SIE-C880-2C
DESCRIPTIVE INFORMATION

YASKAWA ELECTRIC

YASKAWA MOTION CONTROLLER
Motionpack™-34
FOR 1-AXIS POSITIONING
(ABSOLUTE ENCODER)
USER'S MANUAL

INTRODUCTION

Motionpack-34 enables a high accuracy, high resolution and high speed positioning system by employing a servomotor with an absolute encoder and Servopack with Motionpack-34 interface.

Motionpack-34 can be used as a controller for the absolute positioning system combined with Yaskawa's absolute encoder. Therefore, there is no return to home operation when the power is turned on. Because, Motionpack-34 has zone-signal outputs, the user can reduce the number of limit-switche's required for the home position. At the same time Motionpack-34 is provided with functions of variable speed positioning, passing signal output, and angular index detection added to the present functions of Motionpack-33.

Motionpack-34 can supply a system superior in economy, maintenance and efficiency to adjust wide-range automation.

The table below is given for your convenience; ◎ shows the sections for urgent reference and ○ shows the related sections.

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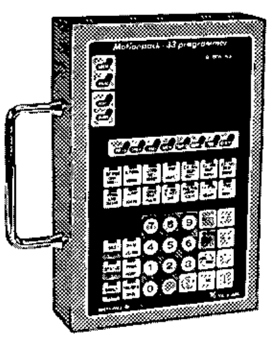
1. SYSTEM CONFIGURATION

This section shows absolute value system Motionpack-34 configuration. For system configuration, use Servomotor with absolute encoder and Servopack with Motionpack-34 interface (Type CACR-SR □ TZ6S □).



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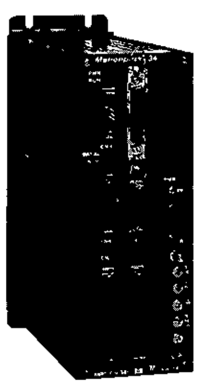

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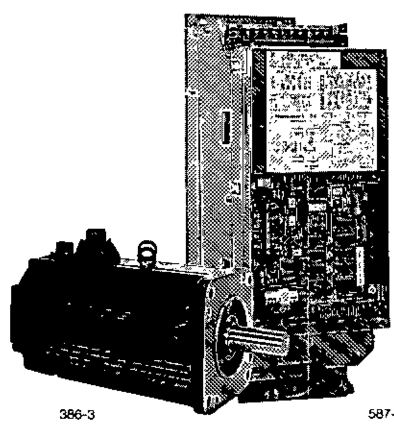

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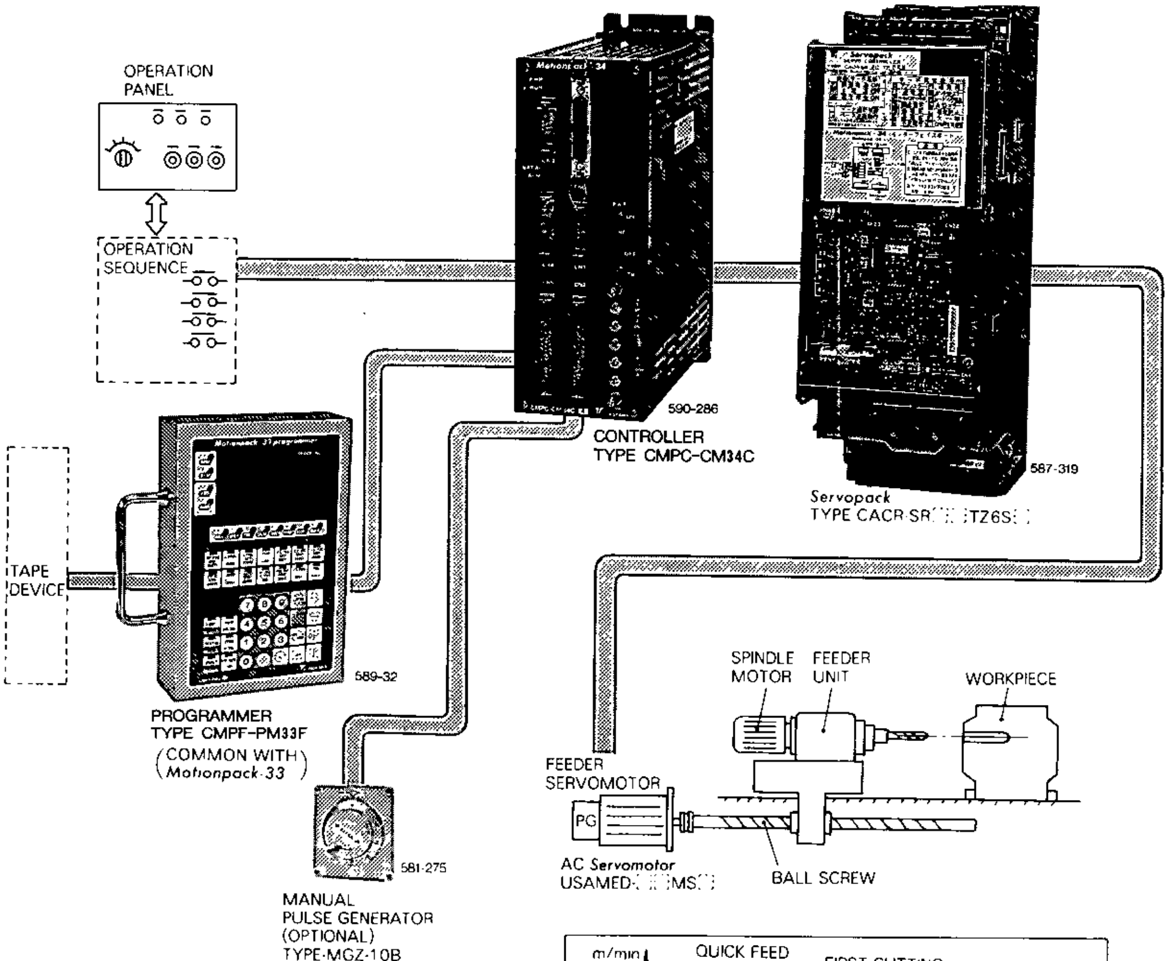
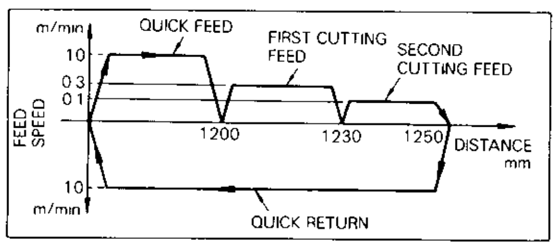
PROGRAMMER CONTROLLER AC SERVOMOTOR *Servopack*

1.1 ABSOLUTE SYSTEM CONFIGURATION

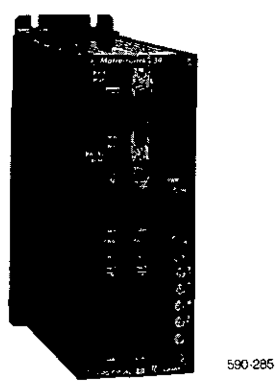




N040 G01 X1200 F10000 I200	Positioning command at 1200 mm point at quick feed of 10m/min with current limitation of 200%
N041 G01 X1230 F300	Positioning command at 1230 mm point at first cutting feed of 0.3 m/min
N042 G01 X1250 F100 I50	Positioning command at 1250 mm point at second cutting feed of 0.1m/min with current limitation of 50%
N043 G04 D1.0	Dwell 1.0s command
N044 G01 X0 F10000 I200	Positioning command at quick feed of 10m/min with current limitation of 200%
N045 M30	Command end

2. SYSTEM

This section describes the features of Motionpack-34 and each component. By combining with YASKAWA servomotor with absolute encoder and its controller Servopack, Motionpack-34 provides a high accuracy, high revolution (8192p/rev max. ± 99999 rev,) and high speed positioning system. This positioning system does not need return to home operation; omitting the limit switch and shortening the cycle time are available.



Motionpack-34 CONTROLLER
TYPE CMPC-CM34C

2.1 FEATURES

Motionpack-34 is 1-axis feeder, motion controller for positioning as a further developement of the existing Motionpack-33. Servo drive unit is provided with AC servomotor with absolute encoder and its controller Servopack. By using absolute encoder, Motionpack-34 does not need a return to home position when power supply is switched on. Motionpack-34 is provided with variable functions as follows for effective and high technic feeder control or flexible and extendable system configuration.

However, relative operations with other axes such as synchronizing or interpolation are not available. It does not contain a sequencer for machine logic control function.

A desired positioning program is executed by being stored in non-volatile semi-conductor memory inside the controller input, by key from program panel or input from a tape device. Tape operation during reading-in tape can not be performed.

(1) Absolute Value Method

Position detection is possible because of absolute encoder even if the power is off. Accordingly, return to home position is not needed when power is switched on.

(2) Torque Control Function

All motion commands can control torque devices. This function enables the following.

(a) If a tool has broken, the machine is protected from additional trouble caused by reaction to the broken tool.

(b) Machining with dwell or machine stop at the end of the stroke by reducing torque has enhanced machining accuracy and simplified drive system.

(c) Programmable "soft" positioning and "soft" grasping which are capabilities required for robots assembly are possible.

(d) Acceleration is controlled in proportional to torque so that the machine and workpiece are protected from shock caused by acceleration and deceleration.

(e) It is possible to get a signal indicating excessive reaction (current limited). That signal permits to detect failure of the drive system.

(3) Selectable Positioning Command Unit

Since the unit of positioning command must correspond to detecting pulses, (e. g. 1 mm command output 1 pulse), in ordinary NC systems, there are limitations to the feeder and speed reducer mechanisms by position detecting pulses.

In Motionpack-34, the unit of positioning command and the unit of detecting position can be changed by parameters and limitations to the feeder and speed reducer mechanisms are reduced.

It is possible to organize a system with a machine tool having an accuracy of 0.001 mm or a feeder unit of 1-mm accuracy.

(4) Selectable Coordinate Systems

It is possible to either designate coordinates or to select a coordinate system separately. This facilitates repetitive operations for a fixed array and combinations of fixed cycle programs.

(5) Subprograms Facilitating Program Repetitive Operations

Provided are subprograms which define the number of repetitions and an end point. They facilitate programming repetitive operations.

(6) Feed Command Controllable by External Signals

A skip signal externally input can stop positioning operation and transfer to the next block. Thus flow of control may be changed by external signals and a kind of adaptable control is possible.

(7) Range Signal Output

Since programmable range signals are provided, range signal corresponding to the present position can be moved to upper-digit sequencer immediately after power is turned on.

(8) Additional New Functions

Motionpack-34 is the successor to Motionpack-33 and is provided with additional new functions as follows for wider applications ;

- Variable speed positioning
- Zone signal output
- Index detector
- Clamp free function
- Infinite length operation
- Extensive M function
- Program selection code

(9) Trouble-free Programming with Individual Function Keys and Guiding LEDs.

The special Programmer (CMPF-PM33F) permites programming through a language-based keyboard. Programming is made even easier with function keys and guidance with LEDs.

(10) Separation between the Sequence Control Area and the Motion Control Area for Use as FMS Control Elements.

Accordingly, flexible and extensive system is provided by total control of Motionpack-34 by programmable controller.

2.2 Motionpack-34 SYSTEM CONFIGURATION

Fig. 2.1 shows Motionpack-34 drive system for one-axis feeder and positioning servomotors.

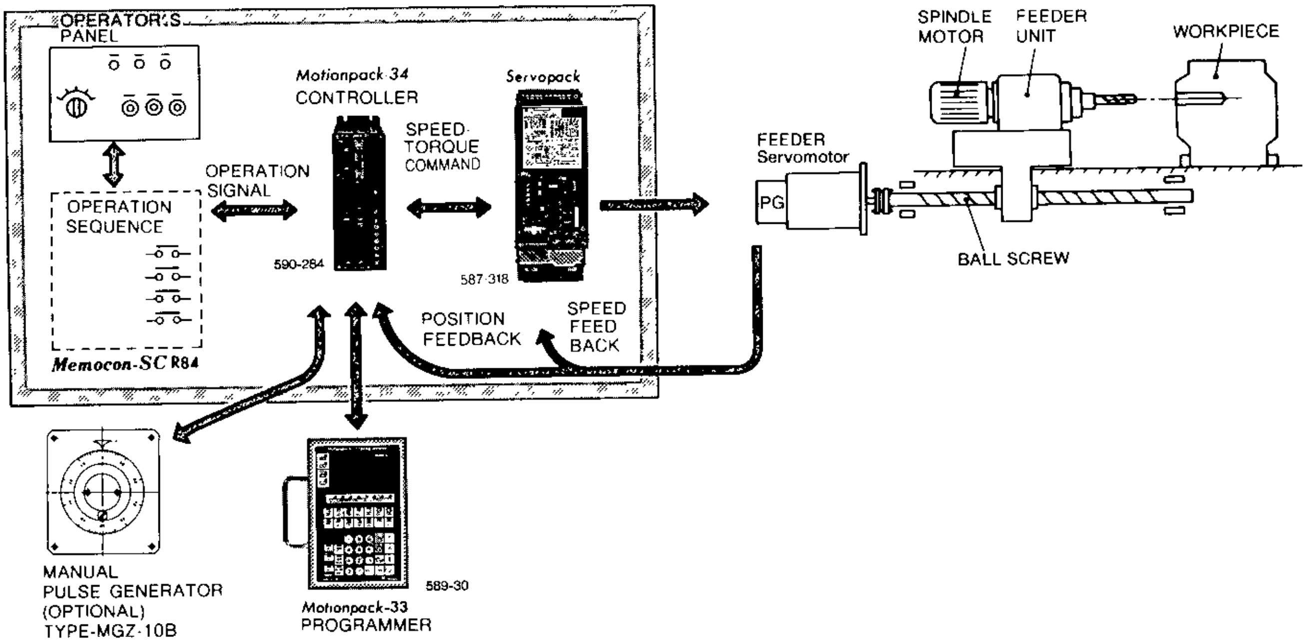


Fig. 2. 1 Motionpack-34 System Configuration

Servomoter

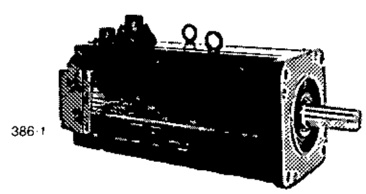


Fig. 2. 2

Mechanical Driver for Feeding and Positioning

- The renowned YASKAWA AC servomotor with absolute encoder offers motors of optimum performance for a wide range of specified applications.

Servopack

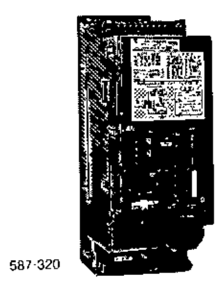


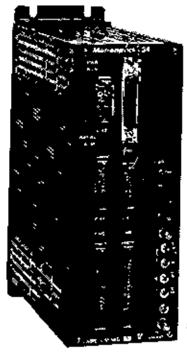
Fig. 2. 3

Servomotor Speed Control Amplifier

- Wide speed control range by the PWM control mode.
- Stable feed control and accurate positioning at speed commands from Motionpack-34 controller
- Controls armature current of the servomotor thru input torque commands from Motionpack-34 controller.

Motionpack-34 CONTROLLER

Fig. 2. 4



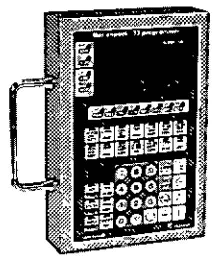
The "Brain" of the Motion Control System

- Return to home position is not needed because of absolute system.
- Up to 500 blocks (100 blocks are extra blocks* of feeding and positioning commands can be stored.
- Operated by control signals from programmable controller, etc.

* For extra blocks, refer to par. 4.1.4.1 (5)(a).

Motionpack-34 PROGRAMMER

Fig. 2. 5



Editing Operation Programs and Displaying System States

- Easy program editing process by the LED guide system.
- Unused during servomotor operation.
- Convenience in maintenance with the display of Motionpack-34 system states.

Fig. 2.6 shows block diagram of basic system configuration.

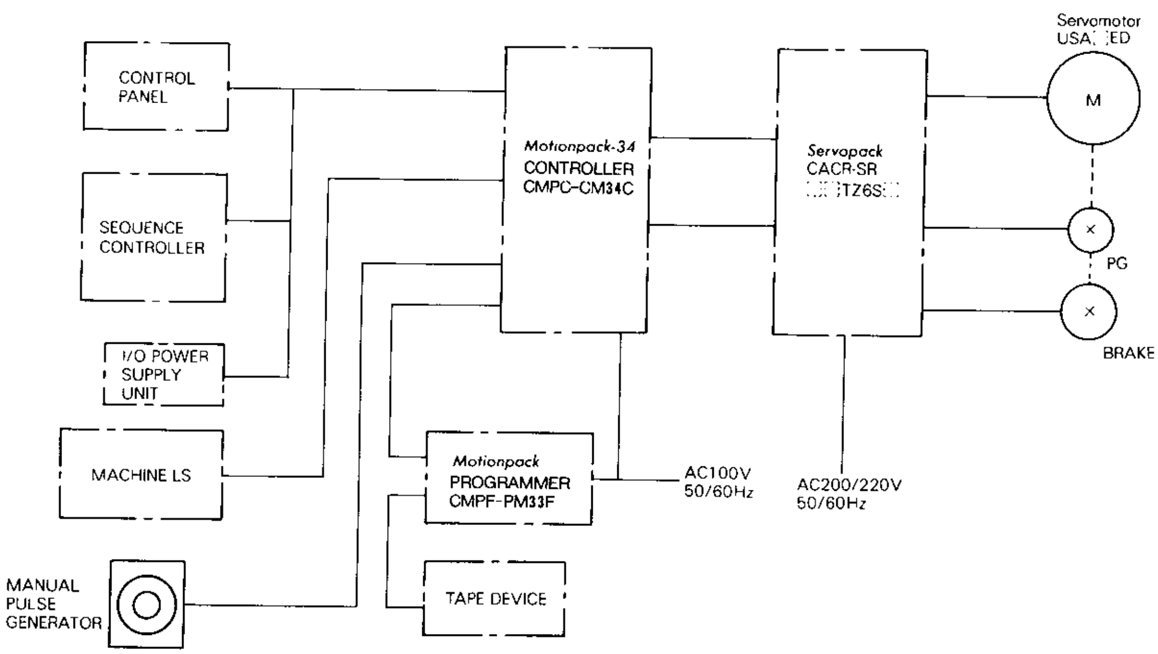


Fig. 2. 6 Basic System Configuration

2.3 SYSTEM CONFIGURATION DEVICE LIST

Table 2.1 shows system configuration device list. For details, refer to par. 3 and onward.

Table 2. 1 System Configuration Device List (Related to Motionpack)

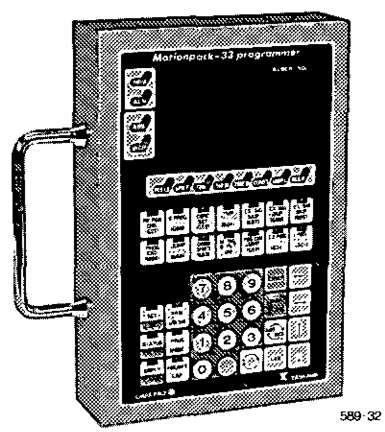
Name	Type	Supply Source
Motionpack-34 Controller	CMPC-CM34C	YE
Motionpack Programmer	CMPF-PM33FE	YE
I/O Signal Power Supply Unit	For specifications, refer to par. 3. 4.	CS
	Example of recommended type: Type: BY242R5 made by Shin Dengen Electric Manufacturing Co., Ltd. Capacity: 24VDC 2.5A	Available from YE
Tape Device	RS-232C Interface built-in For recommended type example, refer to par. 3. 5.	CS
Manual Pulse Generator	PREH-2EST /100-M1 made by Yaskawa Controls Salese Co., Ltd.	YE
Motionpack-34 Signal Cable	Prepare cables equivalent to recommended ones for installation. • Recommended cable (without connector) 20-pin KQVV-SB 20C × 0.2mm 50-pin KQVV-SB 50C × 0.2mm Both conductors are $0.2mm^2$ For detailed specifications, refer to par. 6. 2. 1 (6).	CS Available from YE
Motionpack-34 PG Signal Cable	Prepare cables equivalent to recommended ones for installation. (Connectors are attached to both Motionpack and Servomotor.) • Recommended cable (without connector) KQVV-SB 10P × 0.2mm Twisted shielded, separate specifications provided for moving portion For detailed specifications, refer to par. 6.2.1 (6).	CS Available from YE
Motionpack-34 Servo Signal Cable	Prepare cables equivalent to recommended ones for installation. (Connectors are attached to both Motionpack and Servomotor) • Recommended cable (without connector) KQVV-SB 10P × $0.2mm^2$ Twisted shielded For detailed specifications, refer to par. 6. 2. 1 (6).	CS Available from YE
Servopack	CACR-SR□□TZ6S□	YE
Servomotor	USA□ED-□□S2△△ (△△shows shaft specifications)	YE

YE: Supplied by YASKAWA
CS : Supplied by customer
Available from YE: Available to be supplied by YASKAWA on your order.

3. UNIT SPECIFICATIONS

This section describes performances and functions of the following units needed for system configuration:

(1) Motionpack-34 Controller
(2) Motionpack Programmer
(3) Servopack and Servomotor
(4) I/O Signal Power Supply Unit
(5) Tape Device
(6) Manual Pulse Generator



Motionpack PROGRAMMER
TYPE CMPF-PM33FE

3.1 Motionpack-34 CONTROLLER TYPE CMPC-CM34C

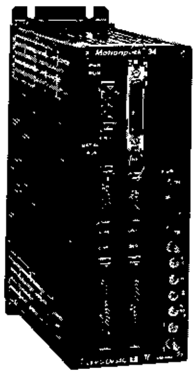


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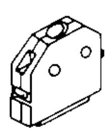
Fig. 3.1 Motionpack-34 CONTROLLER TYPE CMPC-CM34C

Table 3.1 Motionpack-34 Controller Specifications

Controlled Axis	1 axis
Torgue Limiting	10 - 200% of rated torque
Setting	0.001 mm/0.0001 inch
Max Command Value	sign + decimal 7 digits
Max Feedrate	600 kpps at 4-multiplier (36 m/min for detection unit of 0.001 mm)
Speed Command	Decimal 5 digits
Automatic Accel/Decel	Linear accel/decel
Feed Override	Available
Command Method	Input from Programmer Keyboard
Program Capacity	400 Blocks + 100
Work No. Control	40 Work Nos., each consisting of fixed 10 blocks
Positioning Command	Absolute/Incremental, both usable
Positioning by External Signal	Available
Function Mode	Edit/JOG/STEP/AUTO/HANDLE
No. of Operation Signals	Input Signal: 40 (24V) Output Signal: 18 (Open Collector)
Stored Stroke Limit	Available
Feedhold	Available
Automatic Home Return	Not used
Position Detector	YASKAWA absolute encoder
Applicable Conditions	Ambient temp: 0 to 55℃ Storage temp: -20 to 85℃ Humidity: 25 - 95% RH (Non-condensing) Vibration: In compliance with JIS C0911 IIB (Class 3 for 30 min) Installation environment: Avoid atmospheres of corrosive gas, large amounts of dust or metallic filings, and locations with high temperature and humidity. If impossible, provide countermeasures in use of control panel to be mounted Grounding: Less than class 3 (Grounding resistance 100 Ω max.)
Power Supply	Single phase, 100VAC (85-120V) 50/60 Hz, 25VA
Tape I/O	RS-232C interface, ISO code by connecting tape device and programmer.
Weight	2.5 kg

JIS. Japanese Industrial Standard

Table 3. 2 Attachment

	Name	Q'ty	Schematic Diagram	Type
1	MR Connector	2		
2	MR Connector	1		MR-20F (With MR-20L) (Made by Honda Tsushin Co.)
3	MR Connector	2		
4	Name Plate of Connector	1 set	To be attached to Connectors	

3.2 Motionpack PROGRAMMER TYPE CMPF-PM33FE

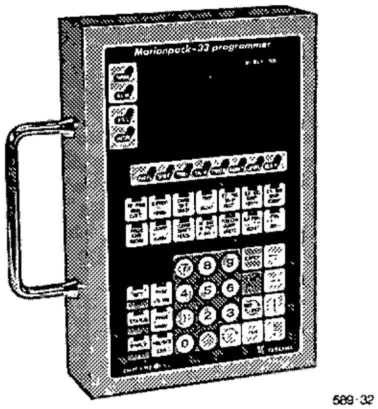
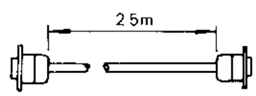
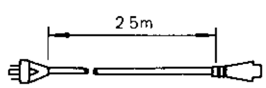


Fig. 3.2 Motionpack PROGRAMMER TYPE CMPF-PM33FE (Common with Motionpack-33)

Table 3. 3 Motionpack Programmer Specifications

Function	(1) Program writing and edition (2) Parameter writing and changing (3) Operation state display (4) Controller error display (5) I/O state display (6) Position error/current position display (7) Program/parameter display (8) Commanded position display (9) Controller communication (10) Tape I/O
Connection with Tape Device	RS232C interface Baud rate setting of 110/300/ 1200/ by parameter. Code: ISO
Environmental Conditions	The same as Motionpack-34 controller Exception: Operation temperature 0 to 50℃
Power Supply	100VAC (85 - 120V), 50/60Hz, 20VA
Weight	2.3kg

Table 3. 4 Attachment

	Name	Q'ty	Schematic Diagram	Remarks
1	Signal Cable ⑫	1		YASKAWA make
2	Power Supply Cable ⑬	1		YASKAWA make

3.3 Servopack AND SERVOMOTOR

Rating and specifications combined with motors are as follows :

Table 3. 5 Rating and Specifications List (Example of M Series)

	Applicable Capacity	kW	0.3	0.6	0.9	1.2	2.0	3.0	4.4	6.0
	Controller Servopack Type CACR-		SR03TZ□	SR06TZ□	SR09TZ□	SR12TZ□	SR20TZ□	SR30TZ□	SR44TZ□	SR60TZ□
	Motor Type USAMED*-		03MS2□	06MS2□	09MS2□	12MS2□	20MS2□	30MS2□	44MS2□	60MS2□
	Input Power Supply		AC 3-phase 200/220 V + 10 %, − 15 %, 50/60 Hz							
	Environmental Conditions		Applicable temp. 0 to + 55 ℃ Storage temp. − 20 to + 85 ℃ Applicable, storage humidity 90 % or less (non-condensing)	Motor section: Applicable temp. 0 to + 40 ℃ Storage temp. − 20 to + 80 ℃ Applicable, storage humidity: 20 to 80 % (non-condensing)						
	Construction		Base mount							
	Weight (Control Device)	kg	8.0	8.0	11.0	11.0	11.5	12.0	13.0	17.0
Servo Output Characteristics	Rating Speed	rpm	1000							
Servo Output Characteristics	Max. Revolutions	rpm	1500							
Servo Output Characteristics	Rated Current	Arms	3.0	5.8	7.6	11.7	18.8	26.0	33.0	45.0
Servo Output Characteristics	Rated Torque	kg•cm	29	58	87.6	117	195	290	428	584
Servo Output Characteristics	Momentary Max. Current	Arms	7.3	13.9	16.6	28.0	42.0	56.5	70.0	80.6
Servo Output Characteristics	Momentary Max. Torque	kg•cm	73	144	197.0	286	449	650	930	1080
Servo Output Characteristics	Allowable GD^2 ($GD^2/4$)	kg•cm²	68	121	183	334	550	850	1315	1315
Servo Basic Spec.	Control Method		Transistor PWM							
Servo Basic Spec.	Feedback		Absolute encoder (8192 p/rev)							
Servo Basic Spec.	Protective Function		• Overvoltage • Overload • Overcurrent • Overspeed • Runaway prevention • MCCB trip • Voltage reduction • Fin overheat • Open phase • Defective regeneration • CPU failure • A/D error • Absolute error • Position error							
Servo Basic Spec.	Condition Display		• Power-on display • Speed command input display • Base cut-off display							
Speed Control Spec.	Speed Control Range		1 : 3000							
Speed Control Spec.	Speed Regulation: Load Fluctuation 0 to 100 %		± 0.03 % or less (at 1000 rpm), ± 0.015 % or less (at 0.3 rpm)	% shows the ratio against the rated speed.						
Speed Control Spec.	Speed Regulation: Voltage Fluctuation Rated ± 10 %		± 0.1 % or less (at 1000 rpm), ± 0.05 % or less (at 0.3 rpm)							
Speed Control Spec.	Speed Regulation: Temp. Fluctuation 0 to 50℃		± 0.5 % or less (at 1000 rpm), ± 0.2 % or less (at 0.3 rpm)							
Speed Control Spec.	Frequency Characteristics		200 Hz ($GD^2_L = 0$) 100 Hz ($GD^2_L = GD^2_M$)							
Speed Control Spec.	Speed Command: Rated Reference Voltage		DC ± 6 V at 1000 rpm							
Speed Control Spec.	Speed Command: Input Impedance		Approx. 30 kΩ							
Speed Control Spec.	Speed Command: Circuit Time Constant		Approx. 30 μs							
AC Mechanical Spec.	Brake Power Supply Output		90 VDC, 0.5 A Max. output							
AC Mechanical Spec.	Servo Alarm		C-contact output (100 V, 0.5 A)							
AC Mechanical Spec.	Speed Monitor Output		± 4.0 V ± 5 %/1000 rpm, Load resistor, 5kΩ or more							
AC Mechanical Spec.	Torque Monitor Output		3.0 V ± 10 %/100 % Torque, load resistor, 5 kΩ or more							
Motor Characteristics	Rotor Inertia ($GD^2/4$)	kg•cm²	13.5	24.3	36.7	66.8	110	143	240	240
Motor Characteristics	Power Rate	kW/s	6.1	13.3	20.3	19.7	33.2	57.0	74.0	138
Motor Characteristics	Toque Constant	kg•cm/A	10.3	10.6	12.3	10.4	10.9	11.8	13.6	13.6
Motor Characteristics	Induced Voltage Constant	mV/rpm	35.2	36.3	41.9	35.9	37.3	40.5	46.7	46.7
Motor Characteristics	Electrical Time Constant	ms	4.2	5.4	6.5	10.4	12.9	15.3	16.2	16.2
Motor Characteristics	Mechanical Time Constant	ms	8.3	5.9	4.6	6.9	5.2	4.1	4.0	4.0
Motor Characteristics	Insulation		• Resistor DC 500 V, 10 MΩ or more • Dielectric strength 1500 VAC for one min. • Class-F							
Motor Characteristics	Weight	kg	10.0	15.0	21.0	24.0	32.0	43.0	70.0	75.0

*6 kW motor type is USAMKD-□

Table 3.6 Combination of Servopack and Servomotor

Series	Servopack Type	Servomotor Type
M Series	CACR-SR 03 TZ 6 SM	USAMED-03 MS 1
	CACR-SR 06 TZ 6 SM	USAMED-06 MS 1
	CACR-SR 09 TZ 6 SM	USAMED-09 MS 2
	CACR-SR 12 TZ 6 SM	USAMED-12 MS 2
	CACR-SR 20 TZ 6 SM	USAMED-20 MS 2
	CACR-SR 30 TZ 6 SM	USAMED-30 MS 2
	CACR-SR 44 TZ 6 SM	USAMED-44 MS 2
	CACR-SR 60 TZ 6 SM	USAMED-60 MS 2
F Series	CACR-SR 03 TZ 6 SF	USAFED-02 FS 1, -03 FS 1
	CACR-SR 05 TZ 6 SF	USAFED-05 FS 1
	CACR-SR 09 TZ 6 SF	USAFED-09 FS 1
	CACR-SR 12 TZ 6 SF	USAFED-13 FS 2
	CACR-SR 20 TZ 6 SF	USAFED-20 FS 2
	CACR-SR 30 TZ 6 SF	USAFED-30 FS 2
	CACR-SR 44 TZ 6 SF	USAFED-44 FS 2
S Series	CACR-SR 03 TZ 6 SS-Y 41	USASEM-02 AS 2
	CACR-SR 03 TZ 6 SS	USASEM-03 AS 2
	CACR-SR 05 TZ 6 SS	USASEM-05 AS 2
	CACR-SR 09 TZ 6 SS	USASEM-08 AS 1
	CACR-SR 12 TZ 6 SS	USASEM-15 AS 1
	CACR-SR 30 TZ 6 SS	USASEM-30 AS 1

3.4 POWER SUPPLY FOR INPUT／OUTPUT SIGNALS

DC power supply is needed for input／output signals of the Motionpack. The user should provide power having the specifications in Table 3.7.

The same power supply can be used for input／output signals of the Motionpack multiaxis system. Current capacity is 2A／axis.

Model : BY242R5
Maker : Shin Dengen Electric Manufacturing Co., Ltd.
Input : 100VAC, 50／60Hz
Output : 24VDC, 2.5A
For dimensions, see par. 10.6.

Table 3.7 DC Power Supply

Item		Specifications
Input Voltage		100/110 VAC±10%, 50/60Hz
Rated Voltage		24 V
Rated Current*		2 A/axis
Output Stability		±10% max
Ripple Noise		300 mV p-p max
Leak Voltage		0.5 mA max
Output		12 msec (min)
Overcurrent Protection		Provided
Overvoltage Protection		30 V max
Temperature Range	Storage	−5 to 60°C
	Operating	−20 to 80°C
Humidity		30 to 85% Relative
Insulation Voltage across	Input and Frame	1500 VAC for 1 minute 500 VDC, 100 MΩ
	Input and Output	
	Output and Frame	

*Rated current changes according to ambient temperature.
Select a DC power supply which provides 2.0 A at 60°C.

3.5 TAPE DEVICE

Programs and parameters can be input and output through tape reader ／punch , if connected, to RS232C interface.

EXAMPLE

Name : PRO-TYPER High-speed ASR type I／O terminal
Model : MODEL 7652
Maker : Citizen Watch K,K,

Name : Hand-held Computer
Model : EPSON HC-40
Maker : EPSON Corporation

Name : Motionpack Data Recoder
Model : DP-1000
Maker : Hokuetsu Denken Co.

3.6 MANUAL PULSE GENERATOR

Use the manual pulse generator described below or the equivalent :

Table 3. 8 Manual Pulse Generator Spec. List (1)

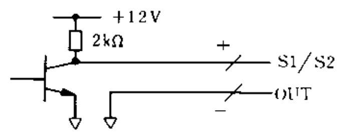
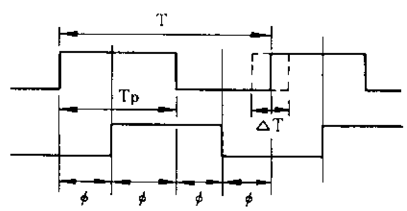
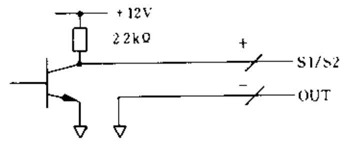
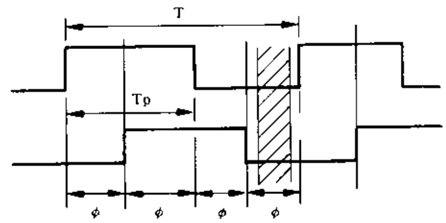
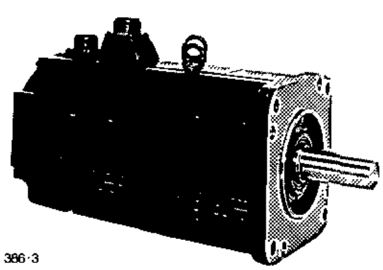
Type	MGX-10 B
Manufacturer	Sumtack Co.
Output Pulse	Rectangular waveform A/B phase 100 p/rev
Output Signal	$V_{OH} \geqq 8$ V $V_{OL} \leqq 0.5$ V tr, tf$\leqq 1.0$ μs Output impedance 2kΩ Output current Max. 20 mA
Output Circuit	
Output Waveform	 Pulse dytu cycle $\frac{Tp}{T} = 50\% \pm 10\%$ Flutter $\frac{\Delta T}{T} \leqq 5\%$ p-p Max. Phase difference $\frac{\phi}{T} = 25\% \pm 10\%$
Input Power Supply Response Frequency	DC$\pm$12 V$\pm$10% 100mA 5 kHz Max.
Allowable Revolution	500 rpm Max.
Required Torque	150 to 1000 g•cm
Vibration Resistance	1 G in the direction of X, Y and Z axes and no failure for two hours
Allowable Load	Thrust 1 kg Radial 2 kg
Water-and Oil-proof	Water-, oil-prevention
Applicable Temp. Range	0 to 50°C
Storage Temp. Range	−30 to +70°C
Humidity	20 to 80% RH
Approx. Weight	500 g

Table 3.9 Manual Pulse Generator Spec. List (2)

Type	PREH-2 E 5T/100-M 1
Manufacturer	Yaskawa Controls Sales Co., Ltd.
Output Pulse	Rectangular waveform A/B phase 100 p/rev
Output Signal	$V_{OH} \geqq 67\%$ V of power supply voltage $V_{OL} \leqq 0.5$ V tr, tf $\leqq 1.0\ \mu$s Output impedance 2.2 kΩ Output current Max. 20 mA
Output Circuit	
Output Waveform	 Pulse duty cycle $\frac{Tp}{T} = 50\% \pm 10\%$ Dial position stopped with click : Hatched section (phase A = phase B = OV) Phase difference $\frac{\phi}{T} = 25\% \pm 10\%$
Input Power Supply Response Frequency	DC±4.5 V to 12.3 V 100mA or less. 10 kHz Max.
Allowable Revolution	500 rpm Max.
Required Torque	450 to 650 g•cm
Vibration Resistance	2 G 50 Hz
Allowable Load	Thrust 1 kg Radial 2 kg
Water-and Oil-proof	dustproof
Applicable Temp. Range	0 to 50°C
Storage Temp. Range	−30 to +70°C
Humidity	20 to 80% RH
Approx. Weight	500 g

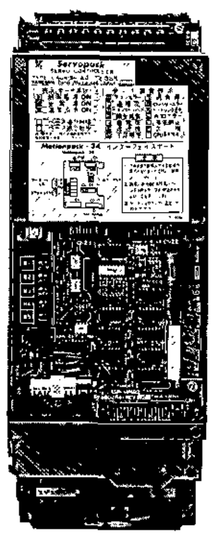
4. UNIT

This section describes details of each unit comprising the system. When designing the system, read this section thoroughly. Par.4.1 describes Motionpack-34 controller functions and parameters. Par.4.2 describes program specifications used for the system or operation methods. Performances, functions or details for use of Servopack and Servomotor are described in Pars.4.3 and 4.4, respectively.



386-3

AC Servomotor with Absolute Encoder



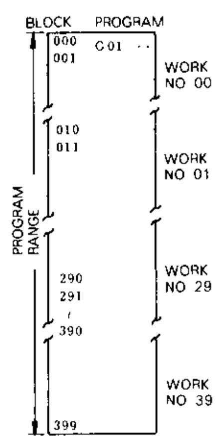
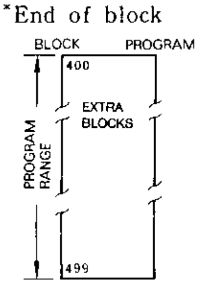
587-315

Servopack
TYPE CACR-SR44 TZ6S

4.1 Motionpack-34 CONTROLLER (CMPC-CM34C)

4.1.1 Specifications

No.	Item	Specifications	Remarks
1	No. of Control Axes	One	
2	Min. Command Unit	Axis system unit is set to the value computed from the following formula by parameter. Min. command unit = L × M/D M, D: Set by parameter Setting range: 1 to 9999999 L: machine transmitted capacity per pulse.	M: No. of pulses D: Distance
3	Min. Detected Unit	Min. detected unit = machine moving capacity per pulse When min. command unit is smaller than min. detected unit in movement command, the amount of movement command which does not fill up min. command unit will be located at the nearest movable position to the movement command value.	
4	Command Input Method	Key input by the Motionpack programmer.	
5	Program Capacity	400 blocks: 000 to 399 100 blocks: extra blocks	
6	Automatic Accel/Decel	Linear accel/decel both in AUTO system and JOG system. S-curve accel/decel as extented function.	
7	Input Binary Point	Binary point position in command input can be set by the parameter.	
8	Absolute/Incremental Command	(1) Absolute command From X 1234.56, the command value is set at 1234.56 of coordinate value. (2) Incremental command From U12.34, the command value is set at the position 12.34 away from the present position.	
9	Operation Mode	Motionpack-34 controller has the following five operation modes: (1) EDIT mode Performs program edition and displays each state. (2) JOG operation mode JOG feed (3) STEP operation mode STEP feed (4) AUTO operation mode Program operation, block operation (5) HANDLE operation mode Performs operation by handle PG. (Note) In (2) to (5), states can be displayed by Motionpack-34.	
10	JOG Feed	This is a manual continuous feed of which speed can be selected from high/mid/low. Each speed (high/mid/low) is set by the parameter.	
11	STEP Feed	This manual step-by-step feed of which speed can be selected from high/mid/low. Each speed (high/mid/low) is set by the parameter.	
12	Speed Limit	When speed limit input signal is turned on, feed speed is set at a value specified by the parameter.	Effective only in AUTO operation mode

No.	Item	Specifications	Remarks
13	Program Operation	(1) This operation is performed in AUTO operation mode. (2) Program can be started at any required time by the signals of PGSL00 to PGSL 30 and PGS0 to PGS9. (3) When the mode is switched to an upper-level mode*, deceleration and program execution are stopped.	*EDIT, JOG or STEP mode
14	Handle Feed	Movement by handle PG is performed. Movable amount per pulse of handle PG can be selected from ×1, ×10 or ×100.	
15	Feed Hold	(1) Interrupts the program during execution by acceleration stop to obtain feed hold state. (2) Program will be executed again by start signal.	
16	Single-Block Operation	(1) When single-block input is ON in AUTO operation mode, block-by-block execution is performed by inputting single start signal. (2) When single-block input is ON during program operation, the operation is stopped after executing one block.	
17	Stored Stroke Limit	(1) Sets a desired movable range by the parameter. (2) Does not start moving by movement command out of specified range to generate MP alarm.	
18	Program Reference	The following are provided as program references. G : Preparation function M : Auxiliary function X : Absolute position reference U : Incremental position reference F : Speed reference I : Torque reference D : Dwell time T : Coordinate system select L : Number of subprogram repetitions P : Subprogram start block No.	
19	Command Range	Command range for each reference is shown below: G : 01, 04, 05, 06, 07, 27, 34, 52, 53, 67, 68, 69 M : 30, 51, 52, 53, 54, 55, 56 X*: −9999999 to +9999999 U*: −9999999 to +9999999 F*: 1 to 60000 I : 10 to 250 (%) D : 0.01 to 600.00 (s) T : 0 to 9 L : 1 to 9 P : 0 to 499	* Ignored decimal point.
20	Program	(1) Program is stored in 400 blocks of block Nos. 000 to 399. (2) Any of work Nos. 00 to 39 is selected by program start signal to allocate each work No. to every 10 blocks. (3) Each block is specified by one of the following formats: 	*End of block  Extra blocks can not be program selected, however can be used as program area by jump.

4.1.1 Specifications (Cont'd)

No.	Item	Specifications	Remarks
20 (Cont'd)	Program	G 01 X······F······I······ * or G 05, G 06, G 07, G 27, G 34 G 04 D······ * or G 04 * G 52 X······T······ * G 53 T······ * G 68 X······P······ * or G 68 L-P······ * G 67 P······ * G 69 P······ * or G 69 * M······ * (4) By connecting tape device with Motionpack programmer, the program can be input, output or checked by the tape.	
21	Coordinate System	(1) There are ten systems from 0 to 9. Any coordinate can be selected for the program. (However, coordinate system 0 is a machine coordinate system; it cannot be selected.) (2) As for coordinate systems 8 and 9, offset capacity can be altered by external signal; They are regarded as tool compensation functions.	
22	Positioning	For positioning, the following special positionings other than G01 for normal use are available: (1) External positioning for setting coordinate system ······G34 (2) Signal skip positioning used for applicable control ······ G05, G06, G07. Use them according to application to enable further high-technic operation.	
23	Auxiliary Function (M Function)	(1) Contains six external decode output signals of "M30" indicating the end of program and "M51" to "M56" used by machine-side sequencer. (2) Decode output of "M51" to "M56" is reset to start executing the next block when M-FIN input signal is ON.	
24	Torque Limit	(1) By specifying "I······" in feed reference programmable feed torque limit (current limit) is given. (2) The specified range will be 10 to 250 % of rated torque.	
25	Standard Function (G Function)	For standard functions, the following are available: G 01: Positioning G 04: Dwell G 05: Signal skip positioning G 06: Signal skip positioning G 07: Signal skip positioning G 27: Home position check G 34: External positioning G 52: Coordinate system select G 53: Coordinate system change G 67: Desired position arrival check G 68: Repetitive specified subprogram call end position specified subprogram call G 69: Jump	

No.	Item	Specifications	Remarks
26	Extended Function	For extended functions, the following are available: G 06: Variable speed positioning G 07: Passing signal output G 05: Angle computing function G 06: Angle computing function G 07: Angle computing function G 05: S-curve accel/decel positioning* G 06: S-curve accel/decel positioning* G 07: S-curve accel/decel positioning* G 05: Clamp free function G 06: Clamp free function G 07: Clamp free function G 34: Infinitive length action G 67: G67 jump prohibit function M: Extended M function : Signal extended function during activating : Program selection encode : External data setting function† : External offset function† : External zone signal output†	Functions with the same G No. and with different functions are selected by the parameter.
27	Range Signal Output	After power is on and SV-RDY is ready, range signal is output in the range set by the parameter (Pr 30 to Pr 35), which has nothing to do with contents of programs. For range signals, "home position return complete signal (ZPM)" and "home position nearby" signal "ZNP" are used. This function works only for absolute value method.	
28	PG Disconnection Detection	When PG output is of line driver type, either A-, B- or C- phase with disconnection may be detected to prevent runaway with the alarm.	
29	ABS-PG Automatic Home Position Setup System	Automatic home position setup is executed when the push torque has reached the torque limit value after the unit arrives at the stopper position.	

*Available from Type CMPC-CM34C2 version on.
†Available from Type CMPC-CM34B4 version on.

4.1.2 Operation of Controller Type CMPC-CM34C

Motionpack-34 controller Type CMPC-CM34C (CM34C) is the central unit of the Motionpack-34 system. It incorporates an 8-bit microcomputer. It reads-in motion signals and program select signals, decodes them, and delivers speed and torque references to Servopack, to perform motion control.

(1) Circuitry of CM34C

Fig. 4.1 shows a block diagram of CM34C. All input output signals are isolated photoelectrically to assure performance under adverse operating conditions.

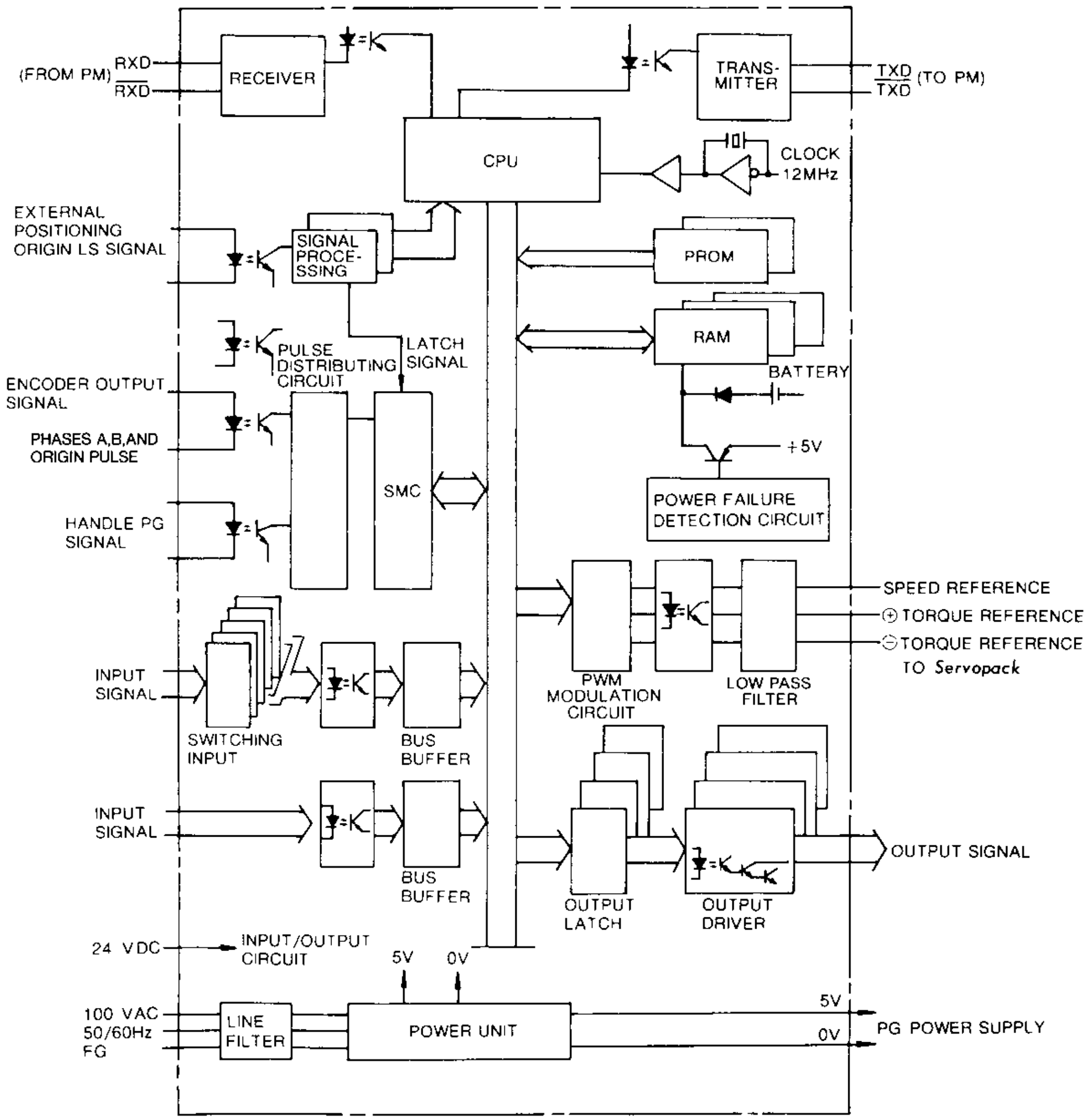


Fig. 4. 1 Functional Block of Motionpack-34 Controller

(2) Control of CM34C

Fig. 4.2 shows the control block of CM34C. Hardware is shown by double boxes and software with single boxes. The CM34C is a control unit which delivers speed reference voltage and torque reference voltage (⊕/⊖) to the servopack, under the control of the program stored in it.

(a) Speed reference voltage

The Speed reference voltage is rated at 6Vaccording to the ratings of Servopack. The stored program generates an automatic acceleration deceleration curve and date of the curve are entered in a deviation counter. The dividing ratio of parameters Pr50 and Pr51 is multiplied. The signal of (PG) is fed back to the deviation counter, and it contains the current deviation of position. PWM converts the deviation of position to a pulse width and the low pass filter converes it to analog voltage. VR shown at the output expresses a function of software. Pr42 sets number of lag pulses at rated output of ±6V.

When a desired position is reached, the deviation counter contains zero and the speed reference becomes 0V. The contents of the deviation counter are checked for excessive deviation or inposition.

The control process described above is the same during manual operation and during return to origin. The only difference is in the acceleration/deceleration curve generated internally.

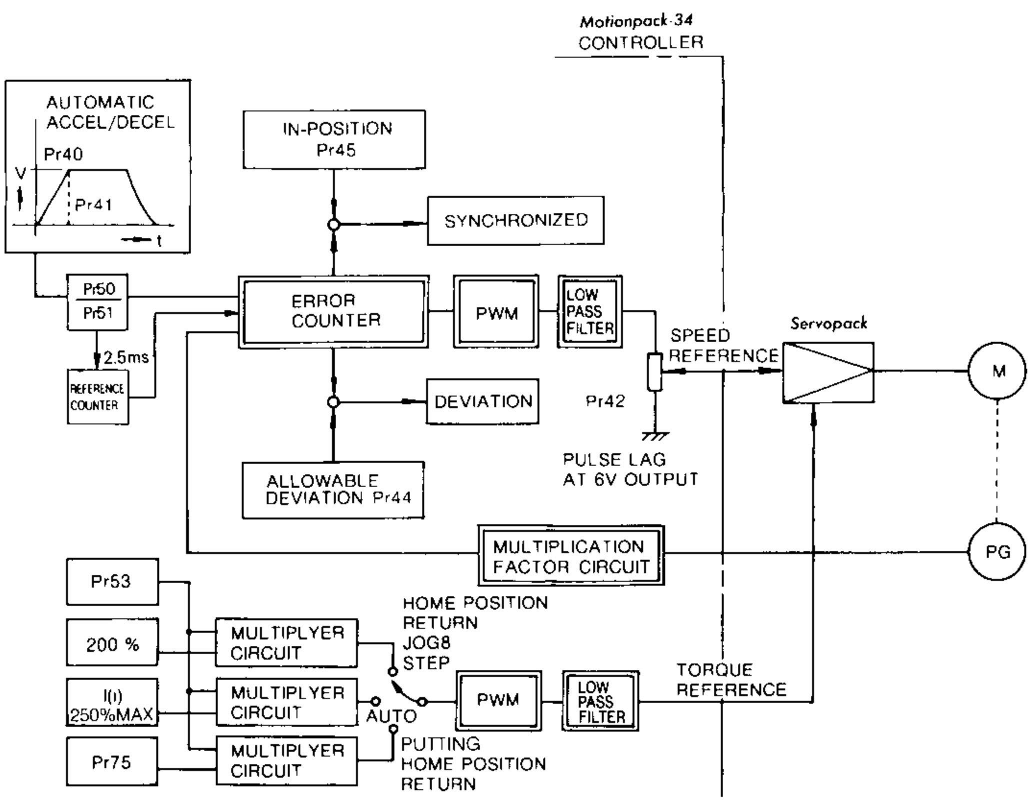


Fig. 4. 2 Control Block of Motionpack-34 Controller

4.1.2 Operation of Controller Type CMPC-CM34C (Cont'd)

(b) Torque reference voltage

Torque reference voltage is positive or negative, depending on the direction. The torque reference is set automatically at 200% during JOG & STEP. It is the value of "I" programmed during automatic operation. Actually the value multiplied by a torque ratio (Pr53/100) is output as the torque reference. When AC servo drive is applied, set it at Pr53 = 100.

Torque refrence data undergoes pulsewidth modulation (PWM) and low pass filter before becoming analog signals of 0 to ±10V. The rotary switch, drawn at the input of PWM, means that software switches torque reference as operating mode changes to JOG and automatic operation.

Fig. 4.3 shows the flow in the program of the CM34C. When power comes on, irrespective of machine condition, an INITIAL program executes in the CM34C to convert parameters, initialize internal data, and preset counters. When SAL signal is on, ABS will start to be formed. SEQUEN executes after INITIAL. SEQUEN will execute repeatedly except during interrupt described below. CLOCK runs, interrupted by pulses of 1.25-msec intervals which are generated by dividing the clock pulse of the CM34C. The programs of TIMER through DRIVE, shown in Fig. 4.3, execute as triggered by an interrupt occurring every 10 msec once every 8 times. SEQUEN starts when execution (started by interrupt) comes to an END.

Table 4.1 summarizes major functions of the programs.

Table 4. 1 Major Functions of Programs

Program	Function
INITIAL	Converts parameters. Initializes internal data. Presets counters
CLOCK	Reads signal. Outputs signal.
TIMER	Times transmission and sequence.
SCAN OUT	Checks for changes of external signals and, if a change is detected, generates interrupt.
SERVO	Reads SMC error register and outputs PWM result.
DRIVE	Pulse distribution for movement.
COMMUN	Used to transmit CM and PM.
ABS	Forms ABS data

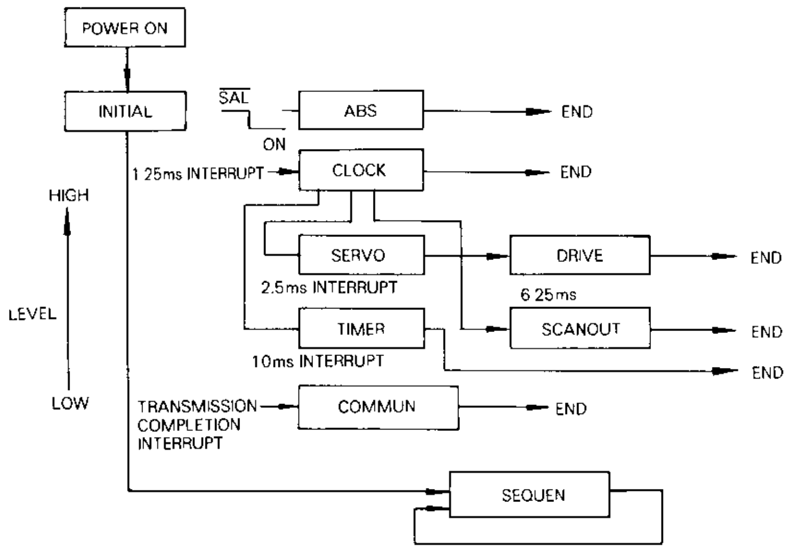


Fig. 4. 3 Software Flow

(c) Absolute value method position data process

Absolute encoder output contains PAO, PBO and PCO as shown in Fig. 4.4.

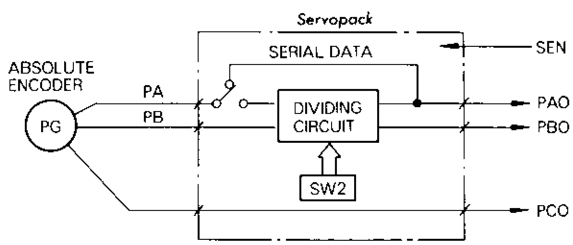


Fig. 4. 4 Absolute Encoder Output

Absolute value data is first output from PAO as serial data by inputting SEN signal (L→H). Next, the data is output as "initial incremental pulse" PAO and PBO (90 phase difference 2-phase pulse). (See Fig. 4.5.)

After that, it will become the same output operation (90 phase difference 2-phase pulse) as the normal incremental encoder.

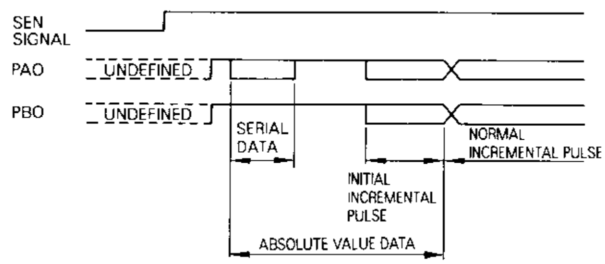


Fig. 4. 5 Absolute Value Data Output

Contents of absolute value data

- Serial data : Indicates at which time of the rotation of the motor shaft is located from reference position (set at set-up time).
- Initial incremental pulse : Oututs pulse at the same speed as that of rotation with 2747 rpm from motor shaft original position to the present motor shaft position.

After power is on, CM34C outputs "SEN" signal and turns absolute encoder power supply on. At the same, CM34C is kept waiting to receive absolute encoder serial data output.

Table 4.2 shows the specifications of serial data.

Table 4. 2 Serial Data Specifications

Data transmission method	A synchronous (ASYNC)
Baud rate	9600 Baud
Start bit	1 bit
Stop bit	1 bit
Parity	Even numbers
Character code	ASCII 7 bits
Data format	8 characters (P) (+/-) (0 to 9) × 5-digit (CR)

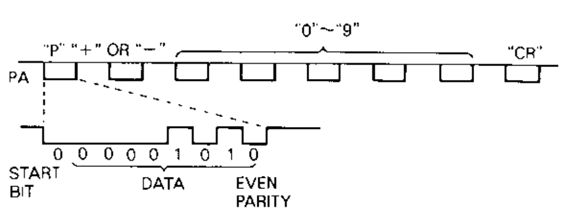


Fig. 4. 6 Serial Data

① Serial data feed 8 bytes (8 characters).

The format is $\boxed{P \pm \times \times \times \times \times CR}$. (× means a number of 0 to 9, CR means carriage return code.)

② Above-mentioned value shows revolutions to the reference point set at set-up time.

③ Zero rotation will be either $\boxed{P + 00000 (CR)}$ or $\boxed{P - 00000 (CR)}$

④ Even when revolution data are zero at ± 100000 revolutions, CM34C maintains normal operation.

CM34C will receive initial incremental pulse.

After receiving serial data and initial incremental pulse, CM34C forms position data from $\boxed{P = M \times R + Po}$.

M (revolutions): Serial data value
Po (pulse): Number of initial incremental pulses
R (pulse/rev): Number of output pulses per one revolution of the motor, defined in Pr76.

4.1.3 Controller CM34C Parameter Setting

Motionpack-34 controller adjusts control specifications to a mating machine by setting parameters shown in Table 4.3. Accordingly, the parameter must be established at the stage of designing the Motionpack-34 system ; set it correctly to the controller upon starting operation.

Table 4.3 Motionpack-34 Parameter List

Parameter No.	Name	Range	Unit	Remarks
1	JOG low speed	0 to 60000	Speed unit	
2	JOG medium speed	0 to 60000		
3	JOG high speed	0 to 60000		
4	STEP speed	0 to 60000	Speed unit	
5	STEP distance, moved short	0 to 999999	Min. reference unit	
6	STEP distance, moved medium	0 to 999999		
7	STEP distance, moved long	0 to 999999		
8	JOG/STEP torque limit	0 to 250	%	
9	Not used			
10	Creep speed	0 to 60000	Speed unit	
11 to 19	Not used			
20	One time modification capacity of axis system 8	0 to 255	Min. reference unit	
21	Max. modification capcity of axis system 8	0 to 9999999		
22	One time modification capacity of axis system 9	0 to 255		
23	Max. modification capacity of axis system 9	1 to 9999999		
24 to 29	Not used			
30	Range 1 definition	−9999999 to +9999999	Min. reference unit	
31	Range 1 definition	−9999999 to +9999999		
32	Range 2 definition	−9999999 to +9999999		
33	Range 2 definition	−9999999 to +9999999		
34	Range 3 definition	−9999999 to +9999999		
35	Range 3 definition	−9999999 to +9999999		
36 to 39	Not used			
40	Max. speed	0 to 60000	Speed unit	
41	Acceleration	50 to 60000	ms	
42	Position loop gain	200 to 30000	No. of pulses	
43	Extended function designation			
44	Servo error deviation	60000 Max.	No. of pulses	
45	In-position range	1 to 255	No. of pulses	
46	G27 allowable deviation	0 to 999999	No. of pulses	
47	Extended function selection			
48 to 49	Not used			
50	Pulse ratio (M)	3999999 Max.	No. of pulses	
51	Pulse ratio (D)	3999999 Max.	Min. reference unit	
52	Decimal point position	0 to 5	No. of digits	
53	Thrust ratio	10 to 250	%	
54	Axis No. designation	0 to 9		
55	Not used			
56	Accel time	60 to 1000	ms	
57	S-curve accel/decel time	30 to 500	ms	
58 to 59	Not used			
60	−Direction stored stroke limit	−9999999 to +9999999	Min. reference unit	
61	+Direction stored stroke limit	−9999999 to +9999999	Min. reference unit	
62 to 69	Not used			
70	Reference point coordinate system			*1
71	Offset of TO coordinate	−9999999 to +9999999	No. of pulses	
72	Waiting position (at rapid traverse)	−9999999 to +9999999	Min. reference unit	*1
73	Rapid return speed	0 to 60000	Speed unit	
74	Home position setting speed	0 to 60000	Speed unit	*1
75	Push torque	10 to 200	%	
76	No. of encoder pulses		Pulse/rev	*1
77	Allowable deviation	1 to 255	No. of pulses	*1
78	Encoder allowable deviation	0 to+9999999	Min reference unit	*1
79	Pushing time	0 to 3000	10 ms	
80	Home position setup command	0, 1		
81	Reference point coordinate	−9999999 to +9999999	Min. reference unit	
82	ABS-PG alarm reset command			
83 to 96	Not used			
97	Baud rate	110, 300, 1200, 2400	bps	
98 to 110	Not used			
111 to 148	Zone definition setting	−9999999 to +9999999	Min. reference unit	
149 to 200	Not used			
201 to 296	External setting data			

* 1 : The name and contents in absolute value method differ from those of incremental method.

4.1.3.1 Parameters related to machinery

(1) Position command unit determination (Pr50, Pr51)

Selection of driving system and position detector determines position detection unit (distance per pulse). Relations between position command unit and position detection unit can be set as required by paramater Nos. Pr50 or Pr51. Specified range contains 1 to 3999999. However, it must be with $\frac{1}{50} < \frac{Pr50}{Pr51} < 50$.

Moving capacity depends on position detection unit; "rounding error" may occur when command value is changed to detection value.

$$\frac{Pr50}{Pr51} = \frac{\text{No.of pulses (pulse)}}{\text{Position command value (Position command unit)}}$$

Motionpack-34 reads-in PG pulse via Servopack.

Servopack divides PG pulse attached to AC Servomotor. This dividing ratio is set according to SW2 on Servopack. (See par. 4.3.3.1 (5) "Setting switch.") Then, set the value of SW2 to determine the number of Motionpack-34 input pulses.

In this case, the upper limit frequency of Motionpack-34 PG signal read-in circuit is 600 kpps (×4) ; dividing ratio to be set must meet these conditions :

$$P\ (p/rev) \times 4 \times \frac{\text{Motor max.rev.(rpm)}}{60} \leqq 600\ \text{kpps}$$

(Example 1) Determine Pr50 and Pr51 in positioning device as shown in Fig. 4.7.

Ball screw pitch : 6 mm/rev

Reduction ratio : $\frac{1}{R} = \frac{1}{\frac{7}{5}}$ PG dividing ratio : 5000 p/rev

PG dividing ratio : 5000 p/rev

Position reference unit : 1/1000 mm

Pr50 = 5000 × 4 = 20000 (pulse)

$$Pr51 = \frac{\text{Ball screw pitch (mm/rev)}}{\text{Position refrence unit} \times \text{Reduction ratio (R)}} = \frac{6\ (mm/rev)}{0.001 \times \frac{7}{5}} = 6000 \times \frac{5}{7}$$

$$\frac{Pr50}{Pr51} = \frac{20000}{6000 \times \frac{5}{7}} = \frac{14}{3} \cdots\cdots \boxed{Pr50 = 14,\ Pr51 = 3}$$

4.1.3.1 Parameters related to machinery (Cont'd)

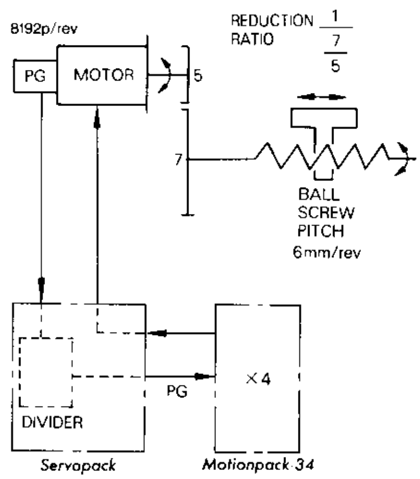


Fig. 4. 7

NOTE

Select the number of detector pulses to result in Pr50 ≧ Pr51. In case of Pr50 < Pr51, command unit accuracy can not be computed because of the rough min. detection unit.

⟨Setting at reverse rotation connection⟩

As described in par.5.2.5.2 "Motor Rotating Direction", when the motor is used for reverse rotation connection, set Pr50 at negative.

Pr50 = ⊖ number of pulses

Also, in that case, Servopack DIR signal must be turned to L. Refer to par.5.2.5.2 description for designing.

(2) Speed reference unit determination (Pr52)

Pr52 is a parameter determining at which digit of position command value expressed in position command unit the decimal point should be located. In Motionpack-34, the distance unit of this decimal point position is speed unit per minute.

(Example 1)

Position command unit = 1μm, Pr52 = 3 ;

X (U) □□□□ . □□□

mm ― 3-DIGIT ― μm

Therefore, command speed unit is mm/min.

(Example 2)

Position command unit = 1μm, Pr52 = 4 ;

X (U) □□□ . □□□□

cm ― 4-DIGIT ― μm

Therefore, speed command unit is cm/min.

(Example 3)

Position command unit = 10μm, Pr52 = 2 ;

X (U) □□□□□ . □□

mm   2-DIGIT   10 μm

Therefore, speed reference unit is mm/min.

The values of Pr52 vary from 0 to 5 and are located by digit, i. e. :

speed command unit = position command value × 10/min. (Pr52).

As shown in (Example 1), when position command value is 1μm and Pr52 = 3, speed reference unit is mm/min ; if a program `G01 X5000.000 F10000 I200` is executed, movement speed will be :

F = 10000mm/min

= 10m/min.

(3) Thrust determination (Pr53)

This parameter is for setting the ratio of the programmed motor shaft torque (taken as 100%) to the rated torque limit of Servopack and servomotor.

$$\mathrm{Pr53} = \frac{\text{Programmed 100\% motor shaft torque}}{\text{Motor rated torque}}$$

$$\times \frac{\text{Motor rated current}}{\text{Servopack 100\% limited current}} \times 100(\%)$$

$$= (\text{Rated thrust/Servo rating}) \times 100(\%)$$

(Example)

Programmed 100% motor shaft torque = 60kg • cm

Servomotor : USAMED-06MS2, rated for 58.0kg • cm/5.8A

Servopack : CACR-SR06TZ6, with 5.8A (100% limited current)

$$\mathrm{Pr53} = \frac{60\text{kg} \cdot \text{cm}}{58\text{kg} \cdot \text{cm}} \times \frac{5.8\text{A}}{5.8\text{A}} \times 100(\%)$$

$$= 103(\%)$$

The setting range of Pr53 is between 1 and 200. However, since the torque restriction accuracy is only around ± 10%, detailed calculation is meaningless. To limit torque at high accuracy, measure the motor current with the machine slide butting against the stop and calculate the parameter from the measured current.

When CACR-SR □TZ6S □type Servopack with absolute encoder is used and detailed designation of movement command torque command is not necessary, set Pr53 to 100.

4.1.3.1 Parameters related to machinery (Cont'd)

(4) Stored stroke limit (Pr60, Pr61)

This parameter is for setting the maximum motion range. Parameter Pr60 is for the minimum value in the - direction, and parameter Pr61 is for the maximum value in the + direction. The setting range is between − 9999999 and + 9999999 in minimum position command units. The coordinate values indicate positions on the T0 coordinate system.

If a feed command over the stored stroke limit is given in the AUTO mode, the command remains ineffective, and the control enters the stored limit error (MP alarm) state. In the JOG mode, the slide decelerates and stops at the stored stroke limit. If further jogging is started beyond the limit, the control enters a stored limit error (MP alarm) state.

When stored stroke limit function is not needed, set Pr60 = Pr61 = 0.
Where no using angular index function (option), do not set "Pr60 = Pr61 ≠ 0" to prevent any error of A0 display.

4.1.3.2 Servo-related parameters

(1) Acceleration determination (Pr40, Pr41)

Pr40 specifies a speed and Pr41 specifies the time in which this speed is to be reached. Set the maximum speed that can be programmed by parameter Pr40. Acceleration/deceleration time should be larger than that of machine including servo-drive. Acceleration/deceleration time can be calculated referring to par. 11.1 (6) "Setting acceleration deceleration time." When torque is limited by feed command I, acceleration/deceleration command becomes slower according to limited torque.

$$\textit{Acceleration} = -\ \textit{deceleration} = \frac{\mathrm{Pr40}}{\mathrm{Pr41}}$$

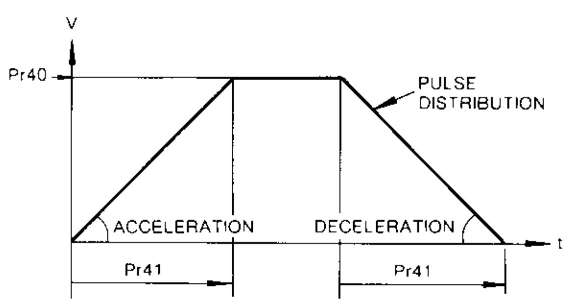


Fig. 4. 8

Pr40 is set in speed command units, and its setting range is 1 to 60000 without a sign. Pr41 is set in msec, and its setting range is 50 to 60000 (1 minute). The 1 msec digit of Pr41 is ineffective.

(Example)

With a drilling machine

If the unit of speed command is mm/min and the maximum speed of 10m/min is reached in 300 msec, set as follows.

Pr40 = 10000

Pr41 = 300

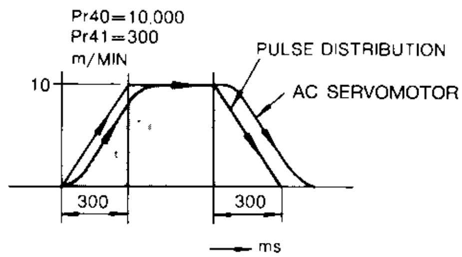


Fig. 4. 9

(2) Position loop gain (Pr42)

This parameter determines the AC Servomotor response accuracy for pulse distribution. The accuracy is specified by type of AC Servomotor and rapid traverse rate.

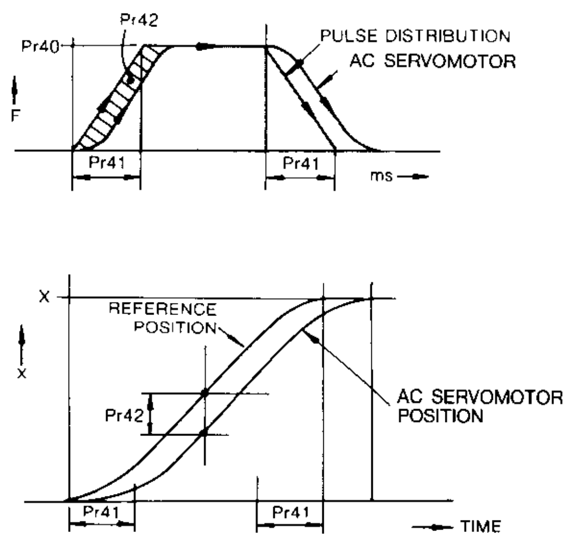


Fig. 4. 10

Fig. 4.10 shows time-speed curve. The hashed area shows Pr42 setting which is follow-up deviation (distance). It indicates the motor delay for reference positions at the constant speed motion shown by time-position curve in Fig. 4.10.

This parameter is for setting the follow-up deviation pulse (error counter) in motion at the rated speed to determine the position loop gain. (The rated speed is one at a Servopack command input voltage of 6V.)

4.1.3.2 Servo-related parameters

$$\text{Pr42} = \text{PPS at rated speed} \times \frac{1}{\text{kp sec}^{-1}}$$

"kp" means position loop gain and is determined by type of AC servomotor.

The loop gain of ordinary machine tools range between approximately 40 $\sec^{-1}$ for rigid machines and 20 $\sec^{-1}$ for flexible machines.

(Example)

AC Servomotor (rating 1000rpm) divides PG pulse and provides Motionpack-34 with 5000 pulses/rev. Motionpack reads-in this value for four times. Now try to set kp at 30s^{-1} :

$$\text{Pr42} = \frac{5000 \text{ p/rev} \times 4 \times 1000 \text{ rpm}}{60\text{s}} \times \frac{1}{30\text{s}^{-1}}$$

$$= 11111 \text{ pulse} \rightarrow 11000 \text{ pulse}$$

Pr42 is set in number of pulses, and it's setting range is 200 to 30000 without a sign. The relation between Pr42 and the number of error pulses is as follows :

$$\text{Pr42} \times \frac{\text{Pr51}}{\text{Pr50}} = \text{d0} \pm 10\%$$

(d0 is the value at rated rotation.)

To obtain the actual value of kp, measure error pulse when the speed is fixed and divided PPS of feedrate by the error pulse. To determine Pr42 actually, substitute the value of the actual motor for the value of kp and calculate Pr42. Then, readjust Pr42 by measuring error pulse during trial when the motor is actually operated. For adjustment, refer to sect. 7 "INSTALLATION AND TEST RUN ADJUSTMENT."

(3) Servo error (Pr44)

It is to detect defects of the servo mechanism. Set an error pulse count within a normal range when the servo mechanism works properly. Normally set the parameter Pr42 determining the loop gain about twice the value. If error (d0) exceeds Pr44, the Motionpack gives an alarm of excessive error (dEr0uEr).

(4) In-position range (Pr45)

Set allowable lag pulses to perform in-position check with G04. For G04, see Par. 4.1.4.3, inposition wait command. Ideally allowable lag pulse value is zero, but it cannot become zero because of drift of D/A, error of adjustment (ZERO) of the Servopack, etc. As lag pulses are reduced, speed is lower and more time is taken until they coincide. Set it to the maximum within the range of percision the system requires. It is set at 30- to 60-pulse count for ordinary machine tools.

(5) Allowable error amount by G27 (Pr46)

This parameter designates the range to looking for home position pulse with a home position check command (G27)*.

The unit is pulse count and 1 to 999999 can be designated.

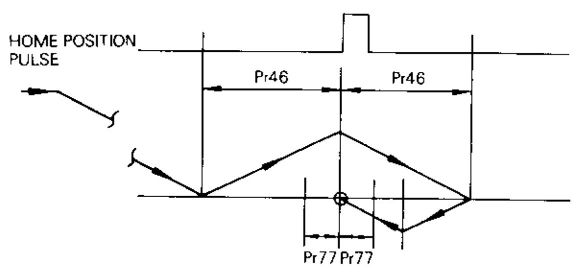


Fig. 4. 11

Select Pr46 to be greater than Pr45 and smaller than the pulse count of half rotation of the motor shaft. If Pr46 is set at 0, the home position pulse coordinate is not checked during execution of the G27 command.

NOTE

For information of parameters 56 and 57 for S-curve accel / decel positioning, refer to par. 11.1.

4.1.3.3 Operation parameters

(1) JOG feedrate (Prl, Pr2, Pr3)

These parameters determine the JOG feedrate. The input signals JLF and JMF determine the feedrate as given in Table 4.4. The unit is that of the speed command and the range of feedrate is 0 to 60000.

(Example)
Make Pr3 = 10000 to set JOG high speed = 10m/min when the unit of speed command is mm/min.

Table 4. 4 JOG Parameter

Speed	Parameter	JLF	JMF
Low	Pr1	ON	OFF
Medium	Pr2	OFF	ON
High	Pr3	ON	ON

(2) STEP feedrate (Pr4)

This parameter determines the STEP feedrate.
The unit is that of the speed command and the range of feedrate is 1 to 60000.
Set 0 for it when not used.

(3) STEP feed (Pr5, Pr6, Pr7)

These parameters determine the unit distance of feed. The input signals JLF and JMF determine the unit feed as given in Table 4.5. The unit is that of the position command and the range of unit feed is 1 to 9999999 unsigned.

(Example)
If STEP is executed with Pr5 = 10 when the unit of position command is 0.001 mm, the distance of feed is 0.001mm × 10 =0.01mm.

Table 4. 5 STEP Parameter

	Parameter	JLF	JMF
Short	Pr5	ON	OFF
Medium	Pr6	OFF	ON
Long	Pr7	ON	ON

(4) JOG/STEP torque limit (Pr8)

This parameter determines torque limit value at JOG and STEP (JLF = ON, JLM = OFF). In the range of 0 to 250 %, the setting is available using the unit of % per rated torque. When 0 % is set in Pr8, torque reference of 200 % is automatically output.

(5) Creep Speed (Pr10)

When the speed limit signal (OVR) is ON during AUTO mode, the F command of program command is limited to the speed designated by Pr10. The F command, if it is smaller than Pr10, remains unchanged.

Pr10 is given in the unit of speed command and the value is 0 to 60000.

4

4.1.3.4 Offset parameters

(1) 8th coordinate correction amount at a rise (Pr20)

This parameter determines the amount of correction made at a rise of + INC8 or − INC8. The value is 1 to 255 without a sign in the minimum command unit. Set 0 for it when not used.

(2) 8th coordinate maximum correction amount (Pr21)

This parameter determines the maximum of the total correction made with + INC8 or− INC8. A correction signal exceeding this maximum value will not be accepted. The value is 1 to 9999999 without a sign in the minimum command unit. Set 0 for it when not used.

(3) 9th coordinate correction amount at a rise (Pr22)

This parameter determines the amount of correction made at a time with +INC 9 or −INC9. The value is 1 to 255 in the minimum command unit. Set 0 for it when not used.

(4) 9th coordinate correction amount (Pr23)

This parameter determines the maximum of total correction made in the No. 9 coordinate system. The value is 1 to 9999999 in the minimum command unit. Set 0 for it when not used.

NOTE

1. The amount of correction made at one time is converted to a pulse count. If the ratio of the minimum command unit to the pulse count is not an integer in the drive system, take the pulse count into consideration to set the parameter. (Rounding is made in conversion from the amount of correction to pulse count.)
2. Offset is correctable during feed hold and after the end of automatic operation.

4.1.3.5 Home position related parameter

(1) Home position coordinate method (Pr70)

Pr70 is a parameter which defines the setting method for home position coordinate and is composed of a 6-digit numerical value.

Pr70 = A B C D E F

- F — Setup method
  - F = 0 to 2 : Setup in use of incremental encoder
  - F = 3 : Use of absolute encoder
  - F = 4 : Automatic home position setup
- E — Return-to-home position direction
  - E = 0 : Minus
  - E = 1 : Plus
- D — Moving direction specified at return-to-home position start
  - Always set 0 in use of absolute encoder.
- C — Home position LS
  - C = 0 : LS for return-to-home position not provided
  - C = 1 to 3 : How to install the LS
  - C = 4 : Limit-point pushing method
- B — Checking home position related signals
  - B = 0 (= 4)
    Check neither home position pulse nor home position LS.
  - B = 1 (= 5)
    Check home position pulse but not home position LS.
  - B = 2 (= 6)
    Check both home position pulse and home position LS.
  - When B is shown as a number in ( ), PG signal cable disconnection check is effective.
- A — Presence of holding position
  - A = 0
    No holding position. In G27 command, T0 coordinate home position is commanded.
  - A = 1
    Holding position exists. In G27, holding position (The position defined by Pr72) is commanded.

Motionpack-34 controls absolute encoder at "Pr70F = 3 or 4" and "ABS ID" = 1 of Servopack input signal. For the absolute encoder home position setup procedure, refer to Par. 11.2.

(2) T0 coordinate offset (Pr71)

By setting up at installation of absolute encoder machine, data of encoder revolutions (output data by serial data when the power is on) can be 0.

However, rotation angle data, (which are output by initial incremental pulse when the power is on) are determined by installation of motor and machine shaft. By setting home position offset to Pr71, Motionpack-34 can define the relation between T0 coordinate home position and encoder home position ; which can match the installation angle deflection of absolute encoder and machine shaft.

Pr71 means the distance from T0 coordinate system home position to absolute encoder home position. The numerical value is − 9999999 to + 9999999 in pulse unit.

At set-up, Pr71 may be set at following temporary values :

- At set-up of coordinate home position
  Set Pr71 at 0, display absolute value encoder output data in A0 display and determine the coordinate offset.
- Set-up of Motionpack position counter
  At set-up, set Pr71 at 9999999 once and turn the controller power off and then on again, and the counter can be reset.

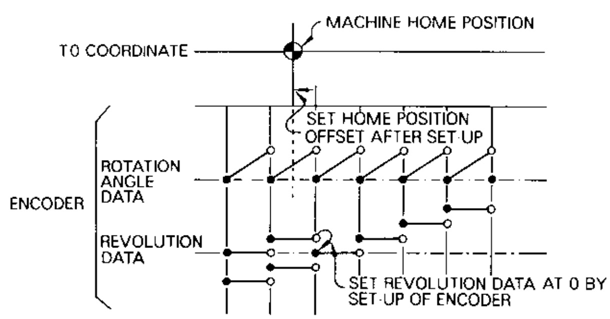


Fig. 4. 12

4.1.3.5 Home position related parameters (Cont'd)

(3) Holding position (Pr72)

Holding position parameter (Pr72) in absolute value method difines quick-return position. If home position return signal (ZRN) is input, Motionpack-34 operates "quick return" and returns to the holding position, which can be accomplished without any relation to the content of the program being executed. At this time, the speed can be defined by Pr73. Holding position is set on T0 coordinate. The numerical value ranges from − 9999999 to + 9999999 in unit.

(4) Quick-return speed (Pr73)

Pr73 can define quick-return speed. (For "quick-return", refer to (2) about Pr72.) The numerical data range from 0 to 60000 in speed reference unit.

(5) No. of encoder pulses (Pr76)

When the power is on, Motionpack-34 forms the present position, based on the data output by the absolute encoder.

The present position P is computed as follows,

$$\boxed{P = M \times R + P_0}$$

M : Revolutions (serial data)

P_0 : Rotation angle (No. of initial incremental pulses)

R : No. of output pulses per one rotation of motor

Here, Pr76 sets the number of output pulses per one rotation of the motor. The absolute encoder has 8192 pulses/rev which are divided according to Servopack SW2 setting. (The standard setting value of Servopack, prior to shipping from the factory, is 5000 pulses/rev.)

Motionpack always reads-in pulses multiplied by 4. Set Pr76 as follows :

Pr76 = 8192 (P/rev) × (Servopack divided ratio) × 4

= (No. of pulses after divided in Servopack) × 4

Number of pulses of Servopack at dividing setting and after dividing are as shown in Table 4.33 on page 140.

(6) Allowable deviation capacity (Pr77)

When home position pulse coordinate is checked by G27 command, allowable error range is defined. When G27 command is executed ; if home position coordinate is located within ±Pr77, it is normal. However, if it is out of the range, G27 error alarm occurs (setting range 1 to 255 pulses).

(7) Encoder allowable error capacity (Pr78)

In absolute value method, position data are stored in the memory even if the power supply is cut off. Simultaneously, change of positions is being read-in when the power supply is cut off. Motionpack-34 checks the allocation of the positions at turning on and off by monitoring. By this checking, it can be detected if the machine has worked during the power cutoff for some reason ; also an allocation occurring in absolute encoder position detection can be detected.

As a result, if the allocation is over Pr78, the alarm occurs. The numerical values of Pr78 are 0 to 9999999 in pulse units ; set 500 or more for normal use. When a vertical shaft makes coasting longer at power on, extend the value. (If Pr78 is set at 0, there is no data check.)

(8) Precautions

Absolute value method and incremental method have different functions of home position coordinate-related parameters. Table 4. 6 shows their comparison.

Table 4.6 Comparison of Parameter Functions

Parameter No.	Absolute Value Method	Incremental Method
70	Home position coordinate setting method	Return to home position method
71	T0 coordinate offset	Home position coordinate
72	Holding position (at quick-return)	Holding position (at return to home)
73	Quick-return speed	Return to home speed
74	Home position setting speed *	Return to home creep speed
75	Push torque*	Return to home torque speed
76	No. of encoder pulses	Coasting allowance
77	Allowable deviation capacity	Allowable deviation capacity
78	Encoder allowable error capacity	Pushing time
79	Pushing time*	Not used
80	Home position setup command*	
81	Reference point coordinate*	
82	ABS・PG alarm reset command*	

* For more information, see par. 11.2.

4.1.3.6 Basic zone signal definition parameter (Pr30 to Pr35)

Parameters Pr30 to Pr35 define sections in which zone signals are ON. As shown in Fig. 4.13, 3 sets of parameters, (Pr30 & Pr31), (Pr32 & Pr33) and (Pr34 & 35) define zone 1 to zone 3, respectively.

However, in this case, the following relations must be kept :

Pr30 < Pr31, Pr32 < Pr33, Pr34 < Pr35

For example, if Pr30 = Pr31 or Pr30 > Pr31 is set, the zone 1 can not be defined.

The unit of Pr30 to Pr35 is minimum speed reference and the value range is within − 9999999 to + 9999999. If two zones overlap or one includes the other, a wrong combination of signal output occurs.

Zones 1 to 3 are defined by the combination of ZPM and ZNP. However, when each of ZPM and ZNP is used as an individual signal cable, set Pr34 = Pr35 and zone 3 is not defined so as to prevent malfunction by disconnection, etc.

Item	Zone 1	Zone 2	Zone 3	Non-defined Zone
ZPM State ZNP State Zone Definition	ON OFF Pr30, Pr31 Pr30<Pr31	OFF ON Pr32, Pr33 Pr32<Pr33	ON ON Pr34, Pr35 Pr34<Pr35	OFF OFF No parameter

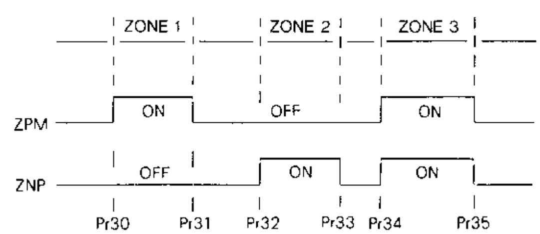


Fig. 4. 13

NOTE

For zone signal definition parameters (Pr111 to Pr148), refer to Pars. 11.5 and 11.6.

4.1.3.7 Extended function selection designation parameter (Pr43/Pr47)

Extended function is selected by Pr43/Pr47 setting value, which differs depending on the extended function. (See Table 4.7.)

Table 4.7

Extended Function	Pr 43	Pr 47
Variable speed positioning	20000	
Passing signal output	4000	
Angular index	2000000, Pr60 = Pr61 ≠ 0	
Clamp free	100, 200, 300, 400, 500, 600, 700	
S-letter accel/decel positioning	1000	
No-limit length	1000000	
G 67 jump prohibit	Not necessary	
Signal extension during operation	20000	
Auxiliary	1 to 99	
Encode of program select signal	40000	
External data setting		20 (No checksum) 30 (checksum)
External offset		40 (No parity check) 50 (Parity check)
Extended zone signal output (A)	100000	
Extended zone signal output (B)	200000	

4.1.3.8 Tape read-in and input related parameters

(1) Shaft No. specified (Pr54)

Pr54 can be specified at 0 to 9. When program is output on the tape, Pr54 is added to the head of the tape. When inputting tape, tape shaft No. is referred to Pr54 stored in the Motionpack -34 to detect a wrong tape. However, when Pr54 is set at 0 ; the program is output on the tape at tape outputting but Motionpack-34 with Pr54 = 0 set will read-in the tape without reference.

(2) Tape device baud rate setting (Pr97)

When tape punch or tape read-in is performed with tape device, specify the transmission baud rate between Motionpack programmer and tape device by Pr97. Transmittable values are 110, 300, 1200 and 2400 ; set any of them according to tape device baud rate.

This parameter is stored in the memory of Motionpack programmer but is lost when the Motionpack programmer power supply fails. Accordingly, set a parameter whenever tape device transmission is performed.

NOTE

For external data storage parameters (Pr201 to Pr296), refer to par.11.3

4.1.4 Functions of Motionpack-34 Controller

4.1.4.1 Operation mode

Motionpack-34 has the following five operation modes.

① EDIT mode
② JOG operation mode
③ STEP operation mode
④ HANDL operation mode
⑤ AUTO operation mode

The Motionpack system is selectively set to one of the five operation modes with external input signals, i. e., EDIT, PLAY, JOG, STEP, and SBK. The five operation modes are given priority ranks as shown below.

① EDIT mode
② JOG operation mode, STEP operation mode, HANDLE operation mode
③ AUTO operation mode

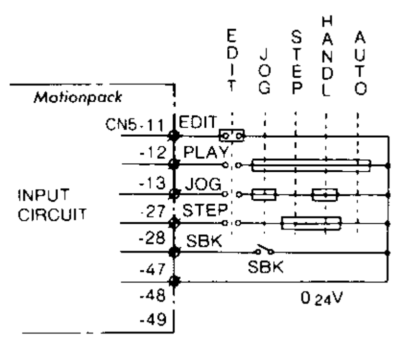


Fig. 4. 14

No two modes can be set simultaneously. When the modes are switched over during operation, the earlier mode remains effective until the operation ends, or the motion is decelerated and stopped.

The selection conditions of each of the five modes are given below. (The EDIT, PLAY, JOG and STEP signals are operation level signals.)

Table 4.8 Operation Modes Selection Conditions

<table>
<tr><th colspan="2">Mode \ Signal</th><th>EDIT</th><th>PLAY</th><th>JOG</th><th>STEP</th><th>SBK</th></tr>
<tr><td colspan="2">EDIT</td><td>ON</td><td>-</td><td>-</td><td>-</td><td>-</td></tr>
<tr><td colspan="2">JOG</td><td rowspan="5">OFF</td><td rowspan="5">ON</td><td>ON</td><td>OFF</td><td>-</td></tr>
<tr><td colspan="2">STEP</td><td>OFF</td><td>ON</td><td>-</td></tr>
<tr><td colspan="2">HANDLE</td><td>ON</td><td>ON</td><td>-</td></tr>
<tr><td rowspan="2">AUTO</td><td>Block operation</td><td rowspan="2">OFF</td><td rowspan="2">OFF</td><td>ON</td></tr>
<tr><td>Program operation</td><td>OFF</td></tr>
</table>

Note: " - " means invalid (regardless of ON or OFF) condition.

(1) EDIT mode

This mode is for writing and editing programs and parameters with the Motionpack programmer. This mode takes priority over the JOG, STEP, HANDLE and AUTO modes.

In the EDIT mode, MP ready signal (connector CN1-③) is OFF, but servo clamp control continues.

(2) JOG operation mode

This mode is for JOG feeding and returning to no HOME position. In the JOG operation mode, while the + JOG & STEP (+JS) signal in ON, the machine is jogged in the plus (+) direction. While the − JOG & STEP (−JS) signal is ON, jogging motion takes place in the minus (−) direction.

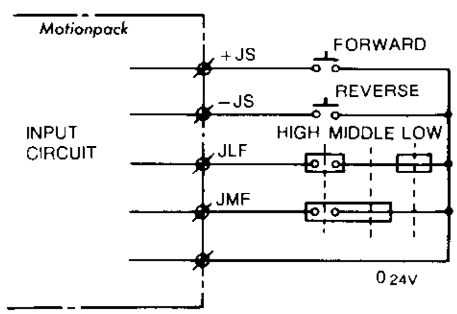


Fig. 4. 15

The feedrate of jog motion is selected by combinations of the JOG middle feedrate signal (JMF) and the JOG low feedrate signal (JLF) among the three feedrates set by three parameters.

Torque limiter is activated for JOG low feedrate. For torque limit setting, use Pr8 in units of %. Pr8= Torque limit value (10 to 250%) when Pr8=0, torque limit is disregarded.

At torque limit, accel/decel time is in proportion to torque limit, and accel/decel is decreased. (Accel/decel time is extended.) The torque limit must be less than the rated torque. Use the limit range so as not to damage the machine and its peripherals.

Table 4. 9

Feedrate	JLF	JMF	Operation
Stop	OFF	OFF	No motion
Low	ON	OFF	Feedrate set by parameter Pr1
Middle	OFF	ON	Feedrate set by parameter Pr2
High	ON	ON	Feedrate set by parameter Pr3

The relationship between program operations and JOG operations is as follows. When a JOG mode is selected during a program operation, the motion stops after deceleration, and the JOG operation mode is turned on. At this time, Motionpack is in the following state.

① The block No. of the program block under execution is cleared, and is reset to the top block No. of the program.

② The following output signals are turned off.

- In-operation (STL)
- M decodes (M51-M56)
- External positioning alarm (EPAL)
- External positioning completion (G34)
- Automatic operation completion (M30)

③ The following output signals maintain their state.

- Motionpack ready (RDY)
- Battery alarm (ALM2)

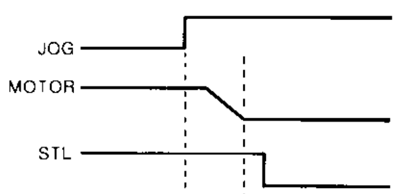


Fig. 4. 16

(3) STEP operation mode

This mode is for STEP feeding. STEP feeding means motion by one step at a time with the distance of a single step being selected from among three set distances, long, medium and short.

When the + JOG & STEP (+JS) signal is switched from OFF to ON, the machine slide moves in the plus (+) direction, through the distance set by the parameter which corresponds to the combination of the two JOG feedrate select signals (JLF and JMF).

In this case, the STEP feedrate is the one set by Pr4. STEP (short) torque limit is available. Set the limit in Pr8.

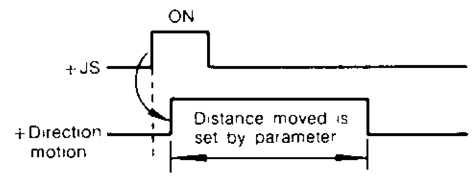


Fig. 4. 17

Table 4. 10

Signal / Feed Distance	JLF	JMF	Operation
Stop	OFF	OFF	No motion
Short	ON	OFF	Distance moved set by parameter Pr5
Medium	OFF	ON	Distance moved set by parameter Pr6
Long	ON	ON	Distance moved set by parameter Pr7
Torque Limit	ON	OFF	Set in parameter Pr8 (%)

The change of the signals when program operation is switched to STEP operation, is the same as with the JOG operation mode.

(4) HANDLE operation mode

In the HANDLE operation mode, operation proceeds according to the pulse input generated from manual pulse generator. Multiplication factor of feed distance can be selected from ×1, ×10, ×100 by combining JLF and JMF signals.

Table 4. 11

Signal / Multiplication Factor	JLF	JMF	Motion
Stop	OFF	OFF	No motion
× 1	ON	OFF	Move amount per pulse Command unit × 1
× 10	OFF	ON	Move amount per pulse Command unit × 10
× 100	ON	ON	Move amount per pulse Command unit × 100

Maximum speed during HANDLE operation is controlled by parameter Pr4. If the manual pulse generator is rotated rapidly or multiplication factor ×10, or ×100 is selected, when maximum speed set by Pr4 is lower than that set by manual pulse generator, feed may be continued after pulse generator is stopped.

Maximum accel/decel speed in the HANDLE operation mode is half the value (two times the accel/decel time) set by parameters Pr40, Pr41.

The current limit is 200 %. HOME return operation cannot be performed in the HANDLE operation mode. The signal change when PROGRAM operation mode is changed to HANDLE operation mode is the same as JOG operation mode. Changing to HANDLE operation mode cancels the program.

In HANDLE mode, the current position is up-dated according to the movement of the manual pulse generator. If an incremental command (like G01 Uuo ···) comes after HANDLE mode has been changed to AUTO mode, the current position moves as much as the increment. With an absolute command (like G01 Xxo ···), the goal is the designated position regardless of the current position.

In HANDLE and other modes, acceleration and deceleration are linearly performed. Soft stroke limit is also effective. Quick return signal (ZRN) is ignored.

NOTE

When stopping the machine in the HANDLE operation mode, turn off the JLF and JMF signals to insure safety. If multiplication factor of ×100 is set, even for one pulse input, the machine can be operated by the distance corresponding to 100 pulses.

〈HANDLE operation in AUTO mode〉

HANDLE PG feed is possible even in AUTO mode if the feedrate (F) of a skip positioning command (G05, G06, or G07) is 0. The pulse magnification factor and the direction of move are the same as those of movement in HANDLE mode.

Execution advances to the next block if a skip signal of Fig. 4.18 or a command when distribution of command pulse by HANDLE PG has come to a designated position.

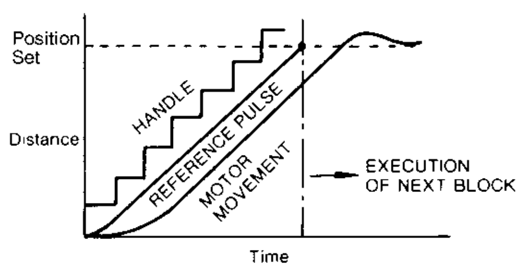


Fig. 4. 18 Reference Pulse and Position Set by HANDLE PG

G01 X250 F8000	Moves around the reference position.
M55	HANDLE PG command
G55 X9999*1 F0	Adjusts to the reference by HANDLE PG. Turns on the skip signal.
G52 X0 T1	Setting the coordinate.
G53 T1	
G01 Xx F8000	

*1X = 9999 must not exceed soft limit range.

(5) AUTO operation mode

In AUTO mode, the Motionpack-34 system operates according to the program held in the controller. The program is a series of function commands evoking specific motions. In AUTO mode, a programmable controller controlling the Motionpack-34 selects a program to execute according to a working schedule and starts operation. Receiving the starting signal, the Motionpack-34 controller executes the function commands one after another automatically, beginning from a designated block, until a program end command (M30) comes.

Thus automatic operation is performed when AUTO mode is selected, the program to execute is designated, and the starting signal has been entered.

(a) Program storing

Store a part program in user program area. Up to 400 blocks are available for the area. A block accommodates one function command. Program numbers are fixed for every 10 blocks. When program number 00 is selected, execution starts at block number 000. Similarly, the selected program number is 01 (02, ⋯ , or 39), execution starts at block number 010 (020, ⋯ , or 390). The program will be executed normally in the order of block numbers but the commands G67, G68, and G69 change the order of execution.

Motionpack-34 provides 400 to 499 blocks with extra blocks. Different from normal blocks, extra blocks cannot be program selected directly. Accordingly, when program is stored in extra blocks, let the program jump from normal blocks by G69P command.

This operation must be completed by M30 in the extra blocks ; or return the program to the normal blocks and complete by M30.

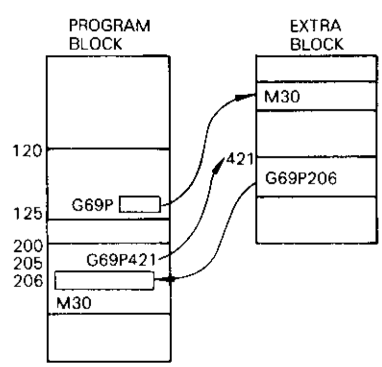


Fig. 4. 19

4.1.4.1 Operation mode (Cont'd)

The program must end with M30 that declares the end of program. There is no no-operation command of the Motionpack-34. If programs are all cleared, M30 enters the programs. No program can be inserted and deleted. When storing programs, do not provide any empty blocks before M30.

Programs can be stored and dumped out through a paper tape reader or punch via the programmer.

(b) Program operation

Program operation is an automatic operation executed under the control of programs stored in the user program area (numbered by block numbers 0-499). The method of specifying programs will be described in detail, later in Par. 4.2. "PROGRAM OPERATION FUNCTIONS." Program operations can be started by either of the following two methods.

(i) Starting by a program start signal PGS 0-9

With a program start signal, the program with the program No. (upper two digits of the block No.) specified by the PGS and PGSL signal is executed.

(Example)

PGSL 10 : ON (LOW) PGS 2 : ON (LOW) Others OFF

With this, program No. 12 is specified, and the program is executed from block No. 120. When a program start signal 0-9 (PGS 0-9) is turned ON, the program starts from the specified block. PGS 0-9 serve both as selecting signals for program Nos. 00-09 and program start signals.

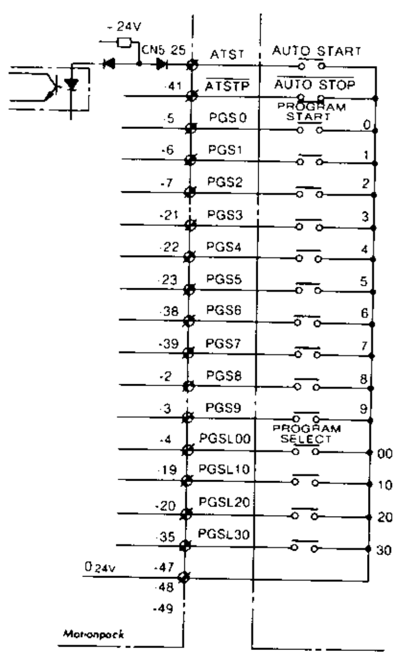


Fig.4.20

CAUTIONS

1. The automatic start signal line (ATST), and the automatic stop signal line $\overline{\text{(ATSTP)}}$, must be in connection with the 0_{24} V point.

2. Program select signals (PGSL 00-30) must be turned on before program start signals (PGS 0-9) are turned on. If not or other PGSL is turned on after PGS0-9 signals are turned on, error ErrnSEL will be activated.

3. Once a PGS (program start signal) is accepted, other program start signals are not accepted, unless any one of the following conditions is satisfied.
   - With the execution of M30, the program operation is completed, and PGS ; is turned off.
   - The program clear (PGCL) signal is turned on in a feedhold state, and the subsequent execution block has returned to the top block.

(ii) Starting by automatic start (ATST) signal or automatic stop (ATSTP) signal

In this case, PGS 0-9 signals are used only as work No. select signals.

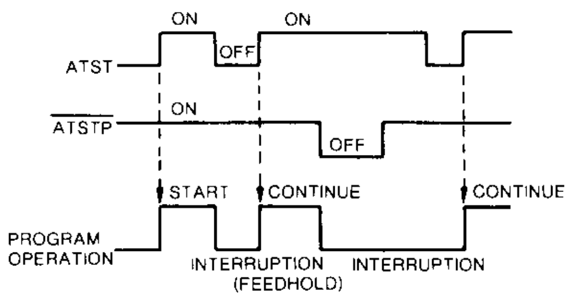


Fig. 4. 21

In this case, when an automatic start (ATST) signal is turned on, the program operation is started. To stop the program operation (feed hold state), turn off the automatic stop (ATSTP) signal, or turn off the ATST signal.

(c) Single block operation

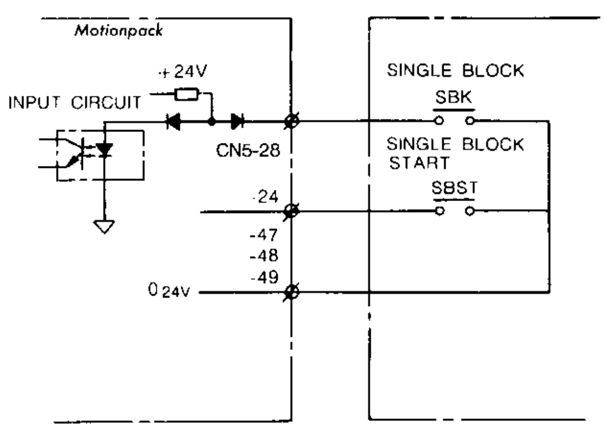


Fig. 4. 22

4.1.4.1 Operation mode (Cont'd)

When a single block mode (SBK) signal is turned on, the machine stops after completing the execution of the current block, and the control enters the single block operation mode.

When a single block start (SBST) signal is turned on in this state, the machine executes the next one block and then stops. If an SBST signal is turned on after the completion of a program, the top block is executed.

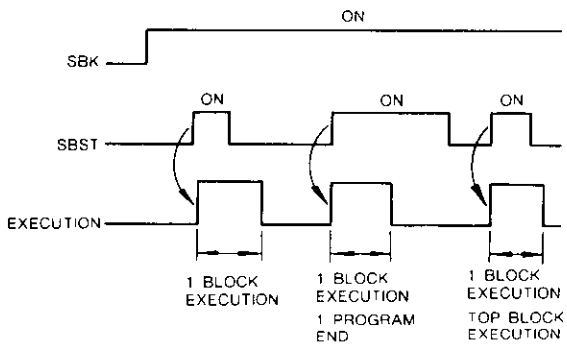


Fig. 4. 23

When the single block operation signal is turned off, the execution of the porgram is restarted, regardless of an SBST signal, and the program is executed continuously.

When a program start signals (PGS 0 to 9) are turned on while a single block operation mode signal is on, the program is not started ; it is started only when a single block start (SBST) signal is turned on. However, if no program start signals (PGS 0-9) are on, a single block start signal is ineffective.

When the single block operation mode signal is cleared after the completion of one program, a subsequent program start (PGS 0-9) signal will start the program.

(d) Feedhold State

To decelerate to a stop motion during a program operation, the following methods are available.

① Turn off PGS 0-9, or turn off automatic start (ATST) signal.
② Turn off the automatic stop (ATSTP) signal.

With method ①, as soon as the feedhold signal ends. Motionpack-34 is cleared of the feedhold state, and resumes the program operation.

With method ②, it is necessary to turn the program start (ATST) signal off and then on again.

A program clear (PGCL) signal is effective only during a feedhold state. When it is turned on, the block number to be executed returns to the top block of the current program. When the subsequent program start signal is turned on, the program is executed from the top block.

When a Motionpack-34 alarm occurs, it has a feedhold state.

(6) Return to home position

Motionpack-34 can be used both in incremental method and absolute value method. For use of incremental method, return to home position function is provided with Motionpack-34. However, when used in absolute value method (Pr70F = 3 or 4 and Servopack ABS ID signal is 1), the return to home position does not appear.

Position data to be formed are transmitted from encoder to Motionpack when the power is ON. Thus, the present position is formed without return to home position. Zone signal is output even if user program (processed program) starts or not after the above position data form has been completed.

The meanings of return to home position related parameters and return to home position related signals differ in incremental method and absolute value method. Tables 4.12 and 4.13 show "Parameter Comparison Table" and "Signal Contrast Table." For details, refer to each paragraph. In absolute value method, setup operation is required when the Motionpack-34 system is installed to machine shaft. For details, refer to par.7.2.6, "Setting up."

Table 4. 12 Parameter Comparison Table

Parameter No.	Absolute Value Method	Incremental Method
70	Home position coordinate setting method	Return to home position method
71	T0 coordinate offset	Home position coordinate
72	Holding position (at quick-return)	Holding position (at return to home)
73	Quick-return speed	Return to home speed
74	Home position setting speed *	Return to home creep speed
75	Push torque*	Return to home torque speed
76	No. of encoder pulses	Coasting allowance
77	Allowable deviation capacity	Allowable deviation capacity
78	Encoder allowable error capacity	Pushing time
79	Pushing time*	Not used
80	Home position setup command*	
81	Reference point coordinate*	
82	ABS • PG alarm reset command*	

*For more information, see Par. 11.2.

Table 4. 13 Signal Contract Table

Signals		Absolute Value Method	Incremental Method
Input	ZRN	Quick-return start*	Return to home position start
Output	ZPM	Zone signal output	Return to home position end
	ZNP	Zone signal output	Near home position
LS Input	LSA	Not used	Home position checking LS
	LSB	Not used	Home position checking LS
Jumper Setting	2A	Not used	Return to home method setting
	2B	Not used	Return to home method setting
	2C	Not used	Return to home method setting
	2D	Not used	Return to home method setting

*When Pr80 = 1 in autmatic home position setup system, this input becomes home position setup signal.

(7) PG cable disconnection detecting function

When either PG output is of line driver type and phase A, B, or C of PG signal is disconnected, PG disconnection detection outputs alarms. PG disconnection detection can select "valid" or "invalid" by setting Pr70 Item B.

Pr70 Item B = 0 to 2 Disconnection detection invalid
Item B = 4 to 6 Disconnection detection valid

This disconnection detection function can detect PG signal cable between Servopack and Motionpack.

(8) Motionpack-34 coordinate system

Motionpack-34 has 10 coordinate systems (T0 to T9). Coordinate system T0 is defined by encoder output. Coordinate systems T1 to T9 are based on Coordinate system T0.

Method of Coordinate System Setting

① Presetting offset amount in Pr 20 (coordinate system T8) and Pr 22 (coordinate system T9) and shifting coordinate system by turning on external signal +/− INC.

② Presetting by programmer

③ Coordinate system setting reference G52

④ External offset function

Relationship between coordinate system T0 and coordinate systems T1 to T9 are determined by shift amount register (Sn) corresponding to axis No. and offset register (On). Fig. 4.24 shows coordinate setting and register.

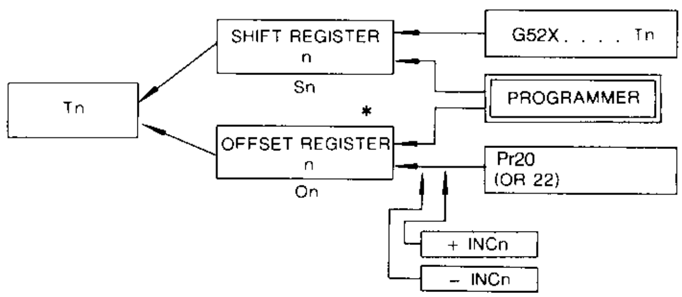


Fig. 4. 24

Each coordinate system is not set by the corresponding program but the same coordinate system can be set in any program.

<Shift amount register, offset amount register and coordinate system shift.>

Where coordinate value at coordinate Tn is tn, shift register corresponding to Tn is Sn, coordinate value is obtained from the following formula : $tn = t_o + Sn$

(Example)

When shift register (S1) at coordinate system T1 is 100, the relationship between coodinate systems T0 and T1 is as shown in Fig. 4.25.

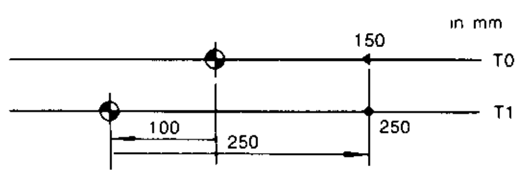


Fig. 4. 25

Coordinate value t_1 of the position of 150 mm at coordinate system T0 at coordinate system T1 is :

$t_1 = t_0 + S_1$

$= 150$ mm (T0) $+ 100$mm

$= 250$ mm

Setting positive values in Sn shifts the home position of coordinate system Tn in the negative direction. This facilitates tool length compensation in setting coordinate system by shift amount. Setting tool length in shift amount register Sn sets the coordinate system of which home position is shifted by the length.

Coordinate systems T8 and T9 are provided with offset amount registers (O8, O9) in addition to shift amount registers (S8, S9). When the coordinate value is t_8 at coodinate system T8, and the corresponding shift amount registers are S8 and O8, t_8 is obtained from the following formula :

$t_8 = t_0 + S_8 + O_8$

(Example)

When shift amount register S_8 of coordinate system T8 is 100mm and offset register O_8 is 2mm, the relationship between T0 and T8 is as shown in Fig. 4.26.

Coordinate value t_8 of the position of 30mm at coordinate system T8 is :

$t_8 = t_0 + S_8 + O_8$

$= 30 + 100 + (-2)$

$= 128$mm

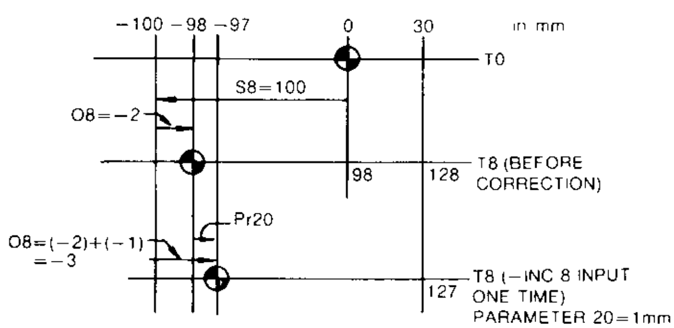


Fig. 4. 26

Coordinate system setting by offset amount applies to compensation for tool wear. Setting tool wear amount shifts the home position by the set value. The direction of home position shift is positive when offset register is negative.

In coordinate system T8, the value set to Pr20 by turning on signals + INC8 (or − INC8) can be added to or retracted from offset register. Setting tool wear compensation per time to Pr20 and turning on signal − INC 8 permits automatic compensation. The same applies to coordinate system T9.

〈Coordinate system setting〉

(a) Coordinate system shifting by + INC／ − INC signals

With the coordinate system T8, each time + INC8 signal or − INC8 signal turns on correction is made in the + or − direction respectively. The correction distance is set by Pr20. After several corrections, as the total correction amounts to the maximum correction as set by Pr21, no further correction is possible, and an answer-back signal for absolute maximum offset (OFM) is output. When + INC8 and − INC8 signals are given simultaneously, no correction is made, and an answer-back signal, offset 0 (OFR), is output.

The coordinate system T9 is corrected similarly by + INC9 and − INC9 signals. The correction distance is set by Pr22 and the maximum correction is set by Pr23. When coordinate system T8 or T9 is selected, the coordinate values are modified by the sum of the shift (S8 or S9) of the coordinate system itself and the offset (O8 or O9), from the values for the T0 coordinate system.

(Example)

When the coordinate system T8 is shifted by shift amount (S8) of 100,000 from T0, and its offset (O8) is − 0.020, the position commanded by G01X200.000 in the T8 coordinate system is as shown in Fig. 4.27 below.

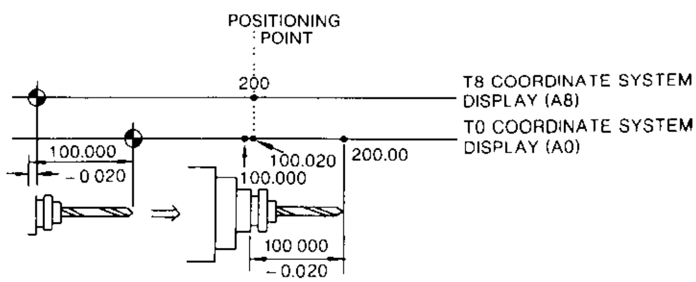


Fig. 4. 27

4.1.4.1 Operation mode (Cont'd)

The related parameters are listed in Table 4.14. For details, see par. 4.1.3.4 "Offset parameters."

Table 4. 14 Offset-related Parameter Setting

Parameter No.	Content	Unit
20	T8 coordinate single correction	Position command unit
21	T8 coordinate max correction	Position command unit
22	T9 coordinate single correction	Position command unit
23	T9 coordinate max. correction	Position command unit

When an INC signal is received, the corresponding coordinate system is corrected (+ or −) by the distance set by the parameter. This correction is executed while the machine is at standby in the AUTO operation mode. When the sum of the values in the offset register 8 exceeds the max. value after adding the latest increment, an offset max. (OFM) signal is output, and when it is below, a ± increment made (INCD) signals are output.

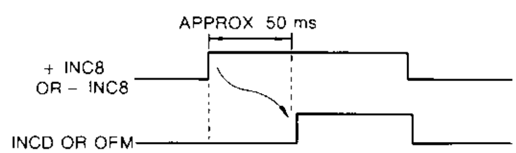


Fig. 4. 28

When + and − incremental commands are received simultaneously, the offset register 8 is zeroed, and an offset 0 (OFR) signal is output.

① When − INC8 is received before executing + INC8 (INCD or OFM).

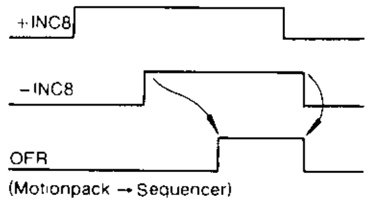


Fig. 4. 29

② When − INC8 is received after the + INC8 completion signal has been output.

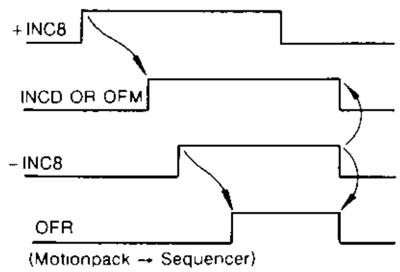


Fig. 4. 30

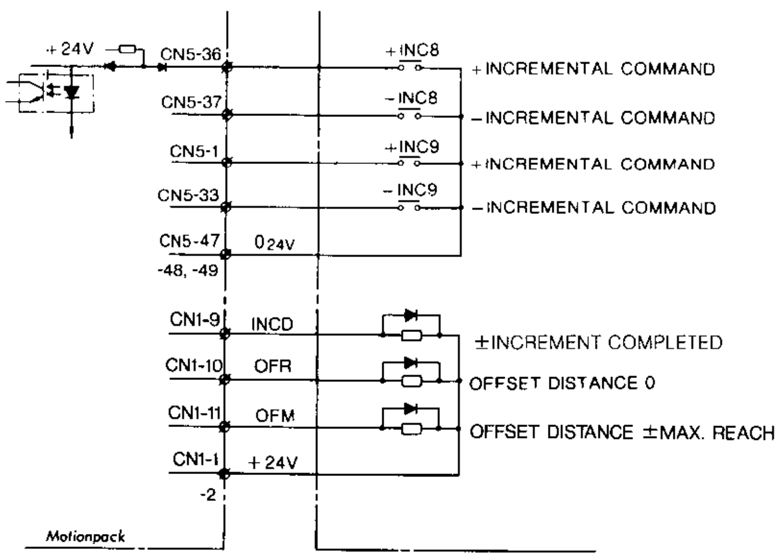


Fig. 4. 31

(b) Presetting by program

In addition to the setting possibility of T1-T9 coordinate systems by programs with G52, they can also be preset by programs. The shift distance of each coordinate system is that from the T0 coordinate system.

In addition to the offset correction possibility of T8 and T9 coordinate system with ±INC8 and ±INC9 signals, the program presetting of the initial values is also possible. When the coordinate system T8 or T9 is used, the position commands specify coordinate values which are corrected by the reduction of the shift distance (S) and the offset distance (O).

When the T8 or T9 coordinate is used, all the position commands are corrected for the shift distance (Sn) and the offset distance (On). "On" is contained in the coordinate systems T8 and T9 only.

These preset values are updated by setting coordinate systems and shifting coordinate systems by INC signals.

① Setting offset

Select position setting mode.

Whenever the [POSITION] mode switch is pressed, block number is indicated as [0 8]↔ [S 8]. Offset selection is indicated by "0." and shift selection by "S." A blinking digit indicates a coordinate number.

Select "0." (offset selection), write a coordinate number, and depress switch [↓] or [↑]. The block number indication stops to blink and the data display begins to blink.

Write an offset value and depress the [WRITE] switch. Then depress switch [↓], and the next coordinate system is selected. Numbers are in the minimum position command unit.

② Setting shift

Select position setting mode.

Depress the [POSITION] mode switch, select "S." (shift selection), write a coordinate number, and depress the switch [↓] or [↑]. The block number indication stops to blink the data display begins to blink.

Write a shift value and depress the [WRITE] switch. Then depress switch [↓], and the next coordinate system is selected. Numbers are in the minimum position command unit.

(c) **Method with a coordinate setting command (G52)**

See par. 4.1.4.3, "Coordinate setting command (G52)".

(d) **Method with external offset.**

See par. 11.4, "External Offset Function."

(9) Zone signal output function

Motionpack-34 is provided with three zone signal output functions in the absolute value system :

- Basic zone signal output
- Extended zone signal output (A) } For detailed information,
- Extended zone signal output (B) } see par.11.5/par.11.6.

〈Basic zone signal output〉

(a) **Output signal**

The following output signals function as zone signals :

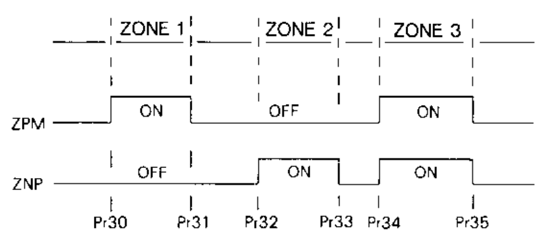
Output signal name : Return to home position end signal (ZPM)

: Signals around home position (ZNP)

(b) **Zone setting**

Zone is set by parameter :

Item	Zone 1	Zone 2	Zone 3	Non-defined Zone
ZPM State	ON	OFF	ON	OFF
ZNP State	OFF	ON	ON	OFF
Zone Definition	Pr30, Pr31 Pr30<Pr31	Pr32, Pr33 Pr32<Pr33	Pr34, Pr35 Pr34<Pr35	No parameter



If Pr30 ≧ Pr31 (Pr32 ≧ Pr33, Pr34 ≧ Pr35) is set, the zone. The zone can not be defined.

Fig. 4. 32

4.1.4.1 Operation mode (Cont'd)

(c) Function

This function is not valid unless the power supply is ON, absolute value position data are completed, and the servo is ready.

Accordingly, even if the program starts or not, three types of zone signals are output by the combination of the above-mentioned two signals corresponding to the present position.

(d) How to use

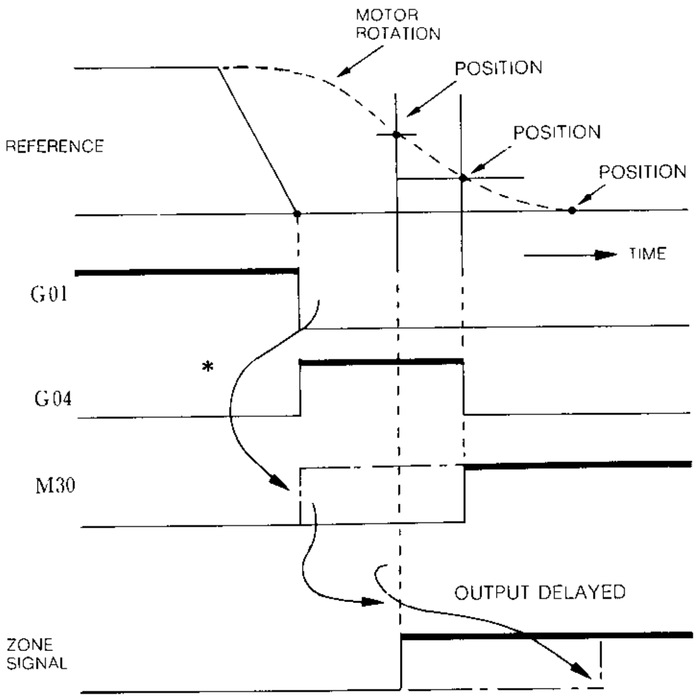
Motionpack-34 provides two types of position outputs. Basically, the following methods should be used :

- Active signal output → Path signal output
- Inactive signal output → Zone signal output

After automatic operation has been completed (with STL signal OFF), zone signal output time increases. When zone signal with minimum delay time is used as an active position output signal, use the following procedure :

1. Insert G04 command (waiting time in-position) following the associated feedrate command.
2. Set zone signal range (e.g. Pr30, Pr31) wider than in-position range (Pr45).
   As a result, M30 is executed (automatic operation completed) in the zone. Zone signal output has no delay.

(Example) Zone signal is output before positioning point.



Program

```
  :
G01   X0.000F_ I_
G04
M30
ZONE; 0.500~-0.500
      Pr30=-0.500
      Pr31=0.500
INPOSITION RANGE=0.100
      Pr45=100
```

* When G04 is not used, broken line is applied as shown in Figure above.

4.1.4.2 Program function command

All the function commands have codes consisting of G sign and two digits. The functions of these commands are diverse, commanding positions, feedrates, torque, auxiliary functions, dwell time, coordinate Nos., number of loops, jump destination block Nos., etc., but the length of each block is fixed irrespective of the command word length.

Motionpack-34 has basic function command and extended function command. The basic function command is used in the continuous state, which is exactly the same as that of Motionpack-33.

Extended function command can be used based on setting input and setting parameter. The same G sign as the basic function command is specified, however the contents of function will change. Before programming, read this manual thoroughly.

(a) Basic functions

Table 4. 15 (a) Basic Function Command List

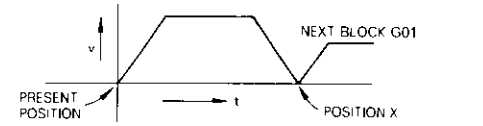
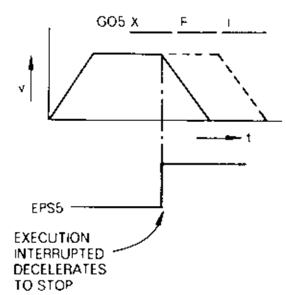
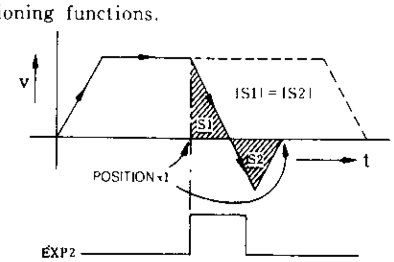
Function Command	Signal	Function Command Words	Contents
Positioning	G 01	G 01 X ..... F ..... I .. .. U	Moves to position X (or U); speed F, torque limit I. 
Skip Positioning	G 05 G 06 G 07	G 05 X ..... F ..... I .... U	If the skip signal is ON during transmission, the execution will be interrupted and execution of the next block starts. Skip Signal Correspondence G05: Skip signal EPS 5 G06: Skip signal EPS 6 G07: Skip signal EPS 7 
External Positioning	G 34	G 34 X ..... F ..... I ..... U	Moves to position X (or U), speed F, torque limit I. If external positioning signal (EXP2) is ON, external positioning functions. 

Table 4. 15 (a) Basic Function Command List (Cont'd)

Function Command	Signal	Function Command Words	Contents
Home Position Check	G 27	G 27 X .... F .... I .... U	Moves to position X(or U), speed F, torque limit I. Pr70 A = 0; X(U) = T0 coordinate home position specified Pr70 A = 1; X(U) = Holding position (Pr72) specified Pr46 ≠ 0; Moves to T0 home position (or holding position) after checking PG home position pulse coordinate.
Waiting for Time	G 04	Waiting for in-position. G 04	Waits for in-position after feed command is executed and moves to the next block
		Waiting for time G 04D	Waits for time specified by D and moves to the next block.
Setting Coordinate	G 52	G52 X.....T..... U	Sets the present position at position X(or U) in Tn coordinate system.
Changing Coordinate	G 53	G 53 T	Changes to Tn coordinate system.
Arrival Check	G 67	G67 P.....	Jumped to P when arriving at X (or U) without skipping by skip positioning command.
Subprogram Call	G 68	Repeating designation subprogram call G 68 L ..... P	Executes subprogram from P-block for L times.
		End position designation subprogram call G 68 X ..... P ..... U	Executes subprogram from P-block until it arrives at position X (or U).
Jump	G 69	Simple jump G 69 P	Moves to execute P-block.
		Return from subprogram G 69	Returns to the block following the subprogram call (G 68).
Auxiliary Function	M	Signal output M ..... (M 51 to M 56)	Outputs M, resets M-signal output when corresponding M-FIN signal is ON, and executes the next block when M- signal is OFF
	M30	Program completed M30	Resets signals (STL) during AUTO to output M30 signal.
Zone Signal Output*	Position state signal		Output is turned ON/OFF corresponding to the present position even if program is executed or not.

*Extended zone signal output is also available.
See par. 11.5/par. 11.6.

4.1.4.2 Program function command (Cont'd)

(b) Extended functions

Table 4. 15 (b) Extended Function List

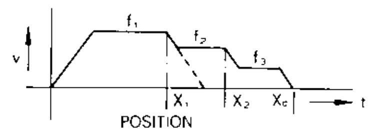
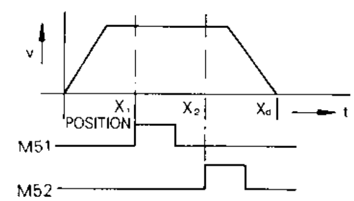
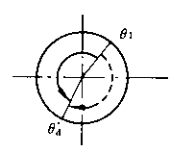
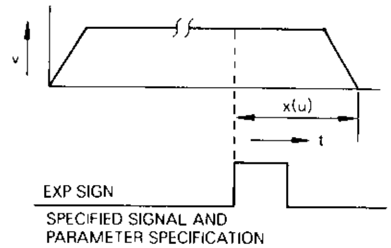
Function Command	Signal	Function Command Words	Conditions	Contents
Variable Speed Positioning	G06	Specified in sub-program SUB PROGRAM G68X_P JUMP G06X x_1 F f1 I G06X x_2 F f2 I G06X x_d F f3 I G69	CN5-18 / 0_{24}V Short-circuit Pr43 = 2000	
Passing Signal Output Function	G07	Specified in sub-program SUB PROGRAM G68X xd P JUMP G 07 X x1 F f I i M51 G 07 X x2 F f I i M52 G 07 X x3 F f I i G 69 * : $x_3 = x_d + \alpha$	CN5-18 / 0_{24}V Short-circuit Pr43 = 4000	M-signal is output at positions x_1 and x_2 during positioning an aimed position Xd. 
Angular Indexing Function	G05 G06 G07	G05X __ F __ I __ U__	Set at Pr60 = Pr61 ≠ 0 Pr43 = 2000000	When positioning at a desired angle, position at an angle less than 360° even if the specified angle (1) One-way rotation (G05)  G05X θd F I θd>0 Forword (---→) θd<0 Reverse (——→) (2) Minimum rotation (G06,G07) Rotates in the minimum direction regardless of sign Xd.
Clamp Free Function	G05 G06 G07	G05U __ F 0 I __	CN5-18 / 0_{24}V Short-circuit Pr43 = □00 □; 1 to 7	When the signal during current limit (CL) is ON while skip positioning (G05, G06, G07) is being executed, Motionpack sets the present feedback signal as the present position with error pulse 0. As a result, alarm does not occur even if the motor is rotated by external force. If the signal in current limit is turned off, positioning is executed from the present position to the desired one. When the skip signal is input, the next block is executed.

Table 4. 15 (b) Extended Function List (Cont'd)

Function Command	Signal	Function Command Words	Conditions	Contents
Infinite Length Operation	G34	G34X x_ F _ I _ U u_	CN5-18 0_{24}V Short-circuit Pr43 = 1000000	Keeps moving unitl EXP signal is turned on; after that, positioning is executed in the desired position (1) X specification; to point X with EXP position as home position (2) U specification; moves for distance U from EXP position 
G67 Jump Prohibit Function	G67	G67P(p)	Prohibits with jump prohibit signal ON	Arrival check jump G67 function is prohibited by external signal.
Extended Function of Activating Signal			Pr43 = 20000 CN5-18 0_{24}V Short-circuit	Turns off the activating signal (STL), not only when the program is being executed or has been completed, but also at temporary stop by feed-hold.
Extended M Function	M	Signal output M___ (M51 to M56)	CN5-18 0_{24}V Short-circuit Pr43 = 1 to 99	If the specified signal and the parameter are set, M-signal has following special function: (1) Encoded M output 6 M output signals of M51 to M56 are encoded to obtain 20 types of outputs of M60 to M79. (2) Set reset output Each of 6 M signal cables are set or reset. Set: M81 to M86 Reset: M91 to M96
Program Select Encode			CN5-18 0_{24}V Short-circuit Pr43 = 40000	By encoding program select Nos. (PGS0 to PGS9, PGSL00 to PGSL30), program operation can be started from any of 0 to 398 blocks.

Note: For the following extended function, see par. 11. 1 and par. 11.3 to par. 11.6.
- S-letter accel/decel positioning
- External data setting
- External offset
- Extended zone signal output (A)
- Extended zone signal output (B)

4.1.4.3 Program function command in detail

(1) Basic functions

(a) Positioning command (G01)

G 01 X F I   U

G01 : Positioning

X : Position in absolute value
(− 9999999 to + 9999999)

U : Position in incremental value
(− 9999999 to + 9999999)

F : Speed (0 to 60000)

I : Torque limit (10 to 250%)

Unit of position data (X and U) is determined by parameters Pr50 and Pr51, and decimal point position, by Pr52. Unit of speed data is determined by positioning command unit and fractional digits (Pr52). See Par. 4.1.3 "Controller CM34 Parameter Setting"

Operation

G01 command gives the movement to position X (or U) in the currently selected coordinate system at speed specified by F and torque I. X is shown in absolute value, and U, in incremental value. Incremental value shows the move amount from the previous command position to the current command position.

Example
Current position : 200mm
Command position : 300mm
Speed : 4m/min
With torque limit (200%).
G01 X300.000 F4000 I200 in absolute value
G01 U100.000 F4000 I200 in incremental value

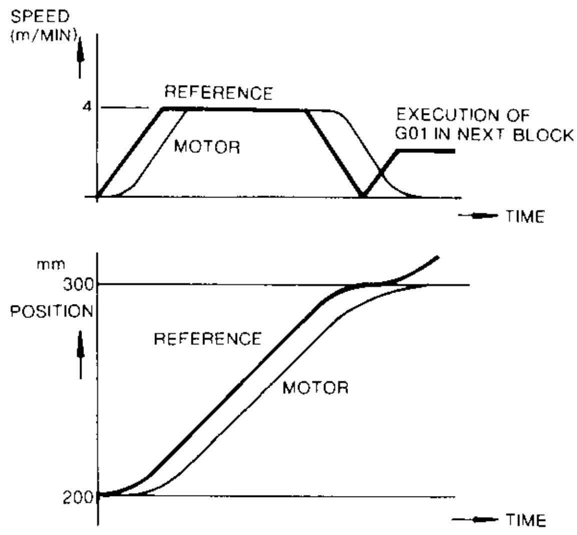


Fig. 4. 33

Fig. 4.33 shows G01 command execution and motor movement. Positioning command is linear accel/decel.

With a positioning command, the speed designation (F) can be omitted. In this case, the previously specified feedrate is used again. (However, after clearing a program, be sure to specify speed in the first feedrate command.) When an override signal (OVR) is on, speeds above the one specified by parameter Pr10 are creeped to the speed of parameter Pr10.

The setting range for torque limit I is between 10 and 250. Its unit is % of the rated torque. In linear accel/decel, use 200%. The ratio of programmed 100% torque to the Servopack and motor rated torque is set by parameter Pr53.

The same torque limit is applied to both the + and − directions, but it is subject to errors up to ±10%. With a positioning command, the torque limit specification can be omitted. In this case, the same value as the previous command is used again. When the program is cleared, the torque limit is switched to 200%.

Execution of next block

When the reference pulses for movement to the specified position programmed by G01, Motionpack-34 controller executes the command of the next block. Fig. 4.33 shows the command in which G01 is programmed in the next block.

As shown in Fig. 4.33, motor motion follows reference pulses with some delay. On completion of reference pulse distribution, motor motion may not arrive at the specified position when the next block starts to execute.

To execute the next block command after motor motion related the specified position, insert in-position command (G04) or time delay command (G04D[ ]). See pars. 4.1.4.3 (1) and 4.1.4.3 (1) (f).

Related parameters

The parameters related to positioning are shown in Table 4.16. Table 4.17 shows the servo parameters. For detailed setting of each parameter, see par. 4.1.3.

4.1.4.3 Program function command in detail (Cont'd)

Table 4. 16 Positioning Parameters

Parameter No.	Description	Unit
45	In-Position range	Pulse
50	Pulse ratio M	
51	Pulse ratio D	
52	Decimal poing position	No. of digits
53	Thrust ratio =rated thrust／servo rating ×100 %	%
54	Axis No. designation	
60	−direction stored stroke limit	Position command unit
61	+direction stored stroke limit	Same as sbove

Table 4.17 Servo Parameters

Parameter No.	Description	Unit
40	Max speed	speed
41	Accel time	ms
42	Position loop gain	pulse
44	Servo error deviation	pulse

(b) Skip positioning command (G05, G06, G07)

Skip positioning command is in three types ; each designated by G05, G06 and G07.

```
G 05  X□□□□□□□□ F□□□□□ I□□□
      U□□□□□□□□
```

The conditions are similar with G06 and G07.

G05, G06, G07 : Skip positioning command

X : Position in absolute value
(− 9999999 to + 9999999)

U : Position in incremental value
(− 9999999 to + 9999999)

F : Speed (0 to 60000)

I : Torque limit (10 to 250%)

Operation

With these commands, the slide moves to the position X (or U) in the currently selected coordinate system at speed F and torque limit I. (F and I can be omitted, as in the case with the positioning command). When a skip signal turns on during the motion, the motion is interrupted, and the execution of the next block is started.

When skip positioning command is being executed, arrival check command (G67) checks for skip and jumps. Thus, if G67 is located at the block next to G05 (or G06, G07), program can be divided with judging conditions of skip existence.

Command G05 is skipped by a signal 5 (EPS5), 06 by signal 6 (EPS6), and G07 by signal 7 (EPS7). If no applicable skip signal turns on during the motion towards the position specified by X (U), the motion is identical with the one under G01.

If an applicable skip signal is already on, when a command G05, G06 or G07 is given, the execution is postponed until the skip signal turns off. If it is not turned off within 2 seconds, the contral enters the skip signal fault (MP alarm) state.

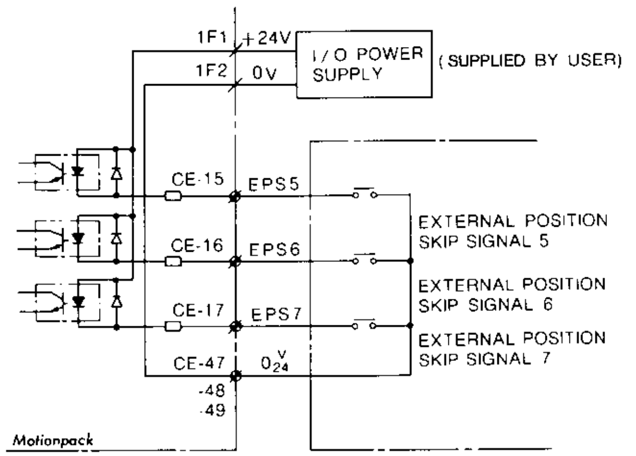


Fig. 4. 34

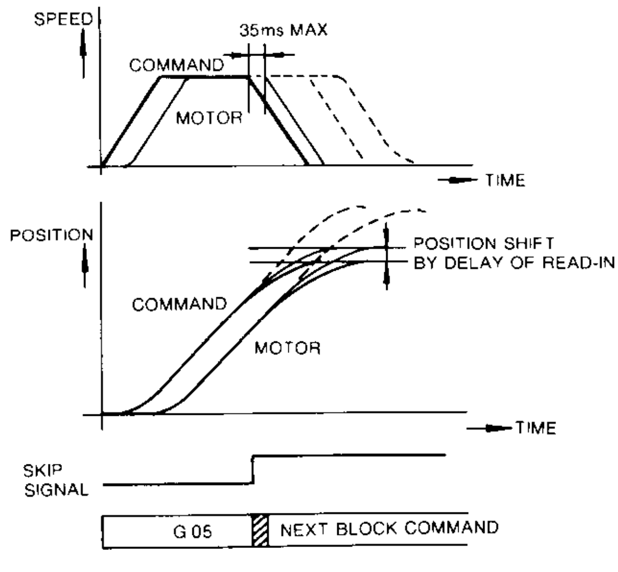


Fig. 4. 35

With the skip positioning command, the positioning motion can be interrupted by an external signal, and the execution can be shifted to different blocks.

4.1.4.3 Program function command in detail (Cont'd)

Execution of the next block

When the controller detects that the associated skip signal is ON, it stops positioning operation, slows down and stops. After the end of distribution of command pulses, it begins to execute the next block. Note that the timing of reading the skip signal may delay 35 msec at maximum and therefore the start of deceleration may be delayed accordingly.

This leads to deviation of the stop position.

The case in which the target position is reached before the skip signal turns ON is the same as with G01.

Related parameters

X : Position in absolute value
(− 9999999 to + 9999999)

U : Position in incremental value
(− 9999999 to + 9999999)

F : Speed (0 to 60000)

I : Torque limit (10 to 250%)

NOTE

When the slide arrives at X (or U) with the skip positioning command without skipping with the arrival check (G 67) command, it jumps to P. [See Par.4 1. 4. 3 (1) (i).]

Example

With the HI-CUP motor feed unit shown in Fig. 4.36 used in deep hole drilling operations, the skip positioning command is useful.

In this case, the feed is commanded by a skip positioning command, and the load on the tool is so detected that it gives skip positioning signals at certain levels. Then, as the tool load reaches these levels, the feedrate is switched down to the predetermined optimum level.

Fig.4.36

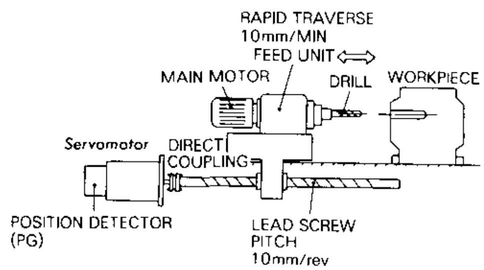
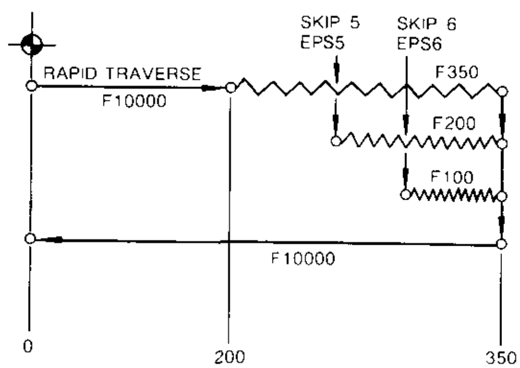


Fig. 4. 37



With the spindle motor current monitored by a proper means, when it exceeds the rated level during feeding at F = 350, a skip signal EPS5 is turned on, and when it exceeds the rated level at F = 200, EPS6 is turned on.

Program example

N040 G53 T3 :	T3 coordinate select
041 G01 X200 F10000 :	Rapid traverse
042 G05 X350 F350 :	F350 drilling feedrate
043 G67 P047 :	Arrival check note
044 G06 X350 F200 :	F200 drilling feedrate select
045 G67 P047 :	Arrival sheck note
046 G01 X350 F100 :	F = 100 drilling feedrate select
047 G04 :	In-position
048 G53 T0 :	T0 coordinate select
049 G69 P300 :	Jump to N=300
N300 G27 X0 F10000 :	Return to home position
301 M30	

4.1.4.3 Program function command in detail (Cont'd)

(c) External positioning command (G34)

G34 X F I
U

G34 : External positioning
X : Position in absolute value
(− 9999999 to 9999999)
U : Position in incremental value
(− 9999999 to 9999999)
F : Speed (0 to 60000)
I : Torque limit (10 to 250%)

Operation

With this command, the slide moves to the position X (U) in the currently selected coordinate system at speed F, and a torque limit I. (F and I can be omitted, as is the case with a positioning command.) When an external positioning signal (EXP2) is turned on during the motion, the slide decelerates and stops at the position where EXP2 is turned on.

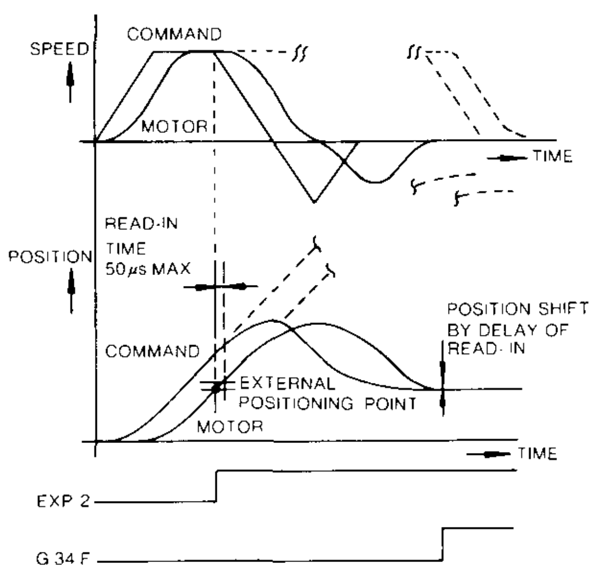


Fig. 4. 38

External positioning signals are read with response deviation within 50 μsec, so that the feedrate need be less than 20 kpps.

When the slide stops by an external positioning signal, and the position is in-position, an external positioning completion signal (G34) is output which is turned off when a completion check signal (G34F) is input.

If no EXP 2 turns on until the slide arrives at the position specified by X (U), and becomes in-position, an external positioning alarm (EPAL) signal is output.

When a completion signal (G34F) is turned on, the completion signal (G34) or the alarm signal (EPAL) is reset. If EXP2 or G34F signal is already on when the execution of G34 command is started, the execution is postponed until these signals are turned off, and if they are not turned off within 2 seconds, an alarm signal (EPAL) is output.

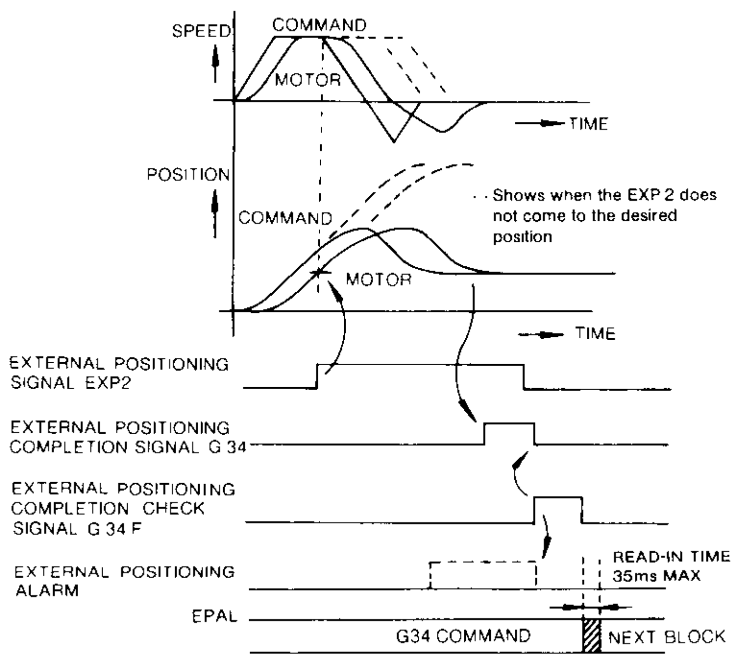


Fig. 4. 39

The rest conditions for the external positioning alarm signal (EPAL) are as follows.

· G34F signal ON

· Mode switching over

4.1.4.3 Program function command in detail (Cont'd)

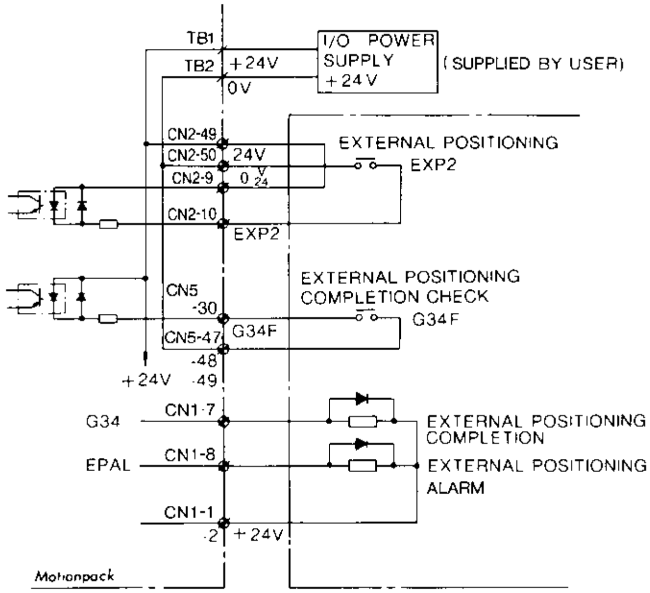


Fig. 4. 40

Since the external positioning function allows the positioning at a position where an external signal (e. g., touch switch) is turned on, it can be used for tool setting, etc.

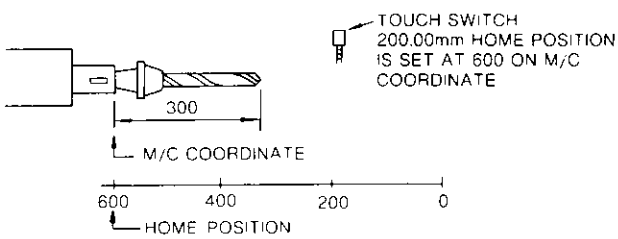


Fig. 4. 41

In Fig. 4.41, assume that the tool point is to be set at a position making contact with the touch switch. Since the tool length is 300 mm, the position where the tool tip makes contact with the touch switch is approximately 500 mm.

N100 G01 X510 F12000 :	Rapid traverse close to depress switch
101 G34 X490 F300 :	External positioning at low speed
102 G52 X200 T1 :	Tool tip setting

Execution of the next block

When the end confirmation signal (G34F) turns ON, the external positioning end signal (G34) or alarm (EPAL) is reset. When the Motionpack – 34 controller detects that signal G34F has turned OFF, program advances to the next block. The timing of reading the G34F signal may vary 35 msec at maximum.

Related parameters

X : Position in absolute value
   (– 9999999 to + 9999999)
U : Position in incremental value
   (– 9999999 to + 9999999)
F : Speed (0 to 60000)
I : Torque limit (10 to 250%)

(d) HOME position check command (G27)

```
G27  X□□□□□□□ F□□□□□ I□□□
     U□□□□□□□
```

G27 : Home position check command
X : Position in absolute value
   (– 9999999 to + 9999999)
U : Position in incremental value
   (– 9999999 to + 9999999)
F : Speed (0 to 60000)
I : Torque limit (10 to 250%)

Operation

In absolute value method, G27 command executes positioning in machine home position or holding position.

- Where Pr70 A = 0 (no holding position) ;
  G27 X 0.000F ( ) I ( )
  : Moves to machine home position (T0 coordinate home position).
- Where Pr70 A = 1 (with holding position) ;
  G27 X 0.000F ( ) I ( )
  : Moves to holding position (Pr72) for positioning.

4.1.4.3 Program function command in detail (Cont'd)

Program example

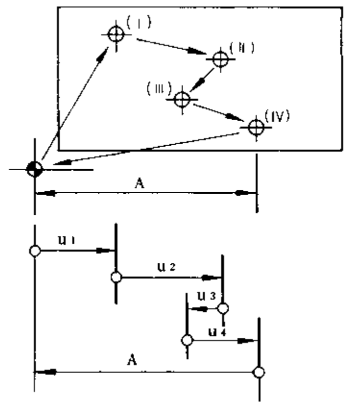


Fig. 4. 42

When positioning in the order of (i) to (iv), the distances of U_1, U_2, U_3 and U_4 are vertically positioned by G01 command.

Then using G27 for the last return to home makes possible program check as follows :

G01 U (U_1) F____ I ____

M51

G01 U (U_2) F____ I ____

M51

G01 U (U_3) F____ I ____

M51

G01 U (U_4) F____ I ____

M51

G27 U (A) F____ I ____

M30

G27 Err alarm will occur unless $A = -(U_1 + U_2 + U_3 + U_4)$. This given dimension A can determine if the U_1 to U_4 in the result are correct or not.

Execution of the next block

X : Position in absolute value
(− 9999999 to + 9999999)

U : Position in incremental value
(− 9999999 to + 9999999)

F : Speed (0 to 60000)

I : Torque limit (10 to 250%)

Related parameters

When Pr46 ≠ 0 is set, it moves to PG home position pulse to check the coordinate before moving to T0 home position (or holding position) specified by X (U). (However, it is designed so that moving to PG home position pulse should not cause any trouble.)

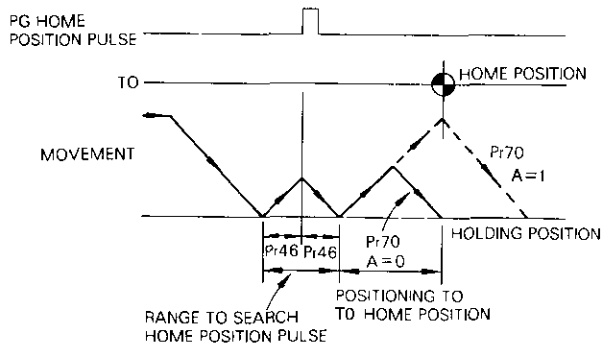


Fig. 4. 43

Set Pr77 to allowable error amount on the PG home position pulse coordinate (1 to 255 pulses).

(e) In-position delay (G04)

Time delay G04

Operation

When the time delay command G04 is given without any time specification, the command is an in-position delay command. Normally, positioning commands G01, G05, G06 and G07 allow the program to proceed to the next block as soon as the command pulses have given out.

When G04 is commanded, the program will not proceed to the next block nutil the machine arrives at the specified position. If the machine fails to arrive at the commanded position within 2 seconds of the G04 command, the system enters the in-position fault (MP alarm) state. The permissible error for the positioning is given in pulses by Pr45.

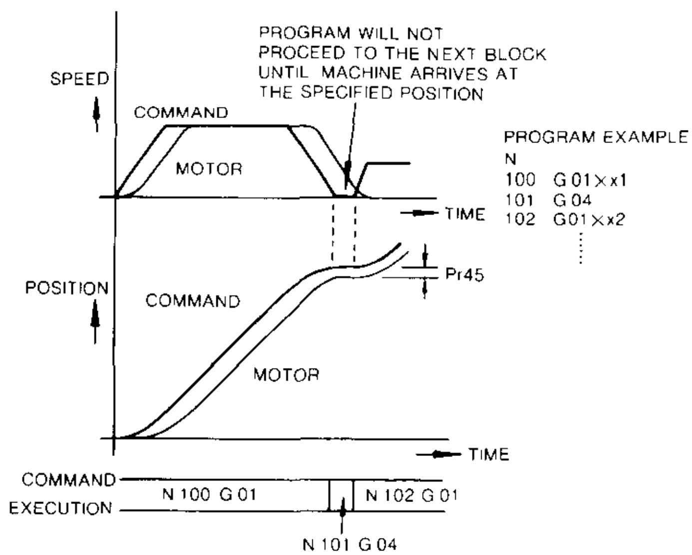


Fig. 4. 44

Execution of next block

As shown in Fig. 4.44, execution of the next block starts when the in-position area has been reached by the immediately preceding feed command.

Related parameter : Pr45

4.1.4.3 Program function command in detail (Cont'd)

(f) Time delay command (G04)

G04 D☐☐☐☐☐

G04 : Time delay command

D : 0.01 to 600.00

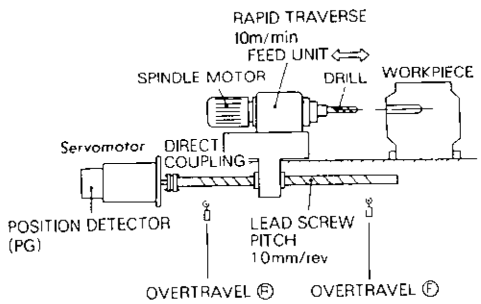
Unit : 10ms

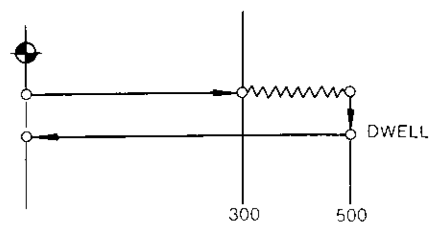
Decimal point position : s

Operation

The machine remains motionless for the time specified by D. In this case, the machine position is not checked for in−position.

A dwelling program using the time delay command is shown below.






```
N010 G53 T1
  011 G01 X300 F10000 :  Rapid traverse
  012 G01 X500 F300 :    Cutting
  013 G04 :              In-position delay
  014 G04 D1 :           Dwell I sec
  015 G53 T0
  016 G27 X0 F10000
  017 M30
```

Fig. 4. 45

Execution of the next block

Execution of the next block starts when the time designated with D has elapsed.

Related parameters

None

(g) Coordinate setting command (G52)

```
G52  X□ □□□ T□
     U□ □□□
```

G52 : Coordinate setting command

X : position in absolute value
(− 9999999 to + 9999999)
U : position in incremental value
(− 9999999 to + 9999999)
T : coordinate No. 1 to 9

Operation

With this command, the current position is set at position X(or U) in coordinate T. Setting a coordinate system with G52 does not switch over the coordinate system. Coordinate T0 is not set by G52.

(Example 1)

```
G01 X322.00
G52 X100.00 T4
```

With this command, the position 322.00 in the current coordinate system is set at 100.00 in coordinate system T4.

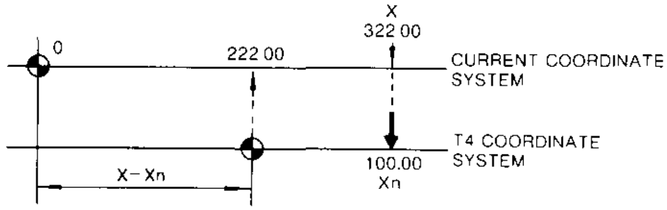


Fig. 4. 46

4.1.4.3 Program function command in detail (Cont'd)

(Example 2)

```
G01 X322.00
G52 U − 222.00 T4
```

T4 coordinate system is set with shift by + 222.00 from the current coordinate system independent of the current position.

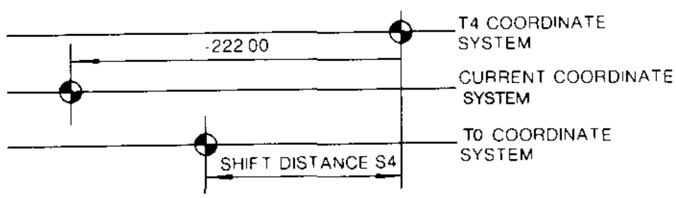


Fig. 4. 47

(Example 3)

```
100 G01 X100.00 ···
101 G52 X200.00 T8
102 G53 T8
103 G01 X250.00
        ⋮
```

The coordinate system T8 has shift length register S8 and offset register O8. The command G52 sets in the shift length regiter. The contents of registers A, S, and O change according to execution of the program, as shown in Table 4. 18.

Table. 4. 18

Command	Contents of Register after Command Execution			
	A0	A8	S8	O8
Initial state	0.000	2.500	0.00	2.500
100 G01 X 100 00	100.000	102.500	0.00	↑
101 G52 X 200.00 T8	↑	202 500	100.00	↑
102 G53 T8	↑	202 500	↑	↑
103 G01 X 250.00	147.500	250 000	↑	↑
+ INC8 = ON (1st)	147.500	250.002	↑	2.502
+ INC8 = ON (2nd)	↑	250.004	↑	2 504
- INC8 = ON (1st)	↑	250 002	↑	2 502
- INC8 = ON (2nd)	↑	250 000	↑	2.500
- INC8 = ON (3rd)	↑	249.998	↑	2.498

When Pr20 = 2 Pr21 = 10

Execution of the next block

Execution of the next block starts in a few milli-seconds of execution time.

(h) Coordinate switching command (G53)

G53 T ...

G53 : Coordinate switching

T : Coordinate 0 to 9

Operation

After this coordinate switch command, all position commands will be executed on the coordinate system specified by the digit following T. (The new coordinate system is shifted from the T0 coordinate system by Sn. With the T8 and T9 coordinate systems, the shift distance is the sum of Sn and the offset On.)

When a program is started immediately after the system energization, coordinate system T0 is selected.

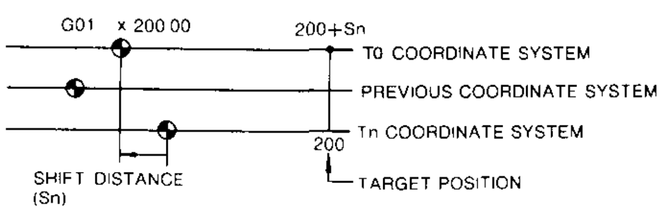


Fig. 4. 48

4.1.4.3 Program function command in detail (Cont'd)

Using coordinate setting G52, tool end coordinate setting is possible for each tool.

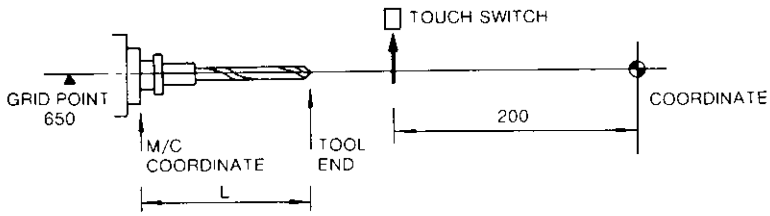


Fig. 4. 49

Tool	L
1, 6	300
2	250
3	455
4	80
5	400
8	250-270

Program Example

Tool Setting Program

N280 G01 X600 F12000 :	Rapid traverse
281 G52 X300 T1 :	Tool 1 end coordinate setting
282 G52 X350 T2 :	Tool 2 end coordinate setting
283 G52 X145 T3 :	Tool 3 end coordinate setting
284 G52 U−80 T4 :	Tool 4 end coordinate setting
285 U52 X−400 T5 :	Tool 5 end coordinate setting
286 G01 U−125 F12000	
287 G34 U−30 F200 :	Move to touch switch
288 G52 X200 T8 :	Tool 8 end coordinate setting
289 G69 P398 : Jump	
N398 G27 X650 F12000 :	Home position return
399 M30 :	End

(i) Arrival check command (G67)

G67 P□□□

G67 : Arrival check command

P : 3-digit No. of block to be jumped

Operation

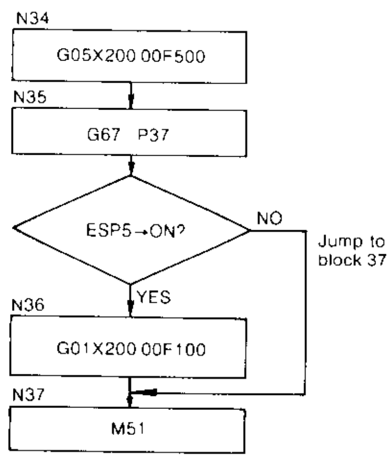
With this command, the execution or no execution of an interim skipping the execution of a G05, G06 or G07 skip positioning command is checked, and then a jump is made accordingly.

If an applicable skip signal is received during the execution of a skip positioning command and a skip is made accordingly, no jump will be made, but the subsequent block will be executed. If no skip signal is received during the execution, so that the machine arrives at the specified X (U) position, a jump to position P will be made.

⋮

N034 G05 X200.00 F500
N035 G67 P37
N036 G01 X200.00 F100
N037 M51

If skip signal 5 (EPS5) is received during the execution of N034 then, N035, N036, and N037 are executed in succession, but if no skip signal is received the program jumps from N035. to N037.



4.1.4.3 Program function command in detail (Cont'd)

(j) Subprogram call command (G68)

A group of blocks in a program is called a subprogram, when the program can return to the subsequent block after the execution of the group.

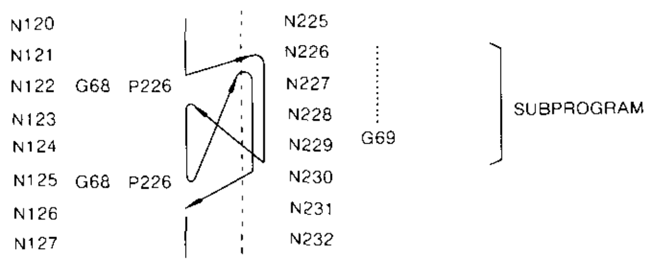


Fig. 4. 50

Subprogram call commands come in two types. In one, repetition count is specified as described below. In the other, an end point is specified as described in Par. 4.4.4.3 (k).

G68 L□ P□□□

G68 : Subprogram call command

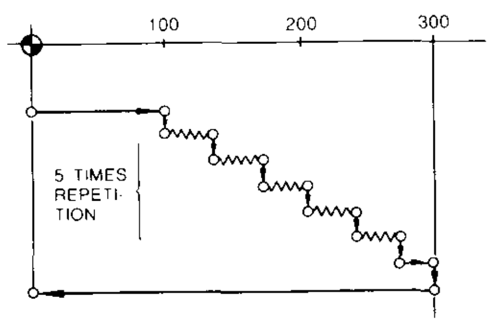
L : No. of repetitions (1 to 9)

P : Subprogram start block (000 to 499)

With this command, subprogram beginning with the block specified by P is repeated L times.

Application example of subprograms

A program example in which a subprogram call command specifying repetition is used as shown below.



```
N110 G01 X100 F12000
 111 G04
 112 M51 :            Related motion
 113 G68 L5 P318 :    5 times subprogram repetition
 114 G01 X300 F12000
 115 G04
 116 M51 :            Related motion
 117 G27 X0 :         Return to home position
 118 M30 :            End
N318 G01 U35 :        Subprogram
 319 G04
 320 M51 :            Related motion
 321 G69 :            Return from subprogram
```

Fig. 4. 51

From a block in a subprogram further jump to another subprogram is also possible, but this is only up to the 4th nesting.

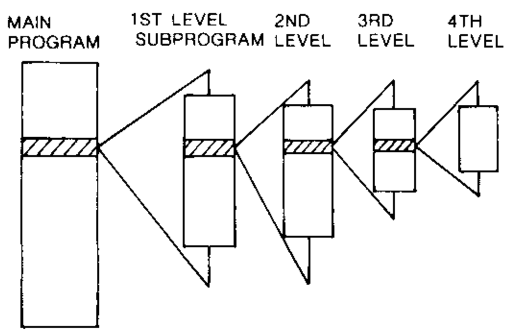


Fig. 4. 52

4.1.4.3 Program function command in detail (Cont'd)

(k) Destination point specified subprogram call command (G68)

```
G68  X          P
     U
```

G68 : Subprogram call command

X : End point (absolute)

U : End point (incremental)

P : Subprogram start block 000-499

Operation

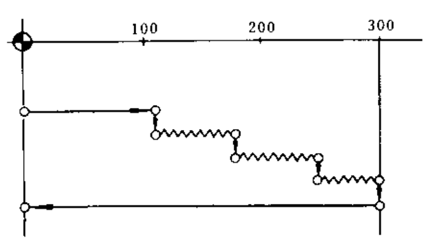
The subprogram starting with P block is repeated until X (U) is reached in the coordinate system specified for G68 execution. Upon arrival at the specified position, the program returns to the block next to the G68 command, even during the course of feeding.

In a subprogram which is to be executed with a specification of the end position, a feed command block for movement in the direction specified by X (U) must be included, so that when this subprogram is repeatedly executed, the specified position will be reached eventually. If the coordinate systems are switched over within a subprogram, the end position specified by X (U) remains at the position in the same coodinate system in which the G68 command was executed.

Within a subprogram, its subroutines can be nested up to the 4th level, but the end position specifying subprogram should not be executed in application.

Application example of subprogram

A program example in which a subprogram call command specifying end position is shown below.



```
N060 G01 X110 F12000
 061 G68 X300 P066 : Repeat subprogram until X=300
 062 G27 X0 F12000
 063 M30
N066 G01 U70 F300 :  Subprogram
 067 M51
 068 G69 :            Return from subprogram
```

Fig. 4. 53

(l) Jump command (simple jump) (G69)

G69 P□□□

G69 : Jump command

P : Block to be jumped to 000-499

Operation

After the execution of the jump command, the block specified by P is executed.

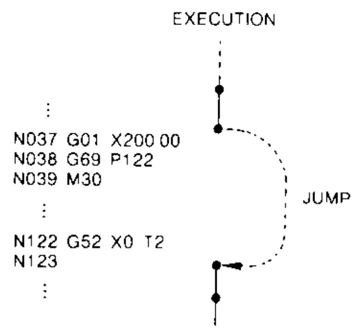


Fig. 4. 54

(m) Return from subprogram (G69)

G69

Operation

This command must always be programmed in the last block of all subprograms. With this cammand, the program returns to the block next to the G68 subprogram call command.

In a subprogram which is specified for repeated execution, G69 makes the program jump to the subprogram start block specified by P until the subprogram is repeated L times, and after repeating L times, the program will jump to the block next to G68.

In a subprogram which is executed to go to the specified end position, G69 makes the program to jump to the start block of the subprogram until the specified end position will be reached.

4.1.4.3 Program function command in detail (Cont'd)

(n) Auxiliary function command (M)

An auxiliary function command cannot be attached to other function commands. It should be programmed in its own block.

M□□

M signal : M51 to M56

Operation

Six M signals M51 through M56 are decoded and output independently. The specified M signal is output when M-FIN is checked for OFF state, and if it is not OFF, only after it is turned off. When M-FIN is turned on, the M output signal is reset. Then, as M-FIN turns off subsequently, the next block is executed.

NOTE

When using extended function, several M signals are limited. See Pars. 11.3/11.4/11.6.

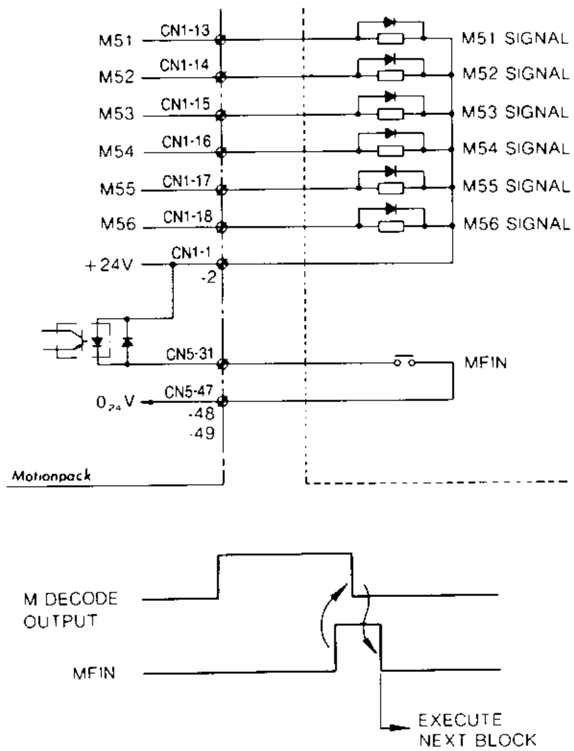


Fig. 4. 55

(o) Program end

End M30

In-operation signal (STL) is reset, and M30 signal is output. When a program start signal (PGS0-PGS9) or an auto start signal (ATST) turns off, an M30 output signal is reset.

(2) Extended function

[Specification method]

For making extended function affective, two point input cable connection and parameter setting are needed.

(i) Input cable connection

Connect CN5 connector No. 18 pin to O_{24} (V). The angular index allocation function is not needed here.

Actual wiring must be provided since this input cable connection reads-in when Motionpack-34 power is ON. (If this input is turned ON by sequencer or relay, the setting may not be effective because the input may be OFF at the power-on.)

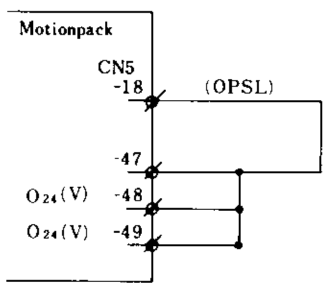


Fig. 4. 56

(ii) Setting parameter

Set the value specified by the extended function at Pr43/Pr47.

Table 4. 19

Extended Function	Pr 43	Pr 43
Variable speed positioning	2000	
Passing signal output	4000	
Angular index	2000000, Pr60 = Pr61 ≠ 0	
Clamp free	100, 200, 300, 400, 500, 600, 700	
S-curve accel/decel positioning	1000	
No-limit length	1000000	
G 67 jump prohibit	Not necessary	
Signal extension during operation	20000	
Auxiliary	1 to 99	
Encode of program select signal	40000	
External data setting		20 (No checksum) 30 (Checksum)
External offset		40 (No parity check) 50 (Parity check)
Extended zone signal output (A)	100000	
Extended zone signal output (B)	200000	

4.1.4.3 Program function command in detail (Cont'd)

(a) Variable speed positioning function (G06)

(i) Function and program method

By specifying main function, feed speed can be changed when discharge position has passed the specified position in the program.

This function makes G68 specifying the desired position the main program and G06 specifying variable speed patterns the subprogram.

Fig. 4. 57 Shows an example where the way speeds are changed to f_1, f_2, f_3 and f_4 during moving to the desired position X4.

Speed line diagram

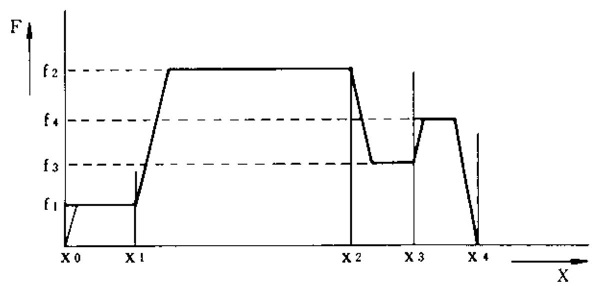


Fig. 4. 57

Program

Nn	G68 X	x_4	Np
Np	G06 X	x_1	Ff1 Ii
Np + 1	G06 X	x_2	Ff2
Np + 2	G06 X	x_3	Ff3
Np + 3	G06 X	$(x_4 \pm \alpha^*)$	Ff4···
Np + 4	G69		

* The desired position of this command is located ahead of Nn block desired position

Operation

G06 cammand in the subprogram does not decelerate the speed to stop at the specified position. When the command position has passed G06 specified position, the next block will be executed and the speed will be changed to the next G06 feed speed command value.

Once G06 specified by speed control option is executed in the subprogram, the moving desired position will be G68 specified position and continuous feed will be performed until the subprogram is completed.

(ii) Parameter setting

Parameter setting value for for effective variable speed positioning is ; Pr43 = 2000 (CN5−18 ↔ 0_{24} V short-circuit is available.)

This parameter setting makes extended function valid only in the subprogram. Thus, G06 in the main program is operated as skip command of the basic functions.

(iii) Precautions for use

① Speed change (at accel/decel start) may be sometimes later than the specified position by a maximum of 15ms. Thus, changing position has distance variation of the maximum (Speed before change × 15ms.)

② Do not perform single-block operation ; otherwise the subprogram will be completed with the first speed G06.

③ If M-code is executed, moving will be continued with the speed of the former block until M-Fin functions. Even if it has already arrived at the desired position before M-Fin, M signal does not stop until M-Fin functions.

④ Do not change the current limit value in the subprogram : Otherwise the deceleration at the final stop position may not function normally.

⑤ Do not mix any other feed command after G06 command has been executed in the subprogram. When there is any command other than feed commands, pay attention to execution time and accuracy caused by traveling.

⑥ Do not specify a position in the opposite direction in the subprogram. Such a position is considered to have been passed. Then the next block will be executed immediately after changes of speed and current limit are performed.

⑦ Do not set any other numerical value to parameter 43. Malfunction may occur by simultaneous selection of another optional function.

⑧ For the last G06 command in the subprogram, set the command position prior to the end position in order to pass the G68 end position.

(b) Passing signal output funciton (G07)

(i) Functions and program method

Based on the main function specified conditions, skip positioning command (G07) is used in the subprogram.

When G07 command gives a movement to the subprogram end position, the next block will be executed after the feedback position has passed the specified position on the way. Thus, M signal output command given in the next block can provide a passing signal.

Fig. 4. 58, shows a programing method where passing signals are output in each position of x_1, x_2 and x_3 when moving to the desired position $x\alpha$ with speed f.

4.1.4.3 Program function command in detail (Cont'd)

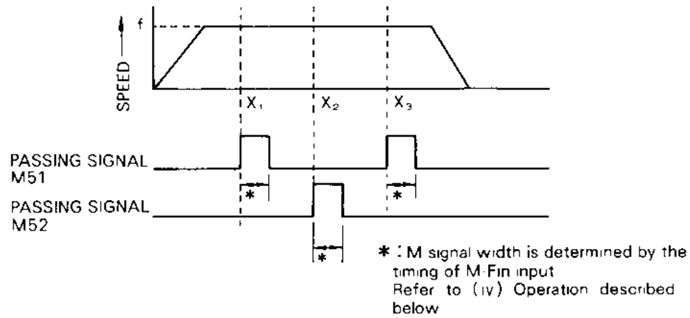


Fig. 4. 58 Passing Signal

① Provide $x\alpha$ as the end position of the end position specified by the subprogram call command.

② Provide x_1, x_2 and x_3 as the desired positions of skip positioning command G07 in the subprogram. Specify the speed f moving to the end position $x\alpha$ by G07 command speed.

③ For passing signals, any of M51 to M56 can be specified. Here choose M51 and M52 as an example:

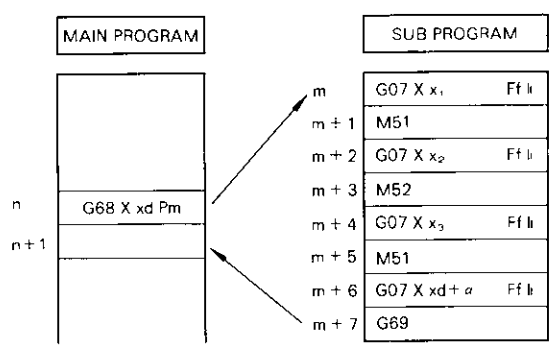


Fig. 4. 59 Program Example

(ii) Setting parameter

For effective passing signal output function, set the parameter at Pr43 = 4000. (Shortcircuit across CN5 − 18 and $O_{24}V$ is required.)

This parameter setting makes extended functions valid only in the subprogram. Thus, G07 in the main program is operated as skip command of the basic functions.

(iii) Precautions

① The subprogram must be ended as shown in Fig. 4. 60.

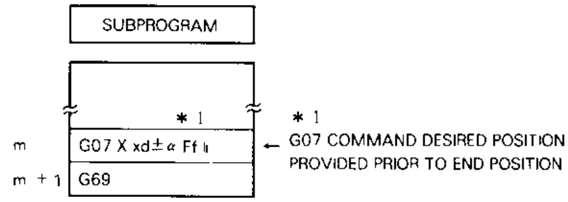


Fig. 4. 60 End Display of the Subprogram

Do not insert any other command between m′ block and m′ + 1 block.
Without m′ block G07X xd ± α Ffli command, Motionpack-34 dose not effectively function even if alarm does not occur.

② For G07 command speed in the subprogram any speed can be selected depending on a block, although speed change will be somewhat delayed. However, do not change the torque specification: the deceleration at the stop position may cause malfunction.

③ When G07 command in the subprogram has accepted skip signal (ESP7), do not use G07 command because it is not certain if the command gives skip operation or not.

④ Do not mix any other feed command after G07 command has been executed in the subprogram. When there is any command other than feed commands, pay attention to execution time and accuracy caused by traveling.

⑤ Do not specify a position in the opposite direction in the subprogram. Such a position is considered to have been passed. Then the next block will be executed immediately after changes of speed and current limit are performed.

⑥ For the last G07 command in the subprogram, set the command position at the end position + α in order to pass the G68 end position.

(iv) Operation

① G07 command in the subprogram specifying the end position dose not decelerate the speed for stopping at the desired position.

When feedback pulse has passed the desired position, the next block will be executed.

② Once the passing signal optional specification G07 command is executed in the subprogram specifying the end position, this command gives a continuous feed until the subprogram is completed, or the feedback pulse arrives at the desired position xα.

③ M signal output used as a passing signal is as shown in the standard specification. Accordingly, when M-Fin signal does not return, M signal will not be reset. If the next passing signal is output before M-Fin signal returns, it must be held until the former passing signal is reset by M-Fin signal return. After the former M signal is reset, turn off M-Fin signal to output next M signal.

4.1.4.3 Program function command in detail (Cont'd)

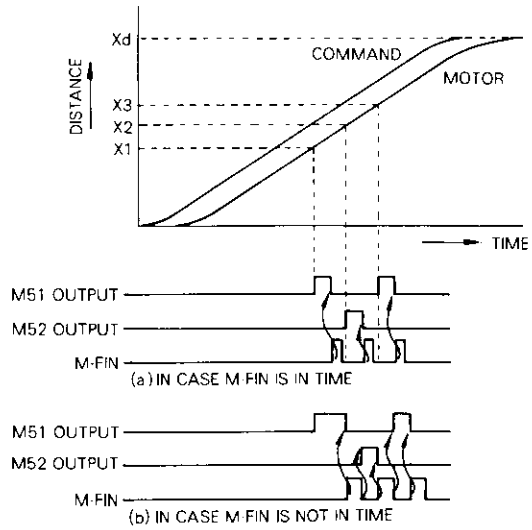


Fig. 4. 61 (a) Passing Signal Output

In the same way, when the specified M-signal is the same as a passing signal and the next passing signal is ON before the former M-signal is reset, the relation of M-signal output and M-Fin signal is as shown in Fig. 4. 61 (b).

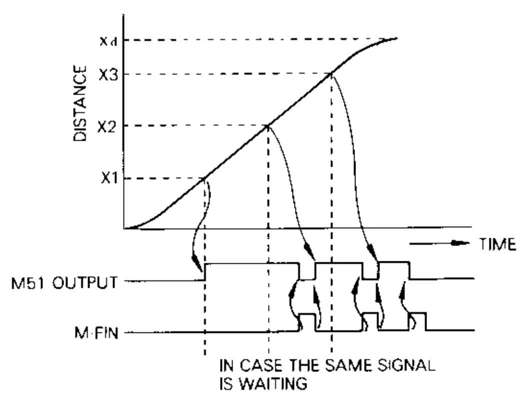


Fig. 4. 61 (b) Passing Signal Operation

④ Use for M-signal output extended function If M-signal output extended function is specified, M-signals can be set/reset at the passing position.

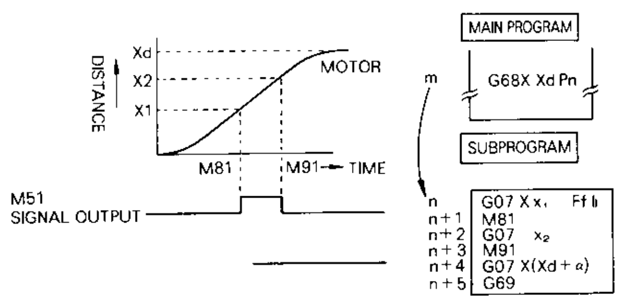


Fig. 4. 62 Example of Extended M Function

When the main extended function and extended M function are specified at the same time, set parameter 43 at 40XX (XX = 01 to 99). When M-signal extended function is used together with them, read (h) Extended M function in this paragraph.

⑤ The time from passing specified position to the next block execution has a maximum of 4 ms variation because of the delay of signal I/O time. Accordingly, this function is not adjustable for the application requiring high accuracy of passing signal position.

⑥ Do not perform single-block operation in the main function.

Otherwise, one block will be executed every time the single-block start signal is turned on. Therefore, at the time when the first G07 command is executed in the subprogram, it gives a movement to the end position.

After that, passing signals are output every time the single-block signal is turned on.
For resetting M-signal, the requirement for the M-Fin signal is the same as that of automatic operation.

(c) Angular indexing function

(i) Function

This function specifies rotation position by angle. This function comprises the following two types in rotating direction specifying method.

* Rotating direction specification type angular indexing function G05
* Short-distance direction automatic selection type angle allocation function...G06, G07

Their functions are described below :

Note that the command position is described by the angle expressed with one rotation 360° in the following description.
Actually, the value expressed in the position command unit defined by parameters 50 and 51 must be commanded.

(ii) Setting parameter

This extended function becomes effective when the parameters are set as below:

Pr43 = 2000000

Pr60 = Pr61 = C

C is the setting value (position command unit) corresponding to one rotation and must not be 0.

(iii) Details of function

① Rotating direction specification type angle allocation function (G05)

• Specifying method:

G05 X (θ) F (f) I (i)

provided, $|\theta| < c = (360°)$

thus, $-360° < \theta < 360°$

4.1.4.3 Program function command in detail (Cont'd)

- Operation
  - Make positioning at $X = \theta$ from the presnt position.
  - Rotating direction depends on X sign :

    $X = \theta \geqq 0$: Forward rotation

    $X = \theta < 0$: Reverse rotation
  - When the present position is in the same location as the command position, there is no movement, which means that movement is completed.
  - After executing this function, the present position becomes the command position θ. ($-360^\circ < \theta < 360^\circ$)

(Example)

Where G05X (340°) F (f) I (i) is executed from the present position X = 825 ;

The present position X :

$$X = 825^\circ$$
$$= 360^\circ \times 2 + 105^\circ$$
$$= 105^\circ$$

The positioning position will be:

$$X = 340^\circ$$

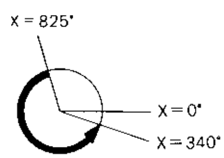


Fig. 4. 63

- This function is valid only for absolute specification. For incremental specification, standard skip positioning function is valid.
- After executing this function, coordinate shift is still valid.
- With $|\theta| \geqq 360^\circ$, this function performs the same operation as standard G05. Where G05X (750°) F (f) I (i) is executed from the present position X = 15°, positioning is made at 30° after 2 rotations from 15°. The coordinate of positioning position will be 750°.

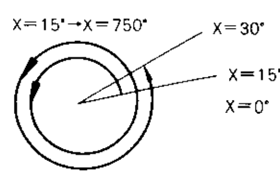


Fig. 4. 64

② Short-distance direction automatic selection type angle allocation function (G06, G07)

• Specifying method

G06X (θ) F (f) I (i),

however, $|\theta| < 360°$ ($-360° < \theta < 360°$)

• Operation

Make positioning at X = θ from the present position.

– Rotating direction takes the shorter distance from the present position.

(Example)

Where G06X270° F (f) I (i) is executed from the present position X = θ ;

X = 440°

= 360° × 1 + 80°

270° − 80° = 190° > 180°

Accordingly, make positioning at X = 270°in the reverse direction.

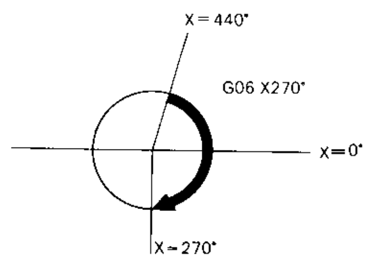


Fig. 4. 65

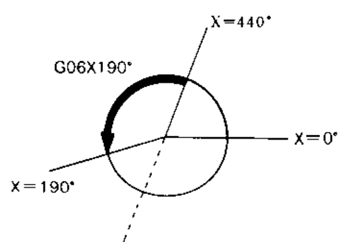


Fig. 4. 66

– When the commanded moving value is 180°, forward rotation is given.
– This function is valid only for absolute specifcation. For incremental specification, standard skip positioning function is valid.
– When the present position is in the same location as the command position, there is no movement, which means that movement is completed.
– After executing this function, the present position becomes the command position θ. ($-360° < \theta < 360°$)
– After executing this function, coordinate shift is still valid.

4.1.4.3 Program function command in detail (Cont'd)

(iv) Precautions for use

• When the command position is at 360° or more :

Standard skip positioning is made.

$\theta = 360° \times n + \delta\theta$

Accordingly, $\delta\ \theta$ is positioned at n-time rotation from the home position.

• Relation of skip signals

When the skip signal is turned on during anglar indexing operation, the machine decelerates and stops to complete the operation in the same way as the standard skip positioning function.

• When using in the subprogram specifying end position

This function can not be used in the subprogram specifying end position.

Executes from X = 0:

$$\left.\begin{array}{l}\text{G05}\\\text{G06}\\\text{G07}\end{array}\right\}\ \text{X765 F (f) I (i)}$$

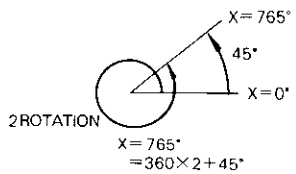


Fig. 4. 67

(d) Clamp free function (G05, G06, G07)

(i) Function

This function enables the motor to be moved freely by external forces after positioning. In this case even if there is no external force, the motor will never return to the first position.

(ii) Program method and operation.

In this function, if the signals in current limit (CN3 connector 12-pin, "CLD" signal) are turned on during execution of skip positioning commands G05, G06 and G07 as described in Par. 4. 1. 4. 3(1) (b) "Skip positioning command (G05, G06 G07)", Motionpack sets the present feedback position as the present position (discharge position) and bank pulse becomes 0.

When the signals in current limit are turned off, Motionpack starts to discharge the command pulse from its present position to command position again and the motor starts to rotate.

Whether CLD is ON (free state) or OFF (normal movement state), the next block is executed by command position arrival skip or skip with skip signal ON. On the G07 operation under normal current limit, when there is no external force bacause of clamp release, etc., the value caused by ferced operation will become the former value rapidly by servo clamp.

Table 4. 20 Program Example

Motionpack		External Sequence
Program	Operation	
⋮		
N85 M55	Clamp start command	
N86 G07 U9999.999* F0 I10	Free External force Free released No movement even in external force 0. Skip	CL signal ON Clamp operation Clamp release CL signal OFF EPS07 ON
N87 G01 X0 F8000 I200	Return	
⋮		

(*): U9999.999 can not exceed soft stroke limit.

(iii) Setting parameter

Set Parameter 43 according to Table 4. 21.

Table 4.21

Parameter Pr43	Command to be Free
100	G05
200	G06
300	G05, G06
400	G07
500	G05, G07
600	G06, G07
700	G05, G06, G07

Short-circuit CN5 - 18 ←→ O_{24} V is needed.

(iv) Precautions for use

- In free state, Motionpack stops the servo clamp operation, but Servopack is under normal operation. According by, of ramdom signals such as noise are superimposed on the servopack input signal,the motor may rotate slowly.

  Since the servo clamp operation is invalid, the motor may rotate slowly by external forces.
- Of the current limit is charged,the signals in current limit are turned on automatically by external forces.
- Set the specified parameter at every 100 numerical value from 100 to 700 setting a value out of the range may cause a malfunction.

NOTE

S-curve accel/decel positining function is extended function of G05 to G07 ; see Par.11.1.

(e) Infinite length operation function (G34)

(i) Function

Infinite length operation (MK2) function continues movement operation until EXP signal is turned on after starting to move by G34 common : it makes positioning at specified length L position after EXP signal is turned on.

Accordingly, this function makes possible positioning by external signals after infinite length operation.

(ii) Specification

With parameter setting Pr43 = 1000000, the infinite length operation is valid. Short-circuit across CN5-18 and $O_{24}V$ is needed.

(iii) Operation and program method

- Specifying method

G34X (L) F (f) I (i) or

G34U (L) F (f) I (i)

- Function operation

  This function makes positioning at the specified length L position from the position with EXP signal ON after starting to move.
- Moving direction
  - Direction specified by G68X (x) in the subprogram (G68X…) specifying end position.
  - Direction specified by G34X/U in case of other than the above-mentioned subprogram.

• Maximum moving distance

– This function gives a movement which stops at the position specified by G68X in the subprogram specifying end position. Until it stops, G34 ALM signal will be turned on unless EXP signal is ON. G34 ALM is reset by turning on G34 FIN signal.

– In the case other than the above, movement distance will be approximately 5×10^8 in position command unit. However if the movement is given more than two minutes, G34 ALM is turned on, though the operation will continue normally.

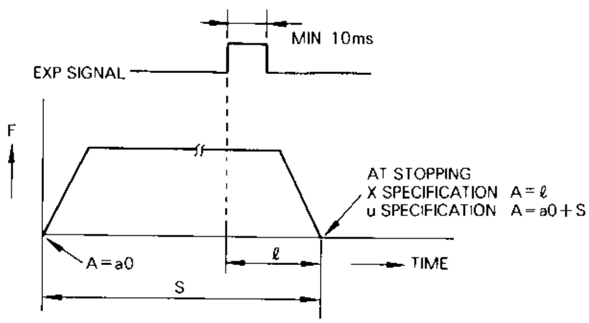


Fig. 4. 68

• Moving distance after EXP signal is ON

Whether the specified position is X or U, L distance is made. Moving distance L can be specified with the value exceeding G68 position specifying X value. G68 position specifying X, specifies the limit position searching for EXP signal.

• Coordinate after external positioning

– In case of U apecification

The coordinate is still in the coordinate system when the G34 command has started. Accordingly, the present position display after external positioning is completed will be in the position added with moving distance from G34 starting point.

– In case of X specification

The position with EXP signal ON is to be a home position. However the coordinate shift is valid.

• Deceleration operation at positioning

When EXP signal is turned on and deceleration is not enabled in the distance L, this function gives a movement to pass once.

After stopping it returns to the position with EXP signal ON.

• Completion in G68

When the position is specified in the G68 subprogram specifying end position, EXP signal is turned ON. When completed by G34 Fin signal after the alarm. The subprogram specifying end position is completed. The movement return to the block next to G68X··· command is given.

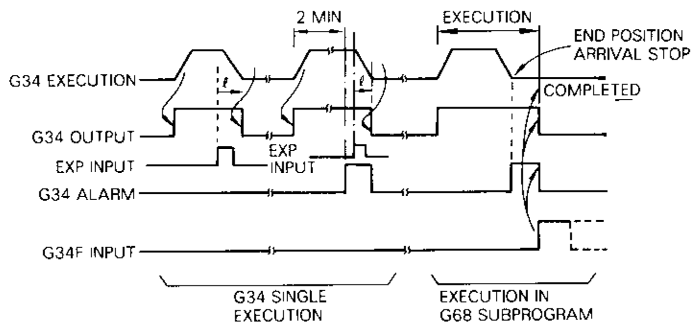


Fig. 4. 69

(f) G67 jump prohibit function

(i) Function

This function prohibits the arrival check jump function G67 by external signals.

(ii) Preconditions of main function specification

This extended function becomes valid by jumper connection*.

*Jumper connection :

Connect CN5 connector 18-pin to 24V system OV.

(iii) Function description

- Specifying method

  G67P (p)

- Function operation

  – Jump prohibit signal (JPIBT)

    In case CN5-32 pin is turned on, the next block will be executed without jumping even if the skip positioning is completed.

  – When JPIBT signal is turned off, this function has the same operation as the standard.

    Thus, the next block will be executed if there is skip operation during skip positioning ; the block execution will jump to the block specified by P when arriving at the desired position without any skip on the way.

(g) Extended function of the signals in activation

(i) Function

This extended function changes the conditions to turn off the signals in activation (STL). Following are the conditions in the standard specifications ;

– Where program clear signal (PGCL) is turned on during feedhold

– Where the mode changes to other mode

– Where M30 is executed and completed

– Where emergency stop occurs.

In any of the conditions above, the signals will not be turned off by feedhold or single-block operation completion. By specifying the extended function if the program is being executed or not, the signals in activation can be turned ON／OFF. Accordingly the signals in activation can be turned OFF not only when M30 execution is completed but also when the operation is temporalily stopped by single-block operation competion or feedhold.

(ii) Specification

Single extension in activation is valid by Parameter setting Pr43 = 20000. Short-circuit across CN15－18 and O_{24}V is needed.

(h) Extended M function

(i) Function

4 types of M functions M51 to M56, M60 to M79, M81 to M86 and M91 to M96 can be specified.

- "M51" to "M56"

  By decoding M code according to the basic function, applied signals from M51 to M56 can be output. Turning on M-Fin resets the output and turning off M-FIN executes the next block.

- "M61" to "M79"

  These functions make M code encoded to output by 5 signals from M51 to M55.
  After a specified time (by parameter) M56 synchronizing signal is output.

  Do not use M60 unless it is absolutely necessary. Turn on M-Fin to reset the output and turn it off to execute the next blok.

Table 4. 22 Functions of M61 to M79

	61	62	63	64	65	66	67	68	69	70	71	…	77	78	79
M51	1	0	1	0	1	0	1	0	1	0	1		1	0	1
52	0	1	1	0	0	1	1	0	0	0	0		1	0	0
53	0	0	0	1	1	1	1	0	0	0	0		1	0	0
54	0	0	0	0	0	0	0	1	1	0	0		0	1	1
55	0	0	0	0	0	0	0	0	0	1	1		1	1	1

M51 … 2^0-digit
M52 … 2^1-digit
M53 … 2^2-digit
M54 … 2^3-digit
M55 … 0 = M60S 1 = M70S
M56 … Strobe signal

- "M81" to "M86"

  As shown in Table 4.23, corresponding M signal output (M decode signal) is turned on by M81 to M86 functions.

  Even if the M signal output is not turned on, the next block is executed. Accordingly, some M signals can be output simultaneously. Even if the M-Fin signal is on, M signal is not influenced.

4.1.4.3 Program function command in detail (Cont'd)

Table 4. 23 Correspondence of M8X and M5X

M Function	M Signal output To Be Turned On
M81	M51
M82	M52
M83	M53
M84	M54
M85	M55
M86	M56

• "M91" to "M96"

As shown in Table 4.24, corresponding M signal output (M decoded signal) is turned off by M91 to M96 functions.

Even if the M signal output is not turned on, the next block is executed. Even if the M-Fin signal is on, M signal is not influenced.

Table 4. 24 Correspondence of M9X and M5X

M Function	M Signal Output to be Turned OFF
M91	M51
M92	M52
M93	M53
M94	M54
M95	M55
M96	M56

(ii) Specification

The time from M code output to simultaneous signal output is set at the Parameter 43.

Pr43 is set at a numerical value between 1 and 99 in units of 10ms.

(Example) Pr43=50 50×10ms=0.5 second When M81 to M86, M91 to M96 are used, set Pr43 at a value of 01 to 99.

Short-circuit across CN15−18 and $O_{24}V$ is needed.

NOTE

When specifying extended function simultaneously, several M signals are limited. See par. 11.3/11.4/11.6.

(i) Encoding program selection signal

(i) Function

Following ara the extended functions:

- By encoding program selection signals (PGS0 to PGS9, PGSL00 to PGSL30), program operation can be started from 0 to 398 blocks.
- Start block is selected by the encoded signals above. Automatic start (ATST) is used for start signal
- After the program has started, one block is executed after another and the program is completed by M30 command, as it is in the standard.

(ii) Specification

By setting parameter 43 at 40000, encoding program signal is valid.

Short-circuit CN5−18 ↔ $O_{24}V$ is needed.

(iii) Program selection signal

This signal is input with 3-digit, binary coded decimal code (BCD code).

Table 4. 25 Program Selection Signal (Odd Parity)

		Signal Name	BCD Code									
			0	1	2	3	4	5	6	7	8	9
1-digit	2^0	PGS 0	0	1	0	1	0	1	0	1	0	1
	2^1	PGS 1	0	0	1	1	0	0	1	1	0	0
	2^2	PGS 2	0	0	0	0	1	1	1	1	0	0
	2^3	PGS 3	0	0	0	0	0	0	0	0	1	1
	Parity bit	PGS 00	1	0	0	1	0	1	1	0	0	1
10-digit	2^0	PGS 4	0	1	0	1	0	1	0	1	0	1
	2^1	PGS 5	0	0	1	1	0	0	1	1	0	0
	2^2	PGS 6	0	0	0	0	1	1	1	1	0	0
	2^3	PGS 7	0	0	0	0	0	0	0	0	1	1
	Parity bit	PGSL 10	1	0	0	1	0	1	1	0	0	1
100-digit	2^0	PGS 8	0	1	0	1	/	/	/	/	/	/
	2^1	PGS 9	0	0	1	1	/	/	/	/	/	/
	Parity bit	PGSL 20	1	0	0	1	/	/	/	/	/	/
Parity Specification		PGSL 30	PGSL 30 = 0: With odd parity check 1: Without odd parity check									

Notes:

1. The Signal cable state in this table is:
   0: Open
   1: Connected to $O_{24}V$
2. Check Odd parity. Where PGSL 30 = 1 (PGSL30 signal to be connected $O_{24}V$), parity is not checked, and PGSL00, PGSL10, PGSL20 are invalid.

4.1.4.3 Program function command in detail (Cont'd)

(iv) Signal timing

The basic function has two ways of automatic operation : by PGS signal and by ATST signal. However, for "encoding program selection signal" extended function, only the method by ATST signal is valid.

In Fig. 4.70 the signal priority of automatic mode selection and program selection is not important. Turn on ATST signal at more than 35 ms after the signal which has changed last.

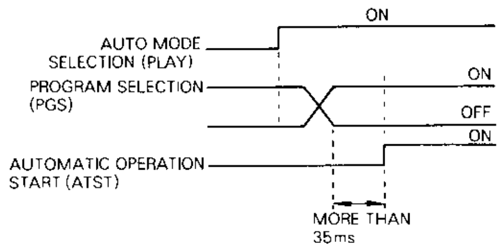


Fig. 4. 70

(v) Error check

- Err nSEL (program selection error)

– PGS signal has changed during automatic operation.

– Parity check error

The program selection signal code has parity error.

– When the extended function specifying signal and the parameter are read-in at power -on, if the extended function specifying signal does not exibecause of disconnection, etc., encoded specification does not work.

Then, if encoded program selection signal is input, it means these are some PGS signals input, which cause program selection error.

– The other errors occur for the same reasons as the basic function.

(vi) Applicable example

Independent positioning of maximum 398 points

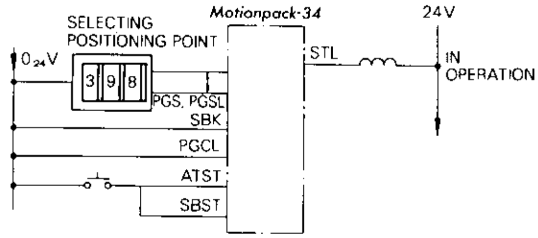


Fig. 4. 71

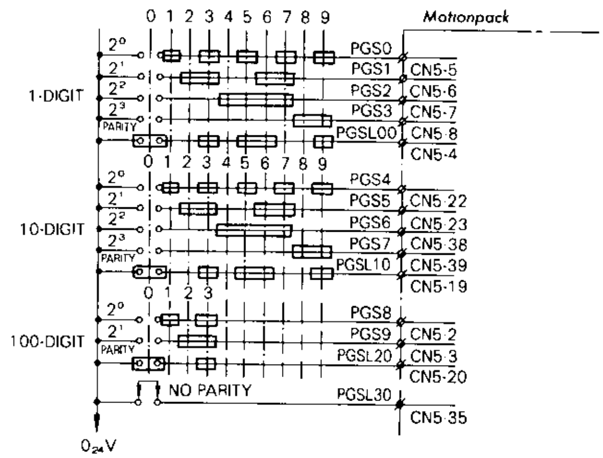


Fig. 4. 72

Starting from 399 block causes program error after movement is completed.

4.2 Motionpack PROGRAMMER (CMPF-PM33F)

The Motionpack-34 programmer is designed for use in checking systems and off-line maintenance. It has the following capabilities.

Motionpack-34 programmer employs CMPF-PM33D/F which is a version of Motionpack-33 programmer CMPF-PC33C.

CMPF-PM33D/F has processing function of parameter 30X adding to the functions of CMPF-PM33C.

- To check and change program and parameters
- To indicate position date of system
- To indicate status of system
- To write, read, and verify programs and parameters to/from a terminal

Note that the Motionpack programmer cannot be used on-line continuously as part of system monitor or control panel.

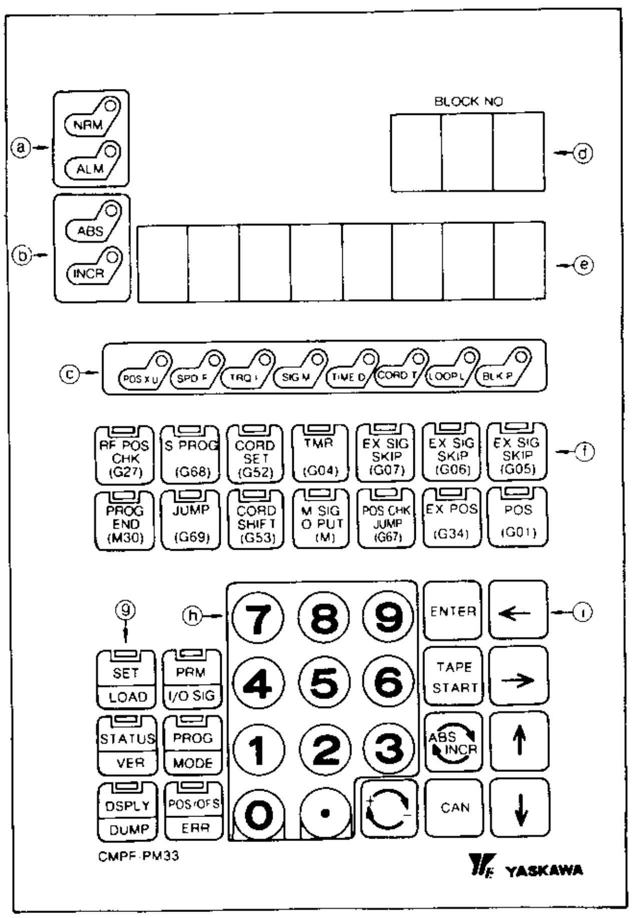


Fig. 4. 73 Motionpack Programmer Panel

Key Block Description

- ⓐ: Normal/alarm display
- ⓑ: Incremental/absolute display
- ⓒ: Address display
- ⓓ: Block No. display
- ⓔ: Data display
- ⓕ: Function selection
- ⓖ: Programmer mode selection
- ⓗ: Digit key
- ⓘ: Operation selection

Table 4. 26 Motionpack Programmer Mode List

Mode Key	Item (Address) Key	Function	Tape Start
SET	PRM	Writing parameter	Reading Parameter
	PROG	Writing program	Reading Program
	POS/OFS	1) Writing coordinate correction (Coordinates 8 and 9 only) 2) Writing coordinate Compensation (Coordinates 1 - 9)	-
STATUS	PRM	1) Input status display (Input) 2) Output status display (Output)	Collating parameter tape
	PROG	1) In-operation display (I status) 2) CM error status display (Error) 3) Cause display (Hold)	Collating program tape
	POS/OFS	Position error display	-
DSPLY	PRM	Parameter display (0-299)	Parameter tape output
	PROG	Program display (0-499)	Program tape output
	POS/OFS	1) Current position display (A) 2) Universal position display 3) Command position display (C) 4) Correction display (O) 5) Compensation display (S)	-

Note:
1. If not Edit is displayed in the universal display while selecting set mode, check that EDIT signal is on. The set mode can only be selected while EDIT is ON.
2. When parameters have been rewritten, be sure to turn off the power supply and turn it on again before starting operation.

4.2.1 Motionpack-34 Programmer Functional Operation

4.2.1.1 Keyboard and display

The Motionpack -34 programmer keyboard panel is shown in Fig. 4.73.

ⓐ NRM-ALM indicators

NRM . . .Lit when the programmer is in normal operating condition.
Out when the programmer is faulty.

ALM . . .Lit when the signal between the programmer and the Motionpack controller is not transmitted correctly.

ⓑ INCR-ABS indicators

Effective only for indicating the coordinate positions in setting or displaying programs.

INCR . . .Lit when the universal in ⓔ is incremental.

ABS . . . Lit when the universal displayed in ⓔ is absolute.

ⓒ Address indicators

They indicate the addresses of the data displayd in ⓔ and are effective only when entering and displaying programs.

ⓓ Block No. display

In entering or displaying programs, block Nos. are displayed, and in setting or displaying parameters, parameter types and coordinate Nos. are displayed. In the status display mode, data types are displayed, and in the signal display mode, the input, or output signal and channels are displayed.

When the decimal point in the block No.display blinks, enter numbers with the digit keys and depress the $\boxed{\downarrow}$ or $\boxed{\uparrow}$ key.

The decimal point stops blinking and the entered numeral is selected.

When the decimal point in the universal display blinks, data entry is requested.

Enter data with the digit keys and depress the $\boxed{\text{ENTER}}$ Key. The decimal point stops blinking, and the data is input (When entering programs, depress the $\boxed{\mapsto}$ or $\boxed{\leftarrow}$ key for each address.)

ⓔ Universal display

Signed decimal data, or special symbols data or status is displayed. Only the (−) sign is displayed and (+) sign is omitted.

ⓕ Function select

These keys with indicators are used to select functions in entering or displaying programs.

ⓖ Programmer mode select

These keys with indicators are used to select or display modes of the programmer.

ⓗ Numerical key

These numerical and sign keys are used to enter numerals.

ⓘ Operation selection keys

These keys are used to select writing, next item, or other operations.

4.2.1.2 Mode select

The setting mode, display mode and data types are selected with these modes are listed in Table 4.26.

(1) Parameter setting

Depress [SET] and [PRM] keys. The block No. display flickers. Write the parameter No. in the block No. display by depressing the digit keys, and then, depress the [↓] or [↑] key. The block No. display stops flickering and the universal display starts to flicker. Write required data with the digit keys, and depress the [ENTER] key. The universal display stops flickering and the data is stored.

To set a subsequent parameter, depress the [↓] key. The parameter No. in the block No. display is increased by one, and the same data is displayed. If the parameter is not to be rewritten, depress the [↓] key. The data set before cannot be rewritten.

To keep [↓] or [↑] key pressed increases/decreases parameter number. Previous/next parameter number and its contents are displayed. When these keys are released, parameter number stops.

When the parameter is to be rewritten, depress the [PRM] mode keys again. The block No. blinks requesting the enter of a parameter No. If wrong digit keys are depressed while writing block Nos. or data, depress the [CAN] key. The digits are reset to 0.

NOTE

- The written parameter data are not checked for the data range. Carefully check the digits when entering them.
- When all parameters have been entered, turn off the power supply to the Motionpack controller once and turn it on again. With this operation, the entered parameters become effective.

(2) Program enter

Depress the [SET] and [PROG] keys. The block No. display blinks. Write the block No. and depress the [↓] or [↑] key. The block No. stops blinking, the function code (G) indicator for the current contents of the displayed block blinks, and the set address indicators among X-P light simultaneously. (No digit is displayed.)

To write a program, depress a selected G code key. Depress the [→] or [←] key. The selected address among the indicators X-P blinks, and the decimal point blinks. Write the numeral, and depress the [→] or [←] key. The next address is displayed. When the address corresponding to the selected G code is finished, the G indicator blinks again. Depress the [ENTER] key. When the program is written, the indicator stops blinking.

When the [→] or [←] key is depressed, the data is checked automatically and, if the data is wrong, dAtAErr is displayed. If required data is not completely written in the [ENTER] mode, the G indicator continues to blink. When a part of the existing program is to be corrected, keep depressing the [→] or [←] key until the required address is displayed.

Keeping [→] or [←] key pressed displays sequentially the data of addresses X to P related to the selected function. After address indicator starts to blink, select the digits and depress the [→] or [←] key and then depress the [ENTER] key.

To cancel the written digits, depress the [CAN] key. Since no address indicator blinks in the following cases, depress the required [G] code key again.

- When an end position designating subprogram call (G68X... P...) is changed to repeat subprogram call (G68L... P...).
- When an in-position pause (G40) is changed to a time pause (G40D).
- When jump from subprogram (G69) is changed to a simple jump (G69P...).

(3) Program all clear

Depress the [SET] key and the [PROG] key. The block No. blinks. Depress the [PROG], [↓] and [CAN] keys simultaneously and then depress the [ENTER] key. All the blocks are rewritten to become M30

(4) Coordinate system select

The coordinate systems T1 through T9 can be selected with a program using G52, and they can also be preset by the programmer.

The shift values for these coordinate systems are specified in reference to the T0 coordinate systems. The T8 and T9 coordinate systems can be offset by ± INC 8 or ± INC 9, respectively, but their initial values can also be preset by the programmer.

When the T8 or T9 coordinate system is used, all the position commands are ones corrected for the shift distance (S) and the offset distance (O)

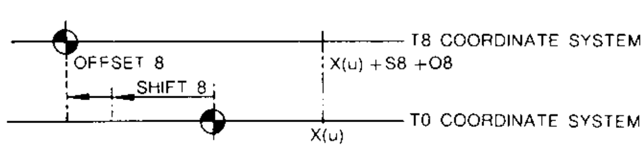


Fig. 4. 74 Coordinate System Select

(a) Offset value setting

Select the position setting mode.

Each time the [POS/OFS] mode key is depressed, the block No. display changes between [0][8] and [5][8]. 0 means OFFSET, and 5 means SHIFT. The blinking digit represents the coordinate No.

Select OFFSET 0, write the coordinate No,. and depress the [↓] or [↑] key. The block No. display stops blinking, and the universal display starts to blinking.

Write an offset value and depress the [ENTER] key. When the [↓] key is depressed, subsequently, the next coordinate system is selected. The value are in minimum position command units.

(b) Shift value setting

Select the position setting mode. ([SET] [POS/OFS]) Depress the [POS/OFS] mode key until 5 (meaning SHIFT) is displayed, write the desired coordinate No. and depress the [↓] or [↑] key. The block No. stops blinking and the universal display starts to blink.

Write the required shift valua and depress the [ENTER] key. When the [↓] key is depressed, subsequently, the next coordinate No. is displayed. Shift values are in minimum position command units.

4.2.1.3 Display method

(1) Parameter display

Select the parameter display mode with the mode select keys. The block No. display blinks. Write the parameter No. for the required parameter in the block No. display, and depress the [↓] or [↑] key.

The data of the parameter is displayed in the universal display. To display the next parameter, depress the [↓] key.

To keep [↓] or [↑] key pressed increases/decreases parameter number. Previoue/next parameter number and its contents are displayed. When these keys are released, parameter number stops. When the [PRM] mode key is depressed, the block No. display blinks, requesting the selection of parameter No.

(2) Program display

Depress the [DSPLY] key and the [PROG] key. The block No. flickers. Enter the desired block No. and press the [↓] or [↑] key. The block No. stop blinking, and the content of the selected block is displayed by the [G] indicator, the address indicator and the universal display.

4.2.1.3 Display method (Cont'd)

When the block contains two or more addresses, the second and subsequent address and their contents are displayed when the [→] or [←] key is pressed. By continuing to press [→] key, all the data (X to P) of the selected block are displayed sequentially, and automatically proceed to the next block.

While the block No. is not blinking, when the [↓] or [↑] key is depressed, the block No. increases or decreases by one, and the contents of that block are displayed. In this case, then the [→] key is depressed last, the left end address in that block is displayed, and when [←] is depressed last, the right end address is displayed. Addresses other than F, I,D,P,X,or L are not displayed.

Stored data are checked by the Motionpack controller. If program error is detected, set the controller in C Err display and check the data displaying by use of [←] or [→] key.

(3) Position display

Select the position display mode.(DSPLY | POS／OFS) Each time the (POS／OFS mode key is depressed, the block No. display changes in the sequence of A → U → C → O → S and the coordinate No. blinks.

The meaning of each symbol is as follows.

A Current position

U Universal display

C Command position

O Offset value

S Shift value

Write the required coordinate No. in the block No. display and depress the [↓] or [↑] key. The coordinate No. stops blinking and the position in the selected coordinate system is displayed. Depress the [↓] key and the position in the next coordinate system is displayed.

Displayed is possible for A and C with coordinates T0 through T9, for O with T8 and T9 and for S with T1 through T9. Display for U is made with the currently selected coordinate system. Display for U0 is the current value, for U1 is the remaining distance, for U2 is the commanded position, for U3 is the position error and for U4 is the feedback position.

(4) Status display

Select the program status mode.(STATUS | PROG) Each time the PROG mode key is depressed, symbols St , Er and Ho are displayed in the block No. display in sequence and the relevant contents are displayed in the universal display.

With the display of St the operation mode is displayed and with Er the error date is displayed. With the display of Ho , the causes for interruption during an automatic operation process is displayed. This display is only effective during an automatic operation cycle. For the details of the displayed data, see par. 11.2 "Motionpack-34 DISPLAY LIST"

(5) Signal display

Select the parameter status mode. (STATUS PRM) Each time the PRM key is depressed, symbols i , and o are displayed in turn in the block No. display and blink.

The symbol i means an input signal and o an output signal. Write a desired channel No. in the block No. display and depress the ↓ or ↑ key. The display stops blinking and the signal data is displayed in the universal display. The 8-digit display represents 8 input or output signal and 0 and 1 indicate OFF and ON respectively. When the ↓ key is depressed, the next channel No. is selected.

(6) Position error display

Select the position status mode. Display d0 in the block No. display. When ↓ or ↑ key is depressed, the display stops blinking and the data in the error counter is displayed in the universal display. The symbol d1 represents the compensation value for D/A drift.

4.2.1.4 Tape

(1) Tape device

Use a tape device designed for the RS232C interface signal. Only ISO data code (even parity) is usable. For connecting a tape device, refer to par. 5.3.2.

(2) Tape format

(a) Parameter tape format

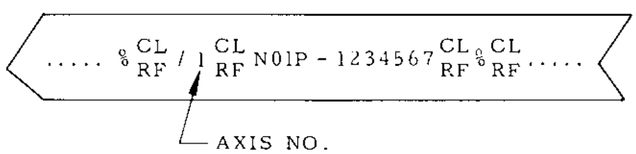


Fig. 4.75 Parameter Tape Example

- Write % before and after the data portion. In reading, the codes after the first % is read as parameter setting data and is stored in the Motionpack controller memory. When the second % is read, the reading process is stopped.
- Write parameter Nos. with an N and two digits and write the setting values with 7 digits with the prefix P.

```
N01   P-1234567   CR
 |        |        |
 |        |        └── END OF BLOCK CODE
 |        └─────────── SET DATA ( = -1234567)
 └──────────────────── PARAMETER NO. ( =01)
```

4.2.1.4 Tape (Cont'd)

The code $\substack{C\\R}$ indicaties the end of each block (end of block code) and should be written at the end of all blocks. Be sure to write the parameter No. in a block before any other data or symbol. If a set value prefixed by P is written before the parameter No., this constitutes a format error.

- The numerals following N or P may be written with the leading zeros omitted.

LEADING ZERO OMITTED

N01P-0000567 $\substack{C\\R}$ ⟶ NIP-567 $\substack{C\\R}$

- In the data portion between tow % signs, only the following codes can be used. Any other codes are regarded as error data.

/	Axis No. designation
N	Parameter No. designation
P	Setting value designation
0-9	Digits
+, −	Signs
$\substack{C\\R}$	End of block
$\substack{L\\F}$	Line feeding
$\substack{S\\P}$	Spacing

(b) Program tape format

··$\substack{CL\\RF}$ / 1 $\substack{CL\\RF}$ N000G01 X 100.F500 I 200 $\substack{CL\\RF}$ M30 $\substack{CL\\RF}$ % $\substack{CL\\RF}$··

Fig. 4. 76 Program Tape Example

- Write % before and after the data portion.
  (same as with parameter tapes)
- Be sure to write $\substack{C\\R}$ at the end of all blocks.
- In the data portion between two % sings, only the following codes are effective. Any other codes are regarded as errors.

/	Axis No. designation
N	Sequence No. designation
G	Function designation

X	Position (absolute) designation
U	Position (incremental) designation
F	Feed speed designation
I	Torque designation
M	Auxiliary function designation
D	Dwell time designation
T	Coordinate No. designation
L	No. of loops designation
P	Jump designation sequence No. designation
0-9	Digits
+ and-	Signs
CR	End of block
LF	Line feeding
SP	Spacing

• G function and subsequent address designations are valid only in the following formats ; any other formats are regarded as errors.

G69
G69P
G67P
G04
G04D
G52X T
G53T
G68L P
G68X P
G01X (I, F) ... Even if I and/or F designation is omitted, a format error does not occur.
G05X (I, F)
G06X (I, F)
G07X (I, F)
G27X (I, F)
G34X (I, F)

• While program tapes are being read, the following errors are detected.
Excess digits after an address code.
Values after an address code exceeding the upper value limit
Sign + or − 〔only effective with a position address code (X and U), in any other case, the sign is regarded as error.〕

(3) Tape operation

Tapes can only be punched, collated and read in the EDIT mode. To operate with a paper tape, Motionpack axis Nos. (parameter54) and transmission baud rates (parameter97) must be set. Axis Nos. are from 1 to 9 and are stores in the Motionpack controller. Transmission baud rates are stored only in the programmer and are erased when the programmer is deenergized.

(a) Punching parameter tape

Depress the [DSPLY] key and the [PRM] key. The block No. display blinks. Depress the [TAPE START] key.

(b) Punching program tape

Deprees the [DSPLY] and [PRM] key. The block No. display blinks. Write the block No. at which the punching is to be started in the block No. display and depress the [↓] or [↑] key. The data of the block are displayed.

Depress the [TAPE START] key. The program is punched from the designated block to M30. Depress the [TAPE START] key again. The next block is punched until M30 appears.

Pressing [TAPE START] key with [ABS INCR] kept pressed, punches out all the data of block numbers 000 through 499. When [TAPE START] key is pressed without [ABS INCR] key punches out the data of block numbers 000 through 399 and omits the M30s, after the first M30.

To stop the tapa punching, press [CAN] key. The data of the block being punched out are entirely punched out and stopped with end mark (%).

(c) Parameter tape collation

Depress the [STATUS] and [PRM] keys. The block No. display blinks, and the input signal is displayed.

Depress the [TAPE START] key. If normal data is not received within 5 seconds after depressing the [TAPE START] key, BAUD ERR is displayed. Discrepancy between the axis No. on the tape and that of parameter 54 is displayed as AXIS ERR.

When data is received in formats different from the N001P000* parameter tape format, FORMAT ERR is displayed. When the read data contains a parity error, PARITY ERR is displayed.

If date is incorrect, CHECK ERR is displayed. When the tape is collated without errors to the end, TAPE END is displayed.

(d) Program tape collation

Depress the $\boxed{\text{STATUS}}$ and $\boxed{\text{PRM}}$ keys. The mode is displayed. Depress the $\boxed{\text{TAPE START}}$ key. If the format of the program tape is wrong, FORMAT ERR is displayed. Other collation methods and results are same with parameter tapes.

(e) Parameter tape reading

Depress the $\boxed{\text{SET}}$ and $\boxed{\text{PRM}}$ keys. The block No. display blinks. Depress the $\boxed{\text{TAPE START}}$ key. If normal data are not received within 5 seconds after depressing the key, BAUD ERR is displayed.

When the axis No. on the tape is different from that of parameter 54, AXIS ERR is displayed. When the parameter tape format is incorrect, FORMAT ERR is displayed.

When the axis No. of parameter 54 is 1 through 9, it is compared with that on the tape. If these axis Nos. are different, the tape cannot be read.

When parameter 54 is 0, axis No. collation is not made.

4

(f) Program tape reading

Depress the $\boxed{\text{SET}}$ and $\boxed{\text{PROG}}$ keys. The block No. display blinks. Depress the $\boxed{\text{TAPE START}}$ key. If the program tape format is incorrect, FORMAT ERR is displayed. Other processes are same with parameter tapes.

(4) Tape-related errors

While tapes are read and collated, the following errors are checked.

- No data after 5 seconds from tape start BAUD ERR
- Parity error PARITY ERR
- Discrepancy of axis Nos. AXIS ERR
- Incorrect tape format. FORMAT ERR

Axis Nos. (parameter 54) are 1 through 9. When the axis No. for parameter 54 is 0, no check is made for axis Nos.

4.3 Servopack (CACR-SR□□TZ6S□)

4.3.1 Type

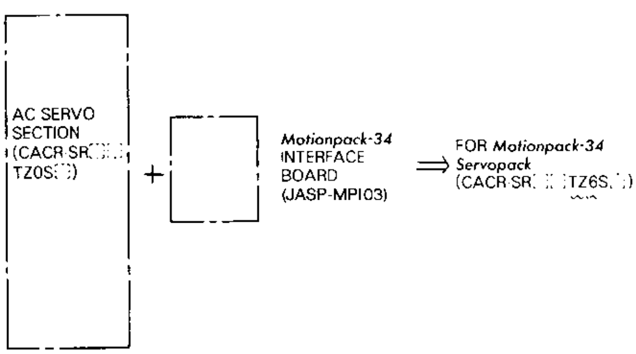
CACR-SR□□TZ6SM

- CACR: FOR AC SERVO Servopack
- SR : FOR SPEED CONTROL
- □□: AC MECHANICAL FEED SPECIFICATION (Motor output, see table)
- T: AC MECHANICAL FEED SPECIFICATION
- Z: DESIGN ORDER
  - Z : Corresponding to Absolute Value Encoder
- 6: AC MECANICAL CORRESPONDING FORM
  - 0 : No Interface
  - 6 : Motionpack-34 With Interface (JASP- MPI03)
- S: DETECTOR SPECIFICATION
  - S : 8192 pulse/rev
- M: APPLICABLE
  - M : M Series
  - F : F Series
  - S : S Series

Motor output

M Series	03	0.3 kW
	06	0.6 kW
	09	0.9 kW
	12	1.2 kW
	20	2.0 kW
	30	3.0 kW
	44	4.4 kW
	60	6.0 kW
F Series	03	0.2 kW, 0.3 kW
	05	0.5 kW
	09	0.9 kW
	12	1.3 kW
	20	2.0 kW
	30	3.0 kW
	44	4.4 kW
S Series	03*	0.2 kW
	03	0.3 kW
	05	0.5 kW
	09	0.8 kW
	12	1.5 kW
	30	3.0 kW

* Servopack type:
CACR-SR03TZ6SS-Y41



4.3.2 Block Diagram

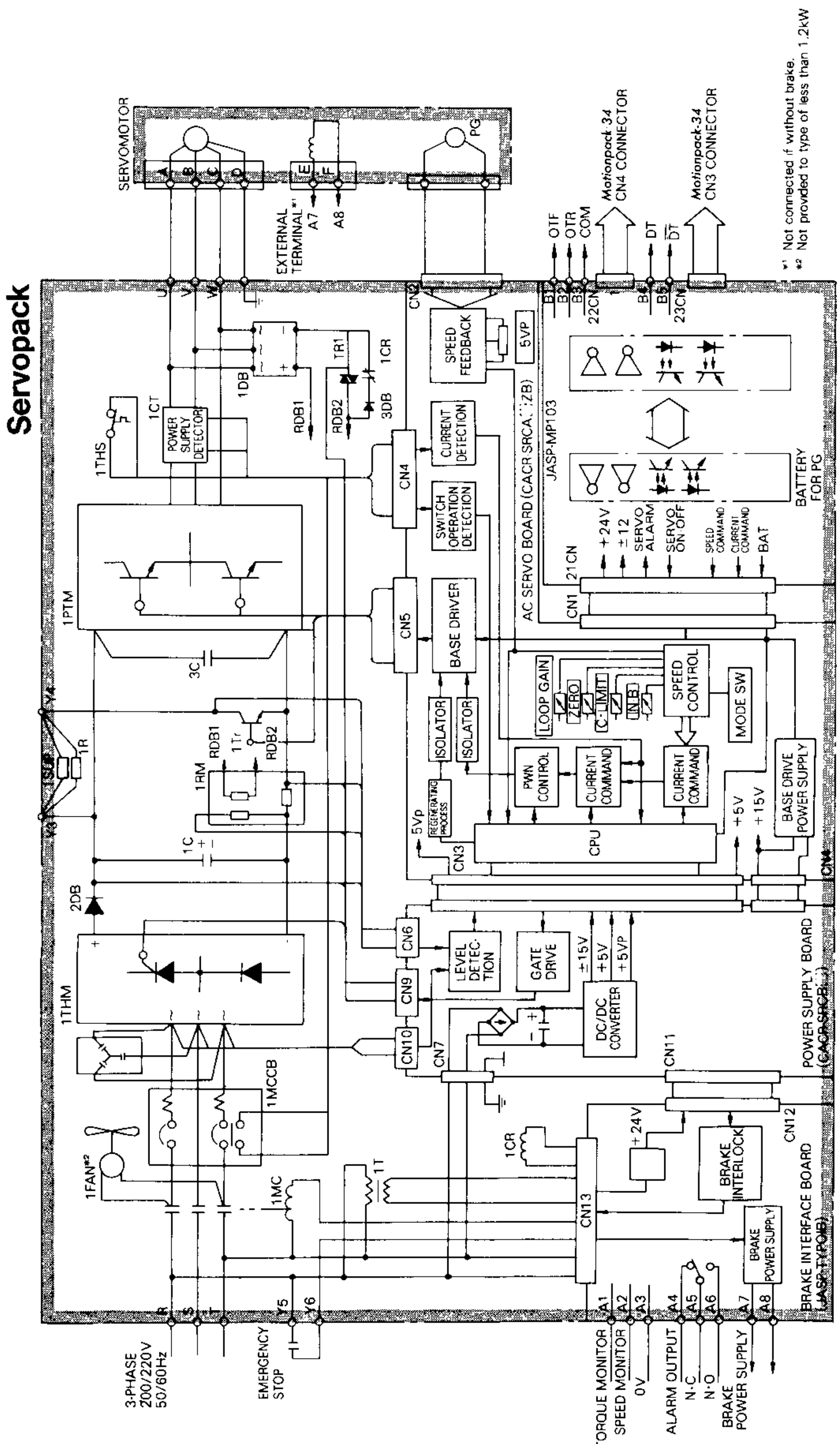


Fig. 4.77 Block Diagram of Type Servopack CACR-SR□□TZ6

4.3.3 Characteristics, Function

4.3.3.1 Servopack AC servo section (CACR-SR□□TZ0S□)

Servopack AC servo section is provided with general-use AC Servopack (CACR-SR□□ Series) added with brake function, etc.

Table 4.27 shows a comparison between CACR-SR□□TZ0S□ and AC Servopack.

Functions and characteristics of the general-use AC Servopack are still retained. For details, refer to TSE-S800-5.1.

Table 4. 27 Comparison with General-use AC Servopack

	Item	CACR-SR□□TZ0S□	General-use CACR-SR□□BZ1S□
1	Contactor to open/close main circuit	Built-in Closed by "AMP ON" signal ON.	Provided externally
2	Power supply for holding brake	Built-in Released by "AMP ON" signal ON.	Provided externally
3	Contact DB circuit	Provided Released by "AMP ON" signal ON.	Not provided
4	Non-contact DB circuit	Provided Released by "SERVO ON" signal ON.	Provided Released by "SERVO ON" signal ON.
5	Operation signal DC24V power supply	Built-in 50m A max.	Not provided
6	Motor load detecting signal	Motor load detecting function provided. Displayed simultaneously by code "7" of the batch alarm display.	Single output signal is output added to that on the left.
7	MCCB trip signal output	Detects MCCB trip and displays alarm code "2".	Single output signal is output added to that on the left.
8	Alarm reset	Alarm reset PB Alarm resrt input display	Alarm reset PB

(1) Error detection function and display

Table 4. 28 Error Detection Function and Display

Error Detection Function	Numerical Display	Description
Overcurrent Detection	1.	Detects when the main circuit has overcurrent. (Detects overcurrent 2 times more than momentary max. current.)
Circuit Protect Trip Detection	2.	Detects circuit protector to trip.
Regeneration Error Detection	3.	Detects when regeneration process circuit is disabled.
Overvoltage Detection	4.	Detects when overvoltage is abnormally high (Detects when it gets approx. 420 V.)
Overspeed Detection	5.	Detects when excessive speed command voltage is input and motor revolution exceeds the following approx. rpm : M series:2400 r/min, F series : 3000 r/min, S series : 3600 r/min
Short Voltage Detection	6.	Detects when main circuit DC voltage is less than approx. 150 V
Overload Detection	7.	Detects when overload states of the motor and Servopack. (For detecting characteristics, refer to Fig. 4. 78.)
Heat Sink Over-heat Detection	A.	Detects when the heat sink in Servopack is abnormal heated. (Approx. 85℃ or more)
A/D Error	b.	Detects when AC servo board element is not normal.
Defective Phase Detection	F.	Detects when one of the 3-phase power supplies is defective. (Detects only when the power is turned on.)
Runaway Prevention	C.	Detects beforehand to prevent motor runaway or wrong PG signal connection
CPU Error		(Not lit) Detects that CPU is not normal
Absolute Error Detection	0.	Detects rpm serial data error closed to the absolute encoder.
Position Error Detection	8.	Detects the counter error operation in the Servopack.

Overload detection (OL) level

Fig. 4.78 shows the overload detection level set at 100 % motor rated current.

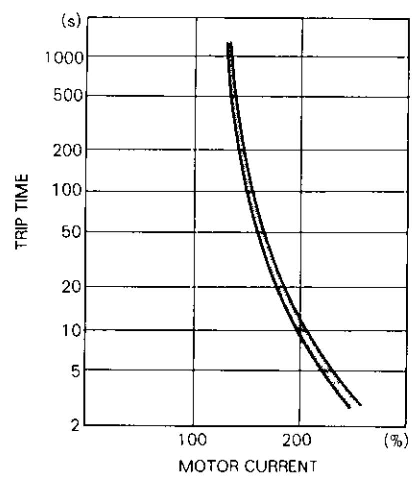


Fig. 4. 78 Overload Characteristics

4.3.3.1 Servopack AC servo section (Cont'd)

(2) Status display

① On servo board

Table 4. 29

Display Form	Display	Description
LED (Green)	P	Lights when control power (to Servopack) is turned on
	MP	Lights when the main circuit power supply (AMP ON command is on) is turned on.
	IN	Lights when the speed command voltage is approx. | ±10mv | or more.
8-segment LED (Red)	.	Base cutoff is released (showing the motor conducting.)
	— .	Base cutoff is functioning (showing the motor conducting is stopped)

② Brake control board

Table 4. 30 LED Name

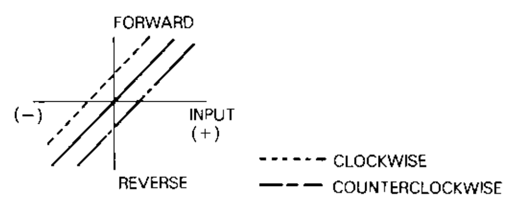
LED Name	Description
P	Lights when the power is turned on.
BR	Lights when motor brake release signal is turned on.

(3) AC servo volume readjustment

Since AC servo volume board was adjusted at the factory prior to shipment, and the standard setting is performed normally, rearrangement by the user is not needed.

5 VP LOOP GAIN ZERO CUR can be adjusted as required from drift arrangement or other machinery. IN-B is not used: set it at the minimum (fully counter-clockwise). (Refer to Fig 4.79) Perform arrangement according to Table 4.31

Table 4. 31 AC Servo Board Volume Adjustment

Volume Name	VR3 ZERO (*)	VR6 LOOP-GAIN
Function	For ZERO drift adjustment	For speed loop gain adjustment
Adjusting Method	Adjust the drift so that the motor may not rotate when the speed command is OV. The motor rpm cannot be set exactly at 0 because of the influence of element drift provided to Servopack. Adjust in order to minimize the drift capacity	Adjust the strength of the motor shaft rigidity. By turning clockwise, the loop gain rises and the shaft rigidity increases. To prevent hunting suitable adjustment is required for the machine.
Characteristics Changed by Adjustment		Turning clockwise markes the loop gain rise and the shaft rigidity increases.

Volume Name	VR 21 5 VP	VR 5 CUR
Function	For PG power supply voltage arrangement	For maximum current arrangement
Adjusting Method	If the wiring to PG is too long it may cause lower voltage (runaway prevention protection or the motor hunting, etc.), increase the voltage for use.	Turning CUR VR fully clockwise provides maximum current. If maximum torque must be decreased the machine side, turn it counter-clockwise.
Characteristics Changed by Adjustment	Turning clockwise increases the voltage. (Preset at 5.5 V when shipped.)	Turning counterclockwise decreases the maximum torque. (Preset fully clockwise when shipped.)

*When Motionpack-34 has performed positioning control, it automatically compensates the drift within ± 511 pulses.

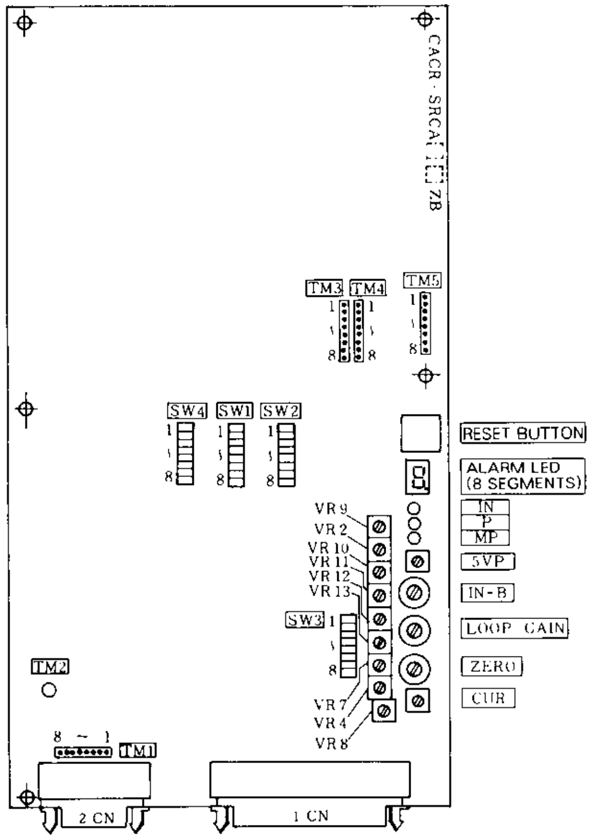


Fig. 4. 79 Servo Board Component Arrangement

① Reset button ········ Used for releasing alarm

② [• Alarm • Status] Display LED (Red) ······ Displays the hexadicimal digit according to the content of alarms. (For details, see Table 4.28.)

③ Status display LED ······ IN ······ Lights when the speed command voltage is approx. | ± 10 mV |.
P ······ Lights when the control power is turned on.
MP ······ Lights when the main circuit power is turned on.

④ Adjusting Voltage ······ IN-B is not used; Turn the volume fully counterclockwise. If necessary the other four can be adjusted. (See Table 4. 31.)

4.3.3.1 Servopack AC servo section (Cont'd)

(4) Setting number of PG pulse

ABS method PG has 8192 pulses/rev and it can be multiplied by 4 by Motionpack-34.

Accordingly, if PG signal is input directly to Motionpack-34, it may exceed the speed (600kpps) which can be processed. It is necessary to take detection unit (discrimination) into consideration and to divide it in the Servopack.

(Example) 10 mm/rev lead screw direct coupling, discrimination 1 μm/p :

Set dividing ratio from 8192 pulses/rev to 2500 pulses/rev with SW2 on the Servopack printed circuit board. At this time, pulse processing speed when rated revolution is 1000r/min (M series) is ;

$$2500\text{pulses/rev} \times \frac{1000\text{r/min}}{60} = 41.7\text{kpps}$$

As multiplied by 4 by the Motionpack-34,

$$\left.\begin{aligned} Pr50 &= 2500 \times 4 = 10000 \\ Pr51 &= \frac{10\text{mm/rev}}{0.001} = 10000 \end{aligned}\right\} \rightarrow \begin{aligned} Pr50 &= 1 \\ Pr50 &= 1 \end{aligned}$$

(5) Setting switch

There are four switches $\boxed{SW1}$, $\boxed{SW2}$, $\boxed{SW3}$, $\boxed{SW4}$,on the board with the following function ;

Table 4. 32

Switch Name	Function	User Setting
$\boxed{SW1}$	Sets motor function. Sets Servopack function.	(M) Possible 1 2 3 4 5 6 7 8 ●○○●○●○○ ●○○●○●○○ (F) 1 2 3 4 5 6 7 8 ○○○●○●○○ ○○○●○●○○ (S) 1 2 3 4 5 6 7 8 ●●○●○●○○ ●●○●○●○○
$\boxed{SW2}$	Sets number of output pulses.	Possible (Refer to Table 4.33.)
$\boxed{SW3}$	Sets speed loop conditions.	Possible (Refer to the figure below.) (However, it can be generally used with the setting at shipping.)
$\boxed{SW4}$	Sets motor characteristics and Servopack function.	Impossible (Since Servopack function is set at the same time the motor torque is set at the optimum value, do not change the setting.)

SW2 Function

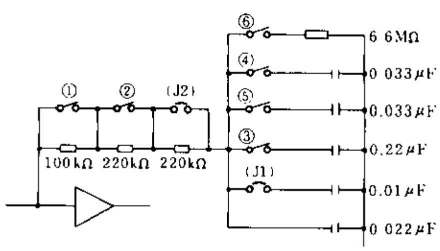
Table 4.33 Setting Divider

Setting 1	2	3	4	5	6	Output Pulse after Dividing (per motor rotation)	Setting 1	2	3	4	5	6	Output Pulse after Dividing (per motor rotation)
○	○	○	○	○	○	6000	○	○	○	○	○		60
	○	○	○	○	○	5000		○	○	○	○		50
○		○	○	○	○	4000	○		○	○	○		40
		○	○	○	○	3000			○	○	○		30
○	○		○	○	○	2500	○	○		○	○		25
	○		○	○	○	2400		○		○	○		20
○			○	○	○	2000	○			○	○		8192
			○	○	○	1600				○	○		4096
○	○	○		○	○	1500	○	○	○		○		2048
	○	○		○	○	1250		○	○		○		1024
○		○		○	○	1200	○		○		○		512
		○		○	○	1000			○		○		256
○	○			○	○	800	○	○			○		128
	○			○	○	750		○			○		64
○				○	○	625	○				○		3600
				○	○	600					○		2160
○	○	○	○		○	500	○	○	○	○			1800
	○	○	○		○	480		○	○	○			1440
○		○	○		○	400	○		○	○			1080
		○	○		○	375			○	○			720
○	○		○		○	320	○	○		○			360
	○		○		○	300		○		○			180
○			○		○	250	○			○			90
			○		○	240				○			45
○	○	○			○	200							
	○	○			○	160							
○		○			○	150							
		○			○	125							
○	○				○	120							
	○				○	100							
○					○	80							
					○	75							

☐ : Pre-set at the factory.

SW3 Function

① Setting constant at PI (① to ⑥)



② Setting f/V filter (⑦)

⑦	Time Constant
Short	1.2ms
Open	0.1ms

③ Setting mode switch (⑧)

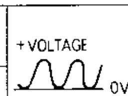
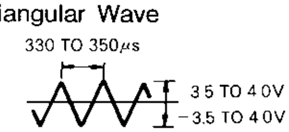
⑧	Mode Switch
Short	Not provided
Open	Provided

(6) Check terminal list

Table 4.34 shows the check terminal list for M series Servopack.

For F or S series, refer to the materials for each.

Table 4. 34 Check Terminal List

Equipment Sign		Signal Name	Description			
TM1	1	PA	Absolute encoder input signal	A-phase pulse input	PA and PB are 2-phase pulses with 90° phase difference. PC occurs once per rotation and is synchronous with PA. Waveform at Motor Forward Rotation. 	
	2	*PA		A-phase reverse rotation input		
	3	PB		B-phase pulse input		
	4	*PB		B-phase reverse rotation input		
	5	PC		C-phase pulse input		
	6	*PC		C-phase reverse rotation input		
	7	–	Not used			
	8	5Vp	+5 V from absolute encoder supplied power			
TM2		0Vp	0V of absolute encoder supplied power (signal common terminal)			
TM3	1	IN-A	For monitoring speed command input (connectors 1 CN ⑫ and ⑬)			
	2	IN-B	For monitoring speed command auxiliary input (connectors 1CN ⑭ and ⑮)			
	3	V_{TG}	For motor torque DC ±4.0V/1000r/min			
	4	T-Mon.	For motor torque DC ±3.0V/100%			
	5	T-Ref	Torque command DC ±2.0 to ±3.0V/100%			
	6	U-sin	For monitoring U-phase standard sine waveform	 · Frewuency varies according to r/min · Amplitude varies according to the torque		
	7	V-sin	For monitoring V-phase standard sine waveform			
	8	SG	Signal 0V			
TM4	1	IU	For monitoring U-phase current	Type	03 / 06 / 09 / 12 / 20 / 30 / 44 / 60	
	2	IV	For monitoring V-phase current	Monitor voltage (V/A)	0.4 / 0.20 / 0.16 / 0.08 (12, 20) / 0.04 (30, 44, 60)	
	3					Triangular Wave 
	4	AU	For monitoring U-phase current amplitude output			
	5	AV	For monitoring V-phase current amplitude output			
	6	AW	For monitoring W-phase current amplitude output			
	7	OSC2	Carrier frequency (triangular wave)			
	8	SG	Signal 0V			

Notes:

1. Check terminals can be observes by oscilloscope.
2. Each waveform of TM3 ans TM4 is observed with a standard of TM3 ⑧ or TM4 ⑧ (signal 0V). 〔TM2 (0Vp), M3 ⑧ and TM4 ⑧ (signal 0V) are impedance connected.〕
3. When observing, do not let adjoining check terminals contact each other. If they make contact, inner element may be destroyed.
4. Do not use TM5 for observation since it is a check terminal only at shipping.

(7) Setting at the time of delivery

(a) M Series

Servopack Type CACR-	SW1 Motor Type	SW2 Output Pulse Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
SR 03 TZ 6 SM to SR 60 TZ 6 SM	1 2 3 4 5 6 7 8 ○ ○ ○ ● ○ ● ○ ○ ○ ○ ○ ● ○ ● ○ ○	5000 pulses/rev 1 2 3 4 5 6 7* 8* ○ ● ● ● ● ● ● ● ○ ● ● ● ● ● ● ●	1 2 3 4 5 6 7 8 ● ○ ○ ● ○ ○ ○ ○ ● ○ ○ ● ○ ○ ○ ○	1 2 3 4 5 6 7 8* ○ ● ● ○ ● ○ ○ ● ○ ● ● ○ ● ○ ○ ●

(b) F Series

Servopack Type CACR-	SW1 Motor Type	SW2 Output Pulse Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
SR 03 TZ 6SF to SR 44 TZ 6SF	1 2 3 4 5 6 7 8 ○ ○ ○ ● ○ ● ○ ○ ○ ○ ○ ● ○ ● ○ ○	5000 pulses/rev 1 2 3 4 5 6 7* 8* ○ ● ● ● ● ● ● ● ○ ● ● ● ● ● ● ●	1 2 3 4 5 6 7 8 ● ○ ○ ● ○ ○ ○ ○ ● ○ ○ ● ○ ○ ○ ○	1 2 3 4 5 6 7 8* ○ ● ● ● ● ○ ○ ● ○ ● ● ● ● ○ ○ ●

(c) S Series

Servopack Type CACR-	SW1 Motor Type	SW2 Output Pulse Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
SR03TZ 6 SS(-Y41) ~ SR 30 TZ 6 SS	1 2 3 4 5 6 7 8 ● ● ○ ● ○ ● ○ ○ ● ● ○ ● ○ ● ○ ○	6000 pulses/rev 1 2 3 4 5 6 7* 8* ○ ● ● ● ● ● ● ● ○ ● ● ● ● ● ● ●	SR 10 BZ, SR 15 BZ 1 2 3 4 5 6 7 8 ○ ● ● ○ ○ ○ ○ ○ ○ ● ● ○ ○ ○ ○ ○ SR03BZ, SR 05 BZ, SR 30 BZ 1 2 3 4 5 6 7 8 ○ ● ○ ● ○ ○ ○ ○ ○ ● ○ ● ○ ○ ○ ○	1 2 3 4 5 6 7 8* ○ ● ● ○ ● ○ ○ ● ○ ● ● ○ ● ○ ○ ●

*Spare short-circuit pin.

4.3.3.2 Motionpack-34 interface board

(1) PG signal junction

After dividing PG signal provided in the Servomoter inside the Servopack ; The interface board outputs for Motionpack-34 from connector 22CN. PG signal is equivalent output to A-, B-, C-phase line driver (SN 75174).

(2) Overtravel detection limit switch signal process

The interface board read-in the overtravel detection limit swich (OT-LS) provided with the machine. If stops feed in the direction of which either forward (OTF) or reverse (OTR) OT-LS is opened. However, feed in the returning direction is still possible.

(3) Current limit detection signal

If the Servopack current is limited, DT/DT contact will be closed. Contact output can be set at 0.1 to 4 seconds delay time by 1VR.

(4) ABS-PG related data

ABS-PG battery is provided to the interface board. Battery voltage can be detected and PGSEN signal can be transmitted.

For Table 4.35

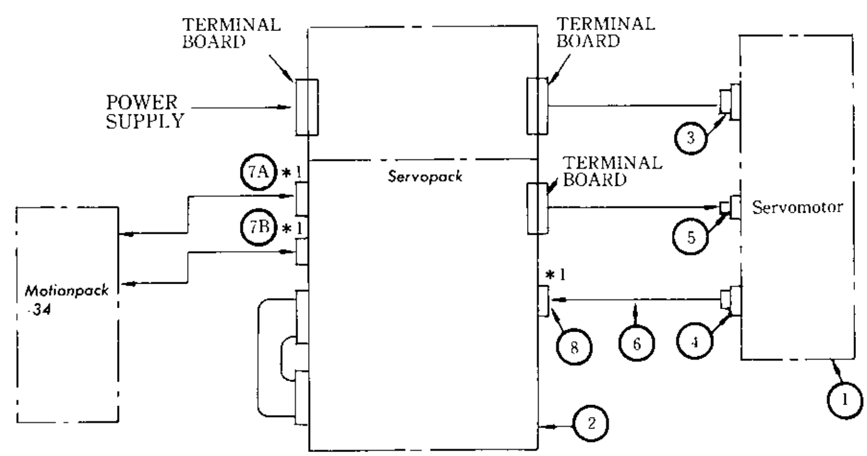


Table 4.35 Connector List (Example of M Series)

Output kW	Supplied by Yaskawa		Not Supplied by Yaskawa			Supplied Yaskawa
	Servomotor USAMED-*3	Servopack CACR-	Motor plug	Plug	Brake plug	PG Cable*4
0.3	03MS2S	SR03TZ6SM	Type*4 D…MS3106A18-10S (D190) N…JA06A-18-10S-J1	Type*4 D…MS3106A20-29S (D190) N…JA06A-20-29S-J1	Type*4 D…MS3106A14S-7S (D190) N…JA06A-14S-7S-J1	Use Yaskawa PG cables or equivalent.
	03MS2T					
	03MS2SD					
	03MS2TD					
0.6	06MS2S	SR06TZ6SM				
	06MS2T					
	06MS2SD					
	06MS2TD					
0.9	09MS2S	SR09TZ6SM				
	09MS2T					
	09MS2SD					
	09MS2TD					
1.2	12MS2S	SR12TZ6SM	Type*4 D…MS3106A22-22S (D190) N…JA06A-22-22S-J1			
	12MS2T					
	12MS2SD					
	12MS2TD					
2.0	20MS2S	SR20TZ6SM				
	20MS2T					
	20MS2SD					
	20MS2TD					
3.0	30MS2S	SR30TZ6SM				
	30MS2T					
	30MS2SD					
	30MS2TD					
4.4	44MS2S	SR44TZ6SM	Type*4 D…MS3106A32-17S (D190) N…JA06A-17S-J1			
	44MS2T					
	44MS2SD					
	44MS2TD					
6.0*5	60MS2S	SR60TZ6SM	Contact your Yaskawa representative.			
	60MS2T					
	60MS2SD					
	60MS2TD					

* 1 Servopack is provided with receptacles 7A, 7B, 8.

* 2 Plug type at cable side.

* 3 Motor type :

□□MS2S – Straight shaft, without brake; □□MS2T – With keyway

□□MS2SD – Straight shaft, with brake; □□MS2TD – With keyway, brake

Oil seal is standard.

D – Brake with manual release mechanism.

B/E – Brake without manual release mechanism.

* 4 Plug type :

D – DAIICHI DENSHI KOGYO CO., LTD.

N – JAPAN AVIATION ELECTRONICS INDUSTRY, LTD.

Straight plug is standard.

* 5 Type of 6kW motor : USAMKD-60MS 2□

4.4 AC Servomotor

4.4.1 Type

USAMED-06MS1

- ·AC SERVOMOTOR
- ·SERIES TITLE

  AM : M Series
  AF : F Series
  AS : S Series

  ENCLOSURE

  E : Totally-enclosed, Self-cooled Type
  K : Totally-enclosed, Externally Fan-cooled Type

- ·MAGNET TYPE

  D : Ferrite Magnet
  M : Rare Earth Magnet

- ·MOTOR OUTPUT
- ·DESIGN REVISION ORDER (A, B, C·········)

  M : M Series
  F : F Series
  S : S Series

- ·WITH ABSOLUTE ENCODER
- ·SHAFT TYPE

  1 : Taper Shaft
  2 : Straight Shaft

- ·DRIVE END SPECIFICATION

  Not Provide : Standard
  O : Standard (When Opposite Drive End is with Brake.)
  K : With Keyway
  S : With Oil Seal
  T : With Keyway, Oil Seal

- ·OPPOSITE DRIVE END SPECIFICATIONS

  Not Provided : Standard
  B : With Brake (S, C Series, 44M and 66M of M Series)
  E : With Brake (03 to 30M of M Series, F Series)

∗MOTOR OUTPUT

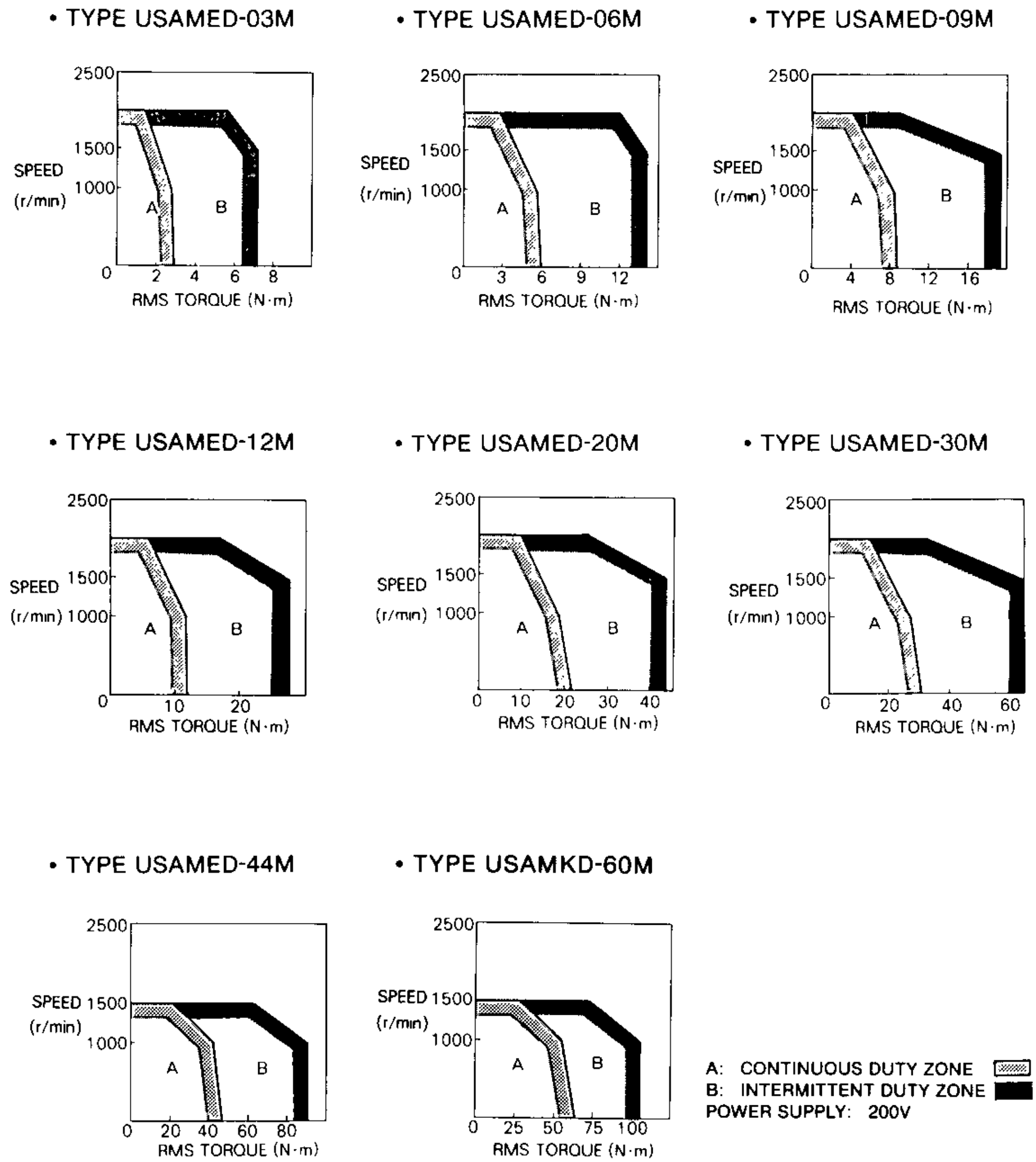
	Motor Type	kW
M Series	USAMED-03MS1	0.3
	USAMED-06MS1	0.6
	USAMED-09MS2	0.9
	USAMED-12MS2	1.2
	USAMED-20MS2	2
	USAMED-30MS2	3
	USAMED-44MS2	4.4
	USAMKD-60MS2	6
F Series	USAFED-02FS1, -03FS1	0.15/0.3
	USAFED-05FS1	0.45
	USAFED-09FS1	0.85
	USAFED-13FS2	1.3
	USAFED-20FS2	1.8
	USAFED-30FS2	2.9
	USAFED-44FS2	4.4
S Series	USASEM-02AS2	0.154
	USASEM-03AS2	0.308
	USASEM-05AS2	0.462
	USASEM-08AS1	0.771
	USASEM-15AS1	1.54
	USASEM-30AS1	3.08

4.4.2 Characteristics and Functions

(1) Torque-speed characteristics

(a) M series motor

Fig. 4.80 shwos torque-speed characteristics of M series motor. The maximum speed at combination with Motionpack-34 is 1200 r/min.



Note : They show TYP. value when power suprly is 200 VAC.

Fig. 4.80 Torque-speed Characteristics of M Series Motor

(b) F series motor

Fig. 4.81 shows torque-speed characteristics of F series motor. The maximum speed at combination with Motionpack-34 is 1800r/min.

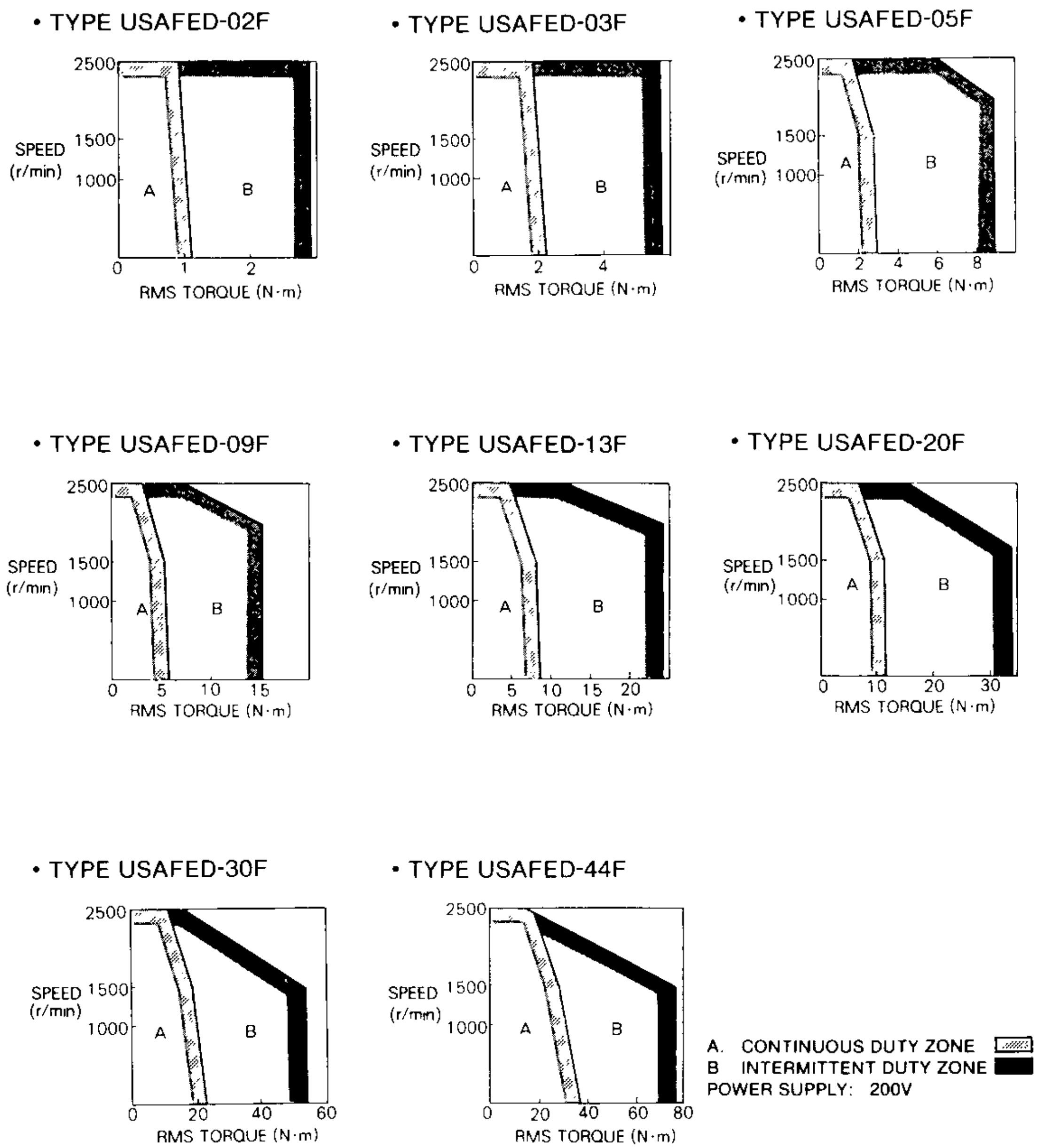


Fig. 4.81 Torque-speed Characteristics of F Series Motor

(c) S series motor

Fig. 4.82 shows torque-speed characteristics (Motor performance) of S series motors. The maximum speed in combination with Motionpack-34 is 3600r/min.
PG output must be less than 600kpps (at × 4).

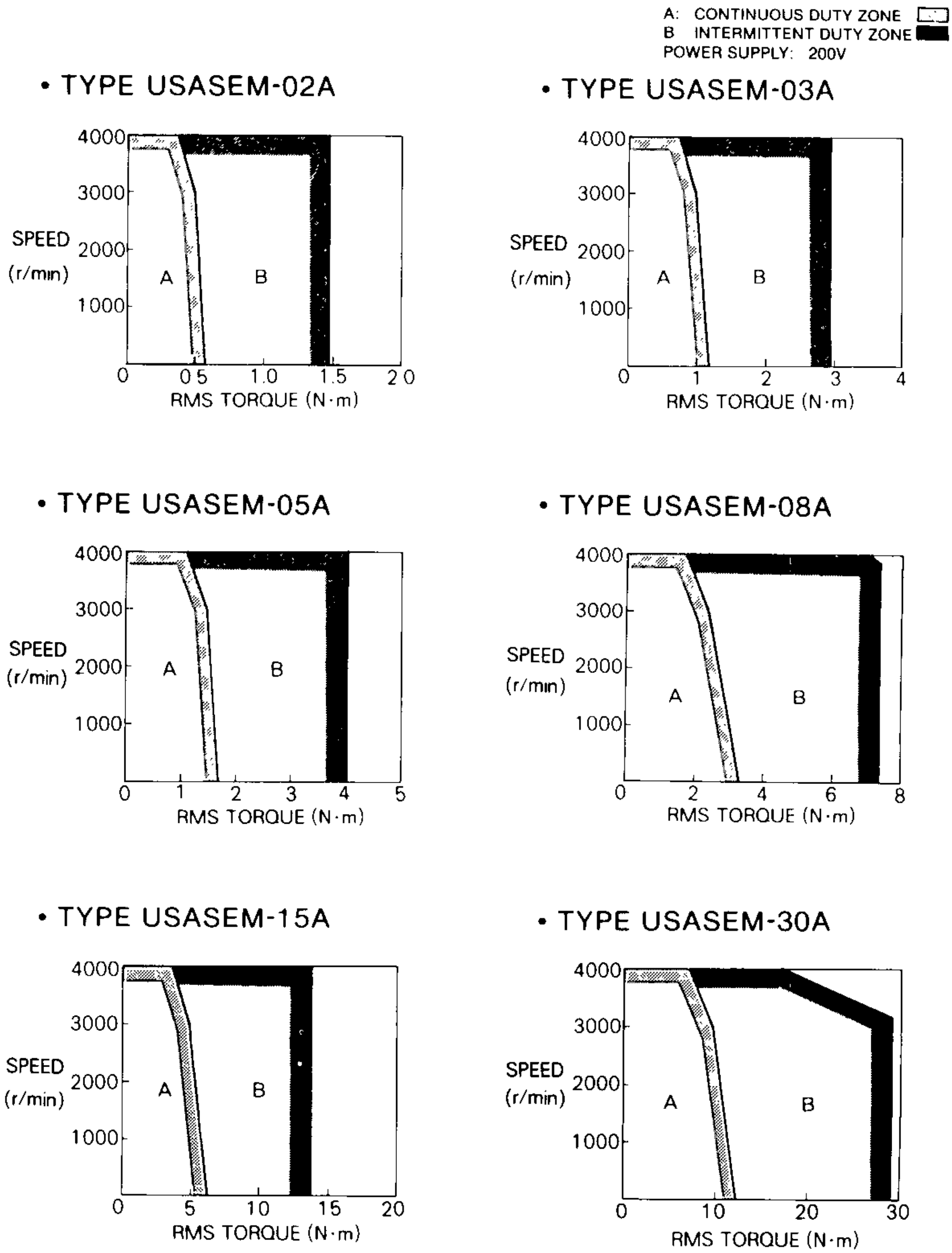


Fig. 4.82 Torque-speed Characteristics of S Series Motor

4.4.2 Characteristics and Functions (Cont'd)

(2) Allowable load inertia J_L ($GD_L^2/4$)

Motor shaft conversion allowable load inertia J_L can be up to 5 times of applicable Servomotor inertia J_M. If the J_L exceeds this value, alarm will occur at deceleration.

In this case ;
- Lower the current limit.
- Lower the max. r/min in use.

For further details, contact your YASKAWA representative.

(3) Motor mechanical characteristics

① Machine strength

AC Servomotor can bear momentary maximum torque 300 % of rated motor on its output shaft.

② Allowable radial load, allowable thrust load Table 4.36 shows output shaft allowable load of AC Servomotor. Do not give excessive load to * since the motor will not rotate.

Table 4.36 Allowable Radial Load and Thrust Load

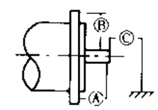
Motor Type		Allowable Radial Load N	Allowable Thrust Load N
M Series	USAMED-03MS1	490	98
	USAMED-06MS1	490	98
	USAMED-09MS2	686	343
	USAMED-12MS2	1470	490
	USAMED-20MS2	1470	490
	USAMED-30MS2	1470	490
	USAMED-44MS2	1764	588
	USAMKD-60MS2	1764	588
F Series	USAFED-02FS1	147	49 *
	USAFED-03FS1	147	49 *
	USAFED-05FS1	490	98 *
	USAFED-09FS1	490	98 *
	USAFED-13FS2	686	343
	USAFED-20FS2	1470	490
	USAFED-30FS2	1470	490
	USAFED-44FS2	1470	490
S Series	USASEM-02AS2	78.4	39.2
	USASEM-03AS2	245	98
	USASEM-05AS2	245	98
	USASEM-08AS1	392	147
	USASEM-15AS1	490	147
	USASEM-30AS1	686	196

Note : Allowable radial load shows the maximum load which can be added to output shaft end.

③ Workmanship accuracy

Table 4.37 shows accuracy of AC Servomotor output shaft and its periphery.

Table 4. 37 Mechanical Specifications in mm

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

*T.I.R.(Total Indicator Reading)
†Accuracy for motor types USAMED-44 MA2 and USAMKD-60MA2.

④ Impact resistance

When mounted horizontally and exposed to vertical shock impulses, the motor can withstand up to two impacts with impact acceleration of 10G (Fig. 4.83). A precision detector is mounted on the opposite drive end AC servomotor. Care should be taken to protect the shaft from impacts that could damage the detector.

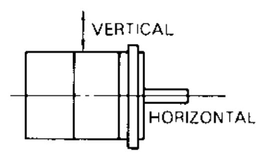


Fig. 4. 83 Impact Resistance

⑤ Vibration resistance

When mounted horizontally, the motor can withstand vibration (vertical, lateral, axial) of 2. 5 G (Fig. 4.84)

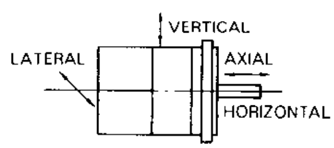


Fig. 4.84 Vibration Resistance

⑥ Vibration calss

Vibration of the motor runnig at rated speed is 15μm or below (Fig. 85)

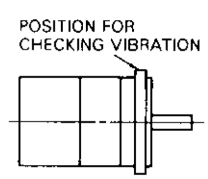


Fig. 4.85 Vibration Checking

4.4.3 Direction of Rotation

AC servomotors rotate counterclockwise viewed from drive end when motor and detector leads are connected as shown below.

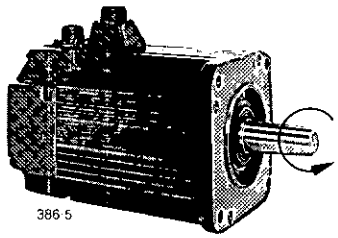
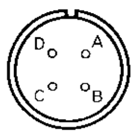


Fig. 4.86 AC Servomotor

(1) Connector Specifications for Standard Servomotors

(a) Motor receptacle

- M,F Series



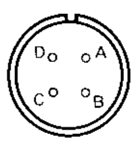
A	Phase U
B	Phase V
C	Phase W
D	Ground

- S Series

(Type USASEM-02A)

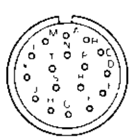
Color of Lead	Applicable
Red	Phase U
White	Phase V
Blue	Phase W
Green	Frame ground

(Type USASEM-03A to 30A)



A	Phase U
B	Phase V
C	Phase W
D	Frame ground

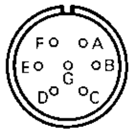
(b) Detector receptacle



A	Channel A output	K	–
B	Channel $\overline{A}$ output	L	–
C	Channel B output	M	–
D	Channel $\overline{B}$ output	N	–
E	Channel Z output	P	–
F	Channel $\overline{Z}$ output	R	For reset
G	0V	S	0V (battery)
H	+5VDC	T	3V (battery)
J	Frame ground	–	–

(2) Connector Specifications for Servomotor with Brake

- M,F Series



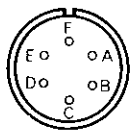
A	Phase U	E	Brake terminal
B	Phase V	F	
C	Phase W	G	–
D	Ground	—	–

- S Series

(Type USASEM-02A)

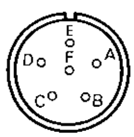
Color of Lead	Applicable	Color of Lead	Applicable
Red	Phase U	Black	Brake
White	Phase V	Black	
Blue	Phase W	Green	Frame Ground

(Type USASEM-03A, −05A)



A	Phase U
B	Phase V
C	Phase W
D	Brake terminal
E	
F	Frame ground

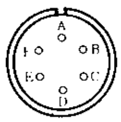
(Type USASEM-08A to 30A)



A	Phase U
B	Phase V
C	Phase W
D	Brake terminal
E	
F	Frame ground

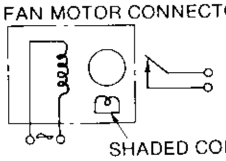
(3) Fan Terminal Connection

(for only type USAMKD-60MA2)



A	Fan motor
B	
C	–
D	Alarm termiral
E	
F	–

FAN MOTOR CONNECTOR



ALARM CONTACT OFF AT FAN NORMAL OPERATION
ON AT 1800 ±200r/min OR LESS
ON FOR APPROX 3 SEC. AT START

CONTACT CAPACITY: RESISTIVE LOAD MAX 110V, 0.3A

POWER SUPPLY SINGLE PHASE
200/200/200V, 50/60/60Hz

Fig.4.87 Fan Terminal Connection

The cooling fan is not of dripproof protected construction.

If the alarm for cooling fan occurs, perform the following:

- The control circuit (provided by user) should be formed to stop the main motor and fan motor if the alarm for cooling fan occurs. (Contact is ON when alarm occurs.)

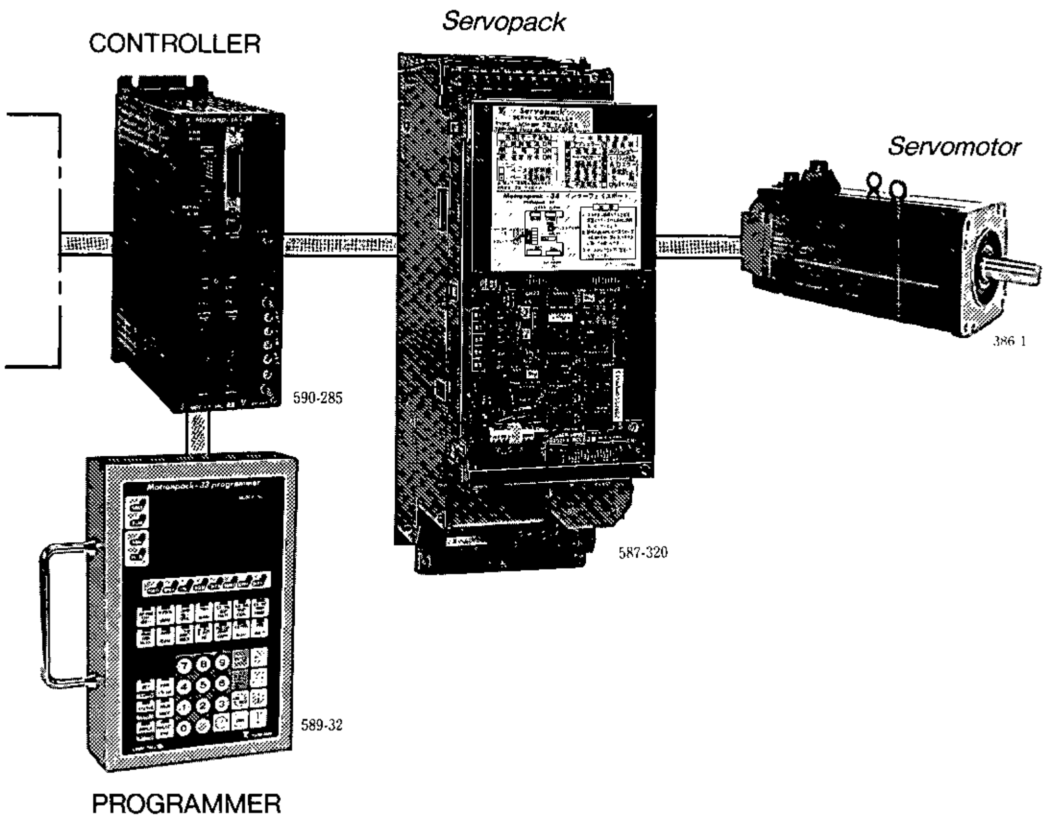
  The action from alarm signal output to nonconducting state should be executed within five minutes, because the self-cooled protection of main motor lasts for five minutes.

- When the cooling fan is started, error detection signal comes ON for three seconds. Therefore, integrate delay relay in the circuit.

5. CONNECTION (1)

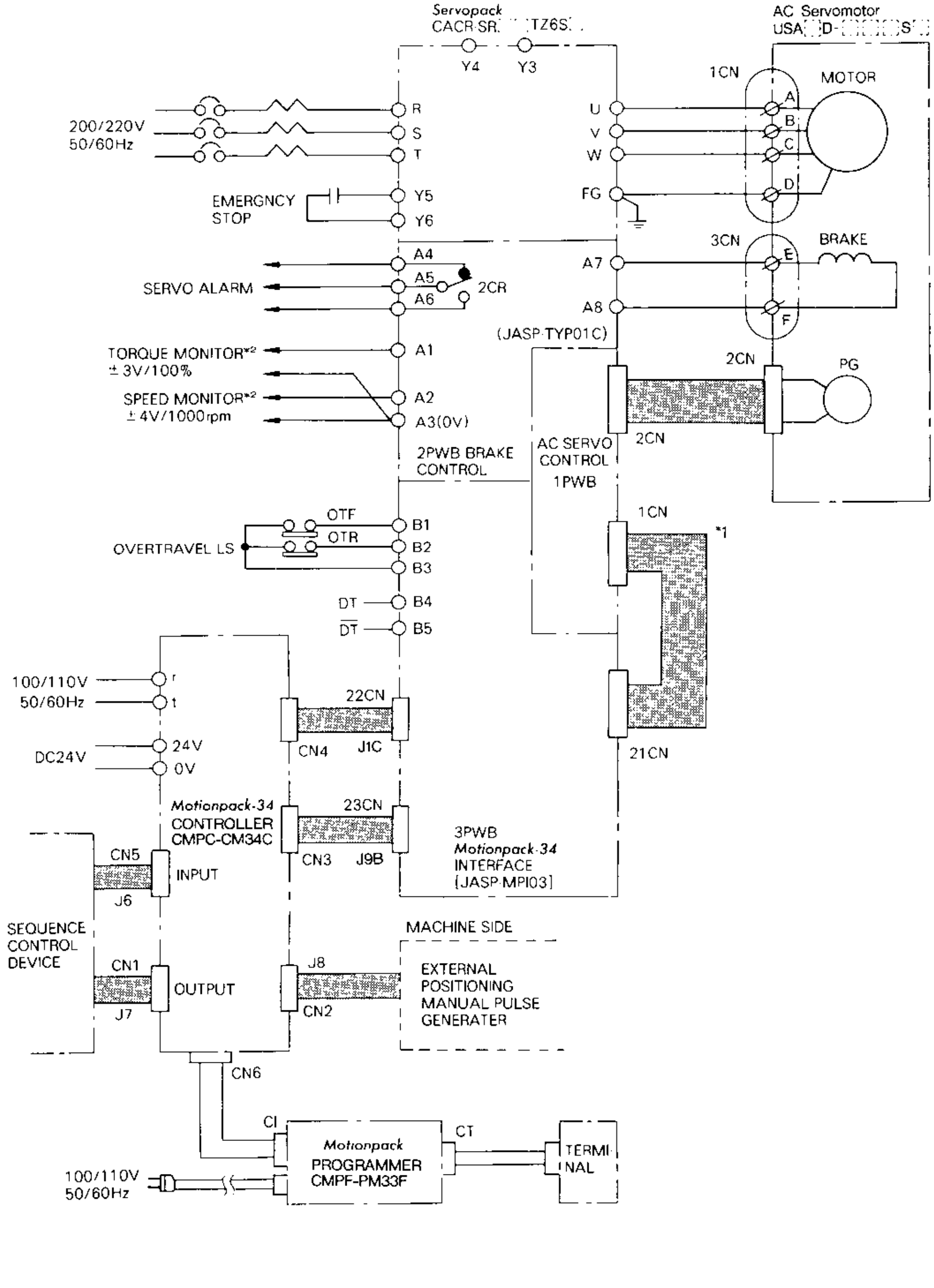
This section describes I/O signal specifications of each unit composing Motionpack-34. Read thoroughly before designing since this section is important for designing system circuit or drawing connection configuration between units.

Functions or timings of signals are individually explained in details.



5. CONNECTION (1)

5.1 INTERCONNECTION



*1: 1CN to 21CN cables have already been connected
*2: Following are recommended for torquemeter and tachometer (scale: 1mA)
- Torquemeter: ±7.5 full scale (In memory specification, 70 is displayed.)
- Tachometer ±7.5 full scale

Note: There is no condition in the order of power-on procedure

Fig. 5. 1 Interconnection Configuration

5.2 Motionpack-34 CONTROLLER I/O SIGNALS

Fig. 5.2 Shows the I/O signal of Motionpack-34 Controller (CM34C).

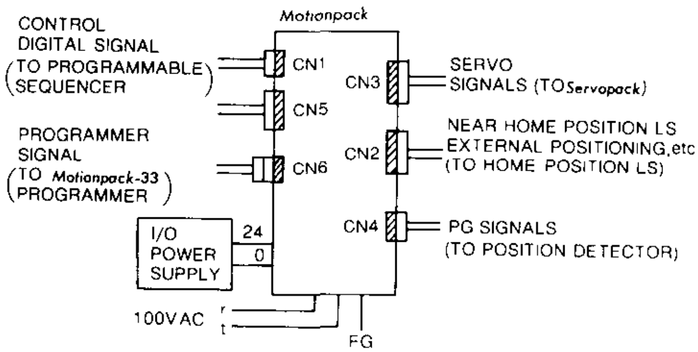


Fig. 5. 2 Input Output Signals

5.2.1 Digital Input Control Signals (Connector CN5)

5.2.1.1 Specifications of the signals

The signals of connector CN5 are classified into two groups.

(a) Scan-read signal

This type of signal enters through varying channels scanned by software. It comes from the machine (or sequencer) to the Motionpack-34 controller and the specifications are as follows.

(i) The input contact should be rated at 30V, 20mA or more, and chattering time not longer than 5 msec.

(ii) ON or OFF lasting 35 msec or more is effective as an input signal.

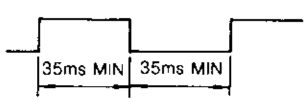


Fig. 5. 3

In the state of "1," Δe is voltage drop of 2V or less at 10mA when the machineside contact is ON.

$\Delta e \leqq 2.0V$ (at 10mA)

In the state of "0," the contact is OFF or Δe is 12V or more.

The state may be uncertain if $2V \leqq e \leqq 12V$.

5.2.1.1 Specifications of the signals (Cont'd)

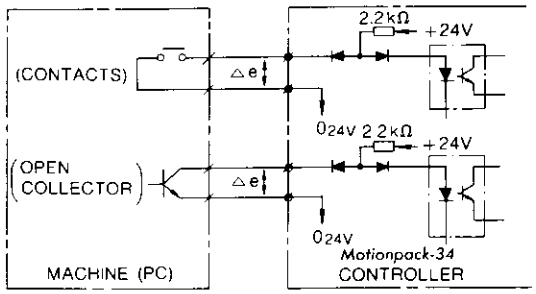


Fig. 5. 4

This type of signal enters through channels (,0 to ,4). Fig. 5.5 shows the timing.

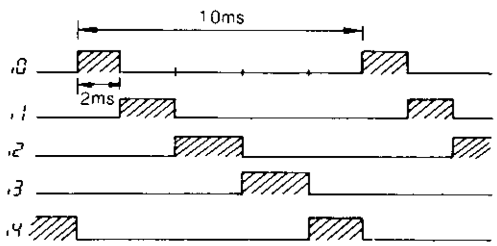


Fig. 5. 5

The signal SEL (see Fig. 5. 6) is 24V in a selected channel and it is separated from the power line in an unselected channel, so that signal of the selected channel alone will be read -in. It repeats cyclically at intervals of 2msec.

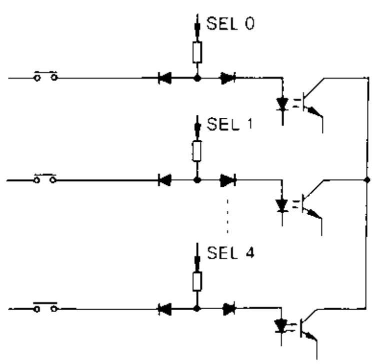
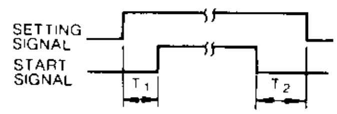
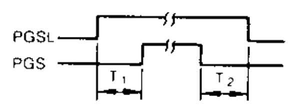
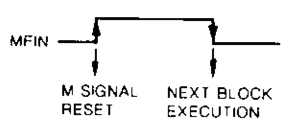


Fig. 5. 6

(b) Individually read signal

This type of signal does not come in from varying channels.

Table 5. 1 Motionpack-34 Input Signal Characteristics

Input/Output Signal		Signal Name	Characteristics	Timing
Setting Signal	Mode Signal	EDIT, PLAY, JOG STEP, SBK, $\overline{\text{ATSTP}}$	Level Signal	 T_1 T_2 > 35ms OVR is variable at any time speed changes with OVR
	Speed Setting	OVR, JLF, JMF	Level Signal	
Start Signal	Operation Signal	+ JS, - JS, ZRN SBST, ATST	Transient signal L→H . ON H→L . OFF	For transient signal reset is performed.
	Program Select Signal	PGS 0 to PGS 9 PGSL 00 to PGSL 30	Transient signal L→H : ON H→L . OFF	 T_1, T_2 > 35 ms
Incremental Command		+ INC 8, - INC 8 + INC 9, - INC 9	Transient signal L→H : ON H→L : OFF	Effective at standstill in Auto mode.
Skip Input		EPS 5, EPS 6, EPS 7, G 34 F	Transient signal L→H : ON H→L OFF	
M- Completion Signal		MFIN	Transient signal L→H : ON H→L : OFF	
Fault Reset		ERS	Transient signal L→H : ON H→L : OFF	Effective during Err ERS resets Err flag and ineffective on the other operations. Home position return completion signal is reset.

Note·

1. The set signals must be entered 35 msec or more before a start signal turns on
   This in the signals
2. The Program Select signal (PGSL) must be ON before the program start signal (PGS), if used to start, turn on.
3. Only the Override signal (OVR), one of the speed setting signals, may change at any time Speed changes as soon as OVR varies.

5.2.1.2 Input signal connections

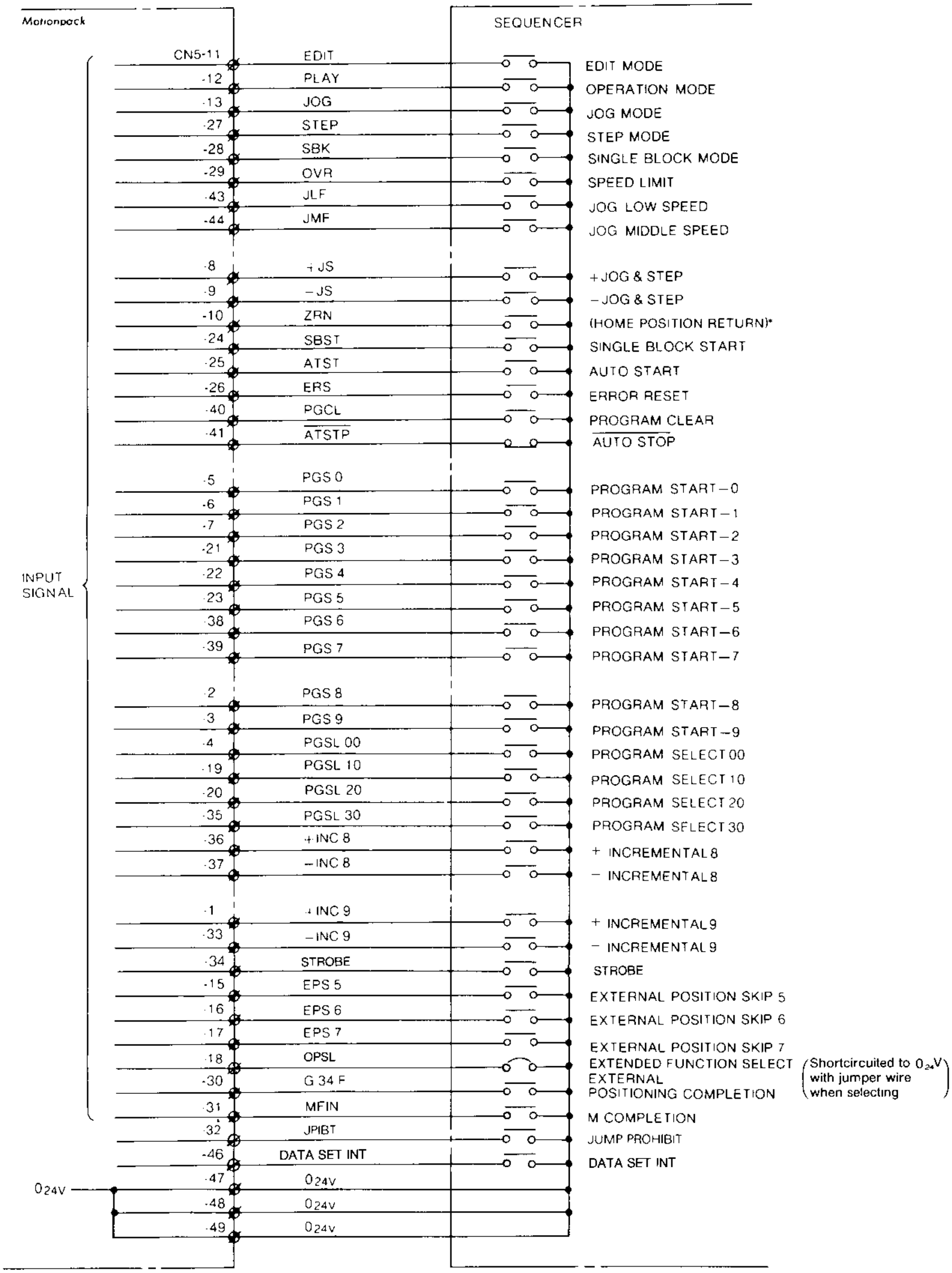


Fig. 5. 7

* ZRN Signal becomes quickreturn signal in absolute value control method

5.2.1.3 Functions of Input Signals (Function and Timing)

Functions and timing of each signal are those when main function is used. For modes marked with *, refer to description of extended function since they will change the functions when the extended function is used.

Table 5. 2 Examples of Channel Display
(12-3 : 2 input channed 10^3 – digit)(Refer to Table 5. 1.)

<table>
<tr><th>Mode</th><th>Signal Name</th><th>Function and Timing</th></tr>
<tr><td>EDIT
Mode</td><td>EDIT
(Scan reading-in
10-0)</td><td>Sets Motionpack controller in EDIT mode with EDIT signal ON, and permits writing and editing of programs and parameters with Motionpack programmer.

JOG, STEP, HANDL, and AUTO operations cannot be made, but servo clamp is effective.</td></tr>
<tr><td>PLAY
Mode</td><td>PLAY
(Scan reading-in
10-1)</td><td>Sets Motionpack controller in any mode of JOG, STEP, HANDL, or AUTO, depending on the states of the JOG and STEP signals. Enables JOG, STEP, HANDL, or AUTO Operation, and returns to origin.

Programs and/or parameters cannot be written through the programmer but status can be displayed.</td></tr>
<tr><td>JOG
Mode</td><td>JOG
(Scan reading-in
10-2)</td><td>Selects any of the below listed operation modes with combination of JOG and STEP signals, when PLAY signal is ON.

<table>
<tr><th>JOG</th><th>STEP</th><th>Operation Mode</th></tr>
<tr><td>ON</td><td>OFF</td><td>JOG</td></tr>
<tr><td>OFF</td><td>ON</td><td>STEP</td></tr>
<tr><td>ON</td><td>ON</td><td>HANDL</td></tr>
<tr><td>OFF</td><td>OFF</td><td>AUTO</td></tr>
</table>

When a JOG signal is received (turned ON) during AUTO operation, the motion stops after deceleration. The program block under execution is cleared and output signals change as follows.

(1) The following output signals are turned off.

(a) In-operation (STL)
(b) M decodes (M51 - M56)
(c) External positioning alarm (EPAL)
(d) External positioning alarm (G34)
(e) Automatic operation completion (M30)
(f) NC alarm (stored limit over only)

(2) The following output signals maintain their states.

(a) Motionpack ready (RDY)
(b) Battery alarm (ALM2)</td></tr>
<tr><td>STEP
Mode</td><td>STEP
(Scan reading-in
10-3)</td><td>See description for JOG mode.</td></tr>
<tr><td>SINGLE
BLOCK
Operation</td><td>SBK
(Scan reading-in
10-4)</td><td>When a single-block mode signal is turned on, the machine stops after completing the execution of the current block, and the control data enters the single-block operation mode.

When a single-block start signal (SBST) is turned on in this state, the machine executes the next block and then stops.

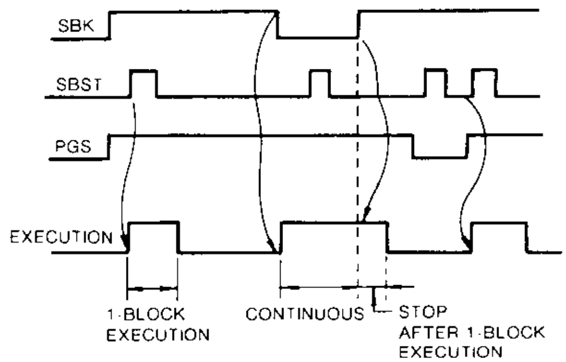
When the single-block operation signal is turned off, the execution of the program is restarted, regardless of an SBST signal, and the program is executed continuously.</td></tr>
</table>

5.2.1.3 Functions of Input Signals (Function and Timing) (Cont'd)

Table 5. 2 Examples of Channel Display (Cont'd)

<table>
<tr><th>Mode</th><th>Signal Name</th><th>Function and Timing</th></tr>
<tr><td>SINGLE
BLOCK
Operation
(Cont'd)</td><td>SBK
(Scan reading-in
10-4)</td><td>When program start signals (PGS 0 to 9) are turned on while a single-block operation mode signal is on, the program is not started; it is started only when a single-block start (SBST), signal is turned on. However, if no program start signals (PGS 0 - 9), are on. a single-block start signal is ineffective.

When the single-block operation mode signal is cleared after the completion of one program, a subsequent program start (PGS 0 - 9) signal will start the program.


</td></tr>
<tr><td>SPEED
LIMIT</td><td>OVR
(Scan reading-in
10-5)</td><td>Determines the speed set by parameter Pr10 as maximum when OVR signal is ON. When OFF, the maximum speed is set as programmed.</td></tr>
<tr><td>JOG
at Middle
Speed

JOG
at Low
Speed</td><td>JMF, JLF
(Scan reading-in
10-6
10-7)</td><td>JMF and JLF are used in combination. The functions vary as follows, depending on whether Motionpack is in JOG, STEP, or HANDLE mode.

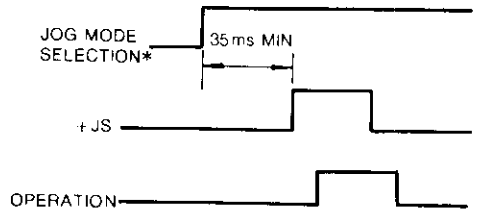
<table><tr><th rowspan="2">JMF</th><th rowspan="2">JLF</th><th>JOG Mode</th><th>STEP Mode</th><th>HANDL Mode</th></tr><tr><th>JOG Feedrate*</th><th>STEP Distance†</th><th>Pulse Multiplication Factor</th></tr><tr><td>OFF</td><td>OFF</td><td>Stop</td><td>←</td><td>←</td></tr><tr><td>OFF</td><td>ON</td><td>Low</td><td>Short</td><td>× 1</td></tr><tr><td>ON</td><td>OFF</td><td>Middle</td><td>Middle</td><td>× 10</td></tr><tr><td>ON</td><td>ON</td><td>High</td><td>Long</td><td>× 100</td></tr></table>
* JOG feedrate is set by parameters:
Parameter Pr1 - Low
Parameter Pr2 - Middle
Parameter Pr3 - High

† STEP distance is set by parameters:
Parameter Pr5 - Short
Parameter Pr6 - Middle
Parameter Pr7 - Long
STEP speed is set by parameters set by Pr4.</td></tr>
<tr><td>+JOG &
STEP</td><td>+JS
(Scan reading-in
11-0)</td><td>Commands the machine to move in the plus direction in JOG and STEP modes.

(1) In JOG mode

While +JS signal is ON, the machine slide moves in the plus direction, through the distance set by JMF (middle speed), or JOG (low speed). Turning off the signal decelerates the machine to a stop.</td></tr>
</table>

Table 5. 2 Examples of Channel Display (Cont'd)

Mode	Signal Name	Function and Timing
+JOG & STEP (Cont'd)	+JS (Scan reading-in I1-0)	(2) In STEP mode When the signal is changed from OFF to ON, Motionpack starts the operation in the STEP operation mode. The distance for STEP is set by Pr5 to Pr7 and selected by JLF and JMF signals. TIMING  *Turn ON +JS at least 35 ms after JOG (or STEP) mode and JOG speed or (STEP distance) have been selected.
-JOG & STEP	-JS (Scan reading-in I1-1)	The same as for +JOG & STEP operation mode except for movement in minus direction.
Return to Home Position (*)	ZRN (Scan reading-in I1-2)	In absolute value method, this signal changes to quick-return signal. When ZRN signal is turned on, functions under execution is immediately interrupted to make positioning at waiting position (defined by Pr 72). When ZRN signal is turned off during the operation, deceleration is performed to stop. Quick-return is valid for any of PLAY modes except for HANDLE mode. Quick-return speed is defined by Pr 73. This function is valid only in absolute value methed (Pr 70 = 3) In incremental method , it is return to home position. In ABS-PG automatic home position setup system, when ZRN signal is turned OFF to ON after " 1 " is set in Pr 80, PG home position setup operation is started.
Single Block Start	SBST (Scan reading-in I1-3)	Start signal in single-block operation mode. When a single block mode (SBK) signal is turned on, the machine stops after completing the execution of the current block, and the control enters the single-block operation mode. If an SBST signal is turned on after the completion of a program, the top block is executed.

5.2.1.3 Functions of Input Signals (Function and Timing) (Cont'd)

Table 5. 2 Examples of Channel Display (Cont'd)

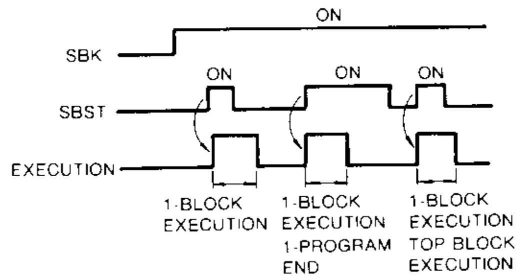
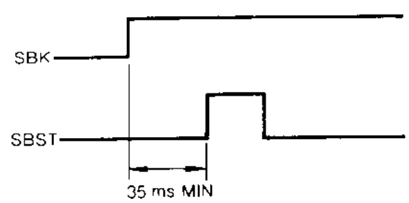
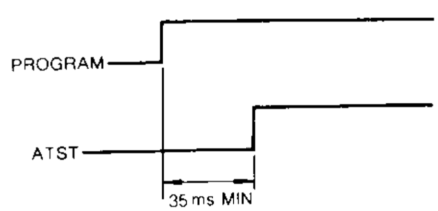
Mode	Signal Name	Function and Timing
Single Block Start (Cont'd)	SBST (Scan reading-in 11-3)	 When program start signals (PGS 0 to 9) are turned off, SBST signals are ineffective. TIMING  Turn on SBST signals 35 ms after the Single-Block Operation mode is selected.
Auto Operation	ATST (Scan reading-in 11-4)	Motionpack executes programs when ATST signal is ON after specifying the block to be executed by program start signals (PGS 0 to PGS 9) and program select signals (PGSL 00 to PGSL 30) in AUTO operation mode. In this case, the automatic stop ($\overline{ATSTP}$) signal should be turned on. If the automatic start signal (ATST) is not used as program start signal, connect it to 0 V.  Turn ATST signal on 35 ms or more after AUTO operation mode is selected and program block to be executed is specified.
Alarm Reset	ERS (Scan reading-in 11-5)	Turning on ERS signal resets MP alarm (ALM 1) output.

Table 5. 2 Examples of Channel Display (Cont'd)

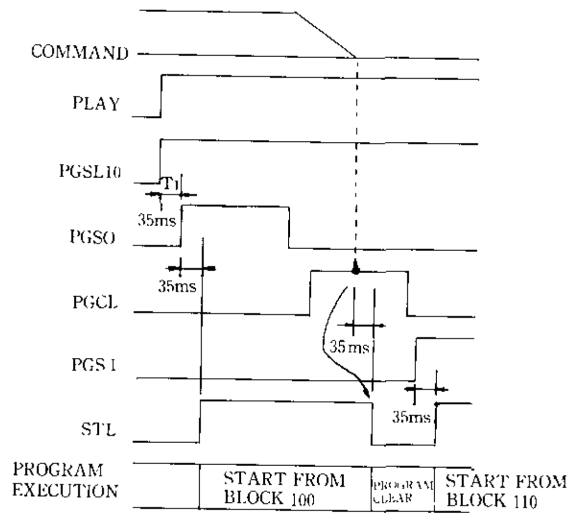
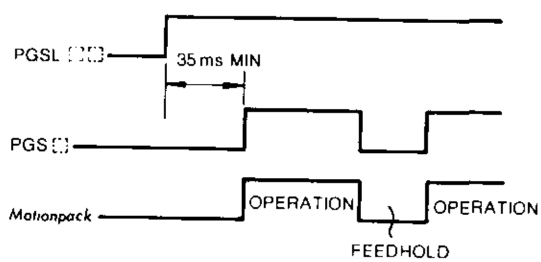
Mode	Signal Name	Function and Timing
Program Clear	PGCL (Scan reading-in 11-6)	PGCL signal is effective when the program start signal is turned off (FEEDHOLD STATE) during the execution of a program. When this signal is turned on, the program returns to the top of the current block. When the next program start signal is turned on, the program will be started from the top. When an incremental command is specified at the top of the program, the motion after Program Clear execution may differ from that mentioned above. TIMING 
Automatic Stop	$\overline{\text{ATSTP}}$ (Scan reading-in 11-7)	Program operation stop (feedhold state) signal for automatic start (ATST). Connect I/O power to 0 V when not in use.
Program Start (*)	PGS0 to PGS9 (Scan reading-in 12-0 to 12-7, 13-0, 13-1)	Start signal in AUTO mode. One of PGS0 to PGS9, when turned ON, designates the ten digit of the start block number. It also works as the start signal of AUTO operation. The hundred digit of the start block number is designated by turning on one of PGSL00 to PGSL30.
Program Select (*)	PGSL00 to PGSL30 (Scan reading-in 13-2 to 13-5)	The machine decelerates and stops (feedhold state) if PGS0 to PGS9 turn OFF during AUTO operation. Execution restarts when they turn ON. The timing of the signals PGSL□□ and PGS□ is shown below. 

Table 5. 2 Examples of Channel Display (Cont'd)

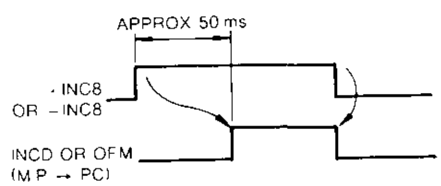
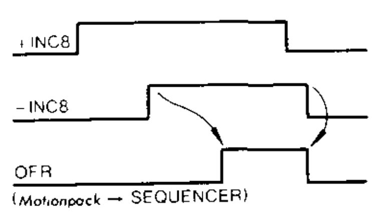
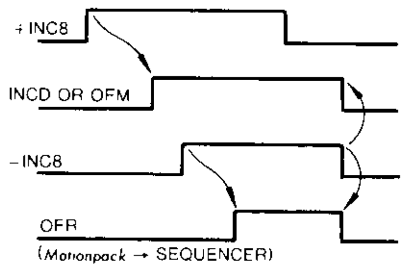
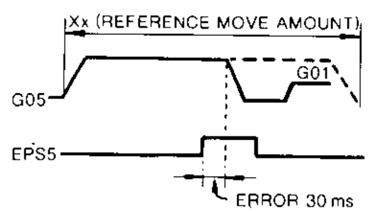
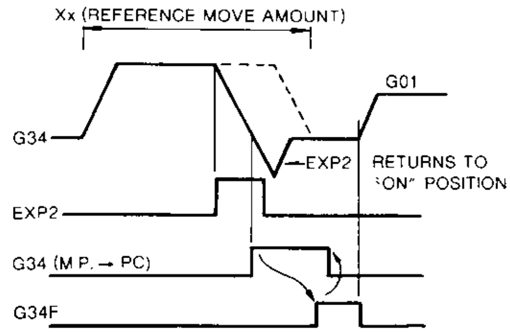
Mode	Signal Name	Function and Timing
Program Select (*) (Cont'd)	PGSL00 to PGSL30 (Scan reading-in 13-2 to 13-5)	The following requirements must be met for signals PGSL□□and PGS□. (1) PGS□ should not be duplicated. A program executed by PGSn may be switched to another PGSn' in the following cases. Alarm Err nSEL appears in other cases. (a) After PGSn has turned OFF, with execution of the current program completed, and M30 executed. (b) After returning to the top of the blocks to be executed the next time and the Program Clear signal (PGCL) turns ON in the feedhold state. (2) Only one PGSL□□ should be ON when PGS□ turns ON. Err nSEL appears if no, or a duplicated PGSL□□ is ON. The Motionpack starts a program after checking PGSL□□ and other starting conditions when it has detected the rise (from L to H) of PGS□. At that time only one PGSL signal must be present. (3) PGS□ and PGSL□ must not change during execution of a program. Err nSEL appears if M30 executes and PGS□ or PGSL□□ changes before the Run Signal (STL) disappears.
+Incremental Command 8 -Incremental Command 8 (*)	+INC8, -INC8 (Scan reading-in 13-6, 13-7)	When +INC8 or -INC8 turns on, an increment (set with parameter Pr20) will be added to (or subtracted from) the offset register 8 corresponding to the coordinate number 8 (T8). This is executed in AUTO mode and not during travel. If +INC8 and -INC8 turn on simultaneously, offset register 8 will be cleared to zero. An Offset +/- Max signal (OFM) will be output if the contents of offset register 8 are equal to or greater than offset +/- max. (set with parameter Pr21) after addition to the tool offset register by +INC8 or -INC8 or otherwise a +/- increment end signal (INCD) will be output.  If +INC8 and -INC8 are on simultaneously, offset register 8 will be cleared to zero with offset zero signal (OFR) output. (1) When -INC8 turns on before the end signal (INCD or OFM) of +INC8 is output: 

Table 5. 2 Examples of Channel Display (Cont'd)

Mode	Signal Name	Function and Timing
+Incremental Command 8 −Incremental Command 8 (*) (Cont'd)	+ INC8, − INC8 Scan reading-in I3-6, I3-7	(2) When −INC8 turns on after completion signal of +INC8 is output : 
+Incremental Command 9 +Incremental Command 9 (*)	+ INC9, − INC9 Scan reading-in I4-0, I4-1	Same as +INC8 and −INC8 except that these correspond to the coordinate numder 9 (T9) +INC8／−INC8 +INC9／−INC9 Coordinate number 8 (T8) ----→ Coordinate number 9 (T9) Offset register8 ----→ Offset register 9 Correction made at a time Pr20 ----→ Pr22 Maximun correction Pr21 ----→ Pr23 +／− increment end signal INCD (common) Offset zero OFM (common) Offset +／− max OFM (common) Refer to the description of +INC8／−INC8 for details of the functions.
External Position Skip 5 (*)	EPS 5 Independent reading-in I5-0	If EPS5 turns ON during feed with a G05 command, the tool decelerates and stops then goes to the next block 
External Postion Skip 6 (*)	EPS 6 Independent reading-in I5-1	Skip signal for G06
External Postion Skip 7 (*)	EPS 7 Independent reading-in I5-2	Skip signal for G07
Extended Function Select (*)	OPSL Independent reading-in	Set this signal at 0V when the extended function is used. If it is not set at 0V when the power is turned on, reading-in will not be operated, which turning on from sequencer during operation is not valid in the extended function.

5.2.1.3 Functions of Input Signals (Function and Timing) (Cont'd)

Table 5. 2 Examples of Channel Display (Cont'd)

Mode	Signal Name	Function and Timing
External Postioning Completion (*)	G34F [Independent reading-in I5-4]	Fin signal that clears the "external positioning end" output signal (G34) of the Motionpack and advances the program to the next block. If an external positioning alarm signal (EPAL) is output from the Motionpack, G34F input clears the signal EPAL. When G34F turns OFF, the program advances to the next block.  Note: Response delay from EXP2 "ON" to "ON" position memorized is 50μs.
M Completion (*)	MFIN [Independent reading-in I5-5]	The signal that clears the M decode outputs (M51-M56) and advances the program to the next block When signal MFIN turns on, the M decode outputs are cleared When MFIN turns off after that, the program of the next block starts.
Jump Prohibit	JPIBT [Independent reading-in I5-6]	In the exended function G67 jump prohibit function, this signal prohibits G67 jump execution When this signal is ON, G67 is prohibited.
Strobe	STROBE [Scan reading-in I4-2]	See Par. 11.3 and Par. 11.4.
Data Setting	DATA SET INT [Independent reading-in I5-7]	See Par. 11.3 and Par. 11.4.

5.2.2 DIGITAL OUTPUT CONTROL SIGNALS (CONNECTOR CN1)

5.2.2.1 Specifications of the Signals

The signals coming from the Motionpack-34 controller to the machine (or sequencer) must meet the following requirements.

① The output capacity is 24 VDC and 100 mA or less.

② Output is non-contact.

③ Non-contact output needs protection as follows.

(a) When the load is inductive, be sure to connect a spark killer in parallel to and within 20 cm of the load. Never connect the spark killer in the reverse polarity for the Motionpack-34 controller will be broken.

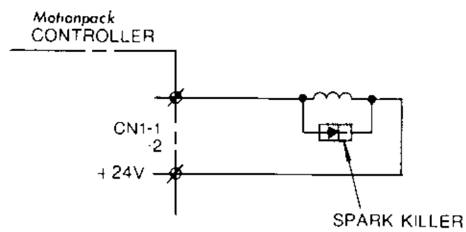


Fig. 5. 8 Connections of Spark Killer Diode IS2462 (VRM = 220V I_0 = 100mA)

(b) When the load is a lamp, insert a preheating resistor and do not permit the ratings to be exceeded even when a rush current flows.

Let the preheating resistor limit the current flowing through the lamp to 20-30% of the lamp rating. Sample calculation

Sample calculation

Preheating resistor : R

Lamp rated current : I Lamp (A)

$$R = \frac{24V}{(0.2 \text{ to } 0.3)\ I \text{ Lamp (A)}}$$

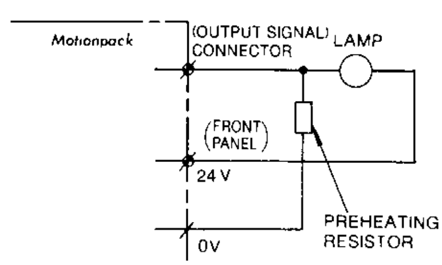


Fig. 5. 9

5.2.2.2 Output Signal Connections

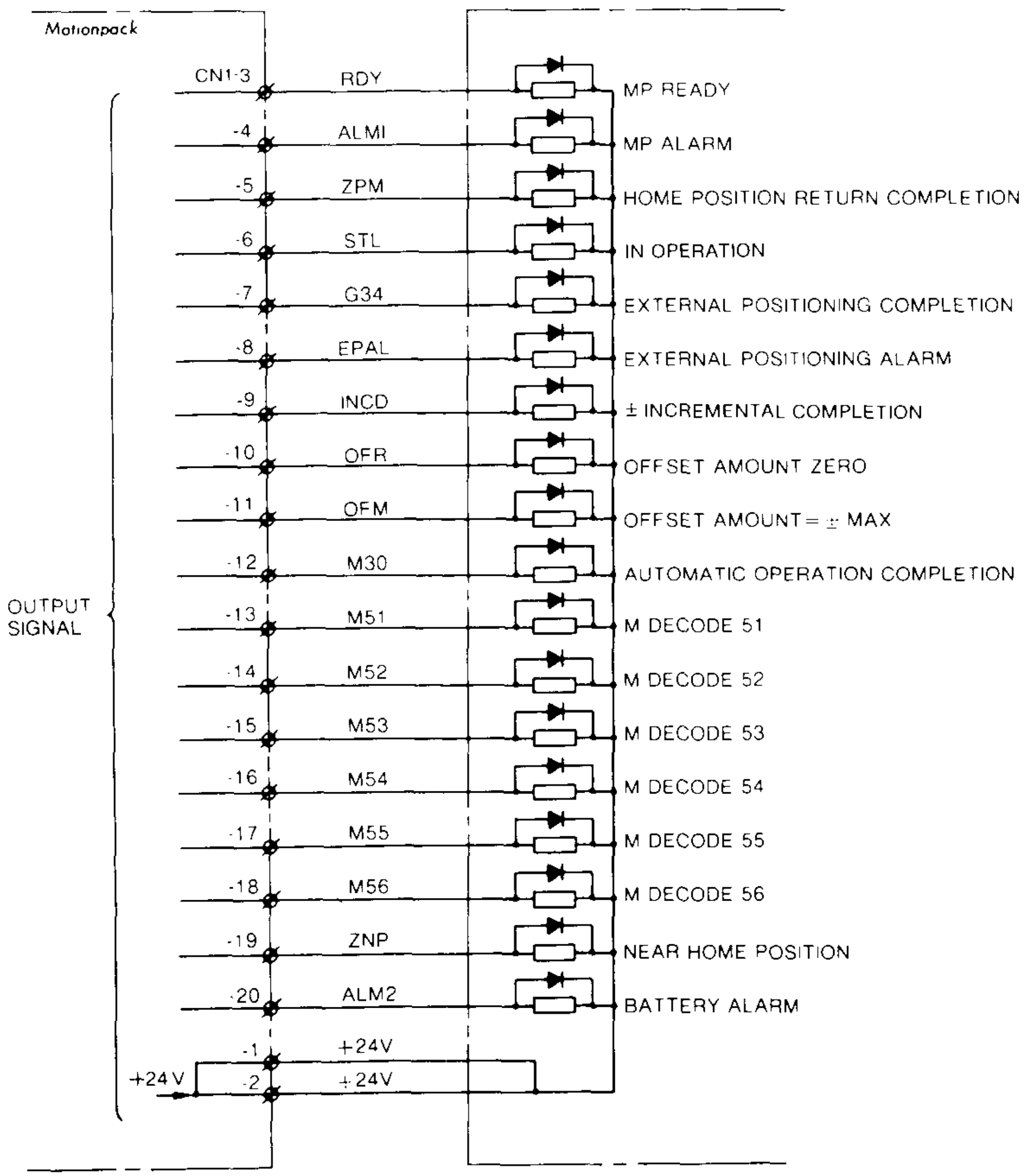


Fig. 5. 10

5.2.2.3 Functions of output signals

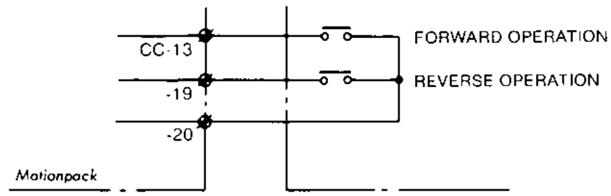
Function and timing of each signal are those when main function is used. For modes marked with *, refer to the description of extended function since they will change the functions when the extended function is used.

Table 5. 3 Examples of Channel Display (2-3 : output channel 10^2 − digit)

Output signal	Symbol	Function and Timing
MP Ready Completion	RDY [$O_{2\text{-}2}$ CN1-3]	This signal indicates that the Motionpack is ready to receive commands from a high-order controller (such as a sequencer). RDY is output (ON) under the following conditions: ① The Motionpack is operating properly ... "Good" indication is ON. ② The Motionpack is in any of AUTO, JOG, STEP, or HANDLE modes ...Signal PLAY = ON, signal EDIT = OFF ③ The servo main circuit power is ON and the servo circuit is good. ... [signal $\overline{\text{SAL}}$ (CN3-7) = ON signal $\overline{\text{OTF}}$ (CN3-13) of $\overline{\text{OTR}}$ = (CN3-19) = ON] → $\overline{\text{SAL}}$. ($\overline{\text{OTF}}$ + $\overline{\text{OTR}}$) = ON ④ When all of the above conditions (① through ③) are met, RDY output = ON
MP Alarm	ALM1 [$O_{0\text{-}0}$ CN1-4]	Alarm output of the Motionpack system. For alarm conditions indicated by ALM1, refer to section 11 Tables 11. 1 and 11 2 The error reset signal ERS resets ALM1
Zone Signal [Return-to- Home Position Completion]	ZPM [$O_{0\text{-}1}$ CN1-5]	In absolute value method system, ZPM signal changes to zone signal. When the feedback position is in the set zone, this signal is turned ON. For details, refer to Par. 4.1.4 Functions of Motionpack-34 Controller for basic zone signal and Par. 11.5/11.6 for extended zone signal (A)/(B).
IN Operation (*)	STL [$O_{0\text{-}2}$ CN1-6]	STL indicates that Motionpack-34 is operating automatically. It is ON during programmed operation or single-block operation It does not turn OFF even when the program start input signal turns OFF (feedhold state) STL turns OFF under any of the following conditions: ① The program clear signal (PGCL) is ON. ② Mode has changed. ③ Execution of M30 has been completed. ④ Emergency stop has occurred.* * Motionpack-34 stops in an emergency if both the F-direction and R-direction movable signals have turned OFF.

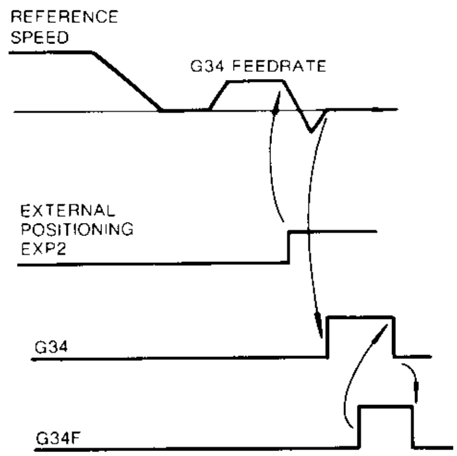
5.2.2.3 Functions of output signals (Cont'd)

Table 5. 3 Examples of Channel Display (Cont'd)

<table>
<tr><th>Output signal</th><th>Symbol</th><th>Function and Timing</th></tr>
<tr><td>In Operation
(*)
(Cont'd)</td><td>STL
$O_{0\text{-}2}$
CN1-6</td><td>
</td></tr>
<tr><td>External
Positioning
Completion</td><td>G34
$O_{0\text{-}3}$
CN1-7</td><td>The external positioning command (G34) causes the machine to decelerate and stop, when the external positioning signal (EXP2) turns ON, and to return to the position at which EXP2 turned ON.

In-position check is performed after positioning. If there is no error, the external positioning end signal (G34) turns ON.

This signal turns OFF when the external positioning end input signal (G34) turns ON.


</td></tr>
<tr><td>External
Positioning
Alarm
(*)</td><td>EPAL
$O_{0\text{-}4}$
CN1-8</td><td>EPAL is the alarm signal of external positioning (G34 command). It turns ON under any of the following conditions:

① EXP2 does not turn ON when the position designated with X (U) of a G34 command has been reached.

② If EXP2 or G34F is already ON, and the signal which is ON has not turned OFF within 2 seconds after a G34 command has started execution.

EPAL is reset under any of following conditions:

① The G34F signal has turned ON.

② Mode has changed.

③ The program clear has been executed.

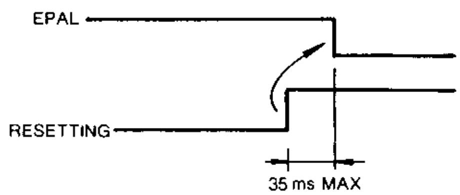
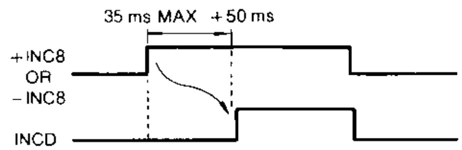
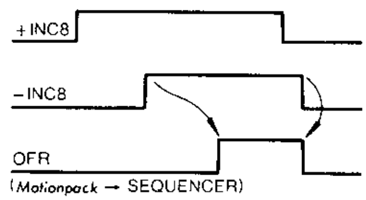
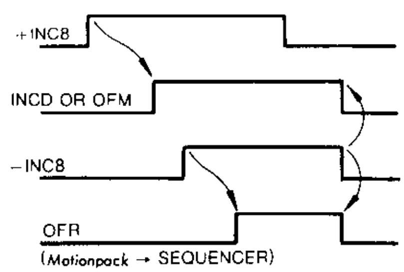
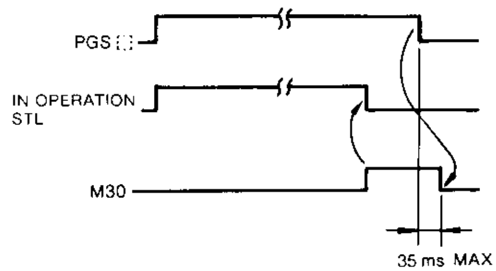
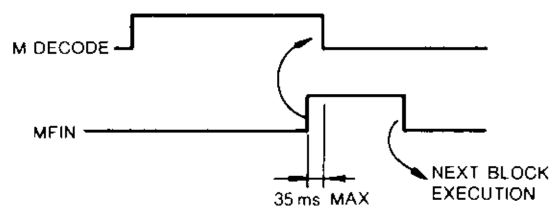

</td></tr>
</table>

Table 5. 3 Examples of Channel Display (Cont'd)

Output signal	Symbol	Function and Timing
± Incremental Command Completion (*)	INCD [$O_{0\text{-}5}$ CN1-9]	A + or − increment end signal (INCD) will be output if the contents of the offset register are smaller than the max offset + ／ − value after the completion of addition to the offset register initiated by a + (or −) incremental command. INCD will be output with a maximum delay of 85 msec because of the presence of a 50-msec timer (software) that checks for simultaneous turn-on of + INC and − INC and a signal read time that takes a maximum of 35 msec Resetting condition + INC (or − INC) has turned OFF. 
Offset Amount 0 (*)	OFR [$O_{0\text{-}6}$ CN1-10]	If + ／ − incremental commands turn ON simultaneously, the offset register will be cleared to zero and an offset zero signal (OFR) output. (1) − INC turns ON before end signal (INCD or OFM) of + INC is output.  (2) − INC turns ON after end signal of + INC is output.  One of M51-56 turns on according to the M function command executed. It is reset when the M end signal (MFIN) turns ON.
Offset Amount ± Max Approach	OFM [$O_{0\text{-}7}$ CN1-11]	OFM turns ON when the absolute value of offset which the offset register holds has exceeded the maximum value set with a parameter. This turns on and is reset following the same timing sequence as INCD. Refer to "± incremental command completion" above

5.2.2.3 Functions of output signals (Cont'd)

Table 5. 3 Examples of Channel Display (Cont'd)

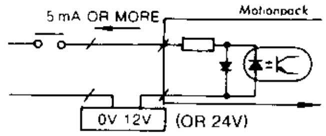
Output Signal	Symbol	Function and Timing
Automatic Operation Completion	M30 [$O_{1\text{-}0}$ CN1-12]	M30 turns ON when a program end command (M30) has executed in programmed operation It is reset when a program start signal (PGS0-PGS9) or auto-start signal (ATST) turns OFF. 
M Decode 51 to M decode 56 (*)	M51 to M56 [$O_{1\text{-}1}$ to $O_{1\text{-}6}$ CN1-13 to CN1-18]	Proper decodes of M51 to M56 are turned on by execution of M function command. M completion signal (MFIN) is turned on to reset 
Zone Signal Near Home Position	ZNP [$O_{1\text{-}7}$ CN1-19]	In absolute value method system, ZNP signal changes to zone signal When the feedback position is in the set zone , this signal is turned ON For details, refer to Par.4.1.4 Functions of Motionpack-34 Controller for basic zone signal and Par.11.5/11.6 for extended zone signal (A)/(B).
Battery Alarm	ALM2 [$O_{2\text{-}0}$ CN1-20]	ALM2 turns ON when the voltage of the memory backup battery has fallen below a certain level. (The memory contains machining porgrams, parameters, shift values,offset, etc) ALM2 is an alarm signal. The Motionpack does not take any action when ALM2 has turned on. As soon as ALM2 turns ON, the "battery out" lamp lights on the Motionpack controller panel If ALM2 comes ON, replace the battery within 30 days Keep supply power ON when replacing the battery. (Refer to 8.5 "BATTERY REPLACEMENT") If the power has been ON more than 3 minutes, the battery can be replaced when turning off the power.

5.2.3 External Positioning Signals (CN2 Connector)

5.2.3.1 Specifications of the signals

Signal voltage is 24V or 12V. Use appropriate terminals according to the signal voltage. Table 5.4 shows specifications of signals.

Table 5. 4 Specifications of Signals

signal voltage	24V, 12V
"ON"	Input current: 5mA or more 
"OFF"	Input current: 1mA or below (The direction is the same as above.)

Note:
1. Precautions for a proximity switch. With a proximity switch, current may leak ON condition may be satisfied even when output is OFF If the above requirements cannot be met, insert a relay designed for low-level signals. Try to avoid chattering of the relay If chattering is anticipated, connect a CR type surge suppressor (CR 50500, for example) in parallel with the relay.
2. For limit switch, use one of plunger types.

5.2.3.2 Signal connections

(1) For use of 24V LS (For use of contact LS for 24V)

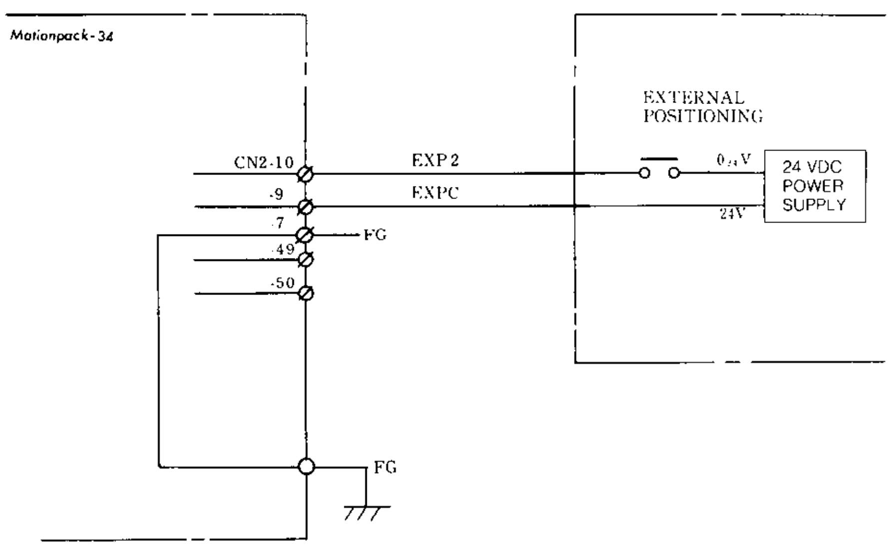


Fig. 5. 11

5.2.3.2 Signal connections (Cont'd)

(2) For use of non-contact LS for 12V

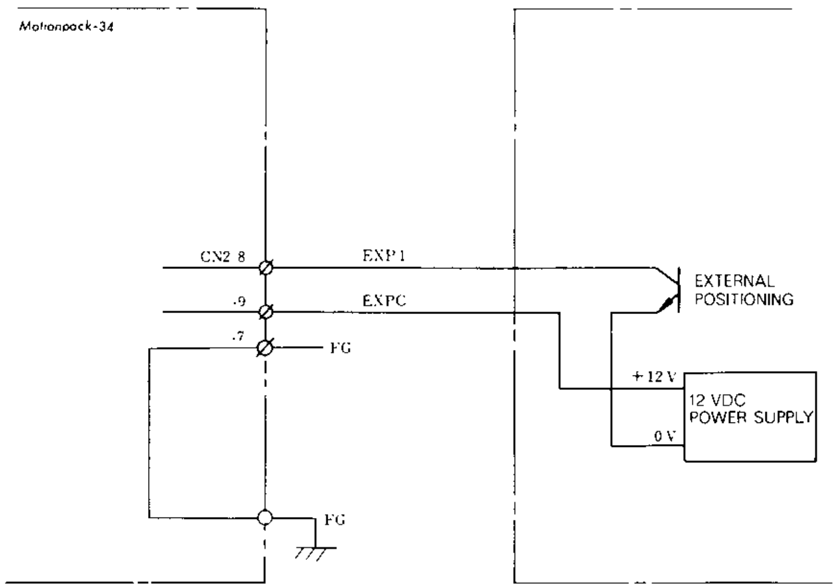


Fig. 5. 12

5.2.3.3 Signal functions

Table 5. 5 Signal Functions

Signal	Signal Name	Functions and Timing
External Positioning	EXPn	When external positioning signal EXPn is ON, the motion is decelerated to stop and returns to the EXPn ON position to make positioning.

Note :
- n = 1 when using 12 V power supply.
- n = 2 when using 24 V power supply.

5.2.3.4 Manual pulse generator

Manual Pulse generator signal is read-in by CN2 connector. Fig 5.13 shows the connecting method.

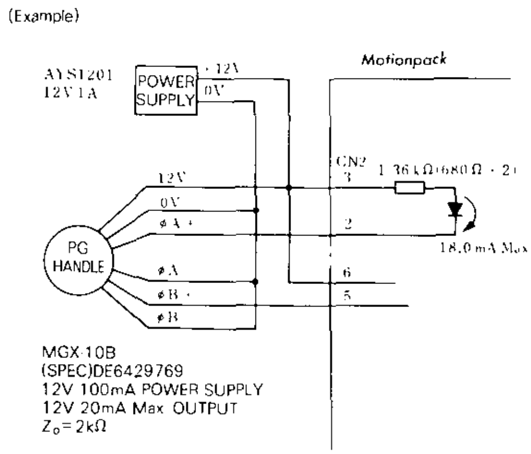
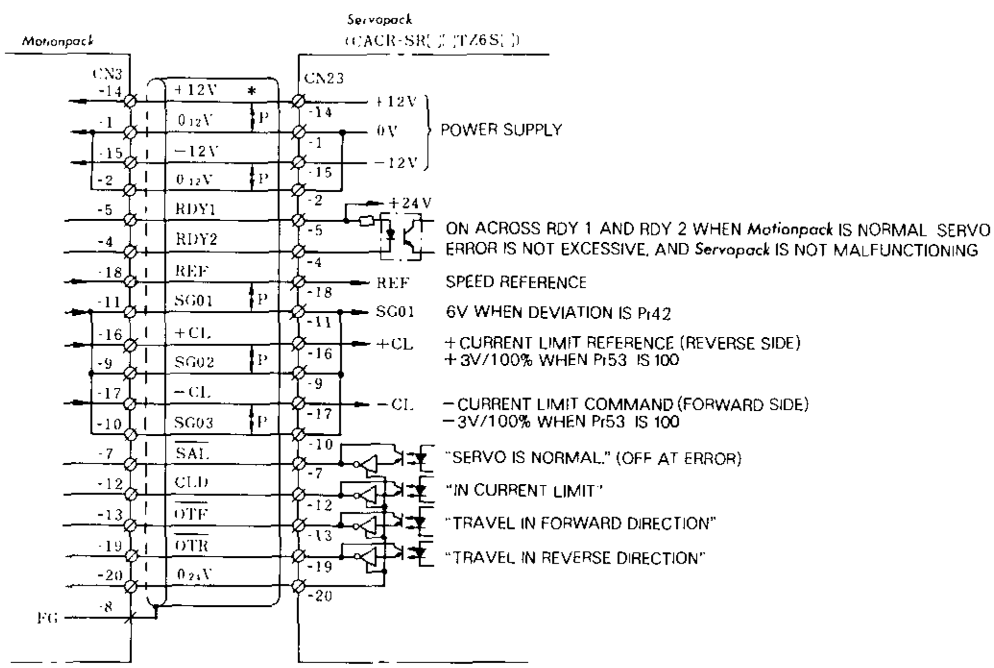


Fig. 5. 13

5.2.4 Servo Related Signals (CN3 Connector)

5.2.4.1 Signal connection



* 2 pin twist shielded wire

Fig. 5. 14

5.2.4.2 Signal Specifications

Table 5. 6 Signal Specifications

<table>
<tr><th></th><th>Signal</th><th>Symbol</th><th>Function</th><th>Specifications</th></tr>
<tr><td rowspan="4">Output</td><td>MP
Ready</td><td>RDY 1
RDY 2
(CN3-5
CN3-4)</td><td>On across RDY 1 and RDY 2 when Motionpack is normal, servo error is not excessive, and Servopack is not malfunctioning.

Indicates thet Motionpack and Servopack are in normal condition and ready to operate.
This signal changes to Servopack "Servo ON" signal on MP-34 interface board

Condition of (RDY 1-RDY 2) ON
= (MP RUN)·$\overline{\text{(dEr Over)}}$·$\overline{\text{(Servo Alarm)}}$·$\overline{\text{(ABS-PG Alarm)}}$</td><td>Across RDY2 and RDY1
Current flow
direction at ON RDY1 → RDY2</td></tr>
<tr><td>Speed
Reference</td><td>REF
SG01
(CN3-18
CN3-11)</td><td>Speed reference output of Motionpack
Connect this signal to the speed command input of Servopack The plus command causes the motor to run in a forward direction.

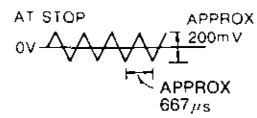
IN-A input is standard. IN-B input is also available by switching Pin connection of SW2 or SW3.

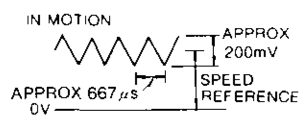
<table><tr><th></th><th>SW 2</th><th>SW 3</th></tr><tr><td>IN-A</td><td>①−②</td><td>①−②</td></tr><tr><td>IN-B</td><td>②−③</td><td>②−③</td></tr></table></td><td>±6V output
at Error do = Pr 42

Signal form is sawtooth waveform at 1.5 kHz

REF · reference value

SG01 : 0V




</td></tr>
<tr><td>+Current
Limit
Reference</td><td>+CL
SG02
(CN3-16
CN3-9)</td><td>The positive signal of the current limit command output of Motionpack limits current when the motor runs in reverse direction
Connect to the external current limit command input terminal of Servopack.

Note: As the external current limit reference of Servopack, apply negative voltage (-3V/ +100% torque) to terminate 23CN-17 for positive current and a positive voltage (+3V /−100% torque) to terminal 23CN-16 for negative current.</td><td>Outputs 3V
at 100% current limit.
(Pr 53 = 100)
Waveform the same as for speed reference.

+CL . signal

SG02 . 0V</td></tr>
<tr><td>−Current
Limit
Reference</td><td>−CL
SG03
(CN3-17
CN3-10)</td><td>The negative signal of the current limit command output of Motionpack limits current when the motor runs in forward direction

Connect to the external current limit command input terminal Servopack

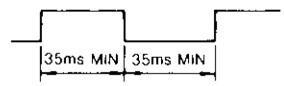
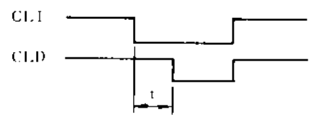
See the note of the + current limit reference above.</td><td>Outputs -3V
at 100% current limit.
(Pr 53 = 100)

Waveform: the same as for speed reference.

-CL : signal

SG03 : 0V</td></tr>
</table>

Table 5. 6 Signal Specifications (Cont(d)

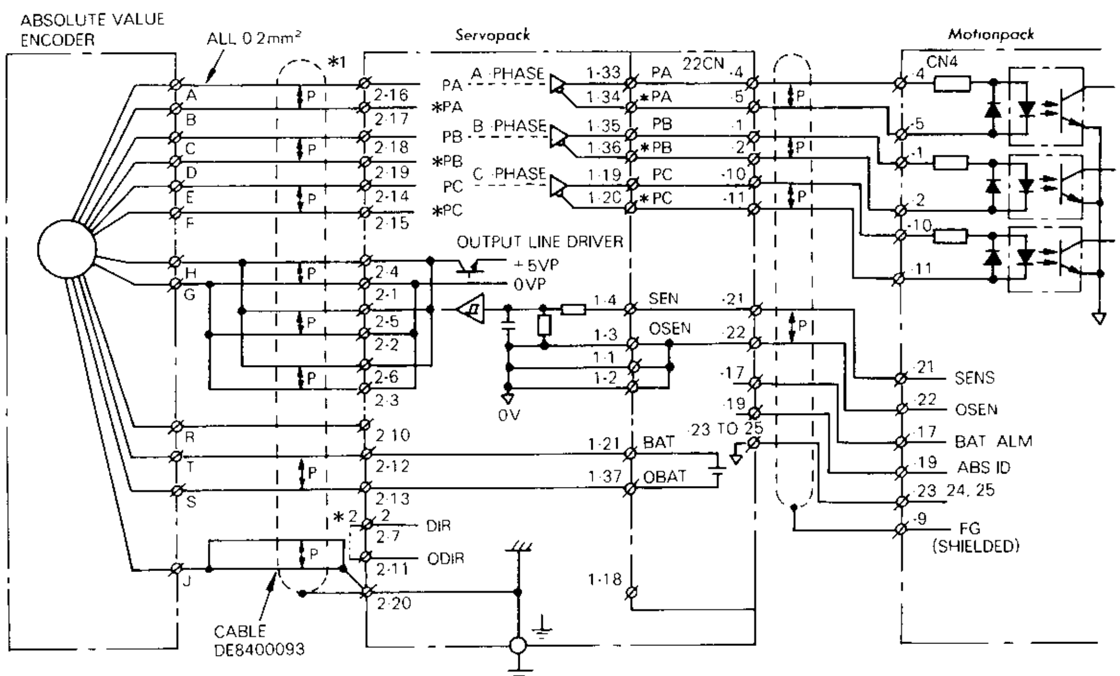
	Signal	Symbol	Function	Spedcifications
Input	Servo Error	$\overline{SAL}$ (CN3-7)	When Servopack is malfunctioning, this signal turns off. When Servopack is normal, $\overline{SAL}$ is 0V.	(a) The input contact capacity is rated at 30V and 20 mA or more. Chattering time should not exceed 5 msec. (b) ON and OFF of input signal lasting for 35 msec or more is effective. 
	Current Limit	CLD (CN3-12)	This signal indicates that Servopack is limiting current.  t = 0. 01. 03S IS SET BY SW1 When CLD = ON, Motionpack stops sending motion pulses. It continues sending motion pulses during execution of G01 and G34 (optional).	The same as $\overline{SAL}$
	Travel in Forward Direction	$\overline{OTF}$ (CN3-13)	Trevel in forward direction is possible when $\overline{OTF}$ = ON. The Motionpack stops in an emergency when both $\overline{OTF}$ and $\overline{OTR}$ are OFF. When Servopack S-RDY is OFF, both $\overline{OTF}$ and $\overline{OTR}$ are OFF.	The same as $\overline{SAL}$
	Travel in Reverse Direction	$\overline{OTR}$	Travel in reverse direction is possible when $\overline{OTR}$ = ON.	The same as $\overline{SAL}$

5.2.5 PG Related Signals

Motionpack-34 has input terminals both for 12VPG and 5VPG, which can be combined with Motionpack-34.

Servopack (CACR-SR□□TZ 6□□) PG output signal is 5V line driver output (output circuit SN 75174 or equivalent) to be connected with Motionpack-34 5VPG signal input terminal.

5.2.5.1 PG signal connection



*1 (P) shows twisted shielded wire.

*2 shows connection at reverse connection. In this case setting Motionpack Pr 50 at "−" (number of pulses) is also required

Fig. 5. 15 PG Signal Connection

5.2.5.2 Motor rotating direction

In case of the connection as shown in par 5.2.5.1, the motor rotates in forward direction (or counterclockwise from drive end) for Motionpack-34 + direction movement command.

When the motor is used for reverse rotation (the motor rotates clockwise from drive end for + direction moving command), the following two methods are available :

Motor reverse rotaion setting

① Input servopack DIR signal

2CN−7 − 2CN−11 to be shortcircuited.

② Set negative number to Motionpack Parameter 50.

Pr 50 = − n   n = number of pulses

AC Servomotor rotates in forward direction, or counterclockwise from drive end.

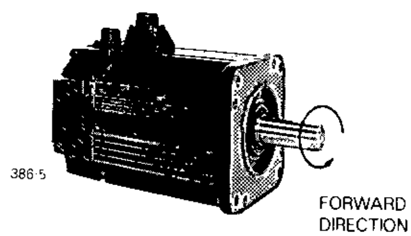


Fig. 5. 16 AC Servomotor

5.3 Motionpack PROGRAMMER INTERFACE

5.3.1 Interface with Controller

Interface between Motionpack-34 controller and Programmer complies with RS422.

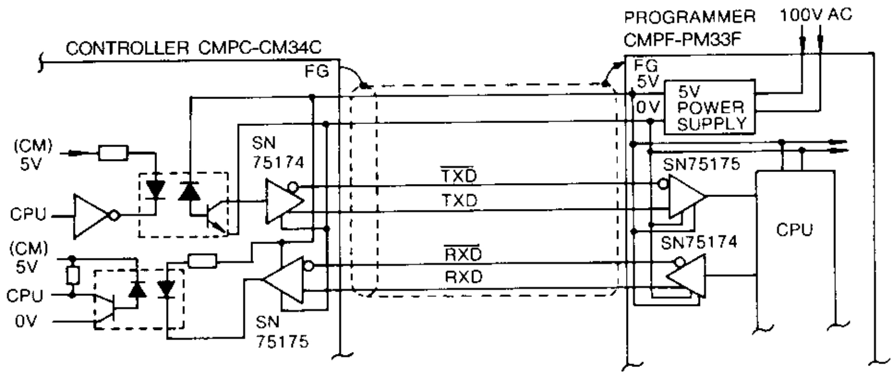


Fig 5. 17 Interface Circuit between CM and PM

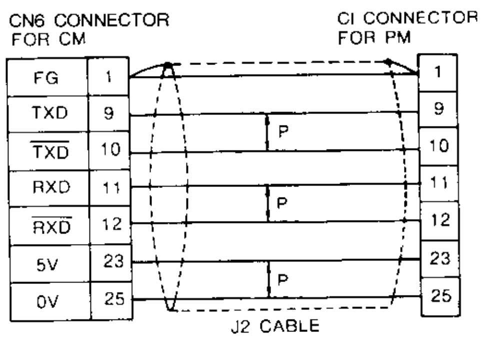


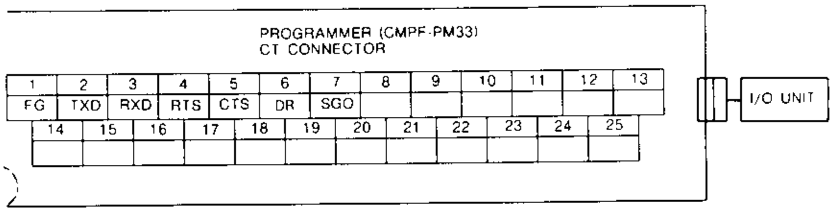
Fig 5. 18 Cables Connecting CM and PM

5.3.2 Interface of Tape Device

5.3.2.1 Interface specifications

Motionpack-34 controller can be connected to tape device through Motionpack-33 programmer and inputs or outputs parameters.

Transmission is RS232C.



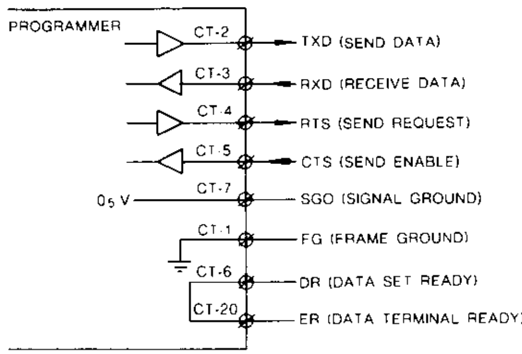


Fig 5. 19

(1) Transmission

Transmission is asynchronous, that is, a start bit precedes the data bit and stop bits follow them.

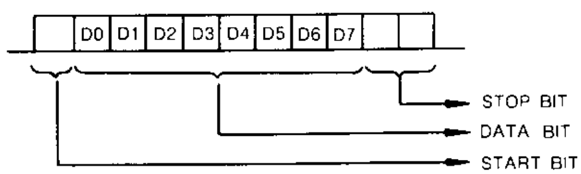


Fig 5. 20

(2) Code : ISO

(3) Signal logic : See Table 5. 7.

Table 5. 7

	+3V or more	−3V or below
Data Signal	0	1
Control Signal	ON	OFF

(4) Transmission rate (baud rate)

The transmission rate is the number of bits transmitted per second. It is possible to select any one given in Table 5. 8.

5.3.2 Interface of Tape Device (Cont'd)

The transmission rate is selected with a parameter. Refer to par. 4. 1. 3. 8 (2) "Tape device baud rate".

Table 5. 8

Transmission Rate
110
300
1200
2400

(5) Cable and connector

The cable connector is Model DB-25P D-subconnector (made by JAE). Normally, the cable should be prepared by the user. The cable prepared by Yaskawa is designated J4. If assistance is required, contact your YASKAWA representative.

5.3.2.2 Connecting to protyper

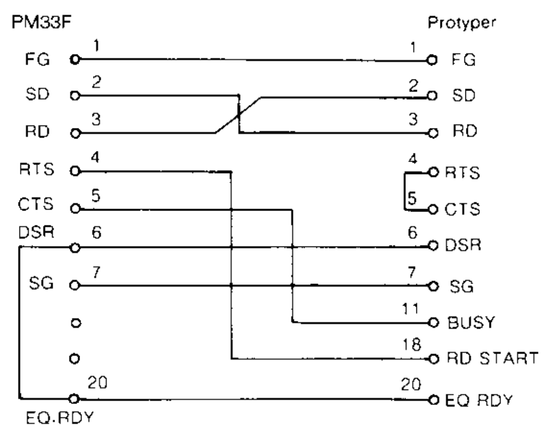


Fig. 5. 21

5.3.2.3 Connecting to Motionpack data recorder

Connection between data recorder and Motionpack programmer requires special cable.

When purchasing the data recoder, request the cable for connecting Motionpack-33 programmer.

5.3.2.4 Connecting to hand-held computer (EPSON HC-40)

Fig 5.21 shows connections of hand-held computer EPSON HC-40, used as a terminal equipment, to Motionpack programmer.

The programs and parameters of Motionpack are stored in the file of microcassette of HC-40.

(1) Hand-held computer

EPSON HC-40: Microcassette with drive Power Supply: With AC adaptor

(2) Cable

(3) Transmission speed (Baud rate)

Baud rete is 2400 bps. Set Pr 97=2400

(4) HC-40 Programs

HC-40 loader program and connection cable must be provided by the user. HC-40 should be provided with microcasstte drive.

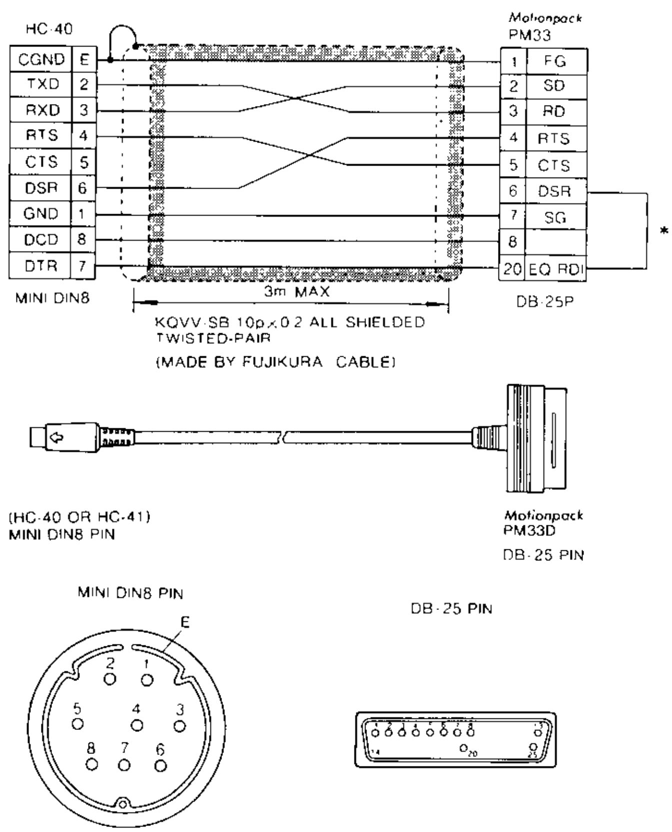


Fig 5. 22 Example of Cables

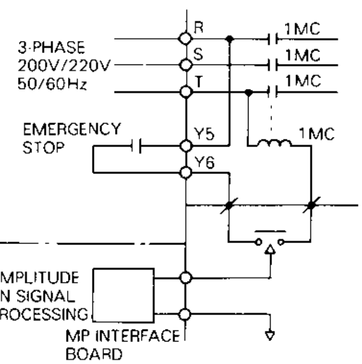
5.4 Servopack INTERFACE (IN CASE OF M SERIES)

For total connection configuration, see par. 6.5.

5.4.1 Servopack Basic Section Signals

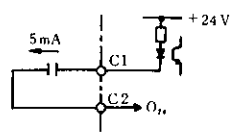
(1) Main unit external terminals

Table 5.9 Description of Main Unit External Terminals

Sigr	Name	Description
R S T	Power input terminal	3-phase AC 200/220V + 10%/ - 15% 50/60Hz
U V W	Motor connection terminal	U with motor A terminal, V with motor B terminal and W with motor C terminal are connected
⏚	Ground terminal	Connected with motor D terminal for grounding
Y3 Y4	Regenerating resistor connection terminal	Usualy not used. They change to external resistor when the internal regenerating resistor cannot manage processing.
Y5 Y6	Emergency stop terminal	They turn or and off internal contactor (1MC) directly and make power cut off together with "AMP ON" signal Opening the cirwit between Y5 and Y6 enables emerg stop tofunction However, Motionpack will have alarm 

(2) Brake control board external terminals

Table 5.10 Description of Brake Control Board External Terminals

Sign	Name	Description
A7 A8	Brake power terminals	When the motor is provided with brake, A7 with motor E terminal, A8 with motor F terminal are connected. When the brake is not provided, no terminal is connected.
A4 A5 A6	Alarm output terminals	When Servopack made defective detection (2CR ON) A4 - A5 …… OFF A6 - A5 … ON (at normal status, 2CR OFF) • Contact capacity 100V 0.5A • A4 A5 … NC A6 - A5 … NO • 2CR is ON for approx. 1 second when the power is turned on. (For initializing the control device.)
A1 A3 (0V)	Torque monitor output terminals	3.0V ± 10% Voltage is output for 100% motor torque. They can be used for checking 1 mA meter connection and torque recorded with pen.
A2 A3 (0V)	Revolution monitor output terminal	4.0V ± 10% current is output for 1000 rpm motor rotation. They can be used for checking 1 mA meter connection and torque recorded with pen.
C1 C2	Brake control	They are not usually used since timing of motor holding blake ON/OFF is performed inside sequence. For use 2PWB 22SW is short-circuited between ② and ③. (Normally between ① and ②) Thus, brake will be released by external command ON. However, inside sequence does not have its operation function. 

5.4.2 Connection with Motionpack-34

5.4.2.1 Connection

(1) PG Signal (Servopack 22CN ↔ Motionpack-34 CN4 Connector)

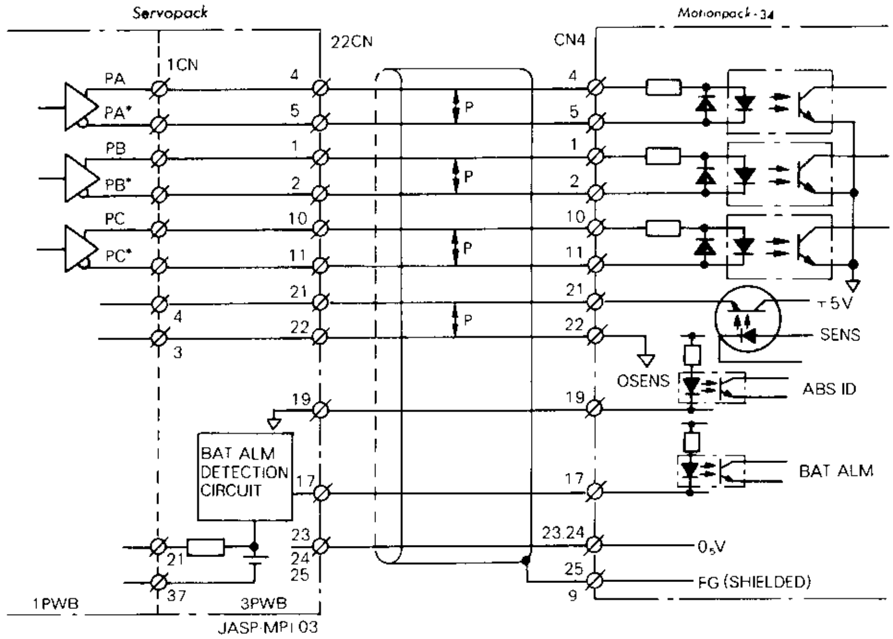


Fig. 5. 23

(2) Servo signal (Servopack 23CN ↔ Motionpack-34 CN3 Connector)

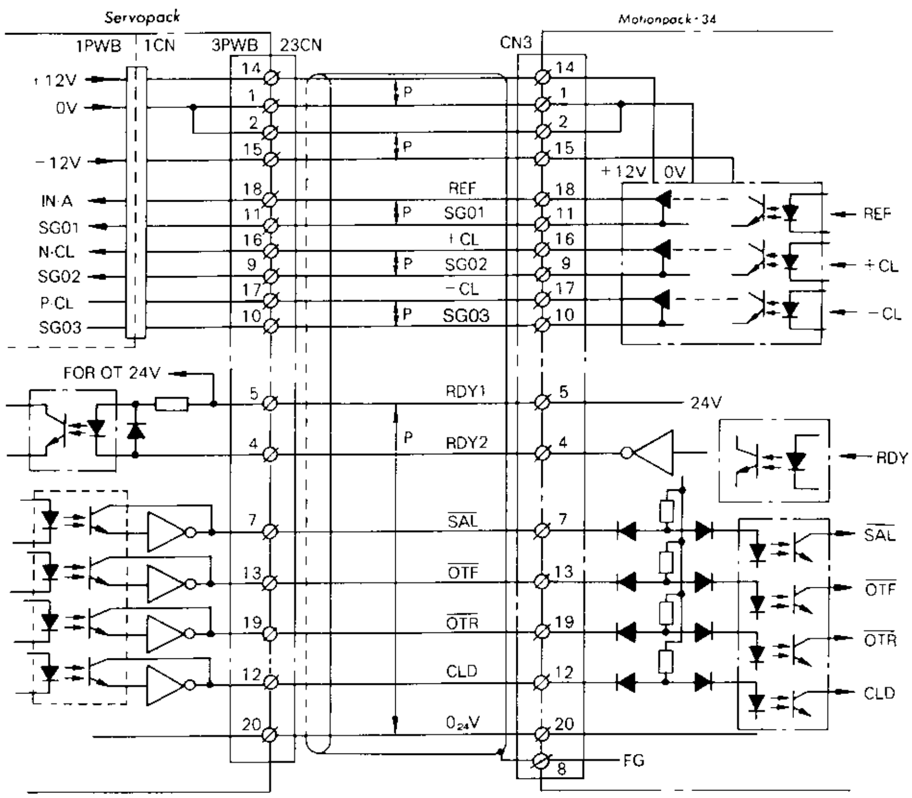
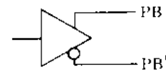
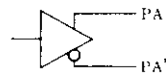
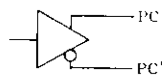


Fig. 5. 24

5.4.2.2 Signal specifications

(1) PG Signal (Servopack 22CN)

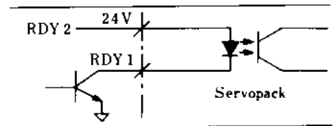
Table 5.11 Specifications

Pin No.	Name	Specifications
1	PB B-phase (+) signal	Output signal relay of AC Servopack main unit Output driver SN75174 MC3487 or equivalent 
2	PB * B-phase (−) signal	
4	PA A-phase (+) signal	Output signal continuation of AC Servopack main unit Output driver SN75174 MC3487 or equivalent 
5	PA * A-phase (−) signal	
10	PC C-phase (+) signal	Output signal relay of AC Servopack main unit Output driver SN75174 MC3487 or equivalent 
11	PC * C-phase (−) signal	
21	SENS	They are signals for ABS and encoder to turn on 5V power supply PG starts to transmit ABS data approx. 1 second after SENS signal is turned on
22	OSENS	
17	BATALM	This is an alarm signal to inform BAT voltage lowering.
19	ABS ID	This is a signal checking if Servopack is in the absolute value method. When it is, the voltage becomes 0V.
3, 6 to 8, 12 to 16, 18, 20	Not used	
23 24 25	0_5V	0V (Circuit power supply)
9	FG	FG

5.4.2.2 Signal specifications (Cont'd)

(2) Servo signal (Servopack 23CN)

Table 5. 12 Specifications

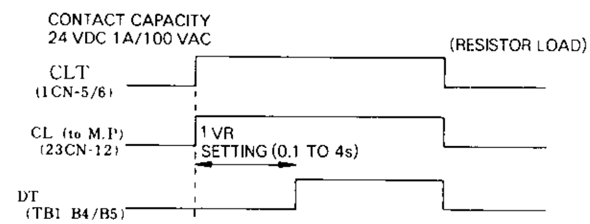
Pin No.	Name	Direction MP ←···· ····→ SP	Specifications
1	0_{12} V	M ←···· S	Analog reference power supply output 0V side
2	0_{12} V	M ←···· S	
3	Not used		
4	RDY2	M ····→ S	By turning on Motionpack output RDY signal, Servopack will receive "Servo ON" signal.
5	RDY1 (24V)	M ····→ S	
7	$\overline{\text{SAL}}$	M ←···· S	Servo alarm signal (reverse output), output capacity 24VDC 100mA max. Turned on at non-alarm State.
9	SG02	M ····→ S	+CL signal ground
10	SG03	M ····→ S	−CL signal ground
11	SG01	M ····→ S	REF signal ground
12	CLD Current limit	M ←···· S	Turned on when Servopack exceeds current limit. Output capacity 24VDC, 100 mA max.
13	$\overline{\text{OTF}}$ Overtravel detection	M ←···· S	Turned off when overtravel is detected. Travel in forward direction is available when this signal is ON. Output capacity 24VDC 100 mA max.
14	+12V	M ←···· S	Analog reference power supply output (+/−12V) 1- and 2-pin is 0V.
15	−12V	M ←···· S	
16	+CL Current limit command	M ····→ S	This signal gives Servopack reverse side current limit input (N-CL). * +3.0V/−100% torque limit
17	−CL Current limit command	M ····→ S	This signal gives Servopack forward side current limit input (P-CL). * −3.0V/+100% torque limit
18	REF Speed reference input	M ····→ S	This signal gives Servopack speed reference input (IN-A) as a standard * F/R rated revolution is 1000r/min at +/−6V. Input | SW 2 | SW 3 IN-A | ①−② | ①−② IN-B | ②−③ | ②−③
19	$\overline{\text{OTR}}$ Overtravel detection	M ←···· S	Turned off when over travel is defected. Traval in reverse direction is available when this signal is ON. Output capacity 24VDC 100 mA max
20	0_{24} V	M ····→ S	0V side of I/O power supply 24V.

*: Needs Motionpack -34
Parameter setting Pr 53 = 100.

5.4.3 Overtravel Limit Switch

External terminals on the Motionpack-34 interface board comprise forward direction overtravel detection limit signal, reverse direction overtravel detection limit switch and current limit detection signal DT (relay contact output).

Table 5.13 Interface Board External Terminal (TB1) Specifications

Terminal No.	Signal Names	Specifications
1	$\overline{OTF}$ Forward direction overtravel detection limit switch	Connect forward direction overtravel detection limit switch. The contact is turned off when forward direction overtravel is detected. When servopack is ready (SV. RDY ON) and $\overline{OTF}$ is turned on, P-OT = ON is fed to Servopack. (Via CN1) At the same time $\overline{OTF}$ = ON is fed to Motionpack-34. For the operation to detect overtravel, refer to (Note)
2	$\overline{OTR}$ Reverse direction overtravel detection limit switch	Connect reverse direction overtravel limit switch The contact is turned off when reverse direction overtravel is detected. When Servopack is ready (SV. RDY ON) and $\overline{OTR}$ is turned on, N-OT = ON is fed to Servopack (Via CN1) At the same time $\overline{OTR}$ = ON is fed to Motionpack-34. For the operation to detect overtravel, refer to (Note).
3	G_2 (0_{24}V)	0V of 24 VDC power supply for reading-in $\overline{OTF}$, $\overline{OTR}$ limit switch. This signal is be the same as Motionpack-34 I/O signal power supply (24VDC) ground.
4	DT	These output signals are closed when servopack exceeds current limit. For contact, delay time of 0.1 to 4 seconds can be set by 1VR.
5	/DT	

NOTE

Overtravel detection signal processing

(1) In case of overtravel occurring by forward opration

(A) Where $\overline{OTF}$ → OFF

(a) The signal next to Servopack input is turned off.

P-OT, P-CON, AMP-ON

However, AMP-ON signal provided with return function is turned on after the motor stops.

(b) Motionpack-34 input $\overline{OTF}$ signal is turned off.

(B) After the motor stops, return operation is performed by JOG operation.

At this time AMP-ON signal has already returned: The motor is in reverse direction under drive-able state.

(C) When entering in drive-able range by return, $\overline{OTF}$ turns ON to be the normal condition.

(2) In case of overtravel occurring by reverse operation same as above.

(3) When Servopack output signal SERVO READY (SV. RDY) signal is turned off, both of $\overline{OTF}$ and $\overline{OTR}$ are turned off to be in emergency stop condition.

(4) SW1 is used to set CLD signal output delay time (See Par. 5. 2. 4. 2 Table 5.6).

5.4.4 Optical Encoder (PG) Signal (Servomotor → Servopack)

AC Servomotor optical encoder output is line driver output. The opposed Servopack input circuit is line receiver circuit, which is used as magnetic pole detection signal in Servopack and outputs A-, B- and C-phase signals as PG signal from the line driver.

5.4.5 Servopack 1CN Related Signals

Servopack 1CN and Motionpack-34 interface board 21CN are already connected by 50-pin cable at shipping from the factory so that the customers do not have to connect them. However, when main unit (CACR-SR□□TZ6S□□) is used as general-use Servopack, the signal content is required. Fig. 5.25 shows the signal content and pin No. (This signal content is slightly different from generaluse Servopack 1CN.)

For reference

Servopack 1CN Connection

In Servopack Type CACR-SR□TZ6S□, 1CN is already connected. When Motionpack inter-face board is removed and Servopack only (speed control type) is used, 1CN is required to be connected. For details, reter to Servopack bulletin.

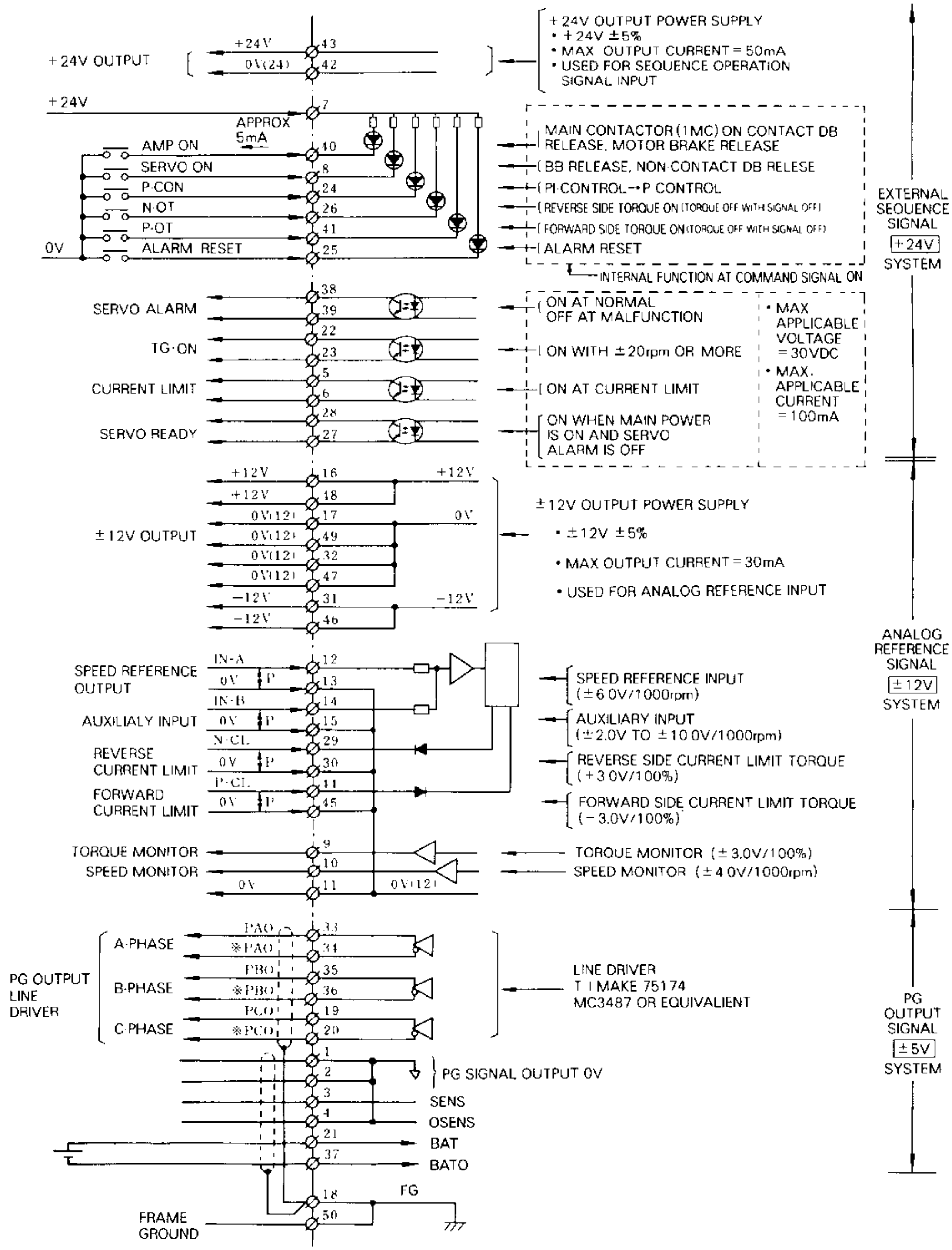


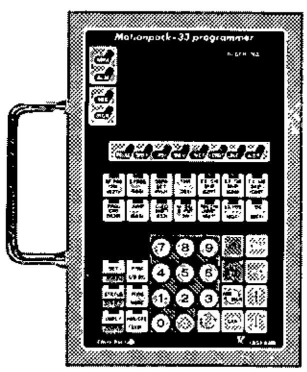
Fig. 5. 25 Servopack 1CN Connection

6. CONNECTION (2)

This section describes details of each unit signal connector type or pin arrangement, cable specifications, applicable cable building method, wiring method, etc.

Read thoroughly before designing control panel or wiring in the panel, or building applicable cable. If cable specifications, wiring routes or grounding method is not proper, malfunction may occur by noise.

Component-to-component connection configuration is provided in Par. 6.5.

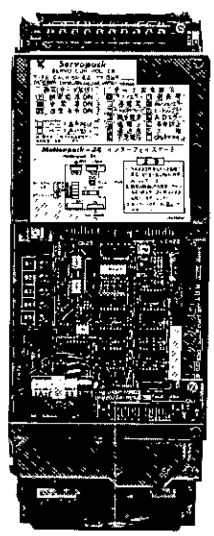


589-30

PROGRAMMER

590-284

CONTROLLER



587-315

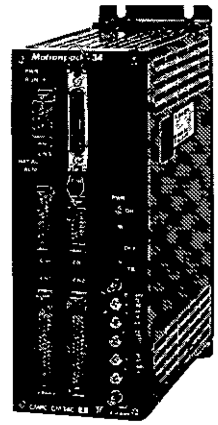
Servopack

6. CONNECTION (2)

6.1 CONNECTOR TERMINAL NO.

6.1.1 Controller CM34C Connector Terminals and Signal Names

Six connectors CN1 to CN6 are built on the panel of Motionpack-34 controller. In anddition, a terminal board TB for the 100VAC and 24VDC power is also built on it.



590-286

Fig. 6. 1 Motionpack-34 CONTROLLER

CN4 CONNECTOR (MR-25RMA)

1	2	3	4	5	6	7	8	9
PB 1	OPB	PB 2	PA 1	OPA	PA 2			FG
10	11	12	13	14	15	16		
PC 1	OPC	PC 2		5 V	5 V	5 V		
17	18	19	20	21	22	23	24	25
PG BATALM		ABSID		SEN	OSEN	0 5 V	0 5 V	0 5 V

CN2 CONNECTOR (MR-50RMA)

1	2	3	4	5	6	7	8	9	10	11	12*	13*	14*	15	16*	17*	18*
HA 1	HAC	HA 2	HB 1	HBC	HB 2	FG	EXP 1	EXPC	EXP 2	FG	LSB 1	LSBC	LSB 2		LSA 1	LSAC	LSA 2
		19	20	21	22	23	24	25	26	27	28	29*	30*	31*	32*		
												2 A	2 B	2 D	2 C		
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
																+ 24 V	0 24 V

Do not connect the connectors marked with * in absolute method

CN3 CONNECTOR (MR-20RMA)

1	2	3	4	5	6	7
0 12 V	0 12 V		RDY 2	RDY 1		$\overline{\text{SAI}}$
8	9	10	11	12	13	
FG	SG 02	SG 03	SG 01	CLD	$\overline{\text{OTF}}$	
14	15	16	17	18	19	20
+ 12 V	− 12 V	+ CL	− CL	REF	$\overline{\text{OTR}}$	0 24 V

CN1 CONNECTOR (MR-20RMA)

1	2	3	4	5	6	7
+ 24 V	+ 24 V	RDY	ALM 1	ZPM	STL	G 34
8	9	10	11	12	13	
EPAL	INCD	OFR	OFM	M 30	M 51	
14	15	16	17	18	19	20
M 52	M 53	M 54	M 55	M 56	ZNP	ALM 2

CN5 CONNECTOR (MR-50RMA)

1	2	3	4	5	6	7	8	9	10*	11	12	13	14	15	16	17	18
+ INC 9	PGS 8	PGS 9	PGSL 00	PGS 0	PGS 1	PGS 2	+ JS	− JS	ZRN	EDIT	PLAY	JOG		EPS 5	EPS 6	EPS 7	OPSL
		19	20	21	22	23	24	25	26	27	28	29	30	31	32		
		PGSL 10	PGSL 20	PGS 3	PGS 4	PGS 5	SBST	ATST	ERS	STEP	SBK	OVR	G 34 F	MFIN	JPIBT		
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
− INC 9	STROBE	PGSL 30	+ INC 8	− INC 8	PGS 6	PGS 7	PGCL	$\overline{\text{ATSTP}}$		JLF	JMF	FG	DATA SET INT	0 24 V	0 24 V	0 24 V	+ 24 V

The connectors marked with * change their function in absolute method

CN6 CONNECTOR (3483-1000)

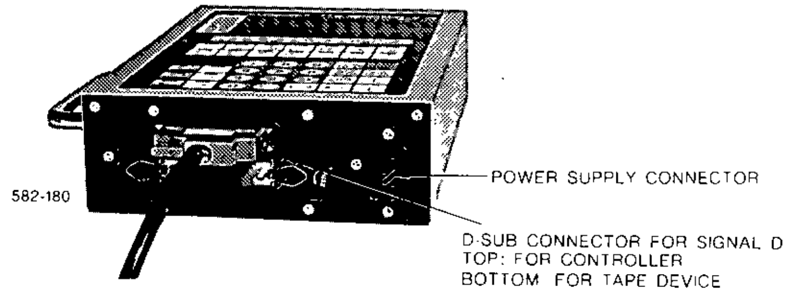
1	2	3	4	5	6	7	8	9	10	11	12	13
FG								TXD	$\overline{\text{TXD}}$	RXD	$\overline{\text{RXD}}$	
14	15	16	17	18	19	20	21	22	23	24	25	
									5 V		0 V	

Note: Pin Nos. and signal names are entered as shown on the right

← PIN NO
← SIGNAL NAME

Fig. 6. 2

6.1.2 Programmer Connectors and Signal Names



C1 CONNECTOR (3483-1000)

1	2	3	4	5	6	7	8	9	10	11	12	13
FG								TXD	$\overline{\text{TXD}}$	RXD	$\overline{\text{RXD}}$	

14	15	16	17	18	19	20	21	22	23	24	25
									5V		0V

CT CONNECTOR (3483-1000)

1	2	3	4	5	6	7	8	9	10	11	12	13
FG	TXD	RXD	RTS	CTS	DR*	SGO						

14	15	16	17	18	19	20	21	22	23	24	25
						ER*					

Note. Conductor marked with * are connected within the programmer

Fig. 6. 3

6.1.3 Servopack Connector Terminals and Signal Names

Servopack related signals are Motionpack-34 connector 22CN (PG signal), 23CN (servosignal) and optical encoder 2CN and external terminal TB1.

22CN (PG signal)

1	2	3	4	5	6	7	8	9
PB 1	*PB1		PA 1	*PA1				FG

10	11	12	13	14	15	16
PC 1	*PC1					

17	18	19	20	21	22	23	24	25
BATALM		ABSID		SEN	OSEN	0_5 V	0_5 V	0_5 V

External terminal (TB1)

1	2	3	4	5
$\overline{\text{OTF}}$	$\overline{\text{OTR}}$	COM	DT	$\overline{\text{DT}}$

23CN (Servo signal)

1	2	3	4	5	6	7
0 12 V	0 12 V		RDY 2	RDY 1 (24 V)		$\overline{\text{SAL}}$

8	9	10	11	12	13
	SG 02	SG 03	SG 01	CLD	$\overline{\text{OTF}}$

14	15	16	17	18	19	20
+12 V	−12 V	+CL	−CL	REF	$\overline{\text{OTR}}$	0 24 V

2CN (Optical encoder signal)

1	2	3	4	5	6	7
0 5 P	0 5 P	0 5 P	+5 P	+5 P	+5 P	DIR

8	9	10	11	12	13
			ODIR	BAT	BATO

14	15	16	17	18	19	20
PC	*PC	PA	*PA	PB	*PB	FG

Fig. 6. 4

6.2 CABLE

6.2.1 Motionpack-34 Related Cable

(1) PG signal related cable (J1C cable)

Since PG signal is output to Servopack 22CN, connect it to Motionpack-34 CN4 connector. Output circuit is line driver; use twisted shielded cable for mating signal.

For connection, refer to par. 5.23.

Ground cable shielded wire at controller side ; use CN4-9 pin for FG terminal.

Use twisted shield cable; KQVV-SB10P × 0.2mm² (made by Fujikura Ltd.) 0.2mm² twisted shielded cable is recommended.

(2) Terminal device (J4) cables

The terminal device is connected to the Motionpack-34 via J4 cable for input and output of parameters and program.

A D-subconnector (DB-25P made by JAE) is fitted on the programmer side of the cable. In most cases, a D-subconnector is used slso on the terminal side. Fig 6.5 shows the pin assignments of the cable fitted with D-subconnectors on both ends.

This cable connector is not provided with Motionpack programmer.

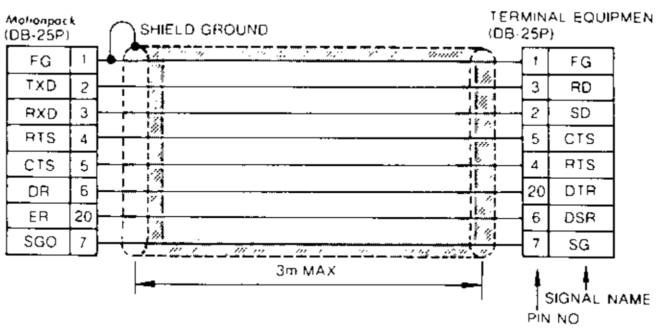


Fig. 6. 5 Cables for Terminal Equipment

(3) Motionpack input/output signals (J6 AND J7) cables

Signals are exchanged between the Motionpack and the programmable controller through the J6 and J7 cables.

J6 : for input signals (PC → Motionpack-34)

J7 : for output signals (Motionpack-34 → PC)

Prepare the cables according to the pin assignments described in par. 6.1.1. Leave the unused pins open.

Lay only as many lines of 0 or 24V of J6 and J7 as are described in par. 5.2.1.2 and par. 5.2.2.2 all in parallel. This will prevent voltage drop which would occur if current flows through the power line (or the line of 0V), inducing noise to the signal voltage.

The J6 and J7 cables are available on order.

J6 cable : 3 meters long, connector fitted on one end KQVV-SB cable of 50C × $0.2mm^2$

J7 cable : 3 meters long, connector fitted on one end, KQVV cable of 20C × $0.2mm^2$

Normally, digital signals should be exchanged between identical control panels. The cable length should not exceed 10 meters.

(4) Motionpack-34 LS signal (J8) cables

J8 cables include external positioning signals. Limit switches are provided to the machine and each of them separates; take proper wiring into consideration.

For proper wiring, as shown in Fig 6.6, relay wiring with relay terminal and provide 24V cable common to improve noise immunity.

For wiring in Fig. 6.6 ∗1, twist a and b, c and d, e and f. If peripheral noise causes big trouble or electronic limit switch way has trouble by the noise, as shown in Fig. 6.6 ∗3 EXP, use shielded cable and connect shieled grounding with FG at the control side.

For the cable in Fig. 6.6 ∗2, shielded cable is suitable KQVV-SB50C × $0.2mm^2$ (made by Fujikura Ltd.) $0.2mm^2$ 50-pin shielded cable is recommended.

6

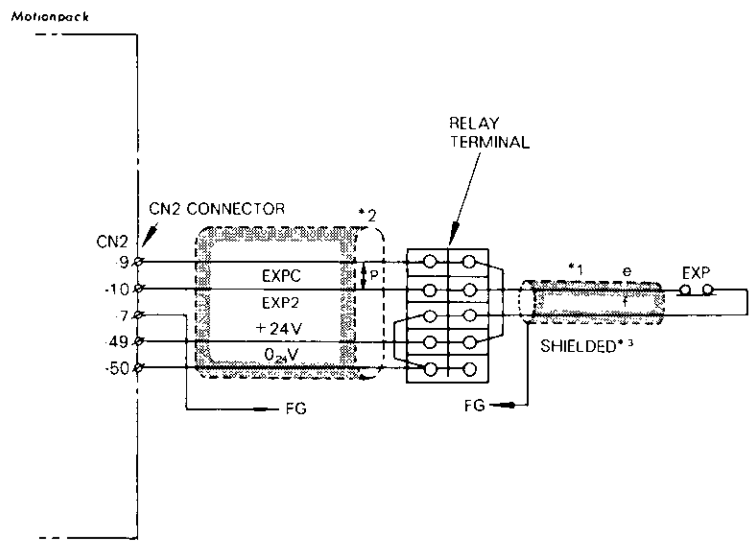


Fig. 6. 6 Connection Configuration

6.2.1 Motionpack-34 Related Cable (Cont'd)

(5) Servo signal (J9) cables

The signals transmitted through these cables include those related to servo control described for the Motionpack Controller CN3 connecter.

Cable connecting Motionpack-34 controller and Servopack is J9 cable which is the same as one of DC Servopack DB unit.

When preparing the cable, twisted pairs must conform exactly to the designated connector pins as shown in Fig, 6.7. If twisted pairs are shifted, noise interference could occur with the resultant effect of twisted pairs lost.

The J9 cable should be a shielded cable. Recommended is KQVV-SB10p × $0.2mm^2$ made by The Fujikura Ltd.

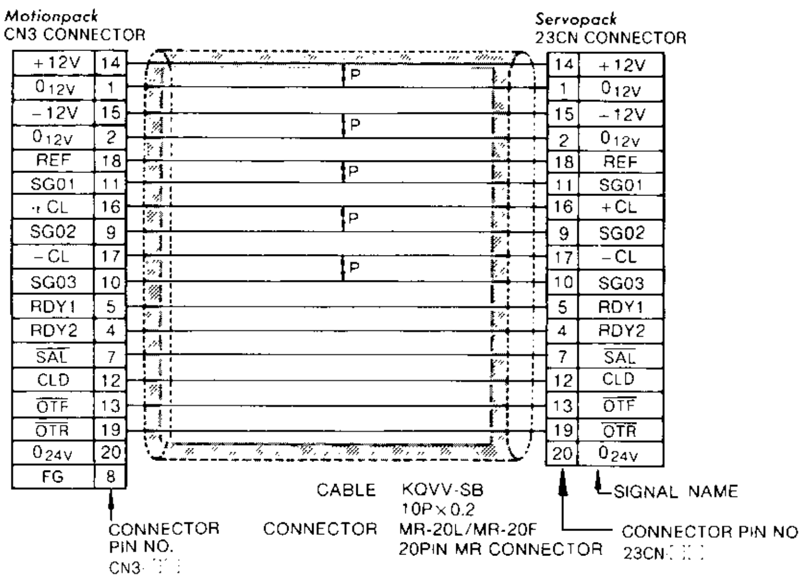


Fig. 6. 7 J9 Cable

(6) Signal cables materials

The signal lines between the Motionpack-34 controller and the sequence are to be connected with the MR connector on the Motionpack-34.

Select a cable by referring to Table 6.1. The suitable twisted-pair cable is the KQVV-SB10P × 0.2mm² shown in Table 6.2.

Signal lines between Motionpack-33 and sequencer should be connected with MR connectors. Cables Should be selected in accordance with Tables 7. 6 and 7. 7 Twisted cables should be KQVV-SB10P × 0.2mm² (or3P × AWG26) shown in Table 6. 3.

Table 6. 1 Signal Cables

	MR-50L/MR-50F	MR-20L/MR-20F
Type	Solder type	Solder type
No. of Cores	50 cores	20 cores
Applicable Wire	AWG ♯24-♯28	AWG ♯24-♯28
Cutter Diameter	16 mm dia max	10 mm dia max
Recommended Cable	Plastic multicore control cable (Example) KQVV50C × 0.2 (0.2mm², 50 cores) manufactured by Fujikura Ltd.	(Example) KQVV20C × 0.2 (0.2mm², 20 cores) manufactured by Fujikura Ltd.
	Cores: 0.2mm² tin-plated soft copper stranged wires. 16/0.12 (cores/mm) Insulating material: Cross-linked vinyl Thickness: 0.3 mm Finished outer dia: 1.1 mm	

Table 6. 2 Dimensions of Cores

AWG	Sectional Area of Conductor mm²	Standard Outer Dia of Vinyl insulation mm
♯24	0.21	1.5 ← Recommended
♯26	0.13	1.3
♯28	0.08	1.2

Table 6. 3 Twisted Cables

Name		Unit	Specifications KQVV-SB
No. of Pairs		Pair	10
Conductor	Material		Tin-plated soft copper stranded wires
	Nominal Sectional Area	mm²	0.2
	Configuration	Numbers/mm	16/0.12
	Outer Diameter	mm	0.55
Insulation	Material	-	Cross-linked vinyl
	Thickness	mm	0.3
Circuit Configuration		-	Paired strands with pitch of 18, 22, 25, 32
Holding		-	Wound with paper tape
Shielding		-	Tin-plated soft copper wire braided
Sheath	Material and Color	-	Vinyl, black
	Thickness	mm	1.2
Approx Finished Outer Dia.		mm	10.0
Approx Weight		kg/km	130

6.2.1 Motionpack-34 Related Cable (Cont'd)

〈Wiring to mobile device〉

There are special considerations for a cable connected to a mobile device. The cable undergoes repeated bending or twisting as the mobile device moves. It exposes the cable conductors to fatigue, leading to breakdown, should some PG signal line break, the moter might run wild and a serious accident occur.

Cable makers advise that the resistance of the cable to bending and twisting is determined by the following factors.

Bending strength

(1) Curvature of bend
(2) Cable tension
(3) Multiple number of twisting pitches of cable core leads
(4) Area of conductor
(5) Structure of conductor

Twisting strength

(1) Twisting angle
(2) Twisting pitch of cable core leads
(3) Cable twisting span

For cables connecting mobile devices, it is recommended to use cables that are made for industrial robots and are capable of withstanding the rigors of bending, twisting, est.

For precise details, address inquiries to the cable makers.

Examples of movable device cables are shown below.

〈Example of Robot Cable〉

Type : CO-FHV-SB 10P × $0.3mm^2$

Manufacturer : Hitachi Cable, Ltd.

Table 6. 4 Cable Specifications

Item		Unit	Standara Value
Number of cores (pair)		–	10
Conductor	Nominal sectional area	mm^2	0.3
	Composition	No./mm	60/0.08
	Outside diameter	mm	0.72
Insulation thickness		mm	0.3
Insulation diameter		mm	1.32
Pair outside diameter		mm	2.64
Twisted cable outside diameter (approx)		mm	8.5
Shielded braid thickness		mm	0.3
Sheath thickness		mm	1.0
Finished outside diameter (max)		mm	11.0
Conductor resistor (20℃)		Ω/km	65
Test voltage		V/min	AC500/1
Insulation resistor (20℃)		MΩ・km	100
Approximately weight		kg/km	160
Standard length		m	200
Packaging method		–	Bundle

Table 6. 5

Pair No.	1st Core	2nd Core	Pair No.	1st Core	2nd Core
1	White	Black	6	Red	Brown
2	White	Red	7	Red	Yellow
3	White	Brown	8	Black	Brown
4	White	Yellow	9	Black	Yellow
5	Red	Black	10	Yellow	Brown

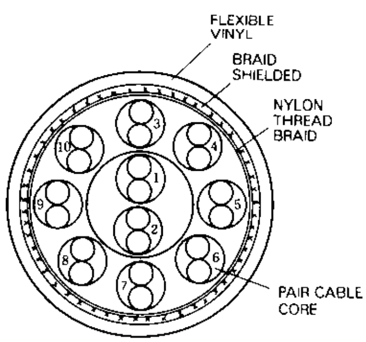
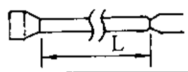
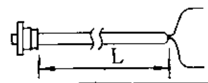
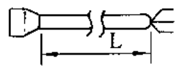
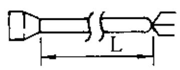
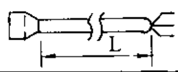
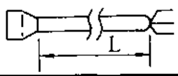


Fig. 6. 8

6.2.1 Motionpack-34 Related Cable (Cont'd)

(7) Cable List

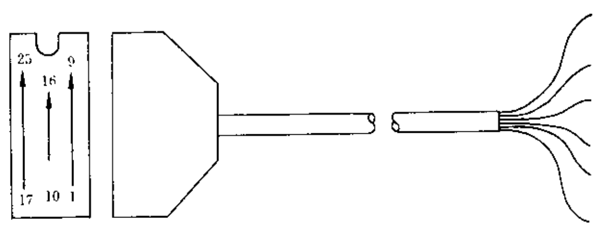
The following cables are available upon request.

Cable	Application	Connecter	request	Standard Cable			No. of
				Specification	Symbol	Length (L)	Cables
J1C	PG Signal [CM34 AC Servopack]	MR-25L/MR-25F	KQVV-SB 0.2×10P	CM-CN4 	J1C	3m	
J4	PM33F ↕ PC	D-Sub Connector DB-25P	KQVV-SB 0.2×10P shielded	CT 	J4	3m	
J6	CM34 (IN) ↕ Sequencer(OUT)	MR-50L/MR-50F	KQVV-SB 0.2×50C	CM-CN5 	J6	3m	
J7	CM34 (OUT) ↕ Sequencer (IN)	MR-20L/MR-20F	KQVV-SB 0.2×20C	CM-CN1 	J7	3m	
J8	CM34 Handle PG Ext. Positioning Signal	MR-50L/MR-50F	KQVV-SB 0.2×50C	CM-CN2 	J8	3m	
J9B	Servo Signal [CM34-AC Servopack]	MR-20L/MR-20F	KQVV-SB 0.2×10P shielded	CM-CN3 	J9B	3m	

Cables mentioned above, are provided with only one connector at Motionpack side.
For connector at the opposite side, select and use a connector according to your requirements.

(a) J1C Cable (PG Signal CM34 • CN4 ↔ AC Servopack)

25	0_5V			9	Shielded
24	0_5V	16		8	
23	0_5V	15		7	
22	OSEN^{*7}	14		6	
21	SEN^{*7}	13		5	OPA^{*2}
20		12		4	PA 1 ^{*2}
19	ABS ID	11	OPC^{*3}	3	
18		10	PC 1 ^{*3}	2	OPB^{*1}
17	BATALM			1	PB 1 ^{*1}

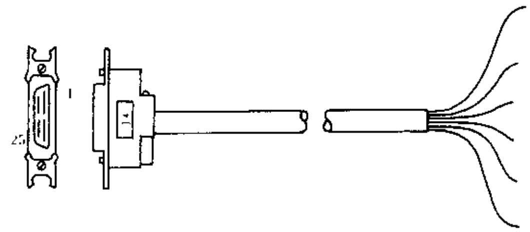


Connector Pin Layout

Note : Cable with * of the same No. are of twisted pair.

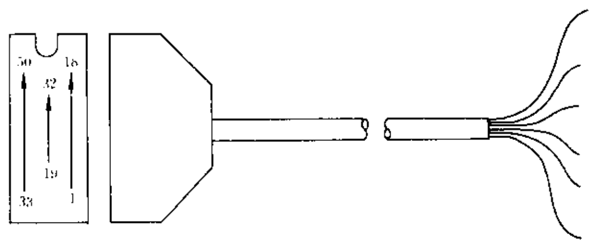
(b) J4 Cable (Programmer ↔ PC)

14		1	FG
15		2	TXD
16		3	RXD
17		4	RTS
18		5	CTS
19		6	
20		7	SGO
21		8	
22		9	
23		10	
24		11	
25		12	
		13	



(c) J6 Cable (Digital input signal, CM34 • CN5 ↔ Sequencer)

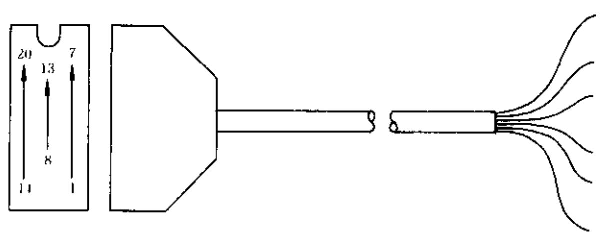
50				18	OPSL
49	O_{24} V			17	EPS 7
48	O_{24} V	32	SEL	16	EPS 6
47	O_{24} V	31	MFIN	15	EPS 5
46	SET INT	30	G34F	14	
45	FG	29	OVR	13	JOG
44	JMF	28	SBK	12	PLAY
43	JLF	27	STEP	11	EDIT
42		26	ERS	10	ZRN
41	$\overline{\text{ATSTP}}$	25	ATST	9	−JS
40	PGCL	24	SBST	8	+JS
39	PGS 7	23	PGS 5	7	PGS 2
38	PGS 6	22	PGS 4	6	PGS 1
37	−INC 8	21	PGS 3	5	PGS 0
36	+INC 8	20	PGSL20	4	PGSL00
35	PGSL30	19	PGSL10	3	PGS 9
34	STROBE			2	PGS 8
33	−INC 9			1	+INC 9



Connector Pin Layout

(d) J7 Cable (Digital output signal CM34 • CN1 ↔ Sequencer)

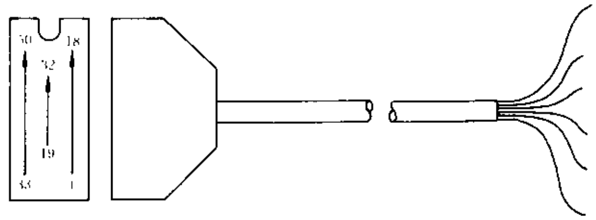
20	ALM 2	13	M51	7	G34
19	ZNP	12	M30	6	STL
18	M56	11	OFM	5	ZPM
17	M55	10	OFR	4	ALM 1
16	M54	9	INCD	3	RDY
15	M53	8	EPAL	2	+24V
14	M52			1	+24V



6.2.1 Motionpack-34 Related Cable (Cont'd)

(e) J8 Cable (External Cable CM34 • CN2 ↔ External Circuit)

50	0_{24} V			18	LSA 2	
49	$+24^{V}$			17	LSAC	*2
48		32	2 C*1	16	LSA 1	
47		31	2 D*1	15		
46		30	2 B*1	14	LSB 2	
45		29	2 A*1	13	LSBC	*2
44		28		12	LSB 1	
43		27		11	FG	
42		26		10	EXP 2	
41		25		9	EXPC	*2
40		24		8	EXP 1	
39		23		7	FG	
38		22		6	HB 2	
37		21		5	HBC	*2
36		20		4	HB 1	
35		19		3	HA 2	
34				2	HAC	*2
33				1	HA 1	



Note :

*1 Common across the following pins :
- ㉙ − ㉚
- ⑬ − ㉜

When removing a common lead, cut off the both ends of the lead from the contacts.

*2 Each signal of HA, HB, EXP, LSA, LSB is provided with two leads for power switching.

HA 2 (HB 2)] 12 V
HA C (HB C)] 5 V
HA 1 (HB 1)

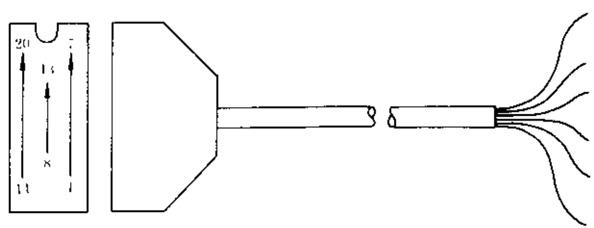
EXP 2] 24 V
EXP C] 12 V
EXP 1

LSA 2 (LSB 2)] 24 V
LSA C (LSB C)] 12 V
LSA 1 (LSB 1)

Cut off an unnecessary lead from the bottom.

(f) J9 Cable (Servo Signal CM34 • CN3 ↔ AC Servopack)

20	0_{24}V			7	$\overline{\text{SAL}}$	
19	$\overline{\text{OTR}}$	13	$\overline{\text{OTF}}$	6	NODB	*
18	REF	12	CLD	5	RDY 1	
17	−CL	11	SG01	4	RDY 2	
16	+CL	10	SG03	3		
15	-12^{V}	9	SG02	2	0_{12}V	
14	$+12^{V}$	8	FG	1	0_{12}V	



* When using AC Servopack for absolute value system, cut off a lead for ⑥ NODB signal from the bottom.

6.2.2 Servopack Related Cable

(1) Optical encoder (PG) cable

Applicable receptacle and cable specifications are as shown in Table 6.6.

Fig. 5.15 shows connecting method of optical encoder connecting Servopack connector 2CN and optical encoder, and slso PG output (connector 1CN) processing method.

Table 6. 6 Applicable Receptacle and Applicable Cable Specifications

Servopack Applicable*1 Connector Specifications	Applicable Receptale Type				Connection Cable Specifications
	Soldered type	Caulking type*3	Case	Manufacturer	
MR-20RMA Right Angle	MR-20F *2	MRP-20F01 Contact MRP-F102 (Continuous terminal) MRP-F112 (Single terminal)	MR-20L *2	Honda Tsushin Co.	DP8409123 or DE8400093

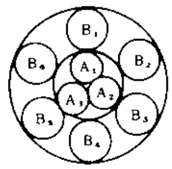
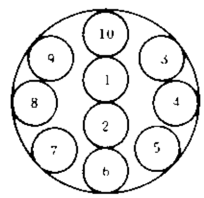
*1: Made by Honda Tsushin Co.
*2: Servopack standard attachment
*3: Not Servopack standard attachment

NOTE

Though the cable with the following specifications are prepared as connecting cable they are not attached to Servopack or motors.

If required, give an order by preparatory length unit. (See Table 6.7.)

Table 6. 7 Details of Specificable of Applicable Cables

Connection	Soldered Type	Caulking Type
Yaskawa Drawing No.	DP8409123	DE8400093
Manufactuer	Fujikura Cable Co.	
Approx Specifications	Double, KQVV-SW AWG22 × 3C AWG26 × 6P	KQVV-SB AWG26 × 10P
(Recommended Receptacle Type)	For Soldered Type  	For Caulking Type 
Internal Composition and Lead Color (DP8409123 Standard Application)	A_1 Red A_2 Black A_3 Green yellow B_1 Blue-White/blue B_2 Yellow-White/yellow B_3 Green-White/green B_4 Orange-White/orange B_5 Purple-White/purple B_6 Grey-White/grey (B_1–B_6: Twisted Cable)	1 Blue-White 2 Yellow-White 3 Green-White 4 Red-White 5 Purple-White 6 Blue-Brown 7 Yellow-Brown 8 Green-Brown 9 Red-Brown 10 Purple-Brown (Twisted Cable)
Yaskawa Standard Specifications	Standard length: 5m, 10m, 20m Terminal ends are not provided (without connectors).	

NOTE

1. Allowable wiring distance between Servopack and motor (PG) is maximum 20m when applicable cable is used.
2. When the wiring distance exceeds 20m contact YASKAWA representative asking for 50m cable (YASKAWA DWG NO DP8409179). DP8409179 composition is AWG16 × 3C, AWG26 × 6P; the lead colors are the same those of DP8409123.

To prevent noise interference, extending the single PG cable is preferable to connecting two cables via terminals at the outlet from the control panel. If connecting cables at terminals is unavoidable, connect the shields as shown in Fig. 6.9.

(2) PG signal related cable

Refer to par. 6.2.1 (1) "PG signal related cable (J1C Cable)"

(3) Servo related signal cable

Refer to par. 6.2.1 (5) "servo related signal cable".

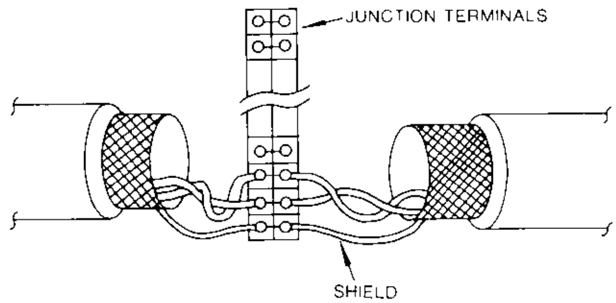


Fig. 6. 9 Junction of Cables

6.2.3 Main Circuit Related Wiring

(1) Rated current and applicable cable size Tables 6.8 and 6.9 show description of external terminals and rated current, and applicable size. Applicable cables and their sizes are choosen for applicable environment and current capacity. Example of applicable cable size is given under the condition of ambient temperature 40° and rated current running on 3 lead bundles.

Table 6. 8 Rated Current

External Terminal Name		Type CACR- / Terminal Sign	Rated Current						
			SR03TZ	SR06TZ	SR12TZ	SR20TZ	SR30TZ	SR44TZ	SR60TZ
On-line terminal	Main circuit power supply input terminal	ⓇⓈⓉ	2 Arms	6 Arms	8 Arms	10 Arms	18 Arms	24 Arms	32 Arms
	Motor connection terminal	ⓊⓋⓌ	3.0	5.8	11.7	18.8	26	33 Arms	45 Arms
	Regeneration resistor connection terminal	(Y3)(Y4)	3.8 A Max.		7.6 A Max	15.2 A Max	30.4 A Max.		46 Arms
	Emergency stop connection terminal	(Y5)(Y6)	0.2 Arms						
	Brake connection terminal	(A7)(A8)	DC0.5A						
Off-line terminal	Control I/O Single connector	15 CN	DC100mA Max.						
	PG Signal connector	2 CN	100mA Max. power line DC 500mA						
	Grounding connector	⏚	—						

6.2.3 Main Circuit Related Wiring (Cont'd)

Table 6. 9 Example of Applicable Cable Size

<table>
<tr><th colspan="2" rowspan="2">External Terminal Name</th><th rowspan="2">Type CACR-
Terminal Sign</th><th colspan="6">Example of Applicable Cable Size</th></tr>
<tr><th>SR03TZ</th><th>SR06TZ</th><th>SR12TZ</th><th>SR20TZ</th><th>SR30TZ</th><th>SR44TZ</th></tr>
<tr><td rowspan="5">On-line terminal</td><td>Main circuit power supply input terminal</td><td>Ⓡ Ⓢ Ⓣ</td><td colspan="3">HIV 2.0 min.</td><td>HIB 3.5 min.</td><td rowspan="2">HIV 5.5 min.</td><td rowspan="2">HIV 2.2min.</td></tr>
<tr><td>Motor connection terminal</td><td>Ⓤ Ⓥ Ⓦ</td><td colspan="2">HIV 2.0 min.</td><td colspan="2">HIV 3.5 min.</td></tr>
<tr><td>Regeneration resistor connection terminal</td><td>(Y3) (Y4)</td><td colspan="2">HIV 2.0 min.</td><td colspan="2">HIV 3.5 min.</td><td colspan="2">HIV 5.5 min.</td></tr>
<tr><td>Emergency stop connection terminal</td><td>(Y5) (Y6)</td><td colspan="6" rowspan="2">HIV 1.25 min. (SR60TZ terminals Ⓢ HIV 1 25 min)</td></tr>
<tr><td>Brake connection terminal</td><td>(A7) (A8)</td></tr>
<tr><td rowspan="3">Off-line terminal</td><td>Control I/O Single connector</td><td>1 5 CN</td><td colspan="6" rowspan="2">Twisted cable or twisted shielded cable
Tin-plated annealed copper twisted cable
Cable finishing externals: 1 CN-ϕ 16 max, 2 CN-ϕ 11 max</td></tr>
<tr><td>PG Signal connector</td><td>2 CN</td></tr>
<tr><td>Grounding connector</td><td>⏚</td><td colspan="6">HIV 2 0 max</td></tr>
</table>

Table 6. 10 Applicable Cable

Type: Mark	Type: Name	Conductor Applicable Temp. (℃)
PVC	General vinyl cable	—
IV	600 V vinyl cable	60
HIV	Special heat-proof vinyl cable	75

NOTE

1. Use pressure-proof cable of 600V at minimum for the main circuit.
2. For strand, pay attention to cable allowable current reduction ratio if the cable is put in the duct (hard vinyl tube, metal tube).
3. When ambient temperture (panel temperature) is high, use heat-proof cable since general vinyl cable would be heat deteriorated in a short time.

6.3 PRECAUTIONS FOR WIRING

6.3.1 Prevention of Interference between Wires

In the Motionpack system, cables of varying power levels such as the lines of PG and digital signals, mix with the motor main circuit through which large current flows. If a high speed signal line such as the PG signal line is laid close to the motor main circuit, noise might be induced in the signal line and result in a failure of positioning.

It is therefore very important to prevent interference between lines.

(1) Wiring division

The lines can be divided into three groups as given in Table 6.11.

Table 6. 11 Group of Lines

	Category I	Category II	Category III
Conditions	May cause noise interference due to large current and highspeed signals.	Vulnerable to serious damage due to external noise induction.	Relatively stabled for both digital or analog.
Connection specifications	• Servopack ⟷ motor • Servopack 200 VAC power input line	• PG leads • Servopack reference input (J9)	• CM I/O signals (J6, J7)

Do not lay lines belonging to different categories in the same duct or bundle.

Observe the following precautions for category II PG signal lines.

(a) Never lay the lines of PG signals close to or parallel to any categoly I lines.

(b) Never lay the lines of PG signals close to parts and units generating noise or parallel to the lines wired to them.

(c) For better results, connect the shielding of any cable coming from PG to the frame ground terminal of the control panel.

(2) Wiring for PG

A serious error, such as mispositioning, would occur if noise added to PG signals. Follow the instructions listed below. Do not braid with category I line or lay lines in the same duct.

(3) Motionpack origin signal (J8) cables

The signals transmitted through the J8 cable include the origin slow-down signal, origin confirmation signal, and external positioning signal.

The cable to the machine may be of considerable length. LS contacts sometimes open during operation and, if this happens, noise is likely to be induced in the cable. Take the following precautions against noise.

(a) Connect a surge supperssor in parallel with each LS contact.

Surge suppressor : CR50500 (of Okaya Industry) or a capacitor (metalized film, 600V／0.1μF)

(b) Lay the cable away from and not parallel to the main circuit wiring.

6.3.1 Prevention of Interference between Wires (Cont'd)

(4) Connecting surge absorber to coil

Be sure to connect a surge absorber to every device having a coil in it, such as relays, contactors, and solenoids.

Surge absorbers :

(a) Use 200 VAC : Surge suppressor CR50500 (of Okaya Industry)

(b) Use 100 VAC : Surge suppressor AU1201 (of Okaya Industry)

(c) Use 24 VDC : Diode IS2462 (of Toshiba Corporation)

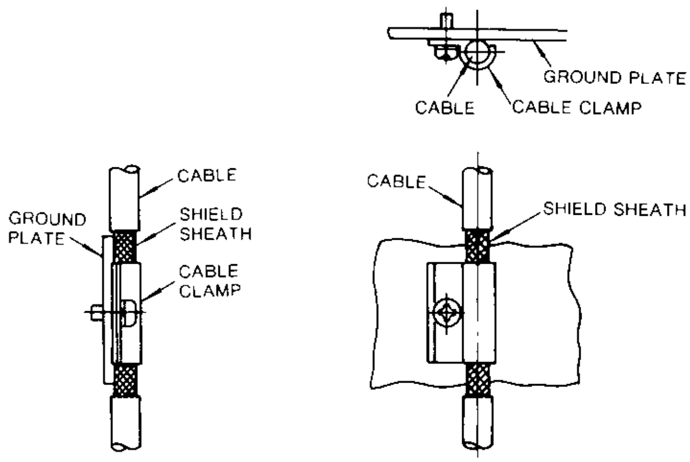
The surge sbsorbers above are usable at the specified voltages.

(5) Fastening cables

Be sure to tighten the locking screw of the MR connector on the cable.

Clamp the cable so that the weight and tension of the cable will not pull on the connector.

The clamp shown in Fig. 6.10 is very effective. The sheath of the shielded cable can be removed to connect the shielding to FG (frame ground).



Note: To clamp the cable (which is not shielded), cable armor should not be stripped.

Fig. 6. 10 Cable Clamp

(6) Assuring correct connection of cable connectors

Input/output circuits of the Motionpack-34 may be damaged, for correct pairs of male and female cable connectors are not mated properly. Observe the following precautions to prevent such an mishap.

(a) Write the name of the cable connector on the nameplate provided and bond it to the connector immediately after you have prepared the cable.

(b) After laying the cables, bind them together so that the cable connectors come to fixed positions.

6.3.2 Connection of the Input/Output Power Supply Unit

One input/output power supply unit can supply power to more then one Motionpack-34. In this case, string the power cable carefully to prevent noise interference occurring due to voltage drop.

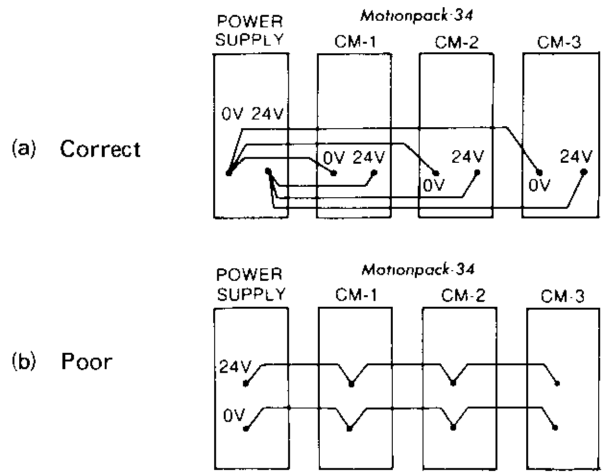


Fig. 6. 11 Input/Output Power Connections

6.3.3 Noise Source Measurement

When sharing the power supply with electrical welder or electrical discharge machine, or there is a high-frequency noise source nearby, provide noise filter or insulation transformer to the power supply or input circuit.

Following must be observed :

(1) Separete the leads of the primary circuit of the noise filter or isolation transformer completely from those of the secondary circuit.

(2) Connect the ground line of the noise filter or isolation transformer to system ground via the shortest path with a heavy wire.

(3) Reduce the length of the line to the input terminal of the noise filter or isolation transformer to the minmum. Take care to prevent noise feom being induced in the circuit. (Refer to instructions above.)

(4) For the control panel, take power from the secondary circuit of noise or isolation transformer.

6.3.4 Grounding

Connect all grounding leads to the ground at one position (grounding better then class 3, grounding resistance 100 ohms or less). Use a thick wire (flat braided wire of $3.5mm^2$ or more) for the grounding lead.

Fig. 6.12 shows a methed for grounding an axis. The frame grounds of the Motionpack -34 controller, DB unit, Servopack, and programmable controller are connected to the ground terminal of the control panel and a single grounding lead of class 3 (100 ohms or less) or better are installed there. The "other circuits" referred to there include the inverter driving the main axis.

The inverter must be grounded directly to the location where the collective grouding of the other components converge.

Fig. 6.13 shows a method for grounding many axes. Such a system includes many units and it would be troublesome to lay grounding leads individually. It indicates an example of laying many individual grounding lines, one for each axis. It is not good to connect units of the same kind together, like controller to controller and Servopack to Servopack.

• Motor frame grounding

When the motor is grounded through the frame at machine side, cf／dv／dt current is given from PWM power section through motor floating capacity (cf). To prevent the influence by this current, connect motor E terminal (motor frame) to Servopack ⏚ terminal for use. (Servopack ⏚ terminal should be directly grounded.)

• Servopack SGOV

When the noise gets on the input signal line, ground SGOV to use.

When the motor wiring is in metal conduit, ground both conduit and box.

Grounding methods mentioned above are single grounding.

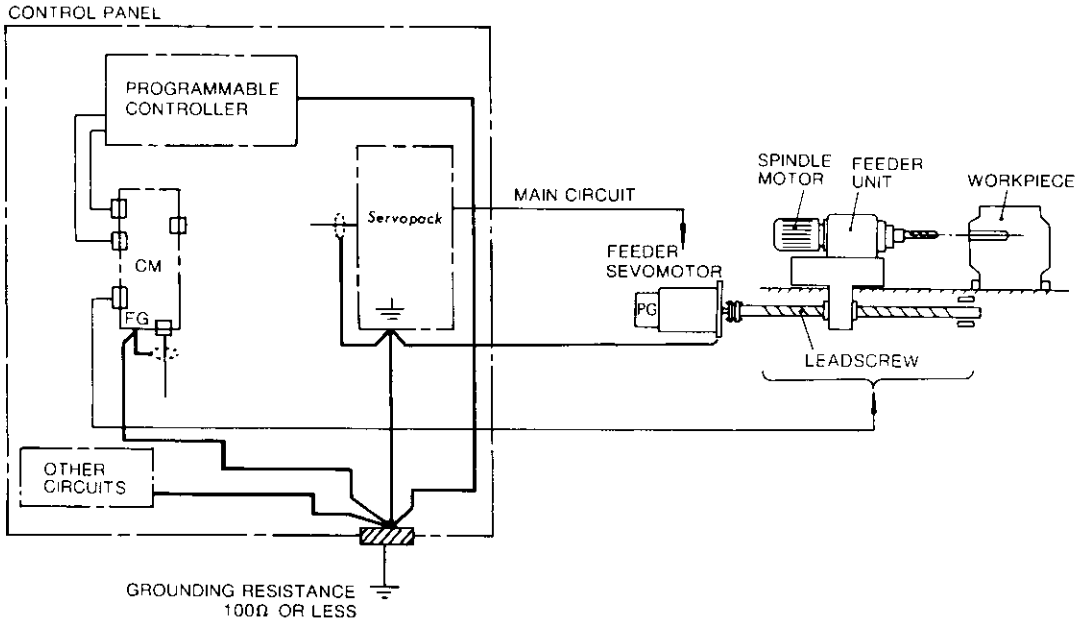
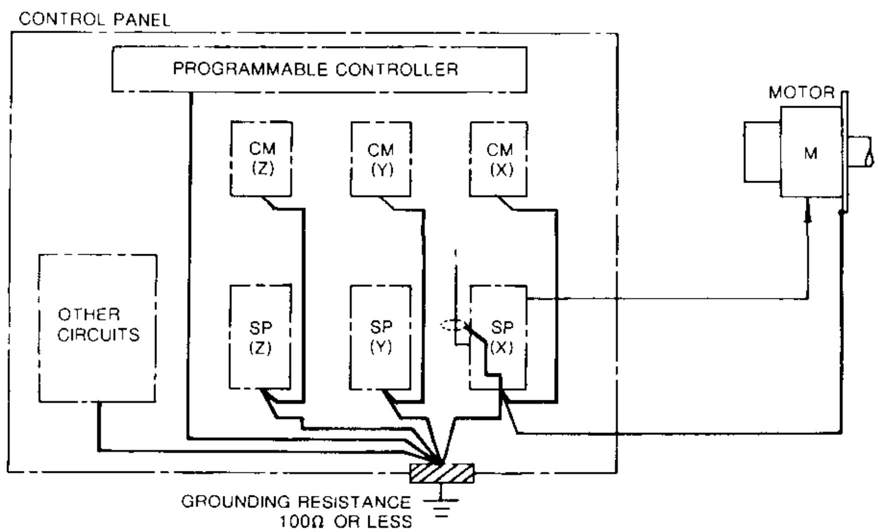


Fig. 6. 12 Grounding for One Axis



Note: Motors for Y and Z axes and their connectors are not shown.

Fig. 6. 13 Grounding for Multiple Axes

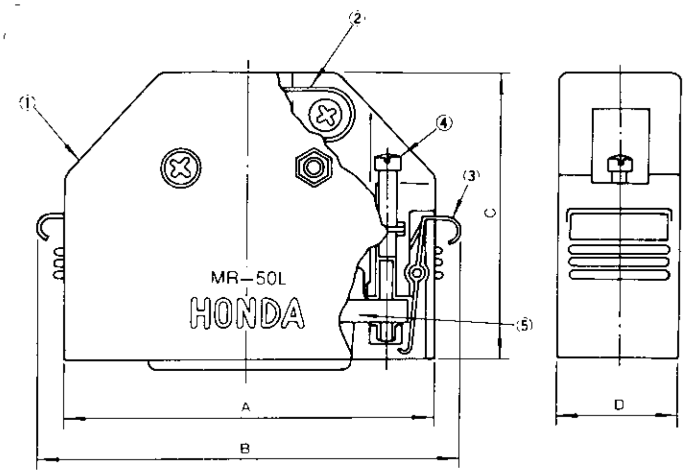
6.3.5 Precautions for Servopack Related Wiring

(1) Separete power line (strong electrical circuit such as AC line, motor line, etc.) and signal line by more then 30cm for wiring.

Do not conduct in the same duct or not strand together.

(2) When electrometer is connected to torque monitor terminals (A1 - A3) and speed monitor terminals (A2 - A3), set the electrometer as close to the control unit as possible and do not strand wires together with power line.

6.4 CONNECTOR DIMENSIONS (Maker : Honda Tsushin Co.)



Model \ Code	A	B	C	D
MR-20L	39.3	44.9	39.8	18
MR-25L	44.5	50.1	40.5	18
MR-50L	67.9	73.5	44.8	18

Code	Name
①	Connector cover
②	Cable clamp
③	Connector clamp spring
④	Connecter clamp screw
⑤*	Connector (MRP-$^{20F}_{50F}$ MR-$^{20F}_{50F}$)

*

1. MRP-20F, -25F, -50F: Solderless type.
   MR -20F, -25F, -50F. Soldered type

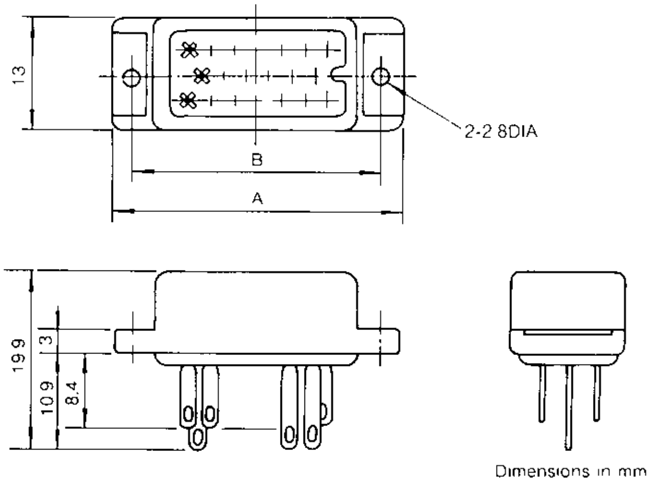
2. Applicable cable OD: MR-20L. . 10mm dia max
   MR-25L 13.5mm max
   MR-50L. 16mm dia max

3. The Motionpack accessory set includes an MR-20F (with MR-20L) and MR-50F (with MR-50F) (soldered type).

   When solderless type connectors (MRP-20F01, MRP-25F01, MRP-50F01) are to be used they must be prepared by the machine builder.

Fig. 6. 14

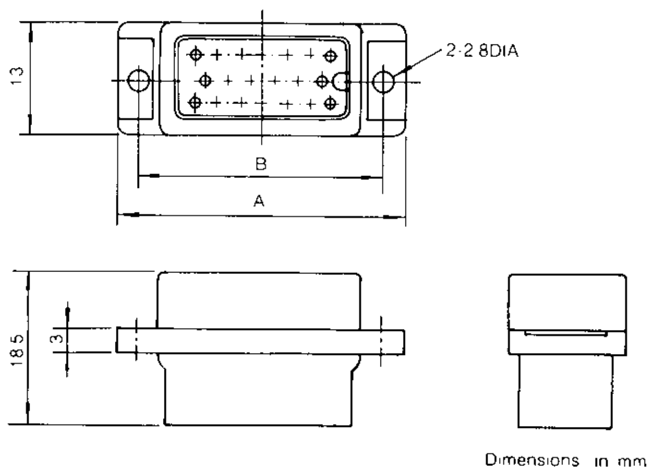
(1) Model MR-20F, MR-25F, MR-50F connectors (Soldered Type)



Model \ Code	A	B	No. of Terminals
MR-20F	32.8	27.8	20
MR-25F	38.0	33.0	25
MR-50F	61.4	56.4	50

Fig. 6. 15

(2) Model MRP-20F01, MRP-25F01, MRP-50F01 connectors (Solderless Type)



Model \ Code	A	B	No. of Terminals
MRP-20F01	32.8	27.8	20
MRP-25F01	38.0	33.0	25
MRP-50F01	61.4	56.4	50

Fig. 6. 16

Note: To use the solderless type connectors, a crimping tool is required, for which inquiries are to be made to Honda Tsushin Co.

6.4 CONNECTOR DIMENSIONS (Maker : Honda Tsushin Co.) (Cont'd)

(3) Terminal No.

Dimensions in mm

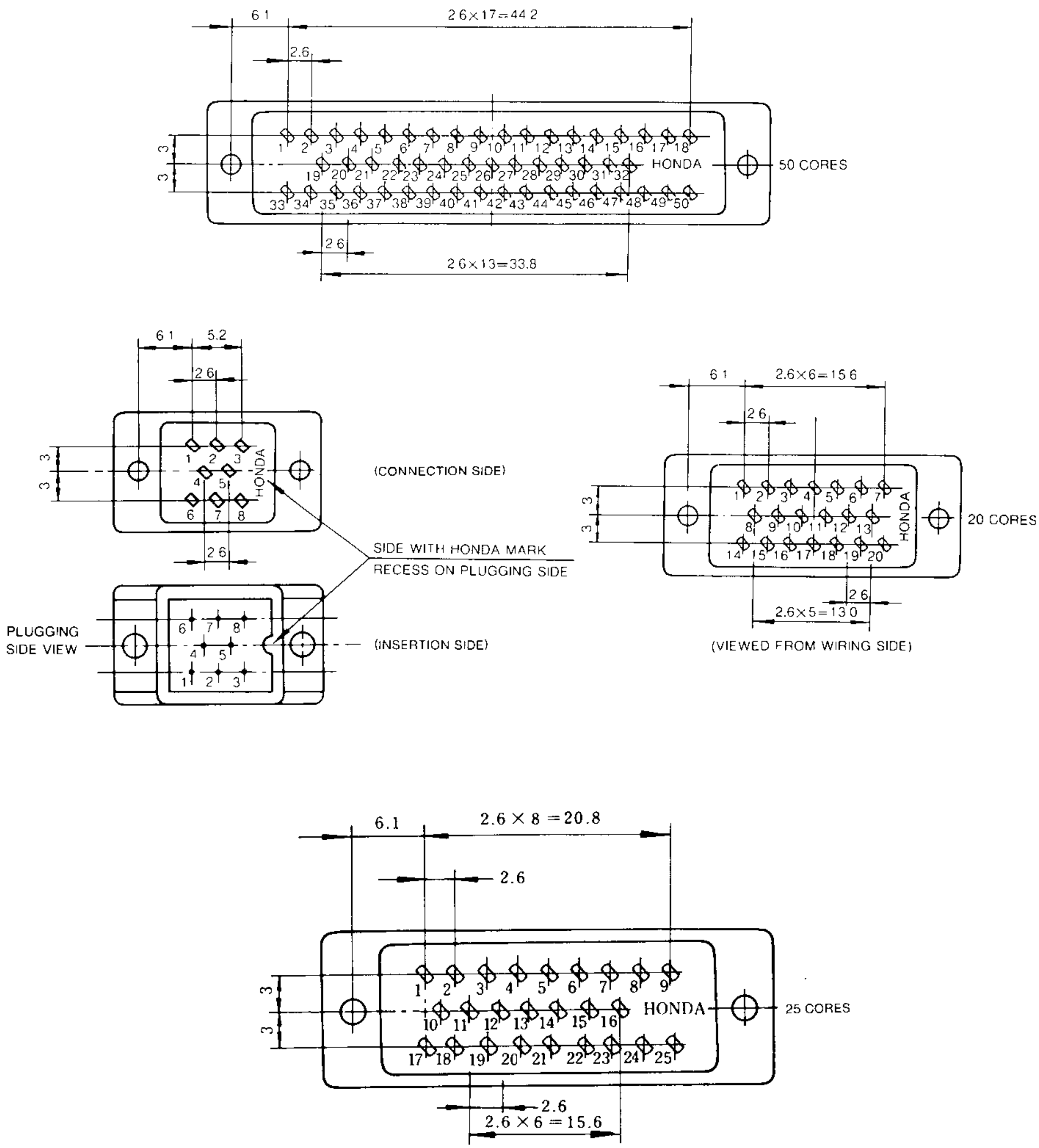


Fig. 6. 17

6.5 COMPONENT-TO-COMPONENT TOTAL CONNECTION

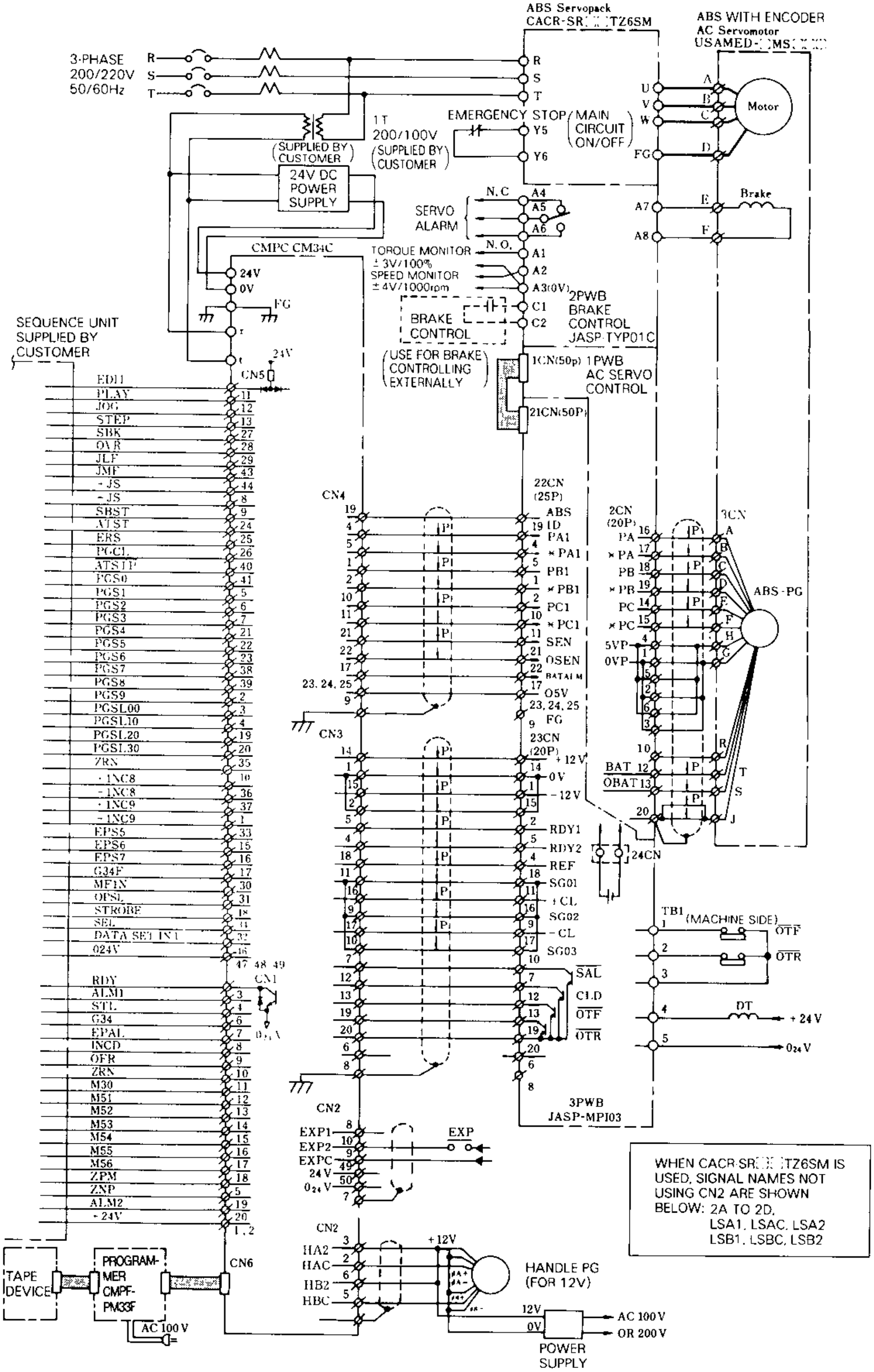
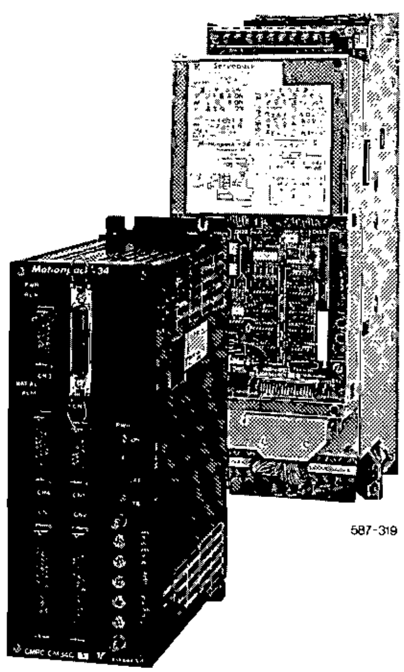


Fig. 6. 18 Motionpack-34 Component-to-Component Total Connection Configuration (When CACR-SR TZ6SM is used.)

7. INSTALLATION, TEST RUN

This section describes the procedures of installing the Motionpack-34 and adjusting it during trial operation.
Installation of units will be described first, together with precautions. The procedures of trial operation and adjustment are flowcharted in Par. 7.2.
Setting up the reference of the coordinate system for absolute positioning is explained in Par. 7.2.6.
Never fail to set up the coordinate point.



Servopack
TYPE CACR-SR20TZ 6S□

587-319

CONTROLLER
Motionpack-34

TYPE CMPC-34C

590-286

7. INSTALLATION, TEST RUN

7.1 INSTALLATION

7.1.1 Motionpack-34 Controller

7.1.1.1 Installation and connection

(1) Installation

The Motionpack-34 Controller has ventilation openings on its sides. Install the unit so that those openings are kept clear (Fig. 7.1).

When installing the Controller, use the four holes provided at the top and bottom of the unit. Install it so that the requirements for environmental conditions given in par. 3.1, "Motionpack-34 CONTROLLER" are satisfied.

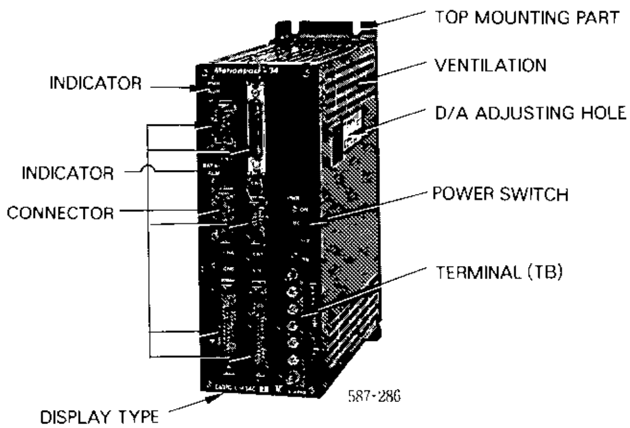


Fig. 7. 1 Motionpack-34 Controller

(2) Connecting supply power

Use single-phase 100 VAC (85-120V, 50/60Hz) power as the power supply. Connect the power leads to r and t of terminal TB on the controller front panel. The controller becomes active when the power switch is ON.

Connect 24VDC power supply to terminals 24V and 0V.

(3) Connecting the cables

Mate the cable connectors with the corresponding connectors on the controller, and tighten them securely with screws.

Do not allow the weight and/or tension of the cable to be borne by the connector or the controller.

The cable used for connection with the Motionpack Programmer is provided with the programmer. Use connector CI and tighten the connection.

7.1.1.2 Indications

The indicators on the front panel are explained in Table 7.1. The locations of the indicators are shown in Fig. 7.2.

Table 7. 1 Description of Indicators

Display	Color	Content	Procedure
RUN	Green	Lit···Normal operation Off···CPU malfunctioning	Operational Refer to par. 7.1.1.6.
PWR	Green	Lit···Power on	—
ALM	Red	Lit···System malfunctioning Off···System normal	Refer to par. 7.1.1.6. Operational
BAT AL	Red	Lit···Battery voltage low Off···Battery normal	Replace battery. Operational

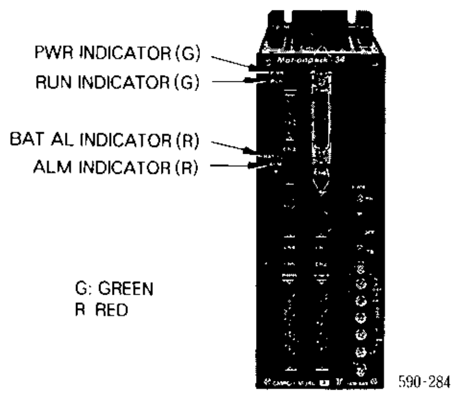


Fig. 7. 2 Front Panel Indicators

7.1.1.3 Low pass filter drift adjustement

Automatic drift adjustment starts at 2 seconds after turn-on of the Servopack drive power. The range of adjustment is within ± 511.

When the value of adjustment (indicated with d1) is nearly maximum, adjust zero of the Servopack to reduce the value of adjustment close to zero.

7.1.1.4 Setting up parameters

Set up parameters before starting operation.

There are two ways of setting parameters : through the keyboard of the Motionpack Programmer or through a tape device with tape. After setting the parameters, turn power off and then on again. For operating procedures, see par. 4.2.1.

7.1.1.5 Setting up the program

Set up the program before starting operation.

There are two ways of setting up the program : through the keyboard of the Motionpack Programmer or through a tape device with tape. For operating procedures, see par. 4.2.1.

7.1.1.6 Operation

Turn on the Motionpack-34 Controller and the RUN (green) and PWR (green) indicators light on the controller panel, indicating that the Motionpack-34 Controller is supplied with power and operating properly.

If RUN does not light while power is on, the Motionpack-34 Controller is defective : replace the unit.

If the ALM (red) indicator lights, locate the cause of trouble through the programmer. ALM will light up immediateiy after poweron if parameters are not set up. The lamp goes out as soon as the parameter is set.

7.1.2 Motionpack Programmer

7.1.2.1 Connection

(1) Connecting supply power

Use single-phase 100VAC (85-120V, 50/60Hz) power as the power supply.

Use the power cable provided.

(2) Connecting the signal cables

The programmer has two connectors at its bottom ; one for connection with the controller and the other for a tape device.

Be sure to lock the connectors while the programmer is in use. Cover the connector which is not in use with a red cap provided with the connector, for protection.

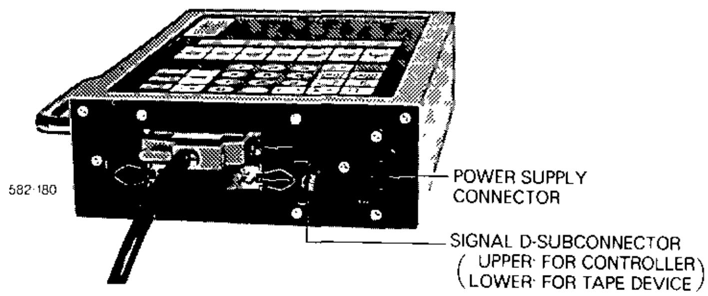


Fig. 7. 3 Motionpack Programmer

7.1.2.2 Operation

The Motionpack Programmer has no power switch of its own. So, it starts operating as soon as the power is connected. (See Table 7.2.)

The Programmer has no reset key, either. If it must be reser, unplug the power cable and reconnect it again (the unit will be automatically reset when the supply voltage rises).

Table 7. 2 Normal/Malfunction Indicator

Display	Color	Description
Normal	Green	Lit when the programmer is in normal operation
Malfunction	Red	Transmission to controller is not enabled.

7.1.3 Servopack

7.1.3.1 Installation

(1) Installation

Servopack model CACR-SR□TZ 6S□ is of base mounting type.

(2) Conditions of installation

- Installation inside an enclosure

  Temperature may rise higher in the inside of an enclosure than in the outside, though it depends on energy loss of the devices installed inside and the size of the enclosure.

  Consider the size of the enclosure, heat dissipation and layout so that the environment of the Servopack must be under 55 °C (Fig. 7.4).

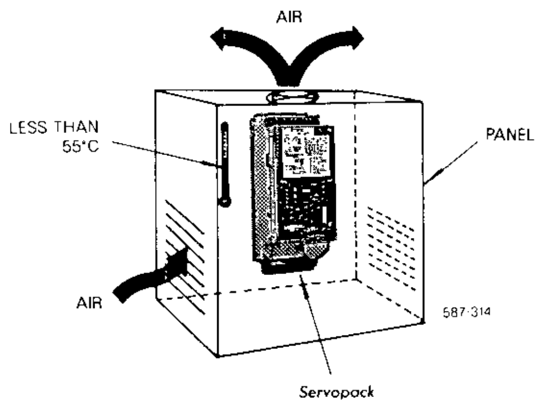


Fig. 7. 4 Example of Housing

- Installation adjacent to heat sources keep temperature (by convection and/or radiation) under 55 °C in the area of the power supply unit and the Servopack (Fig. 7.5).

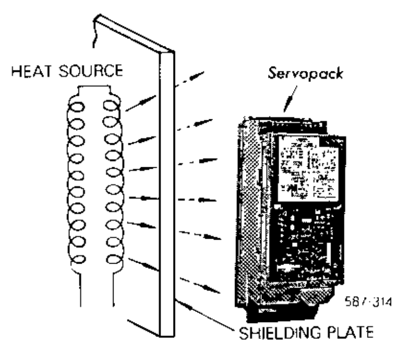


Fig. 7. 5 PROCEDURE EXAMPLE for HEAT SOURCE

- Installation near vibration sources install some shock absorbers between the Servopack and the base.
- Installation in an environment of corrosive gases. Though the existence of corrosive gases does not result in immediate trouble, they can lead to contact failure in electromagnetic contactors and relays used in the main and command circuits.
- Avoid places of high temperature and high humidity and dusty (particularly metallic particles) environment.

(3) Installation

- Directions

  Do not use any method other than the wallmounted installation with the base erected vertically (Fig. 7.6), since cooling is accomplished by natural convection.
- Holes for installation

  Use four holes on the base.

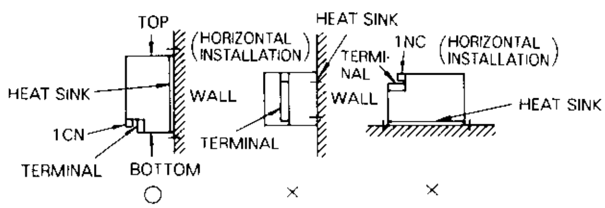


Fig. 7. 6 Installation

7.1.3.2 Power loss

Table 7.3 shows Servopack power loss.

Table 7. 3 Power Loss at Rated Output

Servopack Type CACR-	Output Current (Effective Value) A	Main Circuit Power Loss W	Regenerative Resistance Power Loss W	Control Circuit Power Loss W	Total Power Loss W	Input Capacity kVA
SR03TZ6	3.0	20	10	80	110	0.65
SR06TZ6	5.8	60	20		160	1.5
SR09TZ6	7.6	70	20		170	2.1
SR12TZ6	11.7	80	20		180	3.1
SR20TZ6	18.8	100	40		220	4.1
SR30TZ6	26.0	160	80		320	6.0
SR44TZ6	33.0	210	100		390	8.0
SR60TZ6	45.0	300	120		500	11.0

Note : Regenerative resistance power loss occurs at motor reduction.
Power loss can be disregarded other than for frequent start/stop operation.

7.1.4 Servomotor

The AC Servomotor can be installed horizontally or vertically. If the type of installation or the environmental conditions of the motor is unfavorable, its service life may be shortened or accidents may occur. For correct installation, follow the procedure below.

(1) Installation

Anti-corrosion coating is applied to the tip of the shaft and the flange surface. Before installing the motor, remove the coating using thinner. Be careful to keep the thinner away from any other parts.

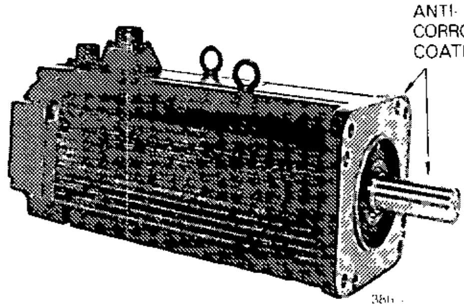


Fig. 7. 7 AC Servomotor

(2) Location of installation

The AC Servomotor is designed for ordinary indoor use. Install it where the following conditions will be met.

- Indoors and out of corrosive or explosive gases
- Ambient temperature of 0 to +40°C
- Good ventilation with little dust or moisture
- Ease of maintenance and cleaning

If the AC Servomotor is subjected to water splashes or oil mist, install a protective cover.

(3) Environmental conditions

Ambient temperature : 0 to + 40 °C

Storage temperature : − 20 to + 60 °C

Humidity : 20 - 80% r.h.(non-condensing)

(4) Matching with the coupled machine

It is important that the motor shaft correctly aligned with the machine axis. If the alignment is off, vibration may occur, damaging the bearings (Fig. 7.8).

Align the motor shaft with axis of the machine accurately. When installing a coupling, reduce shocks that may apply to the shaft by tapping with a wood mallet (or the like) to prevent the bearings from being subjected to excessive force.

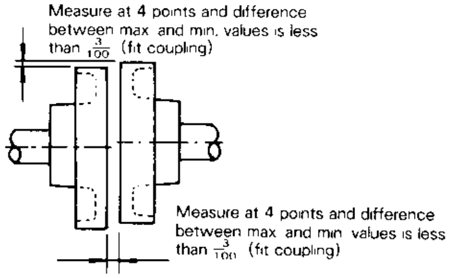


Fig. 7. 8 Aligning

(5) Setting up the encoder when installing the motor with a machine

When the motor has been installed with a machine, set up the absolute encoder by the procedure in par. 7.2.6.1.

(6) Permissible load of the bearings

Do not apply excessive thrust or radial loads to the AC Servomotor. When installing a gear, coupling, or pulley, reduce shocks that may affect the shaft by tapping with a wood mallet (or the like) to prevent the bearings from being subjected to excessive force.

During operation, keep the thrust and radial loads under the values shown in Table 4.35.

7.2 TEST RUN

Table 7.9 shows Motionpack-34 system operation summary.

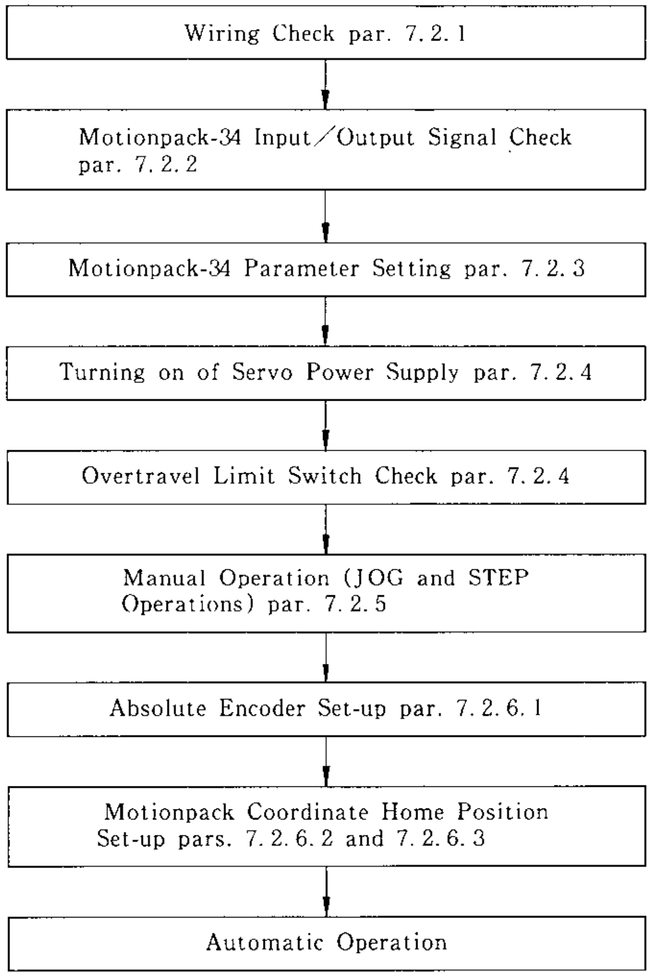


Fig. 7.9

Each step will be explained below. For alarm status and actions to be taken, see sect. 11.

7.2.1 Checking the wiring

Through checking of wiring is very important. Failure to check the wiring completely, may result in trouble, often in a late stage of adjustment during trial operation. This usually is more difficult to locate. So, complete check of the wiring is fundamental to smooth adjustment in trial operation.

The flowchart in Fig. 7.10 outlines the procedures of wiring check. Checks must include : connections, arrangement of wires, the sizes and types of wires, the presence and polarity of the surge suppressor.

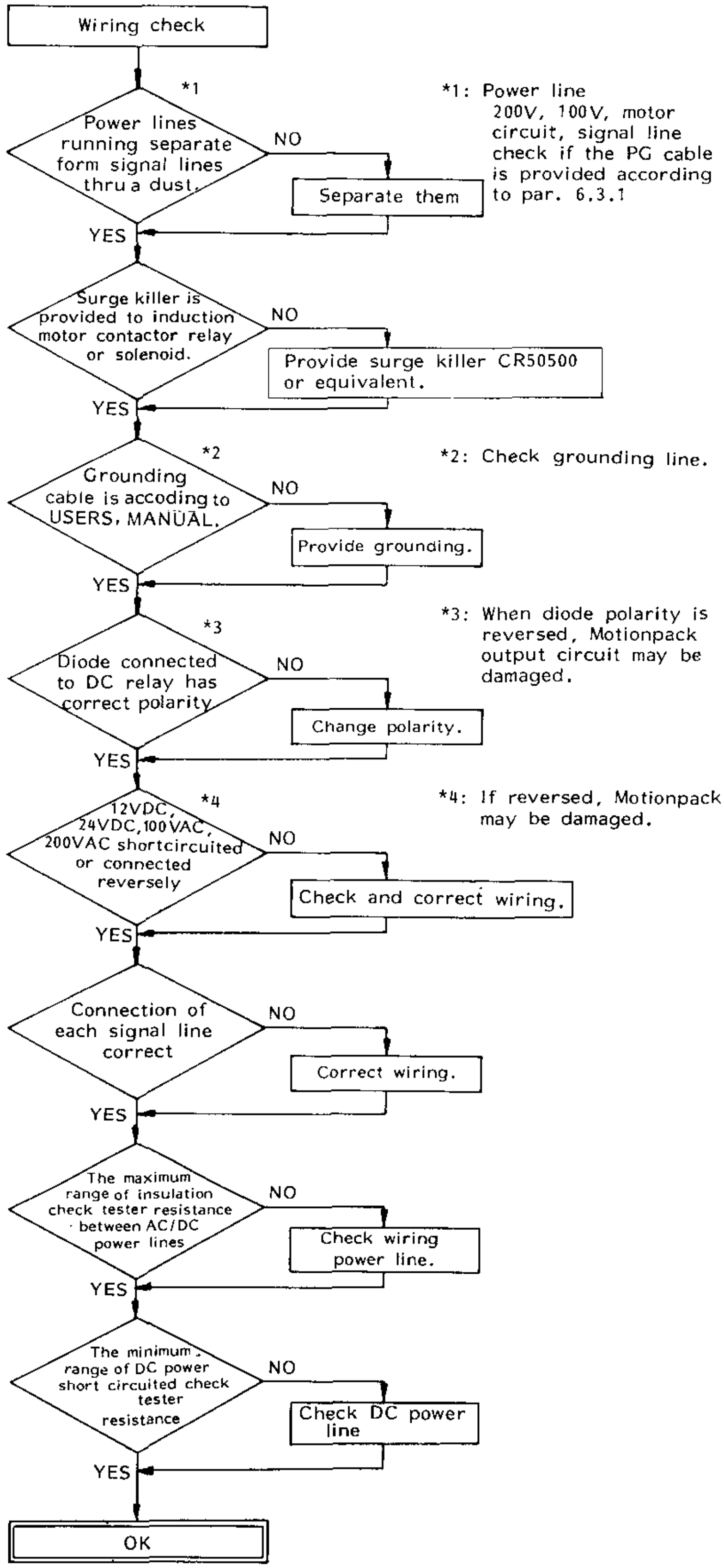
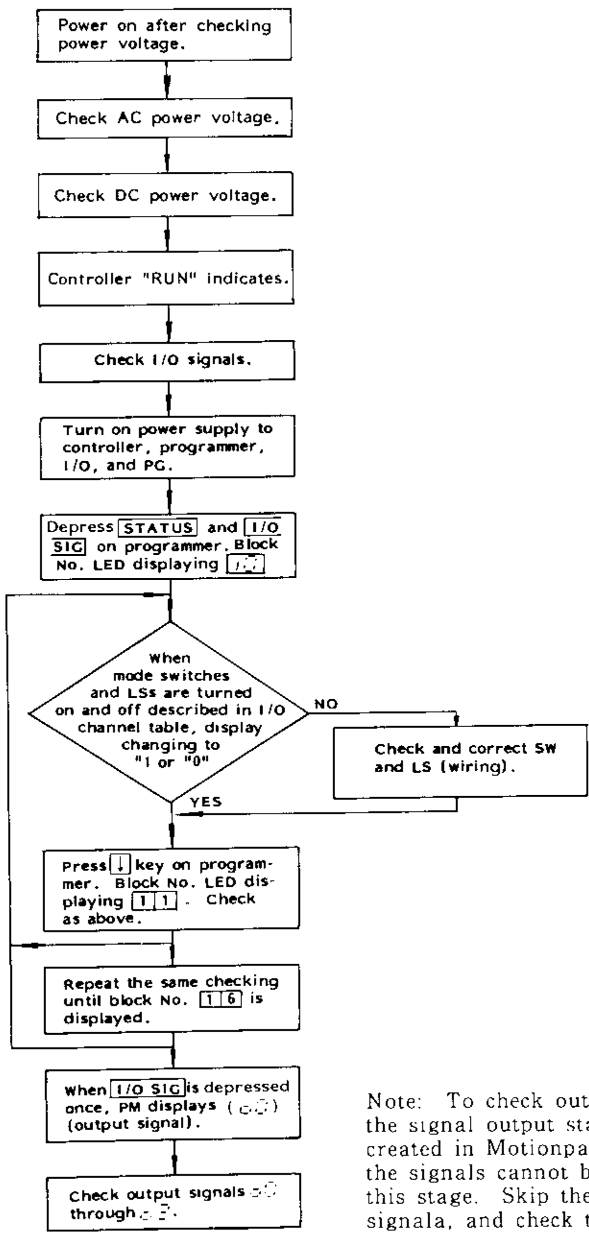


Fig. 7. 10 Wiring Check

7.2.2 Checking I/O signals

Turn on the Motionpack-34 Controller, Programmer and I/O supply power (24VDC) and check I/O signals. First, check the AC and DC supply voltages. Next, with AC power on, make sure that the indicators of the Motionpack-34 Controller indicate the proper status. Then check I/O signals.

* PG is not valid Servopack power is on.



Note: To check output signals the signal output status must be created in Motionpack-34, but all the signals cannot be checked at this stage. Skip these uncheckable signala, and check them latcr.

Fig. 7. 11 I/O Signal Check Flow Chart

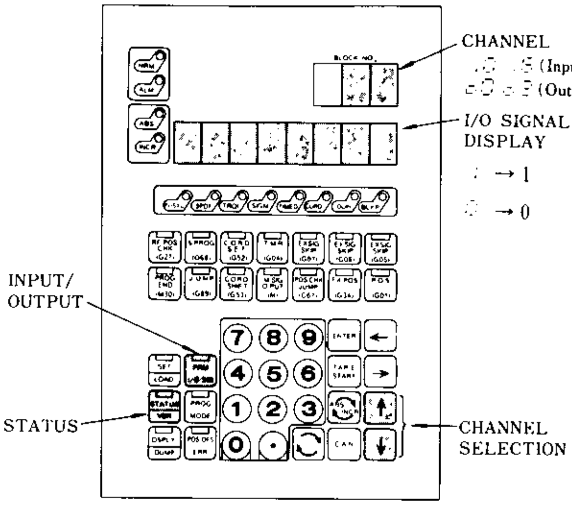


Table 7. 4 I/O Channel List

	Programmer Display	Channel \ Digit Position (Column)	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
Input Signal	,0	0	JMF Jog Middle	JLF Job Low	OVR Override	SKB Single Block	STEP	JOG	PLAY	EDIT
	,1	1	ATS TP Auto Stop	PGCL Program Clear	ERS Fault Reset	ATST Auto Start	SBST Single Block Start	ZRN Home position Return	-JS -Direction Jog & Step	+JS +Direction Jog & Step
	,2	2	PGS7	PGS6	PGS5	PGS4	PGS3	PGS2	PGS1	PGS0 Program Start
	,3	3	-INC8	+INC8	PGSL30	PGSL20	PGSL10	PGSL00	PGS9	PGS8
	,4	4	OTR Over-travel(R)	OTF Over-travel(F)	CLD Current Limit On	SAL Servo Alarm	NODB	STROBE	-INC9	+INC9
	,5	5	DATA SET INT	JPIBT (SEL)	MFIN	G34F	Extended Function Selection OPSL	EPS7	EPS6	EPS5 External Skip 5
	,6	6	LSB	LSA LS Near Home	EXP External Positioning LS	PB Phase B Pulse	PA Phase A Pulse	PC Home Position Pulse	PG Battery Reduction PGBATAL	
Output Signal	o0	0	OFM Offset Max.	OFR Offset 0	INCD Incremental End	EPAL External Positioning Alarm	G34 External Positioning End	STL In-operation	ZPM Home Return End	ALM1 NC Alarm
	o1	1 ·	ZNP Near Home	M56	M55	M54	M53	M52	M51	M30
	o2	2						RDY (PC) MP Ready (PG)	RDY (DB)	ALM2 Battery Alarm

Note: When the signals listed below are input or output, the corresponding column becomes 1 and when not input or output, the column shows 0.

7.2.3 Setting up Parameters

In the Motionpack-34 system, the controller receives information on system specifications in the form of parameters. So, the parameters must be set up for the controller before operation starts. The system will fail if some parameters are given wrong values or not set. Set all the unused parameters except "Pr53" as zero.

The programmer (Fig. 7.12) is used normally to set parameters. But, if a parameter tape is prepared, the parameters can be set from a tape reader via the programmer.
After setting parameters, be sure to turn the controller off and then on again.

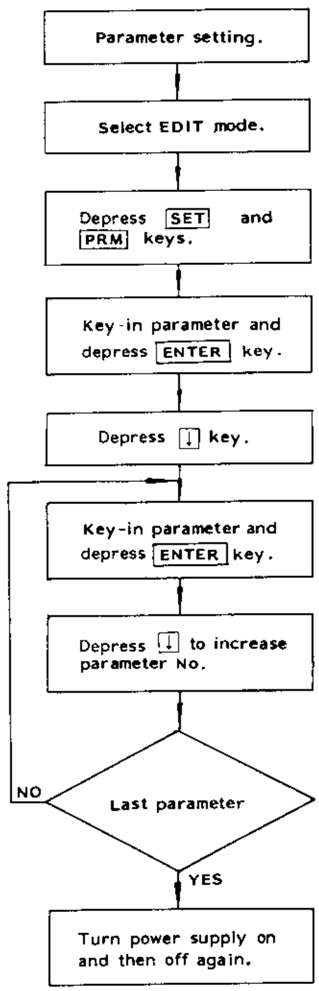
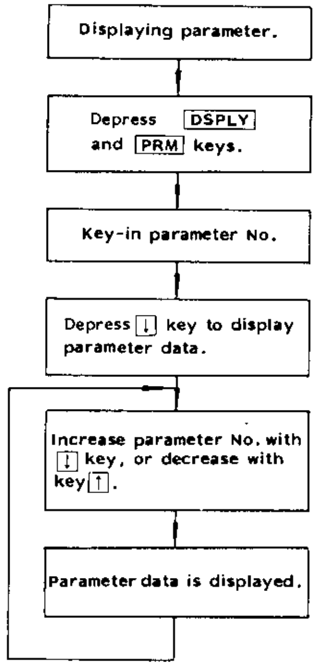
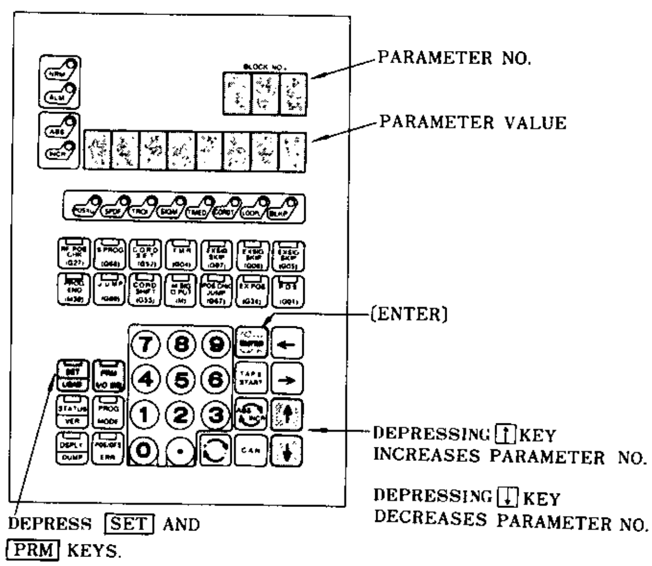


Fig. 7. 12 Parameter Setting Flow Chart



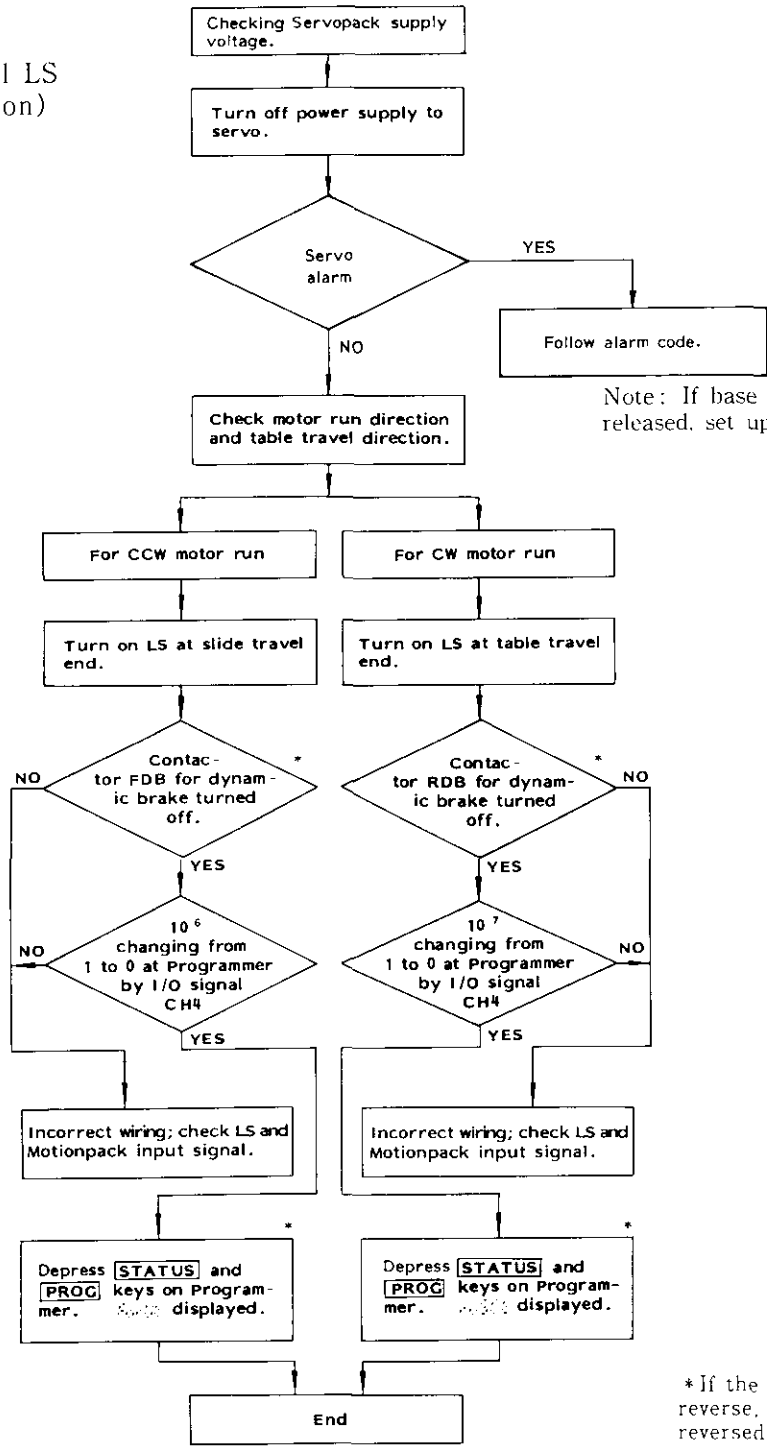
Note: FAULT indicator on the controller panel may light and the parameter error code is displayed, before setting parameters. As long as NORMAL indicator is ON on the controller simultaneously,this is not a fault. When the parameters are set, the FAULT indicator goes out.

Fig. 7. 13 Parameter Check Flow Chart



7.2.4 Checking Power ON to Servo

Checking Overtravel LS
(Standard Connection)



Note: If base block cannot be released, set up the encoder.

*If the motor is connected in reverse, P-OT and N-OT are reversed

Fig. 7. 14 Dynamic Brake Function Check Flow Chart

- If an alarm status occurs with the motor running at a high speed, the polarity of PG is wrong. Check the polarity. The wiring of PG will be reversed between the Servopack and the Motionpack.

• If the motor shaft rotates in the opposite direction for long intervals, gain is set up improperly. Reduce the value of parameter Pr42 and set the speed loop gain 6VR of the Servopack at a higher position by 1 or 2 marks.

7.2.5 Manual Operations (JOG, STEP) Check, Adjustment and Measurement

Check manual operations and adjust servo related parameters.

7.2.5.1 JOG operation and parameter adjustment

JOG Operation

↓

Operation Mode ON (PLAY signal ON)

Mode \ Signal	EDIT	PLAY	JOG	STEP	SINGLE BLOCK
EDIT	ON	–	–	–	–
JOG	OFF	ON	ON	–	–
STEP	OFF	ON	OFF	ON	–
AUTO Block	OFF	ON	OFF	OFF	ON
AUTO Program	OFF	ON	OFF	OFF	OFF

↓

JOG Mode Selection (JOG signal ON)

↓

JOG Speed Selection

Speed	Low	Middle	High	Not Moved
JLF	ON	OFF	ON	OFF
JMF	OFF	ON	ON	OFF
Speed	Pr1	Pr2	Pr3	–

↓

Depress JOG, START key. Turn on ±JOG & STEP signal.

* Turn on ±JOG&STEP signal 35 msec after PLAY and JOG signals are turned on. If these three signals are activated simultaneously, JOG operation cannot be executed.

↓

Adjust the servo-related parameters, referring to "Parameter Adjustment" if any malfunction may occur.

↓

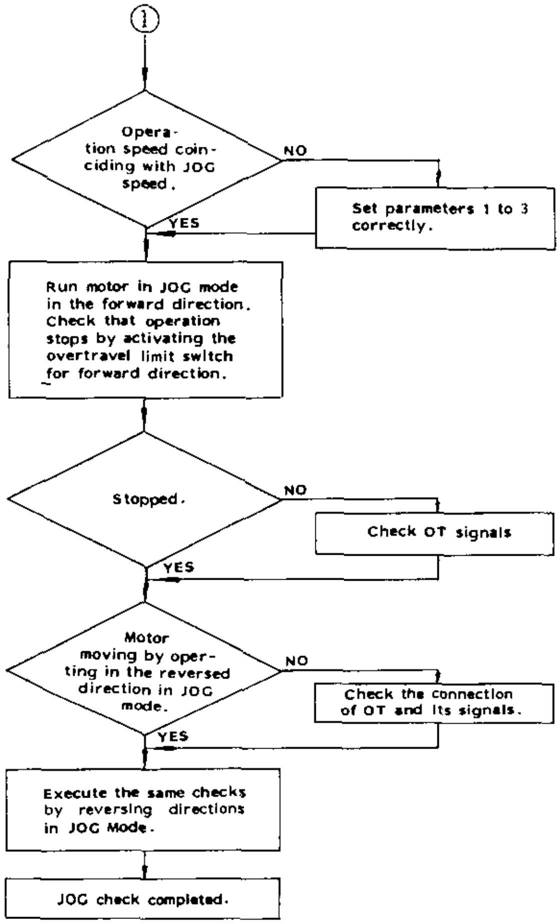
Check the operation by changing JOG speed

↓

①

Fig. 7. 15 JOG Operation Flow Chart

7.2.5.1 JOG operation and parameter adjustment (Cont'd)



(1) Basic requirement

Pr50-52 must be set correctly.

(2) Adjustment of position loop gain

The system must operate properly
if $10 \leqq kp \leqq 50$. Reduce the value of Pr42 to make the machine move more smoothly or increase it if necessary.

Calculate the value of Pr42 from the following formula.

$$Pr42 = \frac{\text{Rated r/min} \times \frac{1}{60} \times \text{P/rev}^{*} \times 4}{kp\ (s^{-1})\ ^{*3}}$$

*: Pulse count after division by the Servopack

MALFUNCTIONS (a) Running out of control (b) Hunting (c) Error messages such as dEr Over, IMPO Err as displayed.

If any of these occurs, check if the parameters are correct.

(a) Check that $10 \leqq kp \leqq 50$ it met.

If the value of Pr42 is wrong the motor will run abnormally if kp is too large. If kp is too small, the target may not be reached, resulting in INPO Err, or hunting may occur because of correction for drift.

(b) Check that Pr50-52 are set properly.

Pr42, Pr50 and Pr51 have the following relation:

$$\boxed{Pr42 \times \frac{Pr51}{Pr50} = d_0 \pm 10\%},$$

were d0 is the value at rated rpm.

(3) Adjustment of starting and stopping times.

Pr40 and Pr41 define the starting and stopping times.

Faulty Actions

(1) Excessive deviation (dEr Over) (2) Hunting

(a) When any of these occurs, check Pr40 and Pr41.

If the motor stops due to dEr Over while Pr40 and Pr41 are set, increase Pr41 (to extend the starting time) so that the motor continues to run and check the motor starting current by the following method.

(b) Check speed and current using an oscilloscope (Fig. 7.16).

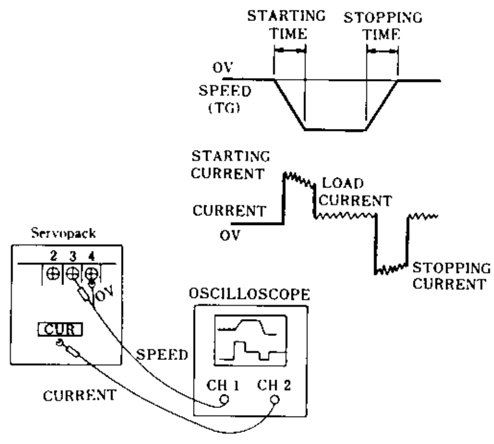


Fig. 7. 16 Checking Speed and Current

7.2.5.1 JOG operation and parameter adjustment (Cont'd)

Measure the starting and stopping currents as shown in Fig. 7.18. The limit at which the starting and stopping currents saturate is the minimum value of Pr41. If the value of Pr41 is far from the designed value, check the starting and stopping times of the machine.

The starting time *tv* is given as follows.

$$tv = \frac{4(J_M + J_L) \times N}{375 \times \left(\frac{I_P}{I_R} \times T_M - T_L\right)} \times 1.3 \text{ (s)}$$

Where I_P : Servopack maximum output current (A)

I_R : Servomotor rated current

J_M : Motor inertia

J_L : Load inertia

N : Rated rpm

T_N : Servomotor rated torque

T_L : Load torque

(c) If the motor is used at a speed above the rated rpm, increase Pr41 (extend the starting time) as appropriate.

(d) Set Pr40 at the system maximum speed.

PRECAUTIONS

- When setting a parameter which defines a speed, take note of its unit. Such a parameter is defined in the same unit of speed as follows.

  Unit of speed = Max. command unit × 10 (Pr52)/min

  (Example)

  Suppose Pr50 = 1, Pr51 = 3 and the minimum command unit 0.001mm.

  Then,

  Unit of speed = 0.001mm

  × 10^3/min = 1mm/min.

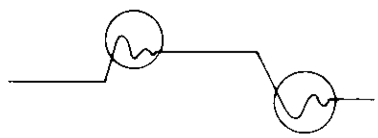
  So, to set JOG high speed at 10 m/mim.

  Pr3 = 10000.

- Note that the value of Pr42 is given as a pulse count.

(4) Waveform of monitors speed

Observe the waveform of V_{TG} in the same way as above. It is no problem even if the waveform includes switching noises of the Servopack. Check if the waveform overshoots.



Position loop gain (Pr42) and acceleration time (Pr41)

The speed loop gain (6VR) of the Servopack is important. Increase Pr42 by some 1000 pulse counts and Pr41 by 50 ms or so until overshoot disappears. It may be advisable to increase the speed loop gain (6VR of the Servopack) by 1 or 2 marks.

(Data)

(1) The output voltage of V_{TG} is DC ± 4V ± 10%/1000 rpm (M series).

(2) Monitoring Servopack current

(a) Checkpoint TM3-4

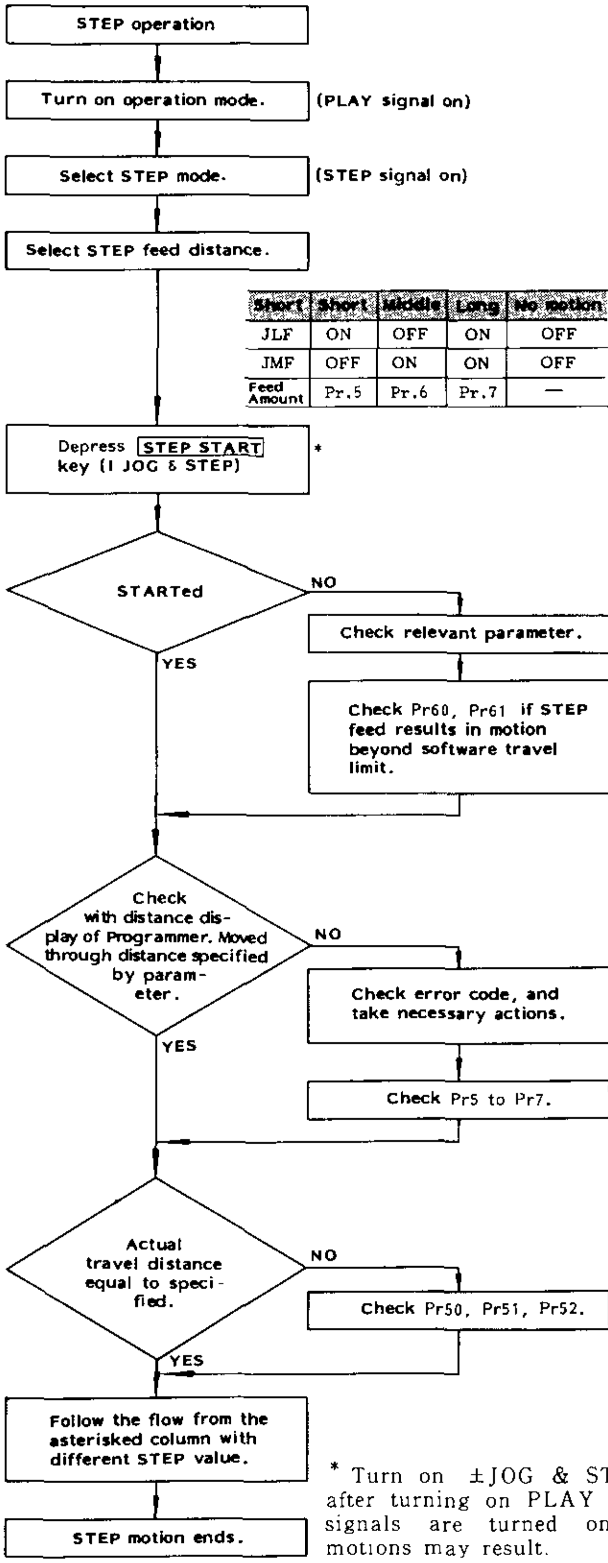
± 3.0VDC/100% when (motor torque monitor) is used.

(b) Checkpoint TM4-1

See the table below when TM4-1 (current monitor of U phase) or TM4-2 (current monitor of V phase) is used.

Type	03	06	09	12	20	30	44	60
Monitor Voltage (V/A)	0.4	0.2	0.16	0.08		0.04		

7.2.5.2 STEP operation



Short	Short	Middle	Long	No motion
JLF	ON	OFF	ON	OFF
JMF	OFF	ON	ON	OFF
Feed Amount	Pr.5	Pr.6	Pr.7	—

* Turn on ±JOG & STEP signals at least 30msec after turning on PLAY and STEP signals. If these signals are turned on simultaneously, abnormal motions may result.

Fig. 7. 17 STEP Operation Flow Chart

7.2.6 Setting up

Set up then absolute type Motionpack-34 system by the following procedures.

Move to reference position (machine origin) manually.
↓
Set up absolute encoder.
↓
Set up Motionpack position counter.
↓
Set up Motionpack coordinate origin.
↓
End

Fig. 7. 18

7.2.6.1 Setting up the absolute encoder

When installing a machine with a motor which is coupled with an absolute encoder set up encoder first.

Yaskawa's encoder delivers absolute position data in the form of rotation angle and revolution number.

- Serial data : Indicates how many turns the motor shaft is rotated from the reference position (defined by setting up).
- Initial incremental pulse : Pulses will be transmitted at the same pulse speed as when the motor shaft rotates from the origin to the current position at about 2747 rpm.

The current position P is given as

$P = M \times R + P_0$

where M (rotation) is the value of serial data, P_0 (pulse) the initial incremental pulse count, and R the output pulse count per motor revolution (depending on the setting of a dividing circuit). The width of data is (8192 pulses/revolution) × (+/- 99999 revolutions).

The initial value of the revolution number data is not necessarily zero. It is recommended that you initialize the data to zero during assmbly with the machine. This is the set-up of the absolute encoder.

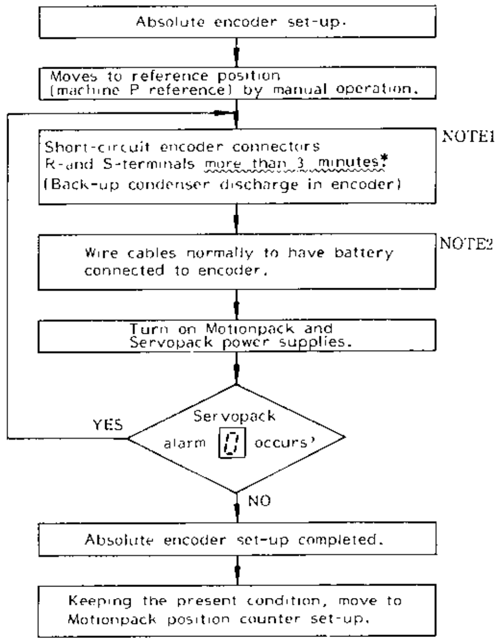
The set-up is performed by short-circuiting a capacitor in the backup supply circuit inside the encoder. It you have left the encoder without any battery connected for more than four days, the internal circuits may not work properly due to fall of the backup voltage. In this case too, you have to set up the encoder again.

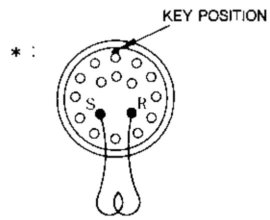
Perform the following procedure to set up the encoder. Never fail to do the following procedure : otherwise the encoder may fail.

(1) Short the terminals R and S of the encoder (see ∗1).

7.2.6.1 Setting up the absolute encoder (Cont'd)

(2) Connect the battery before turning on power (see ∗2 and ∗3).





Notes: 1 After set up, the motor revolution number is reset to 0.

2 If the encoder connector is not accessible because motor is already assembled with a machine, remove CN2 of the Servopack and short the leads of the PG cable at the Servo-pack side connector as shown in Fig 7.19.

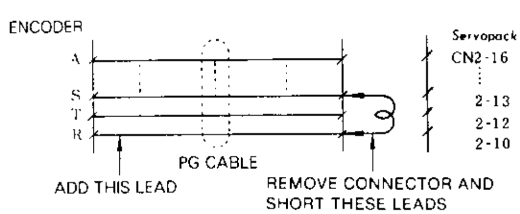
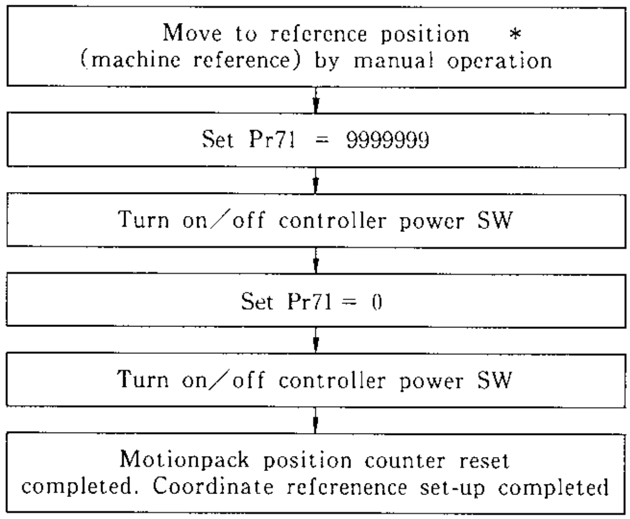


Fig. 7. 19 Setting up by Shorting Leads of the PG Cable

7.2.6.2 Resetting the Motionpack's absolute position counter

The position counter built in the Motionpack will never be reset because it deals with absolute method. During setui8o
eset the counter by the following procedure.



*: Do not change if it is already in that position.

Fig. 7. 20

7.2.6.3 Setting up the Motionpack coordinate reference point

It is actually impossible to accurately align the machine home position with that of the absolute encoder, considering the assembly characteristics of the motor. In the Motionpack, the offset of the absolute encoder home position from the coordinate reference point will be set with Pr71, so that the coordinate system (TO coordinates) of the Motionpack can be aligned with machine home position. This aligning procedure is called setting up the Motionpack coordinate reference point.

The procedure of manual setting up is as follows.

Move to reference point (machine reference) by manual operation
↓
Measure the present position data by programmer U4 display. (Pr71 = 0 is needed.) U4 = a
↓
Set reference offset at Pr71. $Pr71 = (-a) \times \frac{Pr50}{Pr51}$
↓
Turn on/off Motionpack controller power supply
↓
U4 = 0
↓
Setup completed

Fig. 7. 21

NOTE

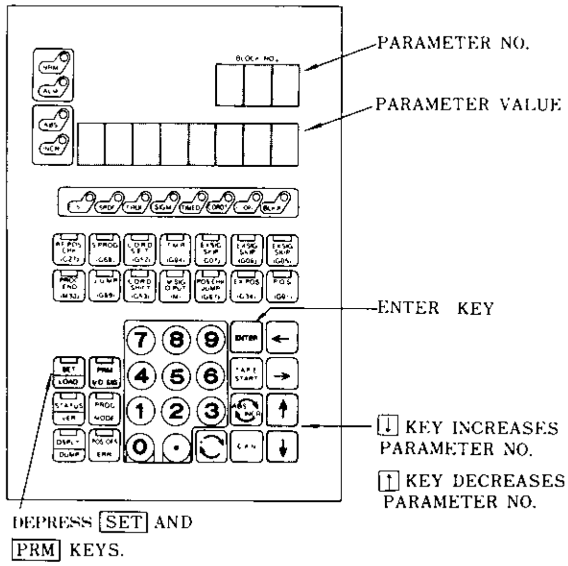
For semi-automatic home position setup system and full-automatic home position setup system, refer to Par. 11.2.

7.2.6.4 Setting up encoder at machine reinstallation

After test run, when the machine is reinstalled, set up the encoder in accordance with encoder setup procedure before turning on the power.

7.2.7 Automatic Operation

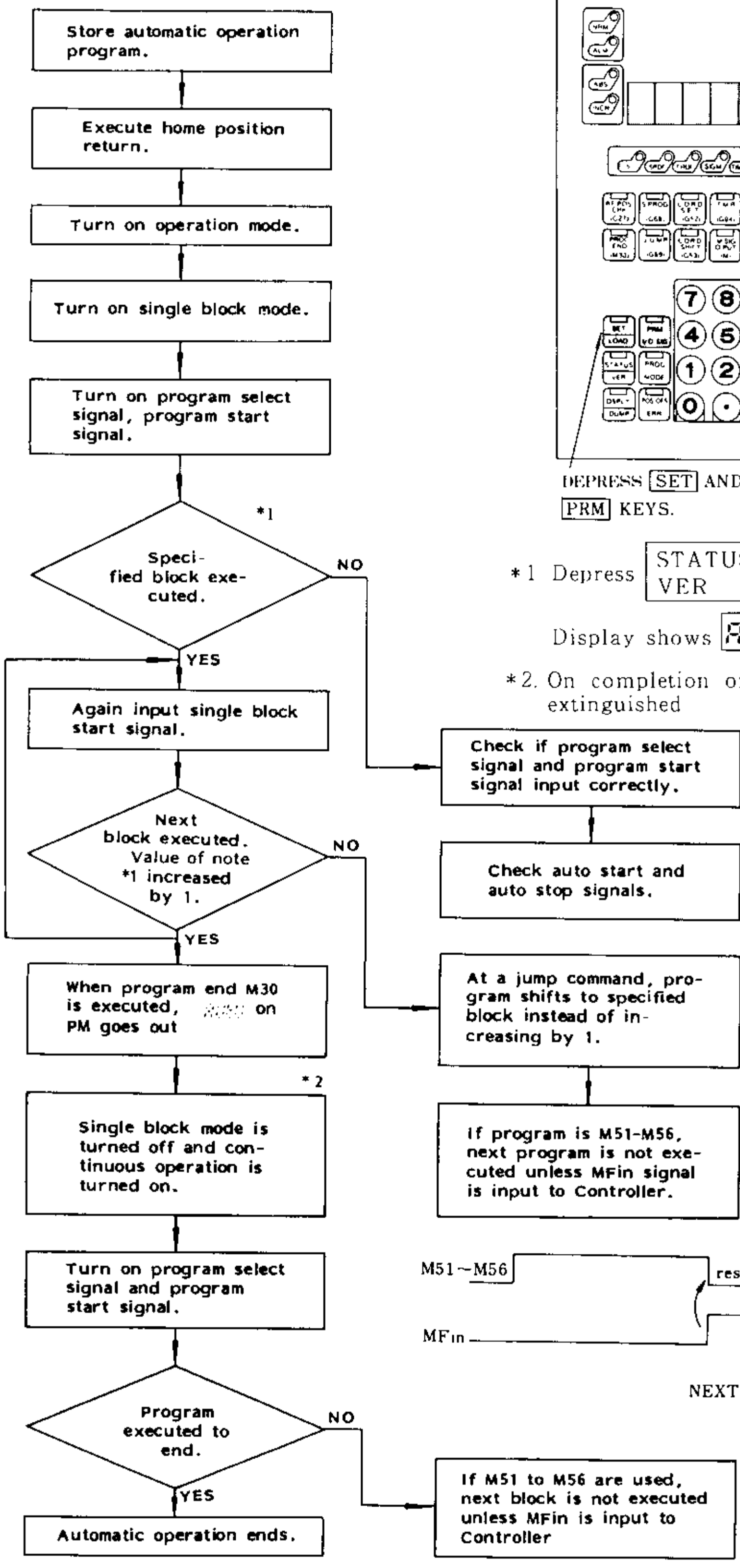
To check the automatic operation, first check the single block operation. If the single block operation mode is not used, execute the step after *2.



*1 Depress [STATUS VER] key and [PROG MODE] key.

Display shows [Aubo□□□]

*2. On completion of execution, asterisked value will be extinguished



Note: If automatic start/stop signals are used, they are turned on.

Fig. 7. 22 Automatic Operation Flow Chart

7.2.7 Automatic Operation (Cont'd)

Single block operation

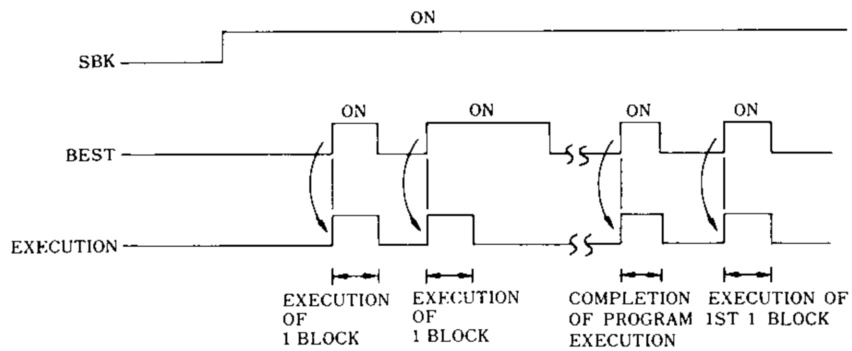


Fig. 7. 23 Single Block Operation

Automatic operation

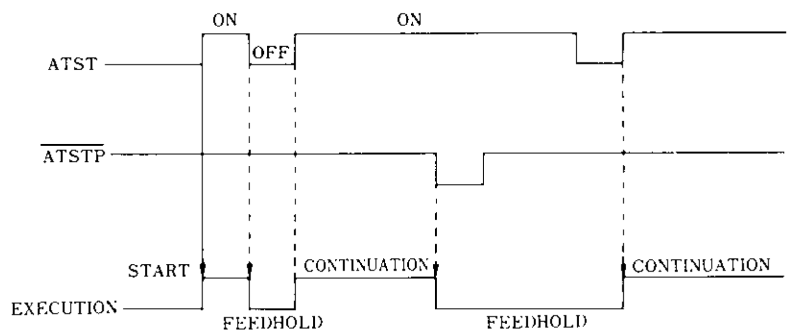


Fig. 7. 24 Automatic Operation

7.3 ALARMS AND REMEDIES

If faults are detected by Motionpack, alarm signals are output. The fault conditions can be checked by programmer. Par. 11.2 describes details of alarm output and its solution.

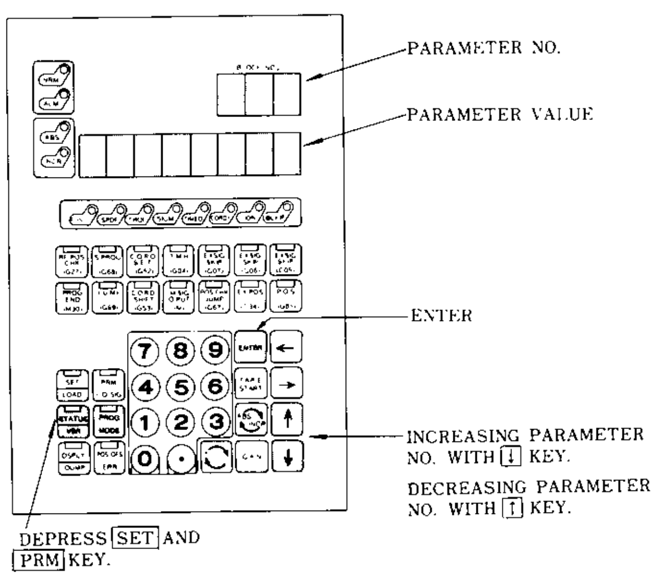
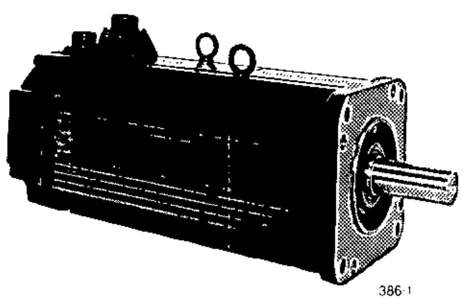


Fig. 7. 25

8. MAINTENANCE

This section describes how to solve problems if the Motionpack-34 system fails to operate properly.
Par. 8.1 shows troubleshooting flowcharts. If a system that has been operating properly fails, possible causes include disconnection of some leads or failure of units. So, the troubleshooting procedures may end by replacing a unit.
This differs very much from the procedures of test run (as failure of units is less likely than wrong wiring, inappropriately defined parameters or programs, etc.) For this reason, it is not recommended to apply the procedures of this chapter to adjustment during test run.



AC Servomotor
TYPE USAMED-40MS2

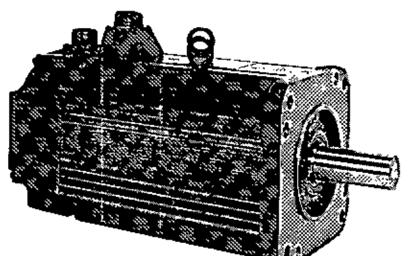
8. MAINTENANCE

This section describes how to solve problems of the Motionpack-34 that may fail to operation properly. If the Motionpack-34 fails, check functions, condition of the Servo system, programmable controller and the Motionpack-34 Controller, to locate the cause. A programmer is availablc with the Motionpack-34 system, which helps locate the cause of trouble by giving information on the trouble status, indicating position data, etc.

If trouble occurs, inform the person in charge of maintenance. It is best to preserve the trouble status if possible and have the person in charge of maintenance examine the problem.

Actually, however, immediate action may have to be taken to prevent production stoppages or devices break down. In such cases, note the status of trouble quickly in order to facilitate taking action later. Thus, preserving and noting trouble status and then taking immediate action is the key to successful troubleshooting. The person in charge of maintenance should ask questions like the following of the person who first, discovered the trouble.

- What function was the machine performing when trouble occurred ?
- How were the control panel and switches set ?
- What did the RUN and ALM indicators indicate on the Motionpack 34 panel ?
- What were the contents of Er, Ho, St and U 0.3 ?
- Did the Servopack indicate any error status ?



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8.1 TROUBLESHOOTING

If trouble has occurred, the Motionpack programmer indicates an error code from which detailed error information can be obtained. Referring to the alarm code indication (see par. 11.2.4), check if the machine can perform simpler operations and try to determine the cause of trouble by dividing operations into two groups : one that machine can execute sucessfully and the other that it connot.

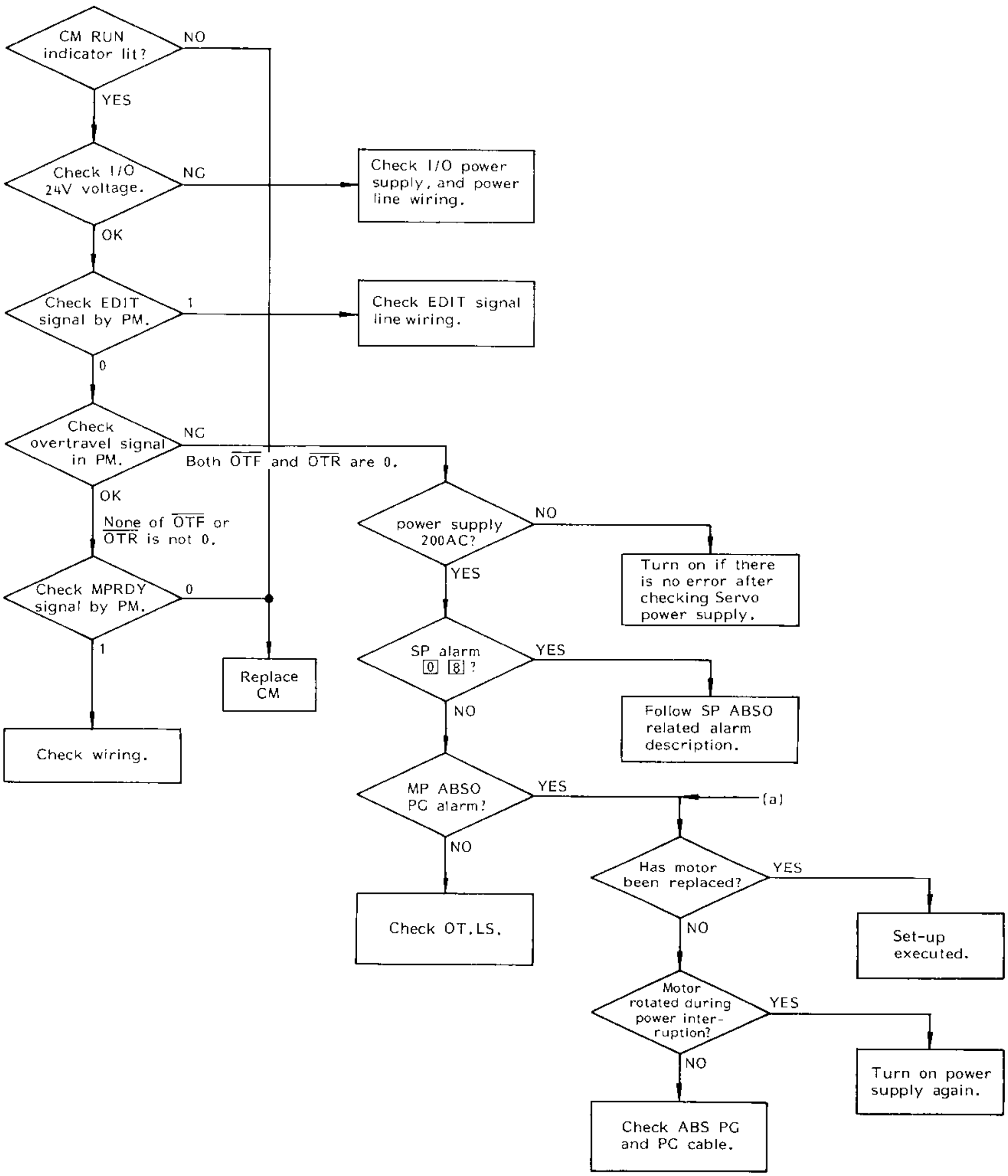
In the Motionpack-34 system, service basically consists of replacing one or more units. Locate the defective unit and replace it.

NOTE

In the flow charts, the units are represented with symbols as follows.

Motionpack-34 :	MP
Motionpack Controller :	CM
Motionpack Programmer :	PM
Servopack :	SP

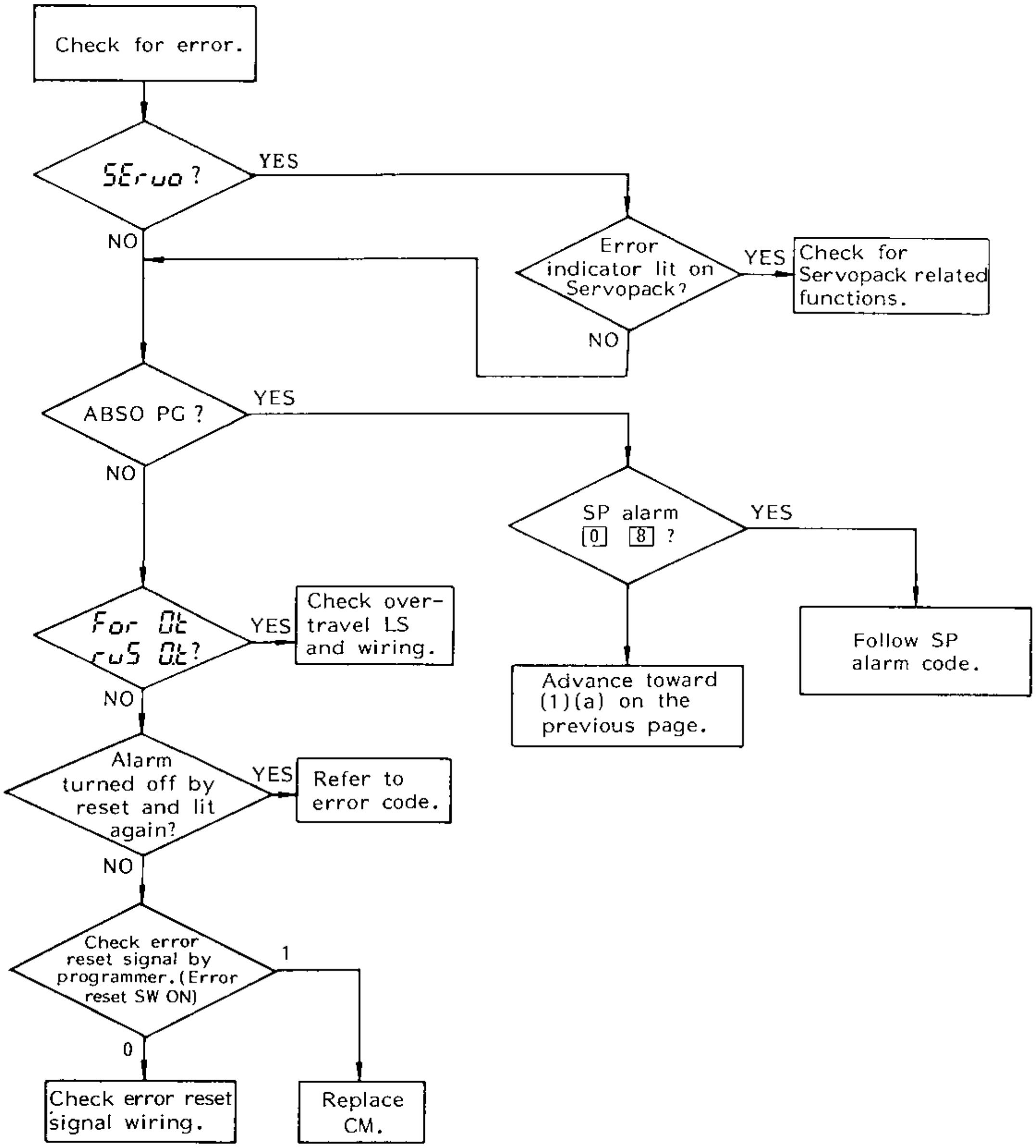
(1) MP RDY Signal is not output



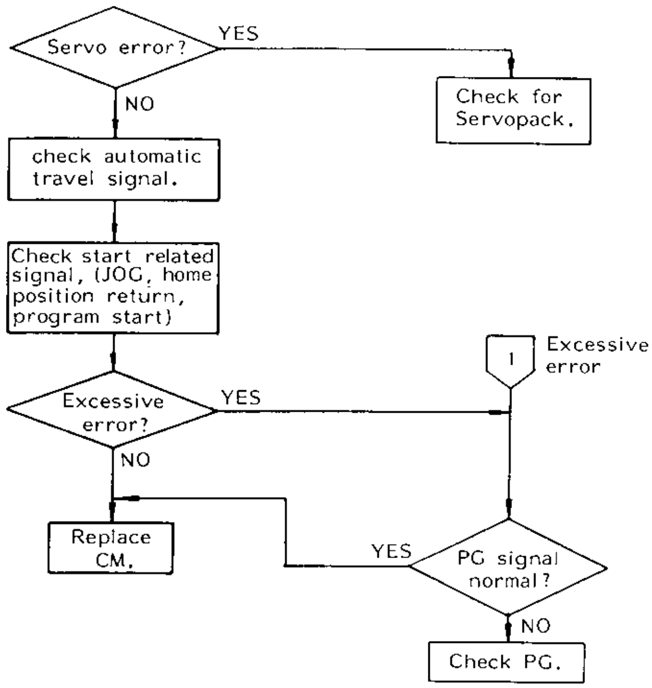
NOTE

When both $\overline{OTF}$ and $\overline{OTR}$ signals are OFF (Servopack drive power supply is OFF)

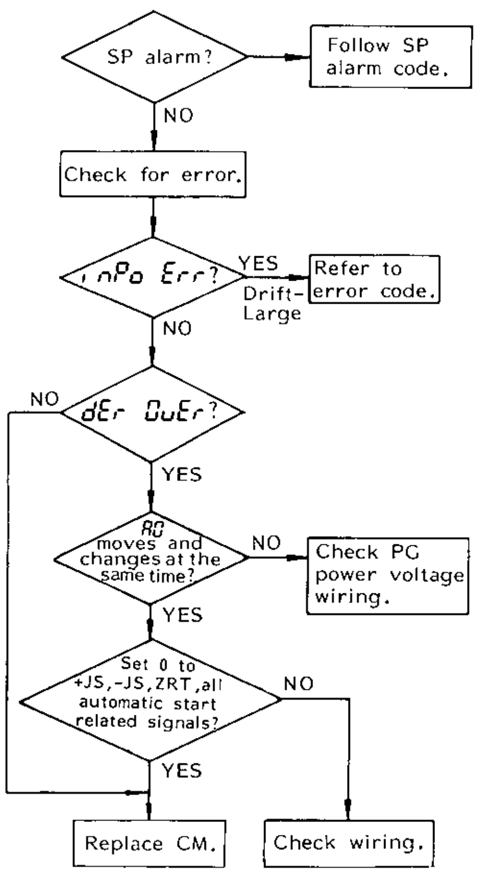
(2) MP alarm cannot be reset.



(3) MP alarm occurs by servo power-ON



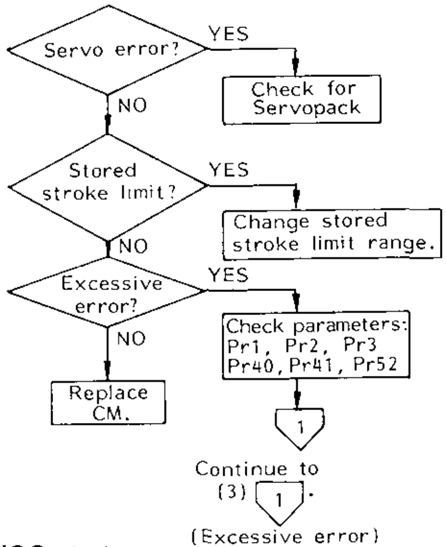
(4) Runaway by servo power-ON (MP alarm occurs after momentary runaway.)



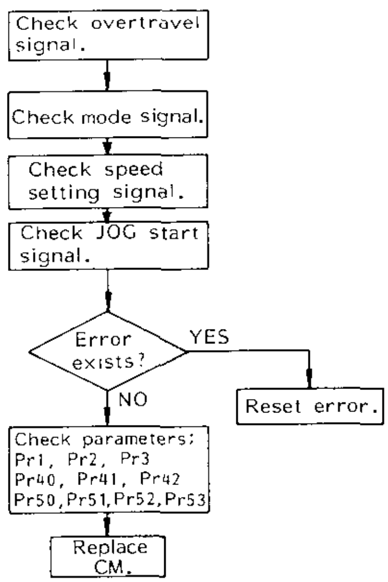
NOTE

When Servo power is turned OFF error may not be checked with .Ec StoP indicator. In this case, without resetting error, turn on servo power to check error code.

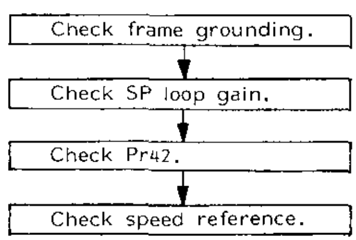
(5) MP alarm occurs by JOG start.



(6) Does not operate by JOG start.



(7) Malfunction at JOG

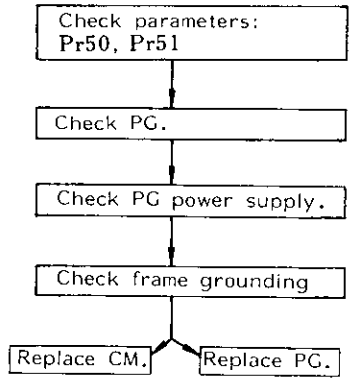


(a) Vibrations may occur if any of the loop gain of SP and the position loop (Pr 42) is too large.

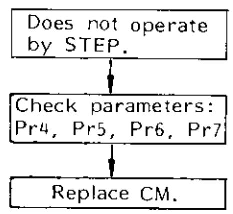
(b) Vibrations may occur if you reduce the loop gain of the Servopack with Pr 42 kept large and servo clamp applied.

(c) If current is too large, check load torque.

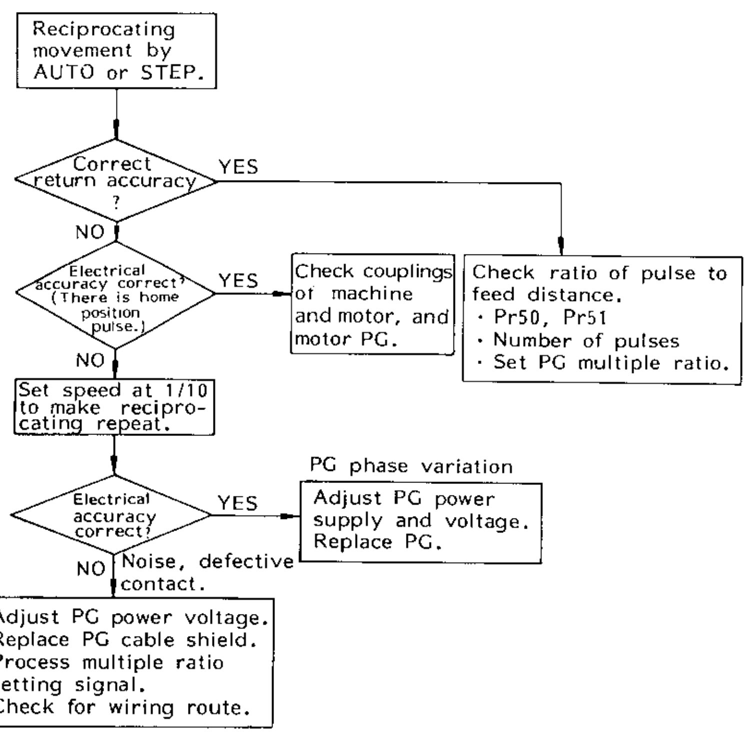
(8) Accuracy malfunction by JOG



(9) Does not oparate by step.



(10) Position accuracy malfunction.

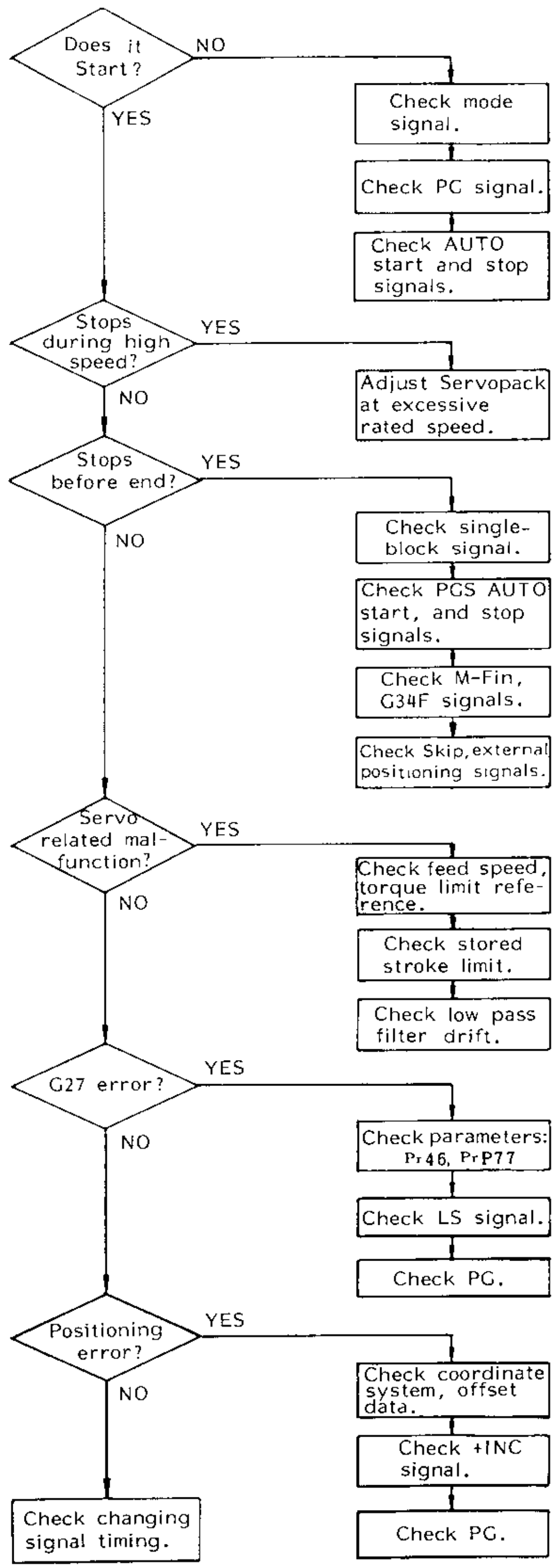


• Set dial gauge on home position pulse and check home position pulse.

• Check dial gauge and home position pulse after starting from home position pulse and several repeats of reciprocating movement.

8.1 TROUBLESHOOTING (Cont'd)

(11) Auto operation malfunction



8.2 CHECKING SIGNALS USING THE Motionpack PROGRAMMER

Check the states of the input and output signals of the Motionpack-34 Controller with the aid of Motionpack Programmer.

Depress 〔STATE〕 and 〔INPUT／OUTPUT〕 keys, then ',n' (input channel n) or ' n' (output channel n) will be displayed. Depress 〔INPUT／OUTPUT〕 key to switch',' (input channel) into ' ' (output channel) or reverse. Use $\boxed{\downarrow}$ and $\boxed{\uparrow}$ to change n.

8.2.1 Status of Input/Output Signals

The Motionpack Programmer will indicate the status of signals read into the Motionpack-34 Controller. Of the signals shown in Table 8.1, those of channels 1-4 are read in by channel switching and time division.

Check the 24V signals (EPS5, EPS6, EPS7, G34F, MFIN, EXP, LSA, LSB) of channels 5 and 6 with a multimeter. But, use an oscilloscope for the signals of channels 0-4.

Table 8. 1 I/O Channel List

Programer Displa	Channel \ Digit Position (Column)	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
,0	0	JMF Jog Middle	JLF Job Low	OVR Override	SBK Single-Block	STEP	JOG	PLAY	EDIT
,1	1	ATS TP Auto Stop	PGGL Program Clear	ERS Fault Reset	ATST Auto Start	SBST Single-Block Start	ZRN Home position Return	−JS −Direction Jog & Step	+JS +Direction Jog & Step
,2	2	PGS7	PGS6	PGS5	PGS4	PGS3	PGS2	PGS1	PGS0 Program Start
,3	3	−INC8	+INC8	PGSL30	PGSL20	PGSL10	PGS00 Program Start	PGS9	PGS8
,4	4	OTR Over-travel (R)	OTR Over-travel (F)	CLD Current Linit On	SAL Servo Alarm	NODB	STROBE	−INC9	+INC9
,5	5	DATA SET INT	JPIBT	MFIN	G34F	①	EPS7	EPS6	EPS5 External Skip 5
,6	6	LSB*	LSA* LS Near Home	EXP External Positioning LS	PB Phase B Pulse	PA Phase A Pulse	PC Home position Pulse	②	

Note :
① Extended Function Selection OPSL.
② PG Battery Reduction PG BATAL.

* Not used in absolute method : Set at 0.

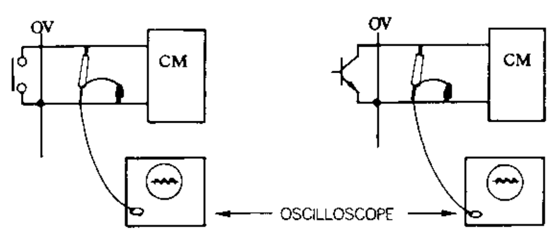


Fig. 8. 1 Measured by Oscilloscope

8.2.2 Output Signal Status

When checking signals by Motionpack programmer, status which Motionpack-34 controller is trying to output is displayed :

Programmer Display	Channel \ Digit Position (Column)	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
10	0	OFM Offset Max.	OFR Offset 0	INCD Incrememtal End	EPAL External Positioning Alarm	G34 External Positioning End	STL In-operation	ZPM Home Return End	ALMI MP Alarm
11	1	ZNP Near Home	M56	M55	M54	M53	M52	M51	M30
12	2						RDY MP Ready (PC)	RDY (DB)	ALM2 Battery Alarm

The status may be different from actual external status output.

8.3 CHECKING DC VOLTAGES

When the cause of trouble is likely to be in the wrong supply voltage, check not only the voltage but slso ripples using an oscilloscope.

For the supply voltages (+12V and −12V) of analog commands, permissible fluctuation including ripples is within ±5%. For the supply voltage (+24V) of I/O signals, permissible fluctuation including ripples is within ±15%. Check the PG supply voltage at the PG-side terminal and the analog command supply voltages at the terminals of DB.

8.4 CHECKING SPEED COMMAND SIGNAL

The speed command of the Motionpack-34 is a sawtooth wave of 1.5 kHz. If the waveform is flat, the device is outside the range of control or has failed.

The speed command voltage is a sawtooth wave as shown in Fig.8.2, but the motor does not vibrate as the motor itself and load absorb the sawtooth changes of the voltage.

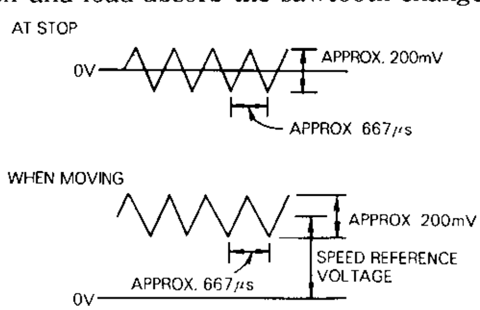


Fig. 8. 2 Speed Reference Signal

8.5 REPLACING THE BATTERIES

The Motionpack-34 system includes two backup batteries. One, installed in the CM34, backs up the memory of the Motionpack-34 Controller (see Fig.8.3).

The other is for the absolute encoder and installed on the Motionpack interface board in the Servopack (see Fig.8.4). The two batteries have the same specifications as follows.

Type :	Thionyl chloride lithium battery
Model :	ER6-C (with leads and socket)
Ratings :	3.6 V, 2000 mA•h
Maker :	TOSHIBA BATTERY CO. LTD

The voltages of the two batteries are monitored separately. When that of either battery reaches the lower limit, the indicator "Battery voltage low" lights and ALM2 occurs. If this happens, check the alarm message by program (see below) and replace the low battery.

"bAt doun" → CM34 battery dead low/dead

"PG bAtt" → Absolute encoder battery dead low/dead

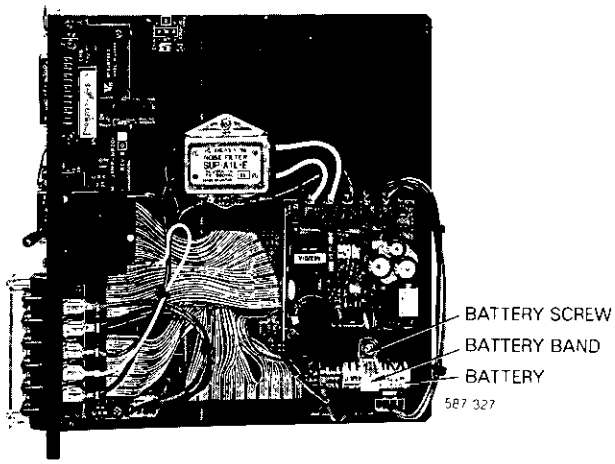


Fig 8.3 Battery in Controller

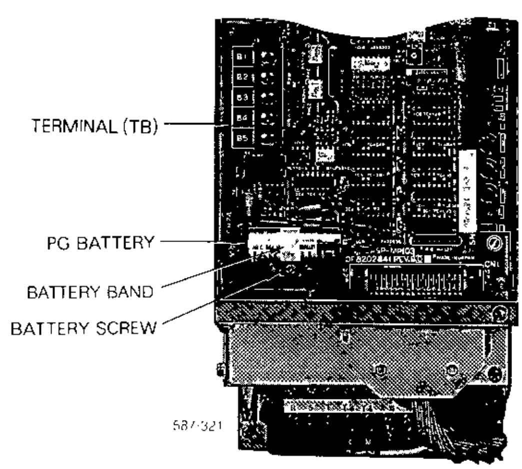


Fig. 8. 4 Battery in Servopack

8.5.1 Replacing the CM34C battery

The battery used for memory backup has a service life of about 5 years. When the BATAL (battery voltage low) indicator is lit, replace the battery within a month.

The memory backup circuit is doubled by a super capacitor and a lithium battery. The super capacitor is charged when power has been kept on for more than 3 minutes and then, even if the power is turned on to replace the battery, the contents of memory will be held unchanged.

Always keep AC power on for more than 3 minutes before turning off power and replacing the battery. Replace the battery as follows :

① Remove four screws on the Motionpack-34 Controller front panel.
② Pull out the base, and the battery is accessible on the right side of the base.
③ Remove the socket and then the battery.
④ Fit the socket of the new battery and install the battery.
⑤ Put the Motionpack-34 base back into position and tighten the four screws.
⑥ Make sure the BAT-AL (battery voltage low) indicator is out.

8.5.2 Replacing The Absolute Encoder Battery

The battery for the absolute encoder is installed on the Motionpack interface board in the Servopack. It has a life of 5 years. When the indication of low battery voltage is given, replace the battery as follows :

(1) Keep power supply of the Motionpack and Servopack on for more than 3 minutes (to charge the super capacitor in the encoder).

(2) Remove the battery socket mounted on the Motionpack interface board and replace the battery. (Leave the Servopack either on or off.)

(3) After spep (1) above, the encoder will operate properly for four days even when AC power is turned off. So, the encoder absolute value data will not be erased during battery replacement.

8.6 ERROR INDICATIONS

Alarm signal will be output if the Motionpack-34 system fails. Alarm signals include ALM1 (Motionpack-34 alarm), ALM2 (battery alarm) and EPAL (external positioning alarm).

8.6.1 Error Code

The state and cause of the Motionpack error can be checked by the Programmer error code indication (Er).

8.6.2 Indicator

(1) Motionpack-34 Programmer

The Motionpack Programmer indicates status when status mode is selected. It indicates not only error status but operating mode, feed hold state, output signal state and contents of the error counter, etc. This information will provide the status of the Motionpack-34 system when it has failed.

There are Normal (green) and Error (red) indicators, too.

Normal : Lights when the Programmer is normal. If not lit, check the power supply and fuses.

Error : Lights when data cannot be transmitted to or from the Motionpack-34 Controller. Check the Motionpack-34 Controller, cable and connectors.

(2) Motionpack-34 Controller

The Motionpack-34 Controller has four indicators : $\boxed{\text{PWR}}$ (green), $\boxed{\text{RUN}}$ (green), $\boxed{\text{ALM}}$ (red) and $\boxed{\text{BAT-AL}}$ (red). Use PM for more detailed information on status.

When a Motionpack-34 alarm occurs, the ALM indicator lights. But, this does not mean that the Motionpack-34 Controller has failed, but there may be something wrong with the system. Use the Programmer to get more detailed information on the error.

Error indications and actions to be taken are explained below.

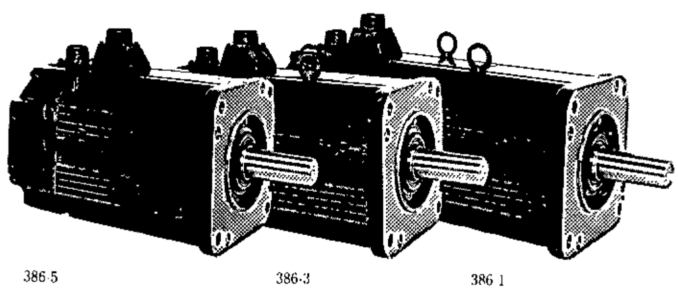
- $\boxed{\text{RUN}}$: Lights when the CPU at the Motionpack-34 Controller is normal and system program is running properly. If not lit, the Motionpack-34 Controller may be defective.
- $\boxed{\text{ALM}}$: Lights, with an MP alarm signal produced, when the Motionpack-34 has a malfunction. Check and correct the error with the programmer.
- $\boxed{\text{BAT-AL}}$: Lights when the voltage of a battery falls. (This lights only when the 100 VAC power is turned on.) When lit, replace the battery within a month.
- $\boxed{\text{PWR}}$: Lights when the power supply is on. When not lit, check the 100 VAC power supply. This does not indicate the states of 24 V power supply for I/O signals or 12 V for analog commands.

8.7 REPLACING THE MOTOR

When replacing the motor, follow the procedures in the Servomotor BULLETIN. After replacement, set up the machine origin since the relation of the absolute encoder and machine origin may vary.

9. SPARES

This section describes battery specifications as spares.



TYPE USAMED-20MS2

TYPE USAMED-09MS2 TYPE USAMED-40MS2

AC SERVOMOTORS

9.1 BATTERY

Lithium battery is used for Motionpack-34 Controller and Servopack. Battery specifications ane shared by Motionpack-34 and Servopack.

For easy replacement, spare battery with socket and lead are available.
(See Fig 9.1.)

Name:	Motionpack-34 battery (lithium battery with socket and lead)
Manufacturer:	Toshiba Battery Co., Ltd.
Content:	Lithium battrry ER6-C type is provided with Motionpack-34 socket and lead. Accordingly soldreing is not needed for replacement: just insert socket.
Order:	Contact your YASKAWA representative on price or delivery.

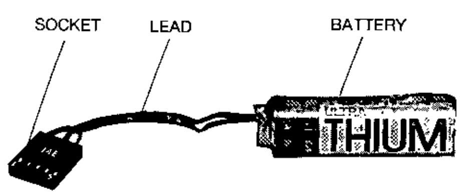


Fig. 9. 1 TYPE ER6-C BATTERY

10. EXTERNAL DIMENSIONS

This section describes external dimensions of following units:

(1) Motionpack-34 controller

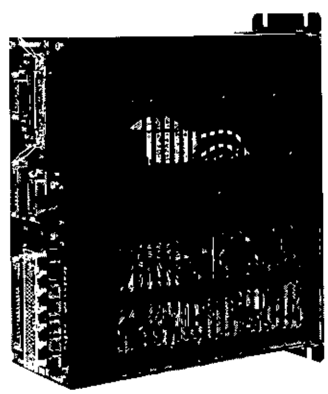
(2) Motionpack Programmer

(3) Servopack

(4) Pulse generator

(5) I/O signal power supply

(6) Tape device

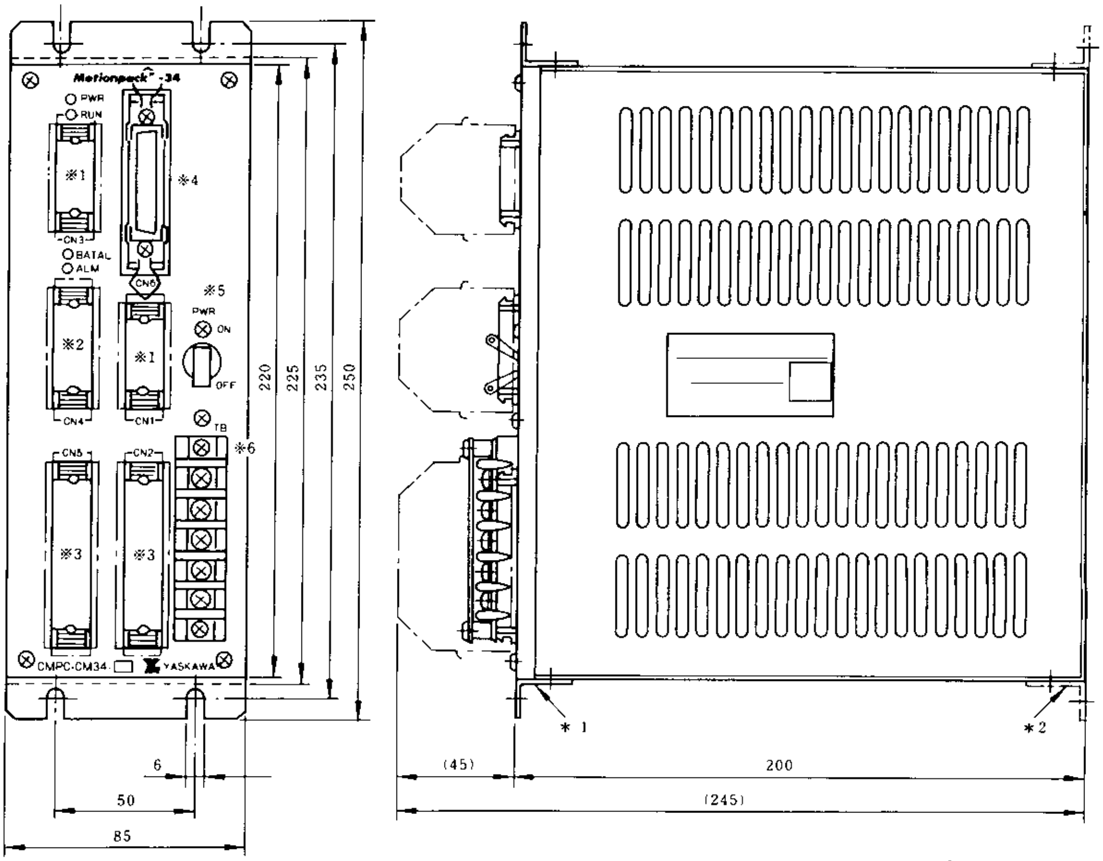


Motionpack-34 CONTROLLER
TYPE CMPC-CM34C

587-326

10. EXTERNAL DIMENSIONS in mm

10.1 Motionpack-34 CONTROLLER (TYPE CMPC-CM34)



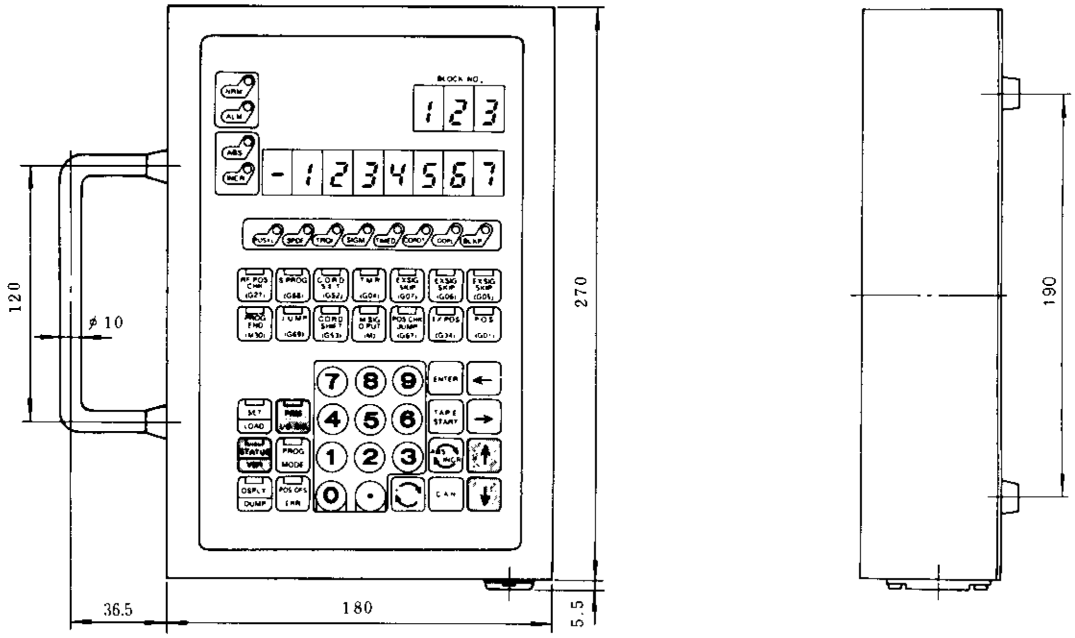
APPROX WEIGHT 2.5kg

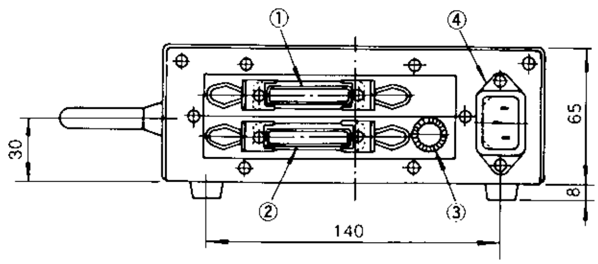
＊1: Installation metal position for rack mount
＊2: Installation metal position for base mount

NO.	Equipment sign	Connector Type	Cable Side Connector Attachment	Remarks
※1	CN1, CN3	MR Connector MR-20RMA	Housing MR20F Hood MR20L Soldered type	Honda Tsushin Co.
※2	CN4	MR Connector MR-25RMA	Housing MR50F Hood MR50L Soldered type	Honda Tsushin Co.
※3	CN2, CN5	MR-Connector MR-50RMA	Housing MR20F Hood MR50L Soldered type	Honda Tsushin Co.
※4	CN6	D-sub Connector DB-25SA	Dust Cover DB-59-20	Japan Aviation Electronics Industry, Ltd

NO.	Equipment sign	Name	Electricals Specifications	Remarks
※5	1MCB(PWR)	Circuit Protector	SPA-1-600F-2.5A	
※6	TB	Power Supply Terminal	Terminal F2035EW.5P With M4 Screw Cover	

10.2 Motionpack PROGRAMMER





Code	Element Code	Name and Specification
①	C1	Connector DBSF-25 S
②	CT	
③	FU	Fuse SM1101-1
④	CC	Plug receptacle 125 VAC

Approx. Weight: 2.3kg

Item	H	Application
A	8	CMPF-PM 33 C · PM 33 D
B	3	CMPF-PM 33 F

Motionpack Programmer connector terminals and signal names

CI connector (3483-1000)

1	2	3	4	5	6	7	8	9	10	11	12	13
FG								TXD	$\overline{TXD}$	RXD	$\overline{RXD}$	

14	15	16	17	18	19	20	21	22	23	24	25
									5V		0V

CT connector (3483-1000)

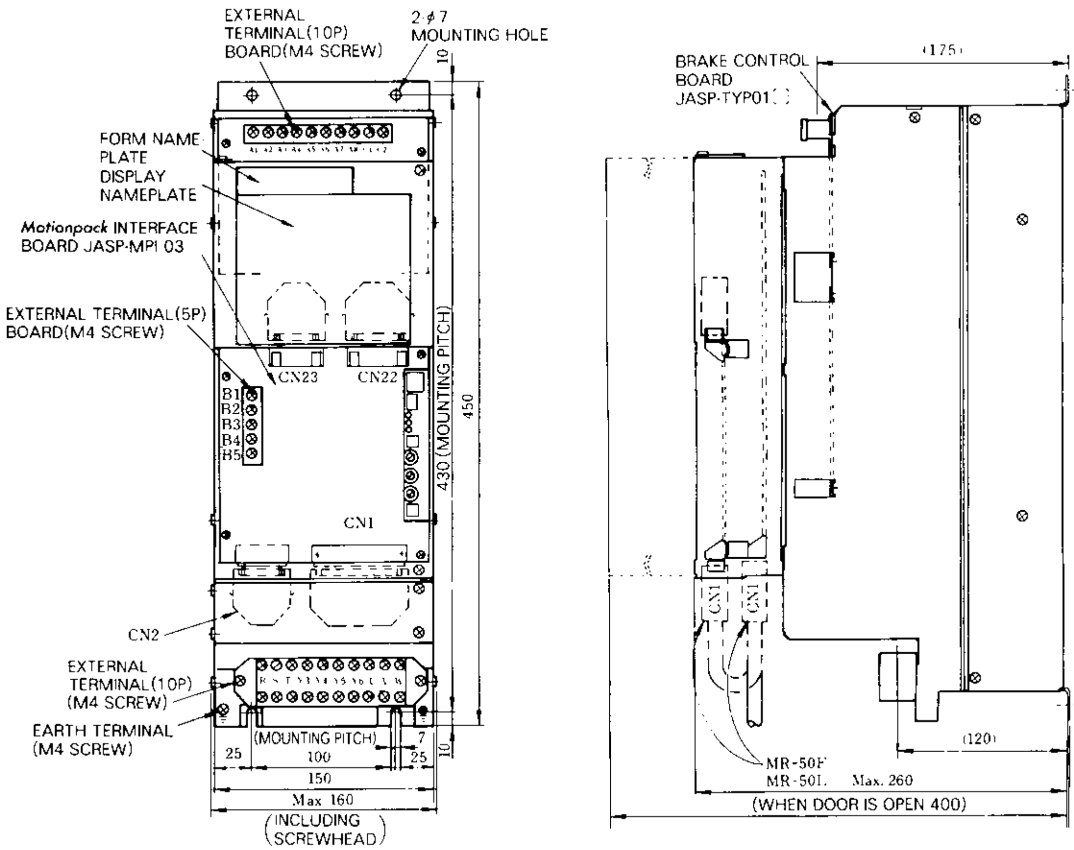
1	2	3	4	5	6	7	8	9	10	11	12	13
FG	TXD	RXD	RTS	CTS	DR*	SGO						

14	15	16	17	18	19	20	21	22	23	24	25
							ER*				

Pins marked with * are connected each other inside the programmer.

10.3 Servopack

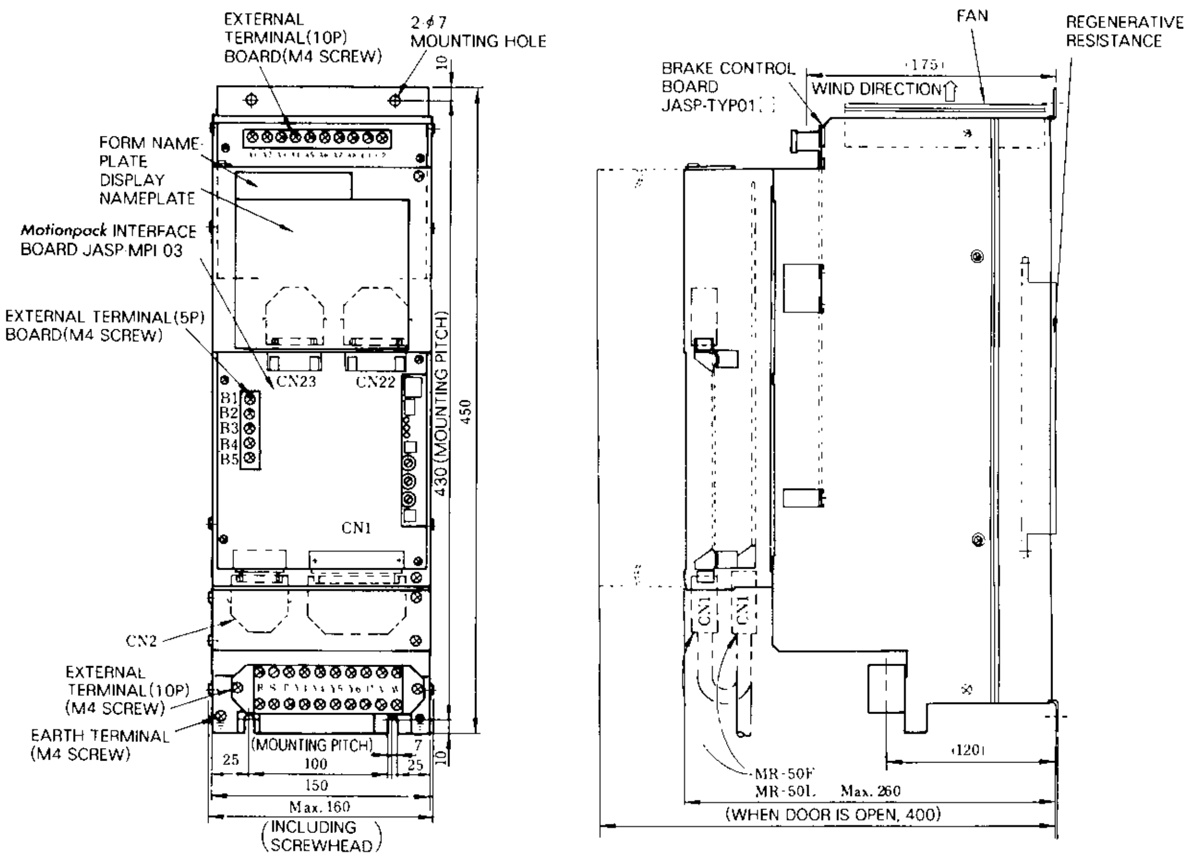
(1) Type CACR-SR03 to 12TZ6S



APPROX. WEIGHT SR-03 · 06 8.0kg
SR-09, ·12 11.0kg

	Servopack Side Connector	Cable Side Connector	Remarks
CN2	MR-20RMA	Servopack attachment Housing MR-20F (Soldered type) Hood MR-20L	Honda Tsushin Co.,
CN22	MR-25RMA	Servopack attachment Housing MR-25F (Soldered type) Hood MR-25L	Honda Tsushin Co.,
CN23	MR-20RMA	Servopack attachment Housing MR-20F (Soldered type) Hood MR-20L	Honda Tsushin Co.,

(2) Type CACR-SR20,-30TZ6S

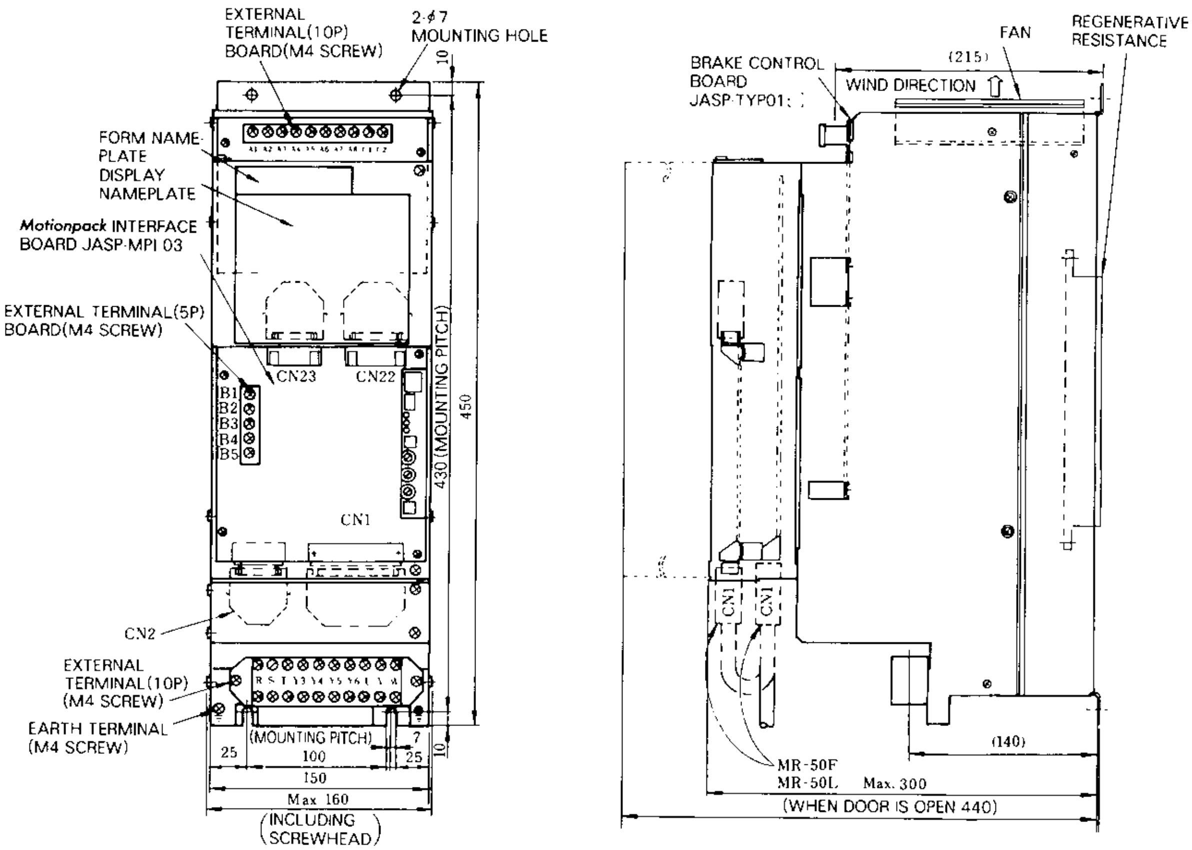


APPROX WEIGHT SR-20 11.5 kg
SR-30 12.0 kg

	Servopack Side Connector	Cable Side Connector	Remarks
CN2	MR-20RMA	Servopack attachment Housing MR-20F (Soldered type) Hood MR-20L	Honda Tsushin Co.,
CN22	MR-25RMA	Servopack attachment Housing MR-25F (Soldered type) Hood MR-25L	Honda Tsushin Co.,
CN23	MR-20RMA	Servopack attachment Housing MR-20F (Soldered type) Hood MR-20L	Honda Tsushin Co.,

10.3 Servopack (Cont'd)

(3) Type CACR-SR44TZ6S



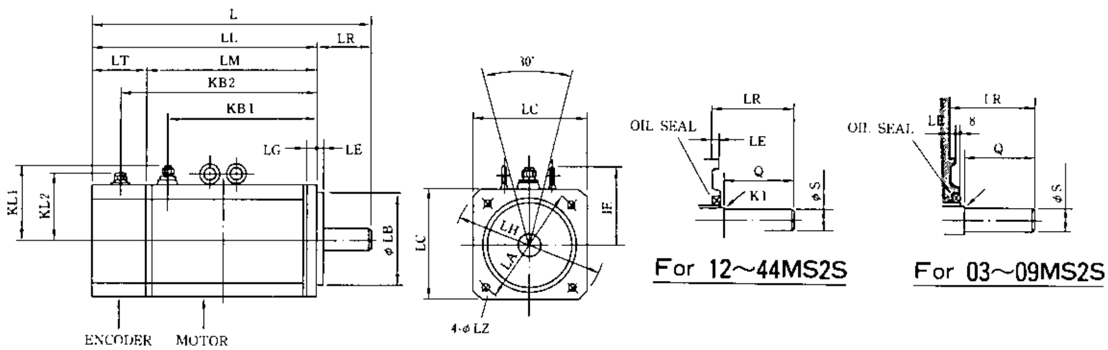
APPROX WEIGHT 13.0 kg

	Servopack Side Connector	Cable Side Connector	Remarks
CN2	MR-20RMA	Servopack attachment Housing MR-20F (Soldered type) Hood MR-20L	Honda Tsushin Co.,
CN22	MR-25RMA	Servopack attachment Housing MR-25F (Soldered type) Hood MR-25L	Honda Tsushin Co.,
CN23	MR-20RMA	Servopack attachment Housing MR-20F (Soldered type) Hood MR-20L	Honda Tsushin Co.,

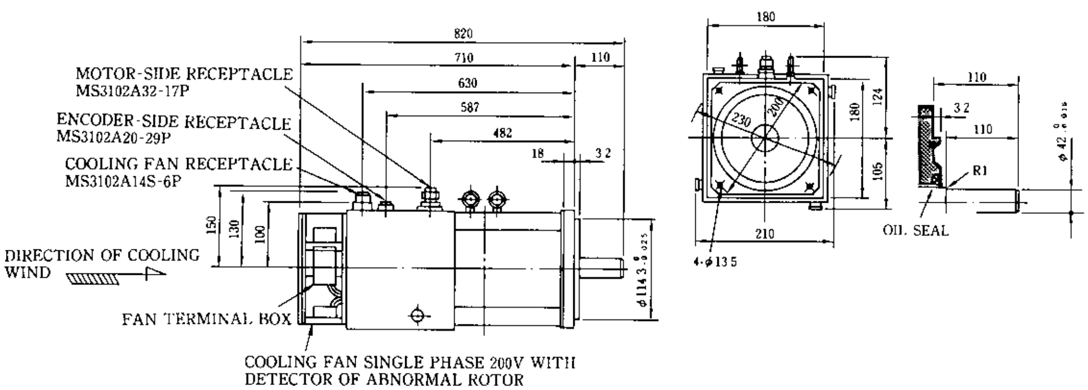
10.4 SERVOMOTOR (For AC Mechanical Feed)

(1) M Series (Straight shaft, without Brake)

• Types USAMED-03MS2S (0.3kw) to -44MS2S (4.4kw)



• Type USAMKD-60MS2S (6kw)

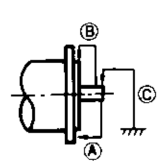


AC Servomotor Type USAMED-	L	LL	LM	LR	LT	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Extension		Receptacle Type		Approx Weight kg
											LA	LB	LC	LE	LG	LH	LZ	φS	Q	Motor	Encoder	
03 MS 2 S*	286	228	182	58	46	124	201	—	112	93	145	$110_{-0.035}^{0}$	130	6	12	165	9	$19_{-0.013}^{0}$	40	MS3102A18 -10P	MS3102A20 -29P	10
06 MS 2 S*	343	285	239	58	46	181	258	—	112	93	145	$110_{-0.035}^{0}$	130	6	12	165	9	$19_{-0.013}^{0}$	40			15
09 MS 2 S*	424	366	308	58	58	247	339	—	112	100	145	$110_{-0.035}^{0}$	130	6	12	165	9	$22_{-0.013}^{0}$	40			21
12 MS 2 S*	355	276	218	79	58	171	237	—	137	110	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$35_{0}^{+0.01}$	76	MS3102A22 -22P		24
20 MS 2 S	413	334	276	79	58	229	295	124	137	110	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$35_{0}^{+0.01}$	76			32
30 MS 2 S	498	419	361	79	58	314	380	124	137	110	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$35_{0}^{+0.01}$	76			43
44 MS 2 S	725	615	557	110	58	482	587	124	150	100	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$42_{-0.016}^{0}$	110	MS3102A32 -17P		70

* Not provided with an eyebolt.

Note: 1. Absolute encoder is used as a detector.
2. Vibration: 15μm or below.
3. Plug and clamp are not attached for receptacle connection.

MECHANICAL SPECIFICATIONS

Accuracy (T. I. R.)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04 0.06†	
Flange diameter concentric to shaft Ⓑ	0.04 0.06†	
Shaft run out Ⓒ	0.02 0.04†	

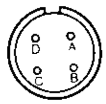
* T I R (Total Indicator Reading)

† Accuracy for motor types USAMED-44MS2S

10.4 SERVOMOTOR (For AC Mechanical Feed) (Cont'd)

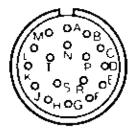
CONNECTOR SPECIFICATIONS

● Incremental Encoder Receptacle



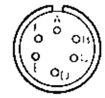
A	Phase U
B	Phase V
C	Phase W
D	Ground

● Motor Receptacle

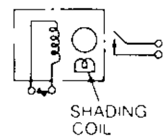


A	Channel A output	K	–
B	Channel $\overline{A}$ output	L	–
C	Channel B output	M	–
D	Channel $\overline{B}$ output	N	–
E	Channel Z output	P	–
F	Channel $\overline{Z}$ output	R	For reset
G	0 V	S	0 V (battery)
H	+5 VDC	T	3 V (battery)
J	Frame ground	–	–

FAN TERMINAL CONNECTION (For Only 60MS2S)



A	Fan motor
B	Fan motor
C	
D	Alarm terminal
E	Alarm terminal
F	



Alarm contact

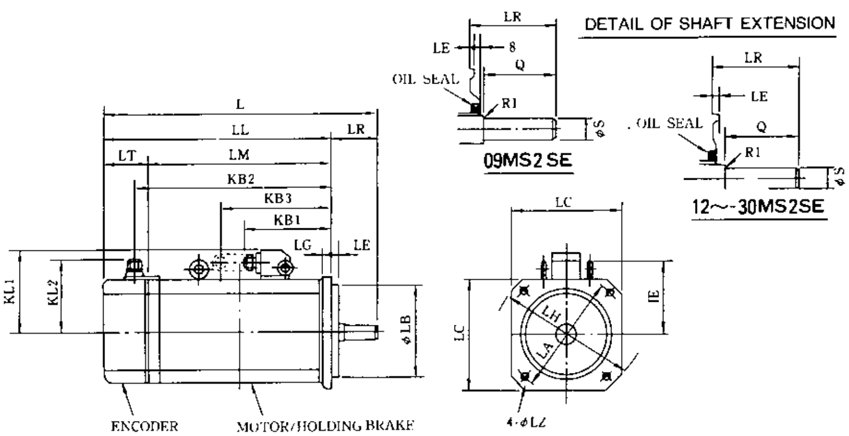
OFF at normal fan rotation
ON at 1800 ± 200r/min or less
(ON during 3 seconds at start-up)

Contact Capacity

Max. resistive load 110V 0.3A

(2) M Series (Straight shaft, with Brake)

• Type USAMED-09MS2SE(0.9kW)to~USAMED-30MS2SE(3kW)



CONNECTOR SPECIFICATIONS

Motor/Brake

A	Phase U	E	Brake Terminal
B	Phase V	F	Brake Terminal
C	Phase W	G	—
D	Ground		

Encoder

A	Channel A output	K	—
B	Channel $\overline{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\overline{B}$ output	N	—
E	Channel Z output	P	—
F	Channel $\overline{Z}$ output	R	For reset
G	0 V	S	0 V (battery)
H	+ 5 V DC	T	3.6 V (battery)
J	Frame ground		

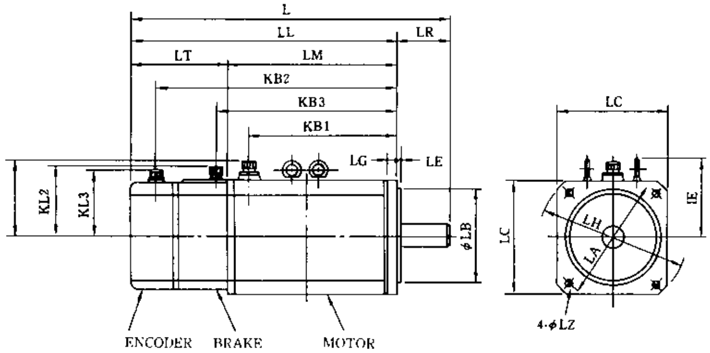
AC Servomotor Type USAMED-	L	LL	LM	LR	LT	KB1	KB2	KB3	IE	KL1	KL2	Flange Surface							Shaft Extention		Approx Weight (kg)	Brake Torque (kg·m)
												LA	φLB	LC	LE	LG	LH	LZ	φS	Q		
09MS2SE*	458	400	356	58	44	116	375	158	–	113	93	145	$110_{-0.035}^{0}$	130	6	12	165	9	$22_{-0.013}^{0}$	40	25	0.6
12MS2SE	432	353	298	79	55	165	317	220	124	143	110	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$35_{0}^{+0.01}$	76	33	3.6
20MS2SE	496	417	362	79	55	165	381	220	124	143	110	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$35_{0}^{+0.01}$	76	41	
30MS2SE	577	498	443	79	55	165	462	220	124	143	110	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$35_{0}^{+0.01}$	76	52	

AC Servomotor Type USAMED-	Receptacle Type		Shaft Run Out T.I.R†	Flange Surface Perpendicular to Shaft T.I.R†	Flange Diameter Concentric to Shaft T.I.R†
	Motor/Brake	Encoder			
09MS2SE*	MS3102A20-15P	MS3102A20-29P	0.02	0.04	0.04
12MS2SE	MS3102A24-10P				
20MS2SE					
30MS2SE					

* Not provided with an eyebolt.
† T. I. R. (Total Indicator Reading)

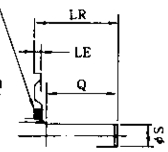
Note : 1. Absolute encoder is used as a detector.
2. Vibration : 15μm or below.
3. Plug and clamp are not attached for receptacle connection.
4. Brake power supply is 90 V DC.

• USAMED-44MS2SB (4.4kW)



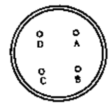
OIL SEAL

Detail of Shaft Extension



CONNECTOR SPECIFICATIONS

Motor

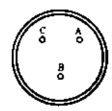


A	Phase U
B	Phase V
C	Phase W
D	Ground

Encoder

A	Channel A output	K	—
B	Channel $\bar{A}$ output	L	—
C	Channel B output	M	—
D	Channel $\bar{B}$ output	N	—
E	Channel Z output	P	—
F	Channel $\bar{Z}$ output	R	For reset
G	0 V	S	0V (battery)
H	+5 V DC	T	3.6V (battery)
J	Frame ground		

Brake



A	Brake terminal
B	Brake terminal
C	

AC Servomotor Type USAMED-	L	LL	LM	LR	LT	KB1	KB2	KB3	IE	KL1	KL2	KL3	Flange Surface							Shaft Extension		Approx Weight (kg)	Brake Torque (kg·m)
													LA	LB	LC	LE	LG	LH	LZ	φS	Q		
44MS2SB	820	710	527	110	183	482	683	577	124	150	93	110	200	$114.3_{-0.025}^{0}$	180	3.2	18	230	13.5	$42_{-0.016}^{0}$	110	80	6

AC Servomotor Type USAMED-	Receptacle Type			Shaft Run Out T.I.R*	Flange Surface Perpendicular to Shaft T.I.R*	Flange Diameter Concentric to Shaft T.I.R*
	Motor	Brake	Encoder			
44MS2SB	MS3102A32-17P	MS3102A14S-7P	MS3102A20-29P	0.04	0.04	0.04

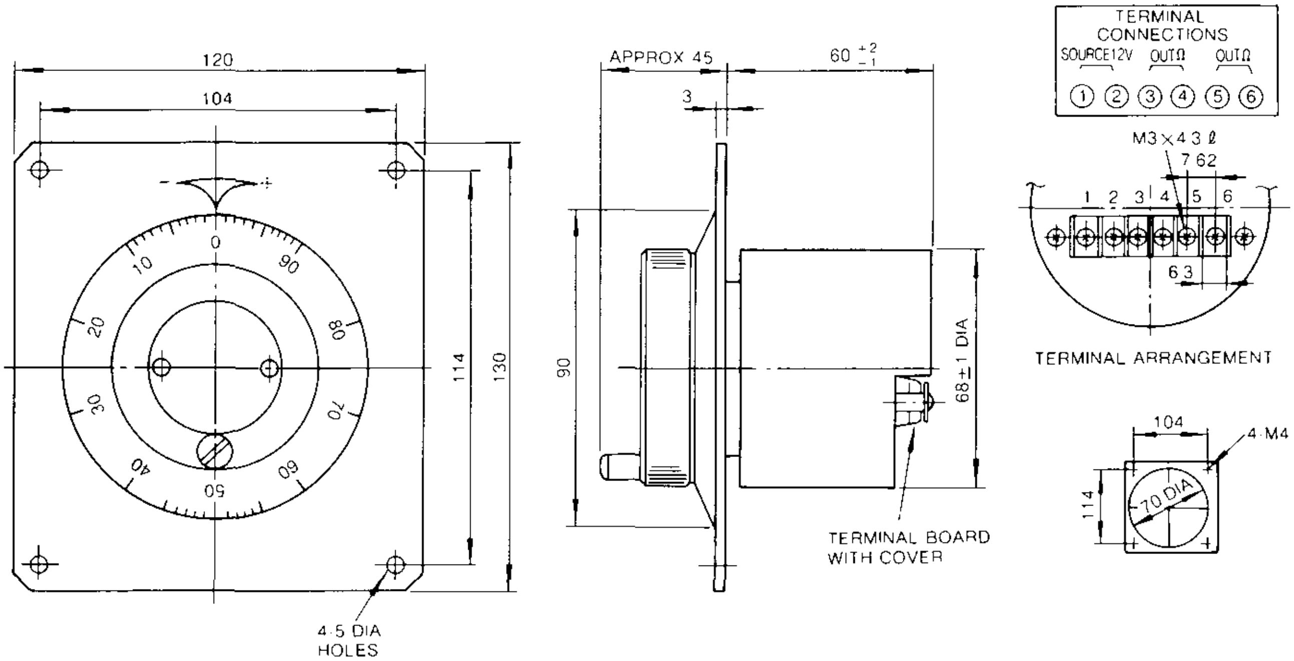
* T. I. R. (Total Indicator Reading)

Note : 1. Absolute encoder is used as a detector.
2. Vibration : 15 μm or below.
3. Plug and clamp are not attached for receptacle connection.

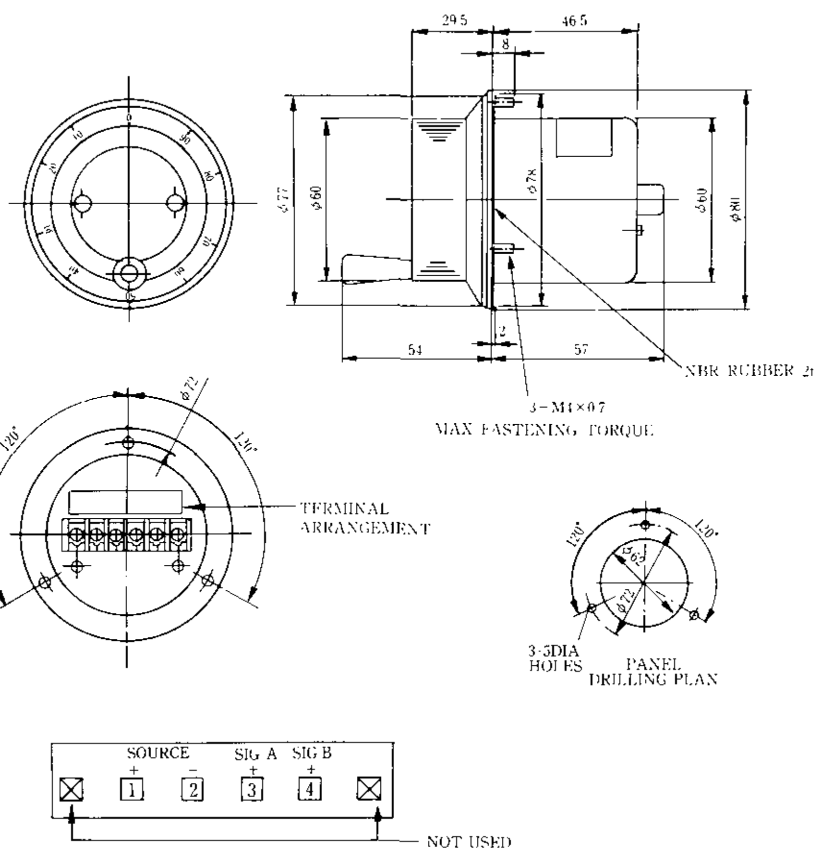
10

10.5 PULSE GENERATOR

(1) Type MGZ-10B



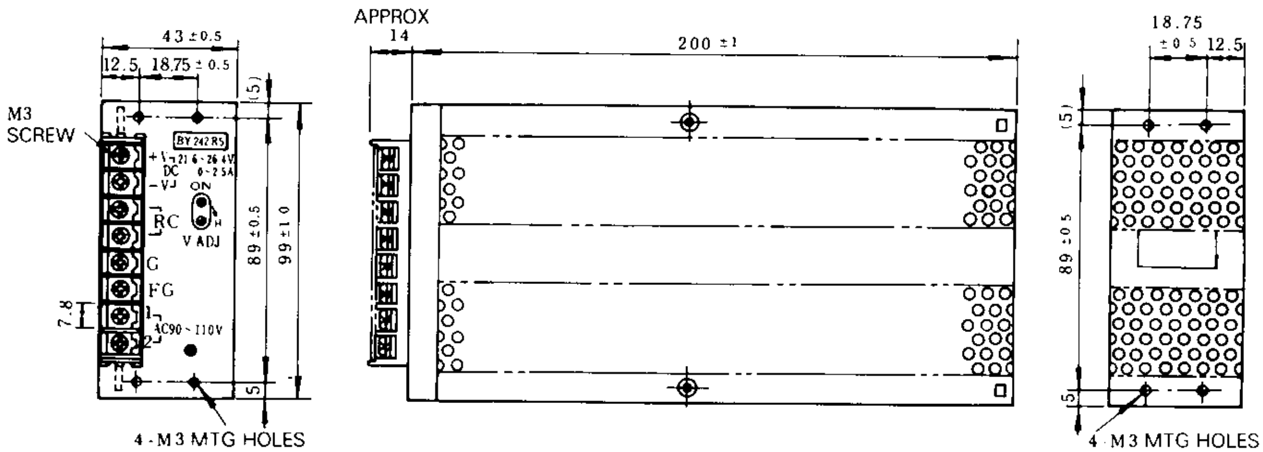
(2) Type PREH-2E5T⁄100-M1



10.6 I/O SIGNAL POWER SUPPLY

Model : BY242R5

Maker : Shindengen Kogyo, KK.

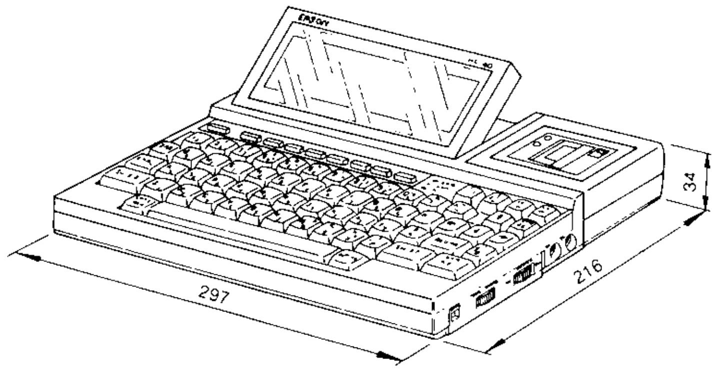


10.7 TAPE DEVICE

(1) Hand-held Computer

Type : EPSON HC-40

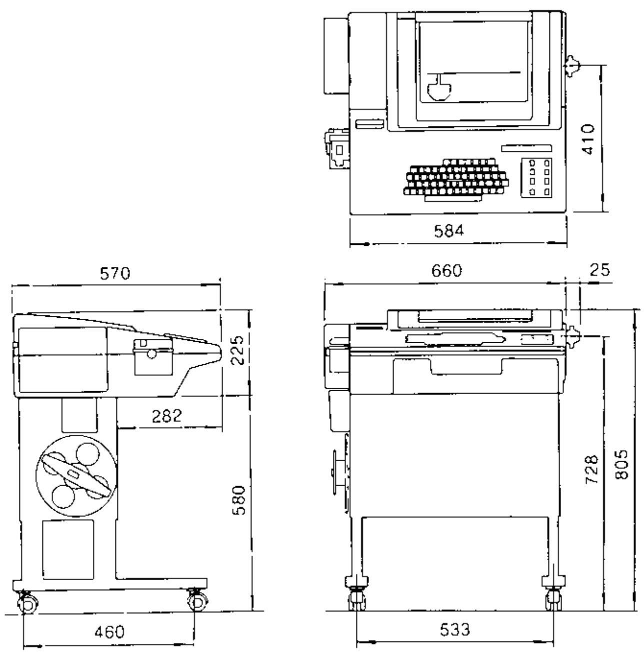
Maker : EPSON Corporation



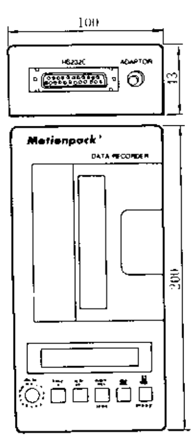
(2) PRO-TYPER High-Speed ASR Input Terminal

Type : MODEL 7652

Maker : Citizen



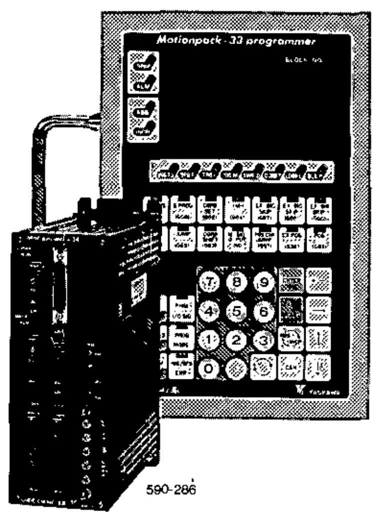
(3) Motionpack Data Recorder



11. EXTENDED FUNCTIONS

This section describes the following extended functions newly added :

(1) S-curve Accel／Decel Positioning
(2) ABS-PG Automatic Home Position Setup System
(3) External Data Setting
(4) External Offset
(5) Extended Zone Signal Output (A)
(6) Extended Zone Signal Output (B)



PROGRAMMER

CONTROLLER

589-30

11.1 S-CURVE ACCEL／DECEL POSITIONING

11.1.1. Features

(1) This is a function to expand the skip positioning function (G05～G07) by setting the accel／decel time in Pr56 and S-curve accel／decel time in Pr57.

(2) The S-curve of accel／decel of positioning motion which means a constant time change rate in accel／decel dampens shock at start and stop.

11.1.2 Specifications

(1) Designation of Function

The designation of this function requires, as in the designation of other expansion functions, setting of parameter and inputting of expansion function selection signals.

(a) Setting of parameter
Set Pr43 = 1000.

(b) Expansion function selection signal
Connect No. 18 terminal of the CN5 connrctor to O_{24}V.
CN5-18 → O_{24}V

(2) Definition of S-curve Accel／Decel Curve

(a) The S-curve accel／decel curve consists of 3 zones, as shown in Fig. 1.
- Time change rate in acceleration zone
- Constant acceleration zone
- Reduced acceleration zone

(b) Accel and decel are symmetrical.

(c) The S-curve accel／decel is defined by the following 3 parameters.
- V1 = Pr40 ··· Maximum speed (Same as setting of basic function)
- ta = Pr56 ··· Acceleration time (in msec. 60 ～ 1000)
- t1 = P457 ··· S-curve time (in msec. 30 ～ 500)

The upper limit value of Pr57 is 500ms or Pr56 × 1／2 whichever smaller.

(d) Relation between command speed and S-curve

- When the command speed F is smaller than V1, the speed increases along the path C' to the speed F.
- When travel is short, the speed increases along the path C.

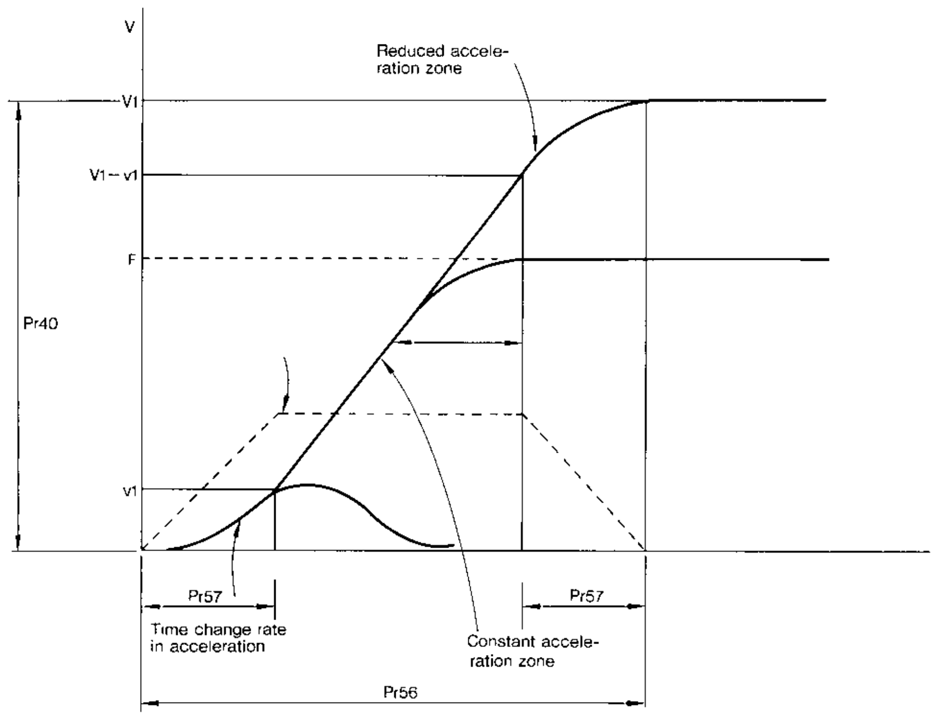


Fig. 11. 1 S-curve Accel/Decel

11.1.2 Specifications (Cont'd)

(3) Motion

G 0 5 X□□□□□□□F□□□□□ I□□□
G 0 5 U□□□□□□□F□□□□□ I□□□

(G06 and G07 are the same)

The basic motion is the same as the G01 positioning motion.
Only the curve is the S-curve. The time of the S-curve are the same as symmetrical.
The speed curve for the S-curve positioning motion is as shown below. Note that if a stop signal is input during operation, the motion will follow the curve shown in Fig. 11.4 depending on the timing of input.

(a) Normal operation

Positioning by symmetrical S-curve shown in Fig. 11.2 is executed.

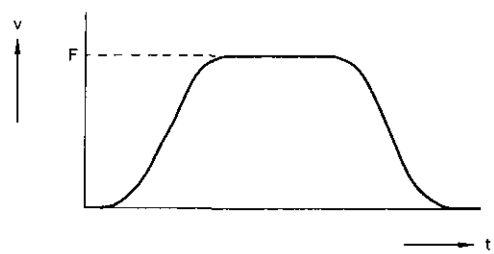


Fig. 11. 2 Normal Speed Curve

(b) Operation when travel distance is short.

When the command travel distance is short, positioning by the curve in Fig. 3 having no constant acceleration and constant speed zones is executed.

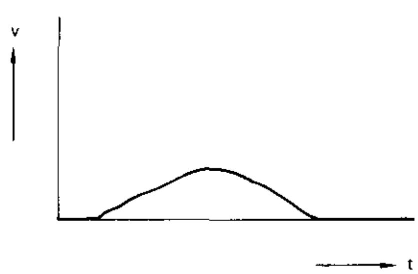


Fig. 11. 3 Speed Curve When Travel Distance is Small

(c) Speed curve at temporary stop

When the motion is stopped temporarily, the speed curve of the motion changes as follows depending on the timing of the stop.

①Stop during acceleration: The motion stops by the symmetrical curve as the (a) curve.

②Stop during constant speed: The motion stops by the deceleration curve of the S-curve accel/decel.

③Stop during deceleration: The motion continues deceleration and stops.

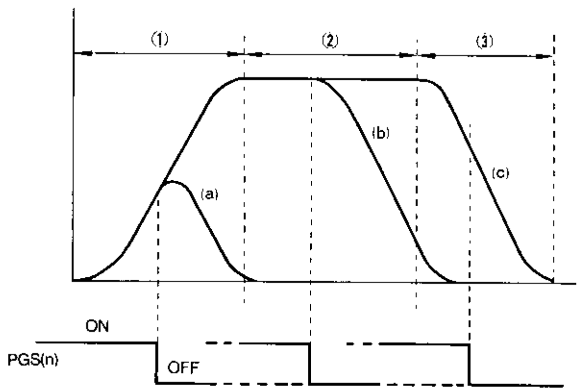


Fig. 11. 4 Speed Curve at Temporary Stop

(d) Speed control signal (OVR)

The speed control signal (OVR) is disregarded during execution of the S-curve accel/decel positioning function. This means that the feed speed cannot be limited to the creep speed by the speed control signal.

11.1.2 Specifications (Cont'd)

(4) Compatibility with Conventional Functions

The compatibility of the S-curve accel／decel function with other expansion functions using G05, G06 and G07 is as shown in Table 11.1.

Table 11.1 Compatibility with Other Expansion Functions

Expansion Function Name	G Code Used	Compatibility with S-Letter	Parameter Setting (Pr43)	Remarks
Variable speed positioning	G06	Compatible	3000	
Passing signal output	G07	Compatible	5000	
Angle indexing	G05 G06 G07	Compatible	2001000	
Clamp free	G05 G06 G07	Incompatible		Use may be divided (Example) G05 : S-letter, G06 : Clamp free
External compensation		Incompatible		
External data setting		Incompatible		

The positioning commands, G01, G27 and G34,other than skip positioning, move the unit at linear accel／decel speed when the S-curve accel／decel function is specified.

11.1.3 Operation

(1) Acceleration (Deceleration) Torque

In S-curve accel／decel positioning, the start and end of acceleration time and start and end of deceleration time involve S-curve accel／decel defined by Pr56, as shown in Fig. 5. And by the rate that the accel／decel speed is restricted by S-curve accel／decel, the accel／decel speed of linear accel／decel at the middle is increased. The linear accel／decel speed becomes the same as when the accel／decel time is Pr56-Pr57, which is the peak torque in S-curve accel／decel positioning.

$$\text{Peak torque of S-curve accel/decel} = \frac{Pr56}{Pr56-Pr57} \times \text{Peak torque of linear accel/decel}$$

From the above formula, the peak torque of S-curve accel／decel and the peak torque of linear accel／decel are equal when Pr57 = 0.

When $Pr57 = \frac{Pr56}{2}$ (or no linear portion), the peak torque of S-curve accel／decel is double the peak torque of linear accel／decel.

NOTE

In practice, Pr57 cannot be set larger than 30 because of restriction of the setting range of Pr57.

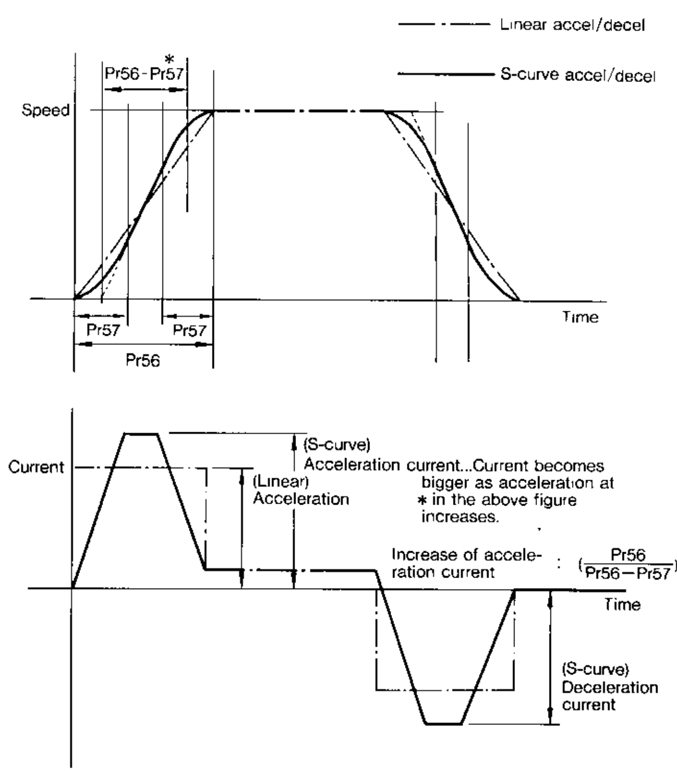


Fig. 11. 5 Torque Curve of S-curve Accel／Decel

11.1.3 Operations (Cont'd)

The relation between Pr57／Pr56 and increase of peak torque is as shown in Fig. 11.6.

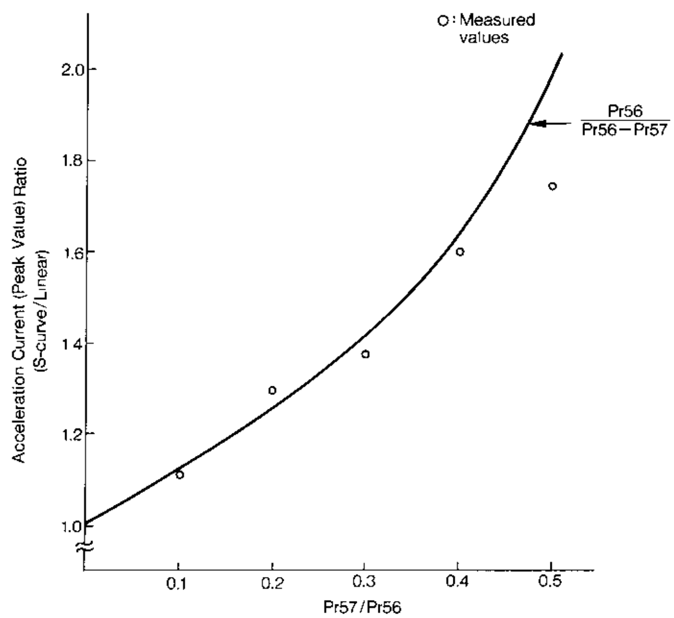


Fig. 11. 6 Increase of Peak Torque

(2) Programing of Torque Limiter

The S-curve accel／decel positioning motion is programed by the following G codes.

G05 X ………………… F ……………… I …………………
(U) (G06 and G07 are the same)

As explained earlier, because the peak torque of accel／decel increases twice as large as the peak torque of linear accel／decel, the accel／decel torque may be insufficient even at I = 200(%). Therefore, it is required to set the program value of I much bigger according to the following rules.

- Max. value of I 250%
- Program value of I × Pr53 (thrust ratio) ≦ 300%

Note that the peak current exceeding the momentary maximum current of the Servopack is not allowed to flow. Refer to Servopack Bulletin.

(3) Adjustment

If necessary, adjust the accel/decel time in the S-curve accel/decel positioning motion by the following procedure.

<Procedure>

1. Measure acceleration current waveforms of linear accel/decel motion with an oscilloscope.
2. Calculate the ratio of the linear acceleration current to the motor rated current.

$$a = \frac{\text{Motor rated current} \times 2^{*}}{\text{Linear acceleration current}}$$

* With Motionpack-34, normally $I = 200\% I_R$

If torque is insufficient, I can be set upto $250\% I_R$

(provided that the Servopack can output this torque).

3. Based on "a" obtained in (2) above,

   $a \leqq 1$: Linear acceleration current is limit of Servopack momentary current.

   To use S-curve accel/decel, the acceleration time must be lengthened.

   $a > 1$: S-curve accel/decel can be used.
4. From Fig. 11.6, obtain the Pr57/Pr56 ratio at acceleration current ratio = a.

   This Pr57 is the limit of the S-curve acceleration time.

(4) Reselection of Servopack

If the above adjustment cannot give a desired accel/decel time and the specifications of accel/decel time cannot be slackened, reselect the capacity of the Servopack.

This means selection of a Servopack of one step larger capacity only for the peak torque at accel/decel. But, this is a servo drive capacity required for quick shockless motion.

If the servo capacity is not to be increased, adjust Pr57 in consideration of a desired shockless motion and keep the peak torque within the range of the momentary maximum current.

11.1.4 Characteristics

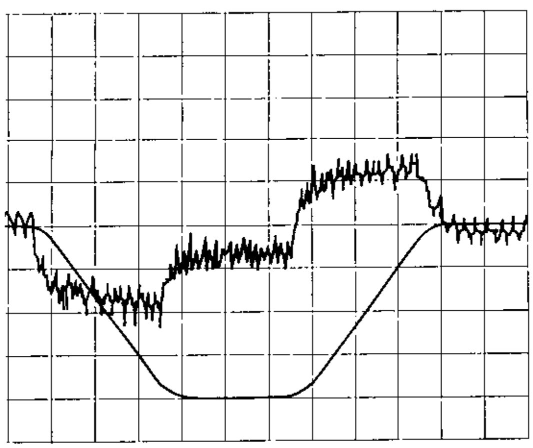
(1) S-curve Accel/Decel Motion

The speed and current of S-curve accel/decel motion are compared with those of linear accel/decel in Fig. 11.7.

Conditions

Moter : M series 1.2 kW/Moter alone

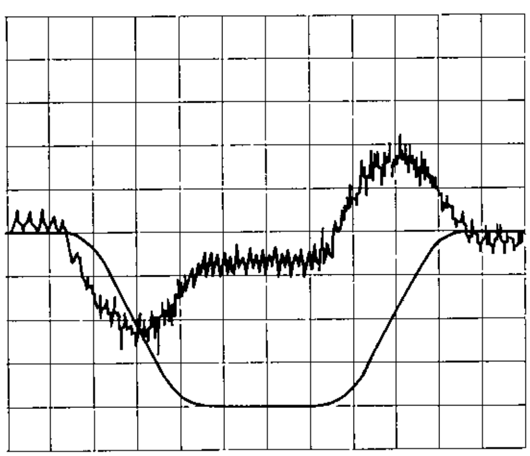
Linear Accel / Decel



Measuring Range
- Speed monitor. 1V/div (±4V/1000 r/min)
- Torque monitor: 500mV/div (±3V/100%)
- Time: 100ms/div

Accel/Decel Condition
- Feedrate: 1000 r/min (Rating)
- Accel/decel time. 300ms

S-curve Accel / Decel



Measuring Range
- Speed monitor. 1V/div (±4V/1000r/min)
- Torque monitor: 500mV/div (±3V/100%)
- Time: 100ms/div

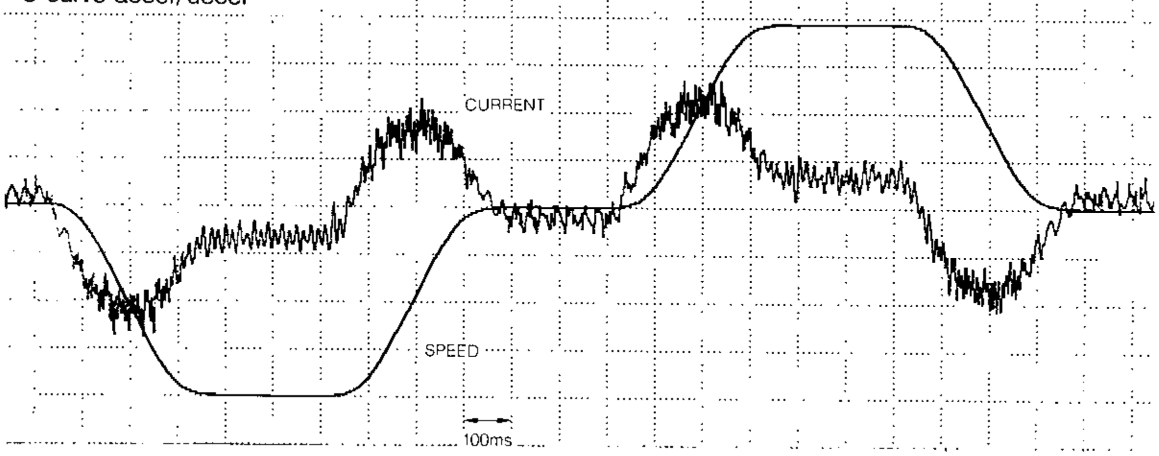
Accel/Decel Condition
- Feedrate: 1000r/min (Rating)
- Accel/decel time: 300ms
- Accel·accel/decel time: 100ms

Fig. 11. 7

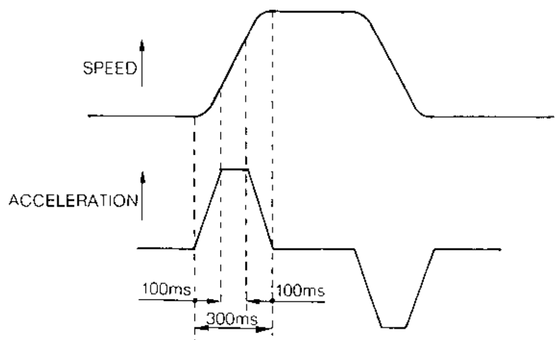
(2) Current Waveform

The current waveforms in positioning motion by S-curve accel/decel and linear accel/decel are shown in Fig. 11.8.

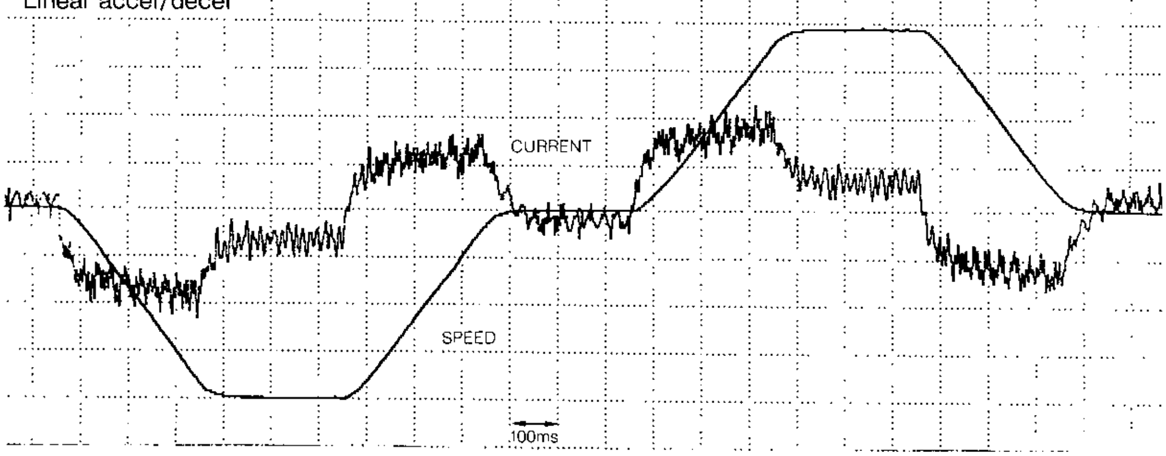
S-curve accel/decel



Pr56 = 300, Pr57 = 100 (ms)
Acceleration current 47%



Linear accel/decel



Pr41 = 300 (msec)
Acceleration current 27%
(Rated current ratio)

Motor : M series 1.2kW, with equivalent inertia

Command : G05 U333 000F200001200
(G01) → 1000 r/min

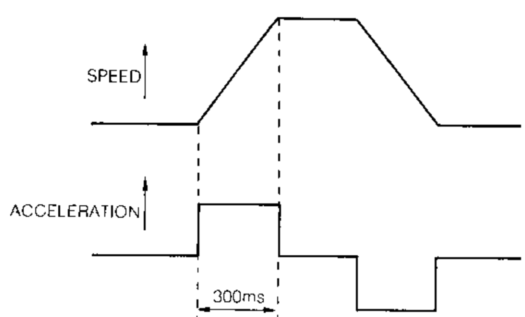


Fig. 11. 8

11.1.4 Characteristics (Cont'd)

(3) S-Curve Accel／Decel Motion and In-Position Fig. 11.9 shows the time from the end of pulse generation of the move command to in-Position.

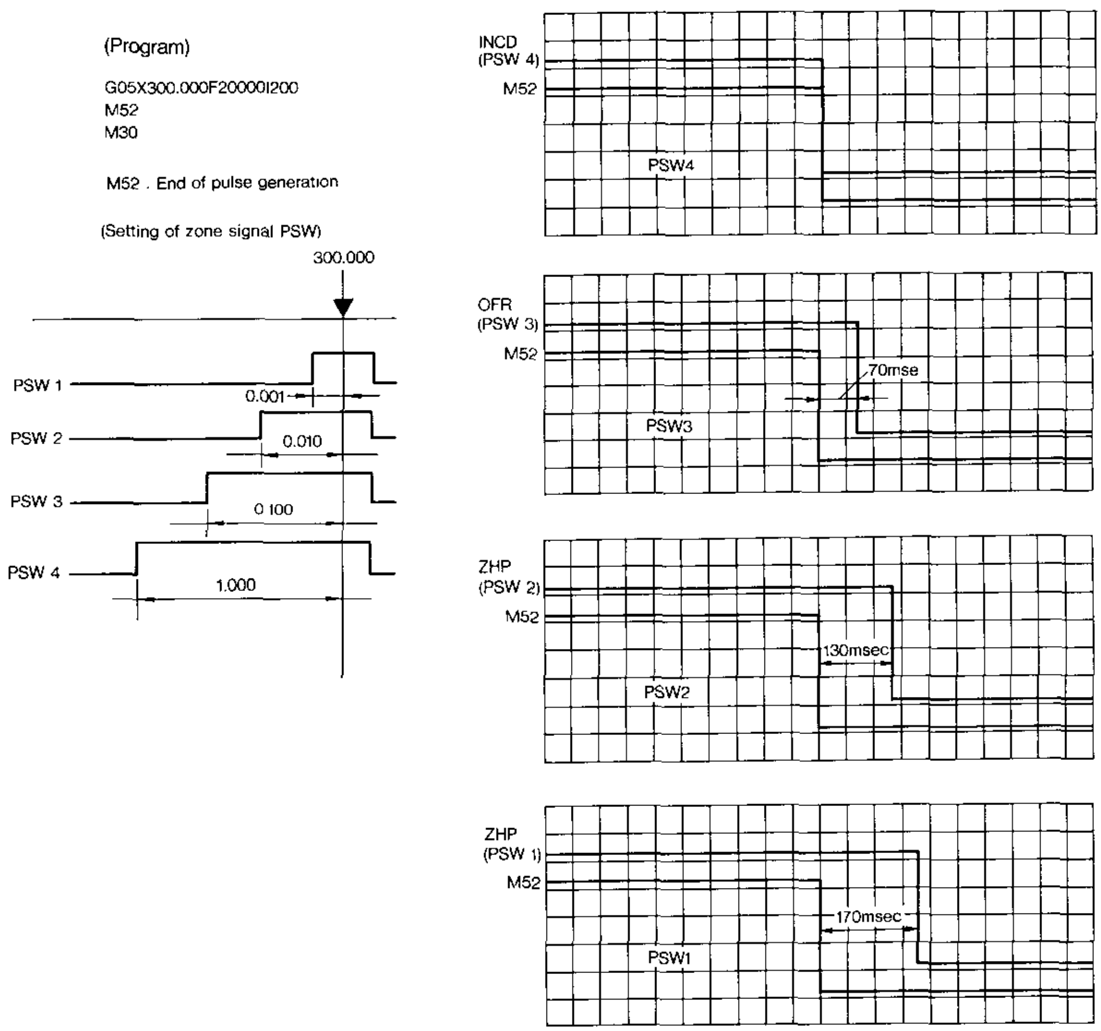


Fig. 11. 9

11.2 ABS-PG AUTOMATIC HOME POSITION SETUP SYSTEM

11.2.1 Introduction

This covers the specifications of the automatic home position setup system to be added to the absolute encoder home position setup procedure with the Motionpack-34 system.

11.2.2 Major Contents of Added Functions

〈Conventional System〉

(1) After manually pushing or moving to the reference point, the feedback position data at that position are ready by the programer.

(2) Then, the feedback position data are multiplied by the pulse dividing ratio and the product is set in Pr71.

(3) These operations make the reference position $A_0 = 0.000$.

〈Contents of Added Functions〉

The addition of the following automatic home position setup system improves home position setup substantially.

(1) When the home position setup signal is input after setting the home position setup command in parameter Pr80 (newly added), Pr71 is automatically set so that the current position becomes the specified coordinate value.

This system requires manually moving to the reference point and is therefore called the semi-automatic home position setup system.

(2) If the push home position system is set in parameter Pr70, when the home position setup signal is input after setting the home position setup command in parameter Pr80 (newly added), Pr71 is automatically set so that the unit is moved and pushed at the reference point and that position becomes the specified coordinate value.

This system automatically performs all the sequence including move to the reference point and therefore is called the full-automatic home position setup system.

11.2.3 Addition of Associated Parameters

In relation to the addition of the specifications, some parameters are added and revised.

(1) Pr70 (Reference point coordinate system)

(a) The following item is added to F of Pr70.

Pr70 = ABCDEF

Automatic home position setup system F = 4 added

Setting of F = 4 designates this automatic home position setup system.

(b) When the full-automatic home position setup system is designated, C of Pr70 should have the same value as the push home position system.

Pr70 = ABCDEF

Reference point push system C=4 set

(2) Setting of Pr71 (Offset of To coordinate)

Pr71 is offset of the To coordinate as before, but is automatically set by home position setting.

(3) Setting of Pr72(Waiting position)

Pr72 is the same as before and defines the rapid return position.

The rapid return position is the point positioned by the rapid return motion executed when the reference point return signal (ZRN) is input. As explained earlier, when the home position setup command is set in Pr80, the home position setting motion is executed and in other cases, the rapid return motion is executed.

(4) Setting of Pr73 (Rapid return speed)

Pr73 is the speed setting parameter at the rapid return motion mentioned above.

The unit is a speed unit and the numerical range is 0~60000.

(5) Setting of Pr74 (Home Position setting speed) ··· Newly added

The pushing move speed in the reference point push system is set in Pr74.

Setting is made in the speed command unit and the numerical range is 0 ~ 60000.

(6) Setting of Pr75 (Push torque) ··· Newly added

The push torque limit value in the reference point push system is set in Pr75.

The setting unit is percentage (%) of the rated torque of the servomotor and the numerical range is 10~250.

(7) Setting of Pr76 (Number of encorder pulses)

Same as before.

(8) Setting of Pr77 (Allowable deviation)

Same as before.

(9) Setting of Pr79 (Pushing time) ··· Newly added

In the reference point push system, the waiting time until setup after the torque limit value is exceeded by pushing against the stopper is set in Pr79.

The setting unit is 10 ms and the numerical range is 0～3000.

(10) Setting of Pr80 (home position setup command) ··· Newly added

When the home position is set by the absolute encoder automatic home position setup system, "1" is set in Pr80 in advance.

This operation sets the Motionpack in the home position setup mode to make it ready for setup.

When the home position setup has been completed, this parameter is automatically reset to "0".

(11) Setting of Pr81 (Reference point coordinate) ··· Newly added

The coordinate value in the coordinate system after home position setting is set in Pr81.

The setting unit is the minimum command unit.

(12) Pr82 (ABS • PG alarm reset command) ··· Newly added

In the case of ABS-PG ALM, Pr82 should be set to 1.

And the power of MP34 be turned off／on to reset alarm.

(13) Setting of Pr78 (Encoder allowable error)

Same as before.

11.2.4 Setting of Parameter Pr70 (Reference Point Coordinate System)

(1) Semi-automatic home position setup system

"4" is set at the least significant place of the parameter setting Pr70=40003 when the conventional absolute value system is used.

Then, when the home position setup signal (ZRN signal) is turned OFF to ON after the home position setup command is set in parameter Pr80 (newly added), Pr71 is automatically set so that the current position becomes the specified coordinate value.

(Example) Pr70 = 40003 (Conventional system)

→ Pr70=40004

When the home position setup signal is input, Pr71 is automatically set so that the current position becomes the specified coordinate value.

11.2.4 Setting of Parameter Pr70 (Reference Point Coordinate System) (Cont'd)

(2) Setting of reference point push (Full-automatic home position setup) system

The push home position system is set at C of Pr70.

Pr70 = A B C D E F

- F — Automatic home position setup system F = 4
- E — Pushing direction E = 0 : − direction
  E = 1 : + direction
- D — Start move direction. "0" Always is set. Move to the direction specified by E.
- C — Reference point push system. C = 4 is set.

The above contents are set in Pr70 and the home position setup command is set in Pr80 just before executing home position setup. Then, when the home position setup signal is input, the unit is moved to the reference point according to the specified sequence and pushed against the stopper.

Next, Pr71 is automatically set so that the stopper position becomes the specified coordinate value.

Example

(Conventional)

Pr70 = 40003

- 3 — Absolute value system
- 4 — Reference pulse, no reference LS

(Revised)

→ Pr70 = 44004

- Absolute value system
- 4 — Automatic home position setup system
- 0 — Moved and pushed in minus direction
- 0 — Start of move to minus direction
- 4 — Specification of push home position system
- 4 — Reference pulse, no reference LS (Same as conventional system

11.2.5 Home Position Setting Operation

The setting operation described below follows the setup of the Motionpack position counter and the absolute encoder described in Section 7 of this Manual.

(1) Push home position (Full-automatic home position setup) system

(a) The following parameters are set in the EDIT mode and the power is turned OFF and ON.

Pr70 = 440□4 Move direction : □ = 0 → − direction

□ = 1 → + direction

Pr80 = 1 home position setup command

Pr81 = Coordinate value of reference point after home position setup (Ao)

Pr74, Pr75, Pr79 and other associated parameters are to be set.

(b) The home position setup signal (ZRN signal) is turned OFF → ON.

The unit starts moving in the direction specified in E or Pr70 at a speed Set in Pr74.

(c) When the unit arrives at the stopper position after stopper pushing time (set at Pr79), it moves to the provisional home position (Ao = 0.000) once with the coordinate value of reference point (Ao) = Pr81 at a move speed of Pr74.

(d) The unit starts again to the reference point from the provisional home position and after it arrives at the reference point, it is pushed against the stopper at a torque limit value set in Pr75. Move speed = Pr74.

(e) After the stopper push time (set in Pr79), after the push torque has reached the torque limit value, home position setup is executed.

(f) Pr71 (home position offset value) is revised so that the coordinate value (Ao) of the reference point becomes the specified value set in Pr81.

At this time, Pr71 is revised in the PLAY mode and the power need not be turned OFF/ON.

(g) Then the unit waits at the home position (Ao = 0.000) again.

(h) Pr80 is automatically reset to "0" to complete home position setup. (Note : During setup operation, software stroke limits are disregarded.)

(2) Semi-automatic home position setup system ··· System to set reference point by manual operation.

(a) Select the EDIT mode and set the following parameters.

Pr70 = 40004

Pr80 = 1

Pr81 = Coordinate value (Ao) of reference point after home position setup.

Then, turn OFF/ON the controller power.

(b) Select the JOG mode. The speed is the JOG low speed.

Set the torque limit Pr8 = 60 ∼ 80.

11.2.5 Home Position Setting Operation (Cont'd)

(c) Turn OFF／ON the JOG start signal and set the unit at the reference point by the JOG operation.

(d) Turn OFF／ON the original setup signal (ZRN signal).

(e) Pr71 is automatically rewritten to the home position offset value so that the coordinate value (Ao) of the reference point becomes the specified value.

At this time, Pr71 is revised in the PLAY mode and the power need not be turned OFF ／ON.

(f) Pr80 is automatically reset to "0" to complete home position setup.

11.2.6 PSW Signal after Home Position Setup Command

After setting Pr80 = 1, the PSW signal becomes invalid.
It becomes valid when Pr80 is reset to "0" after completion of home position setup.

11.2.7 Relation with Conventional System

This system is compatible with the conventional system.

This means that the controller with this system added is much enhanced compared with the conventional controller.

11.2.8 Setup Errors at Full-Auto Reference Point Setup Mode

In the full-auto reference point setup mode if the direction set by Pr70 and the sign set by Pr81 are contradicting, setup error occurs and motor doesn't move when ZRN signal goes on.

In this mode the direction set by Pr70 and the sign of Pr81 should be set according to the table below.

Table. 11. 2

Pr 70	Pr 81
0 (−)	−
1 (+)	+

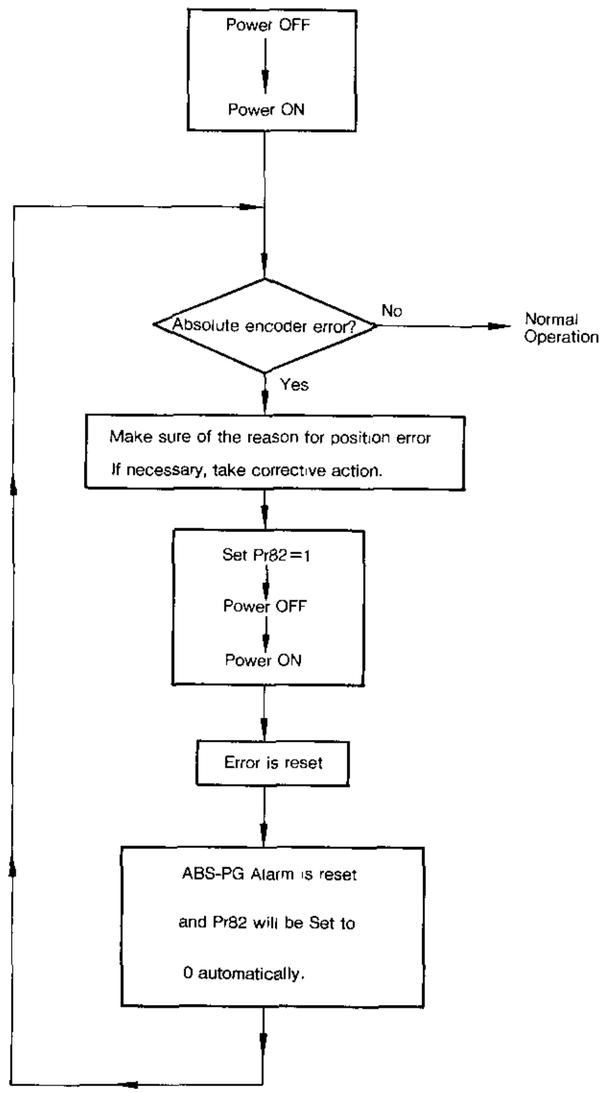
11.2.9 Reset Method of Absolute Encoder Error

If the full-auto reference point setup mode is seleeted (Pr70 = 4 0 4), the reset methed of absolute encoder error is different from conventional ones.

Absolute encoder error is detected when the data read at power ON are different from the data memorized at power OFF over allowable data (set in Pr78).

In this case refer to the flow chart on the next page and reset error.

If the absolute encoder error is caused by another reason, the reset proccdure is the same as a conventional one. Just turn power OFF and ON and the error is reset.



11.3 EXTERNAL DATA SETTING

11.3.1 Introduction

This presents the specifications of the external data setting function which are available with Motionpack-34.

11.3.2 Settings

Before the external data setting function can be used, the following extended functions must be set :

Input line connection : Short across CN5 connector pin 18 and O_{24} (V).

Parameter setting : Pr47 = 20 (No CHECKSUM) or Pr47 = 30 (CHECKSUM)

11.3.3 Functional Overview

Main features of the exernal data setting function are as follows :

(1) Programmable controller (PC) acts as the master unit and inputs data to Motionpack-34.

(2) Motionpack-34 accepts external data and stores it in the corresponding parameter.

(3) Motionpack-34 can execute program operations that are indirectly specified by registers.

(4) When the external data setting function is being used, program selection is performed by special codes.

NOTE

To make programmer available to operate Pr200 series, turn the power of MP-34 off/on after this parameter setting and check the display of Pr47 again.

11.3.4 Hardware Configuration

11.3.4.1 Motionpack-34

The standard specification Motionpack-34 is used.

11.3.4.2 Configuration Diagram

Fig. 11.10 is a block diagram of the Motionpack-34 system that incorporates the external data setting function. The external data set by the digital switch is input via the PC to Motionpack -34.

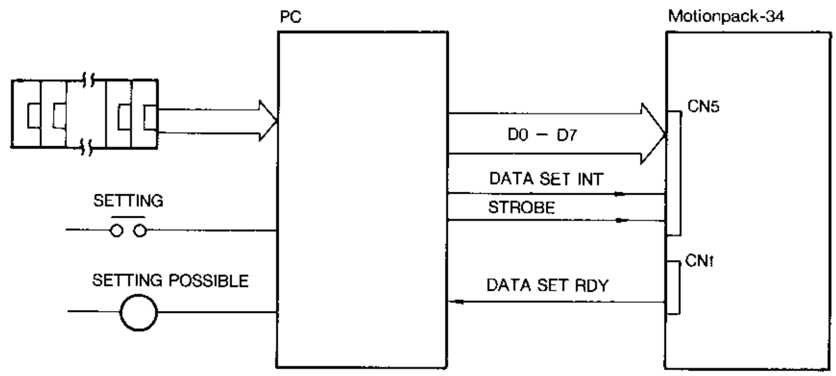


Fig. 11. 10 Motionpack-34 Block Diagram

11.3.5 External Data

11.3.5.1 Types of External Data

The position, speed and torque data for feed command can be set externally.

11.3.5.2 Data Storage

The external data has been input from PC is stored in Pr201-Pr296.
Because specific parameter numbers are not assigned to position, speed and torque data, the user must be careful to avoid confusing the data (e.g., using position data as torque data or speed data).

11.3.5.3 Parameter Initialization

Parameter error (PAr Err) occurs if nothing is set for Pr201-Pr296. Therefore, 0 must be set for each unused parameter.

11.3.5.4 Data Format

(1) Data is input to Motionpack-34 in the following format:
〔Parameter Number〕 + 〔Setting Data〕 + 〔FF〕 $_{HEX}$

(2) Each decimal digit is converted to 4 bits of BCD code, so that two decimal digits make up 1 byte.

(3) The first byte is the least significant 2 digits of the parameter number.

(4) The leading zeros of the setting data are suppressed.

(5) Input data must end with the End of Data code (〔FF〕 $_{HEX}$).

(6) Position data format:
〔N_2N_1〕 〔SP_7〕 〔P_6P_5〕 〔P_4P_3〕 〔P_2P_1〕 〔FF〕 $_{HEX}$
* Maximum data length is 6 bytes.
* 〔S〕 is the sign for the position data. (+) may be omitted. For (−), use 〔F〕 $_{HEX}$.
* $P_7P_6P_5P_4P_3P_2P_1$ constitutes the position data. Decimal point does not need to be specified.

(7) Speed data format:
〔N_2N_1〕 〔OF_5〕 〔F_4F_3〕 〔F_2F_1〕 〔FF〕 $_{HEX}$
* Maximum data length is 5 bytes.

(8) Torque data format:
〔N_2N_1〕 〔OI_3〕 〔I_2I_1〕 〔FF〕 $_{HEX}$
* Maximum data length is 4 bytes.

11.3.6 Operations

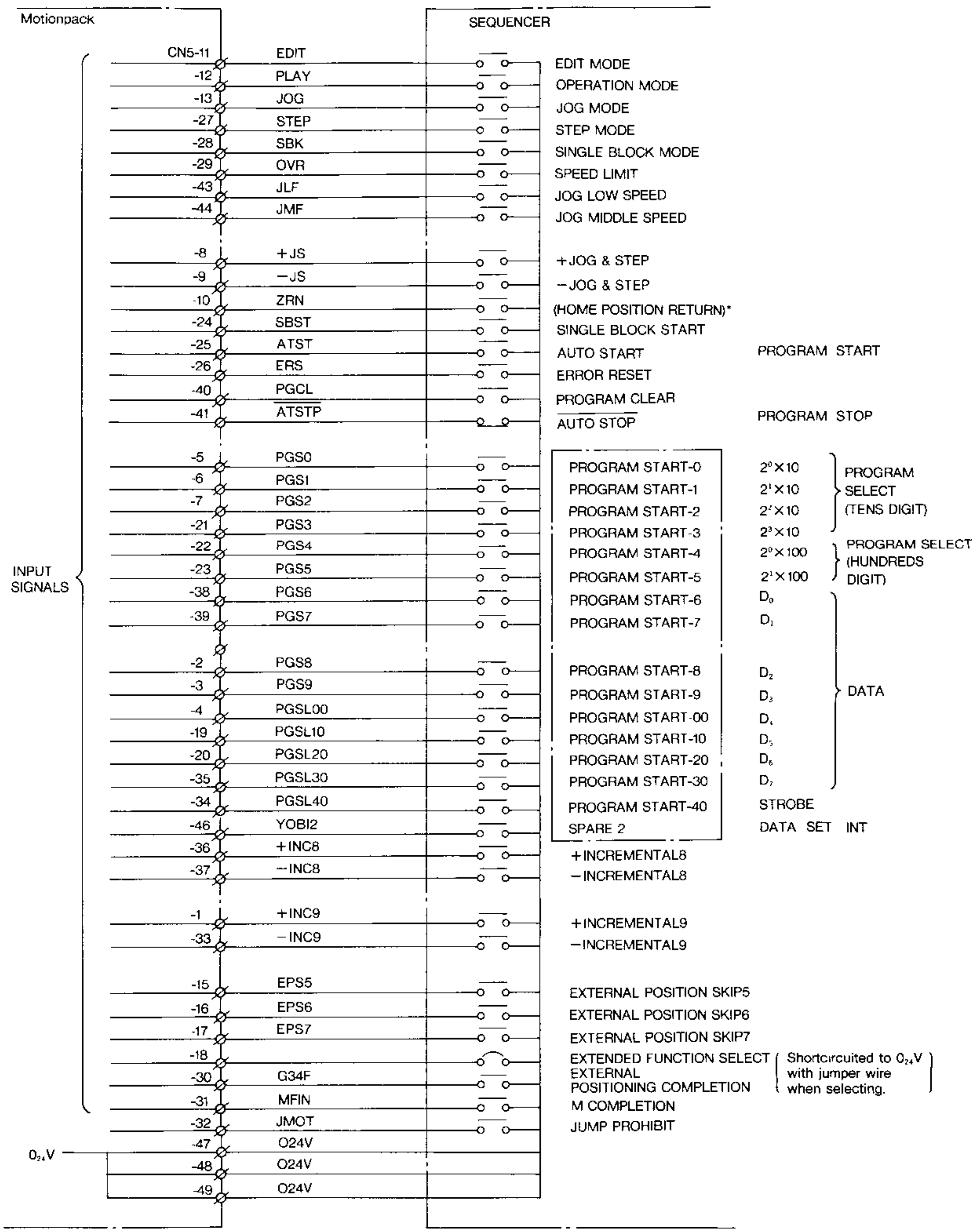
11.3.6.1 Signal Line Connection

(1) Thes is an extended function, and the meaning of signal line differs from that of the basic system.

(2) Figs. 11.11 and 11.12 illustrate how the signal lines are connected.

(3) The standard I/O signal specifications apply.

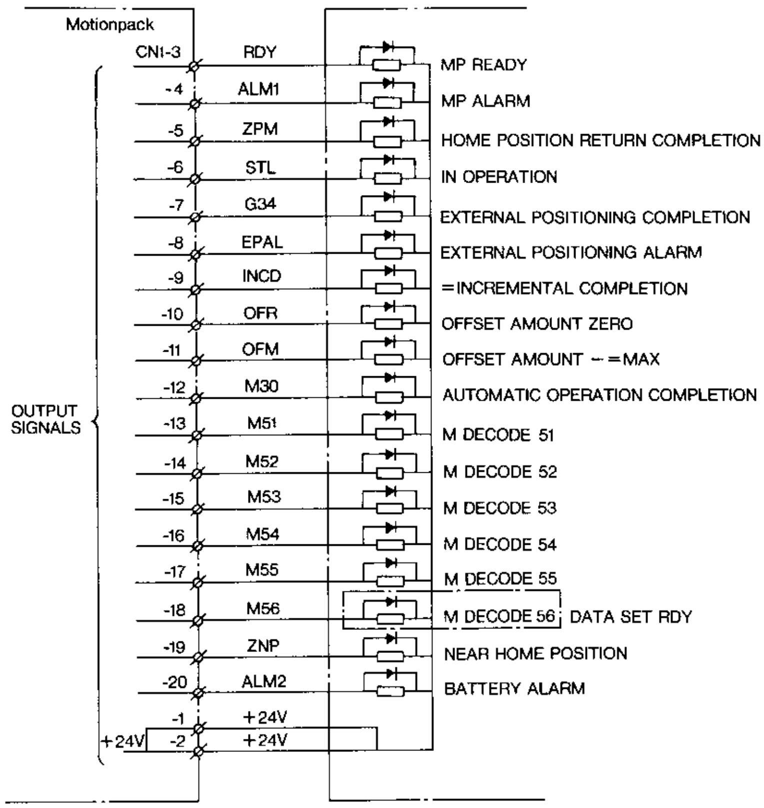
11.3.6.1 Signal Line Connection (Cont'd)



*: ZRN Signal becomes quickreturn signal in absolute value control method.

Note : Signal meanings in ▭ may be changed.

Fig. 11. 11 Input Signal Connections

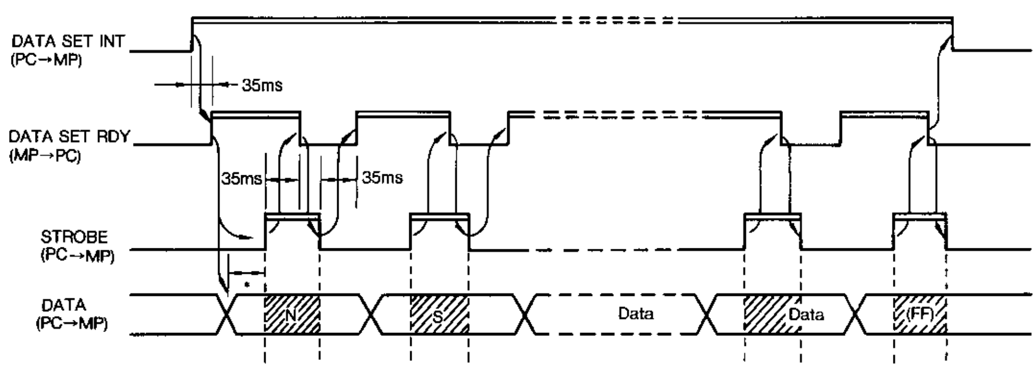


Note : The signal meaning in ⁚⁚ may be changed.

Fig. 11. 12 Output Signal Connections

11.3.6.2 Timing

(1) Fig. 11.13 is the timing diagram for data setting.



*Setting time
Data Set Time = 35ms + (setting Time + 35ms + PC Reading Time + 35ms) × Number of Data
(Example) : Setting Time : 100ms
PC reading time : 20ms
Where No. of data is 6 bytes (max),
Data Set Time=35ms+(100ms+90ms)×6
=1175ms
≒1.2s

Fig. 11. 13 Signal Timing Diagram

11.3.6.3 Operations

(1) External data setting operation is possible only in the AUTO mode and when the motor has stopped (i.e., while move pulse is not being output).

(2) The external data setting function is activated only when the PC turns the external data setting interrupt (DATA SET INT) signal ON.

(3) When Motionpack-34 receives the DATA SET INT signal, it changes to the external data setting mode and sets the data setting ready (DATA SET RDY) signal ON. (The condition described in (1) must be present ; otherwise, Motionpack-34 waits until that condition is established before setting the DATA SET RDY signal ON.)

(4) When the PC recognizes that the DATA SET RDY signal has been set (ON), it sends the data signal (D_0~D_7) and the strobe signal (STROBE).

(5) When Motionpack-34 receives the data signal, it checks the data and if the data is correct, the DATA SET RDY signal is turned OFF.

(6) The PC turns OFF the STROBE signal when the DATA SET RDY signal is turned OFF.

(7) Motionpack-34 turns the DATA SET RDY signal ON when the STROBE signal is turned OFF.

(8) Motionpack-34 completes the external data setting operation when it receives the 〔FF〕$_{HEX}$ code. In order words, it does not set the DATA SET RDY signal ON when 〔FF〕$_{HEX}$ is received.

(9) When Motionpack-34 is executing the external data setting operation, the PC must not input the operation starting signal to Motionpack-34. (See Par. 11.3.7.3(4).)

(10) Fig. 11.13 is the signal timing diagram.

11.3.6.4 Data Check

Data check mode is selected by setting Pr47 as follows:

Pr47 = 20 Use the CHECKSUM function

Pr47 = 30 Do not use the CHECKSUM function

(1) When the CHECKSUM Function is Selected

(a) When the CHECKSUM function is selected by setting Pr47 = 30, checksum data must be input as the last data following the End of Data 〔FF〕$_{HEX}$ code. The checksum data must be specified in such a way that the least significant 8 bits of the summation result including the End of Data code become 〔FF〕$_{HEX}$.

(b) Checksum error processing

When a checksum error is detected, Motionpack-34 will not set the DATA SET RDY signal ON. Therefore, the PC can detect data error by using the timeover function.

(c) Data check

In addition to checksum check, data check is performed to make sure that each piece of data consists only of the permitted characters. When a data check error is detected, Motionpack -34 does not turn the DATA SET RDY signal OFF, so that the PC can detect this error by using the timeover function.

(2) When the CHECKSUM Function is Not Selected

Only the data check operation, described in (1)-(c), above, is performed.

11.3.6.5 Setting by the Programmer

The external data setting parameters can be entered in the Edit mode from the Programmer.

11.3.6.6 Error Reset

When a data error or a checksum error occurs, the error can be reset and the external data setting operation repeated from the beginning by turning the DATA SET INT signal OFF.

11.3.7 Programming Procedures

11.3.7.1 Indirect Register Specification Programs

The data set in Pr201-Pr296 can be specified by the indirect register specification programs.

11.3.7.2 Indirect Register Specification Commands

(1) Indirect register specification setting function (M89)

M89 is the function for declaring indirect register specification, and it does not output the M decode signal. It does not require the M FIN signal. The feed commands (G01, G34, G05, GC6, G07, G68*) at the block numbers that follow M89 become indirectly register specified.

*G68 ; Destination point specified subprogram call command

(2) Indirect register specification release function (M99)

M99 is the function for declaring release of indirect register specification, and it does not output the M decode signal. The feed commands (G01, G34, G05, G06, G07, G68*) at the block numbers that follow M99 are released from indirect register specification.

(3) Indirect register specification functions

The following feed functions, if specified between M89 and M99, and indirectly register specified including when the extended functions are used (See Par. 11.3.8.1) but not when the G27 command is used:

- G01
- G34
- G05
- G06
- G07
- G68 (Destination point specified subprogram call command)

(4) Indirect register specification and the jump command

The jump command can be used within an indirect register specification block. However, the jump command should not be used in the following situations to avoid possible abnormal operation:

(a) Jumping from an indirect register specification block to a normal block.

(b) Jumping from a normal block to an indirect register specification block.

(5) Coding Procedure (Pr52 = 1)

Example 1 : G01 X0.1 F33 I65

Specifies to go to the position specified in Pr201 at speed specified in Pr233 and torque specified in Pr265.

Example 2 : G01 U0.1 F33 I65

The target position is specified by an incremental expression. Specifies to move by the distance specified in Pr201 at the same speed and torque as specified by Example 1.

Example 3 : G01 U-0.1 F___ I___

A sign can be specified in front of a register number if the register stores position data. If Pr201 = 100, the command is to move −100.

Position, speed and torque must be either all indirectly register specified or none at all. Speed and torque specifications may be omitted. If omitted, the previously set values are used. The effectiveness range of previously set values is not influenced by whether or not the indirect register specification function is used. Indirect register specification of position must be accomplished in the right-justified format according to the specification of Pr52.

Examples : X 0.01 if Pr52 = 2 ;

X 0.001 if Pr52 = 3.

11.3.7.3 Program Selection

When the external data setting function is in use, a special code selection procedure is used for program selection. Note that this is different from that the extended function "Program select signal codification" (Pr43 = 40000).

(1) Program selection method

The same program selection method as for the basic function is used (i. e., every 10 blocks).

(2) Program select signal

Program selection is performed by BCD coding of the three signals PGSO ～ PGS3 for the 10 digits of the block number and of the two signals PGS4 and PGS5 for the 100 digits of the block number.

(3) Start／stop signal

Because the program select signal is now a coded signal, program start occurs only when the auto start (ATST) signal begins to rise.

The auto stop (／ATSTP) signal works in the same way as with the basic function. In other words, the program stops when the ／ATSTP signal turns OFF. Normally, this signal is set to ON.

To restart a program after having been stopped by the ／ATSTP signal, the ／ATSTP signal must be turned ON and then the ATST signal turned OFF and ON again.

11.3.7.3 Program Selection (Cont'd)

(4) Program start during external data setting operation

If the ATST signal turns ON when the external data setting operation is in progress, Motionpack-34 begins automatic operation.

Be aware that the external data being set will be lost.

11.3.7.4 M Decode Signal

When using the external data setting function, the specifications for the M decode signals will change as described below.

(1) When Pr43 = * * * * <u>00</u>

Because the least significant 2 digits of Pr43 are 00, the M decode signals are basically the same as when using the basic function. Note, however, that only five M decode signals (M51 ~ M55) can be used because one M decode signal is used by the external data setting function. The same relationship to the M FIN signal exists as when using the basic function.

(2) When Pr43 = * * * * <u>XY</u> (where <u>XY</u>=01 ~ 99)

In this case, the five decode signals (M51 ~ M55) are output as coded signals, with M55 acting as the strobe signal. The value of XY is the delay time (unit : 10 ms) of the strobe signal.

Table. 11. 3 Coded M Signal

M**	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
M51	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
M52	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
M53	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
M54	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

11.3.8 Compatibility with Extended Functions

Table. 11. 4 Compatibility with Extended Functions

Extended Function Specification \ Function	External Data Setting	External Offset Function	Extended Zone Signal A / B	Standard Zone Signal	Number of M Signals	Standard Offset (± INC)	G67 Prohibit Function	Specification Parameter Setting	Extended Function Selection Signal
Basic Specification	Not Possible	Not Possible	Not Possible	Possible (×2)	×6	Possible	Possible	Not required	Not required
External Data Setting	Possible	Not Possible	Not Possible	Possible (×2)	×5	Possible	Possible	Pr47 =20 (No CHECKSUM) =30 (CHECKSUM)	Short across CN5 Pin 18 and 0_{24} V.
Extended Zone Signal A / B	Not Possible	Not Possible	Possible (×4)	Not Possible	A: ×6 / B: ×4	Not Possible	Possible	Pr43 =100000	
External Offset Function	Not Possible	Possible	Not Possible	Possible (×2)	×5	Not Possible	Not Possible	Pr47 =20 (No CHECKSUM) =30 (CHECKSUM)	
[External Data Setting] + [Extended Zone Signal]	Possible	Not Possible	Possible (×4)	Not Possible	×5	Not Possible	Possible	Pr43 =100000 Pr47 =20 =30	
[External Offset] + [Extended Zone Signal]	Not Possible	Possible	Possible (×4)	Not Possible	×5	Not Possible	Not Possible	Pr43 =100000 Pr47 =40 =50	

11.3.8.1 Using with the Angular Index Function

When the rotating direction specified angular index function (G05), which is one of the angular index function options, is used by indirect register specification, the rotating direction will be determined by the sign preceding the register number. This must be kept in mind to avoid rotation in a direction opposite to the intended direction.

Example: G05 X-0.01 F33 I65

- If Pr201 = −100, it rotates in the minus direction for positionign at X = 100.
- If Pr201 = 100, it rotates in the minus direction for positioning at X = −100.

11.4 EXTERNAL OFFSET FUNCTION

11.4.1 Introduction

This presents the specifications of the External Offset Function which is provided as an extended function for Motionpack-34.

11.4.2 Functional Overview

Motionpack-34 basic functions include a coordinate shifting function for the T8 and T9 coordinate systems that uses parameters and shift pulses to compensate for tool length variation.

The external offset function described in this document extends this basic function and enables direct setting of the coordinate shift amounts for the T8 and T9 coordinate systems by external data.

Motionpack-34 basic function allows three methods for coordinate shifting on theT8 and T9 coordinate systems:

(1) By the coordinate setting command (G52)

(2) By the +INC／−INC signal

(3) Presetting by the programmer

The external offset function keeps (1) and (3) unchanged but changes (2) to direct specification by external data.

NOTE

Coordinate shifting by +INC／−INC is disabled.

This extended function enables an operator to directly set the offset value from the operator panel, thereby improving productivity.

11.4.3 Specification of Functions

11.4.3.1 Prerequisite Conditions

The external offset function is enabled only when the following hardware and software conditions are satisfied when the power is turned ON :

(1) Extended function select signal must be 1.

Short across CN5 pin 18 and 0_{24}V.

(2) Pr47 must be specified as follows:

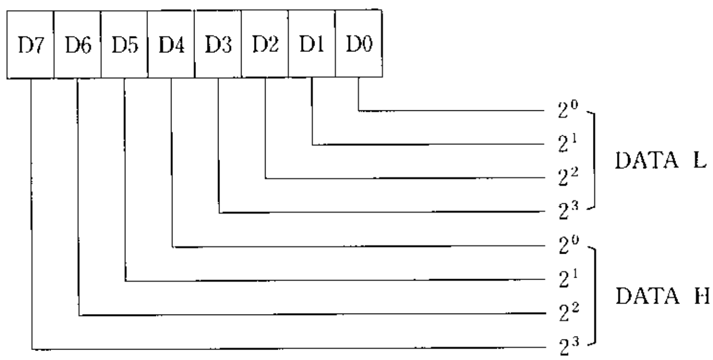
Pr47 = 40 (No parity check)

Pr47 = 50 (Parity check)

11.4.3.2 External Offset Data

The data for the T8 and T9 coordinate system offset registers (O_8 and O_9, respectively) are set externally using this function. The range of external offset data is 0 ～ ± 9999999 (unit is that specified for the position command).

11.4.3.3 Format of External Offset Data



One piece of external offset data is specified by 8-bit data which represents a 2-digit decimal value. Each decimal digit (0-10) is represented by a 4-bit BCD code.

(1) Data Length : Fixed at 4 bytes

(2) Real Number Offset Value : 〔+／− S_6〕 〔S_5 S_4〕 〔S_3 S_2〕 〔S_1 S_0〕

(3) Differential Offset Value : 〔+／− ¥〕 〔S_5 S_4〕 〔S_3 S_2〕 〔S_1 S_0〕

(4) Clear Offset Value : 〔+／− 0〕 〔0 0〕 〔0 0〕 〔0 0〕

(5) Data Codes

	Code		Code
0	0000	7	0111
1	0001	8	1000
2	0010	9	1001
3	0011	+	(0000)
4	0100	−	1101
5	0101	¥	1100
6	0110		

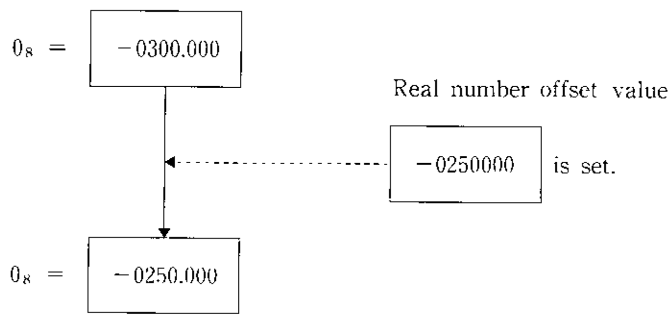
Note: " + " sign is omitted (e. g., 0000).

11.4.3.3 Format of External Offset Data (Cont'd)

(1) Real number offset value

When external offset data are specified as a real number offset value, the specified data set in the offset register O_8 or O_9.

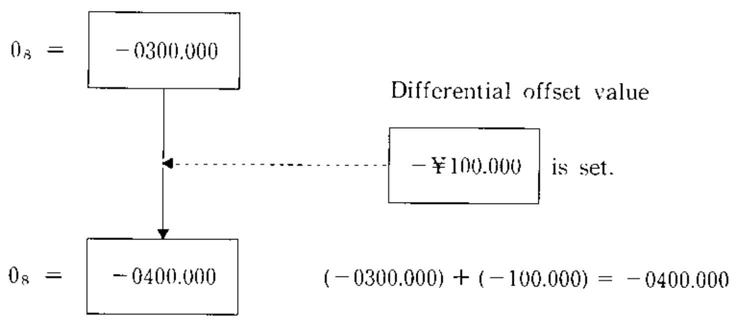
Example :



(2) Differential offset value

When external offset data are specified as a differential offset value, the specified data are added to or subtracted from the current offset register value.

Example :



If the differential offset value is <u>(+)¥100.000,</u> O_8 changes to <u>−0200.000.</u>

(3) Clear offset value

By setting the external offset data as $\boxed{0000.000}$, the specified offset register is cleared to 0. This is the same as setting a real number offset value 0.

11.4.3.4 Signal Lines Used

This section describes the signal lines used by the external offset function. Fig. 11.14 summarizes all signal lines that are used when the external offset function is used.

As described above, each piece of external offset data is input as 8-bit data representing two digits. The timing of external offset data input is determined by the strobe signal.

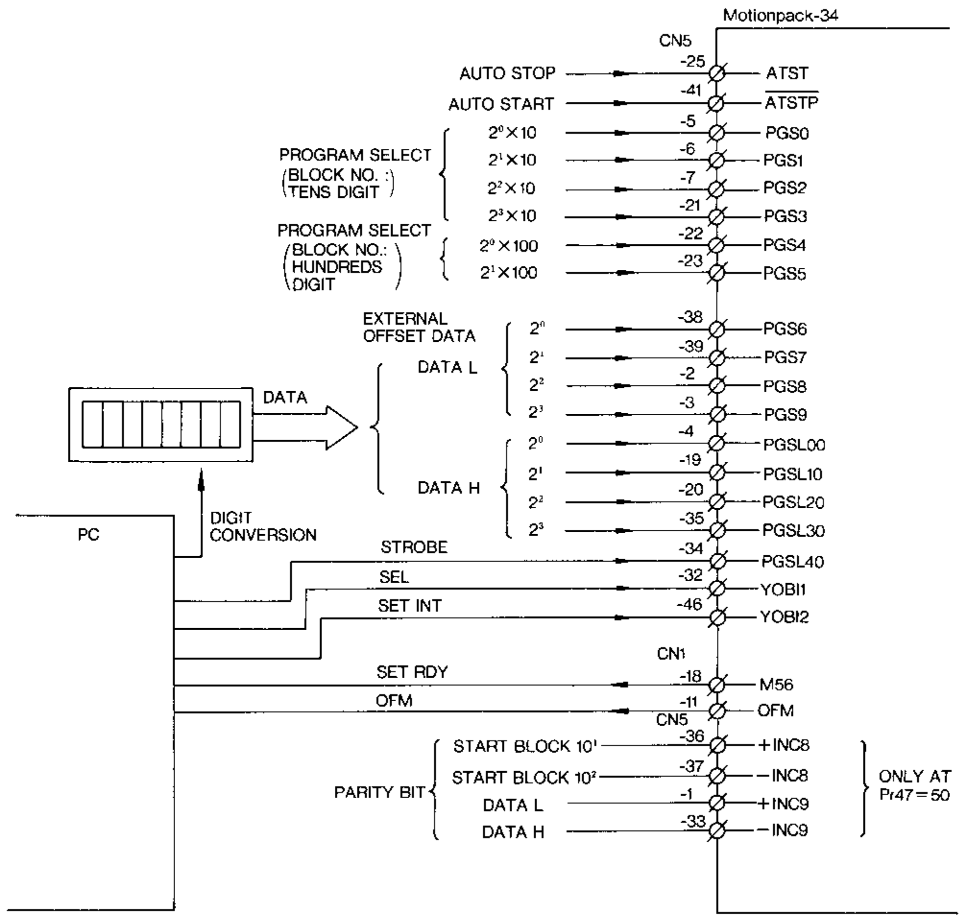


Fig. 11. 14 Signal Line Connection for External Offset Function

(1) External offset data (DATA)

PGS6 ~ PGS9 and PGSL00 ~ PGSL30 are used. These signals are assigned as follows:

PGS6 → 2^0	DATA L	PGSL00 → 2^0	DATA H
PGS7 → 2^1		PGSL10 → 2^1	
PGS8 → 2^2		PGSL20 → 2^2	
PGS9 → 2^3		PGSL30 → 2^3	

(2) Parity bit (PARITY)

When use of parity bit is specified, the four signal lines +INC8, −INC8, +INC9 and −INC9 are used as the parity bit lines for the following data (odd parity):

+INC8 : Start block 10^1

−INC8 : Start block 10^2

+INC9 : DATA L

−INC9 : DATA H

11.4.3.4 Signal Lines Used (Cont'd)

When use of no parity bit is specified and SET INIT is OFF, the ±INC8 and ±INC9 are the increment signals for regular 0_8 and 0_9 registers, respectively.

(3) Strobe signal (STROBE)

The PGSL40 signal is used as the strobe signal for external offset data.

(4) Program select signal (PGSL)

Because the signal lines that are used for program selection by the basic function are used for external offset, as described above, there are less than the necessary number of signal lines available for the program select signals. Therefore, the program select signals are converted to coded signals and transferred via six signal lines (PGS0 ~ PGS5).

The coded signals are defined as follows:

$$\left.\begin{array}{l} \text{PGS0} \rightarrow 2^0 \\ \text{PGS1} \rightarrow 2^1 \\ \text{PGS2} \rightarrow 2^2 \\ \text{PGS3} \rightarrow 2^3 \end{array}\right\} \text{These BCD codes specify the 10 digits of the program block number.}$$

$$\left.\begin{array}{l} \text{PGS4} \rightarrow 2^0 \\ \text{PGS5} \rightarrow 2^1 \end{array}\right\} \text{These BCD codes specify the 100 digits of the program block number.}$$

(5) Register select signal (SEL)

The YOBI 1 signal is used to specify whether the offset data are for the 0_8 register (T8 coordinate) or the 0_9 register (T9 coordinate):

YOBI 1 = 0 : 0_8

YOBI 1 = 1 : 0_9

(6) External offset interrupt signal (SET INT)

External offset interrupt is activated by setting YOBI2 signal ON.

(7) Ready signal (SET RDY)

When Motionpack-34 receives external offest data, it checks the data and, if valid, turns the SET RDY signal OFF. The PC must verify that the SET RDY signal has been turned OFF before turning the strobe signal OFF. When the strobe signal turns OFF, the SET RDY signal is turned ON again for the next data.

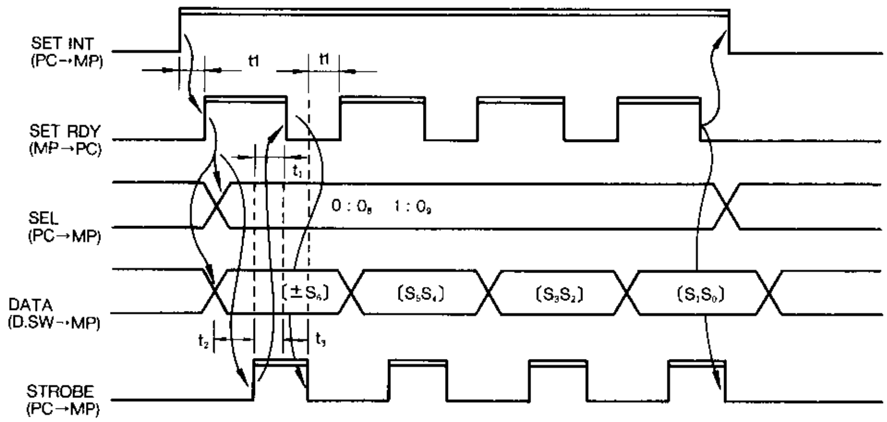
(8) Offset ±MAX reached (OFM)

As in the case of the standard ±INC offset procedure, the OFM signal turns ON when the offset register absolute value reaches the maximum set by parameter (Pr 21 or Pr23). When this occurs, the offset value is not updated and remains the same.

11.4.3.5 Signal Specifications

The signal specifications are the same as for the basic function.
The timing relations are presented in Fig. 11.15.

The setting data signals (DAT L, DATA H) are 8-bit parallel signals, so that attention must be paid to the possible bit-to-bit skew (variation). The strobe signal must be input only after the data signals have stabilized. The SET RDY = OFF condition must be verified before the strobe signal is turned OFF. Motionpack-34 requires approximately 35 msec to read each signal.



$t_1 \fallingdotseq$ 35ms (MP reading delay time)
$t_2 \fallingdotseq$ 100ms (Settling time)
t_3 = 20ms (PC reading delay time)
External Offset Time = 760ms

Fig. 11. 15 Signal Timing Diagram

11.4.3.6 Executing External Offset

The external offset function can be executed only when Motionpack-34 satisfies the condition stated below. If the condition is not satisfied, the function is executed when the condition is satisfied. The SET RDY signal is not output until that time.

Condition : The mode is AUTO and move command pulse is not being output (i.e., motor is stopped).

11.4.3.7 Interruption of External Offset

(1) Interruption during offset operation

If the power fails or the external offset interrupt signal (SET INT) turns off while the external offset operation is in progress, the operation is interrupted. In this case, the offset data being used are cleared so that the external offset data must be input again from the beginning when operation is resumed.

(2) ±MAX offset value reached

The offset operation is not executed when execution of the offset operation will cause the offset register content to reach or exceed the maximum value set by parameter (Pr21 or Pr23). Instead, the ±MAX offset reached signal (OFM) is turned ON and the verify signal (SET RDY) remains ON.

When the external offset interrupt signal (SET INT) turns OFF, the OFM and SET RDY signals turn OFF and the error condition is reset (cleared).

(3) Offset data error

When the offset data read by Motionpack-34 does not consist of the codes listed in Par. 11.4.3.3(5) or a parity error is detected, the SET RDY signal remains ON.

By turning the SET INT signal OFF, the SET RDY signal can be turned OFF and the error condition reset.

(4) Interruption by the ATST signal

If the ATST signal turns ON during external offset operation, the offset operation is interrupted and programmed operation begins.

When this occurs, the offset data being used is cleared.

11.4.3.8 Program Selection

When the external offset function is in use, a special code selection procedure is used for program selection. Note that this is different from taht of the extended function "Program select signal codification" (Pr43 = 40000).

(1) Program selection method

The same program selection method as for the basic function is used (i.e., every 10 blocks).

(2) Program select signal

Program selection is performed by BCD coding of the four signals (PGS0 ~ PGS3) for the 10 digits of the block number and of the two signals (PGS4 and PGS5) for the 100 digits of the block number.

(3) Start/stop signal

Because the program select signal is now a coded signal, program start occurs only when the auto start (ATST) signal begins to rise.

The auto stop (/ATSTP) signal works in the same way as with the basic function. In other words, the program stops when the /ATSTP signal turns OFF. Normally, this signal is set to ON.

To restart a program after having been stopped by the /ATSTP signal, the /ATSTP signal must be turned ON and then tha ATST signal turned OFF and ON again.

11.4.3.9 M Decode Signal

When using the external offset function, the specifications for the M decode signals will change as described below.

(1) When Pr43 = ＊＊＊＊<u>00</u>

Because the least significant 2 digits of Pr43 are 00, the M decode signals are basically the same as when using the basic function.

Note, however, that only five M decode signals (M51 ~ M55) can be used because one M decode signal is used by the external offset function. The same relationship to the M FIN signal exists as when using the basic function.

(2) When Pr43 = ＊＊＊＊<u>XY</u> (XY = 01 ~ 99)

In this case, the five decode signals (M51 ~ M55) are output as coded signals, with M55 acting as the strobe signal. The value of XY is the delay time (unit : 10ms) of the strobe signal.

Table. 11. 5 Coded M Signals

M**	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
M51	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1
M52	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
M53	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
M54	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1

11.4.4 Compatibility with Extended Functions

Table. 11. 6 Compatibility with Extended Functions

Function / Extended Function Specification	External Data Setting	External Offset Function	Extended Zone Signal A / B	Standard Zone Signal	Number of M Signals	Standard Offset (± INC)	G67 Prohibit Function	Specification Parameter Setting	Extended Function Selection Signal
Basic Specification	Not Possible	Not Possible	Not Possible	Possible (×2)	×6	Possible	Possible	Not required	Not required
External Data Setting	Possible	Not Possible	Not Possible	Possible (×2)	×5	Possible	Possible	Pr47 =20 (No CHECKSUM) =30 (CHECKSUM)	
Extended Zone Signal A / B	Not Possible	Not Possible	Possible (×4)	Not Possible	×6 (A) / ×4 (B)	Not Possible	Possible	Pr43 = 100000	
External Offset Function	Not Possible	Possible	Not Possible	Possible (×2)	×5	Not Possible	Not Possible	Pr47 = 40 (No CHECKSUM) = 50 (CHECKSUM)	Short across CN5 Pin 18 and 0_{24} V.
[External Data Setting] + [Extended Zone Signal]	Possible	Not Possible	Possible (×4)	Not Possible	×5	Not Possible	Possible	Pr43 = 100000 Pr47 = 20 = 30	
[External Offset] + [Extended Zone Signal]	Not Possible	Possible	Possible (×4)	Not Possible	×5	Not Possible	Not Possible	Pr43 = 100000 Pr47 = 40 = 50	

11.4.5 Example

Assume that feeding occurs as illustrated in Fig. 11. 6 Fast feed is executed up to X = 40.000 mm and then cutting feed is executed to X = 45.000 mm. Then, the leading edge is advanced by 0.300 mm.

Up to X = 40.000 mm, the T0 coordinate system is used as shown in the Sample Program below. Then, the coordinate system is switched to T8 for cutting feed operation. If there is no coordinate shift on the T8 coordinate system, T8 and T0 coordinate systems will be matched as in Fig. 11.6. Here, shift S = −0.300 mm is set by external data. This causes the T8 coordinate system to shift by the specified amount.

This enables shifting the leading edge.

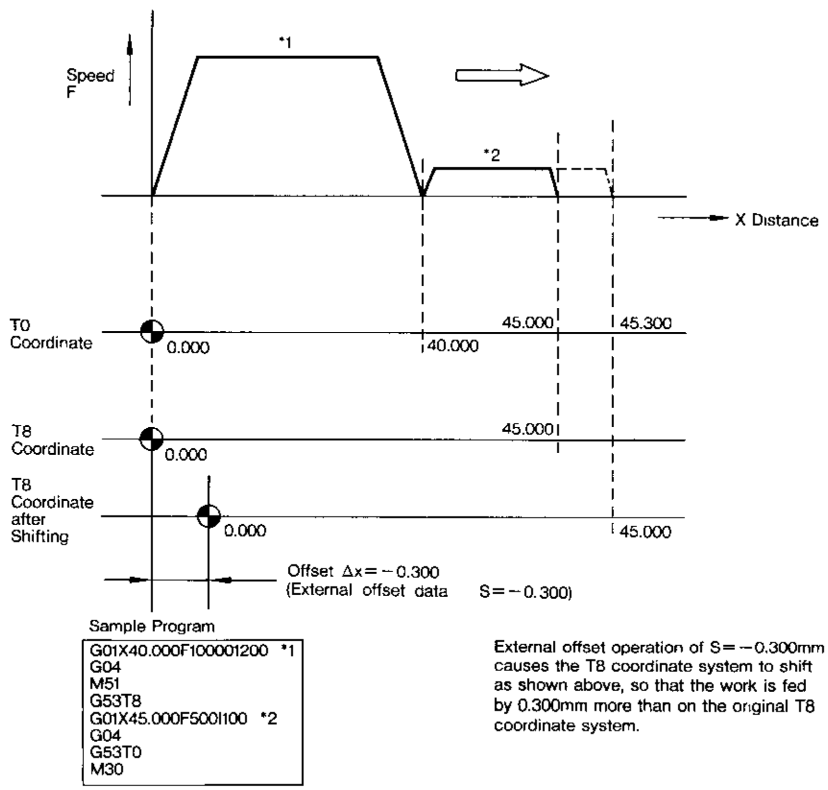


Fig. 11. 16

11.5 EXTENDED ZONE SIGNAL OUTPUT (A)

11.5.1. Introduction

This presents the specifications of the extended zone signal output function (A) which are available with Motionpack-34.

11.5.2 Functional Overview

Main features of the extended zone signal output function are as follows:

(1) There are four zone signal output lines.

(2) Four zones can be set by each signal for a total of 16 zones.

(3) Zones are set in parameters Pr111 ~ Pr148.

(4) Before the extended zone signal output function can be used, the extended function specifying signal and parameter setting must be performed. When this function is specified, the standard extended zone signal output function is disabled.

11.5.3 SETTINGS

The following extended function settings must be made to use this function:

Input line connection: Short across CN5 connector pin 18 and O_{24} (V).

Parameter setting: Pr43 = 100000

11.5.4. SPECIFICATIONS

11.5.4.1 Motionpack-34

The standard specification Motionpack-34 is used.

11.5.4.2 Extended Zone Signal Output Lines

The following four output lines are used by the extended zone signal function:

- ZPM (zero return completed) ——→ PSW1 (CN1-5)
- ZNP (zero point approached) ——→ PSW2 (CN1-19)
- OFR (offset zeero) ——→ PSW3 (CN1-10)
- INCD (±INC completed) ——→ PSW4 (CN1-9)

When the extended zone signal output function is specified, the above listed four signal lines are used for zone signals PSW ~ PSW4.

11.5.4.3 Zone Definition Parameter Setting (Pr111 ~ Pr148)

(+9999999 ~ −9999999 at the Minimum Command Unit)
Each zone signal (PSW1 ~ PSW4) can define up to four zones. Each zone is defined by two end positions, so that up to 8 parameters can be specified for each zone signal. The zones defined by each zone signal are associated with the parameters as presented in Table 11.7.

Note that the following parameter value relationship must be observed:

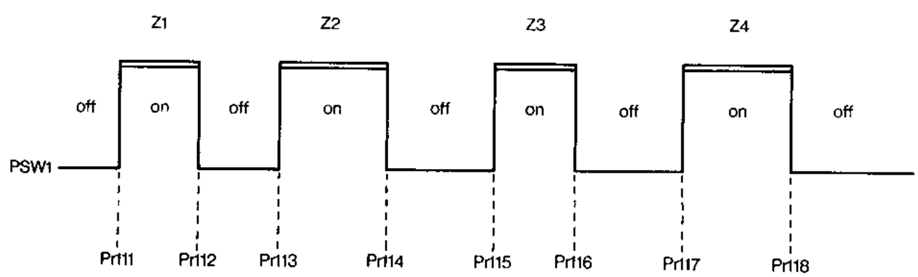
Pr111 < Pr112, Pr113 < Pr114, Pr115 < Pr116, Pr117 < Pr118

If the parameter value relationship is reversed or otherwise violated, the corresponding zone becomes undefined. (Example: Pr111 = Pr112) Therefore, the best procedure is to set both parameters for each unused zone to zero.

Table. 11. 7 Relationship between Zone and Parameter

Signal Name	Zone No.							
	Z1		Z2		Z3		Z4	
PSW 1	Pr 111	Pr 112	Pr 113	Pr 114	Pr 115	Pr 116	Pr 117	Pr 118
PSW 2	Pr 121	Pr 122	Pr 123	Pr 124	Pr 125	Pr 126	Pr 127	Pr 128
PSW 3	Pr 131	Pr 132	Pr 133	Pr 134	Pr 135	Pr 136	Pr 137	Pr 138
PSW 4	Pr 141	Pr 142	Pr 143	Pr 144	Pr 145	Pr 146	Pr 147	Pr 148

For example, the zones defined by PSW1 have the following relationships to the parameters and output signals:



11.5.4.4 Zone Signals

When the current position is inside a zone that has been set by parameters, the corresponding PSW signal is set to the ON state.

There are four PSW signals (PSW1 ~ PSW4), and each PSW signal can define four zones (Z1 ~ Z4) using eight parameters. The zones defined by different PSW signals may overlap.

The zones, parameters and output signal states have the relationships described in Par. 11. 5.4.3

The PSW signal become effective when the power is turned ON, transmission of the initial data for absolute position is completed and the controller becomes ready (RDY). After that, the PSW signals are output according to the current position regardless of whether or not a program is executed.

(The PSW signals will fluctuate until the RDY condition is established, so that they should be disregarded.)

Presence of the PSW signals when a program is not being executed allows checking the interference limit switches before starting a program.

11.5.5 Compatibility with Other Functions

When the extended zone signal output function is specified, the following functions will be disabled:

(1) ±INC function of the T8 and T9 coordinates (the external offset function (an extended function) becomes usable, however).

(2) The basic zone signal output function

The extended zone signal output function is compatible with all other functions so that they may be specified concurrently. See Table 11.8.

Table. 11. 8 Compatibility with Other Functions

Function / Extended Function Specification	External Data Setting	External Offset Function	Extended Zone Signal A / B	Standard Zone Signal	Number of M Signals	Standard Offset (± INC)	G67 Prohibit Function	Specification Parameter Setting	Extended Function Selection Signal
Basic Specification	Not Possible	Not Possible	Not Possible	Possible (×2)	×6	Possible	Possible	Not required	Not required
External Data Setting	Possible	Not Possible	Not Possible	Possible (×2)	×5	Possible	Possible	Pr47 =20 (No CHECKSUM) =30 (CHECKSUM)	
Extended Zone Signal A / B	Not Possible	Not Possible	Possible (×4)	Not Possible	A: ×6 / B: ×4	Not Possible	Possible		
External Offset Function	Not Possible	Possible	Not Possible	Possible (×2)	×5	Not Possible	Not Possible	Pr47 = 40 (No CHECKSUM) = 50 (CHECKSUM)	Short across CN5 Pin 18 and 0_{24} V.
[External Data Setting] + [Extended Zone Signal]	Possible	Not Possible	Possible	Not Possible	×5	Not Possible	Possible	Pr43 =100000 Pr47 =20 =30	
[External Offset] + [Extended Zone Signal]	Not Possible	Possible	Possible (×4)	Not Possible	×5	Not Possible	Not Possible	Pr43 =100000 Pr47 =40 =50	

11.5.6 Applicable Programmer

A higher version programmer is required because the number of parameters used increases.

11.6 EXTENDED ZONE SIGNAL OUTPUT (B)

11.6.1 Introduction

This presents the specifications of the extended zone signal output (B) function which are available with Motionpack-34.

11.6.2 Functional Overview

Main features of the extended zone signal output (B) function are as follows:

(1) There are four zone signal output lines.

(2) Four zones can be set by each signal for a total of 16 zones.

(3) Zones are set in parameters Pr111 ~ Pr148.

(4) Before the extended zone signal output function can be used, the extended function specifying signal and parameter setting must be performed. When this function is specified, the standard extended zone signal output function and extended zone signal output (A) function are disabled.

11.6.3 Settings

The following extended function settings must be made to use this function:
Input line connection : Short across CN5 connector pin 18 and 0_{24} (V).
Parameter setting : Pr43 = 200000

11.6.4 Specifications

11.6.4.1 Motionpack-34

The standard specification Motionpack-34 is used.

11.6.4.2 Extended Zone Signal Output Lines

The following four output lines are used by the extended zone signal function:

- ZPM (zero return completed) → PSW1 (CN1-5)
- ZNP (zero point approached) → PSW2 (CN1-19)
- M54 → PSW3 (CN1-16)
- M55 → PSW4 (CN1-17)

When the extended zone signal output function is specified, the above listed four signal lines are used for zone signals PSW1 ~ PSW4.

11.6.4.3 Zone Definition Parameter Setting (Pr111 ~ Pr148)

(+9999999 ~ −9999999 at the Minimum Command Unit)

Each zone signsl (PSW1 ~ PSW4) can define up to four zones. Each zone is defined by two end positions, so that up to 8 parameters can be specified for each zone signal. The zones defined by each zone signal are associated with the parameters as presented in Table 1

Note that the following parameter value relationship must be observed:

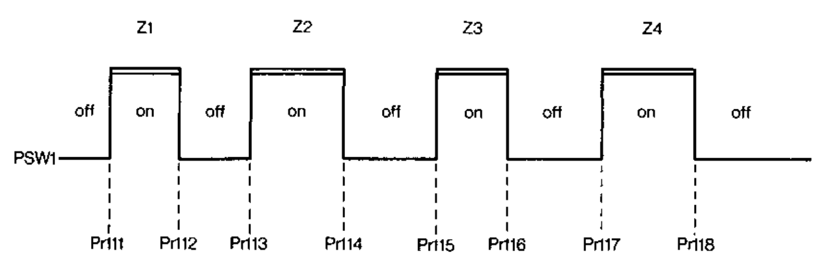
Pr111 < Pr112, Pr113 < Pr114, Pr115 < Pr116, Pr117 < Pr118

If the parameter value relationship is reversed or otherwise violated, the corresponding zone becomes undefined. (Example: Pr111 = Pr112) Therefore, the best procedure is to set both parameters for each unused zone to zero.

Table. 11. 9 Relationship between Zone and Parameter

Signal Name	Zone No.							
	Z1		Z2		Z3		Z4	
PSW 1	Pr 111	Pr 112	Pr 113	Pr 114	Pr 115	Pr 116	Pr 117	Pr 118
PSW 2	Pr 121	Pr 122	Pr 123	Pr 124	Pr 125	Pr 126	Pr 127	Pr 128
PSW 3	Pr 131	Pr 132	Pr 133	Pr 134	Pr 135	Pr 136	Pr 137	Pr 138
PSW 4	Pr 141	Pr 142	Pr 143	Pr 144	Pr 145	Pr 146	Pr 147	Pr 148

For example, the zones defined by PSW1 have the following relationships to the parameters and output signals:



11.6.4.4 Zone Signals

When the current position is inside a zone that has been set by parameters, the corresponding PSW signal is set to the ON state. There are four PSW signals (PSW1 ~ PSW4), and each PSW signal can define four zones (Z1 ~ Z4) using eight parameters. The zones defined by different PSW signals may overlap. The zones, parameters and output signal states have the relationships described in Par. 11.6.4.3.

The PSW signal become effective when the power is turned ON, transmission of the initial data for absolute position is completed and the controller becomes ready (RDY). After that, the PSW signals are output according to the current position regardless of whether or not a program is executed. The PSW signals will fluctuate until the RDY condition is established, so that they should be disregarded.

Presence of the PSW signals when a program is not being executed allows checking the interference limit switches before starting a program.

When the set-up procedure of absolute encoder is executed, PSWs are turned off after Pr80 is set to 1. And PSWs become available when the setup procedure is completed and pr80 is 0

11.6.5 Compatibility with Other Functions

When the extened zone signal output (B) function is specified, the following functions will be desabled :

(1) M54, M55 output signal

(2) The basic zone signal output function

(3) The extended zone signal output (A) function

(4) M56 output signal is available. But in the case that both EXTERNAL OFFSET FUNCTION and EXTERNAL DATA SETTING FUNCTION are specified, M56 will be disabled.

11.6.6 Applicable Programmer

A higher version programmer is required because the number of parameters used increases.

12. APPENDIX

This section describes the following items appendix.

(1) Selecting Servomotor

(2) Motionpack Display List
 (including error code details)

(3) I/O Signal Channel

(4) Parameter List

(5) Servomotor Maintenance

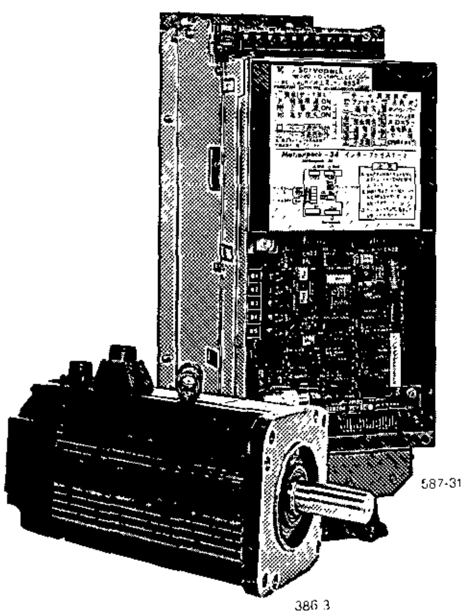
(6) Servomotor Defective Diagnosis

(7) Motionpack Version Upgrade

(8) Motionpack-34 Parameter Sheet

(9) Motionpack-34 Program Sheet

Make copies of (8) and (9) sheet for use



Servopack
TYPE CACR-SR20TZ6S

AC Servomotor
TYPE USAMED-20MS2

12. APPENDIX

12.1 SELECTING SERVOMOTOR

The selection process for servomotors for use with conventional leadscrew feed units are described below.

(1) Mechanical system

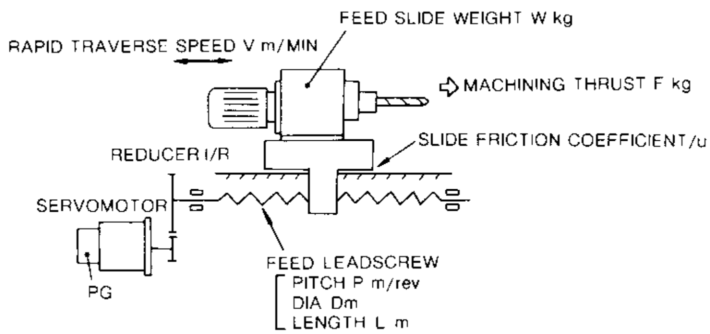


Fig. 12. 1 Servomotor Mechanical System

(2) Determining Servomtor Operational Speed Leadscrew r/min : N_B

$$N_B = \frac{V}{P}(r/min)$$

DC servomtor service rpm : N

$$N = N_B \times R\ (r/min)$$

$$\boxed{N < N_M}$$

N_M : Servomotor rated speed

(3) Evaluation of load torque

Load torque :T_L

$$T_L = \frac{\mu W + F}{2 \times \pi} \times P \times \frac{1}{R \times \eta_G}\ [kg \cdot m]$$

$$\boxed{T_L < T_M}$$

T_M : Servomotor rated torque

(4) Evaluation of load inertia

The inertia of the feed system weight, the lead screw inertia, and the reducer inertia are calculated indivdually.

- Inertia of feed system weight:

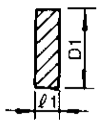
$$GD^2_W = W \times \left(\frac{P}{\pi}\right)^2 \quad [\mathrm{kg{\cdot}m^2}]$$

- Leadscrew inertia: GD^2_B

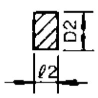
$$GD^2_B = \frac{\pi}{8} \times \rho \times 10^3 \times L \times D^4 \quad [\mathrm{kg{\cdot}m^2}]$$

ρ = Specific weight (= 7.87 for steel)

- Reducer inertia: GD^2_G



$$GD^2_{G1} = \frac{\pi}{8} \times \rho \times 10^3 \times L_1 \times D_1{}^4 \quad [\mathrm{kg{\cdot}m^2}]$$



$$GD^2_{G2} = \frac{\pi}{8} \times \rho \times 10^3 \times L_2 \times D_2{}^4 \quad [\mathrm{kg{\cdot}m^2}]$$

Therefore, load inertia at motor shaft GD^2_L is as follows,

$$GD^2_L = \frac{GD^2_W + GD^2_B + GD^2_{G1}}{R^2} + G^2_{G2} \quad [\mathrm{kg{\cdot}m^2}]$$

$$\boxed{GD^2_L < 5GD^2_M}$$

(5) Tentative selection of servomotor

From the conditions

$N < N_M$, $T_L < T_M$, $GD^2_L <$ 2 to $3GD^2_M$

a suitable motor is selected tentatively out of the servomotor series.

(6) Setting acceleration／deceleration time

Determine the acceleration parameter (Pr41) for Motionpack-34 controller as follows.

Start time for speed loop: t_v

$$t_v = \frac{(GD^2_M + GD^2_L) \times N}{375 \times \left(\frac{I_P}{I_M} \times T_M - T_L\right)} \times 1.3 \ \mathrm{(sec)}$$

where

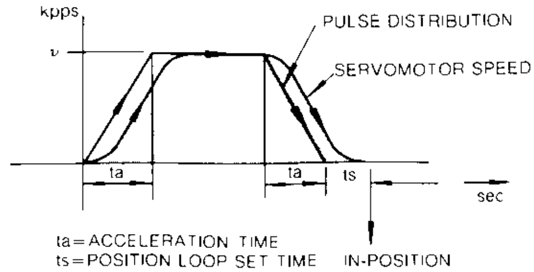
I_P: Servopack max. output current [A]

I_M: Servomtor rated current [A]

Set Pr41 to satisfy Pr41 $> t_v$.

(7) Determining speed diagram

The response to pulse distribution is as shown in Fig. 12.2, and varies with the servomotor and the maximum speed.



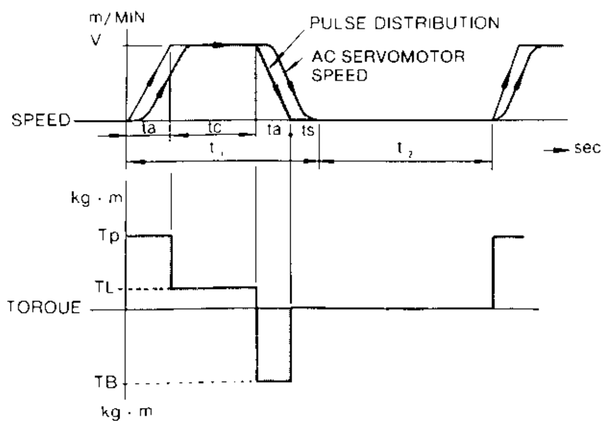
AC Servomotor M Series	$Kp = 30 sec^{-1}$	v<100 kpps $t_S = 0.2sec$
		v>100 kpps $t_S = 0.3sec$

Pulse speed here is a multiplied value. Satisfy Motionpack-34 pulse input Specifications (150kpps or less at 1 multiplier conversion)

Fig. 12. 2 Servomotor Speed and Pulses

(8) Torque check

Calculate the effective torque in one cycle, and check that it is within the rated torque of the DC servomotor.



• Acceleration torque: T_A

$$T_A = \frac{(GD_M^2 + GD_L^2) \times N}{375 \times t_a} \quad [kg \cdot m^2]$$

• Effective torque: Trms

$$Trms = \sqrt{\frac{(T_A + T_L)^2 \times t_a + T_L^2 t_c + (T_A - T_L)^2 \times t_a}{t_1 + t_2}}$$

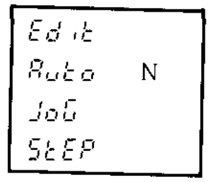
$$\boxed{\text{Applicable where } Trms < T_M \cdot}$$

Fig. 12. 3 Servomotor Speed and Torque

12.2 Motionpack-34 DISPLAY LIST

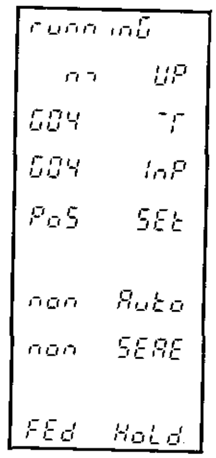
12.2.1 Motionpack Controller StatusDisplay St

1. EDIT MODE
2. AUTO MODE
3. JOG MODE
4. STEP MODE



12.2.2 Motionpack Controller Hold Status Ho Display

1. Command in execution
2. Waiting for M-FIN
3. Waiting G04 time up
4. G04 in position
5. G01-27 waiting for positioning finish
6. Waiting for auto mode
7. Waiting for operation start
8. Feed hold



12.2.3 Controller Error Display

Table 12. 1 Motionpack Alarm List

Alarm	Display	MP RUN OFF	Immediately Stopped	Decelerates to Stop	Stopped at Block End	Battery Alarm Lamp lights up.	MP Alarm Signal Outputs. MP ALM LAMP lights up.	MP Alarm (ALM 2)	MP Ready (RDY) Signal OFF.	READY (RDY1-RDY2) Signal OFF (Breaking ON).	Reset by Error Reset Signal.	Automatically Reset after Counteracting Alarms.	Reset by Servopack Error Reset.	Reset by Mode Selector Signal.	Reset by Program Clear Signal.	Reset by External Positioning Completion Signal
CPU Error	CPU Err	○	○				○		○	○	Repeat turning on and off.					
Program Error	Pro Err				○		○				○					
Parameter Error	PAr Err				○		○				○					
Emergency Stop	Ec StoP		○						○			○				
Servo Error	SErvo		○				○		○	○			○			
Circuit Saturation	EC OvEr											○				
+Overtravel	For Ot		○				○					○				
-Overtravel	rvS Ot		○				○					○				
Home Position Return	SEt uP				○		○				○					
G27 Error	Err G27				○		○				○					
Work Selection Error	Err nSEL				○		○				○					
Power Down	PS doun				○		○				○					
Battery Error	bAt doun					○		○				○*				
+Stored Limit Over	P OvEr			○ JOG	○ AUTO STEP		○				○	○		○	○	
-Stored Limit Over	P-OvEr			○ JOG	○ AUTO STEP		○				○	○		○	○	
Excessive Deviation	dEv OvEr		○				○			○	○					
In-Position Error	InPo Err				○		○				○					
Skip Signal	SP Err				○		○				○					
External Positioning Error	OutP Err													○		○
Encoder Position Error	AbS PG		Detected at power on				○		○	○	○	○				
PG Battery Reduction	PG bAt					○		○				○*				
PG Signal Line Breaking	PG LinE		○				○			○	○					

* Power OFF/ON operation is required

12.2.4 Condition Alarm Code Display

The condition and cause Motionpack-34 malfunctions can be checked by program alarm code display (Er display). Table 12.2 shows the alarm code descriptions.

Table 12. 2 Error Code List

Error Code	Error Condition	Remedial measure
CPU Err	Fault conditions detected by the self-diagnostic function of the CM. If no strong noise source is in the vicinity, and the 100 VAC power supply is in order, the cause must be in the CM itself.	Replace the CM.
Ec StoP	① This code is displayed when OT, LS is tripping in both + and − directions, or the common wire for the OT, LS is broken. ② When the servo drive power supply is turned off, the DB operates in both + and − directions. ③ No MP ready (RDY) signal is output.	(No MP alarm is output.) ① Check OT,LS ② Check the servo drive power voltage (200V) ③ Check the CM.
For O.t	+OT,LS (overtravel limit switch in + direction) has tripped.	① Check the machine position. ② Check the OT,LS signals.
ruS O.t	The-OT, LS (minus direction overtravel limit switch) has tripped.	① Check the machine position. ② Check the OT, LS signals.
SEruo	Servo error dipiay. Servo alarm signal is turned off.	Check the error display of Servopack and take remediary measures.
P OuEr	+direction stored stroke limit over	Check if the values of A0 (at JOG) or C0 (except for JOG) exceed or equal Pr 61.
P-OuEr	−direction stored stroke limit over	Check if the values of A0 (at JOG) or C0 (except for JOG) exceed or equal Pr 60.
PG bAt	PG battery voltage has reduced.	Replace PG battery with in a month.
AbS PG	Following were found at absolute position data transmission when power was turned on: ① Data were not sent in time. ② Absolute position data have exceeded Pr78 (encoder allowable error). ③ PG Signal line has been broken from Servopack to Motionpack. ④ Rewrite the contents of Pr71. In this case, turn the power supply on/off twice.	① Check Servopack, encoder and wiring to if SEN signal is being fed. ② (a)When Pr70=[illegible]0003 is set,check for the cause of exceeding position. If there is no problem,turn on/off the power supply after error reset. (b)When Pr=70[illegible]0[illegible]4is set,check for the cause of exceeding position. If there is no problem, perform the following procedure after error reset. 1.set Pr78 to 0, then turn off/on the power supply. 2.Reset Pr78 to original value, then turn the power supply off/on again. ③ Check PG signal line breaking.
PG LinE	Motionpack PG signal input line is broken. This can be invalid by setting Pr70.	Check PG signal cable, convector, PG I/O circuit breaking between Servopack and Motionpack.

12.2.4 Condition Alarm Code Display (Cont'd)

Table 12. 2 Error Code List (Cont'd)

Error Code	Error Condition	Remedial measure
Err nSEL	Program selection error ① More than 2 program start signals of PGS0 to PGS9 have been input. ② When PGS0 to PGS9 are turned on, no signal or more than 2 are input. ③ Before M30 is executed and start signal (STL) are turned off, PGS0 to PGS9 or PGSL00 to PGSL30 have been switched.	Select PGSL00 to PGSL30 35ms before automatic start.
Pro Err	Program error, A block with destroyed program has been designated.	Check the program.
PAr Err	Parameter error. Parameters with destroyed data are present.	Check the parameters. After correcting the parameter, be sure turn off the power supply and then turn it on.
dEr OuEr	Excessive servo delay. The servo delay (d0) in acceleraiton or deceleration exceeded the servo error permissible limit.	(a) The load inertia is too large relative to the motor torque. Change Pr40 and Pr 41 to reduce acceleration. (b) The servo error permissible limit (Pr44) is too small. Normally set Pr40 at 1.5 -2 times the tracking error (Pr42). However, this setting is a good standard below the rated motor speed, and if the maximum feedrate up to 1.4 times the motor rated speed is used, Pr44 = Pr42 × (1.5 × to 2) × 1.4. When only positioning is intended, and slight overshooting is permissible, the setting must be 2 to 4 times the Pr42 value. The maximum limit for Pr44 is 30,000. (c) Acceleration cannot be obtained sufficietly due to current restriction. • Check the ratio parameter of CM. The max. current is required to be approx. 130% of averaje acceleration current.
InPo Err	In-position error ① When G04' command is executed, servo error (d0) remains larger than $Pr45 \times \frac{Pr51}{Pr50}$ setting after the lapse of 2 seconds, and the in-position does not occur. ② D／A drift automatic correction over-correction. In this case, when the alarm is reset, the slide suddenly jerks after the lapse of 2 seconds, and again the aiarm state occurs. Since an alarm occurs when the correction valve (d0) exceeds ±512, adjust near 0 when zeroing the servopack.	(a) The load is too heavy compared with the current limit. • If the operation is OK when the Servopack current limit commands 13, 14 are disconnected, raise the current limit to the maximum level. Check the current limit parameter (Pr53) and the feed program current limit value. • Check the in-position range (Pr45). • Machine adjustment Let the slide stop from low feedrates in the forward travel and reverse travel, and reduce the frictional resistance in the machine slide until the stopping current becomes within 20% of the rated value. • Do not execute G04 during a current limit dwell.

Table 12. 2 Error Code List (Cont'd)

Error Code	Error condition	Remedial measure
InPo Err (cont'd)		(b) Zero the Servopack. • Turn the knob so that the post-alarm error (d0) approaches 0. (Unless the alarm is reset, the deviation does not change.) • Check the +12V and -12V power supply voltage from the Servopack at the ex ternal terminal. (difference must be within 3%.) • When the voltage difference from the Servopack+12V and -12V is between 3 and 8%, adjustment is possible with the D/A zeroing VR in the CM. When the left cover of the CM is removed, the D/A zeroing VR (IVR) becomes accessible.
SP Err	Skip signal fault.	Check EPS5, EPS6 and EPS7 signals.
EC OuEr	Current saturation. A current signal from the Servopack is turned on.	Check the Servopack. (No MP alarm occurs.)
OutP Err	External positioning error. External positioning error signal (EPAL) is output	Check the signals related to external positioning. (No MP alarm occurs.)
bAt dAun	Battery voltage has dropped.	Replace the battery within one month.
PS doun	Instantaneous power failure The power is turned off and then on under the following condition. (a) While the STL signal is being output. (b) During slide movement in the JOG or STEP mode. (c) During return home motion.	Check the power supply. Check the program if the power supply has been OFF before M30.
Err G27	The following errors have been found at G27 execution: ① Home position pulse coordinate value deflects more than Pr 77 ② Home position pulse could not be read-in within the range of coordinate ±Pr 4 6.	
C Err	Transmission data failure. Transmission failure between CM and PM. (Data from CM is not correct.) PG battery voltage has reduced.	In parameter display or program display, re-write parameter or program, if C Err error occurs at the specified parameter No. or block. (The data may be broken.)
SEL UP	See Par.11.2.	

12.2.5 Indicator Lamp

(1) Motionpack programmer

The Motionpack programmer can display various states as selected by the mode select keys. In addition to error states, also operation modes, feedhold state, output signal states, and error counter contents are displayed, which can be utilized in troubleshooting. In addition to these universal display data, the NORMAL (green) and FAULT (red) indicator lamps are also used. NORMAL indicator lights when no fault is found in the programmer. When it is off, check the power supply and the fuses.

FAULT indicator lights when the Motionpack programmer cannot exchange signals with the Motionpack controller. Check the Motionpack connection cable, and the connector.

(2) Motionpack controller

The Motionpack-34 controller is provided with four indicator lamps ; [PWR] (green), [RUN] (green), [ALM] (red) and [BATAL] (red). For checking detailed state, checking with PM is required.

[PWR] lights when the internal power supply is energized. When it is off, check the 100 VAC power supply. With this indicator, the I/O 24 V and analog command 12 V power supplies cannot be checked.

[RUN] lights when no fault is present in the Motionpack-34 controller. If it is off, the Motionpack-34 controller is faulty.

[ALM] lights when faulta are discovered in the Motionpack-34 system. In this case, and MP alarm signal is also output. Check the fault by the programmer, and repair. (This is not controller error.)

[BAT • AL] lights when the battery, for supplying power to the program and parameter memories during power failure, runs down. (It lights only while the 100 VAC power is on.) When it lights, replace the battery within a month. There is no problem if the battery is replaced more than 3 minutes after the power supply is turned off.

12.3 INPUT/OUTPUT SIGNAL CHANNEL LIST

Table 12. 3 Input Signal List

Programmer Display	Channel \ Digit Position (Column)	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
i0	0	JMF Jog Middle	JLF Jog Low	OVR Override	SBK Single Block	STEP	JOG	PLAY	EDIT
i1	1	Auto stop /ATSTP	PGCL Program Clear	ERS Fault Reset	ATST Auto Start	SBST Single Block Start	ZRN Home Return	-JS -Direction JOG & Step	+JS +Direction JOG & Step
i2	2	PGS7	PGS6	PGS5	PGS4	PGS3	PGS2	PGS1	PGS0 Program Start
i3	3	-INC8	+INC8	PGSL30	PGSL20	PGSL10	PGSL00 Program Select	PGS9	PGS8
i4	4	$\overline{\text{OTR}}$ -Overtravel (R)	$\overline{\text{OTF}}$ +Overtravel (F)	CLD Current Limit on	$\overline{\text{SAL}}$ Servo Alarm	NODB	STROBE	-INC9	+INC9
i5	5	DATA SET INT	JPIBT	MFIN	G34F	OPSL	EPS7	EPS6	EPS5 External Skip 5
i6	6	LSB	LSA LS Near Home	EXP2 External Positioning LS	PB Phase B Pulse	PA Phase A Pulse	PC Home Position Pulse	PG Battery Reduction PG BATAL.	

Table 12. 4 Output Signal List

Programmer Display	Channel \ Digit Position (Column)	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
o0	0	OFM Offset Max.	OFR Offset 0	INCD Inclemental End	EPAL External Positioning Alarm	G34 External Positioning End	STL In-Operation	ZPM Home Return End	ALM1 NC Alarm
o1	1	ZNP Near Home	M56	M55	M54	M53	M52	M51	M30
o2	2						RDY MP Ready (PC)	RDY (DB)	ALM2 Battery Alarm

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12.4 PARAMETER LIST

Table 12. 5 Parameter List

Parameter No.	Name	Rang	Unit	
1	JOG low speed			
2	JOG medium speed	0 to 60000	Speed unit	
3	JOG high speed			
4	STEP speed	0 to 60000	Speed unit	
5	STEP feed distance short			
6	STEP feed distance medium	0 to 999999	Min. reference unit	
7	STEP feed distance long			
8	JOG (low)/STEP (short) torque limit	0 to 200	%	
9	Not used	—	—	
10	Creep speed	0 to 60000	Speed unit	
11 to 19	Not used	—	—	
20	Single correction for coordinate system 8	0 to 255		
21	Max. correction for coordinate system 9	0 to 9999999	Min. reference unit	
22	Single correction for coordinate system 9	0 to 255		
23	Max. correction for coordinate system 9	0 to 9999999		
24 to 29	Not used	—	—	
30	Range 1 definition	−9999999 to +9999999	Min. reference unit	
31	Range 1 definition	−9999999 to +9999999	Min. reference unit	
32	Range 2 definition	−9999999 to +9999999	Min. reference unit	
33	Range 2 definition	−9999999 to +9999999	Min. reference unit	
34	Range 3 definition	−9999999 to +9999999	Min. reference unit	
35	Range 3 definition	−9999999 to +9999999	Min. reference unit	
36 to 39	Not used	—	—	
40	Max. speed	1 to 60000	Speed unit	
41	Acceleration time	50 to 60000	ms	
42	Position loop gain	200 to 30000	Number of pulses	
43	Extended function designation	—	—	
44	Servo error deviation	60000 Max.	Number of digits	
45	In-position range	1 to 255	Number of pulses	
46	G27 allowable deviation	0 to 999999	Number of pulses	
47	Extended function designation	—	—	
48 to 49	Not used	—	—	
50	Pulse ratio M	3999999 Max.	Number of pulses	
51	Pulse ratio D	3999999 Max.	Min. reference unit	
52	Decimal point position	0 to 5	Number of pulses	
53	Thrust ratio	10 to 250	%	
54	Axis No. designation	0 to 9	—	
55	Not used	—	—	
56	Accel/decel time	60 to 1000	ms	
57	S-curve accel/decel time	30 to 500	ms	
58 to 59	Not used	—	—	
60	−Direction stored stroke limit	−9999999 to +9999999	Min. reference unit	
61	+Direction stored stroke limit	−9999999 to +9999999	Min. reference unit	
62 to 69	Not used	—	—	
70	Referance point coordinate system	—	—	
71	TO coordinate offset	−9999999 to +9999999	Number of pulses	
72	Waiting position	−9999999 to +9999999	Min. reference unit	
73	Rapid return speed	0 to 60000	Speed unit	
74	Home position setting speed	0 to 60000	Speed unit	
75	Push torque	1 to 200	%	
76	Number of encoder pulses		Pulse/rev	
77	Allowable deviation	1 to 255	Number of pulses	
78	Encoder allowable deviation	0 to+9999999	Min. reference unit	
79	Pushing time	0 to 3000	10 ms	
80	Home position setup command	0, 1	—	
81	Reference Point coordinate	−9999999 to +9999999	Min. reference unit	
82	ABS-PG alarm reset command	0, 1	—	
83 to 96	Not used	—	—	
97	Baud rate	110, 300, 1200, 2400	bps	
98 to 110	Not used	—	—	
111 to 148	Extended Zone setting	−9999999 to +9999999	Min reference unit	
149 to 200	Not used	—	—	
201 to 296	External setting data	—	—	

* 1 : The name and contents in absolute value method differ from those of incremental method.

	Function	Related Alarm Code and Countermeasure
	Setting speed at JOG operation	(1) Not function by JOG (2) JOG speed does not change → Check setting parameter. (3) Runaway by JOG
	Setting speed at STEP operation	Defective speed or not move at STEP → Check setting parameter.
	Setting moving distance at STEP	STEP is disabled → Check setting parameter.
	Torfui linut for JOG (low) and STEP (short)	
	Setting creep speed when override signal is ON, the speed reference will not exceed the value. Used at test run and program check.	
	Setting correction and its max. value of coordinates by +INC8 (+INC9), −INC8 (−INC9) signals	Coordinate System 8 or 9 deflects → Check any noise on + INC8 (+INC9) and −INC8 (−INC9). Note : When the correction is not required, set the parameter at 0.
	Range definition Pr 30<Pr 31	Reversed when undefined
		Reversed when undefined
	Range definition Pr 32<Pr 33	Reversed when undefined
		Reversed when undefined
	Range definition Pr 34<Pr 35	Reversed when undefined
		Reversed when undefined
	With P41, specifies the time to reach the speed specified by Pr 40 and determines acceleration speed or deceleration speed.	Excessive error alarm (d Er Ou Er)
	The Number of following error pulses when moving by rated speed (error counter) Pr= pps at rated speed/kp	(1) Hunting of machine motion (2) Overshot motor → Set Pr 42 so that Kp can adaptable for the machine
	Limit value to generate excessive error alarm Pr 44≒Pr 42×2	Excessive error alarm(d Er Ou Er)→Setting value is too small.
	Allowable deposit pulse capacity at in-position check by G04 command	In-position error (InPoErr)→Pr 45 is too small.
	No G27 check with in the range of Pr46=0 to search for home position pulse at G27 command execution	G27Err → 1.Pr 46 setting servo system
	Setting the relation between position and number of pulses	Actual moving distance is different that of program.
	Determines at which digit of the minimum different unit a decimal point should be displayed. Position unit of this decimal point position becomes speed unit per minute.	Speed is different.
	Motor output torque becomes torque setting(%)×P53(%) in the program	SETTING torque is different from actual torque.
	Axis No. designation for distinction of program tape	
	To defermine accel / decel curve at S-letter	accel /decel control.
	Setting the max movable range on the program	JOG or STEP is disabled. p-Ou Er p-Ou Er
		SET UP
	(For details, refer to each related paragraph.)	
	To reset ABS-PG alarm in full-automatic home position setup system	
	Setting transmission distance between terminal unit and PM	Reset since it is turned off at PM power-on.
	(For details, refer to each related paragraph.)	

NOTE

(2) Troubleshooting Guide

WARNING

Remedies in $\boxed{}$ should be practiced after turning off the power.

Table 12. 7 Troubleshooting Guide for AC Srevomotor

Trouble	Cause	What to do
Motor does not start	Voltage below rated	Measure voltage across motor terminals U, V, and W with a tester and correct to rated value
	Loose connection	Tighten connection.
	Wrong wiring	Correct.
	Overload	Reduce load or use a larger motor
	Motor defective	Measure voltage across motor terminals U, V and W with a tester. When correct, replace motor
Unstable operation	Wrong wiring	Inspect and correct wiring across motor terminals U, V, and W, and PG
Motor overheats.	Excessive ambient temperature	Reduce below 40 °C.
	Motor dirty	Clean motor surface.
	Overload	Reduce load or use a larger motor
Unusual noise	Motor loosely mounted	Tighten foundation bolts
	Motor misaligned	Realign
	Coupling out of balance	Balance coupling.
	Noisy bearing	Check alignment, loading of bearing, lubrication and contact Yaskawa representative.
	Vibration of driven machine	Contact the machine manufacturer

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12.6 Servopack TROUBLESHOOTING GUIDE

(1) LED Indication (8-segment) for Troubleshooting.

Table 11. 8 LED Indication for Troubleshooting

LED	Detection	Lighting Condition	Probable Cause	Corrective Action
1.	Over-current	Goes on when power is supplied to the control circuit	• Defective control circuit board (1 PWB)	• Replace Servopack.
		Goes on when power is supplied to the main circuit and servo power is turned on. • MCCB does not trip.	• Defective current feedback circuit • Defective main circuit transistor module	• Replace Servopack.
		Goes on when power is supplied to the main circuit and servo power is turned on • MCCB trips	• Defective motor grounding • Defective main circuit transistor module.	• Replace the motor. • Replace Servopack.
		Goes on when power is supplied to the main circuit	• Defective main circuit transistor module	• Replace Servopack.
		Goes on when the motor starts or slows down.	• Incomplete (1 PWB) VR5 adjustment	• Refer to Par. 4.3.3.1 (3).
2.	Circuit protector tripped	Goes on when power is supplied to the control circuit	• Defective control circuit board (1 PWB)	• Replace Servopack.
		Goes on when power is supplied to the main circuit	• Defective main circuit thyristor-diode module.	• Replace Servopack
			• MCCB trips	Wiring check in Servopack: • Disconnection • Conduction of connection part
3.	Regener-ative trouble	Goes on when power is supplied to the control circuit.	• Defective control circuit board (1 PWB)	• Replace Servopack
		Goes on approximate 0 5 to 1 second after power is supplied to the main circuit	• Defective regenerative transistor	• Replace Servopack.
			• Regenerative resistor disconnection.	• Check and replace the regenerative resistor. (Replace the Servopack.)
4.	Over-voltage	Goes on when the motor starts or slows down	• Load inertia (GD^2) too large	• Check the inertia of the machine with the value converted to the motor shaft
			• Defective regenerative circuit	• Replace Servopack.
5.	Over-speed	When the reference is input, the motor runs fast and 5. goes on	• Motor connection error • Absolute encoder connection error.	• Correct the motor connection. • Check and correct pulses in phases A, B, C, U, V and W with 2CN.
			• The reference input voltage too large	• Decrease the reference input voltage.
6.	Voltage drop	Goes on when power is supplied to the main circuit	• Defective main circuit thyristor-diode module.	• Replace Servopack.
7.	Overload	Goes on when power is supplied to the control circuit.	• Defective control circuit board (1 PWB)	• Replace Servopack.
		Goes on during operation • When power to the control circuit is turned off and then turned on again, the operation starts	• Operation with 105% to 130% or more of the rated load	• Check and correct the load (may be overloaded).
A.	Heat sink overheat	Goes on during operation • When power to the control circuit is turned off and then turned on again, 7. or A. goes on again When reset later, the operation starts.	• Fan has stopped.	• Check the fan (SR20, 30, 44, 60)
			• Temperature around the Servopack exceeds 55°C.	• Decrease the temperature below 55°C (The heat sink may be overheated.)
		The motor rotates, but the torque is unavailabe. When power to the control circuit is turned off and then turned on again, the operation starts, but the torque is still unavailable	• Motor circuit error connection, such as U→V, V→W, W→U or single-phase connection.	• Correct the connection.

Table 12. 8 LED Indication for Troubleshooting (Cont'd)

LED	Detection	Lighting Condition	Probable Cause	Corrective Action
b.	A/D error	Goes on when power is supplied to the control circuit.	• Defective control circuit board (1PWB)	• Replace Servopack
(blank)	CPU error	Goes on during operation.	• Faulty internal elements	• Resume after reset operation
			• Defective internal elements.	• Replace Servopack.
F.	Open phase	Goes on when power is supplied to the control circuit	• Defective control circuit board (1 PWB).	• Replace Servopack.
		Goes on when power is supplied to the main circuit	• Poor connection to 3-phase power supply	• Check and correct the connection
C.	Overrun prevention	Goes on when power is supplied to the control circuit	• Defective control circuit board (1 PWB)	• Replace Servopack
		The motor starts momentarily, then [C] goes on.	• Motor connection error.	• Correct the motor connection
			• Absolute encoder connection error	• Check and correct pulses in phases A, B and C with 2CN.
U.	Absolute control error	Goes on when power is supplied to the control circuit	• Defective control circuit board. (1PWB).	• Replace Servopack
		Goes on approximately 1 second after SEN signal is input.	• Faulty absolute encoder • Faulty internal elements	• Drop the SEN signal* and then input the SEN signal again
			• Faulty absolute encoder. • Battery not yet connected.	• Realtemput the setup of absolute encoder.
			• Absolute encoder connection error	• Correct the absolute encoder connection.
			• Defective absolute encoder	• Replace the motor.
8.	Positioning error	Goes on when power is supplied to the control circuit.	• Defective control circuit board (1PWB)	• Replace Servopack.
		Goes on frequently during operati operation	• Defective encoder connection error	• Check and correct pulses in phases A, B and C with 2CN.
			• Faulty internal PG pulse counter.	• Drop the SEN signal* and then input the SEN signal again. • Consider countermeasure for possible noise interference

* Alarm of absolute control error is reset by dropping SEN signal. (Reset button need not be depressed.) SEN signal input is possible again by turning Motionpack-34 power to OFF then ON.

(2) Examples of Troubleshooting for Defective Wiring or Parts

Table 12. 9 Example of Troubleshooting for Defective Wiring or Parts

Trouble	Check Items	What to do
MCCB trips immediately after Power On and Servo On.	• Main circuit wiring (such as the ground of motor)	• Correct the wiring.
The reference is input, but the motor does not run.	• Voltage across Ⓡ, Ⓢ, and Ⓣ. • LED [P] and [MP] on	• Check the AC power supply circuit.
	• Trouble LED off	• If LEDs are on, check the cause.
	• Speed reference voltage • LED [IN] on	• Check servo signal cable.

12.6 Servopack TROUBLESHOOTING GUIDE (Cont'd)

(3) Examples of Troubleshooting for Incomplete Adjustment

Table 12. 10 Examples of Troubleshooting for Incomplete Adjustment

Trouble	Cause	What to do
Motor rotates even if the speed reference voltage is 0 V.	Incomplete ZERO potentiometer adjustment	Adjust VR3 $\boxed{\text{ZERO}}$ correctly
Motor vibrates or vibration frequency is too high, approx 200 to 300 Hz (When vibration frequency equals commercial frequency.)	Speed loop gain too high • Excessively long lead of *Servopack* input circuit • Noise interference due to bundling of signal line and power line	Turn VR6 $\boxed{\text{LOOP}}$ CCW to decrease the speed loop gain • Decrease length of lead • Separate input circuit line from power line or connect input circuit to low impedance less than several 100 ohms
Motor speed overshoot is too large at starting or stopping.	• Speed loop gain too high	• Turn $\boxed{\text{LOOP}}$ CCW to decrease the speed loop gain

12.7 History of Version Upgrade

12.7.1 Applicable Combination

○ : Possible

△ : Not possible for added function
Possible for conventional function

Controller		Programmer (CMPF−PM33−□) C: MP-33	D: MP-34	D3: MP-33/34	F: Handle Dimension Change
Unit. Ver	Main Revision				
Motionpack-33 (CMPC−CM33D)		○	△	○	○
Motionpack-34 (CMPC−CM34−□) —	First product	△	○	○	○
B	① Torque limit (Pr8) added for JOG/STEP feedrate	△	△	○	○
B6	① External data setting function added ② External offset function added ③ Extended zone signal output function added ④ Pr0 added in PROM ♯	△	△	○	○
C	① Incremental encoder system available	△	△	○	○

12.7.2 Compatibility with Other Functions

Table. 12.11 Compatibility with Other Functions

Function / Extended Function Specification	External Data Setting	External Offset Function	Extended Zone Signal A/B	Standard Zone Signal	Number of M Signals	Standard Offset	G67 Prohibit Function	Specification Parameter Setting	Extended Function Selection Signal
Basic Specification	Not Possible	Not Possible	Not Possible	Possible (×2)	×6	Possible	Possible	Not required	Not required
External Data Setting	Possible	Not Possible	Not Possible	Possible (×2)	×5	Possible	Possible	Pr47 =20 (No CHECKSUM) =30 (CHECKSUM)	
Extended Zone Signal A / B	Not Possible	Not Possible	Possible (×4)	Not Possible	A: ×6 B: ×4	Not Possible	Possible	Pr43 =100000	
External Offset Function	Not Possible	Possible	Not Possible	Possible (×2)	×5	Not Possible	Not Possible	Pr47 =20 (No CHECKSUM) =30 (CHECKSUM)	Short across CN5 Pin 18 and 0_{24} V.
[External Data Setting] + [Extended Zone Signal]	Possible	Not Possible	Possible (×4)	Not Possible	×5	Not Possible	Possible	Pr43 =100000 Pr47 =20 =30	
[External Offset] + [Extended Zone Signal]	Not Possible	Possible	Possible (×4)	Not Possible	×5	Not Possible	Not Possible	Pr43 =100000 Pr47 =40 =50	

12.8 Motionpack-34 PARAMETER SHEET

Table 12.12 Parameter Setting

Parameter No.	Set Value	Setting Range	Contents		Unit
Pr 1		0 to 6000	JOG, STEP group	JOG low speed	Speed unit
Pr 2				JOG medium speed	
Pr 3				JOG high speed	
Pr 4		0 to 60000		STEP speed	
Pr 5		0 to +9999999		STEP feed distance, short	Min reference unit
Pr 6				STEP feed distance, medium	
Pr 7				STEP feed distance, long	
Pr 8		0 to 200		Torque limit	%
Pr 9	Not used				
Pr 10		0 to 60000		Creep speed	Speed unit
Pr 10 to Pr 19	Not used				
Pr 20		0 to 255	Offset value group	Single correction for Coordinate system 8.	Min reference unit
Pr 21		0 to 9999999		Max. correction for Coordinate system 8	Min. reference unit
Pr 22		0 to 255		Single correction for Coordinate system 9	Min reference unit
Pr 23		0 to 9999999		Max correction for Coordinate system 9	Min. reference unit
Pr 24 to Pr 29	Not used				
Pr 30		−9999999 to +9999999	Range definition	Range 1 definition	Min. reference unit
Pr 31		−9999999 to +9999999		Range 1 definition	Min reference unit
Pr 32		−9999999 to +9999999		Range 2 definition	Min reference unit
Pr 33		−9999999 to +9999999		Range 2 definition	Min reference unit
Pr 34		−9999999 to +9999999		Range 3 definition	Min. reference unit
Pr 35		−9999999 to +9999999		Range 3 definition	Min reference unit
Pr 36 to Pr 39	Not used				
Pr 40		1 to 60000	Sevo group	Max. speed	Speed unit
Pr 41		50 to 60000		Acceleration time	msec
Pr 42		200 to 30000		Position loop gain	No of pulses
Pr 43				Extended function selection	
Pr 44		60000 Max		Servo error deviation	No. of pulses
Pr 45		1 to 255		In-position range	No of pulses
Pr 46		0 to 9999999	G 27 group	G 27 allowable deviation	No of pulses
Pr 47				Extended function selection	
Pr 48 to Pr 49	Not used				
Pr 50		399999 Max	Unit group	Pulse ratio M	
Pr 51		399999 Max		Pulse ratio D	
Pr 52		0 to 5		Decimal point position	No of digits
Pr 53		10 to 200		Thrust ratio	%
Pr 54		0 to 9	Coordinate address designation		
Pr 55	Not used				
Pr 56		60 to 1000	Servo group	Accel/decel time	ms
Pr 57		30 to 500		S-letter accel/decel time	ms
Pr 58 to Pr 59	Not used				
Pr 63		−9999999 to +9999999	Overtravel group	−Direction stored stroke limit	Min reference unit
Pr 61				+Direction stored stroke limit	
Pr 62 to Pr 69	Not used				
Pr 70			Home position group	Reference point coordinate system	
Pr 71		−9999999 to +9999999		Offset of T0 Coordinate	No of digits
Pr 72				Waiting position	Min. reference unit
Pr 73		0 to 60000		Rapid return speed	Speed unit
Pr 74	Setting 0	0 to 60000		Home position setting speed	
Pr 75	Setting 0	10 to 200		Push torque	%
Pr 76				No of encoder pulses	Pulse/rev
Pr 77		1 to 255		Allowable deviation	No of pulses
Pr 78		−9999999 to +9999999		Encoder allowable deviation	Min. reference unit
Pr 79		0 to 3000		Pushing time	10 ms
Pr 80		0, 1		Home position steup command	
Pr 81		−9999999 to +9999999		Reference point coordinate	Min. reference unit
Pr 82		0, 1		ABS · PG alarm reset command	
Pr 83 to Pr 96	Not used				
Pr 97		110, 300, 1200, 2400	Tape device baud rate setting		bps
Pr 98 to Pr 110	Not used				
Pr 111 to Pr 148		−9999999 to +9999999	Extended zone setting		Min. reference unit
Pr 201 to Pr 296			External setting data		Depends on position, speed, torque

12.9 Motionpack-34 PROGRAM SHEET

No. ________

Date ________

Machine No. ________ Machine Name ________ Work Name ________ Programmed by: ________

Block	M Function	Function	Position	Speed	Torque	Wait Time	Loop	Jump	Coordinate	Remarks
N 0	M	G	X/U	F	I	D	L	P	T	
N 1	M	G	X/U	F	I	D	L	P	T	
N 2	M	G	X/U	F	I	D	L	P	T	
N 3	M	G	X/U	F	I	D	L	P	T	
N 4	M	G	X/U	F	I	D	L	P	T	
N 5	M	G	X/U	F	I	D	L	P	T	
N 6	M	G	X/U	F	I	D	L	P	T	
N 7	M	G	X/U	F	I	D	L	P	T	
N 8	M	G	X/U	F	I	D	L	P	T	
N 9	M	G	X/U	F	I	D	L	P	T	
N 0	M	G	X/U	F	I	D	L	P	T	
N 1	M	G	X/U	F	I	D	L	P	T	
N 2	M	G	X/U	F	I	D	L	P	T	
N 3	M	G	X/U	F	I	D	L	P	T	
N 4	M	G	X/U	F	I	D	L	P	T	
N 5	M	G	X/U	F	I	D	L	P	T	
N 6	M	G	X/U	F	I	D	L	P	T	
N 7	M	G	X/U	F	I	D	L	P	T	
N 8	M	G	X/U	F	I	D	L	P	T	
N 9	M	G	X/U	F	I	D	L	P	T	

NOTE

NOTE

NOTE

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