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YASKAWA ELECTRIC

SIE-C880-2C
DESCRIPTIVE INFORMATION

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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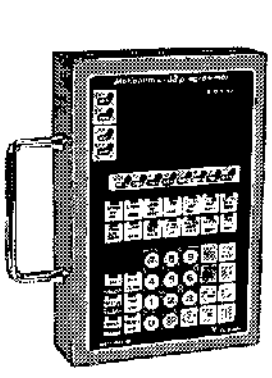
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1. SYSTEM CONFIGURATION

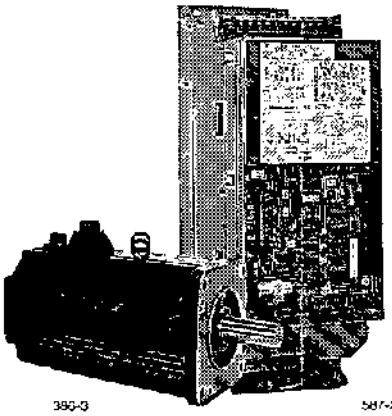
This section shows absolute value system Motionpack-34 configuration. For system configuration, use Servomotor with absolute encoder and Servopack with Motionpack-34 interface (Type CACR-SR ☐ TZ6S ☐).



PROGRAMMER



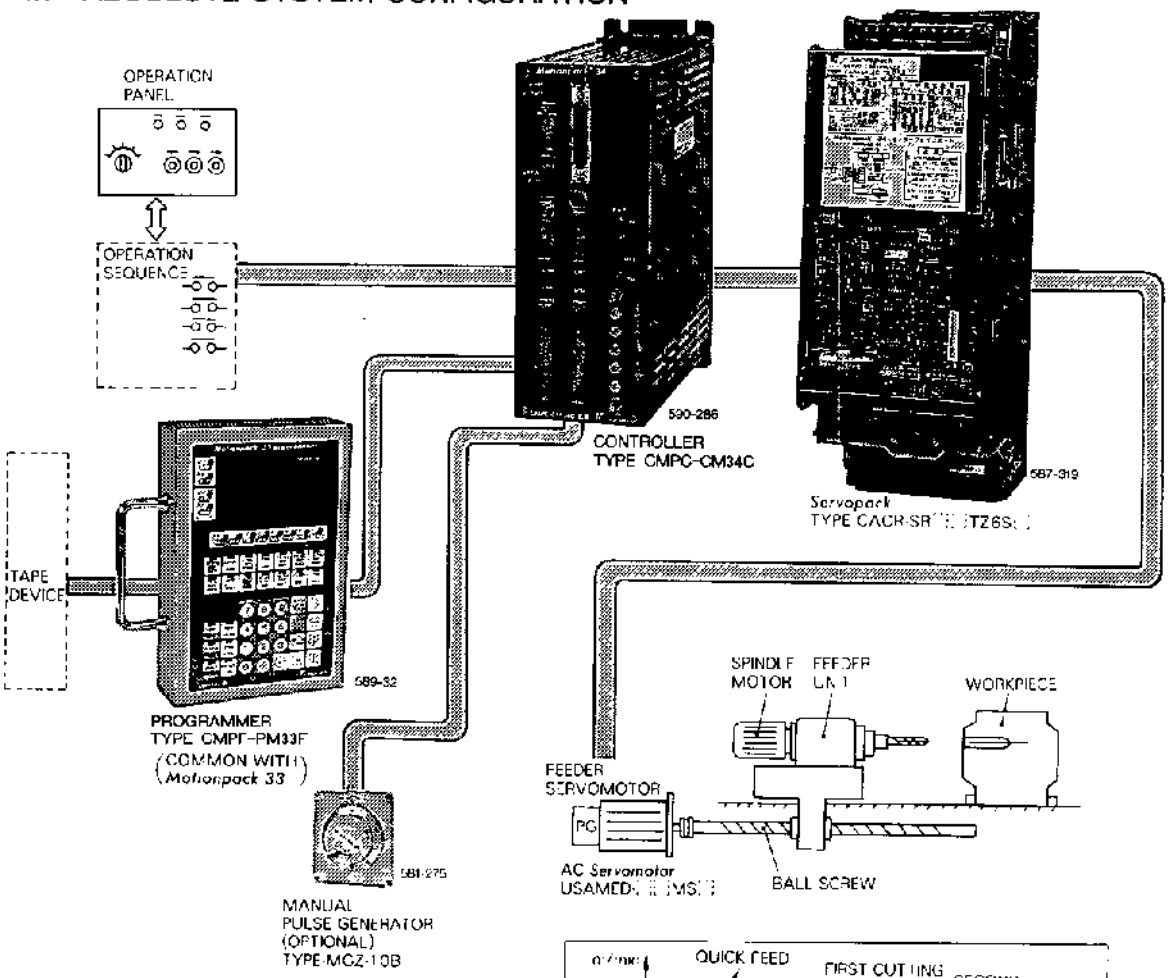
CONTROLLER



AC SERVOMOTOR *Servopack*

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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

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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

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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.

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(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

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

The special Programmer (CMPF-PM33F) permites programming through a languagc-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.

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2.2 Motionpack-34 SYSTEM CONFIGURATION

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

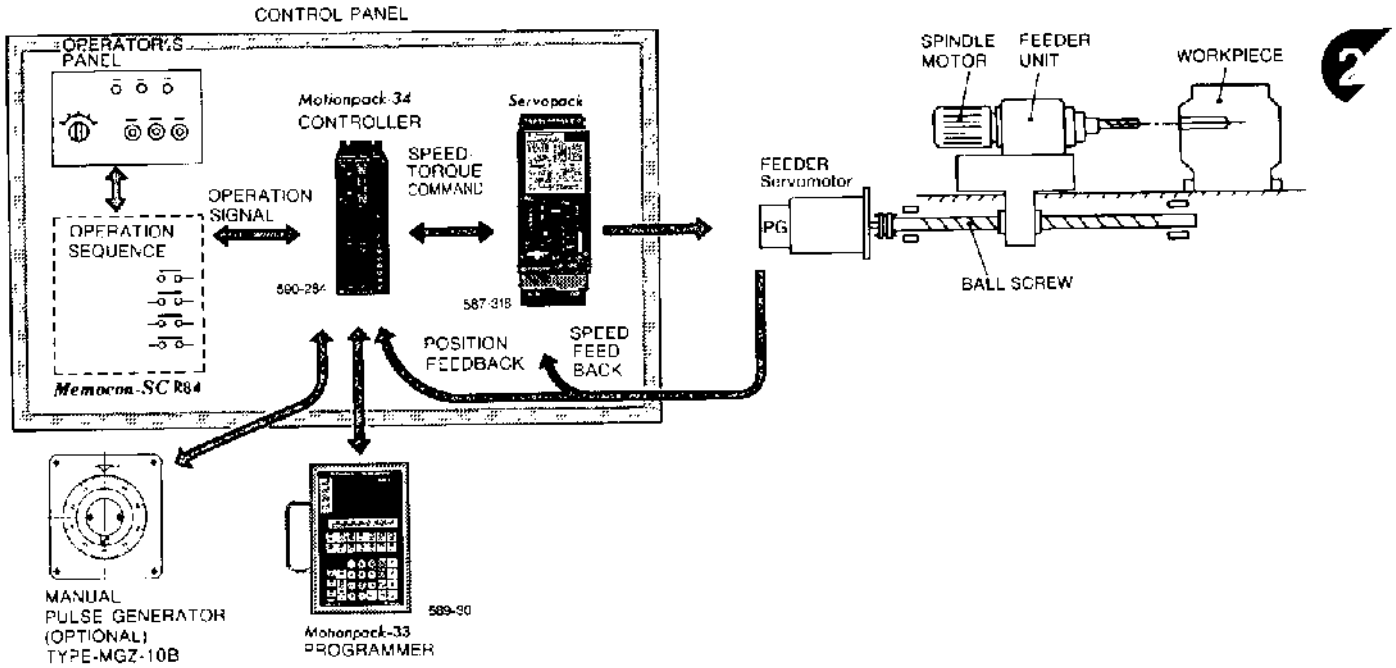


Fig. 2. 1 Motionpack-34 System Configuration

Servomoter

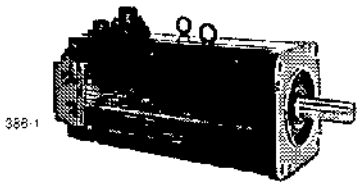


Fig. 2. 2

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

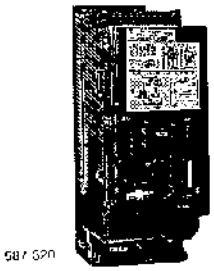


Fig. 2. 3

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.

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Motionpack-34 CONTROLLER

Fig. 2. 4



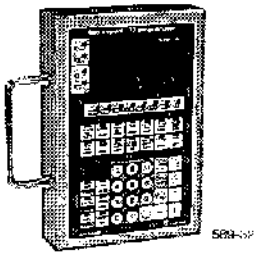
The "Brain" of the Motion Control System

- 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.

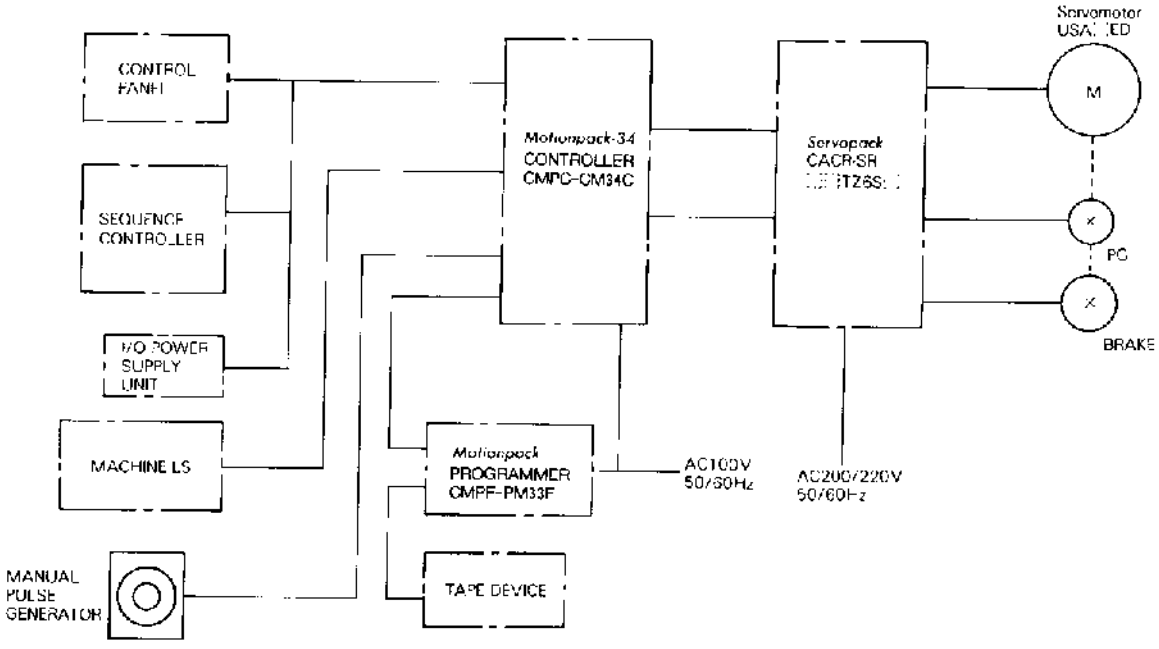


Fig. 2. 6 Basic System Configuration

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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 0.2mm² 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 × 0.2mm² 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.

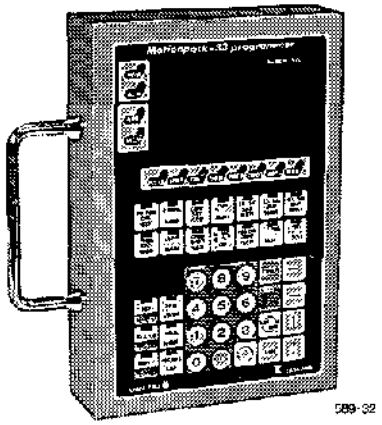
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3. UNIT SPECIFICATIONS

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

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3.1 Motionpack-34 CONTROLLER TYPE CMPC-CM34C

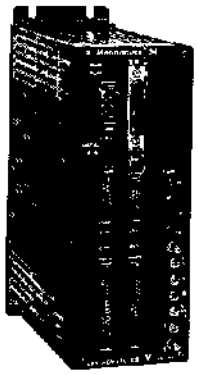


Fig. 3.1 Motionpack-34 CONTROLLER TYPE CMPC-CM34C

Table 3.2 Attachment

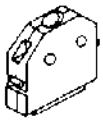
	Name	Q'ty	Schematic Diagram	Type
1	MR Connector	2		MR-20F (With MR-20L) [Made by Honda Tsushin Co.
2	MR Connector	1		
3	MR Connector	2		
4	Name Plate of Connector	1 set	To be attached to Connectors	

Table 3.1 Motionpack-34 Controller Specifications

Controlled Axis	1 axis
Torque 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

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3.2 Motionpack PROGRAMMER TYPE CMPF-PM33FE

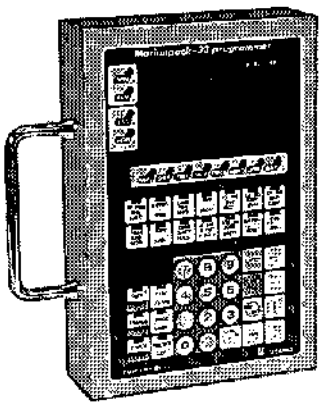


Fig. 3.2 Motionpack PROGRAMMER TYPE CMPF-PM33FE (Common with Motionpack-33)

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	25m	YASKAWA make
2	Power Supply Cable ⑬	1	25m	YASKAWA make

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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 + 60 ℃ 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	83.6
Servo Output Characteristics: Momentary Max. Torque	kg•cm	73	144	197.0	286	449	650	930	1080
Servo Output Characteristics: Allowable GD² (GD²/4)	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 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, 5 kΩ or more							
AC Mechanical Spec.: Torque Monitor Output		3.0 V ± 10 %/100 % Torque, load resistor, 5 kΩ or more							
Motor Characteristics: Rotor Inertia (GD²/4)	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	6.2	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-[ ]

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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

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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.

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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

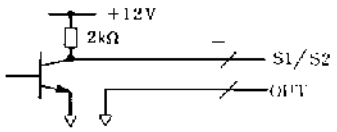
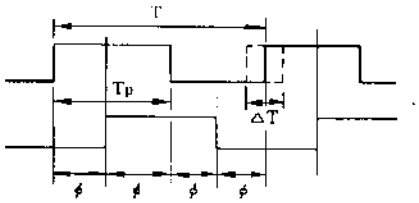
Name : Motionpack Data Recoder
Model : DP-1000
Maker : Hokuetsu Denken Co.

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3.6 MANUAL PULSE GENERATOR

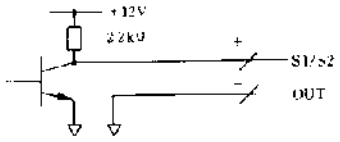
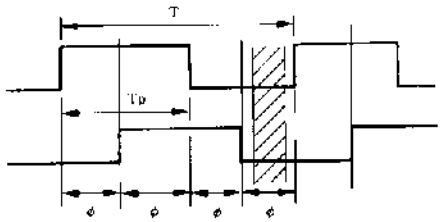
Use the manual pulse generator described below or the equivalent :

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	$V_{OH} \geq 8$ V $V_{OL} \leq 0.5$ V tr, tf ≤ 1.0 μ s 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 ± 12 V ± 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

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Table. 3.9 Manual Pulse Generator Spec. List (2)

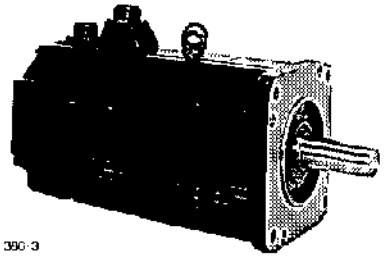
Type	PREH-2 E 5T/100-M 1
Manufacturer	Yaskawa Controls Sales Co., Ltd.
Output Pulse	Rectangular waveform A/B phase 100 p/rev
Output Signal	$V_{OH} \geq 67\%$ V of power supply voltage $V_{OL} \leqq 0.5$ V tr, tf $\leqq 1.0\ \mu$ s Output impedance 2.2 kΩ Output current Max. 20 mA
Output Circuit	
Output 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	DC ± 4.5 V to 12.3 V 100mA or less.
Response Frequency	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

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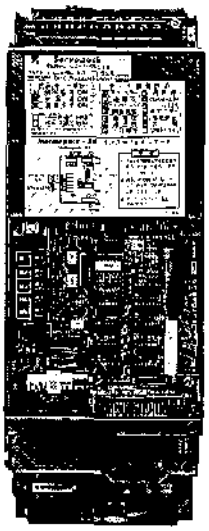
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4. UNIT

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.



AC Servomotor with
Absolute Encoder



Servopack
TYPE CACR-SR44 TZ6S

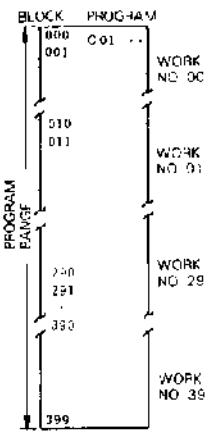
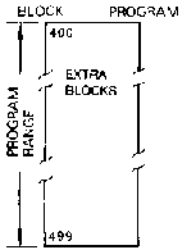
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4.1 Motionpack-34 CONTROLLER (CMPC-CM34C)

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 1231.56, 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 (3) 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

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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.

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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	

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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.

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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.

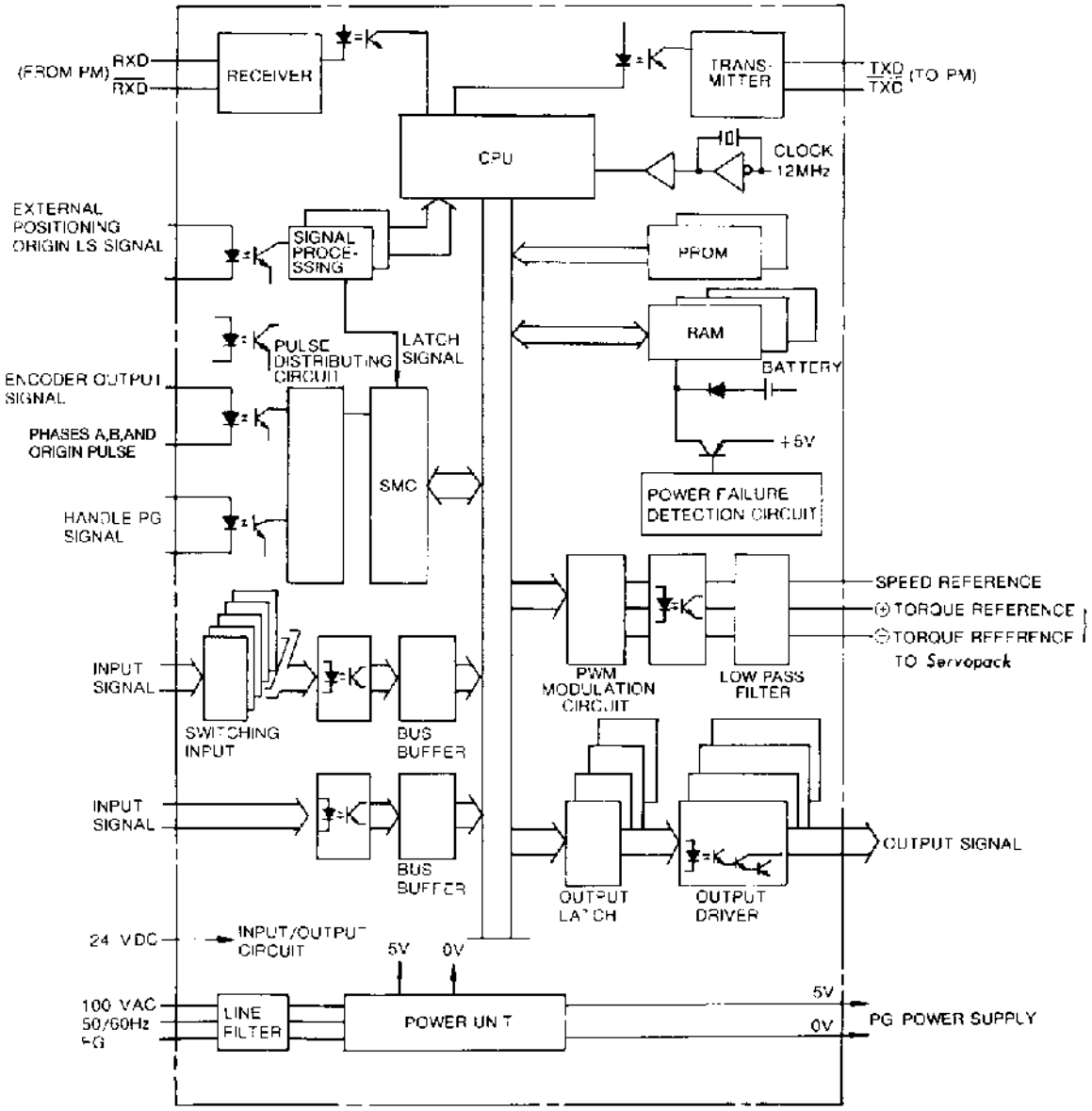


Fig. 4.1 Functional Block of Motionpack-34 Controller

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(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.

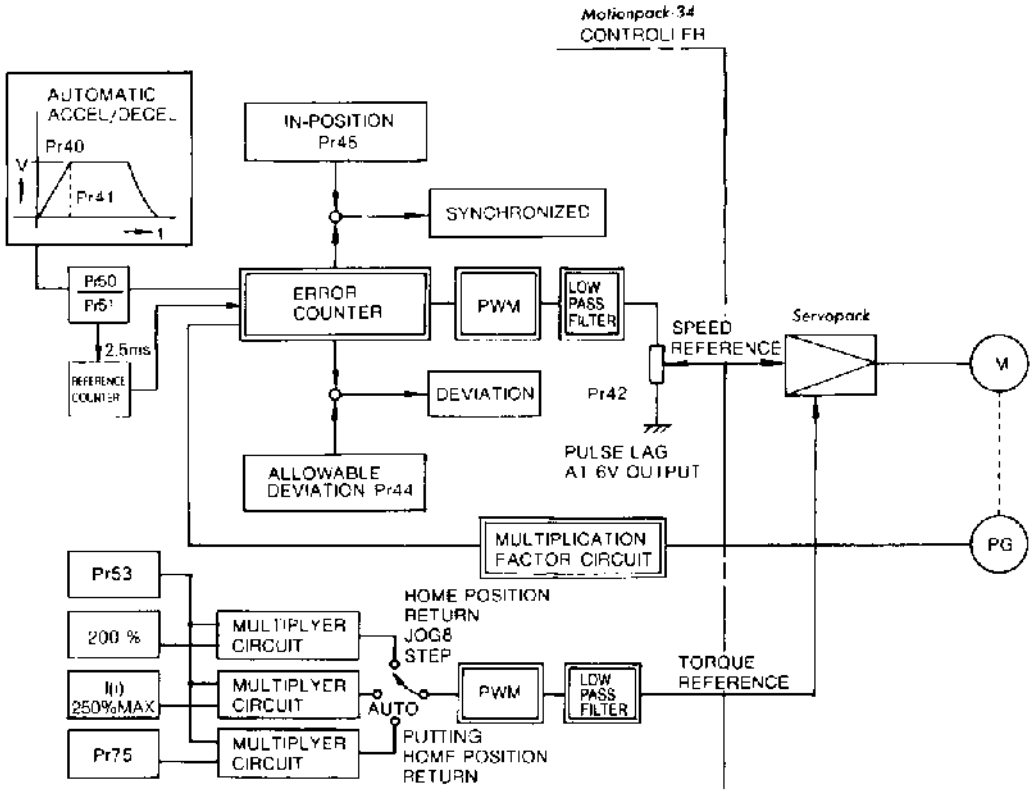


Fig. 4. 2 Control Block of Motionpack-34 Controller

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(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

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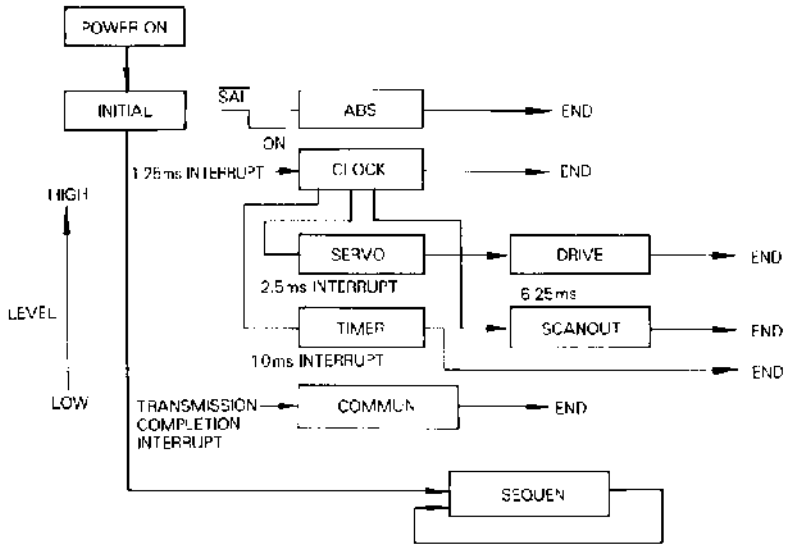


Fig. 4. 3 Software Flow

(c) Absolute value method position data process

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

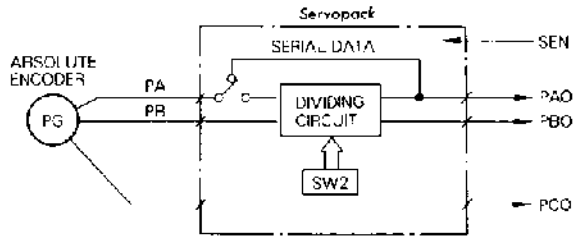


Fig. 4. 4 Absolute Encoder Output

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.

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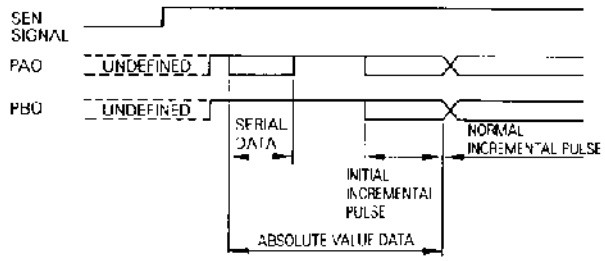


Fig. 4.5 Absolute Value Data Output

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 : Outuls 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)

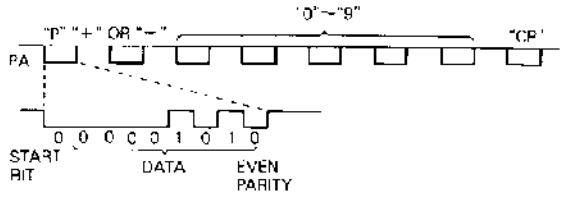


Fig. 4.6 Serial Data

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① Serial data feed 8 bytes (8 characters).

The format is [P ± × × × × × 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 [P + 00000 (CR)] or [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 [P = M × 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.

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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.

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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 :

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

(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

$$Pr50 = 5000 \times 4 = 20000\ \text{(pulse)}$$

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

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

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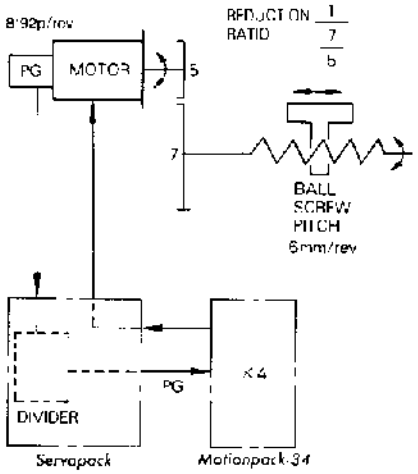


Fig. 4. 7

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 ;

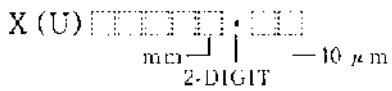
X (U) □□□□ . □□□□
cm ↑ 4-DIGIT, └ μm

Therefore, speed command unit is cm/min.

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(Example 3)

Position command unit = 10μm, Pr52 = 2 ;



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.

$$\text{Pr53} = \frac{\text{Programmed 100\% motor shaft torque}}{\text{Motor rated torque}} \times \frac{\text{Motor rated current}}{\text{Servopack 100\% limited current}} \times 100(\%) - (\text{Rated thrust}/\text{Servo rating}) \times 100(\%)$$

(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)

$$\text{Pr53} = \frac{60\text{kg} \cdot \text{cm}}{58\text{kg} \cdot \text{cm}} \times \frac{5.8\text{A}}{5.8\text{A}} \times 100(\%) = 103(\%)$$

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.

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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 + , acceleration/deceleration command becomes slower according to limited torque.

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

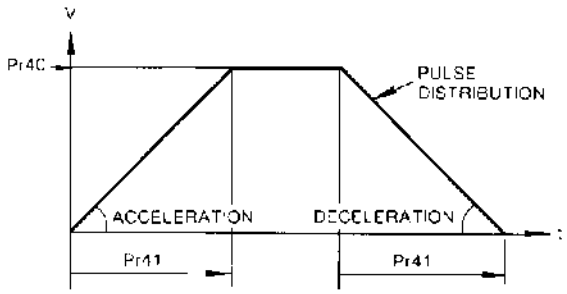


Fig. 4. 8

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.

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(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

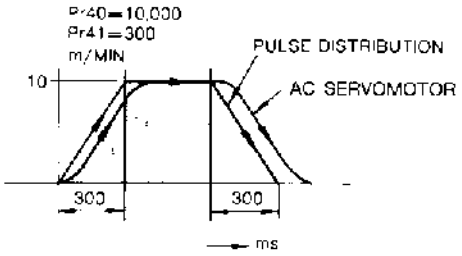


Fig. 4. 9

(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.

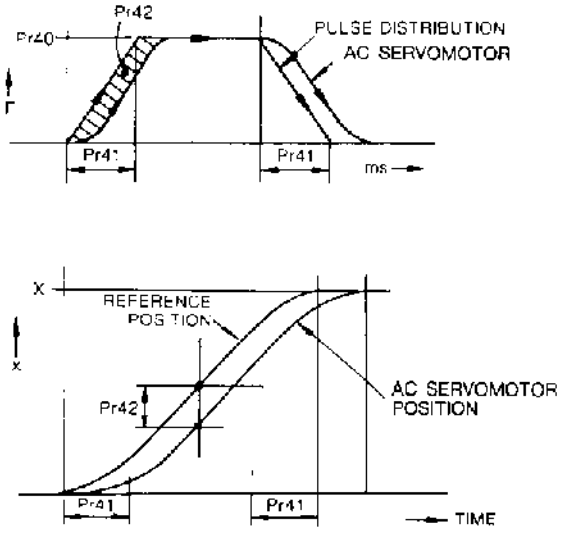


Fig. 4. 10

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.)

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4.1.3.2 Servo-related parameters

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

"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 $30s^{-1}$:

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

$$= 11111\ pulse \rightarrow 11000\ pulse$$

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 :

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

(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 ($dErr0r$).

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(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.

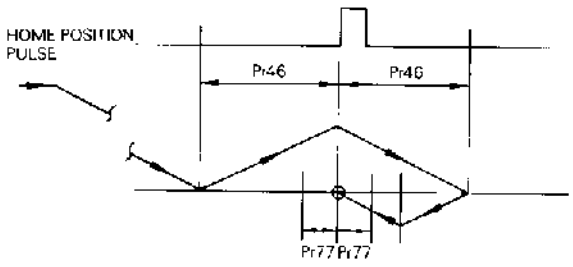


Fig. 4. 11

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.

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4.1.3.3 Operation parameters

(1) JOG feedrate (Pri, 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

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(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.

4.1.3.4 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

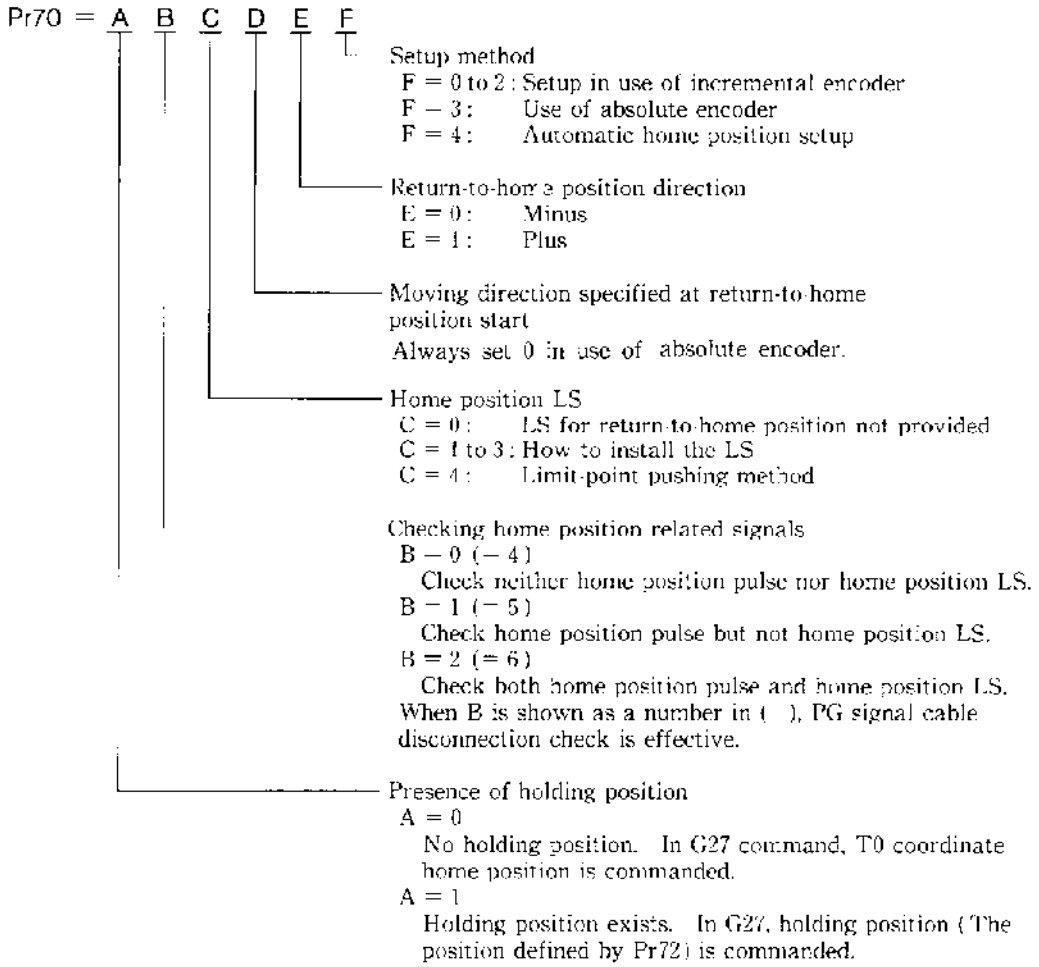
1. The amount of correction made at one time is converted to a pulse count. If the ratio of the minimum command unit to the pulse count is not an integer in the drive system, take the pulse count into consideration to set the parameter. (Rounding is made in conversion from the amount of correction to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

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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.



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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.

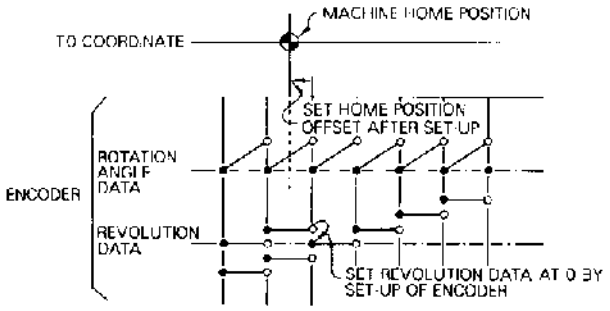


Fig. 4. 12

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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.

$$P = M \times R + P_0$$

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.

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(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.

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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	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

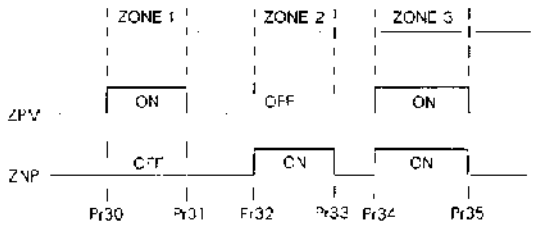


Fig. 4. 13

NOTE

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

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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

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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

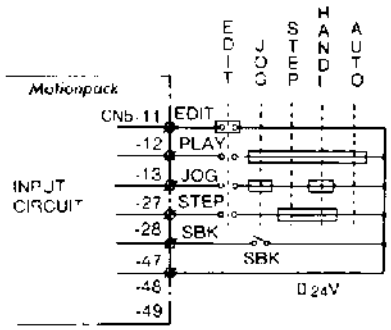


Fig. 4. 14

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.)

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Table 4. 8 Operation Modes Selection Conditions

Mode \ Signal		EDIT	PLAY	JOG	STEP	SBK
EDIT		ON	–	–	–	–
JOG		OFF	ON	ON	OFF	–
STEP				OFF	ON	–
HANDLE				ON	ON	–
AUTO	Block operation			OFF	OFF	ON
	Program operation					OFF

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.

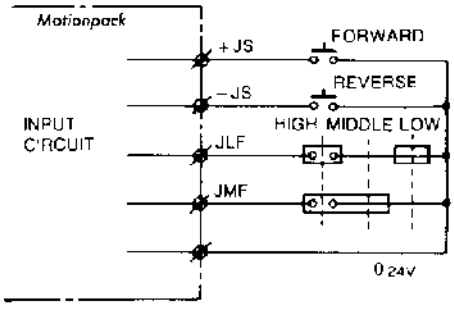


Fig. 4. 15

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

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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)

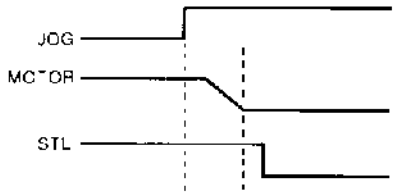


Fig. 4. 16

(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).

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

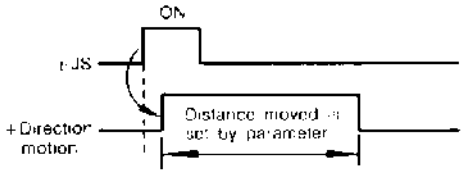


Fig. 4. 17

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.

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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.

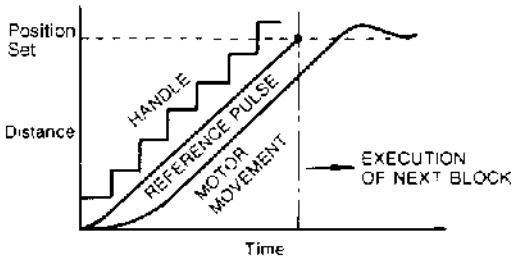


Fig. 4. 18 Reference Pulse and Position Set by HANDLE PG

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```
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
```

*1 X = 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.

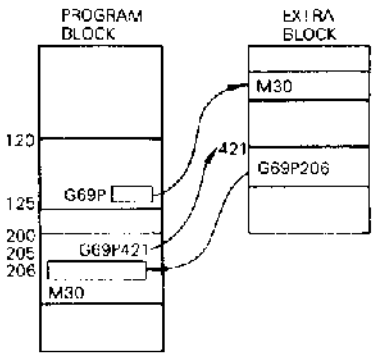


Fig. 4.19

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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.

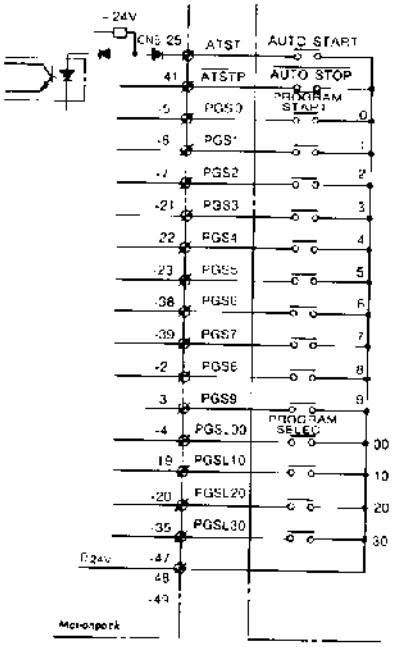


Fig.4.20

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CAUTIONS

1. The automatic start signal line (ATST), and the automatic stop signal line (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 Error SEL 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.

4

(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.

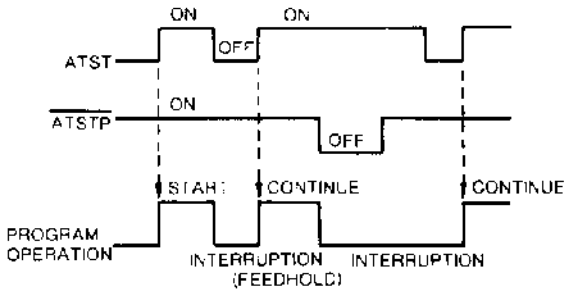


Fig. 4. 21

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

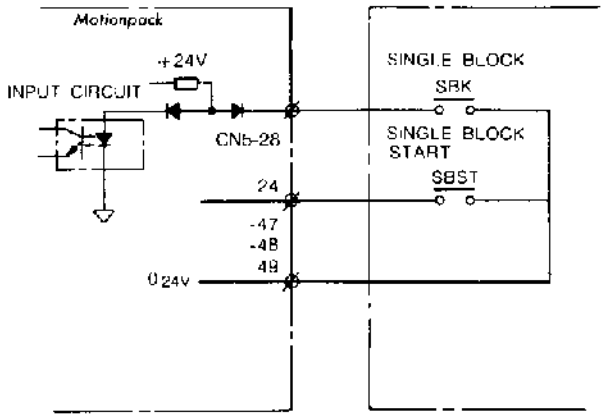


Fig. 4. 22

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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.

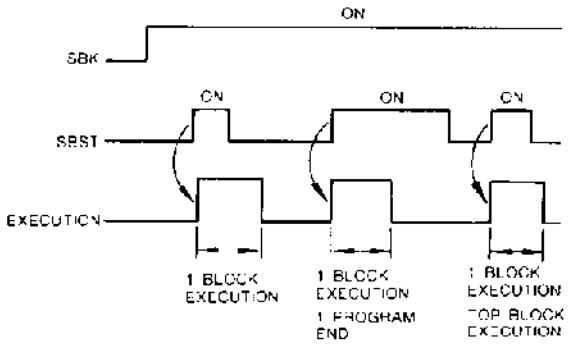


Fig. 4. 23

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.

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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."

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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.

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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 I/ 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.

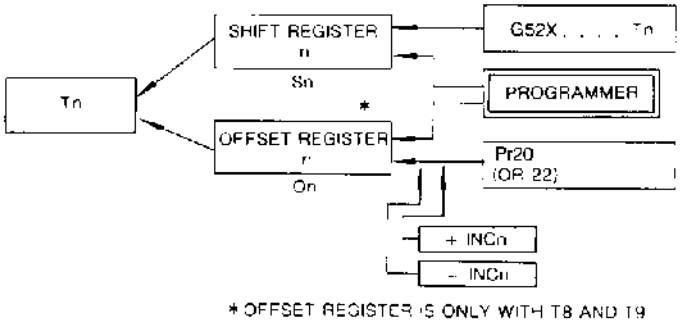


Fig. 4. 24

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.

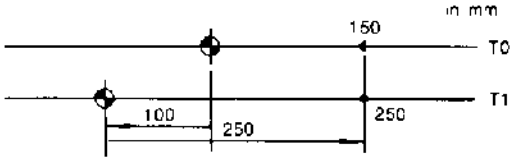


Fig. 4. 25

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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

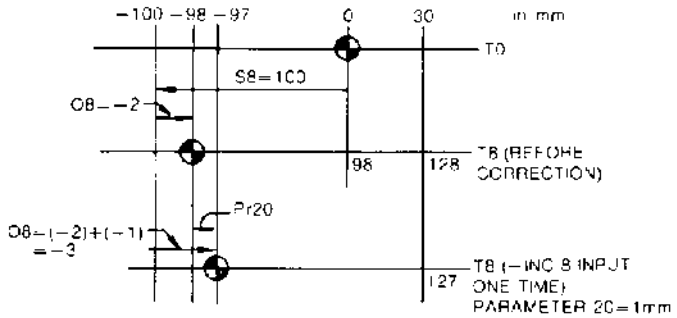


Fig. 4. 26

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.

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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.

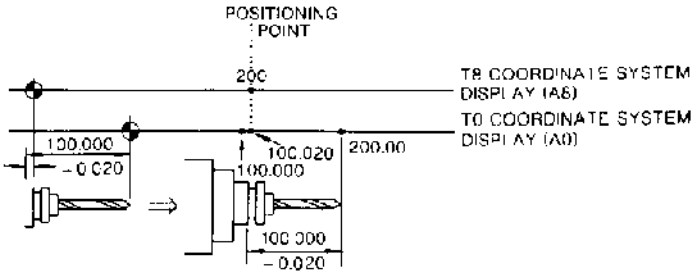


Fig. 4. 27

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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.

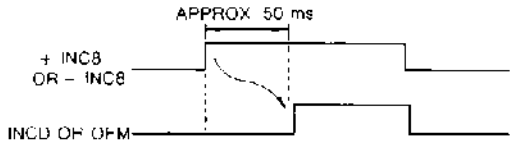


Fig. 4. 28

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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).

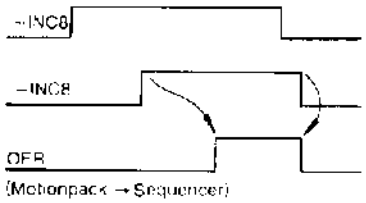


Fig. 4. 29

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

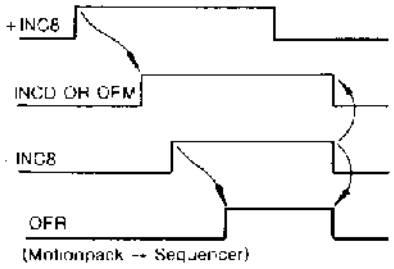


Fig. 4. 30

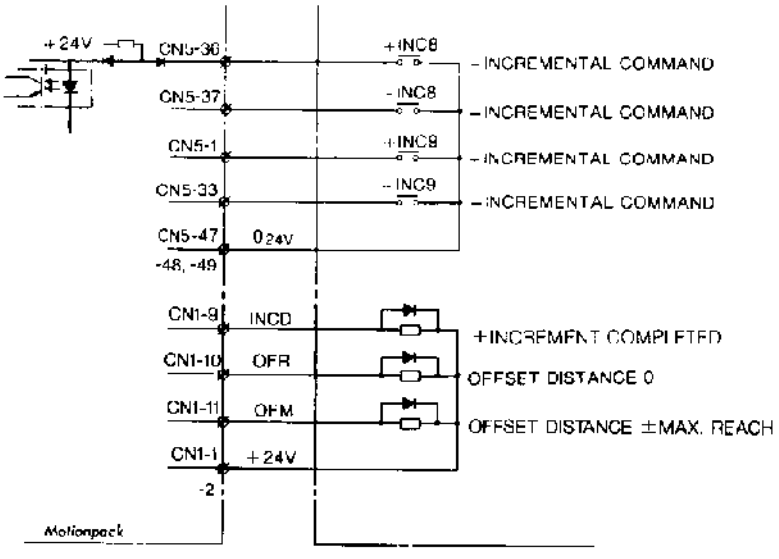


Fig. 4. 31

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(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  · . Offset selection is indicated by "O." and shift selection by "S." A blinking digit indicates a coordinate number.

Select "O." (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.

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(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 :

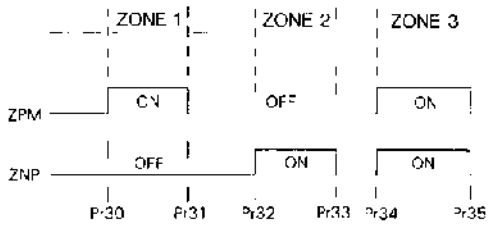
Output signal name : Return to home position end signal (ZPM)

: 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

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(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 :

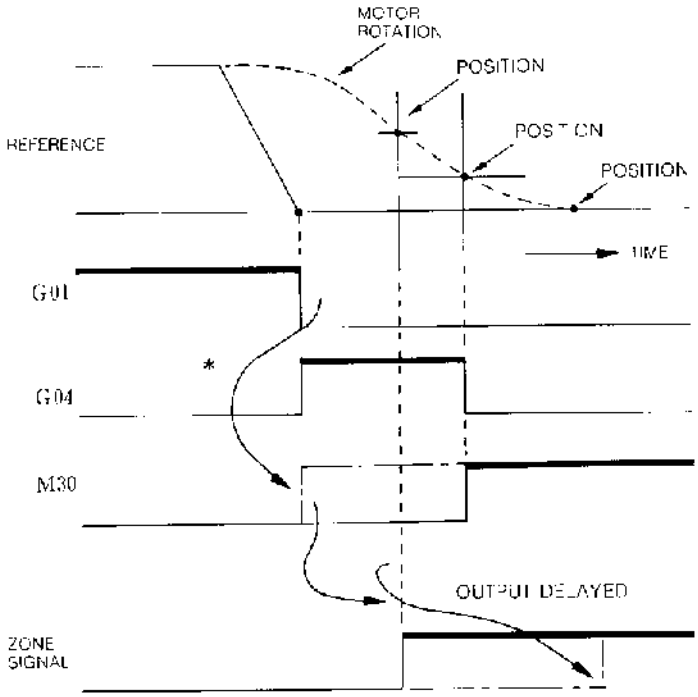
- Active signal output → Path signal output
- Inactive signal output → Zone signal output

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.

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(Example) Zone signal is output before positioning point.



Program

```
G01   X 0.000 F__ 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.

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4.1.4.2 Program function command

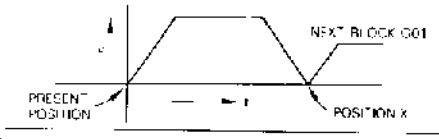
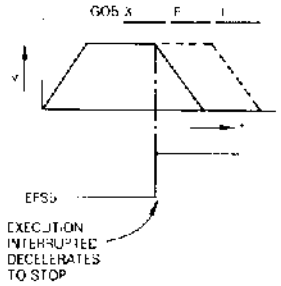
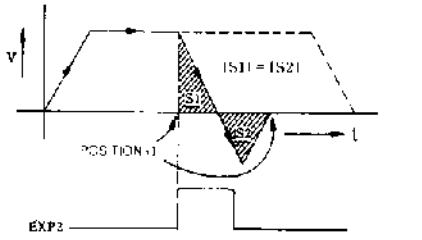
All the function commands have codes consisting of G sign and two digits. The functions of these commands are diverse, commanding positions, feedrates, torque, auxiliary functions, dwell time, coordinate Nos., number of loops, jump destination block Nos., etc., but the length of each block is fixed irrespective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

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

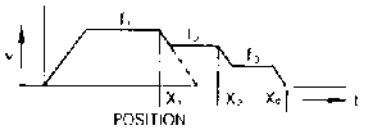
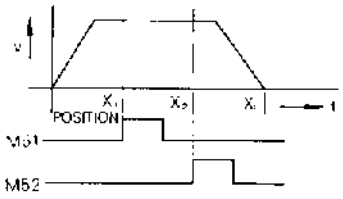
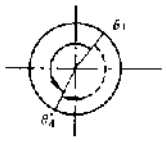
Function Command	Signal	Function Command Words	Contents
Home Position Check	G 27	G 27 X .... F .... I .... U	Moves to position X(or U), speed F, torque limit I. Pr70 A = 0; X(U) = T0 coordinate home position specified Pr70 A = 1; X(U) = Holding position (Pr72) specified Pr46 ≠ 0; Moves to T0 home position (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 (G68).
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.

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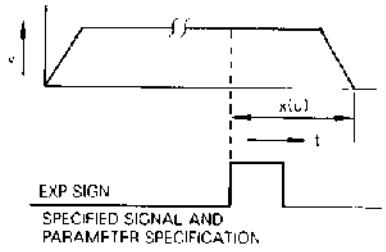
(b) Extended functions

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 Short-O_2V circuit Pr43 2000	
Passing Signal Output Function	G07	Specified in sub program SUB PROGRAM G68X xd P JUMP G07X x_1 F f1 I M51 G07X x_2 F f1 I M52 G07X x_3 F f1 I G69 * : $x_3 = x_d + \alpha$	CN5-18 Short-O_2V 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 Short-O_2V 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.

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

Function Command	Signal	Function Command Words	Conditions	Contents
Infinite Length Operation	G34	G34 X ± __ F __ I ___ U ± __	CN5-18 Short-Circuit Pr43 = 1000000	Keeps moving until 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 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 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 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 396 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)

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4.1.4.3 Program function command in detail

(1) Basic functions

(a) Positioning command (G01)

```
G01  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

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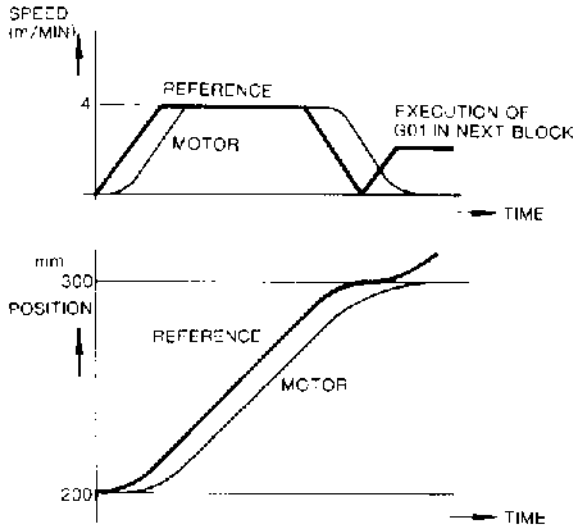


Fig. 4. 33

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 1 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.

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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.

```
G05  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),

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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.

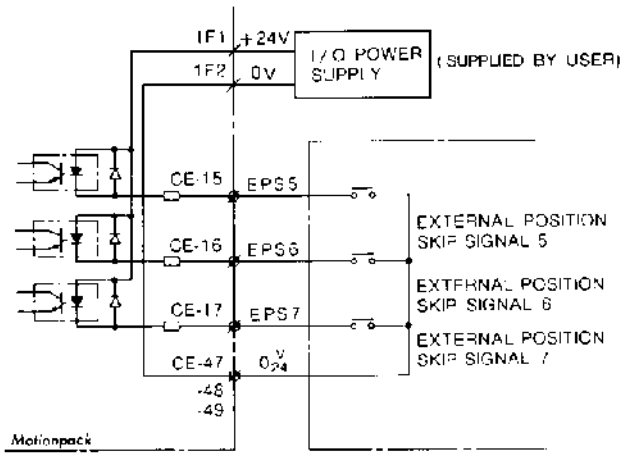


Fig. 4. 34

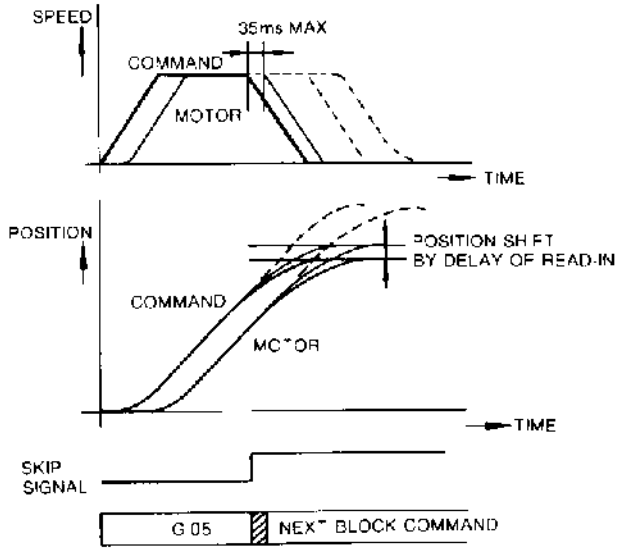


Fig. 4. 35

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

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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).]

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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

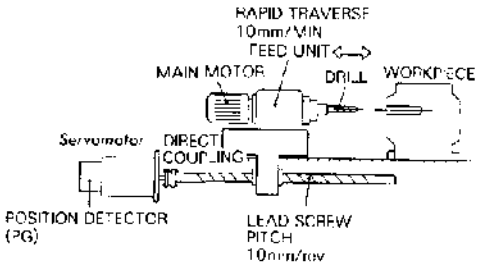
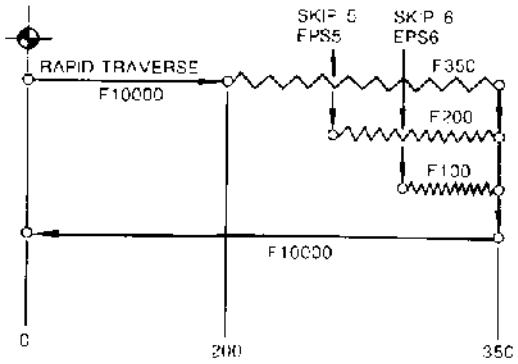


Fig. 4. 37



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
```


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(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.

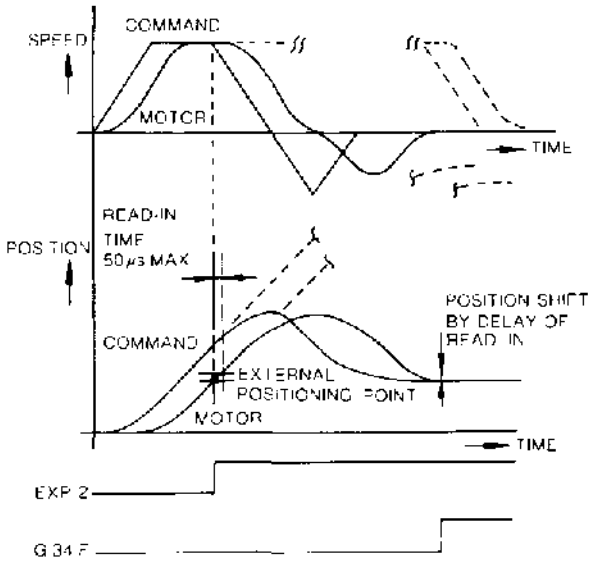


Fig. 4. 38

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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.

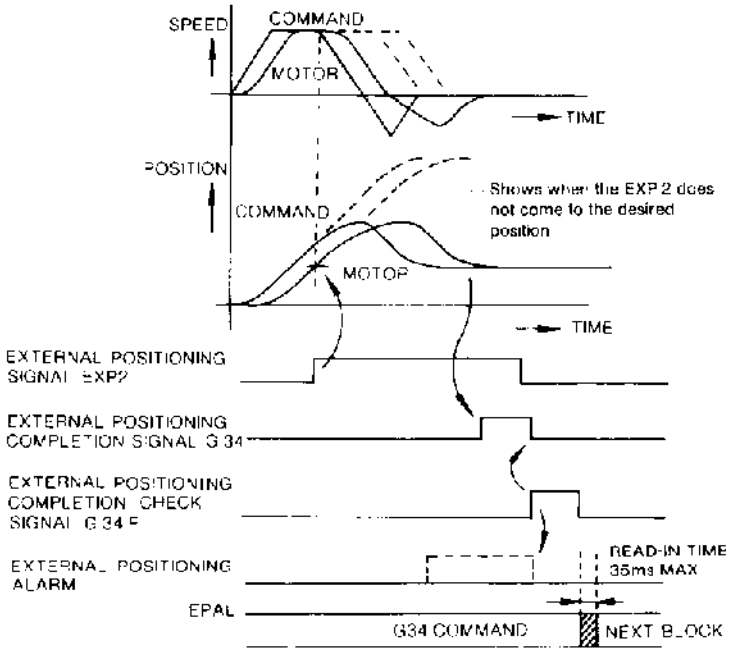


Fig. 4. 39

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

- G34F signal ON
- Mode switching over

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4.1.4.3 Program function command in detail (Cont'd)

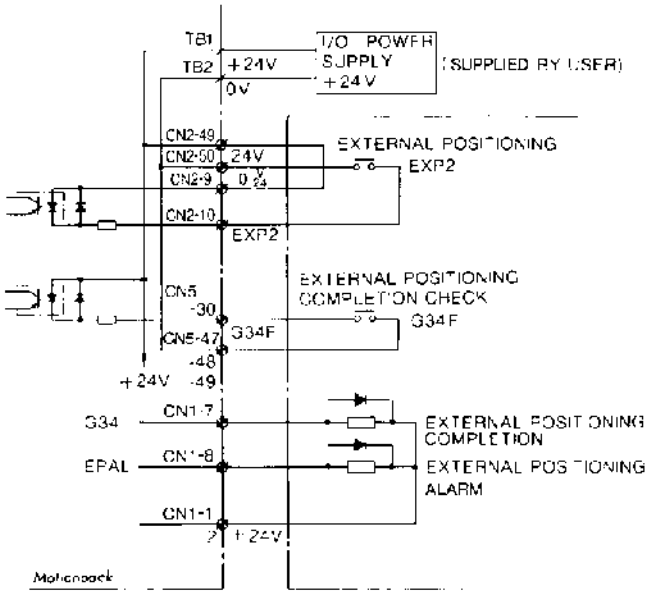


Fig. 4. 40

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.

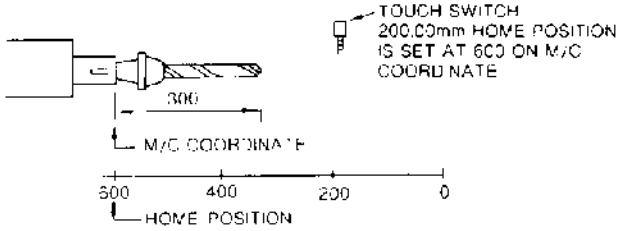


Fig. 4. 41

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
```


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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.

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Program example

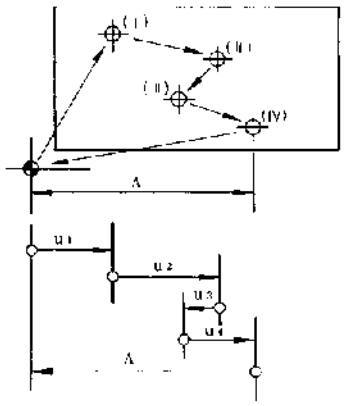


Fig. 4. 42

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.)

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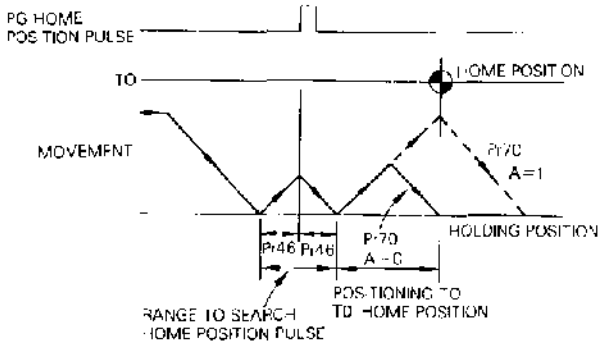


Fig. 4. 43

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 until 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.

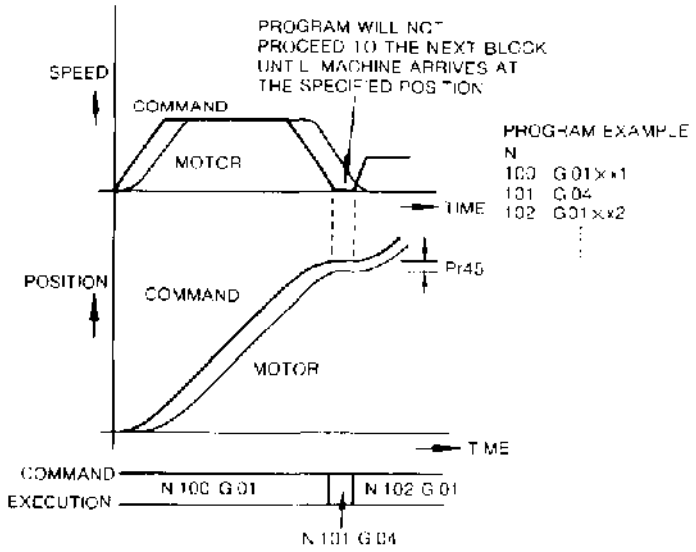


Fig. 4. 44

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

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(f) Time delay command (G04)

G04 D□□□□

G04 : Time delay command

D : 0.01 to 600.00

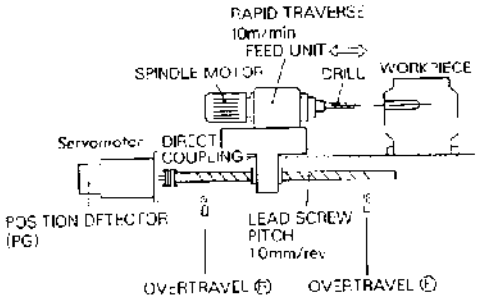
Unit : 10ms

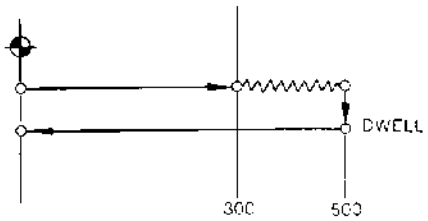
Decimal point position : s

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 1 sec
  015 G53 T0
  016 G27 X0 F10000
  017 M30
```

Fig. 4. 45

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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.

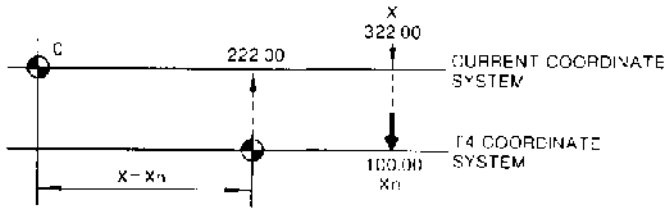


Fig. 4. 46

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(Example 2)

```
G01 X322.00
G52 U    222.00 T4
```

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

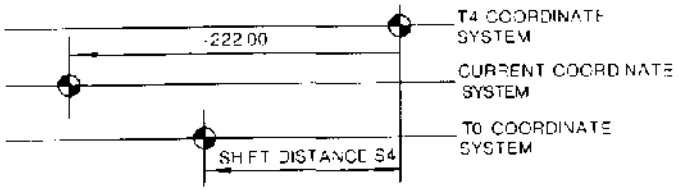


Fig. 4. 47

(Example 3)

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


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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.

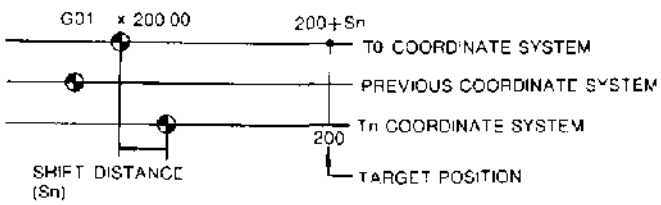


Fig. 4. 48

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4.1.4.3 Program function command in detail (Cont'd)

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

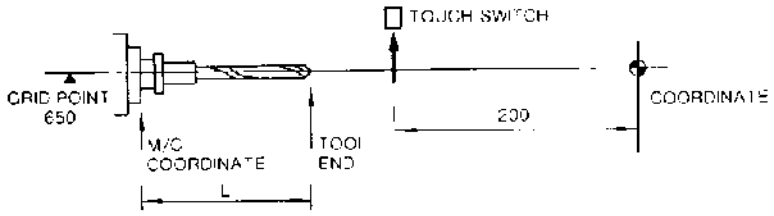


Fig. 4. 49

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
```


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(i) Arrival check command (G67)

G67 P

G67 : Arrival check command

P : 3 digit No. of block to be jumped

Operation

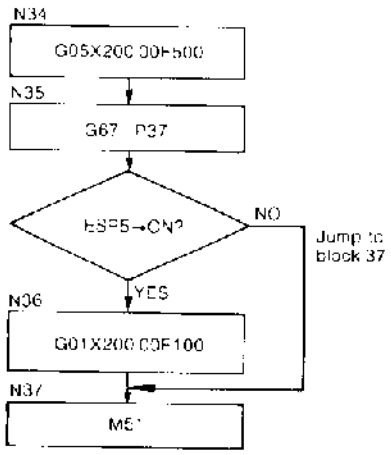
With this command, the execution or no execution of an interim skipping the execution of a G05, G06 or G07 skip positioning command is checked, and then a jump is made accordingly.

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.



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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.

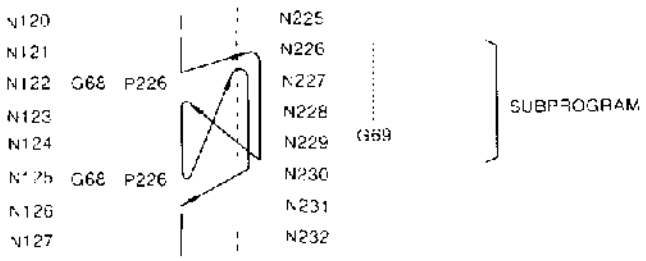


Fig. 4. 50

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

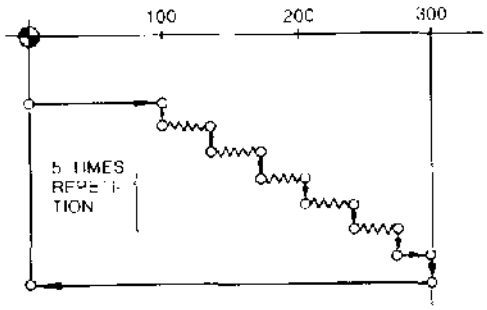
L : No. of repetitions (1 to 9)

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.



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```
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.

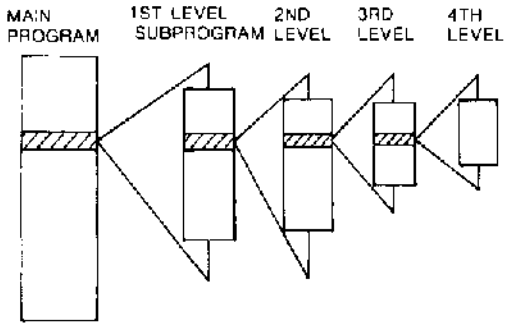


Fig. 4. 52

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(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

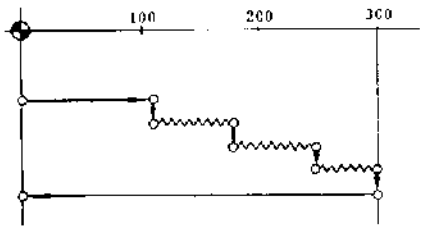
The subprogram starting with P block is repeated until X (U) is reached in the coordinate system specified for G68 execution. Upon arrival at the specified position, the program returns to the block next to the G68 command, even during the course of feeding.

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.



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```
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		L	

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.

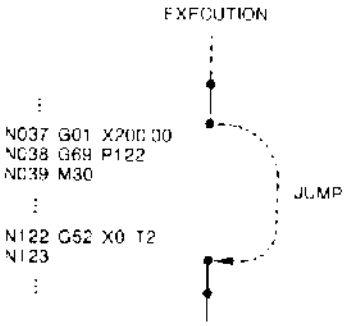


Fig. 4. 54

(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.

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(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.

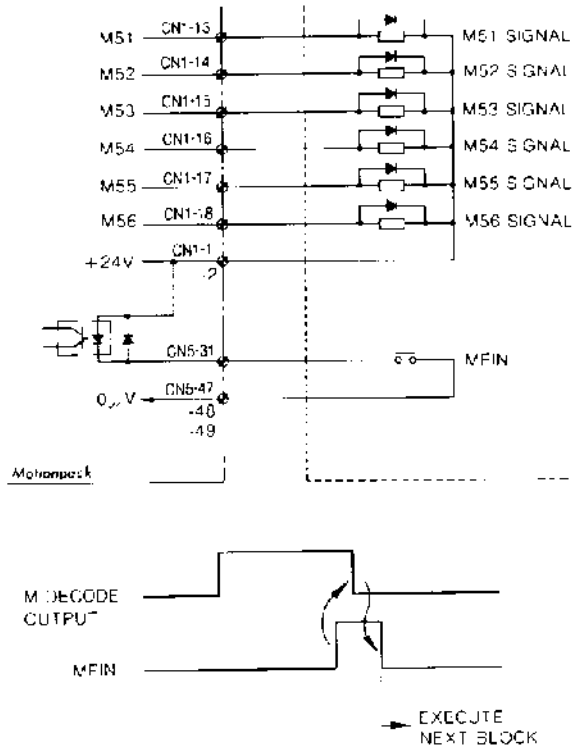


Fig. 4. 55

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(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.)

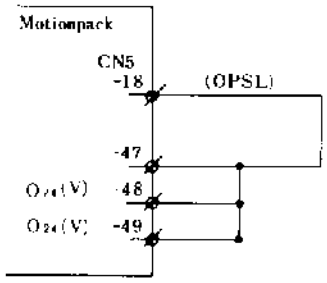


Fig. 4. 56

(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	

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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

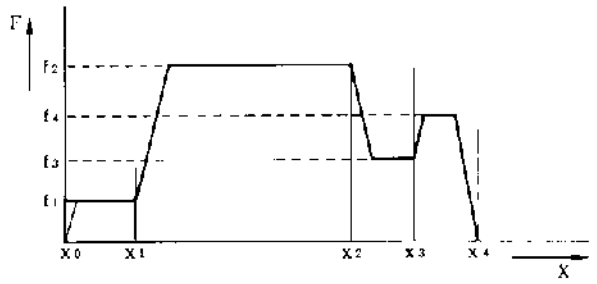


Fig. 4. 57

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	$(x_4 + \alpha^*)$	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.

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(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.

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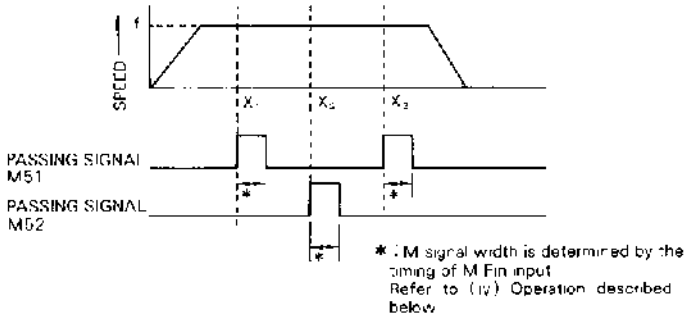


Fig. 4. 58 Passing Signal

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:

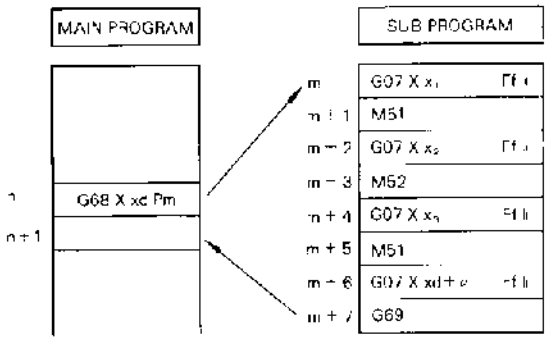


Fig. 4. 59 Program Example

(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.

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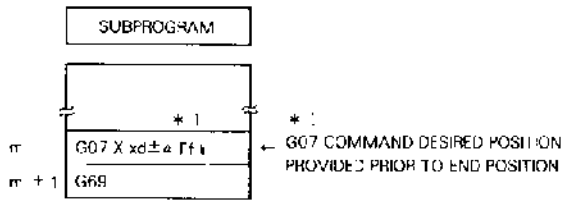


Fig. 4. 60 End Display of the Subprogram

Do not insert any other command between m' block and m' + 1 block.
Without m' block G07X xd ± α FfIi 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.

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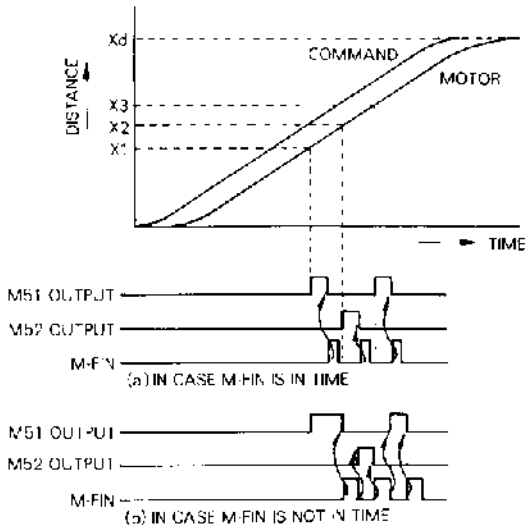


Fig. 4. 61 (a) Passing Signal Output

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).

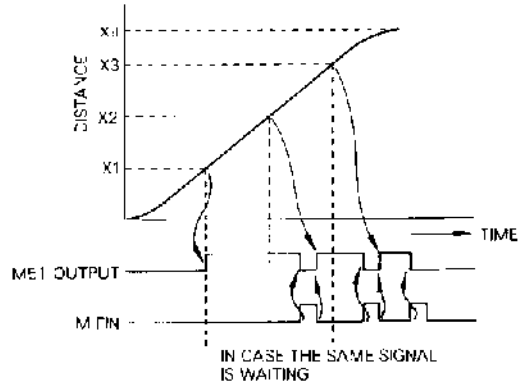


Fig. 4. 61 (b) Passing Signal Operation

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.

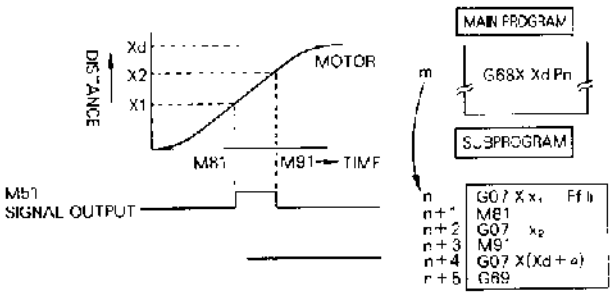


Fig. 4. 62 Example of Extended M Function

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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, $-360° < \theta < 360°$

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• Operation

– Make positioning at X = θ from the presnt position.

– Rotating direction depends on X sign :

X − $\theta \geq 0$: 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. ($-360° < \theta < 360°$)

(Example)

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

The present position X :

X = 825°

= 360° × 2 − 105°

= 105°

The positioning position will be:

X = 340°

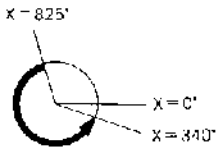


Fig. 4. 63

– 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 $|\theta \geq 360°$, 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°.

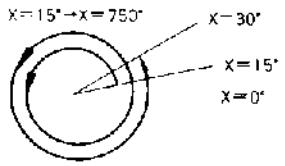


Fig. 4. 64

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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.

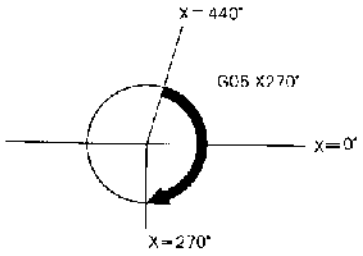


Fig. 4. 65

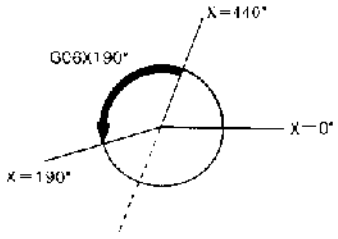


Fig. 4. 66

– 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.

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(iv) Precautions for use

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

Standard skip positioning is made.

$$\theta = 360^\circ \times n + \delta\theta$$

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:

G05 | X765 F (f) I (i)
G06
G07

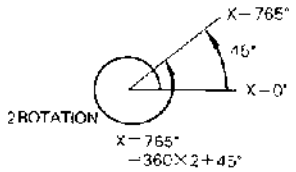


Fig. 4. 67

(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.

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Table 4. 20 Program Example

Motionpack		External Sequence
Program	Operation	
⋮		
N85 M55	Clamp start command	
N86 G07 U9999.999* F0 L0	Free	CL signal ON Clamp operation
	External force Free released No movement even in external force 0.	Clamp release CL signal OFF
	Skip	EPS07 ON
N87 G01 X0 F8000 1200	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.

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(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 0_{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.

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• 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 5×10^6 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.

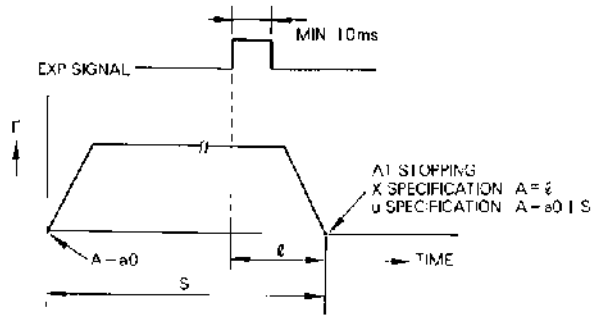


Fig. 4. 68

• 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, specifics 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.

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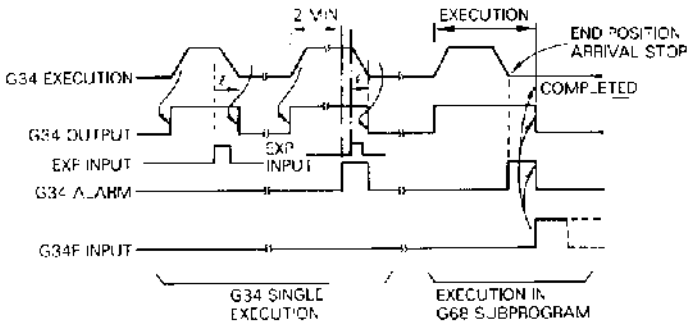


Fig. 4. 69

(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.

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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.

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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 $50 \times 10ms = 0.5$ 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.

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(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.

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(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.

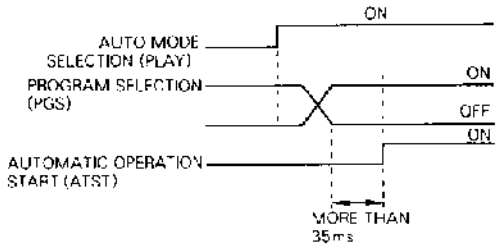


Fig. 4. 70

(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

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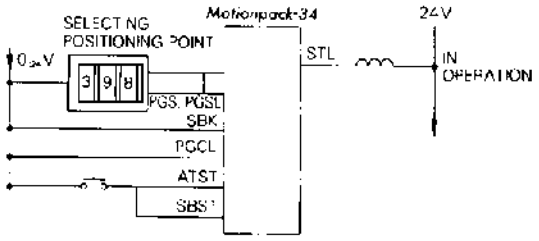


Fig. 4. 71

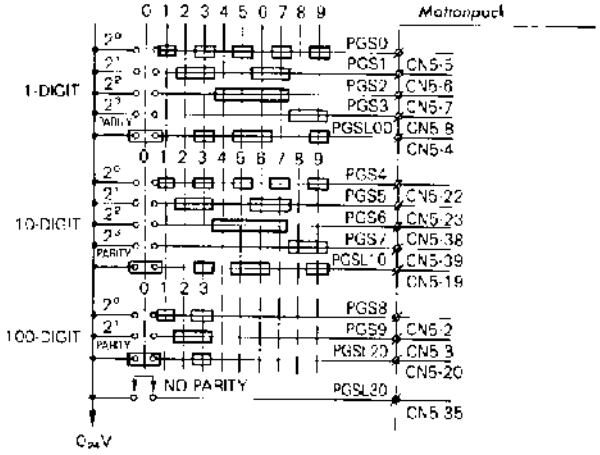


Fig. 4. 72

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

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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.

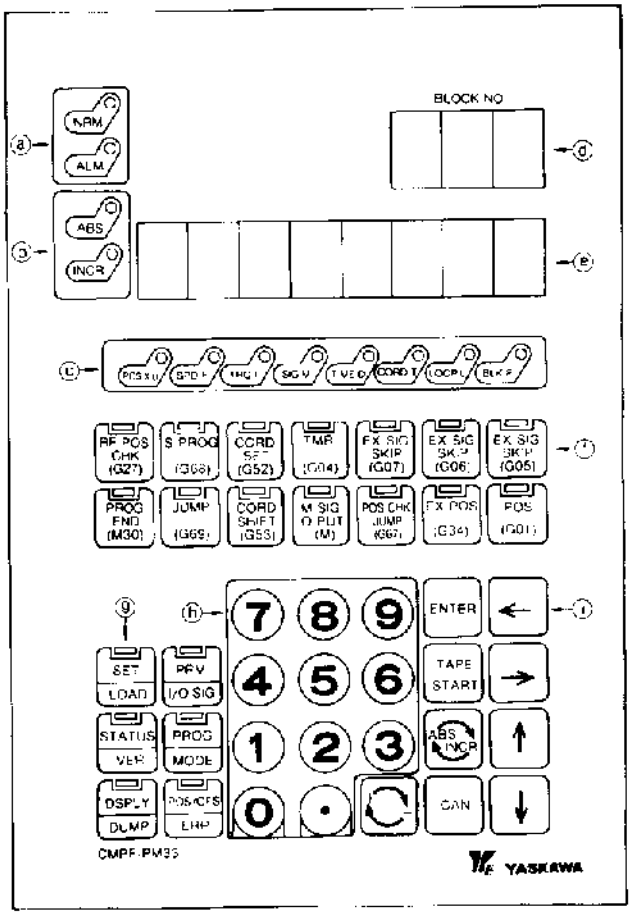


Fig. 4. 73 Motionpack Programmer Panel

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

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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.

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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 [↓] or [↑] 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 [ENTER] Key. The decimal point stops blinking, and the data is input (When entering programs, depress the [→] or [←] 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.

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ⓖ 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

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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, dAtAEr r 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 (G68I... 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)

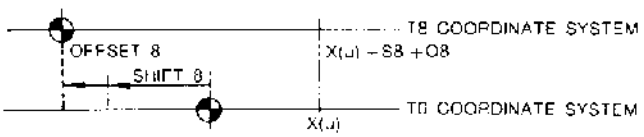


Fig. 4. 74 Coordinate System Select

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(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.

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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 Er 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"

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(5) Signal display

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

The symbol ▪ means an input signal and ◘ 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 dO 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 dI represents the compensation value for D/A drift.

4

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

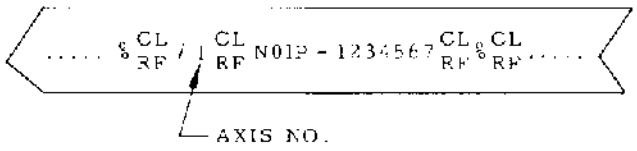
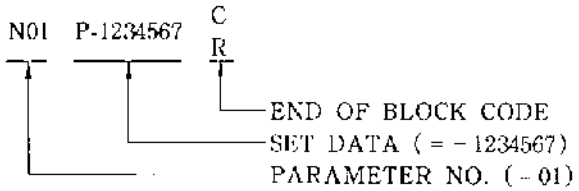


Fig. 4.75 Parameter Tape Example

- 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.



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The code $\begin{matrix}C\\R\end{matrix}$ 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 $\begin{matrix}C\\R\end{matrix}$ —→ NIP-567 $\begin{matrix}C\\R\end{matrix}$

- 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
$\begin{matrix}C\\R\end{matrix}$	End of block
$\begin{matrix}L\\F\end{matrix}$	Line feeding
$\begin{matrix}S\\P\end{matrix}$	Spacing

(b) Program tape format

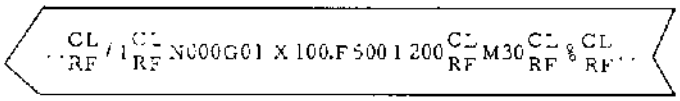


Fig. 4.76 Program Tape Example

- Write % before and after the data portion.
  (same as with parameter tapes)
- Be sure to write $\begin{matrix}C\\R\end{matrix}$ 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

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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.)

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(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.

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(d) Program tape collation

Depress the [STATUS] and [PRM] keys. The mode is displayed. Depress the [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 [SET] and [PRM] keys. The block No. display blinks. Depress the [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.

(f) Program tape reading

Depress the [SET] and [PROG] keys. The block No. display blinks. Depress the [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.

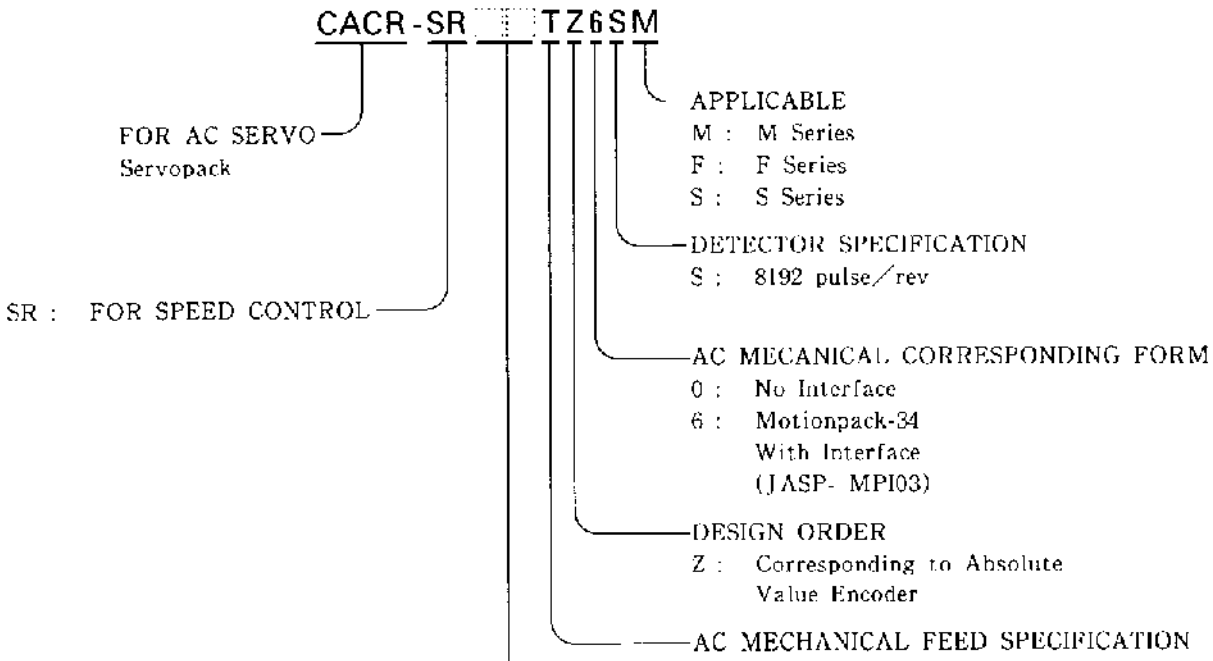
- No data after 5 seconds from tape start BAUD ERR
- Parity error PARITY ERR
- Discrepancy of axis Nos. AXIS ERR
- Incorrect tape format. FORMAT ERR

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

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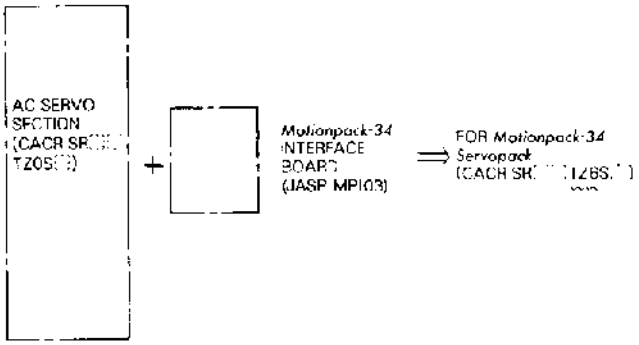
4.3 Servopack (CACR SR☐☐TZ6S☐)

4.3.1 Type



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

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4.3.2 Block Diagram

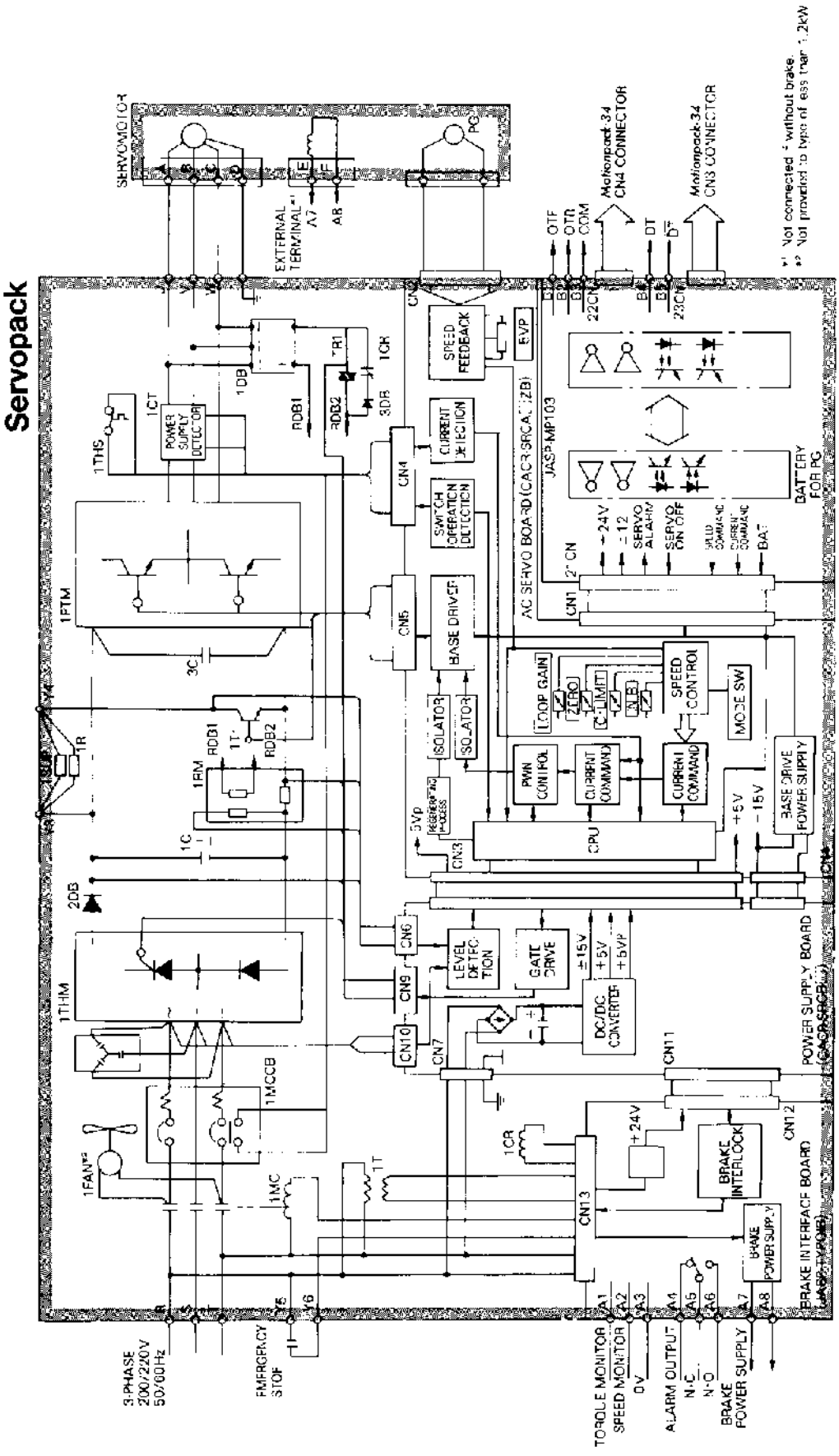


Fig. 4. 77 Block Diagram of Type Servopack CACR-SR□□□□TZ6□

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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

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(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	8.	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.

4

Overload detection (OL) level

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

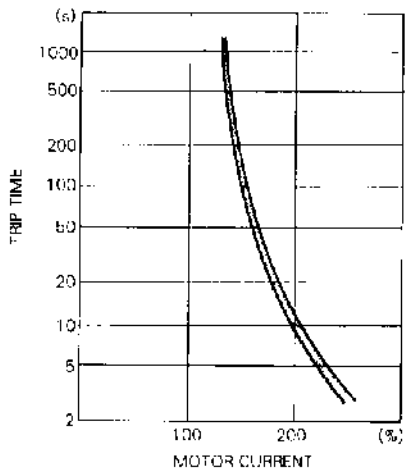


Fig. 4. 78 Overload Characteristics

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(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

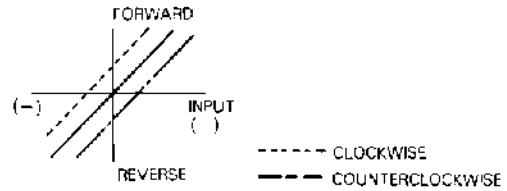
LED Name	Description
P	Lights when the power is turned on.
BR	Lights when motor brake release signal is turned on.

(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 counterclockwise). (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 0V. 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 PC 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 counterclockwise.
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.

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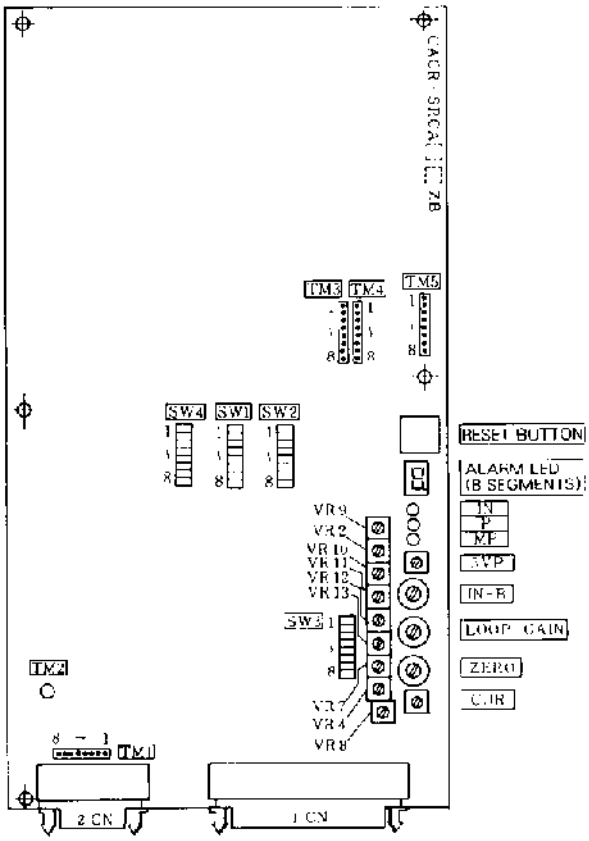


Fig. 4. 79 Servo Board Component Arrangement

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 counter-clockwise. If necessary the other four can be adjusted. (See Table 4. 31.)

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(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 :

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

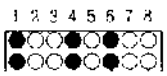
As multiplied by 4 by the Motionpack-34,

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

(5) Setting switch

There are four switches SW1 , SW2 , SW3 , SW4 ,on the board with the following function ;

Table 4. 32

Switch Name	Function	User Setting
SW1	Sets motor function. Sets Servopack function.	(M) Possible  (F)  (S) 
SW2	Sets number of output pulses.	Possible (Refer to Table 4.33.)
SW3	Sets speed loop conditions.	Possible (Refer to the figure below.) (However, it can be generally used with the setting at shipping.)
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.)

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SW2 Function

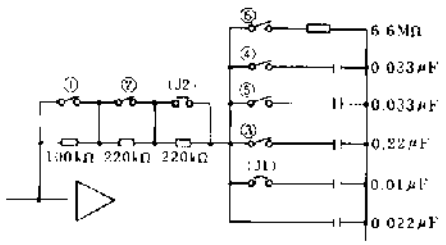
Table 4.33 Setting Divider

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

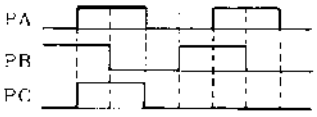
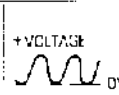
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(6) Check terminal list

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		 · Frequency 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 / 0.04
	3				Triangular Wave 330 TO 350μs 3.5 TO 4.0V −3.5 TO 4.0V
	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		

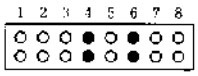
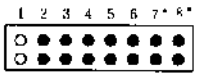
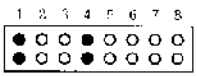
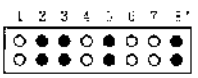
Notes:

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.

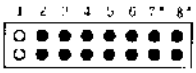
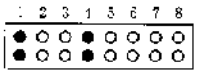
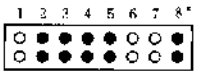
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(7) Setting at the time of delivery

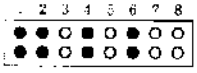
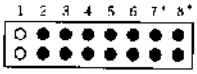
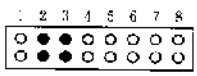
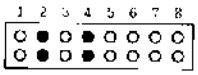
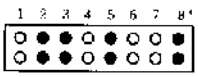
(a) M Series

Servopack Type CACR-	SW1 Motor Type	SW2 Output Pulse Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
SR03TZ6SM to SR60TZ6SM		5000 pulses/rev 		

(b) F Series

Servopack Type CACR-	SW1 Motor Type	SW2 Output Pulse Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
SR03TZ6SF to SR44TZ6SF		5000 pulses/rev 		

(c) S Series

Servopack Type CACR-	SW1 Motor Type	SW2 Output Pulse Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
SR03TZ6SS(-Y41) to SR30TZ6SS		6000 pulses/rev 	SR10BZ, SR15BZ  SR03BZ, SR05BZ, SR30BZ 	

*Spare short-circuit pin.

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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.

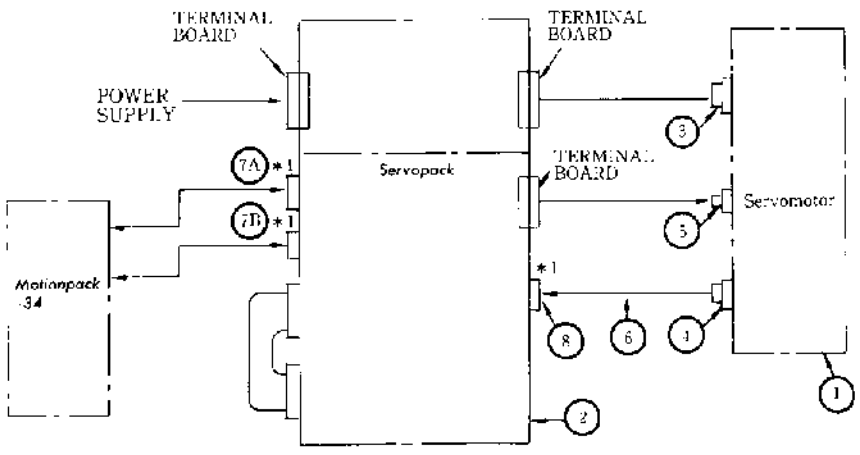
(3) Current limit detection signal

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



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Table 4.35 Connector List (Example of M Series)

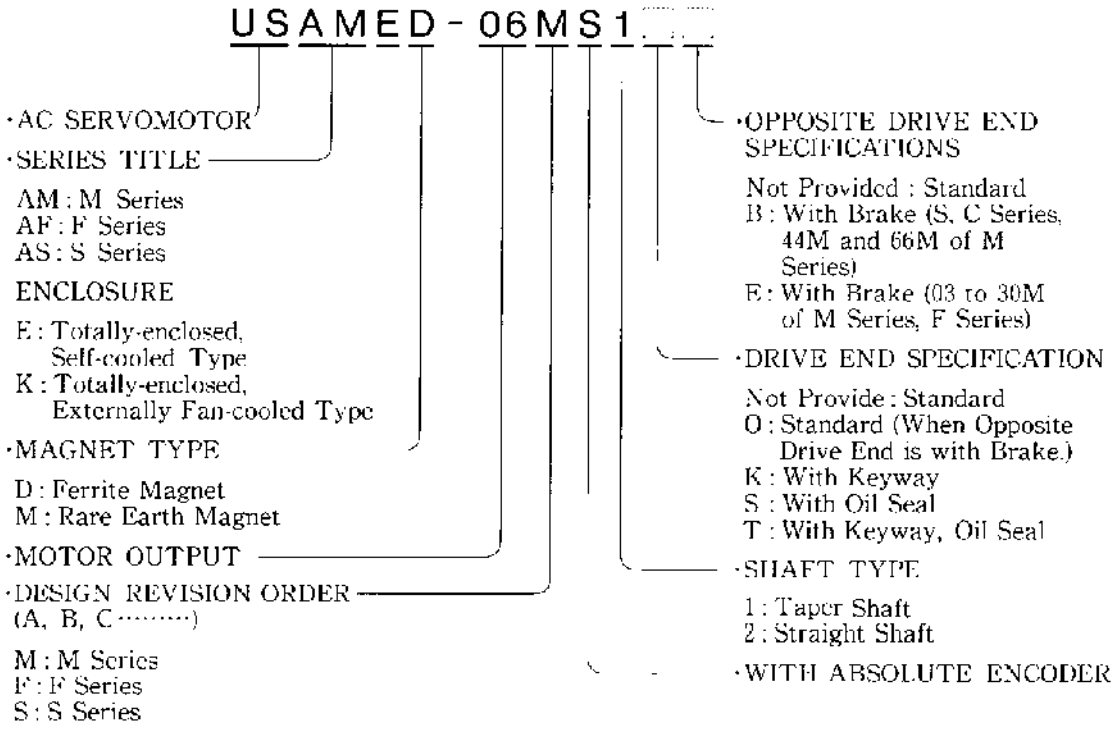
Output kW	Supplied by Yaskawa		Not Supplied by Yaskawa			Supplied Yaskawa
	Servomotor USAMED-*3	Servopack CACR-	Motor plug	Plug	Brake plug	PG Cable*4
0.3	03MS2S 03MS2T 03MS2SD 03MS2TD	SR03TZ6SM	Type*4 D···MS3106A18-10S (D190) N···JA06A-18-10S-J1	Type*4 D···MS3106A20-29S (D190) N···JA06A-20-29S-J1	Type*4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

* 1 Servopack is provided with receptacles Ⓐ, Ⓜ, Ⓑ.
* 2 Plug type at cable side.
* 3 Motor type :
  □S: MS2S – Straight shaft, without brake; □T: MS2T – With keyway
  □S: MS2SD – Straight shaft, with brake; □T: 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□

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4.4 AC Servomotor

4.4.1 Type



*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

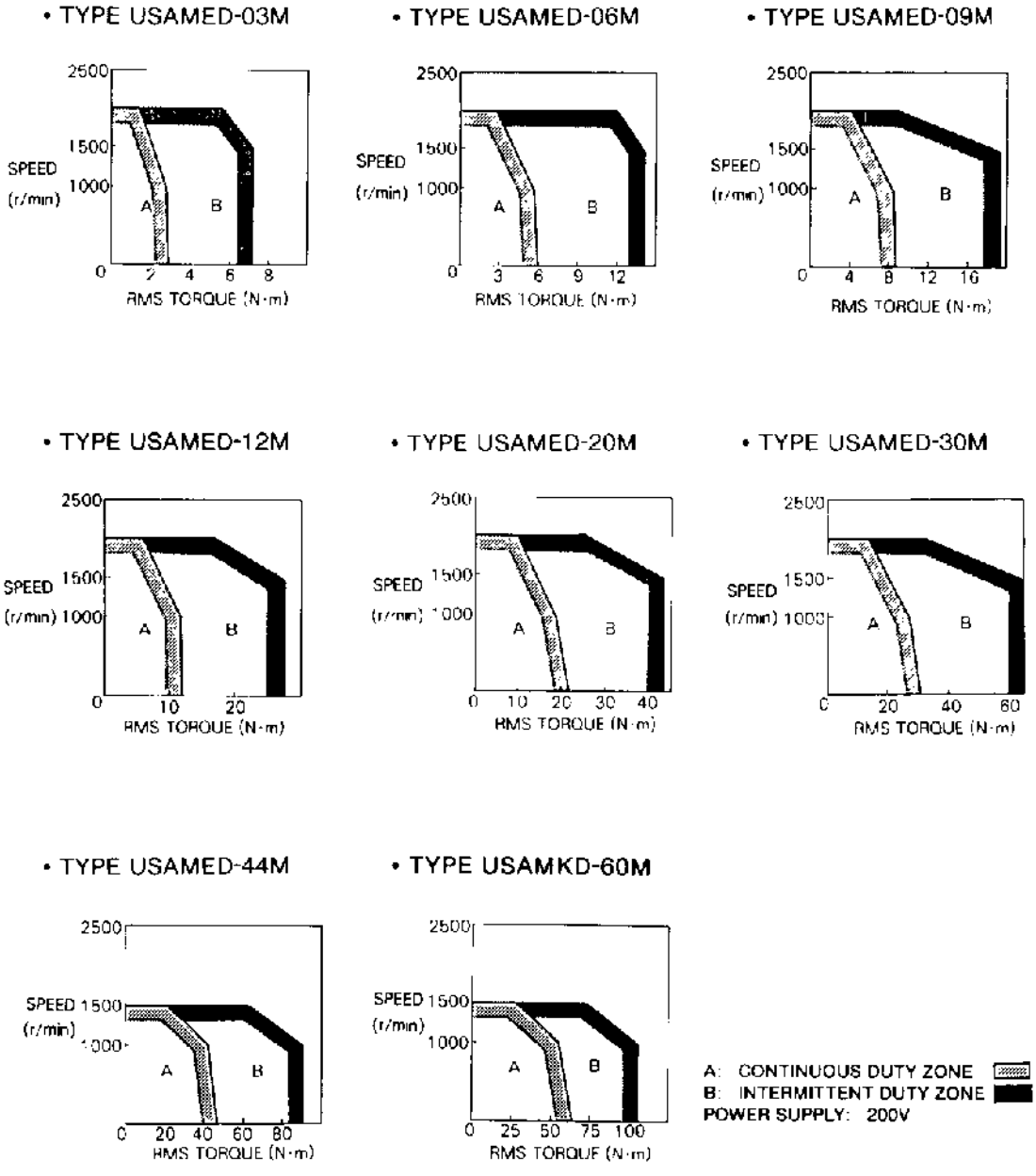
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4.4.2 Characteristics and Functions

(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

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(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.

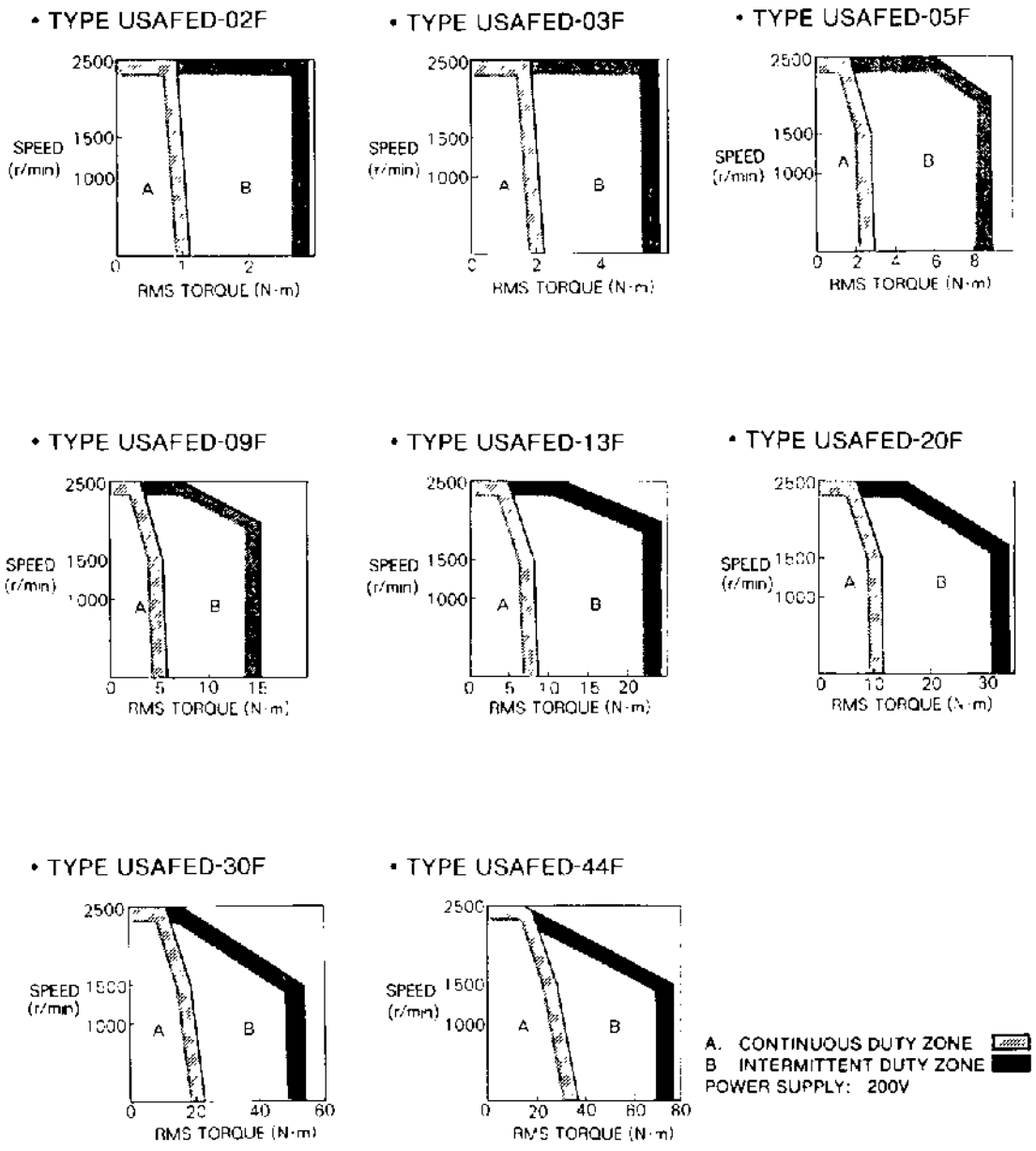


Fig. 4.81 Torque speed Characteristics of F Series Motor

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(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).

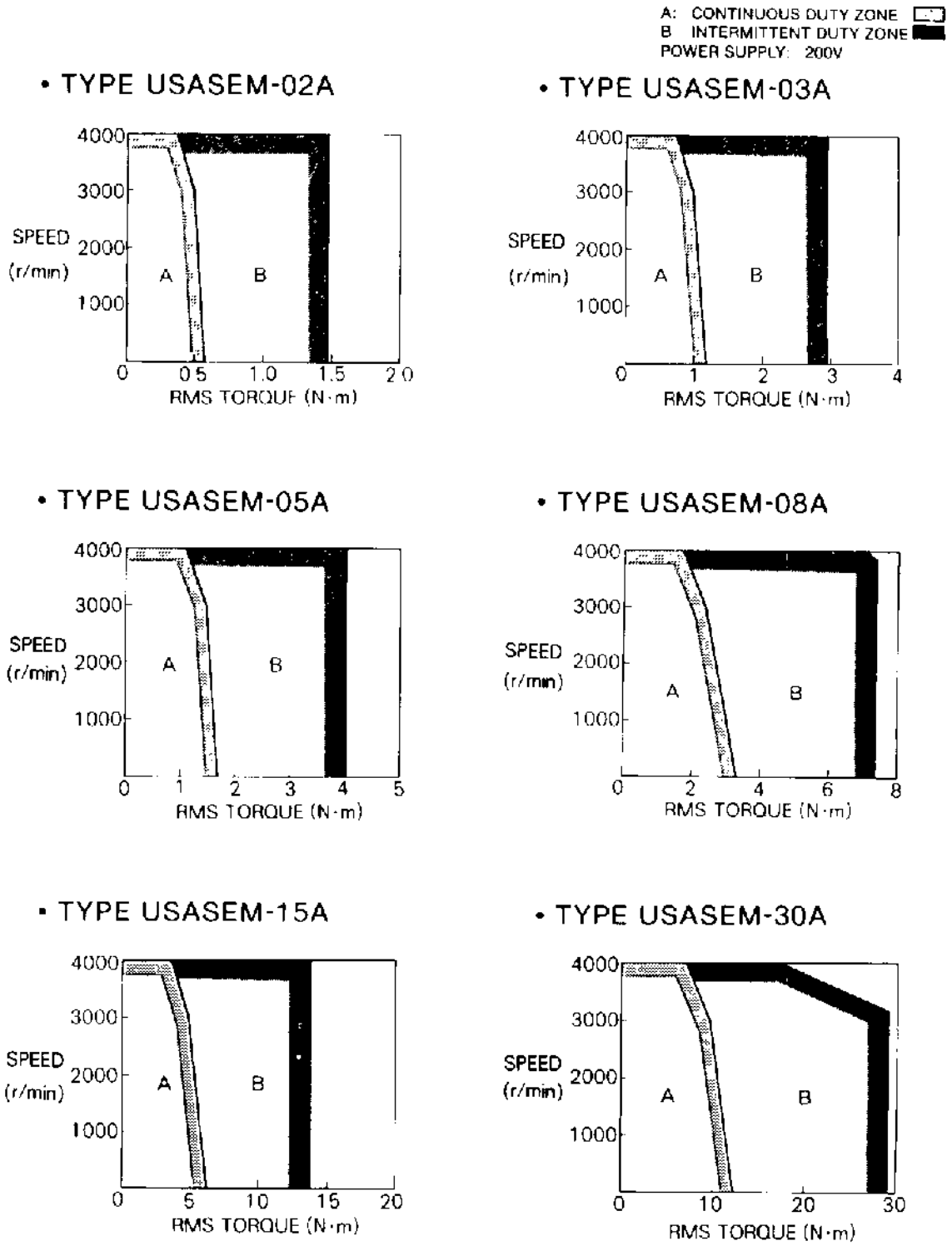


Fig. 4.82 Torque-speed Characteristics of S Series Motor

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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.

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