YASKAWA ELECTRIC

TOE-C843-8.22

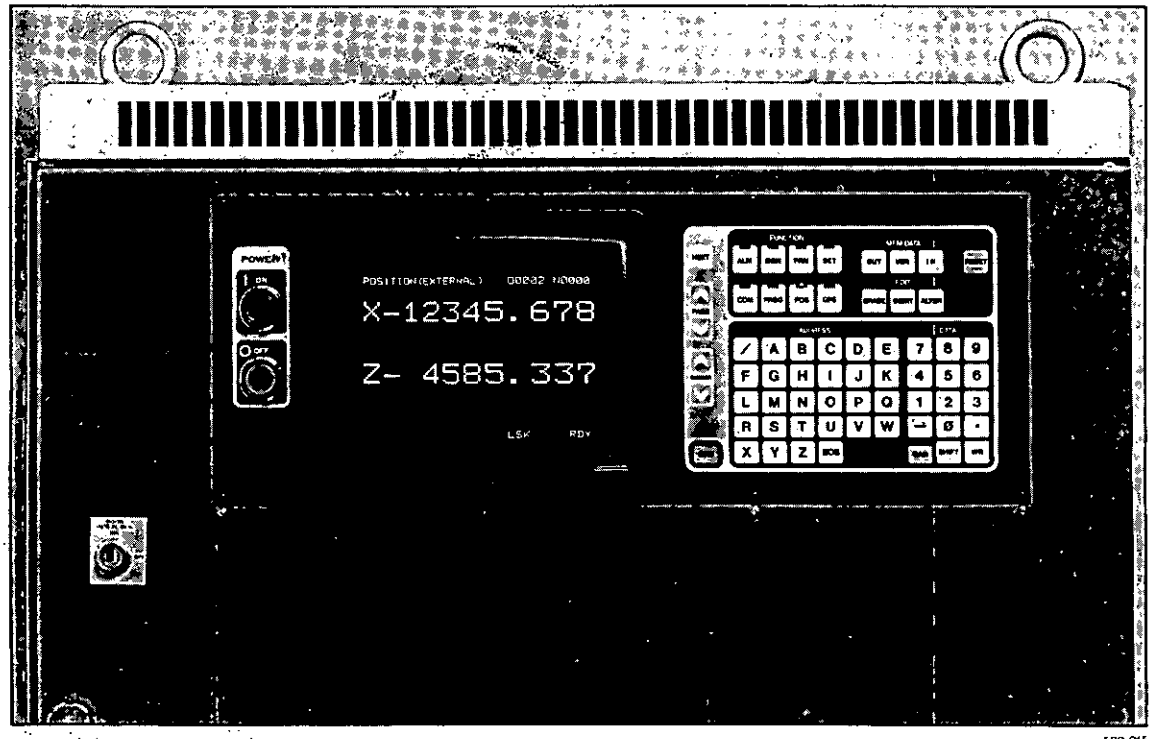
CNC SYSTEM FOR TURNING APPLICATIONS

YASNAC® LX2

CONNECTING MANUAL

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

YASNAC LX2 is an ultraspeed dual processor CNC for turning lathes, and a combination of two high-performance 16-bit microprocessors running in parallel. This manual describes the specifications for connecting YASNAC LX2 with machines, machine interfaces and external equipment.



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YASNAC LX2 OPERATOR'S STATION

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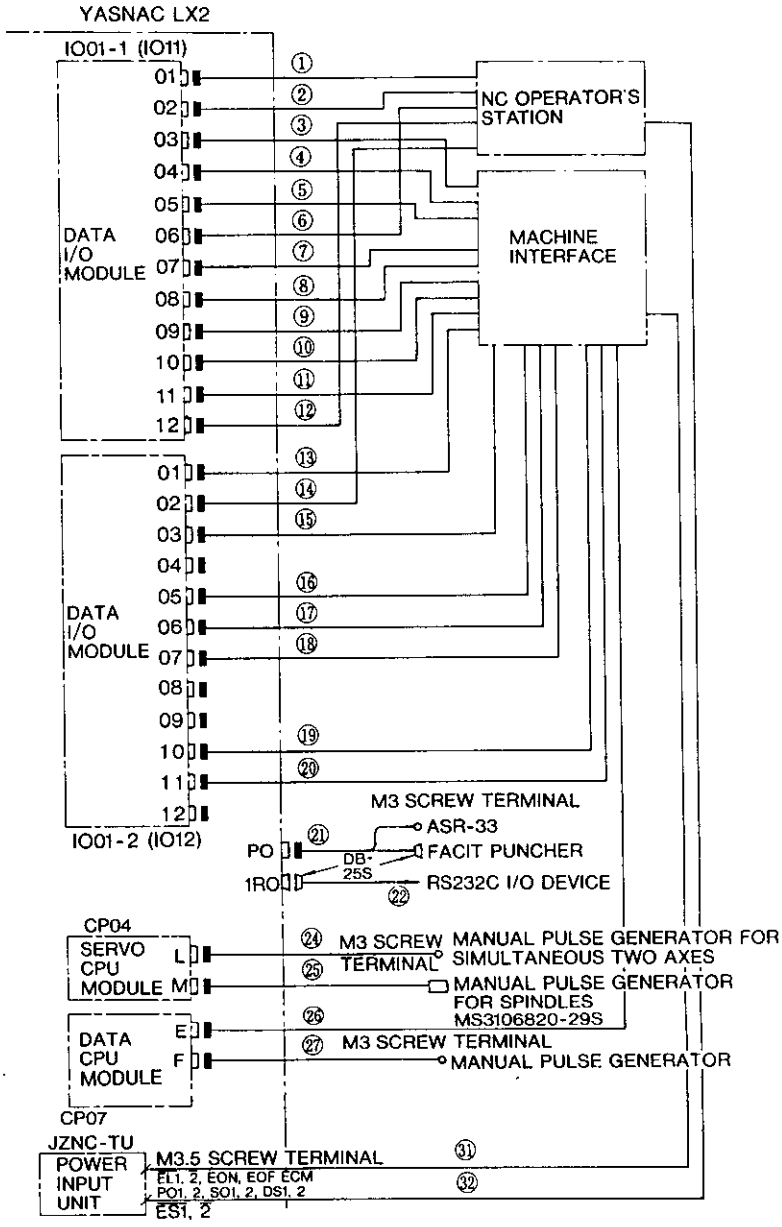
1. CONNECTION DIAGRAMS

This section shows the connections between YASNAC LX2 and external equipment.

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



Note : The following rules apply to connectors without type names in Fig. 1.1 to 1.5.

□ - MR connector 20 pins, male

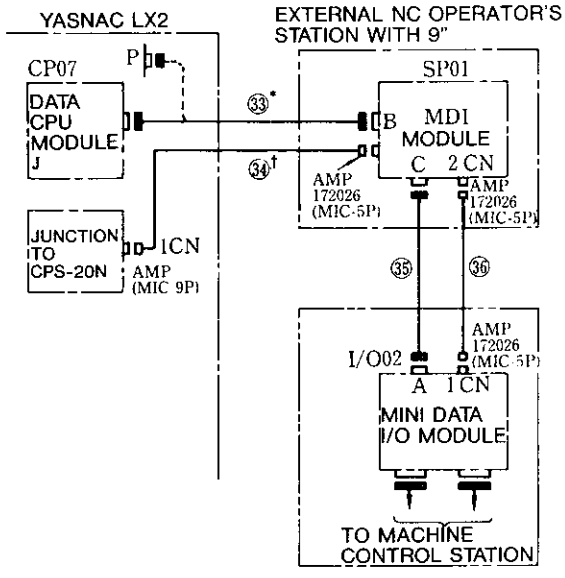
■ - MR connector 20 pins, female

▯ - MR connector 50 pins, male

▮ - MR connector 50 pins, female

Fig. 1.1

1. 2 TOTAL CONNECTION OF YASNAC TO EXTERNAL NC OPERATOR'S STATION WITH 9" CRT



* For unbundled type YASNAC cabinet, cable ㉝ should be connected to junction connector "P".

† For unbundled type YASNAC cabinet, cable ㉞ should be connected to terminals.

Note : The connection diagram is shown where the machine control station with mini data I/O module is employed.

Fig. 1. 2

1. 3 TOTAL CONNECTION OF YASNAC TO EXTERNAL NC OPERATOR'S STATION WITH 14" CRT

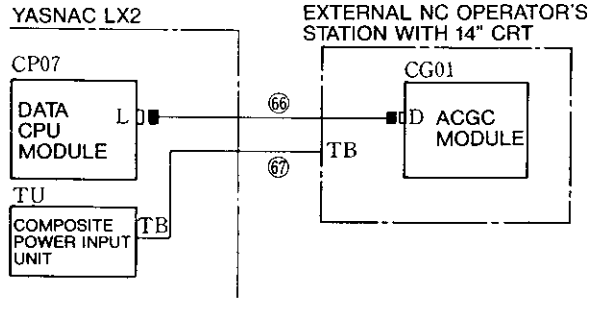


Fig. 1. 3

1. 4 TOTAL CONNECTION OF YASNAC WITH EXTERNAL TAPE READER UNIT

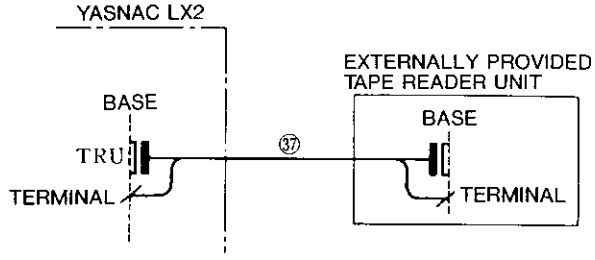


Fig. 1. 4

1. 5 TOTAL CONNECTION OF YASNAC WITH POWER SUPPLY AND SERVOMOTOR

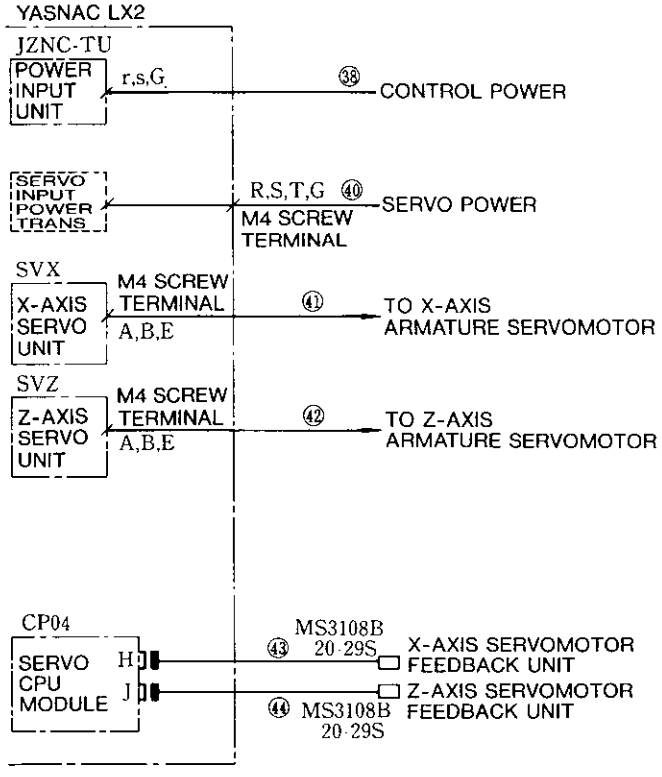


Fig. 1. 5

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.
1–22	Multi-core cable 0.2 mm^2 × 20 core (DWG. No. DE 6428673)	1
23–28, 33, 35, 43, 44, 48, 49, 66	Shield cable 0.2 mm^2 × 10 pairs (DWG. No. DE 8400093)	2
30, 34, 36, 67	Vinyl cabtyre cable 2 mm^2 × 5 cores (DWG. No. DE 8402398)	3
37	Shielded composite cable 2 mm^2 × 2 pairs + 0.2 mm^2 × 17 pairs (DWG. No. DE 8400094)	4

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

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

Table 2.2 Construction

No. of Cable Cores		20
Conductor	Material	Tinned annealed-copper stranded wire
	Nominal sectional area mm^2	0.2
	No. of conductors per mm	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 (20°C) Ω/km	113
Min Insulation Resistance (20°C) MΩ·km	50
Withstand Voltage VAC/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
Dimensions 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 VAC/min	1,000

2.1 CABLES (Cont'd)

3. Specifications of Cable (DWG. No. DE8402398)

Table 2.6 Construction and Characteristics

Item	Specification	Thick-ness (Approx)	Outer Diameter (Approx)
Conductor	Nominal sectional area 2.0 mm^2 JIS* C 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, black Average thickness 90% or more Min thickness 80% or more	1.9	13.0

ELECTRICAL CHARACTERISTICS

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

HEAT TEST

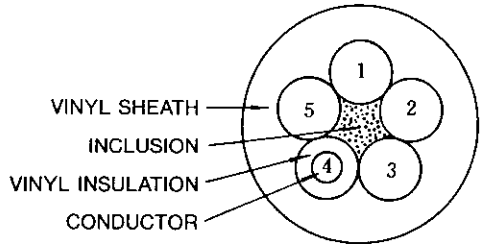
Vinyl insulator: Heating for 48 hours at 100° ±2°C

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	

- Operating temperature: 0 to +60°
- Allowable current wave (at ambient temperature 30°C): 16 A
- Storing temperature: -40 to +60°C

*Japanese Industrial Standard

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

Table 2.8 Characteristics

Item	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 VAC/min	1500	1000

Tadle 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		

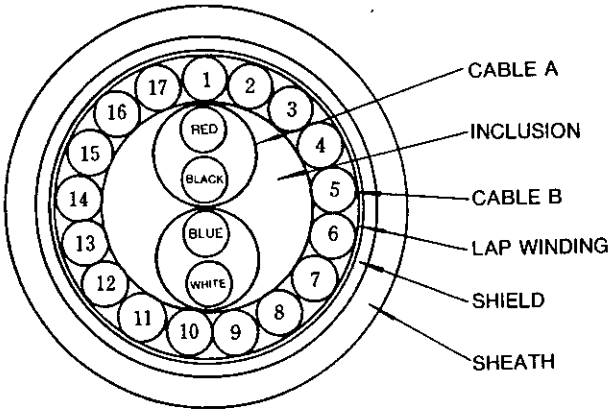


Table 2.10 Cable Supplied by Machine Builders

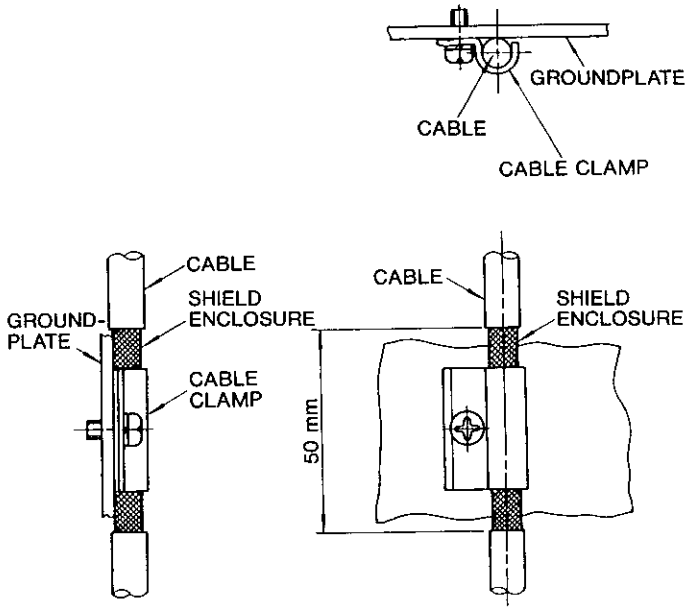
Cable No.	Cable Specifications
31, 32, 46, 47	0.3 mm^2 or more 300 V vinyl cable
38, 39, 45, 55, 57, 60	0.75 mm^2 or more 600 V vinyl cable or vinyl cabtyre cable
65	2 mm^2 or more 600 V special heat resistant vinyl cable
58, 59, 62, 64, 41, 42, 61, 63	600 V special heat resistant vinyl cable or cabtyre cable MR 05, 08, 15 K : 2 mm^2 MR 22 K : 3.5 mm^2 MR 37 K : 5.5 mm^2
40, 52, 53, 54, 56	600 V special heat resistant vinyl cable JUSP DCP 15 A : 2 mm^2 JUSP DCP 30 A : 5.5 mm^2 JUSP DCP 60 A : 14 mm^2

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 LX2 securely with the cable clamping fixtures found in the control panel. (Cables connected to the connectors on connector base are excepted.)

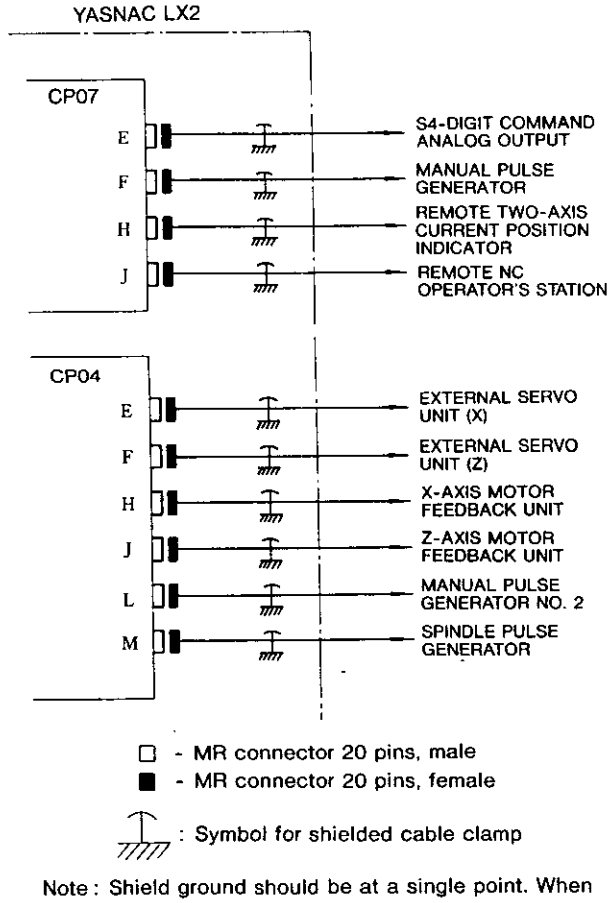
For shielded cables, clamp the cables so that the shield is grounded securely to the plate after stripping the cable sheath as shown in the figure below.



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

Fig. 2.1 Clamping of Shielded Cables

LIST OF SHIELDED CABLE CLAMPS



Note : Shield ground should be at a single point. When shield is grounded externally, shield ground should not be made in the cabinet.

Fig. 2.2

3. CONNECTIONS OF POWER SUPPLY

Specifications of input power of the control unit are shown below.

Standard input power:
200/220/230 VAC, +10% to -15%, at 50/60 Hz ±1 Hz, Single-phase

Input Power B:
200/220 - 240/380/420/460 - 480/550 VAC, +10% to -15%, 50/60 Hz ±1 Hz, Three-phase

Power Capacity

- Power supply for control unit: 1 kVA
- Power supply for servo units is different with capacity

Table 3.1

Type MR	Power Capacity kVA
MR05	1
MR08	1.6
MR15	3
MR22	4
MR37	6.9

The following four modes of power line connection are used with the YASNAC LX2.

(1) Standard input power for free standing type and attached type 2

Applicable to the controls in the free standing type or the attached type 2, without the input power feature B.

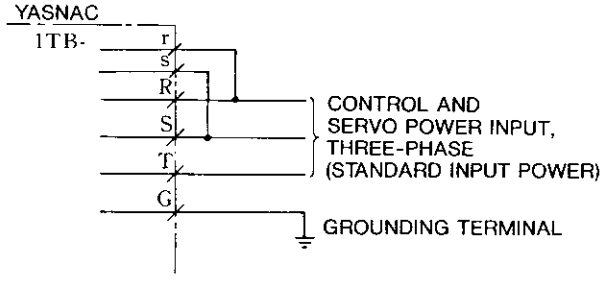


Fig. 3. 1

(2) Input Power B for free standing unit

Applicable to the controls in the free standing type, provided with a transformer for the servo input power B and one for the control input power B.

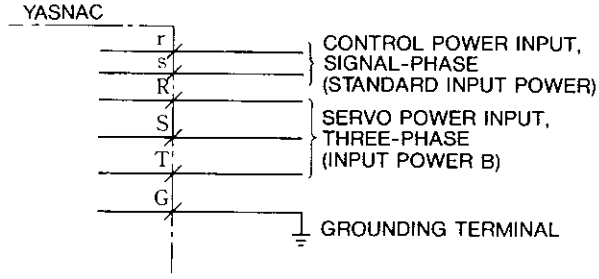


Fig. 3. 2

(3) Input power B for attached type 2

Application to the controls in attached provided with only a transformer for the servo input power B.

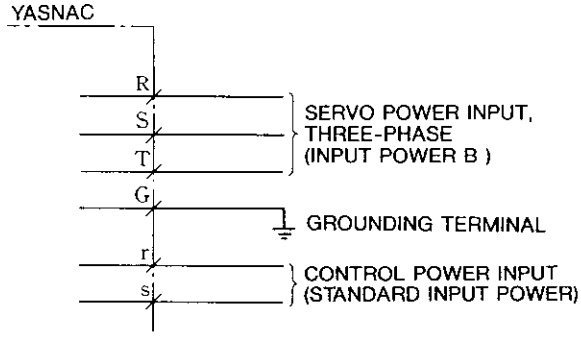
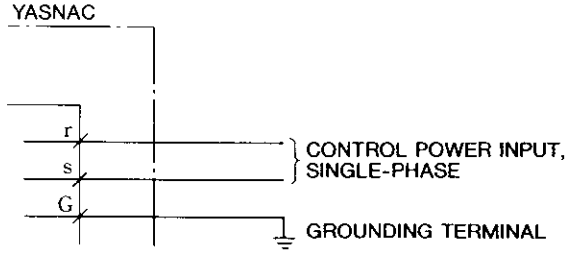


Fig. 3. 3

(4) External servo unit type

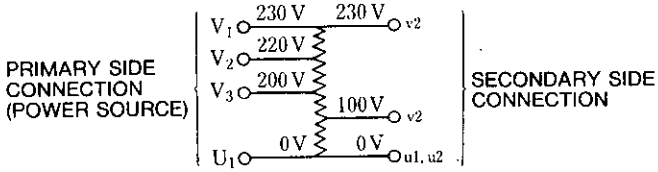


Note : Make class 3 grounding work using a ground terminal 3.5 mm^2 or larger.

Fig. 3. 4

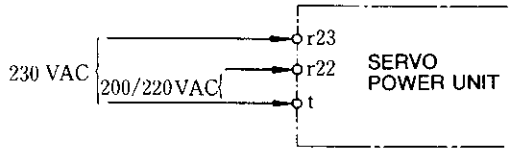
TAP-CHANGE OF TRANSFORMER FOR CONTROL (1T)

When the transformer for control (1T) is provided with the unit, make a tap connection so that input power voltage is within -15% to +10% of tap voltage.



SERVO POWER SWITCHING

When input power voltage is 200/220 VAC or 230 V, the connection of servo power unit should be changed as shown below.



CONNECTIONS OF TRANSFORMER FOR SERVO INPUT POWER B

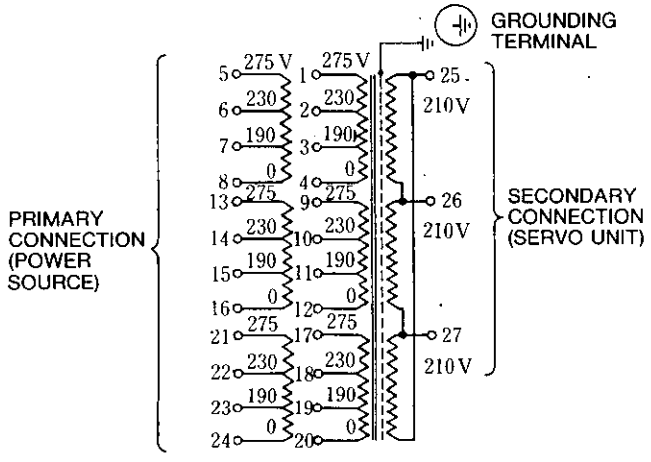


Fig. 3. 5

Table 3. 2 Connections

Supply Voltage	Transformer Primary Side Terminal Connections
200 V	R-3, 3-7, 7-24, 24-20 S-11, 11-15, 15-8, 8-4 T-19, 19-23, 23-16, 16-12
220/240 V	R-2, 2-6, 6-24, 24-20 S-10, 10-14, 14-8, 8-4 T-18, 18-22, 22-16, 16-12
380 V	R-3, 4-7, 8-11 S-11, 12-15, 16-19 T-19, 20-23, 24-3
420 V	R-3, 4-6, 8-11 S-11, 12-14, 16-19 T-19, 20-22, 24-3
460/480 V	R-2, 4-6, 8-10 S-10, 12-14, 16-18 T-18, 20-22, 24-2
550 V	R-1, 4-5, 8-9 S-9, 12-13, 16-17 T-17, 20-21, 24-1

Example: Connections to 220 V Power Supply

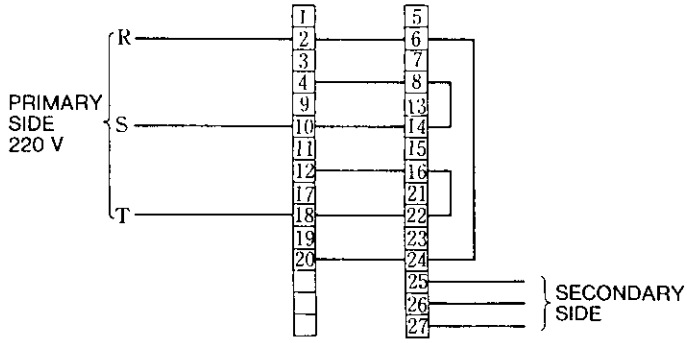


Fig. 3. 6

CONNECTIONS OF TRANSFORMER FOR CONTROL INPUT POWER B

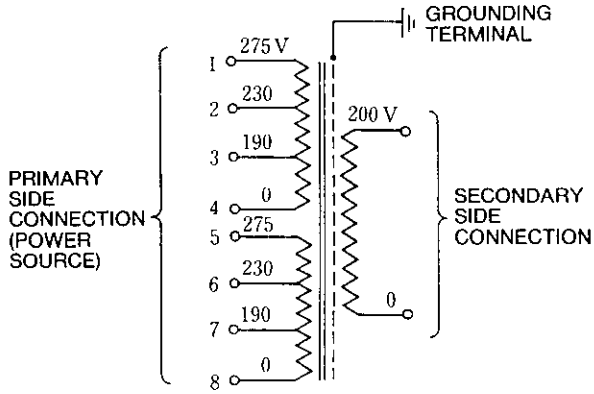


Fig. 3. 7

Table 3. 3 Connections

Supply Voltage	Transformer Primary Side Terminal Connections
200 V	R-3, 3-7, 4-8 T-8
220/240 V	R-3, 2-6, 4-8 T-8
380 V	R-3, 4-7 T-8
420 V	R-3, 4-6 T-8
460/480 V	R-2, 4-6 T-8
550 V	R-1, 4-5 T-8

4. CONNECTION WITH EXTERNAL SERVO CONTROL UNIT

4.1 CONNECTION TO ALL THE SERVO-RELATED UNITS

(1) SERVO-RELATED UNITS

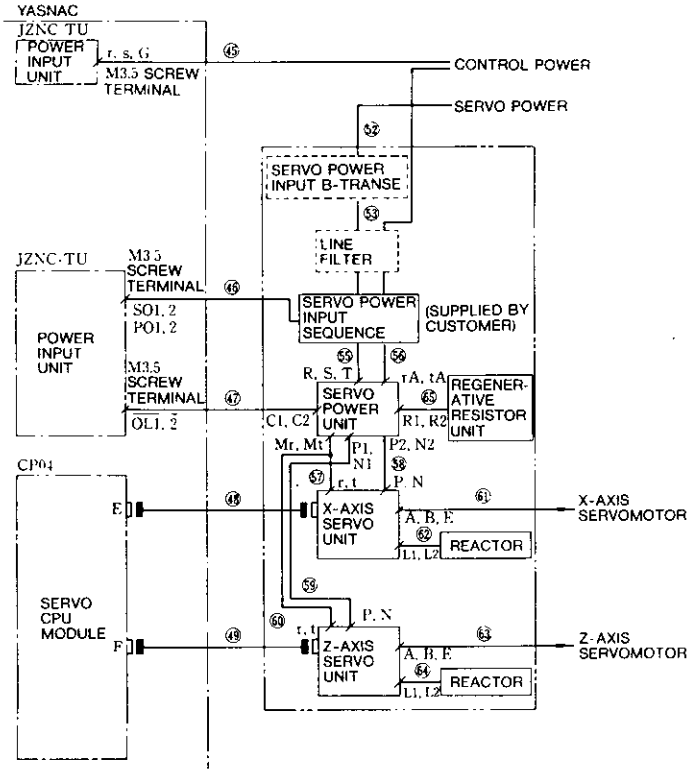
When the servo control unit is installed outside the NC unit, normally, the following units are delivered.

Table 4.1 Units Supplied by Yaskawa

No.	Unit Name	Type	Q'ty
1	Power supply unit	JUSP-DCP	1
2	Regenerative resistor unit	JUSP-RA	1
3	X-axis servo unit	CPCR-MR K	1
4	Z-axis servo unit	CPCR-MR K	1
5	X-axis reactor	5–10mH 11–25 A	1
6	Z-axis reactor		1
7	Line filter	LF 310, LF 320, LF 330 (Tohoku kinzoku)	1

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

(2) TOTAL CONNECTION OF SEPARATELY-MOUNTED SERVO UNITS



□ - MR connector 20 pins, male ■ - MR connector 20 pins, female

Note : For connecting cable, refer to Par. "3. CABLES AND CABLE CLAMPS."

Fig. 4.1

4.2 RECOMMENDED SEQUENCE CIRCUIT FOR SERVO POWER SWITCHING

The recommended circuit, to be prepared by the user, is shown on the next page.

(1) STANDARD INPUT POWER

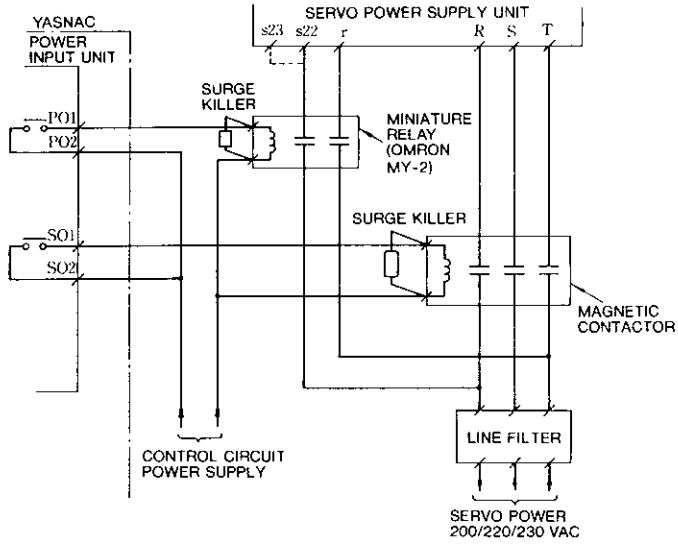


Fig. 4.2

(2) SERVO INPUT POWER B TRANSFORMER

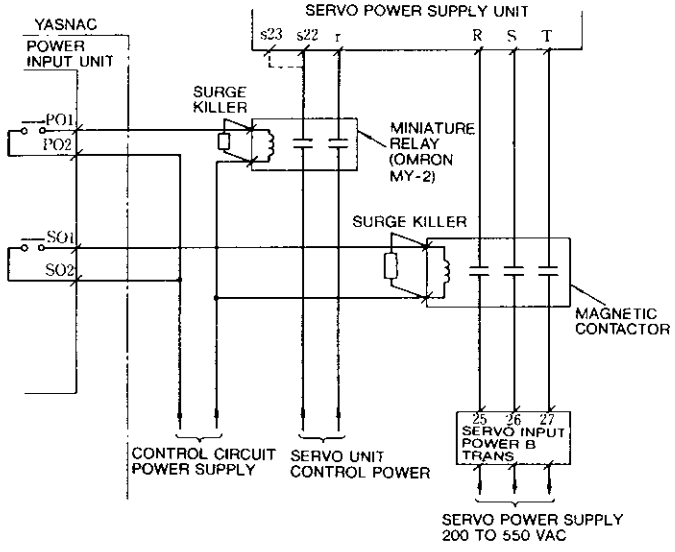
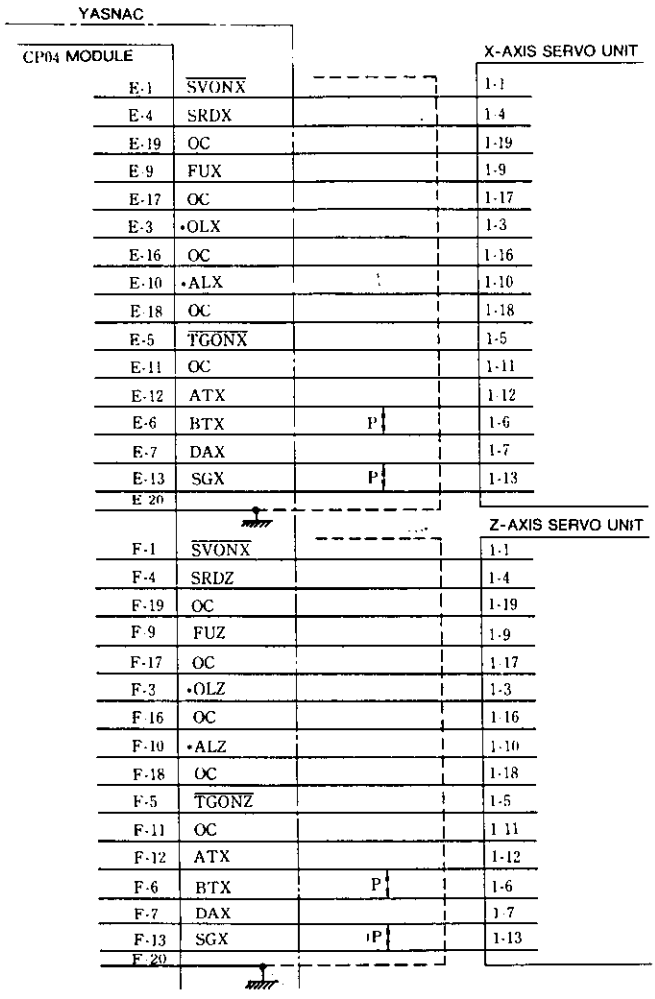


Fig. 4.3

4. 3 CONNECTION BETWEEN SERVO CPU MODULE AND X AND Z AXES SERO UNITS

The connection between the servo CPU module (CP04) and the X and Z axes servo units is as shown in the following diagram.

Connection of CP04 with X-And Z-axis Servo Units



•Asterisked signals activate at LOW. (Normally closed contacts.)

Fig. 4. 4

4. 4 CONNECTIONS BETWEEN SERVO RELATED UNITS

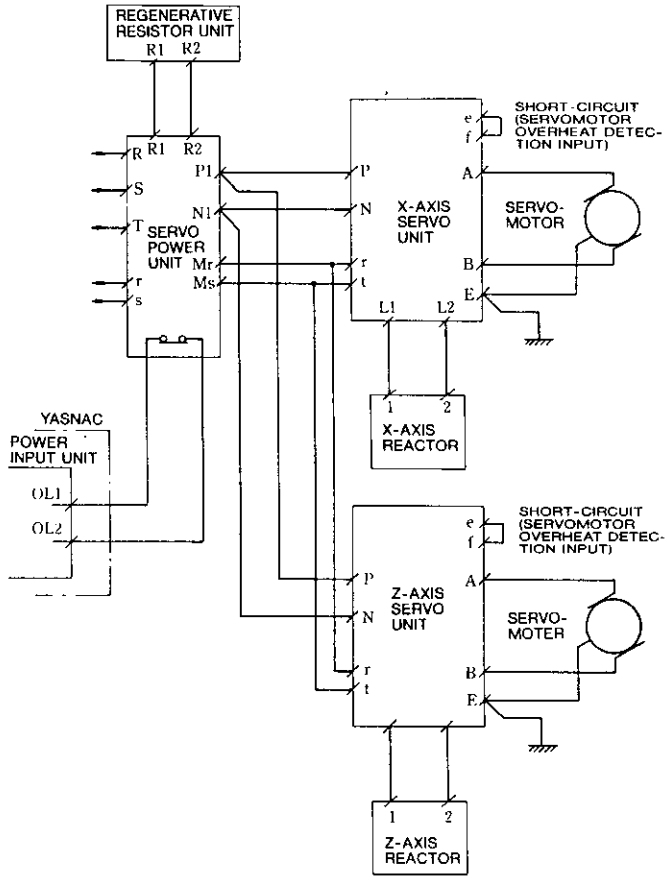


Fig. 4. 5

Note : For the mounting direction, flow rate of forced cooling air, and the maximum permissible temperature rise in the X- and Z-axis servo unit as well as the handling of the component units, refer to "Operation Manual for Servopack Type CPCR-MR . K for YASNAC Control (TOE-C717-13)."

5. CONNECTION OF SERVOMOTORS

The connection of the X-axis and Z-axis servomotors is shown below. This connection is applicable only where the servo units for the X- and Z-axis are incorporated in the NC unit.

(1) CONNECTIONS BETWEEN X-AXIS SERVOMOTOR AND YASNAC LX2

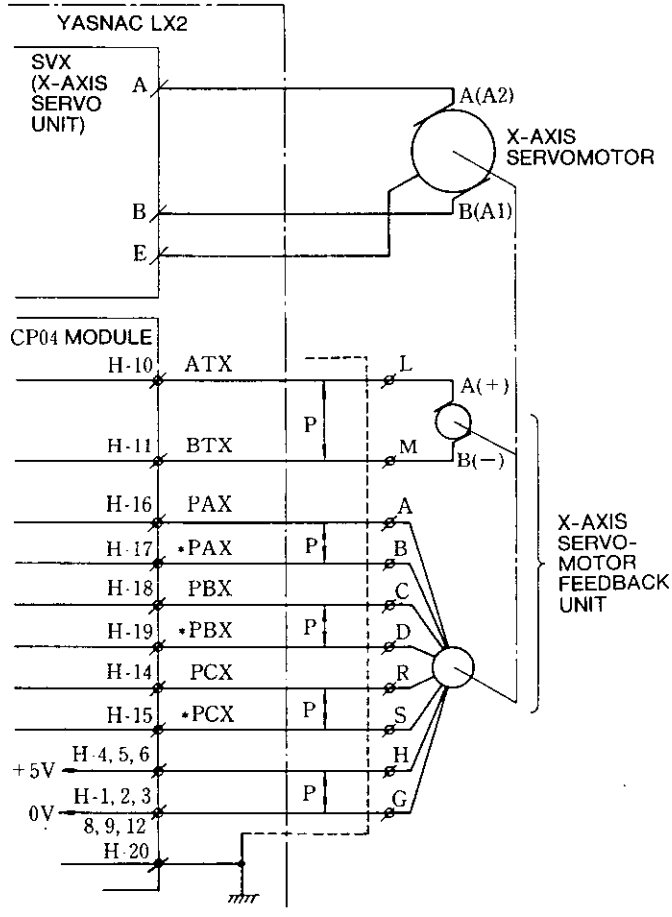


Fig. 5. 1

*Asterisked signals activate at LOW. (Normally closed contacts.)

(2) CONNECTIONS BETWEEN Z-AXIS SERVOMOTOR AND YASNAC LX2

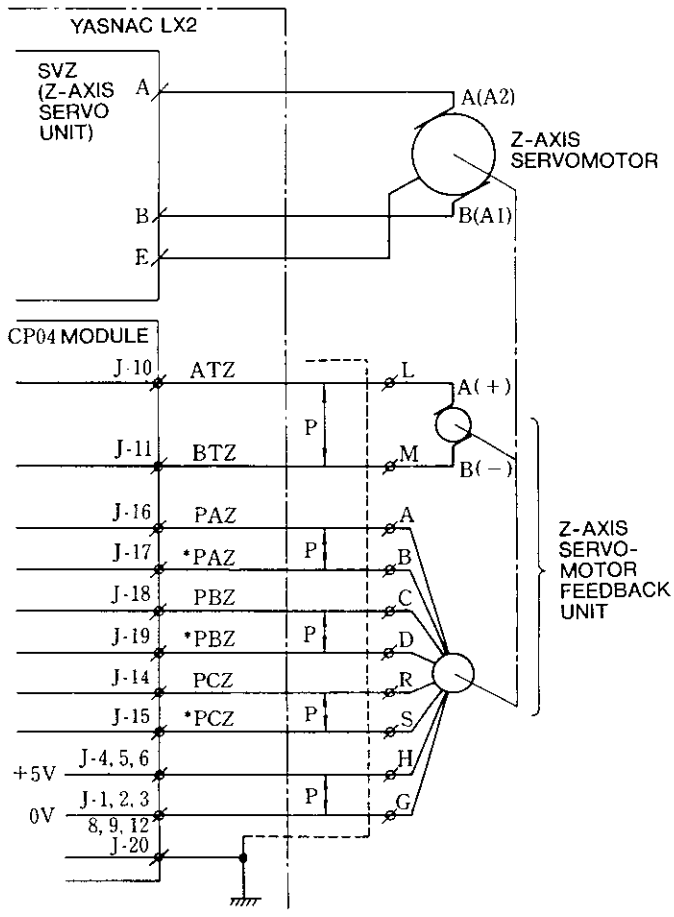


Fig. 5. 2

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 SVX/Z B of SVX/Z	B (A 1) of Servomotor A (A 2) of Servomotor
10 of CP 04, H/J	M of feedback unit
11 of CP 04, H/J	L of feedback unit
16 of CP 04, H/J	C of feedback unit
17 of CP 04, H/J	D of feedback unit
18 of CP 04, H/J	A of feedback unit
19 of CP 04, H/J	B of feedback unit

3. Where the servo units are installed outside the NC unit, the wiring is identical, except that SVX and SVZ are located outside the NC unit. Refer to Para. "4. CONNECTION WITH EXTERNAL SERVO CONTROL UNIT."

6. CONNECTIONS TO EXTERNAL NC OPERATOR'S STATION WITH 9" CRT

The connection between a YASNAC LX2 and an external NC operator's station with 9" CRT is shown below.

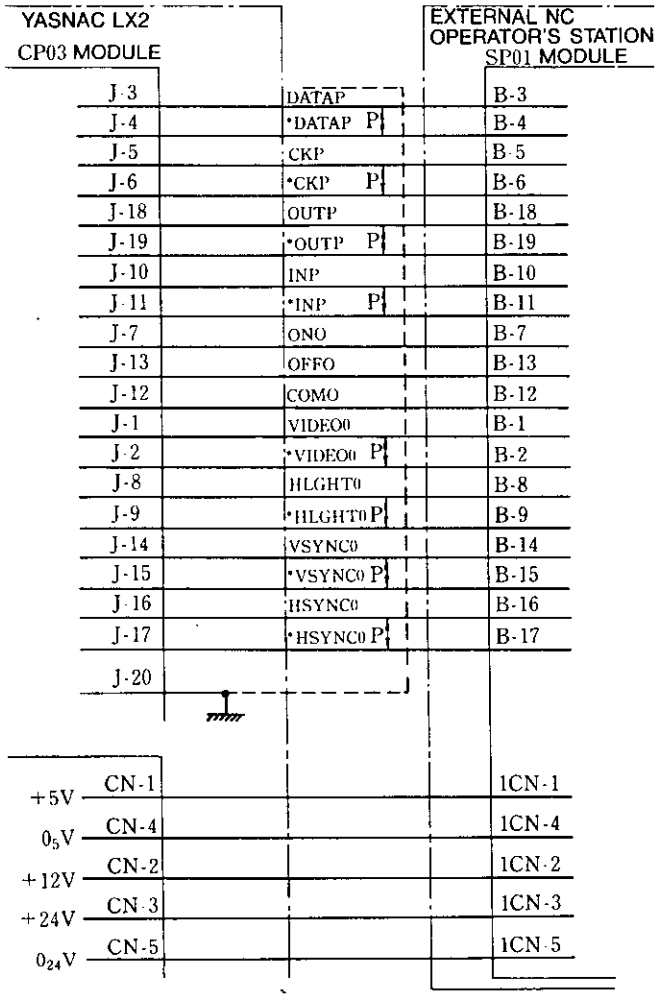


Fig. 6.1

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 Par. "2. CABLES AND CABLE CLAMPS."
3. Ground an external installation type control panel at the grounding base. (No special wire size is specified.)

*Asterisked signals actives at LOW. (Normally closed contacts.)

7. CONNECTIONS TO EXTERNAL NC OPERATOR'S STATION WITH 14" CRT

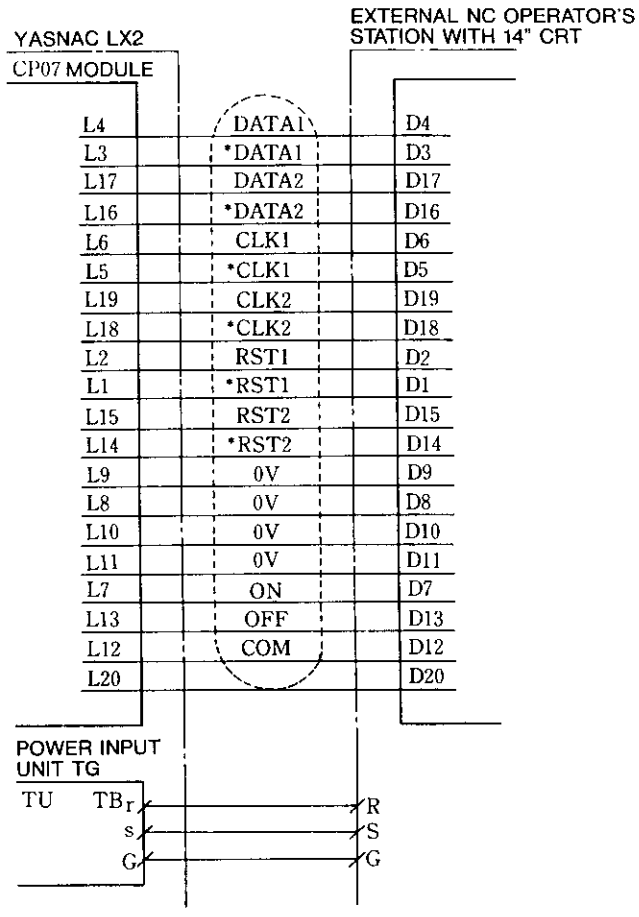


Fig. 7.1

8. CONNECTION WITH EXTERNAL TAPE READER UNIT

The connection between a YASNAC LX2 and an external tape recorder unit is as shown in the following diagram.

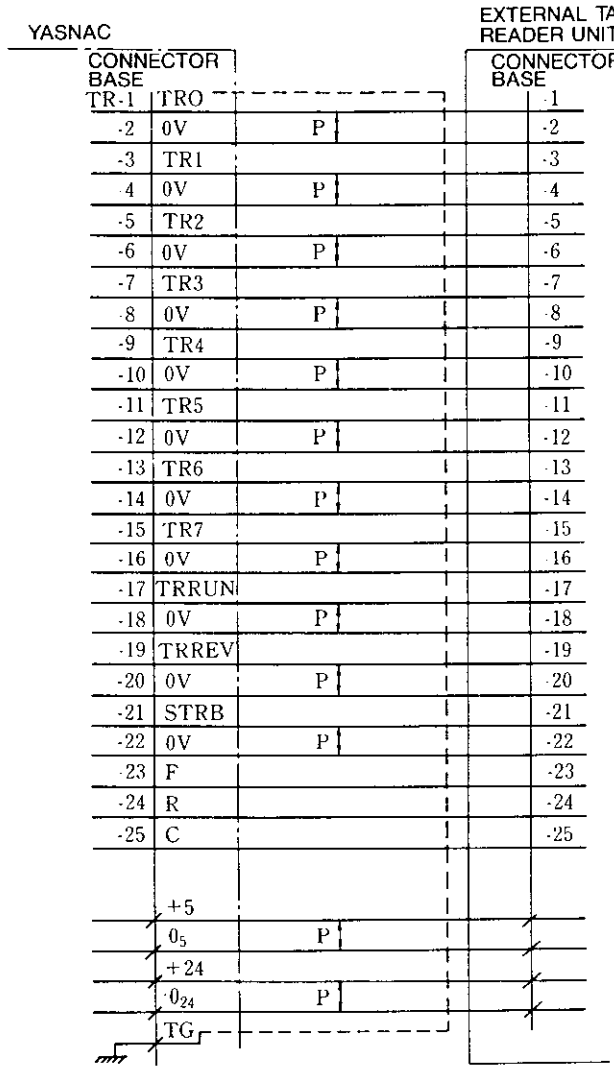


Fig. 8.1

Note :

1. Be sure not to use cables longer than 1.2 m.
2. For the type of the cable to the used, refer to Par. "2. CABLES AND CABLE CLAMPS."
3. For grounding an externally installed type tape reader, connect the grounding cable to its ground base.

9. CONNECTIONS OF YASNAC WITH MANUAL PULSE GENERATOR

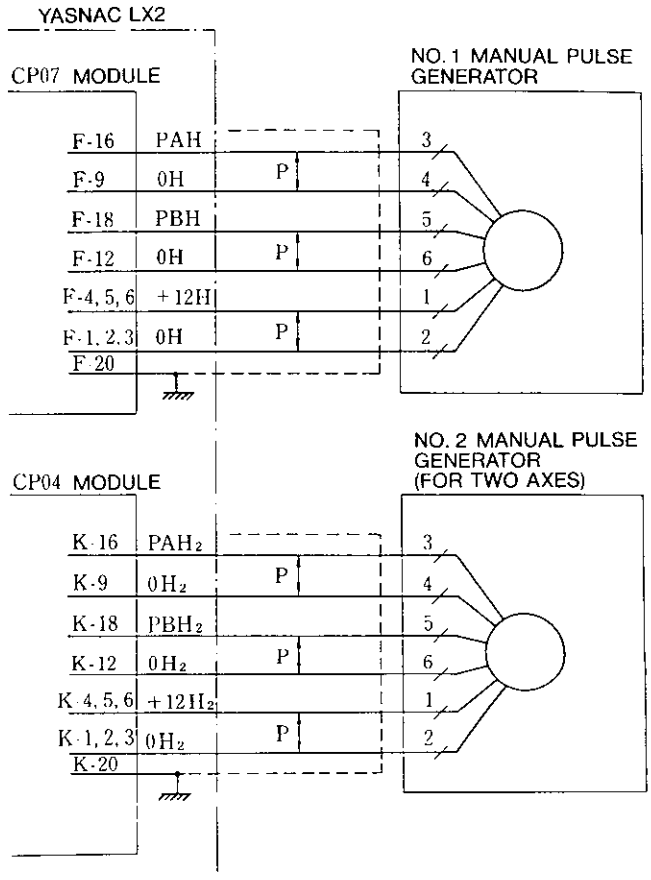


Fig. 9.1

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 Para. "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.)

*Asterisked signals activate at LOW. (Normally closed contacts.)

10. CONNECTIONS OF YASNAC WITH SPINDLE PULSE GENERATOR

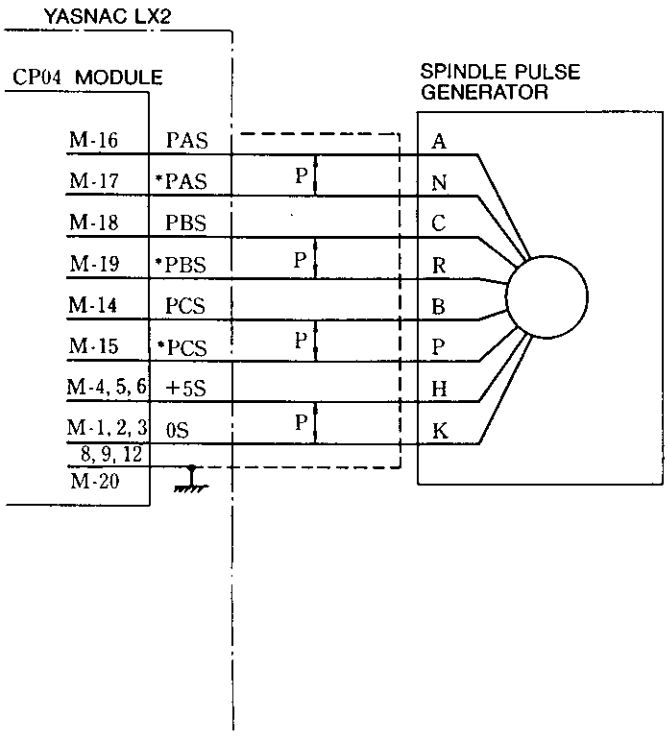


Fig. 10. 1

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 Par. "2. CABLES AND CABLE CLAMPS."

11. CONNECTIONS TO S4-DIGIT SPINDLE COMMAND

Connections of 12-bit non-contact output or analog output to YASNAC LX2.

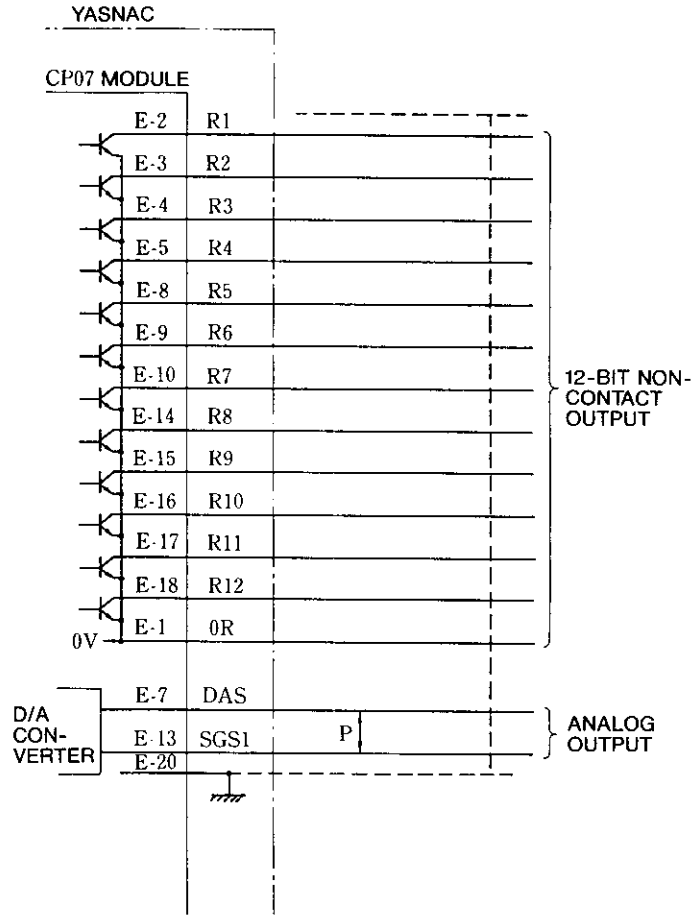


Fig. 11. 1

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 Par. "2. CABLES AND CABLE CLAMPS.
3. For its operation, refer to "14. 4. 35 S4-Digit Command."
4. When using the 12-bit contactless output lines, limit each bit to 70 mA max., and analog output to 5 mA max.

12. 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 12.1

Interface	① FACIT 4070	② Current Loop	③ RS 232C
Type	Parallel voltage interface	Serial voltage (20 mA) interface	Serial voltage interface
Baud Rate	(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 max	50 m max	15 m
Connector* Type	MR-20MR (MR-20F)		DB-25S (DB-25P)

*Type names of connectors provided with the control unit. Type names in parenthsis are the connectors to be plugged-in.

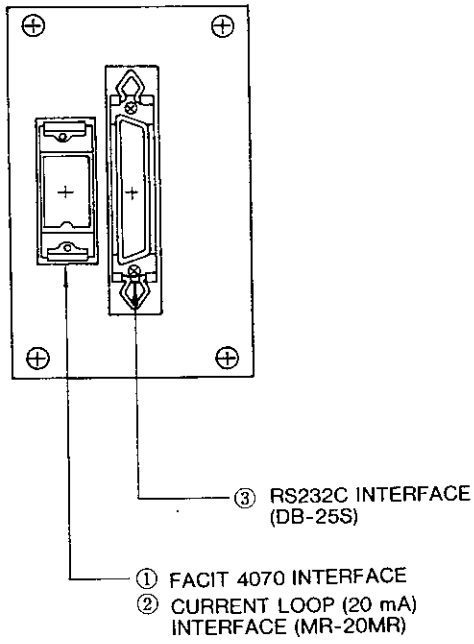


Fig. 12.1 Data Input/Output Interface

(2) SELECTION OF INTERFACES

Select the interface to be used with setting numbers.

· Selection of input interface

Input Interface to be used	#6003 D1 IDVCE1	#6003 D0 IDVCE0
PTR Interface*	0	0
RS 232 C Interface	0	1
RS 422 Interface	1	0

*Interface for tape reader unit (optional) only.

· Selection of output interface

Output Interface to be Used	#6003 D5 ODVCE1	#6003 D4 ODVCE0
FACIT 4070 Interface	0	0
Current Loop Interface, RS 232 C Interface	0	1
RS 422 Interface	1	0

12.1 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 12. 2 FACIT 4070 Interface Connecting Cable

NC (MR-20 F)			Connections	External Equipment (DB-25 P)	
Symbol	Signal Neme	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 INSTRUC-TION	20	○—○	11	PI

Note

Note : The pin numbers are applicable when equipment is FACIT 4070 and plugged-in connector is DB-25 P.

b. Description of signals

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

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

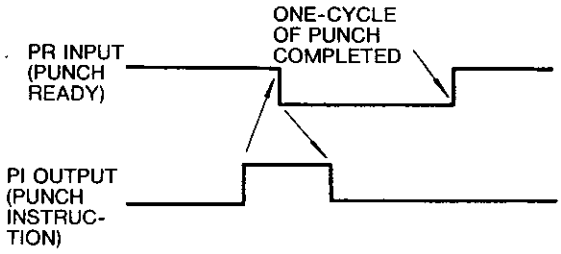


Fig. 12. 2

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

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

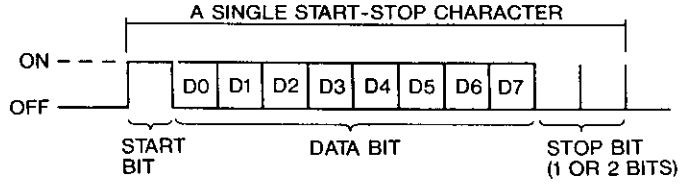
+6 V: FACIT/ASR automatic recognition (input) — When +6 V signals are inputted, and FACIT 4070 interface is opened, the current loop interface mode is entered.

CH1 to 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.

12. 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).

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

12. 2 CURRENT LOOP (20 mA) INTERFACE (Cont'd)

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 12. 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

· The interconnection is as shown below.

Table 12. 4 Current Loop (20 mA) Interface Connection Cable

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

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

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 current loops (and RS232C), set the data transmission Baud rate, stop bit length and the control code output designation with the following parameters.

· Baud rate setting — Setting of 110 Bauds

Table 12. 5

Input		#6026D3	#6026D2	#6026D1	#6026D0
Output		#6028D3	#6028D2	#6028D1	#6028D0
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

· Setting of step bit length

#6026 D4 for input 1: Sets stop bit at two bits.
#6028 D4 for output 0: Sets stop bit at one bit.

· Setting of control code sending

#6026 D5 for input 1: Does not send control code.
#6028 D5 for output 0: Sends control code.

12. 3 RS232C INTERFACE

(1) TRANSMISSION MODE

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

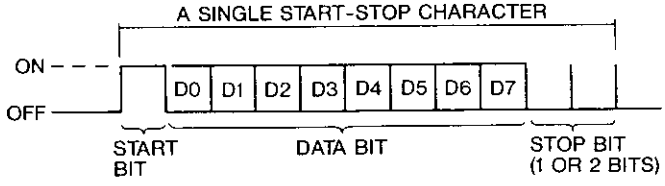


Table 12. 6

	V0 < −3V	V0 > +3V
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).

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

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

Table 12.7

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 9600 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

Table 12.8 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	Receiving data	3			RD
RS	Sending data	4			RS
CS	Capable of sending	5			CS
	Not used	6			DR
SG	Signal grounding	7			SG
		8			$\overline{\text{IO BUSY}}$
	Not used	25			ER

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.

When CS signals of the NC are not used, short CS and RS as shown Table 12.9.

Table 12.9 RS232C Interface Connecting Cable (B)

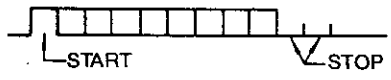
NC (DB-25P)			Connections	External Equipment	
Symbol	Signal Name	Pin No.		Pin No.	Symbol
FG	Frame grounding	1			FG
SD	Sending data	2			SD
RD	Receiving data	3			RD
RS	Sending data	4			RS
CS	Capable of sending	5			CS
	Not used	6			DR
SG	Signal grounding	7			SG
		8			
	Not used	25			$\overline{\text{ER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

b. Description of signals

FG: Safety grounding

SD: Transmission data (output)

RD: Received data (input)



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

CS: For sending (input) — When this input signal is on, NC can send data. If the machine under control is unable to process data in time, it can turn off this signal to interrupt the transmission of data from NC within 2 characters. When this signal is not used, connect lines as shown in Table 12.9.

SG: Signal grounding.

ER: Data terminal ready — Not used by NC.

12.3 RS232C INTERFACE (Cont'd)

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

· 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.

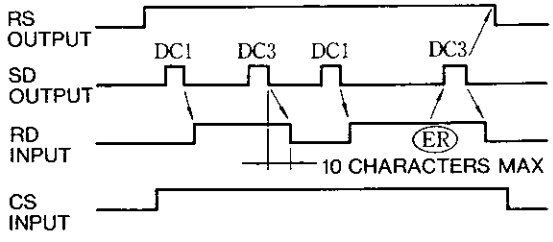


Fig. 12.3

· 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 $\overline{\text{IO BUSY}}$ 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 DC4.

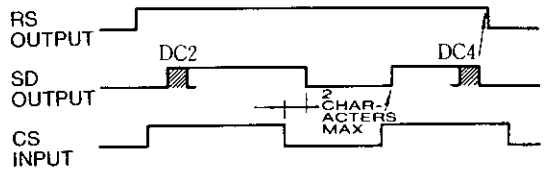


Fig. 12.4

(7) PARAMETER SETTING

When using RS232C (and current loop), set data transmission Baud rates, stop bit lengths, and control code sending specifications with the parameters shown below.

· Baud rate setting

Table 12.10

Input		#6026 D3	#6026 D2	#6026 D1	#6026 D0
Output		#6028 D3	#6028 D2	#6028 D1	#6028 D0
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

· Stop bit length setting

#6026 D4 for input 1: Sets stop bit at two bits.
#6028 D4 for output 0: Sets stop bit at one bit.

· Setting of control code sending

#6026 D5 for input 1: Does not send control code.
#6028 D5 for output 0: Sends control code.

13. CONNECTION WITH POWER INPUT UNITS

13.1 LIST OF CONNECTION SIGNALS

Table 13.1

Signal Symbol	Signal Name	Contact Ratings
PO 1 PO 2	NC power on output	230 VAC, 50 VDC MAX 500 mA MAX
SO 1 SO 2	Servo power on output	
DS 1 or DSA DS 2 or DSD	Door switch output	
$\overline{EL\,1}$ EL 2	Machine end input	30 V MAX 100 mA MAX
$\overline{ES\,1}$ ES 2	Emergency stop input	
EON EOF ECM	External power ON/OFF input	
$\overline{OL\,1}$ OL 2	Overload input	

The switching units are provided with terminals r, s, G, in addition to the above, with the respective functions as shown below.

- r, s, G: Control input power terminals. For their connection, refer to "4. CONNECTIONS OF POWER SUPPLY."
- r1, s1, r2, s2, r3, s3: Wiring terminals for integrated power supply units for NC. They are wired at the factory, and reconnection and additional wiring are strictly to be avoided.

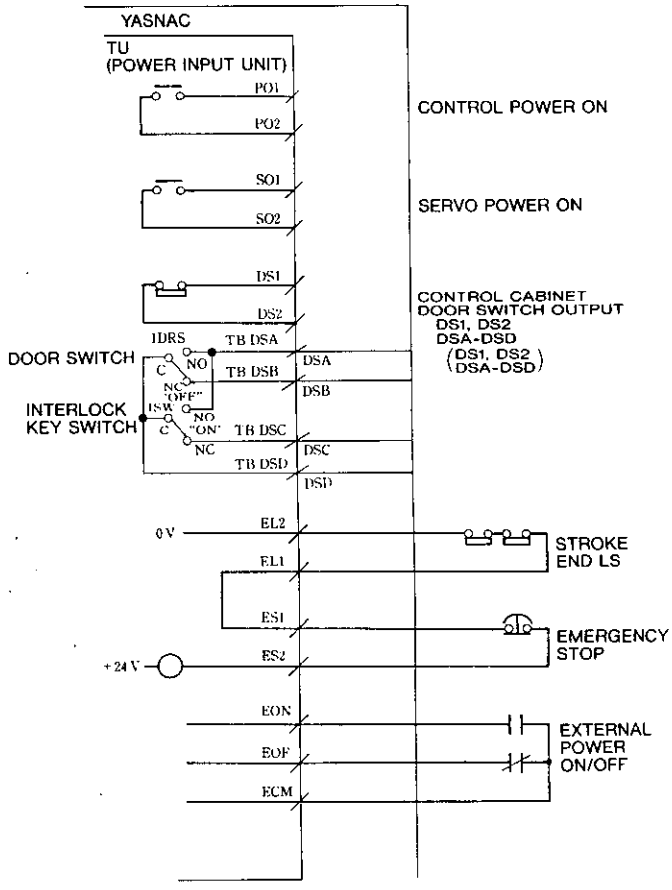


Fig. 13.1

13.2 DETAILS OF SIGNALS

13.2.1 NC POWER ON (PO 1-2) AND SERVO POWER ON (SO 1-2)

(1) PO 1 - 2: This output is turned off when the logic circuit of the control is energized.

(2) SO 1 - 2: 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 PO1 and PO2 (NC power input and output) is closed.

> With an external servo unit, design the servo control circuit power input sequence so that the circuit is energized at the output of PO1 and 2 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 SO1 and SO2 (servo power input and 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 SO 1 and 2 signals.

d. When the external circuit is ready after the circuit between SO 1 and SO 2 is closed, and the control becomes ready, close the MRD (machine ready) input of the I/O module. Then, RDY is displayed on the CRT, and operation becomes possible.

13. 2. 1 NC POWER ON (PO 1-2) AND SERVO POWER ON (SO 1-2)

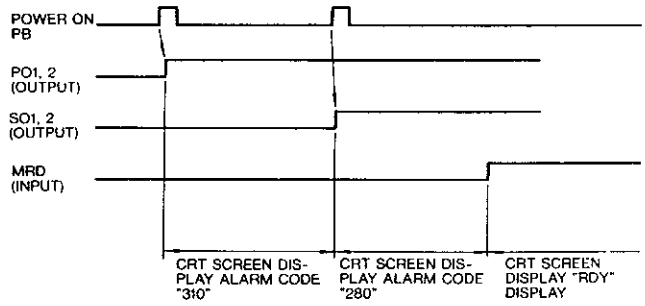


Fig. 13. 2 Time Chart of Power Supply Turning On Sequence

13. 2. 2 DOOR SWITCH (DS 1-2) OUTPUT

(1) DS1-2 Output (Free-standing type and attached type 2)

Door switch output indicates that the control unit door is open. With this output, the circuit between DS1 and 2 is closed, while the door is open.

(2) DSA-D Output (Attached type and unbundle type)

This output indicates the control unit door is open.

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

13. 2. 3 EMERGENCY STOP ($\overline{ES}$ 1-$\bar{2}$) AND MACHINE END ($\overline{EL}$ 1-$\bar{2}$) INPUT

When the circuit between emergency stop input terminals ES1 and ES2 is open or between machine end input terminals EL1 and EL2 is open, the control stops totally, the servo power supply is turned off, and the emergency stop output (*ESPS) of general purpose I/O module is opened.

13. 2. 4 EXTERNAL POWER ON-OFF (EON, EOF, ECM) 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 ECM is closed, the logic circuit or servo power of the control is energized. When the circuit between EOF and ECM is opened, the logic circuit or servo power of the control is deenergized.

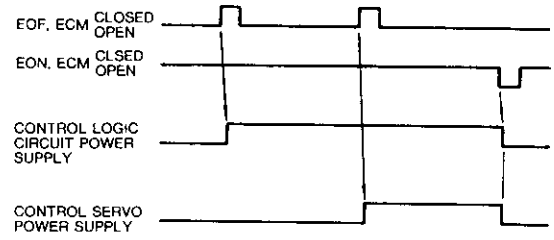


Fig. 13. 3

13. 2. 5 OVERLOAD ($\overline{OL1}$ AND $\bar{2}$) 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.

(Power input unit)		(Servo power unit)
$\overline{OL1}$	⟷	JUSP-DCP-C1
$\overline{OL2}$	⟷	JUSP-DCP-C3

When the circuit between $\overline{OL1}$ and $\overline{OL2}$ is opened, the control turns off the servo unit power supply, opens the circuit between servo power I/O SO1 and SO2, and enters an alarm state. (Alarm code 357 is displayed.)

14. CONNECTION TO GENERAL PURPOSE I/O MODULE

14.1 RATING OF CONTACTS

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

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

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

(Example)
24 V and 200 mA or less current

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

14.2 LIST OF CONNECTION SIGNALS (EXCEPT FOR UNBUNDLED TYPE)

Listed below are the connection signals to I/O modules.

Table 14.2.1

Par. No.	Symbol	Signal Name	I/O Module Connector Pin No.
14.4.1	ST	Cycle start input	IO 01-1. 02-19
	*SP	Feed hold input	IO 01-1. 02-7
	STL	Cycle start output	IO 01-1. 12-2
	SPL	Temporary stop output	IO 01-1. 12-8
14.4.2		(Operation mode input/output)	
	JOG	Jog mode input	IO 01-1. 01-8
	H/S	Handle/step input	IO 01-1. 01-15
	T	Tape input	IO 01-1. 01-9
	MDI	Manual data input operation	IO 01-1. 01-16
	MEM	Memory input	IO 01-1. 01-4
	EDT	Edit input	IO 01-1. 01-10
	AUT	Automatic operation mode input	IO 01-1.10-6
	MAN	Manual operation mode output	IO 01-1. 10-12
	EDTS	Edit operation output	IO 01-1. 10-7
14.4.3	RPD	Rapid traverse selection input	IO 01-1. 01-2
14.4.4	HX	Manual handle X-axis input	IO 01-1. 02-9
	HZ	Manual handle Z-axis input	IO 01-1. 02-16
	HOFS	Automatic handle off-set	IO 01-1. 06-3
14.4.5	+X	Manual feed axis direction selector input	IO 01-1. 02-2
	−X		IO 01-1. 02-8
	+Z		IO 01-1. 02-15
	−Z		IO 01-1. 02-3
14.4.6	MP 1	Handle/step multiplication factor input	IO 01-1. 01-7
	MP 2		IO 01-1. 01-13
	MP 4		IO 01-1. 01-20
14.4.7	FV 1	Feedrate override/ manual jog feedrate selection input	IO 01-1. 01-17
	FV 2		IO 01-1. 01-5
	FV 4		IO 01-1. 01-11
	FV 8		IO 01-1. 01-18
	FV 16		IO 01-1. 01-6
	0VC	Feedrate override cancel input	IO 01-1. 06-2

*Asterisked signals activate at LOW.
(Normally closed contacts.)

14. 2 LIST OF CONNECTION SIGNALS (Cont'd)

Table 14. 2. 1 (Cont'd)

Par. No.	Symbol	Signal Name	I/O Module Connector Pin No.
14. 4. 8	ROV1 ROV2	Rapid feedrate override input	IO 01-1. 01-12 IO 01-1. 01-19
14. 4. 9	ZRN	Manual reference point return input	IO 01-1. 03-3
	*DCX *DCZ	Reference point return deceleration input	IO 01-1. 03-13 IO 01-1. 03-20
	ZPX ZPZ	Reference point output	IO 01-1. 12-16 IO 01-1. 12-4
	2 ZPX 2 ZPZ	Second reference point output	IO 01-1. 12-10 IO 01-1. 12-17
14. 4. 10	ABS	Manual absolute on/off input	IO 01-1. 02-18
14. 4. 11	SBK	Single block input	IO 01-1. 02-4
14. 4. 12	BDT BDT 2 to BDT 9	Optional block skip input	IO 01-1. 02-5 IO 01-1. 05-2, 8, 15, 3, 9, 16, 4 IO 01-1. 05-10
14. 4. 13	MLK DLK	Machine lock input Display lock input	IO 01-1. 02-10 IO 01-1. 02-17
14. 4. 14	DRN	Dry run input	IO 01-1. 02-11
14. 4. 15	PST	Current value storing input	IO 01-1. 02-13
14. 4. 16	PRST	Program restart input	IO 01-1. 06. -8
14. 4. 17	INHEDT	Edit lock input	IO 01-1. 02-12
14. 4. 18	AFL	Aux function lock input	IO 01-1. 02-6
14. 4. 19	SRN	Set up point return input	IO 01-1. 02-20
14. 4. 20	OPRN	Restart after manual interruption	IO 01-1. 06-9
14. 4. 21	*+LX *−LX *+LZ *−LZ	Overtravel input	IO 01-1. 03-6 IO 01-1. 03-12 IO 01-1. 03-19 IO 01-1. 03-7
14. 4. 22	MRD	Machine ready input	IO 01-1. 03-9
14. 4. 23	*ESPS	Emergency stop output	IO 01-1. 09-3
14. 4. 24	ERS RST 1. 2	External reset input Reset output	IO 01-1. 03-4 IO 01-1. 09-15
14. 4. 25	STLK	Interlock input	IO 01-1. 03-5
14. 4. 26	ALM IER ERR 0 ERR 1	Alarm output Input error output External error detection output	IO 01-1. 09-2 IO 01-1. 09-4 IO 01-1. 03-11 IO 01-1. 03-18
14. 4. 27	CDZ	Rapid threading pull-out input	IO 01-1. 03-15
	SMZ	Error detect on input	IO 01-1. 03-8
14. 4. 28	MIX	X-axis mirror image input	IO 01-1. 06-15
14. 4. 29	M 11	M code output	IO 01-1. 08-2
	M 12		IO 01-1. 08-8
	M 14		IO 01-1. 08-15
	M 18		IO 01-1. 08-3
	M 21		IO 01-1. 08-9
	M 22		IO 01-1. 08-16
	M 24		IO 01-1. 08-4
	M 28		IO 01-1. 08-10
	M 31		IO 01-1. 08-5
	M 32		IO 01-1. 08-11
	M 34		IO 01-1. 08-18
	M 38		IO 01-1. 08-6
	S 11	S code output	IO 01-1. 11-2
	S 12		IO 01-1. 11-8
	S 14		IO 01-1. 11-15
	S 18		IO 01-1. 11-3
	S 21		IO 01-1. 11-9
	S 22		IO 01-1. 11-16
	S 24		IO 01-1. 11-4
	S 28		IO 01-1. 11-10
	T 11	T code output	IO 01-1. 11-5
	T 12		IO 01-1. 11-11
	T 14		IO 01-1. 11-18
	T 18		IO 01-1. 11-6
	T 21		IO 01-1. 11-12
	T 22		IO 01-1. 11-19
	T 24		IO 01-1. 11-7
	T 28		IO 01-1. 11-13
	MF	M, S, T code reading output	IO 01-1. 10-8
	SF		IO 01-1. 10-15
	TF		IO 01-1. 10-3
	M 00 R	M code decoded output	IO 01-1. 08-12
	M 01 R		IO 01-1. 08-19
	M 02 R		IO 01-1. 08-7
	M 30 R		IO 01-1. 08-13
	FIN	M, S, T function completion input	IO 01-1. 03-16
14. 4. 30	DEN 1−2	Positioning completion output	IO 01-1. 10-16
14. 4. 31	OP 1−2	Travel on	IO 01-1. 10-4
	THC 1−2	Threadcutting output	IO 01-1. 10-18
14. 4. 32	EOP	End of program input	IO 01-1. 03-10
	RWD	Rewind input	IO 01-1. 03-17
	RWDS 1-2	Rewind output	IO 01-1. 10-5
14. 4. 33	DRSX DRSZ	Display reset input	IO 01-1. 04-12 IO 01-1. 04-19

Table 14. 2. 1 (Cont'd)

Par. No.	Symbol	Signal Name	I/O Module Connector Pin No.
14. 4. 34	EIN	External storing input	IO 01-1. 04-7
	EVER	External collaboration input	IO 01-1. 04-13
	EOUT	External output input	IO 01-1. 04-20
14. 4. 35		(S 4-digit command input/output)	
	R01 to R12	S 4-digit command 12 bits noncontact output	Refer to Par. "12. Connections to S4-digit Spindle Command"
	DAS, SGS1	S 4-digit command analog output	
	GR1	Spindle gear range input	IO 01-1. 04-15
	GR2		IO 01-1. 04-3
	GR3		IO 01-1. 04-9
	GR4		IO 01-1. 04-16
	SINV	S 4-digit analog output	IO 01-1. 04-4
	SINVA	S 4-digit analog output	IO 01-1. 10-2
14. 4. 36	SSTP	Spindle s command "0" input	IO 01-1. 04-10
	GRS	Gear shift indication input	IO 01-1. 04-5
	GSC	Spindle constant speed input	IO 01-1. 04-17
14. 4. 37	SAGR	Spindle speed reach input	IO 01-1. 04-8
14. 4. 38	SPA	Spindle speed override input	IO 01-1. 05-17
	SPB		IO 01-1. 05-5
	SPC		IO 01-1. 05-11
14. 4. 39	SMN	S 4-digit analog output auto and manual selection input/output	IO 01-1. 04-18
	SAT		IO 01-1. 04-6
	MNS		CP 03. E-12
	SG2		CP 03. E-19
	COMS		CP 03. E-6
	SGS1		CP 03. E-1
14. 4. 40	RO1 to RO12	S 4-digit command external output	IO 01-2. 08-2, 8, 15, 3, 9, 16, 4, 10, 5, 11, 18, 6, 12, 19, 7, 13
	SDO0 to SDO15		
	RI1 to RO12	S 4-digit command external input	IO 01-2. 04-15, 3, 9, 16, 4, 10, 17, 5, 11, 18, 6, 12, 19, 7, 13, 20
	SDI0 to SDI15		

Par. No.	Symbol	Signal Name	I/O Module Connector Pin No.
14. 4. 41	WN1	External work No. search input	IO 01-1. 05-18
	WN2		IO 01-1. 05-6
	WN4		IO 01-1. 05-12
	WN8		IO 01-1. 05-19
	WN16		IO 01-1. 05-7
14. 4. 42	EXTC	Time count input	IO 01-1. 04-11
14. 4. 43		(External tool offset input/output)	
	OF11	Offset memory changed amount input	IO 01-2. 03-9
	OF12		IO 01-2. 03-16
	OF14		IO 01-2. 03-4
	OF18		IO 01-2. 03-10
	OF21		IO 01-2. 03-17
	OF22		IO 01-2. 03-5
	OF24		IO 01-2. 03-11
	OF28		IO 01-2. 03-18
	OF31		IO 01-2. 03-6
	OF32		IO 01-2. 03-12
	OF34		IO 01-2. 03-19
	OF38		IO 01-2. 03-7
	OFSN	Offset amount sign input	IO 01-2. 03-13
	DIX	Offset amount sign input ×10 input	IO 01-2. 03-20
	DERR	Data error input	IO 01-2. 03-15
	DEND	Data set completion input	IO 01-2. 03-3
	XSTB	X-axis offset amount set output	IO 01-2. 10-8
	ZSTB	Z-axis offset amount set output	IO 01-2. 10-15
	REND	Change completion output	IO 01-2. 10-3
14. 4. 44		(Spindle index input/output)	
	SID1	Spindle index position designation input	IO 01-2. 01-2
	SID2		IO 01-2. 01-8
	SID3		IO 01-2. 01-15
	SID4		IO 01-2. 01-3
	SID5		IO 01-2. 01-9
	SID6		IO 01-2. 01-16
	SID7		IO 01-2. 01-4
	SID8		IO 01-2. 01-10
	SID9		IO 01-2. 01-17
	SID10		IO 01-2. 01-5
	SID11		IO 01-2. 01-11
	SID12		IO 01-2. 02-18
	SIDXINC	Incremental input	IO 01-2. 02-2
	SIDX	Index request input	IO 01-2. 01-13

14. 2 LIST OF CONNECTION SIGNALS (Cont'd)

Table 14. 2. 1 (Cont'd)

Par. No.	Symbol	Signal Name	I/O Module Connector Pin No.
14. 4. 44 (Cont'd)	SIDXI	Restart input	IO 01-2. 02-8
	SIDXA	Index completion output	IO 01-2. 10-16
	SIDXO	Index output	IO 01-2. 10-5
14. 4. 45	TP 1	Stored stroke limit 3 for each tool	IO 01-2. 01-6
	TP 2		IO 01-2. 01-12
	TP 4		IO 01-2. 01-19
	TP 8		IO 01-2. 01-7
	TPS	Tool No. input	IO 01-2. 01-20
	TPSA	Area change completion output	IO 01-2. 10-4, 10
14. 4. 46	UI 0	User macro system variables input	IO 01-2. 05-2, 8, 15, 3, 9, 16, 4, 10, 17, 5, 11, 18, 6, 12, 19, 7
	to		
	UI 15		
	UO 0	User system variables output	IO 01-2. 11-2, 8, 15, 3, 9, 16, 4, 10, 5, 11, 18, 6, 12, 19, 7, 13
	to		
	UO 15		
14. 4. 47		(External data input/output)	
	ED 0	Data input	IO 01-2. 06-2, 8, 15, 3, 9, 16, 4, 10, 17, 5, 11, 18, 6, 12, 19, 7
	to		
	ED 15		
	EDSA	Data designation input	IO 01-2. 07-2
	EDSB		IO 01-2. 07-8
	EDSC		IO 01-2. 07-15
	EDSD		IO 01-2. 07-3
	EDAS 0	Axis designation incremental/ absolute designation	IO 01-2. 07-9
	EDAS 1		IO 01-2. 07-16
	EDAS 2		IO 01-2. 07-4
	EDCL	Data input request	IO 01-2. 07-10
	EREND	External data input completion output	IO 01-2. 10-7
	ESEND	External data search completion	IO 01-2. 10-13
14. 4. 48		(Tool life control input/output)	
	TLA 11	Tool change completion group No. input	IO 01-2. 02-4
	TLA 12		IO 01-2. 02-10
	TLA 14		IO 01-2. 02-17
	TLA 18		IO 01-2. 02-5
	TLA 21		IO 01-2. 02-11
	TLTM	Tool operation time input	IO 01-2. 02-16
	TLSKP	Tool skip input	IO 01-2. 02-3
	TLRST	Tool change completion input	IO 01-2. 02-15
	TLCH1-2	Tool change request output	IO 01-2. 10-18, 19

Table 14. 2. 1 (Cont'd)

Par. No.	Symbol	Signal Name	I/O Module Connector Pin No.
14. 4. 49	SKIP	Skip input	IO 01-1. 07-2
14. 4. 50	XAE	Tool set error compensation input	IO 01-1. 07-15
	ZAE		IO 01-1. 07-3
14. 4. 51	PINT	Program interruption input	IO 01-1. 07-8
14. 4. 52	COV 1	Multiple canned cycle cut depth override input	IO 01-1. 06-17
	COV 2		IO 01-1. 06-5
	COV 4		IO 01-1. 06-11
	COV 8		IO 01-1. 06-18
	COV 16		IO 01-1. 06-6
14. 4. 53	WOP	Tool wear compensation input	IO 01-1. 06-4
	WOM		IO 01-1. 06-10

14. 3 CONNECTIONS BETWEEN UNITS (EXCEPT FOR UNBUNDLED TYPE)

The diagrams of unit connections for unbundle type should be requested to the company.

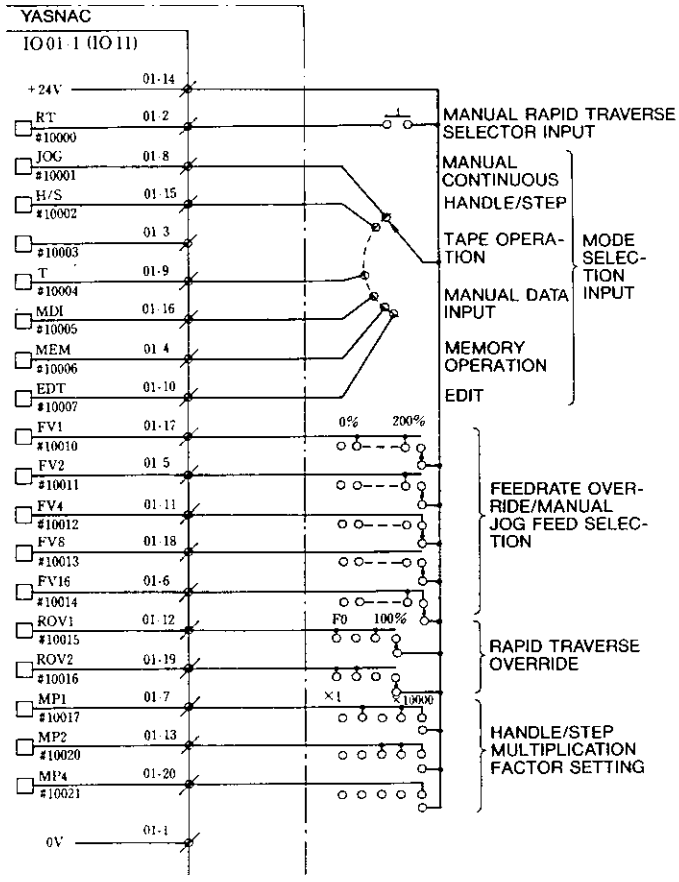


Fig. 14. 1

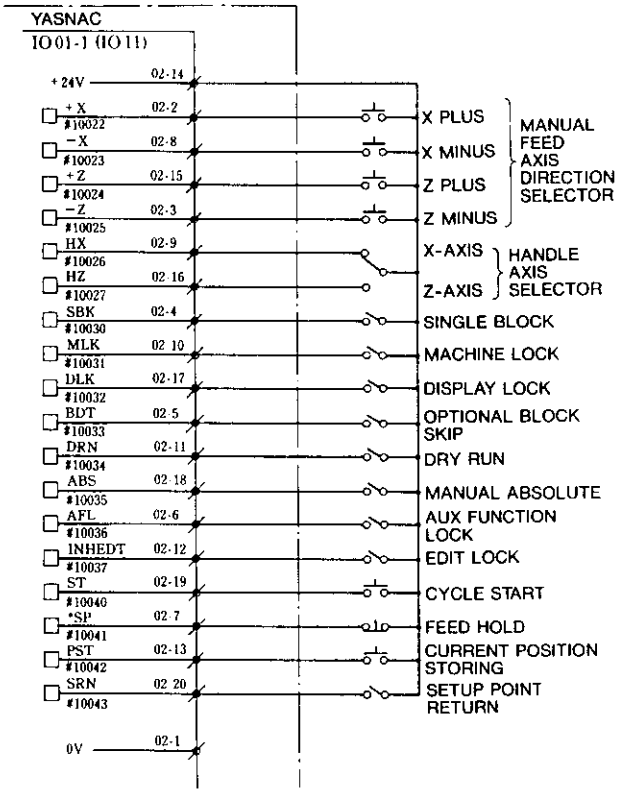


Fig. 14. 2

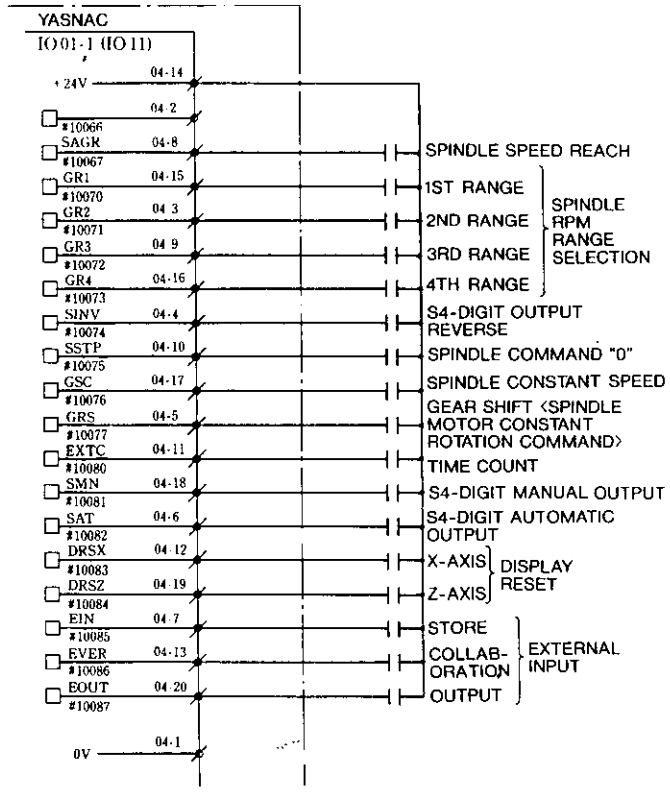


Fig. 14. 4

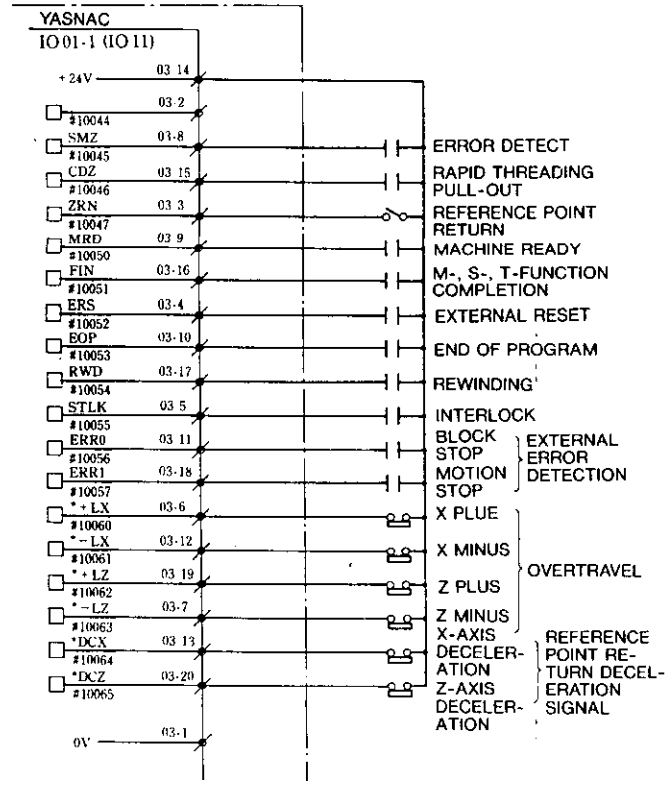


Fig. 14. 3

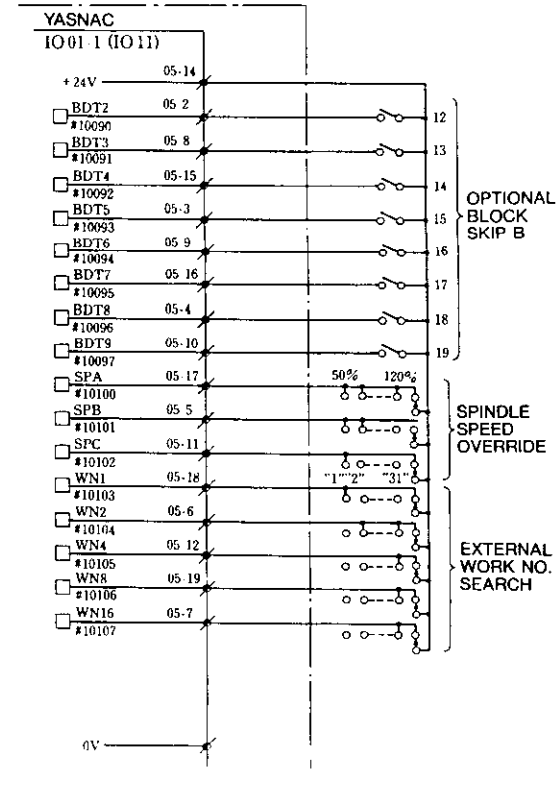


Fig. 14. 5

*Asterisked signals activate at LOW.
(Normally closed contacts.)

14. 3 CONNECTIONS BETWEEN UNITS (Cont'd)

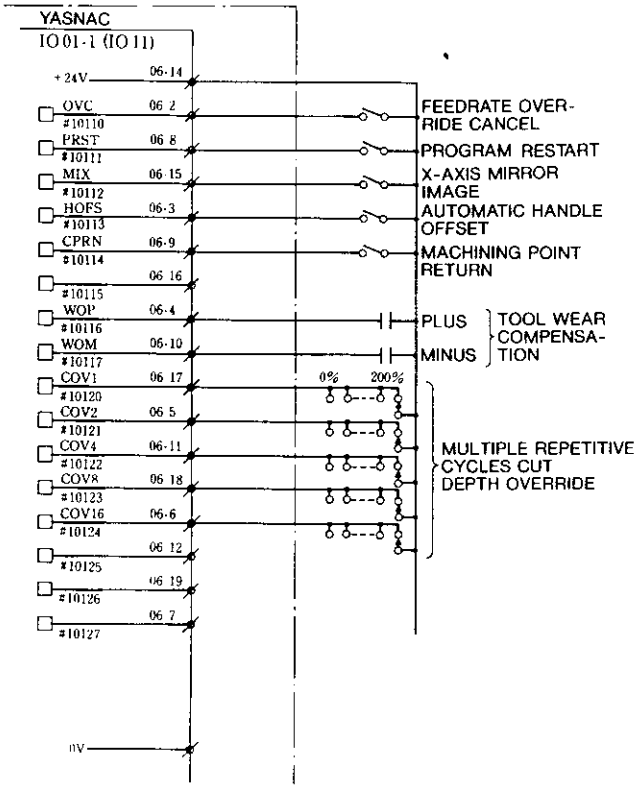


Fig. 14. 6

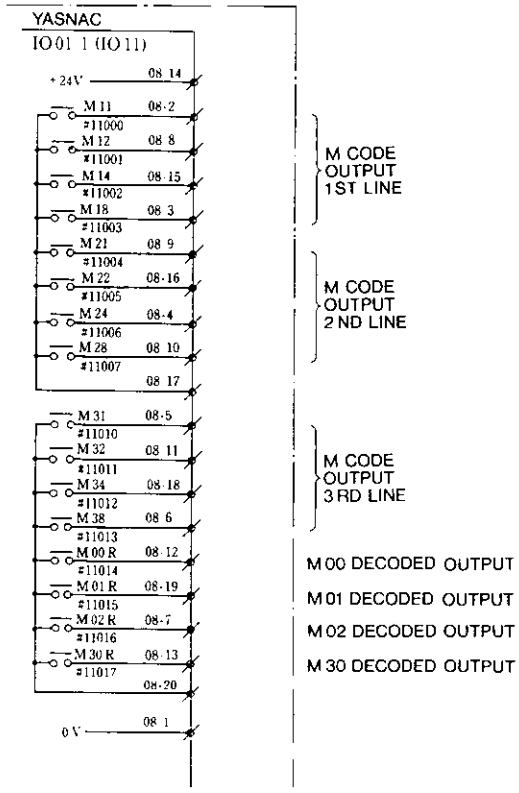


Fig. 14. 8

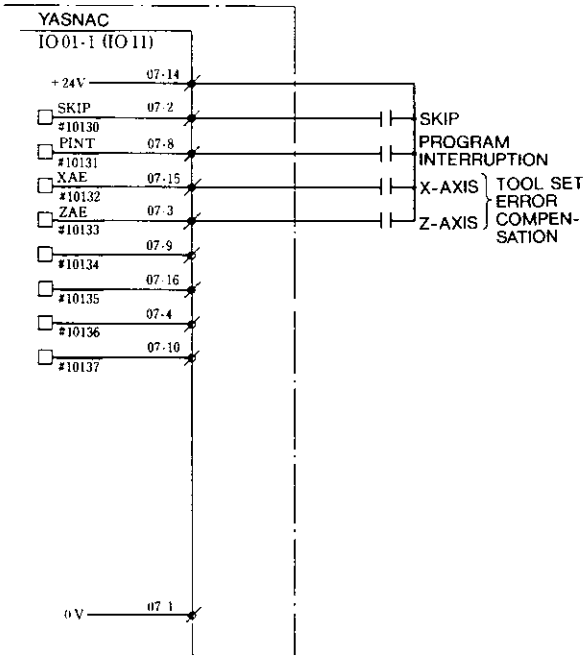


Fig. 14. 7

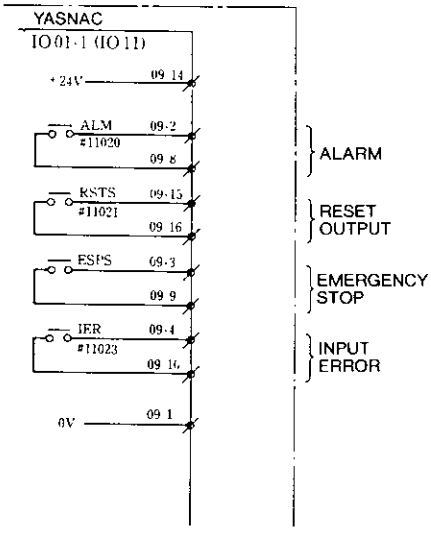


Fig. 14. 9

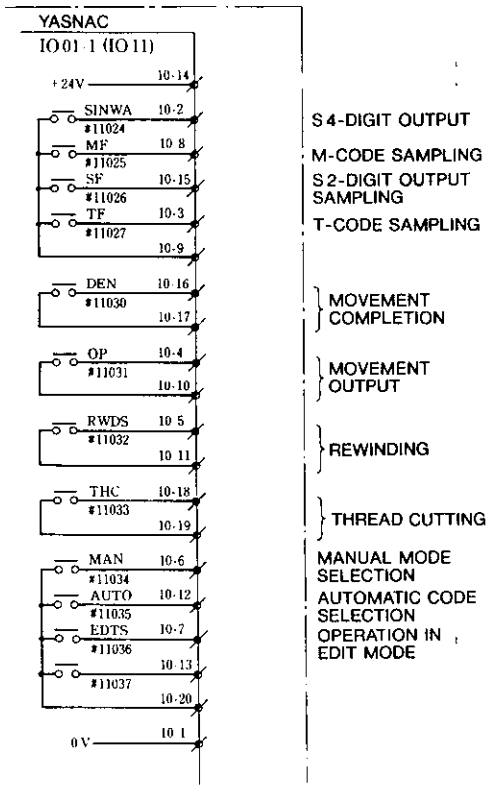


Fig. 14. 10

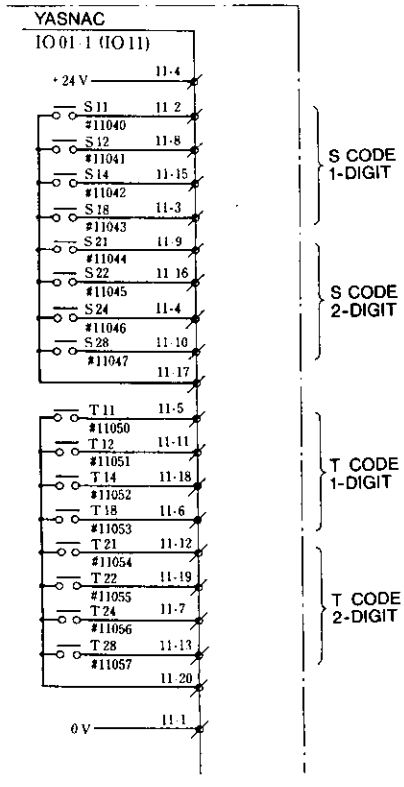


Fig. 14. 11

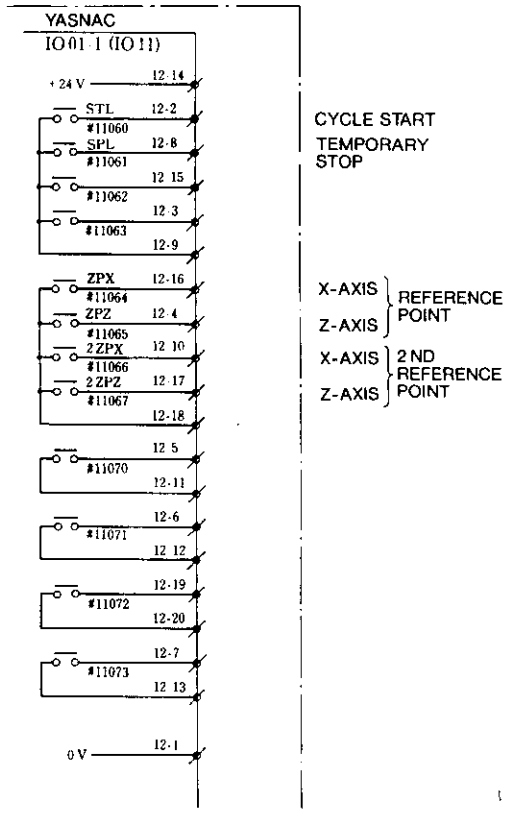


Fig. 14. 12

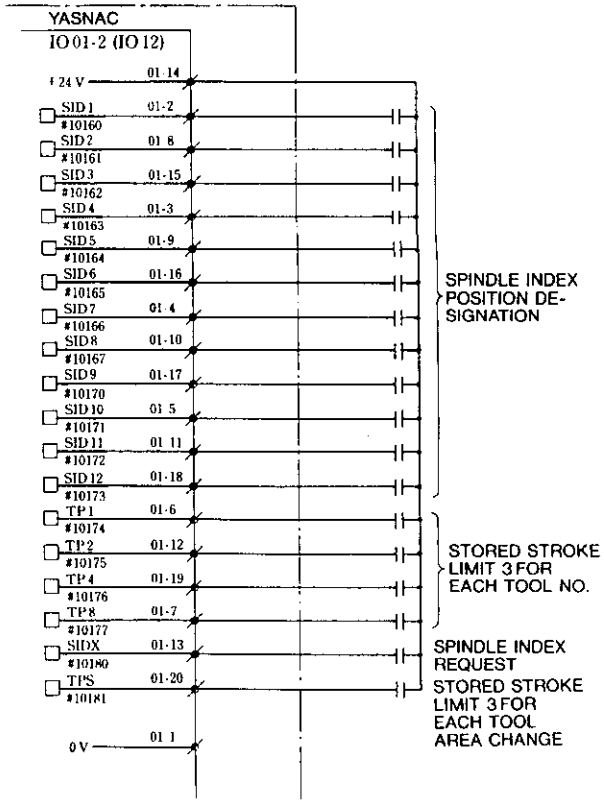


Fig. 14. 13

14. 3 CONNECTIONS BETWEEN UNITS (Cont'd)

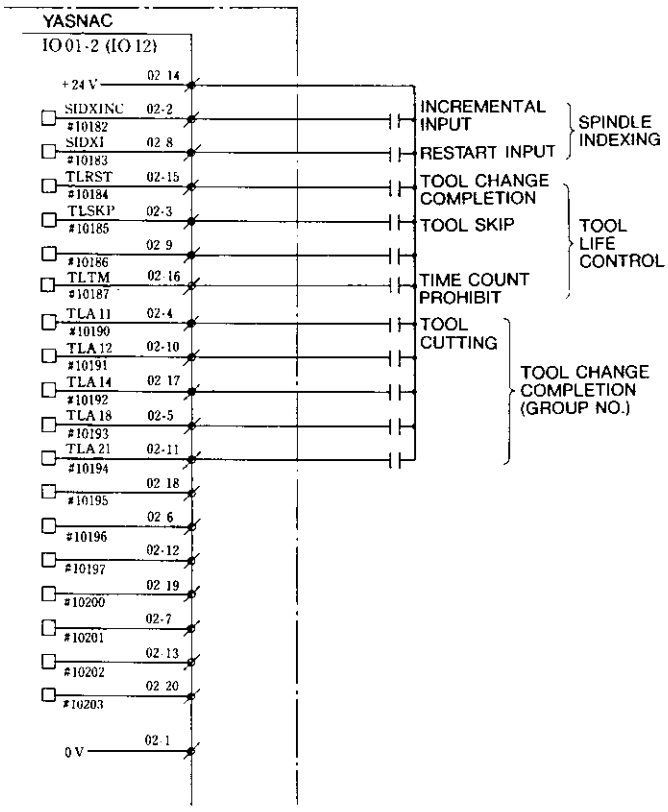


Fig. 14. 14

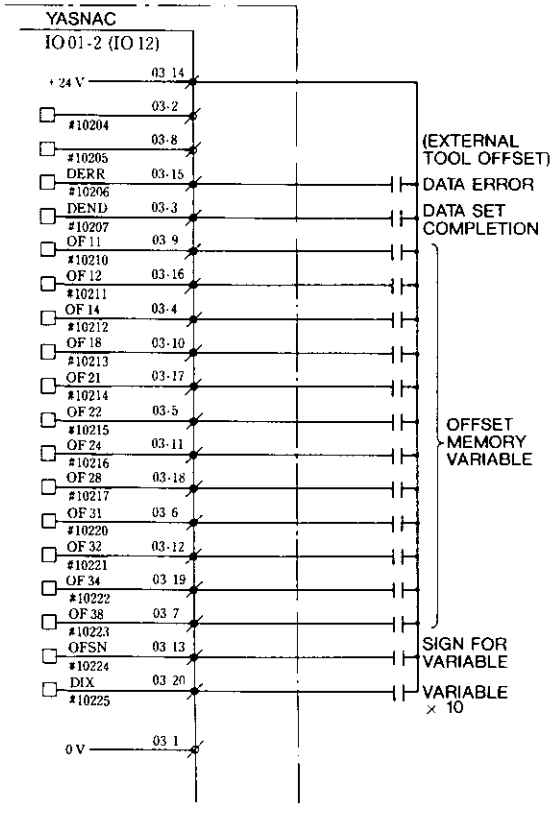


Fig. 14. 15

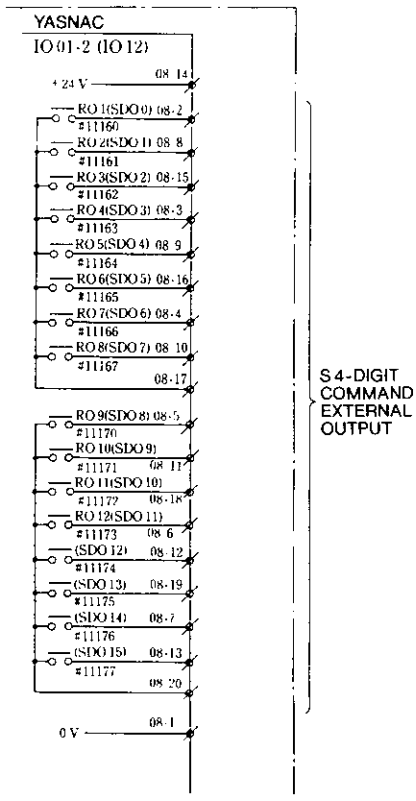


Fig. 14. 16

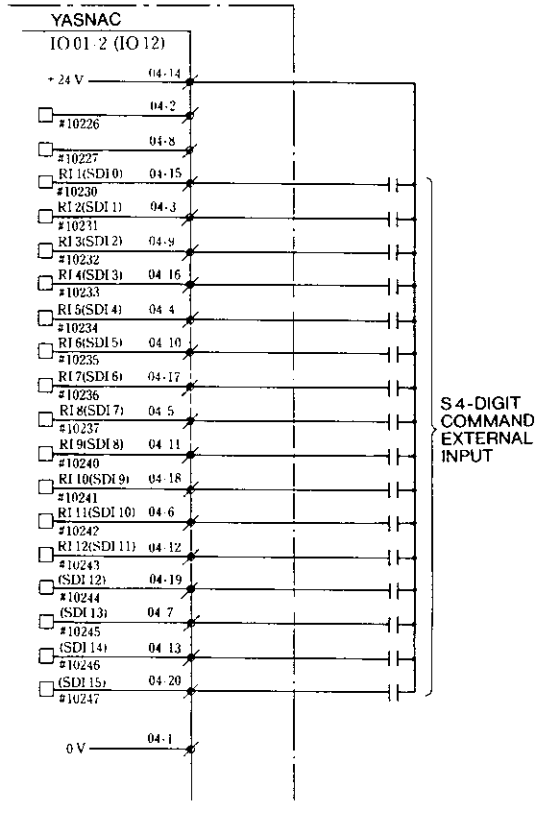


Fig. 14. 17

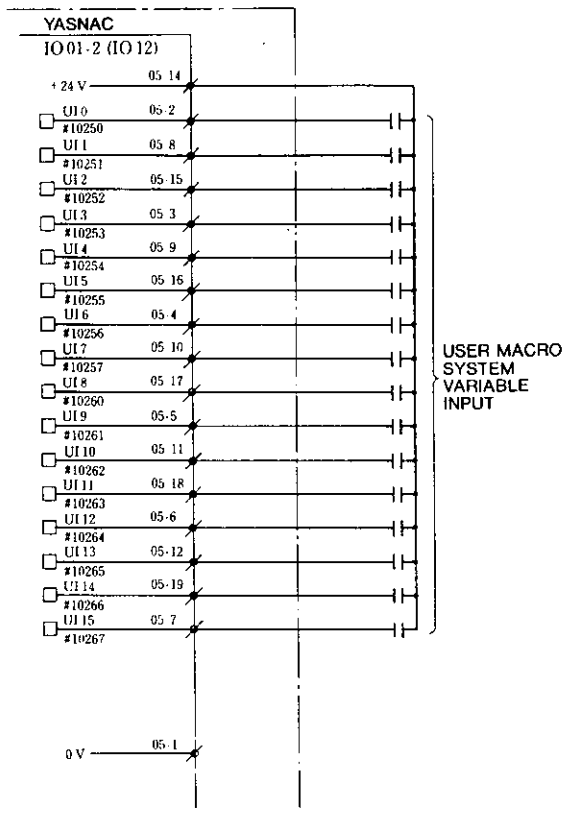


Fig. 14. 18

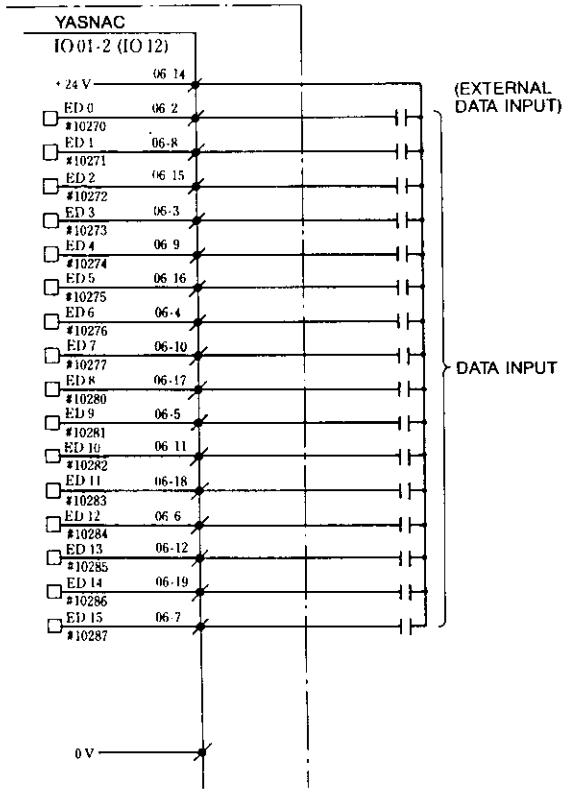


Fig. 14. 20

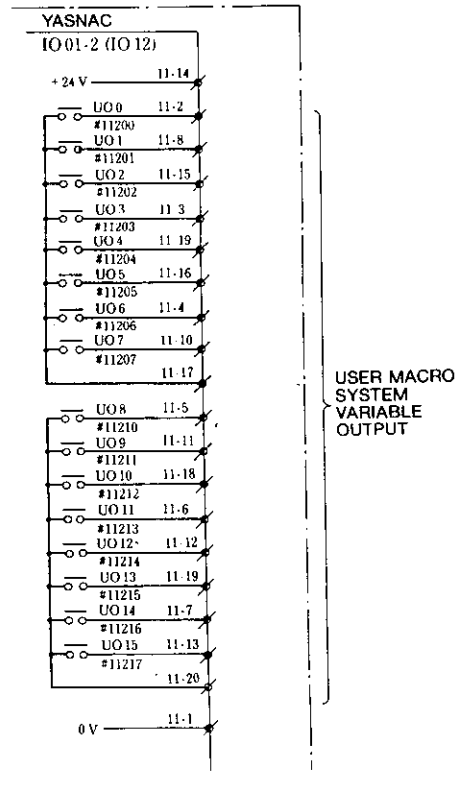


Fig. 14. 19

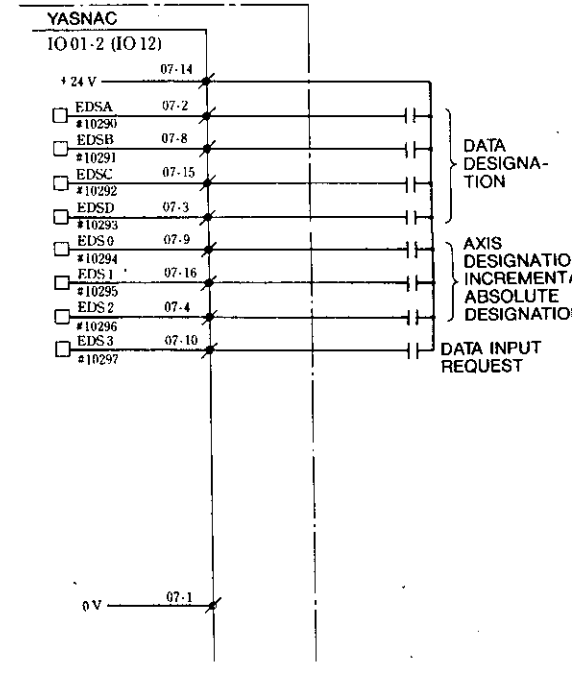


Fig. 14. 21

14. 3 CONNECTIONS BETWEEN UNITS (Cont'd)

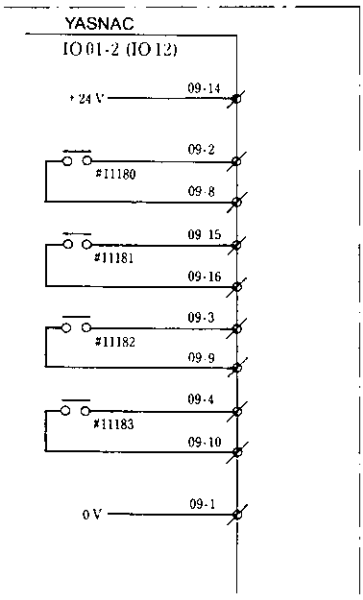


Fig. 14. 22

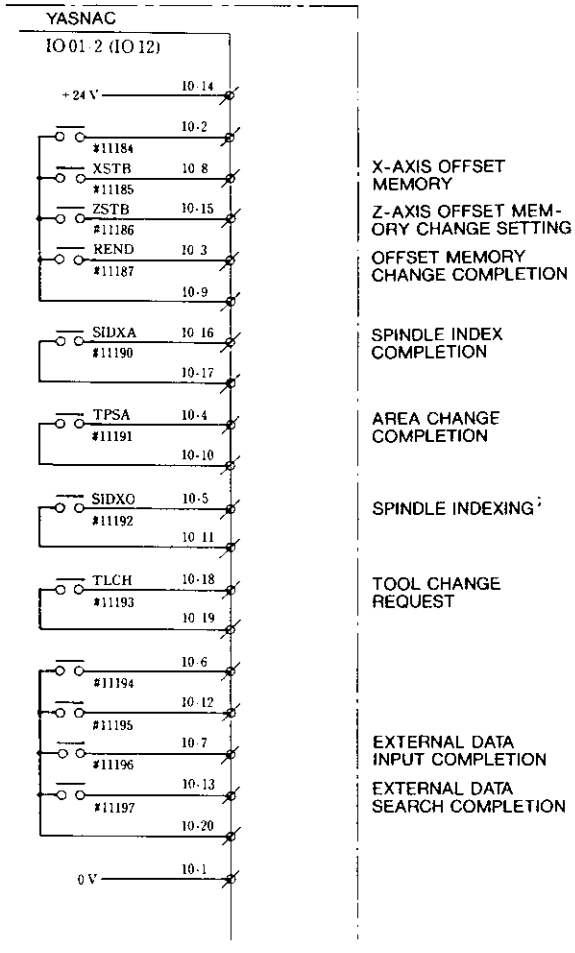


Fig. 14. 23

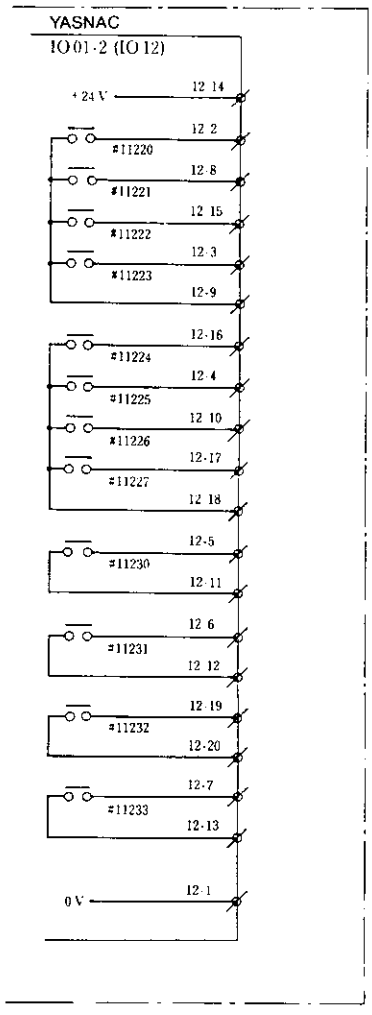


Fig. 14. 24

14. 4 DETAILS OF SIGNALS

14. 4. 1 INPUT SIGNALS FOR CYCLE START (ST), STOP (*SP) OUTPUT SIGNALS DURING 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, 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.

- While the control is in an alarm state. (While an alarm output or an input error output is on.)
- While the feedhold *SP input contact is open.
- While the external reset ERS input contact is closed.
- While the RESET button on the MDI & CRT panel is being pushed.
- 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.

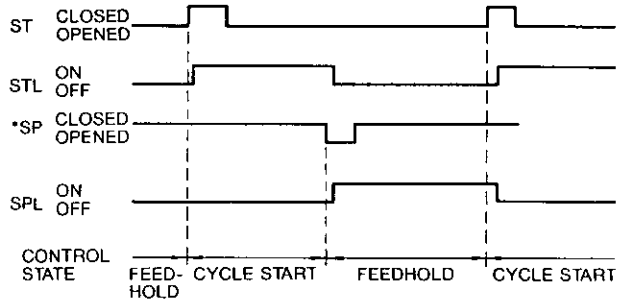
- When a part program has been executed by manual data input in the MDI mode.
- When one block of a part program has been executed with the single block (SBK) input contact closed.
- When the program end (EOP) input contact has been closed by an M command of a part program.

(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, unless the control is equipped with Thread Interruption function.

(4) When the feedhold input contact *SP is closed, and cycle start input contact ST is closed, 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).

*Asterisked signals activate at LOW.
(Normally closed contacts.)



Note :

1. Be sure to keep the cycle start (ST) and feedhold (*SP) input contacts closed or open at least for 100 ms. If the duration is shorter than this, the input may sometimes be neglected.
2. The operation of the cycle start (ST) input contact is reversed by parameter STUD (#6007D6). When the parameter is set to 1, the closing of the contact will start the operation of the control.
3. 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.

14. 4. 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	Manual operation
H/S:	Manual handle/manual step feed mode	Manual operation
T:	Tape operation mode	Automatic operation mode
MDI:	Manual data input operation mode	Automatic operation mode
MEM:	Memory operation mode	Automatic operation mode
EDT:	Program editing mode	Automatic operation mode

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

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 +X, -X, +Z and -Z signals.

14. 4. 2 INPUT AND OUTPUT FOR CONTROL OPERATION MODES (Cont'd)

H/S: Manual handle/manual step feed mode input

When the H/S input contact is closed, and other mode input contacts are opened, the control enters the manual handle mode (when the control is provided with an optional manual pulse generator) or the manual step feed mode, and the machine will be manually fed by the manual pulse generator or fed in steps.

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 interface, and when the control is set for IDVCE0 or IDVCE1 (#6003 D0 or D1), it can control the machine by part programs inputted via the RS232C interface.

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.

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.

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.

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.

MAN: Manual operation mode output

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

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).

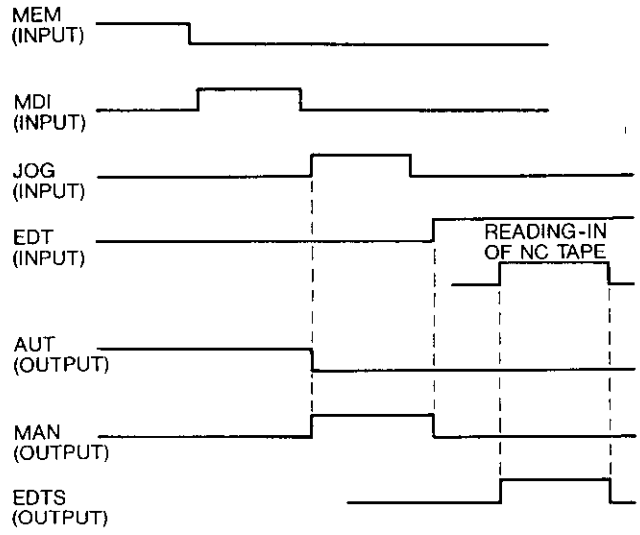


Fig. 14. 26

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.

- Motion command

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

- 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.

  The above applies to S2-digit commands. S4-digit commands do not have sampling output.

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.

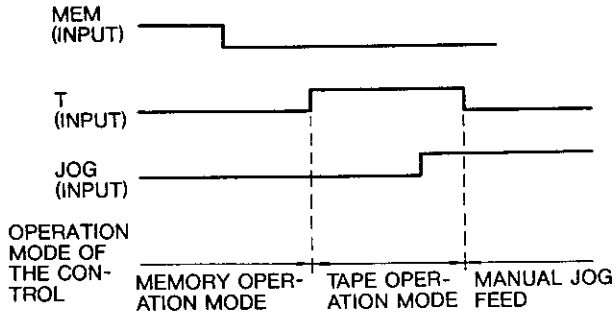


Fig. 14. 27

5. When a manual operation mode input contact is closed during the thread-cutting process in a part program, the automatic operation mode is retained while the thread is being cut.

14. 4. 3 MANUAL RAPID TRAVERSE SELECTION (RPD) INPUT

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

After power supply is input, JOG feed rate can be used as RPD feed rate by parameter #6009 D3 until reference point return for each axis has been executed completely.

14. 4. 4 MANUAL HANDLE FEED AXIS SELECTION (HX, HZ) INPUT, AND AUTOMATIC MODE HANDLE OFFSET (HOFS) INPUT

(1) MANUAL HANDLE FEED AXIS SELECTION (HX, HZ) 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 HZ input contact is open, the motion takes place along the X-axis. When the HZ input contact is closed and the HX input contact is open, the motion takes place along the Z-axis.

Note:
1. When both the HX and HZ input contacts are closed or open, motion cannot be obtained by the manual pulse generator.
2. When the control is provided with a pulse generator for simultaneous 2-axis control, and when a manual step feed is intended, these input contacts are not used.

(2) AUTOMATIC MODE HANDLE OFFSET (HOFS) INPUT

This input is for enabling motion control with the manual handle even during the automatic operation mode (Tape mode, MDI mode, memory mode) with a control provided with a manual pulse generator.

With this input, relative displacements caused by the remounting of the workpieces during automatic operation can be compensated.

When the HOFS input contact is closed, the motion control by the manual pulse generator is effective even during the automatic operation mode. However, during the execution of a positioning command in the automatic operation mode, machine motion cannot be controlled by the manual pulse generator.

The motion axis for the manual pulse generator motion control is selected by the HX and HZ (manual handle feed axis selection) input contacts. When the control is provided with a simultaneous 2-axis manual pulse generator, the machine can be moved simultaneously along the two axes.

The travel distance per step of the manual pulse generator is determined by the MP1, MP2 and MP4 (manual handle multiplication factor setting) input.

Note:
1. In an alarm state (ALM or IER output contact is closed), needless to say, automatic mode handle offset motion is ineffective.
2. When the interruput input (STLK) contact is closed, manual handle mode motion is possible, but automatic mode handle offset motion is not possible.
3. When executing automatic mode handle offset motion, parameter #6022, D_0 and D_1 for HOFSX (X-axis motion) and HOFSZ (Z-axis motion) must be set to 1.
4. When parameter HOFSMV (#6022 D_7) is set to 1, the automatic mode handle offset motion can be applied only to the time during the interpolation in the automatic operation modes.

14. 4. 5 MANUAL FEED AXIS DIRECTION SELECTION (+X, −X, +Z, −Z) INPUT

These inputs specify the motion direction when the control is in the manual jog mode or manual step feed mode.

Table 14. 4. 5

+X	−X	+Z	−Z	Motion Direction of Axis
CLOSED	OPENED	OPENED	OPENED	Plus direction of X-axis
OPENED	CLOSED	OPENED	OPENED	Minus direction of X-axis
OPENED	OPENED	CLOSED	OPENED	Plus direction of Z-axis
OPENED	OPENED	OPENED	CLOSED	Minus direction of Z-axis

Under other input conditions, axis motion is impossible, and current axis motion is stopped after deceleration.

14. 4. 6 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 14. 3

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	

Only when manual handle multiplication factor is 100 pluses/step, the control can be used by any multiplication. The multiplication factor should be set parameter #6223.

14. 4. 7 FEED OVERRIDE/MANUAL JOGGING SPEED SELECTION (FV1, FV2, FV4, FV8, FV16) 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. In the manual jog mode, these inputs determine the manual jog feed rates.

Table 14. 4

1 : CLOSED 0 : OPENED					Feedrate Override (Automatic Operation Mode)	Manual Jog Feedrate (Manual Operation Mode) Parameter Setting
FV1	FV2	FV4	FV8	FV16		
0	0	0	0	0	0%	#6233
1	0	0	0	0	10%	#6234
0	1	0	0	0	20%	#6235
1	1	0	0	0	30%	#6236
0	0	1	0	0	40%	#6237
1	0	1	0	0	50%	#6238
0	1	1	0	0	60%	#6239
1	1	1	0	0	70%	#6240
0	0	0	1	0	80%	#6241
1	0	0	1	0	90%	#6242
0	1	0	1	0	100%	#6243
1	1	0	1	0	110%	#6244
0	0	1	1	0	120%	#6245
1	0	1	1	0	130%	#6246
0	1	1	1	0	140%	#6247
1	1	1	1	0	150%	#6248
0	0	0	0	1	160%	#6249
1	0	0	0	1	170%	#6250
0	1	0	0	1	180%	#6251
1	1	0	0	1	190%	#6252
0	0	1	0	1	200%	#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	0%	#6259
1	1	0	1	1		#6260
0	0	1	1	1		#6261
1	0	1	1	1		#6262
0	1	1	1	1		#6263
1	1	1	1	1		#6264

Note :

1. When parameter FOVAB (#6020 D_5) is set to 1, inputs FV1, FV2, FV4, FV8, and FV16 become effective when the contacts are open, and 0 and 1 in the table for the input state and feed override manual jog speeds are reversed.
2. The manual jog feed rates can be used as the feed rates for part program dry run execution in the automatic operation modes. For details, refer to "14. 4. 4 Dry Run (DRN) Input."
3. For the thread-cutting in part program execution in the automatic operation modes, override is possible only at 100%.

(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.

14. 4. 8 RAPID FEEDRATE OVERRIDE (ROV1, ROV2) INPUT

These inputs are for determining the rapid feed rates, 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 14. 5

Input State		Rapid Feedrate	
ROV1	ROV2	X-axis	Z-axis
CLOSED	CLOSED	#6280 Setting speed	#6281 Setting speed
OPENED	CLOSED	#6280 Setting speed $\times \frac{1}{2}$	#6281 Setting speed $\times \frac{1}{2}$
CLOSED	OPENED	# 6280 Setting speed $\times \frac{1}{4}$	#6281 Setting speed $\times \frac{1}{4}$
OPENED	OPENED	#6231 Setting speed	

Rapid feedrate override is changed from 4 steps to 6 steps by parameter #6018 D2.

Input State			Rapid Feedrate	
ROV1	ROV2	ROV4	X-axis	Z-axis
1	0	1	#6280 Setting speed	#6281 Setting speed
0	0	1	#6280 Setting speed $\times \frac{1}{2}$	#6281 Setting speed $\times \frac{1}{2}$
1	1	0	#6280 Setting speed $\times \frac{1}{4}$	#6281 Setting speed $\times \frac{1}{4}$
0	1	0	#6280 Setting speed $\times \frac{1}{10}$	#6281 Setting speed $\times \frac{1}{10}$
1	0	0	#6280 Setting speed $\times \frac{1}{20}$	#6281 Setting speed $\times \frac{1}{20}$
0	0	0	#6231 Setting speed	

14. 4. 9. REFERENCE POINT RETURN CONTROL I/O SIGNALS (ZNR, *DCX, *DCZ, ZDX, ZDZ, ZPX, ZPZ)

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

The following two reference point return methods are available.

- Grid method: Reference point is determined by the origin pulse (1 pulse/revolution) of the position detector.
- 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 ZRNDRX, ZRNDRZ (#6010 D0, D1) will result in the reference point return motion as shown below. (The same applies to the execution of G28 in the automatic operation modes.)

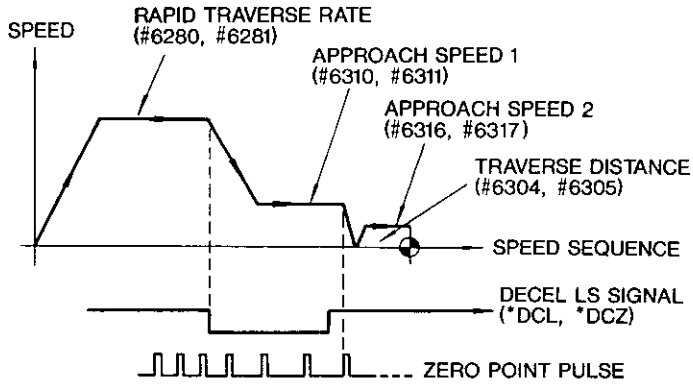


Fig. 14. 28.

(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, ZDZ). See Fig. 14.29.

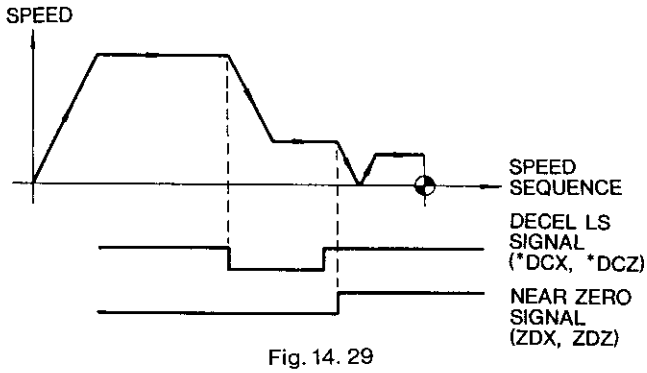
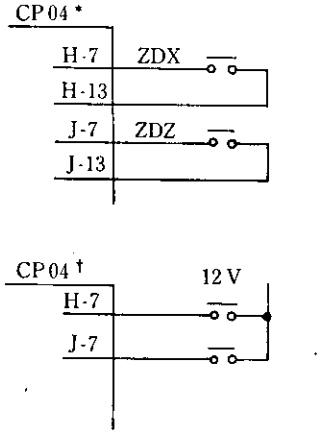


Fig. 14. 29



*Select the +12 V or +24 V pull-up of module parameter (JANCD-CP 04). Signal polarity is set to 1 with input opened.

†Select the 0V pull-down of module parameter (JANCD-CP 04). Signal polarity is set to 1 with input closed.

Note : For module parameter Setting, refer to APPENDIX on page 58.

Fig. 14. 30

14. 4. 9. REFERENCE POINT RETURN CONTROL I/O SIGNALS (ZNR, *DCX, *DCZ, ZDX, ZDZ, ZPX, ZPZ)

When the machine is returned to the reference point once, the return motion, thereafter will be in the positioning motion to the determined reference point.

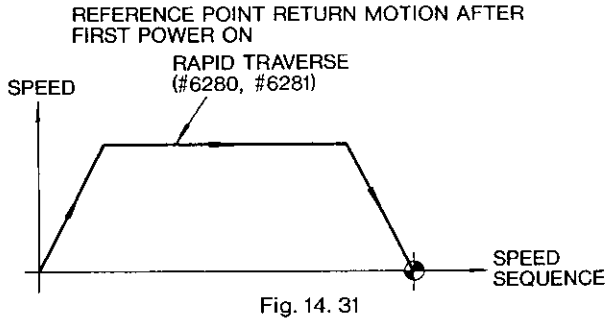


Fig. 14. 31

However, when parameters MZRNHS, AZRNHS (#6010 D4, D5) are set to 1, the same reference point return motion is obtained also for the 2nd time onward.

The grid method or the near-zero method is made by the setting of parameter CNZ, $\overline{NZ}$, $\overline{ORG}$ (#6024).

Table 14. 6

7	6	5	4	3	2	1	0
	ORGZ	NZZ	CNZZ		ORGX	NZX	CNZX

Set the Z-axis of #6024 and Z-reference point return methods.

Reference Point Return Method \ X-axis / Z-axis	ORGX / ORGZ	NZX / NZZ	CNZX / CNZZ
Grid Method (Origin Pulse)	1	0	0
Near Zero Method (Reference point at input closed)	0	1	0
Near Zero Method (Reference point at input opened)	0	1	1

(3) X AND Z REFERENCE POINTS (ZPX, ZPZ) OUTPUT

While the machine is remaining at the reference point after the reference point return motion or positioning ot the reference point, the ZPX and ZPZ output contacts are closed. If the actual position is not within ±3 pulses from the reference point due to the use of metric input in the inch output system or vice versa, the ZPX and ZPZ output contacts are not closed.

(4) 2ND REFERENCE POINT (2ZPX, 2ZPZ) 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, and 2ZPZ output relays are closed, and remain closed as long as the machine remains at this point. The 2nd reference point is defined by the distance from the reference point as set by parameters XZP2L, ZZP2L (#6612, #6613).

14. 4. 10 MANUAL ABSOLUTE ON/OFF (ABS) INPUT

During the execution of part programs 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 determing 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 mode.

- When ABS input relay is open: Does not transfer.
- When ABS input relay is closed: To be transferred, except when circular 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.

```
G01 Z20.000 FΔΔ;
X20.000 Z30.000
X10.000 Z40.000
```

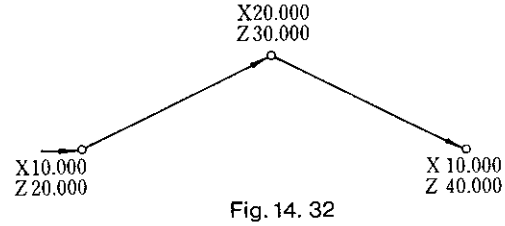


Fig. 14. 32

(1) When the machine is manually moved during a block.

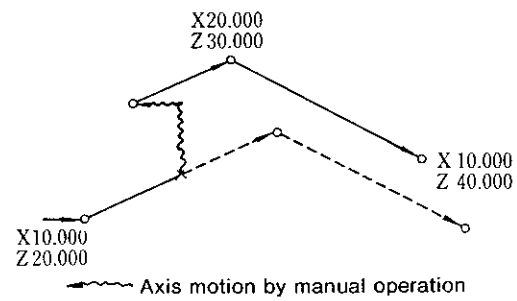


Fig. 14. 33

(2) WHEN ABS INPUT RELAY IS CLOSED.

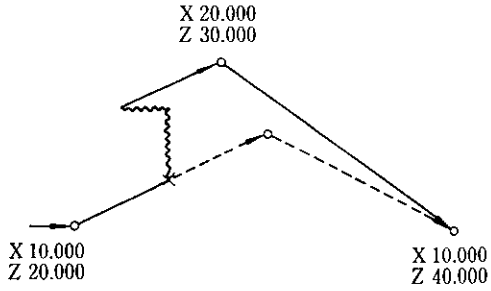


Fig. 14. 34

(3) SUPPLEMENTARY DESCRIPTION

In the following cases, the control transfers 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.

- RESET operation: MDI panel RESET key — on or external reset (ERS) input contact closed
- End of program: Program reset through end of program (EOP) input contact closing by M02, M30 execution
- 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.

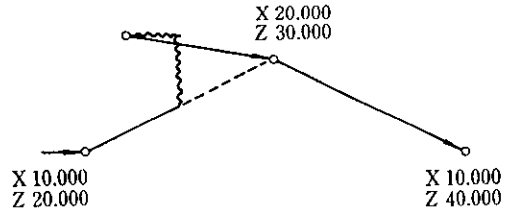


Fig. 14. 35

14. 4. 11 SINGLE BLOCK (SBK) INPUT

This input is for executing part programs one block at a time 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, only one block of the part program is executed, 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.

For details of the use of single block during the execution of multiple cycles, user-macro programs, refer to "Operator's Manual for YASNAC LX1 (TOE-C843-7.20)."

14. 4. 12 OPTIONAL BLOCK SKIP (BDT, BDT 2–BDT 9) 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 14. 7

	Neglected Data between
BDT INPUT CLOSED	"/" or "/1" and "EOB" (End of block)
BDT 2 INPUT CLOSED	"/2" and "EOB"
BDT 3 INPUT CLOSED	"/3" and "EOB"
BDT 4 INPUT CLOSED	"/4" and "EOB"
BDT 5 INPUT CLOSED	"/5" and "EOB"
BDT 6 INPUT CLOSED	"/6" and "EOB"
BDT 7 INPUT CLOSED	"/7" and "EOB"
BDT 8 INPUT CLOSED	"/8" and "EOB"
BDT 9 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.

14.4.13 MACHINE LOCK (MLK) AND DISPLAY LOCK (DLK) INPUT

(1) MACHINE LOCK (MLK) 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 1st display area "EXTERNAL," and external 2-axes current value display) does not change.

14.4.14 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 (FV1, 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.

While the DRN input contact is closed, the feedrates in part program execution in the automatic mode are the ones specified by the manual continuous feed selection input signals, instead of the programmed one. (However, for thread cutting, programmed feedrates remain effective.)

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.

NOTE

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

14.4.15 CURRENT VALUE STORING (PSR) INPUT

This input is for storing current values in the control.

When the PST input contact is closed, the control stores current values (CRT screen POS display 1st area EXTERNAL) into the internal memory, and the LED incorporated in the OFS key in the MDI FUNCTION area flickers.

Then, it performs the following calculation on the offsets written by MDI, and stores the result in the offset memory.

Values to be written in offset memory	=	Input value	-	Current value stored in control

Resetting operation (depressing RESET key on MDI panel, or closing external reset input contact) cancels the current value storing mode and stops the flickering of the LED.

For the details of the usage of the PST input, refer to "6.2.3 Measured Workpiece Value Direct Input in YASNAC LX1 Operator's Manual (TOE-C843-7.20).

14.4.16 PROGRAM RESTART (PRST) INPUT

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

For the details of the usage of the PST input, refer to "6.2.6 Program Restart" in YASNAC LX1 Operator's Manual (TOE-C843-7.20).

14.4.17 EDIT LOCK (INHEDT)

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

- Storing part programs by the MEM DATA "IN" key.
- The change, addition and deletion of part programs in the memory with the EDIT "ALT," "INS" and "ERS" keys.

14. 4. 18 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.

NOTE

With S4-digit instructions, 12-bit non-contact outputs and analog outputs are outputted in accordance with the instructions, even while the AFL input contact is closed.

14. 4. 19 SETUP POINT RETURN (SRN) INPUT

This is the input for positioning the machine at the setup point by manual jogging.

While the SRN input contact is closed, manual jog motion only takes place in the direction towards the setup point.

As the machine arrives at the setup point, manual jog motion stops. When the machine is at the setup point, manual jogging is impossible unless the SRN input contact is opened.

14. 4. 20 INTERRUPTION POINT RETURN (CPRN) INPUT

This is the input for positioning the machine at the interruption point by manual jogging after the control was switched over from the automatic operation mode to the manual operation mode, and subsequently moved away under manual control.

While the CPRN input contact is closed, manual jogging is possible only towards the interruption point.

After arriving at the interruption point, manual jogging motion stops. When the machine is at the interruption point, manual jogging is impossible unless the CPRN input contact is opened.

14. 4. 21 OVERTRAVEL (*+LX, *−LX, *+LZ, *−LZ) 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 14. 8

	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	
*+LZ Input Opened	Motion stop in +Z direction	
*−LZ Input Opened	Motion stop in −Z direction	

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

NOTE

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.

14. 4. 22 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.

For the turning of power sequence, refer to "13 CONNECTION WITH POWER INPUT UNIT."

14. 4. 23 EMERGENCY STOP ON (*ESPS) OUTPUT

When Emergency-Stop Input ($\overline{ES1}$, $\overline{ES2}$) or Machine-End Input ($\overline{EL1}$, $\overline{EL2}$) is opened, *ESPS output is opened.

14. 4. 24 EXTERNAL RESET (ERS) INPUT AND RESET ON (RST 1, 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 14. 9

Output Signals	Output at ERS Input Closed
AUT/MAN ZPX/ZPZ 2 ZPX/2 ZPZ *ESPS PO 1–2 SO 1–2	Previous conditions kept
RST 1–2	Output contact is closed for one second while ERST input contact is closed or is opened.
ALM	Contactor kept closed unless alarm causing factor is removed.
S 11–S 28 T 11–T 28 DS 1–2 SINVA RO 1–12 SDO 0–15	Previous conditions kept.
TLCH 1–2	Contact closed if any of selected. group of tools reaches end of life.
UO 0–15	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.

14. 4. 25 INTERLOCK (STLK) INPUT

This input stops the spindle travel in the automatic operation mode. When "STLK" input is closed during the spindle travel in the automatic operation mode, only the spindle travel is stopped with the automatic operation being activated ("STL" output is in the closed state). When "STLK" input is opened again, the spindle travel is resumed.

"STLK" input does not affect the M, S, and T commands in both manual and automatic operation modes.

14. 4. 26 ALARM (ALM) AND INPUT ERROR (IER) OUTPUTS AND EXTERNAL ERROR DETECT (ERR 0, 1) INPUTS

(1) ALARM (ALM) AND INPUT ERROR (IER) OUTPUTS

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

IER: This output is closed on detection of an alarm caused by the information from the part program or the input device. (Alarm codes "010" through "129.")

ALM: This output is closed on detection of any alarm other than the above. (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) 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 stops on completion of the block being executed.

ERR1: 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.

14. 4. 27 RAPID THREADING PULL-OUT (CDZ) INPUT AND ERROR DETECT-ON (SMZ) INPUT

(1) RAPID THREADING PULL-OUT (CDZ) INPUT

This input determines whether rapid threading pull-out is performed or not in the execution of G92 (thread cutting cycle) or G76 (composite thread cutting cycle). When CDZ input is closed, the rapid threading pull-out is performed; when this input is open, it is not performed.

The control determines by the CDZ input whether rapid threading pull-out is performed or not at the start of a thread cutting cycle. To open/close CDZ input by such a command as M, add the delay time of the input circuit processing and set the state of CDZ input to the start of thread cutting cycle.

(2) ERROR DETECT ON (SMZ) INPUT

This input determines whether "Error Detect On" condition is added to the end conditions for the feed in the automatic operation mode.

"Error Detect On":

Due to the servo system delay, during travelling, the position detected by the position detector follows, the position designated by the logic circuit with a delay. When the designated position and the detected position are found under the values set in parameters XPSET and ZPSET (#6056 and #6057), it is called in the "Error Detect On" state.

When SMZ input is closed, "Error Detect On" condition is added to the feed end conditions in the automatic operation mode. When this input is open, this condition is not added.

SMZ input does not affect any positioning commands. (With each positioning command except G06 (Error Detect Off Positioning), "Error Detect On" condition is added to the end conditions.)

14. 4. 28 X-AXIS MIRROR IMAGE (MIX) INPUT

This input inverts the X-axis travelling direction in the automatic operation mode. When an automatic activation is performed with MIX input closed, the X-axis travelling direction by the part program is made opposite to the specified direction. When MIX input is closed then opened during the execution of the part program, it is made valid for the commands after the satisfaction of the following two conditions:

(1) Compensation cancelled.

(2) Out of automatic operation.

MIX input does not affect the X-axis travel in the manual operation mode.

14. 4. 29 M, S, AND T CODES (M 11 THROUGH M 38, S 11 THROUGH S 28, T 11 THROUGH T 28, MF, SF, TF, FIN) INPUTS/OUTPUTS

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

M code output	M11, M12, M14, M18, M21, M22, M24, M28, M31, M32, M34, M38
S code output	S11, S12, S14, S18, S21, S22, S24, S28
T code output	T11, T12, T14, T18, T21, T22, T24, T28
M code reading output	MF
S code reading output	SF
T code reading output	TF

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 code according to the value that follows the detected command (M = 2 digits/3 digits, S = 2 digits, T = 2 digits).

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

NOTE

1. With the S4 digit command, the 12-bit non-contact output or analog output is provided, disabling the S code output and the S-code read output.
2. M commands (M90 through M109) for logic circuit processing: With the T commands (T○○ΔΔ, T51ΔΔ through T80ΔΔ, T90ΔΔ, T□□90 through T□□95, and T□□99), the M/T code output and the M/T code reading output are not provided.

(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, AND T FUNCTIONS COMPLETION (FIN) INPUTS

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

NOTE

1. For the S4-digit command, FIN input need not be closed.
2. 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 without change.

14. 4. 29 M, S, AND T CODES (M11 THROUGH M38, S11 THROUGH S28, T11 THROUGH T28, MF, SF, TF, FIN) INPUTS/OUTPUTS (Cont'd)

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

a. M command

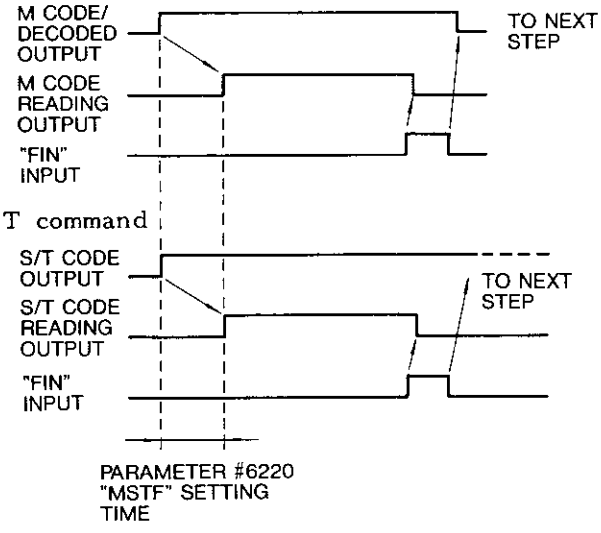


Fig. 14. 36

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, or T operation are executed simultaneously.

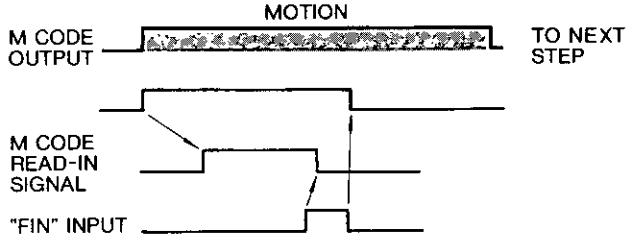


Fig. 14. 37

14. 4. 30 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.

14. 4. 31 TRAVEL ON (OP1, 2) AND THREAD CUTTING ON (THC1, 2) 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 in any of the following situations:

- During the execution of a move command.
- In the state in which a move command is discontinued by the interrupt (STLK) input or the FEEDHOLD (*SP) input.

(2) THREAD CUTTING ON (THC1, 2) OUTPUTS

With these outputs, the control informs that a thread cutting is being performed during the execution of part program in the automatic operation mode. These outputs are closed during thread cutting.

14. 4. 32 END-OF-PROGRAM (EOP) INPUT, REWIND (RWD) INPUT, HIGH SPEED REWIND (HSRWD), AND REWIND ON (RWDS1, 2) OUTPUTS

(1) END-OF-PROGRAM (EOP), REWIND (RWD), AND HIGH SPEED REWIND (HSRWD) INPUTS

With these outputs, the controller 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 M02R or M30R commands is opened then closed:

Table 14. 4. 32

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

Note:

1. When HSRWD input is closed, the control rewind the program at high speed. The HSRWD input is used mainly continuous operation to high speed automatic starting after high speed rewinding by parameter #6023 D0.
2. 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 14. 4. 24 "EXTERNAL RESET (ERS) INPUT."
3. When a program reset operation is performed, Reset On output RST1 and RST2 are closed for one second.

(2) REWIND ON (RWDS1, 2) OUTPUTS

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 RWDOUT (#6007, D4) to "1." Otherwise, they are not provided.

14. 4. 33 DISPLAY RESET (DRSX, DRSZ) INPUTS

These inputs set the external 2-axis current value display and the current value display on the operator's panel CRT to "0." When "DRSX" (X-axis display reset) or "DRSZ" (Z-axis display reset) is closed, "0" is set to the external 2-axis current value display and the current value display on the operator's panel CRT (the first screen "EXTERNAL").

14. 4. 34 EXTERNAL STORE, MATCH, AND OUTPUT (EIN, EVER, AND EOUT) INPUTS

These inputs are used to perform store, match, and output operations on the NC memory of the control from outside.

If these inputs are closed when the control is in the program edit mode and Edit Output On (EDTS) output is closed, the following operations take place:

EIN input is closed:
The part program is stored in the NC memory.

EVER input is closed:
The part program is matched against the NC memory.

EOUT is closed:
The contents of the NC memory are outputted.

While a store, match, or output operation is performed, the In-Edit (EDTS) output is closed.

NOTE

The I/O equipment for the store and match operations depends on setting IDVCE0, 1 and ODVCE0, 1 (#6003).

14. 4. 35 S 4-DIGIT COMMANDS (R 01 THROUGH R12, DAS, SGS1, GR1 THROUGH GR 4, SINV, AND SINVA) 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 4-Digit Analog output.

GR1 through GR4 are used to enter into 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 4-Digit Analog output.

While the polarity is inverted, SINVA signal is outputted.

(1) S4-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 GRIREV: #6271.)

——— ; The output when "GR2" input is closed. (Set the spindle motor maximum speed at gear range "GR2" to parameter GR2REV: #6272.)

——— ; The output when "GR3" input is closed. (Set the spindle motor maximum speed at gear range "GR3" to parameter GR3REV: #6273.)

——— ; The output when "GR4" input is closed. (Set the spindle motor maximum speed at gear range "GR4" to parameter GR4REV: #6274.)

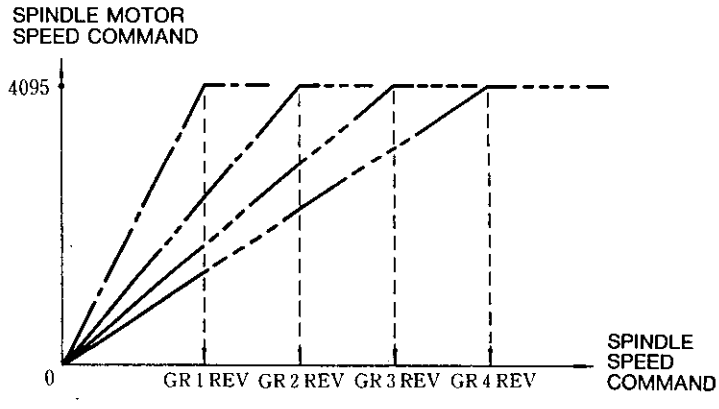


Fig. 14. 38

14. 4. 35 S 4-DIGIT COMMANDS (R 01 THROUGH R 12, DAS, SGS 1, GR 1 THROUGH GR 4, SINV, AND SINVA) INPUTS/OUTPUTS (Cont'd)

(2) S4-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:

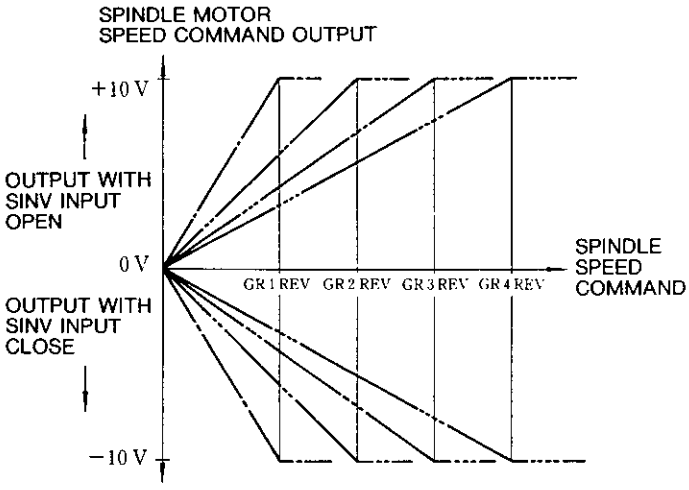


Fig. 14. 39

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

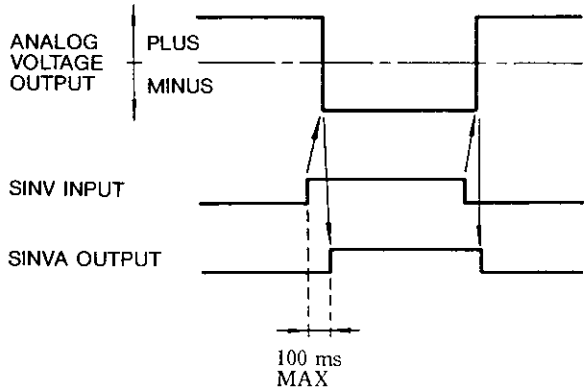


Fig. 14. 40

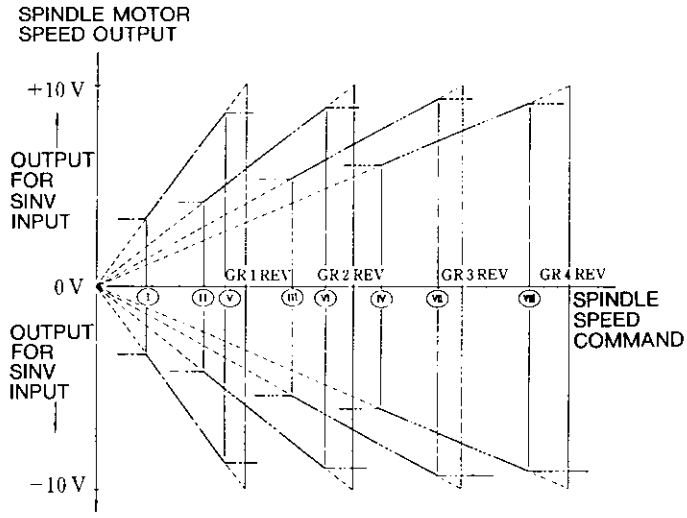
(4) SPINDLE MAXIMUM/MINIMUM SPEED CLAMP

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

Table 14. 11

Parameter	Function	No. in Fig. below
MACGR 1 (#6266)	Spindle maximum speed when "GR 1" input is closed.	V
MACGR 2 (#6267)	Spindle maximum speed when "GR 2" input is closed.	VI
MACGR 3 (#6268)	Spindle maximum speed when "GR 3" input is closed.	VII
MACGR 4 (#6269)	Spindle maximum speed when "GR 4" input is closed.	VIII
MICGR 1 (#6276)	Spindle minimum speed when "GR 1" input is closed.	I
MICGR 2 (#6277)	Spindle minimum speed when "GR 2" input is closed.	II
MICGR 3 (#6278)	Spindle minimum speed when "GR 3" input is closed.	III
MICGR 4 (#6279)	Spindle minimum speed when "GR 4" input is closed.	IV

The following diagram shows an example of the S4-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:

$$\frac{\text{(Spindle speed command)} \times \text{(4095 or 10 V)}}{\text{(Spindle gear range spindle maximum speed determined by GR 1 through GR 4 inputs: parameters \#6271 through \#6274)}}$$

2. With the spindle motor speed command 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).

Table 14.12

SDASGN1 (#6006, D_6)	SDASGN2 (#6006, D_7)	M03 Output	M04 Output
0	0	+	+
1	0	−	−
0	1	+	−
1	1	−	+

When SINV input is closed, the above polarities are inverted.

3. When spindle S Command Stop (SSTP) input is closed, a value other than those described earlier may be outputted for the spindle motor speed command. For details, refer to "SPINDLE S COMMAND STOP (SSTP) INPUT."

4. When two or more of GR1 through GR4 inputs are closed or not closed, the control determines the gear ranges as follows:

Table 14.13

GR1 Input	GR2 Input	GR3 Input	GR4 Input	Gear range
0	0	0	0	
1	1	0	0	Gear range 1
1	0	1	0	
0	1	1	0	Gear range 2
1	1	1	0	Gear range 1
1	0	0	1	
0	1	0	1	Gear range 2
1	1	0	1	Gear range 1
0	0	1	1	Gear range 3
1	0	1	1	Gear range 1
0	1	1	1	Gear range 2
1	1	1	1	Gear range 1

0: Input open 1: Input closed

Supplementary Explanation

Constant surface speed control and S4-digit command output:

When constant surface speed control (G96) is specified by the part program at its execution in the automatic operation mode, the output is varied every 100 msec according to the following relation during a cutting operation:

$$\frac{\text{(Surface speed by S command)}}{\text{(X-axis current value)} \times (\pi)} \times \frac{\text{(4095 or 10 V)}}{\text{(Spindle gear range max. speed determined by GR1 to GR4 inputs)}}$$

Time Chart Example

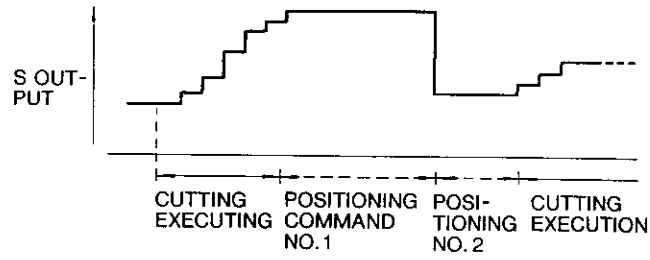


Fig. 14.41

Setting parameter POSG96 (#6020, D0) to "1" enables the control to perform the constant surface speed control also on the positioning command. (However, only the spindle speed obtained by the coordinate value of the positioning end point is outputted.)

14.4.36 SPINDLE S COMMAND "0" (SSTP), GEAR SHIFT ON (GRS) INPUT, AND SPINDLE CONSTANT SPEED (GSC) INPUT

These inputs are used to make the S4-digit command analog output provide the outputs other than the part program S command. When SSTP input is closed, the spindle motor speed command output based on the spindle speed specified in the part program is stopped.

If GRS input is closed in this state, the voltage to set to parameter GRSREV (#6270) is outputted.

If GSC input is closed, the spindle motor speed command voltage is outputted which corresponds to the spindle speed to be set to parameter GSCREV (#6275) by the spindle gear range input.

Table 14.14

SSTP Input	GRS Input	GSC Input	S4-digit Command Analog Voltage
0	0	0	
0	0	1	Voltage corresponding to spindle speed commanded by NC program.
0	1	0	
0	1	1	
1	0	0	0V
1	0	1	Voltage corresponding to parameter GSCREV.
1	1	0	Parameter GRSREV setting value.
1	1	1	0V

0: Contact open, 1: Contact closed

Note:

1. It is possible to make the analog outputs for SSTP, GRS, and GSC inputs negative by the S4-digit analog output invert (SINV) input.
2. The period of time between the setting of SSTP, GRS, or GSC input and the catching-up of the analog voltage value is shorter than 100 msec.
3. Setting parameter SSTPAB (#6020, D_4) to 1 enables the control to provide "*SSTP" input.

14.4.37 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 SAGRT (#6224), makes sure that SAGR input is closed, and starts cutting.

NOTE

1. To perform the above operation by SAGR input, set parameter SAGRCH (#6006, D4) to "1." If it is set to "0," SAGR input is ignored.
2. In G96 mode, SAGR input is checked every time the switching from a positioning command to a cutting command takes place. In G97 mode, SAGR input is checked at the switching only when the spindle speed is different between the positioning start and end times.

14.4.38 SPINDLE SPEED OVERRIDE (SPA, SPB, AND 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.

Table 14.15

SPA Input	SPB Input	SPC Input	Override 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 open

Override is specified to S command within 10% to 200% range by parameter #6018 D1.

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

14.4.39 S4-DIGIT ANALOG OUTPUT AUTO/MANUAL SWITCHING (SMN, SAT, MNS, SG2, COMS, AND SGS1) INPUTS/OUTPUTS

(1) As shown Fig. 14.42, when the S4-digit manual analog input is given between MNS and SG2 from outside to control SMN and SAT inputs, the voltage by the S command in the part program or the external analog voltage input may be outputted between COMS and SGS1.

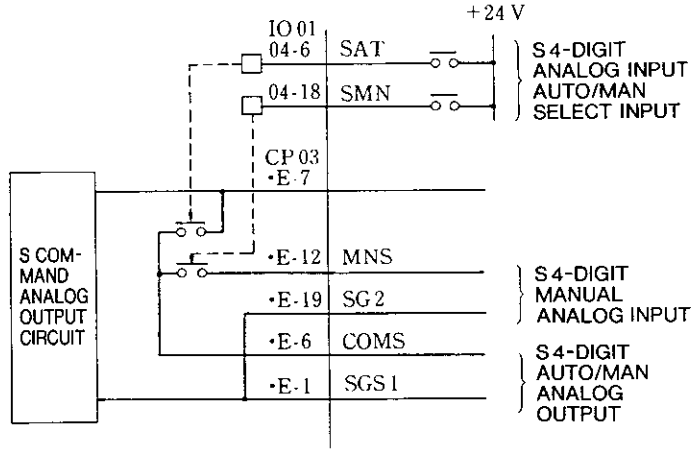


Fig. 14.42

(2) TIME CHART OF INPUT/OUTPUT SIGNALS

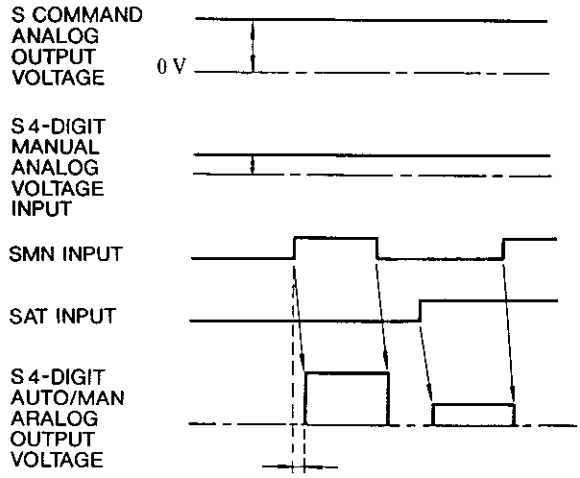


Fig. 14. 43

14. 4. 40 S4-DIGIT COMMAND EXTERNAL OUTPUTS (R01 THROUGH R012 OR SDO0 THROUGH SDO15) AND S4-DIGIT EXTERNAL INPUTS (RI1 THROUGH RI12 OR SDI0 THROUGH SDI15)

These inputs and outputs are used, when the control is of S command 4-digit, to output the results of the operation by the S command in the part program to the outside and perform the actual S4-digit command 12-bit non-contact output or analog output acoording to the inputs from the outside.

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

- Output of operation results to outside: RO1 through RO12
- Inputs from outside to output results to R01 through R12: RI1 through RI12

(2) S4-DIGIT COMMAND ANALOG OUTPUT

- Output of operation results to outside: SDO0 through SDO15
- Inputs from outside to output analog voltage to DAS and SGS1: SDI0 through SDI15

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

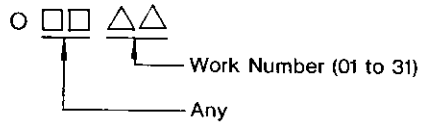
NOTE

The primary purpose of this function is to control the S4-digit command by the sequencer built in the control. This function should not be used for other purposes unless especially required.

14. 4. 41 EXTERNAL WORK NUMBER SEARCH A (WN1, WN2, WN4, WN8, AND WN16) INPUTS

This is a function to select the program by the program number specified by external input from the part programs stored in the part program memory of the equipment.

(1) To use this external work number search A, assign the program number as follows:



The work number search timing is as follows (provided that the external input (WN1 to WN16) is not "00"):

a. A reset operation. (When RESET key is pressed, or the external reset input or EOP input is turned on.)

b. When CYCLE START key is pressed in the memory mode and the label skip on state.

(2) The relationship between external inputs WN1 through WN16 and program numbers is as shown the next page:

14. 4. 41 EXTERNAL WORK NUMBER SEARCH A (WN 1, WN 2, WN 4, WN 8, AND WN 16) INPUTS (Cont'd)

Table 14. 16

Program No.	Input State				
	WN 1	WN 2	WN 4	WN 8	WN 16
□□ 01	1	0	0	0	0
□□ 02	0	1	0	0	0
□□ 03	1	1	0	0	0
□□ 04	0	0	1	0	0
□□ 05	1	0	1	0	0
□□ 06	0	1	1	0	0
□□ 07	1	1	1	0	0
□□ 08	0	0	0	1	0
□□ 09	1	0	0	1	0
□□ 10	0	1	0	1	0
□□ 11	1	1	0	1	0
□□ 12	0	0	1	1	0
□□ 13	1	0	1	1	0
□□ 14	0	1	1	1	0
□□ 15	1	1	1	1	0
□□ 16	0	0	0	0	1
□□ 17	1	0	0	0	1
□□ 18	0	1	0	0	1
□□ 19	1	1	0	0	1
□□ 20	0	0	1	0	1
□□ 21	1	0	1	0	1
□□ 22	0	1	1	0	1
□□ 23	1	1	1	0	1
□□ 24	0	0	0	1	1
□□ 25	1	0	0	1	1
□□ 26	0	1	0	1	1
□□ 27	1	1	0	1	1
□□ 28	0	0	1	1	1
□□ 29	1	0	1	1	1
□□ 30	0	1	1	1	1
□□ 31	1	1	1	1	1

0 : Input open, 1 : Input closed

Note :

1. WN 1 through WN 16 inputs are ignored at the start of a part program in other than memory and running modes. The start of a part program is when an automatic run is activated in the label skip state ("LSK" is being displayed on the CRT screen).
2. The program number selection by a reset operation is performed independently of the running mode.
3. When WN 1 through WN 16 inputs are all open, the program number selection is not performed.
4. If the part program memory of the control contains two or more part programs which have part program numbers 01 through 31 specified by WN 1 through WN 16, the program stored nearest the memory beginning is selected.
5. The program numbers for which this search function is valid are O□□01 through O□□31.
6. If the specified program number is not found after a search operation, error "134" is caused.
7. When this work number search A function is performed, FUNCTION is automatically changed to PROG.

14. 4. 42 TIME COUNT (EXTC) INPUT (OPTIONAL)

This input makes the control count the time. The control accumulates the time in which EXTC input is closed and displays the result in the bottom of "OPERATION TIME DISPLAY," which is on page 3 of "ALM" function on the operator's station CRT. (Operating time display "EXTERNAL" is optional.) The time display is reset by pressing "4" key then [ORG] key by the MDI. Until this reset operation is performed, the time display is retained after such an operation as power-on.

14. 4. 43 EXTERNAL TOOL COMPENSATION (OF 11 THROUGH OF 38, OFNS, DIX, DEND, XSTB, ZSTB, AND REND) INPUTS/OUTPUTS

(1) This is a function to modify the contents of the offset memory of the equipment by the use of the following input/output signals:

- Offset memory modify volume input: BCD 3-digit, OF11 to OF38
- Offset memory modify sign input: OFSN
- Offset memory modify volume × 10 input: DIX
- Data error input: DERR
- Data set complete input: DEND
- X-axis offset memory modify volume setting output: XSTB
- Z-axis offset memory modify volume setting output: ZSTB
- Offset memory modify complete output: REND

(2) To use this function, specify the following in the part program:

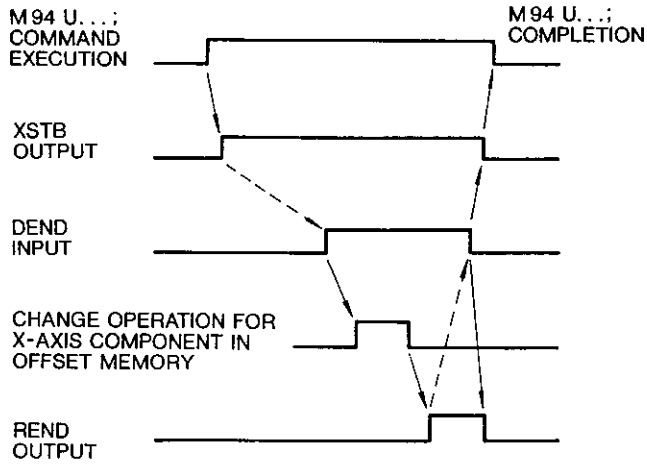
M94 U---; --- For modifying X-axis offset memory

Offset memory number to be modified 00 to 99.

M95 W---; --- For modifying Z-axis offset rmemory.

Offset memory number to be modified 00 to 99.

(3) The timing resulted from the execution of the above commands is as shown the next page:



Note: The solid-line arrow shows the operation of the control, while the broken-line arrow shows the operation of the input by the external equipment.

Fig. 14. 44

In the case of M95 W ---; command, only two points are different in the above timing chart; XSTB to ZSTB, and offset memory X-axis component modify operation to offset memory Z-axis component modify operation.

(4) The offset memory operation in the control is as follows:

i. BCD 3-digit offset memory modify volume of OF11 to 18, OF21 to 28, and OF31 to 38 is written.

ii. When the offset memory modify volume × 10 input (DIX) is closed, the offset memory modify volume written in (i) above is multiplied by 10.

iii. When the offset memory modify sign input (OFSN) is closed, the offset memory modify volume is made negative.

iv. The offset memory modify volume obtained in (i) through (iii) above is added to the X-axis or Z-axis component of the offset memory number specified by U or W command.

NOTE

1. If DERR input is closed when the offset memory modify value is written, the control discontinues the operation, providing the alarm state (alarm code "086" is displayed).
2. The modified offset value is made valid on and after the block that follows the block of M94 U ---; or M95 W ---;. For the notes for part program specification, refer to the YASNAC LX1 OPERATOR'S MANUAL.

14. 4. 44 SPINDLE INDEXING FUNCTION INPUT/ OUTPUT

This input/output is used perform the spindle indexing function which stops the spindle at the desired position by controlling the S4-digit analog output by the pulse from the spindle pulse generator.

(1) INPUT SIGNALS

· SID1 through SID12:

Binary 12-bit (0 to 4095) input signals to specify the spindle stop position. Each signal corresponds to the pulse (4096 pulses/rev) from the spindle pulse generator. Usually, the stop position corresponds to the number of pulses entered by SID1 to SID12 from C-phase pulse (1 pulse/rev) of the spindle pulse generator.

Note: Use of parameter SIDREF (#6342) enables the control to shift the stop position by the number of pulses set from C-phase pulse to this parameter.

· SIDX:

The input signal to request the control for a spindle indexing operation. When this input is closed in the wait state for completion of M, S, or T function, the control performs the spindle indexing operation.

In other states, the control does not perform this operation if this input is closed.

If this input is closed while the spindle is rotating, the speed command to perform indexing is outputted. When the spindle has reached the indexing speed, the spindle indexing operation is started.

After the completion of the indexing operation, the spindle speed command analog output remains a spindle positioning command unless this input is turned off even if the M, S, T function complete signal (FIN) goes on, thereby making the control continue the indexing operation.

· SIDXI and SIDXINC:

SIDXI (spindle indexing restart input) and SIDXINC (spindle stop position designate incremental input) are the inputs for the repetitive spindle indexing sequence. For details, refer to (6) INPUTS FOR SPINDLE INDEXING EXTENTION FUNCTION.

14. 4. 44 SPINDLE INDEXING FUNCTION INPUT/ OUTPUT (Cont'd)

(2) OUTPUT SIGNALS

· SIDXO:

This output goes on when the control is performing a spindle indexing operation (during the output of creep speed command or spindle positioning command).

· SIDXA:

This signal indicates the completion of a spindle indexing operation. It is on while the spindle position is in the range between the position set in parameter SIDRG (#6081) and the position designated by SID1 to SID12.

(3) SPINDLE INDEX TIME CHART

· Spindle index by M-code at spindle stop (Spindle positioning is released after spindle index is completed.) See Fig. 14.45.

· Spindle index by M code at spindle forward operation (Spindle positioning is continued until next spindle speed command after spindle index is completed.) See Fig. 14.46.

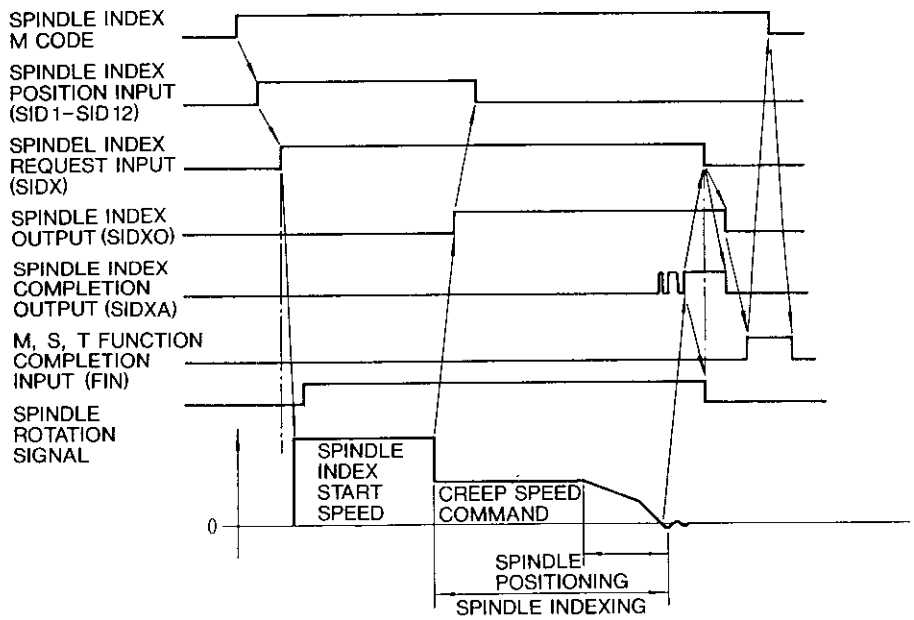


Fig. 14. 45

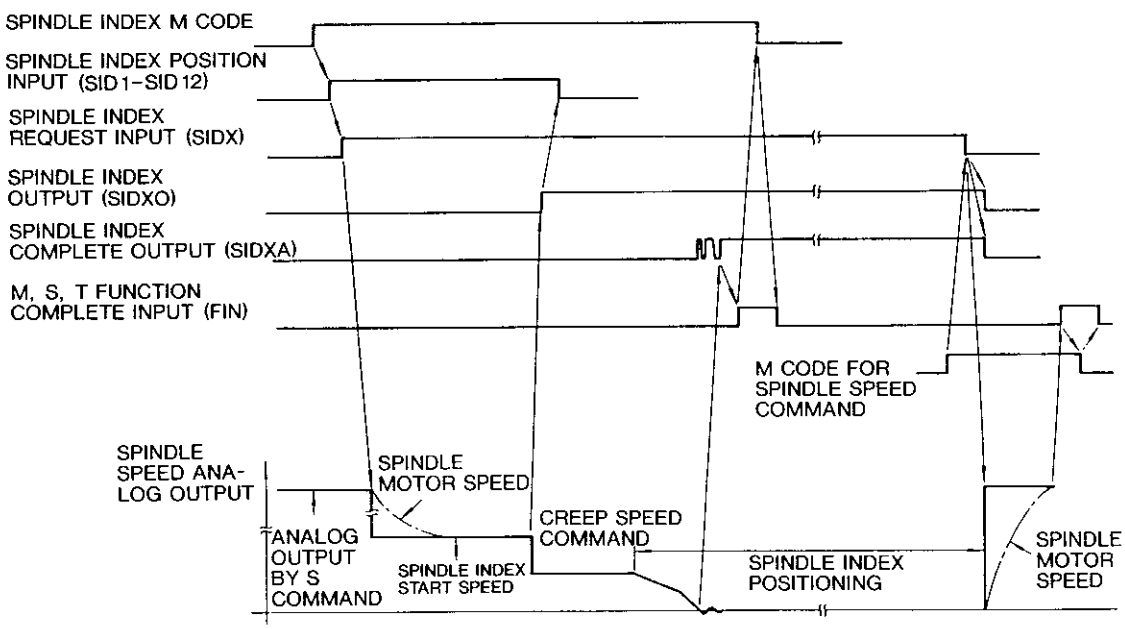


Fig. 14. 46

(4) PARAMETERS FOR SPINDLE INDEXING AND DETAILED SPINDLE INDEXING

Table 14.17

No.	Detailed Function of Spindle Indexing	Setting
#6081 (SIDRG)	Spindle index allowable angle range	1 = 1 pulse
#6083 (SIDGAN 1)	Spindle index command voltage gain No. 1	1 = 0.31 mV/pulse
#6084 (SIDGAN 2)	Spindle index command voltage gain No. 2	1 = 0.31 mV/pulse
#6085 (SIDSER)	Spindle index start speed deviation	$1 = \frac{\text{(Spindle index speed command)}}{100} \times \frac{1}{100}$
#6342 (SIDREF)	Spindle index reference point setting	1 = 1 pulse
#6343 (SIDRV 1)	Spindle index speed command	$1 = \frac{\text{(Max spindle motor speed)}}{100} \times \frac{0.0031}{100}$
#6344 (SIDCRP)	Spindle index creep speed	$1 = \frac{\text{(Max spindle motor speed)}}{100} \times \frac{0.0031}{100}$
#6345 (SIDCRS)	Spindle index creep speed start position	1 = 1 pulse
#6346 (SIDGEP)	Spindle index command voltage gain No. 2 start position	1 = 1 pulse

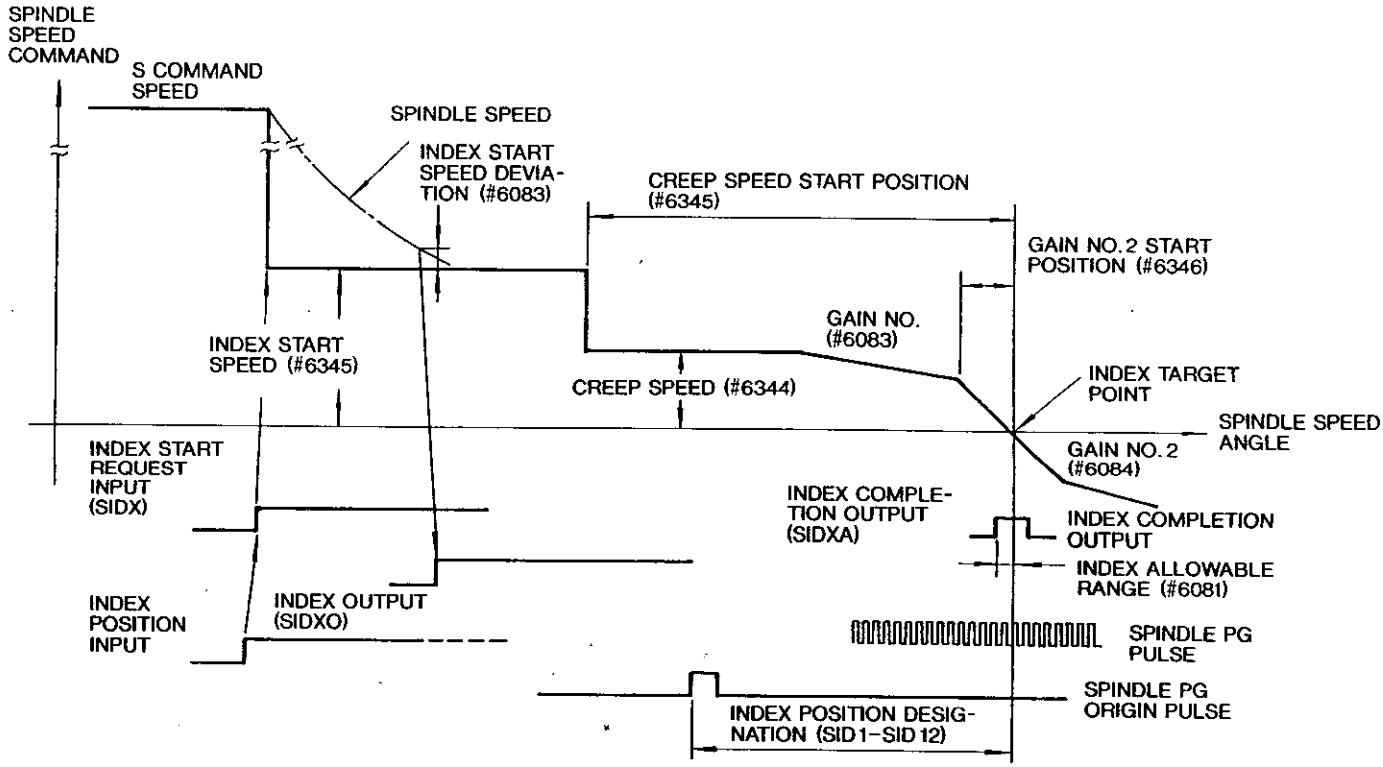
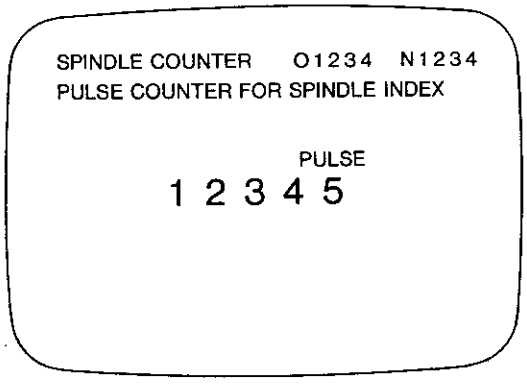


Fig. 14.47 Detailed Spindle Indexing

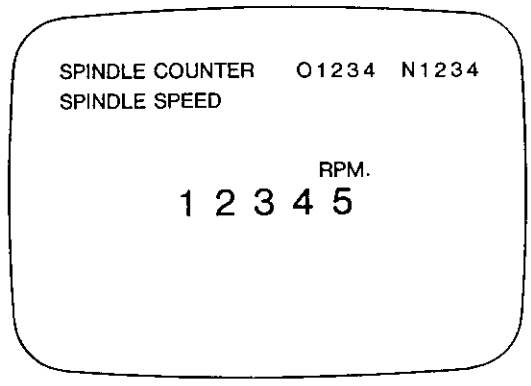
14. 4. 44 SPINDLE INDEXING FUNCTION INPUT/ OUTPUT (Cont'd)

(5) DISPLAY OF SPINDLE INDEXING FUNCTION

When the control contains the spindle indexing option, the following display is made under heading SPINDLE COUNTER on page 8 of the POSITION display on CRT screen:



- During a spindle indexing operation (SIDXO output is on), the number of pulses from the spindle pulse generator is displayed.
- When a spindle indexing operation is not performed (SIDXO output is off), the spindle speed (obtained by converting the number of pulses from the spindle pulse generator) is displayed.



(6) SPINDLE INDEXING EXTENSION FUNCTION INPUT

The control provides the following two inputs to process various spindle indexing sequence made available by application of the spindle indexing function described previously.

- SIDXI:

  Spindle indexing restart input. If this input is closed with Spindle Indexing On (SIDXO) output on, the control stops the spindle indexing operation and turns the SIDXO output off. While the indexing operation is discontinued, the spindle speed command analog output becomes the spindle indexing start speed command. When this input is turned off in this state, the control restarts the spindle indexing operation.

- SIDXING:

  Spindle indexing position incremental input. This input is used to designate an incremental position of the spindle indexing position input (SID1 to SID12) from its previously designated position.

  The use of this input enables the control to rotate the spindle from the current indexing position to the next indexing position without a full rotation. However, this input is invalid when the spindle indexing operation is first made after rotating the spindle in non-indexing operation or when the spindle indexing operation is first made after the power-on operation.

- Example of Spindle Indexing Time Chart using Spindle Indexing Extention Input:

  (i) Restart the spindle index if spindle index is not completed, the specified time after spindle indexing.

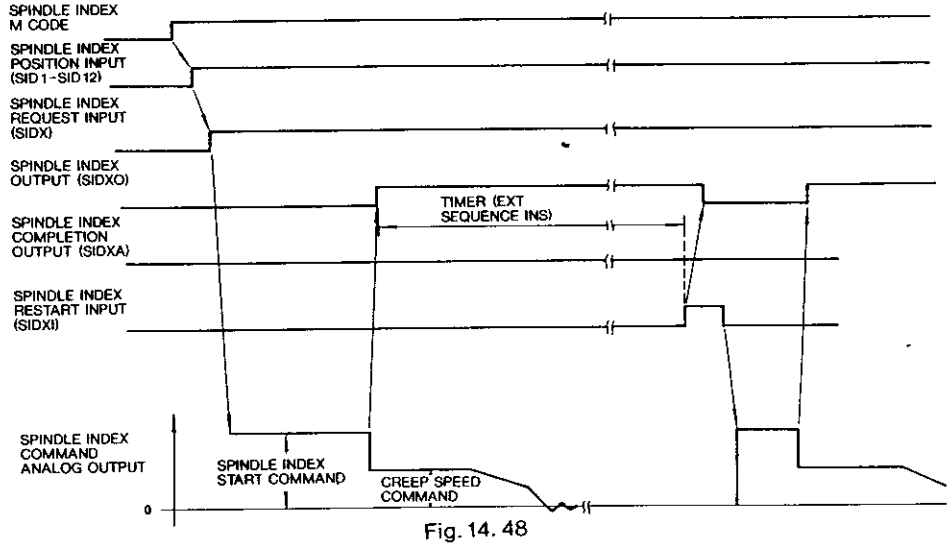


Fig. 14. 48

(ii) Spindle indexing at A position 180° from the indexed position after spindle indexing and mechanical clamp and machining. See Fig. 14.49.

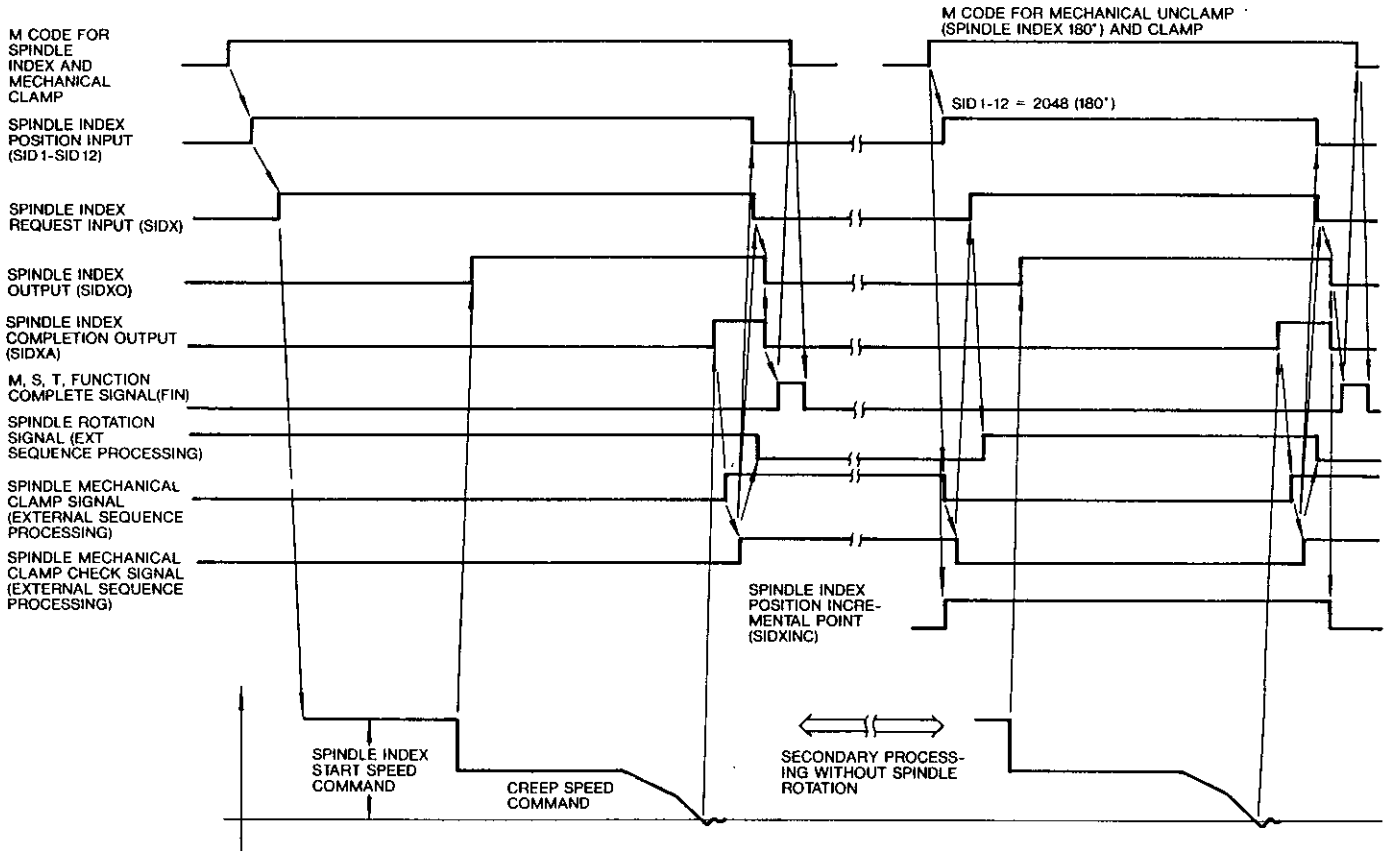


Fig. 14. 49

Note :

1. The spindle indexing function is available only when the control has the S command 4-digit analog output specification. The polarity of S 4-digit analog output should be externally determined by SINV input.
2. To make a spindle index from the spindle reverse rotating state, keep SINV input on while the spindle indexing request input (SIDX) is on.
3. When an incremental spindle indexing operation is performed by turning SPINDLE input on with SINV input being on, the direction of the increment specified by SID 1 to SID 12 is reversed.

14. 4. 45 STORED STROKE LIMIT 3 BY TOOL (TP1, TP2, TP4, TP8, TPS, TPSA1 AND TPSA2) INPUTS/ OUTPUTS

(1) Using the following input/output signals, this function sets a maximum of 15 types of stored stroke limit 3 as classified by tool. This is by the use of the external input:

- Tool number input --- TP1, TP2, TP4, and TP8
- Area change input --- TPS
- Area change complete input --- TPSA1 and TPSA2

(2) At the power-on, reset operation, or closing or TPS input, the control selects the stored stroke limit area as follows according to TP input:

14. 4. 45 STORED STROKE LIMIT 3 BY TOOL (TP1, TP2, TP4, TP8, TPS, TPSA1 AND TPSA2) INPUTS/ OUTPUTS (Cont'd)

Table 14. 18

Input State				Parameter No. Setting Area
TP1	TP2	TP4	TP8	
1	0	0	0	#6508-#6511
0	1	0	0	#6512-#6515
1	1	0	0	#6516-#6519
0	0	1	0	#6520-#6523
1	0	1	0	#6224-#6527
0	1	1	0	#6528-#6531
1	1	1	0	#6532-#6535
0	0	0	1	#6536-#6539
1	0	0	1	#6540-#6543
0	1	0	1	#6544-#6547
1	1	0	1	#6548-#6551
0	0	1	1	#6552-#6555
1	0	1	1	#6556-#6559
0	1	1	1	#6560-#6563
1	1	1	1	#6564-#6567

0: Input open, 1: Input close

(3) When the TPS input is closed, the control performs the area change, upon completion of which area change outputs TPSA1 and TPSA2 are closed.

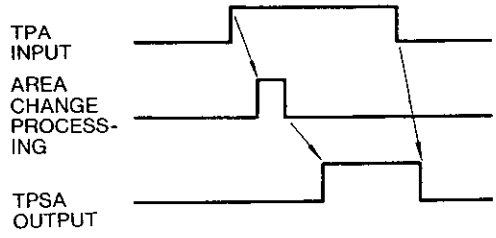


Fig. 14. 50

If the TPS input is turned on during the spindle shift in the auto or manual mode, the area change processing is not performed.

14. 4. 46 USER MACRO INPUT/OUTPUT FUNCTION

These inputs/outputs are used as system variables in user macro programs:

Table 14. 19

System Variables	Input	System Variables	Output
#1000	UI0	#1100	UO0
#1001	UI1	#1101	UO1
#1002	UI2	#1102	UO2
#1003	UI3	#1103	UO3
#1004	UI4	#1104	UO4
#1005	UI5	#1105	UO5
#1006	UI6	#1106	UO6
#1007	UI7	#1107	UO7
#1008	UI8	#1108	UO8
#1009	UI9	#1109	UO9
#1010	UI10	#1110	UO10
#1011	UI11	#1111	UO11
#1012	UI12	#1112	UO12
#1013	UI13	#1113	UO13
#1014	UI14	#1114	UO14
#1015	UI15	#1115	UO15

Input: UI0-UI15, Output: UO0-UO15

For practical uses, refer to YASNAC OPERATOR"S MANUAL ADDENDUM <USER MACRO>.

14. 4. 47 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 C

Search for a 4-digit program number.

b. External tool compensation C

Modification of a 4-digit tool offset.

c. External work coordinate system shift

There are following input signals:

- Data input --- ED0 through ED15.
- Data designation input --- EDSA through EDSD.
- Axis designation --- EDAS0 through EDAS2.
- Data request input --- EDCL.

The details of these input signals are as shown below:

Table 14. 20

Item / Signal Name	External Work No. Search C	External Tool Compensation C
ED0	Program No. No. of 1-digit (BCD code)	Compensation amount No. of 1-digit (BCD code)
ED1		
ED2		
ED3		
ED4	No. of 10-digit	No. of 10-digit
ED5		
ED6		
ED7		
ED8	No. of 100-digit	No. of 100-digit
ED9		
ED10		
ED11	No. of 1000-digit	No. of 1000-digit (0 to 7)
ED12		
ED13		
ED14		
ED15		Sign 0: plus, 1: minus
EDSA	1	0
EDSB	0	1
EDSC	0	0
EDSD	0	0
EDAS0	0 or 1	Axis designation 0: X, 1: Z
EDAS1	0 or 1	0
EDAS2	0 or 1	0: Incremental 1: Absolute
EDCL	Data read-in request	

0: Input open, 1: Input closed

There are the following output signals:

- External data input complete --- EREND
- External data search complete --- ESEND

(2) EXTERNAL WORK NUMBER SEARCH C

This function searches for the part program of a 4-digit program number designated by the input signal ED0 to ED15. The timing of signal transfer is as follows:

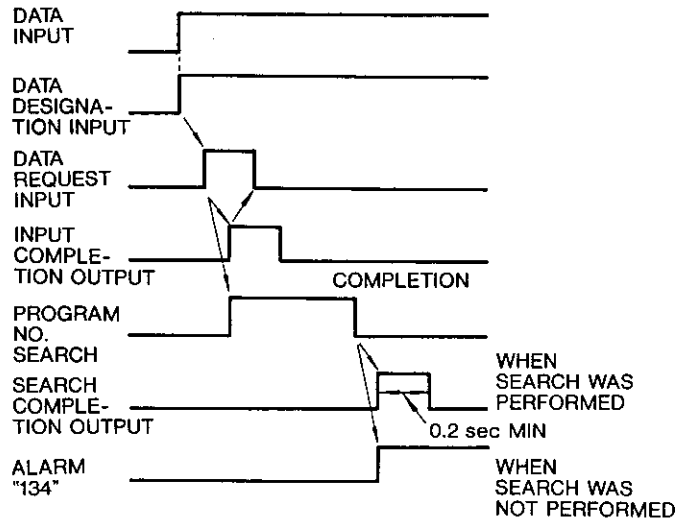


Fig. 14. 51

- EDCL input is detected by the 8 msec scan.
- When EDCL goes on, EREND is outputted within 8 msec, starting the search for the part program of the designated program number.
- If the desired program has been found, ESEND is outputted for more than 200 msec. However, this signal is not outputted when the Reset On output is on. It is outputted only when this output is turned off.
- If the desired program has not been found, error "134" is caused and ESEND is not outputted.

NOTE

This external work number search function is valid only in the memory mode and the label skip state. In any other conditions, EDCL input is invalid.

(3) EXTERNAL TOOL COMPENSATION C

This function adds or replaces the tool offset (0 to ±7.999 mm or 0 to ±0.7999 in.) designated by input ED0 to ED15 to or with the currently designated tool offset memory value. When EDAS2 is "0," addition is made; when it is "1," replacement is made. The timing of signal transfer is as shown below:

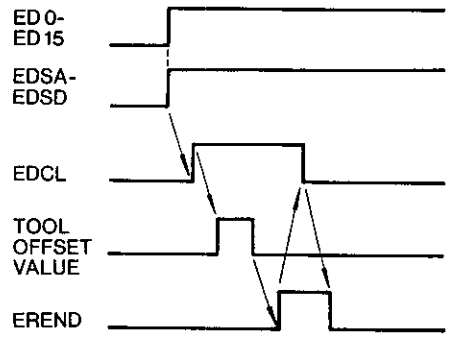


Fig. 14. 52

- EDCL input is detected by the 8 msec scan.
- The tool offset number to be rewritten is the currently designated tool offset number. At the time of single block stop, the contents of the tool offset number of the terminated block are rewritten.

(4) EXTERNAL WORK COORDINATE SYSTEM SHIFT

When the currently designated tool offset number is "00" in the external tool compensation C, this function adds or replaces the value (0 to ±7.999 mm or 0 to 0.7999 in.) designated by input ED0 to ED15 to or with the work coordinate system memory value. When EDAS2 is "0," addition is made; when it is "1," replacement is made. The timing of signal transfer is the same as with the external tool compensation C.

Generally, the external tool compensation C and external work coordinate system shift functions must be activated by specifying a given M code in an appropriate location on the part program and turning on the date request input EDCL by that M code.

14. 4. 48 TOOL LIFE CONTROL (TLA 11 THROUGH TLA 18, TLA 21, TLTM, TLSKP, TLRST, TLCH 1 AND TLCH 2) INPUTS/OUTPUTS

The tool life control function enters the following into the control: the information on tool life (how long a tool is serviceable or how many workpieces a tool can cut), the tool numbers of tool groups of the same type and the compensation numbers to be used. This makes it possible, by simply specifying the T code for tool life control in the part program, for the control to control that T code according to the machining time and the number of workpieces entered.

Described here are only the signals associated with this function. For the program and other information, refer to "YASNAC LX2 OPERATOR'S MANUAL."

14. 4. 48 TOOL LIFE CONTROL (TLA11 THROUGH TLA18, TLA21, TLTM, TLSKP, TLRST, TLCH1 AND TLCH2) INPUTS/OUTPUTS (Cont'd)

This function uses the following inputs/outputs:

- Tool replacement completion tool group number inputs --- TLA11, TLA12, TLA14, TLA18, and TLA21.
- Tool skip input --- TLSKP.
- Tool replacement request outputs --- TLCH1 and TLCH2.

It is also needed to make a registration of the following information through the program tape or operator's panel MDI operation:

Registration of Tool Groups

Table 14. 21

Setting Number	Registration
#8601	Tool group number tool number "01." Setting 1 to 19.
⋮	⋮
#8650	Tool group number of tool number "50." Setting value 1 to 19.

Registration of Tool Life

Table 14. 22

Setting Number	Registration
#6161	Life of tool group "01."
⋮	⋮
#6169	Life of tool group "09." Machining count setting : 1 = once.
#6170	Life of tool group "10."
⋮	⋮
#6179	Life of tool group "19." Machining time setting : 1 = 1 min.

In addition, there are settings for registering compensation numbers and other information. Since they have no relation to the input/output, the explanation is omitted.

(1) TOOL REPLACEMENT COMPLETE TOOL GROUP NUMBER INPUTS (TLA11, TLA12, TLA14, TLA18, AND TLA21) AND TOOL REPLACEMENT COMPLETE INPUT (TLRST)

These inputs inform the control of the completion of tool replacement after the replacement of the tools of the group number whose life has terminated.

Set the tool group number of tool replacement complete to TLA11, TLA12, TLA14, TLA18, and TLA21 according to the table below, and close TLRST input.

When the replacement of the tools of the group number whose life has terminated is all completed, tool replacement request outputs TLCH1 and TLCH2 are opened.

Table 14. 23

TLA 11 Input	TLA 12 Input	TLA 14 Input	TLA 18 Input	TLA 21 Input	Tool Change Completion Group No.
1	0	0	0	0	01
0	1	0	0	0	02
1	1	0	0	0	03
0	0	1	0	0	04
1	0	1	0	0	05
0	1	1	0	0	06
1	1	1	0	0	07
0	0	0	1	0	08
1	0	0	1	0	09
0	0	0	0	1	10
1	0	0	0	1	11
0	1	0	0	1	12
1	1	0	0	1	13
0	0	1	0	1	14
1	0	1	0	1	15
0	1	1	0	1	16
1	1	1	0	1	17
0	0	0	1	1	18
1	0	0	1	1	19

(2) TOOL SKIP INPUT (TLSKP)

This input is used to replace registered tools before their service lives terminate.

When TLSKP input is closed in the automatic feedhold state (STL and SPL outputs are open), the processing that the service life of the currently used tool has terminated is performed within the controller. Then, the new tool is specified by the following T command.

(3) TOOL REPLACEMENT REQUEST OUTPUTS (TLCH1 AND TLCH2)

When a program end or reset operation is performed after the termination of the service lives of all registered tools belonging to a tool group number, TLCH1 and TLCH2 are closed.

When these outputs are closed, make sure of the tool group number which is being displayed on the CRT screen and replace the tools.

NOTE

When TLCH1 and TLCH2 are closed, the automatic activation in the automatic operation mode is disabled.

14. 4. 49 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:
#6568 --- X-axis coordinate value
#6569 --- Z-axis coordinate value

NOTE

1. The block of G31 command moves in the same way as G01. If parameter SKPFED (#6019, D4) is set to "1," the feed rate which is not specified in the part program but is set to parameter G31F (#6232) is provided.
2. If SKIP input is not closed after the completion of the block of G31 command, the following operation takes place:

- When setting SKIPIN (#6004, D0) is set to "0," the following block is executed.
- When setting SKIPIN (#6004, D0) is set to "1," the alarm state (alarm code "087") is generated.

14. 4. 50 TOOL SET ERROR COMPENSATION (XAE AND ZAE) INPUTS

When XAE/ZAE input is closed during the execution of X/Z axis move command by G35 in the automatic operation mode, the control immediately discontinues the movement. Then, using the coordinate value where XAE/ZAE input changed from open to close, the control performs the following computation to change the X/Z value of the specified offset memory number.

(1) X-AXIS MOVE COMMAND BY G35

(New X-axis offset) = (the coordinate value where XAE input changed from open to close) − (the value set to parameter #6624)

(2) Z-AXIS MOVE COMMAND BY G35

(New Z-axis offset) = (the coordinate value where ZAE input changed from open to close) − (the value set to parameter #6625)

When the above processing is completed, the control returns to the start point of G35 command in rapid traverse to complete it.

For the details of the operation and program of tool set error compensation command (G35), refer to "2.8.18 Tool Set error Compensation (G35) in YASNAC LX1 OPERATOR'S MANUAL.

14. 4. 51 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.

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.

14. 4. 52 COMBINED FIXED CYCLE CUTTING OVERRIDE (COV 1, COV 2, COV 4, COV 8, AND COV 16) INPUTS

These inputs are used to override the cut depth of the stock removal cycle specified by G71 and G72. According to the state of these inputs, an override is applied to the cut depth specified in "D."

Table 14. 24

Input					Override (%)
COV 1	COV 2	COV 4	COV 8	COV 16	
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	0	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

0 : Input open, 1 : Input close

Note : To use these inputs, parameter COVP (#6023, bit 2) must be set to "1."

14. 4. 53 TOOL WEAR COMPENSATION (WOP AND WOM) INPUTS

These inputs are used to determine whether to change the offset amount in the offset memory number specified in "ΔΔ" of the tool wear compensation (T90ΔΔ;) command.

If WOP/WOM input is closed at the execution of T90ΔΔ; command, the value set to offset memory numbers 81 to 99 according to the table below is added to or subtracted from the offset amount of the offset memory number specified in "ΔΔ."

14. 4. 53 TOOL WEAR COMPENSATION (WOP AND WOM) INPUTS (Cont'd)

Table 14. 25

Offset Memory No. Specified by "△△"	Offset Memory No. Added to or Subtracted from
01	81
02	82
03	83
04	84
05	85
06	86
07	87
08	88
09	89
10	90
11	91
12	92
13	93
14	94
15	95
16	96
17	97
18	98
19	99

Example

If WOP input is closed at the execution of T9001; command, the offset amount of tool offset memory number "01" is obtained from the following relation:

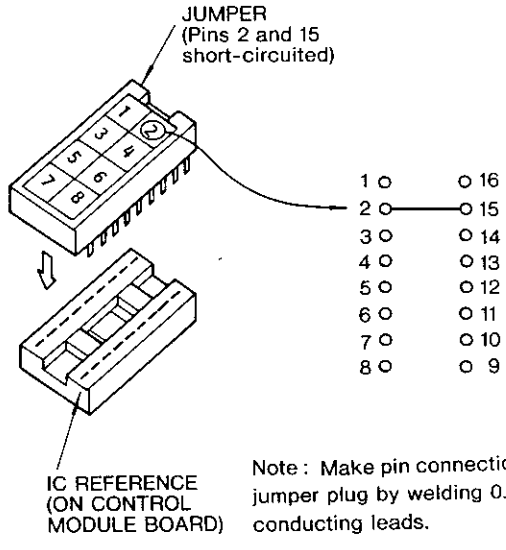
(X/Z axis offset amount of tool offset memory number 01) = (X/Z axis offset amount of tool offset memory number 01) + (X/Z axis setting value of offset memory number 81)

This function is valid when performing a tool wear compensation using the results of work dimension measurement with an external measuring equipment.

If the change of tool offset amount by these inputs is not in time for the machining of the subsequent workpiece (in such a system in which there is a stock work between machining and work dimension measurement, for example), set parameter #6023 D4 (WOPMCT) to "1." After this setting, if WOP or WOM input is closed twice consecutively for the same tool offset memory number, the change of tool offset memory is not performed for the second closing.

APPENDIX CONTROL MODULE PARAMETERS

The control modules (chiefly implemented on printed circuit boards) used on the YASNAC LX2 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

$\overline{CP}$ (LOCATION : 2F)

1 O—O 16 ← FIRST HANDLE PG +12 V SELECT (STANDARD)
2 O—O 15 ← FIRST HANDLE PG +5 V SELECT
3 O O 14
4 O O 13
5 O O 12
6 O O 11
7 O O 10
8 O O 9

(2) MODULE PARAMETERS FOR SERVO CPU MODULE (JANCD-CP04)

CP (LOCATION : 3L)

1 O—O 16 ← X-AXIS PG +12 V SELECT
2 O—O 15 ← X-AXIS PG +5 V SELECT (STANDARD)
3 O—O 14 ← Z-AXIS PG +12 V SELECT
4 O—O 13 ← Z-AXIS PG +5 V SELECT (STANDARD)
5 O O 12

6 o—o 11 ← NEAR ZERO SIGNAL FOR REFERENCE POINT RETURN +12 V PULL-UP SELECT
7 o—o 10 ← NEAR ZERO SIGNAL FOR REFERENCE POINT RETURN +24 V PULL-UP SELECT
8 o—o 9 ← NEAR ZERO SIGNAL FOR REFERENCE POINT RETURN 0 V PULL-UP SELECT

CR (LOCATION : 2 R)

1 o—o 16 ← SECOND HANDLE PG +12 V SELECT (STANDARD)
2 o—o 15 ← SECOND HANDLE PG +5 V SELECT
3 o o 14
4 o o 13
5 o o 12
6 o o 11
7 o o 10
8 o o 9

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

CD (LOCATION : 40 H)

1 o—o 16 ← MODULE 1 SELECT (IO11)
2 o—o 15 ← MODULE 2 SELECT (IO12)
3 o—o 14 ← MODULE 3 SELECT
4 o—o 13 ← MODULE 4 SELECT
5 o o 12
6 o o 11
7 o o 10
8 o o 19

(Selects I/O module. See Notes 1 and 3 on page 60)

CE (LOCATION : 15 A)

1 o—o 16 ← 13 TH INPUT PORT IN THE MODULE +24 V COMMON SELECT (STANDARD)
2 o—o 15 ← 13 TH INPUT PORT IN THE MODULE 0 V COMMON SELECT
3 o—o 14 ← 14 TH INPUT PORT IN THE MODULE +24 V COMMON SELECT (STANDARD)
4 o—o 13 ← 14 TH INPUT PORT IN THE MODULE 0 V COMMON SELECT
5 o o 12
6 o o 11
7 o o 10
8 o o 9

(See Note 6.)

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

CD (LOCATION : 5 E)

1 o—o 16 ← AREA 0-2 SELECT
2 o—o 15 ← AREA 1-1 SELECT
3 o—o 14 ← AREA 1-2 SELECT
4 o—o 13 ← AREA 2-1 SELECT
5 o—o 12 ← AREA 2-2 SELECT
6 o—o 11 ← AREA 3-1 SELECT
7 o—o 10 ← AREA 3-2 SELECT
8 o o 9

(See Notes 1 and 4.)

CE (LOCATION : 7 A)

1 o—o 16 ← 7 TH INPUT PORT IN THE AREA +24 V COMMON SELECT
2 o—o 15 ← 7 TH INPUT PORT IN THE AREA 0 V COMMON SELECT
3 o—o 14 ← 8 TH INPUT PORT IN THE AREA +24 V COMMON SELECT
4 o—o 13 ← 8 TH INPUT PORT IN THE AREA 0 V COMMON SELECT
5 o o 12
6 o o 11
7 o o 10
8 o o 9

(See Note 7.)

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

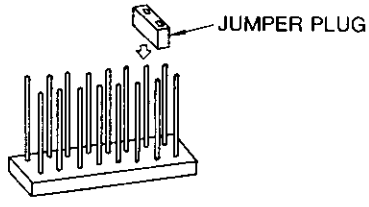
CE (LOCATION : 11 D)

1 o—o 16 ← AREA 0-1 SELECT (STANDARD)
2 o—o 15 ← AREA 0-2 SELECT
3 o o 14
4 o o 13
5 o o 12
6 o o 11
7 o o 10
8 o o 9

(See Note 2.)

(6) MODULE PARAMETER OF THE MEMORY MODULE (JANCD-MM09)

The parameter setting unit of the memory module differs slightly in shape from that of other modules and is as shown in Fig. below.



Module Parameter Setting Unit of the Memory Module

CF (LOCATION : 19E)

1 o o 16
2 o o 15
3 o—o 14 ← NC OPERATOR'S PANEL SELECTION WITH 9" CRT
4 o o 13
5 o o 12
6 o o 11
7 o o 10
8 o—o 9 ← NC OPERATOR'S PANEL SELECTION WITH 14" CRT

Select either of the above NC operator's panels by means of the jumper plug.

APPENDIX CONTROL MODULE PARAMETERS (Cont'd)

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, each divided into area □-1 and □-2.

Input Port				Output Port			
JANCD-IO 01 B		JANCD-IO 02		JANCD-IO 01 B		JANCD-IO 02	
Module No.	Address Port	Area No.	Address Port	Module No.	Address Port	Area No.	Address Port
0		0-1		0		0-1	
		0-2				0-2	
1	#1000 to #1010	1-1	#1000 to #1007	1	#1100 to #1107	1-1	#1100 to #1103
		1-2	#1008 to #1015			1-2	#1108 to #1111
2	#1016 to #1029	2-1	#1016 to #1023	2	#1116 to #1123	2-1	#1116 to #1119
		2-2	#1024 to #1031			2-2	#1124 to #1127
3	#1032 to #1045	3-1	#1032 to #1039	3	#1132 to #1139	3-1	#1132 to #1135
		3-2	#1040 to #1047			3-2	#1140 to #1147
4	#1048 to #1061			4	#1148 to #1155		

2. MDI module SP 01 needs an address space which is a half of the address space needed by one module and may select either area 0-1 (standard) or area 0-2.
3. Standard gencral-purpose input/output module IO 01B needs an address space for one module and may select one of the module 1 through module 4. Hence, for IO 01B alone, only a maximum of tour boards may be installed.
4. Mini general-purpose input/output module IO 02 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 IO 01 Bs and IO 02s, the above area must be so allocated that they do not overlap each other. Area 0-2 may be selected by IO 02 ; generally, however, area 0-2 is reserved for special purpose.
5. When IO 01B is used, input ports 13 and 14 (5th and 6th of area −2) of each module allow the change-over of +24 V common or 0 V common.
6. When IO 02 is used, the 7th and 8th input ports of the area allow the change-over of +24 V common or 0 V common.
7. When 0 V common is selected, input signal status is reversed (0→1, 1→0). Consider this for designing sequence ladder.

MEMO

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