YASNAC i80

CNC SYSTEM FOR MACHINE TOOLS

CONNECTING MANUAL

YASKAWA

CONTENTS

INDEX

1 INTRODUCTION

This manual describes the specifications for connecting YASNAC i 80 with machines, machine interfaces and external equipment.

Necessary connections to be provided by the machine manufacturer differ depending on the type of the CNC cabinet supplied by Yaskawa. Make additions or deletions of connections in accordance with the combination for standard cabinets and integrated units.

The programmable controller system (hereafter called PC) is installed in the YASNAC i 80 CNC cabinet. For details of the PC, refer to Instruction Manual for YASNAC i 80 PC System (TOE-C843-11. 1)

2 CONFIGURATION

2.1 SYSTEM CONFIGURATION

The system configuration of YASNAC i 80 is shown below.

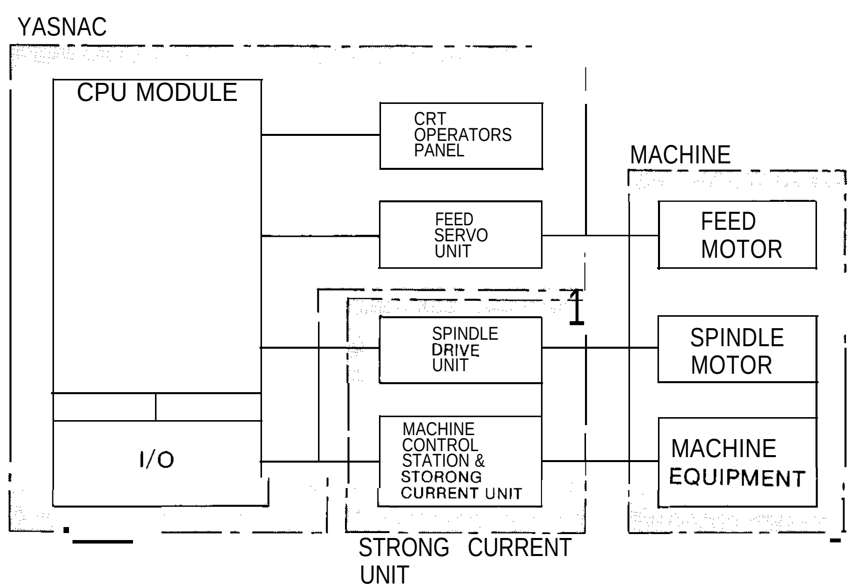


Fig. 2.1 System Configuration of **YASNAC** i 80

3 ENVIRONMENTAL CONDITIONS

The following are conditions for the location where the control panel is installed by the machine manufacturer. Therefore, when working on design, observe the “CONDITIONS FOR CABINET CONSTRUCTION DESIGN” described in Section 4 and design the unit so as to meet the following conditions.

3.1 AMBIENT TEMPERATURE

- During operation: O to +45℃
- During storage and transport: –20 to +60℃

Even if the ambient temperature is less than +45℃ , do not install the control panel in direct sunlight or near heat sources or in the open air.

3.2 HUMIDITY

- Under normal conditions: Relative Humidity: 10 to 90% (non-condensing)

3.3 VIBRATION

- During operation :0.5 G or less

3.4 OPERATING ENVIRONMENT

Do not use in dusty environment or where cutting oil/fluids or organic solvents are present in the air.

4 CONDITIONS FOR CABINET CONSTRUCTION DESIGN

Take the following into consideration when cabinets and pendants used to contain the CPU module and other units are designed.

4.1 MOUNTING CONDITIONS

(1) Make sure that the cabinets are of a totally-enclosed type. (For details, see Par. 4.4.)

(2) Design the cabinet so that the difference between the average inner-air temperature and ambient temperature is less than 10"C. (For details, see Par. 4.2.)

(3) Install a fan inside totally-enclosed cabinets to improve the internal cooling efficiency and to prevent localized temperature increases by circulating air inside the cabinets. (Rule of thumb is: The velocity of the circulating air should be greater than 2m/s on the surfaces of the printed circuit boards of the units) Forced air should not blow directly on the printed circuit boards.

(4) Seal the cable openings, doors, etc. completely.

(5) Since the CRT display on the CRT panel deflects due to magnetic influences and collects air borne dust due to high-voltage operation, special precaution is required. (For details, see Pars. 4.4 and 4.5.)

(6) The units that are exposed to the cabinet surfaces are dust-proof. However, do not install them in locations where cutting fluid and cuttings may directly splash on them.

(7) Mount the units so as to allow easy checking, removal and reinstalling during maintenance work.

(8) For mounting the servo unit, see Section 5.

(9) For mounting the spindle drive unit, read the instruction manual of the spindle drive unit.

(10) Precautions for Mounting CPU Module
Observe particularly the following points when mounting the CPU module.

(a) Mount the unit in the direction shown in the figure below.

(b) Provide space of more than 100 mm in the upper section and 100 mm in the lower section of the unit for better ventilation and easier maintenance. Also provide space of more than 100 mm in both right and left sections of the unit for easier replacement of the battery.

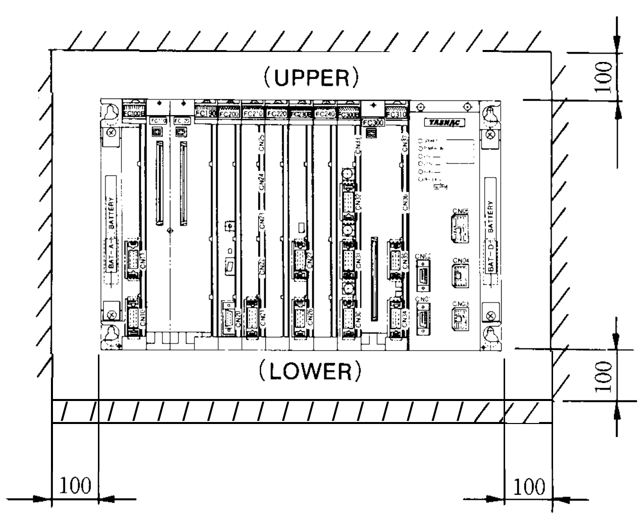


Fig. 4.1 Mounting Space

(c) Allow forced air to circulate inside the unit at 2 m/s. Be careful not to blow air directly on the surfaces of the printed circuit boards.

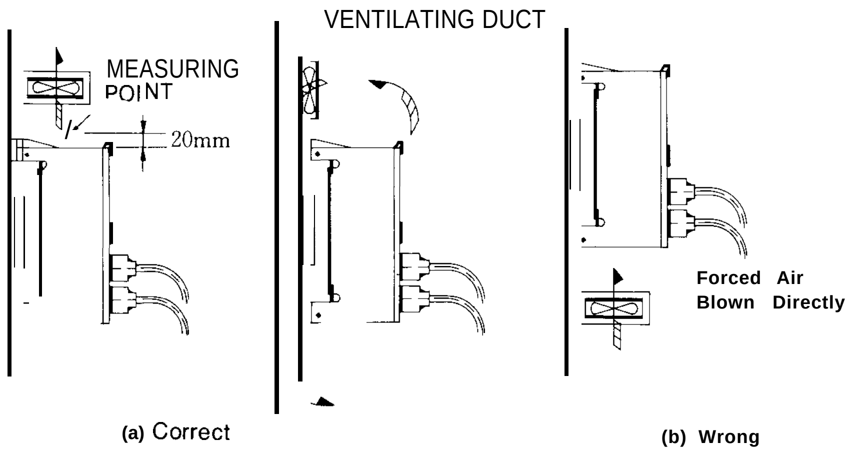


Fig. 4.2

(d) Mounting Cooling Fan

Fan recommended 4715PS (120" X40 ')

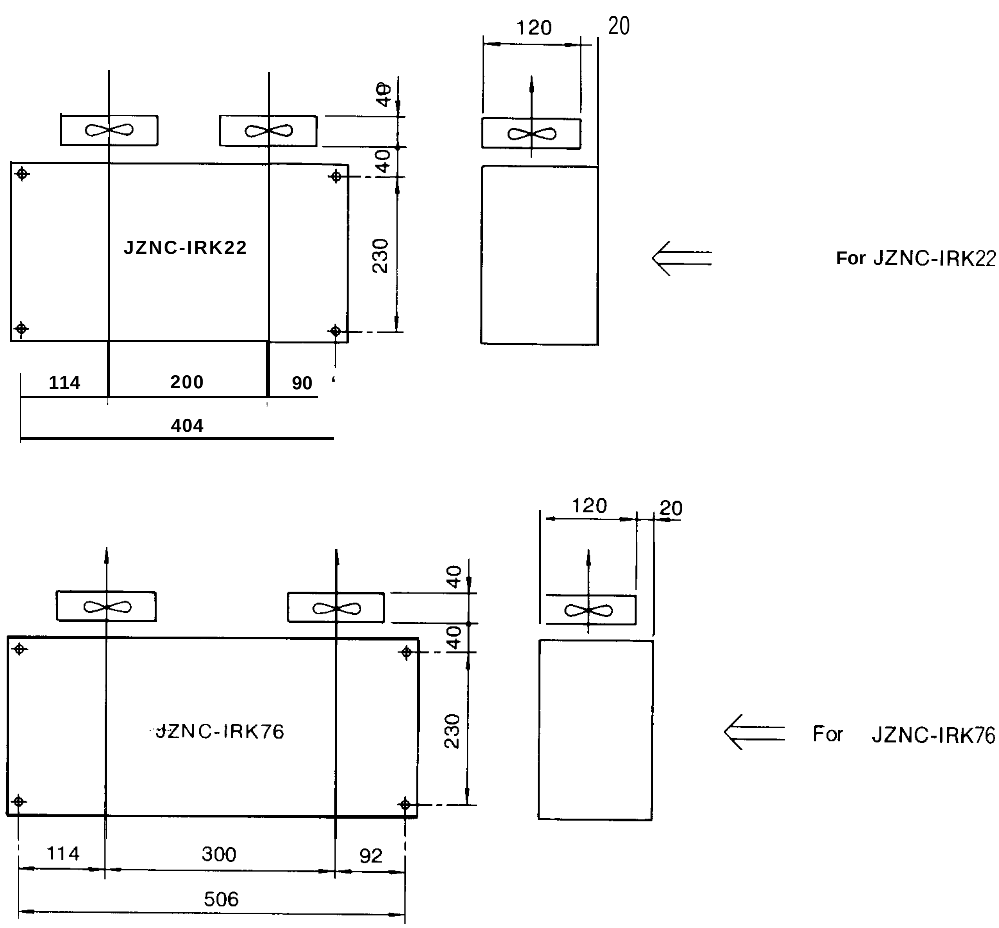


Fig. 4.3 Mounting Cooling Fan (Dimensions in mm)

4.2 CABINET DESIGN FOR HEAT FACTORS

The cabinets used to contain the CPU module and other units should be designed so that they are of totally-enclosed construction and the difference between the inner-air temperature and ambient temperature is less than 10"C. In designing the cabinets, also take the following into consideration.

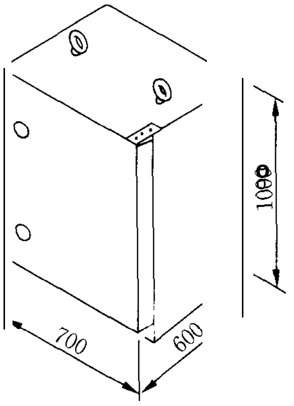
(1) Air Temperature **Rise inside Cabinet (Average Temperature Rise)**

Air temperature rise inside the cabinet made of sheet metal is generally determined as fol lows:

$$\triangle T = \frac{p}{qe} = \frac{p}{K \cdot A}$$

$\triangle T$: Air temperature rise inside cabinet (℃)
P: Heat generated by electric appliance (W)
qe : Cabinet heat transmission (W/℃)
K: Sheet metal-metal transmission ($W/m^2 \cdot$ "C)
6W/m^{2}°C : With a circulating fan
4W/m^{2}°C : Without a circulating fan
A: Effective radiation area of cabinet (m^2)
Surface area of the cabinet through which heat can be radiated.
(Surface area that contacts other objects is excluded)

(Example) Allowable Heat Value inside Cabinet with a Circulating Fan



$A = 3m^2$

Where the heat value generated inside the cabinet is 180W :

$$\Delta T = \frac{P}{qe} = \frac{P}{k \cdot A}$$

$$= \frac{180}{6 \times 3} = 10 \text{ ("c)}$$

Since the value calculated above is less than the allowable temperature rise of 10"C, the design works just fine. When the value is more than 10"C, a separate method for cooling is required.

(2) Cooling Capacity **of Heat Exchanger**
When a circulating fan installed inside the cabinet is not sufficient, the following heat exchangers are available.

Heat Exchanger	Cooling Capacity	Dimensions
REX1 550	100WX1O"C	295W X 890H X 50D
HEATEX02	250W X 10"C	440W X 924H X 50D

The heat value shown in the cooling capacity column represents the allowable heat value when air temperature rise inside the cabinet is less than 10"C.

(Example) Allowable Heat Value inside Cabinet with Heat Exchanger

The heat value inside the cabinet required to keep the inner-air temperature rise below 10℃ with the Heat Exchanger HEATEX 02 installed inside the cabinet as in the example (1) is:

$$P = k \cdot A \cdot \triangle T + 250W/10℃$$
$$= 6 \times 3 \times 10 + 250$$
$$= 430W/10℃$$

Accordingly, the heat value should be less than 430w.

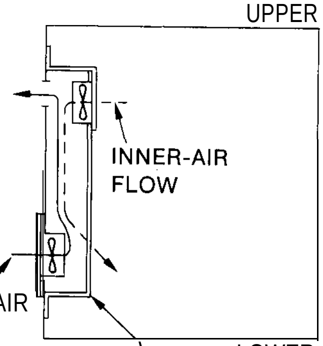


Fig. 4. 4

(3) Installation of **Heat Exchanger**

A heat exchanger is installed to the cabinet made by a machine tool maker.

Shown above is an example of heat exchanger installation. Install the heat exchanger so that the inner air is taken in from the upper section and discharged from the lower section while the outside air is taken in from the lower section and discharged from the upper section. (For details regarding installation, see Appendix 16. Dimensions of heater exchanger.)

4.3 HEAT VALUES OF UNITS

(1) NC UNIT

Unit	Heat Value (W)
CPU Module	70 to 160
9" CRT Operator's Panel	20
Tape Reader	25
6" Tape Reader with Handler	55
8" Tape Reader with Handler	125
I/O Module	5

NOTE :
The heat value of the CPU module varies with option addition

(2) SERVO UNIT

Servo Unit CACR-	Total Heat Value (w)	Internal Heat Value (W)			Regenerative Resistance (w)
		100% Load Factor	70% Load Factor	50% Load Factor	
IR03SB	70	50	47	45	10~20
IR05SB	100	58	52	49	10~20
IR10SB	110	61	55	50	20~40
IR15SB	130	70	63	58	30~50
IR20SB	140	73	65	60	60~100
IR30SB	220	97	82	71	80–120
IR44SB	270	112	92	79	100–140

NOTE :

1) The internal heat value is the heat value remaining inside the cabinet when the fin of the servo unit is exposed outside the cabinet and the outside air of more than 2.5 m/s blows on the fin.

2) In designing the cabinet to contain the servo unit, the load factor differs depending on the specifications of the machine, hut the load factor of 70% is considered normal.

3) The heat value of the regenerative resistance differs depending on the operating conditions.

4.4 DUST-PROOF CONSTRUCTION

Particles floating in the air (dust, cuttings, oil mist, etc.) may cause malfunction of the CPU module and the inner parts of the other boards (particularly CRT) to be mounted inside the cabinets the machine manufacturers design and build. The construction of the cabinets, therefore, should be such that it does not allow dust, etc. to enter inside.

(1) The cabinets should be of totally-enclosed construction.

(2) Seal the cable openings with packing. (See Fig. 4. 5.)

(3) The door and the back cover should be securely sealed with packing. (See Fig. 4. 6.)

(4) Special caution is required for the CRT unit as it operates at high voltage and collects dust in the air. The following points should be observed with regard to the pendant box used to install the CRT unit.

(a) Seal the cable openings, door, back cover, etc. with packing to eliminate gap,

(b) Packing is attached on the surface where the CRT unit is to be mounted. Use the pendant box as it is.

(5) Seal all gaps.

(6) Oil mist easily settles on the ceiling and enters the cabinets through screw holes. Special precaution, therefore, should be made using oil-proof packing, etc.

(Reference) Neoprene sponge rubber (belongs to chloroprene rubber) is recommended for the packing material.

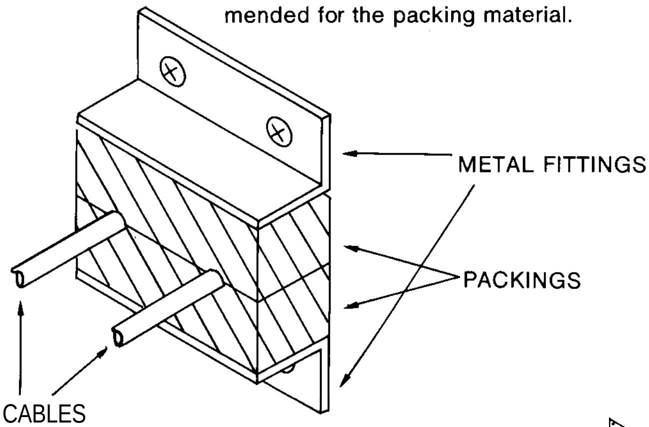


Fig. 4.5 Cable Entrance

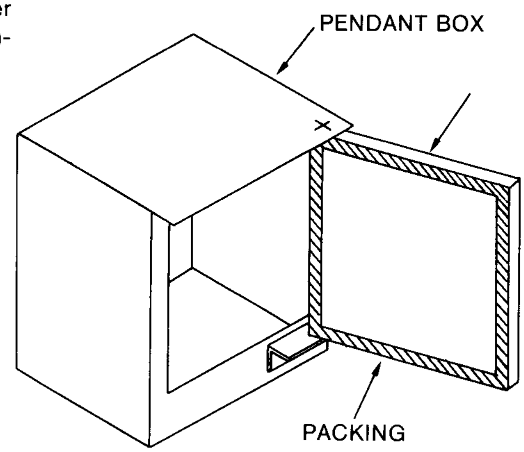


Fig. 4.6 Door **Packing**

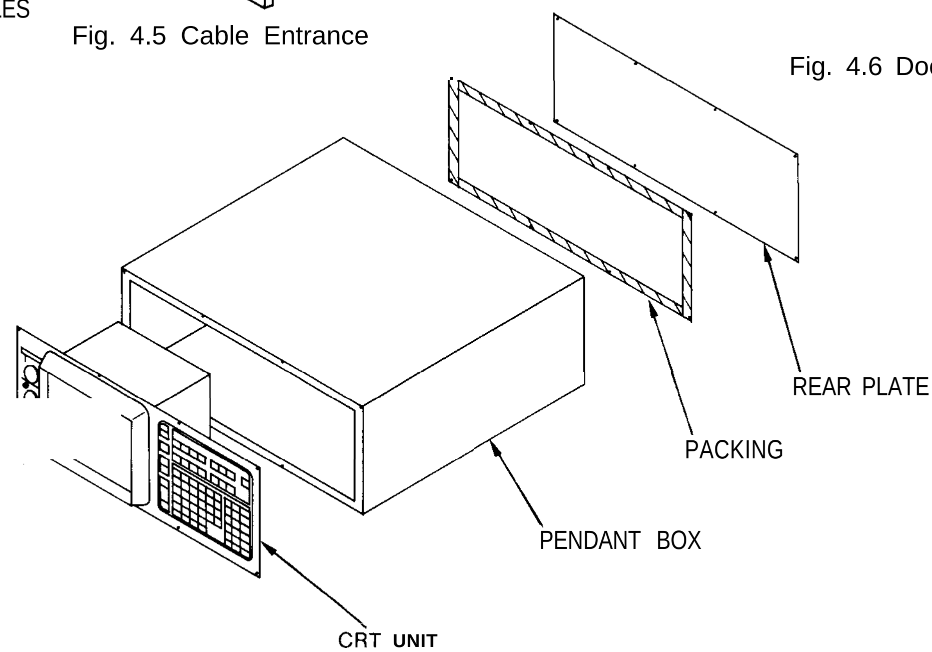


Fig. 4.7 CRT Unit

4.5 PROTECTION FROM MAGNETIC INFLUENCES

The CRT display may be deflected due to external magnetic influences. Sources that generate magnetic fields (such as transformers, reactors, fans, electromagnetic switches, solenoid relays, AC power cables) should be kept about 300 mm away from the CRT display. This distance of 300 mm is a rule of thumb and the optimal distance may differ for each setting. Therefore, full precaution should be given to location of the above components that generate magnetic fields and determine the final layout after checking the condition of the CRT display.

5 PRECAUTIONS FOR INSTALLING SERVO UNIT

(1) The servo unit is a wall-mounted type and should be secured with screws or bolts vertically (so that the printed circuit boards can be seen from the front). (See Fig. 5.1.)

(2) Mount the servo unit so as to allow easy checking, removal and reinstalling during maintenance work.

(3) The servo unit generates some amount of heat. Allow for some space in the upper and lower sides when mounting other units and components so that heat will not saturate the inside the unit. (See Fig. 5.2.)

(4) Expose the radiator fin outside the cabinet and allow the outside air to blow on it to reduce internal thermal loss. (See Fig. 5.1.) This will help reduce the capacity of the heat exchanger even when it is required.

(5) When circulating air inside the cabinet, do not allow forced air to blow directly on the servo unit (to prevent dust from collecting on the unit).

(6) The regenerative resistor generates heat. Full precautions should be given to location of the regenerative resistor and do not place it near components easily affected by heat because a high temperature develops with extremely high frequency in use such as rapid transverse, start and stop.

(7) Clamp the detector (P. G) cable that enters the servo unit to the ground plate inside the cabinet with the cable clamping fixtures. (See Clamping Cables and Grounding Cable Shield described in Par. 6.2.) Make sure to clamp the cable because it is necessary to operate the system properly and to protect it from malfunctioning due to noise

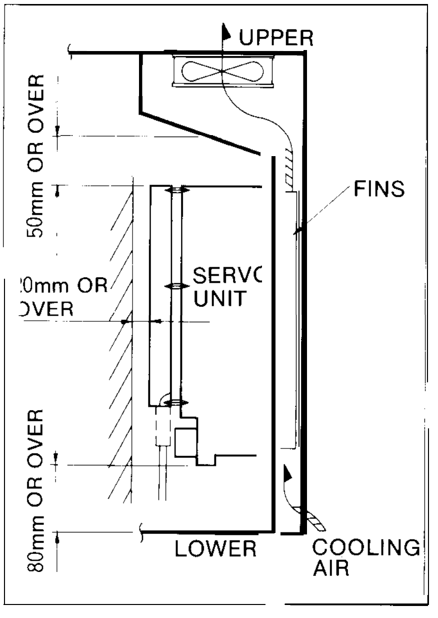


Fig. 5.1 Mounting of **Servo Unit** **(Side View)**

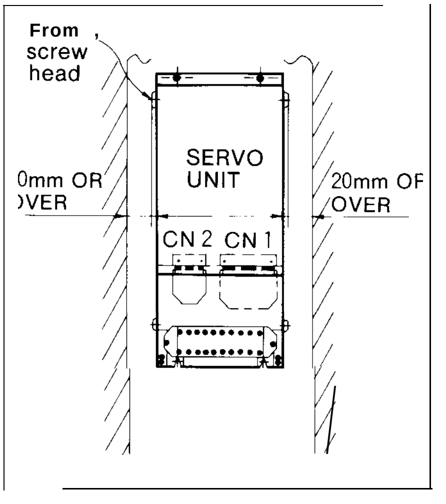
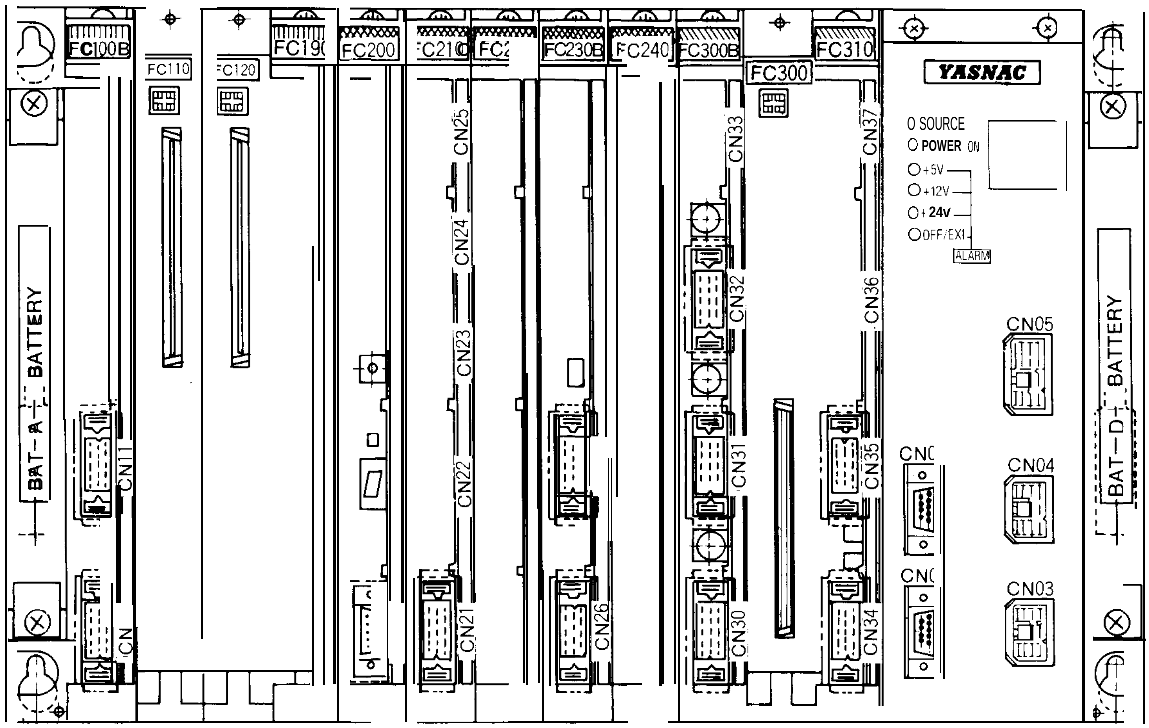


Fig. 5.2 Mounting of Servo Unit (Front View)

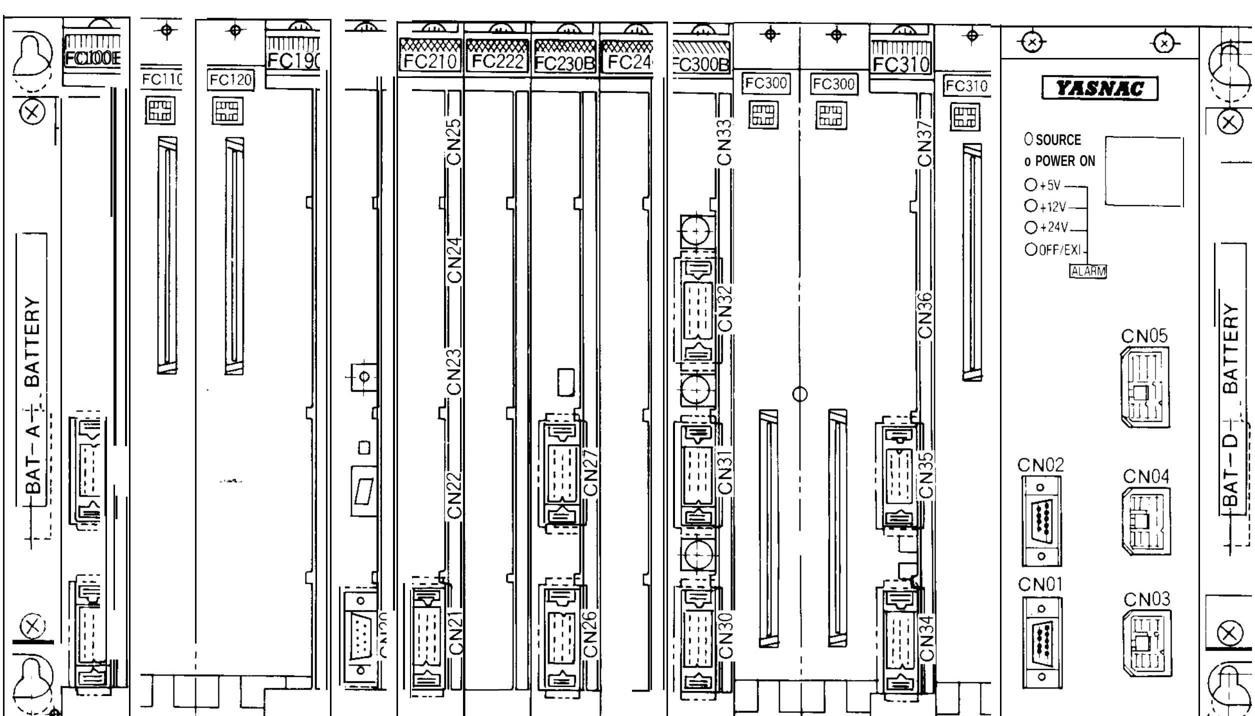
6 CABLE CONNECTION

6.1 LAYOUT OF CABLE CONNECTORS

(a) CPU UNIT JZNC-IRK22



(2) CPU UNIT JZNC-IRK04



6.2 CLAMPING CABLES AND SHIELDING CABLES

Of the cables connected to the YASNAC, clamp those that need shielding to the ground plate securely with the cable clamping fixtures as shown in the figure below. This clamping serves not only as cable support but also as cable shielding. In ensuring safe operation of the system, it is extremely important that you clamp the necessary cables without fail.

(a) Strip part of the cable shield as shown in the figure below to expose the shield enclosure. Press the exposed part onto the ground plate using the cable clamp.

(b) Mount the ground plate near the cable opening.

(c) Stripping cable enclosure is not required for non-shielded cables for clamping.

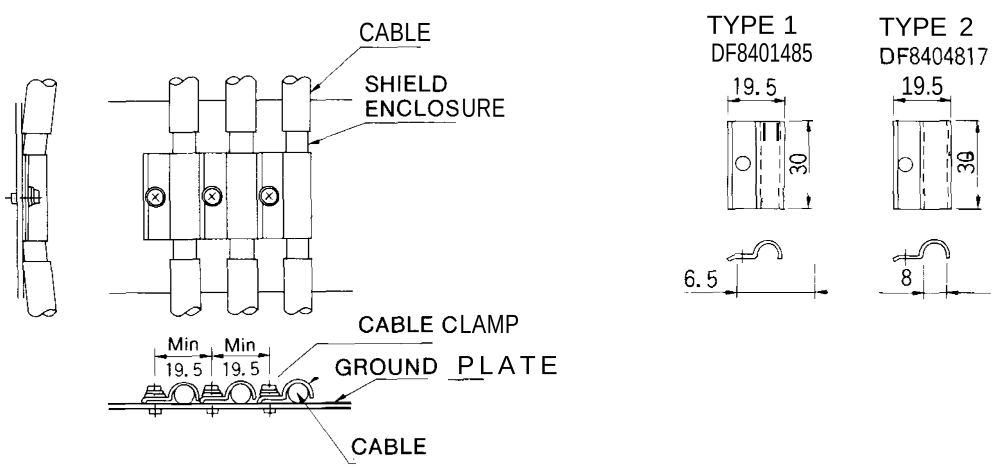
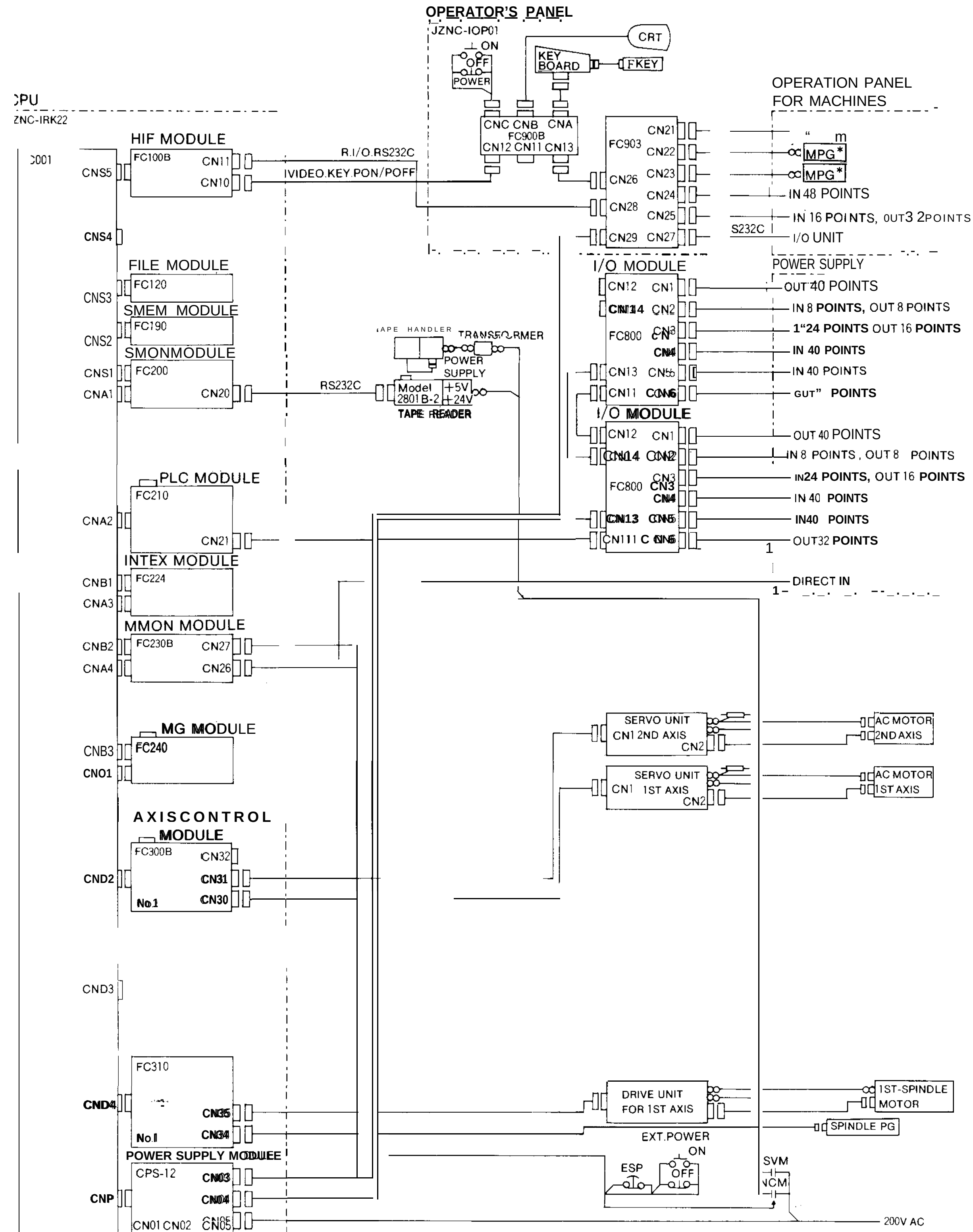


Fig. 6.1 Shielding Cables

7 INTERCONNECTION DIAGRAM

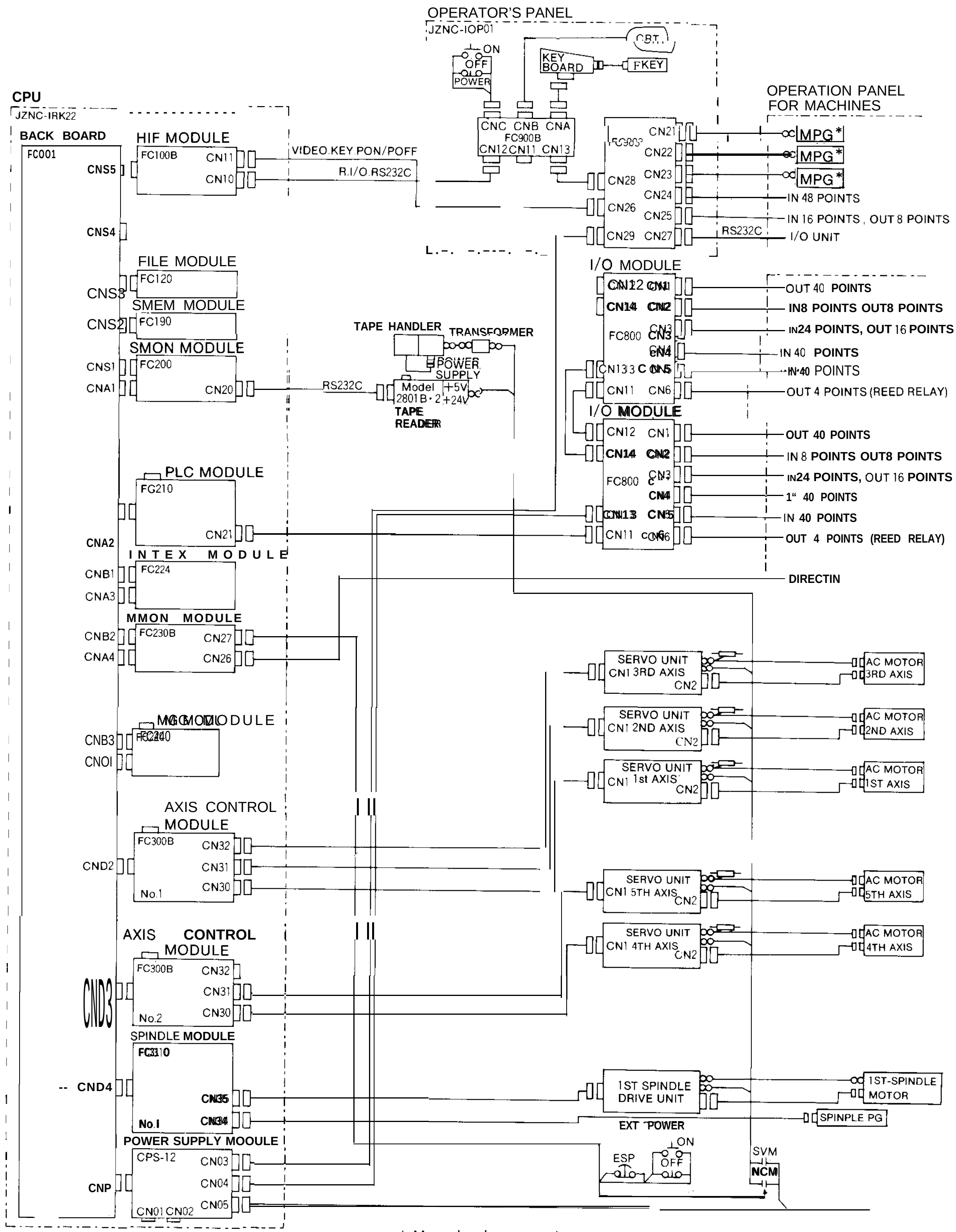
(a) YASNAC i 80L (For Lathes)



∗ Manual pulse generator

Fig. 7.1

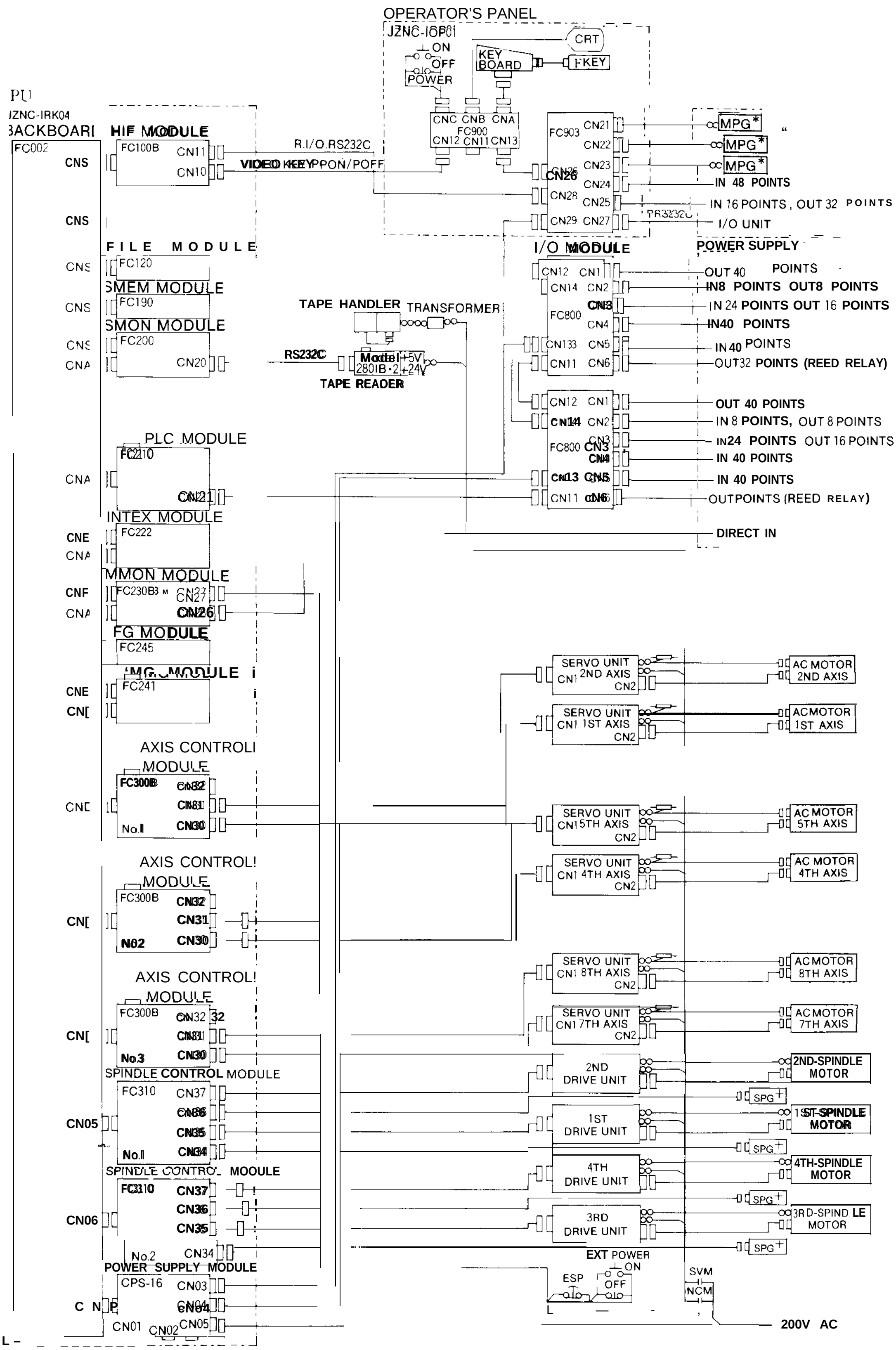
(b) YASNAC i 80M (For Machining Centers)



* Mannal pulse generator

Fig. 7. 2

(c) YASNAC i 80L (For Multiaxis Lathes)



* Mannal pulse generator

+Spindle pulse generator

Fig. 7.3

8 POWER SUPPLY CONNECTION

8.1 POWER SUPPLY CONNECTION TO EACH UNIT

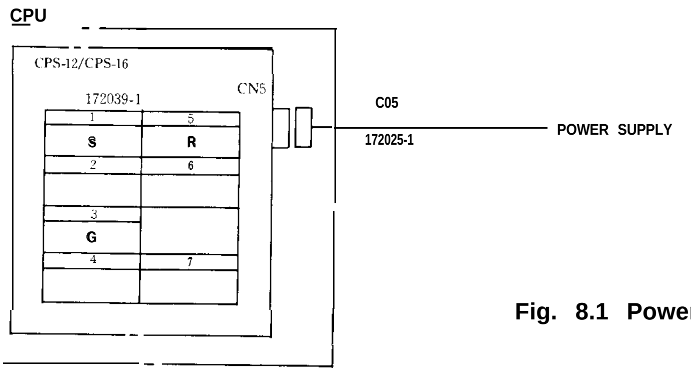
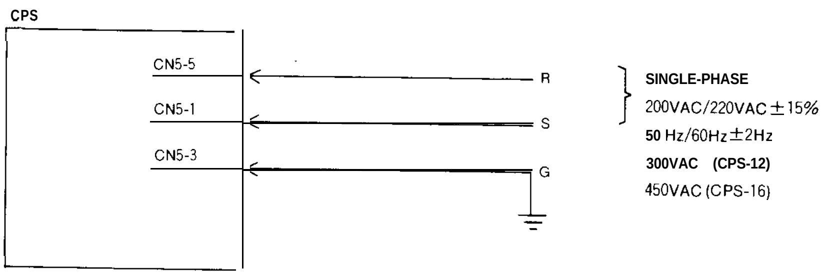


Fig. 8.1 Power Supply Connection

8.2 DETAILS OF CONNECTION



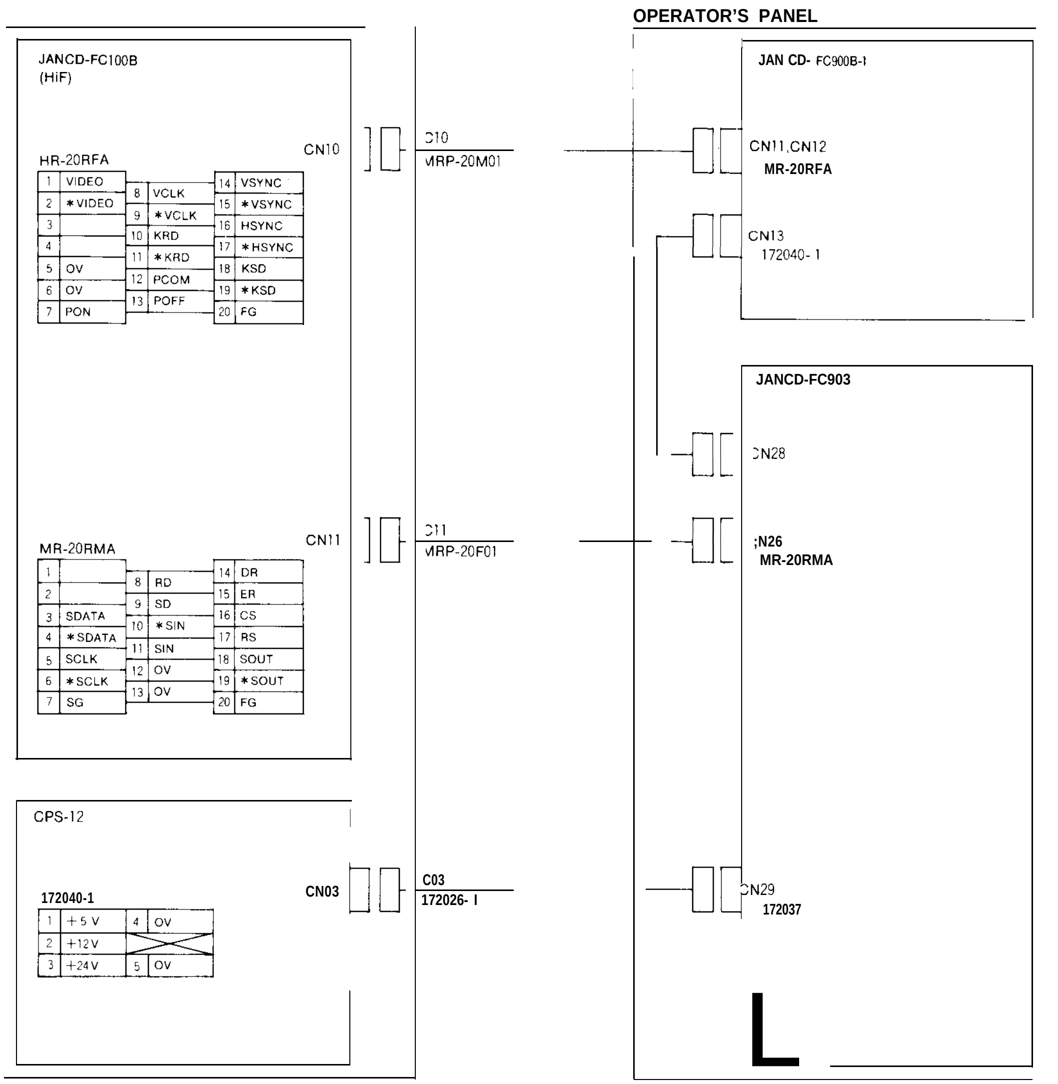
NOTE : The power supply is designed to function normally even in the event of 1 /2-cycle or shorter momentary power loss or 1-cycle or shorter 50% voltage drop,

Fig. 8.2 Details of Power Supply Connection

9 CONNECTION OF OPERATOR'S PANEL

9.1 CONNECTION DIAGRAM

9.1.1 CONNECTION 0F9" CRT OPERATOR'S PANEL



Note: The connection between JANCD-FC900 CN13 and JANCD-FC903 CN28 has been performed by Yaskawa

Fig. 9. 1

9.2 DETAILS OF CONNECTION OF OPERATOR'S PANEL

9.2.1 CONNECTION OF 9" CRT OPERATOR'S PANEL

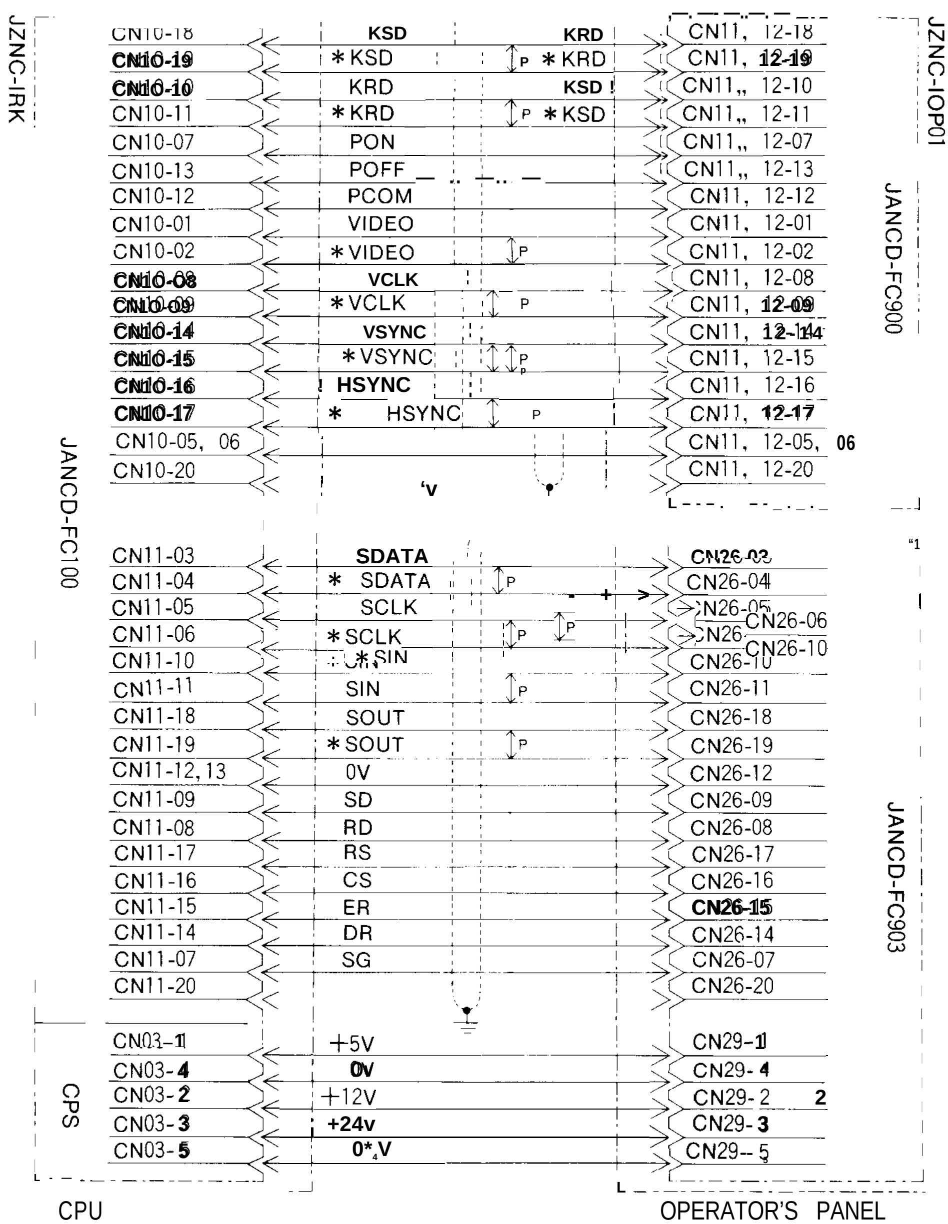
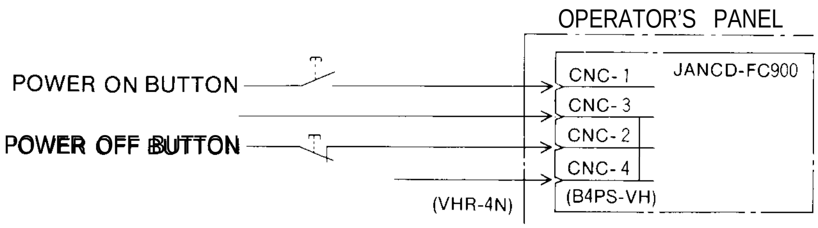


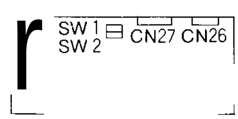
Fig. 9.2

NOTES OF CONNECTION OF 9" CRT OPERATOR'S PANEL

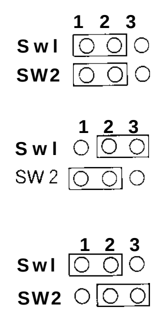
1. We will provide wiring of the power ON/OFF switch for the NC operator's station with keyboard on right side of 9"CRT. Use the following wiring method or remote power unit ON/OFF switch for the separate type and vertical type. (See NOTE 2. (below).)



2. Power ON/OFF can be selected by the following switches. The switches are mounted in the JANCD-FC230B (MMON).



EXTERNAL POWER ON/OFF	EFFECTIVE	SW1, SW2: 1-2
PANEL POWER ON/OFF	EFFECTIVE	
EXTERNAL POWER ON/OFF	INEFFECTIVE	SW1: 2-3, SW2: 1-2
PANEL POWER ON/OFF	EFFECTIVE	
EXTERNAL POWER ON/OFF	EFFECTIVE	SW1: 1-2, SW2: 2-3
PANEL POWER ON/OFF	INEFFECTIVE	



3. Factory setting before shipment: Panel Power ON/OFF "Effective", External Power ON/OFF "Ineffective"

10 CONNECTION OF INPUT SEQUENCE

10.1 CONNECTION TO EACH UNIT

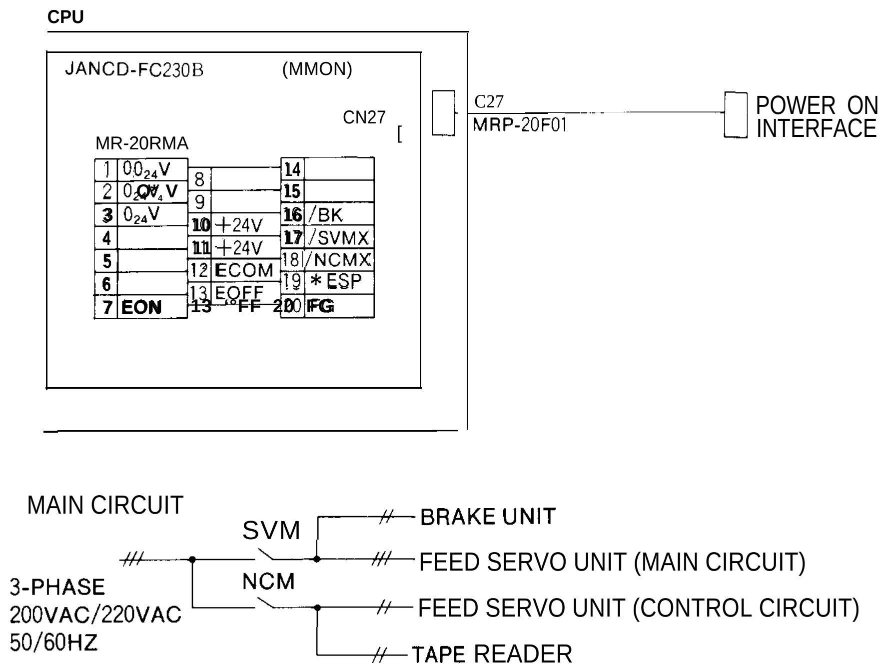
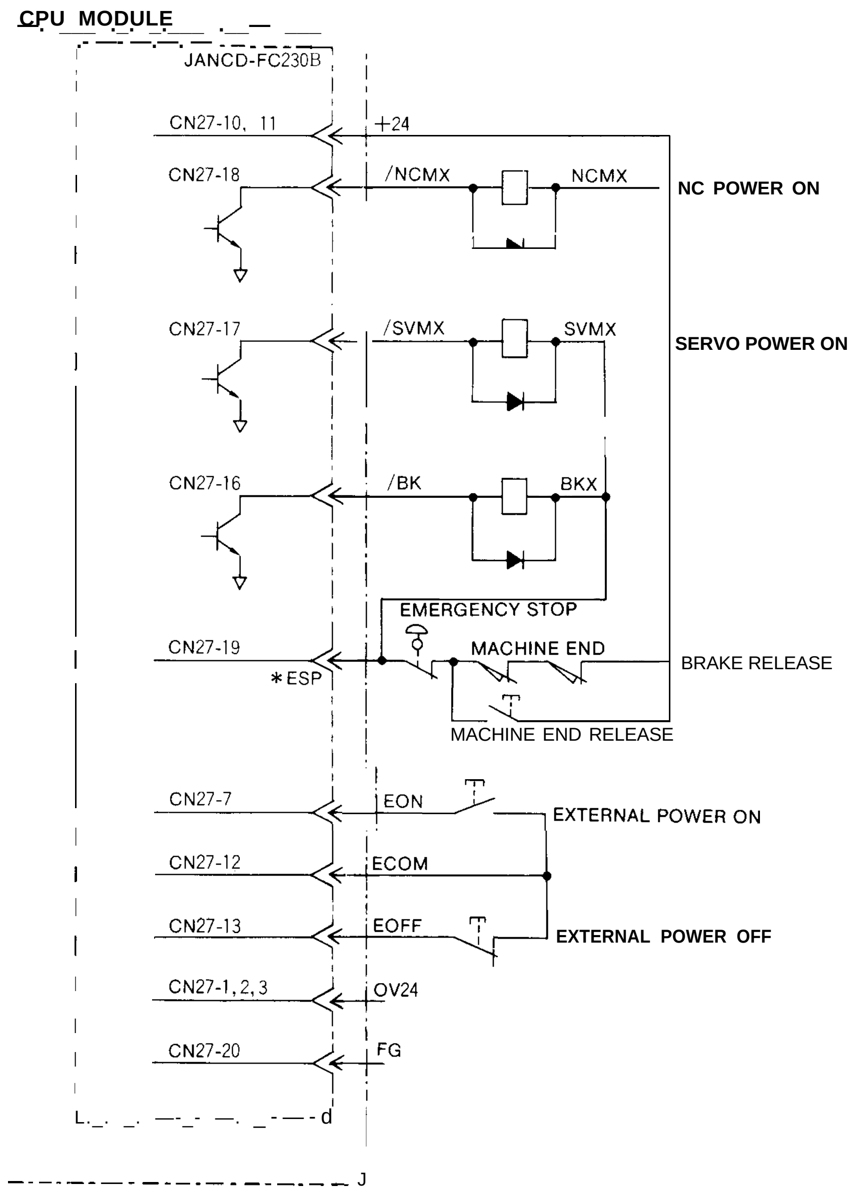


Fig. 10. 1

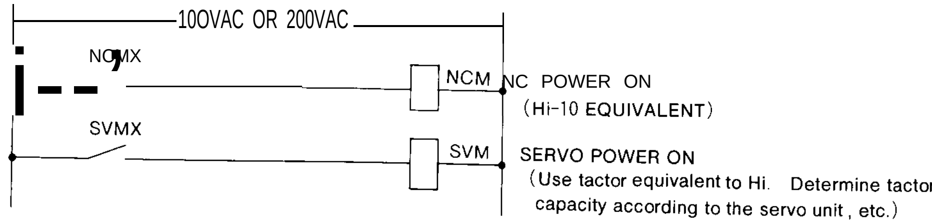
10.2 DETAILS OF CONNECTION OF INPUT SEQUENCE



Note : Use a miniature relay 24VDC for the relay of NCMX, SVMX and BKX. (We recommend the relay type MY-4Z made by OMRON.)

Fig. 10.2

The connection example of the main circuit is shown below.



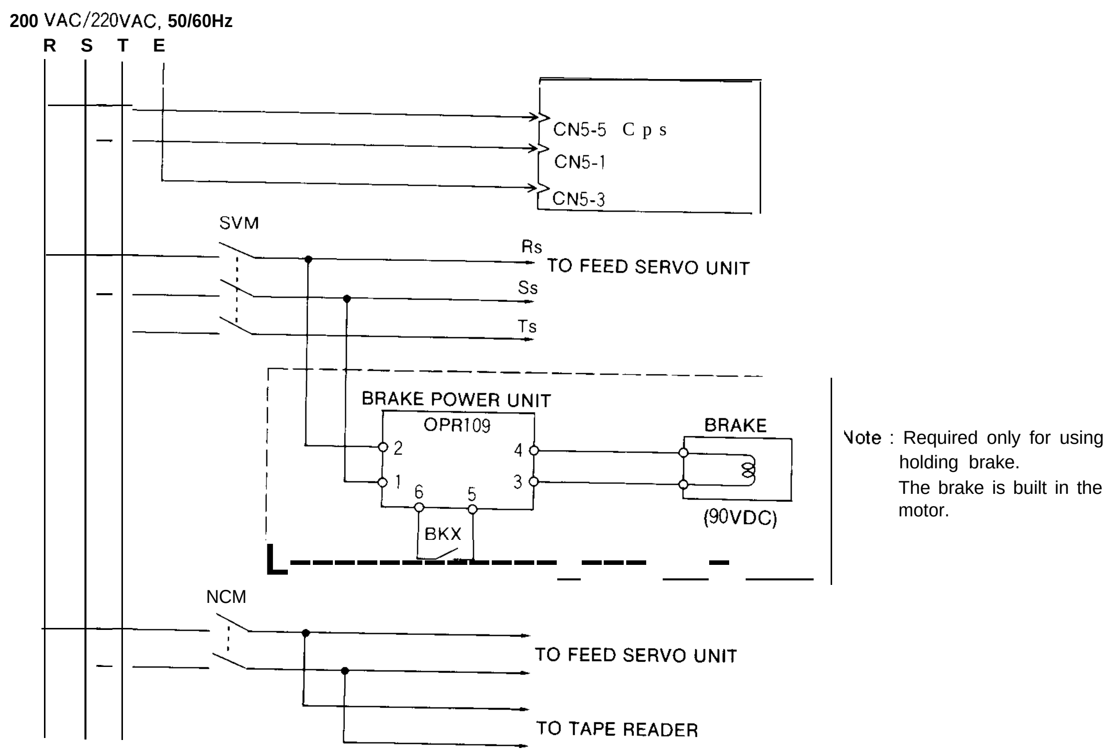


Fig. 10.3

10.3 DETAILS OF SIGNALS

10.3.1 NC POWER ON (/NCMX), SERVO POWER ON (/SVMX) AND BRAKE RELEASE (/BK) OUTPUT

(1) /NCMX: This output is turned on when the logic circuit of the control is energized.

(2) /SVMX: This output is turned on when the servo unit is energized. With an external servo unit, turn on the power supply when this signal is output,

(3) /BK: Output to release the retaining brake of the feed axis.

(4) The power supply turning on sequence is as follows:

(a) Close the power supply main switch for the control

(b) Either depress the POWER ON button on the NC operator's station, or close the circuit between EON and ECOM. Then, the logic circuit and the servo control circuit are both energized, and the output of/NCMX signals (NC power input and output) is activated.

With an external servo unit, design the the servo control circuit power input sequence so that the circuit is energized at the output of/NCMX signals.

(c) Again make the same power switching (depressing the POWER ON button or closing the circuit between EON and ECOM). Now, the servo power supply is turned on, and the output of/SVMX signals (servo power input and output) is activated.
With an external servo unit, design the servo power circuit power input sequence so that the circuit is energized at the output of/SVMX signals.

(d) /BK output is turned on by parameters after the servo is ready (in servo clamp condition). Release the brake unit with this signal.

(e) When the external circuit is ready after the circuit between/SVMX is closed, and the control becomes ready, close the MRD (machine ready) input of the I/O module. Then, RDY is displayed on the CRT, and operation becomes possible.

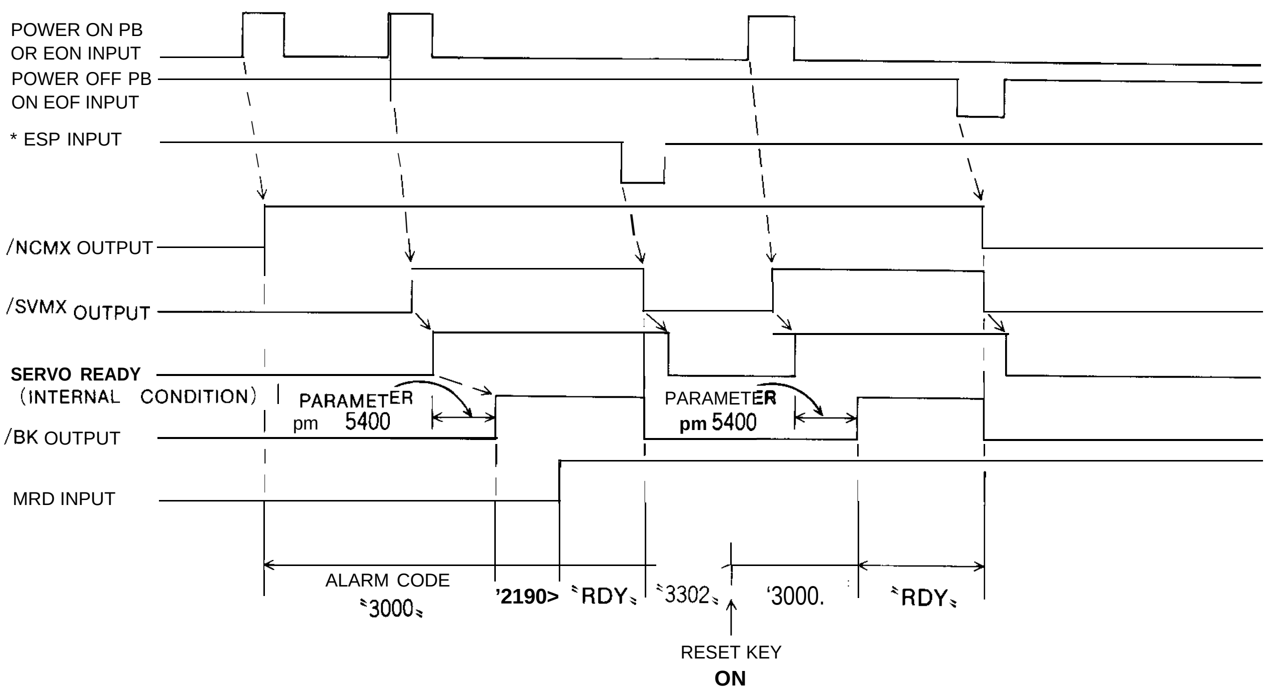


Fig. 10.4 Time Chart of Power Supply Turning on Sequence

10. 3.2 EMERGENCY STOP (∗ ESP) INPUT

When the emergency stop input circuit (* ESP) is open, the control stops totally, the /SVMX and /BK are turned off, and the emergency stop output (∗ESPS) of general purpose I/O module is opened.

10.3.3 EXTERNAL POWER ON- OFF (EON, EOF, ECOM) INPUT

The control can be switched on and off by external input signals, in the same way as the depressing of the POWER ON/OFF buttons on the NC operator’s station. When the circuit between EON and ECOM is closed, the logic circuit or servo power of the control is energized. When the circuit between EOF and ECOM is opened, the logic circuit or servo power of the control is deenergized.

11 CONNECTION TO FEED SERVO UNITS

11.1 CONNECTION TO EACH UNITS

(1) Cable

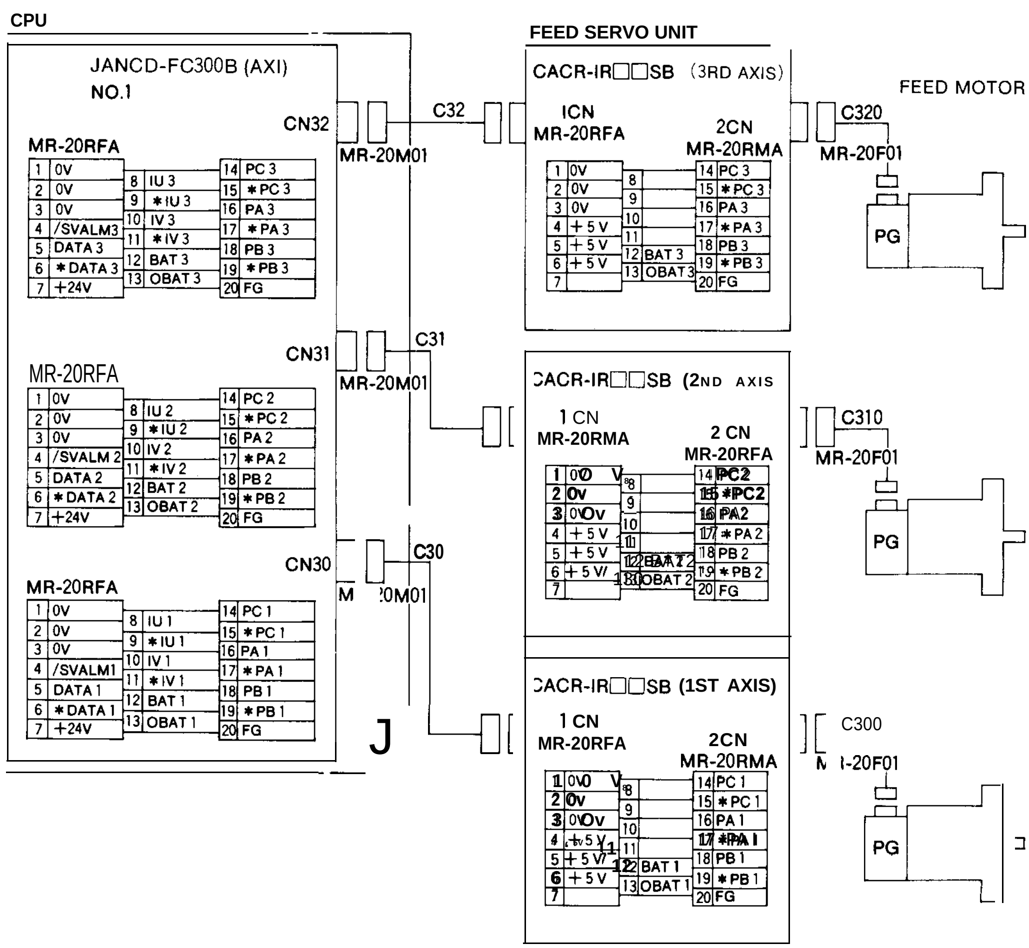


Fig. 11. l Connection to Each Unit
(lst to 3rd Axis)

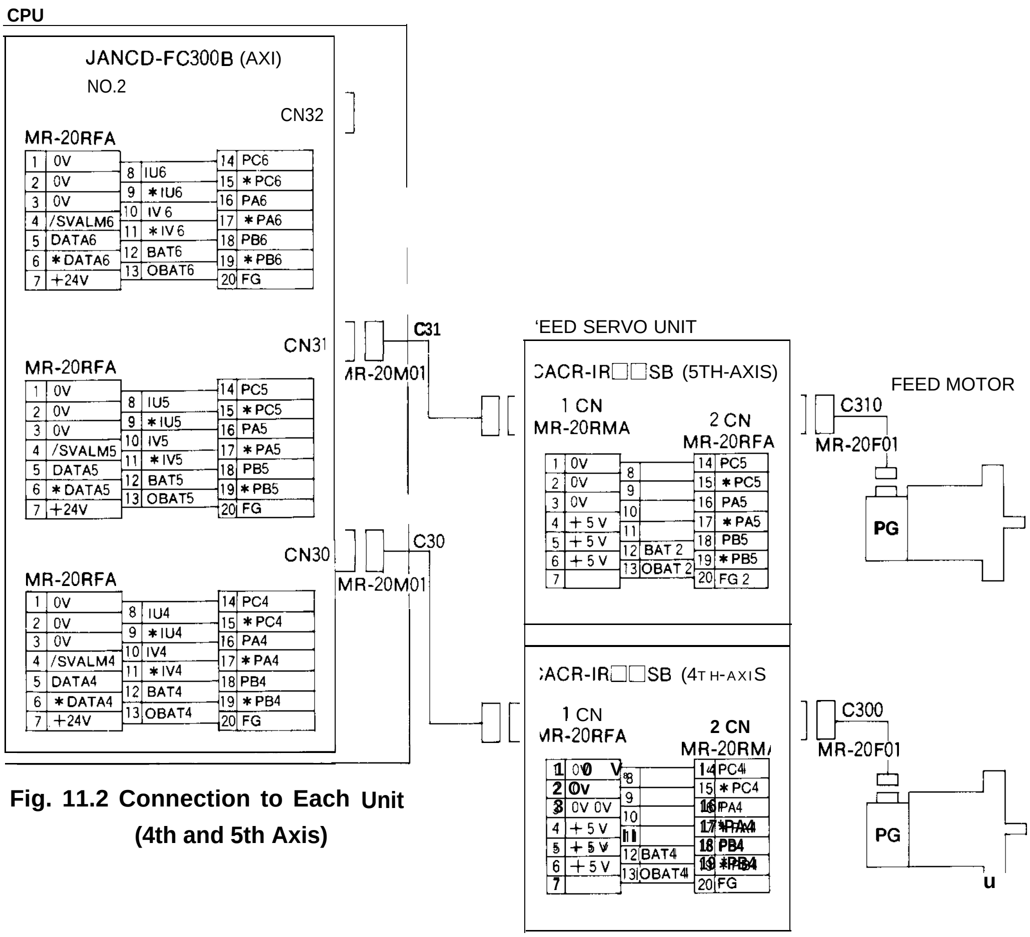


Fig. 11.2 Connection to Each Unit (4th and 5th Axis)

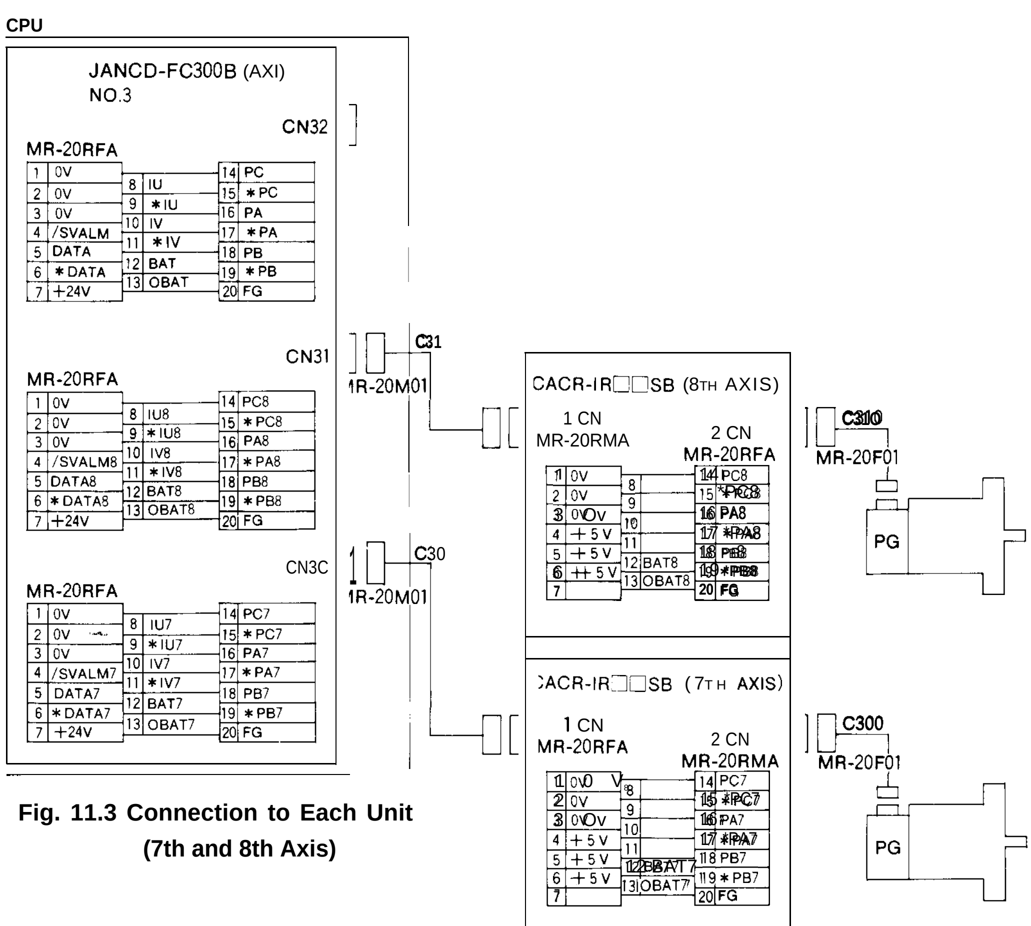


Fig. 11.3 Connection to Each Unit (7th and 8th Axis)

(2) MAIN CIRCUIT

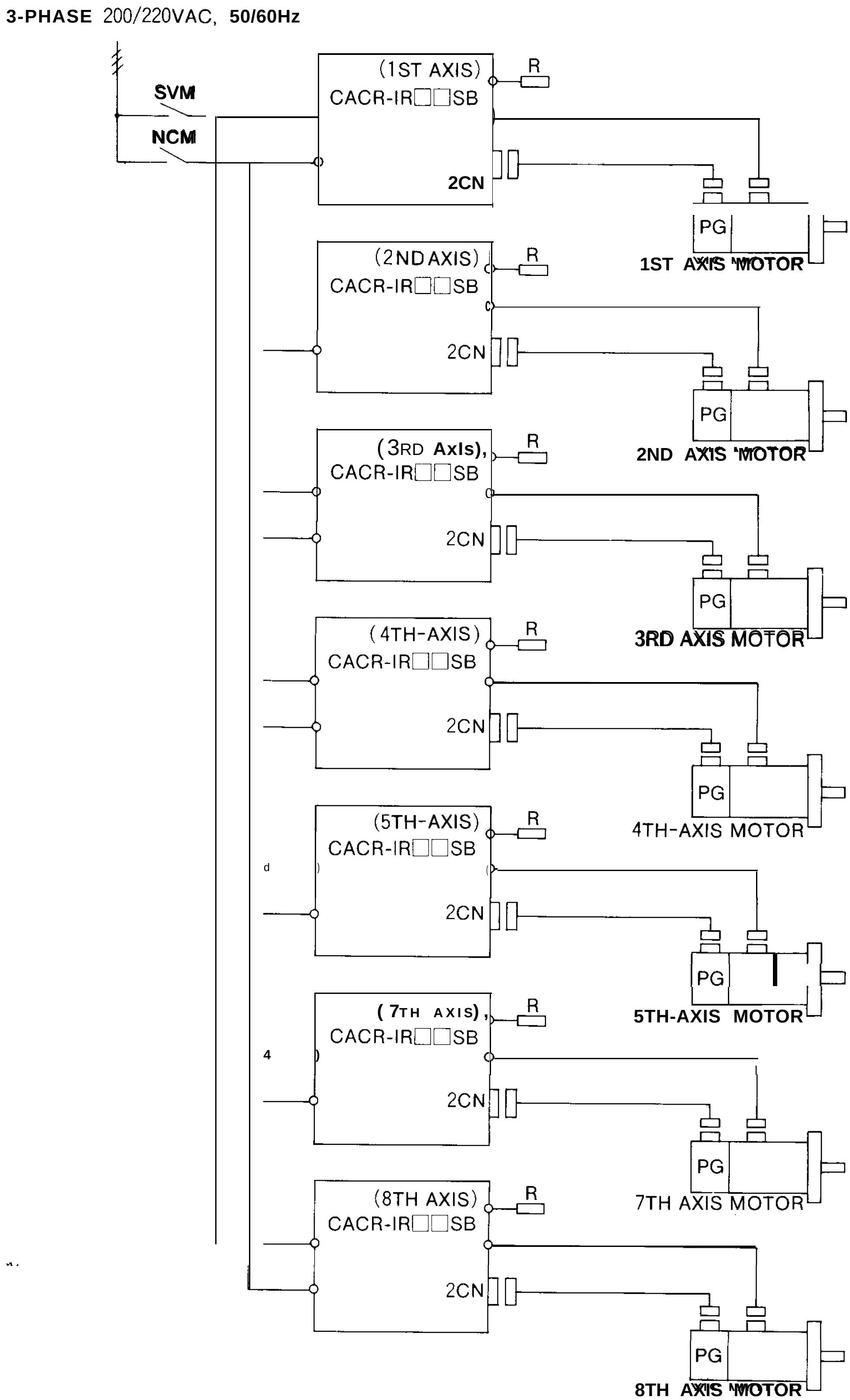
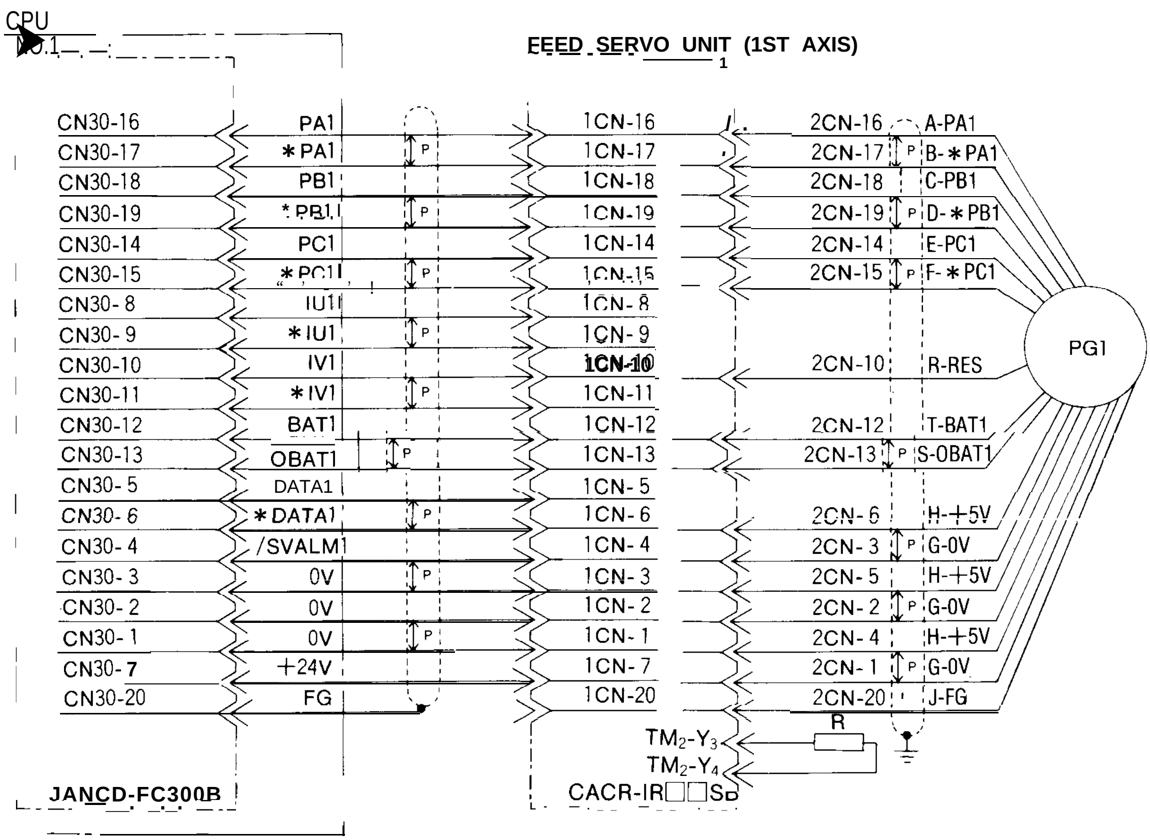


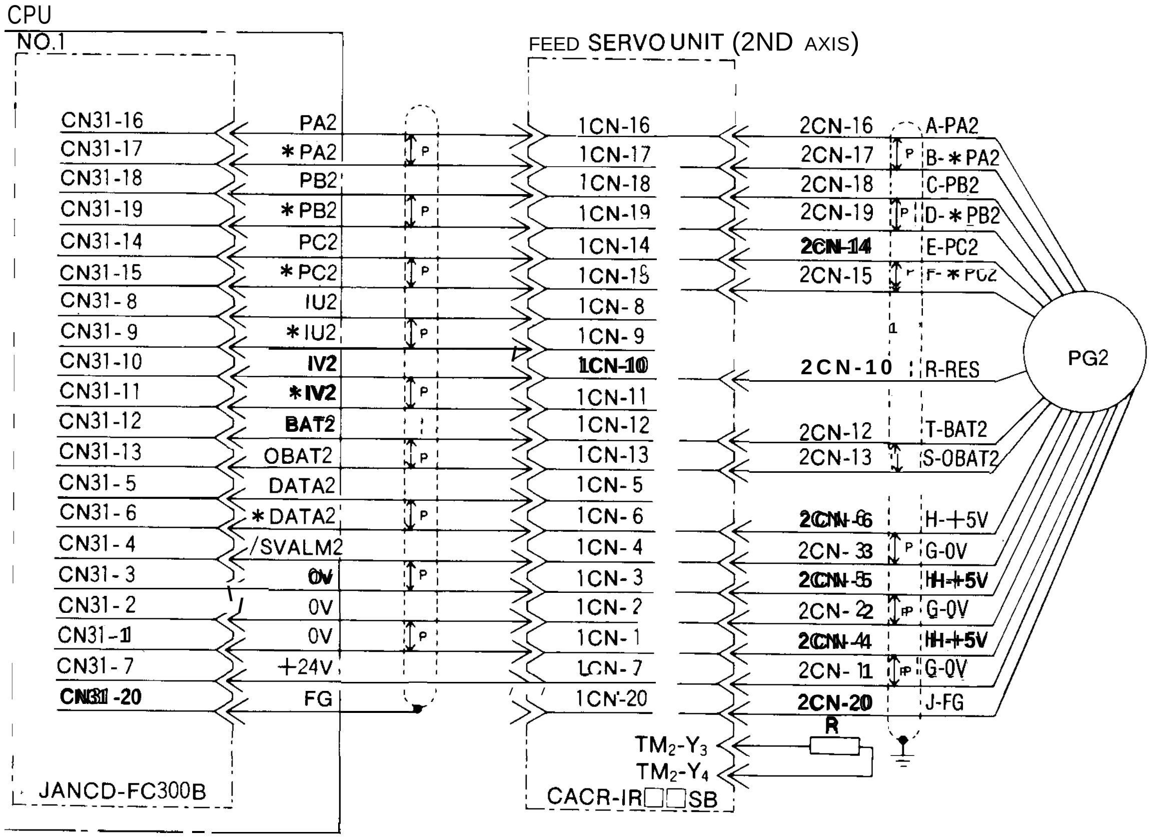
Fig. 11.4 Main Circuit Connection

11.2 DETAILS OF CONNECTION TO FEED SERVO UNITS

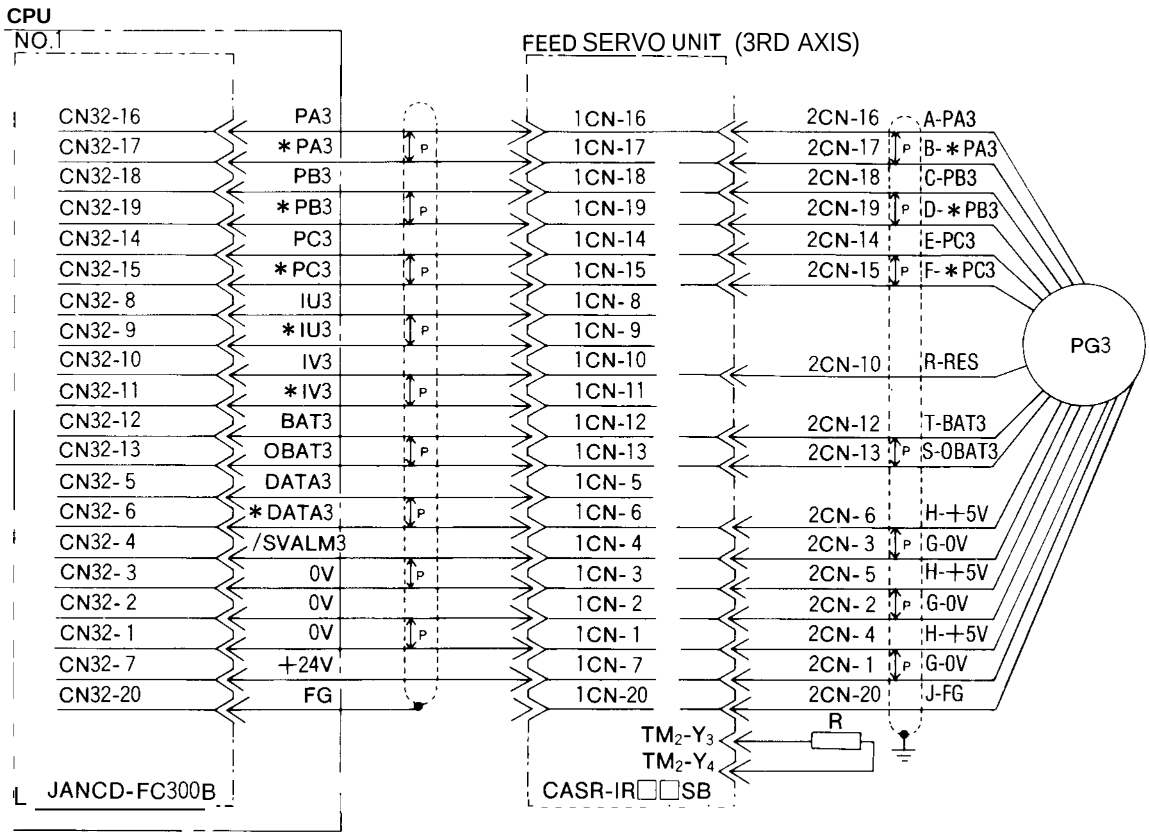
11.2.1 FOR 1 ST-AXIS



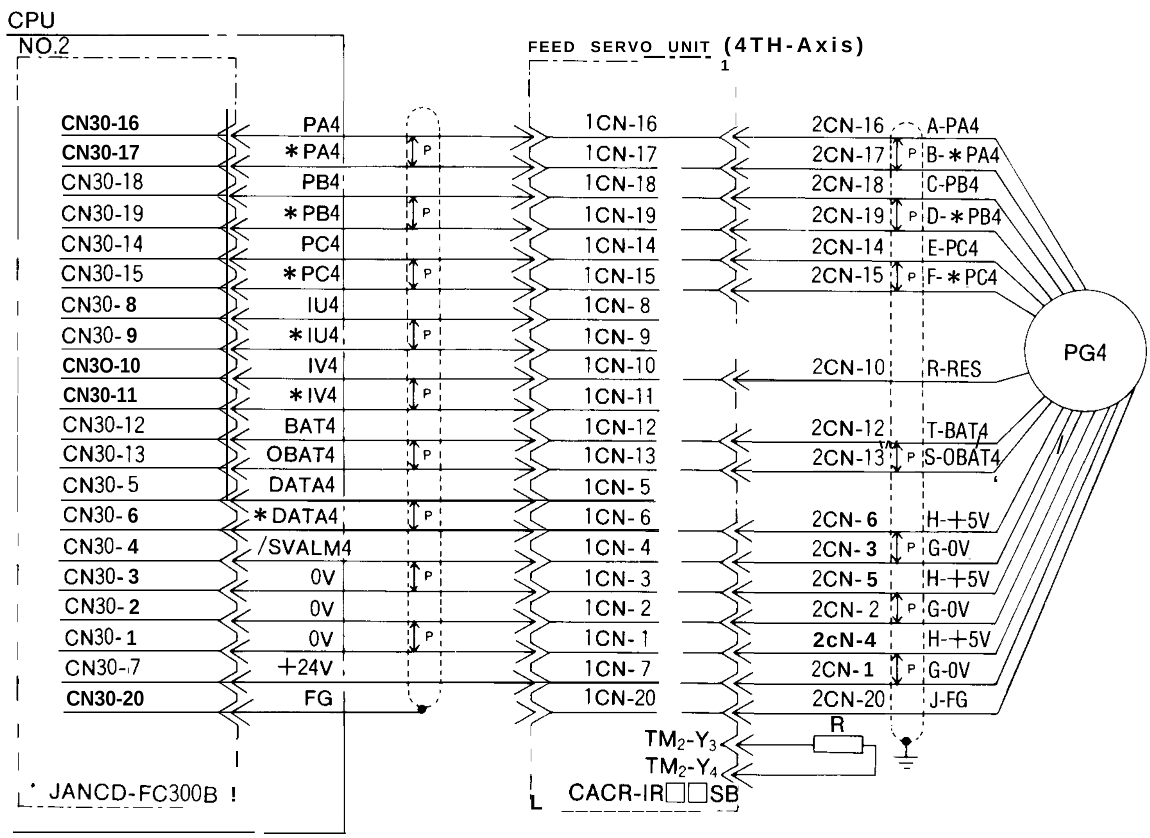
11.2.2 FOR 2ND-AXIS



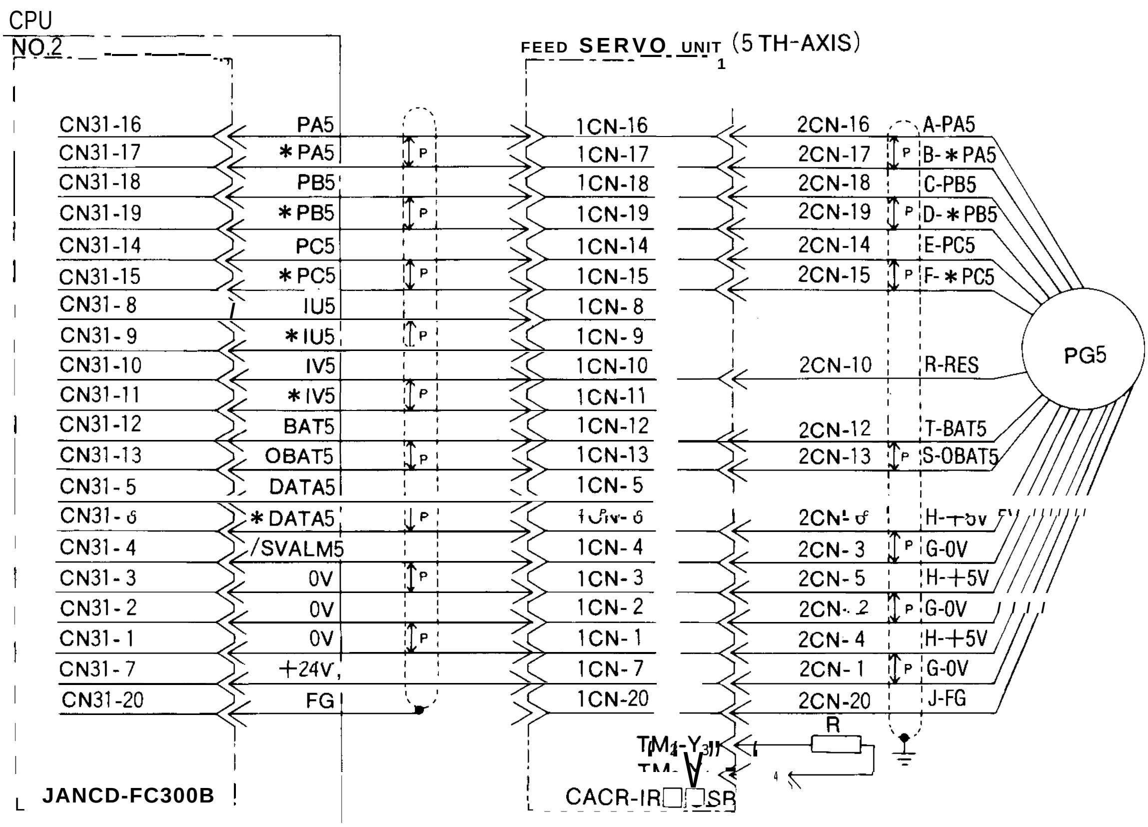
11.2.3 FOR 3RD-AXIS



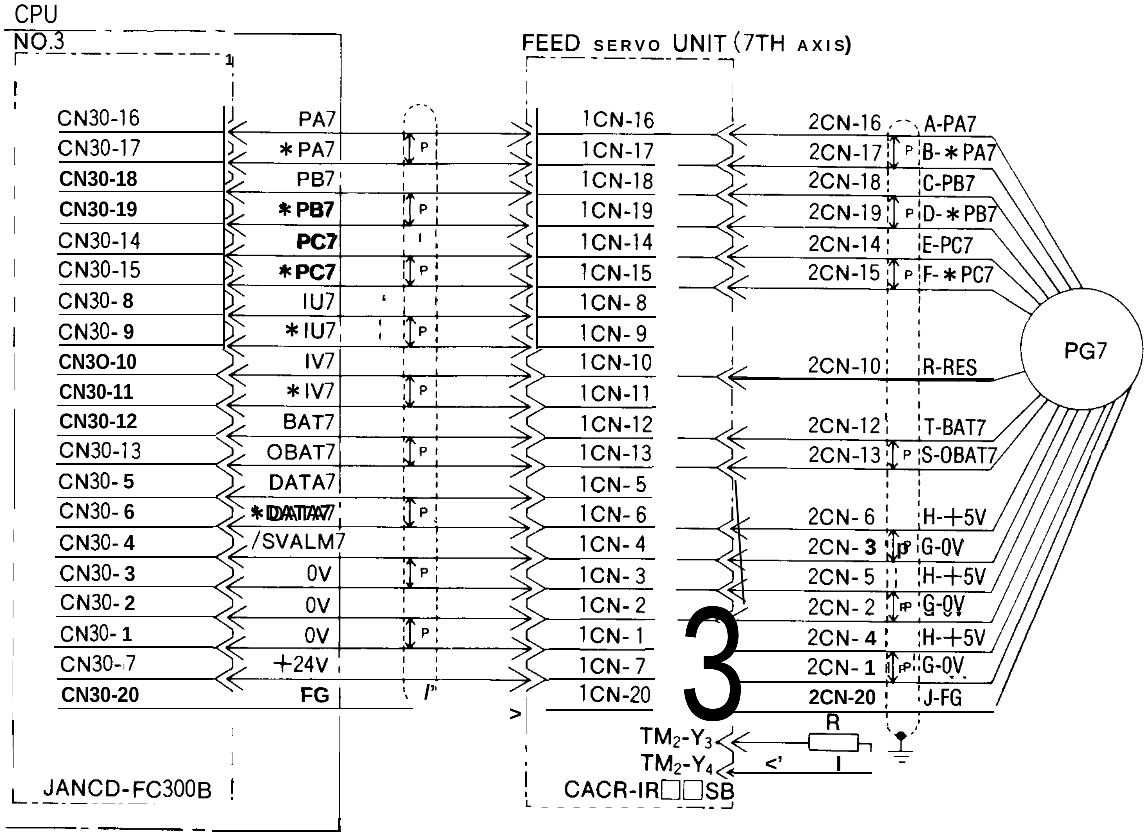
11.2.4 FOR 4TH-AXIS



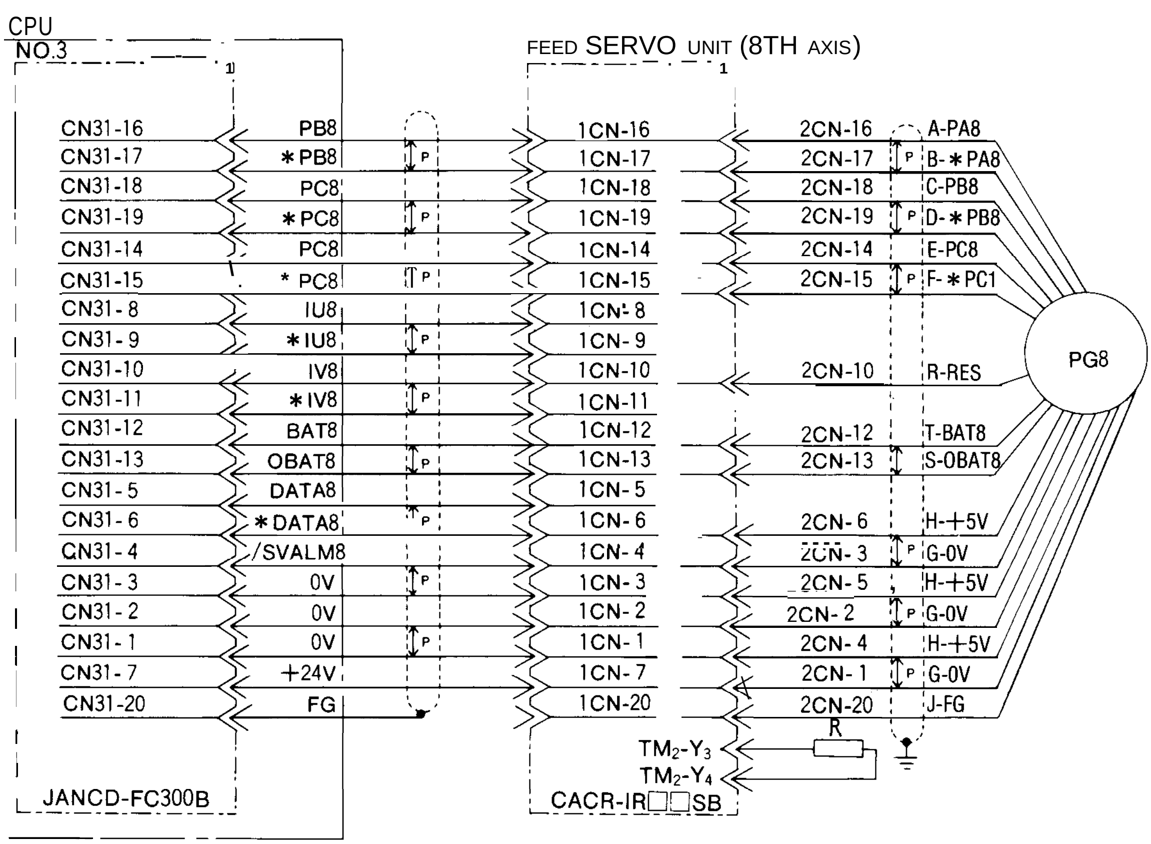
11.2.5 FOR 5TH-AXIS



11.2.6 FOR 7TH-AXIS



11.2.7 FOR 8TH-AXIS



11.3 DETAILS OF CONNECTION TO SERVO UNIT MAIN CIRCUIT

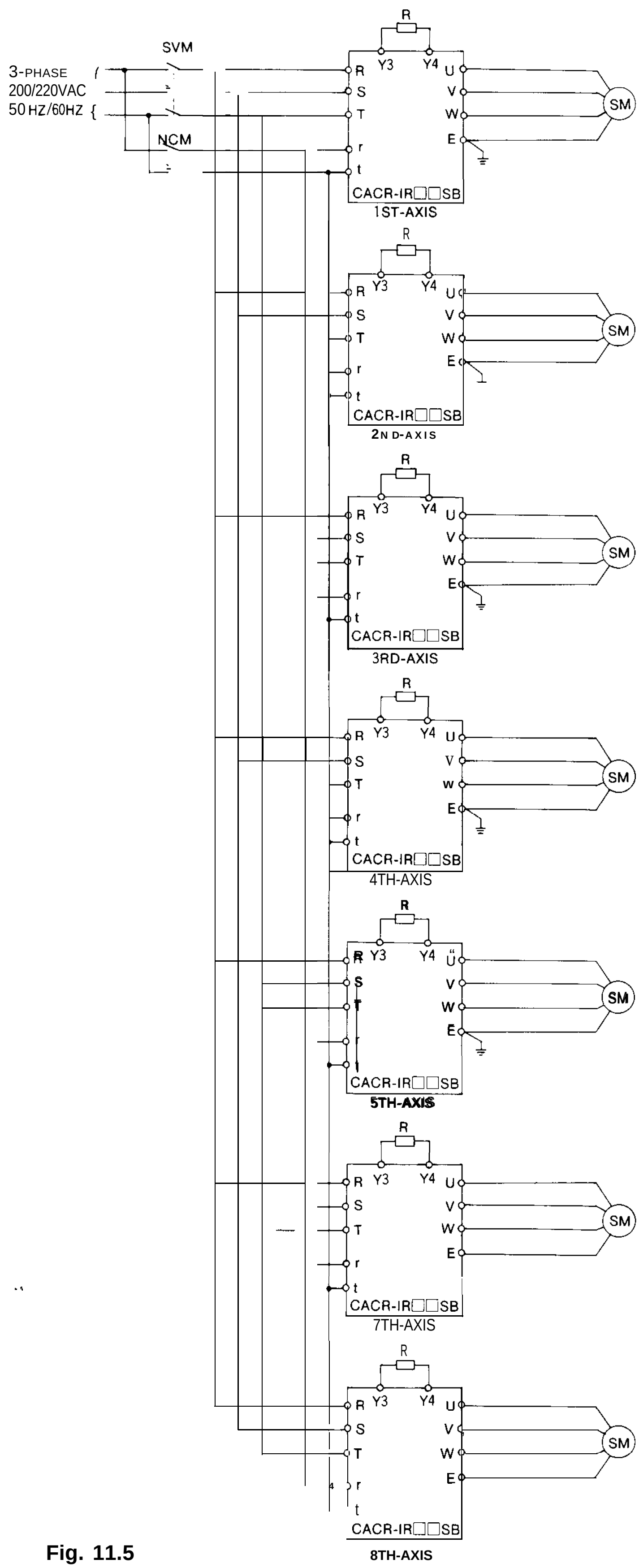


Fig. 11.5

11.4 EXTERNAL FEEDBACK UNIT CONNECTION

When the JANCD-FC301-*(LIF) and JZNC-iAU51-*(DLB) are used in conjunction with the YASNAC-i80, it is easy to operate an external feedback unit (e. g., linear scale).

11,4.1 NAMES AND TYPES OF THE SUPPLIES FROM YASKAWA ELECTRIC CORP.

(1) Linear Scale Interface Circuit Board

Type	Parts code	Remarks
JANCD-FC301-3	DTN6660	3-axis specifications

(2) Patch Bay Unit

Type	Parts code	Remarks
JZNC-iAU52-3	DUN20730	3-axis specifications

(3) iAU52-FC301 Interface Cable

Type	Parts code	Remarks
89-25101-010	DE9300001-1	1 m
89-25101-015	DE9300001-2	1.5 m
89-25101-020	DE9300001-3	2 m

11.4.2 CONNECTION DIAGRAM

See Fig. 11.12 on page 43.

11.4.3 FUNCTIONS

(1) Linear Scale Interface Circuit Board (LIF)

This circuit board serves as the interface between AXIS 1 (JANCD-FC300-*) and external feedback unit (e. g., linear scale).

NOTE: As the LIF receives the feedback signals from up to three axes via its only connector (CN33), it needs the patch bay unit (JZNC-iAU52-*).

(2) Patch Bay Unit

This unit receives the feedback signals from up to three axes, and delivers them to the LIF (JANCD-FC301 - *) via one connector.

Further, this unit supplies power to the connected external feedback unit. The patch bay unit is to be mounted in the NC panel only.

Rated voltage: 5 V (4.5 to 5.5 V)

Current-carrying capacity: 3 A (permissible range: O to 100%)
Input voltage rating: 200 to 240 V AC
Permissible input voltage range: 170 to 264 V AC

11.4.4 FEEDBACK SIGNAL SPECIFICATIONS

The output phase must be as shown in Fig 11.6.

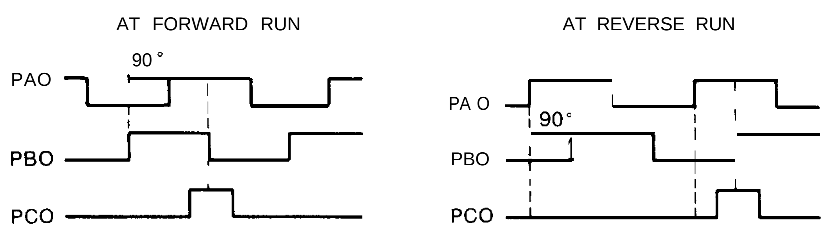


Fig. 11. 6 Forward/Reverse Output Phase

(1) Output Circuit
The output circuit must be as shown in Fig 11.7.
However, ensure that the line driver used (RS-422) is T1's MC3487 IC or equivalent.

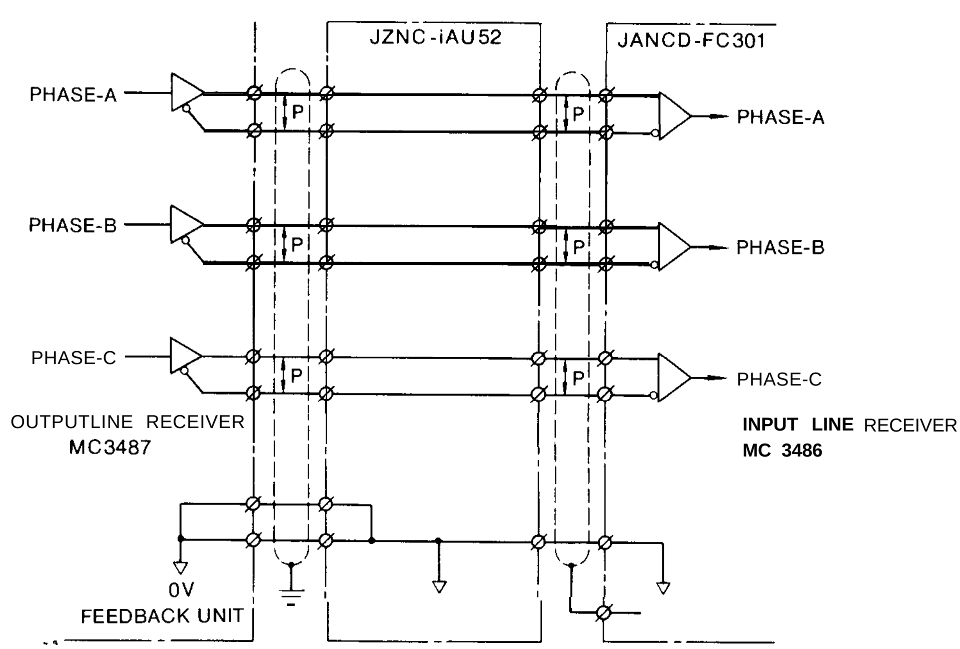


Fig. 11.7 Typical Output Circuit

(2) Reference Point Signal (Phase C Pulse) and Deceleration LS
Be sure that Fig 11.8 is complied with.

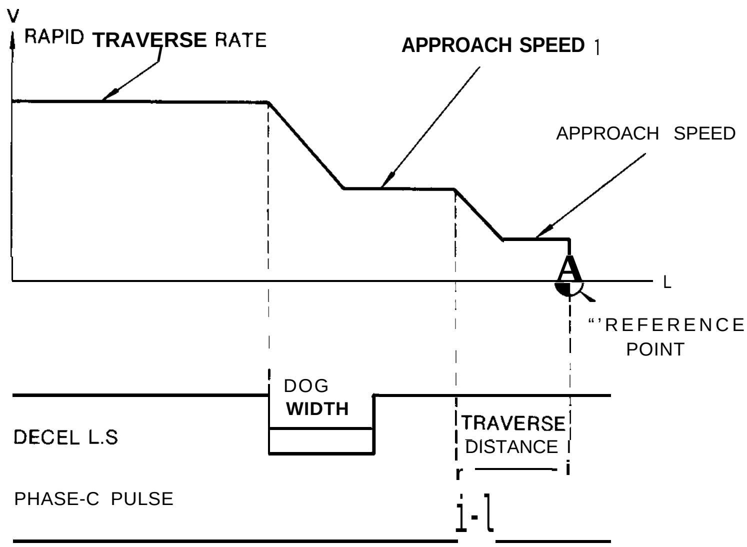
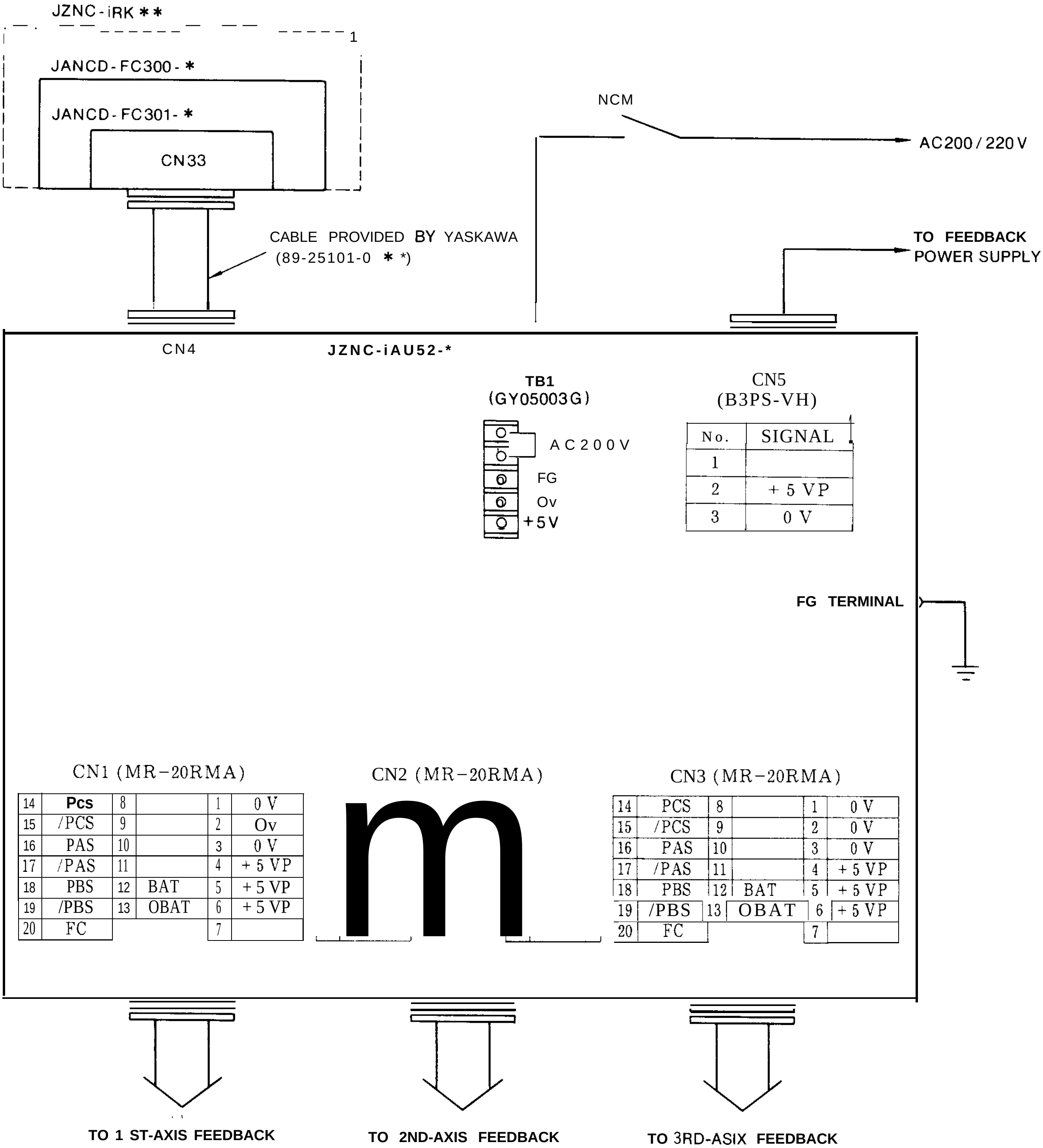


Fig. 11.8 Reference Point Signal and Decel LS

Even when an external feedback unit to be used with the YASNAC-i80M, the feedback signal of the absolute encoder attached to the standard motor is used for speed control.
Therefore, it is necessary to provide the same wiring connection (JAN CD- FC300-*-to-Servo-pack connection) as in cases where no external feedback unit is used.

11.4.5 CONNECTION



CN5 (B3PS-VH)

No.	SIGNAL
1	
2	+ 5 VP
3	0 V

CN1 (MR-20RMA)

14	Pcs	8		1	0 V
15	/PCS	9		2	Ov
16	PAS	10		3	0 V
17	/PAS	11		4	+ 5 VP
18	PBS	12	BAT	5	+ 5 VP
19	/PBS	13	OBAT	6	+ 5 VP
20	FC			7	

CN3 (MR-20RMA)

14	PCS	8		1	0 V
15	/PCS	9		2	0 V
16	PAS	10		3	0 V
17	/PAS	11		4	+ 5 VP
18	PBS	12	BAT	5	+ 5 VP
19	/PBS	13	OBAT	6	+ 5 VP
20	FC			7	

Fig. 11.9 Connection between LIF and DLB

(1) JZNC-iAU52-to-External Feedback Unit Connection

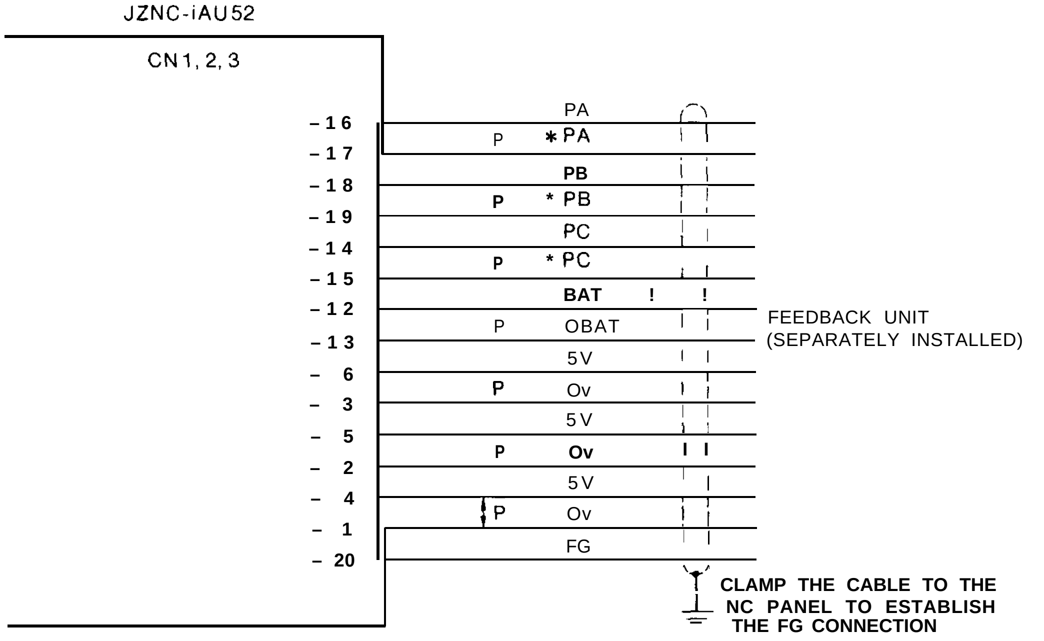


Fig. 11.10 Patch Bay Unit-to-External Feedback Unit Connection

(2) JZNC-iAU52-to-200 VAC Power Supply Connection (NCM)

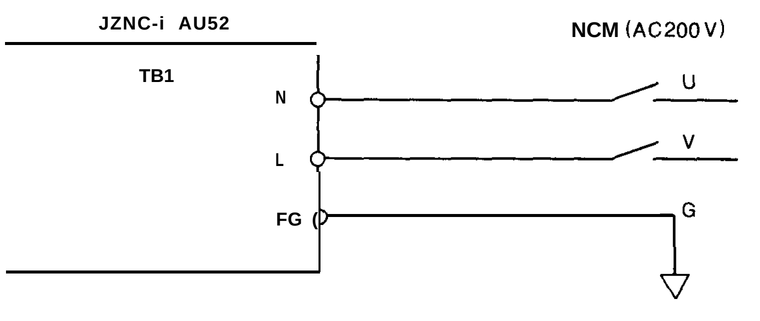
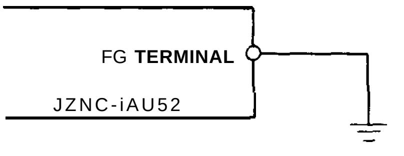


Fig. 11.11 Power Supply Connection

(3) FG Terminal



11.4.6 OUTSIDE DIMENSIONS

See Fig. 11.13 on page 44.

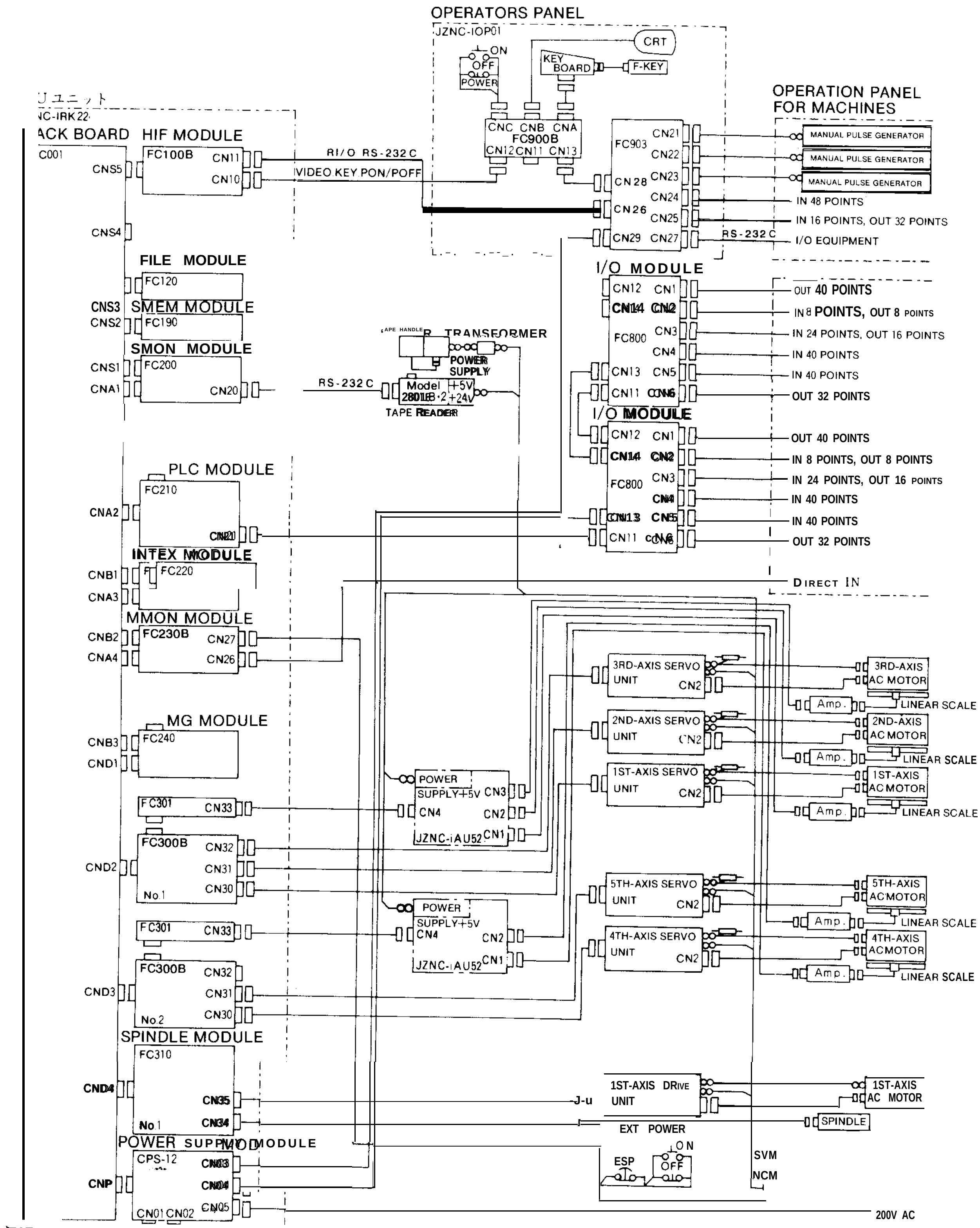
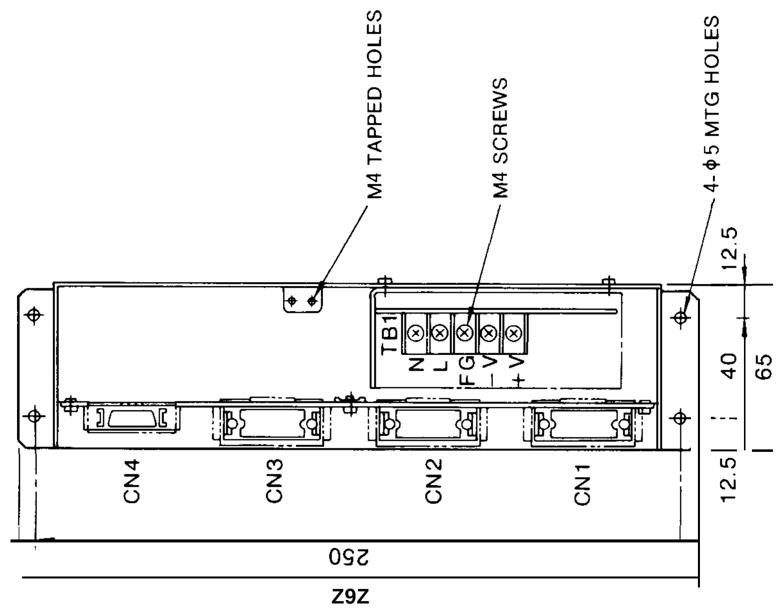


Fig. 11.12 YASNAC i80M (for M/C, Linear Scale Interface Incorporated) Equipment Connection Diagram

No.	Connectors on Printed Circuit Board	Connectors at Cable Side
CN1	MR-20RMA made by Honda Tusin K.K.	MRP-20F01 made by Honda Tusin K.K.
CN2	MR-20RMA made by Honda Tusin K.K.	MRP-20F01 made by Honda Tusin K.K.
CN3	MR-20RMA made by Honda Tusin K.K.	MRP-20F01 made by Honda Tusin K.K.
CN4	175674-4 made by Japan AMP	175677-4 made by Japan AMP



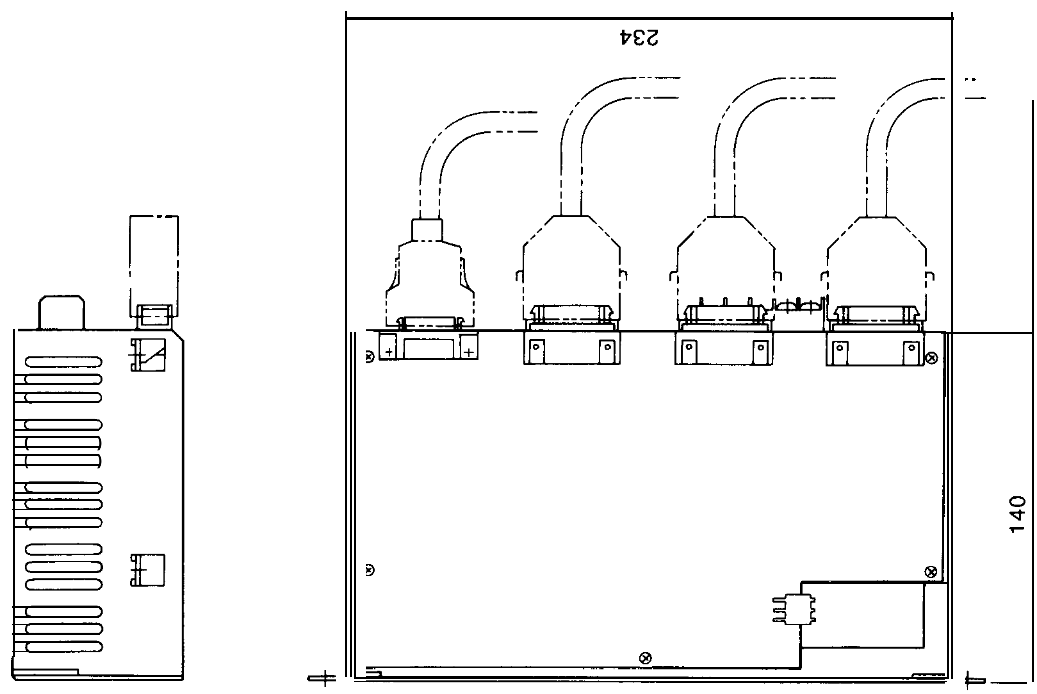


Fig. 11.13 Patch Bay Unit Outside Dimensions (mm)

12 CONNECTION TO SPINDLE DRIVE UNIT

12.1 CONNECTION TO EACH UNIT

(1) FOR MOTOR WITH BUILT-IN PG

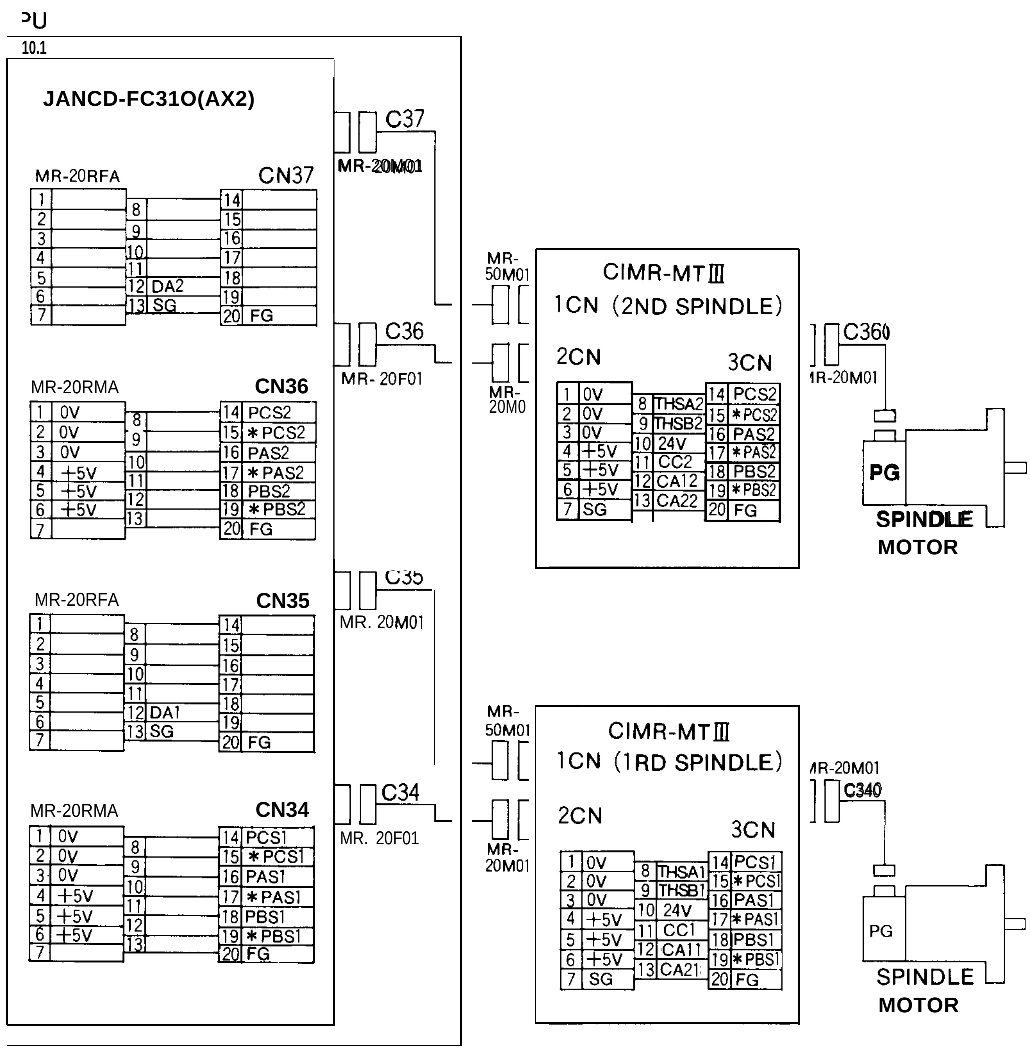


Fig. 12.1

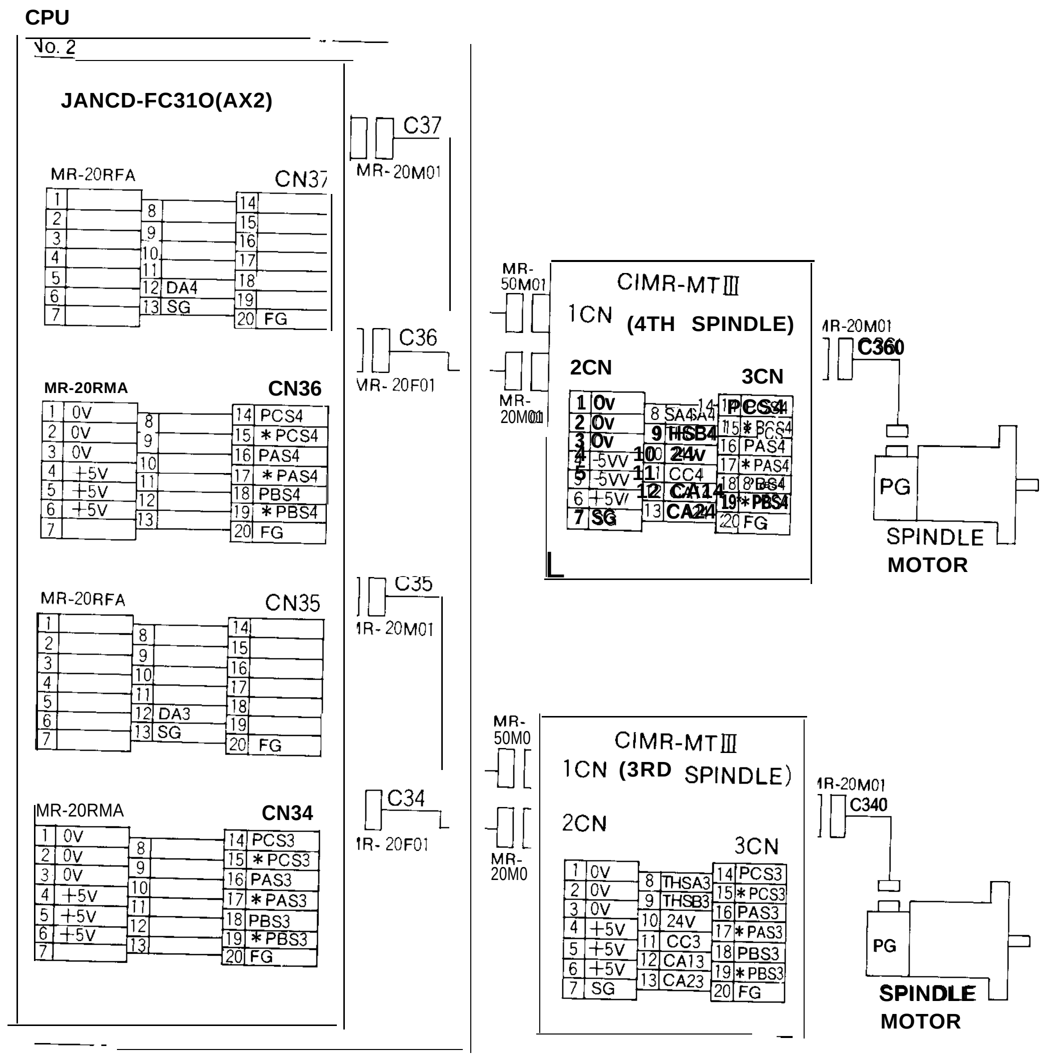

CPU
No. 2
JANCD-FC310(AX2)
MR-20RFA
CN37
C37
MR-20M01
12 DA4
13 SG
20 FG
MR-20RMA
CN36
C36
MR-20F01
1 0V
2 0V
3 0V
4 +5V
5 +5V
6 +5V
14 PCS4
15 *PCS4
16 PAS4
17 *PAS4
18 PBS4
19 *PBS4
20 FG
MR-20RFA
CN35
C35
MR-20M01
12 DA3
13 SG
20 FG
MR-20RMA
CN34
C34
MR-20F01
14 PCS3
15 *PCS3
16 PAS3
17 *PAS3
18 PBS3
19 *PBS3
20 FG
MR-50M01
MR-20M01
CIMR-MTIII
1CN (4TH SPINDLE)
2CN
3CN
MR-20M01
C360
PG
SPINDLE MOTOR
MR-50M0
MR-20M0
CIMR-MTIII
1CN (3RD SPINDLE)
2CN
3CN
1 0V
2 0V
3 0V
4 +5V
5 +5V
6 +5V
7 SG
8 THSA3
9 THSB3
10 24V
11 CC3
12 CA13
13 CA23
14 PCS3
15 *PCS3
16 PAS3
17 *PAS3
18 PBS3
19 *PBS3
20 FG
MR-20M01
C340
PG
SPINDLE MOTOR

Fig. 12. 2

(2) FOR MOTOR WITH SEPARATELY INSTALLEDPG

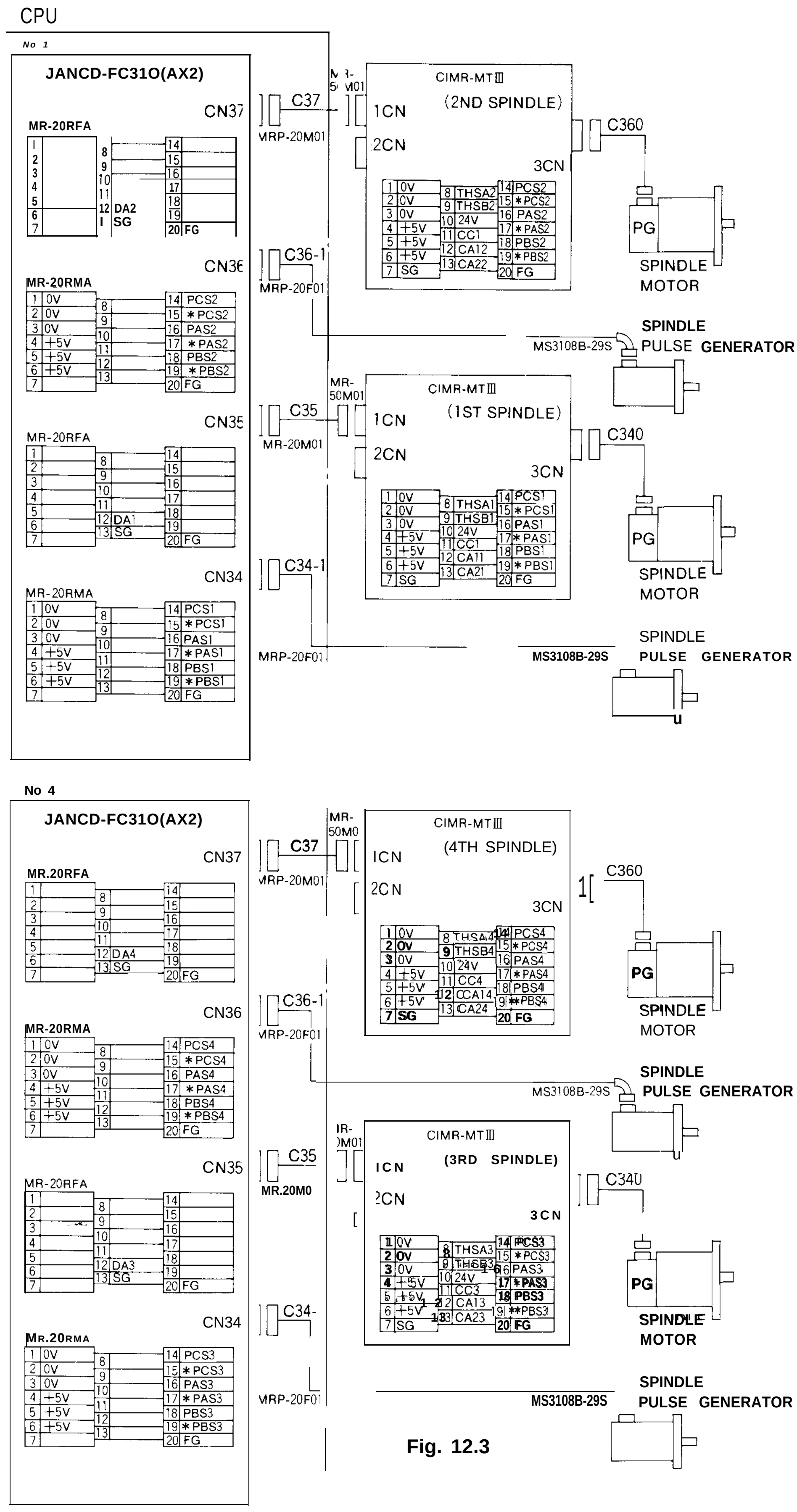


Fig. 12.3

(3) MAIN CIRCUIT

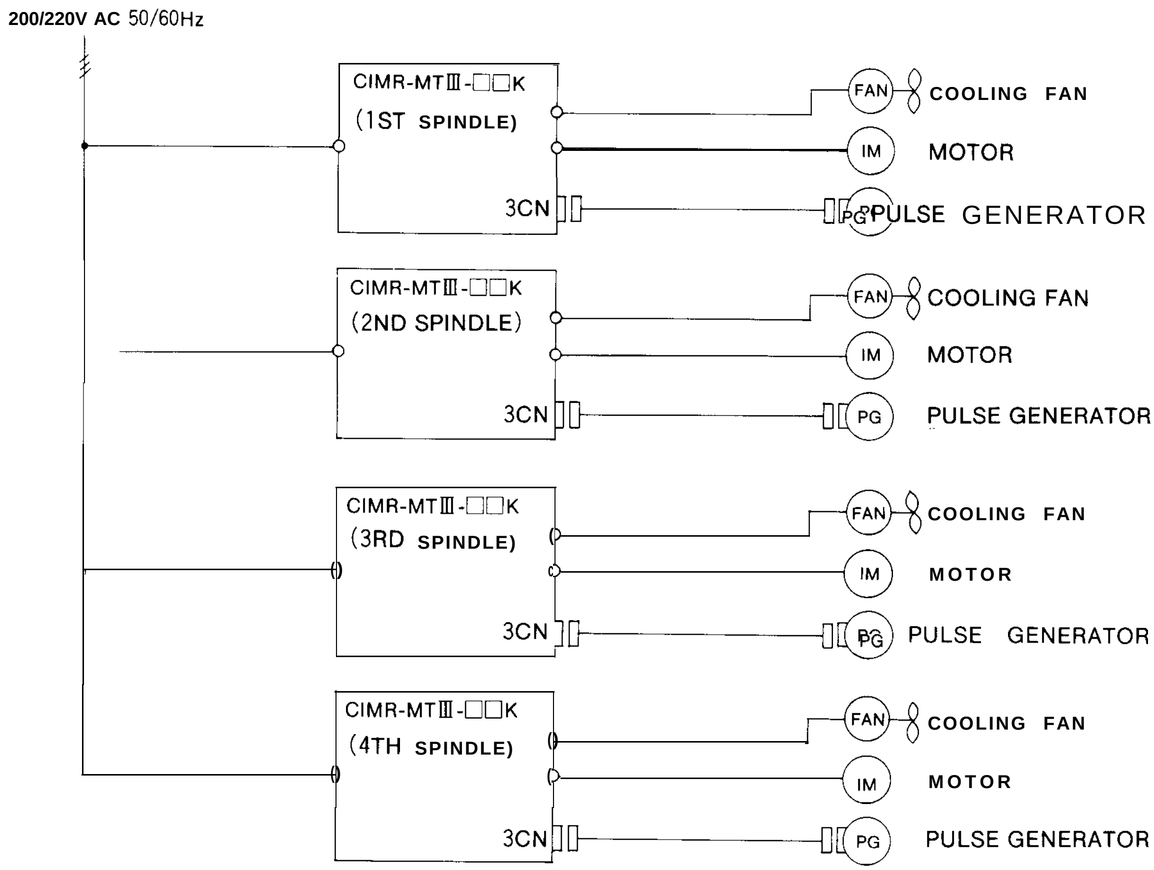


Fig. 12.4

12.2 DETAILS OF CONNECTION TO SPINDLE DRIVE UNIT

(1) FOR MOTOR WITH BUILT-IN PG

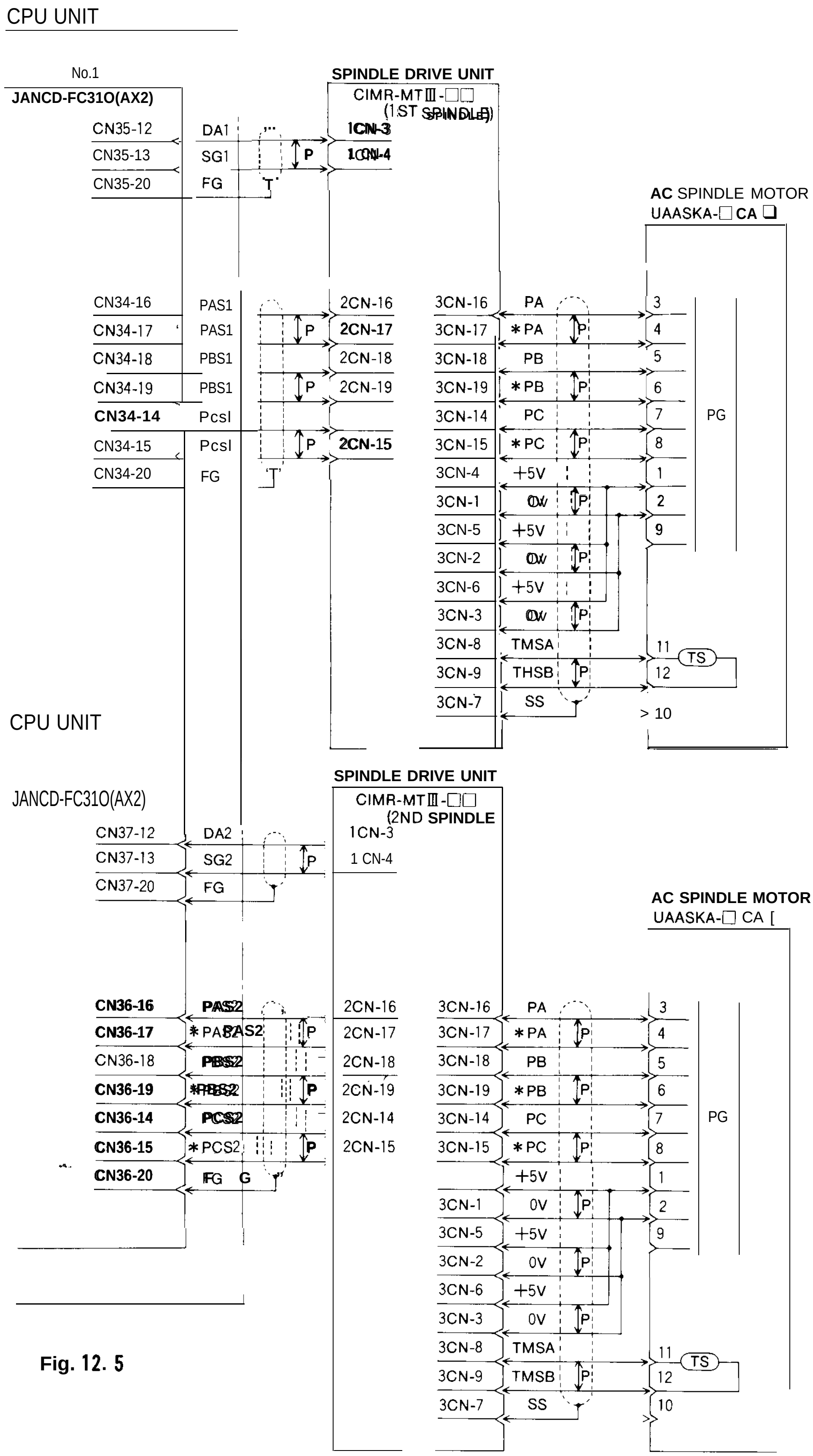


Fig. 12. 5

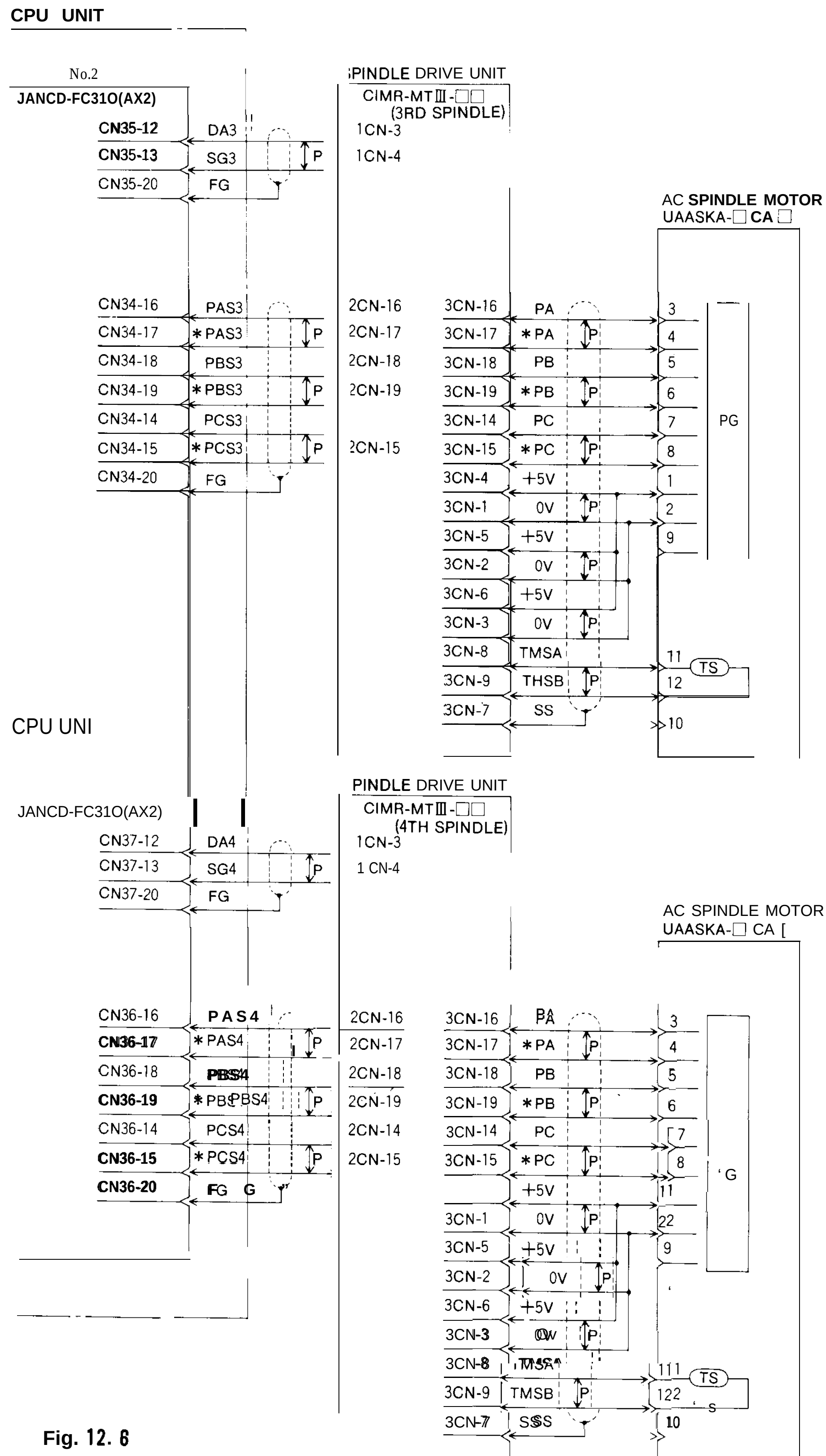

CPU UNIT
No.2
JANCD-FC31O(AX2)
SPINDLE DRIVE UNIT
CIMR-MTIII-□□
(3RD SPINDLE)
CN35-12
CN35-13
CN35-20
DA3
SG3
FG
1CN-3
1CN-4
AC SPINDLE MOTOR
UAASKA-□CA□
CN34-16
CN34-17
CN34-18
CN34-19
CN34-14
CN34-15
CN34-20
PAS3
*PAS3
PBS3
*PBS3
PCS3
*PCS3
FG
2CN-16
2CN-17
2CN-18
2CN-19
2CN-15
3CN-16
3CN-17
3CN-18
3CN-19
3CN-14
3CN-15
3CN-4
3CN-1
3CN-5
3CN-2
3CN-6
3CN-3
3CN-8
3CN-9
3CN-7
PA
*PA
PB
*PB
PC
*PC
+5V
0V
TMSA
THSB
SS
PG
TS
P
CPU UNI
JANCD-FC31O(AX2)
PINDLE DRIVE UNIT
CIMR-MTIII-□□
(4TH SPINDLE)
CN37-12
CN37-13
CN37-20
DA4
SG4
FG
1CN-3
1 CN-4
AC SPINDLE MOTOR
UAASKA-□ CA [
CN36-16
CN36-17
CN36-18
CN36-19
CN36-14
CN36-15
CN36-20
PAS4
*PAS4
PBS4
*PBS4
PCS4
*PCS4
FG
2CN-16
2CN-17
2CN-18
2CN-19
2CN-14
2CN-15
TMSB
SS

Fig. 12. 6

(2) FOR SEPARATELY **INSTALLED** PG

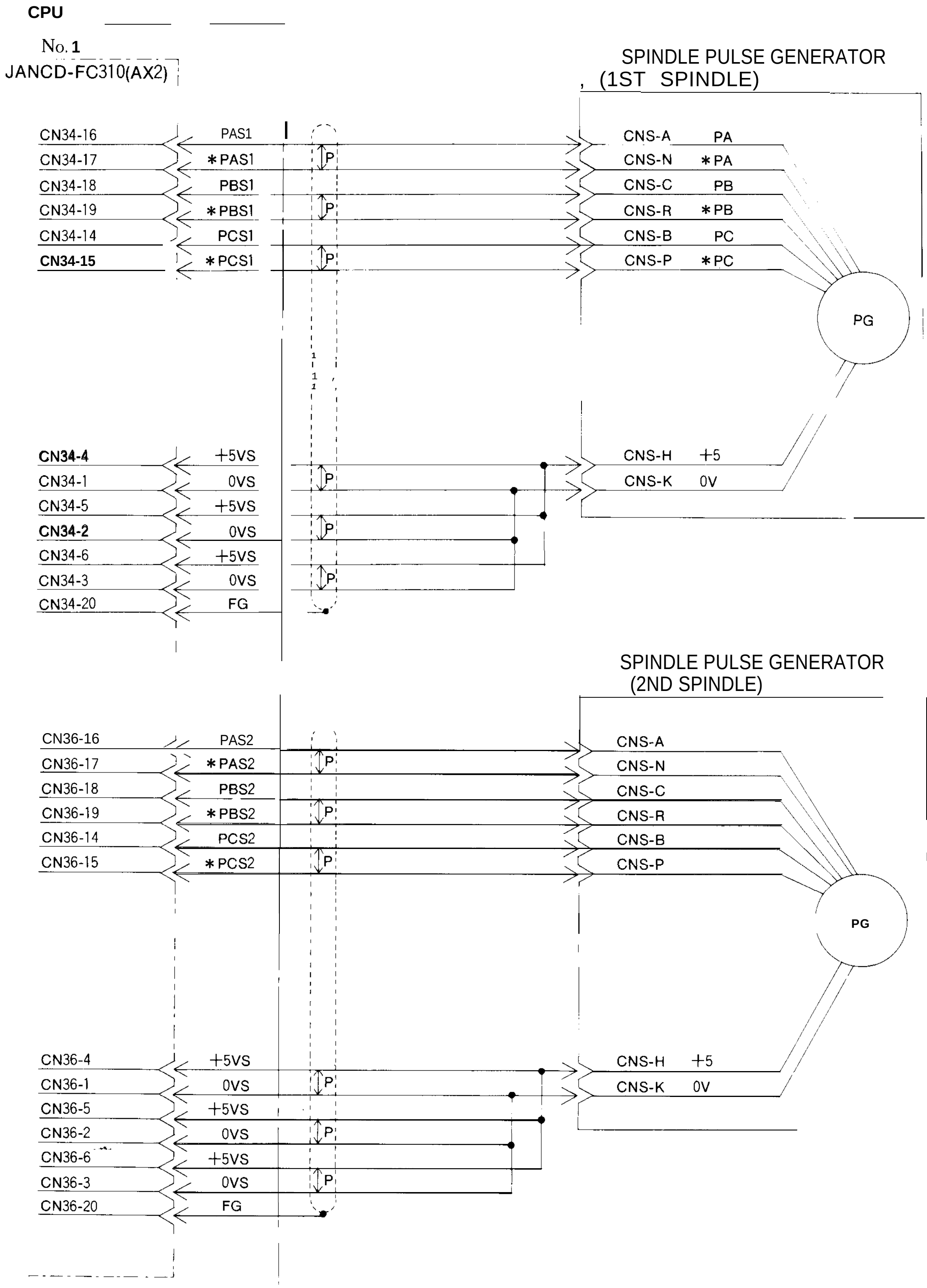


Fig. 12. 7

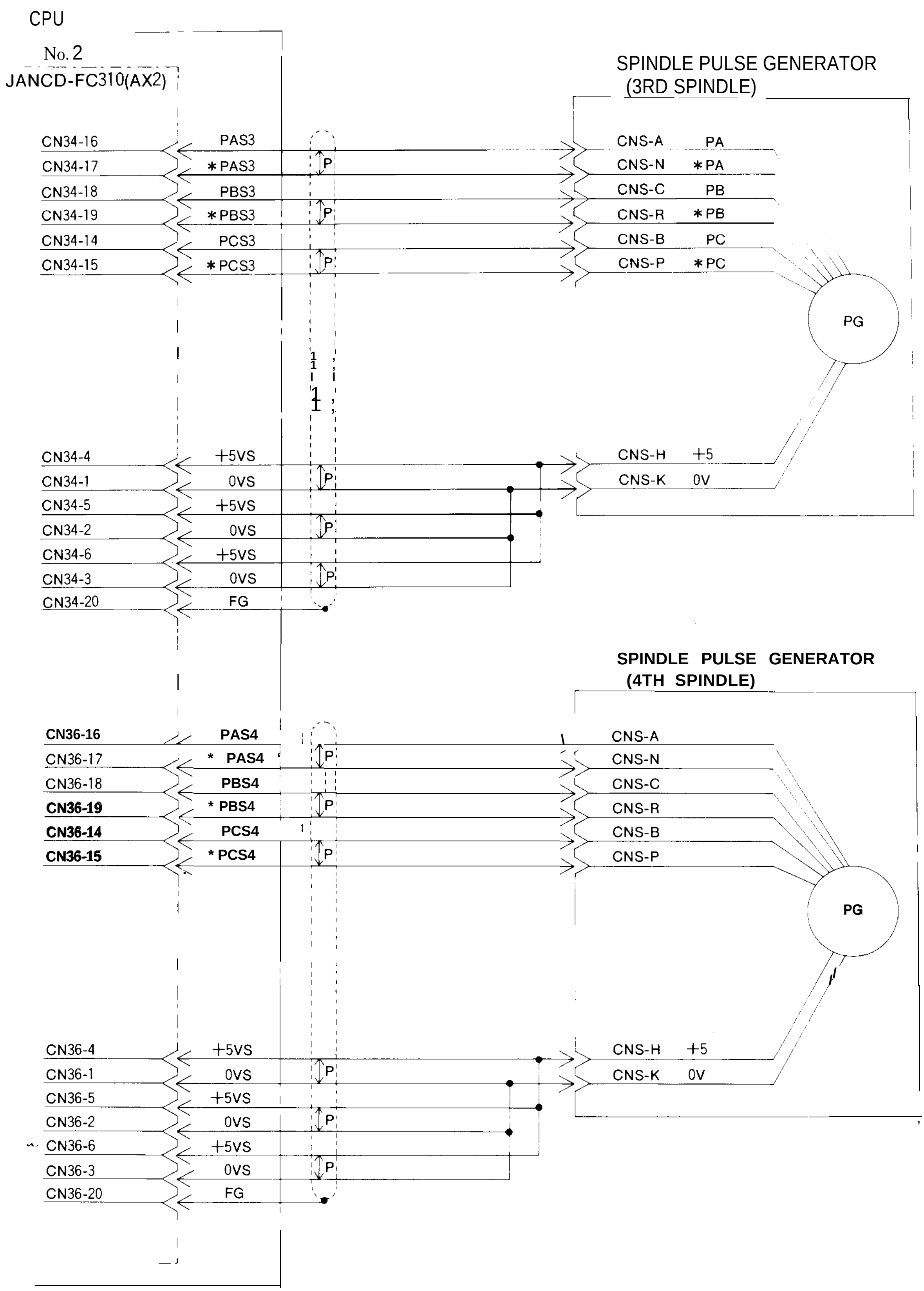

CPU
No. 2
JANCD-FC310(AX2)
SPINDLE PULSE GENERATOR
(3RD SPINDLE)
CN34-16
CN34-17
CN34-18
CN34-19
CN34-14
CN34-15
PAS3
* PAS3
PBS3
* PBS3
PCS3
* PCS3
CNS-A PA
CNS-N * PA
CNS-C PB
CNS-R * PB
CNS-B PC
CNS-P * PC
PG
CN34-4
CN34-1
CN34-5
CN34-2
CN34-6
CN34-3
CN34-20
+5VS
0VS
+5VS
0VS
+5VS
0VS
FG
CNS-H +5
CNS-K 0V
SPINDLE PULSE GENERATOR
(4TH SPINDLE)
CN36-16
CN36-17
CN36-18
CN36-19
CN36-14
CN36-15
PAS4
* PAS4
PBS4
* PBS4
PCS4
* PCS4
CNS-A
CNS-N
CNS-C
CNS-R
CNS-B
CNS-P
PG
CN36-4
CN36-1
CN36-5
CN36-2
CN36-6
CN36-3
CN36-20
+5VS
0VS
+5VS
0VS
+5VS
0VS
FG
CNS-H +5
CNS-K 0V

Fig. 12.8

12.3 CABLE SPECIFICATIONS

Table 12.1 Main Circuit Cable

Model CIMR-MTIII- \ Parts	Cable Type	Cable Size	Controller Terminal	Controller Screw	Motor Terminal	Motor Screw
3.7K	600V Class Cabtyre Cable	5.5mm²	Input R, S, T, E output U, V, W, E	M5	Input U, V, W, E	M4
5.5K		5.5mm²		M5		M5
7.5K		8mm²		M5		M5
11K		14mm²		M8		M8
15K		22mm²		M8		M8
18.5K		30mm²		M8		M8
22K		38mm²		M8		M8
30K		50mm²		M8		M8

Table 12.2 Cooling Fan Motor Cable

Application \ Parts	Cable	Screw
Cooling Fan Motor Cable	600 V Class polyvinyl insulated wire Size 2mm²	Terminal U, V Size M 4

13 CONNECTION TO TAPE READER

13.1 CONNECTION TO EACH UNIT

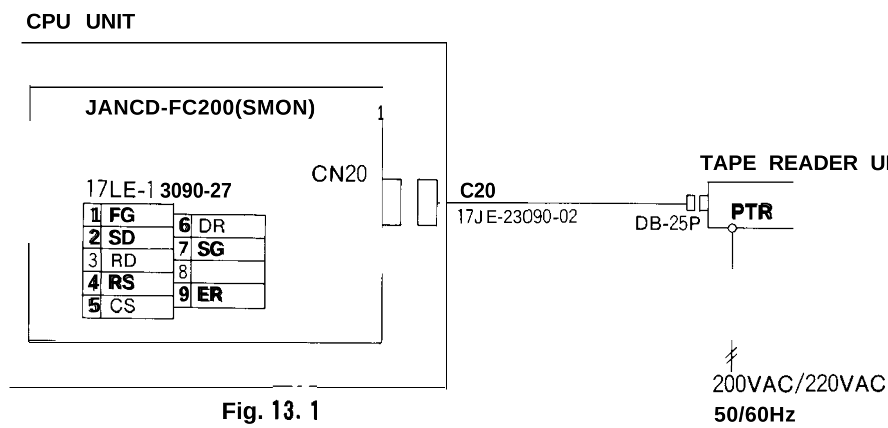


Fig. 13. 1

13.2 DETAILS OF CONNECTION TO TAPE READER

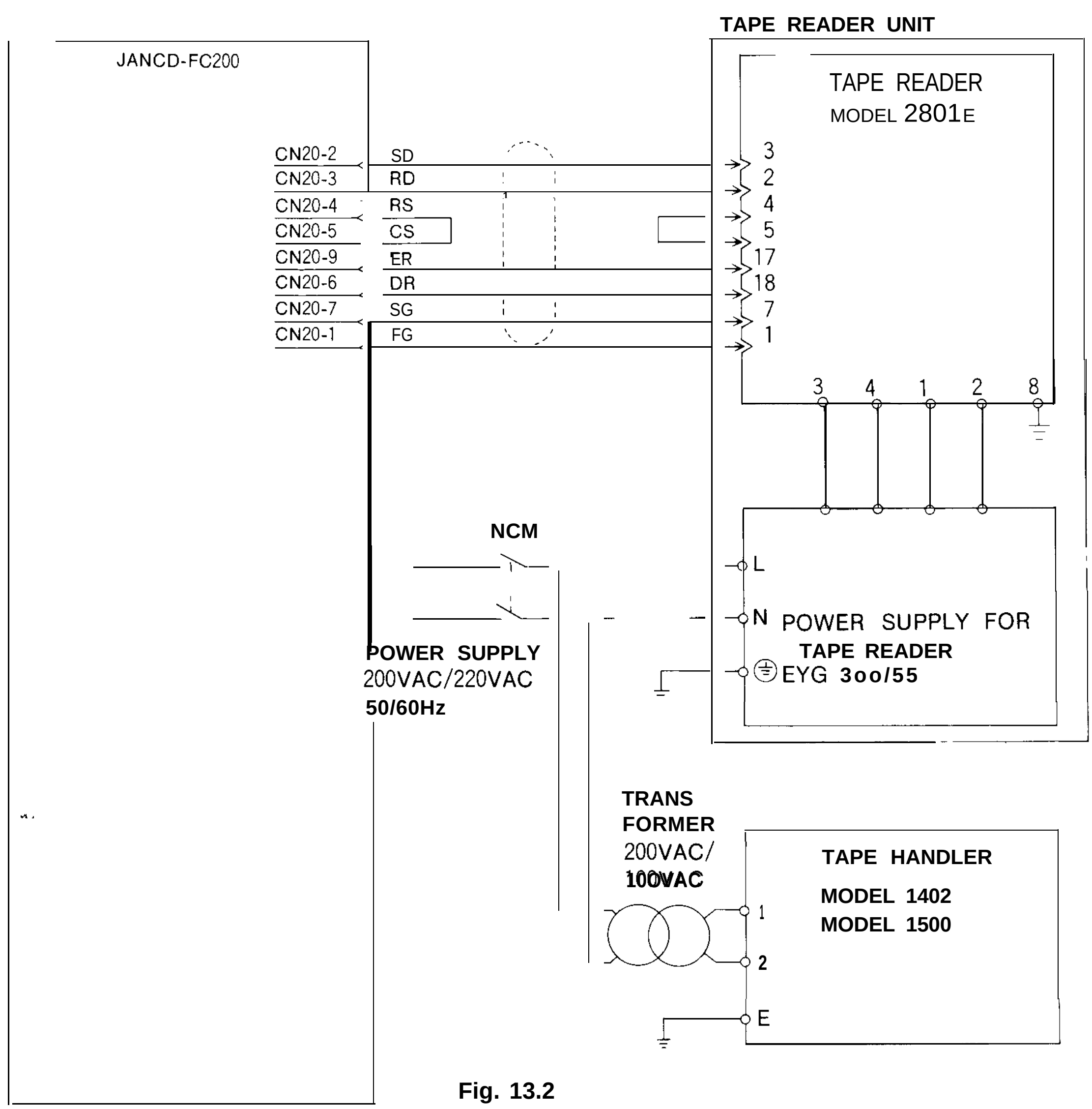


Fig. 13.2

14 CONNECTION TO RS-232C

14.1 CONNECTION TO EACH UNIT

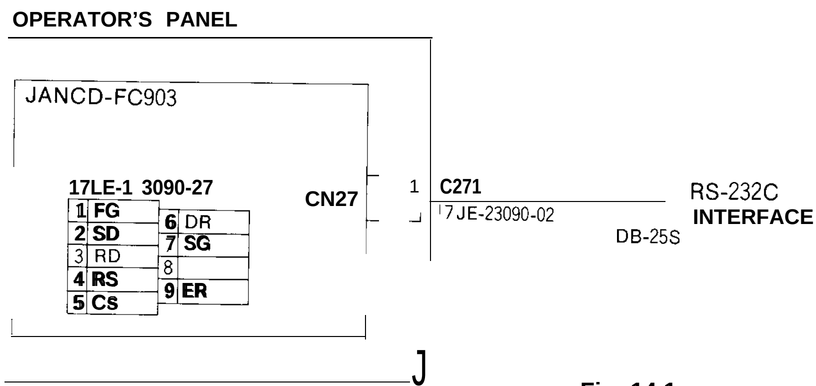


Fig. 14.1

14.2 CONNECTION TO RS-232C

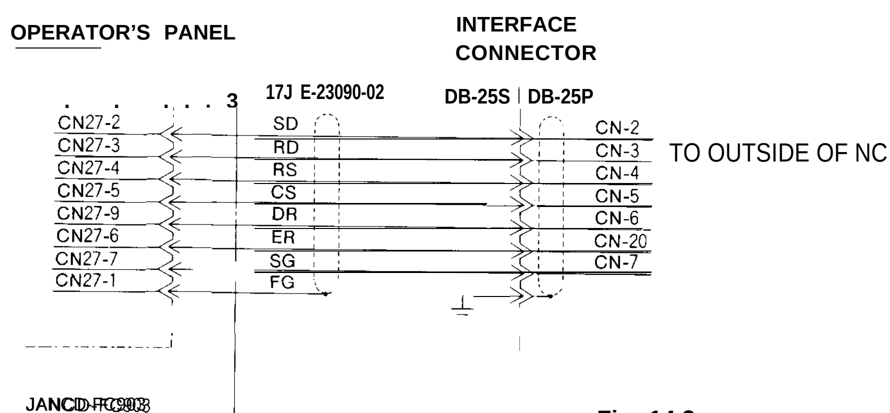


Fig. 14.2

14.3 RS-232C INTERFACE

(1) TRANSMISSION MODE

Start-stop synchronization : Each data bit is preceded by a start signal, and followed by a stop signal,

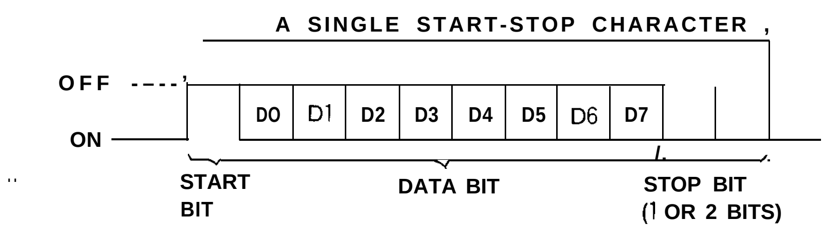


Table 14.1 RS-232 C Voltage Level

	$V_0 < -3$ V	$V_0 > +3$ V
Function	OFF	ON
Signal Condition	Mark	Space
Logic	1	0

(2) CODES USED

The following two types of codes are used, and are selectively used by parameters.

- EIA codes or ISO codes
- EIA codes or ISO codes + control codes (DC1 — DC4)

To use control codes, the machine to be controlled must be able to discriminate codes DC1 through DC4. Codes DC1 — DC4 are as follows.

Table 14.2 DC1 TO DC4 Code and Character

Character		8	7	6	5	4	Feed Hole	3	2	1
DC1	**Tape reader start**				○					O
DC2	Tape reader punching				o				0	
DC3	Tape reader stop	○			0				○	○
DC4	**Tape reader release**				○			'o		

(3) TRANSMISSION BAUD RATE

Transmission Baud rates can be selected with parameters.

(4) CABLE LENGTH

The permissible maximum cable length varies with the machine to be controlled. Refer to the manual of the machine builder's manual. (Standard maximum cable length is 15m.)

(5) INTERCONNECTION

Table 14.3 RS-232 C Interface Connecting Cable (A)

Nc (DB-25P)			Connections	External Equipment
Symbol	Signal Name	Pin No.		Symbol
FG	Frame grounding	1	o — — — o	FG
SD	Sending data	2		SD
RD	Receiving data	3		RD
RS	Sending data	4		RS
Cs	Capable of sending	5		CS
DR	Data set ready	6		DR
SG	Signal grounding	7	0 — o	SG
ER	Data terminal ready	20		IO BUSY
				ER

NC output control codes DC1 – DC4 to start and stop the machine, but the machine can not output control codes to control the NC. However, when the machine under control is unable to process data in time, it can control the CS signals of the NC to halt the data outputting of the NC.

When CS signals of the NC are not used, short CS and RS as shown below.

Table 14.4 RS-232 C Interface Connecting Cable (B)

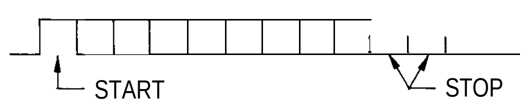
NC (DB-25P)			Connections	External Equipment
Symbol	Signal Name	Pin No.		Symbol
FG	Frame grounding	1		FG
SD	Sending data	2		SD
RD	Receiving data	3		RD
RS	Sending data	4		RS
CS	Capable of sending	5		CS
DR	Data set ready	6		DR
SG	Signal grounding	7		SG
ER	Data terminal ready	20		
				ER (OR ALARM)

.Description of signals

FG : Safety grounding

SD: Transmission data (output)

RD: Received data (input)



RS : Request for sending (output) -When sending data, NC is turned on when starting transmission, and turned off when transmission ends.

CS : For sending (input) -When this input signal is on, NC can send data. If the machine under control is unable to process data in time, it can turn off this signal to interrupt the transmission of data from NC within 2 characters. When this signal is not used, connect lines as shown in Table 14.4.

SG : Signal grounding.

ER : Data terminal ready-Use this signal as a tape rewinding signal if a tape reader is connected to an RS-232C interface. The tape reader can be rewound if this signal is ON,

NOTE

Among the RS-232C interface signals, the following are normally not used by the NC,

DR : Data set ready

ER : Data terminal ready

CD : Data receiving carrier detection

However, when “1” is set for parameter CHKDR (# 6021 D4), a DR (data set ready) interlock is added,

(6) SIGNAL EXCHANGE TIMING

• When NC receives.

Data can be received in the following sequence and timing.

(a) NC sends code DC1.

(b) At code DC1, the machine under control starts to send data to NC.

(c) If the NC can not process data in time, it sends out code-DC3.

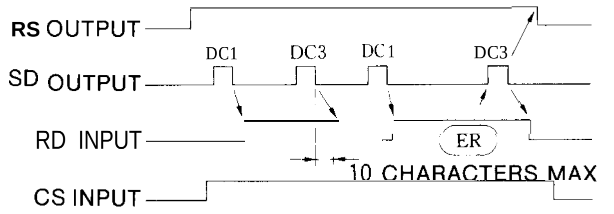
(d) At code DC3, the machine stops sending data within 10 characters.

(e) NC again sends code DC1 after processing data.

(f) At code DC1, the machine sends out the data that follows the previously sent one.

(g) Upon reading in the data, NC sends out code DC3.

(h) The machine stops sending data,



• When NC sends out data

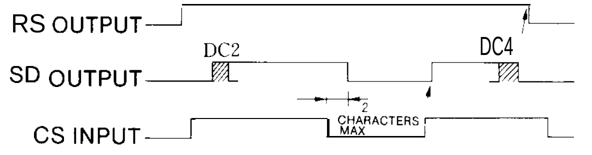
NC sends out data in the following sequence and timing.

(a) NC sends out code DC2, and subsequently sends out data.

(b) If the machine under control can not process the data in time. NC stops CS at no 10 BUSY signal.

(c) Upon completion of the data processing by the machine, NC turns on CS. NC sends out data that succeeds the previous one.

(d) Upon completion of data sending, NC sends out code DC4.



15 CONNECTION TO MANUAL PULSE GENERATOR

15.1 CONNECTION TO EACH UNIT

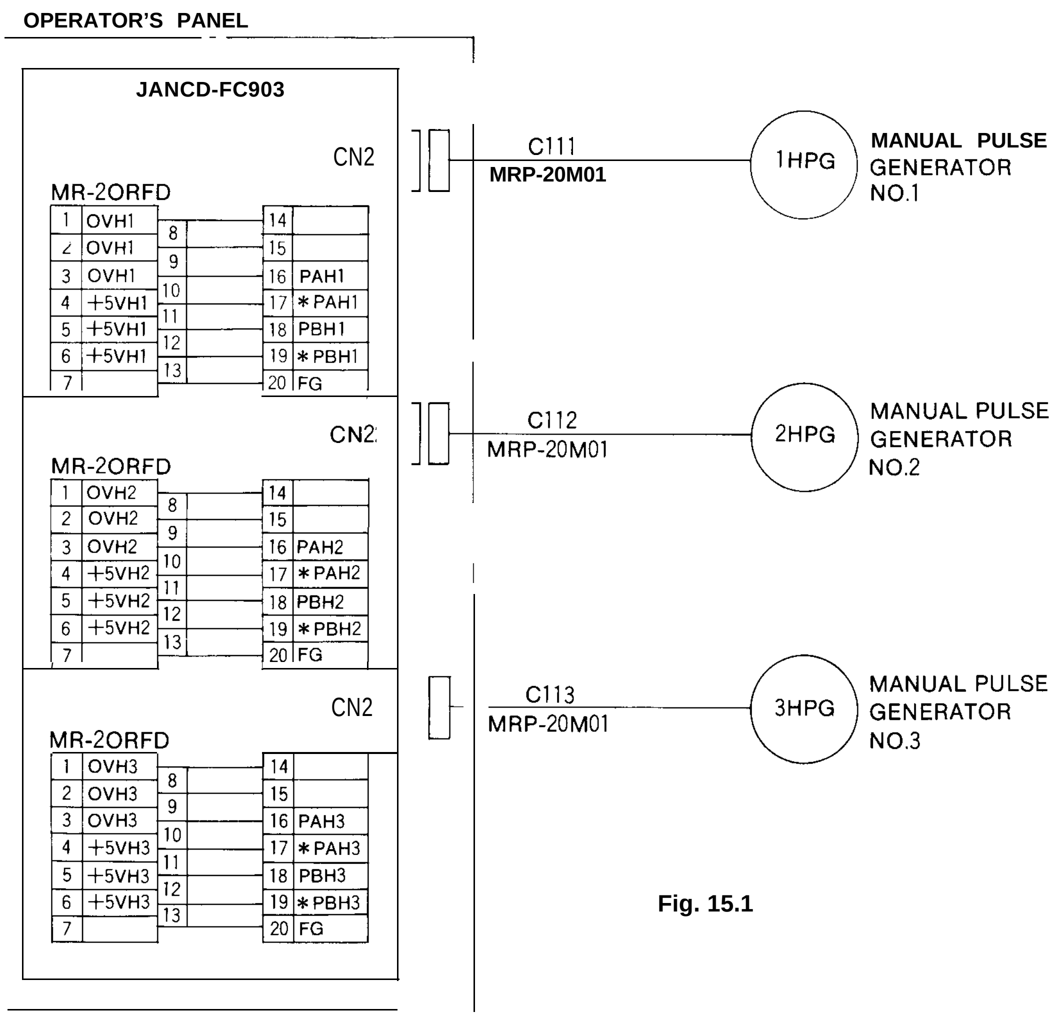


Fig. 15.1

15.2 DETAILS OF CONNECTION TO MANUAL PULSE GENERATOR

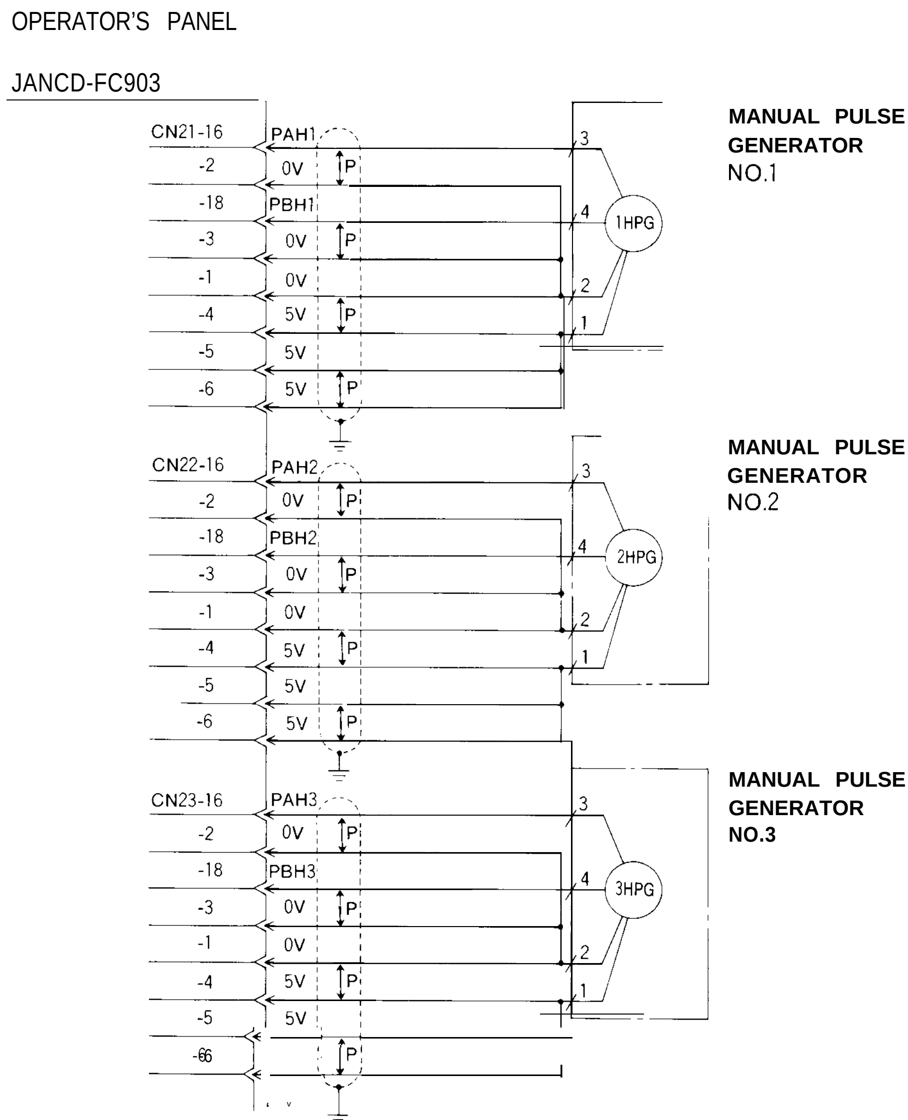


Fig. 15. 2

16 DIRECT-IN CONNECTION

16.1 CONNECTION TO EACH UNIT

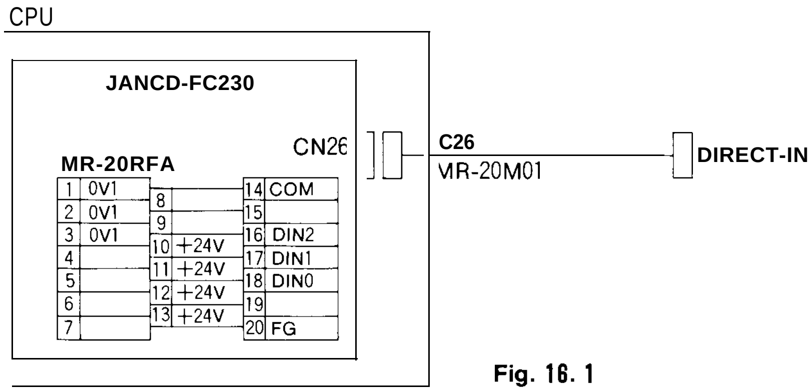
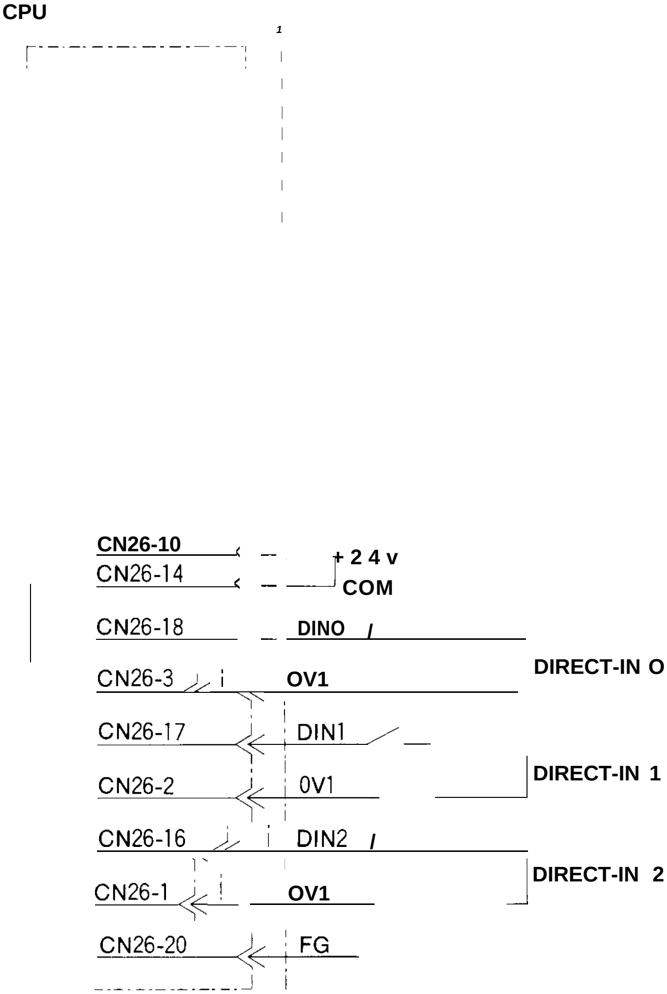


Fig. 16. 1

16.2 DETAILS OF DIRECT-IN CONNECTION

CPU



0V COMMON

Fig. 16.2 (a)

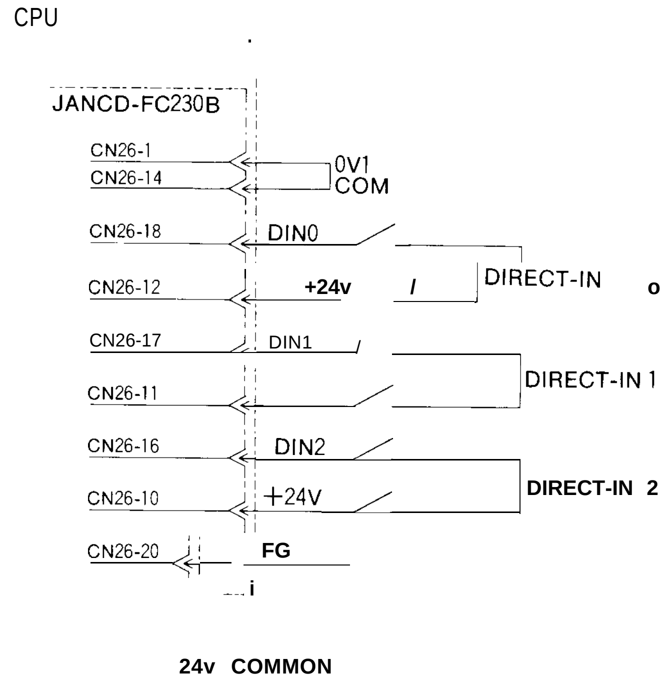


Fig. 16.2 (b)

16.3 DESCRIPTION OF SIGNALS

When direct-in signals require high-speed processing, they are input directly to the NC, instead of general-purpose I/O boards. Shown below is the time chart for the signals.

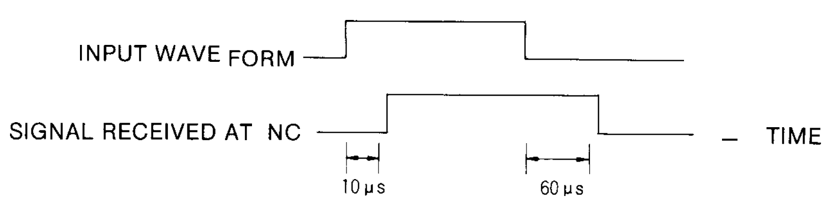


Fig. 16.3

Shown below is the input circuit.

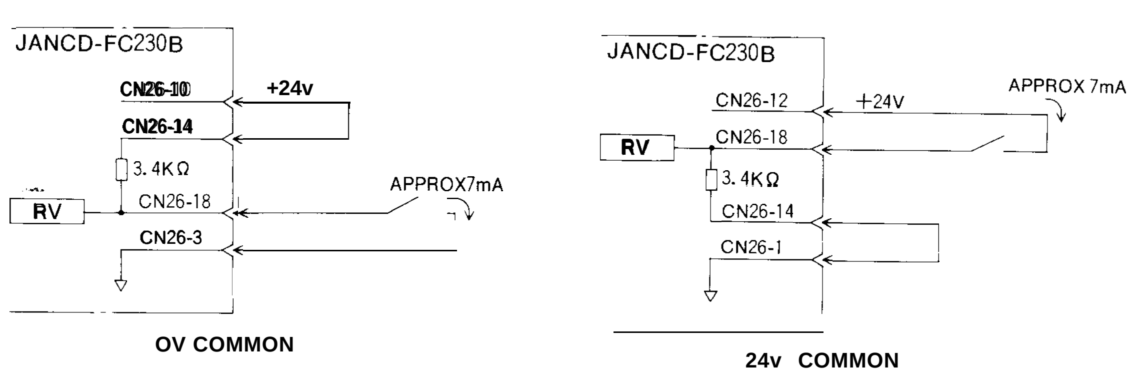


Fig. 16.4

17 CONNECTION TO REMOTE I/O

17.1 CONNECTION TO EACH UNIT

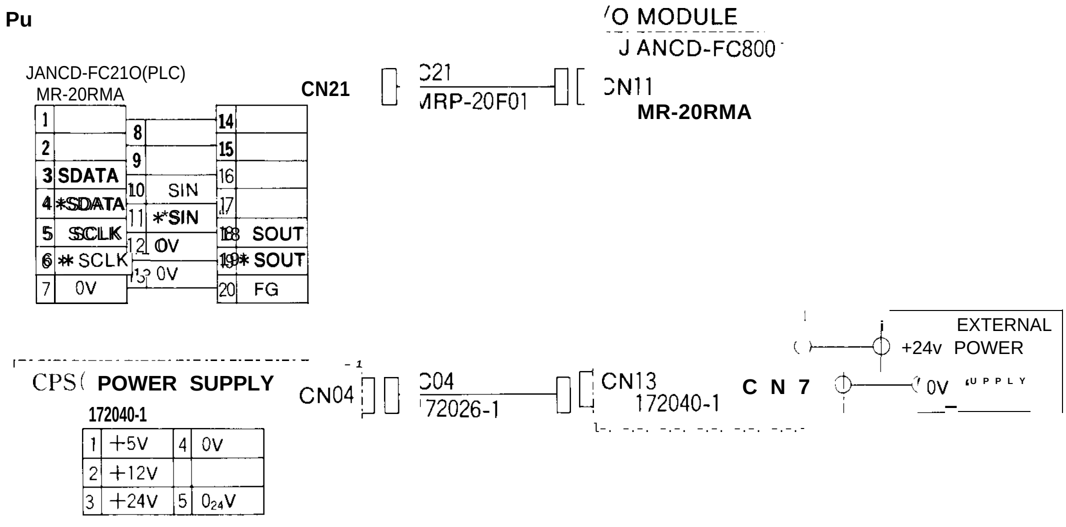


Fig. 17. 1

17.2 DETAILS OF CONNECTION TO REMOTE I/O

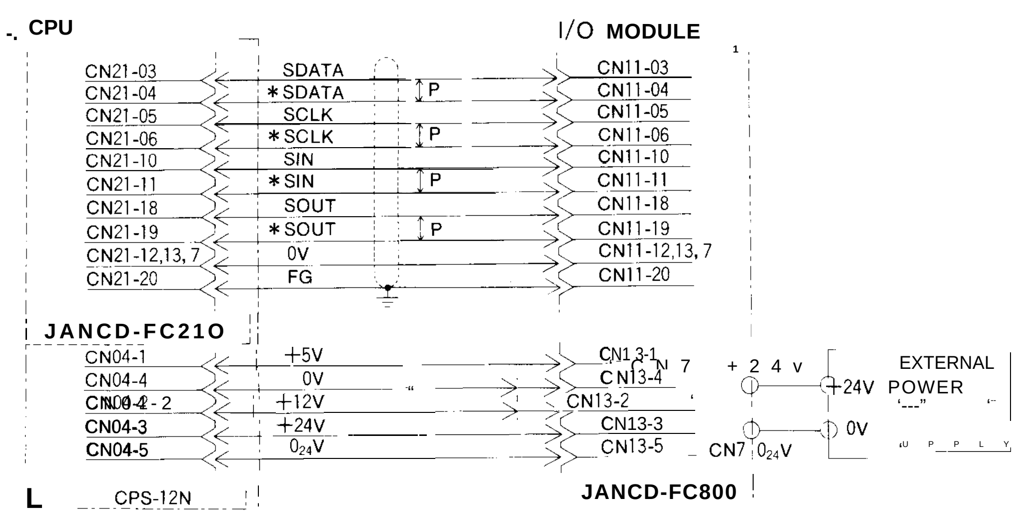


Fig. 17. 2

17.3 CONNECTION TO ADDITIONAL REMOTE I/O

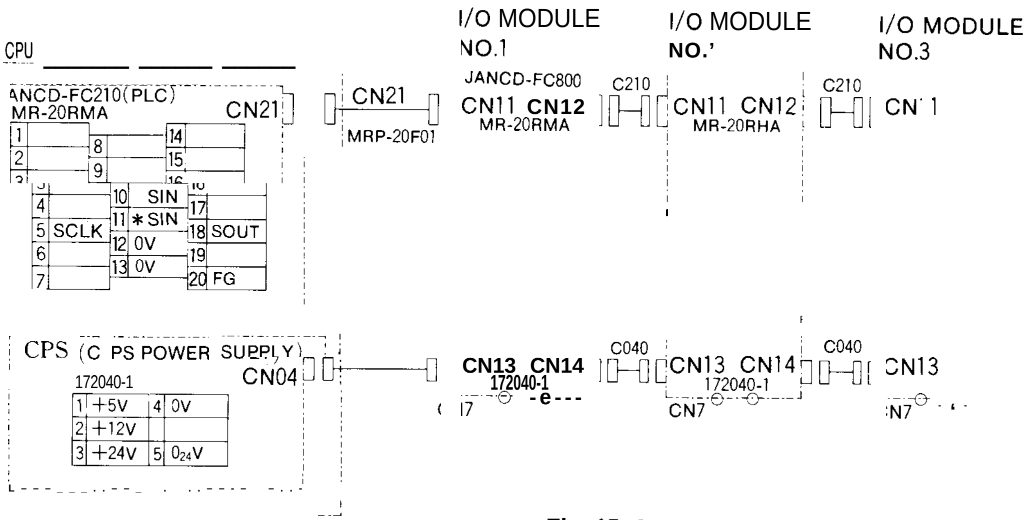


Fig. 17. 3

17.4 DETAILS OF CONNECTION OF ADDITIONAL REMOTE I/O

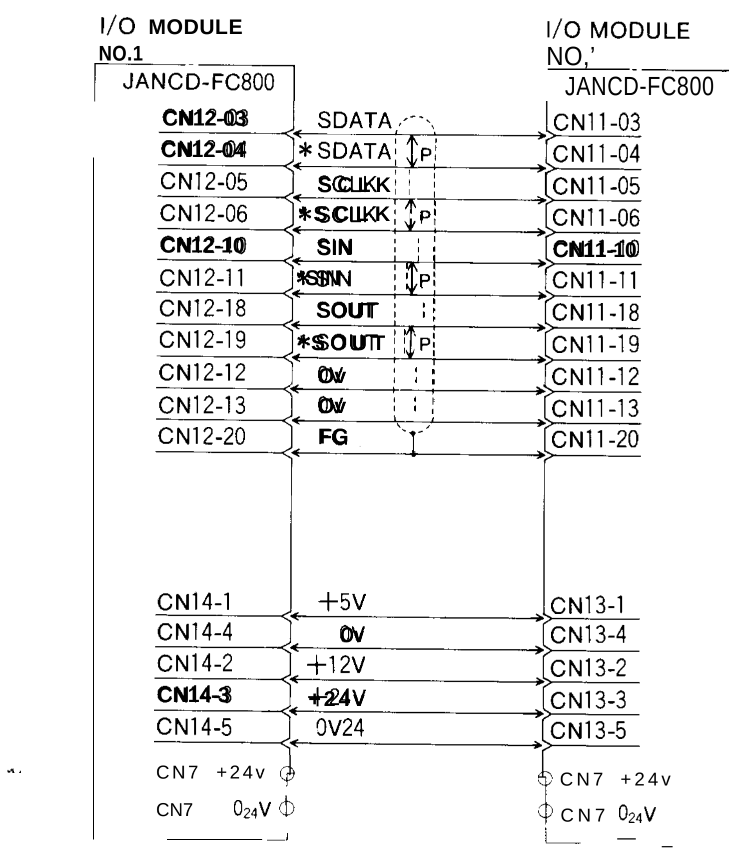
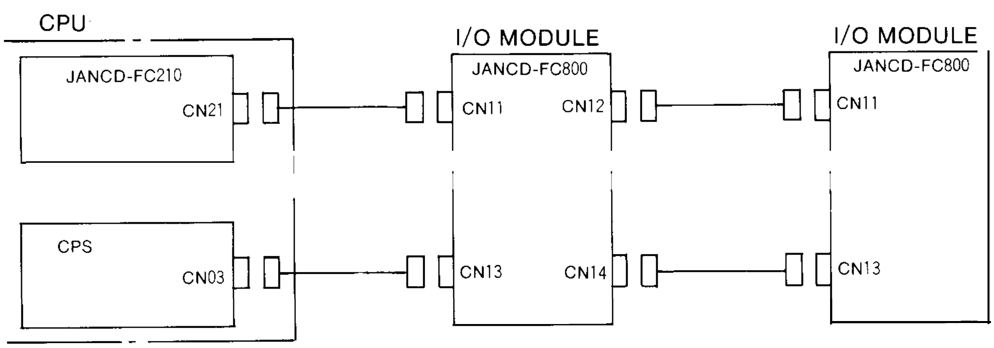
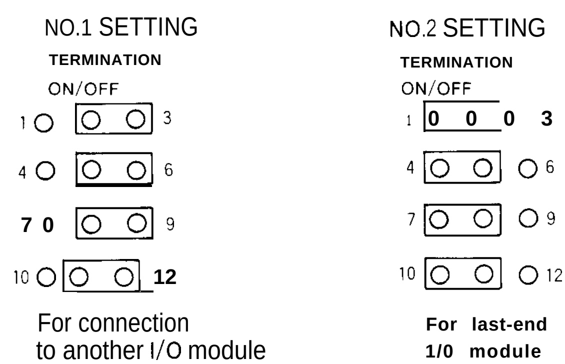


Fig. 17. 4

Note:

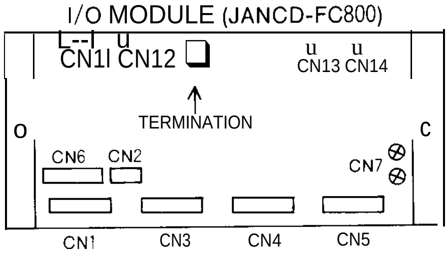
1. **Up to four remote I/O modules can be connected.**
2. **The last remote I/O module needs termination so that another module can be added.**





TERMINATION POSITION

I/O MODULE (JANCD-FC800)



3. The remote I/O module (JANCD-FC903) is terminated on internal circuit board. Therefore, if this module is the last-connected unit, the above setup need not be performed.

18 CONNECTION TO GENERAL-PURPOSE 1/0

18.1 CONNECTION TO EACH UNIT

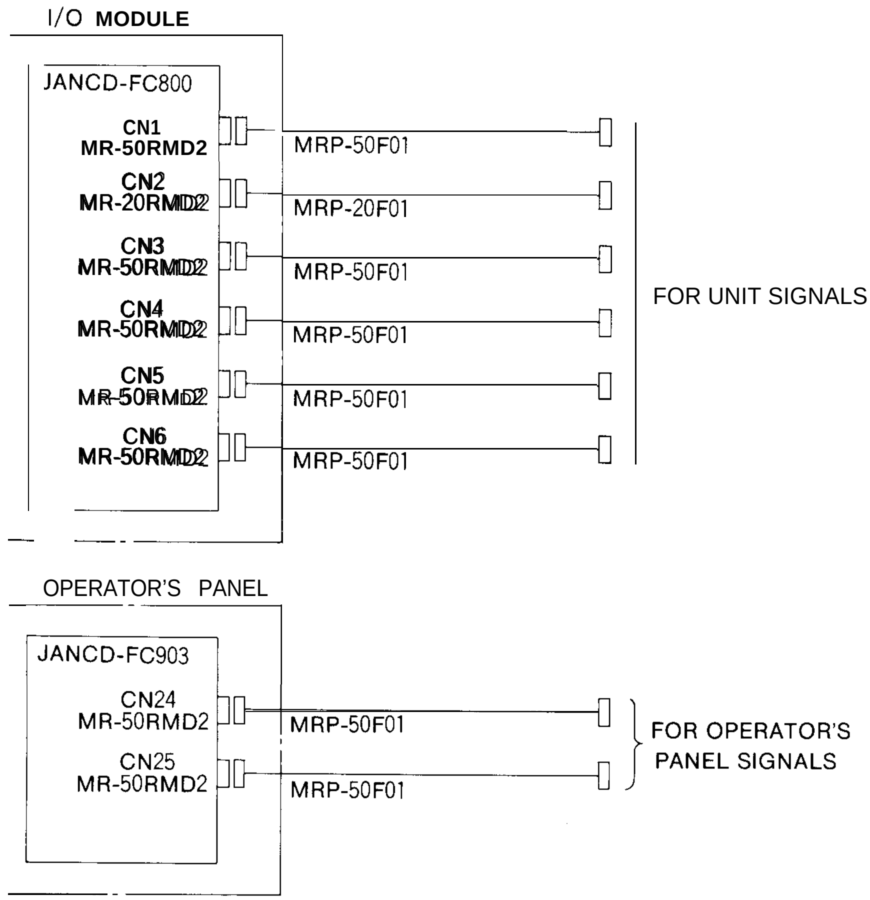
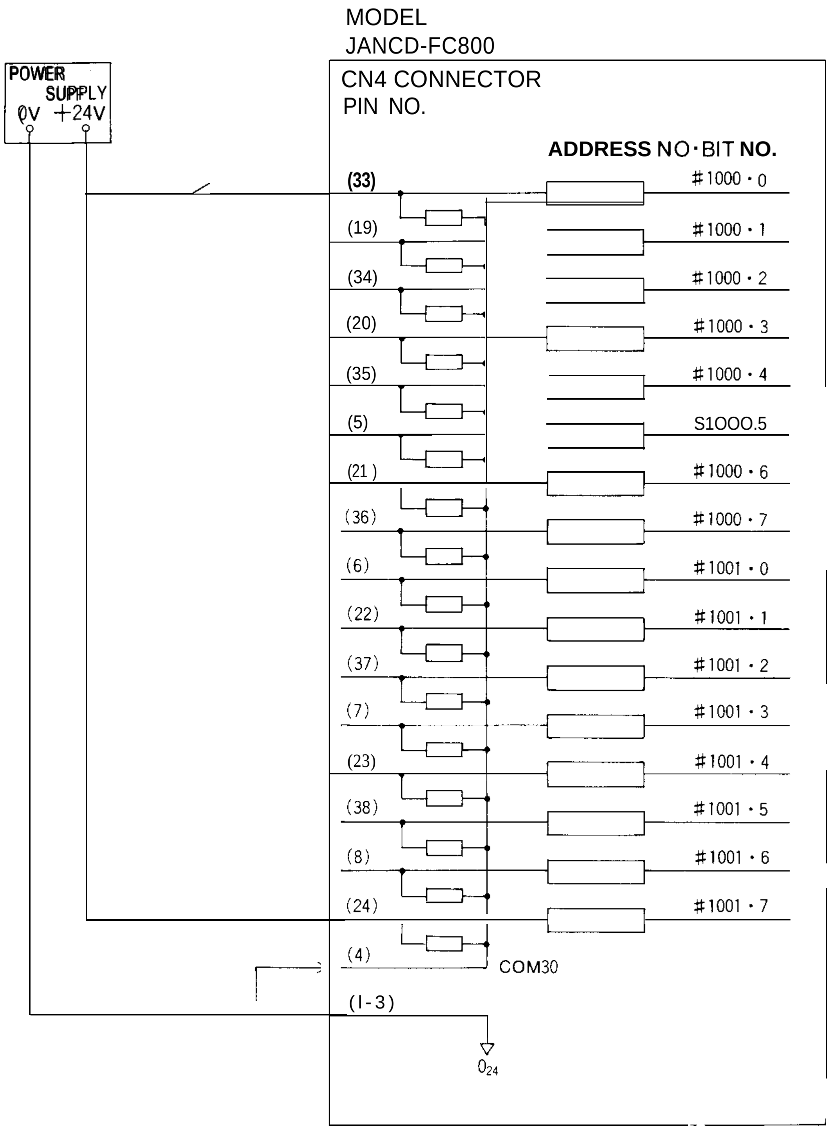


Fig. 18.1 Connection to Each Unit

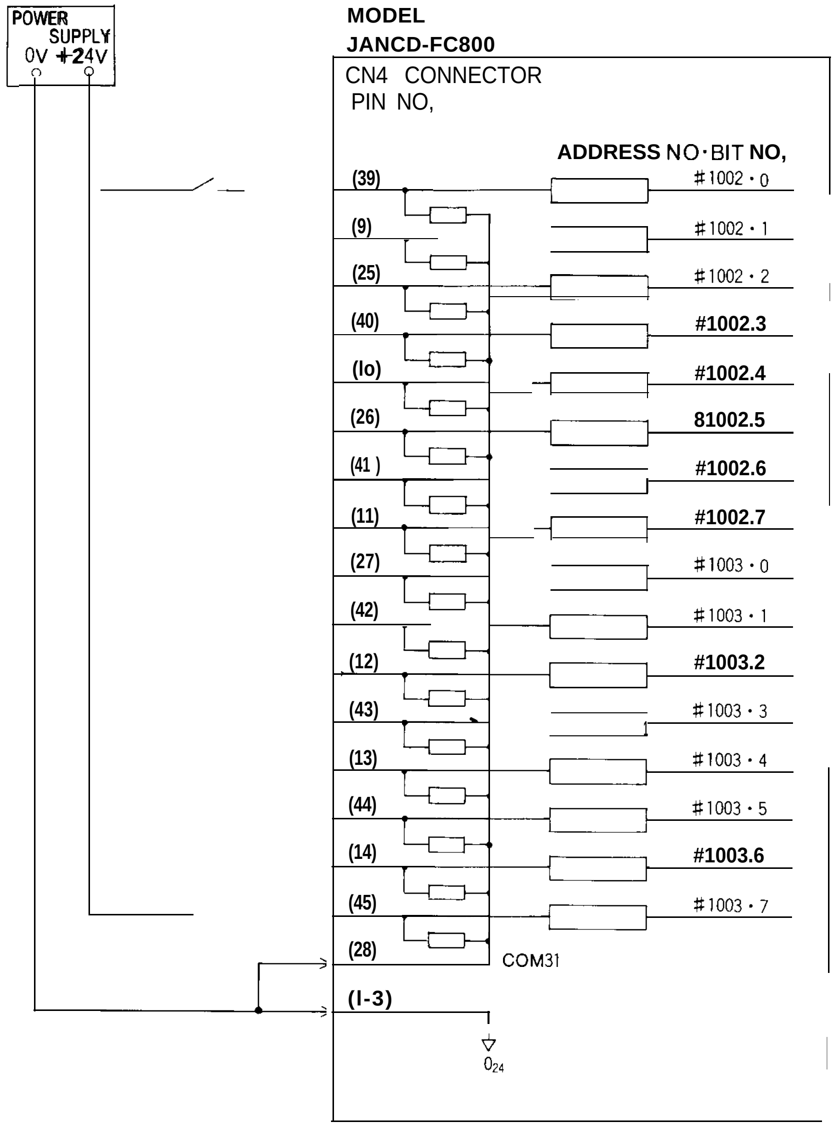
18.2 DETAILS OF CONNECTION TO GENERAL-PURPOSE 1/0

18.2.1 1/0 MODULE



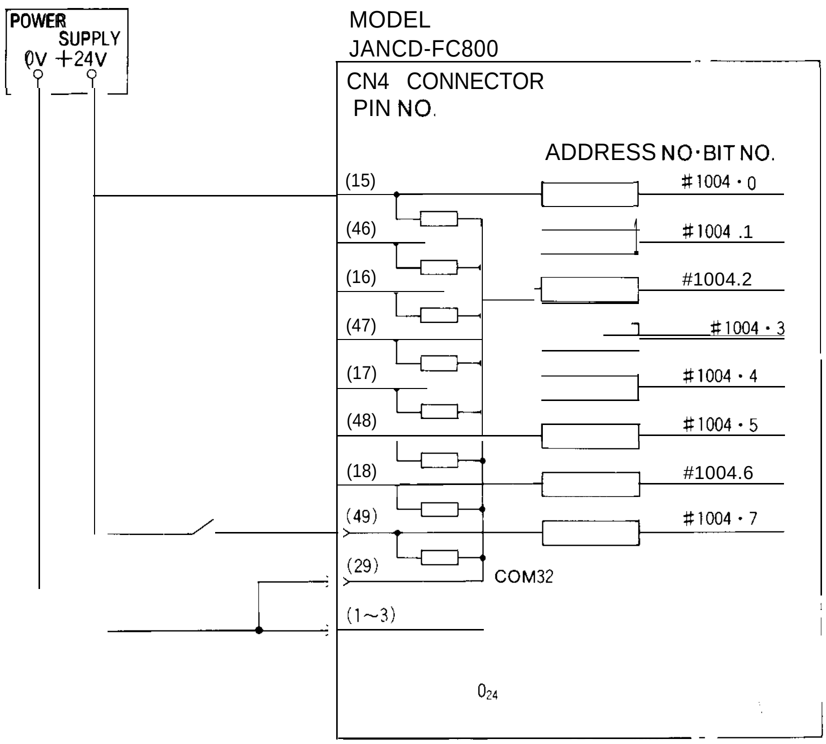
Note:
1. This connection example shows +24 V common.
   O V common is also available. Refer to par.18.3.1, I/O Board for connection details.
2. The addresses are those for module No. 1. (# 1000.0 to # 1001. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.2 Connection to Address and Bit Nos. #1000. O to #1001.7 on FC800 Board



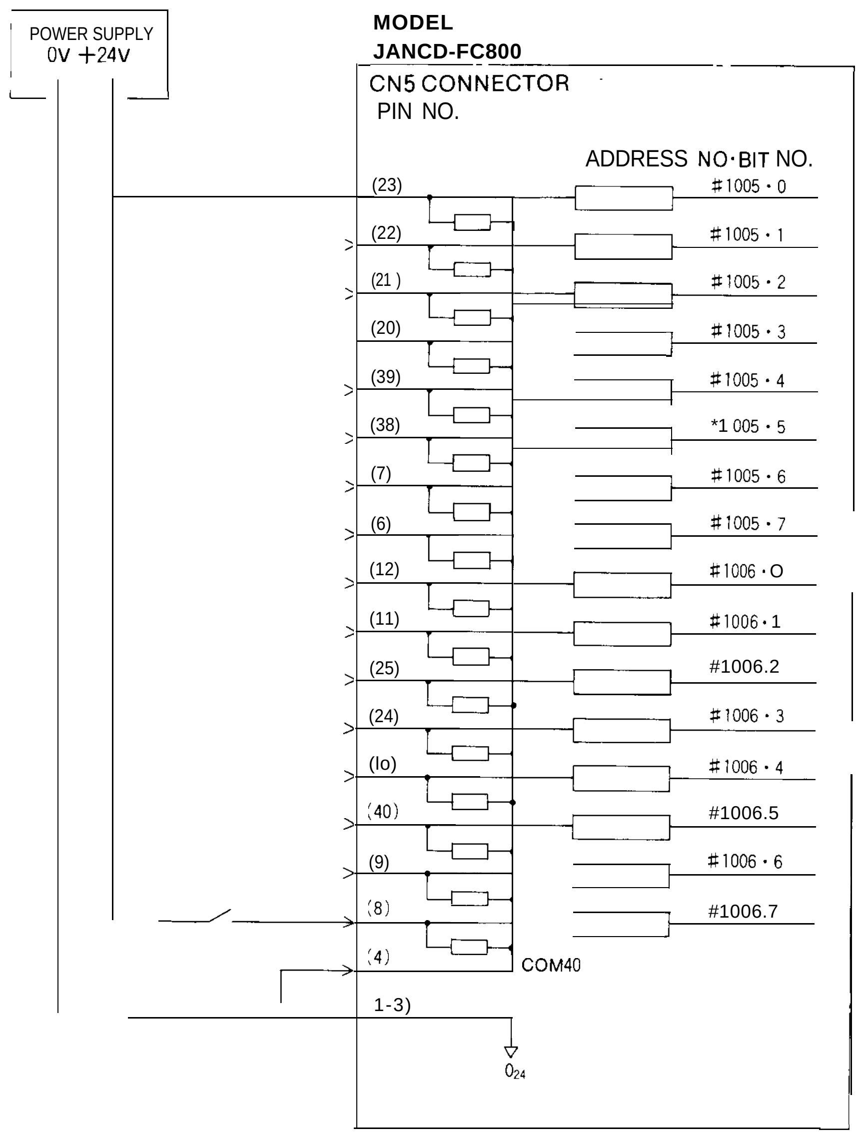
Note'
1. This connection example shows +24 V common.
   O V common is also available. Refer to par.18.3.1, I/O Board for connection details.
2. The addresses are those for module No. 1. (# 1002.0 to # 1003.7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses

Fig. 18.3 Connection to Address and Bit Nos. # 1002.0 to # 1003.7 on FC800 Board



Note:
1. This connection example shows +24 V common.
   O V common is also available. Refer to par. 18.3.1, I/O Board for connection details.
2. The addresses are those for module No. 1. (# 1004.0 to # 1004.7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.4 Connection to Address and Bit Nos. # 1004.0 to # 1004.7 on FC800 Board

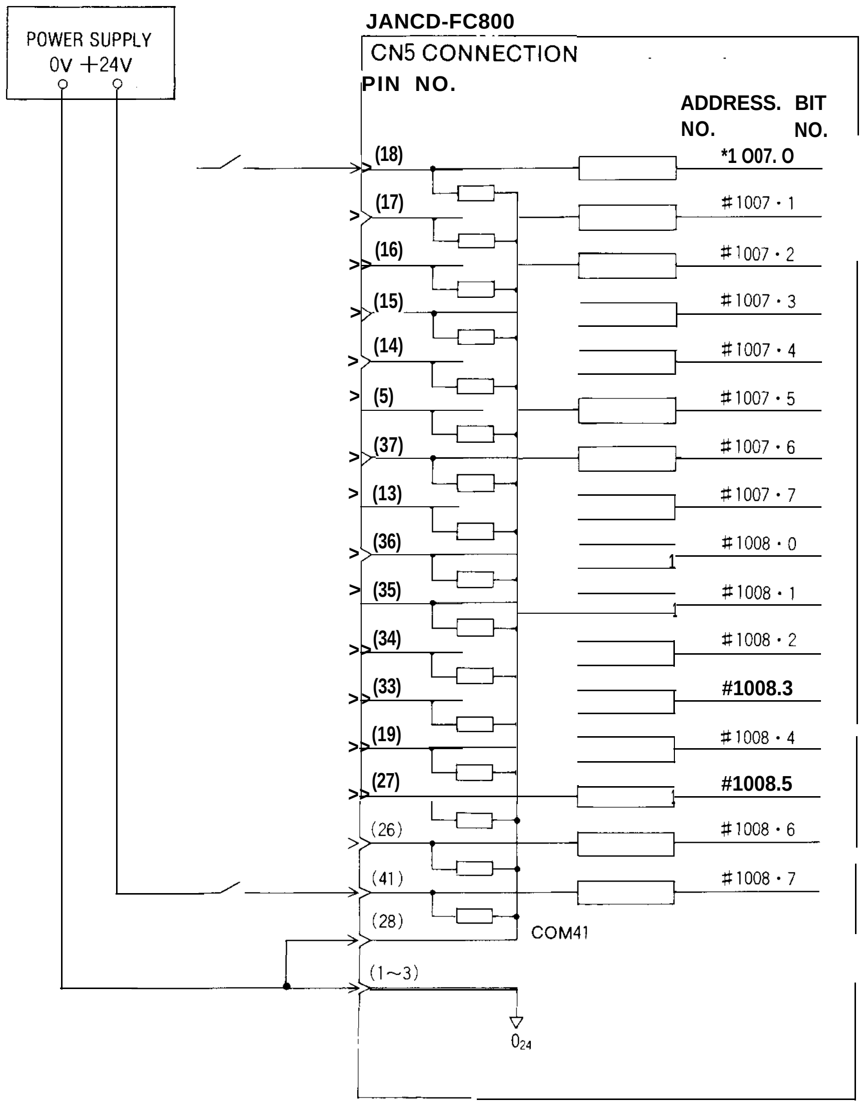


Note:

1 This connection example shows +24 V common.
  OV common is also available. Refer to par. 18.31, I/O Board for connection details.

2. The addresses are those for module No. 1 (#1005. O to #1006.7) The address layouts for module Nos. 2 to4 are the same as shown above starting with newer addresses.

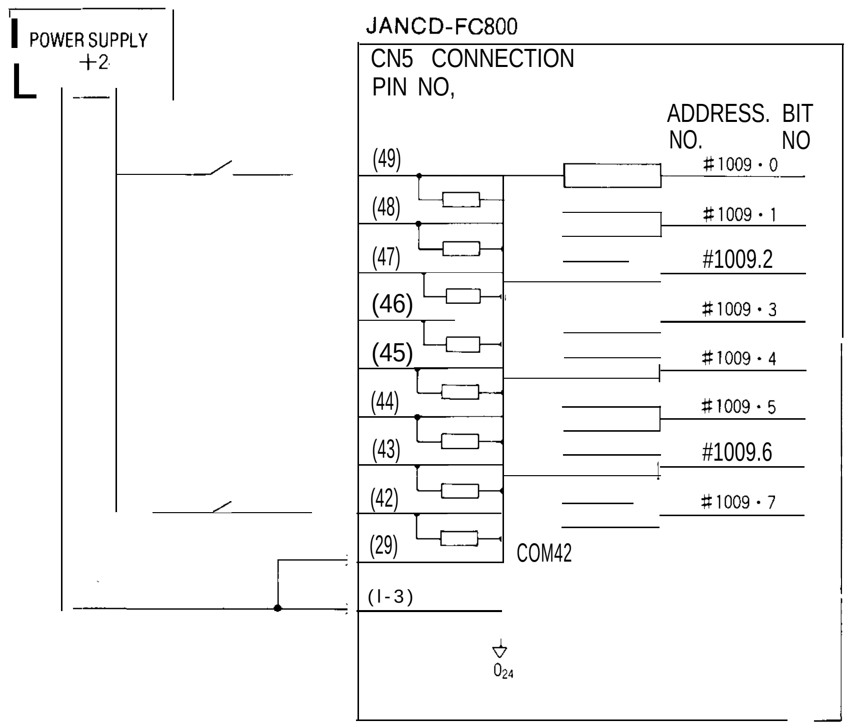
Fig. 18.5 Connection to Address and Bit Nos. # 1005.0 to # 1006.7 on FC800 Board



Note:

1. This connection example shows +24v common. O V common is also available. Refer to par.18. 3. 1, I/O Board Type JAN CD-FC800 for connection details.
2. The addresses are those for module No. 1, (# 1007.0 to # 1008.7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

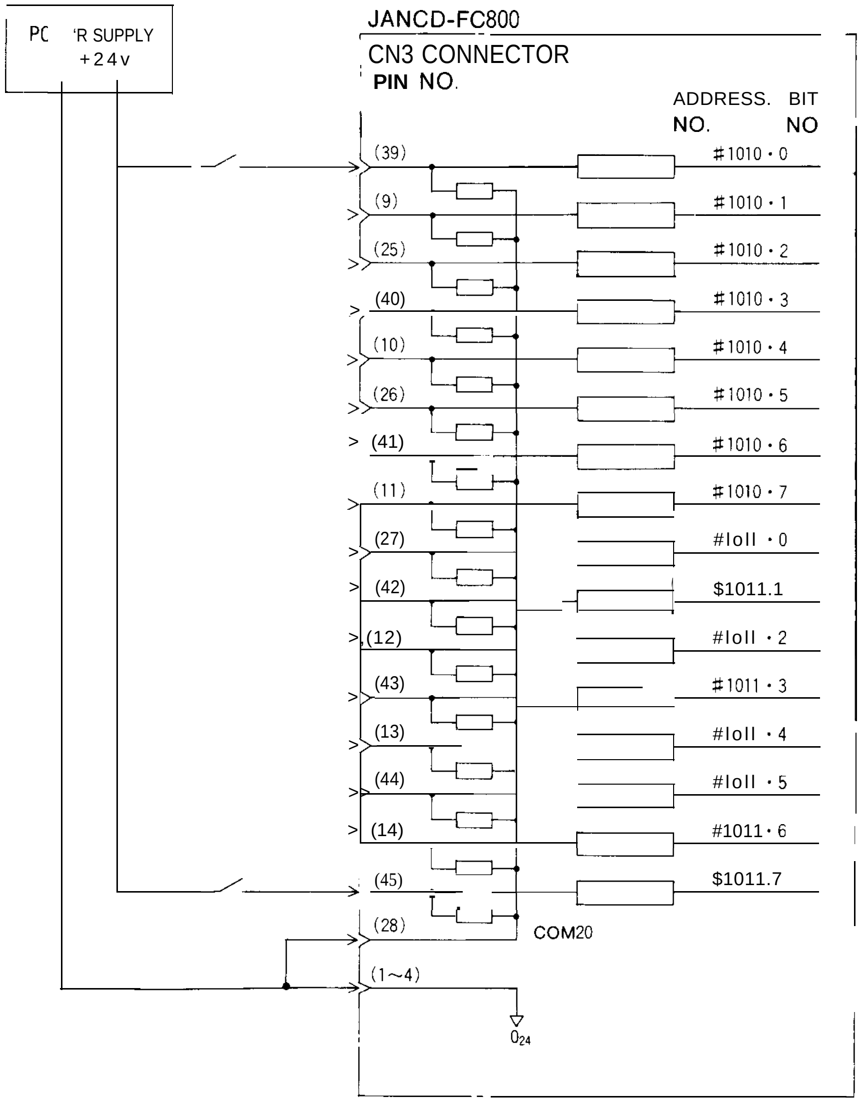
Fig. 18.6 Connection to Address and Bit Nos. # 1007.0 to # 1008.7 on FC800 Board



Note:

1. This connection example shows +24V common. O V common is also available. Refer to par.18. 3. 1, I/O Board Type JANCD-FC800 for connection details,
2. The addresses are those for module No. 1. (# 1009.0 to # 1009.7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses

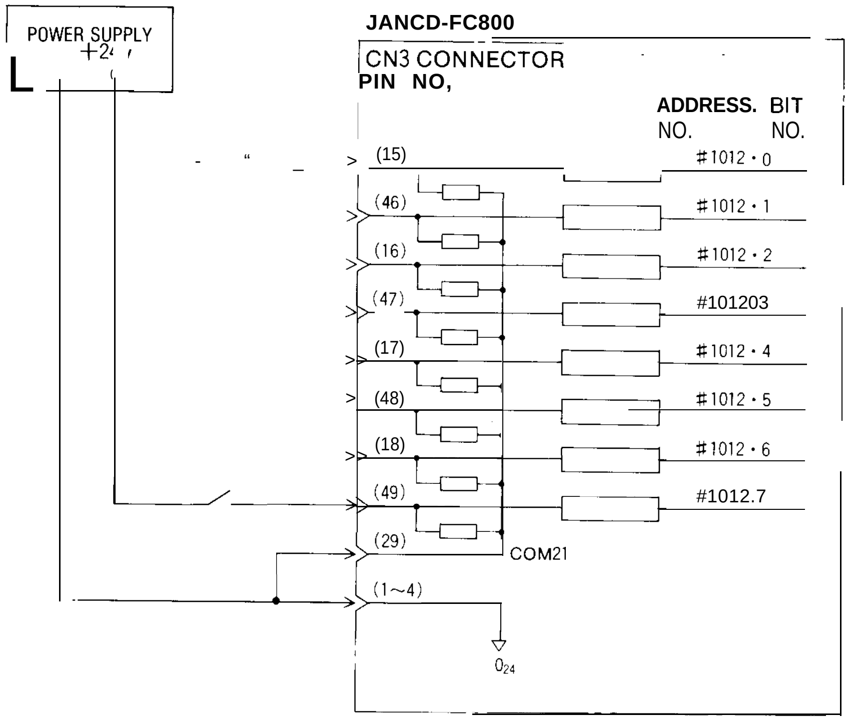
Fig. 18.7 Connection to Address and Bit Nos. #1009. O to # 1009.7 on FC800 Board



Note:

1. This connection example shows +24v common. O V common is also available. Refer to par.18. 3. 1, 1/0 Board Type JAN CD- FC800 for connection details.
2. The addresses are those for module No. 1. (# 1010.0 to # 1011. 7) The address layouts for module Nos. 2 to 4 are the same as shown above Starting with newer addresses

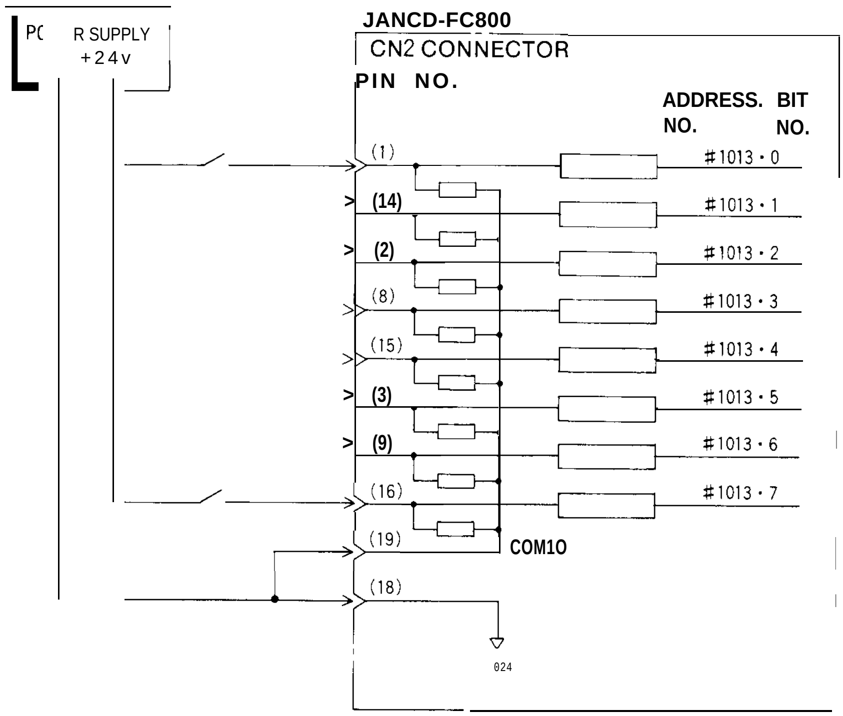
Fig. 18.8 Connection to Address and Bit Nos.
#1010.0 to #1011.7 on FC800 Board



Note:

1. This connection example shows +24V common OV common is also available. Refer to par.18.3.1, I/O Board Type JAN CD- FC800 for connection details,
2. The addresses are those for module No. 1. (# 1012.0 to # 1012. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

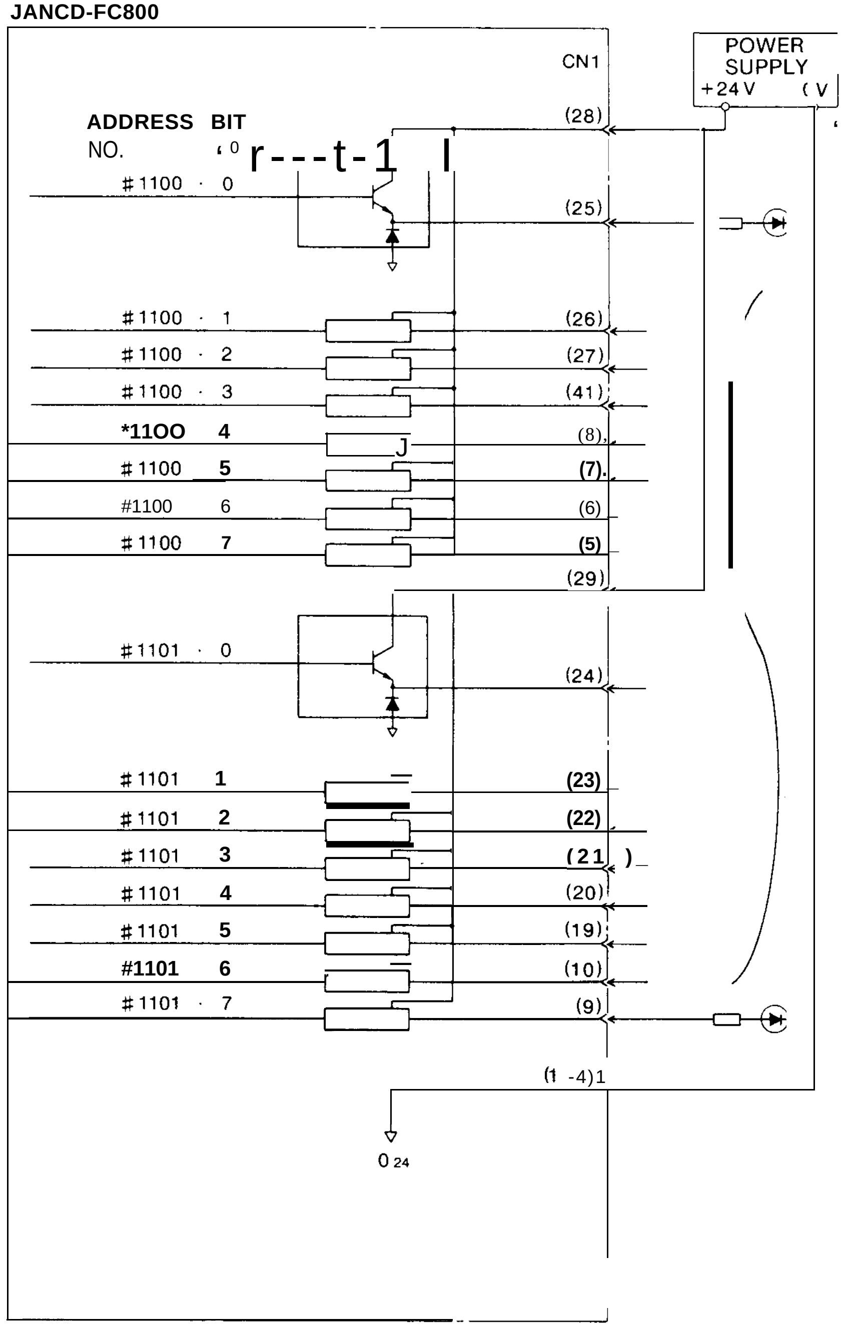
Fig. 18. 9 Connection to Address and Bit Nos. #1012. O to #1012.7 on FC800 Board



Note:

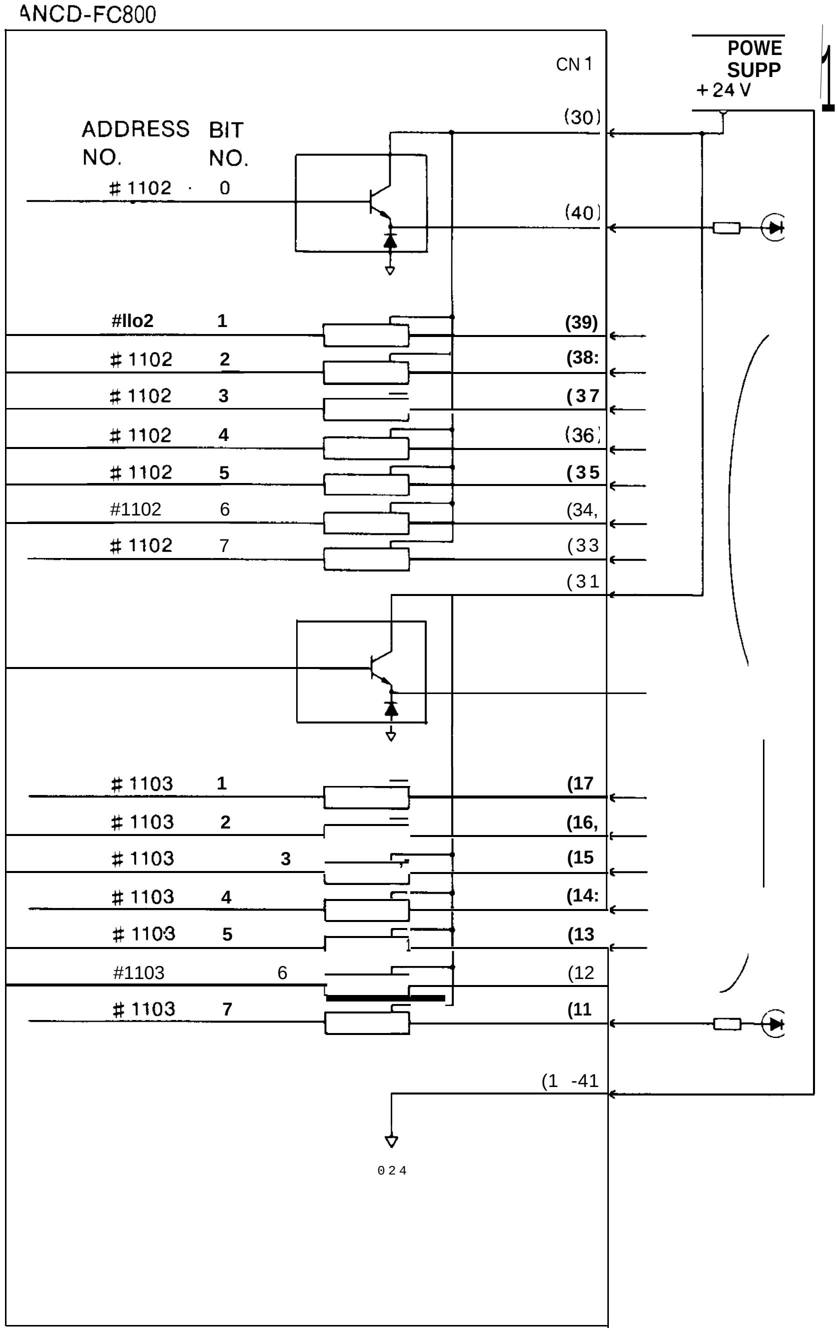
1. This connection example shows +24V common, O V common is also available. Refer to par.18. 3. 1, I/O Board Type JAN CD-FC800 for connection details,
2. The addresses are those for module No. 1. (# 1013.0 to # 1013. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.10 **Connection to Address and Bit Nos. #1013. O to #1013. 7 on FC800 Board**



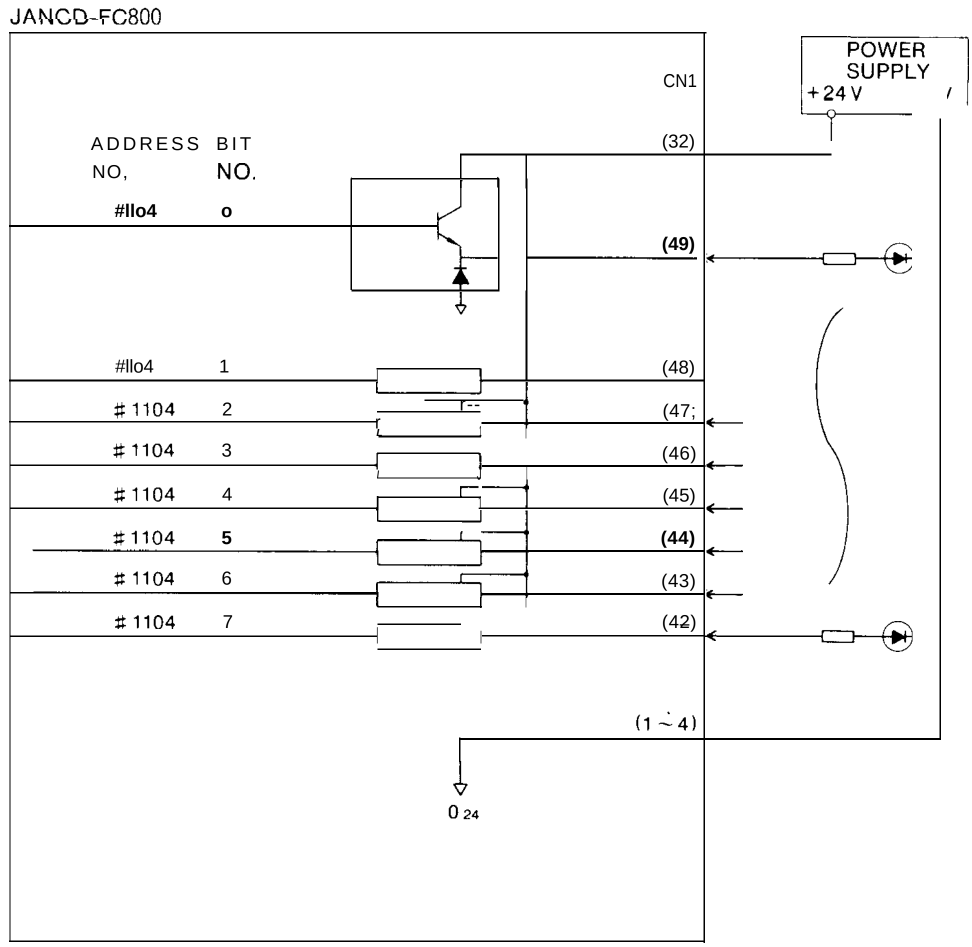
Note :
The addresses are those for module No. 1. (# 1100.0 to # 1101. 7) The address layouts for module Nos 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.11 Connection to Address and Bit Nos. #1100. 0 to #1101. 7 on FC800 Board



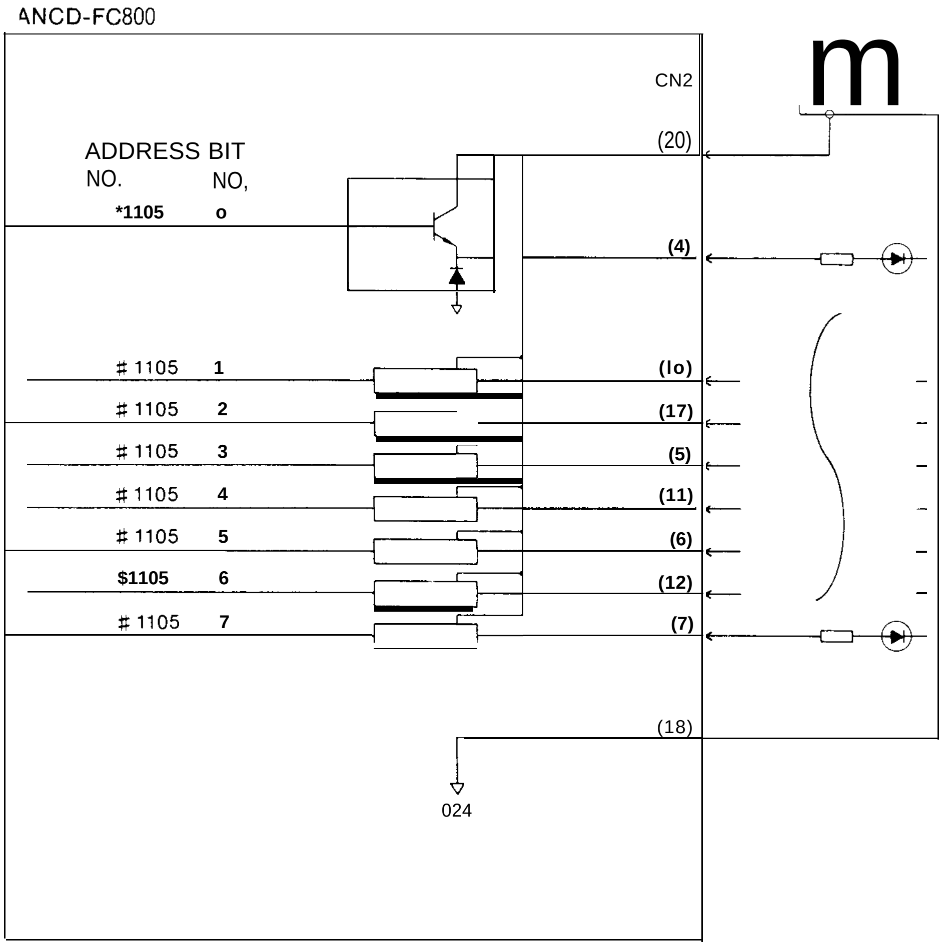
Note:
The addresses are those for module No. 1. (#1102. O to #1103.7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses

Fig. 18. 12 Connection to Address and Bit Nos. # 1102.0 to #1103.7 on FC800 Board



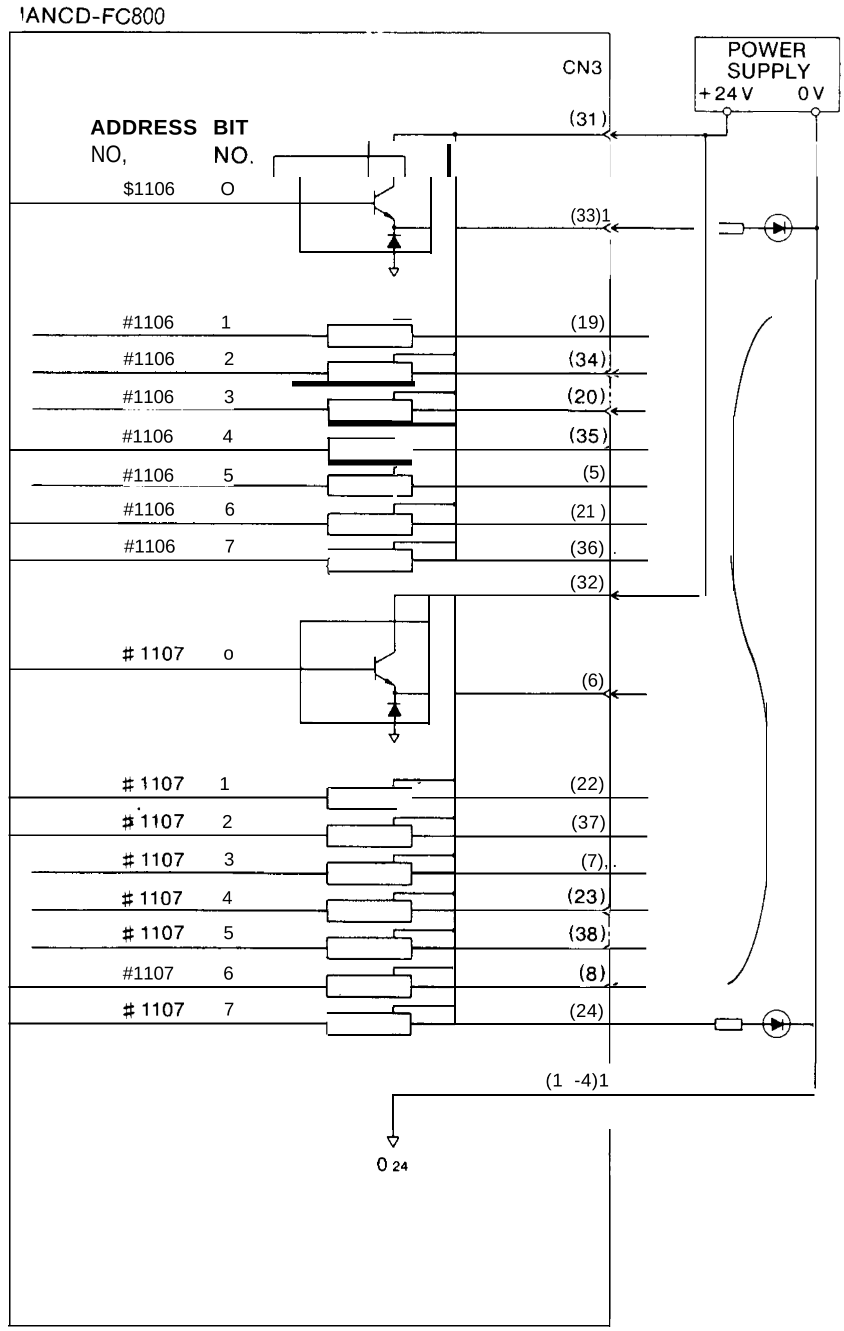
Note:
The addresses are those for module No. 1. (# 1104.0 to # 1104. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.13 Connection to Address and Bit Nos. #1104.0 to #111) 4.7 on FC800 Board



Note :
The addresses are those for module No 1. (# 1105.0 to # 1105. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses

Fig. 18.14 Connection to Address and Bit Nos. #1105.0 to #1105.7 on FC800 Board



Note:
The addresses are those for module No. 1. (# 1106.0 to # 1107. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.15 Connection to Address and Bit Nos. #1106. O to #1107. 7 on FC800 Board

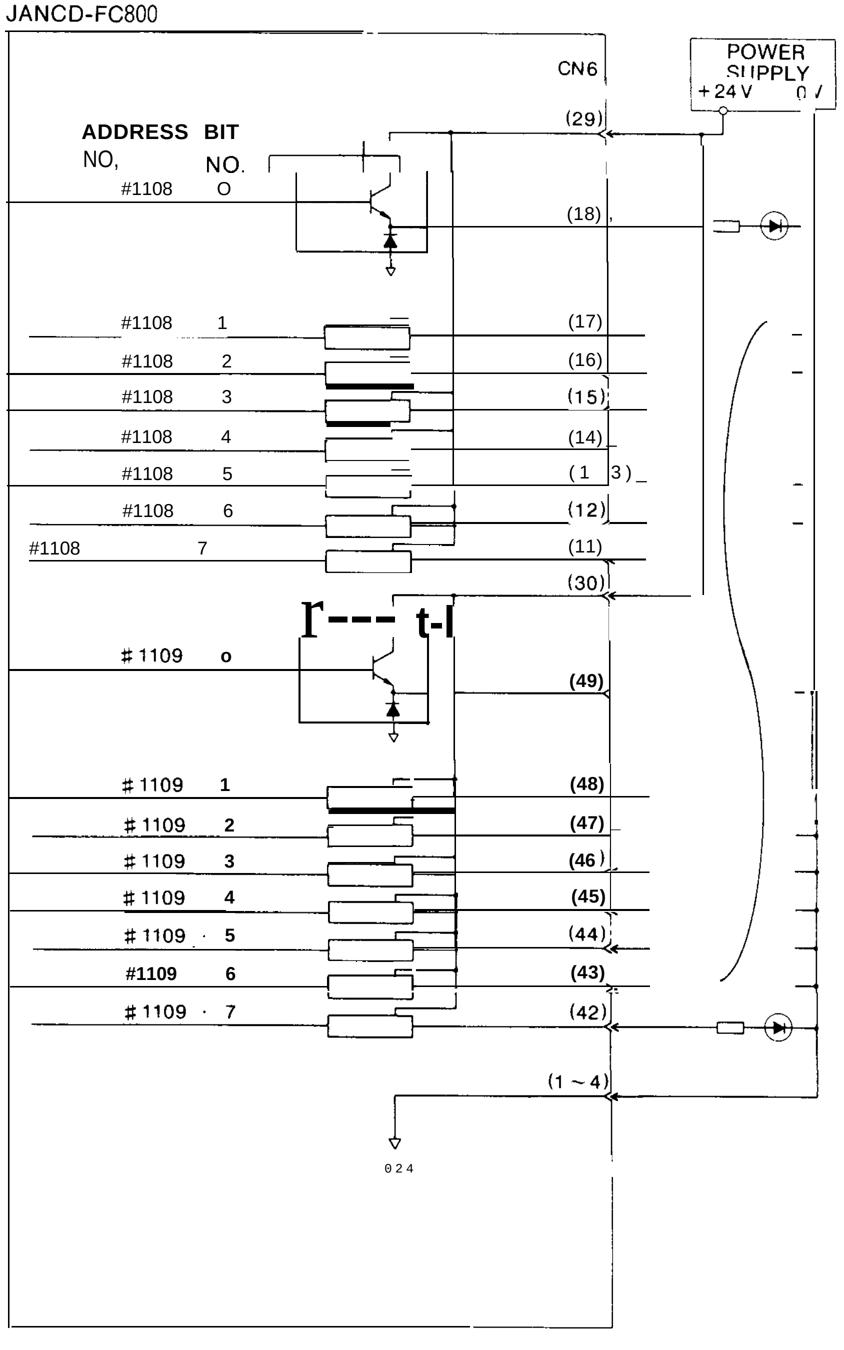


Fig. 18.16 Connection to Address and Bit Nos. #1108. O to #1109. 7 on FC800 Board

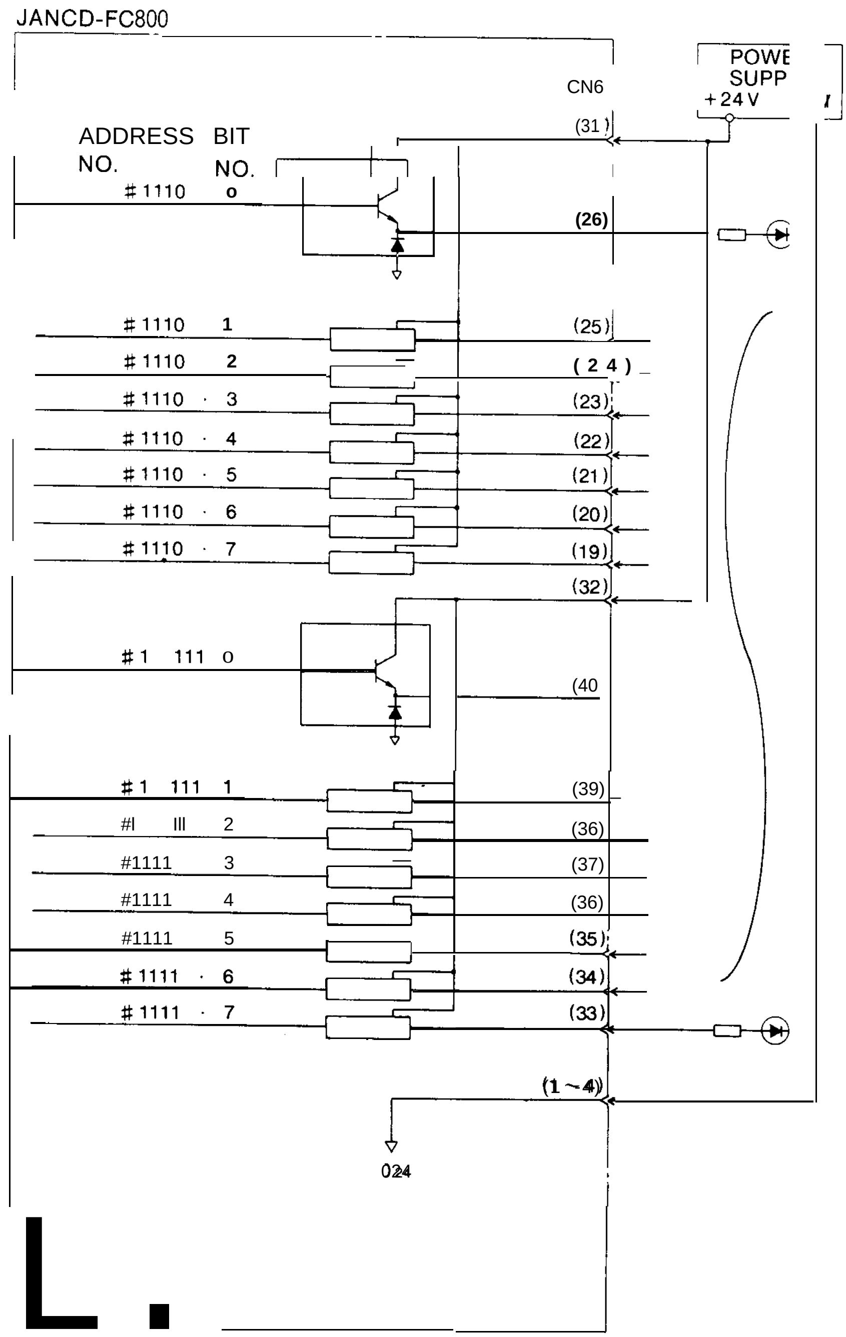
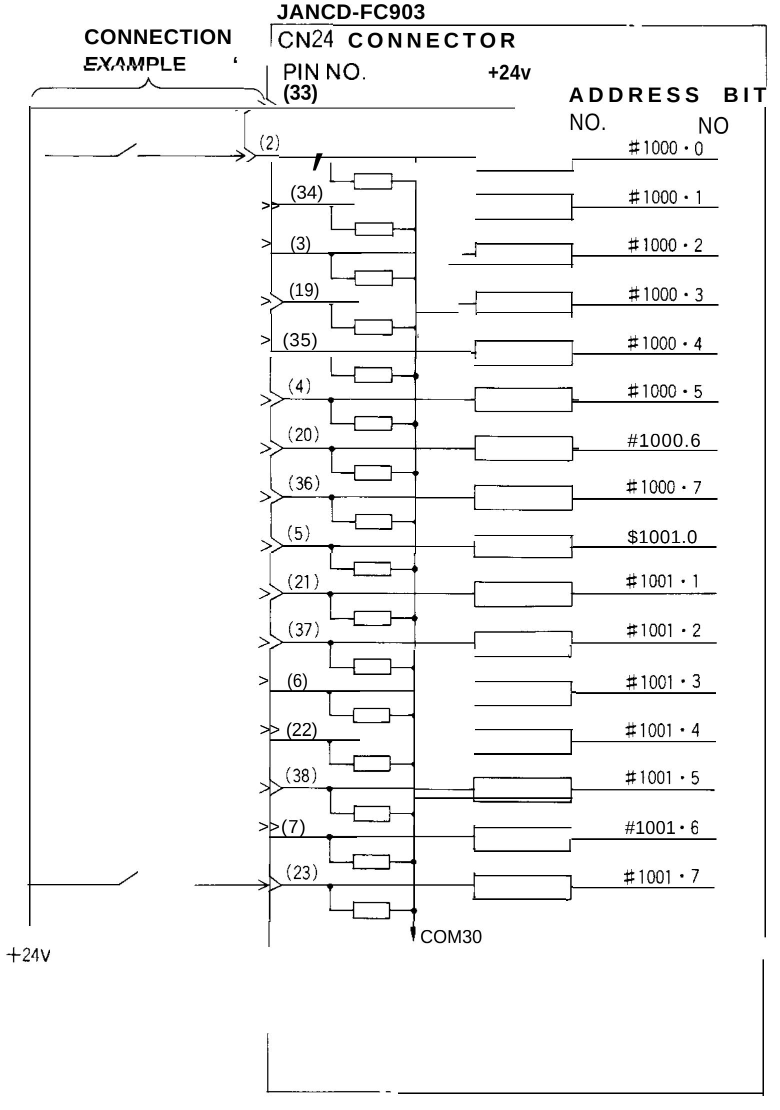


Fig. 18.17 Connection to Address and Bit Nos.
#1110.0 to #1111.7 on FC800 Board

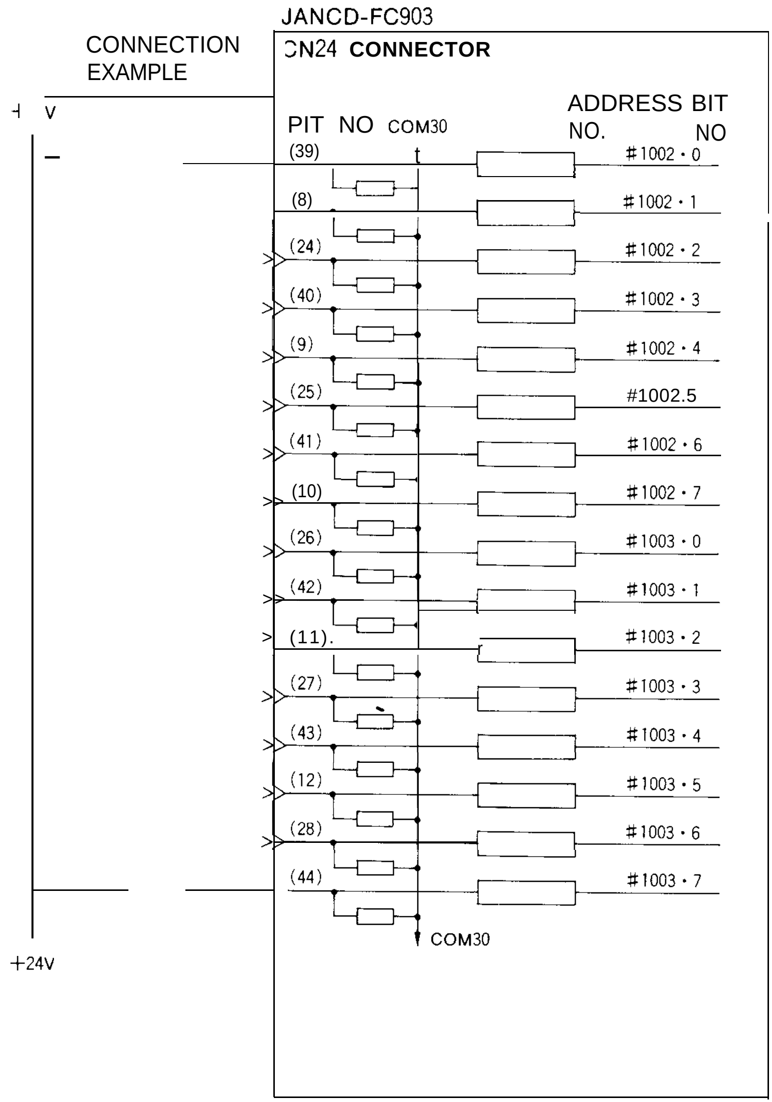
18.2.2 OPERATOR'S PANEL



Note:

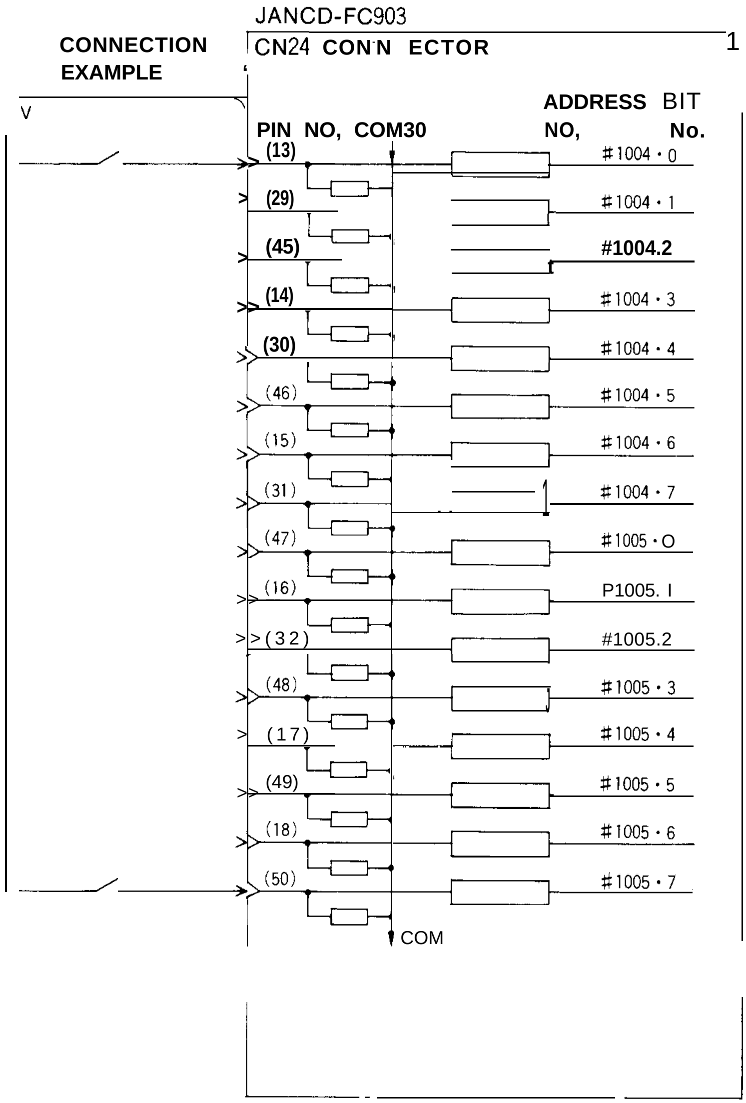
1. This connection example shows +24 V common. O V common is also available. Refer to par.18. 3. 1, I/O Board for connection details
2. The addresses are those for module No. 1. (# 1000.0 to # 1001. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses

Fig. 18.18 Connection to Address and Bit Nos. # 1000.0 to # 1001.7 on FC903 Board



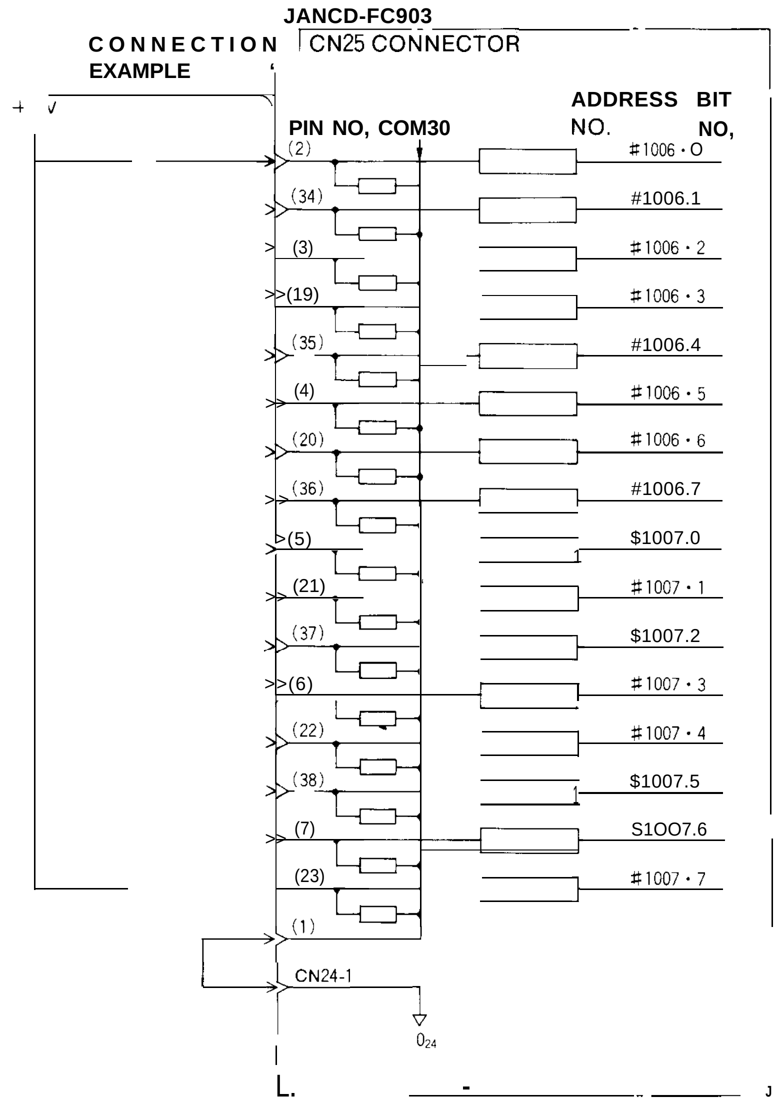
Note:
The addresses are those for module No. 1. (#1002. O to #1103.7) The address layouts for module Nos. 2 to4 are the same as shown above starting with newer addresses.

Fig. 18.19 Connection to Address and Bit Nos. # 1002.0 to # 1003.7 on FC903 Board



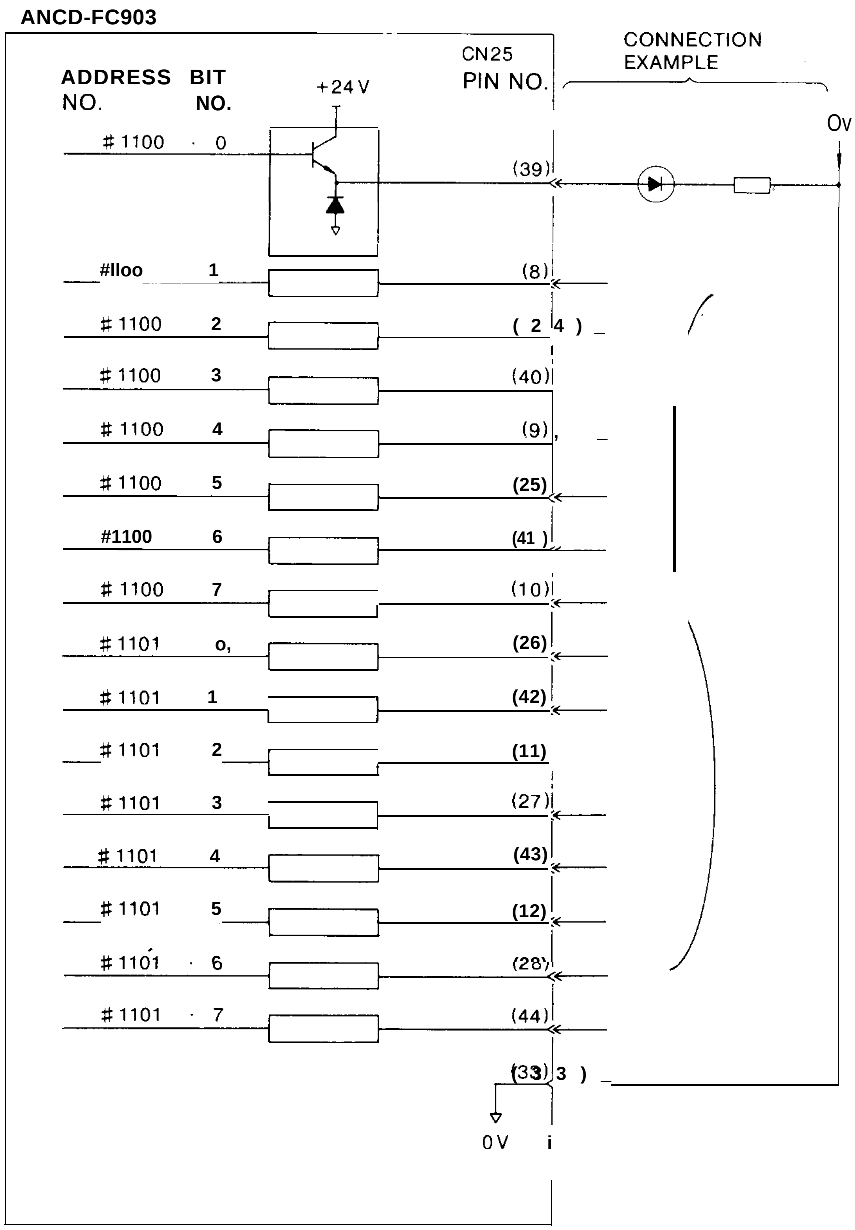
Note:
The addresses are those for module No. 1. (# 1004.0 to # 1005. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.20 Connection to Address and Bit Nos. # 1004.0 to # 1005.7 on FC903 Board



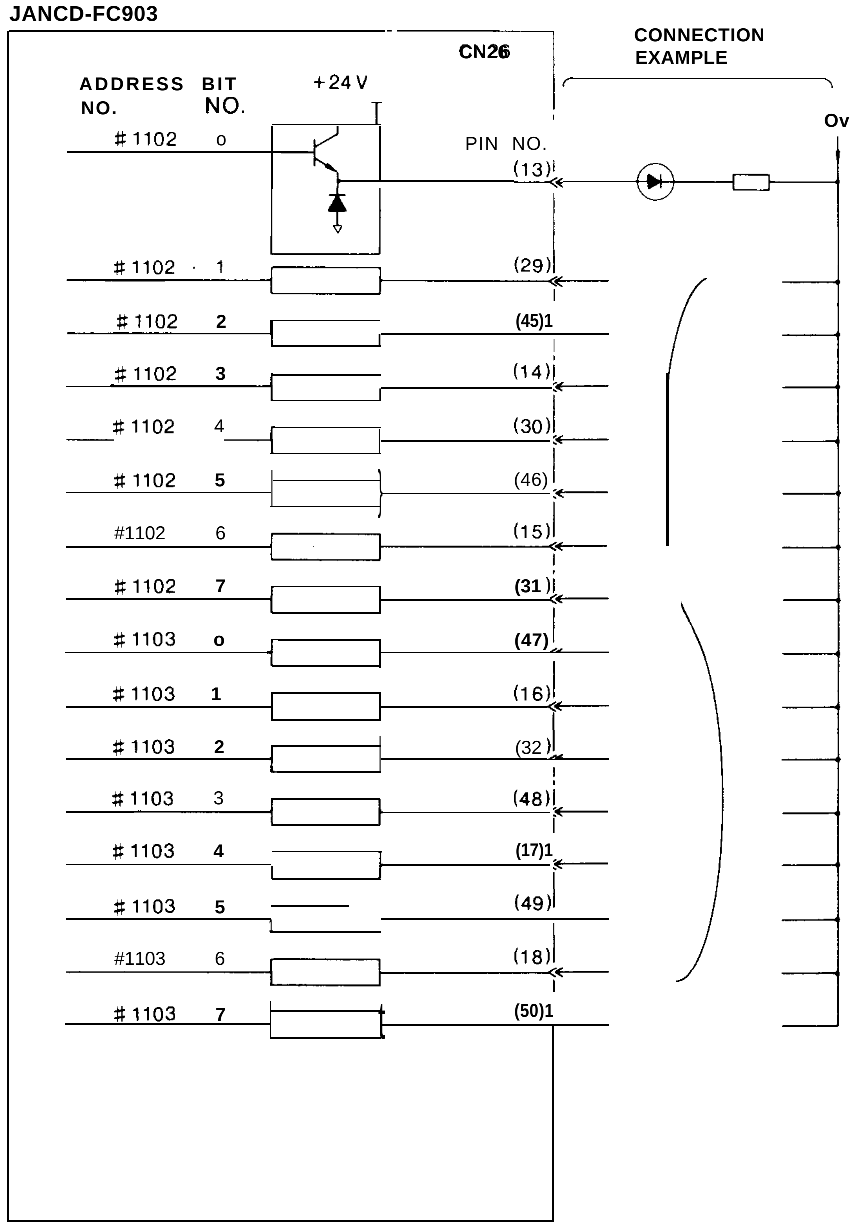
Note:
The addresses are those for module No, 1. (#1006. O to #1007.7) The address layouts for module Nos. 2 to4 are the same as shown above starting with newer addresses.

Fig. 18.21 Connection to Address and Bit Nos. # 1008.0 to # 1007.7 on FC903 Board



Note:
The addresses are those for module No. 1. (# 1100.0 to # 1101. 7) The address layouts for module Nos 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.22 Connection to Address and Bit Nos. #1100. 0 to #1101. 7 on FC903 Board



Note:
The addresses are those for module No. 1. (# 1102.0 to # 1103. 7) The address layouts for module Nos. 2 to 4 are the same as shown above starting with newer addresses.

Fig. 18.23 Connection to Address and Bit Nos. #1102.0 to #1103.7 on FC903 Board

18.3 GENERAL-PURPOSE 1/0 DESCRIPTIONS

The YASNAC system incorporates a mechanical sequencer. Therefore, when a machine tool manufacturer designs a built-in mechanical sequencer, external signal port and address setup can be performed as desired,

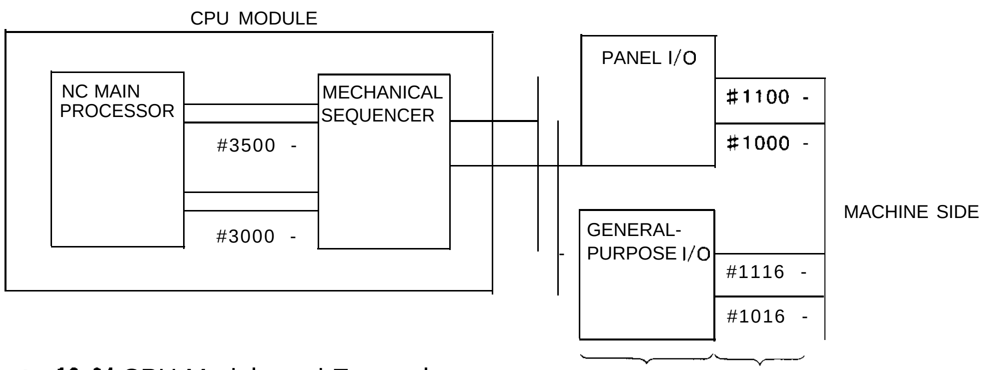


Fig. 18. 24 CPU Module and External **Signals**

(1) Port Setup

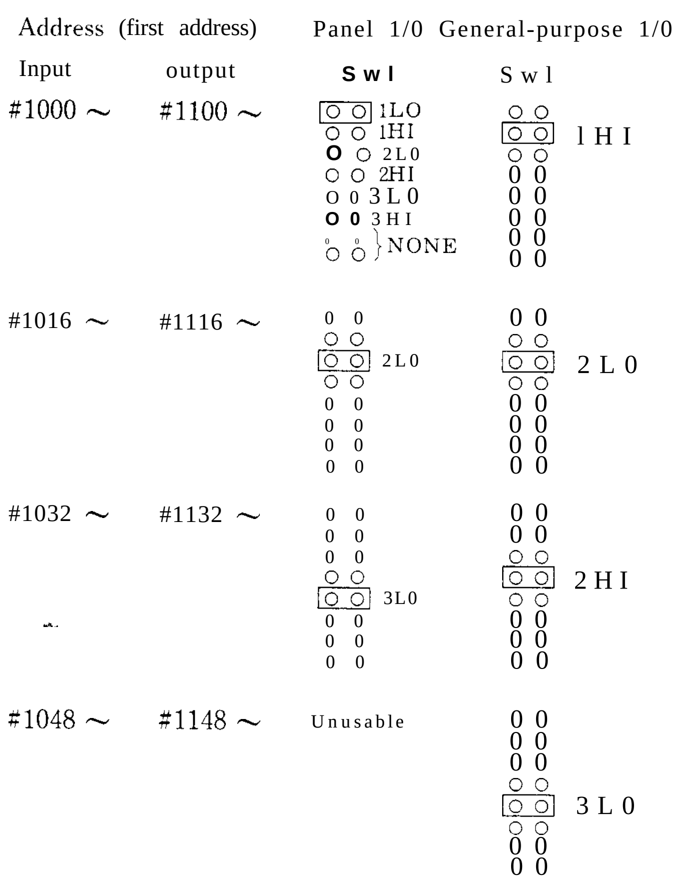
The general-purpose 1/0 can be divided into two types.

Only one panel I/O board can be connected.

Up to four general-purpose I/O boards can be connected.

However, if the panel I/O is used, the maximum number of connectable general-purpose I/O boards is three.

I/O port setup is to be performed by setting the circuit board shorting pins as needed.



It is recommended that port 1 be used for the panel 1/0.

(2) Address Setup

The relationship between the addresses and connectors is indicated in Table 8.1. (This table applies to port 1. If a different port is to be used, address changes are needed.

Table 18.1 Address and Connector

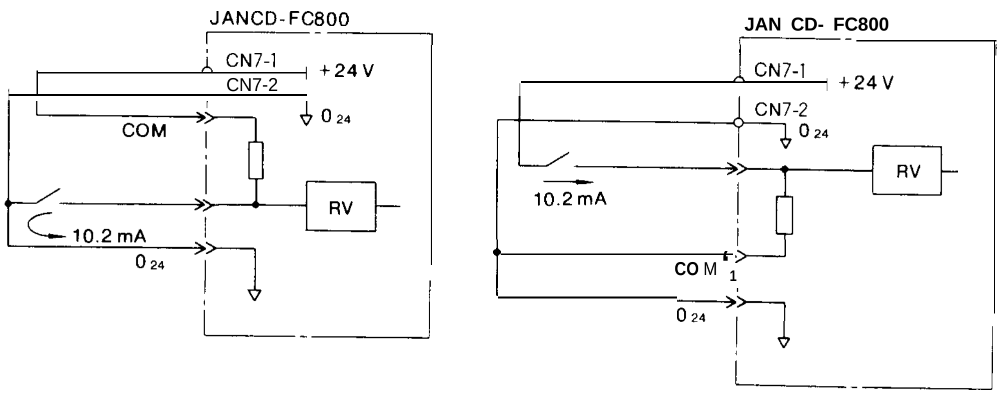
Address		Panel I/O (JANCD-FC903)		General-purpose I/O (JANCD-FC800)	
Input	output				
# 1000		CN24	COM30	CN 4	COM30
# 1001		CN24		CN 4	
# 1002		CN24		CN 4	COM31
# 1003		CN24		CN 4	
# 1004		CN24		CN 4	COM32
# 1005		CN24		CN 5	COM40
# 1006		CN25		CN 5	
# 1007		CN25		CN 5	COM41
# 1008				CN 5	
# 1009				CN 5	COM42
# 1010				CN 3	COM20
# 1011				CN 3	
# 1012				CN 3	COM21
# 1013				CN 2	COM10
	# 1100	CN25		CN 1	
	# 1101	CN25		CN 1	
	# 1102	CN25		CN 1	
	# 1103	CN25		CN 1	
	# 1104			CN 1	
	# 1105			CN 2	
	# 1106			CN 3	
	# 1107			CN 3	
	# 1108			CN 6	
	# 1109			CN 6	
	# 1110			CN 6	
	# 1111			CN 6	
Total		IN 64/OUT 32		IN 112/OUT 96	

18.3.1 1/0 BOARD (JANCD-FC800)

(1) Input Circuits

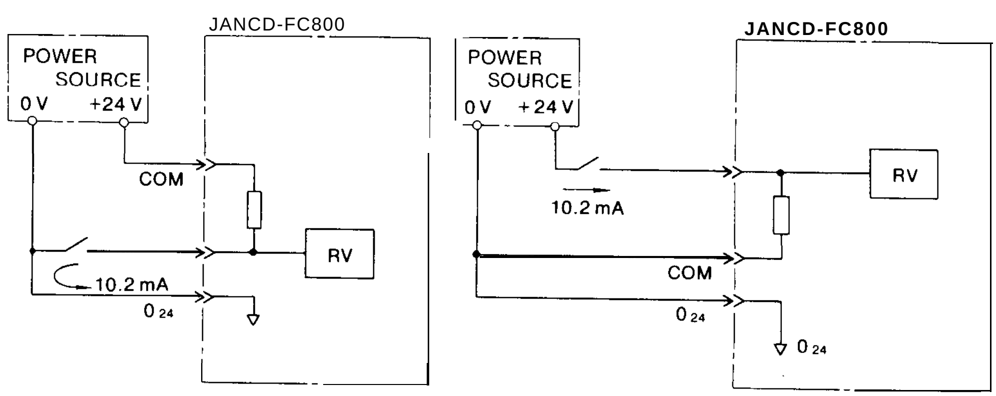
As regards the input circuits, O V common and 24 V common setup can be performed externally. The 24 V power supply is allowed to use either the internal power source or an external power source.

(a) When the internal power source is used



O V common   +24 V common

(b) When an external power source is used



0 V common   +24 V common

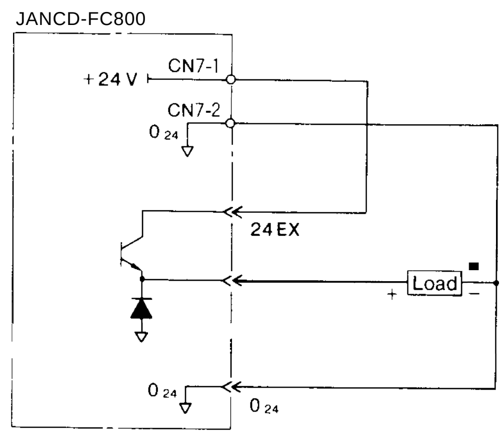
NOTE : "Common" in the input circuit (e. g., COM1O, CO M20,..9 in total) can be either "24 V common" or "O V common" for every 8 or 16 input points Perform setup by making appropriate wiring connections on the cable side.

Fig. 18.25 Input Circuits

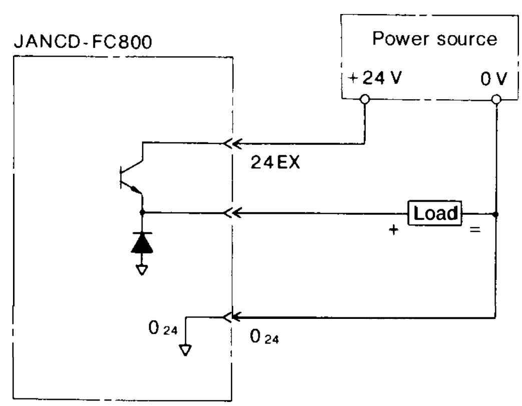
(2) Output Circuits

Polar no-contact outputs are used. The operating current must not exceed 70 mA (per circuit). The 24 V power supply is allowed to use either the internal power source or an external power source,

(a) When the internal power source is used



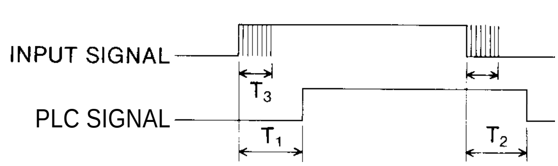
(b) When an external power source is used



NOTE: The output circuit power source (24EX1, . . . 11 in total) can be selected for every 8 output points.
Perform setup by making appropriate wiring connections on the cable side.

Fig. 18.26 Output Circuits

(3) **Input Signal Waveform**



Operation Delay Time $9\ \text{msec} \leqq T_1 = T_2 \leqq 13\text{msec}$

Chattering Time $T_3 < 5\text{msec}$

Fig. 18.7

18.3.2. POWER SUPPLY FOR I/O SIGNALS

(1) **Internal Power Supply**

Internal power supply +24V for I/O signals should be provided by the machine tool maker. If internal power supply is used, calculate the load current according to I/O points and confirm that the current is within the allowable current value since there is a current capacity limit according to I/O ON points.

The allowable current capacity of the internal power supply is 1. 5A.

ⓐ Unit consumed current (When internal power supply is used): O. 1A

ⓑ Panel I/O JANCD-FC903 consumed current (When internal power is used)
Input current (l-point): 5. 1mA (at ON)
Output current (1 -point): 60mA max (differs from load,

ⓒ Remote I/O module 0JANCD-FC800 consumed current
Input current (1 -point): 10. 2mA (at ON)
Output current (1 -point): 60mA max (differs from load.

(Example of Calculation)

When JANCD-FC903 All I/O output are ON with LED load (2. 7kΩ):

5.1 mAX64=326. 4mA (JANCD-FC903 imput comsumed current)
24V/2. 7kX32=28. 4mA (JANCD-FC903 output comsumed current)

1500mA–326mA–284 mA–100mA=790mA (possible supply current)

If the internal power supply is connected to JANCD-FC800 under these conditions, overcurrent alarm of the internal power supply (C PS12N or CPS16F) occurs to the input ON of 77 points or above.

790mA/1 O. 2mA=77 points

(2) Specifications of External Power Supply

Voltage : 24VDC ±5%
Ripple : 10% (P-P)
Provide external supply with the above.

19 CABLES

19.1 LIST OF CABLES

The interface cables are furnished with or without connectors. Those cables shown in Table 19.1 are available.

If the machine manufacturer is supplying the cables, prepare equivalent cables based on the cable specifications,

Connector Cable Type

CABLE-[ ][ ][ ]
- Cable Length 0.5,. L=5m
- Cable Type

Table 19.1 List of Cables

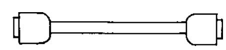
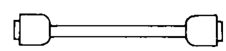
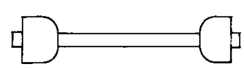
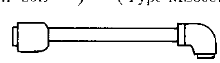
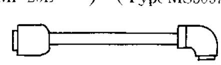
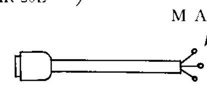
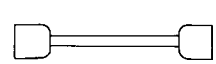
Cable No.	Cable Type	Cable Length (Max)	Configuration	Remarks
C11 C21 C210	CABLE-AA[ ] CABLE-AC[ ] CABLE-AC[ ]	15m	(Type MRP-20F01 / Type MR-20LW) (Type MRP-20F01 / Type MR-20LW)  Type KQVV-SB, D E8400093 (1. 2mm^2× 10,,,,,,.	Remote 1/() RS-232C Remote I/O
C34 C36	CABLE-UB[ ] CABLE-UB[ ]	Less than 15m (including cable C340 to C360)	(Type MRP-20M01 / Type MR-20LW) (Type MRP-20F01 / Type MR-20LW)  Type KQVV-SB, DE8400093 0. 2mm^2 × 10 pairs	Spindle drive unit feed back
C10 C30 C31 C32	CABLE-UA[ ] CABLE-UA[ ] CABLE-UA[ ] CABLE-UA[ ]	Less than 15m (including cable C300 to C320)	(Type MRP-20M01 / Type MR-20LW) (Type MRP-20M01 / Type MR-20LW)  Type KQVV-SB, DE8400093 0. 2mm^2× 10,,.,,,	VIDEO KEY PON/POFF Servo drive unit
C300 C31O C320	CABLE-CC[ ]		(Type MRP-20F01 / Type MP-20L) (Type MS3108B20-29S / Type MS3057-12A)  Type KQVV-SB, DE8400093	optical encoder
C34-1 C36-1	CABLE-CC [ ]	15m	(Type MRP-20M01 / Type MP-20L) (Type MS3108B20-29S / Type MS3057-12A)  Type KQVV-SB, D E8400093	optical encoder
C111 C112 C113 ..	CABLE-JF[ ]	5m for open collecor 15m for differential ype	(Type MRP-20M01 / Type MR-20L) M AMPLIFIER  Type KQVV-SB, DE8400093 0 2mm^2 x 10,,,,,	Manual pulse generator
C03 C04 C040	CABLE-EA[ ]	15m	Type 172026-1 Type 172026-1  Type VCT, D E8402398 2 mm^2 X 5 cores	Remote I/O power supply

Table 19.1 List of Cables (Cent'd)

Cable No.	Cable Type	Cable Length (Max)	Configuration	Remarks
C20	Connector (Cable) Single		Connector : 17 JE-13090-37 DB-25P	. RS-232C interface (Tape reader unit)
C271	Connector (Cable) Single		Connector : 17 JE-13090-37 : DB-25S Cable : KQVV DE6428673	. RS-232C interface
C27	Connector (Cable) Single		Connector : MRP-20F01 Cable : KQVV DE6428673	. Closing sequence
C26	Connector (Cable) Single		Connector : MRP-20M01 Cable : KQVV DE6428673	. Direct-IN
C35 C37	Connector (Cable) Single		Connector : MRP-20F01 Cable : KQVV DE8400093	. Spindle drive unit
C105 C106 C211 C213 C214 C215	Connector (Cable) Single		Connector : MRP-50F01 Type MR-50LW Type Cable : KQVV DE8400095	. 1/()
C212	Connector (Cable) Single		Connector : MRP-20F01 MR-20LW Cable : KQVV DE8408673	

19.2 SPECIFICATIONS OF CABLE

(1) Cable Dwg. NO. DE8400093

(Type KQVV-SB, O. 2mm^{2}X 10 pairs)

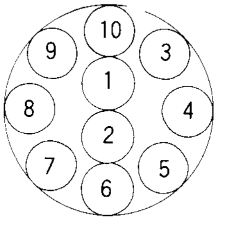
Table 19.2 Construction

No, of Pairs		10
Conductor	Material	Tinned annealed copper stranded wire
	Nominal Sectional Area mm^2	0. 2
	No. of Conductors per mm	16/0. 12
	Dimensions mm	0.55
Insulation	Material	Cross-linked vinyl
	Thickness mm	0.3
Pitch of Twisted-pair cabel		18, 22, 25, 32
Winding		Paper tape lap winding
Shield		Tinned annealed copper stranded wire (with drain wire)
Sheath	Material and Color	Vinyl, black
	Thickness mm	1.2
Dimensions mm		10.0
Approx Weight kg/km		130

Table 19.3 Characteristics

Max **Conduction Resistance** (20℃)	Ω/km	113
Min Insulation Resistance (20℃)	MΩ·km	50
Withstand Voltage	VAC/min	1000
Continuous Operation Temperature Range	℃	−30to +60

· Layout of 10 pairs



Note: Drain wires of O. 2mm^2 are provided inside tinned annealed-copper stranded wire.

Pair No.	Colors
1	Blue/White
2	Yellow/White
3	Green/White
4	Red/White
5	Purple/White
6	Blue/Brown
7	Yellow/Brown
8	Green/Brown
9	Red/Brown
10	Purple/Brown

(2) **Cable** Dwg. NO. DE8400095

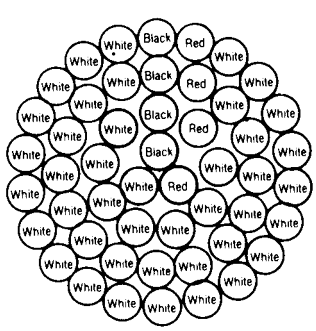
(Type KQVV-SB, O. 2mm^{2}X 50 Cores)

Table 19.4 Construction

No. of Cable Cores		50
Conductor	Material	Tinned annealed-copper stranded wire
	Nominal Sectional Area m m^2	0.2
	No. of Conductors per mm	16/0. 12
	Dimensions mm	0.55
Insulation	Material	Cross-linked vinyl
	Thickness mm	0.3
Winding		Paper tape lap winding
Shield		Annealed copper stranded wire
Sheath	Material and Color	Soft vinyl, black
	Thickness mm	1.2
Finished Cable Diameter mm		Approx 13
Approx Weight kg/km		230

Table 19.5 Characteristics

Max **Conduction Resistance (20 'C) Ω /km**	**113**
Min Insulation Resistance (20℃) MΩ・km	50
Withstand Voltage VAC/min	1000
Continuous Operation Temperature Range ℃	–30 to +60



・Details of Cable DWG.

(3) **Cable** Dwg. NO. **DE6428673**

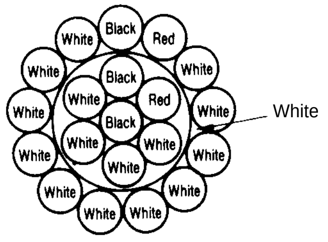
(Type KQVV-SB, O. 2mm^{2}X 50 Cores)

Table 19.6 Construction

No. of Cable Cores		20
Conductor	Material	Tinned annealed-copper stranded wire
	Nominal Sectional Area mm^2	0.2
	No, of Conductors per mm mm	16/0. 12
	Dimensions mm	0.55
Insulation	Material	Cross-linked vinyl
	Thickness mm	**0.3**
Winding		Paper tape lap winding
Sheath	Material and Color	Soft vinyl, black
	Thickness mm	1.2
Finished Cable Diameter mm		8.0
Approx Weight kg/km		90

Table 19.7 Characteristics

Max Conduction Resistance (20 'C)	Ω /km	113
Min Insulation Resistance (20℃)	50MΩ·km	50
Withstand Voltage	VAC/min	1000
Continuous Operation Temperature Range	℃	–30 to +60



0 Details of Cable DWG.

(4) **Cable** Dwg. NO. DE8402388

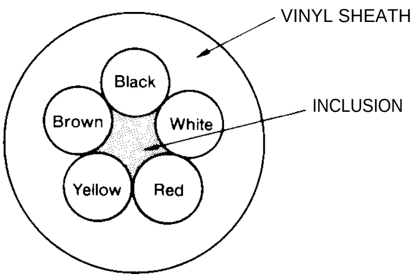
(Type VCT, 2 mm^2X 5 cores)

Table 19.8 Construction

No. of Pairs		5
Conductor	Material	Tinned annealed-copper stranded wire
	Nominal Sectional Area mm^2	2.0
	No. of Conductors per mm	37/0. 26
	Dimensions mm	1.8
Insulation	Material	Insulation vinyl
	Thickness mm	0.8
	Dimensions mm	3.4
Stranding		Right twisted (outer diameter: approx 9.2 mm)
Sheath	Material and Color	Vinyl, black
	Thickness mm	Approx 1.9
Dimensions	mm	13.0

Table 19.9 Characteristics

Max Conduction Resistance (20 ‘C)	Q/km	**10.2**
Min Insulation Resistance (20℃)	MΩ·km	50 or more
Withstand Voltage	VAC/min	**3000**



· **Details of Cable DWG.**

19.3 LIST OF CONNECTORS

(1) CPU Module Connector No.

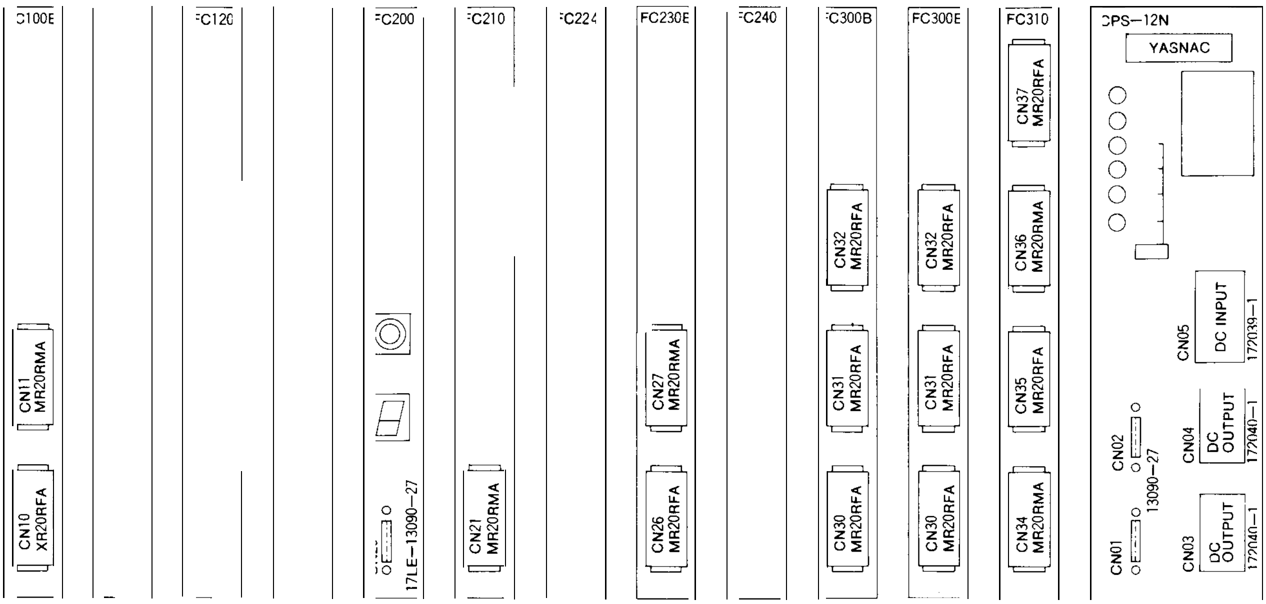
Table 19.10

CPU Module Type	Connector No,	Connector Type for Board Side	Connector Type for Cable Side
CPS-12N (JZNC-IRK22) CPS-16F (JZNC-IRK04)	CN1 CN2 CN3 CN4 CN5	17LE-13090-27 (D2BC) 17 LE-13090-27 (D2BC) 172040-1 (5 pins) 172040-1 (5 pins) 172039-1 (7 pins)	17JE-23090-02 (D8B) 17 JE-23090-02 (D8B) 172026-1 172026-1 172025-1
JANCD-FC310	CN34 CN35 CN36 CN37	MR-20RMA (20 pins) MR-20RFA (20 pins) MR-20RMA (20 pins) MR-20RFA (20 pins)	MRP-20F01 MRP-20M01 MRP-20F01 MRP-20M01
JANCD-FC300B	CN30 CN31 CN32	MR-20RFA (20 pins) MR-20RFA (20 pins) MR-20RFA (20 pins)	MRP-20M01 MRP-20M01 MRP-20M01
JANCD-FC240		Without connector	
JANCD-FC230B	CN26 CN27	MR-20RFA (20 pins) MR-20RMA (20 pins)	MRP-20M01 MRP-20F01
JANCD-FC224 (FC222)		Without connector	
JANCD-FC210	CN21	MR-20RMA (20 pins)	MRP-20F01
JANCD-FC200	CN20	17LE-13090-27 (D2BC)	17JE-23090-02 (D8B)
JANCD-FC190 JANCD-FC120		Without connector	
JANCD-FC100B	CN10 CN11	MR-20RFA (20 pins) MR-20RMA (20 pins)	MRP-20M01 MRP-20F01

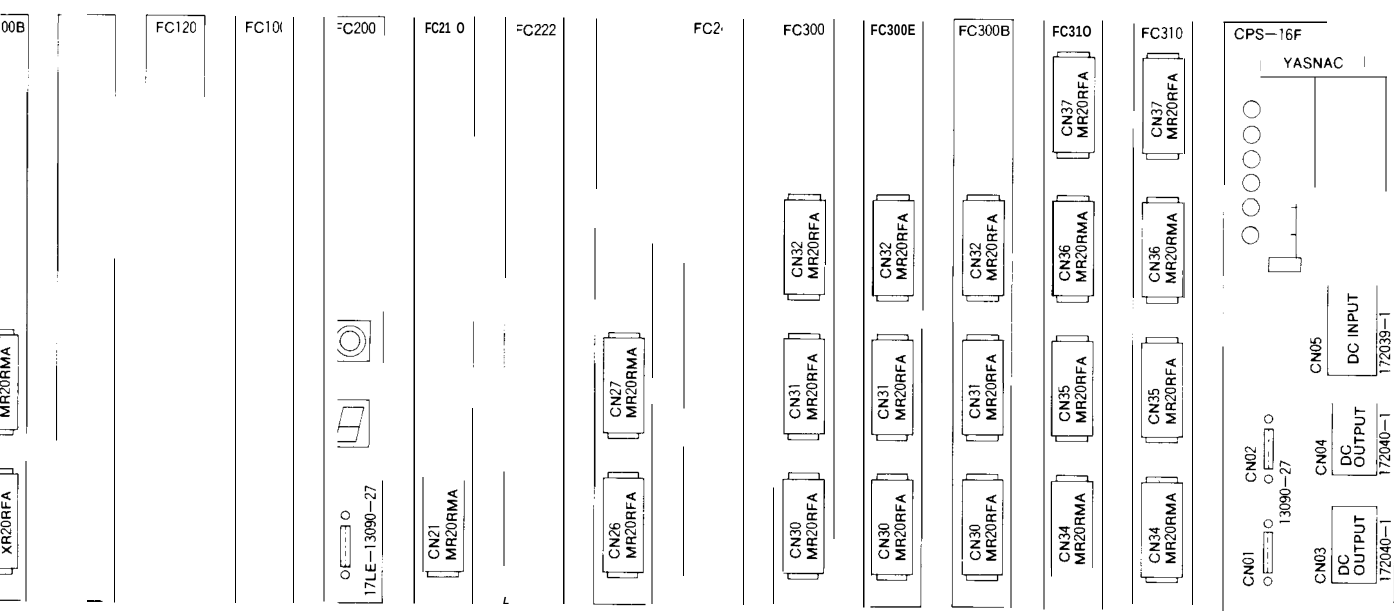
Note : Connectors for the cable side are not attached to the cables.
The machine manufacturer must supply equivalent connectors

CONNECTOR LAYOUT

(a) JZNC-IRK22



(b) JZNC-IRK04



(2) CRT **Panel Connector List**

Table 19.11

CRT Panel Type	Connector No,	**Connector** Type for Board Side	Connector Type for Cable Side
JANCD-FC900	CNA		Connected
	CNB		Connected
	CNC		Connected
	CN11	MR-20RFA (20 pins)	MRP-20M01
	CN12	MR-20RFD2 (20 pins)	MRP-20M01
	CN13	172040-1 (5 pins)	172026-1
JANCD-FC903	CN21	MR-20RFD2 (20 pins)	MRP-20M01
	CN22	MR-20RFD2 (20 pins)	MRP-20M01
	CN23	MR-20RFD2 (20 pins)	MRP-20M01
	CN24	MR-50RMD2 (50 pins)	MRP-50F01
	CN25	MR-50RMD2 (50 pins)	MRP-50F01
	CN26	MR-20RMD2 (20 pins)	MRP-20F01
	CN27	17 JE-13090-37(D2BC)	17 JE-23090-02(D8B)
	CN28	172037-1 (5 pins)	172026-1
	CN29	172037-1 (5 pins)	172026-1

Note : Connectors for cable side are not attached to the cables The machine manufacturer must supply equivalent connectors.

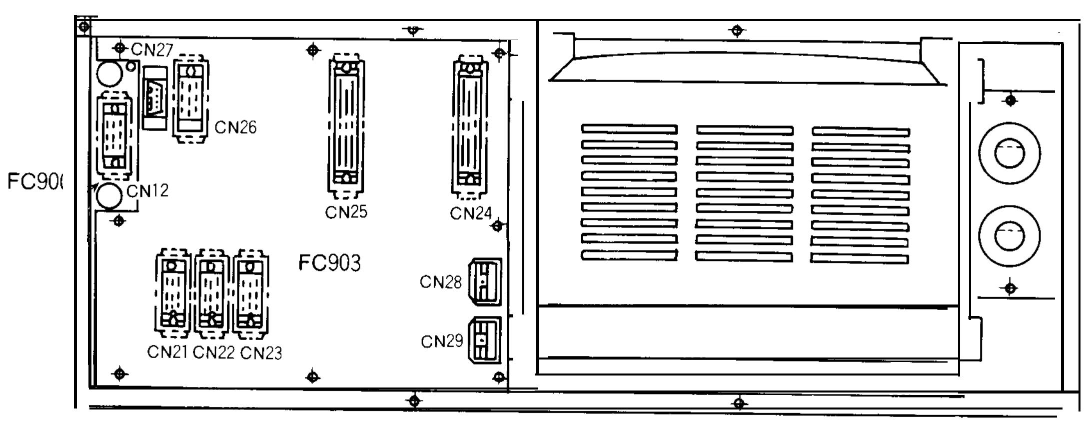


Fig. 19.1 Connector Layout of 9“ Operation (Type JANCD-FC900B- 1)

(3) 1/0 **Module Connector List**

Table 19.12

I/O Module Type	Connector No.	**Connector Type for Board Side**	Connector Type for Cable Side
JANCD-FC800	CN1	MR-50RMD2 (50 pins)	MRP-50FO1
	CN2	MR-20RMD2 (20 pins)	MRP-20FO1
	CN3	MR-50RMD2 (50 pins)	MRP-50FO1
	CN4	MR-50RMD2 (50 pins)	MRP-50FO1
	CN5	MR-50RMD2 (50 pins)	MRP-50FO1
	CN6	MR-50RMD2 (50 pins)	MRP-50FO1
	CN7	F2028P-1 X 4L-2P-CA	
	CNA	P148B30R-6TR2-03	
	CN11	MR-20RMD2 (20 pins)	MRP-20F01
	CN12	MR-20RMD2 (20 pins)	MRP-20F01
	CN13	172040-1 (5 pins)	172026-1
	CN14	172040-1 (5 pins)	172026-1

Note : Connectors for the cable side are not attached to the cables
The machine manufacturer must supply equivalent connectors.

Connector LAYOUT

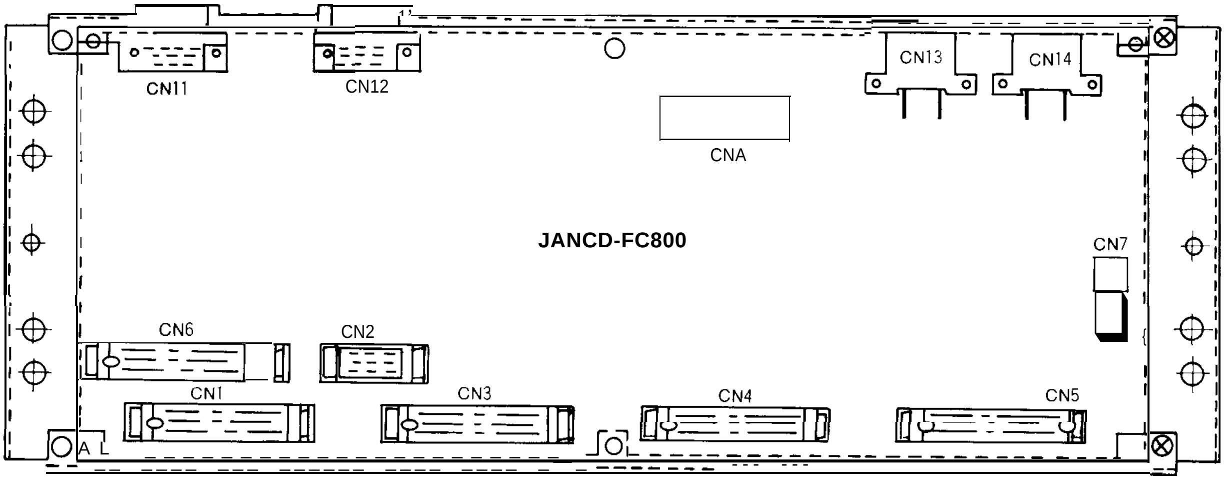


Fig. 19.2 Connector Layout of I/O Module (Type JANCD-FC800)

(4) Drive Unit Connector List

Table 19.13

Unit Type	Connector No.	Connector Type for Board Side	Connector Type for Cable Side
CACR-IR□	CN1 CN2	MR-20RFA (20 pins) MR-20RMA (20 pins)	MRP-20MO1 MRP-20FO1
CIMR-MTⅢ-□	1CN 2CN 3CN	MR-50RFA (50 pins) MR-20RFA (20 pins) MR-20RFA (20 pins)	MRP-50M01 MRP-20MO1 MRP-20MO1

Note : Connectors for the cable side are not attached to the cables.
The machine manufacturer must supply equivalent connectors

Connector Layout

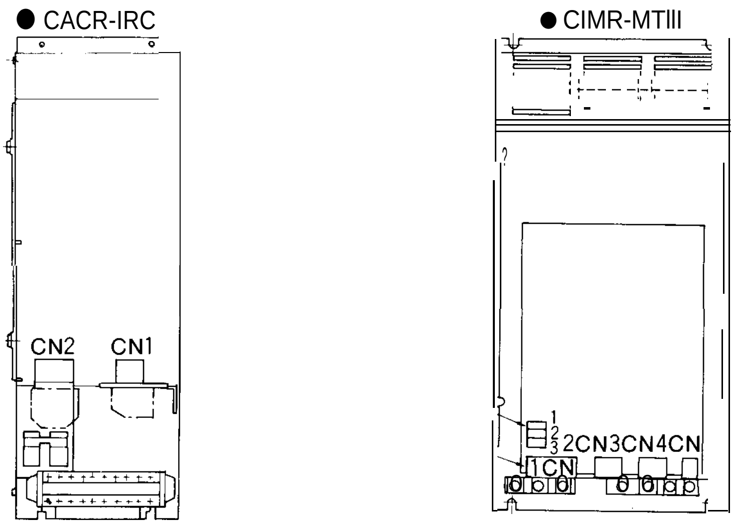
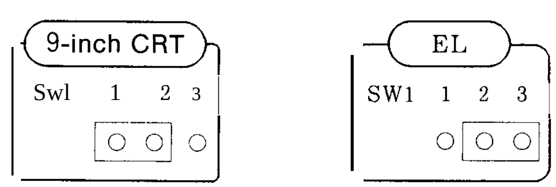


Fig 19.3 Connector Layout of Drive Unit

19.4 MODULE SHORTING PIN SETUPS

.JANCD-FC1OOB

SW1 : 9-inch CRT/EL display selector switch



• JANCD-FC200

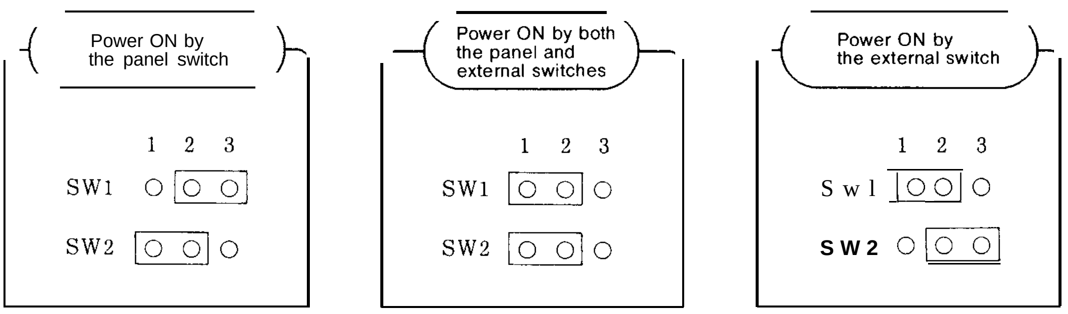
SW1 : System number switch (16-position rotary switch)

SW1 [0] - Normal operation mode
[1] - Parameter change mode
[4] - Ladder edit mode

NOTE: Positions [2] [3] and [5] through [F] of switch SW1 are for maintenance use only No one should be allowed to use these switch positions except a qualified YASKAWA service technician.

• JANCD-FC230B

SW1, SW2 : Panel/external switch ON function selector switch



• JANCD-FC310-1 (-2)

D/A voltage adjustment trimmers: Factory-adjusted prior to shipment. No further adjustments are needed.

VR1 : First spindle gain adjustment

VR2: First spindle zero adjustment

(VR3: Second spindle gain adjustment)

(VR4: Second spindle zero adjustment)

• JANCD-FC400

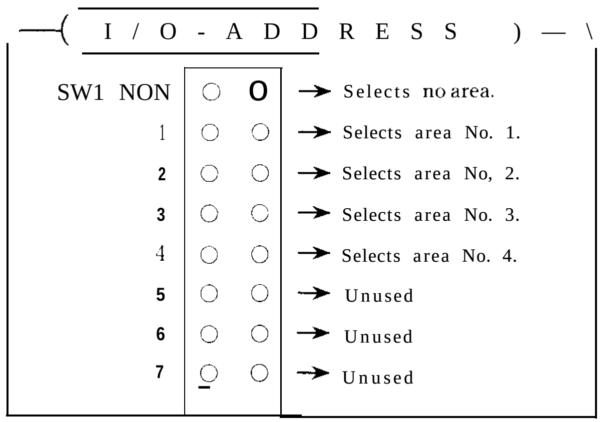
SW1 : System number switch (16-position rotary switch)

SW1 [0] -Normal operation switch
Upon power ON, the system starts up synchronized with the NC and immediately executes the application program (index “1 “).
[1] -NC built-in program development mode Upon power ON, the system starts up synchronized with the NC and displays the application program development mode screen.
[2] -Standalone execution mode
Upon power ON, the ACGC starts up independently and immediately executes the application program (index “1 “).
[4] -Standalone program development mode
Upon power ON, the ACGC starts up independently and displays the application program development mode screen.

NOTE: Positions [3] and [5] through [F] of switch SW1 are for maintenance use only. No one should be allowed to use these switch positions except a qualified YASKAWA service technician.

" JANCD-FC800

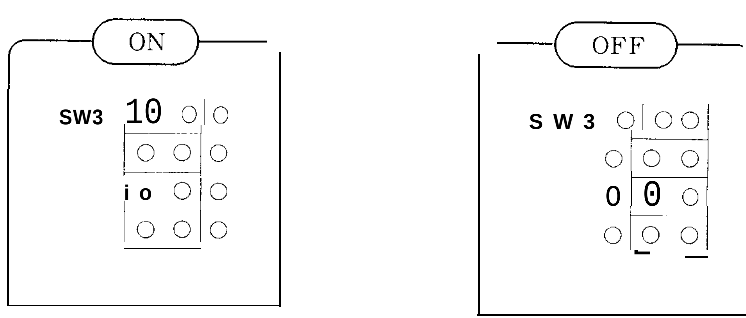
(a) SW1 : I/O address selector switch



(b) SW2: Logic inversion switch

NOTE This switch turns ON and OFF the function that provides logic 1 without regard to +24 V/O_{24} when the contact closes,

(c) SW3 : Terminator



For the only remote I/O circuit board employed or the final-stage circuit board of a multiple circuit boaed setup, set the switch positions to ON.

For the other circuit board, set the switch positions to OFF.

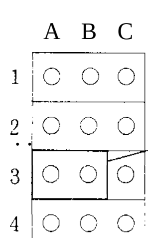
NOTE: Set up the switch in such a manner that all the switch positions are set to ON or OFF.

(d) Relationship between Area Numbers and 1/0 Address Ports

Input Port				Output Port			
Type JANCD-FC903		Type JANCD-FC800		Type JANCD-FC903		Type JANCD-FC800	
Area NO.	Address Port	Area NO.	Address Port	Area NO.	Address Port	Area NO.	Address Port
1-1	#1000 ~ #1007	1	#1000 ~ #1013	1-1	#1100 ~ #1103	1	#1100 ~ #1111
1-2	#1008 ~ #1015			1-2	Prohibit		
2-1	#1016 ~ #1023	2	#1016 ~ #1029	2-1	#1116 ~ #1123	2	#1116 ~ #1127
2-2	#1024 ~ #1031			2-2	Prohibit		
3-1	#1032 ~ #1039	3	#1032 ~ #1045	3-1	#1132 ~ #1135	3	#1132 ~ #1143
3-2	#1040 ~ #1047			3-2	Prohibit		
	Non	4	#1048 ~ #1061		Non	4	#1148 ~ #1159
	Non	5	#1064 ~ #1077		Non	5	#1164 ~ #1175

" JANCD-FC900B

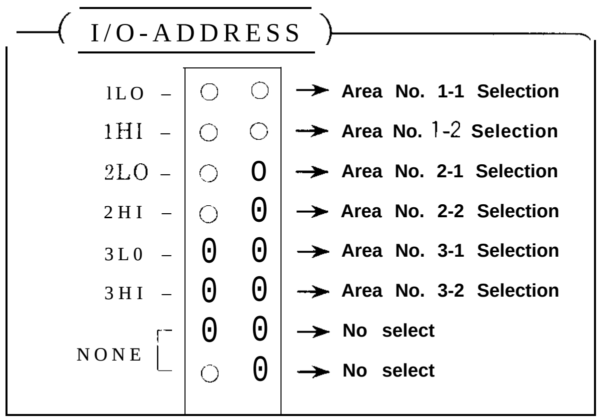
SW1, SW2, SW3: Video signal timing adjustment switches



PRESET BEFORE SHIPMENT.

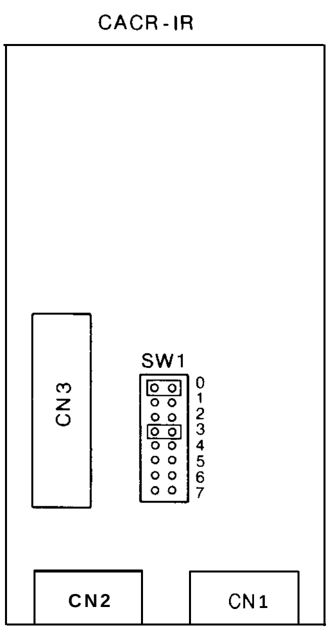
“ JANCD-FC903

SW: I/O address selector switch



CACE-IR Shorting Pin Setup

(1) Shorting Pin Positions



(2) Shorting Pin Descriptions

Swl	Description	
0	Axis address setup	Slot (FC300B) 1st axis
1		Slot (FC300B) 2nd axis
2		Slot (FC300B) 3rd axis
3	I-AMP style	1st axis integration
4		2nd axis integration
5		3rd axis integration
6	Test mode	Used for YASKAWA in-house testing purpose only,
7		

(3) Axis Address Setup

Slot (FC300B) first axis	SW1 -O Short
Slot (FC300B) second axis	SW1 -1 Short
Slot (FC300B) third axis	SW1 -2 Short

For the multi-axis integrated I-AMP, multiple jumpering occurs. When, for instance, there are addreses for the second and third axes of the two-axis integrated I-AMP, switches SW-1 and SW1 -2 are closed.

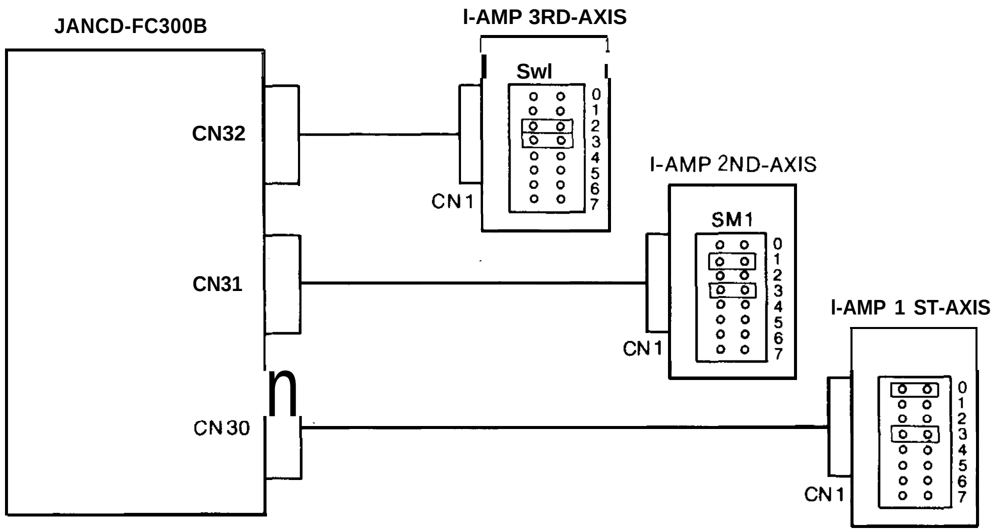
(4) I-AMP Style

First-axis integration	**SW1 -3 Short**
Second-axis integration	SW1 -4 Short
Third-axis integration	SW1 -5 Short

(5) Test Mode

During normal operations, pins 6 and 7 must be open.

(6) Setup Example (When Three Servo Axes and One-axis Integrated Amplifiers Used)



20 STANDARD I/O SIGNALS FOR i80M

20.1 STANDARD I/O SIGNALS LISTS

20.1.1 INPUT SIGNAL PC→NC

	7	6	5	4	3	2	1	0
# 3000	EDT	MEM	MDI	TP	STP	H	JOG	RT
	MOTION MODE							
# 3001								
# 3002	MP4	MP2	MP1	JV16	J v8	JV4	JV2	JV1
	HANDLE PULSE MULTIPLY			MANUAL FEEDRATE OVERRIDE				
# 3003		ROV4	ROV2	ROV1			* SP	ST
		RAPID OVERRIDE					STOP	START
# 3004						STLK	ERS	MRD
						START INTERLOCK	EXTERNAL RESET	FUNCTION PREP COMPLETED
# 3005	ERR2	ERR1	ERR0			CRTOFF	EXTC	SVON
	SERVO OFF	IMMEDIATE STOP	SINGLE BLOCK STOP			CRTOFF	TIME COUNT	SERVO ON
	EXTERNAL ERROR DETECTOR							
# 3006	AFL	MLK		DRN	PRST	DLK	ABS	SBK
	AUX FUNCTION LOCK	MACHINE LOCK		DRY RUN	PROGRAM RESTART	DISPLAY LOCK	MANUAL ABSOLUTE	SINGLE BLOCK
# 3007		F1	RET	TLM1		EDT LK	ZRN2	ZRN
		F1—DIGIT	TOOL LENGTH MEASUREMENT			EDIT LOCK	2ND REFERENCE POINT	ZERO RETURN
# 3008	PLY BAK	EWS				CPRN	HOFS	
	PLAYBACK	EXTERNAL WRITE SIGNAL				MACHINING INTERRUPTION POINT RETURN	AUTO MODE HANDLE OFFSET	
# 3009	SPST	MSKP		OFH	WSG	WSC	WSH	WSS
	TOUCH SENSOR SIGNAL	MANUAL SKIP MODE		OFFSET PRESETTER SIGNAL	REFERENCE GROOVE SIGNAL	COORDINATE ROTATION SIGNAL	REFERENCE HOLE SIGNAL	REFERENCE PLANE SIGNAL

Parameter	7	6	5	4	3	2	1	0	Group
#3010									
#3011	FSED CLR	FSED CH	FSED MEM	FSED M	ECLM	EOUT	EVER	EIN	Bits 7–4: FS AUTO EDITING; Bits 3–0: EXTERNAL I/O CHECK
#3012	TLCTN	TLSKP	TLRST						Bits 7–5: TOOL LIFE CONTROL
#3013									
#3014									
#3015									
#3016								COM	Bit 0: COMPUTER COMMUNICATION
#3017	DSPP3	DSPP2	DSPP1	DSPP0	DSPJ3	DSPJ2	DSPJ1	DSPJ0	Bits 7–4: EXTERNAL SCREEN CHAGEOVER (PROCESS SELECTION); Bits 3–0: EXTERNAL SCREEN CHAGEOVER (JOB SELECTION)
#3018				DSPCHG	DSPF3	DSPF2	DSPF1	DSPFO	Bit 4: EXTERNAL SCREEN CHAGEOVER STROBE SIGNAL; Bits 3–0: EXTERNAL SCREEN CHAGEOVER (FUNCTION SELECTION)
#3019									

	7	6	5	4	3	2	1	0
#3020								
#3021								
#3022								
#3023								
#3024								
#3025	TGN7	TGN6	TGN5	TGN4	TGN3	TGN2	TGN1	TGNO
				TOOL GROUP NO				
#3026								
#3027								
#3028								
#3029								

	7	6	5	4	3	2	1	0	
# 3030	ED7	ED6	ED5	ED4	ED3	ED2	ED1	ED0	EXTERNAL DATA INPUT
#3031	ED15	ED14	ED13	ED12	ED11	ED10	ED9	ED8	EXTERNAL DATA INPUT
# 3032	ED23	ED22	ED21	ED20	ED19	ED18	ED17	ED16	EXTERNAL DATA INPUT
# 3033	ED31	ED30	ED29	ED28	ED27	ED26	ED25	ED24	EXTERNAL DATA INPUT
# 3034	EDCL	EDAS2	EDAS1	EDAS0	EDSD	EDSC	EDSB	EDSA	EXTERNAL DATA INPUT
#3035									
#3036					PINT				PROGRAM INTERRUPTION
# 3037	1HP7	1HP6	1HP5	1HP4	1HP3	1HP2	1HP1	1HP0	HANDLE PULSE INPUT
# 3038	2HP7	2HP6	2HP5	2HP4	2HP3	2HP2	2HP1	2HP0	HANDLE PULSE INPUT
# 3039	3HP7	3HP6	3HP5	3HP4	3HP3	3HP2	3HP1	3HP0	HANDLE PULSE INPUT

	7	6	5	4	3	2	1	0
# 3040	OVC	OPT	BDT	OV16	OV8	OV4	OV2	OV1
	OVERRIDE CANCEL	OPTIONAL STOP	BLOCK DELETE	FEEDRATE OVERRIDE				
# 3041					FIN	RWDH	RWD	EOP
					MST COMPLETION	HIGH-SPEED REWIND & AUTO START	REWIND	END PROGRAM
# 3042	BDT9	BDT8	BDT7	BDT6	BDT5	BDT4	BDT3	BDT2
	BLOCK DELETE							
# 3043								
# 3044								
# 3045								
# 3046	UI7	UI6	UI5	UI4	UI3	UI2	UI1	UI0
	USER MACRO INPUT							
# 3047	UI15	UI14	UI13	UI12	UI11	UI10	UI9	UI8
	USER MACRO INPUT							
# 3048	UI23	UI22	UI21	UI20	UI19	UI18	UI17	UI16
	USER MACRO INPUT							
# 3049	UI31	UI30	UI29	UI28	UI27	UI26	UI25	UI24
	USER MACRO INPUT							

X to 5th Servo Axis Control (1/2)

	7	6	5	4	3	2	1	0
# 3070				H5	H4	HZ	HY	HX

MANUAL HANDLE AXIS SELECT

	7	6	5	4	3	2	1	0
# 3071				+5	+4	+Z	+Y	+ x

MANUAL FEED DIRECTION SELECT

	7	6	5	4	3	2	1	0
# 3072				–5	–4	– z	–Y	– x

MANUAL FEED DIRECTION SELECT

	7	6	5	4	3	2	1	0
# 3073				* DC5	* DC4	* Dcz	* DCY	* DCX

REFERENCE POINT RETURN DECELLS

	7	6	5	4	3	2	1	0
# 3074				* +5	* +4	* +Z	* +Y	* + x

OVERTRAVELLS

	7	6	5	4	3	2	1	0
# 3075				* –5	* —4	* –Z	* —Y	* –X

OVERTRAVELLS

	7	6	5	4	3	2	1	0
# 3076								

	7	6	5	4	3	2	1	0
# 3077								

	7	6	5	4	3	2	1	0
#3078				* IT5	* IT4	* ITZ	* ITY	* ITX

AXIS INTERLOCK

	7	6	5	4	3	2	1	0
# 3079				*SV 0F5	*SV OF4	*SV OFZ	*SV OFY	*SV OFX

EACH AXIS SERVO OFF

X to 5th Servo Axis Control (1 /2)

	7	6	5	4	3	2	1	0	
#3080				2H5	2H4	2HZ	2HY	2HX	2ND MANUAL HANDLE AXIS SELECT
#3081				3H5	3H4	3HZ	3HY	3HX	3RD MANUAL HANDLE AXIS SELECT
#3082				M15	M14	MIZ	MIY	MIX	MIRROR IMAGE SELECT
#3083				DTCH5	DTCH4				AXIS REMOVE SELECT
#3084				AMLK5	AMLK4	AMLKZ	AMLKY	AMLKX	AXIS MACHINE LOCK
#3085									
#3086									
#3087									
#3088									
„308,									

Spindle Control (1/1)

	7	6	5	4	3	2	1	0
#3110	GRO	SOR		SINV	GR4	GR3	GR2	GR1
	GEAR SHIFT	SPINDLE CONSTANT SPEED		S-ANALOG OUTPUT REVERSE	SPINDLE GEAR RANGE			
#3111	SFIN	SAG R		SPE	SPD	SPC	SPB	SPA
	S-FUNCTION COMPLETION	SPINDLE COINCIDENCE		SPINDLE OVERRIDE				
#3112	SD17	SDI6	SDI5	SD14	SD13	SDI2	SDI1	SDI0
	S-COMMAND BINARY							
#3113	SDI15	SDI14	SDI13	SDI12	SDI11	SDI10	SDI9	SDI8
	S-COMMAND BINARY							
#3114	SDI23	SDI22	SDI21	SDI20	SDI19	SDI18	SDI17	SDI16
	S-COMMAND BINARY							
#3115								
#3116						CSV ONS	SPMŌDES	CAX REQ
						SPIDLE SERVO ON STATE	SPINDLE CONTROL MODE	C-AXIS CHAGE REQUEST
#3117				SLPC	SIDX CUT	SIDX I	SIDX INC	SIDX
				SPINDLE POSITION LOOP MODE	SPINDLE INDEX			
#3118	SID7	SID6	SID5	SID4	SID3	SID2	SID1	SID0
	SPINDLE INDEX							
#3119					SID11	SID10	SID9	SID8
					SPINDLE INDEX			

20.1.2 OUTPUT SIGNAL

(1) System Control (1/2)

	7	6	5	4	3	2	1	0
# 3500			BGEDES	WARN S	IERS	∗ESP S	RSTS	ALMS
			BG EDIT ERROR	WARNING	INPUT ERROR	EMERGENCY STOP	RESET	ALARM ERROR
#3501					LSK	EDTS	I 'UT"	MAN
					LABEL SKIP STATE OUTPUT	EDIT	AUTO MODE SELECT	MANUAL MODE SELECT
# 3502	ONPB	OHT	TO	∗ BALM	SSW3	SSW2	Sswl	Sswo
	NC CONTROL MONITOR OUTPUT				SYSTEM NO SWITCH MONITOR			
# 3503			WLOST	ESP	SVALM		*BK	SVON S
			POWER LOSS	EMERGENCY STOP	SERVO ALARM		BRAKEON MONITOR	SERVOON MONITOR
# 3504		ES END	ER END	PRST S		FSED MC	FSED CE	FSED S
		EXTERNAL DATA INPUT FUNCTION COMPLETION		PROGRAM RESTART		FS AUTO EDIT MONITOR		
# 3505						CPRN S		TLMO
						MACHINING INTERRUPTION POINT RETURN		TOOL LENGTH MEASUREMENT MODE
# 3506					SSWS3	SSWS2	SSWS1	Sswso
					SYSTEM NUMBER SETTING MONITOR OUTPUT			
# 3507	MSKPO							
	MANUAL SKIP MODE							
#3508	TLCHA	TLCHB						
	TOOL CHANGE SIGNAL	NEW TOOL SELECTION SIGNAL						
# 3509								

System Control (2/2)

	7	6	5	4	3	2	1	0	Notes
#3510									
#3511									
#3512									
#3513									
#3514		HOUT3	HOUT2	HOUT1		HIN3	HIN2	HIN1	Bits 6–4: DIRECT PROCESSING SIGNAL MONITOR OUTPUT; bits 2–0: MM DIRECT PROCESS SIGNAL MONITOR
#3515	SETS AFL	SETS MLK		SETS DRN	SETS PRST	SETS DLK	SETS ABS	SETS SBK	INTERNAL TOGGLE SWITCH MONITOR
#3516	SETS SRN	SETS F1				SETS EDLK	SETS ZRN2	SETS ZRN	INTERNAL TOGGLE SWITCH MONITOR
#3517	SETS PLBK	SETS STLK	SETS ZNG			SETS CPRN	SETS HOFS		INTERNAL TOGGLE SWITCH MONITOR
#3518				SETS MI5	SETS M14	SETS MIZ	SETS MIY	SETS MIX	INTERNAL TOGGLE SWITCH MONITOR
#3519									

(2) **1st System Control (1/3)**

	7	6	5	4	3	2	1	0
# 3520	MA7	MA6	MA5	MA4	MA3	MA2	MA1	MAO
	M CODE							
#3521	MR30 R	M02 R	MO1 R	MOOR			MA9	MA8
	M DECODE						M CODE	
#3522								
# 3523								
# 3524								
#3525								
#3526								
#3527								
#3528								
#3529								

1st System Control (2/3)

	7	6	5	4	3	2	1	0
# 3530	T7	T6	T5	T4	T3	12	T1	TO
	T-CODE							
# 3531	T15	T14	T13	T12	T11	T10	T9	T8
	T-CODE							
# 3532					T19	T18	T17	T16
					T-CODE			
# 3533	B7	B6	B5	B4	B3	B2	B1	B0
	B-CODE							
# 3534	B15	B14	B13	B12	B11	B10	B9	B8
	B-CODE							
# 3535	TF		BF					MF
	M-, B- AND T-CODE SAMPLING							
# 3536								
# 3537	THC	RWDS	OP	DEN	RPD S	FEED S	SPL	STL
	THREADING	REWINDING	OPERATION	POSITIONING COMPLETED	RAPID	FEED	TEMPORARY STOP	CYCLE START
	SYSTEM MONITOR							
# 3538				SKIP 1	SETS OPT	SETS BDT	G93M	M04s
				SKIP MONITOR	INTERNAL TOGGLE SWITCH MONITOR OUTPUT		G93M	M04
# 3539						TAP	G84s	G80S
						CANNED CYCLE MONITOR		

Ist System Control (3/3)

Register	7	6	5	4	3	2	1	0	
# 3540	U07	U06	U05	U04	U03	U02	Uol	Uoo	USER MACRO
# 3541	U015	U014	U013	U012	UO11	UO1O	U09	U08	USER MACRO
# 3542	U023	U022	U021	u 020	U019	U018	U017	U016	USER MACRO
# 3543	U031	U030	U029	U028	U027	U026	U025	U024	USER MACRO
# 3544		POSX	UVX	OVX	RGX	MCBX	OCX	ABSX	X-AXISI AMP ALARM
# 3545	O-PHX	OIREFX	O FX			OHX			X-AXIS I AMP ALARM
# 3546		POSY	UVY	OVY	RGY	MCBY	OCY	ABSY	Y-AXIS I AMP ALARM
# 3547	O-PHY	OIREFY	O FY			OHY			Y-AXIS I AMP ALARM
# 3548		POSZ	I 'V'	I 'V'	I 'G'	MCBZ	'C' I	ABSZ	Z-AXIS I AMP ALARM
# 3549	O-PHZ	OIREFZ	O F '			O H '			Z-AXIS I AMP ALARM

(5) 1st to 5th servo Axis Control (1 /3)

	7	6	5	4	3	2	1	0
#3610	TGONX	PCX	PBX	PAX	*ALX	*OLX	FUX	SRDX
	SERVO UNIT MONITOR							
#3611	TGONY	PCY	PBY	PAY	*ALY	*OLY	FUY	SRDY
	SERVO UNIT MONITOR							
#3612	TGONZ	Pcz	PBZ	PAZ	*ALZ	*OLZ	FUZ	SRDZ
	SERVO UNIT MONITOR							
#3613	TGON4	PC4	PB4	PA4	*AL4	*OL4	FU4	ARD4
	SERVO UNIT MONITOR							
#3614	TGON5	PC5	PB5	PA5	*AL5	*OL5	FU5	ARD5
	SERVO UNIT MONITOR							
#3615				FUP5	FUP4	FUPZ	FUPY	FUPX
				FOLLOW–UP MONITOR(I)				
#3616				PSET5	PSET4	PSETZ	PSETY	PSETX
				PSET MONITOR (i)				
#3617				DTCH 5S	DTCH 4S			
				AXIS REMOVE				
#3618				AMLK 5S	AMLK 4S	AMLKZS	AMLKYS	AMLKXS
				AXIS MACHINE LOCK				
#3619								

(7)X **to 5th Servo Axis Control (2/3)**

	7	6	5	4	3	2	1	0
# 3630				ZP5	ZP4	ZPZ	ZPY	ZPX
				REFERENCE POINT MONITOR				
# 3631				2ZP5	2ZP4	2ZPZ	2ZPY	2ZPX
				REFERENCE POINT MONITOR				
# 3632				3ZP5	3ZP4	3ZPZ	3ZPY	3ZPX
				REFERENCE POINT MONITOR				
# 3633				4ZP5	4ZP4	4ZPZ	4ZPY	4ZPX
				REFERENCE POINT MONITOR				
# 3634								
# 3635								
# 3636								
# 3637								
# 3638								
# 3639								

X to 5th Servo Axis Control (2/2)

	7	6	5	4	3	2	1	0
#3640								
#3641								
#3642								
#3643								
#3644								
#3645								
#3646								
#3647								
#3648								
#3649								

(8) Spindle Control Signal (1/1)

	7	6	5	4	3	2	1	0
# 3650	GR 4S	GR 3S	GR 2S	GRIS	GRS S	GSC S	G96 S	SINV A
	GEAR RANGE				GRS CONTROLLED	GSC CONTROLLED	G96 CONTROLLED	S BINARY REVERSE
# 3651	SF				Os	SLPS	SIDX0	SIDXA
	S-COMMAND				SPINDLE ORIENTATION	SPINDLE POSITION LOOP MONITOR	SPINDLE INDEX MONITOR	
# 3652							AXMODES	CAXS
							AXIS CONTROL MODE	MODE EXCHANGING
# 3653						Pcs	PBS	PAS
						PG SIGNAL MONITOR		
# 3654	SD07	SD06	SD05	SD04	SD03	SD02	SDO1	SDOO
	S-COMMAND BINARY							
# 3655	SDO15	SDO14	SDO13	SDO12	SDO11	SDO1O	SD09	SD08
	S-COMMAND BINARY							
# 3656	SDO23	SD022	SDO21	SD020	SDO19	SDO18	SDO17	SDO16
	S-COMMAND BINARY							
# 3657	SARM7	SARM6	SARM5	SARM4	SARM3	SARM2	SARM1	SARMO
	SPINDLE ACTUAL SPEED MONITOR							
#3658	SARM15	SARM14	SARM13	SARM12	SARM11	SARM10	'ARM'	SARM8
	SPINDLE ACTUAL SPEED MONITOR							
# 3659	SARM23	SARM22	SARM21	SARM20	SARM19	SARM18	SARM17	SARM16
	SPINDLE ACTUAL SPEED MONITOR							

20.2 DETAILS OF SIGNALS

20.2.1 CONTROL OPERATION MODE INPUT (RT # 30000, JOG # 30001, H # 30002, STP # 30003, TP # 30004, MDI # 30005, MEM # 30006, EDT # 30007) AND OUTPUT (AUTO # 35011, MAN # 35010, EDTS # 35012)

(1) Operation **Mode Input**

This input is provided by the sequencer to select a control operation mode. The following eight different operation modes are selectable.

RT :	Manual rapid traverse mode	Manual operation
JOG :	Manual jog mode	
H :	Manual handle	
STP :	Manual step feed mode	
TP :	Tape operation mode	Automatic operation mode
MDI :	Manual data input operation mode	
MEM :	Memory operation mode	
EDT :	Program editing mode	

When any of the input contacts is closed, the corresponding operation mode is turned on.

(a) RT : Maunal rapid traverse mode input
When the RT input contact is closed with the other mode input contacts opened, the control enters the manual rapid traverse mode so that the machine rapidly traverses at the overriding rapid traverse speed in accordance with the manual feed direction input.

(b) JOG: Manual jog mode input
When the JOG input contact is closed, and other mode input contacts are opened, the control enters the manual jog mode, and the machine jogs in the respective directions in response to the input signals.

(c) H : Manual HANDLE mode input
When the H input contact is closed, and other mode input contacts are opened, the control enters the manual handle mode and the machine will be fed manually by the manual pulse generator according to the specified multiplication factor on the selected axis.

(d) STP: Manual STEP feed mode
When the STP input contact is closed, and other mode input contacts are opened, the control enters the manual step feed mode and the machine will be fed in steps.

(e) TP : Tape operation mode
When the TP input contact is closed and other mode input contacts are opened, the control enters the tape operation mode, and the machine will be controlled by the tape commands read by the tape reader,
When the control is provided with an optional RS232C interface, it can control the machine by part programs input via the RS232C interface.

(f) MDI : Manual data input operation mode input
When the MDI input contact is closed, and other mode input contacts are opened, the control enters the manual data input mode, and part programs will be written or the machine will be operated through MDI.

(g) MEM : Memory operation mode input

When the MEM input contact is closed, and other mode input contacts are opened, the control enters the memory operation mode, and the machine will be controlled by part programs stored in the memory.

(h) EDT : Program edit mode

When the EDT input contact is closed with the other operation mode input contacts are opened, the control mode indicator shows the program edit mode. However, it is possible to store part programs into memory, correct them, and change them in any mode other than TP or MDI.

(2) operation Mode Output

The control outputs the following signals to inform the current operation mode.

(a) AUTO : Automatic operation mode output

This output is generated when the control is in the TP (tape operation), MEM (memory operation), MDI (manual data input operation), or EDT (program edit) mode.

(b) MAN : Manual operation mode output

This output is generated when the control is in the H (manual handle operation), STP (manual step operation), JOG (manual jog), or RT (manual rapid traverse) mode.

(c) EDTS : Editing output

This output is generated during editing operations (part program reading or checking, punching, stored program changing, or other editing operations).

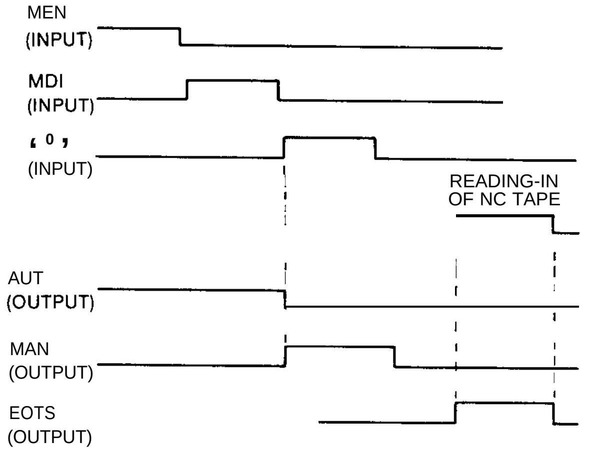


Fig. 20.1 Time Chart of Editting Operation I/O

NOTE

1. When any operation mode input except manual operation mode is given during NC program operation in the memory operation mode, the control stops the execution of the part program after the execution of the current block. The same applies to the part program operation in the tape and MDI modes.

2. When a manual operation mode input contact is closed during the execution of a part program in the memory operation mode, the following changes take place.

i. Motion command

The current motion stops after deceleration, and the program is interrupted. The remaining program can be restarted when the automatic operation mode is turned on again and the cycle start (ST) input contact is closed.

ii. M, S, T command

When pm4009 D7 = O (in the forced Fin mode), the sampling outputs (MFB to MFE) and M code outputs are turned off, and the M/S/T command is regarded to have been executed completely. Therefore, even when the automatic operation mode is restored, the interrupted M/S/T command is not output (the SPL does not light during inactivity). However, when Pm4009 D7 = 1, the M/S/T command is saved and the SPL lights.

3. When an automatic operation mode or program editing mode input contact is closed during motion in the manual operation mode, the motion decelerates to a stops.

4. When any of these operation mode input contacts is closed, that mode becomes effective. Under other input states, the previous operation mode remains effective. When no operation mode input contact is closed after energizing, or when two or more operation mode input contacts are closed, the control enters the manual jog mode.

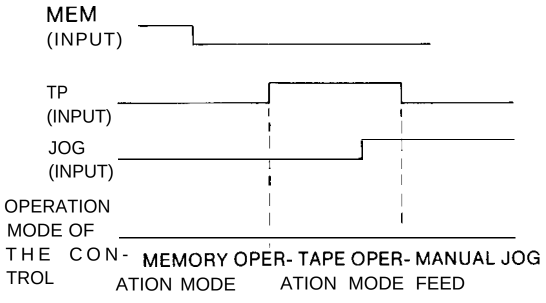


Fig. 20.2 Time Chart of Operation Mode Input

5. When a manual operation mode input contact is closed during the tapping process in a part program, the automatic operation mode is retained while the threads are being cut.

(3) System Number Switch Monitor (SSWO # 35020 -SSW3 #35023) Output

The system number switch monitor output is generated to indicate the status (O-F) of the rotary switch mounted on top of the FC200 circuit board. This switch is important as it determines the operations of the control. Therefore, do not change the setup of this switch under normal conditions.

Table 20.1 System Number Switch Function List

# 35023-# 35020	Rotary Switch number	Function	ROM check	Vatchdog	Remarks
0000	0	Normal operation	☆	☆	Ladder debug function provided
0001	1	End user parameter change mode	☆	☆	Ladder debug function provided
0010	2	Standard/option parameter change mode	☆	☆	Ladder debug function provided
0011	3	Unused			
0100	4	Ladder edit mode	☆	☆	Ladder debug function provided
0101	5	Unused			
0110	6	Unused			
0111	7	Unused			
1000	8	On-line maintenance mode ←For YASKAWA's exclusive use→			Do not use these switch positions as they are provided for YASKAWA'S exclusive use.
1001	9	Soft debug mode 1	☆		
1010	A	Soft debug mode 2			
1o11	B	Running test mode	☆	☆	
1100	c	Circuit board test mode	☆		
1101	D	Unused			
1110	E	Memory operation			
1111	F	Total make mode			

20.2.2 MANUAL JOG FEEDRATE SELECTION (JV1, JV2, JV4, JV8, JV16) INPUT (# 30020 to # 30024)

(1) These inputs specify the manual jog feedrates in the manual JOG mode.

(2) The manual jog feedrates can be used as the feedrates for part program dry run ON execution in the automatic operation mode. For details, refer to par. 20.2.22, "Dry Run (DRN #30064) In put."

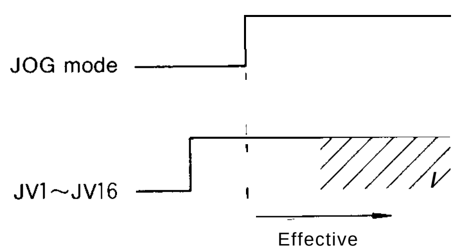


Fig. 20.3 Manual Jog Mode Speed Time Chart

Table 20.2

1 : CLOSED		O: OPEN			Manual Jog Feedrate (Manual Operation Mode) Parameter Setting
JV1	JV2	JV4	JV8	JV16	
0	0	0	0	0	pm 2400
1	0	0	0	o	pm 2401
o	1	0	0	0	pm 2402
1	1	0	0	0	pm 2403
0	0	1	0	0	pm 2404
1	0	1	0	0	pm 2405
0	1	1	0	0	pm 2406
1	1	1	0	0	pm 2407
0	0	0	1	0	pm 2408
1	0	0	1	0	pm 2409
0	1	0	1	0	pm 2410
1	1	0	1	0	pm 2411
0	0	1	1	0	pm 2412
1	0	1	1	0	pm 2413
0	1	1	1	0	pm 2414
1	1	1	1	0	pm 2415
0	0	0	0	1	pm 2416
1	0	0	0	1	pm 2417
0	1	0	0	1	pm 2418
1	1	0	0	1	pm 2419
0	0	1	0	1	pm 2420
1	0	1	0	1	pm 2421
0	1	1	0	1	pm 2422
1	1	1	0	1	pm 2423
0	0	0	1	1	pm 2424
1	0	0	1	1	pm 2425
0	1	0	1	1	pm 2426
1	1	0	1	1	pm 2427
0	0	1	1	1	pm 2428
1	0	1	1	1	pm 2429
0	1	1	1	1	pm 2430
1	1	1	1	1	pm 2431

Note: 1: Closed O: open

20.2.3 MANUAL HANDLE/STEP MULTIPLICATION FACTOR (MP1 , MP2, MP4) INPUT (# 30025, # 30026, # 30027)

When the control is in the manual handle/manual step feed mode, the motion distance per step is determined by these input signals.

Table 20.3 Manual Handle/Step Multiplication Setting

MPl	MP2	MP4	Manual Step Feed	Manual Handle Feed
0	0	0	1 pulse/step	
1	0	0	10 pulses/step	
0	1	0	100 pulses/step	
1	1	0	1000 pulses/step	100 pulses/step
0	0	1	10,000 pulses/step	100 pulses/step
1	0	1	100,000 pulses/step	100 pulses/step
0	1	1	Do not set.	
1	1	1		

1: Closed, O: Open

20.2.4 INPUT SIGNALS FOR CYCLE START (ST # 30030) AND STOP (∗ SP # 30031) : OUTPUT SIGNALS FOR CYCLE START (STL # 35370) AND FEEDHOLD (SPL # 35371)

(1) With the control in any of the TAPE, MEMORY, and MDI, EDT modes, when the input contact ST is closed and opened, the control starts automatic operation control to execute the part program, and at the same time, turn on the STL output signal for cycle start. However, an ST input is disregarded under the following conditions.

(a) While the control is in and alarm state. (While an alarm output or an input error output is on.)

(b) While the feedhold **∗SP** input contact is open.

(c) While the external reset ERS input contact is closed.

(d) While the **RESET button on the** MDI& CRT panel is being depressed.

(e) While the emergency stop ∗ ESP contact is not closed.

(f) While the STL signal output is being generated during automatic operations.

(2) When the following state is entered after cycle start, the control completes operation control, and turns off the STL output.

(a) When a part program has been executed by manual data input in the MDI mode.

(b) When one block of a part program has been executed with the single block (SBK) input contact closed.

(c) When the end of program (EOP) input contact has been closed by an M command of a part program.

(3) When the feedhold input contact "∗ SP" is opened during automatic operation, the automatically controlled motions, etc. are interrupted, and at the same time the cycle start output STL is turned off and the feedhold output SPL is turned on. While a block of thread cutting instruction is being executed, the feedhold input is disregarded.

(4) When the feedhold input contact ∗ SP is closed, and cycle start input contact ST is closed and opened, temporary stop SPL is turned off, and automatic operation is restarted. The cycle start output STL is turned on also.

Timing chart for input of cycle start (ST), feedhold (∗ SP), and cycle start (STL) and temporary stop (SPL) is shown in Fig. 20.4.

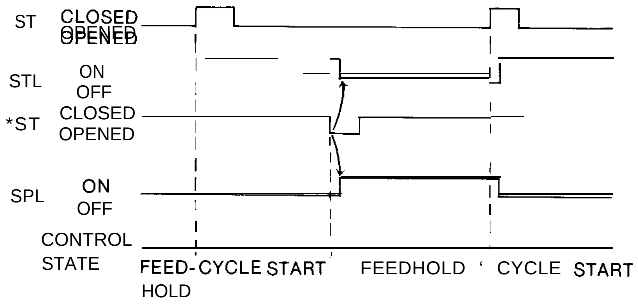


Fig. 20.4 **Timing Chart for Input of Cycle Start (ST), Stop (* SP), and Output of Cycle Start (STL), Feedhold (SPL)**

NOTE

1. **Be sure to** keep the cycle start (ST) and feedhold (∗ SP) input contacts closed or open for at least 100 ms. If the duration is shorter than this, the input may sometimes be disregarded.

2. When the feedhold (∗ SP) input contact is opened, with the control waiting for the completion of the M, S, T, instruction (waiting for FIN input), feedhold (SPL) output is turned on, but when the M, S, T, instruction completion (FIN) input contact is opened, the control enters feedhold state.

3. During SBK stoppage, the STL signal is OFF.

4. The STL signal remains ON while the ALM condition exists.

20.2.5 RAPID TRAVERSERATE OVERRIDE (ROV1, ROV2) INPUT

These inputs are for determining the rapid traverserates, (i.e., the positioning speed when executing programs in the automatic operation modes,) and the motion speed in the manual jog mode when the RT input contact is closed.

Table 20.4 Input Signal and Rapid Traverserate

Input Signal		Rapid Traverserate				
ROV1	ROV2	1st-Axis	2nd-Axis	3rd-Axis	4th-Axis	5th-Axis
1	1	pm 2801 Setting speed	pm 2802 Setting speed	pm 2803 Setting speed	pm 2804 Setting speed	pm 2805 Setting speed
0	1	pm 2801 Setting speed $\times \frac{1}{2}$	pm 2802 Setting speed $\times \frac{1}{2}$	pm 2803 Setting speed $\times \frac{1}{2}$	pm 2804 Setting speed $\times \frac{1}{2}$	pm 2805 Setting speed $\times \frac{1}{2}$
1	0	pm 2801 Setting speed $\times \frac{1}{4}$	pm 2802 Setting speed $\times \frac{1}{4}$	pm 2803 Setting speed $\times \frac{1}{4}$	pm 2804 Setting speed $\times \frac{1}{4}$	pm 2805 Setting speed $\times \frac{1}{4}$
0	0	pm 2447 Setting speed				

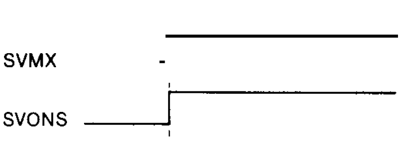
Note : 1: Closed 0: open

20.2.6 MACHINE-READY (MRD # 30040) INPUT

This input informs that the external heavy-current circuit is ready. The MRD input is closed when the NC side is ready and the lubricating oil and coolant pressures of the machine side are properly adjusted.
When the MRD input is closed after the servo power (SVMX) and brake release (BKX) are turned ON by the control upon power ON, the control is completely ready and the CRT screen reads RDY.

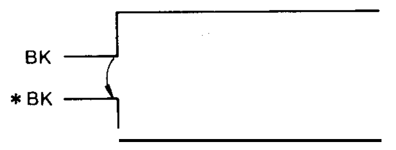
When the MRD input is opened after the control is completely ready, the control is placed in an alarm condition (alarm 2190 : machine not ready) so that operations come to a stop (refer to the power ON sequence time charrt in Par, 10.3. I .).

20. 2.7 SERVO ON MONITOR (SVONS # 35030) OUTPUT



This output signal is closed when the SVMX (servo power ON) output from the power ON circuit goes ON.
It can be used when servo power ON is to be read by the sequencer..

20.2.8 BRAKE ON MONITOR (* BK #35031) OUTPUT



This output is opened when the vertical axis brake release output BK goes ON in the power ON sequence.
It can be used when the brake release information is to be read by the sequencer.

20.2.9 EXTERNAL RESET (ERS #30041) INPUT AND RESET ON (RSTS #35001) OUTPUT

ERS is the input to reset the control, When ERS input is closed, the control stops all of its operations, closing reset On output RSTS for one second. The output signals are opened except for the following.

Table 20.5

Output Signals	Output at ERS Input Close
AUT, MAN ZPX – ZP5 2ZPX～2ZP5 3ZPX–3ZP5 4ZPX–3ZP5 5ZPX – 3ZP5 4NGC, 5NGC	Previous conditions kept.
RST	Output contact is closed for one second while ERS input contact is closed or opened.
AL	Contact kept open unless alarm causing factor is cleared.
SDO0～SDO23	Previous conditions kept.
UO0～UO31	Previous conditions kept.

Note: When ERS input is closed, the control is put in the label state.
However, memory is rewound, while the tape is not.

NOTE

The term “label skip” means that the entire information is to be disregarded until the first end-of-block code is read after power ON or reset (no parameters disable this label skip feature).

20.2.10 INTERLOCK (STLK # 30042) INPUT

This input stops the spindle travel in the automatic operation mode. As long as “STLK” input is closed, spindle travel will not start by closing “ST” input.

Even when the STLK input is closed during startup, the control remains in the preceding state. The STLK input takes effect after the system is brought to a stop by the SBK, feedhold, or other signal.

20.2.11 ALARM (ALMS # 35000) OUTPUT AND EXTERNAL ERROR DETECT (ERR0 # 30056, ERR1 #30057) INPUTS

(1) Alarm (ALMS) Output

These outputs inform that the control is in the alarm state.

ALMS: This output is closed on detection of alarm. (However, the alarm for the fault of the logic circuitry in the control is not included.)

These outputs are opened again when the cause of the detected alarm has been removed and RESET operation is performed.

(2) External Error Detect (ERRO, **ERR1)** Inputs
These inputs put the control in the alarm state from the outside.

ERRO: When this input is closed, the control displays alarm code and is put in the alarm state. If this input is closed during the execution of the part program in the automatic operation mode, the execution is stopped on completion of the block being executed.

ERR1 : When this input is closed, the control displays an alarm code and enters in the alarm condition. If this input is closed during part program execution in the automatic operation mode, the operation comes to a stop after deceleration.

ERR2: When this input is closed, the control displays an alarm code and enters in the alarm condition. If this input is closed during part program execution in the automatic operation mode, the operation comes to an immediate stop with the servo system turned OFF.

20.2.12 INPUT ERROR STATE (**IERS** #35003) OUTPUT

If an operation or NC data input command error is detected, this output is closed. The output is opened by performing the reset procedure.

20.2.13 WARNING STATE (WARNS # 35004) OUTPUT

This output is closed when a minor error is detected in keying or editing operations. The output is opened by depressing any key.

20.2.14 BG EDITING ERROR STATE (**BGEDES** # 35005) OUTPUT

This output is closed when an error is detected while NC machining data input BG (background) operations are performed in the automatic operation mode. The output can be opened by use of a soft key (the output can be cleared by performing the BG reset or NC reset procedure).

20.2.15 EXTERNAL SERVO ON (**SVON** #350050) INPUT

This input turns ON the control servo power, and makes the system ready for operations after verifying the completion of machine side pre-operational preparations. This action is referred to as the second power ON operation, which is triggered by depressing the power ON switch after power ON or receiving the external servo ON signal (SVON) from the PLC.
NOTE: The SVON signal takes effect when Pm5012 DO = ON.

20.2.16 TIME COUNT (**EXTC** #30051) INPUT

While this input is closed, the operating time display external timer operates. The external timer provides a cumulative count when this input is opened, closed, and opened again. The cumulative count can be reset from the operation panel.

20.2.17 CRT-OFF (**CRTOFF** #30052) INPUT

When this input is closed, the CRT power turns OFF to offer the maximum life of the CRT. When this input is opened, closed, and opened, the CRT screen turns ON, OFF, and back ON.

20.2.18 SINGLE-BLOCK (SBK #30060) INPUT

This input is for executing part programs by one block in the automatic operation mode. When an automatic operation cycle is started while the SBK input is closed with the control placed in the automatic operation mode, the control executes only one block of the part program, stops, and then turns OFF the STL (startup state # 35370) output. When the SBK input contact is closed during the execution of a part program, the control stops the machine after the execution of the current block.

20.2.19 MANUAL ABSOLUTE (ABS #30061) INPUT

(1) When ABS Input Relay is Open

The motion path after an intervention by manual axial motion, is the one shifted parallel to the original path by the distance covered by the manual motion.

For details refer to the YASNAC i80M Instruction Manual (TOE-C843-11. 30).

G90
GO1 Z20. 000 F△△;
X20. 000 Y30. 000 ← (1)
X10. 000 Y40. 000

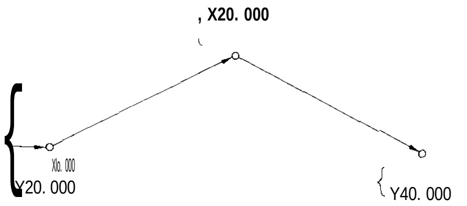


Fig. 20. 5 Motion Path in Automatic Operation Mode

① When the machine is manually moved during a block.

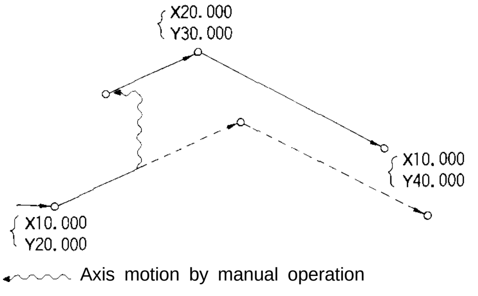


Fig. 20. 6 When ABS Input Relay is open

(2) When ABS Input Relay is Closed

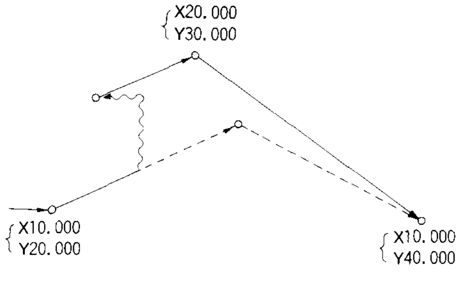


Fig. 20.7 When ABS Input Relay is closed

20.2.20 DISPLAY LOCK (DLK # 30062) INPUT

This input is for preventing the output pulses of the control from being displayed on the external current value display. While the DLK input contact is closed, even when the machine is controlled automatically or manually, the external current value display (CRT-POS "EXTERNAL") does not change.

20.2.21 PROGRAM RESTART (PRST # 30063) INPUT

This input is used when a part program is to be started again after interruption, Close the PRST input contact, turn on the memory mode, and search No. of program restart by the NG operator's station. The M/S/T codes present between the leading end of the program and the searched sequence No. are displayed on the CRT.

20.2.22 DRY RUN (DRN #30064) INPUT

This input is for changing the feed rates of the tools during the execution of part programs in the automatic mode to the rates selected by the manual continuous feed selection inputs (JV1, JV2, JV4, JV8 and JV16).

While the DRN input contact is closed, the feedrate during the execution of part programs in the automatic mode are changed from the programmed ones to the ones selected by the manual continuous feed selection inputs.

When the DRN input contact is closed or opened during the automatic operation of the control, the following changes take place.

During mm/rev feeding: No change of feedrate for the current block.
During mm/min feeding: Feedrate changes even during the current block.

During tapping, however, no changes occur in the middle of the current block. The input takes effect after the execution of the current block is completed. For rapid traverse, either rapid traverse or JOG speed can be chosen using a parameter. As for rapid traverse speed, the rapid traverse override feature works.

The accel/decel time constant is not affected by Dry Run ON/OFF.

- Dry Run internal toggle switch ON/OFF-Pm0000 D3
- Dry Run ON/OFF for rapid traverse-Pm2000 DO

20.2.23 MACHINE LOCK (MLK #30066)

This is the input for preventing the output of control output pulses to the servo unit. While the MLK input contact is closed, even when the logic circuit distributes pulses on the automatic and manual operation modes, the machine does not move. As the logic circuits distribute pulses, the current value display changes with the instructions.

The control must be stopped while the MLK input is closed or opened. In other words, the MLK input works only in the block stop or feedhold state.

This function can be used when final program check is to be performed with the actual machine without moving the axes. With the AMLKX # 30840 to AMLK5 # 30844 inputs, it is possible to activate the machine lock feature variously for all axes. When the MLK is turned ON during SBK operations, the MLK input works on the next block after current-block stop.

20.2.24 AUXILIARY FUNCTION LOCK (AFL # 30067) INPUT

This is the input for omitting the M/S/T function in executing part programs in the automatic operation mode.

While the AFL input contact is closed, the control disregards M/S/T instructions of programs when executing part programs. However, M code decoded outputs (MOOR, MO1 R, M02R, M30R) are output. Also, the analog D/A output is delivered to the spindle,

When the AFL input contact is closed or opened during the execution of part programs, the change becomes effective from the block subsequent to the current block.

20.2.25 REFERENCE POINT RETURN CONTROL 1/0 SIGNALS
(ZRN # 30070, *DCX-* DC5 # 30730-# 30734, ZPX-ZP5 # 36300-# 36304, 2ZPX-1ZP5 # 36310-# 36314, 3ZPX-3ZP5 # 36320-# 36324, 4zPX-4ZP5 # 36330- #36334)

These are input and output signals for bringing the machine to the machine reference point upon the energization of the control,

The following reference point return methods are available,

(1) Grid Method

When this method is employed, the reference point is determined according to the position detector zero point pulse (1 pulse/revolution).

When the ZRN input is closed in the manual jog or RPD mode after power ON and then the axis is moved in the reference return direction, the reference point return operation is performed as indicated in Fig 20.8. (The same applies to the execution of G28 in the automatic operation modes.)

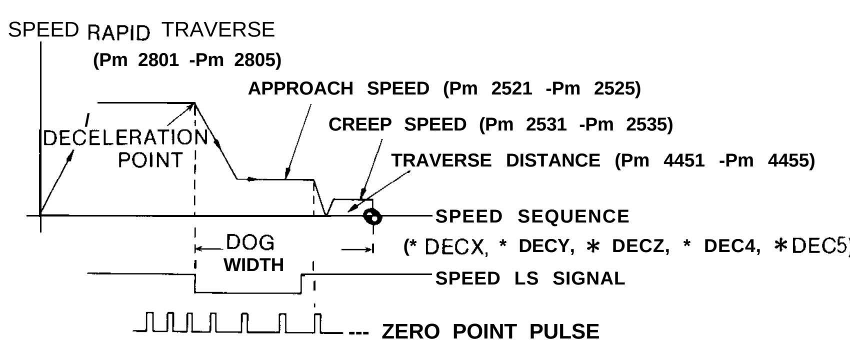
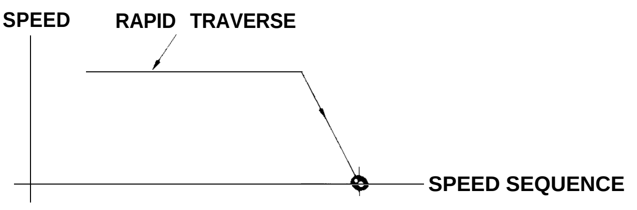


Fig. 20.8 Reference Point Return Operation (Grid Method)

(2) High-speed Method
When reference return is effected once in the high-speed zero return mode (automatic/manual), subsequent reference return is effected so that positioning is accomplished relative to the reference point determined in the first reference return.



Note :
With an appropriate parameter (Pm 4003), it is possible to use the grid method for the second and subsequent reference return operations.

Fig. 20. 9 Second and Subsequent Reference Return (High-speed) Operations after Power ON

(3) Second Reference Return (**ZRN2** #30071) Input
This is the manual second reference return input in cases where the second reference return feature is optionally added. The operations are basically the same as the manual reference return operations.

(4) Reference Point (ZPX-ZP5 #36300-# 36304) Output
The ZPX to ZP5 outputs are closed while the control axis is remaining within ±3 pulses of the reference point after completion of reference return or reference positioning setup.

(5) Second Reference Point (2 ZPX-2ZP5 #36310-#36314) Output
When part program command G30 is executed in the automatic operation mode to position the machine at the second reference point, the second reference point output (2ZPX-2ZP5) is closed.

(6) Third Reference Point (3ZPX-3ZP5 #36320-# 36324) Output
When part program command G30P3 is executed in the automatic operation mode to position the machine at the third reference point, the third reference point output (3 ZPX-3ZP5) is closed.

(7) Fourth Reference Point (4 ZPX-4ZP5 # 36330-# 36334) Output
When part program command G30P4 is executed in the automatic operation mode to position the machine at the fourth reference point, the fourth reference point output (4 ZPX-4ZP5) is closed.

20.2.26 EDIT LOCK (**EDTLK** #30072) INPUT

This input prevents the contents of the control part program memory from being changed.
When the EDT LK input is closed, the INSRT, ALTER, and ERASE key operations and external data storage operations in the program edit mode are disregarded. If an attempt is made to perform editing a warning message appears to indicate that editing is prohibited.

20.2.27 TOOL LENGTH MEASUREMENT (**TLMI** # 30074, RET # 30075, TLMO # 35051) **INPUTS/OUTPUTS**

These inputs and outputs are used with tools mounted on the Z-axis when the manually moved distance from the predetermined reference position to the reference level is written into the tool correction value memory directly and automatically.

These inputs and outputs are provided for tool length measurement, When the TLMI is opened, the current Z-axis value is stored in NC memory as reference position data. At this time, the TLMO output is generated to indicate the tool length measurement mode.

When the RET is closed with the Z-axis moved to the measurement point, the distance moved from the Z-axis reference position is stored in a memory location having a certain correction number.

When the TLMI is opened again, system exits the TLM mode and the TLMO output falls.

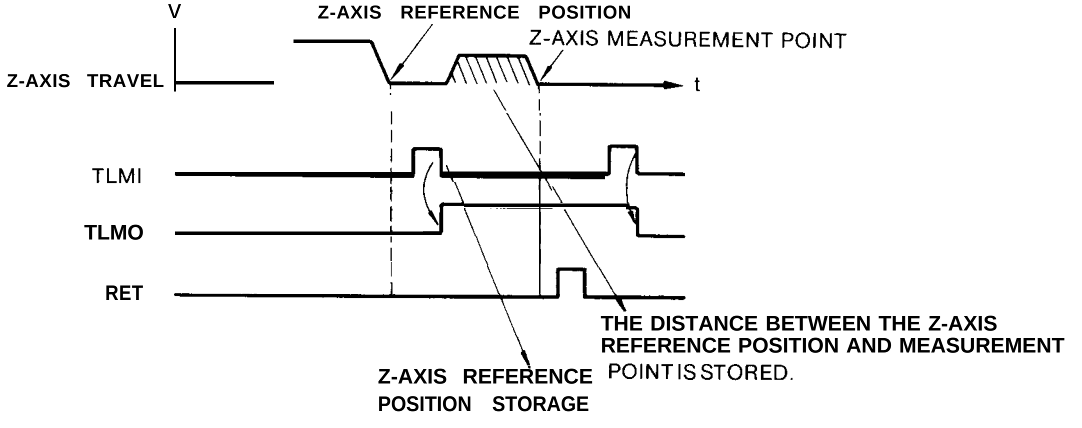


Fig. 20.10 Tool Length Measurement I/O Time Chart

20.2.28 **F1-DIGIT** SELECTION SIGNAL (FI #30076)

When a number between 1 and 9 is designated as a suffix to F, the associated predefined setting parameter (Pm820-Pm828) dictates the feedrate.

When the F1 input is closed, rotating the manual pulse generator increases or decreases the F1 -digit designated feedrate.

As a result of this operation, the F1 -digit speed setting changes.

While the F1 input is open, the feedrate does not vary upon manual pulse generator rotation.

NOTE

1. When this function is added, the normal F function cannot be used to select a feedrate between 1 and 9 mm/min. However, it can be used to select a feedrate of 10 mm/min, or higher,
2. While the Dry Run switch is ON, the Dry Run speed takes precedence.
3. The feed override function does not work on the F1 -digit selection signal.
4. The stored feedrate data are retained even after the power is turned OFF.

5. If the designated F speed is higher than the F1 -alight maximum speed parameter value (Pm2865, 2866) while the F1 -digit selector signal is used, the speed is clamped to that parameter value. If the F1 -digit maximum speed setting parameter value is above the regular maximum cutting speed, the speed is clamped to the regular maximum cutting speed.

20.2.29 SYSTEM NUMBER SETTING MONITOR OUTPUT (SSWSO # 35060 -SSWS3 # 35063)

This output is delivered to the I/O to indicate the setting parameter # 109 state

Note, however, that setting parameter # 109 takes effect only when the FC200 circuit board rotary switch is set to O.

20.2.30 EXTERNAL DATA INPUT (EDO # 30300 THROUGH ED31 # 30337, EDSAO # 30344 THROUGH EDSA2 # 30346, EDCL, EREND AND **ESEND) INPUTS/OUTPUTS**

(1) These inputs/outputs are used to make the machine perform the following functions by external inputs:

(a) External work number search
External inputting of 4-digit program (1 to 99999 BCD) selects the work number desired.

(b) External tool compensation input.
These external input signals can command compensation values for tool length and diameter.

(c) External work coordinate system shift.
The work coordinate system shift value can be entered externally.
Externally entered axis correction value is added to the shift value of the specified axis programmed by G54 to G59 and the result is stored as a new shift value.

(2) Input/Output Signals For Inputting External Data

(a) External data inputs (EDO #30300 to ED31 #30337)
These inputs are used for work No. input signal, offset amout input signal and work coordinate system shift signal.

Table 20.6 External Data Input Signal

External Data Input Signal							
ED7	ED6	ED5	ED4	ED3	ED2	ED1	ED0
ED15	ED14	ED13	ED12	ED11	ED10	ED9	ED8
ED23	ED22	ED21	ED20	ED19	ED18	ED17	ED16
ED31	ED30	ED29	ED28	ED27	ED26	ED25	ED24

(b) External data selection (EDSA #30340 to EDSD #30343)
Input data can be selected by the external data.

Table 20.7 External Data Selection

	External Data Selection			
	EDSD	EDSC	EDSB	EDSA
External work No. designation	0	0	0	1
External tool compensation (H)	0	0	1	0
External tool compensation (D)	O	0	1	1
External coordinate shift	0	1	0	0

1: Closed, 0: open

(c) External data axis selection (EDSAO #30344 to EDAS2 #30346)
This signal is used for specifying the axis for external data and given in three digits.

Table 20.8 External Data Axis Selection

	External Data Axis Selection		
	EDAS 2	EDAS 1	EDAS O
1st-axis	ABS/INC	0	0
2nd-axis	ABS/INC	0	1
3rd-axis	ABS/INC	1	0
4th-axis	ABS/INC	1	1
5th-axis	1	0	1

ABS = 1 INC=0
Note : For external coordinate shift. INC is selected

(d) External data selection strobe (EDCL # 30347)
External data input starts when this signal rises up,

(3) Output Signal For External Data Input
When input data described in (a) to (b) are input and stored in the internal memory, it is indicated by outputting completion signal (EREND #35045 or ESEND #35046).

(4) Time **Chart** of Inputting External Data

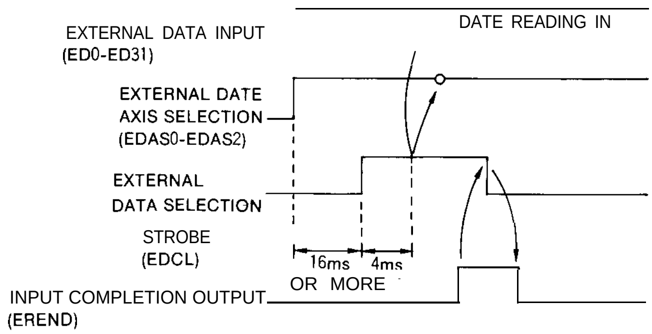


Fig. 20.11 External Data Input Time Chart

For external work No. input, when it is input, ESEND instead of EREND is given as input completion output.

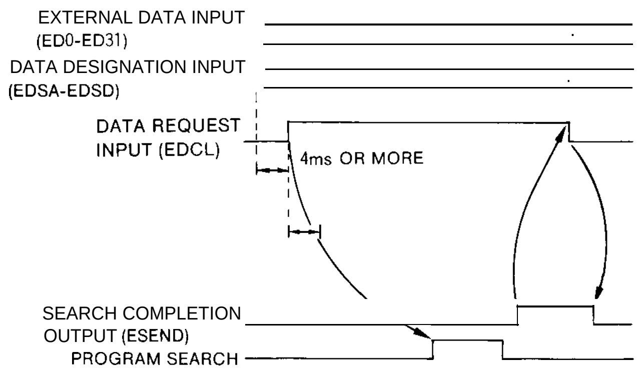


Fig. 20.12 External Work No. Input Time Chart

(5) LIST OF EXTERNAL DATA **INPUT/OUTPUT**

(a) Inputs (See Table 20. 9.)

Table 20.9 List of External Data Input/Output

	Input Strobe	Axis Selection			Data Selection				External Data															
External Data Input/output	ED CL	ED AS2	ED S1	ED AS0	ED SD	ED SC	ED SB	ED SA	ED 31	ED 30	ED 29	ED 28	ED 27	ED 26	ED 25	ED 24	ED 23	ED 22	ED 21	ED 20	ED 19	ED 18	ED 17	ED 16
External Work No. Designation					0	0	0	1	WND10000000				WND1000000				WND100000				WND10000			
									ED 15	ED 14	ED 13	ED 12	ED 11	ED 10	ED 9	ED 8	ED 7	ED 6	ED 5	ED 4	ED 3	ED 2	ED 1	ED 0
									WND1000				WND100				WND10				WND1			
External Tool Compensation (H)		ABS / INC			0	0	1	0	SIGN															
External Tool Compensation (D)		ABS / INC			0	0	1	1	SIGN	+79999999 (BCD)														
External Coordinate System Shift					0	1	0	0	SIGN	Selected by parameter														

(b) Output
ESEND : External search end,
EREND: External data input end.

(6) Supplementary Explanation

(a) External work No. designation

① If the work number is outside the range from O to 99999 in the external work number input state or the designated work number does not exist, the ALMS output is generarated.

② While the operating state output (OP) is closed, the external work number search function is disabled.

(b) External tool offset

① The offset number to be modified is selected by program.

② Type of modification is selected by external input as follows.
EDAS2=0···Externally input data are added to the stored value.
EDAS2=1 ···Externally input data are replaced with the stored data.

③ External tool No. address is selected by two bits of external data select (EDSA-EDSB) as follows.
EDSA="O," EDSB="1"···H for tool length offset
EDSA="1," EDSB="1"···D for tool diameter offset

④ if tool offset No. is not selected (H is set at 00 or D is set at 00), input-completion signal is given without changing any offset value.

⑤ The offset value changed by external input is effective with the block including tool length offset (G43, G44) and tool diameter offset (G41, G42) command. Tool position offset A (G45 to G48) is effective with the next block including the command (G45 to G48).

⑥ Axis selection input EDASO, EDSAl is not required for external tool offset. If designated, the input is disregarded.

⑦ The offset amount commanded by external tool offset input is equivalent to the amount entered by MD I key.

(c) External work coordinate sytem

① The shift value commanded by external work coordinate system shift is equivalent to the value entered by MDI key.

② The shift value commanded by external work coordinate system shift input is added to the stored shift value (G54 to G59).

20.2.31 AUTOMATIC MODE HANDLE OFFSET INPUT (HOFS #30081)

While the HOFS input is closed, the movement caused by the manual pulse generator can be superimposed over the automatic mode movement.

The axis designated by the manual handle feed axis selection input is applicable to this superimposition. The amount of movement per graduation can be varied by changing the handle magnification setting.

NOTE

1. The automatic mode handle offset based movement function always works no matter when block stoppage is effected or no movement command is issued for the currently executed block.

2. While the axis interlock input (∗ITX-∗ IT5) is ON, no movement is initiated by the automatic mode handle offset function.

20.2.32 MACHINING INTERRUPTION POINT RETURN INPUT (**CPRN** #30082)

After manual movement is implemented in the middle of automatic operations for work measurement or cuttings removal purposes, it is possible to return to the machining interruption point by closing the CPRN input and manual feed axis direction selection input for the machining interruption point (at which the system switches from the automatic to the manual mode),

However, while the reference return or second reference return input is closed, the machine does not return to the machining interruption point but returns to the reference or second reference point.

20.2.33 EXTERNAL WRITE INPUT (EWS #30086)

In part program editing, the current values can be written as the axis, F, S, and T command values. That is, the axis command is used to move the axes, and the resulting current axis values can be set as the command values. As regards the F, S, and T values, the current command values can be stored as the command values.

When the RUN process program job places the system in the edit mode and the external write input is closed, the axis and cutting feed operations defined by parameters Pm4024 and Pm 4025 can be written into memory. In the write operation, only the data different from the previous ones are actually written,

Data other than the axis, F, S, and T data are edited in the same manner as in normal editing operations.

20.2.34 PLAYBACK INPUT (**PLAYBAK** #30087)

In part program editing, the current values can be written as the axis, F, S, and T command values. That is, the axis command is used to move the axes, and the resulting current axis values can be set as the command values. As regards the F, S, and T values, the current command values can be stored as the command values.

When the RUN process program job places the system in the edit mode and the playback input closed, the system enters the playback mode.

When the axis is moved to a desired position to be represented by the command value and the [WR] key is depressed after address key activation, the current position value is written into memory as the command value for the axis. If a numerical value is entered before [WR] activation, the sum of the entered value and the current position value is written into memory,

20.2.35 OFFSET PRESETTER FUNCTION INPUT (OFH #30094, SPST #30097)

The offset presetter function is exercised so that the tool offset amount setting data are automatically written into memory using the touch sensor while the tool is manually brought into contact with the reference surface.

When the offset presetter (OFH # 30094) is closed in the automatic mode, the CRT automatically switches to the tool length/tool diameter measurement screen, placing the system in the measurement mode.

When signal SPST #30097 from the touch sensor is closed in this state, the axis offset amount is computed and written into memory.

20.2.36 WORK PRESETTER FUNCTION INPUT (WSS # 30090, WSH # 30091, WSC # 30092, WSG # 30093)

(1) Function Overview

The work coordinate shift amount is automatically written into memory with the reference manually brought into contact with the touch sensor.

(2) Measurement Types

The following four types of measurements are made.

- Reference plane measurement
  When the touch sensor is brought into contact with the X, Y, and Z reference planes, the detected coordinate values are written as the work coordinate shift amount data.
- Reference hole measurement
  When the touch sensor is brought into contact with three arbitrary reference hole points, the reference hole center is written as the X- and Y- axis work coordinate shift amount data.
- Reference groove measurement
  The center of two points of the reference groove or the like is written as the work coordinate shift amount data.
- Coordinate rotation measurement
  The work inclination is measured and written as the work coordinate shift amount data.

(3) Measurement Screen Operating Procedures

(a) Reference Plane Measurement

① Place the X, Y, and Z axes in the measurement start positions.

② Enter the manual mode.

③ Turn ON work presetter (reference plane) signal WSS #30090.

④ Using the page (up/down) and cursor (up/down) keys, set a desired work coordinate system (the page keys do not work for coordinate setup option A).

⑤ Touch sensor signal SPST # 30097 automatically recognizes the axis turned ON (axis moved) and writes the current value (MACHINE POSITION) as the axis work coordinate shift amount data. Reference plane measurement can be made of the X, Y, and Z axes.

⑥ When all necessary work coordinate systems are completely set up, turn OFF work -presetter (reference plane) signal WSS # 30090. The display then switches to the work coordinate system shift screen.

NOTE

1. Even when the fourth and fifth axes are added, only the X, Y, and Z axes can be measured.

2. Manipulate the cursor keys to place the cursor over a desired axis, enter a numerical value, and depress the WR key to write the entered value into memory.

3. When making another measurement after the touch sensor is brought into contact with the reference plane, be sure to return to parameter #6847 or earlier.

(b) Reference Hole Measurement

① Place the X, Y, and Z axes in the measurement start positions.

② Enter the manual mode.

③ Turn ON work presetter (reference hole) signal WSH #30091.

④ Using the page (up/down) and cursor (up/down) keys, set a desired work coordinate system (the page keys do not work for work coordinate setup option A).

⑤ Manually bring the touch sensor into contact with an arbitrary point of the reference hole. The current values (MACHINE POSITION) of the X and Y axes turned ON by touch sensor signal SPST #30097 are then stored in the internal table. As a comment appears on the display to indicate that the second point can be measured, prepare for the second point measurement.

⑥ Bring the touch sensor into contact with the second measurement point of the reference hole. The current values (MACHINE POSITION) of the X and Y axes turned ON by touch sensor signal SPST # 30097 are then stored in the internal table. As a comment appears on the display to indicate that the third point can be measured, prepare for the third point measurement.

⑦ Bring the touch sensor into contact with the third measurement point of the reference hole. The current values (MACHINE POSITION) of the X and Y axes turned ON by touch sensor signal SPST # 30097 are then stored in the internal table. This measurement and the two preceding measurements are computed to determine the central position. The computed value is written as the work coordinate shift amount data.

As the display then shows a comment to indicate that the first point can be measured, prepare for the measurement of the first point of the next reference hole.

⑧ When all necessary work coordinate systems are completely set up, turn OFF work presetter (reference hole) signal WSH # 30091. The display then switches to the work coordinate system shift screen.

NOTE

1. Reference hole measurement can be mede of the X and Y planes only.

2. Before entering WSH # 30091, be sure to enter the manual mode. If WSH # 30091 is entered in a mode other than manual, the machine does not enter the measurement mode.

3. As with the reference plane measurement screen, the setup data can be written into memory with the cursor placed in desired input positions.

4. If the reset procedure is performed before setup completion (in the second or third point measurement wait state), you are returned to the initial state (the first point measurement wait state).

5. If the "measurement point cancel" key is depressed before setup completion (in the second or third point measurement wait state), the preceding measurement point is canceled and you are returned to the preceding measurement point wait state.

6. If the distance to the third measurement point is smaller than defined by parameter # 6848, the system concludes that the setup is in error and gives the "measurement error" warning indication. Performing the reset procedure in this state clears the warning indication and returns you to the state in which "the first point can be measured."

(C) Reference Groove Measurement

① Place the X, Y, and Z axes in the measurement start positions,

② Enter the manual mode.

③ Turn ON work presetter (reference groove) signal WSG #30093.

④ Using the page (up/down) and cursor (up/down) keys, set a desired work coordinate system (the page keys do not work for work coordinate setup option A).

⑤ Manually bring the touch sensor into contact with an arbitrary point of the reference hole. The current values (MACHINE POSITION) of the X and Y axes turned ON by touch sensor signal SPST # 30097 are then stored into the internal tabel. As a comment appears on the display to indicate that the second point can be measured, prepare for the second point measurement.

⑥ Bring the touch sensor into contact with the other side of the reference groove. The current values (MACHINE POSITION) of the axes turned ON by touch sensor signal SPST # 30097 are then stored in the internal table. This measurement and the preceding measurement are computed to determine the groove center. The computed value is written into memory as the work coordinate shift amount data. As a comment appears on the display to indicate that the first point can be measured, prepare for the measurement of the first point of the next reference groove.

⑦ When all necessary work coordinate systems are completely set up, turn OFF work presetter (reference groove) signal WSG # 30093. The display then switches to the work coordinate system shift screen.

NOTE

1. Reference groove measurement can be made of the X and Y planes only,

2. Before entering WSG # 30093, be sure to enter the manual mode, If WSG # 30093 is entered in a mode other than manual, the machine does not enter the measurement mode.

3. As with the reference plane measurement screen, the setup data can be written into memory with the cursor placed in desired input positions,

4. If the reset procedure is performed before setup completion (in the second point measurement wait state), you are returned to the initial state (the first point measurement wait state). If such a condition occurs, make measurement again beginning with the first point.

5. If the "measurement point cancel" key is depressed before setup completion (in the second point measurement wait state), the preceding measurement point is canceled and you are returned to the preceding measurement point wait state.

6. When the first point measurement is for the X-axis, the system does not initiate computation until the second point measurement is made of the X-axis no matter whether the second point measurement is made of the Y-axis.

(4) Coordinate Rotation Measurement

(a) Place the X, Y, and Z axes in the measurement start positions.

(b) Enter the manual mode.

(c) Turn ON work presetter (coordinate rotation) signal WSC # 30092. The coordinate rotation measurement screen is then automatically selected.

(d) Using the page (up/down) and cursor (up/down) keys, set a desired work coordinate system (the page keys do not work for work coordinate setup option A).

(e) Manually bring the touch sensor into contact with an arbitrary point of the reference hole. The current values (MACHINE POSITION) of the X and Y axes turned ON by touch sensor signal SPST # 30097 are then stored into the internal table. As a comment appears on the display to indicate that the second point can be measured, prepare for the second point measurement.

(f) Bring the touch sensor into contact with the second point in the same reference plane as for the first measurement point. The current values (MACHINE POSITION) of the X and Y axes turned ON by touch sensor signal SPST # 30097 are then stored in the internal table. As a comment appears on the display to indicate that the third point can be measured, prepare for the third point measurement.

(9) Bring the touch sensor into contact with the third point in the orthogonal plane. The current values (MACHINE POSITION) of the X and Y axes turned ON by touch sensor signal SPST #30097 are then stored in the internal table. This measurement and the two preceding measurements are computed to update the X, Y, and R work coordinate shift amount data. As the display then shows a comment to indicate that the first point can be measured, prepare for the next first-point measurement.

(h) When all necessary work coordinate systems are completely set up, turn OFF work presetter (coordinate rotation) singal WSC # 30092. The display then switches to the work coordinate system shift screen.

NOTE

1. Reference groove measurement can be made of the X and Y planes only.

2. Before entering WSC # 30092, be sure to enter the manual mode. If WSC # 30092 is entered in a mode other than manual, the machine does not enter the measurement mode.

3. As with the reference plane measurement screen, the setup data can be written into memory with the cursor placed in desired input positions.

4. If the reset procedure is performed before setup completion (in the second or third point measurement wait state), you are returned to the initial state (the first point measurement wait state). If such a condition occurs, make measurement again beginning with the first point.

5. If the “measurement point cancel” key is de pressed before setup completion (in the second or third point measurement wait state), the preceding measurement point is canceled and you are returned to the preceding measurement point wait state.

6. The first and second measurement points must be in the machining plane parallel to the X-axis.

20.2.37 EXTERNAL INPUT, EXTERNAL VERIFICATION, AND EXTERNAL OUTPUT SIGNALS (EIN, EVER, EOUT, ECLM, IER, EDTS)

These external signals are used to perform part program input, verification, and output operations relative to the part program memory in the NC.

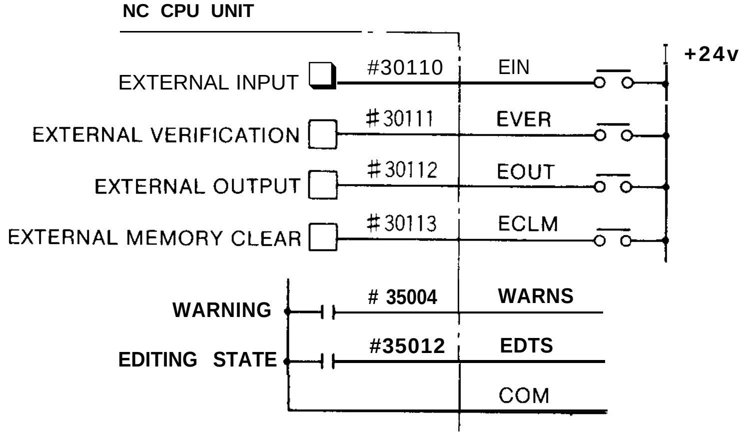


Fig. 20.13 External Input, External Verification, and External Output Signals

(1) External (EIN) Input

When the EIN input is closed in the label skip state, the part program storage operation is performed via the interface defined by the I/O equipment no matter what mode the NC is in.

The part program to be stored must be formatted as indicated in Fig. 20.14.

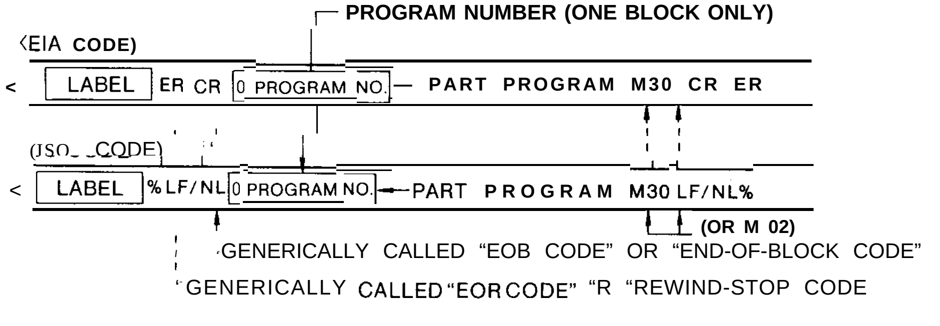


Fig. 20.14 Formatting the Part Program to Be Stored

Program registration is carried out according to the program number (O number) attached to the beginning of a part program.

Program storage is completed when the NC reads the FOR code (ER or %) which is attached to the end of a program.

NOTE

1. If the same O number is already registered, use the external memory clear (ECLM) input, which is described later, to erase the program and then perform the above procedure.

2. However, if parameter pm3005 D0=1, erase the already registered O number and then execute the program storage function. If pm3005 DO=O, a warning condition occurs so that the input stops.

(2) External Verification (EVER) Input and Input Error **(IER)** Output

When the EVER input is closed in the label skip state, the system compares the external part program data against its counterpart in the NC part program memory via the interface defined by the I/O equipment no matter what mode the NC is in. In this case, programs having the specified O number are checked. However, when the data in a number of part programs are checked, the system checks all data between the first EOR code (ER or %) and the last EOR code in a lump and therefore does not stop at the end (M02 or M30) of each program.

If any disagreement is found in the check, the warning (WARNS) output signal is closed. This error output signal is cleared and opened when the external reset (ERS) input turns ON,

(3) External Output **(EOUT)** Input

When the EOUT input is closed in the label skip state, all the part program data registered in the NC part program memory are delivered out via the interface defined by the I/O equipment no matter what mode the NC is in. You cannot selectively output part programs having a specific O number.

(4) External Memory Clear **(ECLM)** Input

When the ECLM input is closed in the label skip state, all the part programs stored in the NC part program memory are erased no matter what mode the NC is in. You cannot selectively erase part programs having a specific O number.

(5) Editing State **(EDTS)** Output

While the machine executes the input, verification, output, or memory clear function with the above EIN, EVER, EOUT, or ECLM input closed, the EDTS signal is closed. This signal opens upon completion of the above function execution.

(6) Typical Use and Time Chart

Typical part program input (storage), verification, and memory operation sequences are indicated below, They are performed via the RS-232C interface using the DC code.

(a) Close the EDIT mode

(b) Close the external reset (ERS) input.
--- The program pointer then returns to the beginning of the currently selected part program, placing the machine in the label skip state.

(c) Close the external memory clear (ECLM) input.
--- The machine then erases all the part programs. During erasure function execution, the EDTS output is closed. The EDTS opens upon completion of erasure.

(d) With the EDTS "open" signal, open the external reset (ERS).
--- The machine is then placed in the label skip state.

(e) Close the external input (EIN) signal,
--- The EDTS then closes.
(i) The NC equipment turns ON the RS-232C interface request-to-send (RS) signal.
(ii) If the remote equipment is ready for transmission, it returns the clear-to-send (CS) signal to the NC.

(iii) The NC transmits control code DC1 via the send data (SD) line.

(iv) When triggered by code DC1, the remote equipment sends the part program data to the NC via the receive data (RD) line.

(v) When the NC reads the EOR code (ER or %), it transmits control code DC3, and at the same time, turns OFF the request-to-send (RS) signal.

(vi) The remote equipment reads code DC3, and then simultaneously stops data transmission and turns OFF the clear-to-send (CS) signal.

(f) When the above part progrm storage operation is completed, the editing state (EDTS) putput opens. The external reset (ERS) signal is then closed if no alarm condition exists.
--- The machine is then placed in the label skip state,

(9) Close the external verification (EVER) signal.
--- In the same manner as indicated in steps (i) through (vi) above, the NC part program data is compared with the external one. During comparison, the EDTS output is closed. The EDTS output opens again upon completion of comparison.

(h) If no alarm condition exists, close the memory operation (M EM) mode.

(i) Close the external reset (ERS) signal.
--- The program pointer then returns to the beginning of the part program just checked. If a number of part programs are checked altogether, the pointer returns to the beginning of the last part program. (To choose any other part program, use the "external work number search" feature of the "external data input" function).

(1) Close the cycle start (ST) input.
--- Automatic operations are then performed according to the selected program.

(k) When FIN signal processing is carried out in compliance with the M02 or M30 command attached to the end of the part program, automatic operations come to an end.
The time chart of the signals involved in the above operations is presented in Fig. 20.15

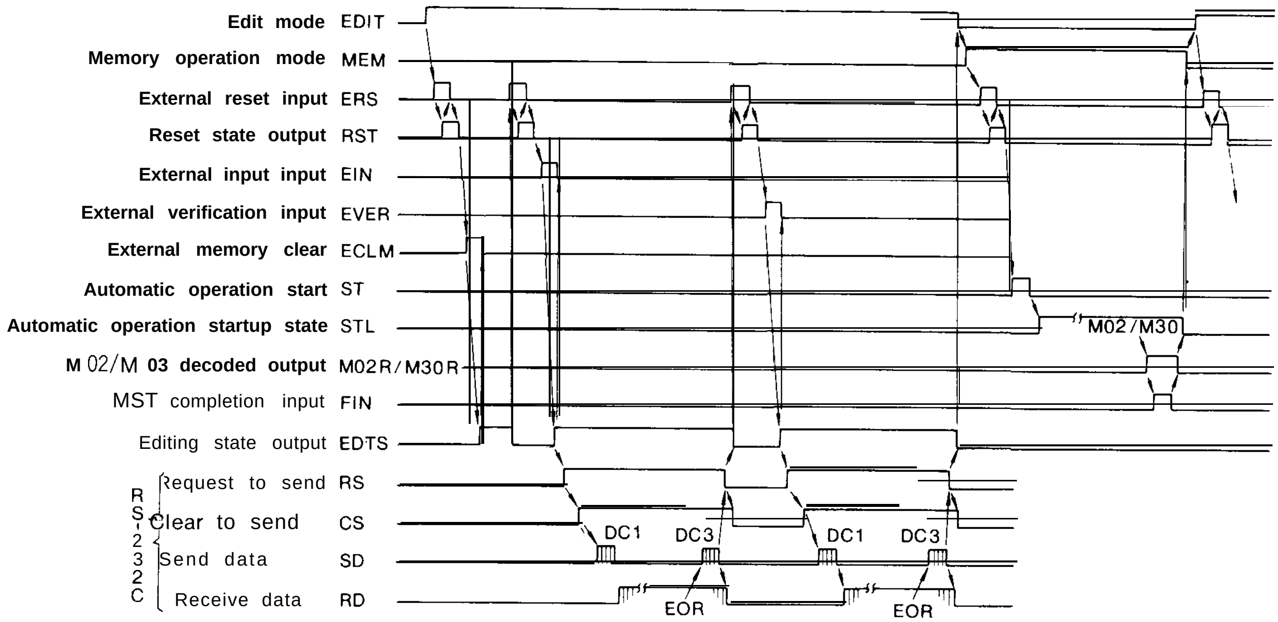


Fig. 20. 15 External Input and External Verification Input Operation Example Time Chart

NOTE

1. Program No. 00000 cannot be used for the above operations.

2. Part programs having no program numbers cannot basically be stored in memory.

3. If the part program memory capacity is about to be exceeded in the part program storage sequence, the warning state output (WARNS) is generated to stop the input operation,

20.2. 38 MANUAL SKIP MODE INPUT (MSKP # 30096), TOUCH SENSOR INPUT **(SPST** #30097), AND MANUAL SKIP MODE OUTPUT **(MSKPO** # 35077)

When the manual skip input (MSKP) is closed, the NC enters the manual skip mode so that the manual skip mode output (MSKPO) closes.
When, for instance, the touch sensor is manually brought into contact with the workpiece while the NC is in the manual skip mode, closing the touch sensor input (SPST) causes the system to read the mechanical coordinate values and direction of contact.

NOTE

1. When the manual skip input (MSKP) signal is entered from the machine, it is disregarded unless the NC is in the manual mode, and therefore the manual skip mode output (MSKPO) is not generated.

2. If no axes have ever been returned to zero point after power ON, the touch sensor signal is disregarded and no measurement takes place when touch sensor input rise is detected in the manual skip mode.

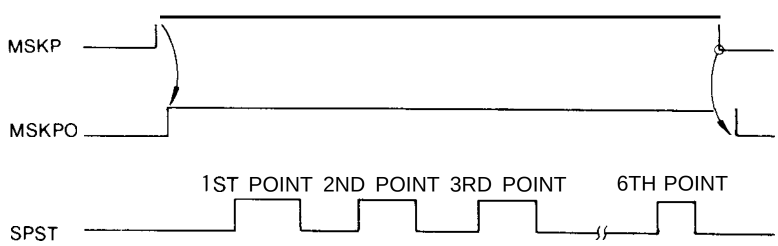


Fig. 20.16 Typical Manual Skip Execution Time Chart

Measurement point monitor parameter

pm107 — Indicates how many point data are currently stored. (The initial value is **0,** The value becomes 1 when one measurement is made.)

Position information parameters

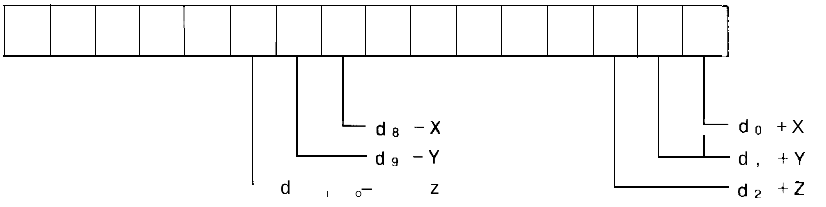
1 = 0.001 mm

pm920 --- X-axis first-point position information
pm921 --- Y-axis first-point position information
pm922 --- Z-axis first-point position information
pm923 --- X-axis second-point position information
pm924 --- Y-axis second-point position information
pm925 --- Z-axis second-point position information
⋮
pm935 --- X-axis sixth-point position information
pm936 --- Y-axis sixth-point position information
pm937 --- Z-axis sixth-point position information

Contact direction parameters

pm420 --- Direction of first-point contact
pm421 --- Direction of second-point contact
pm422 --- Direction of third-point contact
pm423 --- Direction of fourth-point contact
pm424 --- Direction of fifth-point contact
pm425 --- Direction of sixth-point contact

(pm420 - pm425) Dirction of contact



20.2.39 PROGRAM INTERRUPT (PINT #30363) INPUT

During automatic operation mode part program execution, the PINT input is used to cause the system to jump to a desired NC program.

[M91P・・・・・;]
After this command is issued, the program interrupt input turns ON in the middle of program execution and remains ON until the M90 command is issued.
Therefore, the currently executed program is interrupted upon receipt of the above command (if the machine is moving, it decelerates and then stops) and the system jumps to the program having the number designated by P.

[M90;]
This command turns OFF the program interrupt function.

NOTE

During DNC operation, the program interrupt function is inoperative

If the PINT input is closed while the machine is stopped between blocks (single-block stoppage, etc.), the execution of the part program designated by P starts when the operating cycle starts.

20.2.40 DIRECTPROCESSING SIGNALMONITOR OUTPUTS (HINI#35140-HIN3 #35142)

The direct processing signal monitor outputs represent the status of the direct IN signals (DINO-DIN2) which are directly read from FC230B circuit board connector CN26 to the NC.

Tabel 20.10 Relationship between Direct IN Signals and Direct Processing Signal Monitor Outputs

DIN0 ~ DIN2	HIN1 ~ HIN3
0 V	0
24 V	1

20.2.41 POSITIONING COMPLETION (DEN #35374) OUTPUTS

These outputs inform the completion of a move command when an M/S/T or B command and the move command have been specified in the same block at the execution of part program in the automatic operation mode.

The block in which an M/S/T or B command and a move command are specified at the same time is executed, if the M/S/T or B command is not completed at the termination of the move command positioning, completion output DEN is closed.

When FIN input is closed then opened and the M/S/T or B command is completed, the positioning completion outputs are opened.

20.2.42 ON OPERATION (OP #35357) OUTPUTS

This output is generated at the beginning of automatic operations to indicate that the control is operating. The "ON OPERATION" output (OP) is closed when the machine starts. It turns OFF upon reset (including the reset caused by M02 or M30). This output is generated only while the GO1 or GOO operation is conducted in the automatic operation mode.

20.2.43 CANNED CYCLE OPERATION STATE MONITOR OUTPUT (G80S # 35390, G84s # 35391, TAP # 35392)

When canned cycles are being performed, the following monitor signal will be sent out.
The spindle is controlled by M code during canned cycles.

(1) Canned Cycles **(G80S)**
The canned cycles signal (G80S) output is generated within 8 ms after the beginning of canned cycle, The canned cycle signal is turned OFF by the canned cycle cancellation block.

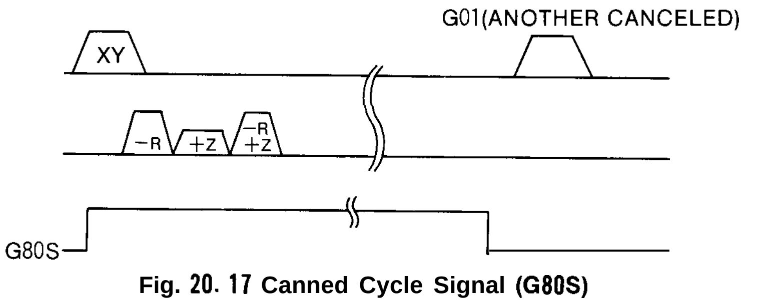


Fig. 20. 17 Canned Cycle Signal (G80S)

(2) Tap Cycle Signal **(G84S)**

The tap cycle signal (G64S) output is generated within 8 ms after the tap cycle (G74/G84) starts. The tap cycle signal can be turned off by canned cycle block cancellation.

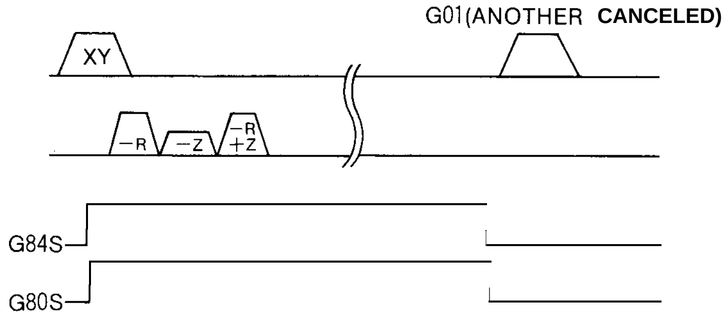


Fig. 20.18 Time Chart of G80S

(3) Tapping (TAP) Output

With these outputs the control informs that tapping is being performed during the execution of part program in the automatic operation mode These outputs are given when tapping starts from point R to point Z and turned off when tapping from point Z to point R is completed.

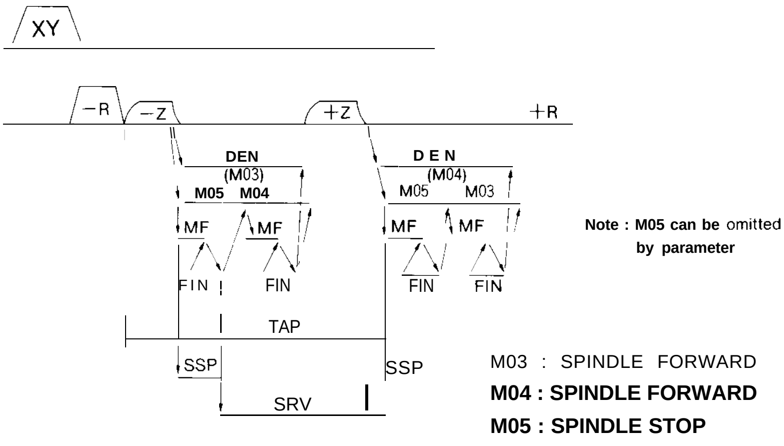


Fig. 20.19 Time Chart of G74 (G84)

(4) Canned Cycle on M Code

The time charts of M code during canned cycles are shown below,

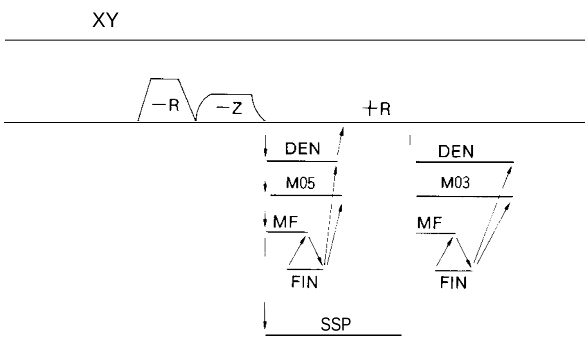


Fig. 20.20 Time Chart of G86 to G88

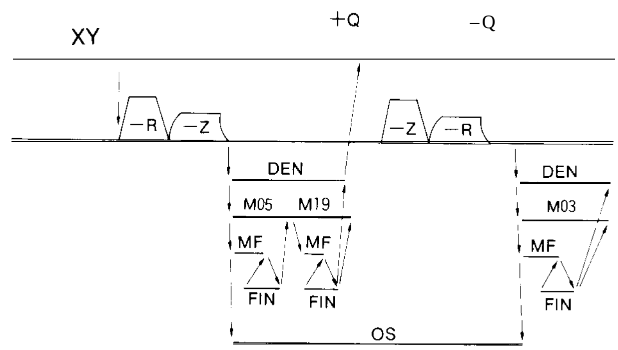


Fig. 20.21 Time Chart of G76

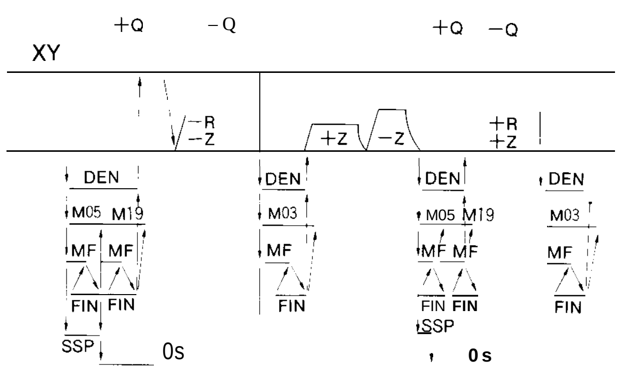


Fig. 20.22 Time Chart of G77

The time chart of M code during canned is shown below.

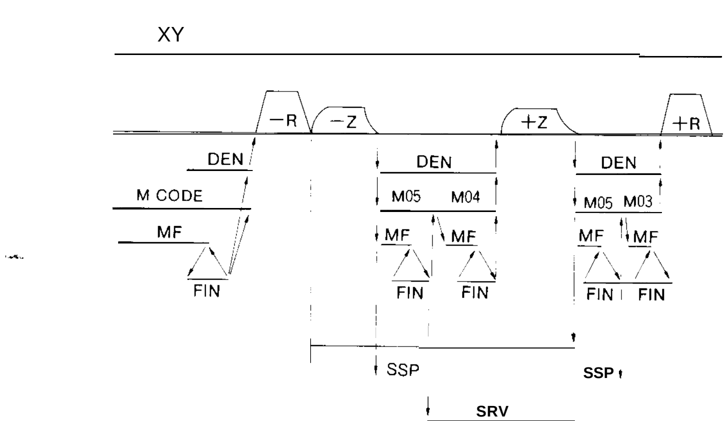


Fig. 20.23 Time Chart of M Code during Canned Cycle

20.2.44 INTERNAL TOGGLE SWITCH MONITOR OUTPUTS (#3515- # 3518)

The setting parameter status can be delivered to the I/O and read by the PC.

The relationship between the parameters and output addresses is indicated below.

Table 20.11 Setting Parameter Number pm 0000 and Output Signals

Setting Parameter Number pm 0000		Output Signals
D O : SBKT	Single-block switch	# 35150 (SETS SBK)
D 1 : MLKT	Machine lock switch	# 35156 (SETS MLK)
D 2 : DRNT	Dry Run switch	# 35154 (SETS DRN)
D 3 : B D T T	Block delete switch	# 35382 (SETS BDT)
D 4 : ABST	Manual absolute switch	# 35151 (SETS ABS)
D 5 : AFLT	Auxiliary function lock switch	# 35157 (SETS AFL)
D 6 : DLKT	Display lock switch	# 35152 (SETS DLK)
D 7 : INHET	Edit prohibit switch	# 35162 (SETSEDLK)

Table 20.12 Setting Parameter Number pm 0001 and Output Signals

Setting Parameter Number pm 0001		Output Signals
D O : OPST	Optional stop	#35383 (SETS OPT)
D 1 : STLKT	Start lock switch	# 35176 (SETS STLK)

Table 20.13 Setting Parameter Number pm 0005 and Output Signals

Setting Parameter Number pm 0005		Output Signals
D O : Z R N	Manual zero return switch	#35160 (SETS ZRN)
D 1 : ZRN2	Manual second zero return switch	# 35161 (SETS ZRN2)
D 2 : CPRN	Machining interrupt point return switch	# 35172 (SETS CPRN)
D 3 : HOFS	Automatic mode handle offset switch	#35171 (SETS HOFS)
D 4 : SRN	Setup point return switch	# 35167 (SETS SRN)
D 7 : PRST	Program restart switch	# 35153 (SETS PRST)

Table 20.14 Setting Parameter Number pm 0002 and Output Signals

Setting Parameter Number pm 0002		Output Signals
D 0 : MI1	Mirror image (X-axis)	#35180 (SETS MIX)
D 1 : MI2	Mirror image (Y-axis)	# 35181 (SETS MIY)
D 2 : MI3	Mirror image (Z-axis)	# 35182 (SETS MIZ)
D 3 : M 1 4	Mirror image (fourth axis)	# 35183 (SETS MI4)
D 4 : MI5	Mirror image (fifth axis)	# 35184 (SETS MI5)

20.2.45 FEEDRATE OVERRIDE (OV1 # 30400,0V2 # 30401,OV4 # 30402,0V8 # 30403,0V16 #30404) INPUT AND FEED OVERRIDE CANCEL (OVC) INPUT

(1) These inputs are used to provide a O to 540 % override for the part program feedrate in the automatic operation mode.

Table 20.15 Feedrate Override List

1 : Closed		O : Open			Feedrate Override (Automatic Operation Mode)
OV1	0V2	OV4	0V8	0V16	
0	0	0	0	0	0%
1	0	0	0	0	10%
0	1	0	0	0	20%
1	1	0	0	0	30%
0	0	1	0	0	40%
1	0	1	0	0	50%
0	1	1	0	0	60%
1	1	1	0	0	70%
0	0	0	1	0	80%
1	0	0	1	0	90%
0	1	0	1	0	100%
1	1	0	1	0	110%
0	0	1	1	0	120%
1	0	1	1	0	130%
0	1	1	1	0	140%
1	1	1	1	0	150%
0	0	0	0	1	160%
1	0	0	0	1	170%
0	1	0	0	1	180%
1	1	0	0	1	190%
0	0	1	0	1	200 %
1	0	1	0	1	220 % (Note)
0	1	1	0	1	240 %
1	1	1	0	1	260 %
0	0	0	1	1	280 %
1	0	0	1	1	300 %
0	1	0	1	1	340 %
1	1	0	1	1	380 %
0	0	1	1	1	420 %
1	0	1	1	1	460 %
0	1	1	1	1	500 %
1	1	1	1	1	540 %

1 : Closed, 0 : Open

NOTE

The 200-540 % range is optionally available.

(2) Feed Override Cancel (OVC #30407) Input

This is the input for fixing the feedrate override at 100%. When the OVC input contact is closed, the feed rate in part program execution in the automatic operation modes is locked at the programmed value, irrespective of the override input conditions.

20.2.46 OPTIONAL BLOCK DELETE (BDT #30405, BDT2 # 30420 -BDT9 #30427) INPUT

This input is for determining whether data between "/" and "EOB" in a part program are executed or disregarded when the part program contains "/."
The effective modes are MEM, TAPE, and MDI.

Table 20.16

	Neglected Data between
BDT INPUT CLOSED	"/" or "/1" and "EOB" (End of block)
BDT2 INPUT CLOSED	"/2" and "EOB"
BDT3 INPUT CLOSED	"/3" and "EOB"
BDT4 INPUT CLOSED	"/4" and "EOB"
BDT5 INPUT CLOSED	"/5" and "EOB"
BDT6 INPUT CLOSED	"/6" and "EOB"
BDT7 INPUT CLOSED	"/7" and "EOB"
BDT8 INPUT CLOSED	"/8" and "EOB"
BDT9 INPUT CLOSED	"/9" and "EOB"

Note :

1. Data can be disregarded only when part programs are executed, When storing or processing part programs, this input has no effect.

2. Whether data may be disregarded or not depends on the state of the optional block skip input relay when the block containing "/" in a part program is stored in the buffer. Therefore, when controlling the optional delete input relay by an external circuit with the use of the auxiliary function, take care to set the input state before the block containing "/" is stored in the buffer.

3. If two or more optinal block delete inputs are provided for one block, the following operation takes place.

Example) When the BDT3 input is closed

/GO1 / 2 X ~~ /3 Y ~~ /4 Z ~~ /5F ~~ ;

| Significant information | Nonsignificant information |

4. The optional block delete function does not work on macroprograms.

20.2.47 END-OF-PROGRAM (EOP # 30410) INPUT, REWIND (RWD # 3041' INPUT, AND REWIND ON (RWDS # 35376) OUTPUTS

(1) End-of-Program (EOP #3041 O) and Rewind (RWD #30411) Inputs

With these outputs, the control determines what processing is to be perform l at completion of an M02 or M30 command. The control performs the following processing depending on the state of EOP and RWD inputs when completion input FIN for an M02 or M30 command is opened, then closed.

Table 20.17

EOP	RWD	Processing
1	1	The control is at standby after rewinding part programs and resetting programs.
1	O	The control is at standby after resetting programs.
O	1	The control is at standby after resetting part programs.
o	0	The control is at standby.

1: Closed, O: Open

Note:

1. Program reset provides the same effects as with depressing of RESET key on MDI panel and the reset operation by closing External Reset (ERS) input. In the program reset, however, the NC memory rewind operation is not performed. For details of the reset operation by closing ERS input, refer to par. EXTERNAL RESET INPUT,
2. RST is closed for a second during program resetting.

(2) Rewinding State Output (RWDS #35376)

This output is generated to indicate that the control is rewinding a part program.

When a part program is rewound by the RWD input in response to the M02 or M30 command, the RWDS is closed during rewinding.

20.2.48 OPTIONAL STOP (OPT # 30406) INPUT

This input determines whether or not to execute the MO1 command in the automatic operation mode (TAPE, MEM, MDI).

- When the OPT is ON
  After the block containing MO1 is executed, the machine stops with the cycle start (ST) remaining closed (the cycle start opens when the FIN signal input is returned). The machine restarts when the ST turns ON.

- When the OPT is OFF
  The MO1 command is disregarded.
  This. input does not work on the currently executed block. In the automatic operation mode, it works on the newly read blocks.

20.2.49 M, S, T AND B CODES (MAO-MA9, **SDO0-SDO23, T0-T19, B0-B15,** MF, SF, TF, * BF, FIN) **INPUTS/OUTPUTS**

(1) M, S, T and B Codes Output and M, S, T and B Codes Reading Outputs

Table 20.18

M code output	MAO to MA9	# 35200 to # 35211
S code output	SDOO to SD023, S28	# 36540 to # 36567
T code output	TO to T19	#35300 to #35323
B code output	BO to B15	**#35330** to #35347
M code reading output	MFA	# 35350
S code reading output	SF	#36517
T code reading output	TF	# 35357
B code reading output	BF	# 35355

These are outputs for the M, S, T or B command specified by the part program at its execution in the automatic operation mode. If any of M, S, T and B command is found at the execution of the part program in the automatic operation mode, the control outputs it in a BCD or binary code according to the value that follows the detected command.

Then, after the elapse of the time set in parameter the M, S, T and B code reading outputs are closed.

NOTE

1. With the S4-digit command, the 12-bit non-contact output or analog output is provided, disabling the S code output and the S code reading output.

2. Logic circuit processing M commands (M90-M99)
   The M code or MFA code outputs are not generated. These commands are the M codes that are processed internally within the control. Therefore, they cannot be used as the external M codes.

3. M decoded outputs (MOOR, MO1 R, M02R, M03R)
   When the MOO, MO1, M02, or M30 command is executed, decoded output MOOR, MO1 R, M02R, or M30R is generated accordingly in addition to the M code and M code reading outputs.

   The M decoded output opens when an automatic operation is started or reset.

   When the decoded output M command and move command are issued for the same block, the M code output is generated at the beginning of the block, but the decoded output is generated after completion of move command execution.

   A typical M decoded output time chart is presented in Fig. 20.24.

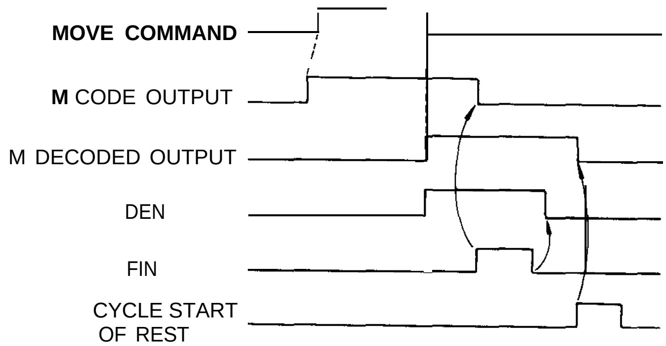


Fig. 20. 24 Typical M Decoded output (M 00 R # 35214-M 30 R #3521 7) Time Chart

(2) M, S, T and B Functions Completion (FIN #30413) Inputs
These inputs give the completion of M, S, T and B commands to the control. When FIN input is closed while the M, S, T and B code reading (MFA, SF, TF and BF) outputs are closed, they are opened. If FIN input is opened again after making sure of their opening, the control assumes that the M, S, or T command has been completed, starting the operation of the next step.

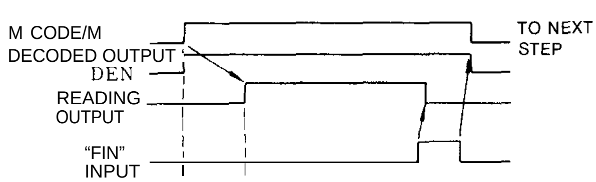
NOTE

1. When the FIN input opens, the M code output opens, but the S, T, and B code outputs retain their current states.

2. As for the T and B codes, only binary outputs are provided. No BCD outputs are provided for such codes.

(3) Time Chart of M, S, T and B Signals

(a) M command



(b) S/T/B command

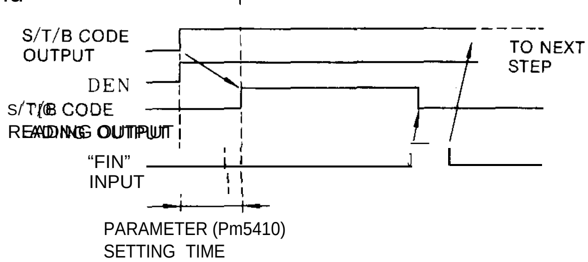


Fig. 20. 25 Time Charts of M, S, T, B Signals.

(c) If a move command and M, S, T or B command are specified in the same block, the move operation and the M, S, T or B operation are executed simultaneously.

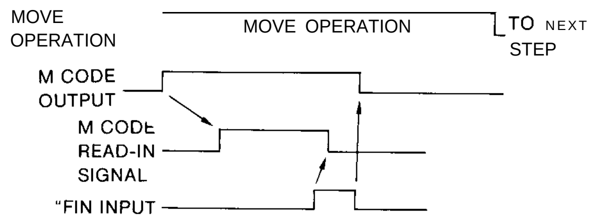


Fig. 20. 26

20.2.50 INTERFACE INPUT SIGNALS (Ui0 # 3046 to Ui31 # 3049, UO0 # 3540 to UO31 # 3543) SYSTEM VARIABLES (USER MACRO)

(1) When an interface input system variable is designated for the right-hand side of an operational expression, the ON/OFF states of the 32-point input signal specialized to the mac-reprogram are read The relationship between the input signals and system variables is indicated in Table 20.19.

Table 20.19 Interface Input Signal and System Variable

System Variable	# 1007	# 1006	# 1005	# 1004	# 1003	# 1002	# 1001	# 1000
Input Signal	UI 7 2^{7}	UI 6 2^{6}	UI 5 2^{5}	UI 4 2^{4}	UI 3 2^{3}	UI 2 2^{2}	UI 1 2^{1}	UI 0 2^{0}
System Variable	# 1015	# 1014	# 1013	# 1012	# 1011	# 1010	# 1009	# 1008
Input Signal	UI 15 2^{15}	UI 14 2^{14}	UI 13 2^{13}	UI 12 2^{12}	UI 11 2^{11}	UI 10 2^{10}	UI 9 2^{9}	UI 8 2^{8}
System Variable	# 1023	# 1022	# 1021	# 1020	# 1019	# 1018	# 1017	# 1016
Input Signal	UI 23 2^{23}	UI 22 2^{22}	UI 21 2^{21}	UI 20 2^{20}	UI 19 2^{19}	UI 18 2^{18}	UI 17 2^{17}	UI 16 2^{16}
System Variable	# 1031	# 1030	# 1029	# 1028	# 1027	# 1026	# 1025	# 1024
Input Signal	UI 31 2^{31}	UI 30 2^{30}	UI 29 2^{29}	UI 28 2^{28}	UI 27 2^{27}	UI 26 2^{26}	UI 25 2^{25}	UI 24 2^{24}

① The value read by a system variable shown in Table 20.19 is either 1.0 or 0.0 depending on whether the associated input signal is ON or OFF.

Table 20.20 Variable Values

Input signal	Variable value
ON	1.0
OFF	0.0

② When system variable # 1032 is designated for the right-hand side of an operational expression, the above-mentioned 32-point input signal (UI0 to UI31) are collectively read as a decimal positive value.

$$\#1032=\sum_{i=0}^{31}\#[1000+i]\times 2^{i}$$

③ **Numerical** values cannot be substituted with a system variable between # 1000 and # 1032 designated for the left-hand side of an operational expression.

(2) When an interface output system variable is designated for the left-hand side of an operational expression, the ON or OFF signal is delivered to the 32-point output signal specialized to the microprogram.

The relationship between the output signals and system variables is indicated in Table 20.21.

Table 20.21 **Interface Output Signal and System Variable**

System Variable	#1107	#1106	#1105	#1104	#1103	#1102	#1101	#1100
Output Signal	UO 7 2^{7}	UO 6 2^{6}	UO 5 2^{5}	UO 4 2^{4}	UO 3 2^{3}	UO 2 2^{2}	UO 1 2^{1}	UO 0 2^{0}
System Variable	#1115	#1114	#1113	#1112	#1111	#1110	#1109	#1108
Output Signal	UO 15 2^{15}	UO 14 2^{14}	UO 13 2^{13}	UO 12 2^{12}	UO 11 2^{11}	UO 10 2^{10}	UO 9 2^{9}	UO 8 2^{8}
System Variable	#1123	#1122	#1121	#1120	#1119	#1118	#1117	#1116
Output Signal	UO 23 2^{23}	UO 22 2^{22}	UO 21 2^{21}	UO 20 2^{20}	UO 19 2^{19}	UO 18 2^{18}	UO 17 2^{17}	UO 16 2^{16}
System Variable	#1131	#1130	#1129	#1128	#1127	#1126	#1125	#1124
Output Signal	UO 31 2^{31}	UO 30 2^{30}	UO 29 2^{29}	UO 28 2^{28}	UO 27 2^{27}	UO 26 2^{26}	UO 25 2^{25}	UO 24 2^{24}

① When the value 1.0 or 0. 0 is substituted for a system variable in Table 20.21, the resultant associated signal output is either ON or OFF,

Table 20.22 Variable value

Output signal	Variable value
ON	1.0
OFF	0.0

When a value other than 1.0 and 0. 0 is substituted for a variable between # 1100 and # 1131, it is handled as follows.

(Empty) or smaller than 0. 5	0.0
Other than above	1.0

② When system variable # 1132 is designated for the left-hand side of an operational expression, the above-mentioned 32-point output signal (UOO to U031) is collectively delivered out. In this case, a decimal positive value substituted for variable # 1132 is converted to a binary 32-bit equivalent and then transferred out.

$$\boxed{\#1132 = \sum_{i=0}^{31} \# [1100+i] \times 2^{i}}$$

③ When a system variable between # 1100 and # 1132 is designated for the right-hand side of an operational expression, the ON/OFF state (1. O, 0.0, decimal positive value) of the last output is read.

20.2.51 MANUAL HANDLE AXIS SELECTION

(1) Manual Handle Feed Axis Selection (HX # 30700 to H5 #30704) Input
When these signals are closed while the manual handle is selected, the corresponding axis can be fed via manual pulse generator. When two or more signals are closed, the first selected axis as viewed from the HX side can be moved.

(2) Manual Simultaneous Three Axes Handle Feed Axis Selection (2HX # 30800 to 2H5 # 30804, 3HX #30810 to 3H5 # 30814)

These inputs, when closed, specify the maximum three axes for the control provided with HANDLE dials (manual pulse generator) for simultaneous control of up to three axes.

1st Handle axis···(H1 to H5)
2nd Handle axis···(2H1 to 2H5)
3rd Handle axis···(3H1 to 3H5)

NOTE : Selection of Handle axis can be for one axis only.

Superimposition occurs if two or more manual pulse generators are chosen for one axis

20.2.52 MANUAL FEED AXIS DIRECTION SELECTION (+ X # 30710 TO + 5 # 30714, –X #30720 TO –5 #30724) INPUTS

These inputs specify the motion direction and the axis to be moved when the control is in the manual jog mode, or manual step feed mode. Each axis moves when either a plus or minus direction axis contact is closed. If all the axes are selected, maximum number of simultaneous controllable axes will work.

When both plus and minus direction contacts for each axis are closed or opened the selected axis cannot move or decelerate to a stop during motion.

20.2.53 OVERTRAVEL) ∗+X # 30740 TO ∗+5 # 30744, ∗ –X # 30750 TO ∗ –5 # 30754) INPUTS

These input signals are for signifying the arrival of the machine slides to their respective stroke ends, When these overtravel input contacts are opened, the machine slides stop motion as shown in Table. 20.23, and close the alarm (ALM) output contact and at the same time, display an alarm on the CRT.

Table 20.23

	Manual Operation Mode	Automatic Operation Mode
∗+1 to ∗+5 Input opened	Motion stop in +1 to ∗+5 directions	Motion stop of all axes
∗—1 to ∗—5 Input opened	Motion stop in –1 to ∗—5 direction	

When an overtravel input contact is opened, move the machine in the reverse direction in the manual operation mode (manual jogging or manual pulse generator) to close the contact, and then, make the RESET operation to clear the alarm output and display.

NOTE

1. Even when the overtravel input contacts are opened, the M code reading output MFA, (S) code reading output SF, and the T code reading output TF are not turned off. If the motion by M codes, S codes or T codes is required to be stopped by overtravelling inputs, interlock the motion with external sequence.
2. In the event of overtraveling, an alarm between No. 2001 and No. 2005 is issued. In this situation, the axis stops (the servo system does not turn OFF).

20.2.54 AXIS INTERLOCK (∗ ITX #30780 TO ∗ IT5 # 30784) INPUTS

Axis interlock is provided with each axis for prohibiting axis motion

(1) When axis interlock contact is opened during motion, the axis is decelerated to a stop. Closing the interlock will resume the remaining operation interrupted by opening the interlock contact. When the remaining operation is completed, operation will advance to the next block.

(2) For simultaneous control of two axes or three axes in interpolation command, opening the axis interlock contact for any one axis stops interpolation and decelerates the axis to a stop.

NOTE: Even if this input is opened in the cycle start process, the STL remains ON.

20.2.55 SERVO OFF SIGNAL (∗ SVOFX # 30790, ∗ SVOFY # 30791, ∗ SVOFZ # 30792, ∗ SVOF4 # 30793, ∗ SVOF5 # 30794)

This signal is used for cutting with the axis mechanically clamped. When the signal ∗SVOF1to 5 contacts are open, servo lock for 1st-axis to 5th-axis are released. To clamp the machine, use M-function.

Shown below is a time chart of servo off signal, machine clamp, auxiliary function and servo ready (SRD1 to SRD5). Output clamp command after positioning signal (DEN) is given.

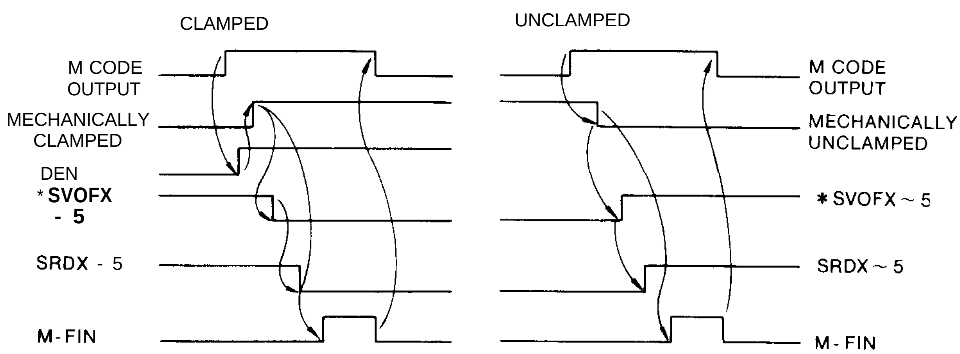


Fig. 20.27 Servo Off Signal Time Chart

Parameter can select execution or no execution of the follow-up process,

When executing the follow-up process, shift the current NC value until the error counter becomes O, as if there has been a command corresponding to the machine motion.

In this case, even when the SVOFF signal is restored to close, the machine remains at the shifted position, and it moves to the correct position when a subseqent absolute command is given, because the current NC value has been shifted from the machine position.

Conversely, when no follow-up process is executed, the servo setting remains in the error counter. Then the machine moves to cancel the setting when the SERVO OFF signal is re - stored to close.

20.2.56 MIRROR IMAGE (MIX #30820 TO M15 #30824)

This input inverts the traveling direction in the automatic operation mode.

When automatic activation is performed with any of MIX to M15 input closed, the directions of X to 5th axis are made opposite to the specified direction.

1. Mirror image input does not affect the axis travel in the manual operation mode. For details, refer to YASNAC i80 Operator's Manual.
2. Mirror image input changeover cannot be effected in the M95 mode. The mirror image input in the M95 mode remains effective until the mirror image mode is turned OFF by the M94 command. For details refer to the YASNAC i80M Instruction Manual (TOE-C843-11. 30).

20.2.57 AXIS DETACHMENT INPUTS (**DTCH4** # 30833 **-DTCH5** # 30834)

The axis detachment inputs are used to detach the fourth and fifth axes.
The detached axes are placed in the same status as in the machine lock state so that the servo alarm conditions occurring on the detached axes are disregaraded.

NOTE

1. Axis detachment must be carried out with the servo power turned OFF. If the axis detachment inputs (DTCH4/DTCH5) are closed with the servo power OFF, the alarm output (ALM) closes.

2. When a detached axis is reinstalled, the power must be turned OFF and then ON again.

3. When detaching an axis, remove the components between the AC Servopack (lamp) and AC servomotor. The components between the FC300B circuit board and AC Servopack (lamp) cannot be removed (see the equipment connection diagram).

4. If the axis detachment input is turned OFF after the servo power is turned ON with an axis detached, the alarm output (ALM) closes.

5. As regards a detached axis, overtravel input (* +4/* +5, * –4/ * –5) detection does not take place.

6. As for a detached axis, the servo system does not turn ON. Therfore, the sevo OFF signal (* SV OF4/ * SV OF5) is invalid.

20.2.58 **S5-DIGIT** COMMAND (**SDO0** # 36540 TO **SDO23** # 36567) INPUTS

These signals are used to determine the speed of the spindle motor when the control is in the state of S command 5-Digit Non-Contact output or S Command 5-Digit Analog output.

GR1 to GR4 (#31 100 to #31 103) are used to enter the control state of the gear range between the spindle and the spindle motor to determine the spindle motor speed by the spindle speed specified in the part program.

SINV input inverts the polarity of the analog output at the time of S command 5-Digit Analog output. While the polarity is inverted, SINV signal is output. When M03 command is executed, M04S contact is opened. When M04 command is started, M04S contact is closed.

(1) S5-Digit Command 24-Bit Non-Contact Output

Binary code 23 bits (O to 8388608= spindle motor speed) are output as follows by the spindle motor speed command and GR1 through GR4 :

——-—— ;The output when "GR1" :input is closed. (Set the spindle motor maximum speed at gear range "GR1" to parameter pm1 408.)

——— — ; The output when "GR2" input is closed. (Set the spindle motor maximum speed at gear range "GR2" to parameter pm1409.)

——---— ; The output when "GR3" input is closed. (Set the spindle motor maximum speed at gear range "GR3" to parameter pm1410.)

— ; The output when "GR4" input is closed. (Set the spindle motor maximum speed at gear range "GR4" to parameter pm141 1.)

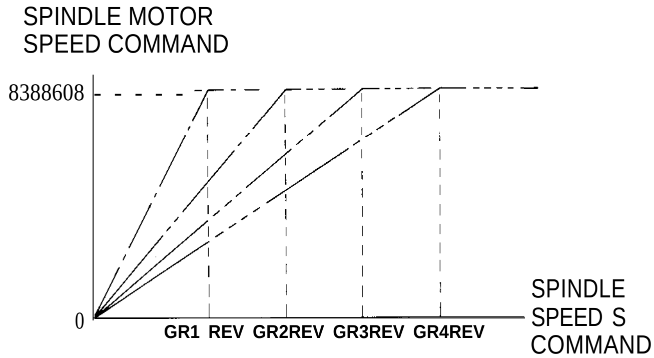


Fig. 20.28 S5-Digit Command 12-Bit Non-Contact Output

(2) S5-Digit Command Analog (DAS, SGS0) Outputs

Analog voltages (-10 V to O V to +10 V) are output as follows by the spindle speed command, GR1 through GR4 inputs, and SINV input:

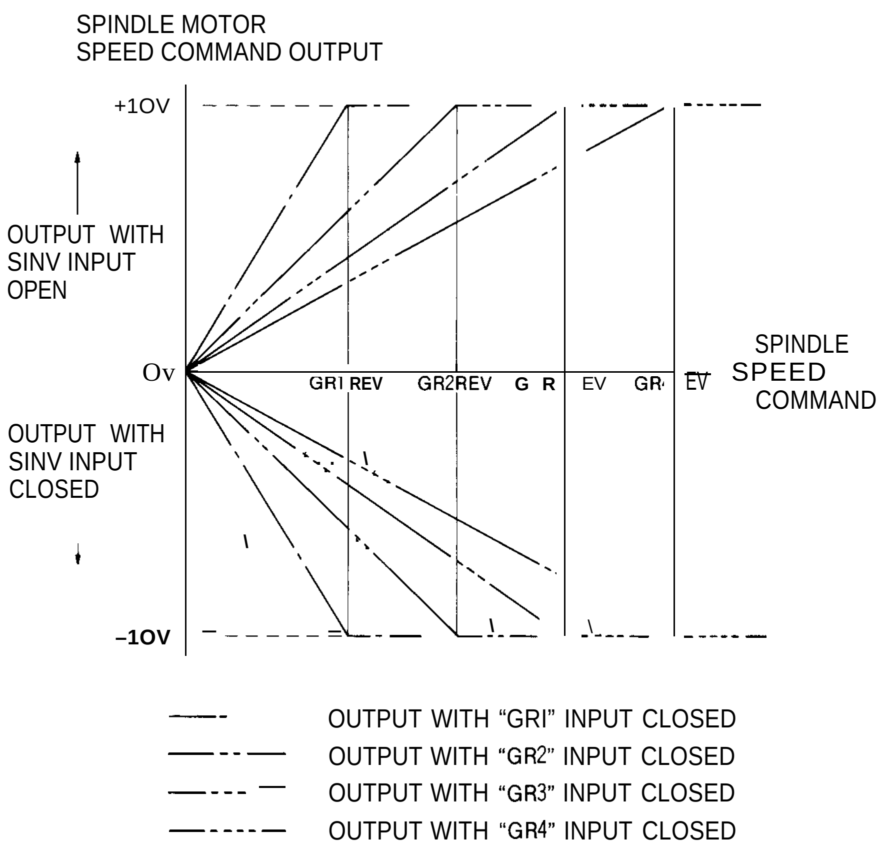


Fig. 20. 29 S5-Digit Command Analog Output

(3) Time Chart of Analog Voltage Output, SINV INPUT, and Sinva Output for Spindle Motor Speed

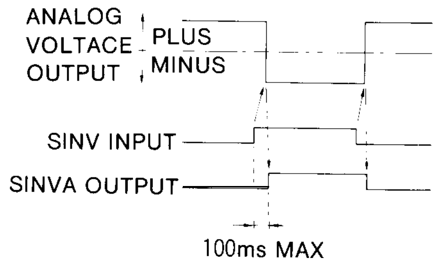


Fig. 20. 30

(4) Spindle Maximum/Minimum Speed Clamp

The spindle maximum/minimum speed at each gear range may be set using the following parameters :

Table 20.24

Parameter		Fig. No.
pm 1404	Spindle maximum speed when "GRI" input is closed.	Ⅴ
pm 1405	Spindle maximum speed when "GR2" input is closed.	Ⅵ
pm 1406	Spindle maximum speed when "GR3" input is closed,	Ⅶ
pm1407	Spindle maximum speed when "GR4" input is closed.	Ⅷ
pm 1400	Spindle minimum speed when "GR1" input is closed,	Ⅰ
pm 1401	Spindle minimum speed when "GR2" input is closed.	Ⅱ
pm 1402	Spindle minimum speed when "GR3" input is closed.	Ⅲ
pm 1403	Spindle minimum speed when "GR4" input is closed.	Ⅳ

Fig. 20.31 shows an example of the S5-digit analog outputs when the spindle maximum/ minimum speeds are clamped by these parameters :

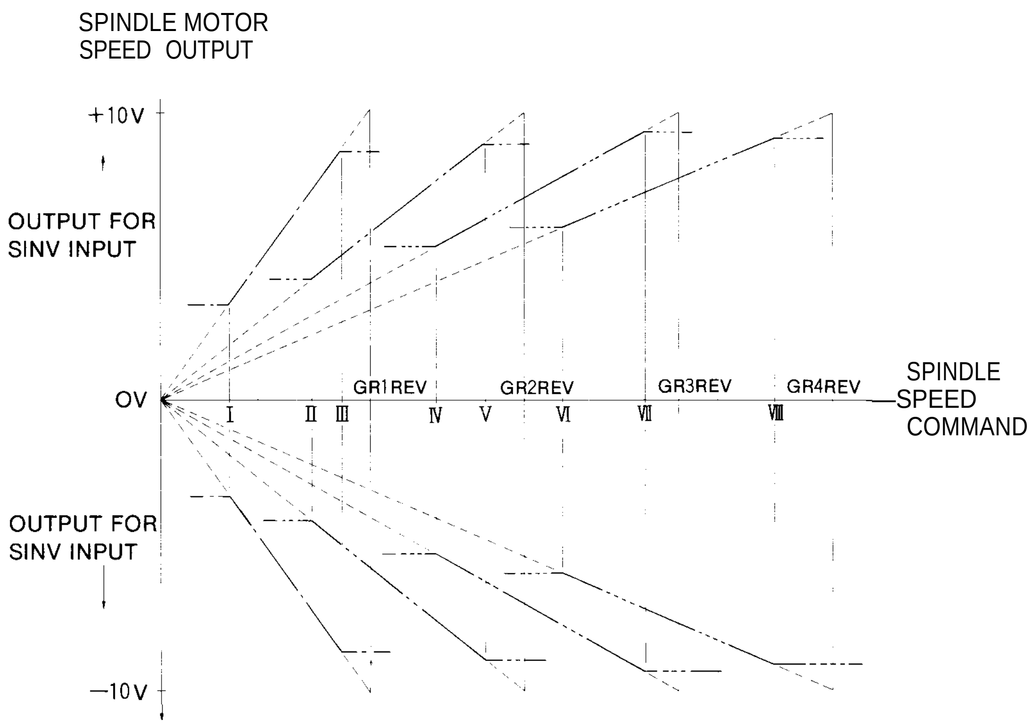


Fig. 20. 31 S5-Digit Analog Outputs When Spindle Maximum/Minimum Speeds Clamped

NOTE

1. The spindle motor speed command output is obtained from the following relation :
(Spindle speed command) X (4095 or 10 V)
(4095 or 10 V output speed in spindle gear range determined by GR1 through GR4 inputs : parameters pm1408 through pm1411.)

2. With the spindle motor speed motor analog output, the polarity may be inverted by processing M03 (spindle forward rotation) or M04 (spindle reverse rotation)within the control by using parameter.

20.2.59 GEAR SELECTION COMMAND **INPUT/OUTPUT** (GR1 # 31100 to GR4 # 31103, GRIS # 36504 to GR4S # 36507, SF # 36517, SFIN # 311 17) **S4-DIGIT** NON-CONTACT OUTPUT OR **S5-DIGIT** ANALOG OUTPUT

After executing S command, the control outputs SF signal and checks maximum gear speed designation at the same time, and outputs gear selection command (GR1 S to GR4S) corresponding to gear speed.

The control compares the output gear signal with current gear selection and sends back SFIN when they meet. If they are different, the control performs gear selection sequence. When the constant speed output is required for gear selection, GRO signal contact is closed. The control immediately outputs constant speed corresponds to GRO.

Input gear input signal (GR1 to GR4) until gear selection is completed and send back spindle gear selection completion signal (SFIN) on completion of gear selection. The control outputs specified spindle speed command as non-contact or D/A output. Send back FIN signal when spindle speed agrees with command.

(Supplementary Explanation)

Example) Timing between S command and output

The typical signal exchange timing diagram presented below applies to cases where the system checks the necessity for gear ratio changeover when a new S command is read, and automatically effects necessary gear ratio changeover to obtain the spindle revolving speed specified by the command.

Let us suppose that “S1 000 M03.•. gear ratio 2“ has been designated for the preceding block and that the “S2000; ..• gear ratio = GR3° speed range is newly designated.

In this situation:

① The control concludes that switching to the GR3 is necessary, and then generates the GR3S output.

② With read command SF which is delayed by time t, read the GR3S and effect machine side gear ratio changeover. If the spindle motor needs to be rotated for gear ratio changeover, turn ON the GRO.

③ When switching to a gear ratio of GR3 is completed, turn ON the GR3 input and then S command completion input SFIN.

④ When the SFIN rises to the ON state, a new S value output is computed and generated.

⑤ When the spindle speed coincides with the specified speed (S20000), turn ON the FIN.

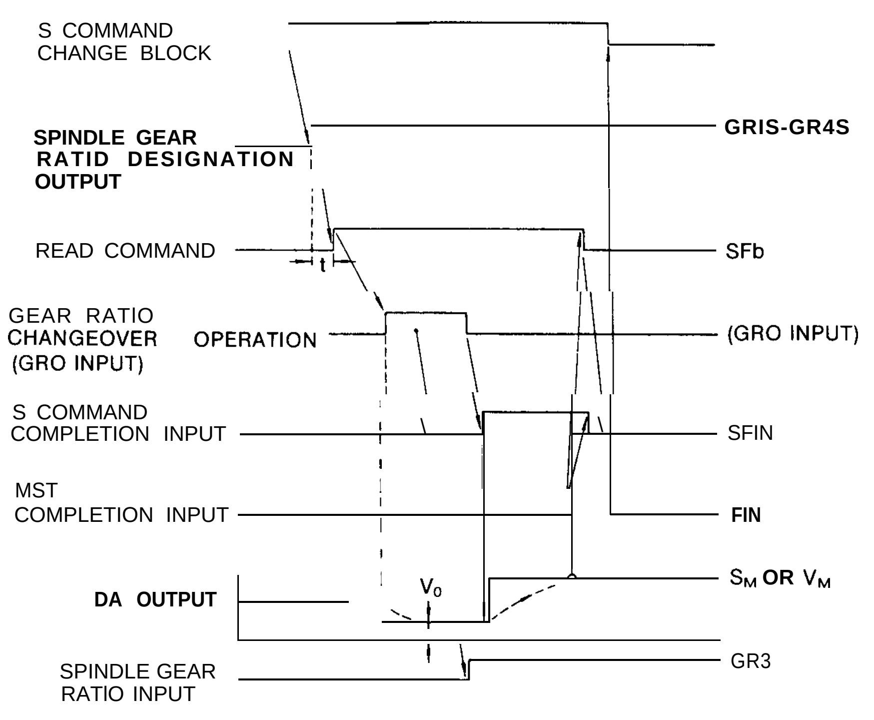


Fig. 20.32 Timing between S Command and output

20.2.60 GEAR SHIFT ON (GRO # 31107) INPUT AND SPINDLE ORIENTATION **(SOR** #31 106) INPUT

These inputs are used to make the S5-digit command analog output and non-contact output provide outputs other than the part program S command. When GRO input is closed, the voltage set by parameter pml 413 is output.

If SOR input is closed, the spindle speed set to parameter pm1412 by the spindle gear range input and spindle motor speed command voltage corresponding to each gear are output.

Table 20.25

GRO Input	SOR Input	S5-digit Command Analog Voltage
0	0	Voltage corresponding spindle speed command by NC program.
0	1	Voltage corresponding to parameter pm 1412
1	0	Voltage corresponding to parameter pm 1413
1	1	Voltage corresponding to parameter pm 1413

1: Closed, 0: open

NOTE

1. With the analog output in response to the GRO/SOR input and the S5-digit analog output inverted (SINV #31 104) input, it is possible to invert the voltage command for spindle drive.
2. The period of time betweent the setting of GRO and SOR inputs and the catching- up of the analog voltage value is shorter than 100 ms.

20.2.61 SPINDLE SPEED REACHED **(SAGR** #311 16) INPUT

This input is used to inform, in the case of the S4-digit command, that the spindle speed has reached the specified value at the start of cutting at the execution of the part program in the automatic operation mode. When the positioning command is replaced by the cutting command, the control initiates a cutting operation after verifying that the SAGR input is closed.

20.6.62 SPINDLE SPEED OVERRIDE (SPA #31110, SPB #31111, SPC #31112) INPUT

These inputs are used, in the case of the S5-digit analog command or non-contact output, to override the S command in a range of 50% to 120% at the execution of the part program in the automatic operation mode.

Table 20.26

SAP Input	SPB Input	SPC Input	Override Corresponding to S Command
1	1	1	50 %
0	1	1	60 %
0	1	0	70 %
1	1	0	80 %
1	0	0	90 %
0	0	0	100 %
0	0	1	110 %
1	0	1	120 %

NOTE
1. 1: Closed, 0: Open
2. A 20-step spindle override is provided by turning ON parameter pm1000D 6.

Table 20.27 Spindle Override (20-step Type)

SPA input	SPB input	SPC input	SPD input	SPE input	Override relative to S command
0	0	0	1	0	10%
0	0	1	1	0	20%
0	1	1	1	0	30%
1	1	1	1	0	40%
1	1	1	0	0	50%
0	1	1	0	0	60%
0	1	0	0	0	70%
1	1	0	0	0	80%
1	0	0	0	0	90%
0	0	0	0	0	100%
0	0	1	0	0	110%
1	0	1	0	0	120%
1	0	1	1	0	130%
1	0	0	1	0	140%
1	1	0	1	0	150%
0	1	0	1	0	160%
0	1	0	1	1	170%
0	1	0	0	1	180%
0	0	0	0	1	190%
1	0	0	0	1	200%

1: Closed, O: Open

20.2.63 S COMMAND BINARY INPUTS (**SDIO** #31120 -sD123 #31147)

These inputs digitally sepecify the spindle speed command with 24-bit resolution instead of using an analog voltage commad. Although 24-bit resolution is provided for the NC, the actual resolution is limited by the output spindle drive input resolution.

20,2.64 SERVO ALARM OUTPUT (**SVALM** #35033)

When the control detects any of the following alarm conditions, this output signal notifies the machine of the alarm condition.

•Alarm conditions

① Alarm conditions detected by the DSP
- D1) Overload (LD)
- D2) Runaway
- D3) PG open circuit
- D4) Excessive deviation
- D5) Overspeed (OS)

② Alarm conditions detected by the monitor CPU
- MI) Positioning error
- M2) ABSO error (encoder abnormality)
- M3) Communication failure

③ Alarm conditions detected by the i-AMP
- i1) Overcurrent (OC)
- i2) MCCB trip
- i3) Regeneration failure
- i4) Overvoltage (OV)
- i5) Undervoltage (UV)
- i6) Heat sink overheat
- i7) Current command cable burnout
- i8) Open phase

20.2.65 SOLID TAP **(G93M, SLPC, SLPS)**

(1) Solid Tap Mode ON (**G93M** # 35381)
This solid tap signal is output when G93 is executed.
The machine receives this signal and turnes on the spindle forward signal. Then, after confirming the spindle zero speed, returns the SLPC (spindle loop command input signal).

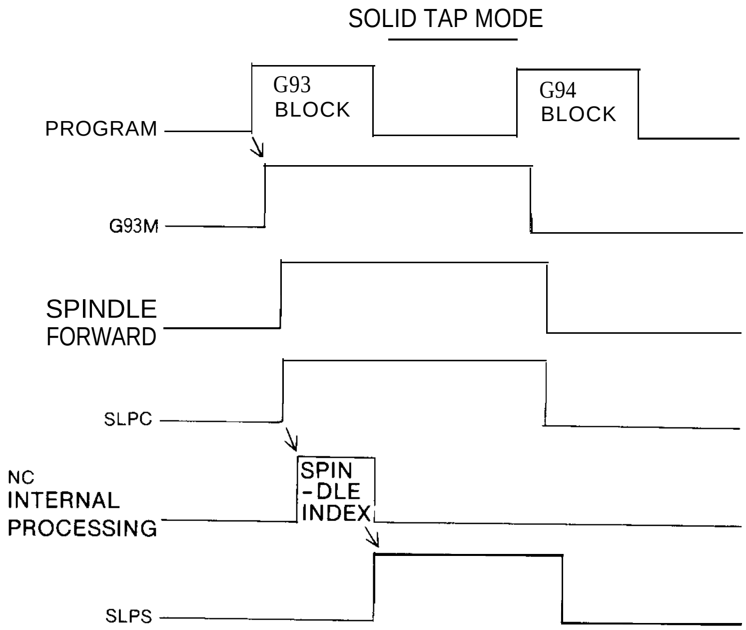
NOTE

1. For the spindle with soft start circuit, simultaneously cancel the signal and SLPC ON.
2. To control accel/decel through NC, turn off the spindle reverse input (SINV) gear shift ON input (GRO) and spindle orientation input (SOR).

(2) Spindle Loop Command (**SLPS** #36512)
When NC makes the position control loop to spindle for solid tap operation, SLPS signal is output. G93 block will be completed by outputting this signal.

(3) Spindle Loop ON (**SLPC** #31 174)
This signal is used to form the spindle control loop for NC.
NC confirms the spindle stop after this signal is ON. Then NC forms the position control loop to the spindle and return SLPS.

(4) Solid Tap Time Chart



(Supplementary Explanation)

①G93M is turned on when G93 block is executed by dry run OFF or by auxiliary function lock OFF.

②G93M is turned off by execution or reset of the G94 block,

③G93 block is completed after SLPS is ON, and advances to the next block.

④G94 block is completed after SLPS is OFF, and advances to the next block.

20.2.66 POWER FAILURE DETECTION MONITOR OUTPUT (PWLOST #35035)

When the input voltage drops to 145 to 165 VAC, power failure detection occurs so that the PWLOST signal output is generated. The response time is 50 ms maximum,

21. i80L STANDARD I/O SIGNALS

21.1 STANDARD 1/0 SIGNALS

The YASNAC i80L provides multi-axis, multi-program control. In its maximum system configuration, it consists of 8 servo axes, 4 spindles, and 3 programs.
The standard I/O signals are as follows.

Input signals

- First program operation mode control designation
- Second program operation mode control designation
- Third program operation mode control designation
- First program NC machining program execution control designation
- Second program NC machining program execution control designation
- Third program NC machining program Execution control designation
- Servo axis control designation
- First spindle control designation
- Second spindle control designation
- Third spindle control designation
- Fourth spindle control designation

Output signals

- First program operation mode control state
- Second program operation mode control state
- Third program operation mode control state
- First program NC machining program execution control state
- Second program NC machining program execution control state
- Third program NC machining program execution control state
- Servo axis control state
- First spindle control state
- Second spindle control state
- Third spindle control state
- Fourth spindle control state
- Axis variable output

21.2 STANDARD I/O SIGNAL LISTS

21. 2.1 PC → NC INPUT ADDRESS LIST

PLC → NC

Address	Content	Page
#3000 ～ #3009	(1) First program operation mode control 1/4	178
#3010 ～ #3019	First program operation mode control 2/4	179
#3020 ～ #3029	First program operation mode control 3/4	180
#3030 ～ #3039	First program operation mode control 4/4	181
#3040- #3049	(2) First program NC machining program execution control 1/1	182
#3050 ～ #3059	(3) Second program NC machining program execution control 1/1	183
#3060 ～ #3069	(4) Third program NC machining program execution control 1/1	184
#3070- #3079	(5) Servo axis control 1/2	185
#3080 ～ #3089	Servo axis control 2/2	186
#3090 -#3099	(6) Unused	187
#3100 ～ #3109	Unused	188
#3110 ～ #3119	(7) First spindle control 1/1	189
#3120 ～ #3129	(8) Second spindle control 1/1	190
#3130 -#3139	(9) Third spindle control 1/1	191
#3140 ～ #3149	(10) Fourth spindle control 1/1	192
#3150 ～ #3159	Unused	
#3160 ～ #3169	11)Second program operation mode control 1/4	193
#3170 -#3179	Second program operation mode control 2/4	194
#3180 ～ #3189	Second program operation mode control 3/4	195
#3190 -#3189	Second program operation mode control 4/4	196
#3200 ～ #3209	(12) Third program operation mode control 1/4	197
#3210 ～ #3219	Third program operation mode control 2/4	198
#3220 ～ #3229	Third program operation mode control 3/4	199
#3230 ～ #3239	Third program operation mode control 4/4	200

21. 2.2 INPUT SIGNALS (PC → NC)

(1) First Program Operation Mode Control (1/4)

NOTE: Signals marked * are common to all programs. They are provided in the first program operation mode control sequence only. As regards the other signals, equivalent types are provided for the first, second, and third programs, respectively.

	7	6	5	4	3	2	1	0
#3000	EDT	MEM	MDI	TP	STP	H	JOG	RT
	OPERATION MODE							
#3001							CRTF1	CRTF0
		PROGRAM SELECT (UNUSED)					CRT DISPLAY PROGRAM SELECT	
#3002	MP4	MP2	MP1	JV16	JV8	JV4	JV2	JV 1
	MANUAL PULSE MAGNIFICATION SELECT			JOG SPEED SELECT				
#3003		ROV 4	ROV 2	ROV 1			*SP	ST
		RAPID TRAVERSE OVERRIDE					START/STOP	
#3004			CDZ	SMZ		STLK	ERS	※ MRD
			THREADING	ERROR DETECT ON		START INTERLOCK	EXTERNAL RESET	MACHINE READI ED
#3005	※ ERR2	ERR1	ERRO				EXTC	※ SVON
	SERVO OFF	DECEL & STOP	BLOCK STOPPAGE				TIME COUNT	EXTERNAL POWER ON
	EXTERNAL ERROR DETECTiON AUXILIARY							
#3006	AFL	MLK		DRN	PRST		ABS	SBK
	FUNCTION LOCK	MACHINE LOCK		DRY RUN	PROGRAM RESTART		MANUAL ABSOLUTE	SINGLE BLOCK
#3007	SRN					※ EDT LK	ZRN2	ZRN
	SETUP POINT RETURN					EDIT LOCK	SECOND REFERENCE RETURN	REFERENCE RETURN
#3008			CTASK	BTASK	PST	CPRN	HOFS	
			C TASK START	B TASK START	CURRENT VALUE	STORAGE MACHINING INTERRUPT POINT RETURN	AUTOMATIC MODE HANDLE OFFSET	
#3009								

(1) First Program Operation Mode Control (3/4)

	7	6	5	4	3	2	1	0
#3010								
#3011	FSEDCLR	FSEDCH	FSEDMEM	FSEDM	※ ECLM	EOUT	EVER	EIN
	FS AUTOMATIC EDIT					EXTERNAL EDITING		
#3012							WOM	WOP
							TOOL WEAR COMPENSATION	
#3013								
#3014								
#3015								
#3016								
#3017								
#3018								
#3019								

(1) 第1系列動作モード制御 (3/4)

	7	6	5	4	3	2	1	0
#3020								
#3021								
#3022								
#3023	TN' 7	TN' 6	TNO 5	TNO 4	TNO 3	TNO 2	TN' 1	TNO 0
	TOOL NO							
#3024							TNO 9	TN' 8
							TOOL NO	
#3025	TGN 7	TGN 6	TGN 5	TGN 4	TGN 3	TGN 2	TGN 1	TGN 0
	TOOL GROUP NO. (TOOL LIFE CONTROL)							
#3026								
#3027								
#3028							TLSKP	TLRST
							TOOL LIFE CONTROL	
#3029								

(1) First Program Operation Mode Control (4/4)

	7	6	5	4	3	2	1	0
#3030	ED7	ED6	ED5	ED4	ED3	ED2	ED1	ED0
	EXTERNAL DATA INPUT							
#3031	ED15	ED14	ED13	ED12	ED11	ED10	ED9	ED8
	EXTERNAL DATA INPUT							
#3032	ED23	ED22	ED21	ED20	ED19	ED18	ED17	ED16
	EXTERNAL DATA INPUT							
#3033	ED31	ED30	ED29	ED28	ED27	ED26	ED25	ED24
	EXTERNAL DATA INPUT							
#3034	EDCL	EDAS2	EDAS1	EDASO	EDSD	EDSC	EDSB	EDSA
	EXTERNAL DATA INPUT							
#3035								
#3036								
※ #3037	1HP7	1HP6	1HP5	1HP4	1HP3	1HP2	1HP1	lHPO
	HANDLE PULSE INPUT							
※ #3038	2HP7	2HP6	2HP5	2HP4	2HP3	2HP2	2HP1	2HP0
	HANDLE PULSE INPUT							
※ #3039	3HP7	3HP6	3HP5	3HP4	3HP3	3HP2	3HP1	3HP0
	HANDLE PULSE INPUT							

(2) First Program NC Machining Program Execution Control (1/1)

	7	6	5	4	3	2	1	0
#3040	OVC	OPT	BDT	OV16	OV8	OV4	OV2	OV1
	OVERRIDE CANCEL	OPTIONAL STOP	BLOCK DELETE	FEEDRATE OVERRIDE				
#3041					FIN	RWDH	RWD	EOP
					MT FUNCTION COMPLETED	HIGH-SPEED REWIND	REWIND	END PROGRAM
#3042	BDT9	BDT 8	BDT 7	BDT 6	BDT 5	BDT 4	BDT 3	BDT 2
	BLOCK DELETE							
#3043								
#3044								
#3045	SSEL1							NMWT1
	ROTARY TOOL SELECT INPUT							WAIT M COMMAND DISREGARD INPUT
#3046	UI7	UI6	UI5	UI4	UI3	UI2	UI1	UI0
	MACROPROGRAM INPUT							
#3047	UI15	UI14	UI13	UI12	UI11	UI10	UI9	UI8
	MACROPROGRAM INPUT							
#3048	UI23	UI22	UI21	UI20	UI19	UI18	UI17	UI16
	MACROPROGRAM INPUT							
#3049	UI31	UI30	UI29	UI28	UI27	UI26	UI25	UI24
	MACROPROGRAM INPUT							

(3) **Second Program NC Machining Program Execution Control (1/1)**

	7	6	5	4	3	2	1	0
#3050	OVC-2	OPT-2	BDT-2	OV16-2	OV8-2	OV4-2	OV2-2	OV1-2
	OVERRIDE CANCEL	OPTIONAL STOP	BLOCK DELETE	FEEDRATE OVERRIDE				
#3051					FIN-2	RWDH-2	RWD-2	EOP-2
					MT FUNCTION COMPLETED	HIGH-SPEED REWIND	REWIND	END PROGRAM
#3052	BDT 9-2	BDT 8-2	BDT 7-2	BDT 6-2	BDT 5-2	BDT 4-2	BDT 3-2	BDT 2-2
	BLOCK DELETE							
#3053								
#3054								
#3055	SSEL1-2							NMWT1-2
	ROTARY TOOL SELECT INPUT							WAIT M COMMAND DISREGARD INPUT
#3056	UI7-2	UI6-2	UI5-2	UI4-2	UI3-2	UI2-2	UI1-2	UI0-2
	MACROPROGRAM INPUT							
#3057	UI15-2	UI14-2	UI13-2	UI12-2	UI11-2	UI10-2	UI9-2	UI8-2
	MACROPROGRAM INPUT							
#3058	UI23-2	UI22-2	UI21-2	UI20-2	UI19-2	UI18-2	UI17-2	UI16-2
	MACROPROGRAM INPUT							
#3059	UI31-2	UI30-2	UI29-2	UI28-2	UI27-2	UI26-2	UI25-2	UI24-2
	MACROPROGRAM INPUT							

(4) **Third Program NC Machining Program Execution Control (1/1)**

	7	6	5	4	3	2	1	0
#3060	OVC-3	OPT-3	BDT-3	OV16-3	OV8-3	OV4-3	OV2-3	OV1-3
	OVERRIDE CANCEL	OPTIONAL STOP	BLOCK DELETE	FEEDRATE OVERRIDE				
#3061					FIN-3	RWDH-3	RWD-3	EOP-3
					MT FUNCTION COMPLETED	HIGH-SPEED REWIND	REWIND	END PROGRAM
#3062	BDT 9-3	BDT 8-3	BDT 7-3	BDT 6-3	BDT 5-3	BDT 4-3	BDT 3-3	BDT 2-3
	BLOCK DELETE							
#3063								
#3064								
#3065	SSEL1-3							NMWT1-3
	ROTARY TOOL SELECT INPUT							WAIT M COMMAND DISREGARD INPUT
#3066	UI7-3	UI6-3	UI5-3	UI4-3	UI3-3	UI2-3	UI1-3	UI0-3
	MACROPROGRAM INPUT							
#306	UI15-3	UI14-3	UI13-3	UI12-3	UI11-3	UI10-3	UI9-3	UI8-3
	MACROPROGRAM INPUT							
#3068	UI23-3	UI22-3	UI21-3	UI20-3	UI19-3	UI18-3	UI17-3	UI16-3
	MACROPROGRAM INPUT							
#3069	UI31-3	UI30-3	UI29-3	UI28-3	UI27-3	UI26-3	UI25-3	UI24-3
	MACROPROGRAM INPUT							

(5) Servo Axis Control (1/2)

	7	6	5	4	3	2	1	0	
#3070	H8	H7	H6	H5	H4	H3	H2	H1	MANUAL HANDLE AXIS SELECT
#3071	+8	+7	+6	+5	+4	+3	+2	+1	MANUAL FEED DIRECTION SELECT
#3072	-8	-7	-6	-5	-4	-3	-2	-1	MANUAL FEED DIRECTION SELECT
#3073	*DC 8	*DC 7	*DC 6	*DC 5	*DC 4	*DC 3	*DC 2	*DC 1	REFERENCE POINT RETURN DECEL SWITCH
#3074	*+OT8	*+OT7	*+OT6	*+OT5	*+OT4	*+OT3	*+OT2	*+OT1	OVERTRAVEL LS
#3075	*-OT8	*-OT7	*-OT6	*-OT5	*-OT4	*-OT3	*-OT2	*-OT1	OVERTRAVEL LS
#3076	MLK8	MLK7	MLK6	MLK5	MLK4	MLK3	MLK2	MLK1	AXIS MACHINE LOCK
#3077									
#3078	*IT8	*IT7	*IT6	*IT5	*IT4	*IT3	*IT2	*IT1	AXIS INTERLOCK
#3079	*C2SVOF	*C1SVOF							C-AXIS SERVO OFF

(5) **Servo Axis Control (2/2)**

	7	6	5	4	3	2	1	0
#3080	2H8	2H7	2H6	2H5	2H4	2H3	2H2	2H1

2ND MANUAL HANDLE **AXIS SELECT**

#3081	3H8	3H7	3H6	3H5	3H4	3H3	3H2	3H1

3RD MANUAL HANDLE AXIS SELECT

#3082								

#3083								

#3084	TRQ1-8	TRQ1-7	TRQ1-6	TRQ1-5	TRQ1-4	TRQ1-3	TRQ1-2	TRQ1-1

SERVO **AXIS TORQUE LIMIT INPUT (1ST** STAGE) **AXIS SELECT**

#3085	TRQ2-8	TRQ2-7	TRQ2-6	TRQ2-5	TRQ2-4	TRQ2-3	TRQ2-2	TRQ2-1

SERVO AXIS TORQUE LIMIT INPUT (2ND STAGE) AXIS SELECT

#3086	PCOPS1-8	PCOPS1-7	PCOPS1-6	PCOPS1-5	PCOPS1-4	PCOPS1-3	PCOPS1-2	PCOPS1-1

PULSE COPY SOURCE AXIS SELECT 1

#3087	PCOPD1-8	PCOPD1-7	PCOPD1-6	PCOPD1-5	PCOPD1-4	PCOPD1-3	PCOPD1-2	PCOPD1-1

PULSE COPY DESTINATION AXIS SELECT 1

#3088	PCOPS2-8	PCOPS2-7	PCOPS2-6	PCOPS2-5	PCOPS2-4	PCOPS2-3	PCOPS2-2	PCOPS2-1

PULSE COPY SOURCE AXIS SELECT 2

#3089	PCOPD2-8	PCOPD2-7	PCOPD2-6	PCOPD2-5	PCOPD2-4	PCOPD2-3	PCOPD2-2	PCOPD2-1

PULSE COPY DESTINATION AXIS SELECT 2

(6) # 3090– # 3109 **(Unused)**

	7	6	5	4	3	2	1	0
#3090								
#3091								
#3092								
#3093								
#3094								
#3095								
#3096								
#3097								
#3098								
#3099								

	7	6	5	4	3	2	1	0
#3100								
H3101								
#3102								
#3103								
3104								
#3105								
#3106								
#3107								
#3108								
U3109								

(7) **First Spindle Control (1/1)**

	7	6	5	4	3	2	1	0
#3110	GRS	GSC	SSTP	SINV	GR4	GR3	GR2	GR1
	GEAR SHIFT	SPINDLE CONSTANT SPEED	S COMMAND OUTPUT STOP	S ANALOG OUTPUT INVERT	SPINDLE GEAR RANGE			
#3111		SAGR		SPE	SPD	SPC	SPB	SPA
		SPINDLE SPEED COINCIDENCE		SPINDLE OVERRIDE				
#3112	SDI 7	SDI 6	SDI 5	SDI 4	SDI 3	SDI 2	SDI 1	SDI 0
	S COMMAND BINARY							
#3113	SDI 15	SDI 14	SDI 13	SDI 12	SDI 11	SDI 10	SDI 9	SDI 8
	S COMMAND BINARY							
#3114	SDI 23	SDI 22	SDI 21	SDI 20	SDI 19	SDI 18	SDI 17	SDI 16
	S COMMAND BINARY							
#3115					S4COP	S3COP	S2COP	S1COP
					SPINDLE INTERLOCKED INPUT			
#3116						CSVONS	SPMODES	CAXREQ
						SPINDLE SERVO ON STATE COPY	SPINDLE CONTROL MODE COPY	NC C-AXIS CHANGE REQUEST
#3117				SLPC	SIDX CUT	SIDX I	SIDX INC	SIDX
				SPINDLE POSITION LOOP MODE	SPINDLE INDEX			
#3118	SID 7	SID 6	SID 5	SID 4	SID 3	SID 2	SID 1	SID 0
	SPINDLE INDEX							
#3119					SID 11	SID 10	SID 9	SID 8
					SPINDLE INDEX			

(8) Second Spindle Control (1/1)

	7	6	5	4	3	2	1	0
#3120	GRS-2	GSC-2	SSTP-2	SINV-2	GR4-2	GR3-2	GR2-2	GR1-2
	GEAR SHIFT	SPINDLE CONSTANT SPEED	S COMMAND OUTPUT STOP	S ANALOG OUTPUT INVERT	SPINDLE GEAR RANGE			
#3121		SAGR-2		SPE-2	SPD-2	SPC-2	SPB-2	SPA-2
		SPINDLE SPEED COINCIDENCE		SPINDLE OVERRIDE				
#3122	SDI 7-2	SDI 6-2	SDI 5-2	SDI 4-2	SDI 3-2	SDI 2-2	SDI 1-2	SDI 0-2
	S COMMAND BINARY							
#3123	SDI 15-2	SDI 14-2	SDI 13-2	SDI 12-2	SDI 11-2	SDI 10-2	SDI 9-2	SDI 8-2
	S COMMAND BINARY							
#3124	SDI 23-2	SDI 22-2	SDI 21-2	SDI 20-2	SDI 19-2	SDI 18-2	SDI 17-2	SDI 16-2
	S COMMAND BINARY							
#3125					S4COP-2	S3COP-2	S2COP-2	S1COP-2
					SPINDLE INTERLOCKED INPUT			
#3126						CSVONS-2	SPMODES-2	CAXREQ-2
						SPINDLE SERVO ON STATE COPY	SPINDLE CONTROL MODE COPY	NC C-AXIS CHANGE REQUEST
#3127				SLPC-2	SIDXCUT-2	SIDX 1-2	SIDX INC-2	SIDX-2
				SPINDLE POSITION LOOP MODE	SPINDLE INDEX			
#3128	SID 7-2	SID 6-2	SID 5-2	SID 4-2	SID 3-2	SID 2-2	SID 1-2	SID 0-2
	SPINDLE INDEX							
#3129					SID 11-2	SID 10-2	SID 9-2	SID 8-2
					SPINDLE INDEX			

(9) Third Spindle Control (1/1)

	7	6	5	4	3	2	1	0
#3130	GRS-3	GSC-3	SSTP-3	SINV-3	GR4-3	GR3-3	GR2-3	GR1-3
	GEAR SHIFT	SPINDLE CONSTANT SPEED	S COMMAND OUTPUT STOP	S ANALOG OUTPUT INVERT	SPINDLE GEAR RANGE			
#3131		SAGR-3		SPE-3	SPD-3	SPC-3	SPB-3	SPA-3
		SPINDLE SPEED COINCIDENCE		SPINDLE OVERRIDE				
#3132	SDI 7-3	SDI 6-3	SDI 5-3	SDI 4-3	SDI 3-3	SDI 2-3	SDI 1-3	SDI O-3
	S COMMAND BINARY							
#3133	SDI 15-3	SDI 14-3	SD] 13-3	SDI 12-3	SDI 11-3	SDI 10-3	SD I 9-3	SDI 8-3
	S COMMAND BINARY							
#3134	SDI 23-3	SDI 22-3	SDI 21-3	SDI 20-3	SDI 19-3	SDI 18-3	SDI 17-3	SD I 16-3
	S COMMAND BINARY							
#3135					S4COP-3	S3COP-3	S2COP-3	S1COP-3
					SPINDLE INTERLOCKED INPUT			
#3136								
#3137				SLPC-3	SIDX CUT-3	SIDX I-3	SIDX INC-3	SIDX-3
				SPINDLE POSITION LOOP MODE	SPINDLE INDEX			
#3138	SID 7-3	SID 6-3	SID 5-3	SID 4-3	SID 3-3	SID 2-3	SID 1-3	SID O-3
	SPINDLE INDEX							
#3139					SID 11-3	SID 10-3	SID 9-3	SID 8-3
					SPINDLE INDEX			

(10) Fourth Spindle Control (1/1)

	7	6	5	4	3	2	1	0
#3140	GRS-4	GSC-4	SSTP-4	SINV-4	GR4-4	GR3-4	GR2-4	GR1-4
	GEAR SHIFT	SPINDLE CONSTANT SPEED	S COMMAND OUTPUT STOP	S ANALOG OUTPUT INVERT	SPINDLE GEAR RANGE			
#3141		SAGR-4		SPE-4	SPD-4	SPC-4	SPB-4	SPA-4
		SPINDLE SPEED COINCIDENCE		**SPINDLE OVERRIDE**				
#3142	SDI 7-4	SDI 6-4	SDI 5-4	SDI 4-4	SDI 3-4	SDI 2-4	SDI 1-4	SDI 0-4
	S COMMAND BINARY							
#3143	SDI 15-4	SDI 14-4	SDI 13-4	SDI 12-4	SDI 11-4	SDI 10-4	SDI 9-4	SDI 8-4
	S COMMAND BINARY							
#3144	SDI 23-4	SDI 22-4	SDI 21-4	SDI 20-4	SDI 19-4	SDI 18-4	SDI 17-4	SDI 16-4
	S COMMAND BINARY							
#3145					S4COP-4	S3COP-4	S2COP-4	S1COP-4
					SPINDLE INTERLOCKED INPUT			
#3146								
#3147				SLPC-4	SIDXCUT-4	SIDX 1-4	SIDXINC-4	SIDX-4
				SPINDLE POSITION **LOOP MODE**	**SPINDLE INDEX**			
#3148	SID 7-4	SID 6-4	SID 5-4	SID 4-4	SID 3-4	SID 2-4	SID 1-4	SID 0-4
	SPINDLE INDEX							
#3149					SID 11-4	SID 10-4	SID 9-4	SID 8-4
					SPINDLE INDEX			

(11) Second Program Operation Mode Control (1/4)

	7	6	5	4	3	2	1	0
#3160	EDT-2	MEM-2	MDI-2	TP-2	STP-2	H-2	JOG-2	RT-2
	OPERATION MODE							
#3161								
#3162	MP4-2	MP2-2	MP1-2	JV16-2	JV8-2	JV4-2	JV2-2	JV1-2
	MANUAL PULSE MAGNIFICATION SELECT			JOG SPEED SELECT				
#3163		ROV4-2	ROV2-2	ROV1-2			*SP-2	ST-2
		RAPID TRAVERSE OVERRIDE					START/STOP	
#3164			CDZ-2	SMZ-2	AXLK-2	STLK-2	ERS-2	
			THREADING	ERROR DETECT ON	ALL AXIS INTERLOCK	START INTERLOCK	EXTERNAL RESET	
#3165		ERR1-2	ERR0-2				EXTC-2	
		DECEL & STOP	BLOCK STOPPAGE				TIME COUNT	
		EXTERNAL ERROR DETECTION						
#3166	AFL-2	MLK-2		DRN-2	PRST-2		ABS-2	SBK-2
	AUXILIARY FUNCTION LOCK	MACHINE LOCK		DRY RUN	PROGRAM RESTART		MANUAL ABSOLUTE	SINGLE BLOCK
#3167	SRN-2						ZRN2-2	ZRN-2
	SETUP POINT RETURN						SECOND REFERENCE RETURN	REFERENCE RETURN
#3168					PST-2	CPRN-2	HOFS-2	
					CURRENT VALUE STORAGE	MACHINING INTERRUPT POINT RETURN	AUTOMATIC MODE HANDLE OFFSET	
#3169								

(11) Second Program Operation Mode Control (2/4)

	7	6	5	4	3	2	1	0
#3170								
#3171	FSEDCLR-2	FSEDCH-2	FSEDMEM-2	FSEDM-2				
	FS AUTOMATIC EDIT							
#3172							W“M-’	WOP-2
							TOOL WEAR COMPENSATION	
#3173								
#3174								
#3175								
#3176								
#3177								
#3178								
#3179								

(11) Second Program Operation Mode Control (3/4)

	7	6	5	4	3	2	1	0
#3180								
#3181								
#3182								
#3183	TNO 7-2	TNO 6-2	TNO 5-2	TNO 4-2	TNO 3-2	TNO 2-2	TNO 1-2	TNO 0-2
	TOOL NO.							
#3184							TNO 9-2	TNO 8-2
							TOOL NO	
#3185	TGN 7-2	TGN 6-2	TGN 5-2	TGN 4-2	TGN 3-2	TGN 2-2	TGN 1-2	TGN 0-2
	TOOL GROUP NO. (TOOL LIFE CONTROL)							
#3186								
#3187								
#3188							TLSKP-2	TLRST-2
							TOOL LIFE CONTROL	
#3189								

(11) Second Program Operation Mode Control (4/4)

	7	6	5	4	3	2	1	0
#3190	ED7-2	ED6-2	ED5-2	ED4-2	ED3-2	ED2-2	ED1-2	ED0-2
	EXTERNAL DATA INPUT							
#3191	ED15-2	ED14-2	ED13-2	ED12-2	ED11-2	ED10-2	ED9-2	ED8-2
	EXTERNAL DATA INPUT							
#3192	ED23-2	ED22-2	ED21-2	ED20-2	ED19-2	ED18-2	ED17-2	ED16-2
	EXTERNAL DATA INPUT							
#3193	ED31-2	ED30-2	ED29-2	ED28-2	ED27-2	ED26-2	ED25-2	ED24-2
	EXTERNAL DATA INPUT							
#3194	EDCL-2		EDAS2-2	EDAS1-2	EDAS0-2	EDSD-2	EDSC-2	EDSB-2 / EDSA-2
	EXTERNAL DATA INPUT							
#3195								
#3196								
#3197								
#3198								
#3199	..							

(12) Third Program Operation Mode Control (1/4)

	7	6	5	4	3	2	1	0
#3200	EDT-3	MEM-3	MD I-3	TP-3	STP-3	H-3	JOG-3	RT-3
	OPERATION MODE							
#3201								
#3202	MP4-3	MP2-3	MP1-3	JV 16-3	JV 8-3	JV 4-3	JV 2-3	JV 1-3
	MANUAL PULSE MAGNIFICATION SELECT			JOG SPEED SELECT				
#3203		ROV 4-3	ROV 2-3	ROV 1-3			*SP-3	ST-3
		RAPID TRAVERSE OVERRIDE					START/STOP	
#3204			CDZ-3	SMZ-3	AXLK-3	STLK-3	ERS-3	
			THREADING	ERROR DETECT ON	ALL AXIS INTERLOCK	START INTERLOCK	EXTERNAL RESET	
#3205		ERR1-3	ERR0-3				EXTC-3	
		DECEL & STOP	BLOCK STOPPAGE				TIME COUNT	
		EXTERNAL ERROR DETECTION						
#3206	AFL-3	MLK-3		DRN-3	PRST-3		ABS-3	SBK-3
	AUXILIARY FUNCTION LOCK	MACHINE LOCK		DRY RUN	PROGRAM RESTART		MANUAL ABSOLUTE	SINGLE-BLOCK
#3207	SRN-3						ZRN2-3	ZRN-3
	SETUP POINT RETURN						SECOND REFERENCE RETURN	REFERENCE RETURN
#3208					PST-3	CPRN-3	HOFS-3	
					CURRENT VALUE STORAGE	MACHINING INTERRUPT POINT RETURN	AUTOMATIC MODE HANDLE OFFSET	
#3209								

(12) Third Program Operation Mode Control (2/4)

	7	6	5	4	3	2	1	0
U3210								
#3211	FSEDCLR-3	FSEDCH-3	FSEDMEM-3	FSEDM-3				
	FS AUTOMATIC EDIT							
#3212							WOM-3	WOP-3
							TOOL WEAR COMPENSATION	
#3213								
#3214								
#3215								
#3216								
#3217								
#3218								
#3219								

(12) Third Program Operation Mode Control (3/4)

	7	6	5	4	3	2	1	0
#3220								
#3221								
#3222								
#3223	TNO 7-3	TNO 6-3	TNO 5-3	TNO 4-3	TNO 3-3	TNO 2-3	TNO 1-3	TNO 0-3
	TOOL NO							
#3224							TNO 9-3	TNO 8-3
							TOOL NO	
#3225	TGN 7-3	TGN 6-3	TGN 5-3	TGN 4-3	TGN 3-3	TGN 2-3	TGN 1-3	TGN 0-3
	TOOL GROUP NO							
#3226								
#3227								
#3228							TLSKP-3	TLRST-3
							TOOL LIFE CONTROL	
#3229								

(12) Third Program Operation Mode Control (4/4)

	7	6	5	4	3	2	1	0
#3230	ED7-3	ED6-3	ED5-3	ED4-3	ED3-3	ED2-3	ED1-3	ED0-3
	EXTERNAL DATA INPUT							
#3231	ED15-3	ED14-3	ED13-3	ED12-3	ED11-3	ED10-3	ED9-3	ED8-3
	EXTERNAL DATA INPUT							
#3232	ED23-3	ED22-3	ED21-3	ED20-3	ED19-3	ED18-3	ED17-3	ED16-3
	EXTERNAL-DATA INPUT							
#3233	ED31-3	ED30-3	ED29-3	ED28-3	ED27-3	ED26-3	ED25-3	ED24-3
	EXTERNAL DATA INPUT							
#3234	EDCL-3	EDAS2-3	EDAS1-3	EDAS0-3	EDSD-3	EDSC-3	EDSB-3	EDSA-3
	EXTERNAL DATA INPUT							
#3235								
#3236								
#3237								
#3238								
#3239								

21. 2.3 NC ← PLC OUTPUT ADDRESS LIST

NC → PLC

Address	Contents	Page
#3500 ~ #3509	(1) First program operation mode control l/2	202
#3510 ~ #3519	First program operation mode control 2/2	203
#3520 ~ #3529	(2) First program NC machining program execution control 1/3	204
#3530 ~ #3539	First program NC machining program execution control 2/3	205
#3540- #3549	First program NC machining program execution control 3/3	206
#3550 ~ #3559	(3) Second program NC machining program execution control 1/3	207
#3560 -- #3569	Second program NC machining program execution control 2/3	208
#3570 ~ #3579	Second program NC machining program execution control 3/3	209
#3580 ~ #3589	(4) Third program NC machining program execution control 1/3	210
#3590- #3599	Third program NC machining program execution control 2/3	211
#3600 ~ #3609	Third program NC machining program execution control 3/3	212
#3610 ~ #3619	(5) Servo axis control 1/4	213
#3620 ~ #3629	Servo axis control 2/4	214
#3630 ~ #3639	Servo axis control 3/4	215
#3640 ~ #3649	Servo axis control 4/4	216
#3650 ~ #3659	(6) First spindle control l/1	217
#3660 ~ #3669	(7) Second spindle control 1/1	218
#3670 ~ #3679	(8) Third spindle control 1/1	219
#3680 ~ #3689	(9) Fourth spindle control l/1	220
#3690 ~ #3699	Unused	221
#3700 ~ #3709	(10) Second program operation mode control 1/2	222
#3710 ~ #3719	Second program operation modecontro12/2	223
#3720 ~ #3729	(11) Third program operation mode control 1/2	224
#3730 ~ #3739	Third program operation mode control 2/2	225
#3740 ~ #3749	(12) Axis variable data l/7	226
#3750 ~ #3759	Axis variable data 2/7	227
#3760 ~ #3769	Axis variable data 3/7	228
#3770 -#3779	Axis variable data 4/7	229
#3780 ~ #3789	Axis variable data 5/7	
#3790 -#3799	Axis variable data 6/7	
#3800 ~ #3803	Axis variable data 7/7	o

21. 2.4 OUTPUT SIGNALS (NC+ PLC)

(1) First Program Operation Mode Control (1/2)

NOTE: Signals marked ∗ are common to all programs, They are provided in the **first** program operation mode control sequence only. As regards the other signals, **equivalent** types are provided for the first, second, and third programs, respectively.

	7	6	5	4	3	2	1	0
			※	※		※		
#3500			BGEDES	WARN S	IERS	*ESP S	RSTS	ALMS
			BG EDIT ERROR STATE OUTPUT	WARNING STATE OUTPUT	INPUT ERROR STATE OUTPUT	EMERGENCY STOP STATE OUTPUT	RESET STATE OUTPUT	ALARM ERROR STATE OUTPUT
	※					※		
#3501	COOPS					EDTS	AUTO	MAN
	COOPERATIVE MULTI-PROGRAM CONTROL STATE					**EDITING STATE OUTPUT**	**AUTOMATIC MODE OUTPUT**	**MANUAL MODE OUTPUT**
	※				※			
#3502	ONPB	OHT	TO	*BALM	SSW3	SSW2	SSW1	SSW0
	NC CONTROL MONITOR OUTPUT				**SYSTEM NUMBER SWITCH MONITOR OUTPUT**			
		※					※	※
#3503		SVMXRST	PWLOST	ESP	SVALM		*BK	SVON S
		SVMX RESET OUTPUT	**POWER LOST OUTPUT**	**EMERGENCY STOP OUTPUT**	SERVO/ **SPINDLE UNIT ALARM UNIT**		**BRAKE ON MONITOR OUTPUT**	**SERVO ON MONITOR OUTPUT**
						※		
#3504		ES END	ER END	PRST S		FSED MC	FSED CE	FSED S
		EXTERNAL DATA INPUT FUNCTION EXECUTION COMPLETION OUTPUT		PROGRAM RERUN STATE OUTPUT		**FS AUTOMATIC EDIT MONITOR OUTPUT**		
						※		
#3505						TLCH	CPRN S	
						LIFE CONTROL TOOL CHANGE **OUTPUT**	MACHINING INTERRUPT POINT **RETURN COMPLETION OUTPUT**	
					※			
#3506					SSWS 3	SSWS 2	SSWS 1	SSWS 0
					SYSTEM NUMBER MONITOR SETTING			
#3507			G311S	OLV1	PWTS123	PWTS3	PWTS2	PWTS1
			DEVIATION SKIP EXECUTION STATE OUTPUT	**SUPERPOSITION** INTERPOLATION **STATE OUTPUT**	**WAIT STATE PROGRAM OUTPUT**			
#3508								
#3509								

(1) First Program Operation Mode Control (2/2)

	7	6	5	4	3	2	1	0
#3510								
#3511								
#3512								
#3513								
		※						
#3514		HOUT 3	HOUT 2	HOUT 1		HIN 3	HIN 2	HIN 1

M. M DIRECT PROCESS
SIGNAL MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3515	SETS AFL	SETS MLK		SETS DRN			SETS ABS	SETS SBK

INTERNAL TOGGLE SWITCH
MONITOR OUTPUT

	7	6	5	4	3	2	1	0
						※		
#3516						SETS EDLK		

INTERNAL TOGGLE SWITCH
MONITER OUTPUT

	7	6	5	4	3	2	1	0
#3517								
#3518								
#3519	“							

(2) First Program NC Machining Program Execution Control (1 /3)

	7	6	5	4	3	2	1	0
#3520	MA7	MA6	MA5	MA4	MA3	MA2	MA1	MA0
	1ST M CODE OUTPUT							
#3521	**M30 R**	**M02 R**	M01 R	M00 R			MA9	MA8
	M **DECODE OUTPUT**						**1ST M CODE OUTPUT**	
#3522	MB7	MB6	MB5	MB4	MB3	MB2	MB1	MB0
	2ND M CODE OUTPUT							
#3523							MB9	MB8
							2ND M CODE OUTPUT	
#3524	MC7	MC6	MC5	MC4	MC3	MC2	MC1	MC0
	3RD M CODE OUTPUT							
#3525							**MC9**	**MC8**
							3RD M CODE OUTPUT	
#3526	MD7	MD6	MD5	MD4	MD3	MD2	MD1	MD0
	4TH M CODE OUTPUT							
#3527							MD9	MD8
							4TH M CODE OUTPUT	
#3528	ME7	ME6	ME5	ME4	ME3	ME2	ME1	ME0
	5TH M CODE OUTPUT							
#3529								
							5TH M CODE OUTPUT	

(2) **First Program NC Machining Program Execution Control (2/3)**

	7	6	5	4	3	2	1	0
#3530	T7	T6	T5	T4	T3	T2	T1	TO

T CODE OUTPUT

	7	6	5	4	3	2	1	0
#3531							T9	T8

T CODE OUTPUT

	7	6	5	4	3	2	1	0
#3532								
#3533								
#3534	TFM	FMOUT2	FMOUT1	MFME	MFMD	MFMC	MFMB	MFMA

MULTI-PROGRAM M/T COMMAND
OUTPUT PROGRAM SELECT & SAMPLING OUTPUT

	7	6	5	4	3	2	1	0
#3535	TF			MFE	MFD	MFC	MFB	MFA

M/T CODE SAMPLING OUTPUT

	7	6	5	4	3	2	1	0
#3536								
#3537	THC	RWDS	‘P	DEN	RPD S	FEED S	SPL	STL
	‘H READING	RWD STATE	OPERATING	FEED COMPLETION	R STATE	F STATE	RESTING	STARTING

PROGRAM OPERATION STATE MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3538					SETS OPT	SETS BDT		

INTERNAL TOGGLE SWITCH
MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3539								

(2) First Program NC Machining **Program Execution Control (3/3)**

	7	6	5	4	3	2	1	0
#3540	U07	U06	U05	’04	U03	’02	U01	U00
	MACRO PROGRAM OUTPUT SIGNAL							
#3541	’015	U014	’013	’012	’011	’010	’09	’08
	MACRO PROGRAM OUTPUT SIGNAL							
#3542	’023	’022	’021	’020	’019	’018	U017	’016
	MACRO PROGRAM OUTPUT SIGNAL							
#3543	’031	’030	’029	’028	’027	’026	’025	’024
	MACRO PROGRAM OUTPUT SIGNAL							
#3544								
#3545								
#3546								
#3547								
#3548								
#3549								

(3) Second Program NC Machining Program Execution Control (1 /3)

	7	6	5	4	3	2	1	0
#3550	MA7-2	MA6-2	MA5-2	MA4-2	MA3-2	MA2-2	MA-2	MAO-2
	1ST M CODE OUTPUT							
#3551	M30 R-2	M02 R-2	MO1 R-2	MOO R-2			MA9-2	MA8-2
	M DECODE OUTPUT						1ST M CODE OUTPUT	
#3552	MB7-2	MB6-2	MB5-2	MB4-2	MB3-2	MB2-2	MB1-2	MB0-2
	2ND M CODE OUTPUT							
#3553							MB9-2	MB8-2
							2ND M CODE OUTPUT	
#3554	MC7-2	MC6-2	MC5-2	MC4-2	MC3-2	MC2-2	MC1-2	MC0-2
	3RD M CODE OUTPUT							
#3555							MC9-2	MC8-2
							3RD M CODE OUTPUT	
#3556	MD7-2	MD6-2	MD5-2	MD4-2	MD3-2	MD2-2	MD1-2	MD0-2
	4TH M CODE OUTPUT							
#3557							MD9-2	MD8-2
							4TH M CODE OUTPUT	
#3558	ME7-2	ME6-2	ME5-2	ME4-2	ME3-2	ME2-2	ME1-2	ME0-2
	5TH M CODE OUTPUT							
#3559							ME9-2	ME8-2
							5TH M CODE OUTPUT	

(3) Second Program NC Machining Program Execution Control (2/3)

	7	6	5	4	3	2	1	0
#3560	T7-2	T6-2	T5-2	T4-2	T3-2	T2-2	T1-2	T0-2
	T CODE OUTPUT							
#3561							T9-2	T8-2
							T CODE OUTPUT	
#3562								
#3563								
#3564	TFM-2	FMOUT2-2	FMOUT1-2	MFME-2	MFMD-2	MFMC-2	MFMB-2	MFMA-2
	MULTI-PROGRAM M/T COMMAND OUTPUT PROGRAM SELECT & SAMPLING OUTPUT							
#3565	TF-2			MFE-2	MFD-2	MFC-2	MFB-2	MFA-2
	M/T CODE SAMPLING OUTPUT							
#3566								
#3567	THC-2	RWDS-2	OP-2	DEN-2	RPDS-2	FEEDS-2	SPL-2	STL-2
	THREADING	RWDSTATE	OPERATING	FEED COMPLETION	R STATE	F STATE	RESTING	STARTING
	PROGRAM OPERATION STATE MONITOR OUTPUT							
#3568					SETS OPT-2	SETS BDT-2		
					INTERNAL TOGGLE SWITCH MONITOR OUTPUT			
#3569								

(3) Second Program NC Machining Program Execution Control (3/3)

	7	6	5	4	3	2	1	0
#3570	U07-2	U06-2	U05-2	U04-2	U03-2	U02-2	U01-2	U00-2
	MACRO PROGRAM OUTPUT SIGNAL							
#3571	U015-2	U014-2	U013-2	U012-2	U011-2	UO1O-2	U09-2	U08-2
	MACRO PROGRAM OUTPUT SIGNAL							
#3572	U023-2	U022-2	U021-2	U020-2	U019-2	U018-2	U017-2	U016-2
	MACRO PROGRAM OUTPUT SIGNAL							
#3573	U031-2	U030-2	U029-2	U028-2	U027-2	U026-2	U025-2	U024-2
	MACRO PROGRAM OUTPUT SIGNAL							
#3574								
#3575								
#3576								
#3577								
#3578								
#3579								

(4) **Third Program NC Machining Program Execution Control (1/3)**

	7	6	5	4	3	2	1	0
#3580	MA7-3	MA6-3	MA5-3	MA4-3	MA3-3	MA2-3	MA1-3	MAO-3
	1ST M CODE OUTPUT							
#3581	M30 R 3	M02 R-3	MO1 R-3	MOO R-3			MA9-3	MA8-3
	M DECODE OUTPUT						1ST M CODE OUTPUT	
#3582	MB7-3	MB6-3	MB5-3	MB4-3	MB3-3	MB2-3	MB1-3	MB0-3
	2ND M CODE OUTPUT							
#3583							MB9-3	MB8-3
							2ND M CODE OUTPUT	
#3584	MC7-3	MC6-3	MC5-3	MC4-3	MC3-3	MC2-3	MC1-3	MC0-3
	3RD M CODE OUTPUT							
#3585							MC9-3	MC8-3
							3RD M CODE OUTPUT	
#3586	MD7-3	MD6-3	MD5-3	MD4-3	MD3-3	MD2-3	MD1-3	MD0-3
	4TH M CODE OUTPUT							
#3587							MD9-3	MD8-3
							4TH M CODE OUTPUT	
#3588	ME7-3	ME6-3	ME5-3	ME4-3	ME3-3	ME2-3	ME1-3	ME0-3
	5TH M CODE OUTPUT							
#3589							ME9-3	ME8-3
							5TH M CODE OUTPUT	

(4) **Third Program NC Machining Program Execution Control (2/3)**

	7	6	5	4	3	2	1	0
#3590	T7-3	T6-3	T5-3	T4-3	T3-3	T2-3	T1-3	TO-3
	T CODE OUTPUT							
#3591							T9-3	T8-3
							T CODE OUTPUT	
#3592								
#3593								
#3594	TFM-3	FMOUT2-3	FMOUT1-3	MFME-3	MFMD-3	MFMC-3	MFMB-3	MFMA-3
	MULTI-PROGRAM M/T COMMAND OUTPUT PROGRAM SELECT & SAMPLING OUTPUT							
#3595	TF-3			MFE-3	MFD-3	MFC-3	MFB-3	MFA-3
	M/T CODE SAMPLING OUTPUT							
#3596								
#3597	THC-3	RWDS-3	OP-3	DEN-3	RPD S-3	FEED S-3	SPL-3	STL-3
	THREADING	RWDSTATE	OPERATING	FEED COMPLETION	R STATE	F STATE	RESTING	STARTING
	PROGRAM OPERATION STATE MONITOR OUTPUT							
#3598					SETS OPT-3	SETS BDT-3		
					INTERNAL TOGGLE SWITCH MONITOR OUTPUT			
#3599								

(4) **Third Program NC Machining Program Execution Control (3/3)**

	7	6	5	4	3	2	1	
#3600	U07-3	U06-3	U05-3	‘04-3	‘03-3	‘02-3	‘01-3	U00-3

MACRO PROGRAM OUTPUT SIGNAL

#3601	‘015-3	‘014-3	‘013-3	‘012-3	‘011-3	‘010-3	‘09-3	‘08-3

MACRO PROGRAM OUTPUT SIGNAL

#3602	‘023-3	‘022-3	‘021-3	‘020-3	‘019-3	‘018-3	‘017-3	‘016-3

MACRO PROGRAM OUTPUT SIGNAL

#“O’	‘031-3	‘030-3	‘029-3	‘028-3	‘027-3	‘026-3	‘025-3	‘024-3

MACRO PROGRAM OUTPUT SIGNAL

#3604								

#3605								

#“O’								

#3607								

#3608								

#3609								

(5) **Servo Axis Control (1/4)**

	7	6	5	4	3	2	1	0
#3610								
#3611								
#3612								
#3613								
#3614								
#3615	FUP 8	FUP 7	FUP 6	FUP 5	FUP 4	FUP 3	FUP 2	FUP 1
	FOLLOW-UP MONITOR OUTPUT							
#3616	PSET 8	PSET 7	PSET 6	PSET 5	PSET 4	PSET 3	PSET 2	PSET 1
	PSET STATUS MONITOR OUTPUT							
#3617								
#3618								
#3619	PCOPE8	PCOPE7	PCOPE6	PCOPE5	PCOPE4	PCOPE3	PCOPE2	PCOPE1
	PULSE COPY STATE MONITOR OUTPUT							

(5) Servo Axis Control (2/4)

Register	7	6	5	4	3	2	1	0
#3620	SRD1	*BB1		ACC01	PSET1	PC1	PB1	PA1
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	1ST AXIS SERVO UNIT MONITOR OUTPUT							
#3621	SRD2	*BB2		ACC02	PSET2	PC2	PB2	PA2
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	2ND AXIS SERVO UNIT MONITOR OUTPUT							
#3622	SRD3	*BB3		ACC03	PSET3	PC3	PB3	PA3
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	3RD AXIS SERVO UNIT MONITOR OUTPUT							
#3623	SRD4	*BB4		ACC04	PSET4	PC4	PB4	PA4
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	4TH AXIS SERVO UNIT MONITOR OUTPUT							
#3624	SRD5	*BB5		ACC05	PSET5	PC5	PB5	PA5
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	5TH AXIS SERVO UNIT MONITOR OUTPUT							
#3625	SRD6	*BB6		ACC06	PSET6	PC6	PB6	PA6
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	6TH AXIS SERVO UNIT MONITOR OUTPUT							
#3626	SRD7	*BB7		ACC07	PSET7	PC7	PB7	PA7
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	7TH AXIS SERVO UNIT MONITOR OUTPUT							
#3627	SRD8	*BB8		ACC08	PSET8	PC8	PB8	PA8
	SERVO READY	BASE BLOCK		ACCEL/DECEL COUNT 0	POSITION SET	PG PHASE C	PG PHASE B	PG PHASE A
	8TH AXIS SERVO UNIT MONITOR OUTPUT							
#3628								
#3629	ABSERR8	ABSERR7	ABSERR6	ABSERR5	ABSERR4	ABSERR3	ABSERR2	ABSERR1
	ABSO POSITIONING DETECTION ERROR							

(5) **Servo Axis Control (3/4)**

	7	6	5	4	3	2	1	0
#3630	ZP8	ZP7	ZP6	ZP5	ZP4	ZP3	ZP2	ZP1
	REFERENCE POINT POSITIONING MONITOR OUTPUT							
#3631	2ZP8	2ZP7	2ZP6	2ZP5	2ZP4	2ZP3	2ZP2	2ZP1
	REFERENCE POINT POSITIONING MONITOR OUTPUT							
#3632	3ZP8	3ZP7	3ZP6	3ZP5	3ZP4	3ZP3	3ZP2	3ZP1
	REFERENCE POINT POSITIONING MONITOR OUTPUT							
#3633	4ZP8	4ZP7	4ZP6	4ZP5	4ZP4	4ZP3	4ZP2	4ZP1
	REFERENCE POINT POSITIONING MONITOR OUTPUT							
#3634								
#3635								
#3636								
#3637								
#3638								
#3639								

(5) **Servo Axis Control (4/4)**

	7	6	5	4	3	2	1	0
#3640	+SOT8	+SOT7	+SOT6	+SOT5	+SOT4	+SOT3	+SOT2	+SOT1

STOKE CHECK MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3641	-SOT8	-SOT7	-SOT6	-SOT5	-SOT4	-SOT3	-SOT2	-SOT1

STOKE CHECK MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3642	SOT2 I					SOT23	SOT22	SOT21
	INTERNAL PROHIBIT					CHECK AXIS 3	CHECK AXIS 2	CHECK AXIS 1

2ND PROHIBIT RANGE STORKE CHECK MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3643	SOT31					SOT33	SOT32	SOT31
	INTERNAL PROHIBIT					CHECK AXIS 3	CHECK AXIS 2	CHECK AXIS 1

3RD PROHIBIT RANGE STORKE CHECK MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3644	SOT4 I					SOT43	SOT42	SOT41
	INTERNAL PROHIBIT					CHECK AXIS 3	CHECK AXIS 2	CHECK AXIS 1

4TH PROHIBIT RANGE STORKE CHECK MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3645	SOT5 I					SOT53	SOT52	SOT51
	INTERNAL PROHIBIT					CHECK AXIS 3	CHECK AXIS 2	CHECK AXIS 1

5TH PROHIBIT RANGE STORKE CHECK MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3646								

	7	6	5	4	3	2	1	0
#3647								

	7	6	5	4	3	2	1	0
#3648	TRQLIM8	TRQLIM7	TRQLIM6	TRQLIM5	TRQLIM4	TRQLIM3	TRQLIM2	TRQLIM1

SERVO TORQUE LIMIT MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3649								

(6) **First Spindle Control Signal (1/1)**

	7	6	5	4	3	2	1	0
#3650	GR4S	GR3S	GR2S	GR1S	GRS S	GSC s	G96 S	SINV A
	GEAR RANGE STATE OUTPUT				GRS CONTROL STATE OUTPUT	GSC CONTROL STATE OUTPUT	G96 CONTROL STATE OUTPUT	S BINARY INVERT STATE OUTPUT
#3651	S4COPE	S3COPE	S2COPE	S1COPE	SF	SLPS	SIDX O	SIDX A
	SPINDLE INTERLOCKED STATE OUTPUT				S COMMAND SAMPLING OUTPUT	SPINDLE POSITION LOOP MONITOR OUTPUT	SPINDLE INDEX MONITOR OUTPUT	
#3652							AXMODES	CAXS
							NC SPINDLE CONTROL MODE	NC SPINDLE CONTROL MODE CHANGE STATE
#3653						Pcs	PBS	PAS
						PG AND OTHER SIGNAL MONITOR OUTPUT		
#3654	SDO 7	SDO 6	SDO 5	SDO 4	SDO 3	SDO 2	SDO 1	SDO 0
	S COMMAND BINARY OUTPUT							
#3655	SDO 15	SDO 14	SDO 13	SDO 12	SDO 11	SDO 10	SDO 9	SDO 8
	S COMMAND BINARY OUTPUT							
#3656	SDO 23	SDO 22	SDO 21	SDO 20	SDO 19	SDO 18	SDO 17	SDO 16
	S COMMAND BINARY OUTPUT							
#3657								
#3658								
#3659	...							

(7) Second Spindle Control Signal (1/1)

	7	6	5	4	3	2	1	0
#3660	GR4 S-2	GR3 S-2	GR2 S-2	GR1 S-2	GRS S-2	GSC S-2	G96 S-2	SINV A-2
	GEAR RANGE STATE OUTPUT				GRS CONTROL STATE OUTPUT	GSC CONTROL STATE OUTPUT	G96 CONTROL STATE OUTPUT	**S BINARY INVERT STATE OUTPUT**
#3661	S4COPE-2	S3COPE-2	S2COPE-2	S1COPE-2	SF-2	SLPS-2	SIDX O-2	SIDX A-2
	SPINDLE INTERLOCKED STATE OUTPUT				S COMMAND SAMPLING OUTPUT	SPINDLE POSITION LOOP MONITOR OUTPUT	SPINDLE INDEX MONITOR OUTPUT	
#3662							AXMODES-2	CAXS-2
							NC SPINDLE CONTROL MODE	NC SPINDLE CONTROL **MODE CHANGE STATE**
#3663						PCS-2	PBS-2	PAS-2
						PG AND OTHER SIGNAL MONITOR OUTPUT		
#3664	SDO 7-2	SDO 6-2	SDO 5-2	SDO 4-2	SDO 3-2	SDO 2-2	SDO 1-2	SDO 0-2
	S COMMAND BINARY OUTPUT							
#3665	SDO 15-2	SDO 14-2	SDO 13-2	SDO 12-2	SDO 11-2	SDO 10-2	SDO 9-2	SDO 8-2
	S COMMAND BINARY OUTPUT							
#3666	SDO 23-2	SDO 22-2	SDO 21-2	SDO 20-2	SDO 19-2	SDO 18-2	SDO 17-2	SDO 16-2
	S COMMAND BINARY OUTPUT							
#3667								
#3668								
#3669								

(8) **Third Spindle Control Signal (1/1)**

	7	6	5	4	3	2	1	0
#3670	GR4 S-3	GR3 s-3	GR2 s-3	GR1 S-3	GRS S-3	GSC S-3	G96 S-3	SINV A-3
	GEAR RANGE STATE OUTPUT				GRS CONTROL STATE OUTPUT	GSC CONTROL STATE OUTPUT	G96 CONTROL STATE OUTPUT	S BINARY INVERT STATE OUTPUT
#3671	S4COPE-3	S3COPE-3	S2COPE-3	S1COPE-3	SF-3	SLPS-3	SIDX O-3	SIDX A-3
	SPINDLE INTERLOCKED STATE OUTPUT				S COMMAND SAMPLING OUTPUT	SPINDLE POSITION LOOP MONITOR OUTPUT	SPINDLE INDEX MONITOR OUTPUT	
#3672								
#3673						PCS-3	PBS-3	PAS-3
						PG AND OTHER SIGNAL MONITOR OUTPUT		
#3674		SDO 6-3	SDO 5-3	SDO 4-3	SDO 3-3	SDO 2-3	SDO 1-3	SDO 0-3
	S COMMAND BINARY OUTPUT							
#3675	SDO 15-3	SDO 14-3	SDO 13-3	SDO 12-3	SDO 11-3	SDO 10-3	SDO 9-3	SDO 8-3
	S COMMAND BINARY OUTPUT							
#3676	SDO 23-3	SDO 22-3	SDO 21-3	SDO 20-3	SDO 19-3	SDO 18-3	SDO 17-3	SDO 16-3
	S COMMAND BINARY OUTPUT							
#3677								
#3678								
#3679								

(9) **Fourth Spindle Control Signal (1/1)**

	7	6	5	4	3	2	1	0
#3680	GR4 S--4	GR3 S-4	GR2 S-4	GR1 S-4	GRS S-4	GSC S-4	G96 S-4	SINV A-4
	GEAR RANGE STATE OUTPUT				GRS CONTROL STATE OUTPUT	GSC CONTROL STATE OUTPUT	G96 CONTROL STATE OUTPUT	S BINARY INVERT STATE OUTPUT
#3681	S4COPE-4	S3COPE -4	S2COPE-4	S1COPE-4	SF-4	SLPS-4	SIDX O-4	SIDX A-4
	SPINDLE INTERLOCKED STATE OUTPUT				S COMMAND SAMPLING OUTPUT	SPINDLE POSITION LOOP MONITOR OUTPUT	SPINDLE INDEX MONITOR OUTPUT	
#3682								
#3683						PCS-4	PBS-4	PAS-4
						PG AND OTHER SIGNAL MONITOR OUTPUT		
#3684	SDO 7-4	SDO 6-4	SDO 5-4	SDO 4-4	SDO 3-4	SDO 2-4	SDO 1-4	SDO O-4
	S COMMAND BINARY OUTPUT							
#3685	SDO 15-4	SDO 14-4	SDO 13-4	SDO 12-4	SDO 11-4	SDO 10-4	SDO 9-4	SDO 8-4
	S COMMAND BINARY OUTPUT							
#3686	SDO 23-4	SDO 22-4	SDO 21-4	SDO 20-4	SDO 19-4	SDO 18-4	SDO 17-4	SDO 16-4
	S COMMAND BINARY OUTPUT							
#3687								
#3688								
#3689								

	7	6	5	4	3	2	1	0
#3690								
#3691								
#3692								
#3693								
#3694								
#3695								
#3696								
#3697								
#3698								
#3699								

(10) Second Program Operation Mode Control (1/2)

	7	6	5	4	3	2	1	0
#3700					IERS-2		RSTS-2	ALMS-2
					INPUT ERROR STATE OUTPUT		RESET STATE OUTPUT	ALARM ERROR STATE OUTPUT
#3701							AUTO-2	MAN-2
							AUTOMATIC MODE OUTPUT	MANUAL MODE OUTPUT
#3702								
#3703								
#3704		ES END-2	ER END-2	PRST s-2		FSED MC-2	FSED CE-2	FSED S-2
		EXTERNAL DATA INPUT FUNCTION EXECUTION COMPLETION OUTPUT		PROGRAM RERUN STATE OUTPUT		FS AUTOMATIC EDIT MONITOR OUTPUT		
#3705							CPRN S-2	
							MACHINING INTERRUPT POINT RETURN COMPLETION OUTPUT	
#3706								
#3707			G311S-2	OLV1-2	PWTS123-2	PWTS3-2	PWTS2-2	PWTS1-2
			DEVIATION SKIP EXECUTION STATE OUTPUT	SUPERIMPOSITION INTERPOLATION STATE OUTPUT	WAIT STATE PROGRAM OUTPUT			
#3708								
#3709								

(10) Second Program Operation Mode Control (2/2)

	7	6	5	4	3	2	1	0
#3710								
#3711								
#3712								
#3713								
#3714								
#3715	SETS AFL-2	SETS MLK-2		SETS DRN-2			SETS ABS-2	SETS SBK-2
	INTERNAL TOGGLE SWITCH MONITOR OUTPUT							
#3716								
	INTERNAL TOGGLE SWITCH MONITOR OUTPUT							
#3717								
#3718								
#3719								

(11) Third Program Operation Mode Control (1/2)

	7	6	5	4	3	2	1	0
#3720					IERS-3		RSTS-3	ALMS-3
					INPUT ERROR STATE OUTPUT		RESET STATE OUTPUT	ALARM ERROR STATE OUTPUT
#3721							AUTO-3	MAN-3
							AUTOMATIC MODE OUTPUT	MANUAL MODE OUTPUT
#3722								
#3723								
#3724		ES END-3	ER END-3	PRST S-3		FSED MC-2	FSED CE-2	FSED S-3
		EXTERNAL DATA INPUT FUNCTION EXECUTION COMPLETION OUTPUT		PROGRAM RERUN STATE OUTPUT		FS AUTOMATIC EDIT MONITOR OUTPUT		
#3725							CPRN S-3	
							MACHINING INTERRUPT POINT RETURN COMPLETION OUTPUT	
#3726								
#3727			G311S-3	OLV1-3		PWTS123-3	PWTS3-3	PWTS2-3	PWTS1-3
			DEVIATION SKIP EXECUTION STATE OUTPUT	SUPER-IMPOSITION INTERPOLATION STATE OUTPUT	WAIT STATE PROGRAM OUTPUT			
#3728								
#3729								

(11) **Third** Program Operation Mode Control (2/2)

	7	6	5	4	3	2	1	0
#3730								
#3731								
#3732								
#3733								
#3734								
#3735	SETS AFL-3	SETS MLK-3		SETS DRN-3			SETS ABS-3	SETS SBK-3

INTERNAL TOGGLE SWITCH MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3736								

INTERNAL TOGGLE SWITCH MONITOR OUTPUT

	7	6	5	4	3	2	1	0
#3737								
#3738								
#3739								

(12) **Axis** Variable Data **(1/7)**

	7	6	5	4	3	2	1	0
#3740	LD1-7	LD1-6	LD1-5	LD1-4	LD1-3	LD1-2	LD1-1	LD1-0

1 ST-AXIS LOAD DATA (L)

#3741	LD1-15	LD1-14	LD1-13	LD1-12	LD1-11	LD1-10	LD1-9	LD1-8

1 ST-AXIS LOAD DATA (H)

#3742	LD2-7	LD2-6	LD2-5	LD2-4	LD2-3	LD2-2	LD2-1	LD2-0

2ND-AXIS LOAD DATA (L)

#3743	LD2-15	LD2-14	LD2-13	LD2-12	LD2-11	LD2-10	LD2-9	LD2-8

2ND-AXIS LOAD DATA (H)

#3744	LD3-7	LD3-6	LD3-5	LD3-4	LD3-3	LD3-2	LD3-1	LD3-0

3RD-AXIS LOAD DATA (L)

#3745	LD3-15	LD3-14	LD3-13	LD3-12	LD3-11	LD3-10	LD3-9	LD3-8

3RD-AXIS LOAD DATA (H)

#3746	LD4-7	LD4-6	LD4-5	LD4-4	LD4-3	LD4-2	LD4-1	LD4-0

4TH-AXIS LOAD DATA (L)

#3747	LD4-15	LD4-14	LD4-13	LD4-12	LD4-11	LD4-10	LD4-9	LD4-8

4TH-AXIS LOAD DATA (H)

#3748	LD5-7	LD5-6	LD5-5	LD5-4	LD5-3	LD5-2	LD5-1	LD5-0

5TH-AXIS LOAD DATA (L)

#3749	LD5-15...	LD5-14	LD5-13	LD5-12	LD5-11	LD5-10	LD5-9	LD5-8

5TH-AXIS LOAD DATA (H)

(12) Axis Variable Data (2/7)

	7	6	5	4	3	2	1	0
#3750	LD6-7	LD6-6	LD6-5	LD6-4	LD6-3	LD6-2	LD6-1	LD6-0
	6TH-AXIS LOAD DATA (L)							
#3751	LD6-15	LD6-14	LD6-13	LD6-12	LD6-11	LD6-10	LD6-9	LD6-8
	6TH-AXIS LOAD DATA (H)							
#3752	LD7-7	LD7-6	LD7-5	LD7-4	LD7-3	LD7-2	LD7-1	LD7-0
	7TH-AXIS LOAD DATA (L)							
#3753	LD7-15	LD7-14	LD7-13	LD7-12	LD7-11	LD7-10	LD7-9	LD7-8
	7TH-AXIS LOAD DATA (H)							
#3754	LD8-7	LD8-6	LD8-5	LD8-4	LD8-3	LD8-2	LD8-1	LD8-0
	8TH-AXIS LOAD DATA (L)							
#3755	LD8-15	LD8-14	LD8-13	LD8-12	LD8-11	LD8-10	LD8-9	LD8-8
	8TH-AXIS LOAD DATA (H)							
#3756	LDS1-7	LDS1-6	LDS1-5	LDS1-4	LDS1-3	LDS1-2	LDS1-1	LDS1-0
	1ST-AXIS LOAD DATA (L)							
#3757	LDS1-15	LDS1-14	LDS1-13	LDS1-12	LDS1-11	LDS1-10	LDS1-9	LDS1-8
	1ST-AXIS LOAD DATA (H)							
#3758	LDS2-7	LDS2-6	LDS2-5	LDS2-4	LDS2-3	LDS2-2	LDS2-1	LDS2-0
	2ND-AXIS LOAD DATA (L)							
#3759	LDS2-15	LDS2-14	LDS2-13	LDS2-12	LDS2-11	LDS2-10	LDS2-9	LDS2-8
	2ND-AXIS LOAD DATA (H)							

(12) Axis Variable Data (3/7)

	7	6	5	4	3	2	1	0
#3760	LDS3-7	LDS3-6	LDS3-5	LDS3-4	LDS3-3	LDS3-2	LDS3-1	LDS3-0

3RD-AXIS LOAD DATA (L)

#3761	LDS3-15	LDS3-14	LDS3-13	LDS3-12	LDS3-11	LDS3-10	LDS3-9	LDS3-8

3RD-AXIS LOAD DATA (H)

#3762	LDS4-7	LDS4-6	LDS4-5	LDS4-4	LDS4-3	LDS4-2	LDS4-1	LDS4-0

4TH-AXIS LOAD DATA (L)

#3763	LDS4-15	LDS4-14	LDS4-13	LDS4-12	LDS4-11	LDS4-10	LDS4-9	LDS4-8

4TH-AXIS LOAD DATA (H)

#3764	S1RC7	S1RC6	S1RC5	S1RC4	S1RC3	S1RC2	S1RC1	S1RC0

1ST-AXIS S RPM REFERENCE (L)

#3765	S1RC15	S1RC14	S1RC13	S1RC12	S1RC11	S1RC10	S1RC9	S1RC8

1ST-AXIS S RPM REFERENCE (H)

#3766	S2RC7	S2RC6	S2RC5	S2RC4	S2RC3	S2RC2	S2RC1	S2RC0

2ND-AXIS S RPM REFERENCE (L)

#3767	S2RC15	S2RC14	S2RC13	S2RC12	S2RC11	S2RC10	S2RC9	S2RC8

2ND-AXIS S RPM REFERENCE (H)

#3768	S3RC7	S3RC6	S3RC5	S3RC4	S3RC3	S3RC2	S3RC1	S3RC0

3RD-AXIS S RPM REFERENCE (L)

#3769	S3RC15	S3RC14	S3RC13	S3RC12	S3RC11	S3RC10	S3RC9	S3RC8

3RD-AXIS S RPM REFERENCE (H)

(12) Axis Variable Data (4/7)

	7	6	5			2	1	0	
#3770	S4RC7	S4RC6	S4RC5			S4RC2	S4RC1	S4RC0	4TH AXIS S RPM REFERENCE (L)
#3771	S4RC15	S4RC14	S4RC13	S4RC12	S4RC11	S4RC10	S4RC9	S4RC8	4TH AXIS S RPM REFERENCE (H)
#3772	S1RS7	S1RS6	S1RS5	S1RS4	S1RS3	S1RS2	S1RS1	S1RS0	1ST SPINDELE ACTUAL SPEED (L)
#3773	S1RS15	S1RS14	S1RS13	S1RS12	S1RS11	S1RS10	S1RS9	S1RS8	1ST SPINDELE ACTUAL SPEED (H)
#3774	S2RS7	S2RS6	S2RS5	S2RS4	S2RS3	S2RS2	S2RS1	S2RS0	2ND SPINDELE ACTUAL SPEED (L)
#3775	S2RS15	S2RS14	S2RS13	S2RS12	S2RS11	S2RS10	S2RS9	S2RS8	2ND SPINDELE ACTUAL SPEED (H)
#3776	S3RS7	S3RS6	S3RS5	S3RS4	S3RS3	S3RS2	S3RS1	S3RS0	3RD SPINDELE ACTUAL SPEED (L)
#3777	S3RS15	S3RS14	S3RS13	S3RS12	S3RS11	S3RS10	S3RS9	S3RS8	3RD SPINDELE ACTUAL SPEED (H)
#3778	S4RS7	S4RS6	S4RS5	S4RS4	S4RS3	S4RS2	S4RS1	S4RS0	4TH SPINDELE ACTUAL SPEED (L)
#3779	S4RS15	S4RS14	S4RS13	S4RS12	S4RS11	S4RS10	S4RS9	S4RS8	4TH SPINDELE ACTUAL SPEED (H)

(12) Axis Variable Data (5/7)

	7	6	5	4	3	2	1	0
#3780	POS1-7	POS1-6	POS1-5	POS1-4	POS1-3	POS1-2	POS1-1	POS1-0
	1ST-AXIS POSITIONING DATA (L)							
#3781	POS1-15	POS1-14	POS1-13	POS1-12	POS1-11	POS1-10	POS1-9	POS1-8
	1ST-AXIS POSITIONING DATA (H)							
#3782	POS2-7	POS2-6	POS2-5	POS2-4	POS2-3	POS2-2	POS2-1	POS2-0
	2ND-AXIS POSITIONING DATA (L)							
#3783	POS2-15	POS2-14	POS2-13	POS2-12	POS2-11	POS2--10	POS2-9	POS2-8
	2ND-AXIS POSITIONING DATA (H)							
#3784	POS3-7	POS3-6	POS3-5	POS3-4	POS3-3	POS3-2	POS3-1	POS3-0
	3RD-AXIS POSITIONING DATA (L)							
#3785	POS3-15	POS3-14	POS3-13	POS3-12	POS3-11	POS3-10	POS3-9	POS3-8
	3RD-AXIS POSITIONING DATA (H)							
#3786	POS4-7	POS4-6	POS4-5	POS4-4	POS4-3	POS4-2	POS4-1	POS4-O
	4TH-AXIS POSITIONING DATA (L)							
#3787	POS4-15	POS4-14	POS4-13	POS4-12	POS4-11	POS4-10	POS4-9	POS4-8
	4TH-AXIS POSITIONING DATA (H)							
#3788	POS5-7	POS5-6	POS5-5	POS5-4	POS5-3	POS5-2	POS5-1	POS5-O
	5TH-AXIS POSITIONING DATA (L)							
#3789	POS5-15	POS5-14	POS5-13	POS5-12	POS5-11	POS5-10	POS5-9	POS5-8
	5TH-AXIS POSITIONING DATA (H)							

(12) Axis **Variable** Data (6/7)

	7	6	5	4	3	2	1	0
#3790	POS6-7	POS6-6	POS6-5	POS6-4	POS6-3	POS6-2	POS6-1	POS6-0
	6TH-AXIS POSITIONING DATA (L)							
#3791	POS6-15	POS6-14	POS6-13	POS6-12	POS6-11	POS6-10	POS6-9	POS6-8
	6TH-AXIS POSITIONING DATA (H)							
#3792	POS7-7	POS7-6	POS7-5	POS7-4	POS7-3	POS7-2	POS7-1	POS7-0
	7TH-AXIS POSITIONING DATA (L)							
#3793	POS7-15	POS7-14	POS7-13	POS7-12	POS7-11	POS7-10	POS7-9	POS7-8
	7TH-AXIS POSITIONING DATA (H)							
#3794	POS8-7	POS8-6	POS8-5	POS8-4	POS8-3	POS8-2	POS8-1	POS8-0
	8TH-AXIS POSITIONING DATA (L)							
#3795	POS8-15	POS8-14	POS8-13	POS8-12	POS8-11	POS8-10	POS8-9	POS8-8
	8TH-AXIS POSITIONING DATA (H)							
#3796	S1OR-7	S1OR-6	S1OR-5	S1OR-4	S1OR-3	S1OR-2	S1OR-1	S1OR-0
	1ST SPINDLE ORIENTATION ANGLE DATA (L)							
#3797					S1OR-11	S1OR-10	S1OR-9	S1OR-8
	1ST SPINDLE ORIENTATION ANGLE DATA (H)							
#3798	S2OR-7	S2OR-6	S2OR-5	S2OR-4	S2OR-3	S2OR-2	S2OR-1	S2OR-0
	2ND SPINDLE ORIENTATION ANGLE DATA (L)							
#3799					S2OR-11	S2OR-10	S2OR-9	S2OR-8
	2ND SPINDLE ORIENTATION ANGLE DATA (H)							

(12) Axis Variable Data (7/7)

	7	6	5	4	3	2	1	0
#3800	S30R-7	S30R-6	S30R-5	S30R-4	S30R-3	S30R-2	S30R-1	S30R-0

3RD SPINDLE ORIENTATION ANGLE DATA (L)

#3801					S30R-11	S30R-10	S30R-9	S30R-8

3RD SPINDLE ORIENTATION ANGLE DATA (H)

#3802	S40R-7	S40R-6	S40R-5	S40R-4	S40R-3	S40R-2	S40R-1	S40R-0

4TH SPINDLE ORIENTATION ANGLE DATA (L)

#3803					S40R-11	S40R-10	S40R-9	S40R-8

4TH SPINDLE ORIENTATION ANGLE DATA (H)

(13) Constant

	7	6	5	4	3	2	1	0
#3990								
#3991								
#3992								
#3993								
#3994								
#3995								
#3996	0	0	0	0	0	0	0	0
#3997	0	0	0	0	0	0	0	0
#3998	0	0	0	0	0	0	0	0
#3999	0	0	0	0	0	0	0	1

21.3 DETAILS OF 1/0 SIGNALS

In the subsequent sections on the program operation mode control signals and program NC machining program execution control signals, only the first program signals are described, because the counterparts of the second and third programs are the same as those of the first program.
The * mark is placed at the right and above the signals common to all three programs.

21. 3.1 PROGRAM OPERATION MODE INPUTS AND OUTPUTS

21. 3.1.1 CONTROL OPERATION MODE INPUTS AND OUTPUTS (JOG # 30001, H # 30002, STP # 30003, TP # 30004, MDI # 30005, MEN # 30006, EDT # 30007, AUTO # 35011, MAN #35010)

(1) Operation Mode Inputs
These inputs are used to select the following six operation modes.

RT :	Manual rapid traverse mode	Manual Operation mode
JOG :	Manual jog mode	
H :	Manual handle	
STP :	Manual step feed mode	
TP :	Tape operation mode	Automatic Operation mode
MD1 :	Manual data input operation mode	
MEM :	Memory operation mode	
EDT :	Program editing mode	

When any of the input contacts is closed, the corresponding operation mode is turned on.

(a) RT : Maunal rapid traverse mode input
When the RT input contact is closed with the other mode input contacts opened, the control enter the manual rapid traverse mode so that the machine rapidly traverses at the overriding rapid traverse speed in accordance with the manual feed direction input.

(b) JOG : Manual jog mode input
When the JOG input contact is closed, and other mode input contacts are opened, the control enters the manual jog mode, and the machine is jogged in the respective directions in response to the input signals.

(c) H : Manual HANDLE mode input
When the H input contacts is closed, and other mode input contacts are opened, the control enters the manual handle mode and the machine will be fed manually by the manual pulse generator according to the specified multiplication factor on the selected axis.

(d) STP : Manual STEP feed mode
When the STP input contact is closed, and other mode input contacts are opened, the control enters the manual step feed mode and the machine will be fed in steps.

(e) TP : Tape operation mode
When the TP input contact is closed and other mode input contacts are opened, the control enters the tape operation mode, and the machine will be controlled by the tape commands read by the tape reader.
When the control is provided with an optional RS232C interface, it can control the machine by part programs input via the RS232C interface.

(f) MC) I :Manual data input operation mode input

When the MDI input contact is closed, and other mode input contacts are opened, the control enters the manual data input mode, and part programs will be written or the machine will be operated through MDI.

(9) MEM : Memory operation mode input

When the MEM input contact is closed, and other mode input contacts are opened, the control enters the memory operation mode, and the machine will be controlled by part programs stored in the memory.

(h) EDT : Program edit mode

When the EDT input contact is closed with the other operation mode input contacts opened, the control mode indicator shows the program edit mode. However, it is possible to store part programs into memory, correct them, and change them in any mode other than TP or MDI.

> NOTE: The YASNAC i80L permits editing even if the machine is not in the program edit mode. Therefore, the YASNAC i80L need not always be placed in the program edit mode.

(2) operation Mode Output

The control outputs the following signals to inform the current operation mode.

(a) AUTO : Automatic operation mode output

This output is generated when the control is in the TP (tape operation), MEM (memory operation), MDI (manual data input operation), or EDT (program edit) mode.

(b) MAN : Manual operation mode output

This output is generated when the control is in the H (manual handle operation), STP (manual step operation), JOG (manual jog), or RT (manual rapid traverse) mode.

(c) EDTS : Editing output

This output is generated during editing operations (part program reading or checking, punching, stored program changing, or other editing operations).

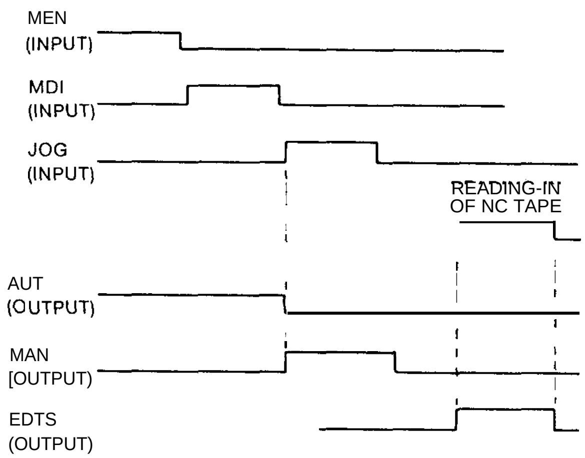


Fig. 21.1 Time Chart of Editting Operation I/O

NOTE

1. If an operation mode input other than the manual operation mode input is received during memory operation mode NC program operations, control part program execution stops after completion of current block execution.

This also holds true for the part program operations in the tape operation and manual data input operation modes.

2. If the manual operation mode input is received during memory operation mode part program operations, the following operations take place:

① Motion command

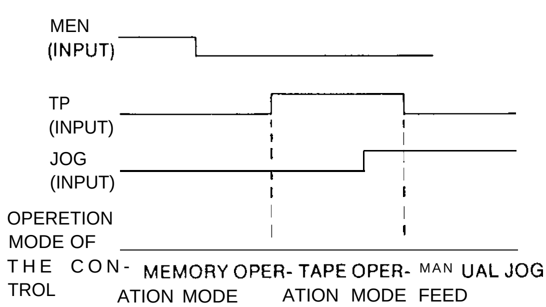
Program execution comes to a stop after deceleration. The remaining portion of the program is executed when the automatic start (*SP) input is turned ON.

② M/T Command

The sampling outputs (MFA, TF) and M code output turn OFF and M/T command execution is considered to have been completed. Therefore, even if the machine returns to the automatic operation mode, the interrupted M/T command will not be issued again.

3. When an automatic operation mode or program editing mode input contact is closed during motion in the manual operation mode, the motion decelerates to a stop.

4. When any of these operation mode input contacts is closed, that mode becomes effective. Under other input states, the previous operation mode remains effective. When no operation mode input contact is closed after energization, or when two or more operation mode input contacts are closed, the control enters the manual jog mode,



5. When a manual operation mode input contact is closed during the tapping process in a part program, the automatic operation mode is retained while the thread is being cut.

21. 3.1.2 CRT DISPLAY PROGRAM SELECTION INPUTS (**CRTF0** #30010, **CRTF1** #30011)
These inputs are used for selecting a program to be displayed on the 9-inch CRT.
Program selection is made according to the inputs, as shown below.

Table 21.1 CRT **Display Program Selection List**

CRTF1	CRTF0	
0	0	First program
o	1	First program
1	0	Second program
1	1	Third program

NOTE: 1: Closed, O: Open

For program selection purposes, you have the option of keying-in a parameter or using the above inputs.

21. 3.1.3 COOPERATIVE MULTI-PROGRAM CONTROL STATE OUTPUT (COOPS # 3501 7)*
In multi-program control, the i80L basically works according to the independent execution system in which each program mode or alarm is independently reset. In the following situations, however, cooperative multi-program control is exercised so that the programs share the mode, alarm, reset, and other functions.
(Cooperative multi-program control conditions)

① When the axis programs are interchanged according to the control axis selection command.
② When the M/T command of a different program is executed
③ When the pulse copy function is executed
④ When the spindle interlock function is executed
⑤ When the cooperative multi-program control mode is selected with a parameter

While the control is exercising cooperative multi-program control, the cooperative multi-program output is closed.

NOTE: To enter the cooperative multi-program mode, it is necessary that conditions ① through ④ be the same for all programs. In condition ⑤, the modes of the second and third programs are rendered the same as the first program mode.

21. 3.1.4 MANUAL JOG FEEDRATE SELECTION INPUTS (JV1 # 30020, JV2 # 30021, JV4 #30022, JV8 # 30023, **JV16** # 30024)

(1) In the manual jog mode, these inputs determine the manual jog feedrate.
(2) The manual jog feedrate is used as the Dry Run state part program execution feedrate in the automatic operation mode.
For details see Par. 21.3.1.18, "DRY RUN INPUT (DRN #30064)".

Table 21.2

1: CLOSED		0: OPEN			Manual Jog Feedrate (Manual Operation Mode) Parameter Setting
JV1	JV2	JV4	JV8	JV16	
0	0	0	0	0	pm 2400
1	0	0	0	0	pm 2401
0	1	0	0	0	pm 2402
1	1	0	0	0	pm 2403
0	0	1	0	0	pm 2404
1	0	1	0	0	pm 2405
0	1	1	0	0	pm 2406
1	1	1	0	0	pm 2407
0	0	0	1	0	pm 2408
1	0	0	1	0	pm 2409
0	1	0	1	0	pm 2410
1	1	0	1	0	pm 2411
0	0	1	1	0	pm 2412
1	0	1	1	0	pm 2413
o	1	1	1	0	pm 2414
1	1	1	1	0	pm 2415
0	0	0	0	1	pm 2416
1	0	0	0	1	pm 2417
0	1	0	0	1	pm 2418
1	1	0	0	1	pm 2419
0	0	1	0	1	pm 2420
1	0	1	0	1	pm 2421
0	1	1	0	1	pm 2422
1	1	1	0	1	pm 2423
0	0	0	1	1	pm 2424
1	0	0	1	1	pm 2425
0	1	0	1	1	pm 2426
1	1	0	1	1	pm 2427
0	o	1	1	1	pm 2428
1	0	1	1	1	pm 2429
0	1	1	1	1	pm 2430
1	1	1	1	1	pm 2431

Note : 1: Closed O: open

21.3.1.5 MANUAL HANDLE/STEP MULTIPLICATION FACTOR (MP1 , MP2, MP4) INPUT (# 30025, # 30026, # 30027)

When the control is in the manual handle/manual step feed mode, the motion distance per step is determined by these input signals.

Table 21.3 Manual Handle/Step Multiplication Setting

M PI	M P2	M P4	Manual Step Feed	Manual Handle Feed
o	0	0	1 pulse/step	
1	0	0	10 pulses/step	
0	1	0	100 pulses/step NOTE 2)	
1	1	0	1000 pulses/step	100 pulses/step NOTE 2)
1 or 0		1	10, 000 pulses/step	100 pulses/step NOTE 2)

NOTE 1) 1: Closed, 0: Open

2) When 100 pulses are chosen for manual handle feed, the pulse magnification can be set as desired by setting pm 2003 D7 to 1. The magnification is to be set by parameter pm 2459,

21. 3.1.6 INPUT SIGNALS FOR CYCLE START (ST # 30030) AND STOP (* SP # 30031) : OUTPUT SIGNALS FOR CYCLE START (STL # 35370) AND FEEDHOLD (SPL # 35371)

(1) With the control in any of the TAPE, MEMORY, MDI, or EDT modes, when the input contact ST is closed and opened, the control starts automatic operation control to execute the part program, and at the same time, turn on the STL output signal for cycle start. However, an ST input is neglected under the following conditions.

(a) While the control is in an alarm state. (While an alarm output or an input error output is on.)

(b) While the feedhold * SP input contact is open.

(c) While the external reset ERS input contact is closed.

(d) While the RESET button on the MDI & CRT panel is being depressed.

(e) While the emergency stop * ESP contact is not closed.

(f) While the STL signal output is being generated during automatic operations.

NOTE: When parameter pm5000 DO=l, the ST becomes effective when it is turned OFF and then ON again.

(2) When the following state is entered after cycle start, the control completes operation control, and turns off the STL output.

(a) When apart program has been executed bymanual data input inthe MDI mode.

(b) When one block of a part program has been executed with the single block (SBK) **input** contact closed.

(c) When the end of program (EOP) input contact has been closed by an M command of a part program.

(3) When the feedhold input contact " ∗ SP" is opened during automatic operation, the automatically controlled motions, etc. are interrupted, and at the same time the cycle start output STL is turned off and the feedhold output SPL is turned on. While a block of thread cutting instruction is being executed, the feedhold input is disregarded.

(4) When the feedhold input contact ∗ SP is closed, and cycle start input contact ST is closed and opened, temporary stop SPL is turned off, and automatic operation is restarted. The cycle start output STL is turned on also.

Timing chart for input of cycle start (ST), feedhold (∗ SP), and cycle start (STL) and temporary stop (SPL) is shown in Fig. 21.2.

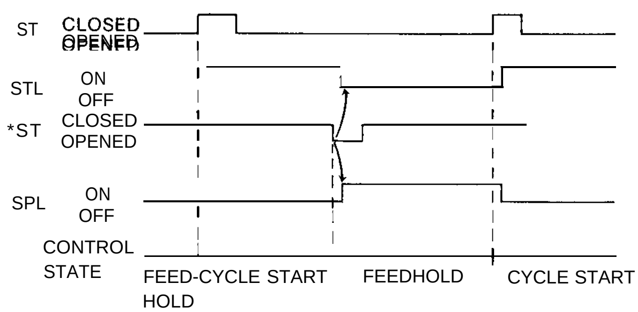


Fig. 21.2 Timing Chart for Input of Cycle/Start (ST), Stop (* SP), and Output of Cycle Start (STL), Feedhold (SPL)

NOTE

1. The cycle start (ST) and stop (*SP) inputs must be closed or opened for a period longer than 100 ms. If such a period is shorter than 100 ms, the inputs may be disregarded.
2. If the cycle stop (*SP) input opens while M/T command execution completion is awaited (the FIN input is awaited), the feedhold (SPL) output turns ON. However, if the M/T command execution completion (FIN) input opens, the machine is placed in the feedhold state.
3. When parameter pm4009 D7 = 1 at the time of mode switching from automatic to manual, the system keeps waiting for M/T command execution completion if the SPL output turns ON. When parameter pm4009 D7 = O, the SPL output does not turn ON and M/T command execution is forcibly terminated. In any case, the travel command causes the machine to decelerate to a stop.

21.3.1.7 RAPID TRAVERSERATE OVERRIDE (ROV1, ROV2) INPUT

These inputs are for determining the rapid traverserates, i.e., the positioning speed when executing programs in the automatic operation modes, and the motion speed in the manual jog mode when the RT input contact is closed.

Table 21.4 Input Signal and Rapid Traverserate

Input Signal		Rapid Traverserate							
ROV1	ROV2	1st-Axis	2nd-Axis	3rd-Axis	4th-Axis	5th-Axis	6th-Axis	7th-Axis	8th-Axis
1	1	pm 2801 Setting speed	pm 2802 Setting speed	pm 2803 Setting speed	pm 2804 Setting speed	pm 2805 Setting speed	pm 2806 Setting speed	pm 2807 Setting speed	pm 2808 Setting speed
0	1	pm 2801 Setting speed x + -	pm 2802 Setting speed x + .	pm 2803 Setting speed $\times\frac{1}{2}$	pm 2804 Setting speed $\times\frac{1}{2}$	pm 2805 Setting speed $\times\frac{1}{2}$	pm 2806 Setting speed $\times\frac{1}{2}$	pm 2807 Setting speed $\times\frac{1}{2}$	pm 2808 Setting speed $\times\frac{1}{2}$
1	0	pm 2801 Setting speed x J_4-	pm 2802 Setting speed $\times\frac{1}{4}$	pm 2803 Setting speed $\times\frac{1}{4}$	pm 2804 Setting speed $\times\frac{1}{4}$	pm 2805 Setting speed $\times\frac{1}{4}$	pm 2806 Setting speed $\times\frac{1}{4}$	pm 2807 Setting speed $\times\frac{1}{4}$	pm 2808 Setting speed $\times\frac{1}{4}$
0	0	pm 2447 Setting speed							

Note : 1) 1: Closed 0: Open
2) 2: For rapid traverserate override 6-step, input signal and the rapid traverse rate are shown in Table 21.5 (6-step specifications: Parameter pm2000D_3= 1)

Table 21.5 Input Signal and Rapid Traverse Rate

Input Signal			Rapid Traverse Rate
ROV1	ROV2	ROV3	1st axis to 8th axis
1	0	1	F2 (pm 2449 setting speed)
0	0	1	F1 (pm 2448 setting speed)
1	1	0	100 %
0	1	0	50 %
1	0	0	25 %
0	0	0	F0 (pm 2447 sett&=

21. 3.1.8 MACHINE-READY INPUT (MRD #30040)*

This input indicates that the external heavy-current circuit is ready.

When the servo power ON/SVMX from the control JANCD-FC230B (MMON) is turned ON after power ON, closing the MRD input makes the control ready.

If the MRD input opens after the control is ready, the control enters an alarm condition (alarm code 2190) and stops operations.

21. 3.1.9 EXTERNAL RESET Inputters #30041)ANDRESET ON OUTPUT (RSTS #35001)

The ERS input resets each program of the control.
When the ERS input is closed, the control stops the entire operation of the associated program and closes the RSTS output for 1 second.

The output signals open except as indicated in Table 21.6.

NOTE: While cooperative multi-program control is being exercised, all the cooperating programs are reset.

Table 21.6 "Closed''Output Signals

Output Signal Name	Output Generated when the ERS Input is closed
AUT, MAN, * ESPS Various monitor outputs (except the program operation status monitor output)	The previous state is retained.
RSTS	The output is closed while the ERS input is closed or for 1 second after the ERS input is opened.
ALMS	The output is left closed if no alarm condition remains,
TO-T9 Spindle control signal	The previous state is retained.
UO0-UO31	The previous state is retained

NOTE

When the ERS input is closed, the memory is rewound, but the tape is not.

21.3.1.10 START INTERLOCK INPUT (STLK # 30042)

This input is used to prohibit automatic operation mode startup.
While the STLK input is closed, startup does not take place even if the ST input closes

21.3.1.11 ERROR DETECT ON INPUT (SMZ # 30044)

This input determines whether or not to add the "error detect ON" condition to the automatic mode cutting feed termination condition set.
Due to the delay elements of the servo system, the position detection operations performed by the position detector provide delayed follow-up relative to the positions designated by the logic circuit in the course of machine traveling. The "error detect ON" state refers to the situation in which the difference between the designated and detected positions is smaller than the parameter pm1321-pm1328 settings,
When the SMZ input is closed, the "error detect ON" condition is added to the automatic mode cutting feed termination condition set. This condition addition does not take place if the SMZ input is open.

NOTE

The SNZ input does not affect the positioning commands.
(All positioning commands except the error detect OFF positioning command [G06] add the "error detect ON" condition to the termination condition set.

21.3.1.12 THREADING INPUT (CDZ #30045)

This input determines whether or not to perform threading during the G92 (threading cycle) or G76 (complex threading cycle).
When the CDZ input is closed, threading is performed.
When the CDZ input is open, threading does not take place.

The control reads the CDZ input at the beginning of threading cycle to determine whether or not to perform threading.

When the CDZ input is to be opened or closed with the M command or the like, you should decide on the CDZ input status at the beginning of threading cycle, considering the delay caused by input processing.

21.3.1.13 EXTERNAL POWER ON INPUT (SVON #30050)

(1) If this input closes when the NC power is turned ON (the NCMX is ON) by performing the power ON procedure, the servo power turns ON.

(2) This input is equivalent to turning ON the servo power with the power supply incorporated PB.

(3) This input is effective when parameter pm5012 DO= 1.
When this parameter is selected, the power supply incorporated PB does not accomplish servo power turn-ON.

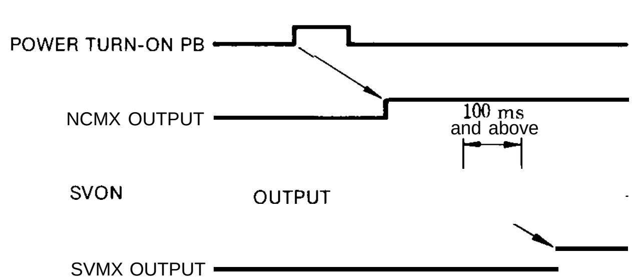


Fig. 21.3 External Power On (SVON) Input Time Chart

21.3.1.14 ALARM STATE OUTPUT (ALMS #35000) INPUTERROR STATE OUTPUT (IERS# 35003), WARNING STATE OUTPUT (WARNS # 35004)*, BG EDIT ERROR STATE OUTPUT (BGEDES # 35005)*, AND EXTERNAL ERROR DETECTION INPUTS (ERR0 #30055, ERR1 #30056, ERR2 #30057)

(1) Alarm State Output (ALMS)

This output indicates that the control is in an alarm condition.

The ALM output closes when an alarm condition is detected (except for the control logic circuit malfunction alarm).

This output opens when the reset procedure is performed after the alarm cause is eliminated.

This output closes when an alarm condition between No. 0000 and No. 8049 occurs.

If the all-program stop alarm condition occurs, the ALMS, ALMS-2, and ALMS-3 outputs are simultaneously generated.

(2) Input Error State Output (IERS)

This output closes when an operating error or an NC data input command related error is detected. The output opens when the reset procedure is performed.

(3) Warning State Output (WARN)*

This output closes when a slight keying error or editing error is detected. The output opens when any key is depressed after such an error occurrs.

(4) BG Edit Error State Output **(BGEDES)***

This output closes if an error is detected while NC machining data input or other BG (background) operations are being performed in the automatic operation mode.

A soft key is used to open this output.

(5) External Error Detection Inputs (ERRO, ERR1, ERR2*)

These inputs are used to place the control in an alarm condition from outside.

ERRO : When this input closes, the control goes into an alarm condition, displaying an alarm code between 1080 and 1082. If this input closes during automatic mode part program execution, the machine stops after completing the current block execution.

ERR1 : When this input closes, the control enters an alarm condition, displaying an alarm code between 2180 and 2182. If this input closes during automatic mode part program execution, the machine comes to an immediate stop.

ERR2* : When this input closes, the control enters an alarm condition, displaying alarm code 3240. If this input closes during automatic mode part program execution, the machine stops immediately and the servo power turns OFF.

21.3.1.15 SINGLE-BLOCK INPUT (SBK #30060)

This input is used so that automatic mode part program execution takes place block by block.

If an automatic operation starts while the control is in the automatic operation mode with the SBK input closed, the control executes only one part program block and then stops.

If the SBK input closes during part program execution, the control stops after completing the current block execution.

NOTE

For the details of single block stoppage in nose R correction, user macro function, canned cycle, complex canned cycle, and other function execution, refer to the **YASNAC i80L Instruction Manual.**

21.3.1.16 MANUAL ABSOLUTE (ABS #30061) INPUT

(1) When ABS Input Relay is Open

The motion path after an intervention by manual axial motion is the one shifted parallel to the original path by the distance covered by the manual motion.

```
G90
GO1 Z20. 000 F△△;
X20. 000 Y30. 000
xl 0.000 Y40. 000
```

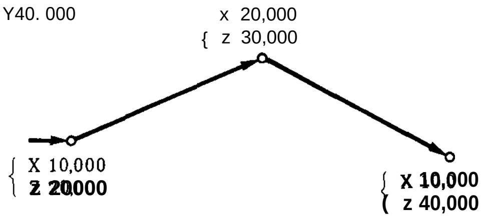


Fig. 21.4 Motion Path in Automatic Operation Mode

① When the machine is manually moved during a block.

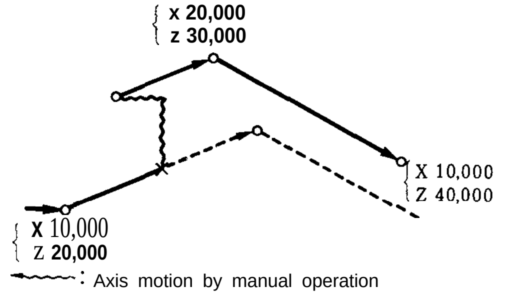


Fig. 21.5 When ABS Input Relay is open

(2) When ABS Input Replay is Closed

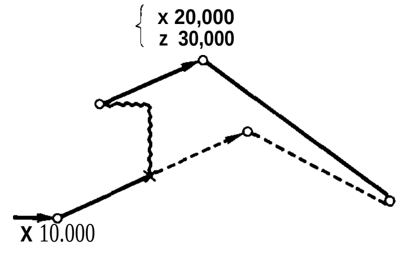


Fig. 21. 6 Motion Path Prevailing When **ABS Input Is Closed**

(3) Supplementary Explanation

When the following conditions occur, the control unconditionally transfers the current values of the absolute coordinate system (the CRT current value display second screen or the coordinate system determined by the coordinate system setup command) to the command value register.

(a) Reset procedure: Turning ON the MDI panel reset key or closing the external reset (ERS) input.

(b) End-of-program: Resetting the program by executing the M03/M30 command to close the end-of-program (EOP) input.

(c) Automatic zero return : Executing the G28 command.

After the absolute coordinate system current values are transferred to the command value register, manual axis movement is reflected in automatic axis movement even if the **ABS** input is open.

If the reset procedure is performed after manual axis movement and the system searches for block (1) and continues with it, the following motion path prevails.

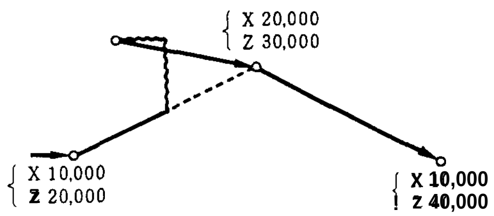


Fig. 21.7 Motion Path Prevailing When Reset Procedure Is Performed after Manual Axis Movement and System Searches for Block (1) and Continues with It

21. 3. 1. 17 PROGRAM RESTART INPUT (PRST # 30063) AND PROGRAM RERUN STATE OUTPUT (PRSTS # 35044)

These signals are used to resume machining operations in the middle of a part program.

Close the SRN input, set up the memory mode, and search for the restart sequence number from the NC operation panel.

The CRT display then shows the M, S, and T codes between the beginning of the program and the retrieved sequence number.

While the program restart input is effective for the NC equipment, the program rerun state output is closed.

NOTE

For the details of the program restart function, refer to the YASNAC i80L Instruction Manual.

21.3.1.18 DRY RUN INPUT (DRN #30064)

This input is used so that the feed operations in automatic mode part program execution are performed at a speed specified by the manual continuous feed selection input (JV1, JV2, JV4, JV8, or JV16).

While the DRN input is closed during automatic mode part program execution, cutting feed is effected at a speed specified by a manual continuous feed selection input and not at a programmed speed. (However, threading is performed at a programmed speed.)

If the DRN input is closed or opened while the control is engaged in automatic operations, the feedrate changes accordingly in the middle of the current block execution.

NOTE

- **When parameter pm2000 DO =1 with the DRN input closed, the feedrate for the positioning command is rendered the same as the selected manual continuous feedrate.**
- **When parameter pm2000 D1 =1 with the** DRN input closed, the feedrate for the threading command is rendered the same as the selected manual continuous feedrate.

21.3.1.19 MACHINE LOCK (MLK #30066)

This input prevents the control output pulses from being delivered to the servo unit.

When the MLK input is closed, the logic circuits distribute pulses but do not initiate axis movement while the control is engaged in automatic or manual operations.

As the logic circuits distribute pulses, the current value display changes with the instructions.

The control must be stopped when the MLK input is closed or opened. The operations are not affected except during block stoppage or feedhold state.

21.3.1.20 AUXILIARY FUNCTION LOCK INPUT (AFL #30067)

This input excludes the M/T function from automatic mode part program execution,

When the AFL input is closed, the control disregards the program M/T command during part program execution. However, the M code decoded outputs (MOOR, MO1 R, M02R, M30R) are generated.

If the AFL input is closed or opened in the middle of part program execution, program execution is affected by the AFL input beginning with the block next to the currently executed block.

21. 3. 1. 21 REFERENCE POINT RETURN CONTROL I/O SIGNALS (ZRN # 30070, ZRN2 # 30072, ● DC1 # 30730 -*DC8 # 30737, ZP1 # 36300-ZP8 # 36307, 2ZP1 #36310-2ZP8 # 36317, 3ZP1 # 36320 -3ZP8 # 36327, 4ZP1 # 36330 -4ZP8 # 36337)

NOTE: Signals other than the ZRN and ZRN2 signals are for servo axis control 1/0.

These I/O signals cause the machine to return to the specified mechanical reference point upon control power ON.

Reference point return is effected by the grid method. According to this method, the reference point is determined by the position detector zero point pulse (1 pulse/revolution).

When the manual jog mode is selected after power ON and the axes are moved in the reference point return direction with the manual reference point return input (ZRN) closed, the reference point return operation is performed in accordance with Fig. 21.8 (as is the case with G28 execution in the automatic operation mode).

If the axes are moved in the reference point return direction with the second manual reference point return input (ZRN2) closed, the machine moves toward the second reference point, decelerates, and stops.

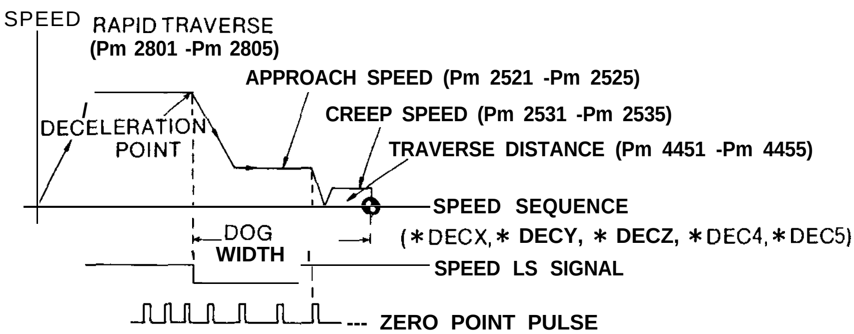
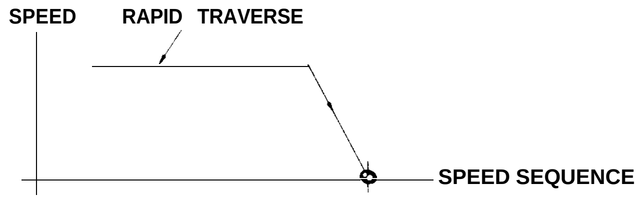


Fig. 21.8 Reference Point Return Operation (Grid Method)

NOTE

1. For manual reference point return, the jog axis movement input must be left closed.
2. Once high-speed reference point return (automatic/manual) is effected, the subsequent return operations are carried out by positioning the machine at the determined reference point.



Note:
With an appropriate parameter (Pm 4003), it is possible to use the grid method for the second and subsequent reference return operations.

Fig. 21.9 Second and Subsequent High-speed Reference Point Return Operations after Power ON

(1) Reference Point Outputs (ZP1-ZP8)

The ZP1 to ZP8 outputs are closed while the control axis stays at the reference point after completion of reference point return or reference point positioning. Due to inch input errors relative to the metric output system or metric input errors relative to the inch output system, however, the ZP1 to ZP8 outputs are actually closed while the control axis remains within ±3 pulses of the reference point.

(2) Second Reference Point Outputs (2ZP1-2ZP8)

When part program command G30 is executed in the automatic operation mode to position the machine at the second reference point, the second reference point outputs (2ZP1-2ZP8) are closed.

The second reference point is determined when the distance to the reference point is defined by parameters pm6811 through pm6818.

(3) Third Reference Point Outputs (3ZP1-3ZP8)

When part program command G30P3 is executed in the automatic operation mode to position the machine at the third reference point, the third reference point outputs (3ZP1-3ZP8) are closed.

The third reference point is determined when the distance to the reference point is defined by parameters pm6821 through pm6828.

(4) Fourth Reference Point Outputs (4ZP1-4zP8)

When part program command G30P4 is executed in the automatic operation mode to position the machine at the fourth reference point, the fourth reference point outputs (4ZP1-4ZP8) are closed.

The fourth reference point is determined when the distance to the reference point is defined by parameters pm6831 through pm6838.

21.3.1.22 EDIT LOCK INPUT (EDT LK #30072)

This input prevents the contents of the control part program memory from being changed,

When the EDTLK input is closed, part program storage into memory and part program corrections with keys are prohibited during program editing.

21.3.1.23 SETUP POINT RETURN INPUT (SRN #30077)

This input accomplishes positioning at the selected coordinate position in the manual jog mode. While the SRN input is closed, manual jog feed stops when the setup point is reached. When the machine is positioned at the setup point, manual jog feed cannot be initiated until the SRN input opens.

21.3.1.24 AUTOMATIC MODE HANDLE OFFSET INPUT (HOFS # 30081)

When a manual pulse generator is provided, this input allows you to move the machine with the manual handle even in the automatic operation mode (tape operation, manual data input operation, or memory operation mode).
With this input, it is possible to offset any displacement resulting from work mounting during automatic operations.

While the HOFS input is closed, the machine can be moved with the manual pulse generator even if the control is in the automatic operation mode. However, the manual pulse generator does not evoke machine movement while the positioning command is being executed in the automatic operation mode.

The manual pulse generator movement axis is determined by the HI -H8 (manual handle feed axis selection) inputs.
When the multiple axis pulse generator is provided, it is possible to move the machine along a number of axes. The distance moved per step provided by the manual pulse generator is determined by the MP1, MP2, or MP4 (manual handle magnification setup) input.

NOTE

1. In an alarm condition (the ALMS or IERS output is closed), the automatic mode handle offset function is disabled.
2, To initiate automatic mode handle offset movement, parameters pm2002 DO (first axis) through pm2002 D7 (eighth axis) must be set to 1.
3. When parameter pm2003 D1 is set to 1, the automatic mode handle offset movement is limited to the interpolation period of the automatic operation mode.

21.3.1.25 MACHINING INTERRUPT POINT RETURN INPUT (CPRN # 30082) AND MACHINING INTERRUPT POINT RETURN COMPLETION OUTPUT (CPRNS #35051)

When the machine has been manually operated after mode switching from automatic to manual, the CPRN input is used to manually return the machine to the automatic mode interrupt point.

When the machine is moved to the machining interrupt point with the CPRN input closed, the manual jog mode movement stops.

While the machine is positioned at the machining interrupt point, manual jog mode movement does not start until the CPRN input opens.

When all axes of a certain program are returned to the machining interrupt points with the CPRN input closed, the CPRNS output closes.

21.3.1.26 CURRENT VALUE STORAGE INPUT (PST #30083)

This input is used to store the current values into the control memory.

When the PST input closes, the control stores the current values into the internal memory.

The offset data written by the MDI are later operated on as follows and then stored into the offset memory.

Data written into offset memory	=	Input data	−	Current value data stored in control memory

When the reset procedure (turning ON the MDI panel reset key or closing the external reset input) is performed, the current value storage mode is canceled with LED blinking terminated.

NOTE

The current value storage position and procedure and offset memory storage value computations vary with the machine.

21. 3. 1. 27 EXTERNAL STORAGE, EXTERNAL VERIFICATION, EXTERNAL OUTPUT, AND EXTERNAL CLEAR SIGNAL INPUTS (EIN # 30110, EVER # 30111, EOUT # 30112, ECLM # 301 13)

These inputs are used to externally perform the storage, verification, output, or clear operation relative to the control NC memory.

When the inputs are closed, the following operations are performed.

(When the EIN input is closed)
Part programs are stored into NC memory.
(When the EVER input is closed)
Part programs are compared against NC memory.
(When the EOUT input is closed)
The contents of NC memory are output.
(When the ECLM input is closed)
The contents of the NC memory are cleared.

While the above storage, verification, output, or clear operation is being performed, the editing state (EDTS) output is closed.

NOTE

The storage/verification 1/0 equipment varies with the setting (#0009).

21. 3.1.28 TOOL LIFE CONTROL INPUTS AND OUTPUTS (TGN0 # 30250 -TGN7 # 30257, TLSKP # 30281, TLRST # 30280, TLCH # 35052)

When the tool life (the cutting time or the number of workplaces cut per tool), tool group number, and tool use compensation number are registered in the control and the tool life control T code is designated for a part program, the tool life control function is exercised to provide T command control in accordance with the machining time and the number of machined workpieces,

This section, however, gives signal descriptions only. For sample programs, refer to the YASNAC i80L Instruction Manual.

The following I/O signals are used for the tool life control function.

- Tool replacement completion tool group number input (TGN0-TGN7) and tool replacement completion input (TLRST)
- Took skip input (TLSKP)
- Tool replacement request output (TLCH1-TLCH2)

Further, it is necessary to make appropriate entries into the NC memory area using the program tape or operation panel MDI.

(1) Tool Replacement Completion Tool Group Number Inputs (TGN0-TGN7) and Tool Replacement Completion Input (TLRST)

The TLRST input informs the control of tool replacement completion after the tools having the group number that indicates the end of useful tool life are replaced.

In accordance with Table 21.7, set the replaced tool group number with the TGNO-TGN7 inputs and close the TLRST input.

When all the tools having the group number that indicates the end of useful life are replaced, the tool replacement request output (TLCH) opens.

Table 21.7 TGN0-TGN7 inputs and Replaced Tool Group Numbers
Input state Replaced tool group number

Input state								Replaced tool group number
'TGN7	TGN6	TGN5	TGN4	TGN3	TGN2	TGN1	TGNo	
0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	1	0	2
0	0	0	0	0	0	1	1	3
0	0	0	0	0	1	0	0	4
1	1	1	1	1	1	1	0	254
1	1	1	1	1	1	1	1	255

(2) Tool Skip Input (TLSKP)

Before a registered tool reaches the preset end of its useful life, this input causes the machine to use a new tool.

When the TLSKP input is closed in the automatic operation pause state (when the STL and SPL outputs are open), the control internally concludes that the currently used tool has reached the end of its useful life, and designates a new tool upon receipt of the next T command.

(3) Tool Replacement Request Output (TLCH)

When a program ends or the rest procedure is performed after all the registered tools having a certain group number have reached the end of useful life, the TLCH output closes.

When this output is closed, note the affected tool group number displayed on the CRT and carry out necessary tool replacement.

NOTE

While the tool replacement request output (TLCH) is closed, the automatic mode automatic startup function is disabled.

21. 3. 1. 29 EXTERNAL DATA INPUT (EDO # 30300 -ED31 # 30337, EDSA # 30340 -EDSD # 30343, EDASO # 30344 -EDAS2 # 30346, EDCL # 30347, EREND # 35045, ESEND # 35046) INPUTS AND OUTPUTS

(1) These inputs and outputs assure that the machine performs the following functions in response to external inputs.

(a) External work number search input
A desired work number is chosen by externally selecting an appropriate program number between 1 and 99999 (BCD).

(b) External tool offset input
Offset adjustments are made according to the external data input signal.

(c) External work coordinate system shift input
The work coordinate system shift amount data are corrected according to the external data input signal.

(2) Input/Output Signals For Inputting External Data

(a) External data inputs (EDO #30300 to ED31 #30337)
These inputs are used for work No. input signal, offset amout input signal and work coordinate system shift signal.

Table 21.8 External Data Input Signal

External Data Input Signal							
ED7	ED6	ED5	ED4	ED3	ED2	ED1	ED0
ED15	ED14	ED13	ED12	ED11	ED10	ED9	ED8
ED23	ED22	ED21	ED20	ED19	ED18	ED17	ED16
ED31	ED30	ED29	ED28	ED27	ED26	ED25	ED24

(b) External data selection (EDSA #30340 to EDSD #30343)
Input data can be selected by the external data.

Table 21.9 External Data Selection

	External Data Selection			
	EDSD	EDSC	EDSB	EDSA
External work No. designation	0	0	0	1
External tool compensation (H)	0	0	1	0
External tool compensation (D)	0	0	1	1
External coordinate shift	0	1	0	0

1: Closed, O : Open

(c) External data axis selection (EDSA0 #30344toEDAS230346)
This signal is used for specifying the axis for external data and given in three digits.

Table 21.10 External Data Axis Selection

	External Data Axis Selection		
	EDAS 2	EDAS 1	EDAS O
1st-axis	ABS/INC	0	0
2nd-axis	ABS/INC	0	1
3rd-axis	ABS/INC	1	0
4th-axis	ABS/INC	1	1

ABS=1 INC=0
Note : For external coordinate shift, INC is selected

NOTE 1 : ABS = 1. INC = 0.
2: C-axis selection is permissible only for work coordinate system shift memory changeover.

(d) External data selection strobe (EDCL)
External data input starts when this signal rises.

(3) Output Signals for External Data Input
When the 2-(1) to 2-(4) input data are entered and completely written into internal memory, the completion output (EREND or ESEND) is generated.

(4) Time Chart of Inputting External Data

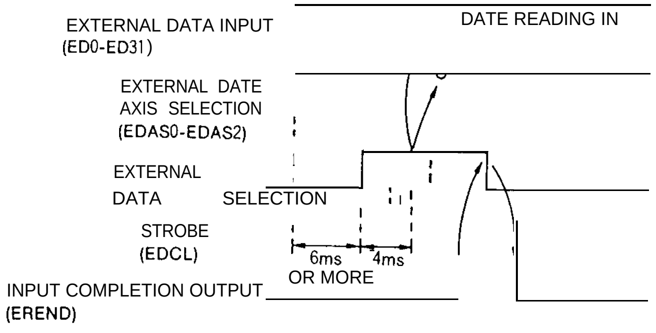


Fig. 21.10 External Data Input Time Chart

For external work No. input, when it is input, ESEND instead EREND is given as input completion output.

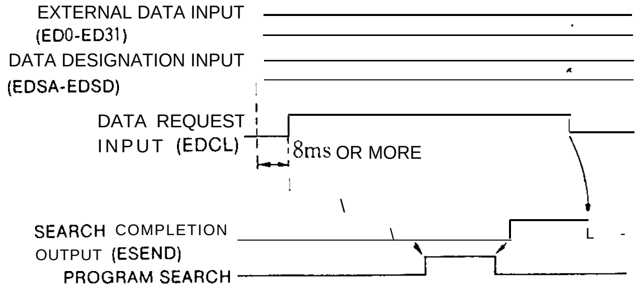


Fig. 21.11 External Work No. Input Time Chart

(5) External Data I/O Data

(a) Inputs

Table 21.11 External Data I/O Data List

	Input Strobe	Axis Selection			Data Selection				External Data											
Symbol	ED CL	ED AS1	ED AS2		ED SD	ED SC	ED SB	ED SA	ED 31	ED 30	ED 29	ED 28	ED 27	ED 26	ED 25	ED 24	ED 23	ED 22	ED 21	ED 20
External Work No. Designation					0	0	0	1												
External Tool Offset, External Work Coordinate System Shift		ABS / INC			0	0	1	0	SIGN	Correction amount 8th digit (0 to 7)			Correction amount 7th digit					Correction amount 6th digit		
										± 999999999 (Binary) Parameter # 5001 DO chooses BCD or binary.										

	External Data																			
Symbol	ED 19	ED 18	ED 17	ED 16	ED 15	ED 14	ED 13	ED 12	ED 11	ED 10	ED 9	ED 8	ED 7	ED 6	ED 5	ED 4	ED 3	ED 2	ED 1	ED 0
External Work No. Designation	Program No, 5th digit				Program No. 4th digit				Program No. 3rd digit				Program No. 2nd digit				Program No. 1st digit (BCD code)			
	1 ~ 99999 (Binary) Parameter # 5001 DO chooses BCD or Binary. (Binary when # 5001 D1= O, BCD when 1)																			
External Tool Offset, External Work Coodiate System Shift	Correction amount 5th digit				Correction amount 4th digit				Correction amount 3rd digit				Correction amount 2nd digit				Correction amount 1st digit (BCD code)			
	± 999999999 (Binary) Parameter # 5001 DO chooses BCD or Binary.																			

(b) Outputs

ESEND: External search end

EREND : External data input end

(6) Supplementary Explanation

(a) External work number designation

① If the work number is outside the range from O through 99999 in the external work number input state or the designated work number does not exist, the completion output is not generated (no particular alarm signal output is generated).

② Work number input is acceptable after the external reset, M02, or M30 function is executed. The newly entered work number takes effect after reset processing.

(b) External tool offset

① The offset number designated by a program is to be corrected. At the time of single block stoppage, the tool offset number of the terminated block is changed.

② Select either of the following external inputs to determine whether addition is to be applied to the current offset amount or the current correction amount is to be replaced by external data (use the axis selection bit).

When EDAS2 = O, addition (I NC) occurs.

When EDAS2 = 1, replacement (ABS) occurs.

③ When defining the offset address, use the external data axis selection signals (EDAS0-EDAS2).

(c) External workpiece coordinate system shift

When the currently chosen external tool offset number is 00, the value designated by the ED0-ED31 data is added to the workpiece coordinate system shift memory or the memory contents are replaced by the designated value.

Signal exchange timing is exactly the same as for external tool offset.

NOTE

The general procedure for exercising the external tool offset and external workpiece coordinate system shift functions is to designate the M code with a part program and use that M code to turn ON the EDCL.

21.3.2 NC MACHINING PROGRAM EXECUTION CONTROL

21. 3.2.1 FEEDRATE OVERRIDE (OV1 # 30400, OV2 # 30401, OV4 # 30402, OV8 # 30403, OV16 # 30404) INPUT AND FEED OVERRIDE CANCEL (OVC) INPUT

(1) These inputs are used to provide a O to 540 % override for the part program feedrate in the automatic operation mode.

Table 21.12 Feedrate Override List

1 : Closed		O : Open			Feedrate Override (Automatic Operation Mode)
OV1	OV2	OV4	OV8	OV16	
o	0	0	0	0	o%
1	0	0	0	0	10%
o	1	0	0	0	20%
1	1	0	0	0	30%
o	o	1	0	0	40%
1	0	1	0	0	50%
o	1	1	0	0	60%
1	1	1	0	0	70%
o	0	0	1	0	80%
1	o	0	1	o	90%
o	1	0	1	0	100%
1	1	0	1	0	110%
o	0	1	1	0	120%
1	0	1	1	0	130%
o	1	1	1	0	140%
1	1	1	1	0	150%
o	0	0	0	1	160%
1	0	0	0	1	170%
o	1	0	0	1	180%
1	1	0	0	1	190%
o	0	1	0	1	200 %
1	0	1	0	1	220 % (Note)
o	1	1	0	1	240 %
1	1	1	0	1	260 %
o	0	0	1	1	280 %
1	0	0	1	1	300 %
o	1	0	1	1	340 %
1	1	0	1	1	380 %
o	o	1	1	1	420 %
1	0	1	1	1	460 %
o	1	1	1	1	500 %
1	1	1	1	1	540 %

1: Closed, 0: Open

NOTE

1. In automatic operation mode part program execution, the feedrate override for the threading portion is fixed at 100%.
2. A 220 to 540% feedrate override range takes effect only when the override expansion option is provided.

(2) Feed Override Cancel (OVC #30407) Input

This is the input for fixing the feedrate override at 10070. When the OVC input contact is closed, the feed rate in part program execution in the automatic operation modes is locked at the programmed value, irrespective of the override input conditions.

21.3.2.2 OPTIONAL BLOCK DELETE (BDT #30405, BDT2 #30420 -BDT9 #30427) INPUT

This input is for determining whether data between "/" and "EOB" in a part program are executed or disregarded when the part program contains "/."
The effective modes are **MEM, TAPE, and** MDI.

Table 21.13

	Neglected Data between
BDT INPUT CLOSED	"/" or "/1" and "EOB" (End of block)
BDT2 INPUT CLOSED	"/2" and "EOB"
BDT3 INPUT CLOSED	"/3" and "EOB"
BDT4 INPUT CLOSED	"/4" and "EOB"
BDT5 INPUT CLOSED	"/5" and "EOB"
BDT6 INPUT CLOSED	"/6" and "EOB"
BDT7 INPUT CLOSED	"/7" and "EOB"
BDT8 INPUT CLOSED	"/8" and "EOB"
BDT9 INPUT CLOSED	"/9" and "EOB"

NOTE

1. Data can be disregarded only when part programs are executed. When storing part programs into memory, this input has no effect.
2. The optional block delete input status prevailing when a part program block containing "/" is stored into buffer, determines whether data are to be considered significant or disregarded.

Therefore, when controlling the optional block delete input status using the auxiliary function and an external circuit, ensure that the input status is set up before the block containing "/" is stored into buffer.

21. 3.2.3 OPTIONAL STOP INPUT (OPT #30406)

This input invalidates the MO1 command.
While the optional stop input is closed, the MO1 command is ignored.

21. 3.2.4 END-OF-PROGRAM INPUT (EOP # 30410), REWIND INPUT (RWD # 3041 1), AND REWIND STATE OUTPUT (RWDS # 35376)

(1) End-of-program **(EOP) and Rewind (RWD) Inputs**

These inputs determine the procedure that the control performs at the end of M02/M30 command execution.
The control takes the actions indicated in Table 21. 14 depending on the EOP and RWD input states prevailing when the completion input (FIN) relative to the M02/M30 command closes.
In general, the M02R output is connected to the EOP input, and the M30R is connected to the RWD input.

Table 21.14 Relationship between the EOP/RWD Inputs and Actions to Be Taken

EOP	RWD	Actions to be taken
1	1	The control goes into standby mode after rewinding part programs and resetting programs, The control goes into standby mode after resetting programs,
1	0	The control goes into standby mode after resetting programs.
0	1	The control goes into standby mode after rewinding part programs.
0	0	The control goes into standby mode,

1: Closed. O : open

NOTE

1. The above EOP/RWD function is the same as the program reset function except that the reset procedure (MDI panel "reset" key ON or external reset (ERS) input closure) and NC memory rewinding procedure are not performed.
For the details of the reset procedure, see under EXTERNAL RESET INPUT (ERS).
2. While the program reset function is being executed, the circuit between reset state outputs RST1 and RST2 is closed for one second.

(2) Rewind State Output (RWDS)

This output indicates that the control is rewinding a part program.
While the RWD input is rewinding a part program in response to the M02/M30 command, the RWDS output is generated.

NOTE

When using this input, set parameter RWDOUT (pm5000 D1) to 1. The output is not generated if the parameter is set to O.

21. 3.2.5 HIGH-SPEED REWIND/START INPUT (RWDli #30412)

(1) When the completion signal (FIN) is returned with this input closed during M30 execution, the NC initiates high-speed rewinding.

(2) When rewinding is completed, automatic startup can be initiated by parameter selection (#6023 D0 = 1).

(3) This input is effective in the MEM mode only.

(4) When this input is used, the RWD and EOP inputs are disregarded.

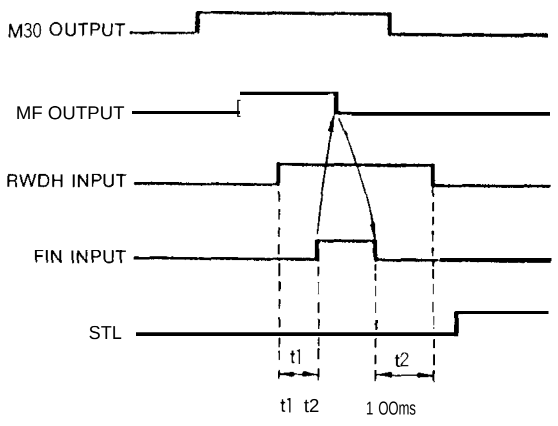


Fig. 21.12 **High-speed Rewind/Start input (RWDH) Time Chart**

21. 3.2.6 M/T CODE INPUTS AND OUTPUTS (MAO-MA9, MOOR, MOIR, M02R, M30R, MB0-MB9, MC0-MC9, MDO-MD9, MEO-ME9, TO-T9, MFA-MFE, TF, FIN)

(1) M/T Code Outputs and M/T Code Reading Outputs

Table 20.15

M code output	MAO to MA9	#35200 to # 35211
S code output	SDO0 to SDO23, S28	#36540 to # 36567
T code output	**TO** to **T19**	**#35300** to **# 35323**
B code output	B0 **to** B15	**#35330 to # 35347**
M code reading output	MFA	**# 35350**
S code reading output	**SF**	**#36517**
T code reading output	TF	**# 35357**
B code **reading output**	B F	# 35355

These outputs are for the M and T commands designated by a part program when it is executed in the automatic operation mode. When the M or T command is encountered during automatic operation mode part program execution, the control generates BIN code outputs in accordance with the numerical value subsequent to the M or T command (M :3 digits; T: 2 or 3 digits).

When the time preset by parameter # 5410 has elapsed, the control generates the M/T code reading signal output.

NOTE

1. The second to fifth M codes are effective only when the one-block multiple-M command option is provided. Note that some M codes do not support multiple-command issuance. For details refer to the YASNAC i80L Instruction Manual.
2. Some M and T codes are internally processed and not transferred out. For details refer to the YASNAC i80L Instruction Manual (TOE-C843-1 1.20).
3. The S code and S reading outputs are not generated,
(For information on the S codes, see the section on spindle control.)

(2) M **Decoded Outputs (MOOR #35214, MOIR #35215, M02R # 35216, M30R # 35217)**
When the MOO, MO1, M02, or M30 command is executed, the associated decoded output (MOOR, MO1 R, M02R, or M30R) is generated in addition to the M code output and M code reading output. Use the M02R and M30R as the end-of-program or rewind function.

The M decoded outputs open at the time of automatic operation startup or resetting,

NOTE

When a decoded output generating M command and a move command are designated for the same block, the M code output is generated at the beginning of the block, but the decoded output is generated after completion of move command execution.

(3) M/T **Function Execution Completion Input (FIN #3041 3)**
This input informs the control of M/T command execution completion

When the FIN input closes while the M/T code reading (MFA-MFE, TF) outputs are closed, the MFA-MFE and TF outputs open. When the FIN input is opened after verifying that the outputs are open, the control concludes that M/T command execution is completed, and then proceeds to the next operation step.

NOTE

1. As for the S command, there is no need to close the FIN input.
2. When the FIN input opens, the M code output opens but the S and T code outputs remain unchanged.

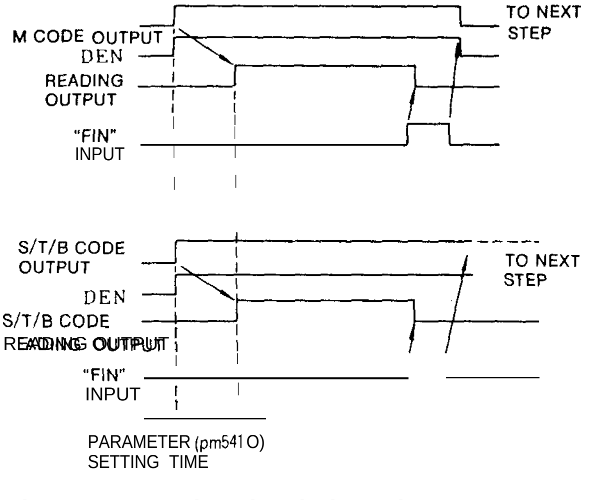


Fig. 21.13 M and T Signal Time Charts

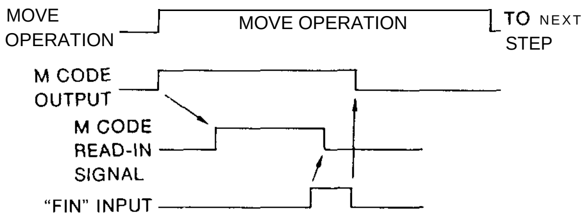


Fig. 21.14

21. 3.2.7 F STATE (FEEDS #35372) AND R STATE (RPDS #35373) OUTPUTS

During automatic operation mode part program execution, these outputs indicate the status of the control. During rapid traverse, the RPDS output is generated. The FEEDS output is generated during cutting feed.

21. 3.2.8 POSITIONING COMPLETION OUTPUT (DEN #35374)

When the M/T command and a move command are designated for the same block for automatic operation mode part program execution, the DEN output indicates the completion of move command execution.

If M/T command execution is not completed when move command execution is completed after execution of the block for which the M/T and move commands are designated, the positioning completion output (DEN) is generated.

When M/T command execution is completed with the FIN input status switched from "closed" to "open," the positioning completion output opens.

21. 3. 2. 9 OPERATING STATE OUTPUT (OOP # 35375) AND THREADING STATE OUTPUT (THC # 35377)

(1) Operating State Output (OP)

This output is generated upon automatic operation start to indicate that the control is operating.

The operating state output closes at the beginning of automatic operations, and opens upon resetting (including the resets caused by the M02 or M30 command).

(2) Threading State Output (THC)

During automatic operation mode part program execution, this output indicates that the control is moving to perform threading.

The threading state output (THC) is generated while the control is moving to carry out threading.

21.3.2.10 WAIT M COMMAND DISREGARD INPUT (NMWT1 #30450)

With this input, it is possible to disregard a wait command in cases where the internal M code instructs the machine to wait for an interval between programs of a multi-program system. This feature is used to individually check one program of a multi-program system.

Table 21.16 Wait M Command Disregard Input

Input	Description
NMWT1	Disregards the wait M command for the interval between the first program and the input-signal-relevant program.

Note: The relevant program contains the input signal.

21.3.2.11 USER MACRO INTERFACE 1/0 SIGNAL SYSTEM VARIABLES (UI0 # 30460 -UI31 # 30497, UO0 # 35400-UO31 # 35430)

(1) When an interface input system variable (# 1000-# 1031) is designated for the right-hand side of an operational expression, the ON/OFF states of the 32-point input signals specialized for the microprogram are read. The relationship between the input signals and system variables is indicated in Table 21.17.

(2) When an interface output system variable (# 1100-# 1131) is designated for the left-hand side of an operational expression, the ON/OFF states of the 32-point output signals specialized for the microprogram are read. The relationship between the output signals and system variables is indicated in Table 21.18.

Table 21.17 System Variable and Input Name

System Variable	Input Name
#1000	UI 0
#1001	UI 1
#1002	UI 2
#1003	UI 3
#1004	UI 4
#1005	UI 5
#1006	UI 6
#1007	UI 7
#1008	UI 8
#1009	UI 9
#1010	UI 10
#1011	UI 11
#1012	UI 12
#1013	UI 13
#1014	UI 14
#1015	UI 15
#1016	UI 16
#1017	UI 17
#1018	UI 18
#1019	UI 19
#1020	UI 20
#1021	UI 21
#1022	UI 22
#1023	UI 23
#1024	UI 24
#1025	UI 25
#1026	UI 26
#1027	UI 27
#1028	UI 28
#1029	UI 29
#1030	UI 30
#1031	UI 31

Table 21.18 System Variable and Output Name

System Variable	Output Name
#1100	UO 0
#1101	UO 1
#1102	UO 2
#1103	UO 3
#1104	UO 4
#1105	UO 5
#1106	UO 6
#1107	UO 7
#1108	UO 8
#1109	UO 9
#1110	UO 10
#1111	UO 11
#1112	UO 12
#1113	UO 13
#1114	UO 14
#1115	UO 15
#1116	UO 16
#1117	UO 17
#1118	UO 18
#1119	UO 19
#1120	UO 20
#1121	UO 21
#1122	UO 22
#1123	UO 23
#1124	UO 24
#1125	UO 25
#1126	UO 26
#1127	UO 27
#1128	UO 28
#1129	UO 29
#1130	UO 30
#1131	UO 31

21. 3.3 SERVO AXIS CONTROL I/O
21. 3.3.1 MANUAL HANDLE AXIS SELECTION

(1) Manual Handle Feed Axis Selection Inputs (HI # 30700-H8 # 30707)

When a manual pulse generator is provided, these inputs designate axis movement by the manual pulse generator.

When one of these signal inputs is closed with the manual handle selected, the manual pulse generator moves the associated axis. If two or more input signals are closed, axis movement does not take place.

(2) Manual 3-axis Simultaneous Handle Feed Axis Selection Inputs (2H1# 30800-2H8 # 30807, 3H1 # 30810-3H8 # 30817)

When this input signal is closed with a manual 3-axis simultaneous pulse generator provided, up to **3** axes can be moved.

First handle axis selection (HI -H8)
Second handle axis selection (2H1-2H8)
Third handle axis selection (3H1 -3H8)

NOTE: Each handle axis selection signal is effective for only one axis.

21. 3.3.2 MANUAL FEED AXIS DIRECTION SELECTION INPUTS (+ 1 # 30710 TO + 8 # 30717, -1 # 30720 TO -8 #30727)

When the control is in the manual jog, rapid traverse, or manual step feed mode, these inputs are used to specify the axis to be moved and the direction of movement.

When the plus or minus direction input of a specific axis is closed, axis movement takes place. When all axes are designated, all of them can be moved simultaneously.

NOTE

If both the plus and minus direction inputs of a selected axis are closed or open, that axis does not move. If such a condition occurs during axis movement, the axis decelerates to a stop.

21. 3.3.3 OVERTRAVEL INPUTS (*+OT1 # 30740 -*+OT8 # 30747, ● –OT1 # 30750 -*–OT8 # 30757)

These inputs are used to indicate that the movable mechanisms have reached the stroke end,

When an overtravel input is opened, the associated axis stops as indicated in Table 21. 19 and the alarm (ALM) output closes to display an alarm on the CRT screen.

Table 21.19 Movement Stop Direction when Overtravel Input is Open

..	Manual operation mode	Automatic operation mode
*+1 to *+8 Inputs Open	*+1 to *+8 Direction Movement stop	All-direction movement stop of all axes
*−1 to *−8 Inputs Open	*−1 to *−8 Direction Movement stop	

To reset the “opened” overtravel input, move the axis in a direction opposite to that of the opened overtravel input in the manual operation mode (manual jog, manual pulse generator) to close the input, and perform the “reset” procedure to clear the alarm output and display.

NOTE

Even when the overtravel input opens, the M code, S code, T code, and reading outputs **MF and TF do not turn OFF.**
If it is necessary to interrupt an M, S, or T code based operation because of overtravel, effect interlock in accordance with an external sequence.

21. 3.3.4 AXIS INTERLOCK INPUTS (*IT1 #30780 -*IT8 #30787)

These interlock inputs are provided for all axes and used to prohibit axis movement.

(1) When the axis interlock opens during axis movement, the axis decelerates to a stop. When the interlock is closed later, the machine performs the remaining operation and then proceeds to the next block.

(2) As regards the 2- or 3-axis simultaneous interpolation command, the machine prohibits interpolation, decelerates, and stops if the interlock for one axis opens.

21. 3.3.5 AXIS MACHINE LOCK INPUTS (MLK1 # 30760 -MLK8 #30767)

These signals are used to machine-lock the axes independently.
For instance, when the MLK3 input is closed, only the third axis machine lock turns ON.

21. 3.3.6 C-AXIS SERVO OFF SIGNALS (* C1SVOF # 30796, *C2SVOF #30797)

These signals are used when heavy-duty or other cutting operations are to be performed with the C-axis mechanically clamped.

When the ● Cl SVOF or ● C2SVOF signal contact opens, the Cl - or C2-axis servo lock is released. For machine clamping purposes, use the M or like function. The servo OFF, mechanical clamp, auxiliary function, and servo ready (SRDC1,SRDC2) signal time chart is presented in Fig. 21. 15. The clamp command output must be generated after positioning signal (DEN) transmission.

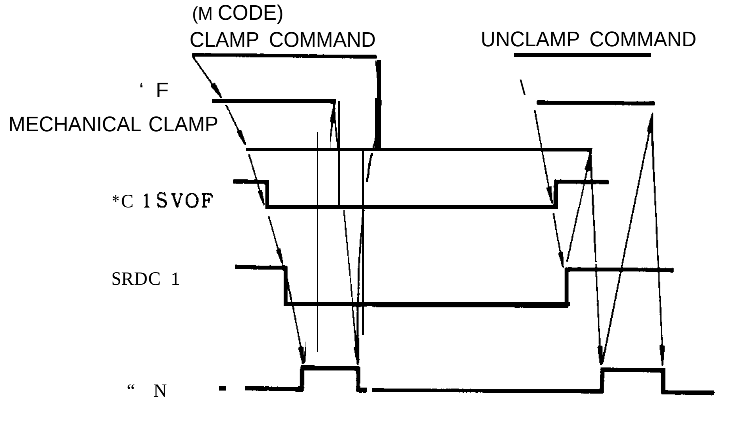


Fig. 21.15 Servo OFF Signal Time Chart

With a parameter, it is possible to perform follow-up processing for the C axes at the time of servo OFF.

21. 3.3.7 PULSE COPY AXIS SELECTION INPUTS (PCOPS1-1 # 30860 -PCOPD2-8 # 30897) AND PULSE COPY STATE MONITOR OUTPUTS (PCOPE1 # 36190 -PCOPE8 # 36197)

The above inputs are used to output the pay-out pulse of a desired axis (first to eighth axes) to another axis. The above outputs are used to monitor the copying state. Two different copying operations can be performed at the same time.

With parameter pm5003, it is possible to make copies with the sign reversed (pm5003 D6 = 1: first pulse copy with the sign reversed ; pm5003 D7 = 1: first pulse copy with the sign reversed).

21. 3.4 SPINDLE CONTROL

21. 3.4.1 S5-DIGIT COMMAND INPUTS AND OUTPUTS (DA1, SG, GR1 # 311 OO-GR4 #31103, SINV #31104, SINVA #36500)

The YASNAC i80L provides simultaneous control over four spindles (S1 -S4).

Various I/O signals are provided for each of the four spindles. All the subsequent spindle related I/O and operation descriptions are given with respect to the S1. The S2, S3, and S4 are the same as the S1 except for the parameters and signal names.

The DA1 and SG signal outputs are generated for spindle motor rotating speed determination.

The GR1 -GR4 inputs are used to enter the spindle/spindle motor gear range information into the control so that the spindle motor rotating speed is determined by the spindle rotating speed specified by the part program. The SINV input inverts the polarity of the S command 5-digit analog output.

While the analog output polarity is inverted by the SINV input, the SINVA signal output is generated.

(1) S5-digit Command Analog Outputs (DA1, SG)

As shown in Fig. 21.15, analog voltage outputs are generated according to the spindle rotating speed command and GR1 -GR4 input.

—-·—- Output generated when the GR1 input is closed
[Set the spindle motor maximum rotating speed for the GR1 gear range as the parameter pm1408 value.]

— -- Output generated when the GR2 input is closed
[Set the spindle motor maximum rotating speed for the GR2 gear range as the parameter pml 409 value.]

——-— Output generated when the GR3 input is closed
[Set the spindle motor maximum rotating speed for the GR3 gear range as the parameter pm1410 value.]

— - ---— Output generated when the GR4 input is closed
[Set the spindle motor maximum rotating speed for the GR4 gear range as the parameter pm1411 value.]

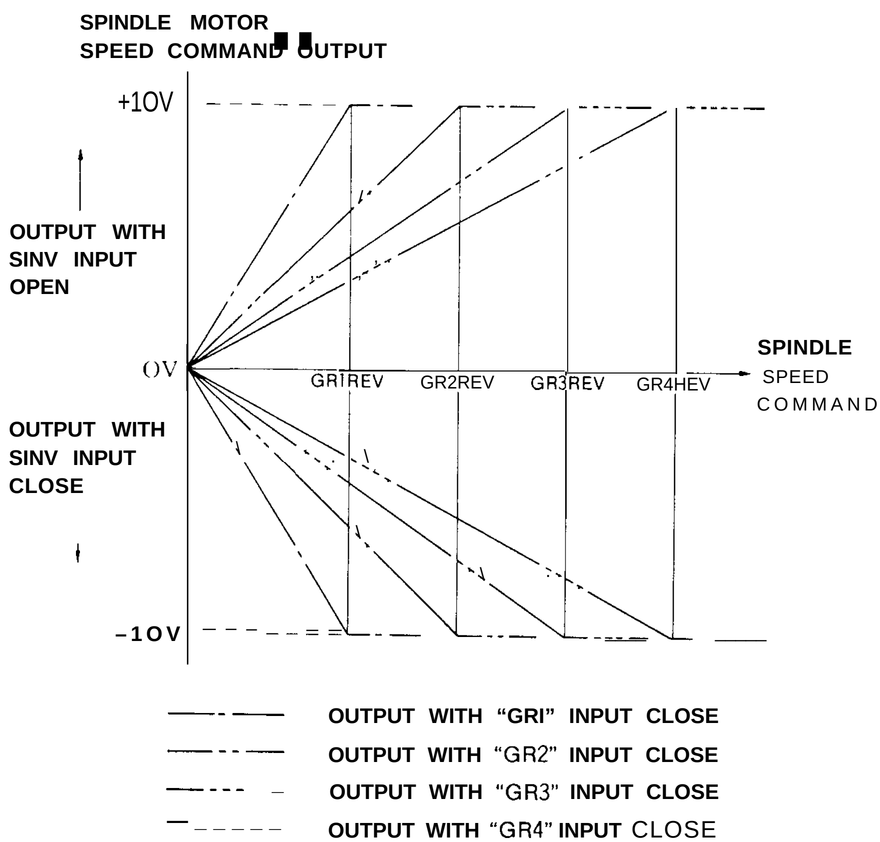


Fig. 21.16 S5-Digit Command Analog Output

(**2**) The spindle motor rotation command analog voltage output, SINV input, and SINVA output time chart is presented in Fig. 21.17.

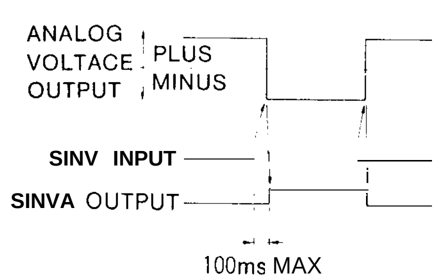


Fig. 21. 17 Spindle Motor Rotation Command Analog Voltage Output, SINV Input, and SINVA Output Time Chart

Table 21.20

Parameter		Fig. No.
pm 1404	Spindle maximum speed when “GRI° input is closed.	V
pm 1405	Spindle maximum speed when “GR2° input is closed.	VI
pm 1406	Spindle maximum speed when “GR3” input is closed.	VII
pm 1407	Spindle maximum speed when “GR4” input is closed.	VIII
pm 1400	Spindle minimum speed when “GRI” input is closed.	I
pm 1401	Spindle minimum speed when “GR2” input is closed.	II
pm1402	Spindle minimum speed when “GR3” input is closed.	III
pm 1403	Spindle minimum speed when “GR4” input is closed.	IV

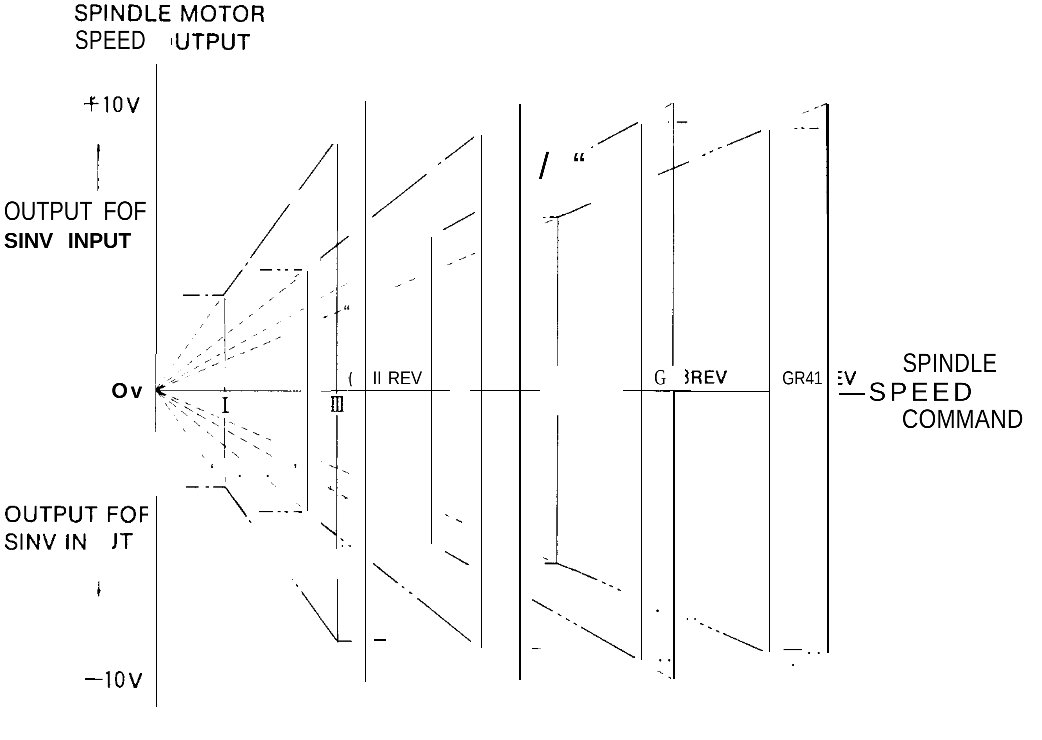


Fig. 21.18 S5-Digit Analog Outputs When Spindle Maximum/Minimum Speeds Clamped

NOTE

1. The spindle motor rotating speed command output calculation formula is given below.

$$\frac{\text{(Spindle rotating speed command)} \times (10V)}{\left\{\begin{array}{l}\text{Spindle gear range determined by the GR1 -GR4 input} \\ \text{Spindle maximum rotating speed: Parameters pm1408-pm1411}\end{array}\right\}}$$

?.. The analog output is positive (+) when the SINV is open or negative (–) when the SINV is closed.

3. When the spindle S command stop (SSTP) input closes, a value other than mentioned above may be output as the spindle motor rotating speed command. For details see the section on the spindle S command stop (SSTP) input.

4. As indicated in the table below, the control internally decides on the spindle gear range depending on whether the GR1 -GR4 inputs are closed or opened.

Spindle Gear Range Determination

GR1 input	GR2 input	GR3 input	GR4 input	Control internal range
0	0	0	0	Gear range 1
1	1	0	0	
1	0	1	0	
0	1	1	0	Gear range 2
1	1	1	0	Gear range 1
1	0	0	1	
0	1	0	1	Gear range 2
1	1	0	1	Gear range 1
0	0	1	1	Gear range 3
1	0	1	1	Gear range 1
0	1	1	1	Gear range 2
1	1	1	1	Gear range 1

NOTE : O: Input Open. 1: Input Closed.

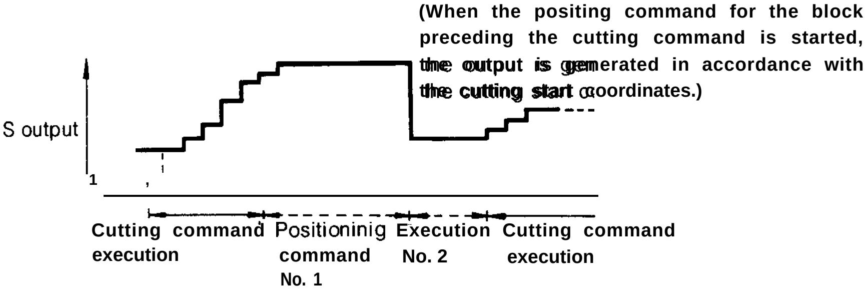
(Supplementary Explanation)

- Constant peripheral speed control and S5-digit command output

  When the constant peripheral speed command (G96) is issued during automatic operation mode part program execution, the output changes at about 40 ms intervals during cutting in accordance with the following formula.

$$\frac{\text{(Peripheral speed specified by the S command)}}{\text{(Current X-coordinate value)} \times \pi \text{ (the ratio of the circumference of a circle to its diameter)}} \times \frac{(10V)}{\text{Spindle gear range maximum rotating speed determined by the GR1 -GR4 input}}$$

(Typical time chart)



When parameter pm4011 D4 is set to 1, the constant peripheral speed control can also be exercised for the positioning command. (However, only the spindle rotating speed based on the positioning end point coordinates is output.)

21. 3.4.2 SPINDLE S COMMAND INPUT (SSTP # 31105), GEAR SHIFT STATE INPUT (GRS #31107), SPINDLE CONSTANT SPEED INPUT (GSC #31106), GEAR SHIFT STATE OUTPUT (GRSS # 36503), AND SPINDLE CONSTANT SPEED STATE OUTPUT (GSCS # 36502)

The above inputs are used so that outputs other than the part program S command are delivered to the S5-digit command analog output.

When the SSTP input is closed, the spindle motor rotaing speed command output based on the spindle rotating speed specified by the part program is stopped.

If the GRS input is closed in this state, the voltage output defined by parameter GRSREV (pm1413) is generated. Further, if the GSC input is closed, the spindle motor rotating speed command voltage output corresponding to the spindle rotating speed defined by parameter GSCREV (pm1412) is generated upon spindle gear range input.

While GRS or GSC based control is exercised, the GRSS or GSCS output is generated.

Table 21.21 SSTP, GRS, and SGC Inputs and S5-digit Command Analog Voltages

SSTP input	GRS input	GSC input	S5-digit command analog voltage
o	0	0	Voltage corresponding to the spindle rotating speed spcified by the NC program
0	0	1	
0	1	0	
o	1	1	
1	0	0	Ov
1	o	1	Voltage corresponding to parameter GSCREV Parameter GESREV setting
1	1	0	Parameter GRSREV setting value
1	1	1	Ov

NOTE: O: Contact open. 1: Contact closed,

NOTE

1. With the S5-digit analog output invert input (SINV), it is possible to provide minus (–) analog outputs for the SSTP, GRS, and GSC inputs.
2. It takes no more than about 40 ms for the analog voltage to change in response to the SSTP, GRS, or GSC input.
3. The "*. SSTP" input is provided by setting parameter pm1000 D5 to 1.

21. 3.4.3 SPINDLE SPEED REACHED INPUT (SAGR #31116)

When a part program is executed in the automatic operation mode in cases where the control uses the S5-digit command, the SAGR input indicates that the specified spindle rotating speed is reached at the cutting start point.

When cutting starts (the positioning command is superseded by the cutting command), the control waits for the delay timer to time out as defined by parameter pm1540, and starts cutting after verifying that the SAGR input is closed.

NOTE

1. To support the above operation based on the SAGR input, parameter pm1000 D7 must be set to 1. If the parameter is set to O, the SAGR input is disregarded.
2. In the G96 mode, the SAGR input is always checked when the positioning command is superseded by the cutting command.
   In the G97 mode, the SAGR input check is performed at the time of positioning-to-cutting command changeover only in cases where the spindle ratating speed at the end of positioning differs from that prevailing at the beginning of positioning.

21. 3.4.4 SPINDLE SPEED OVERRIDE INPUTS (SPA # 31110, SPB # 31111, SPC # 31112, SPD #31113, SPE #31114)

When a part program is executed in the automatic operation mode in cases where the control uses the S5-digit command, the captioned inputs provide a 50 to 120% override for the S command.
With parameters, it is possible to provide a 10 to 200% override.

Table 21. 22—① SPA, SPB, and SPC Inputs and S-command override

SPA input	SPB input	SPC input	S-command override
1	1	1	50%
0	1	1	60%
0	1	0	70%
1	1	0	80%
1	0	0	90%
0	0	0	100%
0	0	1	110%
1	0	1	120%

NOTE 1:1: Closed. 0: Open.
2: When the 20-step spindle override system is specified, the provided override is as follows.

Table 21. 22—② SPA, SPB, SPC, SPD, and SPE Inputs and S-command Override

SPA input	SPB input	SPC input	SPD input	SPE input	S-command override
0	0	0	1	0	10%
0	0	1	1	0	20%
0	1	1	1	0	30%
1	1	1	1	0	40%
1	1	1	0	0	50%
0	1	1	0	0	60%
0	1	0	0	0	70%
1	1	0	0	0	80%
1	0	0	0	0	90%
0	0	0	0	0	100%
0	0	1	0	0	110%
1	0	1	0	0	120%
1	0	1	1	0	130%
1	0	0	1	0	140%
1	1	0	1	0	150%
0	1	0	1	0	160%
0	1	0	1	1	170%
0	1	0	0	1	180%
0	0	0	0	1	190%
1	0	0	0	1	200 %

NOTE: 1: Closed. O: Open.

21. 3.4.5 S5-DIGIT COMMAND EXTERNAL OUTPUTS (SDO0 # 36540 -SDO23 # 36567) AND S5-DIGIT COMMAND EXTERNAL INPUTS (SDI0 #31120 -SDI23 #31147)

When the control uses the S5-digit command, the captioned I/O signals function so that the results of S command based part program computations are externally output, and that the actual S5-digit command analog output complies with the external input.

⟨S5-digit command analog output)

(a) Computation result output to the outside: SDO0-SDO23

(b) External input for transferring analog voltages out to the DAI and SG : SDI0-SDI23

NOTE: Signed binary 23-bit I/O values are used. The relationship between the values and analog voltages is as follows.

–8388607 ～ 0 ～ +8358607
–1OV ～ 0V ～ +10V

NOTE

The main objective of the above I/O signals is to control the S5-digit command from the control built-in sequencer. Under normal conditions, do not use the signals for other purposes.

21. 3.4.6 SPINDLE INTERLOCK INPUTS AND OUTPUTS (S1COP # 31150 -S4COP # 31153, S1COPE # 36514-S4COPE # 36517)

These signals are used to rotate two spindles at the same speed.
When, for instance, copying the first spindle command to the second spindle, set the second spindle control S1 COP to 1 (pm3125 DO = 1). While a copy is being made, the second spindle control S1 COPE (pm3661D4) is 1.

21. 3.4.7 SPINDLE INDEX FUNCTION INPUTS AND OUTPUTS (SID0 # 31180 -SID11 #31193)

These 1/0 signals are used to exercise the "spindle index function" so that the S5-digit analog output is controlled by the pulse output from the spindle pulse generator to stop the spindle at a desired position.

(1) Input Signals

(a) SIDO-SID11 : Binary 12-bit (0-4095) input for spindle stop position designation. It corresponds to the pulse output (4096 pulses/rev) from the spindle pulse generator. The stop position is usually SID1 -SID12 input number of pulses away from the phase C pulse (1 pulse/rev) of the spindle pulse generator.

NOTE: The stop position can be shifted away from the phase C pulse by the amount defined by parameters pml414 and pm1 434.

(b) SIDX: This input request the control to perform spindle indexing.
When this input is closed during spindle rotation, the spindle stop command is issued, and then the spindle indexing operation is performed after the spindle is stopped.
After completion of spindle indexing, the spindle rotating speed command analog voltage remains as the spindle positioning command unless this input turns OFF, and the control continues with spindle indexing.

(c) SIDXI : Spindle indexing restart input
SIDXINC: Spindle stop position selection incremental input
The SIDXI and SIDXINC inputs are provided for the repeated spindle indexing sequence.
For details refer to (5) "Spindle Indexing Function Expansion Inputs".

(2) Output Signals

(a) SIDXO: This output is ON while the control is executing the spindle indexing function (while the creep rotating speed command and spindle positioning command outputs are generated).

(b) SIDXA: Spindle indexing completion output.
This output is ON while the spindle indexed by the control is positioned within the range defined by the SID1-SID12 input and parameter setup pulses (pm1331, pm1332).

(3) Typical Spindle Indexing Time Charts

(a) Performing spindle indexing with the M code while the spindle is stopped (Fig 21. 19)
(The spindle positioning mode is cleared after completion of spindle indexing.)

(b) Performing spindle indexing with the M code while the spindle is rotating in the normal direction
(Even after completion of spindle indexing, the spindle positioning operation is continued until the next spindle rotation command is issued.)

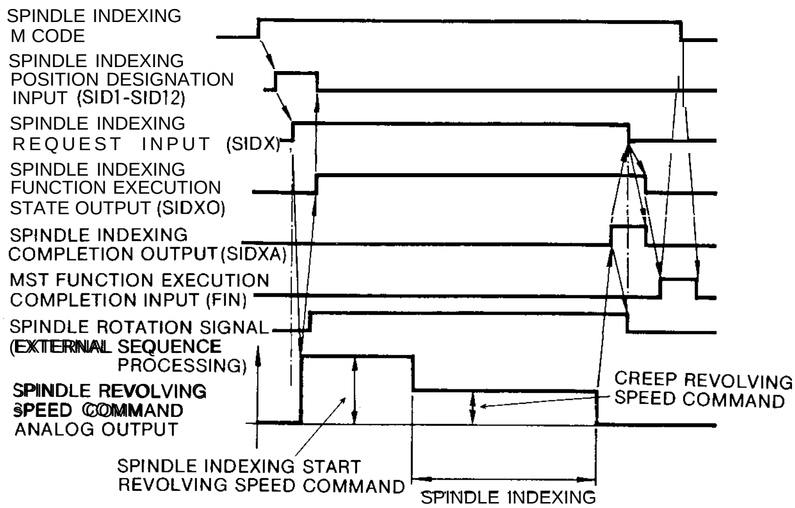


Fig. 21.19 Time Chart of Indexing the Stopped Spindle with the M Code

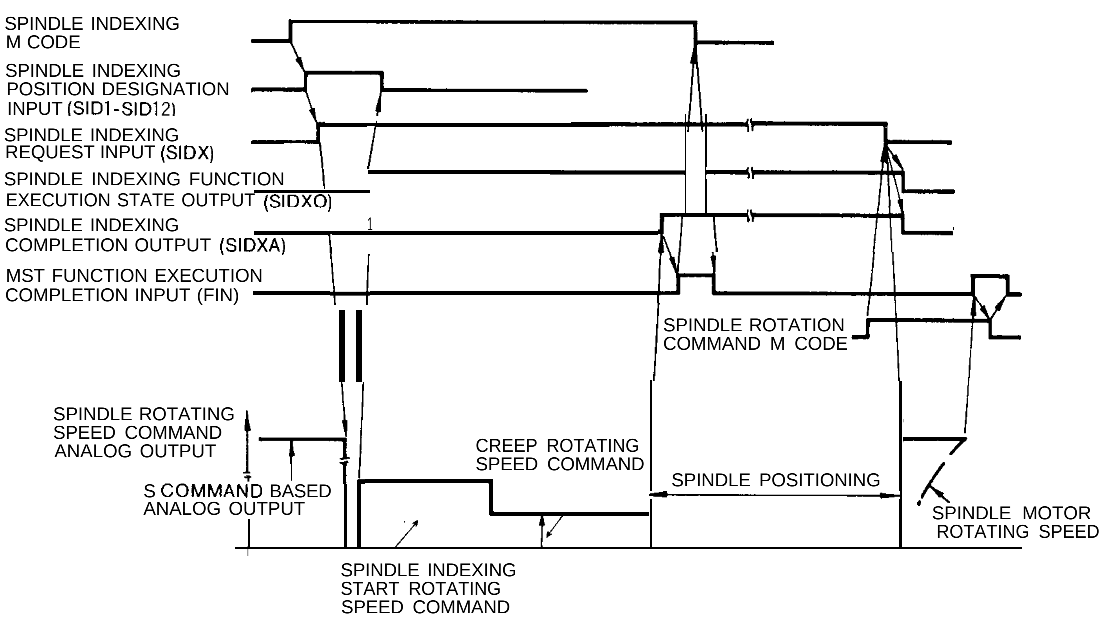


Fig. 21.20 Time Chart of Indexing the Normally Rotating Spindle with the M Code

(4) Details of spindle indexing parameters and operations

The parameters listed in Table 21.23 are used for spindle indexing. The spindle indexing operations are detailed in Fig. 21.21,

Table 21.23 Spindle Indexing Parameters and Operations Category

Category	Number (name)	Description	Setting unit
Loop control basic parameters	pm 1417	Position loop gain	$1=0.01S^{-1}$
	pm 1415	Spindle rotating speed for a loop control gear command Voltage of 10V	1=1/10 rpm
	pm 1416	Maximum spindle rotating speed for loop control	1=1/10 rpm
	pm 1351	Servo error zone magnification for loop control	1=1% [Set the ration of the load to the maximum spindle speed]
	pm 1541	Number of pulses per spindle PG rotation	1 = 1 pulse (Select a setting of 1024.)
Spindle indexing parameters	pm 1220	Spindle stop verification timer	1=4 ms
	pm 1414	Spindle indexing zero point setup	1=1 pulse
	pm 2541	Spindle indexing start speed command	1=1 rpm
	pm 2546	Spindle indexing creep speed command	1=1 rpm
	pm 1225	Spindle stop verification rotating speed	1=1 rpm
	pm 1331	Spindle position error width	1=1 pulse

NOTE: 1 pulse= 0.088° $\left(\frac{360°}{4096 \text{ pulses}}\right)$

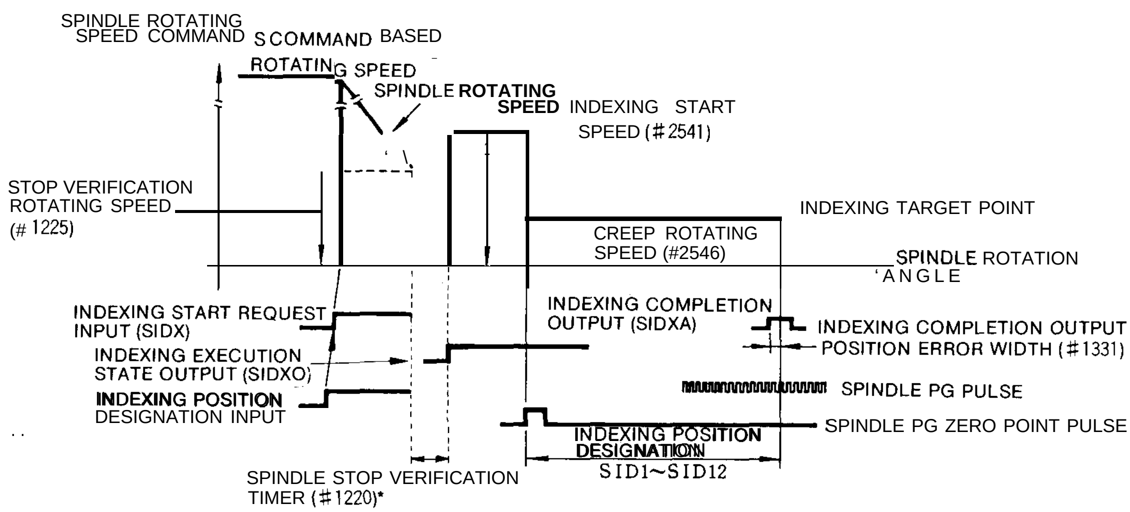


Fig. 21.21 Details of Spindle Indexing Operations

● The spindle stop verification timer starts counting after verifying that the spindle rotating speed for stop verification (# 1225) is reached. If the spindle rotating speed deviates from the stop verification rotating speed during timer counting, the count is reset. Counting restarts when the stop verification rotating speed prevails again, That is, the rotating speed must not be higher than that specified during stop verification timer operation.

(5) Spindle Indexing Function Expansion Inputs

To support various spindle indexing sequences provided by the aforementioned spindle indexing function, the control offers the following two inputs.

(a) SIDX: Spindle indexing restart input

When this input is closed while the spindle indexing function execution state (SIDXO) output is ON, the control halts spindle indexing and turns OFF the SIDXO output. When spindle indexing is halted in this manner, the spindle rotating speed command analog output serves as the spindle indexing start rotating speed command. When this input is turned OFF in this state, the control restarts spindle indexing.

(b) SIDXINC : Spindle indexing position designation incremental input

This input works so that the spindle indexing position designation input (SID1-DID12), which is prepared to permit multiple spindle indexing to different positions, functions to designate the incremental position relative to the previous spindle indexing position.

With this input, it is possible to move from the current index position to the next without causing the spindle to make one revolution. However, turning this input ON does not provide incremental position designation when the first spindle indexing operation is performed after spindle rotation or power ON.

(c) Typical time chart of spindle indexing function expansion input based spindle indexing

i) When a spindle indexing operation is repeated because the preceding spindle indexing operation has not been completed within the specified time (Fig 21. 22)

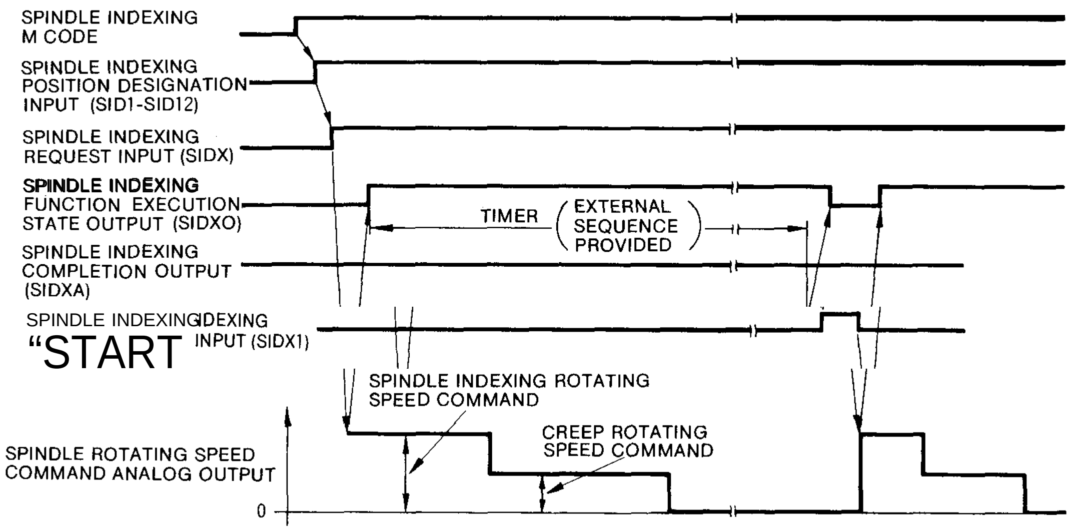


Fig. 21.22 Spindle Indexing Time Chart

[When a spindle indexing operation is repeated because the preceding spindle indexing operation has not been completed within the specified time]

ii) When clamping the spindle indexing operation mechanism, conducting machining, and performing indexing at a position 180° away from the previous indexed position (Fig 21. 23)

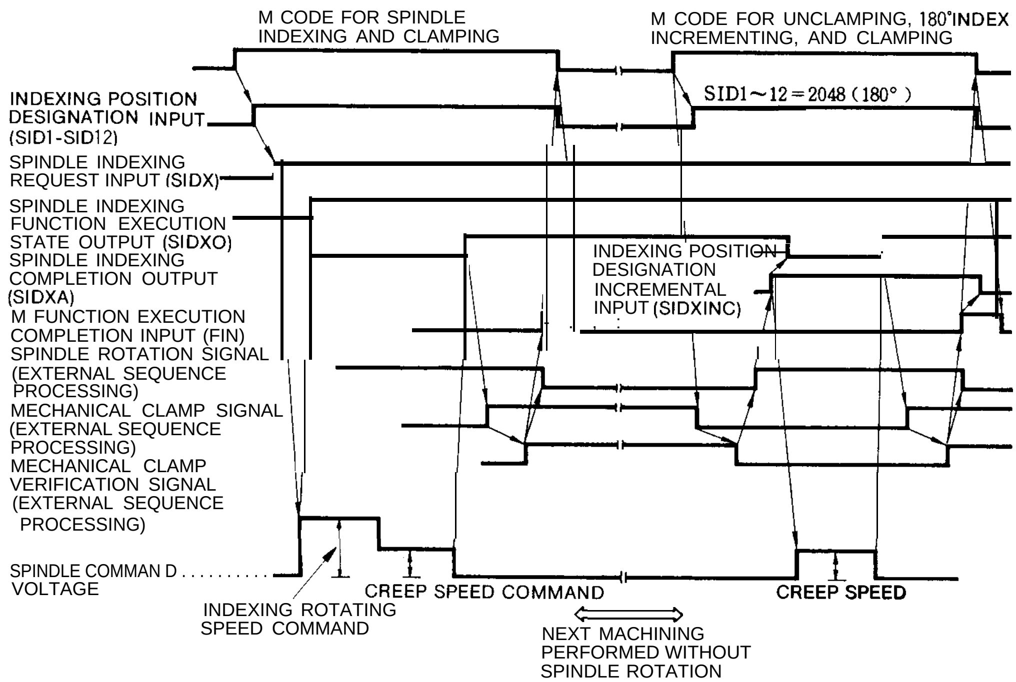
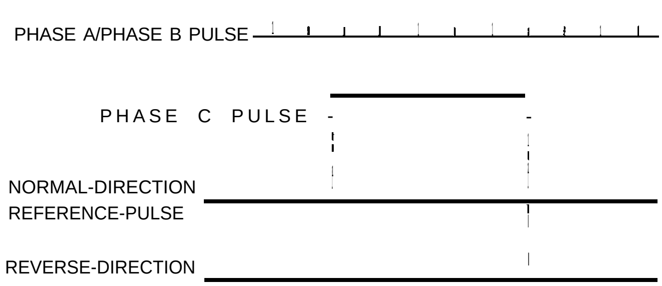


Fig. 21.23 Spindle Indexing Time Chart

[When clamping the spindle indexing operation mechanism, conducting machining, and performing indexing at a position 180” away from the previous indexed position]

NOTE

- When initiating spindle indexing during spindle reverse, ensure that the SINV input is ON while the spindle indexing request input (SIDX) is ON.
- When the SIDXINC input is turned ON to perform incremental spindle indexing with the SINV input turned ON, the SID1-SID12 input provides incrementing in reverse direction.
- Spindle indexing operations are not performed during interpolation pulse output generation.
- Be sure that the pulse count resulting from the increment command does not exceed 1024.
- Spindle indexing is performed with the phase C pulse (1 pulse/rev) edge regarded as the reference pulse. Therefore, if the phase C pulse has a certain width, the index position obtained from normal-direction spindle indexing differs by the phase C pulse width from that obtained from reverse-direction spindle indexing.



APPENDIX 1-1 LIST OF MODEL NUMBER AND SPECIFICATIONS

(1) CPU UNIT (Machining System)

Model No.: JZNC-IRK□M-❑ DDOOO
Ⓐ Ⓑ

Ⓐ22 : Type AMGC-12 slots
76: Type ACGC-16 slots
02: Type AMGC-12 slots
(Basic option)
56: Type ACGC-16 slots (Basic option)
ⒷDependent on the hardware option

(2) CPU UNIT (Lathing System)

Model No.: JZNC-IRK□L – □□□□□□
Ⓐ Ⓑ

Ⓐ22: Type AMGC-12 slots
76: Type ACGC-16 slots
04: Type AMGC-14 slots
(Basic option)
58: Type ACGC-18 slots
(Basic option)
ⒷDependent on the hardware option

(3) AMGC Panel

Model NO.: JZNC-IOP□E – ❑
Ⓐ Ⓑ Ⓒ

Ⓐ01 : Horizontal 9" CRT type
02: Vertical 9" CRT type
04: Horizontal EL type
05: Vertical EL type
ⒷE: English
J : Japanese
Ⓒ0 : Panel I/Os not provided
1: Panel I/Os provided/HPG interface x 1
2: Panel I/Os provided/HPG interface x 2
3: Panel I/Os provided/HPG interface x 3

(4) I/O Boards

Name	Model number	Specifications
101	JANCD-FC 800	IN 112/OUT 96 Source driver out put
102	JZNC-IAU02-□	IN 69/OUT 32 HPG interface (1 to 3 units)

(5) Servo Unit

· One-axis servo unit

Model No.: CACR-IR□SC
Capacity (05-44)

· Two-axis servo unit

Model No. : CACR-IR□□C
Second axis capacity
First axis capacity

0505
1010
2020
3030

· Three-axis servo unit

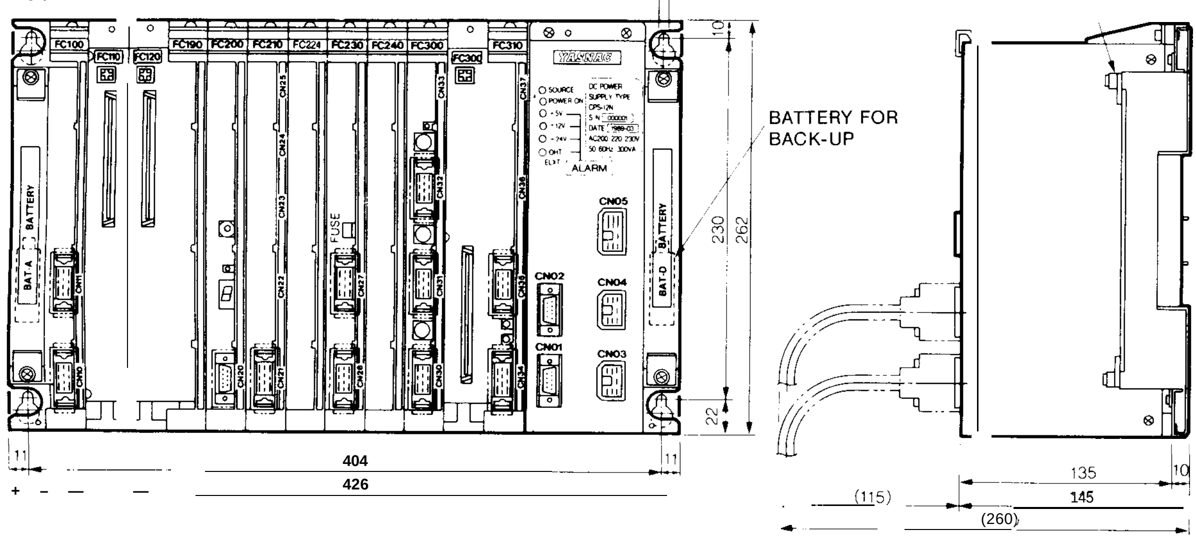
Model NO.: CACR-IR□□□C
Third axis capacity
Second axis capacity
First axis capacity

050505
101010
202020

APPENDIX 1-2 DIMENSIONS in mm

(1) CPU UNIT (12-Slot)

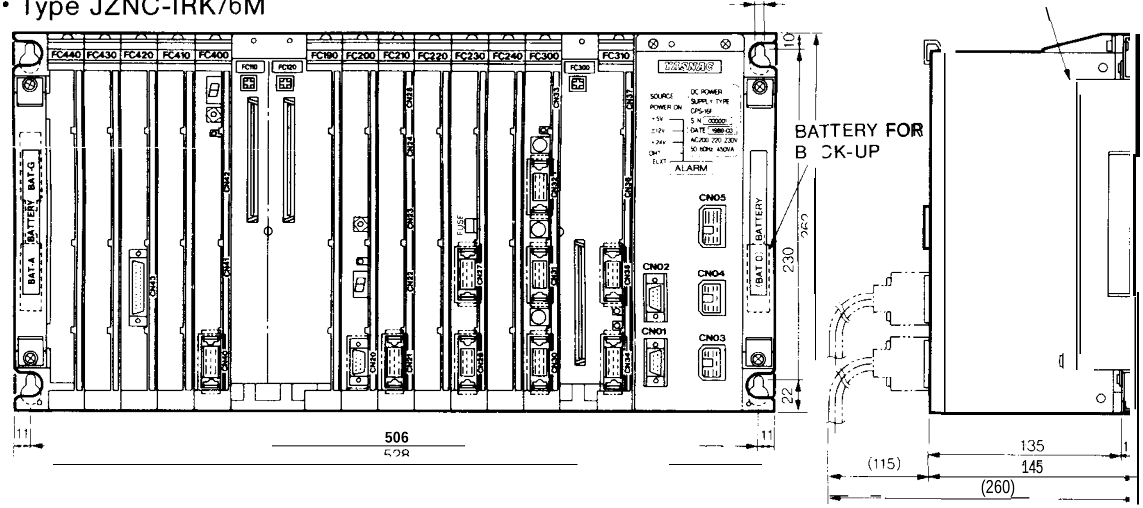
- Type JZNC-IRK02M
- Type JZNC-IRK22M



Approx Weight: 7. 5kg

(2) CPU UNIT (16-Slot)

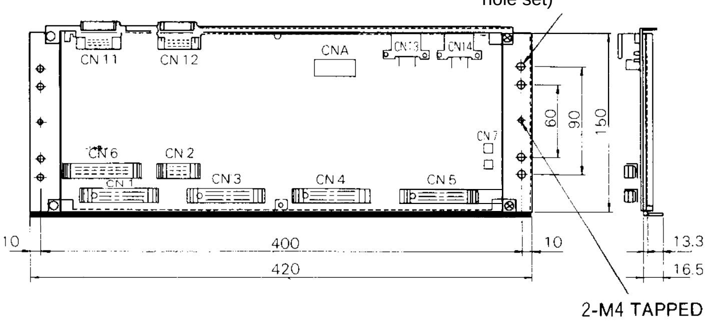
- Type JZNC-IRK56M
- Type JZNC-IRK76M



Approx Weight: 9kg

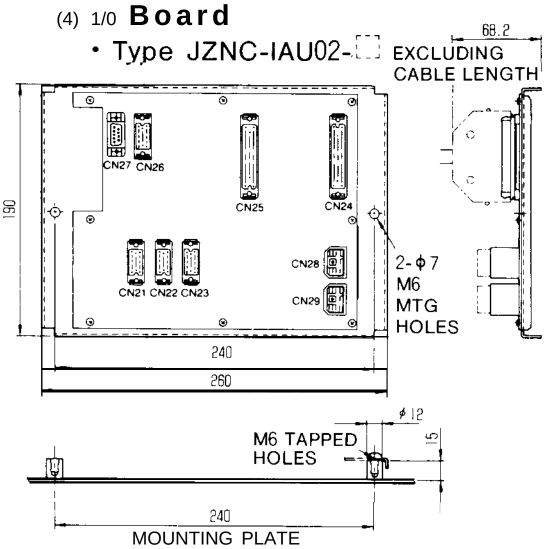
(3) 1/0 Board

- Type JANCD-800

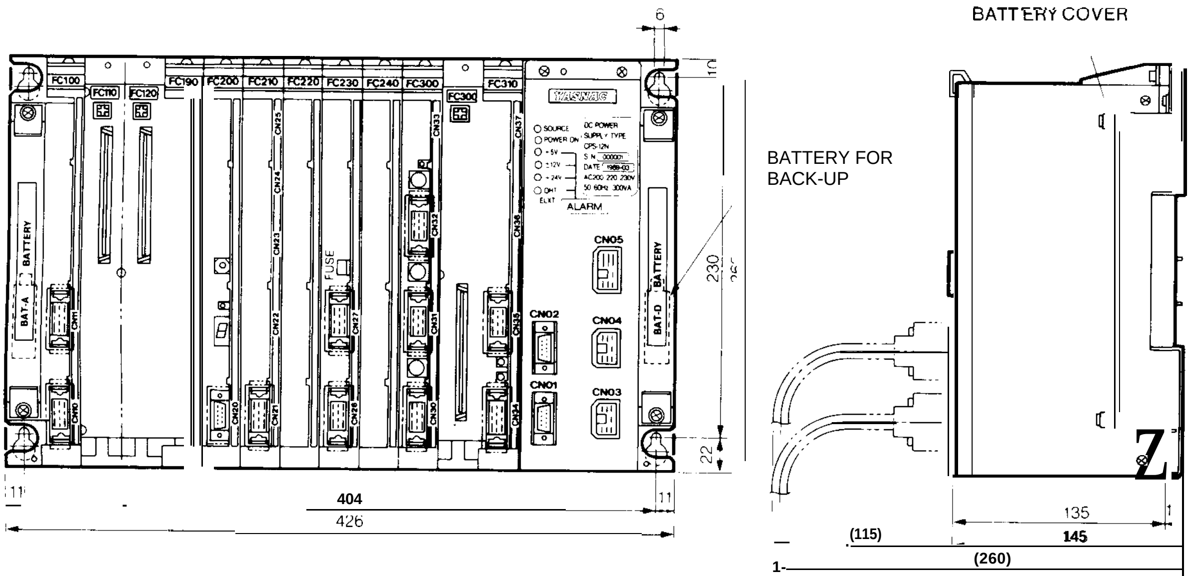


(4) 1/0 Board

- Type JZNC-IAU02-

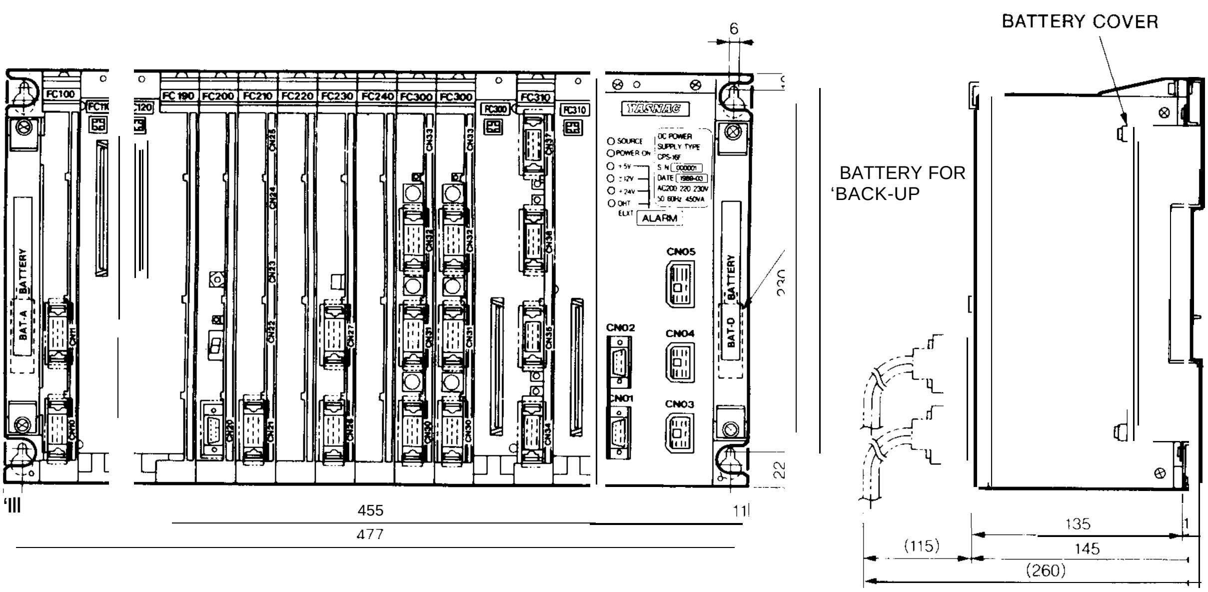


(5) CPU UNIT (1 2-Slot)
•Type JZNC-IRK22L



Approx Weight: 7. 5kg

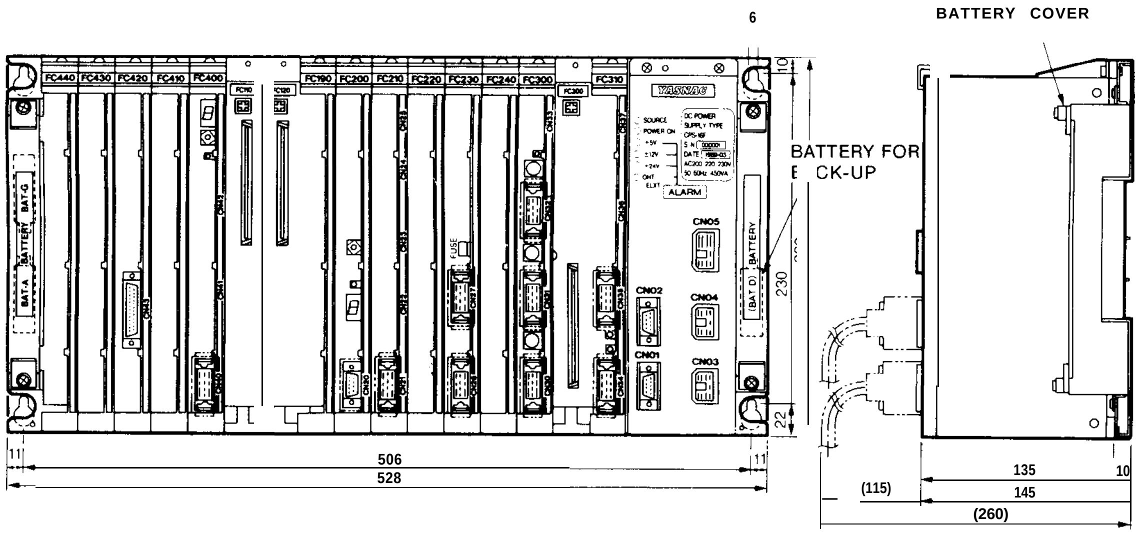
(6) CPU UNIT (14-Slot)
•Type JZNC-IRK04L



Approx Weight 8. Okg

(7) **CPU UNIT (16-Slot)**

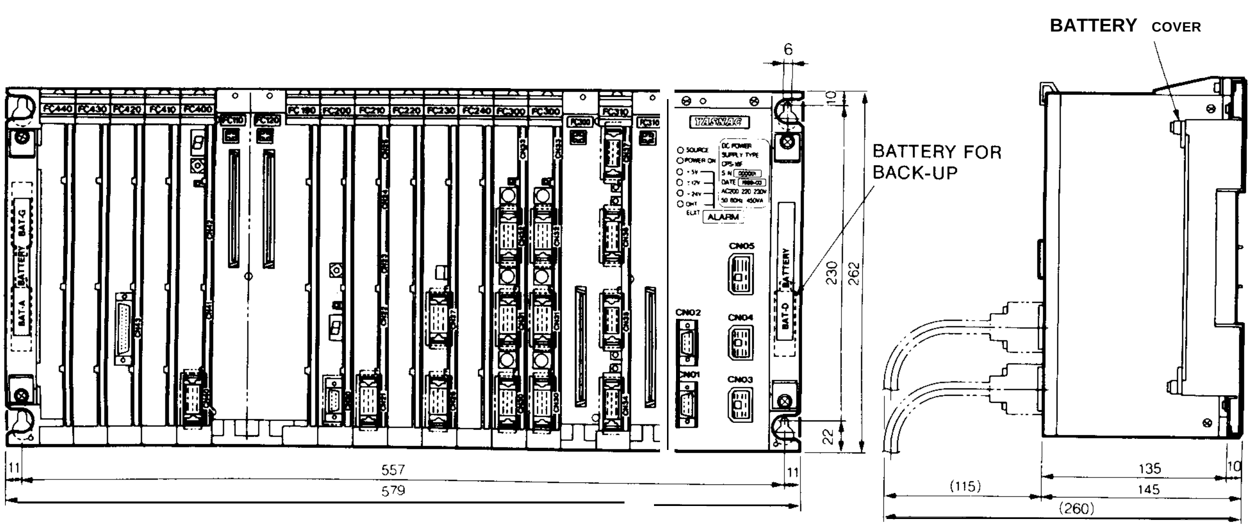
•Type JZNC-IRK76L



Approx Weight: 9. Okg

(8) CPU UNIT (1 8-Slot)

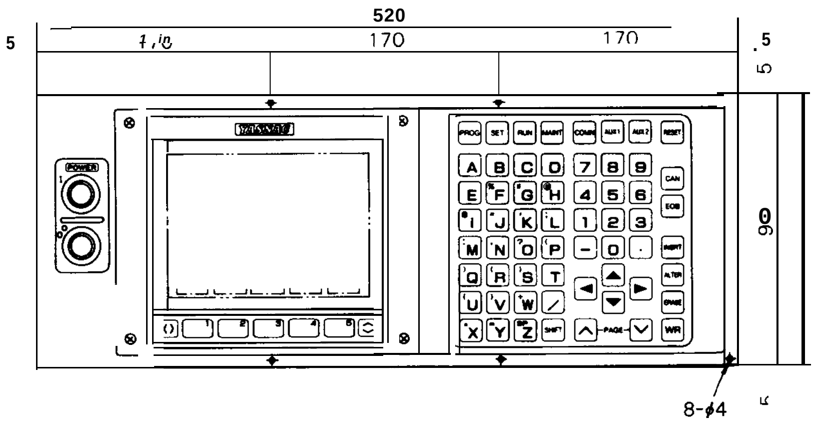
• Type JZNC-IRK58L

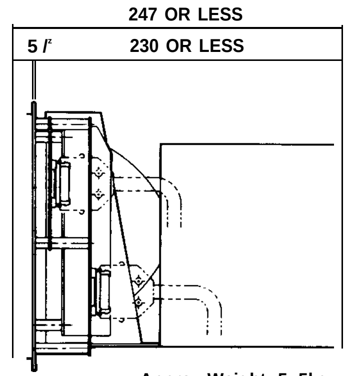


Approx Weight: 10kg

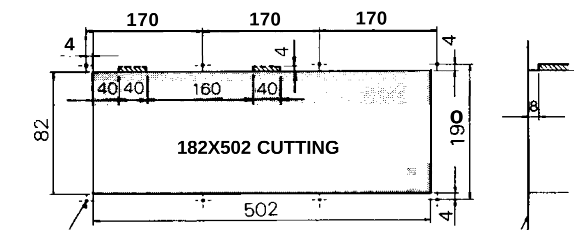
(9) **AMGC (Horizontal 9" CRT) Operator's Station with Keyboard**

• Type JZNC-IOP01□





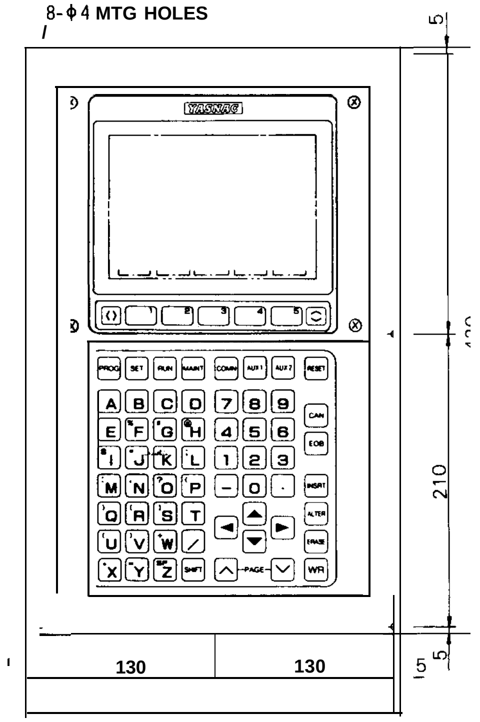
Approx Weight: 5. 5kg

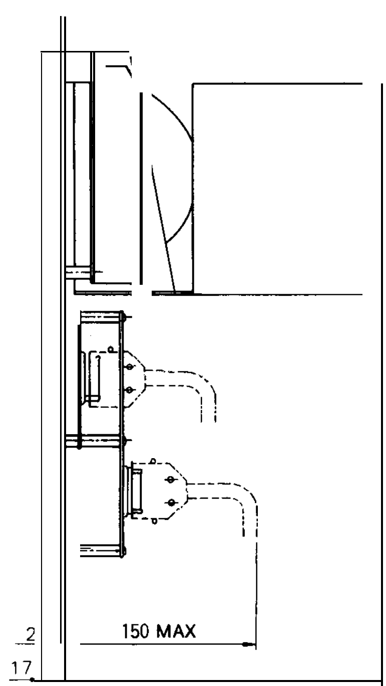


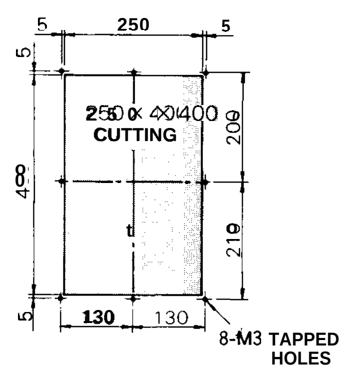
Panel Cutout

(10) **AMGC (Vertical 9" CRT) Operator's Station with Keyboard**

.Type JZNC-IOP02□



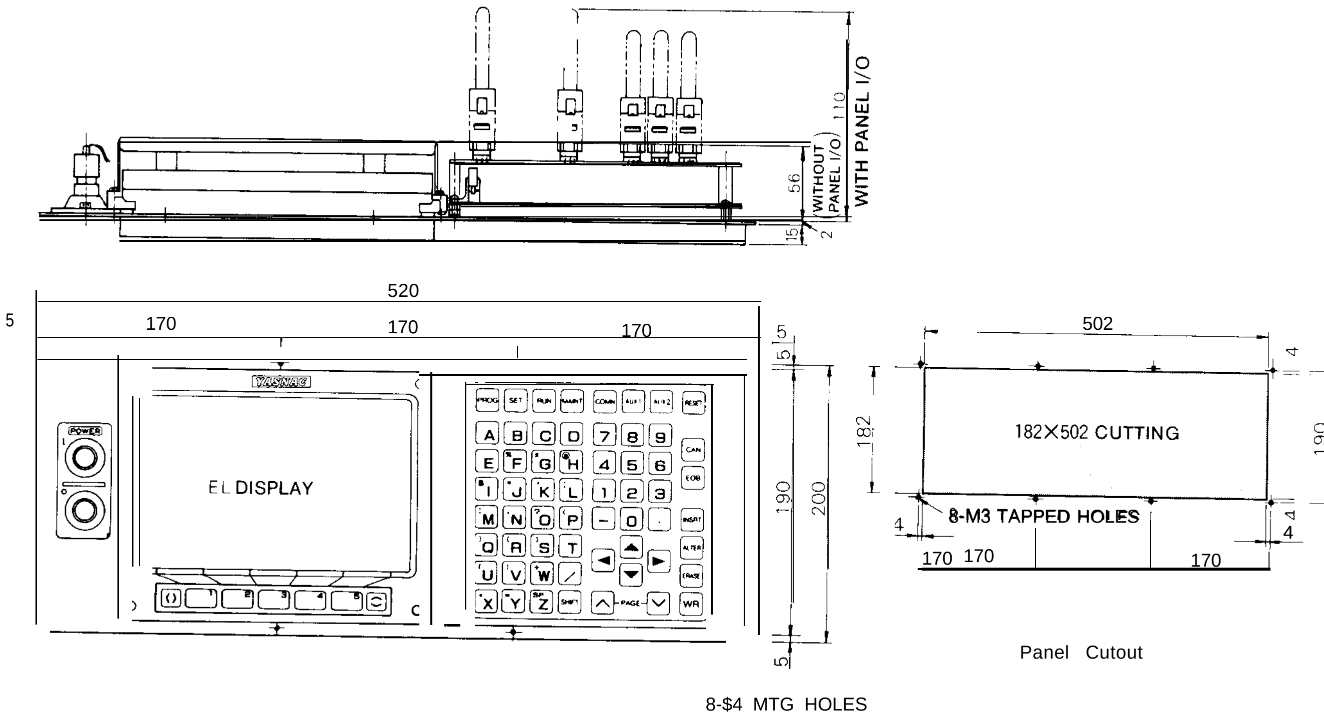




Panel Cutout

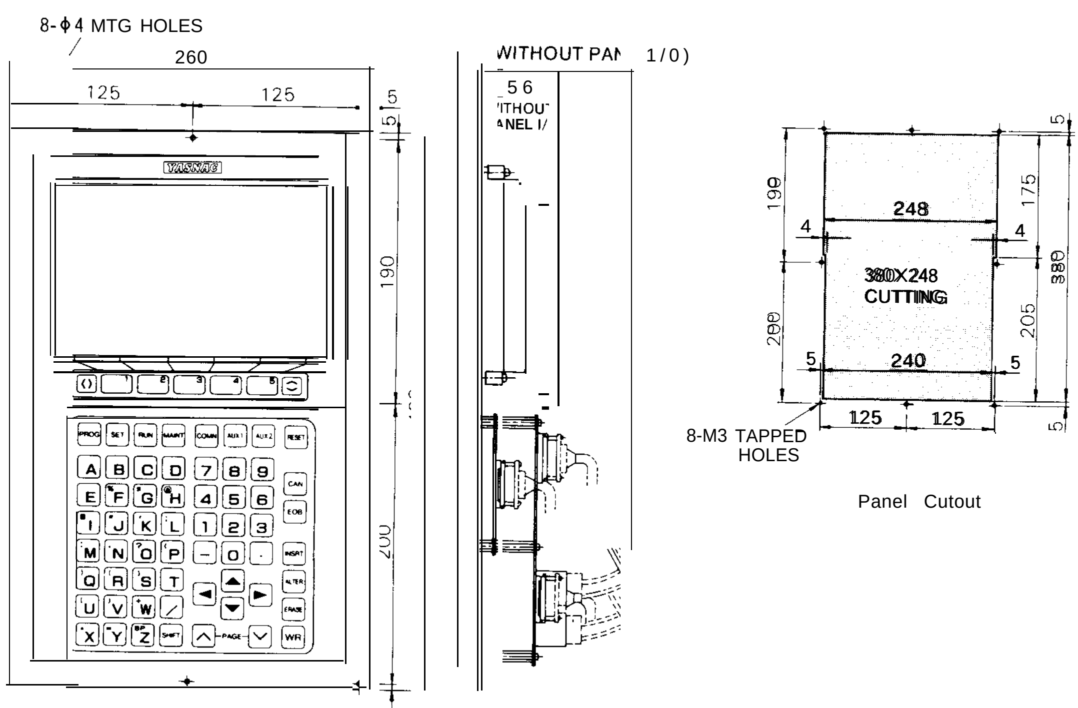
(11) AMGC (Horizontal EL) Operator's Station with Keyboard

- Type JZNC-IOP04□



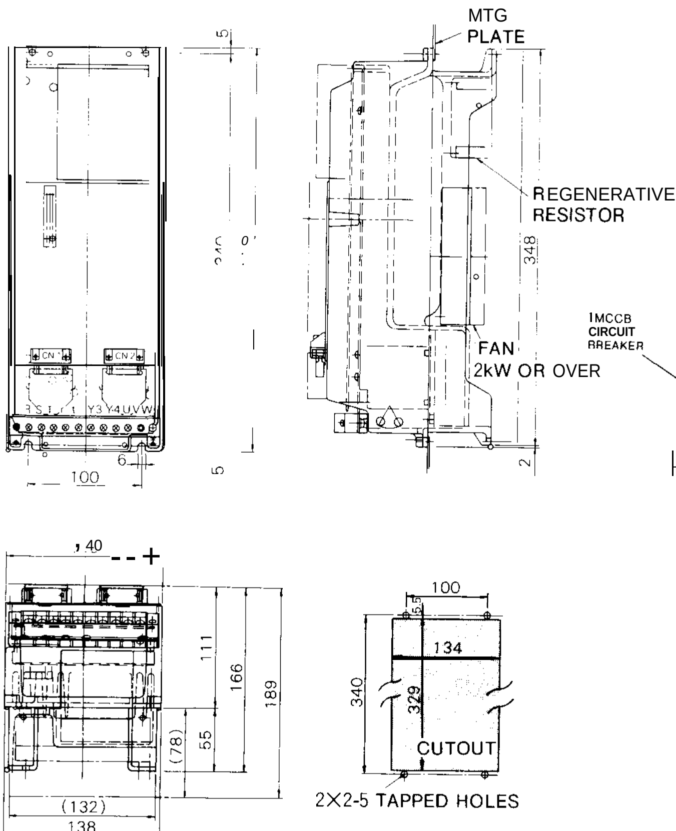
(12) **AMGC (Vertical EL) Operator's Station with Keyboard**

- Type JZNC-IOP06□



(13) **AC Servo Units (for I-Axis)**

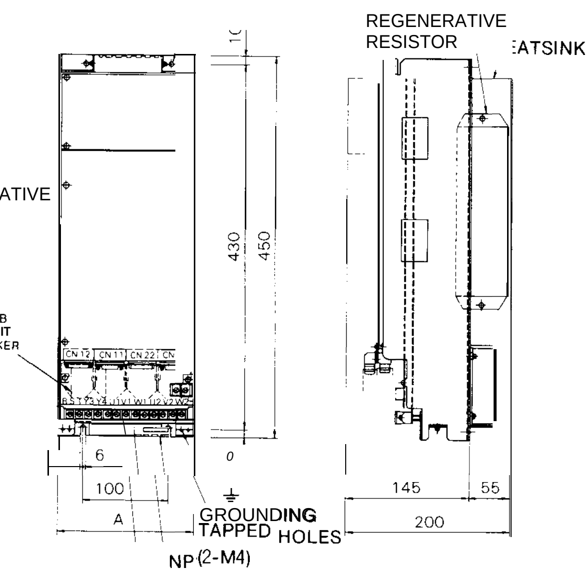
• Type CACR-IR05 to 44SC

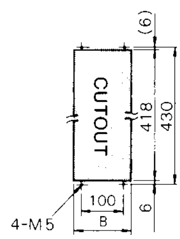


Panel Cutout

(14) **AC Servo Units (for 2-Axis)**

• Type CACR-IR□□C



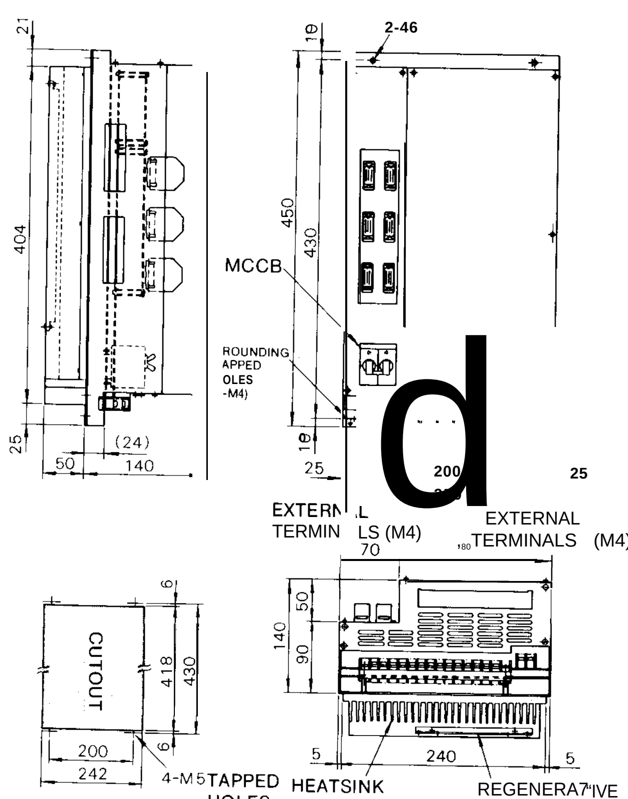


	A	B
CACR-IR0505C CACR-IR1010C CACR-IR2020C	160	140
CACR-IR3030C	200	200

Panel Cutout

(15) **AC Servo Units (for 3-Axis)**

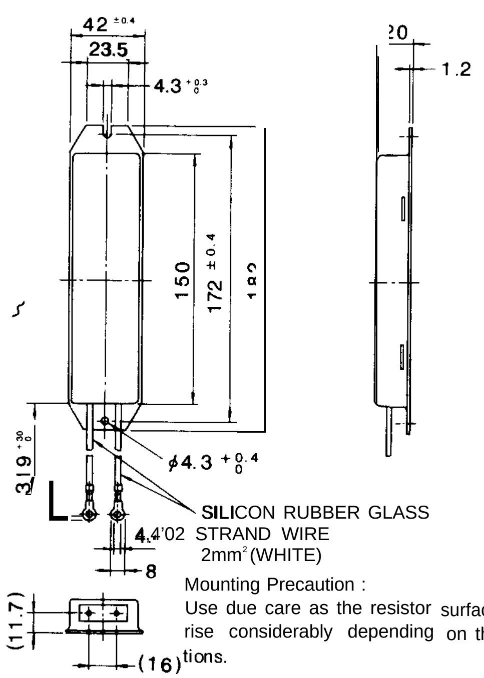
• Type CACR-IR□□□C



Panel Cutout

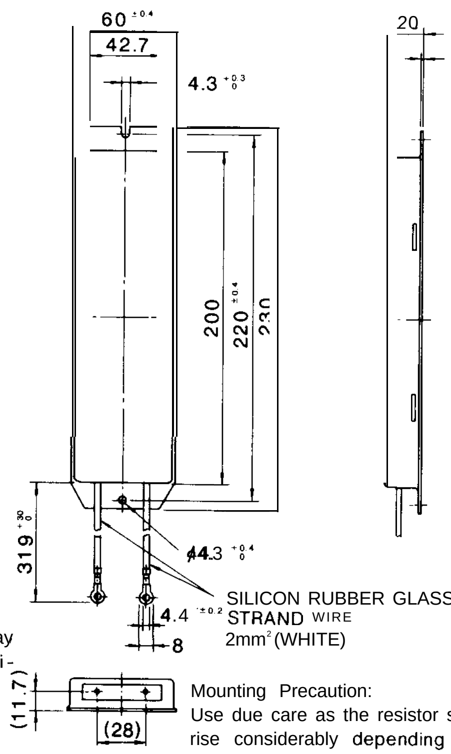
(16) Regenerative Resistors

• Type MRC-12



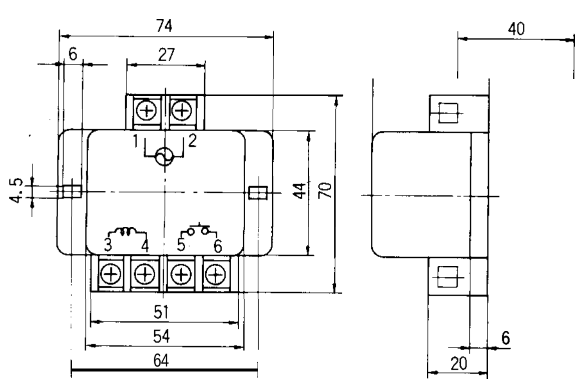
Mounting Precaution :
Use due care as the resistor surface temperature may rise considerably depending on the operating conditions.

• Type MRC-22

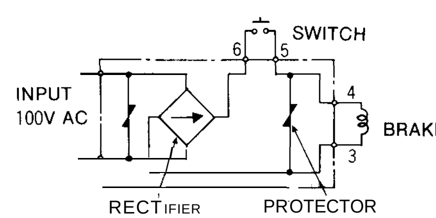


Mounting Precaution:
Use due care as the resistor surface temperature may rise considerably depending on the operating conditires.

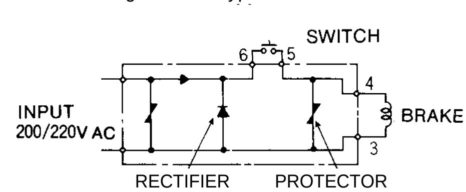
(17) Power Supply Unit for Brake Types OPR109F, OPR1 09A



Circuit Diagram of Type OPR109F



Circuit Diagram of Type OPR1 09A

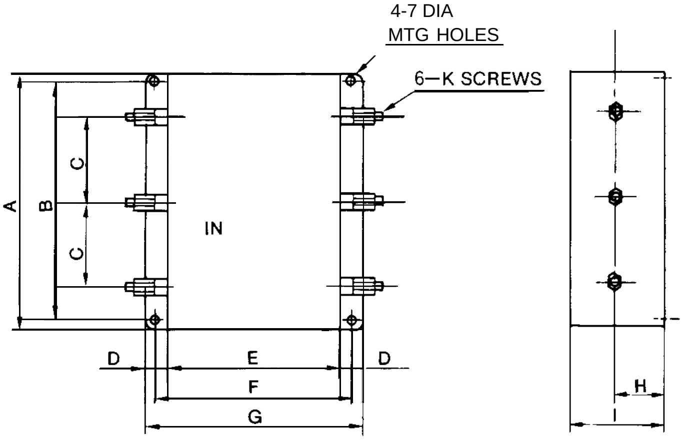


Note:

1. Do not short-circuit output terminals Nos. 3 and 4.
2. Tightly fasten the screws of the terminal blocks.
3. Contains a protective device, Additional external protective devices are not necessary.
4. The making and braking current of the contact for terminal Nos. 5 and 6 must be 5 to 10 times the rated current of the brake to be used. The contacts should be for DC make and break.

Type	Rectifier System	Frequency Hz	AC Input Voltage V	DC Output Voltage V	DC Output Current A	Approx Weight kg
OPR-1 09A	Single-phase half wave	50/60	200	90	1	0.1
OPR-109F	Single-phase full wave	50/60	100	90	1	0.1

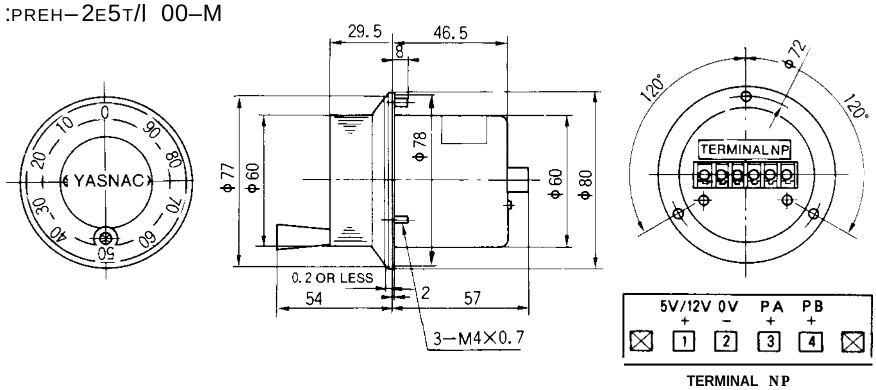
(18) **Noise Filter**

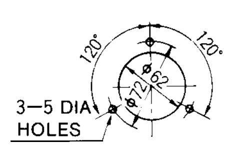


Type	A	B	c	D	E	F	G	H	I	J	K	Approx Weight
LF31 o	180	170	60	25	120	135	150	35	65	4.5	M4	1.9 kg
LF320	180	170	60	29	120	135	150	35	65	4.5	M6	2.4 kg
LF330	180	170	60	29	120	135	150	35	65	4.5	M6	2.4 kg
LF340	180	160	50	30	200	220	240	40	80	6.5	M6	5 kg
LF350	180	160	50	30	200	220	240	40	80	6.5	M5	5 kg
LF360	200	180	60	30	300	320	340	50	100	6.5	M6	7 kg

(19) **Manual Pulse Generators**

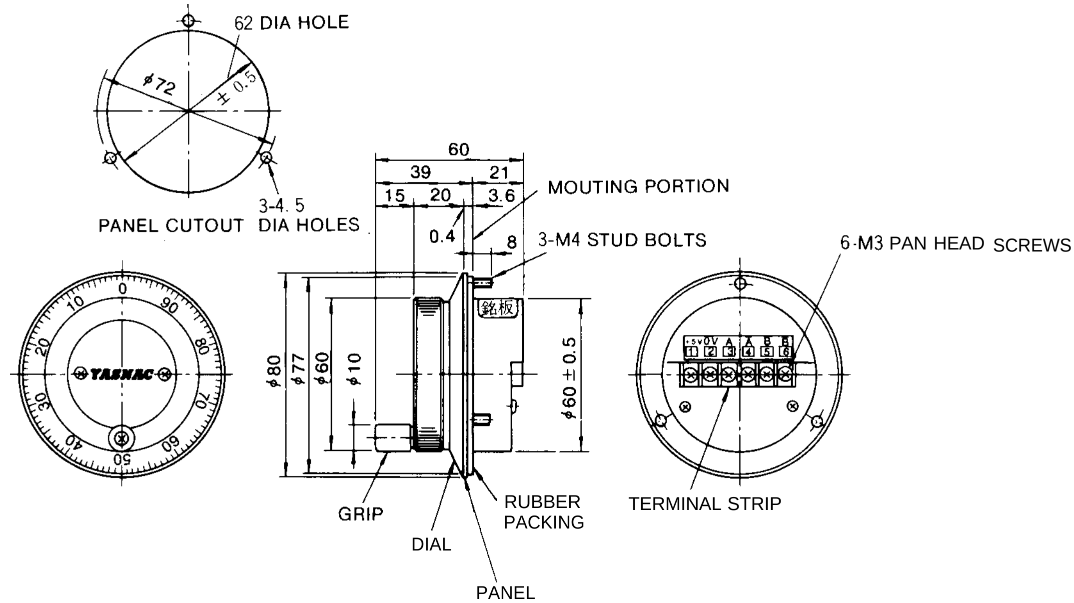
Type :PREH–2E5T/I 00–M



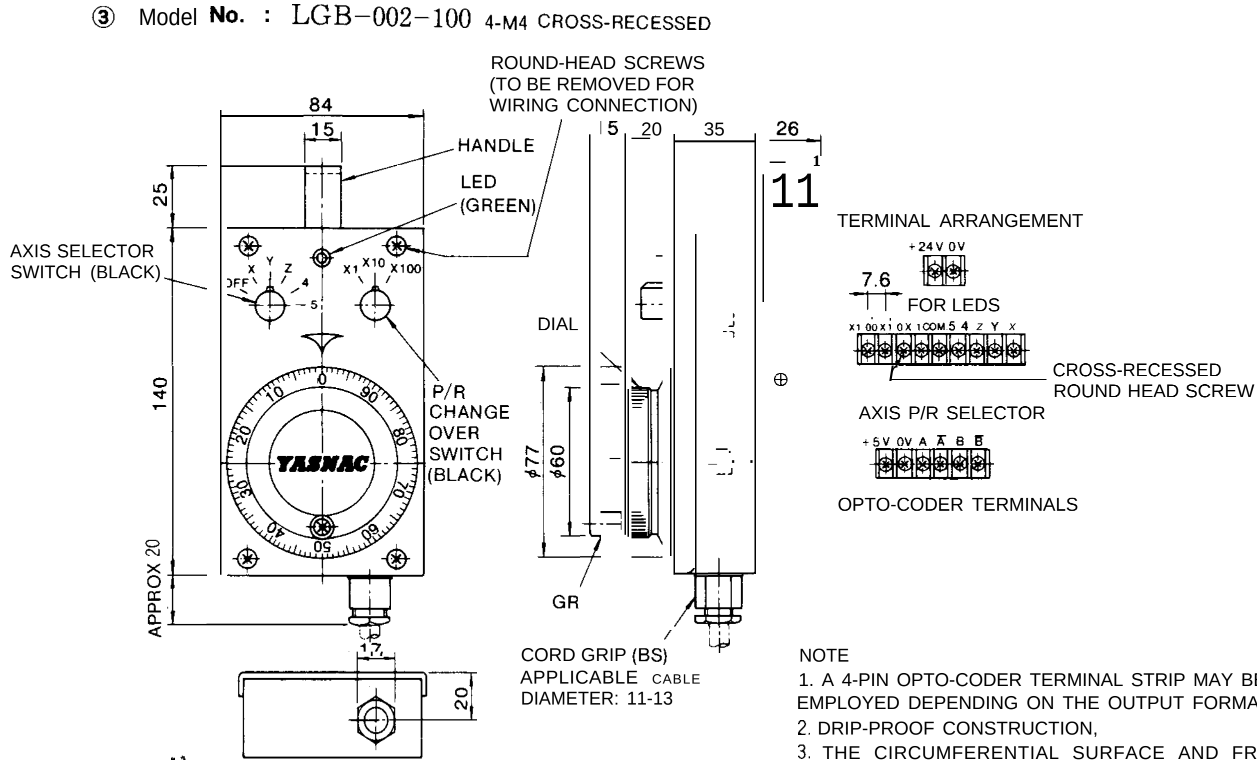


Mtg. Hole
Drilling Plan

② Model No.: LGF-011-100



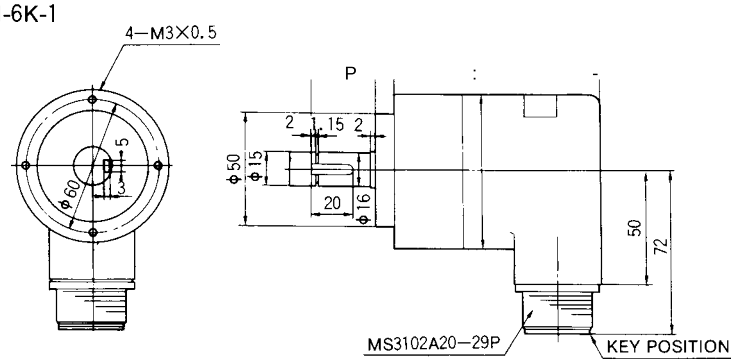
③ Model **No.** : LGB-002-100



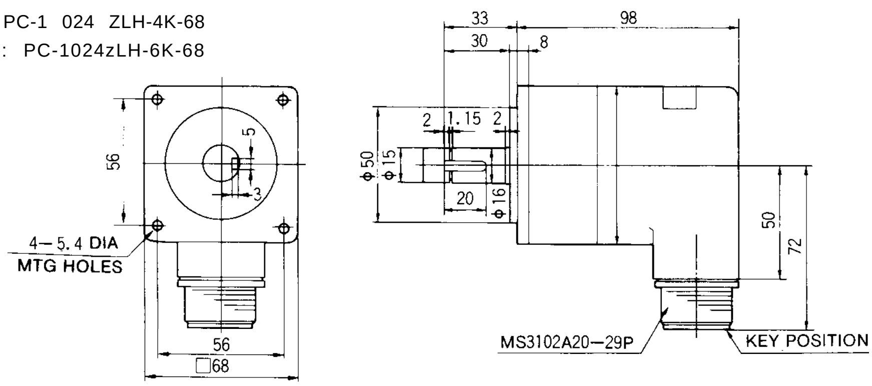
NOTE
1. A 4-PIN OPTO-CODER TERMINAL STRIP MAY BE EMPLOYED DEPENDING ON THE OUTPUT FORMAT.
2. DRIP-PROOF CONSTRUCTION,
3. THE CIRCUMFERENTIAL SURFACE AND FRONT PANEL SURFACE ARE FIN ISHED BY COATING COLOR : MU NSELL N7.5.
4 WEIGHT: APPROX. 650 G.

(20) Manual Pulse Generators

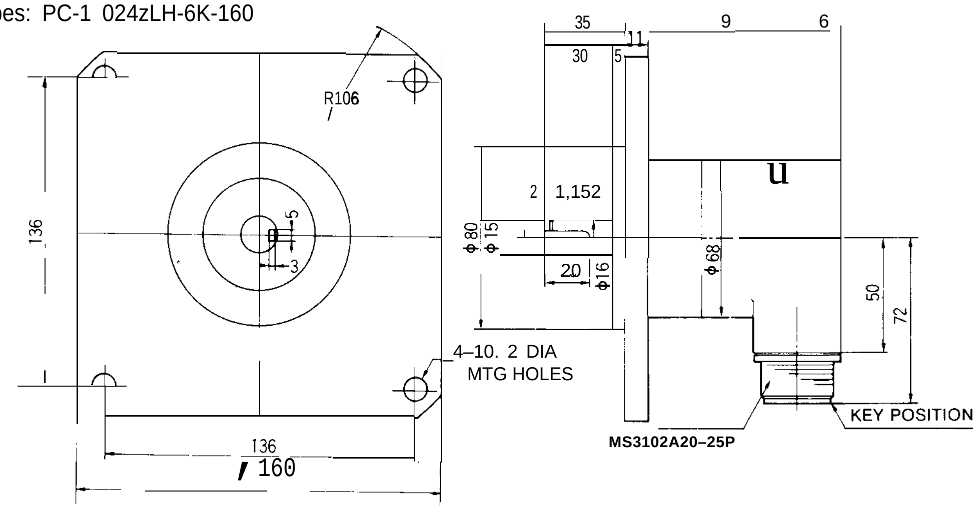
Types: PC-1024 ZLH-4K-1
Types: PC-1 024 ZLH-6K-1



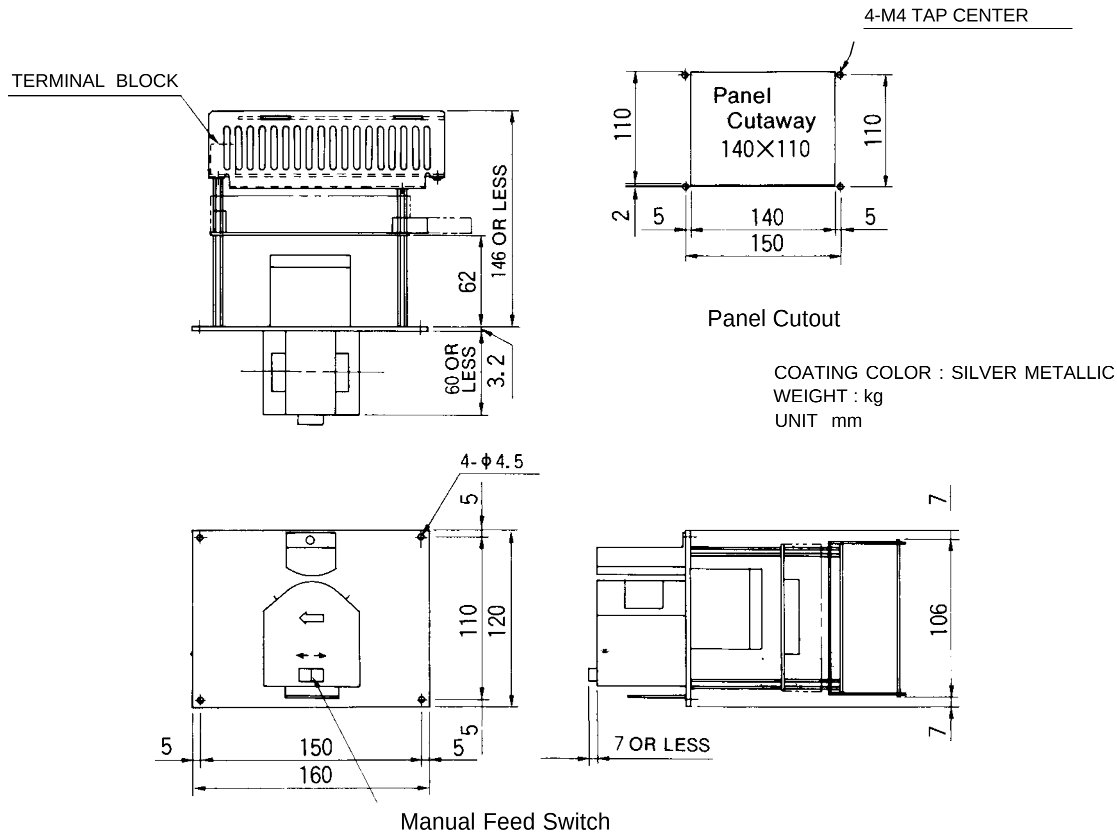
Types: PC-1 024 ZLH-4K-68
Types : PC-1024zLH-6K-68



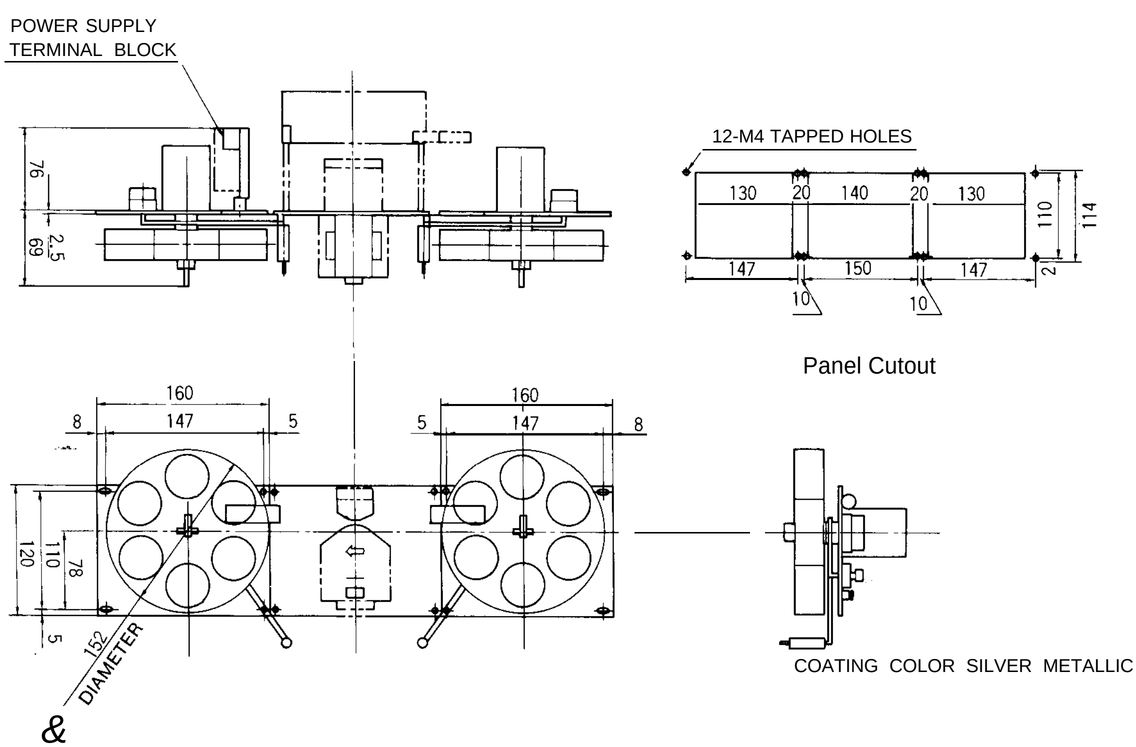
Types: PC-1 024 ZLH-4K-160
Types: PC-1 024zLH-6K-160



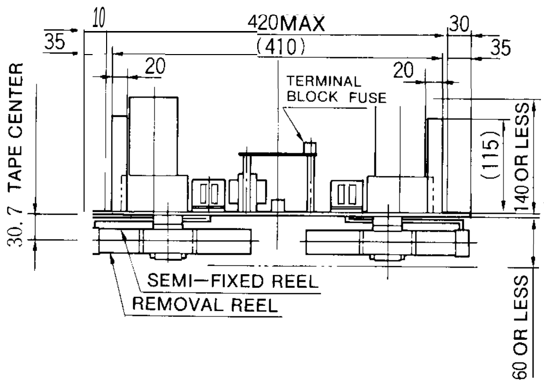
(21) Tape Reader (Power Supply Incorporated Type)

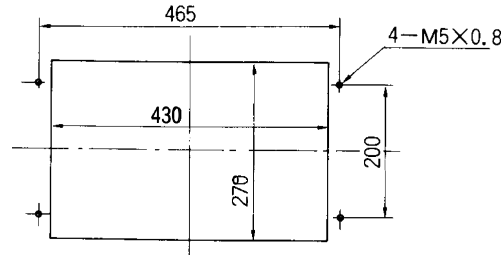


(22) Tape Handler (6-Inch) (Type 1500)

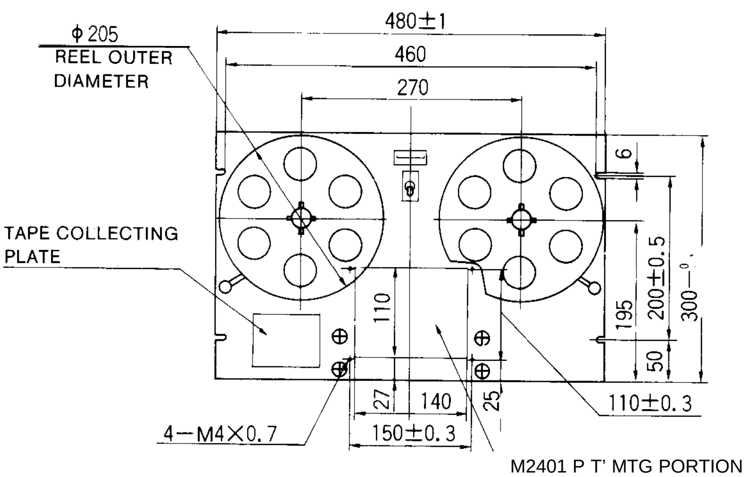


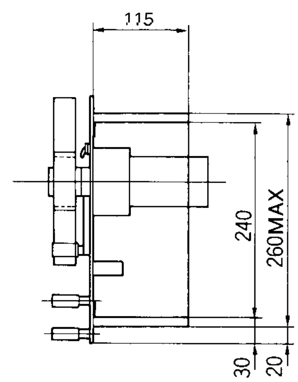
(23) Tape Handler (8-inch) (Type 1402-1)





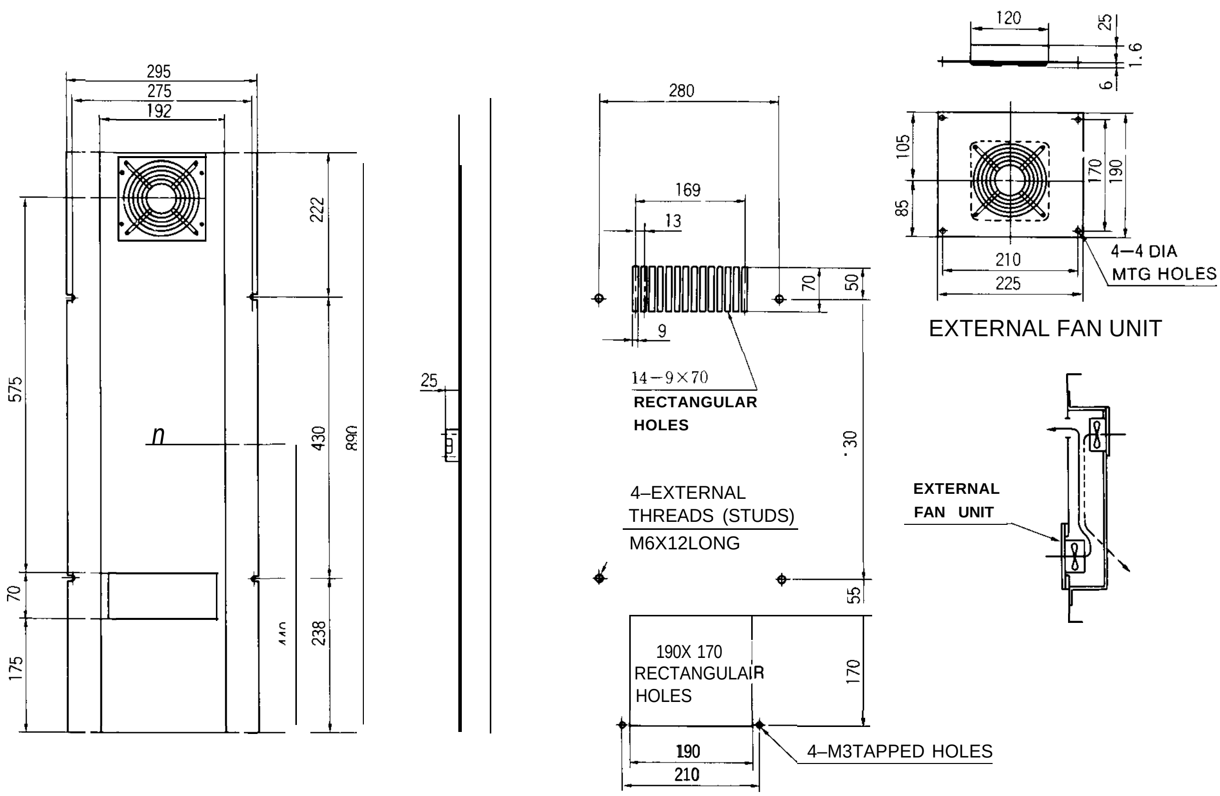
Panel Cutout





(24) **Heat Exchanger**

(a) Type REX1550

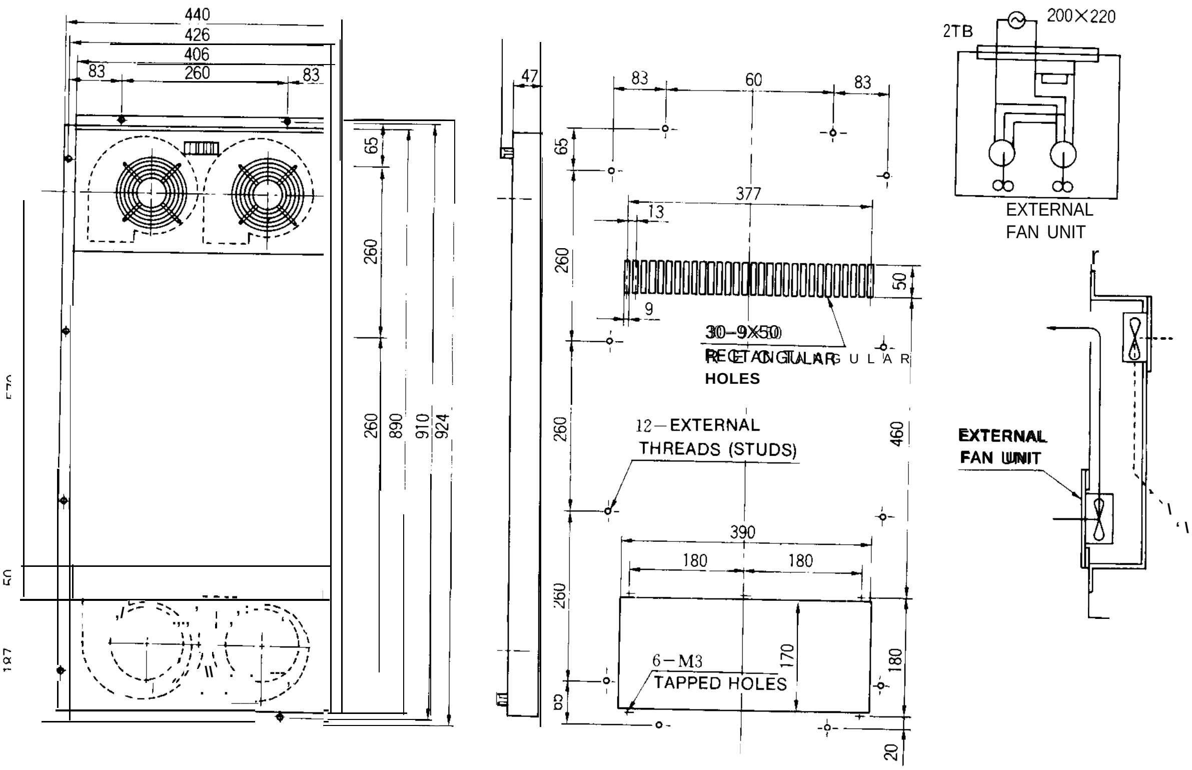


Panel Cutout

Note :

1. Fanpower supply :200/220VAC
2. External fan mounting plate is not furnished to the heat sink. Machine fool maker should provide the plate.

(b) HEATEX 02



Dimension Diagram

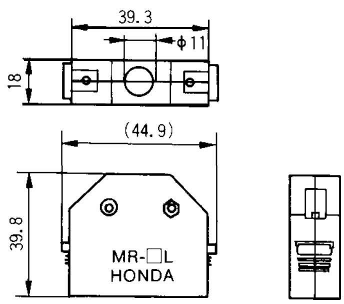
Panel Cutout

Note :

1. Fan power supply is 200/220 VAC and connect the power lines to the second of the terminal 1 TB and the third of 2TB.
2. External fan mounting plate is not furnished to the heat sink. Machine tool maker should provide the plate.
3. The following parts are accessories for the external fan unit.
   - Fan motors (two)
   - Capacitors for starting the motor (two)
   - Fan guards (two)

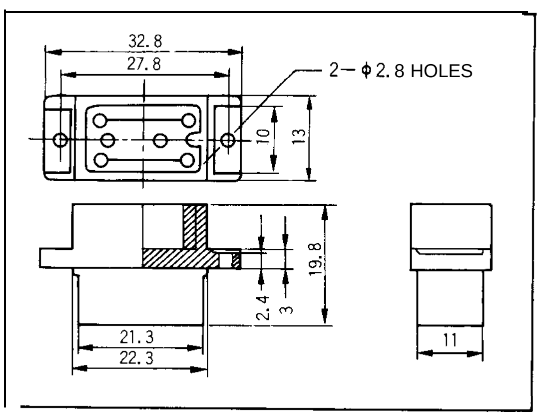
(25) **Connector**

" **MR-20L**

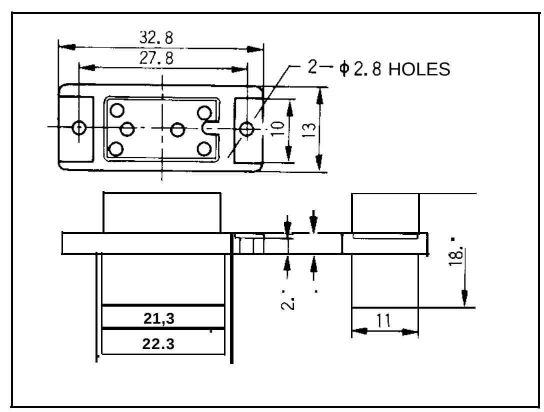


Note: Spring-lock and/or Screw-lock are possible.

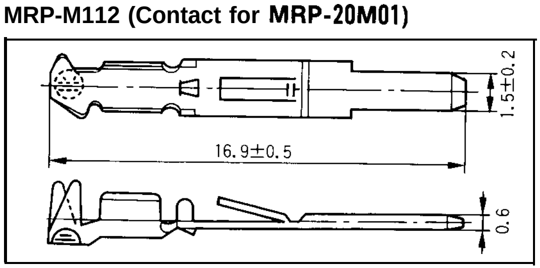
" **MRP-20M01**



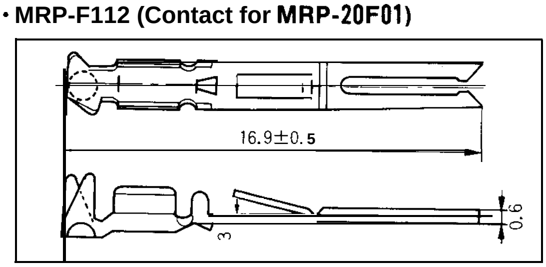
" **MRP-20F01**



. **MRP-M112 (Contact for MRP-20M01)**

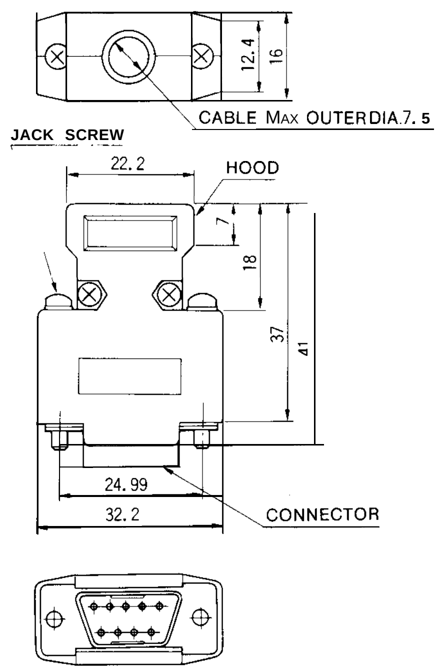


• **MRP-F112 (Contact for MRP-20F01)**



Press-fitting KP-308(Made by Honda Tsusin K, K,)

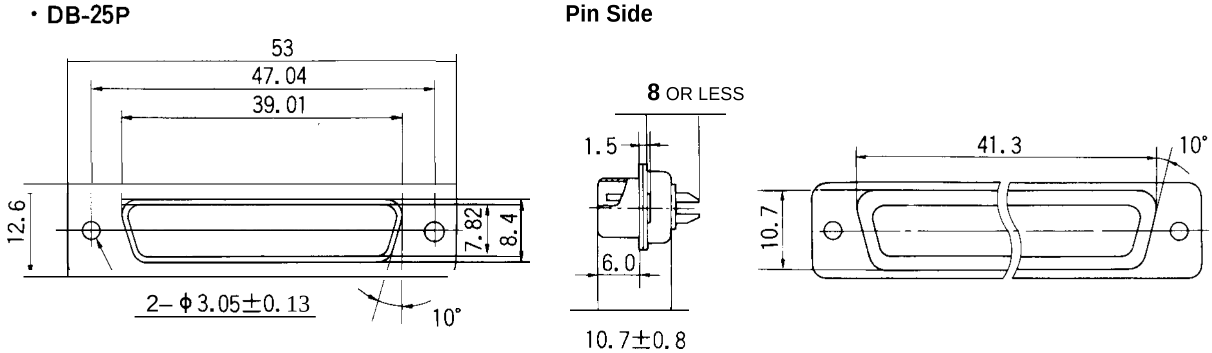
• 17JE-23090-02 (D8B)



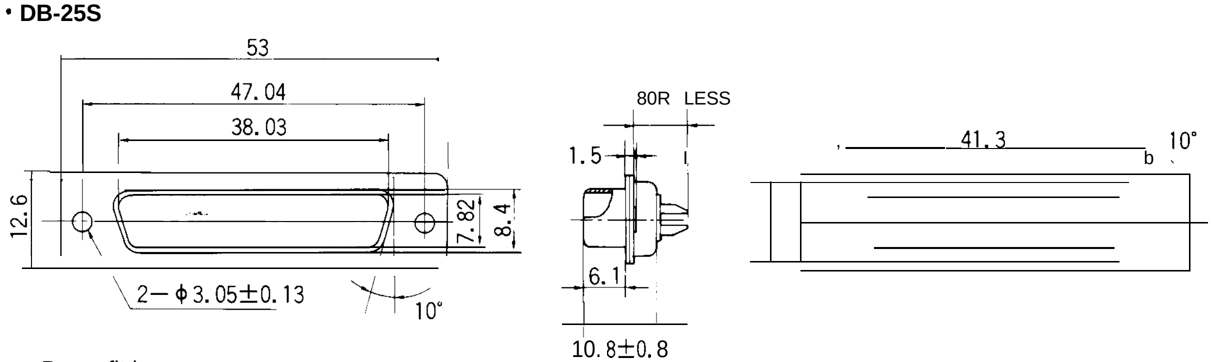
(Made by Dai-ichi Electronics K. K.)

• DB-25P

Pin Side



• DB-25S



Press-fitting
(Made by Japan Koku Densi Kogyo K. K.)

APPENDIX 2 RATINGS AND SPECIFICATIONS OF AC SERVO DRIVES

A2. 1 RATINGS AND SPECIFICATIONS

(1) Servomotor

Table A2. 1 Rating and Specifications of F Series AC Servomotors

			02AS	03AS	05AS	09AS	13AS	20AS	30AS	44AS
Motor USAGED-			02AS	03AS	05AS	09AS	13AS	20AS	30AS	44AS
Servopack CACR-IR			05SC	05SC	05SC	10SC	15SC	20SC	30SC	44SC
Servomotor	Rated Output*	kW	0.15	0.3	0.45	0.85	1.3	1.8	2.9	4.4
	Rated Torque*	N・m	0. 98	1. 96	2. 84	5. 39	8. 34	11. 5	18. 6	28. 4
		(kgf . cm)	10	20	29	55	85	117	190	290
	Instantaneous Peak Torque*	N・m	2. 91	5. 83	8. 92	13. 3	23. 3	28. 0	45. 1	66. 3
		(kgf . cm)	29. 7	59. 4	91	136	238	286	460	676
	Rated Speed*	r/rein	1500							
	Max Speed*	r/rein	3000							
	Rotor Inertia [J M]	$[\frac{GD^2}{4}]$ kg·m^2	1. 3 $\times10^{-4}$	2. 06 $\times10^{-4}$	13. 5 $\times10^{-4}$	24. 3 $\times10^{-4}$	36. 7 $\times10^{-4}$	58 $\times10^{-4}$	110 $\times10^{-4}$	143 X10-^{4}
		(gf・・cm·s^2)	1. 33	2. 1	13. 8	24. 8	37. 4	59	112	146
	Power Rate*	kW/s	7.4	18.3	6. 0	12:	18.9	22. 7	36.5	57
	Speed・Positioning Detector		Absolute encoder (8192P/R)							
	Common Specifications		Time rating : Continuous Insulation : Class F Ambient temperature :0 to + 40 ‘C Vibration : V15 Enclosure : Totally-enclosed, self-cooled Finish in Munsell Notation: N1. 5 Drive method : Direct drive Excitation: Permanent magnet Mounting: Flange-mounted							

∗ Values when servomotor is combined with Servopack and the armature winding temperature is 20 ‘C. Shown are normal (TYP) values above.

(2) Servopack

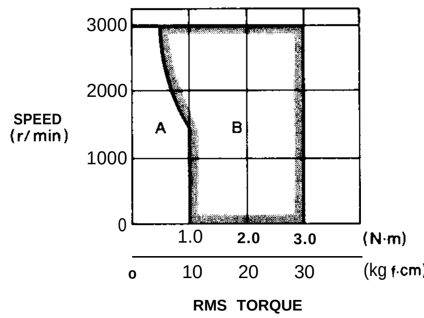
Table A2.2 Servopack Ratings and Specifications

	Motor USAGED-		02 AS	03 AS	05 AS	09 AS	13 AS	20 AS	30 AS	44 AS
	Servopack CACR-IR		05SC	05SC	10SC	10SC	15SC	20 SC	30 SC	44 SC
Servopack / Basic Specifications	Input power	Main circuit	3-phase 200 to 230VAC (+10 to – 15 %), 50/60Hz							
		Control circuit	Single-phase 200 to 230VAC (+10 to – 15%), 50/60Hz							
	Continuous output current A (rms)		3	3	3.8	7.6	11.7	19	26	33
	Maximum output current A (rms)		8.5	8.5	11	17	28	42	56.5	70
	Control system		Transistorized PWM control							
	Feedback		Absolute encoder (8192P/R)							
	Environmental Conditions	Operating temperature	0 to +55℃							
		Storage temperature	–20 to +85℃							
		Operating/storage humidity	90% RH or less (non-condensing)							
		Vibration shok resistance	0.5G/2G							
	Construction		Base-mounted							
Performance	Speed control range		1:5000							
	Speed regulation	Load variation	0 to 100% : –0.01 % or less (at rated speed)							
		Voltage regulation	+10 to –15% : 0%							
		Temperature variation	25±25℃ : ±0.1% or less (at rated speed)							
	Frequency characteristics		100 Hz (at $J_L = J_M$)							
I/O Signals	Speed command	Rated command voltage	±6 V DC (Forward run upon positive command) at rated speed							
		Input impedance	Approx. 30 kΩ							
		Circuit time constant	Approx. 70 μs							
	Auxiliary input	Rated command voltage	±2 to ±10 V DC (Forward run upon positive command) at rated speed							
		Input impedance	Approx. 30 k Ω							
		Circuit time constant	Approx. 70 μs							
	Built-in command power supply		±12V DC ± 5%, ±30mA output							
	Position (PG pulse) output									
		Output format	Line driver (phase A, phase B, phase C, position data)							
		Division ratio	(1-8192) 8192 "							
	Sequence input signals		Servo ON, P operation (torque control, zero clamp), Forward run prohibit (P-OT), reverse run prohibit (N-OT), alarm reset, SEN signal							
	Sequence output signals		Current limit detection state, TGON, servo ready, servo alarm, alarm serial data							
	External current limitation		The setting can be varied from 0 to the ±maximum current rating independently for P and N sides (3 V/100% current)							
Built-in functions	DB function		The built-in automatic DB operates upon main power OFF, servo alarm condition occurrence, servo OFF, or overtraveling							
	Regeneration		Built-in regenerative resistor							
	Allowable load inertia		Up to five times the rotor inertia							
	Overtravel Prevention		The DB stop upon P-OT or N-OT activation							
	Protective. functions		Communication failure, overcurrent, MCCB trip, regeneration failure, overvoltage, overspeed, undervoltage, overload, zero point return failure, A/D conversion failure, runaway (malfunction open circuit), open-phase, CPU failure							
	Display		5digit 7-segment LED indecator (alarm, status, and parameter display)							
	Monitor		Speed : 2V ± 5 %/1000 r/rein ; torque: 3V± 10%/100% torque							
	Other functions		Torque control, zero clamp, soft start, brake interlock, reverse run connection							
Option			Holding brake attached							

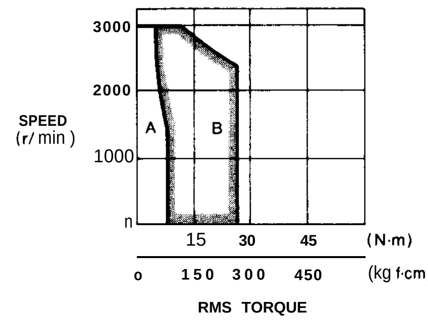
(3) Speed Torque Characteristics

（注）□ : Continuous Duty Zone
□ : Intermittent Duty Zone

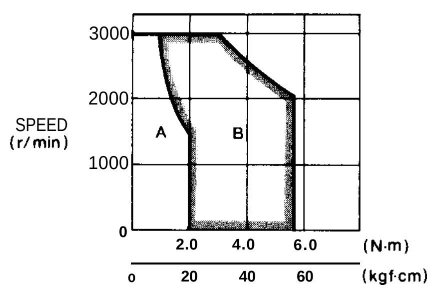
USA GE D–02A



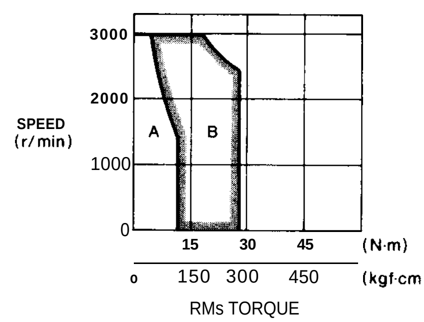
USA GE D-13A



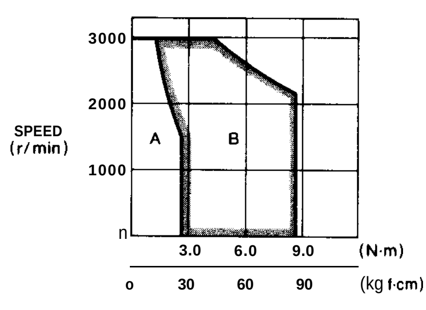
USA GE D-03A



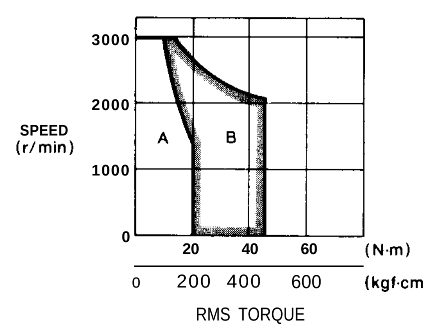
USA GE D−20A



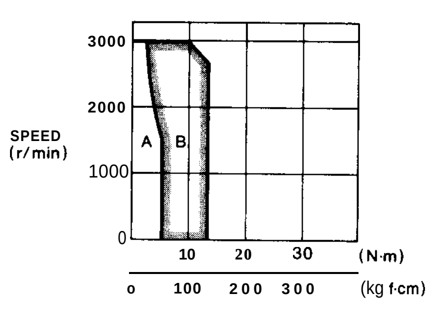
USA GE D−05A



USA GE D-30A



USA GE D−09A



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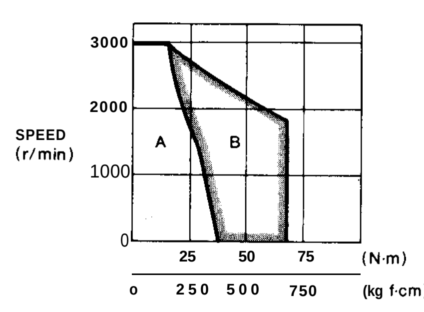


A2 TPYE DESIGNATION

A2. 1 AC SERVOMOTORS

USAGE D-05AS

AC SERVOMOTOR

SERIES
- AM : M Series
- AF : F Series
- AG : G Series

ENCLOSURE
- E : Totally-enclosed Self-cooled Type

MAGNET TYPE
- D : Ferrite
- M : RareEarth

MOTOR OUTPUT *1

DESIGN REVISION ORDER (A, B, C .)

With absolute encoder

SHAFT TYPE
- 1 : Taper
- 2 : Straight

DRIVE END SPECIFICATIONS
- Blank : Standard
- O : Standard (With Brake at opposite-drive end)
- K : With Keyway
- S : With Oil Seal
- T : With Keyway & Oil Seal

OPPOSITE-DRIVE END SPECIFICATIONS
- Blank : Standard
- B : With Brake (For S Series)
- E : With Brake (For M, F, and G Series)

*1

	G Series
02	0.15 kW
03	0.3 kW
05	0.45 kW
09	0.85 kW
13	1.3 kW
20	1.8 kW
30	2.9 kW
44	4.4 kW

(2) Servopack

CACR- IR 05 SC

- AC SERVOPACK
- CONTROL METHOD
  IR : YASNAC
- CAPACITY* 2
- ENCLOSURE
  S : Duct-Ventilation
- DESIGN REVISION ORDER
  (A, B, C ······)

*2

	G Series
05	0.15 kW
	0.3 kW
	0.45 kW
10	0.85 kW
15	1.3 kW
20	1.8 kW
30	2.9 kW
44	4.4 kW

A3. LIST OF STANDARD COMBINATION

Table A3. 1 Combination of G Series Servomotor, Servopack and Associated Units

Servopack Type	Applicable Servomotor Type	Regenerative Resistor	Power Capacity per Servopack kVA	Current Capacity per MCCB or Fuse A	Applicable Noise Filter	Recommended Noise Filter Type	Recommended Noise Filter Specifications	Power ON/OFF Switch
CACR-IR05SC	USAGED-02AS1 USAGED-03AS1 USAGED-05AS1	MRC-12	1.1	5		LF-305	3-Phase 200 VAC class, 5A	HI-15E2 (rated 30A) or equivalent (made by YASKAWA)
CACR-IR1OSC	USAGED-09AS1	MRC-12	2.1	8	Good	LF-315	3-phase 200 VAC class, 15A	
CACR-IR15SC	USAGED-13AS2	MRC-12	3.1	10		LF-315		
CACR-IR20SC	USAGED-20AS2	MRC-22	4.1	12	Poor	LF-320	3-Phase 200 VAC class, 20A	HI-18E2 (rated 35A) or equivalent made by YASKAWA)
CACR-IR30SC	USAGED-30AS2	MRC-22 *	6.0	18		LF-330	3-phase 200 VAC class, 30A	
CACR-IR44SC	USAGED-44AS2	MRC-22 *	8.0	24		LF-340	3-phase 200 VAC class, 40A	

* Two-parallel connection

Table A3. 2 Specifications of G Series Servomotor

Servopack Type	Applicable Servomotor Type	Motor: Receptacle Type	Motor: L-type Plug	Motor: Straight Plug	Motor: Cable Clamp
CACR-IR05SC	USAGED-02AS1	MS3102A 14S-2P	MS3108B 14S-2S	MS3106B 14S-2S	MS3057 -6A
	USAGED-03AS1				
	USAGED-05AS1	MS3102A18 -10P	MS3108B18 -10s	MS3106B18 -10s	MS3057 -10A
CACR-IR1OSC	USAGED-09AS1	MS3102A18 -10P	MS3108B18 -10s	MS3106B18 -10s	MS3057 -10A
CACR-IR15SC	USAGED-13AS2	MS3102A18 -10P	MS3108B18 -10s	MS3106B18 -10s	MS3057 -10A
CACR-IR20SC	USAGED-20AS2	MS3102A22 -22P	MS3108B22 -22s	MS3106B22 -22s	MS3057 -12A
CACR-IR30SC	USAGED-30AS2	MS3102A22 -22P	MS3108B22 -22s	MS3106B22 -22s	MS3057 -12A
CACR-IR44SC	USAGED44AS2	MS3102A22 -22P	MS3108B22 -22s	MS3106B22 -22s	MS3057 -12A

When plugs or clamps are required, contact Yaskawa representative.
Two connection methods are available : soldered type (type MS) and solderless type (type JA)

Table A3. 3 Specifications of Detectors for G Series Servomotors

Servopack Type	Applicable Servomotor Type	Detector			
		Receptacle Type	L-type Plug	Straight Plug	Cable Clamp
CACR-IR05SC	USAGED-02AS1 USAGED-03AS1 USAGED-05AS1	MS3102A2O -29P	MS3108B2O -29S	MS3106B2O -29S	MS3057 -12A
CACR-IR1OSC	USAGED-09AS1	MS3102A2O -29P	MS3108B2O -29S	MS3106B2O -29S	MS3057 -12A
CACR-IR15SC	USAGED-13AS2	MS3102A2O -29P	MS3108B2O -29S	MS3106B2O -29S	MS3057 -12A
CACR-IR20SC	USAGED-20AS2	MS3102A2O -29P	MS3108B2O -29S	MS3106B2O -29S	MS3057 -12A
CACR-IR30SC	USAGED-30AS2	MS3102A2O -29P	MS3108B2O -29S	MS3106B2O -29S	MS3057 -12A
CACR-IR44SC	USAGED-44AS2	MS3102A2O -29P	MS3108B2O -29S	MS3106B2O -29S	MS3057 -12A

Table A3. 4 Specifications of Holding Brakes for G Series Servomotors (Optional)

Servopack Type	Applicable Servomotor Type	Motor + Holding Brake			
		Receptacle Type	L-type Plug	Straight Plug	Cable Clamp
CACR-IR05SC	USAGED-02AS1	MS3102A 14S-6P	MS3108B 14S-6S	MS3106B 14S-6S	MS3057 -6A
	USAGED-03AS1				
	USAGED-05AS1	MS3102A2O -15P	MS3108B2O -15s	MS3106B2O -15s	MS3057 -12A
CACR-IR1OSC	USAGED-09AS1	MS3102A2O -15P	MS3108B2O -15s	MS3106B2O -15s	MS3057 -12A
CACR-IR15SC	USAGED-13AS2	MS3102A2O -15P	MS3108B2O -15s	MS3106B2O -15s	MS3057 -12A
CACR-IR20SC	USAGED-20AS2	MS3102A24 -1OP	MS3108B24 -10s	MS3106B24 -10s	MS3057 -20A
CACR-IR30SC	USAGED-30AS2	MS3102A24 -1OP	MS3108B24 -10s	MS3106B24 -10s	MS3057 -20A
CACR-IR44SC	USAGED44AS2	MS3102A24 -1OP	MS3108B24 -10s	MS3106B24 -10s	MS3057 -20A

A4. CHARACTERISTICS

A4. 1 OVERLOAD CHARACTERISTICS

The overload protective circuit built in YASNAC prevents the motor and Servopack from overload and restricts the allowable conduction time of Servopack.(See Fig. A4. 1.)

The overload detection level is determined precisely with the hot start conditions of ambient temperature 55°C and cannot be changed.

NOTE

Hot start is the overload characteristics when the Servopack is operating at the rated load and thermally saturated.

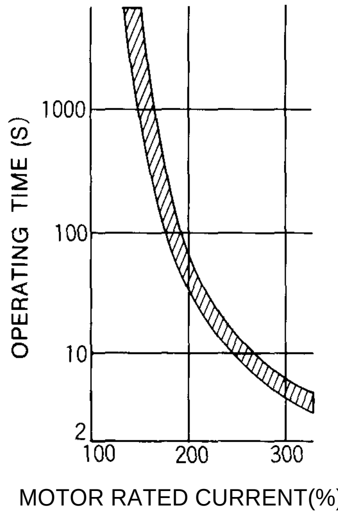


Fig. A4. 1 Overload Characteristics

A4. 2 STARTING AND STOPPING TIME

The starting time and stopping time of servomotor under a constant load is shown by the formula below. Viscous or friction torque of the motor is neglected.

Starting Time: $t_r = 104.7 \times \dfrac{N_R\,(J_M + J_L)}{Kt \cdot I_R \cdot (\alpha - \beta)}$ (ms)

Stopping Time : $t_f = 104.7 \times \dfrac{N_R\,(J_M + J_L)}{Kt \cdot I_R \cdot (\alpha + \beta)}$ (ms)

Where,

N_R: Rated motor speed (rpm)

$J_M (= GD_M^2/4)$: Motor moment of inertia
($kg \cdot cm^2 = lb \cdot in \cdot s^2 \times 10^{-3}$)

$J_L (= GD_L^2/4)$: Load moment of inertia
($kg \cdot cm^2 = lb \cdot in \cdot s^2 \times 10^{-3}$)

Kt : Torque constant of motor (N. m/A= lb · in/A)

I_R : Motor rated current (A)

$\alpha = I_P/I_R$: Acceleration/deceleration current constant

I_P : Acceleration/decelerattion current
(Acceleration/decelerattion current a times the motor rated current) (A)

$\beta = I_L/I_R$: Load current constant

I_L : Current equivalent to load torque
(Load current β times the meter rated current) (A)

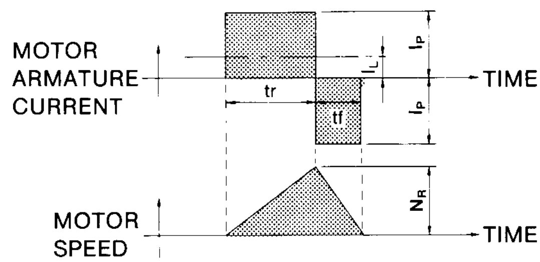


Fig. A4. 2 Timing Chart of Motor Armature Current and Speed

A4. 3 ALLOWABLE FREQUENCY OF OPERATION

The allowable frequency of operation is restricted by the servomotor and Servopack, and both the conditions must be considered for satisfactory operation.

- **Allowable frequency of operation restricted by the Sarvopack**

The allowable frequency of operation is restricted by the heat generated in the regenerative resistor in the Sarvopack, and varies depending on the motor types, capacity, JL, acceleration/deceleration current values, and motor speed. If the frequency of operation exceeds 60 time/min when $J_L = 0$ before the rated speed is reached, or if it exceeds $\frac{60}{m+1}$ cycles/rein when $J_L = J_M \times m$, COntaCt Yaskawa repreSentatiVe.

- **Allowable frequency of operation restricted by the Servomotor**

The allowable frequency of operation varies depending on the load conditions, motor running time and the operating conditions. Typical examples are shown below. See par. A4. 2 Starting and Stopping Time for symbols.

- **When the motor repeats rated-speed operation and being at standstill (Fig. A4. 3)**

Cycle time (T) Should be determined so that RMS value of motor armature current is lower than the motor rated current :

$$T \geqq \frac{Ip^2(tr+tf)+I^2_L ts}{I_R^2} \ (s)$$

Where cycle time (T) is determined, values Ip, tr, tf satisfying the formula above, should be specified.

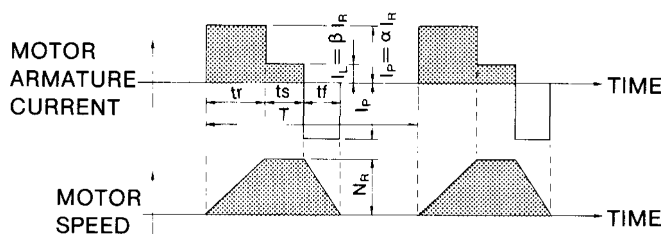


Fig. A4. 3 Timing Chart of Motor Armature Current and Speed

· When the motor remains at standstill between cycles of acceleration and deceleration without continuous rated speed running (Fig. A4. 4)

The timing chart of the motor armature current and speed is as shown in Fig. A4. 4, The allowable frequency of operation "n" can be calculated as follows :

$$n=286.5\times\frac{Kt\cdot I_R}{N_R\,(J_M+J_L)}\left(\frac{1}{\alpha}-\frac{\beta^2}{\alpha}\right)\ \text{(times/min)}$$

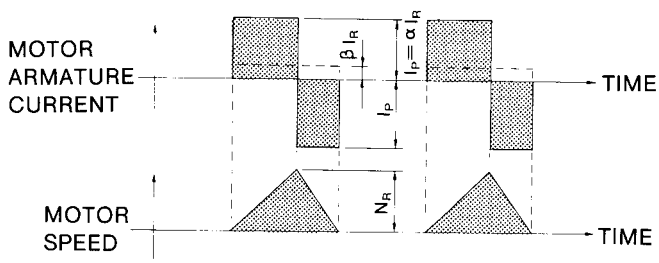


Fig. A4. 4 Timing Chart of Motor Armature Current and Speed

. When the motor accelerates, runs at constant speed, and decelerates in a continuing cycle without being at standstill (Fig. A4. 5)

The timing chart of the motor armature current and speed is as shown in Fig, A4. 5. The allowable frequency of operation "n" can be calculated as follows.

$$n=286.5\times\frac{\;}{N_R\,(J_M+J_L)}\left(\frac{1}{\alpha}-\frac{\beta^2}{\alpha}\right)\ \text{(times/min)}$$

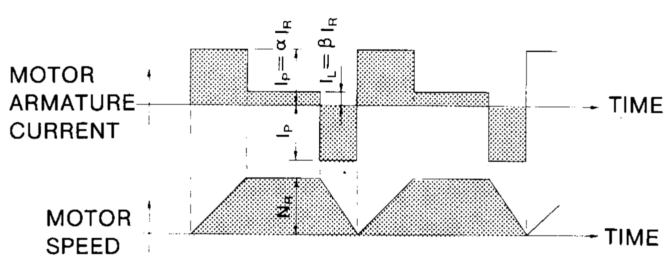


Fig. A4. 5 Timing Chart of Motor Armature Current and Speed

A4. 4 SERVOMOTOR FREQUENCY

In the servo drive consisting of Servopack and servomotor, motor speed amplitude is restricted by the maximum armature current controlled by Servopack.

The. relation between motor speed (N) and frequency (f) is shown by the formula below:

$$N=1.52\times\frac{\alpha\cdot I_R\cdot Kt}{(J_M+J_L)\,f}\ \text{(rpm)}$$

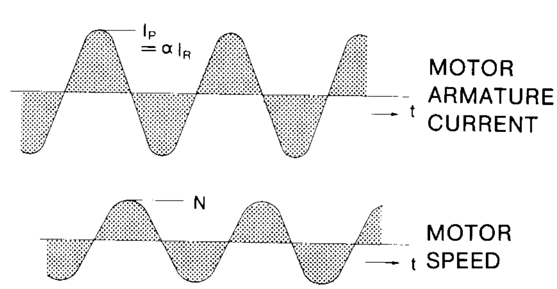


Fig. A4. 6 Timing Chart of Motor Armature Current and Speed

A4. 5 MOTOR MECHANICAL CHARACTERISTICS

A4. 5.1 Mechanical Strength

AC servomotors can carry up to 300% of the rated momentary maximum torque at output shaft,

A4. 5.2 ALLOWABLE RADIAL LOAD AND THRUST LOAD

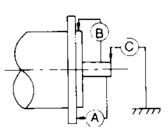
Table A4. 1 G Series Allowable Radial Load and Thrust Load

Motor Type	Allowable Radial Load (kg)	Allowable Thrust Load (kg)
USAGED-05AS1	50	10*
USAGED-09AS1	50	10*
USAGED-13AS2	70	35
USAGED-20AS2	150	50
USAGED-30AS2	150	50
USAGED-44AS2	150	50

* If excessive load is applied, the motor cannot rotate

A4. 5.3 Mechanical Specifications (G Series)

Table A4. 2 Mechanical Specifications in mm

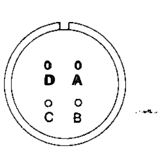
Accuracy (T, 1. R.)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0. 04	
Flange diameter concentric to shaft Ⓑ	0. 04	
Shaft run out Ⓒ	0.02	

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

A4. 5.4 Direction of Rotation

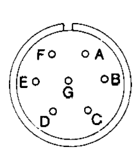
AC servomotors rotate counterclockwise viewed from drive end when motor and detector leads are connected as shown below.

(1) Connector Specifications



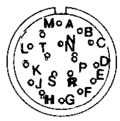
(a) Motor receptacle

A	Phase U
B	Phase V
C	Phase W
D	Ground



(b) With Brake

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



(b) Detector receptacle

A	Channel A output	J	F. G
B	Channel $\overline{A}$ output	K	
c	Channel B output	L	
D	Channel $\overline{B}$ output	M	
E	Channel Z output	N	
F	Channel $\overline{Z}$ output	P	
G	0 V	R	Reset
H	5 V (Power Supply)	s	O V (Battery)
		T	+3. 6 V (Battery)

A4. 5.5 Shock Resistance

When mounted horizontally and exposed to vertical shock impulses, the motor can withstand up to two incidents with shock acceleration of 10G (Fig. A4. 7).

NOTE

A Precision detector is mounted on the opposite-drive end of AC servomotor. Care should be taken to protect the shaft from impacts that could damage the detector.

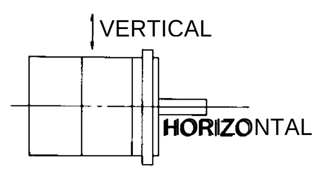


Fig. A4.7 Shock Resistance

A4. 5.6 Vibration Resistance

When mounted horizontally, the motor can withstand vibration (vertical, lateral, axial) of 2.5 G (Fig. A4. 8).

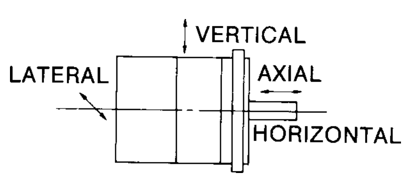


Fig. A4. 8 Vibration Resistance

A4. 5.7 Vibration Class

Vibration of the motor running at rated speed is 15 μm (V15) or below (Fig. A4. 9),

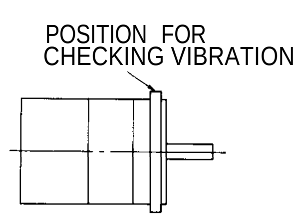


Fig. A4. 9 Vibration Checking

A5. PROTECTIVE CIRCUIT

A5. 1 PROTECTIVE FUNCTIONS

Servopack provides functions to protect the proper (Servopack) and motor from malfunctions.

(1) **Dynamic Brake Function**

Servopack incorporates a dynamic brake for emergency stop. This brake operates when :

- Alarm (fault detection) occurs.
- Servo ON command is opened.
- Main power supply is turned off.

Normally, this dynamic brake is not applied while the motor stops.

(2) **Trouble Detecting Functions**

Table A5. 1 Trouble Detecting Functions

Trouble	Detection
Overcurrent	Overcurrent flow in the main circuit (at 1. 2 times min. inst max current,)
Circuit Protector Trip	Circuit protecter tripped
Regeneration Trouble	Regenerative circuit not activated in Servopack.
Overvoltage	Excessively high DC voltage in the main circuit (approx 420V.)
overspeed	Excessively large speed reference input.
Voltage Drop	Low DC voltage in the main circuit after power ON. (150 V or less.)
overload	Overload condition of motor and Servopack.
Heat Sink Overheat	Overheat of heat sink (approx 85 “C min.)
open Phase	Any one phase open in three-phase power supply.
Overrun Prevention	Wrong wiring of motor circuit or PG signal line.
CPU Error	Any error of CPU
Absolute Control Error	Errors related to absolute encoder

(3) Overload (OL) Detection Level

Fig. A5. 1 shows the setting of overload detection level at 100% rated motor current.

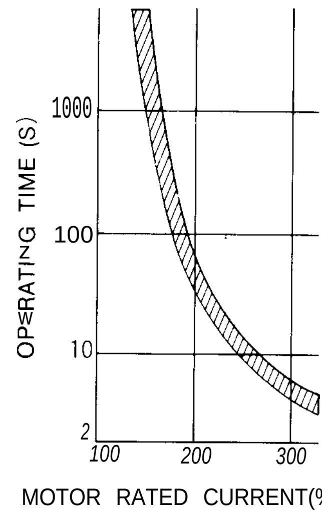


Fig. AS. 1 Overload Characteristics

5.2 LED INDICATION

Table AS. 2 LED Status Indications (Green)

LED Name	Conditions
MP	Servopack main circuit voltage (200 VDC or more) is proper.
P	Servopack control circuit voltage (+ 5V) is proper,

A6. PRECAUTIONS FOR APPLICATION

A6. 1 MINUS LOAD

The motor is rotated by the load; it is impossible to apply brake (regenerative brake) against this rotation and achieve continuous running.

Example : Driving a motor to lower objects (with no counterweight)

Since Servopack has the regenerative brake capability of short time (corresponding to the motor stopping time), for application to a minus load, contact Yaskawa representative.

A6. 2 LOAD INERTIA (GD^2)

The allowable load inertia GD^2 converted to the motor shaft must be within five times the rotor inertia (J_M) of the applicable AC servomotor. If the allowable load inertia (J_L) is exceeded, an overvoltage alarm may be given during deceleration. If this occurs, take the following actions:

- Reduce the current limit.
- Slow down the deceleration curve.
- Decrease the maximum speed.

For details, contact Yaskawa representative.

A6. 3 HIGH VOLTAGE LINE

If the supply voltage is 400/440VAC, the voltage must be dropped three-phase, 400/440VAC to 200VAC by using a power transformer. Table A7. 2 shows the transformer selection. Connection should be made so that the power is supplied and cut through the primary side of the transformer. Single-phase 100VAC class power supply should not be used.

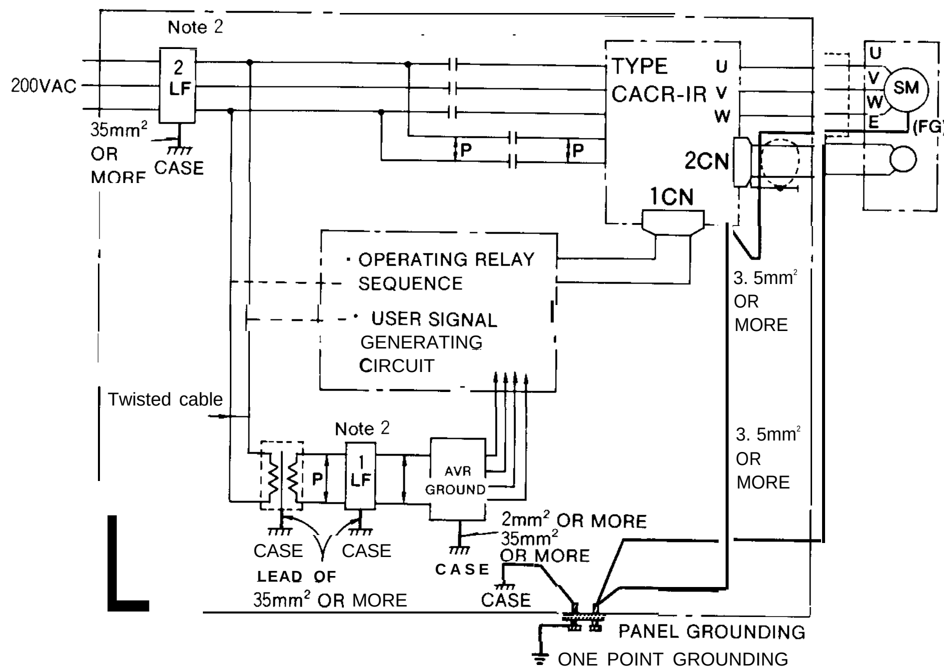
A7. PRECAUTIONS OF OPERATION

A7. 1 NOISE TREATMENT

Servopack used is a power transistor in the main circuit. When these transistors are switched, the effect of $\frac{di}{dt}$ or $\frac{dv}{dt}$ (switching noise) may sometimes occur depending on the wiring or grounding method.

The Servopack incorporates CPU. This requires wiring and treatment to prevent noise interference. To reduce switching noise as much as possible, the recommended method of wiring and grounding is shown in Fig. A7. 1.

(1) Grounding Method (Fig. A7. 1)



Note
1. Use wires of 35mm² or more for grounding to the case (preferably flat-woven copper wire).
2. Connect line filters observing the precautions as shown in (2) Noise Filter Installation.
3. Use twisted pair leads at I portion.

Fig. A7. 1 Grounding Method

- Motor frame grounding

When the motor is at the machine side and grounded through the frame, $Cf\frac{dv}{dt}$ current flows from the PWM power through the floating capacity of the motor. To prevent this effect of current, motor ground terminal E (motor frame) should be connected to terminal ⏚ of Servopack. (terminal ⏚ of Servopack should be directly grounded.)

- Servopack SG O V

Noise may remain in the input signal line, so make sure to ground SG O V. When motor wiring is contained in metal conduits, the conduits and boxes must be grounded. The above grounding uses one-point grounding.

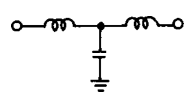
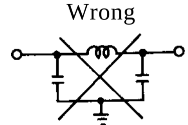
(2) Noise Filter Installation

When noise filters are installed to prevent noise from the power line, the block type must be used. The recommended noise filter is shown in Table A7. 1 The power supply to peripherals also needs noise filters.

NOTE

If the noise filter connection is wrong, the effect decreases greatly. Observing the precautions, carefully connect them as shown in Figs. A7.2 to A7. 5.

Table A7. 1 Recommended Noise Filter

Servopack Type CACR-	Applicable Noise Filter	Recommended Noise filter	
		Type	Specifications
IR05SB	Correct  Wrong 	LF-310	Three-phase 200VAC class 10A
IR10SB IR15SB		LF-315	Three-phase 200VAC class 15A
IR20SB		LF-320	Three-phase 200VAC class 20A
IR30SB		LF-330	Three-phase 200VAC class 30A
IR44SB		LF-340	Three-phase 200VAC class 40A

Note: Noise filters are made by Tokin Corp.

(a) Separate the input and output leads. Do not bundle or run them in the same duct.

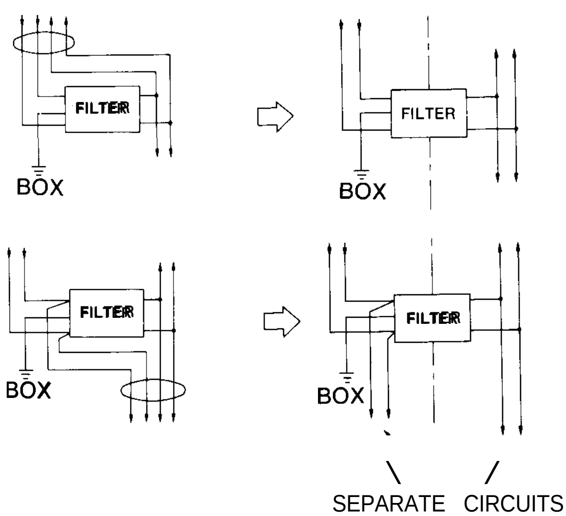


Fig. A7. 2

(b) Do not bundle the ground lead with the filter output line or other signal lines or run them in the same duct.

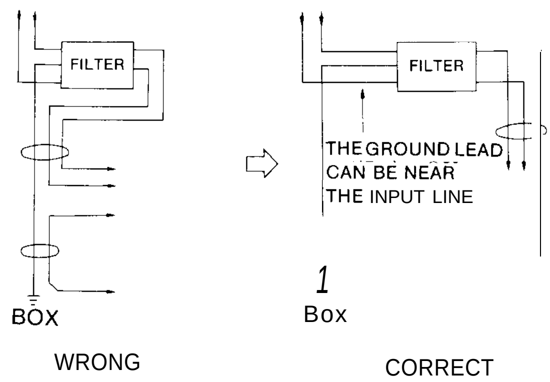


Fig. A7. 3

(c) Connect the ground lead singly to the box or the ground panel.

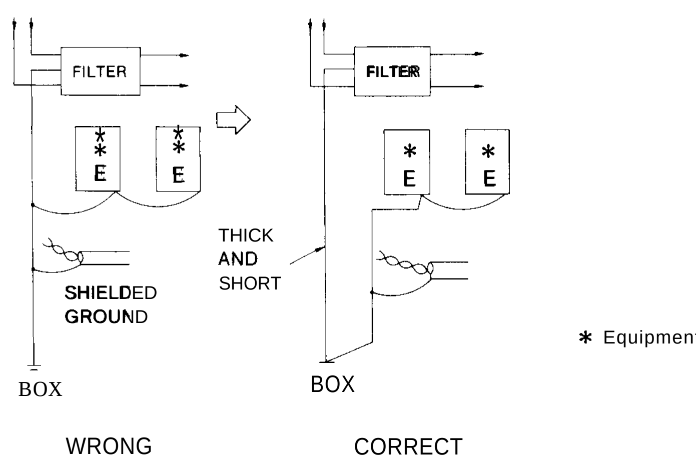


Fig. A7. 4

(d) If the control panel contains the filter, connect the filter ground and the equipment ground to the base of the control unit.

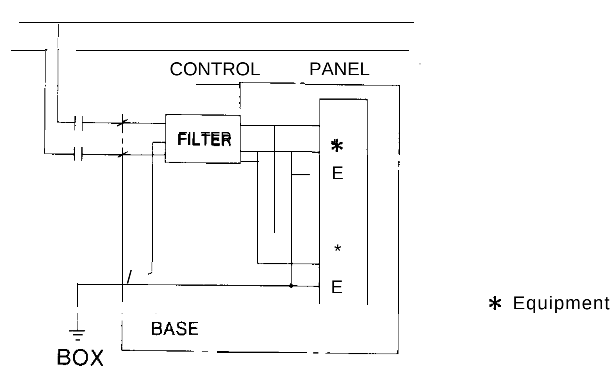


Fig. A7. 5

A7. 2 POWER LINE PROTECTION

The Servopack is operated through the commercial power line (200 V). To prevent the power line accidents due to grounding error, contact error, or to protect the system from a fire, circuit breakers (MCCB) or fuses must be installed according to the number of Servopack used (Table A7. 2).

A quick-melting fuse cannot be used, because the Servopack used the capacitor-input power supply and the charging current might melt such a fuse.

Table A7. 2 Power Supply Capacity and MCCB or Fuse Capacity

Servopack Type CACR-	Power Capacity* per Servopack kVA	Current Capacity per MCCB or Fuse A
IR05SB	1.1	5
IR1OSB	2.1	8
IR15SB	3.1	10
IR20SB	4.1	12
IR30SB	6.0	18
IR44SB	8.0	24

* Values at rated load

A8. INSTALLATION AND WIRING

A8. 1 RECEIVING

This motor has been put through severe tests at the factory before shipped. After unpacking, however, check and see the following.

- Its nameplate ratings meet your requirements.
- It has sustained no damage while in transit.
- The output shaft should be hand-rotated freely. However, the brake-mounted motor does not rotate as it is shipped with the shaft locked.
- Fastening bolts and screws are not loose.

If any part of the motor is damaged or lost, immediately notify us giving full details and nameplate data.

A8. 2 INSTALLATION

A8. 2.1 AC Servomotor

AC Servomotor can be installed either horizontally or vertically.

(1) Before Mounting

Wash out anticorrosive paint on shaft extension and flange surface with thinner before connecting the motor to the driven machine. See Fig. A8. 1.

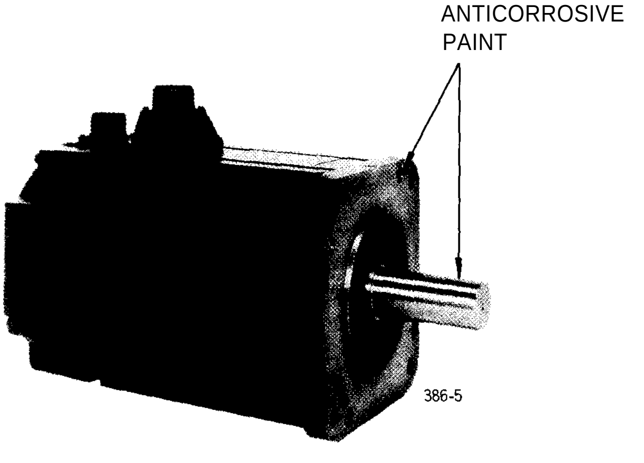


Fig. A8. 1 Anticorrosive Paint to be Removed

(2) **Location**

Use the motor under the following conditions.

- Indoors
- Free from corrosive and/or explosive gases or liquids
- Ambient temperature: O to +40℃
- Clean and dry
- Accessible for inspection and cleaning

If the AC servomotor is subject to excessive water or oil droplets, protect motor with a cover. The motor can withstand a small amount of splashed water or oil.

(3) Environmental Conditions

- **Ambient Temperature: O to +40℃**
- Storage Temperature: –20 to +60℃
- Humidity: 20% to 80% RH (non-condensing)

(4) **Load Coupling**

True alignment of motor and driven machine is essential to prevent vibration, reduced bearing and coupling life, or shaft and bearing failures.

Use flexible coupling with direct drive. The alignment should be made in accordance with Fig. A8. 2

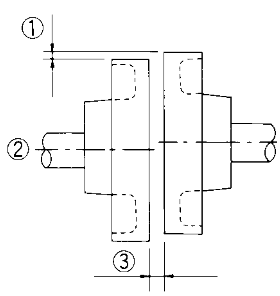


Fig. A8. 2 Alignment of Coupling

①Measure the gap between the straightedge and coupling halves at four equidistant points of the coupling. The each reading should not exceed O. 03mm
②Align the shafts.
③Measure the gap between the coupling faces at four equidistant points around the coupling rim with thickness gage The maximum variation between any two readings should not exceed O. 03mm.

(5) **Allowable Bearing Load**

Avoid both thrust and radial loads to the motor shaft. If unavoidable, never exceed the values in Tables A4. 1.

A8. 2.2 Servopack

(1) Installation

The Servopack type CACR-IR is mounted on the base as standard.

(2) Location

- When installed in a panel :
  Keep the temperature around Servopack at 55℃ or below. (Fig. A8. 3)
- When installed near a heat source:
  Keep the temperature around Servopack below 55°C. (Fig. A8. 4)
- If subjected to vibration:
  Mount the unit on shock absorbing material.
- If corrosive gases are present:
  Avoid locations where corrosive gases exist as it may cause extensive damage over long use.
  Especially vulnerable are switching operation of contractors and relays.
- Unfavorable atmospheric conditions:
  Select a location with minimum exposure to oil, water, hot air, high humidity, excessive dust or metallic particles.

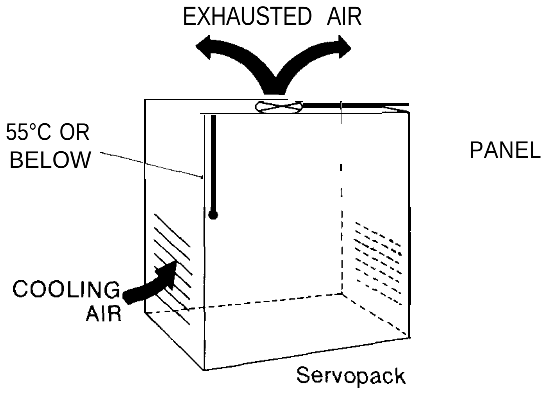


Fig. A8. 3 Typical Layout for Panel Mounting

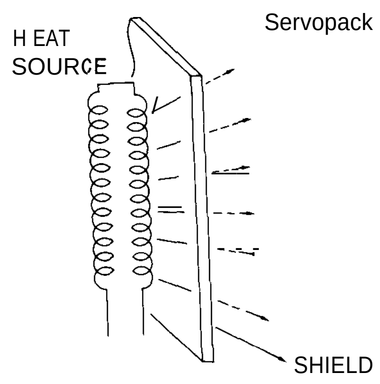


Fig. A8. 4 Protection against Heat Radiation

(3) Mounting Direction

Mount the unit vertically on the wall using the mounting holes (4) on the base plate, with main terminals at the bottom. (Fig. A8. 5)

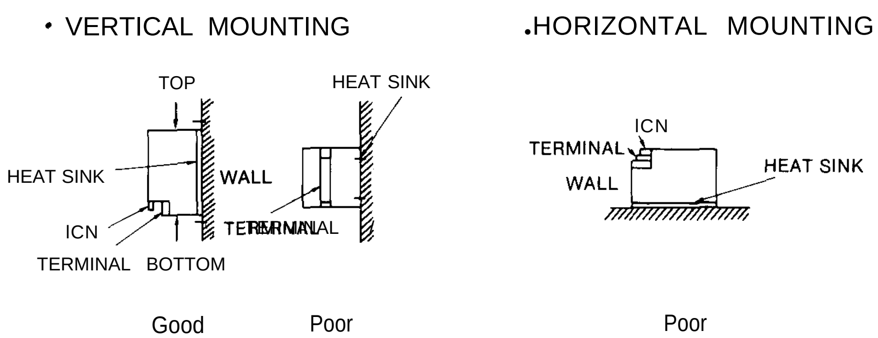


Fig. A8. 5 Mounting Direction of Servopack

A8. 3 WIRING

A8. 3.1 RATED CURRENT AND CABLE SIZE

Tables A8. 1 and A8. 2 show external terminals, rated current, and cable sizes of Servopack. Select the type and size of cables to meet ambient conditions and current capacity. The cable size is calculated so that a bundle of three cables can bear the rated current at an ambient temperature of 40"C.
Table A8. 3 lists the type of cables.

Table A8. 1 Rated Current

External Terminal		Type CACR- / Symbol	Rated Current A (Effective Current)					
			IR05SB	IR1OSB	IR15SB	IR20SB	IR30SB	IR44SB
On Line	Main Circuit Power Input	Ⓡ Ⓢ Ⓣ	5	8	10	12	18	24
	Motor Connection	Ⓤ Ⓥ Ⓦ	4.2	7.6	11.7	18.8	26.0	33.0
	Control Power Input	ⓡ ⓣ	0.5A					
Off Line	Control I/O Signal Connector	1 CN	100mADC max					
	PG Signal Connector	2 CN	100mADC max (500mADC for Power line only)					
	Ground	⏚						

Table A8. 2 Recommended Cable Size of Servopack

External Terminal		Type CACR- / Symbol	Cable Size mm^2					
			IR05SB	IR1OSB	IR15SB	IR20SB	IR30SB	IR44SB
On Line	Main Circuit Power input	Ⓡ Ⓢ Ⓣ	HIV 2. 0 or more		HIV 3.5 or more		HIV 5.5 or more	HIV 5.5 or more
	Motor Connector	Ⓤ Ⓥ Ⓦ						
	Control Power Input	ⓡ ⓣ	HIV 1.25 or more					
off Line	Control I/O Signal Connector	1 CN	. Two-core twisted shielded cable . Core must be O. 2 mm^2 or more . Tin-plated soft-copper twisted cable . Finished cable dimension: 16 dia or less for 1CN 11 dia or less for 2CN					
	PG Signal Connector	2 CN						
	Ground	⏚	HIV 2.0 or more					

Table A8. 3 Cable

Type of Lead (Symbol)	Allowable Conductor Temperature
Vinyl Cable (PVC)	
600V Vinyl Cable (IV)	60
Special Heat-Resistant Cable (HIV)	75

Note:
1 . For main circuits, use cables of 600 V or more.
2 Where cables are bundled or run through a duct (unplasticized polyvinyl chloride conduit or metalic conduit), select the larger cable size than listed considering the current drop rate of the cables.
3. Where the ambient (panel inside) temperature is high (+ 40℃ to + 60℃), use heat-resistant cables,

A8. 3.2 WIRING PRECAUTIONS

Servopack is a device for speed control of 3000:1, and signal level of several mini-volts or less. The following precautions should be taken for wiring.

(1) For signal lines and PG feedback lines, use twisted cables or multi-core shielded twisted-pair cables (Yaskawa Drawing DE8400093).

Cable length is a maximum of 3 m for reference input lines and a maximum of 20 m for PG feedback lines. Use the shortest possible length.

(2) For ground line, cable should be as heavy as possible to provide class 3 ground (ground resistance 100 S2 or less). Make sure to ground at one point. If the motor and machine are insulated, ground the motor.

(3) To prevent malfunction due to noise, take the following precautions:

. Place the noise filter, Servopack and I/O reference as near as possible to each other.

• Make sure to insert a surge absorbing circuit into the relay, electromagnetic contact, and solenoid coils.

• Run the power line and signal line, holding the distance to 30 cm or more; do not run them in the same duct or in a bundle.

.When the same power is used for Servopack, as for an electric welder or electrical discharge machine or when a high-frequency noise source is present in the vicinity, use filters in the power and input circuits.

• The Servopack uses a switching amplifier, and spurious noise may be present in the signal line. Never leave the termination of the analog input wiring open.

(4) Remedy for Radio Frequency Interference (R. F.I)
Servopack is not provided with protected from radio frequency interference. If the controller is adversely affected by radio waves, connect a noise filter to power supply.

(5) The signal line uses cables whose core is extremely fine (O. 2 to 0.3 mm^2). Avoid using excessive force which may damage these cables.

A8. 3.3 POWER LOSS

The power loss of Servopack is shown in Table A8. 4.

Table A8.4 Power Loss at Rated Output

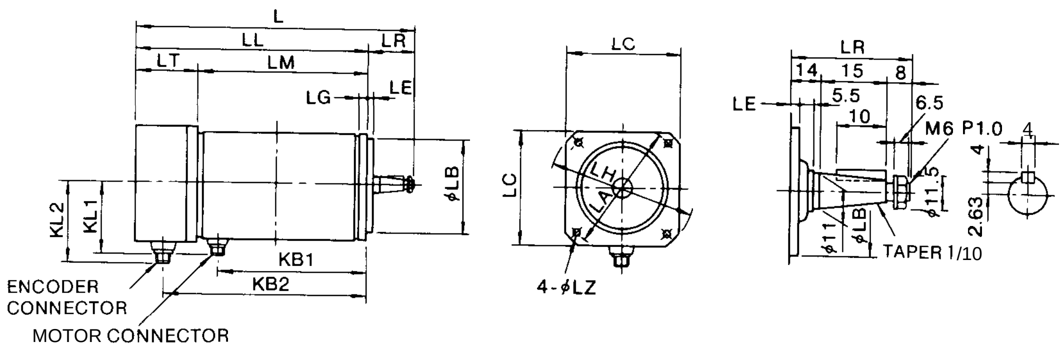
Servopack Type CACR-	output Current A	Power Loss			
		Main Circuit w	Regenerative Resistance w	Control Circuit w	Total w
IR05SB	4.2	40	10	60	110
IR1OSB	7.6	70	20		150
IR15SB	11.7	80	20		160
IR20SB	18.8	100	40		200
IR30SB	26.0	160	80		300
IR44SB	33.0	210	100		370

Note: The regenerative risistor causes power loss when the motor is decelerated, but is negligible if the motor is not started and stopped frequently.

A9. DIMENSIONS in mm

A9. 1 SERVO MOTOR

(1) USAGED-02A S1/03A S1

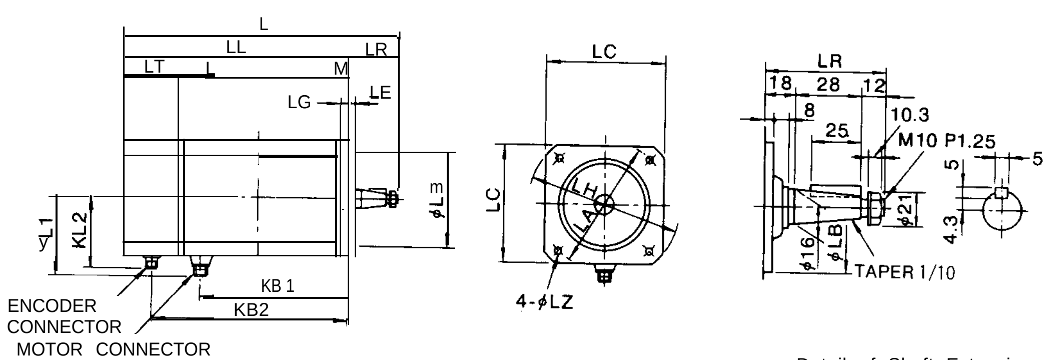


Detail of Shaft Extension

NOTE :

I. Absolute encoder is used.
2. Vibration: 15 μm(V15) or below
3. Plug and clam^p are n'ot attached for receptacle connection
4. Dimensions of the keyway are based on JIS B1301 "Sunk keys and Their corresponding keyways (close keys),"
5. Connector should be installed downward.

(2) USAGED-05A S1/09A S1

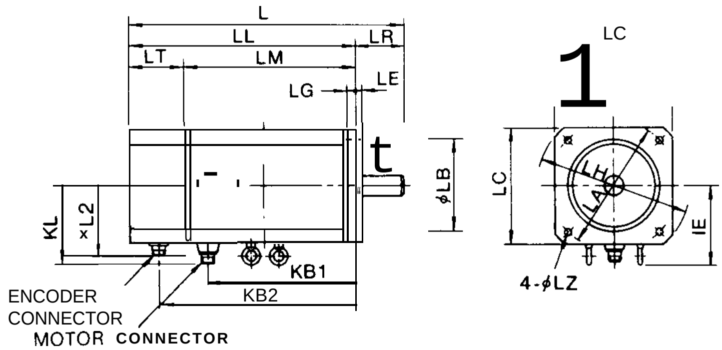


Detail of Shaft Extension

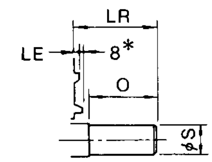
NOTE :

1. Absolute encoder is used
2. Vibration: 15 μm(V15) or below.
3. Plug and clamp are not attached for receptacle connection
4. Dimensions of the keyway are based on JIS B1301 "Sunk keys and Their corresponding keyways (close keys)."
5. Connector should be installed downward,

(3) USAGED-13AS2-44AS2



* For type 13AS2



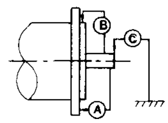
Detail of Shaft Extension

NOTE :
1. Absolute encoder is used.
2. Vibration' 15 μm (V15) or below.
3. Plug and clamp are not attached for receptacle connection.
4. Connector should be installed downward.

Servomotor Type USAGED-	L	L L	LM	L R	L T	KB1	KB2	IE	KL1	KL2	Flange Surface							Shaft Eetension		Appox. Weight kg
											L A	L B	L C	L E	L G	L H	LZ	s	o	
02AS1	234	197	137	37	60	90	172	—	76	87	100	$80^{\ 0}_{-0.030}$	90	4	7	120	6.6	—	—	5.5
03AS1	280	243	183	37	60	136	218	—	76	87	100	$80^{\ 0}_{-0.030}$	90	4	7	120	6.6	—	—	6.5
05AS1	277	219	150	58	69	127	177	—	109	92	145	$110^{\ 0}_{0.035}$	130	6	12	165	9	—	—	9
09AS1	334	276	207	58	69	184	234	—	109	92	145	$110^{\ 0}_{-0.035}$	130	6	12	'165	9	—	—	14
13AS2	403	345	276	58	69	253	303	—	109	92	145	$110^{\ 0}_{-0.035}$	130	6	12	165	9	$22^{\ 0}_{0.013}$	40	20
20AS2	343	264	211	79	53	171	237	—	139	92	200	114.3-:.025	180	3.2	18	230	13.5	$35^{+0.01}_{\ 0}$	76	22
30AS2	401	322	269	79	53	229	295	123	139	92	200	114.3.:.025	180	3.2	18	230	13.5	$35^{+0.01}_{\ 0}$	76	29
44AS2	486	407	354	79	53	314	380	123	139	92	200	114,3-:.025	180	3.2	18	230	13.5	$35^{+0.01}_{\ 0}$	76	41

Note: Eyebolt is not provided for ty pes USAGED-02AS1 to -20AS2.

Table A4. 2 Mechanical Specifications in mm

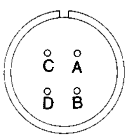
Accuracy (T. I. R.)*		Reference Diagram
Flange surface perpendicular to shaft Ⓐ	0.04	
Flange diameter concentric to shaft Ⓑ	0.04	
Shaft run out Ⓒ	0.02	

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

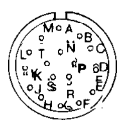
AC Servomotor with brake or straight shaft extension are available.

Receptacle Specifications

Motor



Detector



(a) Motor receptacle

A	Phase U
B	Phase V
C	Phase W
D	F.G Frame Ground

(b) With Brake

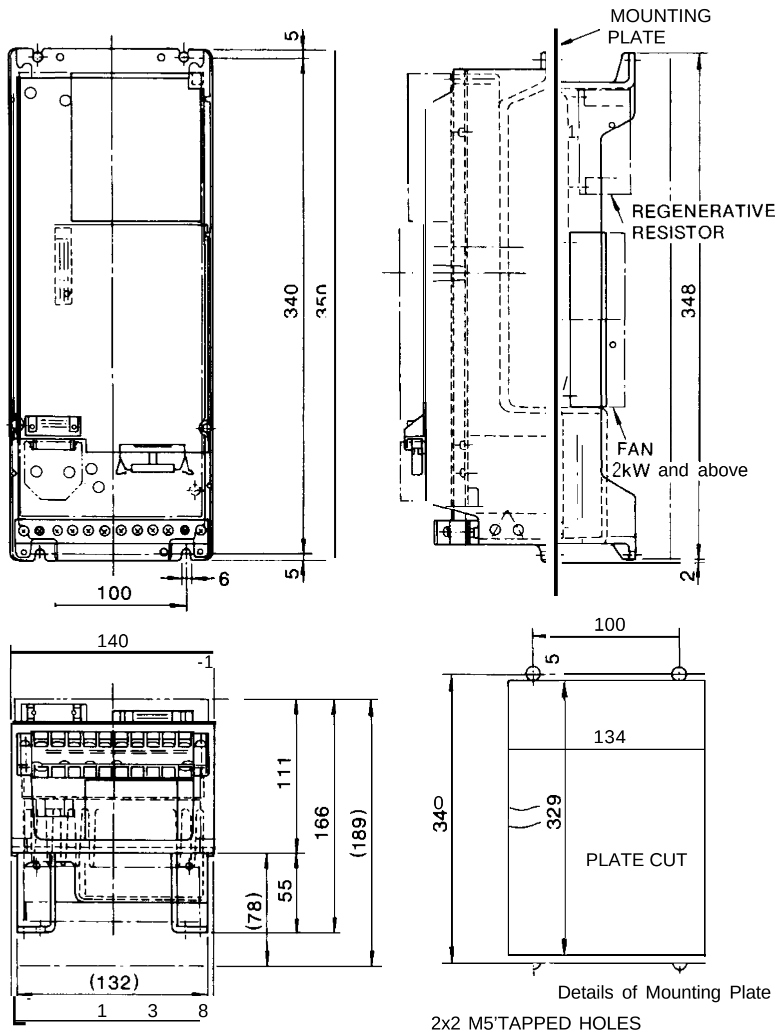
A	Channel A output	K	
B	Channel $\bar{A}$ output	L	
c	Channel B output	M	
D	Channel B output	N	
E	Channel Z output	P	
F	Channel Z output	R	Reset
G	O v	s	O V (Battery)
H	+ 5VDC	T	+3. 6V (Battery)
J	Frame ground		

Connector

Servomotor Type USAGED-	Motor Connector				Encoder Connector			
	Receptacle Type	L-Type Plug	Straight Plug	Cable Clamp	Receptacle Type	L-Type Plug	Straight Plug	Cable Clamp
02AS1 03AS1	MS3102 A14S-2P	MS3108 B14S-2S	MS3106 B14-2S	MS3057-6A	MS3102 A20-29P	MS3108 B20-29S	MS3106 B20-29S	MS3057-12A
05AS1 09AS1 13AS2	MS3102 A18-1OP	MS3108 B18-1OS	MS3106 B18-1OS	MS3057-1OA				
20AS2 30AS2 44AS2	MS3102 A22-22P	MS3108 B22-22S	MS3106 B22-22S	MS3057-12A				

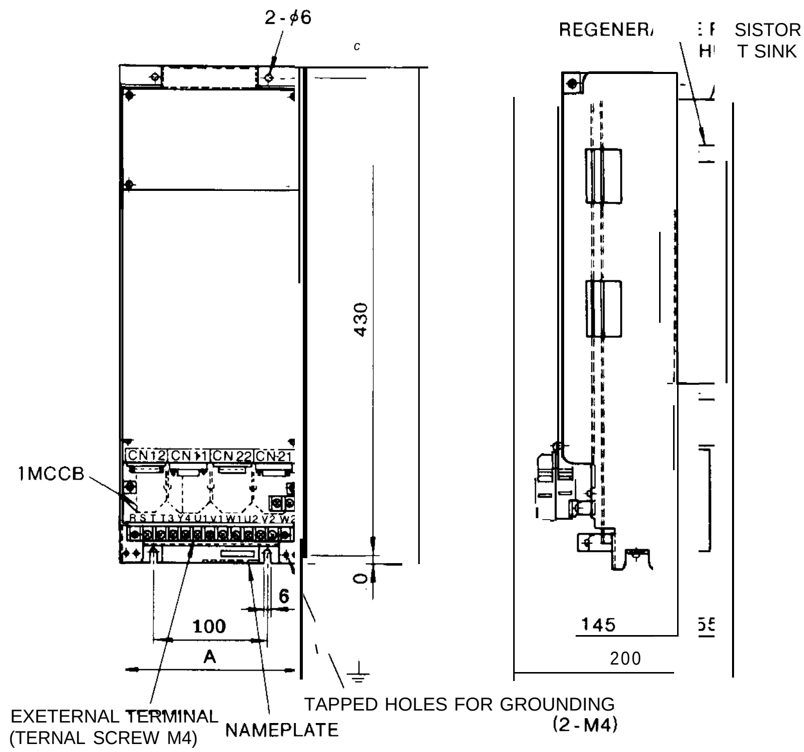
A9. Servopack

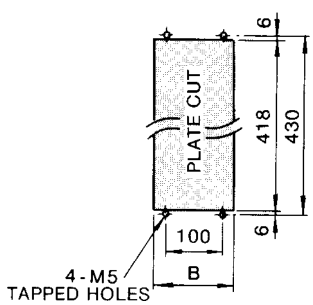
(1) l-axis Servopack CACR-IR□SC



Details of Mounting Plate
2x2 M5'TAPPED HOLES

(2) 2-Axis Servopack CACR-IR□□C

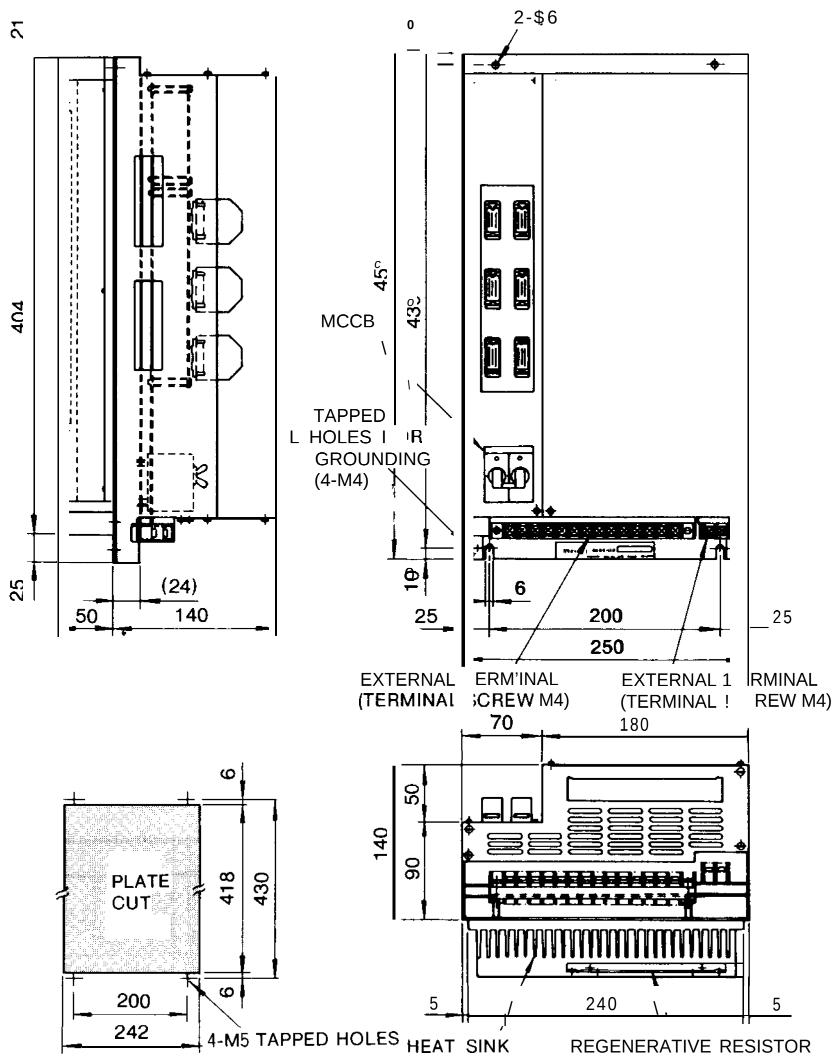




DETAIL OF MOUNTING PLATE

	A	B
CACR-IR0505C CACR-IR1010C CACR-IR2020C	160	140
CACR-IR3030C	200	200

(3) **3-axis Servopack CACR-IR□□□C**



DETAIL OF MOUNTING PLATE

YASNAC i80

CNC SYSTEM FOR MACHINE TOOLS

CONNECTING MANUAL

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