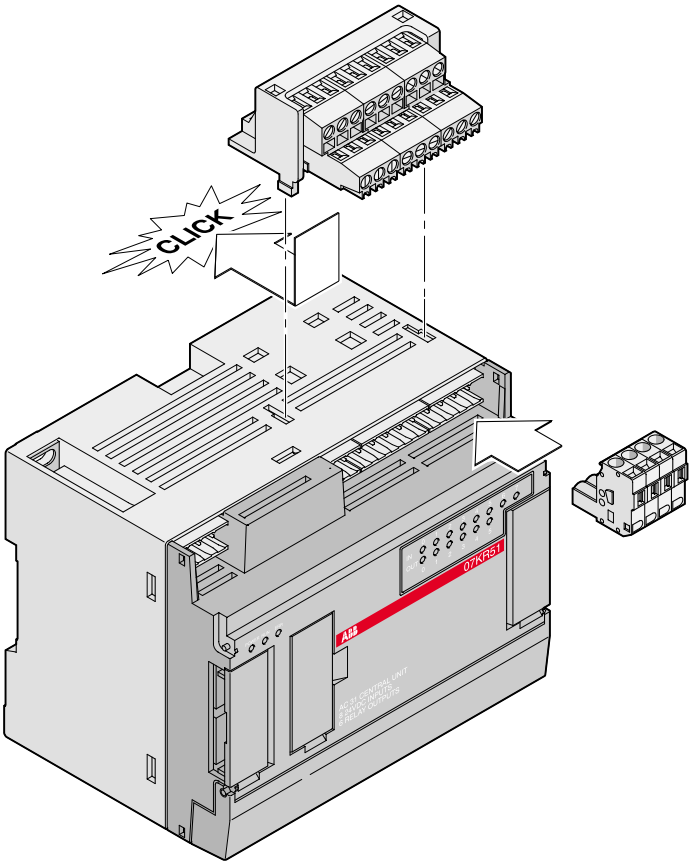
Hardware

Advant Controller 31

Series 40 and 50



Contents

1 Introduction

This chapter gives you an introduction to the AC31 automation, from the overall architecture to the operational rules of the 40 and 50 series basic units.

1.1 General information on the AC31 system

The AC31 system consists of the series 30, 40, 50, and 90. This operating manual describes the series 40 and 50.

The AC31 brings accessibility to beginners and experienced automation users alike, for any application with 14 to approximately 1000 inputs / outputs and more, using the same set of basic components.

From a compact machine fitted with a few automated functions to large installations spread over hundreds of meter, and even kilometers, the AC31 can fit your requirements.

It is therefore possible to realize distributed applications throughout a site, a workshop, or a machine where each component (input / output units, basic unit) is close to the sensors / actuators. The whole setup is connected by a single twisted pair over which all information from the sensors is sent after processing by the basic unit to the actuators via the remote modules. Additional central units configured as slave can also be connected to this CS31 system bus.

In case of the series 40 and 50 the following communication interfaces are available, to extend the AC31's possibilities and integration with the company's other automation systems: MODBUS, ASCII, ARCNET, RCOM, AF100. The developments in this field are continual.

Many users on all the continents have realized numerous applications such as:

Machine control:

- Manufacturing of floor boards
- Assembly of electrical contactors
- Manufacturing of ceramic products
- Metallic pipe welding, etc.

Controlling-commanding installations:

- Wharf cranes
- Water treatment
- Ski lifts
- Wind power machines, etc.

System management:

- Climatic anagement
- Building power management
- Tunnel ventilation
- Alarms in hospital environments
- Greenhouse lighting / humidity, etc.

1.2 General set-up rules

An ABB AC31 system always includes at least one AC31 basic unit. There are three types of basic units:

- The 40 series basic unit, with a local interface for central inputs / outputs extensions
- The 50 series basic unit, with a local interface for central inputs / outputs extensions and a CS31 system bus interface for decentralized extensions
- The 90 series basic unit, with a CS31 system bus interface for decentralized extensions

Each basic unit incorporates a specific number of digital inputs/outputs and in case of the series 90 occasionally analog inputs/outputs. It is possible, depending on the basic unit, to increase the number of inputs / outputs, to add input / output extensions connected directly to the basic units or remote input / output units via the CS31 twisted pair.

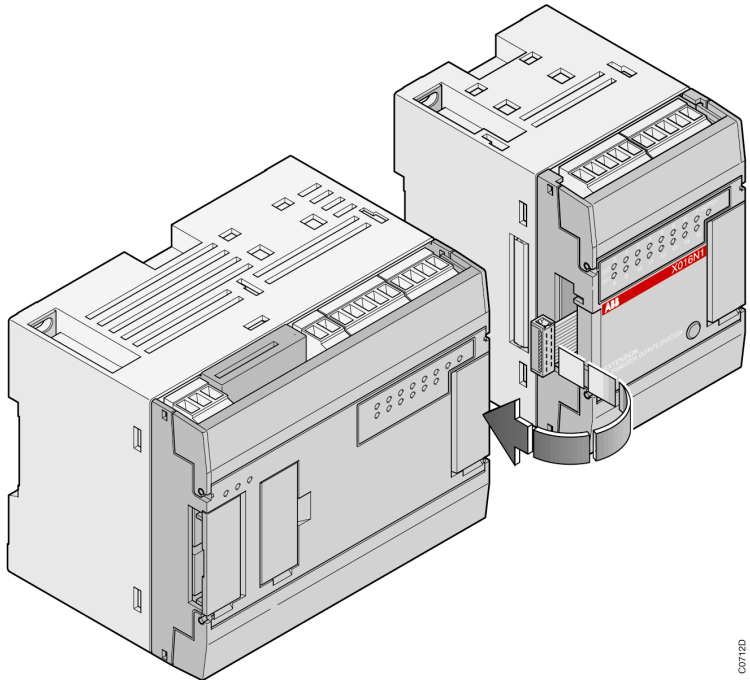


Figure 1a

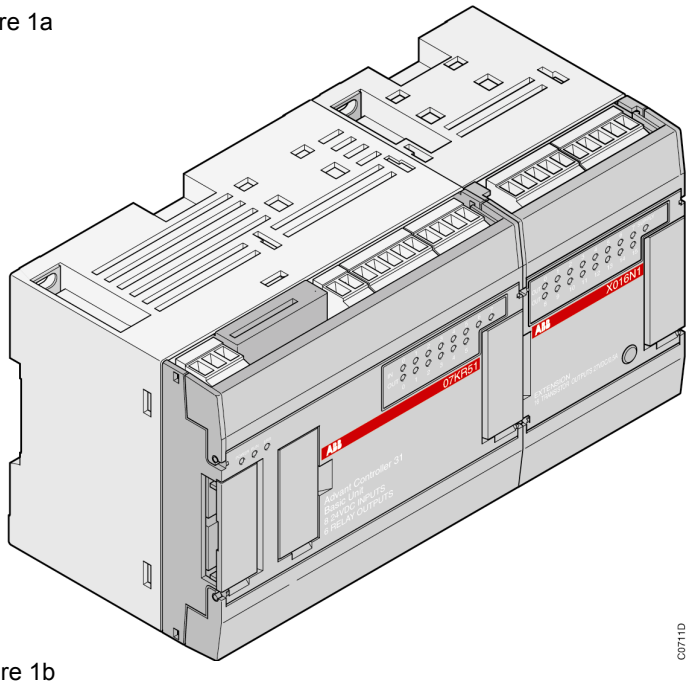


Figure 1b

Figure 1a: Basic unit and central extension module (not mounted)
Figure 1b: Basic unit and central extension module (mounted)

1.2.1 Basic units with central extensions

With the 40 and 50 series, it is possible to increase the number of inputs / outputs of the basic unit by adding up to 6 local extension units of either type, digital or analog (refer to figures 1a and 1b).

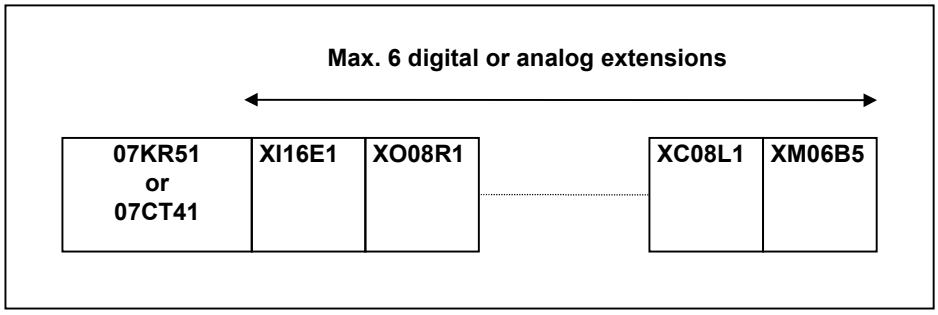


Figure 1-1: A basic unit with central extensions at a local interface for I/O modules

1.2.2 Basic units with CS31 system bus

With the 50 and 90 series it is possible to increase the number of inputs / outputs of the basic unit by adding remote units. The basic unit controlling the system is called the MASTER basic unit. The maximum bus length is **500 m** without an amplifier and **2000 m** with 3 amplifiers (1 NCB or NCBR unit enables bus amplification for 500 m).

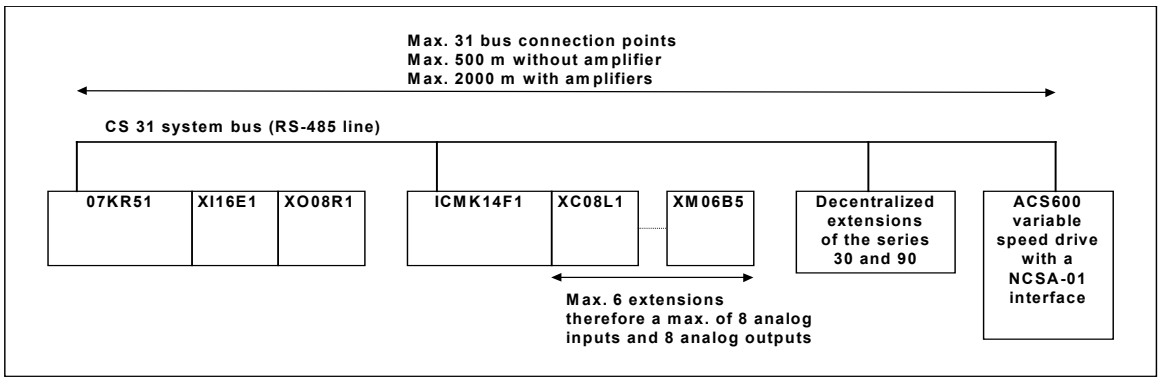


Figure 1-2 : Basic unit with central extensions and additional CS31 system bus (decentralized extensions)

A master basic unit can manage up to **31 connection points**, such as:

- Series 50 remote units with central extension possibilities: a maximum of 6 extension units comprising of e. g. a maximum of 8 analog input channels and 8 analog output channels
- Series 30 and 90 remote unit (without central extension possibilities) with analog or digital inputs / outputs
- An ABB NCSA-01 variable speed drive interface
- A high-speed counter unit
- 30, 50 and 90 series basic units as slave with their own user program
- Or any other device which supports CS31 communication.

Comment:

A connection point fitted solely with digital channels occupies **1 connection point**.

A connection point fitted with digital and analog channels occupies **2 connection points** of the available 31.

The maximum number of remote **analog** units depends on the MASTER basic unit:

- 50 series: - a maximum of **31** remote analog input units
  - or - a maximum of **31** remote analog output units
  - or - a maximum of **15** central extensible remote units (ICMK 14 ..) with analog input/output extensions + **1** remote analog input/output unit (15 x 2 + 1 = 31)
  - or - a mixed digital/analog configuration within the previous limits
- 90 series: - a maximum of **12** remote analog input units
  - or - a maximum of **12** remote analog output units
  - or - a maximum of **12** central extensible remote units with analog extensions
  - or - a mixed digital/analog configuration within the permissible limits

1.3 Power cuts or drops, battery

The 40 and 50 series basic units provide an incorporated battery buffer in order to save the necessary information for the next startup should there be a power drop or cut.

The buffer battery is an usual in the trade Vanadium Lithium accumulator. It is soldered on a printed-circuit board inside the unit and qualified personnel can exchange it by themselves.

The accumulator is 100 % charged after 12 operating hours without interruption. Its lifetime is between 6 and 15 years; it depends on how often and how long the power supply of the unit is switched off.

The battery buffer time is 20 days at 25 °C. During that time data (e.g. flags) can be stored with power supply of the unit switched off.

The status word %IW 1062.15 (EW 62,15), Bit 3 gives information on the status of the battery (0 corresponds to error, 1 corresponds to OK).

Caution:

The following operating instructions are to be observed:

- **Never short-circuit or operate battery with the polarities reversed!** They are likely to overheat and explode. Avoid chance short circuiting and therefore do not store batteries in metal containers and do not place them on metallic surfaces. Escaping lithium is health hazard.
- **Replace battery only with power supply on.** Otherwise data may be lost.
- **Dispose of battery environmentally consciously!**

To save all or part of the data prior configuration of the basic unit is required (refer to volume 2 - System Technology). If the configuration of the basic unit is absent then all functions and internal data will be reset to 0 after power cut.

1.4 Assortment

Products	Description	Order No.
Basic units		
40 Series without CS31-system bus connection	**Central extensible basic units**	
07 CR 41, 24 V DC	Central extensible basic unit, with 8 isolated inputs 24 V DC and 6 relay outputs 250 V AC / 2 A RS-232 interface for programming or ASCII or MODBUS communication 24 V DC power supply.	1SBP260020R1001
07 CR 41, 120/230 V AC	Central extensible basic unit, with 8 isolated inputs 24 V DC and 6 relay outputs 250 V AC / 2 A RS-232 interface for programming or ASCII or MODBUS communication 24 V DC power supply output to power inputs 120 / 230 V AC power supply	1SBP260021R1001
07 CT 41, 24 V DC	Central extensible basic unit, with 8 isolated inputs 24 V DC and 6 transistor outputs 24 V DC / 0.5 A RS-232 interface for programming or ASCII or MODBUS communication 24 V DC power supply	1SBP260022R1001
07 CR 42 - 24 V DC	Extensible stand-alone basic unit, with 8 isolated inputs 24 V DC and 6 integrated relay outputs 250 V AC / 2 A and 3 analog inputs with 2 voltage inputs +/- 10 V RS-232 interface for programming oder ASCII or MODBUS communication, 24 V DC power supply	1SBP260023R1001
07 CR 42 - 120/230 V AC	Extensible stand-alone basic unit, with 8 isolated inputs 24 V DC and 6 integrated relay outputs 250 V AC / 2 A and 3 analog inputs with 2 voltage inputs +/- 10 V RS-232 interface for programming oder ASCII or MODBUS communication, 24 V DC output for supplying the digital inputs 120 / 230 V AC power supply	1SBP260024R1001
07 CT 42 - 24 V DC	Extensible stand-alone basic unit, with 8 isolated inputs 24 V DC and 6 integrated transistor outputs 24 V DC / 0.5 A and 3 analog inputs with 2 voltage inputs +/- 10 V RS-232 interface for programming oder ASCII or MODBUS communication, 24 V DC power supply	1SBP260025R1001

Products	Description	Order No.
Basic units		
50 Series with CS31-system bus connection	**Central and decentralized extensible master and/or slave basic units**	
07 KR 51, 24 V DC	Decentralized extensible basic unit with CS31 system bus with 8 isolated inputs 24 V DC and 6 relay outputs 250 V AC / 2 A RS-232 or RS-485 interface for programming or ASCII or MODBUS communication 24 V DC power supply	1SBP260010R1001
07 KR 51, 120/230 V AC	Decentralized extensible basic unit with CS31 system bus with 8 isolated inputs 24 V DC and 6 relay outputs 250 V AC / 2 A RS-232 or RS-485 interface for programming or ASCII or MODBUS communication 24 V DC power supply output to power inputs 120 / 230 V AC power supply.	1SBP260011R1001
07 KT 51, 24 V DC	Decentralized extensible basic unit with CS31 system bus with 8 isolated inputs 24 V DC and 6 transistor outputs 24 V DC / 0.5 A RS-232 or RS-485 interface for programming or ASCII or MODBUS communication 24 V DC power supply	1SBP260012R1001

Products	Description	Order No.
Couplers		
for coupling to 40/50 series basic units		
07 KP 53	Intelligent coupler as an interface module with 2 serial MODBUS RTU interfaces (RS-232 and RS-485), Master/Slave operation. The communication coupler is used to connect external units to the AC31 system (40 and 50 series). The MODBUS-RTU protocol is used for communication. The coupler is supplied by the basic unit.	1SBP260162R1001

Products	Description	Order No.
Central extensible remote units with CS31 system bus connection	**For basic units of the 50 and 90 series**	
ICMK 14 F1, 24 V DC	Central extensible remote unit with CS31 system bus with 8 isolated inputs 24 V DC and 6 relay outputs 250 V AC / 2 A 24 V DC power supply	1SBP260050R1001
ICMK 14 F1, 120/230 V AC	Central extensible remote unit with CS31 system bus with 8 isolated inputs 24 V DC and 6 relay outputs 250 V AC / 2 A 24 V DC power supply output to power inputs 120 / 230 V AC power supply	1SBP260051R1001
ICMK 14 N1, 24 V DC	Central extensible remote unit with CS31 system bus with 8 isolated inputs 24 V DC and 6 transistor outputs 24 V DC / 0.5 A 24 V DC power supply	1SBP260052R1001
Central extensions without CS31 system bus connection	**For basic units of the series 40, 50 and central extensible remote units with CS31 system bus connection (ICMK 14 ..)**	
XI 16 E1	Digital Extension with 16 isolated inputs 24 V DC external 24 V DC power supply	1SBP260100R1001
XO 08 R1	Digital extension with 8 relay outputs, 250 V / 2 A external 24 V DC power supply	1SBP260101R1001
XC 08 L1	Digital extension with 8 channels configurable as inputs or transistor outputs 24 V DC / 0.5 A external 24 V DC power supply	1SBP260102R1001
XK 08 F1	Digital extension with 4 isolated inputs 24 V DC and 4 relay outputs 250 V / 2 A external 24 V DC power supply	1SBP260104R1001
XO 16 N1	Digital extension with 16 transistor outputs 24 V DC / 0.5 A external 24 V DC power supply	1SBP260105R1001
XO 08 Y1	Digital extension with 8 transistor outputs 24 V DC / 2 A external 24 V DC power supply	1SBP260108R1001
XO 08 R2	Digital extension with 4 NO[1)] relay outputs 250 V AC / 2 A and 4 NO/NC[2)] relay outputs 250 V AC / 3 A external 24 V DC power supply 1) NO = Normally open 2) NC = Normally closed	1SPB260109R1001
XM 06 B5	Analog extension with 4 configurable inputs (current, voltage, Pt 100, Pt 1000, NI1000 and Balco500) and 2 configuable outputs (current, voltage) resolution 12 bits, external 24 V DC power supply	1SBP260103R1001
XE 08 B5	Analog extension with 8 configurable inputs (current, voltage, Pt 100, Pt 1000, NI1000 and Balco500) resolution 12 bits, external 24 V DC power supply	1SBP260106R1001
XTC 08	Display extension with 8 channels (4 figures + sign + selected channel) external 24 V DC power supply	1SBP260107R1001
30 series plug-in base		
ECZ	Plug-in base for mounting series 30 remote units with CS31 system bus connection	FPR 370 0001 R0001

Products	Description	Order No.
30 series digital remote units with CS31 system bus connection	**For basic units of the series 50 and 90**	
ICSI 08 E3, 120 V AC	Digital remote unit with 8 isolated inputs 120 V AC, 120 V AC power supply	FPR 331 6301 R0014
ICSI 08 E4, 230 V AC	Digital remote unit with 8 isolated inputs 230 V AC 230 V AC power supply	FPR 331 6401 R0016
ICSO 08 Y1, 24 V DC	Digital remote unit with 8 transistor outputs 24 V DC / 2 A 24 V DC power supply	FPR 331 1101 R1022
ICSO 08 Y1, 120 V AC	Digital remote unit with 8 transistor outputs 24 V DC / 2 A 120 V AC power supply	FPR 331 1101 R0024
ICSO 08 Y1, 230 V AC	Digitales remote unit with 8 transistor outputs 24 V DC / 2 A 230 V AC power supply	FPR 331 1101 R0026
30 series analog remote units with CS31 system bus connection	**For basic units of the series 50 and 90**	
ICSE 08 A6, 24 V DC	Analog remote unit with 8 configurable inputs (current/voltage), resolution 8 bits 24 V DC power supply	FPR 334 5601 R1012
ICSE 08 A6, 120 V AC	Analog remote unit with 8 configurable inputs (current/voltage), resolution 8 bits 120 V AC power supply	FPR 334 5601 R0014
ICSE 08 A6, 230 V AC	Analog remote unit with 8 configurable inputs (current/voltage), resolution 8 bits 230 V AC power supply	FPR 334 5601 R0016
ICSE 08 B5, 24 V DC	Analog remote unit with 8 configurable inputs (current/voltage), resolution 12 bits 24 V DC power supply	FPR 334 6501 R1012
ICSE 08 B5, 120 V AC	Analog remote unit with 8 configurable inputs (current/voltage), resolution 12 bits 120 V AC power supply	FPR 334 6501 R0014
ICSE 08 B5, 230 V AC	Analog remote unit with 8 configurable inputs (current/voltage), resolution 12 bits 230 V AC power supply	FPR 334 6501 R0016
ICSA 04 B5, 24 V DC	Analog remote unit with 4 configurable outputs (current/voltage), resolution 12 bits 24 V DC power supply	FPR 334 1501 R1042
ICSA 04 B5, 120V AC	Analog remote unit with 4 configurable outputs (current/voltage), resolution 12 bits 120 V AC power supply	FPR 334 1501 R0044
ICSA 04 B5, 230 V AC	Analog remote unit with 4 configurable outputs (current/voltage), resolution 12 bits 230 V AC power supply	FPR 334 1501 R0046

Products	Description	Order No.
90 series digital remote units with CS31 bus connection, not central extensible	**For basic units of the series 50 and 90**	
07 DI 92	Digital remote unit with 32 inputs 24 V DC, 24 V DC power supply	GJR 525 2400 R0101
07 DC 91	Digital remote unit with 16 inputs, 8 transistor outputs and 8 channels configurable as inputs/outputs 24 V DC / 0.5 A 24 V DC power supply	GJR 525 1400 R0202
07 DC 92	Digitales remote unit with 32 channels configurable as inputs/outputs, transistor outputs 24 V DC / 0.5 A 24 V DC power supply	GJR 525 2200 R0101
90 series analog remote units with CS31 bus connection, not central extensible	**For basic units of the series 50 and 90**	
07 AI 91	Analog remote unit with 8 configurable inputs (current /voltage, Pt 100, Pt 1000 or thermocouple types J, K, S), resolution 12 bits 24 V DC power supply	GJR 525 1600 R0202
07 AC 91	Analog remote unit with 16 channels configurable as input or output: 1. 16 channels can be set in pairs as I/O, 8 bits, current, voltage 2. 8 inputs and 8 outputs, 12 bits, current, voltage 24 V DC power supply	GJR 525 2300 R0101
Remote units IP 67 protection with CS31 bus connection, not central extensible	**For basic units of the series 50 and 90**	
07 DI 93-I	Digital remote unit, degree of protection IP 67, with 16 inputs 24 V DC, 24 V DC power supply	GJV 307 5613 R0202
07 DO 93-I	Digital remote unit, degree of protection IP 67, with 8 transistor outputs 24 V DC / 2 A, 24 V DC power supply	GJV 307 5611 R0202
07 DK 93-I	Digital remote unit, degree of protection IP 67, with 8 inputs 24 V DC and 4 transistor outputs 24 V DC / 2 A 24 V DC power supply	GJV 307 5623 R0202
Safety remote modules	**Only for 07 KT 93-S / 07 KT 94-S basic units**	
07 DI 90-S	Safety remote unit with 8 digital inputs 24 V DC 24 V DC power supply	GJR 525 0900 R0202
07 DO 90-S	Safety remote unit with 8 transistor outputs 24 V DC / 0.5 A, 24 V DC power supply	GJR 525 0800 R0202
07 AI 90-S	Safety remote unit with 4 analog inputs, resolution 12 bits, 4...20 mA, 24 V DC power supply	GJR 525 1100 R0202
Remote counter units with CS31 system bus connection, not central extensible	**For basic units of the series 50 and 90** Remote high-speed counter unit, max. 50 kHz 4 inputs A/A, B/B, C/C - 5,15 or 24 V DC modes: incremental, A-B (32 bits), A+B (32 bits), 3 (16 bits) stand-alone-counter or 3 (16 bits) frequency meter, 100 ms to 6536,5 s enable, RESET, set value, reference point, 7 transistor outputs (24 V DC/0.5 A) for local comparison management between 2 instructions and the counter value	
ICSF 08 D1, 24 V DC	24 V DC power supply	FPR 332 3101 R1012
ICSF 08 D1, 120 V AC	120 V AC power supply	FPR 332 3101 R0014
ICSF 08 D1, 230 V AC	230 AC power supply	FPR 332 3101 R0016

Products	Description	Order No.
Display and operating devices	**For basic units of the series 30, 40, 50 and 90**	
TC 50	Display with 2 lines of 20 characters, 7 operator keys, 5 customizable keys for parameter modifications or process control IP 65 front 128 pages with 6 data/page insertion 128 help messages + 128 information messages RS-232 connection via the serial ports of the basic units MODBUS protocol or AC31 programming mode 24 V DC power supply Delivered with connection cable for 40 and 50 series basic units	1SBP260150R1001
TC 50-2	Display with 2 lines of 20 characters, 7 operator keys, 5 customizable keys for parameter modifications or process control IP 65 front 128 pages with 6 data/page insertion 128 help messages + 128 information messages RS-485 connection via the serial ports of the basic units MODBUS protocol or AC31 programming mode 24 V DC power supply Delivered with connection cable for 40 and 50 series basic units	1SBP260151R1001
TCWIN	Programming software for TC 50 and TC 50-2 under Windows NT and 95/98. Delivered with connection cable for connection of TC 50 / TC 50-2 with PC	1SBS260280R1001
CS31 system bus accessories	**For basic units of the series 50 and 90**	
NCB	CS31 system bus amplifier for 500 m max. 2000 m with 3 amplifiers 24 V DC power supply	FPR 347 1200 R1002
NCBR	CS31 system bus amplifier for 500 m max. 2000 m with 3 amplifiers with redundancy in parallel, ring or star configuration 24 V DC power supply	FPR 347 1300 R1002
Cables	**For basic units of the series 50 and 90**	
07 SK 50	PC programming cable for 40 and 50 series basic units, SUB D9 connector to PC	1SBN260200R1001
07 SK 51	MODBUS/ASCII communication cable for 40 and 50 series basic units, SUB D9 connector to PC	1SBN260201R1001
07 SK 52	Programming cable for 40 and 50 series basic units with bare wires / terminal connection to basic unit	1SBN260202R1001
07 SK 53	MODBUS /ASCII communication cable for 40 and 50 series basic units, with bare wires / terminal connection to basic unit	1SBN260203R1001
07 SK 54	Cable to connect TC 50 with 40 and 50 series basic units	1SBN260204R1001
07 SK 55	Programming cable to connect PC with TC 50, SUB D9 connector to PC	1SBN260205R1001
07 SK 57	Cable to connect TC 50 with 30 and 90 series basic units	1SBN260207R1001
07 SK 58	Cable with bare wires / terminal connection to connect TC 50-2 with basic unit	1SBN260208R1001

Products	Description	Order No.
Connectors	**For basic units of the series 40 and 50**	
07 ST 50	Three-wire dual connectors for easy connection, to 40 and 50 series basic units, of sensors or 3 wire digital actuators 2 units	1SBN260300R1001
07 ST 51	Dual connector for easy connection, to 40 and 50 series basic units, of sensors or 3/4 wire analog actuators 2 units	1SBN260301R1001
07 ST 52	Dual cage-clamp type connectors for digital channels 2 units	1SBN260302R1001
07 ST 54	A set of cage-clamp type connectors for basic or remote units	1SBN260311R1001
07 ST 55	A set of cage-clamp type connectors for XI 16 E1 or XO 16 N1 or XE 08 B5 extensions	1SBN260312R1001
07 ST 56	A set of cage-clamp type connectors for XO 08 R1 or XC 08 L1 or XK 08 F1 extensions	1SBN260313R1001
07 ST 57	A set of cage-clamp type connectors for XM 06 B5 extension	1SBN260314R1001
Various accessories	**For devices of the series 40 and 50**	
Labels	Labels for I/O channel description by user (100 units)	1SBN260310R1001
Documentation	English technical documentation for the series 40 and 50 devices	1SAC131699R0201 (for German market) or 1SBC260400R1001 (for French market)
	German technical documentation for the series 40 and 50 devices	1SAC131699R0101

2 Technical specifications

This chapter presents the products and their general characteristics and operating conditions.

2.1 General operating conditions

The AC31 units were developed according to the European EC directives, the main national and international IEC 1131-1 and IEC 1131-2 standards and the EN61131-2 product standard concerning automation devices.

Ambient conditions	
- Temperature:	
operation:	
horizontal	0 °C to + 55 °C
vertical	0 °C to + 40 °C
storage	- 40 °C to + 75 °C
transport	- 25 °C to + 75 °C
- Humidity:	DIN 40040 Klasse F ohne Betauung
annual average	≤ 75 %
up to 30 days per year	95 %
occasinally	85 %
- Atmospheric pressure:	DIN 40050
operation	≥ 800 hPa (≤ 2000 m)
storage	≥ 600 hPa (≤ 3500 m)
Mechanical data	
- Degree of protection	IP20
- Housing	UL V2
- Vibration stress	CEI68-2-6 Test Fc
- Shock stress	CEI68-2-27 Test Ea
Tolerances for mains voltages	
- 24 V DC	19,2 to 30 V (- 20 %, + 25 %)
- 120 V AC (50 / 60 Hz)	97,75 to 126,5 V (- 18,5 %, + 5,5 %)
- 230 V AC (50 / 60 Hz)	195,5 to 253 V (- 15 %, + 10 %)

Creepage distances and clearances	IEC 664-664A and DIN VDE0160
Insulation and delectric test	IEC 1131-2
Electromagnetic compatibility	
Immunity tests against:	
- Electrostatic discharge	IEC 1000-4-2 (Level 3)
- Radiated fields	IEC 1000-4-3 (Level 3)
- Fast transient bursts	IEC 1000-4-4 (Level 3)
- High-energy pulse	IEC 1000-4-5
- Conducted high frequencies	IEC 1000-4-6 (Level 3)
Voltage drops and short power cutoffs	
- DC power supply	Duration of the power cutoffs: ≤ 10 ms Time between 2 voltage drops: ≥ 1 s
- AC power supply	Duration of the power cutoffs: ≤ 20 ms Time between 2 voltage drops: ≥ 1 s
Mountings	
- DIN rail	35 mm
- Screw fittings	Screws with diameter 4 mm (M4)
Connections	
- Connectors	Removable terminal blocks (2.5 mm²)
- Separate terminal blocks for:	
Earth	Rigid or multi-conductor wire AWG 14 (1.95 mm²)
Inputs	Rigid or multi-conductor wire AWG 18 (0.96 mm²) to AWG 14 (1.95 mm²)
Outputs	Rigid or multi-conductor wire AWG 14 (1.95 mm²)
Power supply	Rigid or multi-conductor wire AWG 14 (1.95 mm²)
CS31 system bus	Twisted pair AWG 24 (0.22 mm²) to AWG 18 (0.8 mm²)
- Screws tightning torque	0.5 Nm (given as an indication only)
Serial interface	
- For programming	RS-232 / RS-485
- For the CS31 system bus	RS-485

2.2 Technical specifications of the CS31 system bus

Type	RS-485 serial multi-point interface
Mode	Half-duplex
Number of connection points	1 master and max. 31 connection points
General data - Cross section - Twists - Resistance - Characteristic impedance - Capacity - Shielding - Line termination	Shielded twisted pair 0.22...0.8 mm² > 10 per meter ≤ 100 Ω/km 120 Ω (100 Ω to 150 Ω) < 150 nF/km Braided Resistor 120 Ω, ¼ W, connected to each end of the system bus
Protocol	ABB CS31 (master/slave) or MODBUS master/slave or programming
Data transmission check	CRC
Maximum length	up to 500 m without repeaters up to 2000 m with 3 repeaters (NCB or NCBR)
Bus redundancy	yes, with NCBR (bus repeater)
Potential separation	yes, by opto-couplers
Refresh time	2 ms minimum typically 12 ms with 31 CS31 connection points
Transmission speed	187.5 kBauds

2.3 Basic units 07 CR/CT 41 and 07 KR/KT 51

2.3.1 View of a basic unit

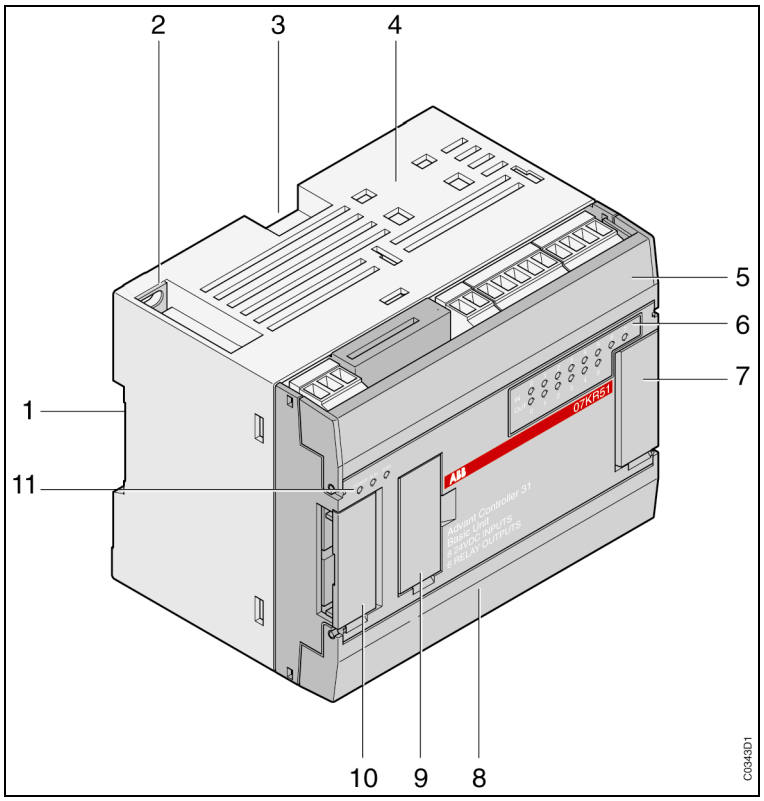


Figure 2-1: Basic unit

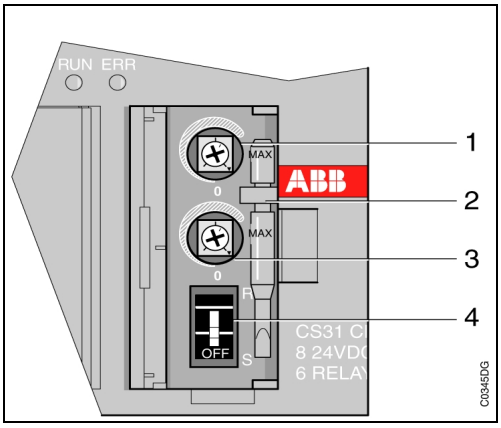


Figure 2-2: Magnification of item 9, cover removed

A description of each position is given on the next page.

Basic unit (description), see figure 2-1 on the previous page

1 - Location for DIN rail

2 - Plate fixture with unit earthing, alternatively to 1

3 - Lock for DIN rail mounting

4 - Location for external dual connector

5 - Location of the cable connectors (underneath cover plate):
- of the CS31 system bus (only available for the 50 series)
- of the 24 V d.c. power output for the inputs (only available for the basic units powered at 120 / 230 V a.c.)
- of the inputs

6 - Visualization set (LEDs) for the status of the 8 inputs / 6 outputs

7 - Location of the connectors for the connection of input/output extensions (underneath cover plate)

8 - Location of connectors (underneath cover plate):
- the serial port for programming or communication ASCII / MODBUS®
- connector for the power supply cabling
- connectors for the outputs cabling

9 - Location of the potentiometers and the On/Off switch (underneath cover plate, see enlargement).

10 - Location of the connector for connection to a coupler (underneath cover plate)

11 - Status visualization area:
- POWER: power on
- RUN: program running
- ERR: error(s) present

Magnification of item 9, see figure 2-2 on the previous page

1 - Potentiometer whose value is read into the %IW 1062.01 (EW 62,01) variable by the program (value of 0 to 150 in the program)

2 - Screwdriver for potentiometer adjustment

3 - Potentiometer whose value is read into the %IW 1062.00 (EW 62,00) variable by the program (value of 0 to 150 in the program)

4 - Basic unit program ON/OFF switch

2.3.2 Technical specifications

	40 series			50 series		
	07 CR 41 24 V DC	**07 CT 41 24 V DC**	**07 CR 41 120/230 V AC**	**07 KR 51 24 V DC**	**07 KT 51 24 V DC**	**07 KR 51 120/230 V AC**
Number of I/O						
- Incorporated digital inputs	8			8		
- Incorporated digital outputs	6			6		
- Incorporated potentiometers	2			2		
- Maximum number of central extension units per basic unit	6			6		
- Maximum number of remote units on the CS31 system bus	-			31		
- Max. number of digital inputs*)	104			1024		
- Max. number of digital outputs*)	102			1004		
- Max. number of analog inputs	48			496		
- Max. number of analog outputs	12			136		
Interfaces						
- CS31 interface	no			yes		
- Interface for: Programming, MODBUS® or ASCII	1 RS-232			1 RS-232 / RS-485		
Memory						
- User program memory size: without ONLINE modifications with ONLINE modifications	17 000 words (typically: 8.5 kInstructions) 8 000 words (typically: 4 kInstructions)			17 000 words (typically: 8.5 kInstructions) 8 000 words (typically: 4 kInstructions)		
- User program memory and the constants	Flash EPROM			Flash EPROM		
- Data memory	SRAM			SRAM		
- Data backup:	yes with battery			yes with battery		
Backup autonomy	40 days at 25 °C			40 days at 25 °C		
Charge time under power	100 % in 12 h			100 % in 12 h		
Further information on the battery	see Chapter 1.3			see Chapter 1.3		

*) Incorporated I/Os inclusive

	40 series			50 series		
	07 CR 41 24 V DC	**07 CT 41 24 V DC**	**07 CR 41 120/230 V AC**	**07 KR 51 24 V DC**	**07 KT 51 24 V DC**	**07 KR 51 120/230 V AC**
Program processing / operands						
- Execution time for 1 kbytes user program: 100% digital instructions 65% digital, 35 % words	0.4 ms 1.2 ms			0.4 ms 1.2 ms		
- Setting the cycle time: Master basic unit Slave or Stand-alone basic unit Selection of cycle time 0 ms Selection of cycle time > 0 ms	0 to 100 ms, in step of 5 ms 0 to 250 ms, in steps of 1 ms Processing the user program as fast as possible. Depending on the user program the cycle time may be not constant. The cycle time is to be selected, that the capacity utilization of the PLC comes to ≤ 80 %.					
- Internal bits	2016			2016		
- Internal words	2016			2016		
- Internal double words	128			128		
- Chain steps / steps per chain step	2016 / 16			2016 / 16		
- Word constants	496			496		
- Double word constants	127			127		
- Timers: Time range	42 simultaneously from 1 ms to 596 h 30 (24 days + 20 h 30)			42 simultaneously from 1 ms to 596 h 30 (24 days + 20 h 30)		
- Counters: Counter range	unlimited - 32767 to + 32767			unlimited - 32767 to + 32767		
- High speed counter function: Incremental encoder Stand-alone counter	1 with max. frequency 5 kHz on the %IX 1062.00 (E 62,00) and %IX 1062.01 (E 62,01) inputs 2, each up to 7 kHz on the %IX 1062.00 (E 62,00) and %IX 1062.01 (E 62,01) inputs			1 with max. frequency 5 kHz on the %IX 1062.00 (E 62,00) and %IX 1062.01 (E 62,01) inputs 2, each up to 7 kHz on the %IX 1062.00 (E 62,00) and %IX 1062.01 (E 62,01) inputs		
- Interruptions: by alarm (on rising edge) cyclic max. length	250 µs delay 2 on the %IX 1062.02 (E 62,02) and %IX 1062.03 (E 62,03) inputs 1 (from 1 ms to 2 s) 3 ms			250 µs delay or 2.5 ms as CS31 master/slave 2 on the %IX 1062.02 (E 62,02) and %IX 1062.03 (E 62,03) inputs 1 (from 1 ms to 2 s) or 5 ms to 2 s as master 1.5 ms as master or 3 ms as slave/stand-alone		
- Command output of step motor with frequency modification (cyclic ratio = 50 %)	10 Hz to 2.66 kHz			10 Hz to 2.66 kHz		
- User program protection in the basic unit	yes with password			yes with password		
- Clock: Drift (typical)	4.3 min / month at 25 °C			4.3 min / month at 25 °C		
Programming						
- Programming software	907 AC 1131 under Windows® (IEC 1131-3)			907 AC 1131 under Windows® (IEC 1131-3)		
- Programming language	FBD/LD: Function blocks and ladder diagrams LD: Ladder diagram IL: Instruction list SFC: Sequential function chart			FBD/LD: Function blocks and ladder diagrams LD: Ladder diagram IL: Instruction list SFC: Sequential function chart		
- Program execution	sequential triggered by clock or triggered by alarm (interruptions)			sequential triggered by clock or triggered by alarm (interruptions)		
- Sub-program: Level	12 1			12 1		
- Operation set: Basic functions Advanced functions	Boolean, arithmetic, comparison over 60			Boolean, arithmetic, comparison over 60		

	40 series			50 series		
	07 CR 41 24 V DC	**07 CT 41 24 V DC**	**07 CR 41 120/230 V AC**	**07 KR 51 24 V DC**	**07 KT 51 24 V DC**	**07 KR 51 120/230 V AC**
- Weight	400 g		800 g	400 g		800 g
Power supply						
- Power supply voltage:						
Nominal value	24 V DC		120 / 230 V AC	24 V DC		120 / 230 V AC
Admissible range	19.2 to 30 V		97.75 to 126.5 V or 195.5 to 253 V	19.2 to 30 V		97.75 to 126.5 V or 195.5 to 253 V
- Consumption:						
basic unit alone typical	120 mA		60/30 mA	120 mA		60/30 mA
Maximum configuration typical	400 mA		100 mA	400 mA		100 mA
- Polarity reversal protection	yes		no	yes		no
- 24 V DC isolated power supply for the inputs:	no		yes	no		yes
Voltage range	-		19.2 to 30 V	-		19.2 to 30 V
Output current max.	-		400 mA	-		400 mA
Short circuit protection	-		yes	-		yes
- Dissipation	5 W	6 W	10 W	5 W	6 W	10 W
Incorporated digital inputs						
- Number of inputs	8	8	8	8	8	8
- Isolation of inputs / electronic (test voltage)	1500 V AC	1500 V AC	1500 V AC	1500 V AC	1500 V AC	1500 V AC
- Input types	PNP and NPN	PNP and NPN	PNP and NPN	PNP and NPN	PNP and NPN	PNP and NPN
- Input voltage:						
Nominal value	24 V d.c.	24 V d.c.	24 V d.c.	24 V d.c.	24 V d.c.	24 V d.c.
Signal at 0 (IEC 1131-2)	0 to + 5 V	0 to + 5 V	0 to + 5 V	0 to + 5 V	0 to + 5 V	0 to + 5 V
Signal at 1 (IEC 1131-2)	+15 to +30 V	+15 to +30 V	+15 to +30 V	+15 to +30 V	+15 to +30 V	+15 to +30 V
- Input current at 24 V DC:						
Inputs %IX 1062.02 (E 62,02) to %IX 1062.07 (E 62,07)	7 mA	7 mA	7 mA	7 mA	7 mA	7 mA
Inputs %IX 1062.00 (E 62,00) and %IX 1062.01 (E 62,01)	9 mA	9 mA	9 mA	9 mA	9 mA	9 mA
- Filtering time:						
Standard input	5 ms	5 ms	5 ms	5 ms	5 ms	5 ms
Input with counter configuration	70 µs	70 µs	70 µs	70 µs	70 µs	70 µs
Input with interruption configuration	90 µs	90 µs	90 µs	90 µs	90 µs	90 µs
- Cable length:						
Unshielded (not for the high speed counter inputs)	300 m	300 m	300 m	300 m	300 m	300 m
Shielded	500 m	500 m	500 m	500 m	500 m	500 m
Non standard inputs	50 m	50 m	50 m	50 m	50 m	50 m

	40 series			50 series		
	07 CR 41 24 V DC	**07 CT 41 24 V DC**	**07 CR 41 120/230 V AC**	**07 KR 51 24 V DC**	**07 KT 51 24 V DC**	**07 KR 51 120/230 V AC**
Incorporated outputs						
- Number of outputs	6 relays	6 transistors	6 relays	6 relays	6 transistors	6 relays
- Isolation of the outputs / electronic	1500 V AC 1 min	1500 V AC	1500 V AC 1 min	1500 V AC 1 min	1500 V AC	1500 V AC 1 min
- Total charging current under voltage:						
with 24 V DC						
resistive load / inrush current	2 A / 5 A	1 A for %QX 1062.00 (A 62,00) and %QX 1062.01 (A 62,01) and 0.5 A for other outputs	2 A / 5 A	2 A / 5 A	1 A for %QX 1062.00 (A 62,00) and %QX 1062.01 (A 62,01) and 0.5 A for other outputs	2 A / 5 A
L / R = 20 ms	2 A		2 A	2 A		2 A
L / R = 30 ms	1 A		1 A	1 A		1 A
L / R = 40 ms	0.6 A		0.6 A	0.6 A		0.6 A
L / R = 60 ms	0.35 A		0.35 A	0.35 A		0.35 A
load current, 24 to 230 V AC	2 A (AC-1) 0.5 A (AC-15)	-	2 A (AC-1) 0.5 A (AC-15)	2 A (AC-1) 0.5 A (AC-15)	-	2 A (AC-1) 0.5 A (AC-15)
- Total charging current	6 x 2 A	4 x 0.5 A + 2 x 1 A	6 x 2 A	6 x 2 A	4 x 0.5 A + 2 x 1 A	6 x 2 A
- Output leakage current	-	< 200 µA	-	-	< 200 µA	-
- Minimum cut-off values	10 mA under 12 V d.c.	12 V	10 mA under 12 V d.c.	10 mA under 12 V d.c.	12V	10 mA under 12 V d.c.
- Breaking capacity under 120 V AC (contact rating code B300) (UL)	2 A		2 A	2 A		2 A
- Breaking capacity under 250 V AC (contact rating code B300) (UL)	2 A (1.5 A according to UL)		2 A (1.5 A according to UL)	2 A (1.5 A according to UL)		2 A (1.5 A according to UL)
- Number of common	2 (2+4)		2 (2+4)	2 (2+4)		2 (2+4)
- Switching frequency:						
for resistive loads	< 1 Hz	5 kHz	< 1 Hz	< 1 Hz	5 kHz	< 1 Hz
for inductive loads	< 0.2 Hz		< 0.2 Hz	< 0.2 Hz		< 0.2 Hz
for lamps	< 0.2 Hz		< 0.2 Hz	< 0.2 Hz		< 0.2 Hz
- Number of switches:						
for AC-1	1 million	-	1 million	1 million	-	1 million
for AC-15	100 000	-	100 000	100 000	-	100 000
- Short-circuit and overload protection	required externally	yes: thermal	required externally	required externally	yes: thermal	required externally
- Surge voltage protection	required externally	yes	required externally	required externally	yes	required externally
- Outputs diagnosis	no	overload and short-circuit	no	no	overload and short-circuit	no
- Cable length:						
unshielded	150 m	150 m	150 m	150 m	150 m	150 m
shielded	500 m	500 m	500 m	500 m	500 m	500 m

2.4 Basic units 07 CR 42 / 07 CT 42

2.4.1 Overview

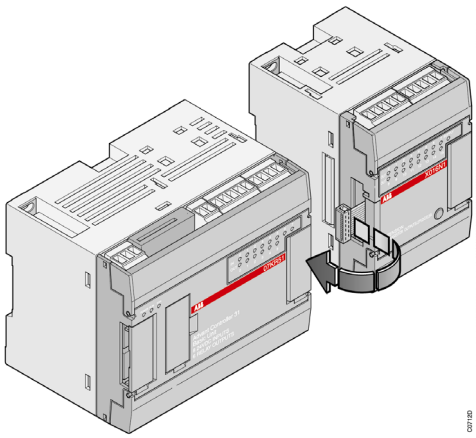
The 07CR42 and 07CT42 central units bring accessibility to beginners and experienced automation users alike, for any application with 14 to 110 inputs / outputs, using the same set of basic components.

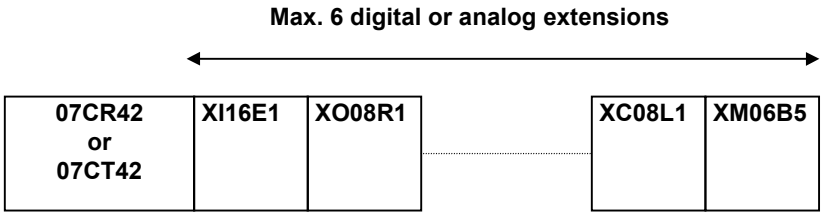
It is therefore possible to realize applications throughout a site, a workshop, or a machine where each component (input / output unit, central unit) is close to the sensors / actuators. All information from the sensors is sent after processing by the central unit to the actuators. The following communication interfaces are available, to extend the AC 31's possibilities and integration with the company's other automation systems: MODBUS, ASCII.

2.4.2 General set-up rules

An ABB AC 31 system always includes an AC 31 central unit.

Each 07CR42 and 07CT42 central units incorporate a specific number of binary inputs / outputs and analog inputs. It is possible, to increase the number of inputs / outputs, to add input / output extensions connected directly to the 07CR42 and 07CT42 central units.





2.4.3 Assortment

Products	Description	Order No.
Basic unit		
07 CR 42 - 24 V DC	Extensible stand-alone central unit, with 8 isolated inputs 24 V DC and 6 incorporated relay outputs 250 V AC / 2 A and 3 analog inputs with 2 voltage inputs +/- 10 V, RS-232 interface for programming or ASCII or MODBUS communication, 24 V DC power supply.	1SBP260023R1001
07 CR 42 - 120/230 V AC	Extensible stand-alone central unit, with 8 isolated inputs 24 V DC and 6 incorporated relay outputs 250 V AC / 2 A and 3 analog inputs with 2 voltage inputs +/- 10 V, RS-232 interface for programming or ASCII or MODBUS communication, 24 V DC power supply output to power inputs, 120 / 230 V AC power supply	1SBP260024R1001
07 CT 42 - 24 V DC	Extensible stand-alone central unit, with 8 isolated inputs 24 V DC and 6 incorporated transistor outputs 24 V DC / 0.5 A and 3 analog inputs with 2 voltage inputs +/- 10 V, RS-232 interface for programming or ASCII or MODBUS communication, 24 V DC power supply	1SBP260025R1001

2.4.4 Technical data

2.4.4.1 General data

	07 CR 42 24 V DC	07 CT 42 24 V DC	07 CR 42 120/230 V AC
Number of inputs and outputs			
- Integrated digital inputs	8		
- Integrated digital outputs	6		
- Integrated analog inputs	3		
- Analog potentiometers	2		
- Maximum number of extension units per basic unit	6		
- Max. number of digital inputs	104		
- Max. number of digital outputs	54		
- Max. number of analog inputs	51		
- Max. number of analog outputs	12		
Interfaces			
- CS31 interface	none		
- Interface for: Programming MODBUS or ASCII	1 RS-232		
Memory			
- User program memory size:			
without ONLINE	17 000 words (typ. 8.5 k instructions)		
with ONLINE	8 000 words (typ. 4 k instructions)		
- User program and constants are in the	Flash EPROM		
- Data memory	SRAM		
- Data backup:	with battery		
Backup time	20 days at 25°C		
Battery charge time under power	100% in 12 h		
Weight	400 g		800 g

2.4.4.2 Functionality and programming

	07 CR 42 24 V DC	07 CT 42 24 V DC	07 CR 42 120/230 V AC
- Execution time for 1 k bytes:			
100% binary instructions	0.4 ms		
65% binary, 35 % words	1.2 ms		
- Internal bits	2016		
- Internal words	2016		
- Internal double words	128		
- Step chains	2016		
- Word constants	496		
- Double word constants	127		
- Timers	42 simultaneously		
Time range	from 1 ms to 596 h 30 (24 Tage + 20 h 30)		
- Number of counters	unlimited		
Counting range	-32767 to +32767		
- High-speed counter function:			
Incremental encoder	1 with max. frequency 5 kHz at the inputs I62.00 and I62.01		
Stand-alone counter	2 with 7 kHz at the inputs I62.00 and I62.01		
- Interrupts:	250 µs delay		
in case of alarm (on rising edge)	2 at the inputs I62.02 and I62.03		
cyclic	1 (from 1 ms to 2 s)		
max. length	3 ms		
- Command output of step motor with frequency modification (duty cycle = 50%)	10 Hz to 2.66 kHz		
- User program protection in the basic unit	yes, with password		
- Clock drift (typically)	4.3 min. / month at 25°C		
- Programming software	907 AC 1131 under Windows® (IEC 1131-3)		
- Programming languages	FBD/LD: Function blocks and ladder diagrams		
	Quick LD: Ladder diagram		
	IL: Instruction list		
	SFC: Sequential function chart		
- Program executionn	sequential, triggered by clock or triggered by alarm (interrupts)		
- Sub-progams:	12		
Level	1		
- Logical operations:			
Basic functions	Boolean op., arithmetic op., comparisons		
Advanced functions	over 80		

2.4.4.3 Power supply

	07 CR 42 24 V DC	07 CT 42 24 V DC	07 CR 42 120/230 V AC
Power supply			
- Supply voltage:			
Nominal value	24 V DC		120 / 230 V AC
Admissible range	19.2 to 30 V		97.75 to 126.5 V or 195.5 to 253 V
- Current consumption:			
Basic unit alone typically	120 mA		60/30 mA
Maximum configuration typ.	400 mA		100 mA
- Polarity reversal protection	yes		no
- 24 V DC isolated voltage output for supplying the digital inputs:	no		yes
Voltage range	-		19.2 to 30 V
Max. load	-		400 mA
Short-circuit protection	-		yes
- Power dissipation	5 W (6 W for 07 CT 42)		10 W

2.4.4.4 Integrated digital inputs

	07 CR 42 24 V DC	07 CT 42 24 V DC	07 CR 42 120/230 V AC
- Number of inputs	8	8	8
- Insulation test voltage	1500 V AC	1500 V AC	1500 V AC
- Input types	PNP or NPN	PNP or NPN	PNP or NPN
- Input voltage:			
Nominal value	24 V DC	24 V DC	24 V DC
Signal at 0 (IEC 1131-2)	0 to +5 V	0 to +5 V	0 to +5 V
Signal at 1 (IEC 1131-2)	+15 to +30 V	+15 to +30 V	+ 15 to +30 V
- Input current at 24 V DC			
Inputs I62.02 to I62.07	7 mA	7 mA	7 mA
Inputs I62.00 and I62.01	9 mA	9 mA	9 mA
- Filtering times:			
Standard inputs	5 ms	5 ms	5 ms
Input with counter configuration	70 µs	70 µs	70 µs
Input with interrupt configuration	90 µs	90 µs	90 µs
- Cable lengths:			
Unshielded (not for the high-speed counter inputs)	300 m	300 m	300 m
Geschirmt	500 m	500 m	500 m
Non-standard inputs	50 m	50 m	50 m

2.4.4.5 Integrated digital outputs

	07 CR 42 24 V DC	07 CT 42 24 V DC	07 CR 42 120/230 V AC
- Number of outputs	6 relay outputs	6 transistor outputs	6 relay outputs
- Insulation test voltage	1500 V AC 1 min.	1500 V AC	1500 V AC 1 min.
- Output load capability:			
at 24 V DC			
resistive load / inrush current	2 A / 5 A	1 A for	2 A / 5 A
L / R = 20 ms	2 A	O62.00 and	2 A
L / R = 30 ms	1 A	O62.01 and	1 A
L / R = 40 ms	0.6 A	0.5 A for the	0.6 A
L / R = 60 ms	0.35 A	other outputs	0.35 A
at 24 to 230 V AC	2 A AC-1 0.5 A AC-15	-	2 A AC-1 0.5 A AC-15
- Total load limit	6 x 2 A	4 x 0.5 A + 2 x 1 A	6 x 2 A
- Output leakage current	-	< 200 µA	-
- Saturation voltage at the output when switched on	-	max. 0.5 V with 500 mA	-
- Minimum load / minimum voltage	10 mA at 12 V DC	12 V	10 mA at 12 V DC
- Breaking capacity at 120 V AC (Contact rating code B300) (UL)	2 A		2 A
- Breaking capacity at 250 V AC (Contact rating code B300) (UL)	2 A (1.5 A according to UL)		2 A (1.5 A according to UL)
- Number of common connectors	2 (2+4)		2 (2+4)
- Switching frequency:			
for resistive loads	< 1 Hz	5 kHz	< 1 Hz
for inductive loads	< 0.2 Hz		< 0.2 Hz
for lamps	< 0.2 Hz		< 0.2 Hz
- Number of switching cycles:			
for AC-1	1 million	-	1 million
for AC-15	100 000	-	100 000
- Short-circuit and overload protection	external	yes, thermic	external
- Surge voltage protection	external	yes	external
- Output diagnosis	none	overload and short-circuit	none
- Cable lengths:			
unshielded	150 m	150 m	150 m
shielded	500 m	500 m	500 m

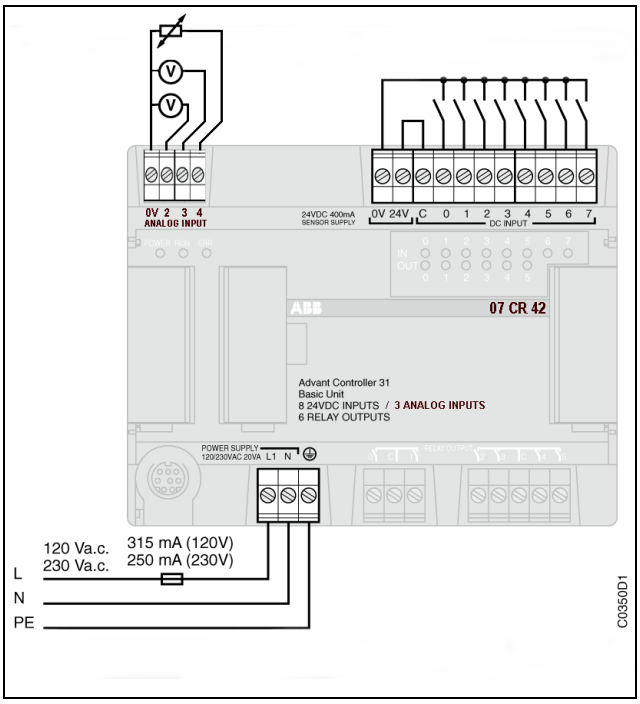
2.4.4.6 Integrated analog inputs

2.4.4.6.1 Technical data

	07 CR 42 24 V DC	07 CT 42 24 V DC	07 CR 42 120/230 V AC
- Number of analog inputs:			
Voltage	2	2	2
Temperature	1	1	1

	Voltage	Temperature	
- Nominal range: Maximum values:	+/- 10 V +/- 30 V	RTD 10 Ω to 7 MΩ	
- Resolution	11 bits + sign (5 ms)	12 bits	
- ± 1LSB is	+/- 2.5 mV	Pt100 0.6° C	Pt1000 0.3° C
- Full-scale precision		≤+/- 1%	≤+/- 2%
- Word value range, read by the basic unit	+/- 32767	Full scale depends on the sensor type	
- Noise ratio between two channels	70 dB	70 dB	
- Input impedance	>20 kΩ	>20 kΩ	
- Linearization for Pt 100 / Pt 1000		with function block FKG	
- Sampling rate	2.5 ms	2.5 ms	
- Filter time	0.5 ms	50 ms	
- Diagnosis	none	none	
- Cable lengths:	50 m	50 m	
Shielding required	yes	yes	

2.4.4.6.2 Cabling of the analog inputs



Example: Connection to 07CR42 for 120/230 V AC

The 8 analog inputs are not electrically isolated.

Warning: The analog inputs have an other connector type as the digital inputs.

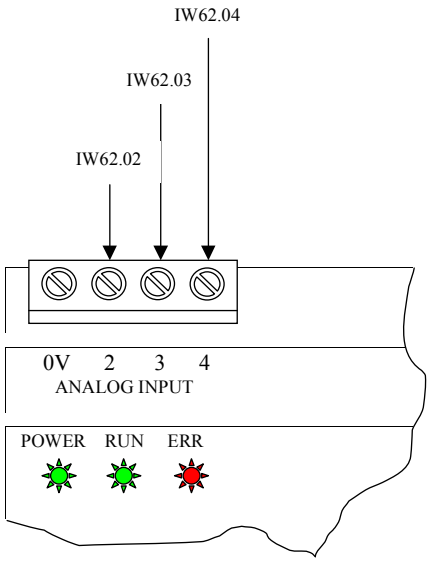
Use rigid or multi-conductor AWG 18 (0.96 mm^2) to AWG 14 (1.95 mm^2) wires for digital inputs and rigid or multi-conductor AWG 14 (1.95 mm^2) wires for the digital outputs.

And use rigid or multi-conductor AWG 28 (0.08 mm^2) to AWG 16 (1.5 mm^2) wires for analog inputs.

2.4.4.6.3 Addressing of the analog inputs

The address 62 is assigned to the analog inputs.

- IW62.02 Voltage format
- IW62.03 Voltage format
- IW62.04 Temperature format



Assignment of the 3 analog inputs

2.4.4.6.4 Voltage format at the analog inputs

The voltage format is only available at the analog inputs IW62.02 and IW62.03.

The measuring range is ±10 V with a resolution of 11 bits plus sign.

1 LSB = 20 V / 2^{12} = 4.88 mV

The numerical value =
[Input voltage (in volts) / 10] * 32767, the range = - 32767 ≤ X ≤ + 32767

Bit 15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
- 10	5	2,5	1,25	625	313	156	78	39	20	10	5	0	0	0	0
Sign	V	V	V	mV	mV	mV	mV	mV	mV	mV	mV	0			

Relationship between the measured value and the positions of the bits in the 16-bit word

The numerical value range is - 32767…. + 32767

Range overflow: + 32767 , range underflow: -32767

Warning:

If an analog input is not connected or if the signal line is broken, the analog value read by the user program will be:

Value = +10800 (+/- 1%), this means about 3.5 V

In case of short-circuit: Value = 0 (+/- 1% of full scale)

Fast reading with fix frequency, independently of cycle time, around 2.5 ms

2.4.4.6.5 Current format 4-20 mA

The analog inputs IW62.02 and IW62.03 can also be used for measuring currents from 4...20 mA. To do this, the input must be bypassed by a shunt.

At the same time, it is necessary, to convert the measured input value into the corresponding current value. Here, mathematical function blocks can be used. In particular, the FKG function block can be configured (just two couples of points are enough).

In order to determine the value of the shunt, it is at first necessary to read the data sheet of the used current sensor. The max. external load resistance is important. It must never be exceeded.

In all cases, the shunt should not be greater than 500 Ω. Dependent on the chosen shunt, the following resolution applies:

R = 500 Ω: 4...20 mA generate 2...10 V, resolution = ca. 11 bits
R = 250 Ω: 4...20 mA generate 1...5 V, resolution = ca. 10 bits
R = 125 Ω: 4...20 mA generate 0.5...2.5 V, resolution = ca. 9 bits

2.4.4.6.6 Temperature format at the analog inputs

The analog input IW62.04 can be used with temperature sensors like Pt100, Pt1000, PTC etc. The analog input can also be configured individually in a lot of different temperature modes.

The appendix shows tables containing the relationship between the resistance values and the analog values.

The configuration is performed by the FKG function block. This function block allows the user to define a curve by n points (X0 / YO… Xn-1 / Yn-1) and performes a linear interpolation between the defined points. The resulting curve, representing the relationship between X and Y, gives the current analog value.

- X corresponds to the current analog value of IW62.04
- Y is the value according to the table "Resistance / Analog value

The FKG function block is decribed in detail in the function block library.

2.4.4.6.6.1 Configuration for Pt100 sensor (Platinum 100 Ω / 0°C)

Value = (32737 * R) / (R + 768)

The resolution for Pt100 is 12 bits,

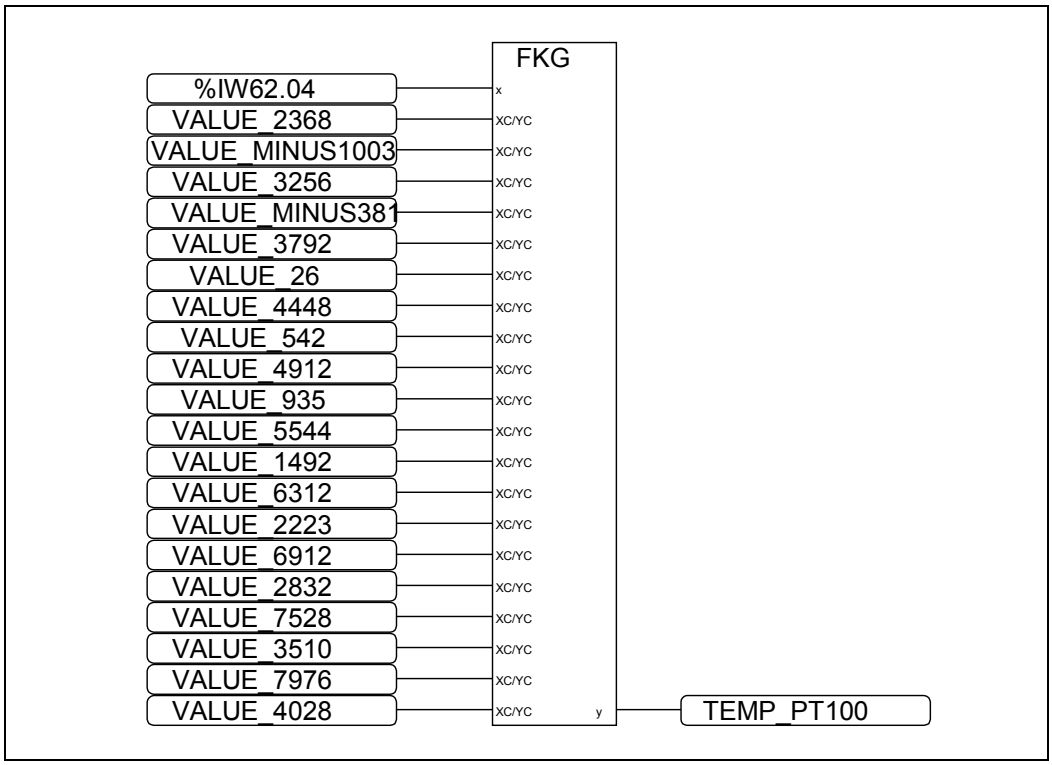
the temperature measuring range (-100.3 to +524.4 °C) is converted by the FKG function block.

Range overflow / broken wire: +32688,

Range underflow / sensor short-circuit: 0

Example of a configuration of a Pt100 sensors with the FKG function block:

If points are set every 30°C in the curve, a precision of better than 0.5 °C can be obtained with a Pt100 sensor (for values see 2.4.4.6.6.2).



2.4.4.6.6.2 Table Pt100 / Resistance value / Analog value / Temperature in °C and °F

R (Ohms)	Value IW	°C / 10	°F / 10
60	2368	-1003	-1485,4
63	2472	-932	-1357,6
66	2584	-858	-1224,4
69	2688	-783	-1089,4
72	2800	-708	-954,4
75	2904	-633	-819,4
78	3008	-558	-684,4
81	3112	-482	-547,6
85	3256	-381	-365,8
89	3392	-280	-184
93	3528	-178	-0,4
95	3592	-128	89,6
97	3664	-77	181,4
99	3728	-25	275
101	3792	26	366,8
103	3864	77	458,6
105	3928	128	550,4
107	3992	180	644
109	4056	231	735,8
111	4128	282	827,6
113	4192	334	921,2
115	4256	386	1014,8
117	4320	439	1110,2
119	4384	490	1202
121	4448	542	1295,6
124	4544	620	1436
127	4632	698	1576,4
130	4728	777	1718,6
133	4824	855	1859
136	4912	935	2003
139	5008	1013	2143,4
142	5096	1092	2285,6
145	5192	1172	2429,6
148	5280	1251	2571,8
151	5368	1331	2715,8
154	5456	1411	2859,8
157	5544	1492	3005,6
160	5632	1572	3149,6
164	5752	1680	3344

R (Ohms)	Value IW	°C / 10	°F / 10
168	5864	1788	3538,4
172	5976	1893	3727,4
176	6088	2002	3923,6
180	6200	2113	4123,4
184	6312	2223	4321,4
188	6424	2333	4519,4
192	6536	2443	4717,4
194	6592	2498	4816,4
196	6640	2555	4919
198	6696	2608	5014,4
200	6752	2664	5115,2
203	6832	2747	5264,6
206	6912	2832	5417,6
209	6992	2915	5567
212	7072	3000	5720
215	7144	3084	5871,2
218	7224	3170	6026
221	7304	3253	6175,4
224	7376	3338	6328,4
227	7456	3423	6481,4
230	7528	3510	6638
233	7608	3595	6791
236	7680	3681	6945,8
239	7752	3767	7100,6
242	7832	3854	7257,2
245	7904	3941	7413,8
248	7976	4028	7570,4
251	8048	4115	7727
254	8120	4203	7885,4
257	8192	4290	8042
260	8264	4380	8204
263	8336	4467	8360,6
266	8408	4556	8520,8
269	8480	4645	8681
273	8568	4763	8893,4
277	8664	4883	9109,4
281	8752	5003	9325,4
285	8848	5123	9541,4
289	8936	5244	9759,2

2.4.4.6.6.3 Configuration for Pt1000 sensor (Platinum 1000 Ω / 0°C)

Wert = (32737 * R) / (R + 768)

The resolution for Pt1000 is 12 bits,

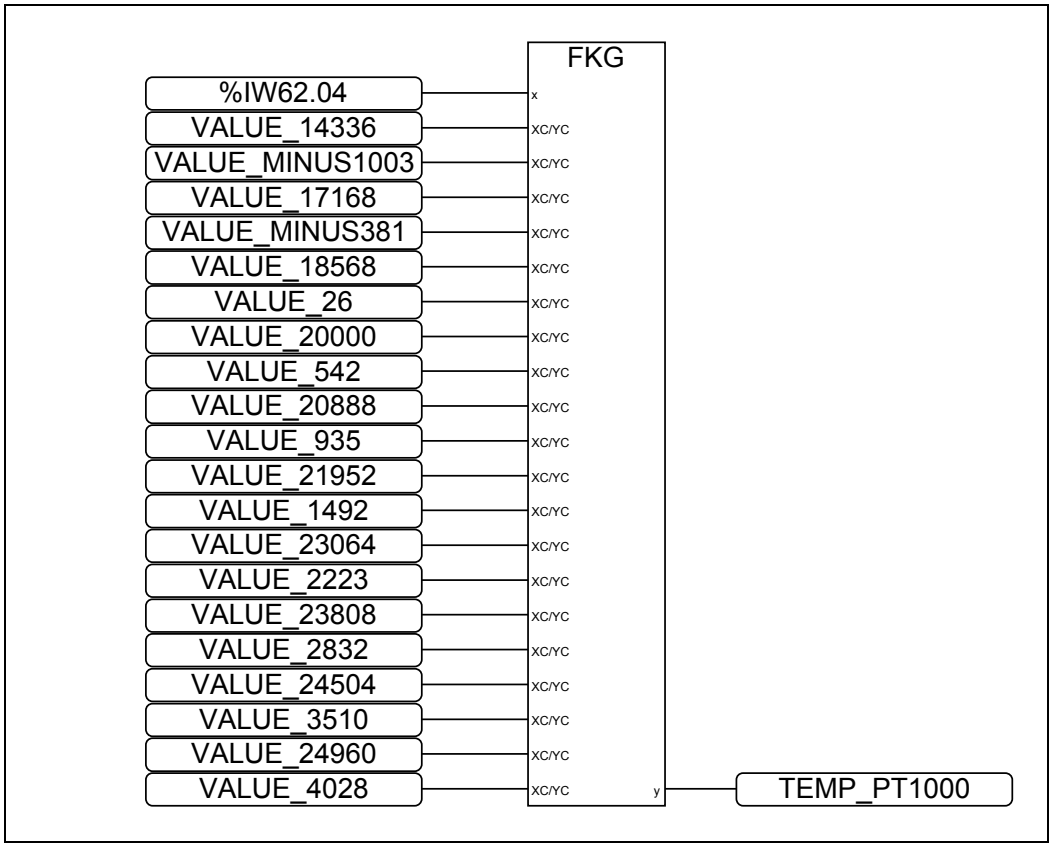
the temperature measuring range (-100.3 to +524.4 °C) is converted by the FKG function block.

Range overflow / broken wire: +32688,

Range underflow / sensor short-circuit: 0

Example of a configuration of a Pt1000 sensors with the FKG function block:

If points are set every 20°C in the curve, a precision of better than 0.3 °C can be obtained with a Pt1000 sensor (for values see 2.4.4.6.6.4).



2.4.4.6.6.4 Table Pt1000 / Resistance value / Analog value / Temperature in °C and °F

R (Ohms)	Value IW	°C / 10	°F / 10
600	14336	-1003	-1485,4
630	14728	-932	-1357,6
660	15104	-858	-1224,4
690	15472	-783	-1089,4
720	15816	-708	-954,4
750	16152	-633	-819,4
780	16472	-558	-684,4
810	16776	-482	-547,6
850	17168	-381	-365,8
890	17544	-280	-184
930	17904	-178	-0,4
950	18072	-128	89,6
970	18240	-77	181,4
990	18408	-25	275
1010	18568	26	366,8
1030	18728	77	458,6
1050	18880	128	550,4
1070	19032	180	644
1090	19176	231	735,8
1110	19320	282	827,6
1130	19464	334	921,2
1150	19600	386	1014,8
1170	19736	439	1110,2
1190	19864	490	1202
1210	20000	542	1295,6
1240	20184	620	1436
1270	20368	698	1576,4
1300	20552	777	1718,6
1330	20720	855	1859
1360	20888	935	2003
1390	21056	1013	2143,4
1420	21216	1092	2285,6
1450	21368	1172	2429,6
1480	21520	1251	2571,8
1510	21664	1331	2715,8
1540	21808	1411	2859,8
1570	21952	1492	3005,6
1600	22088	1572	3149,6
1640	22264	1680	3344

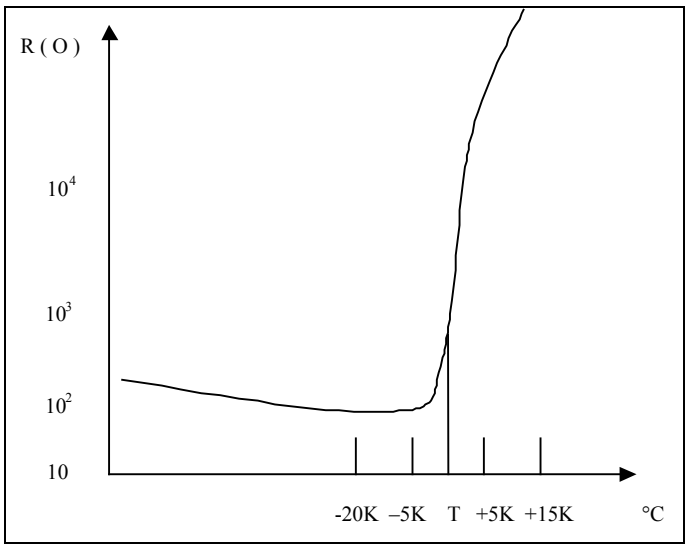
R (Ohms)	Value IW	°C / 10	°F / 10
1680	22432	1788	3538,4
1720	22600	1893	3727,4
1760	22760	2002	3923,6
1800	22912	2113	4123,4
1840	23064	2223	4321,4
1880	23208	2333	4519,4
1920	23352	2443	4717,4
1940	23416	2498	4816,4
1960	23488	2555	4919
1980	23552	2608	5014,4
2000	23616	2664	5115,2
2030	23720	2747	5264,6
2060	23808	2832	5417,6
2090	23904	2915	5567
2120	24000	3000	5720
2150	24088	3084	5871,2
2180	24176	3170	6026
2210	24256	3253	6175,4
2240	24344	3338	6328,4
2270	24424	3423	6481,4
2300	24504	3510	6638
2330	24584	3595	6791
2360	24664	3681	6945,8
2390	24736	3767	7100,6
2420	24816	3854	7257,2
2450	24888	3941	7413,8
2480	24960	4028	7570,4
2510	25032	4115	7727
2540	25096	4203	7885,4
2570	25168	4290	8042
2600	25232	4380	8204
2630	25304	4467	8360,6
2660	25368	4556	8520,8
2690	25432	4645	8681
2730	25512	4763	8893,4
2770	25592	4883	9109,4
2810	25672	5003	9325,4
2850	25752	5123	9541,4
2890	25824	5244	9759,2

2.4.4.6.7 Configuration with another temperature sensor type

It is possible to use other temperature sensors like PTC, NTC…etc.

Here, the configuration is also performed by means of the FKG function block. The parameters can be found in the appendix (relationship between temperature values and analog values).

Example with a PTC thermistor, thermal machine protection, used to protect electric motors from over-temperature. The resistance-temperature characteristic of a PTC thermistor is shown in the following figure.



Typical resistance-temperature characteristic of a thermistor (R in Ω)

where T is the temperature limit for the motor

Example:

- with PTC 80, the resistance value is ca. 1000 Ω at T = 80°C
- with PTC 120, the resistance value is ca. 1000 Ω at T = 120°C

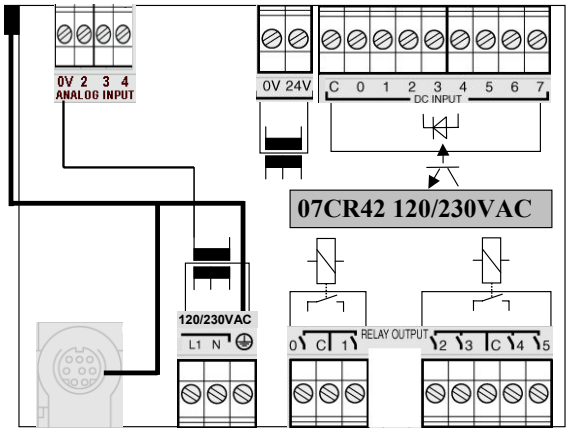
Using comparison functions from the function block library, the analog value can be compared and thus a protection be obtained for the motor. Several PTCs can be connected in series. In this way, more than one PTC can be evaluated by one analog channel at the same time.

2.4.4.6.8 Unit identification for diagnosis

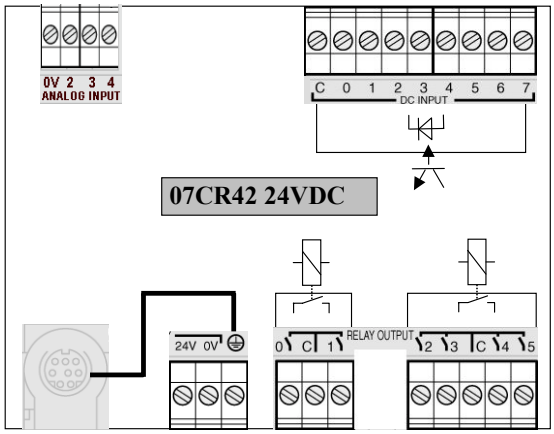
For diagnostic purposes, the units of the 42 series are distinguished as follows:

- Unit type: 228 07CR42
- Unit type: 229 07CT42

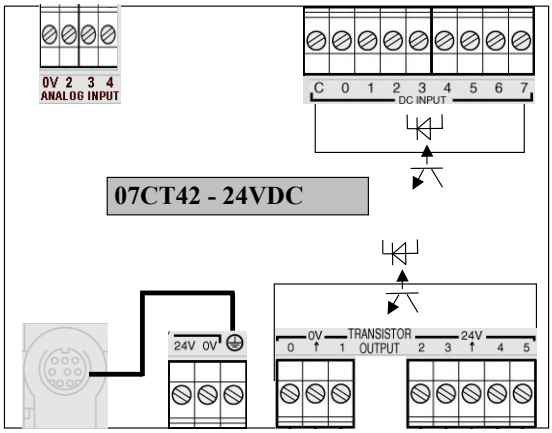
2.4.4.6.9 Electrical isolation (overview)



Electrical isolation at 07 CR 42 - 120/230 V AC



Electrical isolation at 07 CR 42 - 24 V DC



Electrical isolation at 07 CT 42 - 24 V DC

2.4.4.6.10 Appendix: Complete table, Resistance value / Analog value (for IW62.04 only)

R (Ohms)	Value IW
10	416
11	456
12	496
13	544
14	584
15	624
16	664
17	704
18	744
19	784
20	824
22	904
24	984
26	1064
28	1144
30	1224
33	1344
34	1384
35	1424
36	1456
37	1496
38	1536
39	1576
40	1616
42	1688
44	1768
46	1840
48	1920
50	1992
52	2072
54	2144
56	2216
58	2288
60	2368
63	2472
66	2584
69	2688
72	2800
75	2904
78	3008
81	3112
85	3256
89	3392
93	3528
95	3592
97	3664
99	3728
101	3792
103	3864

R (Ohms)	Value IW
105	3928
107	3992
109	4056
111	4128
113	4192
115	4256
117	4320
119	4384
121	4448
124	4544
127	4632
130	4728
133	4824
136	4912
139	5008
142	5096
145	5192
148	5280
151	5368
154	5456
157	5544
160	5632
164	5752
168	5864
172	5976
176	6088
180	6200
184	6312
188	6424
192	6536
194	6592
196	6640
198	6696
200	6752
203	6832
206	6912
209	6992
212	7072
215	7144
218	7224
221	7304
224	7376
227	7456
230	7528
233	7608
236	7680
239	7752
242	7832
245	7904

R (Ohms)	Value IW
248	7976
251	8048
254	8120
257	8192
260	8264
263	8336
266	8408
269	8480
273	8568
277	8664
281	8752
285	8848
289	8936
293	9024
297	9112
301	9200
305	9288
309	9376
313	9464
317	9552
321	9632
325	9720
329	9800
333	9888
337	9968
342	10072
347	10168
352	10272
357	10368
362	10472
367	10568
372	10664
377	10760
382	10856
387	10952
392	11048
397	11136
402	11232
408	11336
414	11448
420	11552
425	11640
430	11728
435	11816
440	11904
445	11992
450	12072
455	12160
460	12240

R (Ohms)	Value IW
465	12328
470	12408
475	12488
480	12568
485	12648
490	12728
495	12808
500	12888
506	12984
512	13072
518	13168
524	13256
530	13344
536	13432
542	13520
548	13608
554	13696
560	13784
566	13864
572	13952
578	14032
584	14120
591	14216
598	14312
600	14336
630	14728
660	15104
690	15472
720	15816
750	16152
780	16472
810	16776
850	17168
890	17544
930	17904
950	18072
970	18240
990	18408
1010	18568
1030	18728
1050	18880
1070	19032
1090	19176
1110	19320
1130	19464
1150	19600
1170	19736
1190	19864
1210	20000

R (Ohms)	Value IW
1240	20184
1270	20368
1300	20552
1330	20720
1360	20888
1390	21056
1420	21216
1450	21368
1480	21520
1510	21664
1540	21808
1570	21952
1600	22088
1640	22264
1680	22432
1720	22600
1760	22760
1800	22912
1840	23064
1880	23208
1920	23352
1940	23416
1960	23488
1980	23552
2000	23616
2030	23720
2060	23808
2090	23904
2120	24000
2150	24088
2180	24176
2210	24256
2240	24344
2270	24424
2300	24504
2330	24584
2360	24664
2390	24736
2420	24816
2450	24888
2480	24960
2510	25032
2540	25096
2570	25168
2600	25232
2630	25304
2660	25368
2690	25432
2730	25512

R (Ohms)	Value IW
2770	25592
2810	25672
2850	25752
2890	25824
605	14400
612	14496
619	14584
626	14680
633	14768
640	14856
647	14944
654	15032
661	15120
668	15208
676	15304
684	15400
692	15496
700	15584
708	15680
716	15768
724	15864
732	15952
740	16040
748	16128
756	16216
765	16312
774	16408
783	16504
792	16592
801	16688
810	16776
819	16872
828	16960
837	17048
847	17144
857	17240
867	17336
877	17424
887	17520
897	17608
907	17696
917	17792
928	17888
939	17984
950	18072
961	18168
972	18256
983	18352
994	18440

R (Ohms)	Value IW
1005	18528
1017	18624
1029	18720
1041	18808
1053	18904
1065	18992
1077	19080
1089	19168
1102	19264
1115	19352
1128	19448
1141	19536
1154	19624
1167	19712
1181	19808
1195	19896
1209	19992
1223	20080
1237	20168
1251	20256
1266	20344
1281	20440
1296	20528
1311	20616
1326	20696
1341	20784
1357	20872
1373	20960
1389	21048
1405	21136
1421	21216
1438	21312
1455	21392
1472	21480
1489	21568
1506	21648
1524	21736
1542	21824
1560	21904
1578	21984
1596	22072
1615	22152
1634	22240
1653	22320
1672	22400
1692	22480
1712	22568
1732	22648
1752	22728

R (Ohms)	Value IW
1773	22808
1794	22888
1815	22968
1836	23048
1858	23128
1880	23208
1902	23288
1924	23360
1947	23440
1970	23520
1993	23600
2022	23688
2052	23784
2082	23880
2113	23976
2144	24064
2176	24160
2208	24256
2241	24344
2274	24440
2308	24528
2342	24616
2377	24704
2412	24792
2448	24880
2484	24968
2521	25056
2558	25144
2596	25224
2634	25312
2673	25392
2713	25480
2753	25560
2794	25640
2835	25720
2877	25800
2920	25880
2963	25960
3007	26040
3052	26120
3097	26192
3143	26272
3190	26344
3237	26424
3295	26512
3354	26600
3414	26688
3475	26776
3537	26856

R (Ohms)	Value IW
3600	26944
3664	27024
3729	27104
3796	27192
3864	27272
3941	27360
4019	27448
4099	27528
4180	27616
4263	27696
4348	27784
4434	27864
4522	27944
4612	28024
4704	28104
4821	28200
4941	28296
5064	28384
5190	28480
5319	28568
5451	28656
5587	28736
5726	28824
5869	28904
6015	28992
6165	29072
6319	29144
6476	29224
6657	29312
6843	29392
7034	29472
7230	29552
7432	29632
7640	29704
7853	29776
8127	29864
8411	29952
8705	30040
9009	30120
9324	30200
9650	30280
10036	30368
10437	30448
10854	30528
11288	30608
11739	30680
12325	30776
12941	30856
13588	30944

R (Ohms)	Value IW
14267	114136
15265	122120
16333	130664
17476	139808
18699	149592
20007	160056
21407	171256
23119	184952
24968	199744
26965	215720
29391	235128
32330	258640

R (Ohms)	Value IW
35563	284504
40897	327176
47031	376248
54085	432680
64902	519216
77882	623056
93458	747664
112149	897192
134578	1076624
161493	1291944
193791	1550328
232549	1860392

R (Ohms)	Value
279058	2232464
390681	3125448
546953	4375624
765734	6125872
1072027	8576216
1500837	12006696
2251255	18010040
3376882	27015056
5065323	40522584
7091452	56731616

2.5 Intelligent MODBUS coupler 07 KP 53

Communication is a subject of great importance in wide area installations. Apart from the CS31 system bus, the AC31 system has other interfaces for different communication tasks.

This chapter describes, in particular, the communication module 07 KP 53, which extends the communication possibilities for the 40 and 50 series.

The 07 KP 53 module is an intelligent coupler with two independent communication interfaces (RS-232 or RS-485), using the MODBUS protocol in master and slave mode.

The data exchange between the basic unit and the coupler is performed independent of the cycle time of the basic unit.

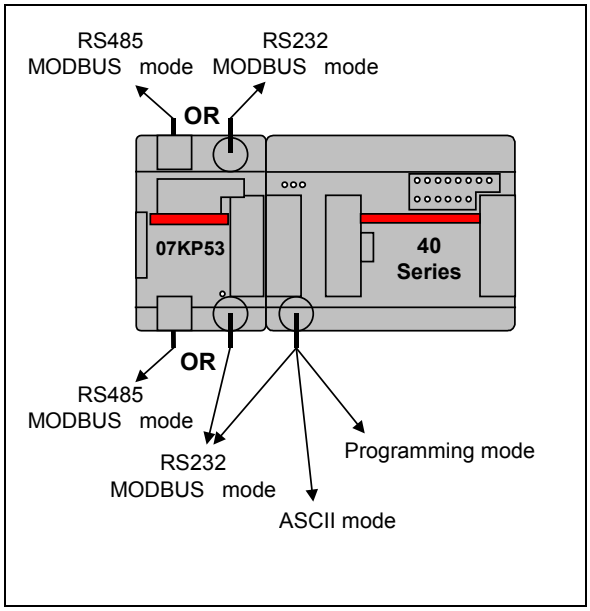


Figure: Communication protocols between series 40 and 07 KP 53

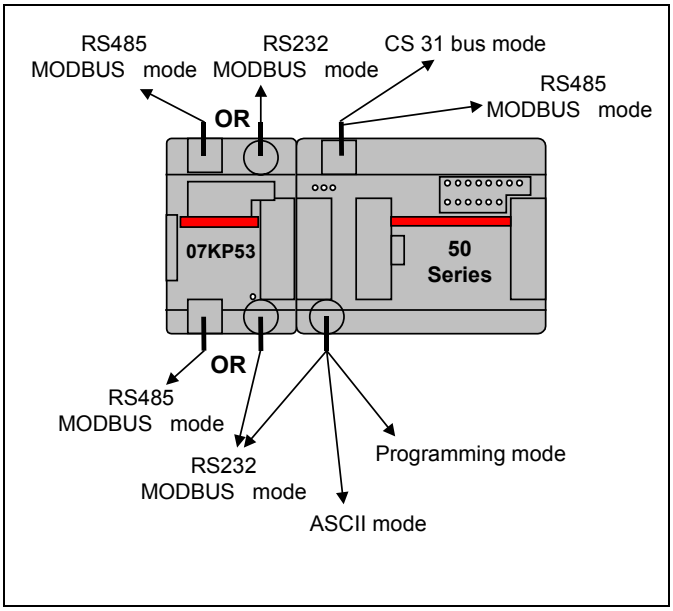


Figure: Communication protocols between series 50 and 07 KP 53

2.5.1 Network communication with the MODBUS interface

2.5.1.1 The MODBUS protocol

The MODBUS protocol, known world-wide, is used with the 07 KP 53 coupler as the **MODICON MODBUS-RTU** protocol im Koppler 07 KP 53.

Numerous automation devices, such as PLCs, display units, variable speed drives or monitoring systems possess a standard, or optional, a MODBUS-RTU interface and can therefore easily communicate with the 40 or 50 series basic units via the 07 KP 53 MODBUS coupler.

Valid for series 50:

The 07 KP 53 coupler can be used with the basic units from **software version 3.2** on:

Basic unit	Version index
07 KR 51 - 24 V DC	from Q32 on
07 KR 51 - 120/230 V AC	from Q32 on
07 KT 51 - 24 V DC	from P32 on

Valid for series 40:

The 07 KP 53 coupler can be used with the basic units from **software version 3.2** on:

Basic unit	Version index
07 CR 41 - 24 V DC	from M32 on
07 CR 41 - 120/230 V AC	from M32 on
07 CT 41 - 24 V DC	from 32 on
07 CR 42 - 24 V DC	from A32 on
07 CR 42 - 120/230 V AC	from A32 on
07 CT 42 - 24 V DC	from A32 on

How do you find out, which version you have?

You can find this piece of information on the label, on the left side of the 40/50 series basic units.

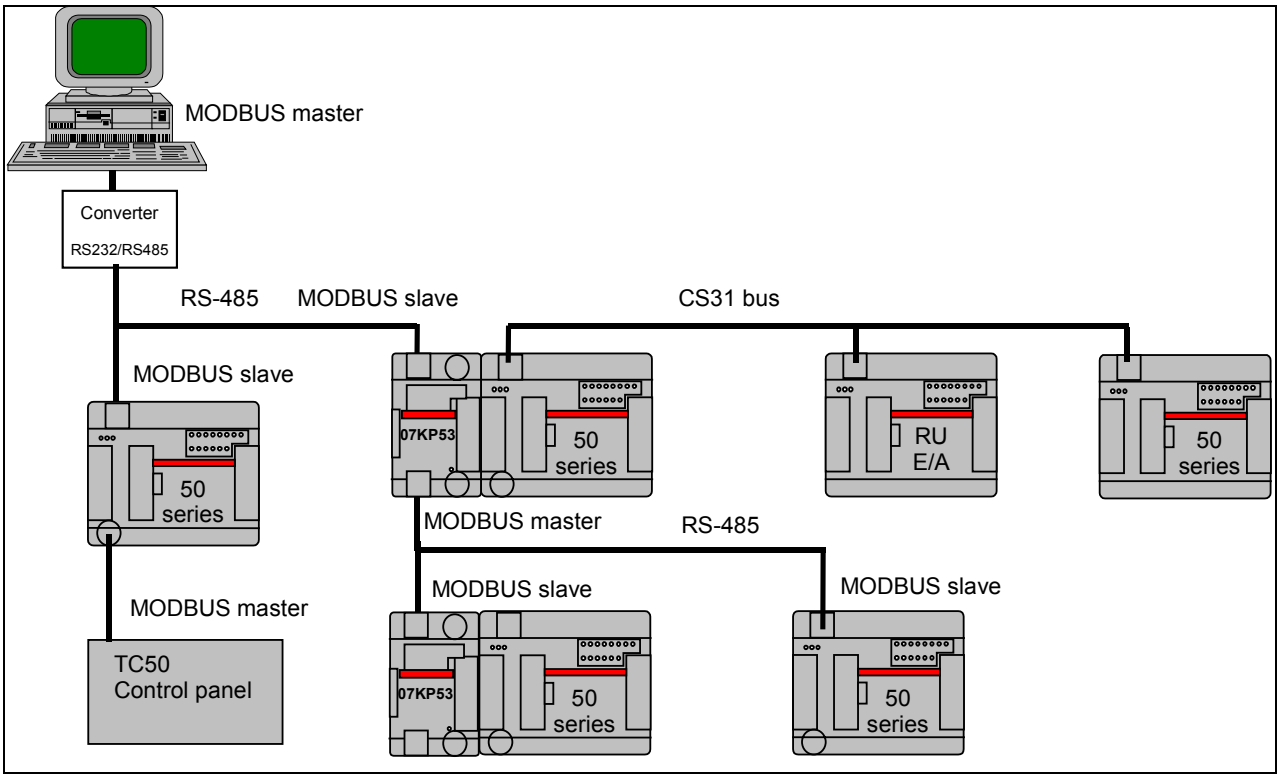


Figure: Network conections between series 50 basic units

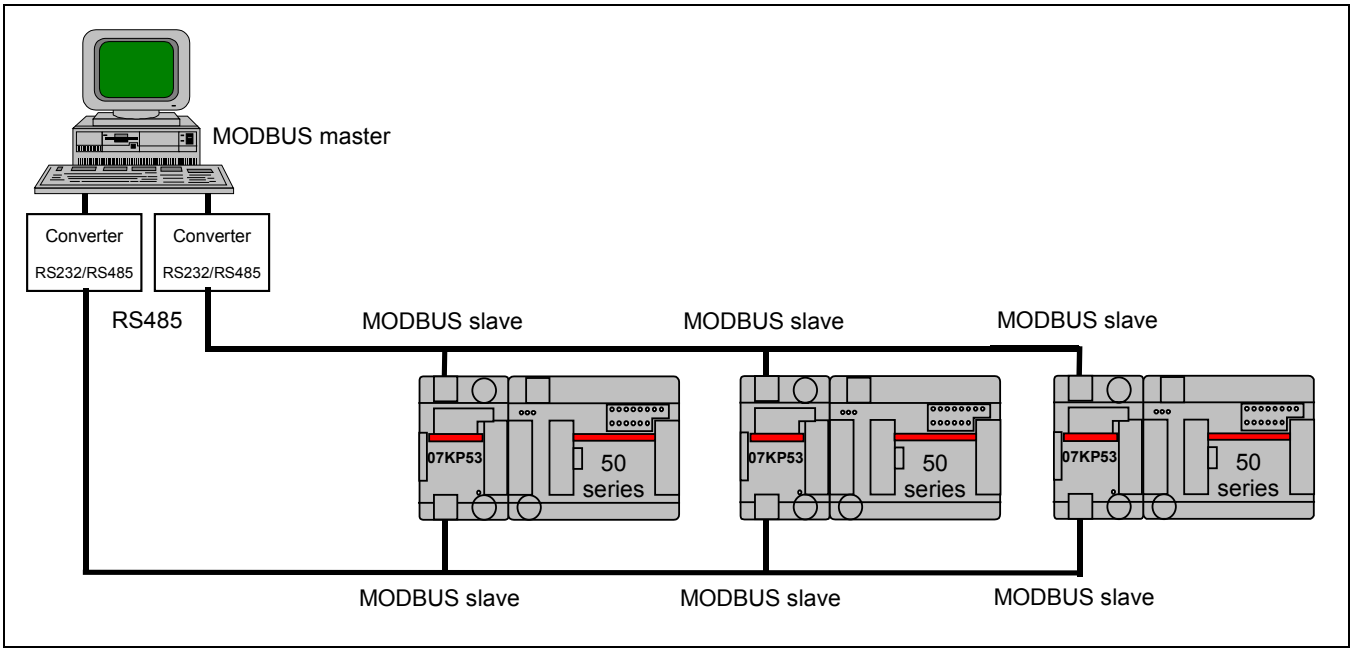


Figure: Network, using a configuration with redundancy

2.5.1.2 Configuration example

- **Example of network connection between the coupler 07 KP 53 and basic units:**
- **Example of network using a configuration with redundancy for transfer of data between a supervisor and different basic units:**

MODBUS is a question-answer type protocol, or still occasionally called master-slave: The master sends a request to the slave and awaits the slave's reply.

The master devices on a MODBUS network are generally basic units, display units or supervisory systems. The slaves on the MODBUS network are generally PLCs, variable-speed drives, etc.

The intelligent 07 KP 53 MODBUS coupler, connected with the 40/50 series basic units, provide the two additional communication ports COM3 and COM4, which can be configured in master or slave modes without restriction. COM3 and COM4 support RS-232 and RS-485 interfaces.

The 07 KP 53 MODBUS coupler does not require its own power supply unit. The supply voltages (5 V DC and 24 V DC) are provided by the basic unit, it is connected to.

The intelligent 07 KP 53 MODBUS coupler can work with the communication modes "synchronous" and "asynchronous", independently of each other and also both at the same time.

Synchronous mode

If the coupler is configured in this mode, its basic unit receives and sends MODBUS frames without any modification. In this case, the coupler provides just two additional communication ports. This is not the fastest solution for communication, the execution is realized after each program cycle of the basic unit.

It is possible to control the reading of the result table of requests in order to provide integrity of data. The integrity of data is always performed for one request, that means, during execution of request, when the result table of request is filling up, the reading of data are forbidden.

The bit N°15 of the word "*Number of data*" within the configuration table allows to manage the integrity of data, it is used to determine if it is possible or not to read on the result table of requests. When the status of bit N°15 is set to 1, and if a reading on the result table occurs then, the response will be realized after that the present request is completely finished.

Asynchronous mode

If the coupler is configured in this mode, it works like a "concentrator". It generates the sequence to link all the MODBUS requests, configured inside its requests table, and it builds also one results table that can be read from basic unit, or one supervisor with only one request.

The response of requests of the different slaves can be realized in only one request, in this the case, it is faster than with the synchronous mode. The asynchronous mode can be used with master or slave modes.

In master mode, the configuration table is only realized by the basic unit of the coupler.

In slave mode, the communication table is realized by the basic unit or directly by one supervisor.

2.5.2 Coupler short data

Products	Description	Order No.
Coupler		
07 KP 53	Intelligent coupler as an interface module with 2 serial MODBUS RTU interfaces (RS-232 and RS-485), Master/SIave operation. The communication coupler is used to connect external units to the AC31 system (40 and 50 series). The MODBUS-RTU protocol is used for communication. The coupler is supplied by the basic unit.	1SBP260162R1001

2.5.3 General operating conditions

The AC 31 units were developed according to the European EC directives, the main national and international IEC 1131-1 and IEC 1131-2 standards and the EN61131-2 product standard concerning automation devices.

Ambient conditions		
- Temperature:		
Operation:	horizontal	0°C to + 55°C
	vertical	0°C to + 40°C
Storage		- 40°C to + 75°C
Transport		- 25°C to + 75°C
- Humidity:		DIN 40040 class F without condensation
Annual average		≤ 75 %
up to 30 days per year		85 %
occasionally		95 %
- Atmospheric pressure:		DIN 40050
Operation		≥ 800 hPA (≤ 2000 m)
Storage		≥ 600 hPA (≤ 3500 m)
Mechanical data		
- Degree of protection		IP20
- Unit		UL V2
- Vibration stress		IEC 60068-2-6 test Fc
- Shock stress		IEC 60068-2-27 test Ea
Mounting		
- DIN rail		35 mm
- with screws		4 screws M4
Weight		220 g

2.5.4 Technical data of the 07 KP 53 MODBUS coupler

Interfaces	COM3, upper side	COM4, lower side
Interface connectors	Mini-DIN 8 for RS-232 and 5.08-mm raster terminal block for RS-485	
Power supply	provided by the basic unit	
Protocol	MODICON MODBUS-RTU (Master / Slave)	
Transmission mode	Half-duplex via RS-485 and full-duplex via RS-232	
Number of connection points	1 master max. **1** slave with RS-232 interface max. **128** slaves with integrated RS-485 interface max. **255** slaves with repeaters	
Transmission control	CRC 16	
Communication diagnosis	by LEDs on the front panel	
Bus configuration	by DIL switches on the left side	
Communication system	synchronous and asynchronous mode	
Transmission speed	up to 115.200 Bauds	
Max. cable lengths	using RS-485: 600 m with 115200 Bauds 1200 m with 19200 Bauds	

The MODBUS frames transmitted by the master contain the following information:

The MODBUS address of the interrogated slave (1 byte), the function code defining the master request (1 byte), the data to exchange (N bytes), the CRC16 control code (2 bytes).

The slave's reply contains the request confirmation, the data to be returned and also a frame control code. The slave returns an error code in the case of an error.

Only the following MODBUS operation codes may be processed by the 40 and 50 series basic units:

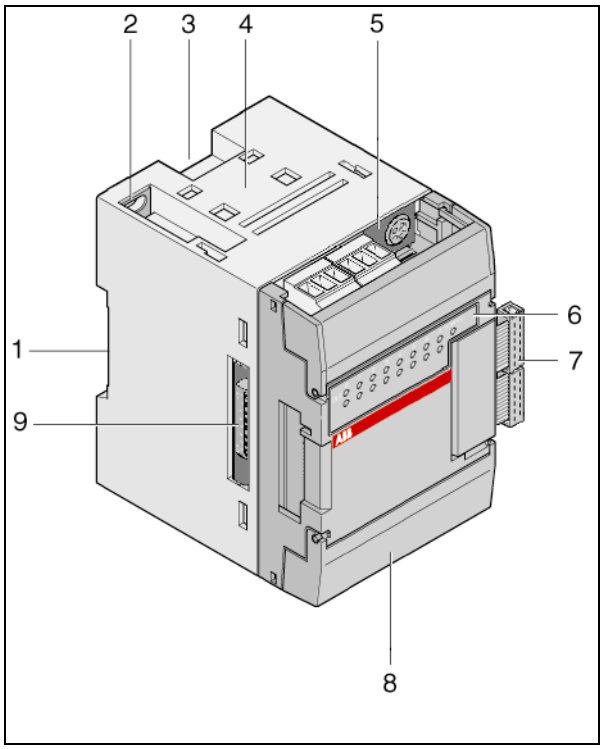
Function code		**Description**	
In hexadecimal	In decimal		
01 or 02	01 or 02	Read n bits	
03 or 04	03 or 04	Read n words	
07	07	Fast reading of 8 bits	only in synchronous mode
08	08	Diagnosis / Initialization	only in synchronous mode
0F	15	Write n bits	
10	16	Write n words	

Generated error codes:

Error codes	**Description**
00	No error
01	Unknown function code
02	Address error
03	Data error
09	Time-out
10	Checksum error (CRC16)

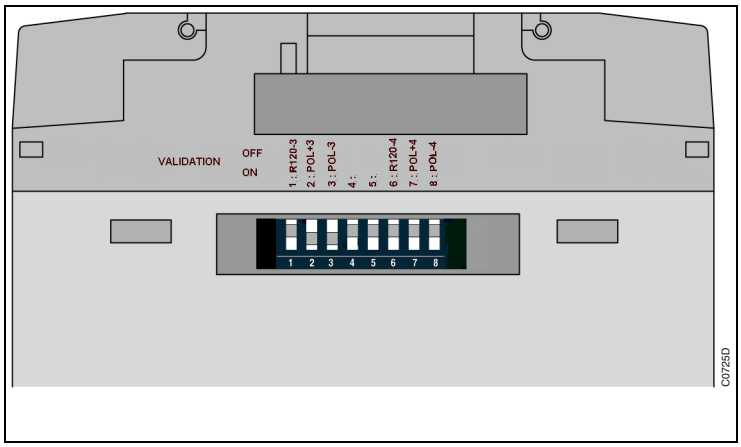
2.5.5 Description of the 07 KP 53 MODBUS coupler

2.5.5.1 Coupler view



1 - Cut-out for the DIN rail
2 - Plate fixing with unit earthing
3 - Lock for DIN rail mounting
4 - Location for external dual connector
5 - COM3 (Mini-DIN 8 for RS-232 and 5.08-mm raster terminal block for RS-485)
6 - Status visualization area of communication (COM3 / COM4)
7 - Connectors for connecting the basic unit
8 - COM4 (Mini-DIN 8 for RS-232 and 5.08-mm raster terminal block for RS-485)
9 - DIL switches for configuration of the bus terminating resistors and the polarity (see figure)

2.5.5.2 DIL switches for configuration of the bus terminating resistors and the polarity



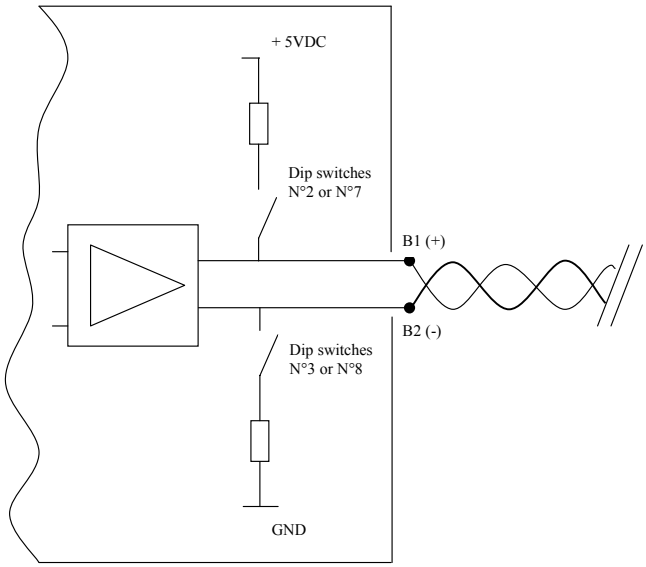
With the DIL switches on the left side of the coupler, the following can be set:

- Polarity of the bus (if the coupler is the master)
- Activation of the internal bus terminating resistors (120 Ω).

DIL switch 1	Position	ON	Terminating resistor for COM3
DIL switch 2	Position	ON	Polarization bus + COM3
DIL switch 3	Position	ON	Polarization bus – COM3
DIL switch 4	Not used		
DIL switch 5	Not used		
DIL switch 6	Position	ON	Terminating resistor for COM4
DIL switch 7	Position	ON	Polarization bus + COM4
DIL switch 8	Position	ON	Polarization bus – COM4

Warning:

- The polarization of bus should only be used when the 07KP53 MODBUS coupler is configured in Master mode.
- The DIL switches 2 and 3 for COM3 and the DIL switches 7 and 8 for COM4 work in pairs.

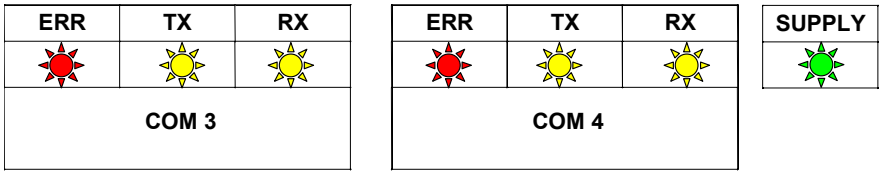


2.5.5.3 Status LEDs

The LED displays on the front panel show the status of communication of COM3 and COM4 and if the supply voltage is present.

COM3 and COM4 have separate LED displays.

The 07KP53 executes a complete series of auto tests and configuration at each start-up. During power ON, all LEDs displays flash and the 07 KP 53 (by default setting in slave mode) detects automatically the speed and the polarity of the bus.



SUPPLY Green LED displays, that 5 V DC is present (via the basic unit).

ERR Red LED indicates communication errors:

- bad frame received in slave mode
- bad answer from slave in master mode
- time-out error in master mode

During the automatic detection of speed and polarity, the ERR LED display flashes.

TX Yellow LED lights up during data transmission (Send Data)

RX Yellow LED lights up during data transmission (Receive Data)

In order to enable a visible display on RX and TX in case of high speed greater than 76800 Bauds, the ON status is maintained for a period of about 250 ms.

It is possible to identify the MODBUS address of the communication ports COM3 and COM4 without the use of a laptop or another terminal device. The principle is, after each initialization of the coupler (after power ON), to use the LED displays to display the MODBUS address encoded on 6 bits (6 LED displays). In binary, this encoding allows to display 64 different MODBUS addresses, which is sufficient for a lot of applications.

Procedure to display the MODBUS addresses of the interfaces COM3 and COM4:

1) After power ON of the coupler, all LEDs light up for half a second. This is for checking their function.
2) After that, the 6 LEDs show the binary-coded MODBUS address of COM3 for about half a second.
3) For the next half a second, the 6 LEDs show the address of COM4.

Interface	COM3			COM4		
LED display	ERR	TX	RX	ERR	TX	RX
Bit number	B5	B4	B3	B2	B1	B0
Decimal value	32	16	8	4	2	1

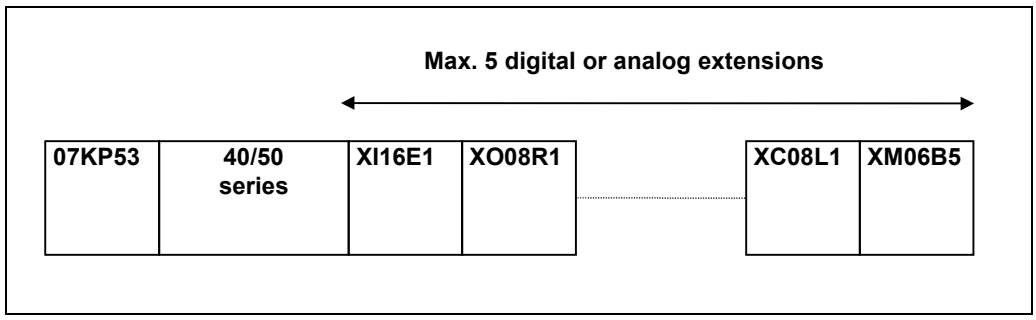


Figure: 07 KP 53 with basic unit and extensions

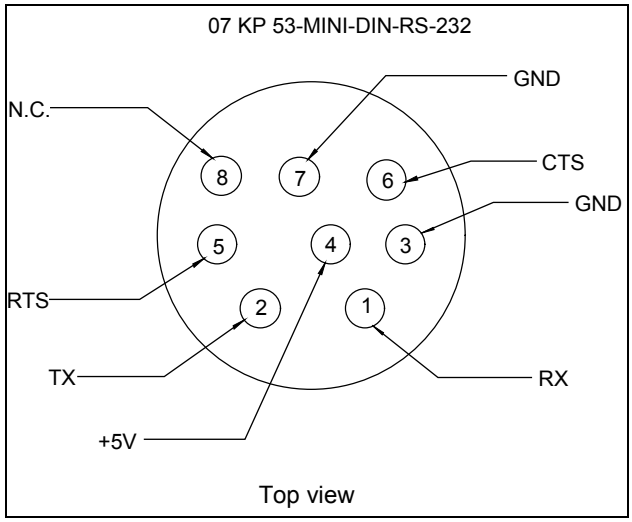


Figure: Pin assignment of the RS-232 interfaces COM3 and COM4

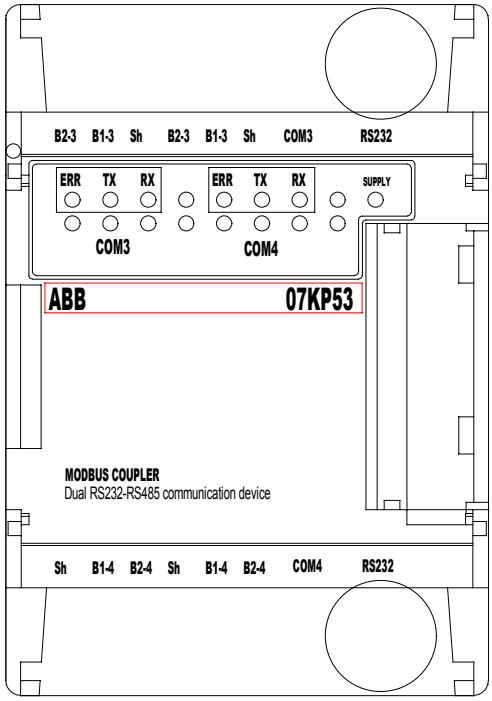


Figure: MODBUS coupler 07 KP 53

2.5.5.4 Installation and cabling

The 07KP53 is powered with 5 V DC by the basic unit. The connection between the 07 KP 53 and the basic unit is established with the two cables situated on the left side of the coupler. Precondition for connecting them together, it is necessary to remove the EMC plastic adhesive.

Warning: The 07 KP 53 must be connected or disconnected only when the power of the basic unit is OFF.

When the 40 and 50 series are used with a 07 KP 53 MODBUS coupler, it is possible to increase the number of inputs / outputs by adding up to only 5 local extension units, instead of 6 without coupler (see figure one page before).

The 07 KP 53 MODBUS coupler, connected to the 40/50 series basic unit, provides the two additional communication ports COM3 and COM4. These ports could be used with RS-232 for point to point communication or with RS-485 for network communication.

COM3 is at the top, **COM4** at the bottom of the coupler.

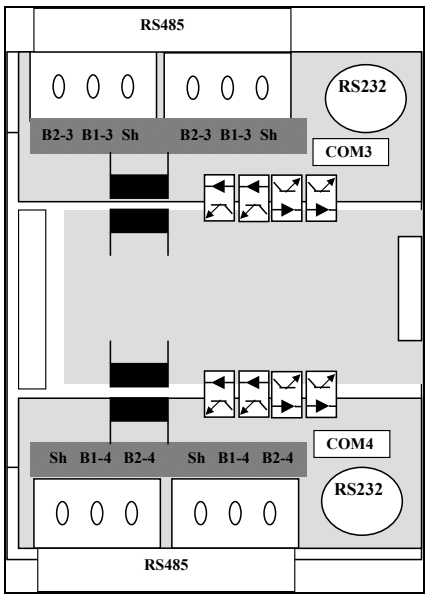
- **RS-232:** 8-pole Mini-DIN plug, for pin assignment see one page before. The available cables 07SK50, 07SK51, 07SK52 and 07SK53 can be used.

- **RS-485:** Connection via two removable 3-pole terminal blocks. At the coupler side, the terminals are circuited in parallel. This enables an easy network cabling. The terminals are suitable for wires up to a cross section of 2.5 mm^2. The recommended tightening torque is 0.5 Nm.

  The MODBUS network is established with shielded and twisted pairs (with a cross section of 0.22 mm^2 per wire, for instance).

  The shield (preferably braided) is connected to earth near the coupler (< 1 m cable length).

2.5.5.5 Electrical isolation



The signals of the interfaces COM3 and COM4 are electrically isolated from each other and also from the internal electronics of the coupler.

2.5.5.6 Software introduction

The intelligent 07KP53 MODBUS coupler, connected to the 40/50 series basic units, provides the two additional communication ports COM3 and COM4, which can be configured in master or slave modes without restriction. It is possible to use them with RS-232 or RS-485 communication interfaces.

The intelligent 07 KP 53 MODBUS coupler can use two different communication systems: synchronous and asynchronous mode. The coupler can use them at the same time, independently of each other.

2.5.5.6.1 Configuration of the communication interfaces

- Factory setting (default)

The interfaces of the 07 KP 53 units have a default MODBUS configuration with the following parameters:

In slave mode, the coupler is able to adjust the speed and the polarity of bus automatically.

	COM3	**COM4**
- Mode	MODBUS slave 99	MODBUS slave 99
- Baud rate	19200 Baud	19200 Baud
- Number of stop bits	1 (receive) 2 (send)	1 (receive) 2 (send)
- Number of databits	8	8
- Parity	none	none

- Parameters of the transmission speed

The following table gives a relationship between the baud rate and the code used for the configuration of the speed of COM3 and COM4.

Baud rate	**Code of the baud rate**	**max. cable length**
2400	2400	1200 m
4800	4800	1200 m
9600	9600	1200 m
19200	19200	1200 m
33600	44	1000 m
38400	38	1000 m
57600	25	800 m
75000	19	800 m
76800	18	800 m
115200	12	600 m

In slave mode, it is not necessary to configure the speed. The speed is automatically detected by the coupler, and when the speed is correctly detected, the value is directly written to the second parameter in configuration table.

In slave mode, it can be of interest to write the value, if it is known, in order to reduce the time of initialization of the network.

2.5.5.6.2 Configuration of coupler operation

The configuration is performed by the MODMASTW function block of the 907 AC 1131 programming system.

Independently of coupler mode (synchronous or asynchronous), it is necessary to configure the communication port for COM3 or COM4.

After that, if the coupler is used in asynchronous mode, it is possible to configure the table of requests by the MODMASTW function block, using the 907 AC 1131 programming software.

The 07 KP 53 possesses a MODBUS address (factory default setting = 1199), that can be changed by writing to the table of configuration. In order to change the configuration of communication ports and configure the table of requests, the program uses the slave MODBUS address corresponding to the port (COM3 = 256 or COM4 = 257).

	COM3	**COM4**
Factory setting (default)	1199	1199
Slave MODBUS address to load the configuration	256	257
Value to cofigure the coupler as MODBUS master	1100	1100
Value to configure the coupler as MODBUS slave No. XX	1100 + XX	1100 + XX

The different tables (configuration and requests) are accessible via the MODBUS addresses described in the following table:

Tables		**MODBUS addresses**	
		decimal	**hexadecimal**
Configuration table of COM3	Begin	30000	7530
Length = 256 words	End	30243	7623
Configuration table of COM4	Begin	30244	7624
Length = 256 words	End	30487	7717
Table of result of requests at COM3	Begin	31000	7918
Length = 244 words	End	31255	7A17
Table of result of requests at COM4	Begin	31256	7A18
Length = 244 words	End	31511	7B17

- Description of the configuration parameters

In the configuration table there are two different areas, one for COM3 and the other for COM4.

A common area is used independently of the communication system (synchronous or asynchronous) in order to configure the communication parameters of COM3 and COM4.

This area contains 4 words, which are used in master mode or in slave mode.

Configuration area for communication interface		Explanation of the parameters
First word	Master / slave	Value = 1100, the coupler is the MODBUS master Value = 1100 +XX, the coupler is the MODBUS slave No. XX
Second word	Baud rate	Value = Code of the baud rate, see table (2 pages before) under "Parameters of the transmission speed" In slave mode, the coupler automatically detects the baud rate.
Third word	RTS delay	Value in ms, gives the delay between the der rising edge of the RTS signal and the transmission of the first character.
Fourth word	Time-out	Value in ms, gives die delay, after which an error is announced by the indicators (LED displays and status word). In master mode: max. delay between master request and slave answer In slave mode: max. delay between the reception of two syntax-correct frames

If the communication system is asynchronous, a further area is used to configure the table of requests. The size of this area depends on the number of requests.

The two interfaces COM3 and COM4 use 60 areas of 4 words each, as follows:

Configuration area for the asynchronous mode		Explanation of the parameters
Fifth word	Request slave No. 1	Slave MODBUS address of the first request
Sixth word	MODBUS function	MODBUS function code of the first request (see 2.5.4 Technical data)
Seventh word	Data address	MODBUS data address of the first slave where data must be written to or read from
Eighth word	Number of data	Number of data of the first request. Requests in word format are limited to 120 words (Read or Write). The highest bit (bit 15) of the word is used to determine if it is necessary to make sure data integrity between the current and the next request. Bit 15 must be 1, if integrity is required.
----	----	----
----	----	----
----	----	----
----	----	----
241st word	Request slave No. 60	Slave MODBUS address of the 60th request
242nd word	MODBUS function	MODBUS function code of the 60th request
243rd word	Data address	MODBUS data address of the 60th slave where data must be written to or read from
244th word	Number of data	Number of data of the 60th request

- Data area and request limits

As seen in the previous paragraph, the internal memory of the coupler (table of configuration of requests) allows to configure a list of 60 requests for each of the communication ports COM3 and COM4. But as for each request the length is limited to 120 words, and the size of result table is max. 256 words for each port, it is possible to determine the two extreme configurations with an equal repartition between the requests:

- 60 requests of 4 words each
- 2 requests of 120 words each

2.5.5.6.3 Area of the status information

- Status of the communication for each request

An area with a length of 4 words is available in master or slave mode to control the correct operation of the requests.

- In master mode, one bit is affected to each request. This bit is set to 1 when the request doesn't receive an answer within the time defined in the word "*Time out*" in the configuration table. The first request sets the least significant bit of the word of the table.

- In slave mode, the least significant bit of the first word indicates that the coupler didn't receive a correct frame within the time defined in the word "*Time out*" in the configuration table. This bit is set to 1 to indicate a network problem.

The different tables of status are accessible via the MODBUS addresses described in the following table:

Tables		**MODBUS addresses**	
		decimal	**hexadecimal**
Counter in ms, which enables to configure the ON time of the LED displays during initialization in order to verify them (multiples of 10 ms).	Begin	30990	790E
Length = 1 word	End	30990	790E
Communication information on COM3, error counter, error type etc.	Begin	30991	790F
Length = 3 words	End	30993	7911
Communication information on COM4, error counter, error type etc.	Begin	30994	7912
Length = 3 words	End	30996	7914
Management of slave failure and initialization commands for COM3 and COM4	Begin	30997	7915
Length = 3 words	End	30999	7917
Status of requests on COM3, 1 bit per request	Begin	32000	7D00
Length = 64 bits	End	32063	7D3F
Status of requests on COM4, 1 bit per request	Begin	32064	7D40
Length = 64 bits	End	32127	7D7F
Informationen on software and hardware versions the coupler	Begin	33000	80E8
Length = 5 words	End	33004	80EC

2.5.5.7 List of cross references for the basic units of the 40/50 series

An exchange of MODBUS data is realized in a table defined by:

- the MODBUS address of the first exchanged variable
- the list size = the total number of variables in the list.

All of the variables of the series 40/50 basic units can, as described in the tables on the following pages, be read or written by the master MODBUS.

- MODBUS addressing method:

VAR 00.00 ⟶ ADDR 0

(VAR = Typ I,O,S,M,IW,OW,MW,KW) (Address of the first selected variable, in decimal)

VAR XX.YY = ADDR 0 + (16 * XX) + YY

(VAR = Typ MD,KD) (Address of the first selected variable, in decimal)

VAR XX.YY = ADDR 0 + (32 * XX) + (2 * YY)

Example: Find the MODBUS address of the variables O62.15 and M232.01 and MD002.07

O 62.15 = 4096 + (16 * 62) + 15 = **5103**
M 232.01 = 8192 + (16 * 232) + 1 = **11905**
MD002.07 = 4000 + (32 * 2) + (2 * 7) = **16462**

Variable type	Variables	MODBUS addresses in hexadecimal	MODBUS addresses in decimal
Digital inputs	I 00.00 I 00.01 ... I 00.15	0000 0001 ... 000F	0000 0001 ... 0015
	I 01.00 ... I 61.15	0010 ... 03DF	0016 ... 0991
	I 62.00 ... I 62.15	03E0 ... 03EF	0992 ... 1007
	I 63.00 ... I 68.15	03F0 ... 044F	1008 ... 1103
Digital outputs	O 00.00 O 00.01 ... O 00.15	1000 1001 ... 100F	4096 4097 ... 4111
	O 01.00 ... O 61.15	1010 ... 13DF	4112 5087
	O 62.00 ... O 62.15	13E0 ... 13EF	5088 ... 5103
	O 63.00 ... O 68.15	13F0 ... 144F	5104 ... 5199
Internal bits	M 000.00 M 000.01 ... M 000.15	2000 2001 ... 200F	8192 8193 ... 8207
	M 001.00 ... M 099.15	2010 ... 263F	8208 ... 9791
	M 230.00 ... M 254.15	2E60 ... 2FEF	11872 ... 12271
	M 255.00 ... M 255.15	2FF0 ... 2FFF	12272 ... 12287
Step chains	S 00.00 S 00.01 ... S 00.15	3000 3001 ... 300F	12288 12289 ... 12303
	S 01.00 ... S125.15	3010 ... 37DF	12304 ... 14303

Variable type	Variables	MODBUS addresses in hexadecimal	MODBUS addresses in decimal
Analog inputs	IW 00.00 IW 00.01 ... IW 00.15	0000 0001 ... 000F	0000 0001 ... 0015
	IW 01.00 ... IW 62.15	0010 ... 03EF	0016 ... 1007
	IW 63.00 ... IW 68.15	03F0 ... 044F	1008 ... 1103
Analog outputs	OW 00.00 OW 00.01 ... OW 00.15	1000 1001 ... 100F	4096 4097 ... 4111
	OW 01.00 ... OW 62.15	1010 ... 13EF	4112 ... 5103
	OW 63.00 ... OW 68.15	13F0 ... 144F	5104 ... 5199
Internal words	MW 000.00 MW 000.01 ... MW 000.15	2000 2001 ... 200F	8192 8193 ... 8207
	MW 001.00 ... MW 099.15	2010 ... 263F	8208 ... 9791
	MW 230.00 ... MW 254.15	2E60 ... 2FEF	11872 ... 12271
	MW 255.00 ... MW 255.15	2FF0 ... 2FFF	12272 ... 12287
Internal double words	MD 00.00 MD 00.01 ... MD 00.15	4000 4002 ... 401E	16384 16386 ... 16414
	MD 01.00 ... MD 07.15	4020 ... 40FE	16416 ... 16638
Indirect word constants	KW 00.00 KW 00.01 ... KW 00.15	3000 3001 ... 300F	12288 12289 ... 12303
	KW 01.00 ... KW 31.15	3010 ... 31FF	12304 ... 12799
Indirect double word constants	KD 00.00 KD 00.01 ... KD 00.15	5000 5002 ... 501E	20480 20482 ... 20510
	KD 01.00 ... KD 07.15	5020 ... 50FE	20512 ... 20734

2.6 Centrally extensible remote units

2.6.1 View of a remote module

For description see next page

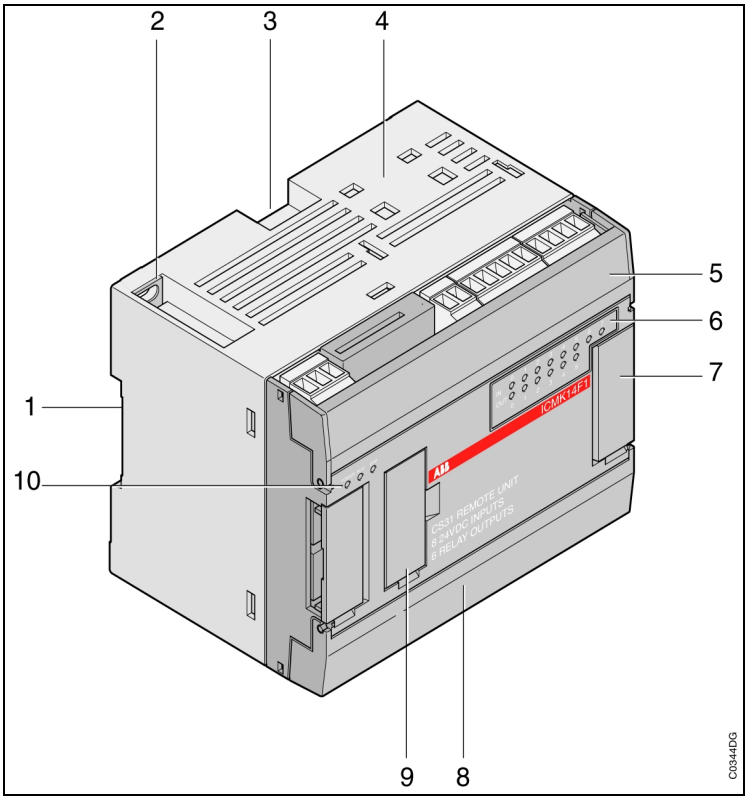


Figure 2-3: View of a centrally extensible remote module

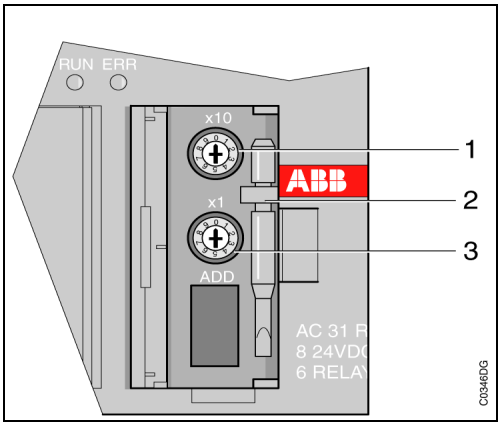


Figure 2-4: Magnification of item 9, cover removed

View of a centrally extensible remote module (description), see also Figure 2-3 on the previous page

1 - Location for DIN rail

2 - Plate fixture with unit earthing, alternatively to 1

3 - Lock for DIN rail mounting

4 - Location for external dual connector

5 - Location of the cable connectors (underneath cover plate):
- of the 24 V d.c. power output for the inputs
  (only available for the remote units with 120 / 230 V a.c. power supply)
- of the inputs

6 - Visualization set (LEDs) for the status of the 8 inputs / 6 outputs

7 - Location of the connectors for the connection of input/output extensions (underneath cover plate)

8 - Location of cable connectors (underneath cover plate):
- for the mains supply
- for the outputs

9 - Location of the addressing rotate selectors (underneath cover plate, see enlargement).

10 - Status visualization area (LEDs):
- POWER: power on
- RUN: always on
- ERR: error(s) present

Magnification of item 9, cover removed (see also Figure 2-4 on the previous page):

1 - Rotary switch to set address: decimal place

2 - Screwdriver for settings adjustments

3 - Rotate switch to set address: unit´s place

2.6.2 Technical specifications of the centrally extensible remote modules

	ICMK 14 F1 24 V DC	ICMK 14 F1 120 / 230 V AC	ICMK 14 N1 24 V DC
- Weight	400 g	800 g	400 g
Power supply			
- Mains voltage:			
Nominal value	24 V DC	120 or 230 V AC	24 V DC
Admissible range	19.2 to 30 V	97.75 to 126.5 V or 195.5 to 253 V	19.2 to 30 V
- Current consumption:			
Unit alone (typical)	80 mA	30 mA	80 mA
Maximum configuration (typical)	400 mA	100 mA	400 mA
- Polarity reversal protection	yes	-	yes
- 24 V d.c. isolated power supply for the inputs:	no	yes	no
Range of voltage value	-	19.2 to 30 V	-
Max. output current	-	400 mA	-
Short circuit protection	-	yes	-
- Dissipation	5 W	10 W	6 W
Incorporated digital inputs			
- Number of inputs	8	8	8
- Isolation of the inputs / electronic (test voltage)	1500 V AC	1500 V AC	1500 V AC
- Input types	PNP and NPN	PNP and NPN	PNP and NPN
- Input voltage:			
Nominal value	24 V DC	24 V DC	24 V DC
Signal at 0 (IEC 1131-2)	0 to + 5 V	0 to + 5 V	0 to + 5 V
Signal at 1 (IEC 1131-2)	+ 15 to + 30 V	+ 15 to + 30 V	+ 15 to + 30 V
- Input current at 24 V d.c.:			
Inputs %IX 10xx.02 (Exx,02) to %IX 10xx.07 (Exx,07)	7 mA	7 mA	7 mA
Inputs %IX 10xx.00 (Exx,00) and %IX 10xx.01 (Exx,01)	9 mA	9 mA	9 mA
- Minimum filtering time	5 ms	5 ms	5 ms
- Cable length:			
unshielded	300 m	300 m	300 m
shielded	500 m	500 m	500 m

	ICMK 14 F1 24 V DC	ICMK 14 F1 120 / 230 V AC	ICMK 14 N1 24 V DC
Incorporated outputs			
- Number of outputs	6 relays	6 relays	6 transistors
- Isolation of the outputs / electronic	1500 V AC 1 min	1500 V AC 1 min	1500 V AC
- Total charging current, under voltage:	.		
with 24 V DC resistive load / inrush current L / R = 20 ms L / R = 30 ms L / R = 40 ms L / R = 60 ms	2 A / 5 A 2 A 1 A 0.6 A 0.35 A	2 A / 5 A 2 A 1 A 0.6 A 0.35 A	1 A for %QX 10xx.00 (A xx,00) and %QX 10xx.01 (A xx,01) and 0.5 A for other outputs
Load current, 24 to 230 V AC	2 A (AC-1) 0.5 A (AC-15)	2 A (AC-1) 0.5 A (AC-15)	
- Total charging current	6 x 2 A	6 x 2 A	4 x 0.5 A + 2 x 1 A
- Output leakage current			< 200 µA
- Minimum cut-off values	10 mA under 12 V DC	10 mA under 12 V DC	12 V
- Breaking power under 120 V AC (contact rating code B300) (UL)	2 A	2 A	
- Breaking power under 250 V AC (contact rating code B300) (UL)	2 A (1.5 A according to UL)	2 A (1.5 A according to UL)	
- Number of common	2 (2+4)	2 (2+4)	
- Commutating frequency :			
for resistive loads	< 1 Hz	< 1 Hz	< 5 kHz
for inductive loads	< 0.2 Hz	< 0.2 Hz	
for lamps	< 0.2 Hz	< 0.2 Hz	
- Number of switches:			
for AC-1	1 million	1 million	-
for AC-15	100 000	100 000	
- Short circuit and overload protection	required externally	required externally	yes: thermal
- Surge voltage protection	required externally	required externally	yes: by transient voltage suppressor
- Outputs diagnosis	-	-	overload and short circuit
- Cable length:			
unshielded	150 m	150 m	150 m
shielded	500 m	500 m	500 m

2.7 Digital central extensions

2.7.1 View of a digital central extension

For description see next page

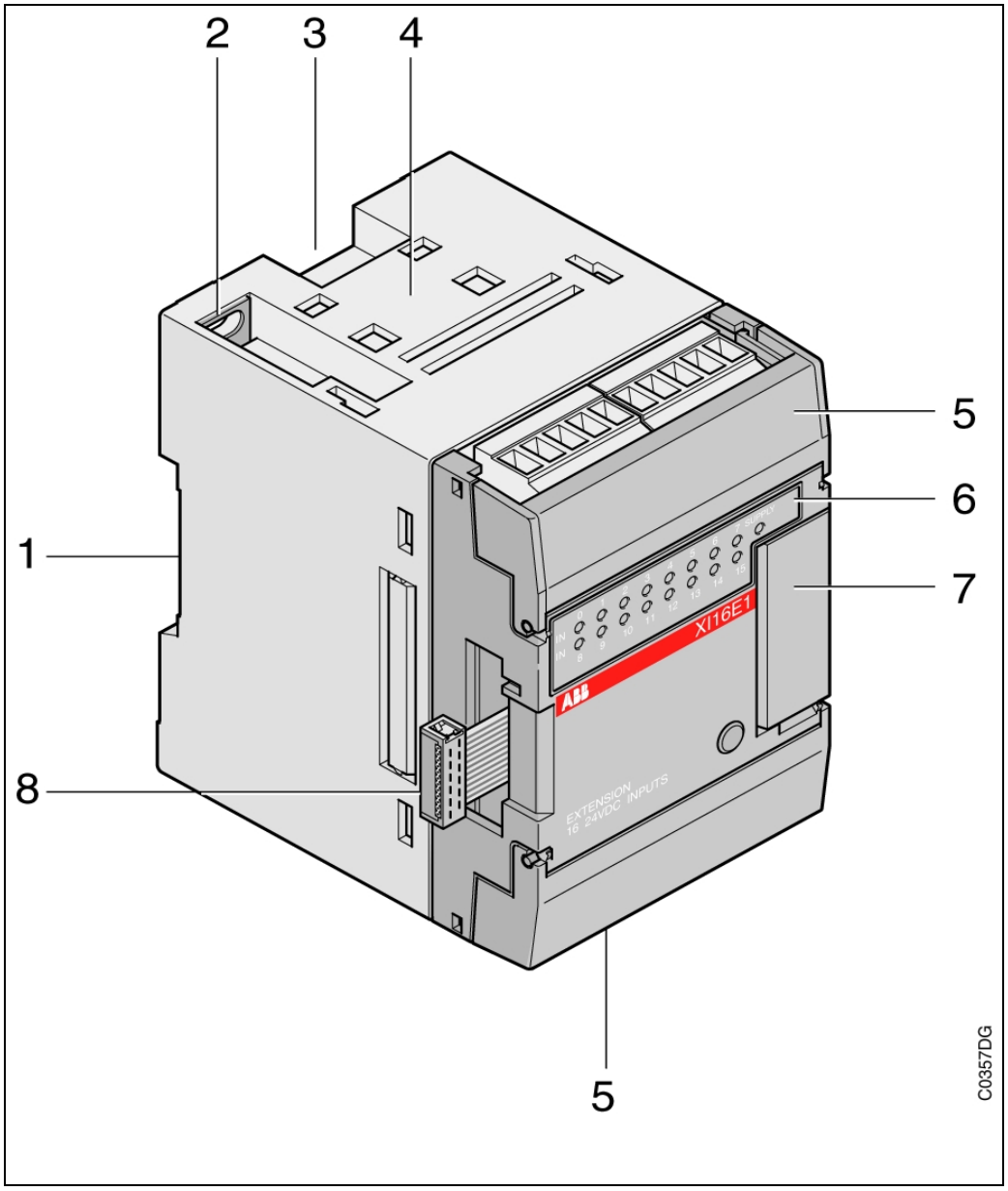


Figure 2-5: View of a digital central extension as an example

Digital central extension (description), see Figure 2-5 on the previous page

1 - Location for DIN rail

2 - Plate fixture with unit earthing, alternatively to 1

3 - Lock for DIN rail mounting

4 - Location for external dual connector

5 - Location of connectors for the input/output cabling (underneath cover plate)

6 - Status visualization area (LEDs) of the inputs/outputs

7 - Connector location for the connection of supplementary input/output extensions (underneath cover plate)

8 - Connector for connection to the basic unit / remote unit or to the last input / output extension connected to the basic/remote unit

2.7.2 Specifications of the digital central extensions

The digital extension modules are powered with 5 V DC by the basic unit or extensible remote unit to which they are connected.

Warning: The extensions must not be connected or disconnected under power!

	XI 16 E1	XO 08 R1	XC 08 L1	XK 08 F1	XO 08 Y1	XO 08R2	XO 16 N1
Weight	220 g	220 g	220 g	220 g	220 g	220 g	220 g
Integrated digital inputs							
- Number of inputs	16	-	8 configurable	4	-	-	-
- Isolation of the inputs	1500 V AC	-	1500 V AC	1500 V AC	-	-	-
- Input type	PNP	-	PNP	PNP/NPN	-	-	-
- Input voltage:							
Nominal value	24 V DC	-	24 V DC	24 V DC	-	-	-
Signal at 0 (IEC 1131-2)	0 bis + 5 V		0 bis + 5 V	0 bis + 5 V			
Signal at 1 (IEC 1131-2)	+ 15 to + 30 V		+ 15 to + 30 V	+ 15 to + 30 V			
- Input current at 24 V DC	4 mA	-	4 mA	7 mA	-	-	-
- Input delay	5 ms	-	5 ms	5 ms	-	-	-
- Cable lengths:							
unshielded	300 m	-	300 m	300 m	-	-	-
shielded	500 m	-	500 m	500 m	-	-	-
Integrated outputs							
- Number of outputs	-	8 relays	8 transistors	4 relays	8 transistors	4 NO[1] + 4 NO/NC[2] relays	16 transistors
- Isolation of the outputs	-	1500 V AC 1 min	1500 V AC 1 min	1500 V AC 1 min	1500 V AC 1 min	1500 V AC 1 min	1500 V AC 1 min
- Total load current at 24 V DC							
resistive load / inrush current	-	2 A / 5 A	0.5 A	2 A / 5 A	2 A	NO[1]: 2A/5A; NO/NC[2]: 3A/7A	0.5 A
L / R = 20 ms		2 A	0.5 A / 0.5 Hz	2 A	2 A / 0.3 Hz	2 A	0.5 A / 0.5 Hz
L / R = 30 ms		1 A	0.5 A / 0.3 Hz	1 A	2 A / 0.2 Hz	1 A	0.5 A / 0.3 Hz
L / R = 40 ms		0.6 A	0.5 A / 0.2 Hz	0.6 A	2 A / 0.15 Hz	0.6 A	0.5 A / 0.2 Hz
L / R = 60 ms		0.35 A	0.5 A / 0.1 Hz	0.35 A	2 A / 0.10 Hz	0.35 A	0.5 A / 0.1 Hz
per output pair					2.5 A		
UL derating					1.5 A		
Load current, 24 to 230 V AC	-	2 A (AC-1) 0.5 A (AC-15	-	2 A (AC-1) 0.5 A (AC-15)	-	NO[1]: 2 A / 0.5 A; NO/NC[2]: 3 A / 0.5 A	-
- Total load current	-	8 x 2 A	8 x 0,5 A	4 x 2 A	10 A	4 x 2 A / 4 x 3 A	16 x 0,5 A
- Output leakage current	-		< 200 µA		< 200 µA		< 200 µA
- Minimum load	-	10 mA at 12 V DC	12 V	10 mA at 12 V DC	7 V	10 mA at 12 V DC	12 V

1) NO = normally open
2) NC = normally closed

	XI 16 E1	XO 08 R1	XC 08 L1	XK 08 F1	XO 08 Y1	XO 08 R2	XO 16 N1
Integrated output (continued)							
- Breaking capacity under 120 V AC (Code B300) (Contact rating UL)	-	2 A		2 A		NO[1] 2A / NO/NC[2] 3A	
- Breaking capacity under 250 V AC (Code B300) (Contact rating UL)	-	2 A (1.5 A according to UL)		2 A (1.5 A according to UL)			
- Number of groups		2 (4+4)		1			
- Switching frequency:	-						
for resistive loads		< 1 Hz	100 Hz	< 1 Hz		< 1 Hz	100 Hz
for inductive loads		< 0.2 Hz		< 0.2 Hz		< 0.2 Hz	
for lamps		< 0.2 Hz		< 0.2 Hz		< 0.2 Hz	
- Max. number of switching cycles:							
for AC-1	-	1 million	-	1 million	-	1 million	-
for AC-15		100 000		100 000		100 000	
- Short-circuit and overload protection	-	required externally	yes: thermal	required externally	yes: thermal	required externally	yes: thermal
- Surge voltage protection	-	required externally	yes: by surge voltage suppressors	required externally	yes: by surge voltage suppressors	required externally	yes: by surge voltage suppressors
- Output diagnosis	-	-	Overload and short-circuit	-	Overload and short-circuit	-	Overload and short-circuit
- Cable lengths:							
unshielded	-	150 m	150 m	150 m	150 m	150 m	150 m
shielded	-	500 m	500 m	500 m	500 m	500 m	500 m

1) NO = normally open
2) NC = normally closed

2.8 Analog central extensions

2.8.1 View of an analog central extension

For description see next page

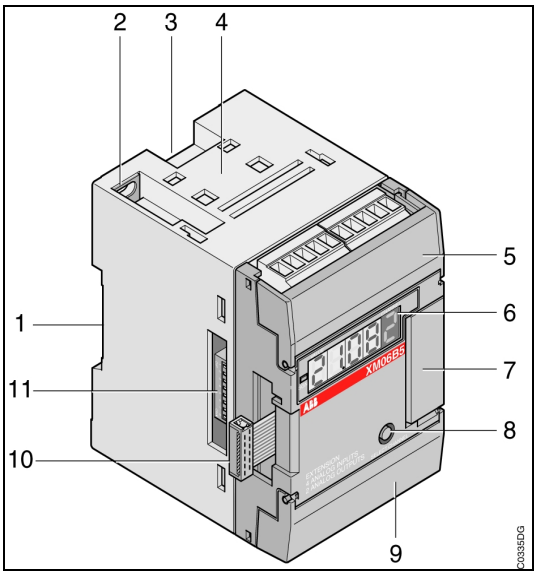


Figure 2-6: Analog extensions XM 06 B5 and XE 08 B5

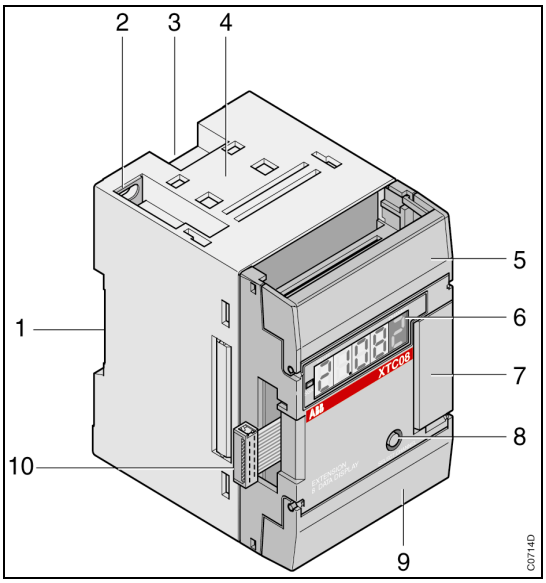


Figure 2-7: Analog display unit XTC 08

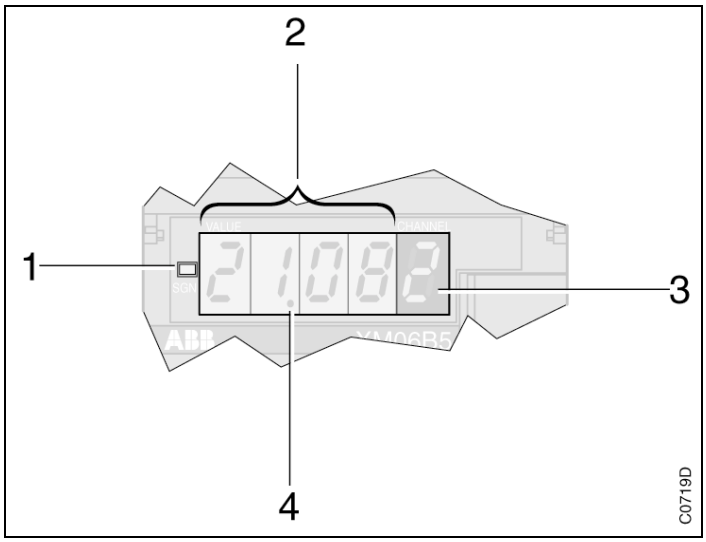


Figure 2-8: Display description

Description of the front panel, see Figures 2-6 and 2-7 on the previous page

1 - Location for the DIN rail

2 - Plate fixture with unit earthing, alternatively to 1

3 - Lock for DIN rail mounting

4 - Location for external dual connector

5 - Location for the input cabling connectors (underneath cover plate)

6 - Visualization of the channel number and the associated analog value with its sign

7 - Location of:
- The connector for the supplementary input/output extensions
- The push button used for the configuration

8 - push button to select the visualized channel

9 - Location of the connectors for the output cabling (underneath cover plate)

10 - Connector for connection to the basic unit / remote unit or to the last input / output extension connected to the basic unit / remote unit

11 - Switches to configure the channels as current, voltage or Pt 100 / Pt 1000 / NI1000 / Balco500

Description of the analog display, see Figure 2-8 on the previous page

1 - Sign of the value (LED permanent on in case of negative value)

2 - Value of the selected channel

3 - Channel identification

4 - Decimal point of the value (it can be programmed by the function block CONFIO)

2.8.2 Technical specifications of the central analog extensions

The analog extensions are powered with 5 V and 24 V DC by the basic unit or extensible remote unit to which they are connected.

The analog value with a customized format of each channel is displayed on a 4 digit display.

The channel number is selected by the push button on the front side.

Warning: The extensions must not be connected or disconnected under power supply.

Warning: In the configuration current 4–20 mA, the sensor should be able to provide 20 mA with min 10 V DC. Moreover, the input is not protected against voltage > 10 V DC and can give an error or destroy the input.

	XM 06 B5	**XE 08 B5**	**XTC 08**
- Number of analog inputs	4	8	-
- Number of analog outputs	2	-	-
- Number of displayed internal values		-	8
- Display range	± 9999	± 9999	± 9999
- Filtering of 50 / 60 Hz	yes	yes	
- Transfer time of the analog I/O	120 ms */ 50 ms	220 ms *	
- Maxi. power dissipation	3 W	3 W	
- Weight	200 g	200 g	150 g

	XM 06 B5 and XE 08 B5					
Analog inputs	**Voltage**	**Current**	**Pt 100**	**Pt 1000**	**NI 1000**	**Balco500**
- Nominal range:	± 10 V	0…20 mA	- 200 °C	- 200 °C	- 50 °C	- 30 °C
		4…20 mA	+ 450 °C	+ 450 °C	+ 170 °C	+ 120 °C
- Maximum values	± 30 V	± 25 mA				
- Isolation of inputs	500 V	500 V	500 V	500 V	500 V	500 V
- Resolution	12 bits + sign	12 bits				
- Min. resolution at input (± 1LSB)	± 2.5 mV	± 5 µA	± 0.1 °C	± 0.1 °C	± 0.1 °C	± 0.1 °C
- Full-scale precision	≤± 0.7 %	≤± 0.8 %	≤± 1.5 °C	≤± 1.5 °C	≤± 1.5 °C	≤± 1.5 °C
- Word value range red by the basic unit	± 32767	0…32767	-2000/+4500	-2000/+4500	-500/+1700	-300/+1200
- Amplification error between two channels	70 dB	70 dB	70 dB	70 dB	70 dB	70 dB
- Input impedance	100 kΩ	100 Ω	100 kΩ	100 kΩ	100 kΩ	100 kΩ
- Linearization for Pt100 / Pt1000 / Ni1000 / Balco 500	yes	yes	yes	yes	yes	yes
- Power dissipation in the sensor 0 °C 450 °C			 0.625 mW 1.6 mW	 0.0625 mW 0.16 mW	 0.0625 mW 0.12 mW	 0.028 mW 0.045 mW
- Standard filtering time *) for all channels	120 ms *)	120 ms *)	220 ms *)	220 ms *)	220 ms *)	220 ms *)
- Diagnosis	none	none	none	none	none	none
- Cable lengths:	50 m	50 m	50 m	50 m	50 m	50 m
shielded short-circuit unused channels?	yes yes	yes yes	yes yes	yes yes	yes yes	yes yes

***)** in case of configuration "FAST": in case of 50 or 60 Hz: additional 5 s

	XM 06 B5	
Analog outputs	**Voltage**	**Current**
- Nominal range	± 10 V	0…20 mA 4…20 mA
- Max. current	2 mA	20 mA
- Isolated outputs	500 V	500 V
- Resolution	11 bits + sign	12 bits
- Min. output resolution (± 1 LSB)	± 5 mV	± 5 µA
- Word value range	± 32767	0…32767
- Error related to full scale	1.2 %	1.3 %
- Acquisition delay	50 ms	50ms
- Max. output load		400 Ω
- Diagnosis	none	none
- Cable length:	50 m	50 m
shielded	yes	yes

- Permissible total voltage drop at the sensors and lines circuited in series = Max 8 V

- Configuration:	Voltage	Current
- With push-button	yes	yes
- With function blocks	yes	yes

For further information on configuration refer to volume 2 - System Technology, Chapter 1.6 - I/O configuration.

The analog configuration through the basic units (functions blocks CONFIO1, CONFIO4, CONFIO8) is available from the following versions on:

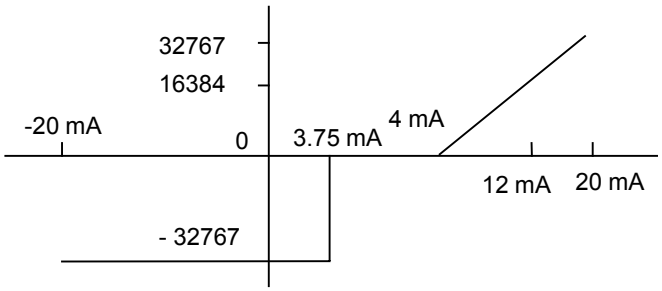
Product	**Version**
07 KR 51	H15
07 KT 51	G15
07 CR 41	E14
07 CT 41	D14
ICMK 14 F1	F14
ICMK 14 N1	D14

Die functionality Ni 1000, Balco 500 are available from the following versions on:

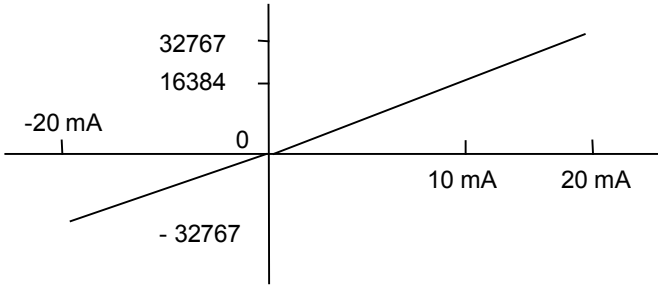
Product	Version
XM 06 B5	F9
XE 08 B5	C3

2.8.3 Analog input diagrams

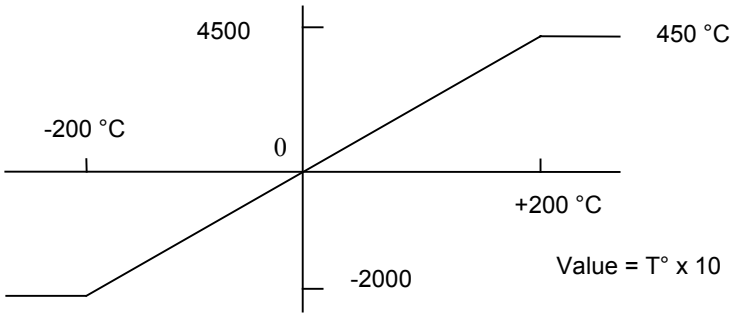
Current 4-20 mA:



Current 0-20 mA:



Pt100/Pt1000:



Voltage input ± 10 V:

1 LSB = 10 / 2^{12} = 2.44 mV — with minimum value (step 8)

V (in Volts) = Value • (10 / 32767) — with value (- 32767 ≤ X ≤ + 32767)

Current input 0-20 mA:

1 LSB = 20 • 10^{-3} / 2^{12} = 4.88 µA — with minimum (step 8)

I (in mA) = Value • (20 • 10^{-3} / 32767) — with value (0 ≤ X ≤ + 32767)

Current input 4-20 mA:

Same resolution as with 0-20 mA

I (in mA) = Value • (16 / 32767) + 4 — with value (0 ≤ X ≤ + 32767)

Ni1000:

Warning: There are several Ni1000 sensors with different characteristics. Compare the table below:

T (°Celsius)	R (Ohms)
- 50	790.0
- 48	798.8
- 46	806.8
- 44	814.7
- 42	822.8
- 40	830.8
- 38	838.9
- 36	847.1
- 34	855.2
- 32	863.4
- 30	871.7
- 28	880.0
- 26	888.3
- 24	896.7
- 22	905.0
- 20	913.5
- 18	922.0
- 16	930.5
- 14	939.0
- 12	947.6
- 10	956.2
- 8	964.9
- 6	973.6
- 4	982.4
- 2	991.2
- 1	995.6
0	1000.0
1	1004.4
2	1008.9
4	1017.8
6	1026.7
8	1035.7
10	1044.8
12	1053.9
14	1063.0
16	1072.2
18	1081.4
20	1090.7

T (°Celsius)	R (Ohms)
22	1100.0
24	1109.3
26	1118.7
28	1128.1
30	1137.6
32	1147.1
34	1156.7
36	1166.3
38	1176.0
40	1185.7
42	1195.5
44	1205.3
46	1215.1
48	1225.0
50	1235.0
52	1245.0
54	1255.0
56	1265.1
58	1275.3
60	1285.4
62	1295.7
64	1306.0
66	1316.3
68	1326.7
70	1337.1
72	1347.6
74	1358.2
76	1368.8
78	1379.4
80	1390.1
82	1400.9
84	1411.7
86	1422.5
88	1433.4
90	1444.4
92	1455.4
94	1466.5
96	1477.6

T (°Celsius)	R (Ohms)
98	1488.8
100	1500.0
102	1511.3
104	1522.6
106	1534.0
108	1545.5
110	1557.0
112	1568.5
114	1580.2
116	1591.8
118	1603.6
120	1615.4
122	1627.2
124	1639.1
126	1651.1
128	1663.1
130	1675.2
132	1687.3
134	1699.5
136	1711.8
138	1724.1
140	1736.5
142	1748.9
144	1761.4
146	1774.0
148	1786.6
150	1799.3
152	1812.0
154	1824.8
156	1837.7
158	1850.6
160	1863.6
162	1876.7
164	1889.8
166	1902.9
168	1916.2
170	1929.5

Balco 500:

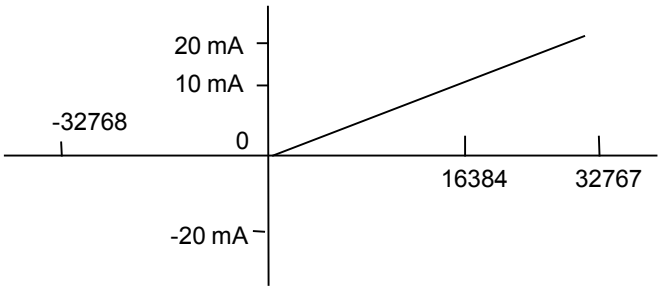
T (°Celsius)	R (Ohms)
- 30	397.05
- 28	400.65
- 26	404.27
- 24	407.91
- 22	411.57
- 20	415.25
- 18	418.95
- 16	422.68
- 14	426.42
- 12	430.18
- 10	433.96
- 8	437.77
- 6	441.59
- 4	445.43
- 2	449.30
- 1	451.24
0	453.18
1	455.13
2	457.09
4	461.01
6	464.96
8	468.92
10	472.91
12	476.92
14	480.94
16	484.99
18	489.06
20	493.15

T (°Celsius)	R (Ohms)
22	497.25
23.33	500.00
24	503.45
26	505.53
28	509.70
30	513.89
32	518.10
34	522.33
36	526.58
38	530.85
40	535.14
42	539.45
44	543.78
46	548.14
48	552.51
50	556.90
52	561.31
54	565.75
56	570.20
58	572.87
60	579.17
62	583.68
64	588.22
66	592.77
68	597.35
70	601.94
72	606.56
74	611.20

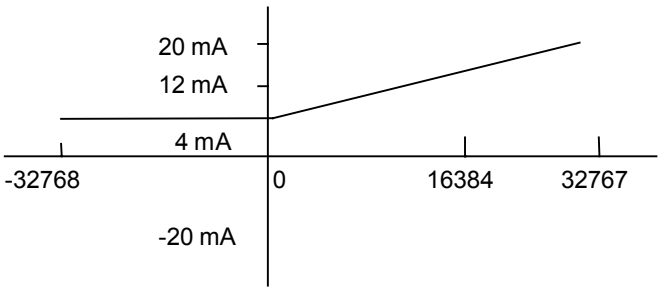
T (°Celsius)	R (Ohms)
76	615.85
78	620.53
80	625.23
82	629.95
84	634.68
86	638.44
88	644.22
90	649.02
92	653.84
94	658.66
96	663.54
98	668.42
100	673.32
102	678.24
104	683.18
106	688.14
108	692.12
110	698.13
112	703.16
114	708.19
116	713.25
118	718.34
120	723.44

2.8.4 Analog output diagrams

Current 0-20 mA:



Current 4-20 mA:



Voltage output ± 10 V:

1 LSB = 10 / 2^{11} = 4.88 mV — with minimum value (step 8)

V (in Volts) = Value • (10 / 32767) — with value (- 32767 ≤ X ≤ + 32767)

Current output 0-20 mA:

1 LSB = 20 • 10^{-3} / 2^{12} = 4.88 µA — with minimum value (step 8)

I (in mA) = Value • (20 • 10^{-3} / 32767) — with value (0 ≤ X ≤ - 32767)

Current output 4-20 mA:

Same resolution as with 0-20 mA

I (in mA) = Value • (16 / 32767) + 4 — with value (0 ≤ X ≤ - 32767)

2.8.5 Hardware configuration

For further information on hardware configuration see Volume 16 - System technology

2.9 Accessories

2.9.1 Programming cables 07 SK 50 and 07 SK 52

These cables allow you to connect the 40/50 series basic units to a PC for programming and testing.

The cables are shielded and 2 m in length.

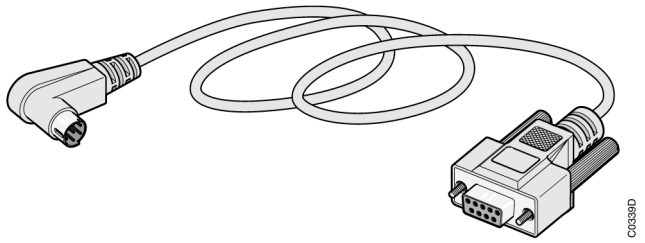
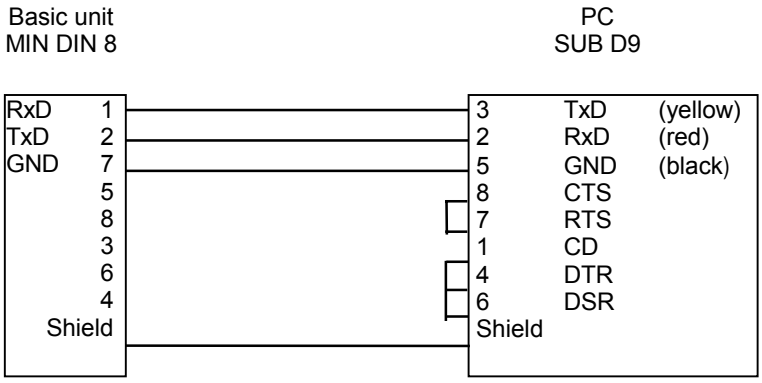


Figure 2-9: Programming cable 07 SK 50 (gray)

07 SK 50 connection diagram:



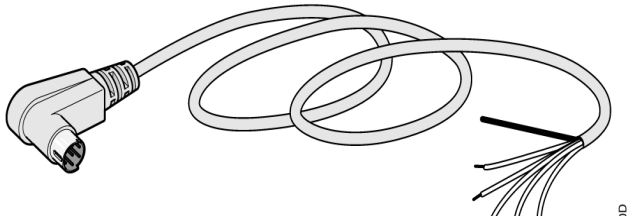
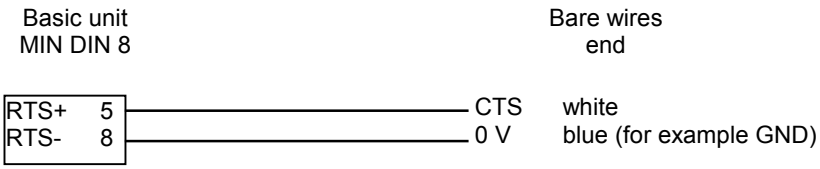


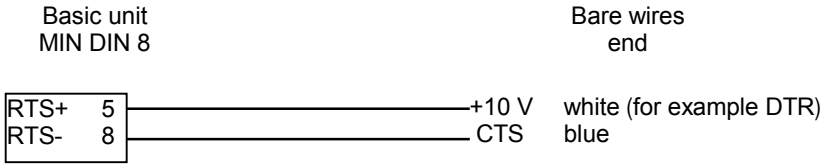
Figure 2-10: Programming cable 07 SK 52 (gray)

07 SK 52 connection diagram:

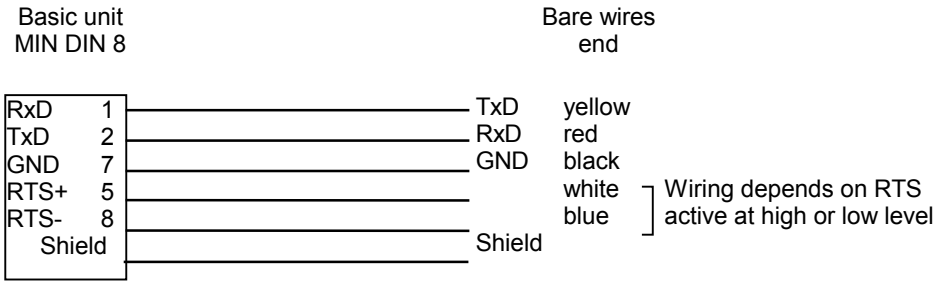
- **Diagram of the RTS signal cabling:**
  - **with RTS active at low level:**



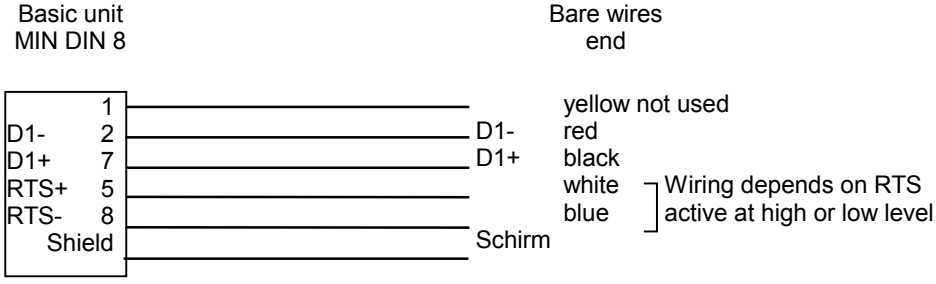
  - **with RTS active at high level:**



- **Using the cable for RS-232:**



- **Using the cable for RS-485:**



Note: In contrast with the ASCII/MODBUS communication cables, this programming cable is gray.

2.9.2 ASCII/MODBUS communication cables 07 SK 51 and 07 SK 53

These cables allow you to connect the 40/50 series basic units to other devices for ASCII or MODBUS communication.

The cables are shielded and 2 m in length.

Figure 2-11: Communication cable 07 SK 51 (black)

07 SK 51 connection diagram:

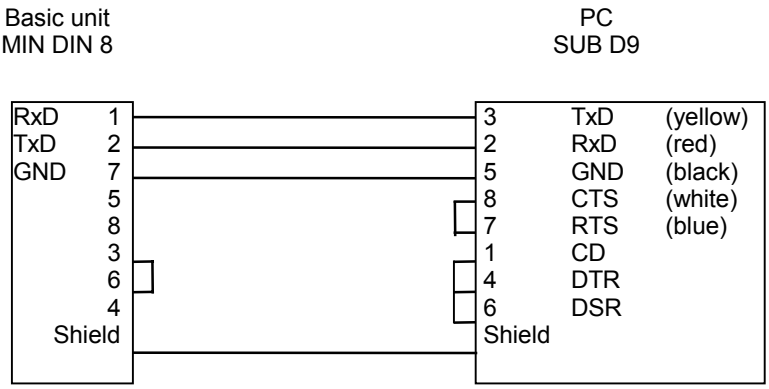
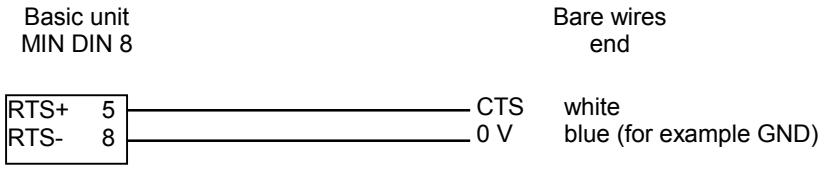


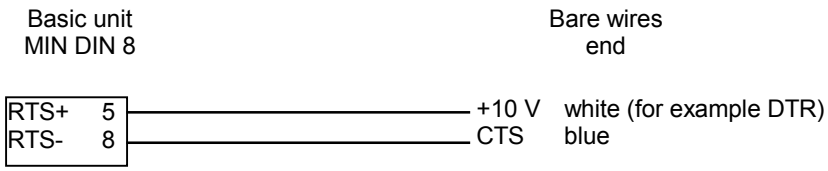
Figure 2-12: Communication cable 07 SK 53 (black)

07 SK 53 connection diagram:

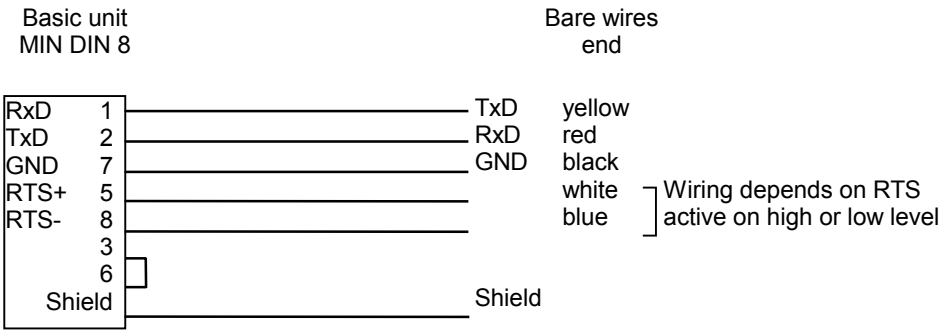
- **Wiring diagram for the RTS signal:**
  - **with RTS active at low level:**



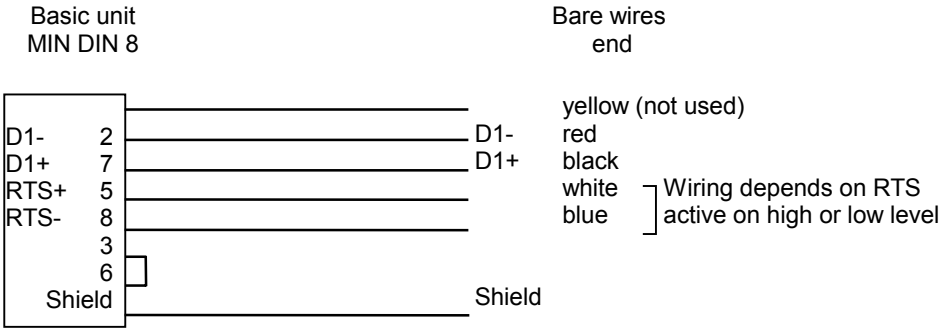
  - **with RTS active at high level:**



- **Using the cable for RS-232**



- **Using the cable for RS-485**



Note: In contrast with the programming cables, this ASCII/MODBUS cable is black.

2.9.3 TC 50 display cables: 07 SK 54 and 07 SK 55

Refer to the TC 50 documentation (provided with the TC 50 display unit)

2.9.4 Connectors

There are two other types of connectors available in addition to the removable connectors supplied. They enable a simplified installation, where applicable (see the following figures).

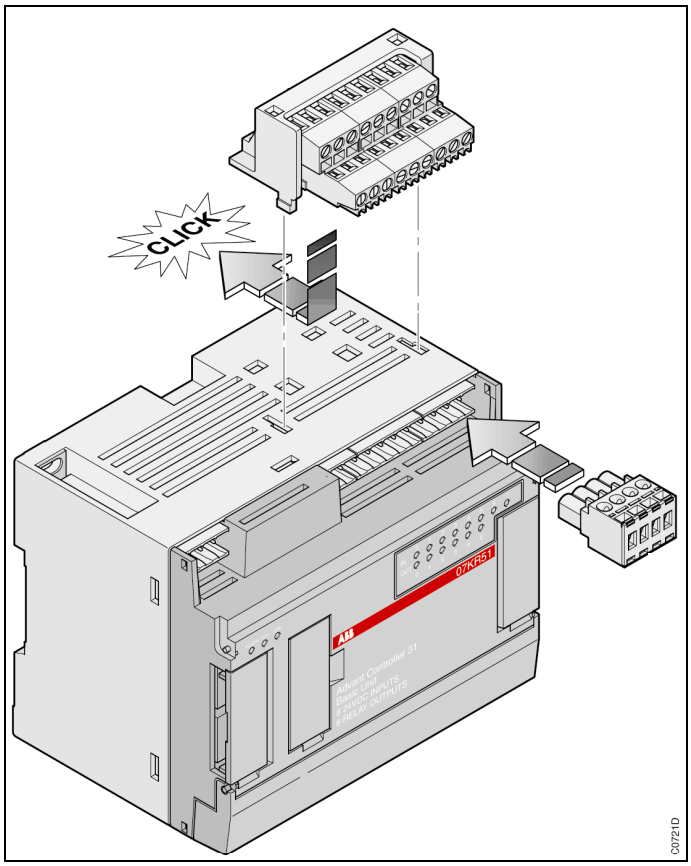


Figure 2-13: External dual connectors (07 ST 50)

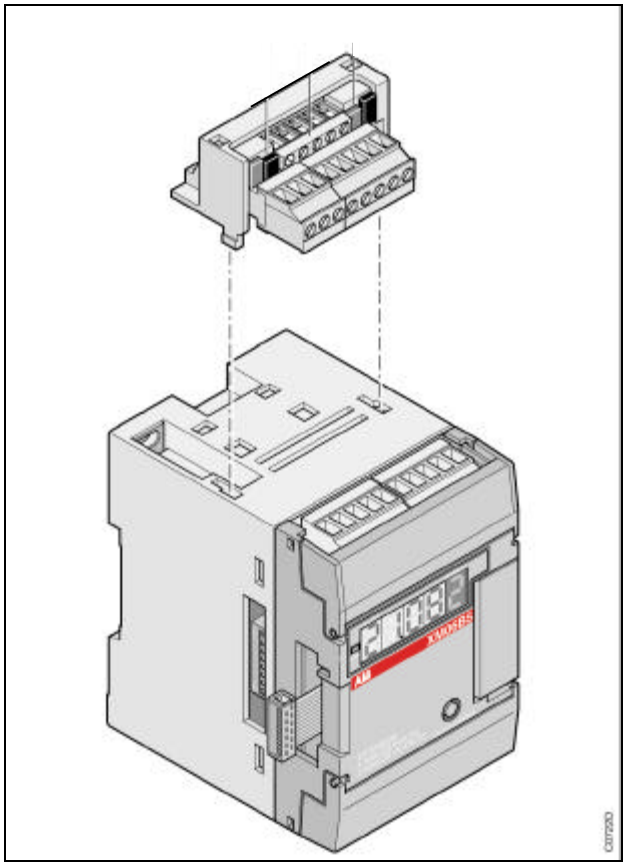


Figure 2-14: External dual connectors (07 ST 51)

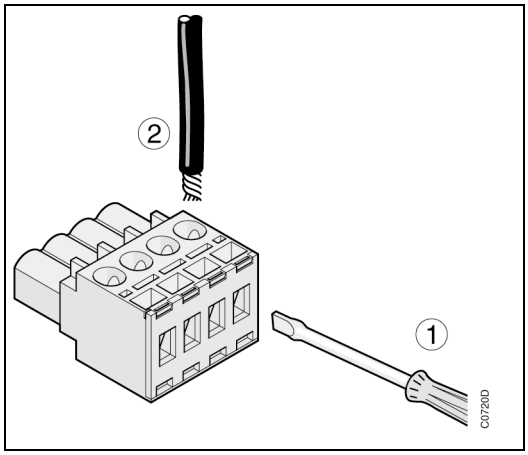


Figure 2-15: "Cage-clamp" type connectors

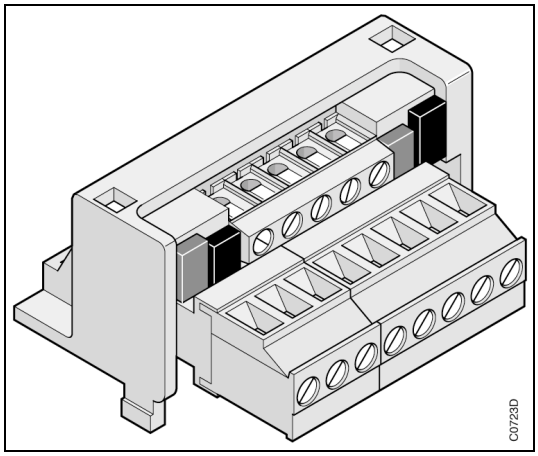


Figure 2-16: External dual connectors (07 ST 51)

External dual connector (three wire terminal): 07 ST 50

This connector is used to connect sensors or three-wire **digital** actuators to the 40 and 50 series products.

All the terminal blocks of the same level are electrically connected.

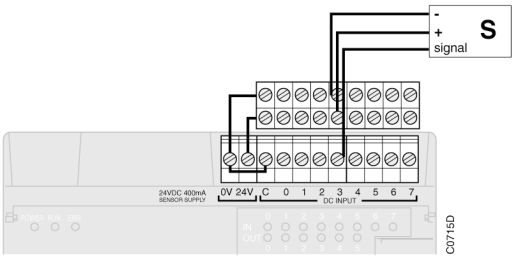


Figure 2-17: Connection of a sensor via an 07 ST 50 connector to a basic unit with 230 V AC power supply

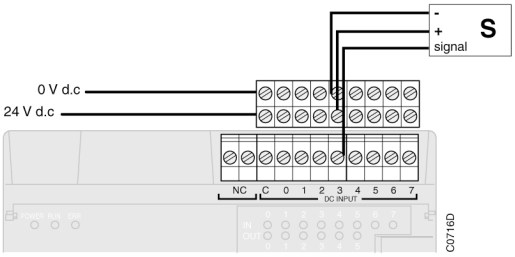


Figure 2-18: Connection of a sensor via an 07 ST 50 connector to a basic unit with 24 V DC power supply

"Cage-clamp" type connectors

The "cage-clamp" type connectors enable rapid cabling of all of the 40 and 50 series products.

All that is required is:

- to press with a screwdriver (see Figure 3-15)
- and insert the bare wire.

The wire should have the following specifications:

- rigid or multi-conductor wire AWG 28 (0.08 mm²) to AWG 12 (3.1 mm²)
- wire bared for a length of 8 to 9 mm

The following connector kits are available:

07 ST 52	"Cage-clamp" type connectors for digital channels. 2 units
07 ST 54	A set of "cage-clamp" type connectors for basic units or remote units
07 ST 55	A set of "cage-clamp" type connectors for XI 16 E1, XO 16 N1, XE 08 B5 extensions
07 ST 56	A set of "cage-clamp" type connectors for XO 08 R1, XC 08 L1, XK 08 F1 extensions
07 ST 57	A set of "cage-clamp" type connectors for XM 06 B5 extension

External dual connector: 07 ST 51

This is a dual connector which enables an easy connection of **analog** sensors to the 40 and 50 series products (XM 06 B5 or XE 08 B5), some other functions are also added with this connector:

Possibility to change a sensor without fall-out the other sensors

Additional protection against short-circuit in case of 4- 20 mA

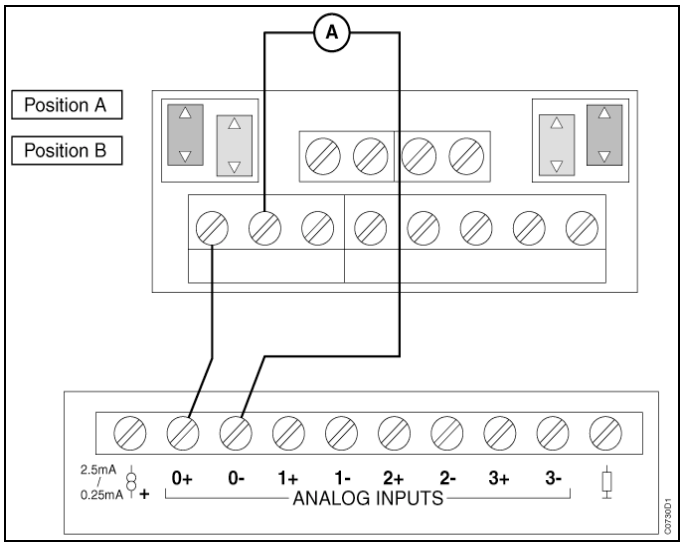


Figure 2-19: Cabling current protection for 4–20 mA with 07 ST 51 / XM 06 B5 or XE 08 B5

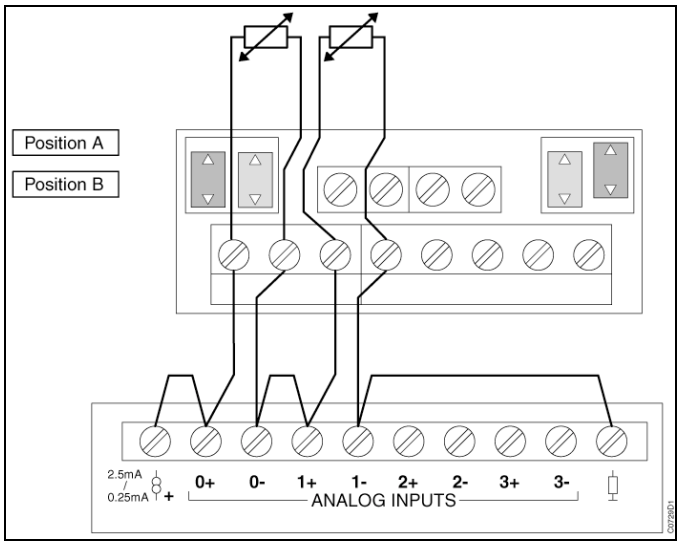


Figure 2-20: Cabling Pt100/Pt1000 with 07 ST 51 and 2-wire probe

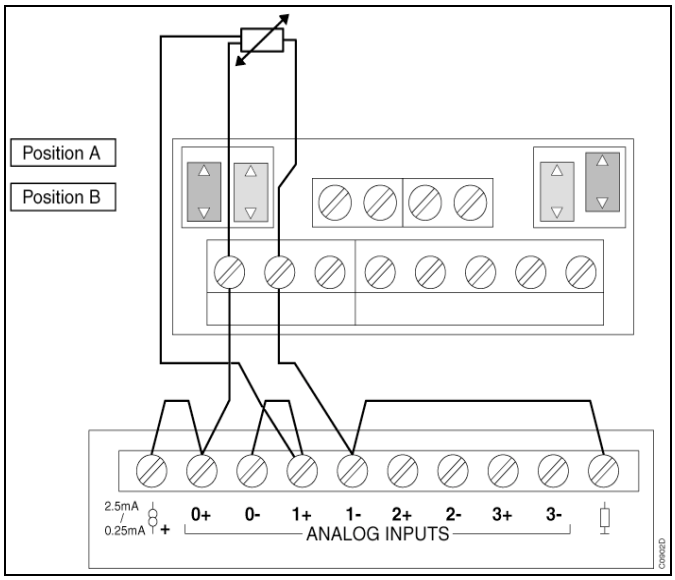


Figure 2-21: Cabling Pt100/Pt1000 with 07 ST 51 and 3-wire probe

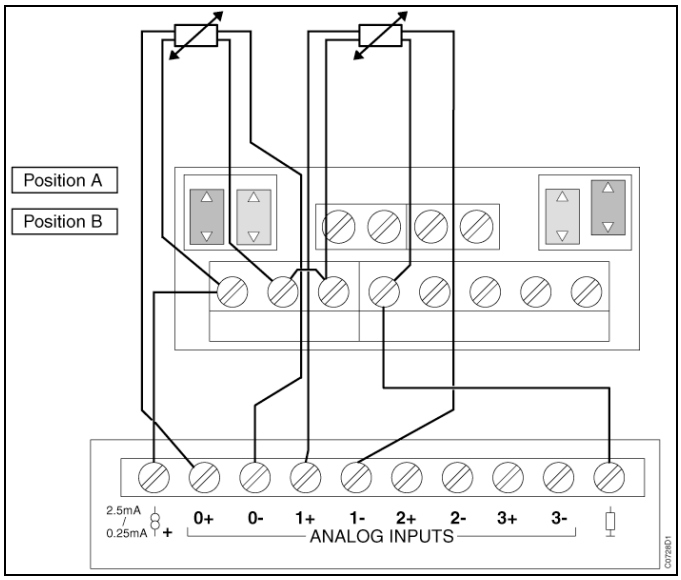


Figure 2-22: Cabling Pt100/Pt1000 with 07 ST 51 and 4-wire probe

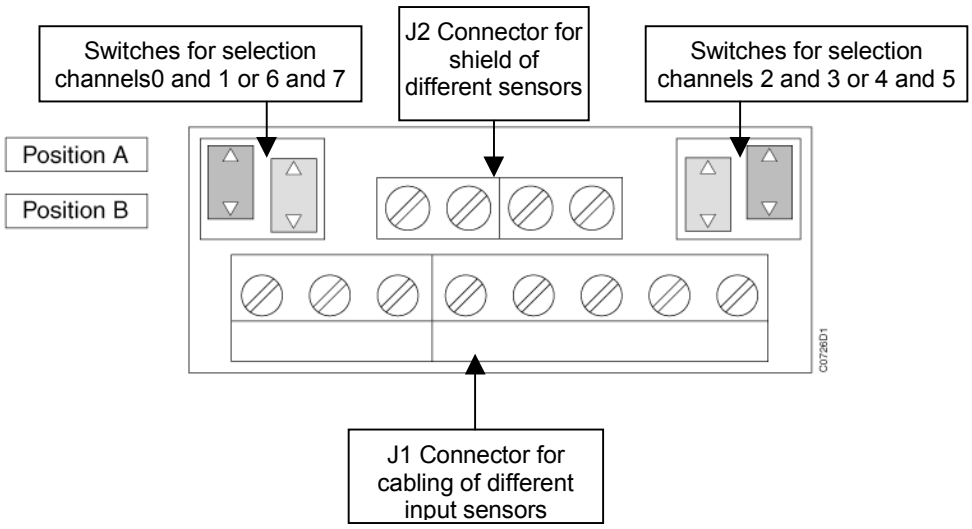


Figure 2-23: Connectors and switches

The switches on the 07 ST 51 are used to select the configuration of channels, one switch for one channel. Two possibilities of configuration, current protection or cabling Pt100/Pt1000.

Position A : Configuration current protection for 4 - 20 mA

Position B : Configuration for Pt100 / Pt1000

The 07 ST 51 includes two connectors, J1 connector is used to cabling the different input sensors, and J2 connector may be used to connect the shielding of the different analog cables.

Warning: In the configuration current 4 – 20 mA, the sensor should be able to provide 20 mA with min 10 V d.c. Moreover, the input is not protected against voltage > 10 V DC An error can occur or the input can be destroyed.

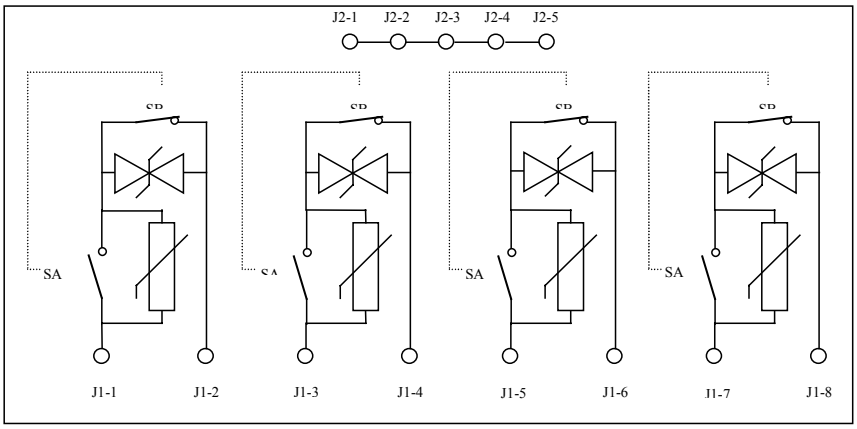


Figure 2-24: Circuit diagram of 07 ST 51

2.9.5 Labels

This labels are used to label the I/O channels.

2.10 TC 50 display unit

The TC50 is used to display and input data, to show status messages (for instance, dynamic tests) or alarm messages in machines or plant controlled by basic unit.

The TC50 communicates directly with the basic unit with MODBUS® protocol without requiring any additional hardware.

The TC50 is programmed using a configuration software TCWIN operating in Windows 95, 98, NT environment on a Computer.

The TC50 is available in two different versions:

TC50 with RS-232 interface, Order No.:	1SBP260150R1001
TC50-2 with RS-485 interface, Order No.:	1SBP260150R1001

TC50 technical documentation, Order No.:	1SBC005499R1001
TCWIN software documentation, Order No.:	1SBC004999R1001

2.11 Dimensions (in mm)

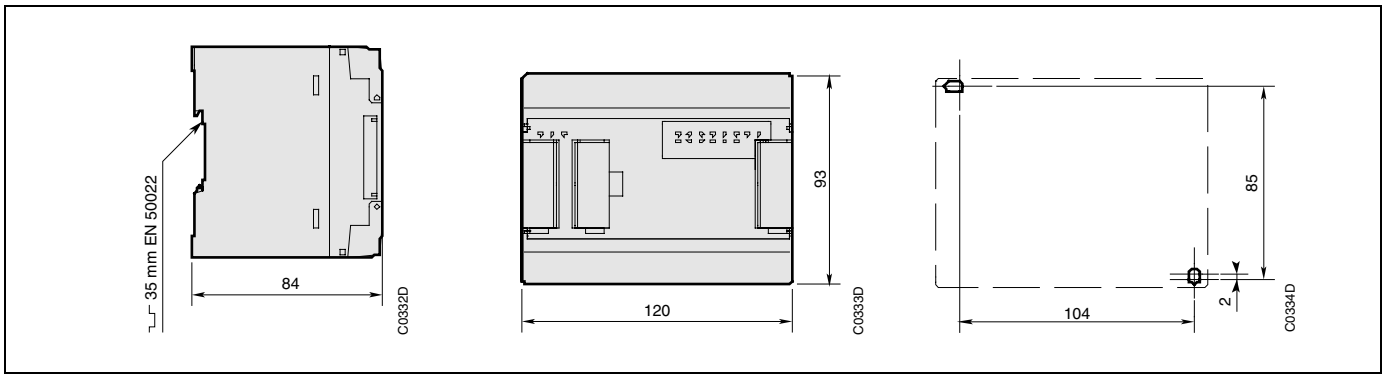


Figure 2-25: Basic unit and remote module

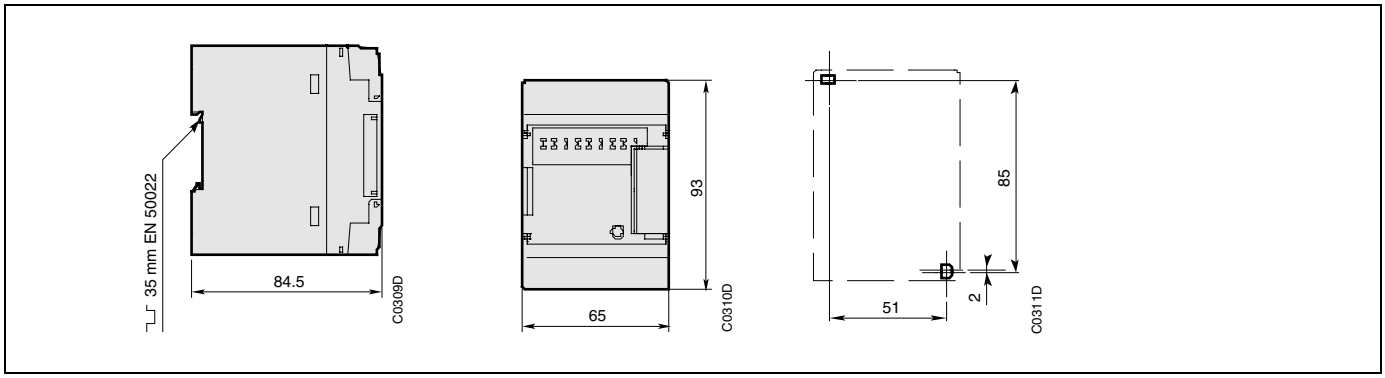


Figure 2-26: Central extension module

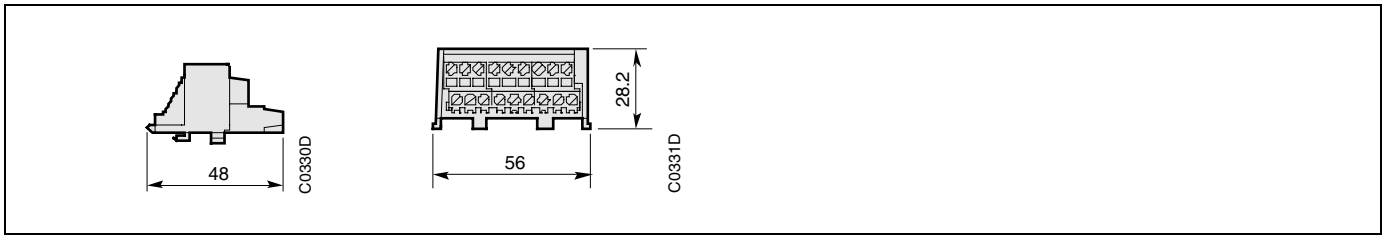


Figure 2-27: Dual connector

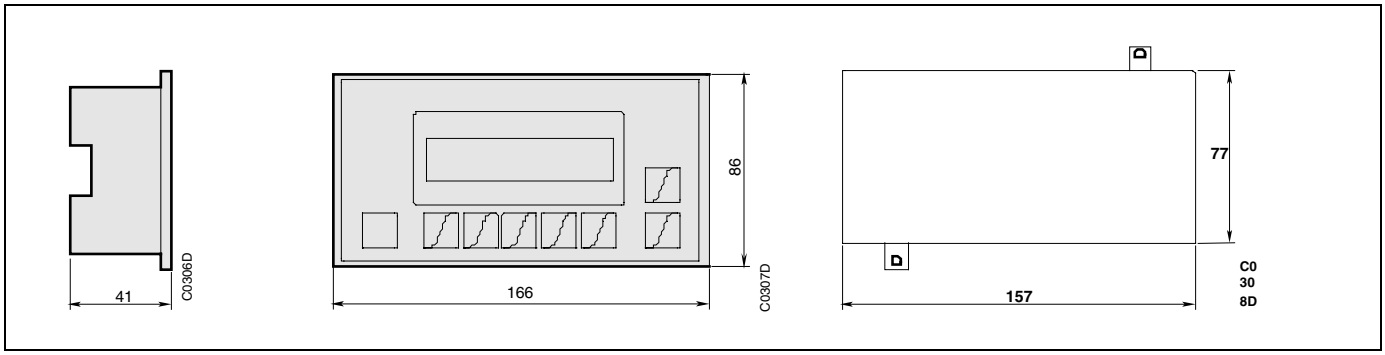


Figure 2-28: Display unit

3 Installation

This chapter contains detailed information on the cabling of the individual products.

3.1 Implementation of an AC31 system

The AC31 product range has been conceived for operation in extreme industrial environments. The correct operation of these products is only ensured if a certain number of rules are adhered to. These rules concern the assembly conditions, the input / output cabling principle, the earthing, the connection of the CS31 system bus and the different types of power supply.

3.1.1 Assembly conditions

The products of the AC31 range may be mounted on two types of fixation. They may be installed vertically or horizontally. (Vertical mounting is possible with restrictions, e.g. by reducing the load, refer also to page 3-1):

- either on a DIN rail (35 mm) by using the support lock.
- or by two screws (4 mm diameter, M4), the fixing holes placed at the base of the units enabling plate mounting.

For a cabinet assembly:

Operating temperature from 0 to 55°C, sufficient free volume around the units is required to allow the heat to dissipate correctly. It is recommended that the cabinet be fitted with a ventilation system.

Warning: Avoid placing heat generating devices next to the products (transformers, mains, power contactors, ...).

All electrical connections are effectuated through removable terminal blocks with an acceptable wire section equal to 2.5 $mm^{2.}$

The tightening torque, for reference, is equal to 0.5 Nm.

3.1.2 Input/output cabling

Use rigid wires or multi-conductor wires AWG 18 (0.96 mm^2) to AWG 14 (1.95 mm^2) for the inputs and rigid wires or multi-conductor wires AWG 14 (1.95 mm^2) for the outputs.

Certain precautions should be taken to reduce installation disturbances from the surroundings. E.g. the cables carrying low voltage signals should not be placed in the same sleeve as the power cables.

One must distinguish between two types of signals:

- 230 V AC power supply
- analog signals (use shielded cables) and low voltage (24 V DC).

3.1.3 Earthing

3.1.3.1 Basic earthing principles

Use rigid wires or multi-conductor wires AWG 14 (1.95 mm^2) or bigger diameter.

The earth and mains wires should be connected in star.

All AC31 components of a cabinet should be connected to the same earth.

When the remote units are situated outside the cabinet they should be connected to the nearest earth.

The 40 and 50 series basic units are fitted with an earth plate with the DIN rail mounting system. Also, if the basic unit is screwed directly to a metal plate, the screw located at the top left of the basic unit (as seen from the front) ensures an electrical connection to the earth via the earth plate.

This earthing ensures protection against electromagnetic disturbances.

The safety earthing cable (on terminal block) should be connected to the cabinet chassis.

3.1.3.2 Earthing principles for several cabinets

When the cabinets are close to each other the different earths should be connected together using a cable with a cross section of at least 16 mm² (see Figure 3- on page 4-3).

The noise generating devices (actuators, motors, etc.) should not be earthed in-between two cabinets. The earthing should be done near to the element causing the most disturbance (see Figure 3-2).

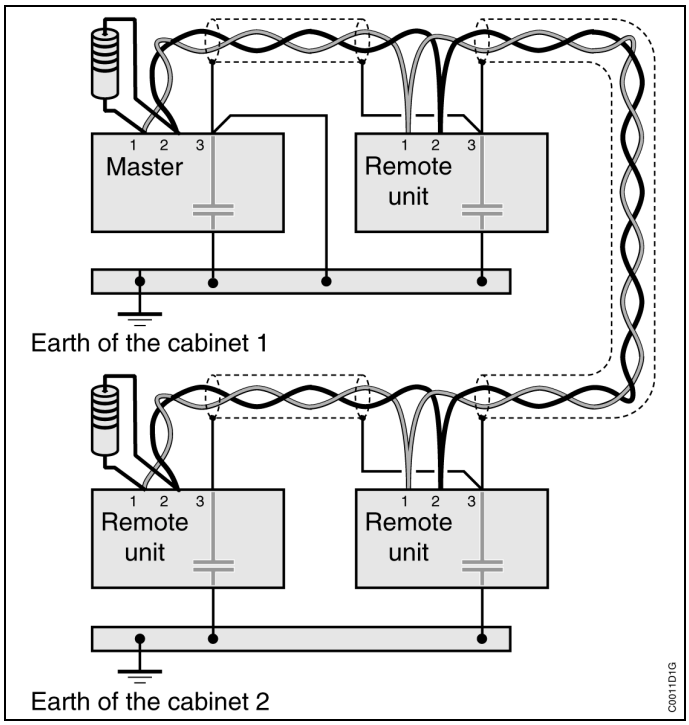


Figure 3-1 : Earthing principle for several cabinets

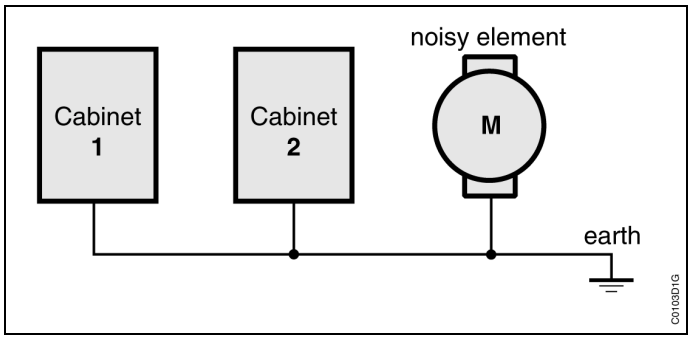


Figure 3-2 : Recommended connection with noise-generating devices

3.1.4 Cabling of the CS31 system bus

The CS31 system bus is a RS-485 serial interface and consists of a shielded twisted pair. This bus is a master/slave bus and only accepts a single master.

Use a AWG 24 (0.22 mm^2) to AWG 18 (0.18 mm^2) twisted pair.

The maximum length is 500 m.

The same cable type should be used for the whole system bus setup.

Bus interruptions should be avoided, during cabinet cable connections for instance, otherwise it should be cabled to the same side of the terminal block (see Figure 3-3 and Figure 3-4).

Warning: STAR connection of the system bus is not permitted!

(see 3-5 and 3-6).

The basic and remote units may be connected at any point of the system bus:

- bus 1 on bus 1
- bus 2 on bus 2
- shielding (preferably braided) on terminal 3 of terminal block 1 and earth connected at the master level (cable < 0.1 m)

The system bus should be terminated with a 120 Ω 1/4 W resistor connected to the bus ends. The twisted pair should be symmetrical (see 3-7 and 3-8).

Connecting the system bus shielding to the earth is recommended, with the intercalation of a 1 nF class Y condenser directly at the cabinet entry, according to the assembly diagram, if noise generating devices are near to the cabinet (see Figure 3-9).

As the CS31 system bus is opto-isolated, it is possible to place elements with different voltage power on the bus.

Refer to the respective descriptions if a bus amplifier or amplifier with bus redundancy is used.

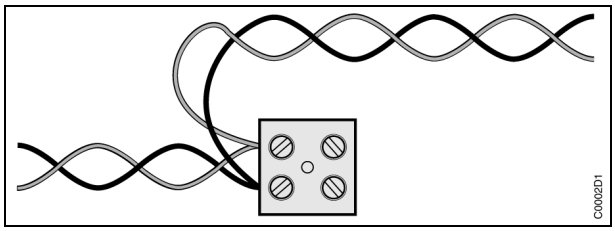


Figure 3-1 : Correct bus cabling during an interruption

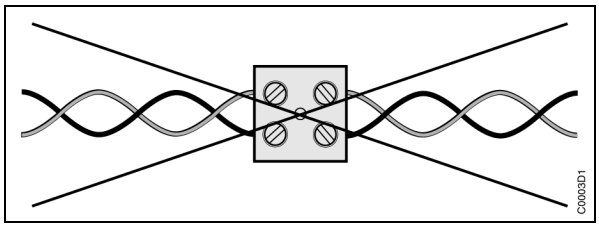


Figure 3-2 : Incorrect bus cabling during an interruption

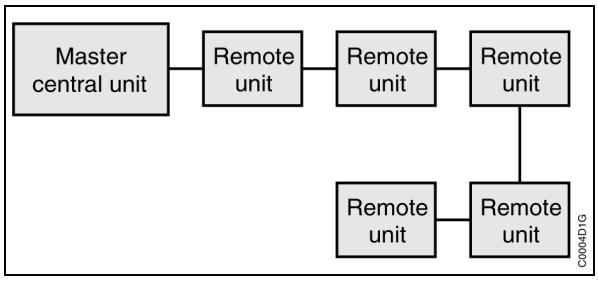


Figure 3-3 : Correct bus cabling

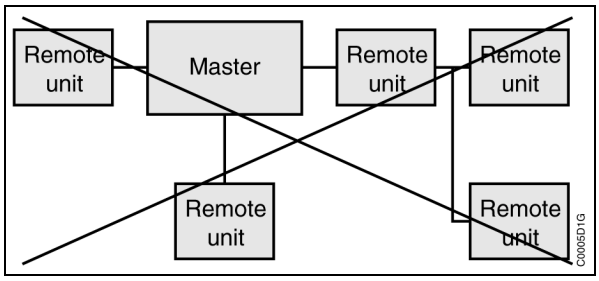


Figure 3-4 : Prohibited star bus cabling

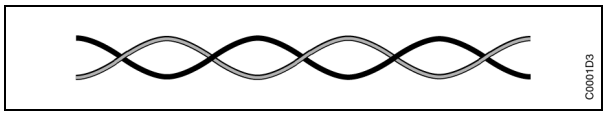


Figure 3-5 : Correct symmetrical twisted pair

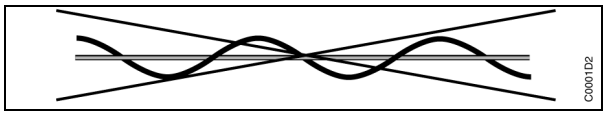


Figure 3-6 : Incorrect twisted pair

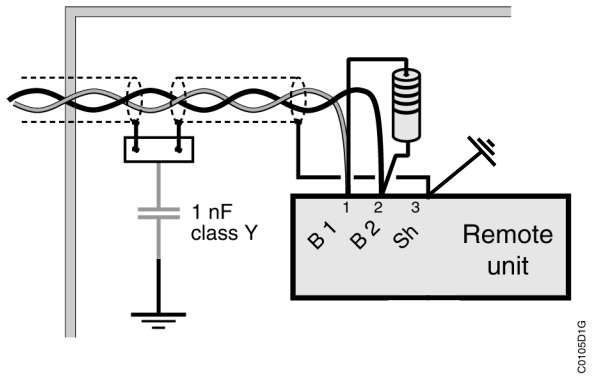


Figure 3-9 : Bus shielding connection diagram

3.2 Basic unit and remote module cabling

3.2.1 Power supply

Use rigid or multi-conductor AWG 14 (1.95 mm^2) wires.

The connection of an external thermal fuse is necessary to provide material protection.

It is possible to select 230 V AC or 120 V AC with the selector switch situated underneath the basic units or extensible remote units. The products are delivered with the selector in the 230 V AC position.

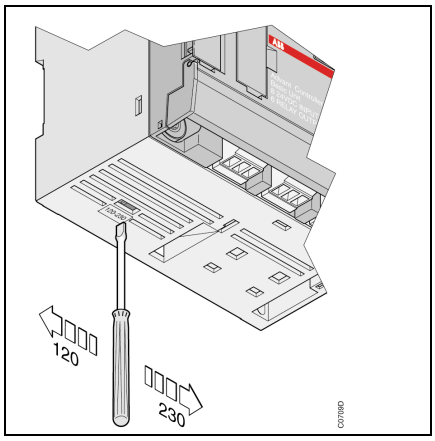


Figure 3-10: Selection of 230 V AC or 120 V AC

An internal 24 V DC power supply is available on 120 / 230 V AC versions. This power supply feeds the digital inputs of the unit and its extensions. This internal power supply is protected against short circuits and overloads. In the case of a short circuit or overload it is available 10 seconds after the fault elimination.

It is also possible to use an external 24 V DC power supply. In this case do not forget to connect the 0 V of the external 24 V DC power supply to that common to the inputs (terminal C). At the external power supply itself the 0 V is to be connected with the PE.

3.2.2 Wiring of the inputs and outputs

Use rigid or multi-conductor AWG 18 (0.96 mm^2) to AWG 14 (1.95 mm^2) wires for inputs and the rigid or multi-conductor AWG 14 (1.95 mm^2) wires for the outputs.

- Input cabling: see Figure 3-11 to Figure 3-14. The common C of inputs has to be linked to the 0 V or 24 V d.c. according to the sensor type.
- Output cabling: see Figure 3-15 and Figure 3-16.

3.2.3 Output protection

The relay outputs may be protected externally against parasites generated by an inductive load with:

- a varistor or an RC module, in alternating current
- a free-wheel diode, in direct current

The presence of an external thermal fuse, connected to the common power supply of the outputs, protects to the output connected devices.

The transistor outputs are protected internally against short circuits and overloads. However with an inductive load, with L/R greater than 40 ms, it is necessary to add a free-wheel diode.

If an error occurs at one of the transistor outputs, it is indicated by the status of the basic unit.

The presence of an external thermal fuse, connected to the common power supply of the outputs, protects the output connected devices and also avoids unit damage should numerous outputs overload.

Warning: In the case of the terminal 0 V is disconnected and in the same time the 24 V DC is connected, the leakage current on output is 16 mA.

3.3 Cabling of the basic unit's inputs/outputs

as well as of the centrally extensible remote modules withCS31 bus connection (ICMK 14..)

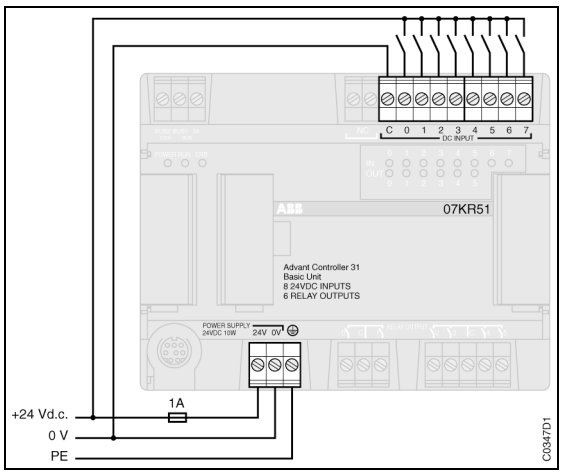


Figure 3-11: Positive logical inputs PNP 24 V DC unit power supply

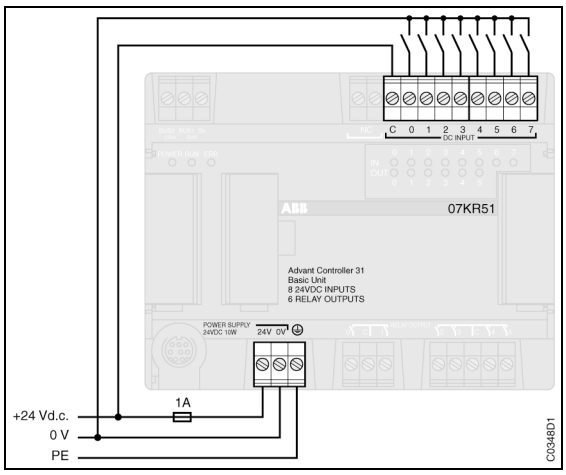


Figure 3-12: Negative logical inputs NPN 24 V DC unit power supply

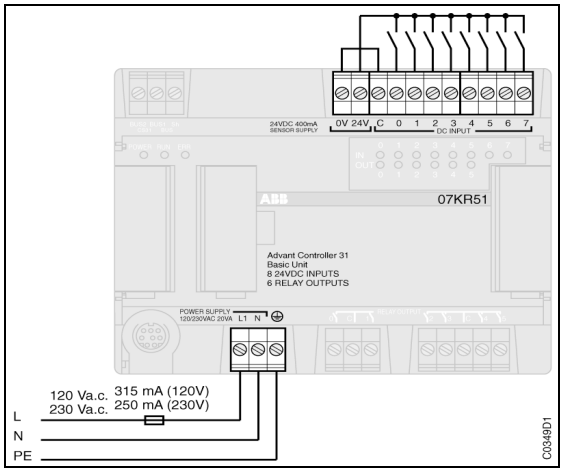


Figure 3-13: Positive logical inputs PNP 120/230 V AC unit power supply

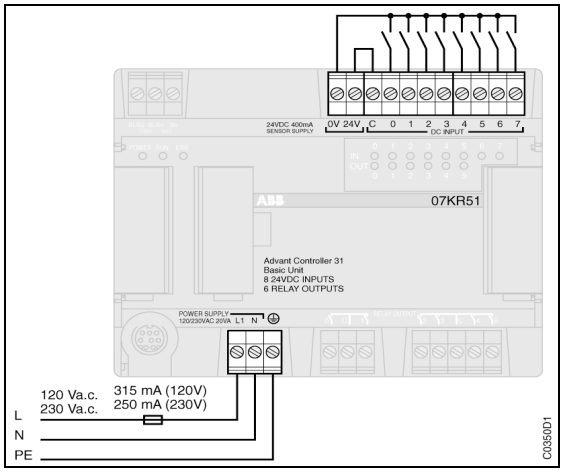


Figure 3-14: Negative logical inputs NPN 120/230 V AC unit power supply

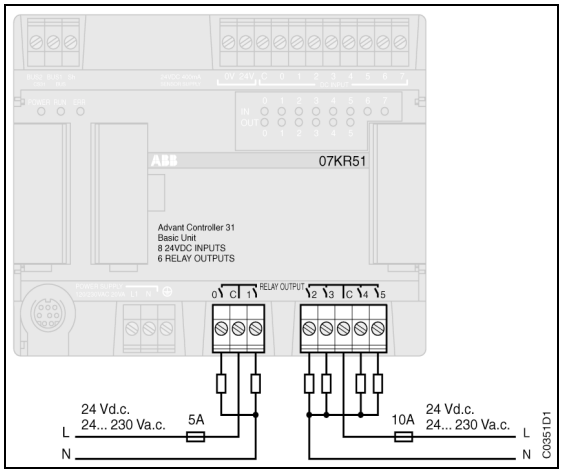


Figure 3-15: Relay outputs

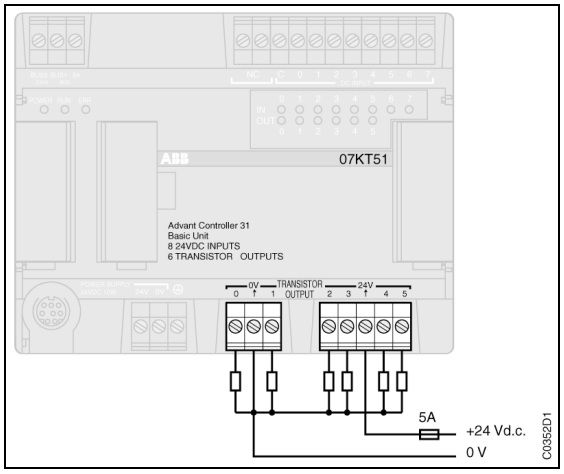


Figure 3-16: Transistor outputs

3.4 Cabling the digital central extensions

The extensions are powered with 5 V by the basic unit or the remote unit. The connection between the extension and the basic unit is effectuated with the cable situated on the left side of the extension.

Warning: The extensions must be connected or disconnected without power supply.

Extension XI 16 E1 (see figure 3-17)

The 24 V DC power supply used for the sensors should be linked to the 0 V and 24 V terminals situated on the top or bottom terminal blocks. These terminals are linked internally, therefore it just requires linking one 0 V and one 24 V DC terminals.

Extension XO 08 R1 (see figure 3-21)

The connection terminals named C1 and C2 are independent.

Extension XC 08 L1 (see figure 3-19)

An external 24 V DC power supply has to be used if the total current exceeds the capacity of the 24 V DC power supply of the basic unit. In this case, it is necessary to connect together the 0 V and 24 V DC of the external power supply and basic unit.
If the external power supply is not connected, the supply led (green) is blinking.

Warning: In the case of the terminal 0 V is disconnected and in the same time the 24 V DC is connected, the leakage current on output is 16 mA.

Extension XO 16 N1 (see figure 3-18)

The 24 V DC power supply used for the loads should be linked to the 0 V or 24 V DC terminals situated on the top or bottom terminal blocks. These terminals are linked internally, therefore it just requires linking one 0 V and one 24 V DC terminals

Warning: In the case of the terminal 0 V is disconnected and in the same time the 24 V DC is connected, the leakage current on output is 16 mA.

Extension XK 08 F1 (see figure 3-20)

The common C of inputs has to be linked to the 0 V or 24 V d.c. according to the sensor type.

Extension XO 08 Y1 (see figure 3-22)

The 24 V DC power supply used for the loads should be linked to the 0 V or 24 V DC terminals situated on the top or bottom terminal blocks. These terminals are linked internally, therefore it just requires linking one 0 V and one 24 V DC terminals

Warning: In the case of the terminal 0 V is disconnected and in the same time the 24 V DC is connected, the leakage current on output is 16 mA.

Extension XO 08 R2 (see figure 3-23)

Extension with 4 relay NO and 4 relay NO/NC
The connection terminals named C0, C1, C2, C3, C4, C5, C6, and C7 are independent.

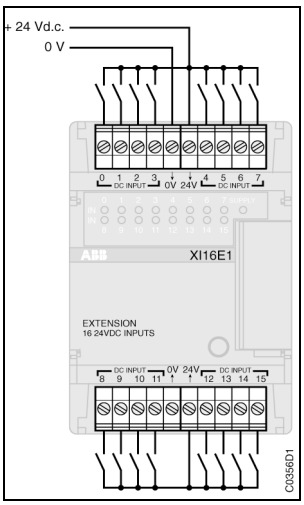


Figure 3-17: Extension XI 16 E1

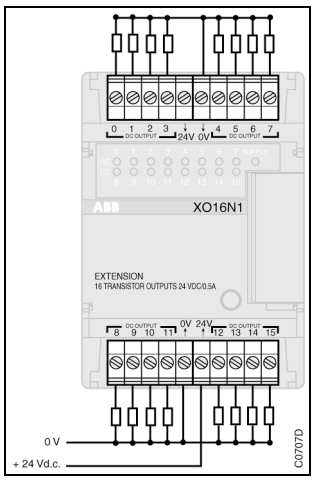


Figure 3-18: Extension XO 16 N1

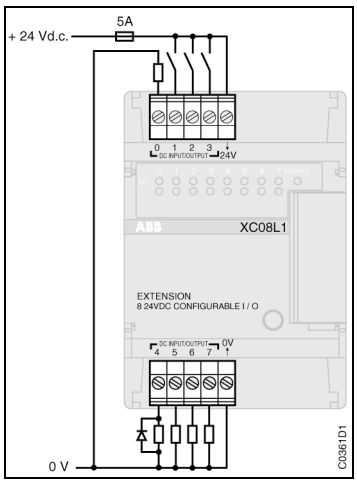


Figure 3-19: Extension XC 08 L1

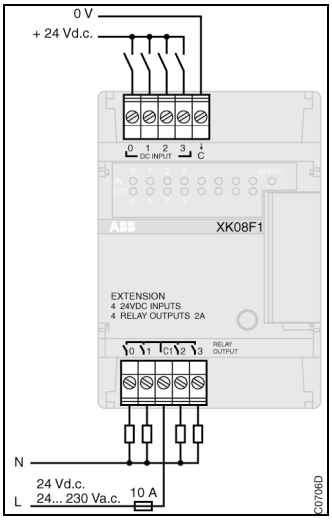


Figure 3-20: Extension XK 08 F1

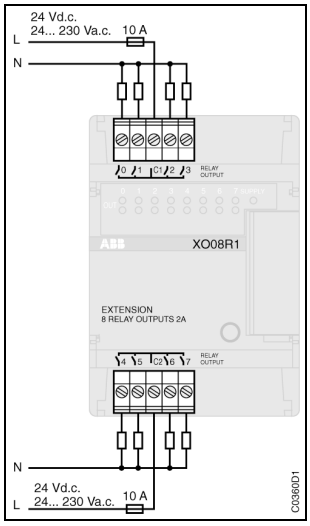


Figure 3-21: Extension XO 08 R1

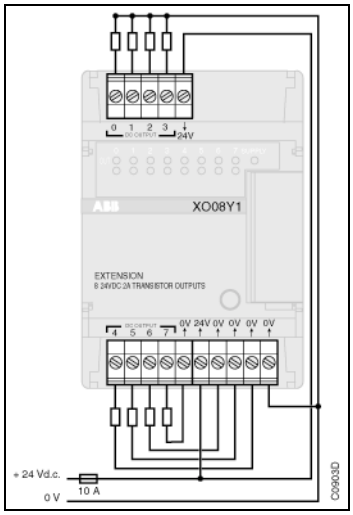


Figure 3-22: Extension XO 08 Y1

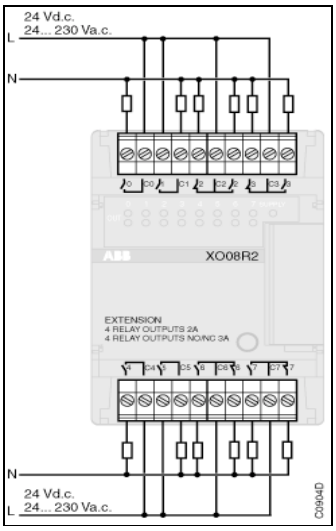


Figure 3-23: Extension XO 08 R2

3.5 Cabling the analog central extensions

Extension XM 06 B5 (see figures 3-24 to 3-26)

The extension is powered with 5 V by the basic unit or the remote unit. The connection between the extension and the basic unit is effectuated with the cable situated on the left side of the extension.

Warning: The extensions must be connected or disconnected without power supply.

Extension XE 08 B5 (see figures 3-27 and 3-28)

The extension is powered with 5 V by the basic unit or the remote unit. The connection between the extension and the basic unit is effectuated with the cable situated on the left side of the extension.

Warning: The extensions must be connected or disconnected without power supply.

The Pt 100 or Pt 1000 probes connected to the XM 06 B5 or XE 08 B5 extension may be the 2 wire, 3 wire sensors (see following Figures).

Usage of the connectors 07 ST 51 is recommended for mounting a 4 wire probe or use the function current protection against short-circuit in case of 4-20 mA or to have the possibility to change a sensor without fall-out the other sensors.

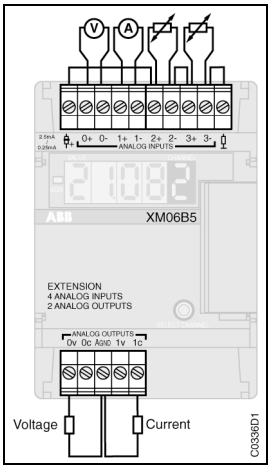


Figure 3-24:
XM 06 B5 with 2 wire probe

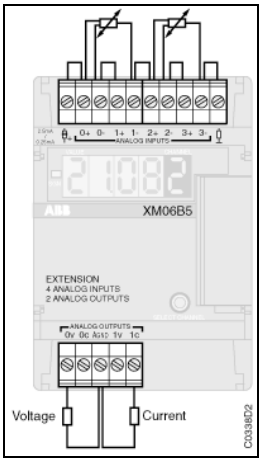


Figure 3-25:
XM 06 B5 with 3 wire probe

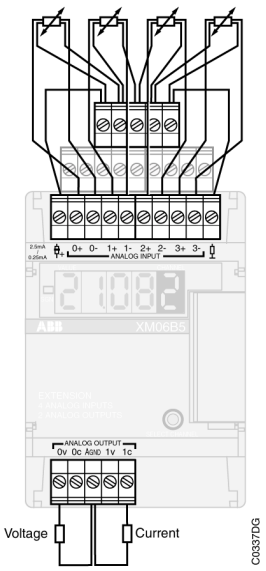


Figure 3-26:
XM 06 B5 with 4 wire probe by using the connector 07 ST 51

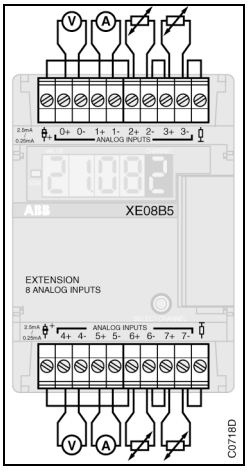


Figure 3-27: XE 08 B5
XE 08 B5 with 2 wire probe

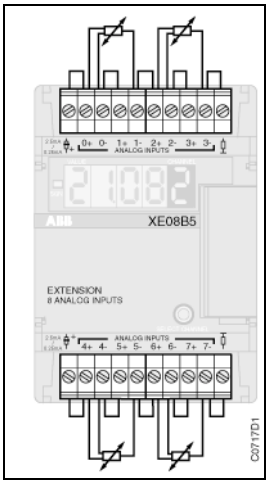


Figure 3-28: XE 08 B5
XE 08 B5 with 3 wire probe

Caution:

Unused analog input channels are to be short-circuited.

Manual No.: 2CDC 120 060 M 0202

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