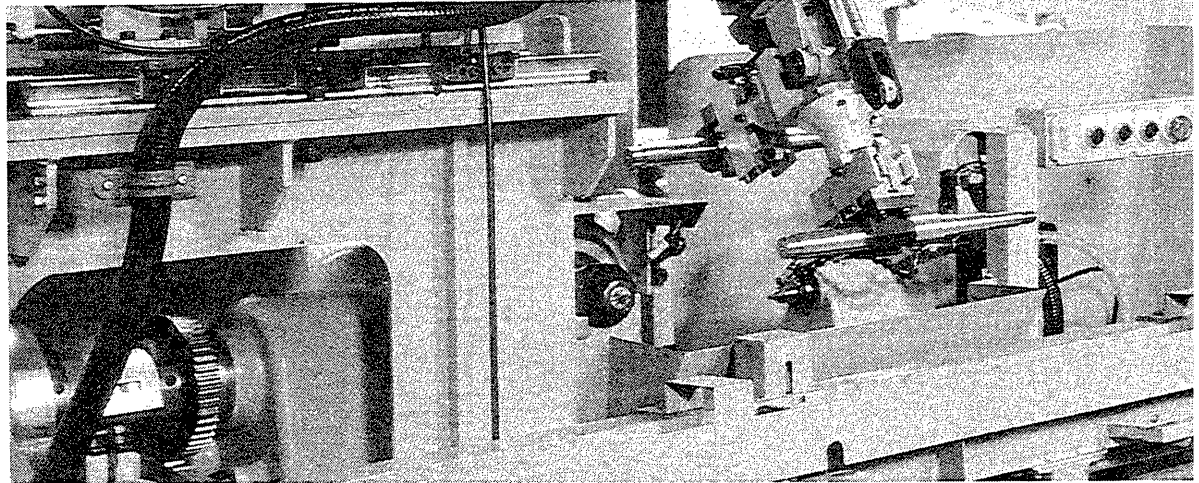


MOTIONPACK FD MODEL 3

YASKAWA MOTION CONTROLLER

SPECIFICATIONS



YASKAWA

This manual provides the information needed to understand specification of MOTIONPACK FD model 3.

CONTENTS

1. FEATURES	3	6.1 FUNCTION COMMAND LIST	25
2. SYSTEM CONFIGURATION	4	7. HARDWARE CONNECTION	28
2.1 MOTIONPACK FD SERIES SYSTEM CONFIGURATION	4	7.1 CONNECTION DIAGRAM	28
2.1.1 Basic System (Model 0)	4	7.2 M-NET (INTERFACE BETWEEN MODULES)	30
2.1.2 MOTIONPACK FD (Model 3) with M-NET (Interface between Modules)	5	7.2.1 Performance Specifications	30
2.2 COMPARISON LIST FOR EACH MODEL (FD SERIES)	6	7.2.2 I/O Signal Allocation (M-NET)	31
3. TYPE DESIGNATION	7	7.3 INPUT SIGNALS FOR SKIP/EXTERNAL POSITIONING	33
3.1 MOTIONPACK FD : CMPR-FD <input type="checkbox"/> B3 <input type="checkbox"/>	7	7.3.1 Signal Connections	33
3.2 PROGRAMMER	7	7.3.2 Signal Functions	33
3.3 AC SERVOMOTOR	7	7.4 CONNECTION OF SPINDLE DRIVER	34
4. UNIT SPECIFICATIONS/RATINGS	8	7.5 CONNECTION OF OFFSET COUNTER CP-601D	35
4.1 MOTIONPACK FD SERIES CONTROLLER	8	8. DIMENSIONS in mm (inches)	36
4.2 SERVOMOTOR RATINGS AND SPECIFICATIONS	14	8.1 CONTROLLER DIMENSIONS	36
4.2.1 Ratings and Specifications of M Series AC Servomotors	14	8.2 PROGRAMMER DIMENSIONS	37
4.2.2 Ratings and Specifications of F Series AC Servomotors	16	8.3 MOTOR DIMENSIONS	38
4.2.3 Ratings and Specifications of G Series AC Servomotors	18	8.3.1 M Series (Absolute Encoder)	38
4.3 MOTIONPACK FD SERIES PROGRAMMER	20	8.3.2 F Series (Absolute Encoder)	40
5. CONTROLLER PARAMETERS	21	8.3.3 G Series (Absolute Encoder)	42
6. FUNCTION COMMAND	25	APPENDIX 1 FEATURES OF MOTIONPACK FD	44
		APPENDIX 2 COMPARISON OF MOTIONPACK-FD AND MOTIONPACK-34	47

1. FEATURES

- (1) Since an all-digital servo is employed for the servo controller section, the MOTIONPACK FD can achieve high speed, driftless system and requires no potentiometer adjustments. Additionally, an absolute value positioning system can be realized by combining with an AC SERVOMOTOR (M, F, S, D or G series) containing an absolute encoder.
- (2) A Servo controller and motion controller are incorporated to realize space-saving or wiring-saving, compared to the conventional models.
- (3) The following optimum and powerful functions are available for mechanical feeders, transfer machines or special machines.
 - (a) Home position return is not necessary at power ON because of the absolute value method.
 - (b) A no limit switch system can be built because of zone signal output signals.
 - (c) Since each feeding function contains a programmable thrust limit function, the following can be available :
 - Push home position setting
 - Push machining
 - Prevention of tool damage or drive system faults by detecting abnormal reaction
 - (d) The MOTIONPACK FD exceeds many of features of the conventional MOTIONPACK-33 and -34.
- (4) Since the additional axis control function is provided, 2-axis related operation such as S-command output, "solid tap" function (option), etc. can be performed.
- (5) Serial communication with the master controller is available.
- (6) The following options are provided for program setting and monitor :
 - New small-size exclusive-use programmer with excellent operability
 - Personal computer (IBM compatible)

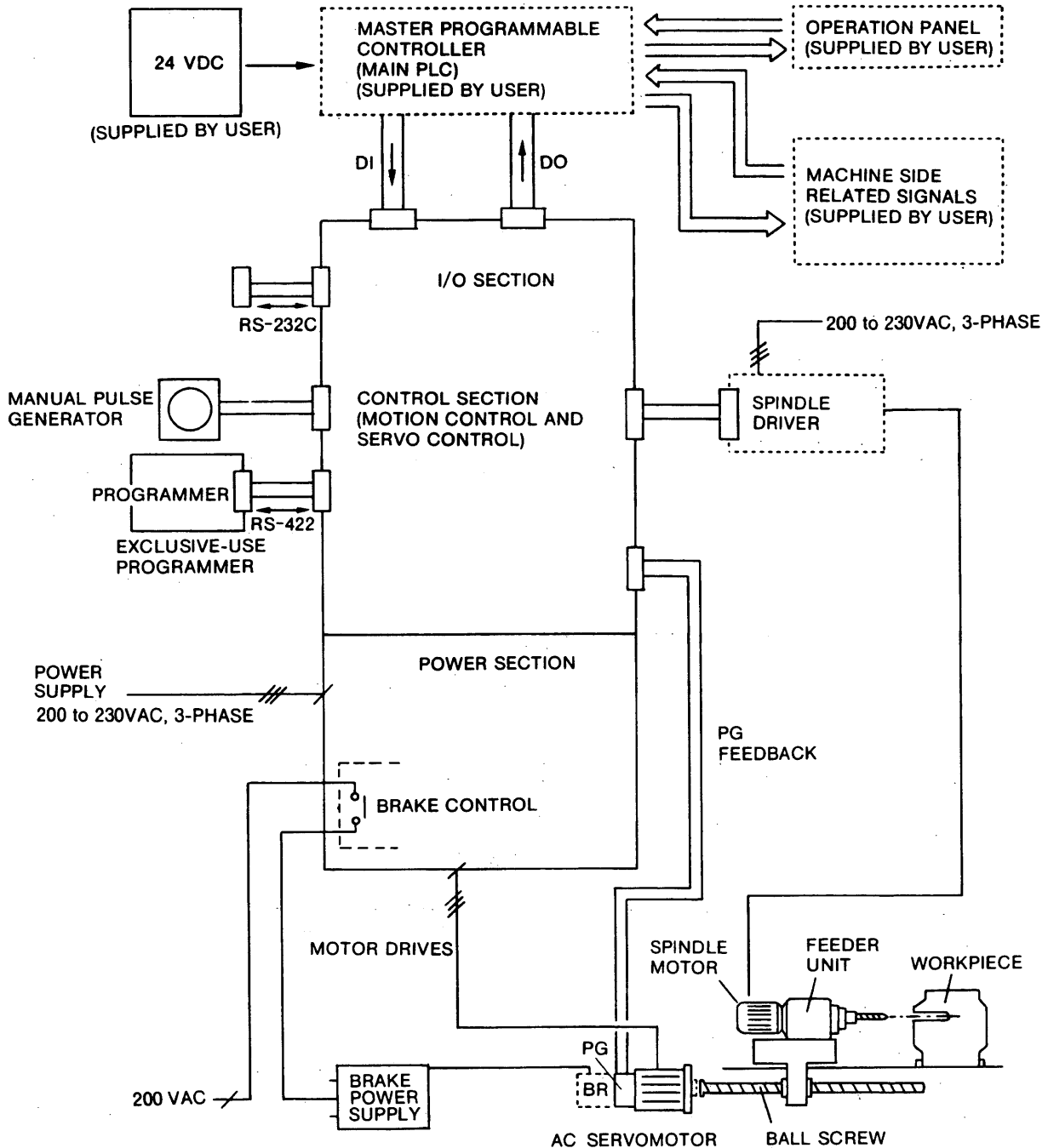
2. SYSTEM CONFIGURATION

2.1 MOTIONPACK FD SERIES SYSTEM CONFIGURATION

2.1.1 Basic System (Model 0)

Fig.2.1 shows the basic system (model 0) of the MOTIONPACK FD series.

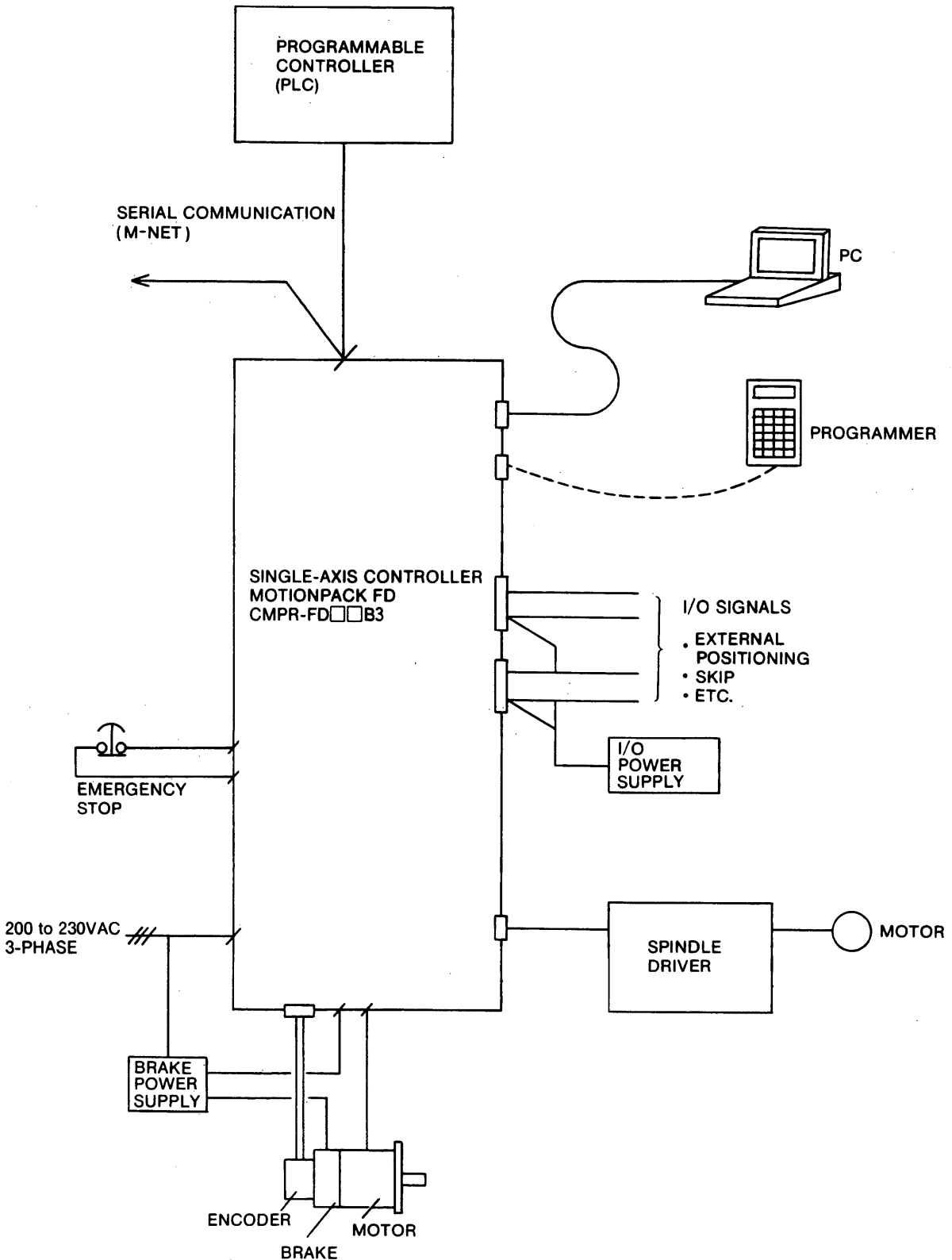
In the basic system of the MOTIONPACK FD series, the MOTIONPACK FD controller and the master PLC send/receive signals by DI/DO. Any serial interface functions such as M-NET interface is not provided.



2.1.2 MOTIONPACK FD (Model 3) with Module Interface

MOTIONPACK FD extension system 3 (model 3) is shown below.

The MOTIONPACK FD controller used in this system is provided with M-NET (serial interface between modules) for communication with master controller.



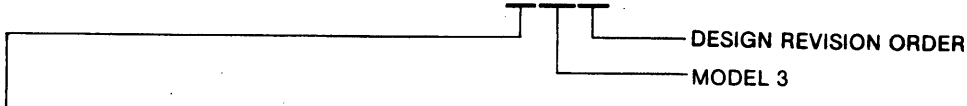
2.2 COMPARISON LIST FOR EACH MODEL (FD SERIES)

Specification Items	Basic System (Model 0)	Extension System 1 (Model 1)	Extension System 2 (Model 2) *	Extension System 3 (Model 3)
Type CMPR-FD□	B0□	B1□	B2□	B3□
Hardware	Basic section	Basic section + Optional board (SI30)	Basic section + Optional board (SI30)	Basic section + Optional board (SI30)
Built-in PLC	Not available	Available	Available	Not available
Ladder PROM	Not available	By customer	By customer	Fixed
Solid Tap	Not available	Available	Not available	Available
No. of Programs	Up to 16	Up to 32	Up to 32	Up to 32
No. of Program Blocks	Up to 1000	Up to 1000	Up to 1000	Up to 1000
Standard I/O	I/O = 24/24	I/O = 24/24	I/O = 24/24	I/O = 24/24
Expand I/O	Not available	I/O = 24/24	I/O = 24/24	I/O = 24/24
Interface between Modules	Not available	Available (Y-mode, T-mode)	Available (Y-mode, T-mode)	Available (Y-mode, T-mode)
Spindle Command	Analog reference ±10V S-command available	Analog reference ±10V S-command available	Analog reference ±10V S-command available	Analog reference ±10V S-command available
No. of Indirect Registers	R01 to R99	R01 to R99	R01 to R99	R01 to R99
Indirect Register Data Setting	Programmer	Programmer, external data setting	Programmer, external data setting	Programmer, external data setting
External Data Setting	Not available	Available	Available	Available
Coordinate Compensation	Provided (T1~T9)	Provided (T1~T9)	Provided (T1~T9)	Provided (T1~T9)
External Compensation	Not available	Available	Available	Available
ALM History	Available	Available	Available	Available
Wave form Monitor	Provided	Provided	Provided	Provided
Offset Counter I/F	Not available	Available	Available	Available
IBM PC Programmer	Connectable	Connectable	Connectable	Connectable

* : To be released soon.

3. TYPE DESIGNATION

3.1 MOTIONPACK FD: **CMPR-FD** **B3**



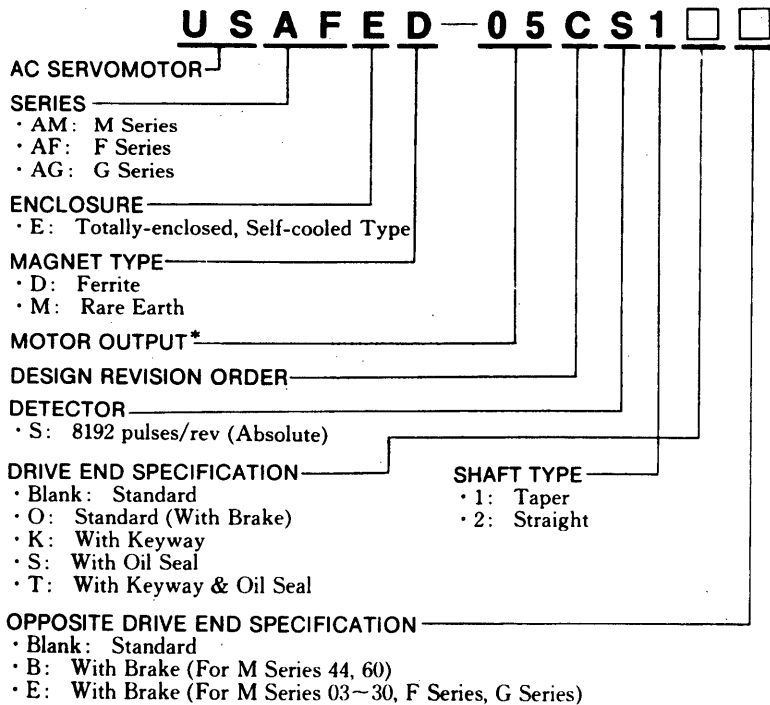
Rated Capacity	M Series	F Series	G Series	Remarks
05		USAFED-02CS	USAGED-02AS	<ul style="list-style-type: none"> Use of same hardware and software. Parameter setting for motor output and series.
	USAMED-03BS	USAFED-03CS	USAGED-03AS	
		USAFED-05CS	USAGED-05AS	
10	USAMED-06BS			Same as above
	USAMED-09BS	USAFED-09CS	USAGED-09AS	
15	USAMED-12BS	USAFED-13CS	USAGED-13AS	
20	USAMED-20BS	USAFED-20CS	USAGED-20AS	
30	USAMED-30BS	USAFED-30CS	USAGED-30AS	
44	USAMED-44BS	USAFED-44CS	USAGED-44AS	
60	USAMKD-60BS			To be released soon.

3.2 PROGRAMMER

MOTIONPACK FD Programmer: **CMPR-PFD30**



3.3 AC SERVOMOTOR



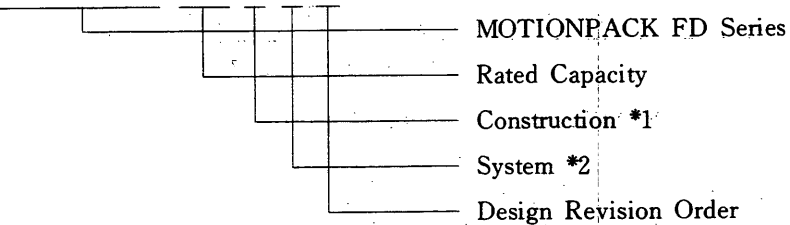
*

	M Series	F Series	G Series
02	—	0.15 kW	0.15 kW
03	0.3 kW	0.3 kW	0.3 kW
05	—	0.45 kW	0.45 kW
06	0.6 kW	—	—
08	—	—	—
09	0.9 kW	0.85 kW	0.85 kW
10	—	—	—
12	1.2 kW	—	—
13	—	1.3 kW	1.3 kW
15	—	—	—
20	2.0 kW	1.8 kW	1.8 kW
22	—	—	—
30	3.0 kW	2.9 kW	2.9 kW
37	—	—	—
44	4.4 kW	4.4 kW	4.4 kW

4. UNIT SPECIFICATIONS/RATINGS

4.1 MOTIONPACK FD SERIES CONTROLLER

(1) Common Specifications

Item	Ratings
Type Designation	<p data-bbox="558 488 896 517">CMPR-FD □ □ B 3 □</p>  <p data-bbox="1029 533 1344 562">MOTIONPACK FD Series</p> <p data-bbox="1029 577 1203 607">Rated Capacity</p> <p data-bbox="1029 622 1203 651">Construction *1</p> <p data-bbox="1029 667 1149 696">System *2</p> <p data-bbox="1029 712 1295 741">Design Revision Order</p> <p data-bbox="558 763 813 792">(*1) B : Base-mounted</p> <p data-bbox="558 808 899 837">(*2) 0 : Model 0, 3 : Model 3</p>
Construction	<p data-bbox="558 862 1036 891">Servo controller built-in motion controller</p> <p data-bbox="558 907 760 936">Unit Construction</p> <p data-bbox="558 952 1422 981">(1) Basic section : Motion controller and servo controller are incorporated.</p> <p data-bbox="558 996 1365 1070">(2) Option section : Option board added on the upper part of the basic section (such as M-NET interface board)</p>
No. of Control Axes	1 axis + spindle (additional axis)
Applicable SERVOMOTOR	AC SERVOMOTOR (M, F, G series) : 0.15 to 4.4 kW
Main Circuit Power Relay	Built-in
Holding Brake	<p data-bbox="558 1301 1003 1330">Holding brake control signal provided.</p> <p data-bbox="558 1330 1133 1359">Brake power supply has to be installed separately.</p>
Encoder	Absolute encoder (8192 p/rev)
Peripheral Device	Programmer : Exclusive-use programmer, personal computer (IBM compatible)
Installation	In-panel mounted type (base-mounted construction)
Power Supply	200VAC to 230VAC (+10%, -15%), 50/60Hz, 3-phase both for main circuit and control power supplies
Environment	<p data-bbox="558 1615 922 1644">Ambient temperature : 0 to 55°C</p> <p data-bbox="558 1650 980 1680">Storage temperature : -20 to +85°C</p> <p data-bbox="558 1686 1110 1715">Humidity : 90%RH (non-condensing)</p> <p data-bbox="558 1722 1390 1751">Atmosphere : Free from corrosive gases, dust, metallic powder</p> <p data-bbox="558 1758 967 1787">Grounding : 100Ω or less</p>

(2) Servo Section Specifications

Ratings and specifications are shown below, in combination with SERVOMOTOR.

(2-1) M Series SERVOMOTOR

MOTIONPACK FD Type CMPR-FD□□□□		05B3	10B3	10B3	15B3	20B3	30B3	44B3	
SERVOMOTOR Type USAMED-□□□□		03B□1	06B□1	09B□2	12B□2	20B□2	30B□2	44B□2	
SERVOMOTOR	Rated Output*	kW	0.3	0.6	0.9	1.2	2.0	3.0	4.4
		HP	0.4	0.8	1.2	1.6	2.7	4.0	5.9
	Rated Torque*	N·m	2.84	5.68	8.63	11.5	19.1	28.4	41.9
		lb·in	25	50	76	102	169	252	372
	Instantaneous Peak Torque*	N·m	7.17	14.1	19.3	28.0	44.0	63.7	91.1
		lb·in	63	125	171	248	390	564	807
	Rated Speed*	r/min	1000						
	Max Speed*	r/min	2000						
	Moment of Inertia $J_M = GD_M^2/4$	$kg \cdot m^2 \times 10^{-4}$	13.5	24.3	36.7	58	110	143	240
		$lb \cdot in \cdot s^2 \times 10^{-3}$	12.0	21.5	32.5	51.2	97.2	126.7	212.6
	Rated Power*	kW/s	6.0	13.3	20.3	22.7	33.2	57.0	74.0
	Speed/Positioning Detector	Absolute encoder (8192 pulses/rev)							
General	<ul style="list-style-type: none"> ● Time Rating : Continuous ● Insulation : Class F ● Ambient Temperature : 0 to +40°C ● Vibration : 15 μm or below ● Finish in Munsell Notation : N1.5 ● Drive Method : Direct drive ● Excitation : Permanent magnet ● Enclosure : Totally enclosed, self-cooled ● Mounting : Flange mounted 								
Servo Control	Power Supply	Main Circuit & Control Circuit	Three-phase 200 to 230 VAC $\begin{smallmatrix} +10\% \\ -15\% \end{smallmatrix}$ 50/60 Hz						
	Continuous Output Current	A(rms)	3	5.8	7.6	11.7	18.8	26	33
	Max Output Current	A(rms)	7.3	13.9	16.6	28	42	56.5	70
	Control Method	Transistorized PWM control							
	Feedback	Absolute encoder (8192 pulses/rev)							
	Environmental Conditions	Ambient Temp.	0 to +55°C						
		Storage Temp.	-20 to +85°C						
		Ambient/Storage Humidity	90% or less (non-condensing)						
		Vibration-/Shock-Resistance	0.5G/2G						
	Mounting Structure	Base-mounted							
Performance	Speed Control Range	1 : 5000							
	Speed Reg.	Load (0 to 100%)	-0.01% or less at rated speed						
		Voltage (+10% to -15%)	0%						
		Temp. (25 \pm 25°C)	\pm 0.1% or less at rated speed						
Frequency Response	100 Hz ($J_L = J_M$)								
Built-in Functions	Dynamic Brake (DB)	Built-in automatic DB activated at : main power OFF, servo alarm, servo OFF							
	Regeneration	Built-in regenerative resistor							
	Load Inertia J_L	Up to 5 times motor inertia (J_M)							
	Protection	Communication error, overcurrent, MCCB trip, regenerative trouble, overvoltage, overspeed, undervoltage, overload, reference point error, A/D conversion error, overrun, open phase, CPU error							
	Others	Torque limit, brake interlock, reverse rotation mode							
Optional	SERVOMOTOR with holding brake								

*Ratings are obtained at armature winding temperature of 20°C, in combination with MOTIONPACK.

(2-2) F Series SERVOMOTOR

MOTIONPACK FD Type CMPR-FD□□□□			05B3		10B3		15B3		20B3		30B3		44B3						
SERVOMOTOR Type USAFED-□□□□			02C□1		03C□1		05C□1		09C□1		13C□2		20C□2		30C□2		44C□2		
SERVOMOTOR	Rated Output*	kW	0.15	0.3	0.45	0.85	1.3	1.8	2.9	4.4									
		HP	0.2	0.4	0.6	1.1	1.7	2.4	3.9	5.9									
	Rated Torque*	N·m	0.98	1.96	2.84	5.39	8.34	11.5	18.6	28.4									
		lb·in	8.7	17	25	48	74	102	165	252									
	Instantaneous Peak Torque*	N·m	2.91	5.83	8.92	15.2	24.7	34.0	54.1	76.2									
		lb·in	26	52	79	135	219	301	479	675									
	Rated Speed*	r/min	1500																
	Max Speed*	r/min	2500																
	Moment of Inertia $J_M (=GD_M^2/4)$	$kg \cdot m^2 \times 10^{-4}$	1.3	2.06	13.5	24.3	36.7	58	110	143									
		$lb \cdot in \cdot s^2 \times 10^{-3}$	1.2	1.8	12.0	21.5	32.5	51.2	97.2	126.7									
Rated Power*	kW/s	7.4	18.3	6	12	18.9	22.7	31.5	57										
Speed/Positioning Detector	Absolute encoder (8192 pulses/rev)																		
General	<ul style="list-style-type: none"> ● Time Rating : Continuous ● Insulation : Class F ● Ambient Temperature : 0 to +40°C ● Vibration : 15 μm or below ● Finish in Munsell Notation : N1.5 ● Drive Method : Direct drive ● Excitation : Permanent magnet ● Enclosure : Totally-enclosed, self-cooled ● Mounting : Flange mounted 																		
Servo Control	Power Supply	Main Circuit & Control Circuit	Three-phase 200 to 230 VAC $\begin{matrix} +10\% \\ -15\% \end{matrix}$ 50/60 Hz																
		Continuous Output Current	A(rms)	3	3	3.8	6.2	9.7	15	20	33								
	Max Output Current	A(rms)	8.5	8.5	11	17	27.6	42	56.5	77									
	Control Method	Transistorized PWM control																	
	Feedback	Absolute encoder (8192 pulses/rev)																	
	Environmental Conditions	Ambient Temp.	0 to +55°C																
		Storage Temp.	-20 to +85°C																
		Ambient/Storage Humidity	90% or less (non-condensing)																
		Vibration-/Shock-Resistance	0.5G/2G																
	Mounting Structure	Base-mounted																	
Performance	Speed Control Range	1 : 5000																	
	Speed Reg.	Load (0 to 100%)	-0.01% or less at rated speed																
		Voltage (+10% to -15%)	0%																
		Temp. (25 \pm 25°C)	\pm 0.1% or less at rated speed																
Frequency Response	100 Hz ($J_L = J_M$)																		
Built-in Functions	Dynamic Brake (DB)	Built-in automatic DB activated at : main power OFF, servo alarm, servo OFF																	
	Regeneration	Built-in regenerative resistor																	
	Load Inertia J_L	Up to 5 times motor inertia (J_M)																	
	Protection	Communication error, overcurrent, MCCB trip, regenerative trouble, overvoltage, overspeed, undervoltage, overload, reference point error, A/D conversion error, overrun, open phase, CPU error																	
	Others	Torque limit, brake interlock, reverse rotation mode																	
Optional	SERVOMOTOR with holding brake																		

*Ratings are obtained at armature winding temperature of 20°C, in combination with MOTIONPACK.

(2-3) G Series SERVOMOTOR

MOTIONPACK FD Type CMPR-FD□□□□			05B3	10B3	15B3	20B3	30B3	44B3			
SERVOMOTOR Type USAGED-□□□□			02A□1	03A□1	05A□1	09A□1	13A□2	20A□2	30A□2	44A□2	
SERVOMOTOR	Rated Output*	kW	0.15	0.3	0.45	0.85	1.3	1.8	2.9	4.4	
		HP	0.2	0.4	0.6	1.1	1.7	2.4	3.9	5.9	
	Rated Torque*	N·m	0.98	1.96	2.84	5.39	8.34	11.5	18.6	28.4	
		lb·in	8.7	17	25	48	74	102	165	252	
	Instantaneous Peak Torque*	N·m	2.91	5.83	8.92	13.3	23.3	28.0	45.1	66.2	
		lb·in	26	52	79	118	207	248	339	587	
	Rated Speed*	r/min	1500								
	Max Speed*	r/min	3000								
	Moment of Inertia J _M (=GD _M ² /4)	kg·m ² ×10 ⁻⁴	1.3	2.06	13.5	24.3	36.7	58	110	143	
		lb·in·s ² ×10 ⁻³	1.2	1.8	12.0	21.5	32.5	51.2	97.2	126.7	
Rated Power*	kW/s	7.4	18.3	6	12	18.9	22.7	36.5	57		
Speed/Positioning Detector	Absolute encoder (8192 pulses/rev)										
General	<ul style="list-style-type: none"> ● Time Rating : Continuous ● Insulation : Class F ● Ambient Temperature : 0 to +40°C ● Vibration : 15 μm or below ● Finish in Munsell Notation : N1.5 ● Drive Method : Direct drive ● Excitation : Permanent magnet ● Enclosure : Totally-enclosed, self-cooled ● Mounting : Flange mounted 										
Servo Control	Power Supply	Main Circuit & Control Circuit	Three-phase 200 to 230 VAC ^{+10%} / _{-15%} 50/60 Hz								
	Continuous Output Current	A(rms)	3	3	3.8	7.6	11.7	19	26	33	
	Max Output Current	A(rms)	8.5	8.5	11	17	28	42	56.5	70	
	Control Method	Transistorized PWM control									
	Feedback	Absolute encoder (8192 pulses/rev)									
	Environmental Conditions	Ambient Temp.	0 to +55°C								
		Storage Temp.	-20 to +85°C								
		Ambient/Storage Humidity	90% or less (non-condensing)								
		Vibration-/Shock-Resistance	0.5G/2G								
	Mounting Structure	Base-mounted									
Performance	Speed Control Range	1 : 5000									
	Speed Reg.	Load (0 to 100%)	-0.01% or less at rated speed								
		Voltage (+10% to -15%)	0%								
		Temp. (25 ± 25°C)	±0.1% or less at rated speed								
Frequency Response	100 Hz (J _L =J _M)										
Built-in Functions	Dynamic Brake (DB)	Built-in automatic DB activated at : main power OFF, servo alarm, servo OFF									
	Regeneration	Built-in regenerative resistor									
	Load Inertia J _L	Up to 5 times motor inertia (J _M)									
	Protection	Communication error, overcurrent, MCCB trip, regenerative trouble, overvoltage, overspeed, undervoltage, overload, reference point error, A/D conversion error, overrun, open phase, CPU error									
	Others	Torque limit, brake interlock, reverse rotation mode									
Optional	SERVOMOTOR with holding brake										

*Ratings are obtained at armature winding temperature of 20°C, in combination with MOTIONPACK.

(3) Controller Specifications

No.	Item	Specifications
1	No. of Control Axes	1 axis + spindle
2	Position Reference Value	Sign + 8 digits
3	Position Reference Unit	Set by parameter according to system specifications.
4	Speed Reference Value	5-digit decimal
5	Max. Pulse Speed	4MPPS (Position feedback pulse speed possible to read-in)
6	Torque Limit	10 to 400% of rated torque
7	Automatic Accel/Decel Control	Linear accel/decel S-curve accel/decel
8	Position Detector	Absolute encoder
9	Coordinate Home Position Matching	Automatic home position setting up ① Stopper pushing method (full-automatic setup method) ② Semi-automatic setup method
10	Program Designation	Designation method by program No.
11	Program Capacity	No. of programs : Up to 32 No. of blocks : Up to 1000
12	Operation Mode	① EDIT mode ② JOG mode ③ HANDL (handle) mode ④ AUTO (automatic) mode
13	Overtravel	Prevented by soft OT (soft stroke limit)
14	Program Reference Items	G : Function reference M : Auxiliary function X : Absolute position reference U : Incremental position reference F : Speed reference I : Torque limit reference S : Spindle reference D : Dwell reference T : Coordinate system setting L : Subprogram repeating time designation P : Subprogram starting program No.
15	Function Reference	① Positioning : G01X/U___ F___ I___ S___ ② Skip positioning (G05, G06) : G05X/U___ F___ I___ S___ ③ Positioning with passing signal : G07X/U___ G12X/U___ F___ I___ M** ④ Speed profile positioning : G08X/U___ G12X/U___ F___ I___ G12X/U___ F___ ⑤ External positioning : G34X/U___ F___ I___ ⑥ Secondary external positioning : G35X/U___ F___ I___ ⑦ S-curve accel/decel positioning : G10 : S-curve accel/decel designation G01X/U : S-curve accel/decel positioning G11 : S-curve accel/decel release

(3) Controller Specifications (Cont' d)

No.	Item	Specifications
15	Function Reference (Cont' d)	⑧ Dwell : In-position check : G04 Dwell time : G04D ___ ⑨ Coordinate setting : G52X/U ___ T ___ ⑩ Coordinate switching : G53T ⑪ Reach check : G67P ⑫ Subprogram call : Repeating time designation G68L ___ P ___ Ending position designation G68X/U ___ P ___ ⑬ Jump : Simple jump G69P ___ Subprogram return G69 ⑭ Spindle reference : Spindle FWD rotation M03S Spindle RVS rotation M04S Spindle stop M05 ⑮ Auxiliary function : M50~M58 Program end M30 ⑯ No operation : NOP
16	Indirect Register Designation	Provided : R01 to 99 Specifies by R ___ in item X/U, F, I or S. (Example) G01X R01 F R02 I 200 S 100
17	Coordinate System	T0 : ABSO-PG coordinate + home position offset T1~T7 : Set by G52 command T8~T9 : Set by G52 command and set by compensation function
18	Compensation Function	① By compensation parameter × number of compensation signals ② By external compensation data input
19	Zone Signal	4 signals (PSW1 to PSW4)
21	I/O Signal	Input 24 points, output 24 points
22	Built-in Sequencer Board	① Input points : 48, output points : 48 when built-in PC is used Standard : Input : 24 points Output : 24 points Built-in sequencer board : Input : 24 points Output : 24 points ② M-NET interface (serial interface)
23	Spindle Reference	Analog reference ±10V
24	Monitor Function	① Servo amplifier speed, torque analog monitoring ② Alarm history ● Storing alarm code, power OFF reset information not stored ● Built-in calendar and timer
25	Programmer	① Personal computer (IBM compatible) ① Exclusive-use programmer
26	Offset Value Indicator I/F	Interfaced with Indicator CP-601D. ● When the controller is turned ON or detects transitional signal from CP-601D, it outputs reset command to CP-601D, then offset signal. ● After that, whenever the controller receives offset value incremental command, it renews the offset value and outputs offset signal to CP-601D.

4.2 SERVOMOTORS

4.2.1 Ratings and Specifications of M Series AC SERVOMOTORS

(1) Ratings

Time Rating: Continuous

Insulation: Class F

Isolation Voltage: 1500 VAC, one minute

Insulation Resistance: 500 VDC, 10M Ω or more

Enclosure: Totally-enclosed, self-cooled
(Equivalent to IP-65 exclusive shaft opening)

Ambient Temperature: 0 to +40°C

Ambient Humidity: 20% to 80%

(non-condensing)

Vibration: 15 μ m or below

Finish in Munsell Notation: N1.5

Excitation: Permanent magnet

Mounting: Flange mounted

Drive Method: Direct drive

Table 4.1 Ratings and Specifications of M Series AC SERVOMOTORS

Item	Motor Type USAMED- *2	Motor Type						
		03B S:1	06B S:1	09B S:2	12B S:2	20B S:2	30B S:2	44B S:2
Rated Output*1	kW (HP)	0.3 (0.4)	0.6 (0.8)	0.9 (1.2)	1.2 (1.6)	2.0 (2.7)	3.0 (4.0)	4.4 (5.9)
Rated Torque*1	N·m (lb·in)	2.84 (25)	5.68 (50)	8.63 (76)	11.5 (102)	19.1 (169)	28.4 (252)	41.9 (372)
Continuous Max Torque*1	N·m (lb·in)	2.94 (26)	5.88 (52)	8.82 (78)	11.8 (104)	21.6 (191)	32.3 (286)	46.1 (408)
Instantaneous Peak Torque*1	N·m (lb·in)	7.17 (63)	14.1 (125)	19.3 (171)	28.0 (248)	44.0 (390)	63.7 (564)	91.1 (807)
Rated Current*1	A	3.0	5.8	7.6	11.7	18.8	26	33
Rated Speed*1	r/min	1000						
Instantaneous Max Speed*1	r/min	2000						1500
Torque Constant	N·m/A (lb·in/A)	1.01 (8.9)	1.04 (9.2)	1.21 (10.7)	1.02 (9.0)	1.07 (9.5)	1.16 (10.2)	1.33 (11.8)
Moment of Inertia $J_M (=GD_M^2/4)$	kg·m ² × 10 ⁻⁴ (lb·in·s ² × 10 ⁻³)	13.5 (12.0)	24.3 (21.5)	36.7 (32.5)	58.0 (51.2)	110 (97.2)	143 (126.7)	240 (212.6)
Power Rate*1	kW/s	6.0	13.3	20.3	22.7	33.2	57.0	74.0
Inertia Time Constant	ms	12.8	6.3	4.4	6.0	5.2	3.5	3.6
Inductive Time Constant	ms	2.7	5.1	6.5	10.4	12.9	15.3	16.2
Insulation	Class F							

*1: Values when servomotor is combined with SERVOPACK and the armature winding temperature is 20°C.
Shown are normal (TYP) values above.

*2: S: of motor type means absolute method.

S: 8192 pulses/rev (absolute)

Optical encoder is used as a detector.

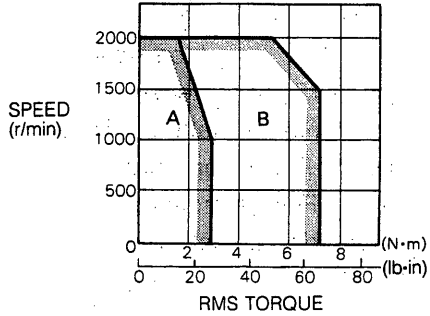
Note: The power supply units for brake:

· Input 100 VAC, Output 90 VDC: Type OPR 109 F

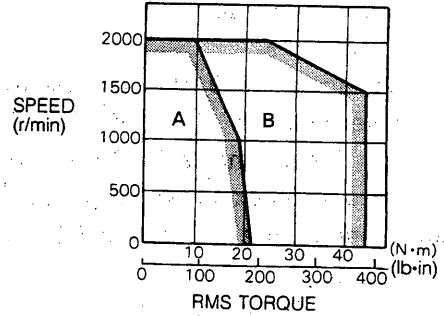
· Input 200 VAC, Output 90 VDC: Type OPR 109 A

(2) Torque-Speed Characteristics (M Series)

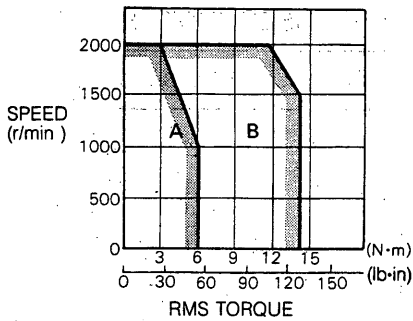
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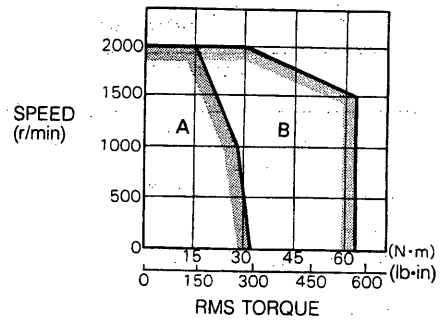
● TYPE USAMED-20BS2



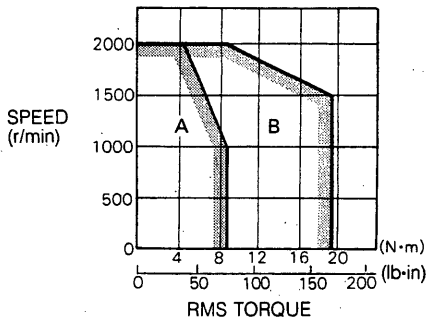
● TYPE USAMED-06BS1



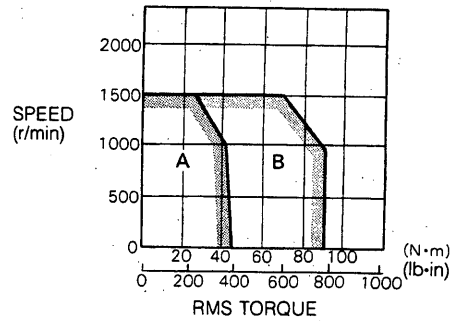
● TYPE USAMED-30BS2



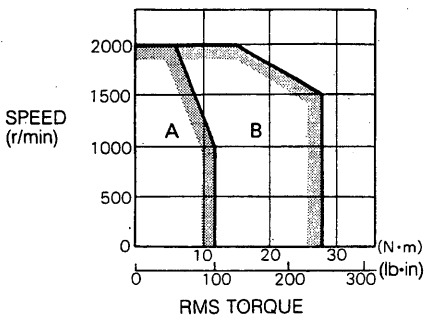
● TYPE USAMED-09BS2



● TYPE USAMED-44BS2



● TYPE USAMED-12BS2



A: CONTINUOUS DUTY ZONE
B: INTERMITTENT DUTY ZONE
 POWER SUPPLY: 200 V

4.2.2 Ratings and Specifications of F Series AC SERVOMOTORS

(1) Ratings

Time Rating: Continuous
 Insulation: Class F
 Isolation Voltage: 1500 VAC, one minute
 Insulation Resistance: 500 VDC, 10M Ω or more
 Enclosure: Totally-enclosed, self-cooled
 (Equivalent to IP-65 exclusive shaft opening)
 Ambient Temperature: 0 to +40°C

Ambient Humidity: 20% to 80%
 (non-condensing)
 Vibration: 15 μ m or below
 Finish in Munsell Notation: N1.5
 Excitation: Permanent magnet
 Mounting: Flange mounted
 Drive Method: Direct drive

Table 4.2 Ratings and Specifications of F Series AC SERVOMOTORS

Item	Motor Type USAFED- *2	02C S:1	03C S:1	05C S:1	09C S:1	13C S:2	20C S:2	30C S:2	44C S:2
Rated Output*1	kW (HP)	0.15 (0.2)	0.3 (0.4)	0.45 (0.6)	0.85 (1.1)	1.3 (1.7)	1.8 (2.4)	2.9 (3.9)	4.4 (5.9)
Rated Torque*1	N·m (lb·in)	0.98 (8.7)	1.96 (17)	2.84 (25)	5.39 (48)	8.34 (74)	11.5 (102)	18.6 (165)	28.4 (252)
Continuous Max Torque*1	N·m (lb·in)	1.08 (10)	2.16 (19)	2.94 (26)	5.88 (52)	8.83 (78)	11.8 (104)	22.6 (200)	37.3 (330)
Instantaneous Peak Torque*1	N·m (lb·in)	2.91 (26)	5.83 (52)	8.92 (79)	15.2 (135)	24.7 (219)	34.0 (301)	54.1 (479)	76.2 (675)
Rated Current*1	A	3.0	3.0	3.8	6.2	9.7	15	20	30
Rated Speed*1	r/min	1500							
Instantaneous Max Speed*1	r/min	2500							
Torque Constant	N·m/A (lb·in/A)	0.36 (3.2)	0.72 (6.3)	0.80 (7.1)	0.92 (8.2)	0.92 (8.2)	0.82 (7.3)	0.98 (8.7)	1.02 (9.0)
Moment of Inertia $J_M (=GD^2_M/4)$	kg·m ² × 10 ⁻⁴ (lb·in·s ² × 10 ⁻³)	1.3 (1.2)	2.06 (1.8)	13.5 (12.0)	24.3 (21.5)	36.7 (32.5)	58 (51.2)	110 (97.2)	143 (126.7)
Power Rate*1	kW/s	7.4	18.3	6.0	12	18.9	22.7	31.5	57.0
Inertia Time Constant	ms	3.9	2.5	10.9	6.0	4.4	5.9	5.2	3.7
Inductive Time Constant	ms	3.4	4.3	3.2	5.2	6.1	10.4	13.0	15.2
Insulation	Class F								

*1: Values when servomotor is combined with SERVOPACK and the armature winding temperature is 20°C.
 Shown are normal (TYP) values above.

*2: S: of motor type means absolute method.
 S: 8192 pulses/rev (absolute)

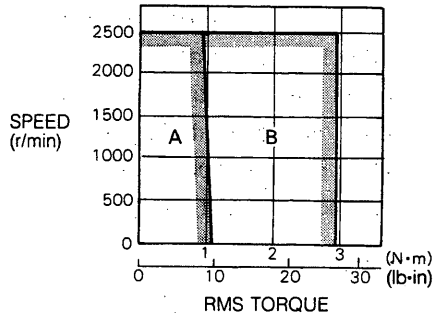
Optical encoder is used as a detector.

Note: The power supply units for brake:

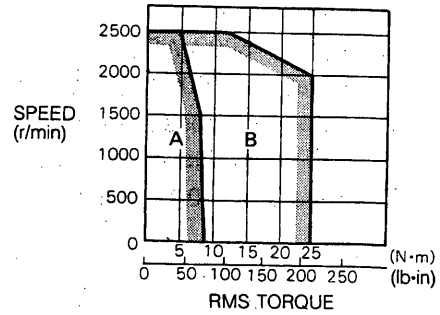
- Input 100 VAC, Output 90 VDC: Type OPR 109 F
- Input 200 VAC, Output 90 VDC: Type OPR 109 A

(2) Torque-Speed Characteristics (F Series)

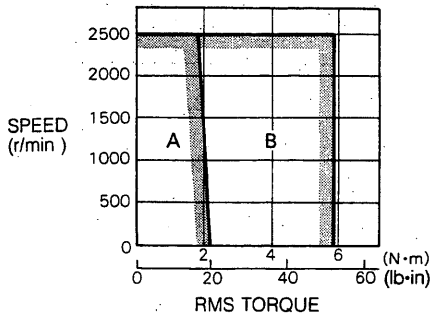
● TYPE USAFED-02CS1



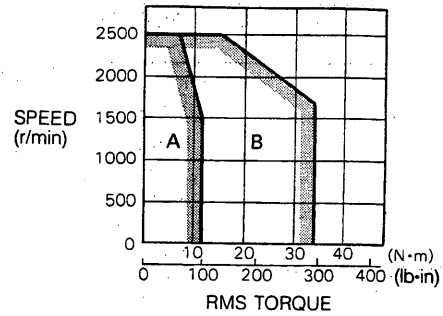
● TYPE USAFED-13CS2



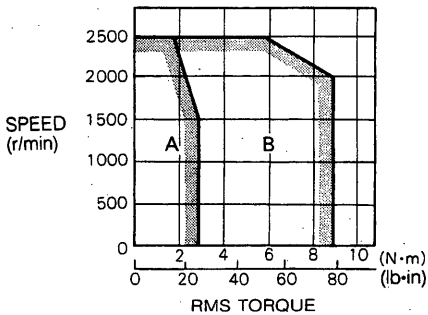
● TYPE USAFED-03CS1



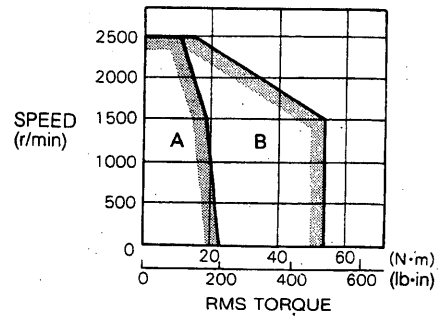
● TYPE USAFED-20CS2



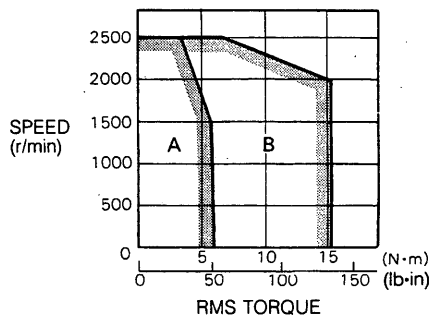
● TYPE USAFED-05CS1



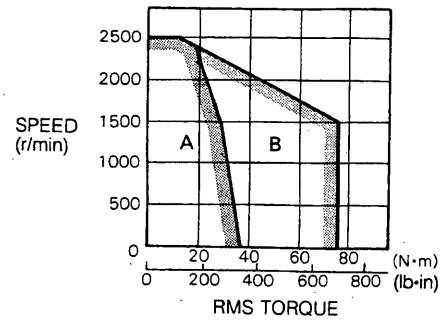
● TYPE USAFED-30CS2



● TYPE USAFED-09CS1



● TYPE USAFED-44CS2



CONTINUOUS DUTY ZONE
 INTERMITTENT DUTY ZONE
 POWER SUPPLY: 200 V

4.2.3 Ratings and Specifications of G Series AC SERVOMOTORS

(1) Ratings

Time Rating: Continuous	Ambient Humidity: 20% to 80%
Insulation: Class F	(non-condensing)
Isolation Voltage: 1500 VAC, one minute	Vibration: 15 μ m or below
Insulation Resistance: 500 VDC, 10M Ω or more	Finish in Munsell Notation: N1.5
Enclosure: Totally-enclosed, self-cooled	Excitation: Permanent magnet
(Equivalent to IP-65 exclusive shaft opening)	Mounting: Flange mounted
Ambient Temperature: 0 to +40°C	Drive Method: Direct drive

Table 4.3 Ratings and Specifications of G Series AC SERVOMOTORS

Item	Motor Type USAGED- *2	02A	03A	05A	09A	13A	20A	30A	44A
		S:1	S:1	S:1	S:1	S:1	S:2	S:2	S:2
Rated Output*1	kW (HP)	0.15 (0.2)	0.3 (0.4)	0.45 (0.6)	0.85 (1.1)	1.3 (1.7)	1.8 (2.4)	2.9 (3.9)	4.4 (5.9)
Rated Torque*1	N·m (lb·in)	0.98 (8.7)	1.96 (17)	2.84 (25)	5.39 (48)	8.34 (74)	11.5 (102)	18.6 (165)	28.4 (252)
Continuous Max Torque*1	N·m (lb·in)	1.08 (10)	2.16 (19)	2.94 (26)	5.88 (52)	8.83 (78)	11.8 (104)	22.6 (200)	37.3 (330)
Instantaneous Peak Torque*1	N·m (lb·in)	2.9 (26)	5.83 (52)	8.92 (79)	13.3 (118)	23.3 (207)	28.0 (248)	45.1 (339)	66.2 (587)
Rated Current*1	A	3.0	3.0	3.8	7.6	11.7	19	26	33
Rated Speed*1	r/min	1500							
Instantaneous Max Speed*1	r/min	3000							
Torque Constant	N·m/A (lb·in/A)	0.36 (3.2)	0.72 (6.3)	0.8 (7.1)	0.8 (7.1)	0.83 (7.4)	0.67 (5.9)	0.80 (7.1)	0.95 (8.4)
Moment of Inertia $J_M (=GD^2_M/4)$	kg·m ² × 10 ⁻⁴ (lb·in·s ² × 10 ⁻³)	1.3 (1.2)	2.06 (1.8)	13.5 (12.0)	24.3 (21.5)	36.7 (32.5)	58 (51.2)	110 (97.2)	143 (126.7)
Power Rate*1	kW/s	7.4	18.3	6.0	12	18.9	22.7	36.5	57.0
Inertia Time Constant	ms	4.5	2.5	10.9	6.1	4.3	5.8	5.2	3.4
Inductive Time Constant	ms	3.4	4.3	3.2	5.2	6.7	10.6	13.2	15.9
Insulation	Class F								

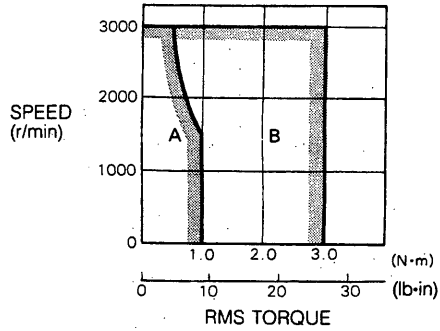
*1: Values when servomotor is combined with SERVOPACK and the armature winding temperature is 20°C.
Shown are normal (TYP) values above.

*2: S of motor type means absolute method.
S: 8192 pulses/rev (absolute)
Optical encoder is used as a detector.

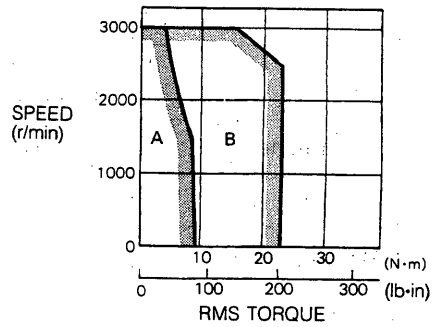
Note: The power supply units for brake:
· Input 100 VAC, Output 90 VDC: Type OPR 109 F
· Input 200 VAC, Output 90 VDC: Type OPR 109 A

(2) Torque-Speed Characteristics (G Series)

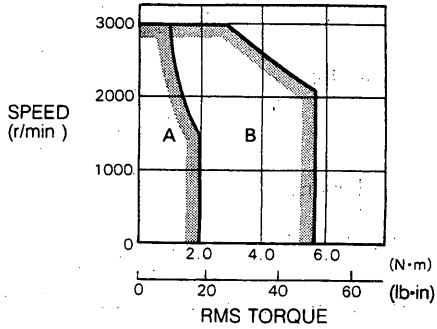
● TYPE USAGED-02AS1



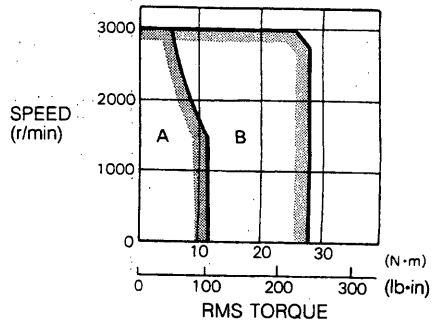
● TYPE USAGED-13AS1



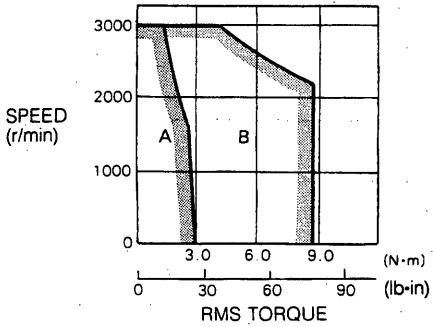
● TYPE USAGED-03AS1



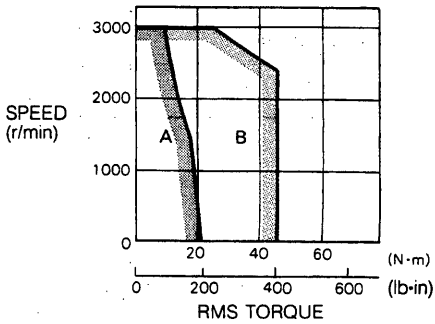
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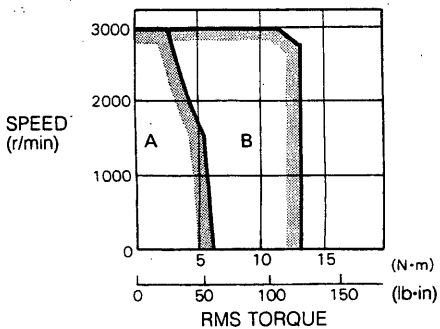
● TYPE USAGED-05AS1



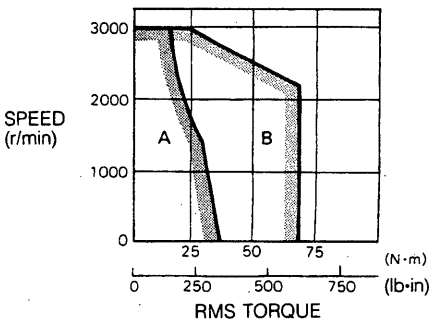
● TYPE USAGED-30AS2



● TYPE USAGED-09AS1



● TYPE USAGED-44AS2



: CONTINUOUS DUTY ZONE
 : INTERMITTENT DUTY ZONE
 POWER SUPPLY: 200 V

4.3 MOTIONPACK FD SERIES PROGRAMMER

Item	Ratings
Type	CMPR-PFD30
Indicator	Liquid crystal module with EL back-light 16 characters × 4 lines and display LEDs
EL Service Lifetime	Luminance is deteriorated a little after approx. 2000 hours.
Switch	Operation key switch × 40
Auxiliary Memory Unit	No-contact method memory card (reader/writer built-in)
Printer Board	RS-232 interface built-in (D-SUB 9-pin)
Power Supply	Supplied from FD controller through cable
Environment	Operation ambient temperature : 0 to 50°C external air cooling Storage ambient temperature : -20 to +60 °C Ambient humidity : 30 to 95%RH (non-condensing) Vibration resistance : In accordance with JIS C0911 (up to 1G) Shock resistance : In accordance with JIS C0912 (up to 10G) Atmosphere : Free from inflammables, corrosive gases, dust, metallic dust
External Dimensions	85(W) × 190(H) × 37(D)
Approx. Mass	450g (0.99lb)

5. CONTROLLER PARAMETERS

Remarks : U : Can be changed anytime S : Can be changed when motor stops.

P : Can be changed when motor stops in EDIT mode.

Effective after power supply on/off.

Pr No.	name	Range	Unit	Remarks
Pr 0	(RESERVED)			
Pr 1	JOG Low Speed	0 to 99999	Speed unit	P
Pr 2	JOG High Speed	0 to 99999	Speed unit	P
Pr 3	HANDLE Feeding Speed	0 to 99999	Speed unit	P
Pr 4	JOG Low Speed Feeding Torque Limit	0 to 400	%	S
Pr 5	HANDLE Reference Speed/Position Select	0,1(0 : position, 1 : speed)	.....	S
Pr 6	Rapid Return Speed	0 to 99999	Speed unit	P
Pr 7	Waiting Position	-99999999 to +99999999	Reference unit	P
Pr 8	Hard OT Effective/Ineffective	0,1(0 : ineffective, 1 : effective)	.....	P
Pr 9	(For future use)			
Pr10	(RESERVED)			
Pr11	Brake Release Time	0 to 2000 Accuracy : 2msec	msec	P
Pr12 to Pr19 (For future use)				
Pr20	T8 Coordinate System One-time compensation	0 to 255	Reference unit	P
Pr21	T8 Coordinate System Maximum compensation	0 to 99999999	Reference unit	P
Pr22	T9 Coordinate System One-time compensation	0 to 255	Reference unit	P
Pr23	T8 Coordinate System Maximum compensation	0 to 99999999	Reference unit	P
Pr24	(RESERVED)			
Pr25	(RESERVED)		.....
Pr26 to Pr29 (For future use)				
Pr30	Maximum Speed	0 to 99999	Speed unit	P
Pr31	Linear Accel/decel Time	0 to 60000	msec	P
Pr32	All S-curve Accel/decel Time	0 to 10000	msec	P
Pr33	S-curve Section Accel/Decel	0 to 2000	msec	P

5. CONTROLLER PARAMETERS (Cont' d)

Pr No.	Name	Range	Unit	Remarks
Pr34	Position Loop Gain	0 to 255	S ⁻¹	U
Pr35	Speed Loop Gain	0 to 600	Hz	U
Pr36	In-position Range	0 to 255	pulse	S
Pr37	Servo Error Deviation	0 to 999999	pulse	P
Pr38	Motor Selection Code	0 to 99	.....	P
Pr39	MRDY Output Mode Change	0, 1	.....	P
Pr40 to Pr49 (RESERVED)				
Pr50	Minimum Reference Unit	0 to 5	10 ⁿ (mm)	P
Pr51	Ball Screw Pitch	1000 to 99999	μm/rev	P
Pr52	Gear Ratio 1 (Numerator)	1 to 999999	.....	P
Pr53	Gear Ratio 2 (Denominator)	1 to 999999	.....	P
Pr54	Decimal Point Position (Speed Unit)	0 to 5	Reference unit × 10 ⁿ /min	P
Pr55	Number of Encoder Pulses	1000 to 32768 (No magnification)	Pulse	P
Pr56	Rotating Direction Designation	0,1(0 : FWD, 1 : RVS)	.....	P
Pr57 to Pr59 (For future use)				
Pr60	Minus Direction Soft Stroke Limit	-99999999 to +99999999	Reference unit	P
Pr61	Plus Direction Soft Stroke Limit	-99999999 to +99999999	Reference unit	P
Pr62 to Pr69 (For future use)				
Pr70	Home Position Coordinate Setting Method	.....	.....	P
Pr71	T0 Coordinate Offset	-99999999 to +99999999	Reference unit	P
Pr72	Reference Point Coordinate Value	-99999999 to +99999999	Reference unit	S
Pr73	Home Position Setup Command	0, 1	.....
Pr74	Home Position Matching Speed	0 to 99999	Speed unit	P
Pr75	Pushing Torque	0 to 400	%	S
Pr76	Stopper Pushing Time	0 to 60000	msec	S
Pr77	Encoder Allowable Moving Value	0 to 99999990	Reference unit	P
Pr78	ABS-PG Alarm Reset Command	0, 1	.....	P

5. CONTROLLER PARAMETERS (Cont'd)

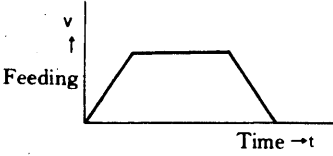
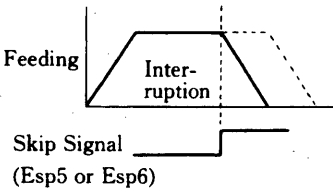
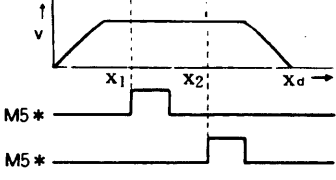
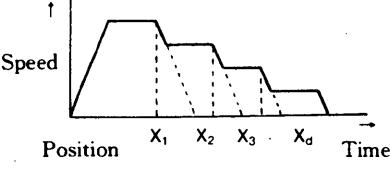
Pr. No.	Name	Range	Unit	Remarks
Pr79	(RESERVED)			
Pr80 to Pr89 (For future use)				
Pr90	Spindle Maximum r/min	0 to 999999	r/min	P
Pr91	Spindle Reference Selection Method	.....	.....	P
Pr92	Spindle PG Disconnection Detection	0,1(0 : not provided, 1 : provided)	.....	P
Pr93 to Pr99 (RESERVED)				
Pr100	Transmission Baud Rate	0.3, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2	kBaud	P
Pr101	MF Output Delay Time	0 to 1000	msec	P
Pr102 to Pr110 (For future use)				
Pr111	PSW1 1st Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr112	PSW1 1st Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr113	PSW1 2nd Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr114	PSW1 2nd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr115	PSW1 3rd Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr116	PSW1 3rd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr117	PSW1 4th Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr118	PSW1 4th Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr119 to Pr120 (For future use)				
Pr121	PSW2 1st Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr122	PSW2 1st Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr123	PSW2 2nd Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr124	PSW2 2nd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr125	PSW2 3rd Zone Lower Limit	-99999999 to +99999999	Reference unit	P

5. CONTROLLER PARAMETERS (Cont'd)

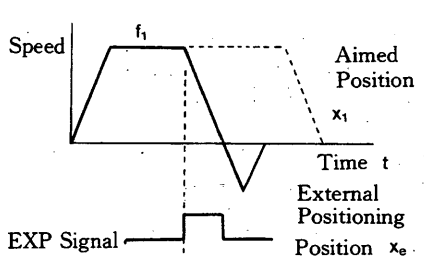
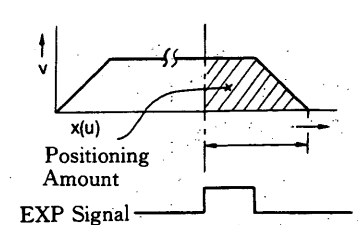
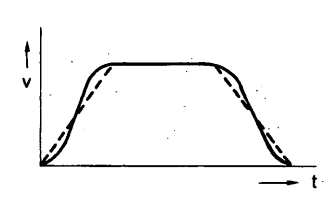
Pr No.	Name	Range	Unit	Remarks
Pr126	PSW2 3rd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr127	PSW2 4th Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr128	PSW2 4th Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr129 to Pr130 (For future use)				
Pr131	PSW3 1st Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr132	PSW3 1st Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr133	PSW3 2nd Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr134	PSW3 2nd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr135	PSW3 3rd Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr136	PSW3 3rd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr137	PSW3 4th Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr138	PSW3 4th Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr139 to Pr140 (For future use)				
Pr141	PSW4 1st Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr142	PSW4 1st Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr143	PSW4 2nd Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr144	PSW4 2nd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr145	PSW4 3rd Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr146	PSW4 3rd Zone Upper Limit	-99999999 to +99999999	Reference unit	P
Pr147	PSW4 4th Zone Lower Limit	-99999999 to +99999999	Reference unit	P
Pr148	PSW4 4th Zone Upper Limit	-99999999 to +99999999	Reference unit	P

6. FUNCTION COMMAND

6.1 FUNCTION COMMAND LIST

Function Command	Symbol	Function Command Word	Contents
Positioning	G01	G01X___F___I___S___ U_____	Speed F to position X (or distance U). Positioning at torque limit I. Spindle command can be set simultaneously. 
Skip positioning	G05 G06	G05X___F___I___S___ U_____	When the skip signal is turned on during feeding, the execution is interrupted and moves to the next block. 
Positioning with passing signal output	G07	G07X_____ G12X_____ M5*_____ G12X_____ M5*_____ Note : G07 is used in common for X and U. M FIN is provided for M50 to M58. M FIN is not required for M80 to M88/M90 to M98. Other encoded M output can be made by signal.	M5* signal is output at the position specified by G12 during moving to the position specified by G07. 
Speed profile positioning	G08	G08X xd_____ G12X x1 F f1 I _____ G12X x2 F f2 I _____ G12X x3 F f3 I _____ G12X xd F f4 I _____ X or U can be specified for G08 and G12.	Speed is changed at the G12 specified position during G08 command positioning. 

6.1 FUNCTION COMMAND LIST (Cont'd)

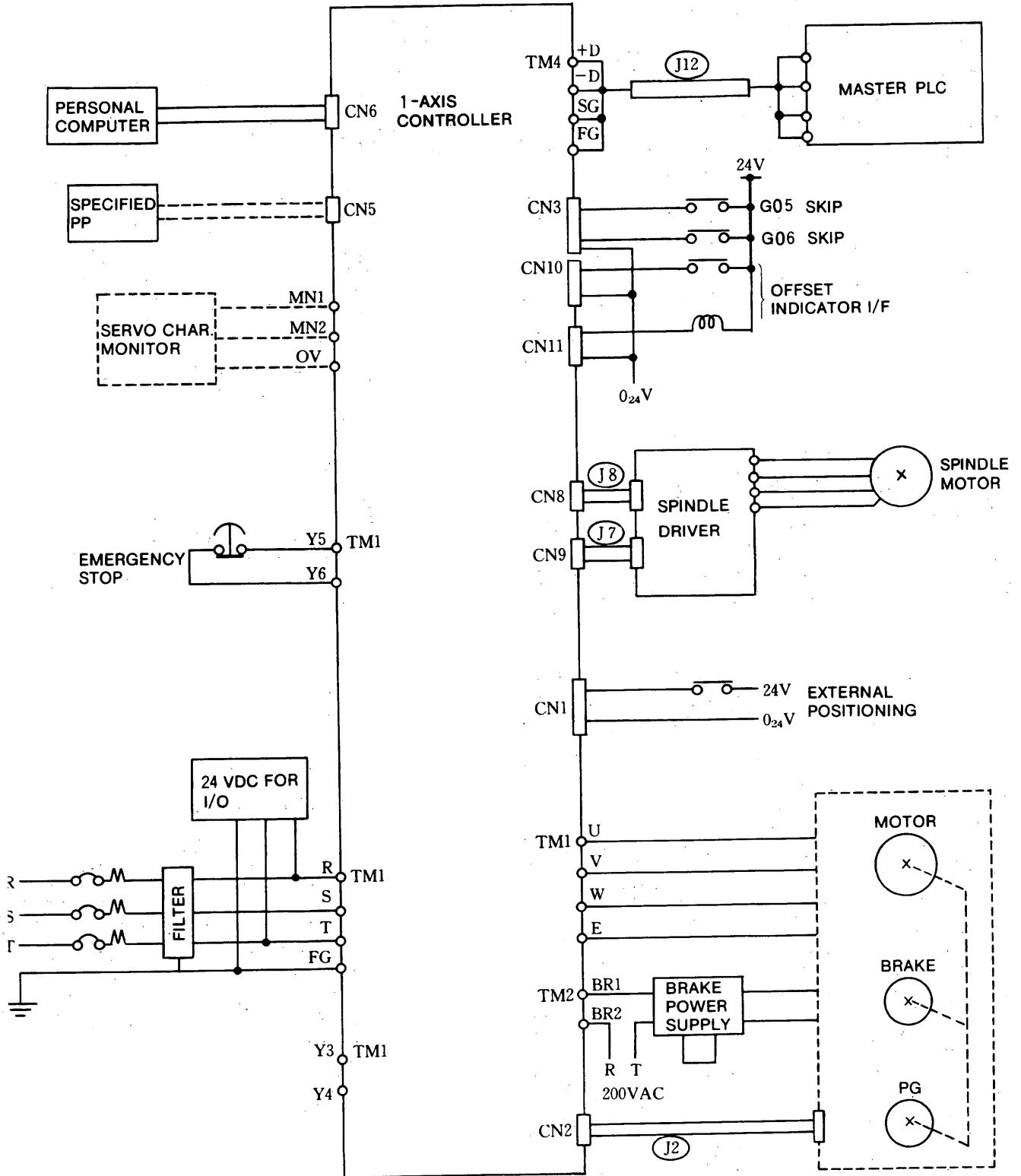
Function Command	Symbol	Function Command Word	Contents
External positioning	G34	G34X <u>x₁</u> F <u>f₁</u> I <u> </u> U <u> </u>	<p>Positioning is performed at a position where external positioning signal (EXP) is turned on during moving at speed F in torque limit I to X (or U) position.</p> 
Second external positioning	G35	G35X <u>(x)</u> F <u> </u> I <u> </u> U <u> </u>	<p>When the machine continues moving until EXP signal is turned on and then EXP is turned on, positioning is performed at the specified position.</p> <ol style="list-style-type: none"> (1) X designation: To point x with EXP position as home position (2) U-distance move from EXP position 
S-curve accel/decel positioning		G10 G01X <u> </u> F <u> </u> I <u> </u> G11 Positioning commands (G01, G05, G06, G34, G35) that are held between G10 and G11 become S-curve accel/decel.	<p>Positioning is performed by S-curve accel/decel specified by the parameters.</p> 
Dwell	G04	In-position check: G04 coded M output can be signal.	The next block is executed by waiting for in-position after feed command execution.
		Dwell time: G04 D...	The next block is executed by waiting for the period of time specified by D.

6.1 FUNCTION COMMAND LIST (Cont'd)

Function Command	Symbol	Function Command Word	Contents
Coordinate setting	G52	G52X ____ T ____ U ____ X or U can be specified for G08 and G12.	Current position is set as Tn coordinate system position X (or U).
Coordinate change	G53	G53T ____	Changed to Tn coordinate system.
Reaching check position	G67	G67P ____	Jumps to P when position X (or U) is reached without skipping by skip positioning command.
Subprogram call	G68	Repeating rotation designation: G68L...P...	Executes subprogram from P block for L times.
		End position designation: G68X ____ P ____ U ____	Executes subprogram from P block until position X (or U) is reached.
Jump	G69	Simple jump: G69P...	Moves to P block execution.
		Subprogram return: G69	Returns to the next block of subprogram call (G68).
Spindle control function	S	S+ ____ S- ____ S 0	M03 : Spindle FWD run command M04 : Spindle REV run command M05 : Spindle stop command The next block is executed by M FIN signal input.
Auxiliary function	M	M40 to M89	When M-BCD and strobe signals are output and M FIN signal is turned on, M signal output is reset and then the next block is executed by M-FIN signal.
		Program end: M30	AUTO signal (STL) is reset and M30 signal is output.
Disregard command	NOP	NOP	When altering program, this command is used to prevent change in jump destination.

7. HARDWARE CONNECTION

7.1 CONNECTION DIAGRAM



CABLE LIST

Cable	Description	Connect to	Cable Connector Type	Controller Connector Type
J2	Servo PG Cable	CN2	MR-20F/MR-20L	MR-20RMA
J5	Programmer Cable		Special Cable	
J8	Spindle Output Cable	CN8	MR-16M/MR-16L	MR-16RFD2
J9	Spindle PG Cable	CN9	MR-16F/MR-16L	MR-16RMD2
J10	Input Signal Cable	CN10	MR-34F/MR-34L	MR-34RMA
J11	Output Signal Cable	CN11	MR-34M/MR-34L	MR-34RFA
J12	M-NET Interface Cable			

7.2 M-NET (INTERFACE BETWEEN MODULES)

7.2.1 Performance Specifications

Transmission mode, allocation of transmission I/Os and transmission speed can be selected by selector switch.

Performance Specifications

Item	Specifications	
Communication Mode	Half-duplex mode	
Synchronization	Asynchronous	
Transmission Distance	Maximum 100m (total)	
Data Configuration	JIS* 7-bit system (Total 10 bits: Start 1 bit, data 7 bits, even parity 1 bit, Stop 1 bit)	
Parity Check	Vertical parity detection (even parity) Horizontal parity detection (even parity)	
Signal Level	In compliance with EIA RS-422	
Transmission Cable†	JKEV-SB 0.75sq.×2p (Polyethylene insulation shielded cable with twisted paired copper)	
Power Consumption (Vcc)	+5V/0.3A per module	
Transmission Speed	9.6 kbps, 19.2 kbps, 38.4 kbps	
Number of Stations	Maximum 7 slave stations	
Transmission Mode	T mode	Y mode
Transmission Discrete I/Os	256 I/Os Input: 128 Output: 128	256 I/Os Input: 128 Output: 128
Transmission Registers		14 Registers Input: 7 registers Output: 7 registers
Paralleling Function‡	None	Yes

* Japanese Industrial Standard

† JKEV-SB is the standard set by Japan Electric Wire and Cable Makers' Association, and the following products conform to this standard:

Sumitomo Electric Inc., Ltd. -DPEV-SB

Fujikura, Ltd. -IPEV-SB

Furukawa Electric Co., Ltd. -KPEV-SB

‡ When the master detects a communication error with a slave, it disconnects the abnormal slave and continues communication with the remaining normal slaves. The master accesses the disconnected slave an interval of 2 cycles, and reconnects it when it confirms that the slave has been restored to normal operation.

7.2.2 I/O Signal Allocation (M-NET)

(1) Input Signals

SVON	SERVO ON	# 42200
EDIT	EDIT Mode)
PLAY	PLAY Mode	
JOG	JOG Mode	
JSPD	JOG Speed	
+JS	Forward Feed	
-JS	Reverse Feed	
MFIN	M Completion		# 42207

ZRN	Return to Home Potition	# 42210
PGST	Program Start)
ERS	Error Reset	
PGSL1	Program Select 1	
PGSL2	Program Select 2	
PGSL3	Program Select 3	
PGSL4	Program Select 4	
PGSL5	Program Select 5	# 42217

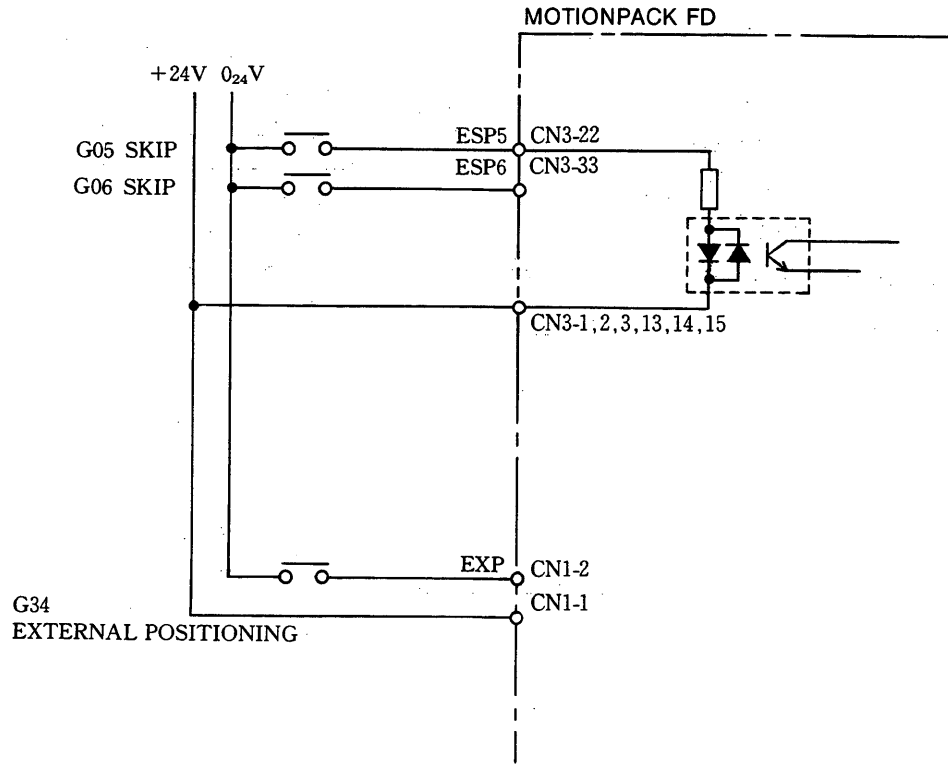
SBLK	Single Block	# 42220
+INC	+Incremental)
-INC	-Incremental	
INC 8/9	INC T8/T9	
G34F	External Positioning Completion	
PGCL	Program Clear	

(2) Output Signals

MRDY	MP Ready	# 43200
SALM	System Alarm	}
BALM	Battery Alarm	
M30	Automatic Operation Completion	
STL	In Operation	
PSW1	Zone Signal 1	
PSW2	Zone Signal 2	# 43207
PSW3	Zone Signal 3	
<hr/>		
M50	M Code BCD 1ST-digit D0	# 43210
M51	M Code BCD 1ST-digit D1	}
M52	M Code BCD 1ST-digit D2	
M53	M Code BCD 1ST-digit D3	
M58	M Code BCD Strobe	
INCD	± Incremental Completion	
OFR	Offset Amount Reset Completion	# 43217
OFM	Offset Amount Reached to ± Max	
<hr/>		
M54	M Code BCD 2ND-digit D0	# 43220
M55	M Code BCD 2ND-digit D1	}
M56	M Code BCD 2ND-digit D2	
M57	M Code BCD 2ND-digit D3	
G34	External Positioning Completion	
EPALM	External Positioning Alarm	
CLD	Current Limit	# 43227
PSW4	Zone Signal 4	

7.3 INPUT SIGNALS FOR SKIP/EXTERNAL POSITIONING

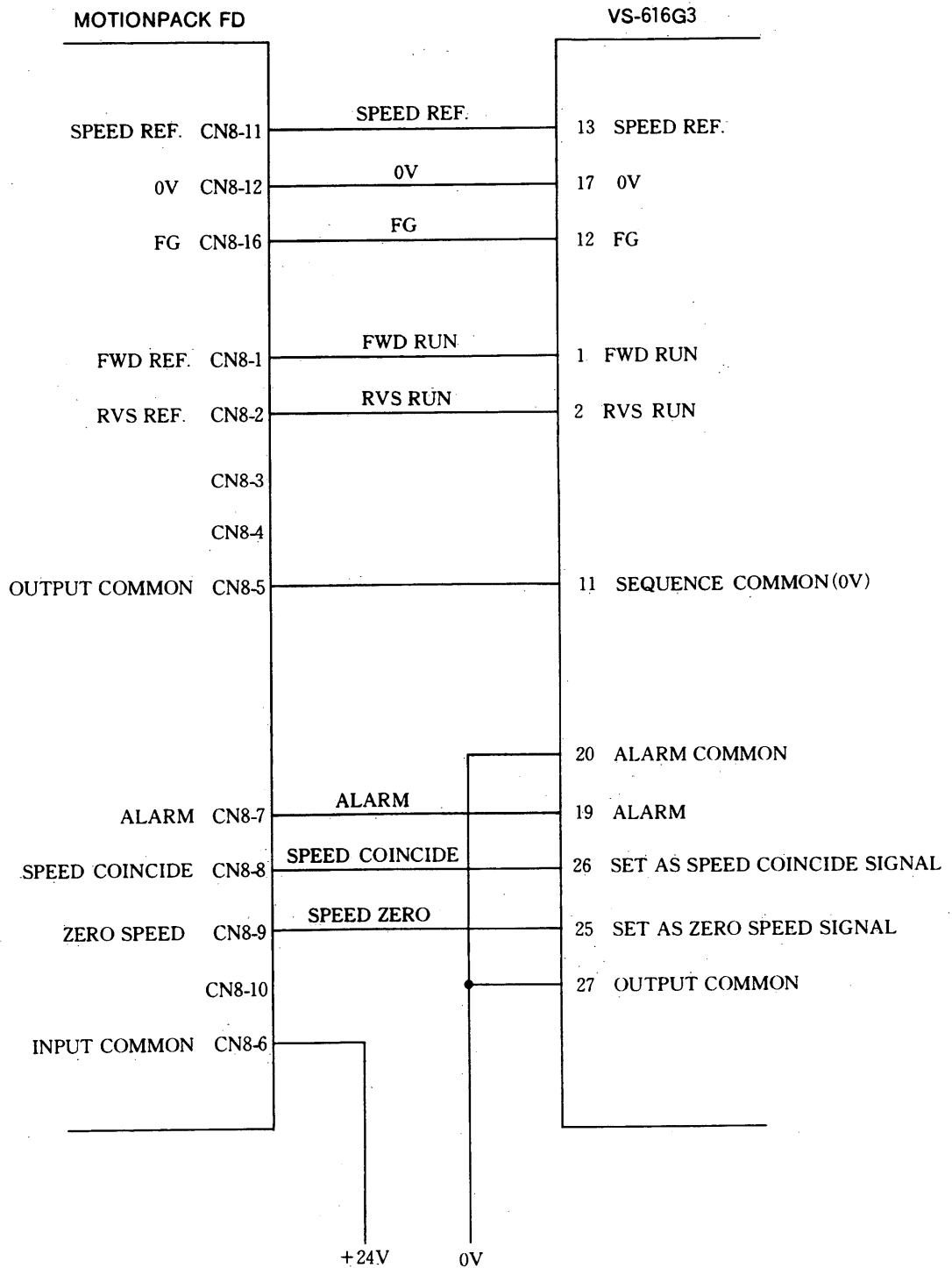
7.3.1 Signal Connections



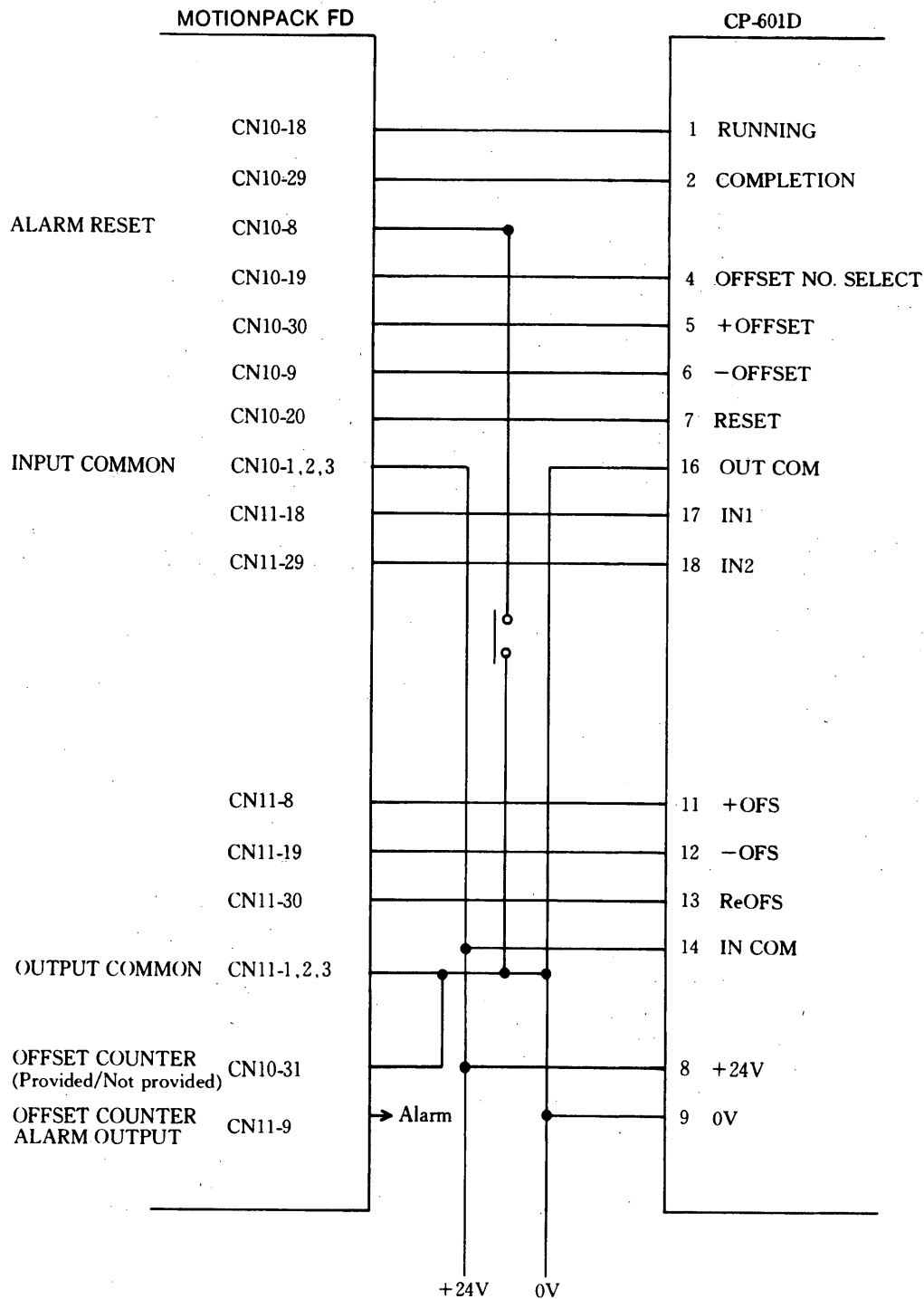
7.3.2 Signal Description

No.	Signal Name	Description
1	External Skip 5 (ESP5)	If ESP5 turns ON during feed with a G05 command, the axis decelerates and stop then goes to the next block.
2	External Skip 6 (ESP6)	Skip signal for G06.
3	External Positioning (EXP)	Positioning signal for G34 and G35. The external positioning command (G34) causes the machine to decelerate to a stop, when EXP turns ON, and return to the position at which EXP turned ON. Then, positioning is performed. G35 is positioning the distance from the position at which EXP turned ON.

7.4 CONNECTION OF SPINDLE DRIVER



7.5 CONNECTION OF OFFSET COUNTER CP-601D

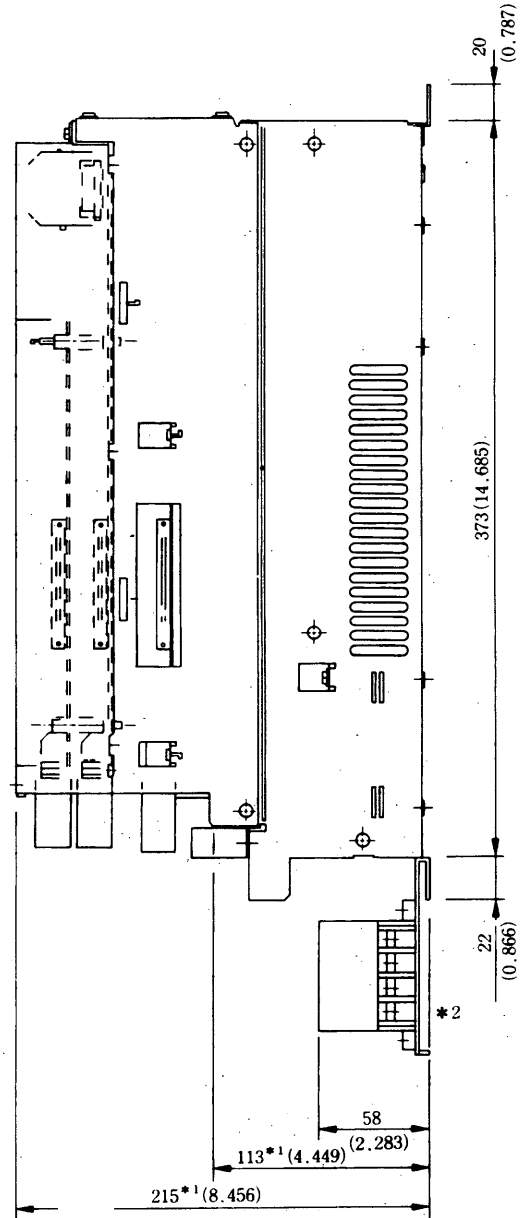
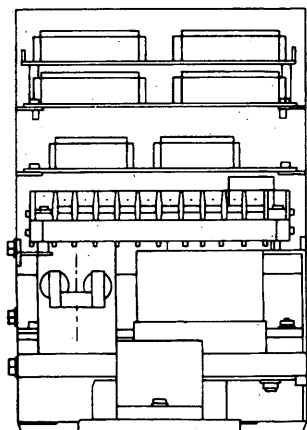
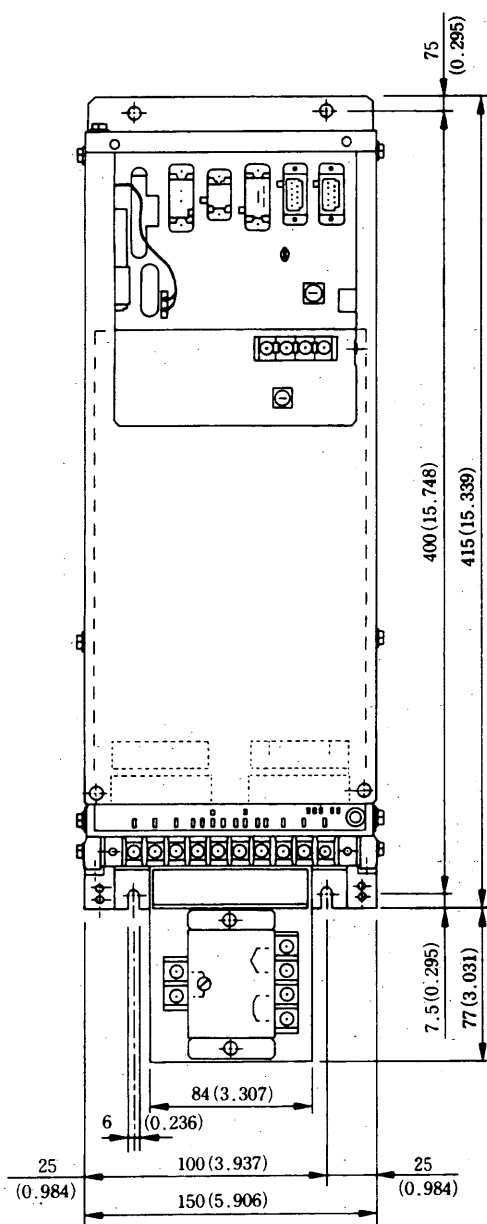


<Description>

1. Alarm reset input <CN10-8> :
Normal when open, reset when closed (35 ms hold).
2. Offset counter (provided/not provided) input <CN10-31> :
Not provided when open, provided (used) when closed.
Note: short-circuit CN10-31 to 0V when using the offset counter.
3. Offset counter alarm output <CN11-9> :
ON when an alarm occurs due to the connection with the offset counter.
Input alarm reset CN10-8.

8. DIMENSIONS in mm (inches)

8.1 CONTROLLER DIMENSIONS

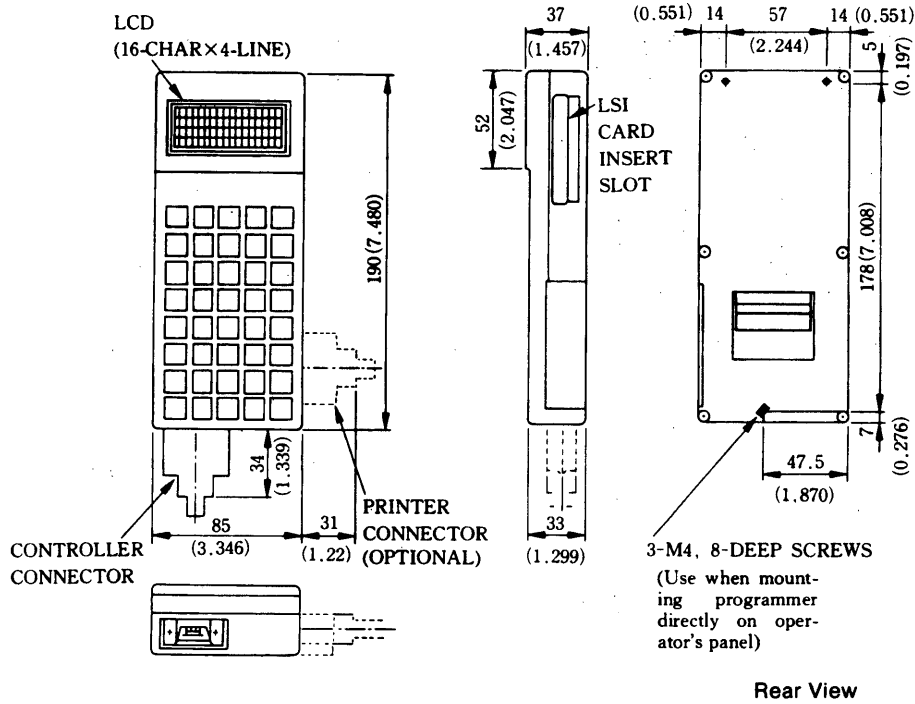


*1 Add 15 mm (0.59 in.) for 4.4 kW controller.

*2 Mounting location for brake power supply.

8.2 PROGRAMMER DIMENSIONS in mm (inches)

TYPE CMPR-PFD30

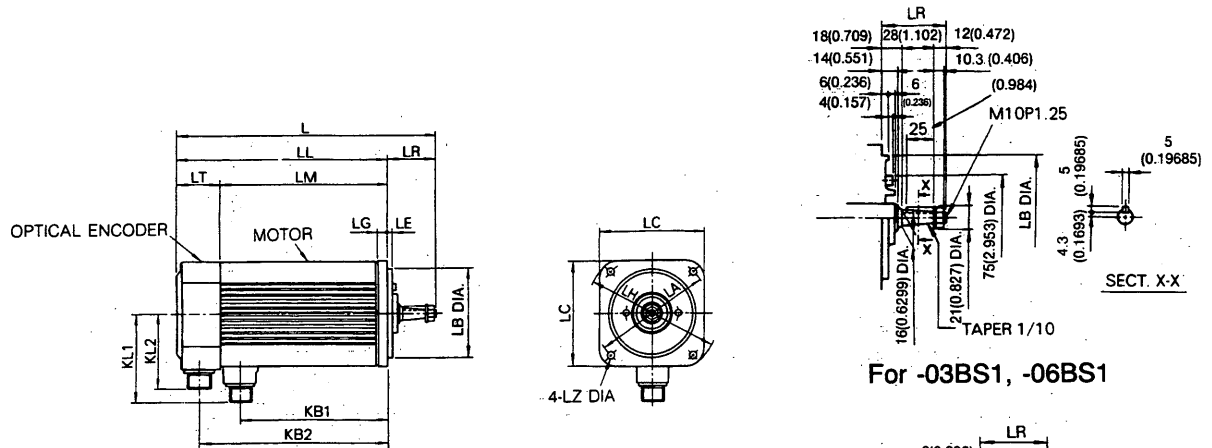


Approx. Mass: 0.45kg (0.99 lb)

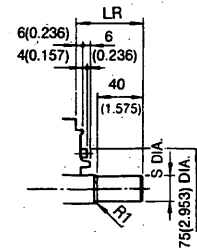
8.3 MOTOR DIMENSIONS in mm (inches)

8.3.1 M Series (Absolute Encoder)

Drawing 1 USAMED-03BS1, -06BS1 (Taper Shaft), -09BS2 (Straight Shaft)



For -03BS1, -06BS1

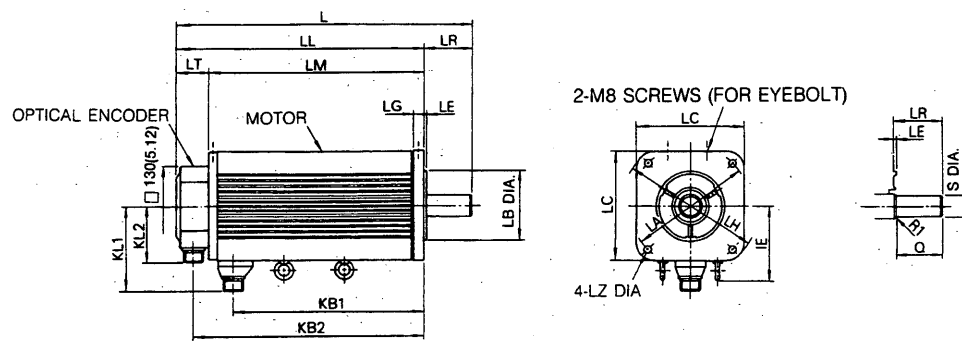


For -09BS2
Detail of Shaft Extension

Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Key and keyway comply with JIS B 1301-1976.
(Parallel key, keyway: common class.)
5. Motor should be mounted with connectors down.

Drawing 2 USAMED-12BS2 to -44BS2 (Straight Shaft)



Detail of Shaft Extension

Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Motor should be mounted with connectors down.

8.3.1 M Series (Cont'd)

in mm (inches)

AC SERVOMOTOR Type USAMED-	Dwg. No.	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface						Shaft Extension		Approx Mass kg (lb)	
												LA	LB	LC	LE	LG	LH	LZ	S		Q
03BS1*	1	277 (10.91)	219 (8.63)	150 (5.91)	58 (2.28)	69 (2.72)	127 (5.0)	177 (6.97)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 ⁰ _{-0.035} (4.3307) ⁰ _{-0.0014}	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	-	-	9(19.9)
06BS1*		334 (13.15)	276 (10.87)	207 (8.15)	58 (2.28)	69 (2.72)	184 (7.24)	234 (9.21)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 ⁰ _{-0.035} (4.3307) ⁰ _{-0.0014}	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	-	-	14(30.9)
09BS1*		403 (15.87)	345 (13.59)	276 (10.87)	58 (2.28)	69 (2.72)	253 (9.96)	303 (11.93)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 ⁰ _{-0.035} (4.3307) ⁰ _{-0.0014}	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	22 ⁰ _{-0.013} (0.8661) ⁰ _{-0.0005}	40 (1.575)	20(44.1)
12BS2*	2	344 (13.55)	265 (10.44)	211 (8.30)	79 (3.11)	54 (2.13)	172 (6.78)	237 (9.33)	-	139 (5.47)	92 (3.62)	200 (7.87)	114.3 ⁰ _{-0.025} (4.5) ⁰ _{-0.001}	180 (7.08)	3.2 (0.13)	18 (0.71)	230 (9.1)	13.5 (0.53)	35 ^{+0.01} ₀ (1.3779) ^{+0.0004} ₀	76 (2.992)	22(48.6)
20BS2*		401 (15.79)	322 (12.68)	268 (10.55)	79 (3.11)	54 (2.13)	229 (9.01)	294 (11.58)	123 (4.85)	139 (5.47)	92 (3.62)	200 (7.87)	114.3 ⁰ _{-0.025} (4.5) ⁰ _{-0.001}	180 (7.08)	3.2 (0.13)	18 (0.71)	230 (9.1)	13.5 (0.53)	35 ^{+0.01} ₀ (1.3779) ^{+0.0004} ₀	76 (2.992)	29(64)
30BS2*		486 (19.13)	407 (16.02)	353 (13.90)	79 (3.11)	54 (2.13)	314 (12.36)	379 (14.93)	123 (4.85)	139 (5.47)	92 (3.62)	200 (7.87)	114.3 ⁰ _{-0.025} (4.5) ⁰ _{-0.001}	180 (7.08)	3.2 (0.13)	18 (0.71)	230 (9.1)	13.5 (0.53)	35 ^{+0.01} ₀ (1.3779) ^{+0.0004} ₀	76 (2.992)	41(90.4)
44BS2		688 (27.09)	578 (22.76)	524 (20.63)	110 (4.33)	54 (2.13)	476 (18.74)	550 (21.65)	123 (4.85)	149 (5.87)	92 (3.62)	200 (7.87)	114.3 ⁰ _{-0.025} (4.5) ⁰ _{-0.001}	180 (7.08)	3.2 (0.13)	18 (0.71)	230 (9.1)	13.5 (0.53)	42 ⁰ _{-0.016} (1.6535) ⁰ _{-0.0006}	110 (4.33)	66(146)

* Not provided with an eyebolt.

CONNECTOR TYPES

AC SERVOMOTOR Type USAMED-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
03BS1 06BS1 09BS2	MS3102 B18-10P	MS3108 B18-10P	MS3106 B18-10S	MS3057 -10A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
12BS2 20BS2 30BS2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				
44BS2	MS3102 A32-17P	MS3108 B32-17S	MS3106 B32-17S	MS3057 -20A				

MECHANICAL SPECIFICATIONS

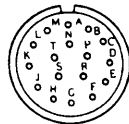
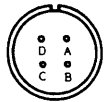
Accuracy (T. I. R)*	Reference Diagram
Flange surface perpendicular to shaft (A)	0.04 (0.0016)
Flange diameter concentric to shaft (B)	0.04 (0.0016)
Shaft run out (C)	0.02 (0.0008)
	0.04† (0.0016†)

SERVOMOTORS with a brake or a modified shaft extension are also available.

* T. I. R. (Total Indicator Reading)
† Accuracy for motor types USAMED-44BS2.

CONNECTOR SPECIFICATIONS

Motor Receptacle Absolute Encoder Receptacle



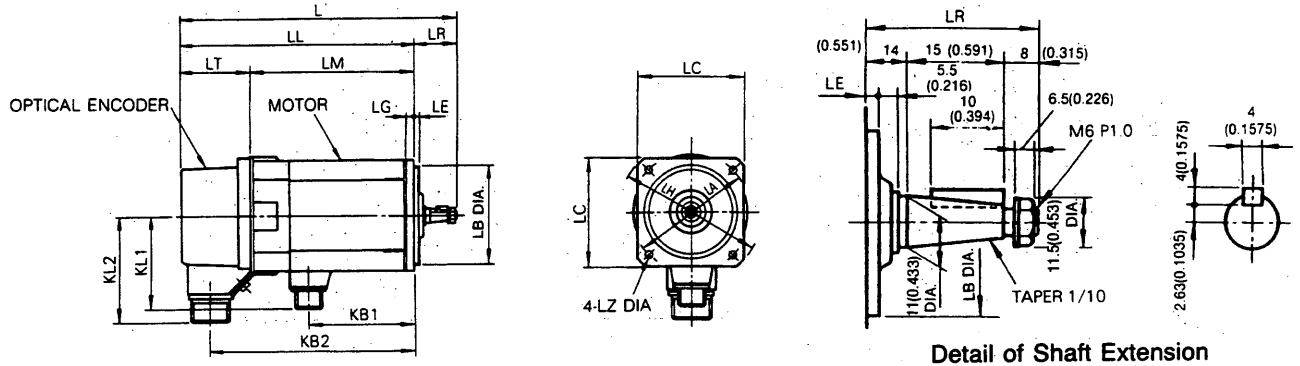
A	Phase U
B	Phase V
C	Phase W
D	Ground

A	Channel A output	K	-
B	Channel A output	L	-
C	Channel B output	M	-
D	Channel B output	N	-
E	Channel C output	P	-
F	Channel C output	R	For reset
G	0 V	S	0V (battery)
H	+5 VDC	T	3.6 V (battery)
J	Frame ground	-	-

8.3 MOTOR DIMENSIONS in mm (inches) (Cont'd)

8.3.2 F Series (Absolute Encoder)

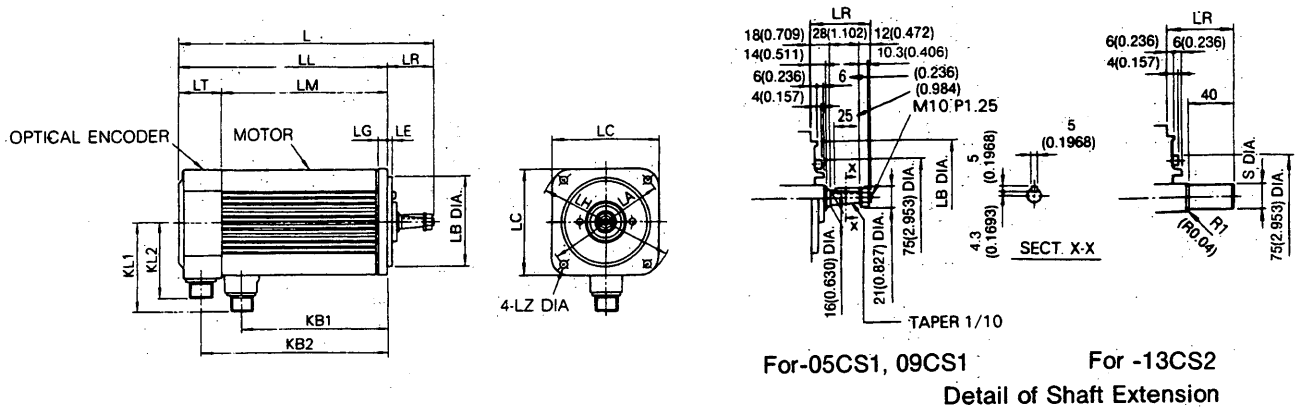
Drawing 1 USAFED-02CS1,-03CS1 (Taper Shaft)



Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Key and keyway comply with JIS B 1301-1976. (Parallel key, keyway: common class.)
5. Motor should be mounted with connectors down.

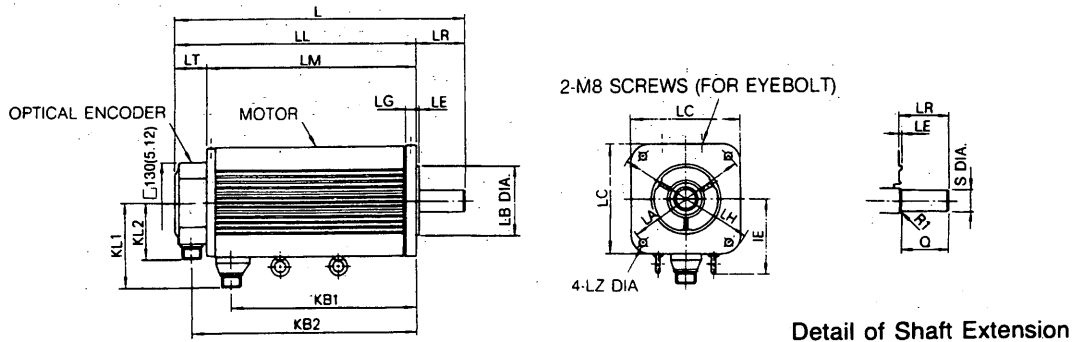
Drawing 2 USAFED-05CS1,-09CS1 (Taper Shaft) , -13CS2 (Straight Shaft)



Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Key and keyway comply with JIS B 1301-1976. (Parallel key, keyway: common class.)
5. Motor should be mounted with connectors down.

Drawing 3 USAFED-20CS2 to -44CS2 (Straight Shaft)



Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Motor should be mounted with connectors down.

8.3.2 F Series (Cont'd)

in mm (inches)

AC SERVOMOTOR Type USAFED-	Dwg. No.	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface						Shaft Extension		Approx Mass kg (lb)	
												LA	LB	LC	LE	LG	LH	LZ	S		Q
02CS1*	1	234 (9.21)	197 (7.75)	137 (5.39)	37 (1.46)	60 (2.36)	90 (3.54)	172 (6.77)	-	76 (3.03)	89 (3.51)	100 (3.94)	80 ⁰ _{-0.030} (3.1496) ⁰ _{-0.0012}	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	-	-	5(11.1)
03CS1*		280 (11.02)	243 (9.56)	183 (7.2)	37 (1.46)	60 (2.36)	136 (5.35)	218 (8.58)	-	76 (3.03)	89 (3.51)	100 (3.94)	80 ⁰ _{-0.030} (3.1496) ⁰ _{-0.0012}	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	-	-	7(15.5)
05CS1*	2	277 (10.90)	219 (8.62)	150 (5.91)	58 (2.28)	69 (2.72)	127 (5.0)	177 (6.97)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 ⁰ _{-0.035} (4.3307) ⁰ _{-0.0014}	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	-	-	9(19.9)
09CS1*		344 (13.14)	276 (10.86)	207 (8.16)	58 (2.28)	69 (2.72)	184 (7.24)	234 (9.21)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 ⁰ _{-0.035} (4.3307) ⁰ _{-0.0014}	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	-	-	14(30.9)
13CS2*		403 (15.87)	345 (13.59)	276 (10.87)	58 (2.28)	69 (2.72)	253 (9.96)	303 (11.93)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 ⁰ _{-0.035} (4.3307) ⁰ _{-0.0014}	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	22 ⁰ _(0.8661) ⁰ _{-0.0013}	40 ⁰ _(1.57) ⁰ _{-0.0005}	20(44.1)
20CS2*	3	344 (13.55)	265 (10.44)	211 (8.3)	79 (3.11)	54 (2.13)	172 (6.78)	237 (9.33)	-	139 (5.47)	92 (3.62)	200 (7.88)	114.3 ⁰ _{-0.025} (4.5) ⁰ _{-0.001}	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 ^{+0.01} (1.3379) ⁰ _{+0.0004}	76 ⁰ (2.99) ⁰ _{+0.0004}	22(48.6)
30CS2		401 (15.79)	322 (12.68)	268 (10.55)	79 (3.11)	54 (2.13)	229 (9.02)	294 (11.58)	123 (4.85)	139 (5.47)	92 (3.62)	200 (7.88)	114.3 ⁰ _{-0.025} (4.5) ⁰ _{-0.001}	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 ^{+0.01} (1.3379) ⁰ _{+0.0004}	76 ⁰ (2.99) ⁰ _{+0.0004}	29(64)
44CS2		486 (19.14)	407 (16.02)	353 (13.90)	79 (3.11)	54 (2.13)	314 (12.36)	379 (14.93)	123 (4.85)	139 (5.47)	92 (3.62)	200 (7.88)	114.3 ⁰ _{-0.025} (4.5) ⁰ _{-0.001}	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 ^{+0.01} (1.3379) ⁰ _{+0.0004}	76 ⁰ (2.99) ⁰ _{+0.0004}	41(90.4)

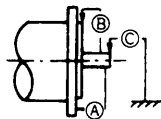
* Not provided with an eyebolt.

CONNECTOR TYPES

AC SERVOMOTOR Type USAFED-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
02CS1 03CS1	MS3102 A14S-2P	MS3108 B14S-2S	MS3106 B14S-2S	MS3057 -6A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
05CS1 09CS1 13CS2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A				
20CS2 30CS2 44CS2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

Accuracy (T. I. R)*		Reference Diagram
Flange surface perpendicular to shaft (A)	0.04 (0.0016)	
Flange diameter concentric to shaft (B)	0.04 (0.0016)	
Shaft run out (C)	0.02 (0.0008)	

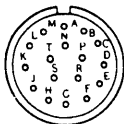
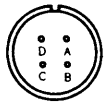


SERVOMOTORS with a brake or a modified shaft extension are also available.

* T. I. R. (Total Indicator Reading)

CONNECTOR SPECIFICATIONS

Motor Receptacle Absolute Encoder Receptacle



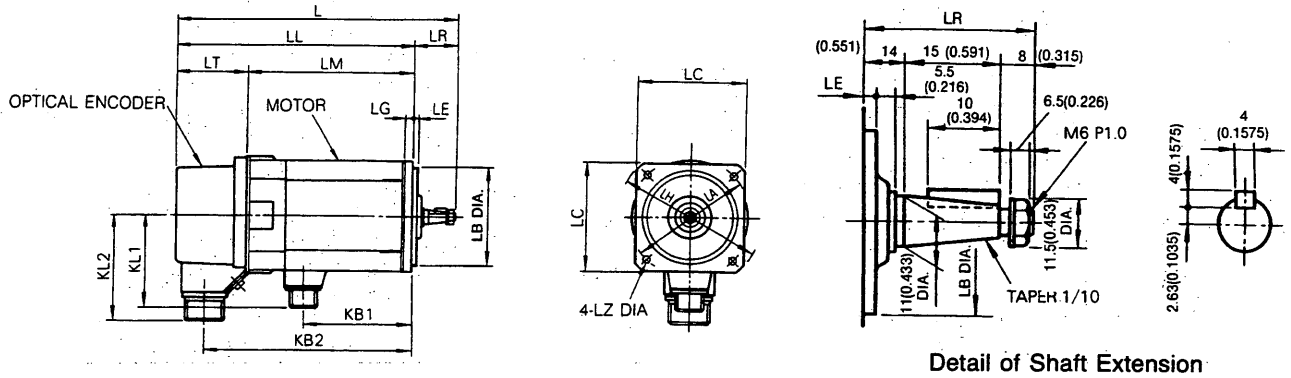
A	Phase U
B	Phase V
C	Phase W
D	Ground

A	Channel A output	K	-
B	Channel A output	L	-
C	Channel B output	M	-
D	Channel B output	N	-
E	Channel C output	P	-
F	Channel C output	R	For reset
G	0 V	S	0 V (battery)
H	+5 VDC	T	3.6 V (battery)
J	Frame ground	-	-

8.3 MOTOR DIMENSIONS in mm (inches) (Cont'd)

8.3.3 G Series (Absolute Encoder)

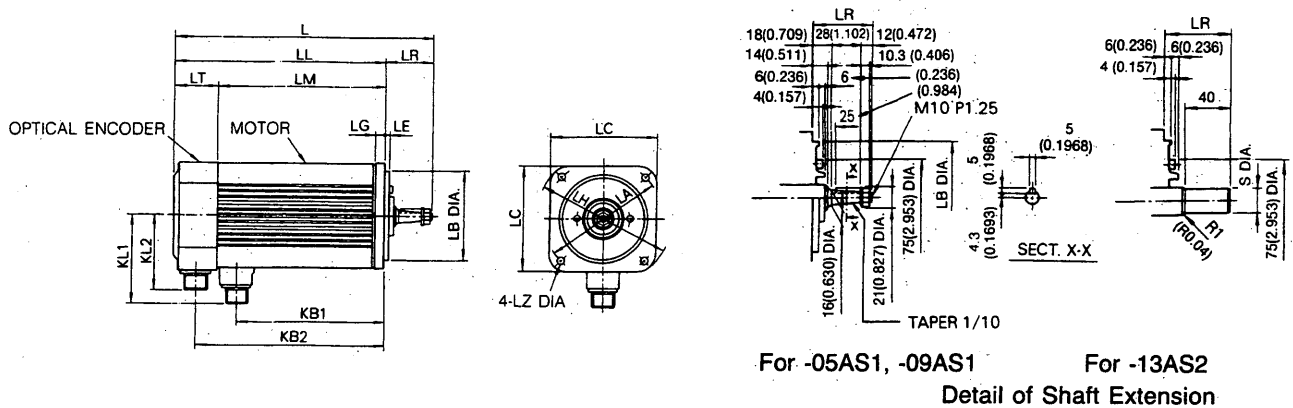
Drawing 1 USAGED-02AS1, -03AS1 (Taper Shaft)



Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Key and keyway comply with JIS B 1301-1976. (Parallel key, keyway: common class.)
5. Motor should be mounted with connectors down.

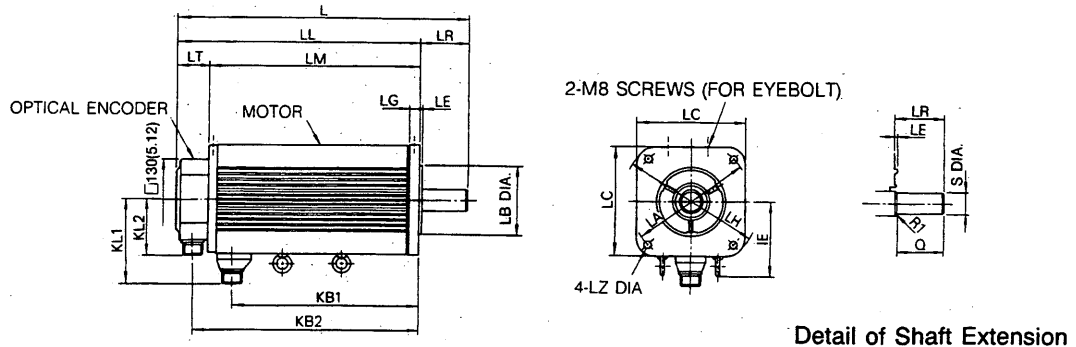
Drawing 2 USAGED-05AS1, -09AS1 (Taper Shaft), -13AS2 (Straight Shaft)



Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Key and keyway comply with JIS B 1301-1976. (Parallel key, keyway: common class.)
5. Motor should be mounted with connectors down.

Drawing 3 USAGED-20AS2 to -44AS2 (Straight Shaft)



Notes:

1. Absolute encoder is used as a detector.
2. Vibration: 15 μ m or below
3. Plug and clamp are not attached for receptacle connection.
4. Motor should be mounted with connectors down.

8.3.3 G Series (Cont'd)

in mm (inches)

AC SERVOMOTOR Type USAGED-	Dwg. No.	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface						Shaft Extension		Approx Mass kg (lb)			
												LA	LB	LC	LE	LG	LH	LZ	S		Q		
02AS1*	1	234 (921)	197 (775)	137 (5.39)	37 (1.46)	60 (2.36)	90 (3.54)	172 (6.77)	-	76 (3.43)	89 (2.99)	100 (3.94)	80 (3.1496)	0 -0.0030 0 -0.0012	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	-	-	5(11.1)	
03AS1*		280 (1102)	243 (9.56)	183 (7.2)	37 (1.46)	60 (2.36)	136 (5.35)	218 (8.58)	-	76 (3.43)	89 (2.99)	100 (3.94)	80 (3.1496)	0 -0.0030 0 -0.0012	90 (3.54)	4 (0.157)	7 (0.276)	120 (4.72)	6.6 (0.26)	-	-	7(15.5)	
05AS1*	2	277 (10.90)	219 (8.62)	150 (5.91)	58 (2.28)	69 (2.72)	127 (5.0)	177 (6.97)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 (4.3307)	0 -0.0035 0 -0.0014	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	-	-	9(19.9)	
09AS1*		344 (13.14)	276 (10.86)	207 (8.16)	58 (2.28)	69 (2.72)	184 (7.24)	234 (9.21)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 (4.3307)	0 -0.0035 0 -0.0014	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	-	-	14(30.9)	
13AS2*		403 (15.87)	345 (13.59)	276 (10.87)	58 (2.28)	69 (2.72)	253 (9.96)	303 (11.93)	-	109 (4.29)	92 (3.62)	145 (5.71)	110 (4.3307)	0 -0.0035 0 -0.0014	130 (5.12)	6 (0.24)	12 (0.47)	165 (6.5)	9 (0.35)	22 (0.8661)	0 -0.03 0 -0.0005	40 (1.57)	20(44.1)
20AS2*	3	344 (13.55)	265 (10.44)	211 (8.3)	79 (3.11)	54 (2.13)	172 (6.78)	237 (9.33)	-	139 (5.47)	92 (3.62)	200 (7.88)	114.3 (4.5)	0 -0.025 0 -0.001	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 (1.3379)	$+0.01$ 0 $+0.0004$ 0	76 (2.99)	22(48.6)
30AS2		401 (15.79)	322 (12.68)	268 (10.55)	79 (3.11)	54 (2.13)	229 (9.02)	294 (11.58)	123 (4.85)	139 (5.47)	92 (3.62)	200 (7.88)	114.3 (4.5)	0 -0.025 0 -0.001	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 (1.3379)	$+0.01$ 0 $+0.0004$ 0	76 (2.99)	29(64)
44AS2		486 (19.14)	407 (16.02)	353 (13.90)	79 (3.11)	54 (2.13)	314 (12.36)	379 (14.93)	123 (4.85)	139 (5.47)	92 (3.62)	200 (7.88)	114.3 (4.5)	0 -0.025 0 -0.001	180 (7.09)	3.2 (0.13)	18 (0.71)	230 (9.06)	13.5 (0.53)	35 (1.3379)	$+0.01$ 0 $+0.0004$ 0	76 (2.99)	41(90.4)

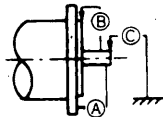
* Not provided with an eyebolt.

CONNECTOR TYPES

AC SERVOMOTOR Type USAGED-	Motor Connector Types				Absolute Encoder Connector Types			
	Receptacle	L-type Plug	Straight Plug	Cable Clamp	Receptacle	L-type Plug	Straight Plug	Cable Clamp
02AS1 03AS1	MS3102 A14S-2P	MS3108 B14S-2S	MS3106 B14S-2S	MS3057 -6A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057 -12A
05AS1 09AS1 13AS2	MS3102 A18-10P	MS3108 B18-10S	MS3106 B18-10S	MS3057 -10A				
20AS2 30AS2 44AS2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057 -12A				

MECHANICAL SPECIFICATIONS

Accuracy (T. I. R)*	Reference Diagram
Flange surface perpendicular to shaft (A)	0.04 (0.0016)
Flange diameter concentric to shaft (B)	0.04 (0.0016)
Shaft run out (C)	0.02 (0.0008)

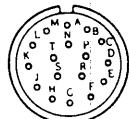
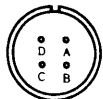


SERVOMOTORS with a brake or a modified shaft extension are also available.

* T. I. R. (Total Indicator Reading)

CONNECTOR SPECIFICATIONS

Motor Receptacle Absolute Encoder Receptacle

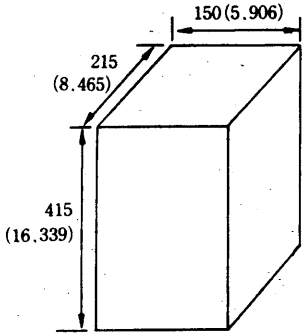
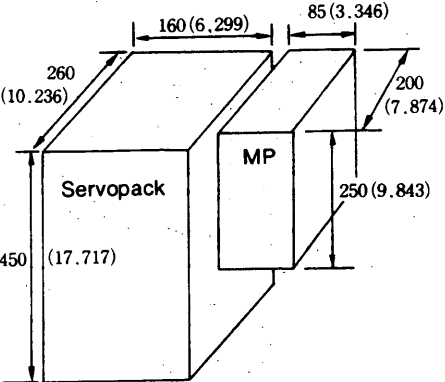


A	Phase U
B	Phase V
C	Phase W
D	Ground

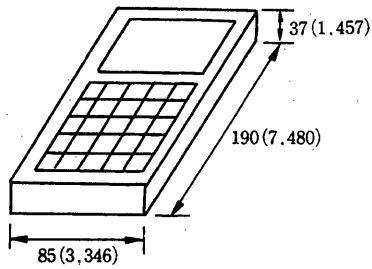
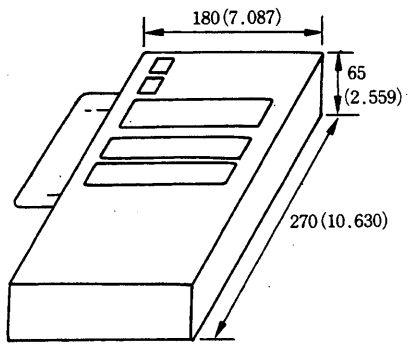
A	Channel A output	K	-
B	Channel A output	L	-
C	Channel B output	M	-
D	Channel B output	N	-
E	Channel C output	P	-
F	Channel C output	R	For reset
G	0V	S	0V (battery)
H	+5VDC	T	3.6V (battery)
J	Frame ground	-	-

APPENDIX 1 FEATURES OF MOTIONPACK FD (COMPARISON WITH MOTIONPACK-34)

Dimensions in mm (inches)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
1	Mounting Space	<p>Space-saving</p> <ul style="list-style-type: none"> • Mounting area 2/3 of MOTIONPACK-34 • Servo incorporated construction 150W × 415H × 215D 	<ul style="list-style-type: none"> • Servo controller attached separately 
2	Wiring	<p>Wire-saving</p> <p>(1) Digital I/O signals: Connected between modules by interface.</p> <ul style="list-style-type: none"> • No. of wiring points: 4 (+D, -D, SG, FG) <p>(2) Servo signals: None (because of servo incorporated construction)</p>	<p>(1) Digital I/O signals Input: 44 points Output: 18 points</p> <p>(2) Servo signals 2 cables, 28 signal lines</p>
3	Compatibility with Servomotors	Compatible for each servomotor series of the same type by using parameters.	Servopack type differs according to matching servo motors.
4	Servo Characteristics	<p>Employing all-digital servo realizes driftless, wide range of speed control or potentiometer (no-adjustment).</p> <ul style="list-style-type: none"> • Speed control range 1 : 5000 • Speed variation range (no-load variation) -0.01% or less (0 to 100% load at rated r/min) • Speed variation rate (voltage variation) 0% (+10 to -15%) • Speed variation rate (temperature variation) ±0.01% or less (25 ± 25°C) 	<p>1 : 3000</p> <p>-0.03% or less</p> <p>±0.1% or less</p> <p>±0.5% or less</p>

APPENDIX 1 FEATURES OF MOTIONPACK FD (Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
5	Serial Interface	Serial interface (M-NET) is provided between modules.	Not provided.
6	Spindle Reference	<p>The following spindle reference is provided :</p> <ul style="list-style-type: none"> • Reference voltage • Analog reference $\pm 10V$ • Spindle related signals • I/O=4/4 points • Programmed by G-commands' S address • Spindle designation is programmed by M code. 	Not provided.
7	Solid Tap	• Provided.	Not provided.
8	Programmer	<ul style="list-style-type: none"> • Personal computer programmer • Compact exclusive-use programmer 	<ul style="list-style-type: none"> • Personal computer programmer • Exclusive-use programmer 
9	Function	<p>Succeeding the functions of MP-34 that have been highly evaluated for special machines or transfer machines.</p> <ol style="list-style-type: none"> ① Absolute value positioning method by motor with absolute encoder → no limit-switch system ② Automatic accel/ decel control Linear accel/ decel S-curve accel/ decel ③ Automatic home position setup method ④ Coordinate system selectable, coordinate axis compensation possible ⑤ Zone signals (4 signals for each of 4 zones) 	

APPENDIX 1 FEATURES OF MOTIONPACK FD (Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
10	Up-graded Functions	<p>The following functions are up-graded from the MP-34.</p> <ul style="list-style-type: none"> ① Position reference value : Signs +8 digits ② Max. pulse speed : 4 Mpps ③ Indirect register designation : R01 to R99 ④ Auxiliary functions : M40 to M89 (BCD output) ⑤ Alarm monitor function : Alarm history function provided. Servo amplifier speed, torque monitor (analog) ⑥ Compensated value indicator interface: Interface possible with CP-601D made by Chita Mfg. ⑦ For the difference of each function, refer to APPENDIX 2 "Comparison of MOTIONPACK FD and MOTIONPACK-34". 	<ul style="list-style-type: none"> ① Position reference value : Signs +7 digits ② Max. pulse speed : 600 kpps ③ Indirect register designation : Parameters ④ Auxiliary functions : M51 to M56 ⑤ Alarm monitor function : Alarm history function not provided. Only analog monitor provided. ⑥ Compensated value indicator interface : Not provided.

APPENDIX 2 COMPARISON OF MOTIONPACK FD AND MOTIONPACK-34 (CHARACTERISTICS, FUNCTIONS)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
1	Configuration	Controller, servo incorporated	MP-34 controller (CMPC-CM34C) + SERVOPACK (CACR-SR□TZ6S□) + SERVOMOTOR (USAMED-□MS1) Controller, SERVOPACK provided separately
2	Applicable Motor	SERVOMOTOR with absolute encoder (new model) M series (USAMED-□BS1) F series (USAFED-□CS1) G series (USAGED-□AS1) Conventional model Servomotor with absolute encoder can be driven.	SERVOMOTOR with absolute encoder M series (USAMED-□MS1) F series (USAFED-□FS1)
3	Encoder	8192 p/rev, absolute encoder, 3.6V battery backup	8192 p/rev, absolute encoder, 3.6V battery backup
4	Programmer	Exclusive-use programmer CMPR-PFD30 Personal computer IBM compatible	Exclusive-use programmer CMPF-PM33F Personal computer IBM compatible
5	Holding Brake	Holding brake control signal provided. Brake power supply should be provided by user.	Brake controller and its power supply built in SERVOPACK.
6	Environment	Operation temperature: 0 to +55°C Storage temperature: -20 to +85°C Humidity: 90% RH or less (non-condensing) Atmosphere: Free from corrosive gases, dust or metallic powder	Operation temperature: 0 to +55°C Storage temperature: -20 to +85°C Humidity: 25 to 95% RH (controller) } Non- 90% RH or less (Servopack) } condensing Atmosphere: Free from corrosive gases, dust or metallic powder
7	Number of Axes	One axis + spindle (reference)	One axis
8	Position Reference Value	Signs + decimal 8 digits	Signs + decimal 7 digits
9	Speed Reference Value	Decimal 5 digits	Decimal 5 digits

APPENDIX 2 COMPARISON OF MOTIONPACK FD AND MOTIONPACK-34

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
10	Max. Pulse Speed	4Mpps (after multiplied by 4)	600kpps (after multiplied by 4)
11	Torque Limit	10 to 400% of rated torque can be set. However, it is limited by either applicable servomotor maximum torque value or programmed limit value that is smaller.	10 to 250% of rated torque
12	Automatic Accel/Decel control	Linear accel/decel, S-curve accel/decel	Linear accel/decel
13	Coordinate Home Position Matching	① Full-automatic setup method (stopper applied) ② Semi-automatic setup method	① Full-automatic setting method ② Semi-automatic setting method ③ Manual setting method
14	Program	Up to 32 (1000 blocks)	Up to 40 (400 blocks)
15	Operation Mode	① EDIT mode ② JOG mode ③ HANDL mode ④ AUTO mode ⑤ SET UP mode No STEP mode provided.	① EDIT mode ② JOG mode ③ STEP mode ④ HANDL mode ⑤ AUTO mode
16	Overtravel	Soft stroke limit	Soft stroke limit
17	Coordinate System	T0 to T9 T0: ABSO-PG coordinate + home position offset T1 to T7: Set by G52 command T8, T9: G52 command and compensation T1 to T9: Preset by programmer	T0 to T9 T0: ABSO-PG coordinate + home position offset T1 to T7: Set by G52 command T8, T9: G52 command and compensation T1 to T9: Preset by programmer
18	Compensation Function (T8, T9)	① Compensation Parameters × number of compensation signals ② Compensation by external compensation data input	① Compensation parameters × number of compensation signals ② Compensation by external compensation data input
19	Zone Signal	① 4 signals (PSW1 to PSW4): 4 zones can be set individually by each signal.	① Basic function: 2 signals, total 4 zones ② Extended function A: 4 signals (PSW1 to PSW4) 4 zones can be set individually by each signal ③ Extended function B: Same as A. Only assigned signals are different.
20	Spindle Reference	Analog reference: ±10V Digital signals: I/O = 4/4	Not provided.

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
21	Digital Input Signal <hr/> Signal List	<div style="text-align: center;">Motionpack</div> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> CN3 </div> <ul style="list-style-type: none"> EDIT MODE (EDIT) — -26 PLAY MODE (PLAY) — -5 JOG MODE (JOG) — -16 HANDLE MODE (HANDL) — -27 RESERVED — -6 JOG SPEED (J SPD) — -34 + JOG START (+JS) — -17 - JOG START (-JS) — -28 RETURN (ZRN) — -7 SINGLE BLOCK (SBLX) — -29 FAULT RESET (ESR) — -10 PROGRAM START (PGST) — -18 PROGRAM SELECT 1 (PGSL1) — -30 PROGRAM SELECT 2 (PGSL2) — -9 PROGRAM SELECT 3 (PGSL3) — -20 PROGRAM SELECT 4 (PGSL4) — -31 + INCREMENT (+INC) — -21 - INCREMENT (-INC) — -32 INC T8/T9(INC8/9) — -11 SKIP 5 (ESP5) — -22 SKIP 6 (ESP6) — -33 EXTERNAL POSITIONING (G34F) — -8 M END (M FIN) — -19 SERVO ON (SV ON) — -12 COMMON LINE (0₂₄ V or 24V) — -1, -2, -3, -13, -14, -23, -24, -25 	
	Signal Specifications	5mA at 24VDC ON, 1 μ A at OFF Power supply provided separately, 0 V common (sink) or + 24 V common (source) selectable	5mA at 24VDC ON Power supply provided separately, 0 V common (sink current) type

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
22	JOG Mode	<p>① Signal Mode: JOG ON Speed: One speed is specified among two speeds by JSPD ON/OFF Run: During +J/S or -J/S ON</p> <p>② Speed: Parameter setting Low/high speed (2-step)</p>	<p>① Signal Mode: PLAY, JOG ON Speed: One speed is selected among three speeds by JLF, JMF. Run: During +J/S or -J/S ON</p> <p>② Speed: Parameter setting Low/medium/high speed (3-step)</p>
23	HANDL Mode	<p>① Signal Mode: HANDL ON Multiplication: ×1 or ×100 selected by JSPD. Speed reference run: Motor stops immediately when HANDL is stopped by Pr5=1.</p>	<p>① Signal Mode: PLAY, JOG, STEP ON Multiplication: ×1, ×10 or ×100 selected by JLF, JLM. Speed reference run: Not possible</p>
24	Single-block Operation	Single-block operation executed by program start (PGST) ON at signal-block (SBLK)ON.	Single-block operation executed by single-block start (SBST) in the signal-block mode (SBK ON).
25	Automatic Operation	<p>① Mode: PLAY ON EDIT OFF JOG</p> <p>② Start by program start (PGST) ON after program select PGSL* ON.</p> <p>③ Program selection One block among 0 to 15 is specified by PGSL. JUMP/head block designation is set to 0 to 15 blocks.</p>	<p>① Mode: PLAY ON EDIT OFF JOG STEP</p> <p>② Start by program PGS* ON after program select PGSL* ON</p> <p>③ Program block selection Selected by start block **0 in code of PGS* and PGSL**.</p>
26	Compensation	<p>① T8 coordinate: INC T8/T9: OFF</p> <p>② T9 coordinate: INC T8/T9: ON +INC/-INC</p>	<p>① T8 coordinate: +INC8/-INC8</p> <p>② T9 coordinate: +INC9/-INC9</p>
27	Skip	<p>① G05, G06 ② ESP5, ESP6</p>	<p>① G05, G06, G07 ② ESP5, 6, 7</p>
28	Speed Limit	Not provided.	Speed limit signal (OVR) ON Creep speed Pr10

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
29	Feed- hold	① Program starts [signal OFF (PGST)] during automatic operation. ② Operation restarts by turning on PGST again.	① PGS * or ATST is turned off during automatic operation. ② Operation restarts by turning ON PGS* or ATST again. ③ Feed-hold is also enabled by turning off ATSTP during automatic operation. In this case, operation restarts by turning off and then on ATST or PGS.
30	Program Clear	Program is cleared when PGSL * changes after feed-hold.	PGCL ON after feed-hold
31	Digital Output Signal <hr/> Signal List <hr/> Signal Specifications		1. OUTPUT SIGNALS
32	Positioning	G01X ___ F ___ I ___ S U ___ Spindle reference and feeding interlock not provided. Spindle reference is modal.	G01X ___ F ___ I ___ U ___ Spindle reference: Not provided.

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
36	External Positioning	G34 X__ F__ I__ U__ When EXP signal is turned on during positioning, positioning is performed at that position.	G34 X__ F__ I__ U__ When EXP signal is turned on during positioning, positioning is performed at that position.
37	Secondary External Positioning	G35 X__ F__ I__ U__ Operation keeps until EXP signal is turned ON. When EXP signal is turned ON, positioning is performed at the programmed position with the position (where EXP signal is turned on) as a reference.	For extensive functions, parameter designation is premised. G34 X__ F__ I__ U__ Operation keeps until EXP signal is turned ON. When EXP signal is turned ON, positioning is performed at the programmed position with the position (where EXP signal is turned on) as a reference.
38	S-curve Accel/Decel Positioning	Positioning command (G01, G05, G06, G34, G35) between G10 and G11 is for S-curve accel/decel. G10 G01 X__ F__ I__ ←S-curve G11 accel/decel S-curve is set by parameter.	Parameter setting is necessary because this is an extended function. G35 X__ F__ I__ U__ S-curve is set by parameter.
39	Time Waiting	G04D__	G04D__
40	In-position Waiting	G04	G04
41	Coordinate Setting	G52	G52
42	Coordinate Change	G53	G53
43	Reach Check	G67	G67

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
44	Subprogram Call Repeating Number Designation	G68L ___ P ___ L = 1 ~ 99	G68L ___ P ___ L = 1 ~ 9
45	End Point Position Designation Subprogram Call	G68X ___ P ___ U ___	G68X ___ P ___ U ___
46	Single Jump	G69P ___	G69P ___
47	Subprogram Return	G69	G69
48	Spindle Designation	S+ ___ ; Forward run S- ___ ; Reverse run Output signal Pr91=0 S+ ___ : + voltage analog reference Forward run command signal ON S- ___ : - voltage analog reference Reverse run command signal ON Pr91=1 S+ ___ : + voltage Operation signal ON S- ___ : - voltage Operation signal ON	Not provided.
49	Auxiliary Function	M50 to M58 ① Pr101 = 0 Single signal output ② Pr101 ≠ 0 Encoded M output M40 to M89	M51 to M56
50	Program End	M30	M30
51	Ineffective Command	NOP	Not provided.
52	Angle Indexing	Not provided.	Extended function
53	Clamp Free	SV-ON signal is turned ON.	Extended function

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34												
54	G67 Jump Prohibit	Not provided.	Extended function												
55	Activation Single Extensive Function	Not provided.	Extended function												
56	Program Select Signal Encoding	Not provided.	Extended function												
57	External Data Setting	Provided. External data : Set in R * * .	Extended function External data : Set in Pr2 * * .												
58	External Compensation	Provided.	Extended function												
59	Parameters	Pr1 = JOG low speed (speed unit) P at JSPD signal=OFF Pr2 = JOG high speed (speed unit) P at JSPD signal=ON Pr1, Pr2 : 0 to 99999	Pr1=JOG low speed (speed unit) Pr2=JOG medium speed (speed unit) Pr3=JOG high speed (speed unit) Pr1 to Pr3=0 to 60000												
	(1) Related to JOG	Pr4 = JOG low speed feeding torque (0 to 400%)	<table border="1"> <thead> <tr> <th></th> <th>Low Speed</th> <th>Medium Speed</th> <th>High Speed</th> </tr> </thead> <tbody> <tr> <td>JLF</td> <td>OFF</td> <td>ON</td> <td>ON</td> </tr> <tr> <td>JMF</td> <td>OFF</td> <td>OFF</td> <td>ON</td> </tr> </tbody> </table> Pr8 = Torque limit value at JOG low speed operation (%) (0 to 250%)		Low Speed	Medium Speed	High Speed	JLF	OFF	ON	ON	JMF	OFF	OFF	ON
		Low Speed	Medium Speed	High Speed											
	JLF	OFF	ON	ON											
JMF	OFF	OFF	ON												
(2) Related to STEP	Not provided.	Pr5=Short (reference unit) Pr6=Medium (reference unit) Pr7=Long (reference unit) Pr4=Moving Speed (speed unit) Pr8 = Torque limit value when "short" is specified. Pr5=Pr7 : 0 to 999999													
(3) Related to HANDL	Pr3=HANDL max. speed (speed unit) (0 to 99999) Pr5=HANDL reference, speed/position change														
(4) Overtravel Detection	Pr8=Hard OT effective/ineffective Pr60=Minus direction soft stroke limit (reference unit) Pr61=Plus direction soft stroke limit (reference unit) (-99999999 to 99999999)	Pr60=Minus direction soft stroke limit (reference unit) Pr61=Plus direction soft stroke limit (reference unit) (-9999999 to 9999999)													

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
59	(5) Coordinate Compensate	Pr20=T8 coordinate system one-time compensated value (0 to 255) (reference unit) Pr21=T8 coordinate system max. compensated value (0 to 99999999) (reference unit) Pr22=T9 coordinate system one-time compensated value Pr23=T9 coordinate system max. compensated value	Pr20=T8 coordinate system one-time compensated value (0 to 255) (reference unit) Pr21=T8 coordinate system max. compensated value (0 to 99999999) (reference unit) Pr22=T9 coordinate system one-time compensated value Pr23=T9 coordinate system max. compensated value (0 to 99999999)
	(6) Related to Accel/Decel	Pr30=Max. speed (0 to 99999) (speed unit) Pr31=Linear accel/decel time (0 to 60000) (msec) Pr32=All S-curve accel/decel time (0 to 10000) (msec) Pr33=S-curve section accel/decel time (0 to 2000) (msec)	Pr40=Max. speed (0 to 60000) (speed reference) Pr41=Accel/decel time (50 to 60000) (msec) Pr56=All S-curve accel/decel time (60 to 1000) (msec) Pr57=S-curve accel/decel time (30 to 500) (msec)
	(7) Related to Servo	Pr34=Position loop gain (0 to 255) (S^{-1}) Pr35=Speed loop gain (0 to 600) (Hz) Pr37=Servo error deviation (0 to 999999) (number of pulses) Pr38=Motor selection code	Pr42=Position loop gain (200 to 30000) (number of pulse) Pr44=Servo error detection (0 to 60000) (number of pulses)
	(8) In-position Range	Pr36=In-position range (1 to 255) (number of pulses)	Pr45=In-position range (1 to 255) (number of pulses)
	(9) Position Reference	Pr50=Min. reference unit (0 to 5) (10^{-N} mm) Pr51=Ball screw pitch (1000 to 99999) (μ m/rev) Pr52=Gear Ratio (1 to 999999) Pr53=Gear Ratio (1 to 999999) Pr54=Decimal point position (speed reference) (0 to 5) (reference unit $\times 10^N$ /min) Pr55=Number of encoder pulses (1000 to 32768) (pulse)	Pr50=Pulse rate (M) Pr51=Pulse rate (D) Pr52=Decimal point position

(Cont'd)

No.	Item	MOTIONPACK FD (Model 3)	MOTIONPACK-34
	(10) Home Position Coordinate Setup	Pr70=Home position coordinate setting method Pr71=T0 coordinate offset (-99999999 to +99999999) (reference unit) Pr72=Reference point coordinate (-99999999 to +99999999) (reference unit) Pr73=Home position setup command (0.1) Pr74=Home position matching speed (0 to 60000) (speed unit) Pr75=Pushing torque (10 to 200) (%) Pr76=Stopper pushing time (0 to 60000) (msec) Pr77=Encoder allowable moving amount (0 to 99999999) (reference unit) Pr78=ABS-PG alarm reset command (0.1)	Pr70=Home position coordinate setting method Pr71=T0 coordinate offset (-99999999 to +99999999) (number of pulses) Pr72=Waiting position (-99999999 to +99999999) Pr73=Quick return speed (0 to 60000) (speed) Pr74=Home position matching speed (0 to 60000) (speed unit) Pr75=Pushing torque (10 to 200) (%) Pr76=Number of encoder pulses (pulses/rev) Pr77=Allowable deviation value (1 to 255) (number of pulses) Pr78=Encoder allowable error (0 to 99999999) (reference unit) Pr79=Pushing time (0 to 3000) (10ms) Pr80=Home position setup command (0.1) Pr81=Reference point coordinate value (-99999999 to +99999999) Pr82=ABS-PG error reset command (0.1)
	(11) Related to Spindle	Pr90=Spindle max. r/min (0 to 99999) (r/min) Pr91=Spindle reference method selection Pr92=Spindle PG disconnection detection (0.1)	Not provided.
	(12) PSW	Pr111~Pr118=PSW1 Pr121~Pr128=PSW2 Pr131~Pr138=PSW3 Pr141~Pr148=PSW4	Pr111~Pr118=PSW1 Pr121~Pr128=PSW2 Pr131~Pr138=PSW3 Pr141~Pr148=PSW4
	(13) External Data Setting	R01 to R99 external setting (register designation possible)	Pr201 to Pr296=External data

MOTIONPACK FD MODEL 3

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