YASKAWA ELECTRIC

TOE-C843-7-32
INSTRUCTIONS

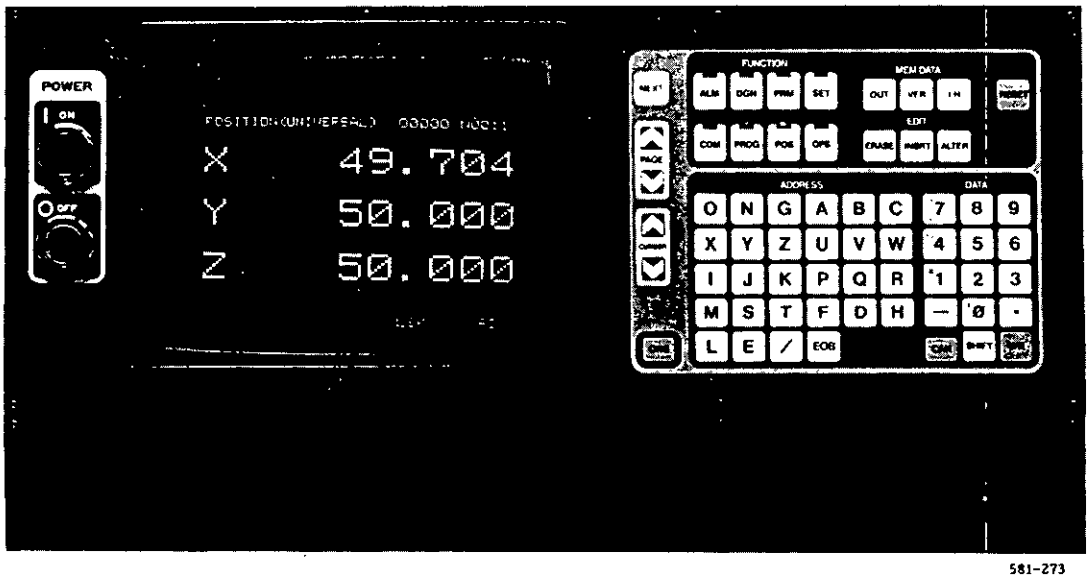
CNC SYSTEM FOR MACHINING CENTERS

YASNAC® MX1

CONNECTING MANUAL

Before initial operation read these instructions thoroughly, and retain for future reference.

YASNAC MX1 is an ultraspeed dual processor CNC for machining centers. This manual describes the specifications of connecting YASNAC MX1 with machines, machine interfaces and external equipment.



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YASNAC MX1 OPERATOR'S STATION

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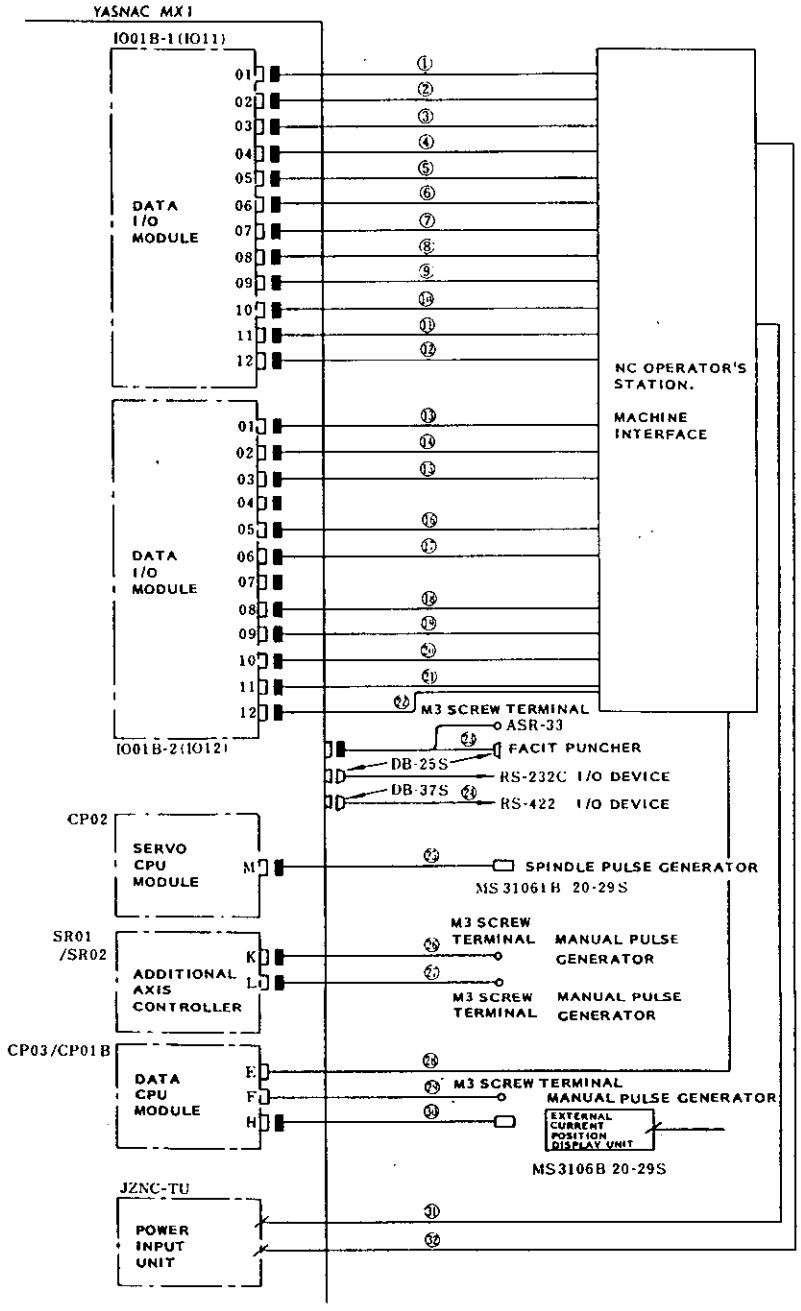
1. CONNECTION DIAGRAMS

This section shows the connections between YASNAC MX1 and external equipment.

1.1 TOTAL CONNECTION OF YASNAC WITH NC OPERATOR'S STATION AND MACHINE INTERFACE

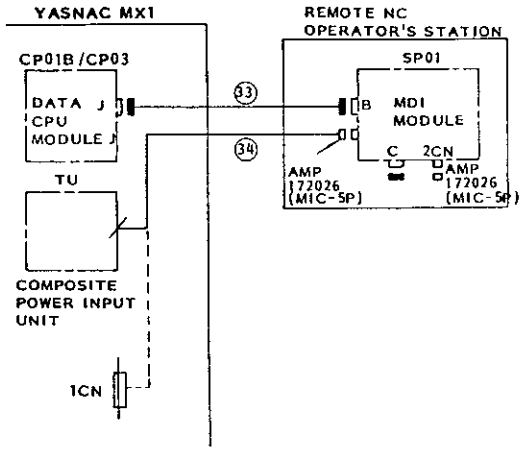


Note: Connectors without type names apply to the following rules:

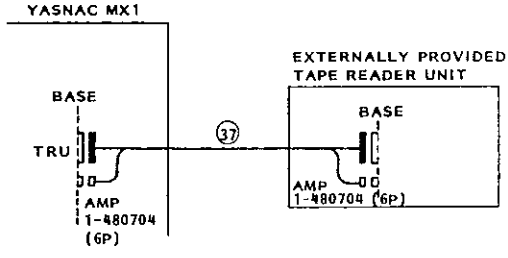
- ▯ - MR connector 20 pins, male
- ▮ - MR connector 20 pins, female
- ▯ - MR connector 50 pins, male
- ▮ - MR connector 50 pins, female

Fig. 1.1

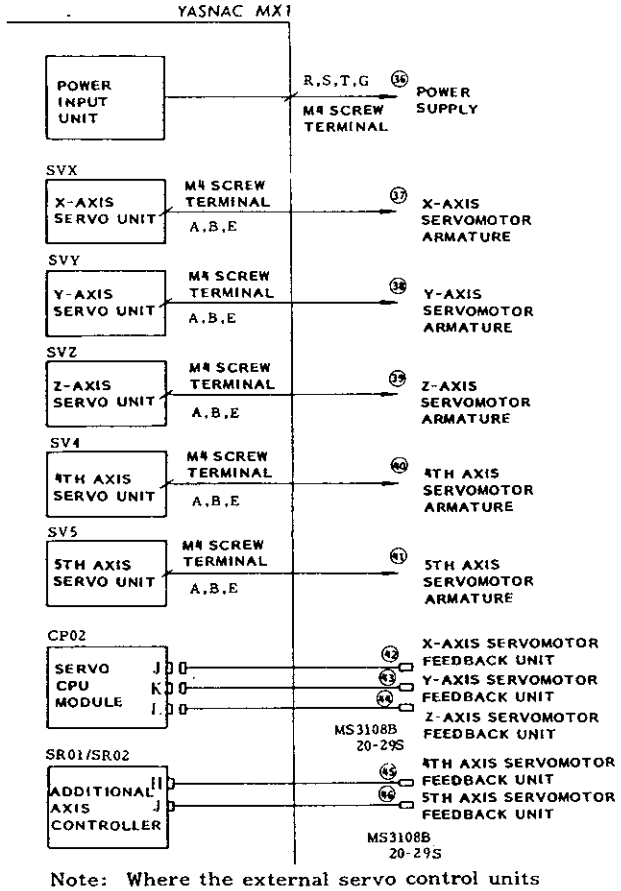
1.2 TOTAL CONNECTION OF YASNAC WITH EXTERNAL NC OPERATOR'S STATION



1.3 TOTAL CONNECTION OF YASNAC WITH EXTERNAL TAPE READER UNIT



1.4 TOTAL CONNECTION OF YASNAC WITH POWER SUPPLY AND SERVOMOTOR



Note: Where the external servo control units are used, refer to 5. Connection with External Servo Control Unit.

1.5 YASNAC MX1 CONNECTOR TERMINAL ARRANGEMENT

Data CPU Modules Type CP03/CP01B

Connector E: MR20 RMA (SDA)

1	2	3	4	5	6	7
OR	R1	R2	R3	R4	EN0	DAS
	8	9	10	11	12	13
	R5	R6	R7		EN1	SGS0
14	15	16	17	18	19	20
R8	R9	R10	R11	R12	SGS1	OG

Connector F: MR20 RMA (HPG)

1	2	3	4	5	6	7
012H	012H	012H	+12H	+12H	+12H	
	8	9	10	11	12	13
		OAH			OBh	
14	15	16	17	18	19	20
		PAH		PBH		EPH

Connector H: MR20 RMA (POSITION DISPLAY)

1	2	3	4	5	6	7
	8	9	10	11	12	13
14	15	16	17	18	19	20

Connector J: MR20 RMA (OPP)

1	2	3	4	5	6	7
VIDEO0	*VIDEO0	DATAP	*DATAP	CKP	*CKP	ON0
	8	9	10	11	12	13
	HLGHT0	*HLGHT0	INP	*INP	COM0	OFF0
14	15	16	17	18	19	20
HSYNC0	*HSYNC0	VSYNC0	*VSYNC0	OUTP	*OUTP	EP

Connector K: MR20 RMA

1	2	3	4	5	6	7
DIN0	DIN1	DATA	*DATA	CK	*CK	0V
	8	9	10	11	12	13
	DIN2	DIN3	IN	*IN		
14	15	16	17	18	19	20
DIN4	DIN5	DIN6	DIN7	OUT	*OUT	

Connector L: MR20 RMA

1	2	3	4	5	6	7
+24V		F	SN0	SN2		SN1
	8	9	10	11	12	13
	R					
14	15	16	17	18	19	20

*Asterisked signals activate at LOW.

Connector M: MR20 RMA

1	2	3	4	5	6	7
EON0	EOF0	ECOM0	C24S	05S	PSALM0	*OHT1
	8	9	10	11	12	13
	*OLD0	TUCOM	+24S	+5S	PWLOST0	*OHT2
14	15	16	17	18	19	20
+24V	*NRD	*FUX	*SVMX	*NCMX	*ESP0	

Data CPU Modules Type CP02

Connector E: MR20 RMA (SVX)

1	2	3	4	5	6	7
*SVONX		*OLX	SRDX	*TGONX	BTX	DAX
	8	9	10	11	12	13
		FUX	*ALX	OC	ATX	SGX
14	15	16	17	18	19	20
		OC	OC	OC	OC	EPX

Connector F: MR20 RMA (SVY)

1	2	3	4	5	6	7
*SVONY		*OLY	SRDY	*TGONY	BTY	DAY
	8	9	10	11	12	13
		FUY	*ALY	OC	ATY	SGY
14	15	16	17	18	19	20
		OC	OC	OC	OC	EPY

Connector H: MR20 RMA (SVZ)

1	2	3	4	5	6	7
*SVONZ		*OLZ	SRDZ	*TGONZ	BTZ	DAZ
	8	9	10	11	12	13
		FUZ	*ALZ	OC	ATZ	SGZ
14	15	16	17	18	19	20
		OC	OC	OC	OC	EPZ

Connector J: MR20 RMA (FBX)

1	2	3	4	5	6	7
05X	05X	05X	+5X	+5X	+5X	
	8	9	10	11	12	13
			ATX	BTX		
14	15	16	17	18	19	20
PCX	*PCX	PAX	*PAX	PBX	*PBX	EPX

Connector K: MR20 RMA (FBY)

1	2	3	4	5	6	7
05Y	05Y	05Y	+5Y	+5Y	+5Y	
	8	9	10	11	12	13
			ATY	BTY		
14	15	16	17	18	19	20
PCY	*PCY	PAY	*PAY	PBY	*PBY	EPY

*Normally closed contacts.

Data CPU Modules Type CP02

L: MR20 RMA (FBZ)

1	2	3	4	5	6	7
05Z	05Z	05Z	+5Z	+5Z	+5Z	
	8	9	10	11	12	13
			ATZ	BTZ		
14	15	16	17	18	19	20
PCZ	*PCZ	PAZ	*PAZ	PBZ	*PBZ	EPZ

Data CPU Modules Type SR01/02

E: MR20 RMA (SV4)

1	2	3	4	5	6	7
*SVON4		*OL4	SRD4	*TGON4	BT4	DA4
	8	9	10	11	12	13
		FU4	*AL4	OC	AT4	SG4
14	15	16	17	18	19	20
		OC	OC	OC	OC	EP4

H: MR20 RMA (FB4)

1	2	3	4	5	6	7
05/012	05/012	05/012	+5/+12	+5/+12	+5/+12	
	8	9	10	11	12	13
	OC4	OA4	AT4	BT4	OB4	
14	15	16	17	18	19	20
PC4	*PC4	PA4	*PA4	PB4	*PB4	EP4

Data CPU Modules Type SR02

F: MR20 RMA (SV5)

1	2	3	4	5	6	7
*SVON5		*OL5	SRD5	*TGON5	BT5	DA5
	8	9	10	11	12	13
		FU5	*AL5	OC	AT5	SG5
14	15	16	17	18	19	20
		OC	OC	OC	OC	EP5

J: MR20 RMA (FB5)

1	2	3	4	5	6	7
05/012	05/012	05/012	05/012	+5/+12	+5/+12	
	8	9	10	11	12	13
	OC5	OA5	AT5	BT5	OB5	
14	15	16	17	18	19	20
PC5	*PC5	PA5	*PAα	PB5	*PB5	EP5

2. CABLES AND CABLE CLAMPS

2.1 CABLES

The cables listed in the table below are to be ordered separately from Yaskawa. When cables are supplied by machine tool builders, cables shall conform to the following cable specifications.

Table 2.1 Cables

Cable No.	Cable Supplied by Yaskawa	Title No.
1-23	Multi-core cable $0.2^2 \times 20$ core (DWG. No. DE6428673)	①
24-30, 33 42-46, 49-53	Shielded cable $0.2^2 \times 10$ pairs (DWG. No. DE8400093)	②
34	Vinyl cabtyre cable $2^2 \times 5$ cores (DWG. No. DE8402398)	③
35	Shielded composite cable $2^2 \times 2$ pairs + $0.2^2 \times 17$ pairs (DWG. No. DE8400094)	④

Note: Cable No. 49 to 53 are shown in 5.1 (2) on page 9 .

The specifications of the cables are given under the group number.

① Specifications of Cable (DWG. No. DE6428673)
Construction

Table 2.2 Construction

No. of cable cores		20
Conductor	Material	Tinned soft-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
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 2.3 Characteristics

Max conduction resistance Ω/km (20°C)	113
Min insulation resistance MΩ·km (20°C)	50
Withstand voltage ACV/min	1,000
Continuous operation temperature range °C	-30 to +60

② Specifications of Cable (DWG. No. DE8400093)

Table 2.4 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
Winding		Paper tape lap winding
Shield		Tinned annealed copper stranded wire
Sheath	Material and color	Vinyl, black
	Thickness mm	1.2
	mm	10.0
Approx weight kg/km		130

Table 2.5 Characteristics

Max conduction resistance(20°C) Ω/km	113
Min insulation resistance(20°C) MΩ·km	50
Withstand voltage (AC) V/min	1,000

③ Specifications of Cable (DWG. No. DE8402398)

Table 2.6 Construction and Characteristics

		Thickness	Outer diameter
Conductor	Nominal sectional area 2.0 mm^2 JIS G 3152 tinned soft-copper wire 37/0.26 mm	—	1.8
Vinyl insulation	JIS K 6723 vinyl compound Insulation vinyl Average thickness 90% or more Min thickness 80% or more	0.8	3.4
Stranding	Right twisted	—	9.2
Vinyl sheath	JIS K 6723 Vinyl compound Sheath vinyl grey Average thickness 90% or more Min thickness 80% or more	1.9	Approx 13.0

Electrical Characteristics
Max conduction resistance 20°C 10.2 Ω/km or less
Withstand voltage 3000 VAC/min (submerged in water)
Min insulation resistance 20°C 50 mΩ·km

Heat Test

Vinyl insulator: Heating for 48 hours at 100° ±2°C

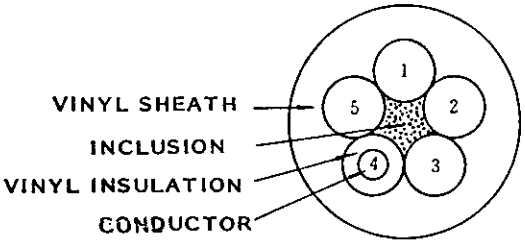
Testing Item	Vinyl insulator	Vinyl sheath
Heating time	48 hours	
Heat temperature	at 100°C ±2°C	
Remaining tensile strength	85% min	
Remaining elongation	80% min	

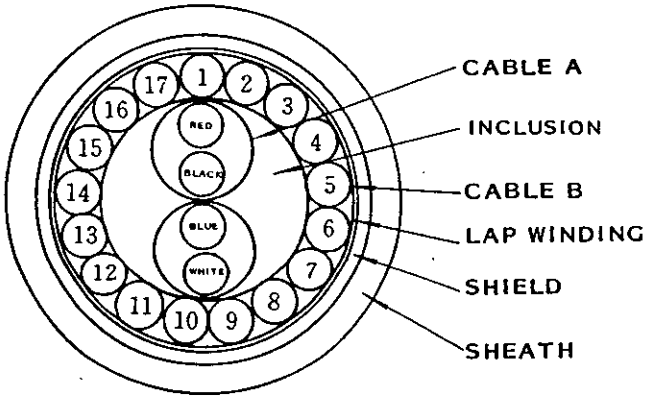
1 Operating temperature 0 to +60°

2 Allowable current wave (at ambient temperature 30°C) 16 A

3 Storing temperature -40 to +60°C

Location No.	1	2	3	4	5
Insulator Color	Black	White	Red	Yellow	Brown





④ Specifications of Cable (DWG. No. DE8400094)

Table 2.7

Lead A	Conductor	37/0.26, Tinned soft
	Insulation	Vinyl, 0.6 thick
Lead B	Conductor	16/0.12, Tinned soft
	Insulation	Cross-linked vinyl, 0.3 thick
Winding		Plastic tape lap winding
Shield		Soft copper stranded wire
Vinyl	Color and thickness	Black, 1.5
Sheath	Outer diameter	21 mm
Approx Weight		440 kg/km

Table 2.8 Characteristics

	Cable A	Cable B
Max conductor resistance (20°C) Ω/km	9.81	113
Min insulation resistance (20°C) MΩ·km	50	50
Withstand voltage ACV/min	1500	1000

Table 2.9

Pair No.	Color	Pair No.	Color
1	Blue - White	10	Purple - Brown
2	Yellow - White	11	Blue - Black
3	Green - White	12	Yellow - Black
4	Red - White	13	Green - Black
5	Purple - White	14	Red - Black
6	Blue - Brown	15	Purple - Black
7	Yellow - Brown	16	Blue - Grey
8	Green - Brown	17	Yellow - Grey
9	Red - Brown		

Table 2.10 Cable Supply by Machine Builders

Cable No.	Cable Specifications
31, 32, 47, 48	0.3 mm^2 or more 300 V vinyl cable
59	0.75 mm^2 or more 600 V vinyl cable or vinyl cabtyre cable
58	2 mm^2 or more 600 V special heat resistant vinyl cable
37 - 41 60 - 70	600 V special heat resistant vinyl cable or cabtyre cable MR05, 08, 15: 2 mm^2 MR22K: 3.5 mm^2 MR37K: 3.5 mm^2
36, 54, 55, 56, 57	600 V special heat resistant vinyl cable JUSP DCP 60 A: 14 mm^2

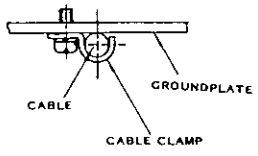
Note: Cable No. 47 to 70 are shown in 4.1(2) on page 7.

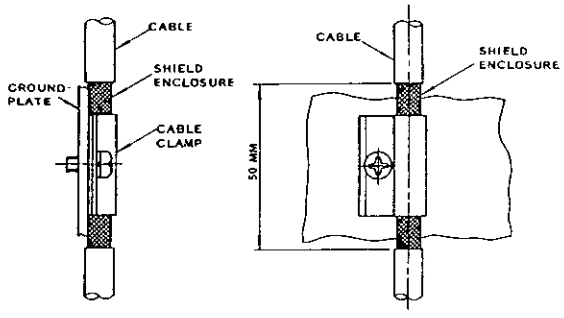
The cable size may be smaller than listed depending on load duty.

2.2 CLAMPING CABLES, AND GROUNDING CABLE SHIELD

Be sure to clamp the cables connected to the YASNAC MX1 securely with the cable clamping metals found in the control panel. (Cables connected to the connectors on connector base are excepted.)

For shielded cables, clamp the cables so that the shield is grounded securely to the plate after stripping the cable sheath as shown in the figure below.

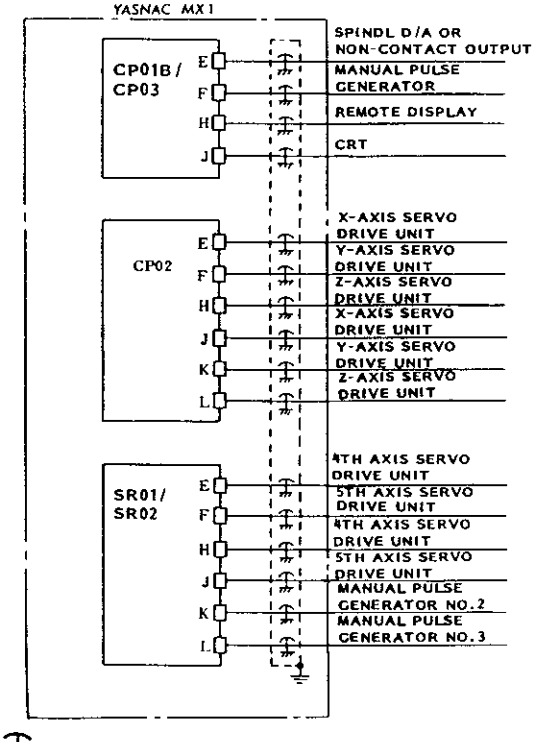




Note: Non-shielded cables do not require stripping cable enclosure for clamping.

Fig. 2.1 Clamping of Shielded Cables

LIST OF SHIELD CABLE CLAMPS



: Symbol for shielded cable clamp

Fig. 2.2

3. CONNECTIONS OF POWER SUPPLY

Specifications of input power of the control unit are as follows:

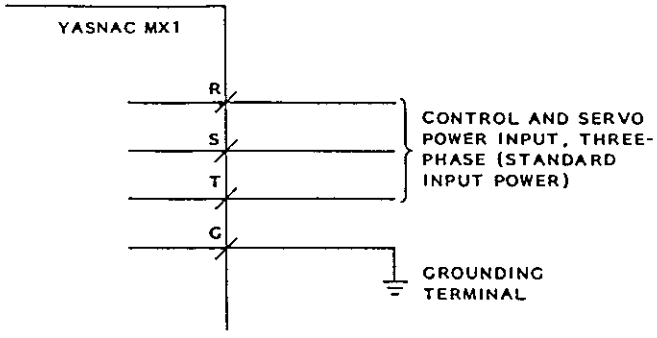
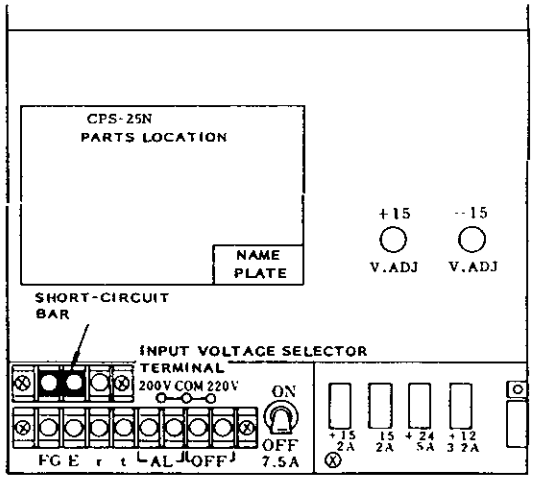
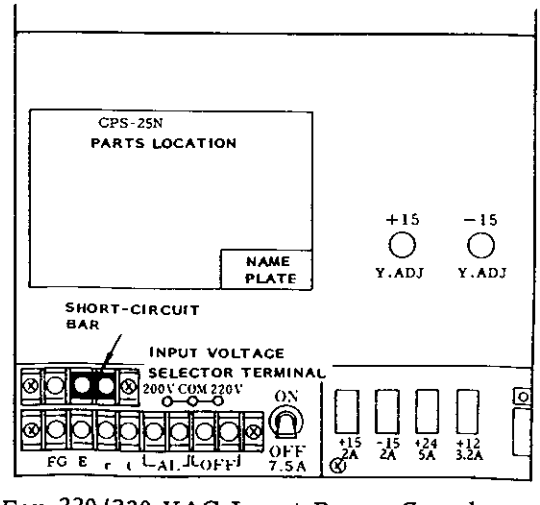


Fig. 3.1

Note: Input voltage selector terminals are provided with control composite power unit (CPS-25N). According to the input power (200 VAC, 220 VAC, or 230 VAC), move the short-circuit bar.



For 200 VAC Input Power Supply



For 220/230 VAC Input Power Supply

Fig. 3.2 AC Input Supply Voltage Selection

4. CONNECTION WITH EXTERNAL SERVO CONTROL UNIT

4.1 CONNECTION TO ALL THE SERVO-RELATED UNITS

(1) SERVO-RELATED UNITS

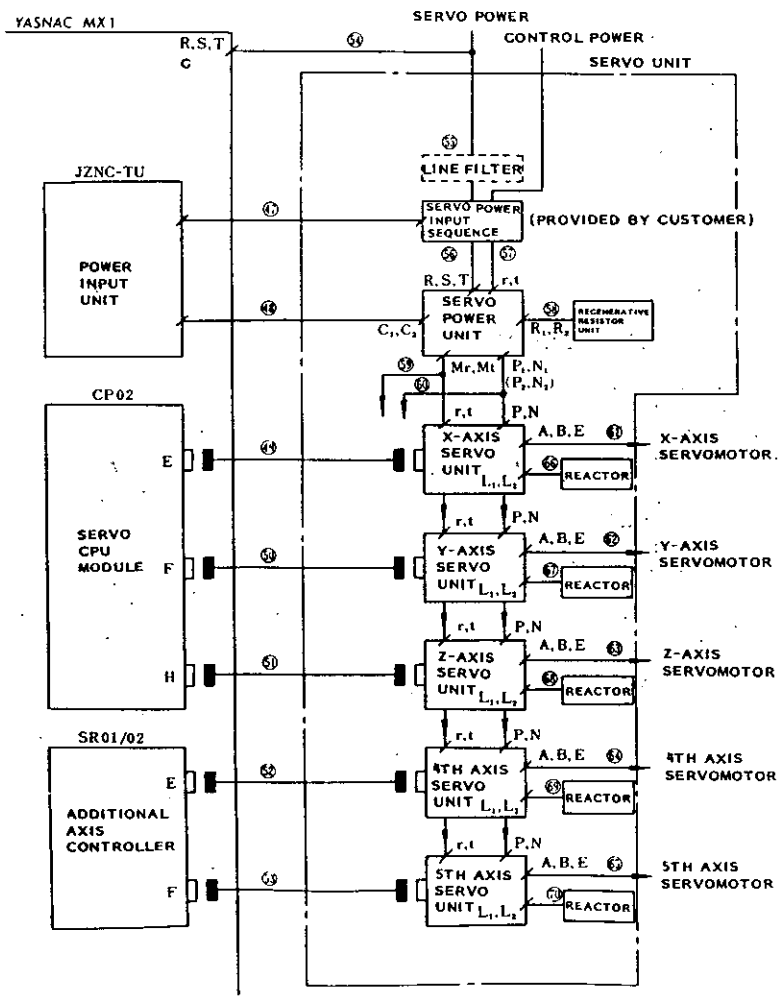
When the servo control unit is installed outside the NC unit, normally, the following units are delivered.

Table 4.1 Units Supplied by Yaskawa

No.	Unit Name	Type	Q'ty
1	Power input unit	JUSP-DCP☐	1
2	Regenerative resistor unit	JUSP-RA☐	1
3	X-axis servo unit	CPCR-MR☐K☐	1
4	Y-axis servo unit	CPCR-MR☐K☐	1
5	Z-axis servo unit	CPCR-MR☐K☐	1
6	4th axis servo unit	CPCR-MR☐K☐	1
7	5th axis servo unit	CPCR-MR☐K☐	1
8	X-axis reactor	5 - 10 mH 11 - 25 A	1
9	Y-axis reactor		1
10	Z-axis reactor		1
11	4th axis reactor		1
12	5th axis reactor		1
13	Line filter	——	1

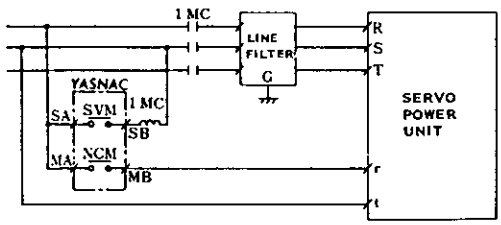
A separate sequence circuit for servo power switching is required to connect these units together.

(2) TOTAL CONNECTION OF SEPARATELY-MOUNTED SERVO UNITS



4.2 RECOMMENDED SEQUENCE CIRCUIT FOR SERVO POWER SWITCHING

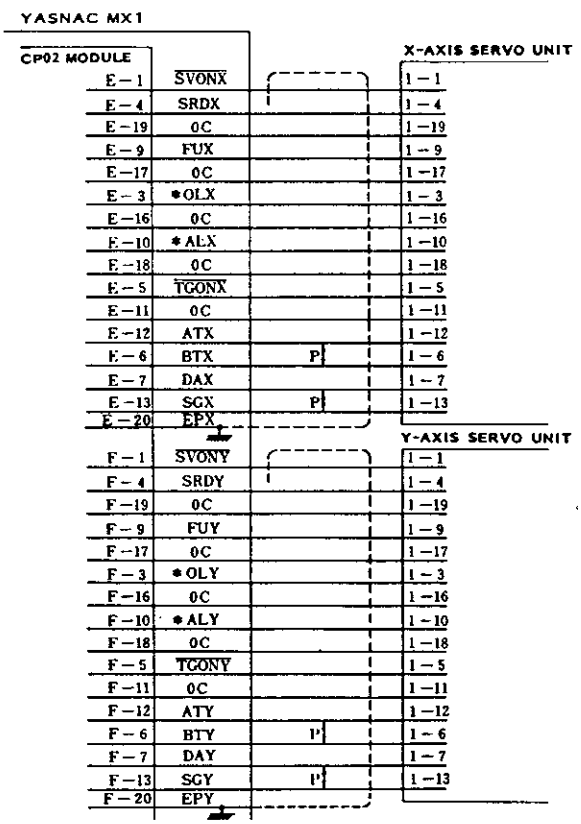
Shown below is the recommended circuit for inputting servo power.



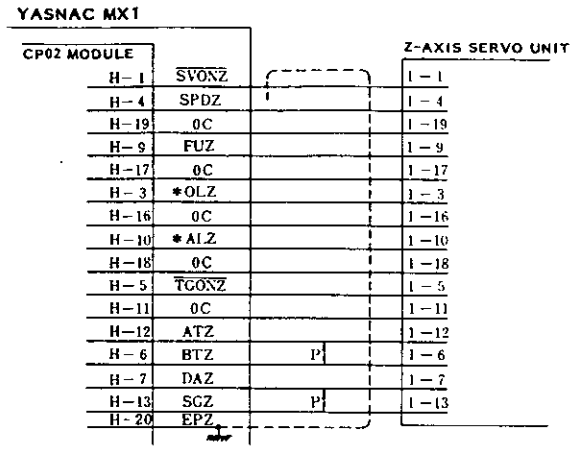
4.3 CONNECTION BETWEEN SERVO CPU MODULE AND EACH SERVO UNIT

Shown below are the connection between the servo CPU module (CP02) and additional axis controller (SR01/SR02), X-, Y-, Z-, 4th, and 5th axis servo units.

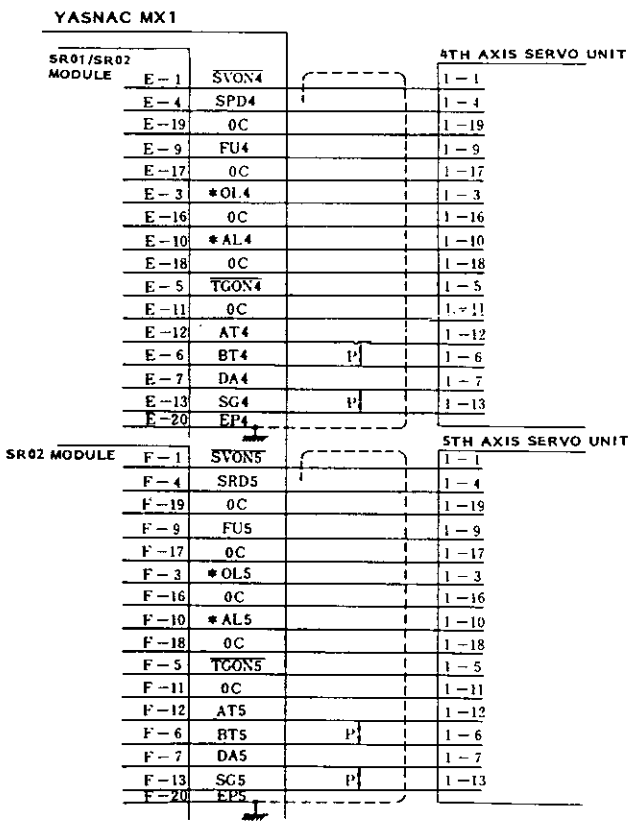
Connection of CP02 with X- and Y-Axis Servo Units



Connection of CP02 with Z-Axis Servo Unit

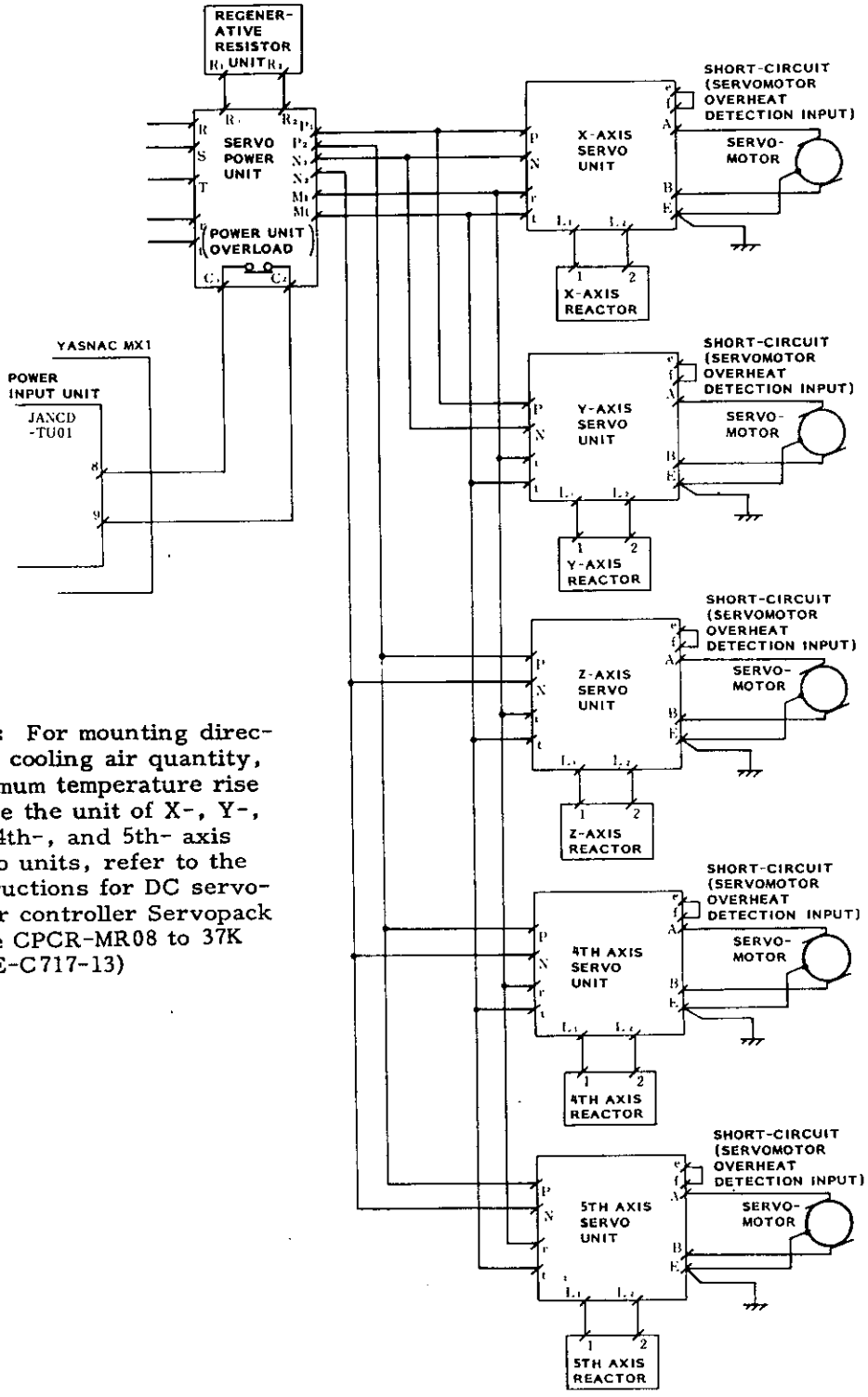


Connection of CP02 with 4th and 5th Axes Servo Units



*Normally closed contacts.

4.4 CONNECTIONS BETWEEN SERVO RELATED UNITS



Note: For mounting direction, cooling air quantity, maximum temperature rise inside the unit of X-, Y-, Z-, 4th-, and 5th- axis servo units, refer to the instructions for DC servomotor controller Servopack Type CPCR-MR08 to 37K (TOE-C717-13)

5. CONNECTION OF SERVOMOTORS

Shown below are connections of X-, Y-, Z-, 4th-, and 5th-axis servomotors to the control incorporating X-, Y-, Z-, 4th-, and 5th-axis servo units.

(1) CONNECTIONS BETWEEN X-AXIS SERVOMOTOR AND YASNAC MX1

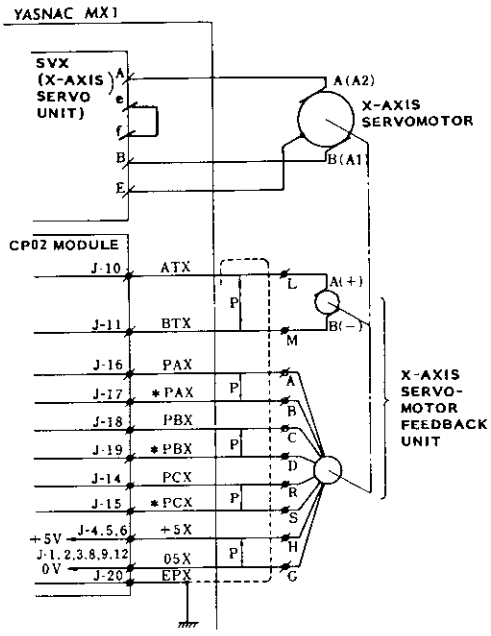


Fig. 5.1

(2) CONNECTIONS BETWEEN Y-AXIS SERVOMOTOR AND YASNAC MX1

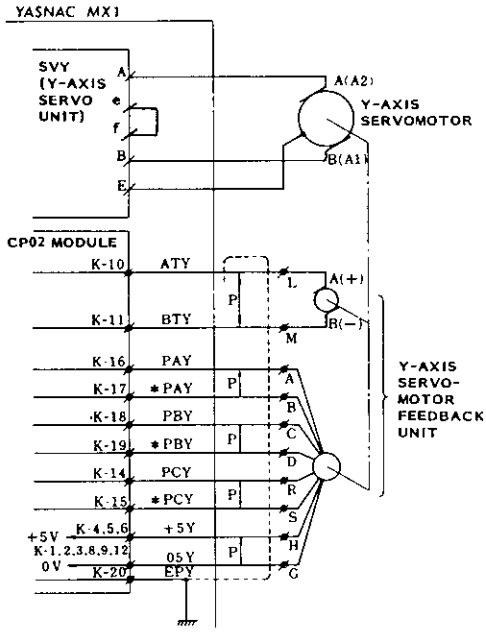


Fig. 5.2

(3) CONNECTIONS BETWEEN Z-AXIS SERVOMOTOR AND YASNAC MX1

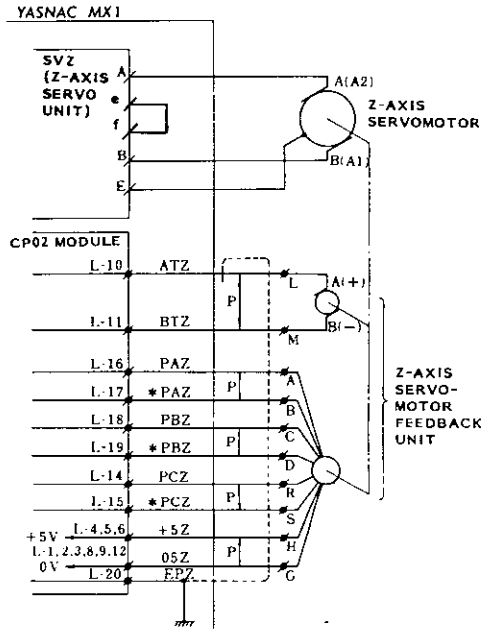


Fig. 5.3

(4) CONNECTIONS BETWEEN 4TH-AXIS SERVOMOTOR AND YASNAC MX1

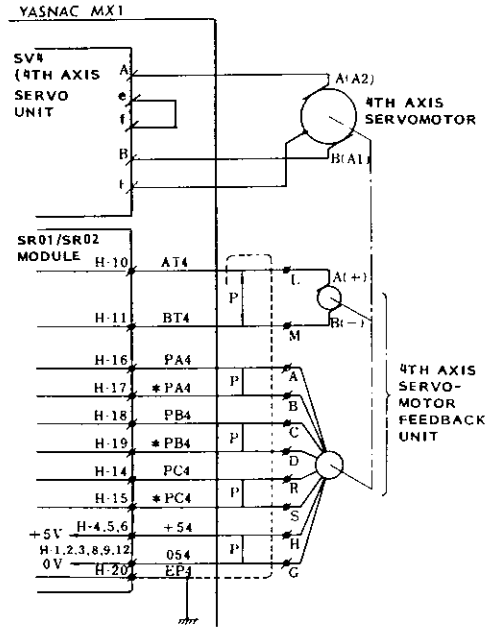


Fig. 5.4

*Asterisked signals activate at LOW.

(5) CONNECTIONS BETWEEN 5TH-AXIS SERVOMOTOR AND YASNAC MX1

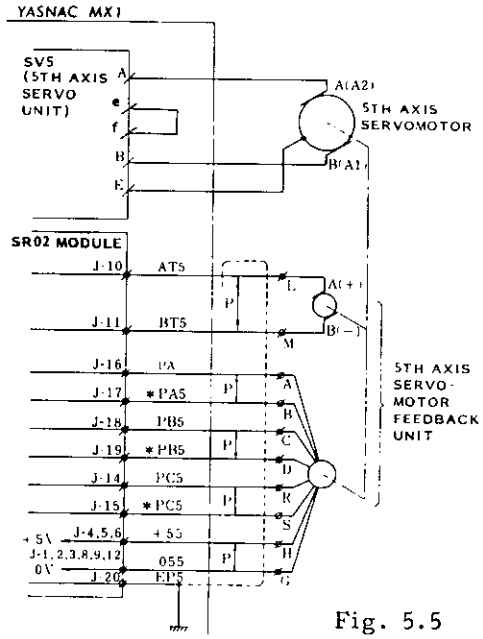


Fig. 5.5

NOTE:

1. When connecting the cable to the feedback unit, be sure to peel the coating and connect the shield to the housing.

2. The connection diagram indicates the connection for the case where "the motor runs clockwise as viewed from the rear of the output shaft for motion in the + direction." For the opposite motor run direction, change the connection as follows.

A of SV□	B (A1) of servo motor
B of SV□	A (A2) of servo motor
10 of CP02, J/K/L and SR01/02 H,J	M of feedback unit
11 of CP02, J/K/L and SR01/02 H,J	L of feedback unit
16 of CP02, J/K/L and SR01/02 H,J	C of feedback unit
17 of CP02, J/K/L and SR01/02 H,J	D of feedback unit
18 of CP02, J/K/L and SR01/02 H,J	A of feedback unit
19 of CP02, J/K/L and SR01/02 H,J	B of feedback unit

3. Where the servo units are installed separate from the NC unit, the wiring is identical, except that SVX to SV5 are located outside the NC unit. Refer to "5. CONNECTION WITH EXTERNAL SERVO CONTROL UNIT."

6. CONNECTIONS TO EXTERNAL NC OPERATOR'S STATION

The connection between a YASNAC MX1 and an external NC operator's station is shown below.

(1) Built-in Type 1 and Unbundled Type

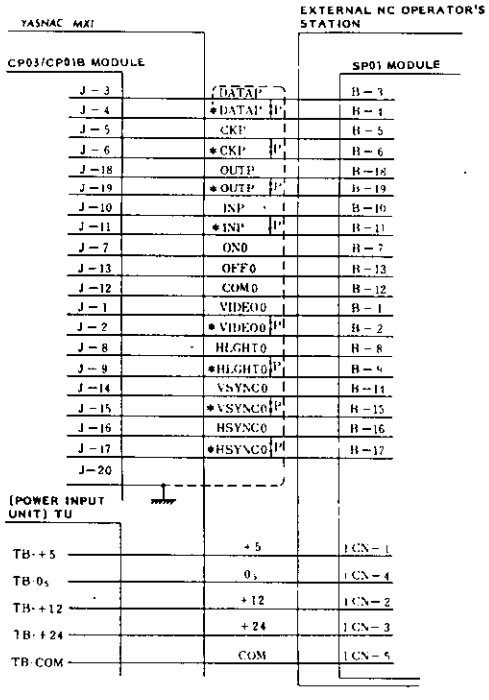


Fig. 6.1

*Asterisked signals activate at LOW.

(2) Free-standing Type

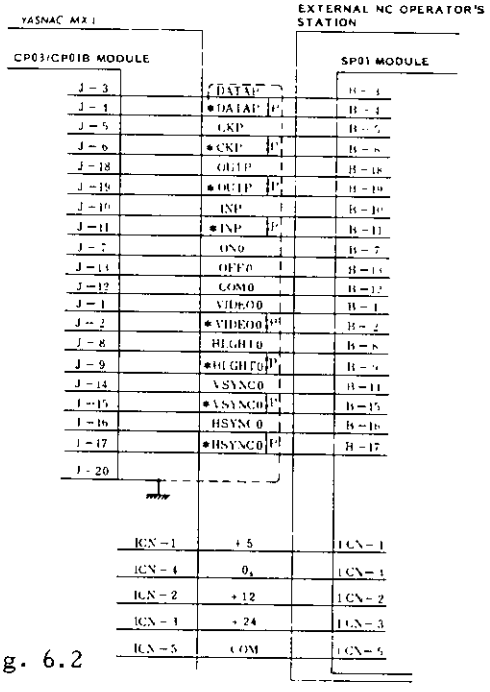


Fig. 6.2

NOTE:

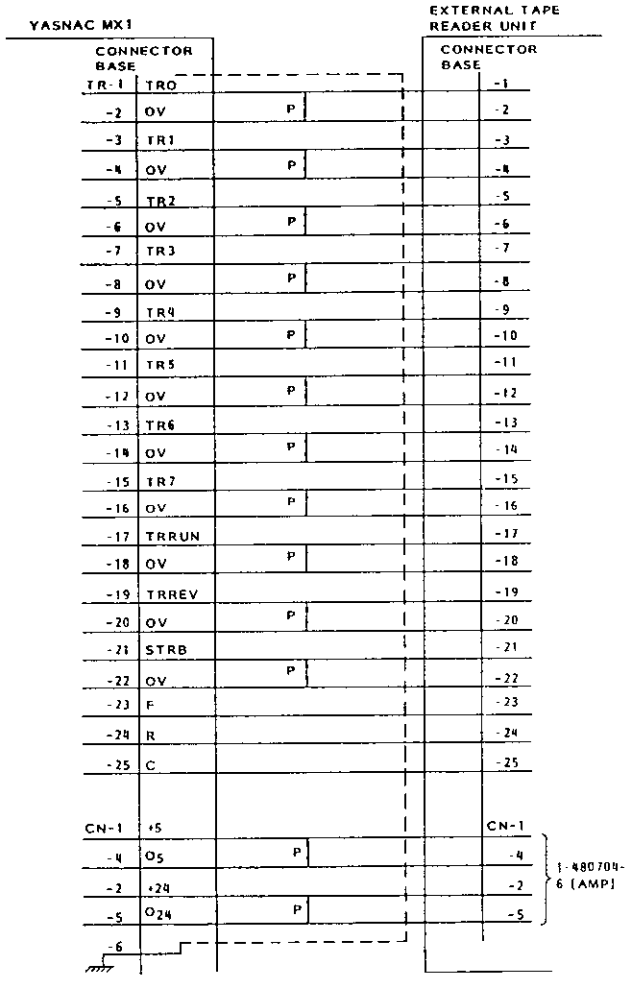
1. When connecting the cable to an external NC operator's unit, be sure to peel the coating and connect the shield to the housing by clamping.

2. Cable length should be 10 m maximum. For cables also refer to "2. CABLES AND CABLE CLAMPS."

3. Ground an external NC operator's station at the grounding base. (No special wire size is specified.)

7. CONNECTION WITH EXTERNAL TAPE READER UNIT (Unbundled Type)

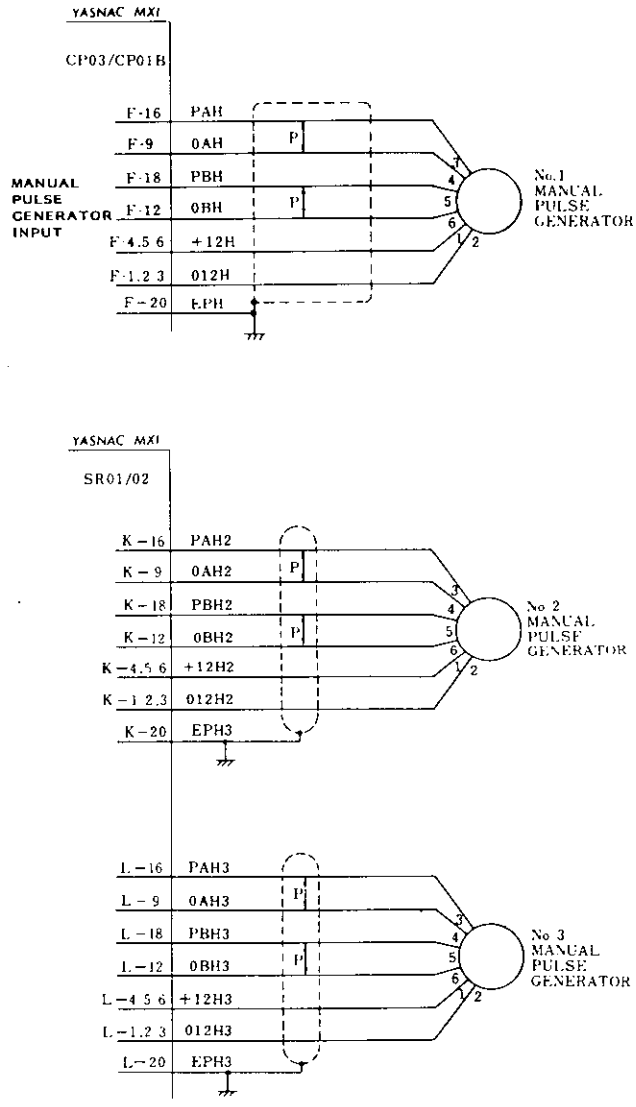
The connection between a YASNAC MX1 and an external tape recorder unit is as shown in the following diagram.



NOTE:

1. Cable length should be 1.2 m maximum.
2. For the type of the cable to be used, refer to "2. CABLES AND CABLE CLAMPS."
3. For grounding an externally installed type tape reader, connect the grounding cable to its ground base.

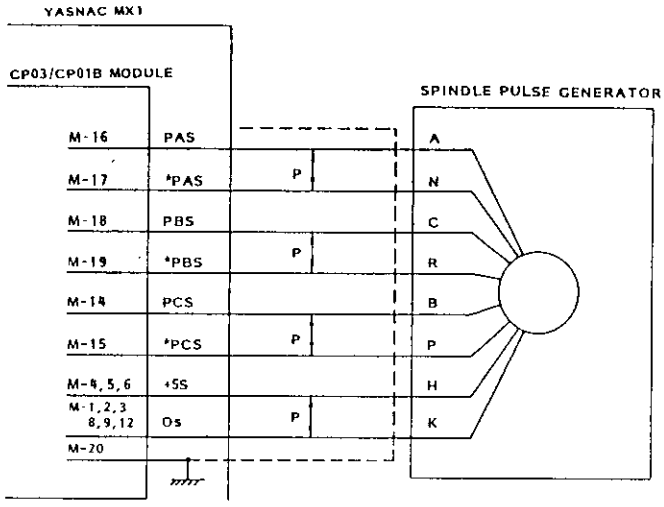
8. CONNECTIONS OF YASNAC WITH MANUAL PULSE GENERATOR



NOTE:

1. When connecting the cable to the manual pulse generator, be sure to peel the coating, and connect the shield to the housing.
2. For the cable, refer to "2. CABLES AND CABLE CLAMPS."
3. Be sure to ground machines, panels, etc. to which a manual pulse generator is installed. (No special wire size is specified.)

9. CONNECTIONS OF YASNAC WITH SPINDLE PULSE GENERATOR



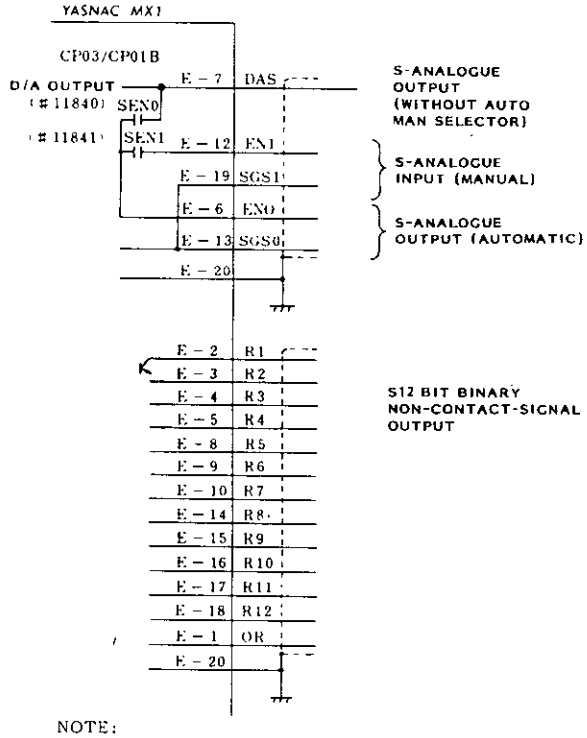
*Asterisked signals activate at LOW.

NOTE:

1. When connecting the cable to the spindle pulse generator, be sure to peel the coating, and connect the shield to the housing.

2. For the cable, refer to "2. CABLES AND CABLE CLAMPS."

10. CONNECTIONS TO S4-DIGIT SPINDLE COMMAND



NOTE:

1. When connecting the S4-digit spindle command cable to the NC, be sure to peel the coating, and connect the shield to the housing.

2. For the cable, refer to "2.CABLES AND CABLE CLAMPS."

3. For its operation, refer to "12.4.35 S4-Digit Command."

4. When using the 12-bit non-contact output lines, limit each bit to 70 mA max., and analog output to 5 mA max.

11. CONNECTION TO FACIT INTERFACE, SERIAL INTERFACE

(1) TYPES AND FUNCTIONS OF INTERFACES

For connection to tape punchers, external tape readers, etc., the following data I/O interfaces are available.

Table 11.1

Interface	FACIT 4070	Current Loop	RS 232C	RS 422
Type	Parallel voltage interface	Serial voltage (20 mA) interface	Serial voltage interface	Serial parallel interface
Baud rate (ch/sec)	(70 ch/sec)	110 Bauds	110 - 9600 Bauds	
Punching	Enable			
Memory storing input	Unable		Enable	
Operation in TAPE mode	Unable		Enable	
Max allowable cable length	5 m	50 m	15 m	100 m
Connector[1] Type	MR-20MR (MR-20F)		DB-25S (DB-25P)	DB-37S (DB-37P)

(1) Type names of connectors provided with the control unit. Parenthesized type names are the male connectors to be used.

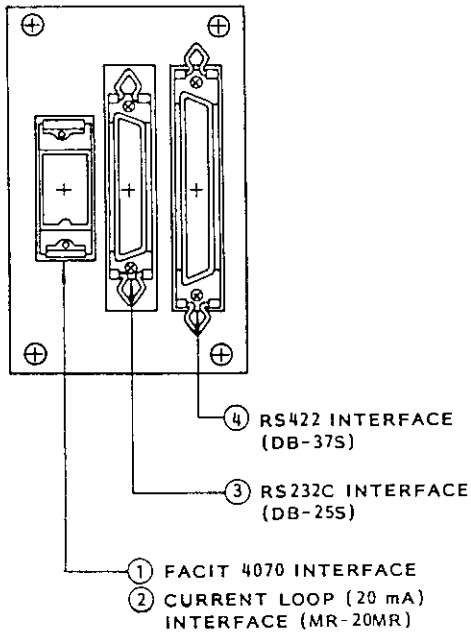


Fig. 11.1 Data Input/Output Interface

(2) SELECTION OF INTERFACES

Select the interface to be used by sitting numbers.

a. Selection of input interface

Input Interface to be used	#6003D1 IDVCE1	#6003D0 IDVCE0
PTR interface (1)	0	0
RS232C interface	0	1
RS422 interface	1	0

(1) Interface for tape reader unit (option) only.

b. Selection of output interface

Output Interface to be used	#6003D5 ODVCE1	#6003D4 ODVCE0
FACIT 4070 interface	0	0
Current loop interface, RS232C interface	0	1
RS422 interface	1	0

11.1 FACIT 4070 INTERFACE

(1) TRANSMISSION MODE

Parallel transmission: 8-bit data is outputted from NC in parallel. Output timing is controlled by the exchange of punch instruction output signals (PI) and punch ready input signals (PR).

(2) CODE

EIA codes or ISO codes are used.

(3) TRANSMISSION RATE

Transmission rates depend on the machine to be controlled. Refer to the manual of the relevant machine maker.

Reference: Standard transmission rate is 70 char/sec

(4) CABLE LENGTH

5 m max.

(5) INTERCONNECTION

a. Interconnection is as shown in the following table.

Table 11.2 FACIT4070 Interface Connecting Cable

NC (MR-20F)			Connections	External Equipment (DB-25P)	
Symbol	Signal Name	Pin No.		Pin No.	Symbol
PR	PUNCH READY	1		12	PR
TL	TAPE LOW	2		21	TL
ERR1	ERROR	3		20	ERR1
	Not Used	4			
+6 V	FACIT/ ASR. Auto-selection	5		24	+6 V
	Not Used	6			
	Not Used	7			
0 V	GROUND	8			
0 V	GROUND	9		10	SD
0 V	GROUND	10		25	0 V
CH1	PUNCH DATA 1	11		1	CH1
CH2	PUNCH DATA 2	12		2	CH2
CH3	PUNCH DATA 3	13		3	CH3
CH4	PUNCH DATA 4	14		4	CH4
CH5	PUNCH DATA 5	15		5	CH5
CH6	PUNCH DATA 6	16		6	CH6
CH7	PUNCH DATA 7	17		7	CH7
CH8	PUNCH DATA 8	18		8	CH8
CH9	FEED HOLD	19		9	CH9
PI	PUNCH INSTRUCTION	20		11	PI

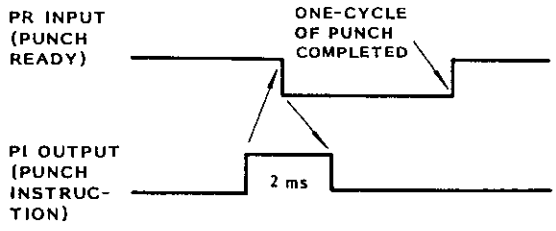
Note

Note: Pin numbers are applicable when the external equipment is FACIT 4070 and plug-in connector is DB-25P.

b. Description of signals

(1) PR: Punch ready (input) — While PR input is on, the FACIT is ready for accepting punching instructions.

(2) PI: Punch instruction (output) — When PI signals are outputted, the FACIT starts to punch. The exchange of signals is as follows:



(3) TL: Tape low (input) — As the paper tape runs out, TL signals are inputted, and punching stops.

(4) ERR: Error (input) — When a fault is detected in the FACIT, ERR signals are inputted, and punching stops.

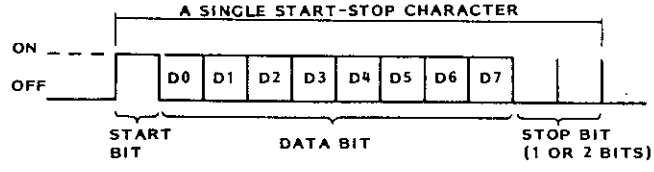
(5) +6 V: FACIT/ASR automatic recognition (input) — When +6 V signals are inputted, and FACIT 4070 interface is opened, the current loop interface mode is entered.

(6) CH1 - CH9: Data (output) — Data in channels 1 through 8. Until a new data is outputted the previous state is maintained. CH9 means a feed hole, and changes similar to PI signals.

11.2 CURRENT LOOP (20 mA) INTERFACE

(1) TRANSMISSION MODE

Start-stop synchronization: Each data bit is led by a start signal and followed by a stop signal.



ON-OFF is 20 mA current loop signals.

(2) CODES USED

The following two codes are used, and they can be selectively used by parameters (#6026D5, #6028D5).

a. EIA code or ISO code

b. EIA code or ISO code + control codes (DC1 - DC4)

To use control codes, the machine to be controlled must be able to discriminate codes DC1 through DC4. DC1 - DC4 codes are as shown below.

Table 11.3

Character		8	7	6	5	4	Feed Hole	3	2	1
DC1	Tape reader start				○					○
DC2	Tape punch designation				○				○	
DC3	Tape reader stop	○			○				○	○
DC4	Tape punch release				○			○		

(3) TRANSMISSION BAUD RATE

The transmission Baud rate is set at 110B with a parameter. Refer to (6) below.

(4) CABLE LENGTH

The permissible maximum cable length varies with the machine to be controlled. Refer to the manual of the machine maker.

Reference: Standard max. cable length = 50 m

(5) INTERCONNECTION

a. The interconnection is as shown below.

Table 11.4 Current Loop (20 mA) Interface Connection Cable

NC (MR-20F)			Connections	External Equipment	
Symbol	Signal Name	Pin No.		Pin No.	Symbol
		1			
	Not Used	⎫			
		4			
+6 V	FACIT/ ASR. Auto-selection	5			
TTY2	Current loop (-)	6	○—○		
TTY1	Current loop (+)	7	○—○		
0 V	GROUND	8			
		9			
	Not Used	⎫			
		20			

(Note 2)

Note:

1. The type of connector and pin number are different with external equipment.

2. When the current loop (20 mA) interface is used, short-circuit pin No. 4 (signal RS) and pin No. 5 (signal CS) of plug connector DB-25P for RS232C. Then connect the plug to the NC receptacle DB-25S.

11.2 CURRENT LOOP (20 mA) INTERFACE (Cont'd)

The NC outputs control codes DC1 through DC4 to start and stop the machine. The machine can not output control codes to control the NC.

(6) PARAMETER SETTING

When using serial interface (current loop, RS232 RS232C, RS422), set the data transmission Baud rate, stop bit length and the control code output designation with the parameters.

Current loop and RS232C interface

Two types of setting are available: 1 common data setting for input and output and 2 independent data setting for input.

#6028 D6

0: Sets data for input and output in common.
1: Sets data for input and output independently.

a. Baud rate setting - Setting of 110B

Common	Input/ Output	#6026 D3	#6026 D2	#6026 D1	#6026 D0
Independent	Input	#6026 D3	#6026 D2	#6026 D1	#6026 D0
	Output	#6028 D3	#6028 D2	#6028 D1	#6028 D0
Baud rate value	50	0	0	0	0
	100	0	0	0	1
	110	0	0	1	0
	150	0	0	1	1
	200	0	1	0	0
	300	0	1	0	1
	600	0	1	1	0
	1200	0	1	1	1
	2400	1	0	0	0
	4800	1	0	0	1
	9600	1	0	1	0

b. Setting of stop bit length

Common	Input/ Output	#6026 D4	= 1: Two bits for stop bit
Independent	Input	#6026 D4	= 0: One bit for stop bit
	Output	#6028 D4	

c. Setting of control code output

Common	Input/ Output	#6026 D5	= 1: Does not send control code.
Independent	Input	#6026 D5	= 0: Sends control code.
	Output	#6028 D5	

11.3 RS232C INTERFACE

(1) TRANSMISSION MODE

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

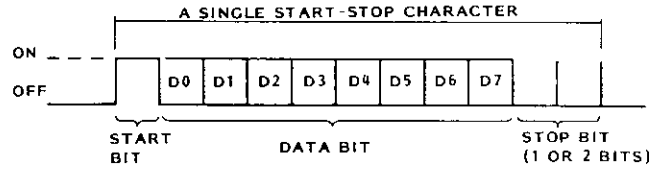


Table 11.6

	$V_0 < -0.2$ V	$V_0 > +0.2$ 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 (#6026D5, #6028D5).

a. EIA codes or ISO codes
b. 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 11.7

Character		8	7	6	5	4	Feed Hole	3	2	1
DC1	Tape reader start				○					○
DC2	Tape reader punching				○				○	
DC3	Tape reader stop	○			○				○	○
DC4	Tape punch release				○			○		

(3) TRANSMISSION BAUD RATE

Transmission Baud rates can be selected at any rate between 50 and 96000 Bauds with parameters. Refer to (7) below.

(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 15 m.)

(5) INTERCONNECTION

a. As shown below.

Table 11.8 RS232C Interface Connecting Cable (A)

NC (DB-25P)			Connections	External Equipment	
Symbol	Signal Name	Pin No.		Pin No.	Symbol
FG	Frame grounding	1			FG
SD	Sending data	2			SD
RD	Sending data	3			RD
RS	Receiving data	4			RS
CS	Capable of sending	5			CS
	Not used	6			DR
SG	Signal grounding	7			SG
		8			IO BUSY
	Not used	25			ER (OR IO ALARM)

NC outputs 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.

Note 1: When CS signals of the NC are not used, short CS and RS as shown below.

Table 11.9 RS232C Interface Connecting Cable (B)

NC (DB-25P)			Connections	External Equipment	
Symbol	Signal Name	Pin No.		Pin No.	Symbol
FG	Frame grounding	1			FG
SD	Sending data	2			SD
RD	Sending data	3			RD
RS	Receiving data	4			RS
CS	Capable of sending	5			CS
	Not used	6			DR
SG	Signal grounding	7			SG
		8			IO BUSY
	Not used	25			ER (OR IO ALARM)

b. Description of signals

i. FG: Safety grounding

ii. SD: Transmission data (output)

iii. RD: Received data (inout)

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

v. 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 12.9 above.

vi. SG: Signal grounding

vii. ER: Data terminal ready — Not used by NC.

Note: Among the RS232C 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

a. When NC receives data.

Data can be received in the following sequence and timing.

i. NC sends code DC1.

ii. At code DC1, the machine under control starts to send data to NC.

iii. If the NC can not process data in time, it sends out code DC3.

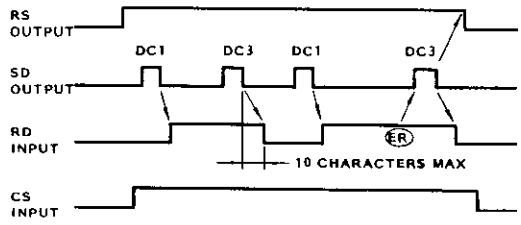
iv. At code DC3, the machine stops sending data within 10 characters.

v. NC again sends code DC1 after processing data.

vi. At code DC1, the machine sends out the data that succeeds the previously sent one.

vii. Upon reading in the data, NC sends out code DC3.

viii. The machine stops sending data.



11.3 RS232C INTERFACE (Cont'd)

b. When NC sends out data

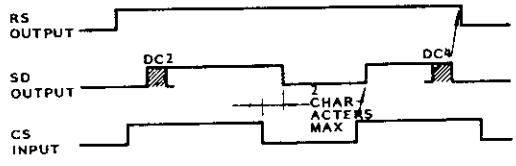
NC sends out data in the following sequence and timing.

i. NC sends out code DC2, and subsequently sends out data.

ii. If the machine under control can not process the data in time, NC stops CS at no IO BUSY signal.

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

iv. Upon completion of data sending, NC sends out code DC.



(7) PARAMETER SETTING

When using serial interface (current loop, RS232C, RS422), set the data transmission Baud rate, stop bit length, and the control code output designation with the parameters.

Current loop and RS232C interface

Two types of setting are available: 1 common data setting for input and output and 2 independent data setting for input and output.

#6028 D6

0: Sets data for input and output in common.
1: Sets data for input and output independently.

a. Baud rate setting

Table 11.10

Common	Input/ Output	#6026 D3	#6026 D2	#6026 D1	#6026 D0
Independent	Input	#6026 D3	#6026 D2	#6026 D1	#6026 D0
	Output	#6028 D3	#6028 D2	#6028 D1	#6028 D0
Baud rate value	50	0	0	0	0
	100	0	0	0	1
	110	0	0	1	0
	150	0	0	1	1
	200	0	1	0	0
	300	0	1	0	1
	600	0	1	1	0
	1200	0	1	1	1
	2400	1	0	0	0
	4800	1	0	0	1
	9600	1	0	1	0

b. Stop bit length setting

Common	Input/ Output	#6026 D4	= 1: Two bits for stop bit
Independent	Input	#6026 D4	= 0: One bit for stop bit
	Output	#6028 D4	

c. Setting of control code output

Common	Input/ Output	#6026 D5	= 1: Does not send control code.
Independent	Input	#6026 D5	= 2: Sends control code.
	Output	#6028 D5	

11.4 RS422 INTERFACE

(1) TRANSMISSION MODE

Start-stop synchronization: In this mode, a start signal and a stop signal respectively preceds and succeeds each data bit.

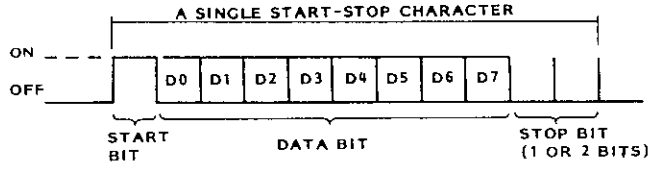
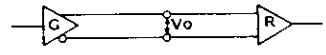


Table 11.11

	$V_0 < -0.2$ V	$V_0 > +0.2$ V
FUNCTION	OFF	ON
SIGNAL CONDITION	MARK	SPACE
LOGIC	1	0



(2) CODES USED

The following two types of codes are used. They are selectively specified by parameters (#6027D5, #6029D5).

a. EIA codes or ISO codes

b. EIA codes or ISO codes + control codes (DC1 - DC4)

To use control codes, the machine to be controlled must be able to descriminate codes DC1 - DC4. Codes DC1 - DC4 are shown below.

Table 11.12

Character		8	7	6	5	4	Feed Hole	3	2	1
DC1	Tape reader start				○					○
DC2	Tape reader punching				○				○	
DC3	Tape reader stop	○			○				○	○
DC4	Tape punch release				○			○		

(3) TRANSMISSION BAUD RATE

Transmission Baud rates between 50 and 9600 B can be specified by parameters. Refer to (6) below.

(4) CABLE LENGTH

The permissible cable length varies with the machines to be controlled. In this respect, refer to the manual of the relevant machine makers.

Standard cable length

60 m — without terminator
100 m — with terminator (option) -- Note

Great care must be paid to the selection of cable routes and machine installation locations to avoid faulty operations of the NC and the machines caused by noise and grounding potential difference.

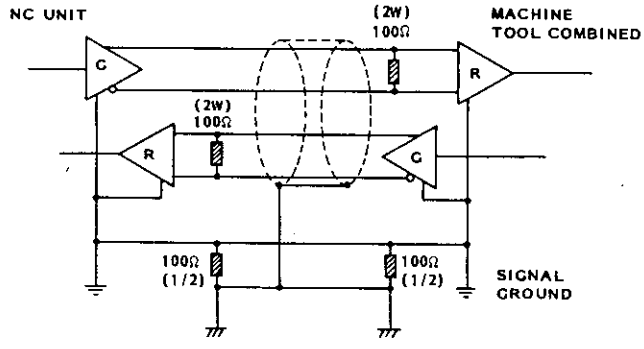


Fig. 11.1

Note: Terminators are resistors shown by ▨. Terminators are required to be connected not only on the NC side, but also on the machine side, as shown.

(5) CONNECTION AMONG MACHINES

a. Connection among machines are as shown below. (RS422 connection cable A)

The NC can start and stop the machine by outputting control codes DC1 - DC4, but the machine can not control the NC by outputting control codes. However, when the machine can not process data in time, it can control CS signals of the NC to halt its data sending.

Table 11.13 RS422 Interface Connection Cable (A)

NC (DB-37P)			Connections	External Equipment	
Symbol	Signal Name	Pin No.		Pin No.	Symbol
SHIELD	Shield	1			
	Not used	2			
	Not used	3			
SD	Sending data	4			SD
	Not used	5			
RD	Receiving data	6			RD
RS	Request sending	7			RS
	Not used	8			
CS	Cable of sending	9			CS
	Not used	10			
	Not used	11			
ER	NC ready	12			ER
DR	I/O device ready	13			DR
		14			
	Not used	⋮			
		18			
SG	Signal grounding	19			
	Not used	20			
	Not used	21			
*SD	Sending data	22			*SD
	Not used	23			
*RD	Receiving data	24			*RD
*RS	Request sending	25			*RS
	Not used	26			
*CS	Capable of sending	27			*CS
	Not used	28			
	Not used	29			
*ER	NC ready	30			*ER
*DR	I/O device ready	31			*DR
	Not used	32			
		⋮ 37			

*Normally closed contacts.

Note: When CS isgnal on the NC side is not used, shortcircuit CS and RS.

Table 11.14 RS422 Interface Connection Cable (B)

NC (DB-37P)			Connections	External Equipment	
Symbol	Signal Name	Pin No.		Pin No.	Symbol
SHIELD	Shield	1			
	Not used	2			
	Not used	3			
SD	Sending data	4			SD
	Not used	5			
RD	Receiving data	6			RD
RS	Request sending	7			RS
	Not used	8			
CS	Cable of sending	9			CS
	Not used	10			
	Not used	11			
ER	NC ready	12			ER
DR	I/O device ready	13			DR
		14			
	Not used				
		18			
SG	Signal grounding	19			
	Not used	20			
	Not used	21			
*SD	Sending data	22			*SD
	Not used	23			
*RD	Receiving data	24			*RD
*RS	Request sending	25			*RS
	Not used	26			
*CS	Capable of sending	27			*CS
	Not used	28			
	Not used	29			
*ER	NC ready	30			*ER
*DR	I/O device ready	31			*DR
	Not used	32			
		37			

b. Description of signals

i. SD, RD, RS, CS and SG are same as those for RS232C.

ii. SHIELD: Shield — The shield of the signal cables is to be connected to this pin. Normally connect in the connector on the NC side.

iii. ER: NC ready (output) — This signal is turned on when the NC becomes ready for operation. Unless this signal is on, all output signals of the NC are ineffective.

iv. DR: I/O unit ready (input) — This signal is turned on when the machine becomes ready to operate. When this signal is turned off during data sending, the sending process is stopped.

(6) PARAMETER SETTING

When using RS232C and current loop interfaces, set the data transmission Baud rate, stop bit length, and the control code output designation with the parameters.

Current loop and RS232C interfaces

Two types of settin are available: 1 common data setting for input and output and 2 independent data setting for input and output.

#6029 D6

0: Sets data for input and output in common.
1: Sets data for input and output independently.

a. Baud rate setting

Common	Input/ Output	#6027 D3	#6027 D2	#6027 D1	#6027 D0
Independent	Input	#6027 D3	#6027 D2	#6027 D1	#6027 D0
	Output	#6029 D3	#6029 D2	#6029 D1	#6029 D1
Baud rate values	50	0	0	0	0
	100	0	0	0	1
	110	0	0	1	0
	150	0	0	1	1
	200	0	1	0	0
	300	0	1	0	1
	600	0	1	1	0
	1200	0	1	1	1
	2400	1	0	0	0
	4800	1	0	0	1
	9600	1	0	1	0

b. Setting of stop bit length

Common	Input/ Output	#6027 D4	= 1:	Two bits for stop bit
Independent	Input	#6027 D4	= 0:	One bit for stop bit
	Output	#6029 D4		

c. Setting of control code output

Common	Input/ Output	#6027 D5	= 1:	Does not send control code.
Independent	Input	#6027 D5	= 0:	Sends control code.
	Output	#6029 D5		

12. CONNECTION WITH SWITCHING UNITS

12.1 LIST OF CONNECTION SIGNALS

Table 12.1

	Signal Name	Contact Ratings
R S	AC power input	———
G	Cabinet grounding	———
+5 V O5 V +12 V +24 V COM	Power output for NC operator's station	———
MA MB	NC power on (contact output)	220 VAC, 13 A 440 VAC, 10 A 550 VAC, 8 A
SA SB	Servo power on (contact output)	
DSA DSD	Door switch (contact output)	230 VAC, 50 VDC MAX, 500 mA MAX
EMSLS1 EMSLS2	Machine end input	30 V MAX 10 mA MAX
MER1 MER2	Machine end release input	
ESP1-1 ESP3-2	Emergency stop input	
OL1 OL4	Overload input	
OHT1 OHT2	Overheat input	
EON EOF ECOM	External power ON/OFF input	
NRD1 NRD2	NC Ready (contact input)	230 VAC, 50 VDC MAX, 500 mA MAX

Note:

1. For connections of AC power input and cabinet ground terminals, see 3. CONNECTIONS OF POWER SUPPLY.
2. For connections of power output terminals for NC operator's station, see 6. CONNECTIONS TO EXTERNAL NC OPERATOR'S STATION.
3. Connections to composite power supply unit made in the power input unit must not be changed.

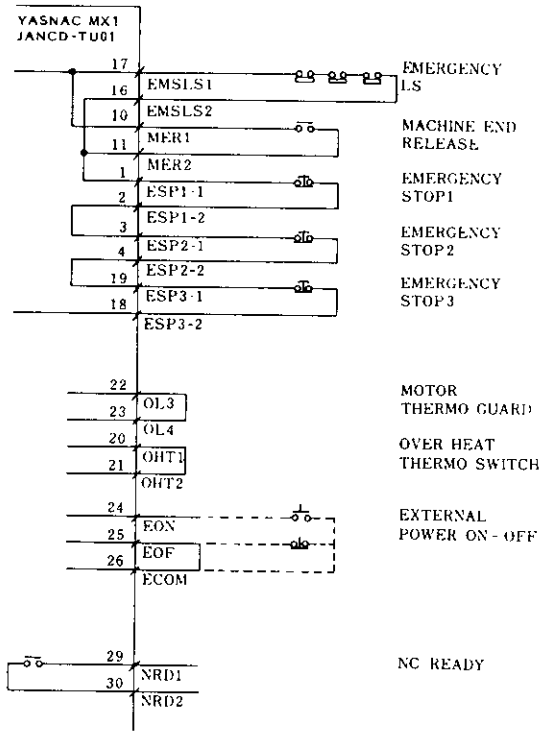


Fig. 12.1

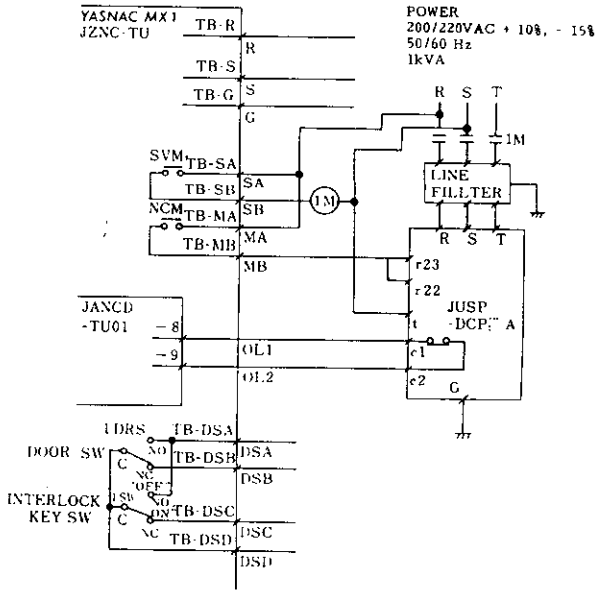


Fig. 12.2

12.2 DETAILS OF SIGNALS

12.2.1 NC Power on (MA, MB) and Servo Power on (SA, SB) Contact Output

(1) MA, MB: This output is turned off when the logic circuit of the control is energized.

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

(3) The power supply turning on sequence is as follows.

a. Close the power supply main switch for the control.

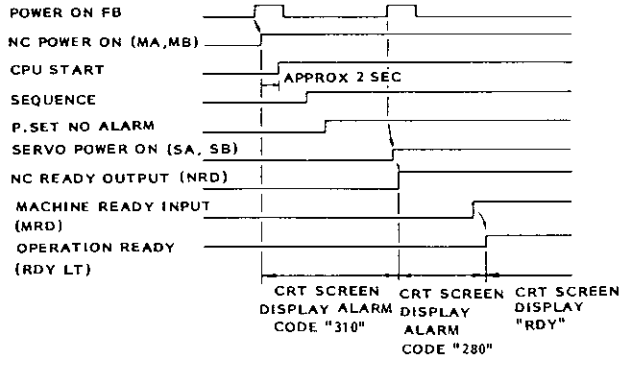
b. Either push the POWER ON button on the NC operator's station, or close the circuit between EON and ECM. Then, the logic circuit and the servo control circuit are both energized, and the circuit between MA and MB (NC power on contact output) is closed.

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

c. Again make the same power switching (pushing the POWER ON button or closing the circuit between EON and ECM). Now, the servo power supply is turned on, and the circuit between SA and SB (servo power on contact output) is closed.

With an external servo unit, design the servo power circuit power input sequence so that the circuit is energized at the output of SA and SB signals.

d. When the external circuit is ready after the circuit between SA and SB 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 showing that operation becomes possible.



12.2.2 Door Switch (DSA-D) Output

This output serves to indicate the control unit door is open. With this output, the circuit between DSA and DSC or between DSA and DSD is closed, while the door is open. When DSA and DSC signals are used, the circuit between them can be kept open by means of door ineffective switch (KEY SW) even while door is open.

With this output, the circuit between DSB and DSC or between DSB and DSD is closed while the door is open. When DSB and DSC signals are used, the circuit between them can be kept open by means of door ineffective switch (KEY SW) even while door is open.

NOTE: Free-standing cabinet is applicable to DSB and DSC outputs only.

12.2.3 Emergency Stop (ESP1-1 to ESP3-2) and Machine End Input and Machine End Release (MER1-2) Input

When the circuit between emergency stop input terminals ESP1-1 and ESP1-2, between ESP2-1 and ESP2-1, or between ESP3-1 and ESP3-2 are open, the control stops all the movements, turns off the servo power, and opens the emergency stop output (*ESPS) of general purpose I/O module.

When the circuit between machine end input between EMSLS1 and EMSLS2 is open, the machine end input can be ineffective by closing the circuit between machine end release input MER1 and MER2.

NOTE: Never close the machine end release signal during machine operation, for failure to do so will cause the impact.

12.2.4 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 pushing 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 de-energized.

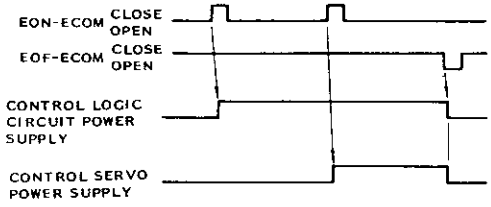


Fig. 12.4

12.2.5 Overload (OL1 and 2) Input

They are for connecting to the overload detection terminals of the servo power unit (JUSP-DCP-□□A). With an external servo unit, connect them as follows.

(Switching unit)	(Servo power unit)
OL1	JUSP-DCP-C1
OL2	JUSP-DCP-C3

When the circuit between OL1 and OL2 is opened, the control turns off the servo unit power supply, opens the circuit between servo power-on contact output SA and SB, and enters an alarm state. (Alarm code 357 is displayed.)

Terminals OL3 and OL4 are connected with OL1 and OL2 in series in the power input unit type TU01. When the terminals OL3 and OL4 are open, the control performs the same function when the terminals OL1 and OL2 are open. Terminals OL3 and OL4 are used as input terminal for motor thermostat. Short-circuit them unless used.

12.2.6 Overheat (OHT1 and 2) Input

It is the connection terminal for excessive temperature detection switch. Opening the circuit between terminals OHT1 and OHT2 enters the control alarm state. (Alarm code "179" is displayed.) Short-circuit them unless used.

12.2.7 NC Ready (NRD1 and 2) Output

When the control is ready to operate after turning on NC power and servo power, the circuit between terminals NRD1 and NRD2 is closed. For the time chart, see Fig.

13. CONNECTION TO GENERAL PURPOSE I/O MODULE

13.1 RATINGS OF CONTACTS

(1) As the input contacts, use ones rated for 30 V, 20 mA or above, and a chattering of 5 msec max.

(2) Use the output contacts under the following conditions.

a. 50 V max.
   500 mA max.
   5 VA max.
   All conditions must be satisfied. (AND)

(Example)
24 V and 200 mA or less current

b. Where an inductive load is connected, be sure to connect a spark killer in parallel within 20 cm of the load.

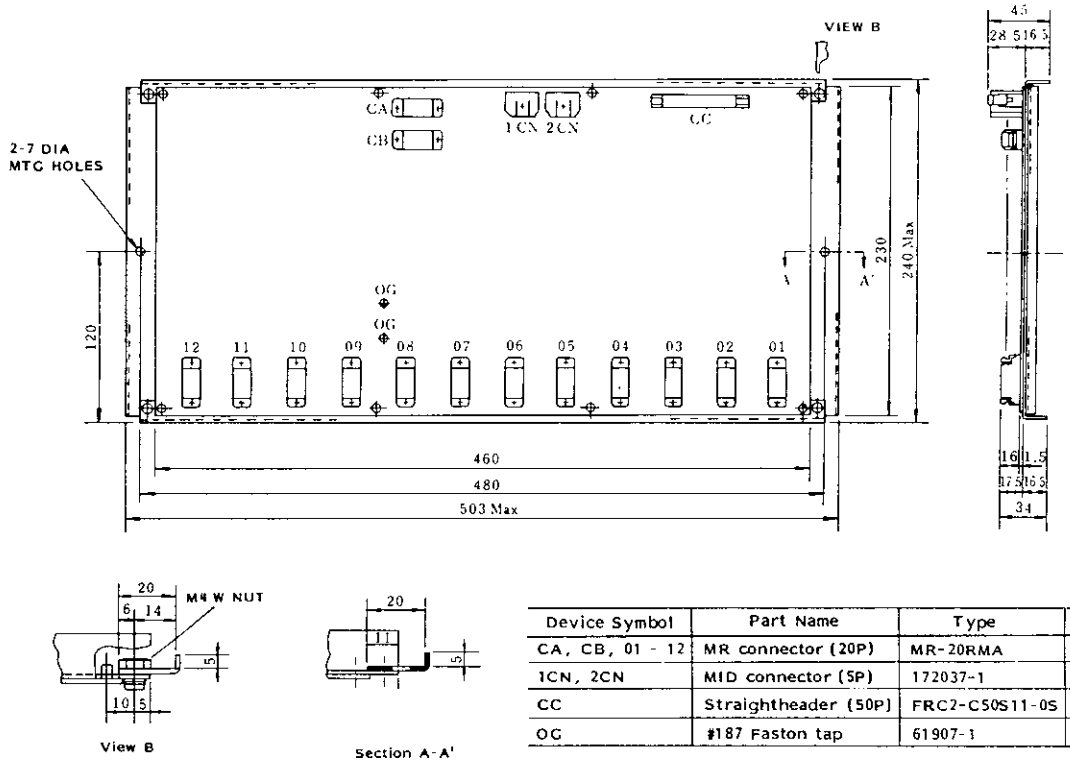
c. Where a capacitive load is connected, be sure to connect a series resistor to limit the total current including the rush current within the conditions given in a.

d. Where a lamp load is connected, be sure to connect a preheating resistor to limit the total current including the rush current within the conditions given in a.

13.2 MODULE CONNECTORS

(1) Fig. 13.1 shows dimensions of I/O modules

(2) Fig. 13.2 and Fig. 14.3 show connector numbers of I/O modules.



Device Symbol	Part Name	Type	Maker
CA, CB, 01 - 12	MR connector (20P)	MR-20RMA	HONDA
1CN, 2CN	MID connector (5P)	172037-1	AMP
CC	Straightheader (50P)	FRC2-C50S11-0S	DDK
OG	#187 Faston tap	61907-1	AMP

Fig. 13.1

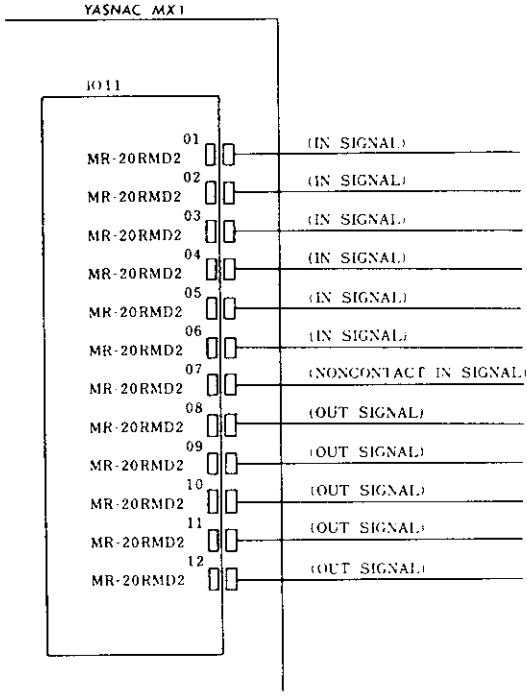


Fig. 13.2

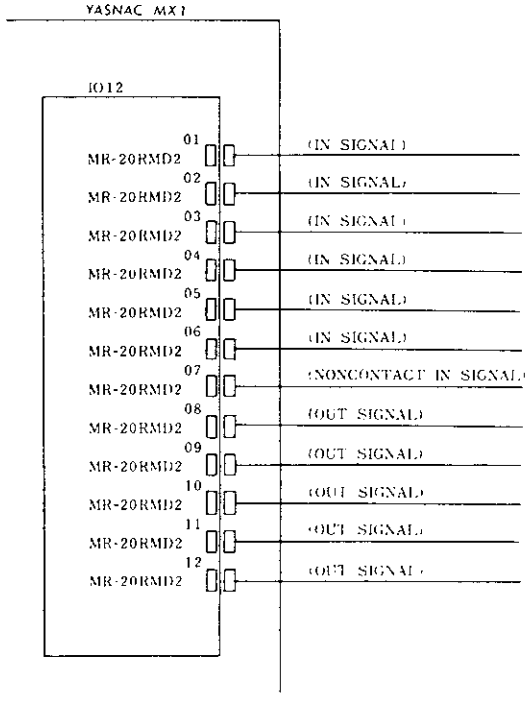


Fig. 13.3

13.3 LIST OF MODULE CONNECTORS

Connector 01: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	RT	S	MEM	OV2	OV16	OVC
	8	9	10	11	12	13
	J	T	EDT	OV4	ROV1	+X
14	15	16	17	18	19	20
+24	H	D	OV1	OV8	ROV2	-X

Connector 02: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	+Y	-Z	JV1	JV8	SPB	HY
	8	9	10	11	12	13
	-Y	+4	JV2	JV16	SPC	HZ
14	15	16	17	18	19	20
+24	+Z	-4	JV4	SPA	HX	H4

Connector 03: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	MP1	DRS	DLK	OPT	ST	ZRN
	8	9	10	11	12	13
	MP2	SBK	BDT	MLK	*SP	TLM1
14	15	16	17	18	19	20
+24	MP4	PLBK	DRN	AFL	EDTLK	RET

Connector 04: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	F1	MIY	ERRO	4NG	4BDT	7BDT
	8	9	10	11	12	13
	SRN	MIZ	ABS	2BDT	5BDT	8BDT
14	15	16	17	18	19	20
+24	MIX	MI4	ZNG	3BDT	6BDT	9BDT

Connector 05: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	MRD	ERS	FIN	GRA	SAGR	SINV
	8	9	10	11	12	13
	STLK	EOP	FFIN	GRB	SEN1	
14	15	16	17	18	19	20
+24	SENO	RWD	GRT	SOR	SFIN	

Connector 06: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	*ITX	*ITY	*DECZ	*-LX	*+LZ	*-L4
	8	9	10	11	12	13
	*ITY	*DECX	*DEC4	*+LY	*-LZ	
14	15	16	17	18	19	20
+24	*ITZ	*DECY	*+LX	*-LY	*+L4	

Connector 07: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	SKIP	ERR2	* SVOFZ			
	8	9	10	11	12	13
	PINT	*SVOFX	*SVOF4			
14	15	16	17	18	19	20
+24	ERR1	*SVOFY				

Connector 08: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	M11/M1	M18/M4	M24/M7	T11/T1	T18/T4	T24/T7
	8	9	10	11	12	13
	M12/M2	M21/M5	M28/M8	T12/T2	T21/T5	T28/T8
14	15	16	17	18	19	20
+24	M14/M3	M22/M6	COM	T14/T3	T22/T6	COM

Connector 09: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	MF	TF	DEN			
	8	9	10	11	12	13
	COM	COM	COM			
14	15	16	17	18	19	20
+24	SF	COM				

Connector 10: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	M00	M30	RST	OP	FMF	SRV
	8	9	10	11	12	13
	M01	COM	COM	COM	SSP	OS
14	15	16	17	18	19	20
+24	M02	AL	COM	SVON	COM	COM

Connector 11: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	1ZPX	1ZP4	2ZPZ	GRL/S11	S18	S24
	8	9	10	11	12	13
	1ZPY	2ZPX	2ZP4	GRH/S12	S21	S28
14	15	16	17	18	19	20
+24	1ZPZ	2ZPY	COM	S14	S22	COM

Connector 12: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	STL	PLBKC	AUTO	TAP	G80S	M31
	8	9	10	11	12	13
	SPL	COM	4NGC	COM	COM	COM
14	15	16	17	18	19	20
+24	TLMO	MAN	RWD	COM	M04S	COM

*Normally closed contacts.

13.3 LIST OF MODULE CONNECTORS (Cont'd)

Data I/O Modules 1012

Connector 01: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	ED0	ED3	ED6	ED9	ED12	ED15
	8	9	10	11	12	13
	ED1	ED4	ED7	ED10	ED13	EDSA
14	15	16	17	18	19	20
+24	ED2	ED5	ED8	ED11	ED14	EDSB

Connector 02: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	EDSC	EDAS1	UI0	UI3	UI6	UI9
	8	9	10	11	12	13
	EDSD	EDSA2	UI1	UI4	UI7	UI10
14	15	16	17	18	19	20
+24	EDAS0	EDCL	UI2	UI5	UI8	UI11

Connector 03: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	UI12	UI15				
	8	9	10	11	12	13
	UI13					
14	15	16	17	18	19	20
+24	UI14					

Connector 04: MR20 RMD2

1	2	3	4	5	6	7
0_{24}		-5		3H5	2HZ	3HY
	8	9	10	11	12	13
		H5		2HX	2H4	3HZ
14	15	16	17	18	19	20
+24	+5	MI5	2H5	2HY	3HX	3H4

Connector 05: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	*+EDX	*-EDY	*+ED4	*-ED5	*DEC5	5NG
	8	9	10	11	12	13
	*-EDX	*+EDZ	*-ED4	*+L5	*IT5	
14	15	16	17	18	19	20
+24	*+EDY	*-EDZ	*+ED5	*-L5	*SVOF5	

Connector 06: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	EIN	ESC0				
	8	9	10	11	12	13
	EVER	ESC1	SSTP			
14	15	16	17	18	19	20
+24	EOUT					

Connector 07: MR20 RMD2

1	2	3	4	5	6	7
0_{24}						
	8	9	10	11	12	13
14	15	16	17	18	19	20
+24						

Connector 08: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	UO0	UO3	UO6	UO8	UO11	UO14
	8	9	10	11	12	13
	UO1	UO4	UO7	UO9	UO12	UO15
14	15	16	17	18	19	20
+24	UO2	UO5	COM	UO10	UO13	COM

Connector 09: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	SENB					
	8	9	10	11	12	13
	COM	COM	COM			
14	15	16	17	18	19	20
+24		COM				

Connector 10: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	3ZPX	3ZP4	2ZP5	3ZP5	4ZPX	4ZPZ
	8	9	10	11	12	13
	3ZPY	COM	COM	COM	4ZPY	4ZP4
14	15	16	17	18	19	20
+24	3ZPZ	1ZP5	COM	4ZP5	COM	COM

Connector 11: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	T31/T9	T38/T12	T44/T15	BF	EREND	5NGC
	8	9	10	11	12	13
	T32/T10	T41/T13	T48/T16	EF	IER	
14	15	16	17	18	19	20
+24	T34/T11	T42/T14	COM	ESEND	EDTS	COM

Connector 12: MR20 RMD2

1	2	3	4	5	6	7
0_{24}	B11/B1	B18/B4	B22/B6	B31/B9	B32/B10	B38/B12
	8	9	10	11	12	13
	B12/B2	COM	B24/B7	COM	COM	COM
14	15	16	17	18	19	20
+24	B14/B3	B21/B5	B28/B8	COM	B34/B11	COM

*Normally closed contacts.

13.4 CONNECTIONS BETWEEN UNITS

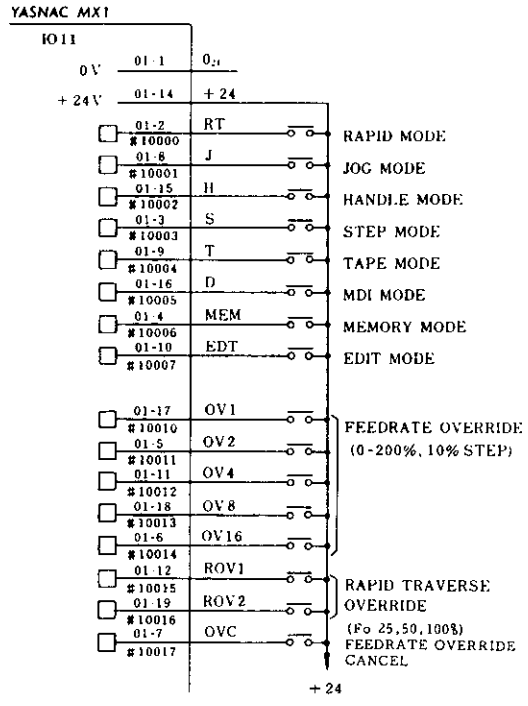


Fig. 13.4

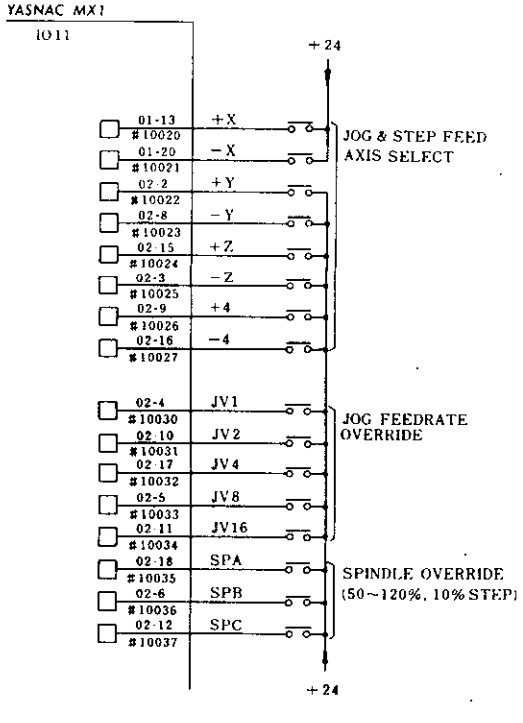


Fig. 13.5

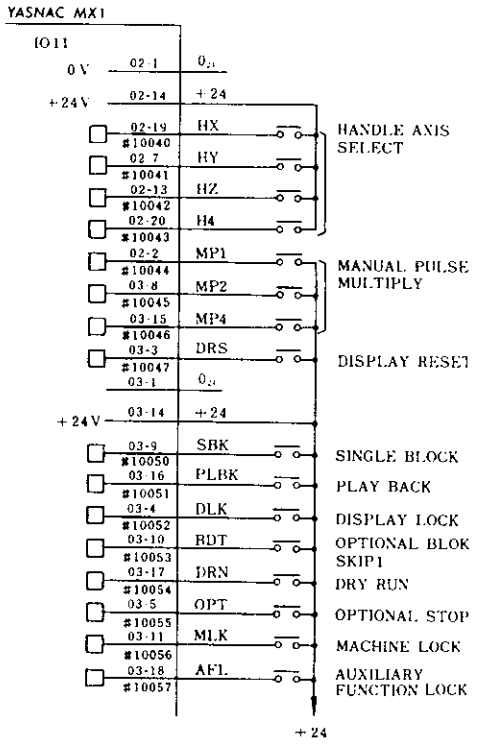


Fig. 13.6

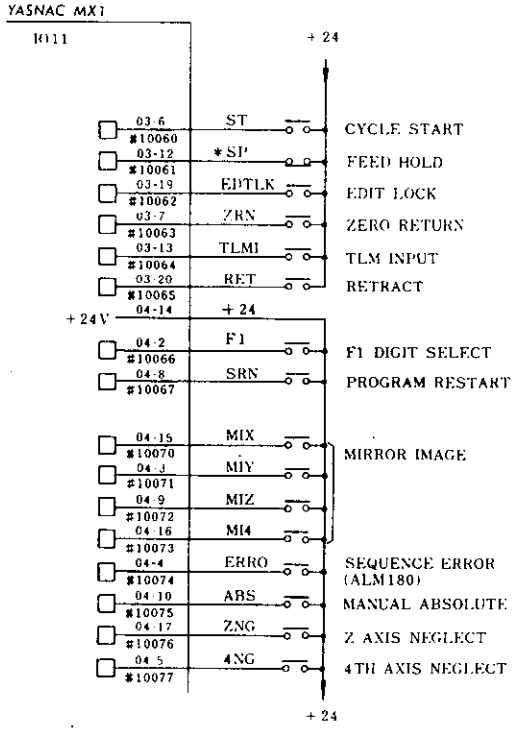


Fig. 13.7

*Normally closed contacts.

13.4 CONNECTIONS BETWEEN UNITS (Cont'd)

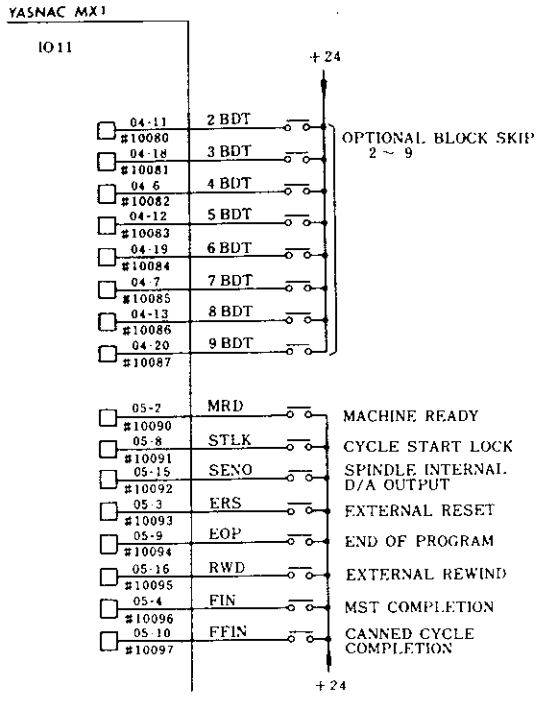


Fig. 13.8

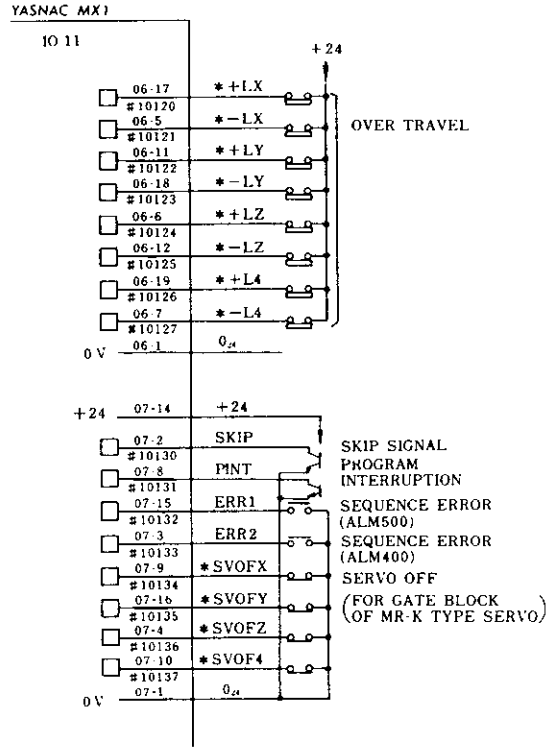


Fig. 13.10

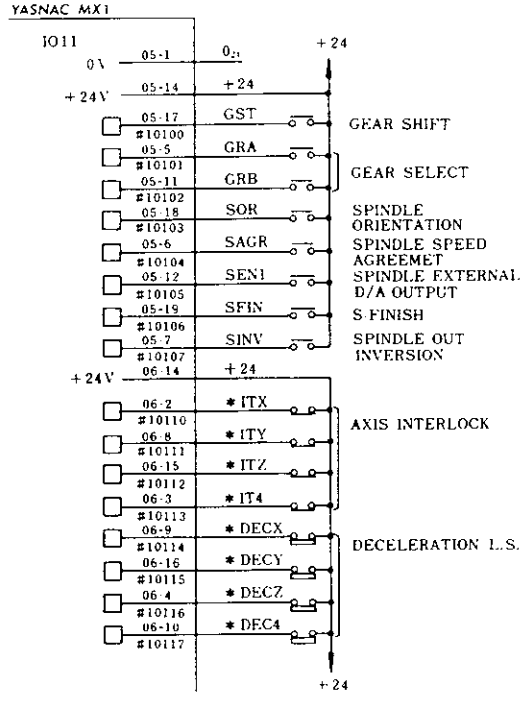


Fig. 13.9

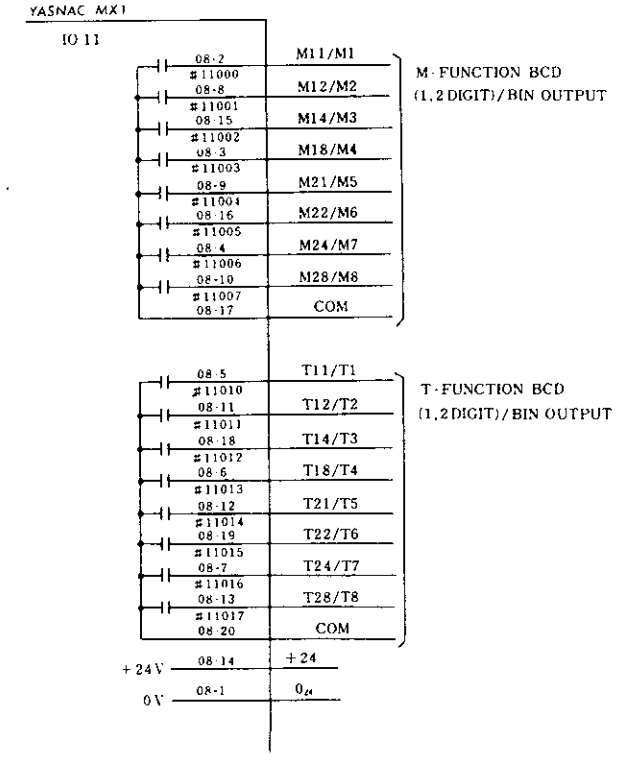


Fig. 13.11

*Normally closed contacts.

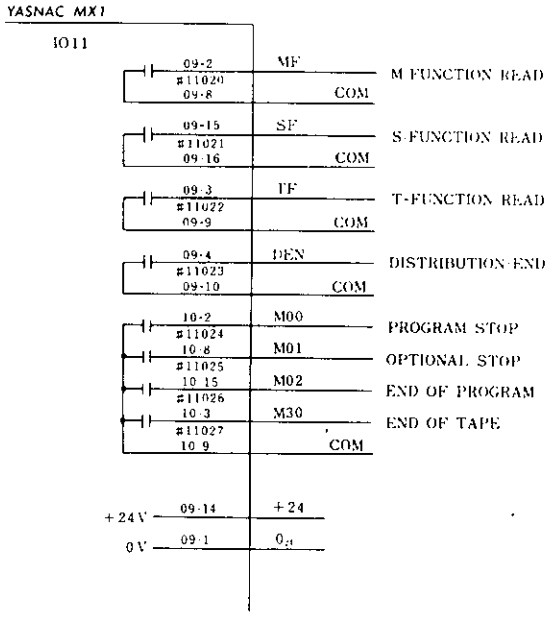


Fig. 13.12

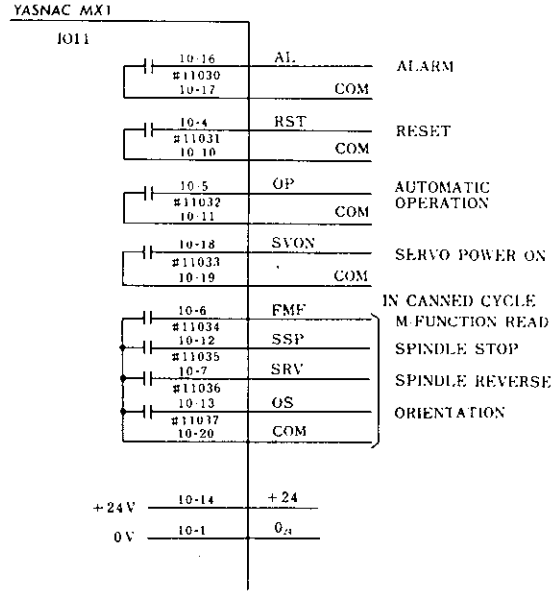


Fig. 13.13

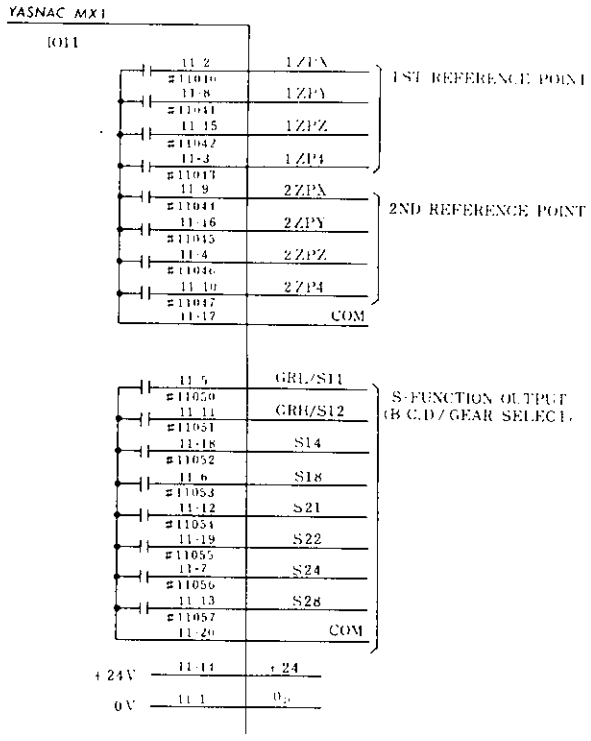


Fig. 13.14

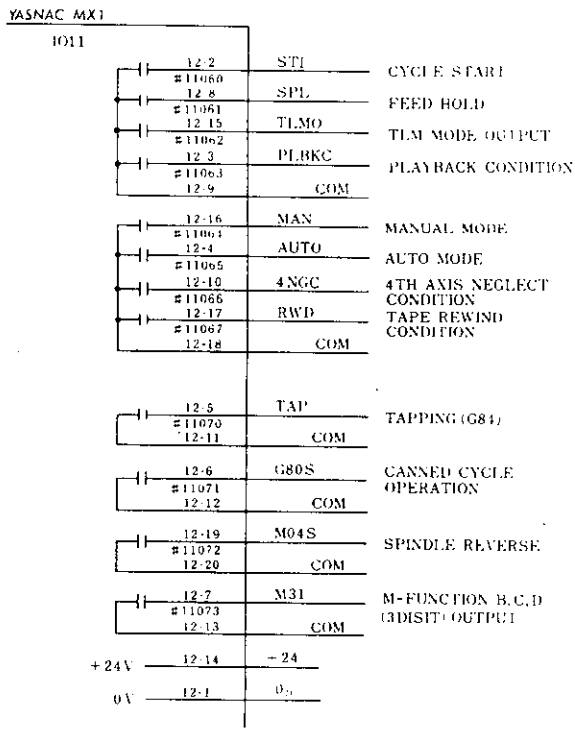


Fig. 13.15

13.4 CONNECTIONS BETWEEN UNITS (Cont'd)

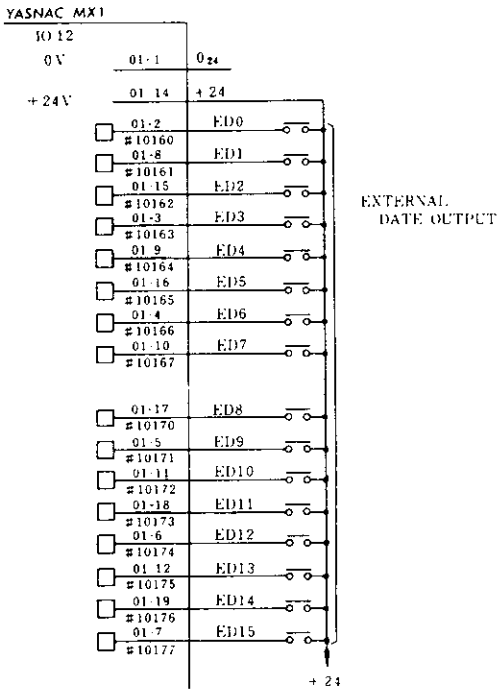


Fig. 13.16

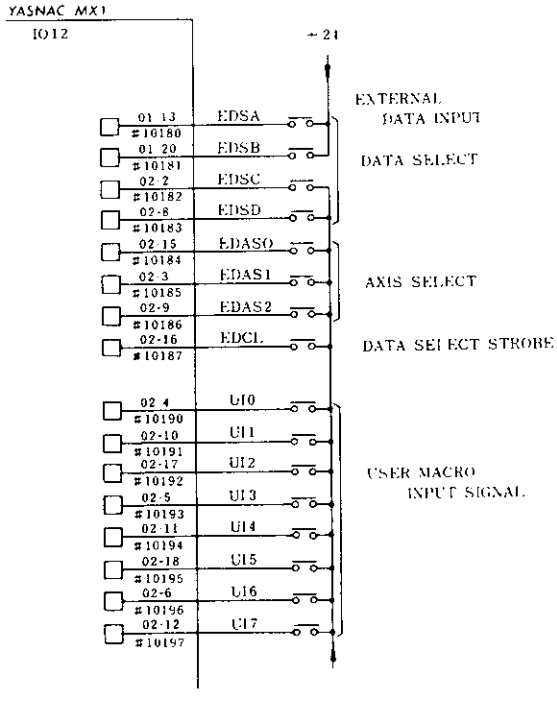


Fig. 13.17

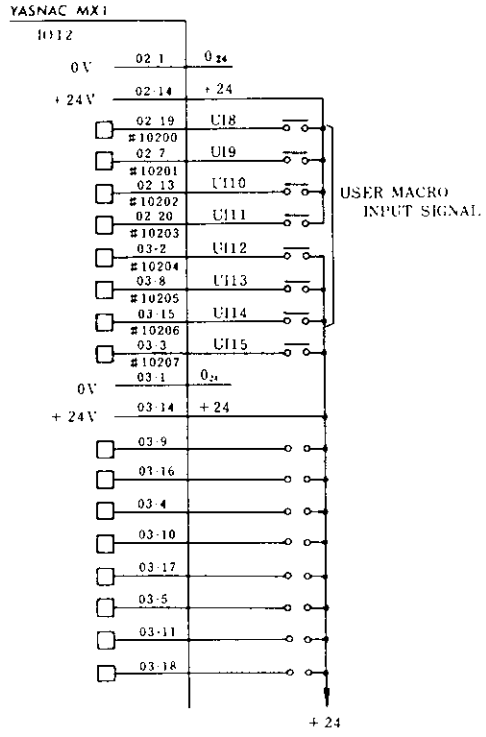


Fig. 13.18

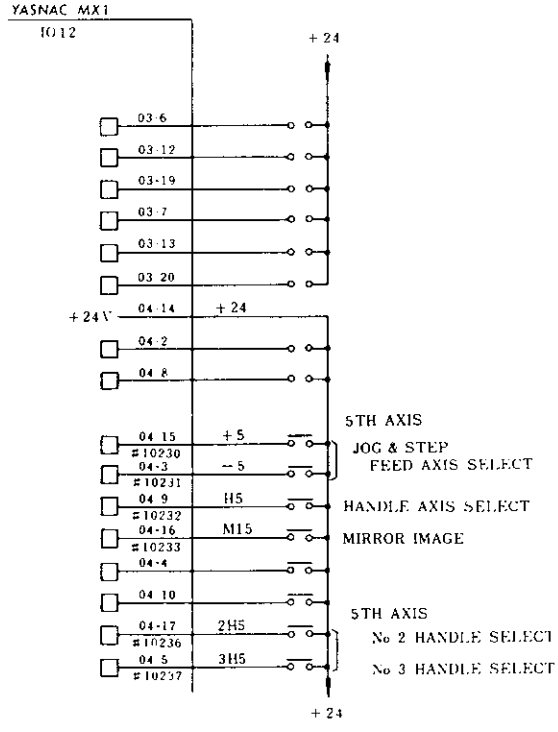


Fig. 13.19

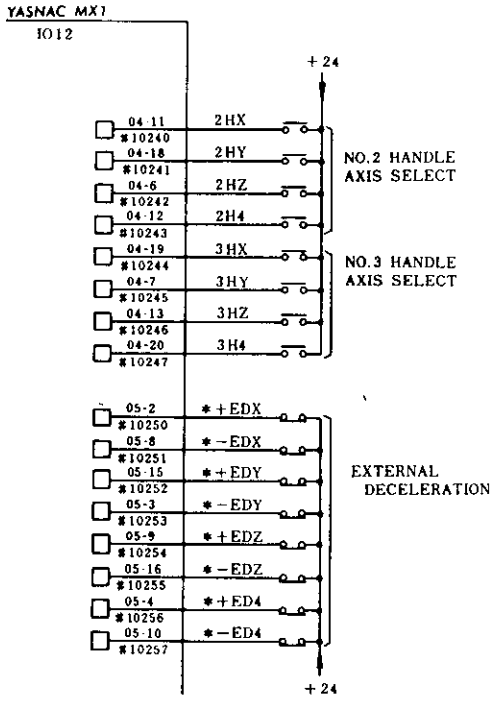


Fig. 13.20

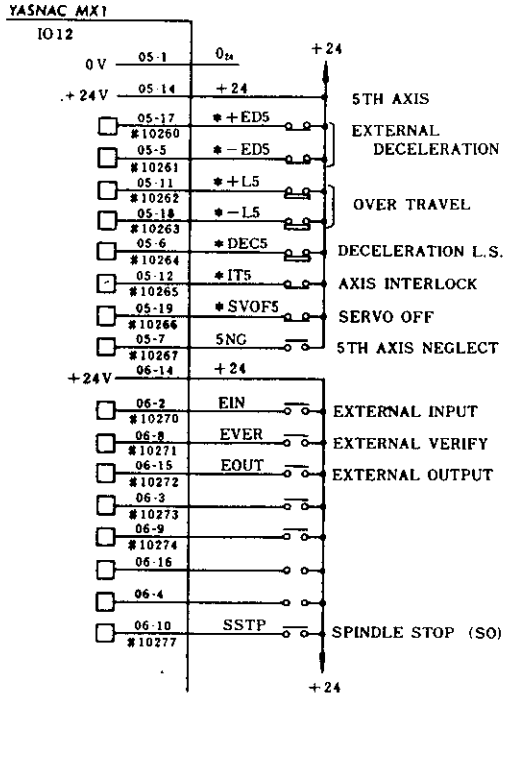


Fig. 13.21

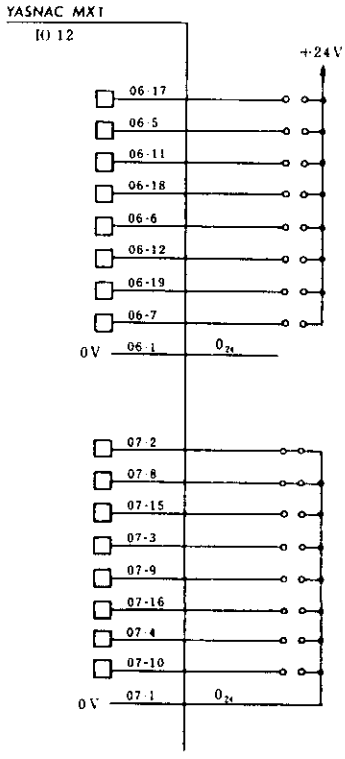


Fig. 13.22

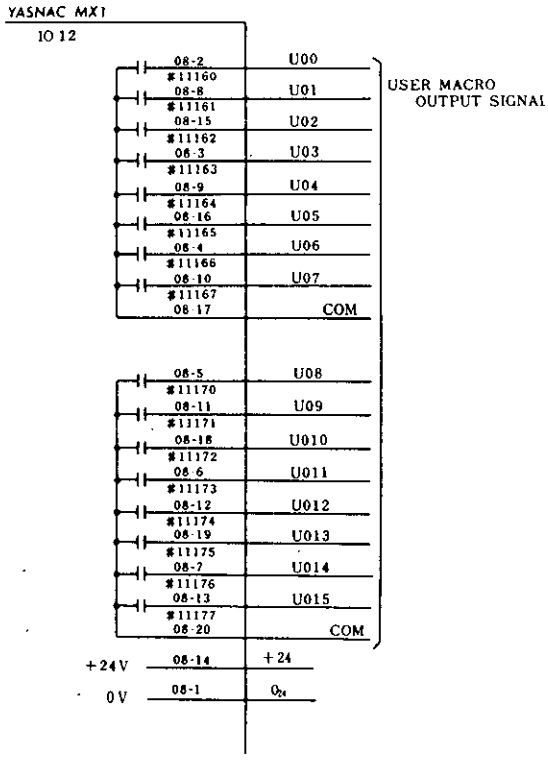


Fig. 13.23

*Normally closed contacts.

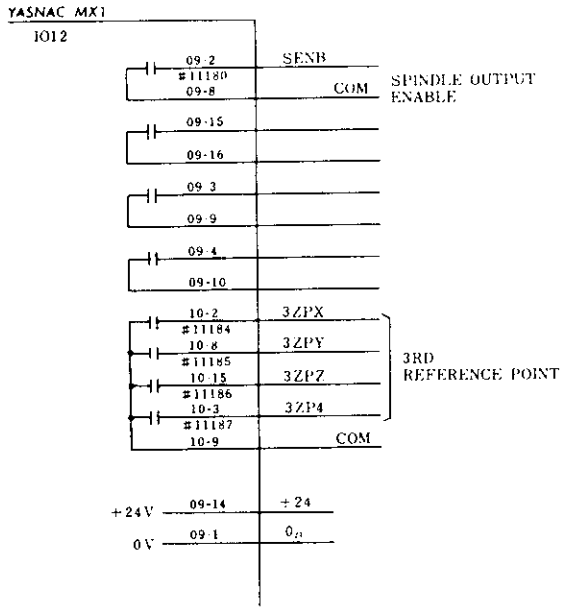


Fig. 13.24

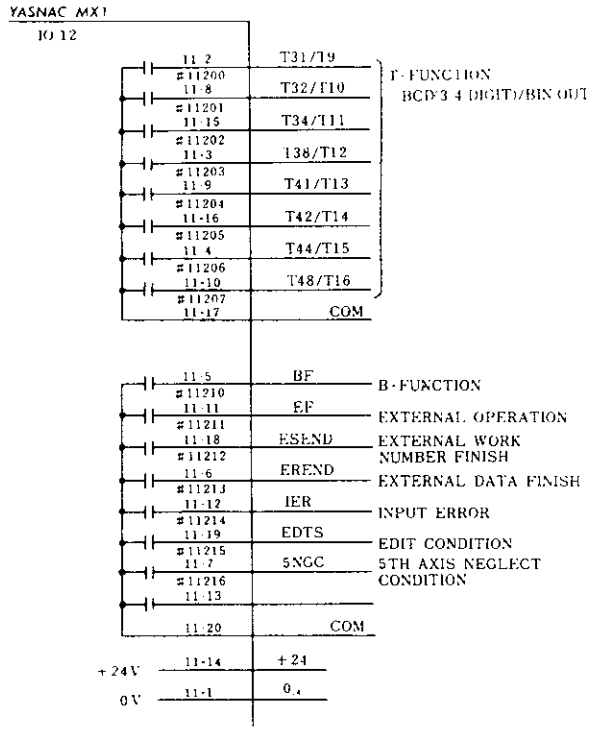


Fig. 13.26

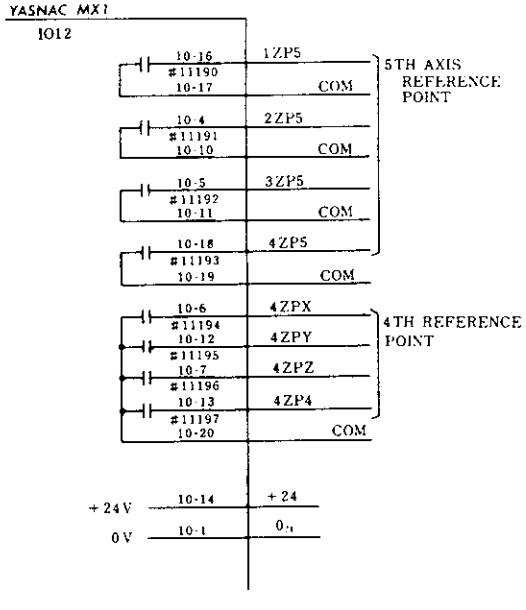


Fig. 13.25

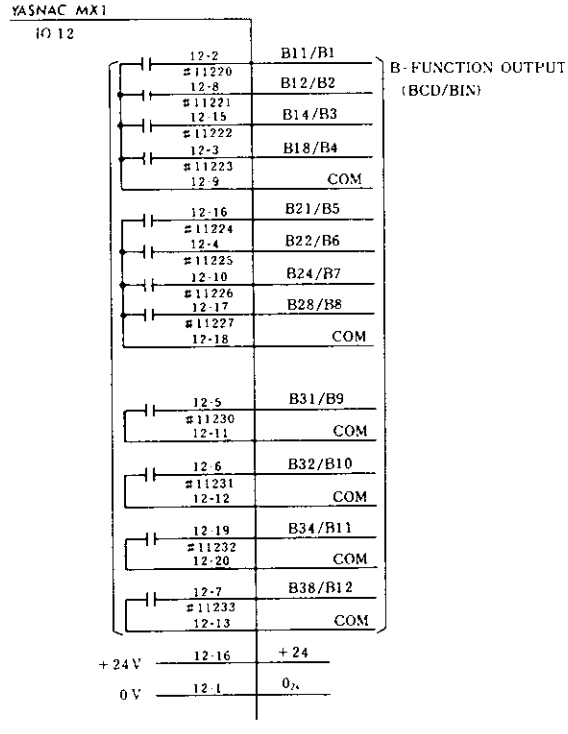


Fig. 13.27

13.5 DETAILS OF SIGNALS

13.5.1 Input Signals for Cycle Start (ST), Stop (*SP), Output Signals for Cycle Start(STL), and Feedhold (SPL)

(1) With the control in any of the TAPE, MEMORY, and MDI 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 condition.

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 pushed.

e. While the system No. switch is in any state except for 0 and 4.

(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 program end (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 neglected.

(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).

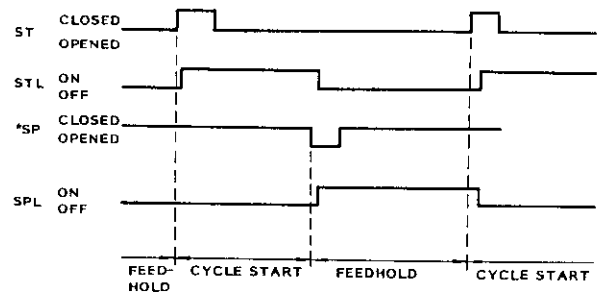


Fig. 13.28

NOTE:

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

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 feedhold (SPL) output is turned off, and the control enters feedhold state.

13.5.2 Input and Output for Control Operation Modes

(1) OPERATION MODE INPUT

The following six operation modes of the control are selected by the respective input contacts.

JOG: Manual jog mode H: Manual handle S: Manual step feed mode	Manual operation
T: Tape operation mode MDI: Manual data input operation mode MEM: Memory operation mode EDT: Program editing mode	Automatic operation mode

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

a. 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 of +Y, -Y, +Z, -Z, +α, -α, +β, and -β signals.

b. 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.

13.5.2 Input and Output for Control Operation Modes (Cont'd)

c. S: Manual STEP feed mode

When the S 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.

d. T: Tape operation mode

When the T 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 or RS422 interface, and when the control is set for #6003 D0 or D1, it can control the machine by part programs inputted via the RS232C or RS422 interface.

#6003 D0 = 1...Selects SI01(RS232C/RS422)
D1 = 1...Selects SI02(RS232C/RS422)

e. 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.

f. 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.

g. EDT: Program edit mode

When the EDT input contact is closed and other operation mode input contacts are open, the control enters the program edit mode, and it can store part programs into the memory, correct and change them.

(2) OPERATION MODE OUTPUT

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

a. AUT: Automatic operation mode output

This output signal is turned on when the control is in the T (tape operation), MEM (memory operation), or MDI (manual data input operation) mode.

b. MAN: Manual operation mode output

This output signal is turned on when the control is in the H (manual handle operation mode), S (manual step operation mode) or JOG (manual jog mode).

c. EDTS: Editing output

This output signal is turned on when the control is in the EDT (program editing) mode, and also performing and editing operation (part program reading, collation, punching, and stored program changing and other processing).

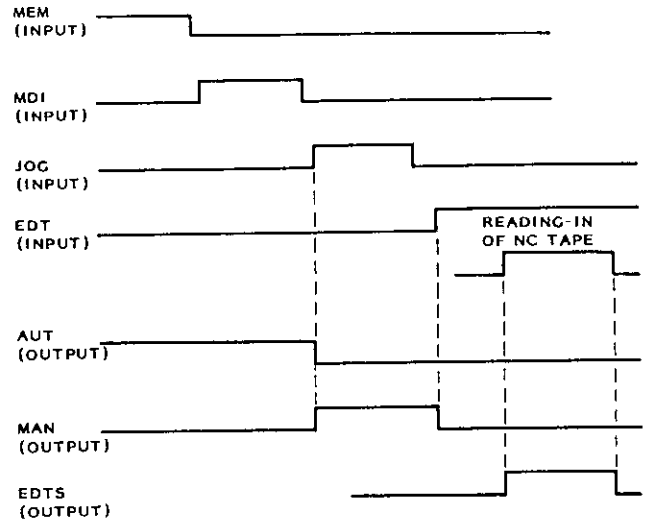


Fig. 13.29

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 (SP) input contact is closed.

ii. M, S, T command

The sampling outputs (MF, SF, TF) and the M code outputs are turned off, and the M, S, T command is regarded to have been executed completely.

Even when the control is returned to the automatic operation mode, the interrupted M, S, T command is not resumed.

3. When an automatic operation mode or program editing mode input contact is closed during motion in the manual operation mode, the motion decelerates and 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 the energization, or when two or more operation mode input contacts are closed, the control enters the manual jog mode.

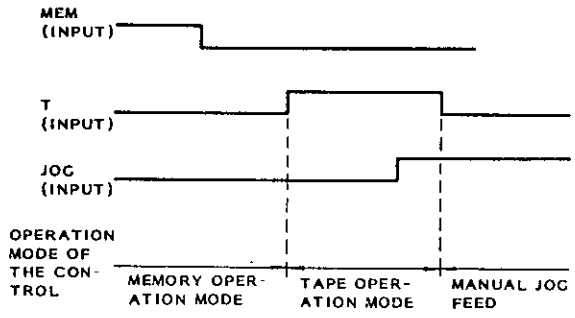


Fig. 13.30

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.

13.5.3 Manual Rapid Traverse Selection (RT) Input

When the RPD input contact is closed while the control is in the manual jog mode, manual feeding in the +X, -X, +Y, -Y, +Z, -Z, +α, -α, +β, and -β directions is performed in the rapid traverse rate.

13.5.4 Manual Feed Axis Direction Selection (+X, -X, +Y, -Y, +Z, -Z, +α, -α, +β, -β) Input

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

NOTE: When both plus and minus direction contacts for each axis are closed or opened, the selected axis cannot move or decelerates to stop during motion.

13.5.5 Manual Handle/Step Multiplication Factor (MP1, MP2, MP4) Input

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

Table 13.1

MP1	MP2	MP4	Manual step feed	Manual feed handle
OPENED	OPENED	OPENED	1 pulse/step	
CLOSED	OPENED	OPENED	10 pulses/step	
OPENED	CLOSED	OPENED	100 pulses/step	
CLOSED	CLOSED	OPENED	1,000 pulses/step	
CLOSED OR OPENED		CLOSED	10,000 pulses/step	

(1) MANUAL HANDLE FEED AXIS SELECTION (HX, HY, HZ, Hα, Hβ) INPUT

This is the input signal for selecting the motion axis for the motion by the manual pulse generator, with a control provided with a manual pulse generator.

When the HX input contact is closed and the HY, HZ, Hα and Hβ input contacts are open, the motion takes place along the X-axis. When the HY input contact is closed and the HX, HZ, Hα and Hβ input contacts are open, the motion takes place along the Y-axis. When the HZ input contact is closed and HY, HZ, Hα and Hβ input contacts are open, the motion takes place along the Z-axis. When the Hα input contact is closed and HX, HY, HZ and Hβ input contacts are open, the motion takes place along the α-axis. When the Hβ input contact is closed, and HX, HY, HZ and Hα are open, the motion takes place along the β-axis.

NOTE: If any two or more of these input contacts are closed, any axis will not move.

(2) MANUAL SIMULTANEOUS THREE AXES HANDLE FEED AXIS SELECTION (HX, HY, HZ, Hα, Hβ, 2HX, 2HY, 2HZ, 2Hα, 2Hβ, 3HX, 3HY, 3HZ, 3Hα, 3Hβ)

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.

(HX, HY, HZ, Hα, Hβ) --- 1st Handle axis

(2HX, 2HY, 2HZ, 2Hα, 2Hβ) --- 2nd Handle axis

(3HX, 3HY, 3HZ, 3Hα, 3Hβ) --- 3rd Handle axis

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

13.5.6 Feedrate Override (OV1, OV2, OV4, OV8 OV16) Input and Feed Override Cancel (OVC)Input

(1) These input signals are for specifying override speeds between 0 and 200% at 10% intervals on the programmed speeds.

Table 13.2

1: CLOSED, 0: OPENED					Feedrate Override (Automatic Operation Mode)
OV1	OV2	OV4	OV8	OV16	
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%
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%

NOTE:

1. For the thread-cutting in part program execution in the automatic operation mode, override is possible only at 100%.

2. For the control with feedrate override option, feedrate override is adjustable between 220% and 540%.

(2) FEED OVERRIDE CANCEL (OVC) 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.

Table 13.3

1: CLOSED 0: OPEN					Manual Jog Feedrate (Manual Operation Mode) Parameter Setting
JV1	JV2	JV4	JV8	JV16	
0	0	0	0	0	#6233
1	0	0	0	0	#6234
0	1	0	0	0	#6235
1	1	0	0	0	#6236
0	0	1	0	0	#6237
1	0	1	0	0	#6238
0	1	1	0	0	#6239
1	1	1	0	0	#6240
0	0	0	1	0	#6241
1	0	0	1	0	#6242
0	1	0	1	0	#6243
1	1	0	1	0	#6244
0	0	1	1	0	#6245
1	0	1	1	0	#6246
0	1	1	1	0	#6247
1	1	1	1	0	#6248
0	0	0	0	1	#6249
1	0	0	0	1	#6250
0	1	0	0	1	#6251
1	1	0	0	1	#6252
0	0	1	0	1	#6253
1	0	1	0	1	#6254
0	1	1	0	1	#6255
1	1	1	0	1	#6256
0	0	0	1	1	#6257
1	0	0	1	1	#6258
0	1	0	1	1	#6259
1	1	0	1	1	#6269
0	0	1	1	1	#6261
1	0	1	1	1	#6262
0	1	1	1	1	#6263
1	1	1	1	1	#6264

13.5.7 Manual JOG Feedrate Selection (JV1, JV2, JV4, JV8, JV16) Input

(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 execution in the automatic operation mode. For details, refer to "14.5.15 Dry Run (DRN) Input."

13.5.8 Rapid Feedrate Override (ROV1, ROV2) Input

These inputs are for determining the rapid feedrates, 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 13.4

Input State		Rapid Feedrate				
ROV1	ROV2	X-axis	Y-axis	Z-axis	α-axis	β-axis
Closed	Closed	#6280 Setting speed	#6281 Setting speed	#6282 Setting speed	#6283 Setting speed	#6284 Setting speed
Opened	Closed	#6280 Setting speed × $\frac{1}{2}$	#6281 Setting speed × $\frac{1}{2}$	#6282 Setting speed × $\frac{1}{2}$	#6283 Setting speed × $\frac{1}{2}$	#6284 Setting speed × $\frac{1}{2}$
Closed	Opened	#6280 Setting speed × $\frac{1}{4}$	#6281 Setting speed × $\frac{1}{4}$	#6282 Setting speed × $\frac{1}{4}$	#6283 Setting speed × $\frac{1}{4}$	#6284 Setting speed × $\frac{1}{4}$
Opened	Opened	#6231 Setting speed				

13.5.9 Reference Return Control I/O Signals (ZRN, *DECX, *DECY, *DECZ, *DECα, *DECβ, ZPX, ZPY, ZPZ, ZPα, ZPβ)

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

The following two reference point return methods are available.

(1) Grid method: Reference point is determined by the origin pulse (1 pulse/revolution) of the position detector.

(2) Near zero method: Reference point is determined by external near-zero inputs.

(1) GRID METHOD

After turning on the power supply, when the manual jog mode is turned on, and the manual reference point return input contact ZRN is closed, the direction of axis motion set by parameter (D0, D1, D2, D3) will result in the reference point return motion as shown below. (The same applies to the execution of G28 in the automatic operation modes.)

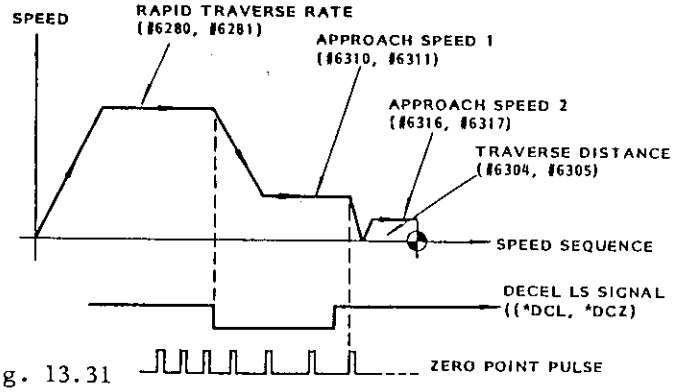


Fig. 13.31

(2) NEAR ZERO INPUT METHOD

With this method, the control panel operation is the same as that of the grid method. In this method, the reference point is determined by near-zero inputs (ZDX-ZD5).

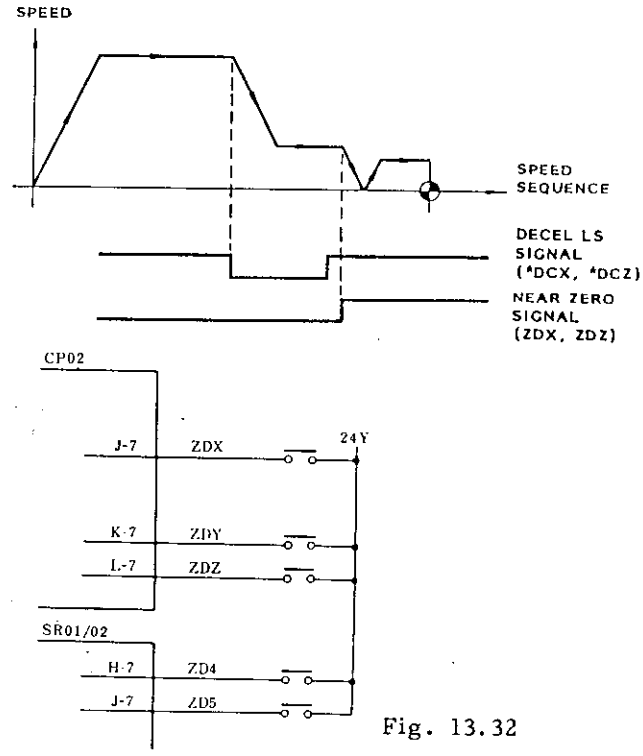


Fig. 13.32

NOTE:
(1) When once the machine is turned to the reference point in high-speed reference point return (automatic, return), the return motion, thereafter will be in the positioning motion to the determined reference point.

13.5.9 Reference Point Return Control I/O Signals (ZRN, *DECX, *DECY, *DECZ, *DECα, *DECβ, ZPX, ZPY, ZPZ, PZα, ZPβ) (Cont'd)

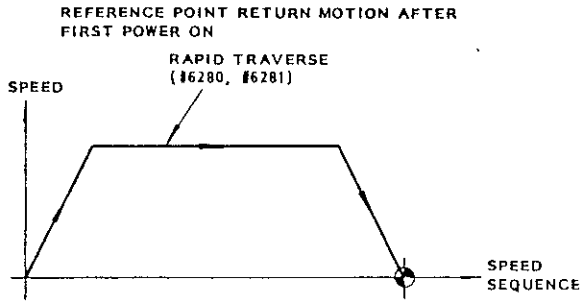


Fig. 13.33

(2) X, Y, Z, α AND β REFERENCE POINTS (ZPX, ZPY, ZPZ, ZPα, ZPβ) OUTPUT

While the machine is remaining at the reference point after the reference point return motion or positioning to the reference point, the ZPX, ZPY, ZPZ, ZPα and ZPβ output contacts are closed. If the actual position is within ±3 pulses from the reference point due to the use of metric input in the inch output system or the use of inch input in the metric output system, the ZPX, ZPY, ZPZ, ZPα and ZPβ output contacts are closed.

(3) 2ND REFERENCE POINT (2ZPX, 2ZPY, 2ZPZ, 2ZPα , 2ZPβ) OUTPUT

When the machine has been positioned to the 2nd reference point by the execution of the part program command G30 in the automatic operation mode, the 2ZPX, 2ZPY, 2ZPZ, 2ZPα and 2ZPβ output relays are closed, and remain closed as long as the machine remains at this point. The end reference point is defined by the distance from the reference point as set by parameters (#6612, #6613, #6614, #6615, #6616).

(4) 3RD REFERENCE POINT (3ZPX, 3ZPY, 3ZPZ, 3ZPα , 3ZPβ) OUTPUT

When the machine has been positioned to the 3rd reference point by the execution of the part program command G30P3 in the automatic operation mode, the 3ZPX, 3ZPY, 3ZPZ, 3ZPα and 3ZPβ output relays are closed. The 3rd reference point is defined by the distance from the reference point as set by parameters (#6618, #6619, #6620, #6621, #6622).

(5) 4TH REFERENCE POINT (4ZPX, 4ZPY, 4ZPZ, 4ZPα , 4ZPβ) OUTPUT

When the machine has been positioned to the 4th reference point by the execution of the part program command G30P4 in the automatic operation mode, the 4ZPX, 4ZPY, 4ZPZ, 4ZPα and 4ZPβ output relays are closed. The 4th reference point is defined by the distance from the reference point as set by parameters (#6624, #6625, #6626, #6627, #6628).

13.5.10 Manual Absolute On/Off (ABS) Input

During the execution of part program in the automatic operation mode, the control stores the command values in an internal command value register (command values are displayed on the 1st CRT area), and the displacement distance between the stored value and the coordinate value in the part program.

Since the control must also control the current position, it controls the current values in the absolute coordinate system (to be displayed in the 2nd CRT area. The coordinate system is defined by a coordinate system setting command.)

This input is for determining whether the current value in the absolute coordinate system is transferred to the command value register or not at the start of the execution of the respective blocks of part programs in the automatic operation mode.

(1) When ABS input relay is open: Does not transfer.

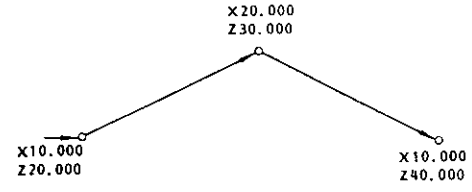
(2) When ABS input relay is closed: To be transferred, except when circuit interpolation is used.

The motion path after a manual control intervention in the automatic operation mode is changed as follows by an ABS input.

(1) WHEN ABS INPUT RELAY IS OPEN

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

G90 G01 Z20.000 FΔΔ:
X20.000 Y30.000 ①
X10.000 Y40.000



① When the machine is manually moved during a block.

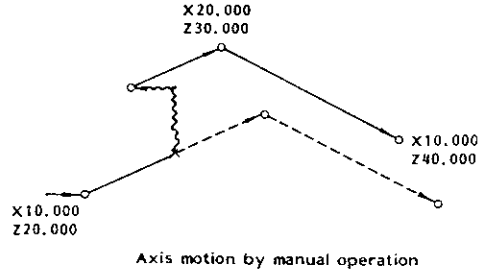


Fig. 13.34

(2) WHEN ABS INPUT RELAY IS CLOSED.

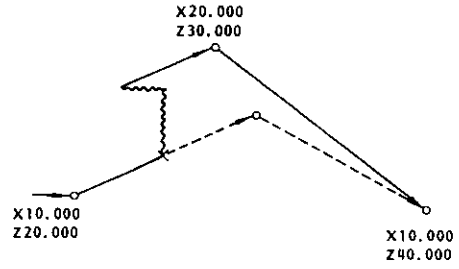


Fig. 13.35

(3) SUPPLEMENTARY DESCRIPTION

In the following cases, the control current value in the absolute coordinate system (coordinate system displayed in the CRT current value 2nd area, or the one determined by coordinate system setting instructions) to the command value register unconditionally.

a. RESET operation: MDI panel RESET key — on or external reset (ERS) input contact closed

b. End of program: Program reset through end of program (EOP) input contact closing by M02, M30 execution

c. Automatic return to reference point: Execution of G28 command

After transferring the current value in the absolute coordinate system to the command value register, manual axial movement is reflected on the automatic axial movement even when the ABS input contact is closed.

When the block ① is searched again by the RESET operation after axial motions by manual operation, the following motion takes place.

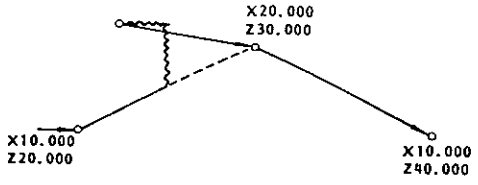


Fig. 13.36

13.5.11 Single Block (SBK) Input

This input is for executing part programs by one block in the automatic operation mode. With the control in the automatic operation mode, and the SBK input contact closed, when an automatic operation cycle is started, the part program is executed only by one block, and the machine stops. 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.

NOTE: For details of the use of single block during the execution of multiple cycles, user-macro programs, refer to the operator's manual.

13.5.12 Optional Block Skip (BDT, BDT2-BDT9) Input

This input is for determining whether data between "/" and "EOB" in a part program is executed or neglected when the part program contains "/."

Table 13.5

	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 neglected only when part programs are executed. When storing or processing part programs, this input has no effect.

2. Whether data may be neglected 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 skip 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.

13.5.13 Machine Lock (MLK) and Display Lock (DLK) Input

(1) MACHINE LOCK (LK) INPUT

This is the input for preventing the outputting of control output pulses to the servo unit. While the MLK input contact is closed, even when the logic circuit distributes pulses in 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. If the MLK contact is closed or opened during the automatic operation of the control, the operation is not influenced until the start of the next block, and during manual operation, until the end of the current motion.

(2) DISPLAY LOCK (DLK) 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.

13.5.14 Dry Run (DRN) 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, 2, 4, 8 and 16).

While the DRN input contact is closed, the feedrates 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 change takes place.

During mm/rev feeding: No change of feedrate for the current block.

During mm/min feeding: Feedrate changes even during the current block.

NOTES:

1. When parameter #6006 D2 is set to 1, while the DRN input contact is closed, the feedrate in positioning command is changed to a manual continuous feedrate.

2. When parameter #6019 D5 is set to 1, while the DRN input contact is closed, the feedrate is changed to a manual continuous feedrate.

13.5.15 Program Restart (SRN) Input

This input is used when a part program is to be started again after interruption. Close the SRN input contact, turn on the memory mode, and search the sequence No. of program restart by the NC 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.

NOTE: For the details of the usage of the PST input, refer to "6.2.6 Program Restarting" in YASNAC Operator's Manual.

13.5.16 Edit Lock (EDTLK)

This is the input for preventing the change of the contents of the stored part program. While the EDTLK input contact is closed, the following operations among the ones in the program edit mode are prohibited.

1. Storing part programs by the MEM DATA "IN" key.

2. The change, addition and deletion of part programs in the memory with the EDIT "ALT," "INS" and "ERS" keys.

13.5.17 Auxiliary Function Lock (AFL) 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 ignores M.S.T. instructions of programs when executing part programs. However, M code decoded outputs (M00R, M01R, M02R, M30R) are outputted.

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.

13.5.18 Overtravel (*+LX, *-LX, *+LY, *-LY, *+LZ, *-LZ, *+Lα, *-Lα, *+Lβ, *-Lβ) 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 below, and close the alarm (ALM) output contact and at the same time, displays alarm on the CRT.

Table 13.6

	Manual operation mode	Automatic operation mode
*+LX Input opened	Motion stop in +X direction	Motion stop of all axes
*-LX Input opened	Motion stop in -X direction	
*+LY Input opened	Motion stop in +Y direction	
*-LY Input opened	Motion stop in -Y direction	
*+LZ Input opened	Motion stop in +Z direction	
*-LZ Input opened	Motion stop in -Z direction	
*+Lα Input opened	Motion stop in +α direction	
*-Lα Input opened	Motion stop in -α direction	
*+Lβ Input opened	Motion stop in +β direction	
*-Lβ Input opened	Motion stop in -β direction	

*Normally closed contacts.

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:
Even when the overtravel input contacts are opened, the M code reading output MF, 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.

13.5.19 Machine-Ready (MRD) Input

This input informs that the external heavy-current circuit is ready. When MRD input is closed after closing of Servo Power Input/Output (SO1, 2) from the power-on/off unit of the control after the power is turned on, the control is ready and "RDY" is displayed on the CRT screen.

When MRD input is opened with the control being ready, the control is put in the alarm state (alarm code "280" is displayed), thereby stopping the operation.

NOTE: For the turning of power sequence, refer to "13 CONNECTION WITH THE POWER-ON/OFF UNIT."

13.5.20 External Reset (ERS) Input And Reset on (RST1, 2) Output

ERS is the input to reset the control. When ERS input is closed, the control stops all of its operations, closing Reset On outputs RST1 and RST2 for one second. The output signals are opened except for the following.

Table 13.7

Output Signals	Output at ERS Input Closed
AUT, MAN 1ZPX, 1ZPY, 1APZ, 1ZP , 1ZP 2ZPX, 2ZPY, 2ZPZ, 2ZP , 2ZP 3ZPX, 3ZPY, 3ZPZ, 3ZP , 3ZP 4ZPX, 4ZPY, 4ZPZ, 4ZP , 4ZP 4NGC, 5NGC SO1 - 2, PO1 - 2	Previous conditions kept.
RST1 - 2	Output contact is closed for one second while ERS input contact is closed or opened.
AL	Contact kept closed unless alarm causing factor is cleared.
SB1 - SB12 SDA1 - SDA16 S11 - S48 B11 - B48	Previous conditions kept.
UO0 - 15	Previous conditions kept.

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

13.5.21 Interlock (STLK) 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.

13.5.22 Alarm (ALM) Output And External Error Detect (ERR0 - 2) Inputs

(1) ALARM (ALM) OUTPUT

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

ALM: 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 (ERR0, ERR1, ERR2) INPUTS

These inputs put the control in the alarm state from the outside.

ERR0: When this input is closed, the control displays alarm code "180" 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 alarm code "500" 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 tool travel is immediately stopped.

ERR2: When this input is closed, the control displays alarm code "400" 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 tool travel is immediately slowed down and stopped.

13.5.23 Mirror Image (MIX, MIY, MIZ, MIα, MIβ)

This input inverts the travelling direction in the automatic operation mode. This input is effective with setting #6000 D0 - D4 at "0."

When automatic activation is performed with MIX, MIY, MIZ, MIα and MIβ input closed, the directions of X-, Y-, Z- 4th, 5th axis are made opposite to the specified direction.

NOTE: Mirror image input does not affect the axis travel in the manual operation mode. For details, refer to 2.8.5 Mirror Image ON/OFF (M95, M94) in YASNAC MX1 OPERATOR'S MANUAL.

13.5.24 M, S AND T Codes (MB01 Through MB08, S11 Through S28, T11 Through T48, MF, TF, BF† FIN) Inputs/Outputs

(1) M, S, AND T CODES OUTPUT AND M, S AND T CODE READING OUTPUTS

Table 13.8

M code output	MB01 - MB08
S code output	S11, S12, S14, S18, S21, S22, S24, S28
T code output	T11, T12, T14, T18, T21, T22, T24, T28, T31, T32, T34, T38, T41, T42, T44, T48
B code output	B11, B12, B14, B18, B21, B22, B24, B28, B31, B32, B34, B38
M code reading output	MF
S code reading output	SF
T code readint output	TF
B code reading output	BF

These are outputs for the M, S and T commands specified by the part program at its execution in the automatic operation mode. If any of M, S and T commands 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 (M = 2 digits/3 digits, S = 2 digits, T = 4 digits, B = 3 digits).

Then, after the elapse of the time set in parameter (#6220), the M, S, T and B code reading outputs are closed.

NOTE:

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

2. M commands (M90 through M99) M code or MF code will not outputted.

(2) M DECODE (M00R, M01R, M02R, AND M30R) OUTPUT

When any of M commands "M00," "M01," "M02," and "M30" is executed, the corresponding decoded output "M00R," "M01R," "M02R," or "M30R" is outputted in addition to the M code output and the M code reading output.

NOTE: When an M command for decoded output and a move command are specified in the same block, the M code output is provided at the start of the block, while the decoded output is provided after completion of the move command.

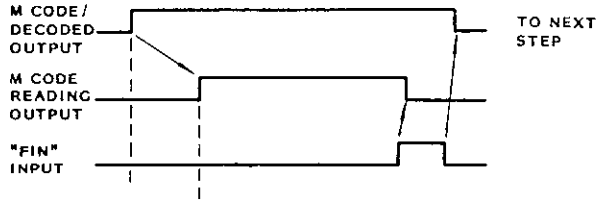
(3) M, S, T AND B FUNCTIONS COMPLETION (FIN) INPUTS

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 (MF, 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: When FIN input is closed then opened, the M code output and the M decoded output are all opened, but the S code and T code outputs remain as they are without change.

(4) TIME CHART OF M, S, T AND B SIGNALS

a. M command



b. S/T command

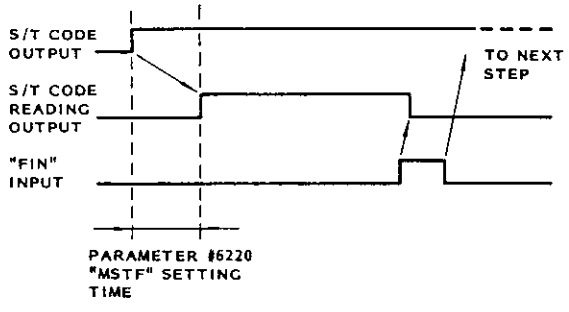


Fig. 13.37

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

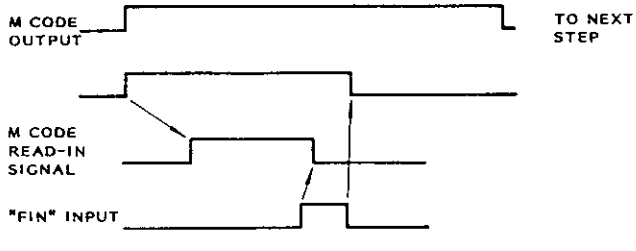


Fig. 13.38

13.5.25 Positioning Completion (DEN1, 2) Outputs

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

The block in which an M, S, or T command and a move command are specified at the same time is executed, if the M, S, or T command is not completed at the termination of the move command, positioning completion outputs DEN1 and DEN2 are closed.

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

13.5.26 Travel On (OP1, 2) Tapping and Canned Cycle On (G80S) Outputs

(1) TRAVEL ON (OP1, 2) OUTPUTS

With these outputs, the control informs that the tool is traveling during the execution of a part program in the automatic operation mode. These outputs are closed when the machine starts. The output is turned off by RESET operation (including RESET by M02, M30 command).

(2) TAPPING (TAP) OUTPUT

With these outputs, the control informs that tapping is being performed during the executiion 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.

(3) CANNED CYCLES (G80S) OUTPUT

This output indicates that the control is performing canned cycles. The output G80S is given when canned cycle block starts and turned off by canned cycle block cancellation.

13.5.27 End-of-Program (EOP) Input, Rewind (RWD) Input, and Rewind On (RWDS1, 2) Outputs

(1) END-OF-PROGRAM (EOP) AND REWIND (RWD) INPUTS

With these outputs, the control determines what processing is to be performed 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 13.9

EOP	RWD	Processing
Close	Close	The control is at standby after rewinding part programs and resetting programs.
Close	Open	The control is at standby after resetting programs.
Open	Close	The control is at standby after resetting part programs.
Open	Open	The control is at standby.

NOTE:

1. Program reset provides the same effects as with pressing 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 "EXTERNAL RESET (ERS) INPUT."

2. When a program reset operation is performed, Reset On output RST1 and RST2 are closed for one second.

(2) REWIND ON (RWDS1, 2)

With these outputs, the control informs that the part program is being rewound. If the part program is rewound by RWD input for an M02 or M30 command, RWDS1 and RWDS2 are closed during the rewinding operation.

NOTE: To use these outputs, set parameter #6007 D4 to "1." At "0," they are not given. from the control.

13.5.28 External Data Input (ED0 Through ED15 EDSA Through EDSD, EDSA0 Through EDSA2, 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 (1000 - 9999 BCD) selects the work number desired.

b. External tool compensation input

This 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 are added to the shift value of the specified axis programmed by G54 to G59 and the result is stored as a new shift value.

13.5.28 External Data Input (ED0 Through ED15 EDSA Through EDSD, EDSA0 Through EDSA2, EDCL, EREND, And ESEND) Inputs/Outputs (Cont'd)

(2) INPUT SIGNALS FOR INPUTTING EXTERNAL DATA

a. External data inputs (ED0 to ED15)

These inputs are used for work No. input signal, offset amount input signal and work coordinate system shift signal.

External Data Input Signal							
ED7	ED6	ED5	ED4	ED3	ED2	ED1	ED0
ED15	ED14	ED13	ED12	ED11	ED10	ED9	ED8
Sign							

b. External data selection (EDSA to EDSD)

Inputted data can be selected by the external data.

Table 13.10

	External Data Input 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

c. External data axis selection (EDAS0 to EDAS2)

This signal is used for specifying the axis for external data and given in three digits.

Table 13.11

	External Data Axis Selection		
	EDAS2	EDAS1	EDAS0
X-axis	ABS/INC	0	0
Y-axis	ABS/INC	0	1
Z-axis	ABS/INC	1	0
4th axis	ABS/INC	1	1
5th axis	1	0	1

ABS = 1, INC = 0

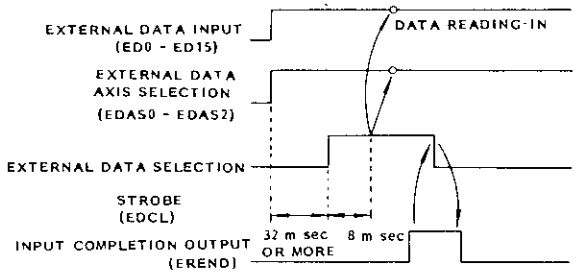
d. External data selection strobe (EDCL)

External data input starts when this signal rises up.

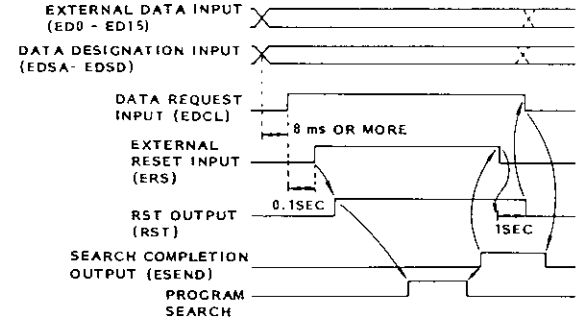
e. Output signal for external data input

When input data described in a. to d. are inputted and stored in the internal memory, it is indicated by outputting completion signal.

(3) TIME CHART OF INPUTTING EXTERNAL DATA



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



(5) LIST OF EXTERNAL DATA INPUT/OUTPUT

a. Inputs (24)

Table 13.12

External Data Input/Output	Input Strobe	Axis Selection			Data Selection				External Data																
	ED CL	ED AS1	ED AS2	ED AS0	ED SD	ED SC	ED SB	ED SA	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					0	0	0	1	WNO1000				WND100				WND10				WNO1			
External tool compensation (H)		ABS/ INC			0	0	1	0	SGIN															
External tool compensation (D)		ABS/ INC			0	0	1	1	SIGN	±7999 (BCD) ±32767 (Binary)														
External coordinate system shift					0	1	0	0	SIGN	Selected by parameter.†														

† Parameter selection #6047 D7 1 = BCD, 0 = Binary

b. Outputs (2)

D7	D6	D5	D4	D3	D2	D1	D0
TAP	M04S	TLMO	G80S	EREND	ESEND	RST	AL

External data input end

External search end

SUPPLEMENTARY EXPLANATION

(1) EXTERNAL WORK NO. DESIGNATION

a. Input-completion output is not given when work No. other than 0 to 9999 is designated or work No. is not found. In this case, alarm is not given.

b. Work No. input is permitted by external reset operation or at the time of execution of M02 or M30. After reset operation, new work No. is effective.

(2) EXTERNAL TOOL OFFSET

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

b. Type of modification is selected by external input as follows.

EDAS2 = 0 --- Externally inputted data is added to the stored value.

EDAS2 = 1 --- Externally inputted data is replaced with the stored data.

(3) External tool No. address is selected by two bits of external data select (EDSA - EDSB) as follows.

EDSA = "0," EDASB = "1" --- H for tool length offset

EDSA = "1," EDASB = "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 EDAS0, EDAS1 is not required for external tool offset. If designated, the input is ignored.

(7) The offset amount commanded by external tool offset input is equivalent to the amount entered by MDI key.

EXTERNAL WORK COORDINATE SYSTEM

(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).

13.5.29 Canned Cycle Spindle Control (FMF, FFIN, SSP, SRV, OS, TAP) (Cont'd)

FMF --- Canned cycle auxiliary signal reading-in

FFIN --- Canned cycle auxiliary completion signal

SSP --- Spindle stop

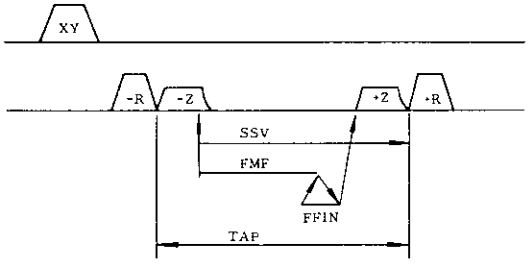
SPN --- Spindle reverse

TAP --- Tapping

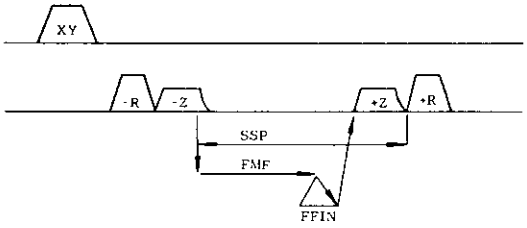
Canned cycles can be performed by G74, G84, G86 to G88 commands. At G74 and G84 commands, FMF and SRV are given, and at G86 to G88 commands, FMF and SSP or stop the spindle. FMF is turned off when FFIN is sent back to the control at completion of spindle reverse or stop.
Turn off signal FFIN when FMF is turned off. When FFIN signal is stopped, the tool retraction from tapped hole is started. Signals SRV from tapped hole is started. Signals SRV and SSP will be turned off when the tool leaves the tapped hole. Accordingly, reverse the spindle to the forward run. Motion by G74 and G84 commands, TAP signal is outputted indicating TAPPING operation. The TAP signal is used to check to see if the spindle runs at the beginning of tapping.

Time Chart

[G74, G84]



[G86 - G89]



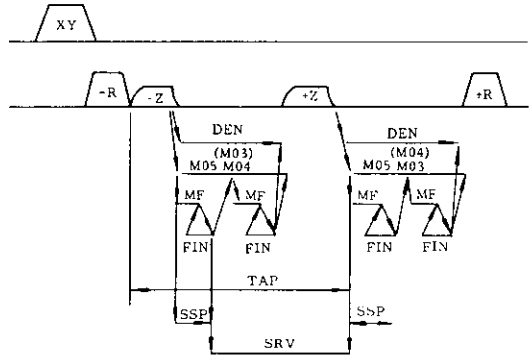
Setting parameter #6018 (D4) to "0" selects signals (M03, M04, M05, M19, MF, FIN) instead of canned cycles (FMF, SSP, SRV) in order to perform canned cycles. In spindle reverse by G74 and G84, spindle can be stopped by setting parameter #6018 (D5) to "1."

Time chart is as follows.

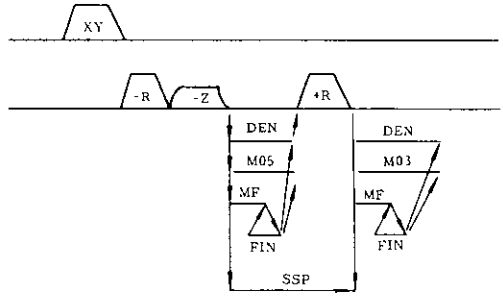
Parameter #6018 D5 = 0 M03→M04

D5 = 1 M03→M05→M04

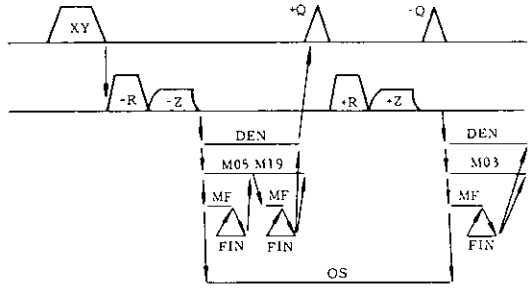
[G74, G84]



[G86 - G88]

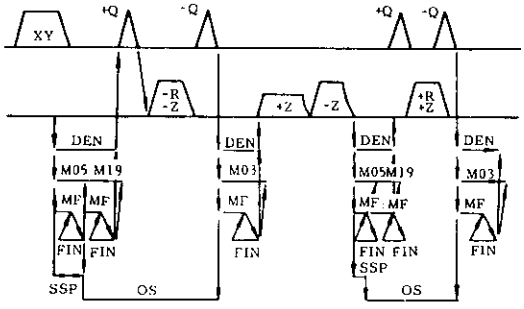


[G76]

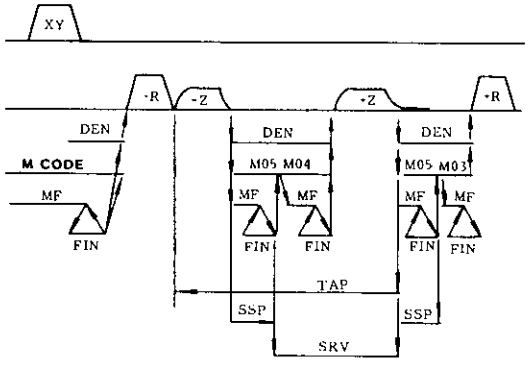


M19: ORIENT SPINDLE STOP
(SPINDLE STOP AT SPECIFIED POSITION

[G77]

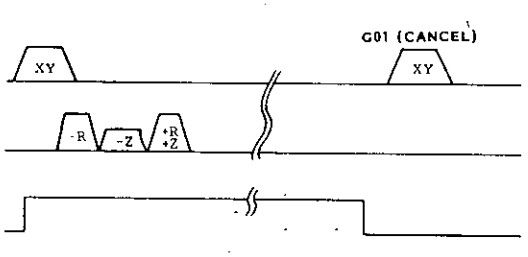


Time Chart of G77 including M Command



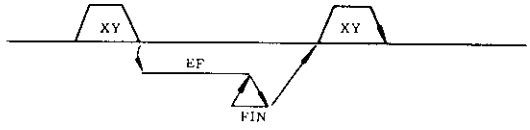
Canned Cycle ON Signal (G80S)

When canned cycle starts, its output is given. The canned cycle signal is stopped in canned cycle cancel block.

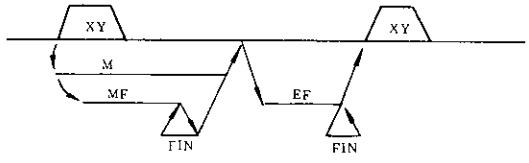


External Operation Function (EF)

External operation function signal is issued on completion of positioning except for Z-axis in canned cycle. The machine controls Z-axis when it receives this signal and sends Z-axis control completion signal (FIN) when the Z-axis control is finished. The operation shown in the following block is performed by the machine.

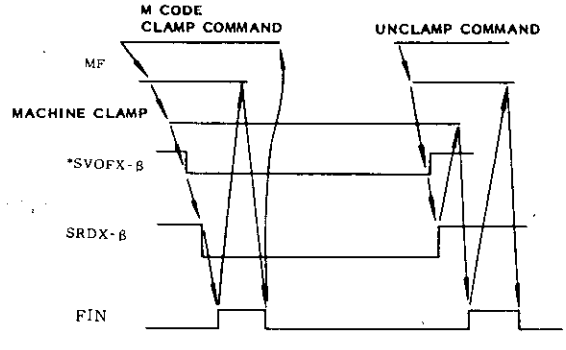


The operation of the block including M command is as follows.



13.5.30 Servo Off Signal (*SVOFX, *SVOFY, *SVOFα, *SVOFβ)

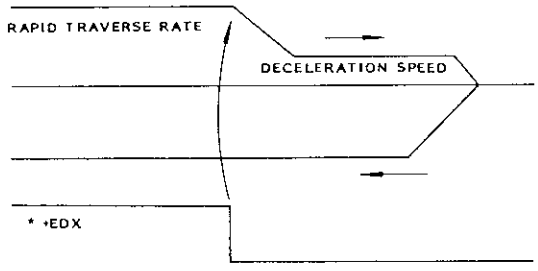
This signal is used for cutting with the axis mechanically clamped. When the signal *SVOFX to β contacts are open, servo lock for β-axis is released. To clamp the machine, use M-function. Shown below is the time chart of servo off signal, machine clamp, auxiliary function and servo ready (SRDX to SRDβ). Output clamp command after positioning signal (DEN) is given.



*Normally closed contacts.

13.5.31 External Deceleration (*+EDX, *-EDX to *+EDα, *-EDβ)

This signal permits the maximum effective stroke of the machine in the control and controls the high-speed operation. When the external deceleration signal corresponding to axis is turned on during rapid traverse or manual jog operation, if the axis direction coincides with commanded direction, the machine decelerates to the speed set by parameter #6340.



*+EDX

Cutting feed function (*+EDX to *+ED β) enable or disable can be set by parameter #6012 to #6013.

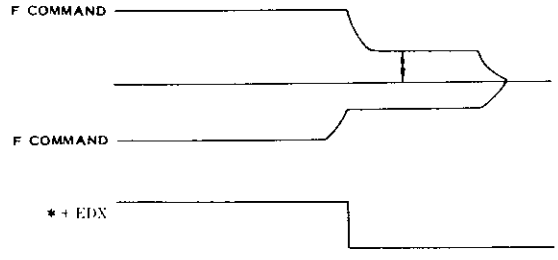
	D4	D3	D2	D1	D0
#6012	β	α	Z	Y	X

External deceleration in plus direction
Enable = 1, Disable = 0

	D4	D3	D2	D1	D0
#6013	β	α	Z	Y	X

External deceleration in minus direction
Enable = 1, Disable = 0

When the axis in moving meets the deceleration conditions, feedrate follows parameter #6341.



When command speed is smaller than deceleration speed, command speed takes priority.

13.5.32 F 1-digit Command (F1)

(1) With a digit of 1 through 9 after an address F, feedrates corresponding to these digits can selectively commanded.

F command	Setting No.
F1	#6561
F2	#6562
F3	#6563
F4	#6564
F5	#6565
F6	#6566
F7	#6567
F8	#6568
F9	#6569

Setting value "1" = 0.1 mm/min

(2) When F 1-digit switch is turned on, the feedrate specified by F 1-digit is increased creased by rotating manual pulse generator. Feedrate increase or decrease value per 1 pulse is set by parameter (F 1-digit multiplication) as shown in the table below.

F command	F 1-digit Multiplication Parameter No.
F1	#6141
F2	#6142
F3	#6143
F4	#6144
F5	#6145
F6	#6146
F7	#6147
F8	#6148
F9	#6149

Setting value "1" = 0.1 mm/min/pulse

(3) Maximum speed limit

Maximum feedrate specified by F 1-digit can be set by parameters listed in the table below. The value exceeding usual maximum feedrate specified by parameter #6228 will be limited by parameter #6228 value.

Parameter No.	Function
#6226	Max feedrate by F1 to F4
#6227	Max feedrate by F5 to F9

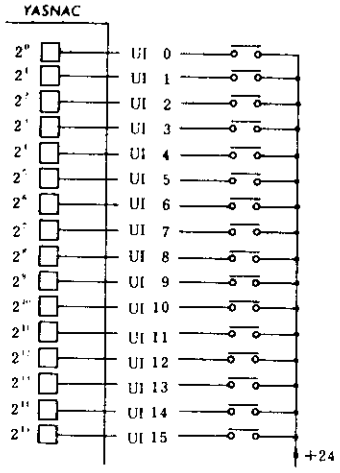
NOTE:
1. With this function, 1 to 9 mm/min cannot be commanded by usual F-function. Command exceeding 10 mm/min can be made.
2. Programming F0 will be indicated by alarm "O30."
3. While Dry Run switch is on, dry run speed will take priority.
4. Feedrate override function will not work on F 1-digit command.
5. Stored feedrate will be kept after turning off power.

13.5.33 Interface Input Signals UI10 - UI15, UO0 - UO15 (#1000 Through #1015, #1032)†

(1) When one of system variable #1000 through #1015 is specified to the right-hand of an operational expression, the on/off state of each of user-macro-dedicated 16-point input signals is read. The relationships between the input signals and the system variables are shown below.

#1007	#1006	#1005	#1004	#1003	#1002	#1001	#1000
UI7 2^7	UI6 2^6	UI5 2^5	UI4 2^4	UI3 2^3	UI2 2^2	UI1 2^1	UI0 2^0
#1015	#1014	#1013	#1012	#1011	#1010	#1009	#1008
UI15 2^{15}	UI14 2^{14}	UI13 2^{13}	UI12 2^{12}	UI11 2^{11}	UI10 2^{10}	UI9 2^9	UI8 2^8

Variable Value	Input Signal
1	Contact Closed
0	Contact Open



Each read variable is 1.0 or 0.0 when the associated contact is "closed" or "open" respectively, regardless of the unit system of the machine.

(2) When system variable #1032 is designated, the input signals (UI0 through UI15) that consist of 16 points (16 bits) are collectively read as a decimal positive value.

$$\#1032 = \sum_{i=0}^{15} \#[1000 + i] * 2^i$$

Sample Program

a. IF [#1015 EQ 0] GO TO 100 ;

Bit 2^{15} (UI15) is read and, if it is "0," a branch is made to sequence number N100.

b. #130 = #1032 AND 255

Bit 2^0 through 2^7 (UI0 through UI7) are collectively read to be stored in common variable #130 as a decimal positive value.

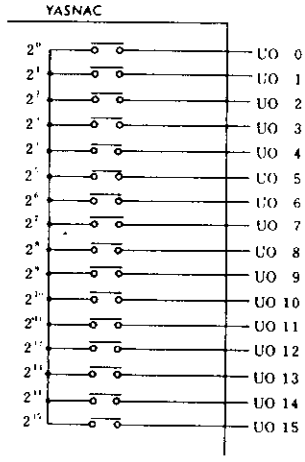
Note: System variables #1000 through #1032 cannot be placed to the left-hand of operational expressions.

13.5.34 Interface Output Signals (#1100 Through #1115, #1132)†

(1) When one of system variables #1100 through #1115 is specified to the left-hand of an operational expression, an on or off signal can be sent to each of user-macro-dedicated 16-point output signals. The relationships between the output signals and the system variables are as shown below:

#1107	#1106	#1105	#1104	#1103	#1102	#1101	#1100
UO7 2^7	UO6 2^6	UO5 2^5	UO4 2^4	UO3 2^3	UO2 2^2	UO1 2^1	UO0 2^0
#1115	#1114	#1113	#1112	#1111	#1110	#1109	#1108
UO15 2^{15}	UO14 2^{14}	UO13 2^{13}	UO12 2^{12}	UO11 2^{11}	UO10 2^{10}	UO9 2^9	UO8 2^8

Variable Value	Output Signal
1	Contact Closed
0	Contact Open



When 1.0 or 0.0 are substituted in any of #1100 through #1115, the associated output contact is outputted in the "closed" or "open" state.

(2) When system variable #1132 is specified, the output signals (UO0 through UO15) that consist of 16 points (16 bits) are collectively this time, the decimal positive value substituted in #1132 is outputted in the form of binary 16-bit value.

$$\#1132 = \sum_{i=0}^{15} \#[1100 + i] * 2^i$$

13.5.34 Interface Output Signals (#1100 Through #1115, #1132)† (Cont'd)

(3) With system variables #1100 through #1132, the value sent last is retained. Hence, when one of them is written to the right-hand of an operational expression, its value is read.

(4) Considerations

When any values other than 1.0 or 0.0 are substituted into one of #1100 through #1115, the values are handled as follows:

"Blank" is assumed to be "0." Values other than "blank" and 0 are assumed to be "1."

Sample Program

a. #1107 = #10 ; (#10 = 1.5)

The output signal of bit 2^7 (UO7) is outputted in the contact (closed) state.

b. #1132 = (#1132 AND 240) OR (#8 AND 15 ;)

The output signal of bits 2^4 through 2^7 (UO4 through UO7) are outputted without change and contents of local variable #8 are outputted to the output signals of bits 2^0 through 2^3 (UO0 through UO3).

(Decimal 240) = 11110000, (Decimal 15) = 00001111

13.5.35 SKIP Input

If SKIP input is closed during the execution of move command by G31 in the automatic operation mode, the control immediately stops the movement and stores the coordinate value where SKIP input changed from open to close. At this point, the block of G31 command is regarded to have been completed, and the following block is taken up.

The coordinate value of the skip position is stored in the following setting numbers:

#6552 --- X-axis coordinate value
#6553 --- Y-axis coordinate value
#6554 --- Z-axis coordinate value
#6555 --- α-axis coordinate value
#6556 --- β-axis coordinate value

NOTE:

1. The block of G31 command moves in the same way as G01. If parameter (#6019, D4) is set to "1," the feedrate which is not specified in the part program but is set to parameter #6232 is provided.

2. If SKIP input is not closed after the completion of the block of G31 command, the following operation takes place:

a. When setting #6004, D0 is set to "0," the following block is executed.

b. When setting #6004, D0 is set to "1," the alarm state (alarm code "087") is generated.

3. SKIP signal is effective, when turned off, by setting parameter #6031, D0 to "1."

13.5.36 Program Interrupt (PINT)Input

This input is used to jump an NC program to be executed by the external input to a given location during the execution of a part program in the automatic operation mode.

When PINT input changes from open to close while the control is executing the block between M91 command and M90 command, it immediately discontinues this block and starts the execution of the part program of the program number (P) and sequence number (Q) specified in the block of M91.

NOTE:

1. If PINT input changes from open to close when the control is at standstill after the execution of a block between M91 command and M90 command on a single block basis, the execution of the part program specified in P and Q is started at the time the automatic activation is performed.

2. PINT signal is effective at rise down (close to open) by setting parameter #6032, D1 to 0.

13.5.37 Display Reset (DRS) Inputs

These inputs set the external 3-axis current value display (EXTERNAL DISPLAY) on the operator's panel CRT to "0." They are used with Handle axis selection input.

DRS	Closed	HX	Closed	External display X-axis reset
			Opened	—
		HY	Closed	External display Y-axis reset
			Opened	—
		HZ	Closed	External display Z-axis reset
			Opened	—
		Hα		External display α-axis reset
			Opened	—
		Hβ	Closed	External display β-axis reset
			Opened	—

13.5.38 Tool Length Offset (TLMI, RET, TLMO) Inputs/Outputs

Opening TLMI contacts stores the Z-axis current value in the control as home position. In this case, tool length mode indicating TLMO is outputted. Closing RET after moving Z-axis to the measured point stores the move distance of Z-axis from the home position in the offset memory. Opening TLMI contact again cancels TLM mode and stops TLMO output.

13.5.39 Axis Interlock (ITX, ITY, ITZ, ITα, ITβ) Inputs

Axis interlock is provided with each axis for inhibiting axis motion.

(1) When axis interlock contact is opened during motion, the axis is decelerated to 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 controlled two axes or three axes in interpolation command, opening the axis interlock contact for any one axis of them stops interpolation and detelerates the axis to stop.

13.5.40 Playback (PLYBK) Input

To put the control in the Playback mode, close the playback input in the manual operation mode (HANDLE, STEP, JOG, RAPID). In the Playback mode, current value for each axis can be edited by PROGRAM function key. Usual manual operation is also permitted. Open the Playback input contact and usual manual operation mode is obtained.

13.5.41 S5-Digit Command (SDA1 Through SDA16, DAS, SGS0, GRL, GRH, GRA, GRB, M04S, SINV, SFIN) Inputs/Outputs

These signals are used to determine the speed of the spindle motor when the control is in the state of S command 4-Digit Non-Contact output or S Command 5-Digit Analog output.

GRA and GRB 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 outputted.

When M03 command is executed, M04S contact is opened. When M04 command is started, M04S contact is closed.

(1) S5-DIGIT COMMAND 12-BIT NON-CONTACT OUTPUT

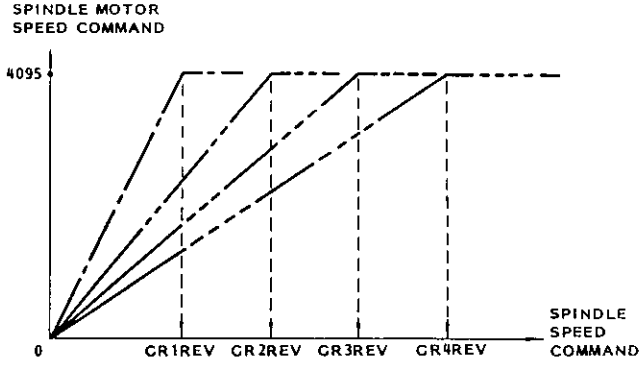
Binary code 12 bits (0 to 4095 = spindle motor speed) are outputted as follows by the spindle motor speed command and GR1 through GR4:

——————; The output when "GR1" input is closed. (Set the spindle motor maximum speed at gear range "GR1" to parameter #6271.)

——— · ———; The output when "GR2" input is closed. (Set the spindle motor maximum speed at gear range "GR2" to parameter #6272.)

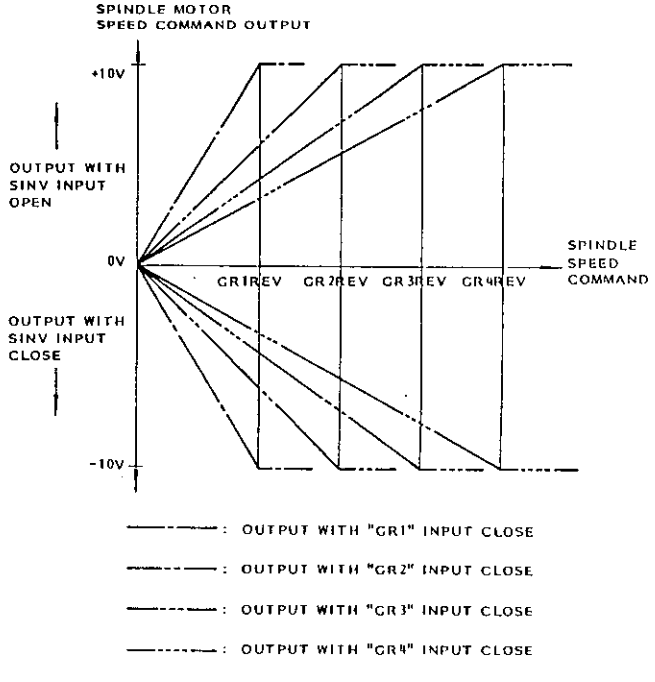
——— - - ———; The output when "GR3" input is closed. (Set the spindle motor maximum speed at gear range "GR3" to parameter #6273.)

——— - - - ———; The output when "GR4" input is closed. (Set the spindle motor maximum speed at gear range "GR4" to parameter #6274.)



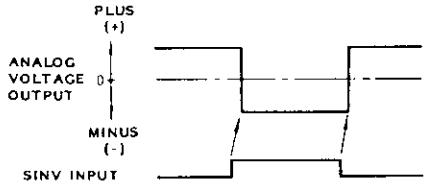
(2) S5-DIGIT COMMAND ANALOG (DAS, SGS1) OUTPUTS

Analog voltages (-10 V to 0 V to +10 V) are outputted as follows by the spindle speed command, GR1 through GR4 inputs, and SINV input:



13.5.41 S5-Digit Commands (SDA1 Through SDA16, DAS, SGS0, GRL, GRH, GRA, GRB, M04S, SINV, SFIN) Inputs/Outputs (Cont'd)

(3) TIME CHART OF ANALOG VOLTAGE OUTPUT, SINV INPUT, AND SINVA OUTPUT FOR SPINDLE MOTOR SPEED



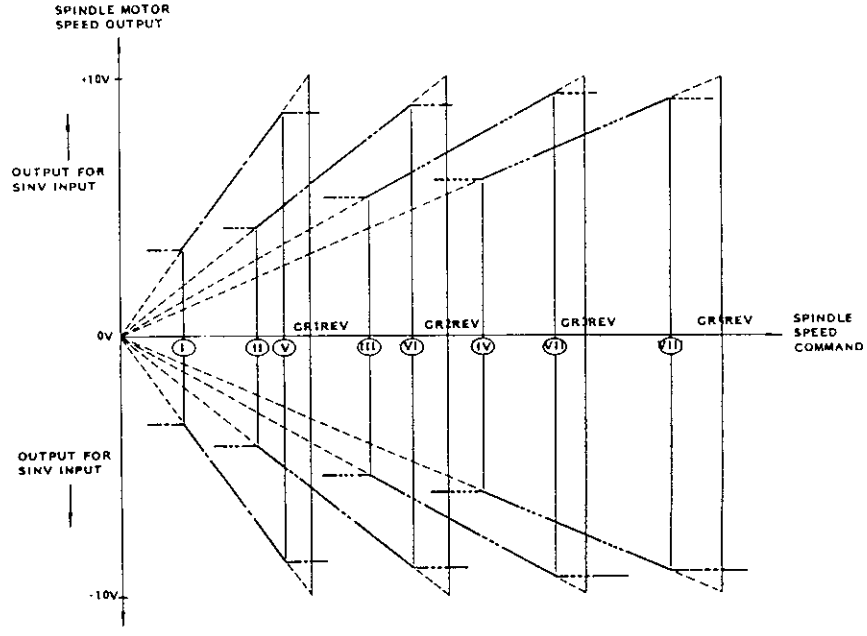
(4) SPINDLE MAXIMUM/MINIMUM SPEED CLAMP

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

Table 13.11

Parameter		Fig. No.
#6266	Spindle maximum speed when "GR1" input is closed.	V
#6267	Spindle maximum speed when "GR2" input is closed.	VI
#6268	Spindle maximum speed when "GR3" input is closed.	VII
#6269	Spindle maximum speed when "GR4" input is closed.	VIII
#6276	Spindle minimum speed when "GR1" input is closed.	I
#6277	Spindle minimum speed when "GR2" input is closed.	II
#6278	Spindle minimum speed when "GR3" input is closed.	III
#6279	Spindle minimum speed when "GR4" input is closed.	IV

The following diagram shows an example of the S5-digit analog outputs when the spindle maximum/minimum speeds are clamped by these parameters:



NOTE:

1. The spindle motor speed command output is obtained from the following relation:

$$\frac{\text{(Spindle speed command)} \times \text{(32767 or 10 V)}}{\text{(Spindle gear range spindle maximum speed determined by GR1 through GR4 inputs: parameters \#6271 throug \#6274.)}}$$

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 SDASGN1 or SDASGN2 (#6006, D6 or D7).

SDASGN1 (#6006, D6)	SDASGN2 (#6006, D7)	M03 Output	M04 Output
0	0	+	+
1	0	-	-
0	1	+	+
1	1	-	-

When SINV input is closed, the above polarities are inverted. [in case of (D6, D7) = (0, 1), (1, 1)]

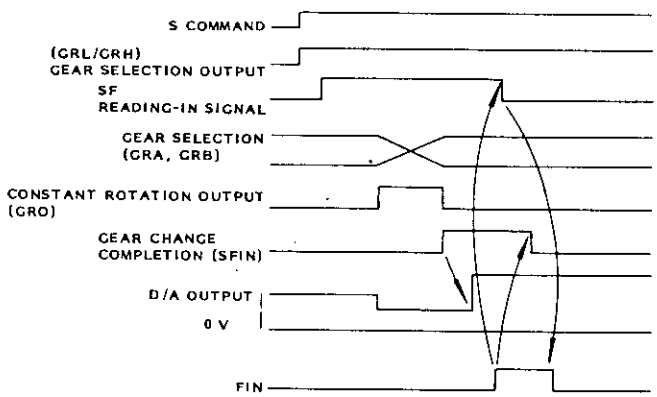
13.5.42 Gear Selection Command Input/Output (GRL, GRH, GRA, GRB, SF, SFIN)

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 (parameter #6266 to #6269) at the same time, and outputs gear selection command (GRL, GRH) corresponding to gear speed.

The control compares the outputted 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 corresponding to GRO.

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



Gear Selection Output (GRL, GRH), Gear Selection

This input selects four types of gear range.

	GRB (H)	GRA (L)
GEAR 1 (GR1)	0	0
GEAR 2 (GR2)	0	1
GEAR 3 (GR3)	1	0
GEAR 4 (GR4)	1	1

13.5.43 Gear Shift On (GRO) Input And Spindle Orientation (SOR) Input

These inputs are used to make the S5-digit command analog output provide the outputs other than the part program S command. When GRO input is closed, the voltage set by parameter #6270 is outputted.

If SOR input is closed, the spindle speed set to parameter #6275 by the spindle gear range input and spindle motor speed command voltage corresponding to each gear are outputted.

Table 13.4

GRO Input	SOR Input	S5-digit command analog voltage
0	0	Voltage corresponding to spindle speed command by NC program.
0	1	Voltage corresponding to parameter #6275.
1	0	Voltage corresponding to parameter #6270.
1	1	Voltage corresponding to parameter #6270.

0: Contact open, 1: Contact closed

NOTE:

1. It is possible to make the analog output corresponding to GRO, SOR inputs negative by the S5-digit analog output invert (SINV) input.

2. The period of time between the setting of GRO and SOR inputs and the catching-up of the analog voltage value is shorter than 100 msec.

13.5.44 Spindle Speed Reached (SAGR) 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. At the start of cutting (when switching from a positioning command to a cutting command takes place), the control delays the time by the value specified in parameter #6224, make sure that SAGR input is closed, and starts cutting.

NOTES: To perform the operation by SAGR input described above, set parameter #6006 D4 to "1." If it is set to "0," SAGR input is ignored.

13.5.45 Spindle Speed Override (SPA, SPB, SPC) Inputs

These inputs are used, in the case of the S4-digit command, to override the S command in a range of 50% to 120% at the execution of the part program in the automatic operation mode.

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%

1: Input Closed, 0: Input Opened

13.5.46 S5-Digit Analog Output Auto/Manual Switching (SEND, SEN1, ENO, SGSO, EN1, SGS1) Inputs/Outputs

(1) As shown below, when the S5-digit manual analog input is given between EN1 and SGS1 from outside to control SENO and SEN1 inputs, the voltage by the S command in the part program or the external analog voltage input may be outputted between ENO and SGS1.

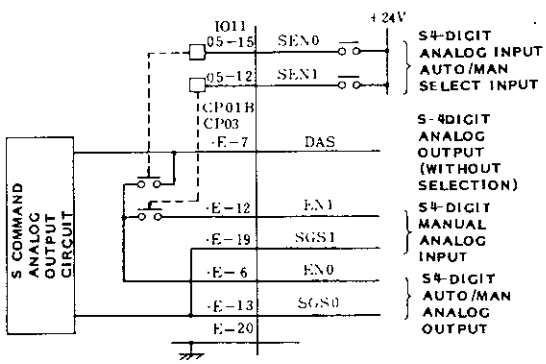
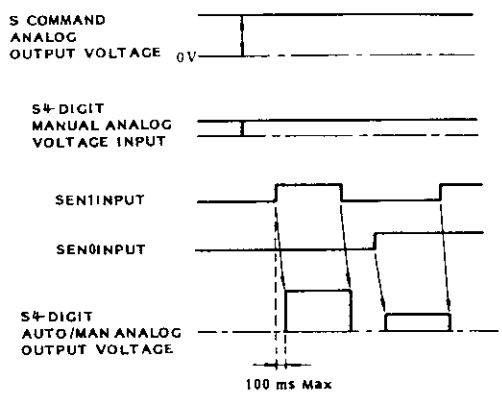


Fig. 13.7

(2) TIME CHART OF INPUT/OUTPUT SIGNALS



14.5.47 S5-Digit Command External Outputs (R01 Through R12)

These inputs and outputs are used, when the control is of S command 5-digit, to output the results of the operation by the S command in the part program to the outside and perform the actual S5-digit command 12-bit non-contact output or analog output according to the inputs from the outside.

(1) S4-DIGIT COMMAND 12-BIT NON-CONTACT OUTPUT

Output of operation results to outside: DA01 through DA16

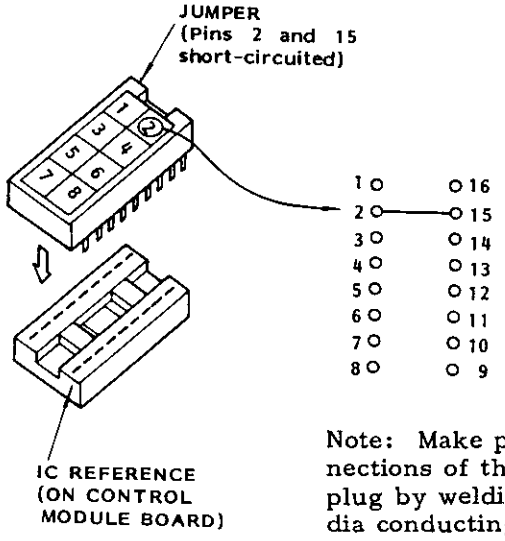
-32768 ~ 0 ~ +32767
-10 V ~ 0 V ~ +10 V

Note: The input/output value is signed binary 16-bit. The relationship with analog voltage is as follows: -32768 to 0 to +32767, -10 V to 0 to +10 V.

NOTE: The primary purpose of this function is to control the S5-digit command by the sequencer built in the control. This function should not be used for other purposes unless especially required.

APPENDIX CONTROL MODULE PARAMETERS

The control modules (chiefly implemented on printed circuit boards) used on the YASNAC LX1 has a jumpering section for specifying the use of the module. This specification is made using module parameters. The parameters may be set by inserting jumper plugs into the 16-pin IC socket mounted on the control module.



Note: Make pin connections of the jumper plug by welding 0.5 mm dia conducting leads.

Setting of Module Parameters

The following are module parameters of each control module.

(1) MODULE PARAMETERS FOR DATA CPU MODULE (JANCD-CP03)

DEVICE ALPHABETS OF IC RECEPTACLE

CP (LOCATION: 2F)

1o——o16 ← FIRST HANDLE PG +12 V SELECT (STANDARD)
2o——o15 ← FIRST HANDLE PG +5 V SELECT
3o o14
4o o13
5o o12
6o o11
7o o10
8o o 9

(2) MODULE PARAMETERS FOR SERVO CPU MODULE (JANCD-CP02)

CP (LOCATION: 1P)

1o——o16 ← X-AXIS PG +12 V SELECT
2o——o15 ← X-AXIS PG +5 V SELECT (Standard)
3o——o14 ← Y-AXIS PG +12 V SELECT
4o——o13 ← Y-AXIS PG +5 V SELECT (Standard)
5o——o12 ← Z-AXIS PG +12 V SELECT
6o——o11 ← Z-AXIS PG +5 V SELECT (Standard)
7o——o10 ← NEAR ZERO SIGNAL FOR ZERO POINT RETURN +24 V PULL-UP SELECT (Standard)
8o——o9 ← NEAR ZERO SIGNAL FOR ZERO POINT RETURN +0 V PULL-DOWN SELECT

(3) MODULE PARAMETERS FOR ADDITIONAL AXIS CONTROLLER (JANCD-SR01/02)

CR (LOCATION: 2T)

1o——o16 ← SECOND HANDLE PG +12 V SELECT (Standard)
2o——o15 ← SECOND HANDLE PG +5 V SELECT
3o——o14 ← THIRD HANDLE PG +12 V SELECT (Standard)
4o——o13 ← THIRD HANDLE PG +5 V SELECT
5o o12
6o o11
7o o10
8o o 9

CP (LOCATION: 2N)

1o——o16 ← 4TH AXIS PG +12 V SELECT
2o——o15 ← 4TH AXIS PG +5 V SELECT (Standard)
3o——o14 ← 5TH AXIS PG +12 V SELECT
4o——o13 ← 5TH AXIS PG +5 V SELECT (Standard)
5o——o12 ← NEAR ZERO SIGNAL FOR REFERENCE POINT RETURN +24 V PULL-UP SELECT
6o——o11 ← NEAR ZERO SIGNAL FOR REFERENCE POINT RETURN +0 V PULL-DOWN SELECT
7o o10
8o o 9

(4) MODULE PARAMETERS FOR STANDARD GENERAL-PURPOSE INPUT/OUTPUT MODULE (JANCD-IO01B)

CD (LOCATION: 40H)

1o——o16 ← MODULE 1 SELECT (IO11)
2o——o15 ← MODULE 2 SELECT (IO12)
3o——o14 ← MODULE 3 SELECT
4o——o13 ← MODULE 4 SELECT

Selects I/O module. See Notes 1 and 3.

5o o12
6o o11
7o o10
8o o 9

CE (LOCATION: 15A)

1o——o16 ← 13RD INPUT PORT IN THE MODULE +24 V COMMON SELECT (Standard)
2o——o15 ← 13RD INPUT PORT IN THE MODULE 0 V COMMON SELECT
3o——o14 ← 14TH INPUT PORT IN THE MODULE +24V COMMON SELECT
4o——o13 ← 14TH INPUT PORT IN THE MODULE 0 V COMMON SELECT (Standard)
5o o12
6o o11 (See Note 6.)
7o o10
8o o 9

(5) MODULE PARAMETERS FOR MINI GENERAL-PURPOSE INPUT/OUTPUT MODULE JANCD-IO02)

CD (LOCATION: 5E)

1o——o16 ← AREA 0-2 SELECT
2o——o15 ← AREA 1-1 SELECT
3o——o14 ← AREA 1-2 SELECT
4o——o13 ← AREA 2-1 SELECT (See Note 1
5o——o12 ← AREA 2-2 SELECT and 4.)
6o——o11 ← AREA 3-1 SELECT
5o——o10 ← AREA 3-2 SELECT
8o o 9

CE (LOCATION: 7A)

1o——o16 ← 7TH INPUT PORT IN THE AREA +24 V COMMON SELECT
2o——o15 ← 7TH INPUT PORT IN THE AREA 0 V COMMON SELECT
3o——o14 ← 8TH INPUT PORT IN THE AREA +24 V COMMON SELECT
4o——o13 ← 8TH INPUT PORT IN THE AREA 0 V COMMON SELECT
5o o12
6o o11 (See Note 7.)
7o o10
8o o 9

(6) MODULE PARAMETERS FOR MDI MODULE (JANCD-SP01)

CE (LOCATION: 11D)

1o——o16 ← AREA 0-1 SELECT (STANDARD)
2o——o15 ← AREA 0-2 SELECT
3o o14
4o o13
5o o12 (See Note 2.)
6o o11
7o o10
8o o 9

NOTE:

Module selection, area, and other information on general-purpose input/output modules

1. The address space for general-purpose input/output has the following configuration. That is, there are five module spaces, module 0 through module 4, IO module divided into area □-1 and □-2.

2. MDI module SP01 needs an address space which is a half of the address space needed by one module and may select area 0-1 (standard).

Input Port				Output Port			
JANCD-IO01B		JANCD-IO02		JANCD-IO01B		JANCD-IO02	
Module No.	Address port	Area No.	Address port	Module No.	Address port	Area No.	Address port
0		0-1 0-2		0		0-1 0-2	
1	#1000 to #1013	1-1 1-2	#1000 to #1007 #1008 to #1015	1	#1100 to #1107	1-1 1-2	#1100 to #1103 #1108 to #1111
2	#1016 to #1029	2-1 2-2	#1016 to #1023 #1024 to #1031	2	#1116 to #1123	2-1 2-2	#1116 to #1119 #1124 to #1127
3	#1032 to #1045	3-1 3-2	#1032 to #1029 #1040 to #1047	3	#1132 to #1139	3-1 3-2	#1132 to #1135 #1140 to #1147
4	#1048 to #1061			4	#1148 to #1155		

3. Standard general-purpose input/output module IO01B needs an address space for one module and may select one of the module 1 through module 4. Hence, for IO01B alone, only a maximum of four boards may be installed.

4. Mini general-purpose input/output module IO02 needs an address space which is a half of the address space needed by one module and may select one of seven areas, area 0-2 through area 3-2. When configuring a system with multiple IO01Bs and IO02s, the above area must be so allocated that they do not overlap each other. Area 0-2 may be selected by IO02; generally, however, area 0-2 is reserved for special purpose.

5. When IO01B is used, input ports 13 and 14 of each module allow the change-over of +24 V common or 0 V common.

6. When IO02 is used, input ports 7 and 8 of each module allow the change-over of +24 V common of 0 V common.

MEMO

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