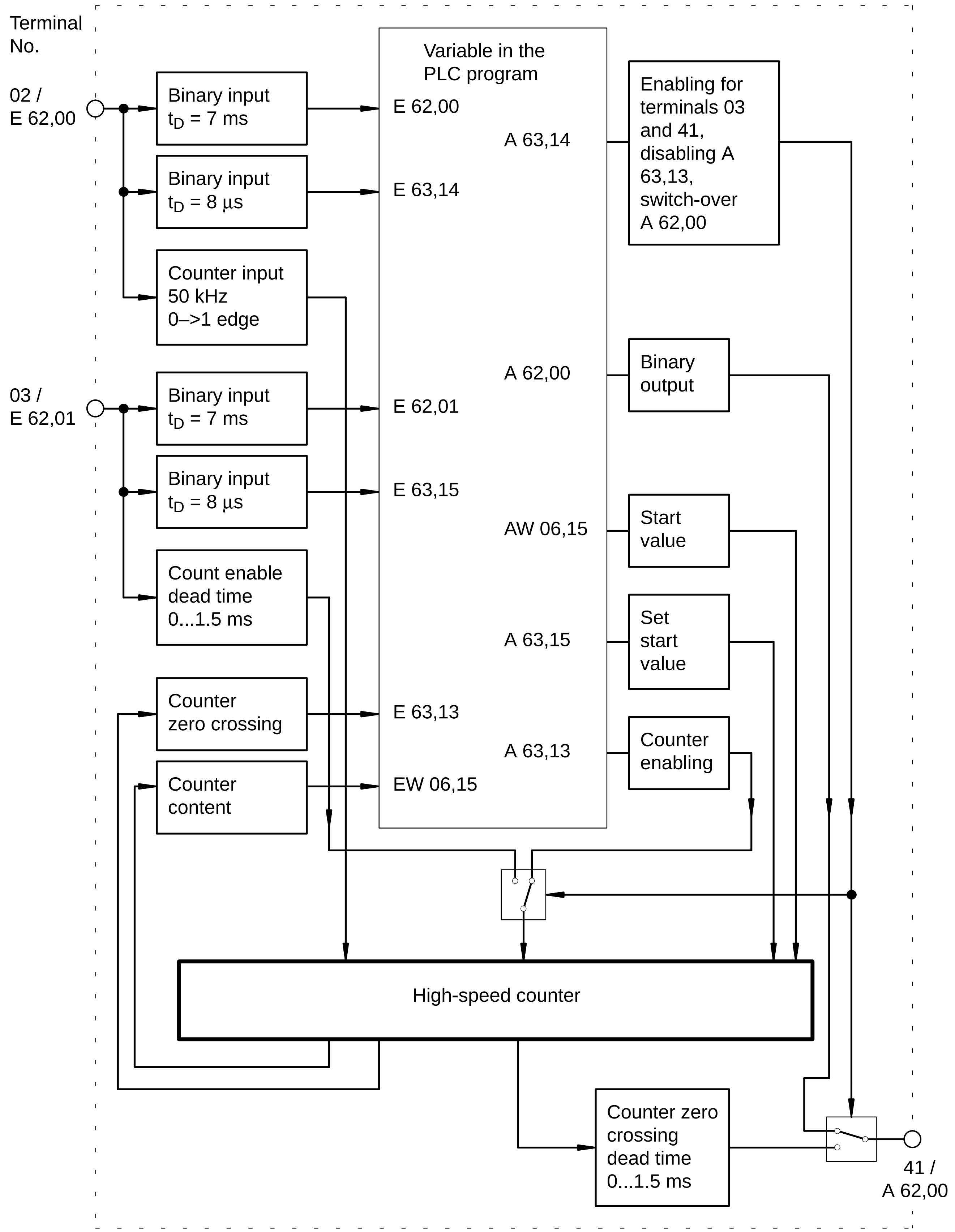


Fig. 2–19: 07 KT 92, High-speed counter, block diagram

Configuration example

- **Task:**
  - 180 pieces each of a unit load have to be filled into a packing.
  - Each filled-in piece generates one pulse.
  - When the packing is full, the counter is immediately prepared for the next filling operation.
  - The enabling signal for the filling operation is sent by the packaging machine.
  - The end of the counting operation has to be signalled to the packaging machine immediately.
- **Wiring**
  - Connect the signal line for the counting pulses to terminal 02.
  - Connect the signal line for the enabling of the counting operation to terminal 03.
  - Connect the signal line for ”zero crossing” of the counter to terminal 41.
- **Configuration steps: PLC program**

1) Activate terminals 03 and 41

- The terminals 03 and 41 are activated using the operand A 63,14.

  IL (instruction list):
  ! K 00,01
  = A 63,14 (with K 00,01 = 1)

2) Preset start value for the counter

The start value (AW 06,15) is set to the value of –180. The counter will then count starting from –180 in positive direction. The transition from –1 to 0 will be signalled.

IL (instruction list):
! KW 01,00
= AW 06,15 (with KW 01,00 = –180)

3) Adopt start value into the counter

After each counting operation, the start value is immediately set again into the counter by means of the ”zero crossing” signal (E 63,13). Operand A 63,15 = 1 has to be set for this purpose. At program start, the start value is loaded once into the counter by means of the initialization flag M 255,15 (M 255,15 has the value of 0 after program start).

IL (instruction list):
! NM 255,15
/ E 63,13
= A 63,15
:
:
other PLC program parts
:
:
! K 00,01
= M 255,15 (set M 255,15 = 1)
! PE   (program end)

Preset start values

You can preset both *positive* and *negative* start values for the counter.
The counting operation starts at the start value and is continued in correspondence with the arrows in the diagram until the enabling is stopped or a start value is loaded again.

Negative start value

The minimum negative start value is
–32768 (8000_H).
By presetting a negative start value it is thus possible to count a maximum of 32768 pulses up to the zero crossing of the counter.

Positive start value

If a positive start value is preset, the counter counts up to the value of +32767 ($7FFF_H$), continues the counting operation at the value of–32768 (8000_H) and then signals the zero crossing when reaching the transition from –1 to 0.
The minimum positive start value is 1. If you preset this value, 65535 pulses will be counted up to the zero crossing.

In order to count more than 32767 pulses up to the zero crossing, the start value has to be calculated according to the following equation:

Start value = 32767 – (number of pulses – 32768)

Example:
40 000 pulses are to be counted.
The start value is in the positive range, because more than 32768 pulses have to be counted.

Calculation:

Start value = 32767 – (number of pulses – 32768)
= 32767 – (40 000 – 32768)
= 25535

2.5 Technical data 07 KT 92

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

2.5.1 General data

Number of binary inputs	12
Number of binary transistor outputs	8
Number of analog inputs	4
Number of analog outputs	1
I/O expansion via CS31 system bus by up to	744 binary inputs 496 binary outputs 96 analog input channels 48 analog output channels max. 31 remote modules altogether
Number of serial interfaces	2 (for programming or connection to man-machine communication)
Number of parallel interfaces	1 special interface for connection of a communication processor (for networking with other bus systems)
Integrated memory, **07 KT 92 R202 / R262:**	Flash EPROM 128 kB (60 kB program + 60 kB user data) RAM 256 kB (30 kB program with online programming or 60 kB program without online programming)
Resolution of the integrated real-time clock	1 second
Data of the integrated high-speed hardware counter	
counting range	0...65,535 (16 bits)
counting frequency	max. 50 kHz
Processing time, binary operation	typ. 0.4...0.6 ms/kB program
Processing time, 65 % bits, 35 % words	typ. 0.7 ms/kB program
Number of software timers	any (max. 80 simultaneously active)
delay time of the timers	5 ms...24.8 days
Number of up/down counter SW blocks	any
Number of bit flags	4096
Number of word flags	4096
Number of double word flags	512
Diagnosis	cycle time monitoring, battery monitoring, detection of syntax errors and checksum monitoring
Indication of operating statuses and errors	31 LEDs altogether

2.5.2 Power supply

Rated supply voltage	24 V DC
Current consumption	max. 0.3 A (R202), max. 0.35 A (R262), plus output current through terminal 39 (output voltage for the supply of the binary inputs)
Protection against reversed terminal connection	yes

2.5.3 24V output voltage for the supply of inputs

Rated voltage	24 V DC
Load capability	max. 120 mA
Protection against overload	with a PTC resistor
Conductor cross section of the removable 3-pole terminal block	max. 2.5 mm^2

2.5.4 Lithium battery

Battery for back-up of RAM contents	07 LE 90 battery module
Lifetime at 25°C	1.5 years (typ. 3 years)

2.5.5 Binary inputs

Number of channels per module	12
Distribution of channels into groups	1 group of 8 channels, 1 group of 4 channels
Common reference potential	
for group 1 (8 channels)	ZP1.0 (channels 62,00...62,07)
for group 2 (4 channels)	ZP1.1 (channels 62,08...62,11)
Electrical isolation	between the groups, between groups and other circuitry (see also Fig. 2–5)
Signal coupling of input signals	with optocoupler
Input signal delay of	
channels E 62,00...E 62,11	typ. 7 ms
channels E 63,14 and 63,15	typ. 8 µs
for counter control	typ. 8 µs
Signalling of input statuses	one green LED per channel, the LEDs correspond functionally to the input signals
Input signal voltage	
signal 0	–30 V...+ 5 V
signal 1	+13 V...+30 V
ripple when signal 0	within –30 V...+ 5 V
when signal 1	within +13 V...+30 V
Allowed input overvoltage	± 36 V, for 100 ms only
Input current per channel	
input voltage = +24 V	typ. 8.0 mA
input voltage = + 5 V	≥ 0.2 mA
input voltage = +13 V	≥ 2.0 mA
input voltage = +30 V	≤ 10.0 mA
Labelling for the inputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Max. cable length unshielded	600 m
Max. cable length shielded	1000 m
Conductor cross section of the removable terminal blocks	max. 2.5 mm^2

2.5.6 Binary outputs

Number of channels per module	8 transistor outputs
Distribution of channels into groups	1 group of 8 channels
Common supply voltage for group 1	 UP1.2 (channels 62,00...62,07)
Electrical isolation	between the group and other circuitry, (see also Fig. 2–5)
Signalling of output statuses	one yellow LED per channel, the LEDs correspond functionally to the output signals
Output current rated value maximum value leakage current with signal 0	 500 mA with UP1.2 = 24 V 625 mA with UP1.2 = 24 V + 25 % < 0.5 mA
Demagnetization of inductive loads	internally with free-wheeling diode and Z-diode (Z-diode voltage is 12 V)
Switching frequency with inductive loads	max. 0.5 Hz
Switching frequency with lamp load	max. 11 Hz with max. 5 W
Max. cable length	400 m (pay attention to voltage drop)
Short-circuit-proof/overload-proof reset can be carried out	yes, – automatically or – by configuration.
Total load (via UP1.2)	max. 4 A
Labelling for the outputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Conductor cross section of the removable terminal blocks	 max. 2.5 mm^2

2.5.7 Analog inputs

Number of channels per module	4
Distribution of channels into groups	1 group of 4 channels
Common reference potential for group 1 (4 channels)	 AGND (channels 06,00...06,03)
Electrical isolation	no (see also Fig. 2–5)
Signalling of input statuses	none
Input signal ranges (selectable at each channel)	0...10 V 0... 5 V 0...20 mA
Input resistance per channel (voltage input)	ca. 100 kΩ (0...10 V range) ca. 50 kΩ (0...5 V range)
Input resistance per channel (current input)	250 Ω
Time constant of the input filter Conversion time	100 µs 20 µs per channel
Resolution	12 bits
Resolution (1 LSB) range 0...10 V range 0... 5 V range 0...20 mA	2.5 mV 1.25 mV 5.0 µA

Relationship between input signal and hex-code	0...100 % = 0000_H...$7FF8_H$ (0...32760 decimal)
Conversion inaccuracy caused by nonlinearity, adjustment error on delivery and resolution	< 1 %
Labelling for the inputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Max. cable length shielded, 2-core shielded and cross section $\geq$ 0.5 mm^2	100 m
Conductor cross section of the removable terminal blocks	max. 1.5 mm^2

2.5.8 Analog outputs

Number of channels per module	2
Reference potential	AGND (channels 06,00 and 06,01)
Electrical isolation	no (see also Fig. 2–5)
Signalling of output statuses	none
Output signal range	–10 V...0...+10 V
Output load capability	max. $\pm$ 5 mA
Resolution	12 bits
Resolution (1 LSB) range –10 V...0...+10 V	5 mV
Relationship between output signal and hex-code	
–32768...–32761 (8000_H...$800F_H$)	≙ –10 V
–00016...–00001 ($FFF0_H$...$FFFF_H$)	≙ – 5 mV
00000...+00015 (0000_H...$000F_H$)	≙ 0 V
+32752...+32767 ($7FF0_H$...$7FFF_H$)	≙ +10 V
Conversion inaccuracy caused by nonlinearity, adjustment error on delivery and resolution	< 1 %
Labelling for the outputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Max. cable length shielded, 2-core shielded and cross section $\geq$ 0,5 mm^2	100 m
Conductor cross section of the removable terminal block	max. 1.5 mm^2

2.5.9 Connection of serial interface COM1

Interface standard	EIA RS–232
Programming with 907 PC 33	by means of IBM PC (or compatible)
Man–machine communication	yes, e.g. with ABB Procontic Operating Station 35 BS 40
Display and updating of timers, counters and parameters	yes, e.g. with TCZ Service Device
Electrical isolation	versus binary inputs and outputs, versus CS31 system bus interface (see also Fig. 2–5)

Potential differences	In order to avoid potential differences between the 07 KT 92 central unit and the peripheral device connected to the COM1 interface, this device is supplied from the switch cabinet socket (see also the earthing connections in Fig. 2–3).
Pin configuration and description of the COM1 interface	see chapter 2.3.14

2.5.10 Connection of serial interface COM2

Interface standard	EIA RS–232
Man–machine communication	yes, e.g. with ABB Procontic Operating Station 35 BS 40
Electrical isolation	versus binary inputs and outputs, versus CS31 system bus interface (see also Fig. 2–5)
Potential differences	see text of COM1 (above)
Pin configuration and description of the COM2 interface	see chapter 2.3.15

2.5.11 Connection to the ABB Procontic CS31 system bus

Interface standard		EIA RS–485
Connection	as a Master PLC	yes, transmitting and receiving area are configurable
	as a Slave PLC	yes, see chapter ”system constants”, A7.3 (Appendix)
Setting of the CS31 module address		yes, by system constant, stored in the Flash EPROM of the Slave PLC
Electrical isolation		versus supply voltage, inputs/outputs, versus COM1/COM2 interfaces (see also Fig. 2–5)
Terminal assignment and description of the CS31 bus interface		see chapter 2.3.5
Conductor cross section of the removable 3-pole terminal block		max. 2.5 mm^2

2.5.12 **Connection to ARCnet** (07 KT 92 **R262** only), see also chapter A8 (Appendix)

ARCnet interface		1 channel for connection to COAX cable
Connector X4		BNC connector
Recommended system cable		COAX cable Type RG–62/U (characteristic impedance 93 Ω)
Cable length		305 m with ARCnet bus with 8 stations. Further information see SMC TECHNICAL NOTE TN7–1.
LED displays	green LED (BS)	Operating mode ”controller active”, i.e. the PLC performs read and write operations
	green LED (TX)	Operating mode ”transmit active”, i.e. the PLC sends data on the ARCnet bus
Electrical isolation		versus supply voltage, inputs/outputs, versus COM1/COM2 interfaces (see also Fig. 2–5)

2.5.13 LED displays

LEDs for indication of:

– statuses of binary inputs	1 green LED per channel
– statuses of binary outputs	1 yellow LED per channel
– power supply exists 1 green LED	
– battery	1 red LED
– program runs (RUN)	1 green LED
– error classes (FK1, FK2, FK3)	1 red LED per error class
– CS31 system bus runs (BA)	1 green LED
– bus specific errors (BE, RE, SE)	3 red LEDs
– overload/short-circuit of the direct binary outputs	1 red LED

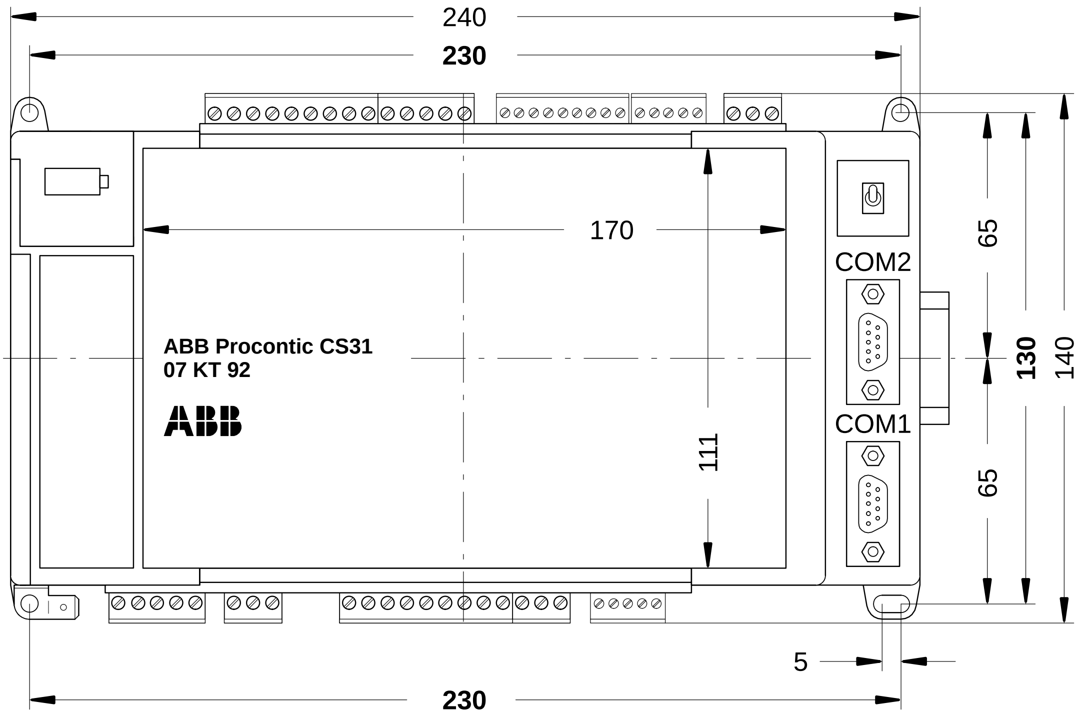
2.5.14 High speed hardware counter

Data of the integrated high–speed hardware counter

counting range 0...65,535 (16 bits)	
counting frequency	max. 50 kHz
used inputs	62,00 and 62,01 (the signal delay of these inputs is set to 8 µs for the counter)
used outputs	62,00

2.5.15 Mechanical data

Mounting on DIN rail	according to DIN EN 50022–35, 15 mm deep. The DIN rail is located in the middle between the upper and the lower edges of the module.
Fastening by screws	using 4 M4 screws.
Width x height x depth	240 x 140 x 85 mm
Wiring method	by removable terminal blocks with screw-type terminals, conductor cross section max. 2.5 mm^2
Weight	1.6 kg
Dimensions (for mounting)	see the following drawing



All dimensions in mm.

The device is 85 mm deep. The interface connectors COM1 and COM2 are set deeper so that the mounting depth required does not become any larger even with detachable interface cables. If, however, a DIN rail is used, the mounting depth is increased by the overall depth of the rail.

The dimensions for assembly bore holes are printed in bold.

2.5.16 Mounting hints

Mounting position	vertical, terminals above and below
Cooling	The natural convection cooling must not hindered by cable ducts or other material mounted in the switch cabinet.

2.5.17 Ordering data

Central unit 07 KT 92 R202		Order No. GJR5 2505 00 R202
Central unit 07 KT 92 R262	(with ARCnet)	Order No. GJR5 2505 00 R262

Scope of delivery

Central unit 07 KT 92 R202 or R262
2 9–pole terminal blocks (5.08 mm raster)
2 5–pole terminal blocks (5.08 mm raster)
3 3–pole terminal blocks (5.08 mm raster)
1 9–pole terminal block (3.81 mm raster)
2 5–pole terminal blocks (3.81 mm raster)
Safety and mounting instructions

Accessories

System cable 07 SK 90	Order No. GJR5 2502 00 R1
System cable 07 SK 91	Order No. GJR5 2503 00 R1
System cable 07 SK 92	Order No. GJR5 2504 00 R1
Battery module 07 LE 90	Order No. GJR5 2507 00 R1
Bus termination resistor	
Simulation device 07 SG 90 (includes a number of switches and push-buttons to enter binary input signals)	Order No. GJR5 2506 00 R1

Programming and test software and operating manual

(both 907 PC 33 **and** 907 PC 331 are required)

907 PC 33	German	[1])	Order No. GJP5 2039 00 R202
907 PC 33	English	[1])	Order No. GJP5 2040 00 R202
907 PC 331	German	[2])	Order No. GJP5 2045 00 R202
907 PC 331	English	[2])	Order No. GJP5 2046 00 R202

Further Literature

System description ABB Procontic CS31	English	Order No. FPTN 440 004 R2001
System description ABB Procontic T200	English	Order No. GATS 1314 99 R2001
System description ABB Procontic T300	English	Order No. GATS 1315 99 R2002
System description ABB Procontic CS31	German	Order No. GATS 1316 99 R1002
System description ABB Procontic T200	German	Order No. GATS 1314 99 R1001
System description ABB Procontic T300	German	Order No. GATS 1315 99 R1002

[1]) Description General Part
[2]) Description 07 KR 91 / 07 KT 92 / 07 KT 93 Specific Part + software diskettes

Operating Manual

ABB Procontic CS31
Intelligent Decentralized
Automation System

Central Units
07 KT 93 R101 and R171

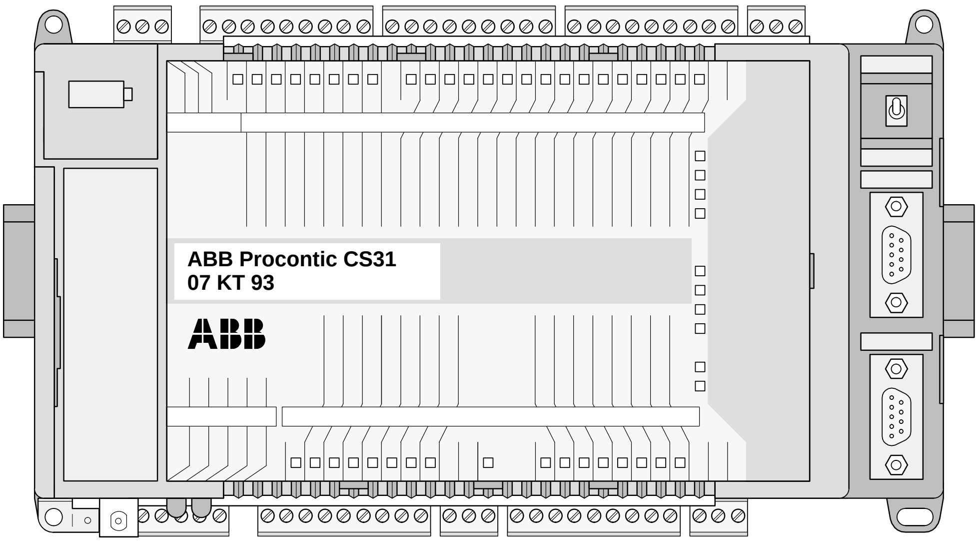


**ABB Schalt–
und Steuerungstechnik**

Regulations
Concerning the Setting up of Installations

Apart from the basic ”Regulations for the Setting up of Power Installations” DIN VDE* 0100 and for ”The Rating of Creepage Distances and Clearances” DIN VDE 0110 Part 1 and Part 2 the regulations ”The Equipment of Power Installations with Electrical Components” DIN VDE 0160 in conjunction with DIN VDE 0660 Part 500 have to be taken into due consideration.

Further attention has to be paid to DIN VDE 0113 Part 1 and Part 200 in case of the control of working and processing machines. If operating elements are to be mounted near parts with dangerous contact voltage DIN VDE 0106 Part 100 is additionally relevant.

If the protection against direct contact according to DIN VDE 0160 is required, this has to be ensured by the user (e.g. by incorporating the elements in a switch-gear cabinet). The devices are designed for pollution severity 2 in accordance with DIN VDE 0110 Part 1. If higher pollution is expected, the devices must be installed in appropriate housings.

The user has to guarantee that the devices and the components belonging to them are mounted following these regulations. For operating the machines and installations, other national and international relevant regulations, concerning prevention of accidents and using technical working means, also have to be met.

The ABB Procontic devices are designed according to IEC 1131 Part 2. Meeting this regulation, they are classified in overvoltage category II which is in conformance with DIN VDE 0110 Part 2.

For the direct connection of ABB Procontic devices, which are powered with or coupled to AC line voltages of overvoltage category III, appropriate protection measures corresponding to overvoltage category II according to IEC–Report 664/1980 and DIN VDE 0110 Part 1 are to install.

Equivalent standards:

DIN VDE 0110 Part 1 ≙ IEC 664
DIN VDE 0113 Part 1 ≙ EN 60204 Part 1
DIN VDE 0660 Part 500 ≙ EN 60439–1 ≙ IEC 439–1

* VDE stands for ”Association of German Electrical Engineers”.

ABB Schalt– und Steuerungstechnik GmbH Heidelberg

3 Central unit 07 KT 93

Central unit with max. 56 kB user program + 30 kB user data

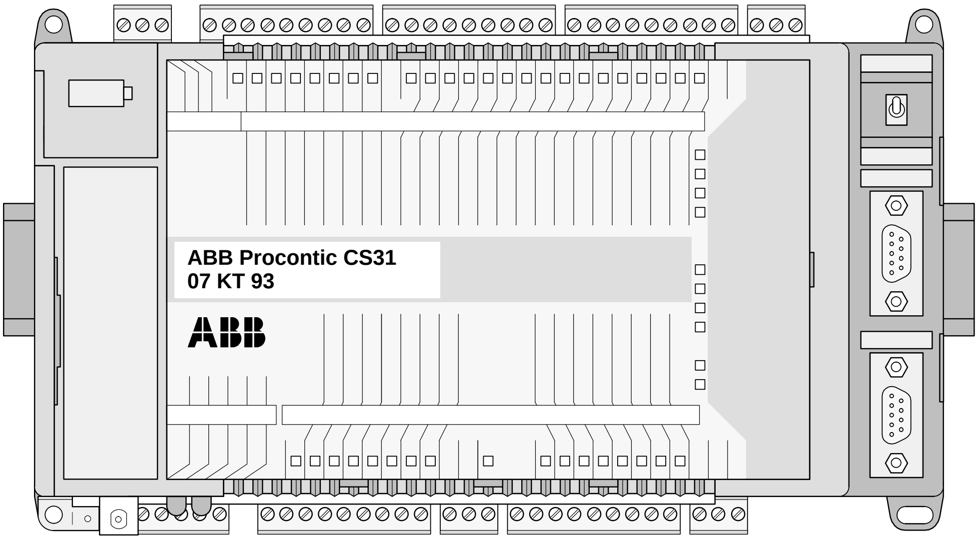


Fig. 3–1: Central unit 07 KT 93

Contents

3.1 Brief description

The central unit 07 KT 93 works either as

- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand–alone central unit.

The device has a 24 V DC power supply voltage. It is provided with an additional interface for connecting communication modules (e.g. 07 KP 90).

The central unit 07 KT 93 R171 is equipped with **an integrated ARCnet coupler** (and an ARCnet interface).

3.1.1 Main features

- 24 binary inputs
- 16 binary transistor outputs
- 1 counting input for counting frequencies up to 10 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  - is set as programming interface
  - can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Serial interface COM2 as an MMC interface
- ARCnet coupler / ARCnet interface (version R171 only)
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw–type terminal blocks
- Detachable plastic sheet on the front side of the device; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  - store and back-up the user program in the RAM
  - store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  - back-up the time and date (real–time clock)
- RUN/STOP switch for starting and aborting the program execution.
- Extensive diagnosis functions
  - Self–diagnosis of the central unit
  - Diagnosis of the ABB Procontic CS31 system bus and the connected modules

3.1.2 Project planning / start–up

The following has to be observed for project planning and start–up:

- Programming
  is performed using ABB Procontic programming software, which can be run on commercially available IBM compatible PCs (see documentation for the programming system 907 PC 331)
- Diagnosis and service device TCZ (terminal mode) (see volume 7.3, see chapter A5 (Appendix), Programming and test, see 3.3.10 Serial interface COM1)
- The processor processes the user program contained in the RAM. It is loaded into the RAM via the serial interface COM1 and can also be changed there. An additional save command is used to save the program in the Flash EPROM.

  Note: In the course of the following operations

  - Power 'ON'
  - RUN/STOP switch from STOP —> RUN
  - Program start-up with programming system
  - Cold start of the PLC

  the RAM is overwritten by the contents of the Flash EPROM, if a user program is contained in the Flash EPROM.
- On-line program modification
  The two existing RAMs allow a quick modification of the user program to be performed without interrupting the operation (see ABB programming system 907 PC 331).
- Change-over between the application modes
  - Stand–alone central unit
  - Bus master central unit and
  - Slave central unit

  The central unit is set to "Stand-alone" upon delivery. Changing the application mode is carried out in the following three steps:

  1. Change the system constant KW 0,0 in the PLC, see chapter A7.3 (Appendix), System constants
  2. Save the user program in the Flash EPROM
  3. Activate new application mode by:
     - calling up the menu item of "Enable PLC mode" in the ABB programming and test system or
     - performing a warm start or
     - performing a cold start.

- Setting the cycle time
  see chapter A1 (Appendix), Processing times
- Addressing when remote modules are connected
  see chapter A2 (Appendix), Addressing
- Back-up of data areas
  Back-up of data areas, i.e. saving of data during power OFF/ON, is only feasible with built-in battery. The following data can be backed, completely or partly:

  – Binary flags
  – Word flags
  – Double word flags
  – Step chains
  – Historical values

  In order to back-up certain data, they have to be excluded from initialization to 0.
- Initialization of data areas
  During *program start,* that data areas are initialized to 0 partly or completely, that are defined by system constants, see chapter A7.3 (Appendix), System constants.

  If no battery is effective or if the system constants are in their default values (factory settings), all of the above mentioned data areas are completely set to 0 after power OFF/ON.
- Reactions on errors of error class 3
  The user can configure whether or not the user program is to be aborted automatically, if an class 3 error occurs, see chapter A7.3 (Appendix), System constants.
- Starting-up the CS31 system after power ON
  The user can enter a number of *n* remote modules in KW 00,09. The user program starts only, i.e. it handles process inputs and outputs only, if at least *n* remote modules have been adopted into the CS31 system bus cycle, see chapter A7.3 (Appendix), System constants.

3.2 Structure of the front panel

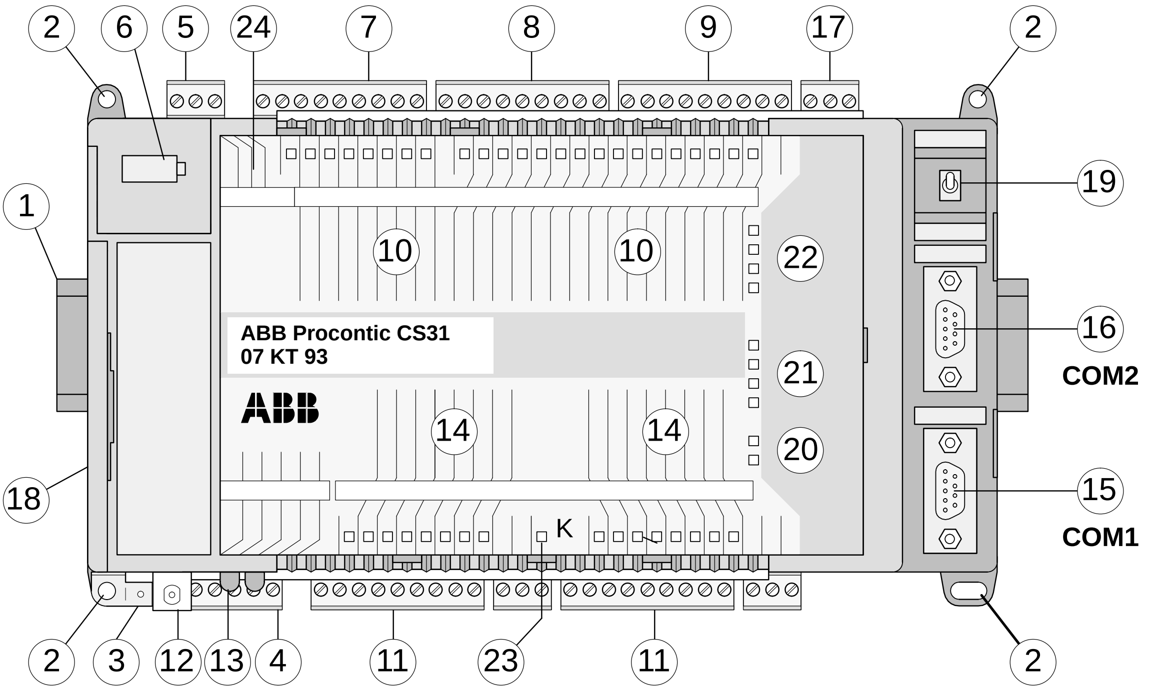


Fig. 3–2: Central unit 07 KT 93 with reference points

1	Fastening of the device on DIN rail
2	Fastening of the device by screws
3	Faston earthing terminal 6.3 mm
4	Supply voltage connection 24 V DC
5	24 V output voltage for input supply
6	Battery compartment
7 - 9	24 binary inputs in three groups
10	Assignment of the identifiers for the inputs
11	16 binary transistor outputs in two groups
12	ARCnet BNC connector (R171 only)
13	2 LEDs for ARCnet operation (R171 only)
14	Assignment of the identifiers for the outputs
15	Serial interface COM1 (programming, MMC)
16	Serial interface COM2 (MMC)
17	Connection for ABB Procontic CS31 system bus
18	Cover of the interface for the connection of communication modules (may only be removed for connecting communication modules)
19	Switch for RUN/STOP operation
20	LEDs for supply voltage and battery
21	LEDs for RUN and error class
22	LEDs for CS31 system bus
23	LED for overload/short-circuit (LED K)
–	Plastic sheet (detachable for labelling)

22

green	**BA**	Bus active
red	**BE**	Bus error
red	**RE**	Remote unit error
red	**SE**	Serial unit error

21

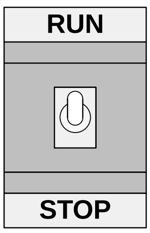
green	**RUN**	User program is running
red	**FK1**	Fatal error
red	**FK2**	Serious error
red	**FK3**	Light error

20

green	**Supply**	Supply voltage available
red	**Battery**	Battery not effective

For further information see chapter A4.3 (App.) Troubleshooting by means of LED displays on the central unit

19



The RUN/STOP switch is used to start or abort the processing of the user program.

3.2.1 Terminal assignment overview

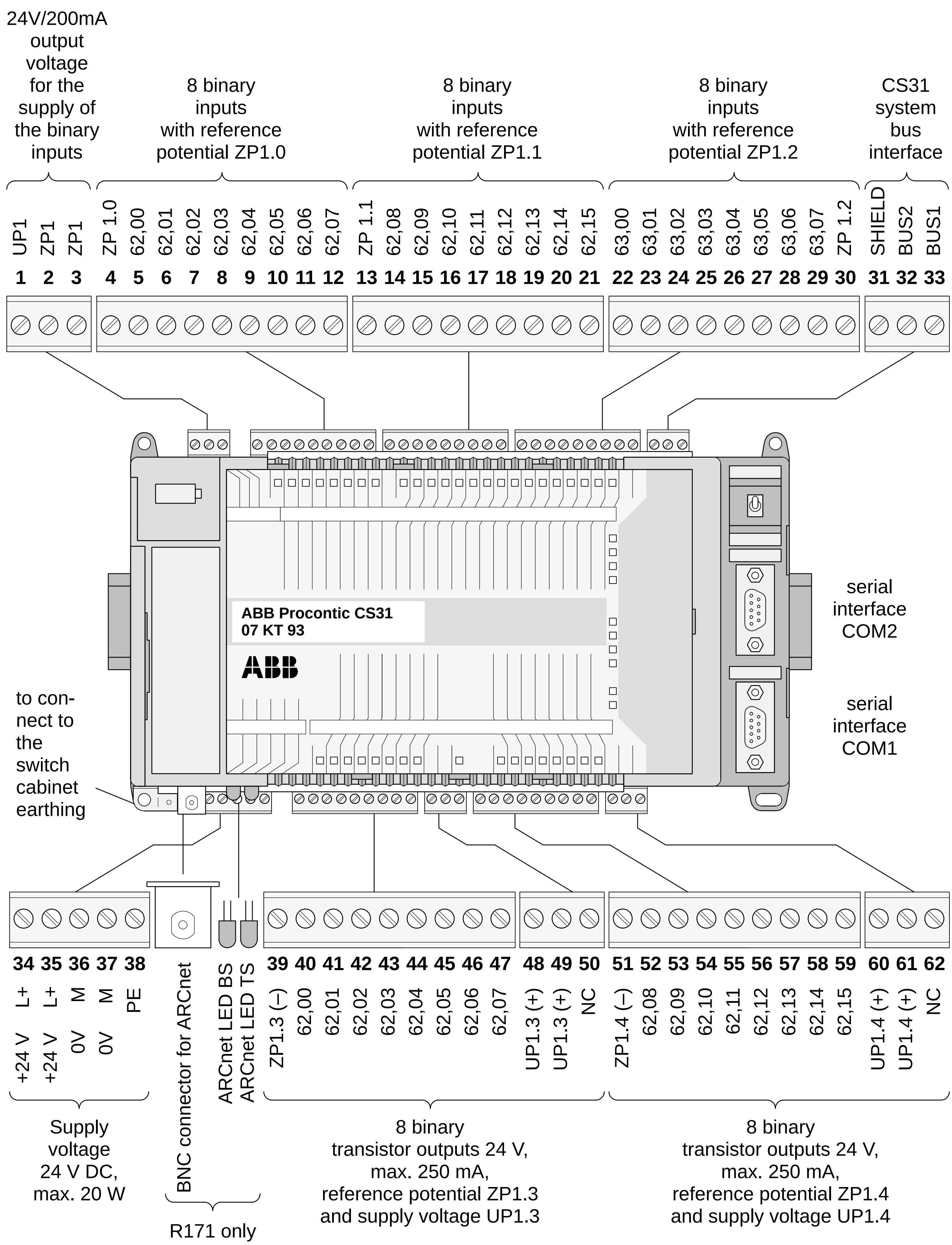


Fig. 3–2a: Central unit 07 KT 93, terminal assignment

3.3 Electrical connection

3.3.1 Application examples for input and output wiring

The following illustration shows an application example in which different possibilities for wiring inputs and outputs are used.

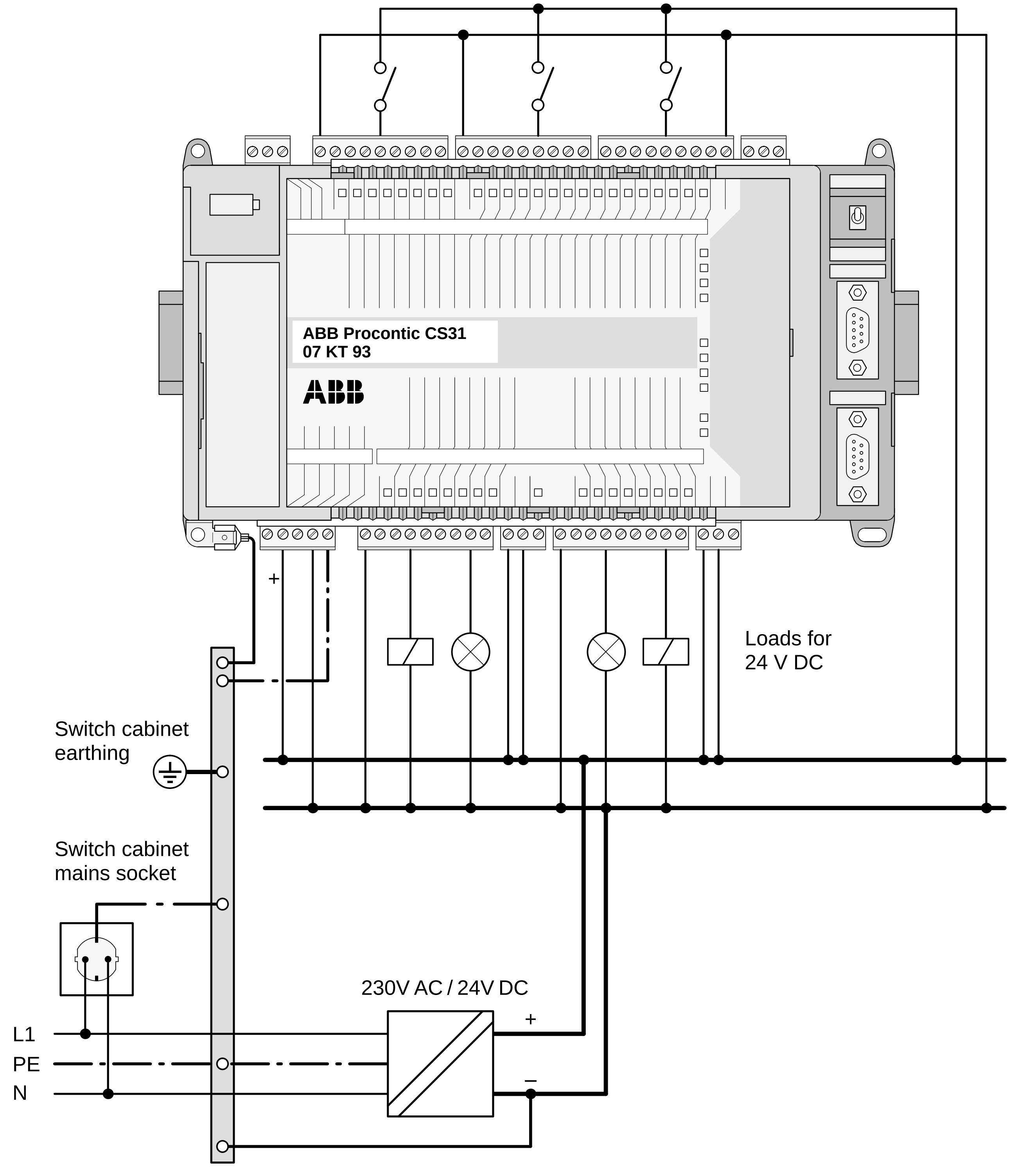


Fig. 3–3: Application example for the central unit 07 KT 93

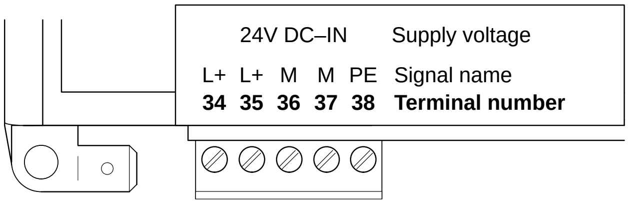
Please observe in particular:

- The earthing measures
- The handling of the electrically isolated input groups
- The handling of the electrically isolated output groups
- The earthing of the switch cabinet mains socket

3.3.2 Connecting the supply voltage

The 24 V DC supply voltage is connected via a 5-pole detachable terminal block.

Attention: Plug and unplug terminal block only with power is off!



Terminal assignment:

34	L+	Supply voltage +24 V DC
35	L+	Supply voltage +24 V DC
36	M	Reference potential (0V)
37	M	Reference potential (0V)
36	PE	Protective Earth terminal, connected with the Faston terminal inside the device. Do not cause earth loops! Connect PE and Faston to the same earthing potential!

Fig. 3–4: Assignment of the terminal block for the *24 V DC–IN* supply voltage

3.3.3 Electrical isolation and notes on earthing

The following illustration shows the parts of the device's circuit which are electrically isolated from each other as well as the internal connections which exist. Both the creepage distances and clearances as well as the test voltages used correspond to DIN/VDE 0160.

The 6.3 mm Faston terminal in the lower left corner has to be connected directly and on the shortest possible way to the switch cabinet earthing using a wire with a cross section of 6 mm^2 in order to ensure safe earthing and as an EMC measure.

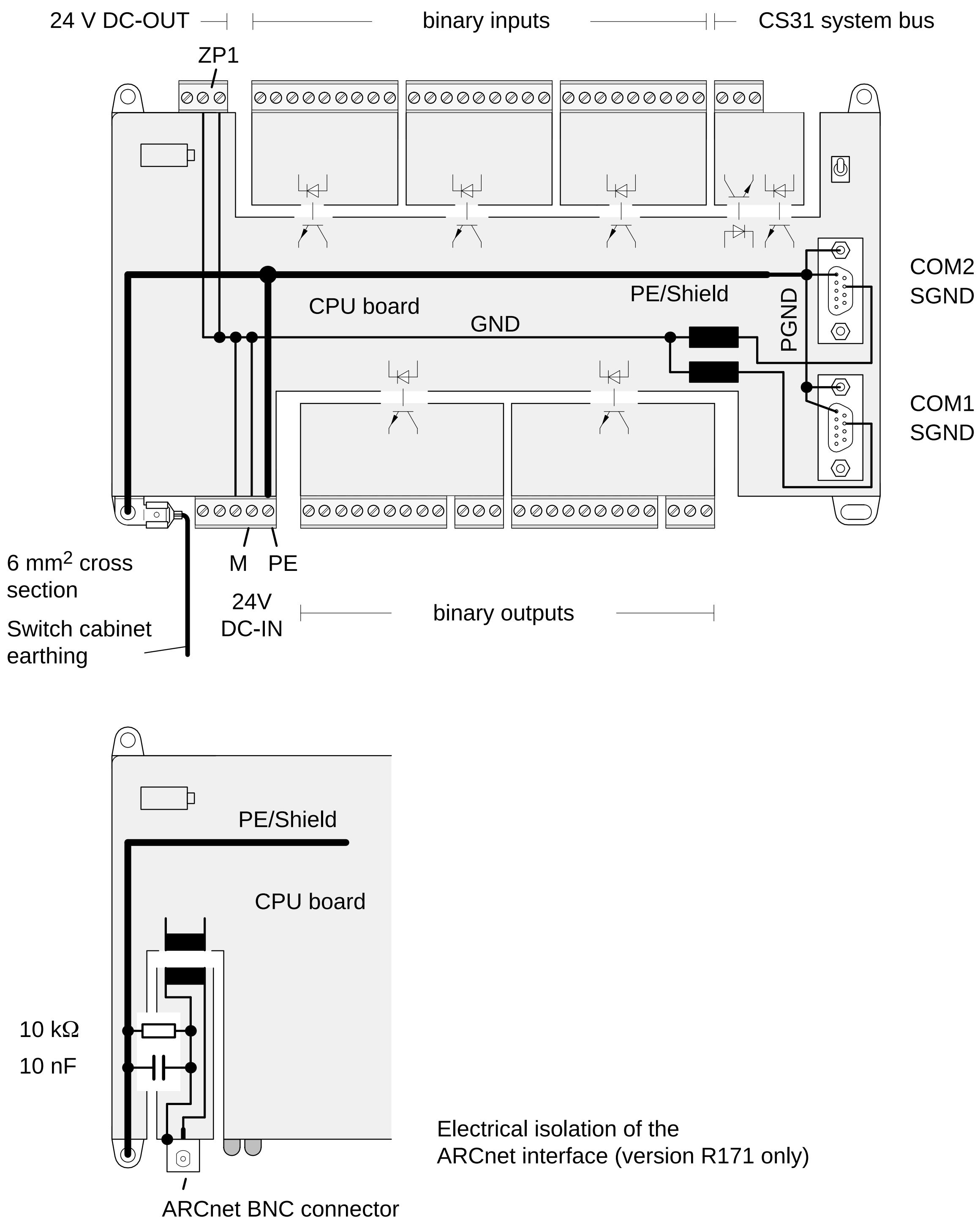
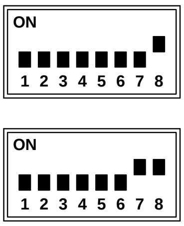


Fig. 3–5: Electrical isolation and connections inside the central unit 07 KT 93

3.3.4 ARCnet interface,
see also chapter A8 (Appendix)

- The ARCnet coupler is integrated in the central unit 07 KT 93 **R171**. The DIL switch for setting the ARCnet address is accessible through the cutout of the external networking interface.
- The ARCnet coupler is supplied from the internal 24 V DC power supply.
- The function blocks AINIT, ASEND, AREC and APOLL are available for the ARCnet coupling.
- The data packages are read from the ARCnet controller interrupt-controlled. The interrupt routine stores the data package in the storage buffer. The APOLL block serves for the sending direction. It transfers data packages from the storage buffer to the ARCnet controller for sending them off.
- The ARCnet coupler interface is designed as a bus with BNC connector for coaxial cable. The ARCnet bus is earthed inside the module via a capacitor. As an EMC measure and for protection against dangerous contact voltages, the bus has to be earthed directly at a central place.
- Using the simplest configuration, called Linear ARCnet, a coaxial cable (RG62, 93 Ω) is layed from station to station and connected with T plugs at all stations. At both ends of the cable, termination resistors with 93 Ω each have to be installed, for more information see chapter A8.1 (Appendix). In a Linear ARCnet, a maximum of 8 stations is possible at a cable length of 300 m.
- The parallel networking interface is used for the ARCnet coupler inside the module. However, it is still available from outside as an external networking interface. The serial interface module 07 KP 92 can be connected here, for instance.

Setting the ARCnet Node Number (station address) of the central unit

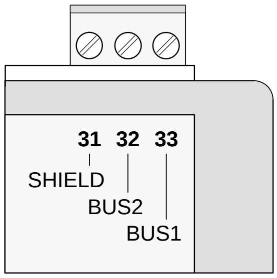


Node address 1

Node address 3

Fig. 3–5a: Setting the ARCnet Node Number (station address) of the central unit 07 KT 93 R171

3.3.5 Connection for ABB Procontic CS31 system bus



Terminal assignment

31 SHIELD
32 BUS2
33 BUS1

Fig. 3–6: Assignment of the ABB Procontic CS31 system bus interface

The connection to the ABB Procontic CS31 system bus is made by means of a 3-pole detachable terminal block. Please observe:

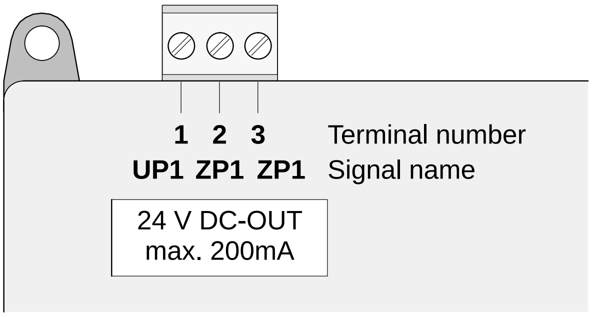
- All of the CS31 devices, no matter whether they are master or slave devices, are connected with the twisted-pair bus line as follows:
  - One core of the bus line is looped through via the BUS1 terminals of all devices to be connected to the CS31 system bus.
  - The other core of the bus line is looped through via the BUS2 terminals of all devices to be connected to the CS31 system bus.
- If the central unit 07 KT 93 is located at the beginning or at the end of the bus line, the bus terminating resistor (120 Ω) has to be connected additionally between the BUS1 and BUS2 terminals.
- The shield of the twisted-pair bus line is looped through via the SHIELD terminals of all the devices to be connected to the CS31 system bus.
- The handling of the CS31 system bus is described in detail in volume 2, System data.

3.3.6 24 V output voltage for the signal supply of the inputs

The central unit 07 KT 93 provides a separate 24 V DC voltage output for the supply of the 24 binary input signals (for this purpose only).

This 24 V output voltage is used only if an external 24 V DC power supply unit is not available.

The internal 24 V power supply is overload-proof. The 24 V output voltage is ready for operation again approx. 2 minutes after an overload has been eliminated.



Terminal assignment:

1 UP1 +24 V, positive pole of power source
2 ZP1 Reference potential (OV), negative pole of the power source
3 ZP1 identical to terminal 2 (internally shorted)

Fig. 3–7: Assignment of the terminal block for the output voltage

3.3.7 Connection of the binary inputs

The following illustration shows the circuit configuration of the binary inputs of the first group as an example.

Features:

- The 24 binary inputs are arranged in three groups.
- The three groups E 62,00...E 62,07, E 62,08...E 62,15 and E 63,00...E 63,07 are electrically isolated from each other (see Fig. 3–5).
- The inputs use 24 V signals in positive logic (1 ≙ +24 V).

Input signals at the terminals 5 and 6

Terminal 5

- **Use as normal input signal:**

  The signal is available in the user program in the operand E 62,00. The signal delay time is 2.5 ms.

  The updating of the operand E 62,00 is performed before the start of each program cycle.

- **Use as high-speed input signal:**

  The signal is available in the user program in the operand E 63,14. The signal delay time is 0.02 ms.

  The updating of the operand E 63,14 is performed before the start of each program cycle.

  In the Dual Port RAM (DPR) this signal is updated after each CS31 bus telegram. With the aid of the function block WOL this signal can be read in the Dual Port RAM (word address C000:1FEH, Bit 14).

- **Use for the high-speed counter:**

  The signal is used as counting input (10 kHz) for the high-speed counter.

Terminal 6

- **Use as normal input signal:**

  The signal is available in the user program in the operand E 62,01. The signal delay time is 2.5 ms.

  The updating of the operand E 62,01 is performed before the start of each program cycle.

- **Use as high-speed input signal:**

  The signal is available in the user program in the operand E 63,15. The signal delay time is 0.02 ms.

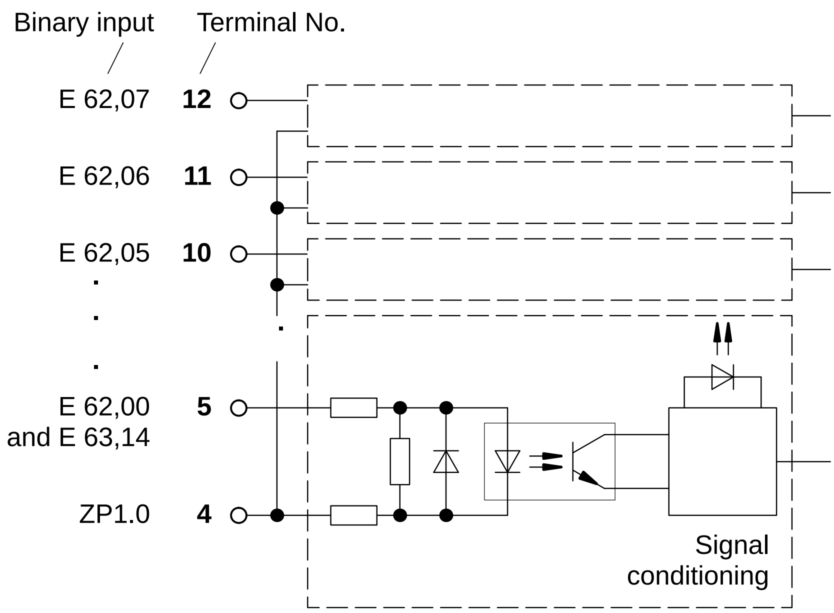
  The updating of the operand E 63,15 is performed before the start of each program cycle.

  In the Dual Port RAM (DPR) this signal is updated after each CS31 bus telegram. With the aid of the function block WOL this signal can be read in the Dual Port RAM (word address C000:1FEH, Bit 15).

- **Use for the high-speed counter:**

  The signal is used as enable input for the high-speed counter.

Circuit configuration of the binary inputs of the first group as an example (E62,00...E 62,07)



The three groups are electrically isolated from each other. ZP1.0, ZP1.1 and ZP1.2 are *not* connected with each other internally.

The input signals have a delay time of typ. 2.5 ms.

Fig. 3–8: Circuit configuration of the binary inputs of the first group as an example

3.3.8 Connection of the binary outputs

The following illustration shows the circuit configuration of the binary outputs.

Features of the outputs:

- The 16 outputs are arranged in two groups. Within one group, the outputs are not electrically isolated from each other.
- The outputs can be loaded with a rated current of 250 mA.
- Each group as a whole is electrically isolated from the rest of the device (see also Fig. 3–5).
- The outputs use transistors and are short-circuit-proof.
- The eight transistors of one group have a common power supply.
- The outputs are automatically switched off in case of overload or short-circuit.
- A overall error message indicates a short-circuit or an overload which has occurred on one or on several outputs.
- An overload is displayed by the red LED K and via error flags in the PLC.
- The user can set by means of a system constant whether the overloaded output is to be switched on again automatically by the PLC or whether it is to be switched on again by configuring within the PLC program, e.g. by means of the function blocks CS31QU or CS31CO. The default setting is the automatic reset of the outputs.
- The red LED K goes out when the overloaded output is switched on again after eliminating the overload.
- The acknowledgement of the error message, i.e. the resetting of the error flags, is done in correspondence with chapter A4.8 (Appendix), Acknowledgement of error messages in the central unit.

Circuit configuration of the binary outputs of the first group as an example (A 62,00...A 62,07)

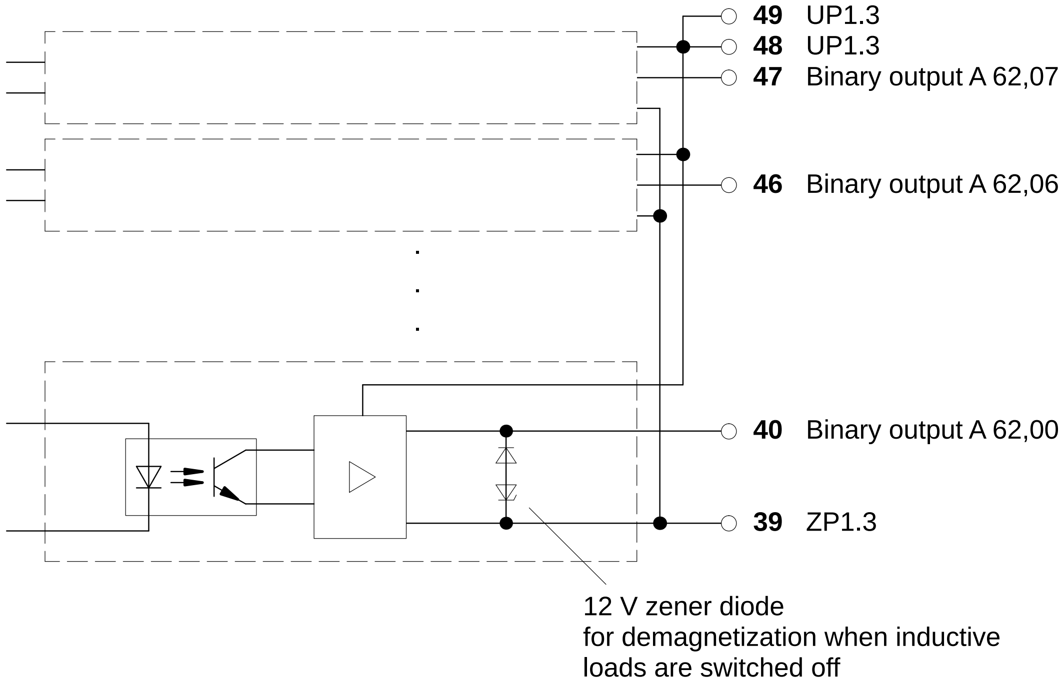
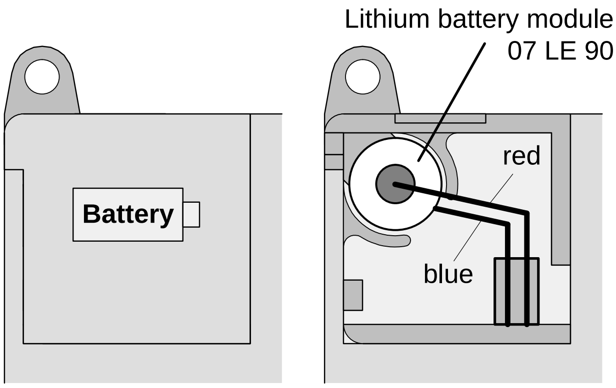


Fig. 3–11: Circuit configuration of the binary outputs of the first group as an example

3.3.9 Battery and battery replacement



Battery compartment closed

Built-in battery module (cover of the battery compartment is open)

Fig. 3–12: Battery and battery replacement

- The lithium battery 07 LE 90 can be inserted into the battery compartment in order to
  - backup data of user program in RAM
  - backup data of additionally in RAM contained information, e.g. flag statuses
  - backup of time and date (real-time clock).

The battery lifetime is 1.5 years (typ. 3 years) at 25°C. The battery lifetime is the time during which the device remains operable in order to backup data while the supply voltage of the central unit is switched off. As long as there is a supply voltage available, there is no more load on the battery other than its own leakage current.

The following handling notes have to be observed:

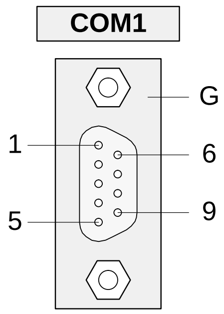
- Use only lithium batteries approved by ABB.
- Replace the battery by a new one at the end of its life.
- **Never short-circuit the battery!**
  There is danger of overheating and explosion. Avoid accidental short-circuits, therefore do not store batteries in metallic containers or boxes and do not bring it into contact with metallic surfaces.
- **Never try to charge the battery!**
  Danger of overheating and explosion!
- **Replace the battery only with the supply voltage switched on!**
  Otherwise you risk data being lost.
- **Dispose of battery environmentally consciously!**
- If no battery is built-in or if the battery is exhausted, the red LED ’Battery’ lights up.

3.3.10 Serial interface COM 1

Interface standard: EIA–232

Assignment of the serial interface COM1

The serial interface has the following pin assignment:



G	Housing	Protective Ground	(Shield)
1	PGND	Protective Ground	(Shield)
2	TxD	Transmit Data	(Output)
3	RxD	Receive Data	(Input)
4	RTS	Request To Send	(Output)
5	CTS	Clear To Send	(Input)
6	PROG *****		(Input)
7	SGND	Signal Ground	(0V)
8	0V out		(0V)
9	+5 V out	Supply for the TCZ service device ******	

***** 1 = Active mode (Programming/test), Pin 6 open
0 = Passive mode (DRUCK/EMAS applications), Pin 6 shorted to 0V out

****** 5V output (only for supplying the TCZ service device):
The connected service device receives its voltage supply via the interface cable.

Fig. 3–13: Assignment of the serial interface COM1

Operating modes of the serial interface COM1

The operating mode of the interface has to be set according to the application in each case:

– Programming and test or
– Man–machine–communication MMC

Active mode: The active mode is used for programming and testing the central unit, i.e. it gives the user access to all the programming and test functions of the central unit.

Passive mode: The passive mode is used to perform a communication configured with the DRUCK and EMAS blocks between the user program and a device connected to the serial interface.

Conditions for setting the operating modes of the interface COM1

RUN/ STOP switch	System constant KW00,06	System cable/ device	Mode set by this
STOP	x	x	Active
RUN	1	x	Active
	2	x	Passive
	0, <0, >2	07 SK 90	Active
		07 SK 91, TCZ	Passive

x: without effect

Temporary interruption of the passive mode

While a communication between the DRUCK or EMAS blocks and a device connected to COM1 is being executed, it may be come necessary to modify the program, for example. For this purpose, you must switch over COM1 from the passive mode into the active mode.

Switch-over: Passive mode ––> Active mode

There are three possibilities for switching over:

- Set the RUN/STOP switch to the ”STOP” position
- Replace cable 07 SK 91 by cable 07 SK 90 (if KW 00,06 is set to ≤0 or >2)
- Send the following special command to the PLC: <DEL><DEL><DEL>

The latter option has the advantage that the switch-over can also be controlled remotely, e.g. via telephone line and suitable dial-up modems. The ASCII character <DEL> has the decimal code of 127 and the hexadecimal code of $7F_H$. You can generate this character by simultaneously pressing the control key <CTRL> and the delete key <—.

Notes:

On German keyboards, the control key is labelled by <Strg> instead of <CTRL>.

If the switch-over to the active mode was performed using the special command <DEL><DEL><DEL>, please observe the following:

During the execution of the PLC program, the system constant KW 00,06 must **not** be sent to the PLC because this would cause the system to be switched back to the passive mode.

The special command assigns the value of ”1” to the image of the system constant KW 00,06 located in the operand memory. The PLC evaluates the value of this image and sets the kind of application of COM1 correspondingly.

Switching back: Active mode ––> Passive mode

There are three possibilities for switching back:

- Return RUN/STOP switch to the ”RUN” position
- Replace cable 07 SK 90 by cable 07 SK 91 again.
- Cancel the special command <DEL><DEL><DEL> as follows:

– If the PLC program is in the ”aborted” condition:

Start the PLC program.

– If the PLC program is in the ”running” condition:

send the original value of the system constant KW 00,06 to the PLC again (907 PC 33 menu item ”Send constants”)

or

overwrite the system constant KW 00,06 by the original value (907 PC 33 menu item ”overwriting”)

Interface parameters

Active mode: The settings of the interface parameters cannot be changed

Data bits:	8
Stop bits:	1
Parity bits:	none
Baud rate:	9600
Synchronization:	RTS/CTS

Passive mode: Default setting

Synchronization:	RTS/CTS
Interface identifier COM1:	1
Baud rate:	9600
Stop bits	1
Data bits:	8
Parity bits:	none
Echo:	off
Send Break Character:	0
Enabling End-of-text character for sending direction:	no 1)
Sending End-of-text character:	<CR> 1)
Receiving End-of-text character:	<CR> 2)

1) The default End-of-text character for the sending direction (CR) is not sent. Nevertheless, this default End-of-text character (CR) must not appear in the message text of the assigned DRUCK block.

2) For the direction of reception, an End-of-text character is always necessary. This default End-of-text character (CR) must not appear neither in the message text nor in the user data of the assigned EMAS block.

For the passive mode of COM1, the interface parameters can be changed using the SINIT function block. If the changed values are not plausible, the COM1 interface uses the default values.

The interface is newly initialized each time the operating mode is switched over.

The active-mode parameters are set in the active mode, whereas in the passive mode the parameters established by the SINIT block or the default values are set.

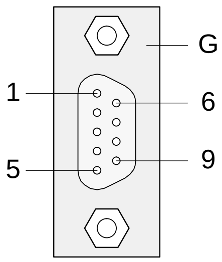
3.3.11 Serial interface COM 2

Interface standard: EIA–232

Assignment of the serial interface COM2

The serial interface has the following pin assignment:

COM2



G	Housing	Protective Ground	(Shield)
1	PGND	Protective Ground	(Shield)
2	TxD	Transmit Data	(Output)
3	RxD	Receive Data	(Input)
4	RTS	Request To Send	(Output)
5	CTS	Clear To Send	(Input)
6	NC		(unused)
7	SGND	Signal Ground	(0V)
8	0V out		(0V)
9	+5 V out	Supply for the TCZ service device **	

** 5V output (only for supplying the TCZ service device):
The connected service device receives its voltage supply via the interface cable.

Fig. 3–14: Assignment of the serial interface COM2

Operating modes of the COM2 interface

The serial interface COM2 is fixedly set to the **passive mode** (MMC interface).

The passive mode is used to perform a communication configured with the aid of the DRUCK and EMAS blocks between the user program and a device connected to the serial interface.

The application-specific initialization of COM2 can be performed using the SINIT function block.

Interface parameter

Passive mode: Default setting

Synchronization:	RTS/CTS
Interface identifier COM2:	2
Baud rate:	9600
Stop bits	1
Data bits:	8
Parity bits:	none
Echo:	off
Send Break Character:	0
Enabling End-of-text character for sending direction:	no [1])
Sending End-of-text character:	<CR> [1])
Receiving End-of-text character:	<CR> [2])

[1]) The default End-of-text character for the sending direction (CR) is not sent. Nevertheless, this default End-of-text character (CR) must not appear in the message text of the assigned DRUCK block.

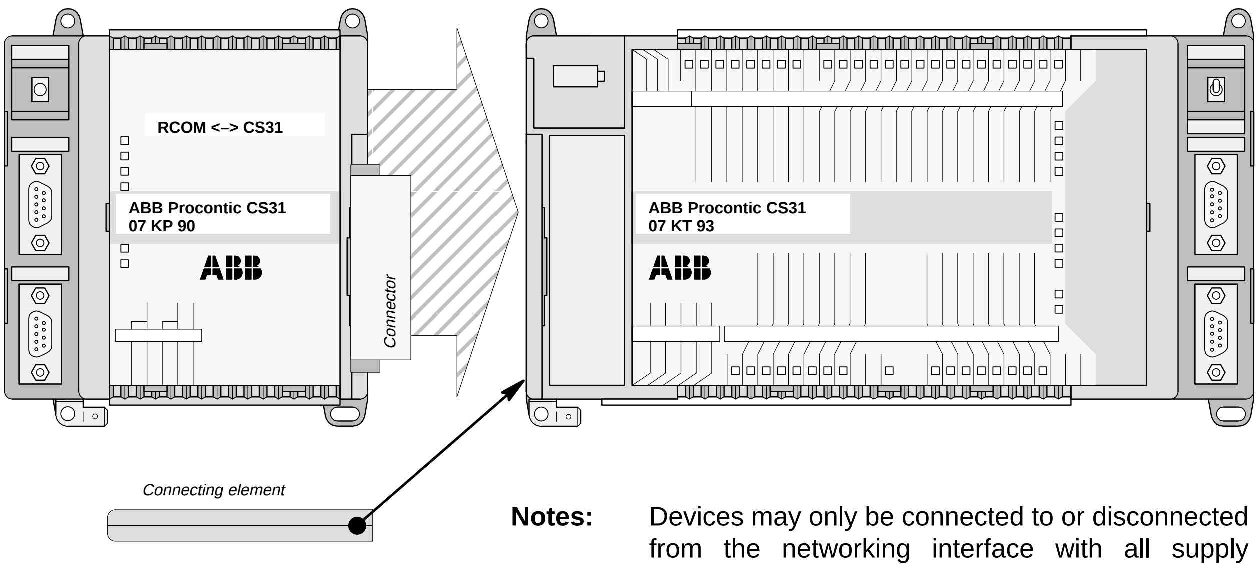
[2]) For the direction of reception, an End-of-text character is always necessary. This default End-of-text character (CR) must not appear neither in the message text nor in the user data of the assigned EMAS block.

For the passive mode of COM2, the interface parameters can be changed using the SINIT function block. If the changed values are not plausible, the COM2 interface uses the default values.

In the passive mode the parameters established by the SINIT block or the default values are set.

3.3.12 Networking interface

The 07 KT 93 central unit is equipped with a special parallel interface. It is thus possible to network it with another bus system using an additional communication processor module. The additional communication processor has its own housing. Both housings (of the 07 KT 93 and of the communication processor) are assembled by means of a snap-on connection.



Notes: Devices may only be connected to or disconnected from the networking interface with all supply voltages switched off.

In order to assemble the two devices with each other, they must be put together on a level ground and then be fastened using the connecting element.

Fig. 3–15: Mounting of 07 KT 93 with expansion (e.g. communication processor 07 KP 90)

3.4 High-speed counter

Features

The high-speed counter used in the central units 07 KR 91, 07 KT 92 and 07 KT 93 works independently of the user program and is therefore able to response quickly to external signals. Its features are as follows:

- The counting frequency is max. 10 kHz. The counter counts the 0–>1 edges at terminal 05 (also designated as E 62,00).
- The counter counts upwards from –32768 to +32767 (8000_H...$7FFF_H$). If +32767 is exceeded, the counter skips to –32768.

  Sequence of the counting procedure:

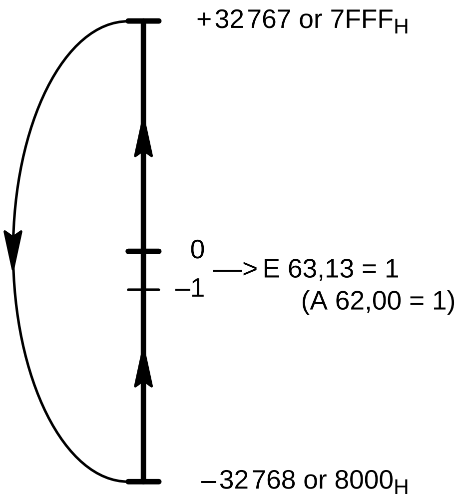


Fig. 3–18:
Sequence of the counting procedure

- Enabling/disabling of the counting procedure using the internal variable A 63,14 in the user program:
  - A 63,14 = 0:
    The internal variable A 63,13 = 1 enables the counting procedure, whereas A 63,13 = 0 disables it.
  - A 63,14 = 1:
    Signal 1 at terminal 06 (also designated as E 62,01) enables the counting procedure, whereas signal 0 disables it. A 63,13 is without effect.
    Note: The dead time may be 0...1.5 ms.
- Setting the counter in the user program:
  - to the value contained in the internal word variable AW 06,15
  - using the internal variable A 63,15 = 1.

  Note: If the internal variable A 63,15 = 1 is present during several processing cycles, the processor sets the counter at the program end in each case.
  During the remaining time of the processing cycle, the counter counts pulses at terminal 05.
- The counter content can be read via the internal variable EW 06,15.
- Zero-crossing message (signal changes from 0 to 1 when the counter contents changes from –1 to 0):
  - always via the internal variable E 63,13,
  - at the terminal 40 (also designated as A 62,00) only, if the internal variable A 63,14 = 1 is set.
    Note: The reaction time may be 0...1.5 ms. The direct control of the output A 62,00 from the user program is disabled by A 63,14 = 1.

  The zero-crossing message is cancelled when the counter is set.
- Fast input of binary signals into the user program with a delay of < 0,02 ms:
  - Terminal 05 (also designated as E 62,00):
    Internal variable E 63,14
  - Terminal 06 (also designated as E 62,01):
    Internal variable E 63,15

Block diagram

see next page

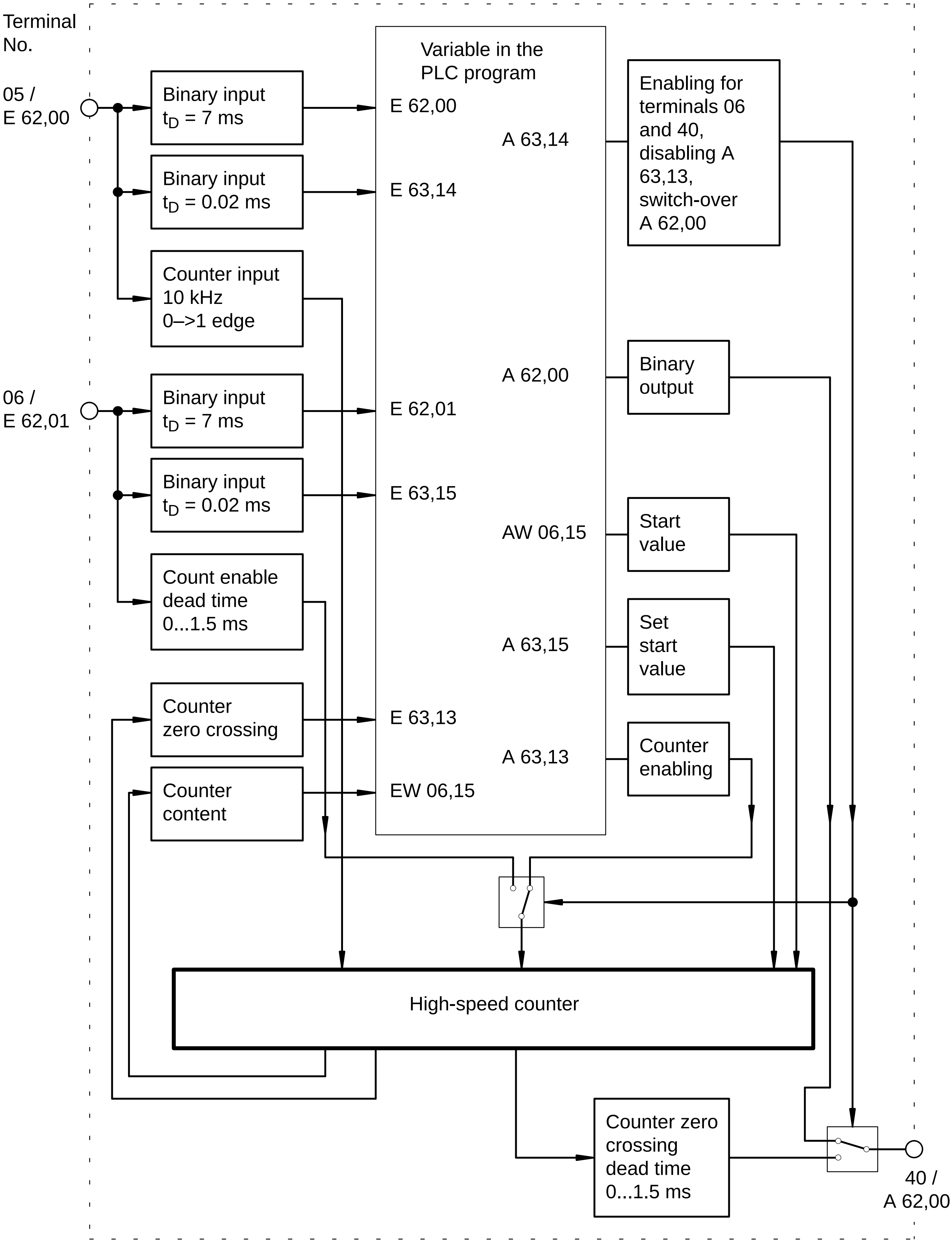


Fig. 3–19: 07 KT 93, High-speed counter, block diagram

Configuration example

- **Task:**
  - 180 pieces each of a unit load have to be filled into a packing.
  - Each filled-in piece generates one pulse.
  - When the packing is full, the counter is immediately prepared for the next filling operation.
  - The enabling signal for the filling operation is sent by the packaging machine.
  - The end of the counting operation has to be signalled to the packaging machine immediately.
- **Wiring**
  - Connect the signal line for the counting pulses to terminal 05.
  - Connect the signal line for the enabling of the counting operation to terminal 06.
  - Connect the signal line for ”zero crossing” of the counter to terminal 40.
- **Configuration steps: PLC program**

1) Activate terminals 06 and 40

- The terminals 06 and 40 are activated using the operand A 63,14.

  IL (instruction list):
  ! K 00,01
  = A 63,14 (with K 00,01 = 1)

2) Preset start value for the counter

The start value (AW 06,15) is set to the value of –180. The counter will then count starting from –180 in positive direction. The transition from –1 to 0 will be signalled.

IL (instruction list):
! KW 01,00
= AW 06,15 (with KW 01,00 = –180)

3) Adopt start value into the counter

After each counting operation, the start value is immediately set again into the counter by means of the ”zero crossing” signal (E 63,13). Operand A 63,15 = 1 has to be set for this purpose. At program start, the start value is loaded once into the counter by means of the initialization flag M 255,15 (M 255,15 has the value of 0 after program start).

IL (instruction list):
! NM 255,15
/ E 63,13
= A 63,15
:
:
other PLC program parts
:
:
! K 00,01
= M 255,15 (set M 255,15 = 1)
! PE (program end)

Preset start values

You can preset both *positive* and *negative* start values for the counter.
The counting operation starts at the start value and is continued in correspondence with the arrows in the diagram until the enabling is stopped or a start value is loaded again.

Negative start value

The minimum negative start value is
–32768 (8000_H).
By presetting a negative start value it is thus possible to count a maximum of 32768 pulses up to the zero crossing of the counter.

Positive start value

If a positive start value is preset, the counter counts up to the value of +32767 ($7FFF_H$), continues the counting operation at the value of–32768 (8000_H) and then signals the zero crossing when reaching the transition from –1 to 0.
The minimum positive start value is 1. If you preset this value, 65535 pulses will be counted up to the zero crossing.

In order to count more than 32767 pulses up to the zero crossing, the start value has to be calculated according to the following equation:

Start value = 32767 – (number of pulses – 32768)

Example:
40 000 pulses are to be counted.
The start value is in the positive range, because more than 32768 pulses have to be counted.

Calculation:

Start value = 32767 – (number of pulses – 32768)
= 32767 – (40 000 – 32768)
= 25535

3.5 Technical data 07 KT 93

In general, the technical system data listed in volume 2 of the system description ABB Procontic CS31 are valid for all modules and central units. Additional data or data which are different from the system data are listed as follows.

3.5.1 General data

Number of binary inputs	24
Number of binary transistor outputs	16
I/O expansion via CS31 system bus by up to	744 binary inputs 496 binary outputs 96 analog input channels 48 analog output channels max. 31 remote modules altogether
Number of serial interfaces	2 (for programming or connection to man-machine communication)
Number of parallel interfaces	1 special interface for connection of a communication processor (for networking with other bus systems)
Networking interfaces (version **R171** only)	1 ARCnet interface (BNC connector)
Integrated memory, **07 KT 93 R101:**	Flash EPROM 128 kB (60 kB program + 60 kB user data) RAM 256 kB (30 kB program with online programming or 60 kB program without online programming)
Integrated memory, **07 KT 93 R171:**	Flash EPROM 128 kB (60 kB program + 60 kB user data) RAM 512 kB (60 kB program with online programming)
Resolution of the integrated real-time clock	1 second
Data of the integrated high-speed hardware counter	
counting range	0...65,535 (16 bits)
counting frequency	max. 10 kHz
Processing time, binary operation	typ. 0.4...0.6 ms/kB program
65 % bits, 35 % words	typ. 0.7 ms/kB program
Number of software timers	any (max. 80 simultaneously active)
delay time of the timers	5 ms...24.8 days
Number of up/down counter SW blocks	any
Number of bit flags	4096
Number of word flags	4096
Number of double word flags	512
Diagnosis	cycle time monitoring, battery monitoring, detection of syntax errors and checksum monitoring
Indication of operating statuses and errors	51 LEDs altogether

3.5.2 Power supply

Rated supply voltage		24 V DC
Current consumption	**R101:**	max. 0.2 A plus output current through terminal 1,
	R171:	max. 0.25 A plus output current through terminal 1 (output voltage for the supply of the binary inputs)
Protection against reversed terminal connection		yes

3.5.3 24V output voltage for the supply of inputs

Rated voltage		24 V DC
Load capability	with rated voltage	max. 200 mA
	with rated voltage + 25 %	max. 240 mA
Protection against overload		with a PTC resistor
Conductor cross section of the removable 3-pole terminal block		max. 2.5 mm^2

3.5.4 Lithium battery

Battery for back-up of RAM contents	07 LE 90 battery module
Lifetime at 25°C	1.5 years (typ. 3 years)

3.5.5 Binary inputs

Number of channels per module		24
Distribution of channels into groups		3 groups of 8 channels each
Common reference potential		
for group 1 (8 channels)		ZP1.0 (channels 62,00...62,07)
for group 2 (8 channels)		ZP1.1 (channels 62,08...62,15)
for group 3 (8 channels)		ZP1.2 (channels 63,00...63,07)
Electrical isolation		between the groups, between groups and other circuitry (see also Fig. 3–5)
Signal coupling of input signals		with optocoupler
Input signal delay of		
channels	E 62,00...E 63,07	typ. 7 ms
channels	E 63,14 and 63,15	typ. 0.02 ms
for counter control		typ. 0.02 ms
Signalling of input statuses		one green LED per channel, the LEDs correspond functionally to the input signals
Input signal voltage		
signal 0		–30 V...+ 5 V
signal 1		+13 V...+30 V
ripple	when signal 0	within –30 V...+ 5 V
	when signal 1	within +13 V...+30 V
Allowed input overvoltage		± 36 V, for 100 ms only
Input current per channel		
input voltage = +24 V		typ. 8.0 mA
input voltage = + 5 V		≥ 0.2 mA
input voltage = +13 V		≥ 2.0 mA
input voltage = +30 V		≤ 10.0 mA

Labelling for the inputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Max. cable length unshielded	600 m
Max. cable length shielded	1000 m
Conductor cross section of the removable terminal blocks	max. 2.5 mm^2

3.5.6 Binary outputs

Number of channels per module	16 transistor outputs
Distribution of channels into groups	2 groups of 8 channels each
Common reference potential	
for group 1 (8 channels)	ZP1.3 (channels 62,00...62,07)
for group 2 (8 channels)	ZP1.4 (channels 62,08...62,15)
Common supply voltage	
for group 1	UP1.3 (channels 62,00...62,07)
for group 2	UP1.4 (channels 62,08...62,15)
Electrical isolation	between the groups, between groups and other circuitry (see also Fig. 3–5)
Signalling of output statuses	one yellow LED per channel, the LEDs correspond functionally to the output signals
Output current	
rated value	250 mA with UP1.3/UP1.4 = 24 V
maximum value	312 mA with UP1.3/UP1.4 = 24 V + 25 %
leakage current with signal 0	< 0.5 mA
Demagnetization of inductive loads	internally with free-wheeling diode and Z-diode (Z-diode voltage is 12 V)
Switching frequency with inductive loads	max. 0.5 Hz
Switching frequency with lamp load	max. 11 Hz with max. 5 W
Max. cable length	400 m (pay attention to voltage drop)
Short-circuit-proof/overload-proof reset can be carried out	yes, – automatically or – by configuration.
Total load via UP1.3	max. 2 A
via UP1.4	max. 2 A
Labelling for the outputs	symbol names or short signal designations can be labelled on the removeable front panel foil
Conductor cross section of the removable terminal blocks	max. 2.5 mm^2

3.5.7 Connection of serial interface COM1

Interface standard	EIA RS–232
Programming with 907 PC 33	by means of IBM PC (or compatible)
Man–machine communication	yes, e.g. with ABB Procontic Operating Station 35 BS 40
Display and updating of timers, counters and parameters	yes, e.g. with TCZ Service Device

Electrical isolation	versus binary inputs and outputs, versus CS31 system bus interface (see also Fig. 3–5)
Potential differences	In order to avoid potential differences between the 07 KT 93 central unit and the peripheral device connected to the COM1 interface, this device is supplied from the switch cabinet socket (see also the earthing connections in Fig. 3–3).
Pin configuration and description of the COM1 interface	see chapter 3.3.10

3.5.8 Connection of serial interface COM2

Interface standard	EIA RS–232
Man–machine communication	yes, e.g. with ABB Procontic Operating Station 35 BS 40
Electrical isolation	versus binary inputs and outputs, versus CS31 system bus interface (see also Fig. 3–5)
Potential differences	see text of COM1 (above)
Pin configuration and description of the COM2 interface	see chapter 3.3.11

3.5.9 Connection to the ABB Procontic CS31 system bus

Interface standard		EIA RS–485
Connection	as a Master PLC as a Slave PLC	yes, transmitting and receiving area are configurable yes, see chapter ”system constants”
Setting of the CS31 module address		yes, by system constant, stored in the Flash EPROM of the Slave PLC
Electrical isolation		versus supply voltage, inputs/outputs, versus COM1/COM2 interfaces (see also Fig. 3–5)
Terminal assignment and description of the CS31 bus interface		see chapter 3.3.5
Conductor cross section of the removable 3-pole terminal block		max. 2.5 mm^2

3.5.10 **Connection to ARCnet** (07 KT 93 **R171** only), see also chapter A8 (Appendix)

ARCnet interface		1 channel for connection to COAX cable
Connector X4		BNC connector
Recommended system cable		COAX cable Type RG–62/U (characteristic impedance 93 Ω)
Cable length		305 m with ARCnet bus with 8 stations. Further information see SMC TECHNICAL NOTE TN7–1.
LED displays	green LED (BS)	Operating mode ”controller active”, i.e. the PLC performs read and write operations
	green LED (TX)	Operating mode ”transmit active”, i.e. the PLC sends data on the ARCnet bus
Electrical isolation		versus supply voltage, inputs/outputs, versus COM1/COM2 interfaces (see also Fig. 3–5)

3.5.11 LED displays

LEDs for indication of:

– statuses of binary inputs	1 green LED per channel
– statuses of binary outputs	1 yellow LED per channel
– power supply exists	1 green LED
– battery	1 red LED
– program runs (RUN)	1 green LED
– error classes (FK1, FK2, FK3)	1 red LED per error class
– CS31 system bus runs (BA)	1 green LED
– bus specific errors (BE, RE, SE)	3 red LEDs
– overload/short-circuit of the direct binary outputs	1 red LED (K)

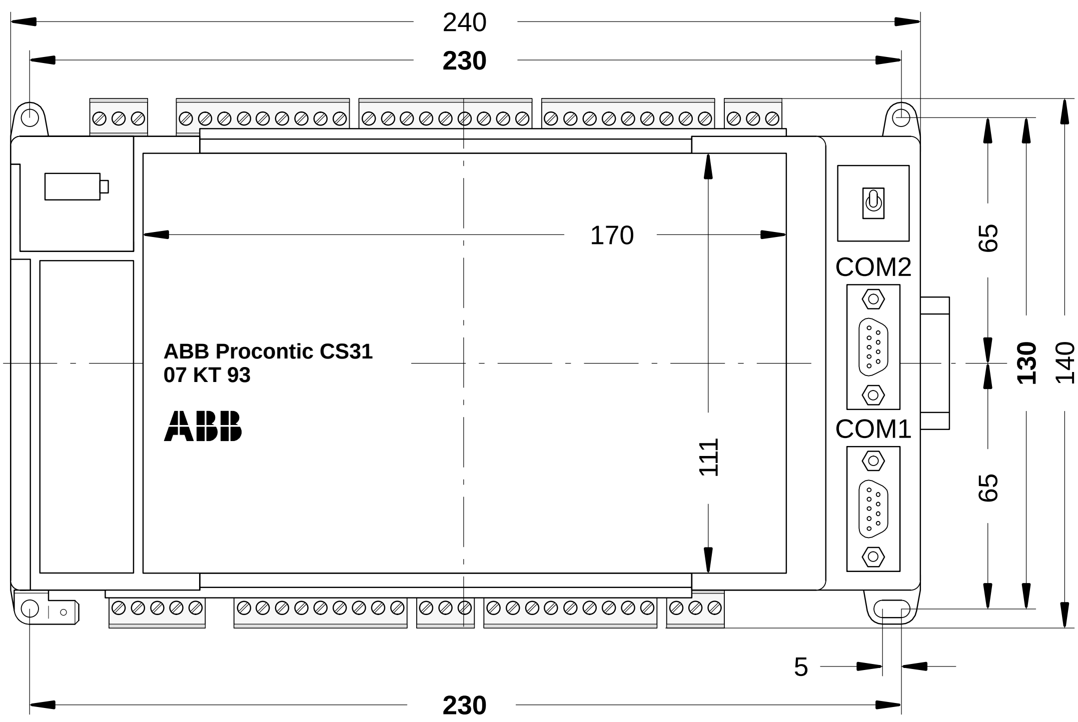
3.5.12 High speed hardware counter

Data of the integrated high–speed hardware counter

counting range	0...65,535 (16 bits)
counting frequency	max. 10 kHz
used inputs	62,00 and 62,01 (the signal delay of these inputs is set to 0.02 ms for the counter)
used outputs	62,00

3.5.13 Mechanical data

Mounting on DIN rail	according to DIN EN 50022–35, 15 mm deep. The DIN rail is located in the middle between the upper and the lower edges of the module.
Fastening by screws	using 4 M4 screws.
Width x height x depth	240 x 140 x 85 mm
Wiring method	by removable terminal blocks with screw-type terminals, conductor cross section max. 2.5 mm^2
Weight	1.6 kg
Dimensions (for mounting)	see the following drawing



All dimensions in mm.

The device is 85 mm deep. The interface connectors COM1 and COM2 are set deeper so that the mounting depth required does not become any larger even with detachable interface cables. If, however, a DIN rail is used, the mounting depth is increased by the overall depth of the rail.

The dimensions for assembly bore holes are printed in bold.

3.5.14 Mounting hints

Mounting position	vertical, terminals above and below
Cooling	The natural convection cooling must not hindered by cable ducts or other material mounted in the switch cabinet.

3.5.15 Ordering data

Central unit 07 KT 93 R101	Order No. GJR5 2513 00 R101
Central unit 07 KT 93 R171	Order No. GJR5 2513 00 R171
Scope of delivery	Central unit 07 KT 93 R101 or R171 5 9–pole terminal blocks 1 5–pole terminal block 4 3–pole terminal blocks Safety and mounting instructions

Accessories

System cable 07 SK 90	Order No. GJR5 2502 00 R1
System cable 07 SK 91	Order No. GJR5 2503 00 R1
System cable 07 SK 92	Order No. GJR5 2504 00 R1
Battery module 07 LE 90	Order No. GJR5 2507 00 R1
Bus termination resistor	
Simulation device 07 SG 90 (includes a number of switches and push-buttons to enter binary input signals)	Order No. GJR5 2506 00 R1

Programming and test software and operating manual

(both 907 PC 33 **and** 907 PC 331 are required)

907 PC 33	German	[1])	Order No. GJP5 2039 00 R202
907 PC 33	English	[1])	Order No. GJP5 2040 00 R202
907 PC 331	German	[2])	Order No. GJP5 2045 00 R202
907 PC 331	English	[2])	Order No. GJP5 2046 00 R202

Further Literature

System description ABB Procontic CS31	English	Order No. FPTN 440 004 R2001
System description ABB Procontic T200	English	Order No. GATS 1314 99 R2001
System description ABB Procontic T300	English	Order No. GATS 1315 99 R2002
System description ABB Procontic CS31	German	Order No. GATS 1316 99 R1002
System description ABB Procontic T200	German	Order No. GATS 1314 99 R1001
System description ABB Procontic T300	German	Order No. GATS 1315 99 R1002

[1]) Description General Part

[2]) Description 07 KR 91 / 07 KT 92 / 07 KT 93–Specific Part + Software Diskettes

Appendix

ABB Procontic CS31
Intelligent Decentralized
Automation System

Central Units
07 KR 91,
07 KT 92 and 07 KT 93

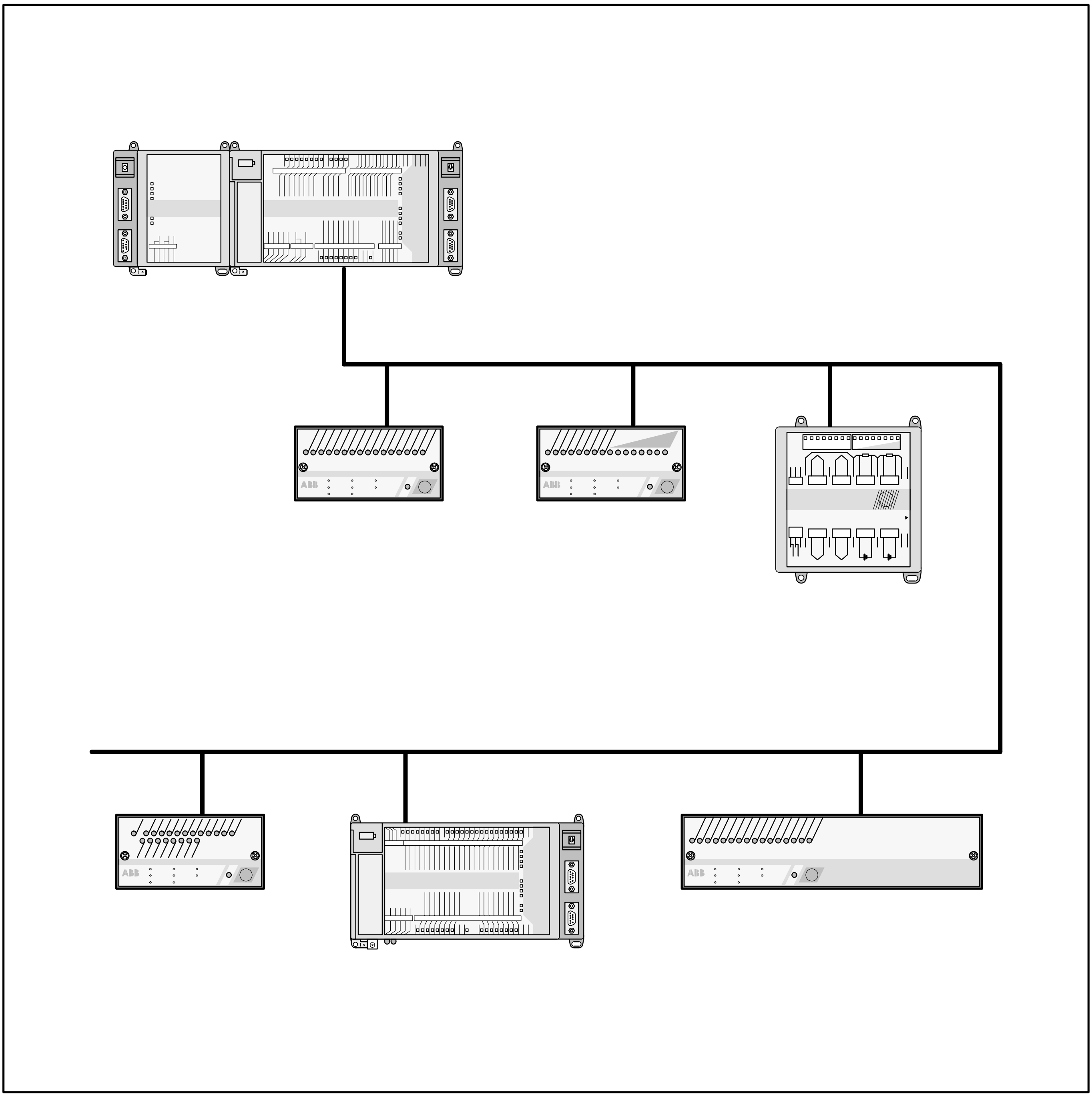


ABB Schalt–
und Steuerungstechnik

Table of Contents

A1 Processing times

The most important times for the application of the central units 07 KR 91 / 07 KT 92 / 07 KT 93 with or without connected remote modules are:

- The **reaction time t_{kk}** is the time between a signal transition at the input terminal and the signal response at the output terminal.

  In case of binary signals, the reaction time consists of the input delay t_D, the cycle time t_C of the program processing and the bus transmission time, if the system is expanded by remote modules.

- The **cycle time t_C** determines the time intervals after which the processor starts the execution of the user program again.

  The cycle time has to be specified by the user. It should be greater than the program processing time t_{UP} of the user program, the data transfer times and the related waiting times.

  The cycle time is also the time base for some time-controlled functions, such as for the PID controller.

- The **program processing time t_{UP}** is the net time for processing the user program.

For the configuration and for determining the reaction time t_{kk}, the following steps are necessary:

– Determining the program processing time t_{UP}

– Addition of the other times which are within the cycle time t_C

– Specification of the cycle time t_C

– Determining the bus cycle time t_b, if there are any remote modules connected to the central unit

– Reaction time t_{kk} as the sum of the input delay t_v, 2 x bus cycle time t_b and 2 x cycle time t_C and output delay t_{DO}.

In addition to calculating the cycle time t_C in accordance with chapter A1.2 (Appendix) it is possible to measure the capacity utilization on the programmed central unit – with the RUN/STOP switch set to RUN. The menu item of ”Display PLC status” in the programming software 907 PC 331 can be used for this purpose. Increase the cycle time t_C until the capacity utilization is below 80 %.

A1.1 Program processing time t_{UP}

- **Binary instructions of the type:**

  !M /M &M =M
  !NM /NM &NM =NM
  Processing time for 1000 instructions: 2 ms

  !M /M &M =SM
  !NM /NM &NM =RM
  Processing time for 1000 instructions: 2.2 ms

- **Word instructions of the type:**

  !MW +MW –MW =MW
  !–MW –MW +MW =–MW
  Processing time for 1000 instructions: 4.1 ms

  !MW *MW :MW =MW
  !–MW *–MW :–MW =–MW
  Processing time for 1000 instructions: 5.4 ms

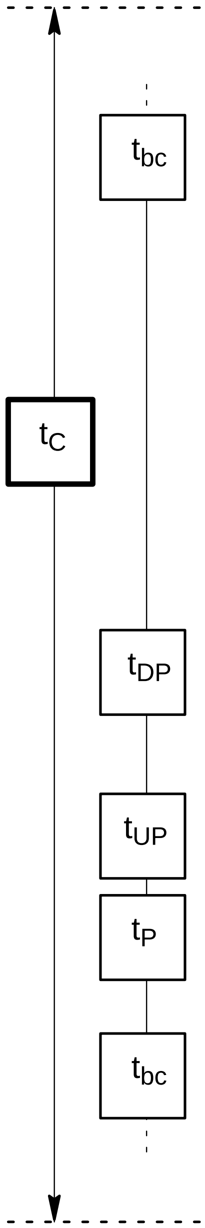
- **Mixed instructions**

  – 65 % binary: !, /, &, =
  – 20 % word: !, +, –, =
  – 15 % word: !, *, :, =

  Processing time for 1000 instructions: 3 ms

- The program processing times of all the function blocks are specified in the documentation of the programming software 907 PC 331.

A1.2 Set cycle time t_C



Times to be taken into consideration when the central unit 07 KR 91 / 07 KT 92 / 07 KT 93 is used as:			
Stand-alone and slave, inputs and outputs of its own	Bus master, inputs and outputs of its own	Bus master, inputs and outputs via remote modules	Explanation
t_{bc} = 0.4 ms	t_{bc} = max. 3.1 ms (1.5 ms) *	t_{bc} = max. 3.1 ms (1.5 ms) *	Block copy time, time for copying the input signals or the out-put signals from/to the transfer memory. It includes: – Net copy time 0.2 ms – 2 interface interrupts of 0.1 ms each – If expanded by remote mod-ules, waiting time for access authorization: binary mod. only: 1.1 ms, also analog mod.: 2.7 ms (2 x interrogation time on the CS31 system bus)
t_{DP} = 0.1 ms	t_{DP}	t_{DP}	Time for depacking. For each binary group (16 bits with common address) 0.05 ms. To be omitted for analog values.
t_{UP}	t_{UP}	t_{UP}	Program processing time, see next page
t_P = 0.05 ms	t_P	t_P	Time for packing. For each binary group 0.05 ms. To be omitted for analog values.
t_{bc} = 0.4 ms	t_{bc} = max. 3.1 ms (1.5 ms) *	t_{bc} = max. 3.1 ms (1.5 ms) *	Block copy time, see above.

* only binary modules which are connected to the CS31 system bus

Fig. 2–20: 07 KR 91 / 07 KT 92 / 07 KT 93, processing times

The cycle time t_C has to be preset by the user taking the following equation into consideration:

$$\boxed{t_C \geq t_{bc} + t_{DP} + t_{UP} + t_p + t_{bc}}$$

This equation assumes that the processor always gets access in the most unfavourable moment.

The cycle time t_C is stored in KD 00,00 and can be selected in 5 ms time steps. If the selected cycle time is too short, the processor will not be able to fulfill the tasks assigned to it. It will come in default then.

If this lack of time is getting too large over several cycles, the processor will abort the program execution and output an error (FK2).

Using some function blocks, such as the PID controller, the error-free execution depends on an exact timing sequence. Make sure that there is a larger time reserve.

The correct setting of the cycle time can be checked by the following procedure:

– Loading the user program into the central unit.

– If the operating mode has been switched over from stand-alone to bus master: Power ON or menu item ”Enable PLC mode” in the programming software.

– Interrogation of the capacity utilization using the menu item of ”Display PLC status”.

– Changing the cycle time t_C until the capacity utilization is below 80 %.

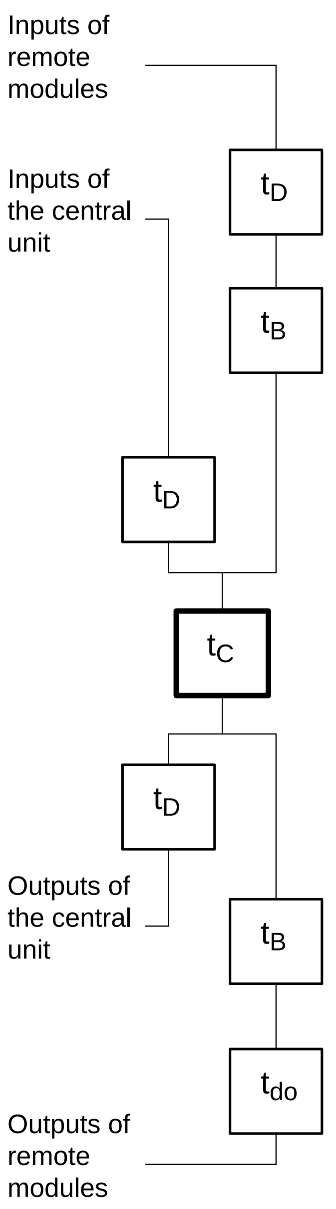
Example: Bus master central unit + 1 binary input module + 1 binary output module + 2 analog input modules

Block copy time:	t_{bc}	= 3.1 ms
20 bin.inputs of the central unit, 16 bin. inputs of the remote module, 3 groups (addresses): 62, 63, 8	t_{DP}	= 0.2 ms
user program:	t_{UP}	= 5 ms
12 binary outputs of the central unit, 8 bin. outputs of the remote module, 2 groups (addresses): 62, 10	t_P	= 0.1 ms
Block copy time:	t_{bc}	= 3.1 ms
	Total	11.5 ms

The calculation results in a cycle time setting of t_C = 15 ms.

A1.3 Reaction time

in case of binary signals



Times to be taken into consideration when the central unit 07 KR 91 / 07 KT 92 / 07 KT 93 is used as:			
Stand-alone and slave, inputs and outputs of its own	Bus master, inputs and outputs of its own	Bus master, inputs and outputs via remote modules	Explanation
–	–	t_D = (8 ms)	Input signal delay t_D of binary remote modules, normally typ. 8 ms
–	–	t_B > 2 ms	Cycle time t_B of the CS31 system bus, depending on number and type of the remote modules, see vol. 2, system data
t_D = typ. 7 ms or 8 µs	t_D = typ. 7 ms or 8 µs	–	Delay time t_D of binary inputs of the central unit: E 62,00...E 63,03: typ. 7 ms E 63,14 a. E63,15: typ. 0.02 ms
$t_C \geq 5$ ms	$t_C \geq 10$ ms	$t_C \geq 10$ ms	Cycle time t_C, to be set by the user
$t_D = 0$	$t_D = 0$	–	Delay time t_D of the outputs of the central unit: negligible
–	–	t_B > 2 ms	Cycle time t_B of the CS31 system bus, depending on number and type of the remote modules, see vol. 2, system data
–	–	t_{do} (<1 ms)	Output signal delay time of binary remote modules: normally < 1 ms

Fig. 2–21: 07 KR 91 / 07 KT 92 / 07 KT 93, reaction time

The maximum reaction time t_{kk} (input terminal to output terminal) results from the asynchronicity of the operations:

- Central unit via its own inputs and outputs

$$\boxed{t_{kk} = t_D + 2 \cdot t_C}$$

- Bus master central unit via inputs and outputs of remote modules

$$\boxed{t_{kk} = t_D + 2 \cdot t_B + 2 \cdot t_C + t_{do}}$$

In case of analog signals, the refresh times are to be entered in the formula instead of the delay times.

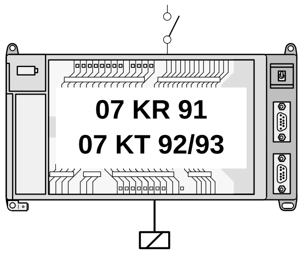
Example: Bus master central unit + 1 binary input module + 1 binary output module + 2 analog input modules, reaction time for binary signals via the remote modules:

Input delay time:	1 ·	t_D = 8 ms
2 · bus cycle time: 2 · (2 ms + 387 µs + 323 µs + 1355 µs + 1355 µs)	2 ·	t_B = 10.8 ms
2 · cycle time:	2 ·	t_C = 30 ms
output delay time:	1 ·	t_{do} = 1 ms
Terminal-to-terminal reaction time		ca. 49.8 ms

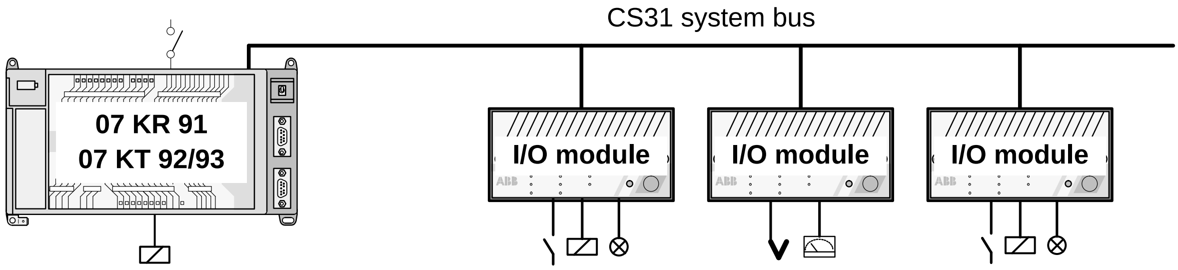
A2 Addressing with 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master

A2.1 Introduction

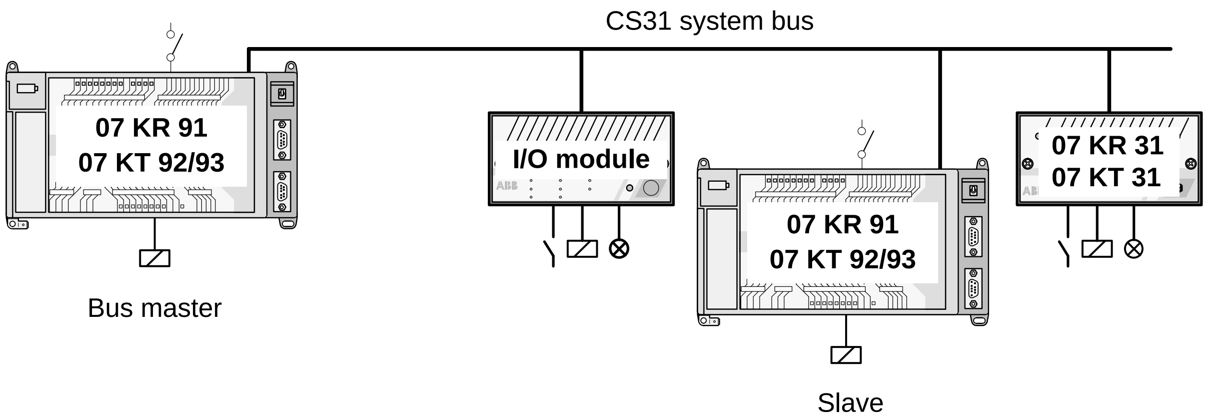
Structure examples with 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master



Example 1: 07 KR 91, 07 KT 92 or 07 KT 93 used as stand–alone PLC



Example 2: 07 KR 91, 07 KT 92 or 07 KT 93 used as bus master on the CS31 system bus, as remote modules only I/O modules are used



Example 3: 07 KR 91, 07 KT 92 or 07 KT 93 as bus master and as slave on the CS31 system bus, 07 KR/KT 31 used as slave, in addition I/O modules

Without regard to the address ranges, the following modules can be connected to a CS31 system bus:

- **max. 1 bus master**
- **max. 31 remote modules / slaves**

Further restrictions result from the address range of the central units 07 KR 91 / 07 KT 92/93:

- **max. 12 analog input modules**
- **max. 12 analog output modules**
- **max. 31 binary input modules**
- **max. 31 binary output modules**

There may be further restrictions according to the structure of the installation and the type of remote modules. For the recommended addresses, see chapter A2.2.

Structure of the input and output addresses in the remote modules

The binary input module ICSI 08 D1 will be explained here as an example.

The bus master central unit reads the input signals as operands. The complete address of an input signal has the following structure:

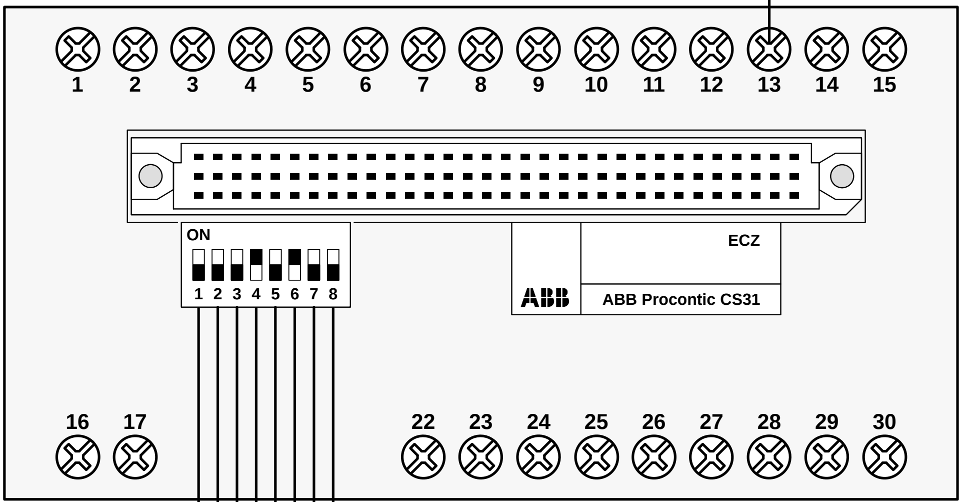
E 10 ,05

- ,05 — Channel number of the input, here: input 05
- 10 — Module address (group number) here: module address 10
- E — Operand identifier, here: binary input

Setting of the module address (group number) on the plug-in base ECZ

Example: Binary input module ICSI 08 D1 results in variable identifier E

Input E5 means channel No. 5 for channel No. range 00...07 (see below)



The channel numbers are in the range of 00...07

Switch = OFF:	0 •	Bit significance	1	=	0
Switch = ON:	1 •	Bit significance	2	=	2
Switch = OFF:	0 •	Bit significance	4	=	0
Switch = ON:	1 •	Bit significance	8	=	8
Switch = OFF:	0 •	Bit significance	16	=	0
Switch = OFF:	0 •	Bit significance	32	=	0
				+	
Modul address (group number)				=	10

Switch position is without effect

Note: Some of other modules may have a more or less different address setting, see the following chapters.

A2.2 Recommended module addresses on the CS31 system bus with several remote modules and central units connected as slaves

The standard addressing has the purpose of
– simplifying and schematizing the setting of addresses on the CS31 system bus
– simplifying diagnosis and troubleshooting.

The standard addressing makes sure that there will be no address overlappings even for modules with a bigger amount of data.

Recommendation:

- Assign a specific module address for each module / each slave central unit, that means the giving up the possibility of double assignment of module addresses by binary and analog modules

- Module addresses for binary remote modules and central units: 8, 10, ..., 58, 60 (all even numbers), see also chapter A2.6 Central units connected as slaves to the CS31 system bus

- Module addresses for analog remote modules: 0...5

- Address switch No. 8 on the plug-in base ECZ always set to OFF (≤7)

A2.3 Address setting for the modules

Input and output modules connected as slaves to the CS31 system bus

The remote modules are mounted on the plug-in base ECZ. This plug-in base is equipped with an address switch (DIL switch) for setting the module address.

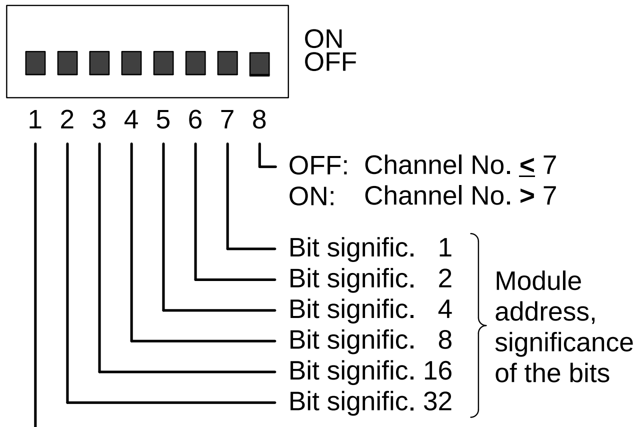
The combination of module type, module address and channel number results in the variable address used by the bus master central unit.

Setting the address switch for binary modules

The possible range of module addresses when using the central units 07 KR 91 / 07 KT 92 / 07 KT 93 is:

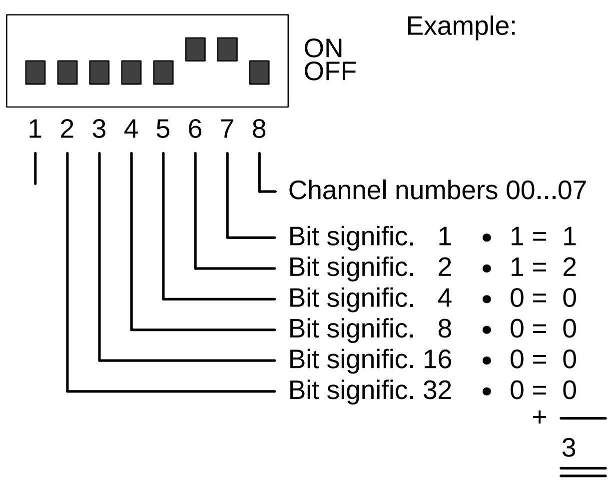
0...61

The function of the address switches is as follows:



- Input modules — ON or OFF (at random)
- Output modules — ON or OFF (at random)
- Combined input/output module — ON or OFF (at random)
- Configurable input/output module — OFF – each channel is assigned an input or an output by the program, ON – each channel is an output.

Note: If the configurable input/output module ICFC 16 L1 is used, the complete addressing has to be performed on the left-hand plug-in base.



Setting the address switches in case of analog modules

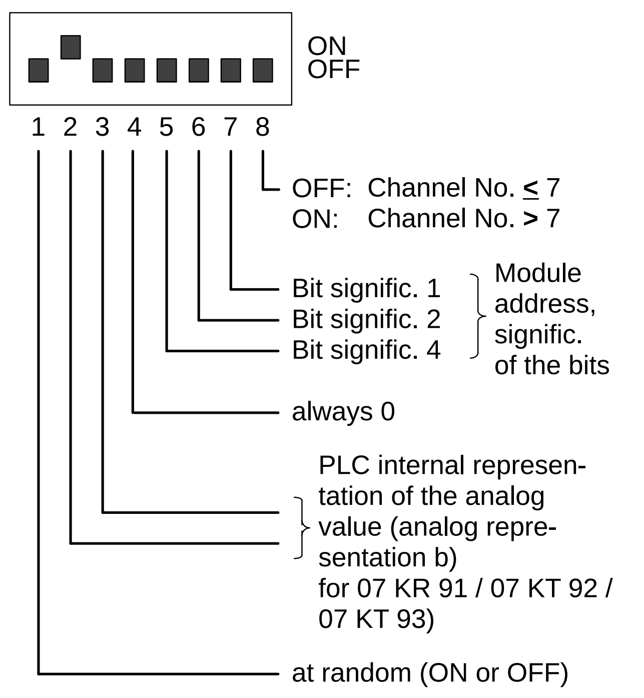
If analog modules are used, their module addresses can be set to

0...5

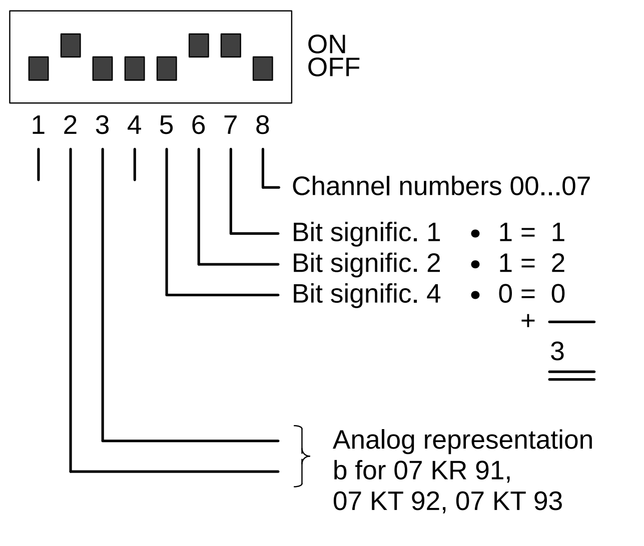
when the central units 07 KR 91 / 07 KT 92 / 07 KT 93 are used as bus master.

The analog representation in the 07 KR 91 / 07 KT 92 / 07 KT 93 is fixed. The analog modules have to supply their values in a suitable form and therefore to be set to the analog representation **b**. For the analog representation, see the general description of the analog modules (volume 2).

The function of the address switches is as follows:



Example:



A2.4 07 KR 91 / 07 KT 92 / 07 KT 93 used as stand-alone central units

If the central units 07 KR 91 / 07 KT 92 / 07 KT 93 are to be used without the CS31 system bus connected, perform the following setting when programming in the user program:

System constant KW 00,00 = –2

This value is the factory setting.

For the 07 KT 92 used as stand-alone central unit, see chapter A2.1 Introduction, Example 1.

A2.5 07 KR 91 / 07 KT 92 / 07 KT 93 used as bus master central unit

If remote modules (slaves) are connected to the central units 07 KR 91 / 07 KT 92 / 07 KT 93 via the CS31 system bus, proceed as follows:

1. Change the system constant: KW 00,00 = –1
2. Save the PLC program in the Flash EPROM
3. Activate the new PLC mode by:
   – Calling the menu item ”Enable PLC mode” in the ABB programming and test system or
   – entering the command WARM <CR> in terminal mode or
   – power ON or
   – cold start.

A2.6 Intelligent I/O remote modules (central units) as slaves on the am CS31 system bus

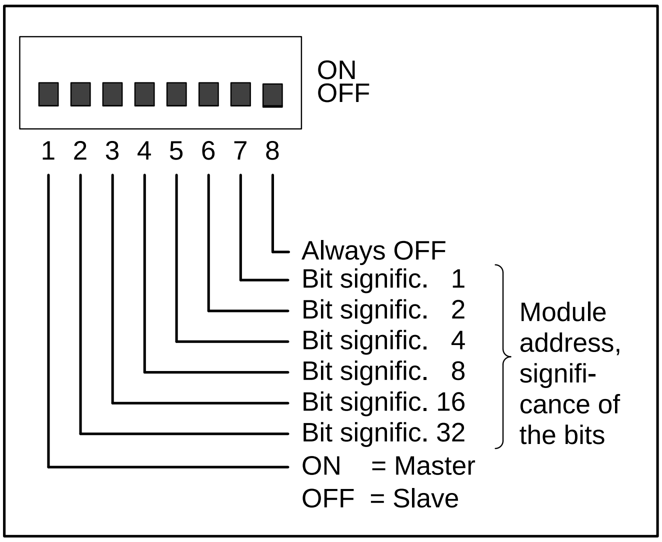
The central units 07 KR 91, 07 KT 92, 07 KT 93, 07 KR 31 and 07 KT 31 can also be used as slaves at the CS31 system bus, see chapter A2.1, Addressing, Introduction, Example 3.
The central units 07 KR 91 / 07 KT 92 / 07 KT 93 / 07 KR 31 / 07 KT 31 may be used both in the binary range and in the word range.

The address can be set to a value from 0 to 61. The maximum permissible address depends on the size of the set transmit and receive range. The larger you choose the transmit or the receive range, the smaller is the maximum permissible address (see examples 1...3).

If you want to switch over to the ”slave mode”, proceed as follows:

1. Change the system constant: KW 00,00 = 0...61.
   Only for 07 KR 31 and 07 KT 31: If KW 00,00 = 100, the address is set on the DIL switch of the plug-in base in the same way as with the standard modules, the address range is 0...61.

Meaning of the DIL switches:



2. Save the PLC program in the EEPROM
3. Activate the new PLC mode by:
   – Calling the menu item ”Enable PLC mode” in the ABB programming and test system or
   – entering the command WARM <CR> in terminal mode or
   – power ON or
   – cold start.

There is no direct access to the inputs and outputs of the slave central unit via the CS31 system bus. The communication between master and slave is performed using input and output operands.

All the master data are consistently transferred to the slave, and all the slave data are consistently transferred to the master.

The slave PLC can be used *either* in the binary range *or* in the word range of the CS31 system bus. The transmit and receive ranges of the slave can be adapted to the application-specific requirements by means of the two system constants KW 00,10 and KW 00,11 (see also chapter ”System constants”).

You can set:

– The size of the transmit and receive ranges and

– the mode of employment of the slave (in the binary or the word range).

Default condition:

If the central units 07 KR 91 / 07 KT 92 / 07 KT 93 / 07 KR 31 / 07 KT 31 are switched over to the ”slave mode”, they behave like binary input and output modules with 32 inputs and 32 outputs when connected to the CS31 system bus.

This means that the default setting of the transmit and receive ranges is within the binary range of the master. Their size is 32 bits each (4 bytes).

Example 1:

Default configuration of the slave (binary range):
KW 00,10 = 0: Slave transmit range: 4 bytes
(4 bytes * 8 channels = 32 binary O)

KW 00,11 = 0: Slave receive range: 4 bytes
(4 bytes * 8 channels = 32 binary I)

Note:
The default configuration is the same as the the configuration KW 00,10 = KW 00,11 = 4.

07 KR 91 / 07 KT 92 / 07 KT 93 / 07 KR 31 / 07 KT 31 as bus master Receive or transmit using E/A operands (I/O operands)	←→	07 KR 91 / 07 KT 92 / 07 KT 93 / 07 KR 31 / 07 KT 31 as slave with: KW 00,10 = 0 or 4 KW 00,11 = 0 or 4 Transmit or receive using E/A operands I/O operands
E n ,00	←	A 00,00
:		:
E n ,15		A 00,15
E n+1,00		A 01,00
:		:
E n+1,15	←	A 01,15
A n ,00	→	E 00,00
:		:
A n ,15		E 00,15
A n+1,00		E 01,00
:		:
A n+1,15	→	E 01,15

n: Module address of the slave central unit, for this example: 0 ≤ n ≤ 60)

For the slave address of n = 12 the following applies, for example:
The output signal A 00,00 of the 07 KR 91 used as slave is the input signal E 12,00 for the 07 KR 91 used as bus master.

Example 2:

Configuration of the slave for the binary range:

KW 00,10 =15: Slave transmit range: 15 bytes
(15 bytes * 8 channels = 120 binary O)

KW 00,11 = 06: Slave receive range: 6 bytes
(6 bytes * 8 channels = 48 binary I)

07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master Receive or transmit using E/A operands (I/O operands)	←→	07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as slave with: KW 00,10 = 15 KW 00,11 = 6 Transmit or receive using E/A operands I/O operands
E n ,00	←	A 00,00
:		:
E n ,15		A 00,15
:		
E n+7,00		A 07,00
:		:
E n+7,07		A 07,07
A n ,00	→	E 00,00
:		:
A n ,15		E 00,15
:		:
A n+2,00		E 02,00
:		:
A n+2,15		E 02,15

Notes:

The upper 8 input channels of the address n+7

E n+7,08...E n+7,15

can be assigned to another binary *8 bit input module (excluding KR/KT)* on the CS31 system bus.

The output channels starting from the address n+3

A n+3,00...A n+7,15

can be assigned to other *output devices (including KR/KT)* on the CS31 system bus.

n: Module address of the slave PLC, for this example: 0 ≤ n ≤ 54)

For the slave address of n = 12 the following applies, for example:
The output signal A 00,00 of the 07 KR 91 used as slave is the input signal E 12,00 for the 07 KR 91 used as bus master.

Example 3:

Configuration of the slave for the word range:

KW 00,10 = 101:	Slave transmit range: (1 word = 1 word output)	1 word
KW 00,11 = 108:	Slave receive range: (8 words = 8 word inputs)	8 words

07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as bus master Receive or transmit using EW/AW operands	↔	07 KR 31 / 07 KT 31 07 KR 91 / 07 KT 92 / 07 KT 93 as slave with: KW 00,10 = 101 KW 00,11 = 108 Transmit or receive using EW/AW operands
EW n,00	←	AW 00,00
AW n,00 : AW n,07	→	EW 00,00 : EW 00,07

Notes:

If a slave KR/KT is configured for the word range, only the lower 8 channels of the address n are assigned to it on the CS31 system bus.

(EW n,00...EW n,07 and AW n,00...AW n,07).

The upper 8 channels of the address n

EW n,08...EW n,15 and
AW n,08...AW n,15

can be assigned to another *analog module (excluding KR/KT)* on the CS31 system bus, for example.

n: Module address of the slave PLC, for this example: $0 \leq n \leq 5$)

For the slave address of n = 4 the following applies, for example:
The output signal AW 00,00 of the 07 KR 91 used as slave is the input signal EW 04,00 for the 07 KR 91 used as bus master.

A2.7 Special modules used as slave on the CS31 system bus

- **Robot coupler ICBG32L7 and ICBG64L7**

The Robot coupler ICBG32L7 (ICBG64L7) behaves on the CS31 system bus like a binary input/output module equipped with 16 (32) inputs and 16 (32) outputs.

The module address can be set by means of the DIL switch on the printed circuit board.

The meaning of the DIL switch is the same as that on the plug-in base ECZ, see chapter A2.3. Switch No. 8 is always set to OFF.

Please note that the set module address and also the following address are assigned by the Robot coupler ICBG64L7.

For the signal names in the user program of the central unit, please see the description of the Robot couplers.

- **Festo valve island / installation island**

The Festo valve island and the Festo installation island behave on the CS31 system bus like binary input and output modules. For the scope of assigned data, please see chapter A2.9.

The module addresses are set by means of the address switches located below the cover of the ”field bus node”. The upper switch is provided for the unit digit, the lower switch for the tens digit.

A2.8 Complex structure examples including addresses

- **Categorization of the modules with respect to the I/O terminals**

There are the following two main module types:

– Binary modules. These modules are controlled by means of binary I/O operands (E or A, respectively). The Robot couplers ICBG 32 L7 and ICBG 64 L7 (always used as slave) belong also to them, as well as the central units 07 KR 91, 07 KT 92, 07 KT 93, 07 KR 31 and 07 KT 31, if they are used as slaves.

– Analog modules. These modules are controlled by means of word I/O operands (EW or AW, respectively). The central units 07 KR 91, 07 KT 92, 07 KT 93 belong to them as well as the high-speed counter ICSF 08 D1, which receives its preset data as word data, for example.

The following table contains an overview of the module types. These designations will be used in example 6.

Please note that the configurable binary modules ICSC 08 L1 and ICFC 16 L1 behave differently according to the performed setting.

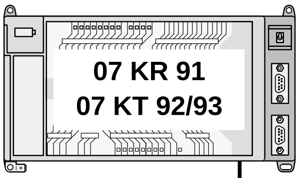
A2.9 Module examples (slaves connected to the CS31 system bus)

Module types, with regard to I/O terminals	Module examples
Binary input modules with 8 inputs	ICSI 08 D1, ICSI 08 E1, ICSI 08 E4
Binary input modules with 16 inputs	ICSI 16 D1, ICSI 16 E1
Binary output modules with 8 outputs	ICSO 08 R1, ICSO 08 Y1; ICSC 08 L1, if switch No. 1 is set to ON
Binary output modules with 16 outputs	ICFC 16 L1, if switch No. 1 is set to ON, Festo valve island with up to 8 valves
Binary output modules with 32 outputs	Festo valve island with more than 8 valves
Binary modules with 8 inputs and 8 outputs	ICSC 08 L1, if switch No. 1 is set to OFF
Binary modules with 16 inputs and 16 outputs (a) or 16 signals each from/to the CS31 bus (b)	(a) ICSK 20 F1, ICDG 32 L1, if switch No. 1 is set to ON, ICFC 16 L1, if switch No.1 is set to OFF, Festo installation island with up to 6 valves, (b) ICBG 32 L7
Binary modules with 32 inputs and 32 outputs (a) or 32 signals each from/to the CS31 bus (b)	(a) Festo installation island with more than 6 valves, (b) ICBG 64 L7, ICDG 32 L1, if switch No. 1 is set to OFF
Binary modules with 120 signals each from/to the CS31 system bus	07 KR 91 as slave 07 KT 92 as slave 07 KT 93 as slave 07 KR 31 as slave 07 KT 31 as slave
Analog input modules with 8 inputs	ICSE 08 A6, ICSE 08 B5, ICST 08 A8, ICST 08 A9

Module types, with regard to I/O terminals	Module examples
Analog output modules with 8 outputs	ICSA 04 B5
Analog modules with up to 4 inputs and 4 outputs	ICSM 06 A6 (4 EA, 2 AA, therefore addressing gaps which cannot be assigned)
Analog modules (word modules) with up to 8 inputs and 8 outputs	ICSF 08 D1 (high–speed counter), 07 KR 91, 07 KT 92, 07 KT 93, 07 KR 31, 07 KT 31

Examples for the assignment of module addresses,

Example 4

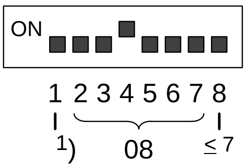
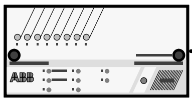
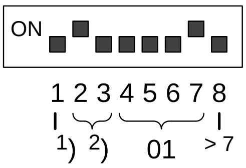
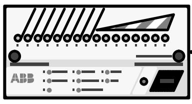


CS31 system bus

07 KR 91	**07 KT 92**	**07 KT 93**
E 62,00	E 62,00	E 62,00
:	:	:
E 62,15	E 62,11	E 62,15
E 63,00	A 62,00	E 63,00
:	:	:
E 63,03	A 62,07	E 63,07
A 62,00	EW 06,00	A 62,00
:	:	:
A 62,11	EW 06,03	A 62,15
	AW 06,00	

Addresses of the inputs and outputs on the bus master central unit

Bus master central unit

Address switch (DIL switch) on the plug-in base ECZ	Remote module	Address in the program of the master CPU	
	 8 binary outputs	A 08,00 A 08,01 : A 08,07	1st binary output 2nd binary output : 8th binary output
	 8 analog inputs	EW 01,00 EW 01,01 : EW 01,07	1st analog input 2nd analog input : 8th analog input

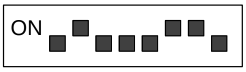
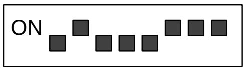
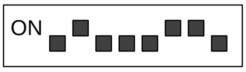
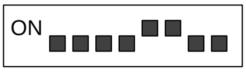
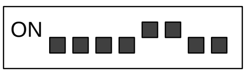
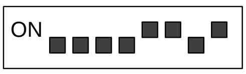
Remote modules (slaves)

1) at random (ON or OFF)

2) If analog modules are connected to 07 KR 91 / 07 KT 92 / 07 KT 93 the analog representation is **b**, see the general description of the analog modules in volume 2.

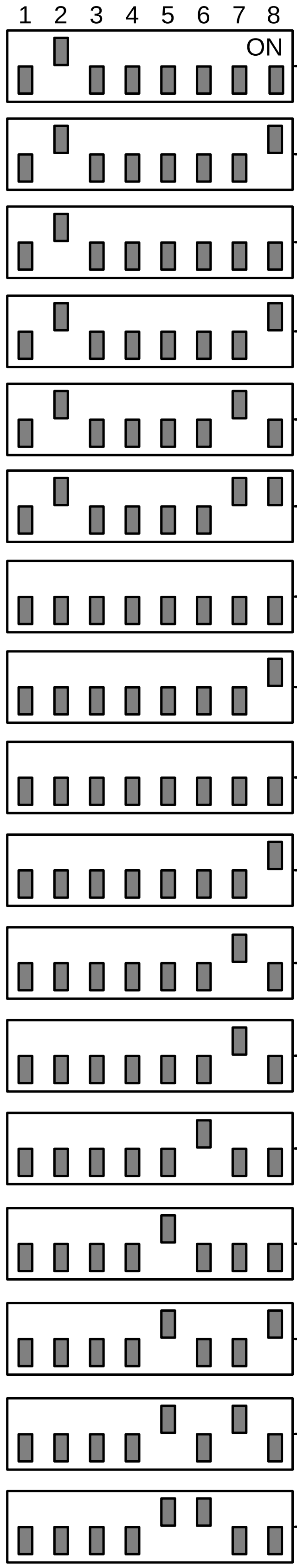
Example 5

	07 KR 91	07 KT 92	07 KT 93	
Address setting in the master: KW 0,0 = –1	E 62,00...E 62,15 E 63,00...E 63,03 A 62,00...A 62,11 —— ——	E 62,00...E 62,11 —— A 62,00...A 62,07 EW 6,00...EW 6,03 AW 6,00	E 62,00...E 62,15 E 63,00...E 63,07 A 62,00...A 62,15 —— ——	Inputs/outputs on the central unit

Address switch on the plug-in base ECZ	Remote module		Address in the program of the master CPU	Remarks
 1 2 3 4 5 6 7 8 * 03 ≤ 7	ICSE 08 A6 8 analog inputs	E0 : E7	EW 03,00 : EW 03,07	– max. 31 slaves on the CS31 bus – Permissible range of module addresses for analog modules: 0...5 – * Analog representation b
 1 2 3 4 5 6 7 8 * 03 > 7	ICSE 08 A6 8 analog inputs	E0 : E7	EW 03,08 : EW 03,15	– 2 analog input modules with 8 channels each can be assigned to one address (16 channels together) – The same address (as for the analog input modules) may also be used for the connection of analog output modules (as shown to the left).
 1 2 3 4 5 6 7 8 * 03 ≤ 7	ICSA 04 B5 4 analog outputs	A0 : A3	AW 03,00 : AW 03,03	Since the module has only 4 channels, AW 03,04...AW 03,07 (or AW 03,12...AW 03,15) cannot be used. The same corresponds to the module ICSM 06 A6.
 1 2 3 4 5 6 7 8 06 ≤ 7	ICSI 16 E1 16 binary inputs	E00 : E15	E 06,00 : E 06,15	– Permissible range of module addresses for binary modules: 0...61, recommendation: 6...60 – The following might be done, but does not bring you any advantage:
 1 2 3 4 5 6 7 8 06 ≤ 7	ICSO 08 R1 8 binary outputs	A0 : A7	A 06,00 : A 06,07	• using the same addresses for binary modules as for analog modules • collecting 2 modules with 8 bits each under one address
 1 2 3 4 5 6 7 8 06 > 7	ICSO 08 R1 8 binary outputs	A0 : A7	A 06,08 : A 06,15	• collecting input and output modules under one address
07 KR 91 / 07 KT 92 / 07 KT 93: KW 0,0 = 4 up to 120 binary inputs and up to 120 binary outputs or up to 8 word inputs and up to 8 word outputs			KR/KT in binary range: E 04,00...E 11,07 A 04,00...A 11,07 or KR/KT in word range: EW 04,00...EW 04,07 AW 04,00...A 04,07	– Slave KR/KT with 120 E and/or 120 A occupies the set address **and** the following 7 addresses (only half of the 7th, though). For address 4 of the example: – Next free address for KR/KT: binary range: 12, word range: 5 – Max. settable KR/KT address: binary range: 54, word range: 5

Example 6

Module type, with regard to I/O terminals	Address switch on the plug-in base ECZ	**07 KR 91 / 07 KT 92 / 07 KT 93**	Permissible addresses
8 analog inputs	Address 0, ≤7	EW 0,00...EW 0,07	0...5 (2=ON, 3=OFF: Analog re-presentation (b))
8 analog inputs	Address 0, >7	EW 0,08...EW 0,15 Collection is possible	
8 analog outputs	Address 0, ≤7	AW 0,00...AW 0,07	
8 analog outputs	Address 0, >7	AW 0,08...AW 0,15	
4 analog inputs and 4 analog outputs	Address 1, ≤7	EW 1,00...EW 1,03 AW 1,00...AW 1,03	
4 analog inputs and 4 analog outputs	Address 1, >7	EW 1,08...EW 1,11 AW 1,08...AW 1,11	
8 binary inputs	Address 0, ≤7	E 0,00...E 0,07	0...61
8 binary inputs	Address 0, >7	E 0,08...E 0,15 Collection is possible	(please note this also for double addresses)
8 binary outputs	Address 0, ≤7	A 0,00...A 0,07	
8 binary outputs	Address 0, >7	A 0,08...A 0,15	A gapless assignment, as selected here, is not obligatory.
16 binary inputs	Address 1, ≤7	E 1,00...E 1,15 Collection is possible	
16 binary outputs	Address 1, ≤7	A 1,00...A 1,15	
32 binary outputs	Address 2, ≤7	A 2,00...A 2,15 A 3,00...A 3,15	
8 binary inputs and 8 binary outputs	Address 4, ≤7	E 4,00...E 4,07 A 4,00...A 4,07 Collection is possible	
8 binary inputs and 8 binary outputs	Address 4, >7	E 4,08...E 4,15 A 4,08...A 4,15	
16 binary inputs and 16 binary outputs	Address 5, ≤7	E 5,00...E 5,15 A 5,00...A 5,15	
32 binary inputs and 32 binary outputs	Address 6, ≤7	E 6,00...E 6,15; E 7,00...E 7,15 A 6,00...A 6,15; A 7,00...A 7,15	



Examples for module types see chapter A2.9

Max. 31 slave modules on the CS31 system bus

A3 I/O configuration

A3.1 Purpose of the I/O configuration of I/O modules

Dependent on the type of I/O modules the following can be configured:

- in case of binary I/O modules, an input delay different from the factory setting,
- in case of binary modules with combined I/O channels, these channels can also be defined as input only or output only,
- in case of binary modules, open-circuit monitoring at inputs and outputs,
- in case of analog modules, measuring or output ranges which differ from the factory setting.

Switching over of inputs and outputs, switching on the diagnosis functions and changing the measuring and output ranges are performed as follows, depending on the module type:

- Performing the I/O configuration via the CS31 system bus, either by means of the user program of the bus master central unit or by means of a terminal
- Setting of switches on the plug-in base ECZ or on the rear side of the input/output module
- External wiring on the input/output module terminals.

In some cases, there is a relation between the settings made on the remote module and the information and diagnosis messages which can be interrogated at the remote module or via the CS31 system bus. This relation will be explained in the following chapters.

There is no need for you to perform an I/O configuration via the CS31 system bus if the factory setting is sufficient. Once an I/O configuration has been performed, it will remain stored in the corresponding I/O module until it is changed again. Even in case of power OFF it will not be deleted.

A3.2 Settings and diagnosis on binary modules

The following tables give you an overview on the I/O configurations and the diagnosis functions related to them for the different module types.

Binary modules, settings and diagnosis									
I/O configurable functions	–	–	–	–	CI	CO	ID	IO	OO
Diagnosis functions according to module type a) always present b) if configured	 UE	 BE	 OL	 SC	 CI	 CO	 –	 –	 –
Readable on the module by pressing the test button [1]) a) Diagnosis messages b) Settings	 –	 –	 OL	 SC	 CI	 CO		 IO	 OO
Available for the bus master user program, readable on the terminal a) cyclic transmission b) interrogable	 –	 –	 OL	 SC	 CI	 CO	 ID	 IO	 –
Module type									
ICSI 08 D1	●	●			●		●		
ICSI 16 D1	●	●			●		●		
ICSI 08 E1	●	●					●		
ICSI 16 E1	●	●					●		
ICSI 08 E4	●	●					●		
ICSO 08 R1	●	●							
ICSO 08 Y1	●	●	●	●					
ICSO 16 N1	●	●	●	●					
ICSK 20 F1	●	●							
ICSK 20 N1	●	●	●	●					
ICSC 08 L1	●	●	●	●	●	●	●	●	●
ICSC 16 L1	●	●	●	●	●	●	●	●	●
ICSF 08 D1	●	●							
ICDG 32 L1	●	●	●	●					
Robot coupler	●	●							
Festo devices	●	●	●	●					
07 KR 91	●	●							
07 KT 92	●	●	●	●					
07 KT 93	●	●	●	●					
07 KR 31	●	●							
07 KT 31	●	●	●	●					

Explanation

● Feature is completely available. Settings and errors can be interrogated from the involved channel.

(●) Feature is partly available, see module description.

[1]) Concerning the interrogation of settings and diagnosis data, see the module description and chapter ”Reading I/O configuration and diagnosis data at the module” (see below).

BE Bus Error = Bus malfunction, always monitored. The module does not receive a call from the bus master, e.g. because of a broken bus line.

CI Cut Wire of Inputs = Open circuit (monitoring) at inputs, if configured. Each input circuit to be monitored has to be equipped with a resistor of 20...30 kΩ, e.g. in parallel to the signalling contact.

CO Cut Wire of Outputs = Open circuit (monitoring) at outputs, if configured. Each output expects a minimum load of approx. 40 mA when an ON signal is output.

ID Input Delay = Change of the signal delay time at inputs.

IO Input only = Each terminal (channel) can be configured so that it works only as an input (not as combined input/output).

OO Output only = This mode is set by means of a switch on the plug-in base ECZ. Setting is not possible by I/O configuration, see the module description.

OL Overload (is always monitored).

SC Short circuit (is always monitored).

UE Unit error = internal error (fault) of the module (always monitored in so far as the internal processor can detect this).

Analog modules, settings and diagnosis

Selectable ranges: I/O configurable **(K)** by means of switches **(S)** or wiring **(V)**				0–10 V	±10 V	0–20 mA	±20 mA	4–20 mA	other range	rough display of the value
Module type										
ICSE 08 A6	●	●		A	–	A	–	K	K	●
ICSE 08 B5	●	●		–	A	–	S,K	S,K	S,K	●
ICSA 04 B5	●	●	●	–	A	S	–	S,K *	–	●
ICSM 06 A6, inputs	●	●		A	–	A,V	–	K	A,K	●
ICSM 06 A6, outputs				–	A	A	–	K		●
Diagnosis functions according to the module type										
a) always available	UE	BE								
b) if configured			OE							
Can be read from the module by pressing the test button 1)										
a) Diagnosis messages	UE	BE								
b) Settings (only switches and I/O configuration)			OE	●	●	●	●	●		
Available for bus master user program, can be read on the terminal										
a) transferred cyclically	UE	BE								
b) can be interrogated			OE					●		

Explanation:

1) Concerning the interrogation of settings and diagnosis data, see the module description and chapter "Reading I/O configuration and diagnosis data at the module" (see below).

*) Changing range by switch, activating the open-circuit monitoring by I/O configuration

BE Bus Error = Bus malfunction, always monitored. The module does not receive a call from the bus master, e.g. because of a broken bus line.

OE Output Error = Error in the output circuit.
ICSA 04 B5: Open circuit at outputs configured to 4...20 mA.
ICSM 06 A6: Short circuit at outputs configured to ± 10 V.

UE Unit error = internal error (fault) of the module (always monitored in so far as the internal processor can detect this).

A Factory setting

K Changing the range by means of the I/O configuration via the CS31 system bus

S Changing the range by means of DIL switches on the rear side of the module

V Change-over between voltage and current by means of an additional external jumper. No specification if only another terminal has to be used.

A3.3.1 Performing and reading the I/O configuration

There are the following possibilities for system structures when using 07 KR 91, 07 KT 92 or 07 KT 93 as bus master:

- Performing and reading the I/O configuration via the user program of the bus master central unit 07 KR 91, 07 KT 92 or 07 KT 93,
- Performing and reading the I/O configuration by means of the terminal or
- Reading the I/O configuration from the remote modules.

Performing and reading the I/O configuration via the user program

The function block CS31CO is available for the I/O configuration of the modules. This function block is part of the programming software 907 PC 331 and is described in the corresponding documentation.

Performing and reading the I/O configuration by means of the terminal or TCZ

This method is based on the fact that the central units 07 KR 91, 07 KT 92 and 07 KT 93 use a dialogue language at the programming interface which allows the I/O configuration to be performed and interrogated by means of simple protocols; see volume 7.3, chapter 3, ”MAIL command”.

07 KR 91 and 07 KT 92/93 are generally equipped with the special function for I/O configuration.

The following devices can be used as terminal:

- A commercially available terminal equipped with an EIA–232 interface, such as VT100.
- A PC equipped with the programming software 907 PC 331. All the interface data are correctly set under the main menu item of ”PLC communication 2”, sub-item ”Terminal emulation”.
- The service device TCZ in the operating mode 1 = TERMINAL, 2 = CHAR.MODE, N = transmission speed unchanged, 9600 Baud.

Reading I/O configuration and diagnosis data at the remote module

Reading the I/O configuration and the diagnosis data for an I/O terminal of a remote module will be shown in the following for the device ICSC 08 L1 as an example. The test button 4 and the LED displays 1 of the module have to be used for this purpose.

When the test button is pressed for the first time, channel E/A0 (input/output 0) is selected: LED 0 flashes. After releasing the button, the diagnosis data of this channel are shown by the yellow LEDs 0 to 7 for approx. 3 seconds.

The LEDs have the following meaning:

0 UE = Unit error
1 BE = Bus error
2 not used
3 CI/CO = Cut wire of inputs/outputs
4 OL = Overload
5 SC = Short circuit
6 Configuration as output
7 Configuration as input

If the LEDs 6 and 7 light up at the same time, the channel is configured as a combined input/output.

The meaning of the LEDs 2 is also printed onto the front panel of the module.

The operation is repeated for the other channels each time the test button is pressed and released.

After the last channel E/A7 (input/output 7) has been scanned, pressing the test button again causes a lamp test (LED test) to be performed. All the 8 LEDs should light up. After the button has been released, the LEDs will show the setting of the DIL switch on the plug-in base for approx. 5 seconds. LED 0 shows the position of switch No. 1 (LEDs 0...7 are assigned to the switches No. 1...8).

All error messages are stored in the module and can only be deleted by pressing the test button for 10 seconds or by power OFF/ON.

A4 Diagnosis

A4.1 Introduction

The diagnosis system of the 07 KR 91 / 07 KT 92 / 07 KT 93 is designed to ensure a quick and efficient troubleshooting. For this purpose, it is classified:

- ”vertically” in diagnosis, error flags, reactions, LED displays and acknowledgement, see chapter A4.7. There are interrelations between the bus master central unit and the remote modules. The central unit reads the diagnosis data which the remote modules have found out. An acknowledgement in the central unit also causes the stored error messages in the remote modules to be deleted.
- ”horizontally” in 4 error classes, in correspondence with the severity of the error, see chapter A4.7.

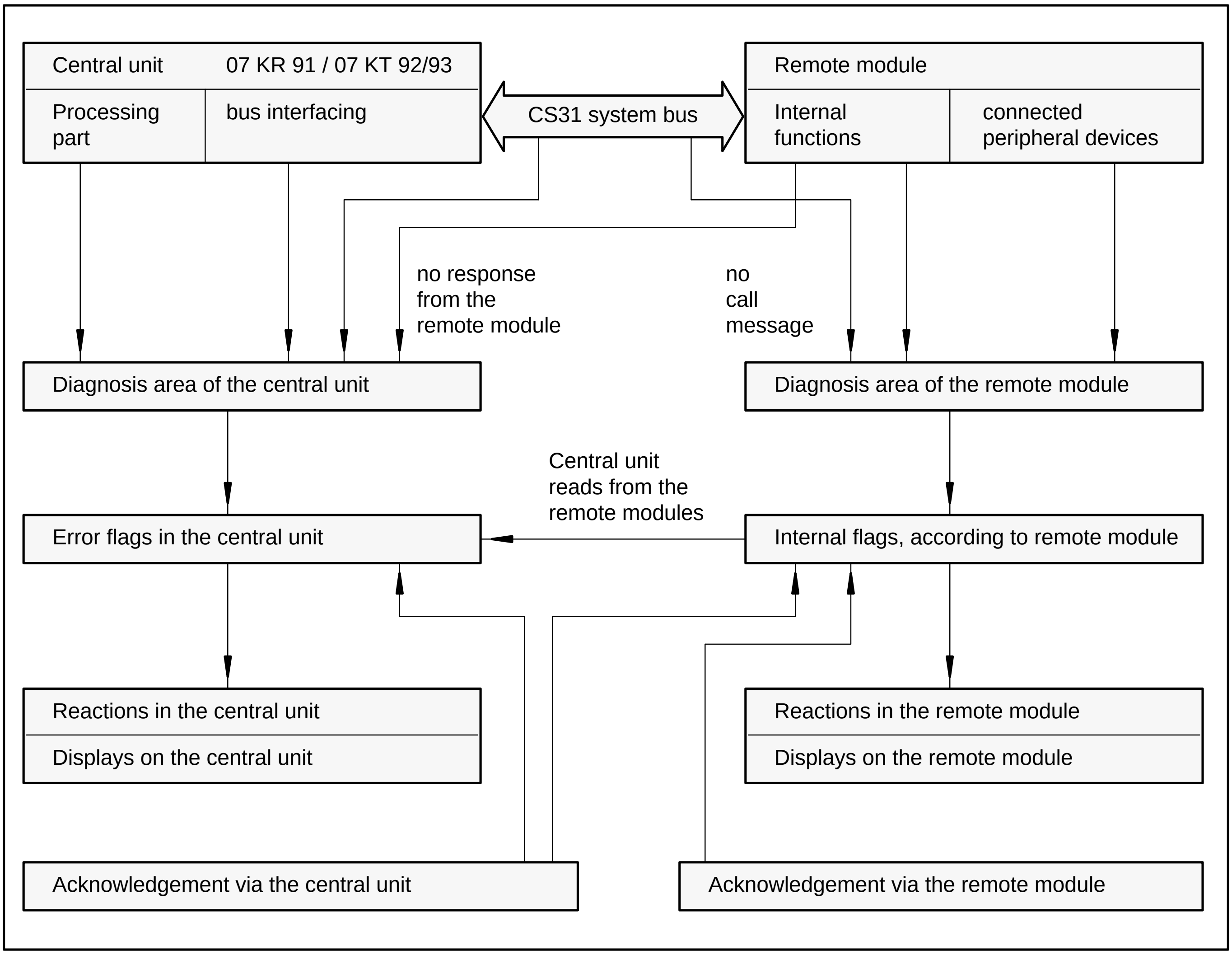
This concept is based on a system structure consisting of a bus master central unit and several remote modules, and remote processors as well. The diagnosis system detects the following errors:

- Errors in the bus master central unit
- Errors on the CS31 system bus
- Errors in the remote modules
- Errors in the wiring of the remote modules on the process side

The troubleshooting is performed as follows:

- The LEDs on the central unit 07 KR 91, 07 KT 92 and 07 KT 93 give first hints, see chapter A4.3. The errors detected by the remote modules are also displayed here.
- If these hints are not sufficient, the error flags have to be read out. For the meaning of the error flags, see chapters A4.7 and A4.10.
- The status register EW 07,15 in the central unit supplies additional information to be used for the diagnosis, see chapter A4.9.
- The remote modules indicate errors occurring in their area. Detailed information can be obtained by pressing the test key on the modules, see chapter A4.4.

A4.2 Structure of the diagnosis



A4.3 Troubleshooting by means of LED displays on the central unit

The LED displays on the front panel of the central unit supply initial information on the errors which occurred:

- BA = CS31 bus processor active
- BE = Bus Error (error on the CS31 system bus)
- RE = Remote Unit Error (error in/on a remote module)
- SE = Serial Unit Error (error in the CS31 bus interfacing of the central unit)
- RUN = User program is running (no error)
- FK1 = Error class 1 (fatal error)
- FK2 = Error class 2 (serious error)
- FK3 = Error class 3 (light error)
- Supply = Supply voltage available
- Battery = Battery is effective
- K = Overload/short circuit on at least one direct binary output of the central unit ZE 07 KT 92 or 07 KT 93

If no LED lights up, the central unit has not found any error. Exception: LED Battery (battery is missing); the battery is only necessary for certain applications.

LEDs for CS31 system bus and bus interfacing

LED / CPU	BA gn	BE rd	RE rd	SE rd	Meaning	Remedy
Stand-alone–CPU, master CPU or slave CPU	☆	□	□	□	Everything ok.	—
	□	X	X	X	A fatal error occurred. The watchdog switched off the CS31 system bus. All outputs are in OFF condition.	• Power OFF/ON. If unsuccessful, device is defective. • Evaluate the error flags.
	☆	□	□	☆	Dual–port RAM defective	• Power OFF/ON. If unsuccessful, device is defective. • Evaluate the error flags.
	□	☆	☆	☆	Initialization phase after power ON or after cold start.	—
Master CPU	☆	☆	□	□	Master CPU does not find any remote modules on the CS31 system bus <u>after</u> power ON or after cold start.	• Install remote modules. • Check the CS31 bus line. • Check the supply voltage of the remote modules. • Evaluate the error flags.
	☆	□	☆	□	Error message from a remote module	• Evaluate the error flags. • Check the remote modules.
	☆	☆	☆	□	1 remote module can suddenly not be controlled by the master CPU anymore.	• Evaluate the error flags. • Check the supply voltage of the remote module. • Check the CS31 bus line. • Check the remote module.
	☆	☆	□	□	There are at least 3 remote modules on the CS31 system bus. 2 remote modules can suddenly not be controlled by the master CPU anymore.	• Evaluate the error flags. • Check the supply voltage of the remote modules. • Check the CS31 bus line. • Check the remote modules.
	☆	☆	☆	☆	There are at least 2 remote modules on the CS31 system bus. Suddenly no remote module can be controlled by the master CPU anymore.	• Evaluate the error flags. • Check the supply voltage of the remote modules. • Check the CS31 bus line. • Check the remote modules.
Slave CPU	☆	□	⁂	□	CS31 system bus does not work.	• Check the CS31 bus line. • Check master central unit.

□ = LED off, ☆ = LED on, ⁂ = LED flashes, X = LED on or off, gn = green, rd = red

LEDs for user program and error display

CPU \ LED	RUN gn	FK1 rd	FK2 rd	FK3 rd	Meaning	Remedy
Stand-alone CPU, master CPU or slave CPU	☆	□	□	□	User program is running.	—
	☆	□	□	☆	User program is running, but a light error occurred.	• Evaluate the error flags and eliminate the error.
	□	□	□	□	The user program does not run.	• Start the user program.
	□	□	□	☆	A light error occurred which caused the user program to be aborted automatically because – the system constant KW 0,7 is not equal to 0, – the ”ABORT” block is not configured.	• Evaluate the error flags and eliminate the error.
	□	□	☆	□	A serious error occurred which caused the user program to be aborted automatically.	• Evaluate the error flags and eliminate the error, if possible.
	□	☆	□	□	A fatal error occurred. The user program cannot be started.	• Evaluate the error flags. • Power OFF/ON. If unsuccessful, device is defective.
	□	□	☆	☆	A light and a serious error occurred.	• Evaluate the error flags and eliminate the error, if possible.
	☆	☆	☆	☆	Initialization phase, power ON, cold start	—

□ = LED off, ☆ = LED on, ⁂ = LED flashes, X = LED on or off, gn = green, rd = red

LEDs for supply voltage and battery

CPU \ LED	Supply gn	Battery rd	Meaning	Remedy
Stand-alone CPU, master CPU or slave CPU	☆	□	Supply voltage available **and** battery is effective.	—
	☆	☆	Supply voltage available and battery is **not** effective.	—
	□	□	Supply voltage is not available.	• Switch power ON. • Check the supply voltage.

□ = LED off, ☆ = LED on, ⁂ = LED flashes, X = LED on or off, gn = green, rd = red

LED K for overload/short circuit on at least one direct binary output A 62,00...A 62,07 (A 62,15) (for 07 KT 92 and 07 KT 93 only)

CPU \ LED	K rt	Meaning	Remedy
Stand-alone CPU, master CPU or Slave CPU	☆	Overload/short circuit on at least one of the direct binary outputs A 62,00...A 62,07 (A 62,15).	• Eliminate overload/short circuit.
	□	There is no overload/short circuit.	—

□ = LED off, ☆ = LED on, ⁂ = LED flashes, X = LED on or off, gn = green, rd = red

A4.4 Troubleshooting on the remote modules

Diagnosis functions for the remote modules

The remote modules are equipped with a number of diagnosis functions. Some of these functions become active only if they have been set by means of the I/O configuration.

Diagnosis, display and messages to the central unit						
Diagnosis functions according to the module						
a) always available	UE	BE	OL	SC		
b) if configured					CI	CO
Readable on the module by pressing the test button [1]						
a) Diagnosis messages	UE	BE	OL	SC	CI	CO
Available for bus master user program, readable on the terminal						
a) cyclic transmission	–	–	OL	SC	CI	CO
Module type						
ICSI 08 D1	●	●			●	
ICSI 16 D1	●	●			●	
ICSI 08 E1	●	●				
ICSI 16 E1	●	●				
ICSI 08 E4	●	●				
ICSO 08 R1	●	●				
ICSO 08 Y1	●	●	●	●		
ICSO 16 N1	●	●	●	●		
ICSK 20 F1	●	●				
ICSK 20 N1	●	●	●	●		
ICSC 08 L1	●	●	●	●	●	●
ICSC 16 L1	●	●	●	●	●	●
ICSF 08 D1	●	●				
ICDG 32 L1	●	●	●	●		
ICSE 08 A6	●	●				
ICSE 08 B5	●	●				
ICSA 08 B5	●	●				●
ICSM 06 A6	●	●		●		
Robot coupler	●	●				
Festo devices	●	●	●	●		
07 KR 91	●	●				
07 KT 92	●	●	●	●		
07 KT 93	●	●	●	●		
07 KR 31	●	●				
07 KT 31	●	●	●	●		

Explanation:

● Feature is completely available. Settings and errors can be interrogated from the involved channel.

(●) Feature is partly available, see module description.

[1]) Concerning the interrogation of settings and diagnosis data, see the module description and chapter A3.3 ”Reading I/O configuration and diagnosis data at the module”.

BE Bus Error = Bus malfunction, always monitored. The module does not receive a call from the bus master. This may have the following reasons:

- The CS31 system bus line is broken, short-circuited or wired with reversed polarity.
- The central unit has< not been set as buster master, see also system constant KW 00,00 in chapter A7.3.

CI Cut Wire of Inputs = Open circuit (monitoring) at inputs, if configured. Each input circuit to be monitored has to be equipped with a resistor of 20...30 kΩ, e.g. in parallel to the signalling contact.

CO Cut Wire of Outputs = Open circuit (monitoring) at outputs, if configured. Each output expects a minimum load of approx. 40 mA when an ON signal is output.

OL Overload (is always monitored).

SC Short circuit (is always monitored).

UE Unit error = internal error (fault) of the module (always monitored in so far as the internal processor can detect this).

Troubleshooting in the remote modules

The LED 3 lights up, if the remote module has detected an error.

The remote module supplies detailed error information via the 8 LEDs 1 , it the test button 4 is pressed; see also the module descriptions.

The procedure will be explained in the following for the module ICSC 08 L1 as an example.

After the test button has been pressed for the first time, channel E/A0 (input/output 0) is selected: LED0 flashes. After the button has been released, The diagnosis data of this channel are shown via the yellow LEDs 0 to 7 for approx. 3 seconds.

The LEDs have the following meaning:

0 Error in the module (UE = Unit error)
1 Error on the bus (BE = Bus error)
2 not used
3 CI/CO = Cut wire of inputs/outputs
4 OL = Overload
5 SC = Short circuit
6 Configuration as output
7 Configuration as input

If the LEDs 6 and 7 light up at the same time, the channel is configured as a combined input/output.

The meaning of the LEDs (2) is also printed onto the front panel of the module.

The operation is repeated for the other channels each time the test button is pressed and released.

After the last channel E/A7 (input/output 7) has been scanned, pressing the test button again causes a lamp test (LED test) to be performed. All the 8 LEDs should light up. After the button has been released, the LED will show the setting of the DIL switch on the plug-in base for approx. 5 seconds. LED 0 shows the position of switch No. 1 (LEDs 0...7 are assigned to switches No. 1...8).

All the error messages are stored in the module and can only be deleted by pressing the test button for 10 seconds or by power OFF/ON.

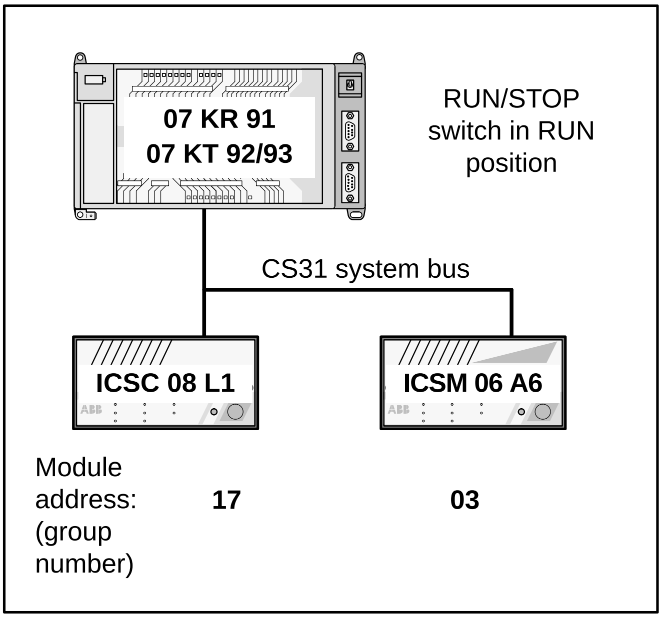
A4.5 Acknowledgement of error messages in the remote modules

The remote modules store and display the error messages detected independently of the central unit. The error messages can be acknowledged

- on the remote module by pressing the test button
- in the user program by means of the function block CS31QU (this also deletes the error message stored in the central unit)
- in the terminal mode by means of the command MAIL, see volume 7.3, chapter 3.

If the error has not been eliminated, the error message appears again.

A4.6 Example of an error message



Errors which occurred:

The bus line to the remote module having the module address 3 has been broken during operation.

Error flags in the central unit 07 KR 91 / 07 KT 92 / 07 KT 93:

It is assumed that the error flags have been set to 0 by acknowledgement/deletion before the error occurred. In the following, only those error flag will be listed the contents of which changes.

- M 255,10 = 1 Summation error message
- M 255,13 = 1 Error class message (FK3 error)
- MW 255,00 = 15 Error detection: remote module is disconnected
- MW 255,01 = 05 Module type: analog input and output
- MW 255,02 = 03 Group number (module address)
- MW 255,03 = 0
- MW 255,04 = 0 not concerned, as well as
- MW 255,05 = 0 all the other error flags
- MW 255,06 = 0 which have not been
- MW 255,07 = 0 mentioned

LED displays on the bus master central unit 07 KR 91 / 07 KT 92 / 07 KT 93:

- BA lights up → CS31 bus processor is active. The data communication with the remote module having the address 17 is continued.
- BE lights up → Bus Error, error on the CS31 system bus.
- RE lights up → Remote Unit Error, error on a remote module.
- SE off → Serial Unit Error, CS31 bus interfacing in the central unit works correctly.
- RUN lights up
- FK3 lights up → light error

Reaction of the bus master central unit 07 KR 91 / 07 KT 92 / 07 KT 93

The processing program and the bus operation continue running (if KW 0,7 = 0).
Reaction of the remote module ICSM 06 A6: All of the outputs turn to 0.
Reaction of the remote module ICSC 08 L1: Data exchange with the bus master central unit 07 KR 91 / 07 KT 92 / 07 KT 93.

Status word EW 07,15 in the central unit 07 KR 91 / 07 KT 92 / 07 KT 93

– Bit 0	= 1	no class 2 error
– Bit 1	= 0	only applicable for 07 KR 91 / 07 KT 92 / 07 KT 93 used as slave
– Bit 2	= 1/0	Date/time of the real-time clock valid / not valid
– Bit 3	= 1/0	Battery effective / not effective
– Bit 4...7		not used
– Bit 8...15	= 2	max. number of modules connected to the CS31 system bus which have been found since the last power-on operation. Will not be altered by the error which has occurred in the meantime.

Acknowledgement of the error flags in the central unit 07 KR 91 / 07 KT 92 / 07 KT 93

Eliminate the error before acknowledgement. Otherwise the error message will appear again.

The bit flags M 255,10 and M 255,13 can be acknowledged by:

- power ON
- program ”Start” (on-line in the programming software 907 PC 331)
- cold start (menu item in 907 PC 331)
- setting the RUN/STOP switch to RUN
- overwriting the flag M 255,13 with ”0” in the user program
- overwriting the flag M 255,13 with ”0” by means of the operating function ”Overwrite”, see volume 7.3, chapter 3
- using the function block CS31QU in the user program. The block is applicable only for errors which concern the CS31 system bus. It also deletes the error message in the remote module.

The relevant LEDs turn off upon the acknowledgement.

The word flags MW 255,00...MW 255,07 can only be deleted by overwriting them. They are overwritten by newly occurring errors.

Acknowledgement of error flags in the remote module ICSM 06 A6

- on the module by pressing the test button for a longer time
- in the user program of the central unit using the CS31QU block
- in the terminal mode by means of the MAIL command, see volume 7.3, chapter 3.

A4.7 Error flags in the central unit, error classification

The central unit offers error messages for the user program which are classified into 4 error classes (FK1...FK4) according to their severity. The error messages are stored in error flags and can be used in the user program and be read by the programming system.

The following table gives you an overview of the error flags.

Error class	**FK1** = fatal error	**FK2** = serious error	**FK3** = light error	**FK4** = warning
General feature of the error class, examples	Save operation of the operating system is no longer ensured. <u>Error examples:</u> – Checksum error in the operating system EPROM – Write/read error when testing the operating system RAM	The operating system works correctly, but the error-free processing of the user program is not guaranteed. <u>Error examples:</u> – Checksum error in the user program (Flash EPROM) – Write/read error when testing the user RAM	The choice whether the user program has to be aborted by the operating system or not depends on the application. The user decides which reactions are to be initiated. <u>Error examples:</u> – Flash EPROM can- not be programmed – Dual port RAM to the CS31 part (LED SE) is faulty – Remote module has failed (LED RE)	Errors which occur on peripheral devices or which will show their effect only in the future. The user decides which reactions are to be initiated. <u>Error examples:</u> – Short circuit on a remote module
Summation error message [1]	M 255,10			
Error class message (if 1, an error exists)	M 255,11	M 255,12	M 255,13	M 255,14
Error detection (word) [2]	MW 254,00	MW 254,08	MW 255,00	MW 255,08
Detailed info 1 (word) [2]	MW 254,01	MW 254,09	MW 255,01	MW 255,09
Detailed info 2 (word) [2]	MW 254,02	MW 254,10	MW 255,02	MW 255,10
Detailed info 3 (word) [2]	MW 254,03	MW 254,11	MW 255,03	MW 255,11
Detailed info 4 (word) [2]	MW 254,04	MW 254,12	MW 255,04	MW 255,12
Detailed info 5 (word) [2]	MW 254,05	MW 254,13	MW 255,05	MW 255,13
Detailed info 6 (word) [2]	MW 254,06	MW 254,14	MW 255,06	MW 255,14
Detailed info 7 (word) [2]	MW 254,07	MW 254,15	MW 255,07	MW 255,15
LED displays after initialization	FK1 lights up or LED RUN does not go on, if RUN/STOP switch is set to RUN	FK2 lights up or LED RUN does not go on, if RUN/STOP switch is set to RUN	FK3 lights up. In addition, according to error type: LED BE (Bus Error) LED RE (Remote Unit Error) LED SE (Serial Unit Error)	LED RE (Remote Unit Error) lights up
Reaction when switching on the central unit / Reaction during operation	All the outputs remain set to 0 or are set to 0. The programming system does not have access. **Attention:** Both processors of the central unit monitor each other mutually, thus facilitating a powerful diagnosis. If the safety requirements are higher, use specially approved controllers.	All the outputs remain set to 0 or are set to 0. The programming system can get access. The user program is not started or is aborted.	You can choose in case of an error: – Just report the error: Evaluate the error flag M 255,13 – Abort the user program: Set system constant KW 0,7 = 1 (FK3_REAK) or M 255,13 to the func- tion block ABORT	Evaluation of the error messages using the user program
Acknowledgement of the summation error message / of the error class message	– Power ON – Cold start	– Power ON – Cold start	– Power ON / cold start – Set the RUN/STOP switch to RUN – Start the program using 907 PC 331 – Set M 255,13 or M 255,14 to 0 – In case of CS31 error: function block CS31QU	

[1]) The summation error flag M 255,10 becomes 1, if at least one of the error class flags is set to 1. If M 255,10 = 0, the central unit has not found any error.
The summation error flag is deleted automatically when the error class flags are acknowledged.

[2]) The central unit enters the last found error into the relevant error flag record for each error class. The entry is made at the end of the program cycle and remains unchanged during the next running program cycle. The word flags can only be acknowledged by overwriting them with ”0”.

A4.8 Acknowledgement of error messages in the central unit

Error messages remain stored and will be displayed until they are acknowledged. The following applies:

- The summation error message, the error class messages (bit flags) and the relevant LEDs FK1, FK2 and FK3 are reset with power ON, for example. For other possibilities for resetting/acknowledging them, see chapters A4.5 to A4.8.

- The error identifiers and the detailed information (word flags) have to be reset by means of the user program or by means of the operating function ”Overwrite”, see volume 7.3, chapter 3. They are also reset when a cold start is performed or by a power-fail, if no back-up battery is effective.

The error message will appear again, if the error has not been eliminated.

A4.9 Additional diagnosis functions

Status word EW 07,15

The following data are continuously updated in the status word EW 07,15:

– Bit 0: This bit is valid for the stand-alone PLC, for the master PLC and for the slave PLC.
Bit 0 = 1, There is *no error* of class 2.
Bit 0 = 0, There is *an error* of class 2.

– Bit 1: This bit is valid only for the slave PLC.
Bit 1 = 1, The slave PLC is adopted into the bus cycle of the master PLC.
Bit 1 = 0, The slave PLC is *not* adopted into the bus cycle of the master PLC.

– Bit 2: This bit is valid for the stand-alone PLC, for the master PLC and for the slave PLC.
Bit 2 = 1, Date and time of the real-time clock *are valid.*
Bit 2 = 0, Date and time of the real-time clock *are not valid.*

– Bit 3: This bit is valid for the stand-alone PLC, for the master PLC and for the slave PLC.
Bit 3 = 1, Battery is *effective.*
Bit 3 = 0, Battery is *not effective.*

– Bits 4..7 are not used

– Bits 8...15: *Maximum* number of remote modules which have been existing in the CS31 bus cycle of the master PLC since the last power-ON or since the last cold start. Their number may be larger than the number of the remote modules which are *currently* existing in the CS31 bus cycle.

A4.10 Meaning of the contents of the error word flags

Explanation of the following table:

– Address = Memory address at which the error was detected.

– Group number = Module address of the remote module

– Channel number = Number of the faulty channel

– Module type Meaning

Module type	Meaning
000	Binary input
001	Analog input
002	Binary output
003	Analog output
004	Binary input/output
005	Analog input/output
255	Bus master or slave central unit in which the error has occurred and is stored.

Error class	Error description	Error identifier in MW 254,00 **D**ec **H**ex	Detailed info **1** in MW 254,01	Detailed info **2** in MW 254,02	Detailed info **3** in MW 254,03	Further detailed infos in MW 254,04 : MW 254,07
FK1 Fatal error	Checksum error of the system EPROM	**1**$_D$ **1**$_H$	–	–	–	–
	Operating system of the central unit is defective, or a defective RAM is detected when a cold start is performed (complete RAM test)	**2**$_D$ **2**$_H$	Address	–	–	–

Error class	Error description	Error identifier in MW 254,08 **D**ec **H**ex	Detailed info **1** in MW 254,09	Detailed info **2** in MW 254,10	Detailed info **3** in MW 254,11	Further detailed info in MW 254,12 : MW 254,15
FK2 Serious error	RAM defective (user program or operand memory)	**128$_D$ 80$_H$**	Address	–	–	–
	Illegal master-slave identifier	**129$_D$ 81$_H$**	–	–	–	–
	A serious error has occurred when the CS31 bus interfacing was initialized. The CS31 bus processor does not give any response to the PLC side within the specified time.	**130$_D$ 82$_H$**	–	–	–	–
	PLC is overloaded, cycle time is too short.	**131$_D$ 83$_H$**	–	–	–	–
	An error which cannot specified in detail is detected by the operating system during the execution time.	**132$_D$ 84$_H$**	–	–	–	–
	Checksum error in the Flash EPROM	**133$_D$ 85$_H$**	–	–	–	–
	CS31 bus processor does not send an OK response to the PLC after a cold start command issued by the PLC.	**134$_D$ 86$_H$**	–	–	–	–
	Error detection not used at the moment.	**135$_D$ 87$_H$**	–	–	–	–
	CS31 bus processor reports an error via EW 07,15 bit 0. This bit is checked before each start of the PLC program.	**136$_D$ 88$_H$**	–	–	–	–
	An illegal value has been configured (KW 00,10 or KW 00,11) for specifying the size of the I/O area between the master PLC and the slave PLC.	**137$_D$ 89$_H$**	–	–	–	–
	More timers than available in the PLC were required during the execution time.	**257$_D$ 101$_H$**	–	–	–	–
	An unknown operator/block is detected in the user program during the execution time.	**258$_D$ 102$_H$**	–	–	–	–
	The CS31 bus processor does not work correctly. Therefore it does not authorize the operating processor to access the dual-port RAM.	**259$_D$ 103$_H$**	–	–	–	–

Error class	Error description	Error identifier in MW 255,00 **D**ec **H**ex	Detailed info **1** in MW 255,01	Detailed info **2** in MW 255,02	Detailed info **3** in MW 255,03	Further detailed info in MW 255,04 : MW 255,07
FK3 Light error	Remote module disconnected	**15**$_{\mathbf{D}}$ **F**$_{\mathbf{H}}$	Module type	Group number	–	–
	CS31 bus error (there is no remote module on the bus) **Note:** If there are only analog modules connected to the CS31 system bus, this error message may occur when the supply voltage is switched on although the analog modules have been correctly adopted into the CS31 bus cycle after a certain time. **Reason:** The analog modules have a long initialization time. After this time is over, they only now appear at the CS31 bus as remote modules. During the initialization time the master PLC cannot recognize them.	**16**$_{\mathbf{D}}$ **10**$_{\mathbf{H}}$	–	–	–	–
	The Flash EPROM is not programmable.	**128**$_{\mathbf{D}}$ **80**$_{\mathbf{H}}$	Address of defective memory cell	–	–	–
	The Flash EPROM cannot be deleted.	**129**$_{\mathbf{D}}$ **81**$_{\mathbf{H}}$	Address of the memory cell which cannot be deleted	–	–	–
	The PLC application mode configured in the system constant KW 00,00 has not been activated yet. Please perform activation (see also system constant KW 00,00).	**130**$_{\mathbf{D}}$ **82**$_{\mathbf{H}}$	Value of KW 00,00 activated last	Value of KW 00,00 not yet activated	–	–
	CRC error in Flash EPROM	**131**$_{\mathbf{D}}$ **83**$_{\mathbf{H}}$	Address of the block with CRC error	Segment address of the block with CRC error	–	–

Error class	Error description	Error identifier in MW 255,08 **D**ec **H**ex	Detailed info **1** in MW 255,09	Detailed info **2** in MW 255,10	Detailed info **3** in MW 255,11	Further detailed info in MW 255,12 : MW 255,15
FK4 Warning	Internal error of a remote module	**1** $_D$ **1** $_H$	Module type	Group number	Channel number	–
	Cut wire (open circuit)	**2** $_D$ **2** $_H$	Module type	Group number	Channel number	–
	Wrong level of an analog output	**3** $_D$ **3** $_H$	Module type	Group number	Channel number	–
	Overload	**4** $_D$ **4** $_H$	Module type	Group number	Channel number	–
	Overload + short circuit	**6** $_D$ **6** $_H$	Module type	Group number	Channel number	–
	Short circuit	**8** $_D$ **8** $_H$	Module type	Group number	Channel number	–
	Short circuit + cut wire	**10** $_D$ **A** $_H$	Module type	Group number	Channel number	–
	Overload + short circuit	**12** $_D$ **C** $_H$	Module type	Group number	Channel number	–
	Short circuit + overload + cut wire	**14** $_D$ **E** $_H$	Module type	Group number	Channel number	–
	There is no user program when the system is started.	**128** $_D$ **80** $_H$	–	–	–	–
	During start-up, the system detects that the program end is missing	**129** $_D$ **81** $_H$	–	–	–	–
	During start-up, the system detects that the number of block parameters has not been specified correctly for a certain block.	**130** $_D$ **82** $_H$	Program address of the block	Progr. addr. of the faulty block parameter	–	–
	During start-up, the system detects a syntax error in the user program.	**131** $_D$ **83** $_H$	Program address	–	–	–
	During start-up, the system detects that the historical value memory is too small.	**132** $_D$ **84** $_H$	–	–	–	–
	During start-up, the system detects that no cycle time has been set.	**133** $_D$ **85** $_H$	–	–	–	–
	During start-up, the system detects that there are bracketing errors in the user program.	**134** $_D$ **86** $_H$	Program address	–	–	–
	During start-up, the system detects that the target label for a conditional jump is missing.	**135** $_D$ **87** $_H$	Program address	–	–	–

Error class	Error description	Error identifier in MW 255,08 **D**ec **H**ex	Detailed info **1** in MW 255,09	Detailed info **2** in MW 255,10	Detailed info **3** in MW 255,11	Further detailed info in MW 255,12 : MW 255,15
FK4 Warning	Internal error (non-maskable internal interrupt has occurred)	**136_D 88_H**	–	–	–	–
	Internal error (an inhibited interrupt has occurred)	**137_D 89_H**	–	–	–	–
	The PLC program is not started because the number of remote modules which are adopted into the CS31 bus cycle is smaller than the number configured in KW 00,09.	**138_D $8A_H$**	Configured number of remote modules (KW 00,09)	Actual number of modules connected to the CS31 bus cycle	–	–
	The PLC does not access the process inputs and outputs yet because the number of remote modules which are adopted into the CS31 bus cycle is smaller than the number configured in KW 00,09.	**139_D $8B_H$**	Configured number of remote modules (KW 00,09)	Actual number of modules connected to the CS31 bus cycle	–	–

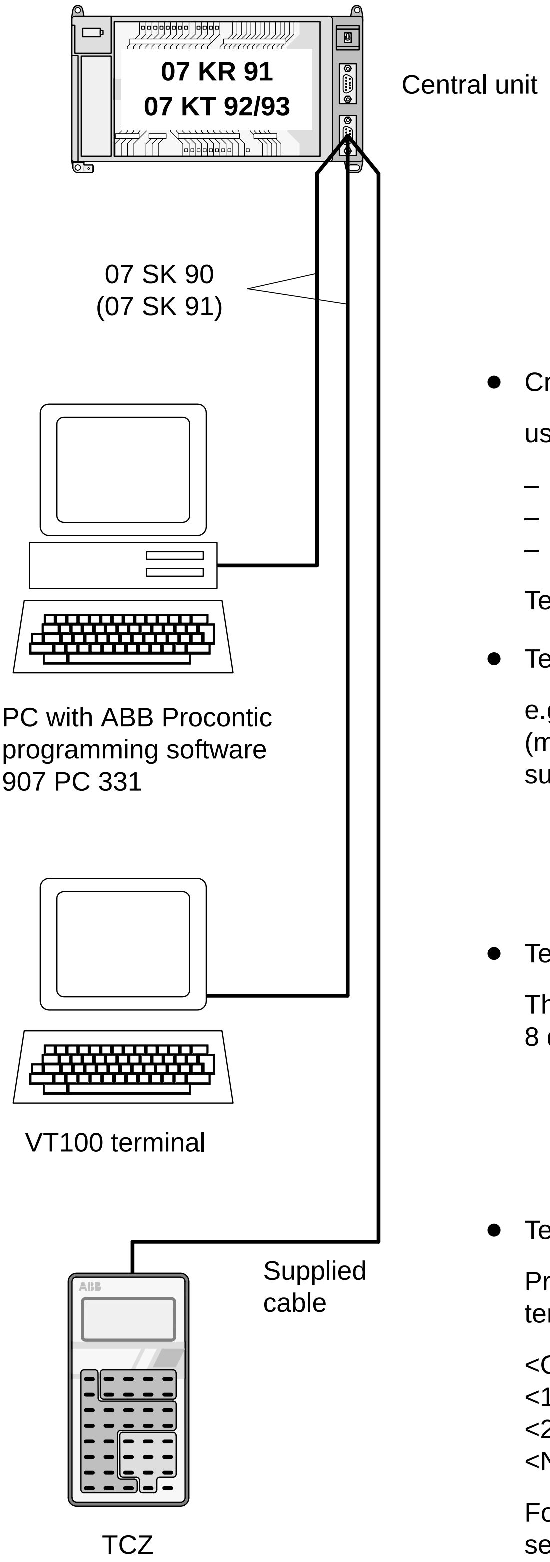
A4.11 Reaction on the bus master central unit and the remote modules in case of errors

No.	Error	Display/reaction of the bus master central unit	Display/reaction of the input/output remote modules	Display/reaction of the slave central units
1	Bus master central unit has failed, e.g. because of power failure	No display, all outputs are off.	LED 3 lights up. All the outputs are turned to 0.	07 KR 91 / 07 KT 92/93: – LED BA is on LED RE flashes – Bit 1 = 0 in the status word EW 07,15 07 KR 31 / 07 KT 31: – Error LED flashes – Bit 1 = 0 in the status word EW 07,15
2	Bus master function of the central unit (Serial Unit) has failed, e.g. the bus processor is defective	Displays: FK2 = Serious error RE = Remote Unit Error SE = Serial Unit Error Flags: M 255,10 = 1 M 255,12 = 1 for further flags see A4.7		
3a 3b	CS31 system bus is disconnected (all the remote modules are disconnected) or CS31 system bus is short-circuited	Displays: FK3 = Light error BE = Bus Error RE = Remote Unit Error SE = Serial Unit Error Flags: M 255,10 = 1 M 255,13 = 1 for further flags see A4.7		
4a	CS31 system bus is disconnected (the remote modules are only disconnected in part)	Displays: FK3 = Light error BE = Bus Error SE = Serial Unit Error Flags: M 255,10 = 1 M 255,13 = 1 for further flags see A4.7	Remote modules **without** connection to the bus master central unit: same as 1	Slave central units **without** connection to the bus master central unit: same as 1
4b			Remote modules **with** connection to the bus master central unit: no display/reaction	Slave central units **with** connection to the bus master central unit: no display/reaction
5a	A remote module has been lost on the CS31 system bus. Cause:	Displays: RE = Remote Unit Error Flags: M 255,10 = 1 M 255,13 = 1 for further flags see A4.7	Remote modules **with** connection to the bus master central unit: no display/reaction	Slave central units **with** connection to the bus master central unit: no display/reaction
5b	No connection to the CS31 system bus		Remote modules **without** connection to the bus master central unit: same as 1	Slave central unit **without** connection to the bus master central unit same as 1
5c	defective remote module		not clear	Error class FK1 / FK2, all outputs turn to 0.
5d	Power failure		all outputs turned to 0	all outputs turned to 0
6a	An error has occurred at the inputs or outputs of a remote module, e.g. a short circuit.	same as 5	Concerned remote module: LED 3 light up, the LEDs 1 supply by means of the test button 4 detailed infos.	Concerned 07 KT 92/93: LED K = Short circuit 07 KT 31: Error LED is ON Flags (07 KT 92 / 07 KT 93/ 07 KT 31): M 255,10 = 1 M 255,14 = 1 for further flags see A4.7
6b			Not concerned remote modules: no display/reaction	Not concerned slave central units: no display/reaction

Reaction on the bus master central unit and the remote modules in case of errors (continued)

No.	Error	Display/reaction of the bus master central unit	Display/reaction of the input/output remote modules	Display/reaction of the slave central units
7a	Two remote input modules of the same type have been set to the same address.	The error is detected only when the signal statuses of the two modules become different. The message is faulty in this case, and the modules are considered to be disconnected. Display: RE = Remote Unit Error Flags: M 255,10 = 1 M 255,13 = 1 for other flags see A4.7 / A4.10	Concerned modules: same as 1 Other modules: no display/reaction	same as 1
7b	Two remote modules of the same type have been set to the same address.	No reaction, unless there is a large distance between the remote modules.	Faultless operation of the two modules, unless they are far apart from each other.	Not applicable because inputs and outputs are always present.
7c	Two remote modules of different types, but with overlapping ranges have been set to the same address, e.g. ICSI 16 D1 and ICSK 20 F1.	The error is already detected during the initialization. The two remote modules are not adopted into the bus cycle.	Concerned modules: same as 1 Other modules: no display/reaction	Concerned modules: same as 1 Other modules: no display/reaction
7d	Address 62 or 63 has been set to a binary remote module.	Is not detected.	– Output of the signals in parallel to the bus master – Input signals are ignored.	–
7e	An address higher than 5 has been set to an analog remote module.	Is not detected.	same as 1	–

A5 Programming and test



- Creation of the user program

  using the programming languages

  – Extended instruction list (ext. IL)
  – Function block diagram (FBD) and
  – Ladder diagram (LD)

  Test in ext. IL, FBD and LD (see 907 PC 331)

- Test in terminal mode,

  e.g. in the programming software 907 PC 331
  (main menu ”PLC commun. 2”,
  submenu ”Terminal emulation”)

- Test

  The terminal interface has to be set to 9600 baud, 8 data bits, no parity bit and 1 stop bit.

- Test

  Press the following <keys> in order to activate the terminal mode:

  <CR>,
  <1> for TERMINAL,
  <2> for CHAR. MODE and
  <N> for data rate unchanged.

  For the interfacing to the 07 KR 91 / 07 KT 92/93 see the following.

In order to establish the connection between the programming and test tools *and* the central unit 07 KR 91 / 07 KT 92 / 07 KT 93, the serial interface COM1 of the central unit 07 KR 91 / 07 KT 92 / 07 KT 93 has to be set to ”Active mode” in all cases, see chapter ”Serial interface COM1” in the description of the central unit.

A6 Man-machine communication (MMC)

A7 Operands of 07 KR 91, 07 KT 92 and 07 KT 93 (variables and constants)

A7.1 Freely available variables and constants

Inputs

E 00,00...E 61,15	:	Binary inputs, CS31 remote modules
E 62,00...E 63,03	:	Binary inputs of the central unit 07 KR 91
E 62,00...E 62,11	:	Binary inputs of the central unit 07 KT 92
E 62,00...E 63,07	:	Binary inputs of the central unit 07 KT 93
E 63,14 and E 63,15	:	High-speed binary inputs ($T_D = 8\ \mu s$), signal is identical to E 62,00 and E 62,01
E 63,13	:	High-speed counter, interrogation of ”Zero crossing”
EW 00,00...EW 05,15	:	Analog inputs, CS31 remote modules
EW 06,00...EW 06,03	:	Analog inputs of the central unit 07 KT 92
EW 06,15	:	High-speed counter, interrogation of the counter content
EW 07,00...EW 07,07	:	reserved
EW 07,08...EW 07,14	:	Reading of the real-time clock
EW 07,15	:	Status for CS31 system bus, clock, battery

Outputs

A 00,00...A 61,15	:	Binary outputs, CS31 remote modules
A 62,00...A 62,11	:	Binary outputs of the central unit 07 KR 91
A 62,00...A 62,07	:	Binary outputs of the central unit 07 KT 92
A 62,00...A 62,15	:	Binary outputs of the central unit 07 KT 93
A 62,00	:	High-speed counter, direct output of ”Counter zero crossing” after activation
A 63,13...A 63,15	:	High-speed counter, enabling, activation of E 62,01 and A 62,00, adoption of start value
AW 00,00...AW 05,15	:	Analog outputs, CS31 remote modules
AW 06,00...AW 06,01	:	Analog outputs of the central unit 07 KT 92 (–10V...+10V)
AW 06,15	:	High-speed counter, ”Start value”

Internal operands

M 00,00...M 255,09	:	Binary flags
S 00,00...S 127,15	:	Steps
K 00,00...K 00,01	:	Binary constants
MW 00,00...MW 253,15	:	Word flags
KW 01,00...KW 39,15	:	Word constants
MD 00,00...MD 31,15	:	Double word flags
KD 00,01...KD 07,15	:	Double word constants

Time values for time functions

KD yy,xx : Time values for time functions such as ESV, ASV etc. are configured as *double word constants* or as
MD yy,xx : *double word flags.* Only integral multiples of 5 ms are permitted.

A7.2 System constants / diagnosis flags / CS31 status (overview)

Setting the operating modes

The constants KW 00,00...KW 00,15 are reserved as system constants. Even the constants KW 00,13...KW 00,15 which are not used yet may *under no circumstances* be used for other purposes.

KW 00,00	:	Setting the PLC operating modes, (Stand-alone PLC, Master PLC, Slave PLC)
KW 00,01	:	Initialization: bit flag area
KW 00,02	:	Initialization: word flag area
KW 00,03	:	Initialization: double word flag area
KW 00,04	:	Initialization: step chain flag area
KW 00,05	:	Initialization: historical values
KW 00,06	:	Application modes of the serial interface COM 1
KW 00,07	:	PLC reaction to class 3 errors

KW 00,08 : PLC reaction to an overload/short-circuit at the transistor outputs A 62,00...A 62,07 (A 62,15) (07 KT 92 and 07 KT 93 only)
KW 00,09 : Initialization of the CS31 system after power ON, warm start or cold start
KW 00,10 : Size of the transmitting area of the slave PLC
KW 00,11 : Size of the receiving area of the slave PLC
KW 00,12 : Automatic warm start after an FK2 error

Setting the cycle time

KD 00,00 : The cycle time of the PLC program is preset with this constant. The cycle time is given in the unit of measurement milliseconds. Only integral multiples of 5 ms are permitted.

Error diagnosis

Summation error display		:	M 255,10 indicates, that the PLC has detected an error
Fatal error,	FK1	:	M 255,11 = 1 i.e. error detected, detailed information in MW 254,00...MW 254,07
Serious error,	FK2	:	M 255,12 = 1 i.e. error detected, detailed information in MW 254,08...MW 254,15
Light error,	FK3	:	M 255,13 = 1 i.e. error detected, detailed information in MW 255,00...MW 255,07
Warning,	FK4	:	M 255,14 = 1 i.e. error detected, detailed information in MW 255,08...MW 255,15

First-cycle detection

M 255,15

This binary flag can be used for detection of the *first* program cycle after a program start. It is always set to ”zero” after each program start, independent of the initialization instructions given by the system constants. If this flag is read by the user program and then set to ”1”, it can be found out whether or not the user program was started once more.

CS31 status word

EW 07,15

Bit 0 = 1 : No class 2 error present.
Bit 1 = 1 : PLC has been adopted into the CS31 bus cycle (only relevant if used as a slave).
Bit 2 = 1 : Time and date are valid.
Bit 3 = 1 : Battery is effective.
Bit 4...7 : Not used.
Bit 8..15 : Maximum number of modules on the CS31 system bus, found out until now (only relevant if used as a master).

A7.3 System constants / Setting of operating modes

- **Definitions**

Cold start

- All of the RAM memories are tested and deleted.
- If there is *no user program* in the Flash–EPROM, the default values are set to all of the system constants (identical to the factory settings).
- If there is *a user program* in the Flash–EPROM, this program is loaded into the RAM including the system constants.
- The operating modes given by the system constants are set.
- The CS31 system bus is initialized again(only when used as a master on the CS31 system bus).

Performing a cold start

- Power OFF/ON, if there is *no* backup battery or
- Command KALT <CR> in terminal mode (see volume 7.3) or
- Menu field ”Cold start” in the programming system

Warm start

- All of the RAM memories, with the exception of the program memory and the operand memory (flags), are tested and deleted.
- If there is a *user program* in the Flash–EPROM, this program is loaded into the RAM including the system constants.
- The operating modes given by the system constants are set.
- The CS31 system bus is initialized again(only when used as a master on the CS31 system bus).

Performing a warm start

- Power OFF/ON, if there is a backup battery or
- Command WARM <CR> in terminal mode (see volume 7.3) or
- Menu field ”Release PLC mode” in the programming system

- **Operating mode: Master PLC, Slave PLC or Stand–alone PLC**
  - Absolute identifier: KW 00,00
  - Symbolic identifier: MAST_SLV
  - Meaning of the value of the constants:
    - Master PLC at the CS31 system bus –1 ($FFFF_H$)
    - Stand-alone PLC –2 ($FFFE_H$)
    - Slave PLC at the CS 31 system bus module address

      CS31 module addresses 0...61

- Range of values: –2, –1, 0...61
- Default value: –2 (Stand-alone)

Important!

The change of the PLC operation mode is carried out in three steps:

1. Change system constant KW 00,00 in the PLC
2. Save PLC program in the Flash EPROM
3. Activate new PLC operating mode with the following steps:
   - Call menu point ”Release PLC mode” in the ABB programming and test system or
   - perform a warm start or
   - perform a cold start.

- **Back-up of data areas**

  Back-up of data areas, i.e. saving of data during power OFF/ON, is only feasible with built-in battery. The following data can be backed, completely or partly:

  - Binary flags
  - Word flags
  - Double word flags
  - Step chains
  - Historical values

  In order to back-up certain data, they have to be excluded from initialization to 0.

- **Initialization of data areas**

  During *program start,* that data areas are initialized to 0 partly or completely, that are defined by system constants. The initialization works as shown in the following table.

If no battery is effective or if the system constants are in their default values (factory settings), all of the above mentioned data areas are completely set to 0 after power OFF/ON.

Conditions, —> Action	Flags, step chains, and historical values which are initialized (set to 0)
No battery available, —> Power ON	all
Menu item —> Abort —> Cold start	all
Battery effective, RUN/STOP switch to RUN, —> Power ON	according to the values of the system constants (see below)
RUN/STOP switch, —> RUN	according to the values of the system constants (see below)
Menu item —> Abort —> Start	according to the values of the system constants (see below)

Initialization: Binary flags

- Absolute identifier: KW 00,01
- Symbolic identifier: INIT_M

Value **n** of the system constant KW 00,01	Binary flag areas which are initialized (set to 0)
n = 0 (default)	M 000,00...M 255,15
n = 1...255	M n,00...M 255,15
n < 0, n > 255	M 255,10...M 255,15

- Example: KW 00,01 = 52

  Initialized is: M 52,00...M 255,15

  Backed is: M 00,00...M 51,15

  Precondition: Battery is available

Initialization: Word flags

– Absolute identifier: KW 00,02
– Symbolic identifier: INIT_MW

Value **n** of the system constant KW 00,02	Word flag areas which are initialized (set to 0)
n = 0 (default)	MW 000,00...MW 253,15
n = 1...253	MW n,00...MW 253,15
n < 0, n > 253	no initialization

Initialization: Double word flags

– Absolute identifier: KW 00,03
– Symbolic identifier: INIT_MD

Value **n** of the system constant KW 00,03	Double word flag areas which are initialized (set to 0)
n = 0 (default)	MD 00,00...MD 31,15
n = 1...31	MD n,00...MD 31,15
n < 0, n > 31	no initialization

Initialization: Step chains

– Absolute identifier: KW 00,04
– Symbolic identifier: INIT_S

Value **n** of the system constant KW 00,04	Step chain areas which are initialized (set to 0)
n = 0 (default)	S 000,00...S 127,15
n = 1...127	S n,00...S 127,15
n < 0, n > 127	no initialization

Initialization: Historical values

– Absolute identifier: KW 00,05
– Symbolic identifier: INIT_VW

Value **n** of the system constant KW 00,05	Historical values which are initialized (set to 0)
n = 0 (default)	Initialization of all historical values
n < 0, n > 0	no initalization

- **Application mode: Serial interface COM1**
  – Absolute identifier: KW 00,06
  – Symbolic identifier: MODE_SST
  – Default value: 0

Table: Conditions for the settings of the operating modes of the COM1 interface

RUN/ STOP switch	System constant KW00,06	System cable/ device	Mode set by this
STOP	x	x	Active
RUN	1	x	Active
	2	x	Passive
	0, <0, >2	07 SK 90	Active
		07 SK 91, TCZ	Passive

x: without effect

  – A change of this system constant becomes effective:
    – immediately

- **SPS reaction to class 3 errors**
  – Absolute identifier: KW 00,07
  – Symbolic identifier: FK3_REAK
  – Meaning of the value of the constant:
    Just output error: 0
    Output error and abort PLC program <0, >0
  – Range of values: <0, =0, >0
  – Default value: 0
    i.e. just output error
  – A change of this system constant becomes effective:
    – immediately

- **PLC reaction to the occurrence of an overload/ short circuit at the direct transistor outputs A 62,00...A 62,07...A 62,15 (07 KT 92 and 07 KT 93 only)**
  – Absolute identifier: KW 00,08
  – Symbolic identifier: ÜLAST_REAK
  – Meaning of the value of the constant:
    Overloaded output is switched on again automatically: 0
    Overloaded output is **not** switched on again automatically: 1
    If another value than 0 or 1 is given, the PLC selects the standard setting ”automatic reset”

– Range of values: 0, 1
– Default value: 0
i.e. the overloaded output is switched on again automatically by the PLC.

Important!

The change of the PLC reaction on an overload/short-circuit is carried out in three steps:

1. Change system constant KW 00,08 in the PLC
2. Save PLC program in Flash EPROM
3. Activate new PLC operating mode with the following steps:
   – perform a warm start or
   – perform a cold start.

- **Initialization of the CS31 system after power ON, warm start or cold start**
  – Absolute identifier: KW 00,09
  – Symbolic identifier: HOCHFAHR
  – This system constant is only effective if the central unit is configured as a bus master.
  – Meaning of the value of the constants:

  The user program is started. The central unit takes no notice of initialization of the CS31 remote modules and their adoption into the CS31 bus cycle: =0

  The user program is not started until at least *n* remote modules have been initialized and adopted into the CS31 bus cycle: =+n

  The user program is started. It does not handle the process inputs and outputs until at least *n* remote modules have been initialized and adopted into the CS31 bus cycle. However, the CS31 status information in EW 07,15 is available as early as with the program start. This is also valid for the dual port RAM image of the two high-speed inputs at terminals 02 and 03: =–n

  – Range of values: –31...+31
  – Default value: 0
  i.e. the user program is started immediately.

  A change of this system constant becomes effective:
  – with the next warm start or
  – with the next cold start.

- **Size of the transmitting area of the slave PLC**
  – Absolute identifier: KW 00,10
  – Symbolic identifier: SLV_SEND
  – Meaning of the value of the constants:

  The slave PLC can be used at the CS31 system bus *either* in the binary area *or* in the word area. The binary values are transferred byte by byte. It is possible to set the number of bytes (or words) which are to be sent from the slave PLC to the master PLC.
  – For use in the binary area:
  Transmitting: 0...15 bytes 0...15
  – For use in the word area:
  Transmitting 0...8 words 100...108

  – Default value: 0
  – Range of values: 0...15 and 100...108

  A change of this system constant becomes effective:
  – with the next warm start or
  – with the next cold start.

  Note:

  The default setting
  – in the binary area is:
    – transmit 4 bytes and
    – receive 4 bytes.

  This is defined by the default combination KW 00,10 = KW 00,11 = 0.
  The configured combination KW 00,10 = KW 00,11 = 4 has the same result as the default combination.

  The combination KW 00,10 = KW 00,11 = 100 *is inadmissible!* It would mean:
  Transmit 0 words and receive 0 words.

  When employed in the word area, the unused higher 8 channels of the address can be used by an analog modul (no KR/KT).

- **Size of the receiving area of the slave PLC**
  – Absolute identifier: KW 00,11
  – Symbolic identifier: SLV_REC
  – Meaning of the value of the constants:

  The slave PLC can be used at the CS31 system bus *either* in the binary area *or* in the word area. It is possible to set the number of bytes (or words) which are to be received by the slave PLC from the master PLC.
  – For use in the binary area:
  Receiving: 0...15 bytes 0...15
  – For use in the word area:
  Receiving: 0...8 words 100...108

– Default value: 0

– Range of values: 0...15 and 100...108

A change of this system constant becomes effective:

– with the next warm start or

– with the next cold start.

Note:

The default setting
– in the binary area is:
  – transmit 4 bytes and
  – receive 4 bytes.

This is defined by the default combination
KW 00,10 = KW 00,11 = 0.
The configured combination
KW 00,10 = KW 00,11 = 4 has the same result as the default combination.

The combination
KW 00,10 = KW 00,11 = 100
is inadmissible! It would mean:
Transmit 0 words and receive 0 words.

When employed in the word area, the unused higher 8 channels of the address can be used by an analog modul (no KR/KT).

- **Automatic warm start after an FK2 error**
(only for 07 KT 92)

– Absolute identifier: KW 00,12

– Symbolic identifier: SYSTEM

– By means of the system constant KW 00,12 an automatic warm start can be configured after an FK2 error:

Bit 0 of KW 00,12 = 0:	no automatic warm start
Bit 0 von Kw 00,12 = 1:	automatic warm start

The bits 1...15 of KW 00,12 have to be 0.

In the default setting KW 00,12 = 0 the module 07 KT 92 **R202/262** has the same behaviour as the module 07 KT 92 **R101** (no warm start after an FK2 error).

A change of this system constant becomes effective:

– with the next warm start.

- **PLC cycle time**

– Absolute identifier: KD 00,00

– Symbolic identifier: ZYKL_ZEIT

– Meaning of the value of the constants:
The PLC program is processed cyclically in the time intervals stated by the set cycle time.
The entries are made in the unit of measurement [ms]. The smallest cycle time that can be entered is 5 ms. Only integral multiples of 5 ms are permissible.

– Range of values: ≥ 5

– Default value: 10

A change of this system constant becomes effective:

– with the next program start.

A8 The ARCnet system (Attached Resource Computer Network)

- ARCnet is a system for data transmission in local networks
- The ARCnet protocol is based on the Token Passing principle.
- By passing an identifier (token) from station to station it is guaranteed, that only one station can start a data transmission (transmission without collisions).
- The order of sequence, in which the stations are accessed, is automatically adapted by the existing conditions in the network, i.e. that the network is reconfigured automatically each time a station is added to the network or switched off.

A8.1 The networking configurations

Linear ARCnet

- In the Linear ARCnet configuration, the stations are connected to one another directly, i.e. without using any distribution units.
- Each station is inserted into the network by using a T connector.
- Both cable ends must be terminated by termination resistors.
- A maximum of 8 stations can be connected to one linear ARCnet.
- The maximum length of the network is 300 m.
- An additional segment can be connected at the end of the wired segment via an Active Hub (active distribution unit), see next page.

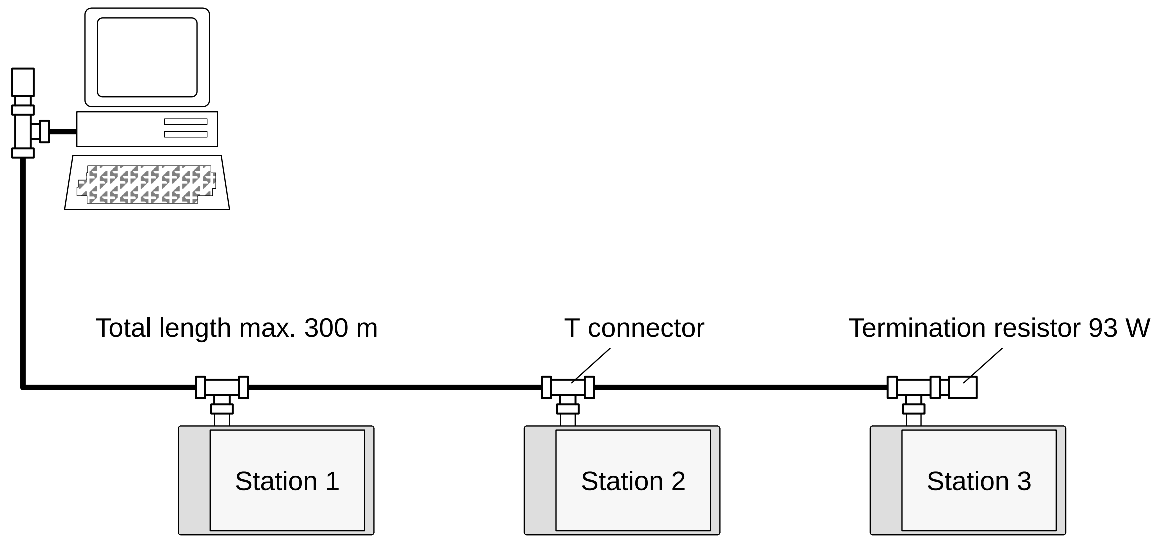


Fig.: Linear ARCnet

Linear ARCnet, expanded by active distribution units (Active Hubs)

- Active Hubs amplify the arriving signals. So they stabilize the network configuration and allow especially for high distances. The Active Hub decouples the station connectors from one another. Therefore, the entire network does not fail if one of the connections fails.
- The maximum length of the network is 6 km.
- A maximum of 255 stations can be used.

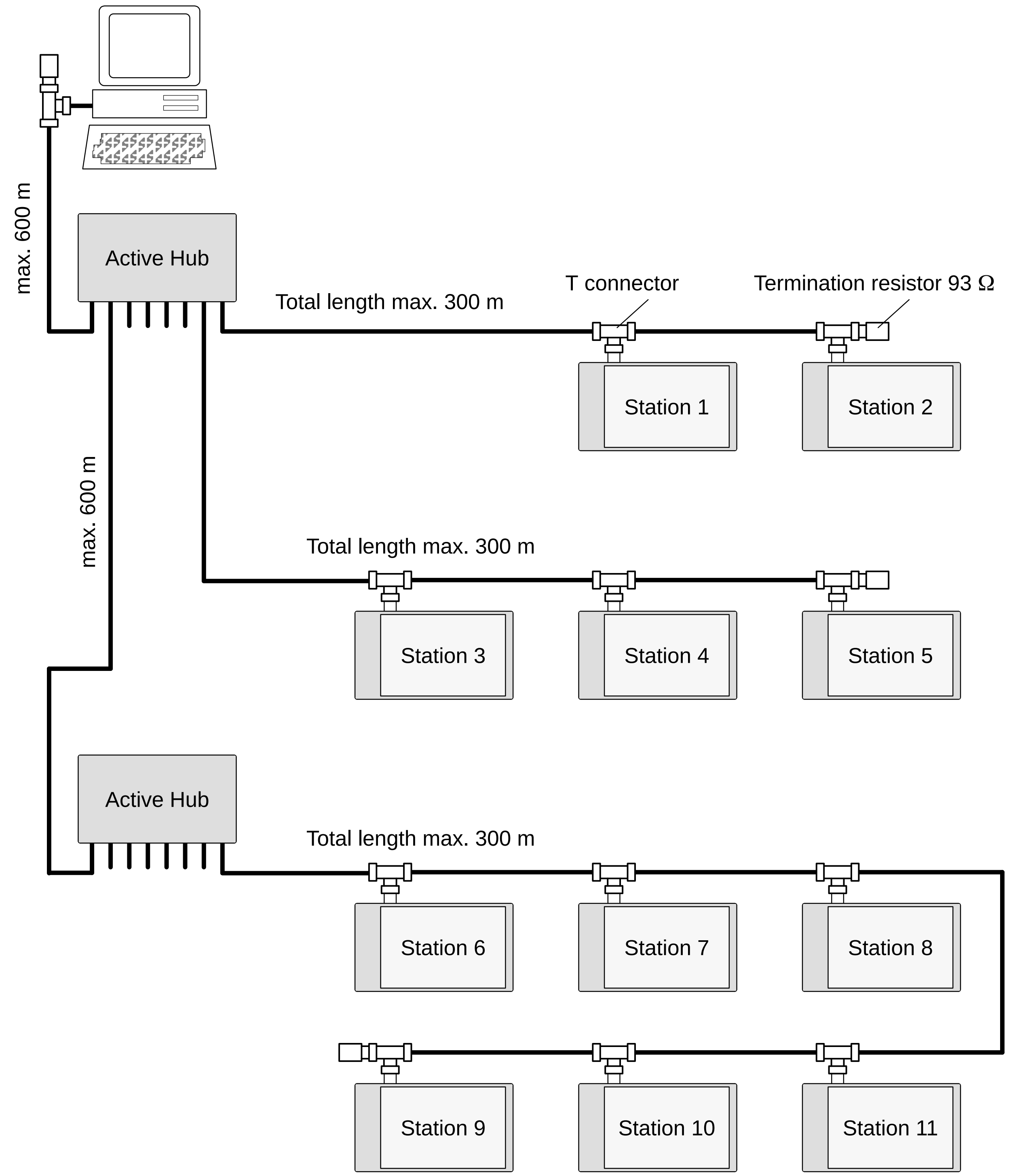


Fig.: Linear ARCnet, expanded by active distribution units (Active Hubs)

A8.2 The features of the ARCnet system

- Data transmission rate 2.5 MBit/s
- Coaxial cable of type RG62/U, 93 Ω
- Maximum number of stations: 255

Maximum distances

- The maximum distance between two stations amounts to 6 km.
- The maximum distance between an Active Hub and an ARCnet station or between two Active Hubs amounts to 600 m.
- The maximum distance between a Passive Hub and an ARCnet station or between an Active Hub and a Passive Hub is 30 m. A Passive Hub works like a resistor network which carries out the cable termination at the stations.
- The maximum distance within a Linear ARCnet is 300 m. A maximum of 8 stations can be connected.

Contents

Central processing units
PCZB/CS 20
UCZA/UCZB

- Documentations : Ref. FPTC 404368 P2001-Edition 07.92 c.p.u. "**PCZB/CS 20**"
  Ref. FPTC 404366 P2001-Edition 07.92 c.p.u. "**UCZA/UCZB**"

are still in force but are no longer included in this present April '94 edition.

- If required, above the documentation in the April '94 edition can be separately supplied on your request :
  please quote : Ref. FPTC 404368 P2001-a Edition 04.94 c.p.u. "**PCZB/CS 20**"
  Ref. FPTC 404366 P2001-a Edition 04.94 c.p.u. "**UCZA/UCZB**"

- Documentations : Ref. FPTC 404369 P2001-Edition 07.92 "**Handheld terminal TCZ**"
  Ref. FPTC 404370 P2001-Edition 06.92/09.92 "**Software PC 29**"
  are still in force but are no longer included in this present November '96 edition.

- If required, above the documentation in the November '96 edition can be separately supplied on your request :
  please quote : Ref. FPTC 404369 P2001-a Edition 04.94 **"Handheld terminal TCZ"**
  Ref. FPTC 404370 P2001-a Edition 04.94 **"Software PC 29"**

Operating Manual

ABB Procontic CS31
Automation System
in Decentralized Structure

Monitor

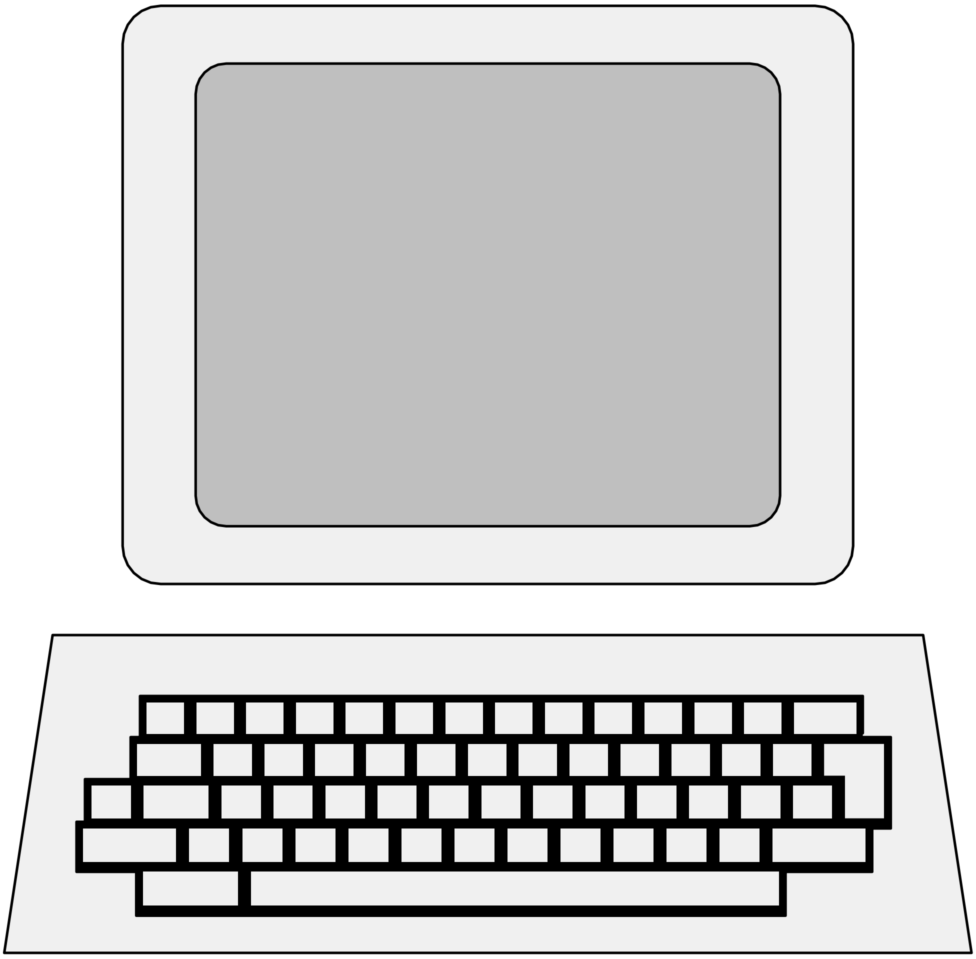


ABB Schalt–
und Steuerungstechnik

Regulations
Concerning the Setting up of Installations

Apart from the basic ”Regulations for the Setting up of Power Installations” DIN VDE* 0100 and for ”The Rating of Creepage Distances and Clearances” DIN VDE 0110 Part 1 and Part 2 the regulations ”The Equipment of Power Installations with Electrical Components” DIN VDE 0160 in conjunction with DIN VDE 0660 Part 500 have to be taken into due consideration.

Further attention has to be paid to DIN VDE 0113 Part 1 and Part 200 in case of the control of working and processing machines. If operating elements are to be mounted near parts with dangerous contact voltage DIN VDE 0106 Part 100 is additionally relevant.

If the protection against direct contact according to DIN VDE 0160 is required, this has to be ensured by the user (e.g. by incorporating the elements in a switch-gear cabinet). The devices are designed for pollution severity 2 in accordance with DIN VDE 0110 Part 1. If higher pollution is expected, the devices must be installed in appropriate housings.

The user has to guarantee that the devices and the components belonging to them are mounted following these regulations. For operating the machines and installations, other national and international relevant regulations, concerning prevention of accidents and using technical working means, also have to be met.

The ABB Procontic devices are designed according to IEC 1131 Part 2. Meeting this regulation, they are classified in overvoltage category II which is in conformance with DIN VDE 0110 Part 2.

For the direct connection of ABB Procontic devices, which are powered with or coupled to AC line voltages of overvoltage category III, appropriate protection measures corresponding to overvoltage category II according to IEC–Report 664/1980 and DIN VDE 0110 Part 1 are to install.

Equivalent standards:

DIN VDE 0110 Part 1 ≙ IEC 664
DIN VDE 0113 Part 1 ≙ EN 60204 Part 1
DIN VDE 0660 Part 500 ≙ EN 60439–1 ≙ IEC 439–1

* VDE stands for ”Association of German Electrical Engineers”.

ABB Schalt– und Steuerungstechnik GmbH Heidelberg

Table of Contents

1 Operating and test functions

The operating and test functions of the PLC can be used with the aid of a terminal, the TCZ service device or the ABB Procontic programming system.

Note:

If the user works with the ABB Procontic programming and test system, this provides him with a convenient operator interface. When communicating with the control system, the ABB Procontic programming and test system uses the operating and test functions described in this chapter.
The ABB Procontic programming and test system has its own operating instructions.

Operator control commands

The operator control commands can be subdivided into:

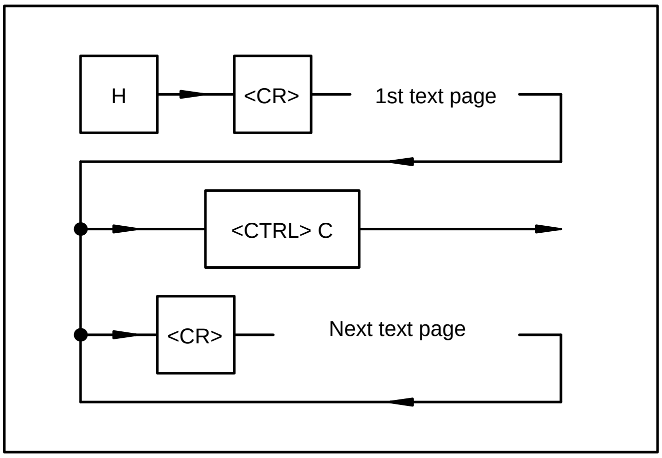
- Commands for creating and modifying user programs
- Commands for testing the user programs
- Commands for configuring the PLC

Notes:

- User entries require no ”blanks”. Any ”blanks” entered are ignored.
- In order to provide greater clarity when describing the commands, the user entries
  – for keywords are shown in
    UPPER–CASE LETTERS
  – and other entries (addresses etc.) are shown in
    lower–case letters.
- Outputs generated by the PLC software on the monitor are shown in
  lower–case italics.

All available commands are displayed with the HELP command on the screen.

Help command



Function:
All available operator control and test functions are displayed on the monitor. Use <CR> to scroll the HELP text.

Note on service device TCZ:
The four–line liquid–crystal display (LCD) of the service device TCZ does not suffice to display this command.

Commands for creating the user program (overview)

Command	Function	Page
AEND	Prepare a program change on a running PLC program	1– 3
AEND	Reject a program change which has not yet been enabled	1– 3
ALT	Reject an enabled program change on a running PLC program and reactivate the old program status	1– 3
AL	Display PLC capacity utilization	1– 3
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FREI	Enable a program change on a running PLC program	1– 5
IDA	Display program identification	1– 6
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NOP	Delete program part, i.e. overwrite program part with NOPs	1– 7
O	Optimize program	1– 7
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S	Enter/edit user program (Substitute)	1– 8
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V	Move user program	1– 9

*) **not** with 07 KR 31 / 07 KT 31
) **only with 07 KR 31 / 07 KT 31

Commands for testing the user program (overview)

Commands for configurating

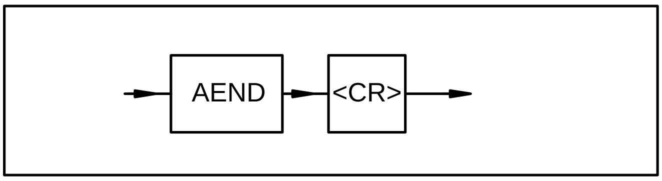
---

*) **not** with 07 KR 31 / 07 KT 31
) **only with 07 KR 31 / 07 KT 31

1.1 Commands for creating the user program

Prepare a program change on a running PLC program

Command:



Function:

The command announces to the PLC that modifications are to be carried out on the running PLC program. After this command has been entered, the PLC is ready to accept the program and constant modifications.

When command AEND is entered, all currently active test functions are deactivated. However, Force values of I/O signals remain active.

The following commands for program modifications and operation of the PLC are permitted after entering command AEND:
AL, CROSS, D, F, IDA, IDR, IDS, K, N, NOP, O, P, PA, S, SO, V, CTRL W, FEHLER, LED.

Reject a program change which has not yet been enabled

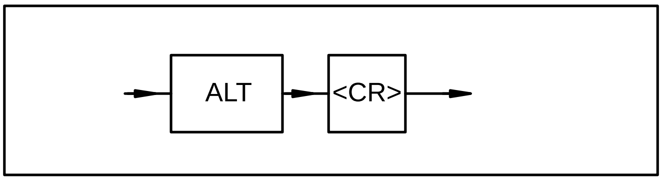
Entering the AEND command again rejects all program modifications performed to date, and the PLC is ready to accept program modifications again.

The following commands are activated with the program **running**, **and also** reject the AEND command and, thus, all program modifications performed after entry of the AEND command:

A, BA, BR, BS, EA, EAA, ES, ESA, EZ, EZA, FORC, FORC A, FORC R, G, L, PS, ST, TRACE, TRACE E, W, Y. Command AEND must be entered again in order to permit you to perform program modifications again.

Reject an enabled program change on a running PLC program and reactivate the old program status

Command:



Function:

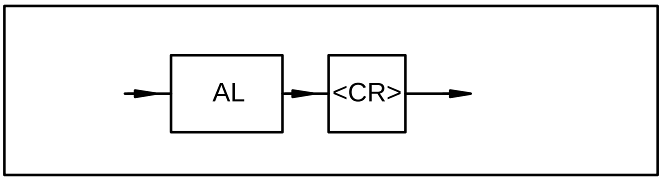
Modifications which have been performed on a running PLC program **and** which have been enabled are rejected again. In addition, the PLC restores the old program status. The old program status is the status of the program which existed before the program modification, i.e. before entry of command AEND in the PLC.

After command ALT is entered, the old program status is reactivated within approximately 1 ms without further intervention on the part of the user.

The command can be used if the user recognizes that the program modifications implemented do not achieve the intended result.

Display PLC capacity utilization

Command:



Function:

The PLC’s present capacity utilization is displayed in percent. This display indicates to what extent the capacity of the PLC is being utilized owing to execution of the user program.

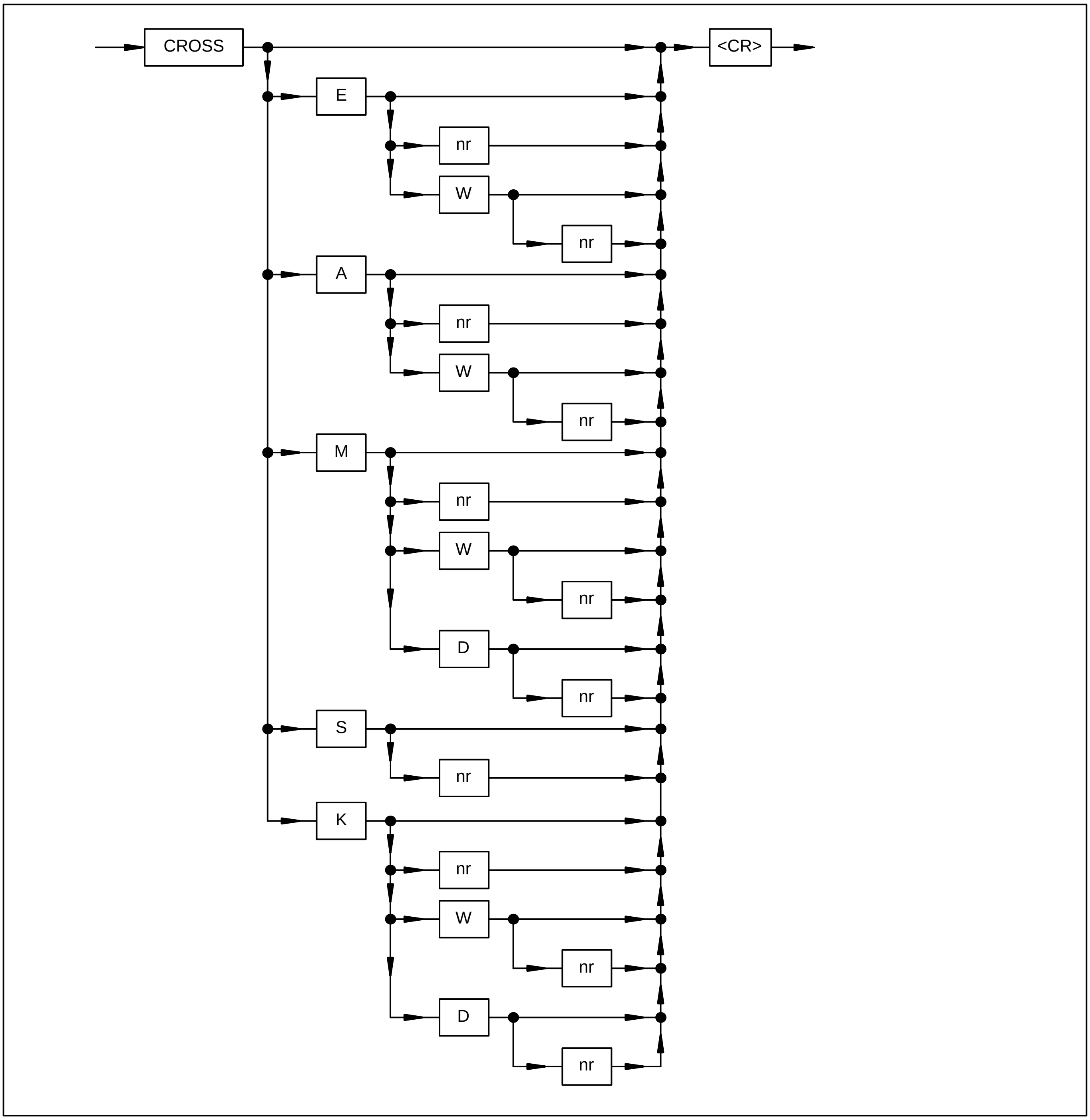
The processor capacity which corresponds to the difference between 100 % and the capacity utilization display is available for operation of the serial interfaces, i.e. for communication with the devices connected to the serial interfaces. The utilization should not be greater than 95 % for the longest program path so that communication is still possible via the serial interfaces. Note that the capacity utilization of the PLC is also determined by the current program branches (conditional branches and consecutive number blocks).

Note:

The capacity utilization display provides a correct indication of the utilization caused by the user program only if *no communication* is occurring via the serial interfaces at the instant of display.

Display CROSS reference list

Command:



Where:

E: Abbreviation for input
A: Abbreviation for output
S: Abbreviation for step
M: Abbreviation for flag
K: Abbreviation for constant
W: Abbreviation for word variable
D: Abbreviation for double–word variable
nr: Number of the operand

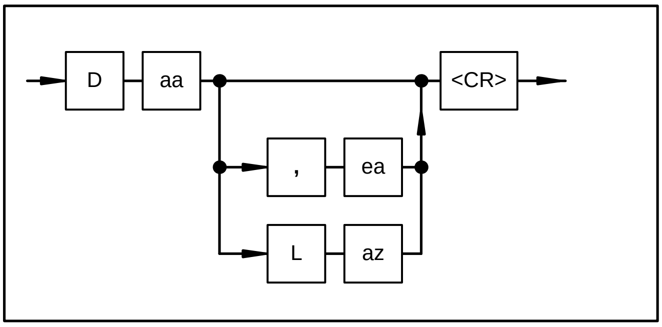
Function:
The cross–reference list is the assignment of operands to the program memory addresses at which they occur. The cross–reference list can be output for

- all operands occurring in the program,
  entry: CROSS <CR>
- a specific operand type,
  entry, e.g.: CROSS E <CR>
- a single operand,
  entry, e.g.: CROSS KD 00,12 <CR>

Note on service device TCZ:
The four–line liquid–crystal display (LCD) of the service device TCZ does not suffice to display this command.

Display program

Command:



aa: Start address as of which the program is to be displayed

ea: End address of the program part to be displayed

L: Length (keyword)

az: Number of program memory words to be displayed

Function:
The specified program part is displayed.

Example:

- D 0,20 <CR>

The user program is displayed from address 0 through to address 20 on the monitor.

- D 10 L 20 <CR>

20 program memory words are displayed, starting from address 10.

Display format in the case of sentences:

start address operator operand
:
:

Display format in the case of block calls:

address n !ba number
address n+1 type
address n+2 content of addr n+2

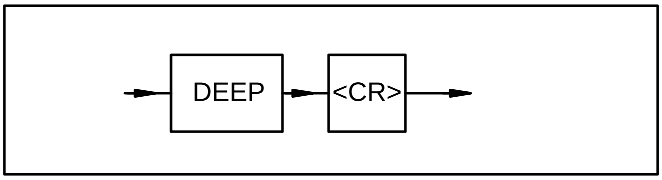
Example:

0000 !E 00,00
0002 &E 00,01
0004 =A 00,00
0006 !BA001
0007 AWT
0008 A 00,00
0009 KW 00,00
0010 KW 00,01
0011 AW 00,00

Note on service device TCZ:
This command can be used only with the following restriction: A maximum of three instructions can be displayed on the liquid–crystal display.

Erase PLC program on Flash EPROM

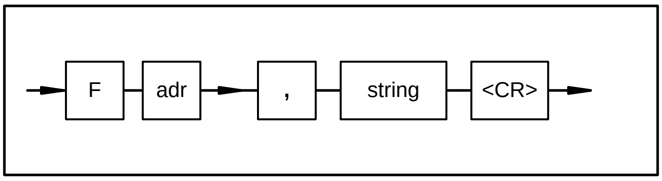
Command:



Function:
A PLC program stored on the Flash EPROM is erased (rendered invalid).

Search for string in user program (Find)

Command:



adr: Start address as of which searching is to be carried out. If no start address is entered, searching is performed as of address 0.

string: Maximum 8 commands, i.e. 16 words of the intermediate code.

Function:
The user program memory is searched for the string entered by the user as of the entered start address through to the end of the user program memory. If the string is found, the address is displayed. If the string occurs several times in the program, the next program address which corresponds to the string is displayed in each case if you enter a semicolon (;).

Example:

F, E 0,0 & E 0,1 <CR>

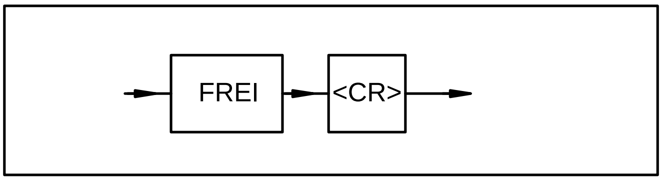
The entered string is sought as of the program memory start address 0.

F 100, !BA1 <CR>

Block call 1 is sought as of the program memory start address 100.

Enable a program change on a running PLC program

Command:



Function:

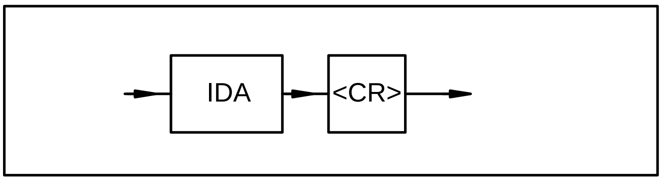
The modifications on a running PLC program performed after entry of command AEND are enabled for execution.

Before entry of command FREI, the program modifications performed are not yet executed by the PLC.

After entry of command FREI, the modifications performed are executed by the PLC. Command ALT can be used to reactivate the old program status. The functionality of the PLC program can be further–modified by a further program modification.

Display program identification

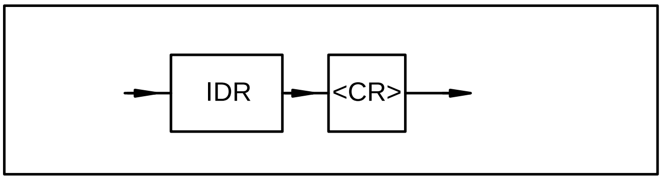
Command:



Function:
The identification entered by the user for the user program is displayed. If no identification has been issued for the program, nothing is displayed either (see also command: IDS).

Delete program identification

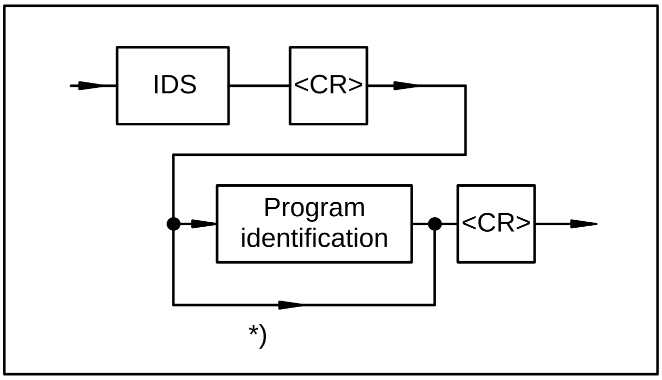
Command:



Function:
The identification entered by the user for the user program is deleted.

Enter program identification

Command:



Program identification: These characters are assigned as the identification to the user program.

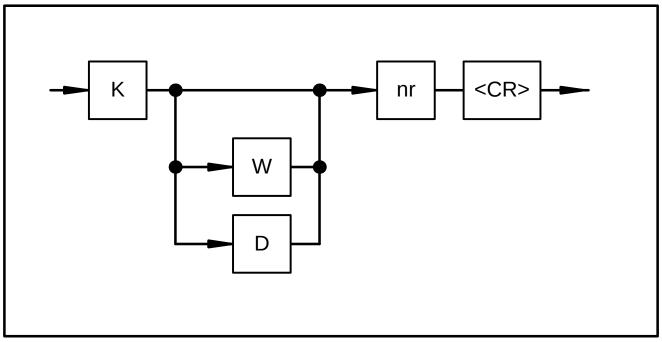
---

*): No program identification is entered for this path. An already existing program identification is deleted.

Function:
The identification entered by the user for the user program is stored in the program memory. The identification may comprise maximum 16 characters. It serves, for instance, to store the project name and the creation date of the program in the PLC.

Enter/edit values of indirect constants

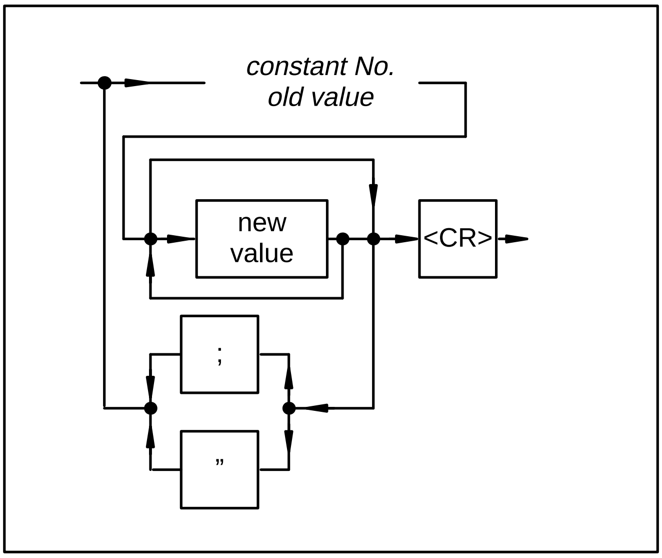
Command:



W: Abbreviation for word constants

D: Abbreviation for double–word constants

nr: Entered number of the constant



constant No. old value:
Displayed number and value of the constant.

new value: The user can overwrite the value of the displayed constant by a new value. In the case of the word and double–word constants, a hexadecimal value may also be entered in place of a decimal value. An H is prefixed to the numerical value for this purpose.

Caution: Values H8000 and H8000 0000 are forbidden in two's–complement arithmetic (practical only in the case of masks for instance).

;: Entering a semicolon results in display of number and value of the constant with the next number up. If the semicolon is entered without entering a new value, the old value of the displayed constant is retained.

↑: Entering character ”↑” results in display of number and value of the constant with the next number down. If character ”↑” is entered without entering a new value, the old value of the displayed constant is retained. (Use character ”^” on the PC keyboard.)

<CR>: The command is terminated by entering a <CR>.

Function:
The required numerical values are assigned to the indirect constants.

This value assignment can also be performed with the user program running. This means that time values of timers can be modified when the system is running for instance.

Cycle time:
The cycle time is set with the double–word constant KD 00,00. The set cycle time must be an integral multiple of the basic time of 5 ms, i.e. 5 ms, 10 ms, 15 ms etc.

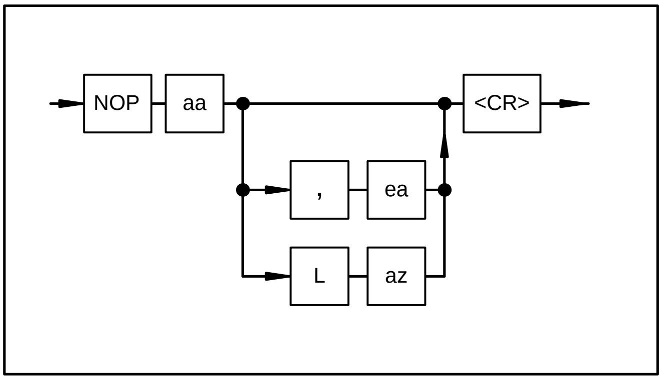
Example:
K 0,0 <CR>
Output of the number and value of the binary constant K 00,00. This value can be overwritten if required. If a semicolon is entered, the number and value of the next binary constant (K 00,01) is output.

KW 0,4 <CR>
Output of the number and value of the word constant KW 00,04.

KD 0,0 <CR>
Output of the number and value of the double–word constant KD 00,00. The cycle time is preset with this constant.

Delete program part, i.e. overwrite program part with NOPs

Command:



aa: Start address of the program part to be deleted

ea: End address of the program part to be deleted

L: Length (keyword)

az: Number of program memory words to be deleted

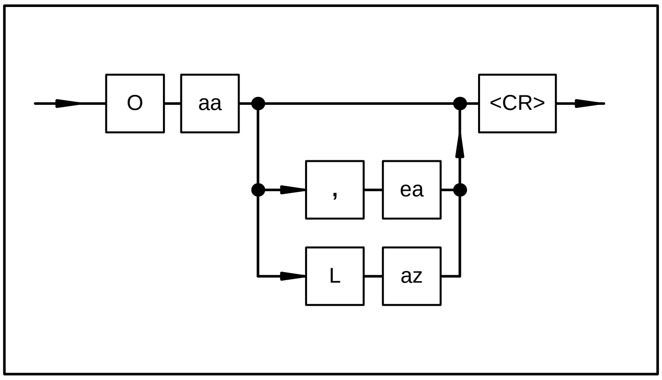
Function:
The specified program part is deleted. A prompt is displayed in order to establish whether you really do want to delete this program part before deletion. The user must once again either confirm deletion with ”J” or cancel deletion with ”N”.

Example:
NOP 0,20 <CR>
The user program is deleted from address 0 through to address 20.

NOP 10 L 20 <CR>
20 program memory words are deleted, as of address 10.

Optimize program

Command:



aa: Start address of the area as of which the program memory is to be optimized.

ea: End address of the area

L: Length (keyword)

az: Number of program memory words

Function:
All NOPs are removed and the program is compressed in the given program part.

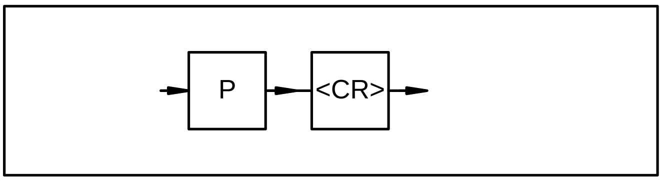
Example:
O 0 <CR>
The entire program memory is optimized.

O 0,10 <CR>
The program memory is optimized as of address 0 through to address 10.

O 10 L 10 < CR>
The NOPs within the next 10 program memory words as of address 10 are removed and the program is compressed accordingly.

Display free program memory area

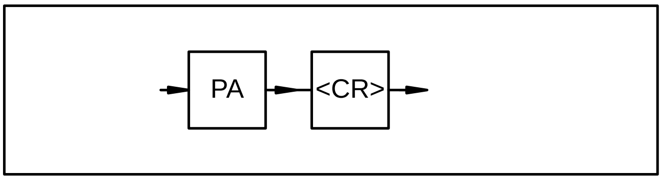
Command:



Function:
The program memory is searched for NOPs from the end. If a word which does not correspond to an NOP is found in the intermediate code, the number of NOPs found, i.e. the number of free program memory words, is displayed.

Program preparation

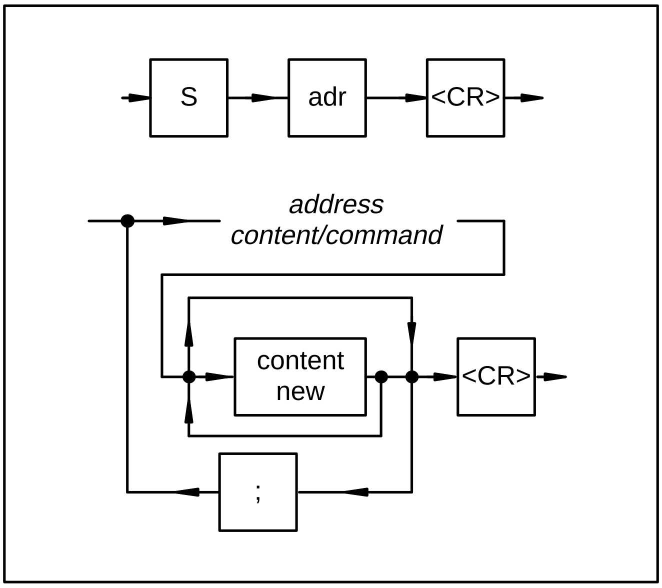
Command:



Function:
The I/O signals planned in the user program are enabled in the I/O configuration list of the PLC. In addition, a syntax check is conducted for the user program. In the case of sentences with relational operators using bracketed expressions, the RIGHT BRACKET in front of the binary assignment is stored by the translator as a binary RIGHT BRACKET in the intermediate code. This binary RIGHT BRACKET is corrected to form a word bracket by program preparation. PA computes the target addresses and the historical values to be skipped for the branch blocks and consecutive number blocks. The PA command is called automatically each time the program is started (G command).

Enter/edit user program (Substitute)

Command:



adr: Program memory address as of which the program is to be entered or modified in instruction list.

address: The program memory address whose content is to be modified is displayed by the PLC.

content: Applies to block calls only. The content of the program memory address, translated back, is displayed.

command: Applies to sentences and the block header (number and type). The command or block header, translated back, is displayed, always as an entire command, i.e. operand and operator or block call and block type. If an address which does not point to the start of a command or to a block call is entered, this is corrected to the start of the command by the PLC.

content new: New content of the user program.

;: Entering a semicolon displays the subsequent program memory address and its content, and this can be modified if required. If no new ’content’ is entered before the semicolon, the old content of the displayed program memory address remains unchanged.

Function:
Entering or modifying the PLC program in instruction list. A program memory word is selected and displayed on the monitor as an instruction or operand. The displayed content can then be overwritten.

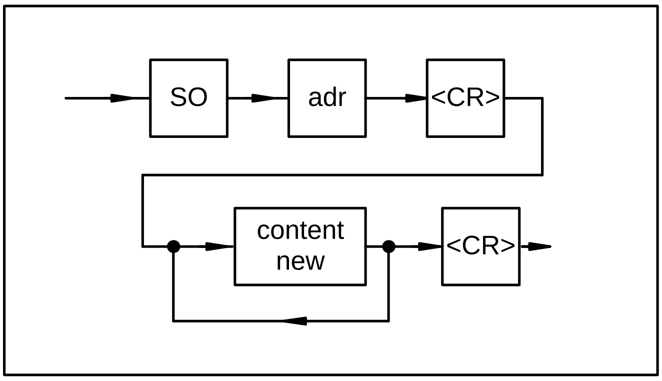
Note:
You will also find the following information for entering/modifying the instruction list with this command at the end of this Appendix:

– Syntactic structure of the instruction list

– Instructions on how texts for function blocks DRUCK/EMAS are entered and displayed.

Enter/edit user program without echo

Command:



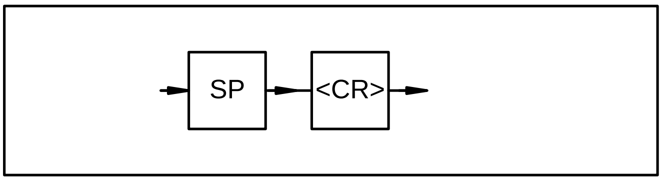
adr: Program memory address as of which the program is to be entered of modified

content new: New content of the user program

Function:
The program memory address as of which the program is to be entered is preset. The program can then be entered consecutively. The PLC returns *no* echo of the entered program. However, in the event of an error, the PLC returns an error message (e.g. Incorrect Entry).

Save PLC program in Flash EPROM

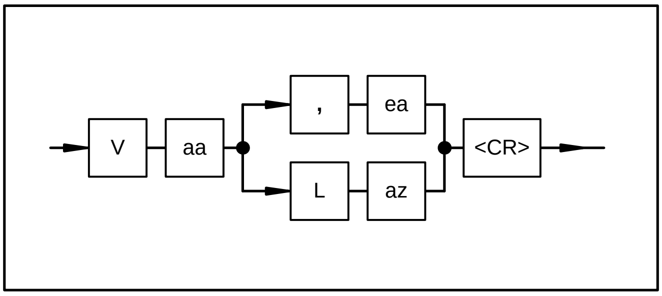
Command:



Function:
The PLC program is transferred from the RAM to the Flash EPROM. Character <*****> is displayed on the monitor at intervals of approximately 1 second during programming.

Move user program

Command:



aa: Start address of program part to be moved

ea: End address

L: Length (keyword)

az: Number of program memory words by which the program part is to be moved

Function:
The program is moved from address aa to address ea or from address aa by the specified number of program memory words. The gap which results is filled with NOPs. New program parts can be inserted in this gap. Moving is possible only if the required space is still available at the end of the user program. However, this is checked automatically.

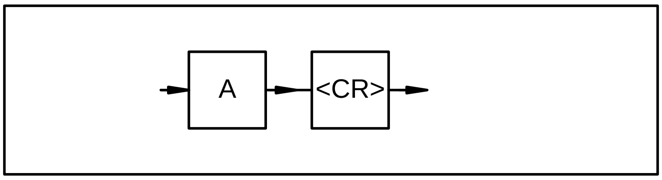
Example:
V 0,10 <CR>
The program is moved from address 0 to address 10. NOPs are inserted from address 0 through to address 9.

V 10 L 20 <CR>
The program is moved from address 10 by 20 program memory words to address 30, and 20 NOPs are inserted.

1.2 Commands for testing the user program

Abort user program

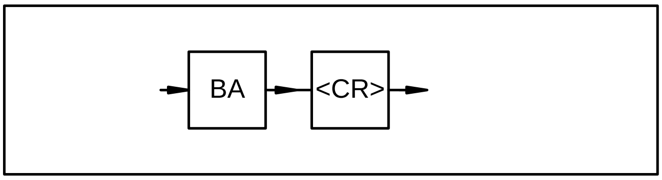
Command:



Function:
Execution of the user program is aborted. All outputs (binary and word) are set to zero. The user program can be restarted by entering ”G”.
Timers which have been started continue to run independently of the program status in the operating system. They are aborted only by a cold–start or power OFF/ON.

Display breakpoints

Command:

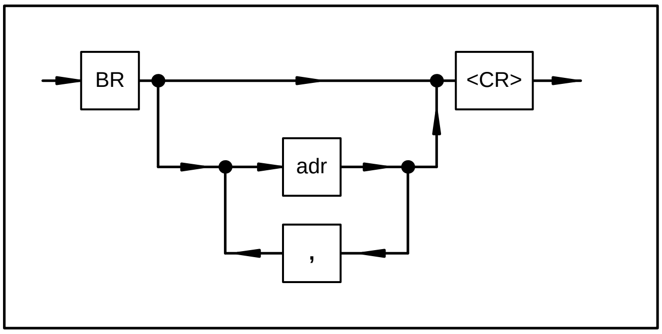


Function:
All breakpoints of the program are displayed. The address of the start of the command and its content are displayed and not the breakpoint address when the command is issued.

Note on service device TCZ:
This command can be used only with the following restriction:
A maximum of three program memory points at which breakpoints are set can be displayed on the liquid–crystal display (LCD).

Reset breakpoints

Command:



adr: Address of the breakpoint to be reset

,: If only specific breakpoints are reset, the individual addresses must be separated by a comma when entering.

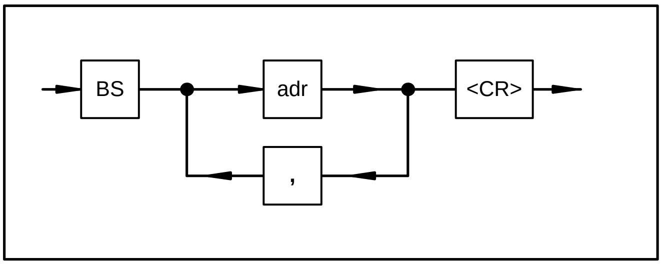
Function:
The breakpoints can be reset individually. Command

BR <CR>

resets all breakpoints of the program.

Set breakpoints

Command:



adr: Address of the breakpoint

,: If several breakpoints are set, the addresses must be separated by a comma when entering.

Breakpoints can be set:

- to the address of the operand *after* an assignment character
- to the address of a RIGHT BRACKET
- to the address of the last parameter of a block
- to the address of the end of the program

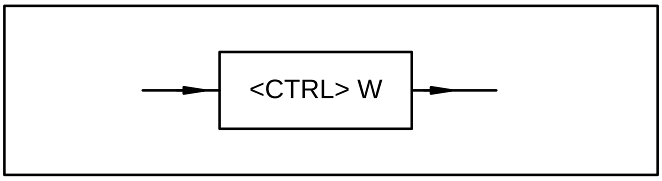
Function:
After the program start, the program stops at the first breakpoint. Breakpoints may also be entered with the program running. A maximum of 15 breakpoints may be set.

Advancing to the next breakpoint: If a *semicolon* is entered, the program runs to the next breakpoint after expiry of the cycle time and displays the program address and the command at this address. If the next breakpoint is *not* reached after a specific period, owing to a long cycle time, the display operation can be aborted by entering <CTRL>C if required.

If a breakpoint is set to a program point which is *not* executed, e.g. owing to a branch, the program continues its cycles but with four times the cycle time, which may have a disadvantageous effect on the functionality.

Change–over between operator control functions <–––> monitor

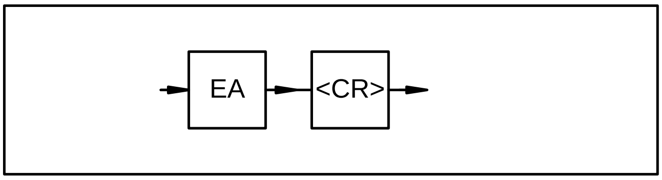
Command:



Function:
Pressing key <CTRL> and key W simultaneously takes you to the monitor program of the PLC. This makes available certain basic functions at the monitor level to the user. If you are in the monitor program, you can switch back to the operating program of the PLC by entering <CTRL> and W again (see also chapter Monitor functions)

I/O test mode

Command:



Function:
This mode permits the user to check the wiring of his I/O signals from the PLC through to the process in order to ensure that the wiring is correct.

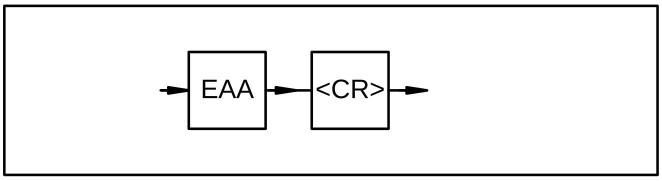
After starting the user program, it is *not* executed. Only the I/O signals planned in the program are operated, i.e. the input signals are read in and the output signals are brought out.

By actuating limit switches etc., it is possible to check whether the signals arrive under the declared designation in the PLC. By setting outputs in targeted manner, it is possible to check whether the signals arrive at the correct point in the process. Command Z or ZD can be used to display the required I/O variables in the PLC.

Command ”EA” can also be entered with the program running. In this case, the mode does not take effect until the start of the next program cycle.

Deactivate I/O test mode

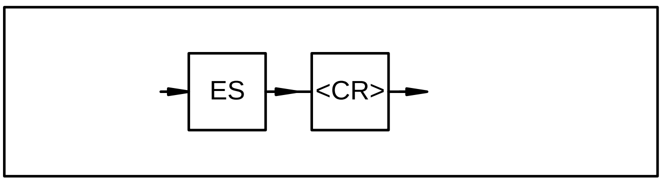
Command:



Function:
Mode I/O test is deactivated with this command, i.e. the user program continues to run normally as of this point. It is advisable to abort the program before deactivating the I/O test.

Single–step mode ON

Command:



Function:
After starting the program, only one sentence or one block is executed and the program stops after each assignment, RIGHT BRACKET and at the end of each block.

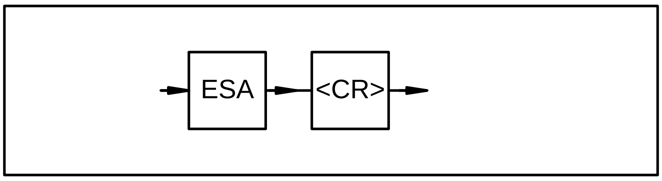
Command Z can be used to display variable values.

Command ”ES” can also be entered with the program running. In this case, the mode does not take effect until the start of the next program cycle.

Advancing by one step:
If you enter a *semicolon*, the program runs to the next breakpoint after expiry of the cycle time and displays the program address and the command at this address. If the next breakpoint is *not* reached after a specific period, owing to a long cycle time, the display operation can be aborted by entering <CTRL>C if required.

Single–step mode OFF

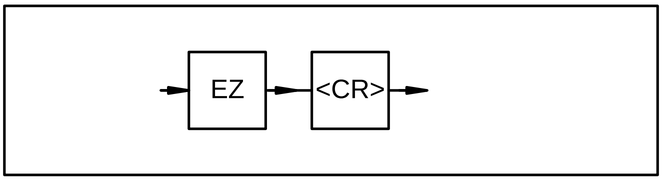
Command:



Function:
Single–step mode is deactivated, i.e. the user program continues to run normally as of the current breakpoint.

Single–cycle mode ON

Command:



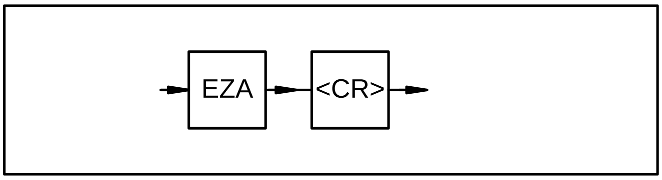
Function:
When the program is started, the program stops at the end of the program. Command ”EZ” can also be entered with the program running.

The mode does not come into effect until the start of the next program cycle.

Advancing by one program cycle:
If a *semicolon* is entered, the program is run through *once* after expiry of the cycle time and displays the program address and the command at this address (!PE). If the next breakpoint is *not* reached after a specific period, owing to a long cycle time, the display operation can be aborted by entering <CTRL>C if required.

Single–cycle mode OFF

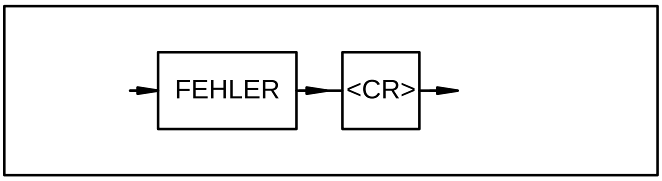
Command:



Function:
Single–cycle mode is deactivated, i.e. the program is executed normally again.

Display contents of the error register

Command:



Function:
The error information stored in the PLC is output.

Enter Force values

On the PLC, the user can ”force” input signals and output signals. This means that values are preset for I/O signals by the user. The PLC then operates with the force values instead of the real input signals. In turn, the PLC issues the force values to the output devices and not the output signals computed in the PLC program. The force values apply until forcing is cancelled for individual I/O signals or for all I/O signals. Both the values supplied by the input devices and the values assigned to outputs in the PLC program thus have *no effect* during forcing. Forcing can be applied both to binary I/O signals and to word I/O signals.

Maximum number of I/O signals to be forced:

- Binary inputs: 64
- Word inputs: 16
- Binary outputs: 64
- Word outputs: 16

Forcing is performed in the following way:

Forcing inputs

The PLC generates an image of the input signals planned in the PLC program at the start of each program cycle. If inputs are to be forced, their real values are replaced by the force values preset by the user after read–in. The PLC operates only with the modified input image during the program cycle, and, thus, signal changes on the input device during the program cycle are unimportant.

Forcing outputs

At the end of the program cycle, the PLC transfers the output image of the output signals planned in the PLC program to the output devices. If outputs are to be forced, their real values are replaced by the force values before they are output in the output image.

Behavior after power failure, RESET or warm–start

After a power failure, the PLC has ”forgotten” the force job. The list of I/O signals to be forced, entered *before* the power failure, is, however, still present in the PLC and can also be displayed with command FORC A <CR>. The *overall force list* is reactivated and forcing is placed back into effect by entering a single signal to be forced.

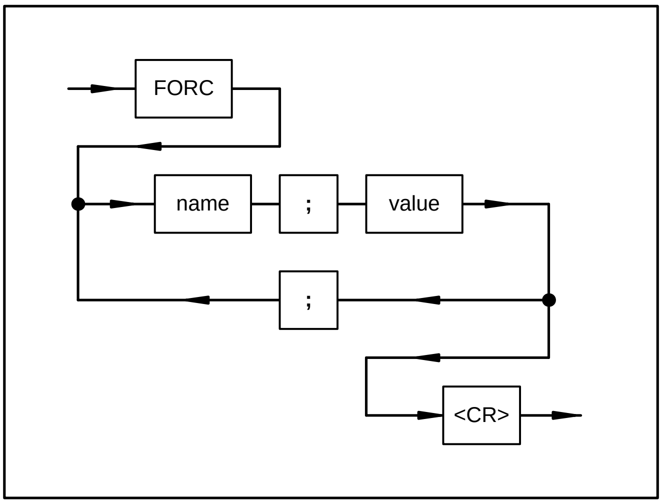
The following commands are available for forcing I/O signals:

- FORC: Enter force value
- FORC A: Display force value
- FORC R: Delete forcing

Enter force value

The name of the I/O signal to be forced and the force value are entered with command FORC.

Command: FORC Enter force value



name: Name of the input or output signal to be forced

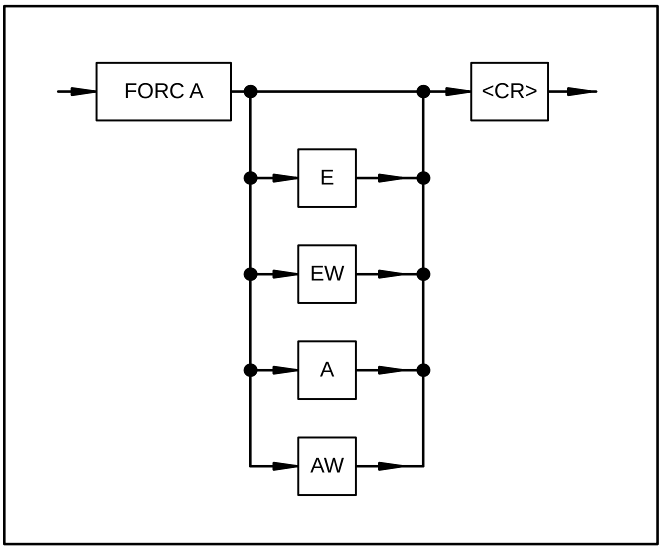
value: Force value for the input or output

;: A semicolon is used as the separator between the name and the force value. If several inputs/outputs are to be forced, they must also be separated by a semicolon.

Function:
Entering the I/O signals to be forced and their values. The list specifying which inputs/outputs are to be forced is stored power–fail–safe in the operand memory of the PLC (if a battery is fitted).

Display force value

Command:



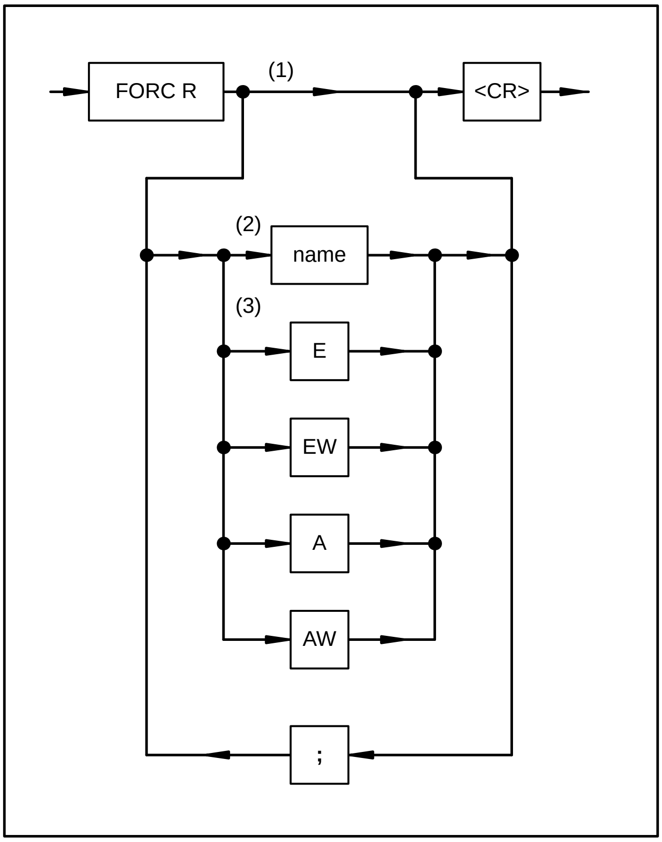
Function:

- Displaying all inputs and outputs to be forced
- Displaying all inputs/outputs of a specific group of inputs/outputs to be forced

Note on service device TCZ:
This command can be used only with the following restriction:
A maximum of three I/O signals with related force values can be displayed on the liquid–crystal display (LCD).

Delete forcing

Command:



name: Name of the inputs/outputs for which forcing is to be terminated

;: If forcing is terminated only for specific inputs/outputs, the individual names must be separated by a semicolon when entering them.

Function:

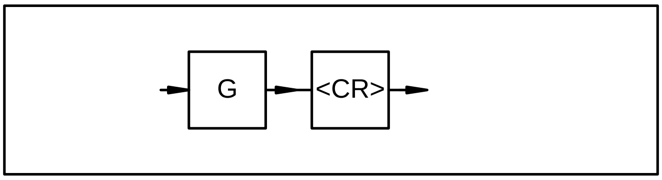
(1) Terminating forcing for all I/O signals

(2) Terminating forcing for *single* I/O signals

(3) Terminating forcing for *one* specific group of I/O signals

Start user program

Command:

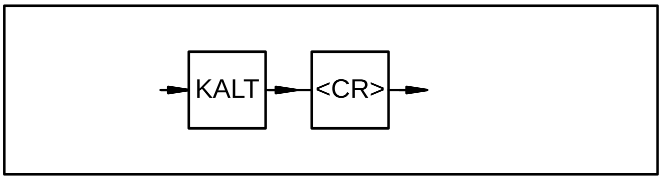


Function:
The user program is started and the operands are initialized.

The operand areas are initialized in accordance with the corresponding system constant.

Perform cold–start

Command:



Function:
The cold–start command is only allowed, when the PLC program is ”aborted”.

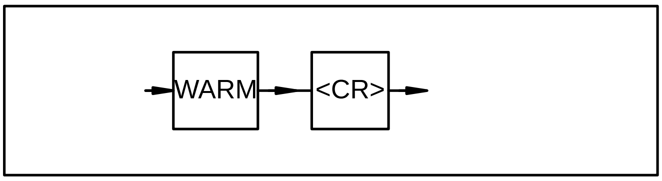
- All RAM memories will be tested and deleted.
- If there is *no user program* in the Flash EPROM, the default values will be set to all system constants (same as factory setting).
- If there is *a user program* in the Flash EPROM, this will be stored in the RAM inclusive the system constants.
- The operating modes defined by the system constants will be adjusted.
- The CS31 system bus will be initialized again (only in case of CS31 system bus master)

Performing a cold start

- Command KALT <CR> in terminal mode or
- Voltage OFF/ON, when *no* battery is existing or
- menu item ”Kaltstart” in the programming system

Perform warm start

Command:



Function:
The warm start command is only allowed, when the PLC program is ”aborted”.

Warm start

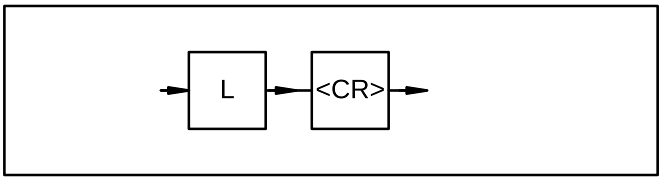
- All RAM memories will be tested and deleted with the exception of program memories and operand memories.
- If there is *a user program* in the Flash EPROM, this will be stored in the RAM inclusive the system constants.
- The operating modes defined by the system constants will be adjusted.
- The CS31 system bus will be initialized again (only in case of CS31 system bus master)

Performing a warm start

- Command WARM <CR> in terminal mode or
- Voltage OFF/ON, if a battery is existing or
- menu item ”Enable PLC mode” in the programming system

Continue user program

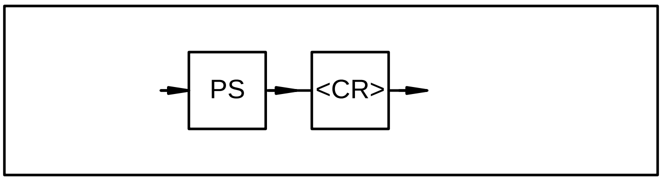
Command:



Function:
The user program is continued after a preceding stop (”W”). When continuing, the flags and internal statuses have the same value as with program stop.
Timers which have started continue to run independently of the program status in the operating system. They are aborted only by a cold–start or power OFF/ON.

Display program status

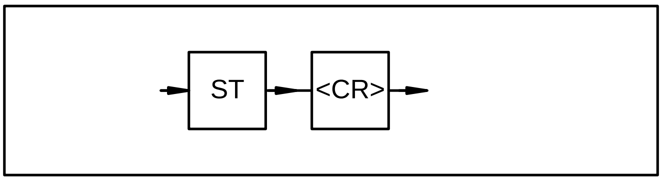
Command:



Function:
The status (program at breakpoint, program aborted, program stopped, program running) of the user program is displayed.

Display PLC status

Command:

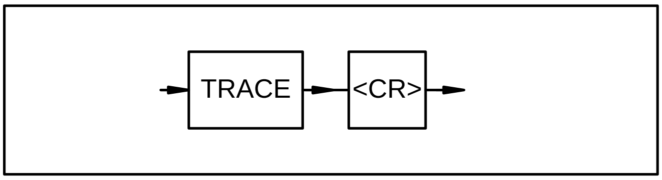


Function:
The entire PLC status is displayed as follows:

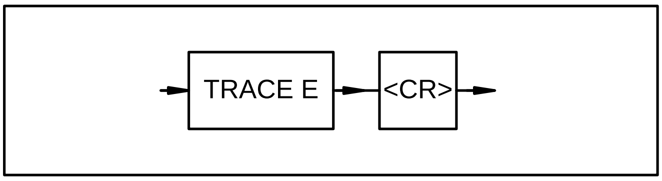
Program identification
Cycle time
Program status
Active test functions
TRACE registers
Error messages
Capacity utilization

TRACE mode

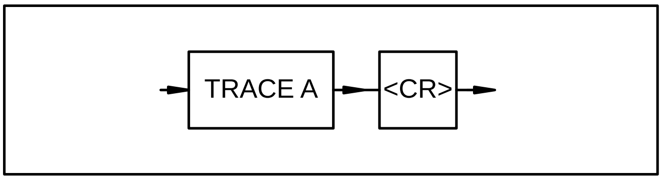
Command: Display TRACE memory



Command: Activate TRACE mode



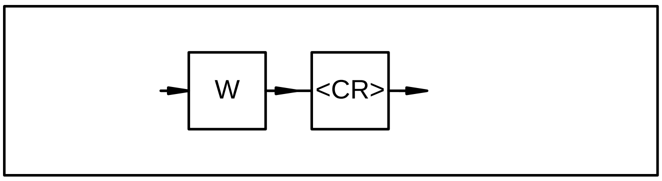
Command: Deactivate TRACE mode



Function:
In TRACE mode, the PLC notes the address of the block last executed or the address of the instruction last executed. After a system crash, the operator is thus provided with information as to how far the user program has been executed. The contents of the TRACE memory are retained in the event of a RESET.

Stop user program

Command:

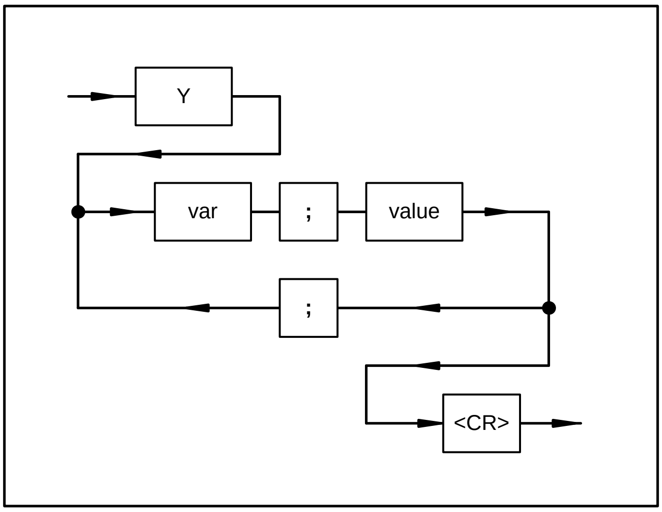


Function:
The user program is stopped.

The values of the outputs and of the flags are retained. Timers which have been started continue to run independently of the program status in the operating system. They are aborted only by a cold–start or power OFF/ON.

Overwrite value of a variable with a value to be entered

Command:



var: Name of the variable or indirect constant

value: New value which is to be assigned to the variable

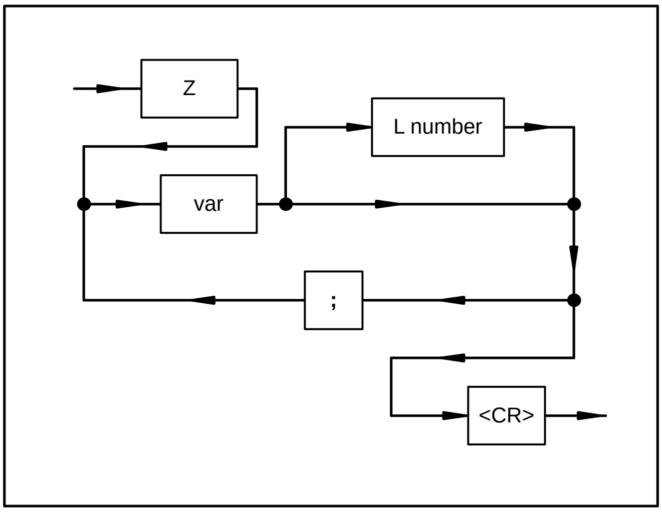
;: There must be a semicolon between the name and the value of the variable. If several variables are to be overwritten, these must also be separated by a semicolon.

Note:
If the variable is a step variable, it can only be set and not reset. When step variables are set, all other steps of the chain are automatically reset.

If an indirect constant is modified with this command, this modification is performed only in the operand memory and not in the program memory, i.e. this value is overwritten again by the value from the program memory with the next program start.

Display status of variables

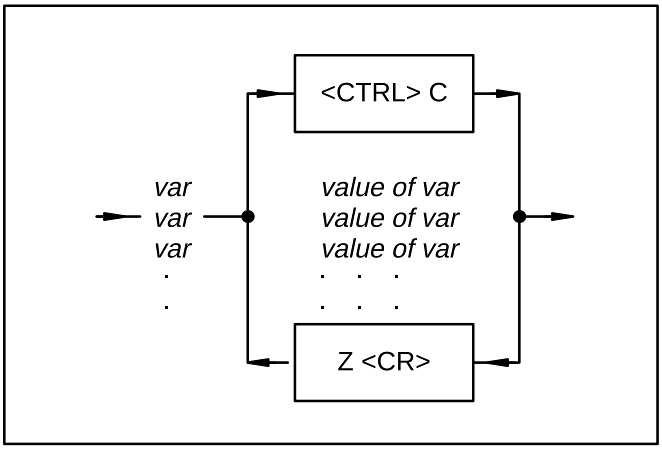
Command:



var: Variable (flag, step, input, output, indirect constant) to be displayed

;: The individual variables must be separated by semicolons.

L number: Number of consecutively numbered variables as of the variable var which are to be displayed.
Example: M 0,0 L 3
The following are displayed:
M 0,0 M 0,1 M 0,2



Z: The values of the variables (max. 22) are each updated when character Z <CR> is entered.

Function:
The variable names preset by the user are displayed on the monitor. The value of this variable is updated each time character Z <CR> is entered. The displayed variable values always originate from the same program cycle and represent a ”snapshot” at the end of the cycle.

The number of variables to be displayed is restricted to 22 with this command since no more screen lines than this are available.

Note on service device TCZ:
This command can be used only with the following restriction: Only the status *of one* variable is displayed.

Computer connection instead of terminal

If a computer is connected instead of the terminal for evaluation of the status values, the following commands may also be used if required instead of Z (same syntax diagram as with command Z):

ZO: Number of possible variables maximum 120, otherwise as for command Z.

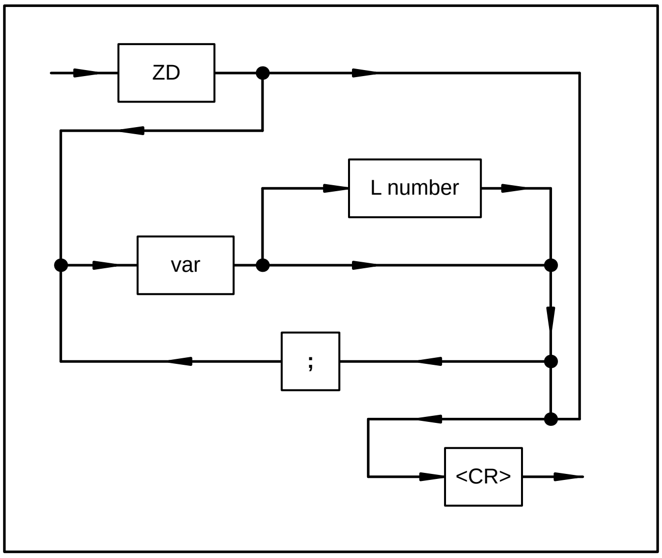
Screen control: In the case of commands Z, ZO and ZD, the following control characters are used by the PLC for screen control:

Carriage return:	<CR>
Line feed:	<LF>
Clear screen:	<ESC>[2J
Position cursor:	<ESC>[<line>;<column>H

ZZ: Number of possible variables maximum 120. The PLC sends no ESC sequences to the screen controller, but only the variable values, each followed by a <CR>. The variable values have the same order as the preset variable list, otherwise as with command Z.

Display and continually update status of variables

Command:

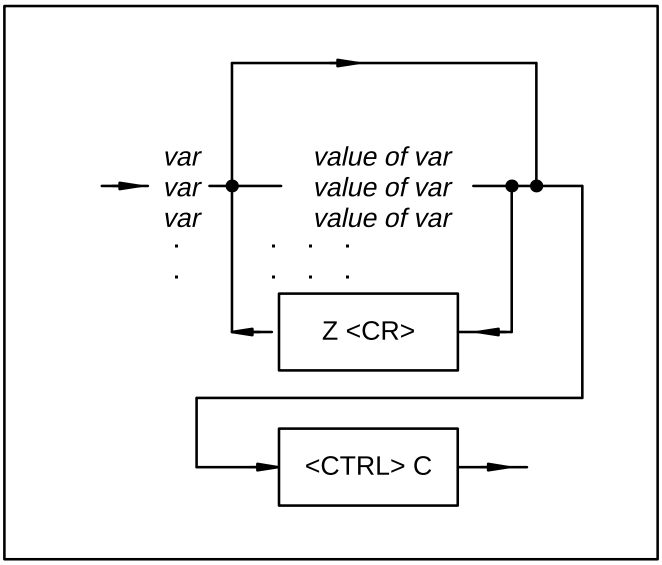


var: Variable (flag, input, output, indirect constant) to be displayed

;: The individual variables must be separated by semicolons.

L number: Number of consecutively numbered variables as of the variable var which are to be displayed.

Example: M 0,0 L 3
The following are displayed:
M 0,0 M 0,1 M 0,2



Function:
The variable names preset by the user are displayed on the monitor. The related variable values are updated automatically. The displayed variable values always originate from the same program cycle and represent a ”snapshot” at the end of the cycle.

The maximum number is 22. The command is terminated by a <CTRL>C.

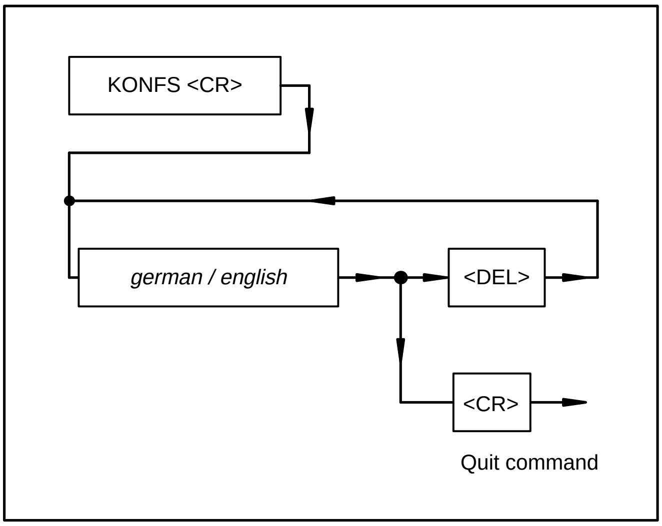
If character Z <CR> or ZD <CR> is then entered, the status display is reactivated for the previously entered variables.

Note on service device TCZ:
This command can be used only with the following restriction:
Only the status of one variable is displayed.

1.3 Commands for configurating

Display/change operating modes

Command:



Function:

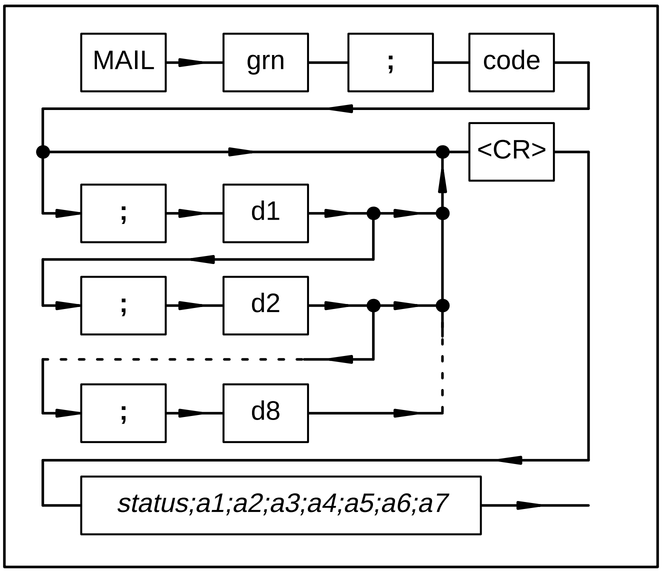
After command KONFS <CR> is entered, the set language is displayed on the monitor. If you press key <DELETE> (<CTRL> and the Backspace key on PCs), the language is switched over. The command is terminated by entering a <CR>.

Note:
The DELETE key is frequently not available on personal computers. The key code ($7F_H$) of the DELETE key can be generated on such keyboards by pressing two keys. In general, these keys are keys <CTRL> and the Backspace key.

Note on service device TCZ:
On the servicing unit TCZ, you switch over by pressing keys <CTRL> and <DEL> one after the other.

Configuration / interrogation of the configuration of CS31 remote modules (07 KR 91, 07 KT 92, 07 KT 93)

Command:



grn: Group number with which the local module is addressed by the PLC program

code: Job code

d1: 1st data byte of the job

: : :

d8: 8th data byte of the job

;: The individual values of the job must be separated by semicolons.

status: Status of the response:
51 (OK response)
170 (Not–OK response)

a1: 1st data byte of the response

: : :

a7: 7th data byte of the response

;: The individual values of the response are separated by semicolons.

Function:
The user has the option of configuring CS31 remote modules and interrogating the set configuration. The jobs are handled internally via a transmit mailbox (job) and receive mailbox (response).

List of jobs:

The OK responses are described for the relevant jobs.
The not–OK responses of the individual jobs are always as follows:

- **Not–OK response**
  status: 170

a1: 1 = Unknown job code
2 = Invalid parameter, e.g. group number
3 = Remote module does not respond
10 = Mail box not free within 3 sec.
11 = Job has been aborted owing to actuation of the RUN/STOP switch
12 = Job is not fetched within 6 sec.
13 = No reply within 6 sec.

a2...a7: 0

- **Updating the maximum number of remote modules detected.**

The contents of the input word EW 07,15 include the maximum number of remote modules detected in the past. The current actual number of existing remote modules may be less than this.

This command updates this value. The existing modules are counted and the value is stored.

The user can interrogate this value in the PLC program (EW 07,15, bits 8...15).

- **Job**
  grn: 255 (Master PLC with bus)
  code: 132
  d1...d8: Not used

- **OK response**
  status: 51
  a1...a7: 0

- **Interrogation whether open-circuit monitoring is activated or deactivated for an input**

- **Job**
  grn: Group number 0...63
  code: 32
  d1: Channel number 0...15
  d2...d8: Not used

- **OK response**
  status: 51
  a1: 47 = Open-circuit monitoring ON
  32 = Open-circuit monitoring OFF
  a2...a7: 0

- **Interrogation whether open-circuit monitoring is activated or deactivated for an output**

- **Job**
  grn: Group number 0...63
  code: 33
  d1: Channel number 0...15
  d2...d8: Not used

- **OK response**
  status: 51
  a1: 47 = Open-circuit monitoring ON
  32 = Open-circuit monitoring OFF
  a2...a7: 0

- **Activating or deactivating open-circuit monitoring of an input**

- **Job**
  grn: Group number 0...63
  code: 224 = Open-circuit monitoring ON
  160 = Open-circuit monitoring OFF
  d1: Channel number 0...15
  d2...d8: Not used

- **OK response**
  status: 51
  a1...a7: 0

- **Activating or deactivating open-circuit monitoring of an output**

- **Job**
  grn: Group number 0...63
  code: 225 = Open-circuit monitoring ON
  161 = Open-circuit monitoring OFF
  d1: Channel number 0...15
  d2...d8: Not used

- **OK response**
  status: 51
  a1...a7: 0

- **Interrogation whether a channel is configured as an input or as an input/output**

- **Job**
  grn: Group number 0...63
  code: 34
  d1: Channel number 0...15
  d2...d8: Not used

- **OK response**
  status: 51
  a1: 34 = Input
  35 = Input/output
  a2...a7: 0

- **Configuration of a channel as an input or input/output**

- **Job**
  grn: Group number 0...63
  code: 162 = Input
  163 = Input/output
  d1: Channel number 0..15
  d2...d8: Not used

- **OK response**
  status: 51
  a1...a7: 0

- **Interrogation of the input delay of a channel**

  - **Job**
    grn: Group number 0...63
    code: 38
    d1: Channel number 0...15
    d2...d8: Not used

  - **OK response**
    status: 51
    a1: Input delay:
    2 = 2 ms
    4 = 4 ms
    .
    .
    .
    30 = 30 ms
    32 = 32 ms
    a2...a7: 0

- **Setting the input delay of a channel**

  - **Job**
    grn: Group number 0...63
    code: 166
    d1: Channel number 0...15
    d2: Input delay
    2 = 2 ms
    4 = 4 ms
    .
    .
    .
    30 = 30 ms
    32 = 32 ms
    d3...d8: Not used

  - **OK response**
    status: 51
    a1...a7: 0

- **Acknowledging error on remote module**

  This command resets the error messages registered on the selected remote module. The error messages can be reset only if the cause of the error has been remedied.

  - **Job**
    grn: Group number 0...63
    code: 232
    d1: First channel number on the module:
    0 = First channel number on the module is 0 (≤7)
    8 = First channel number on the module is 8 (>7)
    d2: Module type:
    0 = Binary input
    1 = Analog input
    2 = Binary output
    3 = Analog output
    4 = Binary input/output
    5 = Analog input/output
    Note:
    Bit: even number (0, 2, 4)
    Word: odd number (1, 3, 5)
    d3...d8: Not used

  - **OK response**
    status: 51
    a1...a7: 0

- **Acknowledging errors on remote module and resetting configuration values to default setting**

  In addition to job ”Acknowledging error on remote module”, all configurable settings are reset to the default setting.

  - **Job**
    grn: Group number 0...63
    code: 233
    d1: First channel number on the module:
    0 = First channel number on the module is 0 (≤7)
    8 = First channel number on the module is 8 (>7)
    d2: Module type:
    0 = Binary input
    1 = Analog input
    2 = Binary output
    3 = Analog output
    4 = Binary input/output
    5 = Analog input/output
    Note:
    Bit: even number (0, 2, 4)
    Word: odd number (1, 3, 5)
    d3...d8: Not used

  - **OK response**
    status: 51
    a1...a7: 0

- **Interrogation of the configuration of an analog input**

  - **Job**
    grn: Group number 0...63
    code: 42
    d1: Channel number 0...15
    d2...d8: Not used

  - **OK response**
    status: 51
    a1: 50 = Input 0...20 mA
    49 = Input 4...20 mA
    a2...a7: 0

- **Interrogation of the configuration of an analog output**

  - **Job**
    grn: Group number 0...63
    code: 43
    d1: Channel number 0...15
    d2...d8: Not used

- **OK response**
  status: 51
  a1: 50 = Output 0...20 mA
  49 = Output 4...20 mA
  51 = Output ±10V
  a2...a7: 0

- **Configuration of an analog input**
  - **Job**
    grn: Group number 0...63
    code: 170
    d1: Channel number 0...15
    d2: 50 = Input 0...20 mA
    49 = Input 4...20 mA
    d3...d8: Not used
  - **OK response**
    status: 51
    a1...a7: 0

- **Configuration of an analog output**
  - **Job**
    grn: Group number 0...63
    code: 171
    d1: Channel number 0...15
    d2: 50 = Output 0...20 mA
    49 = Output 4...20 mA
    51 = Output ±10V
    d3...d8: Not used
  - **OK response**
    status: 51
    a1...a7: 0

- **Interrogation of the bus configuration**

  The bus interface of the Master PLC has a list which stores specific data of the remote modules. In this list, the remote modules are numbered in the order in which they are encountered on the CS31 bus. This command involves specifying the internal number of the modules. The response received is the group number stored under this number and the status information on the corresponding module.

  - **Job**
    grn: 0 (is not evaluated)
    code: 80
    d1: Number from the module list (1...31)
    d2...d8: Not used
  - **OK response**
    status: 51
    a1: Status of the remote module:
    Bits 0...3: Number of process data bytes (binary module) or words (word module) sent by the module to the Master.
    Bits 4...7: Number of process data bytes (binary module) or words (word module) sent by the Master to the module.
    a2: Group number (0...63)
    a3: Bit 0: 0 = First channel number ≤7
    1 = First channel number >7
    Bit 1: 0 = Binary module
    1 = Word module
    a4...a7: 0

- **Reading 1...6 bytes (07 KR 91, 07 KT 92, 07 KT 93)**
  - **Job**
    grn: Group number 0...63
    code: 49 = Read 1 byte
    50 = Read 2 bytes
    51 = Read 3 bytes
    52 = Read 4 bytes
    53 = Read 5 bytes
    54 = Read 6 bytes
    d1: First channel number on the module:
    0 = First channel number on the module is 0 (≤7)
    8 = First channel number on the module is 8 (>7)
    d2: Module type:
    0 = Binary input
    1 = Analog input
    2 = Binary output
    3 = Analog output
    4 = Binary input/output
    5 = Analog input/output
    Note:
    Bit: even number (0, 2, 4)
    Word: odd number (1, 3, 5)
    d3: Byte start address (low byte)
    d4: Byte start address (high byte)
    d5...d8: Not used
  - **OK response**
    status: 51
    a1: Value of the 1st byte
    a2: Value of the 2nd byte or 0
    a3: Value of the 3rd byte or 0
    a4: Value of the 4th byte or 0
    a5: Value of the 5th byte or 0
    a6: Value of the 6th byte or 0
    a7: 0

- **Reading 1 bit of 1 byte**
  - **Job**
    grn: Group number 0...63
    code: 63
    d1: First channel number on the module:
    0 = First channel number on the module is 0 (≤7)
    8 = First channel number on the module is 8 (>7)
    d2: Module type:
    0 = Binary input
    1 = Analog input
    2 = Binary output
    3 = Analog output
    4 = Binary input/output
    5 = Analog input/output

Note:
Bit: even number (0, 2, 4)
Word: odd number (1, 3, 5)

d3: Byte start address (low byte)
d4: Byte start address (high byte)
d5: Bit position within the byte 0...7
d6...d8: Not used

- **OK response**
  status: 51
  a1: Bit value (0 or 1)
  a2...a7: 0

- **Writing 1...4 bytes (07 KR 91, 07 KT 92, 07 KT 93)**

  - **Job**
    grn: Group number 0...63
    code: 65 = Write 1 byte
    66 = Write 2 bytes
    67 = Write 3 bytes
    68 = Write 4 bytes
    d1: First channel number on the module:
    0 = First channel number on the module is 0 (≤7)
    8 = First channel number on the module is 8 (>7)

    d2: Module type:
    0 = Binary input
    1 = Analog input
    2 = Binary output
    3 = Analog output
    4 = Binary input/output
    5 = Analog input/output

    Note:
    Bit: even number (0, 2, 4)
    Word: odd number (1, 3, 5)

    d3: Byte start address (low byte)
    d4: Byte start address (high byte)
    d5: Value of the 1st byte
    d6: Value of the 2nd byte or not used
    d7: Value of the 3rd byte or not used
    d8: Value of the 4th byte or not used

  - **OK response**
    status: 51
    a1...a7: 0

- **Writing 1 bit of a byte**

  - **Job**
    grn: Group number 0...63
    code: 79
    d1: First channel number on the module:
    0 = First channel number on the module is 0 (≤7)
    8 = First channel number on the module is 8 (>7)
    d2: Module type:
    0 = Binary input
    1 = Analog input
    2 = Binary output
    3 = Analog output
    4 = Binary input/output
    5 = Analog input/output

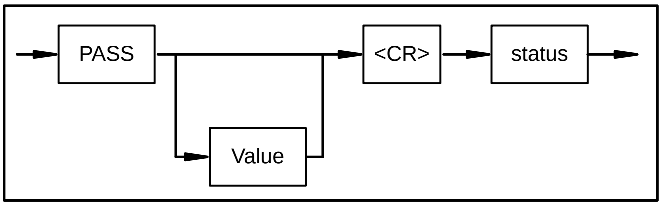
    Note:
    Bit: even number (0, 2, 4)
    Word: odd number (1, 3, 5)

    d3: Byte start address (low byte)
    d4: Byte start address (high byte)
    d5: Bit position within byte 0...7
    d6: Bit value (0 or 1)
    d7...d8: Not used

  - **OK response**
    status: 51
    a1...a7: 0

Password (only with 07 KR 31 / 07 KT 31)

Command:



Function:

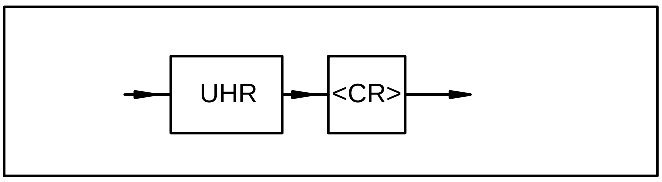
The command PASS value activates or disactivates the password. As a password, any 4–digit hexadecimal number (except 0000) can be used. If a password is activated, the following commands are disabled: AEND, D, DEEP, FREI, N, NOP, O, S, V.

Value: Any 4–digit hexadecimal number.
Caution: The value of 0000 has no effect.

status: The activation or disactivation of the password is displayed.

Display time and date (07 KR 91, 07 KT 92, 07 KT 93)

Command:



Function:

The time and date are displayed on the monitor in the following form:

SYSTEM TIME : HH:MM:SS
SYSTEM DATE : DAY OF WEEK TT.MM.JJ

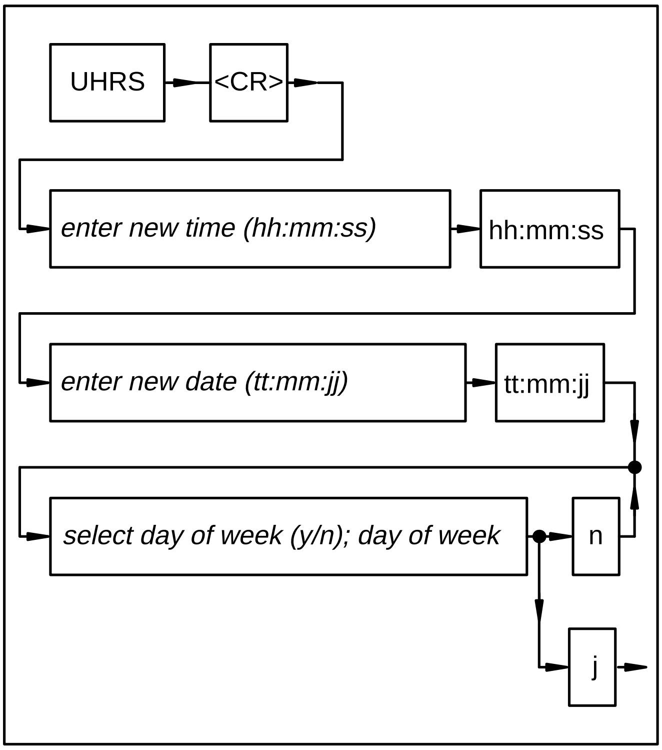
where:

HH:	Hours
MM:	Minutes
SS:	Seconds
DAY OF WEEK:	Name of the day of the week
TT:	Day
MM:	Month
JJ:	Year

Note on service device TCZ:
The four–line liquid–crystal display (LCD) of the servicing unit TCZ does not suffice to display this command.

Set time and date

Command:



Function:

Setting the time and date. For the day of the week, the clock manages a number between 1 and 7 internally. When converting the number to the name, it assumes that Monday is the first day of the week (number 1 —> Monday). If the clock is set with block UHR (see also Block catalog), a different number may then be assigned to Monday. In this case, the display of the day of the week no longer corresponds to the command UHR <CR> since the display function always assumes that Monday is assigned the number 1.

hh or hh:	Hours
mm or mm:	Minutes
ss or ss*:*	Seconds
tt or tt:	Day
mm or mm:	Month
jj or jj:	Year
day of week:	Name of the day of the week
n:	Enter for ’no’
j:	Enter for ’yes’

1.4 Texts in the instruction list

Certain PLC blocks (DRUCK, EMAS) operate with texts stored in the user program.

Entering the texts in the user program

A text is entered with the terminal or service device TCZ embedded in the code characters #” and ”#. The key code character #” identifies the start of a text string and the key code character ”# identifies the end of a text string.

All ASCII characters between 0_H and $7F_H$ may be entered.

Storing the texts in the user program

Each text character entered occupies *one* word in the user program. The ASCII code of the text character is stored in the low byte and the prefix FA is stored in the high byte.

Example:

Text entry and storage as of address 100 in the PLC program:

```
Entry:      S 100  <CR>
            00100  NOP
              #”ABB”#<CR>

Storage:    00100  FA41
            00101  FA42
            00102  FA42
```

Overview of the possible text characters, how they are entered and how they are displayed on a monitor

ASCII character	Hex-value	User entry	Display
NUL	00	<CTRL><SP>	<NUL> *
SOH	01	<CTRL> A	<SOH>
STX	02	<CTRL> B	<STX>
ETX	03	<CTRL> C	<ETX>
EOT	04	<CTRL> D	<EOT>
ENQ	05	<CTRL> E	<ENQ>
ACK	06	<CTRL> F	<ACK>
BEL	07	<CTRL> G	<BEL>
BS	08	<CTRL> H	<BS>
HT	09	<CTRL> I	<HT>
LF	0A	<CTRL> J	<LF>
VT	0B	<CTRL> K	<VT>
FF	0C	<CTRL> L	<FF>
CR	0D	<CTRL> M	<CR>
SO	0E	<CTRL> N	<SO>
SI	0F	<CTRL> O	<SI>
DLE	10	<CTRL> P	<DLE>
DC1	11	<CTRL> Q	<DC1>
DC2	12	<CTRL> R	<DC2>
DC3	13	<CTRL> S	<DC3>
DC4	14	<CTRL> T	<DC4>
NAK	15	<CTRL> U	<NAK>
SYN	16	<CTRL> V	<SYN>
ETB	17	<CTRL> W	<ETB>
CAN	18	<CTRL> X	<CAN>
EM	19	<CTRL> Y	<EM>
SUB	1A	<CTRL> Z	<SUB>
ESC	1B	<CTRL> [	<ESC>
FS	1C	<CTRL> /	<FS>
GS	1D	<CTRL>]	<GS>
RS	1E	<CTRL> ∼	<RS> *
US	1F	<CTRL> ?	<US> *
SP	20	<SP>	<SP> **
!	21	!	!
”	22	”	”
#	23	#	#
$	24	$	$
%	25	%	%
&	26	&	&
’	27	’	’
(	28	(	(
)	29	)	)
*	2A	*	*
+	2B	+	+
,	2C	,	,
–	2D	–	–
.	2E	.	.
/	2F	/	/
0	30	0	0

ASCII character	Hex-value	User entry	Display
1	31	1	1
2	32	2	2
3	33	3	3
4	34	4	4
5	35	5	5
6	36	6	6
7	37	7	7
8	38	8	8
9	39	9	9
:	3A	:	:
;	3B	;	;
<	3C	<	<
=	3D	=	=
>	3E	>	>
?	3F	?	?
@	40	@	@
A	41	A	A
B	42	B	B
C	43	C	C
D	44	D	D
E	45	E	E
F	46	F	F
G	47	G	G
H	48	H	H
I	49	I	I
J	4A	J	J
K	4B	K	K
L	4C	L	L
M	4D	M	M
N	4E	N	N
O	4F	O	O
P	50	P	P
Q	51	Q	Q
R	52	R	R
S	53	S	S
T	54	T	T
U	55	U	U
V	56	V	V
W	57	W	W
X	58	X	X
Y	59	Y	Y
Z	5A	Z	Z
[	5B	[	[
\	5C	\	\
]	5D	]	]
↑	5E	↑	↑
_	5F	_	_
‘	60	‘	‘
a	61	a	a

ASCII character	Hex-value	User entry	Display
b	62	b	b
c	63	c	c
d	64	d	d
e	65	e	e
f	66	f	f
g	67	g	g
h	68	h	h
i	69	i	i
j	6A	j	j
k	6B	k	k
l	6C	l	l
m	6D	m	m
n	6E	n	n
o	6F	o	o
p	70	p	p
q	71	q	q
r	72	r	r
s	73	s	s
t	74	t	t
u	75	u	u
v	76	v	v
w	77	w	w
x	78	x	x
y	79	y	y
z	7A	z	z
{	7B	{	{
|	7C	|	|
}	7D	}	}
∼	7E	∼	∼
DEL	7F	<DEL>	<DEL>

* To older terminals applies:

NUL	0	<CTRL> @	<NUL>
RS	1E	<CTRL> ↑	<RS>
US	1F	<CTRL> _	<US>

** In the case of *text entry*, a SPACE is displayed as a blank. When *displaying* the user program, it is displayed as <SP> in order to permit it to be recognized easier.

Note:

Interrelationship between value and ASCII character

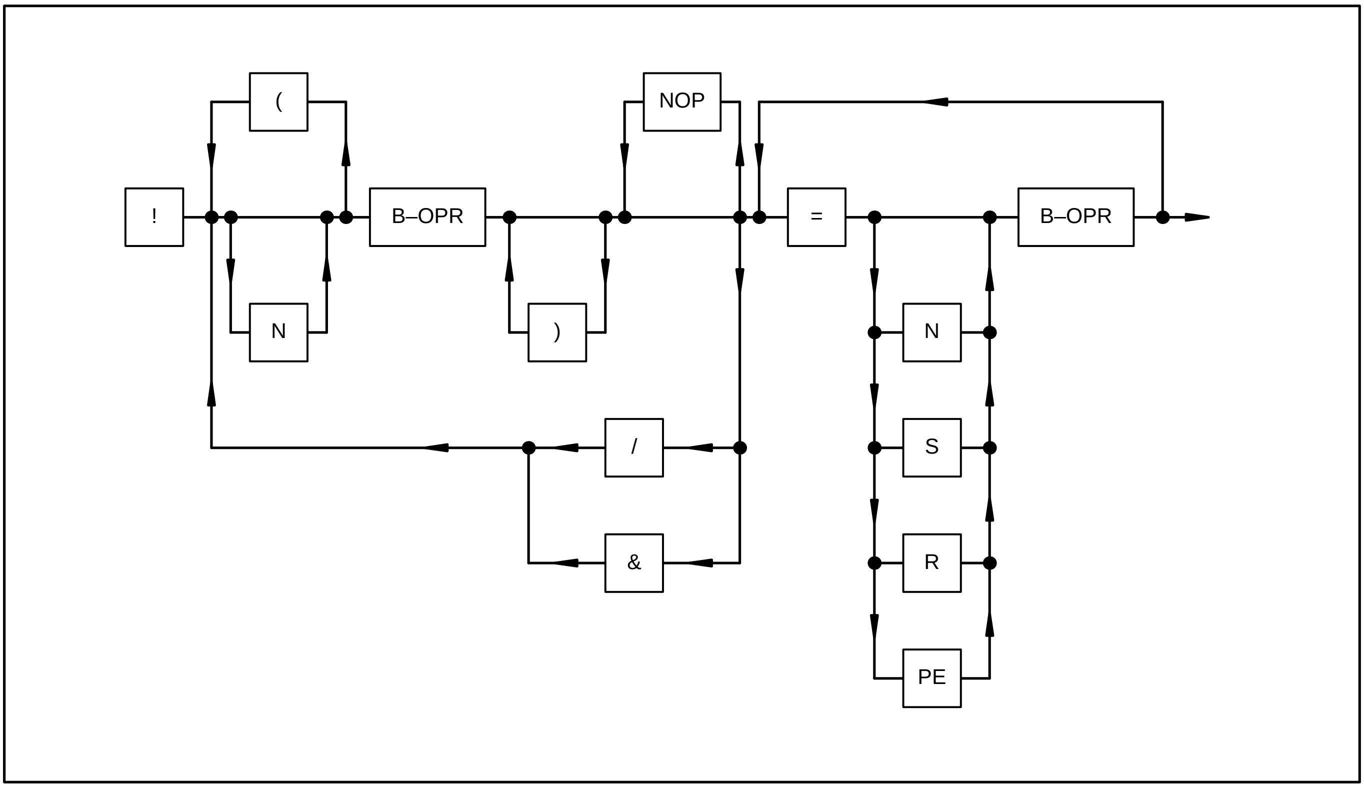
Binary value in the computer
1011 ($0B_H$, 11_{DEC})

Represented as:
- Decimal ASCII: 31_H, 31_H
- Hexadecimal ASCII: 42_H

Output by DRUCK as hexadecimal value: 1011

1.5 Syntax diagrams for instruction list (IL)

1.5.1 Syntax diagram: BOOLEAN SENTENCE

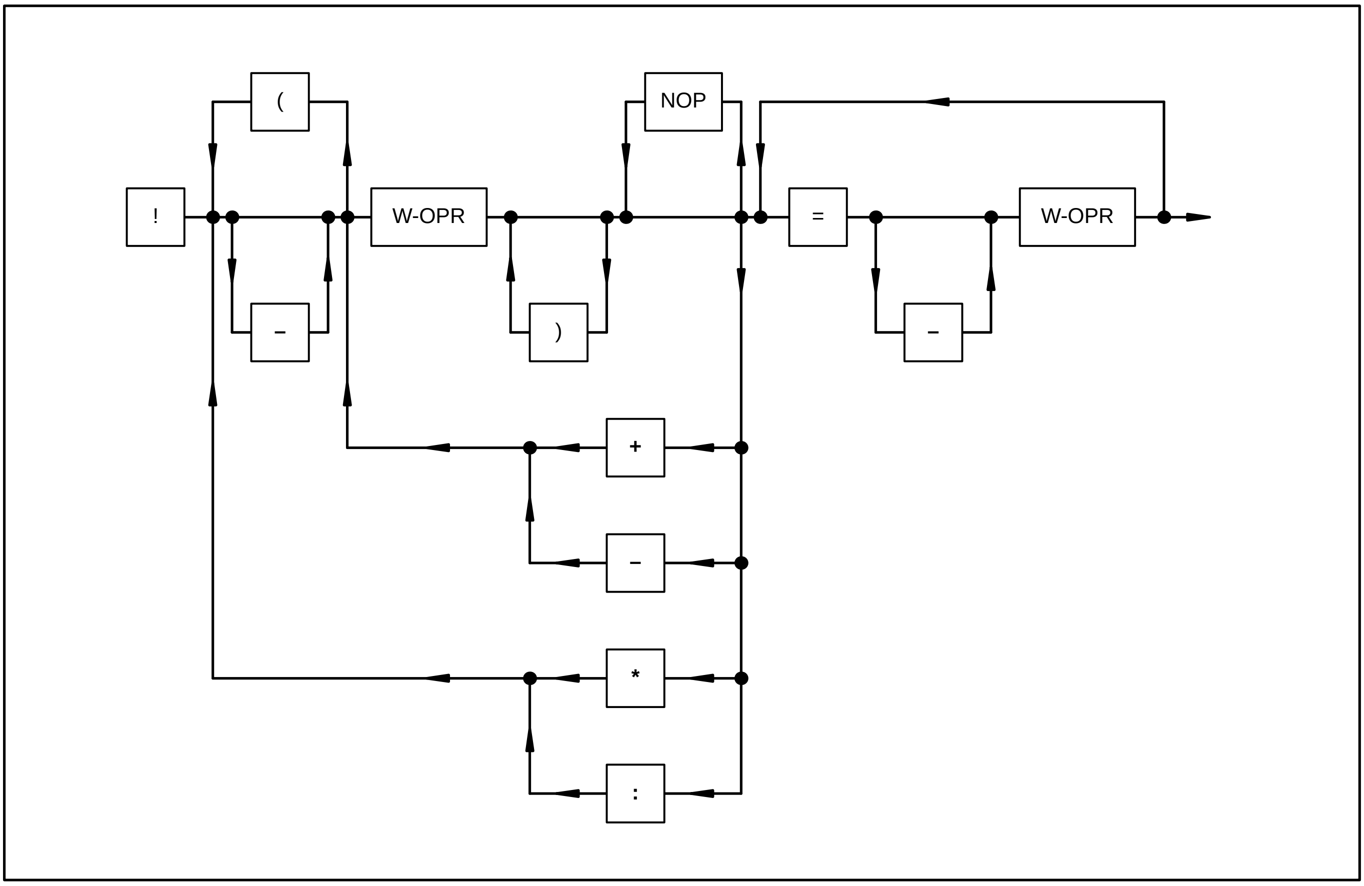


Signal flow: in the direction of arrow, otherwise from left to right.

Brackets: sum ”LEFT BRACKET” = sum ”RIGHT BRACKET”, nesting depth: 15.

B–OPR: Binary operand (E, A, M, S, K)
Example: E 00,03 A 07,06 M 05,01 S 05,04 K 00,01

1.5.2 Syntax diagram: ARITHMETIC SENTENCE



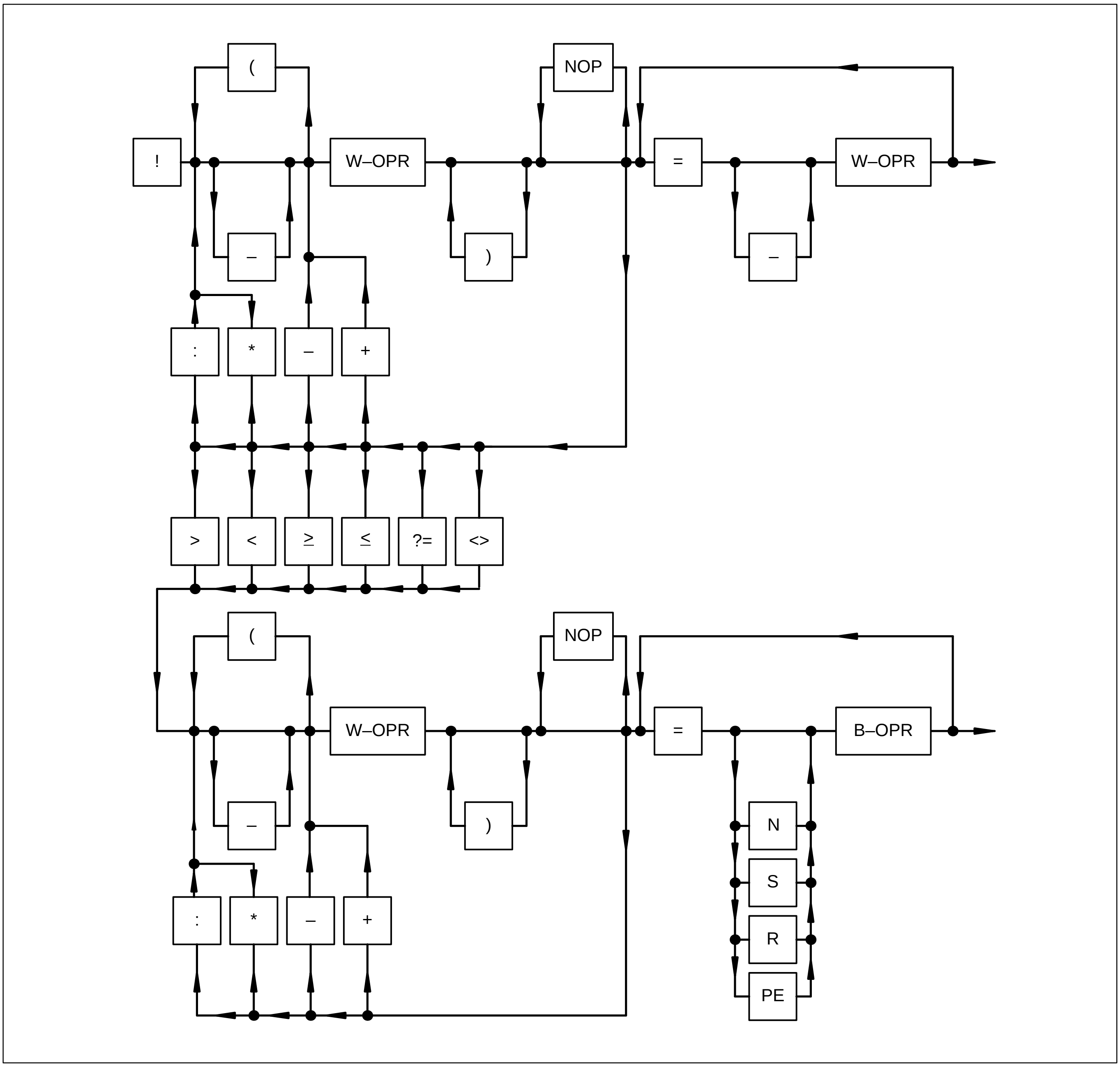
Signal flow: in direction of arrow, otherwise from left to right.

Brackets: sum ”LEFT BRACKET” = sum ”RIGHT BRACKET”, nesting depth: 15.

W–OPR: Word operand (EW, AW, MW, KW)
Example: EW 03,05 AW 11,12 MW 22,15 KW 09,06

1.5.3 Syntax diagram: HYBRID SENTENCE

See also chapter ”Language repertoire”, Relational operators



Signal flow: in direction of arrow, otherwise from left to right.

Brackets: sum ”LEFT BRACKET” = sum ”RIGHT BRACKET”, nesting depth: 15.

W–OPR: Word operand (EW, AW, MW, KW)
Example: EW 03,05 AW 11,12 MW 22,15 KW 09,06

B–OPR: Binary operand (E, A, M, S, K)
Example: E 00,03 A 07,06 M 05,01

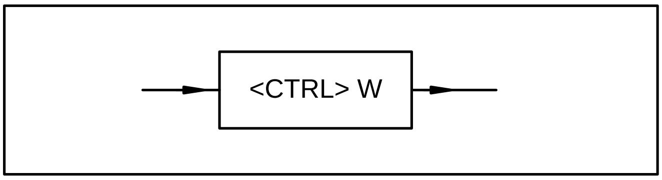
2 Monitor functions

The monitor program offers the specialist access at hexadecimal level to the entire address range of the PLC. Memory areas can be displayed and modified, and hardware tests can be conducted.

Monitor commands which change memory areas may endanger the functionality of the PLC. For this reason, take care when using the monitor functions.

Switchover Operator-control functions <–––> Monitor functions

Command:



Not available in 07 KR 31 / 07 KT 31

Function:

By pressing key <CTRL> and key W simultaneously, you access the monitor program of the PLC. If you are in the monitor program, you can change back to the operator-control program of the PLC by entering <CTRL> and W again.

Explanation of the syntax:

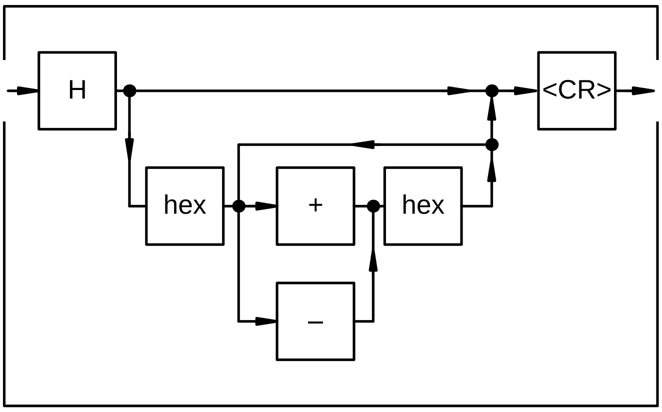
- The monitor program responds with character * and waits for an entry.
- All numbers are hexadecimal numbers (leading zeroes may be omitted).
- If more digits than necessary are entered, only the last digits are valid (the last two digits in the case of byte commands and the last four digits in the case of word commands).
- The blank character (Space) is ignored and can be used for more clearly structured entries.
- Character CTRL C aborts the currently running operation.
- Every display on the monitor can be stopped with <CTRL>S (XOFF) and can be continued with <CTRL>Q (XON).
- If no segment is specified when entering an address, the working segment is used (see Y instruction).

Overview of the monitor functions

Display help text / calculate hexadecimally

When command H <CR> is entered, all available functions of the monitor are displayed on the screen. In addition, this command permits you to calculate simple hexadecimal arithmetic expressions.

Command:

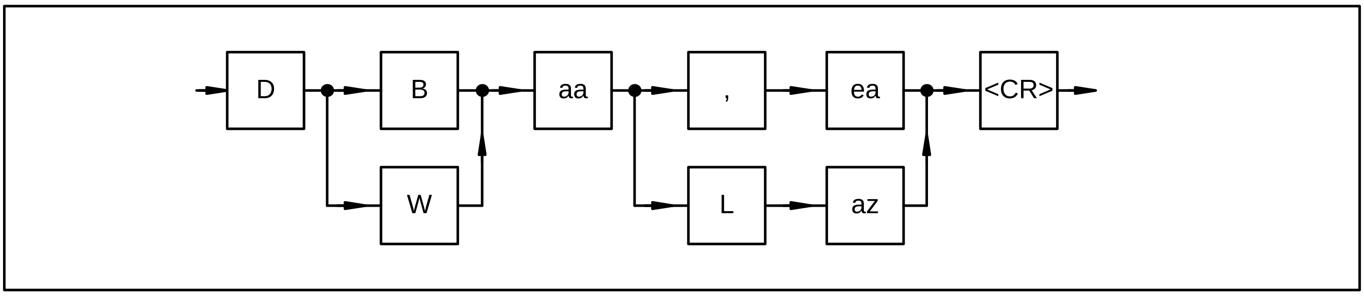


hex: Hexadecimal number

Display memory contents

The memory contents can be displayed byte-serially or word-serially.

Command:



B: Byte-serially (keyword)
W: Word-serially (keyword)
aa: Start address as of which the memory contents are to be displayed
,: Keyword (separator)
ea: End address of the memory contents to be output
L: Length (keyword)
az: Number of bytes/words to be output

Example:

DB 0:0L2<CR> Display memory contents byte-serially

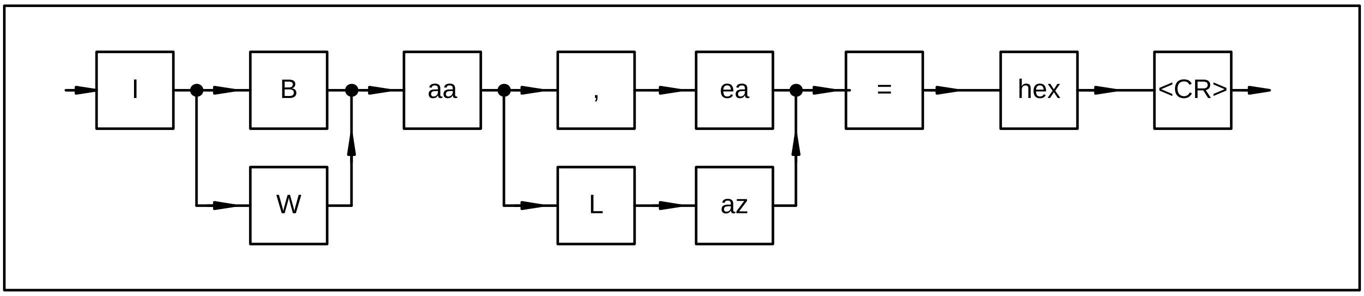
0000:0000 02 00 Monitor display

DW 0,2<CR> Display memory contents word-serially

0000:0000 0002 0000 Monitor display

Fill memory area with a value

Command:



B: Byte-serially (keyword)
W: Word-serially (keyword)
aa: Start address as of which the memory contents are to be filled with the specified value
,: Keyword (separator)
ea: End address of the memory area
L: Length (keyword)
az: Number of bytes/words to be filled
hex: Hexadecimal value with which the memory area is to be filled

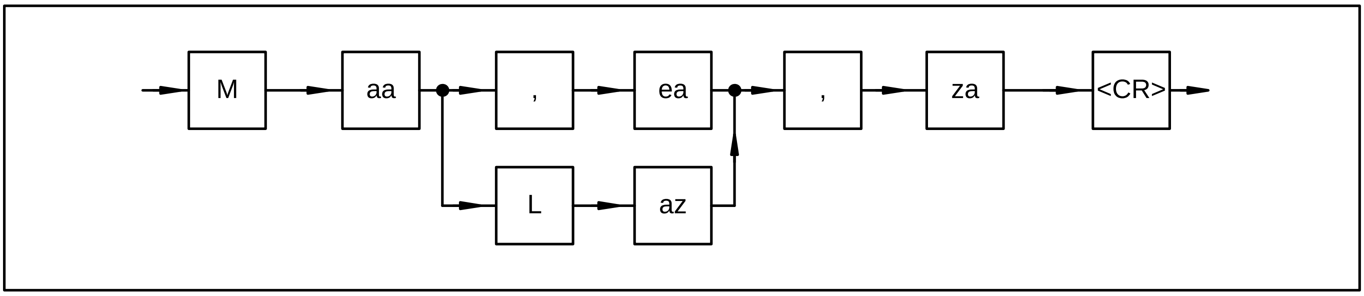
Example:

IB 8000:80L3=FF<CR> The memory contents of 8000:80_H, 8000:81_H and 8000:82_H is overwritten with FF

Transfer memory areas

A memory area can be copied to another area. The data are transferred word-serially, but the number is specified in bytes when entering (i.e. one word is transferred in the case of az = 3).

Command:



aa: Start address as of which the memory contents are to be copied
,: Keyword (separator)
ea: End address of the memory area
L: Length (keyword)
az: Number of bytes to be copied
za: Target address of the memory area

Example:

M 8000:80L4,8000:90<CR> or M 8000:80,84,8000:90<CR>

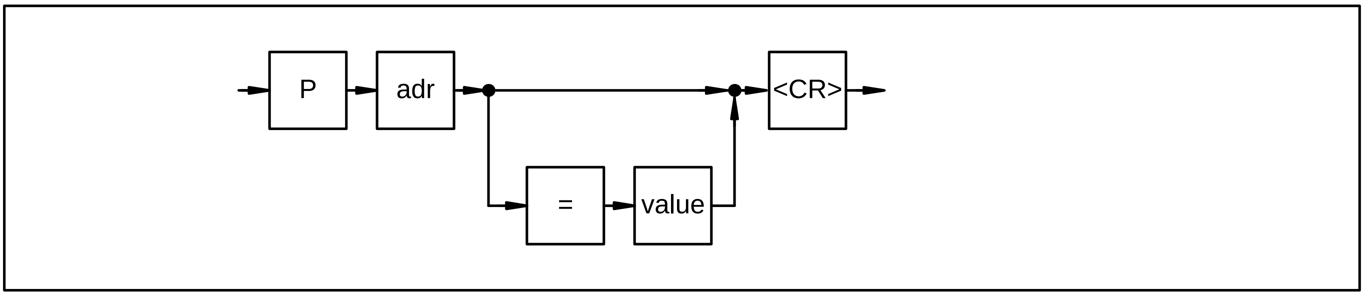
The following are copied:

8000H:80H ——> 8000H:90H
:81H ——> :91H
:82H ——> :92H
:83H ——> :93H

Read/write port

A value from the I/O area is displayed and modified byte-serially.

Command:

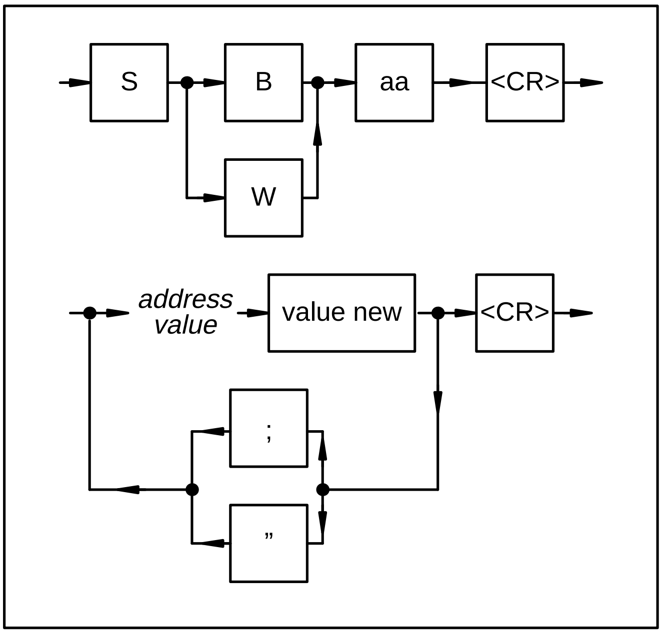


adr: I/O address
value: Byte value to be written to the I/O address
=: Keyword

Display/edit memory contents

The memory contents can be displayed and modified byte-serially or word-serially.

Command:

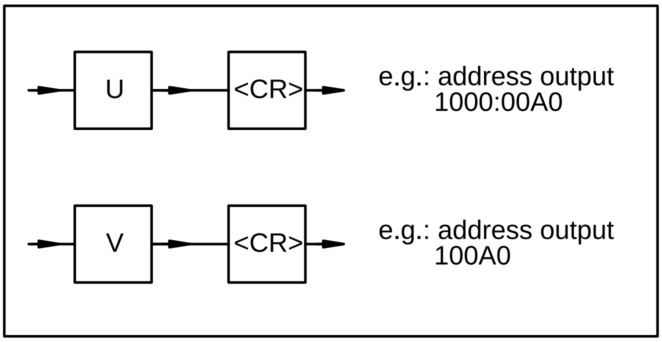


B: Byte-serially (keyword)
W: Word-serially (keyword)
aa: Start address as of which the memory contents are to be displayed/modified
address: Address of the memory contents
value: Value of the memory contents
value new: New value of the memory contents (user entry)
;: Entering a semicolon increments the address by 1 (command SB) or by 2 (command SW)
↑: Entering an ”arrow up” (^ on the PC) decrements the address by 1 (command SB) or by 2 (command SW)

Edit address output format

The monitor program is set to SEGMENT:OFFSET address format when it is initialized, and this format is used for each address output. The address output format can be freely selected with the user commands U<CR> (Segment:Offset format) and V<CR> (Absolute format).

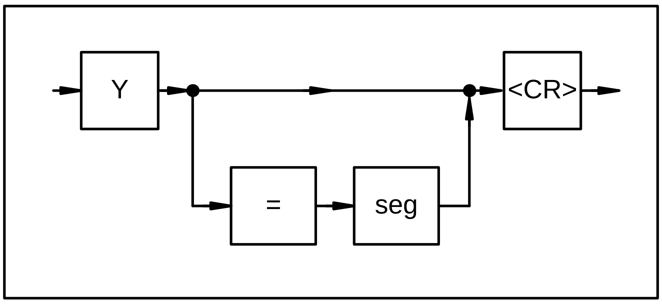
Command:



Display/edit working segment

If only an offset and no segment is specified when entering an address, the working segment Y is used as the segment. The default value of the working segment is zero.

Command:



seg: New segment address of the working segment
=: Keyword

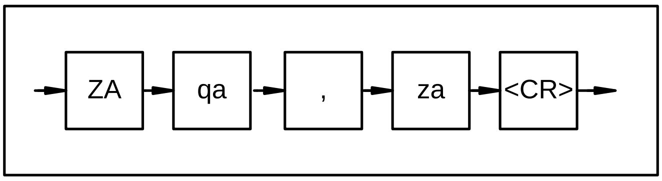
Example:

Y <CR>	User command: Display working segment
Y 0000	Screen display
DB 0L2	Display memory contents byte-serially
0000:0000 02 00	Screen display
Y=8000<CR>	Modify working segment

Cyclic read and write

A value is read cyclically from a source address and written to a target address. The operation can be aborted with CTRL C.

Command:



qa: Source address from which the value is read
za: Target address to which the value is written
,: Keyword (separator)

Example:

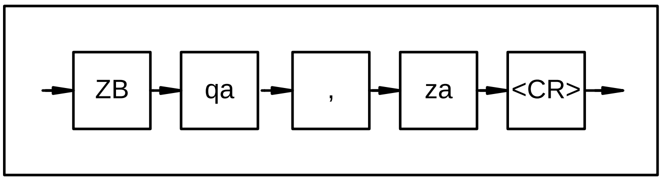
ZA 1000:0, 1000:100 <CR>

A value is read cyclically from address $1000:0_H$ and written cyclically to address $1000:100_H$.

Cyclic read and write with waiting time

A value is read cyclically from a source address and written cyclically to a target address. The operation can be aborted with CTRL C. The waiting time between two read cycles is approximately 1 ms.

Command:



qa: Source address from which the value is read
za: Target address to which the value is written
,: Keyword (separator)

Example:

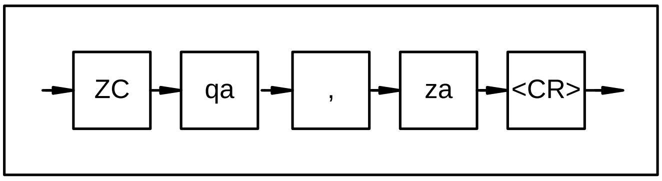
ZA 1000:0, 1000:100 <CR>

A value is read cyclically from address $1000:0_H$ and written cyclically to address $1000:100_H$.

Read and write on keystroke

After each keystroke, a value is read from the source address and written to a target address. The operation can be aborted with CTRL C.

Command:



qa: Source address from which the value is read
za: Target address to which the value is written
,: Keyword (separator)

Example:

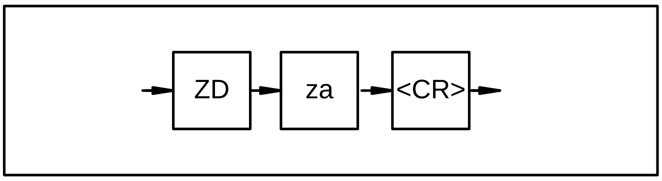
ZC 1000:0, 1000:100 <CR>

With each keystroke, a value is read from address $1000:0_H$ and written to address $1000:100_H$.

Cyclic write

The value of a counter is decremented and written to a target address. The operation can be aborted with CTRL C.

Command:



za: Target address to which the value is written

Example:

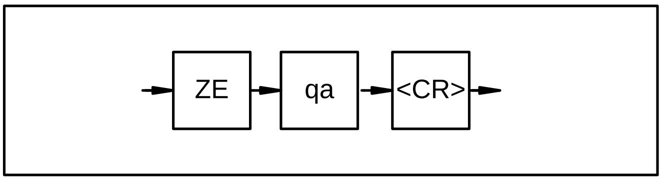
ZE 1000:100 <CR>

The value of a counter is written to $1000:100_H$. The counter is decremented after each write operation.

Cyclic read

A source address is read cyclically. The operation can be aborted with CTRL C.

Command:



qa: Source address from which the value is read

Example:

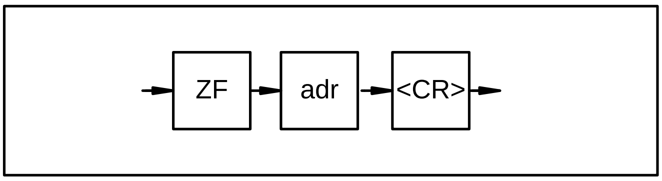
ZE 1000:100 <CR>

The value of address $1000:100_H$ is read cyclically.

Cyclic write and read

The value of a counter is written cyclically to an address and then read again. The operation can be aborted with CTRL C.

Command:



adr: Address to which the value of the counter is written and from which the value is read

Example:

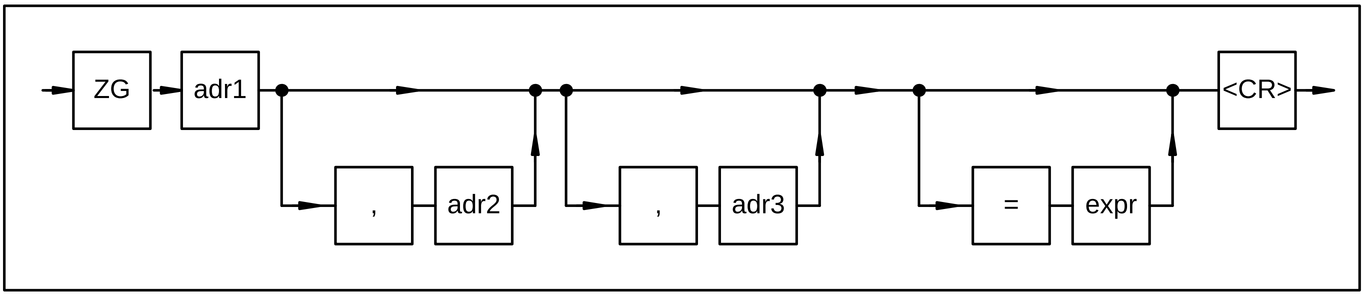
ZF 1000:0 <CR>

The value of a counter is written to address $1000:100_H$. After each write operation, the value is read from address $1000:100_H$ and the counter is decremented.

Simultaneous output of 3 values

The ZG command permits the values of maximum 3 addresses to be displayed. Whenever the value of the first address changes, the values are updated on the monitor. The expression ”expr” states how frequently updating of the values is to be suppressed.

Command:



adr1: 1st address whose value is displayed on the monitor. If the value of adr1 changes, the values are updated on the monitor.
adr2: 2nd address whose value is displayed on the monitor.
adr3: 3rd address whose value is displayed on the monitor.
expr: Number expressing how frequently updating of the values on the monitor is to be suppressed when the value of adr1 changes.
,: Keyword (separator)
=: Keyword

Example:

ZG 1000:0, 1000:100 <CR>

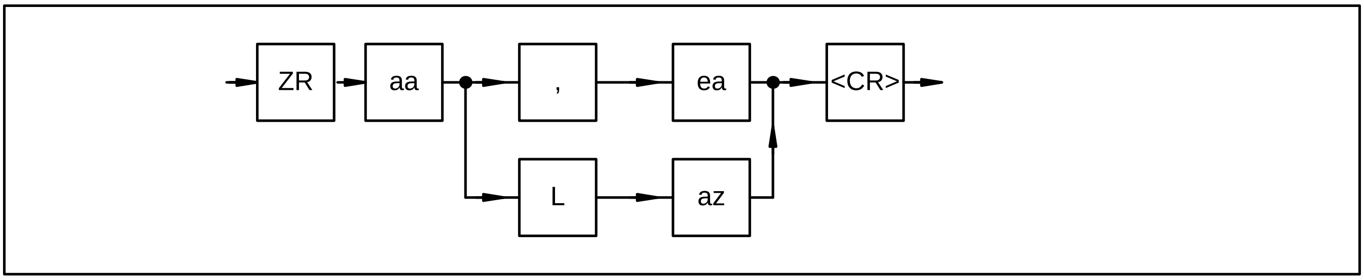
The values of addresses $1000{:}0_H$ and $1000{:}100_H$ are displayed on the monitor. If the value of address $1000{:}0_H$ changes, the values of the two addresses are updated on the monitor.

RAM test

The specified area is written with a test pattern (FFFF, 5555, AAAA), and a check is then conducted in order to establish whether the test values have been stored correctly in the specified area. If an error is established, the address, actual value and required value are output. The test can be continued by pressing any key (apart from <SPACE>). CTRL C aborts the test.

3 test cycles are performed with test values whose order is reversed. The 4th test cycle consists of storing a counter at the start address, checking for correct storage and repeating the test with the decremented counter until it reaches value zero. The RAM test is then terminated with monitor message (*).

Command:



aa: Start address of the RAM area
ea: End address of the RAM area
L: Length (keyword)
az: Number of bytes of the RAM area
,: Keyword (separator)

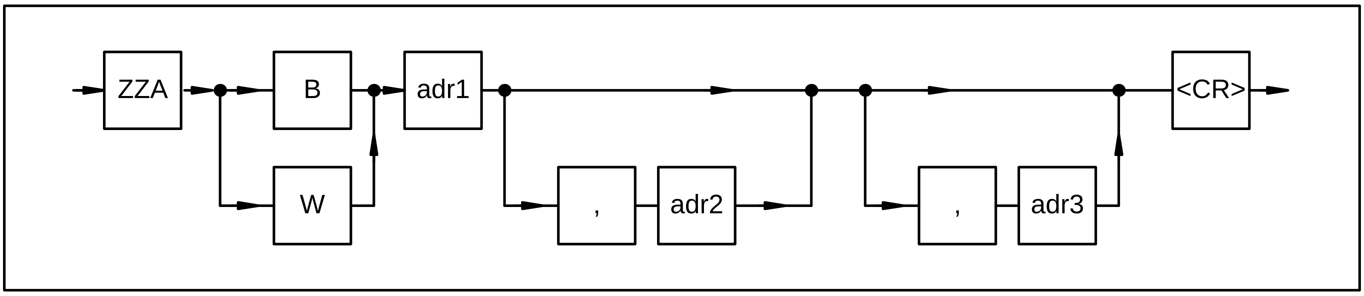
Example:

ZR 1000:0L100<CR> RAM test over the specified memory area.

Output of 3 values after entering a semicolon (;)

Command ZZA permits you to display the values (byte or word) of maximum 3 addresses each time a semicolon (;) is entered. The command can be aborted with <CR>.

Command:



B: Byte-serially (keyword)
W: Word-serially (keyword)
adr1: 1st address whose value is displayed on the monitor.
adr2: 2nd address whose value is displayed on the monitor.
adr3: 3rd address whose value is displayed on the monitor.
,: Keyword (separator)

Example:

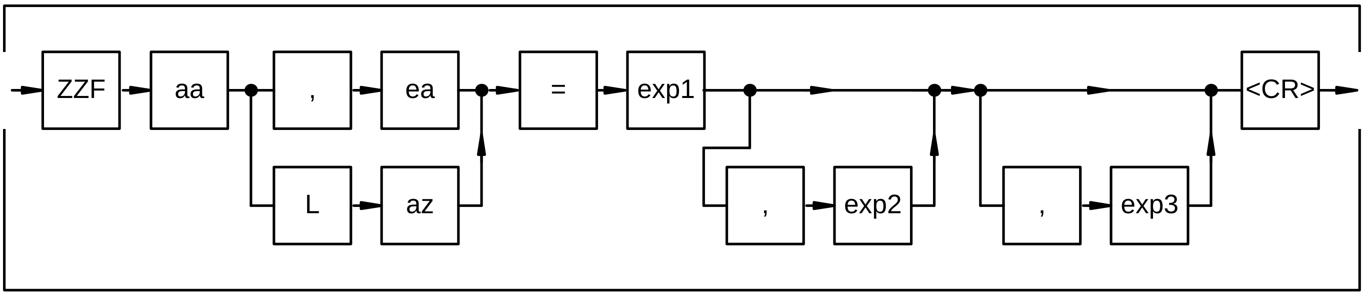
ZZA 1000:0, 1000:100 <CR>

After entry of a semicolon (;), the values of addresses 1000:0_H and 1000:100_H are displayed on the monitor.

Search for string

Command ZZF can be used to search for a string with maximum 3 words in the specified memory area. If the string is found, the address is displayed on the monitor. The search is continued by entering a semicolon (;). If the string is not found, monitor message <#07> is displayed.

Command:



aa: Start address of the memory area
ea: End address of the memory area
L: Length (keyword)
az: Number of words in the memory area
exp1: 1st word of the string
exp2: 2nd word of the string
exp3: 3rd word of the string
,: Keyword (separator)

Example:

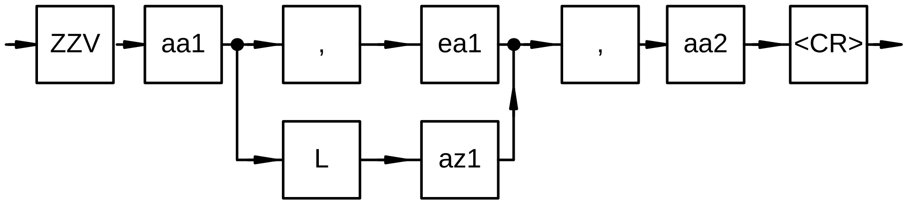
ZZF 1000:0, 100 = AAAA, BBBB <CR>

The entered string ($AAAA_H$, $BBBB_H$) is sought in the area 1000:0_H to 1000:100_H.

Compare memory areas word–serially

Command ZZV is used to compare a memory area 1 word-serially with a memory area 2. If a difference is established, the address 1, the contents 1, the address 2 and the contents 2 are displayed on the monitor. The operation can be aborted with CTRL C.

Command:



aa1: Start address of the memory area 1
ea1: End address of the memory area 1
L: Length (keyword)
az1: Number of words in the memory area 1
aa2: Start address of the memory area 2
,: Keyword (separator)

Example:

ZZV A000:0 L 100, 8000:0 <CR>

Memory area 1 between A000:0_H and A000:100_H is compared with memory area 2 as of 8000:0_H.

Read Intel HEX file

Using the R command, it is possible to read in an INTEL HEX file via the COM2 serial interface of unit 07 KT 92 and to store the HEX file data in the PLC.
The following records are accepted in this case:

- address extension record
- data record
- end record

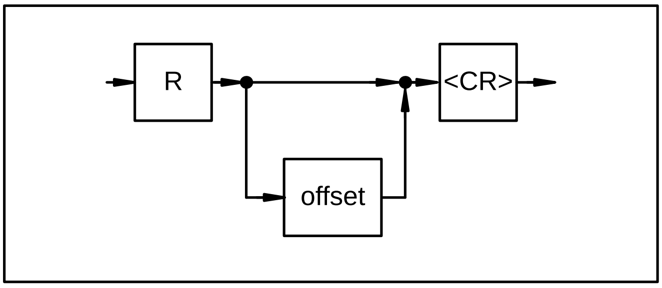
The following transfer format applies:

- 8 data bits
- no parity bit
- 1 stop bit

The data of the INTEL HEX file are stored in the PLC as of the following address:

- The segment address is determined by the address in the address extension record of the INTEL HEX file. If an offset is specified when entering the command, this offset is added to the segment address in the address extension record. This results in a new segment address as of which the data of the HEX file are stored. This permits the storage area for the HEX file data in the PLC to be preset.
- The offset address is determined by the address in the data record of the INTEL HEX file.

Command:



offset: Offset (by addition to the segment address of the address extension record, this results in the new segment address)

Example:

R <CR>	The PLC is ready to receive an INTEL HEX file.
R 2F00 <CR>	The PLC is ready to receive an INTEL HEX file. The HEX value $2F00_H$ is added to the segment address of the address extension record. The resultant new segment address is the address used for storing the HEX file data.

Write INTEL HEX file

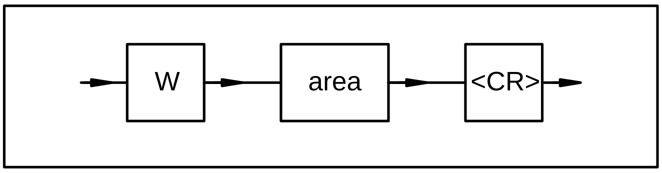
The W command permits a data area of the PLC to be output as an INTEL HEX file via the serial interface COM2 of the unit 07 KT 92.
The following records are generated in this case:

- address extension record
- data record
- end record

The following transfer format applies:

- 8 data bits
- no parity bit
- 1 stop bit

Command:



area: Memory area to be output as an INTEL HEX file.

Example:

W 8000:0,FFFF <CR>	The memory area from $8000{:}0_H$ up to and including $8000{:}FFFF_H$ is output as an INTEL HEX file via serial interface COM2 of the PLC.
W 8000:0LFFFF <CR>	The memory area from $8000{:}0_H$ up to and including $8000{:}FFFE_H$ is output as an INTEL–HEX file via serial interface COM2 of the PLC.

3 Memory overview

3.1 Memory overview for 07 KR 91, 07 KT 92 and 07 KT 93

3.1.1 User program RAM

	38C20
Not used	38C12
Constants for program 2 702_H bytes	38510
Turbo RAM program 2 $12EB0_H$ bytes	25660
User program memory 2 7800_H bytes	1DE60
Not used	1DE52
Constants for program 1 702_H bytes	1D750
Turbo RAM program 1 $12EB0_H$ bytes	0A8A0
User program memory 1 7800_H bytes	030A0
Not used	03080
Program identification	03070
Organizational directory for program 2	0305A
Organizational directory for program 1	03044
Organizational directory PLC–specific	03030
Control block 0...2	03000

Explanation of terms:

- Organizational directory
  - PLC–specific: This is used to store organizational data relating to the entire PLC.
  - for user program 1: This is used to store organizational data relating to program memory 1.
  - for user program 2: This is used to store organizational data relating to program memory 2.
- Program identification:
  16 bytes for an identification, e.g. project name.

3.1.2 User program Flash–EPROM

Checksum	A7FFE
Not used $8C_H$ bytes	A7F72
User program 7800_H bytes	A0772
Constants 702_H bytes	A0070
Not used 20_H bytes	A0050
Program identification	A0040
Organizational directory for program 2	A002A
Organizational directory for program 1	A0014
Organizational directory PLC–specific	A0000

- User program memory 1:
  Memory for the PLC program.
- Turbo RAM program 1:
  Machine code for user program memory 1.
- Constants for program 1:
  This area is used to store the indirect constants of the user program memory 1.
- User program memory 2:
  Memory for the PLC program.
- Turbo RAM program 2:
  Machine code for user program memory 2.
- Constants for program 2:
  This area is used to store the indirect constants of the user program memory 2.

3.1.3 Operand memory

40000			SEG:F3E0
3FFF0	not used	10_H	SEG:F3D0
3FE60	I/O configu-ration list 2	190_H	SEG:F240
3FCD0	I/O configu-ration list 1	190_H	SEG:F0B0
3FCC8	Not used	8_H	SEG:F0A8
3FA40	I/O force lists	288_H	SEG:EE20
3FA30	Not used	10_H	SEG:EE10
3F930	Stack 2	100_H	SEG:ED10
3F830	ASAS 2	100_H	SEG:EC10
3E030	VWS	1800_H	SEG:D410
3D830	S	800_H	SEG:CC10
3D030	MD	800_H	SEG:C410
3B030	MW	2000_H	SEG:A410
3A030	M	1000_H	SEG:9410
39F30	AW	100_H	SEG:9310
39B30	A	400_H	SEG:8F10
39A30	EW	100_H	SEG:8E10
39630	E	400_H	SEG:8A10
39430	KD	200_H	SEG:8810
38F30	KW	500_H	SEG:8310
38F2E	K	2_H	SEG:830E
38E20	Free Pool	$10E_H$	SEG:8200
38D20	Stack 1	100_H	SEG:8100
38C20	ASAS 1	100_H	SEG:8000
			SEG =30C2

Explanation of terms:

ASAS 1: Work memory program 1
Stack 1: Stack for program 1
K: Indirect constants BINARY
KW: Indirect constants WORD
KD: Indirect constants DOUBLE WORD
E: Process image of the inputs BINARY
EW: Process image of the inputs WORD
A: Process image of the outputs BINARY
AW: Process image of the outputs WORD
M: Flags BINARY
MW: Flags WORD
MD: Flags DOUBLE WORD
S: Step chains
VWS: Historical value memory
ASAS 2: Work memory for program 2
Stack 2: Stack for program 2

I/O force lists:
This is where the I/O signals to be forced and their force values are entered.

I/O configuration list 1:
This is where the I/O signals planned in program 1 are entered so that they are allowed for when generating and outputting the process image.

I/O configuration list 2:
This is where the I/O signals planned in program 2 are entered so that they are allowed for when generating and outputting the process image.

3.1.4 Dual-port RAM

CS31–status (EW 07,15)	C03FF C03FE
read real time clock EW 07,08...EW 07,14	C03FD C03F0
spontaneous mail box (EW 07,04...EW 07,07)	C03EF C03E8
receive mail box (EW 07,00...EW 07,03)	C03E7 C03E0
direct: EW 06,00...EW 06,15 CS31: EW 00,00...EW 05,15	C03DF C0300
reserved	C02FF
send mail box	C02FE C02F4
reserved	C02F3 C02E0
direct: AW 06,00...AW 06,15 CS31: AW 00,00...AW 05,15	C02DF C0200
direct: E 62,00...E 63,15 CS31: E 00,00...E 61,15	C01FF C0180
reserved	C017F C0100
read/write permission read/write request	C00FF C00FE
reserved	C00FD C0080
direct: A 62,00...A 63,15 CS31: A 00,00...A 61,15	C007F C0000

3.2 Memory overview for 07 KR 31 and 07 KT 31

3.2.1 System addressing (Mapping)

Address	Contents
FFFF – D800	Compiled program 1
D7FF – B000	Compiled program 2
AFFF – AF00	Reserved
AEFF – AC00	I/O data
ABFF – A800	Reserved
A7FF – 8981	Micro code in RAM
8980 – 8800	Constants
87FF – 8000	RAM non-safeguarded
7FFF – 5000	Reserved
4FFF – 4000	Data
3FFF – 2000	UAR T
1FFF – 1000	ASIC 2 – input ASIC
0FFF – 0000	ASIC 1 – output ASIC

3.2.2 Data addressing (Data mapping)

Address	Contents
AEFF	EW 15,15
AD00	EW 00,00
ACFF	E 63,15
AC80	E 00,00
AC7F	A 63,15
AC00	A 00,00
47D1	S 015,15
47B2	S 000,00
467F	MD 001,15
4600	MD 000,00
8980	K 00,00; K 00,01
897F	KD 01,15
8900	KD 00,00
88FF	KW 07,15
8800	KW 00,00
85FF	AW 07,15
8500	AW 00,00
4581	MW 255,15
4542	MW 254,00
4541	MW 239,15
4402	MW 230,00
4401	MW 005,15
4342	MW 000,00
4341	M 255,15
4340	M 255,00
433F	M 239,15
432C	M 230,00
432B	M 021,15
4300	M 000,00
42FF – 4100	Historical values
40FF – 4000	Timers

Contents

Networking

Operating Manual
Hardware

ABB Procontic CS31
Automation System
in Decentralized Structure

07 KP 90 R202
Communication Module
RCOM

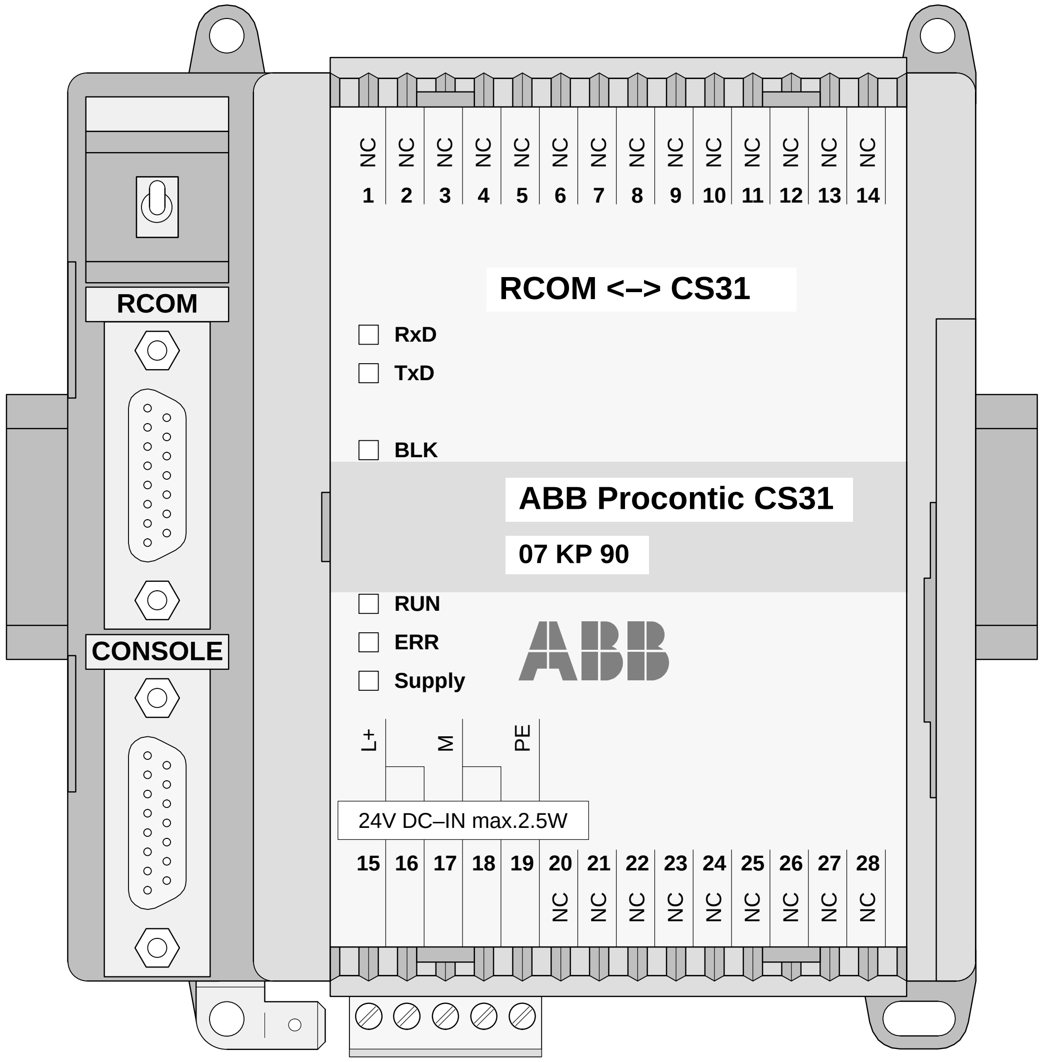


ABB Schalt– und Steuerungstechnik

Regulations
Concerning the Setting up of Installations

Apart from the basic ”Regulations for the Setting up of Power Installations” DIN VDE* 0100 and for ”The Rating of Creepage Distances and Clearances” DIN VDE 0110 Part 1 and Part 2 the regulations ”The Equipment of Power Installations with Electrical Components” DIN VDE 0160 in conjunction with DIN VDE 0660 Part 500 have to be taken into due consideration.

Further attention has to be paid to DIN VDE 0113 Part 1 and Part 200 in case of the control of working and processing machines. If operating elements are to be mounted near parts with dangerous contact voltage DIN VDE 0106 Part 100 is additionally relevant.

If the protection against direct contact according to DIN VDE 0160 is required, this has to be ensured by the user (e.g. by incorporating the elements in a switch-gear cabinet). The devices are designed for pollution severity 2 in accordance with DIN VDE 0110 Part 1. If higher pollution is expected, the devices must be installed in appropriate housings.

The user has to guarantee that the devices and the components belonging to them are mounted following these regulations. For operating the machines and installations, other national and international relevant regulations, concerning prevention of accidents and using technical working means, also have to be met.

The ABB Procontic devices are designed according to IEC 1131 Part 2. Meeting this regulation, they are classified in overvoltage category II which is in conformance with DIN VDE 0110 Part 2.

For the direct connection of ABB Procontic devices, which are powered with or coupled to AC line voltages of overvoltage category III, appropriate protection measures corresponding to overvoltage category II according to IEC–Report 664/1980 and DIN VDE 0110 Part 1 are to install.

Equivalent standards:

DIN VDE 0110 Part 1 ≙ IEC 664
DIN VDE 0113 Part 1 ≙ EN 60204 Part 1
DIN VDE 0660 Part 500 ≙ EN 60439–1 ≙ IEC 439–1

* VDE stands for ”Association of German Electrical Engineers”.

ABB Schalt– und Steuerungstechnik GmbH Heidelberg

1 Communication module 07 KP 90 R202
Communication via RCOM protocol

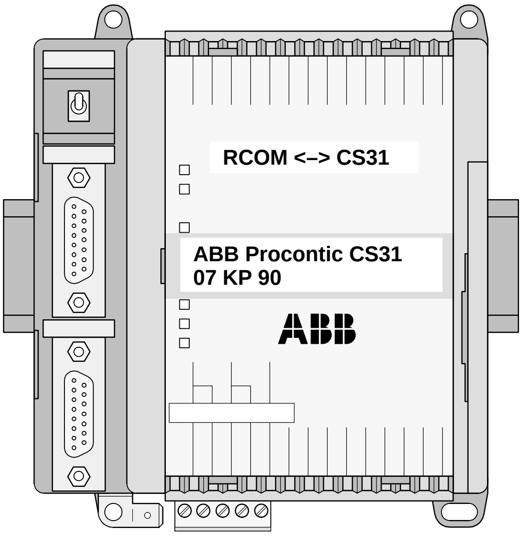


Fig. 1: Communication module 07 KP 90 R202

Contents

1.1 Brief description

The 07 KP 90 R202 RCOM communication module can be connected as an expansion unit to basic units such as 07 KR 91 R252, 07 KT 92, 07 KT 93 of the decentralized automation system ABB Procontic CS31.

The 07 KP 90 R202 communication module permits communication via the RCOM protocol. Using this protocol it permits data exchange

– between ABB MasterPiece 200 control systems, ABB Procontic T200 systems and ABB Procontic CS31 systems or
– between ABB Procontic CS31 systems amongst themselves.

One advantage is that RCOM (**R**emote **COM**munication) permits large distances to be spanned.

Communication can be performed via various transmission media, such as:

– leased or private dedicated lines
– existing cable paths,
– telephone lines (dial–up connections).

Adaptation to the required transmission path can be performed by selection of various modems (e.g. VF or current loop modems, telephone modems, multidrop modems).

An RCOM network always consists of the master and one or more slaves, with the following data transmission options:

– Master transmits data to a slave,
– master reads data from a slave,
– event–driven transmission: a slave can store process events with a time stamp and transfer them to the master on request (event polling).

1.2 Features

– The RCOM 07 KP 90 R202 communication module can be planned as RCOM master or slave.
– A network may have up to 254 RCOM slaves (max. 8 slaves if using MasterPiece 200, max. 30 slaves in case of dial–up mode).

- The RCOM protocol is compatible with MP200/1 with DSCA 180A. All RCOM services are available (cold start, warm start, normalization, clock synchronization, write data, read data, event polling).
- The RCOM interface for connection of the modem complies with EIA RS–232. It can also be used as an EIA RS–485 interface.
- An additional operator interface (CONSOLE) complying with EIA RS–232 is provided as a commissioning aid (indication of the communication sequence, planning telephone numbers etc.)
- Software clock; time can be used in the PLC program.

1.3 Planning with the 907 KP 90 R202 software package

The communication sequence is planned with connection elements contained in the 907 KP 90 R202 documentation and software package (see also Ordering information). This package also contains the manual for the RCOM 07 KP 90 R202 communication module and planning examples.

1.4 Structure of the front panel elements

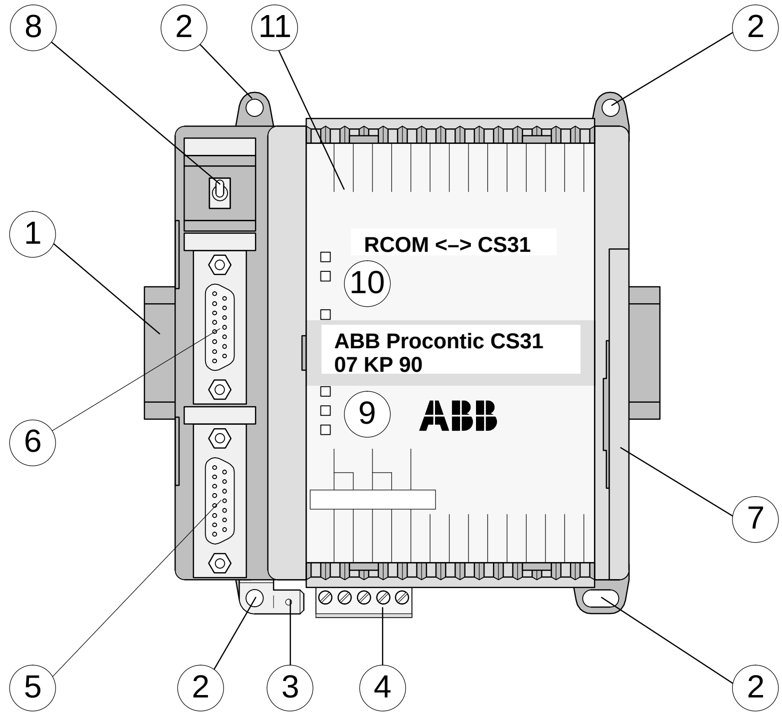


Fig. 2: Communication module 07 KP 90 R202 with reference points (see below for explanation)

1 Mounting the unit on a DIN rail

2 Mounting the unit with screws

3 6.3 mm Faston earthing terminal

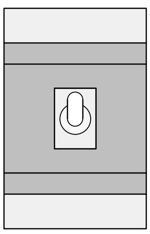
4 24 V DC supply voltage

5 Serial interface CONSOLE

6 Serial interface RCOM

7 Networking interface to the ABB Procontic CS31 central unit

8 Switch



The switch has no function.

9 LED indicators see below

10 LED indicators see below

10		
yellow	RxD	07 KP 90 is receiving an RCOM telegram
yellow	TxD	07 KP 90 is transmitting data via the RCOM interface
yellow	BLK	Transmission of user data blocked as the result of communication error
9		
green	RUN	07 KP 90 R202 is ready for RCOM communication (running)
red	ERR	RCOM communication error
green	Supply	Supply voltage present

Refer to Section 1.6 Diagnosis for further information

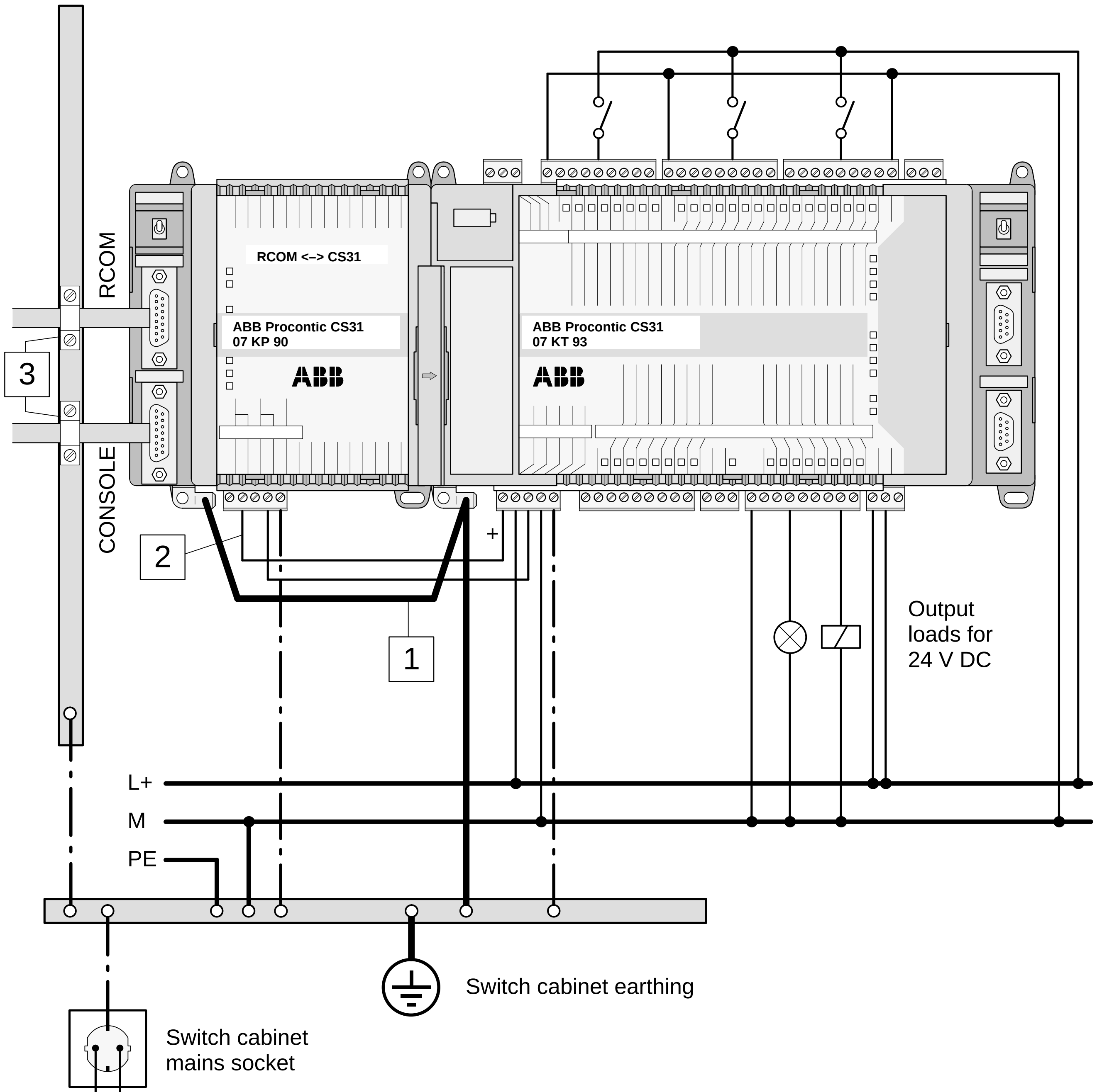
11 Plastic film (detachable for labelling)

1.5 Electrical connection

1.5.1 Application example for connecting the inputs and outputs

The following illustration shows an application example with the 07 KT 93 which utilizes various possibilities for connecting inputs and outputs. Attention must be paid to the following in detail:

- The earthing measures
- Connection of the communication module 07 KP 90 R202
- Looping through the supply voltage (24 V DC) from the 07 KT 93 to the 07 KP 90 R202
- Earthing the switch cabinet mains socket
- Handling serial interfaces



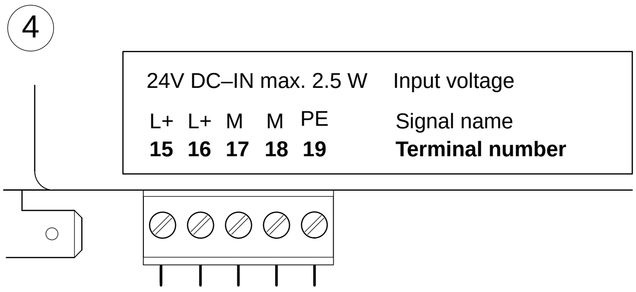
1	Earth connection: Use supplied parts (see Figure 6)
2	Supply voltage: Short, direct connection between the modules, wires 15 cm, 2.5 mm^2 (see Figure 6)
3	Cable shields: In the case of permanent wiring at the switchgear cabinet inlet, earth via clamps and do not put shield in the plug. Otherwise, lay the cable shield in the plug to PGND.

Fig. 3: Application example:
Communication module 07 KP 90 R202 at central unit 07 KT 93
(Section 1.3 Electrical connection applies similarly to 07 KR 91 and 07 KT 92.)

1.5.2 Connecting the 24 V DC supply voltage

The supply voltage is fed in via a 5–pole detachable terminal block.

Important:
Plug and unplug terminal block only with power is off!



Terminal designation:

15	L+	*)	Supply voltage +24 V DC
16	L+	*)	Supply voltage +24 V DC
17	M	*)	Reference potential (0V)
18	M	*)	Reference potential (0V)
19	PE		Protective earth terminal, connected with the Faston terminal inside the device. Do not cause earth loops. Connect PE and Faston to the same earthing potential!

*) Exclusively for connection to the ABB Procontic CS31 basic unit (also see Figure 6).

Fig. 4: Assignment of the terminal block for the *24 V DC–IN* supply voltage

1.5.3 Electrical isolation and notes on earthing

The following illustration shows which circuit parts of the unit are electrically isolated from each other and which internal connections exist. Here, both the clearances and creepage distances and also the test voltages used correspond to DIN/VDE 0160.

The unit is connected via the 6.3 mm Faston terminal (bottom left) to the functional earth (switch cabinet earth) via a wire with a cross section of 6 mm^2 (also see Figure 6).

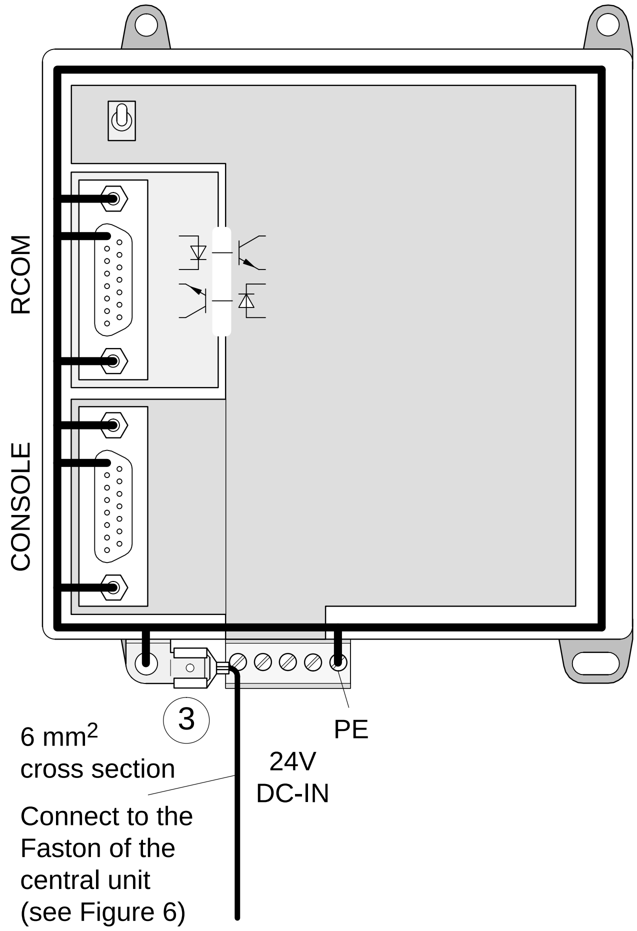


Fig. 5: Electrical isolation and notes on earthing

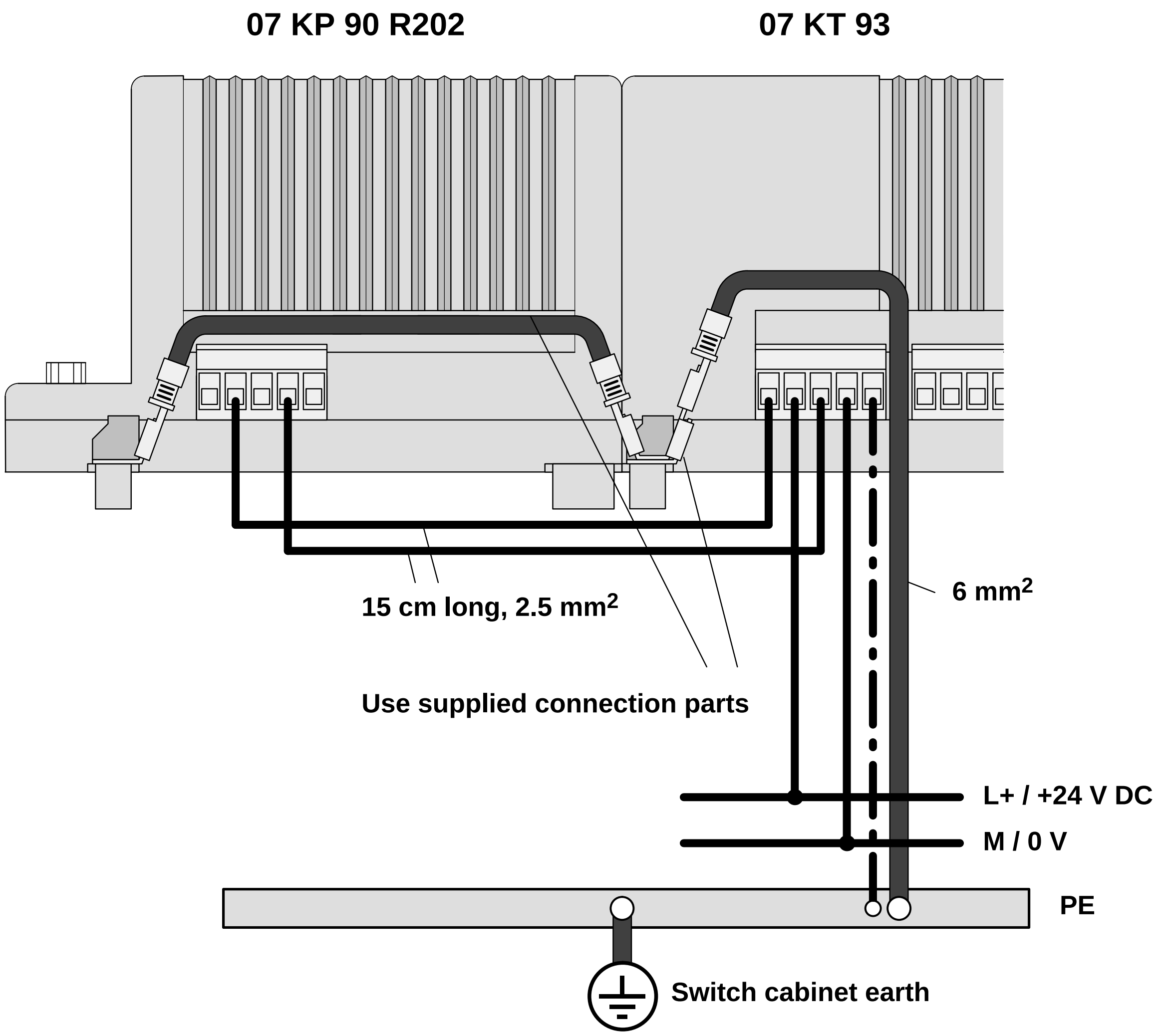


Fig. 6: Earthing connections and voltage supply for 07 KP 90 R202

1.5.4 Serial interfaces

Serial interface CONSOLE

A terminal (e.g. an IBM–PC with 907 PC 33 in Terminal mode) can be connected to the CONSOLE interface for commissioning. The CONSOLE interface can be used to

- configure the telephone directory or configuration data (only in the case of dial–up modems),
- follow the communication sequence (fault–finding during commissioning). This function can be deactivated after commissioning.

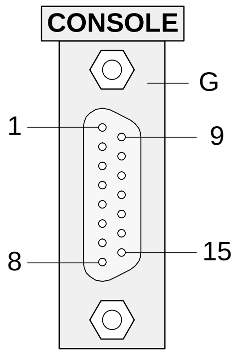
Serial interface RCOM

The RCOM network is connected to this interface. It is connected via a modem with standard interface.

Serial interface CONSOLE: Terminal assignment

Interface standard: EIA RS–232

5



G	Chassis	Protective Ground	(Shield)	
1	PGND	Protective Ground	(Shield)	
2	TxD	Transmit Data	(Output)	(EIA RS–232)
3	RxD	Receive Data	(Input)	(EIA RS–232)
4	RTS	Request To Send	(Output)	(EIA RS–232)
5	CTS	Clear To Send	(Input)	(EIA RS–232)
6	NC *****			
7	SGND	Signal Ground	(0V)	(EIA RS–232)
8 to 15	not connected			

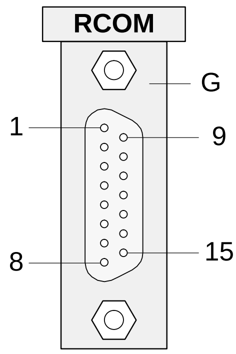
* NC not connected this PIN must not be connected

Fig. 7: Terminal assignment of the serial interface CONSOLE

Serial interface RCOM: Terminal assignment

Interface standard: EIA RS–232 or EIA RS–485

6



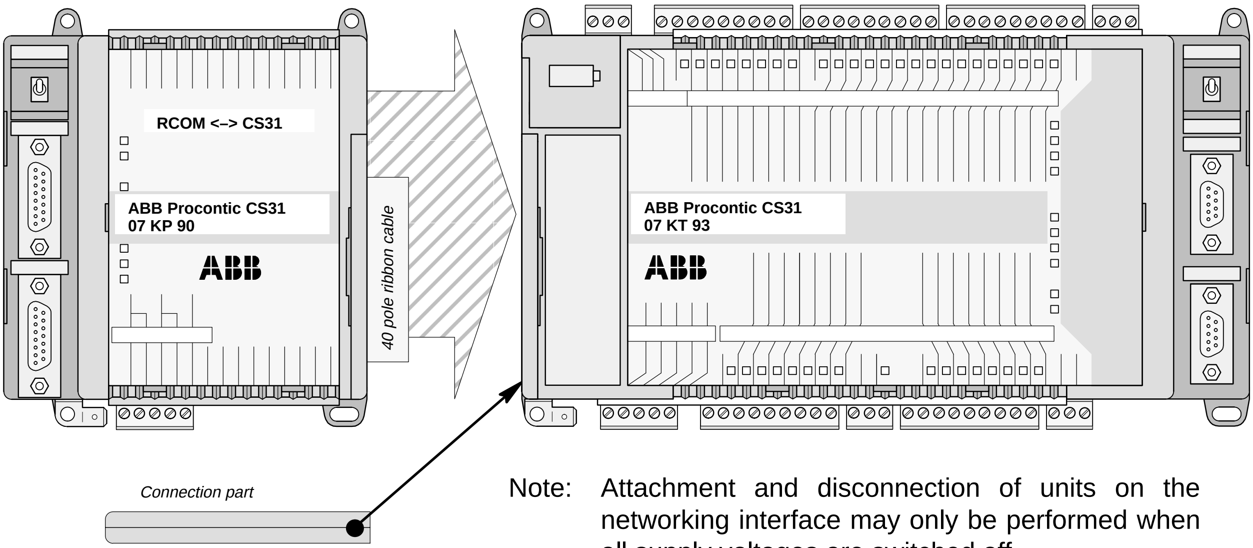
G	Chassis	Protective Ground	(Shield)	
1	PGND	Protective Ground	(Shield)	
2	TxD	Transmit Data	(Output)	(EIA RS–232)
3	RxD	Receive Data	(Input)	(EIA RS–232)
4	RTS	Request To Send	(Output)	(EIA RS–232)
5	CTS	Clear To Send	(Input)	(EIA RS–232)
6	NC *****			
7	SGND	Signal Ground	(0V)	(EIA RS–232)
8	not connected			
9	not connected			
10	RxD–P, TxD–P	Receive Data	(Input)	(EIA RS–485)
11	RxD–N, TxD–N	$\overline{\text{Receive Data}}$	(Input)	(EIA RS–485)
12 to 15	not connected			

* NC not connected this PIN must not be connected

Fig. 8: Terminal assignment of the serial interface RCOM

1.5.5 Networking Interface 7

The networking interface, a special parallel interface, allows the 07 KP 90 R202 communication module to be connected to ABB Procontic CS31 central units (such as 07 KR 91 R252, 07 KT 92, 07 KT 93). The housing of the communication module is connected to the housing of the ABB Procontic CS31 basic unit by a snap–fit connection. The electrical connection is via a 40–pole ribbon cable with socket connector, soldered onto the 07 KP 92 R202 side.



Note: Attachment and disconnection of units on the networking interface may only be performed when all supply voltages are switched off.

Fig. 9: Example: Connecting 07 KP 90 R202 with 07 KT 93

Mounting the expansion housing

1. Detach the cover on unit 07 KT 93 from the networking interface.
2. Plug the socket strip of the 40–pole ribbon cable secured to the 07 KP 90 R202 onto the networking connector of the 07 KT 93.
3. Place both units on a level surface and slide them together so that they engage.
4. Slide in the connection part to fix the housing in position.

Note: Mounting of the 07 KP 90 R202 to 07 KR 91 / 07 KT 92 takes place in a similar way.

1.6 Diagnosis

LED displays for RCOM system messages

9

yellow	☐ **RxD**
yellow	☐ **TxD**
yellow	☐ **BLK**

RxD: 07 KP 90 is receiving an RCOM telegram.

TxD: 07 KP 90 is transmitting data via the RCOM interface

BLK: Transmission of user data blocked as the result of communication error. After normalization LED ‘BLK’ goes out again.

Fig. 10: LED displays for RCOM system messages

LED displays for RUN, ERR and Supply

10

green	☐ **RUN**
red	☐ **ERR**
green	☐ **Supply**

RUN: 07 KP 90 is ready for RCOM communication (running).

ERR: A RCOM communication error has occured. In the case of recoverable errors the LED goes off again after a short time. In the case of fatal errors, the LED remains on continuously. The ’RUN’ LED also goes off.

Supply: Supply voltage is present.

Fig. 11: LED displays for RUN, ERR and Supply

Operating states, error displays

RUN gn	RxD rd	TxD rd	BLK rd	Supply gn	ERR rd	Meaning	Remedy
☐	☐	☐	☐	☐	☐	Supply voltage not present. .	• Switch on supply voltage. • Check supply voltage.
☐	☐	☐	☐	☆	☐	Supply voltage present. 07 KP 90 R202 not ready for communication. • during device reset or • after fatal error	• Switch supply voltage of 07 KP 90 R202 and 07 KT 93 off and then on again.
☆	☐	☐	☐	☆	☐	The 07 KP 90 R202 is ready for communication.	—
☆	☆	☐	☐	☆	☐	The 07 KP 90 R202 is receiving a data telegram.	—
☆	☐	☆	☐	☆	☐	The 07 KP 90 R202 is transmitting a data telegram.	—
☆	X	X	☐	☆	☐	RCOM operation	—
☆	X	X	☆	☆	☐	Transmission of user data not possible owing to the communication sequence.	• Normalization.
☆	X	X	☐	☆	☆	RCOM communication error.	• The ERR LED goes out again automatically in the case of recoverable errors.
☐	☐	☐	☐	☆	☆	Fatal RCOM communication error.	• Switch supply voltage of 07 KP 90 R202 and 07 KT 93 off and then on again.
X	☆	☆	☆	X	☆	Hardware error. (RAM, EPROM, DP–RAM error)	• Switch supply voltage of 07 KP 90 R202 and 07 KT 93 off and then on again.

☐ = LED off, ☆ = LED on, ⁂ = LED blinks, X = LED on or off, gn = green, rd = red

Fig. 12: Signalling operating states and error display

1.7 Technical data

In general, the details in Section 1 ”System data and system structure” of volume 2 of the system description ”ABB Procontic CS31” apply as technical data. Supplementary and deviating data is listed below.

1.7.1 General data

Number of serial interfaces	2
Number of parallel interfaces	1 networking interface for connecting to the ABB Procontic CS31 central unit
Operating and error displays	6 LEDs: RUN, ERR, Supply, RxD, TxD, BLK
Conductor cross section for the removable terminal blocks	max. 2.5 mm^2

1.7.2 Supply voltage for 07 KP 90 R202

Rated supply voltage	24 V DC
Power dissipation	typ. 2.5 W
Max. current consumption	
with rated voltage	210 mA
with supply voltage 30 V	170 mA
Protection against reversed terminal connection	yes

1.7.3 Connection serial interface RCOM, CONSOLE

Interface standard	EIA RS–232 or EIA RS–485 (RCOM only)
Electrical isolation	yes, RCOM interface with respect to the rest of the unit (also see Figure 5)
Potential differences	So that no earthing potential differences arise between the 07 KP 90 R202 and the peripheral units connected to RCOM and CONSOLE, the latter are supplied from the switch cabinet mains socket (also see earthing connections in Figure 5).
Transmission speed (Baud rate)	
RCOM	300...19200 Baud
CONSOLE	9600 Baud
Terminal assignment and description of the interfaces RCOM, CONSOLE	See Page 8 onwards

1.7.4 LED displays

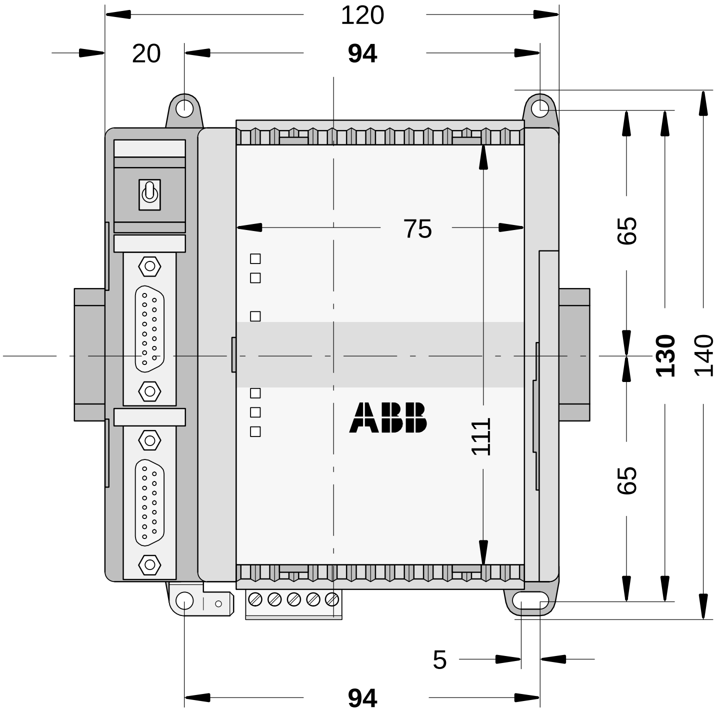
1.7.5 LED displays

LEDs for operating and error displays:

– Supply voltage present (Supply)	1 green LED
– Fatal or serious error occurred (ERR)	1 red LED
– Ready for RCOM communication (running), (RUN)	1 green LED
– Interface signals RxD, TxD	2 yellow LEDs
– Protocol status BLK	1 yellow LED

1.7.6 Mechanical data

Mounting on DIN rail	in accordance with DIN EN 50022–35, 15 mm deep The DIN rail is located in the middle between the upper and the lower edges of the module.
Fastening by screws	using 4 M4 screws.
Width x height x depth	140 x 120 x 85 mm
Wiring method	by removeable terminal blocks with screw–type terminals, max. 2.5 mm^2
Weight	450 g
Dimensions for mounting	see the following drawing



All dimensions in mm.

The device is 85 mm deep. The interface connectors RCOM and CONSOLE are set deeper so that the mounting depth required does not become any larger even with detachable interface cables. If, however, a DIN rail is used, the mounting depth is increased by the overall depth of the rail.

Fig. 13: Dimensions of the Communications module 07 KP 90 R202, front view, **the dimensions for assembly bore holes are printed in bold**

1.7.7 Mounting hints

Mounting position	vertical, terminals above and below
Cooling	The natural convection cooling must not be hindered by cable ducts or other material mounted in the switch cabinet.

1.7.8 Ordering data

Communication module 07 KP 90 R202	Order No. GJR5 2510 00 R0202
Scope of delivery	Communication module 07 KP 90 R202 1 5pole terminal block (5.08 mm grid) Cable including terminals for making the earth connection Earthing instructions enclosed

Further literature

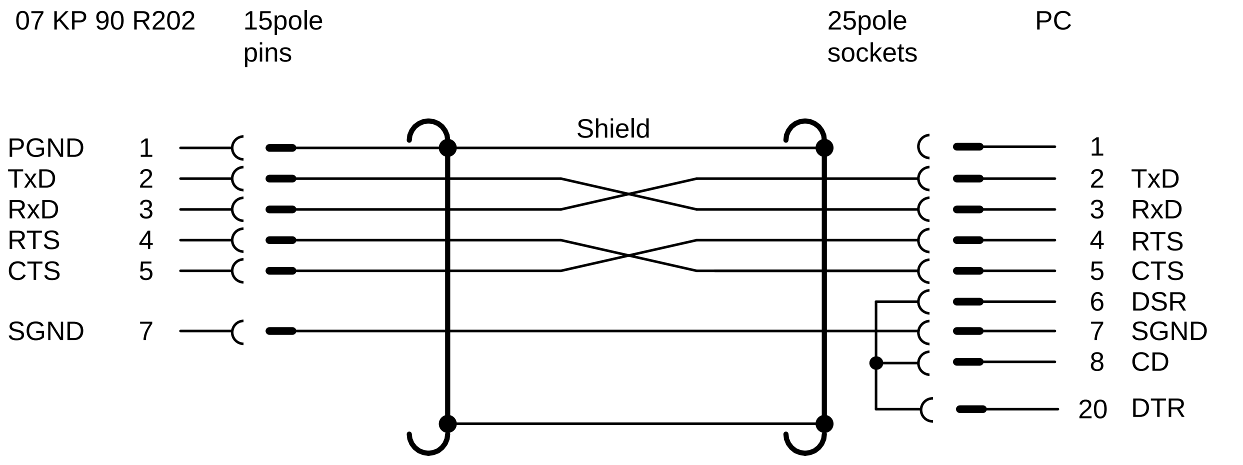
System description ABB Procontic CS31, English	Order No. FPTN 4400 04 R2001
System description ABB Procontic T200, English	Order No. GATS 1314 99 R2001
System description ABB Procontic T300, English	Order No. GATS 1315 99 R2002
Operating manual 07 KR 91, English	Order No. GATS 1316 01 R2001
Operating manual 07 KT 92, English	Order No. GATS 1316 02 R2001
Operating manual 07 KT 93 R101, English	Order No. GATS 1316 12 R2001
System description ABB Procontic CS31, German	Order No. GATS 1316 99 R1002
System description ABB Procontic T200, German	Order No. GATS 1314 99 R1001
System description ABB Procontic T300, German	Order No. GATS 1315 99 R1002
Operating manual 07 KR 91, German	Order No. GATS 1316 01 R1001
Operating manual 07 KT 92, German	Order No. GATS 1316 02 R1001
Operating manual 07 KT 93 R101, German	Order No. GATS 1316 12 R1001

Software

907 KP 90 R202, English documentation, CE library and example programs,	GJP5 2051 00 R0202
907 KP 90 R202, German documentation, CE library and example programs,	GJP5 2052 00 R0202

1.8 System cables

1.8.1 CONSOLE to PC (25–pole) for commissioning



PGND	Protective Ground	DSR	Data Set Ready
TxD	Transmit Data	DTR	Data Terminal Ready
RxD	Receive Data	CD	Carrier Detect
RTS	Request To Send	SGND	Signal Ground
CTS	Clear To Send		

Fig. 14: Connecting CONSOLE to PC (25–pole) for commissioning

1.8.2 RCOM as EIA RS–232 to modem

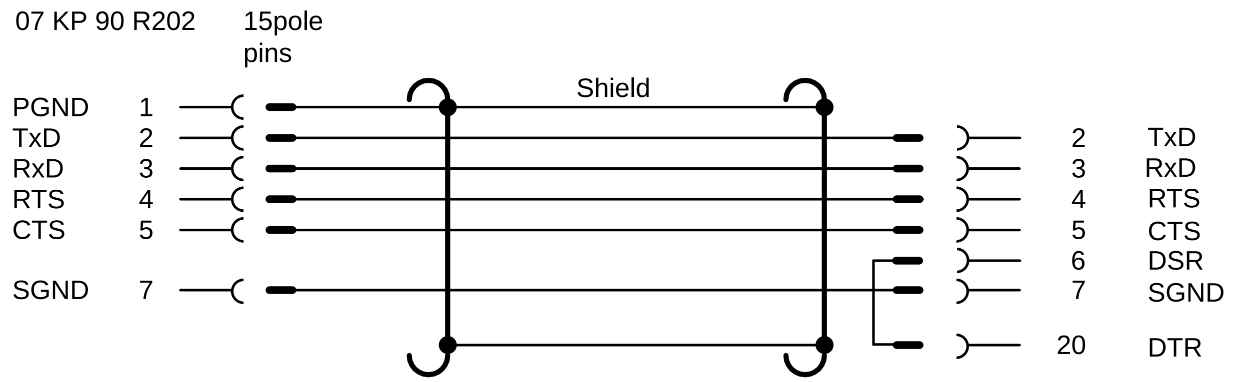


Fig. 14: Connecting RCOM as EIA RS–232 to modem

1.8.3 RCOM as EIA RS–485

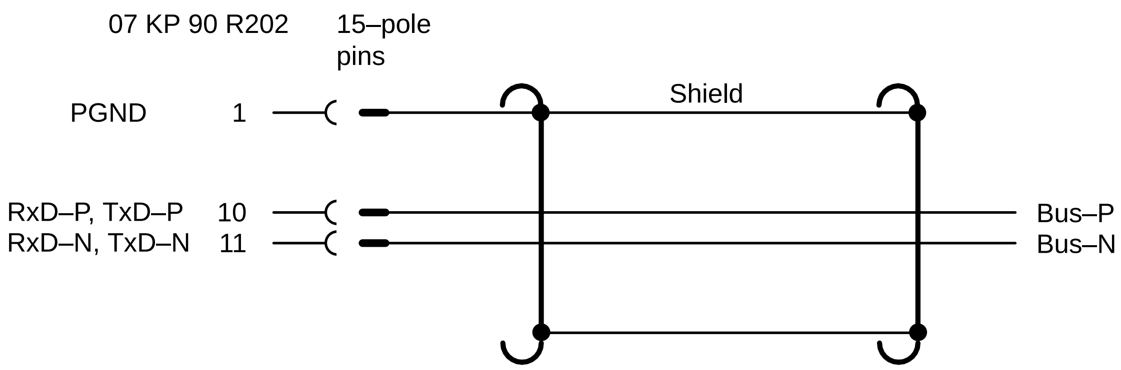


Fig. 16: Connecting RCOM as EIA RS–485

1.8.4 Adaptor 15–pole/9–pole

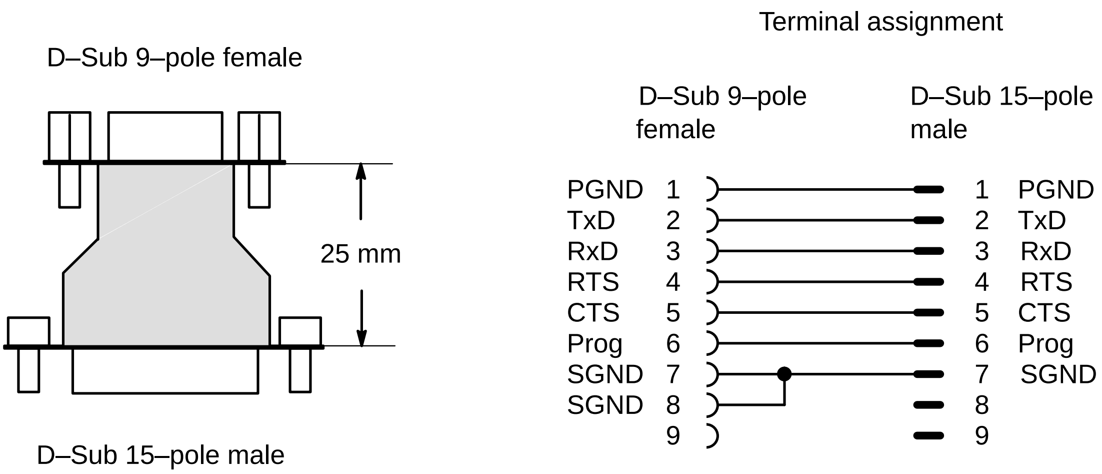


Fig. 17: Adaptor 15–pole/9–pole, terminal assignment

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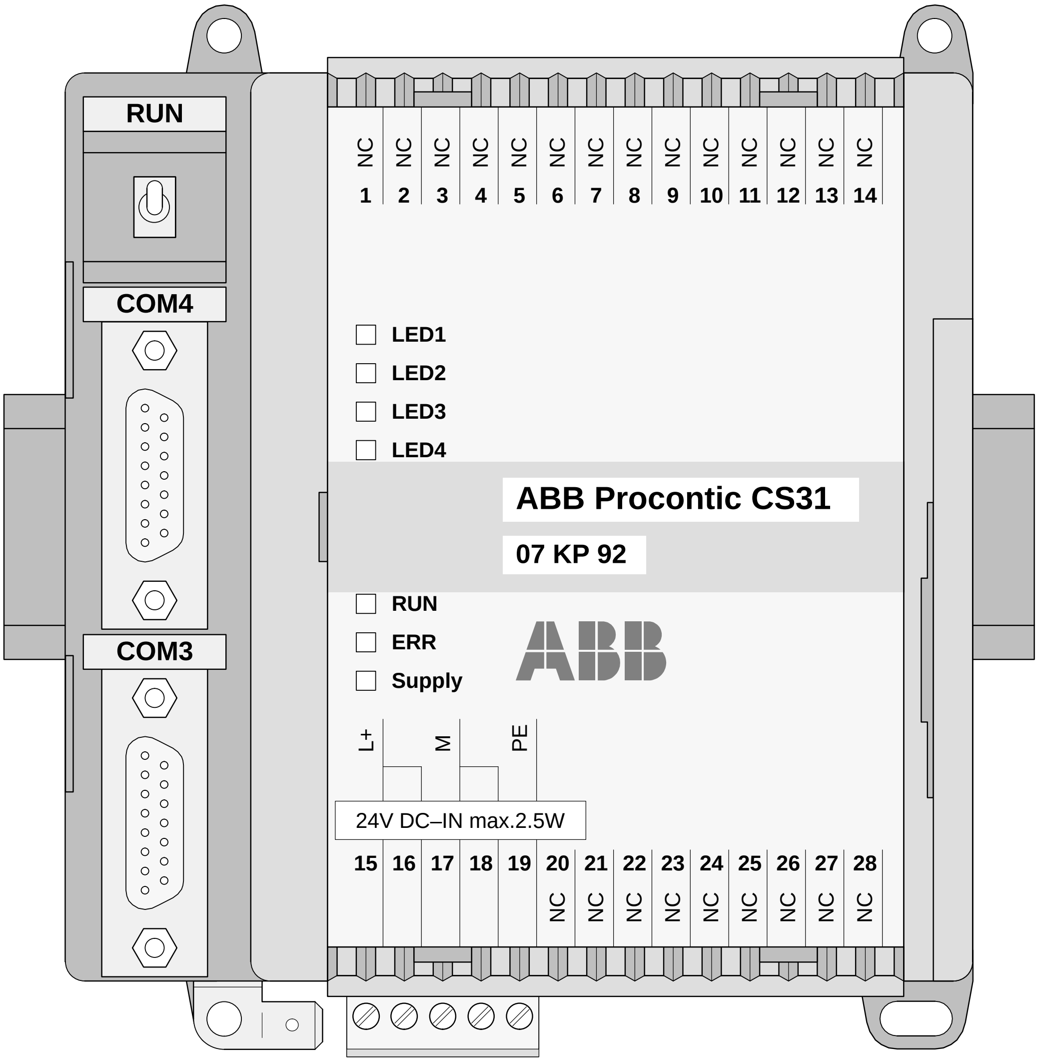
Operating Manual
Hardware

ABB Procontic CS31
Automation System
in Decentralized Structure

07 KP 92 R101
Communication module



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Regulations
Concerning the Setting up of Installations

Apart from the basic ”Regulations for the Setting up of Power Installations” DIN VDE* 0100 and for ”The Rating of Creepage Distances and Clearances” DIN VDE 0110 Part 1 and Part 2 the regulations ”The Equipment of Power Installations with Electrical Components” DIN VDE 0160 in conjunction with DIN VDE 0660 Part 500 have to be taken into due consideration.

Further attention has to be paid to DIN VDE 0113 Part 1 and Part 200 in case of the control of working and processing machines. If operating elements are to be mounted near parts with dangerous contact voltage DIN VDE 0106 Part 100 is additionally relevant.

If the protection against direct contact according to DIN VDE 0160 is required, this has to be ensured by the user (e.g. by incorporating the elements in a switch-gear cabinet). The devices are designed for pollution severity 2 in accordance with DIN VDE 0110 Part 1. If higher pollution is expected, the devices must be installed in appropriate housings.

The user has to guarantee that the devices and the components belonging to them are mounted following these regulations. For operating the machines and installations, other national and international relevant regulations, concerning prevention of accidents and using technical working means, also have to be met.

The ABB Procontic devices are designed according to IEC 1131 Part 2. Meeting this regulation, they are classified in overvoltage category II which is in conformance with DIN VDE 0110 Part 2.

For the direct connection of ABB Procontic devices, which are powered with or coupled to AC line voltages of overvoltage category III, appropriate protection measures corresponding to overvoltage category II according to IEC–Report 664/1980 and DIN VDE 0110 Part 1 are to install.

Equivalent standards:

DIN VDE 0110 Part 1 ≙ IEC 664
DIN VDE 0113 Part 1 ≙ EN 60204 Part 1
DIN VDE 0660 Part 500 ≙ EN 60439–1 ≙ IEC 439–1

* VDE stands for ”Association of German Electrical Engineers”.

ABB Schalt– und Steuerungstechnik GmbH Heidelberg

1 Communication module 07 KP 92 R101

Connecting external units

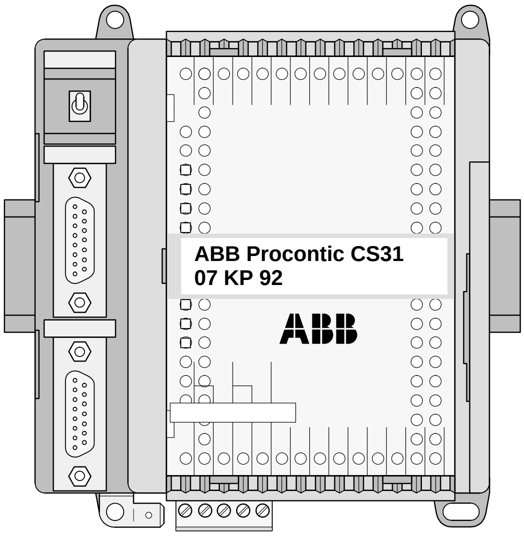


Fig. 1: Communication module 07 KP 92

Contents

1.1 Brief description

The 07 KP 92 R101 communication module is a freely programmable interface module with 2 serial interfaces.

The communication module allows external units to be connected to the ABB Procontic CS31 system via a serial interface.

The communications protocols and transmission types can be freely defined by the user.

Programming is performed on a PC with the programming and test software 907 KP 92.

The communication module is connected to ABB Procontic CS31 central units via the networking interface, e.g. 07 KR 91 (index h onwards), 07 KR 91 R252, 07 KT 92 (index i onwards) or 07 KT 93.

The most important features of the communication module are:

- 2 serial interfaces, optionally configurable in accordance with EIA RS–232 or EIA RS–422 or EIA RS–485 (COM3, COM4)
- Freely programmable with a comprehensive function library
- Communication with ABB Procontic CS31 central unit via connection elements
- Configurable LEDs for diagnosis
- Programming and testing on a PC via COM3 or COM4
- Saving applications in a Flash EPROM

Processing of the serial interfaces and the networking interface is provided for in an applications program.

Programming is in a language similar to the standard language ”C”. It provides elements for structuring and a comprehensive library for using the interfaces.

The exchange of data between the serial communication module and the ABB Procontic CS31 central unit is realized by connection elements in the central unit.

1.2 Structure of the front panel elements

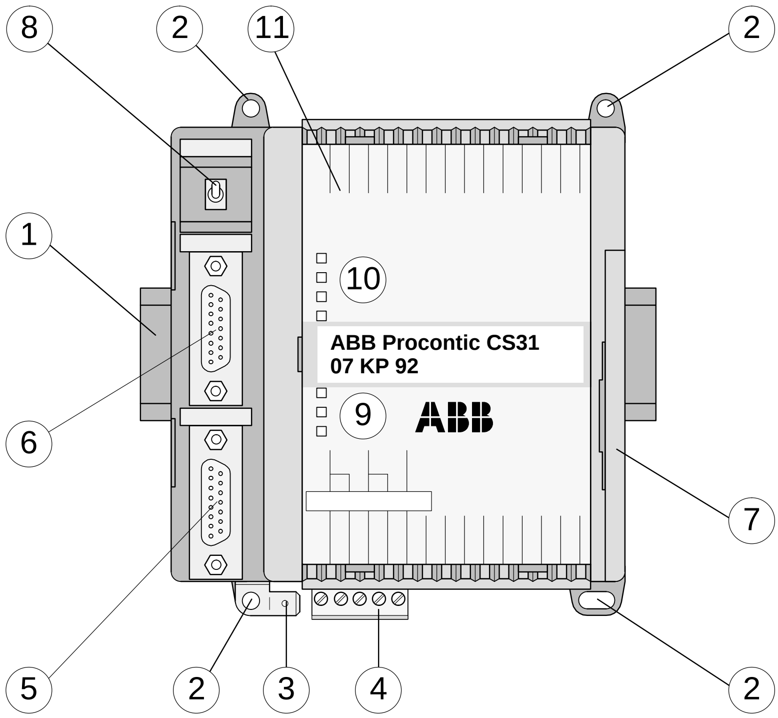


Fig. 2: Communication module 07 KP 92 with reference (see below for explanation)

1 **Mounting the unit on a DIN rail**

2 **Mounting the unit with screws**

3 **6.3 mm Faston earthing terminal**

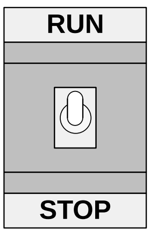
4 **24 V DC supply voltage**

5 **Configurable serial interface COM3**

6 **Configurable serial interface COM4**

7 **Networking interface for the ABB Procontic CS31 central unit**

8 **Switch for RUN/STOP operation**



The RUN/STOP switch controls the processing of the user application.

STOP –> RUN
If the switch is switched from STOP to RUN, the user application is loaded into the main memory and processing of the application program is started.
The status of the application program is indicated by the LED RUN: The LED RUN lights up while the program is being processed. If an error occurred during loading (e.g. program not present), the LED RUN remains OFF.

RUN –> STOP
If the switch is switched from RUN to STOP, the program processing is aborted. The LED RUN goes out.

9 **LED displays for system messages**

10 **LED displays freely configurable**

10		
yellow	LED1	
yellow	LED2	
yellow	LED3	
yellow	LED4	
9		
green	RUN	Application program is running
red	ERR	Fatal or serious error
green	Supply	Supply voltage present

Refer to Section 1.4 Diagnosis for further information

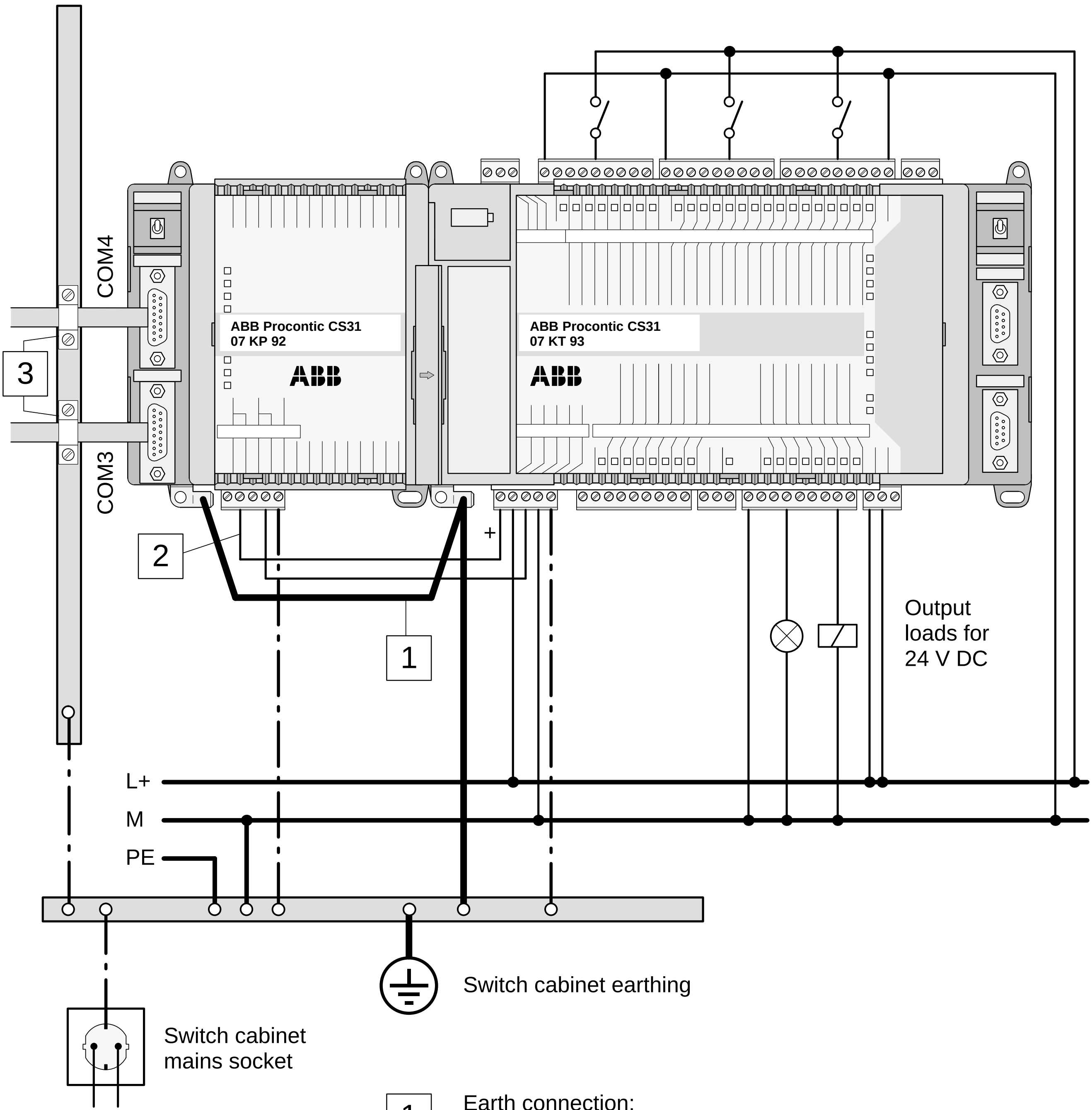
11 **Plastic sheet (detachable for labelling)**

1.3 Electrical connection

1.3.1 Application example for connecting the inputs and outputs

The following illustration shows an application example with the 07 KT 93 which utilizes various possibilities for connecting inputs and outputs. Attention must be paid to the following in detail:

- The earthing measures
- Connection of the 07 KP 92 communication module
- Looping through the supply voltage (24 V DC) from the 07 KT 93 to the 07 KP 92
- Earthing the switch cabinet mains socket
- Handling serial interfaces



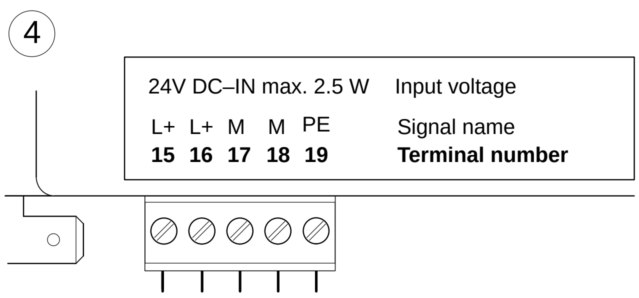
1	Earth connection: Use supplied parts (see Figure 6)
2	Supply voltage: Short, direct connection between the modules, wires 15 cm, 2.5 mm^2 (see Figure 6)
3	Cable shields: In the case of permanent wiring at the switchgear cabinet inlet, earth via clamps and do not put shield in the plug. Otherwise, lay the cable shield in the plug to PGND.

Fig. 3: Application example:
Communication module 07 KP 92 at central unit 07 KT 93
(Section 1.3 Electrical connection applies similarly to 07 KR 91 and 07 KT 92.)

1.3.2 Connecting the 24 V DC supply voltage

The supply voltage is fed in via a 5–pole detachable terminal block.

Important:
Plug and unplug terminal block only with power is off!



Terminal designation:

15 L+ *) Supply voltage +24 V DC
16 L+ *) Supply voltage +24 V DC
17) M* Reference potential (0V)
18) M* Reference potential (0V)
19 PE Protective earth terminal, connected with the Faston terminal inside the device. Do not cause earth loops. Connect PE and Faston to the same earthing potential!

*) Exclusively for connection to the ABB Procontic CS31 basic unit (also see Figure 6).

Fig. 4: Assignment of the terminal block for the *24 V DC–IN* supply voltage

1.3.3 Electrical isolation and notes on earthing

The following illustration shows which circuit parts of the unit are electrically isolated from each other and which internal connections exist. Here, both the clearances and creepage distances and also the test voltages used correspond to DIN/VDE 0160.

The unit is connected via the 6.3 mm Faston terminal (bottom left) to the functional earth (switch cabinet earth) via a wire with a cross section of 6 mm^2 (also see Figure 6).

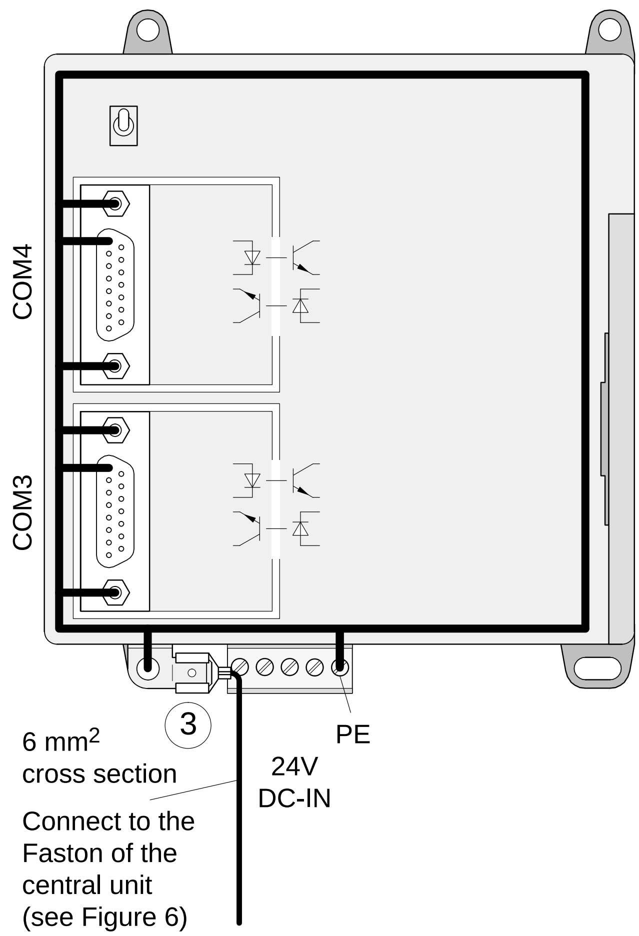


Fig. 5: Electrical isolation and notes on earthing

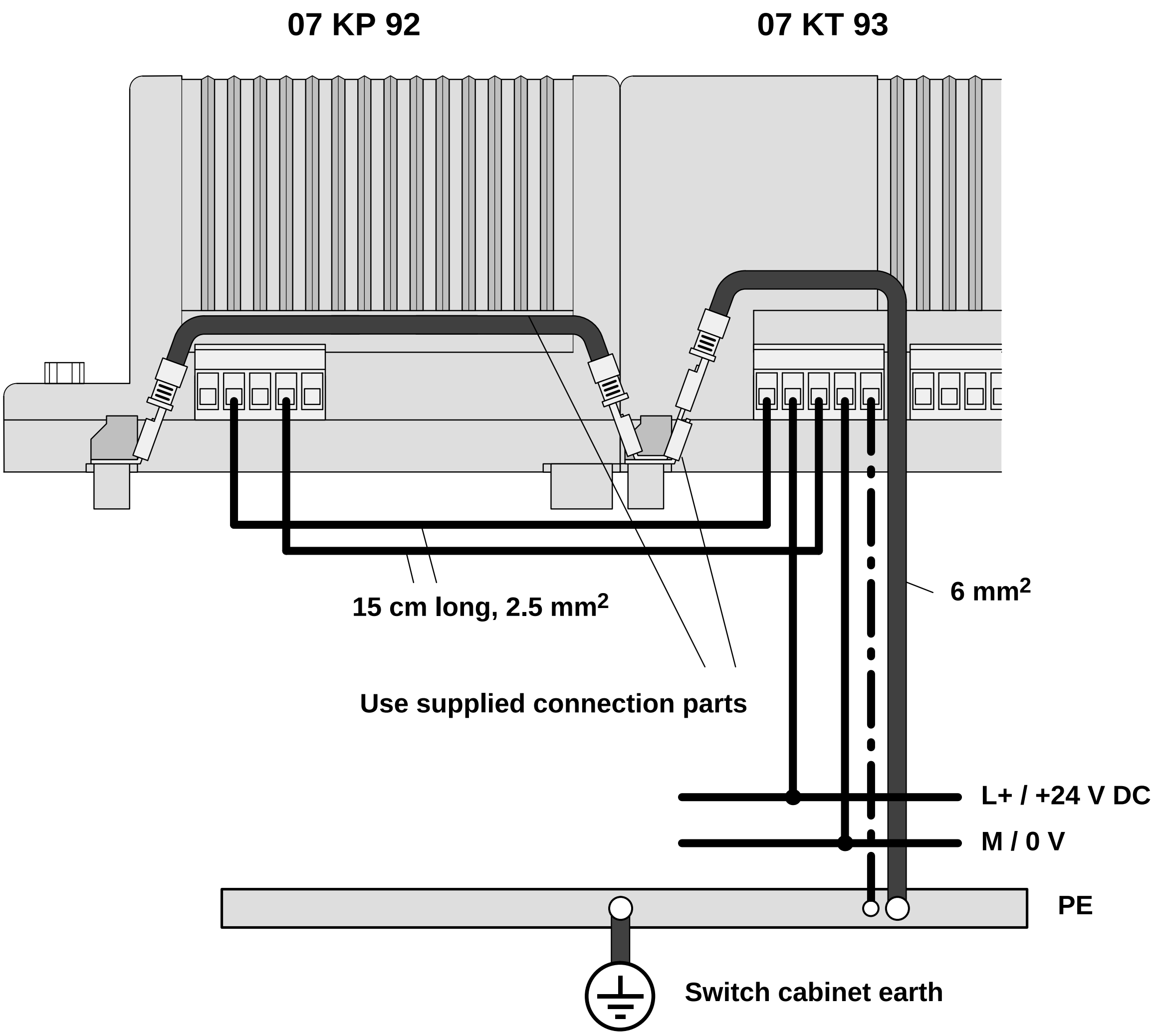


Fig. 6: Earthing connections and voltage supply for 07 KP 92

1.3.4 Serial interfaces

Use

External units can be connected to the ABB Procontic CS31 system via the serial interfaces. The interfaces are independent of each other. They can be managed via freely definable protocols.

Scope of functions

The two serial interfaces can be configured independently of each other in the following scope of functions:

- Data format 7 or 8 bit
- Even, odd or no parity
- Discrete baud rates
  from 300 Bd to 19200 Bd
- Automatic processing of the SW handshake (XON/XOFF)
- Automatic processing of the HW handshake (RTS/CTS)
- Error detection
  (Parity, framing, overrun, break)

Serial interfaces COM3, COM4

Interface standard

– EIA RS–232 or
– EIA RS–422 or
– EIA RS–485

Both interfaces can be run independently of each other in one of the interface standards each. Selection is by choosing the corresponding interface signals.

Mode

– Programming and test mode
– Application mode

In each case, one of the two interfaces can be used as a programming and test interface. This involves the mode being set at pin 6 of the interface connector by the signal status.

Electrical isolation

Both interfaces are electrically isolated.

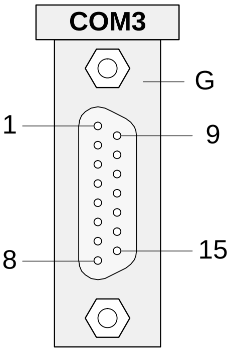
Connection

Connection is via a 15–pole D–SUB connector (socket) in each case.

Serial interface COM3: Terminal designation

Interface standard: EIA RS–232, EIA RS–422, EIA RS–485

5



G	Chassis	Protective Ground	(Shield)	
1	PGND	Protective Ground	(Shield)	
2	TxD	Transmit Data	(Output)	(EIA RS–232)
3	RxD	Receive Data	(Input)	(EIA RS–232)
4	RTS	Request To Send	(Output)	(EIA RS–232)
5	CTS	Clear To Send	(Input)	(EIA RS–232)
6	PROG *****		(Input)	
7	SGND	Signal Ground	(0V)	(EIA RS–232)
8	TxD–P	Transmit Data	(Output)	(EIA RS–422)
9	TxD–N	$\overline{\text{Transmit Data}}$	(Output)	(EIA RS–422)
10	RxD–P	Receive Data	(Input)	(EIA RS–422 / EIA RS–485)
11	RxD–N	$\overline{\text{Receive Data}}$	(Input)	(EIA RS–422 / EIA RS–485)
12	RTS–P	Request To Send	(Output)	(EIA RS–422)
13	RTS–N	$\overline{\text{Request To Send}}$	(Output)	(EIA RS–422)
14	CTS–P	Clear To Send	(Input)	(EIA RS–422)
15	CTS–N	$\overline{\text{Clear To Send}}$	(Input)	(EIA RS–422)

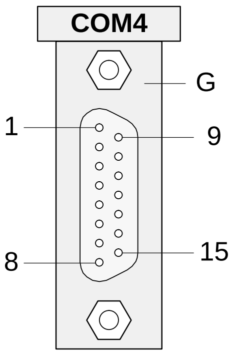
***** Programming and test mode
Pin 6 open
Application mode
Pin 6 jumpered in the interface connector with pin 7 (0V SGND)

Fig. 7: Terminal assignment for the serial interface COM3

Serial interface COM4: Terminal designation

Interface standard: EIA RS–232, EIA RS–422, EIA RS–485

6



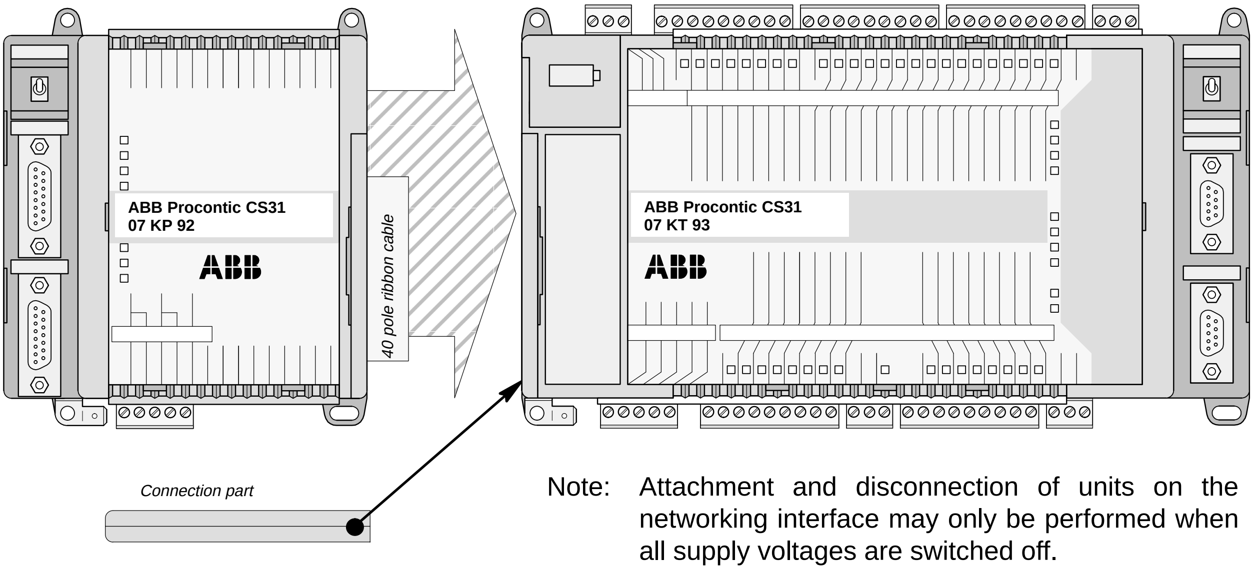
G	Chassis	Protective Ground	(Shield)	
1	PGND	Protective Ground	(Shield)	
2	TxD	Transmit Data	(Output)	(EIA RS–232)
3	RxD	Receive Data	(Input)	(EIA RS–232)
4	RTS	Request To Send	(Output)	(EIA RS–232)
5	CTS	Clear To Send	(Input)	(EIA RS–232)
6	PROG *****		(Input)	
7	SGND	Signal Ground	(0V)	(EIA RS–232)
8	TxD–P	Transmit Data	(Output)	(EIA RS–422)
9	TxD–N	$\overline{\text{Transmit Data}}$	(Output)	(EIA RS–422)
10	RxD–P	Receive Data	(Input)	(EIA RS–422 / EIA RS–485)
11	RxD–N	$\overline{\text{Receive Data}}$	(Input)	(EIA RS–422 / EIA RS–485)
12	RTS–P	Request To Send	(Output)	(EIA RS–422)
13	RTS–N	$\overline{\text{Request To Send}}$	(Output)	(EIA RS–422)
14	CTS–P	Clear To Send	(Input)	(EIA RS–422)
15	CTS–N	$\overline{\text{Clear To Send}}$	(Input)	(EIA RS–422)

***** Programming and test mode
Pin 6 open
Application mode
Pin 6 jumpered in the interface connector with pin 7 (0V SGND)

Fig. 8: Terminal assignment for the serial interface COM4

1.3.5 Networking interface 7

The networking interface, a special parallel interface, allows the 07 KP 92 communication module to be connected to ABB Procontic CS31 central units (such as 07 KR 91 R151, 07 KT 92, 07 KT 93). The housing of the communication module is connected to the housing of the ABB Procontic CS31 basic unit by a snap–fit connection. The electrical connection is via a 40–pole ribbon cable with socket connector, soldered onto the 07 KP 92 side.



Note: Attachment and disconnection of units on the networking interface may only be performed when all supply voltages are switched off.

Fig. 9: Example: Connecting 07 KP 92 with 07 KT 93

Mounting the expansion housing

1. Detach the cover on unit 07 KT 93 from the networking interface.
2. Plug the socket strip of the 40–pole ribbon cable secured to the 07 KP 92 onto the networking connector of the 07 KT 93.
3. Place both units on a level surface and slide them together so that they engage.
4. Slide in the connection part to fix the housing in position.

Note: Mounting of the 07 KP 92 to 07 KR 91 / 07 KT 92 takes place in a similar way.

1.4 Diagnosis

LED displays for system messages RUN, ERR, Supply

9

green	☐ **RUN**
red	☐ **ERR**
green	☐ **Supply**

The green LED ”RUN” lights up when the user application is being processed.

The red LED ”ERR” lights up when a fatal error (RAM error, DP–RAM error, EPROM error, Flash EPROM error) or a serious error is present.

The green LED ”Supply” indicates the presence of the supply voltage.

Fig. 10: LED displays for system messages RUN, ERR, Supply

Freely configurable LED displays

The yellow LEDs ”LED1...LED4” are configurable. They can be controlled in the applications program.

10

yellow	☐ **LED1**
yellow	☐ **LED2**
yellow	☐ **LED3**
yellow	☐ **LED4**

Fig. 11: LED displays, freely configurable

Operating states, error display

RUN gn	ERR rd	Supply gn	Meaning	Remedy
☐	☐	☐	Supply voltage not present.	• Switch on supply voltage. • Check supply voltage.
☐	☐	☆	Supply voltage present. 07 KP 92 is ready to process the user application. – Load user application with 907 KP 92. – Start application processing: Switch RUN/STOP switch to RUN.	
☆	☐	☆	The user application is running.	
X	☆	☆	A serious error is present which caused the user application to abort automatically.	• Read out error and remedy if this is possible.
☆	☆	☆	Initialization phase. Voltage ON.	

☐= LED off, ☆= LED on, X = LED on or off, gn = green, rd = red

Fig. 12: Signalling operating states and error display

1.5 Programming and test software 907 KP 92

The communication module is programmed with the programming and test software 907 KP 92. This software can be run on an IBM–compatible PC. The PC can be connected to either interface COM3 or COM4 of the communication module.

In addition to the programming and test software, the package 907 KP 92 contains documentation of the communication module 07 KP 92, the CE library and configuration examples.

1.6 Technical data

In general, the details in Section 1 ”System data and system structure” of volume 2 of the system description ”ABB Procontic CS31” apply as technical data. Supplementary and deviating data is listed below.

1.6.1 General data

Number of serial interfaces	2
Number of parallel interfaces	1 networking interface for connecting to the ABB Procontic CS31 central unit
Built–in application software memory	Flash EPROM 32 kbytes
Diagnosis	4 configurable LEDs: LED1...4 (control led by the application program)
Operating and error displays	3 LEDs: RUN, ERR, Supply
Conductor cross section for the removable terminals	max. 2.5 mm^2

1.6.2 Supply voltage for 07 KP 92 R101

Rated supply voltage	24 V DC
Power dissipation	typ. 2.5 W
max. current consumption	
with rated voltage	210 mA
with supply voltage 30 V	170 mA
Protection against reversed terminal connection	yes

1.6.3 Connection serial interface COM3, COM4

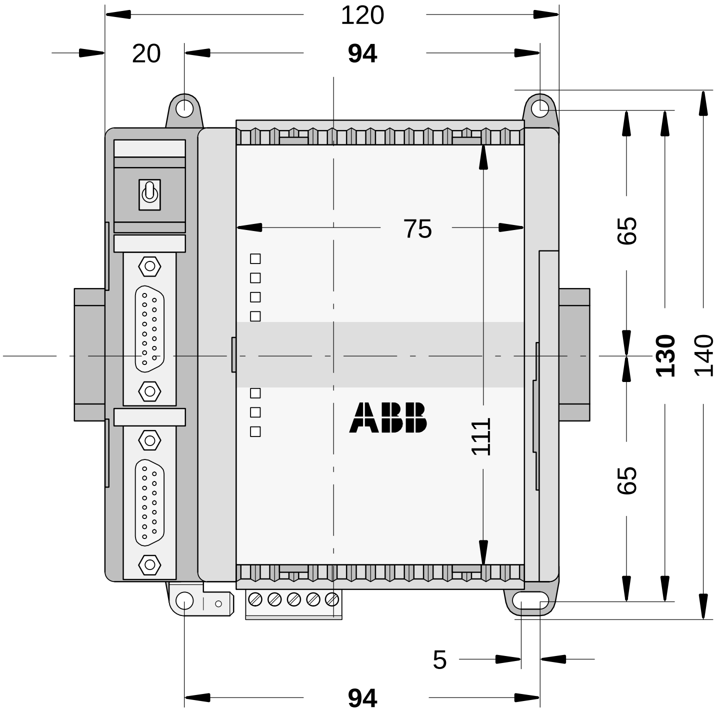
Interface standard	EIA RS–232 or EIA RS–422 or EIA RS–485
Programming with 907 KP 92	via IBM–PC (or compatible)
Man–machine communication	yes, e.g. via ABB Procontic operating station 35 BS 40
Electrical isolation	yes, interfaces with respect to each other and with respect to the rest of the unit (also see Figure 5)
Potential differences	So that no earthing potential differences arise between the 07 KP 92 and the peripheral units connected to COM3 and COM4, the latter are supplied from the switch cabinet mains socket (also see earthing connections in Figure 5).
Terminal assignment and description of the interfaces COM3, COM4	See Page 7 onwards

1.6.4 LED displays

LEDs for operating and error displays:	
– Supply voltage present (Supply)	1 green LED
– Fatal or serious error occurred (ERR)	1 red LED
– Application program processing running (RUN)	1 green LED
Configurable LEDs for diagnosis:	
LED1...LED4	4 yellow LEDs

1.6.5 Mechanical data

Mounting on DIN rail	in accordance with DIN EN 50022–35, 15 mm deep The DIN rail is located in the middle between the upper and the lower edges of the module.
Fastening by screws	using 4 M4 screws.
Width x height x depth	140 x 120 x 85 mm
Wiring method	by removeable terminal blocks with screw–type terminals, max. 2.5 mm^2
Weight	450 g
Dimensions for mounting	see the following drawing



The device is 85 mm deep. The interface connectors COM3 and COM4 are set deeper so that the mounting depth required does not become any larger even with detachable interface cables. If, however, a DIN rail is used, the mounting depth is increased by the overall depth of the rail.

Fig. 13: Dimensions of the Communications module 07 KP 92, front view, **the dimensions for assembly bore holes are printed in bold**

1.6.6 Mounting hints

Mounting position	vertical, terminals above and below
Cooling	The natural convection cooling must not hindered by cable ducts or other material mounted in the switch cabinet.

1.6.7 Ordering data

Communication module 07 KP 92 R101	Order No. GJR5 2515 00 R0101
Scope of delivery	Communication module 07 KP 92 R101 1 5–pole terminal block (5.08 mm grid) Cable including terminals for making the earth connection Earthing instructions enclosed

Further literature

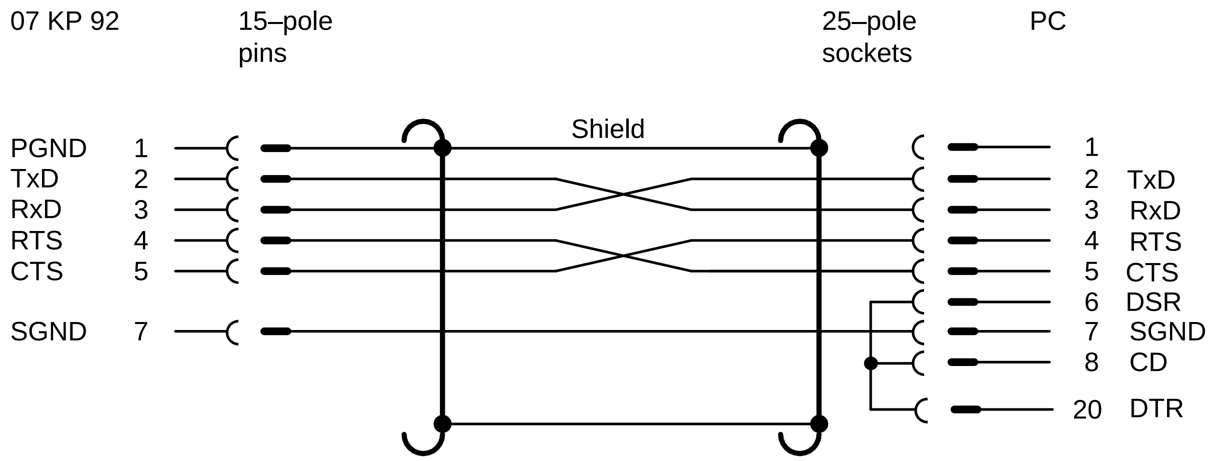
System description ABB Procontic CS31, English	Order No. FPTN 4400 04 R2001
System description ABB Procontic T200, English	Order No. GATS 1314 99 R2001
System description ABB Procontic T300, English	Order No. GATS 1315 99 R2002
Operating manual 07 KR 91, English	Order No. GATS 1316 01 R2001
Operating manual 07 KT 92, English	Order No. GATS 1316 02 R2001
Operating manual 07 KT 93 R101, English	Order No. GATS 1316 12 R2001
System description ABB Procontic CS31, German	Order No. GATS 1316 99 R1002
System description ABB Procontic T200, German	Order No. GATS 1314 99 R1001
System description ABB Procontic T300, German	Order No. GATS 1315 99 R1002
Operating manual 07 KR 91, German	Order No. GATS 1316 01 R1001
Operating manual 07 KT 92, German	Order No. GATS 1316 02 R1001
Operating manual 07 KT 93 R101, German	Order No. GATS 1316 12 R1001

Software

Programming and test software 907 KP 92, CE library and example programs, German documentation	GJP5 2059 00 R0102
Programming and test software 907 KP 92, CE library and example programs, English documentation	GJP5 2060 00 R0102

1.7 System cables

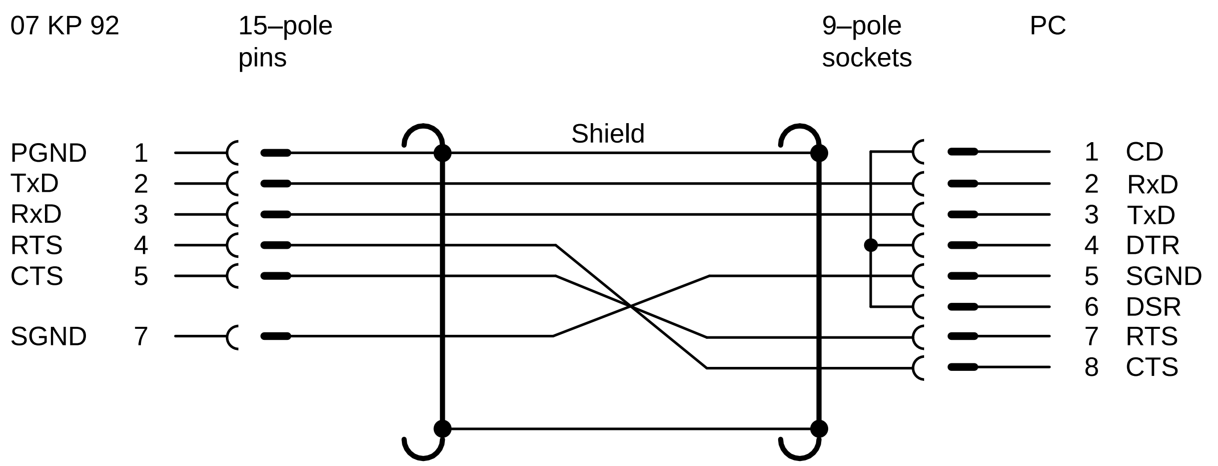
1.7.1 COM3, COM4 to PC (25–pole) for programming und test software 907 KP 92



PGND	Protective Ground	DSR	Data Set Ready
TxD	Transmit Data	DTR	Data Terminal Ready
RxD	Receive Data	CD	Carrier Detect
RTS	Request To Send	SGND	Signal Ground
CTS	Clear To Send		

Fig. 14: Connecting COM3, COM4 to PC (25–pole) as EIA RS–232

1.7.2 COM3, COM4 to PC (9–pole) for programming– and test software 907 KP 92



PGND	Protective Ground	DSR	Data Set Ready
TxD	Transmit Data	DTR	Data Terminal Ready
RxD	Receive Data	CD	Carrier Detect
RTS	Request To Send	SGND	Signal Ground
CTS	Clear To Send		

Fig. 15: Connecting COM3, COM4 to PC (9–pole) as EIA RS–232

1.7.3 COM3, COM4 as EIA RS–232 interface

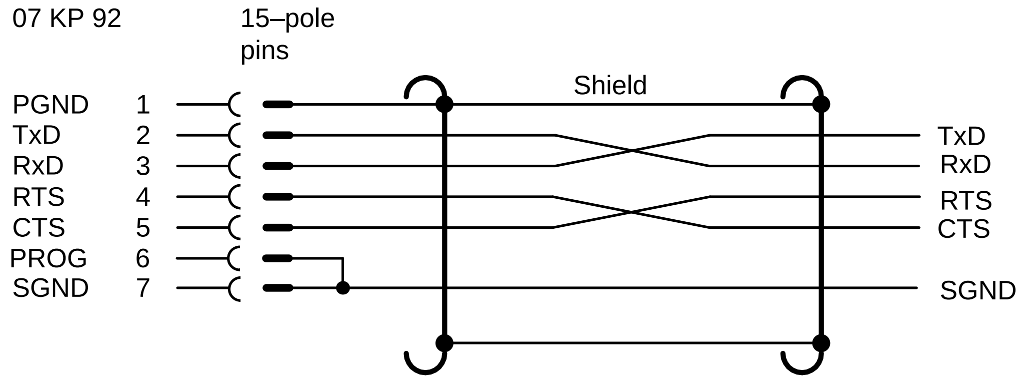


Fig. 16: Connecting COM3, COM4 as EIA RS–232 interface

1.7.4 COM3, COM4 as EIA RS–422 interface

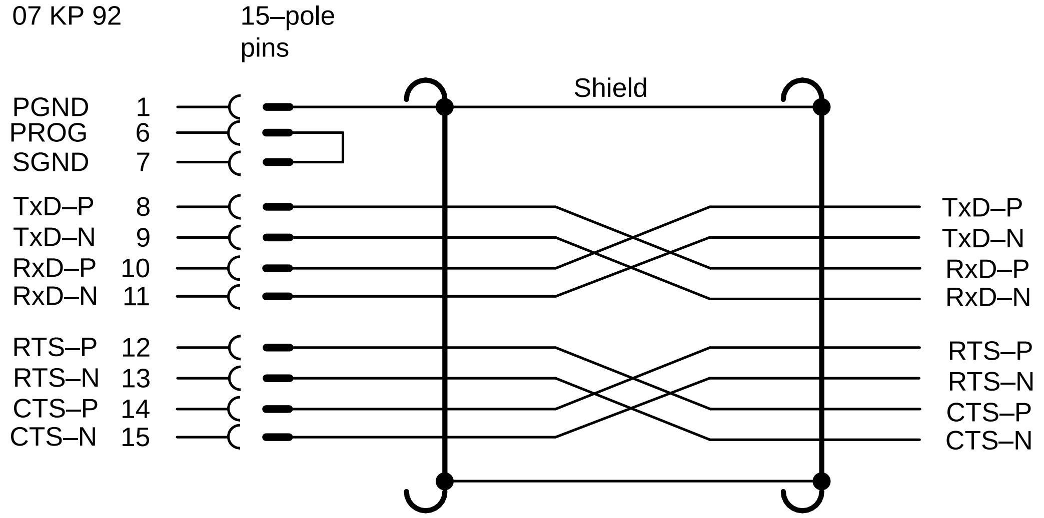


Fig. 17: Connecting COM3, COM4 as EIA RS–422 interface

1.7.5 COM3, COM4 as EIA RS–485 interface

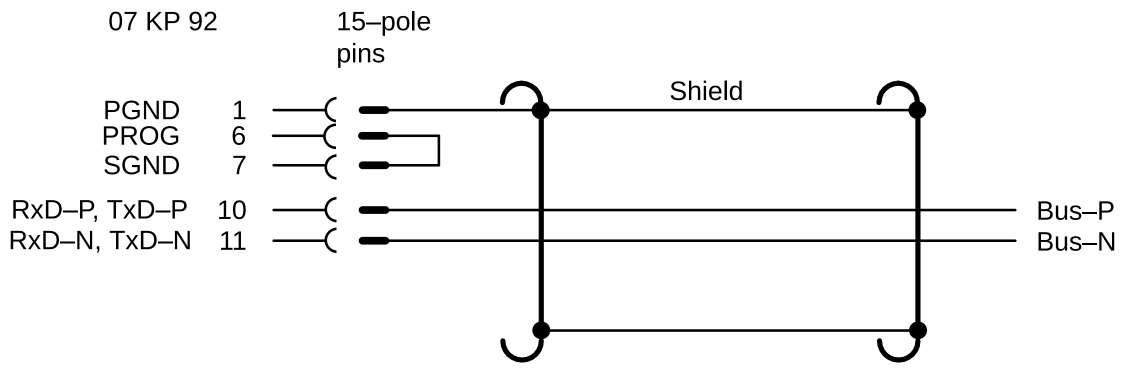


Fig. 18: Connecting COM3, COM4 as EIA RS–485 interface

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Contents

Temporary documents

- Enclosed pages bearing volume N° " 2 " are temporarily classified in Volume 9 of the present April'94 edition.

In a next edition, these pages shalll become part of volume N° " 2 ".

Notes

2 Overview Central Units

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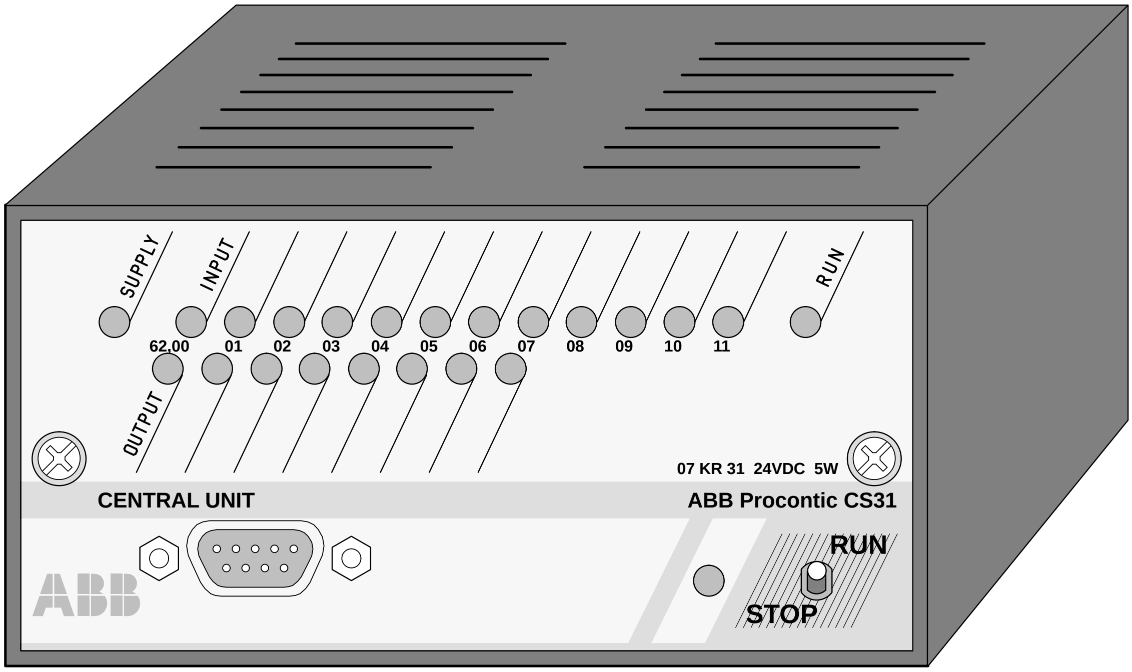
2.2	07 KT 31	Central unit for a user program containing typ. 2 k instuctions
2.3	07 KR 91 R202 / R252	Central unit for a user program containing max. 28 kB of user program
2.4	07 KT 92 R202 / R262	Central unit for a user program containing max. 56 kB of user program + 30 kB user data
2.5	07 KT 93 R101 / R171	Central unit for a user program containing max. 56 kB of user program + 30 kB user data
2.6	07 GV 93 R101	Positioning module for 3 axes

2.1 Central Unit 07 KR 31

Central units for a user program containing max. 2 k of instructions



Central unit 07 KR 31

The comprehensive description for this central unit is located in part 3 of this volume.

Brief description

The central unit 07 KR 31 works either as

- **bus master** in the decentralized automation system ABB Procontic CS31 or as
- **intelligent I/O module** (slave remote processor) in the decentralized automation system ABB Procontic CS31 or as
- **stand–alone central unit.**

The module is supplied by 24 V DC or by 120 V AC or 230 V AC.

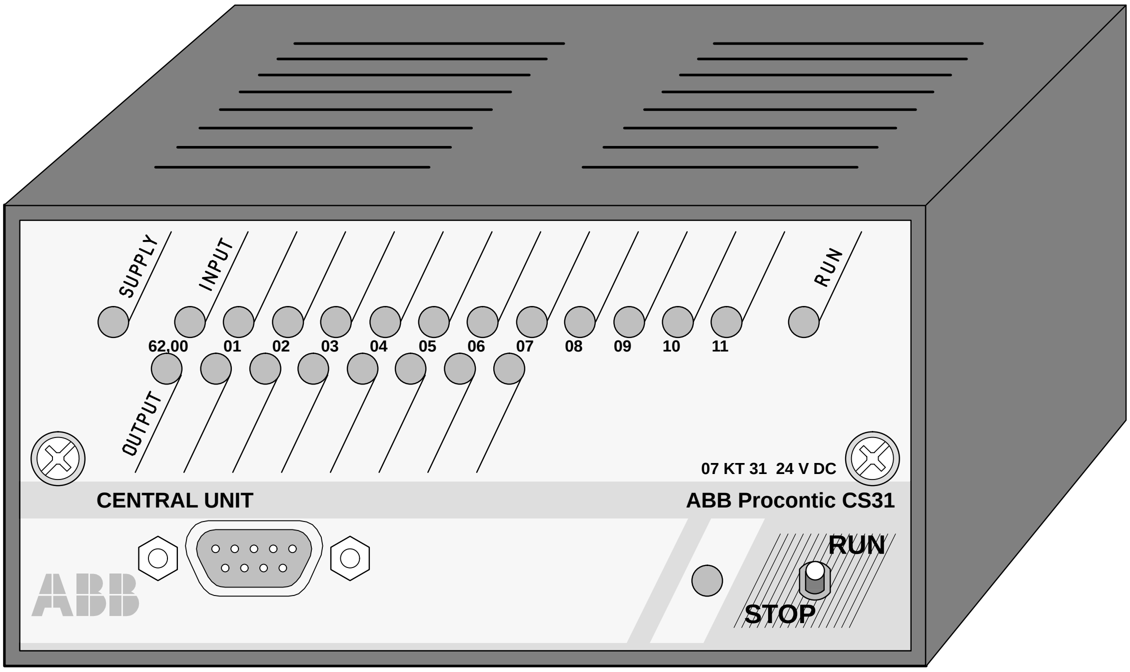
Main features

- 12 binary inputs
- 8 binary relay outputs
- 1 output with 24 V DC (regulated) for the 230-V-AC versions
- 1 counting input for counting frequencies up to 10 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  - is set as programming interface
  - can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
  - can be set as a MODBUS interface: master and slave
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Mounting by insertion into the plug-in base ECZ. The plug-in base can either be snapped on a DIN rail or fastened by screws. Wiring over the plug-in base ECZ.
- Built-in lithium battery for back-up of the RAM contents, its lifetime is 10 years.
- Reading and writing protection of the user program by password
- Programming with the programming software 907 PC 331
- User program containing max. 2 k of instructions
- RUN/STOP switch for starting and aborting the program execution

- Extensive diagnosis functions
  - Self–diagnosis of the central unit
  - Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.2 Central Unit 07 KT 31

Central units for a user program containing max. 2 k of instructions



Central unit 07 KT 31

The comprehensive description for this central unit is located in part 3 of this volume.

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The central unit 07 KT 31 works either as

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The module is supplied by 24 V DC or by 120 V AC or 230 V AC.

Main features

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- 8 binary transistor outputs
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- 1 counting input for counting frequencies up to 10 kHz
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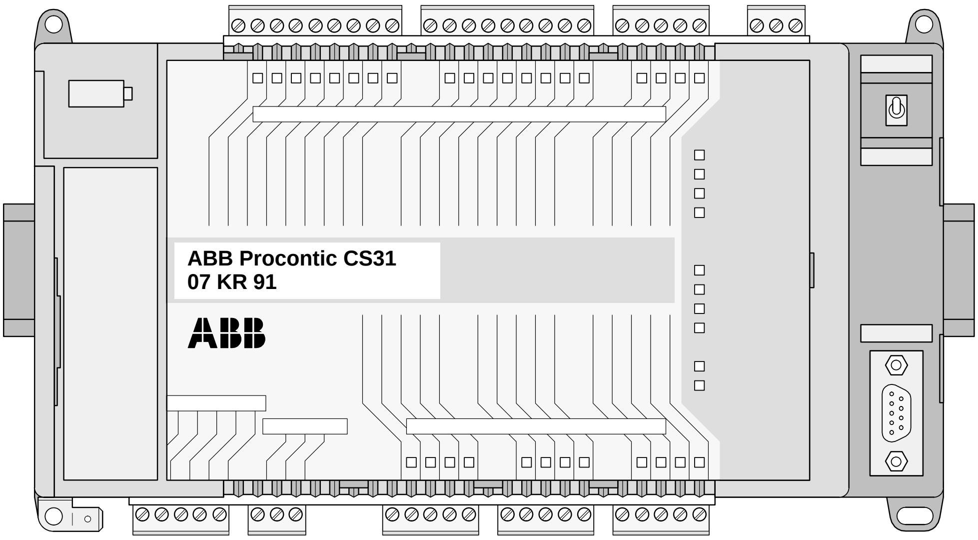
- Serial interface COM1
  - is set as programming interface
  - can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
  - can be set as a MODBUS interface: master and slave
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Mounting by insertion into the plug-in base ECZ. The plug-in base can either be snapped on a DIN rail or fastened by screws. Wiring over the plug-in base ECZ.
- Built-in lithium battery for back-up of the RAM contents, its lifetime is 10 years.
- Reading and writing protection of the user program by password
- Programming with the programming software 907 PC 331
- User program containing max. 2 k of instructions
- RUN/STOP switch for starting and aborting the program execution

- Extensive diagnosis functions
  - Self–diagnosis of the central unit
  - Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.3 Central Unit 07 KR 91 R202 and R252

Central unit for a user program containing max. 28 k of user program



Central unit 07 KR 91

The comprehensive description for this central unit is located in part 4 of this volume.

Brief description

The central unit 07 KR 91 works either as

- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand–alone central unit.

The module is provided in two versions with supply voltages of 24 V DC and 115/ 230 V AC:

07 KR 91 R202:

The device has a 115/230 V AC power supply voltage. It provides a 24 V output voltage for the supply of its own binary inputs.

07 KR 91 R252:

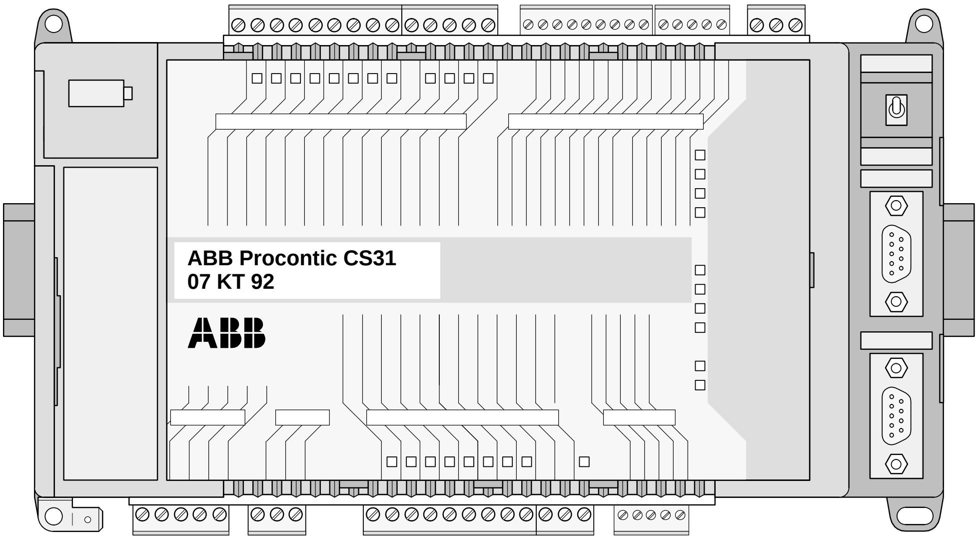
The device has a 24 V DC power supply voltage. It is provided with an additional interface for connecting communication modules (e.g. 07 KP 90).

Main features

- 20 binary inputs
- 12 binary relay outputs
- 1 counting input for counting frequencies up to 10 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  - – is set as programming interface
  - – can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw–type terminal blocks
- Detachable plastic sheet on the front side of the device; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  - – store and back-up the user program in the RAM
  - – store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  - – back-up the time and date (real–time clock)
- RUN/STOP switch for starting and aborting the program execution
- Extensive diagnosis functions
  - – Self–diagnosis of the central unit
  - – Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.4 Central Unit 07 KT 92 R202 and R262

Central unit for a user program containing max. 56 kB of user program + 30 kB user data



Central unit 07 KT 92 R202

The comprehensive description for this central unit is located in part 4 of this volume.

Brief description

The central unit 07 KT 92 works either as

- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand–alone central unit.

The module is supplied by 24 V DC. It is provided with an additional interface for connecting communication modules (e.g. 07 KP 90).

The module 07 KT 92 **R262** is additionally provided with an **integrated ARCnet coupler** (and an ARCnet interface).

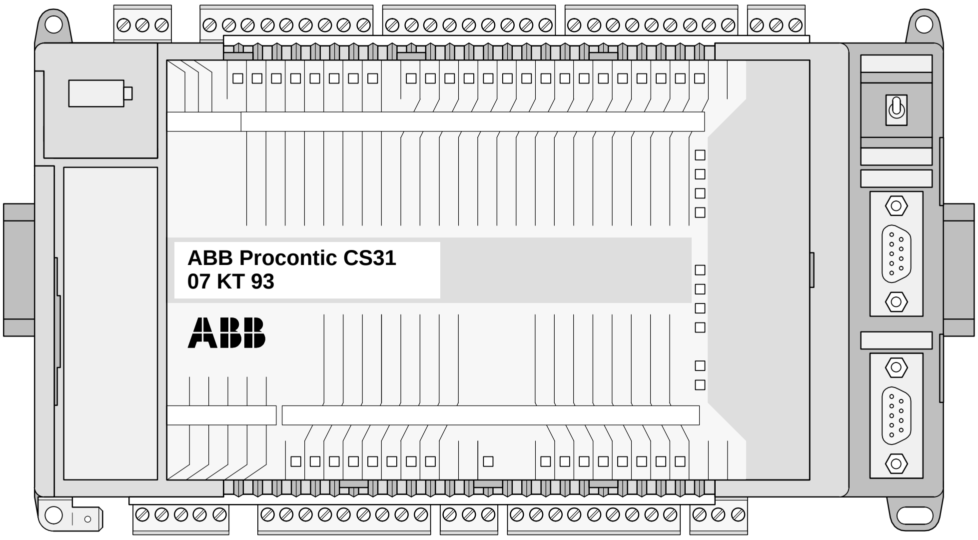
Main features

- 12 binary inputs
- 8 binary transistor outputs
- 4 analog inputs
- 2 analog output
- 1 counting input for counting frequencies up to 50 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  – is set as programming interface
  – can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Serial interface COM2 as an MMC interface
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw–type terminal blocks
- Detachable plastic sheet on the front side of the device; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  – store and back-up the user program in the RAM
  – store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  – back-up the time and date (real–time clock)
- RUN/STOP switch for starting and aborting the program execution

- Extensive diagnosis functions
  - Self–diagnosis of the central unit
  - Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.5 Central Unit 07 KT 93 R101 and R171

Central unit for a user program containing max. 56 kB of user program + 30 kB user data



Central unit 07 KT 93

The comprehensive description for this central unit is located in part 4 of this volume.

Brief description

The central unit 07 KT 93 works either as

- bus master in the decentralized automation system ABB Procontic CS31 or as
- slave (remote processor) in the decentralized automation system ABB Procontic CS31 or as
- stand–alone central unit.

The module is supplied by 24 V DC. It is provided with an additional interface for connecting communication modules (e.g. 07 KP 90).

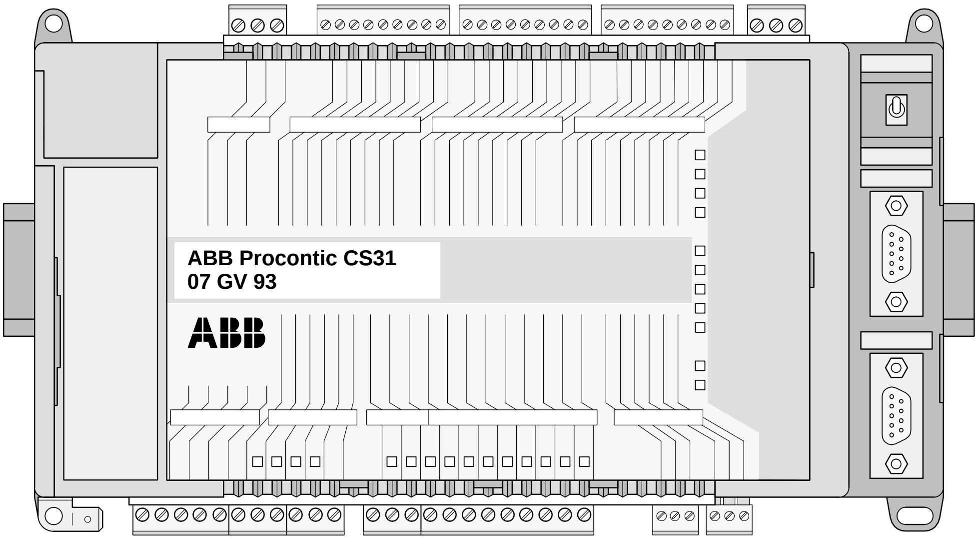
The module 07 KT 93 **R171** is additionally provided with an **integrated ARCnet coupler** (and an ARCnet interface).

Main features

- 24 binary inputs
- 16 binary transistor outputs
- 1 counting input for counting frequencies up to 10 kHz
- 1 CS31 system bus interface for system expansion
- Serial interface COM1
  – is set as programming interface
  – can be set as an ASCII interface for connecting peripheral devices (e.g. MMC devices)
- Serial interface COM2 as an MMC interface
- ARCnet coupler / ARCnet interface (only R171)
- Additional interface for connecting communication modules (e.g. 07 KP 90)
- Real–time clock
- LEDs for displaying the binary input and output signals as well as operating conditions and error messages
- Detachable screw–type terminal blocks
- Detachable plastic sheet on the front side of the device; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- The lithium battery 07 LE 90 can be put into the battery compartment in order to
  – store and back-up the user program in the RAM
  – store and back-up data which is additionally contained in the RAM, e.g. the status of flags
  – back-up the time and date (real–time clock)
- RUN/STOP switch for starting and aborting the program execution

- Extensive diagnosis functions
  - Self–diagnosis of the central unit
  - Diagnosis of the ABB Procontic CS31 system bus and the connected modules

2.6 Positioning Module 07 GV 93
for 3 axes



Positioning module 07 GV 93 R101

The comprehensive description for the positioning module is located in the 07 GV 93 operating manual in DIN A5 format, order No. GATS 1316 07 R2001.

Brief description

The positioning module 07 GV 93 is a subsystem within the decentralized automation system ABB Procontic CS31. It moves and positions three independent axes. The move sequences are programmed in a simple way by means of sets. Machine parameters which can be freely chosen adapt the positioning module to the mechanical units of the machines or the installation.

When used as a stand-alone module, the 07 GV 93 positioning module automatically moves and positions the axes on the basis of the programmed positioning sets. Additional input/output modules, connected via the CS31 system bus, allow the external control of the positioning sets and positioning sequences programmed in 07 GV 93.

The positioning module 07 GV 93 can also be used as a slave on the CS31 system bus. In this case, the positioning sets and sequences programmed in 07 GV 93 are controlled by a central unit 07 KR 91 / 07 KT 92 / 07 KT 93. This configuration allows the connection of additional positioning modules, slave central units as well as input and output modules.

The main features of the 07 GV 93 positioning module are:

- 1...3 axes
- Speed setpoint $\pm$ 10 V DC
- Connection to incremental encoders
- High traversing speed of up to 100 m/min
- Position control cycle 4 ms
- Internal numerical representation 32 bits
- Adjustable ramps per axis for both traverse directions
- Encoder error detection
- Power supply 24 V DC
- LEDs for displaying the input and output signals as well as operating conditions and error messages
- Detachable screw–type terminal blocks
- Detachable plastic sheet on the front side of the device; can be labelled with the signal names in order to have the inputs and outputs directly assigned
- Fastening by screws or by snapping the device onto a DIN rail
- RUN/STOP switch for starting and aborting the program execution
- Diagnosis functions

Operating and programming

A means for operating and programming the positioning module 07 GV 93 is the operating station 35 BS 40. It is configured as a simple terminal when the power is switched on and no further programming is to be done. The control of the display which includes 2 lines of 40 characters each is performed completely by the module 07 GV 93. Entry is done via function keys and a numerical keypad.

The following functions are available for programming:

- Absolute and incremental dimensions
- Override 0...125 %
- 300 positioning sets per axis
- Machine data set for machine-specific parameters
- Software limit switches
- 1–, 2– and 4–fold evaluation of the positioning encoders
- Metric system
- Reference point drive
- Automatic single set and automatic next set
- Manual control (Feed, Jog, Pos)
- Error detection, diagnosis

12 Bus-compatible modules from external manufacturers

VIFB–02...FB5	Valve island (Festo)
IIFB–02...FB5	Installation island (Festo)

12.1 Valve island VIFB–02...FB5 (Festo)

4 to 10 valves, 24 V supply, with field bus nodes for ABB Procontic CS31 system bus

Size	No. of valve positions	Data length	Bus transfer time
4	4	2 Bytes	387 μs
6	6	2 Bytes	387 μs
8	8	2 Bytes	387 μs
10	10	4 Bytes	452 μs

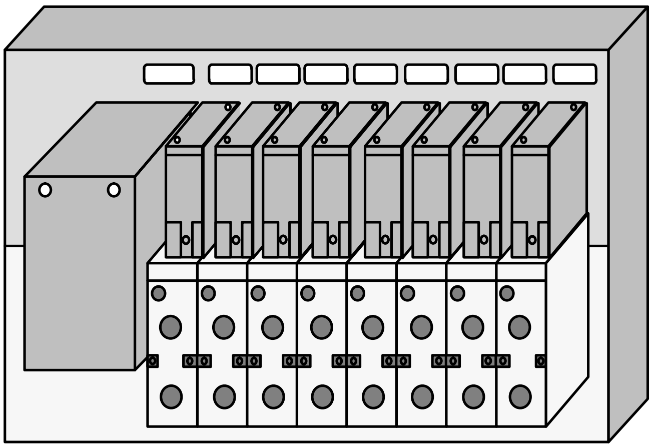


Fig. 12.1–1: Valve island VIFB–02...FB5 (Festo)

The valve island comprises the following:

- Connection block for the valves (valves support with pneumatic connections)
- Valve coupling unit (with the electrical outputs for the valve solenoids). The signal statuses are displayed.
- Valves, mostly two–way valves, for travel cylinders with monostable and bistable versions
- Field bus nodes (connection for ABB Procontic CS31 system bus)

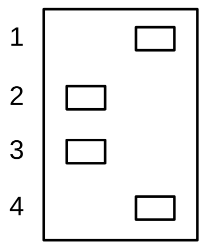
Manufacturer and source of supply: Festo KG, Esslingen.

Order No.: VIFB–02–x/x–x–FB5–x...
x: Pneumatic connection, No. of valves, valves type,...

The address of the field bus node on the system bus is set at the two–decade rotary switches after removing the front cover.

Upper switch → Units
Lower switch → Tens

The DIL switch must be set as follows:



Connections on the field bus node:

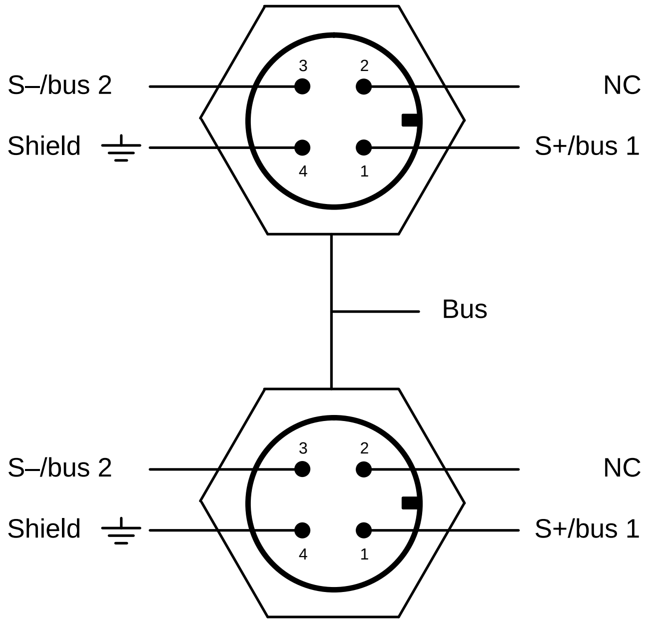


Fig. 12.1–2: Connections on the field bus node

Both socket–outlets are internally wired in parallel.

Connections for 24 V supply:

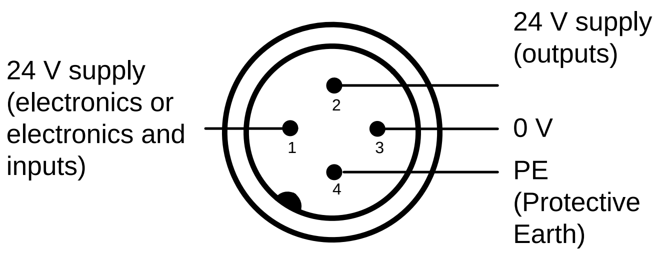


Fig.12.1–3: Connections for 24 V supply

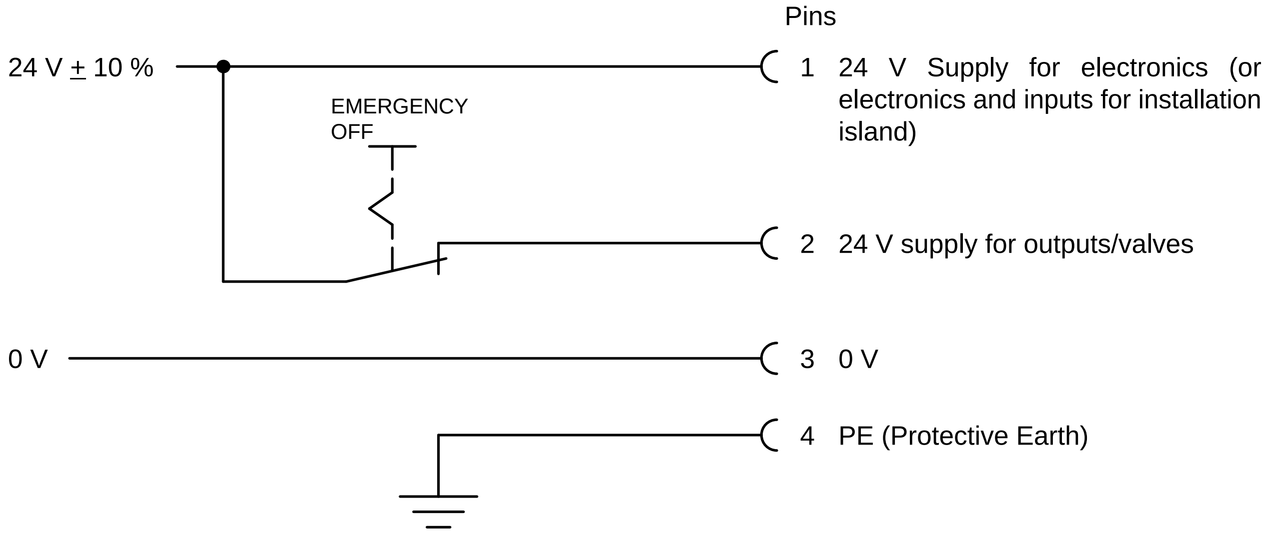


Fig. 12.1–4: Example: 24 V supply connection

Address assignment

No. of valve positions	Valve No.	Output No.	Operands for the central units PCZB, 07 KR 91 and 07 KT 92	Operands for the coupler 07 CS 61 *)	Operands for the central unit UCZA
10 8 6 4	0	O 0.00	A n , 00	A n , 00	A n , 00
	0	O 0.01	A n , 01	A n , 01	A n , 01
	1	O 0.02	A n , 02	A n , 02	A n , 02
	1	O 0.03	A n , 03	A n , 03	A n , 03
	2	O 0.04	A n , 04	A n , 04	A n , 04
	2	O 0.05	A n , 05	A n , 05	A n , 05
	3	O 0.06	A n , 06	A n , 06	A n , 06
4	3	O 0.07	A n , 07	A n , 07	A n , 07
	4	O 0.08	A n , 08	A n , 08	A n+1 , 00
	4	O 0.09	A n , 09	A n , 09	A n+1 , 01
	5	O 0.10	A n , 10	A n , 10	A n+1 , 02
6	5	O 0.11	A n , 11	A n , 11	A n+1 , 03
	6	O 0.12	A n , 12	A n , 12	A n+1 , 04
	6	O 0.13	A n , 13	A n , 13	A n+1 , 05
	7	O 0.14	A n , 14	A n , 14	A n+1 , 06
8	7	O 0.15	A n , 15	A n , 15	A n+1 , 07
	8	O 1.00	A n+1 , 00	A n , 16	A n+2 , 00
	8	O 1.01	A n+1 , 01	A n , 17	A n+2 , 01
	9	O 1.02	A n+1 , 02	A n , 18	A n+2 , 02
10	9	O 1.03	A n+1 , 03	A n , 19	A n+2 , 03
	Not used	O 1.04	A n+1 , 04	A n , 20	A n+2 , 04
		O 1.05	A n+1 , 05	A n , 21	A n+2 , 05
		O 1.06	A n+1 , 06	A n , 22	A n+2 , 06
		O 1.07	A n+1 , 07	A n , 23	A n+2 , 07
		O 1.08	A n+1 , 08	A n , 24	A n+3 , 00
		O 1.09	A n+1 , 09	A n , 25	A n+3 , 01
		O 1.10	A n+1 , 10	A n , 26	A n+3 , 02
		O 1.11	A n+1 , 11	A n , 27	A n+3 , 03
		O 1.12	A n+1 , 12	A n , 28	A n+3 , 04
		O 1.13	A n+1 , 13	A n , 29	A n+3 , 05
		O 1.14	A n+1 , 14	A n , 30	A n+3 , 06
		O 1.15	A n+1 , 15	A n , 31	A n+3 , 07
Permissible module adresses n for central unit or coupler: Values in brackets apply to valve island with 10 positions.			PCZB: 1...31 (30) 07 KR 91: 0...60 07 KT 92: 0...60	07 CS 61: 0... 8 (7) 10...18 (17) 20...28 (27) 30...38 (37) 40...48 (47) 50...58 (57) 60	UCZA: 0...60
Next higher address that can be set on another module			n+1 (n+2)	n+1	n+2 (n+4)

*) For the coupler 35 CS 91 (ABB Proconic T300), the assignment is freely programmable, see the description of the coupler 35 CS 91 (in preparation) in the system description ABB Protonic T300, order No. GATS131599R2002.

- The outputs 8 to 15 cannot be used with the valve island when operating with the UCZA. They are available on the bus for other CS31 modules.

- The setting for channel <7 or > 7 is omitted for the valve/installation island
- Error displays on the device:
  - Green LED lights up: Operating voltage is present
  - Red LED lights up: Hardware error or short–circuit or voltage is too low.
  - Red LED flashes quickly: Baud rate or address is incorrect.
  - Red LED flashes slowly: Bus connection is not okay.
- Error displays are automatically deleted after remedying the error

Technical data

See the device description in the Festo documents.

12.2 Installation island IIFB–02...FB5 (Festo)

4 to 10 valves, 24 V supply, with field bus nodes for ABB Procontic CS31 system bus

Size	No. of valve positions	Data length	Bus transfer time
4	4	2 Bytes / 2 Bytes	516 μs
6	6	2 Bytes / 2 Bytes	516 μs
8	8	4 Bytes / 4 Bytes	772 μs
10	10	4 Bytes / 4 Bytes	772 μs

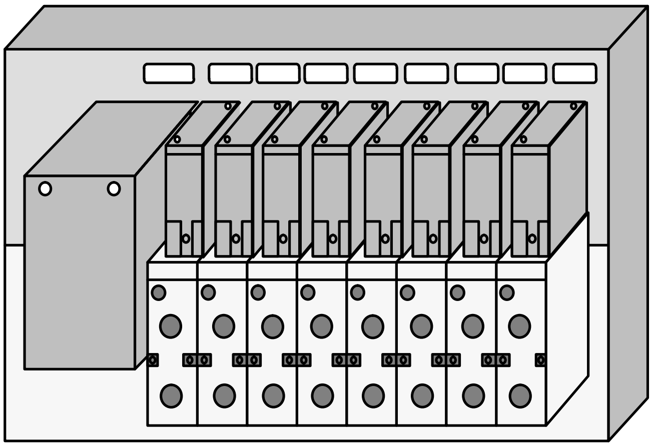


Fig. 12.2–1: Installation island IIFB–02 (Festo)

The installation island comprises the following:

- Connection block for the valves (valve support with pneumatic connections)
- Valve/sensor coupling unit (with the electrical outputs for the valve solenoids, with 2 signal inputs for each valve position and with 2 additional signal inputs and 2 signal outputs 500 mA). All signals are displayed.
- Valves, mostly two–way valves, for travel cylinders with monostable and bistable versions
- Field bus nodes (connecton for ABB Procontic CS31 system bus)

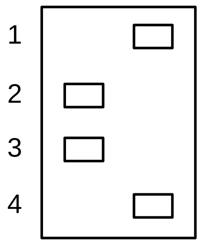
Manufacturer and source of supply: Festo KG, Esslingen.

Order No.: IIFB–02–x/x–x–FB5–x...
x: Pneumatic connection, No. of valves, valve type,...

The address of the field bus node on the system bus is set at the two–decade rotary switches after removing the front cover.

Upper switch → Units
Lower switch → Tens

The DIL switch must be set as follows:



Connection on the field bus node:

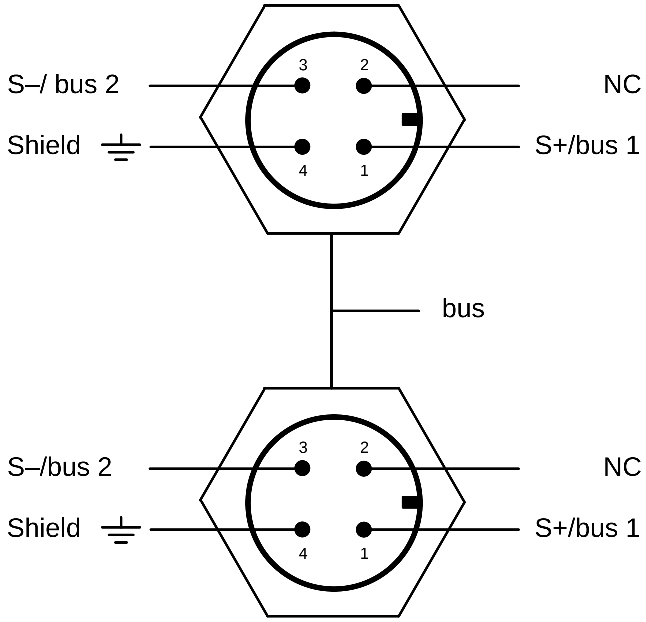


Fig. 12.2–2: Connection on the field bus node

Both socket–outlets are internally wired in parallel.

Connections for 24 V supply:

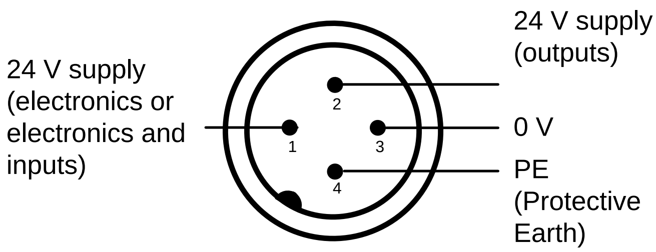


Fig. 12.2–3: Connections for 24 V supply

Connections for signal inputs and outputs

The socket–outlets are located at the top on the valve–sensor coupling unit.

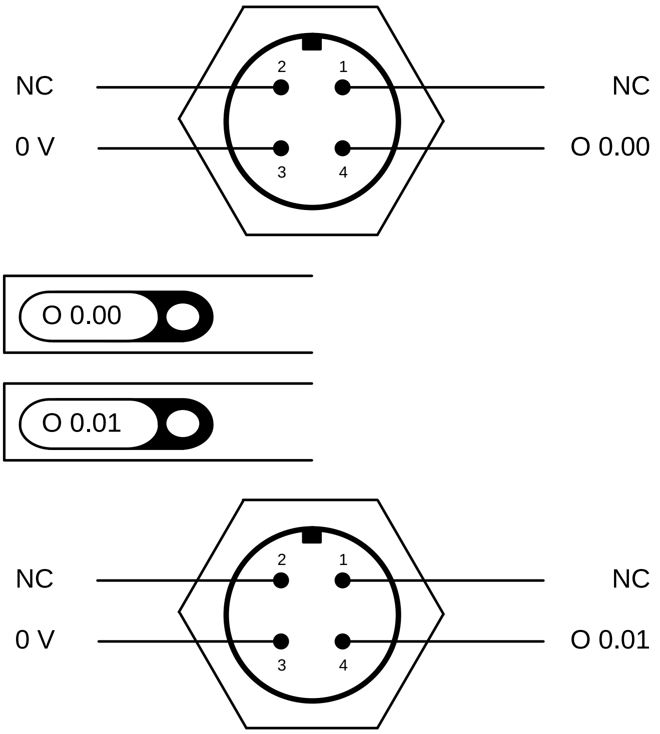


Fig. 12.2–4: Connections for additional outputs

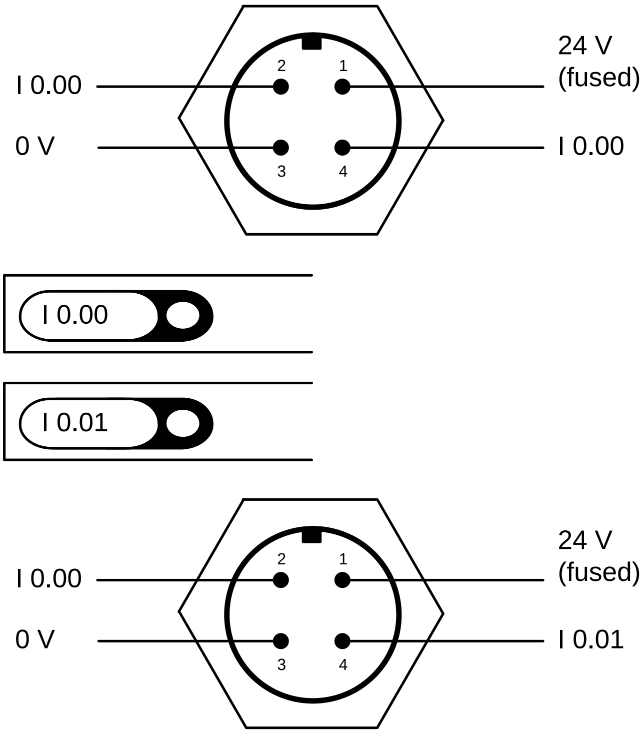


Fig.12.2–5: Connections for signal inputs

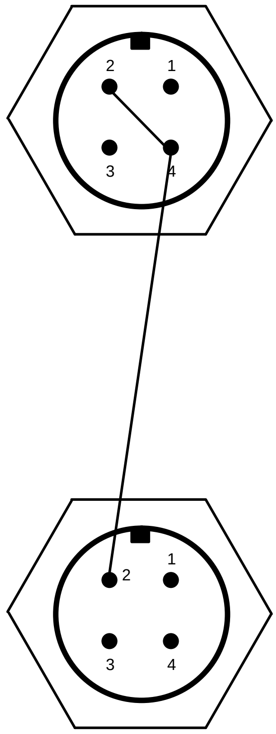


Fig.12.2–6: Signal inputs, internal connection

Address assignment for the installation islands sizes 4 and 6

Outputs

No. of valve positions	Output pair/valve No.	Installation island outputs *)	Operands for the central units PCZB, 07 KR 91 and 07 KT 92	Operands for the coupler 07 CS 61 **)	Operands for the central unit UCZA
	Additional outputs	O 0.00	A n , 00	A n , 16	A n , 00
		O 0.01	A n , 01	A n , 17	A n , 01
	0	O 0.02	A n , 02	A n , 18	A n , 02
	0	O 0.03	A n , 03	A n , 19	A n , 03
6 4	1	O 0.04	A n , 04	A n , 20	A n , 04
	1	O 0.05	A n , 05	A n , 21	A n , 05
	2	O 0.06	A n , 06	A n , 22	A n , 06
	2	O 0.07	A n , 07	A n , 23	A n , 07
	3	O 0.08	A n , 08	A n , 24	A n+1 , 00
	3	O 0.09	A n , 09	A n , 25	A n+1 , 01
	4	O 0.10	A n , 10	A n , 26	A n+1 , 02
	4	O 0.11	A n , 11	A n , 27	A n+1 , 03
	5	O 0.12	A n , 12	A n , 28	A n+1 , 04
	5	O 0.13	A n , 13	A n , 29	A n+1 , 05
	Diagnosis bits	O 0.14	A n , 14	A n , 30	A n+1 , 06
		O 0.15	A n , 15	A n , 31	A n+1 , 07
Permissible module addresses n for central unit or coupler:			PCZB: 1...31 07 KR 91: 0...60 07 KT 92: 0...60	07 CS 61: 0... 8 10...18 20...28 30...38 40...48 50...58 60	UCZA: 0...60
Next higher address that can be set on another module			n+1	n+1	n+2

**) For the coupler 35 CS 91 (ABB Procontic T300), the assignment is freely programmable, see the description of the coupler 35 CS 91 (in preparation) in the system description ABB Procontic T300, order No. GATS131599R2002.

- When operating with the UCZA, the cannels 8 to 15 cannot be used with the CS31 designator with the valve/installation island. They are available for other CS31 modules.
- The setting for channel <7 or >7 is omitted for the valve / installation island.
- Error displays on the device:
  - Green LED lights up: Operating voltage is present
  - Red LED lights up: Hardware error or short–circuit or voltage is too low.
  - Red LED flashes quickly: Baud rate or address is incorrect.
  - Red LED flashes slowly: Bus connection is not okay.
- Error displays are automatically deleted after remedying the error.
- Note:
  For T200 coupling: Configuration type EA16

Address assignment for the installation islands sizes 4 and 6

Outputs

No. of valve positions	Output pair/valve No.	Installation island outputs *)	Operands for the central units PCZB, 07 KR 91 and 07 KT 92	Operands for the coupler 07 CS 61 **)	Operands for the central unit UCZA
	Additional outputs	O 0.00	A n , 00	A n , 16	A n , 00
		O 0.01	A n , 01	A n , 17	A n , 01
	0	O 0.02	A n , 02	A n , 18	A n , 02
	0	O 0.03	A n , 03	A n , 19	A n , 03
6 4	1	O 0.04	A n , 04	A n , 20	A n , 04
	1	O 0.05	A n , 05	A n , 21	A n , 05
	2	O 0.06	A n , 06	A n , 22	A n , 06
	2	O 0.07	A n , 07	A n , 23	A n , 07
	3	O 0.08	A n , 08	A n , 24	A n+1 , 00
	3	O 0.09	A n , 09	A n , 25	A n+1 , 01
	4	O 0.10	A n , 10	A n , 26	A n+1 , 02
	4	O 0.11	A n , 11	A n , 27	A n+1 , 03
	5	O 0.12	A n , 12	A n , 28	A n+1 , 04
	5	O 0.13	A n , 13	A n , 29	A n+1 , 05
	Diagnosis bits	O 0.14	A n , 14	A n , 30	A n+1 , 06
		O 0.15	A n , 15	A n , 31	A n+1 , 07
Permissible module addresses n for central unit or coupler:			PCZB: 1...31 07 KR 91: 0...60 07 KT 92: 0...60	07 CS 61: 0... 8 10...18 20...28 30...38 40...48 50...58 60	UCZA: 0...60
Next higher address that can be set on another module			n+1	n+1	n+2

**) For the coupler 35 CS 91 (ABB Procontic T300), the assignment is freely programmable, see the description of the coupler 35 CS 91 (in preparation) in the system description ABB Procontic T300, order No. GATS131599R2002.

- When operating with the UCZA, the cannels 8 to 15 cannot be used with the CS31 designator with the valve/installation island. They are available for other CS31 modules.
- The setting for channel <7 or >7 is omitted for the valve / installation island.
- Error displays on the device:
  – Green LED lights up: Operating voltage is present
  – Red LED lights up: Hardware error or short–circuit or voltage is too low.
  – Red LED flashes quickly: Baud rate or address is incorrect.
  – Red LED flashes slowly: Bus connection is not okay.
- Error displays are automatically deleted after remedying the error.
- Note:
  For T200 coupling: Configuration type EA16

Address assignments for the installation islands sizes 8 and 10

Inputs

No. of valves positions	Input pair/valve No.	Installation island inputs *)	Operands for the central units PCZB, 07 KR 91 and 07 KT 92	Operands for the coupler 07 CS 61	Operands for the central unit UCZA
	Additional	I 0.00	E n , 00	E n , 00	E n , 00
	inputs	I 0.0	E n , 01	E n , 01	E n , 01
	0	I 0.02	E n , 02	E n , 02	E n , 02
	0	I 0.03	E n , 03	E n , 03	E n , 03
10 8	1	I 0.04	E n , 04	E n , 04	E n , 04
	1	I 0.05	E n , 05	E n , 05	E n , 05
	2	I 0.06	E n , 06	E n , 06	E n , 06
	2	I 0.07	E n , 07	E n , 07	E n , 07
	3	I 0.08	E n , 08	E n , 08	E n+1 , 00
	3	I 0.09	E n , 09	E n , 09	E n+1 , 01
	4	I 0.10	E n , 10	E n , 10	E n+1 , 02
	4	I 0.11	E n , 11	E n , 11	E n+1 , 03
	5	I 0.12	E n , 12	E n , 12	E n+1 , 04
	5	I 0.13	E n , 13	E n , 13	E n+1 , 05
	6	I 0.14	E n , 14	E n , 14	E n+1 , 06
	6	I 0.15	E n , 15	E n , 15	E n+1 , 07
	7	I 1.00	E n+1 , 00	E n , 16	E n+2 , 00
	7	I 1.01	E n+1 , 01	E n , 17	E n+2 , 01
	8	I 1.02	E n+1 , 02	E n , 18	E n+2 , 02
	8	I 1.03	E n+1 , 03	E n , 19	E n+2 , 03
	9	I 1.04	E n+1 , 04	E n , 20	E n+2 , 04
	9	I 1.05	E n+1 , 05	E n , 21	E n+2 , 05
	Not used	I 1.06	E n+1 , 06	E n , 22	E n+2 , 06
		I 1.07	E n+1 , 07	E n , 23	E n+2 , 07
		I 1.08	E n+1 , 08	E n , 24	E n+3 , 00
		I 1.09	E n+1 , 09	E n , 25	E n+3 , 01
		I 1.10	E n+1 , 10	E n , 26	E n+3 , 02
		I 1.11	E n+1 , 11	E n , 27	E n+3 , 03
		I 1.12	E n+1 , 12	E n , 28	E n+3 , 04
		I 1.13	E n+1 , 13	E n , 29	E n+3 , 05
	Diagnosis	I 1.14	E n+1 , 14	E n , 30	E n+3 , 06
	bits	I 1.15	E n+1 , 15	E n , 31	E n+3 , 07
Permissible module addresses n for the central unit or coupler:			PCZB: 1...30 07 KR 91: 0...60 07 KT 92: 0...60	07 CS 61: 0... 8 10...18 20...28 30...38 40...48 50...58 60	UCZA: 0...60
Next higher address which can be set on another module			n+2	n+1	n+4

- Note:
  For T200 coupling: Configuration type EA32

Technical data

See the description in the Festo documentation.

Address assignment for the installation islands sizes 8 and 10

Outputs

No. of valve positions	Output pair/ valve No.	Installation island outputs	Operands for the central units PCZB, 07 KR 91 and 07 KT 92	Operands for the coupler 07 CS 61	Operands for the central unit UCZA
	Additional	O 0.00	A n , 00	A n , 32	A n , 00
	outputs	O 0.01	A n , 01	A n , 33	A n , 01
	0	O 0.02	A n , 02	A n , 34	A n , 02
	0	O 0.03	A n , 03	A n , 35	A n , 03
10 8	1	O 0.04	A n , 04	A n , 36	A n , 04
	1	O 0.05	A n , 05	A n , 37	A n , 05
	2	O 0.06	A n , 06	A n , 38	A n , 06
	2	O 0.07	A n , 07	A n , 39	A n , 07
	3	O 0.08	A n , 08	A n , 40	A n+1 , 00
	3	O 0.09	A n , 09	A n , 41	A n+1 , 01
	4	O 0.10	A n , 10	A n , 42	A n+1 , 02
	4	O 0.11	A n , 11	A n , 43	A n+1 , 03
	5	O 0.12	A n , 12	A n , 44	A n+1 , 04
	5	O 0.13	A n , 13	A n , 45	A n+1 , 05
	6	O 0.14	A n , 14	A n , 46	A n+1 , 06
	6	O 0.15	A n , 15	A n , 47	A n+1 , 07
	7	O 1.00	A n+1 , 00	A n , 48	A n+2 , 00
	7	O 1.01	A n+1 , 01	A n , 49	A n+2 , 01
	8	O 1.02	A n+1 , 02	A n , 50	A n+2 , 02
	8	O 1.03	A n+1 , 03	A n , 51	A n+2 , 03
	9	O 1.04	A n+1 , 04	A n , 52	A n+2 , 04
	9	O 1.05	A n+1 , 05	A n , 53	A n+2 , 05
		O 1.06	A n+1 , 06	A n , 54	A n+2 , 06
		O 1.07	A n+1 , 07	A n , 55	A n+2 , 07
		O 1.08	A n+1 , 08	A n , 56	A n+3 , 00
		O 1.09	A n+1 , 09	A n , 57	A n+3 , 01
	Not used	O 1.10	A n+1 , 10	A n , 58	A n+3 , 02
		O 1.11	A n+1 , 11	A n , 59	A n+3 , 03
		O 1.12	A n+1 , 12	A n , 60	A n+3 , 04
		O 1.13	A n+1 , 13	A n , 61	A n+3 , 05
		O 1.14	A n+1 , 14	A n , 62	A n+3 , 06
		O 1.15	A n+1 , 15	A n , 63	A n+3 , 07
Permissible module addresses for the central unit or coupler:			PCZB: 1...30 07 KR 91: 0...60 07 KT 92: 0...60	07 CS 61: 0... 8 10...18 20...28 30...38 40...48 50...58 60	UCZA: 0...60
Next higher address which can be set on another module			n+2	n+1	n+4

- Note:
  For T200 coupling: Configuration type EA32

Technical data

See the device description in the Festo documentation.

13.8 Interface Cables 07 SK 90 R1, 07 SK 91 R1 and 07 SK 92 R1
for connection of peripheral units to the 9–pole serial interfaces of the compact PLCs 07 KR 91, 07 KT 92 (ABB Procontic CS31) and the communication processors 07 KP 62, 07 KP 63 and 07 KP 64 (ABB Procontic T200) and 07 KP 90 (ABB Procontic CS31)

13.8.1 Survey table

The following table shows, which interface cables can be used for connections between the peripheral units and the 9–pole interfaces of the CS31 compact PLCs and the T200 communication processors. In order to connect printers no definite cables can be proposed, because printers of different make have different interface pin assignments. However, under 13.8.5 a schematic diagram of a possible interface cable is proposed to connect the 07 DR 12 printer.

Connection from the processor unit, interface,	**through** the system cable (interface cable)	**to the peripheral unit.**
07 KR91 COM1 07 KT92 COM1 07 KP62 COM1	07 SK 90	Programming unit 07 PH 32 with 907 PC 331
07 KR91 COM1 07 KT92 COM1 07 KP62 COM1	07 SK 90	Operating station 35 BS 93 in active mode
07 KR91 COM1 07 KT92 COM1 07 KP62 COM1 07 KP63 COM1 07 KP64 CONSOLE 07 KP90 CONSOLE	07 SK 90	Terminal
07 KR91 COM1 07 KT92 COM1 07 KT92 COM2 07 KP62 COM1 07 KP62 COM2	07 SK 91	Operating station 35 BS 40
07 KR91 COM1 07 KT92 COM1 07 KT92 COM2 07 KP62 COM1 07 KP62 COM2	07 SK 91	Operating station 35 BS 93 in passive mode
07 KR91 COM1 07 KT92 COM1 07 KT92 COM2 07 KP62 COM1 07 KP62 COM2 07 KP64 RCOM 07 KP90 RCOM	07 SK 92	Modem with a standard interface, for signal names and pin assignment see 13.8.4
07 KR91 COM1 07 KT92 COM1 07 KT92 COM2 07 KP62 COM1 07 KP62 COM2	special printer cable, suitable for the used printer	Printer, under 13.8.5 a schematic diagram of an interface cable is proposed to connect the 07 DR 12 printer

13.8.2 Interface Cable 07 SK 90 R1 with adaptor

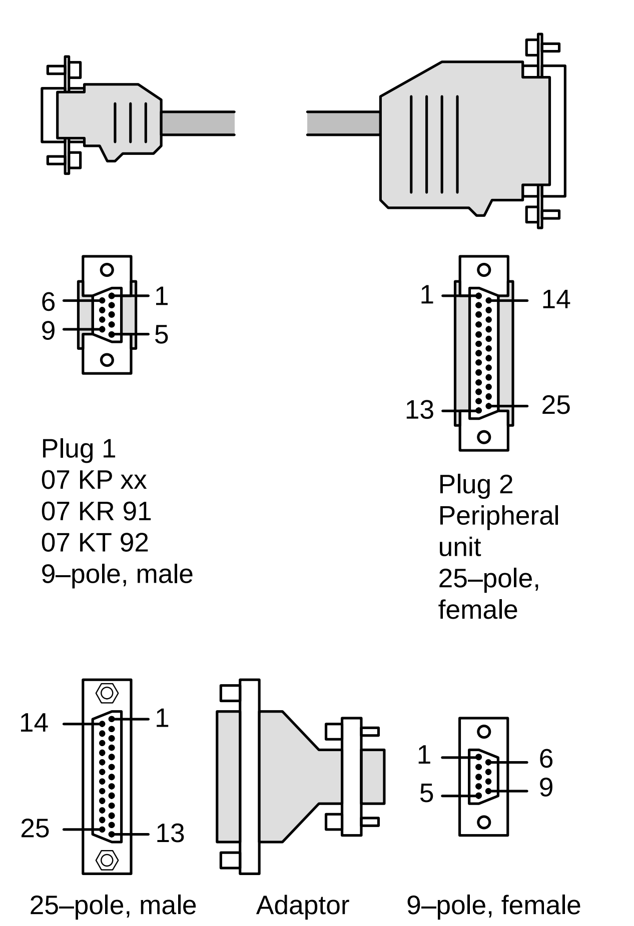


Fig. 13.8.2–1:
Interface cable 07 SK 90 R1 with adaptor

Intended Purpose

The cable 07 SK 90 is used to connect a 9–pole serial interface connector of CS31 compact PLCs or T200 communication processors with a peripheral unit in order to operate in programming or active mode (see 13.8.1 Survey table). If the peripheral unit has a 9–pole connector, the adaptor provided with (25–pole to 9–pole) can be employed for adaption.

Mechanical Design

Plug 1

SUB–D plug, 9–pole male, on the side of 07 KP 6x, 07 KR 91, 07 KT 92.
The housing is metal–plated, the shield is connected to the metal plate.

Plug 2

SUB–D plug, 25–pole female, on the side of the peripheral unit.
The plugs are mounted to both interfaces by means of screws.

Cable type

LICYCY 5 x 0.14/15

Adaptor provided

25–pole male/9–pole female for connection of peripheral units with 9–pole interfaces (male)

Technical Data

Length	5 m
Weight	220 g
Order number	GJR5 2502 00 R1

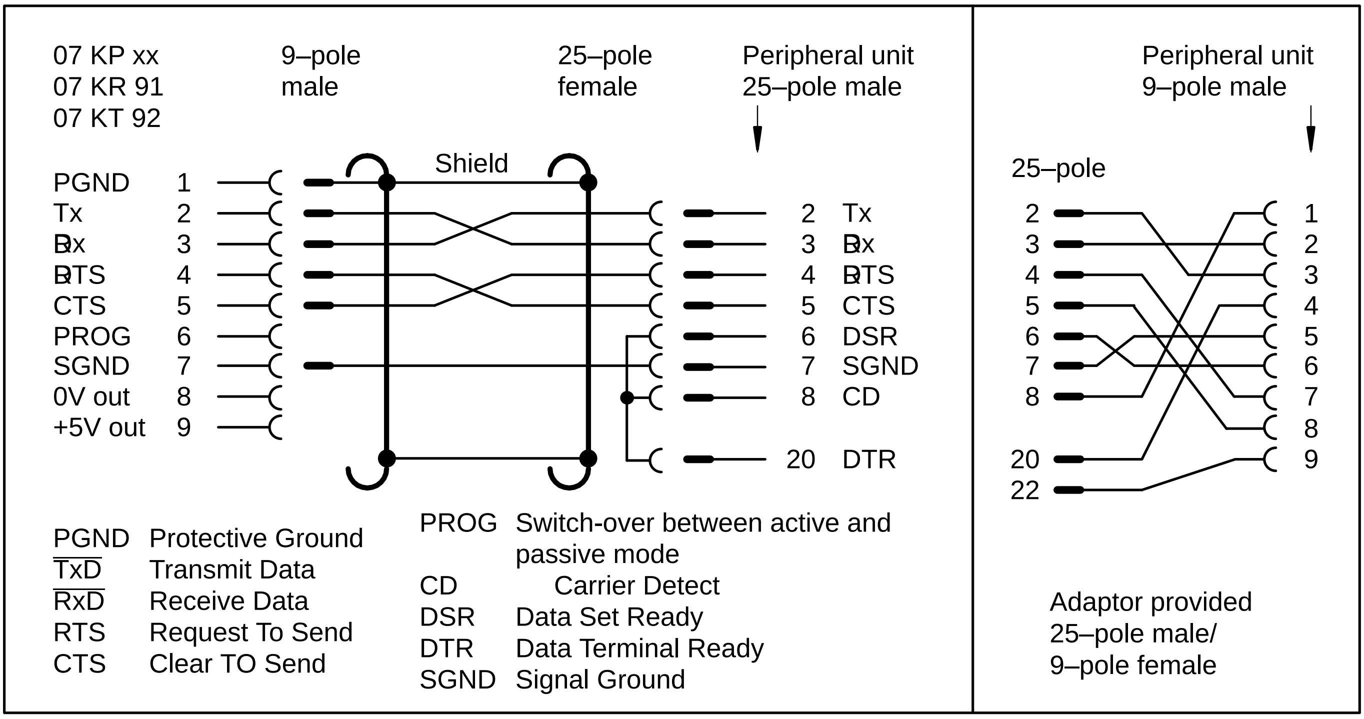


Fig. 13.8.2–2: Terminal assignment of the 07 SK 90 interface cable and the adaptor provided with

13.8.3 Interface Cable 07 SK 91 R1 with adaptor

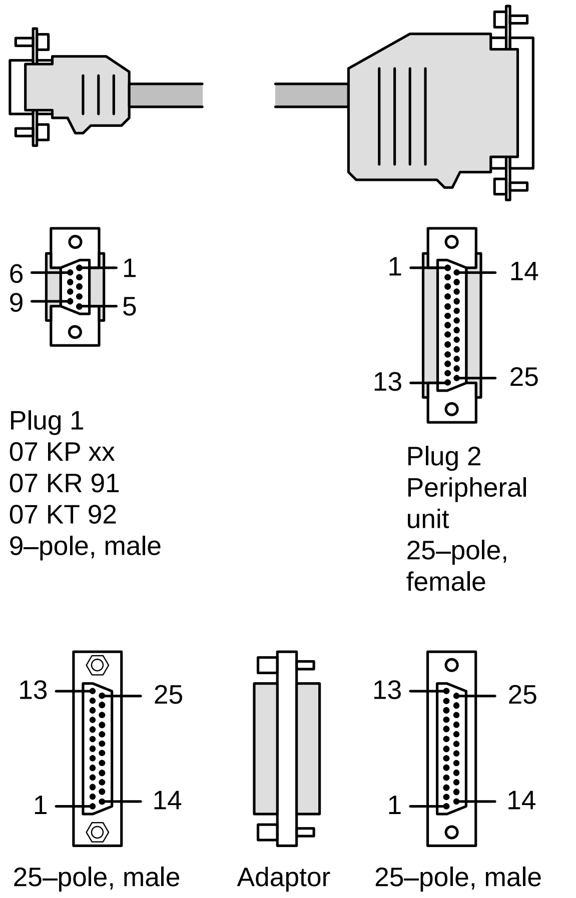


Fig. 13.8.3–1:
Interface cable 07 SK 91 with adaptor

Intended Purpose

The cable 07 SK 91 is used to connect a 9–pole serial interface connector of CS31 compact PLCs or T200 communication processors with a peripheral unit in order to operate in MMC mode or passive mode (see 13.8.1 Survey table). If the peripheral unit has a 9–pole connector, a commercially available adaptor (25–pole to 9–pole) has to be employed for adaption.

Mechanical Design

Plug 1

SUB–D plug, 9–pole male, on the side of 07 KP 6x, 07 KR 91, 07 KT 92.
The housing is metal–plated, the shield is connected to the metal plate.

Plug 2

SUB–D plug, 25–pole female, on the side of the peripheral unit.
The plugs are mounted to both interfaces by means of screws.

Cable type

LICYCY 5 x 0.14/15

Adaptor provided

25–pole male/25–pole male for connection of peripheral units with 25–pole interfaces (female)

Technical Data

Length	5 m
Weight	220 g
Order number	GJR5 2503 00 R1

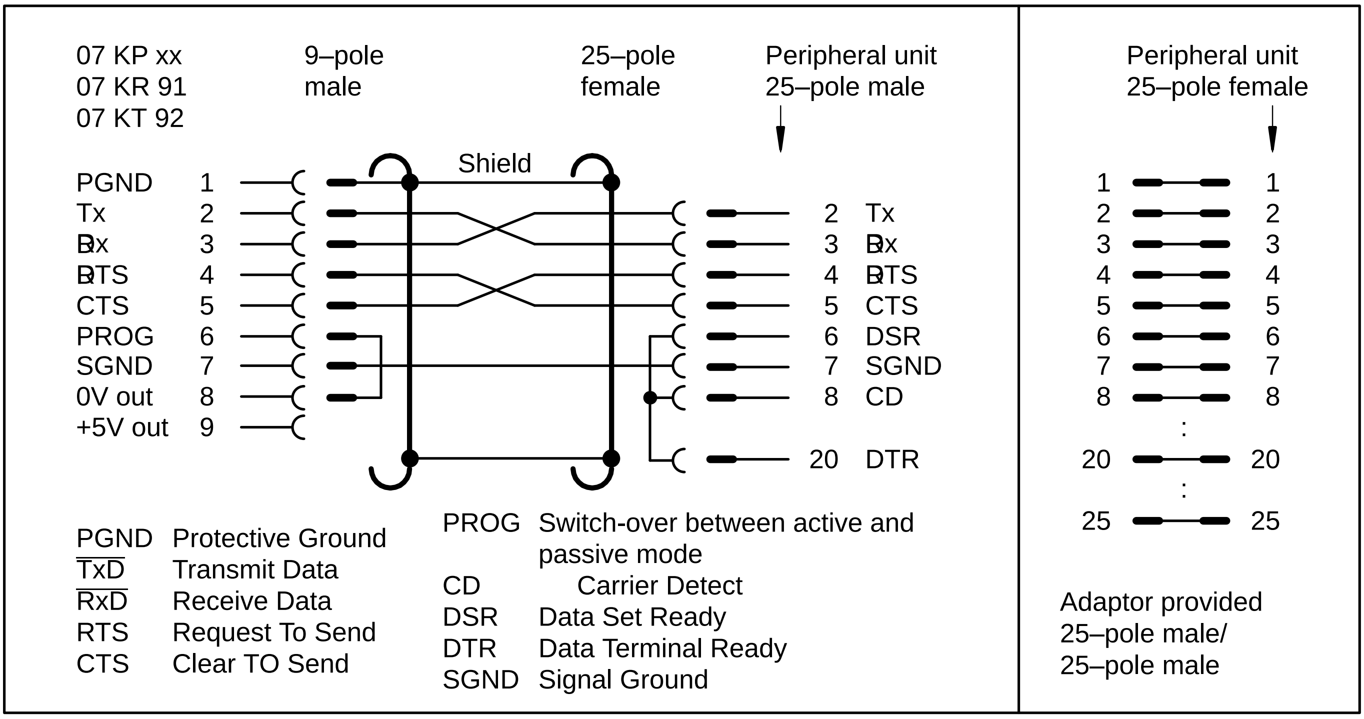


Fig. 13.8.3–2: Terminal assignment of the 07 SK 91 interface cable and the adaptor provided with

13.8.4 Interface Cable 07 SK 92 R1

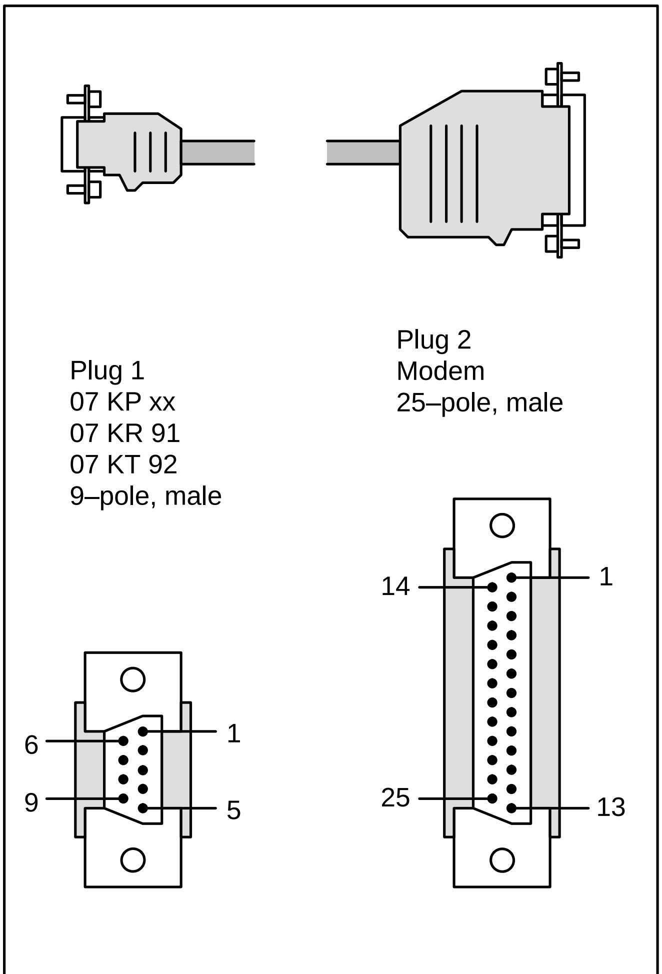


Fig. 13.8.4–1:
Interface cable 07 SK 92 R1

Intended Purpose

The cable 07 SK 92 is used to connect a 9–pole serial interface connector of CS31 compact PLCs or T200 communication processors with a modem with a standard interface (see 13.8.1 Survey table). If another modem has to be connected, the cable must be modified possibly.

Mechanical Design

Plug 1

SUB–D plug, 9–pole male, on the side of 07 KP 6x, 07 KR 91, 07 KT 92.
The housing is metal–plated, the shield is connected to the metal plate.

Plug 2

SUB–D plug, 25–pole male, on the side of the modem.
The plugs are mounted to both interfaces by means of screws.

Cable type

LICYCY 5 x 0.14/15

Technical Data

Length	5 m
Weight	220 g
Order number	GJR5 2504 00 R1

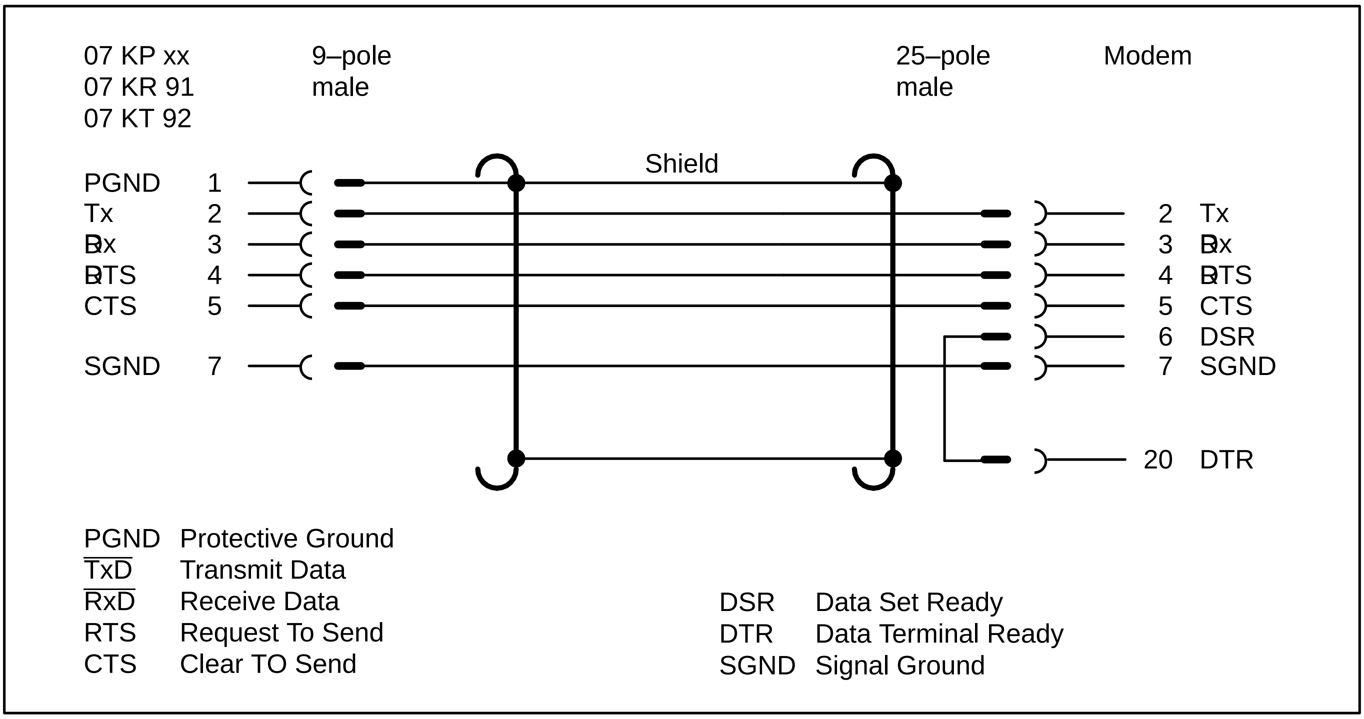


Fig. 13.8.4–2: Terminal assignment of 07 SK 92

13.8.5 Interface Cable for the 07 DR 12 printer (schematic diagram)

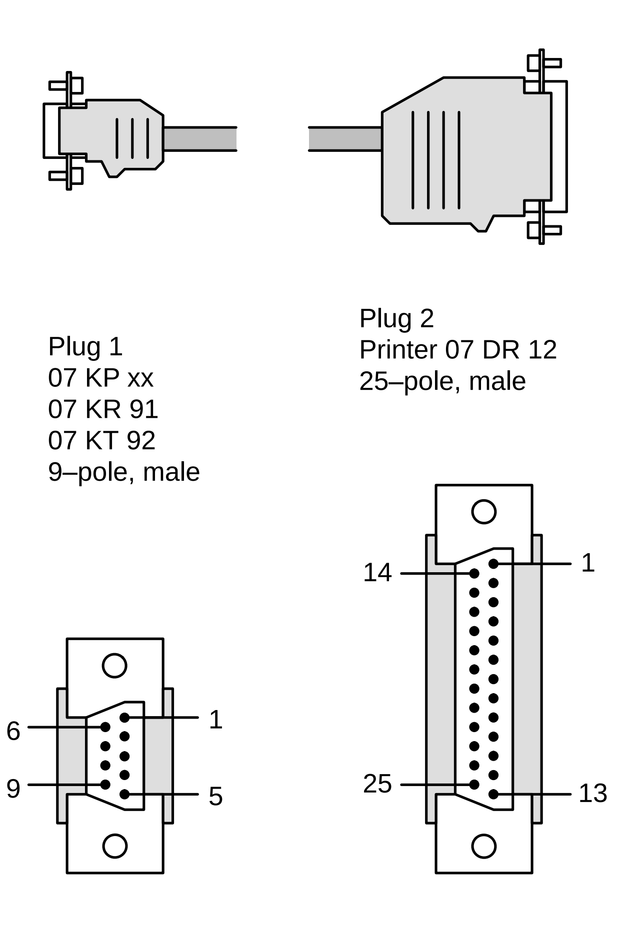


Fig. 13.8.5–1:
Interface cable for the 07 DR 12 printer

Intended Purpose

The shown cable can be used to connect a 9–pole serial interface connector of CS31 compact PLCs or T200 communication processors with the 07 DR 12 printer (EPSON FX 870, serial interface C823061) (see 13.8.1 Survey table). If another printer has to be connected, the cable must be modified possibly.

Mechanical Design

Plug 1

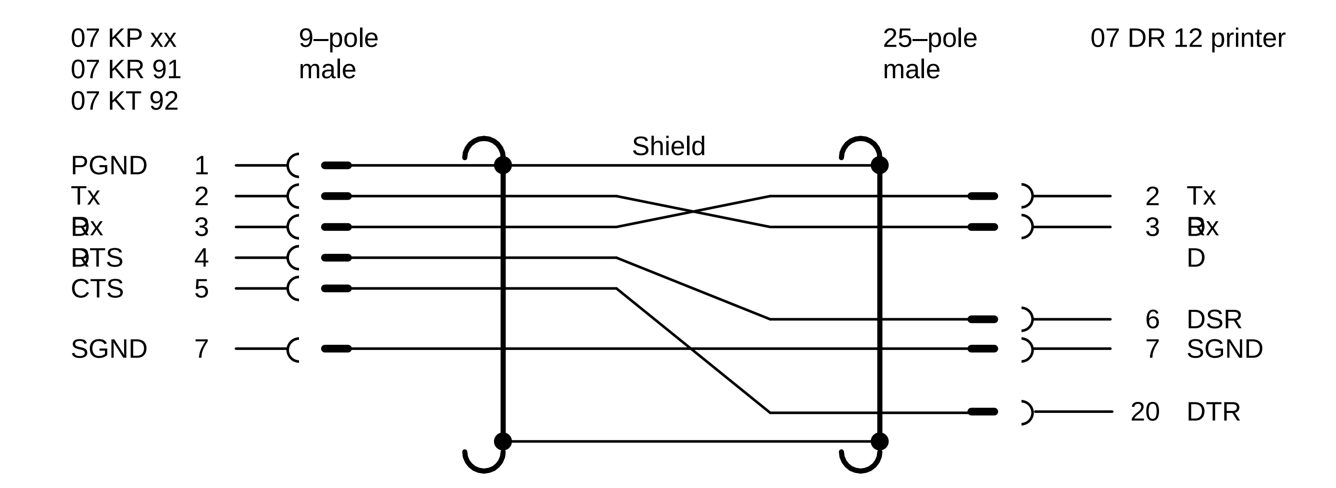
SUB–D plug, 9–pole male, on the side of 07 KP 6x, 07 KR 91, 07 KT 92.
The housing is metal–plated, the shield is connected to the metal plate.

Plug 2

SUB–D plug, 25–pole male, on the side of the printer.
The plugs are mounted to both interfaces by means of screws.

Usable cable type

LICYCY 5 x 0.14/15



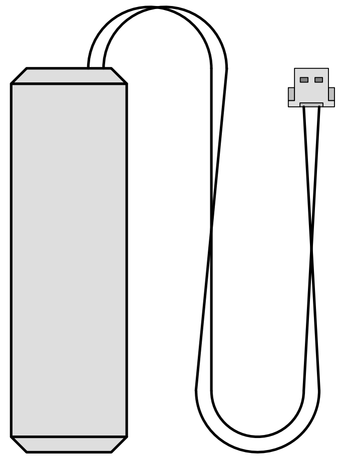
PGND Protective Ground
TxD Transmit Data
RxD Receive Data
RTS Request To Send
CTS Clear TO Send

DSR Data Set Ready
DTR Data Terminal Ready
SGND Signal Ground

Fig. 13.8.5–2: Schematic diagram of an interface cable for the 07 DR 12 printer

14.6 Lithium Battery Module 07 LE 90 R1

for data back-up in processor units of ABB Procontic systems



Lithium battery module 07 LE 90 R1

The 07 LE 90 R1 lithium battery module is used for RAM data back-up in several processor units of ABB Procontic programmable control systems. In order to change the battery quickly, it is equipped with a 2–pole plug and two soldered wires.

The following handling advice has to be taken into due consideration:

- Use only genuine ABB lithium battery modules.
- Replace battery before it is fully exhausted.
- **Do not short–circuit battery!** It may cause overheating or explosion. Prevent accidental short–circuit. Therefore, do not put battery into metallic boxes or on metallic surfaces.
- **Do not try to charge battery!** It may cause overheating or explosion.
- **Replace battery only during the power is on.** Otherwise you can lose data.
- **Dispose of the battery ecologically!**
- **Pay attention to the battery monitoring facilities on the devices, e.g.,**

  LED indications, whether the battery is exhausted or missing. The battery lifetime depends on the unit where it is installed.

Battery Lifetime

The value of the battery lifetime says how long the battery is able to back-up the stored data while the unit is not supplied by the internal voltages. If the internal voltages are switched on, the battery is only discharged by its own leakage current.

Type of unit, where the battery is installed		Battery lifetime t (guaranteed values @ 25 °C)
07 KP 62 R101	(ABB Procontic T200)	min. 5 000 h
07 KP 63 R101	(ABB Procontic T200)	min. 5 000 h
07 KR 91	(ABB Procontic CS31)	min. 5 000 h
07 KT 92	(ABB Procontic CS31)	min. 5 000 h

Technical Data

Capacity	1000 mAh
Storage temperature	– 10 _C...+ 75 °C
Operating temperature	0 _C...+ 55 °C
No–load voltage	3.6 V
Rated voltage	3.5 V
Temperature coefficient of rated voltage	ca. –1 mV/K
Temperature coefficient of capacity	≤ –1,5 % @ 0...70 °C
Self discharge	≤ 3.0 % per year @ 25 °C ≤ 6.0 % per year @ 40 °C ≤ 25.0 % per year @ 70 °C
Weight	20 g
Dimensions 18 mm x 53 mm	
Order number	GJR5250700R1