SIE-C880-1.2B
DESCRIPTIVE INFORMATION

YASKAWA ELECTRIC

YASKAWA PROGRAMMABLE MOTION CONTROLLER

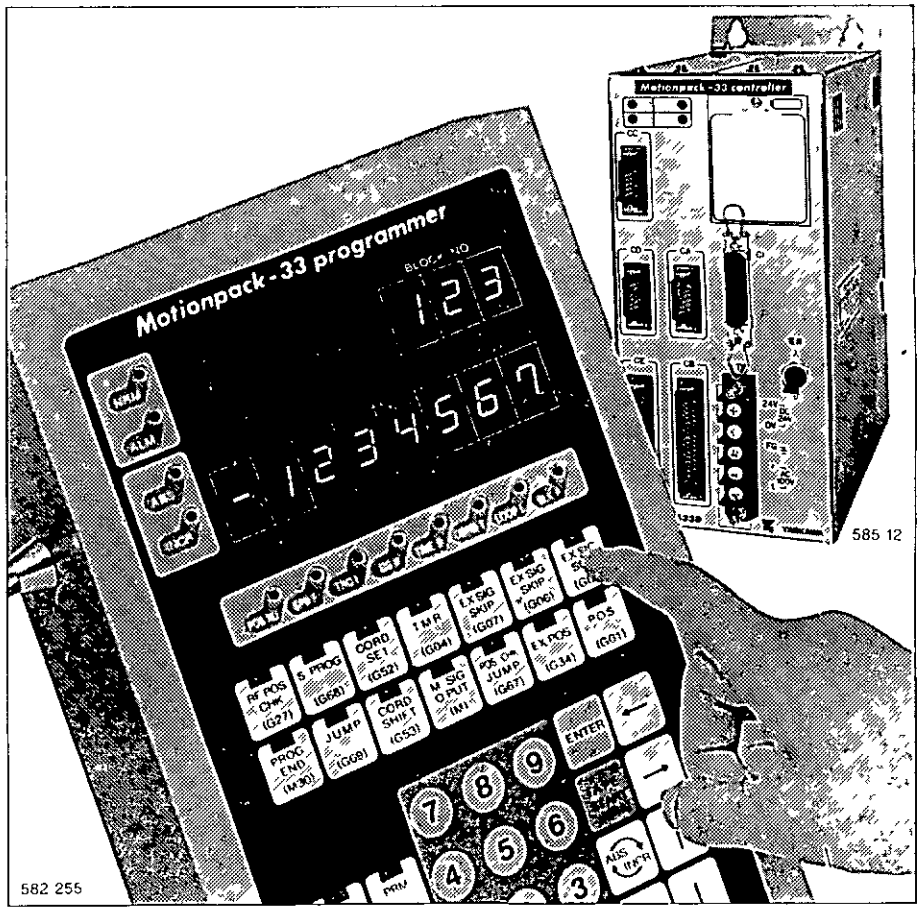
Motionpack™-33

FOR FEED AND POSITIONING OF MACHINE TOOL

USER'S MANUAL

Motionpack-33 is an easy-to-stored program controller designed for feed and positioning control at machine tool operations. It is combined with DB unit, DC servomotor, and its controller Servopack as a basic motion control system.

This manual contains system configuration, functional description of and connections between the system components, and operation, programming, and maintenance instructions. For detailed operation and adjustment, refer to Motionpack-33 Setup Manual (TOE-C788-1 3)



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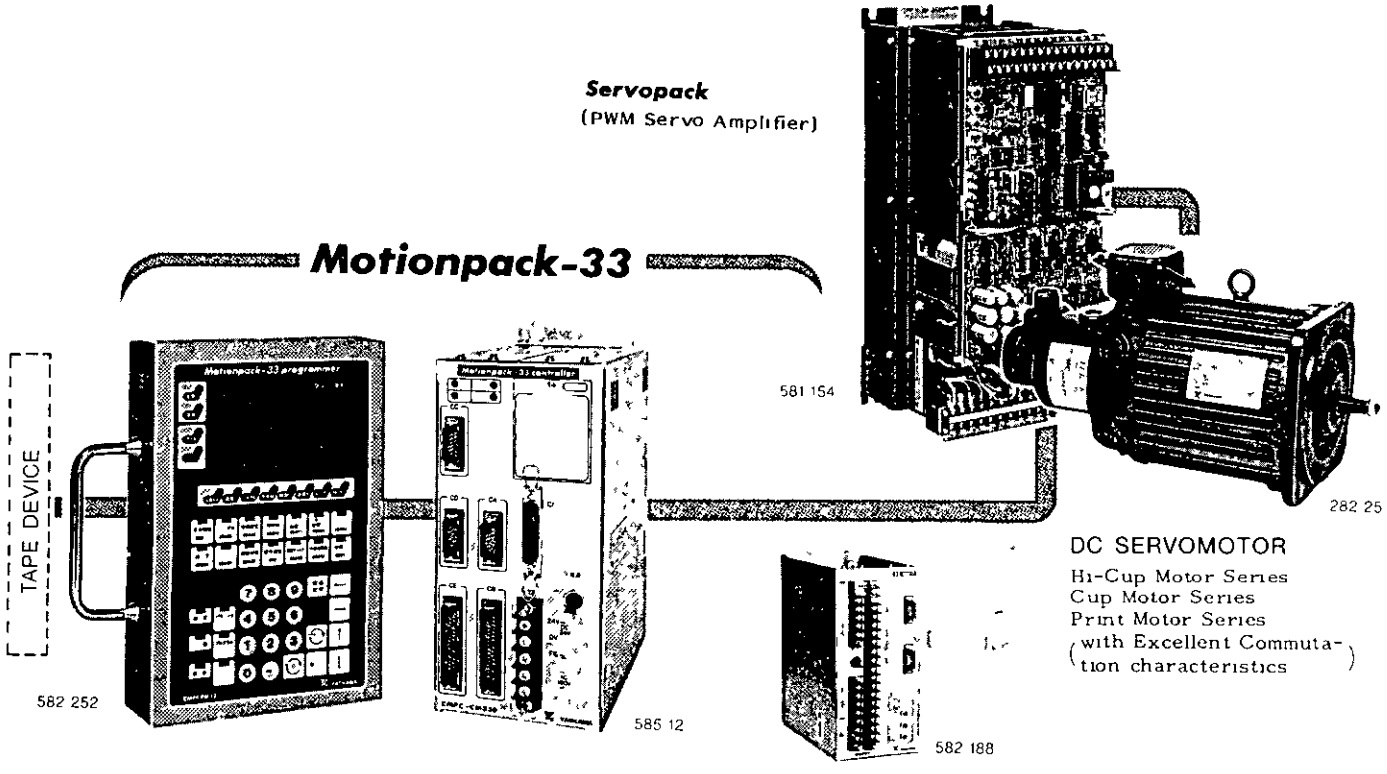
1. INTRODUCTION

Yaskawa Motionpack is a stored program controller designed for feed and positioning control at machine tool operations The part programs stored in the Motionpack executes the operation in the response to the input from the programmer, or the associated host computer, establishing an automatic production line

Motionpack-33, in combination with DC servomotors and Servopack offers compact, low-cost, high-reliability features, and is an easy to maintain single axis feed and position control system with high operation flexibility Motionpack-33 is designed for joint use with a high-level computer or with a programmable controller It has no data processing functions, no machine sequence control functions It has large data areas for feed control and positioning control

With the feed and positioning control made intelligent, Motionpack-33 is capable of numerical control over a wide range of low end actuators in manufacturing systems to serve as a very useful tool in establishing an automatic but flexible manufacturing system In addition, Motionpack-33 is a versatile feed and position controller for machine tools, industrial machines and many other precision manufacturing functions



Typical Drive System Using Motionpack-33

2. Motionpack-33 SYSTEM

This chapter describes the Motionpack-33 system and its component unit

2.1 FEATURES

Motionpack-33 is an intelligent, single-axis, feeding/positioning controller which incorporates a microprocessor and LSIs Its basic function is control positioning of ordinary machines Control of speed and torque is combined with positioning control

Motionpack-33 has the following advantages for more flexible application than with ordinary, single-axis, NC machines

(1) Torque control function

All motion commands can control torque devices This function enables the following (when the Servopack and the CPCR-MR series are used)

(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 It is possible to get a signal indicating excessive reaction (current limited) if the CPCR-MR□□CT series is used with Servopack. That signal permits to detect failure of the drive system

(2) 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-33, 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

(3) Varying methods of returning to home position

To return the machine to home position, it is possible to select methods of returning to home position by parameter from common method of using home position pulses of a position sensor, a method using a fixed position sensor, or permitting the machine to stop at the end of the stroke by reducing torque This enables suiting the system to varying positioning devices

(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) Trouble-free programming with individual function keys and guiding LEDs

The special Programmer (CMPF PM33C/D) permits programming through a language-based keyboard Programming is made even easier with function keys and guidance with LEDs

(8) Separation between the sequence control area and the motion control area for use as FMS control elements

The sequence control section has been removed from the motion control section to provide more flexibility in the organization of control tools for FMS

2. 2 Motionpack-33 SYSTEM CONFIGURATION

Fig 2 1 shows Motionpack-33 drive system for one-axis feeder and positioning servomotors

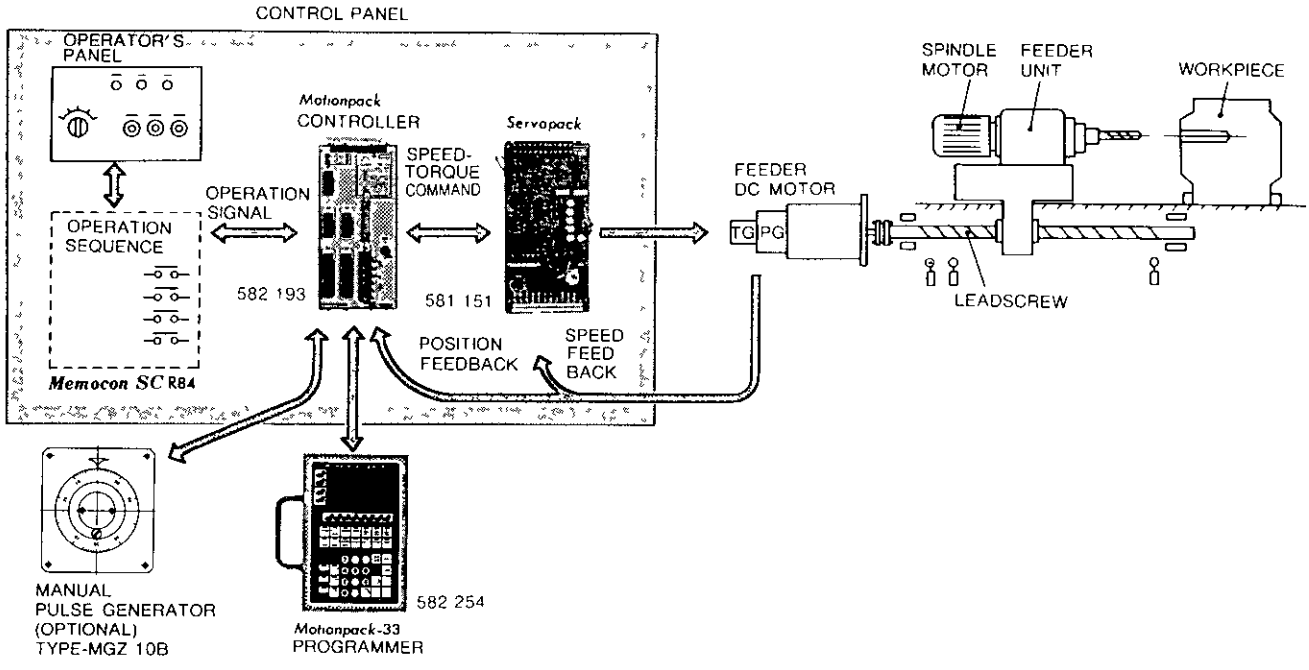


Fig 2 1 Motionpack-33 System Configuration

DC SERVOMOTORS

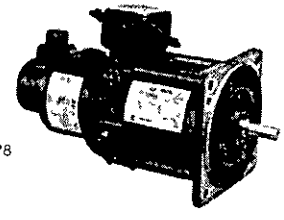


Fig 2 2

Mechanical Driver for Feeding and Positioning

The renowned YASKAWA DC servomotor series offers motors of optimum performance for a wide range of specified applications Hi-Cup motor series, Cup motor series, Print motor series, and Minertia motor J series, Mini series, RM series, and AC Servomotors

The modular servomotors incorporating an optical tachometer for position detection, and a tachometer generator for speed detection, are available in compact units

Servopack

Fig 2 3

DC Servomotor Speed Control Amplifier

Wide speed control range by the PWM control mode

Stable feed control and accurate positioning at speed commands from Motionpack-33 controller

Controls armature current of the DC servomotor thru input torque commands from Motionpack-33 controller

Motionpack-33 CONTROLLER

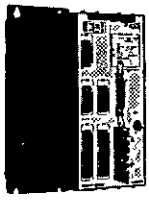


Fig 2 4

The "Brain" of the Motion Control System

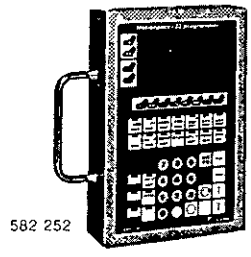
Up to 400 blocks of feeding and positioning commands can be stored

Operated by control signals from programmable controller, etc

2.2 Motionpack-33 SYSTEM CONFIGURATION (Cont'd)

Motionpack-33 PROGRAMMER

Fig 2 5



Editing Operation Programs and Displaying System States

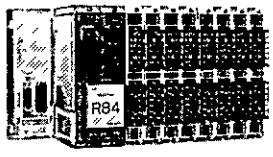
Easy program editing process by the LED guide system

Unused during DC servomotor operation

Convenience in maintenance with the display of Motionpack-33 system states

Memocon-SC R84

Fig 2 6



Sequence Control of Machine and Operatior

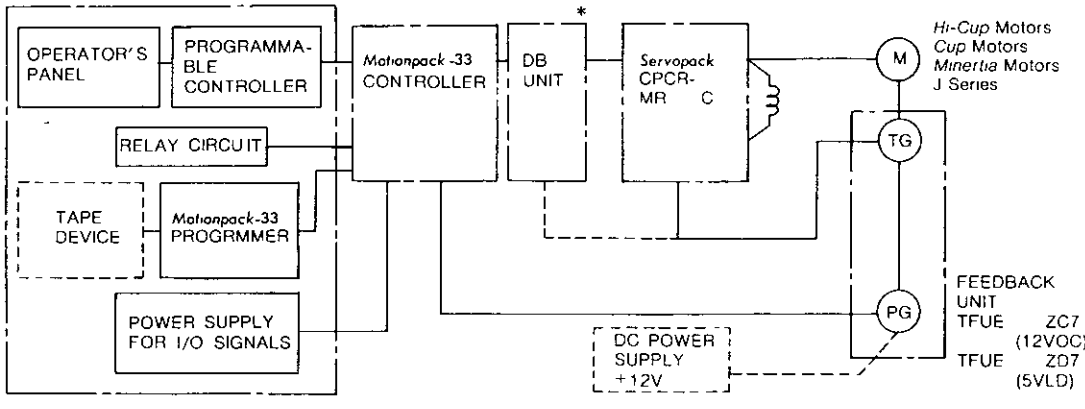
Easy system design and maintenance

2.3 BLOCK DIAGRAMS OF Motionpack-33 DRIVE SYSTEMS

Fig 2 7 to Fig 2 12 show the Motionpack-33 drive systems for types of DC servomotors The vertical axis of a driven machine will drop when power is off or servo clamp is released To hold the machine axis, drive motors require braking function For combination with AC servomotor, refer to para 11

2.3 1 Hi-Cup MOTORS, Cup MOTORS, AND Minertia MOTORS J SERIES

(1) Large-capacity (Servopack Type CPCR-M08C or above)



*DB unit functions

Dynamic braking for emergency stop

Signals for base-off function and P drive command

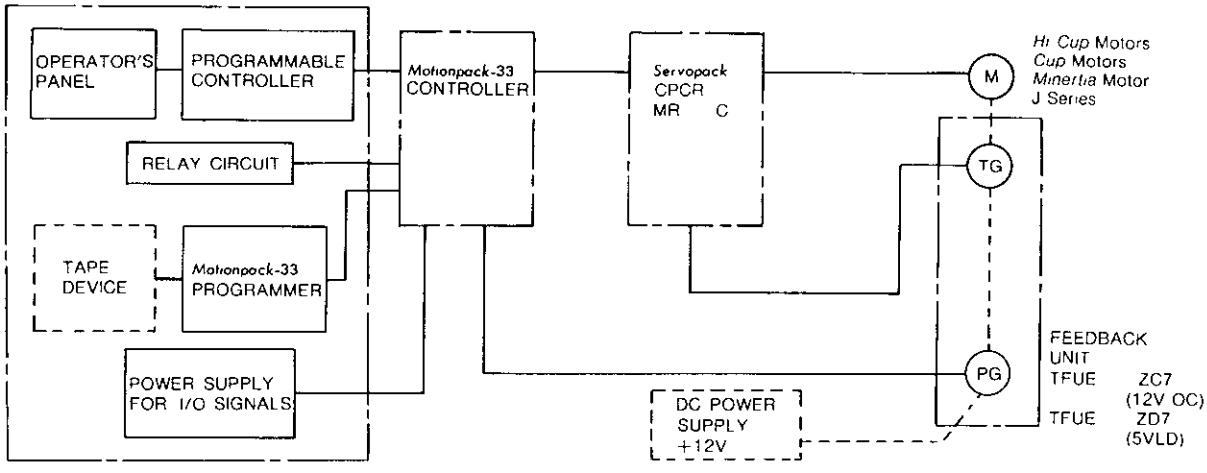
CL detection prohibition

DB unit VR permits (1) torque limit setting and (2) dwell time setting
Motionpack system does not use them
Torque limit is controlled by Motionpack-33 controller output signal Making functions (1) or (2) in external circuits can construct a system without DB units

Note For applied circuits, refer to par 10 2 1 for circuits with DB units, and par 10 2 2 for circuits without DB units

Fig 2 7 Use of Servopack Type CPCR-M08C or above

(2) Small-capacity (Servopack Type CPCR-MO8C or above)

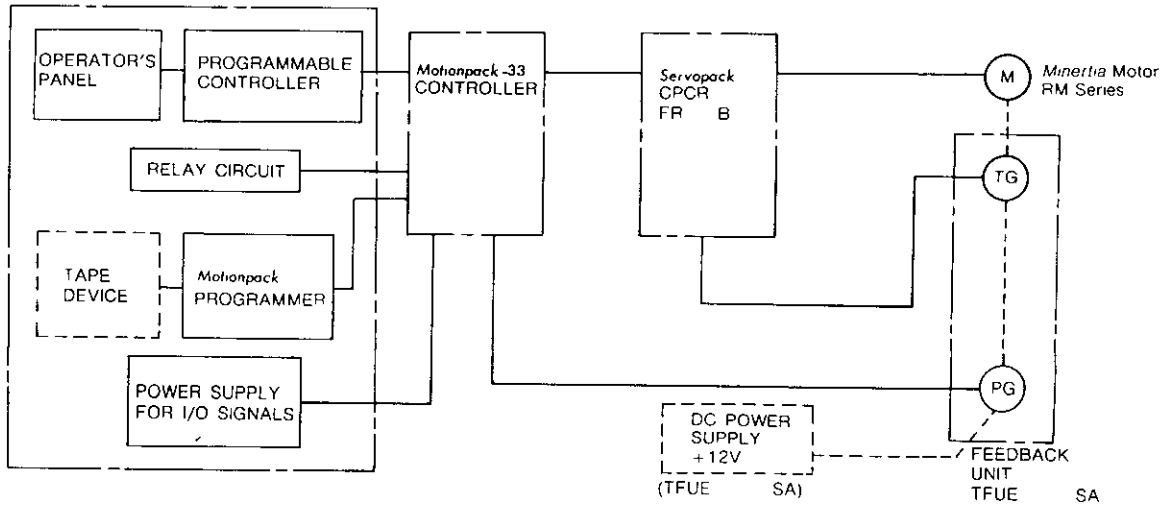


Note For applications see par 10 2 3

Fig 2 8 Use of Servopack Type CPCR-M08C or below

2 3.2 Minertia Motor RM SERIES

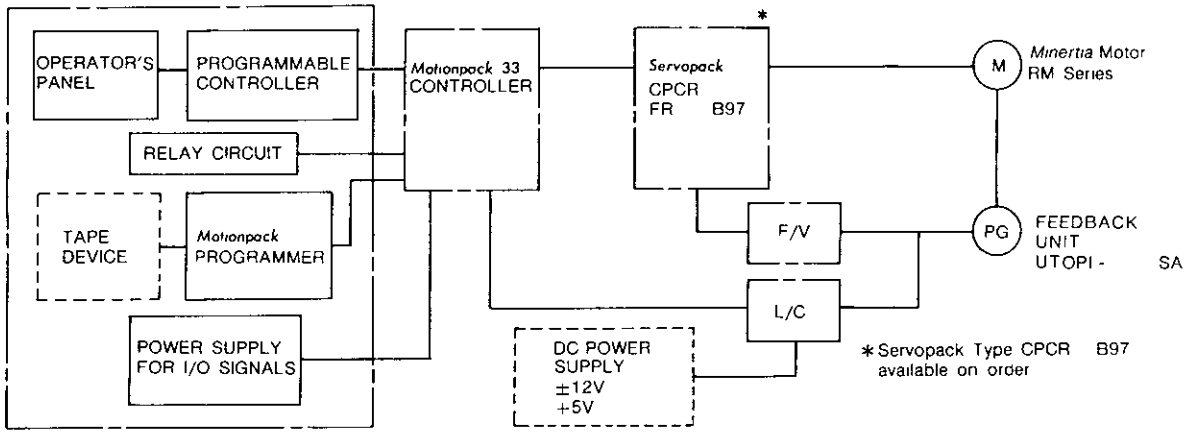
(1) With Feedback Units



Note For applications, see par 10 2 4

Fig 2 9 With Feedback Unit

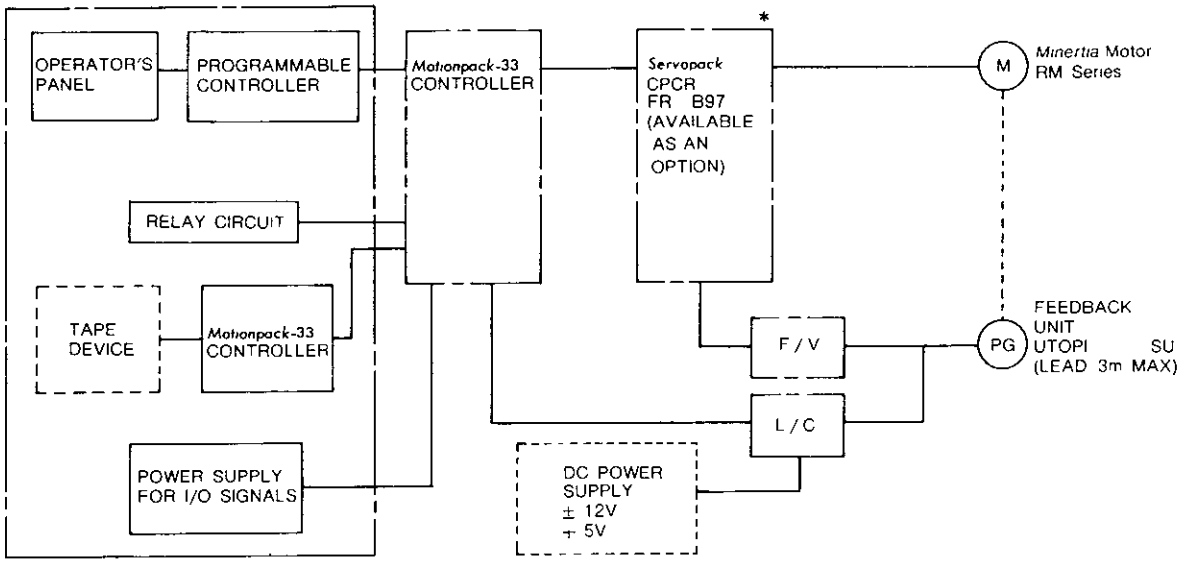
(2) With 12 V PG (Type UTOPI- [illegible] SA)



Note For applications, see par 10 2 5

Fig 2 10 Use of 12V Pulse Generator Type UTOI-[illegible]SA

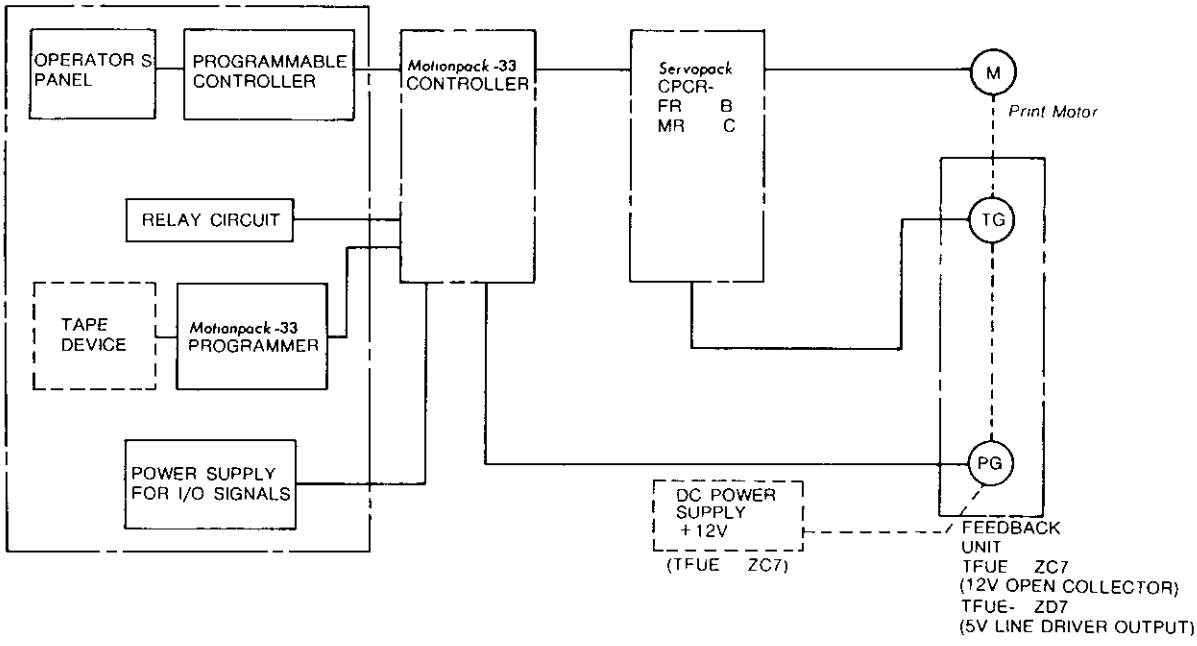
(3) With 5 V PG (Open collector Type UTOPI-SU)



Note For applications, see par 2 5

Fig 2 11 Use of 5V Pulse Generator (Open Collector Type UTOPI-SW)

2. 3. 3 Print MOTOR



Note For applications of Type MR, see par 10 2 3 and for Type FR, see par 10 2 4

Fig 2 12 Use of Print Motor

2. 4 SPECIFICATIONS OF Motionpack-33 SYSTEM COMPONENTS

2. 4. 1 Motionpack-33 CONTROLLER TYPE CMPC-CM 33 D

2. 4 2 Motionpack-33 PROGRAMMER TYPE CMPF-PM 33 C/D

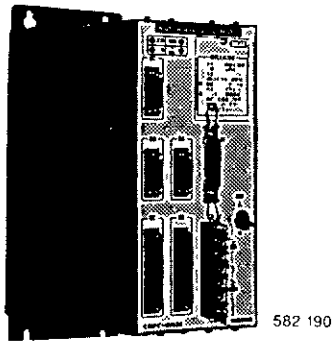


Fig 2 13 Motionpack Controller Type CMPC-CM 33 D

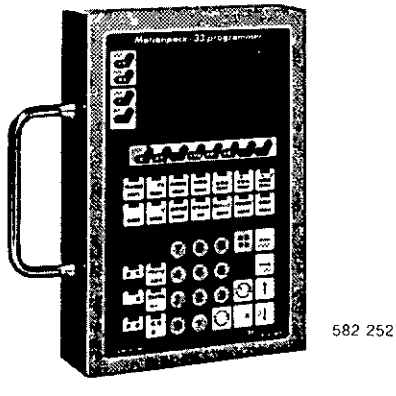


Fig 2 14 Motionpack Programmer Type CMPF-PM 33 C/ D

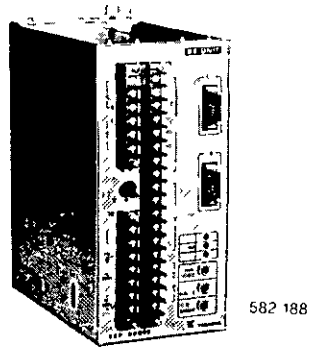


Fig 2 15 DB Unit Type JESP-DB 002

2. 4. 1 Motionpack-33 CONTROLLER TYPE CMPC-CM 33D

Table 2 1 Motionpack-33 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	300 kpps at 4-multiplier (18 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
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	Several Modes Available by Parameters
Main Input Parameters	Command unit, detection unit, speed command unit, stored stroke limit, acceleration/deceleration, position loop gain
Servomotor	YASKAWA DC Servomotors
Servo Amplifier	Servopack Model CPCR-MR C, CPCR-FR , A
Position Detector	Phase A/B, origin pulse
Ambient Temperature	Operational 0 to 60°C, Storage -20 to +85°C relative (No condensation)
Power Supply	Single phase, 100VAC (85-120V) 50/60 Hz, 25VA
Vibration	In compliance with JIS* C0911
Location	Protected from corrosive gases, dust, metallic particles, moisture, and high temperature
Grounding	Grounding resistance 100Ω max
Weight	3 6 kg

* Japanese Industrial Standard

2. 4. 2 Motionpack-33 PROGRAMMER TYPE CMPF-PM 33 C/D

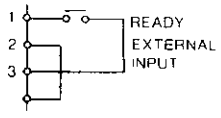
Table 2 2 Motionpack-33 Programmer Specifications

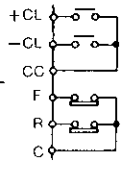
Function	(1) Program writing and edition (2) Parameter writing and changing (3) Operation state display (4) Controller error display (5) I/O state display (6) Position error/current position display (7) Program/parameter display (8) Commanded position display (9) Controller communication (10) Paper tape I/O
Connection with Tape Device	RS232C interface Baud rate setting of 110, 300/ 1200/ 2400 by parameter code ISO
Environmental Conditions	The same as Motionpack-33 controller Exception Operation temperature 0 to 50°C
Power Supply	100VAC (85 - 120V) 50/60Hz 20VA
Weight	2 3 kg

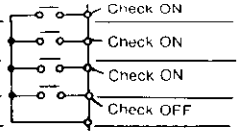
2 4 3 DB UNIT TYPE JESP-DB002

Table 2 3 DB Unit Specifications

Item			Terminal	Signal Type	Rating, Specification
Power Supply	Input	Voltage	ⓡ - ⓣ		Single phase, 50/60Hz, 200/220VAC±10%
		Capacity			20VA
		Voltage	Ⓡ - Ⓣ		Single-phase 50/60Hz, 200/220VAC±10%
		Capacity			50VA
	Control Output Power	+12V	⊕12 - ⓪		+12 VDC ±0 5V, +20mA
		-12V	⊖12 - ⓪		-12 VDC ±0 5V, -20mA
Built-in Function	Emergency stop Dynamic Brake		Ⓐ - Ⓑ		Forward, reverse independently braked Built-in brake resistor 2 Ohms
	[Torque Limit] Adjustable range		⊕		0 to +8 0 V
			⊖		0 to -8 0 V
	[Delay Time Setting] Adjustable Range				0 1 to 4 0 sec
	DB Stop, Base Cutoff, P-action Operation Conditions				READY signal, Servopack alarm disable signal Terminal (R)-(T) ON signal, Operating when one overtravel detection signal is missing
	CL Detection inhibited				Speed command 0 → ±6V rise time, for approx 2 seconds detection inhibited
Input Signal	TG Signal		TG 1 - 2	DC Voltage	7V/1000 rpm
	READY		READY 1	Contacts	+24 VDC output
			READY 2		0V
			READY 3		Relay coil, +voltage input
			READY 4	Common	Relay coil, -voltage output
	Control Signal		REF	DC Voltage	Speed command signal input, ±6 0V/1000 rpm
			SGOV		
			+CL	Contacts	Forward run torque command inhibit, +12V → 10mA
			-CL		Reverse run torque command inhibit, -12V ← 10mA
			CC		Common
	Overtravel		OT F	Contacts	Forward run Overtravel signal +24V ← 40mA
			OT R		Reverse run overtravel signal +24V ← 40mA
			OT C		Common
Output Signal	Control Signal		OTF	Contacts	Forward, DB action check
			OTR		Reverse, DB action check
			CL		Current limit check
			ALM		Servopack alarm check
			COM		Common
					* Contact capacity 100VAC, 2VDC
Display	Power Supply				Display of control power supply on (green)
	Torque Restriction				Display of torque restriction on (green)
	Dwell				Display of set dwell time out (green)
Conditions	Operation Ambient Temperature				-10 to +60°C
	Storage Temperature				-40 to +70°C
	Humidity				85% max (no water condensation)
Structure					Box, base-mounted
Weight					4 8 kg



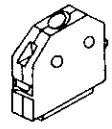
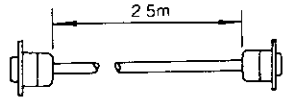
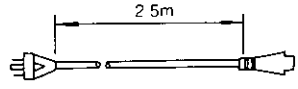
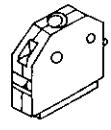




2.4.4 ACCESSORIES

Table 2 4 lists the accessories for Motionpack-33 controller, programmer, and DB unit

Table 2 4 Lists of Accessories

	Part Name	Q'ty	Sketch	Type, Capacity	Applicable Unit
1	MR Connector	3		MR-20F (with MR-20L) (HONDA TSUSHIN)	Motionpack controller (CMPC-CM33)
2	MR Connector	2		MR-50F (with MR-50L) (HONDA TSUSHIN)	
3	Signal Cable (J2)	1		(YASKAWA ELECTRIC)	Motionpack programmer (CMPF-PM33)
4	Power Cable (J3)	1			
5	MR Connector	2		MR-20F (with MR-20L) (HONDA TSUSHIN)	DB Unit (JESP-DB002)
6	Connector Name Tag (NP)	1	Be sure to apply to the connector, provided by user		

2 4 5 Servopack-Servomotor COMBINATION

List of combinations of Servopacks and servomotors are shown in Table 2 5 for reference of selection The following points should be considered before selection

(1) Current limit function is not provided with Servopack Type CPCR-FR For this function, use Type CPCR-MR

(2) Yaskawa detectors should be used as a rule If the pulse generator of the company except Yaskawa is used, contact Yaskawa representative

(3) Transmission distance of detectors is limited If application requires the longer distance shown in Table 2 5, contact Yaskawa representative

(4) DB unit cannot be connected to small-sized Servopack Type CPCR-FR and CPCR-MR01C to MR07C or AC Servopack

(5) DB circuit can be arranged by resistor and contactor without DB unit Refer to Bulletin (TSE-C717-12)

(6) For combination of Servopack and AC servomotors, refer to para 11

Table 2 5 Combination of Servopack and Servomotor

Servomotors		Servopack			Detectors				
					Feedback Unit		PG + TG	Optical Encoder	
		CPCR-MR CT	CPCR-MR C	CPCR-FR B	TFUE- ZD7	TFUE- ZC7		UPOPI- SA	UPOPI- SU
Hi-Cup Motor (Non-standard) Type UGHMED- YT		○					○		
		○					○		
Hi-Cup Motor (Standard) Type UGHMED			○		○				
			○			○			
Cup Motor (Standard) Type UGCMED			○		○				
			○			○			
Minertia Motor Series Type UGJMED			○		○				
						○			
Minertia Motor Mini Series Type UGTMEM				○					
				○ †				○ †	
				○ ‡					○ ‡
Minertia Motor RM Series Type UGRMEM				○			TG TG-7S¹V, ○PG UTOPI- SA		
				○ †				○ †	
				○ ‡					○ ‡
			○*				TG TG-7S¹V, ○PG UTOPI- SA		
Print Motor Type PMES			○			○			
				○		○			
Function	External Current Limit	○	○		5 V balanced output (line driver)	12 V transistor open collector output		12 V transistor open collector output	5 V Transistor output
	Current Limit	○	CPCR-MR CL -H		5 V power supply built-in Motion-pack.	12 VDC external power supply required		12 VDC external power supply required	5 V power supply
Transmission Distance					25 m max	10 m max		10 m max	3 m max

* Servopack Type CPCR-MR CY26, protective circuit unit Type JESP-PT L

† Servopack Type CPCR-FR B97, level converter Type JASPD-LC010, F/V converter Type JASP-FV010

‡ Servopack Type CPCR-FR B97, level converter Type JASPD-LC001 , F/V converter Type JASP-FV002 -

§ Type IFUE- SA as feedback unit

2 4 6 POWER SUPPLIES (PROVIDED BY USER)

Power supplies for I/O signals and for 12 V optical encoders must be provided by the user Power supplies should be capable of supplying regulated voltages and performance assured in the operating temperature range of the Motionpack (0° to 60°C)

Examples of power supply units are shown below These units or equivalent, should be used

(1) Power supply unit for PG

Feedback unit Type TFUE- ZC7 and optical encoder Type UPOPI- SA require 12V power supply The user should select the power supply which covers the following specifications

Table 2 6 Power Supply for PG

Type		DC Stabilized Power
Output Voltage		12 VDC
Output Voltage Adjustable Range		12 V ± 10%
Output Current		200 mA for a single PG
Ripple Noise		120 mV max
Output Voltage Stability		± 3% max
Power Failure Back-up Time		30 ms
Overcurrent Protection		Required
Temperature Range	Storage	- 5°C to + 60°C
	Operating	- 20°C to + 80°C
Humidity		30 to 85% Relative
Insulation Voltage		1500 VAC for 1 minute 500 VDC 1MΩ

Model AYS 1201
Maker Shin Dengen Electric Manufacturing Co , Ltd
Input 100VAC (50/60Hz)
Output 12VDC, 1A

(2) 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 2 7

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

Table 2 7 DC Power Supply

Input Voltage		100/110 VAC ±10% 50/60 Hz
Rated Voltage		24 V
Rated Current*		2A/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

Model BY242R5
Maker Shin Dengen Electric Manufacturing Co , Ltd
Input 100 VAC, 50/60 Hz
Output 24 VDC, 2 5 A

For dimensions, see para 8 6

2 4 7 TAPE DEVICE

Programs and parameters can be input and output through tape reader/punch, if connected, of 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

3. Motionpack-33 CONTROLLER TYPE CMPC-CM33D

3.1 OPERATION OF CONTROLLER TYPE CMPC-CM33D

Motionpack-33 controller Type CMPC-CM33D (CM33D) is the central unit of the Motionpack-33 system It incorporates an 8-bit micro-computer It reads-in motion signals and program select signals, decodes them, and delivers speed and torque references to Servopack, to perform motion control

3.1 1 CIRCUITRY OF CM33D

Fig 3 1 shows a block diagram of CM33D All input/output signals are isolated photoelectrically to assure performance under adverse operating conditions

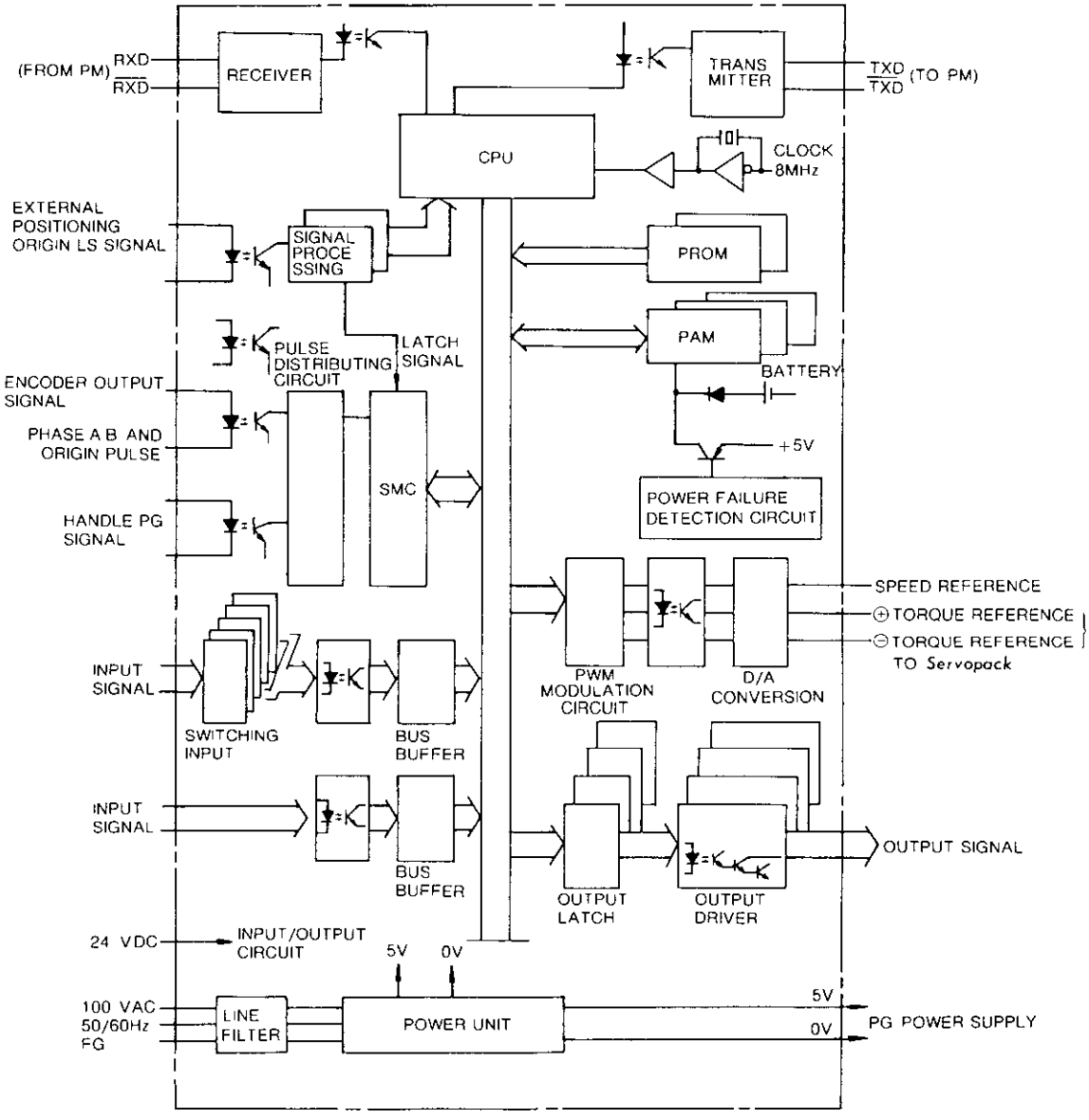


Fig 3 1 Functional Block of Motionpack-33 Controller

3.1.2 CONTROL OF CM33D

Fig 3 2 shows the control block of CM33D Hardware is shown by double boxes and software with single boxes The CM33D 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

(1) Speed reference voltage

The speed reference voltage is rated at 6 V according to the ratings of Servopack The stored program generates an automatic acceleration/deceleration curve and data 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 D/A converter converts it to analog voltage. VR shown at the output expresses a function of software Pr42 sets number of lag pulses at rated output of ±6 V

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

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

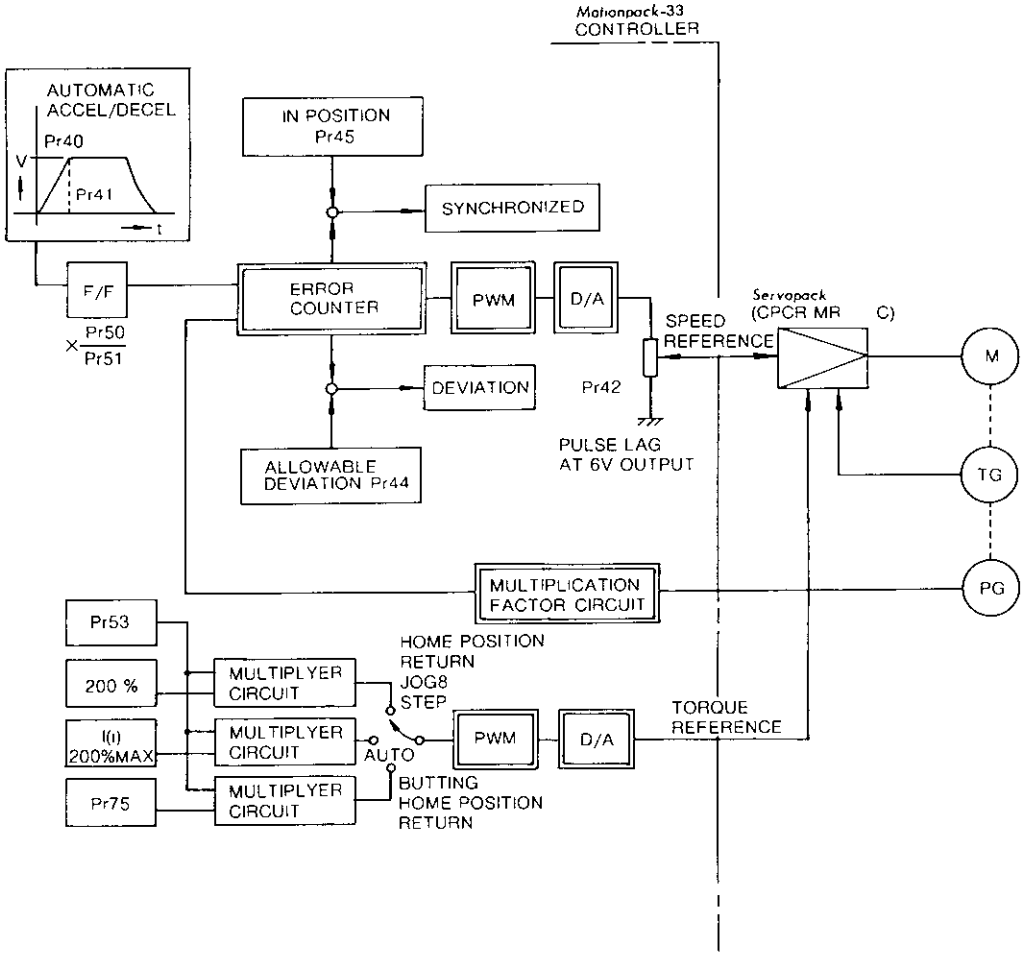


Fig 3 2 Control Block of Motionpack-33 Controller

(2) 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 and returns to the origin It is the value of "I" programmed during automatic operation and the value of Pr 75 during return to origin Actually the value multiplied by a torque ratio (Pr53/100) is output as the torque reference

Torque reference data undergoes pulse-width modulation (PWM) and D/A conversion before becoming analog signals of 0 to ±8 V The rotary switch, drawn at the input of PWM, means that software switches torque reference as operating mode changes over JOG, return to origin, and automatic operation The torque reference is effective only when Servopack Type CPCR-MRC is used

Fig 3 3 shows the flow in the program of the CM33D When power comes on, irrespective of machine condition, an INITIAL program executes in the CM33D to convert parameters, initialize internal data, and preset counters

SEQUEN executes after INITIAL SEQUEN will execute repeatedly except during interrupt described below CLOCK runs, interrupted by pulses of 2-msec intervals which are generated by dividing the clock pulse of the CM33D The programs of TIMER through DRIVE, shown in Fig 3 3, execute as triggered by an interrupt occurring every 10 msec SEQUEN starts when execution (started by interrupt) comes to an END

Table 3 1 summarizes major functions of the programs

Table 3 1 Major Functions of Programs

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

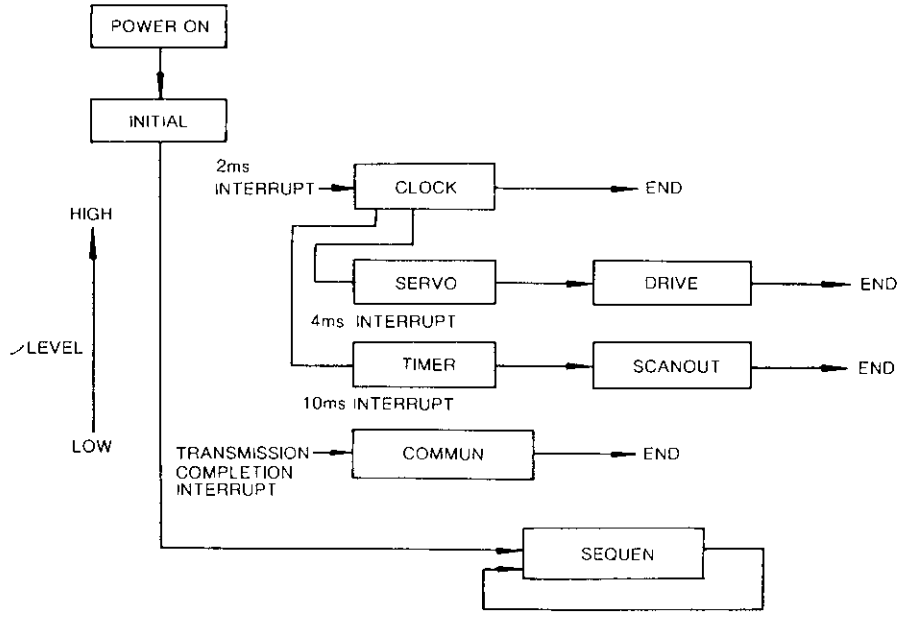


Fig 3 3 Software Flow

3. 2 Motionpack-33 CONTROLLER I/O SIGNALS

Fig 3 4 Shows the I/O Signals of Motionpack-33 Controller (CM33D)

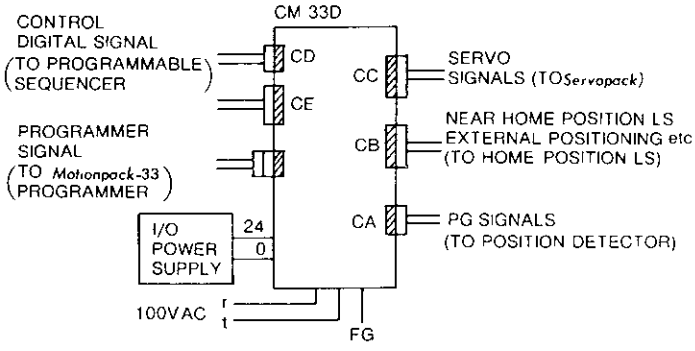


Fig 3 4 Input/Output Signals

3.2.1 DIGITAL INPUT CONTROL SIGNALS (CONNECTOR CE)

(1) Specifications of the signals

The signals of connector CE are classified into two groups

(a) Scan-read signal

This type of signal enters through varying channels scanned by software It comes from the machine (or sequencer) to the Motionpack-33 controller and the specifications are as follows

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

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

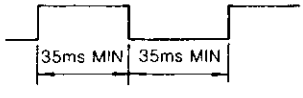


Fig 3 5

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

$\Delta e \leq 2\ 0$ V (at 10 mA)

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

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

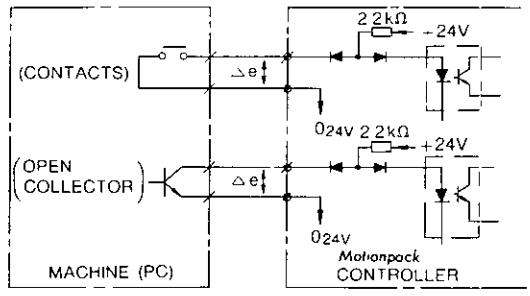


Fig 3 6

This type of signal enters through channels (,0 to ,4) Fig 3 7 shows the timing

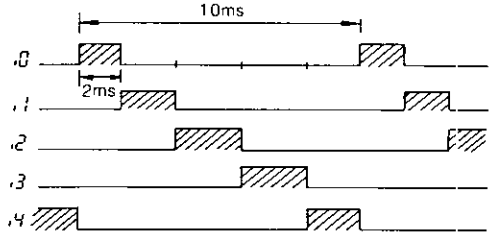


Fig 3 7

The signal SEL (see Fig 3 8) is 24 V in a selected channel and it is separated from the power line in an unselected channel, so that signal of the selected channel alone will be read-in It repeats cyclically at intervals of 4 msec

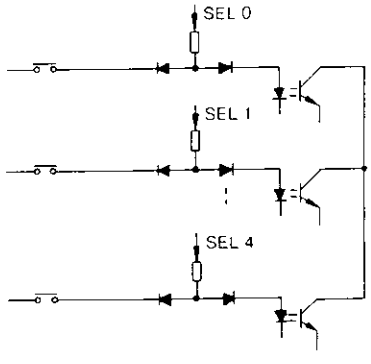
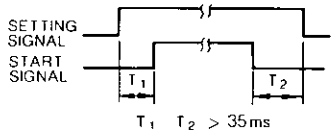
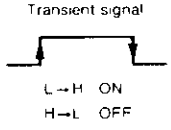
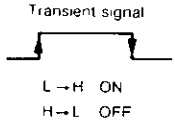
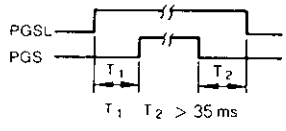
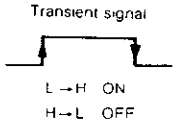
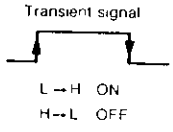
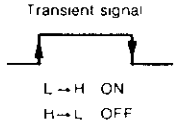
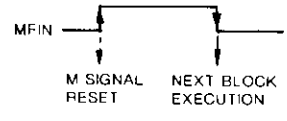
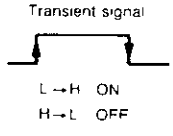


Fig 3 8

(b) Individually read signal

This type of signal does not come in from varying channels

Table 3 2 Motionpack Input Signal Characteristics

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

Note

1 The set signals must be entered 35 msec or more before a start signal turns on This is necessary for the Motionpack to read in the signal

2 The Program Select signal (PG SL) must be ON before the Program Start signal (PGS), if used to start turns on

3 Only the Override signal (OVR) one of the speed setting signals, may change at any time Speed changes as soon as OVR varies

4 The Error Reset signal (ERS) is a transient signal and effective only after an error has occurred ERS only resets the error status and the signal (ZPM) indicating completion of return to origin but does not affect any other operation

3 2.1 DIGITAL INPUT CONTROL SIGNALS (CONNECTOR CE)

(2) Input signal connections

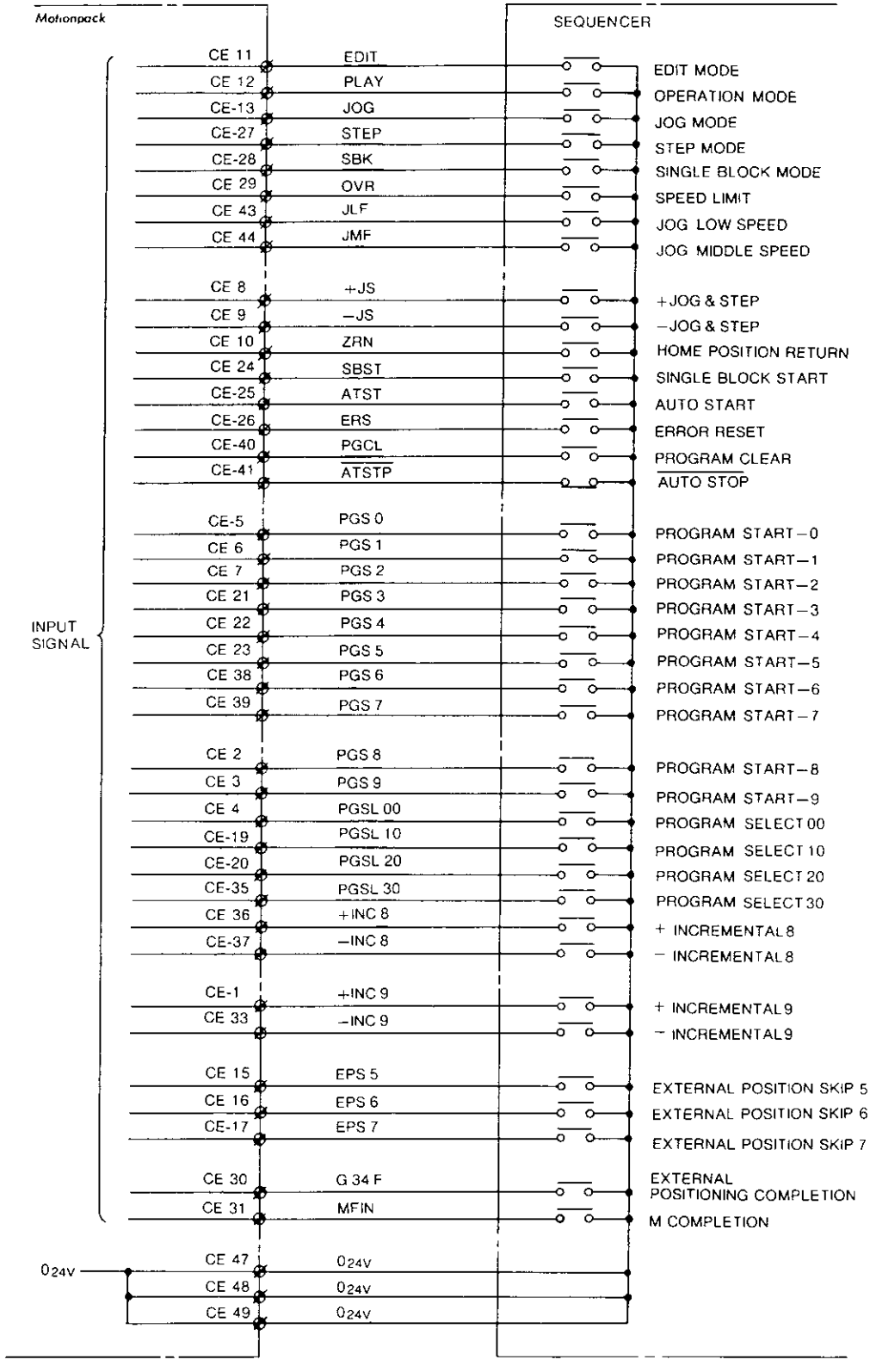


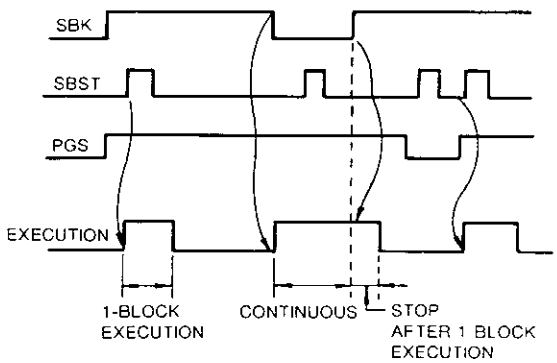
Fig 3 9

(3) Functions of input signals

Mode	Signal Name	Function and Timing
EDIT Mode	EDIT (Scan reading-in 10-0)	Sets Motionpack controller in EDIT mode with EDIT signal ON, and permits writing and editing of programs and parameters with Motionpack programmer JOG, STEP, HANDL, and AUTO operations cannot be made but servo clamp is effective
PLAY Mode	PLAY (Scan reading-in 10-0)	Sets Motionpack controller in any mode of JOG STEP, HANDL, or AUTO depending on the states of the JOG and STEP signals Enables JOG, STEP, HANDL, or AUTO Operation, and returns to origin Programs and/or parameters cannot be written through the programmer but status can be displayed
JOG Mode	JOG (Scan reading-in 10-2)	Selects any of the below listed operation modes with combination of JOG and STEP signals, when PLAY signal is ON JOG / STEP / Operation Mode ON / OFF / JOG OFF / ON / STEP ON / ON / HANDL OFF / OFF / AUTO When a JOG signal is received (turned ON) during AUTO operation, the motion stops after deceleration The program block under execution is cleared and output signals change as follows (1) The following output signals are turned off (a) In-operation (STL) (b) M decodes (M51 - M56) (c) Home position return completion (ZPM) (d) External positioning alarm (EPAL) (e) External positioning alarm (G34) (f) Automatic operation completion (M30) (g) NC alarm (stored limit over only) (2) The following output signals maintain their states (a) Motionpack ready (RDY) (b) Battery alarm (ALM2) (c) Near home position (ZNP)
STEP Mode	STEP (Scan reading-in 10-3)	See description for JOG mode
SINGLE BLOCK Operation	SBK (Scan reading-in 10-4)	When a single-block mode signal is turned on, the machine stops after completing the execution of the current block, and the control data enters the single-block operation mode When a single-block start signal (SBST) is turned on in this state, the machine executes the next block and then stops When the single-block operation signal is turned off, the execution of the program is restarted, regardless of an SBST signal, and the program is executed continuously

3. 2. 1 DIGATAL INPUT CONTROL SIGNALS (CONNECTOR CE) (Cont'd)

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

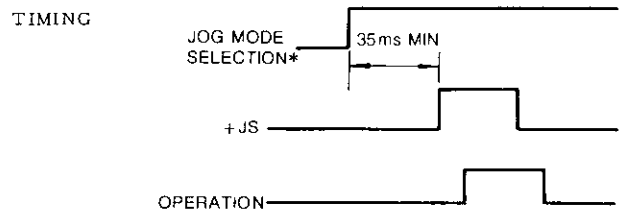
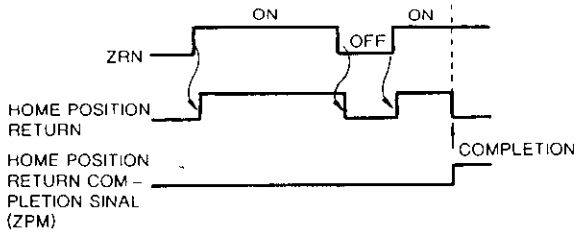
When the single-block operation mode signal is clea ed after the comple-tion of one program, a subsequent program start (PGS 0 - 9) signal will start the program
 
</td></tr>
<tr><td>SPEED LIMIT</td><td>OVR
(Scan reading-in 10-5)</td><td>Determines the speed set by parameter PIO as maximum when OVR signal is ON When OFF, the maximum speed is set as prog ammed</td></tr>
<tr><td>JOG at Middle Speed

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

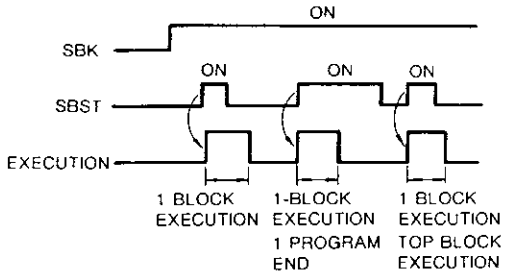
<table>
<tr><th rowspan="2">JMF</th><th rowspan="2">JLF</th><th>JOG Mode</th><th>STEP Mode</th><th>HANDL Mode</th></tr>
<tr><th>JOG Feedrate*</th><th>STEP Distance†</th><th>Pulse Multiplication Factor</th></tr>
<tr><td>OFF</td><td>OFF</td><td>Stop</td><td>←</td><td>←</td></tr>
<tr><td>OFF</td><td>ON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

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

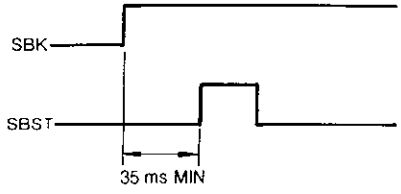
(1) In JOG mode
While +JS signal is ON, the machine slide moves in the plus direction, through the distance set by JMF (middle speed) or JOG (low speed) Turning off the signal decelerates the machine to a stop</td></tr>
</table>

Mode	Signal Name	Function and Timing
+JOG & STEP (Cont'd)	+JS (Scan reading-in I1-0)	(2) In STEP mode When the signal is changed from OFF to ON Motionpack starts the operation in the STEP operation mode The distance for STEP is set by Pr5 to Pr7 and selected by JLF and JMF signals  *Turn ON +JS at least 30 ms after JOG (or STEP) mode and JOG speed or (STEP distance) have been selected
-JOG & STEP	-JS (Scan reading-in I1-1)	The same as for +JOG & STEP operation mode except for movement in minus direction
Return to Home Position	ZRN (Scan reading-in I1-2)	Starts the Home Position Return operation When ZRN signal is turned on Motionpack starts the Home Position Return operation When Motionpack detects that ZRN signal changed to OFF, it decelerates the machine to a stop It will keep the machine stopped until the signal is turned on When the signal turns on, Home Position Return operation is resumed On completion of Home Position Return, the machine will be kept motionless at home position even if the signal is kept ON However, if it is turned OFF and ON, Home Position Return operation is performed again The signal is effective when MP alarm (ALM 1) is not operated Home Position Return can be performed in JOG, STEP, and AUTO modes  Types B and C interrupts operation when ZRN signal turns on In AUTO mode, Home Position Return starts when start signal turns off In STEP mode, Home Position Return starts on completion of operation block Before starting Home Position Return, stop the operation On completion of home positon return, programs are cleared
Single Block Start	SBST (Scan reading-in I1-3)	Start signal in single-block operation mode When a single block mode (SBK) signal is turned on the machine stops after completing the execution of the current block and the control enters the single-block operation mode If an SBST signal is turned on after the completion of a program, the top block is executed

3 2 1 DIGITAL INPUT CONTROL SIGNALS (CONNECTOR CE)

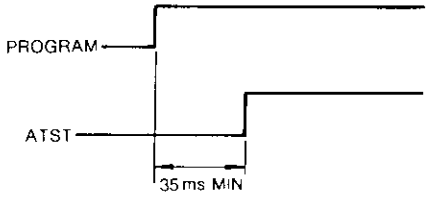
<table>
<tr><th>Mode</th><th>Signal Name</th><th>Function and Timing</th></tr>
<tr><td>Single Block Start (Cont'd)</td><td>SBST
(Scan reading-in 11-3)</td><td> 

When program start signals (PGS 0 to 9) are turned off, SBST signals are ineffective

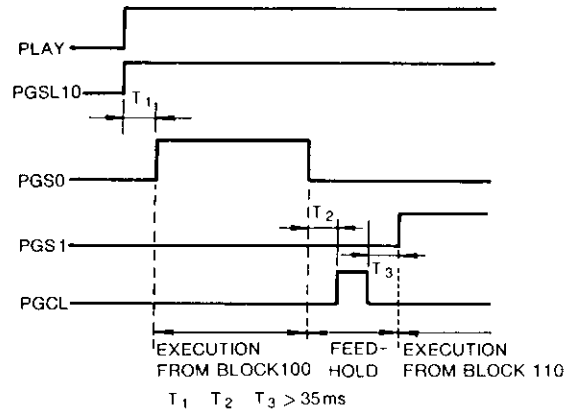
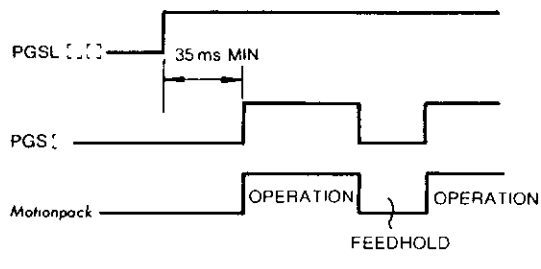
TIMING
 

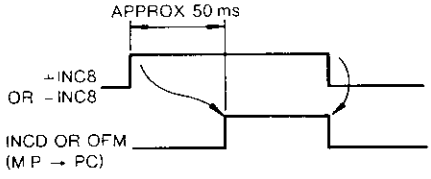
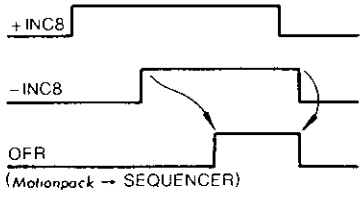
Turn on SBST signals 35 ms after the Single-Block Operation mode is selected</td></tr>
<tr><td>Auto Operation</td><td>ATST
(Scan reading-in 11-4)</td><td>Motionpack executes programs when ATST signal is ON after specifying the block to be executed by program start signals (PGS 0 to PGS 9) and program select signals (PGSL 00 to PGSL 30) in AUTO operation mode

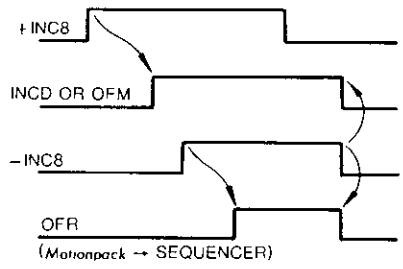
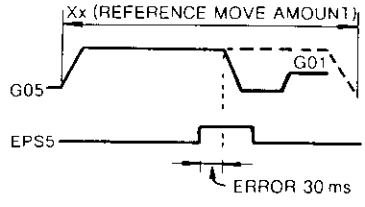
In this case, the automatic stop ($\overline{\text{ATSTP}}$) signal should be turned on If the automatic start signal (ATST) is not used as program start signal, connect it to 0 V

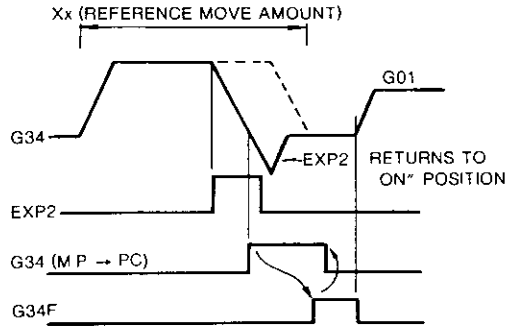
Turn ATST signal on 35 ms or more after AUTO operation mode is selected and program block to be executed is specified</td></tr>
<tr><td>Alarm Reset</td><td>ERS
(Scan reading-in 11-5)</td><td>Turning on ERS signal resets MP alarm (ALM 1) output</td></tr>
</table>

Mode	Signal Name	Function and Timing
Program Clear	PGCL (Scan reading-in 11-6)	PGCL signal is effective when the program start signal is turned off (FEEDHOLD STATE) during the execution of a program When this signal is turned on, the program returns to the top of the current block When the next program start signal is turned on, the program will be started from the top When an incremental command is specified at the top of the program, the motion after Program Clear execution may differ from that mentioned above TIMING 
Automatic Stop	$\overline{\text{ATSTP}}$ (Scan reading-in 11-7)	Program operation stop (feedhold state) signal for automatic start (ATST) Connect I/O power to 0 V when not in use
Program Start	PGS0 to PGS9 (Scan reading-in 12-0 to 12-7 13-0, 13-1)	Start signal in AUTO mode One of PGS0 to PGS9, when turned ON, designates the ten digit of the start block number It also works as the start signal of AUTO operation The hundred digit of the start block number is designated by turning on one of PGSL00 to PGSL30
Program Select	PGSL00 to PGSL30 (Scan reading-in 13-2 to 13-5)	The machine decelerates and stops (feedhold state) if PGS0 to PGS9 turn OFF during AUTO operation Execution restarts when they turn ON The timing of the signals PGSL00 and PGS0 is shown below 

Mode	Signal Name	Function and Timing
Program Select (Cont'd)	PGSL00 to PGSL30 (Scan reading-in 13-2 to 13-5)	The following requirements must be met for signals PGSL00 and PGS0 (1) PGS0 should not be duplicated A program executed by PGSn may be switched to another PGSn in the following cases Alarm Err nSEI appears in other cases (a) After PGSn has turned OFF, with execution of the current program completed, and M30 executed (b) After returning to the top of the blocks to be executed the next time and the Program Clear signal (PGCL) turns ON in the feedhold state (2) Only one PGSL00 should be ON when PGS0 turns ON Err nSEL appears if no, or a duplicated PGSL00 is ON The Motionpack starts a program after checking PGSL00 and other starting conditions when it has detected the rise (from L to H) of PGS0 At that time only one PGSL signal must be present (3) PGS0 and PGSL0 must not change during execution of a program Err nSEL appears if M30 executes and PGS0 or PGSL00 changes before the Run Signal (STL) disappears
+Incremental Command 8 -Incremental Command 8	+INC8 -INC8 13-6, 13-7	When +INC8 or -INC8 turns on an increment (set with parameter Pr20) will be added to (or subtracted from) the offset register 8 corresponding to the coordinate number 8 (T8) This is executed in AUTO mode and not during travel If +INC8 and -INC8 turn on simultaneously, offset register 8 will be cleared to zero An Offset +/- Max signal (OFM) will be output if the contents of offset register 8 are equal to or greater than offset +/-max (set with parameter Pr21) after addition to the tool offset register by +INC8 or -INC8 or otherwise a +/- increment end signal (INCD) will be output  If +INC8 and -INC8 are on simultaneously offset register 8 will be cleared to zero with offset zero signal (OFR) output (1) When -INC8 turns on before the end signal (INCD or OFM) of +INC8 is output 

Mode	Signal Name	Function and Timing
+Incremental Command 8 -Incremental Command 8 (Cont'd)	+INC8 -INC8 13-6, 13-7	(2) When -INC8 turns on after completion signal of 
+Incremental Command 9 -Incremental Command 9	+INC9, -INC9 (Scan-reading-in 14-0, 14-1)	Same as +INC8 and -INC8 except that these correspond to the coordinate number 9 (T9) +INC8/-INC8 +INC9/-INC9 Coordinate number 8 (T8) ---> Coordinate number 9 (T9) Offset register 8 ---> Offset register 9 Correction made at a time Pr20 ---> Pr22 Maximum correction Pr21 ---> Pr23 +/- increment end signal INCD (common) Offset zero OFR (common) Offset +/- max OFM (common) Refer to the description of +INC8/-INC8 for details of the functions
External Position Skip 5	EPS 5 (Independent reading-in 15-0)	If EPS5 turns ON during feed with a G05 command, the tool decelerates and stops then goes to the next block 
External Position Skip 6	EPS 6 (Independent reading-in 15-1)	Skip signal for G06
External Position Skip 7	EPS 7 (Independent reading-in 15-2)	Skip signal for G07
External Position Completion	G34F (Independent reading-in 15-4)	Fin signal that clears the "external positioning end" output signal (G34) of the Motionpack and advances the program to the next block If an external positioning alarm signal (EPAL) is output from the Motionpack, G34F input clears the signal EPAL When G34F turns OFF, the program advances to the next block

ɔITAL INPUT CONTROL SIGNALS (CONNECTOR CE) (Cont'd)

Mode	Signal Name	Function and Timing
Exteranl Position Completion (Cont'd))	G34F (Independent reading-in 15-4)	 Note Response delay from EXP2 "ON" to "ON" position memorized is 50 μs
M Completion	MFIN (Independent reading-in 15-5)	The signal that clears the M decode outputs (M51-M56) and advances the program to the next block When signal MFIN turns on, the M decode outputs are cleared When MFIN turns off after that, the program of the next block starts

3.2.2 DIGITAL OUTPUT CONTROL SIGNALS (CONNECTOR CD)

(1) Specifications of the signals

The signals coming from the Motionpack-33 controller to the machine (or sequencer) must meet the following requirements

① The output capacity is 24 VDC and 100 mA or less

② Output is non-contact

③ Non-contact output needs protection as follows

(a) When the load is inductive, be sure to connect a spark killer in parallel to and within 20 cm of the load. Never connect the spark killer in the reverse polarity for the Motionpack controller will be broken

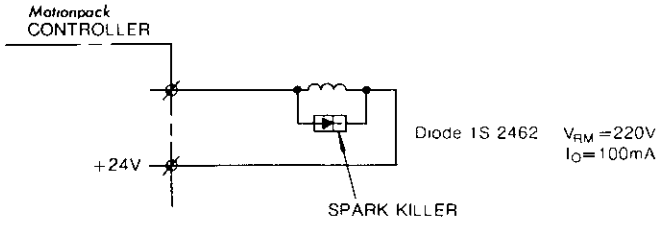


Fig 3 10 Connections of Spark Killer

(b) When the load is a lamp, insert a preheating resistor and do not permit the ratings to be exceeded even when a rush current flows

Let the preheating resistor limit the current flowing through the lamp to 20-30% of the lamp rating Sample calculation
Sample calculation

Preheating resistor R
Lamp rated current I Lamp

$$R = \frac{24\,V}{(0.2 \text{ to } 0.3)\,I\,Lamp}$$

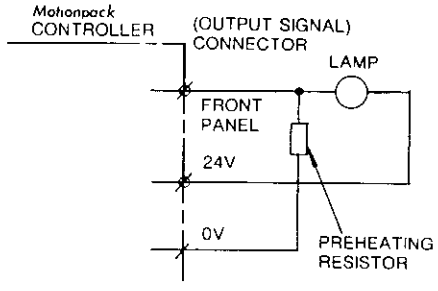


Fig 3 11

(2) Output signal connections

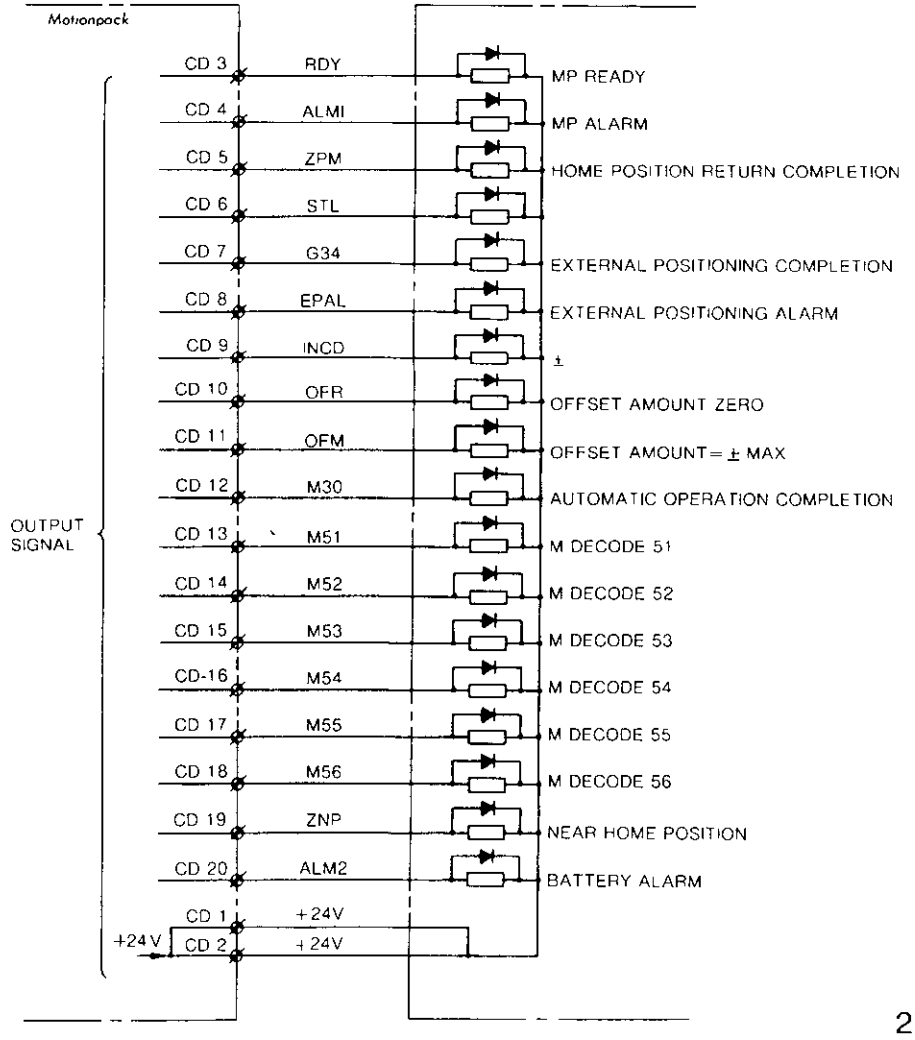
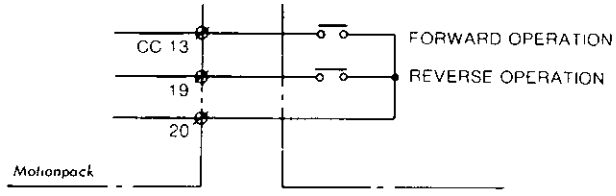
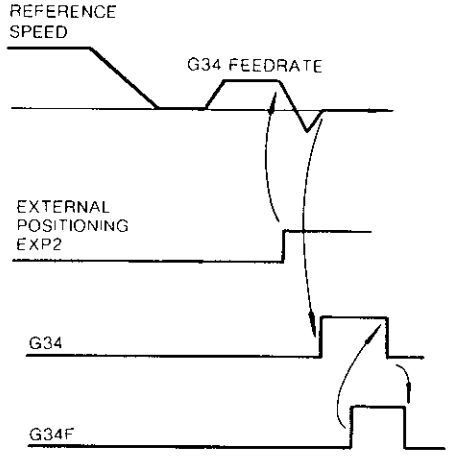
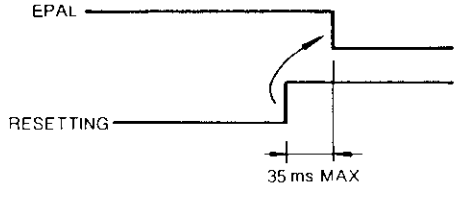


Fig 3 12

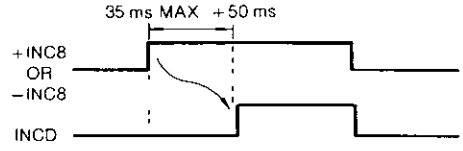
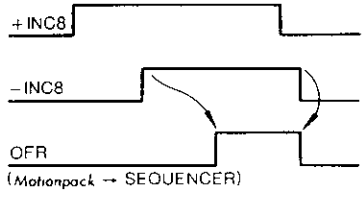
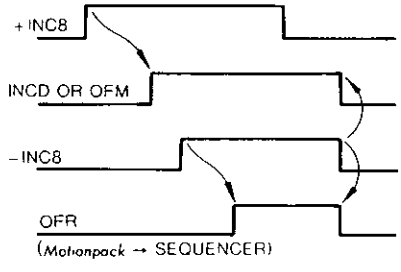
3.2.2 DIGITAL OUTPUT CONTROL SIGNALS (CONNECTOR CD) (Cont'd)

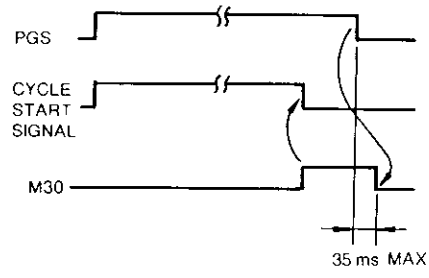
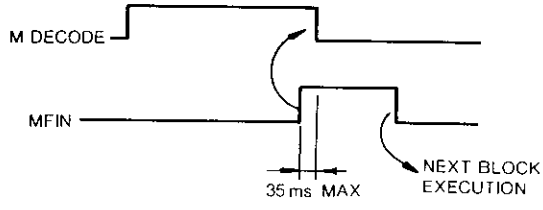
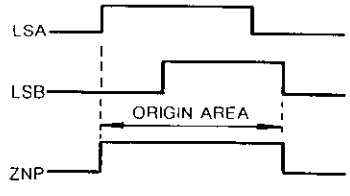
(3) Functions of output signals

Output Signal	Symbol	Function and Timing
MP Ready Completion	RDY	This signal indicates that the Motionpack is ready to receive commands from a high-order controller (such as a sequencer) RDY is output (ON) under the following conditions ① The Motionpack is operating properly "Good" indication is ON ② The Motionpack is in any of AUTO, JOG, STEP, or HANDLE modes Signal PLAY = ON signal EDIT = OFF ③ The servo main circuit power is ON and the servo circuit is good { signal SAL $\overline{SAL}$ (CC-7) = ON signal $\overline{OTF}$ (CC-13) of $\overline{OTR}$ (CC-19) = ON } --→ $\overline{SAL}$ ($\overline{OTF}$ + $\overline{OTR}$) = ON ④ When all of the above conditions (① through ③) are met, RDY output = ON
MP Alarm	ALM 1	Alarm output of the Motionpack system For alarm conditions indicated by ALM1, refer to Appendices 2 and 3 beginning on page 128 The error reset signal ERS resets ALM1
Home Position Return Completion	ZPM	This turns ON upon completion of return-to-origin and turns OFF under the following conditions ① Mode has changed ② Power is OFF ③ The return-to-origin signal has turned ON ④ The error reset signal ERS has turned ON when MP ALAM1 is ON ⑤ The emergency stop (servo power OFF both signal OFF (CC-13) and the signal OTR (CC-19) are OFF) If home position return has a wait position positioning is completed at the wait position
In Operation	STL	STL indicates that Motionpack-33 is operating automatically It is ON during programmed operation or single-block operation It does not turn OFF even when the program start input signal turns OFF (feed-hold state) STL turns OFF under any of the following conditions ① The program clear signal (PGCL) is ON ② Mode has changed ③ Execution of M30 has been completed ④ The step of return-to origin has started ⑤ Emergency stop has occurred Motionack-33 stops in an emergency if both the F-direction and R-direction movable signals have turned OFF If the DB unit is connected it stops when both the F-direction and R-direction OT are OFF and DB brake is applied in both directions

Output Signal	Symbol	Function and Timing
In Operation (Cont'd)	STL	
External Positioning Completion	G34	The external positioning command (G34) causes the machine to decelerate and stop when the external positioning signal (EXP2) turns ON, and to return to the position at which EXP2 turned ON In-position check is performed after positioning. If there is no error, the external positioning end signal (G34) turns ON This signal turns OFF when the external positioning end input signal (G34F) turns ON 
External Positioning Alarm	EPAL	EPAL is the alarm signal of external positioning (G34 command). It turns ON under any of the following conditions ① EXP2 does not turn ON when the position designated with X(U) of a G34 command has been reached ② If EXP2 or G34F is already ON and the signal which is ON has not turned OFF within 2 seconds after a G34 command has started execution EPAL is reset under any of the following conditions ① The G34F signal has turned ON ② Mode has changed ③ The programs have been cleared ④ The step of return-to-origin has started 

3.2 2 DIGITAL OUTPUT CONTROL SIGNALS (CONNECTOR CD) (Cont'd)

Output Signal	Symbol	Function and Timing
±Incremental Command Completion	INCD	A + or - increment end signal (INCD) will be output if the contents of the offset register are smaller than the max offset +/- value after the completion of addition to the offset register initiated by a + (or -) incremental command INCD will be output with a maximum delay of 85 msec because of the presence of a 50-msec timer (software) that checks for simultaneous turn-on of +INC and -INC and a signal read time that takes a maximum of 30 msec Resetting condition +INC (or -INC) has turned OFF 
Offset Amount 0	OFR	If +/- incremental commands turn ON simultaneously, the offset register will be cleared to zero and an offset zero signal (OFR) output (1) -INC turns ON before end signal (INCD or OFM) of +INC is output  (2) -INC turns ON after end signal of +INC is output  One of M51-56 turns on according to the M function command executed It is reset when the M end signal (MFIN) turns ON
Offset Amount ±Max Approach	OFM	OFM turns ON when the absolute value of offset which the offset register holds has exceeded the maximum value set with a parameter This turns on and is reset following the same timing sequence as INCD Refer to "+/- incremental end" above

Output Signal	Symbol	Function and Timing
Automatic Operation Completion	M30	M30 turns ON when a program end command (M30) has executed in programmed operation It is reset when a program start signal (PGS0-PGS9) or auto-start signal (ATST) turns OFF 
M Decode 51 to M decode 56	M51 to M56	
Near Home Position	ZNP	ZNP turns ON when at least one of the origin deceleration LS, or origin check LS is depressed If there is only the origin deceleration LS the area where ZNP turns ON is the same as the area of the origin deceleration LS 
Battery Alarm	ALM2	ALM2 turns ON when the voltage of the memory backup battery has fallen below a certain level (The memory contains machining programs parameters, shift values, offset, etc) ALM2 is an alarm signal The Motionpack does not take any action when ALM2 has turned on As soon as ALM2 turns ON, the "battery out" lamp lights on the Motionpack controller panel If ALM2 comes ON replace the battery within 30 days Keep supply power ON when replacing the battery [Refer to the Motionpack-33 maintenance manual (SIE-C788-1 1B)]

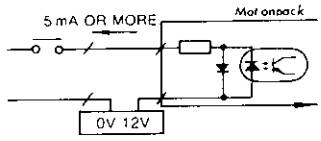
3 2.3 NEAR HOME POSITION LS, EXTERNAL POSITIONING SIGNAL (CONNECTOR CB)

(1) Specifications of the signals

Signal voltage is 12 V or 24 V Use appropriate terminals according to the signal voltage [see (2) below]

Table 3 3 shows specifications of signals

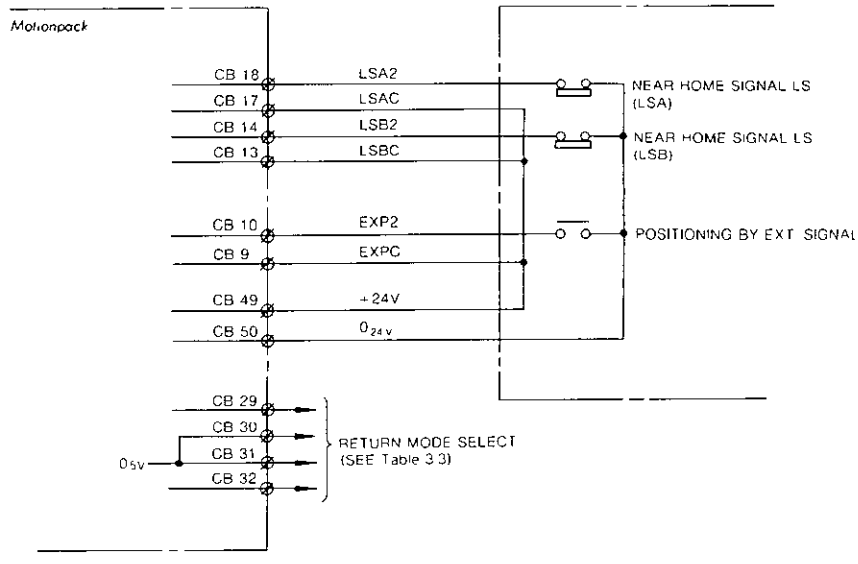
Table 3 3 Specifications of Signals

Signal Voltage	12 V 24 V
"ON"	Input current 5 mA or more 
"OFF"	Input current 1 mA or below

Note Precautions for the use of a proximity switch With a proximity switch, current may leak and ON condition may be satisfied even when output is OFF If the above requirements cannot be met, insert a relay designed for low-level signals Try to avoid chattering of the relay If chattering is anticipated, connect a CR type surge suppressor (CR 50500, for example) in parallel with the relay

(2) Connections of signals

(a) With 24V LS



(b) With 12V Non-contact LS

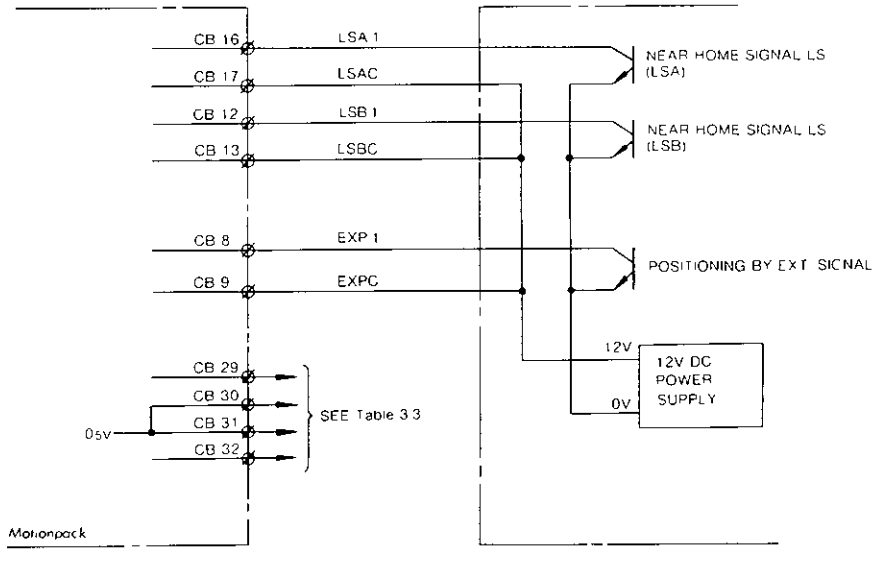
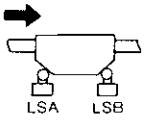
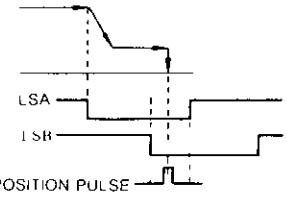
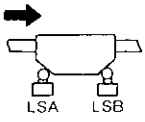
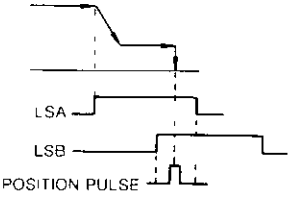
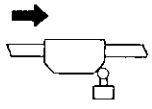
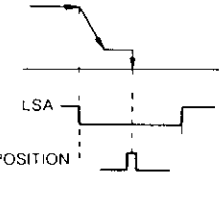
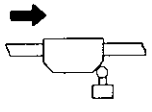
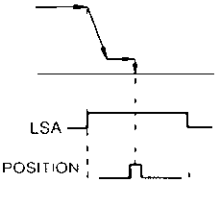
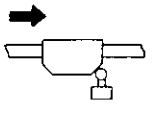
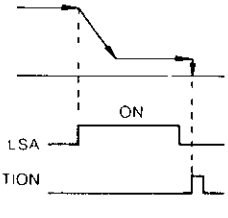
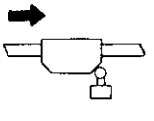
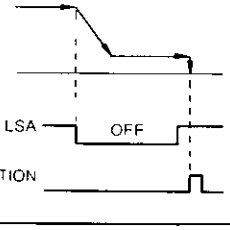


Fig 3 13 Connections of Home Position Signal

(c) Selection of Home Position Return Method

Home Position Return method can be selected by changing connections of CB connector whether the home position LS uses NC contacts or NO contacts Table 3 4 shows the Home Position Return Method and CB connectors

Table 3 4 Selection of Home Position Return Operation

Home Position Return Method (CB Connector)	LS Position for Home Return	Home Position Return Operation
Terminal symbol / Connections CB-29 CB-30 CB-31 — CB-32		
Terminal symbol / Connections CB-29 — CB-30 CB-31 CB-32		
Terminal symbol / Connections CB-29 CB-30 CB-31 — CB-32		
Terminal symbol / Connections CB-29 CB-30 CB-31 CB-32		
Terminal symbol / Connections CB-29 — CB-30 CB-31 CB-32		
Terminal symbol / Connections CB-29 — CB-30 CB-31 — CB-32		

Note Connection should be made using connector pins Extending the connector leads outside the casing may cause malfunction

3. 2. 3 NEAR HOME POSITION LS, EXTERNAL POSITIONING SIGNAL (CONNECTOR CB) (Cont'd)

(3) Signal functions

Signal	Signal Name	Function and Timing
Home position decel signal LS	LSA	Decelerates home position return speed home position return creep speed near home position during home position return
Home position check signal LS	LSB	When home position return is made by 2 LS's (parameter Pr 70 = [ ][ ] 3 [ ][ ]), home position pulse when LSA and LSB are ON, is set as a home position When a LS is used, open the terminals
External positioning	EXP	When external positioning signal EXP is ON, the motion is decelerated to stop and returns to the EXP ON position to make positioning

3.2.4 SERVO-RELATED SIGNALS

(1) Connections of signals

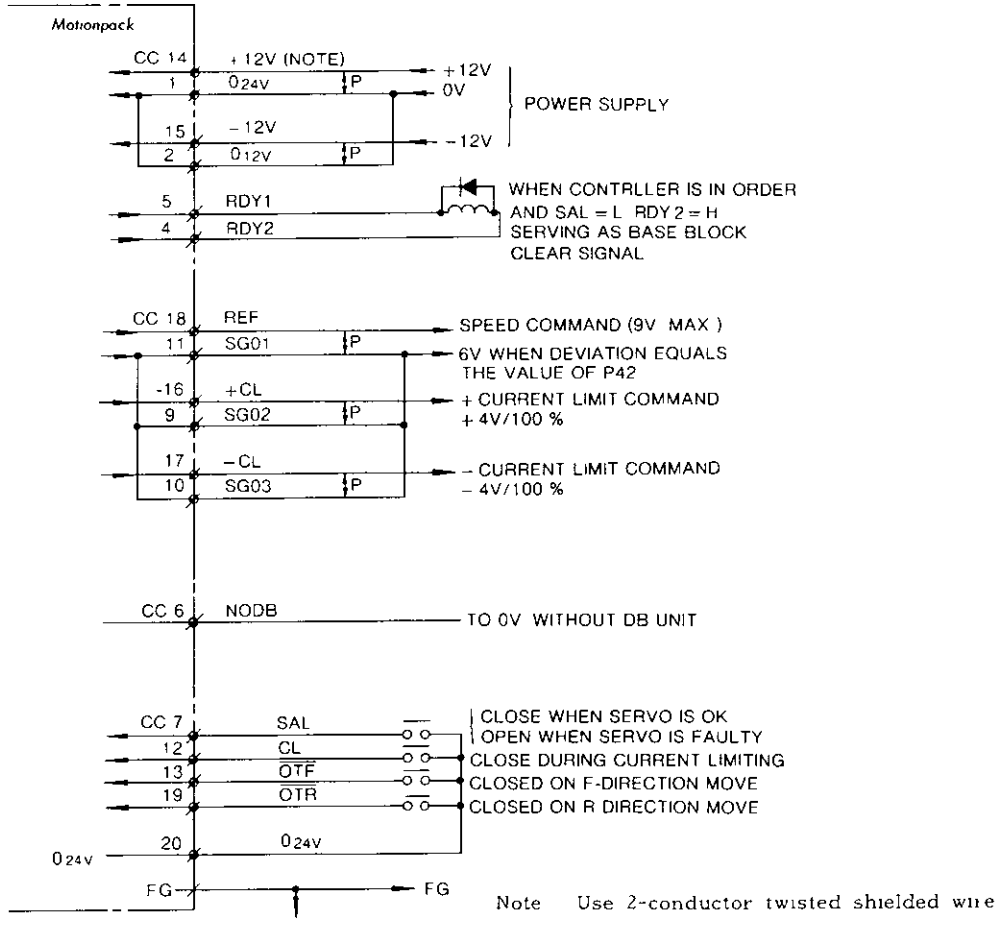
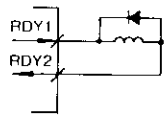
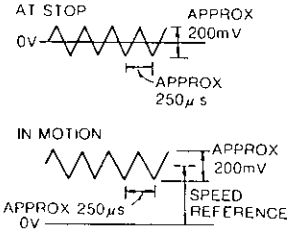
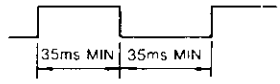


Fig 3 14 Servo-related Signals

(2) Signal specifications

	Signal	Symbol	Function	Specifications
Output	MP Ready	RDY 1 RDY 2	On across RDY 1 and RDY 2 when Motionpack is normal, servo error is not excessive and Servopack is not malfunctioning Indicates that Motionpack and Servopack are in normal condition and ready to operate This signal, when turned on trips the relay, shuts off the base of Servopack and the P-motion command Thus operation is ready When this signal is turned off, perform base cutoff of the Servopack and initiate P-motion command Condition of (RDY 1 - RDY 2) ON = (MP normal)·($\overline{\text{dEr Over}}$)	 Output capacity 24 VDC 100 mA max Current flow direction at ON RDY1 → RDY2
	Speed Reference	REF SG01	Speed reference output of Motionpack Connect this signal to the speed command input of Servopack The plus command causes the motor to run in a forward direction	Voltage -9V to +9V ±6V output at Error do = Pr42 Signal form is sawtooth waveform at 4 kHz REF reference value SG01 0V 
	+Current Limit Reference	+CL SG02	The positive signal of the current limit command output of Motionpack limits current when the motor runs in reverse direction Connect to the external current limit command input terminal (13) of Servopack Type CPCR-MR□□C□ Note As the external current limit command of Servopack, apply negative voltage (0 to -9V) to terminal (14) for positive current and a positive voltage (0 to 9V) to terminal (13) for negative current	Voltage 0V to +9V Outputs 4V at 100% current limit Waveform the same as for speed reference +CL signal SG02 0V
	-Current Limit Reference	-CL SG03	The negative signal of the current command output of Motionpack limits current when the motor runs in forward direction Connect to the external current limit command input terminal (14) of Servopack Type CPCR-MR□□C□ See the note of the + current limit reference above	Voltage 0V to -9V Outputs -4V at 100% current limit Waveform the same as for speed reference -CL signal SG03 0V

3 2 4 Servo-RELATED SIGNALS (Cont'd)

	Signal	Symbol	Function	Specifications
Input	Without DB Unit	NODB	The signal that permits Motionpack controller to detect the presence or absence of the DB unit Without DB unit Connect 0 V With DB unit Open	According to the system configuration, determine whether to connect the input terminal to 0V or leave it open
	Servo Error	$\overline{SAL}$ Across Terminals CC and ⑦	This signal is 0 V when the servo driver is ready to operate SAL = 0, when, for example, Servopack is normal and the main circuit supply power is ON (ready for operation) If this terminal is open, RDY1 to RDY2 (MP preparation end) does not turn ON	(a) The input contact capacity is rated at 30V and 20 mA or more Chattering time should not exceed 5 msec (b) ON and OFF of input signal lasting for 35 msec or more is effective 
	Current Limit	CL	This signal indicates that Servopack CPCR-MR□□C□ is limiting current When CL=ON, Motionpack stops sending motion pulses It continues sending motion pulses during execution of G01 and G27	The same as $\overline{SAL}$
	Travel in Forward Direction	$\overline{OTF}$	Travel in forward direction is possible when $\overline{OTF}$ = ON The Motionpack stops in an emergency when both $\overline{OTF}$ and $\overline{OTR}$ are OFF Let both $\overline{OTF}$ and $\overline{OTR}$ turn off in case of power failure, servo failure, or MP failure See the sample application circuit shown in par 10 2	The same as $\overline{SAL}$
	Travel in Reverse Direction	$\overline{OTR}$	Travel in reverse direction is possible when $\overline{OTR}$ = ON	The same as $\overline{SAL}$

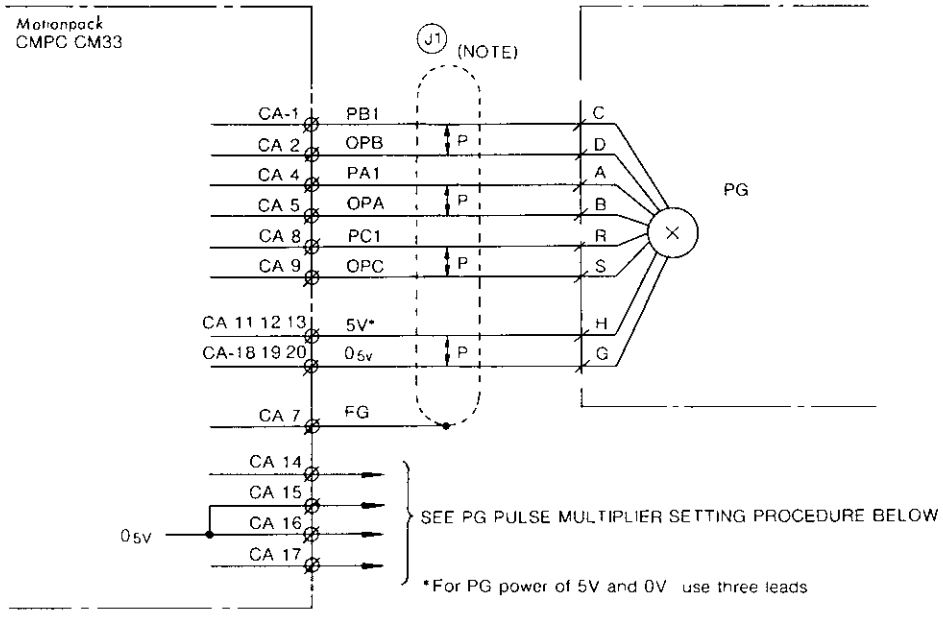
3. 2. 5 PG SIGNALS

(1) Connections of detectors

Detectors (PG) to be combined with Motionpack should be Yaskawa produced Connections are different depending on Type of detectors

(a) With 5V type PG

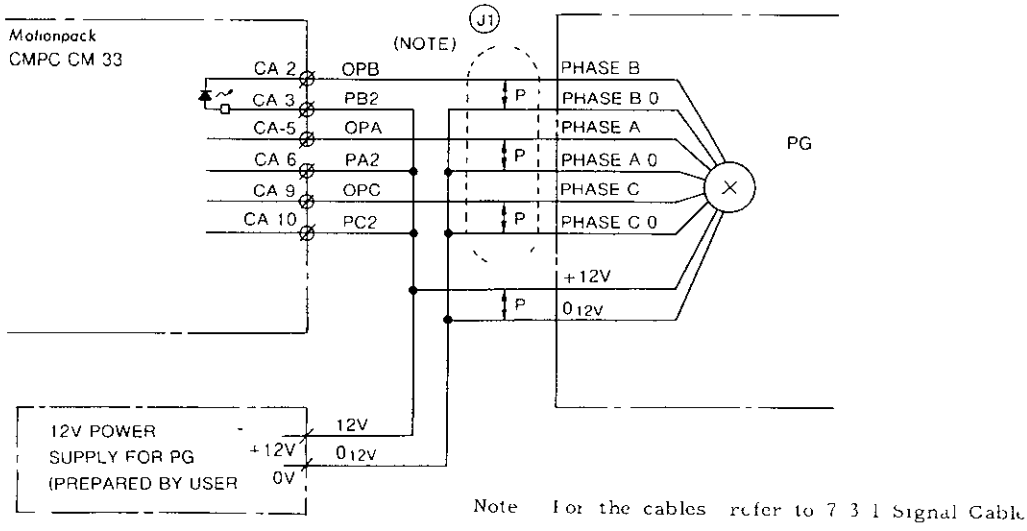
Feedback unit Type TFUE-[ ][ ],ZD7
Transmission distance 25 m max



(a) With 5V Type PG

(b) With 12V type PG

Feedback unit Type TFUE-[ ][ ],ZC7
Optical encoder Type UPOPI-[ ]SA[ ]
Transmission distance 10 m max



(b) With 12V Type PG

Fig 3 15

3 2 5 PG SIGNALS (Cont'd)

(c) With manual pulse generator

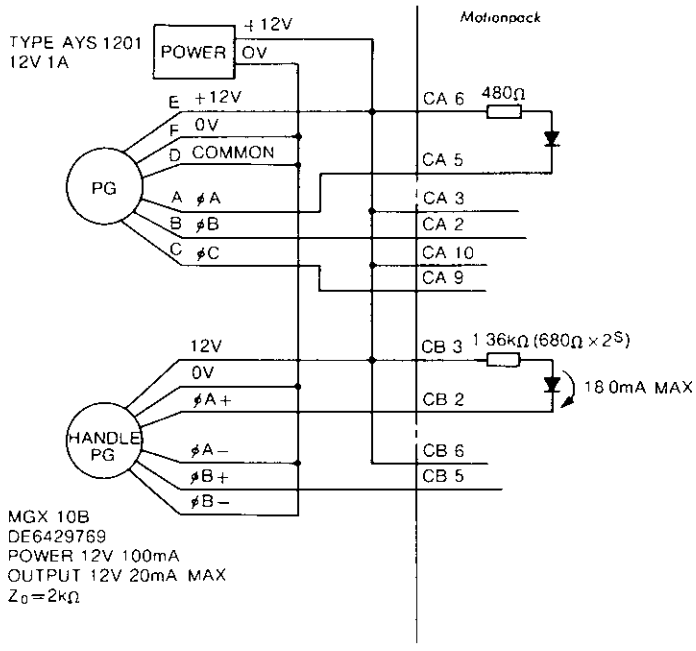


Fig 3 15

(2) PG pulse multiplier setting

The setting of PG pulse multiplier is as shown below For example, to double the PG pulses, short CA-14 and CA-15 Connection must be terminated inside the connector casing Extending line wire will cause malfunction

Terminal No	x1	x2	x4
CA-14			
CA-15			
CA-16			
CA-17			

(3) Motor direction of rotation

The motor direction of rotation is determined by the connection polarity to the motor terminals, PG terminals and the TG terminals as shown below Forward direction of motor rotation is counterclockwise viewed from drive end as shown below Some motors like Minertia Motor Mini series run clockwise as forward direction, check with the motor dimension diagram separately provided

(a) PG + TG

Standard connection

TERMINAL SYMBOL →	A	B	C	D	R	S	
SIGNAL NAME →	PA1	0PA	PB1	0PB	PC1	0PC	
	G	H	F	F		1	2
	0 5V	5V	FG	FG		TG1	TG2

A	B
A	B

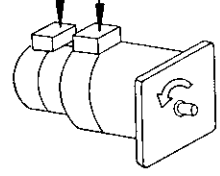


Fig 3 16 Direction of Motor Rotation under ⊕ Motion Command

Reverse connection

A	B	C	D	R	S	
PB1	0PB	PA1	0PA	PC1	0PC	
G	H	F	F		1	2
0 5V	5V	FG	FG		TG2	TG1

A	B
B	A

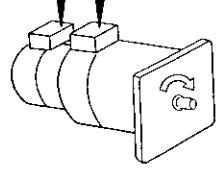


Fig 3 17 Direction of Motor Rotation under ⊖ Motion Command

(b) Feedback unit (Standard Type TFUE-□,ZC7)

Standard connection

FEED BACK UNIT TERMINAL SYMBOL →	A	B	C	D	F	F	C	H
	0 PA	0 PB	0 PC	COM	+ 12V	0 12 V	TC 1	TG 2

A	B
A	B

Reverse connection

A	B	C	D	F	F	C	H
0 PB	0 PA	0 PC	COM	+ 12V	0 12 V	TC 2	TG 1

A	B
B	A

(c) Feedback unit (High-speed Type TFUE-□,ZD7

Standard connection

A	B	C	D	R	S	
PA1	0PA	PB1	0PB	PC1	0PC	
G	H	F	5		G	H
0 5V	5V	FG	FG		TG1	TG2

A	B
A	B

Reverse connection

A	B	C	D	R	S	
PB1	0PB	PA1	0PA	PC1	0PC	
G	H	F	5		G	H
0 5V	5V	FG	FG		TC 2	TG 1

A	B
B	A

3. 3 Motionpack-33 CONTROLLER PARAMETER

Motionpack-33 controller can meet the control specifications of combined machine by setting parameters listed in Table 3 6. The parameters must be determined in designing Motionpack-33 drive system Before operation, they must be set correctly

Table 3 6 Motionpack-33 Parameter List

Parameter No	Description		Unit
1	JOG, STEP group	JOG, low speed	Speed unit
2		JOG, medium speed	Speed unit
3		JOG, high speed	Speed unit
4		STEP speed	Speed unit
5		STEP distance, moved short	Min command unit
6		STEP distance, moved medium	Min command unit
7		STEP move distance, moved long	Min command unit
8-9	Unused		
10	Creep speed		Speed unit
11-19	Unused		
20	Offset group	Coordinate 8 single correction	Min command unit
21		Coordinate 8 max correction	Min command unit
22		Coordinate 9 single correction	Min command unit
23		Coordinate 9 max correction	Min command unit
24-39	Unused		
40	Servo group	Max speed	Speed unit
41		Acceleration time	msec
42		Position loop gain	No of pulses
43		Unused	No of pulses
44		Servo error deviation	No of pulses
45		In-position range	
46	G27 group G27 permissible error		
47-49	Unused		
50	Unit group	Pulse ratio M	
51		Pulse ratio D	
52		Decimal point position	No of digit columns
53		Thrust ratio (thrust rating/servo rating) x 100	
54	Axis No designation		
55-59	Unused		
60	Overtravel group	-direction stored stroke limit	Min position unit
61		+direction stored stroke limit	Min position unit
63-69	Unused		
70	Home position group	Return home mode	
71		Home position coordinate	No of pulses
72		Waiting position	Min position unit
73		Return home speed	Speed unit
74		Return home creep speed	
75		Return home torque limit	%
76		Coasting allowance	No of pulses
77		Permissible error	No of pusles
78		Butting time	10 msec
97	Tape device Baud rate setting		bps

3 3 1 MACHINE PARAMETERS

3 3 1 1 Position Command Unit (Pr50, Pr51)

The relationship between the position command unit and the position detection unit can be set arbitrarily by parameters Pr50 and Pr51, between 1 and +3999999 The value should be in the range $\frac{1}{50} < \frac{Pr50}{Pr51} < 50$ Since motion distance are expressed in position detection units, some rounding error may be introduced when a command value is converted into a detection value

$$\frac{Pr\ 50}{Pr\ 51} = \frac{No.\ of\ pulses\ (pulse)}{Position\ command\ value\ (Position\ command\ unit)}$$

EXAMPLE 1 To determine Pr50 and Pr51 for a positioning device shown in Fig 3 18

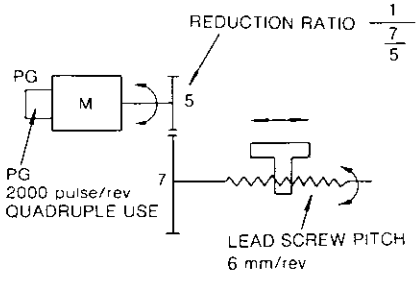


Fig 3 18

Leadscrew pitch 6 mm/rev

Reduction ratio 1/R = 1/7/5

PG 2000 pulses/rev, Quadruple multiplier

Position command unit 1/1000 mm

$$Pr\ 50 = No.\ of\ pulses = 2000 \times 4 = 8000\ pulses/rev$$

$$Pr\ 51 = \frac{Leadscrew\ pitch\ (mm/rev)}{Position\ command\ unit \times reduction\ ratio\ (R)}$$

$$= \frac{6}{0.001 \times \frac{7}{5}} = 6000 \times \frac{5}{7}$$

$$\frac{Pr\ 50}{Pr\ 51} = \frac{8000}{6000 \times \frac{5}{7}} = \frac{28}{15} \qquad \boxed{Pr\ 50 = 28\ \ Pr\ 51 = 15}$$

EXAMPLE 2 To determine Pr50 and Pr51 for the example shown

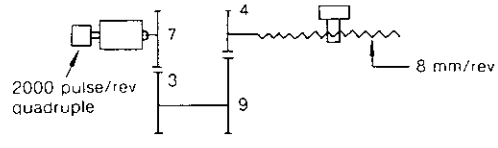


Fig 3 19

Leadscrew pitch 8 mm/rev

Reduction ratio 1/R $R = \frac{1}{7} \times \frac{4}{3} = \frac{4}{21}$

PG 2000 pulses/rev, Quadruple use

Positioning command unit 10 μ

$$Pr\ 50 = 2000 \times 4 = 8000\ (pulses)$$

$$Pr\ 51 = \frac{Leadscrew\ pitch\ (mm/rev)}{Positioning\ command\ unit \times reduction\ ratio\ (R)}$$

$$= \frac{8}{0.01 \times \frac{4}{21}} = 4200$$

$$\frac{Pr\ 50}{Pr\ 51} \times \frac{8000}{4200} \times \frac{40}{21}$$

Note If Pr50 < Pr51, the min detection unit is coarser than the command unit, and the accuracy cannot be as good as the level of the command unit

3 3 1 2 Speed Command Unit (Parameter Pr52)

This parameter is for determining the position of the decimal point in the minimum command unit The speed command unit is determined by the position of decimal point as specified by this parameter

EXAMPLE 1

Min command unit is 1μ, Pr52 = 3

X(U) [ ][ ][ ][ ].[ ][ ][ ]

μm

3RD DIGIT FROM THE RIGHT

mm

The speed unit is mm/min

EXAMPLE 2

Min command unit is 1μ, Pr52 = 4

X(U) [ ][ ][ ][ ].[ ][ ][ ][ ]

μm

cm

4TH DIGIT FROM THE RIGHT

The speed unit is cm/min

EXAMPLE 3

Min command unit is 10μ, Pr52 = 2

X(U) [ ][ ][ ][ ][ ].[ ]

X 10μm

mm

2ND DIGIT FROM THE RIGHT

The speed unit is mm/min.
The setting range of Pr52 is from 0 to 5, specifying the position of decimal point

Speed unit = Position command unit x 10/min

If position command unit is 1μ, and Pr52=3 as shown in Example 1, speed command unit is mm/min, and feedrate when G01 x 5000,000 F10000 I200 is executed is, F = 10000mm/min = 10 m/min

3 3 1 3 Thrust Ratio (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

$$Pr\,53 = \frac{Programmed\ 100\%\ motor\ shaft\ torque}{Rated\ motor\ torque} \times \frac{Rated\ motor\ current}{Servopack\ 100\%\ limited\ current} \times 100\,(\%)$$

$$= (Rated\ thrust/servo\ rating) \times 100(\%)$$

EXAMPLE 1

Programmed 100% motor shaft torque = 60 kg·cm

Servomotor UGHMED-06, rated for 58 4 kg cm/ 6 2A

Servopack CPCR-MR 08CT, with 100% current limited at 5 7 A

$$Pr\,53 = \frac{60\ kg\ cm}{58.4\ kg\ cm} \times \frac{6.2\ A}{5.7\ A} \times 100 = 112$$

EXAMPLE 2

Programmed 100% motor shaft torque = 100 kg cm

Servomotor UGHMED-12, rated for 117 kg cm/ 10 6A

Servopack CPCR-MR15CT, with 11 4A

$$Pr\,53 = \frac{100\ kg\ cm}{117\ kg\ cm} \times \frac{10.6\ A}{11.4\ A} \times 100 = 79$$

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 measure current

3 3 1 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 the stored limit error (MP alarm) state Stored stroke limit is effective after completion of Home position return

3 3 2 SERVO-RELATED PARAMETERS

3 3 2 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 servodrive Acceleration/deceleration time can be calculated referring to Appendix A (6) setting acceleration/deceleration time

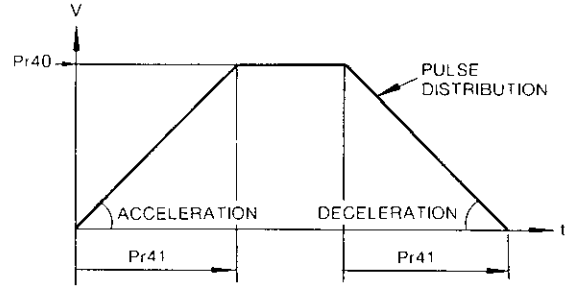


Fig 3 20

$$Acceleration = -deceleration = \frac{Pr\,40}{Pr\,41}$$

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

Example With a drilling machine
If the unit of speed command is mm/min and the maximum speed of 10 m/min is reached in 300 msec, set as follows

Pr40 = 10000

Pr41 = 300

3 3 2 1 Acceleration Determination (Pr40, Pr41) (Cont'd)

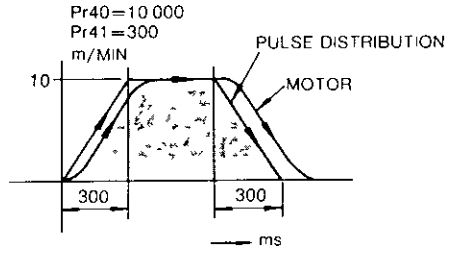


Fig 3 21

3 3 2 2 Position Loop Gain (Pr42)

This parameter determines the DC servomotor response accuracy for pulse distribution The accuracy is specified by type of DC servomotor and rapid traverse rate

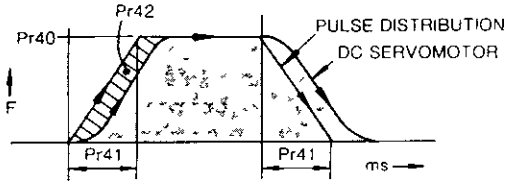


Fig 3 22

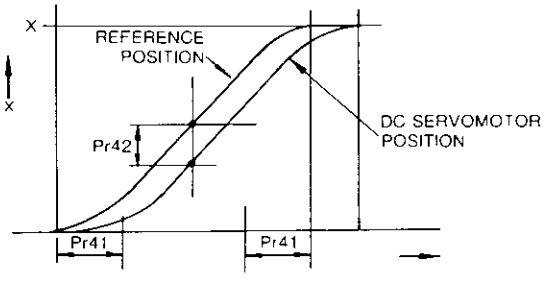


Fig 3 23

Fig 3 21 shows time-speed curve The area of ▨ 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 3 23

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)

$$Pr\ 42 = PPS\ at\ rated\ speed \times \frac{1}{\text{kp sec}^{-1}}$$

"kp" means position loop gain and determined by type of DC servomotor

Hi-cup motor Cup motor Minertia Motor J Series	kp = $30s^{-1}$
Print motor	kp = $40s^{-1}$

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

EXAMPLE

With a drive system based on a Hi-Cup motor (rated speed 1000 rpm) with a PG for 3000 pulses/rev x 4 times feedback, a loop gain with a kp of 40 sec^{-1} is to be set

Assuming Pr50 = 1, Pr51 = 1,

$$Pr\ 42 = \frac{3000\ P/r \times 4 \times 1000\ r/M}{60\ s/M} \times \frac{1}{40\ 1/sec}$$

$$= 5000\ pulses$$

Pr42 is the error pulse count of 200 to 30000 without signals

When a speed command is input to the auxiliary input terminals (⑨-②) of the Servopack, loop gain is determined when Input Adjust (IN-B of the Servopack is set for the rated revolution number at 6 V. The actual value of kp varies according to the setting of Input Adjust

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 operated actually For adjustment, refer to the Motionpack-33 (SIE-C788-1 3)

3 3 2 3 Servo Error (Pr44)

It is to detect defects of the servomechanism Set an error pulse count within a normal range when the servomechanism works properly

Normally set some twice of the parameter Pr42 determining the loop gain

If error (d0) exceeds Pr44, the Motionpack gives an alarm of excessive error (dRr OuEr)

3 3 2 4 In-position Range (Pr45)

Set allowable lag pulses to perform in-position check with G04 For G04, see 3 4 2 5, in-position wait command

Ideally allowable lag pulses 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 coincidence Set it to the maximum within the range of precision the system requires

It is set at 30 to 60 pulse count for ordinary machine tools

3 3 2 5 Allowable Error Amount by G27 (Pr46)

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

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

* With the G27 command, designated pulses are distributed for point A Then origin pulse is searched during travel from the point A to B, and the point C where the origin was read is reached

Then it is examined where the point C is within the range of the origin +/- Pr77

Inside the range --- good

Outside the range --- G27 Err

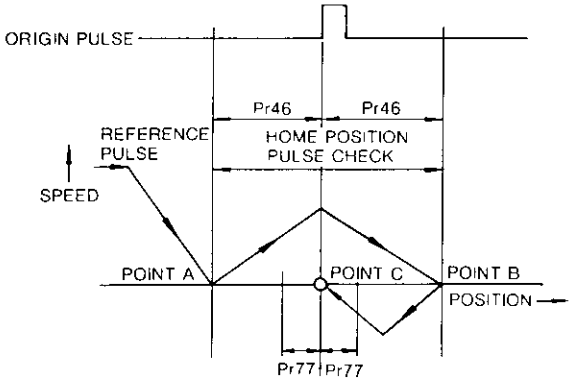


Fig 3 24

Select Pr46 to be greater than Pr45 and smaller than the pulse count of half rotation of the motor shaft

If the parameter is 0, the command position will be checked but the origin pulse coordinate not during execution of the G27 command

3.3 3 OPERATION PARAMETERS

3 3 3 1 JOG Feedrate (Pr1, Pr2, Pr3)

These parameters determine the JOG feedrate The input signals JLF and JMF determine the feedrate as given in Table 3 7

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 = 10 m/min when the unit of speed command is mm/min

Table 3 7 JOG Parameter

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

3 3 3 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

3 3 3 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 3 8

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 0 001 mm x 10 = 0 01 mm

Table 3 8 STEP Parameter

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

3 3 3 4 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 with 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

3 3 4 OFFSET PARAMETERS

3 3 4 1 8th Coordinate Correction Amount at a Rise (Pr20)

This parameter determines the amount of correction made at a rise of +INC9 or -INC9

The value is 1 to 255 unsigned in the minimum command unit Set 0 for it when not used

3 3 4 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 unsigned in the minimum command unit See 0 for it when not used

3 3 4 3 9th Coordinate Correction Amount at a Rise (Pr22)

This parameter determines the amount of correction made at a time with +INC9 or -INC9

The value is 1 to 255 in the minimum command unit Set 0 for it when not used

3 3 4 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 a 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

3.3.5 HOME POSITION RETURN PARAMETERS

3 3 5 1 Return to Home Position Mode (Pr70)

This 6-digit parameter selects a manner of returning to the origin

Pr70 = ABCDEF

A Presence or absence of a waiting position after the end of return to the origin

B Ensuring origin-related signals

C Origin LS method

D Direction of move at the beginning of return to the origin

E Direction to return to the origin

F Setup method

The meaning of each of A to F is explained below

(1) A Presence or absence of a waiting position after the end of return to the origin

A = 0 Stay there after the end of return to the origin

A = 1 Move to the position designated with Pr72 after the end of return to the origin and stay there

NOTE

When A = 0, the machine is not positioned at the origin after the end of return to the origin If necessary, set A = 1 and Pr72 = Pr71

(2) B Ensuring origin-related signals

There are two functions defined here One is to check whether or not the coordinate of the position where the origin pulse has been read-in is equal to the coordinate of the origin (Pr71) after return to the origin It is good if the coordinate is in the range of Pr71 ± Pr77 Otherwise setup alarm results This is called check of origin pulse The other is to check the state of origin LS at the position of the origin pulse In the case of Figure 3 25, for example, it is checked if the states of the slow-down LS and the ensuring LS are all at the ON position of the origin pulse It is the same with only one LS Setup alarm results if an error is detected

B = 0 Neither origin pulse nor origin LS is checked

B = 1 Origin pulse is checked but orig n LS not

B = 2 Origin pulse and origin LS are checked

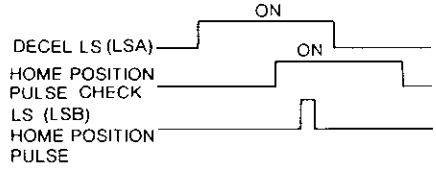


Fig 3 25

(3) Origin LS method

This parameter defines the method of origin LSs (deceleration LS and ensuring LS)

C = 0 Neither origin pulse nor origin LS is used

C = 1 One slow-down LS is provided and the origin pulse is searched at low speed in the area of the LS The reference point is the position where the origin pulse has been read-in

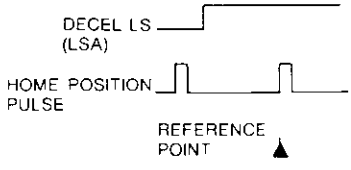


Fig 3 26

C = 2 When a slow-down LS is pressed, the tool moves at low speed and reads in the origin pulse off the slow-down LS

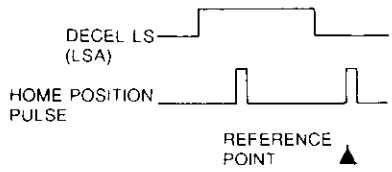


Fig 3 27

C = 3 When a slow-down LS causes the tool to decelerate, and the origin pulse read in the area where confirmation LS and slow-down LS are pressed becomes the reference point

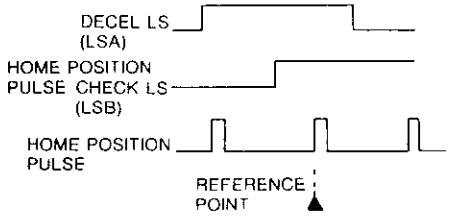


Fig 3 28

C = 4 After decelerated at a slow-down LS, the tool comes to a stopper and the point becomes the reference point
This method requires that the Servopack is of the CPCR-MR..CL type and the DB unit is used

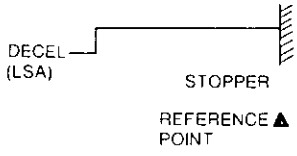


Fig 3 29

(4) Direction to start travel

This defines the direction in which the tool moves at the beginning of return to the origin

D = 0 The tool begins to move unconditionally in the direction of return to the origin defined in (5)

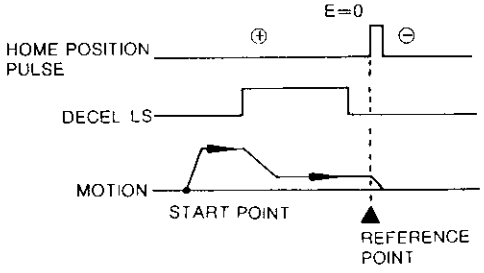


Fig 3 30

D = 1 The direction of return to the origin but error on a slow-down LS In Fig 3 31, return-to-origin operation may start at the point a but not at the point b

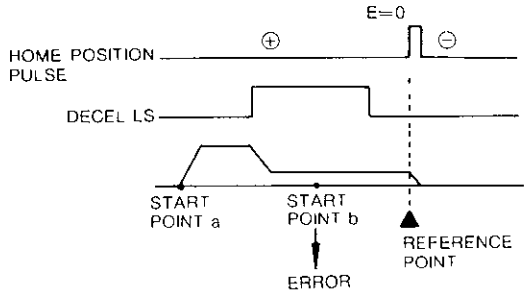


Fig 3 31

D = 2 The direction of return to the origin but, on a slow-down LS, rotation reverses until outside is reached In Fig 3 32, movement continues from the start point a to the slow-down LS at the return-to-origin speed After the slow-down LS is pressed, movement is made with speed reduced to the return-to-origin creep speed until the origin pulse is read-in

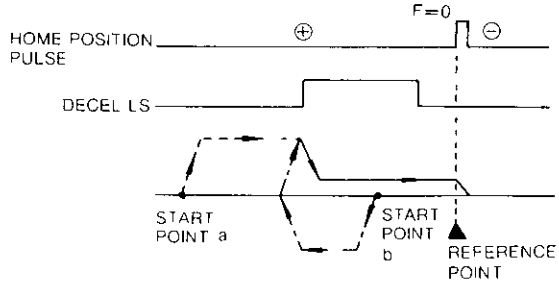


Fig 3 32

D = 3 From the position of power-off which is memorized, the system judges the direction of the origin automatically and causes movement in that direction If the power-off position is in the area of the origin ± Pr76, the device may have overtraveled the origin by inertia Therefore the system does not judge the direction of the origin automatically Rather the direction of rotation is reversed until the origin LS is passed, to return to the origin.
Note that, if the motor has run by some external force during power interruption, the return-to-origin operation could not be performed properly (Refer to the description on Pr76)

3 3 5 1 Return to Home Position Mode (Pr70) (Cont'd)

(5) Direction to return to the origin

This defines the direction of move to return to the origin

E = 0 - direction

E = 1 + direction

(6) Setup method

"Setup" means to define the position where the origin pulse has been read-in as the reference point and to set the coordinate of the position in Pr71

F = 0 Setup will not be performed

F = 1 Setup will be performed once after power-on After then the system checks whether or not the reference point has changed The maximum permissible change is ± Pr77 (Fig 3 33)

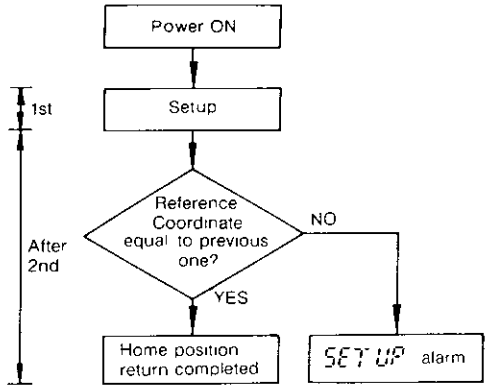


Fig 3 33 (F=1)

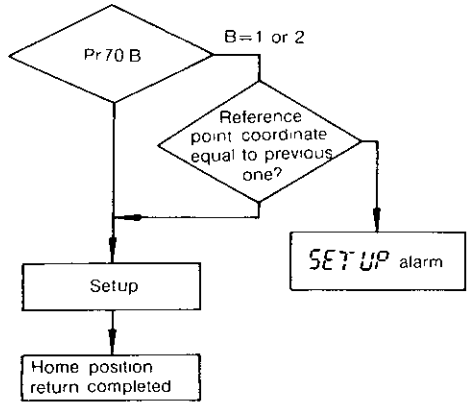


Fig 3 34 (F=2)

3 3 5 2 T0 Coordinate Offset (Pr71)

In the return home motion, the tool slide returns to a preset home position When the coordinate of the home position is specified on the T0 coordinate system by this parameter, the 0 point (origin) of the coordinate system is determined, from the home position

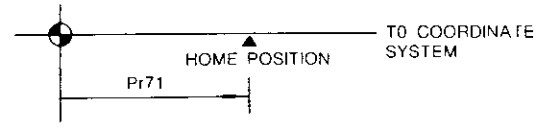


Fig 3 35

Pr71 gives the distance from the T0 coordinate 0 point to the home position given in number of pulses with a sign, between -9999999 and 9999999

3 3 5 3 Wait Position (Pr72)

The tool slide can be moved to a specified position for waiting, after returning home (Pr71, A = 1)

Parameter Pr72 is for specifying the waiting position The waiting position is to be set by the distance from the home position in the T0 coordinate system The setting range is between -9999999 and 9999999, with a sign

When Pr70 A = 0, wait position is not set and Pr72 is ineffective In this case, set Pr72 = 0

3 3 5 4 Home Return Speed (Pr73)

This parameter is for specifying the speed outside the deceleration LS Specify speed from which deceleration to the creep speed can be amply made at the rate specified by the speed and time parameters (Pr40, Pr41) within the length of the deceleration LS

As the length of the deceleration LS, reduce the reserve length for the servo lag 1/kp and coasting 50 msec from the theoretical length The value is set between 0 and 60000 in speed command units

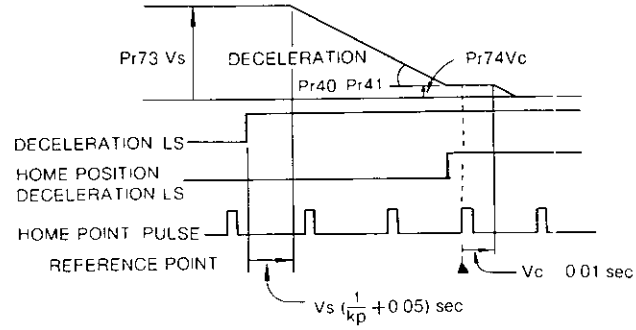


Fig 3 36

3 3 5 5 Home Return Creep Speed (Pr74)

This parameter is for specifying the creep speed in return home motion within the deceleration LS range The maximum speed at which the home position pulse can be read is 20 kpps

After reading the home position pulse, the slide decelerates at the rate determined by Pr40 and Pr41, with a delay up to 10 msec, to stop When setting the creep speed, take the inertia run after the home position pulse fully into consideration

In the stopper stop mode, take the permissible impact of the collision into consideration when setting the creep speed The setting value range is between 0 and 60000 in speed command units

3 3 5 6 Home Return Torque Limit (Pr75)

This parameter is for limiting the torque in hitting against the stopper in the stopper stop mode (Pr70, C = 4) return home motion (The return home torque in the home position pulse mode is always 200% of the rated level, regardless of the setting of this parameter)

For this setting, take the mechanical strength of the stopper into consideration The setting value range is between 10 and 250%

3 3 5 7 Coasting Allowance (Pr76)

Determine the range of inversion by taking into consideration the case where the origin is passed by coasting after power interruption in the method of returning to the origin that the direction of the origin is automatically judged from the position of power-off (D of Pr70 = 3) Make the value of Pr76 greater than the coasting distance of the mechanical system and well smaller than half of the length of the slow-down LS This parameter is ineffective except with the method of returning to the origin with the direction of the origin automatically judged (make Pr = 0)

The value is 0 to 9999999 (unsigned) in pulse unit

3 3 5 8 Maximum Permissible Home Position Error (Pr77)

This parameter is for setting the maximum permissible error for checking the home position pulse after returning to home The setting value range is between 1 and 255, without a sign

3 3 5 9 Stopping Time (Pr78)

This parameter is for the delay time from the time of hitting overcurrent at the stopper to the setting up, in the stopper return home mode (Pr70, C = 4) The setting value range is between 0 and 30000 (300 seconds) in 10 msec units

EXAMPLE

Return-to-home-position mode and parameter Pr70 relationship

(1) When Home position LSA and LSB are used

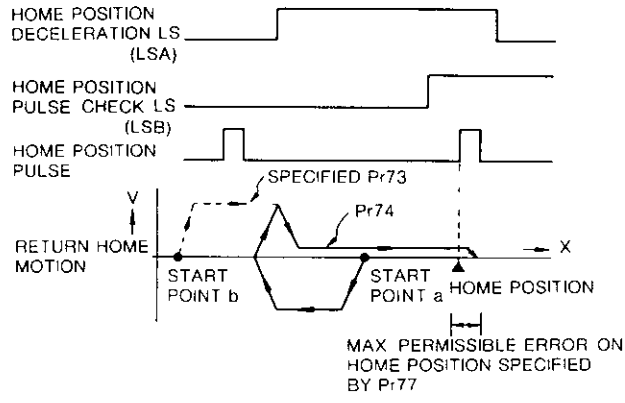
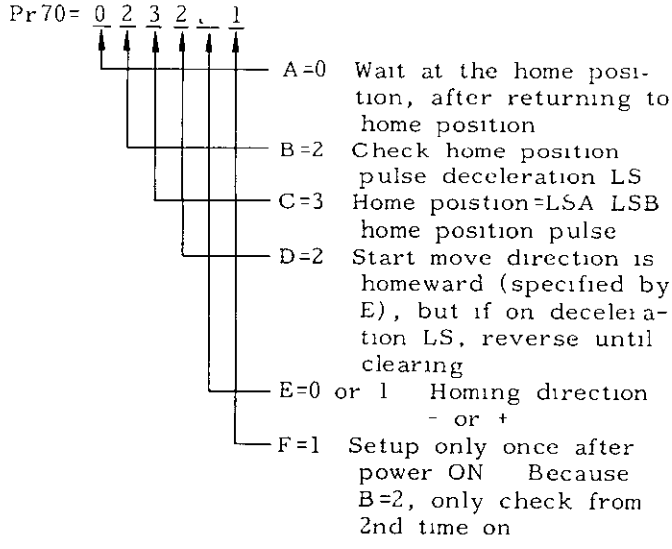


Fig 3 37

In this case, the specification of parameter Pr70 is as follows



Since only one homing direction is specified in this mode, the execution must be started after the slide is first moved to the deceleration LS, if the return start point is not known to be on which side of the LS

3 3 5 9 Stopping Time (Pr78) (Cont'd)

To enable homing regardless of the starting position location relative to the home position, set D or parameter 70 to 3

Pr70= 0 2 3 3 ' ' 1

D=3 Automatic descrimination of homing direction based on stored power off position data

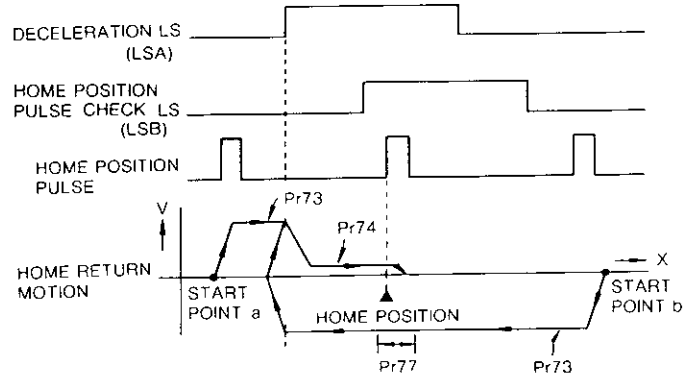


Fig 3 38

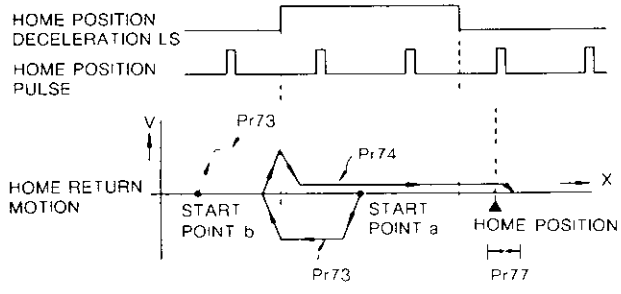


Fig 3 39

(2) When deceleration LS and home position pulse are used

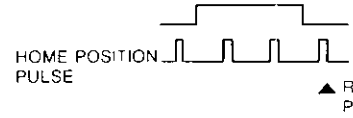
In this mode, when the tool slide leaves the home position deceleration LS, the first home position pulse is taken as the reference point

Pr70= 0 1 2 2 ' ' 1

A=0 Wait at the home position, after returning to home position

B=1 Check home position pulse

C=2 Deceleration LS



D=2 Start move direction is homeward (specified by L), but if on deceleration LS, reverse until clearing

E=0 or 1 Homing direction - or +

F=1 Set up only once after power ON, checked only from 2nd time on

(3) Stopper stop mode

In this mode, the tool slide is stopped by a mechanical stopper, and this position is regarded as the home position

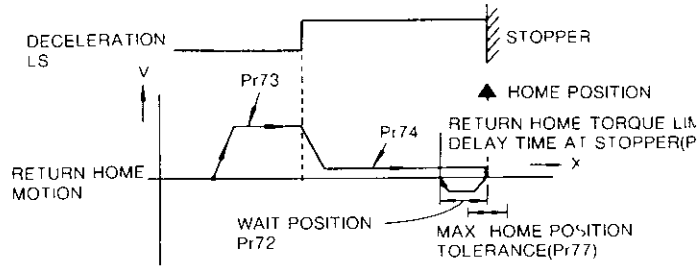


Fig 3 40

The parameters for the homing motion are set as follows

Pr70= 1 0 4 0 ' ' 2

A=1 After completion of returning to home, move to, and wait at, the position specified by Pr72

B=0 Checking unnecessary

C=4 Stopper stop mode

D=0 Always returning-to home direction

E=0 or 1 Homing direction

F=2 Setup at each home returning

3 3 6 TAPE READING-IN AND PRINTING-OUT PARAMETERS

3 3 6 1 Axis No Designation (Pr54)

The setting range of Pr54 is 0 - 9 Pr54 is added to the top of the tape when programs are output to the tape, and when the taped program is input, its axis No is compared against the Pr54 stored in Motionpack-33 to detect any mistake When Pr54=0, this is output to the tape, but a Motionpack-33 set for Pr54=0 reads tapes without collation

3 3 6 2 Tape Device • Baud Rate Setting (Pr97)

The parameter Pr97 defines the baud rate of transmission between the Motionpack-33 and a paper tape punch or reader

Select an appropriate baud rate out of 110, 300, 1200, and 2400 according to the paper tape device

The parameter is stored in the Motionpack-33 programmer and will be lost once supply of power to the Motionpack-33 programmer stops Set the parameter each time before making transmission to or from the paper tape device

3 3 7 PARAMETER SETTING

All parameters must be given before operation starts However, you can set some parameters simply to 0 if the functions related with the parameters are not used Some other parameters must be set appropriately for the system Relationships of the parameters are explained below

Table 3 9 Parameter Setting

Parameter No	Function	Setting
Pr 1 to Pr 3	JOG speed	Sets the JOG speed only to be used Set 0 when not in use
Pr 4	STEP speed	Sets when STEP is used Set 0 when not in use
Pr 5 to Pr 7	STEP feed amount	Sets the STEP feed amount only to be used Set 0 when not in use
Pr 10	Creep speed	Set 0 when OVR signal is not used
Pr 20 to Pr 23	OFFSET amount	Set 0 when OFFSET correction is not used
Pr 40 to Pr 45	Servo	*
Pr 46	G27 Allowable error amount	*
Pr 50 to Pr53	Unit	* If not precise, Pr 53 = 100
Pr 54	Axis No	Set 0 when axis no is not used
Pr 60 to Pr 61	Overtravel	*
Pr 70 to Pr 78	Home position	* When writing position is not set Pr 72 = 0 Pr 75, Pr 78 = 0 except for butting home position return Pr 76 = 0 except for power failure back-up
Pr 97	Tape device baud rate	Set baud rate before using tape device

*Set the value applicable to the system

3.4 FUNCTIONS OF Motionpack-33 CONTROLLER

3.4.1 OPERATION MODE

Motionpack-33 has the following five operation modes

(1) EDIT mode

(2) JOG operation mode

(3) STEP operation mode

(4) HANDL opertion mode

(5) AUTO operation mode

The EDIT mode is for writing programs and setting parameters with the Motionpack programmer, and involves no machine motion The JOG, STEP, HANDL, and AUTO operation modes are manual or program-controlled operation modes

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, HANDL operation mode

(3) AUTO operation mode

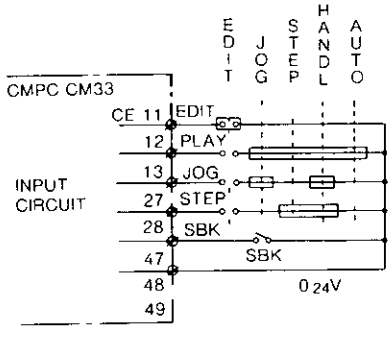


Fig 3 41

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

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

Table 3 10 Operation Modes Selection Conditions

Mode Signal		EDIT	PLAY	JOG	STEP	SBK
EDIT		ON	-	-	-	-
JOG		OFF	ON	ON	-	-
STEP				OFF	ON	-
HANDLE				ON	ON	-
AUTO	Block Operation			OFF	OFF	ON
	Program operation					OFF

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

3 4 1 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, HANDL and AUTO modes

In the EDIT mode, MP ready signal (connector CD-③) is OFF, but servo clamp control continue

3 4 1 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 is 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

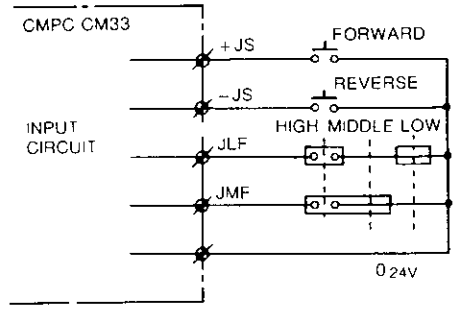


Fig 3 42

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

Table 3 11

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 signal is received turned low 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

(a) In-operation (STL)

(b) M decodes (M51 - M56)

(c) Home position return completion (ZPM)

(d) External positioning alarm (EPAL)

(e) External positioning completion (G34)

(f) Automatic operation completion (M30)

(3) The following output signals maintain their state

(a) Motionpack ready (RDY)

(b) Battery alarm (ALM2)

(c) Near HOME position (ZNP)

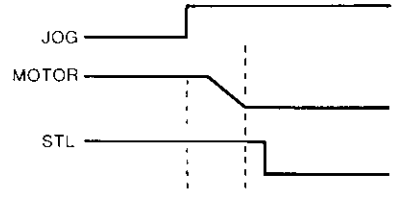


Fig 3 43

3 4 1 3 STEP Operation Mode

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

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

In this case, the STEP feedrate is the one set by parameter 4

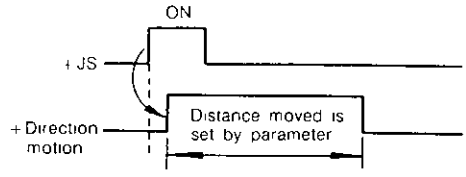


Fig 3 44

Table 3 12

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

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

3 4 1 4 HANDL Operation Mode

In the HANDL operation mode, operation proceeds according to the pulse input generated from manual pulse generator Multiplication factor of feed distance can be selected from X1, X10, X100 by combining JLF and JMF signals

Table 3 13

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

Maximum speed during HANDL operation is controlled by parameter Pr4 If the manual pulse generator is rotated rapidly or multiplication factor X10, or X100 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 parameter Pr40, Pr41

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

3 4 1 4 HANDL Operation Mode (Cont'd)

Changing to HANDLE operation mode cancels the program Operations in sequence of AUTOMATIC, HANDLE, and AUTOMATIC cannot be executed Second automatic operation is performed on the top block of the program

In HANDL mode, the current position is updated according to the movement of the manual pulse generator If an incremental command (like G01 Uuo) comes after HANDL 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 HANDL and other modes, acceleration and deceleration are linearly performed Soft stroke limit is also effective

NOTE

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

< HANDL operation in AUTO mode >

HANDL 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 HANDL mode

Execution advances to the next block if a skip signal of Fig 3 43 or a command when distribution of command pulse by HANDL PG has come to a designated position

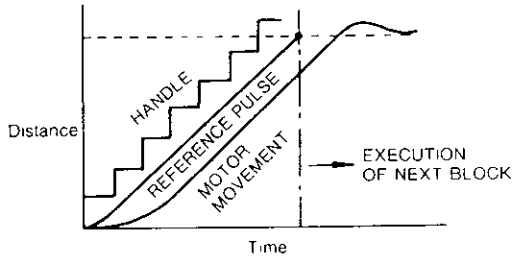


Fig 3 45 Reference Pulse and Position Set by Handle PG

```
G01 X 250 F8000    Moves around the reference
                   position
M55                HANDLE PG command
G05 X 9999*1 F0    Adjusts to the reference by
                   HANDLE PG
                   Turns on the skip signal
G52 X    0   T1    Setting the coordinate
G53          T1
G01 X    x   F8000
```

*1 X = 9999 must not exceed soft limit range

3 4 1 5 AUTO Operation Mode

In AUTO mode, the Motionpack-33 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-33 selects a program to execute according to a working schedule and starts operation Receiving the starting signal, the Motionpack-33 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

(1) Program storing

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

The program must end with M30 that declares the end of program

There is no no-operation command of he Motionpack 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 cut through a paper tape reader or punch via the programmer

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 (PGS0 - 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 as program start signals

(2) PROGRAM Operation

Program operation is an automatic operation executed under the the control of programs stored in the user program area (numbered by block numbers 0 - 399) The method of specifying programs will be described in detail, later in section 4 2 Program Operation Functions

Program operations can be started by either of the following two methods

Starting by a program start signal PCS 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

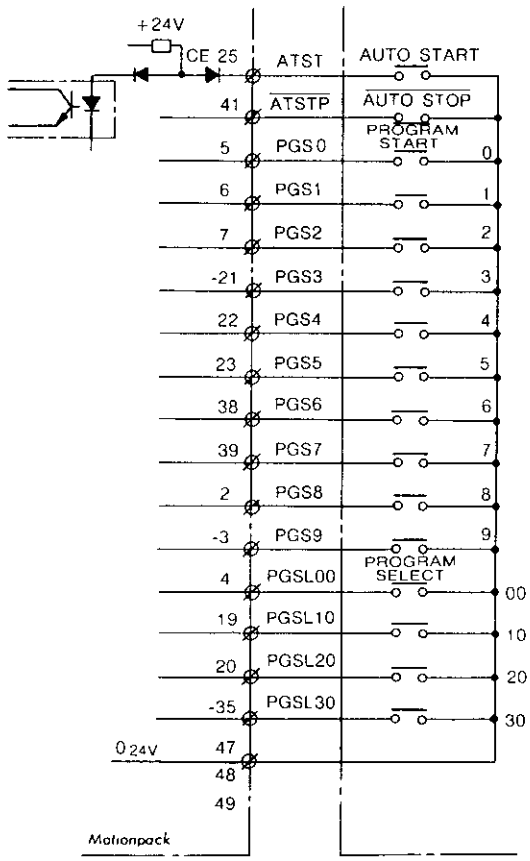


Fig 3 46

CAUTIONS

The automatic start signal line (ATS), and the automatic stop signal line (ATSTP), must be in connection with the 024V point

Program select signals (PGSL 00 - 30) must be turned on before program start signals (PGS 0 - 9) are turned on If not, error Err nSEL will be activated

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

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

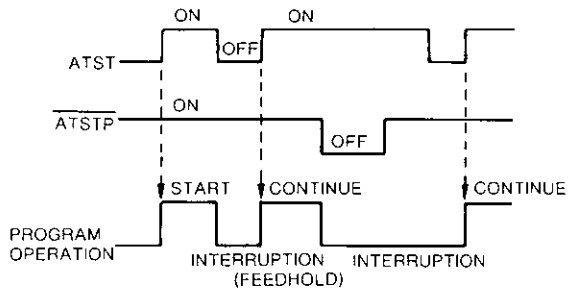


Fig 3 47

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

(3) Single Block Operation

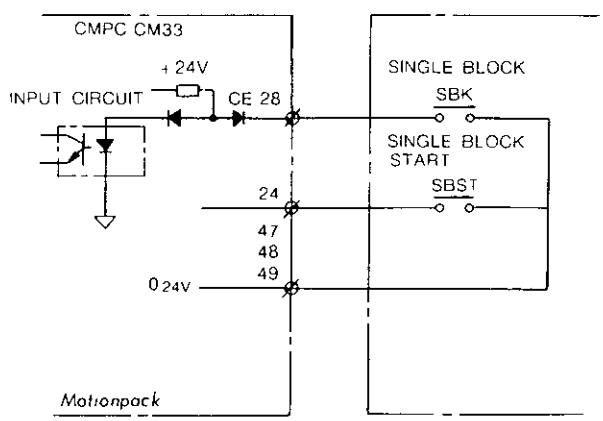


Fig 3 48

3 4 1 5 AUTO Operation Mode (Cont'd)

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

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

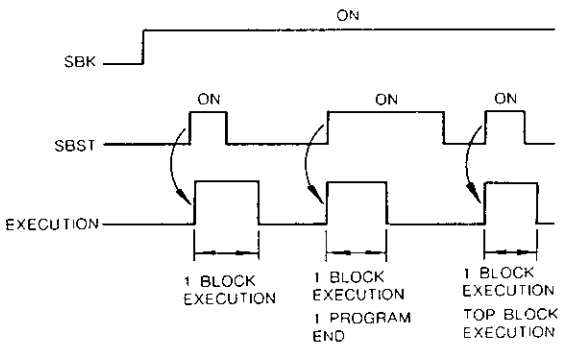


Fig 3 49

When the single block operation signal is turned off, the execution of the program is restarted, regardless of an SBST sitgnal, 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

(4) 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 ($\overline{\text{ATSTP}}$) signal With method (1), as soon as the feedhold signal ends, Motionpack is cleared of the feedhold state, and resumes the program operation

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

3 4 1 6 Return to Home Position

Home position return should be executed before starting under the following conditions because home position coordinate of Motionpack-33 is changed

Motionpack-33 controller power supply is turned on

Machine position is changed for maintenance or repair

Return to Home position is possible in the JOG operation mode, STEP operation mode, and the AUTO operation mode, provided the system is clear of the alarm (ALM1) state

When home position return (ZRN) signal is turned on in these modes, the return HOME mode is turned on, and the tool slide moves to the home position When the slide returns to the home position, it stops, and Home position return completion (ZPM) signal is output Stored stroke limit is effective after home position return is completed

Upon returning to the home position, the slide remains motionless even if the home position return (ZRN) signal remains on, but when the signal is once turned off and then turned on, a return home motion is executed again

When the return home signal is turned off while the slide is moving towards home, the slide stops

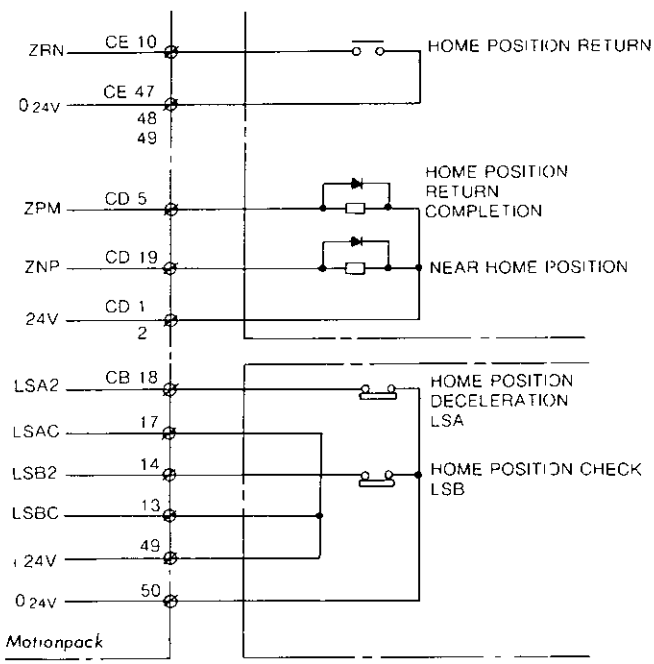


Fig 3 50

The near home position (ZNP) signal is turned on while the tool slide is in the immediate vicinity of the home position, but is turned off in other positions

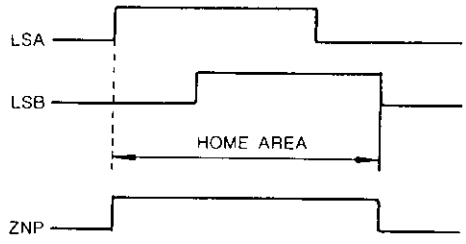


Fig 3 51

The home return completion (ZPM) signal is turned on when a home return motion is completed, but is turned off under the following conditions

Mode switching over

Return Home signal ON

Both Motionpack alarm (ALM1) and error reset (ERS) ON

Emergency stop [see (Note) on Fig 4 7]

With Motionpack-33, if the motion signals for both forward and reverse directions are turned off, the machine stopped for emergency With a circuit connected to a DB unit, if both the forward and reverse OTs are turned off, the machine stopped for emergency The DB brake is applied for both directions

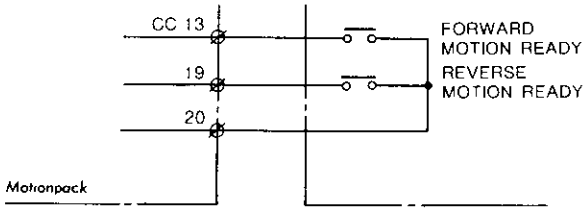


Fig 3 52

The return-to-origin operation is defined by parameters Pr 70 to Pr 78 as summarized in Table 3 14 Refer to par 3 3 for the details of parameters

Table 3 14 Return Home Parameters

Parameter No	Description	Unit
Pr 70	Return home mode	
Pr 71	Home position coordinate	No of pulses
Pr 72	Wait position	Speed unit
Pr 73	Return home speed	Speed unit
Pr 74	Return home creep speed	Speed unit
Pr 75	Return home torque limit	%
Pr 76	Coasting allowance	No of pulses
Pr 77	Permissible error	No of pulses
Pr 78	Butting time	10 msec

It is possible to select the origin LS as an A- or B-contact by connections to terminals ㉙, ㉚, ㉛, and ㉜ of the CB connector

3 4 1 7 Motionpack-33 Coordinate System

Motionpack-33 has 10 coordinate systems (T0 to T9) Coordinate system T0 is defined by PG home position pulse and home position LS Coordinate systems T1 to T9 are based on Coordinate system T0

Method of Coordinate System Setting

① Presetting offset amount in parameter 20 (coordinate system T8) and parameter 22 (coordinate system T6) and shifting coordinate system by turning on or off external signal +/- INC

② Presetting by programmer

③ Coordinate system setting reference G52

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 3 51 shows coordinate setting and register

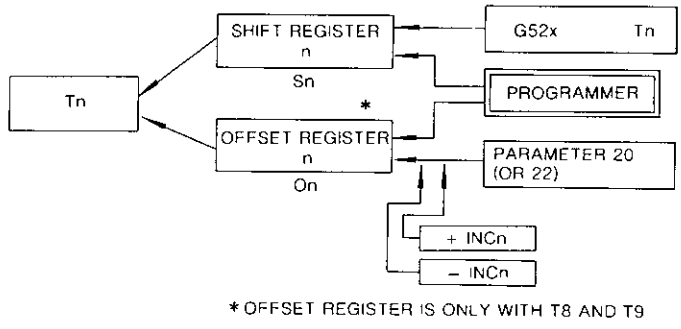


Fig 3 53

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= to+Sn

Example

When shift register (S1) at coordinate system T1 is 100, the relationship between coordinate systems T0 and T1 is as shown in Fig 3 52

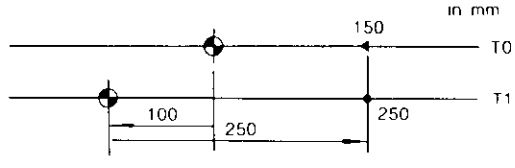


Fig 3 54

3 4 1 7 Motionpack-33 Coordinate System (Cont'd)

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

$$t_1 = t_0 + S1$$
$$= 150 \text{ mm (T0)} + 100 \text{ mm}$$
$$= 250 \text{ mm}$$

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 coordinate 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 system T_8 is 100mm and offset register O_8 is 2mm, the relationship between T0 and T8 is as shown in Fig 3 55

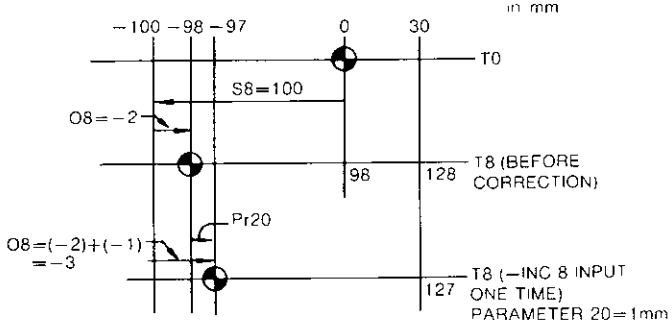


Fig 3 55

Coordinate value t_8 of the position of 30 mm at coordinate system T_8 is

$$t_8 = t_0 + S_8 + O_8$$
$$= 30 + 100 + (-2)$$
$$= 128 \text{ mm}$$

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

In coordinate system T8, the value set to parameter 20 by turning on or off signals +INC8 (or -INC8) can be added to or retracted from offset register Setting tool wear compensation per time to parameter 20 and turning on or off signal -INC8 permits automatic compensation The same applies to coordinate system T9

(1) 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 parameter Pr20 After several corrections, as the total correction amounts to the maximum correction as set by parameter 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 parameter Pr22 and the maximum correction is set by parameter 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 3 56 below

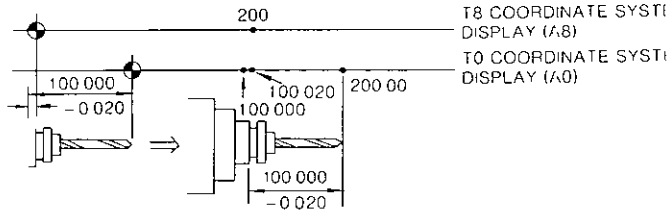


Fig 3 56

The related parameters are listed in Table 3 15 For details, see par 3 3 4 Offset Parameters

Table 3 15 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 is output

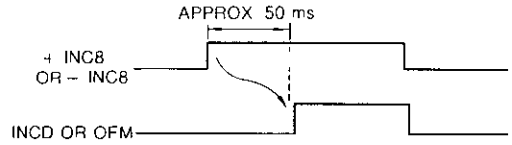


Fig 3 57

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)

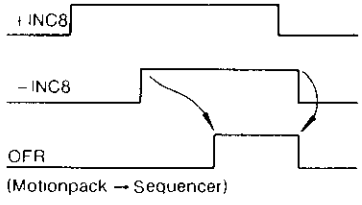


Fig 3 58

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

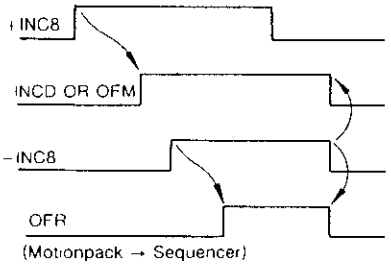


Fig 3 59

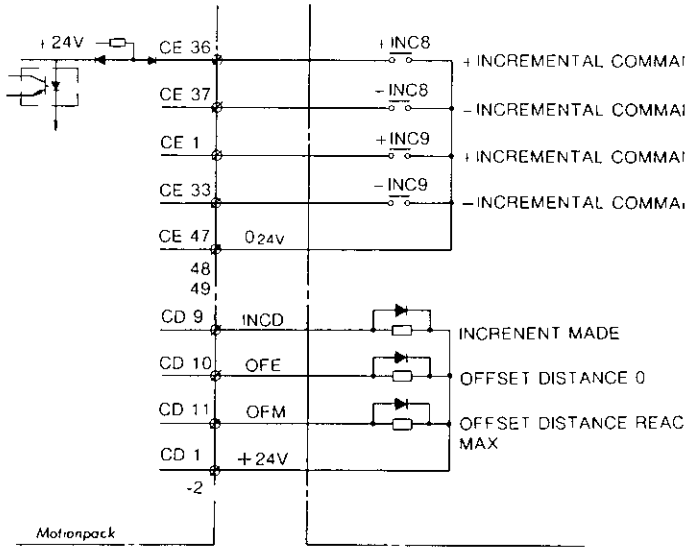


Fig 3 60

(2) Coordinate system setting 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

(a) Setting offset

Select position setting mode
Whenever the POSITION mode switch is pressed, block number is indicated as [0][8] ←→ [5][8]
Offset selection is indicated by "0" and shift selection by "5 " A flashing digit indicates a coordinate number

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

Write an offset value and touch the WRITE switch

Then touch switch, and the next coordinate system is selected.

Numbers are in the minimum position command unit

(b) Setting shift

Select position setting mode
Touch the POSITION mode switch, select "5" (shift selection), write a coordinate number, and touch the switch [↓] or [↑] The block number indication stops flashing the data display begins to flash

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

(3) Method with a coordinate setting command (G52) See par 3 4 2 7, Coordinate setting command (G52)

3 4.2 FUNCTION LIST

All the function commands have codes consisting of G 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.

Table 3 16 Function Command List

Function Command	Code	Function Command Word	Description
Positioning	G01	G01X F I U F, I can be omitted	Move to position X (or U) at speed F and torque limit I
Skip Positioning	G05 G06 G07	G05X F I U	When skip signal turns on, execution is interrupted, and jumps to the next block G05 skip signal EPS5 G06 skip signal EPS6 G07 skip signal EPS7
Positioning by External Signal	G34	G34X F I U	Move to X (or U) position at speed F and torque I When external positioning signal (EXP2) is received, the slide is positioned there
Home Position Check	G27	G27X F I U	Move to X (or U) position at speed F and torque I and check home position at that position
Delay	G04	Delay for in-position	After executing feed command, delay until in-position state is entered, then, move to next block
		Delay time	Delay until time specified by lapses, and then, move to next block
Coordinate Switching	G52	G52X T U	Set current position as X (or U) in Tn coordinate system
Coordinate Setting	G53	G53T	Switching into Tn coordinate system
Arrival Check	G67	G67P	When arriving at X (or U) by skip positioning without skipping, jump to P
Subroutine Call	G68	Repeat calling subroutine G68L P	Execute subroutine L times from P
		Calling end-specified subroutine G68X P U	Execute subroutine from P until arrival at X (or U)
Jump	G69	Simple jump G69P	Go to execute P block
		Return from subroutine G69	Return to block next to subroutine call (G68)
Aux Function	M	Signal output M (M51 to M56)	Output M signal, and when corresponding M-FIN signal turns on, reset M signal output, then, when M-FIN signal turns off, execute next block
	M30	Program end M30	Reset In-operation signal (STL), and output M30 signal

3 4 2 1 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 200%)

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 3 3

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

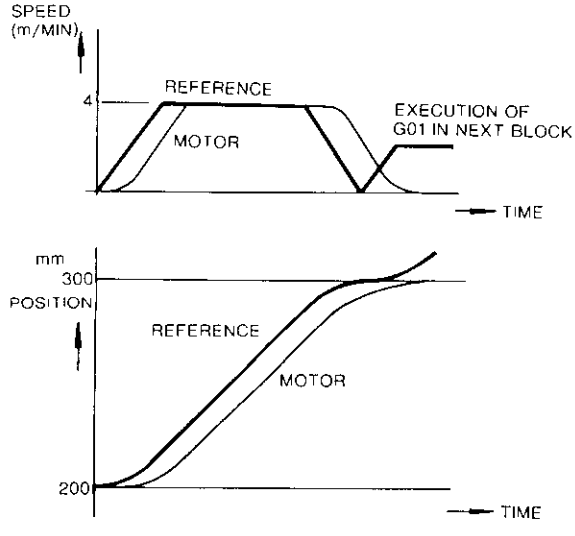


Fig 3 61

Example

Current position 200 mm
Command position 300 mm
Speed 4 m/min
With torque limit (10 to 200%),
G01 X300 000 F4000 I200 in absolute value
G01 U100 000 F4000 I200 in incremental value

Fig 3 61 shows G01 command execution and motor movement Positioning command is linear accel/decel

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

The setting range for torque limit I is between 10 and 200 Its unit is % of the rated torque 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-33 controller executes the command of the next block Fig 3.61 shows the command in which G01 is programmed in the next block

As shown in Fig 3 61, 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 reaches the specified position, insert In-position command (G04) or time delay command (G04D) See par 3 4 2 5 and 3 4 2 6

The parameters related to positioning are shown in Table 3 17 Table 3 18 shows the servo parameters For detailed setting of each parameter, see par 3 3

Table 3 17 Positioning Parameters

Parameter No	Description	Unit
45	In-position range	Pulse
50	Pulse ratio M	
51	Pulse ratio D	
52	Decimal point 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 above

Table 3 18 Servo Parameters

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

3 4 2 2 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 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 200%)

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 is 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

To execute the command of the next block after the motor has reached the target position it is necessary to insert the in-position wait command (G04) or wait command (G04D) Refer to para 3 4 2 5, In-position Wait Command, and para 3 4 2 6, Wait Command

Command G05 is skipped by a signal 5 (EPS5), G06 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 control enters the skip signal fault (MP alarm) state

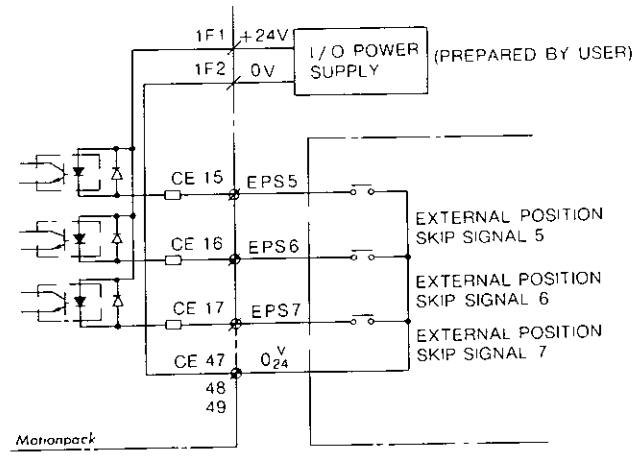


Fig 3 62

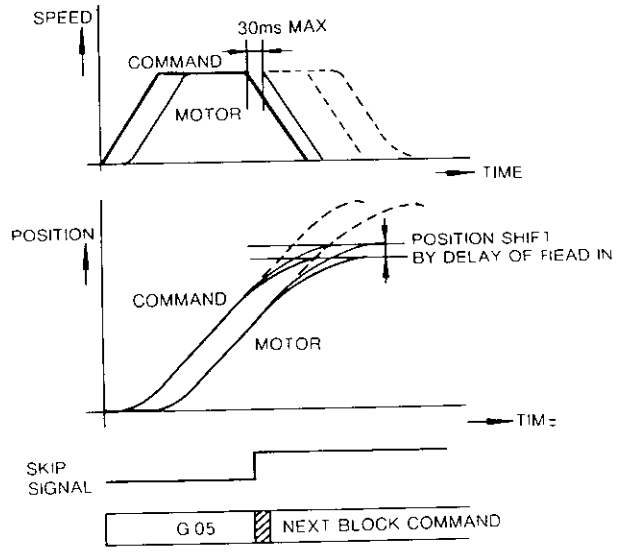


Fig 3 63

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

For example, with the HI-CUP motor feed unit shown in Fig 3 62, 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

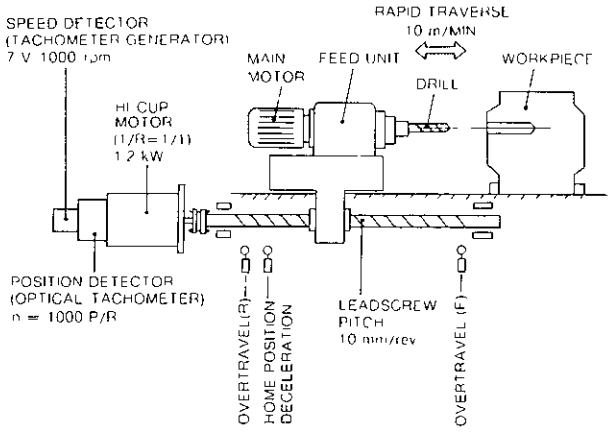


Fig 3 64

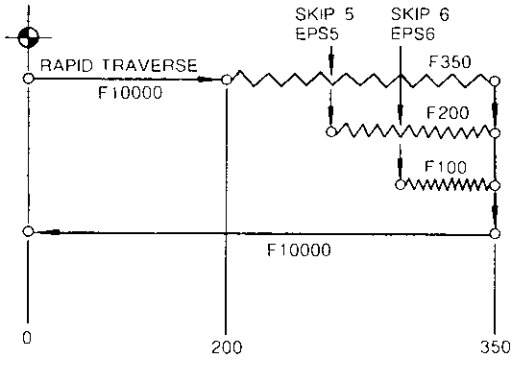


Fig 3 65

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   F=350 drilling feedrate
 043 G67 P047   Arrival check Note
 044 G06 X350 F200   F=200 drilling feedrate select
 045 G67 P047   Arrival check 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
```

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 3 4 2 9)

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 30 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 (refer to par 3 4 21)

Related parameters
Refer to par 3 4 21

3 4 2 3 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 200%)

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

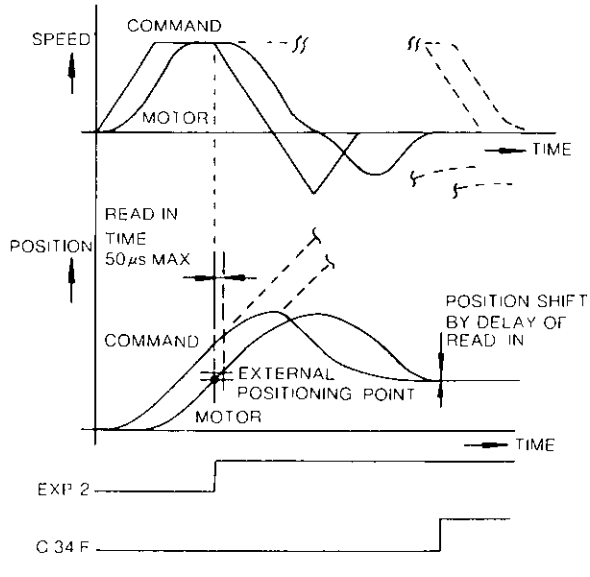


Fig 3 66

3 4 2 3 External Positioning Command (G34) (Cont'd)

External positioning signals are read with response deviation within 50 μ sec, 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

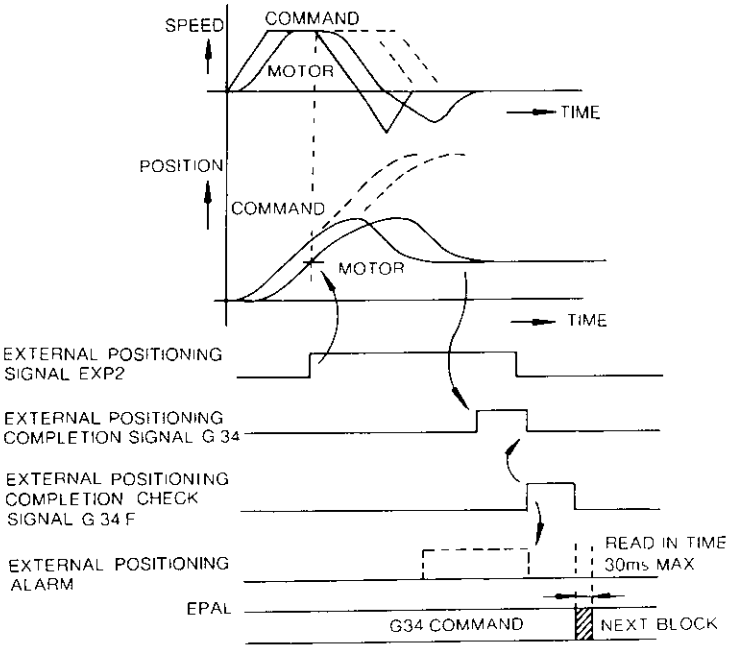


Fig 3 67

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

G34F signal ON

Mode switching over

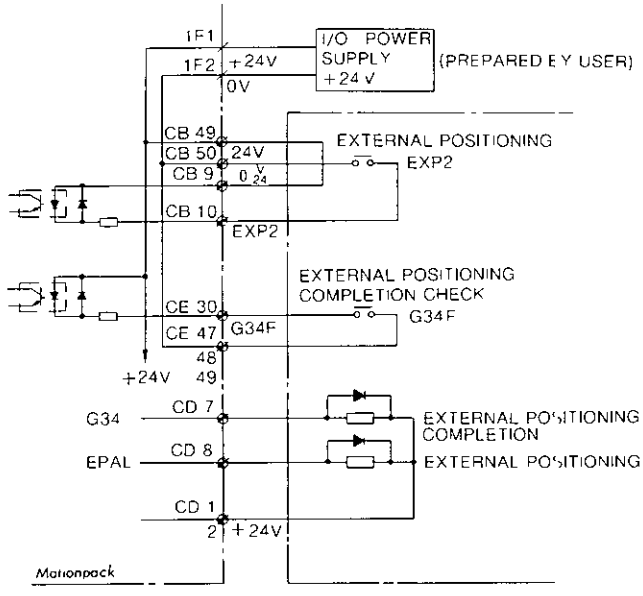


Fig 3 68

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

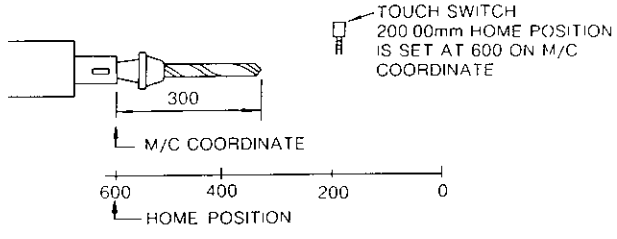


Fig 3 69

In execution of a skip positioning command, the arrival check command (G67) skips after judging whether or not skipping has occurred Therefore, G67 can be placed in the next block of G05 (or G06 or G07) to branch the program, depending on whether or not skipping has occurred

In Fig 3 69, 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 touch switch
101 G34 X490 F300	External positioning at low speed
102 G52 X200 T1	Tool tip setting

Execution of the next block

When the end confirmation signal (G34F) turns ON, the external positioning end signal (G34) or alarm (EPAL) is reset When the Motionpack-33 controller detects that signal G34F has turned OFF, program advances to the next block The timing of reading the G34F signal may vary 30 msec at maximum

Related parameters
Refer to par. 3 4 2 1

3 4 2 4 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 200%)

Operation

The origin confirmation signal (G27) checks if the coordinate of the PG origin of programmed operation is correct As described in par 3 3 5 1, Motionpack-33 determines the PG origin from the origin pulse (1 pulse/rev) of PG and origin-related LSs and its coordinates are defined with parameter Pr71

The G27 command determines if the position designated with X(U) is the PG origin currently selected, then moves to the destination at speed F and torque limit I (F and I can be omitted as in the positioning command)

The Motionpack-33 controller distributes command pulses, taking the target position -Pr46 (or +Pr46) as the temporary target position Then, moving in the range of the target position ±Pr46, it seeks the origin pulse

Reading the origin pulse, it determines if the coordinate is the same as the PG origin (PG origin - Pr77 ≦ C-phase pulse ≦ PG origin + Pr77) At the same time, it checks the origin LS signal at the PG origin

If the return-to-origin method uses a waiting position, it must be given G27 error results if it is not given In the stopper method, G27 cannot be used since the origin pulse is not used

G27 error (MP alarm) results if the command position is wrong or the slow-down LS signal is erroneous.

When the command position is wrong, G27 error (Err G27) results with no movement made G27 error also results when the coordinate of the PG origin is wrong or the origin LS signal is erroneous

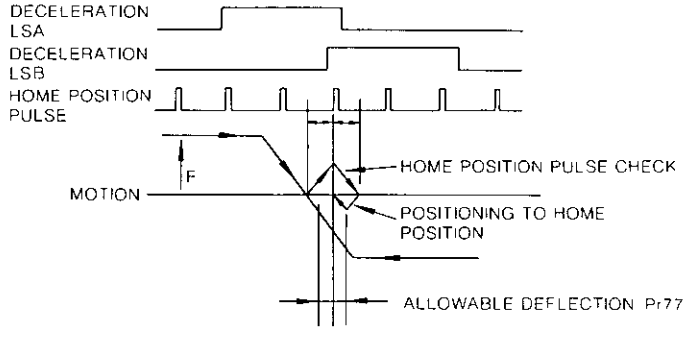


Fig 3 70

Execution of the next block

The coordinate of the PG origin and the origin LS signal on the PG origin are checked and, if everything is correct, execution of the next block starts Otherwise, G27 error results with an alarm given and execution of the next block does not start

Related parameters

Home position check parameters (Pr70 to Pr77) and G27 allowable error amount (Pr46) in addition to positioning and servo parameters

3 4 2 5 In-position Delay (G04)

Time delay G04

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

3 4 2 5 In-position Delay (G04) (Cont'd)

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 parameter P45

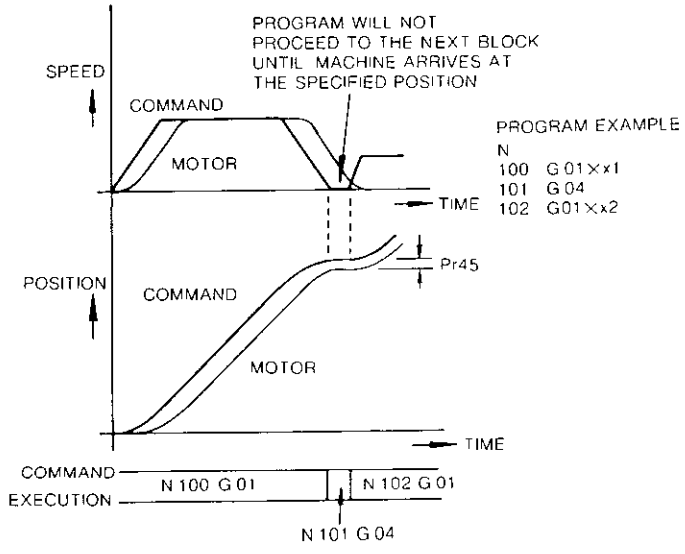


Fig 3 71

Execution of next block

As shown in Fig 3 66, execution of the next block starts when the in-position area has been reached by the immediately preceding feed command

Related parameter Pr45

3 4 2 6 Time Delay Command (G04)

G 04 D [illegible]

G04

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

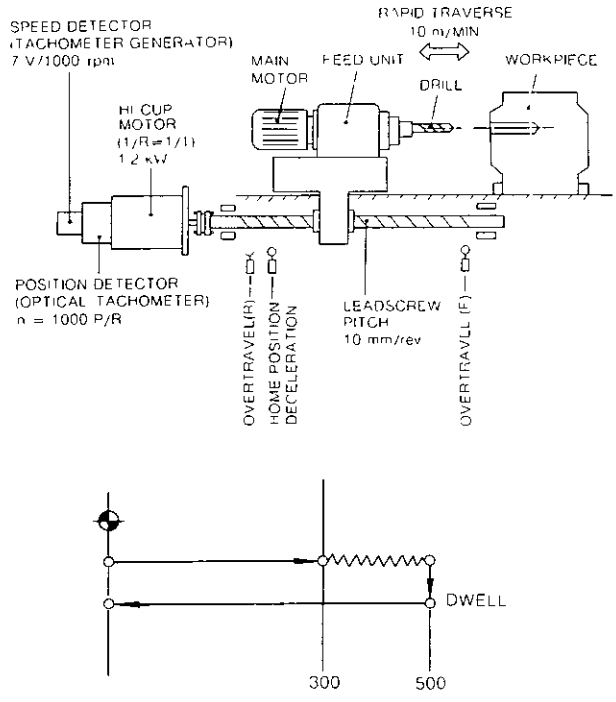


Fig 3 72

```
010 G53 T1
011 G01 X300 F10000   Rapid traverse
012 G01 X500 F300     Cutting
013 G04               In-position delay
014 G04 D1            Delay 1 sec
015 G53 T0
016 G27 X0 F10000
017 M30
```

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

Related parameters
None

3 4 2 7 Coordinate Setting Command (G52)

G 52 X [illegible] T [illegible] U [illegible]

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 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 X 322 00
G52 X 100 00 T4
```

With this command, the position 322 00 in the current coordinate system is set at 100 00 in coordinate system T4

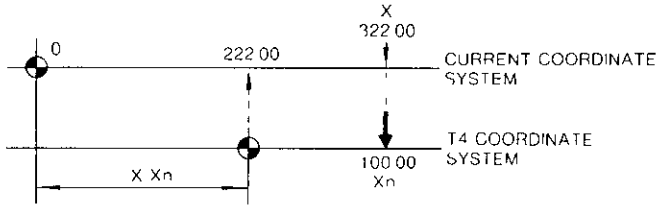


Fig 3 73

Example 2

```
G01 X 322 00
G52 U −222 00 T4
```

T4 coordinate system is set with shift by +222 00 from the current coordinate system independent of the current position

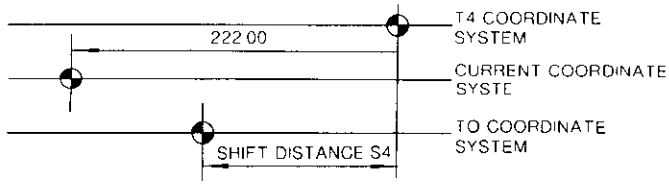


Fig 3 74

Example 3

```
100  G01 X 100 00
101  G52 X 200 00 T8
102  G53 T8
103  G01 X 250 00
```

The coordinate system T8 has shift length register S8 and offset register O8 The command G52 sets in the shift length register The contents of registers A, S, and O change according to execution of the program, as shown in Table 3 19

Table 3 19

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 milliseconds of execution time

3 4 2 8 Coordinate Switching Command (G53)

```
G 53  T [ ]
```

G53 Coordinate switching

T Coordinate 0 to 9

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

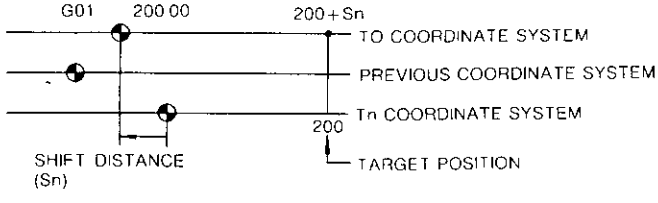


Fig 3 75

3 4 2 8 Coordinate Switching Command (G53) (Cont'd)

Using coordinate setting G52 and coordinate switching G53, tool end coordinate setting is possible for each tool

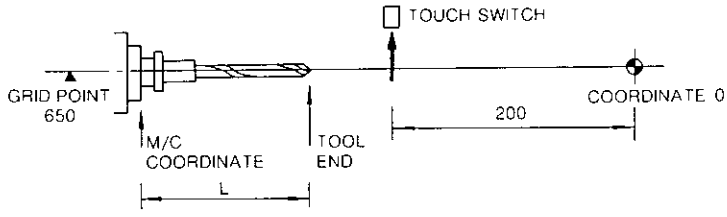


Fig 3 76

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 G52 U-400 T5 Tool 5 end coordinate setting
 286 G01 U-249 F12000
 287 G34 U-22 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
```

3 4 2 9 Arrival Check Command (G67)

```
G 67  P [   ]
```

G67 Arrival check command

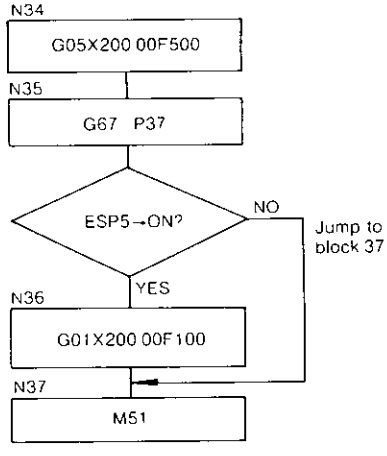
P 3-digit No of block to be jumped

With this command, the execution or no execution of an interrim skipping the execution of a G05, G06 or G07 skip positioning commanc 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
N027 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



3 4 2 10 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 From a block in a subprogram, further jump to another subprogram is also possible, but this is up to the 4th nesting

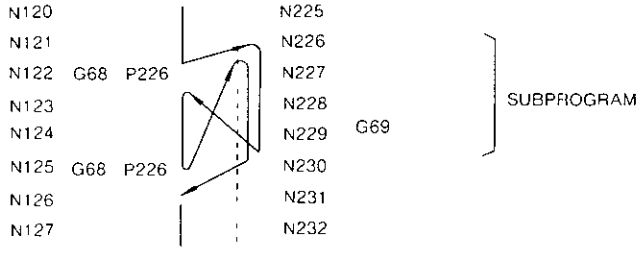


Fig 3 77

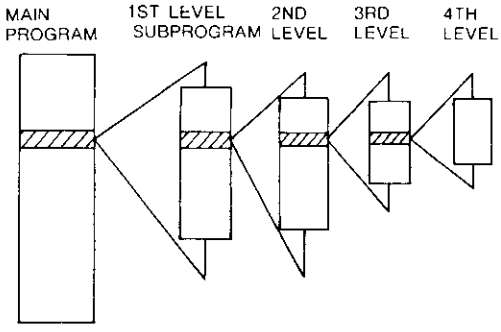


Fig 3 78

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 para 3 4 2 11

G 68 L[ ], P[ ]

G68 Subprogram call command
L No of repetitions (1 to 9)
P Subprogram start block (000 to 399)

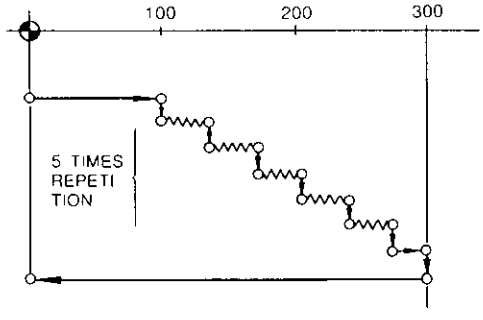
With this command, subprogram beginning with the block specified by P is repeated L times

Application of subprograms

Shown below is the programming example using subprogram call command with specification of repetition

Application example 1
Subprogram example (1)

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




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

Fig 3 79

3 4 2 11 Destination Point Specified Subprogram Call Command (G68)

G 68 X[ ] P[ ] U[ ]

G68 Subprogram call command
X End point (absolute)
U End point (incremental)
P Subprogram start block 000-399

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 coordinate system in which the G68 command was executed

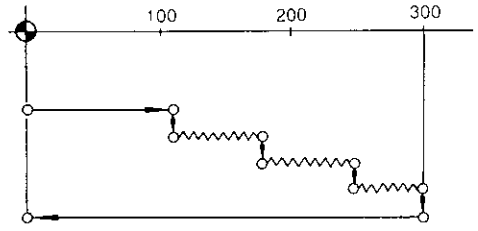
Within a subprogram, its subroutines can be nested up to the 4th level, but the end position specifying subprogram should not be executed in duplication

3 4 2 11 Destination Point Specified Subprogram Call Command (G68) (Cont'd)

Application example

Subprogram example (2)

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




```
N060 G01 X110 F1200
 061 G68 X300 P066  Repeat subprogram until
                    X = 3
 062 G27 X0   F12000
 063 M30

N066 G01 U70 F300   Subprogram
 067 M51
 068 G69   Return from subprogram
```

Fig 3 80

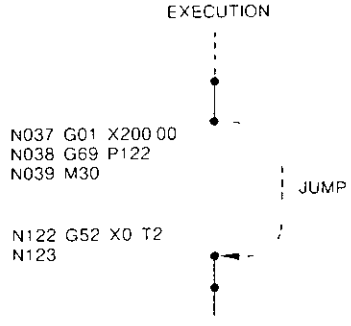
3 4 2 12 Jump Command (Simple Jump) (G69)

G 69 P[ ]

G69 Jump command

P Block to be jumped to 000-399

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



3 4 2 13 Return from Subprogram (G69)

G 69

Operation

This command must be programmed always in the last block of all subprograms With this command, 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

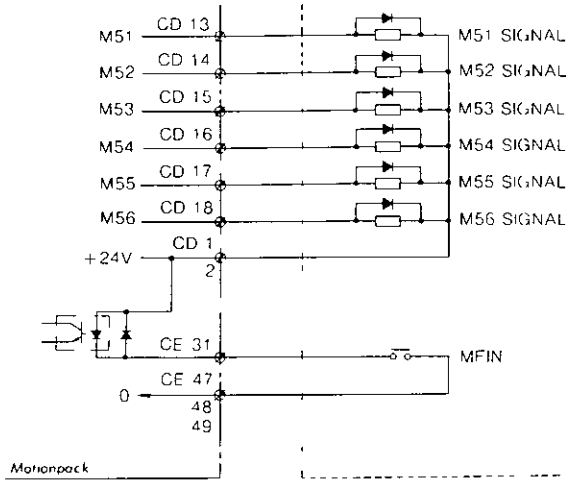
3 4 2 14 Auxiliary Function Command (M)

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

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



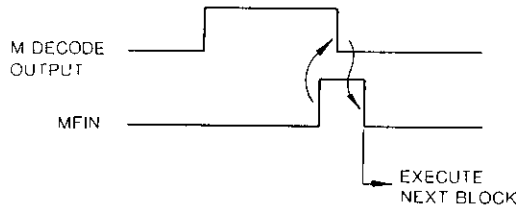


Fig 3 81

3 4 2 15 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

4. Motionpack-33 PROGRAMMER (CMPF-PM33 C/D)

The Motionpack-33 programmer is designed for use in checking systems and off-line maintenance It has the following capabilities

To check and change program and parameters

To indicate position data of system

To indicate status of system

To write, read, and verify programs and parameters to/from a terminal

Note that the Motionpack-33 programmer cannot be used on-line continuously as part of system monitor or control panel

4.1 Motionpack-33 PROGRAMMER FUNCTION AND OPERATION

4 1.1 KEYBOARD AND DISPLAY

The Motionpack-33 programmer keyboard panel is shown in Fig 4-1

ⓐ 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 displayed 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 push 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 push the ENTER key The decimal point stops blinking, and the data is input (When entering programs, push 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

ⓖ Mode select

These keys with indicators are used to select or display modes of theprogrammer

ⓗ Digit key

These digit and sign keys are used to enter numerals

ⓘ Operation keys

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

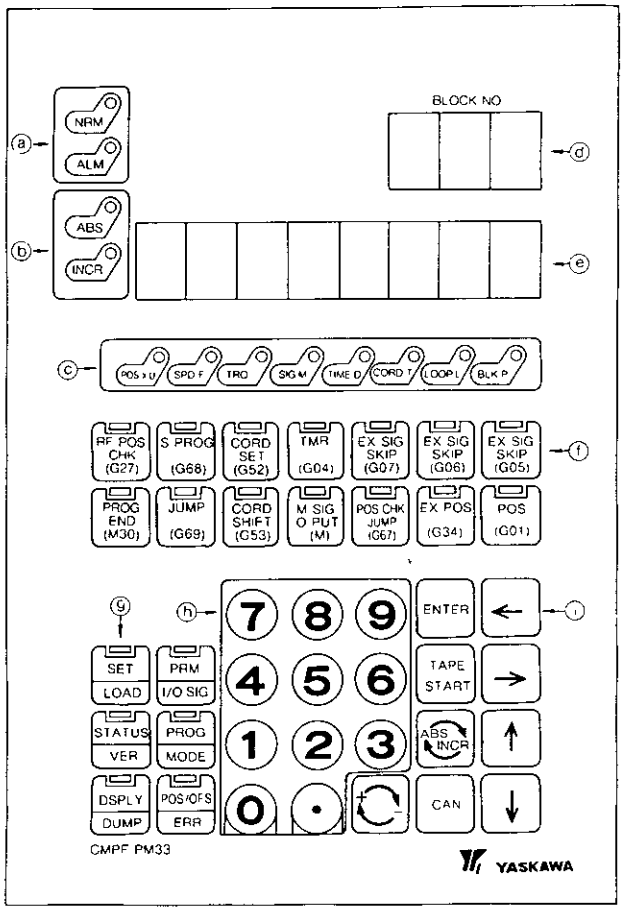


Fig 4 1 Motionpack-33 Programmer Panel

4 1 2 MODE SELECT

The setting mode, display mode and data types are selected with these mode select keys The functions of these modes are listed in Table 4 1

Table 4 1 Motionpack-33 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 (Coordinate 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 (0-99)	Parameter tape output
	PROG	Program display (0-399)	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 modes check that EDIT signal is on The set mode can only be selected while EDIT is ON
2 When parameters have been rewritten be sure to turn off the power supply and turn it on again before starting operation

4.1 3 PARAMETER SETTING

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

To set a subsequent parameter, push the [↓] key The parameter No in the block No display is increased by one, and the same data is displayed If the paramerer is not to be rewritten, push 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, push the [PRM] mode key again The block No blinks requesting the entry of a parameter No If wrong digit keys are pushed while writing block Nos or data, push 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 Motion-pack controller once and turn it on again With this operation, the entered parameters become effective

4 1.4 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 push the [↓] or [↑] key

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

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 [PRM] mode key is pushed, the block No. display blinks, requesting the selection of parameter No

4.1 5 PROGRAM ENTER

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

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

When the [→] or [←] key is pushed, the data is checked automatically and, if the data is wrong, dAtA Err 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 pushing 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 push the [→] or [←] key and then push the [ENTER] key.

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

When an end position designating subprogram call (G68X P) is changed to a repeat subprogram call (G68L L .)

When an in-position pause (G04) is changed to a time pause (G04D)

When jump from subprogram (G69) is changed to a simple jump (G69P)

4.1 6 PROGRAM ALL CLEAR

Push the [SET] key and the [PROG] key The block No blinks Push the [PROG] and [CAN] keys simultaneously and then push the [ENTER] key All the blocks are rewritten to become M30

4.1 7 PROGRAM DISPLAY

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

4.1 7 PROGRAM DISPLAY (Cont'd)

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

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

4.1 8 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 are specified in reference to the T0 coordinate system The T8 and T9 coordinate systems can be offset by ±INC8 or ±INC9, 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)

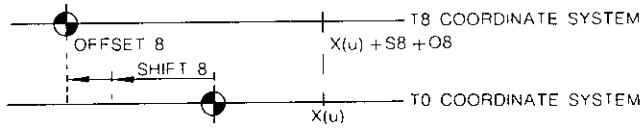


Fig 4 2 Coordinate System Select

(1) Offset value setting

Select the position setting mode
Each time the [POS/OFS] mode key is pushed, the block No display changes between [0 0] 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 push the [↓] or [↑] key The Block No display stops blinking, and the universal display starts to blinking,

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

(2) Shift Value Setting

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

Write the required shift value and push the [ENTER] key When the [↓] key is pushed, subsequently, the next coordinate No is displayed Shift values are in minimum position command units

4.1 9 POSITION DISPLAY

Select the position display mode ([DSPLAY] [POS/OFS]) Each time the [POS/OFS] mode key is pushed, the block No display changes in the sequence of A→U→C→O→S and the coordinate No blinks

The meaning of these symbols 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 push the [↓] or [↑] key The coordinate No stops blinking and the position in the selected coordinate system is displayed Push the [↓] key and the position in the next coordinate system is displayed

Display 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 and for U3 is the position error PM33D programmer is provided with U4 display (encoder feedback position)

4 1 10 STATUS DISPLAY

Select the program status mode ([STATUS] [PROG]) Each time the [PROG] mode key is pushed, symbols SE Er and Ro are displayed in the block No display in sequence and the relevant contents are displayed in the universal display

With the display of SE the operation mode is displayed and with Er the error data is displayed With the display of Ro , 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 B-14

4.1 11 SIGNAL DISPLAY

Select the parameter status mode ([STATUS] [PRM]) Each time the [PRM] key is pushed, 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 push 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 pushed, the next channel No is selected

4.1 12 POSITION ERROR DISPLAY

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

4 1.13 TAPE

4 1 13 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 paragraph 4 2 1 and 5 2 4

4 1 13 2 Tape Format

(a) Parameter tape format

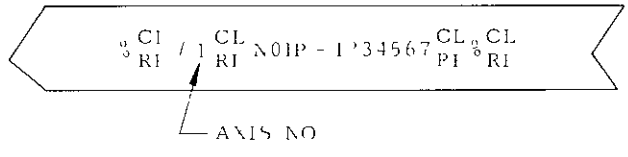
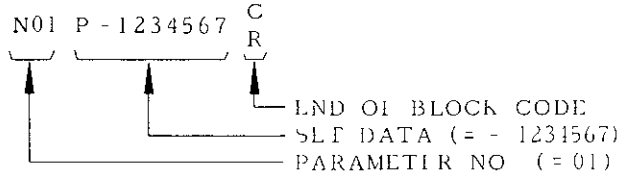


Fig 4 3 Parameter Tape Example

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



The code CR indicates 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 CR N1P-567 CR

In the data portion between two % 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
CR	End of block
LF	Line feeding
SP	Spacing

(b) Program tape format

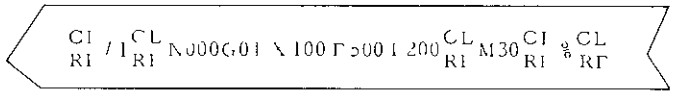


Table 4 4 Program Tape Example

Write % before and after the data portion (same as with parameter tapes)

Be sure to write CR at the end of all blocks

In the data portion between two % signs, only the following codes are effective Any other codes are regarded as errors

/	Axis No designation
N	Sequence No designation
G	Function designation
X	Position (absolute) designation
U	Position (incremental) designation
F	Feed speed designation

4 1 13 2 Tape Format (Cont'd)

I Torque designation

M Auxiliary function designation

D Dwell time designation

T Coordinate No designation

L No of loops designation

P Jump destination sequence No designation

0-9 Digits

+ and - Signs

CR End of block

LF Line feeding

SP Spacing

G functions 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)

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]

4 1 13 3 Paper Tape Operation

Paper tapes can only be punched, collated and read in the EDIT mode To operate with a paper tape, Motionpack axis Nos (parameter 54) and transmission baud rates (parameter 97) must be set Axis Nos are from 1 to 9 and are stored in the Motionpack controller Transmission baud rates are stored only in the programmer and are erased when the programmer is deenergized

4 1 13 4 Punching Parameter Tape

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

4 1 13 5 Punching Program Tape

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

Pressing [TAPE START] key with ABS/INCR kept pressed, punches out all the data of specified block number thru 399 When [TAPE START] key is pressed without ABS/INCR key punches out the data of specified block number thru 399 and omits the M30s, after the first M30

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

4 1 13 6 Parameter Tape Collation

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

Push the [TAPE START] key If normal data is not received within 5 seconds after pushing 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 N001 P000* parameter tape format, FORMAT ERR is displayed When the read data contains a parity error, PARITY ERR is displayed

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

4 1 13 7 Program Tape Collation

Push the [STATUS] and [PRM] keys The mode is displayed Push 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

4 1 13 8 Parameter Tape Reading

Push the [SET] and [PRM] keys The block No display blinks Push the [TAPE START] key If normal data are not received within 5 seconds after pushing the key, BAUD ERR is displayed

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

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

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

4 1 13 9 Program Tape Reading

Push the [SET] and [PROG] keys The block No display blinks Push the [TAPE START] key FORMAT ERR is displayed Other processes are same with parameter tapes

4 1 13 10 Tape-related Errors

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

No data after 5 seconds from tape start BAUD ERR

Parity error	PARITY ERR
Discrepancy of axis Nos	AXIS ERR
Incorrect tape format	FORMAT ERR

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

4 1 14 STATUS DISPLAY

When the [STATUS] key and the [MODE] key are pushed, the current status is displayed in the universal display

(1) Motionpack controller status display SE

1	EDIT MODE	Ed iE
2	AUTO MODE	Auto 399
3	JOG MODE	JoG
4	STEP MODE	StEP

(2) Motionpack controller hold status display Ho

1	Command in execution	run inG
2	Waiting for C-Fin	n1 UP
3	Waiting G04 time up	G04 tI
4	G04 in position	G04 inP
5	G01 - G27 waiting for positioning finish	PoS SEt
6	Waiting for auto mode	non Auto
7	Waiting for operation start	non SEAE
8	Feed hold	FEd HoLd

(3) Motionpack controller error display Er

1	CPU error	CPU Err
2	Program error	Pro Err
3	Parameter error	PAr Err
4	Emergency stopped	Ec SEoP
5	Servo error	SErvo
6	Current saturation	EC OvEr
7	Forward overtravel	For 0 t
8	Reverse overtravel	rvS 0 t
9	Home position return error	SEt UP
10	G27 error	Err 27
11	Workpiece select error	Err nSEL
12	Power down	PS down
13	Battery error	bAE down
14	Forward stored limit over	P OvEr
15	Reverse stored limt over	P - OvEr
16	Excess deviation	dEr OvEr
17	In-position error	inPo Err
18	Skip signal fault	SP Err
19	External positioning error	OvbP Err
20	Transmission error (Motionpack controller programmer)	C Err
21	No error	non Err

4. 2 Motionpack-33 PROGRAMMER INTERFACE

4 2 1 INTERFACE WITH Motionpack-33 CONTROLLER

Interface between Motionpack-33 controller and programmer complies with RS422

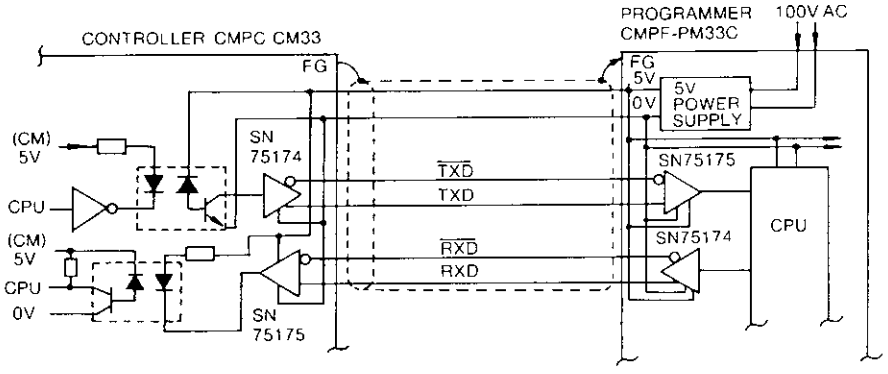


Fig 4 5 Interface Circuit between CM and PM

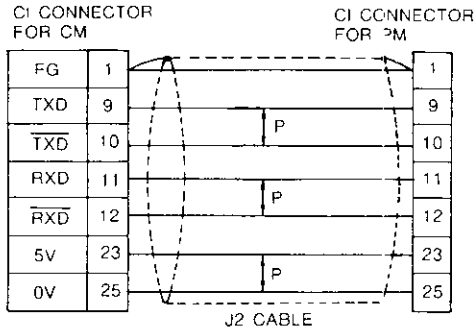


Fig 4 6 Cables Connecting CM and PM

4 2. 2 INTERFACE OF TAPE DEVICE

Motionpack-33 controller can be connected to tape device through Motionpack-33 programmer and inputs or outputs parameters Transmission is RS232C

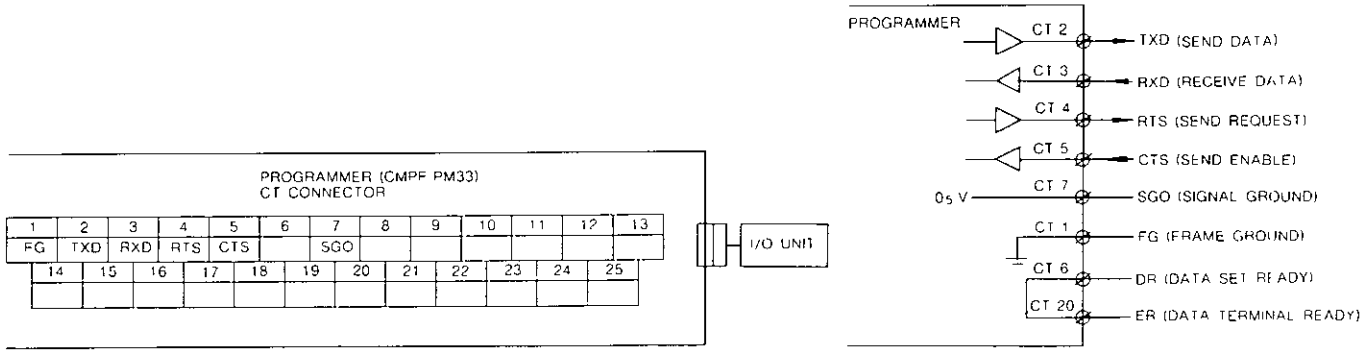


Fig 4 7

(1) Transmission

Transmission is asynchronous, that is, a start bit precedes the data bits and stop bits follow them

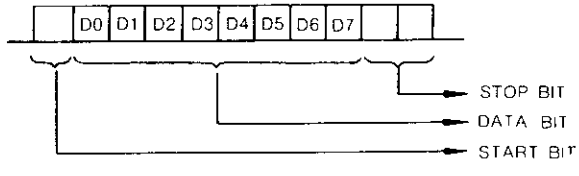


Fig 4 8

(2) Code ISO

(3) Signal logic See Table 4 2

Table 4 2

	+3 V or more	-3 V or below
Data Signal	0	1
Control Signal	ON	OFF

(4) Transmission rate (baud rate)

The transmission rate is the number of bits transmitted per second It is possible to select any one given in Table 4 3

The transmission rate is selected with a parameter Refer to par 3 3 6 2, Tape Device Baud Rate

Table 4 3

Transmission Rate
110
300
1200
2400

(5) Cable and connector

The cable connector is Model DB-25P D-sub connector (made by JAE) Normally, the cable should be prepared by the user The cable prepared by Yaskawa is designated J4 If assistance is required, contact your YASKAWA representative

4 2 2 1 Connecting to Protyper

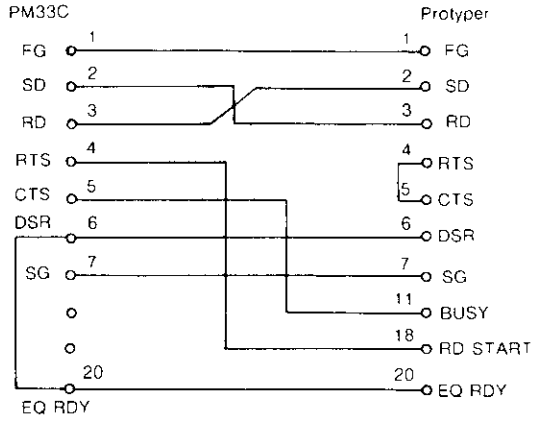


Fig 4 9

4 2 2 2 Connecting to Hand-held Computer (EPSON HC-40)

Fig 4 10 shows connections of hand-held computer EPSON HC-40, used as a terminal equipment, to Motionpack programmer The programs and parameters of Motionpack are stored in the file of microcassette of HC-40

(1) Hand-held computer

EPSON HC-40 Microcassette with drive
Power Supply With AC adaptor

(2) Cable

(3) Transmission speed (Baud rate)

Baud rate is 2400 bps Set Pr97 = 2400

(4) HC-40 programs

HC-40 loader program and connection cable must be provided by the user HC-40 should be provided with microcassette drive For detailed instructions for HC-40, refer to HC-40

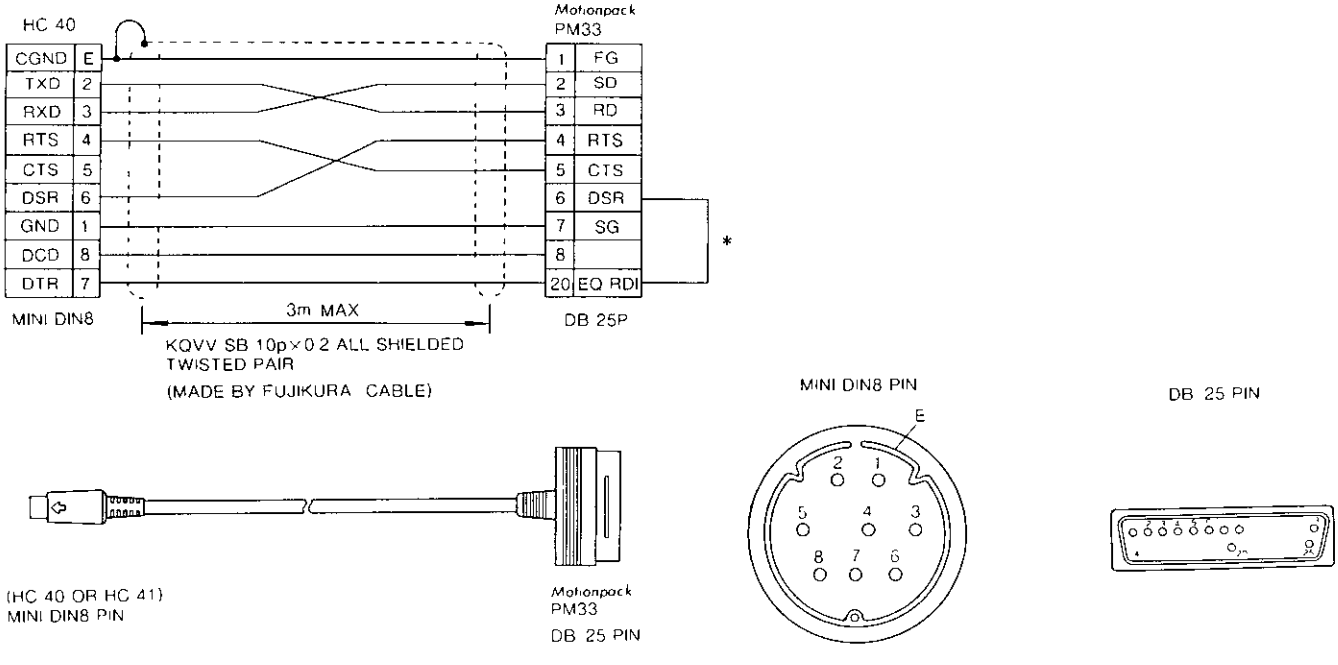


Fig 4 10 Example of Cables

5. DB UNIT (JESP-DB002)

5.1 DB UNIT FUNCTION

Major functions of the DB unit are as follows

(1) Dynamic brake for emergency stop

(2) Sending Servopack base cutoff and P operation command signals

(3) Prohibiting detection of CL (current limited)

(4) ① Setting torque limit and ② dwell time with VR

The Motionpack-33 system sets torque limit with an output signal of the Motionpack-33 controller while VR of the DB unit is kept at MAX

Normally in the Motionpack-33 system, the dwell function is controlled with the G04 command

(1) POWER Switch

When the POWER switch is set to ON, the DB unit is routed or energized Since the power supply switch is designed to serve also as a circuit breaker, keep it normally on, and turn on and off the power supply by an external sequence unit

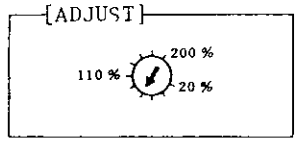
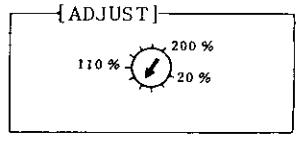
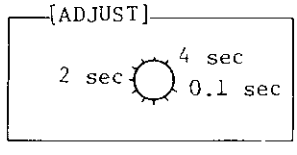
(2) Display

Table 5 1 DB Unit Display and Function

Name	Color	Function
POWER	Green	Indication of the application of 200/220VAC across terminals (r) and (t)
TRQ LMT	Green	Attainment of torque limit (current limit)
DWELL	Green	Lapse of time set by delay time setting after the attainment of torque limit (current limit)

(3) Adjustment

Table 5 2 DB Unit Function and Adjustment

Adjuster	Funciton and Adjustment
⊖ CURRENT LMT ADJ	See NOTE below Adjustment of current limit value (torque limit) on the forward run side Adjustable range 20 - 200% of motor rated current 
⊕ CURRENT LMT ADJ	See NOTE below Adjustment of current limit value (torque limit) on the reverse run side Adjustable range 20 - 200% of motor rated current 
DWELL TIME ADJ	Adjustment of lapse time after the attainment of torque limit (current limit) Adjustable range 0 1 - 4 seconds 

Note

1 When a preset time elapses after the attainment of the torque limit, a signal (DT) is output, and the DWELL lamp lights

2 The motor run direction is determined by the polarity of the connection with the Servopack and of the speed command voltage In the above case no consideration is given to the connection with the Servopack and the forward run direction is assumed to be the one corresponding to plus speed command voltages and vice versa

5. 2 BLOCK DIAGRAM OF DB UNIT

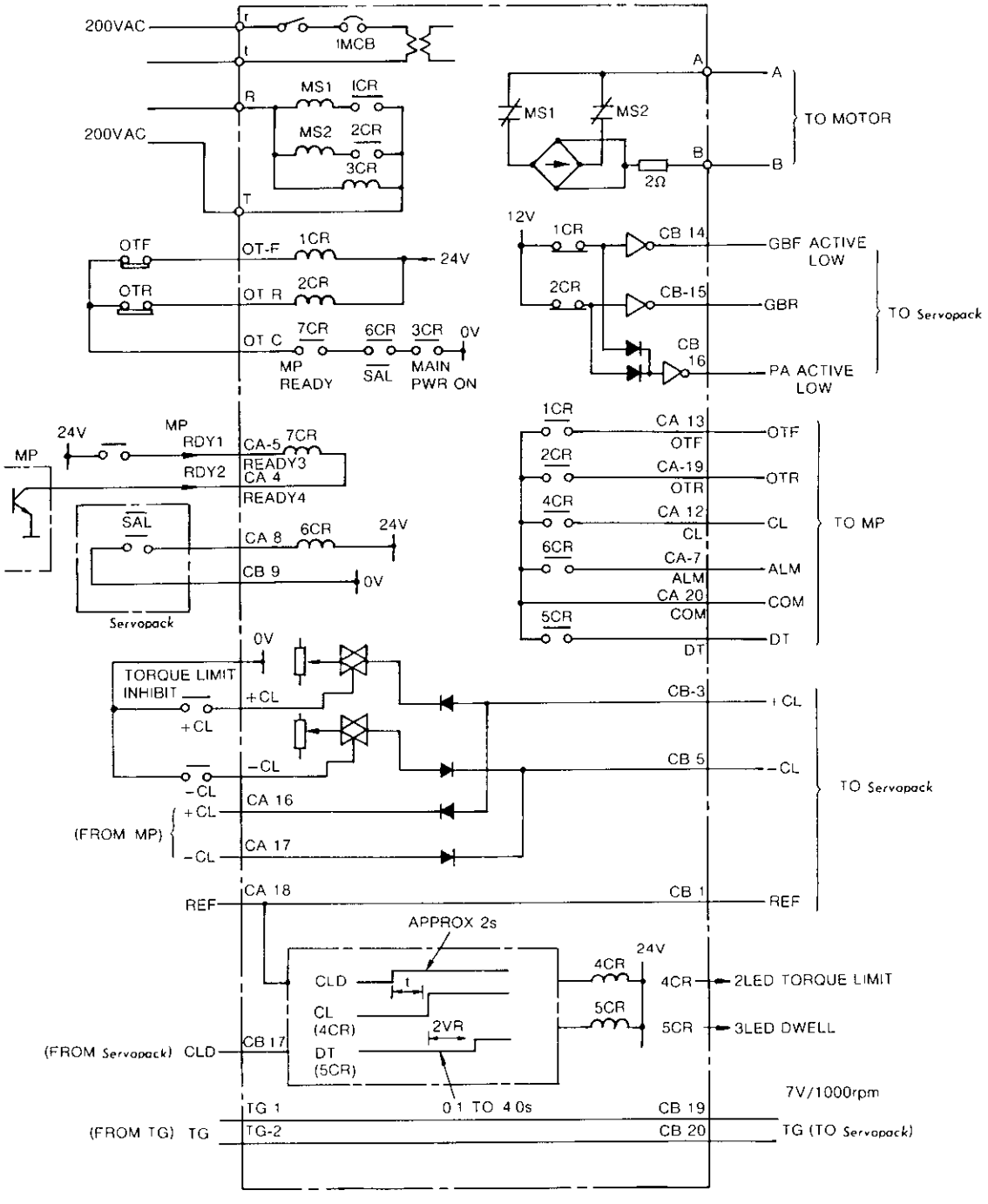


Fig 5 1 Block Diagram of DB Unit

5. 3 CONNECTIONS BETWEEN UNITS

5 3. 1 CONNECTIONS TO Motionpack-33 CONTROLLER

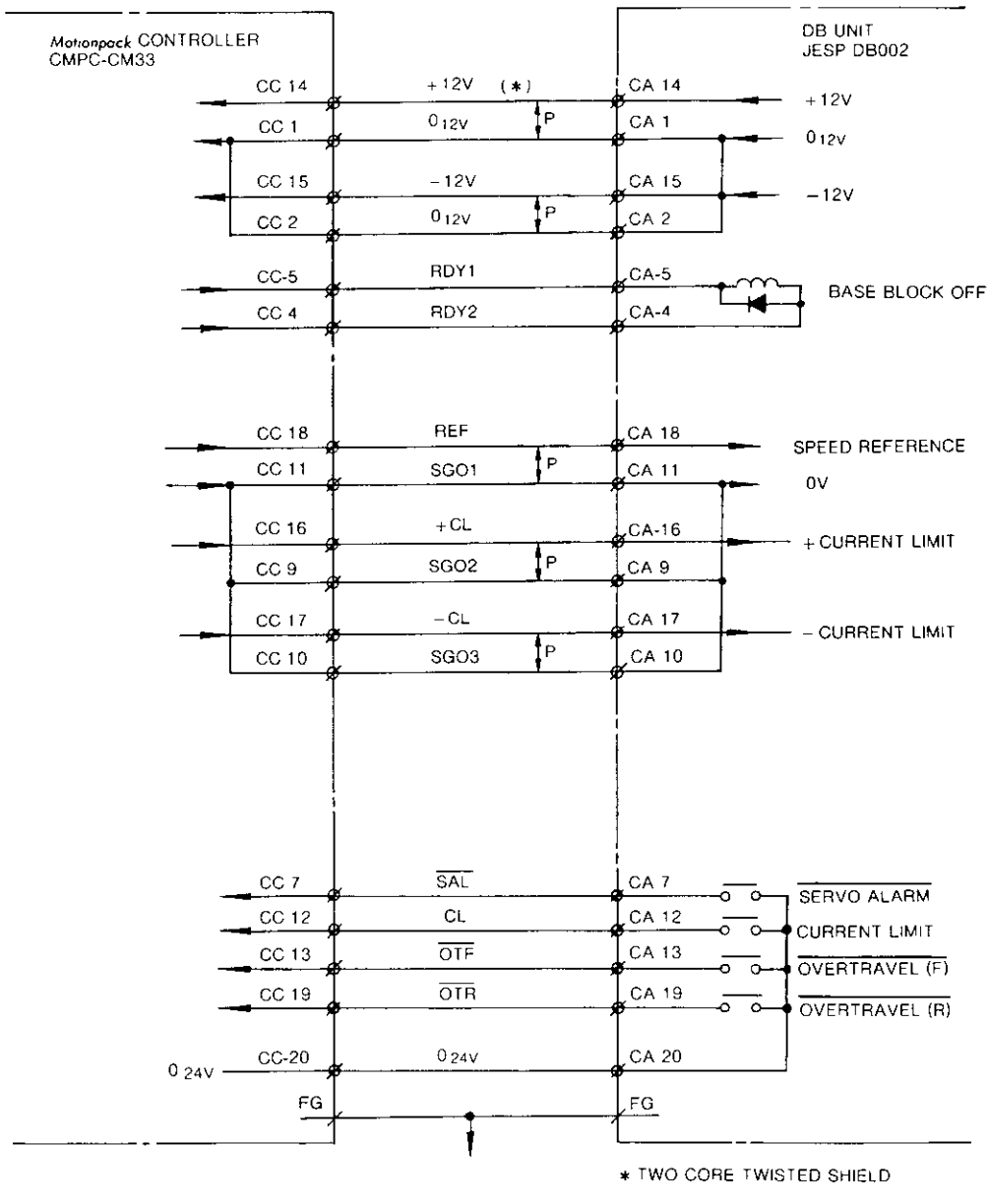


Fig 5 2 Connections of Controller

5 3 2 CONNECTIONS TO Servopack

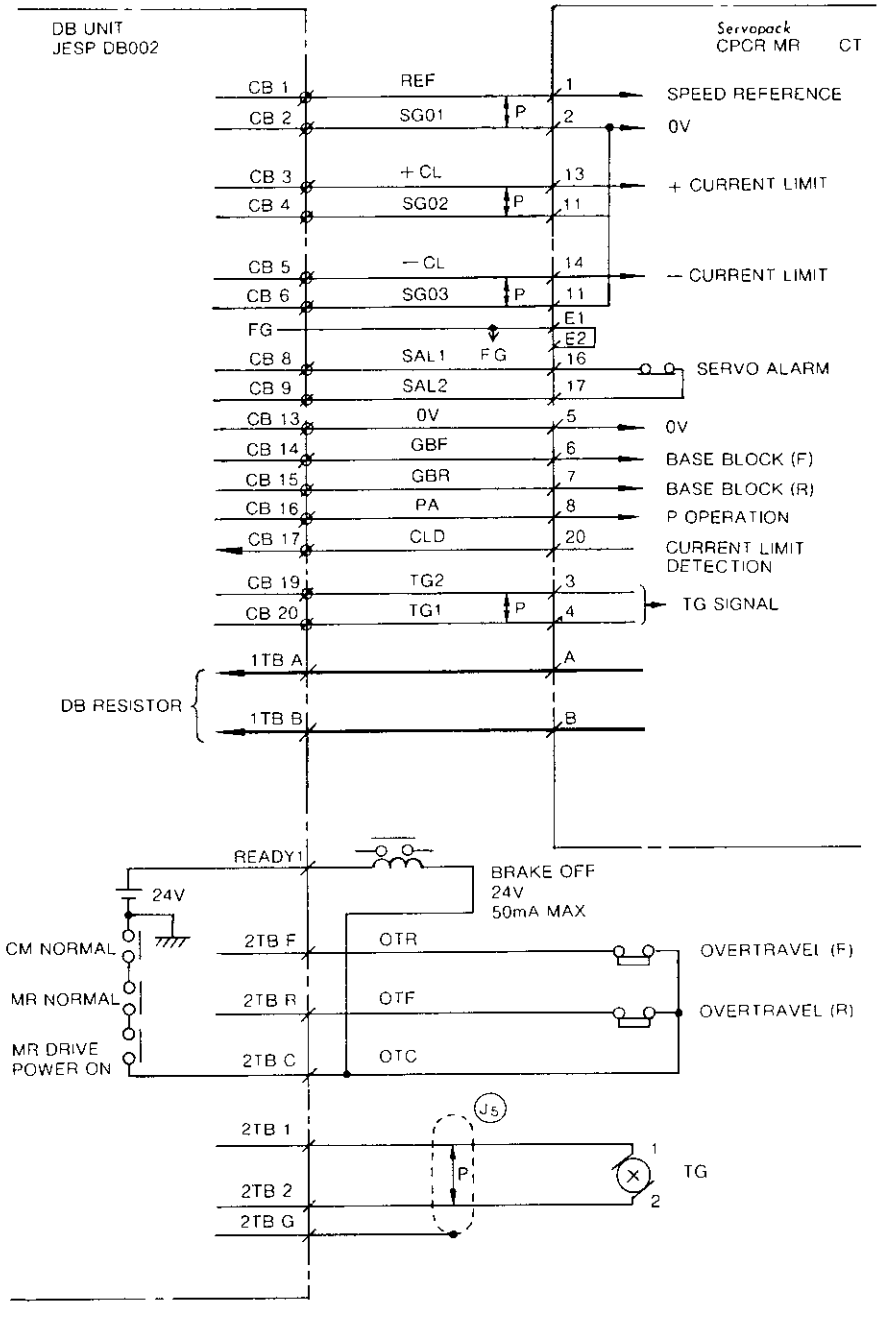
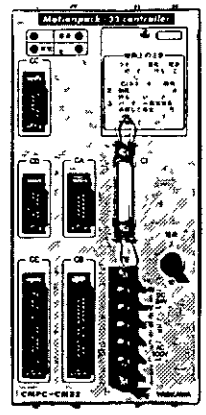


Fig 5 3 Connections with Servopack

6. CONNECTOR TERMINALS

6. 1 Motionpack-33 CONTROLLER CONNECTOR TERMINALS AND SIGNAL NAMES

Six connectors, CA, CB, CC, CD, CE and CI, are built on the panel of Motionpack-33 controller In addition, a terminal board TB for the 100VAC and 24VDC power is also built on it



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Front Panel of Motionpack-33 Controller

CA CONNECTOR (MR 20RMA)

1	2	3	4	5	6	7
PB1	0PB	PB2	PA1	0PA	PA2	FG
	8	9	10	11	12	13
	PC1	0PC	PC2	5V	5V	5V
14	15	16	17	18	19	20
1A	1B	1D	1C	0V	0V	0V

CB CONNECTOR (MR 50RMA)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
HA1	HAC	HA2	HB1	HBC	HB2	FG	EXP1	EXPC	EXP2	FG	LSB1	LSBC	LSB2		LSA1	LSAC	LSA2
		19	20	21	22	23	24	25	26	27	28	29	30	31	32		
												2A	2B	2D	2C		
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
																+24V	0V

CC CONNECTOR (MR-20RMA)

1	2	3	4	5	6	7
0V	0V		RDY2	RDY1	NODB	SAL
8	9	10	11	12	13	
	SG02	SG03	SG01	CL	$\overline{OTF}$	
14	15	16	17	18	19	20
+12V	−12V	+CL	−CL	REF	$\overline{OTR}$	0V

CD CONNECTOR (MR-20RMA)

1	2	3	4	5	6	7
+24V	+24V	RDY	ALM1	ZPM	STL	G34
8	9	10	11	12	13	
EPAL	INCD	OFR	OFM	M30	M51	
14	15	16	17	18	19	20
M52	M53	M54	M55	M56	ZNP	ALM2

CE CONNECTOR (MR-50RMA)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
+INC9	PGS8	PGS9	PGSL00	PGS0	PGS1	PGS2	+JS	−JS	ZRN	EDIT	PLAY	JOG		EPS5	EPS6	EPS7	
		19	20	21	22	23	24	25	26	27	28	29	30	31	32		
		PGSL10	PGSL20	PGS3	PGS4	PGS5	SBS1	ATS1	ERS	STEP	SBK	OVR	G34E	MFIN			
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50
−INC9	RESERVE	PGSL30	+INC8	−INC8	PGS6	PGS7	PGCL	$\overline{ATSTP}$		JLF	JMI			0V	0V	0V	+24V

CI CONNECTOR (3483-1000)

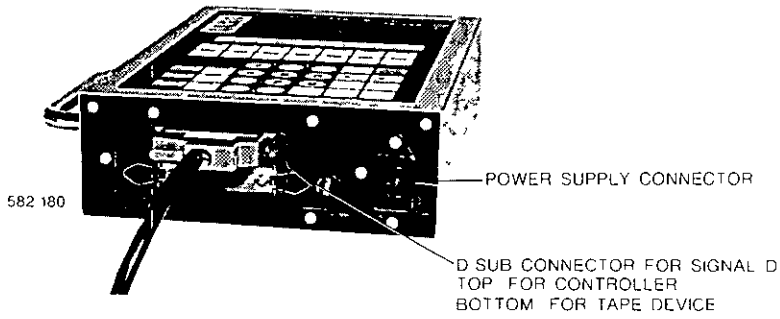
1	2	3	4	5	6	7	8	9	10	11	12	13
FG								TXD	$\overline{TXD}$	RXD	$\overline{RXD}$	
14	15	16	17	18	19	20	21	22	23	24	25	
									5V		0V	

Note Pin Nos and signal names are entered as shown on the right

← PIN NO
← SIGNAL NAME

Fig 6 1

6. 2 PROGRAMMER CONNECTORS AND SIGNAL NAMES



CI CONNECTOR (3483-1000)

1	2	3	4	5	6	7	8	9	10	11	12	13
FG								TXD	$\overline{\text{TXD}}$	RXD	$\overline{\text{RXD}}$	RTS

14	15	16	17	18	19	20	21	22	23	24	25
$\overline{\text{RTS}}$				CTS	$\overline{\text{CTS}}$				5V		0V

CT CONNECTOR (3483-1000)

1	2	3	4	5	6	7	8	9	10	11	12	13
FG	TXD	RXD	RTS	CTS	DR*	SGO						

14	15	16	17	18	19	20	21	22	23	24	25
						ER*					

Note Conductor marked with * are connected within the programmer

Fig 6 2 Motionpack Programmer Connectors and Signal Names

6. 3 DB UNIT CONNECTORS AND SIGNAL NAMES

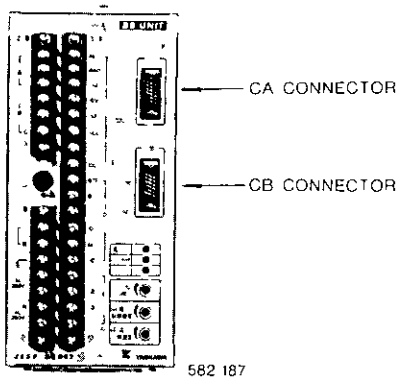


Fig 6 3 DB Unit Connectors

CA CONNECTOR (MR 20RMA)

1	2	3	4	5	6	7
0 12 V	0 12 V		RDY 2	RDY 1		SAL

	8	9	10	11	12	13
		SG 02	SG 03	SG 01	CL	$\overline{\text{OTF}}$

14	15	16	17	18	19	20
+12 V	−12 V	+ CL	− CL	RFI	$\overline{\text{OTR}}$	0 24 V

CB CONNECTOR (MR 20RMA)

1	2	3	4	5	6	7
RFI	SG 01	+ CL	SG 02	− CL	SG 03	

	8	9	10	11	12	13
	SAL 1	SAL 2				0 V

14	15	16	17	18	19	20
GBT	GBR	PA	CLD		TG 2	TG 1

7. CABLE FORMATION AND CONNECTIONS

This chapter describes the connection method for Motionpack-33 system

7.1 Motionpack SYSTEM CONNECTIONS

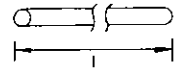
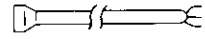
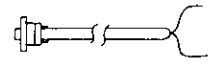
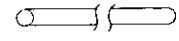
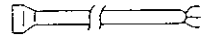
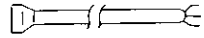
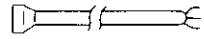
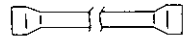
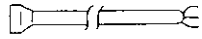
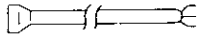
Motionpack-33 system contains a digital operation circuit which processes low-level, high-speed signals and a servo control circuit which drives a servomotor Connection route of power supply, motor main circuit, and system components, as well as wiring distance, grounding, distance between cables, and cable selection, are important factors in providing normal operation

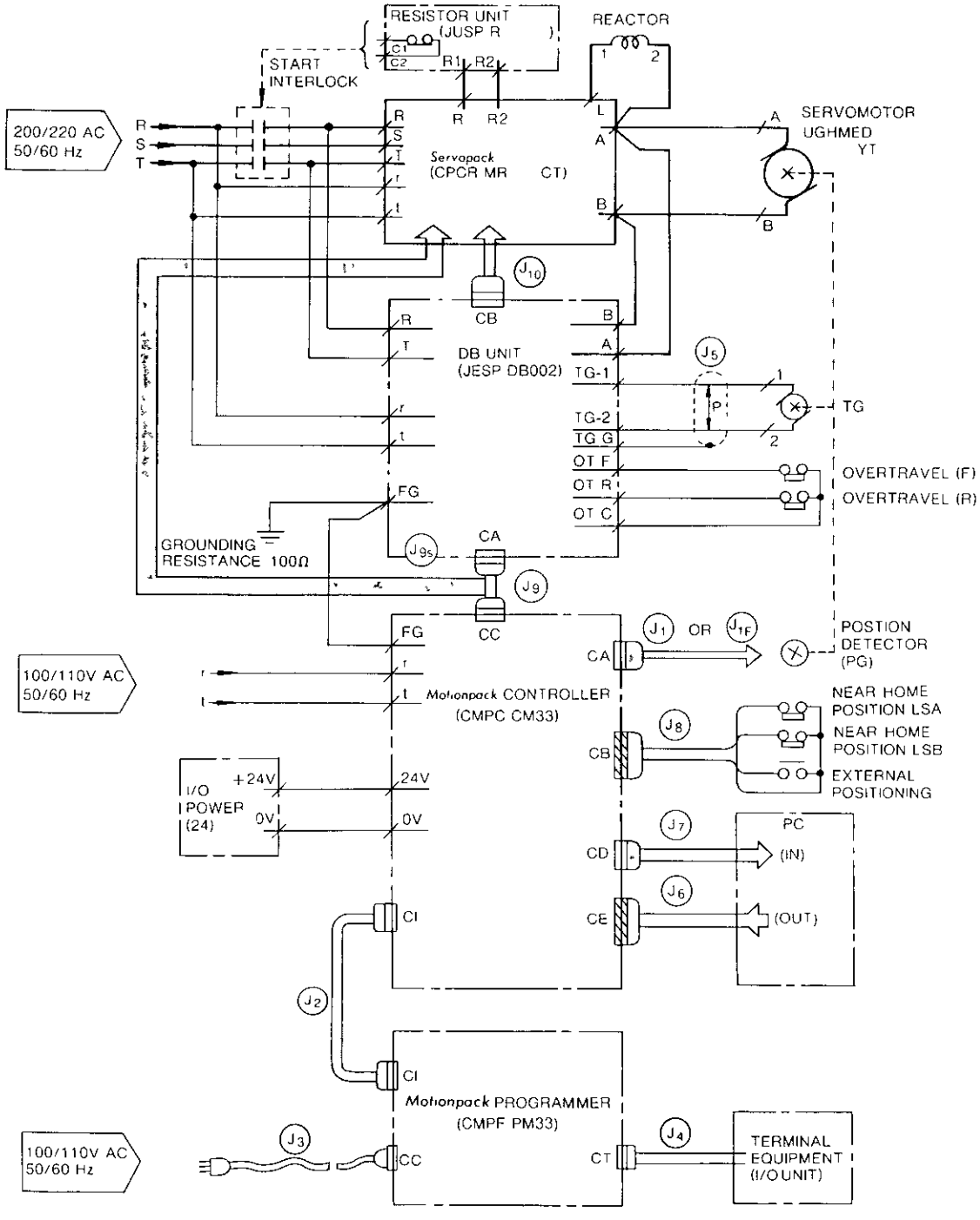
7.2 CONNECTIONS BETWEEN SYSTEM COMPONENTS

Fig 7 1 shows the connections and cables to be used for the typical Motionpack system J9S cable in Fig 7 1 is to connect Motionpack controller and Servopack when DB unit is not employed TG signals are fed back to Servopack directly, J5 cable is connected to Servopack In this case, J9 and J10 cables are not required

Table 7 1 lists the cable specifications Cable should be provided by customers However, they can be supplied by Yaskawa on request

Fig 7 1 Connections between Units

Cable	Application	Connector	Type	Specifications
J1	PG signal		KQVV-SB 10P × 0 2 Shielded	 l = 10 m = 15 m = 25 m
J1F	PG signal	MR-20L/MR-20F	KQVV-SB 10P × 0 2 Shielded	 l = 3 m
J4	Connections between PM and terminal equipment	D-Sub Connector DB-25P	KQVV-SB 10P × 0 2 Shielded	 l = 3 m D-Sub connector
J5	TG signal		RG-108A/U Twisted pair	 l = 10 m = 15 m = 25 m
J6	CM input signal (CM-CE connector)	MR-50L/MR-50F	KQVV-SB 50C × 0 2	 l = 3 m
J7	CM output signal (CM-CD connector)	MR-20L/MR-20F	KQVV 20C × 0 2	 l = 3 m
J8	CM home position signal (CM-CB connector)	MR-50L/MR-50F	KQVV-SB 50C × 0 2	 l = 3 m
J9	Connections between CM and DB unit	MR-20L/MR-20F	KQVV-SB 10P × 0 2 Shielded	 l = 1 m
J9F	Connections between CM and Servopack	MR-20L/MR-20F	KQVV-SB 10P × 0 2 Shielded	 l = 3 m
J10	Connections between DB unit and Servopack	MR-20L/MR-20F	KQVV-SB 10P × 0 2 Shielded	 l = 3 m



Note Connectors and terminals are as shown below

MR CONNECTOR 20P
MR CONNECTOR 50P
SCREW TERMINAL
D Sub CONNECTOR 25 P
J CABLES

Table 7 1 Cable List

7.3 CABLE FORMATION

7.3.1 PG (J1/J1F) CABLES

PG comes in two types, one with 5V line driver output and the other with 12V open-collector output. Make connections according to the type of PG, as outlined below.

7.3.1.1 With 5V PG

Fig. 7.2 shows the cable connections with 5V PG (a line driver is used in the output stage).

Be sure to lay the three pairs of 5V and 0V lines all parallel, as shown in Fig. 7.2. Ground the cable shield on the controller side. The CA-7 pin is the terminal of FG.

When laying jumpers to define a pulse multiple ratio, connect pin to pin directly with as short a jumper as possible.

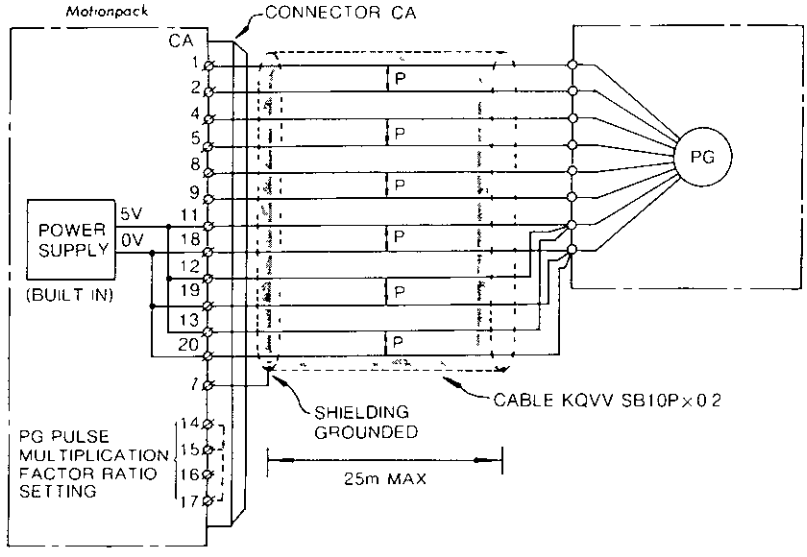


Fig. 7.2 Connections of 5V PG Cables

7.3.1.2 With 12V PG

Figure 7.3 shows the cable connections with 12V PG (an open-collector output stage is used).

Use of a twisted-pair cable to raise noise immunity is also necessary for 12V PG. An external power supply unit must be connected in the middle of cables.

For cable specifications, see para. 7.3.1.1, with 5V PG.

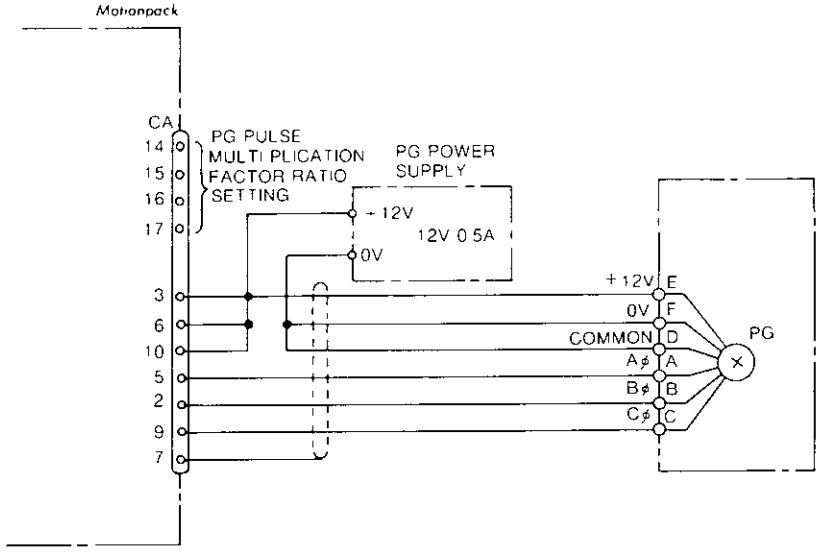


Fig. 7.3 Connections of 12V PG Cables

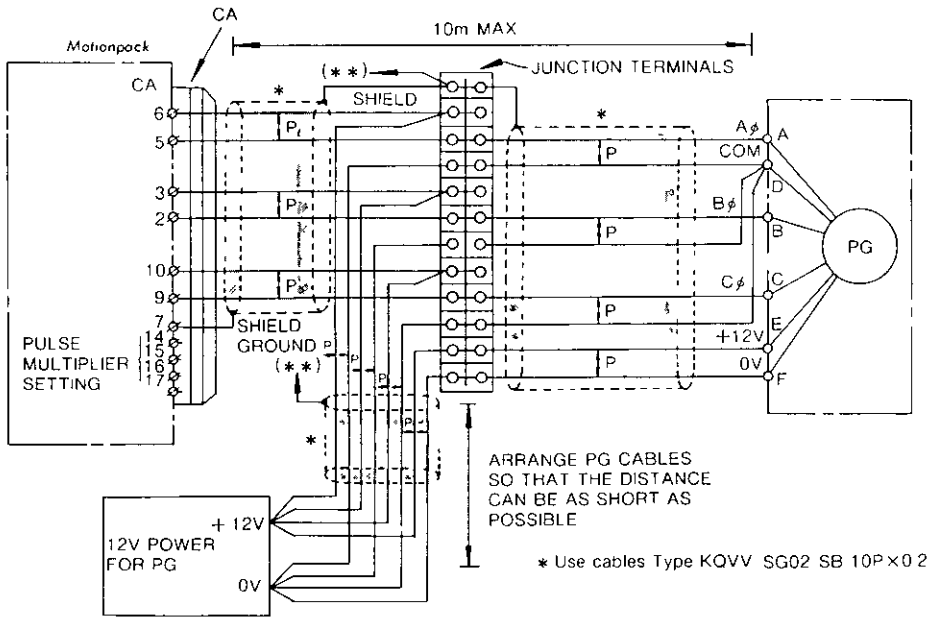


Fig 7 4 12V PG Connections

7 3 1 3 Connecting PG Cables

To prevent noise interference, extending the single PG cable is preferable to connecting two cables via terminals at the outlet from the control panel If connecting cables at terminals is unavoidable, connect the shields as shown in Fig 7 5.

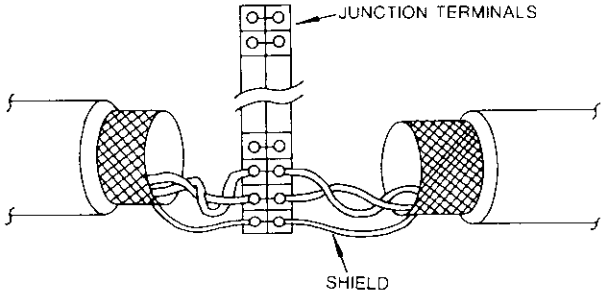


Fig 7 5 Junction of Cables

7.3.2 TERMINAL DEVICE (J4) CABLES

The terminal device is connected to the Motionpack via the J4 cable for input and output of parameters and program

A D-subconnector (DP-25P made by JAE) is fitted on the programmer side of the cable In most cases, a D-subconnector is used also on the terminal side Fig 7 6 shows the pin assignments of the cable fitted with D-subconnectors on both ends

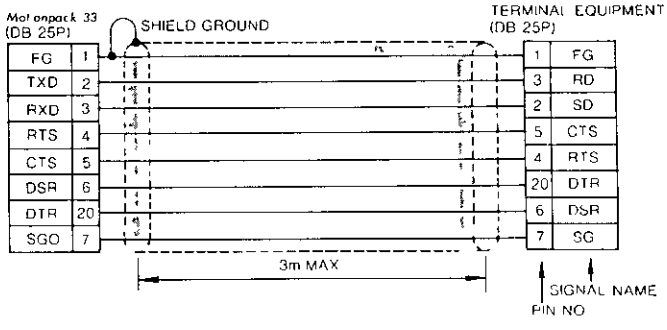


Fig 7 6 Cables for Terminal Equipment

7 3 3 TG (J5) CABLES

The Servopack controls speed at a ratio of 1000 1 and even a very small change of the TG signal is significant For laying a TG cable, sufficient care must be taken in the same manner as the PG cable

A shielded cable of twisted-pair lines is suitable Cable Type RG108A/U (made by Fujikura Ltd) is recommended

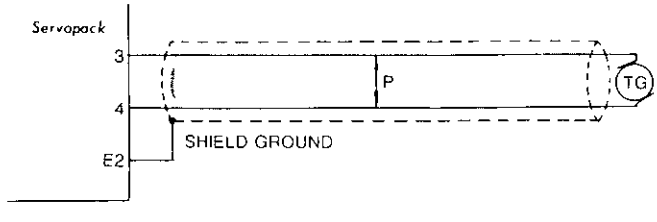


Fig 7 7 TG Cables

7. 3. 4 Motionpack INPUT/OUTPUT SIGNALS (J6 AND J7)

Signals are exchanged between the Motionpack and the programmable controller through the J6 and J7 cables

J6 for input signals (PC --> Motionpack)

J7 for output signals (Motionpack --> PC)

Prepare the cables according to the pin assignments described in para 6 1 Leave the unused pins open

Lay only as many lines of 0 or 24 V of J6 and J7 as are described in para 3 2 1(2) and para 3 2 2(2) all in parallel This will prevent voltage drop which would occur if current flows through the power line (or the line of 0 V), inducing noise to the signal voltage

The J6 and J7 cables are available on order

J6 cable 3 meters long, connector fitted one end KQVV-SB cable of 50 cm × 0 2 mm^2

J7 cable 3 meters long, connector fitted on one end, KQVV cable of 20 cm × 0 2 mm^2

Normally, digital signals should be exchanged between identical control panels The cable length should not exceed 10 meters

7 3. 5 Motionpack ORIGIN SIGNAL (J8) CABLES

The signals transmitted through the J8 cable include the origin slow-down signal, origin confirmation signal, and external positioning signal

Do not extend the cable length because LSs are installed on the machine and they are separated from each other

To lay the cable over the shortest distance, use the terminal block shown in Fig 7 9 and connect the common lines of 24 V there This will enhance noise immunity

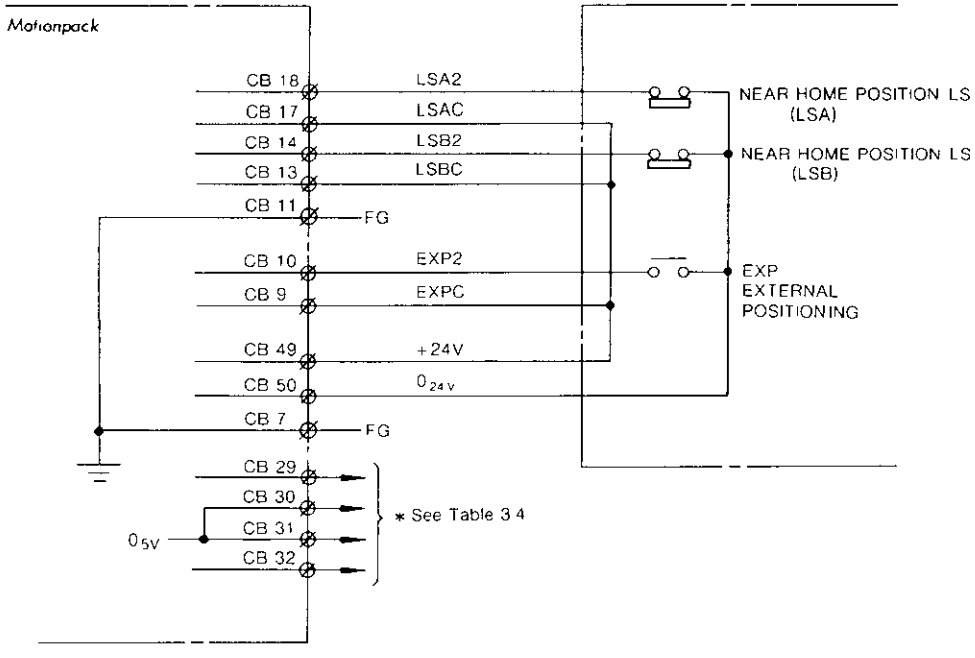


Fig 7 8 Use of 24V LS

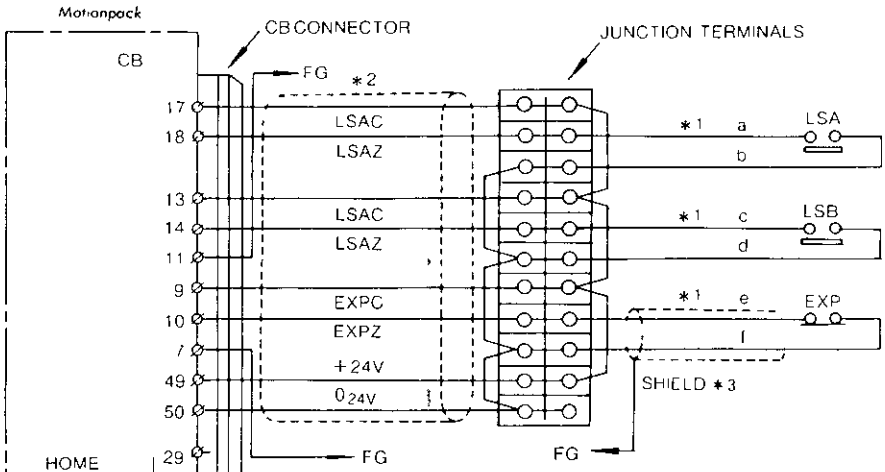


Fig 7 9

Note For the lines marked as *1 twist a and b c and d, e and f in pairs
If there should be considerable environmental noise or noise from electronic switches used for LSs use shielded cables as shown with EXP in Fig 7 9 and connect the shielding to FG on the control panel side
Shielded cable is suitable for that marked as *2
Recommended is KQVV-SB50C ×0 2mm² [made by Fujikura Cable]
0 2 mm² 50-lead shielded cable
When laying jumpers to select a method of returning to origin for CB-29 through CB-32 connect pin to pin with jumpers as short as possible within the connector case

7.3.6 SERVO SIGNAL (J9 AND J9S) CABLES

The signals transmitted through these cables include those related to servo control described for the Motionpack Controller CC connector

J9 cable fitted with MR connectors on both ends This is to be used when the DB unit (JESP-DB002) is installed

J9S cable not fitted with any connector on the end which is to connect to the Servopack This is to be used when the DB unit (JESP-DB002) is not installed When preparing the cable, twisted pairs must conform exactly to the designated connector pins as shown in Fig 7 10 If twisted pairs are shifted, noise interference could occur with the resultant effect of twisted pairs lost

The J9 cable should be a twisted-pair cable with shielding Recommended is KQVV-SB 10p ×0 2mm² made by The Fujikura Ltd

The J9S cable differs from the J9 cable shown in Fig 7 10 only in that the end of the J9S cable which is to connect to the DB unit is not fitted with any connector but ends simply with the leads

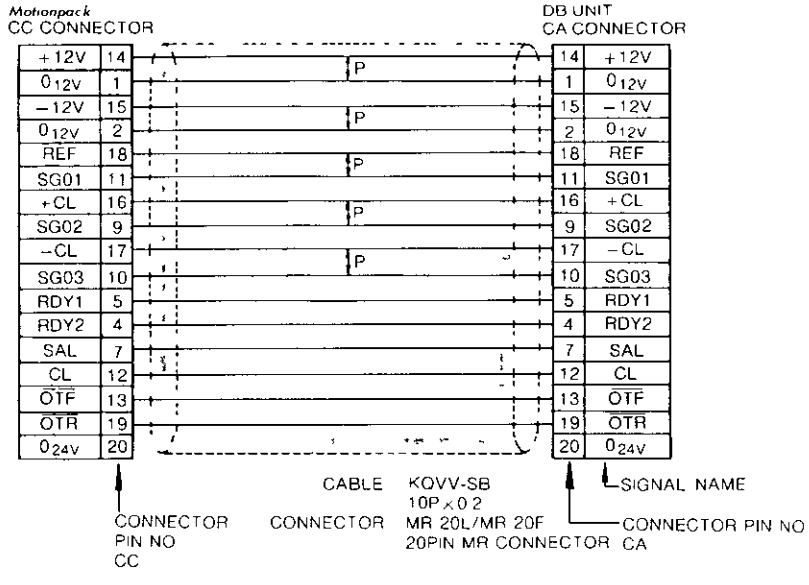


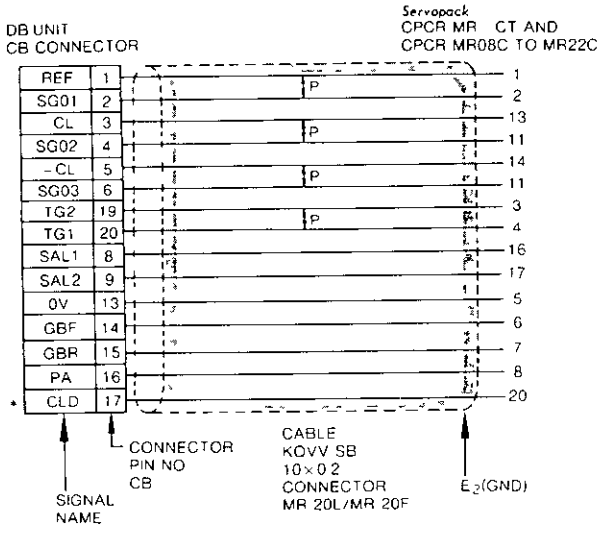
Fig 7 10 J9 Cable

7.3.7 Servo SIGNAL (J10) CABLES

J10 cable connects DB unit and Servopack It includes speed reference, TG feedback, and current limit signals

Fig 7 11 shows the construction of J10 cables Use twisted leads for pair of REF/SG01, +CL/SG02, -CL/SG03, TG2/TG1 Exchanging pair of leads will eliminate functions as twisted lead, and result in malfunction

Shielding of J10 cable should be grounded at Servopack side through FG DB unit and Servopack should be mounted in the same panel If they are installed on different panels, connections should be made in order to prevent noise interference The cable should be a twisted-pair cable with shielding Recommended is Type KQVV-SB 10p × 0 2 mm^2 (made by Fujikura Ltd)



* Asterisked connections are for Type CPCR-MR CT only, and not required for Type MR C

Note Some of the signal terminals are different depending on Servopack type Match the Motionpack signal terminal No with that of Servopack

Fig 7 11 J10 Cable

7.4 PRECAUTIONS FOR WIRING

7 4 1 PREVENTION OF INTERFERENCE BETWEEN WIRES

In the Motionpack system, cables of varying power levels, such as the lines of PG and digital signals, mix with the motor main circuit through which large current flows If a high-speed signal line such as the PG signal line is laid close to the motor main circuit, noise might be induced in the signal line and result in a failure of positioning

It is therefore very important to prevent interference between lines

The lines can be divided into three groups as given in Table 7 2

Do not lay lines belonging to different categories in the same duct or bundle

Observe the following precautions for category II PG signal lines

(1) Never lay the lines of PG signals close to or parallel to any category I lines

(2) Never lay the lines of PG signals close to parts and units generating noise or parallel to the lines wired to them.

(3) For better results, connect the shielding of any cable coming from PG to the frame ground terminal of the control panel

Fig 7 12 shows the wiring around the Servopack when the DB unit is not used and Fig 7 13 shows the condition when the DB unit is used

Table 7 2 Group of Lines

	Category I	Category II	Category III
Conditions	May cause noise interference due to large current and high-speed signals	Vulnerable to serious damage due to external noise induction	
Connection Specifications	Servopack ⟷ motor DB unit ⟷ motor Servopack 200 VAC power input line Regenerative unit	• PG — CM (J1/J11) PC leads TG — Servopack (J5) TG ⟷ DB unit Servopack reference input (J9 J9S J10) Origin signals (J8)	CM I/O signals (J6 J7)

7.4.2 WIRING FOR PG

A serious error, such as mispositioning, would occur if noise is added to PG signals Follow the instructions listed below

Par 7 3 1 PG Cables

Par 7 4 1 Prevention of interference between wires

The lines belong to category II Keep them away from any category I lines (e g power lines) Never lay them in the same duct or bundle

Possible trouble may occur where noise from a servo motor is induced in PG lines via TG signal lines when TG and PG signals are transmitted in the same cable Use separate shielded cables for TG and PG

7.4 3 WIRING FOR TG

For TG signals, use twisted-pair shielded cables as described in par 7.3 3

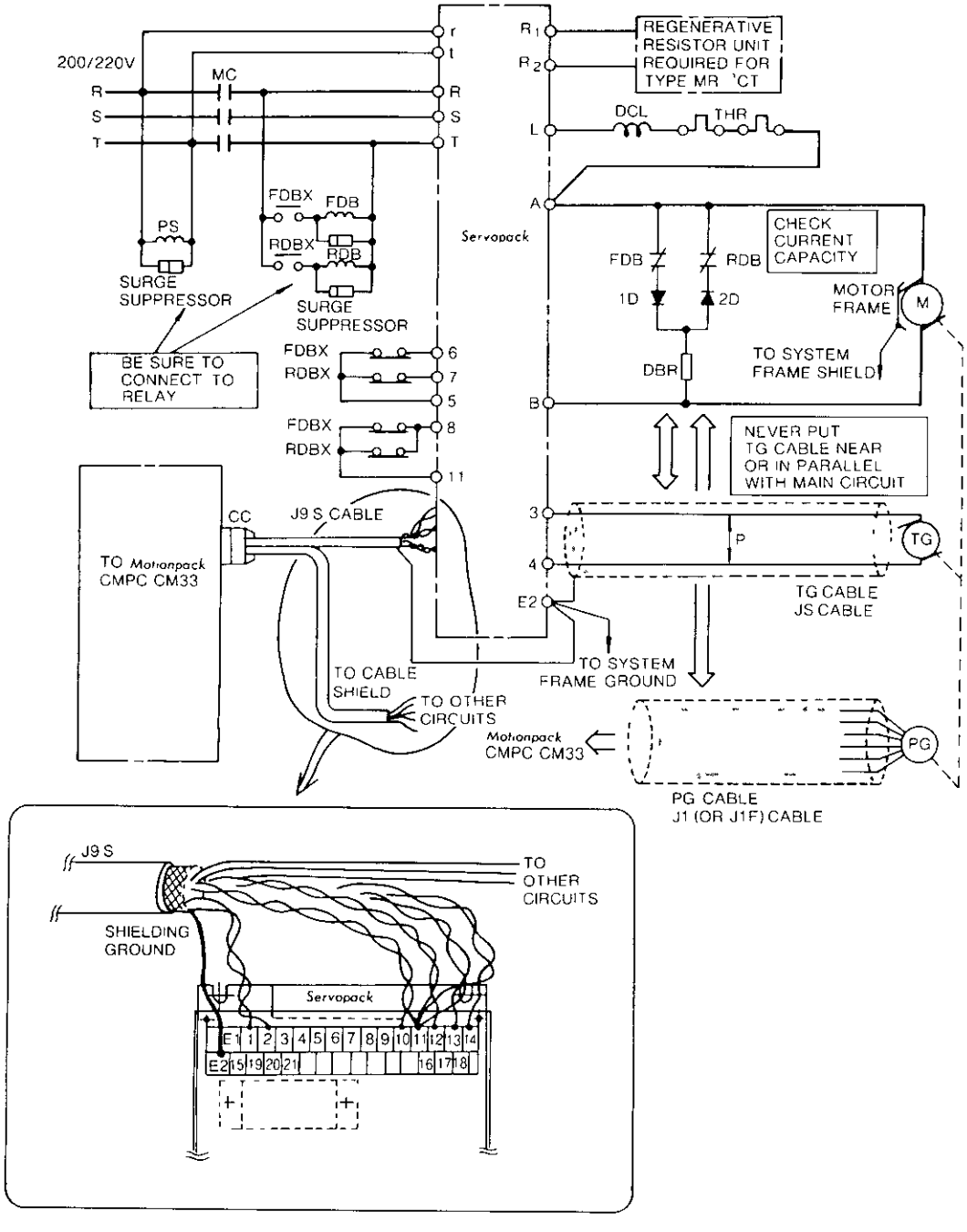


Fig 7 12 Connections of Servopack

7 4 3 WIRING FOR TG (Cont'd)

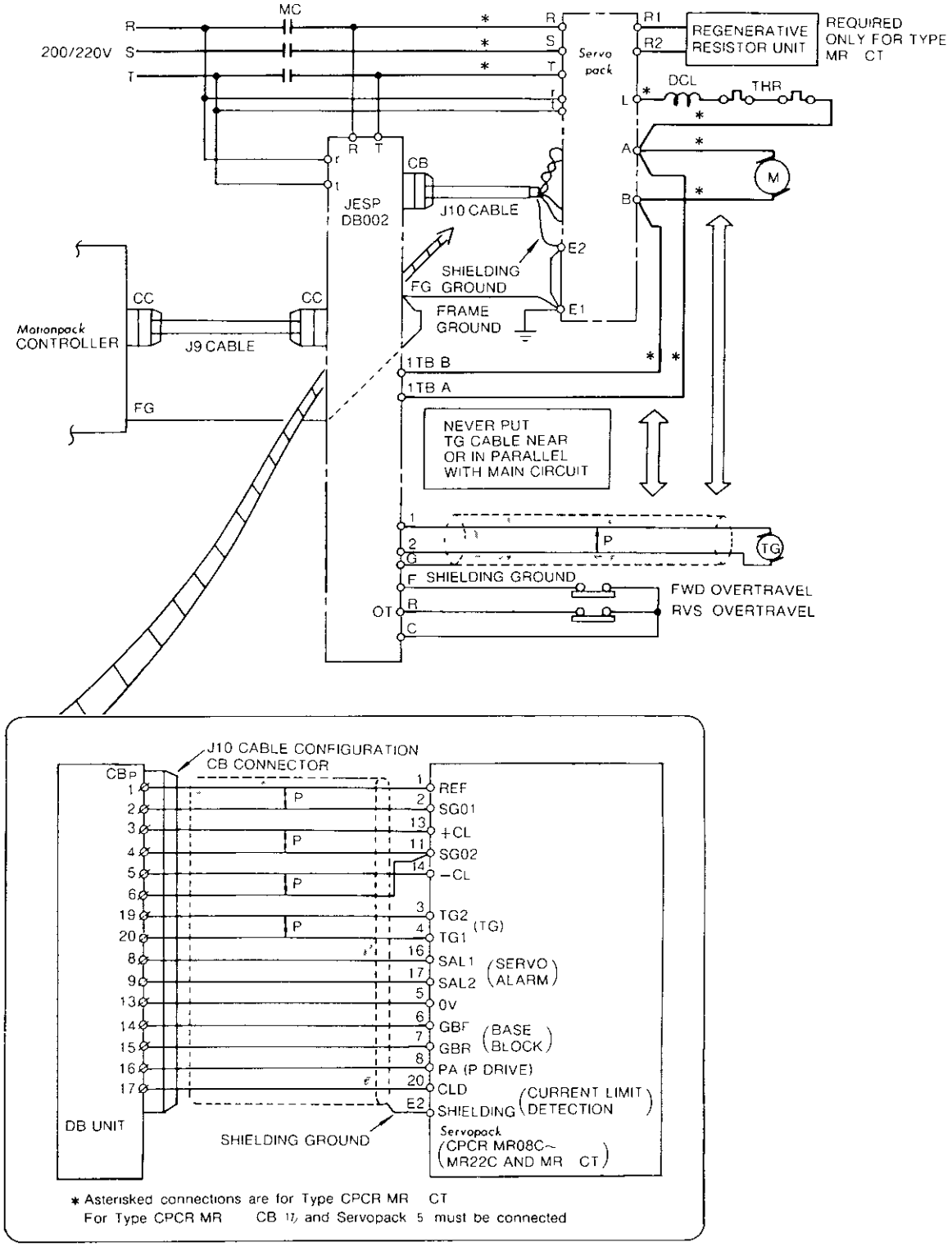


Fig 7 13 Connections of DB Unit

7 4.4 Motionpack ORIGIN SIGNAL (J8) CABLES

The signals transmitted through the J8 cable include the origin slow-down signal, origin confirmation signal, and external positioning signal

The cable to the machine may be of considerable length LS contacts sometimes open during operation and, if this happens, noise is likely to be induced in the cable Take the following pre cautions against noise

(1) Connect a surge suppressor in parallel with each LS contact

Surge suppressor CR50500 (of Okaya Industry) or a capacitor (metalized film, 600 V/0 1 uF)

(2) Lay the cable away from and not parallel to the main circuit wiring.

7.4.5 CONNECTING SURGE ABSORBER TO COIL

Be sure to connect a surge absorber to every device having a coil in it, such as relays, contactors, and solenoids

Surge absorbers

(1) Use 200 VAC Surge suppressor CR50500 (of Okaya Industry)

(2) Use 100 VAC Surge suppressor AU1201 (of Okaya Industry)

(3) Use 24 VDC Diode IS2462 (of Toshiba Corporation)

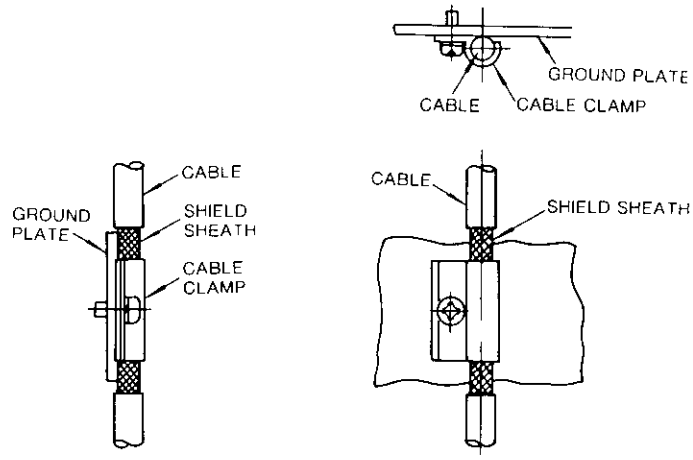
The surge absorbers above are usable at the specified voltages

7 4 6 FASTENING CABLES

Be sure to tighten the locking screw of the MR connector on the cable

Clamp the cable so that the weight and tension of the cable will not pull on the connector

The clamp shown in Fig 7 14 is very effective The sheath of the shielded cable can be removed to connect the shielding to FG (frame ground)



Note To clamp the cable (which is not shielded), cable armor should not be stripped

Fig 7 14 Cable Clamp

7.4.7 ASSURING CORRECT CONNECTION OF CABLE CONNECTORS

Input/output circuits of the Motionpack may be damaged correct pairs of male and female cable connectors are not mated properly Observe the following precautions to prevent such an mishap

(1) Write the name of the cable connector on the name plate provided and bond it to the connector immediately after you have prepared the cable

(2) After laying the cables, bind them together so that the cable connectors come to fixed positions

7.4 8 CONNECTION OF THE INPUT/OUTPUT POWER SUPPLY UNIT

One input/output power supply unit can supply power to more than one Motionpack In this case, string the power cable carefully to prevent noise interference occurring due to voltage drop

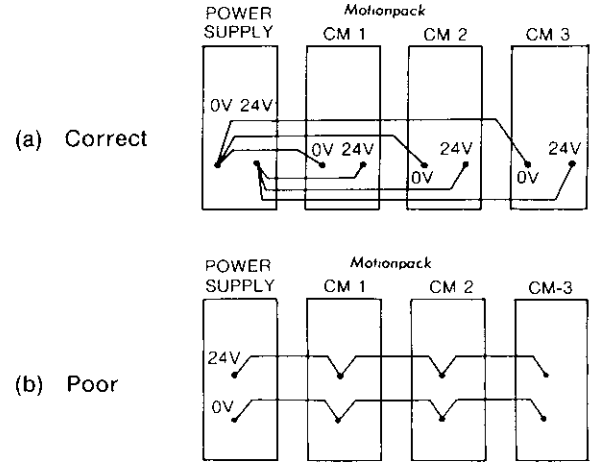


Fig 7 15 Input/Output Power Connections

7.4.9 NOISE SOURCES

Insert a noise filter in the power supply and input circuit if the Motionpack-33 etc with an electric welding machine, an electrospark machine etc shares the same power source or there is a source of high-frequency noise close to the Motionpack-33

7 4 10 HEAT SINK

The heat sink of type CPCR-FR will heat up to a maximum of 85°C to 90°C Do not permit wires to come in contact with the heat sink

7 4 11 LINE FILTER AND ISOLATION TRANSFORMER

Insert a line filter or isolation transformer in the power line if it picks up excessive external noise

Observe the following in this cases

(1) Separate the leads of the primary circuit of the line filter or isolation transformer completely from those of the secondary circuit

(2) Connect the ground line of the line filter or isolation transformer to the system ground via the shortest path with a heavy wire

(3) Reduce the length of the line to the input terminal of the line filter or isolation transformer to the minimum Use care to prevent noise from being induced in the circuit (Refer to instructions above)

(4) For the control panel, take power from the secondary circuit of the line filter or isolation transformer

7. 5 GROUNDING

Connect all grounding leads to the ground at one position (grounding better than class 3, grounding resistance 100 ohms or less) Use a thick wire (flat braided wire of 3 5 mm^2 or more) for the grounding lead

Ground SG01, terminal (2) of the Servopack Terminal (E) of the Servopack is usable only for a grounding lead recess It is not connected inside

Be sure to ground the DC servomotor if it is isolated from the machine

Fig 7 16 shows a method for grounding an axis The frame grounds of the Motionpack controller, DB unit, Servopack, and programmable controller are connected to the ground terminal of the control panel and a single grounding lead of class 3 (100 ohms or less) or better are installed there The 'other circuits' referred to there include the inverter driving the main axis

The inverter must be grounded directly to the location where the collective grounding of the other components converge

Fig 7 17 shows a method for grounding many axes Such a system includes many units and it would be troublesome to lay grounding leads individually It indicates an example of laying many individual grounding lines, one for each axis It is not good to connect units of the same kind together, like controller to controller and Servopack to Servopack

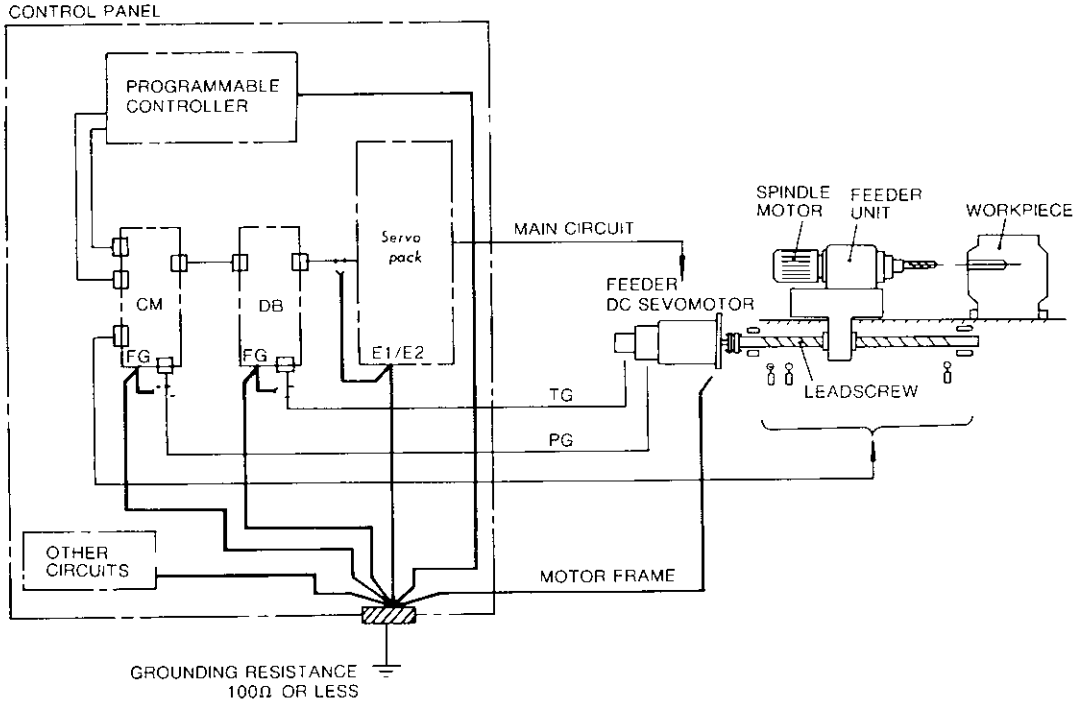
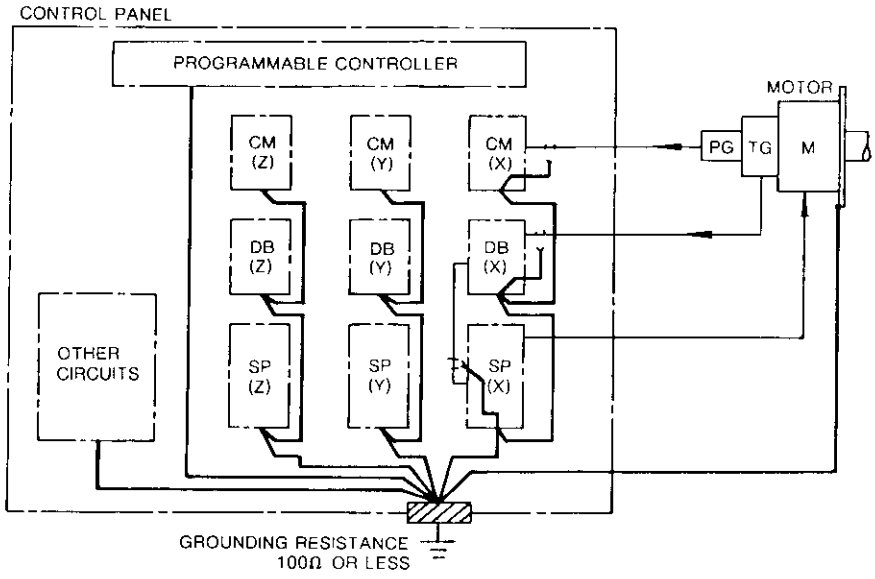


Fig 7 16 Grounding for One Axis



Note Motors for Y and Z axes and their connectors are not shown

Fig 7 17 Grounding for Multiple Axes

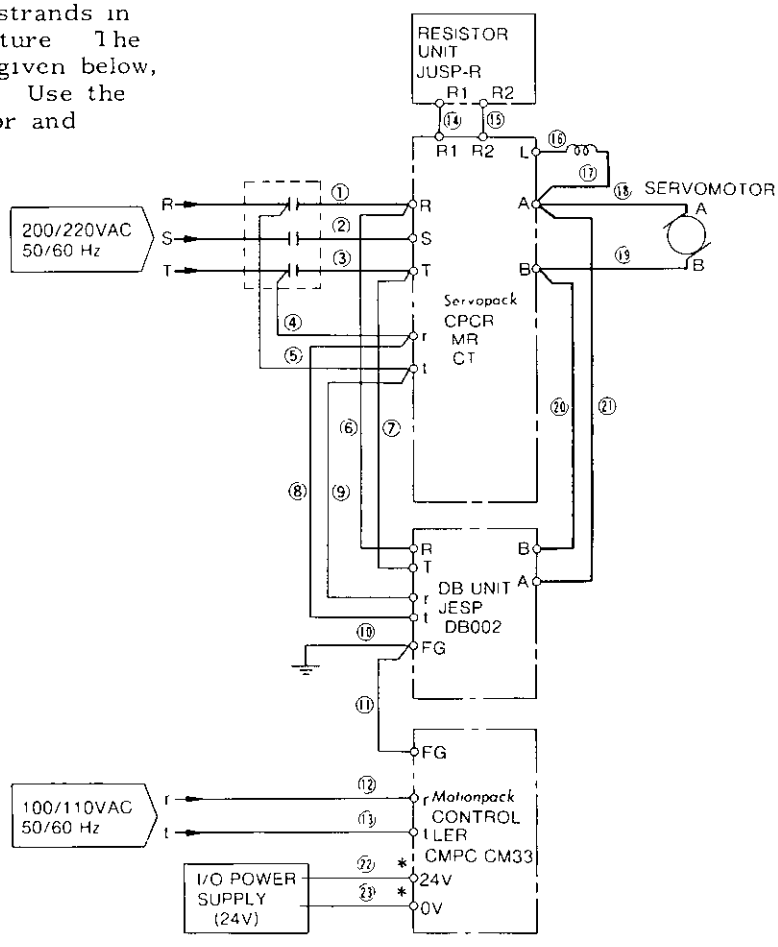
7.6 SELECTION OF WIRES

7.6 1 MAIN CIRCUIT

The wire of the main circuit is determined by the motor rated current, the number of strands in the cable, and mean ambient temperature The data for the main circuit wiring are given below, assuming the use of a Hi-cup motor Use the wiring data which relates to the motor and Servopack employed

Servopack Type CPCR-MR□□C

Servomotor Hi-cup Motor



When more than one Motionpack controller is used in the system, connections between each Motionpack and common power supply unit should be independent

Fig 7 18 Main Circuit Connections

7.6.1 MAIN CIRCUIT (Cont'd)

Table 7 3 Servopack Rated Current

External Terminals Name		Motor capacity / No	Rated Current A UGHMED -06YT	UGHMED -12YT	UGHMED -20YT	UGHMED -30YT
Main Circuit Power		① ② ③	5	9	12	18
Motor		⑱ ⑲	7	12	18	25
Resistor		⑭ ⑮	6	6	16	21
DC Reactor		⑯ ⑰	7	12	18	25
Servopack Control Power Input		④ ⑤	0 1 (Max)			
DB Unit	Control Power Input	⑥ ⑦ ⑧ ⑨	0 1 (Max)			
	DB	⑳ ㉑	17 A peak	30 A peak	43 A peak	53 A peak
	FG	⑩	*			
Motionpack Controller	Control Power Input	⑫ ⑬	1 0 (Max)			
	FG	⑪	*			
	I/O Power	㉒ ㉓	2 0 (Max)			

* Connect a wire of 0 75 mm^2 or more to terminal FG

Note

1 Use wire having a capacity of 600 V or more for the main circuit

2 The peak current value is noted for terminal DB Therefore, use wire of 3 5 mm^2 or more (regardless of the motor capacity)

3 See Fig 7 3 for the main circuit connections

Table 7 4 Wire Size
(Ambient Temperature 40°C, No of Strands 3)

External Terminals Name		Motor capacity / No	Wire Size mm^2 UGHMED -06YT	UGHMED -12YT	UGHMED -20YT	UGHMED -30YT
Main Circuit Power		① ② ③				
Motor		⑱ ⑲	HIV	HIV	HIV	HIV
Resistor		⑭ ⑮	2 0 Min	2 0 Min	3 5 Min	5 5 Min
DC Reactor		⑯ ⑰				
Servopack Control Power Input		④ ⑤	PVC 1 25 Min			
DB Unit	Control Power Input	⑥ ⑦ ⑧ ⑨				
	DB	⑳ ㉑	HIV 3 5 Min			
	FG	⑩	PVC 0 75 Min			
Motionpack Controller	Control Power Input	⑫ ⑬	PVC 1 25 Min			
	FG	⑪	PVC 0 75 Min			
I/O Power		㉒ ㉓	PVC 1 25 Min			

Note

1 When binding wires together or running them in a duct (hard PVC or metal conduit), the maximum permissible current of the wires becomes smaller

2 If the ambient temperature (inside the enclosure) is high, ordinary PVC-clad wires deteriorate fast and then duration of their usable life is reduced Table 7 5 shows some heat-resistant wires Select those which are suitable

Table 7 5

Conductor Max Permissible Temperature(°C) (Ambient Temp + Rise by Current)	Type	
75	Heat-resistant vinyl wire	HIV SHIV
80	Epick Wire	IP LP
90	Cross-linked polyethylene + heat resistant vinyl	H-CV

7.6 2 SIGNAL CABLES

The signal lines between the Motionpack-33 controller and the sequence are to be connected with the MR connector on the Motionpack

Select a cable by referring to Table 7 6 The suitable twisted-pair cable is the KQVV-SB10P × 0 2 mm^2 shown in Table 7 7 Signal lines between Motionpack-33 and sequencer should be connected with MR connectors Cables should be selected in accordance with Tables 7 6 and 7 7 Twisted cables should be KQVV-SB 10P × 0 2 mm^2 (or 3P × AWG26) shown in Table 7 8

Table 7 6 Signal Cables

	MR-50L/MR-50F	MR-20L/MR-20F
Type	Solder type	Solder type
No of Cores	50 cores	20 cores
Applicable Wire	AWG #24-#28	AWG #24-#28
Cutter Diameter	16 mm dia max	10 mm dia max
Recommended Cable	Plastic multicore control cable (Example) KQVV50C×0 2 (0 2mm^2, 50 cores) manufactured by Fujikura Ltd	(Example) KQVV20C×0 2 (0 2mm^2, 20 cores) manufactured by Fujikura Ltd
	Cores 0 2 mm^2 tin-plated soft copper stranded wires 16/0 12 (cores/mm) Insulating material Cross-linked vinyl Thickness 0 3 mm Finished outer dia 1 1 mm	

Table 7 7 Dimensions of Cores

AWG	Sectional Area of Conductor mm^2	Standard Outer Dia of Vinyl Insulation mm
#24	0 21	1 5 ← Recommended
#26	0 13	1 3
#28	0 08	1 2

Table 7 8 Twisted Cables

Name		Unit	Specifications KQVV-SB
No of Pairs		Pair	10
Conductor	Material	—	Tin-plated soft copper stranded wires
	Nominal Sectional Area	mm^2	0 2
	Configuration	Numbers/mm	16/0 12
	Outer Diameter	mm	0 55
Insulation	Material	—	Cross-linked vinyl
	Thickness	mm	0 3
Circuit Configuration		—	Paired strands with pitch of 18, 22 25 32
Holding		—	Wound with paper tape
Shielding		—	Tin-plated soft copper wire braided
Sheath	Material and Color	—	Vinyl black
	Thickness	mm	1 2
Approx Finished Outer Dia		mm	10 0
Approx Weight		kg/km	130

7.6.3 WIRING TO MOBILE DEVICE

There are special considerations for a cable connected to a mobile device The cable undergoes repeated bending or twisting as the mobile device moves It exposes the cable conductors to fatigue, leading to breakdown, should some PG signal line break, the motor might run wild and a serious accident occur

Cable makers advise that the resistance of the cable to bending and twisting is determined by the following factors

Bending strength

(1) Curvature of bend

(2) Cable tension

(3) Multiple number of twisting pitches of cable core leads

(4) Area of conductor

(5) Structure of conductor

Twisting strength

(1) Twisting angle

(2) Twisting pitch of cable core leads

(3) Cable twisting span

For cables connecting mobile devices, it is recommended to use cables that are made for industrial robots and are capable of withstanding the rigors of bending, twisting, etc

For precise details, address inquiries to the cable makers

7.7 CONNECTOR DIMENSIONS
(Maker HONDA TSUSHIN)

7 7 1 MODEL MR-20L, MR-50L CONNECTORS

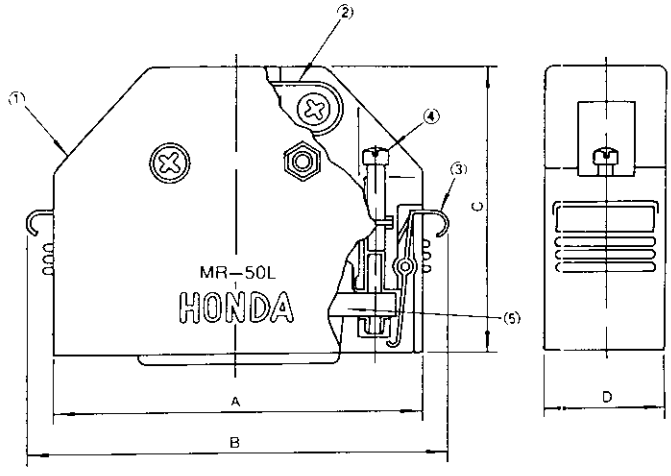


Fig 7 19 Connector Dimensions in mm

Model \ Code	A	B	C	D
MR-20L	39 3	44 9	39 8	17
MR-50L	67 9	73 5	44 8	18

Code	Name
1	Connector cover
2	Cable clamp
3	Connector clamp spring
4	Connector clamp screw
5 (Note 1)	Connector (MRP-$^{20F}_{50F}$ MR-$^{20F}_{50F}$)

Note

1 MRP -20F -50F Solderless type
MR -20F, -50F Solder type

2 Applicable cable OD MR-20L 10 mm dia max
MR-50L 16 mm dia max

3 The motionpack accessory set includes an MR-20F (with MR-20L) and MR-50F (with MR-50L) (solder type)

When solderless type connectors (MRP 20F01, MRP-50F01) are to be used they must be prepared by the machine builder

7 7 2 MODEL MR-20F, MR-50F CONNECTORS
(Solder Type)

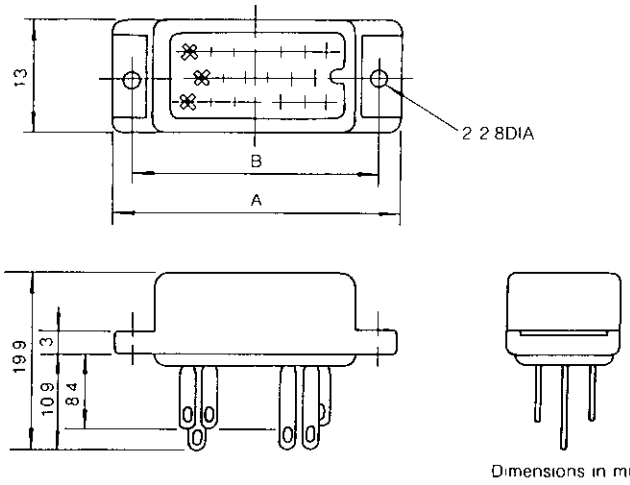


Fig 7 20 Connectors Models MR-20F, MR-50F

Code / Model	A	B	No of Terminals
MR-20F	32 8	27 8	20
MR-50F	61 4	56 4	50

7. 7. 3 MODEL MRP-20F01, MRP-50F01 CONNECTORS (Solderless Type)

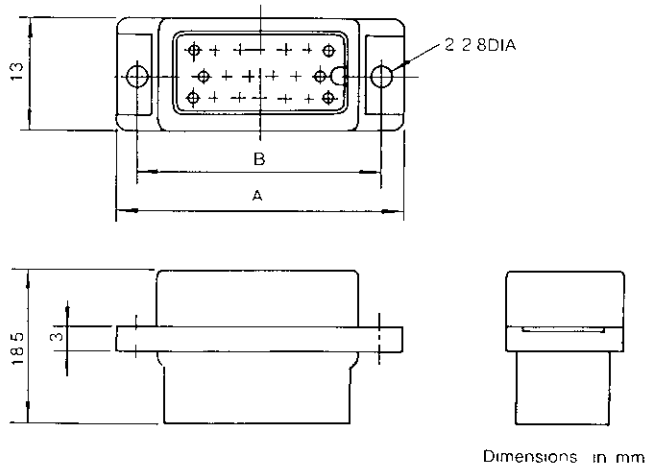


Fig 7 21 Connectors of Models MRP-20F01, MRP-50F01

Code / Model	A	B	No of Terminals
MRP-20F01	32 8	27 8	20
MRP-50F01	61 4	56 4	50

Note To use the solderless type connectors a crimping tool is required for which enquiries are to be made to HONDA TSUSHIN

7 7. 4 TERMINAL NO

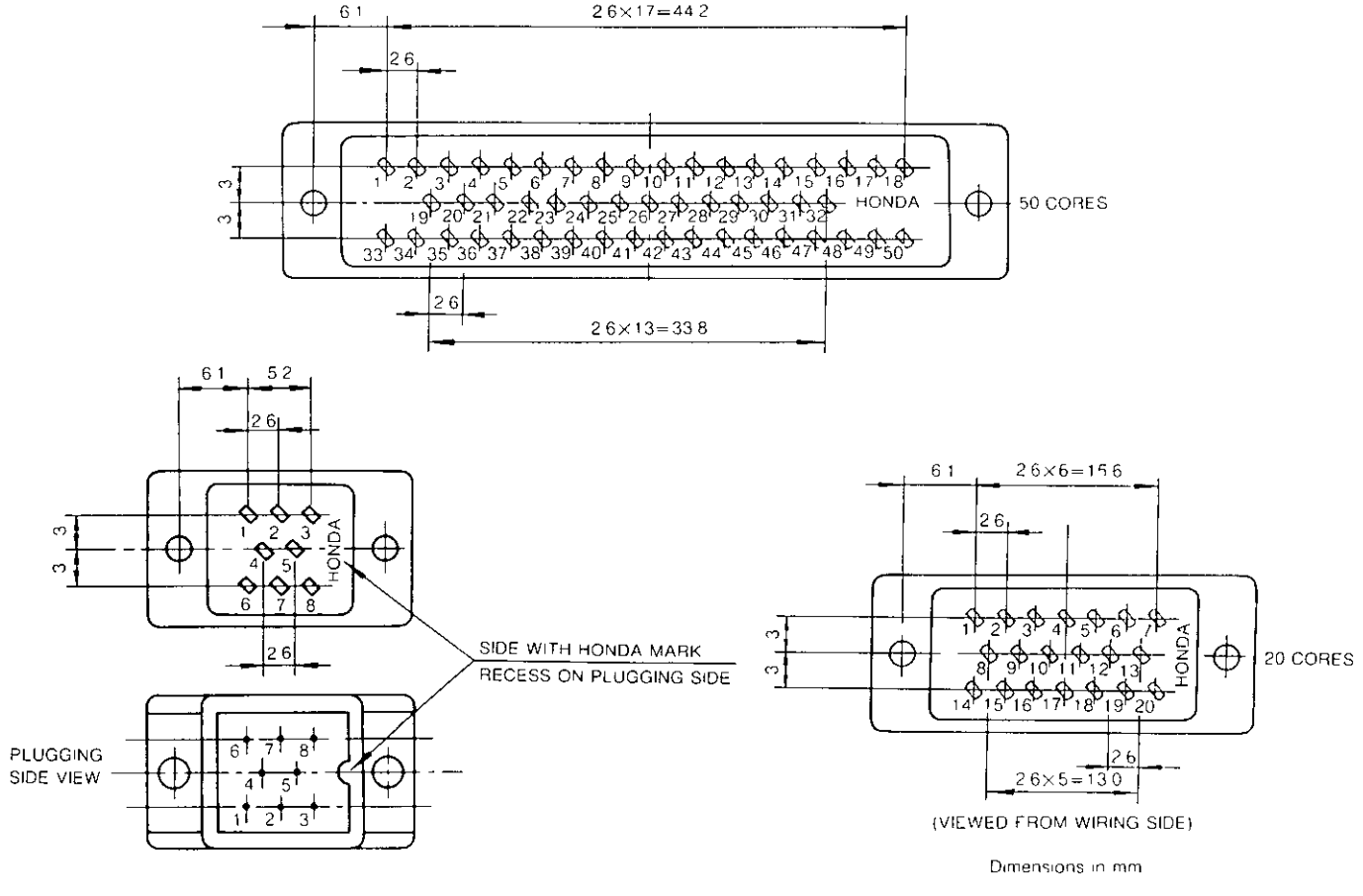
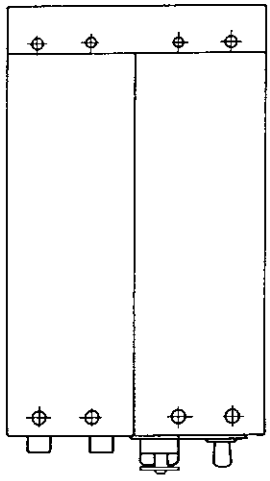


Fig 7 22 Connector Terminal Numbers

8. Motionpack-33 UNIT DIMENSIONS in mm

8.1 Motionpack-33 CONTROLLER



Code	Element Code	Name and Specifications
1		Circuit protector T11-3-1 00A-01-11
2	TB	Terminal F2035E with M4 screw cover
3	CI	Connector 3483-1000
4	CC	Connector MR-20RMA(HONDA)
5	CA	Connector MR-20RMA(HONDA)
6	CD	Connector MR-20RMA(HONDA)
7	CB	Connector MR-50RMA(HONDA)
8	CE	Connector MR-50RMA(HONDA)
9		Connector MRP-20F or MR-20F
10		Connector MRP-50F or MR-50F

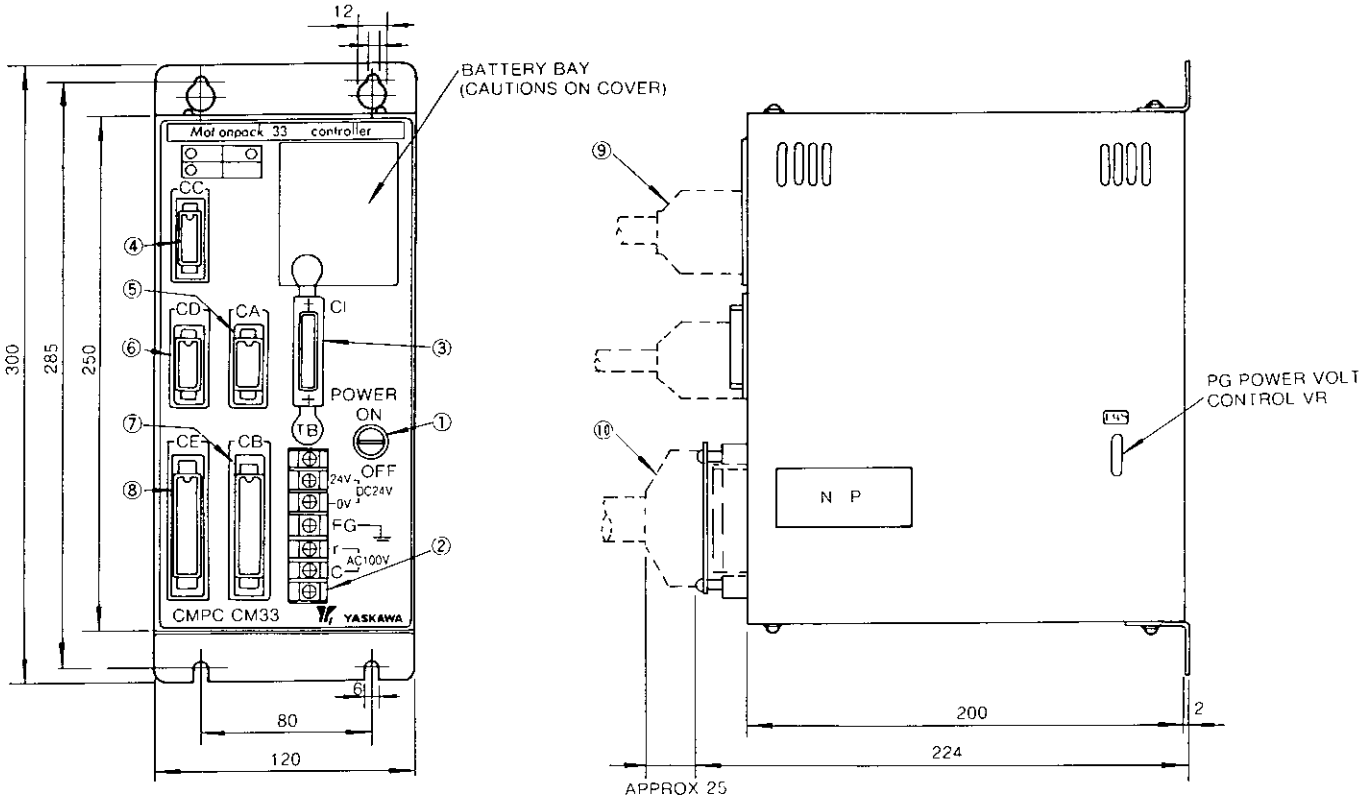
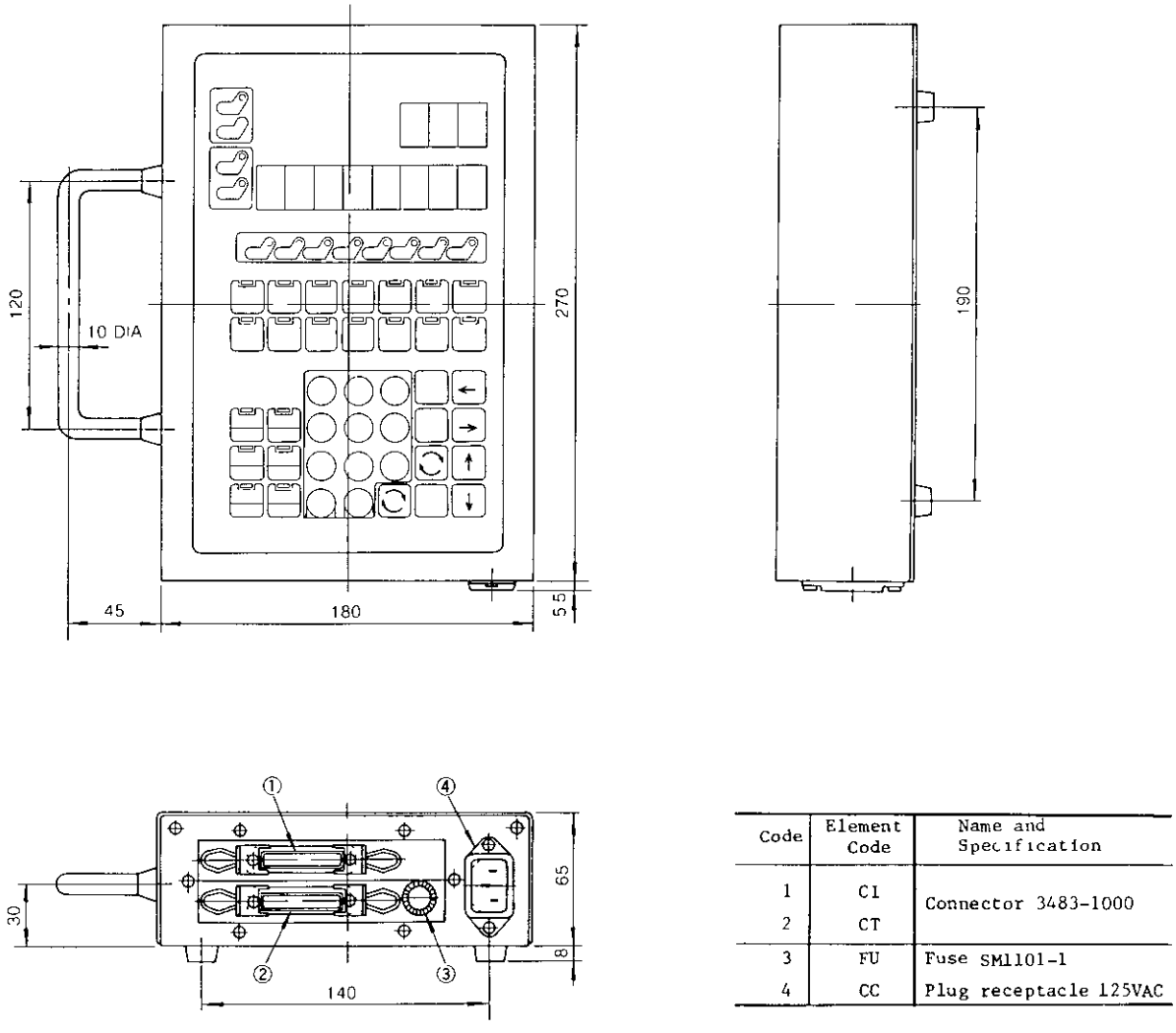


Fig 8 1 Motionpack Controller Dimensions in mm

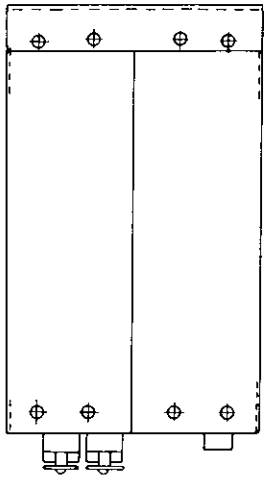
8. 2 Motionpack-33 PROGRAMMER



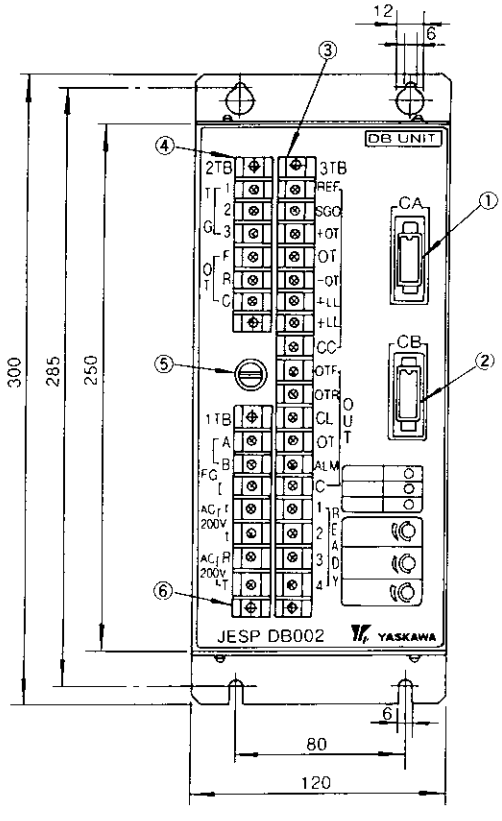
Code	Element Code	Name and Specification
1	C1	Connector 3483-1000
2	CT	
3	FU	Fuse SM1101-1
4	CC	Plug receptacle 125VAC

Fig 8 2 Motionpack Programmer Dimensions in mm

8.3 DB UNIT



Code	Element Code	Name and Specification
1	CA	Connector MR-20RMA(HONDA)
2	CB	Connector MR-20RMA(HONDA)
3	3TB	Terminal F2035E with M4 screw cover
4	2TB	Terminal F2035E with M4 screw cover
5		Circuit protector, T11-3-0 10A-01-11
6	1TB	Terminal F2035E with M4 screw cover
7		Connector MRP-20F or MR-20F



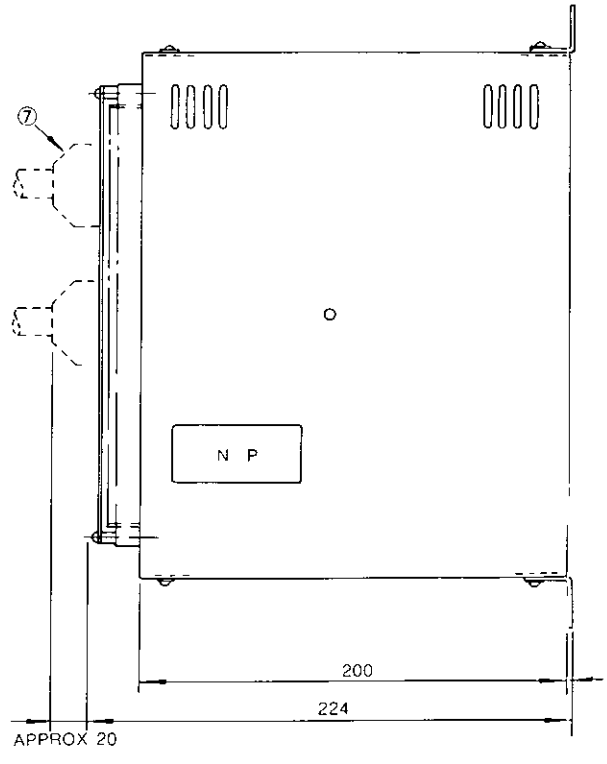


Fig 8.3 DB Unit Dimensions in mm

8.4 PULSE GENERATOR

Type MGZ-10B

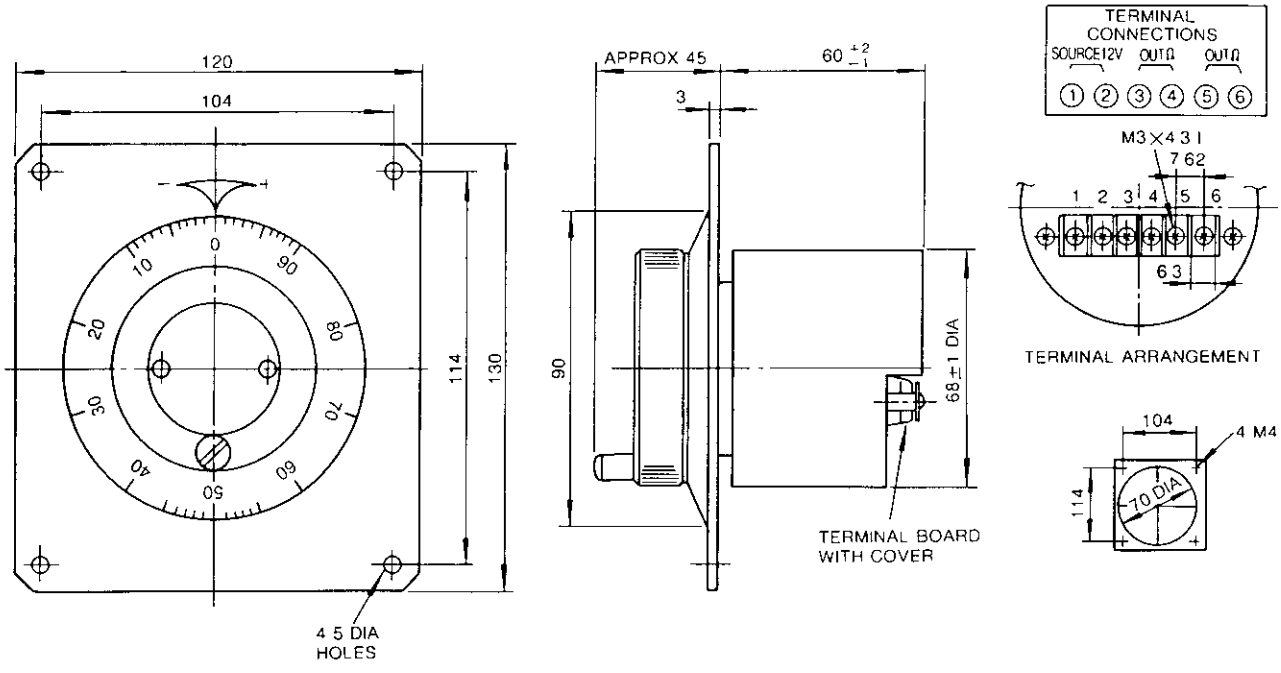


Fig 8 4

8.5 PG POWER SUPPLY

Model AYS 1201

Maker Shin Dengen Electric Manufacturing Co , Ltd

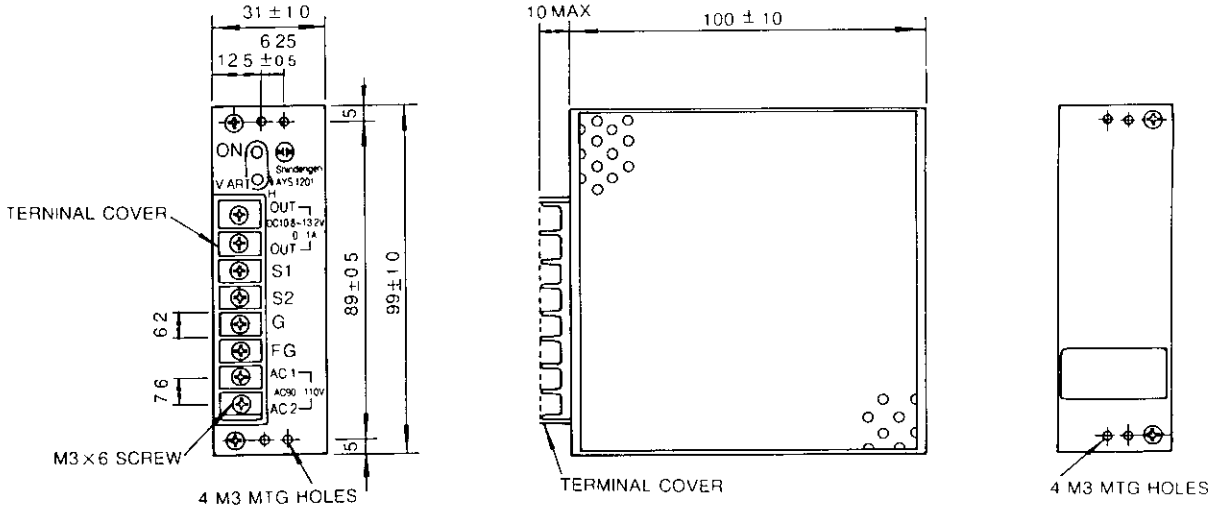


Fig 8 5 Dimensions of PG Power Supply in mm

8.6 I/O SIGNAL POWER SUPPLY

Model BY242R5

Maker Shin Dengen Electric Manufacturing Co , Ltd

Input 100VAC (50/60Hz)

Output 24VDC, 2 5A

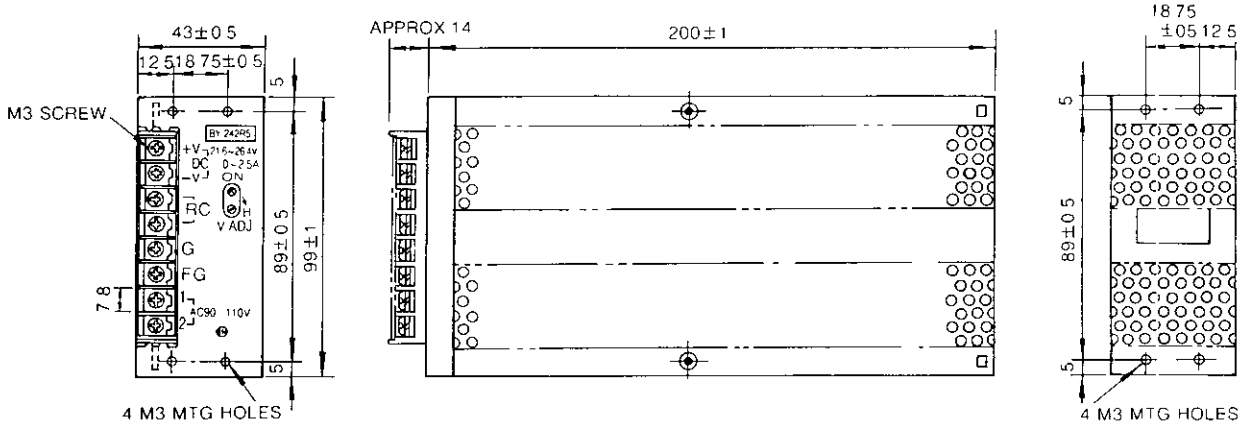


Fig 8 6 Dimensions of I/O Signal Power Supply in mm

8.7 TAPE DEVICE

(1) Hand-held Computer
Type EPSON HC-40
Maker EPSON Corporation

(2) PRO-TYPER High-Speed ASR Input Terminal
Type MODEL 7652
Maker Citizen

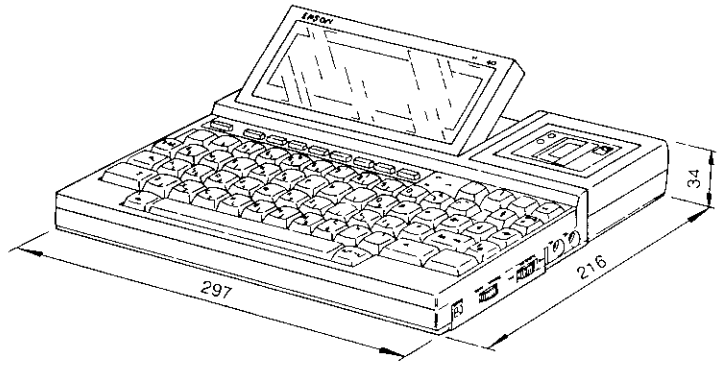


Fig 8 7

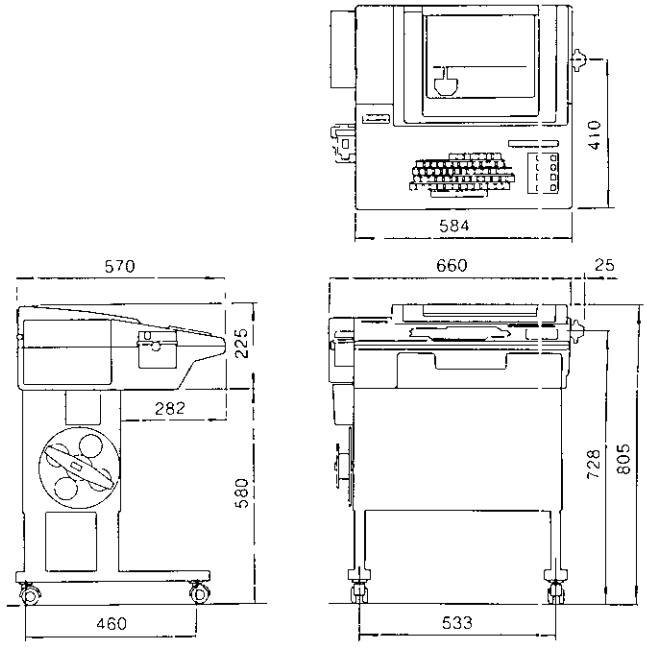


Fig 8 8

9. PROGRAMMING EXAMPLES

9.1 COMBINATION OF POSITIONING, WAIT, AND AUXILIARY OUTPUT

9.1.1 OPERATION PATTERN

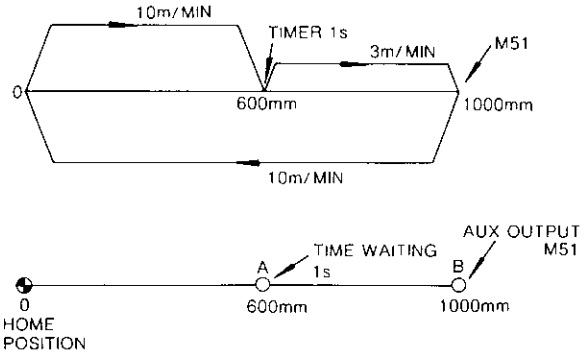


Fig 9 1

9 1 2 PROGRAMMING

Example 1 Absolute positioning

```
N 000 G01 X600   F10000  I200
N 001 G04 D1 00
N 002 G01 X1000  F3000   I200
N 003 G04
N 004 M51
N 005 G01 X0     F10000  I200
N 006 M30
```

Example 2 Absolute and incremtntal positioning

```
N 000 G01 A600   F10000  I200
N 001 G04 D1 00
N 002 G01 U400   F3000   I200
N 003 G04
N 004 M51
N 005 G01 X0     F10000  I200
N 006 M30
```

9.2 REPETITION OF POSITIONING AND AUXILIARY OUTPUT

9 2 1 OPERATION PATTERN

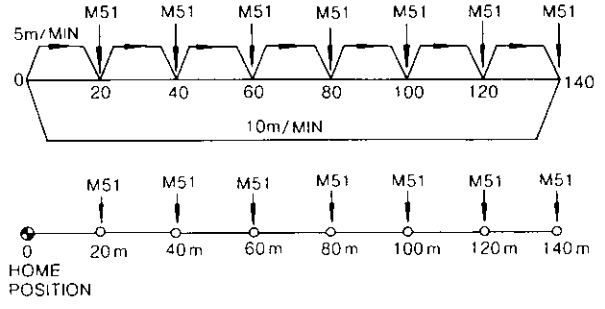


Fig 9 2

9 2 2 PROGRAMMING

Example 1 Absolute (or incremental) positioning

```
N 010  G01  X20(U20)  F5000  I200
N 011  G04
N 012  M51
N 013  G01  X40(U20)
N 014  G04
N 015  M51
N 016  G01  X60(U20)
N 017  G04
N 018  M51
N 019  G01  X80(U20)
N 020  G04
N 021  M51
N 022  G01  X100(U20)
N 023  G04
N 024  M51
N 025  G01  X120(U20)
N 026  G04
N 027  M51
N 028  G01  X140(U20)
N 029  G04
N 030  M51
N 031  G01  X0(U-140)  F10000  I200
N 032  M30
```

Example 2 Use of Subprograms (Subprograms for repetition)

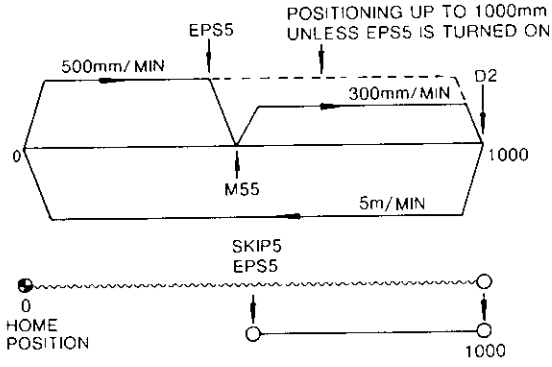
```
N 010  G68  L7  P015
N 011  G01  X0  F10000  I200
N 012  M30
N 015  G01  U20  F5000  I200
N 016  G04
N 017  M51
N 018  G69
```

Example 3 Use of Subprograms (Subprograms specifying end position)

```
N 010  G68  X140  P015
N 011  M51
N 012  G01  X0  F10000  I200
N 013  M30
N 015  G01  U20  F5000  I200
N 016  G04
N 017  M51
N 018  G69
```

9. 3 SKIP POSITIONING

9 3.1 OPERATION PATTERN



Note 1 When G05 is started, turn off EPS 5
2 Current should be 100% at feeding

Fig 9 3

9. 3 2 PROGRAMMING

```
N 040  G05  X1000  F500  I100
N 041  G67  P044
N 042  M55
N 043  G01  X1000  F300  I100
N 044  G04  D2
N 045  G01  X0  F5000  I200
N 046  M30
```

9. 4 EXTERNAL POSITIONING, COORDINATE SETTING, AND SUBPROGRAMS

9. 4. 1 OPERATION PATTERN

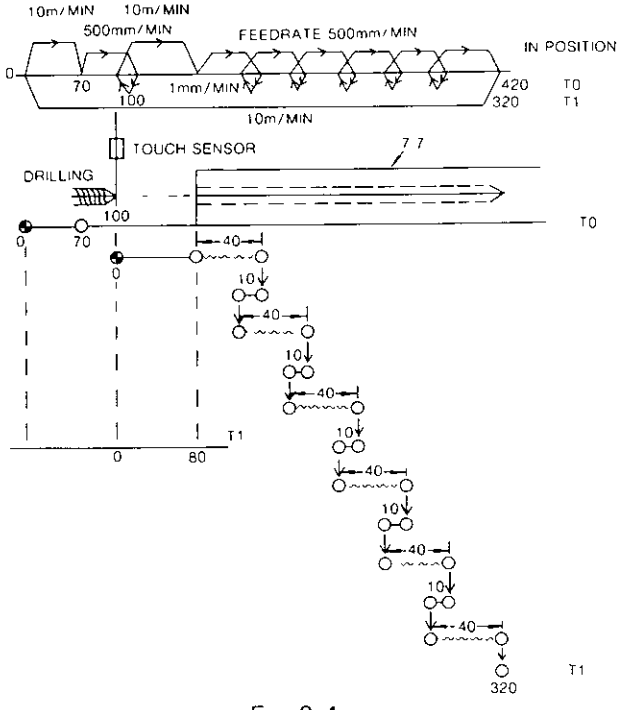


Fig 9 4

9. 4 2 PROGRAMMING

```
N 050  G01  X70  F10000  I200
N 051  G34  X110  F500
N 052  G52  X0  T1
N 053  G53  T1
N 054  G01  X80  F10000  I200
N 055  G68  X320  P060
N 056  G04
N 057  G53  T0
N 058  G01  X0  F10000  I200
N 059  M30
N 060  G01  U40  F500  I100
N 061  G01  U-10  F1000
N 062  G69
```

9. 5 POSITIONING FOR PUNCHING

9. 5. 1 OPERATION PATTERN

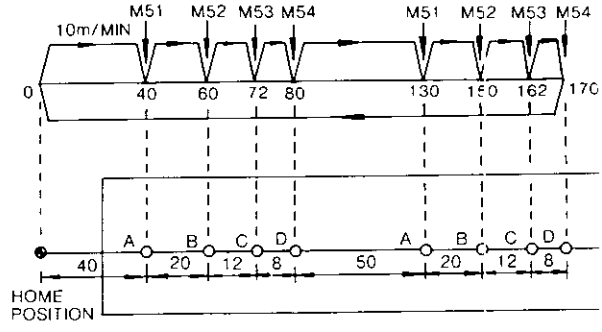


Fig 9 5

9 5 2 PROGRAMMING

Example 1

```
N 070  G01  X40  F10000  I200
N 071  M51
N 072  G01  X60
N 073  M52
N 074  G01  X72
N 075  M53
N 076  G01  X80
N 077  M54
N 078  G01  X130
N 079  M51
N 080  G01  X150
N 081  M52
N 082  G01  X162
N 083  M53
N 084  G01  X170
```

```
N 085  M54
N 086  G27  X0
N 087  M30
```

Example 2 Use of subprograms

```
N 070  G01  X40  F10000  I200
N 071  G68  L1  P80
N 072  G01  X130  F10000
N 073  G68  L1  P80
N 074  G27  X0  F10000
N 075  M30
N 080  M51
N 081  G01  U20  F10000
N 082  M52
N 083  G01  U12
N 084  M53
N 085  G01  U8
N 086  M54
N 087  G69
```

Example 3 Switching coordinates

```
N 070  G52  X-40  T1
N 071  G52  X-130  T2
N 072  G53  T1
N 073  G68  L1  P79
N 074  G53  T2
N 075  G68  L1  P79
N 076  G53  T0
N 077  G27  X0  F10000
N 078  M30
N 079  G01  X0  F10000  I20
N 080      The same as
  )      N 080 ~ N 087
N 087      in Example 2
```

9.6 POSITIONING OF X-AXIS AND Y-AXIS

9 6 1 OPERATION PATTERN

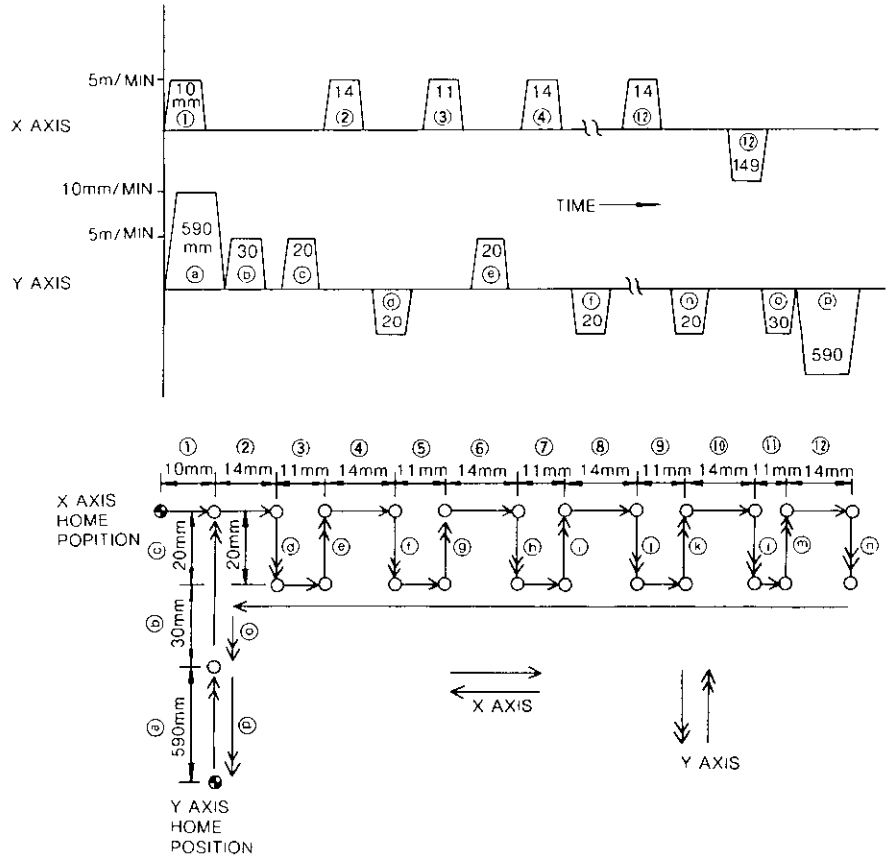


Fig 9 6

9.6 2 PROGRAMMING

Table 9 6 2 Programming

Block No	X Axis	Y Axis	Remarks
100 101 102 103 104	G01 X10 F5000 I200 G04 M51 M30	G01 X590 F10000 I200 G01 X620 F5000 G04 M51 M30	When M51 is output for X and Y axes, M fin is output and N110 is selected for Y-axis
110 111 112 113 114 115 116 117		G01 U20 F5000 G04 M52 G01 U-20 F5000 G04 M52 G68 L5 P140 M30	When M52 for Y-axis is given, N120 for X-axis is specified
120 121 122 123 124 125 126 127 128 129 130	G01 U14 F5000 I200 G04 M52 G01 U11 F5000 G04 M52 G68 L4 P140 G01 U14 G04 M52 M30		M FIN is output at M52 for Y-axis command and N123 is given to X-axis M52 for X-axis outputs M FIN and N113 is given to Y-axis M52 for X-axis outputs M FIN and N140 is given to Y-axis M30 for X-axis specifies N150
140 141 142 143 144 145 146	G01 U14 F5000 I200 G04 M52 G01 U11 F5000 G04 M52 G69	G01 U20 F5000 I200 G04 M52 G01 U-20 F5000 G04 M52 G69	During subprogram execution, M52 for X-and Y-axis and M FIN are processed
150 151 152	G27 XOF10000 I200 M30	G01 X590 F5000 I200 G27 X0 F10000 M30	For returning to home position

10. APPLICATION CIRCUITS

10. 1 POWER-ON CIRCUIT

In the Motionpack-33 controller, the 5VDC power rises immediately after supply of 100VAC power Then the controller performs initialization In approximately 2 seconds, the Motionpack is ready and the READY indicator (LED) lights

An output signal may turn ON momentarily (for a few milliseconds or less) while 5VDC is rising before the READY indicator lights To prevent the wrong signal from being memorized, turn on 24V for input/output signals 3 seconds or more after power-on of the Motionpack-33 controller, or incorporate an input circuit to the incorporate an input circuit to the programmable controller to hold the output signals of the Motionpack-33 cable after the system is ready

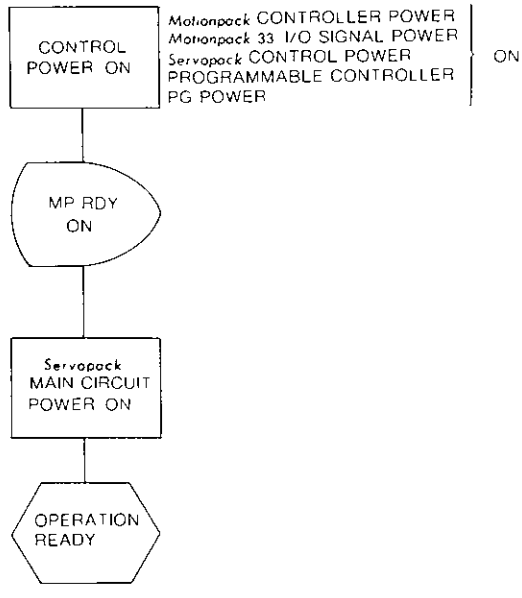


Fig 10 1

Power input circuit

In the circuit shown below, when master switch (NFB) is turned on, control power is turned on

Then main circuit power is turned on by main circuit switch.

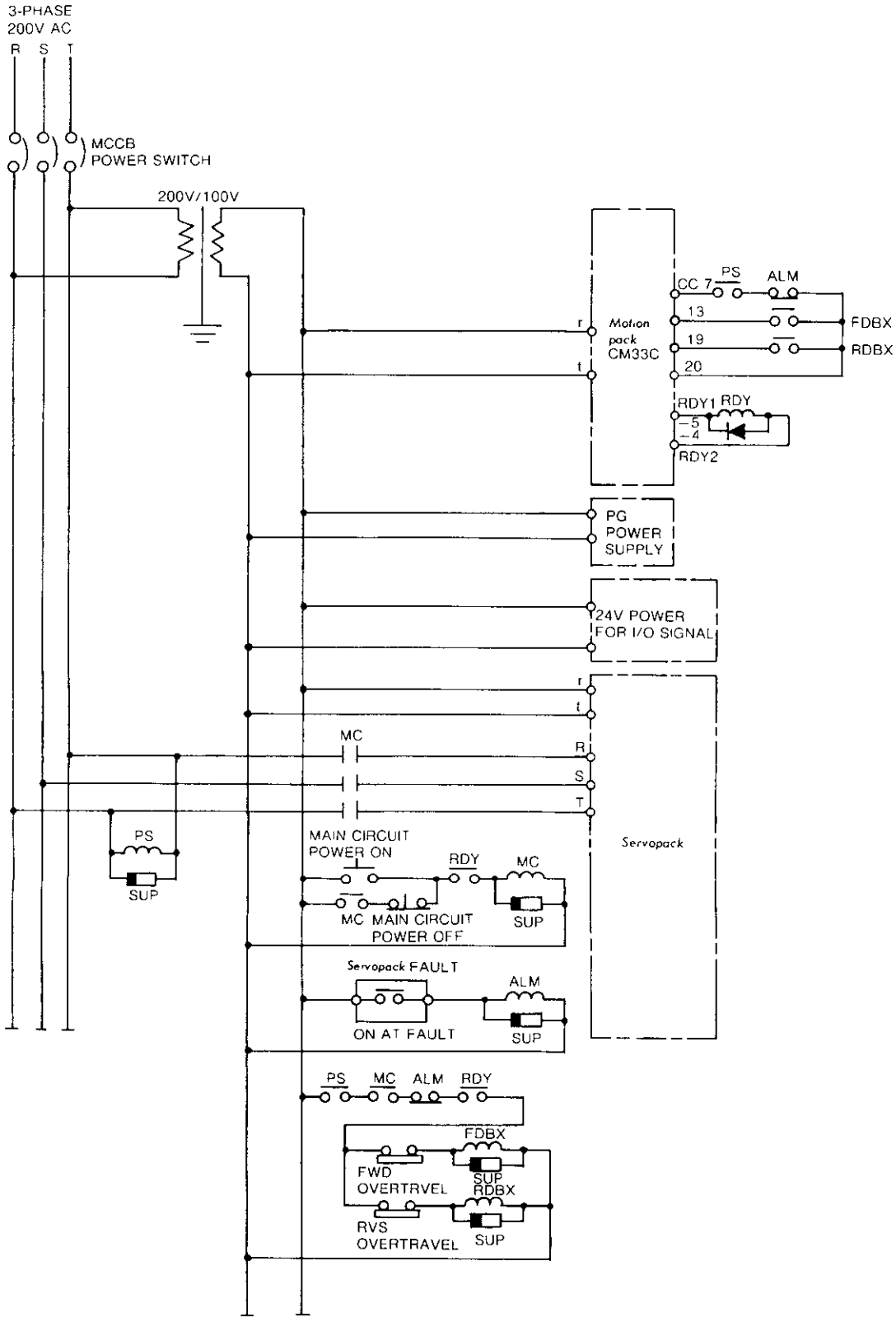


Fig 10 2

10. 2 APPLICATION CIRCUITS

10 2. 1 LARGE CAPACITY Servopack TYPE CPCR-MR, WITH DB UNIT

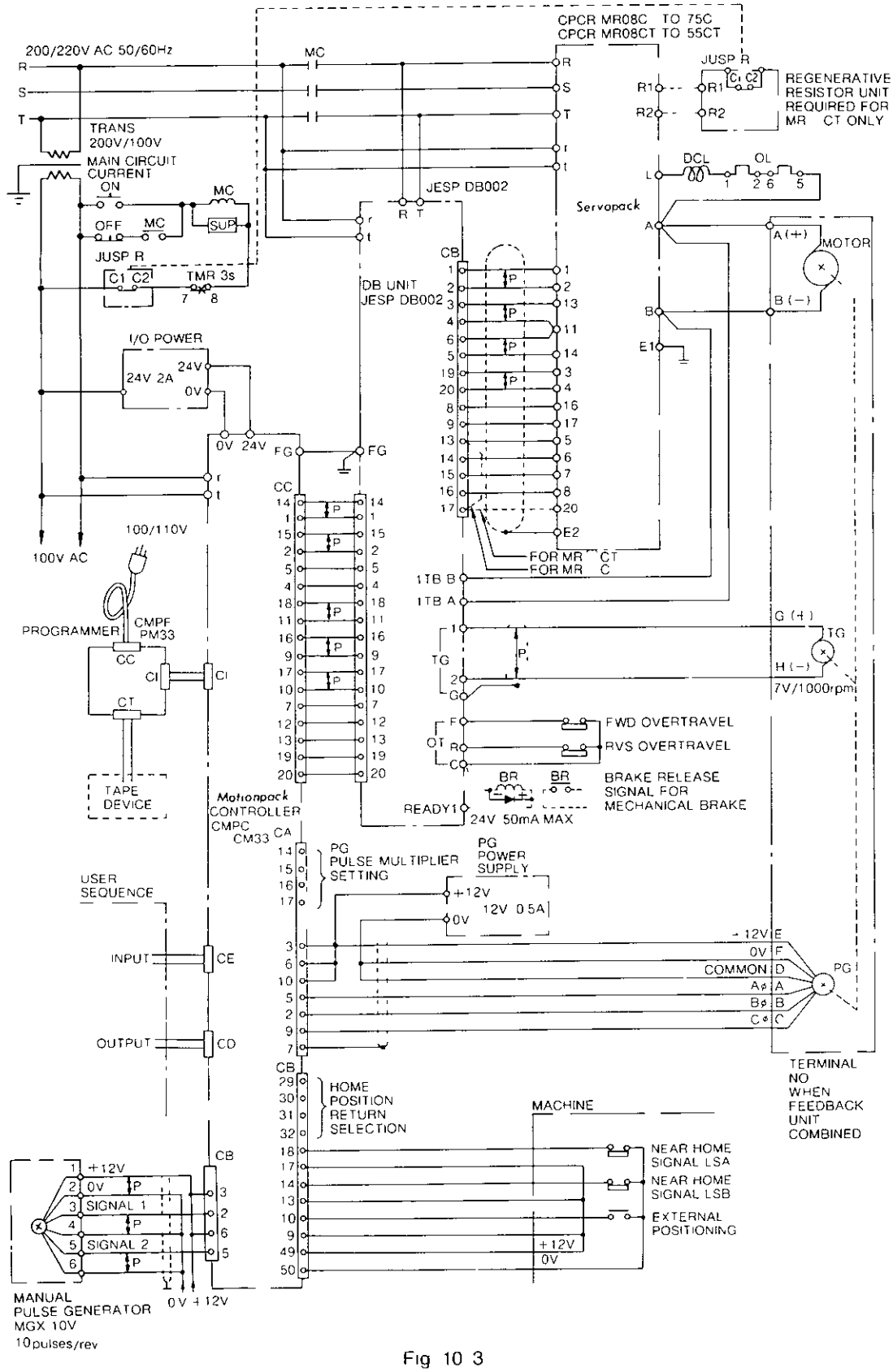


Fig 10 3

10. 2. 2 LARGE CAPACITY Servopack TYPE CPCR-MR, WITHOUT DB UNIT

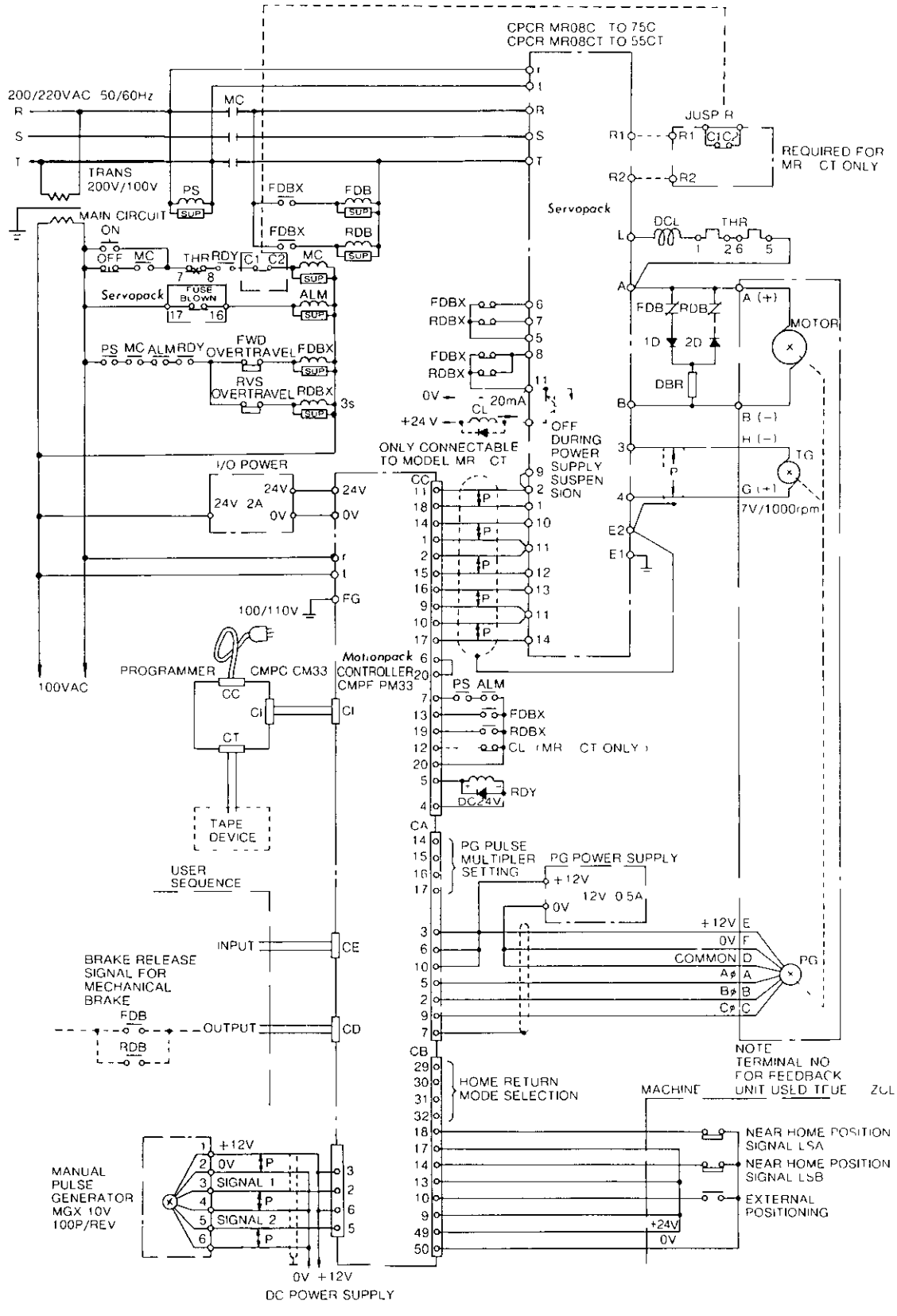


Fig 10 4

10. 2. 3 SMALL CAPACITY Servopack TYPE CPCR-MR, WITHOUT DB UNIT

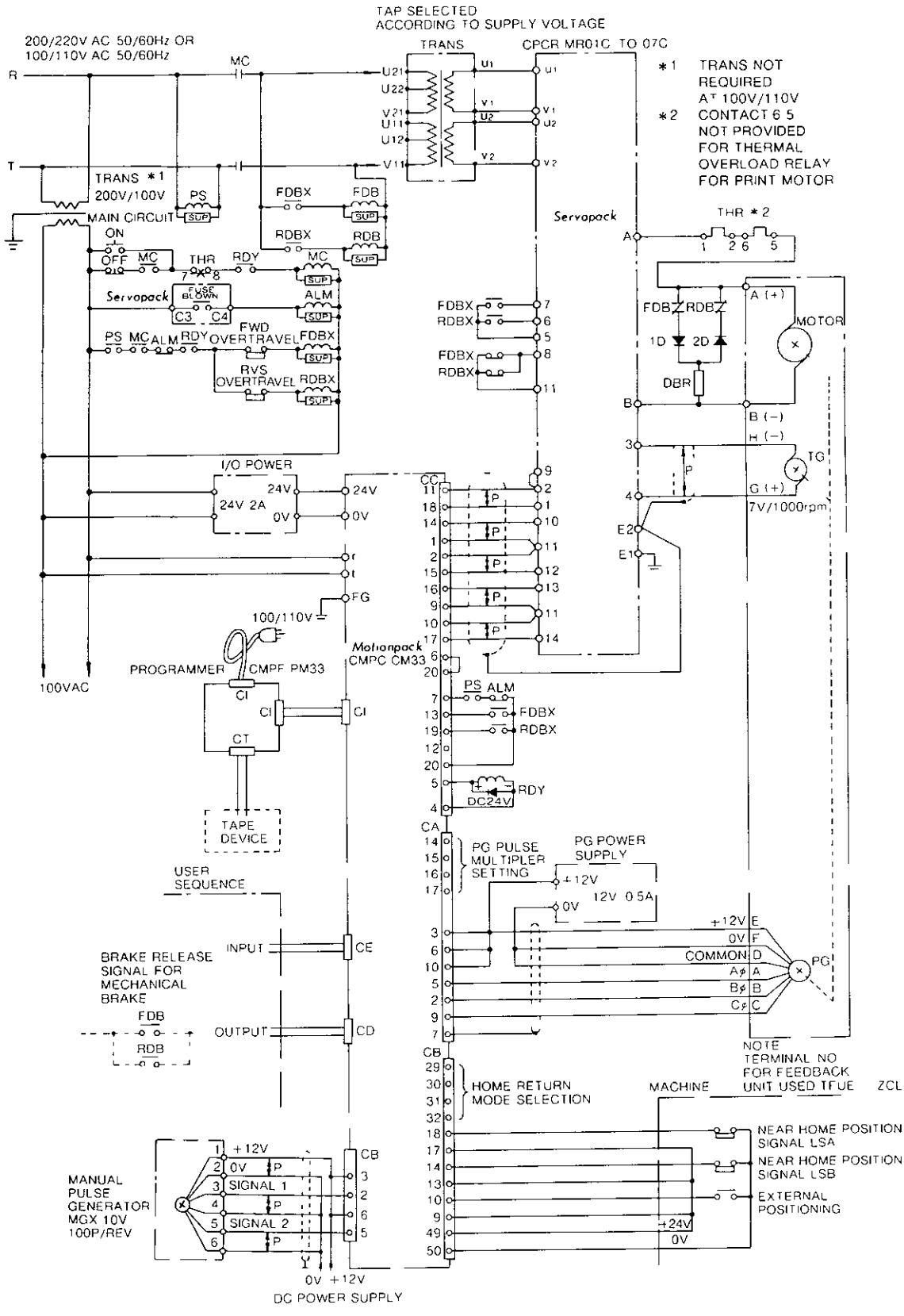


Fig 10 5

10. 2. 4 Servopack TYPE CPCR-FR, WITHOUT DB UNIT

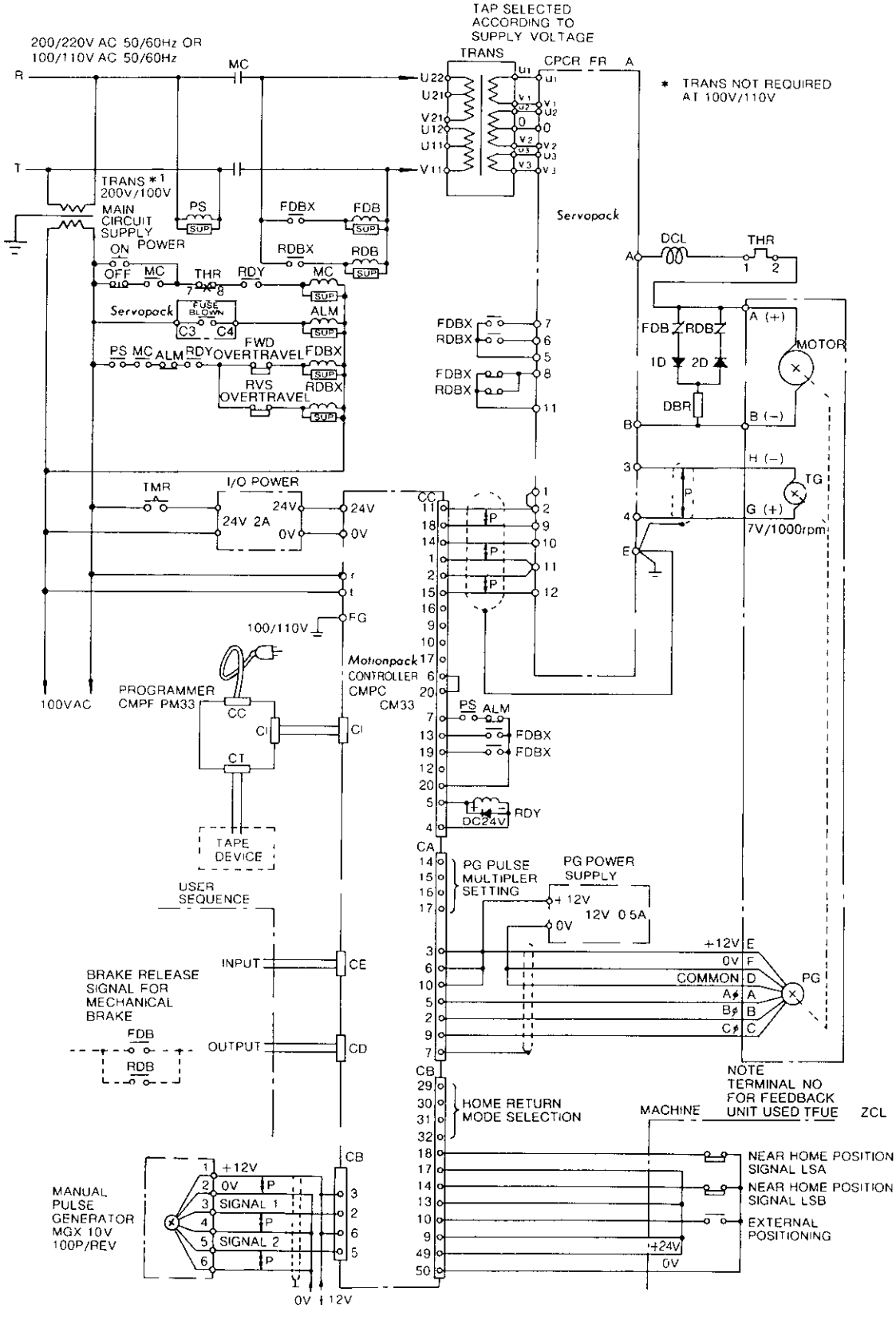


Fig 10 6

10 2 5 Servopack TYPE CPCR-FR

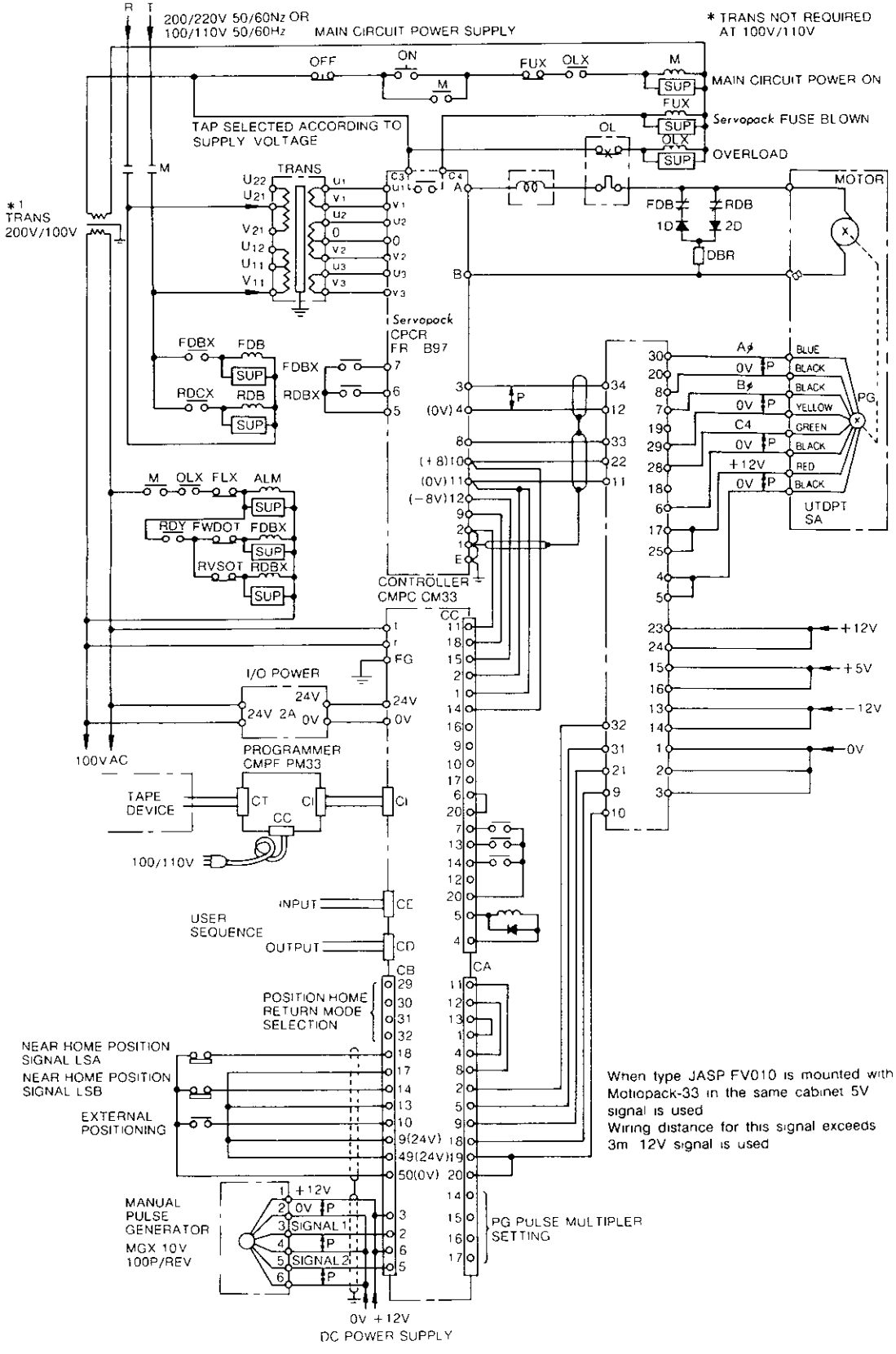


Fig 10 7

11. CONNECTIONS TO AC SERVO DRIVE

Operation of Motionpack-33 is basically the same in AC and DC servo drives This section shows the key points for operation of Motionpack-33 system using AC servo drives (M, F, S series).

Model B AC Servopack described in this section contains the following three types

- M series Type CACR-SR□BB1□M
  - A, B, D
- F series Type CACR-SR□BB1□F
  - A, B, D
- S series Type CACR-SR□BB1□S
  - C, E, I

Model A is also available on request However, in use, there is little diference between Models A and B For detailed information, see Par 11 2.

11.1 CONNECTIONS OF AC SERVO DRIVE (M,F,S SERIES)

For details on AC servo drive M, F, S series for speed control, refer to Bulletin (TSE-S800-2 1) Especially, in selection of AC servomotor and Servopack, thoroughly read Section 4 CHRACTERISTICS in this Bulletin

(1) Connection

Refer to Fig 11 2

(2) Wiring

The inter-unit connection and the cable names in a typical Motionpack-33 system configuration using an AC servo drive are shown in Fig 11 1

In this system, cables of varying power levels, such as the lines of PG and digital signals, mix with the motor main circuit through which large current flows If a high-speed signal line such as the PG signal line is run close to the motor main circuit, noise might be induced in the signal line result in a failure of positioning

Be sure to connect a surge absorber to every device containing a coil, such as relays, contactors, and solenoids

For detailed information, refer to Section 7 CABLE FORMATION AND CONNECTIONS

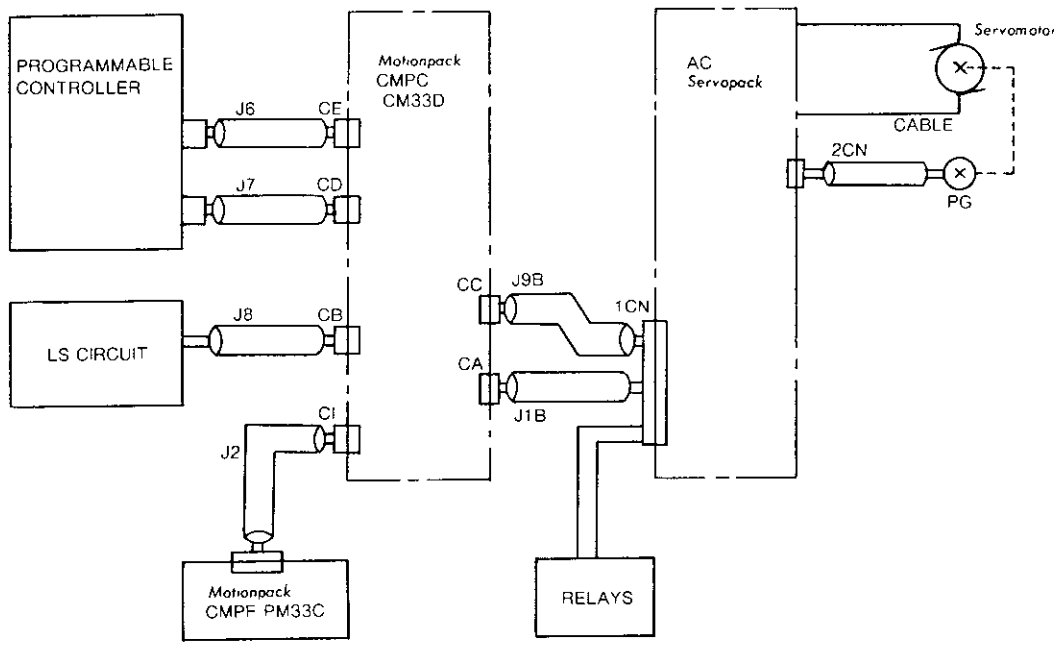


Fig 11 1 Connections and Cables

In this diagram, make cables J6, J7 and J8 as described in Par 7 3 4 and 7 3 5 and for the AC Servopack 2CN PG cable, refer to the AC Servopack Technical Sheet (TSE-S800-2 1)

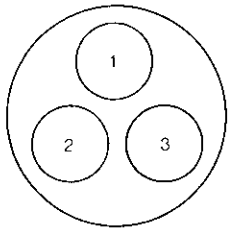
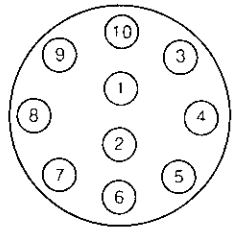
Note that the cable between 1CN 50-c connector MR of AC Servopack and connectors CC and CA of Motionpack-33 is branched.

Two twist cables and separate relay circuit signal lines must be connected to connector 1CN As the maximum outer diameter of the cable adapted to 1CN (50-c connector MR) is 16 mm, use specified cables

Table 11 1 Specifications of Cable J9B and J1B

Cable	Motionpack Connector	Servopack Connector	Applicable Cable	Signal
J9B	CC	1CN	• KQVV-SB • DE8400093 • 10P × 0.2	• Servo analog signals
J1B	CA		• KQVV-SW • DP8409130-A • 3P × 0.2	• PG signals
Independent Wiring	Independent relay circuit		Independent vinyl stranded leads	Contact signals • READY • ALM • BASE-BLOCK

Table 11 2 Cable Specifications

	Cable 1	Cable 2
	DP8409130 - A	DE8400093
	Fujikura Cable Co	
	KQVV-SW AWG 26 × 3P Finish dia 5 0 mm max	KQVV-SB AWG 26 × 10P Finish dia 10 mm max
Internal Composition and Lead Color		

1	Red-Black (Red)	
2	Blue-Black (Blue)	
3	Yellow-Black (Yellow)	

1	Blue-White	Twisted Cable
2	Yellow-White	
3	Green-White	
4	Red-White	
5	Purple-White	

6	Blue-Brown	Twisted Cable
7	Yellow-Brown	
8	Green-Brown	
9	Red-Brown	
10	Purple-Brown	

Note Cables for J1A (Yaskawa Dwg No DP8409130-A) are suitable only for use in enclosed cabinets To connect cabinets, use cables of Yaskawa Dwg DE8400093

(3) Setting AC Servopack

(a) Number of pulses

The PG outputs 6000 pulses/rev, 5000 pulses/rev or 4000 pulses/rev (2500, 1500 or 1000 pulses/rev) but the divider incorporated in Servopack can divide them into 1/N (N=1 to 64) or 2/N (N=2 to 64)

Set the dividing ratio according to Tables 11 3 and 11 4 Note that the dividing ratio must be able to divide the number of the optical encoder pulses without a remainder For an optical encoder of 5000 pulses/rev, 1/3, 1/6, 1/7, etc cannot be used.

The upper limit of frequency of the Motionpack PG signal read circuit is 75 kpps Therefore, the number of pulses after division, P (pulses/rev), must satisfy the following formula

$$P\ (\text{pulses/rev}) \times \frac{Max\ motor\ speed\ (\text{rpm})}{60} = 75\ (\text{kpps})$$

Table 11 3 Selection of Motor and PG

SW 1								Selection	
1	2	3	4	5	6	7	8	Motor Type	PG pulses / rev
○			○					USAMED (M series)	—
			○					USAFED (F series)	—
○	○		○					USASEM (S series)	—
				○	○	○	○	—	1000
				○		○	○	—	1500
				○	○		○	—	2500
				○			○	—	4000
							○	—	5000
				○	○	○		—	6000

Table 11 4 Setting of PG Pulse Frequency Dividing Ratio

SW2									Pulse Frequency Dividing Output (pulses/rev)					
1	2	3	4	5	6	7	8	PG Pulse Frequency Dividing Ratio (1/N)	PG = 6000	PG = 5000	PG = 4000	PG = 2500	PG = 1500	PG = 1000
○	○	○	○	○	○	○		1/1	6000	5000	4000	2500	1500	1000
	○	○	○	○	○	○		1/2	3000	2500	2000	1250	750	500
○		○	○	○	○	○		1/3	2000	—	—	—	500	—
		○	○	○	○	○		1/4	1500	1250	1000	625	375	250
○	○		○	○	○	○		1/5	1200	1000	800	500	300	200
	○		○	○	○	○		1/6	1000	—	—	—	250	—
			○	○	○	○		1/8	750	625	500	—	—	125
	○	○		○	○	○		1/10	600	500	400	250	150	100
		○		○	○	○		1/12	500	—	—	—	125	—
○				○	○	○		1/15	400	—	—	—	100	—
				○	○	○		1/16	375	—	250	—	—	—
		○	○		○	○		1/20	300	250	200	125	75	50
			○		○	○		1/24	250	—	—	—	—	—
○	○	○			○	○		1/25	240	200	160	100	60	40
	○				○	○		1/30	200	—	—	—	50	—
			○	○		○		1/40	150	125	100	—	—	25
				○		○		1/48	125	—	—	—	—	—
	○	○	○			○		1/50	120	100	80	50	30	20
		○				○		1/60	100	—	—	—	25	—
	○	○	○	○	○			2/2	6000	5000	4000	2500	1500	1000
○		○	○	○	○			2/3	4000	—	—	—	1000	—
		○	○	○	○			2/4	3000	2500	2000	1250	750	500
○	○		○	○	○			2/5	2400	2000	1600	1000	600	400
	○		○	○	○			2/6	2000	—	—	—	500	—
			○	○	○			2/8	1500	1250	1000	625	—	250
	○	○		○	○			2/10	1200	1000	800	500	300	200
		○		○	○			2/12	1000	—	—	—	250	—
○				○	○			2/15	800	—	—	—	200	—
				○	○			2/16	750	—	500	—	—	125
		○	○		○			2/20	600	500	400	250	150	100
			○		○			2/24	500	—	—	—	125	—
○	○	○			○			2/25	480	400	320	200	120	80
	○				○			2/30	400	—	—	—	100	—
			○	○				2/40	300	250	200	125	75	50
				○				2/48	250	—	—	—	—	—
	○	○	○					2/50	240	200	160	100	60	40
		○						2/60	200	—	—	—	50	—

The switches SW1 and SW2 have been factory-adjusted as follows Adjust them according to number of pulses to be set

Table 11 5 Field-setting Switch Position for M Series

Servopack Type CACR–		SW1 Motor Type, PG Pulse Setting	SW2 Pulse Resolution Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
Standard	SR03BB1AM to SR60BB1AM	6000 1 2 3 4 5 6 7 8	×1 1 2 3 4 5 6 7 8 *	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
Optional	SR03BB1BM to SR60BB1BM	5000 1 2 3 4 5 6 7 8			
	SR03BB1DM to SR60BB1DM	4000 1 2 3 4 5 6 7 8			

* Spare short circuit pin

Table 11 6 Field-setting Switch Position for F Series

Servopack Type CACR–		SW1 Motor Type, PG Pulse Setting	SW2 Pulse Resolution Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics Servopack Function Setting
Standard	SR03BB1AF to SR44BB1AF	6000 1 2 3 4 5 6 7 8	×1 1 2 3 4 5 6 7 8 *	1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
Optional	SR03BB1BF to SR44BB1BF	5000 1 2 3 4 5 6 7 8			
	SR03BB1DF to SR44BB1DF	4000 1 2 3 4 5 6 7 8			

* Spare short-circuit pin

Table 11 7 Field-setting Switch Position for S Series

Servopack Type CACR–		SW1 Motor Type, PG Pulse Setting	SW2 Pulse Resolution Setting	SW3 Speed Loop Condition Setting	SW4 Motor Characteristics, Servopack Function Setting
Standard	SR10BB1CS to SR30BB1CS	2500 1 2 3 4 5 6 7 8	×1 1 2 3 4 5 6 7 8 *	• SR10BB SR15BB 1 2 3 4 5 6 7 8	1 2 3 4 5 6 7 8
	SR03BB1ES to SR05BB1ES	1500 1 2 3 4 5 6 7 8		• SR03BB SR05BB SR30BB 1 2 3 4 5 6 7 8	
Optional	SR03BB1FS to SR30BB1FS	1000 1 2 3 4 5 6 7 8			

* Spare short circuit pin

[Examples of pulse setting]

① When the lead screw pitch is 10 mm/rev and the position detection unit is 1 μm/pulse, use a motor with PG outputting 5000 pulses/rev The frequency dividing ratio of Servopack is set to 1 2 to supply 2500 pulses/rev to Motionpack In this case, the permissible maximum speed n (rpm) of the motor is 1800 rpm

$$2500 \text{ pulses/rev} \times \frac{n \text{ (rpm)}}{60} \leqq 75 \text{ (kpps)}$$

$$n \leqq \frac{75 \text{ kpps} \times 60}{2500 \text{ pulses/rev}} = 1800 \text{ rpm}$$

When the PG pulse multiplier of Motionpack is 4, the position detection unit becomes 1 μm/pulse as calculated below

$$\frac{10 \text{ mm/rev}}{2500 \text{ pulses/rev} \times 4} = 1 \text{ μm/pulse}$$

② When the lead screw pitch is 12 mm/rev, and the position detection unit is 1 μm/pulse, use a motor with PG outputting 6000 pulses/rev Servopack frequency dividing ratio setting of 1 2 gives 3000 pulses/rev to Motionpack In this case, the permissible maximum speed n (rpm) of the motor is 1500 rpm

$$3000 \text{ pulses/rev} \times \frac{n \text{ (rpm)}}{60} \leqq 75 \text{ kpps}$$

$$n \leqq \frac{75 \text{ kpps} \times 60}{3000 \text{ pulses/rev}} = 1500 \text{ rpm}$$

When the Motionpack PG pulse multiplier is 4, the position detection unit becomes 1 μm/pulse as calculated below

$$\frac{12 \text{ mm/rev}}{3000 \text{ pulses/rev} \times 4} = 1 \text{ μm/pulse}$$

(b) Speed reference

The speed reference given by Motionpack is input to the IN-A input terminal of the Servopack Therefore, the position of the loop gain in the system is determined only by parameter Pr42

(4) Motionpack setting

(a) PG pulse multiplier setting

The setting of PG pulse multiplier is as shown below For example, to double the PG pulses, short CA-14 and CA-15 Connection must be terminated inside the connector casing Extending line wire will cause malfunction

Table 11 8 PG Pulse Multiplier Setting

Terminal No	× 1	× 2	× 4
CA-14			
CA-15			
CA-16			
CA-17			

(b) Parameter setting

The Motionpack delivered to the user contains the same parameter settings as those made durir the pre-shipping test at the factory Be sure t set parameters suited to the intended system be fore starting operation, because parameters are important data for adapting the Motionpack con trol specifications to the system specifications Note that some of the parameters may be set to "0" when they are not used, as shown below

Set the thrust ratio (Pr53) as follows

The limit current output of Motionpack is ±4V / 100% On the other hand, the limit current characteristic of AC Servopack is ±3 V/100% Therefore, calculate the thrust ratio parameter Pr53 as follows

$$Pr\,53 = \frac{100\%\ Motor\ Axis\ Torque\ Programmed}{Motor\ Rated\ Torque} \times \frac{Motor\ Rated\ Current}{Servopack\ 100\%\ Current\ Limit\ Current} \times \frac{3}{4} \times 100$$

Table 11 9 Motionpack-33 Parameter List

Parameter No	Description		Unit	Remarks
1	JOG, STEP group	JOG, Low speed	Speed unit	Unused parameters for JOG or CREEP speed, or STEP feed amount can be set to 0
2		JOG, medium speed	Speed unit	
3		JOG, high speed	Speed unit	
4		STEP speed	Speed unit	
5		STEP distance, moved short	Min command unit	
6		STEP distance, moved medium	Min command unit	
7		STEP move distance, moved long	Min command unit	
8-9	Unused			
10	Creep speed		Speed unit	
11-19	Unused			
20	Offset group	Coordinate 8 single correction	Min command unit	Set to 0 when correction function is not used Pr45 cannot be set to 0
21		Coordinate 8 max correction	Min command unit	
22		Coordinate 9 single correction	Min command unit	
23		Coordinate 9 max correction	Min command unit	
24-39	Unused			
40	Servo group	Max speed	Sepeed unit	Input optimum data matching system requirements to these parameters
41		Acceleration time	msec	
42		Position loop gain	No of pulses	
43		Unused	No of pulses	
44		Servo error deviation	No of pulses	
45		In-position range		
46	G27 group G27 permissible error			Pr46 cannot be set to 0
47-49	Unused			
50	Unit group	Pulse ratio M		Input optimum data matching system requirements to these parameters
51		Pulse ratio D		
52		Decimal point position	No of digit columns	
53		Thrust ratio (thrust rating/servo rating)×100	%	
54	Axis No designation			Set to 0 if Axis No check is not required
55-59	Unused			
60	Overtravel group	-direction stored stroke limit	Min position unit	Motor cannot move if Pr60, 61 is set to 0
61		+direction stored stroke limit	Min position unit	
63-69	Unused			
70	Home position group	Return home mode		Input optimum data matching system requirements to Pr70 to Pr77 Set Pr75, 78 to 0 except for butting home position return Set Pr76 to 0 except for power failure back-up
71		Home position coordinate	No of pulses	
72		Waiting position	Min position unit	
73		Return home speed	Speed unit	
74		Return home creep speed	Speed unit	
75		Return home torque limit	%	
76		Coasting allowance	No of pulses	
77		Permissible error	No of pulses	
78		Butting time	10 msec	
79-96	Unused			
97	Tape device Baud rate setting		Baud	Set to 0 except when output is made by tape

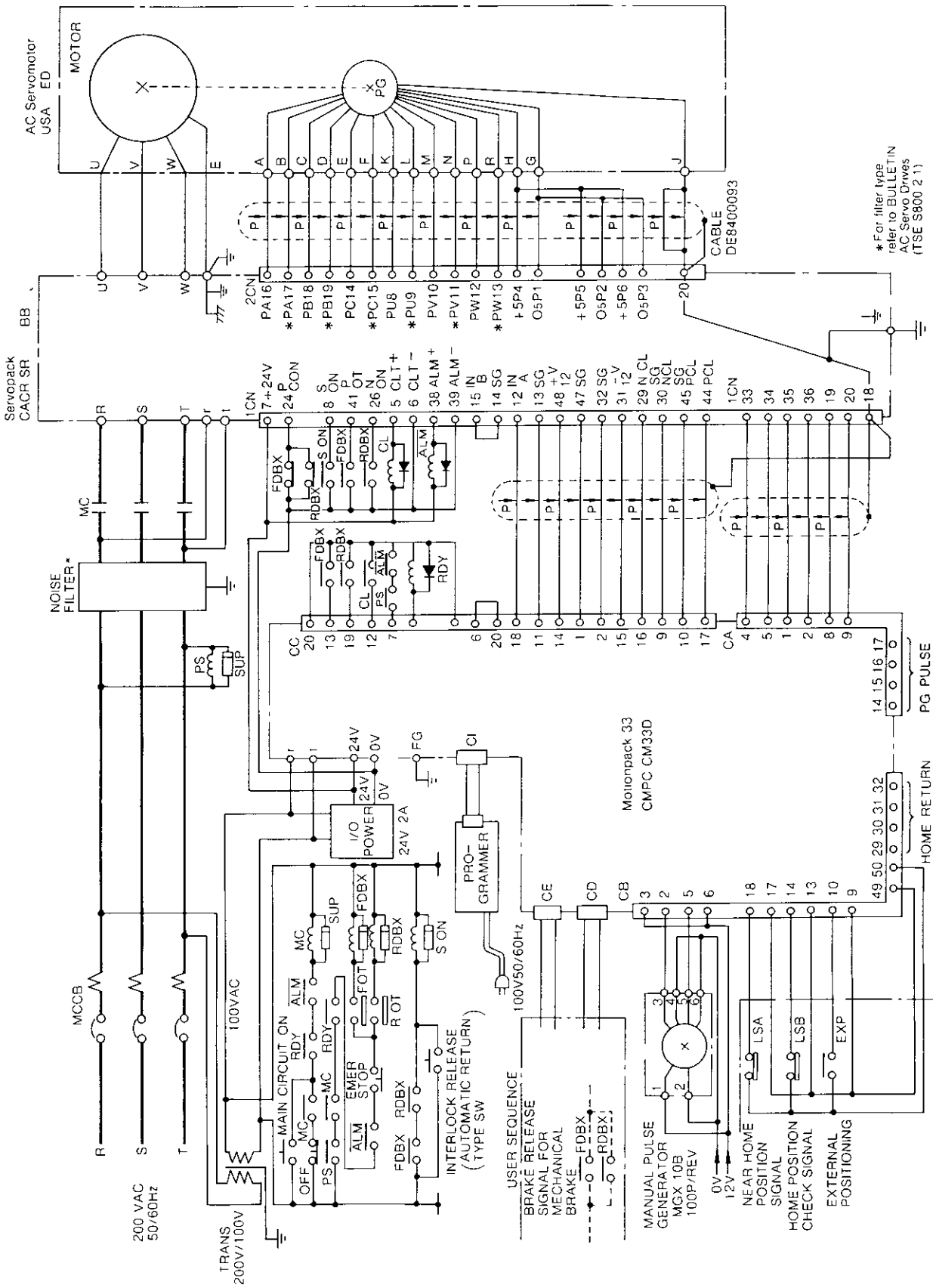


Fig 11 2 Application Circuit of AC Servo Drive (M,F,S Series)

11.2 DIFERENCES IN USE OF MODEL-A AND -B Servopacks

Table 11 10 lists diferences in use between model -A and -B Servopacks Where adapting the model A, be aware of the diferences

Table 11 10 Diferences in Use of Model-A and -B Servopacks

Items	Model B*	Model A†
Speed Reference Input	• IN-A input used • No IN-B VR adjustment required. • Position of loop gain determined by parameter Pr42	• IN B input used • IN-B VR adjustment required If no adjustment MP alarm dEr OvEr occurs • Position of loop gain determined by IN-B VR
Corrective Action at Overtravel	Built-in dynamic brake (DB) circuit is operated at overtravel state to stop motor running Actually, S-ON signal is turned OFF	If overtravel limit switch is activated, Servopack OT input signal is turned OFF to interrupt motor running For dynamic braking, external DB resistor is required.
Thrust Ratio (Parameter 53)	• Torque limit voltage ±3 0V/±100% • Motionpack-33 torque limit output ± 4 V/±100% Therefore, parameter Pr53 is calculated by the following formula $Pr53 = \frac{T_{100}}{T_R} \times \frac{I_R}{I_{100}} \times \frac{3}{4} \times 100\%$	• Torque limit voltage ±1 5V/±100% • Motionpack-33 torque limit output ± 4 V/±100% Therefore, parameter Pr53 is calculated by the following formula $Pr53 = \frac{T_{100}}{T_R} \times \frac{I_R}{I_{100}} \times \frac{1\ 5}{4} \times \frac{12}{8} \times 100\%$
	T_{100} 100% motor axis torque programmed I_R Motor rated torque	I_{100} 100% current limit current of Servopack I_R Motor rated current
Setting of Frequency Dividing Ratio	See Tables 11 3 and 11 4	• 1000 rpm series See Table 11 11 • 3000 rpm series See Table 11 12
Connection Diagram	See Fig 11 2	• 1000 rpm series See Fig 11 3 • 3000 rpm series See Fig 11 4

*Type CACR-SR 'BB1 '
†Type CACR-SR' BA1' for 1000 rpm series
Type CACR-SR' 'AA2' for 3000 rpm series

Note For more information of model A Servopack refer to the related Bulletin

11.2 DIFERENCES IN USE OF MODEL-A AND -B Servopacks (cont'd)

Table 11 11 Setting of PG Pulse Frequency Dividing Ratio in Model A Servopack (1000rpm Series)

PG Pulse Frequency Dividing Ratio (1/N)	SW 2 ①	②	③	④	⑤	⑥	Pulse Frequency Dividing Output (P/R) 6000P/R	5000P/R	PG Pulse Frequency Dividing Ratio (2/N)	SW 2 ①	②	③	④	⑤	⑥	Pulse Frequency Dividing Output (P/R) 6000P/R	5000P/R
1	○	○	○	○	○	○	6000	5000	2							×	×
1/2		○	○	○	○	○	3000	2500	2/2		○	○	○	○		6000	5000
1/3	○		○	○	○	○	2000	×	2/3	○		○	○	○		4000	×
1/4			○	○	○	○	1500	1250	2/4			○	○	○		3000	2500
1/5	○	○		○	○	○	1200	(1000)	2/5	○	○		○	○		2400	(2000)
1/6		○		○	○	○	1000	×	2/6		○		○	○		2000	×
1/7	○			○	○	○	×	×	2/7	○			○	○		×	×
1/8				○	○	○	750	625	2/8				○	○		1500	1250
1/9	○	○	○		○	○	×	×	2/9	○	○	○		○		×	×
1/10		○	○		○	○	600	(500)	2/10		○	○		○		1200	(1000)
1/11	○		○		○	○	×	×	2/11	○		○		○		×	×
1/12			○		○	○	500	×	2/12			○		○		1000	×
1/13	○	○			○	○	×	×	2/13	○	○			○		×	×
1/14		○			○	○	×	×	2/14		○			○		×	×
1/15	○				○	○	400	×	2/15	○				○		800	×
1/16					○	○	375	×	2/16					○		750	×
1/17	○	○	○	○		○	×	×	2/17	○	○	○	○			×	×
1/18		○	○	○		○	×	×	2/18		○	○	○			×	×
1/19	○		○	○		○	×	×	2/19	○		○	○			×	×
1/20			○	○		○	300	(250)	2/20			○	○			600	(500)
1/21	○	○		○		○	×	×	2/21	○	○		○			×	×
1/22		○		○		○	×	×	2/22		○		○			×	×
1/23	○			○		○	×	×	2/23	○			○			×	×
1/24				○		○	250	×	2/24				○			500	×
1/25	○	○	○			○	240	(200)	2/25	○	○	○				480	(400)
1/26		○	○			○	×	×	2/26		○	○				×	×
1/27	○		○			○	×	×	2/27	○		○				×	×
1/28			○			○	×	×	2/28			○				×	×
1/29	○	○				○	×	×	2/29	○	○					×	×
1/30		○				○	200	×	2/30		○					400	×
1/31	○					○	×	×	2/31	○						×	×
1/32						○	×	×	2/32							×	×

Note
1 Circles indicate the short-circuit pin is inserted into the switch
2 The pulse frequency dividing ratio indicated by × cannot be used
3 Apply a PG of 6000 P/rev except for pulse frequency dividing output of 5000 P/rev, 2500 P/rev, 1250 P/rev and 625 P/rev

• Type CACR-SR, SW2

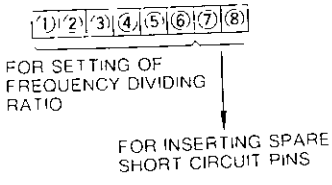


Table 11 12 Setting of PG Pulse Frequency Dividing Ratio in Model A Servopack (3000rpm Series)

PG Pulse Frequency Dividing Ratio (1/N)	SW 2						Pulse Frequency Dividing Output (P/R)		PG Pulse Frequency Dividing Ratio (2/N)	SW 2						Pulse Frequency Dividing Output (P/R)	
	①	②	③	④	⑤	⑥	1500P/R	1000P/R		①	②	③	④	⑤	⑥	1500P/R	1000P/R
1	○	○	○	○	○	○	1500	(1000)	2							×	×
1/2		○	○	○	○	○	750	(500)	2/2		○	○	○	○		1500	(1000)
1/3	○		○	○	○	○	500	×	2/3	○		○	○	○		1000	×
1/4			○	○	○	○	375	(250)	2/4			○	○	○		750	(500)
1/5	○	○		○	○	○	300	(200)	2/5	○	○		○	○		600	(400)
1/6		○		○	○	○	250	×	2/6		○		○	○		500	×
1/7	○			○	○	○	×	×	2/7	○			○	○		×	×
1/8				○	○	○	×	(125)	2/8				○	○		×	(250)
1/9	○	○	○		○	○	×	×	2/9	○	○	○	○	○		×	×
1/10		○	○		○	○	150	(100)	2/10		○	○		○		300	(200)
1/11	○		○		○	○	×	×	2/11	○		○		○		×	×
1/12			○		○	○	125	×	2/12			○		○		250	×
1/13	○	○			○	○	×	×	2/13	○	○			○		×	×
1/14		○			○	○	×	×	2/14		○			○		×	×
1/15	○				○	○	100	×	2/15	○				○		200	×
1/16					○	○	×	×	2/16					○		×	×
1/17	○	○	○	○		○	×	×	2/17	○	○	○		○		×	×
1/18		○	○	○		○	×	×	2/18		○	○	○			×	×
1/19	○		○	○		○	×	×	2/19	○		○	○			×	×
1/20			○	○		○	75	(50)	2/20			○	○			150	(100)
1/21	○	○		○		○	×	×	2/21	○	○		○			×	×
1/22		○		○		○	×	×	2/22		○		○			×	×
1/23	○			○		○	×	×	2/23	○			○			×	×
1/24				○		○	×	×	2/24				○			×	×
1/25	○	○	○	○		○	60	(40)	2/25	○	○	○	○			120	(80)
1/26		○	○			○	×	×	2/26		○	○				×	×
1/27	○		○			○	×	×	2/27	○		○				×	×
1/28			○			○	×	×	2/28			○				×	×
1/29	○	○				○	×	×	2/29	○	○					×	×
1/30		○				○	50	×	2/30		○					100	×
1/31	○					○	×	×	2/31	○						×	×
1/32						○	×	×	2/32							×	×

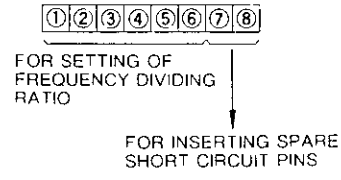
Note

1 Circles indicate the short-circuit pin is inserted into the switch

2 The pulse frequency dividing ratio indicated by × cannot be used

3 Apply a PG of 1500 P/rev except for pulse frequency dividing output of 400 P/rev, 80 P/rev and 40 P/rev

• Type CACR-SR, SW2



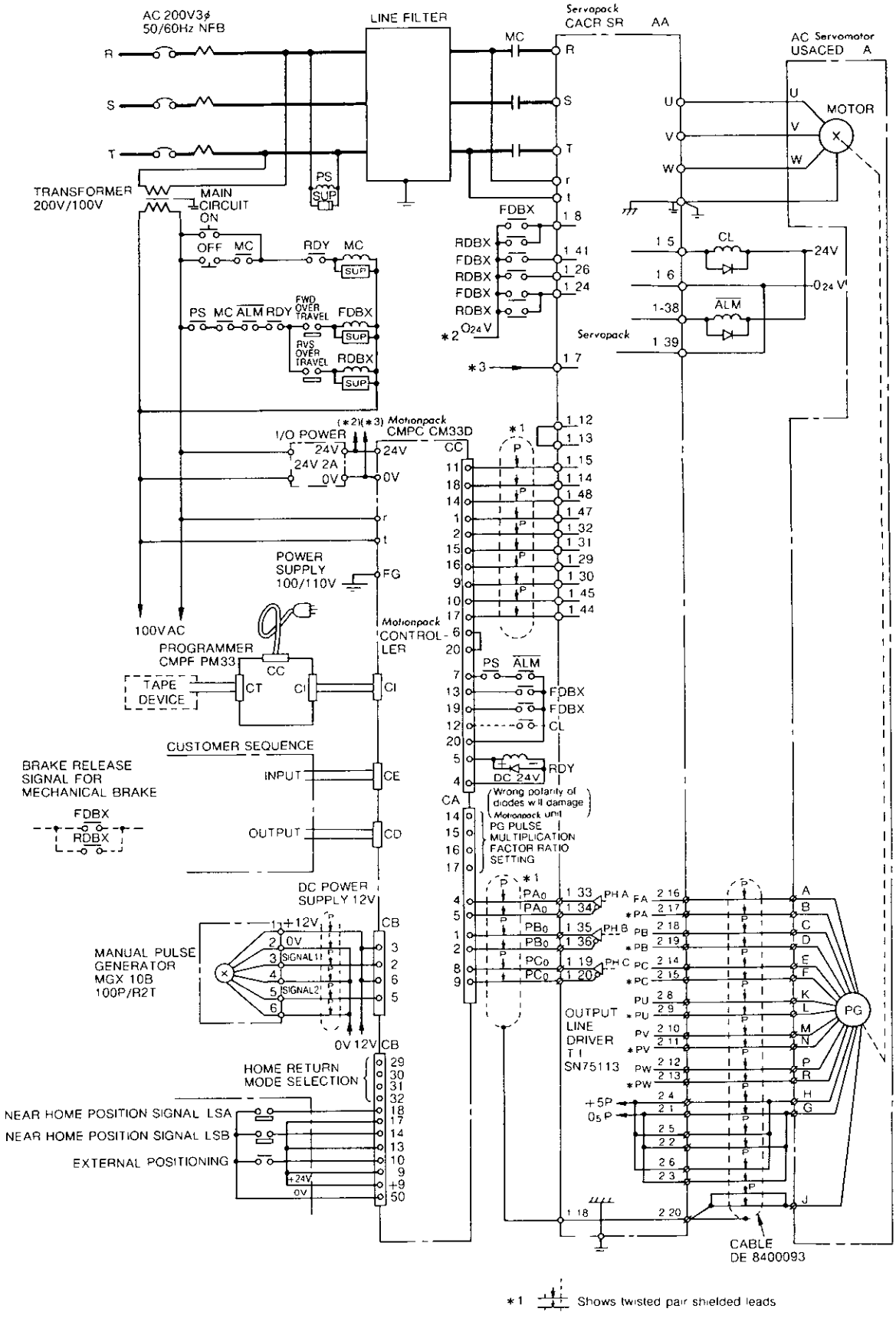


Fig 11 3 Application Circuit of AC Servo Drive
Using Model A Servopack (1000rpm Series)

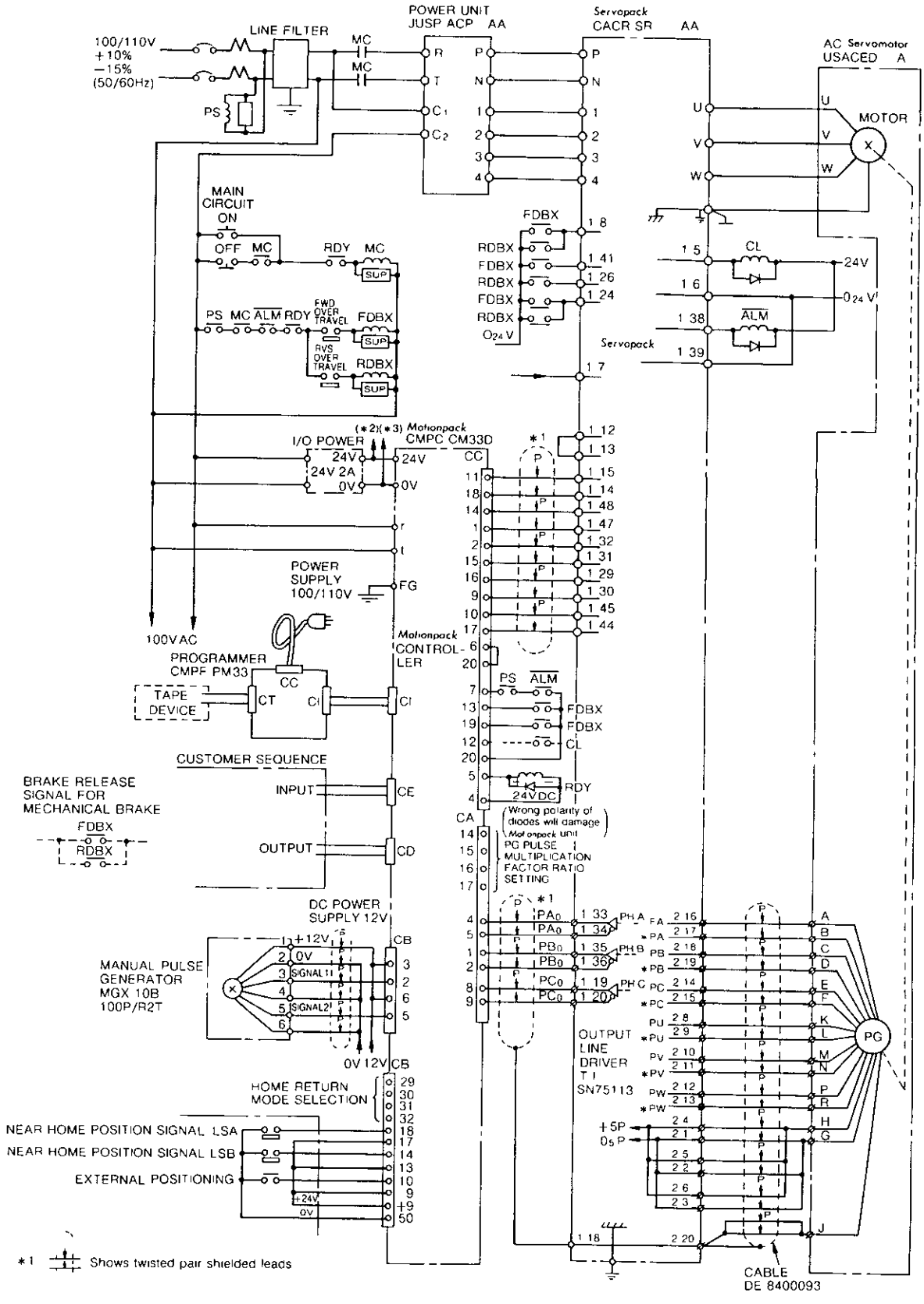


Fig 11 4 Application Circuit of AC Servo Drive
Using Model A Servopack (3000rpm Series)

APPENDIX

A-1 SELECTING DC SERVOMOTOR

The selection process for DC servomotors for use with conventional leadscrew feed units are described below.

(1) Mechanical system

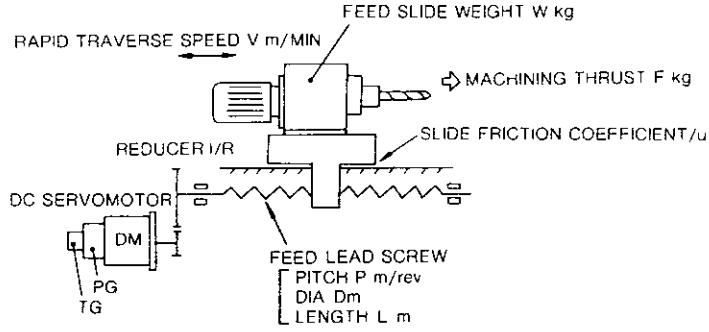


Fig A-1 Servomotor Mechanical System

(2) Determining DC Servomotor Operational Speed

Leadscrew rpm N_B $N_B = \frac{V}{P}$ (rpm)

DC servomotor service rpm N

$$N = N_B \times R \text{ (rpm)}$$

$$N < N_M$$

N_M DC servomotor rated speed

(3) Evaluation of load torque

Load torque T_L

$$T_L = \frac{\mu W + F}{2 \times \pi} \times P \times \frac{1}{R \times \eta G} \text{ kg m}$$

$$T_L < T_M$$

T_M DC servomotor rated torque

(4) Evaluation of load inertia

The inertia of the feed system weight, the lead screw inertia, and the reducer inertia are calculated individually

Inertia of feed system weight

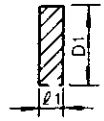
$$GD_W^2 = W \times \left(\frac{P}{\pi}\right)^2 \text{ kg m}$$

Leadscrew inertia GD^2_B

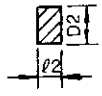
$$GD_B^2 = \frac{\pi}{8} \times \rho \times 10^3 \times L \times D^4 \text{ [kg m}^2\text{]}$$

ρ = Specific weight (= 7.87 for steel)

Reducer inertia GD^2_G



$$GD_{G1}^2 = \frac{\pi}{8} \times \rho \times 10^3 \times l_1 \times D_1^4 \text{ [kg m}^2\text{]}$$



$$GD_{G2}^2 = \frac{\pi}{8} \times \rho \times 10^3 \times l_2 \times D_2^4 \text{ [kg m}^2\text{]}$$

Therefore, load inertia at motor shaft GD'^2_L is as follows

$$GD_L^2 = \frac{GD_W^2 + GD_B^2 + GD'^2_G + GD'^2}{R^2} G^2 \text{ [kg m}^2\text{]}$$

$$GD_I^2 < 2\text{-}3 GD_M^2$$

$2\text{-}3\,GD_M^2$ = *DC Servomotor rotor inertia*

(5) Tentative selection of DC servomotor

From the conditions $N < N_M$, $T_L < T_M$

$$GD_I^2 < 2\text{-}3\,GD_M^2$$

a suitable motor is selected tentatively out of the HI-CUP motor series, Cup motor series, MINERTIA motor J series, or the Print motor series

(6) Setting acceleration/deceleration time

Determine the acceleration parameter (P41) for Motionpack-33 controller as follows
Start time for speed loop t_V

$$t_V = \frac{(GD_M^2 + GD_L^2) \times N}{375 \times \frac{I_P}{I_M} \times T_M - T_L} \text{ sec}$$

where

I_P Servopack max output current [A]

I_M DC servomotor rated current [A]

Set P41 to satisfy P41 > $t_V \times 1.3$ and P41 > 200 msec

A-1 SELECTING DC SERVOMOTOR (Cont'd)

(7) Determining speed diagram

The response to pulse distribution is as shown in Fig A-2, and varies with the DC servomotor and the maximum speed

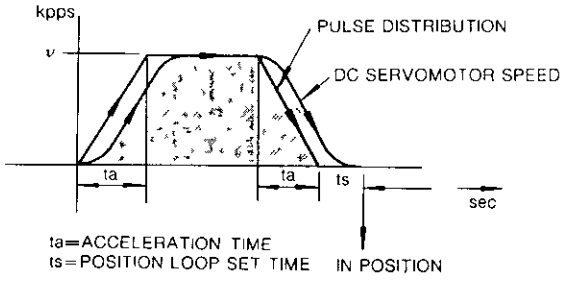


Fig A-2 Servomotor Speed and Pulses

High-cup Motor Series Cup Motor Series Minertia Motor J Series	kp=30sec^{-1}	v <100 kpps	t_S = 0 2sec
		v >100 kpps	t_S = 0 3sec
Print Motor Series	kp=40sec^{-1}	v <100 kpps	t_S = 0 15sec
		v <100 kpps	t_S = 0 25sec

(8) Torque check

Calculate the effective torque in one cycle, and check that it is within the rated torque of the DC servomotor

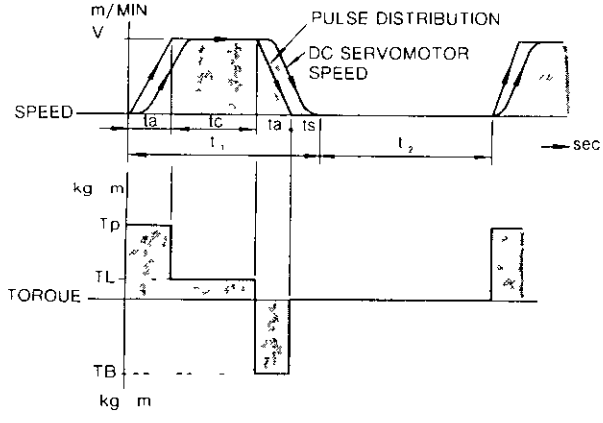


Fig A-3 Servomotor Speed and Torque

Acceleration torque T_A

$$T_A = \frac{(GD_M^2 + GD_L^2) \times N}{375 \times t_a} \text{ kg m}$$

Effective torque Trms

$$Trms = \frac{(T_A + T_L)^2 \times t_a + T_L^2 t_c + (T_A - T_L)^2 \times t_a}{t + t_2}$$

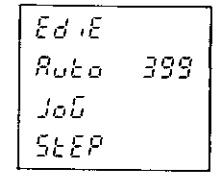
[Applicable where Trms < T_M]

A-2 MESSAGE DISPLAY

When the [STATUS] key and the [MODE] key are pushed, the current status is displayed in the universal display

(1) Motionpack controller status display SE

1	EDIT MODE
2	AUTO MODE
3	JOG MODE
4	STEP MODE



(2) Motionpack controller hold status display Ho

1	Command in execution
2	Waiting for C-Fin
3.	Waiting G04 time up
4	G04 in position
5	G01 - G27 waiting for positioning finish
6	Waiting for auto mode
7	Waiting for operation start
8	Feed hold

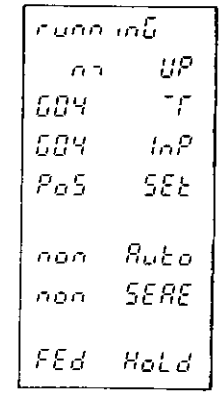


Table A-1 Motionpack Alarm List

Alarm \ Operation When Alarm occurs		MP	Immediately stopped	Decelerates to stop	Stopped at Block End	Battery Alarm Lamp lights up	MP Alarm Signal outputs MP Failure Lamp lights up	MP Ready (RDY) Signal OFF	READY (RDY1-RDY2) Signal OFF (Braking OFF)	Reset by Error Reset Signal	Automatically reset after counteracting alarms	Reset by Servopack Error Signal	Reset by Mode Selector Signal	Reset by Program Clear Signal	Reset by External positioning Completion Signal
CPU Error	CPU Err	○	○					○	○	Repeat turning on and off					
Program Error	Pro Err				○		○			○					
Parameter Error	PAr Err				○		○			○					
Emergency Stop	Ec StoP		○					○			○				
Servo Error	SErvo		○				○					○			
Circuit Saturation	EC OvEr										○				
+Overtravel	For Ot		○				○				○				
-Overtravel	rvS Ot		○				○				○				
Home Position Return	SEt UP				○		○			○					
G27 Error	Err G27				○		○			○					
Work Selection Error	Err nSEL				○		○			○					
Power Down	PS doun				○		○			○					
Battery Error	bAt doun					○					○				
+Stored Limit Over	P OvEr			○ JOG	○ AUTO STEP		○			○	○		○	○	
-Stored Limit Over	P-OvEr			○ JOG	○ AUTO STEP		○			○	○		○	○	
Excessive Deviation	dEr OvEr		○				○		○	○					
In-Position Error	InPo Err				○		○			○					
Skip Signal	SP Err				○		○			○					
External Positioning Error	OutP Err												○		○

A-2 MESSAGE DISPLAY (Cont'd)

Table A-2 Error Code List

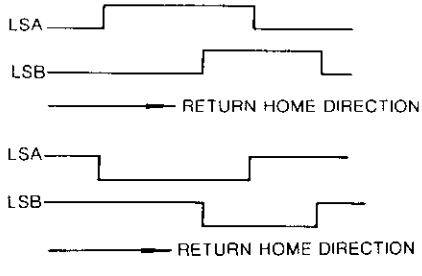
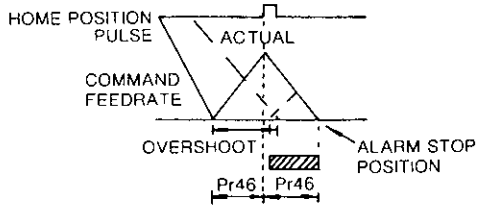
Error Code	Error condition	Remedial measure
CPU Err	Fault conditions detected by the self-diagnostic function of the CM If no strong noise source is in the vicinity, and the 100VAC power supply is in order, the cause must be in the CM itself	Replace the CM
Ec StoP	The DB in the DB unit remains in the braking condition in both the + and - directions ① The DB operates only in the required direction when the OT, LS is tripped This code is displayed when OT, LS is tripping in both + and - directions, or the common wire for the OT, LS is broken ② When the servo drive power supply is turned off, the DB operates in both + and - directions ③ No MP ready (RDY) signal is output	(No MP alarm is output) ① Check OT, LS ② Check the servo drive power voltage (200V) ③ Check the CM
For O.t	+OT, LS (overtravel limit switch in + direction) has tripped	① Check the machine position ② Check the OT, LS signals
ruS Ot	The -OT, LS (minus direction overtravel limit switch) has tripped	① Check the machine position ② Check the OT, LS signals
SErvo	Servo error display Servo alarm signal is turned off	Check the error display of Servopack (CPCR-MR□□CT), and take remediary measures
P OvEr	+direction stored stroke limit over	Check to see if the values of A0(at JOG) or C0(except for JOG) exceed or equal Pr61
P-OvEr	-direction stored stroke limit over	Check to see if the values of A0(at JOG) or C0(except for JOG) exceed or equal Pr60
SEt UP	Return home error ① The home pulse position is different beyond the permissible range set by Pr77 from the one immediately after power on (Pr70 = 1) or the previous one (Pr70 = 2) When this happens, mostly, the current position (A0) is not exactly on the home position, but beyond it If the difference is nearly one revolution, the deceleration LS or the check LS is often malfunctioning ② Decelerations LS (LSA) or check LS (LSB) is on the home position, but does not operate properly In this case, an error display is made, but the current position display (A0) shows correct home position ③ LSA or LSB is malfunctioning  When this is the case, not only in the return home motion, but also in the STEP and AUTO modes, an error state occurs when the home LSA and LSB	ⓐ Check the return home parameter (Pr70-Pr78) ⓑ Move the slide in the STEP mode until the current position (A0) becomes close to the home position, and check if the home position pulse (input 6CH, the 3rd bit from the right of 8)changes If the home position pulse does not change, faults are in the pulse reading area ⓒ Check the actuation of LSA and LSB Chattering Position overlapping of LSA and LSB near the home position (Overlapping in the right-left must be approximated half the motor turn) ⓓ When pulse reading function is faulty (i) Check the PG power supply voltage on the PG terminal If it is within ±5% of the rated voltage, check with the PG connected (ii) Make sure that the power lead is sufficiently thick (In the YASKAWA standard cable, 3 each 5V and 0V leads are used in parallel) (iii) Check shield connection of the PG cable It must be connected to FG on the CM side, and be open on the PG end (iv) Check the connector and terminals for full contact (v) Check the PG signal with an oscilloscope for absence of noise and irregularity of signals Note If an SEt UP alarm persists, unless the CM is deenergized once, it cannot be started again

Table A-2 Error Code List (Cont'd)

Error Code	Error condition	Remedial measure
Err nSEL	Program seleciton error ① Two or more program start signals PGS0 to PGS9 are input ② When PGS0 to PGS9 is turned on, PGSL00 to PGSL30 is missing, or redundant ③ Before the execution of M30 to turn off the in-operation signal (STL), PGS0 to PGS9 or PGSL00 PGSL00 to PGSL30 were switched over	Readjust so that PGSL00 to PGSL30 will be selected before the automatic starting by 50 msec or more
Pro Err	Program error A block with destroyed program has been designated	Check the program
PAr Err	Parameter error Parameters with destroyed data are present	Check the parameters After correcting the parameter, be sure to once turn off the power supply and then turn it on
dEr OuEr	Excessive servo delay The servo delay (dU) in acceleraiton or deceleration exceeded the servo error permissible limit	ⓐ The load inertia is too large relative to the motor torque Change Pr40 and Pr41 to reduce acceleration ⓑ The servo error permissible limit (Pr44) is too small Normally set Pr40 at 1 5 - 2 times the tracking error (Pr42) However, this setting is a good standard below the rated motor speed, and if the maximum feedrate up to 1 4 times the motor rated speed is used, Pr44 = Pr42×(1 5× to 2) × 1 4 When only positioning is intended, and slight overshooting is permissible, the setting must be 2 to 4 times the Pr42 value The maximum limit for Pr44 is 30,000 ⓒ Acceleration cannot be obtained sufficiently due to current restriction Adjust the DB current limiting VR to the maximum current Check the torque ratio parameter of
inPo Err	In-position error ① When G04* command is executed, servo error (dU) remains larger than P45 setting after the lapse of 2 seconds, and the in-position does not occur ② D/A drift automatic correction overcorrection In this case, when the alarm is reset, the slide suddenly jerks after the lapse of 2 seconds, and again the alarm state occurs Since an alarm occurs when the correction valve (dU) exceeds ±512 adjust near 0 when zeroing the servopack	ⓐ The load is too heavy compared with the current limit If the operation is OK when the Servopack current limit commands 13 14 are disconnected, raise the DB current limit to the maximum level Check the current limit parameter (Pr53) and the feed program current limit value Check the in-position range (Pr45) Machine adjustment Let the slide stop from low feedrates in the forward travel and reverse travel and reduce the frictional resistance in the machine slide until the stopping current becomes within 20% of the rated value do not execute G04* during a current limit dwell ⓑ Zero the Servopack Turn the knob so that the post-alarm error (dU) approaches 0 (Unless the alarm is reset, the deviation does not change) Check the +12V and -12V power supply voltage for the DB at the external terminal (difference must be within 3%) When the voltage difference for the DB +12V and -12V is between 3 and 8% adjustment is possible with the D/A zeroing VR in the CM When the left cover of the CM is removed the D/A zeroing VR (1VR) becomes accessible

A-2 MESSAGE DISPLAY (Cont'd)

Table A-2 Error Code List (Cont'd)

Error Code	Error condition	Remedial measure
S.P Err	Skip signal fault	Check EPS5, EPS6 and EPS7 signals
EC OuEr	Current saturation A current signal fromt the Servopack (CPCR-MR , CT) is turned on	Check the Servopack (CPCR-MR , CT) (No MP alarm occurs)
OutP Err	External positioning error External positioning error signal (EPAL) is output	Check the signals related to external positioning (No MP alarm occurs)
bAt dRun	Battery voltage has dropped	Replace the battery within one month When changing the battery, be sure to leave the AC power supply on If it is turned off, the memory will be destroyed Be sure to use a lithium battery Model BR-2/3A, 3V made by MATSUSHITA BATTERY, and change as follows ① Remove the battery case cover fixing screws, and remove the battery case cover ② Remove the nylon socket, and take out the battery ③ Solder the socket leads to the battery quickly, and be sure to connect in the correct polarity (red lead ⊕ , black lead ⊖) ④ Insert the nylon socket, and put the battery into the case ⑤ Check the display to make sure that the error code has gone Install the battery case cover again
PS doun	Instantaneous power failure The power is turned off and then on under the following conditions ⓐ While the STL signal is being output ⓑ During slide movement in the JOG or STEP mode ⓒ During return home motion	Check the power supply
Err G27	① The G27 X(U) position is not equal to the home position (when Pr70 = 0) or the wait position (when Pr70 = 1) In this case, the error code is displayed without the slide moving as commanded by G27 ② The home position pulse location is different from the home position to which the slide has returned (by more than the permissible range set by Pr77) In this case the slide stops at the position where it has travelled through the distance equal to the permissible error for G27 (distance set by Pr46) in the homeward direction ③ LSA and LSB are not tripping correctly at the home position In this case, the current position (A0) is the home position ④ Excessive overshooting in positioning When the slide returns to the home position by a G27 command, it overshot the home position  In this case, the slide stops after travelling the G27 permissible error distance in the homeward direction	① Check the program ② Move the slide in the STEP mode until the current position becomes the home position, and check if the home positon pulse changes the fault is in pulse reading area (Refer to SEE UP ③ Check the home position-related LSs for correct tripping (Refer to SEE UP ④ Reduce the acceleration setting (Pr40, Pr41) Increase the G27 permissible error (Pr46) range
C Err	Transmission data failure Transmission failure between CM and PM (Data from CM is not correct)	In parameter display or program display, rewrite parameter or program, if C Err error occurs at the specified parameter No or block (The data may be broken)

(5) Indicator Lamp

(i) Motionpack programmer

The Motionpack programmer can display various states as selected by the mode select keys In addition to error states, also operation modes, feedhold state, output signal states, and error counter contents are displayed, which can be utilized in troubleshooting In addition to these universal display data, the NORMAL (green) and FAULT (red) indicator lamps are also used NORMAL indicator lights when no fault is found in the programmer When it is off, check the power supply and the fuses

FAULT indicator lights when the Motionpack programmer cannot exchange signals with the Motionpack controller Check the Motionpack controller, the connection cable, and the connector

(ii) Motionpack controller

The Motionpack controller is provided with foud indicator lamps, POWER (green), NORMAL (green), FAULT (red) and BATTERY FAULT (red). For checking detailed state, checking with PM is required

Power indicator lights when the internal power supply is energized When it is off, check the 100VAC power supply With this indicator, the I/O 24V and analog command 12V power supplies cannot be checked

NORMAL indicator lights when no fault is present in the Motionpack controller If it is off, the Motionpack controller is faulty

FAULT indicator lights when faults are discovered in the Motionpack system. In this case, and MP alarm signal is also output Check the fault by the programmer, and repair

BATTERY FAULT indicator lights when the battery, for supplying power to the program and parameter memories during power failure, runs down (It lights only while the 100VAC power is on) When it lights, replace the battery with in a month. Replace the battery without turning off the power supply

(iii) DB unit

The DB unit is provided with three indicator lamps, POWER (green), TORQUE LIMIT (green), and DWELL (green).

POWER indicator lights when the internal power supply is energized If it is off, check the 200VAC supply

TORQUE LIMIT indicator lights while full current at the commanded torque limit is (flowing Check the torque limit command and the load torque Check also the setting of the variable resistors for + current limit and - current limit for sufficiently high levels

DWELL indicator lights when the torque restriction is on continuously during the set dwell time

A-3 INPUT/OUTPUT SIGNAL CHANNEL LIST

Table 3-1 Input Signal List

Programmer Display	Channel	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
i0	0	JMF Jog Middle	JLF Jog Low	OVR Override	SBK Single Block	STEP	JOG	PLAY	EDIT
i1	1	-Auto Stop	PGCL Program Clear	ERS Fault Reset	ATST Auto Start	SBST Single Block Start	ZRT Home Return	-JS -Direction JOG & Step	+JS +Direction JOG & Step
i2	2	PGS7	PGS6	PGS5	PGS4	PGS3	PGS2	PGS1	PGS0 Program Start
i3	3	-INC8	+INC8	PGSL30	PGSL20	PGSL10	PGS00	PGS9	PGS8
i4	4	$\overline{\text{OTR}}$ -Overtravel (R)	$\overline{\text{OTR}}$ -Overtravel (F)	CL Current Limit on	SAL -Servo Alarm			-INC9	+INC9
i5	5			MFIN	G34F		EPS7	EPS6	LPS5 External Skip 5
i6	6	LSB2	LSA2 LS Near Home	EXP2 External Positioning LS	PB Phase B Pulse	PA Phase A Pulse	PC Home Position Pulse		

Table 3-2 Output Signal List

Programmer Display	Channel	10^7	10^6	10^5	10^4	10^3	10^2	10^1	10^0
o0	0	OFM Offset Max	OFR Offset 0	INCD Inclemental End	EPAL External Positioning Alarm	G34 External Positioning End	STL In-Operation	ZPM Home Return End	ALM1 NC Alarm
o1	1	ZNP Near Home	M56	M55	M54	M53	M52	M51	M30
o2	2						RDY MP Ready (PC)	RDY (DB)	ALM2 Battery Alarm

A-4 PARAMETER SETTING

Table A-4 Parameter List

Parameter No	Set Value	Setting Range	Contents		Unit
Pr1		0 ~ 60000	JOG, STEP group	JOG low speed	Speed unit Note 1)
Pr2				JOG middle speed	
Pr3				JOG high speed	
Pr4		0 ~ 60000		STEP speed	
Pr5		-9999999 ~ +9999999		STEP feed distance, short	Min command unit Note 2)
Pr6				STEP feed distance, medium	
Pr7				STEP feed distance, long	
Pr8 ~ Pr9	Not used				—
Pr10		0 ~ 60000		Creep speed	Speed unit
Pr10 ~ Pr19	Not used				—
Pr20		1 ~ 255	Offset value group	Single correction for Coordinate system 8	Minimum command unit
Pr21		1 ~ 9999999		Max correction for Coordinate system 8	Minimum command unit
Pr22		1 ~ 255		Single correction for Coordinate system 9	Minimum command unit
Pr23		1 ~ 9999999		Max correction for Coordinate system 9	Minimum command unit
Pr24 ~ Pr39	Not used				—
Pr40		1 ~ 60000	Servo group	Max speed	Speed unit
Pr41		50 ~ 60000		Acceleration time	msec
Pr42		200 ~ 30000		Position loop gain	No of pulses
Pr43	Not used			Unused	—
Pr44		60000 Max		Servo error	No of pulses
Pr45		1 ~ 255		In-position range	No of pulses
Pr46		0 ~ 9999999	G27 group	G27 permissible error	No of pulses
Pr47 ~ Pr49	Not used				—
Pr50		3999999 Max	Unit group	Pulse ratio M	—
Pr51		3999999 Max		Pulse ratio D	—
Pr52		0 ~ 5		Decimal point position	No of digits
Pr53		1 ~ 250		Thrust ratio (thrust rating/servo rating) × 100	—
Pr54		0 ~ 9	Coordinate address (X, Y, Z) designation		—
Pr55 ~ Pr59	Not used				—
Pr60		+9999999 -9999999	Overtravel group	-direction stored stroke limit	Min position unit
Pr61				+direction stored stroke limit	
Pr62 ~ Pr69	Not used				—
Pr70			Home position group	Return home mode	—
Pr71		+9999999 -9999999		Home position coordinate	No of pulses
Pr72				Wait position	Min command unit
Pr73		0 ~ 60000		Return home speed	Speed unit
Pr74				Return home creep speed	
Pr75		10 ~ 250		Return home torque limit	%
Pr76		0 ~ 9999999		Coasting allowance	No of pulses
Pr77		1 ~ 255		Permissible error	
Pr78		0 ~ 30000		Butting time	10 msec
Pr79 ~ Pr96	Not used				—
Pr97		110, 300, 1200, 2400	Tape device Baud rate setting		Baud
					—

Appendix 5 Motionpack Program Sheet

No. _____

Date _____

Machine No _____ Machine Name _____ Work Name _____ Programmed by _____

Block	M Function	Function	Position	Speed	Torque	Wait Time	Loop	Jump	Coordinate	Remarks
N 0	M	G	X/U	F	I	D	L	P	T	
N 1	M	G	X/U	F	I	D	L	P	T	
N 2	M	G	X/U	F	I	D	L	P	T	
N 3	M	G	X/U	F	I	D	L	P	T	
N 4	M	G	X/U	F	I	D	L	P	T	
N 5	M	G	X/U	F	I	D	L	P	T	
N 6	M	G	X/U	F	I	D	L	P	T	
N 7	M	G	X/U	F	I	D	L	P	T	
N 8	M	G	X/U	F	I	D	L	P	T	
N 9	M	G	X/U	F	I	D	L	P	T	
N 0	M	G	X/U	F	I	D	L	P	T	
N 1	M	G	X/U	F	I	D	L	P	T	
N 2	M	G	X/U	F	I	D	L	P	T	
N 3	M	G	X/U	F	I	D	L	P	T	
N 4	M	G	X/U	F	I	D	L	P	T	
N 5	M	G	X/U	F	I	D	L	P	T	
N 6	M	G	X/U	F	I	D	L	P	T	
N 7	M	G	X/U	F	I	D	L	P	T	
N 8	M	G	X/U	F	I	D	L	P	T	
N 9	M	G	X/U	F	I	D	L	P	T	

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