T0397

CNC SYSTEMS

OSP 500L-G
OSP 5020L

LB Series, LNC 8 CNC Lathes

MAINTENANCE MANUAL

OKUMA

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Note: To avoid any confusion over the use of the letter "O(oh)" and the figure "Ø(zero)" in this manual, the numerical value "Ø(zero)" is expressed as "Ø" if there is any possibility of misunderstanding.

SECTION 1 SPECIAL FEATURES OF OSP5ØØ/OSP5Ø2Ø SERIES

Based on the OSP series that has an outstanding production record as a CNC all over the world, the OSP5ØØ/OSP5ØØØ series is a high performance computerized numerical control system that functions as an Intelligent Manufacturing Cell (IMC) forming an operator unattended production system.

(1) A multiprocessor CNC system

The OSP5ØØL-G/OSP5Ø2ØL is a multiprocessor CNC system using plural high-performance microprocessors, and features architectures capable of coping of high level NC functions.

(2) Versatility

Through distributed processing by the multiprocessor, the OSP5ØØL-G/OSP5Ø2ØL provides versatile functions not available on existing NCs, such as alarm monitor data processing, link with high level computers, advanced online automatic programming function, and large capacity part program storage. This CNC is complete also with functions such as diagnostics and operation guides, display of alarm data and display of production control information, by means of the CRT.

(3) Tremendously Expandable, Never Obsolete

The computer software is stored in the bubble memory. Therefore, it is easy to change the software, enabling any addition and alteration of functions in the future, and this OSP5ØØL-G/OSP5Ø2ØL can be used always as a most up-to-date system ready to meet the customer's application needs.

(4) High Reliability

High reliability is ensured by various kinds of functions such as automatic memory error correction, perfect noise isolation by a photocoupler, high integration of hybrid ICs and LSIs, etc., reduced consumption power and thorough monitoring of CPU power supply, and by a simple structure mounted in the totally enclosed cabinet.

(5) Uniquely Designed for Easy Operation

Since a CRT is provided as standard on an operation panel, it is exceedingly easy to operate.

SECTION 2 SUMMARY OF OPERATION

The OSP5ØØL-G/OSP5Ø2ØL employs a closed loop system with absolute position feedback. The following is a brief summary of its operation:

The value (command value) which is read into the CNC in the form of taped commands generates path functions (operation value, RCON) within the CNC to produce a commanded tool path at the commanded feedrate.

Meanwhile, the OSP position encoder detects actual position signals (RAPA) of each axis. This RCON and RAPA are continuously compared, the difference (DIFF) between RCON and RAPA is added to the feedrate command and the result is input to the drive unit as motor drive current command (digital value). The drive unit controls the brushless servo motor so that value DIFF will be zeroed.

For details, refer to Section 4-3, "Operation and Structure of the NC".

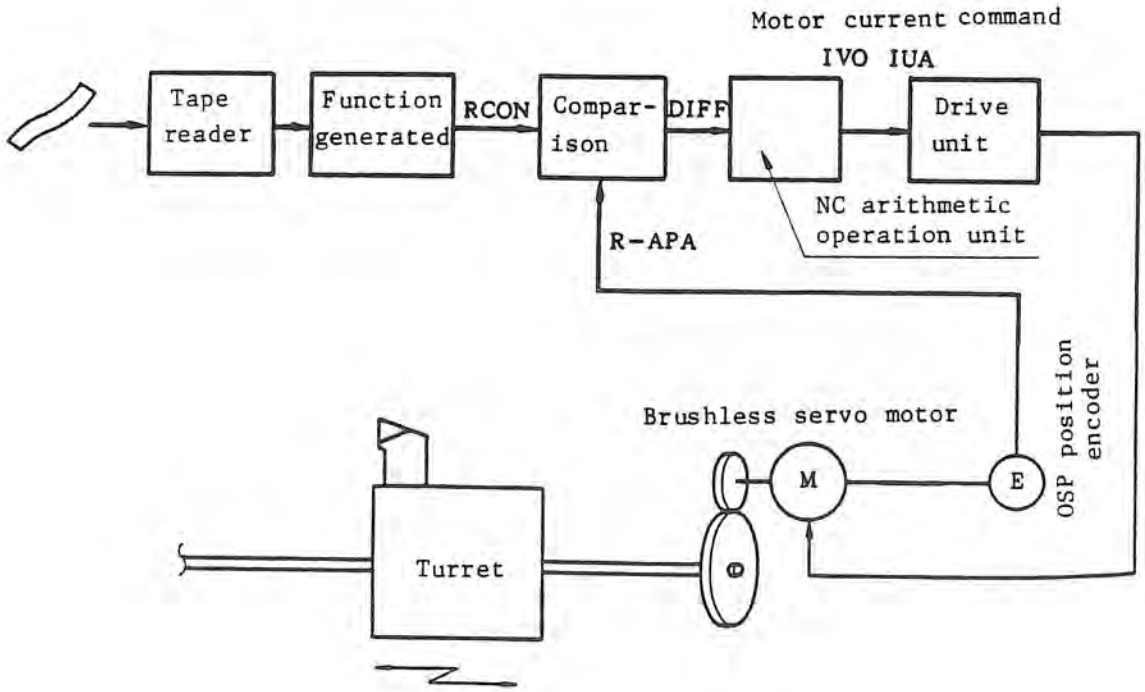


Fig. 2-1 Operation of OSP5ØØL-G/OSP5ØØØL-G

SECTION 3 STRUCTURE OF OSP5ØØL-G/OSP5Ø2ØL

This section outlines the overall structure of the OSP5ØØL-G/ OSP5Ø2ØL . For further information, consult the following sections of this manual.

Section 4-3: Operation and Structure of the NC
Section 5 : Trouble and Troubleshooting

3-1. CPU UNIT

This is the heart of the CNC system and consists of the following printed circuit board modules and units:

See Fig. 5-9.

*Printed Circuit Board

MAIN BOARD-IIB
MAIN CARD 11
MAIN CARD 13
BUBBLE CARD

CRP Board-IIC or CRP Board-9 (Note 1)

SERVO PROCESSOR BOARD-IID ...Axis control processor

EC BOARD ..... EC input/output

The parts listed above are for standard system specifications. For optional specifications, printed circuit boards for selected functions will be added.

Note 1:

Standard specification of OSP5ØØL-G:

CRP 9

Graphic Specification of OSP5ØØL-G:

CRP BOARD-IIC is used instead of CRP 9.

*Power Supply Unit

This supplies all the power required for CPU operations.

3-2. SERVO DRIVE UNIT

The servo drive unit receives motor current command (digital value) outputted from the CPU to control brushless servo motors which drive X- and Z-axis. This accurately controls movements of the turret in accordance with the programmed commands.

The servo drive unit consists of the following units:

a) DC power supply

Supplies DC power to the brushless motors.

b) Servo amplifier unit

Controls brushless servo motors in response to the command input from the CPU.

3-3. RELAY AND MAGNET SWITCH CIRCUITS

These circuits are used to control machine-mounted solenoids, electric motors, etc., and also conveys signals from machine-mounted pushbutton switches and limit switches to the CPU.

The following panels are provided:

PS Panel ..... Panel with magnet switches
RUP Panel .... Panel with control relays
PT Panel ..... Power supply

3-4. VAC SPINDLE DRIVE MOTOR CONTROL

LB series CNC lathes use a VAC spindle drive motor.

The control unit receives speed command signals given from the CPU, in the form of analog voltage, and controls the motor speed to the commanded speed.

3-5. CONTROL ENCLOSURE

Arranged in a single enclosure are the CPU, drive units, relay and magnet switch circuits, spindle motor drive unit and others.

The totally enclosed construction provides reliable protection against the entry of oil mist, chips, dust and dirt, ensuring stable performance of semiconductors, relays and magnetic switches.

Mounted on the common machine base, this space-saving CNC package forms a compact machine-control combination.

3-6. OPERATION PANEL

All the controls necessary for operating the machine such as operating switches, manual switches and the pulse handle are incorporated into and mounted to this accessible pendant-type operation panel. A large-sized CRT is provided as standard, assuring ease of operation.

3-7. ABSOLUTE POSITION FEEDBACK ENCODERS

To each servomotor for the X- and Z-axis, the absolute position feedback encoder that produces accurate information concerning the instantaneous position of each axis is provided. The output signals from these encoders are fed into the CNC system for accurate positioning of each axis.

Attached to the main spindle is a main spindle pulse generator to detect the spindle speed.

3-8. COOLING UNIT

The cooling unit provided above or at the side of the control box keeps the temperature inside the control enclosure virtually at room temperature level. This provides the CNC system with higher reliability.

SECTION 4 MAINTENANCE AND INSPECTION

Daily checks greatly help to keep your CNC operating properly at all times. When any trouble occurs, integrated testing circuits within the CNC system will help you diagnose most malfunctions and pinpoint their location quickly, thus enabling you to reset to normal operation with little inconvenience.

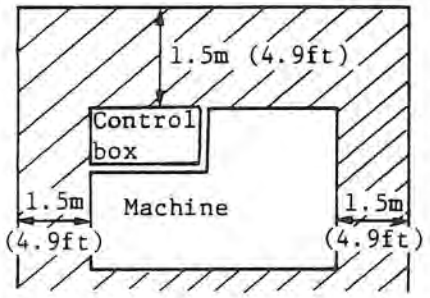
Consult also the following section:

Section 5 Trouble and Troubleshooting

4-1. INSPECTION DURING INSTALLATION

4-1-1. Installation Site

During initial installation, careful consideration should be given to easy access for inspection and maintenance purposes as well as for operation.



Arrange the machine and the machine control unit as shown in the left figure.

Since the machine control unit doors must be opened and some space must be given for maintenance and inspection, install the machine and the machine control unit so that they are not close to a wall.

Fig. 4-1 Layout

4-1-2. Environmental Requirements

Pay attention to the following items:

(1) Do not install the CNC system in a place exposed to direct sunlight.

(2) The CNC system should be kept away from chips, coolant, oil, etc.

(3) The site should be free of excessive vibration.

(4) Ambient temperature should be between 0°C and 40°C.

(5) The site should be free of large electrical noise sources such as welding machines. (Power should be preferably drawn from the plant power source.)

(6) Avoid dirty and dusty areas.

4-1-3. Power Supply Voltage Inspection

The allowable variance in the input voltage for the CNC system is +10%,-15% of the available input voltage. An excessive voltage drop because of insufficient power capacity in the plant will cause NC malfunctions. It will also be subject to unavoidable influence from other equipment. In such cases, proper measures should sometimes be taken against those sources.

4-2. PERIODICAL INSPECTION

The CNC system incorporates highly advanced electronic circuits which are susceptible to moisture, oil, dirt, dust, and chips present in machine shops. Elevated temperatures within the enclosure may result from clogging of filters in the cooling unit.

(1) Weekly Inspection

Tape Reader Light Receiving Surface:

Keep the light receiving glass surface clean at all times.

Clean carefully with gauze or soft cloth so as not to scratch it.

Perforated Tape Inspection:

Dirty, torn or worn out paper tape from excessive use may lead to NC malfunctions and troubles.

Tape Reader Projector Lens Cleaning:

Remove the front cover of the tape reader, and carefully clean the projector and lens with soft cloth so as not to scratch them.

(2) Every Three Months Inspection

Cooling Unit Cleaning:

Make sure that the cooling unit on the control box operates to blow air hard. If the filter mesh screens are clogged, clean.

4-3. OPERATION AND STRUCTURE OF THE NC

To gain an overall understanding of CNC operations, study the following carefully:

4-3-1. Example of Operation

When G01 X100.000 F0.1 S300 T0101 M03 CR is given as command data, the unit operates as follows:

(1) Press the CYCLE START button, and the CPU starts running according to the command data stored in memory.

(2) S, T, and M operation starts.

The S, T, M commands read are transferred to the EC relay circuit via the EC board.

The spindle rotation command is converted into the motor speed command, which is then converted into analog voltage on the TIMING CONTROL board. The analog voltage is outputted to the spindle drive motor control unit.

Thus, the spindle starts rotating in the forward direction at 300 rpm. The turret is indexed to select the #1 tool.

After these S, T and M commands have been executed and the commanded states are established, the execution completion signals are given to the CPU.

(3) Operation of Interpolator

After the completion of execution of S, T and M commands, cutting can be started. Therefore, axis movement commands now may be started. Pulse signals from the pulse generator coupled with the spindle is read through the TIMING CONTROL board and functions are generated at the feedrate of F0.1 mm/rev (0.004 ipr) from a present coordinate point to the commanded coordinate point (X100.000) along a G01 straight-line path.

(4) Movement of Axes

R-CON the output from the interpolator is compared with the actual position data R-APA given from the position encoder. The difference DIFF between R-CON and R-APA is converted into the motor current value (digital value) and the result is outputted from the servo processor to the servo drive.

The servo drive unit controls the brushless servo motor so that the DIFF input will be zeroed at all times, and as a result, R-CON and R-APA are matched, and positioning to X100.000 is completed.

4-3-2. Description on Each Major NC Unit

(1) The Power Supply Unit receives AC 22ØV supply and supplies all the power required for operation of the CPU. It also controls the sequence for power supply ON/OFF. Press the CONTROL ON button on the operation panel, and the Power Supply Unit supplies first voltage to the CPU and drives the CPU. Press the CONTROL OFF button, and this unit cuts off voltage supply to the CPU after stopping CPU operation. Moreover, this unit detects abnormalities such as abnormal drop and rise of output voltage, abnormal drop of input voltage, and elevated temperature within the unit, etc., causes the CPU to stop the operation, cuts off voltage supply and has a monitor function to display the cause of an abnormality on the monitor display. The monitor display is effective even if supply voltage to the CPU is cut off by pressing the CONTROL OFF button on the operation panel, unless power supply to the CNC system is cut off by turning off the main switch (no-fuse circuit breaker).

(2) The CPU Unit is the central controller of the OPS5ØØL-G/ OSP52ØL and of the multi-processor structure consisting of plural processors.

The standard unit consists of five BOARDs and CARDs annexed to the BOARDs as follows:

a) MAIN BOARD-IIB: Main Processor Board

This consists of the main processor which controls the IC memories, bubble memory, slave processors and interface circuits, and IC memories which store the control software for controlling the processor. The control software stored in IC memories is transferred to the bubble memory when power is turned on.

BUBBLE CARD: Bubble Memory

This is a memory to store taped commands, and control software when power is switched OFF. The operation of writing the control software into the bubble memory is called "loading". Such control software is supplied in floppy disks with all NC system.

When loading is carried out according to the "Loading" procedure in Section 5-6-3, if required, the contents of the bubble memory can be rewritten.

MAIN CARD 13: PUNCHER

The circuit interfacing the paper tape puncher

b) CRP Board-IIC or CRP Board-9: PANEL

The circuit interfacing the operation panel.

c) SERVO PROCESSOR BOARD-IID

The circuits interfacing the position encoder, the sensor input, the servo drive unit and position encoder, and the circuit interfacing the measuring devices.

d) EC BOARD: EC input/output

The circuits interfacing the power relays, magnet switches, solenoid valves and limit switches, etc.

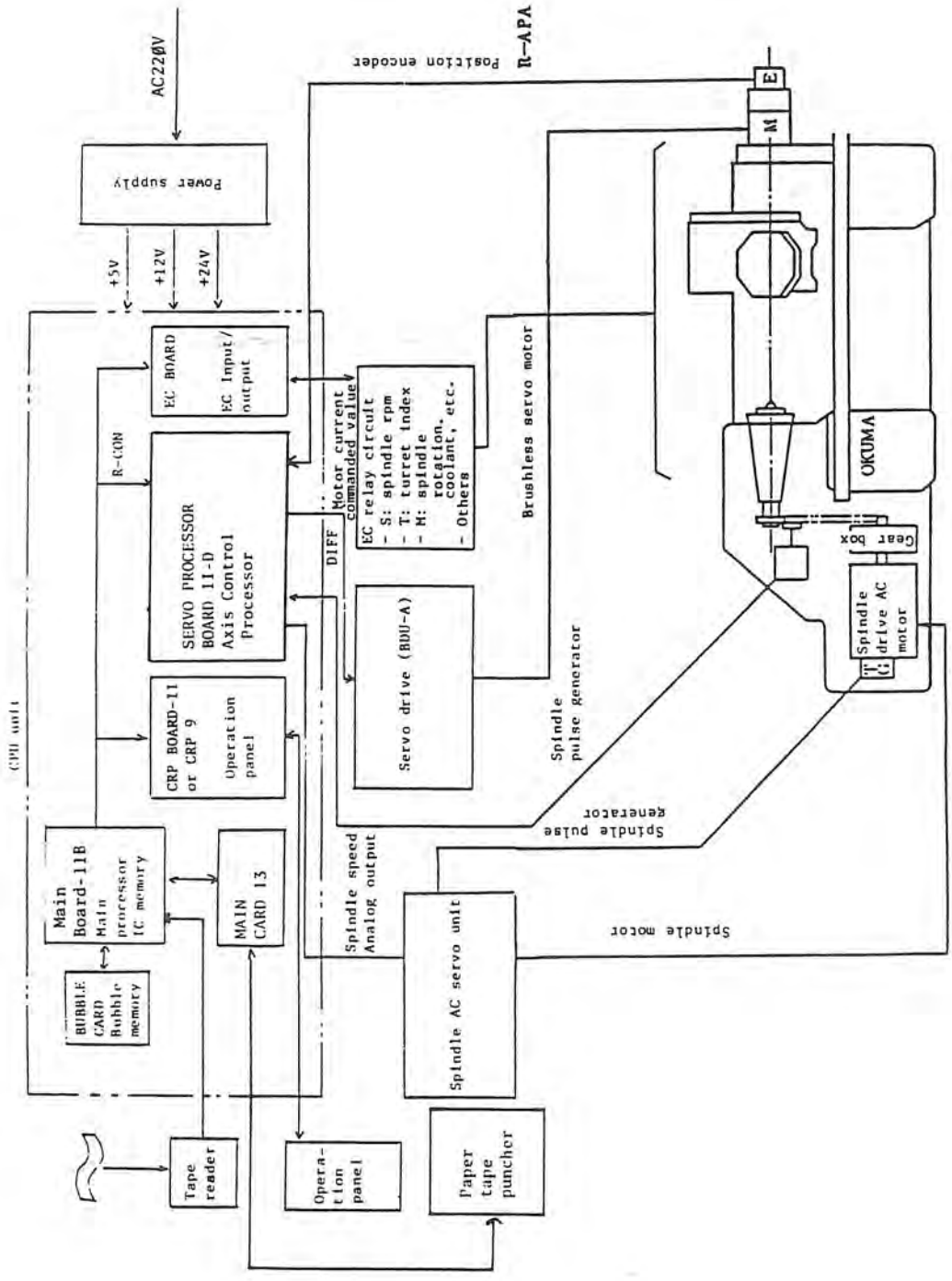


Fig. 4-2 OSP5000L-G/OSP5000L-G System Configuration

4-4. SELF-DIAGNOSTICS

The OSP5ØØL-G/OSP5Ø2ØL is a sophisticated CNC system that is designed to make the most of its built-in computer capabilities. The self-diagnostic function is one of the advantages a computerized numerical control system can provide. This function is classified into the following two items:

- Check function by alarm display and error display
- Check function by check data display

Check Function by Alarm Display and Error Display:

This function constantly monitors any defect including programming, operational errors and NC malfunctions.

When any defect such as the programming error and NC malfunction requiring stop of the machine operation occurs, the ALARM lamp goes on, the machine is stopped, and the contents of the alarm will be displayed on the CRT. When the defect is an operational error during editing operation, etc. not requiring the machine to be stopped, the ALARM lamp does not go on, but the contents of the error only will be displayed on the CRT. From these displays, the contents of the defect can be judged.

Check Function by Check Data Display:

With check data displayed on the CRT, it is possible to check internal conditions of the CNC, input/output signals of the NC and so on. This is a useful function to adjust and check the CNC.

4-4-1. Alarm Display and Error Display

The CNC constantly monitors the operating conditions of the machine, the program data and the operation of the machine operator. When any problem takes place, it gives the operator a warning by displaying an alarm message or error message.

Alarm Display ... The machine is stopped. The ALARM lamp under NC STATUS goes on. The corresponding alarm message is displayed on the 2nd line of the CRT.

Error Display ... Mainly warning against any of the items input by the operator, and does not cause the machine to be stopped.

The ALARM lamp does not go on and the error message is displayed on the 18th to 22nd line on the CRT.

CPU Alarm ..... This alarm indicates CPU malfunction. When this type of alarm occurs, machine operation cannot be resumed until power supply is turned on again. Naturally, the machine instantly stops.

When the CPU does not function normally, the message is displayed below the central portion on the CRT.

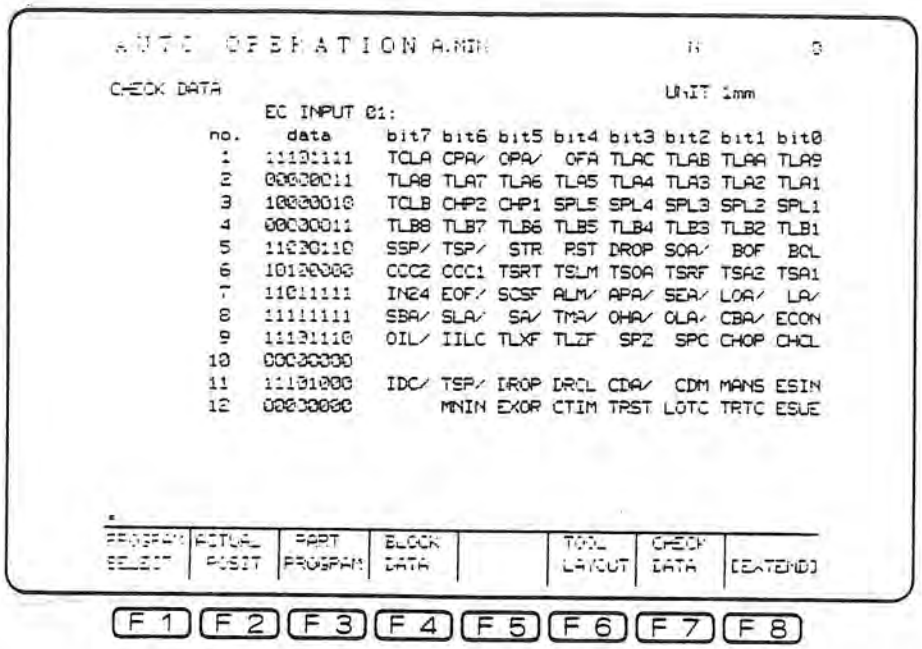
For alarm and error messages, refer to Alarm & Error List for OSP5ØØL-G/OSP5Ø2ØL

4-4-2. Check Data Display

The CNC constantly monitors internal conditions of the CNC and input/output signals of the NC, and the operator can see these data through check data displayed on the CRT.

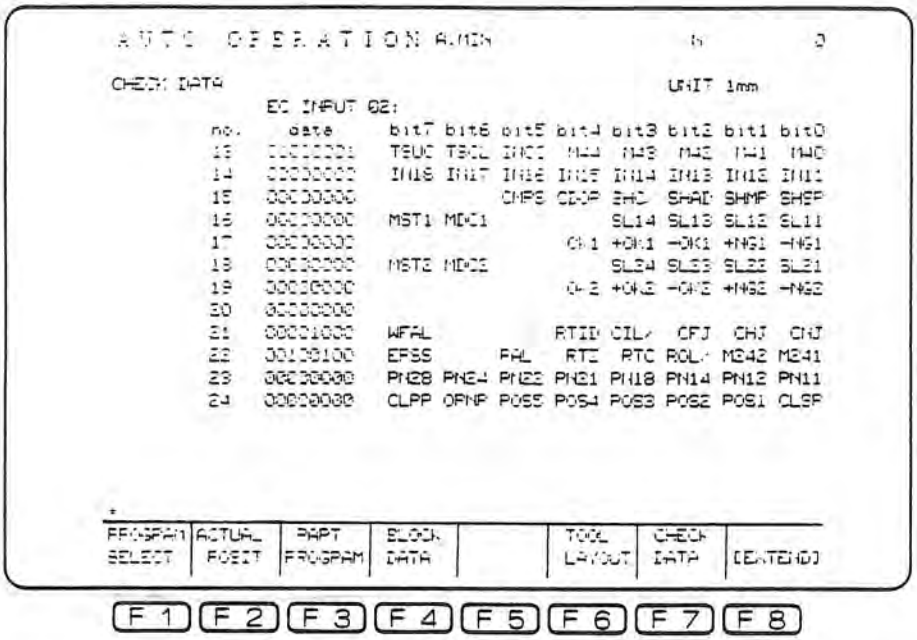
Check data displayed on the CRT and its contents are shown in the following pages.

(1) Status Display of EC Input Signal (No. 1)



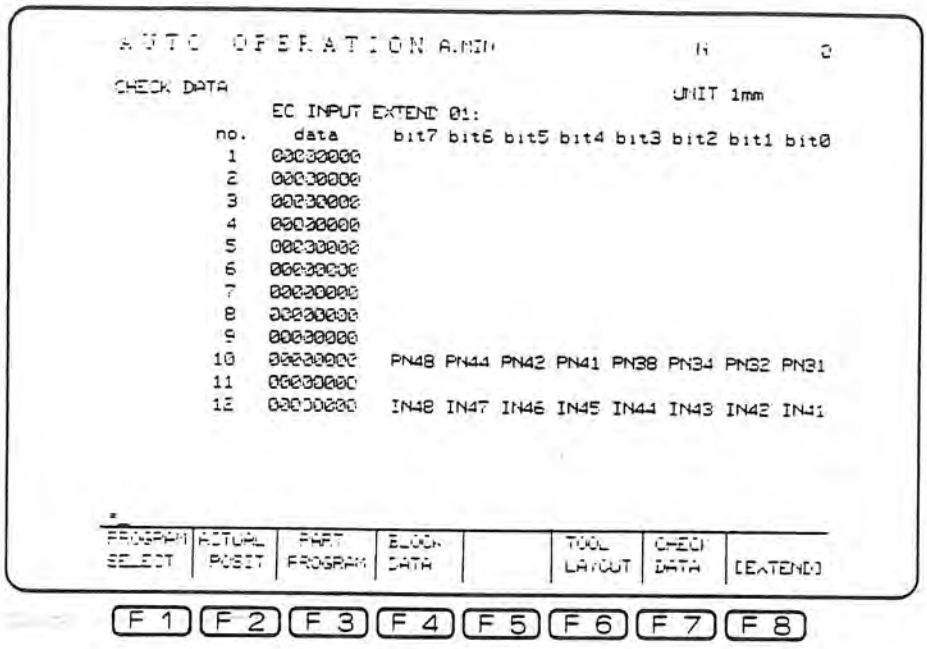
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1		Chuck Pressure Low	Hydraulic Source Pressure Low/	Alarm - Oil Filter Clogged				
2								
3		Chuck Pedal #2	Chuck Pedal #1					
4								
5	External Cycle Stop/	External Slide Hold/	External Cycle Start	External Reset	Door Open Confirmation Switch	Spindle Lubrication Pressure Low/	Slideway Lube Oil Flow	Slideway Lube Oil Level low
6	Chip Cover Close Confirmation Switch 2	Chip Cover Close Confirmation Switch 1	Tailstock Quill Retraction Confirmation Switch	Tailstock Quill In-position Confirmation Switch	Tailstock Quill Over-advance Confirmation Switch	Tailstock Quill Retraction Foot Switch	Tailstock Quill Advance Foot Switch 2	Tailstock Quill Advance Foot Switch 1
7	External Input 24	Emergency Limit Switch Release	Spindle Orientation Completion	External Alarm/	SMW Chuck Pressure Low/	Alarm - Travel End/	Alarm - LDU Overload/	Alarm - Static Pressure Unit Cooler
8	Alarm - Spindle Brush Wear/	Alarm - Spindle Overload/	Alarm - SDU/	Alarm - CPU Temperature/	Alarm - Transformer Overheat/	Alarm - EC Overload/	Alarm - EC Circuit Breaker/	Emergency Stop
9	External Interlock	Internal Interlock Released	Turret X-axis Free	Turret Z-axis Free	Spindle Zero Speed	Spindle at Constant Speed	Chuck Open Confirmation Switch	Chuck Close Confirmation Switch
10								
11	Index Chuck Completion Limit	Sensor Protect Limit/	Door Open	Door Close	Coupling Device Alarm/	Interlock Mode	Answer for Aux. M Code	External Spindle Jog
12		Operation Monitor External Input	External Spindle Orientation	Calender Timer Input	CEJ Transfer Start	Lot Completed	Tool Retraction Cycle Interrupt Input	External Start Disabled

(2) Status Display of EC Input Signal (No. 2)



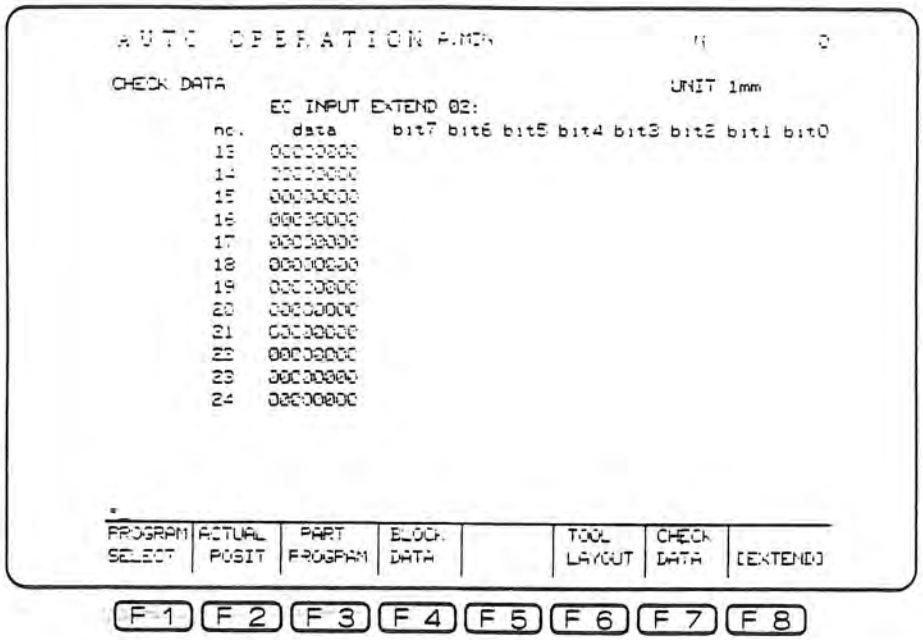
bit No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
13	Tailstock Joint ON	Tailstock Joint OFF	Spindle Jog Reverse	← Spindle Speed Range → M44	M43	M42	M41	M40
14	External Input 18	External Input 17	External Input 16	External Input 15	External Input 14	External Input 13	External Input 12	External Input 11
15	UVE Air Chuck Open	UVE Air Chuck Close	Chucking Error Pressure Switch	Coupling Device Retraction Position	Optical Sensor Workpiece Detect	Sensor Head Advance Position	Sensor Head Interme-diate Position	Sensor Head Retraction Position
16	Gauging Start	Gauging Data Clear			← Switching Signal → (Post-process Gauging 1)			
17				← Judging Signal → OK1	+OK1	-OK1	+NG1	-NG1
18	Gauging Start	Gauging Data Clear			← Switching Signal → (Post-process Gauging 2)			
19				← Judging Signal → OK2	+OK2	-OK2	+NG2	-NG2
20								
21	Work Abnor-mal Runout Input			Revolving Tool Spindle Orientation	Interlock/	← C-axis → Connect Confirma-tion	Connect Start Con-firmation	Disengaged Confirma-tion
22	External Program Selection Start	External Program Selection Parity	← Revolving Tool → Alarm/	Zero Speed	Constant Speed	Overload/	Gear High	Gear Low
23	← External Program Selection →							
	← 2nd Digit → PN28	PN24	PN22	PN21	PN18	← 1st Digit → PN14	PN12	PN11
24	Clamp Con-firmation Pressure Switch	← Long Stroke Chuck → Open End	POS 5	POS 4	POS 3	POS 2	POS 1	Close End

(3) Status Display of Extended EC Input Signal (No. 1)



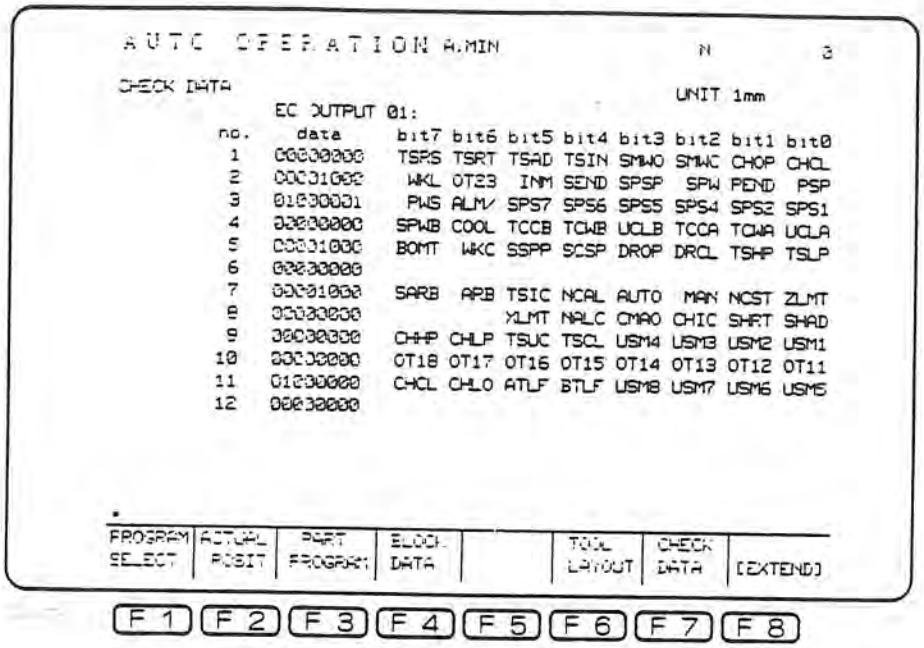
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1								
2								
3								
4								
5								
6								
7								
8								
9								
10	← External Program Selection →							
	← 4th Digit →					← 3rd Digit →		
	PN48	PN44	PN42	PN41	PN38	PN34	PN32	PN31
11								
12	← External Input →							
	48	47	46	45	44	43	42	41

(4) Status Display of Extended EC Input Signal (No. 2)



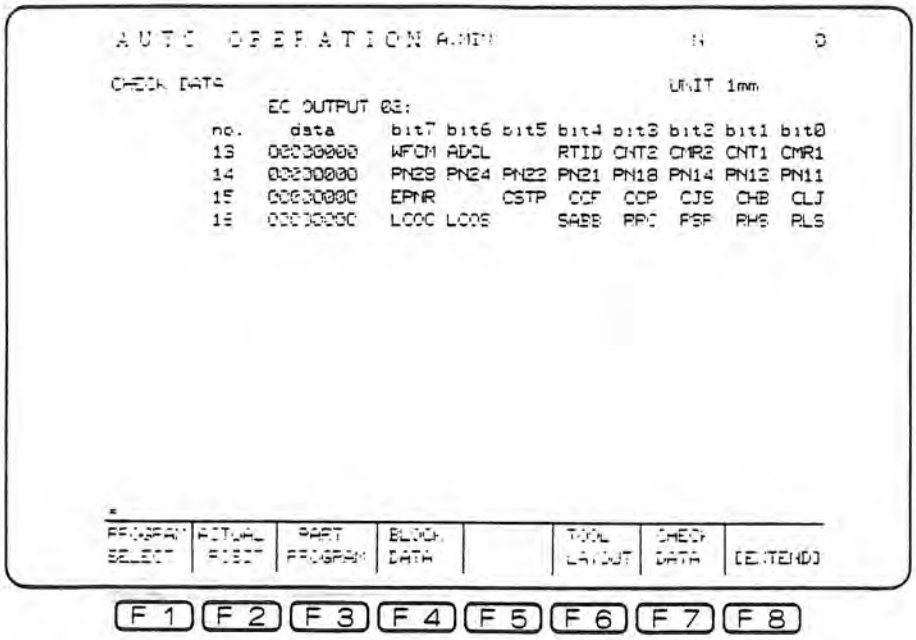
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

(5) Status Display of EC Output Signal (No. 1)



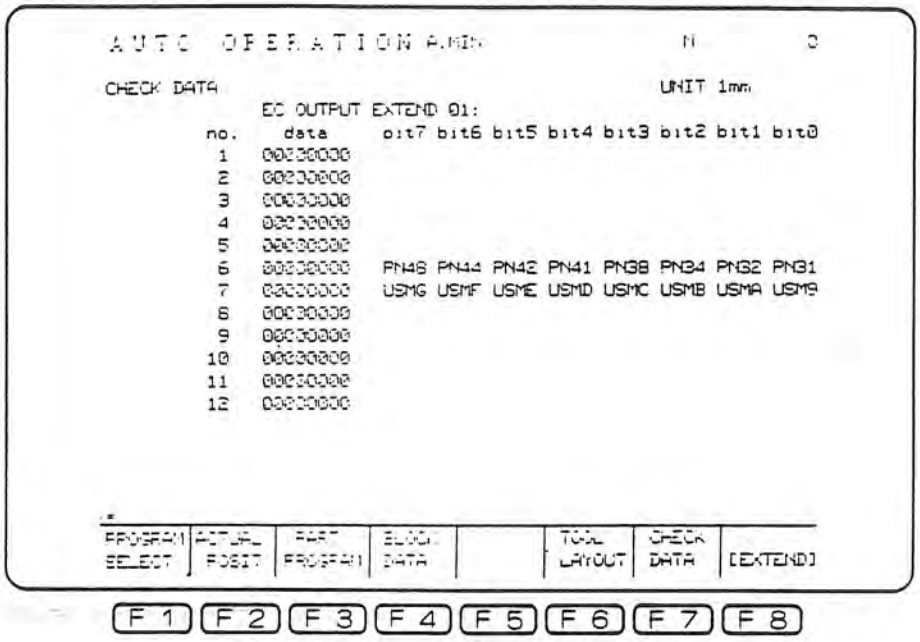
bit No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Tailstock Quill Advance Reset	Tailstock Quill Retract Reset	Tailstock Quill Advance	Tailstock Quill Advance - inching	SMW Chuck Open	SMW Chuck Close	Chuck Open	Chuck Close
2	Work Lamp	External Output 23	Hour Meter	Schedule End	Spindle in Stop	Spindle Rotation Command	Program End	Program Stop
3	Power Save Command	NC Alarm/	Spindle Gear Selection Solenoid					
4	Spindle CCW Command	Coolant	Turret B Reverse Rotation	Turret B Forward Rotation	Turret B Unclamp	Turret A Reverse Command	Turret A Forward Rotation	Turret A Unclamp
5	Slideway Lubrication Motor	Work Count	Spindle Orientation Pin IN	Spindle Orientation in Execution	Door Open	Door Close	Tailstock Quill Thrust High	Tailstock Quill Thrust Low
6								
7	Spare Air Blower	Air Blower	Tailstock Interlock Neglect	Alarm Lamp	Automatic Mode	Manual Mode	In Operation	Z-axis at Emergency Limit
8			X-axis at Emergency Limit	Alarm Output	Chucking Error Air ON	Chuck Interlock Neglect	Sensor Head Retraction	Sensor Head Advance
9	Chuck High Pressure	Chuck Low Pressure	Tailstock Joint ON (Swing Advance)	Tailstock Joint OFF (Swing Retraction)	M104	M103	M102	M101
10	External Output 18	External Output 17	External Output 16	External Output 15	External Output 14	External Output 13	External Output 12	External Output 11
11	Chuck Clamp	Chuck Unclamp	Life of Tool on Turret A Expired	Life of Tool on Turret B Expired	M108	M107	M106	M105
12								

(6) Status Display of EC Output Signal (No. 2)



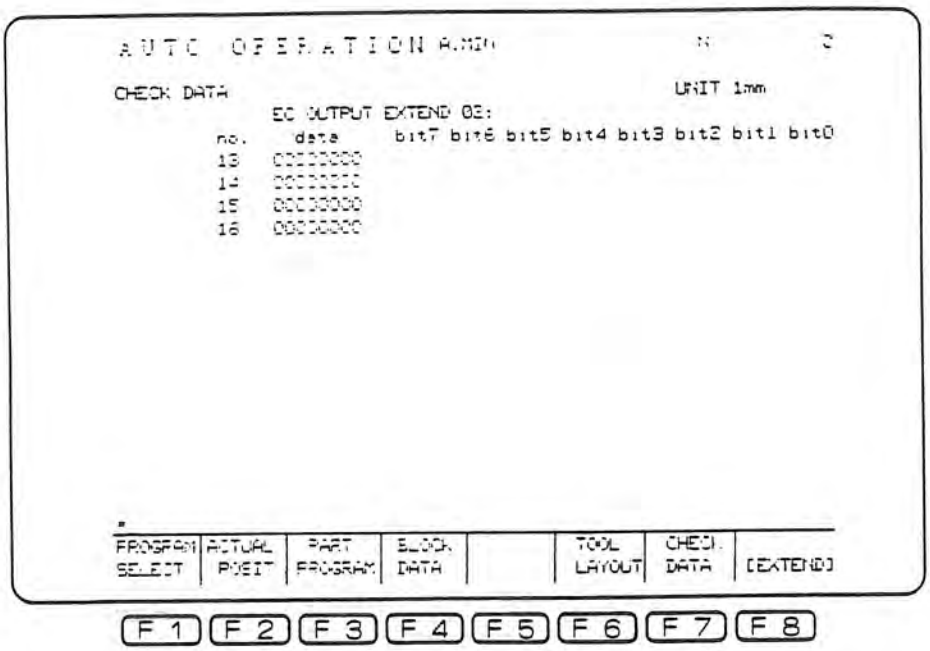
bit No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
13	Workpiece Deflection Detection	Additional Coolant		Revolving Tool Spindle Orientation	CEJ New Tool 2	CEJ Data Transfer Request 2	CEJ New Tool 1	CEJ Data Transfer Request 1
14	External Program Selection							
		2nd Digit				1st Digit		
	PN28	PN24	PN22	PN21	PN18	PN14	PN12	PN11
15	External Program Selection, Number Confirmation Request		C-axis Stop	Positioning Complete	C-axis Clamp	C-axis Connect	High Pressure Brake	Low Pressure Connect
16	Long Stroke Chuck Unclamp Stop Release	Long Stroke Chuck Unclamp Stop		Spare Air Blower	Revolving Tool Spindle Rotation Command	Revolving Tool Spindle Stop	Revolving Tool Spindle High Speed	Revolving Tool Spindle Low Speed

(7) Status Display of Extended EC Output Signal (No. 1)



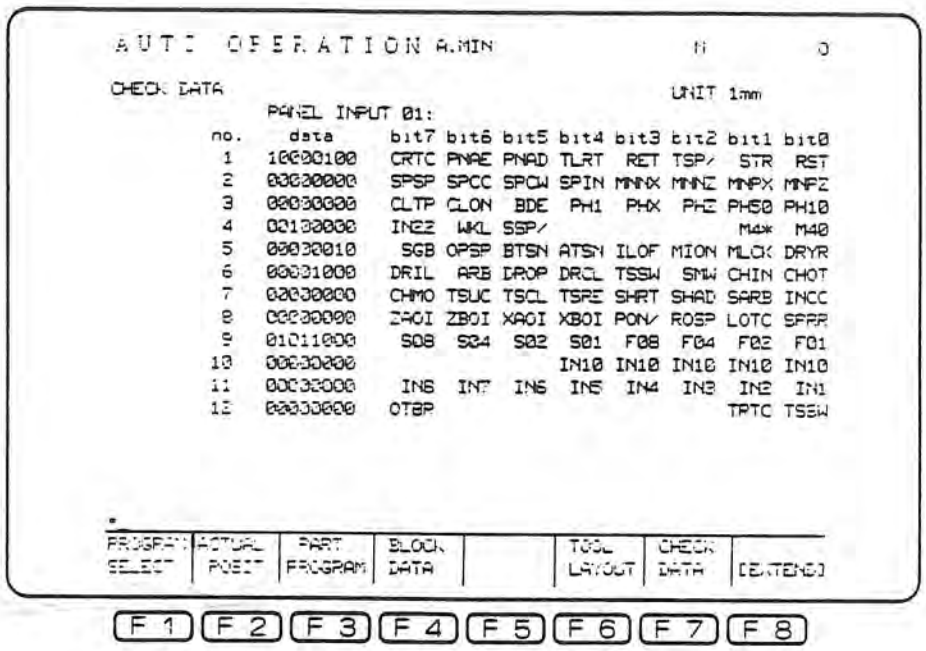
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1								
2								
3								
4								
5								
6	← External Program Selection →							
	← 4th Digit →						← 3rd Digit →	
	PN48	PN44	PN42	PN41	PN38	PN34	PN32	PN31
7	M237	M236	M235	M234	M233	M232	M231	M230
8								
9								
10								
11								
12								

(8) Status Display of Extended EC Output Signal (No. 2)



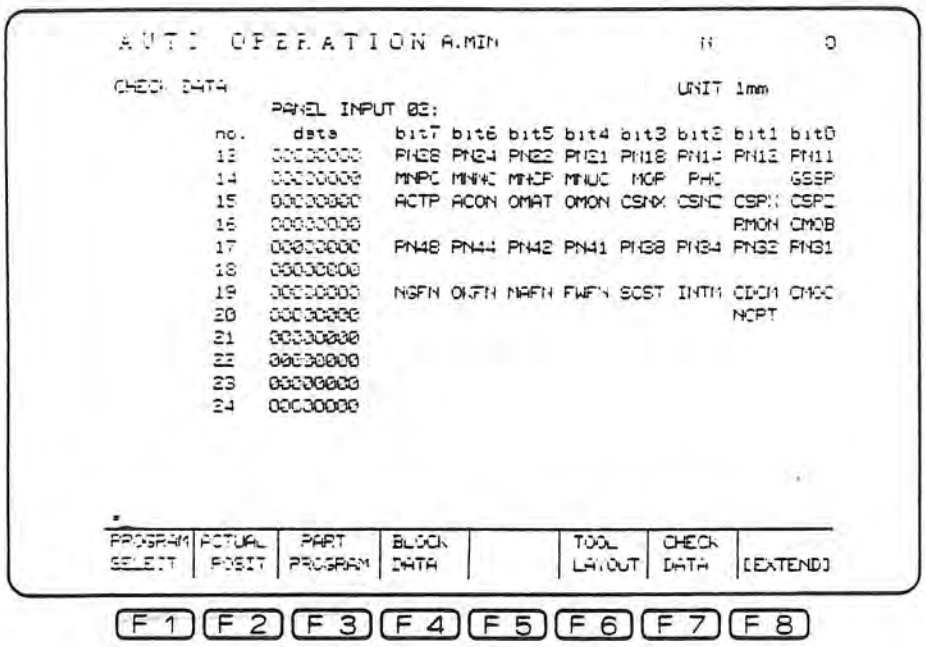
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								

(9) Status Display of Machine Operation Panel Input Signal (No. 1)



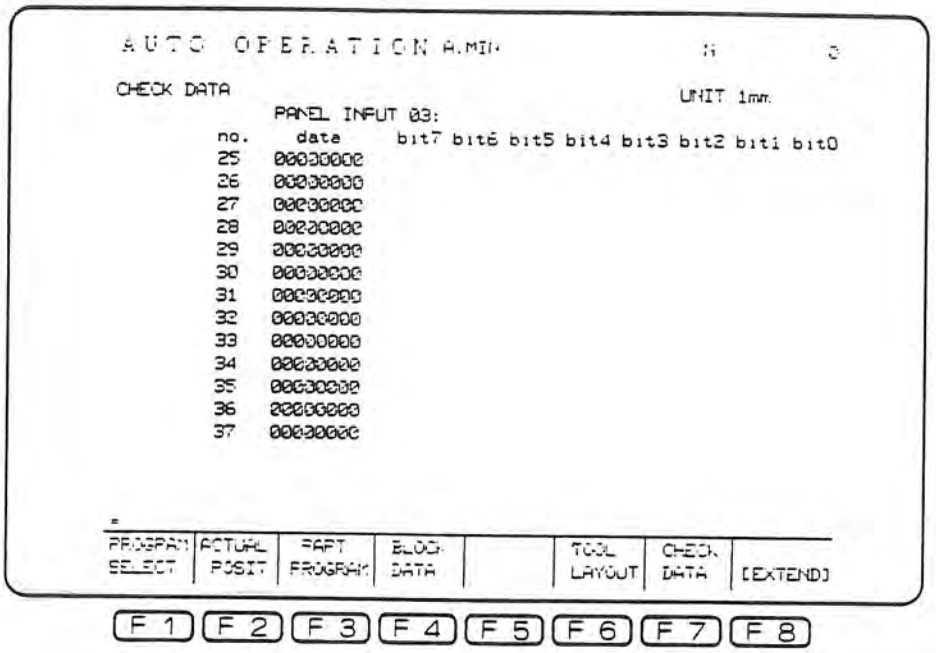
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	CRT OFF	NC Panel Limited Use	NC Panel Disabled	Tool Index	Sequence Restart	Slide Hold	Cycle Start	NC Reset
2	Spindle Stop	Spindle CCW	Spindle CW	Spindle Jog	Slide Jog	Slide Jog	Slide Jog	Slide Jog
3	Coolant Auto	Coolant Manual	Block Delete	Pulse Handle 1/1	Pulse Handle X-axis	Pulse Handle Z-axis	Pulse Handle 50/1	Pulse Handle 10/1
4	External Input 22	Work Lamp	Cycle Stop/				Spindle Drive Gear ON	Spindle Drive Gear Neutral
5	Single Block	Optional Stop	Individual Operation of Turret B	Individual Operation of Turret A	Interlock	Mid-Auto Manual Operation ON	Machine Lock	Dry Run
6	Door Interlock	Air Blower	Door Open	Door Close	Tailstock Quill, Center Work	SMW Chuck	Chuck ID Gripping	Chuck OD Gripping
7	Chucking Error ON	Tailstock Joint ON	Tailstock Joint OFF	Tailstock Joint Position Return	Sensor Head Retraction	Sensor Head Advance	Spare Air Blower	Spindle Jog Reverse Direction
8	ZA-axis Overload	ZB-axis Overload	XA-axis Overload	XB-axis Overload	Gauging Data Printer ON/	Robot Optional Stop	Lot Completion	Schedule Program Reset
9	Spindle Speed Override					Feedrate Override		
10						External Input 10		
11	External Input 38	External Input 37	External Input 36	External Input 35 Broken Tool Detection Cycle	External Input 34 Data Read-out Cycle	External Input 33 First Part Gauging Cycle ON	External Input 32 Work Gauging Cycle ON	External Input 31 Master Ring Gauging Cycle ON
12	External Output 31-38 Reset						Tool Retraction Cycle Interrupt Input	External Program Selection Strobe

(1Ø) Status Display of Machine Operation Panel Input Signal (No. 2)



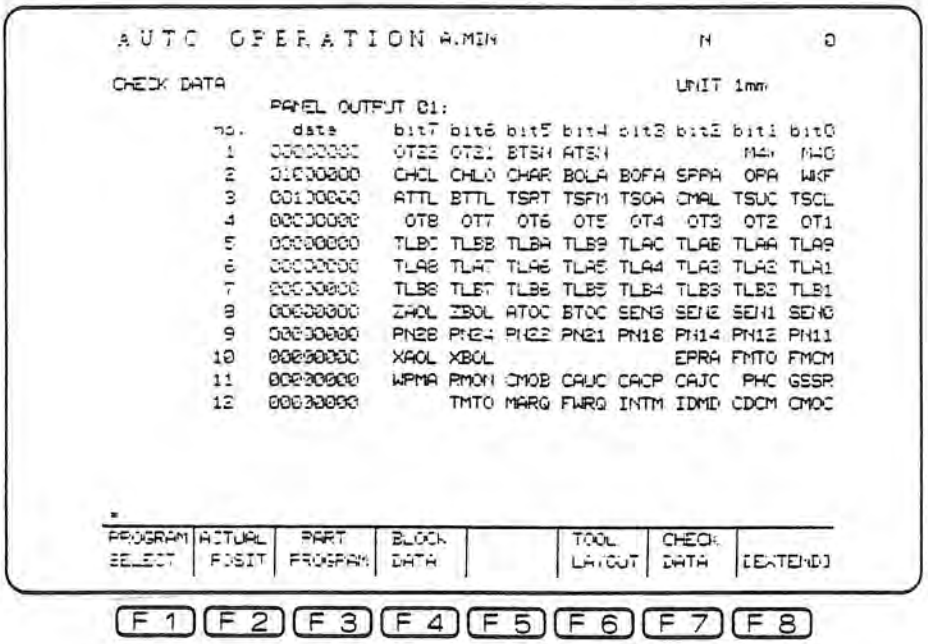
bit No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit Ø
13	External Program Selection: 2nd Digit					1st Digit		
	PN28	PN24	PN22	PN21	PN18	PN14	PN12	PN11
14	C-axis							
	Manual +C	Manual -C	Manual Clamp	Manual Unclamp	MOP OFF	Pulse Handle C-axis		Revolving Tool Spindle Selection
15	Additional Tape	Coolant ON	Overload Monitor Auto-set	Overload Monitor ON	Touch Setter: Cycle Start -X	Cycle Start -Z	Cycle Start +X	Cycle Start +Z
16							DNC-B Remote Mode ON	DNC-B Communi-cation ON
17	External Program Selection: 4th Digit					3rd Digit		
	PN48	PN44	PN42	PN41	PN38	PN34	PN32	PN31
18								
19	DNC-C							
	Cycle Completion NG	Cycle Completion OK	Work Setup Complete	First Part Machining Complete	Schedule Start	FMS INT.	FMS Auto Start	FMS ON
20							DNC-C Reverse Communi-cation	
21								
22								
23								
24								

(11) Status Display of Machine Operation Panel Input Signal (No. 3)



No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
25								
26								
27								
28								
29								
30								
31								
32								
33								
34								
35								
36								
37								

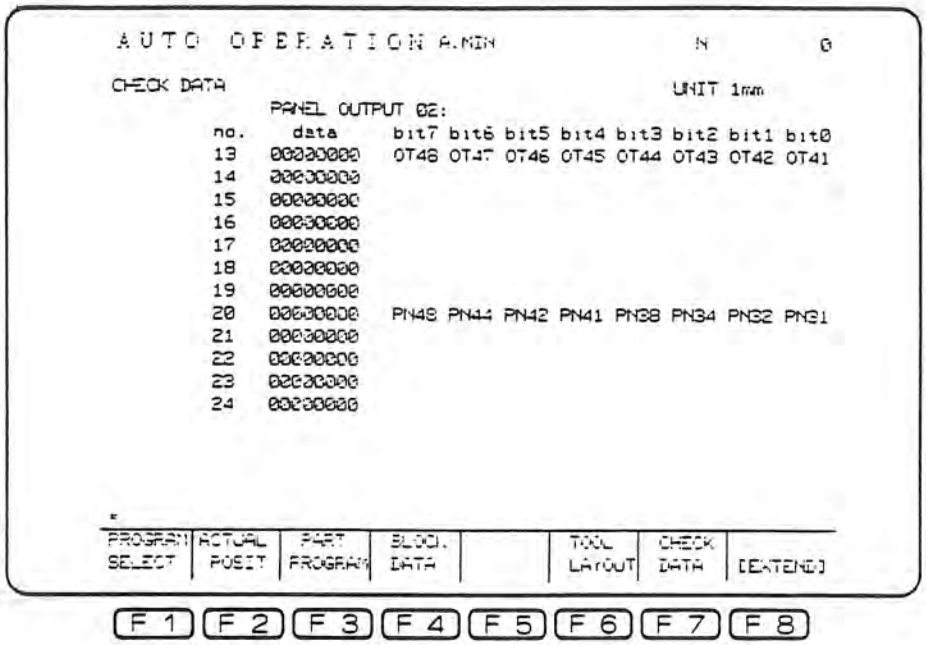
(12) Status Display of Machine Operation Panel Output Signal (No. 1)



bit No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Input Touch Setter Sensor Input	Gauging NG Ignore ON	Individual Operation of Turret B	Individual Operation of Turret A			—Spindle Drive Gear— ON	Neutral
2	Chuck Clamp	Chuck Unclamp	Chuck Air Pressure Low	Alarm - Slideway Lube Oil Level	Alarm - Slideway Lube Oil Flow	Alarm - Spindle Lubrication Pressure Low	Alarm - Hydraulic Pressure Low	Operation End Lamp
3	Tool Life A	Tool Life B	Tailstock Quill Retraction	Tailstock Quill In-position	Tailstock Quill Over-advance	Chucking Error Alarm	Tailstock Joint OFF	Tailstock Joint ON
4	External Output 8	External Output 7	External Output 6	—NG	—Gauging Result Output— -OK	OK	+OK	+NG
5	—Tool Life Turret B 9 - 12—				—Tool Life Turret A 9- 12—			
6	—Tool Life Turret A 1 - 8—							
7	—Tool Life Turret B 1 - 8—							
8	ZA-axis Overload	ZB-axis Overload	Turret A Monitoring	Turret B Monitoring	Turret B Tool Gauging Sensor Input	Turret B Touch Sensor Input	Turret A Tool Gauging Sensor Input	Turret A Touch Sensor Input
9	—External Program Selection—							
	—2nd Digit—					—1st Digit—		
10	XA-axis Overload	XB-axis Overload				External Program Selection Answer	FMS Cycle Time Over	FMS Data Transfer
11	Work Pushing Error Alarm	DNC-B Remove Mode ON	DNC-B DNC ON	C-axis Unclamp	C-axis Clamp	C-axis Connect	Pulse Handle C-axis	Revolving Tool Spindle Selection
12		—DNC-C— Data Transfer	Setup Change Request	First Part Machining	FMS INT.	FMS Independent	FMS Automatic	FMS ON

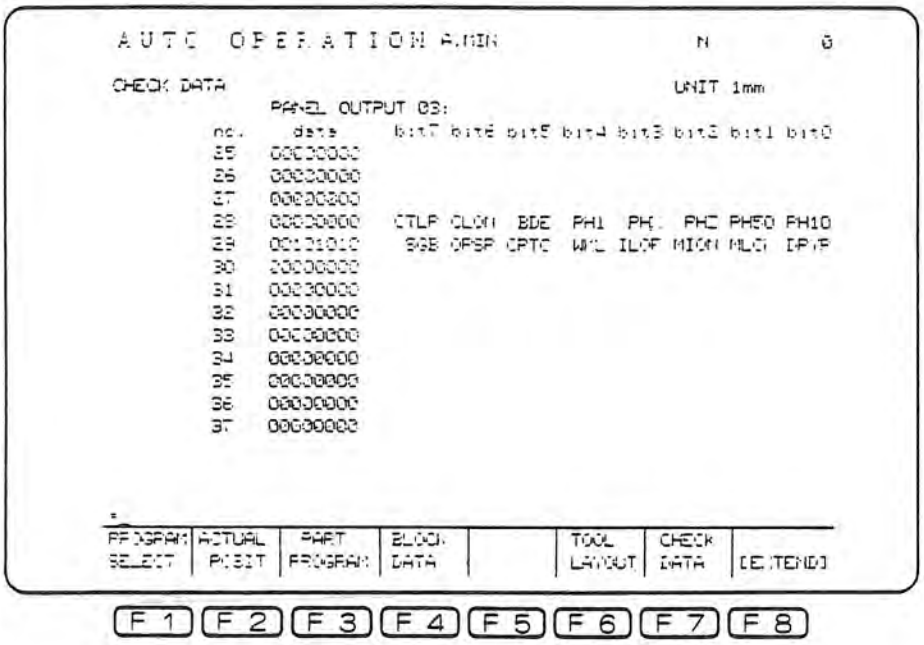
* 1, 11 for flat panel specification

(13) Status Display of Machine Operation Panel Output Signal (No. 2)



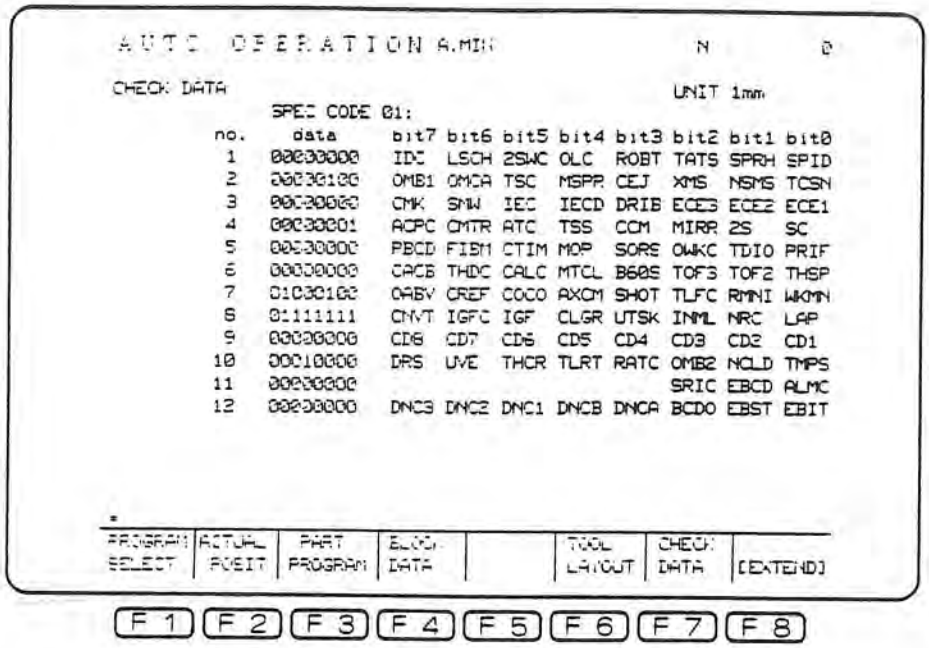
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
13	External Output 38	External Output 37	External Output 36	External Output 35 Broken Tool Detection Cycle	External Output 34 Data Read-out Cycle	External Output 33 First Part Gauging Cycle ON	External Output 32 Work Gauging Cycle ON	External Output 31 Master Ring Gauging Cycle ON
14								
15								
16								
17								
18								
19								
20	External Program Selection							
	4th Digit					3rd Digit		
	PN48	PN44	PN42	PN41	PN38	PN34	PN32	PN31
21								
22								
23								
24								

(14) Status Display of Machine Operation Panel Output Signal (No. 3)



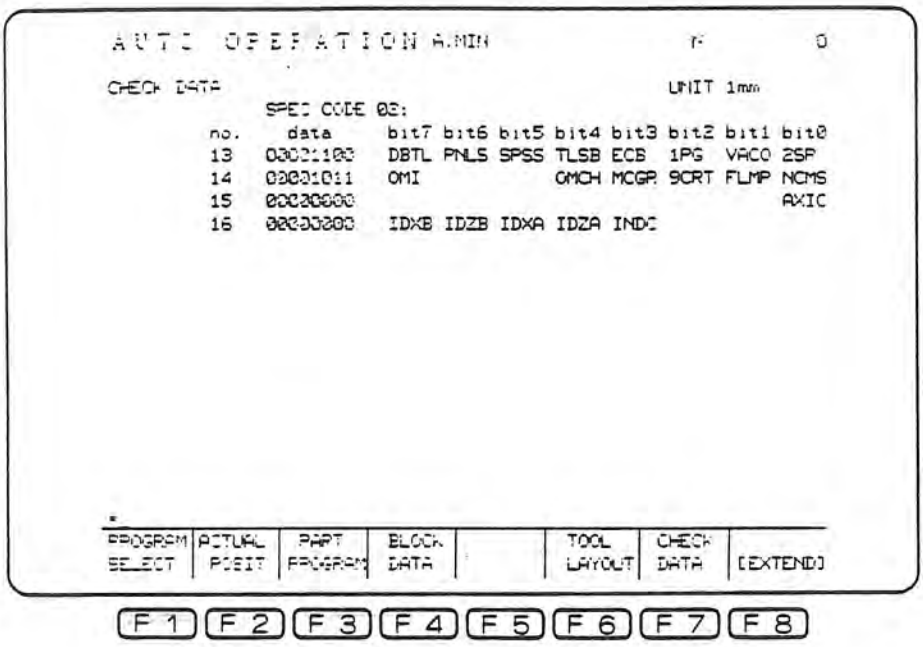
No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
25								
26								
27								
28	Coolant Auto	Coolant Manual	Block Delete	Pulse Handle 1/1	Pulse Handle X-axis	Pulse Handle Z-axis	Pulse Handle 50/1	Pulse Handle 10/1
29	Single Block	Optional Stop	CRT OFF	Work Lamp	Interlock Release	Manual Int. ON	Machine Lock	Dry Run
30								
31								
32								
33								
34								
35								
36								
37								

(15) Display of Specification Code (No. 1)



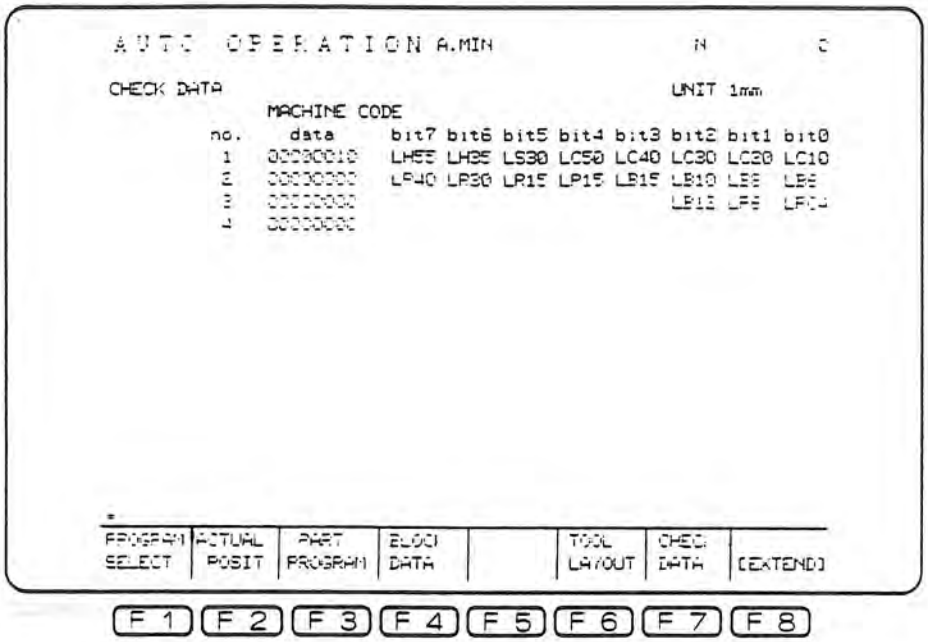
bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	Index Chuck	Long Stroke Chuck	2-saddle Work Catcher	Overload Detect	Okuma Robot	Program-mable Tail-stock	Orientation (Electric)	Orientation (Pin/Brake)
2	Load Monitor-B1	Load Monitor-A	Touch Setter	Gauging Data Print	CEJ Matic Gauging	Post-process Gauging	Tool Gauging	Touch Sensor Gauging
3	Chucking Error Alarm	Air Chuck	IEC Chuck	IEC Door	Door Interlock B	EC Board (Card) Addition 3	EC Board (Card) Addition 2	EC Board (Card) Addition 1
4	AC Motor Pole Change	Comb-type Turret	ATC	Tailstock Swing	Multi-Machining	Mirror Image	4-axis 2-saddle	Center Work
5	Coupling External Device Program Selection	Floppy Input/ Output (IBM)	Calendar Timer	MOP	Edit Inter-lock	External Work Counter	Tape Data Input/ Output	Robot Request (Special)
6	C-axis Connect (high-speed B)	Thread Cutting Phase Matching	C-axis Connect (low-speed)	Cycle Time Calculation	Buffer 60 m	Tool Offset 96 Sets	Tool Offset 64 Sets	G34/G35 Slide Hold
7	Arbitrary Angle Chamfering	Profile Generation	Coordinate System Conversion	Pitch Error Compensa-tion	Operation Hour Reduction Function	Tool Life Management	NC Opera-tion Monitor	NC Work Counter
8	Tape Convert	IGF Convert	IGF	Graphic	User Task 2	Inch/Metric Switchable	Nose R 2B	LAP3
9	Coupling Spec. 8	Coupling Spec. 7	Coupling Spec. 6	Coupling Spec. 5	Coupling Spec. 4	Coupling Spec. 3	Coupling Spec. 2	Coupling Spec. 1
10	Door Open/Close (Special)	Front Drive Air Chuck	Arc Thread Cutting	Tool Retraction Cycle Interrupt Input	LR15M-ATC	Load Monitor-B2	NC Loader	Thermal Displace-ment Com-pensation
11						Max. Spindle Speed Interlock Release	External Program Selection C2	Alarm C Output
12	DNC-C3	DNC-C2	DNC-C1	DNC-B	DNC-A	← External Program Selection → C	B	A

(16) Display of Specification Code (No. 2)



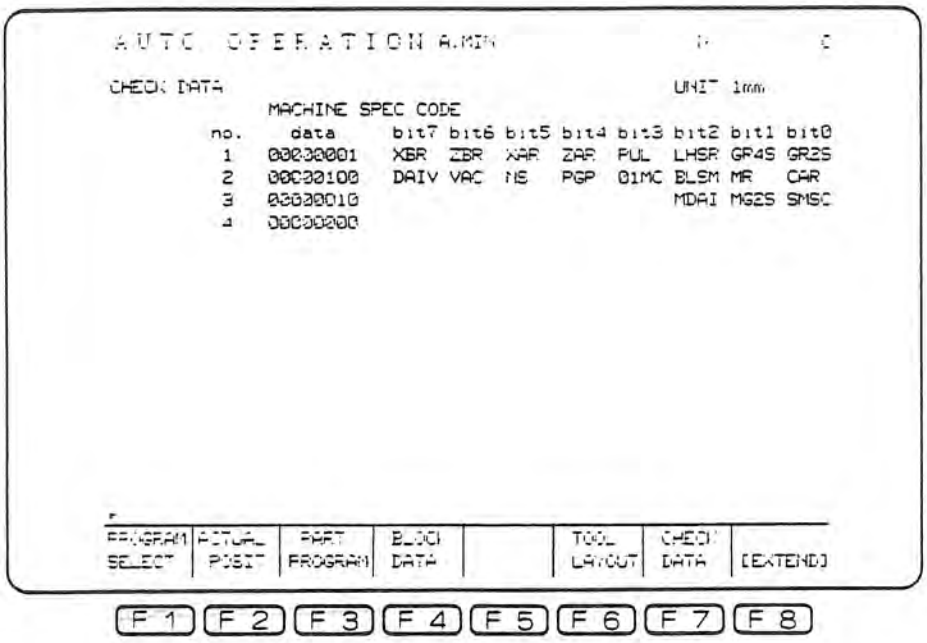
No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
13	Double Tooling	Operation Panel Position (Special)	Spindle Stop (Special)	Tool Index Type B	EC Bus Spec.	1-phase Pulse Generator	VAC Runout	Z-spindle
14	OMI Message Display			Monochrome Character Display (Current)	Monochrome Graphic Display	OSP500L-G Operation panel	Operation Panel with Flat Key	NC Master
15								Inductosyn Compensation
16			Inductosyn					

(17) Display of Machine Code



bit / No.	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1	LH55	LH35	LS30	LC50	LC40	LC30	LC20	LC10
2	LR40	LR30	LR15	LP15	LB15	LB10	LB8	LB6
3						LB12	LP6	LPC4
4								
5								
6								
7								
8								

(18) Display of Machine Spec Code



No. \ bit	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
1					Pulley Change	LH50 Standard Spindle	Gear 4 steps	Gear 2 steps
2	Spindle DA Output Reversal	VAC Motor	Minor Change	Pulse Generator Reverse Rotation	0.1μ Control	Brushless Servo Motor	ATC Magazine Position Encoder Reverse	C-axis Position Encoder Reverse
3						M-axis DA Output Reversal	Revolving Tool Gear 2 Steps	Slideway Lubrication Motor Soft Control
4								
5								
6								
7								
8								

SECTION 5 TROUBLE AND TROUBLESHOOTING

The purpose of this section is to minimize downtime of the machine through speedy detection and remedies of the cause of any trouble that might occur.

It is extremely important to make detailed checks on the condition of the machine and CNC system when the trouble arose and to carry out various kinds of tests described in this section. Thus, the customer himself will be able to fix the machine in most cases. The test results reported to your local Okuma representative will be a great help in determining the nature and extent of the trouble and the remedies to be applied.

Generally, check the following matters:

(1) When trouble occurs,

- o Mode of operation
- o Current position and command position
- o What STATUS display lamp is going on?
- o Is the ALARM lamp on?

  When the ALARM lamp is on, the cause of the alarm can be known from the contents of the alarm message given on the CRT.

(2) After resetting the CNC system,

- o Does the trouble occur at the same situation repeatedly?
- o Does the same trouble occur in other modes of operation?
- o How about frequency of the trouble?
- o Does the trouble arise regularly in terms of time, temperature, etc.?

This section covers the basic troubleshooting procedures, along with structure, operation and method of inspection for the major CNC component parts such as the CPU, servo drive units, relays in the machine control unit and the spindle control unit.

When any trouble occurs, see Section 4 "Maintenance and Inspection" together with this Section 5 and carry out necessary checks in accordance with the instructions.

5-1. ANALYSIS OF TROUBLE

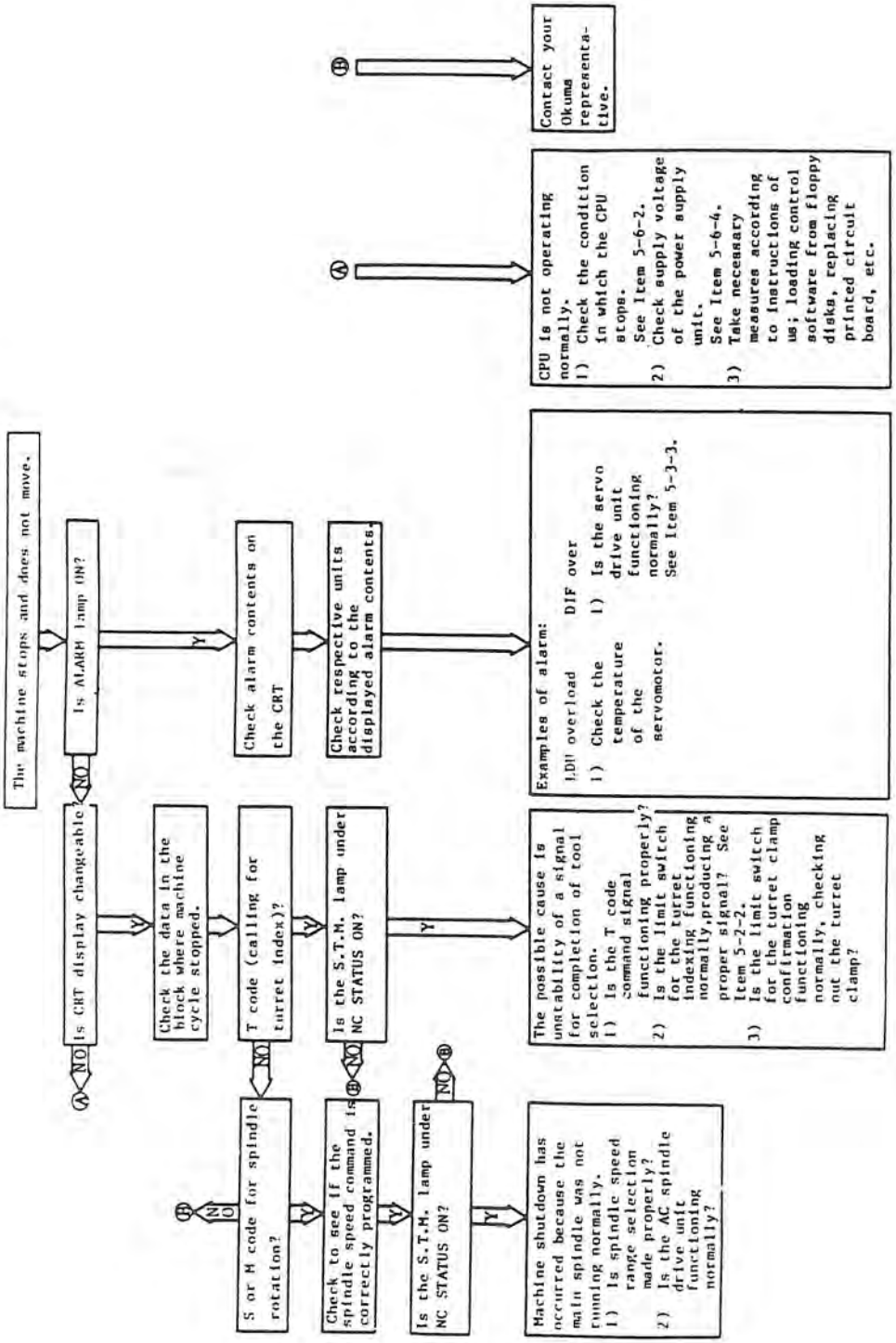


Fig. 5-1 Locating Problems

5-2. MACHINE-MOUNTED ELECTRICALS

Mounted on the machine are limit switches, solenoids, motors and other electro-mechanical components. As these machine-mounted electricals are placed in a very severe environment affected by chips, coolant, oil, dirt and dust, careful consideration has been given in design to protect these components from excessive moisture, dirt and dust. Nevertheless, electrical trouble causes a high rate of the NC troubles.

However, most of the electricals are relatively simple in their operation and can be easily checked and repaired if required by the customer's maintenance technicians. The checking procedures given under Section 5-7, "Relays and Magnet Switch Circuits" should be also consulted for solving electrical problems.

This Section describes the practical method to inspect limit switches and rotary switches. For other machine-mounted electricals, check in a similar way.

5-2-1. Inspection of Limit Switches (Check Method by Multi-Meter)

Limit switches are used for detecting travel end signal of individual axes, and clamp confirmation signal of turret.

In order to test a limit switch "LB15 turret clamp" actuation, for example, remove the cover from the turret first, and the terminal box is exposed. Then remove the access cover from the terminal box. As this limit switch is wired to terminals Nos. 54N and 165, make the multi-meter connections as shown in Fig. 5-2.

WARNING: TURN OFF POWER SUPPLY BEFORE ATTEMPTING THIS INSPECTION.

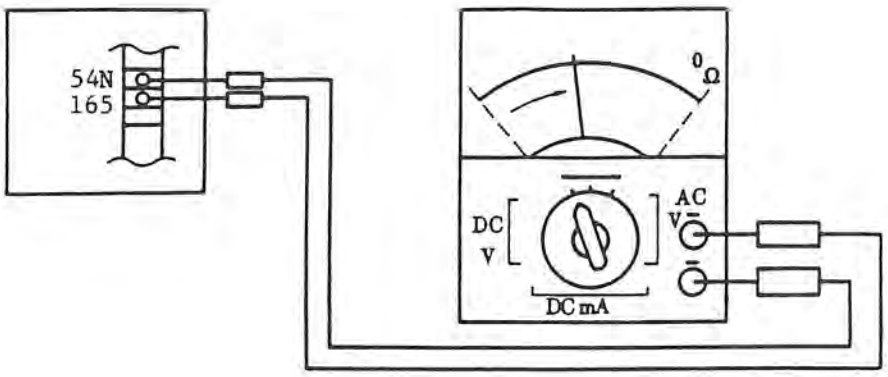


Fig. 5-2 Multi-Meter Connections to Check a Limit Switch

(1) Set the multi-meter to the resistance range.

(2) Apply multi-meter probes to the terminals (54N and 165).

(3) When the multi-meter pointer deflects fully to the right on its scale, this indicates that resistance is zero and there is continuity between Terminals Nos. 54N and 165.

(4) With the turret clamped in position, the limit switch is ON, with its contacts closed; the limit switch is considered to be normal when resistance between terminals No. 54N and No. 165 is zero.

5-2-2. Inspection of Limit Switches for Turret Indexing Switches (Testing by Self-Diagnostic Function)

Limit switches are installed in the turret and the combination of ON/OFF signals from them is used to identify the selected station (active tool position) by distinguishing the selected tool from other tools mounted on the turret. Failure of the limit switch may cause a serious trouble since the control fails to identify the number of the tool indexed.

(The testing method mentioned in 5-2-1 can also be used to check the turret indexing limit switches for their actuating condition.)

The following paragraphs cover the testing method using the self-diagnostic function of the CNC system.

Testing Procedure:

As explained under Section 4-4, "Self-Diagnostics", the CNC system and the NC I/O signals can be checked up through display in the CRT. In this case, output signals of the limit switches or a rotary switch, designated as TLA1, TLA2, TLA3 and so on, in tables of Section 4-4-2 can be checked by reading the bit data on the EC INPUT page.

(1) Select Tool No. 1 in the manual mode.

If this causes signal TLA1 and TLA2 to be read into the CNC, the limit switches are considered to be in good condition. To check this, proceed further as follows:

(2) Select "CHECK DATA EC INPUT Ø1" page of CRT display. This indicates ON/OFF status of the EC input signals.

(3) Bit data on the No. 2 line on this page shows the input signal status of the turret index position confirmation limit switches or a rotary switch.

LB15 : Limit switches are used. For the combination of signals for representing the turret position, refer to Fig. 5-4.

Tool number 1 corresponds to bit Ø and bit 1 of No. 1, which are identified by signal names TLA1 and TLA2, respectively. Check the bit data condition at the data column in the left section which should be "1" (for both bit Ø and bit 1) with other bit data "0". If any of other bit data is "1" while the turret is indexed to tool number 1 position, it indicates an abnormal state.

(4) Repeat the operations above for each of the turret index position to check the signal status from the limit switches or a rotary switch.

The limit switch, explained in the previous section, can be checked in the same manner without using a multi-meter.

Tool No. \ Bit in No. 2 line	bit 7	bit 6 (TLA7)	bit 5 (TLA6)	bit 4 (TLA5)	bit 3 (TLA4)	bit 2 (TLA3)	bit 1 (TLA2)	bit Ø (TLA1)
T1	Ø	Ø	Ø	Ø	Ø	Ø	1	1
T2	Ø	Ø	Ø	Ø	1	Ø	Ø	1
T3	Ø	Ø	Ø	Ø	Ø	1	Ø	1
T4	Ø	Ø	Ø	1	Ø	Ø	Ø	1
T5	Ø	Ø	Ø	1	Ø	1	1	1
T6	Ø	Ø	Ø	1	1	1	Ø	1
T7	Ø	Ø	Ø	Ø	1	1	1	1
T8	Ø	Ø	Ø	1	1	Ø	1	1
T9	Ø	1	Ø	1	Ø	Ø	1	1
T1Ø	Ø	1	Ø	Ø	1	1	Ø	1
T11	Ø	Ø	1	Ø	1	1	Ø	1
T12	Ø	Ø	1	1	Ø	Ø	1	1

Fig. 5-3
Combination of Limit Switch Signals for Tool No. Identification

5-3. BRUSHLESS SERVO MOTOR DRIVE UNIT

The brushless servo motor drive unit BL-D was developed by Okuma to drive its brushless servo motors, especially those used for machine tool axis drive. The brushless servo motor is another product of Okuma, one of the major suppliers of mechatronics technology in the world. The major features of the BL-D are listed below:

(1) The use of a brushless servo motor eliminates the need for inspection and replacement of commutator brushes, which is a must with DC motors.

(2) The transistor PWM system assures smooth and quick response.

(3) It promises good acceleration/deceleration characteristics.

(4) The high-resolution OSP position encoder directly coupled to the motor detects both the motor speed and position. Therefore, control and construction are quite simple.

(5) Various measures to protect the motor are provided. They include:

- motor overload detection
- no-fuse breaker
- overcurrent alarm
- input voltage detection
- circuit failure

5-3-1. Configuration of BL-D

The BL-D consists of the DC power supply and the servo amplifier unit. A DC power supply can supply power to multiple servo amplifiers and one brushless servo motor requires one servo amplifier. Fig. 5-4 shows the configuration of the BL-D.

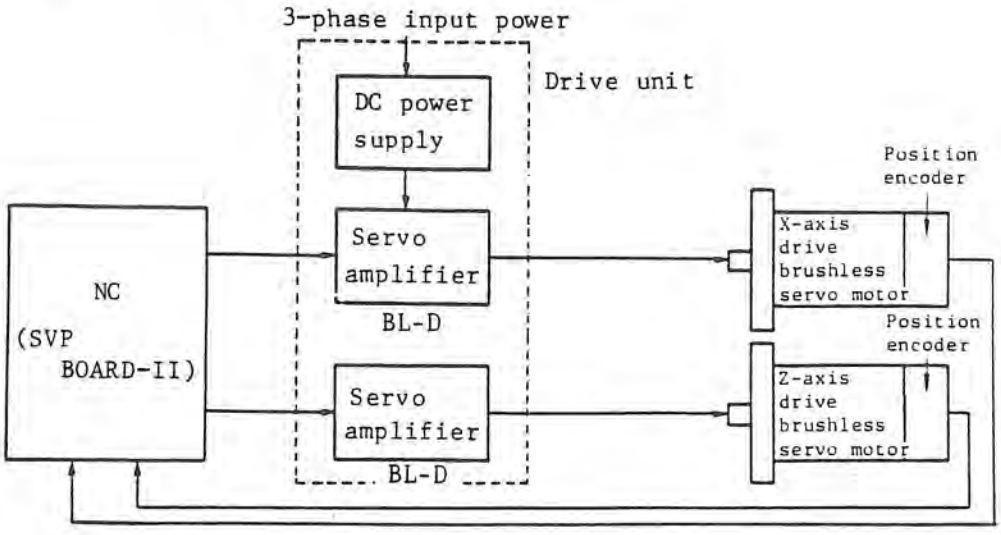


Fig. 5-4 BDU-A Configuration

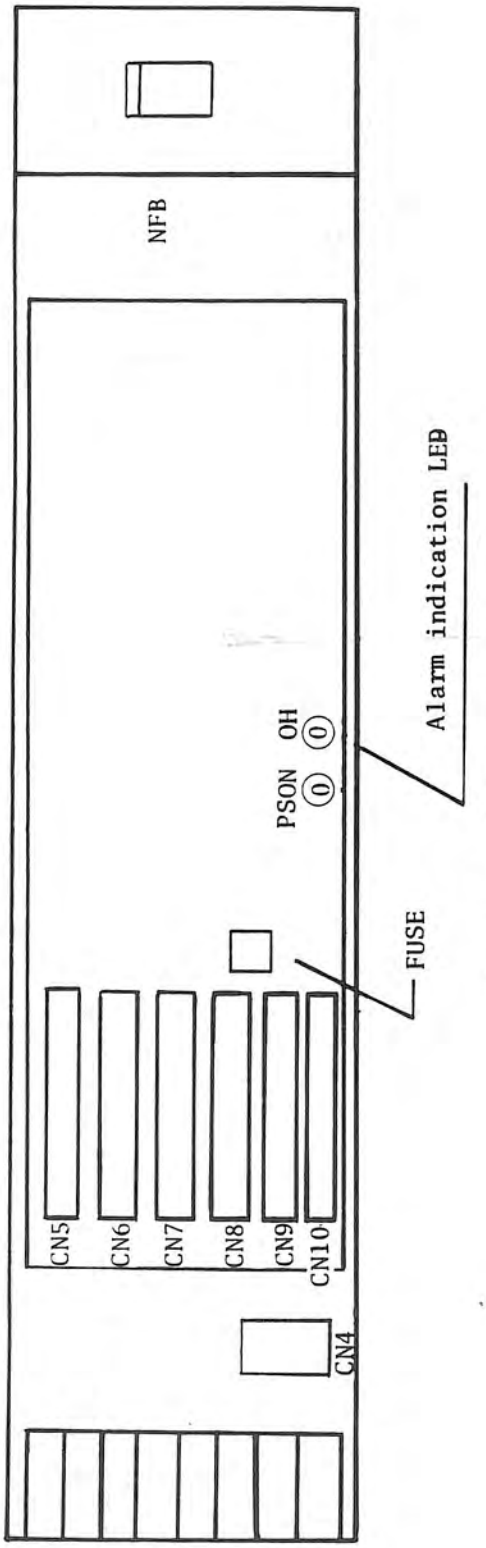


Fig. 5-5 DC Power Supply

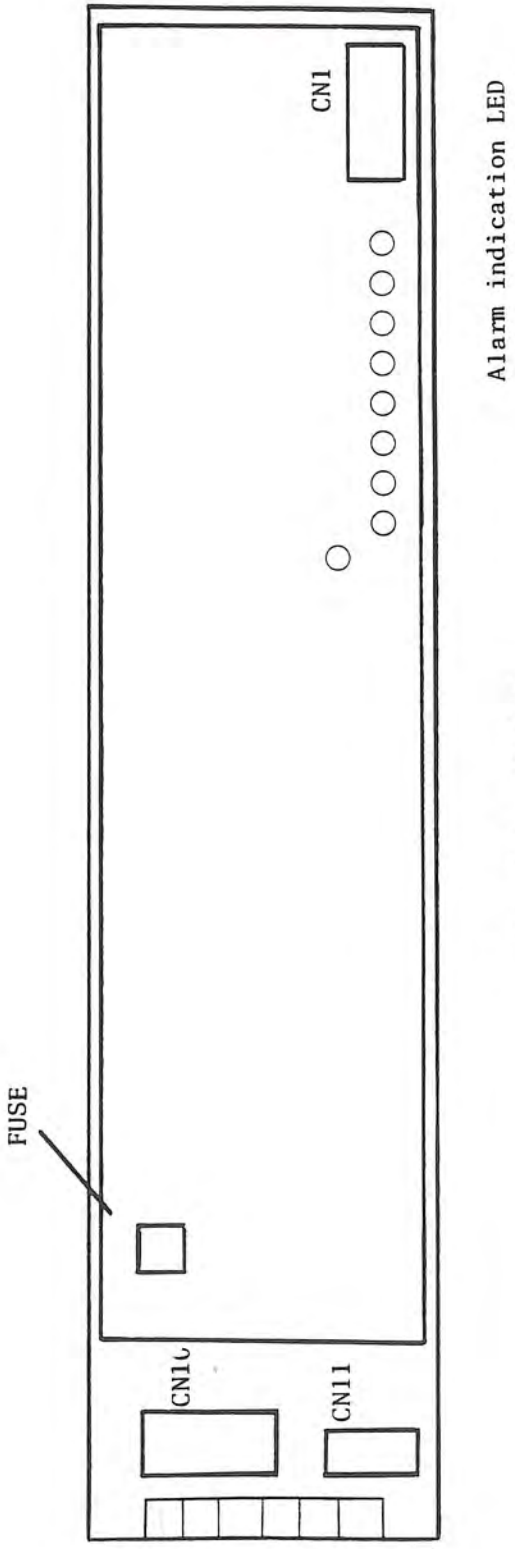


Fig. 5-6 BL-BXXA

5-3-2. BL-D Protection Function and Alarm Indication

(1) Protection Function

The BL-D has protection functions indicated in Table 5-1.

Table 5-1

Protection Function	Indication	Contents
Fuse	Fuse element is blown out. See item (3) in 5-3-2.	It protects the BL-D from short of load connected to the control circuit of DC power supply and servo amplifier.
No fuse breaker	The no-fuse breaker lever is turned to the OFF position.	It protects the BL-D from short of load connected to the power line or grounding of power line of DC power supply and servo amplifier.
Overload	Indication lamp	This detects the overload of motor.
Alarm of: overcurrent over voltage low voltage phase loss circuit alarm	LED	Refer to item (2) of 5-3-2.

(2) Alarm Indication and Alarm Contents

a) DC power supply

The printed circuit board in the DC power supply has light emitting diodes to indicate alarm occurrence as summarized in Table 5-2. If one of these red LEDs is illuminated, the magnet switch in the DC power supply is turned off, thus disabling the control of the brushless servo motor.

TABLE 5-2

LED	Alarm name	Contents of Alarm and Points to Check
OH	Over heat	DC Power Supply temperature has risen excessively

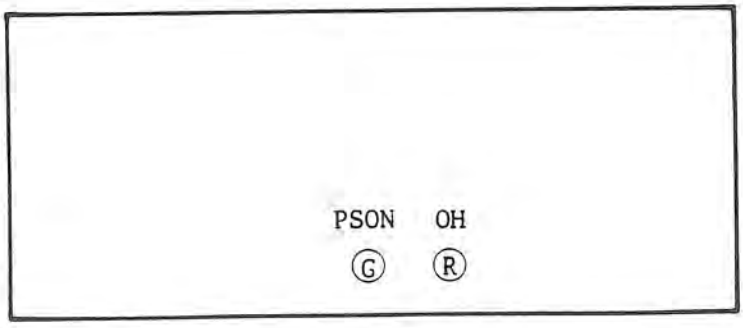


Fig. 5-7 Printed circuit board in DC power supply

b) Servo amplifier (BL-D)

The printed circuit board in the servo amplifier has light emitting diodes to indicate alarm occurrence as summarized in Table 5-3. If one of these red LEDs is illuminated, the base signal of a transistor in the servo amplifier is blocked and the alarm signal is outputted to the OSP at the same time.

Table 5-3

LED	Alarm Name	Contents of Alarm and Points to Check
VR	Control power alarm	±12 V power in the control circuit has dropped below the specified level.
IOC-M	Instantaneous over current	Overcurrent flowing through the motor. Check the brushless servo motor for burning and insulation.
IOC-S	Short	Excessive current flowing through the transistor bridge.
LV	Low voltage	DC power supply voltage has dropped excessively. Check the no-fuse breaker of the servo amplifier for tripping.
HV	High voltage	DC power supply voltage has risen excessively.
MOL	Motor over heat	Motor temperature has risen excessively
FOL	BL-D over heat	BL-D temperature has risen excessively

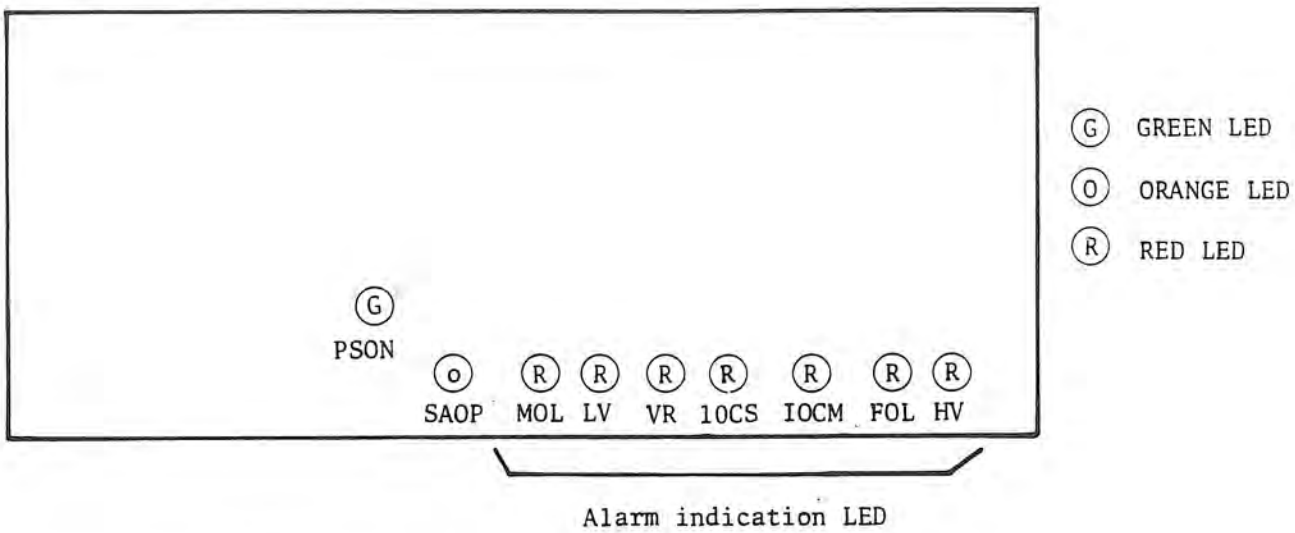


Fig. 5-8 Printed Circuit board in BL-D

5-3-3. Trouble and Troubleshooting

(1) Checkups after occurrence of a problem

If a problem occurs with the BL-D, carry out checkups referring to Table 54

Table 5-4

Item	Phenomenon	Checkups
1	The BL motor fails to rotate even when axis movement commands are given.	Is the no-fuse breaker of the DC power supply tripped? Is the no-fuse breaker of the servo amplifier tripped? Is any of the alarm indicating LEDs on the printed circuit board of the DC power supply or the servo amplifier illuminated?
2	An alarm state occurs when the BL motor starts.	Check load current. Is it too large?

5-4. INSPECTION OF POSITION ENCODER

The position encoder detects the present position of each axis accurately. Any fault in this encoder prevents the present position from being found easily, which will result in any of the following troubles.

- o Rough cut surface
- o Hunting
- o APA pattern data alarm, APA speed alarm and APA check data alarm

Checking The Position Encoder:

While moving each axis slowly with the pulse handle, check that the output value from the position encoder changes smoothly by the following procedures.

(1) Obtain the CHECK DATA *NC AXIS DATA* page on the CRT.

(2) Then, the position detected value of each axis, R-APA, operational value R-CON, and the difference R-DIF can be monitored. Here, note the R-APA, the position detection value of the axis to be checked.

(3) Switch the mode to MANUAL, and move the axis slowly with the pulse handle.

- o Check that the value changes from the smaller digit slowly.
- o Check that no value is omitted and that no value repeats.
- o Check that the digit carry is done properly.

Normal case:

18 ⟶ 19 ⟶ 2Ø ⟶ 21 ⟶ 22 .....

Abnormal case:

18 ⟶ 2Ø ⟶ 21 ⟶ 22 .....
18 ⟶ 19 ⟶ 21 ⟶ 2Ø .....

If the value and change are not normal, it can be assumed that there is a fault in the encoder. In addition, there is a possibility that there is a fault in the connector contact or the SVP BOARD-II of the CPU printed circuit boards.

5-6. CPU

This section describes matters related to the CPU. The complete operation of the NC machine is described in 4-3, "Operation and Structure of the NC", and should be referred to.

5-6-1. Operation and Structure of the CPU

Refer to Fig. 4-2.

As described in 4-3, the main component of the OSP5ØØ/OSP5Ø2ØLis the CPU, which consists of BOARDS and CARDS added to the BOARD.

Signals are communicated between each processor and external equipment (rape reader, position encoder, operation panel, servo drive, etc.) through the interface circuit contained in the BOARD.

The OSP5ØØ/OSP5Ø2ØLis a computer NC with control programs (control software) designed specially to each user's specifications, and delivered as control floppy disk with each NC system. The operation to store control software into the bubble memory is called software loading.

When the specifications are changed or a bubble memory is replaced, loading is required.

The power supply unit supplies all power required for the CPU. An 220 VAC input direct switching method is employed because it gives high efficiency and causes less heat generation.

Refer to Fig. 5-9 for CPU and Power Supply Unit.

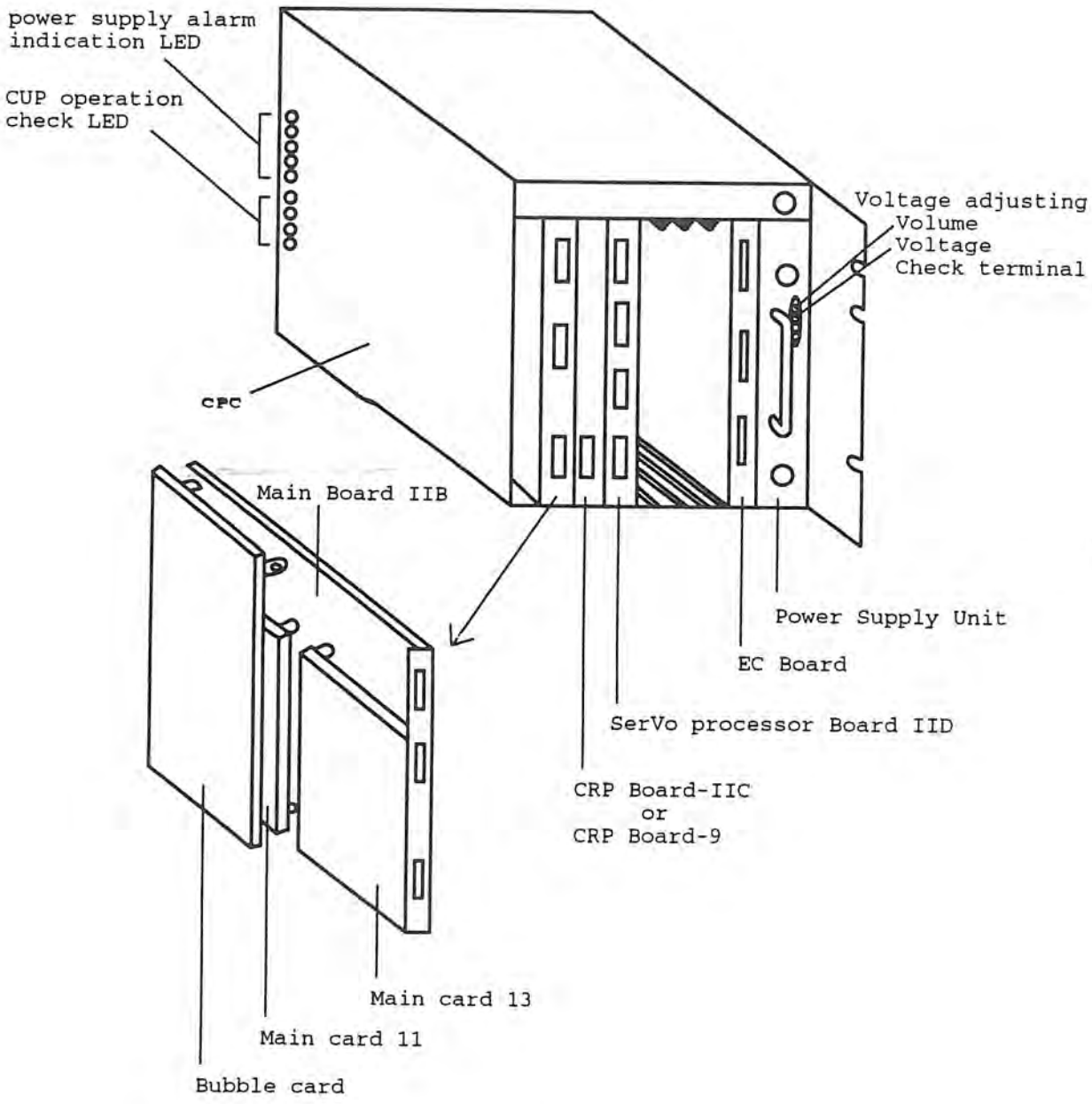


Fig. 5-9 CPU and Power Supply unit.

5-6-2. Checking CPU Operations

Simple checking for proper computer functioning can be carried out by checking if the indication on the CRT screen operates properly. For example, try to change the page indicated on the CRT screen. If the page is actually changed, it can be assumed that the computer works well. In order to check what condition the computer remains in, make a check by the CPU operation check indication on the CPU unit. Refer to Fig. 5-14.

Indication Contents

POWER ..... Power supplied to CPU

RUN ..... CPU running.

BUS ERROR ..... More than two errors occur at same time. CPU stops running.

ECC ERROR ..... Error in more than two bits are caused in the main memory.

DIA ERROR ..... Errors occur in self diagnostics.

LOOP ERROR ..... Errors occur when the control software execution is looped.

CYCLE ERROR .... Errors occur if the control command of the control software is not completed within a specified time.

WPRT ERROR ..... Errors occur if the control software enters memory address area not yet defined.

Fig. 5-10 CPU Operation Check Indication

- Two lamps, POWER and RUN, light in normal condition.

- When errors occur

  For any error except BUS ERROR:

  The CPU continues running and processes errors, and the CRT screen on the operation panel indicates the contents of the errors.

  For BUS ERROR:

  The RUN lamp goes off and CPU operation stops.

- Error indication means abnormality in the computer and will not go off when the OSP5ØØ/OSP5Ø2ØLis reset.

- To start NC operation again, switch OFF the power and then switch ON again. The computer starts RUN automatically and goes into NC operation several tens of seconds later.

- If the abnormality is continuous, the error occurs again and the computer stops. When the computer carries out normal NC operation, continue using it and observe the operation.

5-6-3. Loading Control Software through Floppy Disk

Loading the control software through the floppy disk can store the necessary information for controlling the OSP5ØØL-G/OSP5Ø2ØL in the bubble memory. This loading operation is required when changing the control specifications or after replacing bubble memory due to an occurrence of problems with the bubble memory.

The floppy disk storing the control software (to be referred to as the control floppy disk, hereafter) is supplied with the control system in a case.

The control floppy disk stores information necessary for initializing bubble memory, the NC control programs, and the data required for executing the NC control programs.

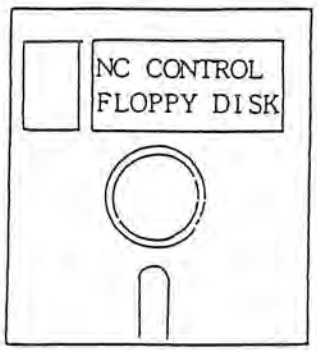


Fig. 5-11 Control Floppy Disk

Loading Procedure:

1) Turn off power supply and connect the portable floppy disk drive to the OSP5ØØL-G/OSP5Ø2ØL as shown in Fig. 5-12.

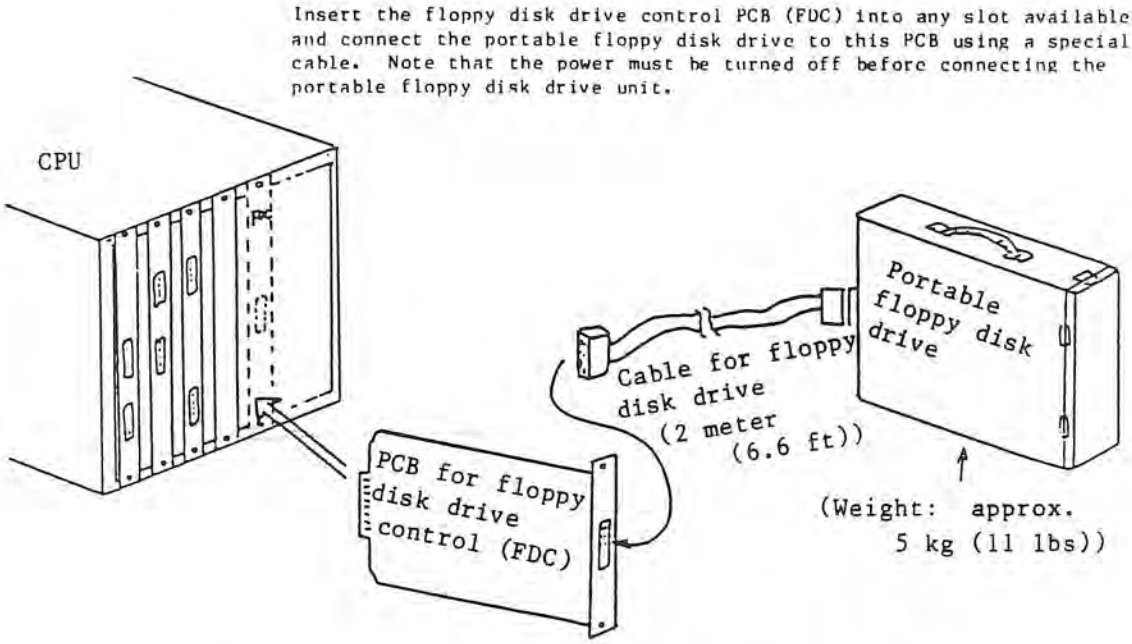


Fig. 5-12 Connection of Portable Floppy Disk Drive

Remark: When there is no empty slot for inserting the FDC, remove any board such as EC board, except the main board to insert the FDC.

2) Connect the portable tape reader.

3) Turn on power.

4) Turn the CONTROL PROGRAM LOAD ON/OFF switch on the portable tape reader to the ON position. Refer to Fig. 5-13.

5) Press the SYSTEM RESET button. The OSP5ØØL-G/OSP5Ø2ØL is placed in the loading wait condition and the CRT will display the message "control floppy loading wait".

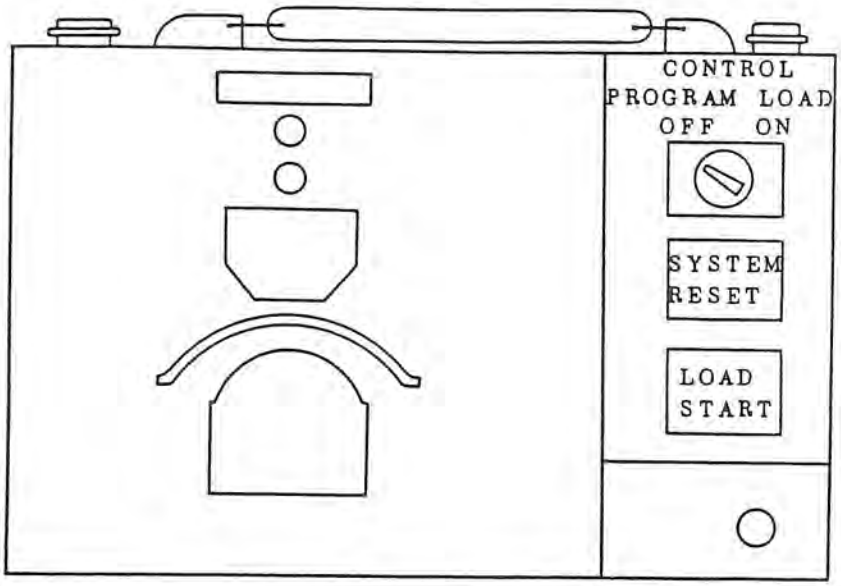


Fig. 5-13 Portable Tape Reader

6) After making sure the display on the CRT, insert the control floppy disk into the portable floppy disk drive.

7) Press the LOAD START button.

   The floppy disk drive starts and the control software on the floppy disk is read into the OSP5ØØL-G/OSP5Ø2ØL . The CRT will first display the message "control floppy loading start" and then the program name being read.

   After all programs on the control floppy disk have been loaded, the message "control floppy loading end" appears and the message "control floppy loading wait" will be displayed below it.

8) After all control software programs have been loaded, turn the LOAD switch OFF and press the CONTROL ON button after turning off power by pressing the CONTROL OFF button. The OSP5ØØL-G/OSP5Ø2ØL will start operation automatically and after an elapse of about several tens of seconds it starts the NC control in accordance with the loaded control software.

Warning:

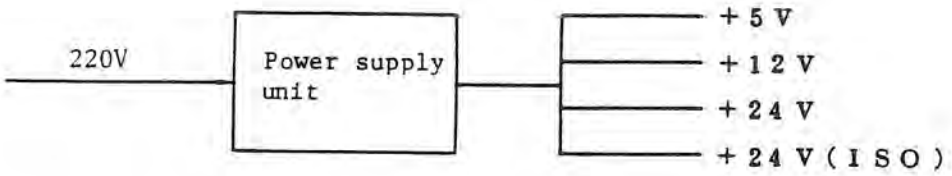
1. Never turn on and off power with the control floppy disk set in the floppy disk drive. The information on the floppy disk will become unreliable.

2. After the completion of the loading be sure to keep the control floppy disk in the floppy disk case after removing it from the floppy disk drive.

5-6-4. CPU Power Supply

The power supply for the CPU has the arrangement shown here.

VAC 220 is input into the power supply unit and this supplies the voltage required for the CPU. This unit is mounted on the CPU unit as shown in Fig. 5-9. Each output voltage is supplied for the following destinations.



+5V : Power supply for IC's in CPU unit

+12V : Bubble memory, position encoder, main spindle pulse generator, manual pulse generator

+24V : Bubble memory, tape reader

ISO+24V: Power supply for EC input/output isolator

Voltage check terminals for each output are provided to check these output voltages. A variable resistor to adjust the voltage is provided for +5V. Refer to Fig. 5-9.

This power supply has the function that continuously monitors input/output voltage and temperature. When an abnormality occurs, the cause is indicated by the power supply alarm indicating lamps shown in figure below, and CPU operation stops.

AC INPUT UV ALARM	Input Voltage dropped too low.
OVER TEMP ALARM	Power supply unit temperature has risen excessively.
UNDER VOLTAGE	A Voltage dropped too low. (including short circuit)
OVER VOLTAGE	A Voltage rose too high.
ISO 24V .....)	The voltage on which under voltage or over voltage alarm has occured is indicated.
+ 24V .....)	
+ 12V .....)	
+ 5V .....)	

Fig. 5-14 Power Supply alarm indication

- When any of these alarm lamps lights, power supply to the CPU is turned OFF and the CPU stops running.

- This alarm indicates an abnormality in the power supply unit or in the input and output parts. In this case, all power supplies in the NC system, including the operation panel, are cut off.

- To start the NC operation again, turn OFF the AC input to the NC system once (switch OFF the main breaker), and turn back ON the main breaker after confirming that the alarm indication disappears several tens of seconds later. Then press the POWER ON button. The CPU starts running automatically and the OSP5ØØL-G/ OSP5ØØØL-G starts operation.

- If the abnormality is continuous, the power supply alarm comes on again, but if the CPU runs normally, continue using it and observe the operation.

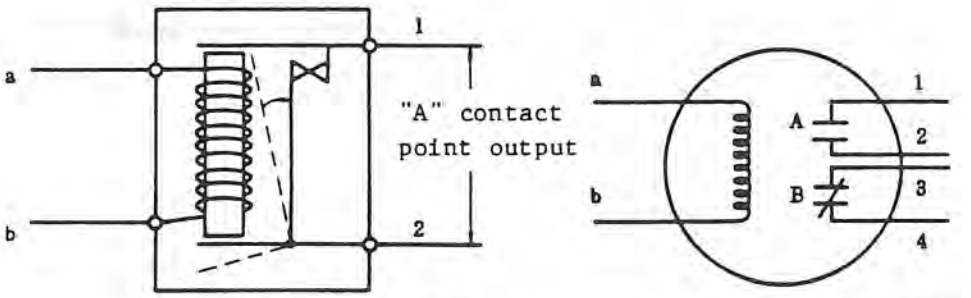
5-7. RELAY AND MAGNET SWITCH CIRCUITS

The relay and magnet switch circuits control devices requiring high voltage which cannot be controlled by semiconductors, such as motors, clutches, and solenoids. Since the relays and magnet switches can be checked visually, the operation check is relatively easy. Check according to the relay circuit diagrams provided for each machine.

5-7-1. Operation and Structure of a Relay and Magnet Switch Circuit

The same operation principle applies to all magnet relays.

When an energizing voltage is charged at both ends of the coil (a) and (b), an attractive force is generated in the coil and turns ON contact point A which is normally open (NO contact), and turns OFF contact point B which is normally closed (NC contact).



Relay operation diagram Relay circuit diagram

Fig. 5-15 Relay Operation

When the coil is energized, NO contact is closed and NC contact is opened.

On the other hand, when the coil de-energized, NO contact is opened and NC contact is closed. The coil will be energized by either DC voltage or AC voltage. Generally, most small relays are energized by direct current, while most large relays by alternating current.

With the LB series CNC lathes, most of the relay control circuits are replaced by computer software, and only the absolutely necessary number of relays are used. For arrangement of the relays, consult the Appended Figures (6), (7) and (8) Internal Layout of OSP5ØØL-G/OSP5Ø2ØL CNC Unit.

5-7-2. Inspection of a Relays and Magnet Switches

Large relays are called magnet switches. They are mainly used to control motors.

(1) Operation check of a magnet switch (MS)

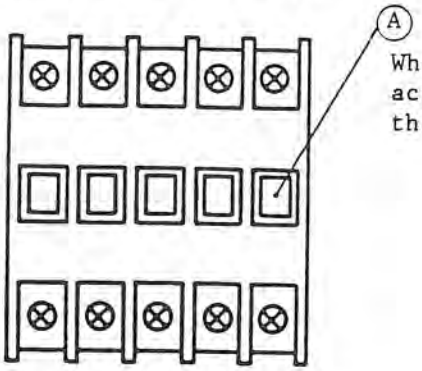


Fig. 5-16 Magnet Switch

When the magnet switch is actuated:

If the contact is closed, it is called contact point "A", and indicated in a circuit diagram by the symbol (1).

If the contact is opened, it is called contact point "B", and in a circuit diagram by the symbol (2).

Sometimes troubles of a relay are caused. When the coil is energized, a contact point may fail to open and close (due to poor contact or foreign matter clogging), or the Part A may occasionally remain pulled in (fused, etc) even when the coil is not energized.

(2) Operation check of relay (CR)

The operation and work of the relay is the same as for the magnet switch. For contact point (A) and (B), it is also the same.

Most relays are mounted on the printed circuit board called RUP panel. However, a few relays are mounted on other panels within the control cabinet.

Relays mounted separate from the RUP Panel have an indication LED. When the relay is actuated the LED is ON. See Fig. 5-16.

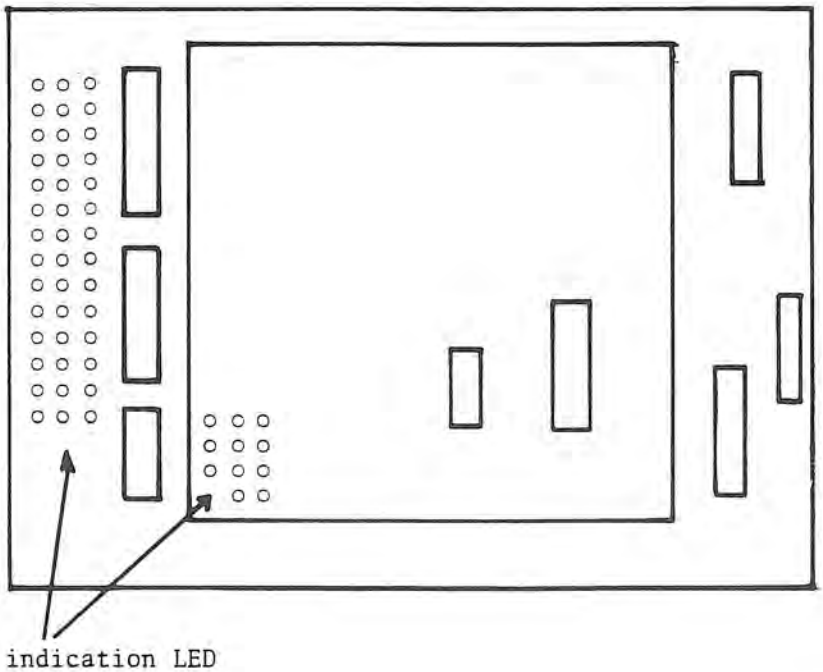


Fig. 5-16 RUP-panel

(3) Inspection of overload protection relays

For protecting motors and solenoids, etc., from overcurrent and overload, an overload relay is used.

To reset the tripped relay, push in the reset rod. Note that pushing in the reset rod right after the relay has been tripped, cannot reset the relay. Allow the switch to cool before resetting it.

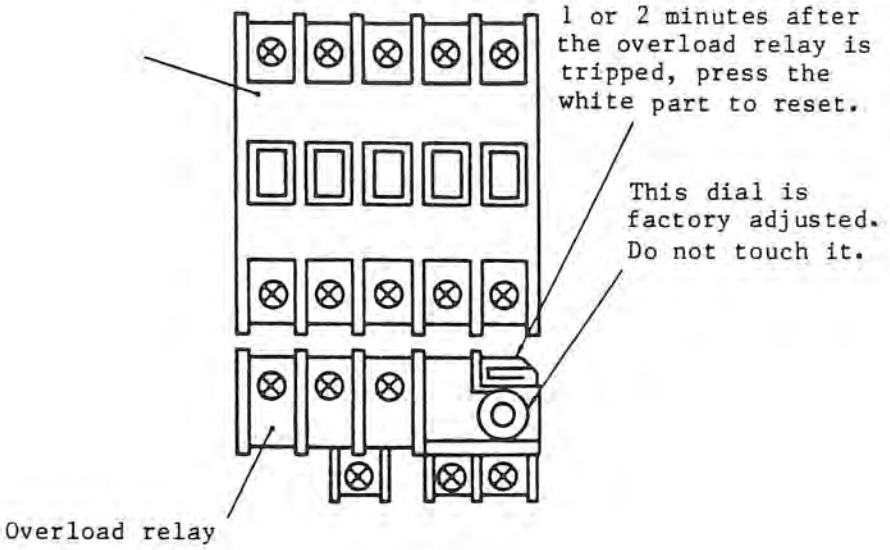


Fig. 5-17 Overload Relay

The circuit breaker and fuses prevent overcurrents from surging through the control circuit.

With circuit breakers, functions of the circuit can be recovered by simply resetting the tripped breaker.

SECTION 6 SPINDLE DRIVE UNIT FOR VAC MOTOR (FANNC MAKE)

6-1. GENERAL

This Instruction Manual covers AC Spindle Servo Unit Models and the related optional components.

This AC Spindle Servo Unit adopting microcomputers can drive the spindle smoothly, quietly and stably by means of our unique spindle drive system. In addition, our own regenerative control system can save power consumption by returning the regenerated energy to the power supply while AC spindle drive motor speed is decelerated.

6-1-1. Construction

The AC Spindle Servo Unit consists of the following unit and components.

(1) Spindle control unit
  (1.1) Power unit
  (1.2) Printed circuit board
  (1.3) ROM
(2) Fuses (for spare)
(3) Connectors (for connection)
(4) Transformer for different voltage supply (optional specification)
(5) Speed gain switchover control circuit

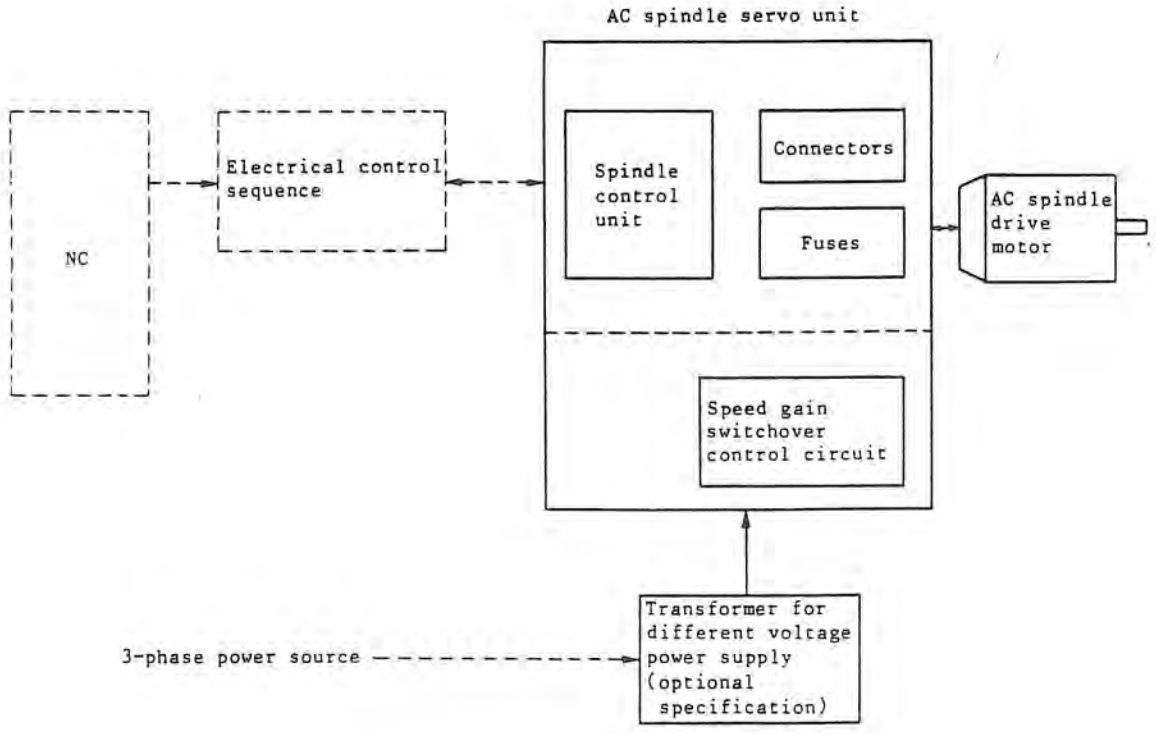


Fig. 6-1

6-2 MAINTENANCE

To maintain the designed performance of the spindle drive AC motor and the servo unit, check and clean them periodically - every six months desirable - according to the instructions below. However, if they are contaminated heavily when checked, it will be necessary to check them more frequently than specified.

(1) Spindle Drive AC Motor

Dust and dirt accumulated on the ventilation holes, cooling fan, or fanguard (screen) of the spindle drive AC motor deteriorates the radiation efficiency of the motor. In this case, clean them using compressed air or a vacuum cleaner.

(2) Servo Unit

Since the cooling fan is located on the upper side of the servo unit, nearby components such as resistors will be contaminated by dust and dirt after a long time of operation. If the servo unit is contaminated heavily, clean it using a vacuum cleaner.

6-3. TROUBLESHOOTING

If a trouble occurs, locate the possible cause and take necessary measures, referring to the instructions in 6-8-1, "Classification of Troubles". BEFORE STARTING INSPECTION, CHECK AC POWER SUPPLY VOLTAGE AND DC POWER SUPPLY VOLTAGE ON PCB AS INDICATED IN TABLE 6-1.

Table 6-1

Confirmation of AC Power Voltage	Confirm between Input Terminals R, S, T, and G
Confirmation of DC Power Voltage on the Printed Circuit Board	

Voltage	Check Terminals (across)	Rated Value
+24 V	+24 and Ø V	Approx. 25 V ± 1Ø% Approx. Ø.5 V of ripple
+15 V	+15 and Ø V	+15 V ± 4% (not adjustable)
+ 5 V	+ 5 and Ø V	+5 V ± 1% (adjust by RV15)
-15 V	-15 and Ø V	-15 V ± 4% (not adjustable)

6-3-1. Classification of Troubles

Table 6-2

No.	Trouble	Reference Item
1	POWER ON indicator (PIL) does not turn on.	(1)
2	Alarm indicator on the printed circuit board is on	(2)
3	Motor does not rotate, or its speed is not as commanded.	(3)
4	Excessive vibration and noise while motor runs.	(4)
5	Noise during deceleration.	(5)
6	Motor speed overshoots or hunts.	(6)
7	Low cutting performance.	(7)
8	Spindle orientation cannot be correctly performed.	(8)
9	Long acceleration and deceleration time.	(9)

(1) POWER ON INDICATOR "LED1" DOES NOT TURN ON.

Table 6-5

No.	Problem	Inspection	Remedy
1	No AC power supply	Check supply voltage between terminals R, S and T.	
2	Fuse F4 is blown.	See Appendix 1.	Replace F4 (5 A).
3	Any of fuses AF1, AF2 and AF3 is blown.	Check if warning indication of fuse AF1, AF2 or AF3 is visible. Refer to Appendix 1.	Replace the blown fuse, AF1, AF2, or AF3. If the new fuse is blown, replace the printed circuit board.
4	Connectors CN6 and CN7 for the printed circuit board are not inserted properly.	Check to be sure that the recess on the connector guide can be seen at the surface of the connector on the printed circuit board.	Insert them properly.
5	No output voltage at terminals 19A and 19B due to faulty transformer.	Measure the voltage across the following check terminals on the printed circuit board: 19A and CT 19B and CT Normal voltage across the terminals 19A and CT, and 19B and CT is approx. 19 V AC.	Replace transformer TF.
6	Power supply circuit on the printed circuit board is defective.	Since the indicator PIL is lighted by the voltages, +5 V and -15 V, check the power supply voltage referring to Table 6-3.	Replace the printed circuit board.

(2) ALARM INDICATOR ON THE PRINTED CIRCUIT BOARD IS ON

Alarm indication No. is shown in display on the printed circuit board.

Table 6-6 Contents of Alarm

ALARM NUMBER	CONTENTS OF ALARM
AL-01	Motor has overheated. (Thermostat has activated)
AL-02	Excessive servo error
AL-03	Fuse F7 in the DC line has blown.
AL-06	Motor speed exceeded the rated max. speed. (Analog system detection: 13% TYP)
AL-07	Motor speed exceeded the rated max. speed. (Digital system detection: 11%)
AL-08	Power voltage (+24 V) is too high.
AL-10	Power supply voltage of +15 V has dropped abnormally.
AL-11	Voltage at the DC capacitor has risen abnormally.
AL-12	Over current at DC capacitor
AL-16-23	CPU Alarm
No display	ROM

a) Alarm No. 1: Motor Overheat

No.	Problem	Inspection	Remedy
1	Failure of the fan motor in the motor.	Check if the fan motor rotates.	Replace the fan motor.
2	Overload	Confirm the reading of the load meter.	Examine the cutting conditions or tools.
3	Contaminated motor cooling system		Clean it by the compressed air or vacuum cleaner.
4	Wrong connection	Check the connection between the motor and the servo unit.	

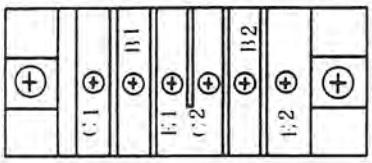
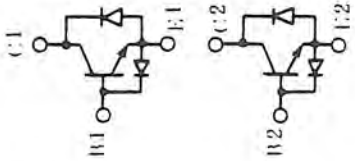
b) Alarm No. 2: Excessive Servo Error

No.	Problem	Inspection	Remedy
1	Overload	Confirm the reading of the load meter.	Examine the cutting conditions or tools.
2	Poor contact of the connector	Check the connection between CN2 and motor connector.	
3	Malfunction of torque limiter	Confirm the reading of the load meter.	Replace the printed circuit board.
4	Failed speed feedback signal		Replace the printed circuit board.

c) Alarm No. 3: Fuse (F7) in the DC line has blown.

If the fuse (F7) in the DC line has blown, the power transistor module may be faulty. Check the faulty element and replace it with new one according to the following procedure. If the power transistor module is damaged possibly, caused by a problem in the control printed circuit board, it is also recommended to replace the printed circuit board.

Step	Procedure
1	After turning the AC power supply OFF (i.e., turn the main circuit breaker OFF), disconnect the power line to the motor.

Step	Procedure
2	Measure the resistance between the collector and emitter, and collector and base of the transistor module using a multitester (setting: X1Ø Ω range). Across Collector and Base  Across Collector and Emitter  Terminals of Transistor Module Acceptable: Several hundred ohms Unacceptable: Ø Ω - 1Ø Ω C1, C2: Collector B1, B2: Base E1, E2: Emitter
3	Replace the defective element. Be sure to apply silicon grease to the new one when replacing.
4	After completing replacement, measure the resistance as per step 2.
5	If the printed circuit board is possibly faulty, replace the printed circuit board.
6	Connect the power line to the motor and replace Fuse F7; operation can be resumed now.

d) Alarm No. 6: Overspeed (Analog Detection System)

No.	Problem	Inspection	Remedy
1	Improper setting and adjustment of the printed circuit board	Check the setting and adjustment of the printed circuit board.	Check the setting of S5.
2	Defective ROM (Memory IC)		Replace ROM.
3	Defective printed circuit board		Replace the printed circuit board.

e) Alarm No. 7: Overspeed (Digital Detection System)

Inspect in the same manner as Alarm No. 6.

f) Alarm No. 8: Overvoltage at +24 V Terminal

No.	Problem	Inspection	Remedy
1	AC supply voltage is higher than the rated voltage by +1Ø% or more.	Check the supply voltage.	Replace the printed circuit board.
2	Wrong setting of the toggle switch for voltage selection	Check the supply voltage.	Refer to Table 6-1 and confirm the proper voltage, either 2ØØ V or 22Ø V.

g) Alarm No. 1Ø: Voltage Drop at +15 V Terminal

This alarm indicates large drop in AC supply voltage. (dropped by 15% or more with respect to the rated voltage)

k) Alarm No. 11: Overvoltage in the DC Line

No.	Problem	Inspection	Remedy
1	Fuse F5 or F6 has blown.	Check fuses F5 and F6 using a tester. If fuse F5 or F6 has blown, it is also recommended to examine the transistor module in the same manner as applied to Alarm No. 3.	Replace the blown fuse.
2	Large power source impedance		Examine the specification of AC power source. Refer to Table 6-1.
3	Defective printed circuit board		Replace the printed circuit board.

l) Alarm No. 12: Overcurrent in the DC Line

No.	Problem	Inspection	Remedy
1	Short-circuit at the output terminal or inside the motor	Check the connections.	
2	Defective power transistor module	If Alarm No. 12 persists right after it is reset, check the transistor module in the same manner as detailed in c) Alarm No. 3.	Replace the defective element.
3	Defective printed circuit board		Replace the printed circuit board.

(3) MOTOR DOES NOT ROTATE, OR ITS SPEED IS NOT AS COMMANDED.

No.	Problem	Inspection	Remedy
1	Examine the problem according to each condition	When rotation command is provided, alarm display on the printed circuit board of the spindle drive servo unit lights up. Alarm does not occur.	Refer to 6-6. To No. 2 and No. 3 below.
2	Faulty connection of the signal circuit	Check the connection of the signal line.	
3	Defective printed circuit board		Replace the printed circuit board.

(4) EXCESSIVE VIBRATION AND NOISE WHILE MOTOR RUNS

No.	Problem	Inspection	Remedy
1	Faulty motor		Replace the motor.
2	Defective printed circuit board		Replace the printed circuit board.

(5) NOISE DURING DECELERATION

Regenerative energy is returned to the power source through the regenerative circuit while motor is decelerating, but regenerative limit circuit is activated when the regenerative energy becomes too high, causing the waveform to be changed. This sometimes causes the noise of the motor.

Setting the variable resistor RV6 to the position smaller than the standard setting "3" by turning it counterclockwise can eliminate the noise. However, such setting results in a larger deceleration time.

(6) MOTOR SPEED OVERSHOOTS OR HUNTS

No.	Problem	Inspection	Remedy
1	Faulty setting and adjustment of the printed circuit board		Readjust.
2	Spindle hunts.		Readjust.

(7) LOW CUTTING PERFORMANCE

No.	Problem	Inspection	Remedy
1	Torque limit command is provided.	Check the pertaining signal.	
2	Loose drive belts	Check the tension of the belts.	

(8) SPINDLE ORIENTATION CANNOT BE CORRECTLY PERFORMED.

No.	Problem	Inspection	Remedy
1	Defective printed circuit board of the speed gain switchover control circuit		Replace the printed circuit board.
2	Faulty adjustment of the spindle control circuit		Adjust the printed circuit board.

(9) LONG ACCELERATION AND DECELERATION TIME

No.	Problem	Inspection	Remedy
1	Torque limit command is provided.		
2	Faulty adjustment of the printed circuit board		Readjust

6-4. FUSE REPLACEMENT

To replace fuses F2, F3, F4, F5, F6 and F7 inside the unit, it is necessary to open the cover plate of the unit, as shown in Fig. 6-1 below.

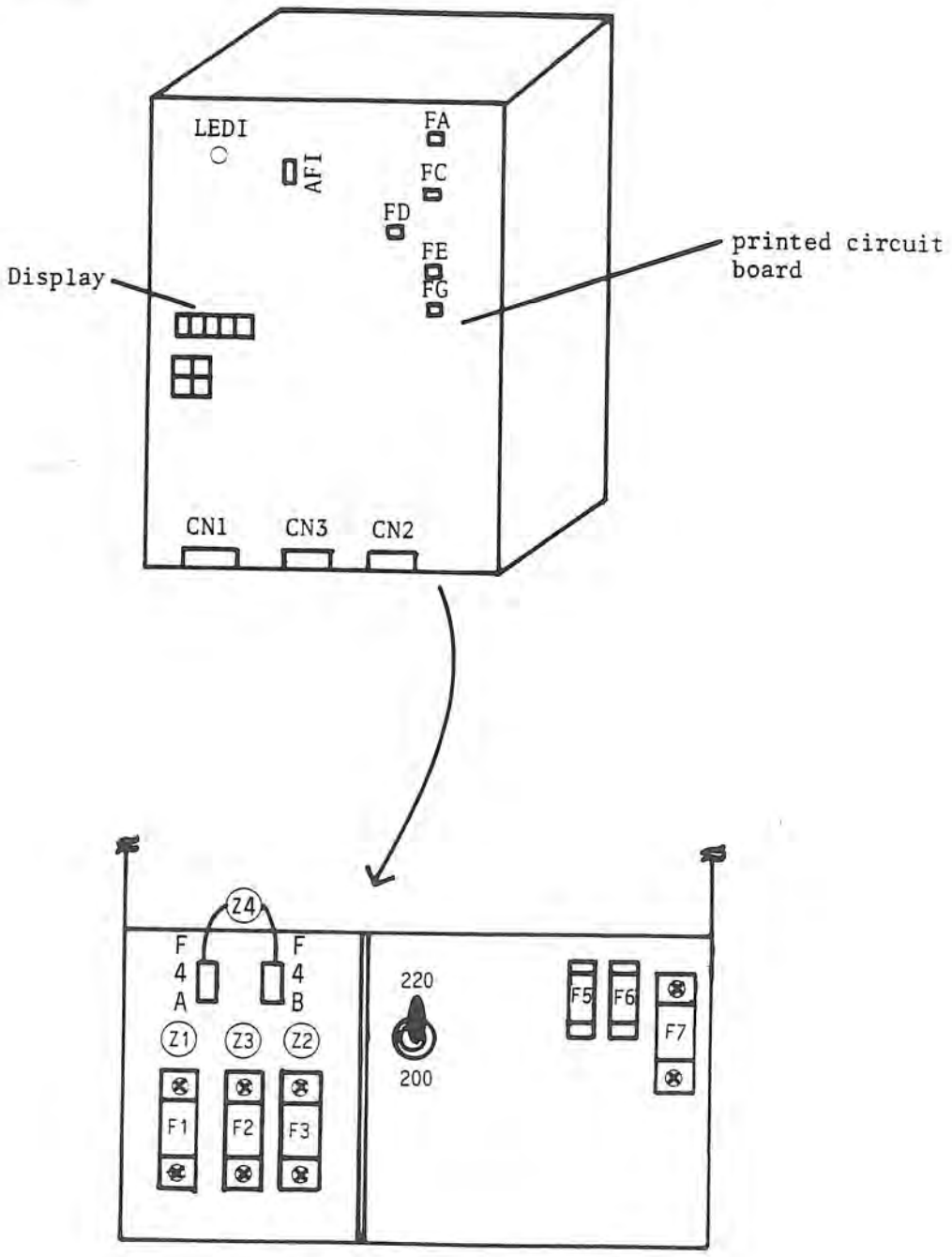


Fig. 6-1 AC Spindle Drive Unit

SECTION 7 SPINDLE DRIVE UNIT FOR VAC MOTOR (OKUMA MAKE)

7-1. OUTLINE

This manual is prepared for Okuma's VAC motors and VAC drive units. Okuma's VAC motors are built especially for driving machine tool spindles and feature high reliability, wide constant output range and compact construction.

Okuma's VAC drive units adopt the vector control method using a 16 bit microprocessor to promise excellent response and stable control.

7-2. MAINTENANCE AND INSPECTION

VAC motors and VAC drive units do not require special regular inspection. However, inspection and cleaning on the following points in every six months are recommended to maintain their designed performance.

However, if they are contaminated heavily, check them more frequently than specified.

Table 7-1 Inspection Items

Inspection Point	Inspection Procedure	Measures
VAC motor VAC drive unit Cooling fan Fan guard (screen) Ventilation holes	Check for dust and dirt accumulation.	Remove dust and dirt by compressed air or vacuum cleaner.

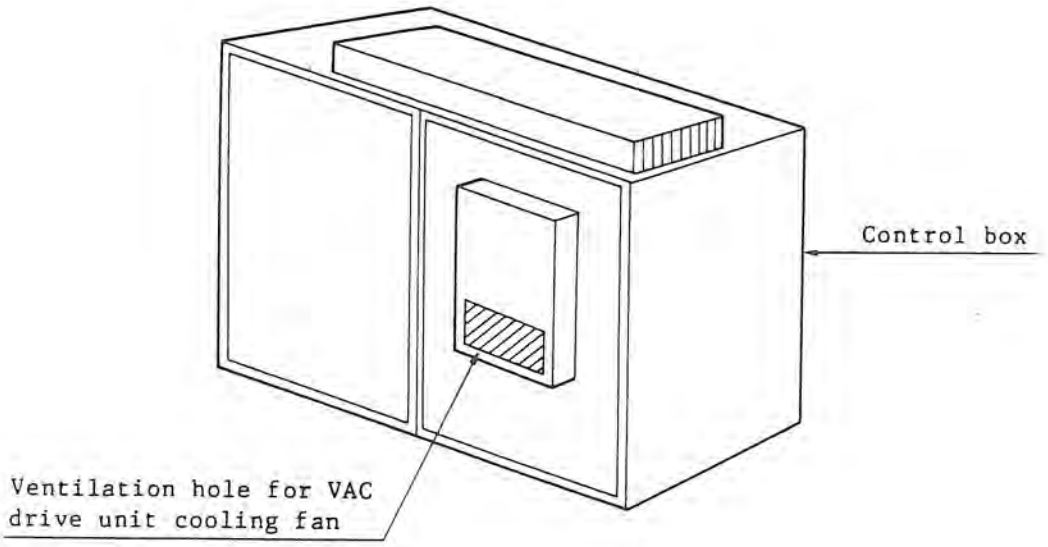


Fig. 7-1 VAC Drive Unit

7-3. TROUBLES AND TROUBLESHOOTING

7-3-1. VAC DRIVE UNIT CONSTRUCTION

Arrangement of parts which will require checkup when a problem has occurred is shown in Figs. 7-2, 7-3, 7-4 and 7-5.

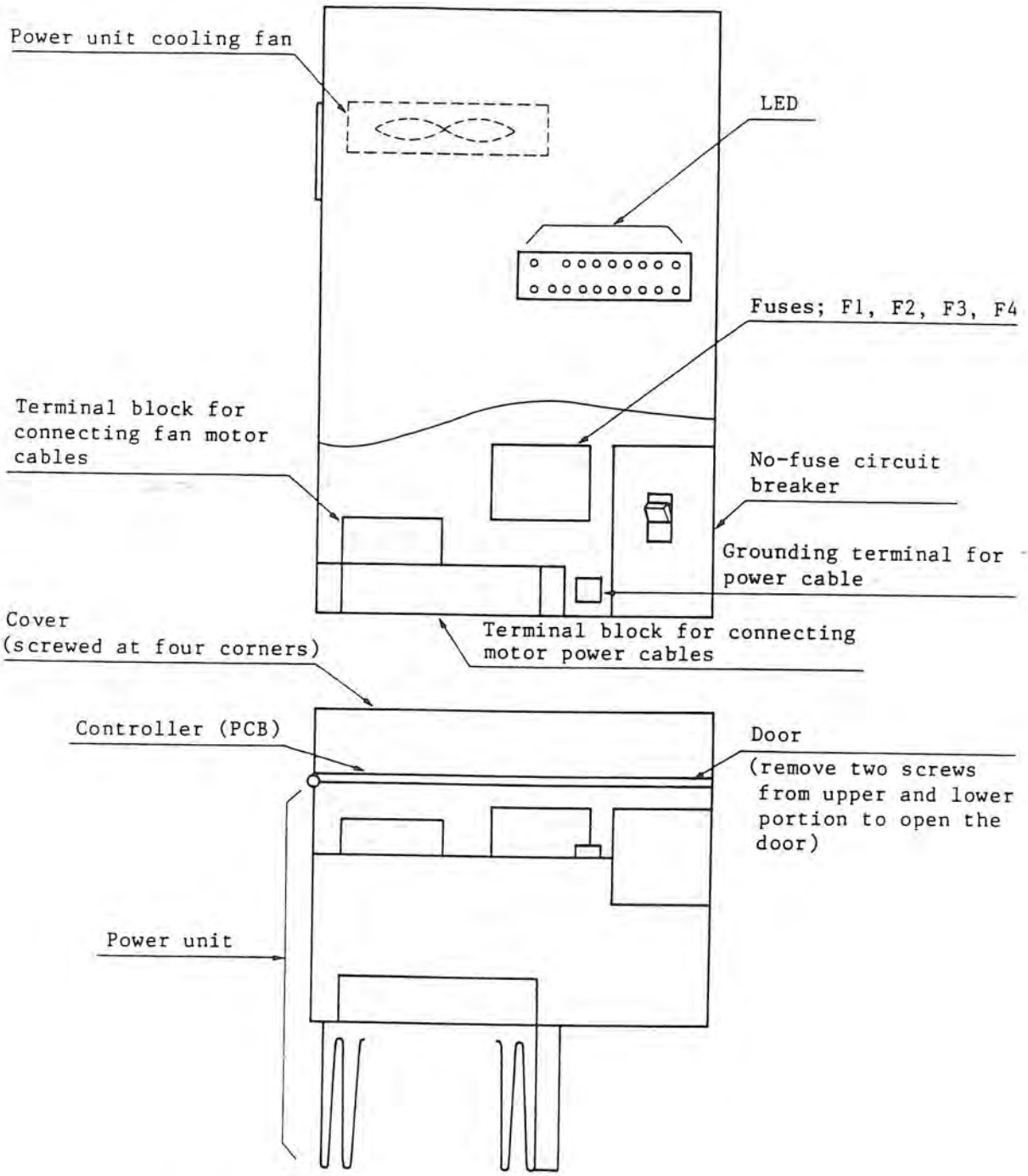


Fig. 7-2 Arrangement of Major Component Parts of D3/D6

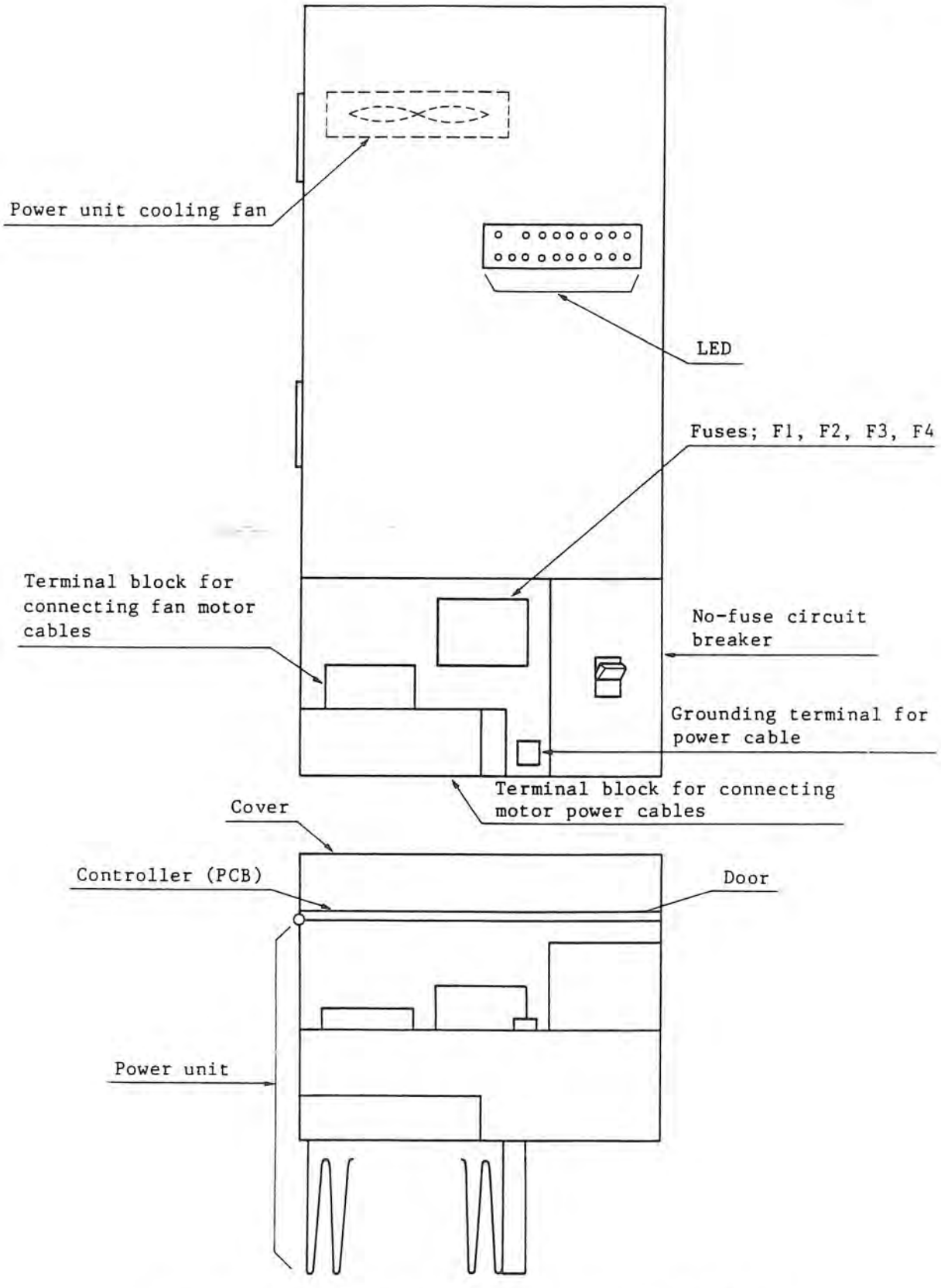


Fig. 7-3 Arrangement of Major Component Parts of D11

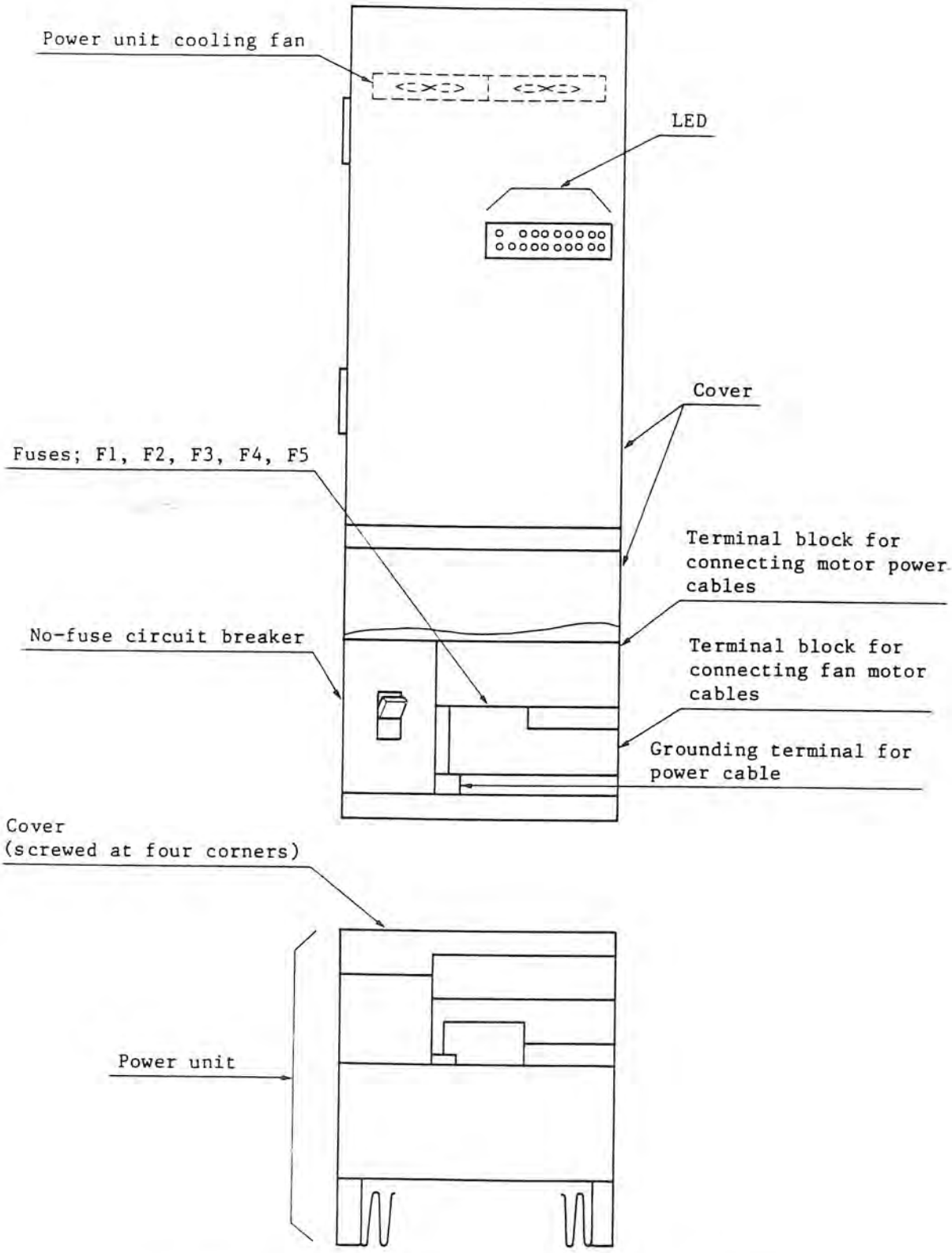


Fig. 7-4 Arrangement of Major Component Parts of D22

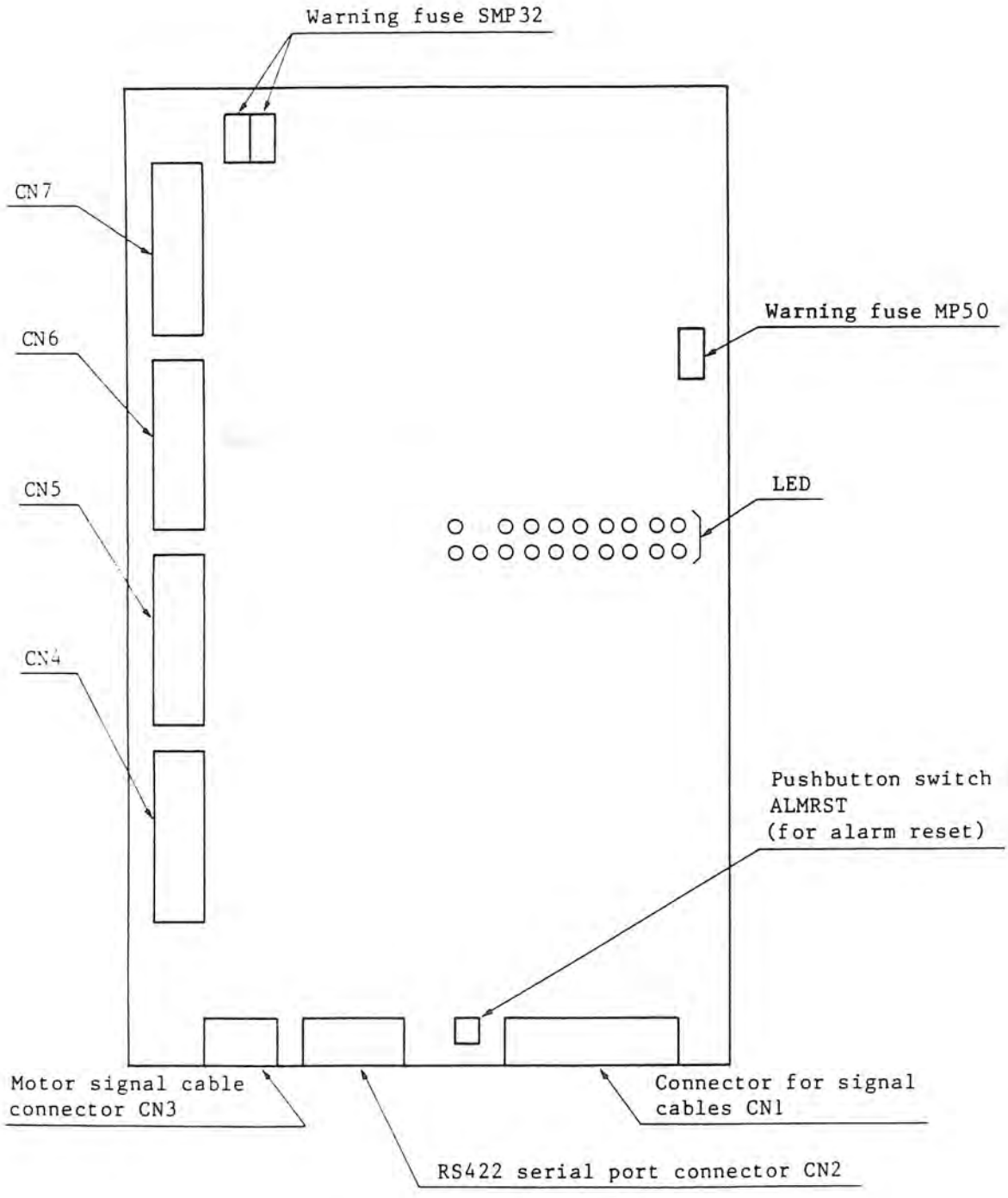


Fig. 7-5 Arrangement of Major Component Parts on Printed Circuit Board

7-3-2. OPERATION STATUS DISPLAY

Operation status of the VAC drive unit is indicated with the LED's at the PCB.

The LED's illuminating conditions can be observed through the hole in the cover (See Figs. 7-2, 7-3 and 7-4.).

LED's nomenclature is shown in Fig. 7-6.

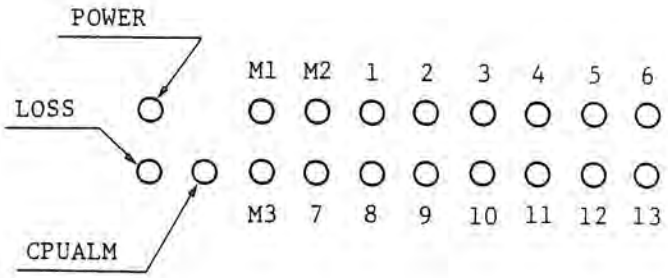


Fig. 7-6 LED's Nomenclature

7-3-2-1. Operation Indicating LED's

These three LED's indicate the operation condition of the VAC drive unit. Functions of them are summarized in Table 3-1.

Table 7-2 Function of Operation Indicating LED's

LED Name	Color	Function	Remark
POWER	Green	Indicates that power supply for control circuit of the VAC drive unit is being supplied.	If this LED is OFF while power supply to the VAC drive unit is ON, it indicates failure of the unit.
LOSS	Red	Indicates that voltage being applied to the operation circuit in the VAC drive unit is outside the specification.	If this LED lights up, it indicates that the operation circuit is not functioning correctly.
CPUALM	Red	Indicates that the operation circuit in the VAC drive unit is faulty.	Contents of failure are indicated by the operation status indicating LED's.

7-3-2-2. Operation Status Indicating LED's

A total of 16 LED's are used to indicate the operation status of the VAC drive unit and the VAC motor. There are two operation status indication modes such as "failure operation status indication" and "normal operation status indication".

Under the failure operation status:

a) LED's M1 and M2 flash at the same time
b) LED M1 lights up
c) LED M2 lights up

Other LED's light up corresponding to the failure conditions to indicate the contents of failure.

In any of these cases, normal operation of the VAC drive unit and the VAC motor is impossible.

Table of failure operation status indications is given in Table 7-3.

Figs. 7-7, 7-8 and 7-9 indicate the contents of failure.

Under the normal operation status:

The LED's indicate the input/output conditions of the input/output signals.

Fig. 7-10 shows the contents of indication. Input/output signals are explained in Section 7-6.

Table 7-3 LED Lighting Conditions when Failure Occurs

LED Lighting Conditions				Contents of Failure	
M1	M2	M3	Failure Cause Indicating LED		
Flash	Flash	OFF	1	RES	Resolver faulty
			2	AD	A/D access error
			3	PAR	RAM parity error
			4	ACC	Microcomputer access error
			5	LOOP	INT6 loop error
			6	WDOG	Watch dog error
		ON	7	IOCM	Overcurrent of power transistor
			8	IOCS	Short of power transistor
			9	IOCR	Short of power transistor at regeneration unit
			10	OV	Over-voltage
			11	UV	Under-voltage
			12	PH	Phase loss
			13	LOSS	Loss of power supply at operation circuit
ON	OFF	OFF	1	OS	Over-speed
			2	READ	Speed command read error
			3	UVP	Power circuit under-voltage
			4	RAER	RAM faulty
			5	DSE	DIP switch setting error
			7	LOOP4	INT4 loop error
			8	LOOP1	INT1 loop error
OFF	ON		1	OH	Heat sink over-heat
			2	OL	Motor over-load

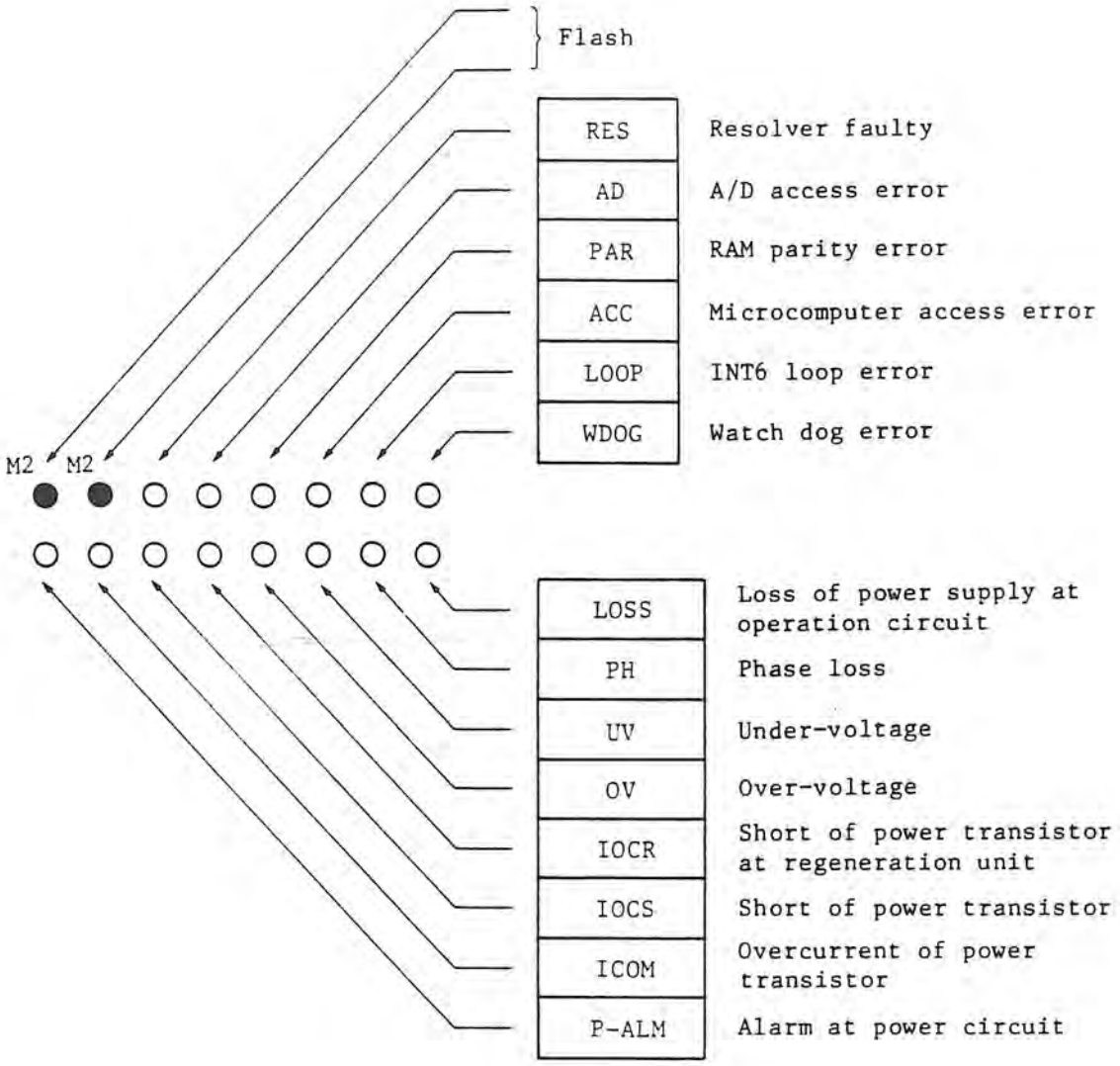


Fig. 7-7 Failure Indication by LED
(with M1 and M2 LED's flashing)

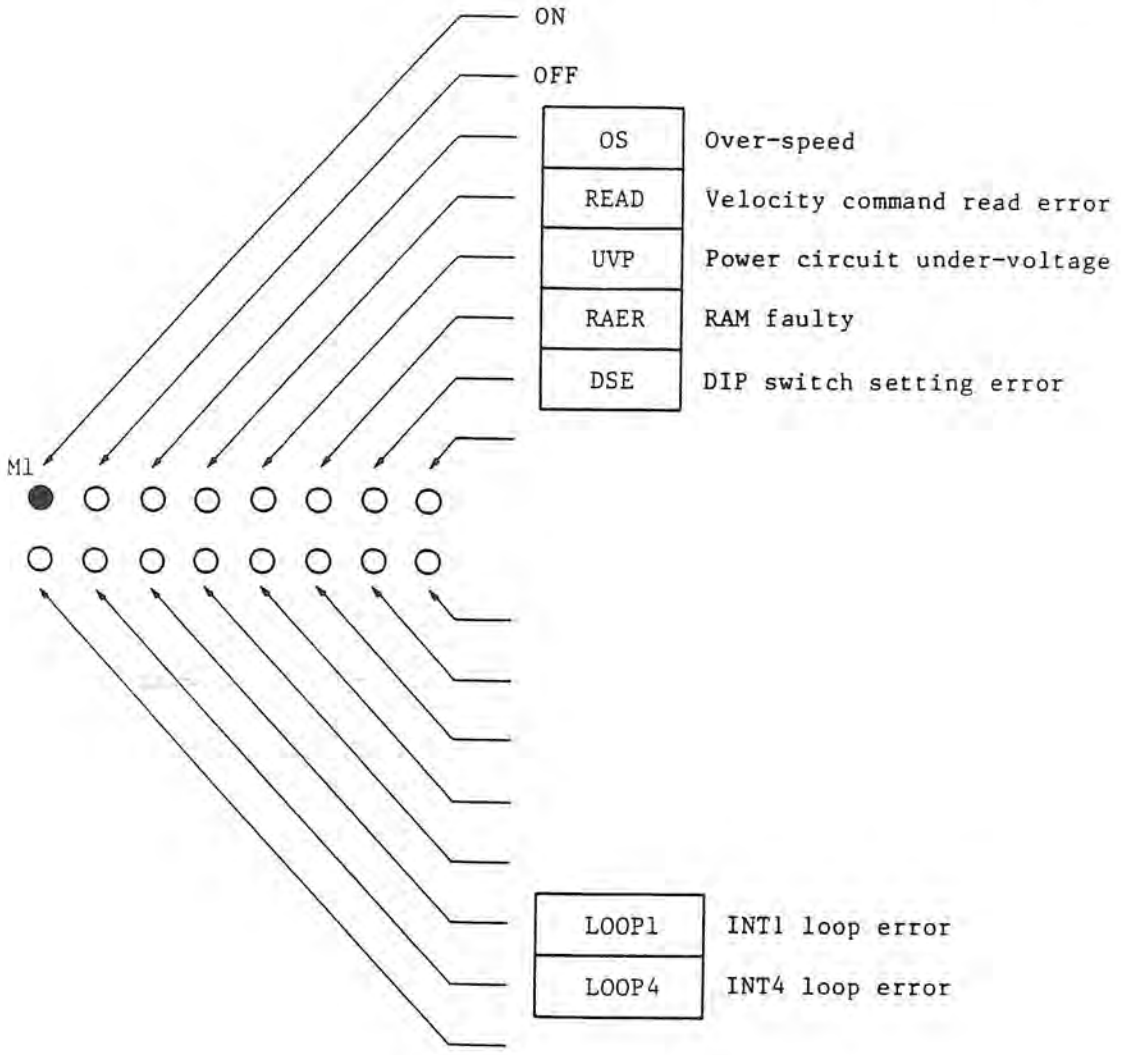


Fig. 7-8 Failure Indication by LED (with M1 ON)

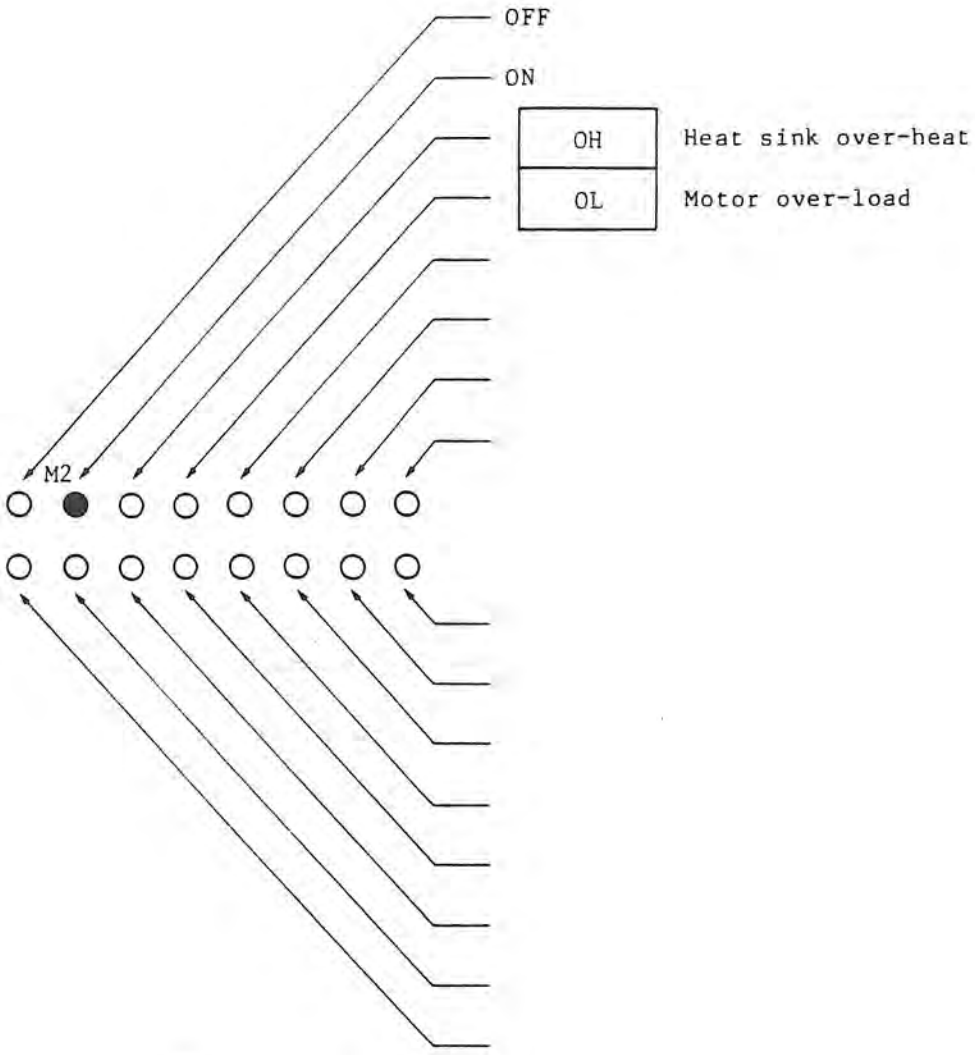


Fig. 7-9 Failure Indication by LED (with M2 ON)

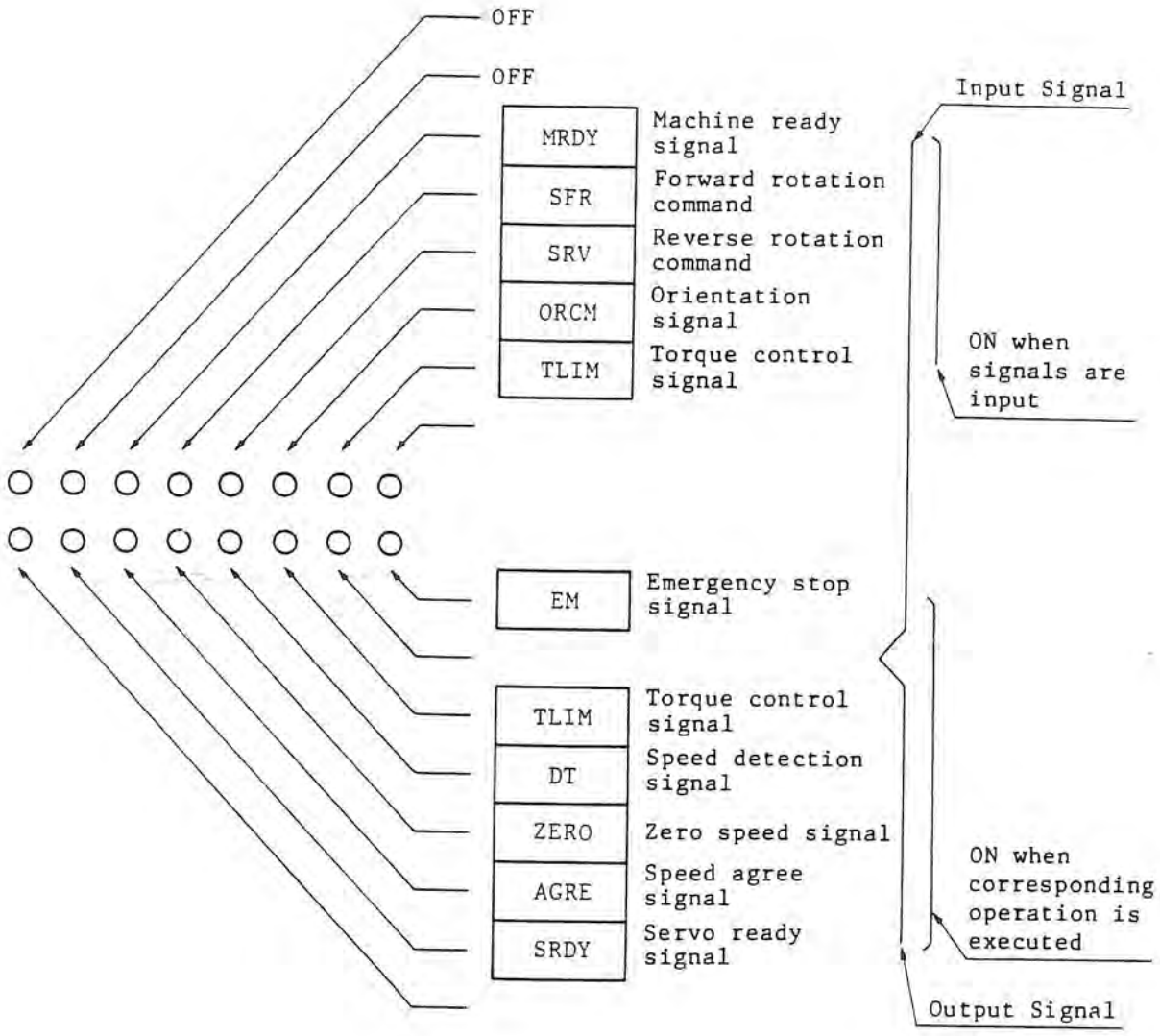


Fig. 7-1Ø Signal Indicated by LED during Normal Operation Status

7-3-3. MEASURES TO TAKE

Measures to take after an occurrence of failure are explained in 7-3-3-1 and 7-3-3-2. Arrangement of component parts is shown in Section 7-3-1.

Since high voltage is applied to the VAC drive unit, first record the number of LED illuminating and turn off power supply to the VAC drive unit before attempting to touch inside the unit.

7-3-3-1. Confirmation of Power Supply, Connectors and Signals

Before proceeding to checkups and taking necessary measures as explained in 7-3-3-2, check power supply, connectors and signals in accordance with Table 7-4.

Table 7-4 Confirmation of Power supply, Connectors and Signals

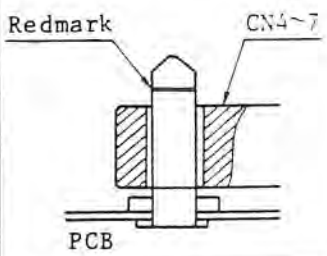
Item	Confirmation	Measures
Power supply	Measure input voltage at input terminals R, S and T of no-fuse breaker to make sure that input voltage is within the allowable range. Allowable input voltage range: AC 3-phase, 170 - 240V 50/60 Hz 1%	Make necessary adjustments so that input voltage is within the specified range.
Connectors	Make sure that MR connectors (CN1 through CN3) are securely clamped in place with screws. Make sure that red mark of the connector guide is at the front side of the PCB side connector (for PCB connectors CN4 through CN7).	Correct connection. 
Signal	When the LED's are indicating normal operation conditions, make sure that the LED's light up corresponding to the input signals.	Refer to Table 7-5.

Table 7-5 Measures to Take when LED Fails to Turn ON in Response to Input Signals

Cause of Failure	How to Check	Measures
Open of control signal circuit	Disconnect the signal cables and carry out continuity check.	Replace the control signal cable.
Cause of failure lies at the machine side	Refer to the operation manual for the machine.	Refer to the operation manual for the machine.
Others	Make sure that all items above are correct.	Contact your local Okuma service representative.

7-3-3-2. Classification of Failure Occurrence Conditions and Measures

When a failure occurs, take measures following the steps indicated in Table 7-6.

For the confirmation of fuses, refer to Section 7-4, "Fuse Replacement".

Note that locations and the number of fuses used in type D22 VAC drive unit differ from other types of VAC drive units. Therefore, for type D22, change the information related with the fuse numbers as indicated below:

Fuses F1 and F2 ⟶ Fuses F1, F2 and F3
Fuses F3 and F4 (D3, D6, D11) ⟶ Fuses F4 and F5 (D22)

Table 7-6 Classification of Failures

Failure	Reference Item
POWER LED does not light up.	(1)
LOSS LED lights up.	(1)
LED's show failure occurrence condition.	(2)
Commanded motor speed cannot be obtained.	(3)
Motor does not rotate.	(3)
Low cutting performance	(4)
Long acceleration and deceleration time	(5)
Spindle orientation cannot be correctly performed.	(6)
Excessive vibration and noise while the motor is rotating	(6)
Others	(6)

(1) POWER LED does not light up.

LOSS LED lights up.

Table 7-7

Cause of Failure	How to Check	Measures
Input power supply is abnormal.	Refer to Table 7-4.	Refer to Table 7-4.
Fuse F3 or F4 is blown.	Check the fuses whether they have been blown or not.	Replace blown fuse, F3 or F4. (Refer to Figs. 7-2, 7-3, 7-4 and 7-5.)
Warning fuse SMP32 or MP50 is blown.		
Connector CN7 for the printed circuit board is not inserted properly.	Check to be sure that the red mark on the connector guide can be seen at the surface of the connector on the printed circuit board.	Insert the connector properly.
Others	Make sure that all the items above are correct.	Contact your local Okuma service representative.

(2) LED's show failure occurrence condition.

If the LED's are indicating the failure occurrence status, first check the contents of failure and follow the measures as indicated in Table 7-8.

Table 7-8

<table>
<tr><th>Contents of Failure</th><th>Reference Item</th><th>Contents of Failure</th><th>Reference Item</th></tr>
<tr><td>RES</td><td>(a)</td><td>PH</td><td>(e)</td></tr>
<tr><td>AD</td><td rowspan="5">(b)</td><td>LOSS</td><td>(f)</td></tr>
<tr><td>PAR</td><td rowspan="2">OS</td><td rowspan="2">(g)</td></tr>
<tr><td>ACC</td></tr>
<tr><td>LOOP</td><td>UVP</td><td>(h)</td></tr>
<tr><td>WDOG</td><td>RAER</td><td rowspan="5">(i)</td></tr>
<tr><td>IOCM</td><td>(c)</td><td>DSE</td></tr>
<tr><td>IOCS</td><td rowspan="3">(d)</td><td>LOOP4</td></tr>
<tr><td>IOCR</td><td>LOOP1</td></tr>
<tr><td>OV</td><td>OH</td><td>(j)</td></tr>
<tr><td>UV</td><td>(e)</td><td>OL</td><td>(k)</td></tr>
</table>

Remarks: If the LED which does not correspond to the failure content indicated lights up, follow the steps indicated in (l).

a) RES lamp is ON.

Table 7-9

Cause of Failure	How to Check	Measures
Loose connection of the connectors of motor signal cables.	Check whether connector CN3 and the connector in the VAC motor terminal block are inserted properly.	Insert them properly.
Open of motor signal circuit	Disconnect the signal cables and carry out continuity check.	Replace the control signal cable.
Others	Make sure that all items above are correct.	Contact your local Okuma service representative.

b) AD, PAR, ACC, LOOP or WDOG lamp is ON.

Contact your local Okuma service representative.

c) IOCM lamp is ON.

Table 7-1Ø

Cause of Failure	How to Check	Measures
Loose connection of motor power cables at terminal block	Check motor power cable connection at the terminal block of the motor and the VAC drive unit.	Connect the cables correctly.
Motor power cables are broken.	Check continuity.	Replace the cables.
Others	Make sure that all items above are correct.	Contact your local Okuma service representative.

d) IOCS, IOCR or OV lamp is ON.

Contact your local Okuma service representative.

e) UV or PH lamp is ON.

Table 7-11

Cause of Failure	How to Check	Measures
Input power supply is abnormal.	Refer to Table 7-4.	Refer to Table 7-4.
No-fuse breaker is in the OFF position.	Check the no-fuse breaker.	Turn the no-fuse breaker ON.
Connector CN6 for the printed circuit board is not inserted properly.	Refer to Table 7-4.	Insert them properly.
Others	Make sure that all the items above are correct.	Contact your local Okuma service representative.

f) LOSS lamp is ON.

Follow the measures as indicated in Table 7-7.

g) OS or READ lamp is ON.

Contact your local Okuma service representative.

h) UVP lamp is ON.

Follow the measures as indicated in Table 7-11.

i) REAR, DSE, LOOP4 or LOOP1 lamp is ON.

Contact your local Okuma service representative.

j) OH lamp is ON.

Table 7-12

Cause of Failure	How to Check	Measures
Fuse F1 or F2 is blown.	Check the fuses whether they have been blown or not.	Replace the blown fuse, F1 or F2.
Cooling fan and heat sink are contaminated by dust and dirt.	Check contamination of the coolant fan, heat sink, etc.	Remove dust and dirt by compressed air or vacuum cleaner.
Overload	Confirm the reading of the load meter.	Examine the cutting conditions.
Connector CN5 for the printed circuit board is not inserted properly.	Refer to Table 7-4.	Insert the connector properly.
Input power supply is abnormal.	Refer to Table 7-4.	Refer to Table 7-4.
Others	Make sure that all the items above are correct.	Contact your local Okuma service representative.

k) OL lamp is ON.

Table 7-13

Cause of Failure	How to Check	Measures
Overload	Confirm the reading of the load meter.	Examine the cutting conditions.
Cooling fan, fan guard, and ventilating holes are contaminated by dust and dirt.	Check contamination of the cooling fan, fan guard, ventilating holes, etc.	Remove dust and dirt by compressed air or vacuum cleaner.
Loose connection of fan motor cables at terminal block.	Check fan motor cable connection at the terminal block of the motor and the VAC drive unit.	Connect the cables correctly.
Fan motor cables are broken.	Check continuity.	Follow the measures as indicated in Table 7-9.
Others	Make sure that all the items above are correct.	Contact your local Okuma service representative.

1) The LED which does not correspond to the failure content indicated lights up.

Contact your local Okuma service representative.

(3) Commanded motor speed cannot be obtained, motor does not rotate.

Motor does not rotate.

Table 7-14

Cause of Failure	How to Check	Measures
Drive unit and motor are faulty.	When rotation command is issued, the LED's at the printed circuit board light up indicating the failure status.	Refer to item (2).
Failure with the control signal cables or with the machine	Check whether the LED's at the printed circuit board light up in response to the input contact signal when rotation command is issued.	Refer to Table 7-5.
Others	Make sure that all items above are correct.	Contact your local Okuma service representative.

(4) Low cutting performance

Table 7-15

Cause of Failure	How to Check	Measures
Torque limit command is provided.	Check the pertaining signal. TLIM lamp lights up. (Fig. 7-1Ø)	
Loose drive belts	Check the tension of the belts.	Replace the belt.

(5) Long acceleration and deceleration time

Table 7-16

Cause of Failure	How to Check	Measures
Torque limit command is provided.	Check the pertaining signal. TLIM lamp lights up. (Fig. 7-1Ø)	
Others		Contact your local Okuma service representative.

(6) Spindle orientation cannot be correctly performed.

Excessive vibration and noise while the motor is rotating

Others

Contact your local Okuma service representative.

7-3-4. RECOVERY FROM FAILURE STATUS

When LED's indicate the failure status, it is necessary to remove the cause of failure first and then reset the alarm state to recover the operations of the VAC drive unit.

To reset the alarm,

1) Turn off power supply to the VAC drive unit, or

2) Press the ALMRST button at the printed circuit board.

Note that correct operations are impossible unless the cause of the failure has been removed.

If the cause of the failure is 1) blown fuse, or 2) tripping of the no-fuse breaker, other causes must also be checked since such abnormal status is caused by some types of malfunctions of the VAC drive unit.

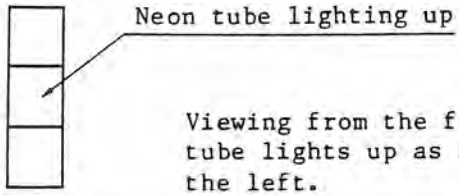
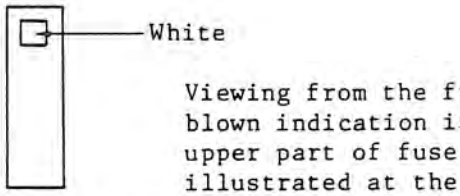
If the same failure recurs due to the same cause, contact your local Okuma service representative.

7-4. FUSE REPLACEMENT

7-4-1. FUSE BLOWN STATE

Blown state of the fuses used in the VAC drive unit is indicated in Table 7-17.

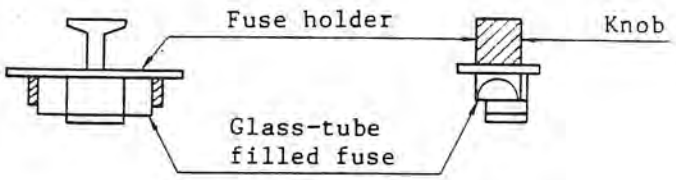
Table 7-17 Fuse Blown State

Name	Blown State
Fuses F1, F2, F3, F4 (F5 only for type D22)	 Viewing from the front, the neon tube lights up as illustrated at the left.
Warning fuse SMP32 MP50	 Viewing from the front, white fuse blown indication is observed at the upper part of fuse holder as illustrated at the left.

7-4-2. FUSE REPLACEMENT

The procedure to replace the fuses used in the VAC drive unit are indicated in Table 7-18 below.

Table 7-18 Fuse Replacement

Name	Replacement Procedure
Fuses F1, F2, F3, F4 (F5 only for type D22)	 1) Pull out the fuse holder with the fuse by holding the knob. 2) Remove the glass-tube filled fuse from the fuse holder. 3) Set a new glass-tube filled fuse to the fuse holder. 4) Set the fuse holder to the VAC drive unit. For types D3 and D6, replace the fuses with the door open. For type D22, replace the fuse with the lower cover of the drive unit removed.
Warning fuse SMP32 MP50	1) Remove the drive unit cover. 2) Pull the fuse out of the fuse holder. 3) Set a new fuse in the holder. 4) Replace the cover.

7-5. SPARE PARTS LIST

The VAC drive units have the following spare parts as indicated in Table 7-19.

Table 7-19 Spare Parts List

Part Name	Type	Okuma Part No.	Qty
Fuse (F1, F2, F3, F4, F5)	200V 5A F7161	E2442-290-124	2
Warning fuse (SMP32)	SMP32 3.2A Daito Tsushin	E2445-392-228	2
Warning fuse (MP50)	MP50 5A Daito Tsushin	E2445-392-215	1

7-6. INPUT/OUTPUT SIGNALS

(1) INPUT SIGNALS

Signal Name	Connector Pin No.	When Activated	Contents
Machine Ready Signal MRDY	CN1 [43 27]	Close	When this signal is input after power supply to the VAC drive unit has been turned on, spindle speed command can be received.
Forward Rotation Command SFR	CN1 [44 28]	Close	The SFR and SRV commands can be received after the output contact point signal SRDY is closed (ON).
Reverse Rotation Command SRV	[45 29]		After the SFR and SRV commands are received with the corresponding contact point closed (ON), the motor begins rotating in accordance with the spindle speed command.
Orientation Signal ORCM	CN1 [47 31]	Close	When the orientation signal ORCM is turned on (contact point closed), the spindle speed control loop gain, controlled by the controller, is increased establishing the spindle orientation enabled condition.
Torque Control Signal TLIM	CN1 [46 30]	Close	When the torque control signal TLIM is turned on (contact point closed), the motor is placed in the torque limited state.
Emergency Stop Signal EM	CN1 [41 25]	Open	When the emergency stop signal EM is turned on (contact point opened), the motor is braked (regeneration braking) and stopped. Then, current to the motor is interrupted to stop power supply to the motor.

(2) Output Signals

Signal Name	Connector Pin No.	When Activated	Contents
Torque Limit Signal TLIM	CN1 [7 8]		This signal is output when the motor shaft output torque is limited with the torque limit signal input.
Speed Detection Signal DT	CN1 [9 10]	Close	This signal is output when the motor output shaft speed has dropped below the preset value.
Zero Speed Signal ZERO	CN1 [5 6]	Close	This signal is output when the spindle speed is lowered to zero speed conditions (below 30 rpm).
Speed Agree Signal AGRE	CN1 [3 4]	Close	This signal is output when the motor output shaft speed falls within the predetermined range with respect to the commanded speed.
Servo Ready Signal SRDY	CN1 [15 16]	Close	This signal is output when the status in which the speed command signal may be received after the reception of the MRDY signal.

SECTION 8 COOLING UNIT

The cooling unit is provided on the top of or at the side of the control unit box to prevent the temperature rise in the control box, thus improving the reliability of the CNC system.

8-1. MAINTENANCE AND INSPECTION

Check the following items at least once every three months to keep the cooling unit functioning normally.

(1) Check for clogging in the air suction opening. Clogging will raise the temperature in the control box to degrade the reliability of the CNC system. Always make sure there is good ventilation.

(2) Check that the cooling fan is rotating normally.

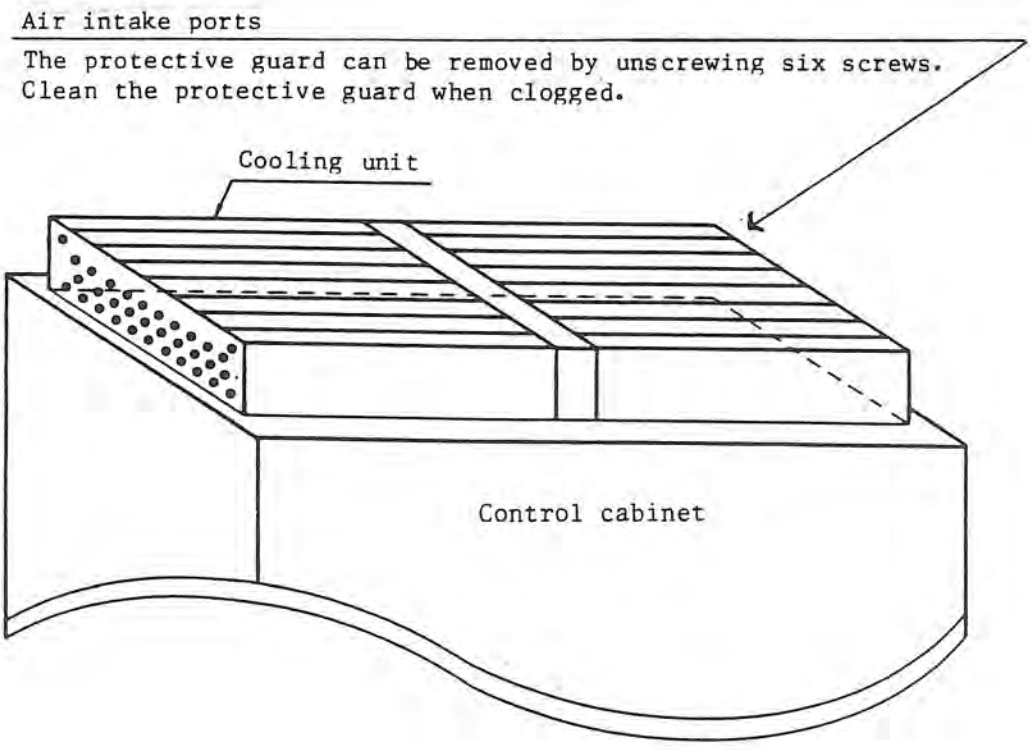


Fig. 8-1 Cooling Unit

SPARE PARTS LIST FOR LB15 (OSP5020L)
LIST NO. : 003

1) LB15 SPECIFICATION

OSP5020L / OSP500LG
SPINDLE MOTOR : 7.5/11 Kw (OKUMA)

2) SPARE PARTS LIST

ITEM	DESCRIPTION	Q'TY	PURPOSE
LENS CLEANER	ACCESSORY OF PTR	1	PTR CLEANING
FUSE	F7161 5A	2	AC SPINDLE DRIVE
FUSE	SMP32 3.2A	2	"
FUSE	MP50 5A	1	"
FUSE	2A	2	RUP UNIT
PIN REMOVER	JIET-DC-20	1	PUNCHER INTERFACE PIN REARRANGEMENT

SPARE PARTS LIST FOR LB25 (OSP5Ø2ØL)
LIST NO. : ØØ3

1). LB SPECIFICATION

OSP5Ø2ØL / OSP5ØØLG
SPINDLE MOTOR: 22/3Ø kw (OKUMA)

2) SPARE PARTS LIST

ITEM	DESCRIPTION	Q'TY	PURPOSE
LENS CLEANER	ACCESSORY OF PTR	1	PTR CLEANING
FUSE	F7161 5A	2	AC SPINDLE DRIVE
FUSE	SMP32 3.2A	2	"
FUSE	MP5Ø 5A	1	"
FUSE	2A	2	RUP UNIT
PIN REMOVER	JIET-DC-2Ø	1	PUNCHER INTERFACE PIN REARRANGEMENT

SPARE PARTS LIST FOR LNC-8 (OSP5020L)
LIST NO. : 003

1) LNC-8 SPECIFICATION

OSP5020L / OSP500LG
SPINDLE MOTOR : 5.5/7.5 kw

2) SPARE PARTS LIST

ITEM	DESCRIPTION	Q'TY	PURPOSE
FUSE	F7161 5A	2	AC SPINDLE DRIVE
FUSE	SMP32 3.2A	2	"
FUSE	MP50 5A	1	"
FUSE	2A	2	RUP UNIT
PIN REMOVER	JIET-DC-20	1	PUNCHER INTERFACE PIN REARRANGEMENT

LOAD CALCULATION **MODEL:** LB15

1.	SPINDLE MOTOR	7.5/11	kw
2.	BL-MOTOR		
	X-AXIS	1.5	kw
	Z-AXIS	2.4	kw
3.	HYDRAULIC PUMP MOTOR	1.5	kw
4.	COLLANT PUMP MOTOR	Ø.25	kw
5.	LUBRICATION MOTOR	Ø.Ø25	kw
6.	NC CONTROL POWER SUPPLY	1.5	kva
7.	EC CONTROL POWER SUPPLY	Ø.9	kva

$$\text{SPINDLE MOTOR kva} = \frac{\text{VAC CONSTANT kw}}{(\cos\theta)\ (\text{EFFICIENCY})}$$

$$= \frac{7.5\text{ kw}}{(Ø.95)\ (Ø.85)} = 9.29 \text{ kw}$$

$$\text{BL-MOTOR kva} = \frac{(\text{kw})\ (Ø.25)}{(\cos\theta)\ (\text{EFFICIENCY})}$$

$$= \frac{(1.5\text{kw} + 2.4\text{kw})\ (.25)}{(Ø.95)\ (Ø.85)} = 1.21 \text{ kva}$$

HYDRAULIC PUMP MOTOR = (1.5kw) (1.2) =	1.8Ø	kva
COOLANT PUMP MOTOR = (Ø.25kw) (1.2) =	Ø.3Ø	kva
LUBRICATION MOTOR = (Ø.Ø25kw) (1.2) =	Ø.Ø3	kva
NC CONTROL POWER SUPPLY =	1.5	kva
EC CONTROL POWER SUPPLY =	Ø.9	kva
TOTAL kva =	15.Ø3	kva

MAIN CIRCUIT BREAKER RATED CURRENT: 6Ø A

LOAD CALCULATION **MODEL:** LB25

1. SPINDLE MOTOR	22/3Ø	kw
2. BL-MOTOR		
X-AXIS	2.Ø	kw
Z-AXIS	3.7	kw
3. HYDRAULIC PUMP MOTOR	1.5	kw
4. COOLANT PUMP MOTOR	Ø.25	kw
5. LUBRICATION MOTOR	Ø.Ø25	kw
6. NC CONTROL POWER SUPPLY	1.5	kva
7. EC CONTROL POWER SUPPLY	Ø.9	kva

$$\text{SPINDLE MOTOR kva} = \frac{\text{VAC CONSTANT kw}}{(\cos\theta)(\text{EFFICIENCY})}$$

$$= \frac{22\text{kw}}{(Ø.95)(Ø.85)} = 27.24 \text{ kva}$$

$$\text{BL-MOTOR kva} = \frac{(\text{kw})(Ø.25)}{(\cos\theta)(\text{EFFICIENCY})}$$

$$= \frac{(2.Ø\text{kw}+3.7\text{kw})(.25)}{(Ø.95)(Ø.85)} = 1.76 \text{ kva}$$

HYDRAULIC PUMP MOTOR	= (1.5kw)(1.2)	=	1.8Ø kva
COOLANT PUMP MOTOR	= (Ø.25kw)(1.2)	=	Ø.3Ø kva
LUBRICATION MOTOR	= (Ø.Ø25kw)(1.2)	=	Ø.Ø3 kva
NC CONTROL POWER SUPPLY		=	1.5 kva
EC CONTROL POWER SUPPLY		=	Ø.9 kva
	TOTAL kva	=	33.53 kva

MAIN CIRCUIT BREAKER RATED CURRENT: 1ØØ A

LOAD CALCULATION **MODEL:** LNC-8

1. SPINDLE MOTOR	5.5/7.5	kw
2. BL-MOTOR		
X-AXIS	1.5	kw
Z-AXIS	2.4	kw
3. HYDRAULIC PUMP MOTOR	2.9	kw
4. COOLANT PUMP MOTOR	Ø.25	kw
5. LUBRICATION MOTOR	Ø.Ø25	kw
6. NC CONTROL POWER SUPPLY	1.5	kva
7. EC CONTROL POWER SUPPLY	Ø.9	kva

$$\text{SPINDLE MOTOR kva} = \frac{\text{VAC CONSTANT kw}}{(\cos\theta)(\text{EFFICIENCY})}$$

$$= \frac{5.5\text{kw}}{(Ø.95)(Ø.85)} = 6.81 \text{ kva}$$

$$\text{BL-MOTOR kva} = \frac{(\text{kw})(Ø.25)}{(\cos\theta)(\text{EFFICIENCY})}$$

$$= \frac{(1.5\text{kw}+2.4\text{kw})(.25)}{(Ø.95)(Ø.85)} = 1.21 \text{ kva}$$

HYDRAULIC PUMP MOTOR	= (2.9kw)(1.2)	=	3.48 kva
COOLANT PUMP MOTOR	= (Ø.25kw)(1.2)	=	Ø.3Ø kva
LUBRICATION MOTOR	= (Ø.Ø25kw)(1.2)	=	Ø.Ø3 kva
NC CONTROL POWER SUPPLY		=	1.5 kva
EC CONTROL POWER SUPPLY		=	Ø.9 kva
	TOTAL kva	=	14.23 kva

MAIN CIRCUIT BREAKER RATED CURRENT: 60 A