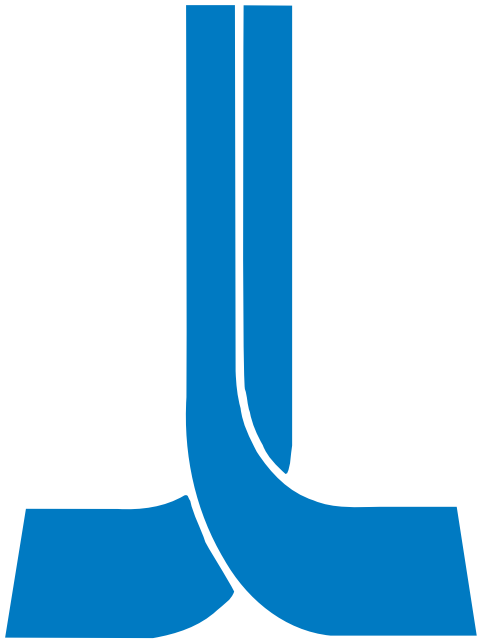

OKUMA

5000/5020 CONTROL

LATHE / MACHINING CENTER
ELECTRICAL MAINTENANCE
TRAINING MANUAL

EL 501

REV. C

Intro

Factory Training

for

Basic Electrical Maintenance for Okuma Lathes, Machining Centers and Grinders with the OSP 5000/5020/500 series control.

Course Code : EL 501
Prerequisite : Basic Electronics
Credits : 0
Course length : 4.5 days
Class Size : 6 persons

COURSE OBJECTIVES - Upon completion, the individual will be proficient in all basic skills necessary to troubleshoot an electrical side problem on any Okuma CNC machine tool with the OSP 5000/5020 or 500 control.

The course is designed to provide the information needed to diagnose any machine problem. The individual will be capable of diagnosing a problem and be able to communicate via the phone to Okuma service representatives if the need arises for further assistance.

Course emphasis is a blend of classroom instructional theory and “hands on” time spent on the machine tool.

COURSE REGISTRATION – To obtain program availability dates, please contact Von Pickett at (803-981-7000) the Institute for Manufacturing Productivity to obtain program availability dates, or check our website http://imp.okuma.com

Basic Electrical Maintenance for Okuma Lathes, Machining Centers, and Grinders with the OSP 5000/5020/500 series control.

Course Outline

MONDAY SECTION

1. Instructor and Class Introductions

2. Okuma History

3. Terminology

4. Safety — One

5. Okuma Documentation — Two

6. Machine Definition — Three
   - A) Introduction to CNC

7. Machine Operation — Four
   - A) CNC Operation Panel and Functions.
   - B) Machine operation panel and Functions.

8. Schematics — Nine
   - A) How to Read Okuma Prints
     - a) Symbols (old and new)OSP 5020 Construction

TUESDAY — SECTION

1. OSP 5020 Construction — Five
    - A) Power Supplies
    - B) Printed Circuit Board Functions
    - C) Servo Systems
        - a) Axis Drives
        - b) Spindle Drives
    - D) Feedback Systems

2. Diagnostics — Six
    - A) Using Actual Position Pages
    - B) Using Block Data Pages
    - C) Using Check Data Pages

WEDNESDAY

1. Diagnostics continued
    - D) Alarms
2. Parameters — Seven
    - A) Setting Stroke End Limits
    - B) Setting Zero Offsets

THURSDAY

1. Software — Eight
    - A) Data Management Card
    - B) Software Transfer Procedures
        - a) Backing up parameters
        - b) Initializing a B diskette
        - c) Loading software

2. Hands-On

FRIDAY

1. Hands-On
    - A) Troubleshooting

In 1898 Eiichi (ah-ee-ee-chee) Okuma started a special engineering firm in Nagoya, Japan. By 1904 Okuma Machinery Works Ltd., (OMW) started manufacturing lathes and milling machines. The Okuma Symbol depicts two pieces of metal conjoined in a perfect union to symbolize the union of two cultures, teamwork, and a single supplier of machine and control. A blending of two separate forces to provide a single source in support of a common purpose.

OKUMA

The following is a history of Okuma's technological advancement. Other milestones are noted on Okuma's path to becoming one of the world's best machine-tool builders. Okuma employs over 1600 people worldwide.

1959 Okuma introduces the first Japanese imported engine lathe to the American market.

1963 Introduced the first OSP series NC unit, the OSP 220. Developed the Absolute Position Encoder which is standard on all Okuma machines.

1964 Introduced its first Grinder.

1968 Developed mm/rev feed control on lathes.

1969 Opened a new plant in Oguchi, Japan.

1972 Okuma develops the first FMS (Flexible Machining System) and exhibits it at the Chicago Metal show (pre IMTS).

1973 Introduced Japan's first CNC control, the OSP 2000 series. Developed tape edit function which allowed operation by data stored on paper tape.

1974 Introduced tool nose radius compensation feature.

1975 Formed "Single Source mechatronics" manufacturing policy.
Introduced the OSP 2000 series control to the American market.

1976 Takeo (tah-kay-o) Okuma, son-in-law of founder, became 4th president.
Introduced the first 2-saddle, 4-axis lathe.

1978 Introduced automatic gauging built into control.

1979 Introduced the next generation CNC, the OSP 3000 series.
Okuma opened a branch office in Long Island, New York for sales and service.

1980 Started using CRT's on controls along with a tool path display feature.

1981 Introduced the industries first 16 bit CNC which provided parallel background editing and graphics programming (IGF), the OSP 5000 series.

1982 Developed the machine monitoring function (MOP).
Started using fiber optics for data communications.

1983 Introduced high-precision fully digital servo systems with brushless motors.
Introduced a new E-type Absolute Position Encoder capable of 163,000 incre/rev.

1984 Okuma and Mitsui established a joint venture company, Okuma Machinery Incorporated (OMI).
Introduced colored animation display (OSP 5000*-G).

1985 Became the world's largest Machine Tool builder and second largest manufacturer of CNC controls.
Introduced the load monitor function, built-in spindle motor, and spindle variable speed controller (VAC).

1986 Named Japan's Factory Automation and Industry advancement leader.
Introduced a Die manufacturing system (DMS).
Introduced a Tool monitoring system (MOP-TOOL).

1987 Opened a 163,000 sq ft plant in Charlotte, North Carolina. This company was called Okuma Machine Tools (OMT).
OMW introduced a wide-range constant output spindle motor and high-speed numerical control (Hi-NC).

1988 OMI was relocated to Charlotte, North Carolina.
OMI and OMT became Okuma Machine of America (OMA).
Okuma introduced high-speed, high-accuracy NC (Hi²-NC).

1989 Hajime (hah-jee-may) Okuma (son of Takeo) became president of OMT.
John Hendrick became president of OMI.
OMW introduced synchronous control technology.
Introduced the OSP 5020 control.

1990 OMW introduced AI (Artificial Intelligence) based interactive automatic programming function (one-touch IGF). Opened a new $21 million, 36,000 sq ft R & D Technology center in Oguchi, Japan.

1991 Okuma (OMW) changed its name to Okuma Corporation of Japan (OCJ).
Yutaka Maeda became president of OCJ.
Opened new 250,000 sq ft plant with 7 FMS's in Kani, Japan.
Scott Nishio became president of OMT and introduced the "Made In America" 2-axis lathe (Cadet).
Introduced a cam turning function, NC-turret, and NC-ATC.

1992 OMT built their 3000th machine.

1993 OMA is given their largest contract ever by GM Corp., to build 134 machines.

1994 OMA is given their second largest contract ever by GM Corp., 114 machines.
Introduced the OSP 7000 with the Mac Man feature
Opened Okuma Technology Institute, a 53,000 sq ft facility.

1995 Instituted Okuma CARE, a 24 hour-a-day, seven day-a-week customer service support program for it's North American customers.

1996 Purchased Plant 2, a 112,000 sq ft facility for manufacturing machining centers. OMA renamed OAC (Okuma America Corporation)

1997 OTI became the international training center for Okuma. OAC opens a Sales & Service facility in Sao Paulo, Brazil.

The following terms or acronyms pertain to some of the terminology used at Okuma. Some of the terminology is used throughout the industry while some pertain only to Okuma machines.

AB0	Axis board
AC1	Axis card
ACC/DEC	Acceleration/Deceleration
ACP	Animation CRT Processor board
AD	Analog to Digital
Address	A location of a specific cell in a computers' memory.
Address bus	The wires in a computer that carry signals used to locate a given memory address.
APT	Automatic Programmed Tools
AD-APT	Adaption of APT
ALU	Arithmetic/Logic Unit
ASCII	American Standard Code for Information Interchange
ATC	Automatic Tool Changer
APC	Automatic Pallet Changer
BB0	Bubble memory section (control software on 5000/5020 series)
BB1	Bubble memory section (part programs on 5000/5020 series)
BDU	Brushless Drive Unit (1st generation Axis drive)
Bit	The smallest unit of information in a computer.
BLD	Brushless Drive Unit (2nd generation Axis drive)
BLIID	Brushless Drive Unit (3rd generation Axis drive)
Bus	Set of wires carrying signals around a computer. A conductor or set of conductors that transmit information between parts of a computer.
Byte	Eight bits
CAD	Computer Aided Design
CAM	Computer Aided Manufacturing
CAP	Computer Aided Program
CCP	Communication Control Processor board
CCOP	Communication Control Optical card
CIM	Computer Integrated Manufacturing

Clock	A device usually based on a quartz crystal that gives off regular pulses used to coordinate a computers' operations.
CMOS	Complementary metal-oxide semiconductor
CNC	Computerized Numerical Control
CPU	Central Processing Unit
CRP	CRT Processor board
CRT	Cathode-Ray Tube
DA	Digital to Analog
Data bus	The wires in a computer that carry data to and from memory locations.
DBR	Dynamic Braking Resistor
DCPS	Drive Control Power Supply
DDB	Digital Data Bus
DMA	Direct Memory Access
DMAC	Direct Memory Access Controller
DNC	Distributed Numerical Control
DRAM	Dynamic Random Access Memory
EC/EO	I/O board on Okuma Lathes and Grinders
ECP	Electrical Control Processor board I/O control board on Okuma M/C's
EIA	Electronics Industries Association
EEPROM	Electrically Erasable Programmable Read Only Memory
EPROM	Erasable Programmable Read Only Memory
FCOM	Fieldnet Common terminal card
FDC	Floppy Disk Controller board
FDD	Floppy Disk Drive unit
Fiber Optics	The technology of encoding data or pulses of laser light beamed through thin strands of glass.
FIPC2	Field Input Photocoupler card
FOPT	Fieldnet Output Power Transistor card
Flash Memory	Flash memory is a combination of EPROM and EEPROM technology. A non-volatile storage device.
FMS	Flexible Machining Systems
FUB-DR	Fieldnet Unit Board-Driver/Receiver board
FUB-P4M4	Fieldnet Unit Board-Photocoupler(4 bytes)MOS-FET(4-bytes)

FUB-P4R2	Photocoupler(4 bytes)Relay outputs(2 bytes)
GHP	Graphics High Power (CPU power supply on 5000*-G)
GLP	Graphics Low Power (CPU power supply on 5000*-G)
IC	Integrated Circuit
ID	Inside Diameter
IF	Interface
IGBT	Insulated Gate Bipolar Transistor
IGF	Interactive Graphics Function
IJP	Injection Processor board
IOCM	Instantaneous over-current in motor
IOCS	Instantaneous over-current in servo
ISO	International Standards Organization
ISO 24 Vdc	Isolated 24 volts dc
LAP	Lathe Automatic Programming
LDU	Linear Drive Unit
Long Word	32 bits, 4 bytes, 2 words
MAP	Machine Automatic Programming
MB	Main board
MC	Main Card
MD0:	Directory in CMOS (Memory Disk) for parameter backup files
MD1:	Directory in CMOS (Memory Disk) for part programs
MOP-Tool	Monitored Overload Protection
MPR	Multi-Pole Resolver
NC	Numerical Control
NIPS	Numerical Instruction Per Second
OCON	RCON with Acc/Dec activated
OD	Outside diameter
ODIF	RDIFF with Acc/Dec activated
OPUS	Okuma Processing Unit and System
OSP	Okuma Sampling Path
Parallel	Several bits (8,16, or 32) of information processed at a time.
PCB	Printed circuit board
PG	Pulse Generator
PH	Pulse Handle

PIP	Peripheral Interface Program
PPS	Pulse Phase Shift
PTR	Paper Tape Reader
PWM	Pulse Width Modulation
RAM	Random Access Memory
RAPA	Actual Position of Axis data (data from A. P. Encoder)
RCON	Calculated (Commanded) axis position data
RDIFF	The difference between RAPA and RCON(following error or lag)
RLP	Rack Low Power (CPU power supply on 5020)
RHP	Rack High Power (Opus power supply on 5020)
RPP	RS232C/Printer/Puncher board
RSAPA	Axis position when Touchsetter is detected
SAOP	Sub Amp Operation
SCSI	Serial Communication System Interface
SDU	Spindle Drive Unit
SEL	Stroke End Limit
SERCOS	Serial Realtime Communication System
Serial	One bit of information is processed at a time.
SPC	Servo Processor Card
SSR	Solid State Relay
S.T.M.	Spindle, Tool, M Codes
SVP	Servo Processor board
TB0	Timing Board
TCC	Turret Control Card
TCU	Turret Control Unit
TFP	Timing Fieldnet Processor board
VAC	Spindle Drive on Okumas **V**ector Controlled **A**C Motor **C**ontrol
Word	16 bits, half a long word, 2 bytes

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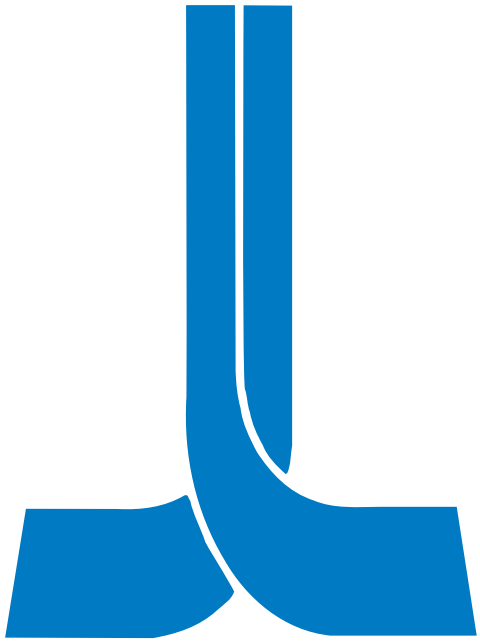


OKUMA

OSP 5000/5020 CONTROL

SAFETY

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

SAFETY PRECAUTIONS

Okuma machines are fully equipped with various safety devices to prevent operators and the machine itself from accidents. However, operators are urged to operate the machine with safety in mind. Strict observance of all safety guidelines indicated in the documentation provided with the machine is essential. The following are some points to observe when working with any machine tool.

CHECK THE FOLLOWING BEFORE TURNING ON POWER

1) Close the doors of the electric control cabinet and the operation panel.
2) Never place obstacles around the machine.
3) Turn on power to the machine in the following sequence:

   Depress the Emergency stop button.
   Turn on the Main power disconnect.
   CONTROL ON button on the operation panel.
   (POWER ON button on the control cabinet on machining centers.)

4) Once the control “boots up”, release E-stop and press the Control On button.

PRECAUTIONS TO OBSERVE WHEN USING A CHUCK

1) Before starting the spindle or cutting operations, close the front door.
2) Strictly observe the allowable spindle speed for the chuck installed. Never exceed the maximum allowable spindle speed.
3) When a chuck or fixture unique to the user’s applications is used, check the allowable maximum spindle speed and run the spindle within the allowable range. Pay due attention to workpiece gripping force and balance.
4) The maximum spindle speed can be limited by inputting the spindle speed with G50. To ensure safety in operation, input this spindle speed limiting command in the program (G50S****).
5) If the spindle is operated at a speed close to the allowable maximum speed:

   Avoid imbalance in the workpiece clamped in the chuck.
   Apply the maximum allowable pressure to grip the workpiece since increased centrifugal force reduces the chuck’s gripping force.

   The maximum allowable spindle speed and applicable pressure for the chuck are indicated on the name plate attached to the front door as well as on the chuck body. The maximum allowable speed and the applicable pressure ensure a chucking force larger than one-third the original chuck gripping force with the standard soft-top jaw set in line with the chuck body’s outer periphery.

6) When special jaws larger than standard soft-top jaws are used:

   Lower the spindle speed because the chuck’s gripping force is reduced due to increased centrifugal force and lowered efficiency.

   If the jaw clamping nut (jaw nut) is outside the chuck’s outer periphery, only one clamping bolt holds the jaws in place, causing very dangerous conditions. Jaw nuts must always be located within the chuck body’s outer periphery.

   Machine the jaws to the shape of the workpiece.

7) Tighten the bolts on the chuck body, jaws, and block securely. Clamping force should be greater than 40 to 50 kg.

CHECKUP AROUND THE MACHINE

1) Before starting daily operations, always check the lubrication oil levels.
2) Always use the specified brand or grade of lubrication oil.
3) For cutting fluid (coolant), use Okuma's recommendation whenever possible.
4) Change and replenish lubrication oil for each reservoir at the predetermined schedule as explained in the operation & maintenance manual.
5) Clean the filters periodically according to the schedule explained in the operation & maintenance manual.
6) Check the pressure gauges of the air and hydraulic lines to make sure they all read the correct values as specified in the operation & maintenance manual.
7) For any work required inside the machine door, turn off power and ensure safety beforehand. For work done at the back of the machine that requires the operator to enter the machine operating zone, do not forget to turn off power before attempting any work.

PRECAUTIONS FOR MACHINE OPERATIONS

1) Always follow the instructions given in the operation manuals.
2) Never run the machine without protective covers and doors, such as the front door and chuck cover.
3) Close the front door first before starting the machine.
4) With a new program, never attempt to start actual cutting operations. First run the program without setting a workpiece in the machine to check machine operations and interference; after making sure that the program is completely free of bugs, cut a workpiece in the single block mode operation. Only after making sure that the workpiece can be cut without problems in the single block mode operation should the automatic mode operation be started.
5) Before attempting the following, always make sure that untended operation can be accomplished safely:

   Spindle rotation
   Turret indexing
   Axes movements

6) While the spindle is revolving, never touch chips or the workpiece.
7) Never try to stop a revolving object with hands or tools.
8) Confirm the jaw installation conditions, hydraulic pressure, and allowable maximum speed for the power chuck.
9) Check the installed conditions and arrangement of the tools.
10) Confirm the tool and zero offset settings.
11) Set the spindle speed and feedrate override dials to 100 %.
12) Before feeding the turret, confirm the soft-limit settings and the emergency limit switch settings for both X and Z axes.
13) Confirm the position where the turret index or rotation is allowed.
14) Confirm the tailstock position.
15) Make sure that cutting is conducted within the allowable transmission power and torque ranges.
16) Clamp the workpiece in the chuck or fixture securely.
17) Check the cutting fluid nozzle positions. Set them at positions to supply cutting fluid correctly to the cutting point.

SETUP

1) Always make sure that the setup is complete.
2) After changing the setup, operate the machine step by step to make sure the cutting can be conducted without problems.
3) Before replacing the chuck and/or chuck jaws, make sure that the new set fit the job intended.
4) When two or more workers work as a group, establish the necessary safety signs, for example, when lifting or setting heavy objects confirm with other workers whether or not it's "okay" to start the next process.
5) When handling heavy objects use a crane or equivalent tool.
6) When attempting unfamiliar setups check the setup again before going on to the next step.

WORKPIECE LOADING and UNLOADING

1) Load and unload workpieces securely.
2) Retract the turret before loading and unloading a workpiece to a position where the cutting tools on the turret will not injure the operator's hands.
3) Before attempting to load or unload a workpiece, make sure the spindle has come to a complete stop.
4) Before running a new program, first rotate only the spindle to make sure the workpiece is securely clamped in the chuck.
5) To machine irregularly shaped workpieces, make sure the workpiece is clamped in the chuck securely without imbalance.
6) When handling heavy workpieces, use a crane, hoist, or other tool.
7) Before setting a workpiece in the machine, make sure the workpiece has portions that can be used for proper chucking.

MACHINING CENTERS

1) Never touch the spindle or tool while the spindle is rotating.
2) Never touch the spindle or tool while the spindle is being oriented, or while it is changing speed range. The spindle might rotate suddenly.
3) Never start spindle rotations with a tool or any other object mounted in the spindle in such a way that it could easily come loose.
4) Always wait until the spindle has come to a dead stop before attempting to remove chips from the tool.
5) Never begin operations without first checking that the workpiece has been securely mounted on the table.
6) Never start table movements with anyone on the table.
7) The automatic tool changer and automatic pallet changer are particularly dangerous when they are in operation and all personnel should be kept clear of their operation zone.
8) Inspection or changes of tools in the magazine of the ATC should be carried out only when the ATC is in the manual operation mode.
9) If, for whatever reason, the ATC or APC should stop moving during an operation and it should become necessary to inspect them without first cutting off power, always secure an emergency escape zone and never touch the problem unit directly with your hands.
10) Never attempt to clean the machine or inspect it while it is operating. Always bring it to a complete stop before conducting such operations.

AT THE END OF THE DAY

1) Clean the machine.
2) Locate the turret at the predetermined retraction position.
3) Before leaving the machine, turn off all power switches.
4) Turn off power to the machine in the following sequence:

   CONTROL OFF button on the operation panel.
   The main power disconnect.

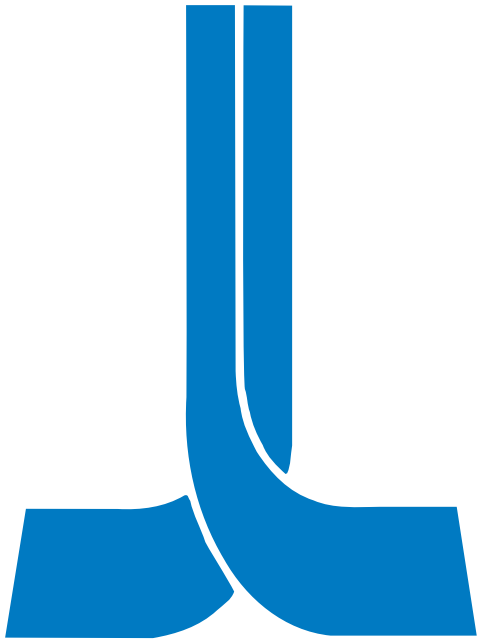
WHEN A PROBLEM OCCURS

1) Stop all spindle (s) and axes movement by pushing the closest EMERGENCY STOP switch.
2) Contact the maintenance person to determine what action to take.
3) Use only the fuses and other replacement parts of the specified rating.
4) Be extra careful when handling the following high-voltage units:

   Main Breaker
   Servo Drive unit (BL-IID)
   VAC drive unit
   Power cables

OTHER GENERAL PRECAUTIONS

1) Wear suitable safety clothes.
2) Keep work areas clean as well as the machine.
3) Do not touch controls with wet hands.



OKUMA

OSP 5000/5020 CONTROL

DOCUMENTATION

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

The following is a list of the common manuals that come with every Okuma machine:

OPERATION

MAINTENANCE

OPERATION & MAINTENANCE

SPECIAL FUNCTIONS #1,2,3 or 4

ELECTRICAL SCHEMATICS

ALARM & ERROR LIST

PROGRAMMING

DRIVE UNITS

PARTS BOOK

The following is a brief description of the subject matter of each manual.

OPERATION Manual

This manual contains information about the basic operation of the machine. The file handling procedures and communication protocol are also explained in this manual. The last part of this manual explains the parameters in the control.

MAINTENANCE Manual

This manual has information pertaining to the electrical side of the machine. A description of the boards and the power requirements along with the layout of the electrical components are shown in this manual.

OPERATION & MAINTENANCE Manual

This manual has the information pertaining to the mechanical side of the machine. Foundation and leveling information along with lubrication specifications are in this manual.

SPECIAL FUNCTIONS Manuals

These manuals are labeled #1,2,3,or 4. These manuals contain information pertaining to the operation, parameter settings, and alarms associated with “special functions” on the machine. The following is a list of some of the topics found in these manuals:

ELECTRICAL SCHEMATICS

These are the electrical diagrams for the machine. There is a standard set of schematics that pertain to the standard machine. If the machine has special options, there will be a separate set of schematics that will accompany the machine.

ALARM & ERROR LIST

This is the alarm book which contains most of the alarms that can occur on the machine. Some special alarms can be found in the *Special Functions* manuals.

PROGRAMMING

This manual contains information pertaining to the programming functions of the machine.

DRIVE UNITS

This manual has information pertaining to the BL-IID,VACII, and VACIII.

PARTS Book

This manual contains layouts of the parts on the machine.

The rest of this section provides a topic directory. It is intended as a reference guide when looking for certain information about an Okuma CNC machine. Some manuals are specific to a certain application or a certain machine and might not be mentioned here. For example, there is a manual for first time users of MC-V, MC-H, and MCR-B type machining centers that is labeled OPERATION GUIDE.

Topic	Manual	Section
Air Blower	Special Functions	Spare Air Blower
Alarms	Alarm & Error List	Alarms
Print Out Function	Special Functions	Alarm Data Print Out
Alarm & Error Display	Maintenance	Self-Diagnostics
Animation	Special Functions	Animation Function
Any-angle Chamfering	Special Functions	Any-angle Chamfering
Applications	Operation	Applications
Automatic Operation	Operation	Operation/Funct & Oper
Auto Pallet Changer		
Construction	Operation & Maintenance	Auto Pallet Changer
Manual Operation	Operation & Maintenance	APC
Sequence Number	Maintenance	Logic Tables
Auto Tool Changer		
Adjustment	Operation & Maintenance	Maintenance
Logic Table	Maintenance	Diagnosis Messages
Manual Operation	Operation & Maintenance	ATC
Prep of Cutting Tools	Operation & Maintenance	ATC
Tool Adjustments	Operation & Maintenance	ATC
Sequence Numbers	Operation & Maintenance	ATC
Specifications	Operation & Maintenance	Machine Specifications
Axis		
Nomenclature	Operation & Maintenance	Operation
Travel	Operation & Maintenance	Machine Specifications
Back-End Cutting Device	Special Functions	Back-End Cutting
Bar Feeder	Special Functions	Bar Feeder
Belt Tension	Operation & Maintenance	Insp & Maint
BDU/BLD	Maintenance	Brushless Servo
Alarms	Maintenance	Brushless Servo
Troubleshooting	Maintenance	Brushless Servo
Bubble Memory	Operation	Applications
C-axis		
Brake Information	Operation & Maintenance	Machine Operation
Control Angle	Operation & Maintenance	Machine Specifications
Joint Mechanism	Maintenance	C-axis
Operation	Maintenance	C-axis
Rapid Feedrate	Operation & Maintenance	Machine Specifications
Troubleshooting	Maintenance	C-axis
Calendar Timer	Special Functions	Calendar Timer
Carriage		
Feedrate	Operation & Maintenance	Machine Specifications

Topic	Manual	Section
Rapid Feedrate	Operation & Maintenance	Machine Specifications
Travel	Operation & Maintenance	Machine Specifications
Chip Air Blow	Operation & Maintenance	Operation
Chuck		
Clamping Force	Operation & Maintenance	Machine Operation
Construction	Operation & Maintenance	Machine Operation
Cutting Soft Jaws	Operation & Maintenance	Machine Operation
Error Detection	Special Function	Chucking Error Detection
High/Low Chucking	Special Functions	Chuck High/Low Select
Indexing	Special Functions	Index Chuck
Installation	Operation & Maintenance	Machine Operation
Long Stroke	Special Functions	Long Stroke Chucking
Maintenance	Operation & Maintenance	Machine Operation
Precautions	Operation & Maintenance	Machine Operation
Pressure Adjustment	Operation & Maintenance	Machine Operation
Proximity Switch Adj.	Operation & Maintenance	Machine Operation
Spindle Speed Chart	Operation & Maintenance	Machine Operation
Circular Thread Cutting	Special Functions	Circular Thread Cutting
Consumable Items	Operation & Maintenance	Spare Parts
Control Software Load	Maintenance	Troubleshooting
Control		
Auto Functions	Operation	Specifications
Basic Functions	Operation	Specifications
Board Operation	Maintenance	Maintenance & Inspection
Check Data Display	Operation/Maintenance	Apps/Maint & Insp
CPU Inspection	Maintenance	Troubleshooting
Description	Maintenance	Special Features
Diagnostics	Maintenance	Maintenance & Inspection
Installation Req.	Maintenance	Maintenance & Inspection
Operation	Operation	Operation
Operation Functions	Operation	Specifications
Panel Layout	Operation/Maintenance	Oper/Appended Figures
Periodic Maintenance	Maintenance	Maintenance & Inspection
Peripheral Functions	Operation	Specifications
Specifications	Operation	Specifications
Structure	Maintenance	Structure
Coolant		
High/Low Pressure	Special Functions	Coolant High/Low
Unit	Maintenance	Coolant Unit
Tank	Operation & Maintenance	Periodic Maintenance

Topic	Manual	Section
Cooling Unit	Maintenance	Cooling Unit
Coordinate Conversion	Special Functions	Coordinate Conversion
CPU Power Supply	Maintenance	Troubleshooting
Cross-slide		
Feedrate	Operation & Maintenance	Machine Specifications
Rapid Rate	Operation & Maintenance	Machine Specifications
Travel	Operation & Maintenance	Machine Specifications
CRT Display	Operation	Applications
Panel	Operation	Display of CRT Panel
Cut-Off Device	Special Functions	Cut-Off Device
Cycle Start Disable	Special Functions	Cycle Start Disabling
Cycle Time Calculation	Special Functions	Cycle Time Calculation
Reduction	Special Functions	Cycle Time Reduction
DC Code Control	Special Functions	DNC-A
DNC-A	Special Functions	DNC-A
Data Setting	Operation	Data Setting
Dimensional Drawings	Operation & Maintenance	Machine Specs/General
Door Interlock	Oper & Maint/ Special Functions	Mach Oper/Front Door Interlock
Door Open/Close	Special Functions	Auto Door Open/Close
EC Power Supply	Maintenance	Troubleshooting
EIA/ISO Code Chart	Operation	Program Creation
Edit Aux. Mode	Operation	Applications
Edit Interlock	Special Functions	Edit Interlock Function
Electrical Equip Layout	Maintenance	Appended Figures
Electrical Spare Parts	Operation & Maintenance/ Maintenance	Spare Parts List/ Electrical Spare Parts
Executable Conditions	Maintenance	Machine Executable Cond
External M codes	Special Functions	External M Signal
External Prog Select	Special Functions	External Prog Select
Feedrates	Operation & Maintenance	Machine Specifications
File Management	Operation	Applications/ Program Management
Filters	Operation & Maintenance	Periodic Maintenance
Floppy Disk		
IBM/OSP Format	Special Functions	NC Mach Prog I/O Functions
Loading Software	Maintenance	Troubleshooting
Handling	Operation	Floppy Disk Handling
Maintenance	Maintenance	Maint & Insp
Foundation Requirements	Operation & Maintenance	Handling & Installation

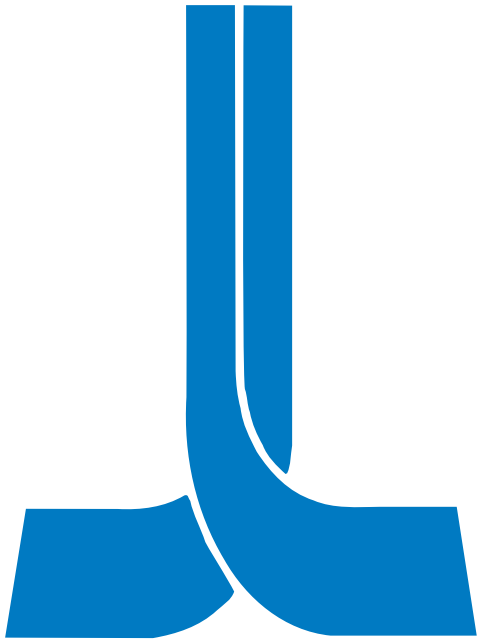
Topic	Manual	Section
Gauging Attachment	Operation & Maintenance	Optional Specifications
Spare Parts	Operation & Maintenance	Optional Specifications
Print Out Function	Special Functions	Gauging Data Functions
Gib Adjustment	Operation & Maintenance	Periodic Maintenance
Headstock		
Alignment	Operation & Maintenance	Periodic Maintenance
Lubrication	Operation & Maintenance	Periodic Maintenance
Hydraulics		
Circuit Diagram	Operation & Maintenance	Technical Data
Oil Requirements	Operation & Maintenance	Machine Operation
Power Unit Operation	Operation & Maintenance	Machine Operation
Pressure Adjustments	Operation & Maintenance	Mach Oper/Maint
Pressure Settings	Operation & Maintenance	Machine Operation
Spare Parts	Operation & Maintenance	Spare Parts
Installation	Operation & Maintenance	Handling & Installation
Interlock Function	Operation	Operation
Leveling	Operation & Maintenance	Handling & Installation
Limit Switch Insp.	Maintenance	Troubleshooting
Layout	Operation & Maintenance	Appended Diagrams
Loader Interlock	Special Functions	Loader Interlock
Logic Table Layout	Maintenance	Logic Table
Lubrication		
Adjustments	Operation & Maintenance	Periodic Maintenance
Chart	Operation & Maintenance	Periodic Maintenance
Specifications	Operation & Maintenance	Periodic Maintenance
Symbols	Operation & Maintenance	Prep of Machine for Oper
M-Tool		
Flat Turning	Special Functions	M-Spindle Flat Turning
Power/Torque Chart	Operation & Maintenance	Machine Operation
Spindle Speed	Operation & Maintenance	Machine Specifications
Machine Dimensions		
Distance Between Ctrs	Operation & Maintenance	Machine Specifications
Maximum turning dia	Operation & Maintenance	Machine Specifications
Swing over bed	Operation & Maintenance	Machine Specifications
Swing over carriage	Operation & Maintenance	Machine Specifications
Machine Height	Operation & Maintenance	Machine Specifications
Machine Operation	Operation & Maintenance	Machine Operation
Machine Specifications	Operation & Maintenance	Machine Specifications
Magnetic Relays	Maintenance	Troubleshooting
Manual Data Input	Operation	Operation

Topic	Manual	Section
Manual Mag. Op Panel	Maintenance	Appendix
Manual Operation	Operation & Maintenance	Operation
Math Operation Function	Operation	Applications
Maximum Tool Dimensions	Operation & Maintenance	ATC
Motors		
Spindle	Operation & Maintenance	Machine Specifications
Carriage	Operation & Maintenance	Machine Specifications
Cross-slide	Operation & Maintenance	Machine Specifications
Hydraulic Pump	Operation & Maintenance	Machine Specifications
Guideway Lube Pump	Operation & Maintenance	Machine Specifications
Headstock Lube Pump	Operation & Maintenance	Machine Specifications
Coolant Pump	Operation & Maintenance	Machine Specifications
C-axis	Operation & Maintenance	Machine Specifications
M-tool Spindle	Operation & Maintenance	Machine Specifications
Specifications	Operation & Maintenance	Machine Specifications
Net Weight	Operation & Maintenance	Machine Specifications
Oil Mist	Operation & Maintenance	Operation
Operation	Operation	Operation
Operation Monitor	Special Functions	NC Operation Monitor
Optional Specifications	Operation & Maintenance	Operation
OSP 5000/5020 Control		
Check Data Display	Maintenance	Maintenance & Insp/Diag
Description of Comp	Maintenance	Maintenance & Insp
Periodic Maintenance	Maintenance	Maintenance & Insp
Self Diagnostics	Maintenance	Maintenance & Insp
Structure	Maintenance	Structure
Summary of Operation	Maintenance	Summary of Operation
Troubleshooting	Maintenance	Troubleshooting
Overload Detection	Special Functions	Overload Detection
Overload Monitor	Special Functions	Overload Monitor
Pallet Dimensions	Operation & Maintenance	Machine Specifications
Panel Layout	Maintenance	Appendix
Parameters	Operation	Applications/Parameters
Periodic Maintenance	Operation & Maintenance	Periodic Maintenance
Phase Matching Function	Special Functions	Phase Matching Function
Pick-Off Attachment	Special Functions	Pick-Off Attachment
Pitch Error Comp.	Special Functions	Pitch Error Comp.
Pneumatic Circuit Diagram	Operation & Maintenance	Appended Diagrams
Position Encoder Insp.	Maintenance	Troubleshooting
Power Chuck & Cylinder	Operation & Maintenance	Technical Data

Topic	Manual	Section
Power Requirements	Operation & Maintenance/ Maintenance	Installation/ Power Requirements
Power Transistor Insp.	Maintenance	Brushless Servo
Pre-start Checklist	Operation & Maintenance	Machine Operation
Preparation for Delivery	Operation & Maintenance	Handling & Installation
Program Format	Operation	Applications
Program Selection	Operation	Applications
Pulse Generator	Maintenance	C-Axis
Relay Layout	Maintenance	Appended Figures
Relay Inspection	Maintenance	Troubleshooting
Robot Interlock	Special Functions	Robot Interlock
RS232C	Special Functions	Tape Punch Interface
Safety Precautions	Operation & Maintenance	Safety Precautions
Sequence Number Search	Operation	Applications
Sequence Restart	Operation	Applications
Shear Pin Replacement	Operation & Maintenance	Periodic Maintenance
Skeleton Diagrams	Operation & Maintenance	Appended Diagrams
Slide Hold During Thread Cutting	Special Functions	Slide Hold Function
Solenoid Valve Layout	Operation & Maintenance	Appendix
Spare Parts	Operation & Maintenance/ Parts Book/Elec Schem.	Spare Parts List/ D-drawings
Specifications	Operation/Oper & Maint	Specifications/General
Spindle		
Diameter	Operation & Maintenance	Machine Specifications
Drive Unit	Maintenance	Spindle Drive Unit
Gear Ranges	Operation & Maintenance	Machine Specifications
Nose Dimensions	Operation & Maintenance	Technical Data
Nose Type	Operation & Maintenance	Machine Specifications
Orientation	Maintenance/Special Functions	C-axis/Spindle Orientation
Power/Torque Chart	Operation & Maintenance	Machine Operation
Speed Range	Operation & Maintenance	Machine Specifications
Taper	Operation & Maintenance	Machine Specifications
Through Hole Size	Operation & Maintenance	Machine Specifications
Structure of OSP	Maintenance	Structure of OSP
Sub Programs	Special Functions	Sub Programs
Swing Arm Loader	Special Functions	Swing Arm Loader
SSR Output	Maintenance	Troubleshooting
Table Specifications	Operation & Maintenance	Machine Specifications

Topic	Manual	Section
Tailstock		
Adv/Ret During Rotate	Special Functions	Adv/Ret During Rotate
Auto-tailstock Adj.	Operation & Maintenance	Machine Operation
Bearing Life Chart	Operation & Maintenance	Optional Specs
Center Work Interlock	Special Functions	Cancellation of CW int.
Dimensions	Operation & Maintenance	Technical Data
High/Low Thrust	Special Functions	Tailstock High/Low
Live Center Load	Operation & Maintenance	Machine Operation
Operation	Operation & Maintenance	Machine Operation
Position Setting	Operation & Maintenance	Machine Operation
Positioning Function	Special Functions	Programmable Tailstock
Pressure Adj.	Operation & Maintenance	Machine Operation
Spindle Diameter	Operation & Maintenance	Machine Operation
Spindle Taper	Operation & Maintenance	Machine Operation
Spindle Travel	Operation & Maintenance	Machine Operation
Swing Operation	Special Functions	Tailstock Swing
Thrust Chart	Operation & Maintenance	Machine Operation
Timing Belt Adj.	Operation & Maintenance	Periodic Maintenance
Working Range Diag.	Operation & Maintenance	Optional Specs.
Tape Data I/O	Special Functions	Tape Data I/O
Tape Format	Operation	Program Creation
Tape Punch Interface	Special Functions	Tape Punch IF
Tape Reader Operation	Operation	Tape Reader Handling
Technical Data	Operation & Maintenance	Technical Data
Through-the-Tool Coolant	Operation & Maintenance	Operation
Timing Belt Replacement	Operation & Maintenance	Maintenance
Toolholder Dimensions	Operation & Maintenance	Technical Data
Tool		
Interference Chart	Operation & Maintenance	Technical Data
Offsets	Operation	Operation
Life Management	Special Functions	Tool Life Management
Retraction	Special Functions	Tool Retraction Cycle
Settings	Oper & Maint/Oper	Mach Oper/Oper
Touch Setter	Operation & Maintenance	Touch Setter
Spare Parts	Operation & Maintenance	Touch Setter
Trace	Special Functions	Tool Path Display
Transportation of Machine	Operation & Maintenance	Handling & Installation
Troubleshooting	Maintenance	Troubleshooting
Mechanical	Operation & Maintenance	Insp & Maint
Spindle	Maintenance	Spindle Drive

Topic	Manual	Section
Turret		
Alignments	Operation & Maintenance	Periodic Maintenance
Control Card	Maintenance	Turret Control
Control Unit	Maintenance	Turret Control
Coolant Trottle Adj.	Operation & Maintenance	Machine Operation
ID Tool Size	Operation & Maintenance	Machine Specifications
Index Speed Adjust	Operation & Maintenance	Periodic Inspection
Limit Switch Inspect	Maintenance	Troubleshooting
Lubrication	Operation & Maintenance	Lubrication
NC Turret	Maintenance	NC Turret
OD Tool Size	Operation & Maintenance	Machine Specifications
Offsets	Operation	Operation
Troubleshooting	Operation & Maintenance	Troubleshooting
Tool Capacity	Operation & Maintenance	Machine Specifications
Type	Operation & Maintenance	Machine Specifications
Unloader by M Code	Special Functions	Unloader Adv/Ret
VAC		
Diagnostics	Maintenance	Spindle Drive Unit
Fuse Replacement	Maintenance	Spindle Drive Unit
I/O Signal Table	Maintenance	Spindle Drive Unit
Layout	Maintenance	Spindle Drive Unit
Status Indicators	Maintenance	Spindle Drive Unit
Troubleshooting	Maintenance	Spindle Drive Unit
Work Catcher	Special Functions	Work Catcher
Work Counter	Special Functions	Work Counter
Working Range Diagram	Operation & Maintenance	Technical Data
Work Reset	Special Functions	Work Reset by M Code
Zero Offsets	Operation	Operation



OKUMA

OSP 5000/5020 CONTROL

MACHINE DEFINITION

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

Machine Tool

A machine tool is a power driven machine used to shape solid work by removing material with a suitable cutting tool or by deformation of the metal.

Numerical Control Machine

A Numerical Control (NC) machine is a machine tool whose actions is controlled by direct insertion of numerical data by way of coded instructions. An NC machine is positioned automatically along a pre-programmed path by these coded instructions. These instructions are letters, numbers, and other symbols that are translated into binary code.

Computerized Numerical Control Machine

A Computerized Numerical Control (CNC) machine is an NC machine that uses a computer as the control system. A CNC is composed of two major components: the machine tool and the Machine Control Unit (MCU). The CNC improved the handling of machine data (coded instructions) which resulted in increased speed and accuracy of the machine tool.

A CNC needs at least four hardware items to exist:

1. Main Processing Unit - The main processing unit has a central processing unit (CPU) which is the nerve center or main controller of the CNC and an Arithmetic/Logic Unit (ALU) which handles all arithmetic and logical functions within the control. With the miniaturization of electronic circuits, the CPU and ALU circuitry are built into the same IC chip and have adopted the name microprocessor (µp).

2. Memory - The memory stores all data, whether temporary or permanent, that is used by the microprocessor.

3. Servo System - The servo control system is needed to control axis movement and spindle rotation.

4. Input/Output system (I/O) - This area of the (CNC) carries out the sending and receiving of information to external devices.

The following information describes these four areas in more detail to give the student a basic understanding of how a control functions:

MICROPROCESSOR

All operations that take place in the CNC are under direct control of the CPU. The CPU directs the flow of data in a computer system. It constantly keeps track of what is taking place within the control by performing a series of diagnostic operations. If any hazardous conditions are detected it will shut down operations to prevent damage to the machine or injury to an operator.

The microprocessor (µp) acts on instructions from programs stored in memory. It runs the executive program (Control Software) which defines the capabilities of the machine. This program initiates all operations and controls all data management functions. Without the executive program the µp could not function.

The ALU determines axis position, spindle and axis speed, and performs program calculations in a CNC control. It also determines what to do if a limit switch is activated or an overload is detected. The ALU performs all the calculations and logical decisions necessary when processing information.

MEMORY

The computer cannot run without some means of storing information. There are numerous types of memory available for this purpose and they fall into one of three categories: Permanent, Long-Term, or Temporary.

Permanent Storage

Data resident in permanent storage is information that will be required for all applications. This data is not updated under normal operating conditions. This type of memory is referred to as nonvolatile memory. The data is not lost when the machine is turned off. The most common storage device in this category is ROM (Read Only Memory). ROM comes in different styles.

PROM (Programmable Read Only Memory) - Data is stored in this device through electronic means and cannot be erased. If data is unusable or must be changed a new PROM must be made.

EPROM (Erasable Programmable Read Only Memory) - After data is stored in the EPROM, it can later be erased by placing the device under an ultra violet light source. This restores the EPROM to a blank state and new information can then be entered. This device usually has a clear plastic window on top of the chip to expose the components to the UV light source. Under normal operating conditions this window is covered with a piece of tape to prevent accidental changing of the data. On Okuma controls, this chip contains the System Boot Program.

EEPROM (Electrically Erasable Read Only Memory) - Similar to the EPROM, the stored information in an EEPROM can be erased by using a higher than normal current rather than a UV light source. Because of this ability, the EEPROM can be erased and new data stored while it is in the CNC control.

A new type of permanent memory device is appearing on some computers and CNC controls which is referred to as “Flash Memory”. This device is also a nonvolatile memory device. It is basically a combination of EPROM and EEPROM technology. Flash memory has the advantage of having the physical size of the EPROM and the quick erase capability of the EEPROM.

Long-Term Storage

There are certain types of data that need to be stored for a long period of time, but will need to be changed or deleted periodically. Information such as part programs, parameters, tool offsets, etc. can be stored in this type of device. Two types of long term memory storage devices currently being used on Okuma controls are C-MOS and Bubble memory.

C-MOS Memory - This is a RAM (Random Access Memory) type device. Under normal operating conditions this type of memory would lose the stored information when power is shut off. A device that loses stored data when power is turned off is said to be volatile. To prevent the loss of this information, a battery is attached to the unit to maintain backup power in the event machine power is lost.

Bubble Memory - This is a non-volatile storage device. It does not lose information when power is lost. Data is stored on tiny bubbles of a ferrous material that is magnetized to represent the binary information. Large quantities of data can be stored in a very small area. However, unlike C-MOS, the data must be read in a set order (serially) which makes it slow in responding with information.

Temporary Storage

Some information is only needed once, or for a limited number of times, and then is discarded. This type of information is stored in temporary memory. Active programs or numbers that are continuously changing would fall into this category.

RAM - This type of memory is used to run the active programs such as the machine operating system or the active part programs. Once power is cut off to the machine, this memory is lost. Okuma uses both D-RAM and S-RAM. D-RAM stands for Dynamic Random Access Memory. Its memory is constantly being refreshed. S-RAM stands for Static Random Access Memory. Its contents can be saved by battery back-up.

Register - This is a small (one or two bytes in size) temporary device designed to store data for a very short period of time. Registers are used to hold numbers during arithmetic operations or to hold memory addresses during data transfer. They temporarily house data entering and leaving the microprocessor chip.

SERVO SYSTEM

Every CNC has to have some means of controlling axis movement and/or spindle rotation. A servo system needs a command signal, a servo control amplifier, a motor, and a feedback device.

The main processing unit acting on instructions from a part program will send the positioning and speed information to the servo control unit which will convert the information it receives into a command signal.

This command signal is sent to the servo control amplifier. The “servo amp” acting on the command signal sends the proper amount of voltage in the proper sequence to the axis or spindle motor.

For safety and accuracy purposes, some kind of feedback device is needed to monitor actual servo movement. The feedback device sends a signal back to the servo control unit and/or the servo amp. This feedback signal is compared with the command signal. If they are not the same or very close to being the same the servo control unit will send out an alarm signal to the main processing unit which will stop machine operation.

I/O Devices

I/O devices connect the CPU with the outside world through interfaces. The interfaces are electronic circuits that permit controlled data flow from the CPU and its memory components to various peripherals.

Tape Reader

This is one of the first I/O devices ever used on an NC control and was carried over to the CNC. This unit reads a paper tape which has a number of holes arranged in a specified pattern along its length. Each pattern represents a code or character which can be deciphered by the control.

Disk Drives

A floppy disk drive is constructed similar to a record player. A platter or disk coated with a ferrous material is rotated while a read/write head is moved over the surface and magnetizes the ferrous material in patterns representing binary data. Data is stored in concentric circles on the surface of the disk. Each circle is referred to as a track. Each track can be divided into a number of sectors. When data is written on the disk, the head actuator pushes or pulls the read/write head over the surface of the disk until it is aligned with the proper track. The sectors are then searched until the proper location is found to read or write the data.

On a hard disk drive, the head floats above the surface of the platter. If it were to come into contact with the disk surface, or if some form of contamination were to get between the read/write head and the disk, it would cause damage to the ferrous material.

Technically, tape readers and disk drives are also referred to as permanent storage devices.

RS-232 Interface

Data is sometimes generated or stored using a device that is not a part of the CNC control, i.e., external disk drive, PC (Personal Computer), main frame computer, etc. This data can then be transferred from the external device to the CNC control via an RS-232 port. This port can also be used for DNC (Direct Numerical Control) communications. DNC has several levels of operation. In its simplest form it transfers data from an external device to the CNC control. In some applications it has the capability of transferring all control of the machine to an external computer.

External Switches

The simplest form of an I/O device is the external switch. Examples of input devices are limit switches, proximity switches, pressure switches, etc. Relays, solenoids, LED’s, and lamps are examples of output devices.

LATHE

A Lathe is defined as a machine tool for the removal of material from a workpiece by gripping it securely in a holding device and rotating it under power against a suitable cutting tool. On lathes the tool moves along a rotating workpiece. The carriage or Z-axis moves the tool toward the spindle. The cross slide or X-axis, mounted on the carriage, moves the turret that holds the tool toward and away from the spindle. The origin of the coordinate system is the center of the spindle. Okuma lathes can be Flat bed or Slant bed type lathes. The slant bed allows the chips to fall into the chip pan rather than on tools or slideways. Figure 3-1 shows the axis nomenclature for an Okuma lathe.

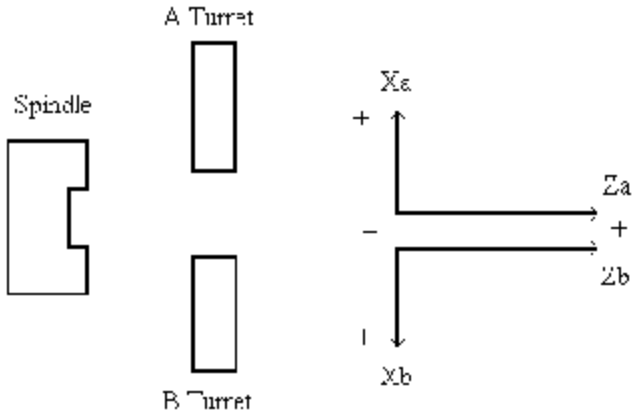


Fig. 3-1

MACHINING CENTER

A machining center is an NC machine that can perform milling, drilling, boring, and tapping operations. On machining centers, the rotating tool machines the workpiece as it moves across the face of the tool. The workpiece moves due to the movement of the table. The rotational axis is perpendicular to the table on vertical machining centers and parallel to the table on horizontal machining centers. The origin of the coordinate system is the center of the table.

Figure 3-2 shows the axis nomenclature for the vertical machining center. The X axis is the table longitudinal movement and is positive when fed left. The Y axis is the saddle crosswise movement and is positive when fed towards the operator. The Z axis is the spindle head vertical movement and is positive when fed upward.

Figure 3-3 shows the axis nomenclature for the horizontal machining center. The X axis is the table longitudinal movement and is positive when fed right. The Y axis is the spindle head vertical movement and is positive when fed upward. The Z axis is the saddle crosswise movement and is positive when fed towards the operator. The rotating motion of a rotary table is positive when fed clockwise.

Fig. 3-4 shows the axis nomenclature for the traveling column type machining center. Fig. 3-5 shows the axis nomenclature for the double column type machining center.

VERTICAL MACHINING CENTER

X axis: Longitudinal movement of the table (positive when fed to the left)
Y axis: Crosswise movement of saddle (positive when fed toward the operator)
Z axis: Vertical movement of Spindlehead (positive when fed upward)

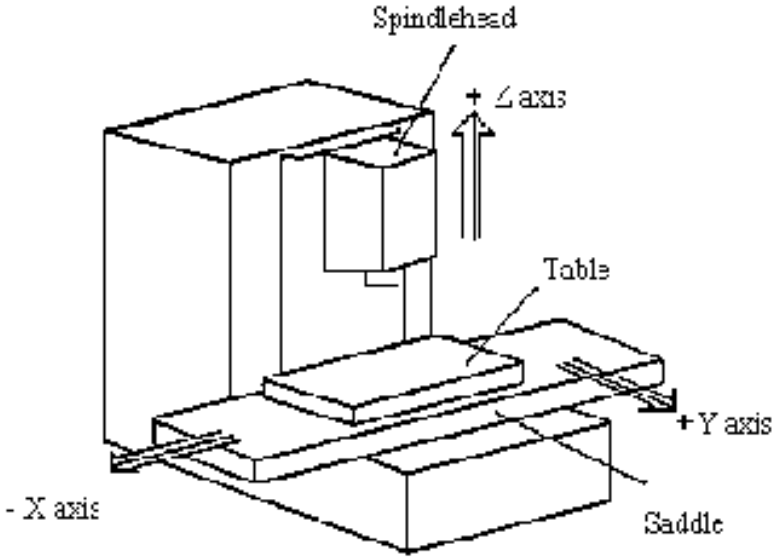


Fig. 3-2

HORIZONTAL MACHINING CENTER

X axis: Longitudinal movement of the table (positive when fed to the right)
Y axis: Vertical movement of Spindlehead (positive when fed upward)
Z axis: Crosswise movement of saddle (positive when fed toward the operator)
B axis: Rotating motion of NC rotary table (positive when fed clockwise)

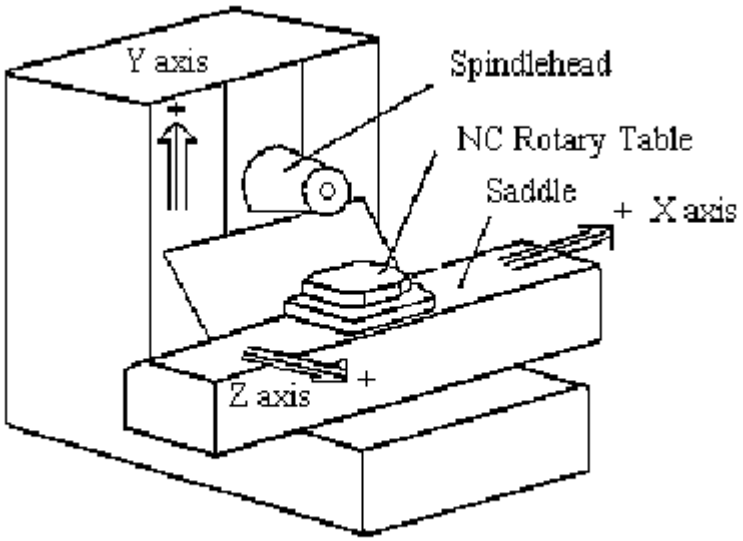


Fig. 3.3

TRAVELLING COLUMN TYPE HORIZONTAL MACHINING CENTER

X axis: Longitudinal movement of the table (positive when fed to the right)
Y axis: Vertical movement of Spindlehead (positive when fed upward)
Z axis: Crosswise movement of Column (positive when fed away from the operator)
B axis: Rota

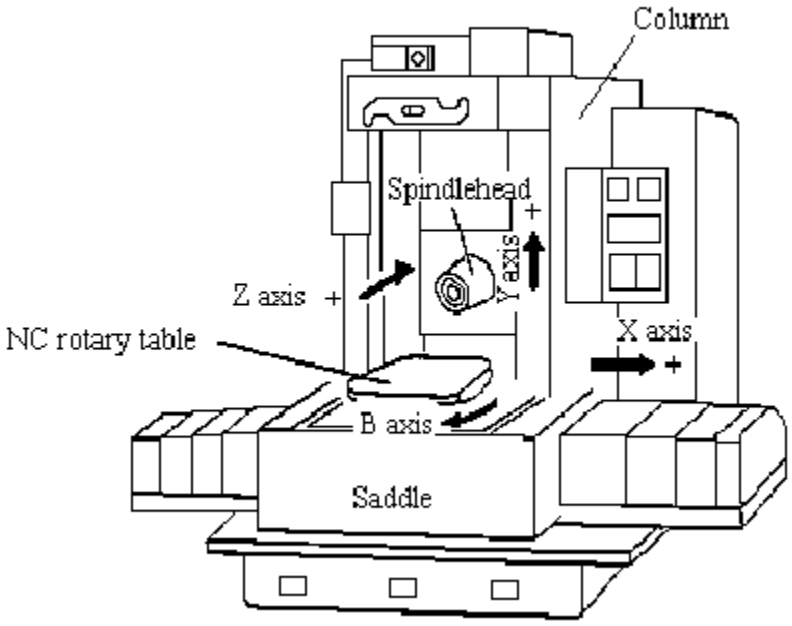


Fig. 3-4

DOUBLE COLUMN MACHINING CENTER

X axis: Longitudinal movement of the table (positive when fed toward the operator)
Y axis: Spindlehead crosswise movement (positive when fed leftward)
Z axis: Spindle Quill vertical movement (positive when fed upward)
W axis: Crossrail vertical movement (positive when fed upward)

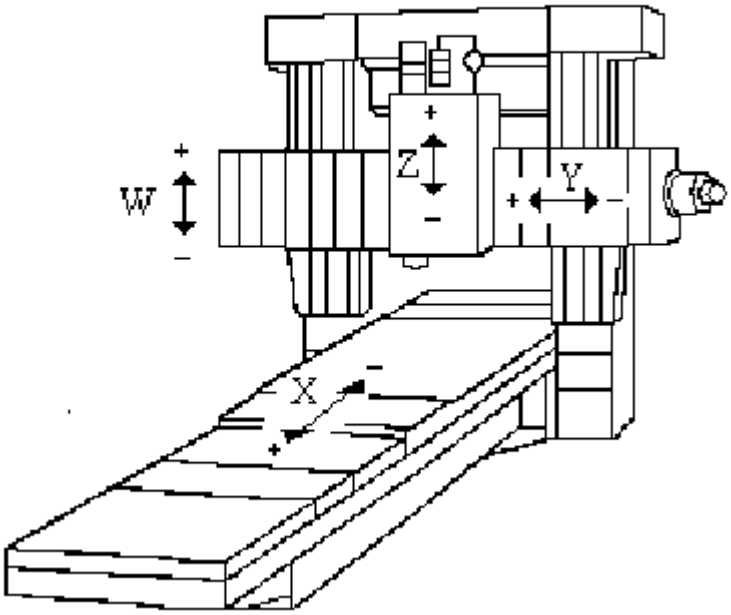


Fig. 3-5

GRINDER

A grinder is a machine tool that employs a rotating abrasive wheel instead of a cutting tool. The purpose of grinding is to leave a finely finished surface on the metal and at the same time to remove the small amount of stock left after the previous finishing operation has brought the piece almost to size.

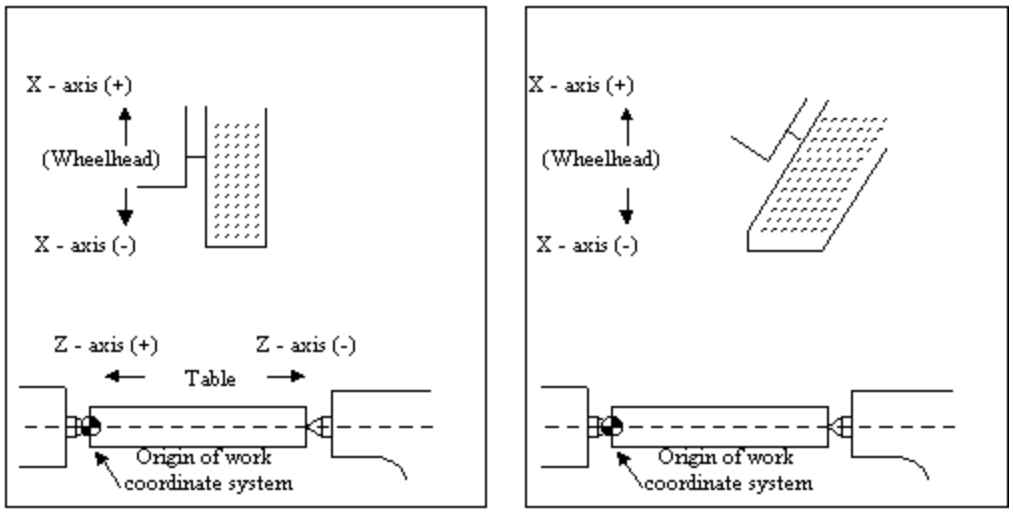
On Okuma grinders there are two types of coordinate systems. One is a work coordinate system for grinding and the other is a wheel coordinate system for wheel dressing.

The work coordinate system is based on the workpiece. For external grinding, the origins of the work coordinate system is located at the end point of the center on the headstock. See figure 3-6.

For internal grinding, the origin is similar to that of lathes. The center of the chuck holding the workpiece is the origin. See figure 3-7.

The origins of the wheel coordinate system is referenced to the grinding wheel itself for both OD and ID grinding. See figure 3-8.

a) Plane OD Grinding (GP-N, GU-S) b) Angle OD Grinding (GA-N, GU-S)



Work Coordinate System for OD Grinding

Fig. 3-6

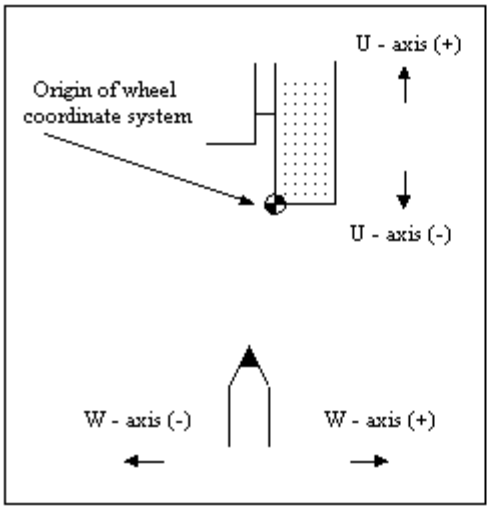
c) ID Grinding (GP-N, GU-S) d) ID Grinding (GI-N)

Work Coordinate System for ID Grinding

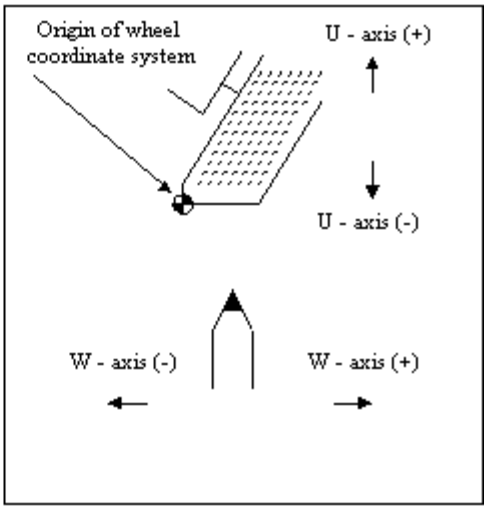
Fig. 3-7

For External (OD) Grinding

a) Plane OD Grinding (GP-N, GU-S)



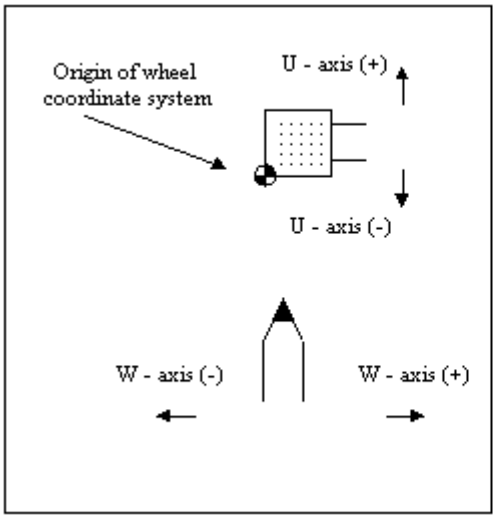
b) Angle OD Grinding (GA-N, GU-S)



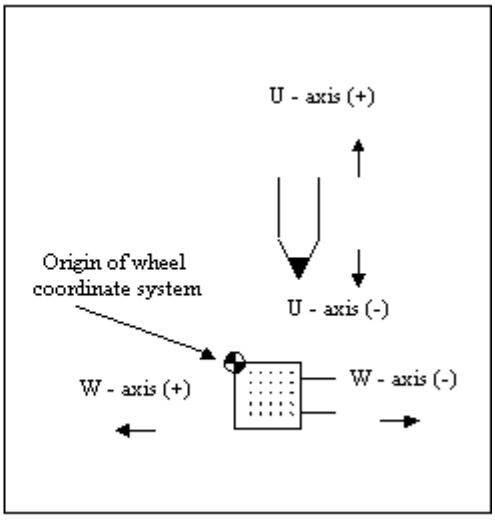
Wheel Coordinate System for OD Grinding

For Internal (ID) Grinding

c) ID Grinding (GP-N, GU-S)

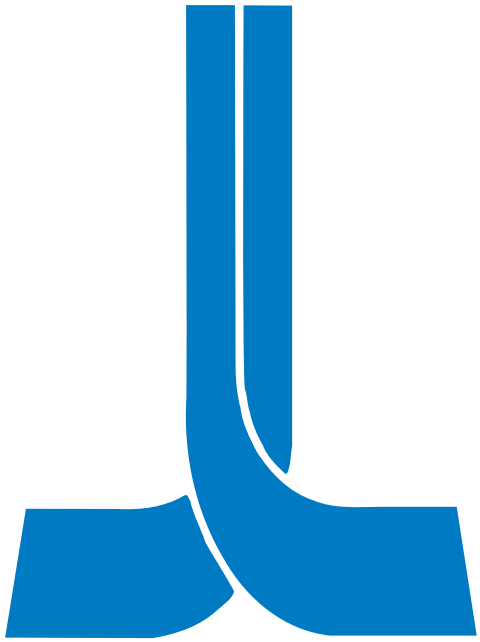


d) ID Grinding (GI-N)



Wheel Coordinate System for ID Grinding

Fig. 3-8



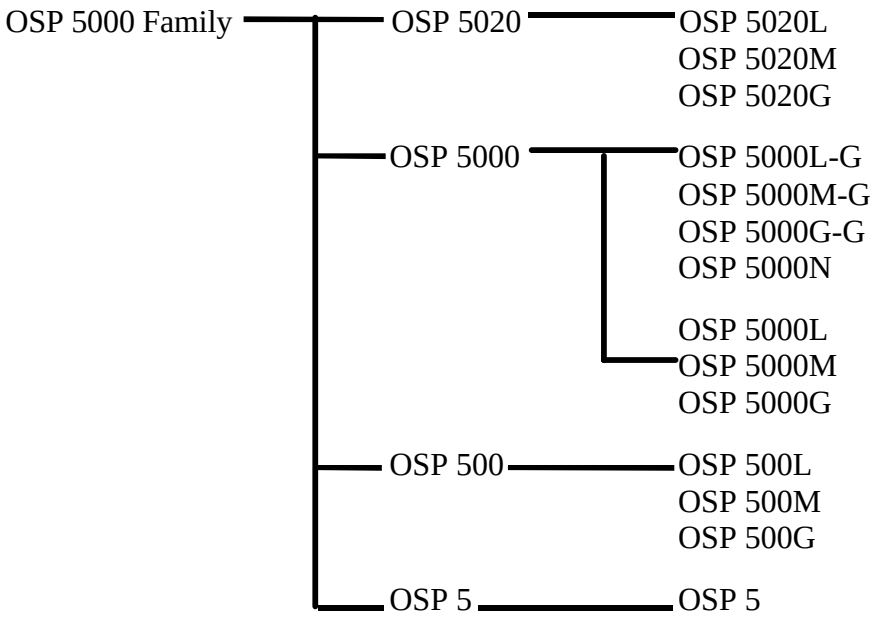
OKUMA

OSP 5000/5020 CONTROL

MACHINE OPERATION

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

The OSP 5000 series family has been around since 1981. In 1985 Okuma incorporated the graphics function into the 5000 series control. In 1988 Okuma introduced the OSP 5020 series control whose speed and accuracy was dramatically increased. The newly developed high-precision digital servo technology and 32-bit double-engine architecture increased the machines' cutting feedrate from 1.25 m/min to 15 m/min. The following is a chart of the OSP 5000 series controls. For the rest of this manual, if the specific control type is not mentioned, the topic being discussed refers to all these controls.



Basic Construction of the Operation Panels

Okuma machine tools with the OSP 5000 series controls mainly consist of four panels.

1. NC Operation Panel (Common Panel)
2. Machine Operation Panel
3. Pendant Operation Panel
4. Option Panel

NC Operation Panel

The NC operation panel is common on all Okuma machines. The 5000 series controls are equipped with a 12-inch CRT. The 500 series controls are equipped with a 9-inch CRT. A picture of a 5020M and a 5020L NC operation panel can be seen on page 4-31 and 4-33 respectively. The following is a description of the OSP 5000 series NC operation panel.

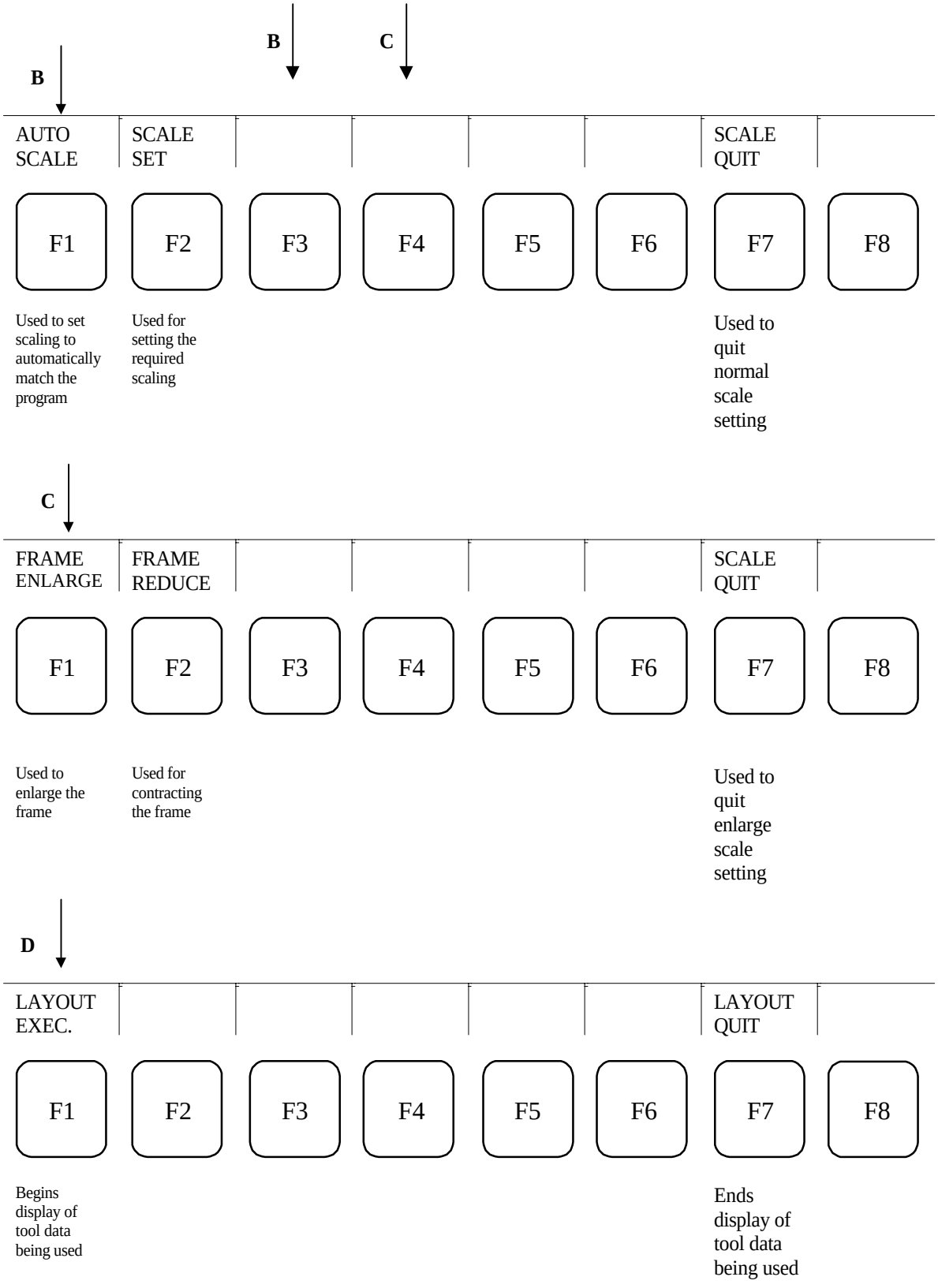
This control has eight function keys located below the CRT. These function keys are used to access the different menus on the control. Each mode key has a different set of menus. Depending on which mode the control is in, the function keys will help the user to access the menus associated with these individual modes.

The following is an outline of the menus associated with the different operating modes on the (OSP 5020L) control. for **LATHES**

AUTO

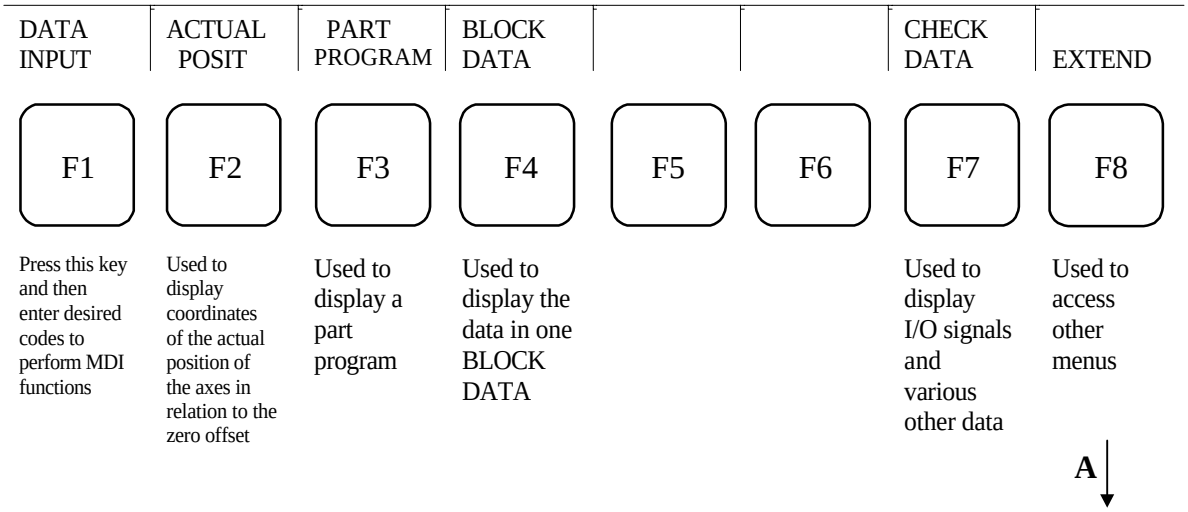
The following shows the functions available when the AUTO mode key is pressed.

PROGRAM SELECT	ACTUAL POSIT	PART PROGRAM	BLOCK DATA		TOOL LAYOUT	CHECK DATA	EXTEND
F1	F2	F3	F4	F5	F6	F7	F8
Used to select a part pro-gram for a desired cut-ting operation	Used to display coordinates of the actual position of the axes in relation to the zero offset	Used to display a part program	Used to display the data in one BLOCK DATA		Used to display the data of the tools to be used	Used to display I/O signals and various other data	Used to access other menus
					D		
NUMBER SEARCH	RESTART		SP SELECT	SP - N SEARCH			EXTEND
F1	F2	F3	F4	F5	F6	F7	F8
Used to search for the specified BLOCK DATA of the part program currently selected by turret selection (also possible by locating the cursor)n	Used to search for the specified BLOCK DATA of the part program currently selected; the data up to that BLOCK DATA are all read		Used to selected a scheduled program	Used to search for a specified BLOCK DATA in the scheduled program			Used to access other menus
							A
STD/EXT GRAPHIC		NORMAL SCALE	ENLARGE SCALE	TRACE/ ANIMATE	MATE-RIAL	CLEAR	EXTEND
F1	F2	F3	F4	F5	F6	F7	F8
Used to select the standard or enlarged graphic display		Used for setting the scaling on the standard graphic display	Used for setting the scaling on the enlarged graphic display	Used for selecting the tool path/ animation display	Used for displaying blank material, chuck and tailstock	Used for clearing the display	Used to return to first menu


B
B
C
AUTO SCALE
SCALE SET
SCALE QUIT
F1
F2
F3
F4
F5
F6
F7
F8
Used to set scaling to automatically match the program
Used for setting the required scaling
Used to quit normal scale setting
C
FRAME ENLARGE
FRAME REDUCE
SCALE QUIT
F1
F2
F3
F4
F5
F6
F7
F8
Used to enlarge the frame
Used for contracting the frame
Used to quit enlarge scale setting
D
LAYOUT EXEC.
LAYOUT QUIT
F1
F2
F3
F4
F5
F6
F7
F8
Begins display of tool data being used
Ends display of tool data being used

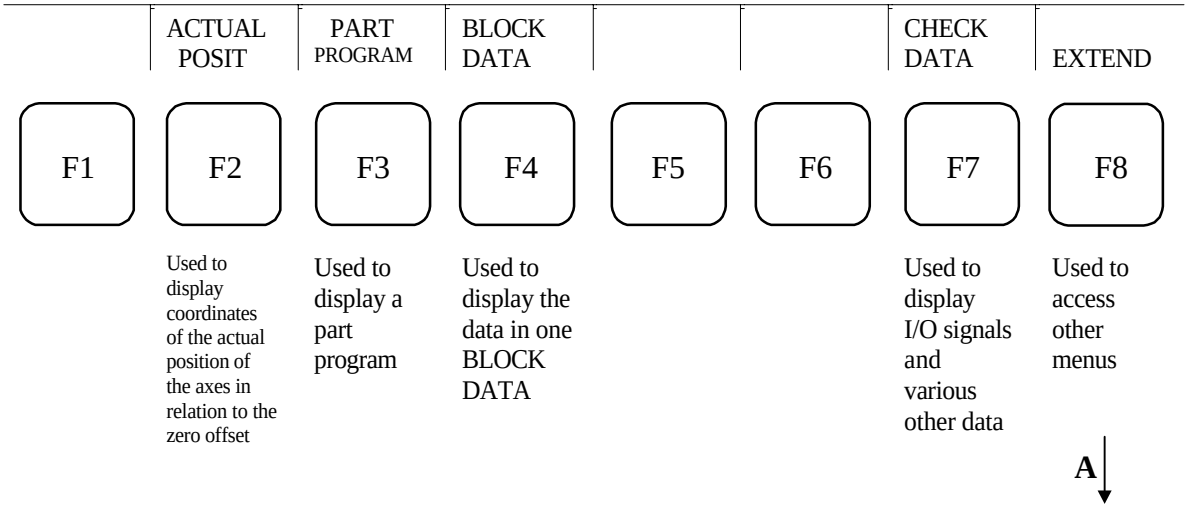
MDI

The following shows the functions available when the MDI mode key is pressed. All the functions are the same as in AUTO except for the PROGRAM SELECT (F1) is DATA INPUT and function F6 is blank.



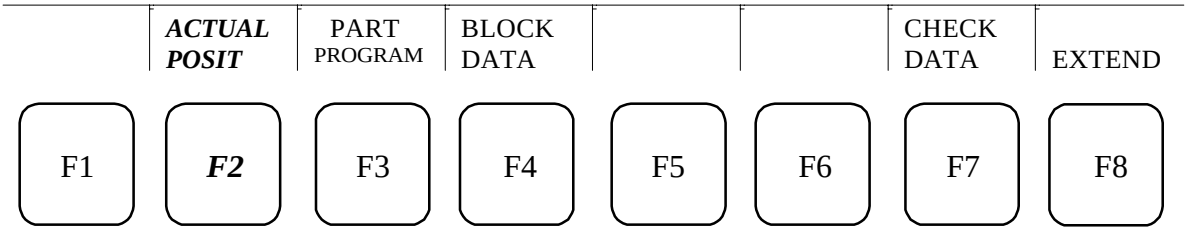
MANUAL

The following shows the functions available when the MANUAL mode key is pressed. All the functions are the same as in DATA INPUT except F1 is blank.

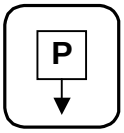


The following describes what is shown in the Actual Posit, Part Program, Block Data and Check Data menus.

Actual Position

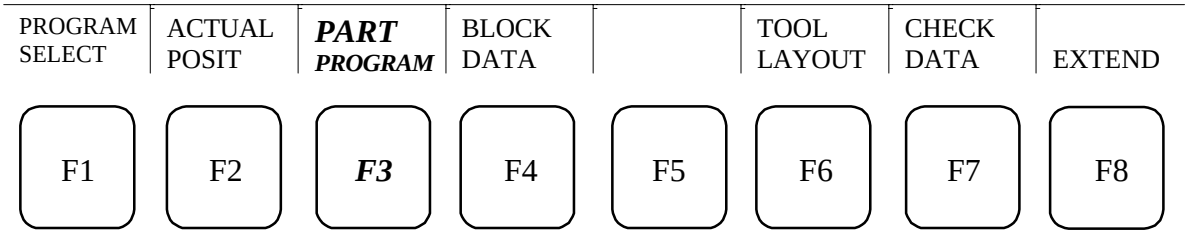


By using the PAGE key on the NC operation Panel, various screens can be accessed after the ACTUAL POSIT function key has been pressed. The following bullets describe what the different screens show:

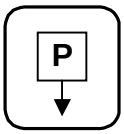


- Displays the actual position data of the individual axes in enlarged characters. This actual position is in relation to the zero offset.
- Simultaneous display of actual position data and the NC program being executed.
- Simultaneous display of actual position data, machine status (i.e. chuck clamped) and load conditions.
- Simultaneous display of actual position data, distance remaining to target point, actual data from absolute position encoder, tool offset and shift data.

PART PROGRAM



By using the PAGE key on the NC operation Panel, various screens can be accessed after the PART PROGRAM function key has been pressed. The following bullets describe what the different screens show:

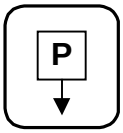


- Displays the NC program for the currently selected turret, A or B.
- Simultaneous display of NC program for both turrets, A and B.
- Display of data entered through the keyboard in MDI mode.
- Display of the scheduled programs.

BLOCK DATA

PROGRAM SELECT	ACTUAL POSIT	PART PROGRAM	***BLOCK DATA***		TOOL LAYOUT	CHECK DATA	EXTEND
F1	F2	F3	***F4***	F5	F6	F7	F8

By using the PAGE key on the NC operation Panel, various screens can be accessed after the BLOCK DATA function key has been pressed. The following bullets describe what the different screens show:



- Displays the data in the block **currently** being executed.
- Displays the data in the **NEXT** block to be executed.
- Displays the data in the block succeeding (**QUEUED**) the next block.
- Displays the data last stored in the buffer (**READ**) register.

CHECK DATA

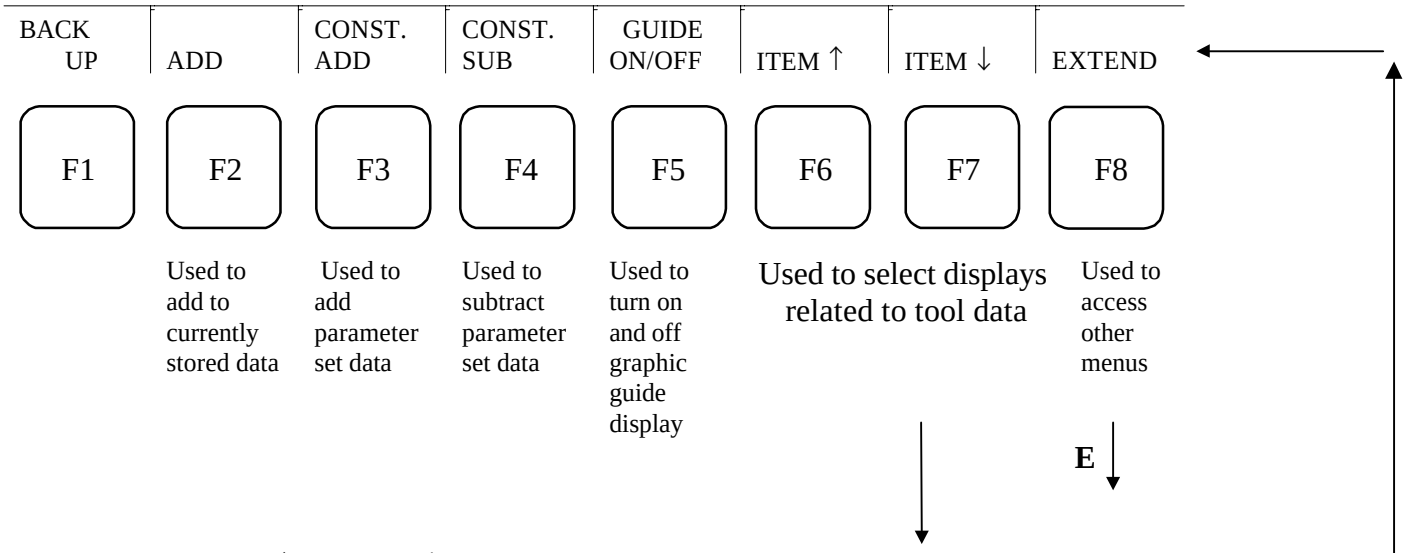
DATA INPUT	ACTUAL POSIT	PART PROGRAM	BLOCK DATA		TOOL LAYOUT	***CHECK DATA***	EXTEND
F1	F2	F3	F4	F5	F6	*F7*	F8

By using the PAGE key on the NC operation Panel, various screens can be accessed after the CHECK DATA function key has been pressed. The following bullets describe what the different screens show:

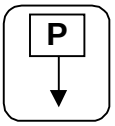
- Displays servo data related to individual axes.
- Displays EC inputs (machine side inputs).
- Displays EC outputs
- Displays Machine Operation Panel inputs.
- Displays Machine Operation Panel outputs.
- Displays machine's specification codes.
- Displays machine's model code.
- Displays machine's machine specification codes.
- Displays history of alarms (last 12 alarms).
- Displays ATC I/O's (if applicable).
- Displays post process gauging data (if applicable).
- Displays in process gauging data (if applicable).

Data Setting Mode Keys (Tool Data, Edit Aux, Zero Set and Parameter)

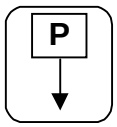
TOOL DATA



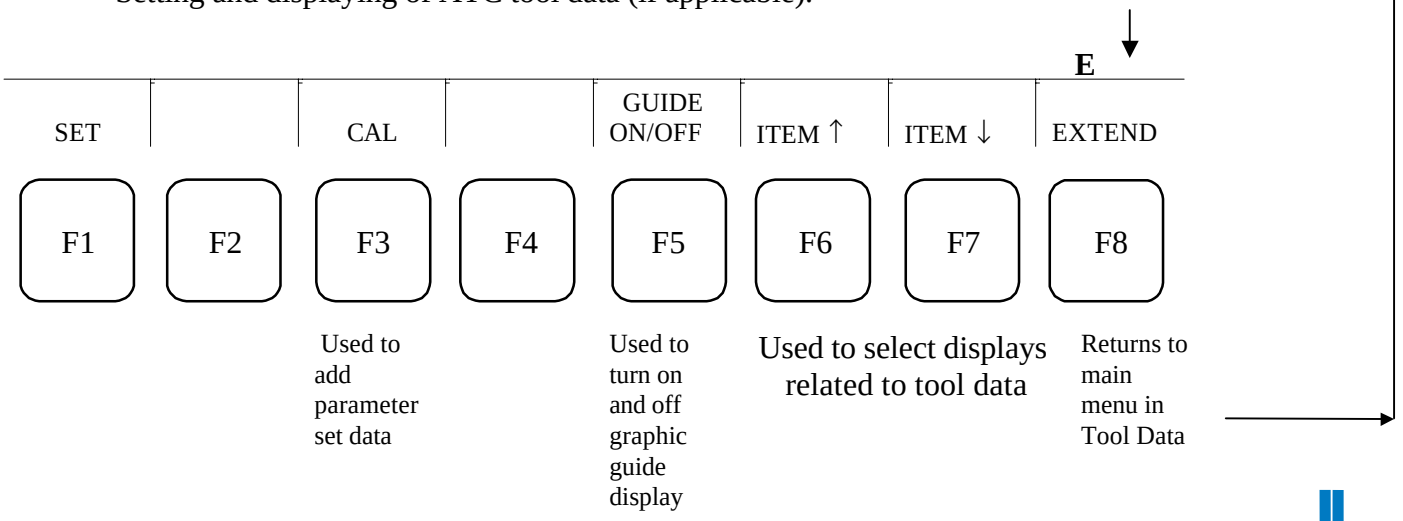
By using the ITEM ↑ or ITEM ↓ key, various screens can be accessed after the TOOL DATA mode key has been pressed. The following bullets describe what the different screens show:



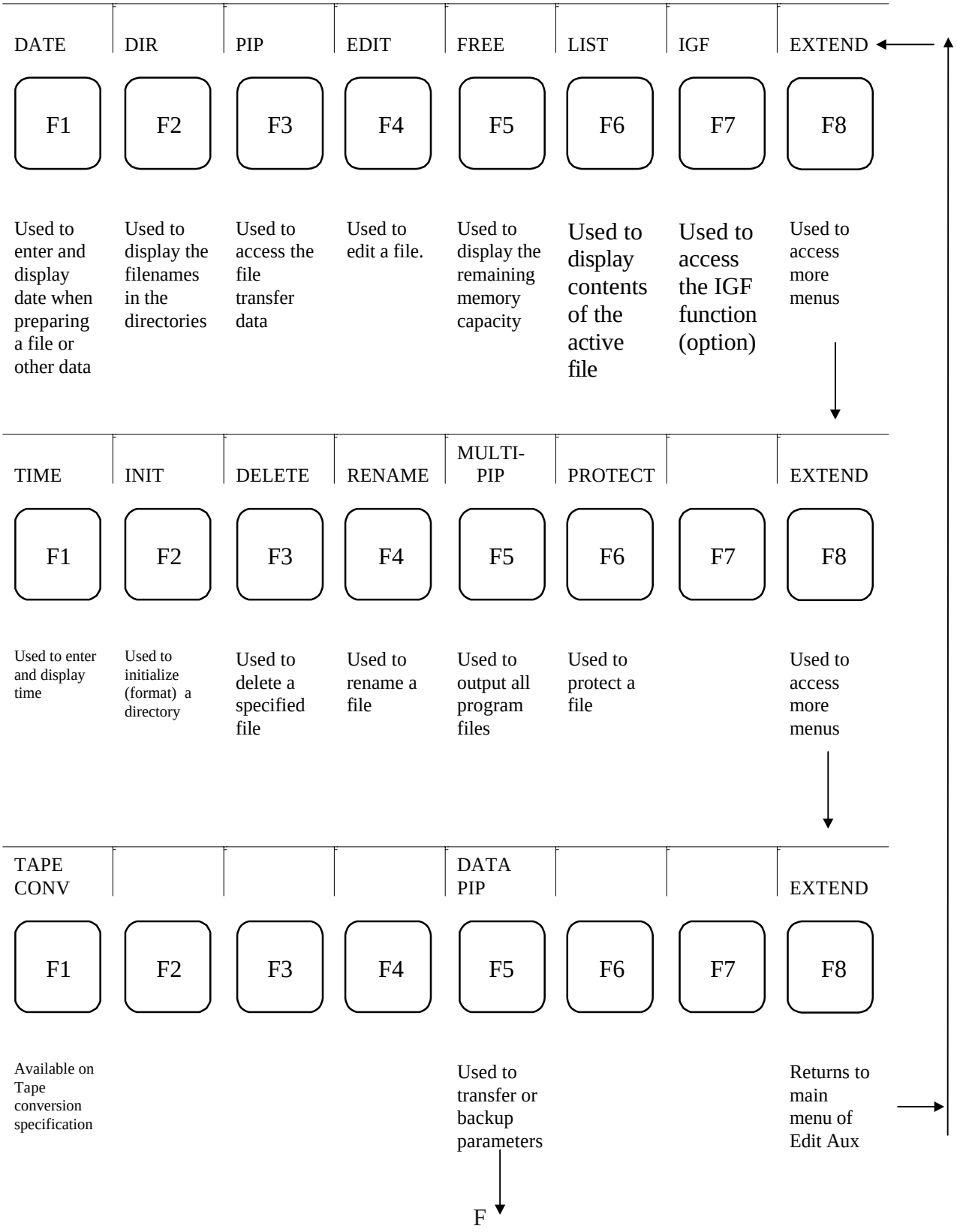
- The tool offsets are displayed and can also be changed in this menu. Use the key to access tools # 13 to 32 if applicable.
- Displays tool interference data.
- The tool interference data (TOOL FORM SELECT) are displayed and can also be changed in this menu. (not available for the graphics specification) Use the key to access tools # 13 to 32 if applicable.

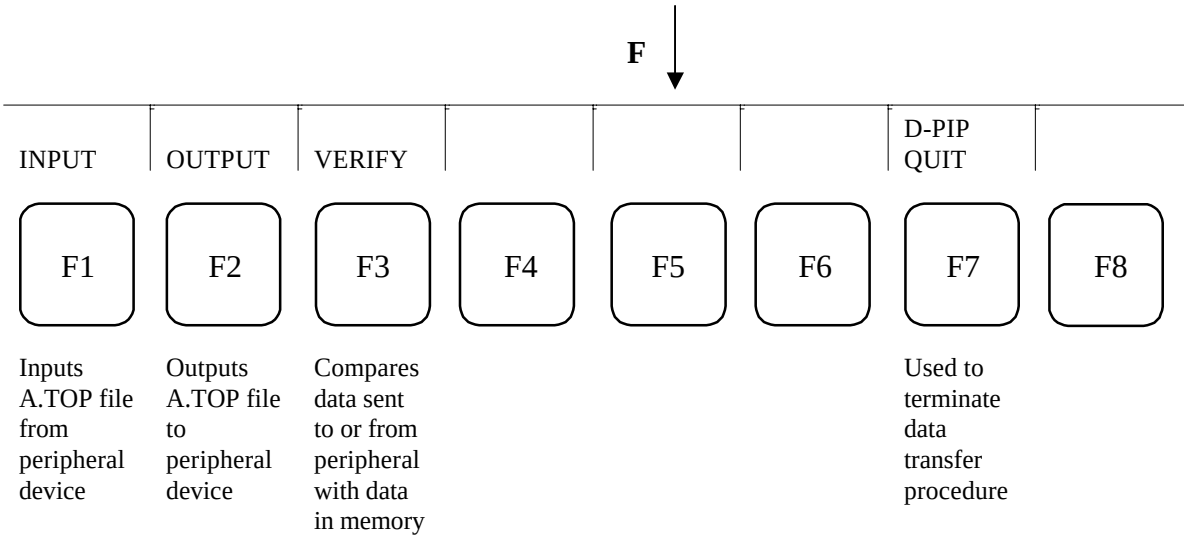


- Displays tool group data
- Displays post process gauging results.
- Setting and displaying of ATC tool data (if applicable).

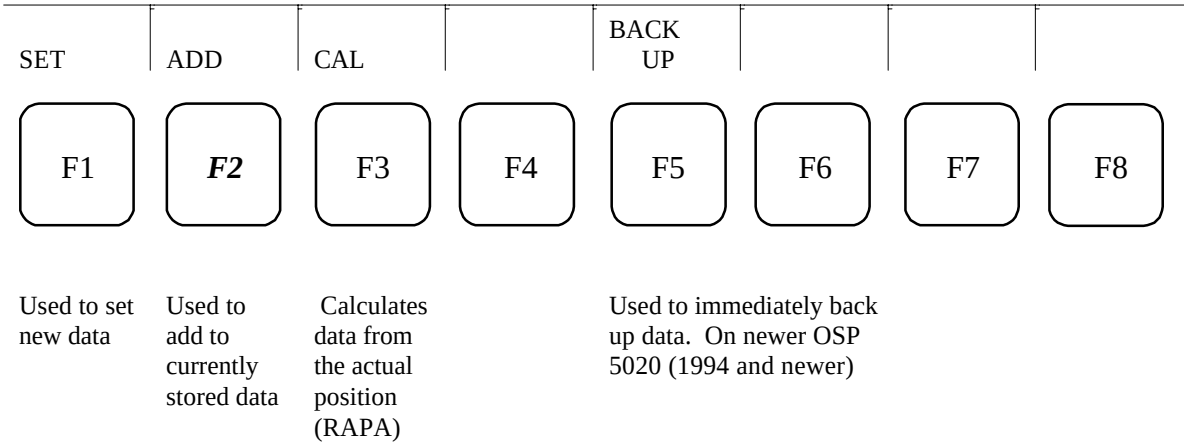


EDIT AUX


DATE
DIR
PIP
EDIT
FREE
LIST
IGF
EXTEND
F1
F2
F3
F4
F5
F6
F7
F8
Used to enter and display date when preparing a file or other data
Used to display the filenames in the directories
Used to access the file transfer data
Used to edit a file.
Used to display the remaining memory capacity
Used to display contents of the active file
Used to access the IGF function (option)
Used to access more menus
TIME
INIT
DELETE
RENAME
MULTI-PIP
PROTECT
EXTEND
Used to enter and display time
Used to initialize (format) a directory
Used to delete a specified file
Used to rename a file
Used to output all program files
Used to protect a file
Used to access more menus
TAPE CONV
DATA PIP
EXTEND
Available on Tape conversion specification
Used to transfer or backup parameters
Returns to main menu of Edit Aux
F


F
INPUT
OUTPUT
VERIFY
D-PIP QUIT
F1
F2
F3
F4
F5
F6
F7
F8
Inputs A.TOP file from peripheral device
Outputs A.TOP file to peripheral device
Compares data sent to or from peripheral with data in memory
Used to terminate data transfer procedure

ZERO SET

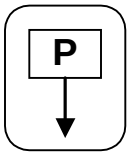

SET
ADD
CAL
BACK UP
F1
F2
F3
F4
F5
F6
F7
F8
Used to set new data
Used to add to currently stored data
Calculates data from the actual position (RAPA)
Used to immediately back up data. On newer OSP 5020 (1994 and newer)

PARAMETER

SET	ADD	CAL		BACK UP	ITEM ↑	ITEM ↓	
F1	***F2***	F3	F4	F5	F6	F7	F8
Used to set new data	Used to add to currently stored data	Calculates data from the actual position (RAPA)		Used to immediate ly back up data. On newer OSP 5020 (1994 and newer)	Used to access displays related to parameter data.		

By using the ITEM ↑ or ITEM ↓ key, various screens can be accessed after the PARAMETER mode key has been pressed. The following bullets describe what the different screens show:

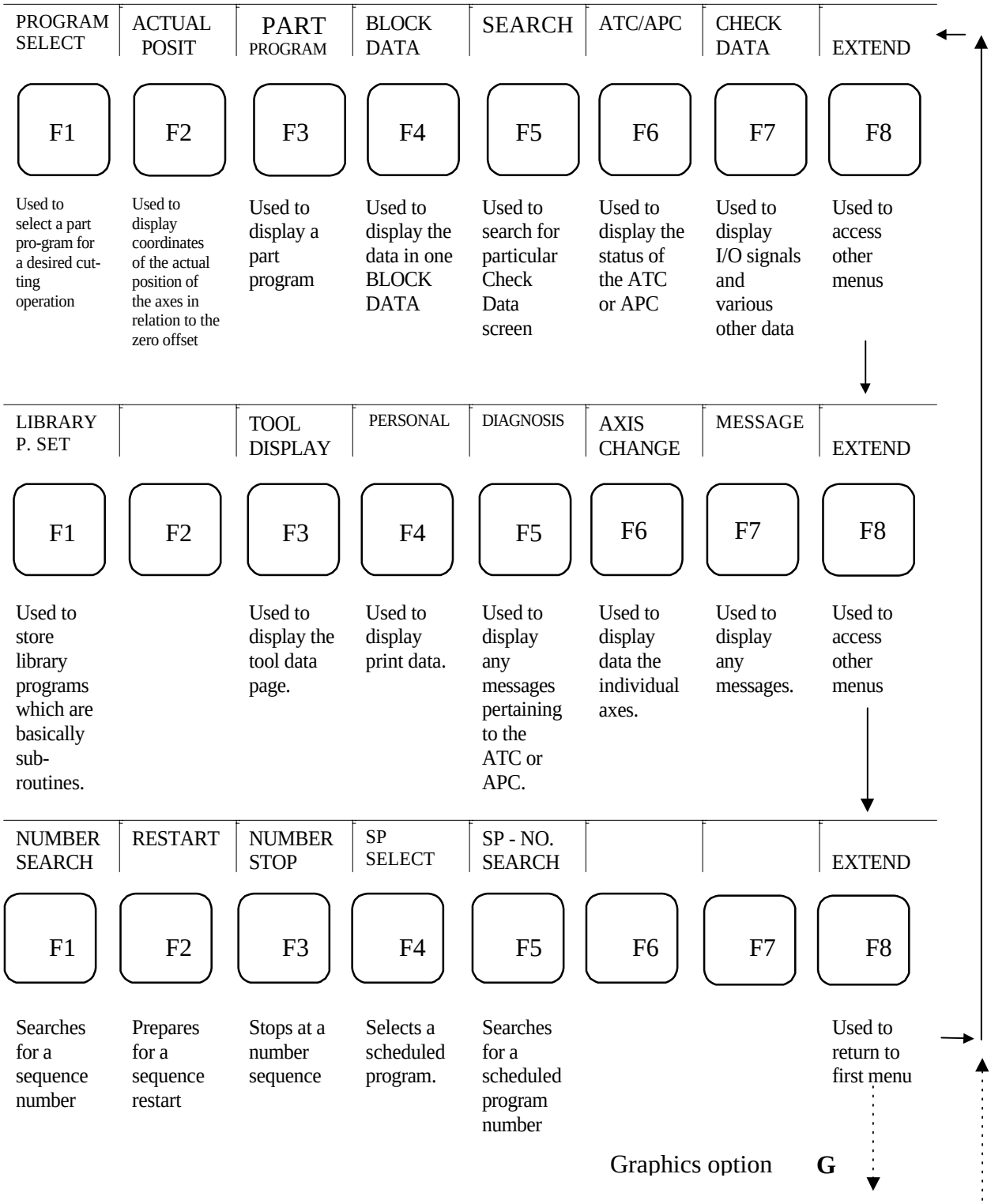
- User Parameters
- Chuck/Tailstock
- Common Variable
- System Parameters
- Optional Parameter (Long Word)
- Optional Parameter (Word)
- Optional Parameter (Bit)
- Turret Angle
- Turret Parameter Bit

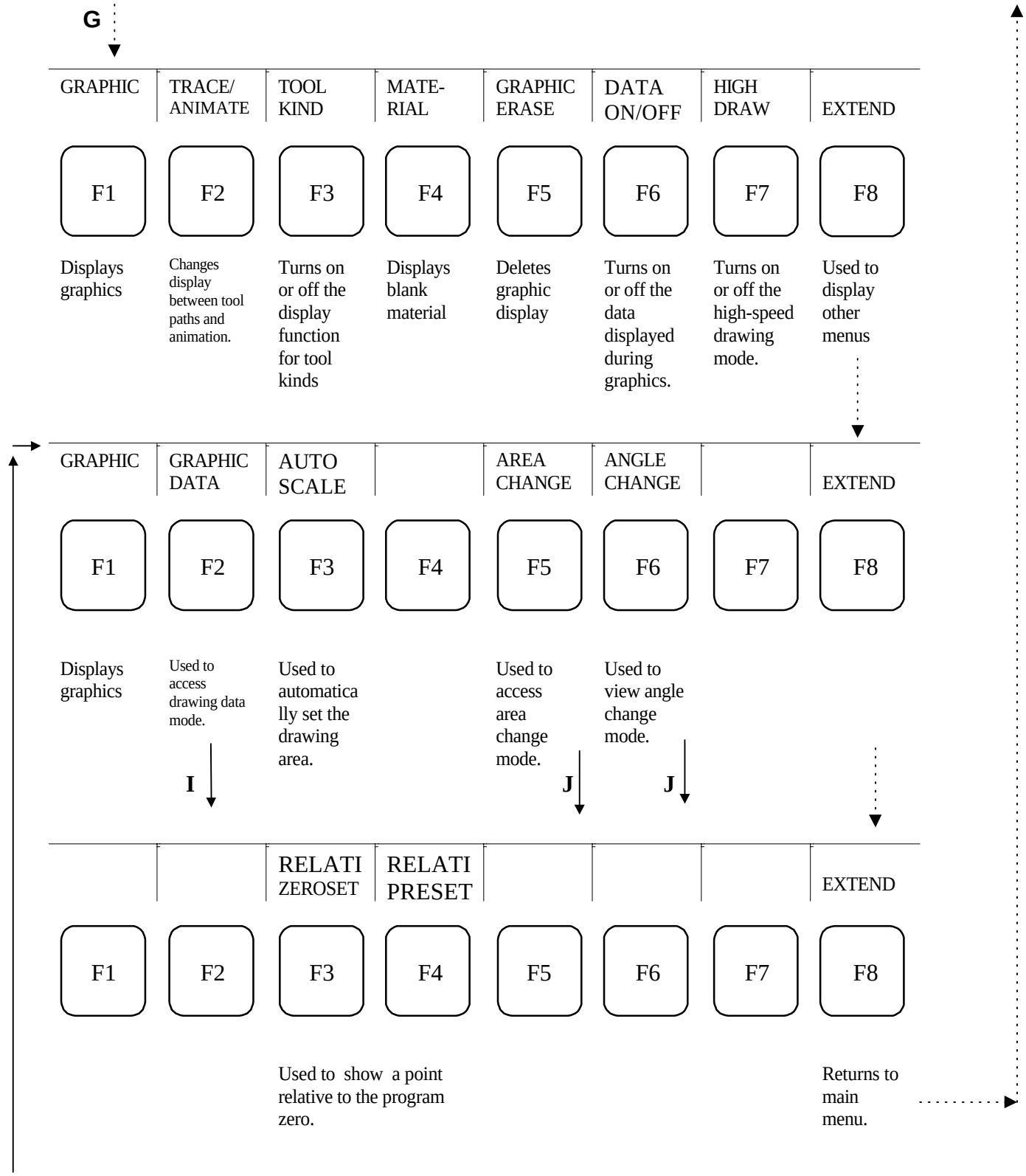
Some of the screens displayed will have more than one page. These pages can be accessed by pressing the 

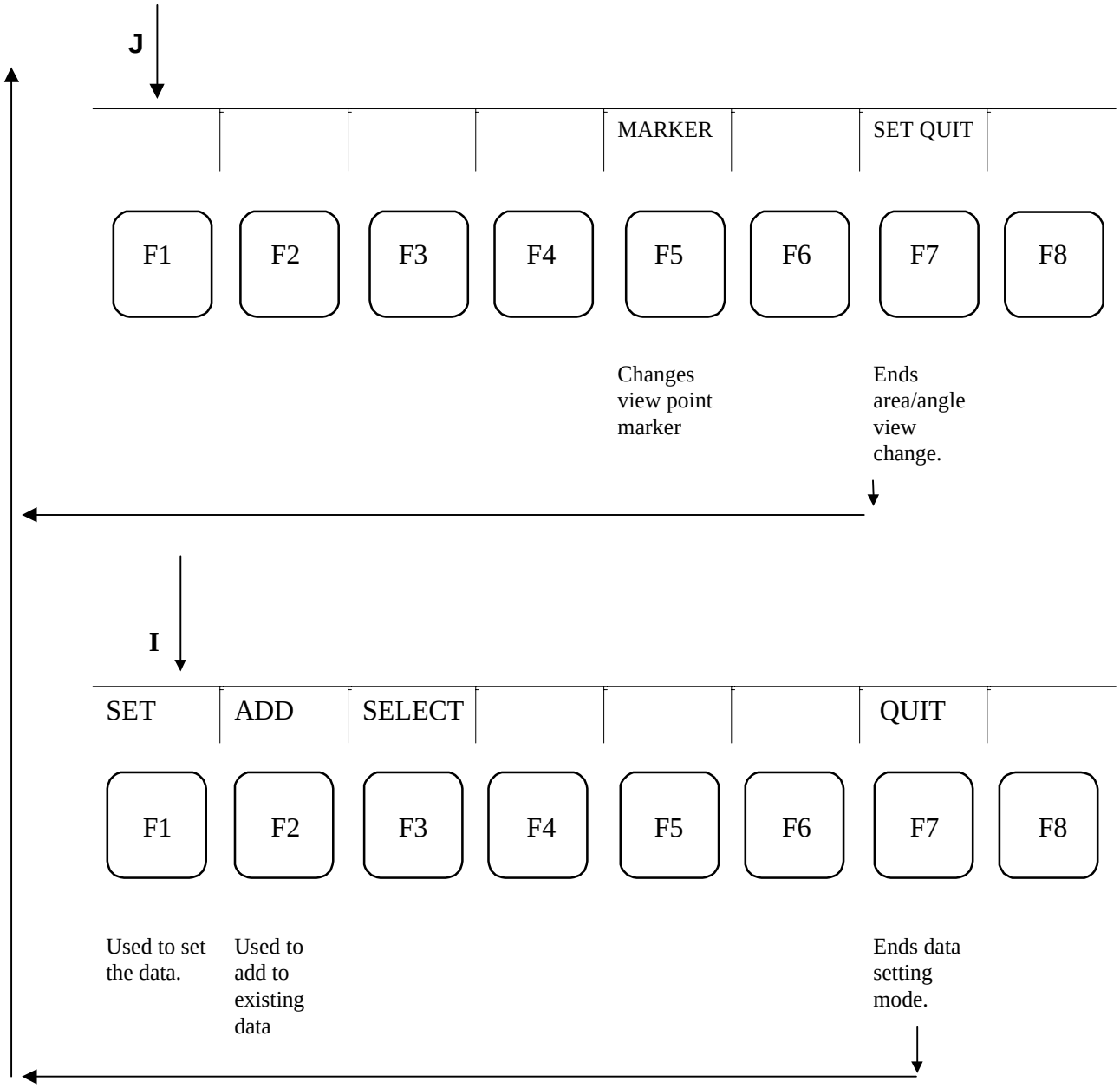
key on the NC Operation Panel.

The following is an outline of the menus associated with the different operating modes on the **Machining Center** (OSP 5020) control.

AUTO Mode

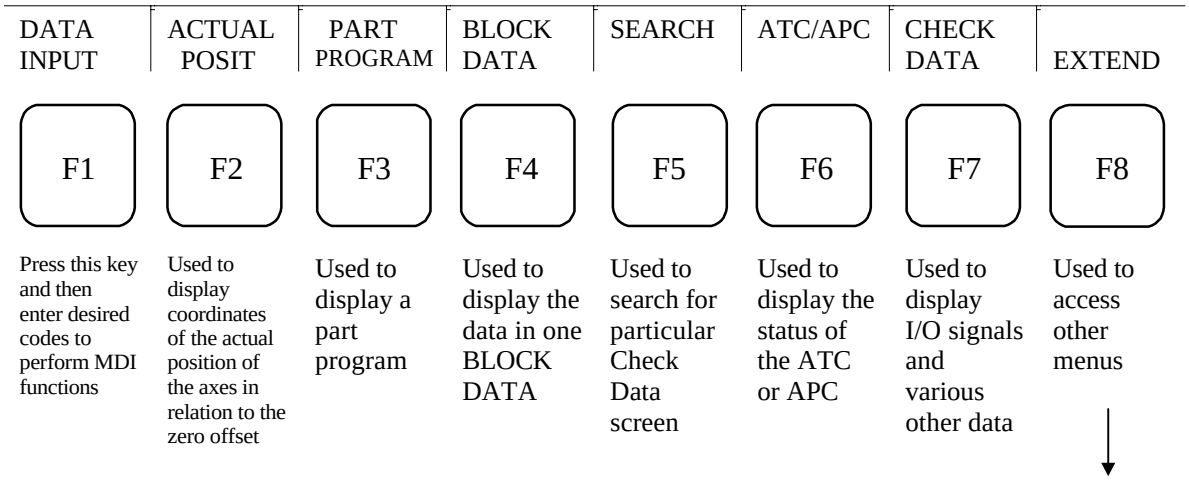



G
GRAPHIC
TRACE/ ANIMATE
TOOL KIND
MATE-RIAL
GRAPHIC ERASE
DATA ON/OFF
HIGH DRAW
EXTEND
F1
F2
F3
F4
F5
F6
F7
F8
Displays graphics
Changes display between tool paths and animation.
Turns on or off the display function for tool kinds
Displays blank material
Deletes graphic display
Turns on or off the data displayed during graphics.
Turns on or off the high-speed drawing mode.
Used to display other menus
GRAPHIC
GRAPHIC DATA
AUTO SCALE
AREA CHANGE
ANGLE CHANGE
EXTEND
F1
F2
F3
F4
F5
F6
F7
F8
Displays graphics
Used to access drawing data mode.
Used to automatica lly set the drawing area.
Used to access area change mode.
Used to view angle change mode.
I
J
J
RELATI ZEROSET
RELATI PRESET
EXTEND
F1
F2
F3
F4
F5
F6
F7
F8
Used to show a point relative to the program zero.
Returns to main menu.


J
MARKER
SET QUIT
F1
F2
F3
F4
F5
F6
F7
F8
Changes view point marker
Ends area/angle view change.
I
SET
ADD
SELECT
QUIT
F1
F2
F3
F4
F5
F6
F7
F8
Used to set the data.
Used to add to existing data
Ends data setting mode.

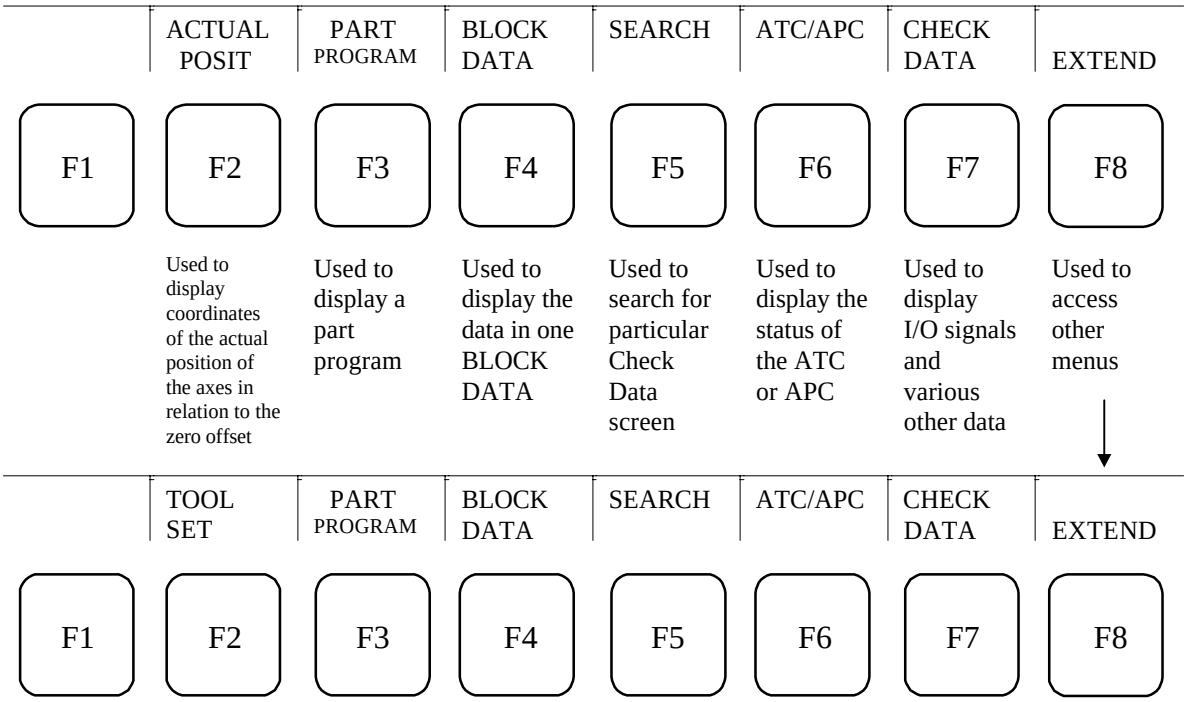
MDI

The following shows the functions available when the MDI mode key is pressed. All the functions are the same as in AUTO except for the DATA INPUT (F1) function.



MANUAL

The following shows the functions available when the MANUAL mode key is pressed. All the functions are the same as in DATA INPUT except F1 is blank.

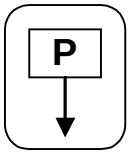


The following describes what is shown in the Actual Posit, Part Program, Block Data and Check Data menus.

Actual Position

	ACTUAL POSIT	PART PROGRAM	BLOCK DATA			CHECK DATA	EXTEND
F1	***F2***	F3	F4	F5	F6	F7	F8

By using the PAGE key on the NC operation Panel, various screens can be accessed after the ACTUAL POSIT function key has been pressed. The following bullets describe what the different screens show:

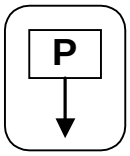


- Displays the actual position data of the individual axes in enlarged characters. This actual position is in relation to the zero offset.
- Simultaneous display of actual position data and the NC program being executed.
- Simultaneous display of actual position data, machine status (i.e. chuck clamped) and load conditions.
- Simultaneous display of actual position data, distance remaining to target point, actual data from absolute position encoder, tool offset and shift data.

PART PROGRAM

PROGRAM SELECT	ACTUAL POSIT	***PART PROGRAM***	BLOCK DATA		TOOL LAYOUT	CHECK DATA	EXTEND
F1	F2	***F3***	F4	F5	F6	F7	F8

By using the PAGE key on the NC operation Panel, various screens can be accessed after the PART PROGRAM function key has been pressed. The following bullets describe what the different screens show:

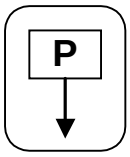


- Displays the NC program for the currently selected turret, A or B.
- Simultaneous display of NC program for both turrets, A and B.
- Display of data entered through the keyboard in MDI mode.
- Display of the scheduled programs.

BLOCK DATA

PROGRAM SELECT	ACTUAL POSIT	PART PROGRAM	***BLOCK DATA***		TOOL LAYOUT	CHECK DATA	EXTEND
F1	F2	F3	***F4***	F5	F6	F7	F8

By using the PAGE key on the NC operation Panel, various screens can be accessed after the BLOCK DATA function key has been pressed. The following bullets describe what the different screens show:

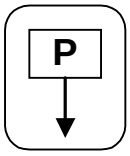


- Displays the data in the block **currently** being executed.
- Displays the data in the **NEXT** block to be executed.
- Displays the data in the block succeeding (**QUEUED**) the next block.
- Displays the data last stored in the buffer (**READ**) register.

CHECK DATA

DATA INPUT	ACTUAL POSIT	PART PROGRAM	BLOCK DATA		TOOL LAYOUT	***CHECK DATA***	EXTEND
F1	F2	F3	F4	F5	F6	*F7*	F8

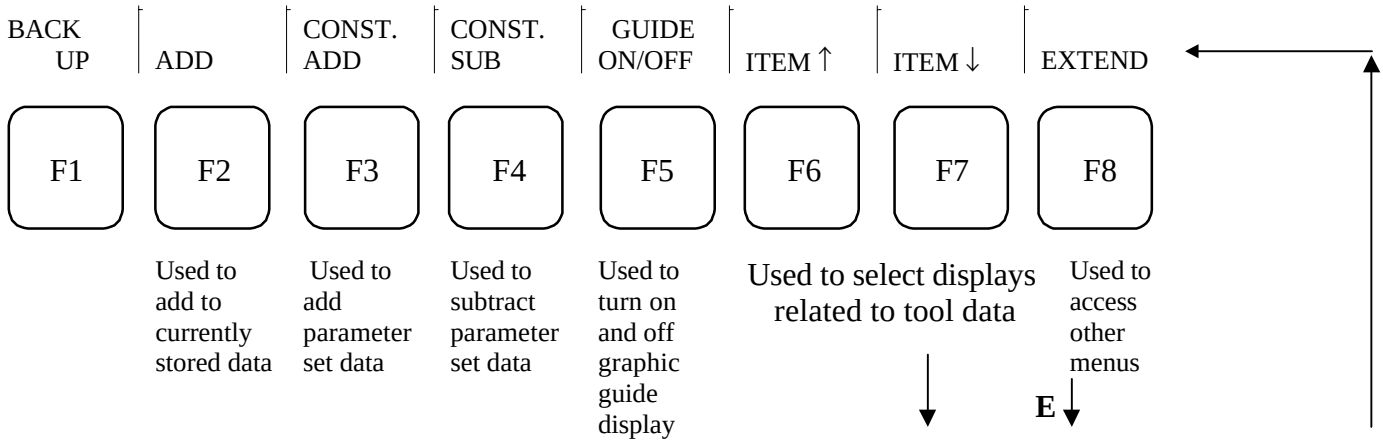
By using the PAGE key on the NC operation Panel, various screens can be accessed after the CHECK DATA function key has been pressed. The following bullets describe what the different screens show:



- Displays servo data related to individual axes.
- Displays EC inputs (machine side inputs).
- Displays EC outputs
- Displays Machine Operation Panel inputs.
- Displays Machine Operation Panel outputs.
- Displays machine's specification codes.
- Displays machine's machine specification codes.
- Displays history of alarms (last 12 alarms).
- Displays ATC I/O's (if applicable).
- Displays post process gauging data (if applicable).
- Displays in process gauging data (if applicable).

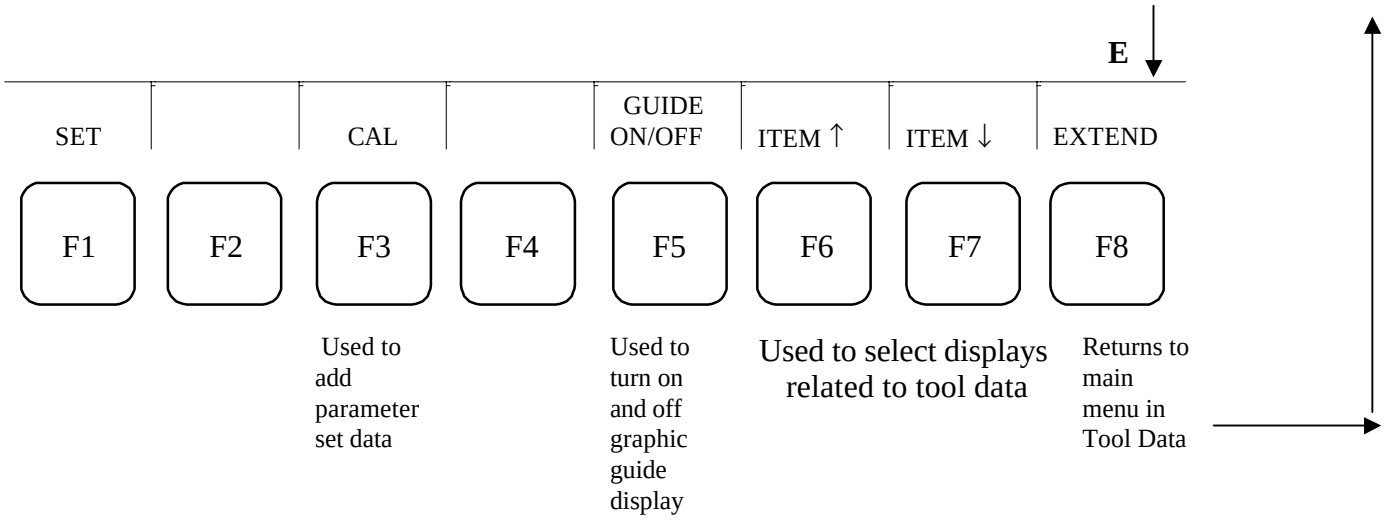
Data Setting Mode Keys (Tool Data, Edit Aux, Zero Set and Parameter)

TOOL DATA

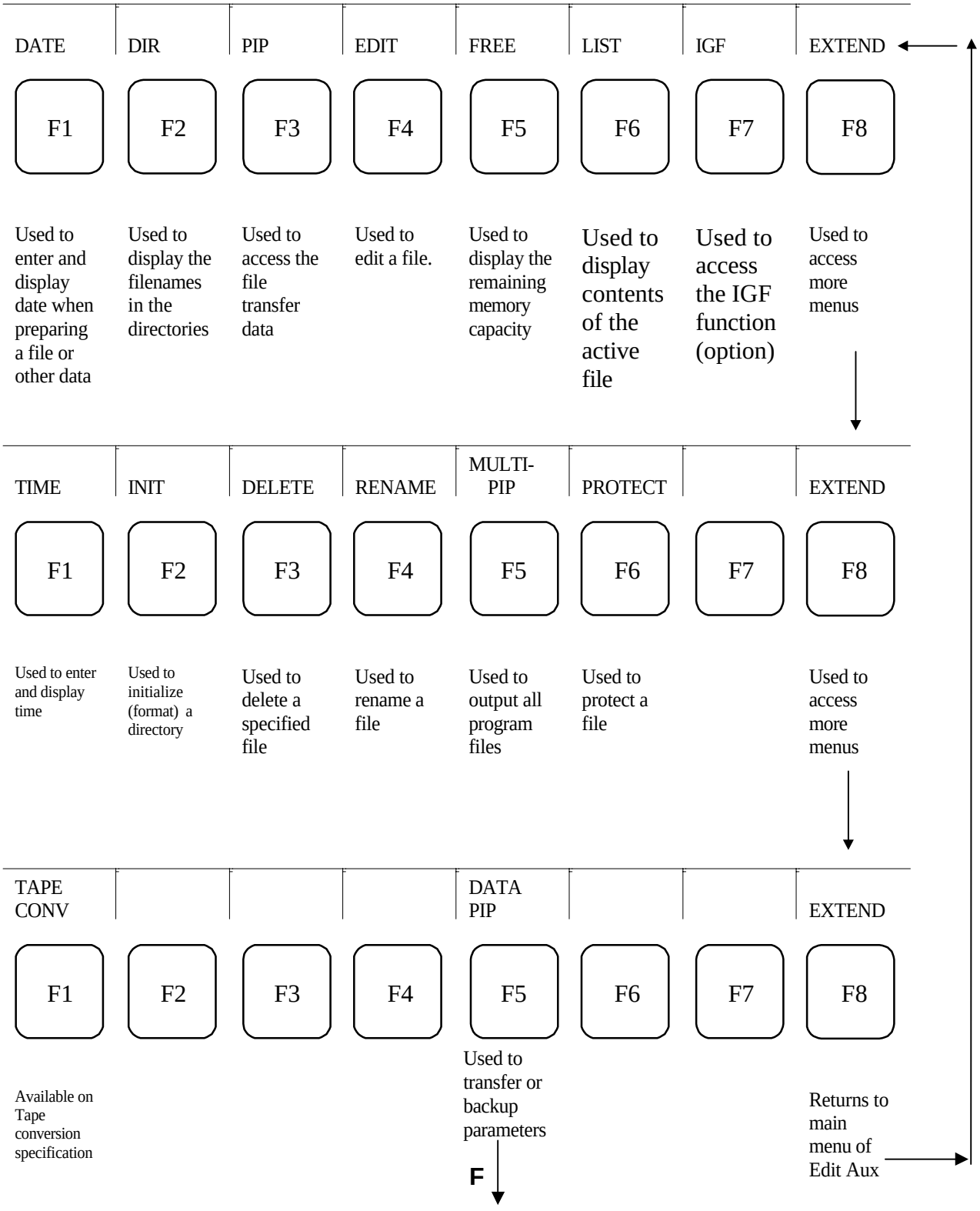


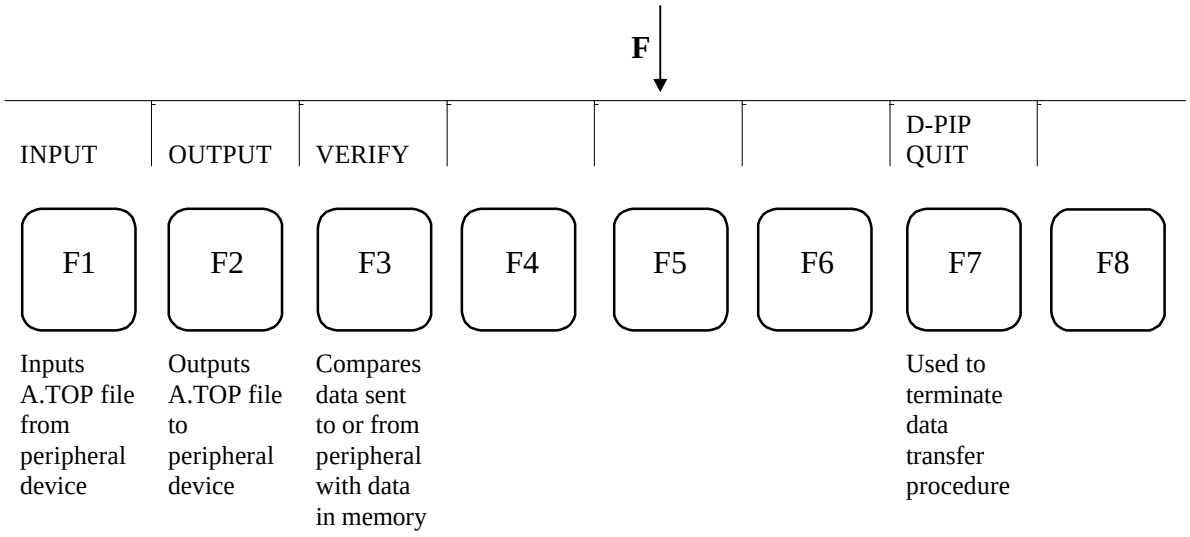
By using the ITEM ↑ or ITEM ↓ key, various screens can be accessed after the TOOL DATA mode key has been pressed. The following bullets describe what the different screens show:

- The tool offsets are displayed and can also be changed in this menu. Use the key to access tools # 13 to 32 if applicable.
- Displays tool interference data.
- The tool interference data (TOOL FORM SELECT) are displayed and can also be changed in this menu. (not available for the graphics specification) Use the key to access tools # 13 to 32 if applicable.
- Displays tool group data
- Displays post process gauging results.
- Setting and displaying of ATC tool data (if applicable).

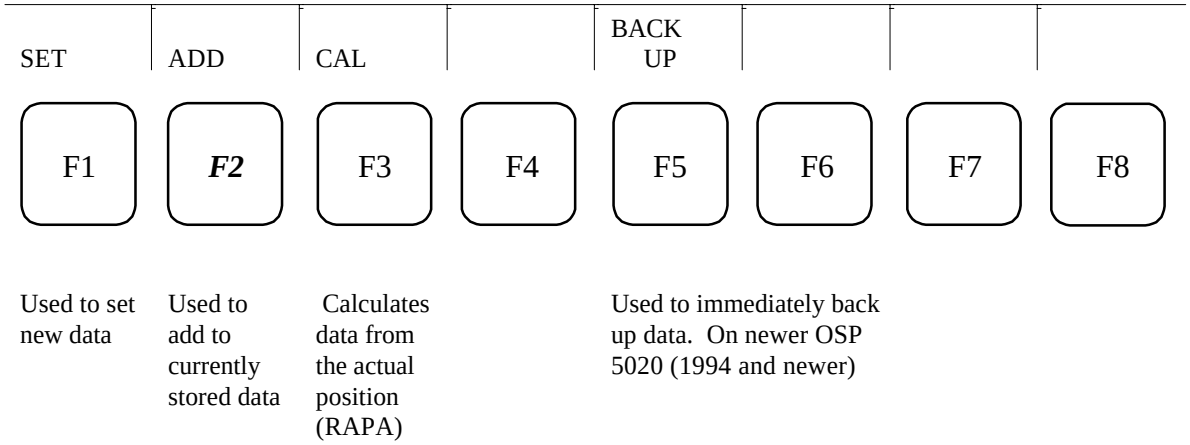


EDIT AUX

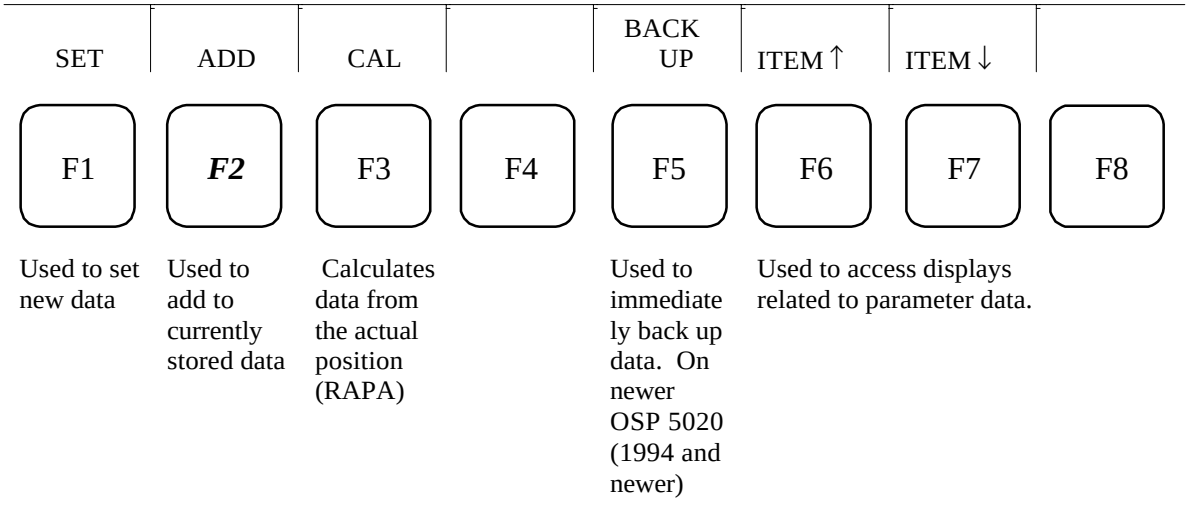

DATE
DIR
PIP
EDIT
FREE
LIST
IGF
EXTEND
F1
F2
F3
F4
F5
F6
F7
F8
Used to enter and display date when preparing a file or other data
Used to display the filenames in the directories
Used to access the file transfer data
Used to edit a file.
Used to display the remaining memory capacity
Used to display contents of the active file
Used to access the IGF function (option)
Used to access more menus
TIME
INIT
DELETE
RENAME
MULTI-PIP
PROTECT
EXTEND
Used to enter and display time
Used to initialize (format) a directory
Used to delete a specified file
Used to rename a file
Used to output all program files
Used to protect a file
Used to access more menus
TAPE CONV
DATA PIP
EXTEND
Available on Tape conversion specification
Used to transfer or backup parameters
F
Returns to main menu of Edit Aux


F
INPUT
OUTPUT
VERIFY
D-PIP QUIT
F1
F2
F3
F4
F5
F6
F7
F8
Inputs A.TOP file from peripheral device
Outputs A.TOP file to peripheral device
Compares data sent to or from peripheral with data in memory
Used to terminate data transfer procedure

ZERO SET


SET
ADD
CAL
BACK UP
F1
F2
F3
F4
F5
F6
F7
F8
Used to set new data
Used to add to currently stored data
Calculates data from the actual position (RAPA)
Used to immediately back up data. On newer OSP 5020 (1994 and newer)

PARAMETER



By using the ITEM ↑ or ITEM ↓ key, various screens can be accessed after the PARAMETER mode key has been pressed. The following bullets describe what the different screens show:

-

User Parameters
- Chuck/Tailstock
- Common Variable
- System Parameters
- Optional Parameter (Long Word)
- Optional Parameter (Word)
- Optional Parameter (Bit)
- Turret Angle
- Turret Parameter Bit

Some of the screens displayed will have more than one page. These pages can be accessed by pressing the P key on the NC Operation Panel.

NC Status Display Lamps

RUN — This lamp comes on when the machine is running in Auto or MDI mode.

S.T.M. — This lamp comes on when a command other than axis motion is executed. If an S, T, or M command is executed, this lamp will stay on until the confirmation signal is received.

The S.T.M. lamp will flicker if a spindle speed, speed range, or tool change command is changed during automatic mode operation. Changing one of these three commands can be done with the manual operation intervention function.

SLIDE HOLD — This lamp comes on when the Slide Hold button on the machine operation panel is pushed.

With two-saddle lathes, this lamp will also come on when the designated commands for one saddle are being completed and the other is placed in slide hold mode. This condition only occurs when the single block function is activated.

PROGRAM STOP — This lamp comes on when the control sees a program stop (M00), optional stop (M01), or end of program code (M02).

This light will flicker when the control reads a dwell command (G04). The duration depends on the F word programmed with the dwell command.

LIMIT — This lamp turns on when an axis has reached the soft-limit position. It will start flickering if:

1) The active spindle speed reaches the specified limit.
2) The selected spindle speed is too high or too low for the selected gear range.

ALARM — This lamp will come on whenever the control detects certain alarm conditions. An alarm number will be displayed on the CRT. Details concerning the alarm displayed are provided in the Alarm & Error List manual.

Mode Selection Keys

The mode keys are classified into two groups, data setting mode and operation mode.

Data Setting Mode:

TOOL DATA — Pressing this key will allow the operator to check, set, or modify tool offset data. This mode is also used to set tool management, cutter compensation, and tool nose radius compensation data.

ZERO SET — This mode is used for checking and or setting the zero offsets of the individual axes.

PARA-METER — This mode is used for setting, checking, or modifying the various parameters.

EDIT AUX	This mode is used for editing or transferring programs. This mode is also used for setting the date and time. Any kind of file handling would be done through this mode key.

Operation Mode:

MANUAL	This mode is used for manual operation of the machine. For example, jogging the axes or using the pulse handle would be done in this mode.
MDI	Manual Data Input mode is used when a block of commands are entered through the keyboard on the control.
AUTO	This mode is used for automatic operation. In this mode a stored NC program is entered and executed.
IGF	This mode key is not classified as one of the two groups mentioned above but is used to access the Interactive Graphics Function. This is an on board graphics programming option.

When any one of these mode keys are pressed, an indication lamp on the upper left side of the key will turn on. When going from one of the three operation modes to one of the data setting modes, the indication lamp will flicker to remind the operator which operation mode the control is in.

Character Keys

These keys are used to input alphabetic characters and other symbols shown on the upper right side of each key. To input one of these symbols, use the UPPER CASE key. The SP key is used to insert a space. The CTRL key is a control key which is not used under normal conditions. The HT key is also not used under normal applications. It stands for horizontal tabbing.

BS	This is the back space key. Each time this key is pressed, the last character entered is erased. This key is also used to display the next page of a file or directory.
CAN	This is the cancel key. This key is used to delete a block (line) of data.
WRITE	This is the enter key. This key is pressed whenever data is set or after inputting the name of the program to be executed.

Numeric Keypad

The numeric keypad is used to input the numeric characters. Included in the numeric keypad are the operator keys. These are the basic arithmetic keys.

_	The subtraction key can be used to input a minus or hyphen symbol.
+	This key is used to input the addition symbol.
*	This key is used to input the asterisk symbol for multiplication. It is also used as the wild card symbol when working with files.
/	This key is used to input the division or forward slash symbol.

Cursor Keys

These four arrow keys are used for moving the cursor on the CRT.

Page Keys

These two keys are used for changing the display page on the CRT. In some cases, the **item up** and **item down** function keys (F6 and F7) are used to change the display screen when going from one page to the next in a menu (i.e. Parameter mode).

Turret Keys

These two keys are used to select A or B turret display menus on lathes with two-saddle and two-turret capability.

LATHE Machine Operation Panel

The following is a description of the various switches on a machine operation panel for an OSP 5020L type control.

CYCLE START — Press this button to start machine operation in Auto or MDI mode.

SLIDE HOLD — Pressing this button will stop all axes movement. It will not stop spindle rotation. If this button is pressed when no axis movement is active, the machining cycle will stop when an axis movement command is read and decoded.

Press the cycle start button to resume axis movement.

EMG. STOP — When this button is pushed all power to the machine is shut off except for the power to the control.

SLIDE JOG — The four slide jog buttons are used to manually jog the axes. The Feedrate override dial is effective in this mode.

FEEDRATE — The feedrate override dial is used to modify the commanded feedrate for optimizing the cutting operation. Override range is 0 to 200 % in 15 steps.

This rotary switch setting is ignored during the thread cutting function(G33).

The Feedrate override switch is effective if:

1) G00 is programmed in MDI mode.
2) Single Block mode is ON in AUTO mode.
3) Jogging the axes in MANUAL mode.

This rotary switch is not effective in Auto mode with G00 programmed and Single Block mode off.

PULSE HANDLE — The pulse handle is used to manually feed the individual axes. The control must be in Manual mode to use the pulse handle.

A magnification selection and an axis selection button determines which axis movement is initiated. The magnification selection is used to select the axis feed amount per pulse (notch).

1/1	Axis moves 1µm/pulse (.001 mm)(.0001in/pulse in inch mode).
10/1	Axis moves 10µm/pulse (.01 mm)(.001in/pulse in inch mode).
50/1	Axis moves 50µm/pulse (.05 mm)(.005in/pulse in inch mode).

SPINDLE — These buttons are used to manually turn and stop the spindle.

STOP — Stops the spindle rotation after the CCW or CW buttons have been pressed.

CCW — Makes the spindle turn counter clockwise. Must press the STOP button to stop the rotation.

CW — Makes the spindle turn clockwise. Must press the STOP button to stop the rotation.

JOG — With this button pressed, the spindle will rotate clockwise. Forward rotation will stop as soon as the button is released.

For the CCW and CW buttons to work properly, the following conditions must be met:

1. The spindle speed has been entered beforehand through MDI.
2. The spindle gear range selection (M41–M44) has been made.
3. For center work, the tailstock is advanced.
4. Chuck fulfills the spindle rotation condition:
   Chuck closed during OD gripping.
   Chuck open during ID gripping.

On machine models with DC spindle drive motors, it is not possible to go from CW to CCW instantaneously.

SPINDLE OVERRIDE

The spindle override rotary switch is used to modify the commanded spindle speed. This switch will not override the maximum allowable spindle speed or the spindle speed set by the G50 code.

COOLANT

The coolant keys are used to control the coolant supply condition.

AUTO and MANUAL OFF	Coolant is not supplied regardless of the operation mode selected.

AUTO ON — Coolant on/off mode is controlled by M codes. (M08-ON M09-OFF)

MANUAL ON — Coolant is supplied in any operation.

Auto and Manual modes cannot be on at the same time.

SPINDLE GEAR

This function allows the operator to place the spindle in neutral. This enables the chuck to be rotated by hand. The control has to be in Manual mode. This function is only for models with a spindle speed change mechanism where some kind of mechanical gear shifting and a neutral is involved. The following keys are associated with this function.

NEUTRAL

When this key is pressed the spindle is placed in the neutral state. The gear position data is saved and can be recalled even after the power has been turned off and back on again.

ENGAGE

By pressing this key, the spindle gear range selected previously is automatically selected. The selected range is displayed on the CRT at the MACHINE STATUS display on the ACTUAL POSITION display screen. The corresponding M code will be shown (M41 – M44).

The lamp at the upper left corner of the ENGAGE key will light up when the gear position and confirmation limit switch match. If they do not match, the light will flicker at intervals of 0.4 sec. This holds true when operating in Auto or MDI modes.

For a machine with a mechanical gear change mechanism but no neutral position, the ENGAGE key LED will flicker during gear change operation. The LED will flicker until the confirmation signal is read. The Cadet (LNC-8) has this feature.

The spindle speed does not change when the gear range is changed only the torque is increased or decreased.

LOAD MONITOR — This function is an option which is used to monitor the cutting load of the feed axes or the spindle.

TOOL INDEX — This button is used to rotate the turret. Push it once and the turret will index one position. Keep the button pressed, the turret will rotate until the button is released.

For two-saddle or two-turret models, the turret to be index has to be selected via the turret select keys (INDIVIDUAL MODE) on the machine operation panel.

In most cases the X or Z axis have to be at the positive variable soft limit before the turret will index. This can be checked by observing the LIMIT status lamp on the NC operation panel. As a precaution, a visual inspection of the turret should be made before attempting to rotate the turret.

LIGHTING — This key is used to turn on or off the work light on the machine.

SINGLE BLOCK — When this function is used, the control will execute one block (line) of a program at a time. This function is used in AUTO mode when machining a part for the first time. CYCLE START must be pressed after each block of data is processed.

BLOCK DELETE — When this key is turned on, the blocks in a program that are preceded by a forward slash (/) will not get executed.

OPTIONAL STOP — If this key is turned on, the control will stop executing a program when it sees an M01 (optional stop) command. It will complete all the commands on the same block as the M01 and then stop. When this key is turned off, the M01 command is ignored.

DRY RUN — Turn on this key when checking a newly prepared part program in AUTO mode. With this function activated, cutting feedrate commands, with the exception of manual feed and G00 mode feed, are all executed at the milling feedrate (mm/min) set by the parameter. The parameter long word No. 9 is factory set to 2,400 mm/min.

MACHINE LOCK — When a part program is executed with this key activated, all commands in the part program are executed without actual machine operation. The simulated operation can be checked on the CRT. In this mode, the cutting feedrate is determined by the programmed spindle speed.

MID AUTO MANUAL — Press this key to interrupt an AUTO mode operation; carry out the required manual mode operation, and resume the AUTO mode operation.

INDIVIDUAL MODE

These keys are available on two-saddle machines. On these machines, normal operation is made in the simultaneous 4-axis control mode. These two keys are used to select the required operation mode:

Individual A turret operation:

A	ON	With this setting, only the A turret is activated in
B	OFF	the operation modes.

Individual B turret operation:

A	OFF	With this setting, only the B turret is activated in
B	ON	the operation modes.

Individual A/B turret operation:

A	ON	A and B turrets are activated individually according
B	ON	to the designated synchronizing commands.

Normal operation:

A	OFF	Normal machining cycle is performed according to
B	OFF	the programmed commands.

INTER LOCK — This key is used to activate the following keys:

DRY RUN
MACHINE LOCK
INDIVIDUAL MODE

The INTERLOCK key must be pressed at the same time as the aforementioned keys in order to activate those functions.

CRT DISPLAY — This key is used to turn off the CRT display. It is used to extend the life to the CRT.

SEQUENCE RESTART — This key is used to restart the AUTO mode operation which has been interrupted due to a tool breakage or a machining cycle was too long. For details refer to the Operation Manual.

CONTROL ON/RESET — Press this switch to turn on the power supply to the control and the servo systems. The main switch on the side of the control cabinet has to be turned on first. When the CONTROL ON switch is pressed, the pilot lamp inside this push switch will turn on. This switch is also used to reset the control.

CONTROL OFF — Press this switch to turn off power to the control and the servo systems. Always press this button first before turning off the main switch.

NC PANEL

EDIT LOCK (OPT)(PL)	The EDIT AUX and PARAMETER mode keys are disabled when the key is placed in this position.
UNLOCK (ON)(|)	All controls on the NC and Machine operation panels are enabled.
LOCK (OFF)(O)	All controls on the NC operation panel are disabled.

Stroke End Limit Cancel/Load Mode Panel

This small panel is found on the right inside wall of the control cabinet on the LNC-8 (Cadet) and the LB 15. The following is a description of the switches on this panel.

Load Mode	Turning this toggle switch on will put the control in the Load mode to load new software.
Load Start	Pushing this button will initiate the loading procedure.
System Reset	Pushing this button resets the control. This is sometimes referred to as a soft boot.
Stroke End Limit Cancel	With this toggle switch set to ON, the operator is allowed to use the Pulse Handle to move an axis off of a stroke end limit switch.

Machining Center Machine Operation Panel

The following is a description of the various switches on the machine operation panel for an OSP 5000/5020M type control. A picture of this panel can be seen on page 4-34.

AXIS SELECT — This set of keys allows the operator to choose which axis he or she wants to move in Manual mode. The pulse handle mode key is turned on if the operator wishes to go into PH mode.

RAPID +/– — Press the RAPID + or RAPID – to feed the designated axis in the plus or minus direction. The axis will move as long as one of these button are pressed and the control is in Manual mode.

RAPID OVERRIDE — This rotary switch is effective when the RAPID +/– push buttons are used and during programmed rapid feed modes (G00, G60, etc.). This setting can be observed in the Block Data screen of the CRT (fm).

SPINDLE

ORIENTATION

Pressing this key while holding down the INTERLOCK RELEASE key will orient the spindle. The spindle will be positioned at a preset angle to allow for proper tool changes. This key is effective with the spindle at rest or in motion. Once this key is pressed, the indicating lamp on the upper left corner will start to blink. Once the spindle orientation is completed, the light will stay on until the spindle is given a command to rotate or the RELEASE key is pressed.

CW — Pressing this key while holding down the INTERLOCK RELEASE key will initiate spindle rotation in the clockwise direction. The control must be in Manual mode. The spindle speed is dependent on the S command given through MDI mode before pressing the CW key. The spindle speed commanded (So) and the actual spindle speed (Sr) can be viewed in the Block Data screen on the CRT.

STOP — Press this key to stop the spindle rotation.

CCW — This key has the same function as the CW key except the spindle will rotate in the counter clockwise direction.

RELEASE

Pressing this key will place the spindle in a neutral state. This allows the operator to rotate the spindle by hand. This push button is effective only when the spindle is at rest and the tool clamping mechanism is on.

SPINDLE OVERRIDE — This is a spindle speed override rotary switch. The spindle gear range is automatically selected when an S command is given. The spindle override switch will effect the speeds that fall within the gear range selected.

JOG +/O/–	These keys are called the JOG feed buttons. Press the JOG +/– keys to move the selected axis in a plus or minus direction. The control must be in Manual Mode. To stop the axis motion, press the JOG OFF key (O). While the axis is moving, pressing a JOG feed button which requires the axis to go in the opposite direction will stop the axis motion and start the axis moving in the new direction.
JOG SPEED	This is the jog feedrate selector switch. The jogging feedrate can be adjusted in inches or millimeters per minute through this switch. This feedrate can be observed on the Actual Position page of the CRT.
FEEDRATE	This is the cutting feedrate override switch. This switch is effective for programmed cutting feedrates (G01, G02, and G03). This setting is ignored during tapping cycles (G74 and G84). The override rate is set at 100% when M136 is programmed regardless of the switch setting. When the M137 code is commanded and executed, the cutting feedrate override switch becomes effective.
COOLANT	When this key is pressed, the coolant pump motor is turned on and coolant is sprayed on the tool. The indication lamp on the upper left corner of the key will turn on to show that the motor is on. This key is effective no matter which operation mode is on.
OIL MIST	When this key is pressed, an oil mist is delivered to the tool. An example of this would be a tapping function.
A. B. NOZ.	This key is the air blower nozzle switch. The nozzle used for the oil mist is also used for the air blower. This function is used to blow chips away from the cutting area.
OIL HOLE	This key is used to manually spray coolant. This push button is used when a machining center has the Through-The-Tool Coolant Supply System. High pressure coolant is sprayed out from the drill tip. The drill is cooled and lubricated and chips are removed from the drilling area.
A. B. ADAPT	This key is used when an air blow adapter is mounted to the machine. This function is used as an air only blower.
SHOWER	This key is used mostly to wash off chips on a pallet before moving the pallet away from the chip conveyor.
LIGHT	This key turns on or off the work light.
CRT OFF	This key is used to turn off the CRT display to prolong the service life of the CRT.
LUB.	When this key is pressed, the axis slideways are lubricated. Each time this key is pressed, the axis lube pump runs for 60 seconds.
CHIP CON	This key is used to turn on and off the chip conveyor.
RESET	This button resets the control. This button is also used to clear certain types of alarms.

NC PANEL

EDIT LOCK — The EDIT AUX and PARAMETER mode keys are disabled when the key is placed in this position.

UNLOCK — All controls on the NC and Machine operation panels are enabled.

LOCK — All controls on the NC operation panel are disabled.

CYCLE START — The cycle start button is used to start machine operation of a scheduled program (AUTO) or a block of instructions (MDI). It is also used to restart a program after slide hold has been pressed.

SLIDE HOLD — Axis movement and program execution are temporarily stopped when this button is pushed. On machining centers this switch can be deactivated by using the M140 command.

EMG. STOP — When this button is pressed all power except for the control power is shut off.

NC Operation

MIRROR IMAGE — Each axis on a machining center has a key for turning on and off the mirror image function. The sign of the designated axis is reversed. The INTERLOCK RELEASE key must be held down when turning on this function.

INTERLOCK RELEASE — This key is used to turn on certain keys on the machine operation panel. This is to prevent certain keys from accidentally being turned on.

MACHINE LOCK — This function is used to check a new program. The actual position values are displayed on the CRT as the program is executed but actual machine movements are prohibited. The INTERLOCK RELEASE key must be held down to turn on this function.

DRY RUN — Dry run is a function for running the machine at the feedrate set by the cutting feedrate rotary switch. NC optional parameter No. 2 bit 2 determines whether dry run is effective or not. This function is also effective while the machine lock function is active. This function is used mostly to check the cutting feedrates of a new program.

BLOCK SKIP — Any block preceded by a forward slash (/) can be disregarded when the block skip key is switched on. These three Block Skip switches are assigned codes of /1, /2, and /3. "/" is equal to /1.

CYCLE STOP — When this key is turned on, the machine will stop after the execution of a main program.

S.T.M. LOCK	This is the function to check the program by executing the axis movement commands without miscellaneous commands.
AXIS COM. CANCEL	This is the axis command cancel function. An axis can still be moved by Manual mode or manual intervention operation.
OPTIONAL STOP	With this key activated, the program will stop executing when the control sees the optional stop command (M01).
SINGLE BLOCK	This function is used to check the program, block by block. The machine stops after every block and cycle start must be pressed to execute the next block of the program.
MID AUTO MANUAL	When this key is turned on, a manual operation can be performed during AUTO mode. The procedure on how to carry out this manual intervention function is described in detail in the Operation manual.
PULSE HANDLE SHIFT	With this key on, axis motion control by the pulse handle can be inserted into the program. An example of this would be when machining a cast workpiece on which stock removal varies.
SEQ. RESTART	When a machining cycle is interrupted during automatic operation due to a tool breakage or other problem, the sequence restart button is used to resume the program after the necessary measures have been taken to resolve the problem.

The (on or off) condition of the NC operation keys are saved (backed up). If, for example, the DRY RUN key is turned on and the power to the machine is then turned off, the control will remember that and turn the DRY RUN mode on when the control is powered up again.

If a key is turned on or off, and the back up key is not pressed or the allotted time has not elapsed (three to six minutes) before the power is turned off the control will not retain the condition of the key just pressed.

ATC Operation

ATC	Pressing this button will put the control in the ATC mode of operation. This allows the operator to move the ATC in manual mode. The “ATC DATA” screen on the CRT can be accessed by pressing the “atc/apc” function key (F6).
APC	Pressing this button will put the control in the APC mode of operation. This allows the operator to move the APC in manual mode. The “APC DATA” screen on the CRT can be accessed by pressing the “atc/apc” function key (F6).
INTER LOCK RELEASE	When this key is pressed, the spindle orientation completion conditions and the tool change position conditions are ignored. It will not ignore other mechanical conditions.

1 CYCLE START	Pressing this key automatically carries out one complete automatic tool change cycle. This operation consist of a series of tool change cycles in which a tool picked up from the magazine is set into the spindle and the tool that was in the spindle is returned to the magazine. This operation is only allowed when the message "READY" is displayed on the CRT with the ATC sequence number set at "01".
RETURN CYCLE START	This button can be pressed with the ATC operation sequence set to any number. If the tool change arm has not completed its 180 degree rotation, pressing this button will start the tool return cycle and no tool change cycle will occur. If this button is pressed after the tool change arm has completed its 180 degree rotation, the automatic tool change cycle will be completed.
1 STEP ADVANCE	Pressing this key advances the ATC operation one step at a time. If the "RUN" message is being displayed on the CRT, this key will not work. If the sequence does not advance because of some unfulfilled condition, it is possible to ignore those conditions and continue operations. Pressing the 1 Step Advance key while holding down the INTERLOCK RELEASE key will allow the operation to continue. If a mechanical condition is not met, the operation is not allowed to continue and the "RUN" message is displayed on the CRT.
1 STEP REVERSE	The function of this key is the same as the 1 STEP ADVANCE key except the operation is done in reverse.

If the E-STOP button is pressed while the tool change arm is in operation, the signals AHP (X,Y, and Z-axis tool change position) and SHP (spindle orientation complete) turn off. This sometimes renders the ATC operation keys inoperative. If so, press the 1 STEP ADVANCE key while pressing the INTERLOCK RELEASE key, and the tool change sequence will advance to the next step.

The tool in the spindle will be clamped when the ATC cycle is interrupted by an E-STOP condition. This will render the ATC operation keys inoperative. In this case, press the TOOL UNCLAMP button on the operation panel at the side of the main operation panel.

APC Operation

The control must be in MANUAL mode and the APC key on for the following keys to be effective.

1 CYCLE START	When this key is pressed, one automatic pallet change cycle is carried out. During this operation, the pallet on the machine is unloaded to the APC and the pallet on the APC is loaded to the machine. This operation is effective only if the "READY" message is displayed on the CRT.
RETURN CYCLE START	When this key is pressed, the automatic pallet change cycle is carried out in the reverse order back to sequence number "01". This will return the pallet to the machine.
1 STEP ADVANCE	The automatic pallet change cycle will advance step by step every time this key is pressed. This operation is ineffective if the "RUN" message is displayed on the CRT.

1 STEP REVERSE	The function of this key is the same as the 1 STEP ADVANCE key except the steps are reversed.

If the E-STOP button is pressed while the shifter is moving, the shifter retraction position signal is turned off. This sometimes renders the APC operation keys inoperative. If so, press the 1 STEP ADVANCE key while pressing the INTERLOCK RELEASE key. This should advance the automatic pallet change cycle one step at a time.

When the RUN status lamp is on, the ATC/APC operation keys mentioned above are inoperative. Press the RESET key to turn off the RUN lamp. In other words, these keys are ineffective when the control is in AUTO or MDI operation mode.

Pendant Operation Panel

The pendant operation panel will differ from machine to machine. These types of panels are mostly used on double column machining centers. Most of the switches on this type of panel are the same as the switches on the Machine Operation panel. For a description of the switches on this panel, please refer to the Operation manual of the machine in question.

Optional Panel

This panel is for switches and lamps related to the optional functions that can be purchased with the machine. An example of an option panel would be a panel for Auto door open/close and the Touchsetter option.

On machining centers the Power ON and OFF buttons are located on an option panel located on the control cabinet door. The following is a description of the controls that are on this option panel. A picture of this panel can be seen on page 4-35.

Puncher

SERIAL	This is the RS-232C interface connector. This interface connector is called the CN0 port and is now standard.
PARALLEL	This is the parallel port interface.
AC 100V 2A	This is the power receptacle for the Paper tape puncher.

HOUR METER

The first hour meter with the lightening symbol is the power on time meter. It accumulates the amount of time the machine has been on.

The second hour meter is the NC Running Time meter. It accumulates the length of time the RUN lamp on the NC operation panel is on.

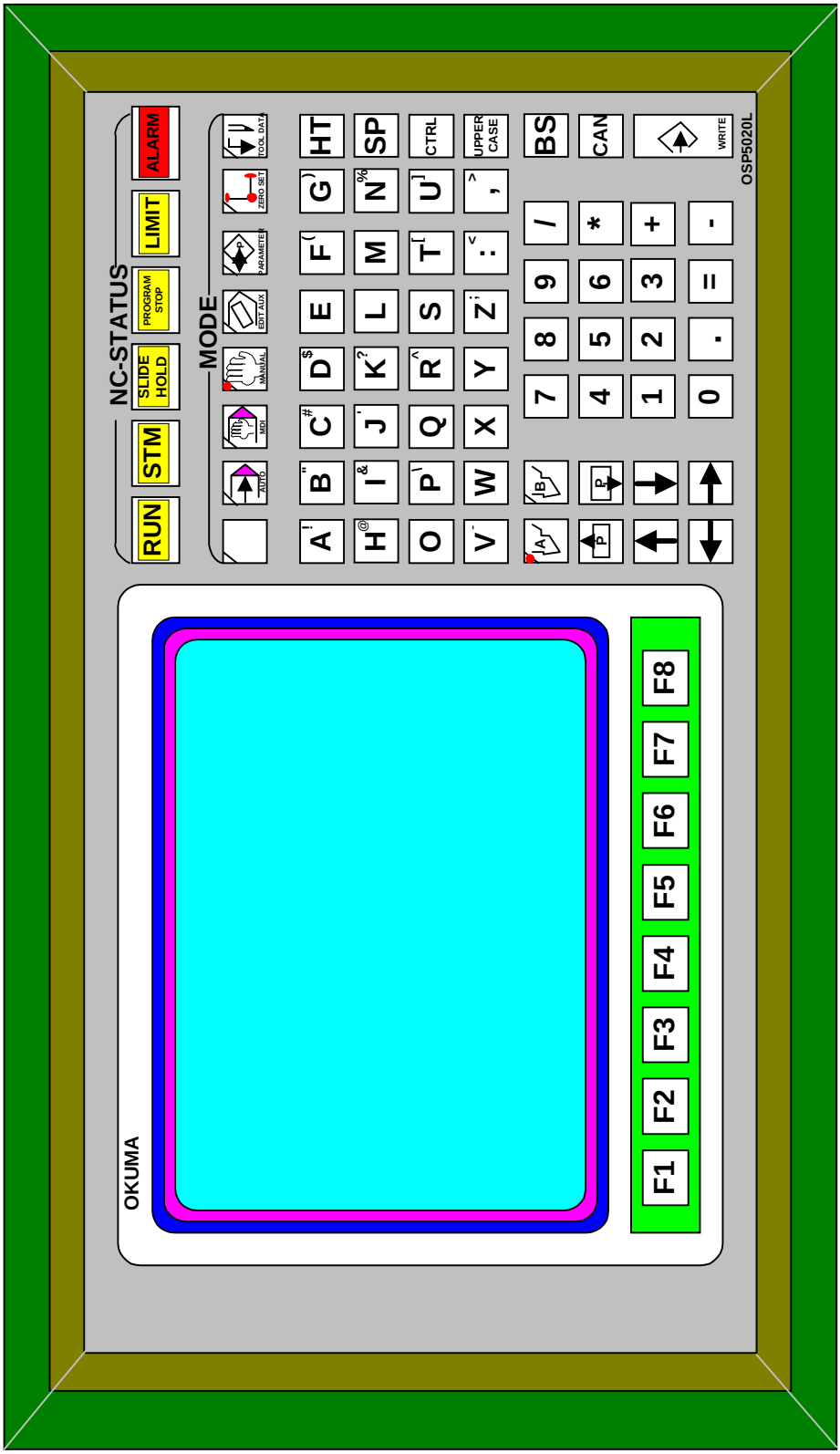
Operation End Mode

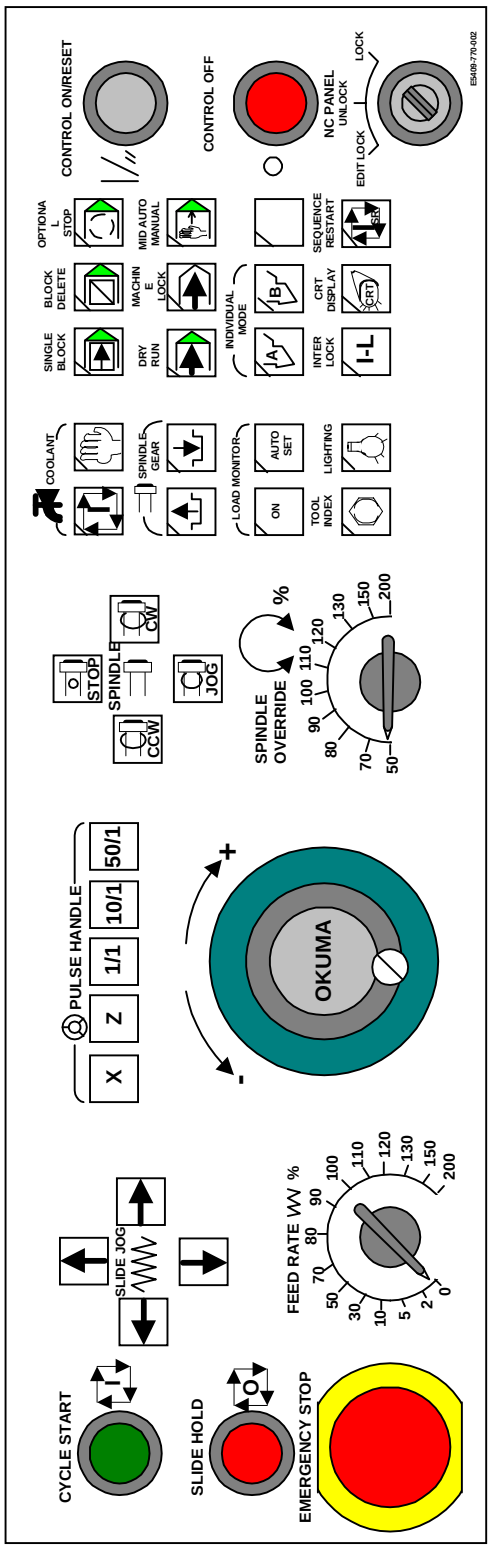
BUZZER	This is the Operation End Buzzer activation switch. If this switch is on, the buzzer will sound at the end of a program run. The length of time it sounds is set by MC user parameter word No. 7.
LIGHT	This is the Operation End Light activation switch. If this switch is on, the YELLOW light on the pendant arm will come on when an end of program code is read.

ERROR	This is the Error Light activation switch. If this switch is on, the RED error light will come on if an alarm state is detected.
AUTO POWER OFF	This switch is called the Auto Power Shut Off switch. If this switch is on, the power will shut off automatically after the execution of an “End of Program” (M02) command or after executing an “End of Tape” (M30) command in a main program. This switch is ineffective when single block mode is on. On some of the new machines this function is a parameter setting. (Optional Parameter Bit 14 bit 0)

Control On/Off

POWER ON	This is the Power On button. Press this button after turning on the main circuit breaker on the side of the control cabinet to power up the machine.
POWER OFF	This is the Power Off button. Press this button first before turning off the main circuit breaker when turning off the machine. If any peripherals are hooked up to the machine, they should be powered off first.
EMG. STOP	This is an extra emergency stop button. If any of the E-stop buttons are pushed in, the **red** indicator lamp on this panel will be on. The **green** indicator lamp will come on as soon as the main breaker is turned on. It turns off as soon as the Power On button is pressed.


NC-STATUS
RUN
STM
SLIDE HOLD
PROGRAM STOP
LIMIT
ALARM
MODE
AUTO
MDI
MANUAL
EDIT AUX
PARAMETER
ZERO SET
TOOL DATA
OSP5020L
OKUMA
F1
F2
F3
F4
F5
F6
F7
F8


CONTROL ON/RESET
CONTROL OFF
NC PANEL UNLOCK
LOCK
EDIT LOCK
ES408-770-002
OPTIONAL STOP
MID AUTO MANUAL
SEQUENCE RESTART
BLOCK DELETE
MACHINE LOCK
CRT DISPLAY
SINGLE BLOCK
DRY RUN
INDIVIDUAL MODE
INTER LOCK
COOLANT
SPINDLE GEAR
LOAD MONITOR
AUTO SET
LIGHTING
ON
TOOL INDEX
STOP
SPINDLE
CW
CCW
JOG
SPINDLE OVERRIDE %
50 70 80 90 100 110 120 130 150 200
PULSE HANDLE
X
Z
1/1
10/1
50/1
OKUMA
+
-
SLIDE JOG
FEED RATE %
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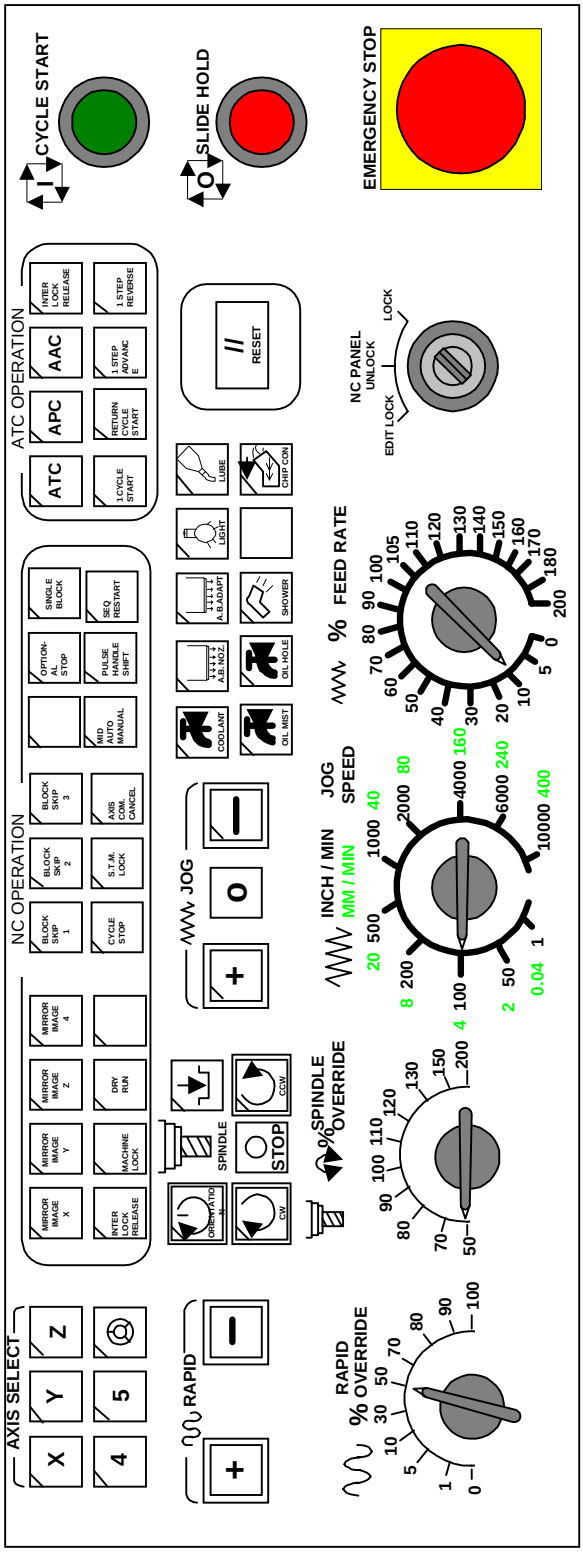
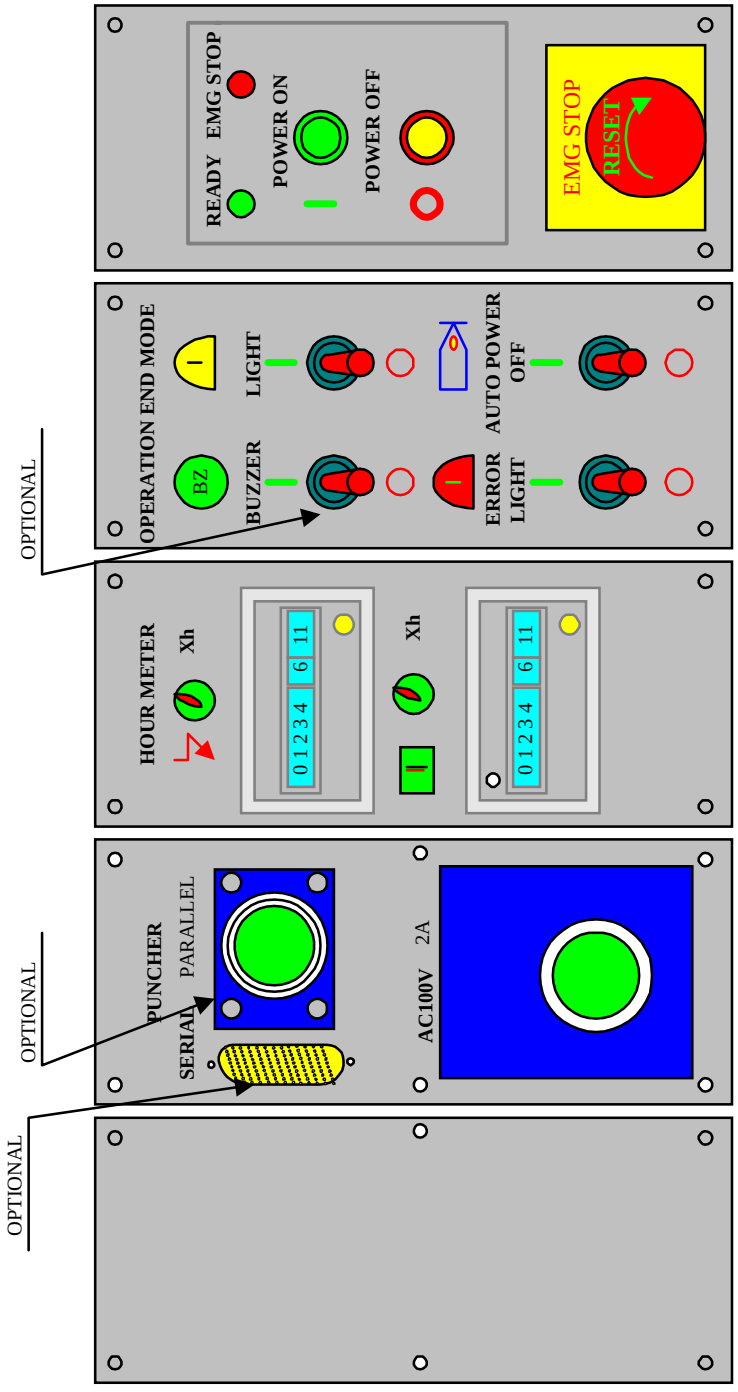
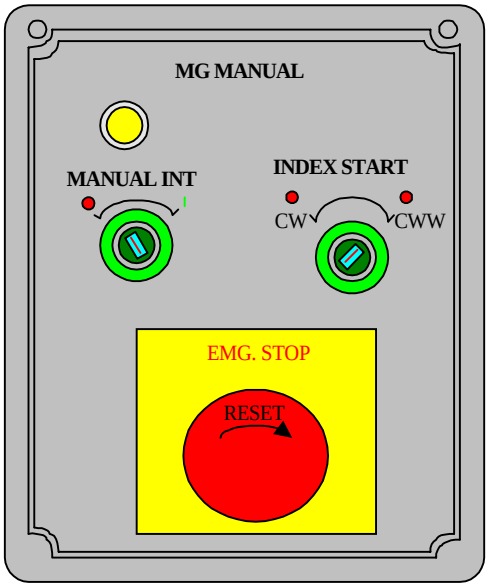
CYCLE START
SLIDE HOLD
EMERGENCY STOP

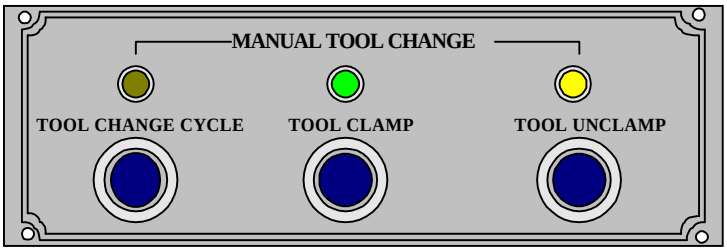

CYCLE START
SLIDE HOLD
EMERGENCY STOP
RESET
NC PANEL UNLOCK
LOCK
EDIT LOCK
AXIS SELECT
X
Y
Z
4
5
RAPID
NC OPERATION
ATC OPERATION
JOG
INCH / MIN
MM / MIN
JOG SPEED
% FEED RATE
SPINDLE
STOP
CW
CCW
% SPINDLE OVERRIDE
% RAPID OVERRIDE
COOLANT
OIL MIST
OIL HOLE
SHOWER
LUBE
CHIP CON
LIGHT



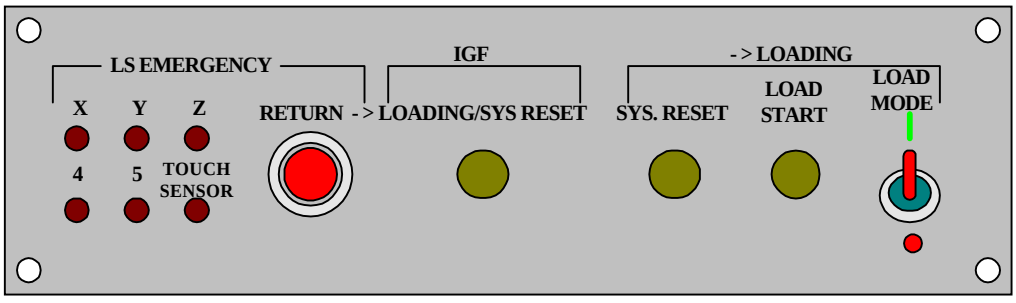
Operational Panel above Tape Reader



ATC Magazine Operation Panel



Manual Tool Change Operation



Check Panel

MDI Operation

MDI is an abbreviation for Manual Data Input. One block (line) of data is entered at a time. Each block of data entered is executed once the CYCLE START key is pressed. To execute a block of commands in MDI, do the following:

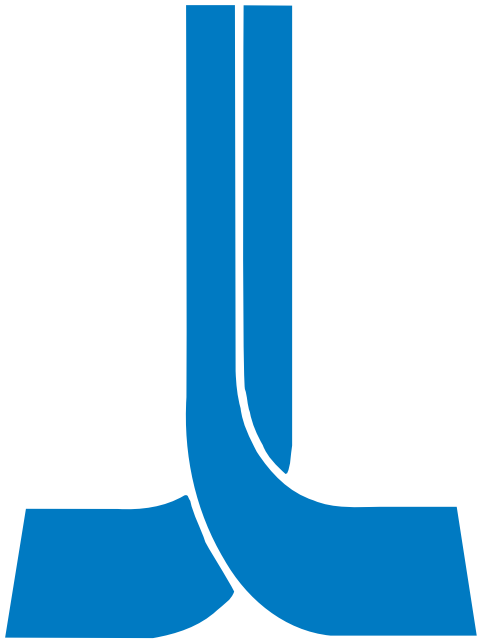
1. Press the MDI mode key. The following functions are displayed:

DATA INPUT	ACTUAL POSIT	PART PROGRAM	BLOCK DATA			CHECK DATA	[EXTEND]
F1	F2	F3	F4	F5	F6	F7	F8

2. “IN” is displayed on the lower left side of the screen (21st line). Enter the desired commands. On lathes with the OSP 5020 series control, the F1 key has to be pressed to get the “IN” cursor.
3. Press the WRITE key.
4. Press the CYCLE START button. At this time the commands are executed.

The following is a list of some of the codes that are useful to know when troubleshooting a machine side problem.

Code	Description
M03	Spindle rotation (CW)
M04	Spindle rotation (CCW)
M05	Spindle stop
M40	Spindle gear range neutral for Lathe
M41	1st gear
M42	2nd gear
M55	Tailstock quill retract
M56	Tailstock quill advance
M83	Chuck clamp
M84	Chuck unclamp
M86	Turret indexing direction (CW)
M87	Turret indexing direction (CCW)
G00	rapid positioning
X	X axis positioning
Y	Y axis positioning
Z	Z axis positioning
S	Spindle rotation speed in RPM.



OKUMA

OSP 5000/5020 CONTROL

CONSTRUCTION

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

This section will cover the basic construction of the electrical side of any Okuma machine tool with a 5000/5020 series control. The various power supplies, the boards in the control rack and in the EC I/O rack (mostly on M/C's), and the different servo systems found on Okuma machine tools with the 5000/5020 series control will be discussed.

Every Okuma machine tool comes with a set of electrical schematics and there is a "System Configuration Sheet" at the beginning of these schematics which shows a basic electrical layout of the machine. The system configuration sheet for some machining centers can be seen in the maintenance manual for the machine in question. An example of a "System Configuration Sheet" is shown on the following page.

Power Supplies

Most Okuma machines are designed to work on 208 volts AC incoming power. On some machines, a multi-tap transformer is standard. As a precaution, the incoming power and the taps on the transformer should be checked before power is supplied to a newly installed machine.

As a precaution, the incoming power and the taps on the transformer should be checked before power is supplied to a newly installed machine.

If more than one machine tool is connected to the same single power source, the "Power Source Inductance" should be noted if power related problems start occurring. "Power Source Inductance" can be obtained by dividing the value in the table by the number of machine tools connected to the single power source.

Wiring inductance in 50 meters (164 ft) of cable is approximately 12 µH when general cable is used.

VAC Unit	Applicable Motor	Power Source Inductance 220V	Power Source Inductance 200V
D45	37/30 kW to 55/45 kW	Less than 45 µH.	Less than 115 µH.
D30	22/18.5 to 37/30 kW	Less than 70 µH.	Less than 170 µH.
D22	22/15 to 30/22 kW	Less than 110 µH.	Less than 230 µH.
D11	11/7.5 to 15/11 kW	Less than 230 µH.	Less than 480 µH.
D6	Less than 7.5/5.5 kW	Less than 350 µH.	Less than 850 µH.

If the Power Source Inductance is too high, the following problems will arise.

- Deceleration time will be extended.
- During deceleration, the motor will generate noise.
- Transistor modules in the servo drives will fail prematurely.

If the system is operated in an environment where the inductance is too high, the control will generate an “excessive power source voltage fluctuation” alarm.

To verify the incoming power source is sufficient, divide the KVA rating of the machine by [the square root of 3 (1.732) times the incoming voltage]. This will give you the amount of current (amperage) needed to operate the machine.

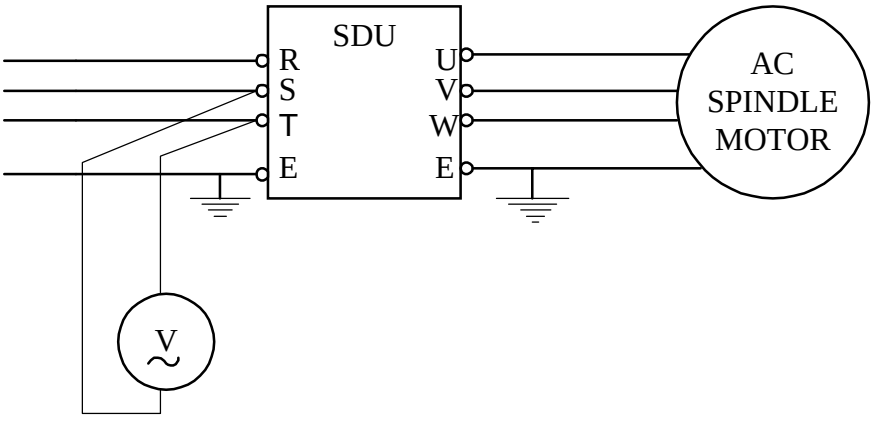
$$\text{I (amperage)} = \frac{\text{KVA}}{\sqrt{3}\ \text{X incoming voltage}}$$

Another way to verify if the incoming power is sufficient is to check the impedance of the incoming power. Impedance is the total opposition to the flow of current in an AC circuit. When the spindle decelerates a load is put on the incoming power source and the voltage increases slightly. This voltage variation has to be less then 6 %. To determine if the incoming power is sufficient, do the following calculation:

$$\frac{\text{Vdec - Vstop}}{\text{Vstop}} \text{ X100\% = Vvar (Vvar should be less than 6\% at 220V or 15\% at 200V)}$$

In other words, (Vdec minus Vstop) divided by Vstop times 100% should be less than 6%. Vstop is the voltage measured across the same to terminals of the spindle drive unit when it is at a standstill. Vdec is the voltage measured across the same two terminals when the spindle starts to decelerate.

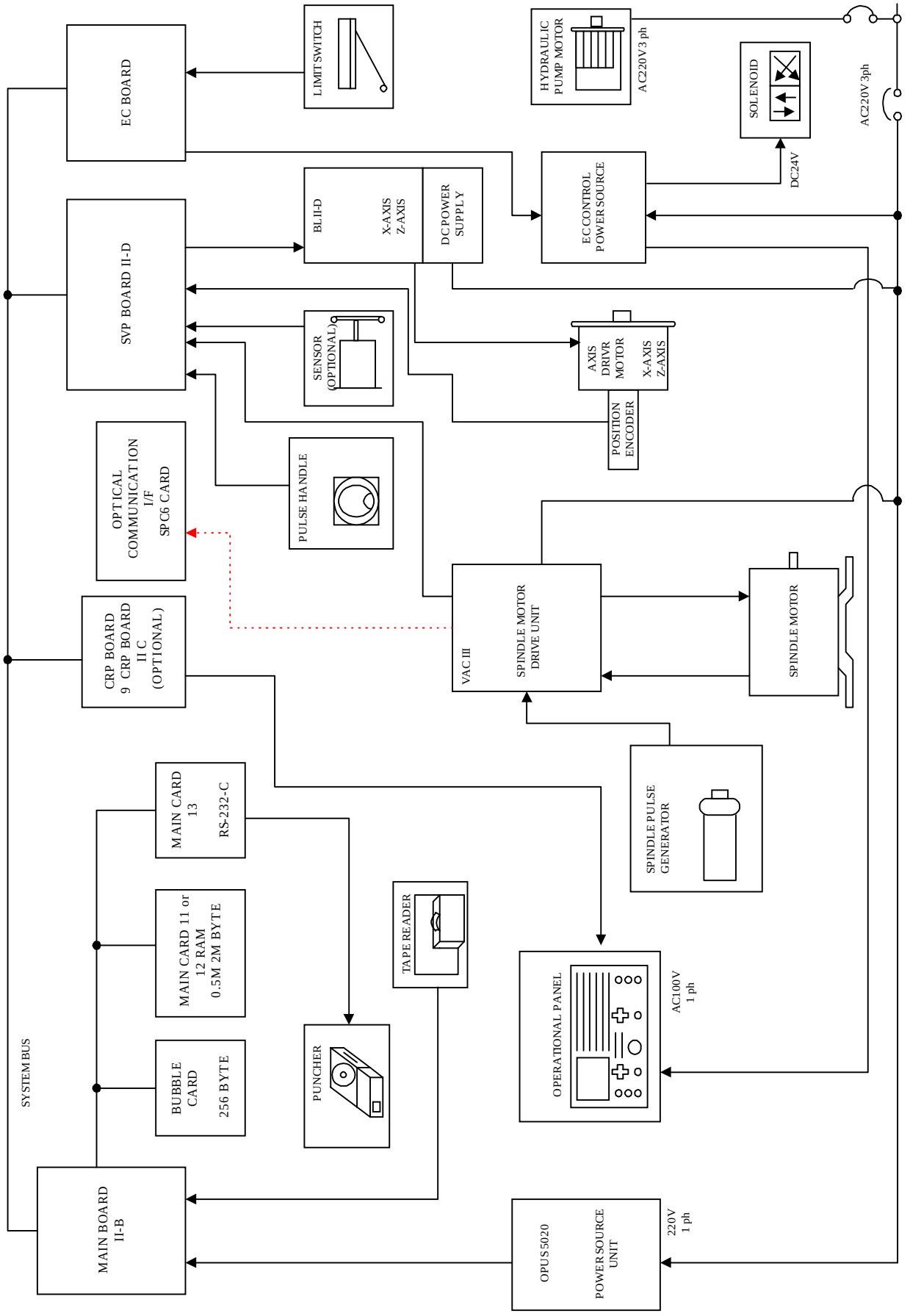
When determining the Vdec the programmed spindle speed should be the maximum programmable spindle speed for the machine. The measuring device should be an analog volt meter or an oscilloscope. Some of the latest DVMs are fast enough, i.e. Fluke 87.



A power supply is defined as a device for converting external alternating current (AC) into the direct current (DC) needed to run a computer's electronic circuits.

The incoming power gets branched off to various power supplies in the system. The system configuration sheet shows how the power gets distributed throughout the system.

The EC control power source is a step down transformer and a 24 volts DC power supply. These two components are usually mounted next to each other. The step down transformer takes the incoming single phase power and converts it to 100 and 120 volts single phase AC. This power source also provides the -24 volts DC "working 24 volts" which controls or turns on the various solenoids and relays on the machine. The EC control power source provides power to such things as the operation panel, work light, hour meter, and the ISO 24 volt power supply.


EC BOARD
LIMIT SWITCH
HYDRAULIC PUMP MOTOR
AC220V 3ph
SOLENOID
AC220V 3ph
DC24V
EC CONTROL POWER SOURCE
SVP BOARD II-D
BLII-D
X-AXIS Z-AXIS
DC POWER SUPPLY
SENSOR (OPTIONAL)
AXIS DRIVR MOTOR
X-AXIS Z-AXIS
POSITION ENCODER
OPTICAL COMMUNICATION I/F SPC6 CARD
PULSE HANDLE
CRP BOARD 9 CRP BOARD II C (OPTIONAL)
VAC III
SPINDLE MOTOR DRIVE UNIT
SPINDLE MOTOR
SPINDLE PULSE GENERATOR
MAIN CARD 13
RS-232-C
MAIN CARD 11 or 12 RAM 0.5M 2M BYTE
BUBBLE CARD 256 BYTE
TAPE READER
PUNCHER
OPERATIONAL PANEL
AC100V 1 ph
SYSTEM BUS
MAIN BOARD II-B
OPUS5020 POWER SOURCE UNIT
220V 1 ph

The servo systems (axes and spindle drives) receive the incoming 3 phase power and convert it to the DC voltage (300 Vdc) needed to drive the motors. These power supplies will be discussed in the servo systems part of this section.

220 volts single phase AC also gets sent to the OPUS power supply unit (CPU power supply) which provides all the power needed for the control rack.

On machining centers, 220 volts single phase also gets sent to the EC I/O rack. Once there, the voltage gets distributed and rectified as needed for the I/O boards.

OPUS 5000/5020 Power Supply Unit

Okuma's CPU power supply converts the incoming 220 AC voltage into the various stabilized DC voltages needed to run the OSP 5000/5020 control. It controls the On/Off sequence. It provides power to the CPU first and makes sure the CPU is the last to power off. There are two types of CPU power supplies on 5020 controls: RLP and RHP.

The RHP (Rack High Power) outputs the following voltages:

+ 5V	For the integrated circuits (IC's) in the control.
+ 12V	For the bubble memory, position encoder, main spindle pulse generator, and the manual pulse generator (Pulse Handle).
+24V	For the bubble memory and tape reader.

The RLP (Rack Low Power) outputs all of the above DC voltages plus:

ISO +24V	For the photo-couplers used in the CNC's I/O system.

The ISO 24V is an isolated power source used to protect the internal circuitry of the control. The ISO 24V is generated externally when an RHP is used. It is generated by a DC power supply that converts 120 volts AC to 24 volts DC. The ISO 24V circuitry does go through the RHP for monitoring purposes.

The RLP and RHP are located or housed in the CPU rack.

The first CPU power units that came out with the OSP 5000 series control were called HP and LP. When the graphics capability was incorporated into the control, the power units were labeled GHP and GLP. These four CPU power supplies output all the voltages mentioned above. These four units are physically larger than the RLP and RHP units. They are located above the CPU rack. Some of the latest models (5020 controls) still use the GHP CPU power supply instead of the RHP.

The RHP power supply has two pins that can be “jumpered” to disable the ISO under voltage alarm function. These two pins should only be jumpered for troubleshooting purposes. The location of these two pins can be seen in figure 5-2. Make sure to remove this jumper after checking this power source.

Only the + 5 volts supply is adjustable on these CPU power supplies. It is factory set at 5.1 volts. If an adjustment is necessary, measure the voltage between the check terminals “0V” and “+5V”. Make sure to check this voltage under a full load (machine on). When making adjustments, make sure to turn the “+5V adjustment potentiometer very slowly.

The low voltage detection alarm for the 5 volt supply turns on when approximately 4.6 volts is detected. If this alarm occurs, proper adjustment cannot be made without disabling this low-voltage detection function. On the non-rack type CPU power supplies, a toggle switch is used to disable this 5 volt low-voltage alarm detection function. On the rack type power supplies, the machine must be powered off and the power supply has to be removed from the control rack. Once the CPU power supply is removed from the rack, the “shorting jumper” on the PCB has to be moved to the UV OFF position as shown below.

Once the adjustment procedure is completed, make sure to move the shorting jumper back to the UV ON position. This will ensure that the 5 volt monitoring circuit is re-activated.

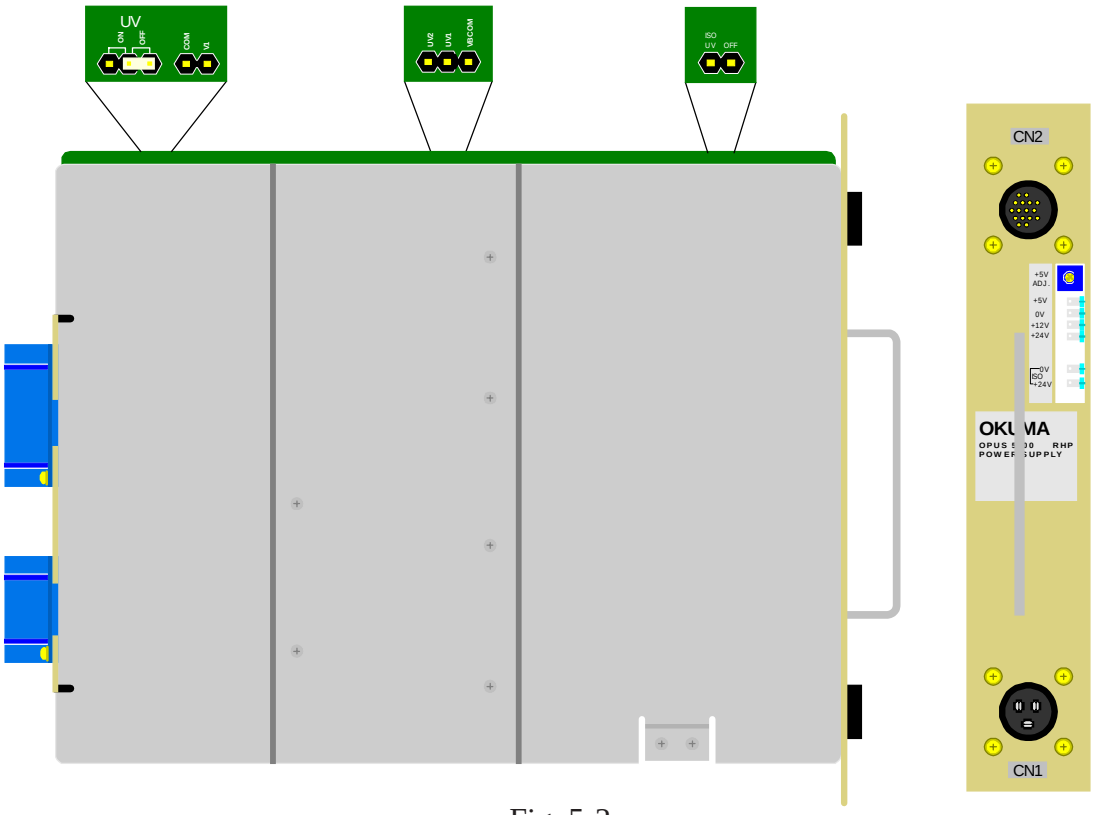


Fig. 5-2

The following is a description of the alarm and CPU status LED's located on the control rack. For the non-rack type CPU power supplies the alarm LED's are located on the power supply itself.

Alarm LED's

AC	Input voltage dropped too low.
TEMP	Temperature in power supply rose too high.
UV	Under voltage or possible short circuit.
OV	Voltage rose too high. (over voltage)

ISO 24V +24V +12V +5V	One of these LED's will be on when a UV or OV alarm occurs to indicate which voltage source is affected.

CPU status LED's

POWER	There is 5 volts going to the mother board (back plane). Main board is plugged into mother board.
RUN	CPU is operational or running.
BUS Error	More than one error occurred at the same time. The CPU stops running.
ECC Error	Error in the main memory of the system.
DIA Error	An error occurred during the self-diagnosis function.
LOOP Error	The CPU interrupt time has exceeded its limit.
CYCLE Error	The CPU tried to access a peripheral device and did not get a response within the specified time (17 micro seconds).
WPRT Error	The CPU tried to access a user inhibited address.

Printed Circuit Boards

In 1981 Okuma introduced the industry's first 16 bit CNC which incorporated Motorola's 68000 microprocessor chip. This chip had the capability of multiplying two 16 bit numbers in 3.2 millionths of a second. Okuma still uses Motorola's family of 68000 microprocessor chips as the nerve center of the OSP 5000/5020 series control. The following is a description of each major unit that makes up the control rack of the OSP 5000/5020 series control. The control (or logic) rack is referred to as the OPUS (Okuma Processing Unit and System).

Main Board IIB Main Processor Board

The MB-IIB is the main control board for the OSP 5000/5020. It consists of a main processor and associated interfaces for data communication. The system features a high performance Motorola 68000 microprocessor with a clock frequency of 15Mhz. The MB-IIB controls the IC memory (ROM), bubble memory, slave processors, and interface circuits. A system bus (mother board or back plane) and a local bus (ribbon cables) are provided for system expansion purposes.

Typically the 5000 controls have the MB main board and the CRT display is green in color. The 5000*-G controls can have the MB-II, MB-IIA or MB-IIB main boards. These controls have graphics capability and have a color display. The 5020* controls have the MB-IIB main board and also have graphics and color display.

Bubble Card Bubble Memory

This memory is used to store control software, machine parameters, and part programs. Bubble cards come in the following capacities: 4, 8, 12, and 16 Mbits. Up to two bubble cards may be mounted on the MB-IIB, with a maximum bubble memory capacity of 32 Mbits (4 Mbytes).

The latest OSP 5020 controls (as of 11/93) are now using CMOS memory instead of bubble memory. These CMOS memory cards have a back up battery pack mounted on them. To replace this battery, the main board is pulled out of the rack and the battery pack is replaced. A “super charge” capacitor retains the memory while the battery is being replaced.

A911-1511 4Mbit X 1
A911-1512 4Mbit X 2
A911-1513 4Mbit X 3
A911-1514 4Mbit X 4

If Alarm 2045 is displayed one of two things must be done to clear the Alarm:
The first is to perform the procedure below after the Battery has been replaced. The procedure only works if you are getting Alarm 2045 with a code of 0000010C. The 1 being the determining factor.

1. Software Load Mode Switch on.
2. Control Power on . After booting “Control Floppy Loading Wait” will appear.
3. Press the “&” key, (Upper Case I), “C-Mos Memory Initial Test Wait” will appear.
4. Press the Load Start Button. “C-Mos Memory Initial Test Start” will appear.
5. When completed “C-Mos Memory Initial Test Finished” will appear.
6. Turn the Load Mode Switch off and push System Reset. Finished.

If a code other than 1 is displayed, the System Software must be reloaded.

Main Card 11, 12 RAM

When the machine is turned on, the software is downloaded from bubble memory to RAM. The active program is run from DRAM on the MC 11 and MC 12 cards. These cards are mounted on the MB-IIB. MC 11 can handle 512 Kbytes of memory while the MC 12 can handle 2 Mbytes of memory. Up to three MC 11 or three MC 12 cards may be mounted on the MB-IIB but a combination of both kinds is not permitted. The CPU can only access one or the other. As of January “94” the MC 11 card is no longer being used on new models.

The following is a summary of the main control boards' memory capability on the 5000/5020 series control. A listing of the memory cards and their part numbers is shown below. Also shown are which memory cards are compatible with the different main boards associated with the 5000/5020 series control. On Okuma controls, the bubble memory capacity is usually referred to in bits and ram memory capacity is referred to in bytes.

1Mbit X 1 = 256Kbit X 4 = 128Kbyte

Main Board	Bubble Memory	Ram Cards
A911-1520 **MB-IIB** The maximum bubble memory capacity on the MB-IIB is 32 Mbits.	A911-1224 4 Mbit X 1 A911-1225 4 Mbit X 2 A911-1226 4 Mbit X 3 A911-1227 4 Mbit X 4	A911-1522 MC 11 .5 Mbyte A911-1523 MC 12 2 Mbyte The MB-IIB has no standard ram memory on it. The rams maximum capacity is 6 Mbytes.
A911-1509 **MB-IIA** The maximum bubble memory capacity for the MB-IIA is 32 Mbits. The 1220 card is sometimes referred to as 256 Kbit X 4.	A911-1220 128 Kbyte A911-1221 1 Mbit X 1 A911-1222 1 Mbit X 2 A911-1223 1 Mbit X 4 A911-1224 4 Mbit X 1 A911-1225 4 Mbit X 2 A911-1226 4 Mbit X 3 A911-1227 4 Mbit X 4	A911-1501 MC1-II .5 Mbyte A911-1505 MC5-II 1.5 Mbyte A911-1510 MC9 1 Mbyte The maximum ram capacity for the MB-IIA is 2 Mbytes. This board has .5 Mbytes of standard ram memory.
A911-1500 **MB-II** The maximum bubble memory capacity for the MB-II is 16 Mbits.	A911-1220 128 Kbyte A911-1221 1 Mbit X 1 A911-1222 1 Mbit X 2 A911-1223 1 Mbit X 4	A911-1501 MC1-II .5 Mbyte A911-1505 MC5-II 1.5 Mbyte A911-1510 MC9 1 Mbyte The MB II has .5 Mbytes of standard ram and a maximum capacity of 2Mbytes.
A911-1100 **MB** The maximum bubble memory capacity on the MB board is 16 Mbits. The MB board is sometimes referred to as the MB0 board.	A911-1220 128 Kbyte A911-1221 1 Mbit X 1 A911-1222 1 Mbit X 2 A911-1223 1 Mbit X 4	A911-1105 MC 5 384 Kbytes A911-1101 MC 1 128 Kbytes The MB has 128 Kbytes of standard ram and a maximum capacity of .5 Mbytes

The following is an explanation of the different board configurations which can be found on Okuma machines with the OSP 5000 series control. Not all the boards are mentioned here, just the standard set of boards that are found with the particular main board.

Main Board		
MB0 (128K of RAM)	MBII (.5 M of RAM) MBIIA (.5 M of RAM)	MBIIB (no RAM)
Memory		
Any array of 1megabit X 4 bubble memory sections	As mentioned in the previous table, the MBIIA can use any array bubble memory cards.	Any array of 4 megabit sections and new CMOS memory cards
RAM		
MC1 (128 Kbytes of ram) MC5 (384 Kbytes of ram)	MC1-II (.5M) MC9 (1M) MC5-II (1.5M)	MC 11 (.5M) MC 12 (2M)
Servo Control		
AB0 (axis board)for LDU's AC1 (axis card) SVP0 (BDU's) TB0	SVPII,IIB, or IIC TB1 (for M/C), TB2 TB2-1, (flat panel) TB2C, TB2C-1 (VAC II)	SVPIID SPC1 (axis card) SPC6 (VAC II & III)
I/O boards EC board for lathe ECP board for M/C	 same ECPII	 same ECPIIA
Video Control		
MC2(PTR & panel IF) MC4-1 (PTR & panel IF) MC4-2 (PTR & panel IF)	CRPII	CRPIIC CRP-9 (monographic)
Communication Boards		
MC3 (Com and Puncher) FDC board (8" FDD)	MC2-II (PTR IF) MC3 (RS-232C and puncher IF) FDC board (8" FDD)	FDC II (3.5" FDD) FRP card (8" FDD to 3.5"FDD) MC13 (RS-232C only)

*FDC board could also be labeled FDO

Main Card 13 (A911-1521) RS-232 card

This card contains the RS-232-C interface and is mounted on the MB-IIB with the component sides of both boards facing each other. Tape readers, punchers, printers, PC's, and any other peripheral which conforms to the RS232-C standard can be connected via this interface.

Main Card 15 (A911-1526) Sub CPU card

This is an optional card on the OSP 5020M controls only. It incorporates a 32 bit double engine architecture. A microprocessor (M68020) and a math co-processor (M68881) for the Hi-speed/ Hi-Accuracy machining centers are the two "engines" on this card. This option is referred to as Hi²NC.

Main Card 16 (A911-1516) Sub CPU card

This card is standard equipment on the OSP 5020M controls. This card performs the multi-axis contouring functions for the machining centers.

Main Card 17 (A911-1517) Sub CPU card

This is an option card employed when the One-Touch IGF function is purchased. This option allows the operator to do some graphics programming at the machine.

CRP-IIC (A911-1692) or (A911-1693) CRT Processor board

This board is used for data communication with the OSP 5000/5020 NC operation panel. It transmits the video signal to the NC operation panel for the CRT display. This board is comprised of a Character IF, a Color Graphic IF, and a Serial IF. The 1692 board is the standard board. The 1693 board is used if the TM-APT (Remote programming station) option is purchased with the machine.

Character IF

This interface is used to control the character display mode (half-size, normal size, and enlarged size). After being combined with the color-graphics IF video signals, the character IF signals are transmitted to the NC operation panel as video signals and the characters are displayed at the CRT.

Color-Graphics IF

The graphic controller provides a total of 4 color graphic screens. Graphic control is possible only by using the graphic controller. After being combined with the character IF video signal, the color graphic video signal is transmitted to the NC operation panel, with the color graphic signal then being displayed at the CRT.

Serial IF

The Serial IF is used for data communication between the CRP board and the NC operation panel. The CRP board transmits the LED indicator data and buzzer data to the NC operation panel. The NC operation panel in turn transmits the keyboard data and the switch data of the machine operation panel back to the CRP board. The status of the switches and lamps can be viewed at the Panel I/O screen in the Check Data function.

CRP 9 (A911-1580) CRT Processor board

This board has the same function as the CRPII-C board. The only difference is the CRP 9 board has no graphics support. It does not have the Color graphics IF. The CRP 9 board is standard on the OSP 500 control.

SVP-IID Servo Processor board

This board is used to control the brushless servo motors. The SVP board determines the axis speed and position. The SVP is equipped to handle one DA/AD, one pulse generator, one pulse handle, and six sensors. The three major signals that are computed by the SVP are RAPA, RCON, and RDIFF. RAPA is the actual axis position data coming from the absolute position encoder used on the axis servo motors. RCON is the computed or commanded axis position data. RDIFF is the following error. A single SVP board can control two axes. For control of more than two axes, additional SVP boards and axis cards can be added to the system. Up to 10 axes may be controlled by one OSP 5020 CNC.

There are three versions of the SVP-IID board. The part number for the standard SVP board used on lathes is A911-1531. The part number for the standard SVP board used on machining centers is A911-1533. This board has no DA interface (IF).

Machines with more than five axes use the SVP board part number A911-1531 along with the SVP board part number A911-1532. The 1532 board has an SPC5 card mounted to it which receives the clock signals from the SPC4 card. The SPC5 card is only used with the 1532 board.

The DA IF generates a full scale +/- 10 volts analog signal which is used for spindle speed control. The AD IF is a 0 to 10 volts signal which is used to display the spindle load status at the CRT.

The pulse generator IF is used for spindle speed and position feedback. The pulse handle IF is used for determining and storing the number of notches the pulse handle has moved. The six sensors are used for touch setter options.

Prior to the design of the SVP-IID, the SVP-IIC was used in conjunction with the TB board. The TB board provided timing for the SVP as well as providing the DA signal for the spindle. These two functions have now been combined into the SVP-IID board.

SPC1 (A911-1534) Additional 1 axis card

This card contains one axis control, position encoder IF, and sensor IF. Up to 3 SPC1 cards may be mounted on an SVP IID.

SPC2 (A911-1535) Additional Pulse Handle card

This card contains two additional pulse handle circuits. This card is frequently used on Grinders.

SPC3 (A911-1536) Additional Pulse Generator and DA card

This card contains an additional pulse generator and DA IF. An example of where this could be used is on a machine with a sub-spindle.

SPC4 (A911-1537) Clock Driver card

When additional SVP-IID boards are used this card is used to transfer the clock signals from one board to the next. A ribbon (flat) cable is used to transfer these signals.

SPC6 (A911-1538) Fiber Optics card

This card is used when high-speed communications is needed. This card serves as an I/O card and has no CPU. The SPC6 is mounted on the SVP-IID board and is connected to a high-precision VAC unit by a fiber optic cable.

EC Board (A911-1120) Electrical Control board

This board provides the I/O information to the main processor (MB-IIB). This board has no CPU. It reads the machine status from the limit switches, etc. and controls the various solenoids, indicator lamps, and relays, etc. This board has 72 inputs and 40 outputs. Up to 6 EC boards can be added to the OSP 5020 CNC. The EC boards are labeled E0 to E5 and the address setting switch has to be set accordingly. This board is used on Lathes and Grinders.

ECP Board IIA Electrical Control Processor board

This is the Electrical Control board for the OSP 5020M controls. It is also used on some OSP 5020L controls that have special functions, such as robot or gantry loader systems. It contains a main processor with main memory and back-up memory. This board has a high-speed 16 bit microprocessor with a clock frequency of 15 MHz. This board has the following features: up to 3 DA channels, 2 channels for F-type encoders, EC bus IF.

The main memory is a 128Kbyte D-RAM. This type of RAM is continually being refreshed to keep it from losing any data. The back-up memory is a 48Kbyte S-RAM. This type of RAM is a C-MOS type memory device whose contents are retained by a 3.6 V lithium battery. The back-up memory is used to save tool location and position data. It also saves APC data.

There are three versions of the ECP-IIA board. The ECP-IIA (A911-1542) has three DA channels, (A911-1547) has one DA channel, and (A911-1548) has no DA channel. The DA channels are for the D type servo drives and VAC I (spindle drive unit).

The ECP board converts the spindle motor speed command into an analog voltage and sends it to the VAC. If a High-Precision VAC (VAC II & III) is used, this signal comes from the SVP board.

The ECP board can handle two F-type encoders which provide the feedback signals from the EC controlled servo drives of the ATC and APC.

The EC bus IF has a buffer memory. The data communication between the buffer memory and the EC I/O rack is transmitted via the EC bus.

ECP Card 2 (A911-1142) Expansion card

This card provides an additional 32 inputs and 32 outputs.

ECP Card 3 (A911-1143) Expansion card

This card provides an additional 2 channels for Pulse Generator interface. It also provides 4 additional inputs and 4 additional outputs.

ECP Card 4-II (A911-1544) Expansion card

This card provides an additional 3 channels for position encoders and 3 channels for DA interface.

FDC II BOARD (A911-1703) Floppy Disk Control board

This board is used exclusively for 3.5 inch FDD control. It has no RS-232C IF or printer IF.

Floppy DiskSize	Manufacturer	Model	Guaranteed Signal Cable Length
3.5"	Y.E. Data Co.	YD-686C-1501C (1.0/1.6M dual-type)	4.5m Max.
3.5"	Y.E. Data Co.	YD-702-6037 (1.0/2.0M dual-type)	0.5m Max.
8"	Hitachi	FDD412A	6m Max.

RS Board (A911-125*) RS-232C Interface board

This is a communication board with RS-232C protocol. It can have up to four channels. The last digit in the part number will coincide with the number of channels the board has.

CCP Board (A911-1594) Communication Control Processor board

This is a high-performance, serial communication board used with the DNC option. This board allows for high-precision, high-speed serial communications processing.

CCPC2 Card (A911-1596) Signal Converter card

This card converts the signal level for RS-232C protocol.

CCPC3 Card (A911-1597) Signal Converter card

This card converts the signal level for RS-422 protocol.

TCC-A (A911-1598) Turret Control card
TCC-B (A911-1599)

The TCC is used for high-speed turret indexing. A single TCC can control 2 turrets, using a hydraulic drive system. The TCC-A card has a built-in CPU along with 2 resolver IF's, 2 solenoid IF's, 2 contact IF's, and a local bus. The TCC-A is the main control card and the TCC-B is the valve control card.

A learning function monitors the indexing position each time the turret indexes, with each subsequent indexing operation becoming more precise.

EC I/O Rack

The EC I/O rack is external or separate from the OPUS control rack. This rack is found mostly on Okuma machining centers. This rack consist of a Driver/Receiver board and some individual I/O boards. The D/R board is also called the EC Control Unit and acts as the interface between the ECP-IIA board and the EC I/O rack. A power supply unit is housed on the I/O rack. This power supply provides all necessary power to the I/O boards. The I/O boards are equipped with signal status LEDs.

DR (A911-1270) Driver/Receiver board

I-PT (A911-1275) Input board

This board has 32 inputs. Power supply to this board is +5 volts DC.

O-AC1 (A911-1271) AC SSR Output board

This board can handle a total of 8 output signals. This board has a maximum load of 1 amp. The LED turns on when a minimum of .1 amp is detected. Power supply to this board is +5 and +12 volts DC. The 8 outputs are fused. The solid state relays can handle 100 volts AC.

O-DC1 (A911-1272) DC SSR Output board

This board was replaced by the O-AC1 board. This board has a maximum load of 1.6 amps and the SSR's can handle 24 volts DC. It also has 8 output signals.

O-TRP (A911-1268) Power Transistor Output board

This board has a total of 16 output signals. The maximum load this board can handle is 2 amps. Power to this board is +5 volts DC. The transistors in this board can handle 24 volts DC.

O-TR (A911-1273) Transistor Output board

This board can handle a total of 32 output signals. This board is used for driving small indicating lamps. Power supplied to this board is +5 volts DC. The transistors on this board can handle 60 mA.

O-TRH (A911-1278) Transistor High Output board

This board is the same as the O-TR board except its transistors can handle 150 mA. This board is used to drive slightly larger indicating lamps.

O-RR (A911-1274) Reed Relay Output board

This board has 8 outputs. It is used for driving small power relays. Power delivered to this board is +5 and +12 volts DC.

Fieldnet I/O Unit

The Fieldnet unit basically consist of two parts: I/O units (substation) and Fieldnet card (main station). Fiber optic cables are used to transmit data between the Fieldnet card and the I/O units. The Fieldnet card is the interface between the ECPIIA board and the machine side components. A block diagram is provided in figure 3. The following is a description of the boards associated with the Fieldnet I/O unit.

FN Card (A911-1840) Fieldnet card

This card acts as the interface between the Fieldnet I/O unit and the ECP IIA board. It is mounted on the ECPIIA board. It converts electrical signals to optical pulses that are sent out to the CCOP cards. The FN card also converts optical pulses it receives from the CCOP cards to electrical signals . The fieldnet card is referred to as the main station of the fieldnet I/O unit.

Double Column machining centers use an FN card (A911-1837) that has more power. This extra power is needed to transmit optical pulses through longer fiber optic cables.

CCOP (A911-1841) Communication Control
Optical card

This card converts optical pulses it receives from the FN card to electrical signals needed to control the I/O's on the APC. It also converts electrical signals coming from the APC to optical pulses and send them to the FN card. This card is used exclusively for the APC. This card is referred to as a substation card.

FCOM (A911-1846) Terminal card

This card is used to connect the "common" terminals (N24A1) for solenoids and switches used to control the APC.

CCOP2 (A911-1847) Communication Control
Optical card 2

This card combines a CCOP and an FIPC. This card is a substation capable of handling 32 inputs.

CCOP3 (A911-1848) Communication Control
Optical card 3

This card is used when more than 32 inputs are needed. This extension card is connected to the CCOP2 substation. Only two CCOP3 cards can be connected to the CCOP2 card. If more than 96 inputs are needed, an additional CCOP2 card has to be added.

FIPC2 (A911-1843) Fieldnet Input Photo Coupler card

This card has 16 inputs. This card is mounted to the CCOP card. This card reads the signals sent from various switches and relay contacts associated with the APC.

FOHT (A911-1849) Fieldnet Output High Transistor card

This is an output card capable of handling 32 outputs. This card is used for turning on LED's and small control relays. The communication card (CCOP*) can handle only one FOHT.

FOPT (A911-1844) Fieldnet Output Power Transistor card

This card has eight outputs and is used to turn on solenoids, lamps, and relays. One communication card (CCOP*) can handle up to four FOPT cards.

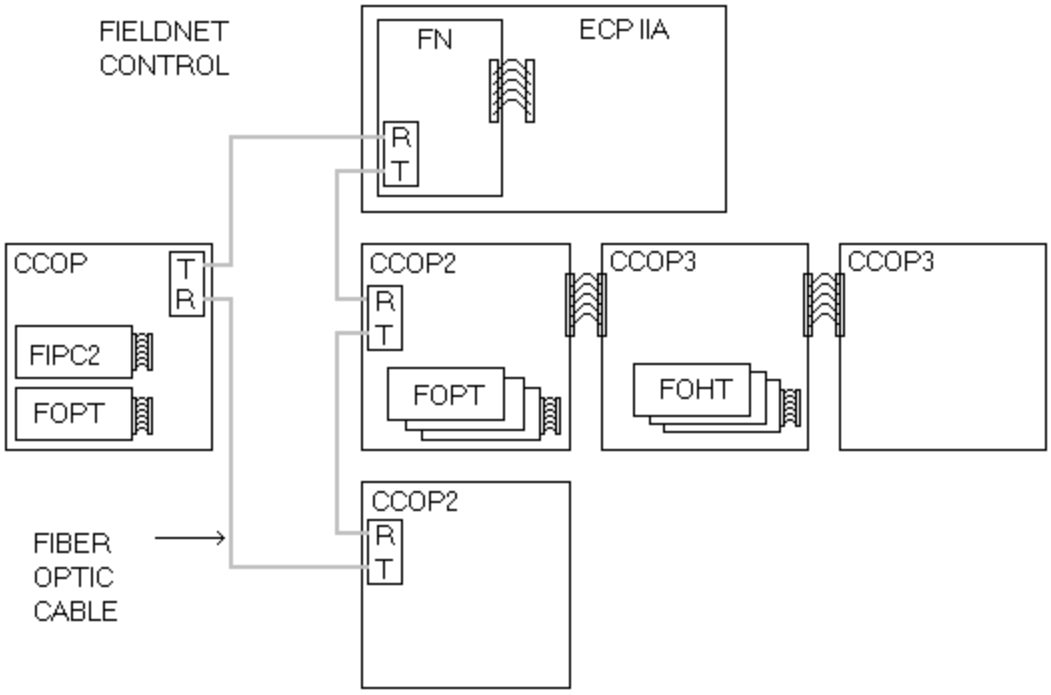


Fig. 3

Fiber Opitic Cable Part Numbers

E4982-702-002-5M	**(5 meters)Single Core**
E4982-702-002-4M	**(4 meters) Single Core**
E4982-702-002-2M	**(2 meters) Single Core**
E9101-I06-001	**(3 meters) Single Core**
E4982-702-003	**(6 meters) Double Core**
E9101-I06-002	**(10 meters) Double Core**
E9101-I06-003	**(5 meters)Double Core**
E9101-I06-006	**(1 meter) Double Core**

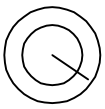
The following is information on how to troubleshoot a fiber optic cable.

The first step in checking a fiber optic cable is to do the light check. Simply put a light source around one end of the fiber optic cable. If a light source is seen at the other end of the cable the cable is good. There will be some cases where the light source is seen but one of the tips might be damaged causing an alarm. To check the tip of a fiber optic cable, a low cost slide microscope can be used. The following are examples of tips that are either good or bad.

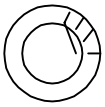
PASS

Perfect

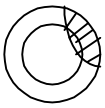
The outside edge is clean cut and a line that is less than 2/3 of the circumferenceof the fiber itself.



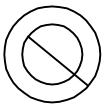
A piece of the outside edge is broken but is less than 1/5 of the circumference of the fiber.



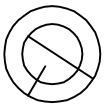
FAIL



A piece of the outside edge is broken whick is more than 1/5 of the circumference of the fiber.



The outside edge is clean cut but a line that is more than 2/3 of the circumference of the fiber itself.



SERVO SYSTEMS

This section will cover the different types of servo systems used on Okuma's 5000/5020 series CNC machines. A servo system can be defined as a system for the automatic control of motion by means of feedback. The controlled motion can be for positioning and/or velocity (RPM). Okuma uses servo systems to control axis positioning and spindle revolution. Most of the servo systems on machines with the 5000/5020 series control system use AC drive technology. Some of the early models use DC drive technology with DC brush type motors. The following is a description of the servo systems used on Okuma machines.

AXIS DRIVES

LDU 600

Some of the older lathes that use the early 5000L CNC control have the LDU 600 axis drive servo system. LDU stands for Linear Drive Unit. This is a thyristor control system which controls the rotational speed of a DC motor by regulating the firing angle of the thyristors. This system utilizes PPS technology where the input voltage is converted into a series of gate pulses with phase angles. PPS stands for Pulse Phase Shifting. A block diagram of the LDU 600 can be seen below.

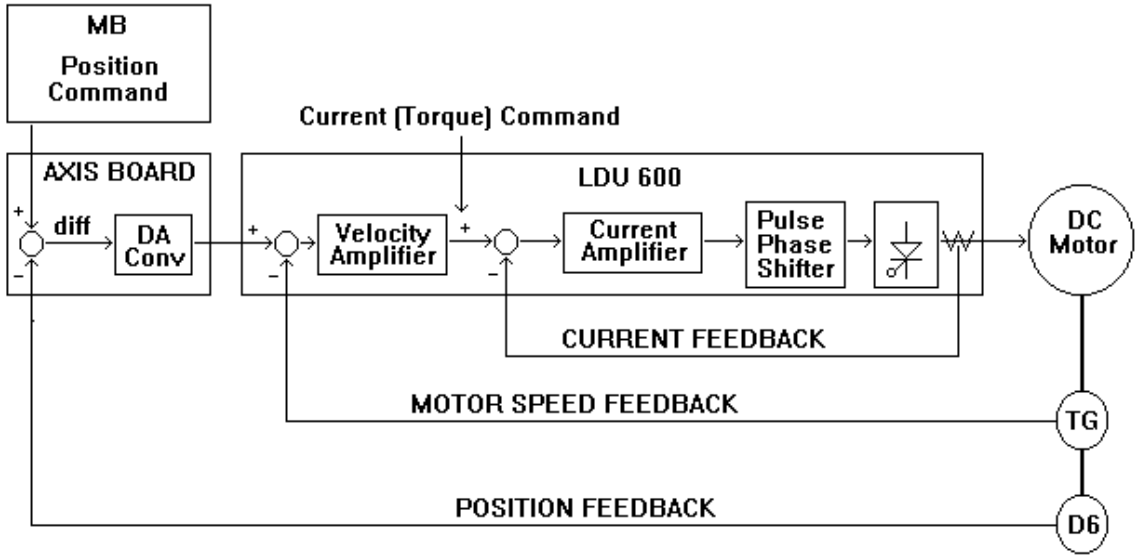


Fig. 5-3

LDU TR

Some of the older machining centers with the early 5000M CNC controls have the LDU TR axis drive system. The TR stands for Transistor. This drive system utilizes PWM technology. PWM stands for Pulse Width Modulation. The width or duration of the pulse is proportional to the amplitude of the incoming DA signal at the pre-determined sampling time. A block diagram of the LDU TR system is shown below.

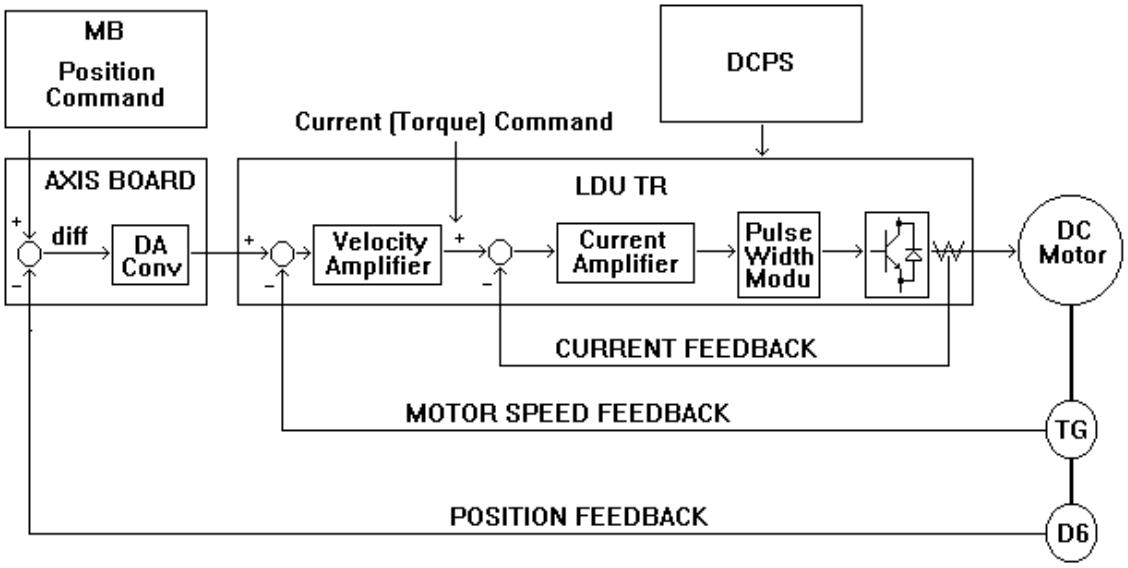


Fig. 5-4

BDU

The next axis drive servo system Okuma introduced was a flux vector Brushless Drive Unit. This servo system incorporates AC drive technology. This drive system also utilizes PWM technology. The DC power supply (DCPS) for this servo system can provide power for up to six drive amplifiers. One drive amplifier can handle one BL (brushless) motor. There are two types of BDU axis drives. The BDU-A which is used for axis positioning and the BDU-D which is used for magazine or table positioning on ATC's and APC's.

The BDU-A system receives a digital command signal (RCON) from the SVP board. A block diagram can be seen in Figure 5-5. The BDU-A drive amplifier is composed of three parts: base unit, BDC board, and SVC board. The BDU type drives have 3 phase 220 VAC going to their PCB's.

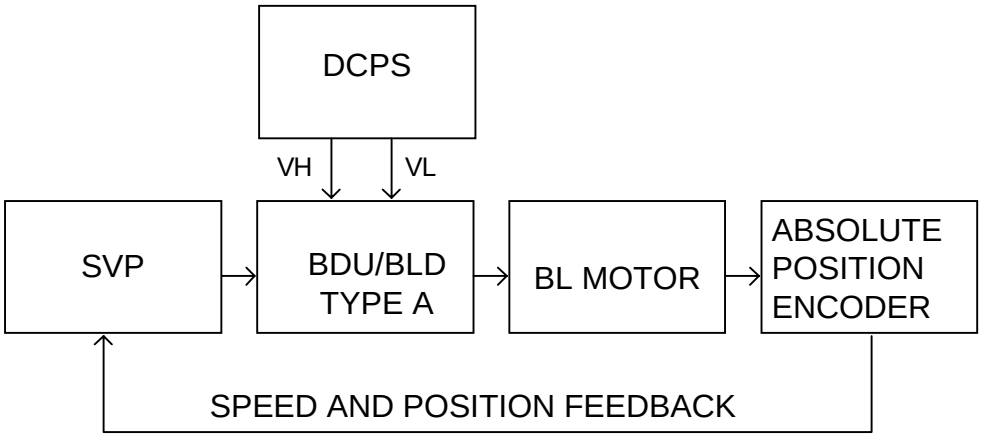


Fig. 5-5

The BDU-A and BDU-D use the same type of DCPS. This DC power supply converts the incoming 220 VAC to 300 VDC. There are seven LED indicators on the PCB of the DCPS. The following table shows what they mean.

Description of LED's on BDU style DCPS.

LED	Color	Description
PS	Green	Power is supplied to the DCPS.
MCON	Green	Relay MCS on DCPS is energized.
Dis	Yellow	The switching regulator is turning on and dumping VH to VL.
LV	Red	Low voltage-The 300 VDC dropped below 220 VDC.
HV	Red	High voltage was detected. The 300 VDC went above 430 VDC.
PH	Red	A Phase Loss was detected in one of the 3 phases coming into the DCPS.
Over Dis	Red	The regeneration circuit was left on for too long.

There are five check terminals on the lower right side of this same PCB board. The voltage levels that should be measured are shown below the individual check terminals. The middle terminal is the common and extreme caution should be taken when attaching a lead to this terminal because there is a 100K ohm 2 watt (green) resistor right above this terminal that has 220 VAC going through it! Figure 5-5A illustrates how close the resistor is to the check terminal.

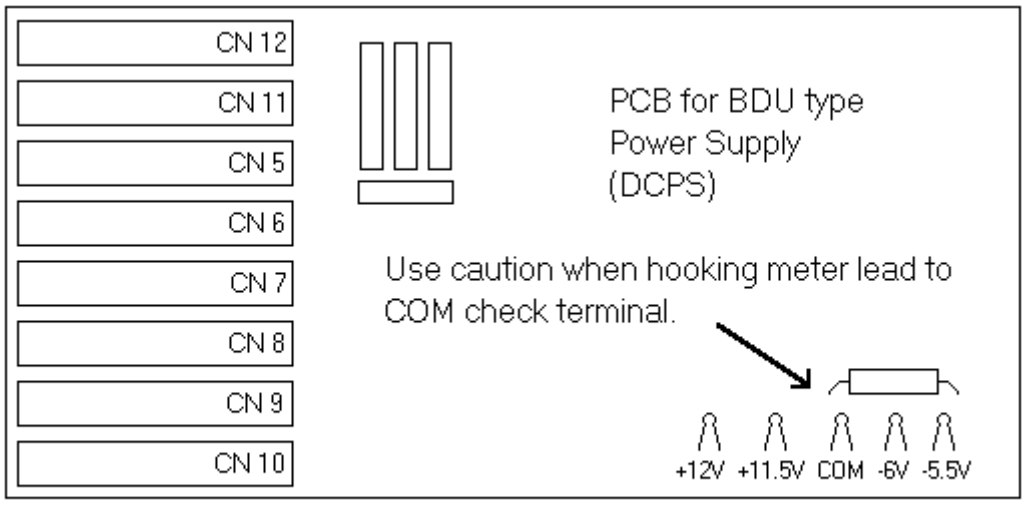


Fig. 5-5A

The BDU type power supply has a “Push Switch” on it which is used to discharge the C5 capacitor before doing any work on it. Do not press this push button when power is still being supplied to the drives. The BLD and BLIID have an indication lamp that remains lit until the capacitor is discharged. Wait until this lamp is off before doing any work on the drives.

The SVC board on the BDU-A drive amplifier has ten LED indicators on it. The following table describes what they mean.

Description of LED’s on the SVC board of a BDU-A type drive amplifier.

LED	Color	Description
PH Loss	Red	Phase loss in 220 VAC supplied to the BDC board.
VR Loss	Red	The + or - 12 VDC and/or 5 VDC has dropped below specifications.
IOCM	Red	Instantaneous Over Current in the Motor.
IOCS	Red	Instantaneous Over Current in the Servo amplifier.
LV	Red	Low Voltage
HV	Red	High Voltage
OC	Yellow	Over Current-Is triggered at 10 % of IOCM trigger level.
SAT	Yellow	Saturation-Drive amplifier received a heavy load.
SAOP	Yellow	Sub Amp Operation-Turns off when machine ready signal is received.
PSON	Green	Power is supplied to drive amplifier.

The BDU-D type axis drive as mentioned previously is used for controlling the ATC magazine and the APC pallets. The two big differences about this drive compared to the BDU-A is the command signal is an analog signal and comes from the ECP board. A block diagram of this servo system can be seen in Figure 5-6.

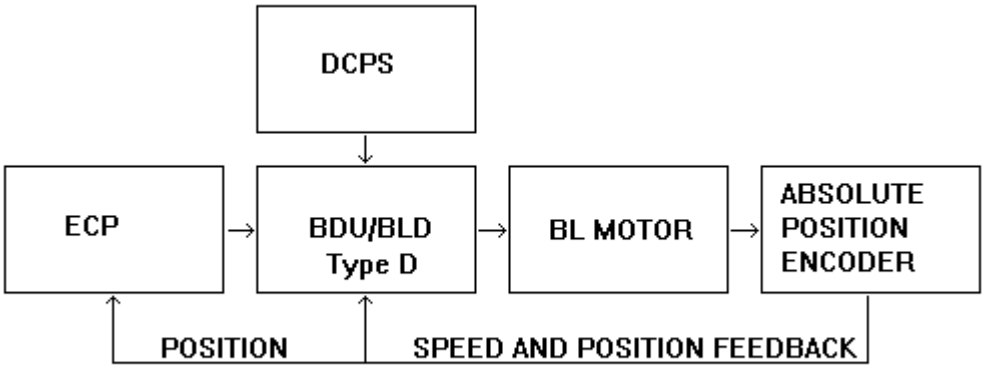


Fig. 5-6

The BDU-D drive amplifier is composed of four parts: base unit, BDC board, SVC-1 board, and SVC-2 board.

The SVC-1 board has eight LED indicators on it. The following table describes what they mean.

Description of LED's on SVC-1 board of a BDU-D drive amplifier.

LED	Color	Description
D0	Yellow	Used for inspection purposes during assembly.
D1	Yellow	Used for inspection purposes during assembly.
D2	Yellow	Used for inspection purposes during assembly.
APA	Red	This LED turns on whenever RCON and RAPA do not match.
MPR	Red	This LED turns on whenever the MPR data from the encoder is abnormal.
E8	Red	This LED turns on whenever the E8 data from the encoder is abnormal.
CPU	Green	CPU is in normal operation. CPU is running.
ALA	Red	This Alarm LED turns on when the APA,MPR, or E8 LED turns on.

The SVC-2 board has the same LED indicators as the SVC board on a BDU-A drive amp. Refer to the table for the SVC board on the previous page for a description of these LED's.

BLD

The BLD type drive system is basically a 2nd generation of the BDU drive. Like the BDU drives, the BLD series has two types of drives, the BLD-A and BLD-D. The block diagram for these drives are the same as the BDU types and can be seen in Figure 5-5 and 5-6. The BLD type drives are physically smaller then the BDU type drives. It is possible to replace a BDU drive with a BLD type drive. The BLD type drives only have single phase 220 VAC going to their PCB's. On the BLD-A, the BDC and SVC boards are combined and called the SVC-A board.

Like the BDU drives, the same DCPS is used for both BLD-A and BLD-D drives. The PCB on this power supply only has two LED's on it. The following table shows what they mean.

LED	Color	Description
PSON	Green	Power is supplied to the DCPS.
OH	Red	Over Heat-The regeneration circuit is staying on too long.

The following is a description of the LED's found on the BLD-A type axis drive amplifier.

Description of LED's on BLD-A type drive amplifier.

LED	Color	Description
PSON	Green	Power is supplied to the servo amp via connector 10.
SAOP	Yellow	Sub Amp Operation-Turns off when machine ready signal is received.
MOL	Red	Motor Over Load
LV	Red	Low Voltage
VR	Red	The + or - 15VDC and/or the 5 VDC has dropped below specification.
IOCS	Red	Instantaneous Over Current in the Servo amplifier.
IOCM	Red	Instantaneous Over Current in the Motor.
F.OL	Red	Fin Over Load-Heatsinks are getting too hot.
HV	Red	High voltage was detected. The 300 VDC went above 430 VDC.
Amp Sat	Yellow	Amp Saturation-Drive amplifier received a heavy load.

The BLD-D type drive amplifier is also composed of four parts: base unit, BDC board, SVC-1 board, and SVCA-2 board. The SVC-1 board has the same LED indicators as the SVC-1 board on a BDU-D drive amplifier. These LED's are located on the lower left side of the SVC-1 board. In addition, the LED's that are on the SVC-2 board on the BDU-D drive amplifier are incorporated into the SVC-1 board of the BLD-D except for the PSON LED which is still on the SVCA-2 board. The following table describes these LED's which are located on the lower right side of the SVC-1 board.

Description of LED's on right side of the SVC-1 board on a BLD-D type drive amplifier.

LED	Color	Description
SAOP.N	Yellow	Sub Amp Operation-Turns off when machine ready signal is received.
IOCS	Red	Instantaneous Over Current in the Servo amplifier.
IOCM	Red	Instantaneous Over Current in the Motor.
VR	Red	The + or - 15VDC and/or the 5 VDC has dropped below specification.
F.OL	Red	Fin Over Load-Heatsinks are getting too hot.
M.OL	Red	Motor Over Load
LV	Red	Low Voltage
HV	Red	High voltage was detected. The 300 VDC went above 430 VDC.

There is a characteristics table for the D type servo drives (Servo Characterisitics Table). This table defines the characteristics of the D type drive amplifier. These characteristics vary from machine to machine and are dependent on the type or size of motor the drive amp is controlling. There are four settings that should be looked at when a machine is first installed or a D type drive amplifier is replaced. These are VLG, VNFB, VCOM and DA zero.

The first adjustment that needs to be made on the BLD-D drive amp when it is first installed in the field is the DA zero check. With the machine powered up and the axes at a standstill, check the voltage at check terminal DAC on the SVC # one board. Hook the common lead of the DVM to the COM check terminal and the positive to the DAC check terminal. Adjust the "DA Zero" potentiometer until the DVM reads 0.00 volts DC.

Set VNFB and VLG to the value given in the Servo Characterisitics Table.

The next adjustment that should be made is VCOM which needs to be adjusted until the correct DIFF value (on characteristics table) is seen on the CRT during rapid movement (GOO).

BLIID

The latest type of axis drive servo system is the BLIID. This is the 3rd generation drive. This drive combines the DCPS and two drive amplifiers into one package. If a third axis is needed, a BLIID with one axis control is installed. The BLIID is not interchangeable with its predecessors. Like the 1st and 2nd generation drive amplifiers, there are two types of BLIID's: BLIID-A and BLIID-D. The BLIID-A is composed of two parts: SVCII board and Power board. A block diagram of a BLIID-A can be seen in Figure 5-7. The following table describes the LED indicators on the SVCII board of a BLIID-A.

Description of LED's on BLIID-A type drive amplifier.

LED	Color	Description
PON	Green	Power is supplied to the control board (SVCII).
OP	Yellow	Sub Amp Operation of first axis-Turns off when machine ready signal is received.
OCM	Red	Instantaneous Over Current in the Motor of first axis.
OCS	Red	Instantaneous Over Current in the Servo amplifier of first axis.
OV	Red	The inverter DC voltage (VH) is abnormally high.
UV	Red	The inverter DC voltage (VH) is abnormally low.
ROH	Red	The regenerative discharge circuit is overheating.
BOH	Red	The power board is overheating.
LOSS	Red	The control circuit voltage has dropped below specification.
OCS	Red	Instantaneous Over Current in the Servo amplifier of second axis.
OCM	Red	Instantaneous Over Current in the Motor of second axis.
OP	Yellow	Sub Amp Operation of second axis-Turns off when machine ready signal is received.

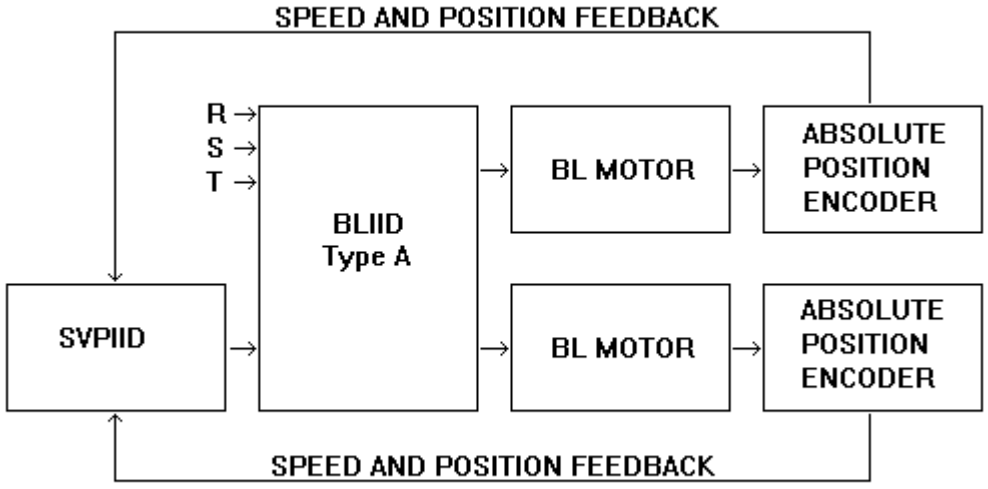


Fig. 5-7

The BL-IID type D is used for some ATC magazines and tool change arms, table positioning on some APC's and for crossrail positioning on some double column machining centers. This drive receives an analog command signal from the ECP board. This D type drive is **not** used on machines with the OSP 7000 control. The BL-IID D type is composed of four parts: power board, SVCII board, and two SVC-1 boards. Each SVC-1 board controls an axis. The SVC-1 board used on a BL-IID type D is the same as the SVC-1 board on the BLD-D. A block diagram of a BL-IID type D drive can be seen in figure 5-8.

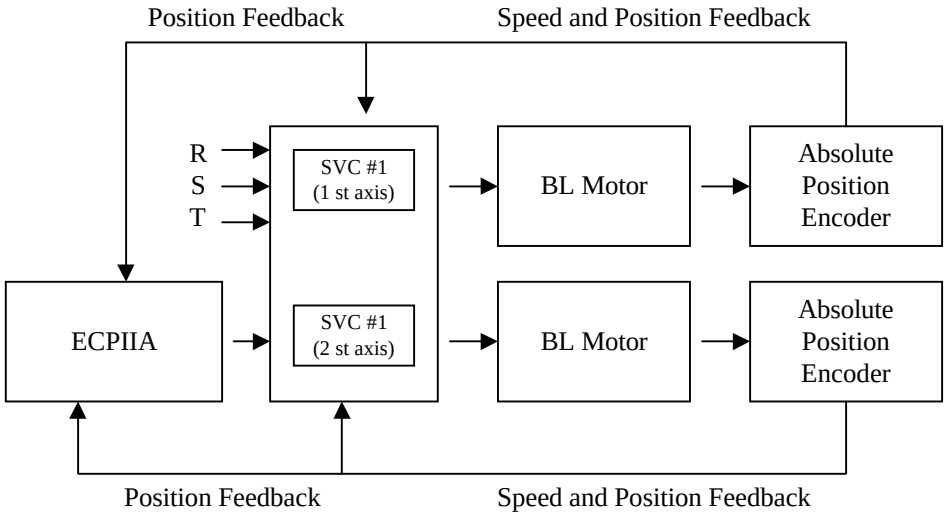


Fig. 5-8

The BL-IID type D axis drive as mentioned previously is used for positioning some ATC's, APC's and crossrails. The two big differences about this drive compared to the BLII-D type A is the command signal is an analog signal and it comes from the ECP board. The SVCII board is the same as the SCVII board on the type A drives. The SVC-1 board has eight LED indicators on it. The following table describes what they mean.

LED	Color	Description
D0	Yellow	Used for inspection purposes during assembly.
D1	Yellow	Used for inspection purposes during assembly.
D2	Yellow	Used for inspection purposes during assembly.
APA	Red	This LED turns on whenever RCON and RAPA do not match.
MPR	Red	This LED turns on whenever the MPR data from the encoder is abnormal.
E8	Red	This LED turns on whenever the E8 data from the encoder is abnormal.
CPU	Green	CPU is in normal operation. CPU is running.
ALA	Red	This Alarm LED turns on when the APA, MPR, or E8 LED turns on.

The following table describes the LED's which are located on the lower right side of the SVC-1 board on BL-IID type D drive.

LED	Color	Description
SAOP.N	Yellow	Sub Amp Operation - Turns off when machine ready signal is received.
IOCS	Red	Instantaneous Over Current in the Servo amplifier.
IOCM	Red	Instantaneous Over Current in the Motor.
VR	Red	The + or – 15DC and / or the 5 VDC has dropped below specification.
F.OL	Red	Fin Over Load-Heatsinks are getting too hot.
M.OL	Red	Motor Over Load
LV	Red	Low Voltage
HV	Red	High voltage was detected. The 300 VDC went above 430 VDC.

There is characteristics table for the BL-IID type D servo drives. This table defines the characteristics of the BL-IID type D drive amplifier. These characteristics vary from machine to machine and are dependent on the type or size of motor the drive amp is controlling. There are three settings that should be looked at when a machine is first installed or a BL-IID type D drive amplifier is replaced. These are VLG, VNFB, and VCOM.

Before removing the drive unit.

The BDU servo system has a capacitor discharge switch on the DCPS (power supply). If a BDU drive unit or power supply has to be removed, ***power off*** and then push this discharge button to discharge the capacitors before removing the high voltage wires (VH & VL). This button is labeled "**Push Switch**".

The BLD and BL-IID servo systems do not have a "Push Switch", they have an LED that stays on if the capacitors are still charged. In most cases the LED on the BLD servo system will slowly extinguish as soon as you power off. On BL-IID's the LED does not extinguish right away. If necessary the NFB breaker on the unit itself can be turned off to discharge the capacitors immediately. If the breaker is not turned off, it will take 5 or 10 minutes for the capacitors to discharge.

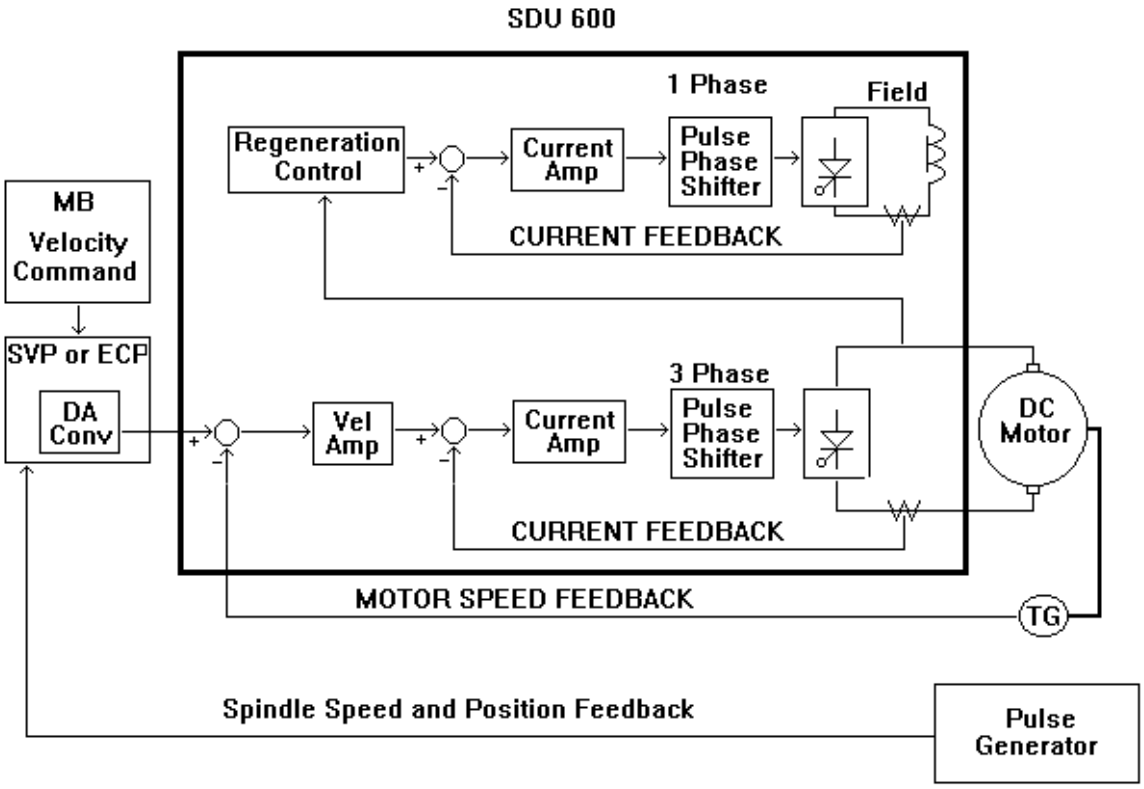
In Okuma language, the BDU, BLD, and BLIID type A drives are referred to as NC controlled axis drives. These drive amplifiers are used for high accuracy positioning. They receive a digital command signal from the SVP board.

The type D drives are referred to as EC controlled axis drives. They receive an analog command signal from the ECP board. These axis drives are used for positioning the tool magazine of the ATC, the pallets on the APC, and the crossrail on double column machining centers.

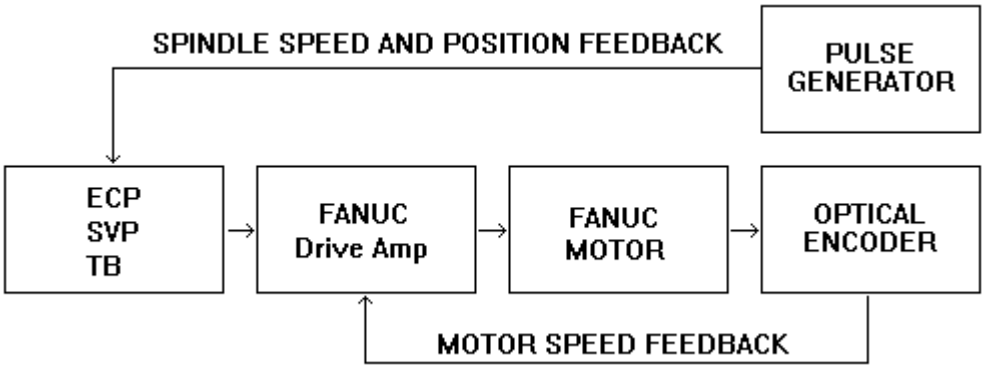
The latest drive amplifiers (BLIID's) use IGBT technology. These Insulated Gate Bipolar Transistors generate less heat. Hybrid IC's along with IGBT's have helped in reducing the physical size of drive amplifiers.

Spindle Drives

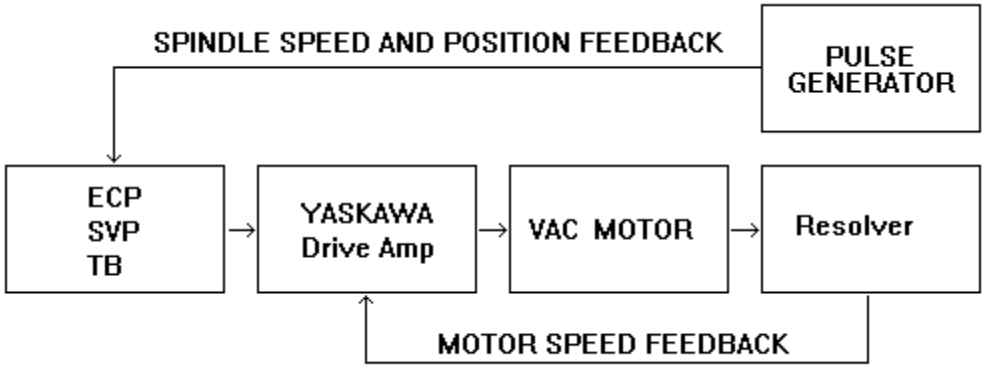
Some of the older lathes that use the early 5000L CNC control have the **SDU 600** spindle drive servo system. SDU stands for Spindle Drive Unit. Like the LDU 600 axis drive, this is a thyristor control system that controls the rotational speed of a DC motor by regulating the firing angle of the thyristors. This system uses a tach generator as the feedback device for the motor and an optical pulse generator as the feedback device for the spindle. A block diagram of the SDU 600 can be seen below.



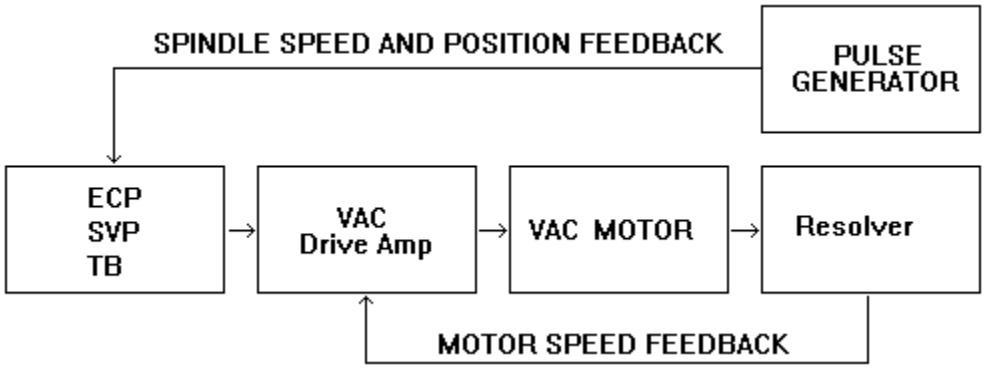
Some Okuma machines are equipped with **Fanuc** spindle servo drives and motors. This servo system utilizes an optical encoder for the motor speed feedback and a pulse generator for spindle speed and position feedback. On machining centers, the command signal is generated by the ECP board. On Lathes, the command signal is generated by the SVP IID board. Prior to the SVP IID, the command signal was generated by the Timing board (TB0). The diagram below depicts this type of servo system.



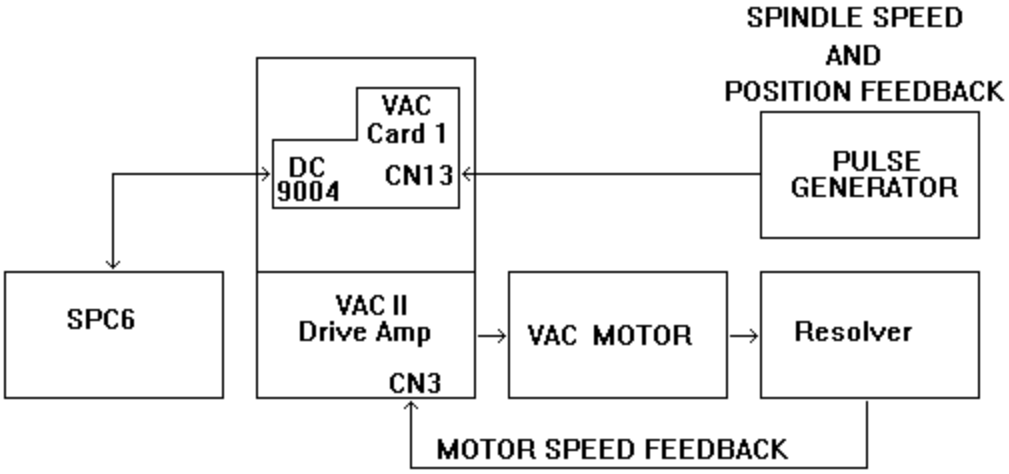
Another type of spindle servo system found on Okuma machines utilizes a **Yaskawa** drive amplifier and a Yaskawa spindle motor. This system uses a resolver for motor speed feedback and a pulse generator for spindle speed and positioning feedback. The command signal origination is the same as the Fanuc spindle servo system. See diagram below. The velocity command signals from the ECP and SVP boards are analog.



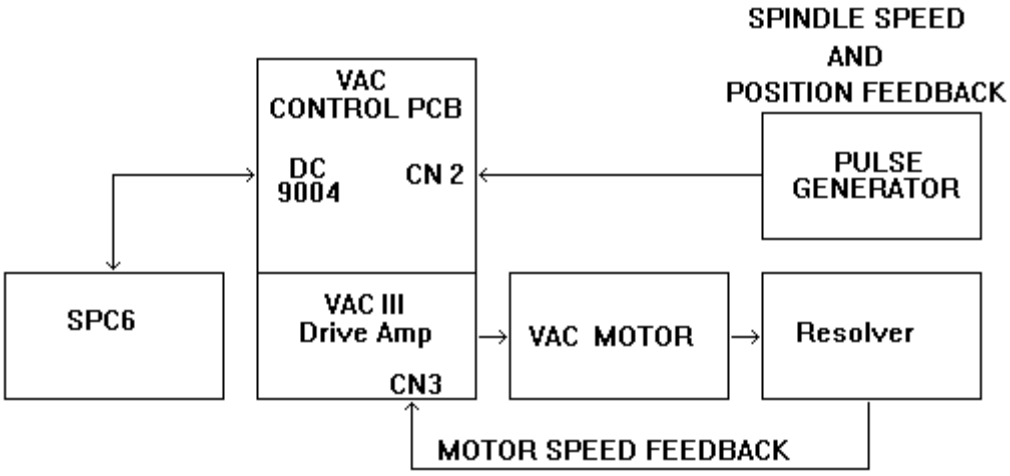
In 1985, Okuma introduced its own **VAC** spindle drive amplifier. All the characteristics of this spindle servo system are basically the same as the Yaskawa system. The feedback system and command signal origination are very similar. This drive has a light blue face plate.



In 1990, Okuma introduced the **VAC II**. This spindle drive amplifier utilizes fiber optics. For any machine using a VAC II, the command signal is generated by the SVP IID and converted from digital to optical pulses by the SPC6 card. The spindle speed and position feedback is sent to the VAC Card I (CN 13) where it is converted into optical pulses and sent back to the SPC6 card. This drive has a dark brown face plate.



In 1994, Okuma introduced the **VAC III**. The VAC III is very similar to the VAC II except for its physical size. The VAC card I was incorporated into the VAC control board. The spindle speed and position feedback are sent to the VAC control board (CN 2) where it is converted into optical pulses and sent back to the SPC6 card. Like the BL IID axis drive amplifiers, the VAC III utilizes IGBT's and hybrid IC's which have helped in reducing the physical size of this latest Okuma spindle drive amplifier.



Diagnosing a spindle drive alarm.

When the control receives an alarm signal from the spindle servo system, it generates a generic alarm which the control sends to the CRT. This A level alarm is number 110 on lathes and 109 on machining centers. If this generic SDU alarm appears on the CRT, refer to the appropriate maintenance manual to decipher the alarm condition.

The VAC has three operation status LED's labeled M1, M2, and M3 and thirteen numbered status LED's on its control PCB. During normal operation, M1, M2, and M3 are off and the thirteen status LED's show the status of the I/O signals on the VAC. In an alarm condition, the on/off condition of these status LED's can mean different things depending on the on/off condition of the operation status LED's (M1, M2, and M3). The signal assignment of the status LED's can be determined by looking in the maintenance manual.

The VAC II and VAC III spindle drive amplifiers do not use a generic SDU alarm. The A level alarms associated with VAC II's and III's on lathes range from 1102 to 1142. On machining centers these alarms range from 300-335. These two latest types of spindle drive amplifiers also have two seven segment display LED's which show an alarm number. Again, the meaning of these status LED's and alarm numbers can be deciphered by looking in the proper maintenance manual.

FEEDBACK DEVICES

A CNC control needs some kind of feedback from its servo systems in order to control the machine's axes accurately. A feedback device provides speed and positioning information. The following is a summary of the different types of feedback devices found on Okuma machines with the 5000 series control. A brief description of each type is also included.

The early 5000 controls have DC drives as mentioned earlier in this section. The LDU 600 and LDU TR utilize a tachometer and a D6 absolute position encoder for axis speed and position feedback. The SDU 600 utilizes a tachometer and a pulse generator for spindle speed and position feedback.

All the other Okuma axis drives which use the BL motor have an absolute position encoder (E,F,FB,or FC) for speed and position feedback. Some machines utilizes MPR's or Inductosyn transducers along with the absolute position encoder for high accuracy positioning.

All of the Okuma AC spindle servo systems utilize a resolver and a pulse generator for speed and position feedback. The Fanuc spindle servo system is the only exception. It utilizes an optical encoder instead of a resolver for motor speed feedback.

Some of the Okuma lathes have TCC resolvers which are used to control turret positioning. Some of the latest lathes have turrets that are driven by a BL motor which have an HC type absolute position encoder.

Tachometer

Commonly referred to as a tachgenerator this type of device is used for velocity (speed) feedback. This device generates a DC voltage. On Okuma machines, the tachgenerator is used to monitor actual motor speed. The faster the DC motor turns the higher the DC voltage level. If the rotation direction is changed, so will the polarity of the voltage generated by the tachgenerator. Most tachgenerators are rated for a certain voltage level. For example, if a tachgenerator is rated at 7v/1000rpm, the voltage generated by the tachgenerator will be 7 vdc when the motor is turning at 1000 rpm, 14 vdc when the motor is turning at 2000 rpm and so on. This voltage signal should be a DC level, with very little noise or ripple. Most tachgenerators used on the Okuma axis drive motors are rated at 7 volts per 1000 rpm and 20 volts per 1000 rpm for the SDU 600. The voltage that the tachgenerator is rated at can be determined by looking at the characteristics sheet for the axis or spindle drive in question. Again, this type of feedback device is found on any machines with DC spindle drives.

Absolute Position Encoder

This Okuma patented device is used for axis speed and position feedback. The D6 type is only used on DC axis servo systems (LDU's). The axis servo systems which utilize the BL motor (BDU, BLD, or BLIID) use the E,F,FB, or FC type absolute position encoder. The E and F types are being phased out. If an E or F type is replaced, it is replaced with an FB or FC. The FC type absolute position encoder is the newest and is physically shorter (approx. 3/4 of an inch) then the older styles. Hence, the FB,F, or E types cannot take the place of an FC. The E, F, FB, and FC types are capable of making 2048 revolutions before turning over(back to zero). An HC type absolute position encoder has been developed for high speed turrets and rotary tables. The output shaft of the HC can turn 7200 revs before turning over.

The absolute position encoder uses a multi-pole resolver (MPR) for lower digit positioning (.0001) along with pulse type heads for upper digit positioning (123.4560). The control sends a 5 kHz sine and cosine signal to the MPR in the absolute position encoder. The CNC control generates a clock signal (81.92 Mhz) which it compares to the phase offset between the sine signal and the MPR feedback signal. The control counts the number of clock pulses per phase shift and multiplies this number by the distance per pulse. Every time the output shaft of the absolute position encoder turns 36°, there is a 360° offset between the sine signal and the MPR feedback signal. This equates to 16384 clock pulses per tenth of a revolution. This The E8-1 rotor rotates one position for every 360° phase shift. This feedback signal is sent back to the OSP control. The parallel pulse signals from the pulse type heads are digitized inside the encoder and also sent back serially to the OSP control.

The absolute position encoder is physically attached to the BL motor. In some cases this encoder is used on ATC magazines which are hydraulically driven. This encoder is referred to as an encoder with shaft. This encoder has a casing around it with a shaft sticking out where as the more common absolute position encoder has no casing around it and has a coupler that is mounted onto a shaft in the BL motor.

Procedure for Replacing Absolute Position Encoders

Removing Encoder From Motor

1. Unscrew the four clamping bolts (M4 or M5) to remove the back cover of the motor.
2. Remove the cover and resin frame. It may not be easy to remove by hand due to the adhesion of packing. In this case, the cover can be removed by lightly hitting the cover with a soft hammer. Positively prohibit hitting it with a metallic hammer or hitting it hard with a soft hammer since the parts may be broken.
3. Disconnect the encoder input/output connector (ribbon cable) by pulling down the lock levers on both sides of the connector.
4. The encoder diaphragm is attached to the motor chassis by four special long head bolts. Remove these bolts to detach the encoder diaphragm from the chassis of the motor.

Removing the encoder from the motor shaft.

> The encoder input shaft and the motor shaft are joined by an M5 hexagon socket head bolt. There is a hole in the center of the encoder's printed circuit board. The encoder can be removed from the motor shaft by inserting the long side of an M5 Allen wrench through this hole, inserting it into the head of the hexagon bolt. Insert a pipe into the short side of the wrench (or use a T handle wrench)and loosen the bolt. It might be necessary to secure the motor shaft so that it does not rotate while this bolt is being loosened. If there is a pulley attached to the motor shaft, for example, holding the pulley by hand will be sufficient to secure the motor shaft. When the pulley cannot be held by hand, take into consideration placing a prop between slide table and body.

This completes the procedure for removing the Absolute Position Encoder.

Installing the encoder to the motor (Basically, install the encoder in the reverse order of removal.)

Installing the encoder to the motor shaft.

Prepare and confirm the following items before installing the encoder to the motor shaft.

- Check for damage or rust on the taper.
- Check for dirt or foreign substances.
- Check for deformation of motor shaft positioning key slot.

When installing the encoder to the motor shaft, adjust the positional relationship of the encoder to the motor on the two following items.

- Align the motor shaft adjusting key slot and the encoder input shaft adjusting pin.

- Align the diaphragm phase adjusting pin of encoder and the adjusting pin hole made in the motor flange. (The adjusting pin hole made in the motor flange is placed at the bottom right viewed from the encoder installing side.

Adjust the positional relationship of the motor shaft and encoder input shaft and lightly tighten the encoder input shaft M5 bolt with the allen wrench through the center of encoder's printed circuit board. At this time, while the bolt is still loose, align the diaphragm phase adjusting pin of the encoder with the adjusting pin hole made in the motor flange. If the input shaft is tightened in the condition that the pin and hole are not aligned correctly, it will cause the diaphragm to be distorted, so that the encoder cannot be installed properly. Therefore, care should be taken to align the pin and hole. Remount the four special long head bolts to attach the encoder diaphragm to the chassis of the motor.
Finally tighten the input shaft to 60kg/cm(854inch pounds).

Connecting the encoder input/output (ribbon cable) connector.

Since this connector has a protruding portion to prevent an error during insertion, care should be paid to its insertion direction. (Insert the connector with its protruding portion pointed at the center (inside) of shaft. Turn the lock levers towards the inside. At this time, check for a clicking noise. If the connector is not inserted sufficiently, the clicking noise will not be heard or felt.

Install the cover and resin frame

The installation of the encoder is completed.

At this point, refer to the Parameter section to redefine the Stroke End Limits and Zero Offsets. If the absolute position encoder is replaced on a machining center, only the Zero Offset has to be redefined.

MPR

Some machines have an MPR (MultiPolar Resolver) mounted directly to the ballscrew. This MPR is the same as the MPR in the absolute position encoder. The MPR is used in conjunction with the absolute position encoder to provide greater accuracy. This resolver has eight poles; four sine poles and four cosine poles. The sine and cosine signals are generated by the OSP control. As the stator (located in the center of the eight poles) rotates, a feedback signal is generated. This feedback signal will be phase shifted up to 360 degrees depending on the position of the stator which is directly coupled to the output shaft of the MPR. As mentioned above, the OSP generates a clock signal which it compares to the phase shift between the feedback and sine signals. There is a set number (163,840) of clock signals within a 360 degree phase shift. By knowing the distance the axis travels for each clock pulse, the control counts the number of clock pulses per 360 degree phase shift and multiplies the number by this set distance to determine how much the axis has traveled.

Inductosyn

The bigger the machine, the longer the axis ballscrew. The longer the ballscrew , the more room there is for error due to heat expansion of the ballscrew. An inductosyn feedback system is a practical way of compensating for ballscrew growth. It is also used on machines requiring high accuracy positioning. An inductosyn feedback used in conjunction with the absolute position encoder enables the control to detect axis positioning in units of .1 microns.

An inductosyn transducer is a high accuracy multi-pole position data device. There are linear and rotary inductosyns. The linear inductosyn uses an inductive scale that is attached to the table of the machine. A reference signal is sent to this scale. On the other side is the slider which has a sine and cosine pickup coil. As the slider is moved across the face of the scale, two signals are induced (sine & cosine) which are 90° out of phase. These two signals are sent to the preamp board where they are combined and sent back to the OSP control as the POS(position) signal.

It is critical that the sine & cosine signals are 90 degrees out of phase. This can be checked by looking at CT1 and CT2 on the preamp board. The VR1 potentiometer on the pre-amp board is adjusted to get the desired POS signal. The desired signal is a steady sinewave anywhere from 6 to 12 Vpp at the POS check terminal. The POS signal is compared to the reference signal. Like the resolver, the control determines the phase offset between the POS and reference signals and calculates how much the axis has moved.

Rotary inductosyn transducers work in the same way. Instead of a scale and slider you have a rotor and stator. Okuma uses inductosyn transducers mostly on machining centers. The data from the MPR and inductosyn feedback devices are used for positioning purposes.

VAC Resolver

VAC spindle motors have a resolver mounted to it to determine actual motor speed. The control sends a sine and cosine signal to the stator. The rotor induces a feedback signal. This signal is 7812 hertz when the motor is stopped. The control determines the actual motor speed and direction by the frequency level of this signal. The frequency can be calculated by using the following equation:

$f = 1/T = 1/(128 \times 10^{-6}) \pm 8N/60$

where N is the motor speed, add in the forward direction, and subtract in the reverse direction. The motor to spindle speed ratio can be determined by looking in the Operation and Maintenance manual.

Pulse Generators

Okuma uses pulse generators for spindle speed and position feedback. One exception is machines with Fanuc spindle drives and spindle motors. The Fanuc motor uses an optical encoder for motor speed feedback. Encoder is a more common name for a pulse generator. Pulse generators on Okuma machines can be of the optical or magnetic type.

The optical encoder (pulse generator) contains a glass or metallic disk with a number of lines etched on its surface. The outer row divides one revolution into a specific number of units. The inner row contains the marker pulse which indicates to the control where to start counting.

Similar to an inductosyn transducer, two signals are generated (A and B phase) by the pulse generator which are 90° out of phase. These two signals are sent back to the control. The 90° phase difference for these two signals is how the control determines which direction the pulse generator is turning. The control monitors the frequency of these signals to determine how fast it is turning.

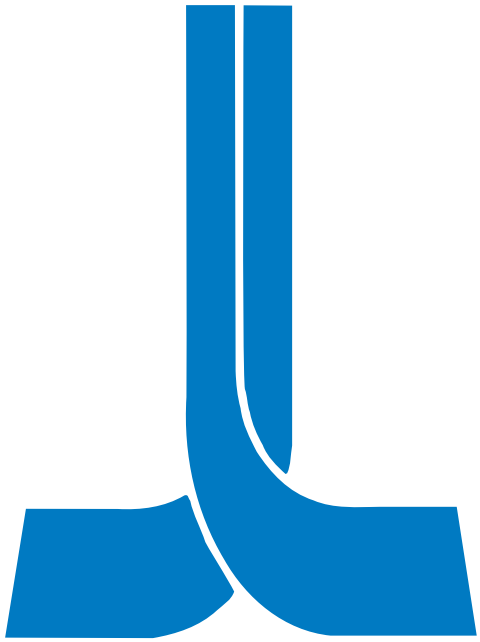
The magnetic pulse generator does basically the same thing. Instead of a light source, a rotary

disc is attached to the spindle assembly. In the magnetic pulse generator are magnetic resistor devices which produce the A and B phase signals mentioned above. There is a marker pulse (Z phase) on this same rotary disc which is used to orient or position the spindle.

On Okuma machine tools, the pulse generator is used mostly for spindle orientation and spindle speed display. The resolver in the spindle motor is used to monitor and control the spindle speed. On machining centers, the pulse generator and the resolver signals are used to monitor the spindle speed.

TCC Resolver

This resolver is used for turret positioning. A sine and cosine signal is sent to it from the control and a feedback signal is sent back to determine the distance traveled. This type of resolver is seen mostly on the Okuma LR, LT, and Cadet M series lathes. The adjustment procedure for this feedback device can be seen in the maintenance manual for the specified machine.



OKUMA

OSP 5000/5020 CONTROL

DIAGNOSTICS

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

This section will cover the CRT displays (menus) which are often used for troubleshooting purposes. This section will also discuss the different types of alarms that are generated by the control.

For the most part, three CRT display menus are used for diagnosing a machine problem. These modes can be accessed as long as the machine is in one of the three operation modes. They can be accessed by pressing the appropriate function key.

ACTUAL POSIT	F2
BLOCK DATA	F4
CHECK DATA	F7

ACTUAL POSITION

The Actual Position mode is used to show axis position data. In this mode, the actual position can be viewed in enlarged characters. The part program can be viewed along with the actual position data. The Load Display can be viewed in this mode also. The following is a description of the data shown in the individual menus of the Actual Position mode on a 5000/5020L series control.

The first line on the CRT will display the operation mode currently selected. If a program has been selected, the program name along with the block number currently active is also shown on the first line.

XA	Actual X axis position data of A turret
ZA	Actual Z axis position data of A turret
XB	Actual X axis position data of B turret {seen on two-saddle or}
ZB	Actual Z axis position data of B turret { two-turret machines }

Pressing the Page up or Page down key will bring up the next menu. Pressing the A or B turret select keys will show the individual turret conditions.

XA(B)	Actual X axis position
Xd	Remaining distance to X axis target point
ZA(B)	Actual Z axis position
Zd	Remaining distance to Z axis target point
Fx	X axis feedrate in mm/min
Fz	Z axis feedrate in mm/min
N	Sequence number
T	Tool change command
S	Actual spindle speed in rpm
CA	Actual position of the spindle in degrees

On this same menu, the program is shown on the right side of the CRT. The line identified by the arrow-up mark (↑) is the block being executed. The right arrow symbol (≫) indicates the blocks read and stored into the buffer.

Pressing the "Page Down" key will show the machine state and load display menu. This page shows the following additional information.

M	Spindle gear range
V	Surface cutting speed

The right side of the CRT shows the load status of the spindle, X and Z axes.

Another menu in the Actual position mode shows the following information.

Program	Actual position data
Distance	Remaining axis travel amount of the individual axes
Shift	Shows the actual position value from the zero offset
Machine	Shows the raw data coming from the absolute position encoder (RCON)
Tool Offset	Shows the active tool offset amounts
Pitch	Shows the pitch error compensation data when applicable

Machining Center

The following is a description of the data shown in the individual menus of the Actual Position mode on a 5000/5020M series control.

X	X axis position
Y	Y axis position
Z	Z axis position
B	B axis position in degrees
CO	Work coordinate system number
F	Actual feedrate
S	Actual Spindle speed
H=	Tool length offset number
D=	Cutter radius compensation number
O	Currently active subprogram name
N	Sequence number (block number)
Gear	Spindle drive gear condition
Touch Sensor	Reverse display indicates the Touch Sensor is on.
Touch Probe	Reverse display indicates the Touch Probe is on.

The Load Status display screen on the right side of this display screen shows the load conditions of the spindle and individual axes.

The following data is on a third page of the Actual Position mode.

Local Coordinates	The distance referenced to the origin of the local coordinate system
Work Coords (APA)	The distance referenced to the origin of the work
Work Coords	coordinate system
Machine Coords	The distance referenced to the machine origin (zero offset)
Feedback Coords	Raw data coming from the absolute position encoder (RAPA)
Target Value	The programmed destination point
Distance Remaining	The distance remaining to the programmed destination point
Manual Shift Actual	The manual shift amount of axis in the current operation
Manual Shift Total	The total manual shift amount
Pitch Error Comp	Shows the pitch error compensation at the present position

A-Mtd This indicates the normal running operation method has been selected for the program being executed. B-Mtd would indicate a larger memory volume was selected.

BLOCK DATA

The block data soft key allows the operator to access the menus that show the programmed conditions of the machine one block at a time. The operator can see what block of information is being, or will be executed. The following pertains to 5000/5020L controls.

Lathe

The “CURRENT” screen shows the program data of the currently executed block.
The left side of the screen shows the G and M codes that are in effect. The following is a description of the data shown in the Block Data mode.

X	Target value of X axis
Z	Target value of Z axis
Xa	Target value of X axis in thread cutting mode
Za	Target value of Z axis in thread cutting mode
Xb	Starting point of thread cutting in X axis
Zb	Starting point of thread cutting in Z axis
Xc	Target point of thread cutting in X axis
Zc	Target point of thread cutting in Z axis
I	Programmed I value (radius of cut with respect to the X axis)
K	Programmed K value (radius of cut with respect to the Z axis)

Lathe

Ia End point of arc
Ka End point of arc
C Target value of C axis
F Programmed F value (feedrate)
Fa Programmed dwell time (G04)
E Programmed E value (specifies the lead variation rate per pitch)
S Programmed S value (spindle speed)
T Tool number
Ta Tool offset number
Tx Tool offset value with respect to X axis
Tz Tool offset value with respect to Z axis
P Programmed P value (synchronization command for 4 axes cutting)
W Target value for W axis
SB Rotary tool command
WA (on LT 15-M)
N Sequence name

The following data is shown on the right side of the screen no matter which menu is selected in the Block Data mode.

Sr	Actual spindle speed
Sm	Maximum spindle speed
fx	Feedrate of X axis in mm/min
fz	Feedrate of Z axis in mm/min
fm	Axis traverse speed in mm/min
fr	Axis traverse speed in mm/rev
Sb	Rotary tool spindle speed
Om	Main program name
Pr	Programmed number of main program repetitions
Pe	Actual number of programs executed
BC	Block counter (number of lines executed)
Buffer Data	
Full	Buffer register is full
Empty	Buffer register is empty

The three other menus in the Block Data mode are:

NEXT	Displays the data to be executed after the “CURRENT” data.
QUEUED	Displays the data to be executed after the “NEXT” data.
READ	Displays the latest block of data stored in the buffer register.

Machining Center

The Block Data menus on 5000/5020M controls are very similar to the menus on lathe controls. The four menus are labeled: “CURRENT”, “BUFFER”, “SECOND BUFFER”, and “THIRD BUFFER” on machining center controls. On some controls the fourth menu is labeled like the lathe controls, “READ”.

The block data soft key allows the operator to access the menus that show the programmed conditions of the machine one block at a time. The operator can see what block of information is being, or will be executed. The “CURRENT” screen shows the program data of the currently executed block. The left side of the screen shows the G and M codes that are in effect. The following is a description of the data shown in the Block Data mode on 5000/5020M controls.

X	Target value of X axis
Y	Target value of Y axis
Z	Target value of Z axis
B	Target value of B axis
I	Programmed I value (radius of cut with respect to the X axis)
J	Programmed J value (radius of cut with respect to the Y axis)
K	Programmed K value (radius of cut with respect to the Z axis)
F	Programmed F value (feedrate)
Fd	Feedrate command value (0.001mm/12.8msec)
Ft	Feedrate (F1 digit command option)
F1	Feedrate (F1 digit command option)(feedrate setting command)
S	Programmed S value (spindle speed)
Tc	Active tool number
Tn	Next tool number
M	M command value
H	Tool offset number
D	Cutter radius compensation number
Ha	Work coordinate system number
Np	Hole number in coordinate calculation
Hc	Work coordinate system number

The following data is shown on the right side of the screen no matter which menu is selected in the Block Data mode.

Sr	Actual spindle speed
So	Programmed spindle speed (overridden)
fm	Axis traverse speed in mm/min
fr	Axis traverse speed in mm/rev
Pr	Programmed number of main program repetitions
Pe	Actual number of programs executed
Nr	Hole number for restart
Ns	Sequence specified by the sequence stop

Cr	Number of times the subprogram is to be repeated
Ce	Number of times the subprogram has been repeated
BC	Block counter (number of lines executed)
EMPTY	No data in buffer register
EXIST	Data in buffer register

CHECK DATA

The check data soft key allows the operator to check the individual I/O's of the machine. From a maintenance standpoint, the check data mode is one of the most useful functions on the control. This mode can be accessed while the machine is in any of its three operation modes. The different menus are accessed by pressing the Page up or Page down buttons. The following menus pertain to the 5000/5020L controls.

Axis

This menu displays data related to the various axes on the machine. The menus are labeled "Axis (1)","Axis (2)", etc. A description of the data is provided.

RDIF	Following error of axis drives, difference between RCON and RAPA
RAPA	Actual position data coming from the absolute position encoder
RCON	The calculated actual position data
RSKP1	Coordinates of touch point (sensor 1)
RSKP2	Coordinates of touch point (sensor 2)
RSKP3	Coordinates of touch point (sensor 3)
RSKP4	Coordinates of touch point (sensor 4)
QSPPC	Spindle position (PG outputs 4096 pulses/rev)
RSVPVAR1	Servo processor variable
RSVPVAR2	Servo processor variable
RD6PRD	Output from a type F position encoder
RIDSYND	Inductosyn scale output data
RLASER	Output from a laser beam measuring device
RTRTM	Turret rotation time during tool change (The time duration from the moment the turret is unclamped and reclamped during a tool change.)
RLOAD	Displays the actual percentage of torque (load) on the servo motors
RHTRT	Rotation speed of a high-speed turret in rpm

Lathe

EC I/O's

The EC input and output screens show the status of the machine related electrical devices. An example of an EC input would be a signal from a proximity switch or a pressure switch. A confirmation signal is usually an EC input that the control is looking for before it moves on to its next operation. An example of an EC output is a signal coming out of the control to turn on a light or energize a solenoid.

MDI OPERATION N 0

CHECK DATA UNIT 1 INCH

EC INPUT 01:

no.	data	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
1	11101111	TCLA	CPA/	OPA/	OFA	TLAC	TLAB	TLAA	TLA9
2	00000010	TLA8	TLA7	TLA6	TLA5	TLA4	TLA3	TLA2	TLA1
3	10010001	TCLB	CHP2	CHP1	SPL5	SPL4	SPL3	SPL2	SPL1
4	00000100	TLB8	TLB7	TLB6	TLB5	TLB4	TLB3	TLB2	TLB1
5	11000110	SSP/	TSP/	STR	RST	DROP	SOA/	BOF	BOL
6	11100000	CCC2	CCC1	TSRT	TSLM	TSOA	TSRF	TSA2	TSA1
7	01011111	IN24	EOF/	SCSF	ALM/	APA/	SEA/	LOA/	LA/
8	11111111	SBA/	SLA/	SA/	TMA/	OHA/	OLA/	CBA/	ECON
9	00111001	OIL/	IILC	TLXF	TLZF	SPZ	SPC	CHOP	CHCL
10	11111111								
11	11001100	IDC/	TSP/	DROP	DRCL	CDA/	CDM	MANS	ESIN
12	10000000		MIN	EXOR	CTIM	TRST	LOTC		ESUE

=

DATA INPUT	ACTUAL POSIT	Part Program	BLOCK DATA			CHECK DATA	EXTEND
F1	F2	F3	F4	F5	F6	F7	F8

EC Extend I/O's

If a machine needs extra I/O's, an additional EC board is added to the control rack and these I/O's can be viewed in the Extended EC I/O menus.

Lathe

Panel I/O's

Panel inputs and outputs are the I/O's pertaining to the machine operation panel and any option panels the machine might have. These I/O signals communicate with the control via the CRP board. A button being pressed on the machine operation panel is an example of a panel input. An LED being turned on is an example of a panel output signal.

When an I/O signal is active ("high" or "1" or "true"), the signal name is shown in reverse display. Signal names with a forward slash (/) indicate these signals are normally active signals. This allows for quick diagnosis of a problem.

Spec Code

This menu shows which specification codes have been "turned on". These codes activate software files that are needed when certain options are purchased with the machine.

Machine Code

Only one of these machine codes will be on. This code tells the control what type of machine it is controlling. If the maintenance person is not sure of the machine type he or she can look at this menu to verify the type.

Machine Spec Code

These codes indicate the type of hardware applications or upgrades that have been added to the machine. These modifications are usually done during assembly.

Alarm Message List

This page shows what type of alarms have occurred. CPU and "P" type alarms are not displayed on this menu. The latest alarm is added to the top (No. 1) and the last one (No. 12) is dropped. The list can be cleared by typing in ALMC and pressing the **WRITE** button. If an accurate time is needed of when an alarm occurred, reset the time. The time and date can be reset by going into the Edit Aux. mode and pressing the F1 function key for the date and the Extend function key (F8) for the time.

Machining Center

The following information pertains to the 5000/5020M controls.

The display screens in the Check Data mode are numbered. The individual menus can be accessed by pressing the Page up or Page down keys or by using the “Search” command. Press the soft key SEARCH (F5) and input the desired page number then press the **WRITE** key.

Pressing the SEARCH key and immediately pressing the WRITE key will automatically bring up an index of the different menus in check data mode. Entering the number of the desired menu and pressing the WRITE key will access the desired menu. This is a faster way of accessing a certain menu in the check data mode.

Panel I/O’s

These I/O’s have the same function as the Panel I/O’s on the lathe controls.

NC I/O’s

These signals are used by the microprocessor on the main board to communicate with the rest of the machine. Because of the excellent diagnostic capability of the OSP control,

these I/O’s are rarely looked at when troubleshooting a problem.

Machine I/O’s

These I/O’s are equivalent to the EC I/O’s on the lathe controls. These signals monitor switch conditions and control solenoids and lamps on the machine itself.

Machine EX I/O’s

These signals are extended inputs and outputs that are used when extra Machine I/O’s are needed.

NC Spec Table

These specification codes are used to turn on the software files needed for the particular machine the OSP control is controlling.

MC Spec Table

These specification codes are used to tell the control what type of hardware the machine has. The machines’ Management Data Card will show which codes should be turned on. These specification codes are labeled EC spec codes on the Management Data Card.

NC Axis Data

This menu displays the data related to the NC servo drives(X,Y,Z). One page shows the ODIF, RAPA, and load percentage of the individual axes in larger letters. The data displayed on the other page is shown below.

RDIF	The difference between RCON and RAPA
ODIF	The RDIF when acc/dec is active
RCON	The calculated position
RAPA	Position encoder output
RSAPA	The raw data from the absolute position encoder when contact with the touch setter is detected.
RSVPVAR1	Servo data
RSVPVAR2	Servo data

Machine Axis Data

This menu shows the servo related data of the “EC controlled” axes. An example of these types of axes are the APC shifter arm and magazine axes. The data displayed is shown below.

RDIF	Difference between RCON and RAPA
RCON	Calculated value
RAPA	Encoder output
RCOM	The commanded value

CA	Carrier axis
MG1	Magazine axis
MG2	Magazine axis number 2
MG3	Magazine axis number 3
W	APC shifter arm axis

Pressing the “Extend” function key (F8) and then the “Axis Change” function key (F6) will show the W axis (pallet shifter arm) data.

Alarm List

This function is the same as the alarm list function on the lathe control.

System Variables

System variables are values the programmer can access through the control (NC) for checking the condition of the machine. For example, tool length and its diameter could be accessed through these variables. (VTOFH and VTOFD)

ALARMS

The OSP control is designed to make the most of its built-in computer capabilities. The self-diagnostics function of the control constantly monitors the internal conditions of the CNC. The control also monitors external conditions, such as machine conditions, program data, and operator input conditions. When a fault is detected, the control displays an alarm or error message. Depending on the severity of the alarm, the machine can be brought to a complete stop immediately or the work process can be completed and then the machine will stop.

When an alarm message is displayed, the alarm light on the NC operation panel turns on and the message is displayed on the 2nd line of the CRT.

CPU alarms are displayed on the central portion of the CRT. A CPU alarm will display an access address. This access address indicates which board the CPU was trying to access when the alarm occurred. Of the 8 digits displayed, only the six digits from the right are used when looking up which board was being accessed. It is important to know what type of main board is in the control rack (MB, MBII, MBIIA, or MBIIB) when checking the access address tables.

An error message is usually a warning that the operator has entered wrong data. This message is displayed on lines 19 to 22 on the CRT and the alarm light does not turn on. An error message is usually cleared as soon as another function is performed.

Machining centers also have a diagnostic message display function for ATC and APC operation. These message displays can be accessed by pressing the EXTEND (F8) function key and then the DIAGNOSIS (F5) function key. A description of these messages can be found in the Maintenance manual of the machine in question.

When deciphering what an alarm means, it is useful to know how to count in Hexadecimal. It is also useful to know how to convert from “hex” to binary or octal. The following is a brief explanation of the different numbering systems used in computer technology.

In decimal, each position to the left of the decimal point indicates an increased power of ten. In binary, base two, each place to the left signifies an increased power of two. The binary system represents all numbers as strings of the digits one and zero. Either digit represents a bit which is the smallest unit of information in a computer system. A nibble is four bits and a byte is eight bits. A word is two bytes (16 bits) and a long word is two words (32 bits). Any one of these units can occupy a single storage location and can be processed as a single unit by the computer. Hexadecimal is a base 16 numbering system. One Hexadecimal number represents four bits. Octal is a base eight numbering system. One Octal number represents three bits.

The following is a chart showing the different numbering systems.

Decimal	Binary	Hexidecimal	Octal
0	0000	0	0
1	0001	1	1
2	0010	2	2
3	0011	3	3
4	0100	4	4
5	0101	5	5
6	0110	6	6
7	0111	7	7
8	1000	8	10
9	1001	9	11
10	1010	A	12
11	1011	B	13
12	1100	C	14
13	1101	D	15
14	1110	E	16
15	1111	F	17

The following table gives an example of how to convert from one numbering system to another. The hexadecimal word “CE” is shown in the table below. This “hex word” converts to 11001110 in binary.

	bit 7	bit 6	bit 5	bit 4
	2^3	2^2	2^1	2^o
	8	4	2	1
binary	1	1	0	0
Hex	C			

bit 3	bit 2	bit 1	bit 0
2^3	2^2	2^1	2^o
8	4	2	1
1	1	1	0
E			

	bit 7	bit 6
	2^1	2^o
	1	1
Octal	3	

bit 5	bit 4	bit 3
2^2	2^1	2^o
0	0	1
1		

bit 2	bit 1	bit 0
2^2	2^1	2^o
1	1	0
6		

The following table provides a description of the different types of alarms the control can generate.

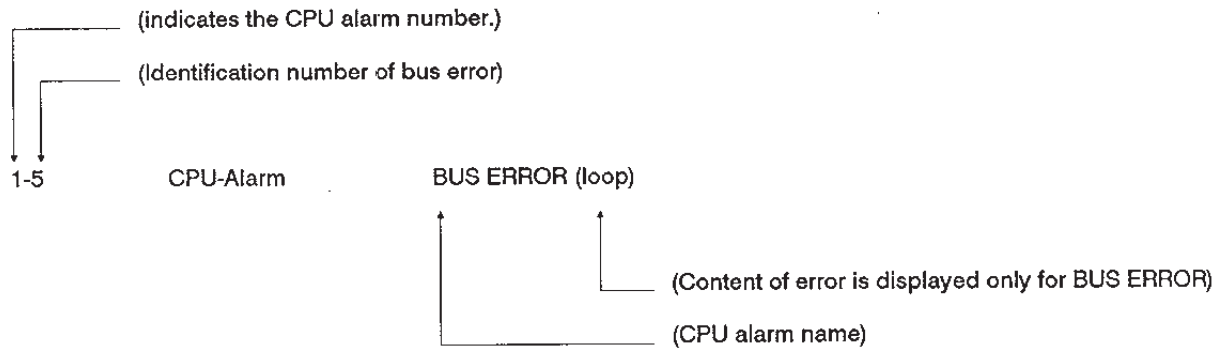
Alarm Type	Machine Condition	Possible Operations	Reset Procedure
CPU Alarm 1–15	All machine functions stop. CPU status is displayed on CRT.	No operations are possible. Changing display is not possible.	Power off and back on again. Replace defective part if necessary.
Alarm P 50–99	Same as above. Alarm # is displayed on CRT.	Same as above.	Same as above.
Alarm A 100–399 1100–1199 (L)	All axes movement stops.	Changing displays is possible. Machine operation is not possible.	Press the RESET button.
Alarm B 400–899	All commands in the currently executed block are completed.	Manual operations are possible. MDI and Auto operation are not possible.	Press the RESET button.
Alarm C 900–999 1900–1907 (L)	The program being executed will be completed. The control will stop the machine when it sees an M02 or an M30.	New programs cannot be executed until this alarm is reset.	Press the RESET button.
Alarm D W00–W***	All machining functions work normally.	All operations are possible.	The alarm state is cleared by removing the cause of the alarm.
Error Messages 2000–2999	Same as above.	Same as above.	Error messages are cleared as soon as another function is performed.

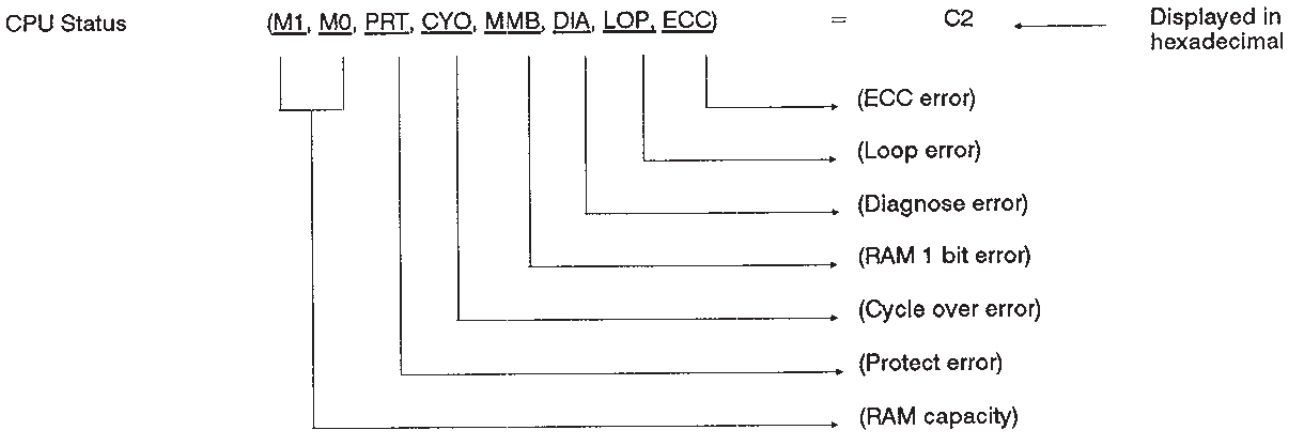
The following is an example of what appears on the screen when a CPU level alarm occurs.

```
1-1   CPU - ALARM  BUS  ERROR  (CYCLE OVER)
CPU  STATUS (M1,M0,PRT,CYO,MMB,DIA,LOP,ECC)  =  10
FUNCTION CODE  =  10A1          ACCESS ADDRESS  =  FFFF7E2A
INSTRUCTION REGISTER  =  10BC

D0 = 434E3000      D1 = 00010600      D2 = 434E3000      D3 = 00000000
D4 = 20200004      D5 = 80000000      D6 = 00000000      D6 = 00000000
A0 = FFFFDE90      A1 = 00001D0C      A2 = 000015B8      A3 = 0000A128
A4 = 00888000      A5 = 00880000      A6 = 00075B80      A7 = 00072FFC
US = 000762EC      SR = 00000004      PC = 000235E0


SBP MONITOR
>
```

If this alarm occurs, look up the access address displayed on the screen in the access address tables at the end of this section. Make sure to verify which vintage Main Board is in the machine. There are three different tables, one for the MB-IIB, MB-II & IIA and one for the original MB board. The board or card corresponding to the address having been accessed will most likely be faulty. If necessary replace the board or card to which the address points. The two left most digits are dropped when looking for the address.

Display Format of CPU Alarms (Bus Error)





Function code = 0836 Access address = 00FFE700 ← (Indicates the address the CPU has accessed.)

Instruction register = 0838 ← (Indicates the instruction latched.)

D0=43520000	D1=00000000	D2=0000000B	D3=00000210	(Indicates the data register D0 through D7.)
D4=0000000A	D5=00000000	D6=00000000	D7=00000000	
A0=FFFFCC06	A1=00000000	A2=00FFF7C7	A3=00000000	(Indicates the address register A0 through A7.)
A4=00000000	A5=00000000	A6=00000600	A7=000005E4	
US=00000000	SR=0000210D	PC=00FFE704		
(Indicates the user stack pointer.)	(Indicates the status register.)	(Indicates the program counter.)		

1	BUS ERROR

This alarm is caused when the bus error exception has occurred with the CPU. Display format is indicated on page 2.

Details of BUS error:

When the bus error occurs, the CPU status is displayed in hexadecimal numbers.

At the same time, the red LED at the CPU rack lights up.

The bus error includes the following five types of errors:

1) Cycle time over error
2) ECC error
3) Protect error
4) Loop error
5) Double-bus error

Note: Error display is not available in the case of double-bus error.

Index	None
Character-string	None
Code	CPU status
Probable Faulty Locations	Printed circuit boards
	Mother board
	Loose card edge connector connection
	Loose flat cable connection
	Switch settings
Measures to Take	Depending on the type of error encountered, check the following points.

1) ECC error . . . . . MB, MC1, MC5, MC9, MC11, MC12
2) Protect error . . . . . MBII
3) Cycle timer over error . Judge the faulty PCB from the access address.
4) Loop error . . . . . PCB which generates the interruption in question; judge the interruption level from the status register.
5) Double-bus error . . . . . All PCB's

Then, carry out the following steps.

1) Check the switch settings.

   Make sure that the boards are free of foreign material.

   Make sure that flat cables are inserted correctly.

   Make sure that card edge connectors are clean.
2) Change the card insertion slots; check if the problem occurrence status changes.
3) Replace the suspicious boards.

Access Address (MB II B)

Address	Board and Card
000000 - 07FFFF	Main card 11 (first) or 12 (first)
080000 - 0FFFFF	Main card 11 (second) or 12 (first)
100000 - 17FFFF	Main card 11 (third) or 12 (first)
180000 - 1FFFFF	Main card 12 (first)
200000 - 3FFFFF	Main card 12 (second) or (first)
400000 - 5FFFFF	Main card 12 (third) or (first)
600000 - 7FFFFF	Not-used area
800000 - 8FFFFF	Main card 10
900000 - AFFFFF	Not-used area
800000 - BOFFFF	Main board IIB
B10000 - CFFFFF	Not-used area
D00000 - D1FFFF	CCP board or CCP card (eighth)
D20000 - D3FFFF	CCP board or CCP card (seventh)
D40000 - D5FFFF	CCP board or CCP card (sixth)
D60000 - D7FFFF	CCP board or CCP card (fifth)
D80000 - D9FFFF	CCP board or CCP card (fourth)
DA0000 - DBFFFF	CCP board or CCP card (third)
DC0000 - DDFFFF	CCP card (second)
DE0000 - DFFFFF	CCP board or CCP card (first)
E00000 - E77FFF	Not-used area
E78000 - E7FFFF	CRP board 9
E80000 - EFFFFF	ECP board II 9 (second)
F00000 - F7FFFF	ECP board II (first)
F800000 - F87FFF	SVP board II (first)
F88000 - F8FFFF	SVP board II (second)
F90000 - F97FFF	SVP board II (third)
F98000 - F9FFFF	SVP board II (fourth)
FA0000 - FA7FFF	SVP board II (fifth)
FA8000 - FAFFFF	Timing board
FB0000 - FCFFFF	CRP board II
FD0000 - FEFFFF	Not used area
FF0000 - FF7FFF	System I/O area
FF8000 - FFCFFF	Not-used area
FFD000 - FFDFFF	Local I/O area
FFE000 - FFFFF	Not-used area

Address	Board and Card *1
F00000 - F1FFFF	ECP board II and Card 1-II (volatile RAM)
F20000 - F77FFF	Not-used area
F78000 - F7BFFF	ECP board II and card 1-II (non-volatile RAM)
F7C000 - F7CFFF	Main card 2 (panel 1F)
F7D000 - F7DE3F	Not-used area
F7DE40 - F7DE5F	ECP card 4-II
F7DE60 - F7DEF7	ECP card 3 (PG, EC I/O)
F7DE80 - F7DEBF	Main card 3 (RS232C)
F7DECO - F7DEDF	Main card 3 (puncher, centronics)
F7DEE0 - F7DEFF	ECP card 2 (EC I/O)
F7DF00 - F7DF3F	Not-used area
F7DF40 - F7DF5F	ECP card 4-II
F7DF60 - F7DF9F	Not-used area
F7DFA0 - F7DFBF	Main card 2-II of main card 2, 4
F7DFCO - F7DFFF	Not-used area
F7E000 - F7FCFF	User-inhibited area
F7FD00 - F7FFFF	ECP board II(D/A, R1C, encoder, ECBUS)

Address	Board and card *2
FFD000 - FFD05F	IJP card 3
FFD060 - FFDO7F	IJP card 5
FFD080 - FFD09F	IJP card 6
FFD0A0 - FFD0BF	Not-used area
FFD0C0 - FFD0FF	Main card 14
FFD100 - FFDCFF	Not-used area
FFDD00 - FFDE1F	Main board IIB
FFDE20 - FFDE5F	Main card 7
FFDE60 - FFDE7F	Not-use area
FFDE80 - FFDEBF	Main card 13
FFDEC0 - FFDEDF	Main board IIB
FFDEE0 - FFDEEF	ECP card 2 (first)
FFDEF0 - FFDEFF	ECP card 2 (second)
FFDF00 - FFDFBF	Main board IIB
FFDFCO - FFDFEF	Main board IIB, bubble card
FFDFF0 - FFDFFF	Main board, bubble card, main card 6, BE board

Address	Board and card
FF0000 - FF003F	CRT board (for 300 panel for OH)
FF0040 - FF6FFF	Not-used area
FF7000 - FF77FF	ECBUS board
FF7800 - FF78FF	RS board (sixth)
FF7900 - FF79FF	RS BOARD (fifth)
FF7A00 - FF7AFF	RS BOARD (fourth)
FF7B00 - FF7BFF	RS BOARD (third)
FF7C00 - FF7CFF	RS BOARD (second)
FF7D00 - FF7DFF	RS BOARD (first)
FF7E00 - FF7E0C	EC BOARD (E0)
FF7E10 - FF7E1F	EC BOARD (E1) or EC Card
FF7E20 - FF7E2F	EC BOARD (E2) or EC Card
FF7E30 - FF7E3F	EC BOARD (E3) or EC CARD
FF7E40 - FF7E7F	HC BOARD (MOP unit)
FF7E80- FF7EBF	DATA BOARD (RS-232C 1ch.)
FF7EC0 - FF7EDF	DATA BOARD (RS-232C 2ch.)
FF7EE0 - FF7EFF	DATA BOARD or FDC BOARD
FF7F00 - FF7F1F	DATA BOARD (printer: centronics)
FF7F20 - FF7F3F	Graphic board IG or graphic board
FF7F40 - FF7F5F	HDC board
FF7F60 - FF7F7F	OSP500 CRP board
FF7F80 - FF7F9F	Not-used area
FF7FA0 - FF7FBF	Not-used area
FF7FC0 - FF7FDF	(for DNC)
FF7FE0 - FF7FFF	OSP5 (remote display unit)

*** 1** Addresses of main cards are those when they are mounted on ECP board II.

***2** Addresses of IJP cards and ECP cards are those when they are mounted on main board II.

***3** Two digits from the left are ignored. Six digits from the right are effective.

Access Address (MB II, MB II A)

Address	Board and Card
000000 - 07FFFF	Main board II
080000 - 0FFFFF	Main card 1-II or 5-II
100000 - 1FFFFF	Main card 5-II
200000 - AFFFFF	Use-inhibited area
B00000 -B00007	Main board II
B00008 - B03FFF	Main board II
B04000 - B07FFF	Not-used area
B08000 - BFFFFF	User inhibited area
C00000 - E77FFF	Not-used area
E78000 - E7FFFF	OSP5 CRP board (RX-CRP board)
E80000 - EFFFFF	ECP board II (second)
F00000 - F7FFFF	ECP board II (first) or IJP board
F80000 - F87FFF	SVP board II (first)
F88000 - F8FFFF	SVP board II (second)
F90000 - F97FFF	SVP board II (third)
F98000 - F9FFFF	SVP board II (fourth)
FA0000 - FA7FFF	SVP board II (fifth)
FA8000 - FAFFFF	Timing board
FB0000 - FCFFFF	CRP board II
FD0000 - FEFFFF	Not-used area
FF0000 - FF7FFF	System I/O area
FF8000 - FFBFFF	AXIS board
FFC000 - FFCFFF	Operation panel for OSP5000M-G
FFD000 - FFDFFF	Local I/O area
FFE000 - FFFFFF	Not-used area

Address	Board and Card *1
F00000 - F1FFFF	ECP board II and Card 1-II (volatile RAM)
F20000 - F77FFF	Not-used area
F78000 - F7BFFF	ECP board II and card 1-II (non-volatile RAM)
F7C000 - F7CFFF	Main card 2 (panel 1F)
F7D000 - F7DE3F	Not-used area
F7DE40 - F7DE5F	ECP card 4-II
F7DE60 - F7DEF7	ECP card 3 (PG, EC I/O)
F7DE80 - F7DEBF	Main card 3 (RS232C)
F7DECO - F7DEDF	Main card 3 (puncher, centronics)
F7DEE0 - F7DEFF	ECP card 2 (EC I/O)
F7DF00 - F7DF3F	Not-used area
F7DF40 - F7DF5F	ECP card 4-II
F7DF60 - F7DF9F	Not-used area
F7DFA0 - F7DFBF	Main card 2-II of main card 2, 4
F7DFCO - F7DFFF	Not-used area
F7E000 - F7FCFF	Use-inhibited area
F7FD00 - F7FFFF	ECP board II(D/A, R1C, encoder, ECBUS)

Address	Board and Card *2
FFD000 - FFD05F	IJP card 3 (AD)
FFD060 - FFDO7F	IJP card 5 (DA, PHP, FEED-P)
FFD080 - FFD09F	IJP card 6 (differential transformer)
FFD0A0 - FFDCFF	Not-used area
FFDD00 - FFDE1F	Main board II (DMA)
FFDE20 - FFDE5F	Main card (RS-422)
FFDE60 -FFDE7F	Main board 2-II (general purpose switch)
FFDE80 - FFDEBF	Main board 3 (RS232C)
FFDEC0 - FFDEDF	Main board 3 (FACIT punch)
FFDEE0 - FFDEFF	ECP card 2
FFDF00 - FFDE1F	Main board II
FFDF20 - FFDF5F	(Main board)
FFDF60 - FFDF9F	Main board II (RTC, PTM,DIA)
FFDFA0 - FFDFBF	Main card 2-II (PTR) or (Main card 2,4)
FFDFCO - FFDFCF	Main board II (bubble card (first))
FFDFD0 - FFDFDF	Main board II (bubble card (common))
FFDFEO - FFDFEF	Main board II (bubble card (second))
FFDFF0 - FFDFFF	Main board II, Main card 6, BE board (bubble card)

Address	Board and Card	Address	Board and Card
FF0000 - FF003F	CRT board (for 300 panel for OH)	FF7E30 - FF7E3F	EC BOARD (fourth) or EC CARD
FF0040 - FF6FFF	Not-used area	FF7E40 - FF7E7F	HC BOARD (MOP unit)
FF7000 - FF77FF	ECBUS board	FF7E80- FF7EBF	DATA BOARD (RS-232C 1ch.)
FF7800 - FF78FF	RS board (sixth)	FF7EC0 - FF7EDF	DATA BOARD (RS-232C 2ch.)
FF7900 - FF79FF	RS BOARD (fifth)	FF7EE0 - FF7EFF	DATA BOARD or FDC BOARD
FF7A00 - FF7AFF	RS BOARD (fourth)	FF7F00 - FF7F1F	DATA BOARD (printer: centronics)
FF7B00 - FF7BFF	RS BOARD (third)	FF7F20 - FF7F3F	Graphic board IG or graphic board
FF7C00 - FF7CFF	RS BOARD (second)	FF7F40 - FF7F5F	HDC board
FF7D00 - FF7DFF	RS BOARD (first)	FF7F60 - FF7F7F	OSP500 CRP board
FF7E00 - FF7E0C	EC BOARD (first)	FF7F80 - FF7F9F	Not-used area
FF7E10 - FF7E1F	EC BOARD (second) or EC Card	FF7FA0 - FF7FBF	Not-used area
FF7E20 - FF7E2F	EC BOARD (third) or EC Card	FF7FC0 - FF7FDF	(for DNC)
		FF7FE0 - FF7FFF	OSP5 (remote display unit)

*** 1** Addresses of main cards are those when they are mounted on ECP board II.

***2** Addresses of IJP cards and ECP cards are those when they are mounted on main board II.

***3** Two digits from the left are ignored. Six digits from the right are effective.

Access Address (MB) (OSP5000)

Address	Board and Card
000000 - 07FFFF	Main board
020000 - 03FFFF	Main card 1 or 5
040000 - 07FFFF	Main card 5
080000 - EFFFFF	User-inhibited area
F00000 - F3FFFF	ECP board (second)
F40000 - F7FFFF	ECP board (first)
F80000 - F87FFF	SVP board (first)
F88000 - F8FFFF	SVP board (second)
F90000 - F97FFF	SVP board (third)
F98000 - F9FFFF	SVP board II (fourth)
FA0000 - FA7FFF	SVP board II (fifth)
FA8000 - FAFFFF	Timing board
FB0000 - FCFFFF	CRP board (OSP500L)I
FD0000 - FEFFFF	Not-used area
FF0000 - FF7FFF	System I/O area
FF8000 - FFBFFF	AXIS board
FFC000 - FFCFFF	Main card 2 or main card 4 (OSP5000)
FFD000 - FFDFFF	Local I/O area
FFE000 - FFFFFF	Main board

Address	Board and Card *1
F40000 - F5FFFF	ECP board, ECP Card 1
F60000 - F77FFF	Not-used area
F78000 - F79FFF	ECP board and ECP card 1
F7A000 - F7BFFF	Not-used area
F7C000 - F7CFFF	Main card 2
F7D000 - F7DE3F	Not-used area
F7DE40 - F7DE4F	ECP card 4
F7DE50 - F7DE5F	Not used area
F7DE60 - F7DEF7	ECP card 3
F7DE80 - F7DEDF	Main card 3
F7DEE0 - F7DEEF	ECP card 2 (first)
F7DEF0 - F7DEFF	ECP card 2 (second)
F7DF00 - F7DF9F	Not-used area
F7DFA0 - F7DFBF	Main card 2
F7DFCO - F7FCFF	Not-used area
F7FD00 - F7FFFF	ECP board

*** 1** Addresses of main cards are those when they are mounted on ECP board.

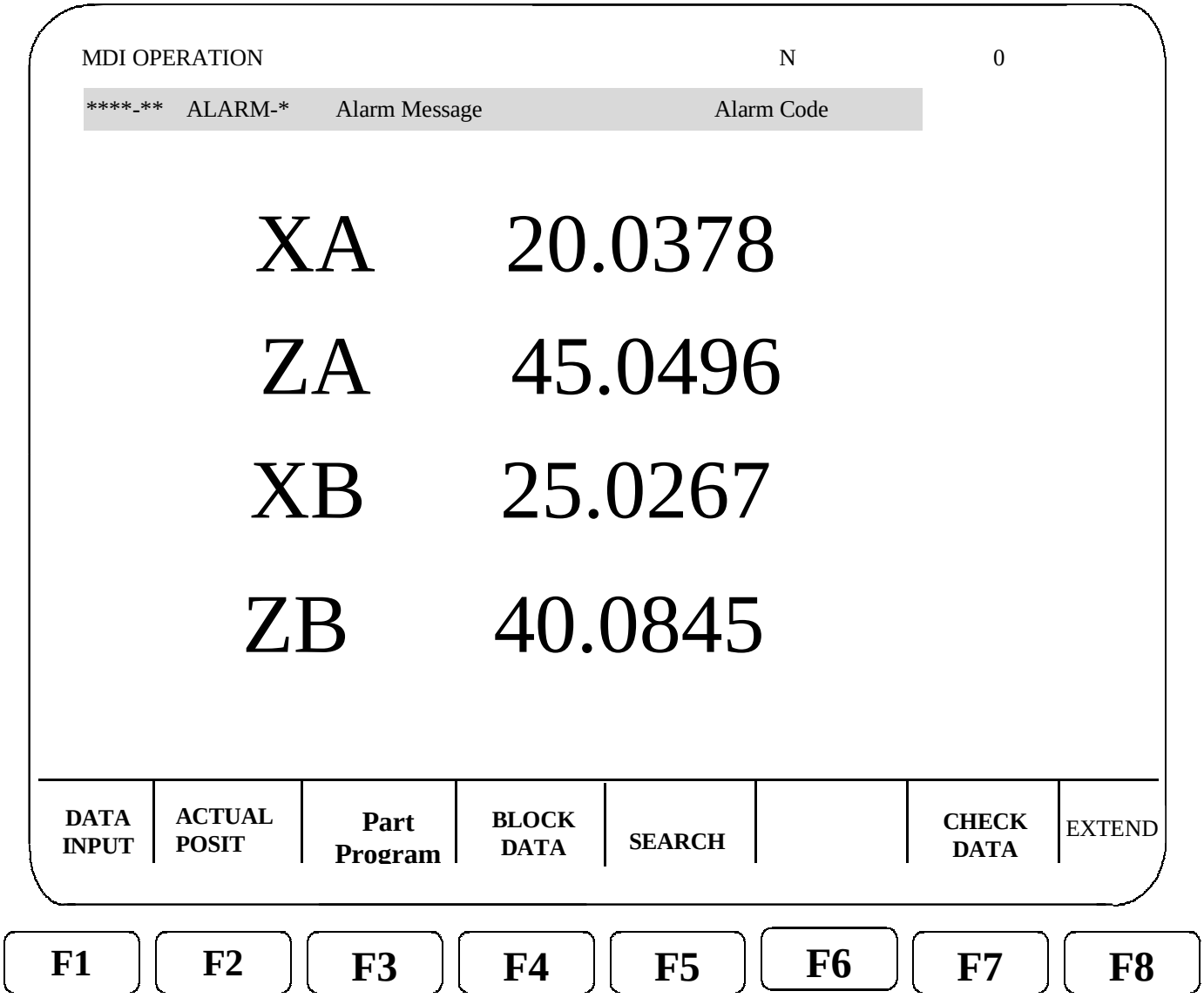
***2** Two digits from the left are ignored. Six digits from the right are effective.

Address	Board and Card *2
FF8000 - FF9FFF	AXIS board
FFA000 - FFBCFF	Not-used area
FFBD00 - FFBD3F	AXIS board
FFB040 - FFBD4F	AXIS card 3
FFBD50 - FFBD5F	AXIS card 4
FFBD60 - FFBD7F	Not-used area
FFBD8F - FFBD9F	AXIS card 6
FFBDA0 - FFBDBF	AXIS card 1
FFBDC0 - FFBDDF	AXIS board, Axis card, Axis card 4
FFBDE0 - FFBDFF	AXIS board
FFBE00 - FFBFFF	AXIS board, AXIS card 1

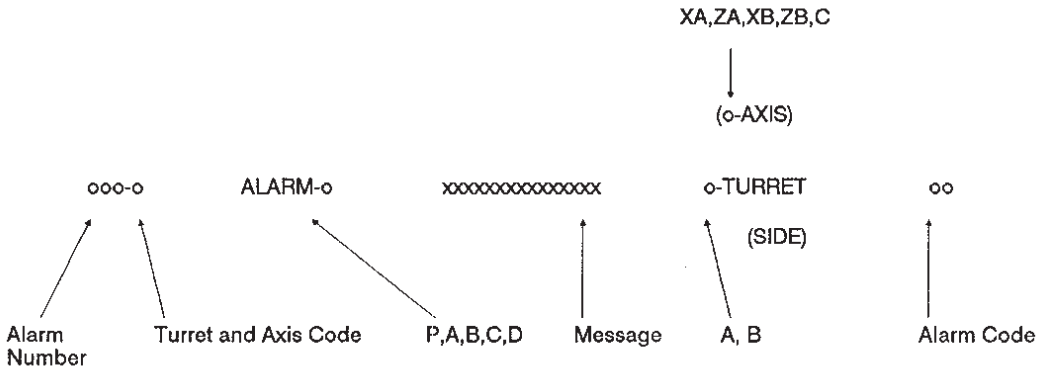
Address	Board and Card *2
FFD000 - FFD05F	IJP card 3
FFD060 - FFDO7F	IJP card 5
FFD080 - FFD09F	IJP card 6
FFD0A0 - FFDCFF	Not-used area
FFDD00 - FFDE1F	Main board
FFDE20 - FFDE5F	Main card 7
FFDE60 -FFDE7F	Not-used area
FFDE80 - FFDEBF	Main card 3
FFDEE0 - FFDEEF	ECP card 2 (first)
FFDEF0 - FFDEFF	ECP card 2 (second)
FFDF00 - FFDF9F	Main board
FFDFA0 - FFDFBF	Main card 2 or 4
FFDFC0 - FFDFEF	Main board, bubble card
FFDFF0 - FFDFFF	Main board, Bubble card, Main card 6, BE board

Address	Board and Card		
FF0000 - FF003F	CRT board (for 300 panel for OH)	FF7E30 - FF7E3F	EC BOARD (fourth) or EC CARD
FF0040 - FF6FFF	Not-used area	FF7E40 - FF7E7F	HC BOARD (MOP unit)
FF7000 - FF77FF	ECBUS board	FF7E80- FF7EBF	DATA BOARD (RS-232C 1ch.)
FF7800 - FF78FF	RS board (sixth)	FF7EC0 - FF7EDF	DATA BOARD (RS-232C 2ch.)
FF7900 - FF79FF	RS BOARD (fifth)	FF7EE0 - FF7EFF	DATA BOARD or FDC BOARD
FF7A00 - FF7AFF	RS BOARD (fourth)	FF7F00 - FF7F1F	DATA BOARD (printer: centronics)
FF7B00 - FF7BFF	RS BOARD (third)	FF7F20 - FF7F3F	Graphic board IG or graphic board
FF7C00 - FF7CFF	RS BOARD (second)	FF7F40 - FF7F5F	HDC board
FF7D00 - FF7DFF	EC BOARD (first)	FF7F60 - FF7F7F	OSP500 CRP board
FF7E00 - FF7EOF	RS BOARD (first)	FF7F80 - FF7F9F	Not-used area
FF7E10 - FF7E1F	EC BOARD (second) or EC Card	FF7FA0 - FF7FBF	Not-used area
FF7E20 - FF7E2F	EC BOARD (third) or EC Card	FF7FC0 - FF7FDF	(for DNC)
		FF7FE0 - FF7FFF	OSP5 (remote display unit)

The following is an example of how an alarm is displayed on the 2nd line of the CRT when an alarm occurs. The 1st group of asterisk on the left display the alarm number and axis code. This axis code indicates which axis the alarm is being generated by if any. To the right of the alarm number and axis code, the alarm level is displayed followed by a message. Then to the far right is the alarm code. This code is in a hexadecimal format and sometimes needs to be converted to a binary format to decipher the source of the problem. Look up the alarm in the "Alarm & Error List" manual for an explanation of the alarm.



Display Format of Alarm P, A, B, C and D



When an alarm has occurred, it is displayed on the CRT in the format as shown above.

The turret and axis code indicates the spindle or the axis involved in the alarm and it has the same meaning as o-TURRET and/or o-AXIS displayed after the message.

Turret and axis code:

None	No distinguishing on turret and axis
1	A-turret (A-side)
2	B-turret (B-side)
3	XA- or X-axis
4	ZA- or Z-axis
5	XB-axis
6	ZB-axis
7	C-axis
8	MA-axis
9	MB-axis
10	MC-axis
11	MS-axis
12	W-axis

Note: Display of A-TURRET and B-TURRET is available only with the two-saddle model.
Display of A-SIDE and B-SIDE is available only with the two-spindle model.

Alarm Codes:

In this manual, alarm codes are explained using such as "X", "XX", and "XXYY".

Explanation is given in the following methods:

1) The alarm code indicated in this text can be used directly as the key to find the contents of error.
2) The alarm code indicated in this text should first be converted into bit expression (pattern), which is then used as the key to find the contents of error.

The procedure to convert the alarm code into bit pattern is shown below.

Bit conversion method:

Hexadecimal (alarm code to be displayed)	Bit Pattern
0	0 0 0 0
1	0 0 0 1
2	0 0 1 0
3	0 0 1 1
4	0 1 0 0
5	0 1 0 1
6	0 1 1 0
7	0 1 1 1
8	1 0 0 0
9	1 0 0 1
A	1 0 1 0
B	1 0 1 1
C	1 1 0 0
D	1 1 0 1
E	1 1 1 0
F	1 1 1 1

How to check alarm contents:

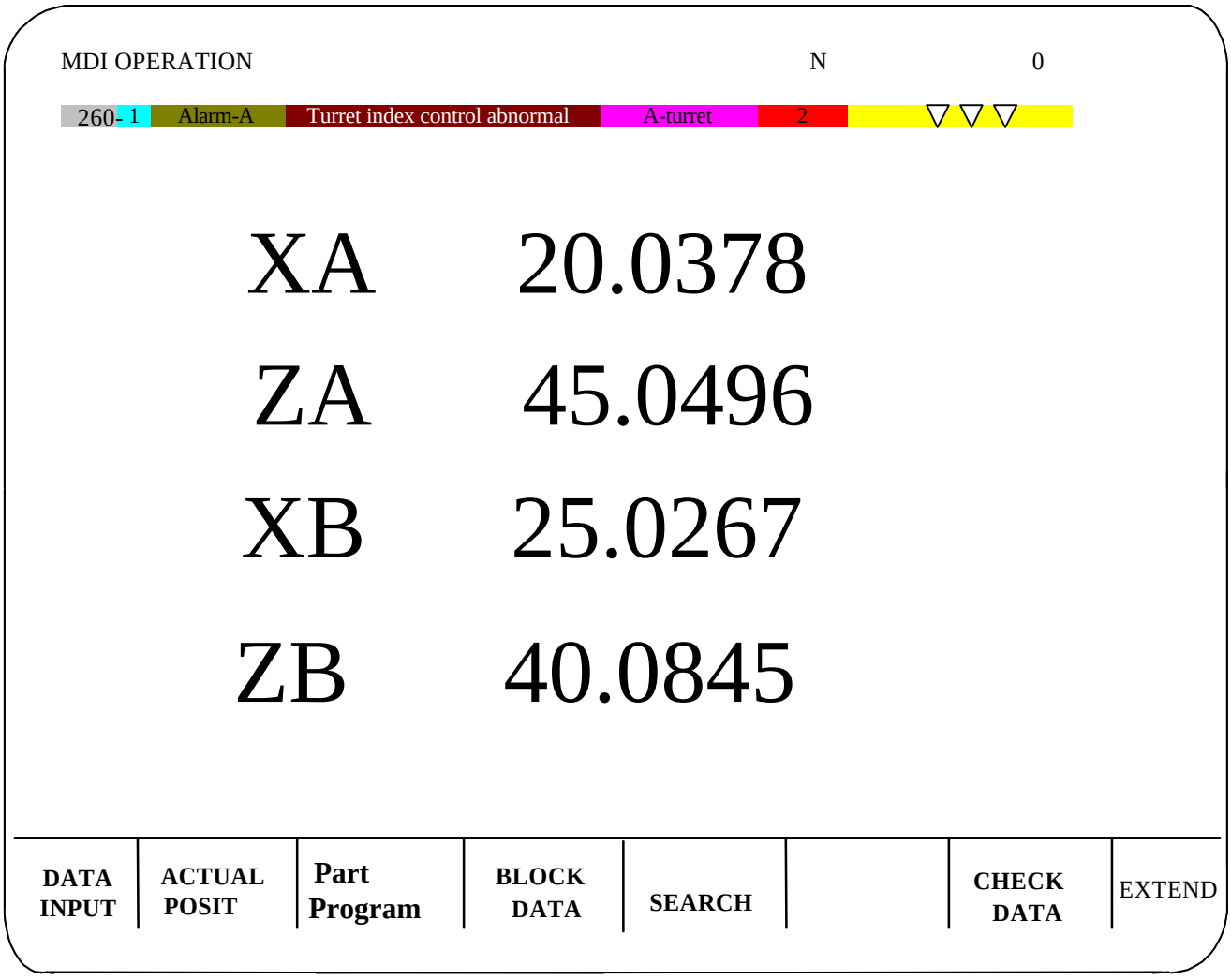
The method to find the details of the alarm indicated by the bit pattern is explained below using an example.

Example: Code: XX

XX	bit 0	Battery error
	bit 1	EC I/O power shut off error
	bit 2	ECC error
	bit 3	Not used
	bit 4	Not used
	bit 5	EDRQ INT signal
	bit 6	ECP INT signal
	bit 7	ECP RUN signal

If an alarm occurs, a hexadecimal number is displayed. If "$C1" is displayed, for example, first convert this "$C1" into bits.

After the conversion, it is known that bit 0, bit 6, and bit 7 are ON. See the information above and you will find that these error codes correspond to "battery error", "ECP INT signal", and "ECP RUN signal", respectively.


MDI OPERATION
N
0
260- 1
Alarm-A
Turret index control abnormal
A-turret
2
XA 20.0378
ZA 45.0496
XB 25.0267
ZB 40.0845
DATA INPUT
ACTUAL POSIT
Part Program
BLOCK DATA
SEARCH
CHECK DATA
EXTEND
F1
F2
F3
F4
F5
F6
F7
F8

3274-E P-17

<Alarm P>

60	ECP bus error

Bus error and ECC error are detected while the ECP memory is cleared and initialized after the EC processor has started.

Index — None

Character-string — None

Code — XXYY

YY:

Bit 2 ..... Position encoder busy error
Bit 3 ..... Oscillation stop error
Bit 4 ..... Loop error
Bit 5 ..... Cycle over error
Bit 6 ..... Parity error
Bit 7 ..... ECC error

XX:

Bit 0 ..... Battery error
Bit 1 ..... EC I/O power off error
Bit 2 ..... ECC error
Bit 5 ..... EDRQ INT signal
Bit 6 ..... ECP INT signal
Bit 7 ..... ECP RUN signal

Probable Faulty Locations — - ECP board
- Battery

61	EC bus EC I/O power

Power supply to the EC I/O rack connected to EC bus is off, or its voltage is low.

Index — None

Character-string — None

Code

Bit 2..... Power supply to I/O rack at CH1
Bit 3..... Power supply to I/O rack at CH2
Bit 4..... Clock signal generation

62	EC bus clock start stop

Clock signals for scanning EC bus are not generated.

Index — None

Character-string — None

Code

Bit 2..... Power supply to I/O rack at CH1
Bit 3..... Power supply to I/O rack at CH2
Bit 4..... Clock signal generation stopped

64	Peripheral processor start

A problem occurs with the peripheral processor when the NC operation is started, resulting in no response within a preset period.

Index None

Character-string None

Code XY

X = 1 . . . . . EC processor 1 (robot)

X = 2 . . . . . Axis processor

X = 3 . . . . . Servo processor

X = 4 . . . . . EC processor 2 (ATC)

X = 5 . . . . . PSC processor for cam turning

Y

Sequence count value until the response from the peripheral processor is received

65	SVP start

The servo processor has failed to function correctly at the start of the control (cycle start).

Index None

Character-string None

Code XXYYZZZZ

XX:

1 . . . . . APA pattern data alarm
→ ZZZZ:APA upper-digit data

2 . . . . . APA velocity alarm
→ ZZZZ:APA variation absolute value

6 . . . . . APA check data alarm
→ ZZZZ:Calculated upper-digit data

8 . . . . . Servo data alarm
→ ZZZZ:Abnormal servo data code (see below)

A . . . . . Type F position encoder error compensation data alarm
→ ZZZZ:Code indicating the cause of abnormality (see below)

E . . . . . Insufficient RAM memory capacity for pitch error compensation
→ ZZZZ:RAM memory capacity code (see below)

F . . . . . Type of the motor mounted position encoder is not correct
→ ZZZZ:Encoder type code, accuracy designating code (see below)

11 to 24 . . . . . Refer to Alarm A 200.

FF . . . . . CPU stop
→ ZZZZ:Servo processor status (refer to Alarm A 200)

YY:

00 . . . . . ZA-axis

01	XA-axis
02	ZB-axis
03	XB-axis
04	C-axis
05	MA-axis (M-axis on the A-turret)
06	MB-axis (M-axis on the B-turret)
07	MC-axis (M-axis on the 3rd turret)
08	MS-axis (sub-spindle axis)
09	W-axis

Code of abnormal servo data

ZZZZ:

0001	Compensation code A
0002	Compensation code B
0003	Compensation code C
0004	Compensation code D
0011	Integration limit code
0012	Torque limit code A
0013	Torque limit code B
0014	Velocity amplifier gain
0019	Speed reduction ratio
0021	KV value
0022	Hard servo coefficient
0023	Slow up/slow down coefficient
0039	Backlash
FFFF	SVP specification code
003A	CON velocity limit

Code indicating the cause of abnormality

ZZZZ:

0001	Compensation data collection disabled (The NC is started by pressing the **RESET** button)
0002	Sum check error
0003	Compensation data code error
0004	Overflow in converting the compensation data to absolute values.
0005	Compensation data pattern error

RAM memory capacity code

ZZZZ:

0001	16 Kbyte
0002	64 Kbyte
0003	128 Kbyte
0004	256 Kbyte

Encoder type code/Accuracy designating code

Encoder type code

01	Type E
02	Type F, Type G
05	Type FB
FF	Identification disabled

Accuracy designating code

00	Encoders other than the type E can be used
01	Any encoder can be used
02	Only the type FB can be used.

Probable Faulty Locations

The servo data setting alarm occurs when the servo data (stored in the bubble memory) of the machine and the SVPROM version do not match each other.

The error compensation data alarm with the type F position encoder occurs when the ROM and the position encoder type do not match each other, for example, type E position encoder is used with the type F compatible SVPROM. Or an error occurs with the type F position encoder.

66	Timing generator stop

The source oscillation for the timing generator on the timing control board has stopped.

Index: None

Character-string: None

Code: XX: Timing board status

Bit 5	Oscillation stop for timing generator

Probable Faulty Locations: Timing board

121	Tool number input

The tool number of the turret is not input as specified.

* The turret tool number input signals differ depending on machine models. Refer to the description below.

LC series
LH series
LS series
} Bit 0 - bit 7 of EC input No. 2 correspond to tool numbers 1 - 8.
Bit 0 - bit 3 of EC input No. 1 correspond to tool numbers 9 - 12.

LB10
LB15 (machine #1 - #2760)
LP15
} See Table 1.

LB15 (machine #2761-)
LC20 (with slight change)
} See Table 2.

Table 1 LB10/LB15 (#0 - #2760)/LP15

EC Input Bit / Tool No.	EC Input 01: No. 2							
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	0	0	0	0	0	0	1	1
2	0	0	0	0	0	1	0	1
3	0	0	0	0	1	0	0	1
4	0	0	0	1	0	0	0	1
5	0	0	0	1	1	1	0	1
6	0	0	0	1	1	0	1	1
7	0	0	0	1	0	1	1	1
8	0	0	0	0	1	1	1	1
9	0	1	0	0	1	0	1	1
10	0	1	0	1	0	1	0	1
11	0	0	1	1	0	1	0	1
12	0	0	1	0	1	0	1	1

Table 2 LC20 (after slight change)/LB15 (#2761 -)

EC Input Bit / Tool No.	EC Input 01: No. 2							
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
1	0	0	0	0	0	0	1	1
2	0	0	0	0	1	0	0	1
3	0	0	0	0	0	1	0	1
4	0	0	0	1	0	0	0	1
5	0	0	0	1	0	1	1	1
6	0	0	0	1	1	1	0	1
7	0	0	0	0	1	1	1	1
8	0	0	0	1	1	0	1	1
9	0	1	0	1	0	0	1	1
10	0	1	0	0	1	1	0	1
11	0	0	1	0	1	1	0	1
12	0	0	1	1	0	0	1	1
13	0	1	0	0	0	1	1	1
14	0	1	0	1	1	0	0	1
15	0	0	1	0	0	1	1	1
16	0	0	1	1	1	0	0	1

Table 3 LB9

EC Input Bit / Tool No.	EC Input 01: No. 2							
	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
T1	0	0	0	0	0	0	1	0
T2	0	0	0	0	1	0	0	0
T3	0	0	0	0	0	1	0	0
T4	0	0	0	0	0	0	0	0
T5	0	0	0	0	0	1	1	0
T6	0	0	0	1	1	1	0	0
T7	0	0	0	0	1	1	1	0
T8	0	0	0	1	1	0	1	0
Limit	–	–	–	LS5T	LS4T	LS3T	LS2T	LS1T

Index	SPINDLE	
Character-string	None	
Code	XXX	Tool No. input when the alarm has occurred (hexadecimal)
Probable Faulty Locations	Turret related limit switches	
	Turret related wiring	
Measures to Take	Check the limit switches and wiring related with the turret.	

201	Servo amp

This alarm is indicated when an alarm has occurred with the BDU unit (red LED at SVC board ON). This alarm occurs by the following two causes:

1) Alarm with the BDU-A unit
2) Alarm with the DC-PS unit (LV alarm of the BDU-A unit always ON)

Alarm indication of the BDU-A and DC-PS is explained below:

A) BDU-A

PH-LOSS	Phase missing in 3-phase input power
VR-LOSS	±12 V power for PCB has dropped to a value below 80% of the rated voltage
IOCM	More than 120% of motor rated current flowed
IOCS	More than 120% of transistor rated current flowed through the transistor bridge.
HV	DC power supply voltage becomes higher than 450 V.
LV	DC power supply voltage becomes lower than 200 V.

B) DC-PS

HV, LV, PH-LOSS	Same as the BDU-A
OVER DIS	Discharge circuit of the regeneration circuit has actuated for more than the specified period.

Index	AXIS, TURRET
Character-string	None
Code	ZZZZ: With this alarm, servo processor status information is not used.

Probable Faulty Locations

A) BDU-A

PH-LOSS	BDC BOARD or BOARD fuse
VR-LOSS	BDC BOARD or SVC BOARD
IOCM, IOCS	BDU unit
HV, LV	BDU unit or DC-PS unit

B) DC-PS

PH-LOSS	PCB BOARD
HV, LV, , OVERDIS	PCB or DC-PS unit

Measures to Take

A) BDU-A

PH-LOSS	Replace BDC BOARD fuse; replace BDC BOARD.
VR-LOSS	Replace BDC BOARD; replace SVC BOARD.
IOCM, IOCS	Replace BDU unit.
HV, LV	Replace BDU unit; replace DC-PS unit.

B) DC-PS

PH-LOSS	Replace PCB fuse or PCB.
HV, LV, OVERDIS	Replace PCB or DC-PS unit.

258	Collet unclamp

The spindle rotation command is designated while the collet is unclamped, or the collet is unclamped while the spindle is rotating.

Index	None
Character-string	None
Code	1
Probable Faulty Locations	Operation error
	Faulty EC input (unclamp when bit 3 of EC extended input No. 15 is "ON")
Measures to Take	Check EC input unless any operation error was found.

260	Turret index control abnormal

An alarm occurs with the turret index controller.

Index: TURRET

Character-string: None

Code: XY: Alarm code sent from the turret index controller

X:

0	Turret unclamped state
3	T-command value larger than the number of turret angles is designated.
4	Turret clamped state

Y:

0	Run-away of the turret index controlling CPU
1	Error in the processing of the turret index controlling CPU
2	Unclamp time over
3	Acceleration time over
4	Rotation speed over
5	Index time over
6	Rotation direction error
7	Deceleration time over
8	Creep time over
9	Clamp error
A	Position detection error I
B	Position detection error II
D	DIP switch setting error
E	Communication error

Probable Faulty Locations: Program error or error in the command input from the keyboard in the case of code X = 3

For the code other than it, the turret index controller will be defective, or the mechanical or electrical (EC) system related with the turret index operation is faulty.

Measures to Take: Correct the program ..... The maximum number programmable as a T code is the number of the faces of the turret.

Adjust or replace the turret index controller. Adjust and repair the related mechanical and electrical component parts.

SECTION 4 ALARM A

Alarm Table - ALARM A

Alarm No.	Alarm Message
100	DIF over
101	DA over
102	CON speed
103	APA speed
104	APA BCD data
105	Thread pitch
106	Plus travel limit over
107	Minus travel limit over
108	Barrier
109	Spindle drive unit
110	Spindle drive motor overload
111	Spindle speed over
112	Hydraulic pump motor overload
113	Hydraulic pressure
114	Hydraulic balancer pressure
115	Spindle lube motor OFF
116	Axis drive motor overload
117	Axis interlock
118	Spindle rotation interlock
119	Travel limit
120	
121	
122	Active tool NG3
123	Carrier system checking
124	Magazine system checking
125	Axis drive unit
126	Sequence count over
127	MOP: motor rated current over
128	
129	
130	

118	Spindle rotation interlock

The alarm occurs if spindle rotation enable conditions are turned off or on for more than 0.5 seconds during spindle rotation.

Index: None

Character-string: None

Code:

1 ..... Low spindle speed range confirmation LS is turned off.

2 ..... Middle spindle speed range (high spindle speed range for 2-speed model) confirmation LS is turned off.

3 ..... High spindle speed range confirmation LS is turned off.

5 - 1FF ..... The input condition which must be ON is turned off.
The code displayed is a hexadecimal of [(machine input No. − 1) × 8 + (bit No.) + 1].

200 - 3FF ..... The input condition which must be OFF is turned on.
The code displayed is a sum of 200 and hexadecimal of [(machine input No. − 1) × 8 + (bit No.) + 1].

Examples:

1) Machine input No. 21 bit 1 (ON condition) is turned OFF.
(21 − 1) × 8 + 1 + 1 = 162 = A2 (hexadecimal)

2) Machine input No. 21 bit 2 (OFF condition) is turned ON.
(21 − 1) × 8 + 2 + 1 = 163 = A3 (hexadecimal) + 200 = 2A3

The codes for individual machine models (standard specifications) are summarized below:

(1) MC-30VA

14 ..... VAC ready signal is turned off.

23 ..... Air source pressure confirmation PS is turned off.

45 ..... Tool in spindle clamp confirmation NS is turned off.

246 ..... Tool in spindle unclamp confirmation NS is turned on.

3E ..... Tool change arm at standby position confirmation NS is turned off.

(2) VR-40

29 ..... Cylinder in spindle clamp LS is turned off.

27 ..... Cylinder outside spindle clamp LS is turned off.

22A ..... Cylinder in spindle unclamp LS is turned on.

228 ..... Cylinder outside spindle unclamp LS is turned on.

(3) MC-4VA/5VA/6VA

14	VAC ready signal is turned off.
43 (53)	Tool change arm A retract confirmation LS is turned off.
44 (54)	Tool change arm B retract confirmation LS is turned off.
45 (45)	Tool in spindle clamp confirmation LS is turned off.
246 (244)	Tool in spindle unclamp confirmation LS is turned on.

( ): For machines manufactured before October 1985.

(4) MC-40VA/50VA/60VA

34	Cylinder in spindle clamp LS is turned off.
235	Cylinder in spindle unclamp LS is turned on.
236	Cylinder outside spindle unclamp LS is turned on.
FFFFF004	Tool change arm is at other than the retract position.

(5) MC-80H

45	Tool in spindle clamp confirmation LS is turned off.
246	Tool in spindle unclamp confirmation LS is turned on.
59	Tool change arm A retract confirmation LS is turned off.
55	Tool change arm B retract confirmation LS is turned off.

(6) MC-400H

61	Spindle belleville spring clamp LS is turned off.
62	Spindle belleville spring unclamp LS is turned on.
63	Manual tool clamp LS is turned off.
64	Manual tool unclamp LS is turned on.
83	Tool change arm at home position LS is turned off.
87	Automatic tool clamp LS is turned off.
288	Automatic tool unclamp LS is turned on.

(7) MC-500H/600H/800H

4C	Tool in spindle (inner cylinder) clamp LS is turned off.
24D	Tool in spindle (inner cylinder) unclamp LS is turned on.
59	Tool change arm at home position LS is turned off.
6C	Tool in spindle clamp LS (outer cylinder) is turned off.
26D	Tool in spindle unclamp LS (outer cylinder) is turned on.

(8) MDB-A, MCV-A

8E	Spindle rotation enabled confirmation LS is turned off. (Tool draw screw specification)
8F	Tool in spindle clamp confirmation LS is turned off.
290	Tool in spindle unclamp confirmation LS is turned on.
C3	Tool change arm A retract confirmation LS is turned off. (24-tool ATC)
C5	Tool change arm B retract confirmation LS is turned off. (24-tool ATC)
281	Crossrail unclamp confirmation LS is turned on.
2CD	ATC tool change unit at spindle position confirmation LS is turned on. (50-tool ATC)

(9) MDB-B, MCV-B

8E	Tool in spindle clamp LS is turned off.
290	Tool in spindle unclamp LS is turned on.
C3	Tool change arm A retract confirmation LS is turned off. (24-tool ATC)
C5	Tool change arm B retract confirmation LS is turned off. (24-tool ATC)
2B1	Spindle index pin IN confirmation LS is turned on.
281	Crossrail unclamp confirmation LS is turned on.
BA	Attachment encoder OUT confirmation LS is tuned off.
BD	Attachment clamp confirmation LS is turned off.
BE	Attachment unclamp confirmation LS is turned off. (during attachment indexing)

(10) MCR

8E	Tool in spindle clamp LS is turned off.
290	Tool in spindle unclamp LS is turned on.
C3	Tool change arm A retract confirmation LS is tuned off.
C5	Tool change arm B retract confirmation LS is turned off.
B2	Spindle index pin OUT confirmation LS is turned off.
2B1	Spindle index pin IN confirmation LS is turned on.
281	Crossrail unclamp confirmation LS is turned on.
BA	Attachment encoder OUT confirmation LS is turned off.
2B9	Attachment encoder IN confirmation LS is turned on.
BD	Attachment clamp confirmation LS is turned off.
B9	Attachment encoder IN confirmation LS is turned off. (during attachment indexing)
2BA	Attachment encoder OUT confirmation LS is turned on. (during attachment indexing)
BE	Attachment unclamp confirmation LS is turned off. (during attachment indexing)
BF	Attachment engaged confirmation LS is turned off.
2C0	Attachment disengaged confirmation LS is turned off.

(11) MCM

8E	Tool in vertical spindle clamp confirmation LS is turned off.
290	Tool in vertical spindle unclamp confirmation LS is turned on.
B3	Tool in horizontal spindle clamp confirmation LS is turned off.
2B4	Tool in horizontal spindle unclamp confirmation LS is turned on.
B2	Spindle index pin OUT confirmation LS is turned off.
2B1	Spindle index pin IN confirmation LS is turned off.
C3	Tool change arm A retract confirmation LS is turned off.
C5	Tool change arm B retract confirmation LS is turned off.
281	Crossrail unclamp confirmation LS is turned on.
BD	Swivel head clamp confirmation LS is turned off.
2BE	Swivel head unclamp confirmation LS is turned on.
2BF	Swivel head index pin IN confirmation LS is turned on.
C0	Swivel head index pin OUT confirmation LS is turned off.

(12) MCR-B

6	VAC ready signal is turned off.
39	Tool in spindle clamp 1 confirmation LS is turned off.
23A	Tool in spindle unclamp confirmation LS is turned on.
3B	Tool in spindle clamp 2 confirmation LS is turned off.
241	Crossrail unclamp confirmation LS is turned on.
24F	Tool change unit at spindle position confirmation LS is on.
53	Tool change arm swing A confirmation LS is turned off.
54	Tool change arm swing B confirmation LS is turned off.
61	Attachment clamp confirmation LS is turned off.
261	Attachment clamp confirmation LS is turned on (during attachment indexing).
262	Attachment unclamp confirmation LS is turned on.
62	Attachment unclamp confirmation LS is turned off (during attachment indexing).
263	Attachment encoder IN confirmation LS is turned on.
63	Attachment encoder IN confirmation LS is turned off (during attachment indexing).
64	Attachment encoder OUT confirmation LS is turned off.
264	Attachment encoder OUT confirmation LS is turned on (during attachment indexing).

Probable Faulty Locations

1) The spindle is mechanically placed in the rotation disabled condition. (Dog or LS position is shifted.)
2) Malfunctioning LS's which constitute spindle rotation conditions
3) Faulty input card

119	Travel limit over

The travel end limit switch of X-, Y- or Z-axis is tripped. This alarm occurs if the NC axis emergency stop signal is turned off.

(1) VR-40

Machine Input Signal No. 2 bit 1

(2) MC-4VA/5VA/6VA

Machine Input Signal No. 1 bit 6
(No. 2 bit 2 for machines manufactured before October 1985)

(3) MC-80H

Machine Input Signal No. 2 bit 2

(4) MC-400H

Machine Input Signal No. 3 bit 3

(5) MC-500H/600H/800H

Machine Input Signal No. 3 bit 5
(No. 5 bit 3 for machines manufactured before March 1991)

(6) MDB-A/B, MCV-A/B, MCR, MCM

Machine Input Signal No. 13 bit 5

(7) MCR-B

Machine Input Signal No. 2 bit 0

Index	None
Character-string	None
Code	None
Probable Faulty Locations	1) Setting error of system parameter 2) Malfunctioning LS
Measures to Take	Check the axis which has tripped the travel end LS on the check panel. Reset the NC while pressing the **TRAVEL END RELEASE** button and return the axis inside the travel range by rotating the pulse handle.

125	Axis drive unit

An alarm with the transistor axis drive unit (for the DC motor specification model) is detected.

Contents of alarm indication of LDU-TR and DC-PS are briefly explained below.

(1) LDU-TR

Alarm Indication	Description
PH-LOSS	Phase open of 3-phase input
VR-LOSS	PCB control voltage ±12 V has dropped to a level lower than about 80% of the rating.
IOCM	Current more than 120% of limit value has flowed.
IOCS	More than 120% of rated transistor current has flowed the transistor bridge.
HV	DC supply voltage has exceeded 450 V.
LV	DC supply voltage has dropped below 200 V.

(2) DC-PS

Alarm Indication	Description
HV	Same as LDU-TR
LV	Same as LDU-TR
PH LOSS	Same as LDU-TR
OVER DIS	Discharge circuit of the regeneration circuit has functioned for a period longer than the specification.

Index None
Character-string None
Code None

126	Sequence count over

Abnormal ATC, APC or AAC operation sequence number

Index None
Character-string None
Code None ..... ATC
80 ..... APC
100 ..... AAC (floor type)
480 ..... AACT (table type)

Probable Faulty Locations Contents in the battery back up memory on the ECP-Ⅱ board become unreliable.

Measures to Take
1) Replace ECP card 1 (or ECP-C1-Ⅱ).
2) Replace the ECP-Ⅱ board.

911	ATC system condition

During execution of the ATC (AT-ATC) cycle, ATC input information does not match the ATC sequence advance conditions (indicated in the ATC input logic chart) in three minutes.

Index None

Character-string None

Code XYZZ

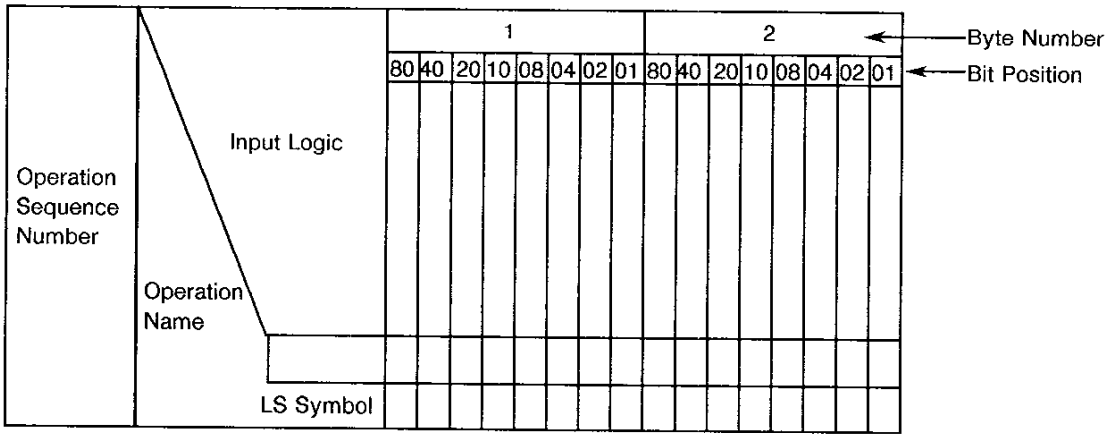
X:

None . . . . . Input conditions are not turned on.

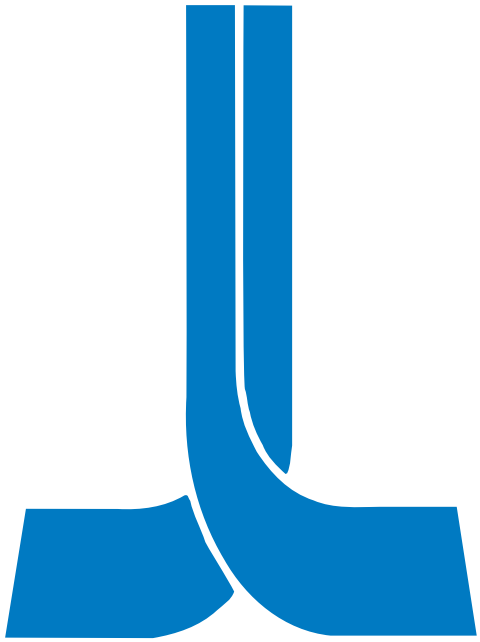
1 . . . . . Input conditions are not turned off.

Y: . . . . . Hexadecimal number of the byte number in input logic chart

ZZ: . . . . . Bit position in input logic chart



For code details, refer to the Maintenance Manual or Instruction Manual for Attachment ATC.



OKUMA

OSP 5000/5020 CONTROL

PARAMETERS

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

Parameters are specific values that define the limits and capabilities of a machine. The control needs parameters to control the machine efficiently and safely. The parameter settings dictate the characteristics of a particular machine. Most of the parameters are factory set and should not be changed. However, some parameters do need to be changed from time to time and a record of parameters changed should be logged. An updated copy of all parameters should be copied to a diskette or other peripheral device.

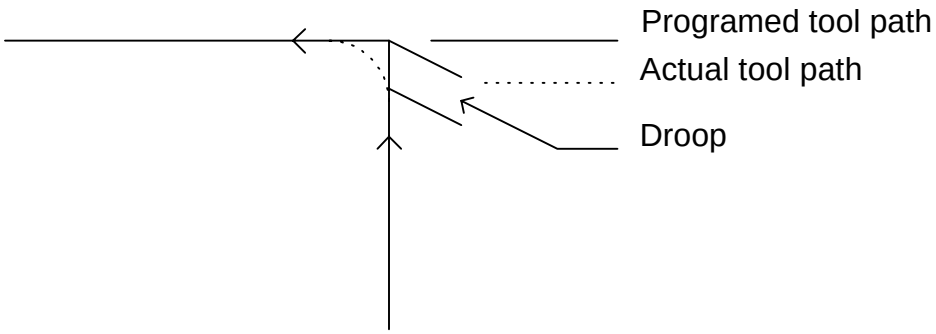
Parameters are accessed by pressing the Parameter mode button. The different parameter menus are accessed by pressing the Item up or Item down function keys. To access the next page of a particular menu press the Page up or Page down buttons.

The following are the different types of parameters on Okuma lathes with the OSP 5000/5020L series controls.

User Parameter

User parameters contain the variable soft limits and droop data. Variable soft limits are used to reduce the cycle time of a workpiece. For example, in most cases, a turret has to be at a soft limit before the control will allow it to index (rotate). The variable soft limits are designed to protect the chuck and tailstock from collision. The variable soft limits cannot be set outside the stroke end limits. When a stroke end limit is set, the corresponding variable soft limit is set to the same value and must be reset if need be.

The actual tool path will not agree with the programmed tool path when cutting sharp corners. Droop data is used to eliminate or reduce these path tracing errors. Droop amount can be set from 0 to 1.000 mm.



Chuck/Tailstock

These parameters tell the control whether chucking is ID or OD and whether the control is in chuck or tailstock work mode. If the tailstock is being used, it is referred to as center work. The chuck and tailstock can have a barrier built around them to further protect them from collisions. Parameter long word #'s 18 to 23 are used along with these parameters to provide further protection. **This chuck barrier data is ignored during manual operation!!**

Common variable

Common variables are programming variables that can be used from one program to another. They can be used in sub and main programs.

System Parameter

The system parameters are different for every machine. They define the characteristics of the individual axes.

STROKE END LIMIT

The stroke end limits (SEL's) define the limits of the axis travel. With SEL's the ballscrews are protected from overrun. SEL's are also referred to as the machines soft limits. The machines are also protected with stroke end limit switches (hard limits). If any of these limit switches are actuated, the power to the machine, with exception of the control, is shut off and machine operation is brought to a complete stop.

SETTING STROKE END LIMITS

Any time an Absolute Position Encoder is replaced, a belt is broken, or a motor is removed for inspection, the Stroke End Limits in the System Parameter menu have to be reset. After the Absolute Position Encoder has been replaced, power on an do the following to check or reset the Stroke End Limit parameters:

1. Check the RAPA (in CHECK DATA) signal for the indicated axis and set the +/- Stroke End Limits a minimum of 20 inches to either side of this value. This will allow you to jog the axis in either direction.

2. Run (Use the Pulse Handle) the axis in the positive direction until alarm 123 Stroke End Limit appears. Check the RAPA signal for the present position and subtract .2 inches from this value.

3. Enter this new value into the "+" Stroke End Limit in the System Parameters. This will allow you to jog the axis to the outer limit just before tripping the hard limit switch.

4. Turn the STROKE END LIMIT CANCEL switch on and move the axis off of the hard limit switch by using the Pulse Handle.

5. Turn the STROKE END LIMIT CANCEL switch off and repeat the above steps for the negative limit. Remember to add .2 inches to the RAPA value to set the - SEL.

When the Stroke End Limits are reset the USER Parameters are assigned the same dimensions. The operator needs to reset the User Parameters.

BACKLASH

The backlash compensates for the lost motion on each axis when the axis feed direction is reversed. The set backlash value is subtracted from the value read by the absolute position encoder when the axis motion is reversed. Typically if the backlash setting is higher than .0015 inches, the ballscrew assembly needs to inspected for mechanical lost motion problems.

PR ZERO OFFSET

This is the zero offset for the absolute position encoder. This parameter can be used as the difference in position between the previously and currently mounted encoder. This parameter is usually set to zero.

STROKE COMP

Stroke compensation makes up for axis positioning error. The tolerance for every 100 mm of travel is 3 µm. If the positioning error is greater, the error is compensated by this parameter.

The system parameters are factory set and recorded on the OSP control card that is sent out with every machine. If an encoder has to be changed, then these SEL's and zero offsets will have to be reset.

Rapid

This parameter is on the second page of the system parameter menu. It is accessed by pressing the Page down button on the NC operation panel after accessing the system parameter menu.

The control calculates RCON every 12.8 msec. The amount of travel it calculates is determined by this parameter. This Rapid parameter is referred to as the "feed unit amount". The feed unit amount is expressed as µm/12.8 msec. Setting this value too high will generate alarm 101 "CON velocity".

Accel Rapid

This parameter is referred to as the "acceleration unit amount". The acceleration/ deceleration time is set by this parameter. When the axis starts moving, initially the feed unit amount is "0". The amount calculated is increased by the acceleration unit amount every 12.8 msec until the feed unit amount (Rapid) is reached. The same happens in reverse when an axis is commanded to stop. Every 12.8 msec the feed unit amount (Rapid) is reduced by the acceleration unit amount (Accel Rapid) until RCON reaches "0".

CAUTION

If the acceleration unit amount (Accel Rapid) is changed to a value larger than the preset one, it could adversely affect motor and machine performance. Therefore, be sure to contact your Okuma distributor when a change of the acceleration unit amount is desired.

Jog Feed

This parameters sets the amount of travel calculated when the axis is moved manually. This parameter determines the axis travel speed in jog mode.

Accel Jog Feed

This parameter sets the amount of travel calculated when the axis accelerates and decelerates in jog mode.

Torque

This is the NC torque limiter parameter. The control will send out an alarm if the current level in the drive amplifier exceeds the level set in this parameter. The number in this parameter is the percentage of the total current capacity of the axis drive amplifier.

Turret Offset

This page of the system parameters shows the offsets of the individual tool stations. These parameters allow the operator to move a tool from one station to another without having to change the tool offset.

T

This page shows the system parameters for the NC turret (T axis). The following parameters are shown on this page.

Rapid	Accel Rapid	Torque	PR Zero Offset
Jog Feed	Accel Jog Feed	Droop Data	Unclamp Timer

PR ZERO OFFSET

This is the zero offset of the NC turret axis. If the encoder on a NC turret is changed, the PR ZERO OFFSET has to be reset.

1. With the machine on, verify at which station the turret in question is clamped. If the turret is not clamped, turn on the parameter which allows movement of the turret with the pulse handle.(OPB 40.2 for A turret, OPB 40.3 for B turret) Position the turret so it will clamp.
2. Press the PARAMETER key, item to the “Turret Angle” page. Note the angle that corresponds to the clamped station.
3. Press the item key until SYSTEM PARAMETERS can be viewed. Press the page key until T-AXIS can be viewed.
4. Make sure the correct turret is selected and move the cursor to PR ZERO OFFSET.
5. Press {F1}(SET) function key and press the WRITE key (this sets PR ZERO OFF SET to zero).
6. Press the {F5}(BACKUP) function key.
7. Turn power OFF and back ON.
8. Go back to PR ZERO OFFEST for the turret, press the {F3} (CAL) function key and enter the angle value which was noted in step 2 then press the WRITE key.
9. Press the {F5} (BACKUP) function key.
10. Turn the power OFF and back ON.
11. Manualy index the turret, then index the turret to each position with MDI or AUTO. (the positions will be “fine tuned” if indexed in Auto mode)

Optional Parameter (long word)

Optional parameter long words are parameters whose value can be higher than the decimal equivalent of a 16 bit word which can be 5 digits or higher in length. An example of this type of parameter would be for chuck and tailstock barrier dimensions.

Optional Parameter (Word)

Optional parameter word parameters are used to control miscellaneous operations such as chuck open/close and spindle start/stop. These parameter values can be up to 5 digits in length.

Optional Parameter (Bit)

These parameters control the turning on and off of functions needed for proper program operations. Inch/metric mode would be an example of this parameter. These parameter values are either a “1” or a “0”.

Spindle Control Parameter

These parameters are used on high precision VAC's (VACII & VACIII). The optimal values for these parameters are factory set and should not have to be changed. A description of these parameters can be found in the 10th edition of the operation manual.

Some parameters are looked at only once when the control is powered up. These parameters are referred to as power reapplication parameters.

When a power reapplication parameter is changed, the CRT will display the message **"ALARM-D W01 ;power on effective parameter set"**. When this alarm occurs, check the number at the backup counter (BC=00) on the 4th line of the CRT and wait until this number appears again (approx. 3 min) before turning off the power. After powering up again, check that the parameters have been changed to the new settings. The alarm is cleared after the machine is powered up again. The backup counter counts in Hexadecimal from 00 to 4F on a continuous basis.

The following are the different types of parameters on Okuma machining centers with OSP 5000/5020M series controls.

Common Variable

These programming variables have the same function as the common variables on lathes, they are common to all programs. There are 128 on machining center controls and they are labeled VC1 to VC128.

User Parameter

PROG LIMIT

These parameters contain the adjustable soft limits of the individual axes. In this menu, the Work Coordinate value (WRK) and the Machine Coordinate value (MC) can be seen.

G60 OVERRUN AMT

The G60 overrun amount is the amount of travel the axis will overshoot when uni-directional positioning is active.

BACKLASH

The backlash compensates for the lost motion on each axis when the axis feed direction is reversed. The set backlash value is subtracted from the value read by the absolute position encoder when the axis motion is reversed.

CLAMP IN-P

This parameter shows the clamp in-position width for each axis. If this parameter is set to “0”, clamp in-position check is not carried out. If the axis moves out of this “window” an alarm will be displayed on the CRT.

G/M Code Macro

These parameters allow the programmer to call up macros which contain sub-programs that have specific functions.

MC User Parameter (long word)

These parameters are mostly positioning information about the APC or ATC. Up to 8 digits can be entered in these parameters. The decimal equivalent of these parameters can be 5 digits or higher.

MC User Parameter (word)

These parameters are mostly for setting up the on/off time of the various functions that are required to be activated for some length of time.

Parameter # 40 set to one will allow the operator to move an axis with the Pulse Handle in an alarm condition.

MC User Parameter (bit)

These parameters turn on or off various machining functions. For example, with parameter 9 bit 2 set to a "1", the operation end warning buzzer will not be turned off by the timer.

MC System Parameter (long word)

These parameters are used to control the various "EC controlled" axes. These parameters are used to control the ATC magazine and APC shifter arm positioning. The following MC System Parameter (long word) parameters are looked at often when troubleshooting an ATC or APC.

9 Shows the zero offset of the ATC magazine.
41 Shows the zero offset of the APC shifter arm.
48 Shows the orientation offset for high precision spindle drives (VAC II & III)

MC System Parameter (Word)

These parameters are mostly for the ATC and APC operation. The following parameters should be looked at and recorded whenever repairs or maintenance is being performed on the machine.

1 Sequence number the ATC is presently positioned at.
2 Sequence number the APC is presently positioned at.
5 Tool changer arm (TA) A. B. mode
6 Pallet A.B. mode
21 Spindle orientation offset for VACI.

NC Optional Parameter (long word)

These parameters are CNC related parameters that the control needs to look at when machining parts. These parameters check for programming errors when certain functions are performed, i.e. cutter radius compensation.

NC Optional Parameter (word)

These parameters can use up to 5 digit values. Some of these parameters are used to set up the control for proper data transfer or file handling.

NC Optional Parameter (bit)

These parameters turn on or off various functions. The value setting on these parameters are “1” or “0”. NC optional parameter bit No. 16 bit 7 has to be set to a “1” when checking the following parameters.

System Parameters
Pitch Error Compensation
Machine System Parameter (long word)
Machine System Parameter (word)
NC Optional Parameter long word number 33 and up
NC Optional Parameter word number 33 and up
NC Optional Parameter bit number 17 and up
Spindle Control Parameter

Input Unit System

On this parameter page, it is possible to view the unit of measurement being used. The unit systems set by the NC optional parameter bit No. 3 bit 0 to bit 7 and No. 9 bit 0 and 1 can be confirmed on this display page.

Although it is possible to change the unit system settings from this page, it is recommended that the changes be made at the NC optional parameter bit page. These settings are determined by a combination of data bits, changing the unit systems from the Input Unit System page might unexpectedly change other unit system settings.

System Parameter

TRAVEL LIMIT

These parameters set the travel limits of the individual axes. These limits are very similar to the SEL’s on lathes.

PITCH ERROR COMP

These parameters specify the range for which pitch error compensation is used within the total travel range of the axis.

IN POSITION

This parameter sets up the window of allowable positioning when executing exact stop checks. Once the axis is inside this window, the control moves on to the next block in the program. Setting this parameter to zero can cause the machine to “hang up” without an alarm indication.

ZERO OFFSET

This parameter sets the zero offset of the machine coordinate system for each axis. Figure 2 shows a description the zero offsets on machining centers.

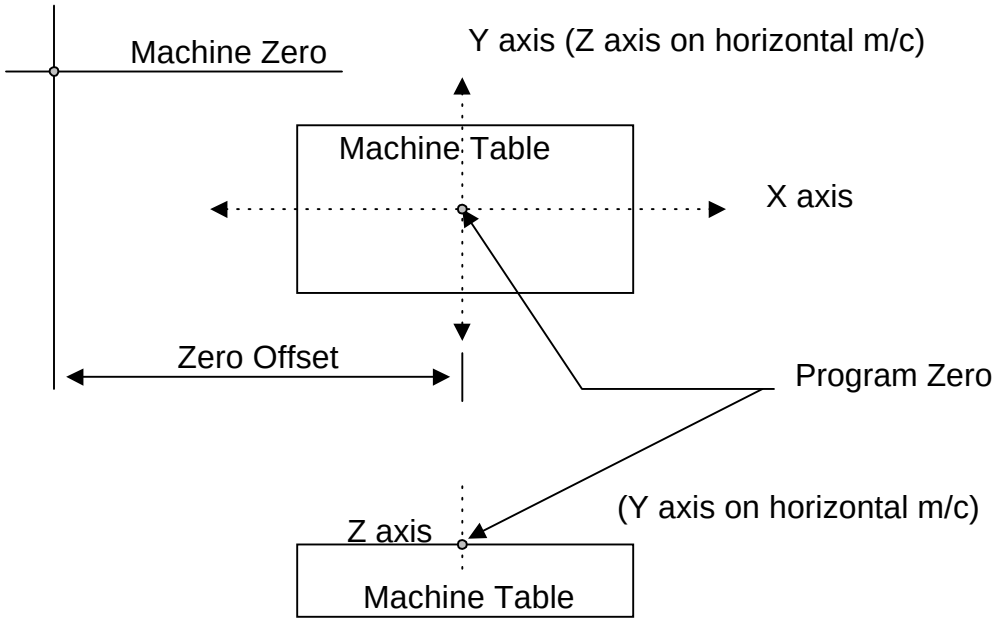


Fig. 2

SETTING ZERO OFFSET

Any time an Absolute Position Encoder is replaced, a belt is broken, or a motor is removed for inspection, the zero offset of that particular axis has to be reset.

Before changing the encoder, move the axis to the zero position if possible. If you can jog the axis, move it to the zero position or in MDI enter G00 (axis in question)0 , WRITE and cycle start. Power off, change encoder, power up, go to zero offset in system parameters, position cursor at the appropriate axis and press CAL then WRITE.

If you can not move the axis, note the distance from the zero position (the difference between the RAPA number and the zero offset number) to the actual position of the axis. Power off, change encoder, Power up, go to zero offset page in the system parameters, position cursor, press CAL, enter the difference noted earlier, and press WRITE.

IN POSITION (H)

Sets the in-position width used in positioning the individual axes when executing a tool change, pallet change, etc. When the axes are moving towards their individual home positions, the next block of data will be processed when the axes only have the amount specified in this parameter left to travel to reach their home position.

SWL HD

These four parameters set the position of the horizontal spindle when it is swiveled and becomes a vertical spindle. This type of spindle head is used on double column machines. (MCM)

BARRIER (Y,Z)

On horizontal machining centers, if both the Y and Z axes enter a certain area at the same time, they will interfere with each other. To prevent this, a barrier zone is set up so an alarm will occur if this happens.

ENCODER OFFSET

This parameter offsets the zero-cross point of the position encoder.

HOME POSITION

These parameters allow the user to machine multiple workpieces on a pallet or table. No. 1, 3, and 4 home positions are reserved for the ATC and APC. No. 1 shows the home position of the axes when a tool change is performed. No. 3 shows the home positions when the A pallet is being changed. No. 4 shows the home positions when the B pallet is being changed.

HOME POSITION MOVEMENT ORDER

Sets up the order in which the axes will move. For example, when a tool change is performed on a vertical machining center, the Z axis has to move to position first. The setting range is 0 to 3 with 0 meaning no movement and 1st, 2nd, and 3rd setting the order in which the axes will move.

INDUCTOSYN OFFSET

This parameter data is used to align the phase of the feedback signal of the inductosyn or MPR feedback device with the absolute position encoder signal.

PITCH COMP SPAN.

This data specifies the distance between sets of pitch points for setting the pitch error compensation data.

PITCH POINT

This parameter sets the total number of pitch points for each axis.

PITCH ERROR COMPENSATION

The ball screws each have their own pitch-to-pitch errors. This set of parameters compensate for those errors. To see the pitch error compensation data for the other axes, press the “axis change” function key (F5).

NC HOUR METER

The NC Hour Meter parameter accumulates the following hours and displays them on the CRT screen.

POWER ON TIME

Accumulates the amount of time that power is supplied to the NC

NC RUNNING TIME

Records the amount of time the NC is running (RUN light is on).

SPINDLE REVOLUTION TIME

Records the amount of time the spindle has been rotating.

CUTTING TIME

Records the amount of time the cutting feedrates are fed to the axes.

The last three parameters mentioned will not record the time when the Machine Lock mode is on.

EXTERNAL INPUT TIME

Records the amount of time the external input signal is on.

These timers can be preset so when the COUNT data exceeds the SET value, a C level alarm will show up on the CRT.

NC WORK COUNTER

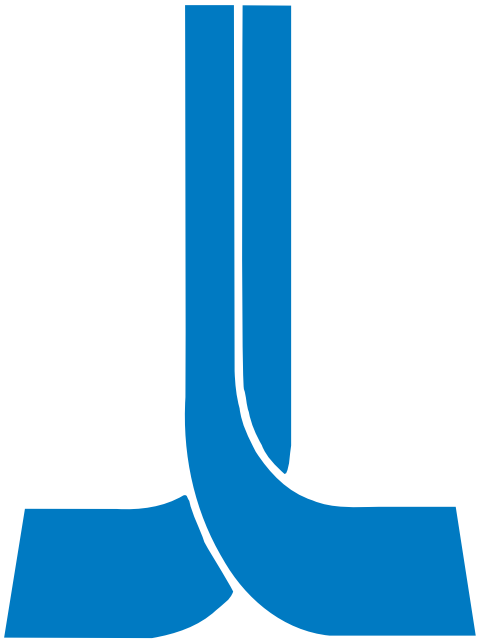
Pressing the PAGE key will display this screen (when at NC Hour Meter parameter screen). These counters increment whenever an M02 or M30 are executed. During Machine Lock mode, these counters do not increment.

SPINDLE CONTROL PARAMETER

These parameters are servo constants and other related data that are set at the factory. These parameters should not be changed unless requested by Okuma.

On machining centers, the backup counter is not shown. Data can be backed up immediately by pressing the “extend key” (F8) then the “backup” key (F7). It is recommended that this procedure be done every time a parameter is changed.

Incidentally on Okuma Grinders, the backup occurs as soon as the WRITE key is pressed.



OKUMA

OSP 5000/5020 CONTROL

SOFTWARE

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

OSP DATA MANAGEMENT CARD (1/2)

Type of OSP OSP5020L

type of machine	machine serial NO.	production NO.	
LNC8 N 1S - C turret V12	# C450	B118-4555- 46	

Spindle motor (AC) 7.5/5.5 Kw	spindle speed 75-4200 rpm	tape storage 60 m

TYPE of CONTROL SOFTWARE					
no.1	BIN08-006-B	.BBM	no.3	LCU06-00-A	.PBU
no.2	FOSE4-07-A	.SYS	no.3		.PBU
no.3	LAU16-9G-U5	.PBU	no.3		.PBU
no.3	LSU16-9B-F	.PBU	no.3		.PBU
M	M M M	M	M M M	M	
no.4	LAA06-14EQ	.POL	no.4		.POL
no.4	LAME6-14EQ	.POL	no.4		.POL
no.4		.POL	no.4		.POL
no.4		.POL	no.4		.POL
no.4		.POL	no.4		.POL
no.4		.POL	no.4	LOA04-03-G	.POL
no.5		.POL	no.5		.POL
no.6		.POL	no.6		.POL
no.6		.POL	no.6		.POL
no.6		.POL	no.6		.POL
no.7	LFME6-10-I	.LOB			
no.8		.POL			
no.10		.MSB			

HARDWARE					
MB-IIB (E105)	O	Memory Card 4Mx1			
MC11(0.5MB)		Memory Card 4Mx2	O		
MC12(2MB)	O	Memory Card 4Mx3			
MC13(RS232C CARD)	O	Memory Card 4Mx4			
MC17(SUB CPU)		RSB(RS232C BOARD)			
CRP-9(CHARACTER)	O	IJPC3			
CRPII-C(GRAPHIC)		ECP-II			
SVP-IID(E105A)	O	ECP CARD2			
SVP-IID 2AX(E105A)		PANEL 5020 L-SM	O		
SPC1 (E105A)		PANEL 5020 L-SC			
SPC3		PANEX CARD 2A			
SPC4		PANEX CARD 3A			
SPC6	O	PANEX CARD 4	O		
ECB E0,	O	LOW POWER SUPPLY	O		
ECC		FLAT MACHINE PANEL	O		
FDCBII V2		TCC ( )			
FRPC V2					

OPTION FEATURES

S 0000 - 1001 - 0300 - 8007 - 0000 - 0C00 - 1002 - 0000

Center work	R1	LAP 4	(S)	Prog. select A (button)		Cycle time over check		
2 saddle machine		Tool nose radius comp.	O	Prog. select B (rotary)		Size catcher		
Mirror image		Inch/Metric switchable	O	Prog. select C1 (BCD)		Load monitor SW on panel		
Multiple machine		User task 2		DNC-A (DNC-1)		Inductosyn feedback C		
Tail stock swing		Color graphic		DNC-B (RM buffer)		Inductosyn feedback ZA		
LC40M-ATC		IGF		DNC-C1 (Basic)		Inductosyn feedback XA		
Gang tooling		IGF convert		DNC-C2 (Basic)		Inductosyn feedback ZB		
AC motor pole change		Tape convert(3000->5000)		DNC-C3 (Basic)		Inductosyn feedback XB		
EC Board(card) add on 1		NC Work counter		Alarm "C" output		Induc. pitch error comp.		
EC Board(card) add on 2		NC Working monitor		Prog. select C2 (BCD)		Buffer 160m		
EC Board(card) add on 3		Tool life management		Spindle max speed inter.	O	Buffer 320m		
Door interlock B		Cycle time reduction		Door interlock C	O	Buffer 640m		
IEC auto door check	O	Pitch error compensation		Door interlock D		Cent. work interl. release		
IEC chuck		Plane conversion		Home position		Parts catcher ILK. (M-cord)		
Air chuck		Profile generation		Touch setter (slide)		Pick off unit		
Chucking miss detect		Expand auto chamfering	O	NC Torque lim. (shear pin)		Flat turning		
Touch sensor measuring		Thread among feed hold		Parts catcher interlock		NC master		
Tool gauging system		Tool offset 64 pairs		NC loader		Flat panel	O	
External measure		Tool offset 96 pairs		Load monitor B2		OSP500L-G Panel		
CEJ matic (ext. measure)		Buffer 60m		LR15M-ATC		Mono. Graphic		
Print out (measure data)		Cycle time calculation		Tool retract function		Old mono. character		
Touch setter		C-axis joint (low speed)		ARC thread cutting		Chuck interlock release		
Load monitor A		Thread start point offset		Front drive air chuck		Robot/loader IF type "C"		
Load monitor B1		C-axis joint B		Door control (answer off)		Test software		
Orientation (pin/brake)		NC Torque limiter	O	Link 1		2 Spindle machine		
Spindle orientation (elec.)		Tape in/out for tool offset	O	Link 2		VAC-uni direction		
Programmable tailstock		One-Touch IGF		Link 3		Pulse generator 1 phase		
Robot (OKUMA)		Edit lock		Link 4		EC BUS		
Overload detection fun		MOP (Monitor processor)		Link 5		Turret limit type B	O	
Work catcher (for 2S)		Calendar timer		Link 6		Program stop special		
Long stroke chuck		Floppy in/out (IBM)		Link 7		Panel position special		
Index chuck		External program select		Link 8		Double tooling		

OPTION SPECIFICATION

						USA SPEC.	O
Chip conveyor Enable	O	Coolant pump motor (Kw)		pressure H/L switchable			
Part finish light (Yellow)		Air blow		(chuck, tailstock,)			
Alarm light (Red)		(chuck, sensor, tailstock)		Work measurement ( )			
Load monitor (A , B)		Bar feeder ( )		(Internal , External)			
Spindle orientation ( )		touch setter (A , M , IA)		spare M-CODE (sets)			

R1 F1885 SEP/26/'94 C.A	R2 4828 12/14/94 C.A.	R3	R4
R5	R6	R7	R8
R9	R10	R11	R12

OSP DATA MANAGEMENT CARD (2 / 2)

Type of OSP OSP5020L

type of machine	machine serial NO.	production NO.	
LNC8 N 1S - C turret V12	# C450	B118-4555- 46	

TYPE of CONTROL SOFTWARE		
no.3 LVU16-9G-D1-1 .PBU	no.3 .PBU	no.3 .PBU
no.3 .PBU	no.3 .PBU	no.3 .PBU
no.3 .PBU	no.3 .PBU	no.3 .PBU
no.6 .POL	no.6 .POL	no.6 .POL
no.6 .POL	no.6 .POL	no.6 .POL
no.6 .POL	no.6 .POL	no.6 .POL
no.6 .POL	no.6 .POL	no.6 .POL
no.6 .POL	no.6 .POL	no.6 .POL
no.6 .POL	no.6 .POL	no.6 .POL

OPTION FEATURES							
S 0 0 0 1 - 0 0 0 0 - 0 0 0 0 - 0 0 0 0 - 0 0 0 0 - 0 0 0 0 - 0 0 0 0 - 0 0 0 0							
Synchronized Tapping							
OKUMA Simple Loader							
Air Pressur Detect							
Robot/Loader Door ILK.							
KNCS chuck (1ST SP)							
KNCS chuck (2nd SP)							
Press H/L SP (1st SP)							
Press H/L SP (2nd SP)							
M-axis 1 point Citch							
SMW chuck(2nd SP)							
IEC chuck(2nd SP)							
Front Drive Chuck(2nd SP)							
C-Axis 5' Index.							
C-axis Zero Offset							
TCC Turret control							
HI Precision VAC(1st SP)	O						
HI Precision VAC(2nd SP)							
HI Precision VAC(MA-axis)							
HI Precision VAC(MB-axis)							
HI Precision VAC(1st Caxis)							
HI Precision VAC(2ndCaxis)							
		POP UP turret indx.					
EC Board(card)add on 4		Pulse Handle movable					
EC Board(card)add on 5		Simple Tow-Along					
M-axis Orientation		FTL R side					
Bar feeder/chuck ILK.		NC Turret control					
EX Measure (RS232C)		Robot / Loader IF D					
Touch Setter IA		2s Sub-SP Parts Catcher					
B Turret M-axis		Work count Special					
Sub Spindle		Sequencer Alarm					

R1		R2		R3		R4	
R5		R6		R7		R8	
R9		R10		R11		R12	

		Approved by (NC software)	(EC software)	(Hardware)	Prepared by	Issued by
		Petty 9-28-92		Cody 9-28-92	TH 9.28.92	

☐ Test software

OSP Management Data Card

Type of OSP
OSP5020M

Date 09 / 28 / 92

Type of Machine	MC-4 V A E ☐ MDB-☐ /MCV-☐ /MCR-☐ /MCM	Customer	
Nominal Size	–	Address	
Serial No. of Machine	# 9787	Machine Assembly No.	9209 -28
Machine Production No.	B 263 – 4540 – 66	Power Supply	AC 3φ 220/440 V 50/60 Hz
		Phone	
		Machine Delivery Data	/ /

Type of Control Soft (NC Software)

Bubble initialize	BIN	12 – 008 – B	.BBM	B#Patch	MAZ					.POL
System	NOS	E4 – 54 – A	.SYS		MAZ					.POL
	MOA	04 – 53 – G	.POL		MAZ					.POL
Backup	MAU	07 – CC – I	.PBU		MAZ					.POL
Data file	MDU	07 – CC – H	.PBU		MAZ					.POL
Servo data	MSU	27 – C4 – C	.PBU	VAC data	MVU	–	–	–		.PBU
NC spec, code	MCU	00 – 00 – A	.PBU	TAP data	MVT	–	–	–		.POL
	MAS	00 – 00 – A	.POL							
NC main	MAA	07 – 09BJ	.POL	MOP TOOL	CMA	–	–			.LOB
	MAR	07 – 09BJ	.POL							
	MAY	07 – A9BJ	.POL							
NC message	MAM	E7 – 09BJ	.POL	Attachment PBU	MRU	–	–			.PBU
Model	MAX	07 – A9BJ	.POL	Attachment MSB	MAQ	–	–			.MSB
				Automatic gauging	MAQ	–	–			.MSB
Graphic (Animation)	MAH	07 – 09BJ	.POL							
	MGU	00 – 00 – B	.PBU	Library	MAL	–	–			.LIB
PPC	MAF	–	.POL							
DNC-B	MAC	07 – 09BJ	.POL	I-MAP backup	MBU	–	–			.PBU
	CAA	01 – 10 – B	.LOB	I-MAP main	MBA	–	–			.POL
DNC-C	MAJ	–	.POL	I-MAP message	MBM	–	–			.POL
	CBA	– –	.LOB	I-MAP MSB	MAQ	–	–			.MSB
	CLA	– –	.LOB	I-MAP Patch	MBZ	–	–	–		.POL
	MHU	– –	.PBU	I-MAP Patch	MBZ	–	–	–		.POL
	MIU	– –	.PBU							

Type of Control Soft (EC Software)

Back up of ECP	MEU	02 – C2 – C	.MPB	Patch	MEZ	02 – 01 – H		– P32		.POL
EC main	MEA	02 – 01 – H	.POL	Patch	MEZ	–	–	– P		.POL
Model main	MEB	–	.POL	B # Patch	MEZ	–				.POL
APC	MED	–	.POL	B # Patch	MEZ	–				.POL
AAC	MEE	– – –	.POL	B # Patch	MEZ	–				.POL
EC message	MEK	–	.POL	B # Patch	MEZ	–				.POL
EC message	MEM	E2 – 01 – HD	.POL							
EC spec. code	MES	00 – 00 – A	.POL							

Optional Features (NC Software)

NC spec. code: SA 7B08 – 4029 – 0052 – 8023 – 0000 – 2009 – 8000 – 0000
0000 – 0000 – 0000 – 4000 – 2000 – 0000 – 0000 – 0000

Color display		○	Rotary axis with limit	B		MSB Tool length comp./break. detect.							
Floppy read/write		○	Rotary axis with limit	C		MSB Tool length comp./break. detect.							
Floppy R/W IBM format			Index rotary table	A		MSB Tool breakage detection							
IGF			Index rotary table	B		MSB Optical touch prove							
Pallet pool line control			Index rotary table	C		MSB Gauging/zero point compensation							
Graphic display		○	5" index	A		MSB zero point compensation							
Program select. 2 digits			5" index	B		MSB KURODA touch probe							
Program select. 4 digits			5" index	C		MSB Reference tool length. 150mm							
Synchronized control X axis			Inductosyn	Z		Machine MC-H						JOG Speed MAX 5m/min	
Synchronized control Y axis			Inductosyn	U		Machine MC-V/6VA							
Synchronized control Z axis			Inductosyn	V		Machine MCV							
Synchronized control 4th axis			Inductosyn	W		Machine MDB							
Rotary 2 axis with limit 5			Inductosyn	A		Machine MCM							
Rotary 2 axis (Parallel)			Inductosyn	B		Machine MCR							
Synchronized control 5th axis			Inductosyn	C		Machine MC-3VA/4VA/5VA		○					
Animation		○	Rotary axis with limit	A									
Axis processor			Additional axis name	U									
EC processor		○	Additional axis name	V									
(AXP test)			Additional axis name	W									
(ECP test)			Additional axis name	A									
Brushless servo motor		○	Additional axis name	B									
			Additional axis name	C									
Main card 13		○	Inductosyn	X									
External display (3,4 or 5-axis)			Inductosyn	Y									
Rum head compensation (MCM)			One part program capacity	160m		Spare tool changed							
F1 feed (8 sets)			One part program capacity	320m		Tool life management							
			One part program capacity	640m		CRT Display (Print function)							
F1 feed (4 sets)			One part program capacity	1280m									
F1 feed (Parameter)			One part program capacity	2560m		Unmaned operation record function							
			Old monochrome character display			Auto escape/return function							
Print out (OKUMA PP-5001)						Tool length comp./break. detect.							
Print out (EPSON)			Flat panel		○	Gauging/zero point compensation							
Helical cutting												Program branch	
One-directional positioning			DNC-A										
Skip function			DNC-B										
Change of work coordinate system		○	DNC-C1									Auto any-angle chamfering	
3-Dimensional tool offset			DNC-C2									Cylinder side machining	
Exact stop check		○	DNC-C3									Slope machining	
Programmable mirror image			Point calculation (I-MAP)									Work coordinate system, 100sets	
Enlargement/Reduction			Add pattern cycle (I-MAP)									Simple load monitor	
4-Axis control						NC master						Synchronized tapping	
5-Axis control			No manual feed hold			Rapid feed MIN. 5%						VAC-II (type A)	
6-Axis control			Axis lock			EC board 1						VAC-II (type B)	
Pulse handle EC input (MC-H/V series only)						EC board 2						Semi synchro operation	
Pulse handle, 2 sets						EC board 3							
Pulse handle, 3 sets			Cancellation of axis command		○	EC board 4							
Pulse handle, separate type (MC-H/V series only)		○	Sequence restart from mid-block			Attachment index compensation							
			Sequence stop			Graphic (I-MAP)						Edit lock out function	
Large memory capacity, over 320m			Coordinate cal. functions									Automatic schedule program update	
Multi volume operation			Area machining functions			Rotary table external manual operation						Manual gauging work/tool	
3-Dimensional circular INT			Coordinate system conversion function			NC operation monitor						Interactive gauging work	
Work coordinate system, 20 sets		○	Return from mid-point									Interactive gauging tool	
Work coordinate system, 50 sets			Programmable limit			I-MAP B							
Tool date, 200 sets			Message function			Thread cutting							
Tool data, 300 sets			Playback (I-MAP)									JOG Speed MAX 6m/min	
Tool data, 100 sets			I-MAP			TEST Message						JOG Speed MAX 10m/min	
Inch/metric switchable		○	Block skip (2 or 3 sets)										
mm/rev or mm/min feedrate		○	Block skip (3 sets)										
0.1μm control			Mirror image 4th axis										
Angle command 1/10000		○	Mirror image 5th axis									Hi-NC	
System variables		○	Mirror image 6th axis									MOP TOOL (Stand Alone)	
Additional math function			Ext. program select, A									Linear positioning interpolation	○
Sub programs		○	Ext. program select, B									MOP TOOL (NC inside)	
Schedule programs			Axis name designation										

Optional Features (EC Software)

EC spec. code	SE 1A0	– 0005	– 0000	– 0000	– 0200	– 0006	– 0000	– 0000
	0000	– 0000	– 0000	– 0000	– 0000	– 0000	– 0000	– 0000

Alarm lamp	○	Magazine, 30 pots		(Transistor LDU)				
		Magazine, 32 pots		Coolant (flat panel)	○			
2nd hour meter (NC run)	○	Magazine, 50 pots		Air blow nozzle (〃)	○			
2nd hour meter (Spindle revolution)		Magazine, 70 pots		Air blow adapter (〃)				
3rd hour meter (NC run)		Magazine, 100 pots		Oil mist (〃)				
3rd hour meter (Spindle revolution)		Magazine, 120 pots		Oil hole (〃)				
Coolant high press (MC-H)				Shower (〃)				
Special pendant		Splash guard						
Hydraulic oil cooling system		AAC floor type		APC hydraulic unit		AT. manual tool change		
		AAC table type		Without preparating station		AAC column right		
Coolant level detection		AAC installed on column		Crosswise APC		AT. No. New method		
Touch sensor movable type						Cross-rail Up & Down AC		
						APC shifter cover interlock		
Attachment head		-						
Pull-stud without ATC				Multi-pallet PME type				
		AT-ATC		Chip conveyor (flat panel)				
Spindle revolution 1	○	Spindle tool clamp unclamp M-code		Multi-pallet PMC type				
Spindle revolution 2		Attachment M-code		Twin pallet rotary type		Spindle Air Dryer		
Spindle revolution 3		AAC table M-code		6-pallet APC		3VA before # 128		
		Ext. hour meter		10-pallet APC		Thru-the-tool (simple type)		
Spindle overload detection (meter relay)				12-pallet APC		MCV-B from # 93		
		Germany safety standards		Pallet rotary type		MCM from # 142		
Spindle motor spec 1		Re tapping hole airblow		With APC safety guard		Ball screw Coolant		
		Extention AT-ATC		Multi-pallet magazine CW CCW turn				
Spindle AC motor		Spindle thru coolant		MC-800H		Oil hole AT quill type		
Spindle VAC motor	○	Warming-up		MC-4VA·MC-40VA	○	APC Interlock		
Spindle VAC motor (FANUC)		No Machine input/cycle start/Slide hold		MC-5VA·MC-50VA		AT. air cooling		
Spindle VAC motor (OKUMA)	○	Magazine door interlock				MCV-A, MDB-A from # 1529		
With ATC	○	Cross-rail vertical positioning		MC-4VB·MC-40VB				
With APC		Cross-rail vertical positioning (10 Point)		MC-600H		Attachment load monitor		
With AAC		Cross-rail wide		MC-30VA		Cycle time reduction		
With LTC		Spindle head cooling system (Simple type)		800H·500H # 152·600H # 127		APC chain type		

System floppy disk (3.5)/8 inch

NC·EC options

Spec. name	Yes None	Related to soft	Related to hard	Drawing No.	Spec. name	Yes None	Related to soft	Related to hard	Drawing No.	Spec. name	Yes None	Related to soft	Related to hard	Drawing No.
Tape storage 80m	○	Ⓝ	○	☒	Tool breakage detection		Ⓝ	○		APC		Ⓝ	○	
One part program capacity 80m	○	Ⓝ	○	☒	Zero point compensation		Ⓝ	○		PPC		Ⓝ	○	
Color CRT (Graphic)	○	Ⓝ	○	☒	Manual gauging/ Interactive gauging		Ⓝ	○	☒	AAC st		Ⓝ	○	
Floppy disk drive unit (3.5)/8inch	○	Ⓝ	○		Pulse handle (2/3 sets) (NC input, EC input)		○	○		AT-ATC		Ⓝ	○	
					External M code (4/8 sets)	○	☒	○						
Tape puncher I/F parallel/RS-232C	○	Ⓝ	○		FI feed (4/8 sets)		Ⓝ	○						
					DNC-A Ⓝ C		Ⓝ	○						
Puncher cable type ( )	☒		○		DNC additional channel		☒	○						
IGF		Ⓝ	○		Inductosyn X·Y·Z		Ⓝ	○						
MOP-TOOL AE sensor. exist/none		Ⓝ	○		Additional axis A·B·C type ( )		Ⓝ	○						
Hi²-NC		Ⓝ	○	☒	Tape winder 180m		☒	○	☒					
I-MAP		Ⓝ	○	☒	Trans former	○	☒	○						
					Synchronized tapping		Ⓝ							

* Drawing No. shows W609-200-

Standard drawing A20004

OSP5020M-E-0-AO

MC-4VAE - # 9787

System

Name	Yes/None	Order No.	Name	Yes/None	Order No.	Name	Yes/None	Order No.
MB-IIB (SBP)	○	A911-1520	FDCII (FLOPPY)	○	A911-1703	PANEX2A		A911-1551
MC16 (SUB CPU)	○	-1516	FRPB (FLOPPY/RS-232C)		-1702	PANEX3A		-1552
MC15 (SUB CPU)		-1526	FRPC		-1704	PANEX5	○	-1555
MC11 (RAM512KB) 3 sheets	○	-1522	HC 1ch (parallel bus)		-1160	PANEX6		-1557
MC12 (RAM2MB) sheets		-1523	RSB (RS-232C× ch)		-125	PAN IGF CARD		-155
MC13 (RS-232C)	○	-1521	CCPB (2) 1 sheets		-1594			
MC6 (BBM EX)		-1106	CCPC2 (RS-232C) 1 sheets		-1596			
BBC 4M1 1 sheets (3)		-1224	CCPC3 (RS-422) sheets		-1597			
BBC 4M2 1 sheets	○	-1225	ECB		-1120			
BBC 4M3 sheets		-1226	ECPIIA	○	-154			
BBC 4M4 sheets		-1227	ECPC2		-1142	EIO D & R 1 sheets	○	-1270
CRP-9		-1580	ECPC3B	○	-1543	EIO I-PT 3 sheets	○	-1275
CRP-IIC-NC (v4.7)	○	-1692	ECPC4II		-1544	EIO O-TRH 1 sheets	○	-1278
PANEL 5020M-SC	○	-18	CCPC4		-1590	EIO O-AC 1 sheets	○	-1271
SVPIID (E101B)	○	-1533	FN CARD		-1840	EIO O-TRP 2 sheets	○	-1268
SPC1 (E101B) 1 sheets	○	-1534				EIO Rach 14 units		-127
SPC2 (PHDX2)		-1535	Rach type 17-1 3B	○	-10	EIO Rach 8 1 units	○	-126
SPC6		-1538	RHP	○	-1205	Cable extension AT sheets		-1193
SVPIID 2AX ( ) sheets		-1532	GHP		-1202	Cable extension AT sheets		-1190

Motor·Drive unit·Position encoder

Axis name	Rapid traverse	Type of motor·Capacity	Drive unit	Encoder
Spindle	60–6000 rpm	VAC motor 5.5 / 7.5 KW	YASUKAWA·FANUC·(OKUMA)	PG LF1024-BM-S11 Mag. PG TS5270N1
X	15000mm/min.	OKUMA BL- MH101E–12S 1.2 KW	BL-D 30 A	FII MRP.FII (with shaft)
Y	15000mm/min.	OKUMA BL- MH101E–12S 1.2 KW	BL-D 30 A	FII MRP.FII (with shaft)
Z	13000mm/min.	OKUMA BL- MH101E–12SB 1.2 KW	BL-D 30 A	FII MRP.FII (with shaft)
W	mm/min.	OKUMA BL- – KW	BL-D A	FII MRP.FII (with shaft)
A·B·C	deg/min.	OKUMA BL- – KW	BL-D A	FII MRP.FII (with shaft)
A·B·C	deg/min.	OKUMA BL- – KW	BL-D A	FII MRP.FII (with shaft)
1°·5°	deg/min.	OKUMA BL- – KW	BL-D A	FII MRP.FII (with shaft)
DC power supply unit			DC-S A axis	
Crossrail	mm/min.	AC KW·OKUMA BL- KW	BL-D D	E E (with shaft)
MG	pots./min.	Hydraulic pump motor·OKUMA BL- KW	BL-D D	E E (with shaft)
CA	mm/min.	OKUMA BL- – KW	BL-D D	E E (with shaft)
AT Index				E (with shaft)
ATMG		Hydraulic pump motor·OKUMA BL- KW	BL-D D	E E (with shaft)
APC		Hydraulic pump motor·OKUMA BL- KW	BL-D D	E E (with shaft)
APC		Hydraulic pump motor·OKUMA BL- KW	BL-D D	E E (with shaft)

Note	Customer
	Phone – –
	Map

1	2505 T.P. 3 DEC 92	2	2689 T.P. 4th-93	3		4	
5		6		7		8	
9		10		11		12	

#262

System floppy disk (3.5) 8 inch

NC·EC options

Spec. name	Yes	Related to		Drawing No.	Spec. name	Yes	Related to		Drawing No.	Spec. name	Yes	Related to		Drawing No.
	None	soft	hard			None	soft	hard			None	soft	hard	
Tape storage 320 m	○	(N)	○	X	Tool breakage detection		(N)	○		APC Twin Pallet Parallel type	○	(NE)	○	2-713
One part program capacity (60 m	○	(N)	○	X	Zero point compensation		(N)	○		PPC		(N)	○	
Color CRT (Graphic)	○	(N)	○	X	Manual gauging/ Interactive gauging		(N)	○	X	AAC st		(NE)	○	
Floppy disk drive unit (3.5) 8inch	○	(N)	○	2-691 -1	Pulse handle (2/3 sets) (NC input, EC input)		○	○		AT-ATC		(NE)	○	
					External M code (4/8 sets)		X	○		B-axis NC	○		○	2-712
Tape puncher I/F parallel/(RS-232C)	○	(N)	○	2-690	FI feed (4/8 sets)		(N)	○		Coolant cooling system	○		○	2-738
					DNC-A·B·C		(N)	○		lubrication 2ch	○		○	2-696
Puncher cable type ( )	X		○		DNC additional channel		X	○		Coolant system	○		○	2-822-1
IGF		(N)	○		Inductosyn X·Y·Z		(N)	○		Splash conveyor	○		○	2-822
MOP-TOOL AE sensor. exist/none		(N)	○		Additional axis A·B·C type ( )		(NE)	○						
HP-NC		(N)	○	X	Tape winder 180m		X	○	X					
I-MAP		(N)	○	X	Trans former	○	X		2-731					
					Synchronized tapping	○	(N)		X					

* Drawing No. shows W609-200-_____

Standard drawing		
	Circuit diagram W6000-200- 783-1	Box internal connection diagram W6000-200- 784-1
	Operation box internal connection diagram W6000-200-	Machine connection diagram W6000-200- 785-1

This section will cover software related functions. In this section ∅ refers to the number zero and O or o refers to the letter O. The Management Data Card will be discussed in this section. The software loading procedures will also be discussed along with parameter backup procedures.

Every Okuma machine comes with its own Management Data Card (MDC). This sheet of paper is very useful when troubleshooting or diagnosing a problem. The MDC shows which software files should be in the memory of the machine. The specification codes on the MDC show which options have been purchased with the machine. The hardware for the machine is also shown. The drawing numbers for the electrical schematics are also shown on most MDCs'. Japanese built lathes, some grinders, and the American built Cadet (LNC 8) do not show the drawing number for the machine's electrical schematics. The drawing number for the schematics of these machines can be found on the machine's identification plate (nameplate).

Every machine's memory is divided into two sections (directories): BB∅ and BB1. The BB0 directory is for the system software files and the BB1 directory is for part programs. Most lathes have two system software diskettes. The A diskette which has all the NC software, and the B diskette which has all the parameter data. Most machining centers have three system software diskettes: The A1 diskette (NC software), the A2 diskette (EC software), and the B diskette (parameter data). All the software files in the BB∅ directory have to match what is on the diskette label and the MDC. The only two exceptions are the BIN file and the MEU file (M/C). The BIN file is used to initialize the memory in the machine. It is erased from memory after it has initialized the memory. The data in the MEU file on machining centers is stored in the RAM of the ECP board. This file is not seen in the BB0: directory.

The following describes the different methods of saving files on **lathes**.

PIP — This function is accessed by going into EDIT AUX mode. This function is used to transfer Part Programs. (BB1 files)

DATA PIP — This function is used to transfer Parameters, Offsets, and Tool Data etc. It is also accessed by going into EDIT AUX mode.

Both use the CN0 (RS - 232C) and/or FD∅ (Floppy Disk Drive) ports. All parameter data is backed up to a file named A.TOP.

The FDC (Floppy Disk Controller) board and the disk drive is needed to load the system software files.

The following describes the different methods of saving files on **Machining Centers**.

PIP — This function is accessed by going into EDIT AUX mode. This function is only used to transfer Part Programs. (BB1 files)

The utility disk (D Disk) is needed to back up(save to a diskette) Parameter, Offsets, and Tool Data etc. The “D” diskette is not needed to reload data.

With software version 709BF and higher, the **Punch/Read** function can be used to reload Parameter, Offsets, and Tool Data etc.

To find out what software version the machine has, look at the MAA file in the BB∅ Directory. With this version (709BF) and higher, all parameter data can be transferred through a default file named A.TOP.

PUNCH /READ — on machining centers the Punch/Read function is accessed by going into Parameter mode.

The FDC (Floppy Disk Drive) is needed to load the system software.

As a precaution, all part programs and parameter data should be saved to a diskette before doing any work on a machine. This can save hours of down time if the system software has to be reloaded. It is possible to load just the B diskette if faulty parameter data is suspected.

Initializing a diskette

When the Okuma disk drive is used, the diskette has to be formatted (initialized) to the OSP format.

To initialize a diskette do the following:

1. Insert a new diskette into the floppy disk drive.

2. Press EDIT AUX mode key.

3. Press the EXTEND function key (F8) once.

4. Press the INIT function key (F2), the CRT will display:

   =IN

5. Type in **FD∅:** press the WRITE key, the CRT will display:
   initialize OK (Y/N)!

   If nothing is typed in and the WRITE key is pressed the memory for the part programs will be erased because BB1 is the default!

6. Type in “Y” and press WRITE , the CRT will display:
   formatting (Y/N)!

7. Type in "Y" and press Write , the CRT will display:
   format (2DD-72∅K=∅,2HD-1.44M=1)!

8. Type in a "1" or "∅" depending on the type of diskette you have and press the **Write** key. In most cases, the 1.44M is used.

When the equal (=) sign appears, formatting is completed.

Backing Up Part Programs

9. **The control should be put in metric mode (NC optional parameter bit number three bit zero set to a zero)** Go into **EDIT/AUX** mode and press **F3** to access the **PIP** function. Press the **COPY** function key and key in **BB1:*.*,FD∅:** and press the **WRITE** key. This copies all the files in BB1: to the diskette.(@ > Press PIP QUIT)

LATHES

The control should be put in metric mode (NC optional parameter bit number three bit zero set to a zero) before saving files. The date should also be set before saving files so the user will know how old the data is on the diskette.

When the parameters are copied to a peripheral device the control automatically names the file A.TOP. The following is a procedure on how to back up the parameters (A.TOP file) on a **lathe**.

1. Go into Edit Aux mode.

2. Go into Data Pip menu. (Press F8 twice then F5)

3. Go into Output. (Press F2)

4. At the cursor (> op), {See NOTE}. type **CN∅:** if using the RS 232 port or type **FD∅:** if using a floppy disk drive then press **Write** (enter) The CRT will display:

   "output data is?
   !"

5. If the Write key is pressed at this time, the file automatically gets named "A.TOP". When the cursor (>) appears at the bottom of the screen, the backup is complete.Press D-PIP Quit.

NOTE:

The A.TOP file can be named something else by inputting a new name before pressing the Write key in STEP 4. The file extension (.TOP) will automatically get added to the new file name. For two turret machines, it is suggested that the parameters for each turret be saved separately. For example, typing in **FDØ:UP.TOP;A**, will save all parameters pertaining to the upper turret to a file called UP.TOP. If **;B** is entered after the filename, all parameters pertaining to the lower turret would be sent to the output device.(Be sure tochange the file name.)

Special Notes for W-axis and LT machines.

There are two parameters that relate to interference distances on LT and W-axis machines. These parameters ARE NOT saved during the A.TOP file OUTPUT process. Therefore it is necessary to record these parameters and input them manually through the control.(in metric mode)

LT machines Optional Parameter Long Word # 53
How to manually set this data.

1. Measure the physical distance between the spindle interference points. (spindle nose B to spindle nose R). i.e. 500 mm is measured

2. SET 500,000 as the data for O.P.L.W. # 53. (Can only set one time.)

3. Add -460,000 to this value to bring it down to 40,000. At this point the spindles should be moveable.

4. Add small positive values until the desired interference distance is reached. (i.e. 200000 = 2.000”) (Setting range is 40000 - 9999999)

W-axis machines

Do the same procedure for the W-axis interference distance with the exceptions of set 100,000 at step #2 and add –100,000 at step #3(on W-axis this value can be brought to zero). The data for the W-axis interference is entered in O.P.L.W. # 45.

The following describes how to backup parameters through the A.TOP file on **machining centers** with software version 709BF and higher:
MAKE SURE ATC & APC ARE AT SEQUENCE # 1.

1. Go into **Parameter** mode.

2. Set NC optional parameter bit number 16.7 to a "1" and 3.∅ & 9.∅ to a "∅".

3. Press Extend. (F8) then press Punch (F2).

4. At the cursor (=PU), type **CN∅:** if using the RS 232 port or type **FD∅:** if using a floppy disk drive then press **Write** (enter). The CRT will display:

   "Please input message!"

   At this point you can type in a message, i.e. machine and serial number this parameter file belongs to or name of the particular parameters being backed up.

   Press the **Write** key. (It is not necessary to input a message.)

5. The CRT will display:

   "Parameter!"

   At the top of the CRT, the following menu is displayed: "Parameter Tape Punch Menu". A menu is displayed of the different parameter files. The following table displays the menu shown. The individual files can be saved or all of them at once. To save one particular file type in the number and press the **Write** key. To save all the files type in the first file number (1∅∅) then a dash (-) and then the last file number and press the **Write** key.

1∅∅	Zero Offsets	7∅∅	Optional Parameter Long Word
2∅∅	Tool Length Offsets	71∅	Optional Parameter Word
21∅	Cutter Radius Compensation	72∅	Optional Parameter Bit
22∅	Tool Management No.	8∅∅	MC User Parameter Long Word
23∅	Tool Management Data	81∅	MC System Parameter Long Word
3∅∅	Common Variable	82∅	MC User Parameter Word
4∅∅	System Parameters	83∅	MC System Parameter Word
41∅	User Parameters	84∅	MC User Parameter Bit
6∅∅	Pitch Error Compensation		

(Press Page Down to view all of the menu.)

6. When the equal sign (=) appears at the bottom of the screen, the backup procedure is complete.

Reloading The Parameters

LATHES

To reload the parameters on a **lathe** do the following:

1. Go into **Edit Aux** mode.

2. Go into **Data Pip** menu. (Press **F8** twice then **F5**)

3. Go into **Input.** (Press **F1**)

4. At the cursor (> IN), type **CN∅:** if using the RS 232 port or type **FD∅:** if using a floppy disk drive; type the file name if "A.TOP" is not used, then press the **WRITE** key(enter).

   When the cursor (>) reappears at the bottom of the CRT, press **Back Up** key or wait for BC to count around, turn power off. Then reload part programs by using the COPY key and type FD∅:*.MIN,BB1: **WRITE** , when the = sign appears, the loading procedure is completed.

If an alarm occurs when reloading the A.TOP file, it will show which line in the A.TOP file is causing the alarm. Make a note of this data, i.e. [P1/A]N1X250.000Z250.00. In this example, the P1 represents a group of parameters. The A represents the upper turret and the N1 is the line number.

To resolve this alarm, the ?.TOP file can be transferred to the BB1: directory to be edited. To transfer the UP.TOP file, follow the same procedure as above and type in **UP.TOP** instead of ***.MIN**. Press PIP QUIT (F4) to get out of the PIP function. To edit the file, press the Edit function key (F4) and enter ***.***. Cursor down to the file UP.TOP and press the WRITE key. You can cursor down to the line in question or use the FIND command to locate the line to be edited. To locate the line via the FIND command for the example above, press the FIND (F1) function key and type in **/P1/** and press WRITE. Position the cursor on the line in question and press the LINE DELETE function key. Once the line is located delete all the characters on that line. Once this is done, re-copy the file back to the diskette. Rename the file when you copy it back to the floppy and keep the original file. To do this, type in **BB1:UP.TOP,FD∅:U.TOP** when the file is copied back to the diskette. This will rename the file U.TOP.

Once this is done, repeat the procedure to reload the parameters to see if everything loads up properly. Remember to reload the edited file and **not** the original ?.TOP.

3-2. Tape Format Table

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
TOOL DATA SET	Tool offset	T1	1 - 32 (96)	X (axis), Z (axis)	
	Nose R compensation	T2	1 - 32 (96)	X (axis), Z (axis), Q (nose radius pattern)	
	Tool interference	T3	1 - 12 (96)	A (pattern), B (Z minus), C (Z plus), D (X minus), E (X plus)	Effective only for 2-saddle specification, with no graphics
	Tool life management tool table	T4	1 - 12 (96)	G (group number), A (set workpiece quantity), B (actual machined quantity), C (set machining time), D (actual machining time), E (set wear amount), F (actual wear amount), I (offset No. 1), J (offset No. 2), K (offset No. 3), H (tool NG flag), L (tool life flag)	
	Tool life management group table	T5	1 - 12 (24)	S (selected tool No.), L (tool group life flag)	
	Post-process gauging auto compensation data	T6	1 - 8	I (input data No.), C (compensation amount), Q (tool offset No.), G (tool group No.), F (tool offset group No.), A (axis), S (skip counter), D (compensation ignore counter)	
	CEJ matic gauging compensation data	T7	1 - 12	Q (tool offset No.), F (tool offset group No.)	

In the Data No. column, the numeric value in ( ) applies for the ATC specification.

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
TOOL DATA SET	Tool form select	T10	1 - 12 (96)	A (tool angle), B (edge angle), C (sticking out), D (drill diameter), E (tool width), I (offset No. 1), J (offset No. 2), K (offset No. 3), S (classification code), L (form code)	Effective with graphic specification
	ATC tool form	T11	1 - 96	I (1st position tool's offset No. 1), J (1st position tool's offset No. 2), K (1st position tool's offset No. 3), A (2nd position tool's offset No. 1), B (2nd position tool's offset No. 2), C (2ndposition tool's offset No. 3), S (2nd position tool's tool classification code), L (2nd position tool's tool form code)	Effective for the ATC specification with color graphics
	Load monitor base	T12	1 - 64	X (axis), Z (axis), C (axis), S (spindle), M (M-tool spindle), W (axis), B (sub spindle)	M can be designated for the B-turret.
	Load monitor first limit	T13	1 - 64	X (axis), Z (axis), C (axis), S (spindle), M (M-tool spindle), W (axis), B (sub spindle)	M can be designated for the B-turret.
	Load monitor second limit	T14	1 - 64	X (axis), Z (axis), C (axis), S (spindle), M (M-tool spindle), W (axis), B (sub spindle)	M can be designated for the B-turret.
	Post-process gauging, RS232C method	T15	1 - 12	I (gauging point), C (turret), Q (axis), G (G flag), F (group No./ offset No.), A (offset group No.), S (??)	

In the Data No. column, the numeric value in ( ) applies for the ATC specification.

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
ZERO SET	Zero point	O1	1 - 2	X (axis), Z (axis), W (axis), C (axis)	N1: ZERO OFFSET, N2: ZERO SHIFT
	Pitch	O2	1	X (axis), Z (axis)	
	Screw pitch compensation	O3	1 - 120	X (axis), Z (axis), C (axis)	
	2nd spindle zero point	O4	1 - 2	X (axis), Z (axis), C (axis)	N1: ZERO OFFSET, N2: ZERO SHIFT
PARAMETER SET	User parameter	P1	1 - 4, 9	X (axis), Z (axis), W (axis), C (axis)	N1: + VARI. LIMIT P N2: – VARI. LIMIT P N3: + VARI. LIMIT M N4: – VARI. LIMIT M N9: DROOP DAT
	Common variable	P2	1 - 32	R (data)	
	System parameter	P3	1 - 15	X (axis), Z (axis), W (axis), C (axis)	N1: + STROKE END LIMIT N2: – STROKE END LIMIT N3: BACKLASH N4: PR CONNECT CMP N5: + SENSOR POSITION (PROG) N6: – SENSOR POSITION (PROG) N7: + SENSOR POSITION (MACH) N8: – SENSOR POSITION (MACH) N9: STANDARD RING

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
PARAMETER SET	System parameter	P3	1 - 15	X (axis), Z (axis), W (axis), C (axis)	N10: ATC TOOL CHANGE POS. N11: Position encoder offset N12: Rapid feedrate unit amount N13: Rapid feedrate acceleration/ deceleration unit amount N14: Manual feedrate unit amount N15: Manual feedrate acceleration/ deceleration unit amount N16: Machine zero offset N17 Torque setting value N18 Positive stroke offset value N19 Negative stroke offset value
	Turret position compensation	P4	1 - 12 (20)	X (axis), Z (axis)	
	Optional parameter long word	P5	1 - 96	R (data)	
	Optional parameter word	P6	1 - 96	R (data)	
	Optional parameter bit	P7	1 - 48	R (data)	

In the Data No. column, the numerical value in ( ) is effective for double-tooling turret specification.

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
PARAMETER SET	Spindle orientation parameter	P8	1 - 32	R (data)	
	Measure counter	P9	1 - 32	R (data)	
	NC work counter	P10	1 - 4	Q (actual), R (full count)	
	NC hour meter	P11	1 - 5	Q (actual), R (full count)	N1: POWER ON TIME N2: NC RUNNING TIME N3: SPINDLE REVOLUTION TIME N4: CUTTING TIME N5: EXTERNAL INPUT TIME
	Tool interference parameter	P12	1 - 80	A (pattern), B (Z minus), C (Z plus), D (X minus), E (X plus)	Effective with graphic specification and 2-saddle specification
	Chuck/ tailstock barrier	P13		A (jaw dimension L1), B (jaw dimension D1), C (jaw position CX), D (jaw position CZ), E (center dimension L2), F (center dimension D2), I (center position D3), J (workpiece end-face WR)	
	Home position	P14	1 - 8	X (axis), Z (axis)	
	2nd spindle chuck barrier	P15		A (jaw dimension L1), B (jaw dimension D1), C (jaw position CX), D (jaw position CZ), E (graphic zero offset ZOF)	

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
PARAMETER SET	2nd spindle user parameter	P16	1 - 4, 9	X (axis), Z (axis), C (axis)	N1: + VARI. LIMIT P N2: – VARI. LIMIT P N3: + VARI. LIMIT M N4: – VARI. LIMIT M N9: DROOP DAT
	2nd spindle system parameter	P17	1 - 8	X (axis), Z (axis)	N1: + STROKE END LIMIT N2: – STROKE END LIMIT N3: BACKLASH N4: PR CONNECT CMP N5: + SENSOR POSITION (PROG) N6: – SENSOR POSITION (PROG) N7: + SENSOR POSITION (MACH) N8: – SENSOR POSITION (MACH)

Note: The data in the above table is for all system specifications. Therefore, all data cannot always be handled by the tape data input/output function.

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
Spindle Control Parameter (with high-precision VAC motor specification)		P18	1 - 32	A (M41) B (M42) C (M43) D (M44)	N1 Spindle control acceleration/ deceleration unit amount N2 Spindle index starting angle (θ1) N3 Spindle deceleration starting angle (θ2) N4 Spindle creep starting angle (θ3) N5 Spindle index finishing angle (θ4) N6 Spindle position loop gain setting angle (θ5) N7 Spindle index starting speed (V2) N8 Spindle creeping speed (V3) N9, N10 Not used N11 Backlash offset amount N12 Lost motion offset amount N13 Ftp maximum N14 Ft1 maximum N15 Ft1 minimum N20 Attachment backlash offset amount N21 KV value N22 Torque feed forward N23 Tp maximum N24 T1 maximum N25 T1 minimum N26 T2 maximum N27 T2 minimum

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
Spindle Control Parameter (with high-precision VAC motor specification)		P18	1 - 32	A (M41) B (M42) C (M43) D (M44)	N28 T1 N29 T2 N30 Not used N31 CH1 number N32 CH2 number
M-tool Spindle Control Parameter (with high-precision VAC motor specification)		P19	1 - 32	A (M41) B (M42) C (M43) D (M44)	N1 Spindle control acceleration/ deceleration unit amount N2 Spindle index starting angle (θ1) N3 Spindle deceleration starting angle (θ2) N4 Spindle creep starting angle (θ3) N5 Spindle index finishing angle (θ4) N6 Spindle position loop gain setting angle (θ5) N7 Spindle index starting speed (V2) N8 Spindle creeping speed (V3) N9, N10 Not used N11 Backlash offset amount N12 Lost motion offset amount N13 Ftp maximum N14 Ft1 maximum N15 Ft1 minimum N20 Attachment backlash offset amount N21 KV value

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
M-tool Spindle Control Parameter (with high-precision VAC motor specification)		P19	1 - 32	A (M41) B (M42) C (M43) D (M44)	N22 Torque feed forward N23 Tp maximum N24 T1 maximum N25 T1 minimum N26 T2 maximum N27 T2 minimum N28 T1 N29 T2 N30 Not used N31 CH1 number N32 CH2 number
M-tool Spindle Control Parameter		P20	1 - 9	R (data)	N1 M-tool spindle acceleration/ deceleration unit amount N2 M-tool spindle backlash N3 M-tool spindle droop amount N4 M-tool spindle zero offset N5 M-tool spindle index angle for synchronized tapping N6 M-tool spindle jog speed N7 M-tool spindle oscillating speed N8 M-tool spindle servo processor constant time at 1st step N9 M-tool spindle servo processor constant time at 2nd step

Setting Mode	Data Type	Data ID	Data No. (N)	Description	Remarks
NC Turret Control Parameter		P20	1 - 8	R (data)	N1 Rapid feedrate unit amount N2 Rapid feedrate acceleration/ deceleration unit amount N3 Manual feedrate unit amount N4 Manual feedrate acceleration/ deceleration unit amount N5 Torque setting value N6 Encoder offset N7 Droop amount N8 Unclamp timer
NC Turret Index Angle		P21	1 - 12	R (data)	

MACHINING CENTERS

To reload the parameters on a **machining center** with software file 709BF and higher do the following with the machine in "**E STOP**":

1. Go into **Parameter** mode. Set NC Optional Parameter Bit number 16.7 to "1"and, 3. ∅ and 9. ∅ to "∅".

2. Go into **Extend.** (Press **F8**)

3. Go into **Read**. (Press **F1**)

4. At the cursor (R _), type **CN∅:** if using the RS 232 port or type **FD∅:** if using a floppy disk drive then press **Write** (enter). The CRT will display:

   Message (**********)
   Read Continuing?(Y/N)

5. Type in "Y" and press the **Write** key. When the cursor(>) appears, the load procedure is finished.

- ❖ Check MC System Parameter Long Word 9,41 & 48
- ❖ Check MC System Parameter Word 1,2,5,6,21

The cable configuration from the OSP control to various peripherals is shown in the Special Functions Manual.

Loading Software

The following is a procedure on how to load the system software files on an Okuma lathe or machining center.

1. Compare the software files in the BB∅ directory with the files on the A diskette. This will insure that the correct software files for the machine in question are about to be loaded.

2. Compare the spec codes in the machine to the spec codes in the Management Data Card.

3. Load Mode On (1). This switch is located in the control cabinet or in the Tape Reader Box.

4. Press System Reset, CRT displays:

Control Floppy Loading Wait

5. Insert A diskette into floppy disk drive.
6. Press Load Start

The CRT will display:

Control Floppy Loading Start

The files being loaded will be displayed. When all the files on the A diskette have been loaded the CRT will display:

Control Floppy Loading Finish (or End)
Control Floppy Loading Wait

7. If there is more than one system software file diskette, load it at this time. When the following appears again move on the step 8.

Control Floppy Loading Finish (or End)
Control Floppy Loading Wait

8. Turn the Load Mode switch Off.

9. Press the System Reset switch.

10. Re-load the parameters using the parameter loading procedure.

5020M D-Disk Procedure

The following is a step by step procedure to back up the B diskette using the utility (D) diskette. All parameter backup files (.PBU) should be saved except for the MSU and MVU files. These two files contain servo data. With software version 709BF and higher the MCU file does not need to be backed up either.

The customer should back up all the part programs for the machine before this procedure is done. If the system software files have to be loaded, all part programs and parameter data that is not backed up will be erased.

1. Power up with E-STOP on.
   (NOTE MC SYSTEM PARAMETER (WORD) ONE THROUGH SIX SETTINGS.)
2. Set the date and time.
3. Load Mode ON (1)
4. Push System Reset, CRT will display:

   Control Floppy Loading Wait

5. Press upper case and D ($), CRT displays:

   FDOS Load Wait

6. Insert utility (D) diskette into the floppy disk drive (FD0).

7. Press Load Start, CRT displays:

   Operating System Program II-A**.***
   Okuma 19**.*.**
   =

8. Type in "BPIP" and press the write key, CRT displays:

   Load:SYS

   >A…Address set for Dump >D…Dump MPB file
   >B…Backup PBU file >C…Copy
   >U…Update PBU file >R…Recover(floppy B)

9. Remove D diskette and load B diskette into floppy disk drive.

10. Type in "B" and press the write key, CRT displays:
    MAU
    Backup OK(Y/N)!

11. Type in "Y" and press the write key, CRT displays:

"Next PBU file search (Y/N)!"

12. Type in "Y" and press the write key, CRT displays:

MDU
Backup OK (Y/N)!

13. Type in "Y" and press the write key, CRT displays:

Search next (Y/N)!

14. Type in "Y" and press the write key, CRT displays:

MGU
Backup OK (Y/N)!

15. Type in "Y' and press the write key, CRT displays:
Search next (Y/N)!

16. Type in "Y' and press the write key, CRT displays:

MSU
Backup OK (Y/N)!

17. Type in "N" and press the write key, CRT displays:

MVU
Backup OK (Y/N)!

18. Type in "N" and press the write key, CRT displays:

PBU file not found
>

Files that need to be backed up might vary from machine to machine because of options. The important thing is **NOT TO BACK UP** the MSU and MVU files (and MCU). It is ***Very Important*** to **save** the MAU (user parameters) and the MDU (system parameters). The MGU file should be saved if the customer has the MOP Tool or IGF function.

19. Type in “D” and press the write key, CRT displays:

F78000-F7BFFF
Dump OK (Y/N)!

20. Type in “Y” and press the write key, CRT displays:

MEU 03
Overwrite (Y/N)!

21. Type in “Y” and press the write key, CRT displays:

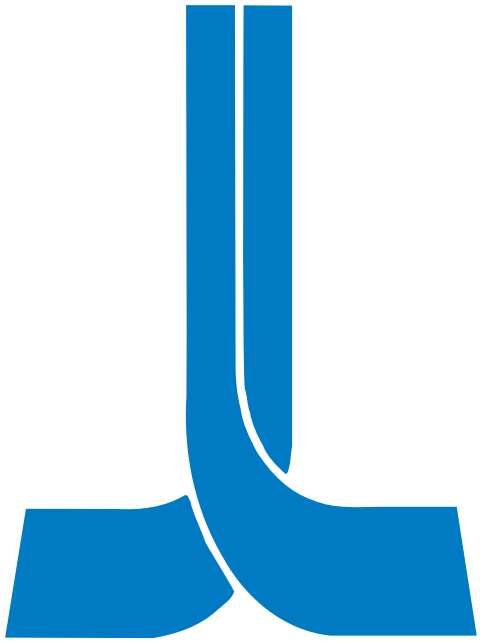
>

This dumps the tool data from the ECP battery backed up area into the MEU file.

22. At the cursor type in “Q” for quit and press the write key.

When the equal “=” sign appears, the task is finished. Typing in the following data, will show all the data that has been backed up on the upper part of the CRT:
“DIR(space)FD0: , PN:”

23. ***LOAD MODE OFF***
24. Remove B disk from floppy disk drive.
25. Press ***SYSTEM RESET.***
26. Power **OFF**
27. Power **ON**

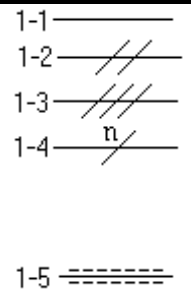
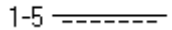
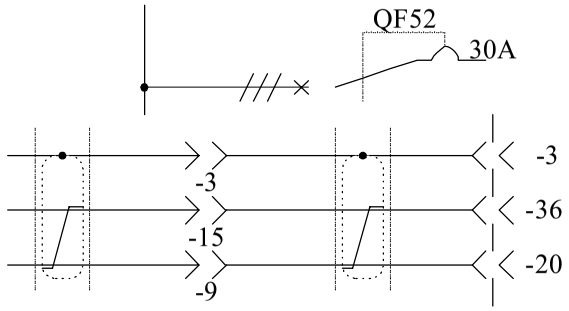
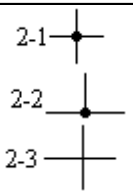
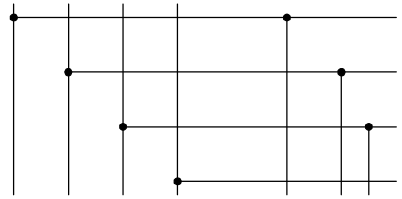
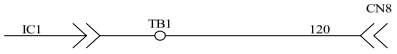
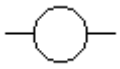
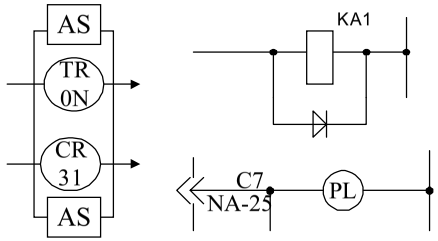


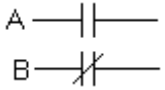
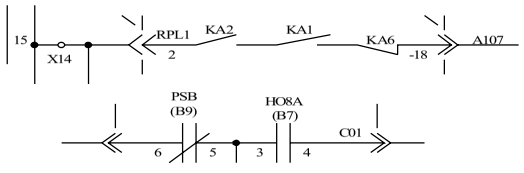
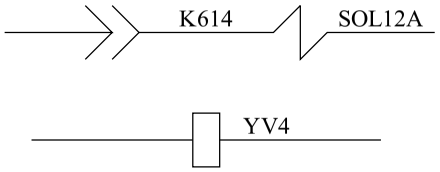
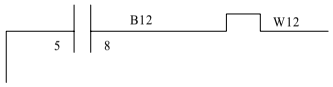
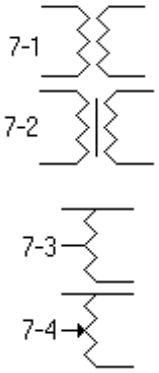
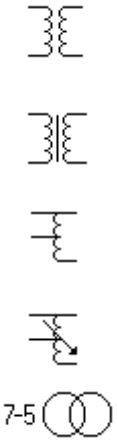
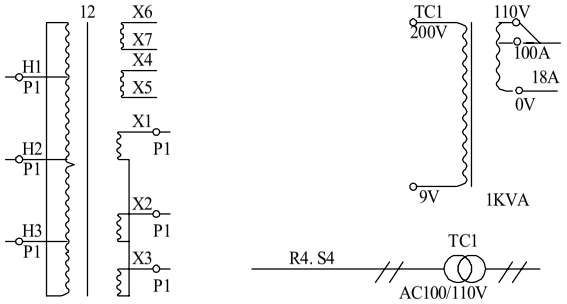
OKUMA

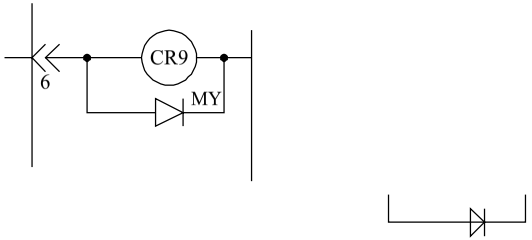
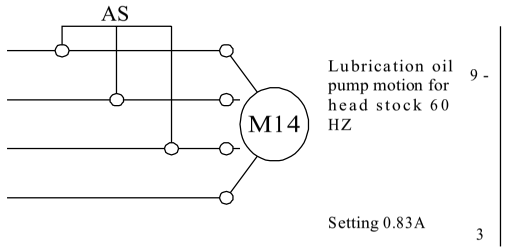
OSP 5000/5020 CONTROL

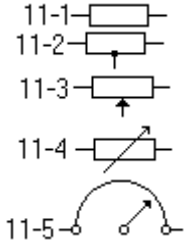
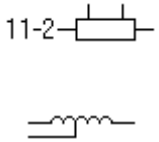
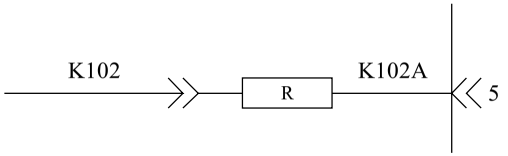
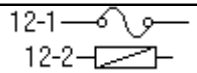
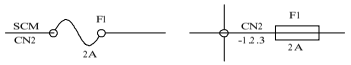
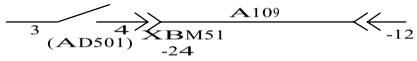
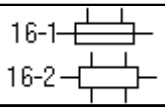
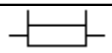
SCHEMATIC SYMBOLS

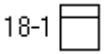
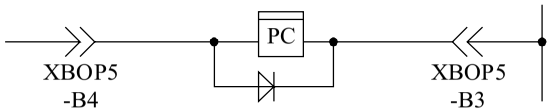
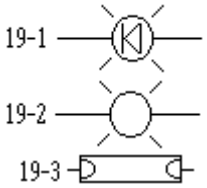
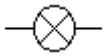
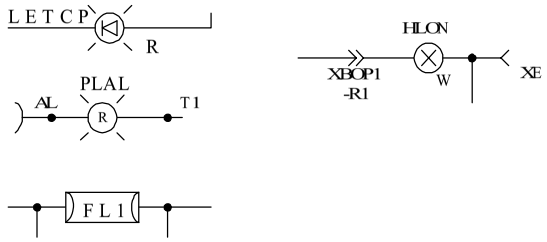
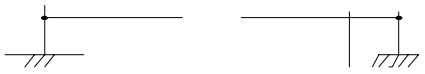
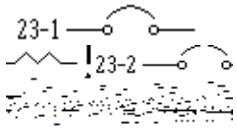
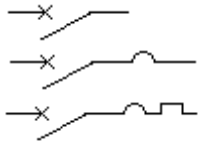
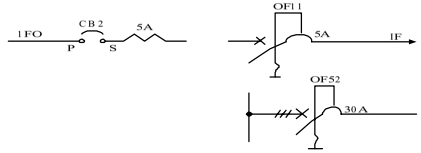
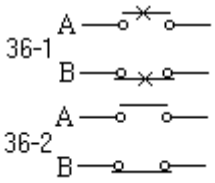
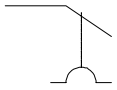
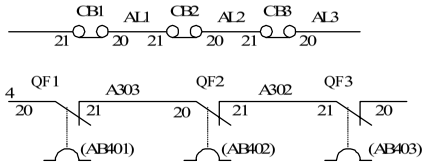
ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

No.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
1	Conductor					1-1 One conductor (wire) 1-2 Two conductors 1-3 Three conductors 1-4 n equals number of conductors in cable 1-5 Shielded cable	
2	Node Not Node					2-1 Connected 2-2 Connected 2-3 Not connected	
3	Terminal		TB		XT XJ	Terminal Block Test Jack	
4	Coil		MS CR TR CTR		KM KA KL KP KR KT	Contact (Motor Starter) Instantaneous Latching relay Polarized relay Reed relay Time-Delay	

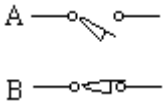
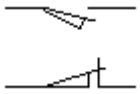
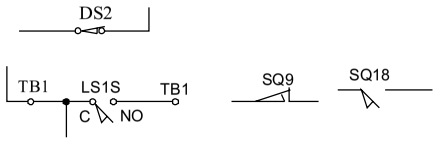
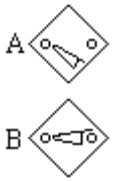
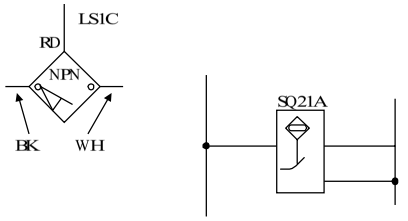
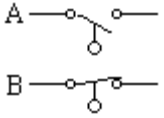
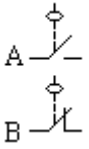
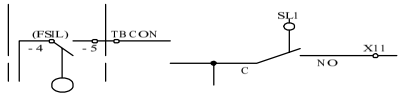
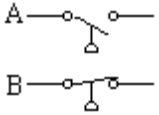
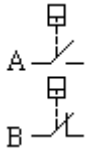
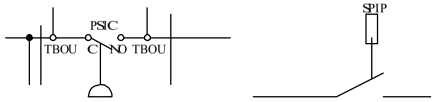
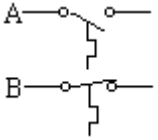
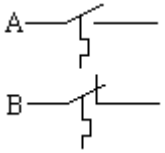
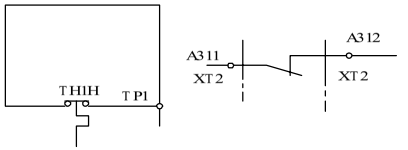
No.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
5	Relay Contact		MS CR		KM KA KL KP KR KT	Contact (Motor Starter) Instantaneous Contact Latching Relay Polarized relay Reed relay Time-Delay	
6	Solenoid		SOL MB MC CH		YV YB YC YH YA	Solenoid Valve Magnetic Brake Magnetic Clutch Magnetic Chuck Electromagnet	
7	Overload		OL		OL FR	Thermal overload relay Current threshold protective device with time-lag action.	
8	Trans-former		T PT		TA TC TM TS TV 7-2 Iron core transformer 7-3 Fixed or Tap transformer 7-4 Variable transformer TC	Current Transformer Transformer for Control circuit supply Power transformer Magnetic Stabilizer Voltage Transformer 7-5 Step down transformer	

No.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
9	Choke coil	8-1 8-2 8-3	X CH		X CH	Reactor Choke Coil 8-1 Fixed 8-2 Adjustable 8-3 Iron core	
10	Rectifiers	9-1 9-2 9-3	REC		REC	9-1 Diode 9-2 Full wave rectifier 9-3 Bridge rectifier	
11	Motor	10-1 10-2	M G MG TG		M	Motor (M DC Motor) Generator (G DC Gen) Motor Generator Tacho Generator 10-1 Field on DC 10-2 Armature on DC	

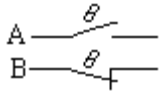
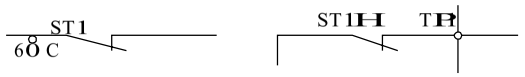
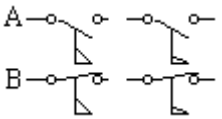
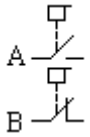
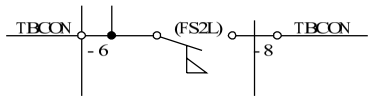
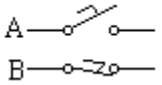
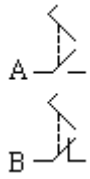
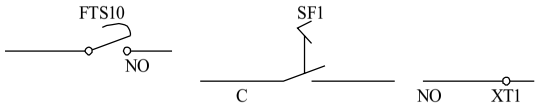
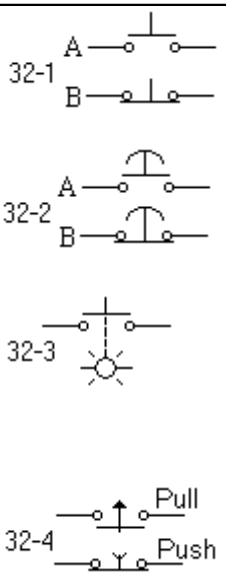
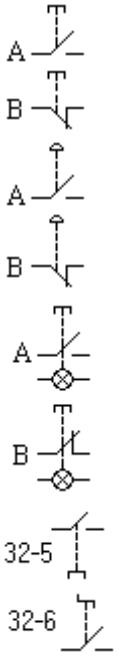
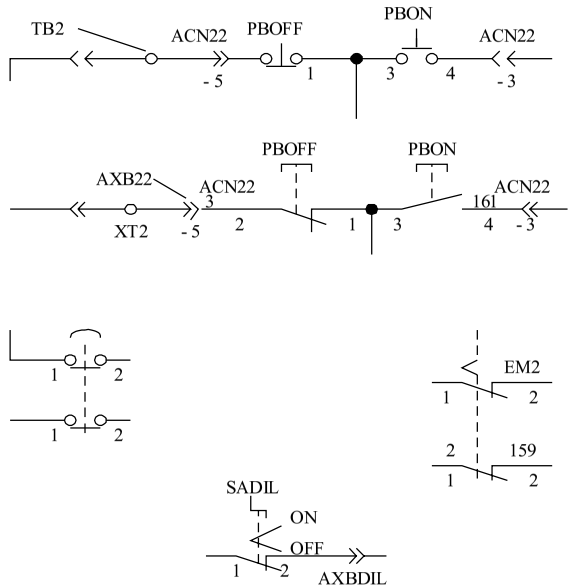
no.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
12	Resistor		R		R	11-1 Fixed resistor 11-2 Tap resistor Variable resistors 11-3 Linear 11-4 Rotary 11-5 Dial Type	
13	Fuse		F		FU	12-1 General 12-2 Enclosed	
14	Bell		BL		BL	Bell	
15	Buzzer		BZ		BZ	Buzzer	
16	Connector		CN		XB XP XS	Connector Plug Socket Receptacle	
17	Shunt connection		SH		SH MLT	16-1 Shunt 16-2 Multiplier	
18	Current Transformer		CT		CT	Current Transformer	

No.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
19	Meter Measuring Instrument				A V W S N HM PC	Ampere meter Volt meter Watt meter Speedometer Tachometer 18-1 Hour Meter Parts Counter	
20	Lamp Color description is shown with the symbol.				LED L PL FL HL	19-1 Light Emitting Diode 19-2 Lamp Pilot Lamp 19-3 Fluorescent LED	
21	Ground				E FG	Earth Frame or Chassis	
22	Circuit Breaker		CB		QF QM	23-1 Circuit Interrupter 23-2 Magnetic CB 23-3 Thermal Magnetic CB	
23	Circuit Breaker Contact		CB		QF	36-1 Breaker has to be manually reset. 36-2 Breaker resets automatically.	

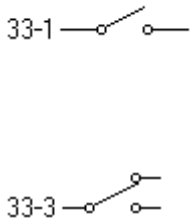
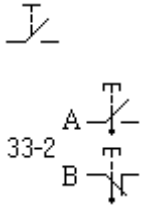
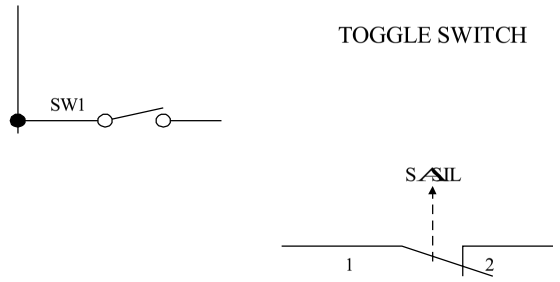
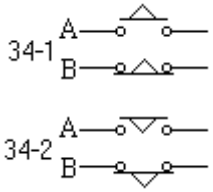
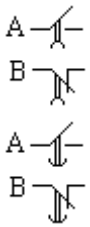
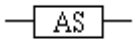
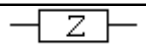
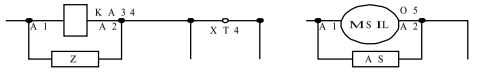
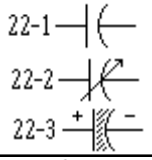
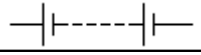
A: Normally Open B: Normally Closed

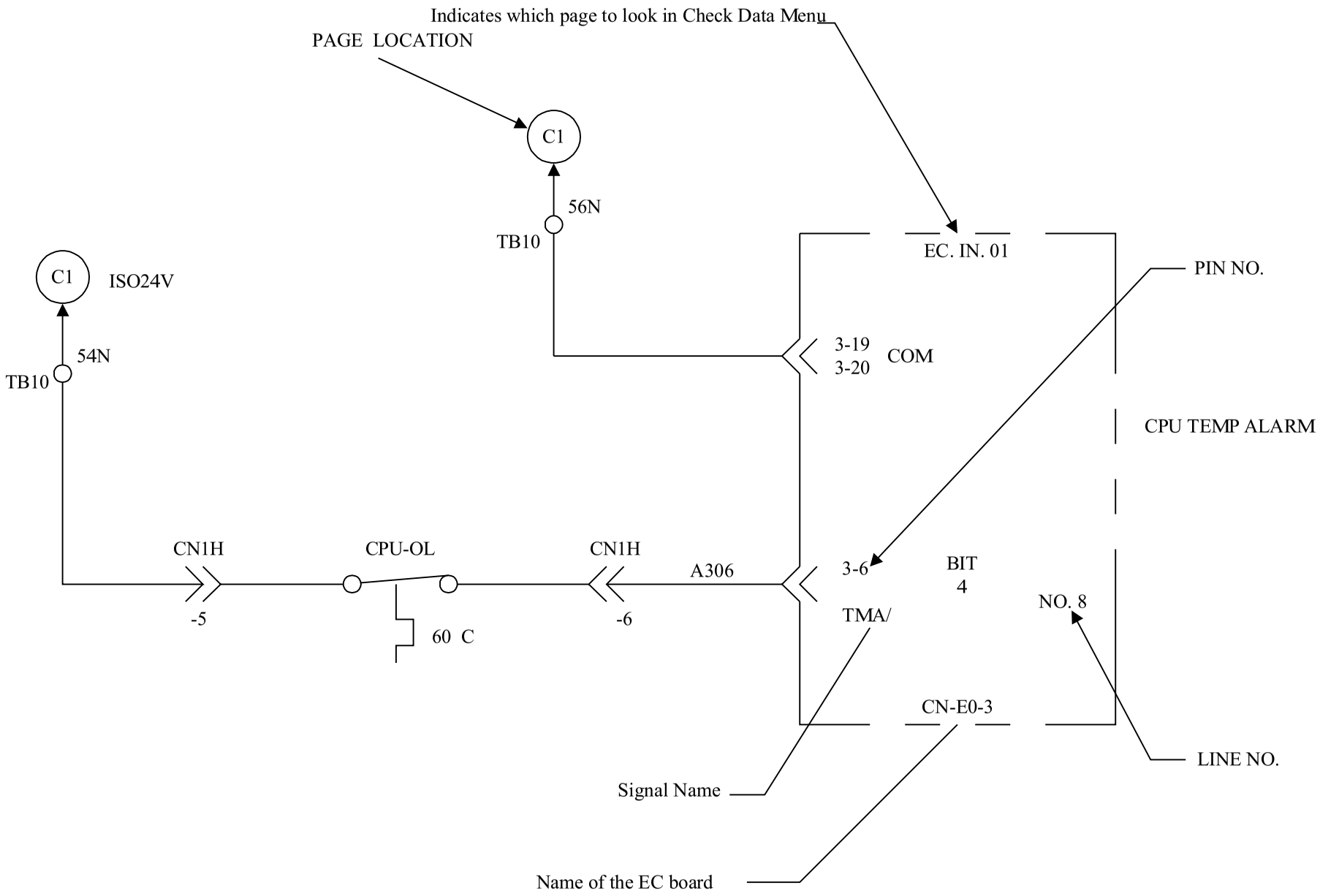
No.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
24	Limit Switch		LS		SQ	Limit Switch Micro Switch	
25	Proximity Switch		LS		SQ	Position sensor 25-1 Magnetic Prox Switch	
26	Float Switch		FS		SL	Liquid level sensor	
27	Pressure Switch		PS		SP	Pressure sensor	
28	Thermal Switch				THS	Auto Reset Manual Reset	

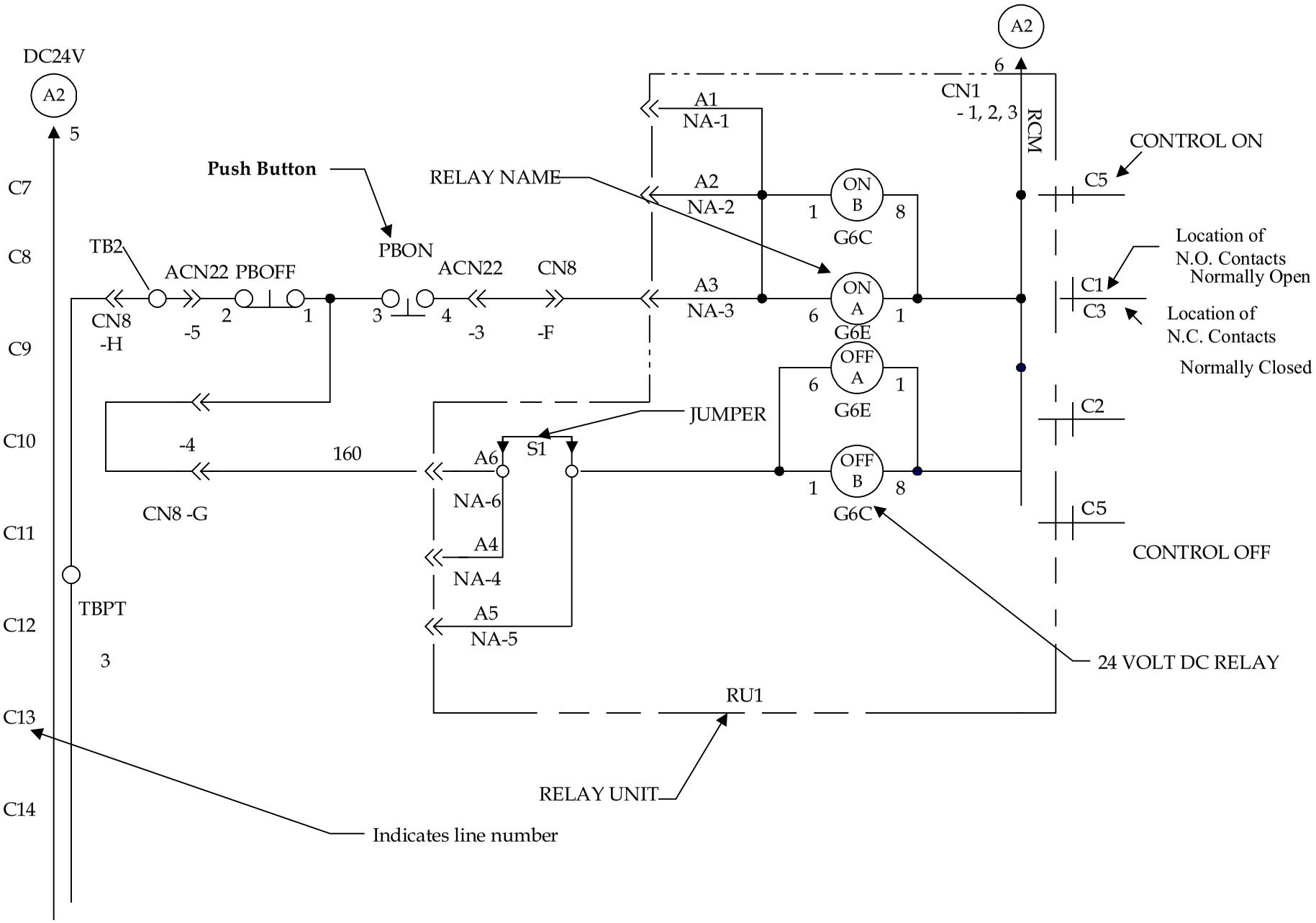
A: Normally Open B: Normally Closed

No.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
29	Temper-ature		ST		ST	Temperature Switch	
30	Flow Switch				FS	Flow switch for air, water, oil, etc.	
31	Foot Switch				FTS	Also labeled Pedal Switch	
32	Push Button Switch		PB		PB	32-1 Push Button 32-2 Mushroom Head 32-3 Push Button Switch with a light 32-4 Push Pull Switch 32-5 Pull Switch 32-6 Turn Switch	

A: Normally Open B: Normally Closed

No.	Name	Old Symbol	Abrev	New Symbol	Abrev	Remarks	Example
33	Switch				SW	33-1 Single-pole, Single-throw (Flat panel switch) 33-2 Toggle Switch 33-3 Single-pole, Double-throw	
34	Timer Relay Contact		TR			34-1 Instantaneous operation in the direction of the arrow. Time delay in the opposite direction. 34-2 Instant operation Time delay reset	
35	Arc Suppressor		AS		Z	Arc Suppressor	
36	Capacitor		C		C VC C	22-1 Fixed Capacitor 22-2 Variable Capacitor 22-3 Electrolytic Capacitor	
37	Battery		B		GB	If more than one battery. 	


Indicates which page to look in Check Data Menu
PAGE LOCATION
C1
56N
TB10
EC. IN. 01
PIN NO.
C1
ISO24V
54N
TB10
3-19
3-20
COM
CPU TEMP ALARM
CN1H
CPU-OL
CN1H
A306
3-6
BIT
4
NO. 8
-5
60 C
-6
TMA/
CN-E0-3
LINE NO.
Signal Name
Name of the EC board


DC24V
A2
5
C7
C8
C9
C10
C11
C12
C13
C14
TBPT
3
TB2
CN8
-H
-5
ACN22 PBOFF
2
1
Push Button
PBON
3
4
ACN22
-3
CN8
-F
-4
160
CN8 -G
A6
S1
NA-6
A4
NA-4
A5
NA-5
JUMPER
RELAY NAME
A1
NA-1
A2
NA-2
A3
NA-3
ON B
G6C
ON A
G6E
OFF A
G6E
OFF B
G6C
A2
6
CN1
- 1, 2, 3
RCM
CONTROL ON
C5
Location of
N.O. Contacts
Normally Open
C1
C3
Location of
N.C. Contacts
Normally Closed
C2
C5
CONTROL OFF
24 VOLT DC RELAY
RU1
RELAY UNIT
Indicates line number

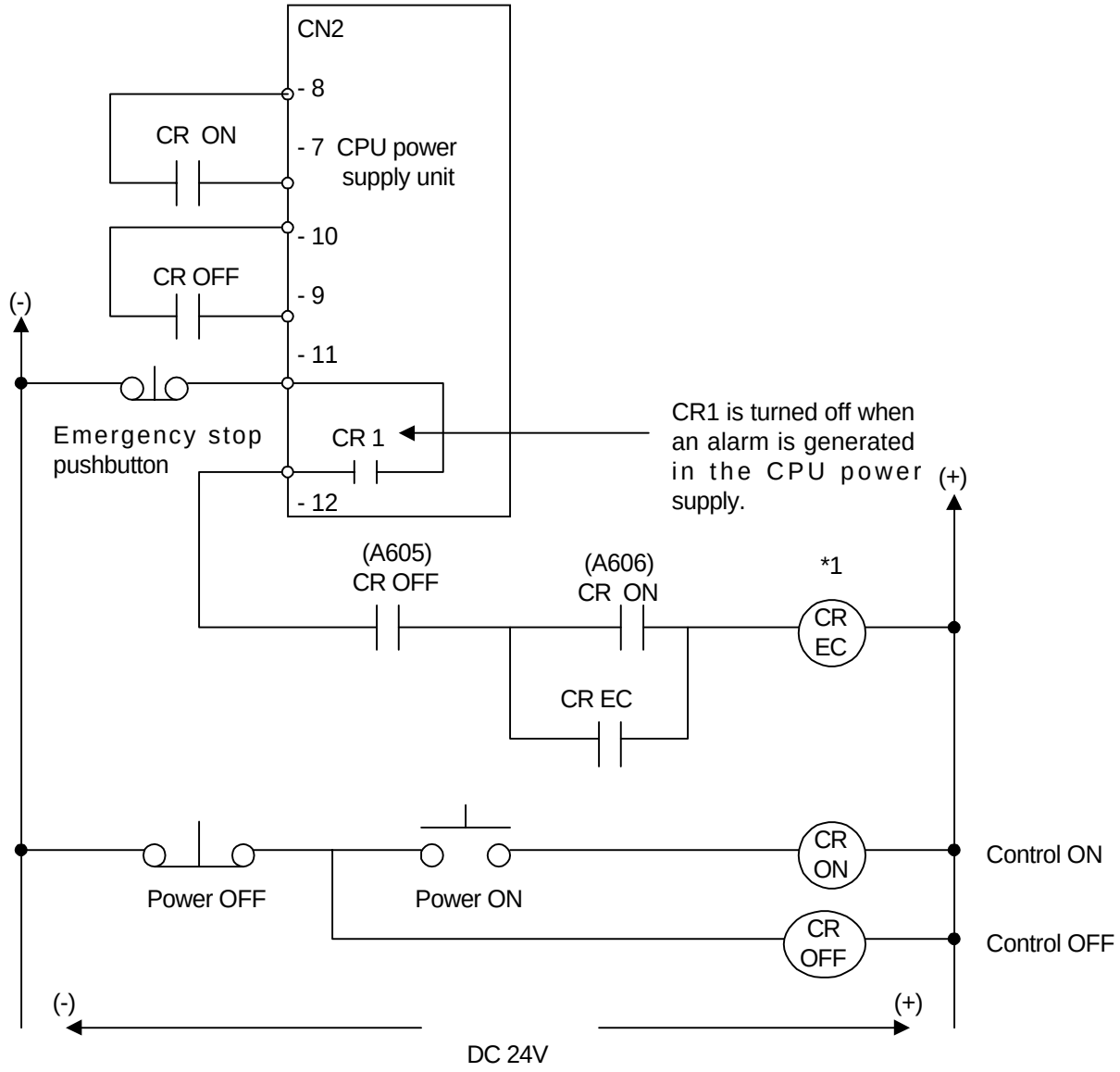


Fig. 1-1

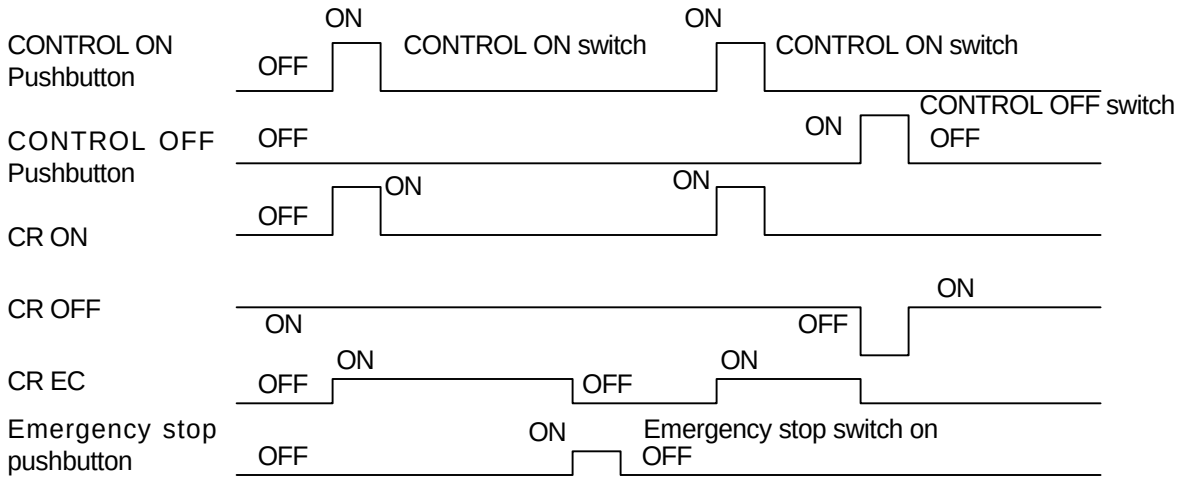
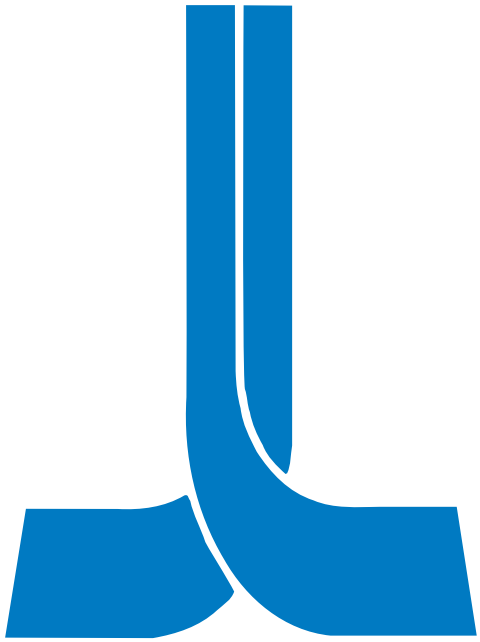


Fig. 1-2

NOTE: The relay name varies depending on the machine models.

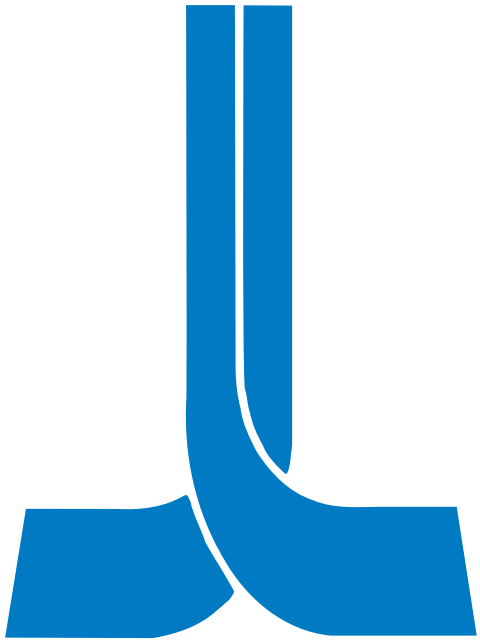


OSP 5000/5020 CONTROL

LATHE SCHEMATICS

A40003

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501



OKUMA

OSP 5000/5020 CONTROL

MACHINING CENTER SCHEMATICS

ELECTRICAL MAINTENANCE
TRAINING MANUAL EL 501

- LZL - 00Z - 0009M

図面番号	図サ	内容	頁	部品明細表番号
W2001 - 200 - 549 -	A2	制御箱 外形図		
W2003 - - 732 -		制御箱 配置図		N
W3500 - - 108 -		ペンダント箱 外形図		N
W2002 - - 298 -		ペンダント箱 配置図		N
W2300 - - 486 -		本機系統図		
- - -				
- - -				
- - -				
W1002 - 200 - 936 -	A3	I/O カード & GRAY コード表		N
- - 937 -		OSP5020M システム構成図		N
- - 968 -		電源系統図	A0	N
- - 969 -		電気回路図 (1)	A1	N
- - 970 -		(2)	$A1_A$	N
- - 971 -		(3)	$A1_B$	N
W1001 - - 961 -		操作電源回路図 (1)	A2	
- - 342 -		(2)	$A2_A$	
- - 962 -		(3)	A3	
W1002 - - 773 -		NC 制御電源回路図	B1	
- - 972 -		ユニット間電源回路図	C1	N
- - 973 -		主軸モータ回路図	D1	N
W1001 - - 348 -		モータ 回路図	D2	
- - 349 -		軸駆動ユニット回路図	E1	
W1002 - - 735 -		サーボ系統図	$E1_A$	
- - 776 -		X軸駆動ユニット回路図	E2	
- - 777 -		Y軸	E3	
- - 778 -		Z軸	E4	
- - 779 -		付加軸	E5	
- - 780 -		SVP II-1 コントロール回路図	E6	
- - 781 -		SVP II-2	E7	
W1001 - - 965 -		NC パネル回路図	F1	

特記事項

1	. :			第1製番	機種、仕様名称
1	. :			基本構成表 — —	電気回路図 1/2
1	. :		MC-4VA OSP5020M	田	GIFU 柵
1	. :		適用機種		図面構成表
1	. :				

10・2・89

W6000-200-727-

OKUMA MACHINERY WORKS LTD.

-LZL-002-0009M

図面番号	図サ	内容	頁	部品明細表番号
W1001-200-966-	A3	操作パネル入力 (1)	F2	
-967-		(2)	F3	
-968-		(3)	F4	
-969-		(4)	F5	
-970-		(5)	F6	
-971-		出力 (1)	F7	
-972-		(2)	F8	
-973-		PANEX バスライン 回路図 (1)	F9	
-974-		(2)	F9A	
-975-		操作パネル 回路図	F10	
W1002-782-		ECP バスライン 回路図	G1	
-974-		EC CONTROL 入力 (1)	H1	N
W1001-370-		(2)	H2	
-371-		(3)	H3	
-976-		出力 (1)	J1	
-373-		(2)	J2	
-374-		(3)	J3	
-375-		(4)	J4	
W1002-783-		ECP CONTROL 回路図 (MG軸)	L1	
W1001-377-		PTR. TH ローディング 回路図	M1	
W1002-784-		PG. PHD. SP CONTROL 回路図	N1	
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				

特記事項

	MC-4VA OSP5020M 適用機種	第1製番	機種、仕様名称 電気回路図 2/2	10.2'89
		基本構成表 — —	図面構成表	W6000-200-727-
		田口 GIFU 桐		

OKUMA MACHINERY WORKS LTD.

- 727 - 002 - 0009M

DRAWING NO.	DWG.SIZE	CONTENTS	PAGE	REMARKS
W2001 - 200 - 549 -	A2	EXTERNAL VIEW OF CONTROL ENCLOSURE		
W2003 - - 732 -		INTERNAL LAYOUT OF CONTROL ENCLOSURE		
W3500 - - 108 -		EXTERNAL VIEW OF PENDANT BOX		
W2002 - - 298 -		INTERNAL LAYOUT OF PENDANT BOX		
W2300 - - 486 -		GENERAL SYSTEM FIGURE OF MACHINE MOUNTED		
- - -				
- - -				
- - -				
W1002 - 200 - 936 -	A3	I/O CARD & GRAY CODE LIST		
- - 937 -		SYSTEM FIGURE OF OSP 5020M		
- - 968 -		POWER SUPPLY SYSTEM DIAGRAM	A0	
- - 969 -		POWER SUPPLY CIRCUIT DIAGRAM (1)	A1	
- - 970 -		(2)	A1A	
- - 971 -		(3)	A1B	
W1001 - - 961 -		CONTROL POWER CIRCUIT (1)	A2	
- - 342 -		(2)	A2A	
- - 962 -		(3)	A3	
W1002 - - 773 -		CIRCUIT DIAGRAM OF NC CONTROL POWER	B1	
- - 972 -		POWER BETWEEN UNIT	C1	
- - 973 -		SPINDLE MOTOR	D1	
W1001 - - 348 -		MOTORS CIRCUIT	D2	
- - 349 -		CIRCUIT DIAGRAM OF AXIS DRIVE UNIT	E1	
W1002 - - 735 -		SERVO SYSTEM DIAGRAM	E1A	
- - 776 -		CIRCUIT DIAGRAM OF X-AXIS DRIVE UNIT	E2	
- - 777 -		Y-AXIS	E3	
- - 778 -		Z-AXIS	E4	
- - 779 -		A-AXIS	E5	
- - 780 -		SVP II-1 CONTROL	E6	
- - 781 -		SVP II-2	E7	
W1001 - - 965 -		NC OPERATION PANEL	F1	

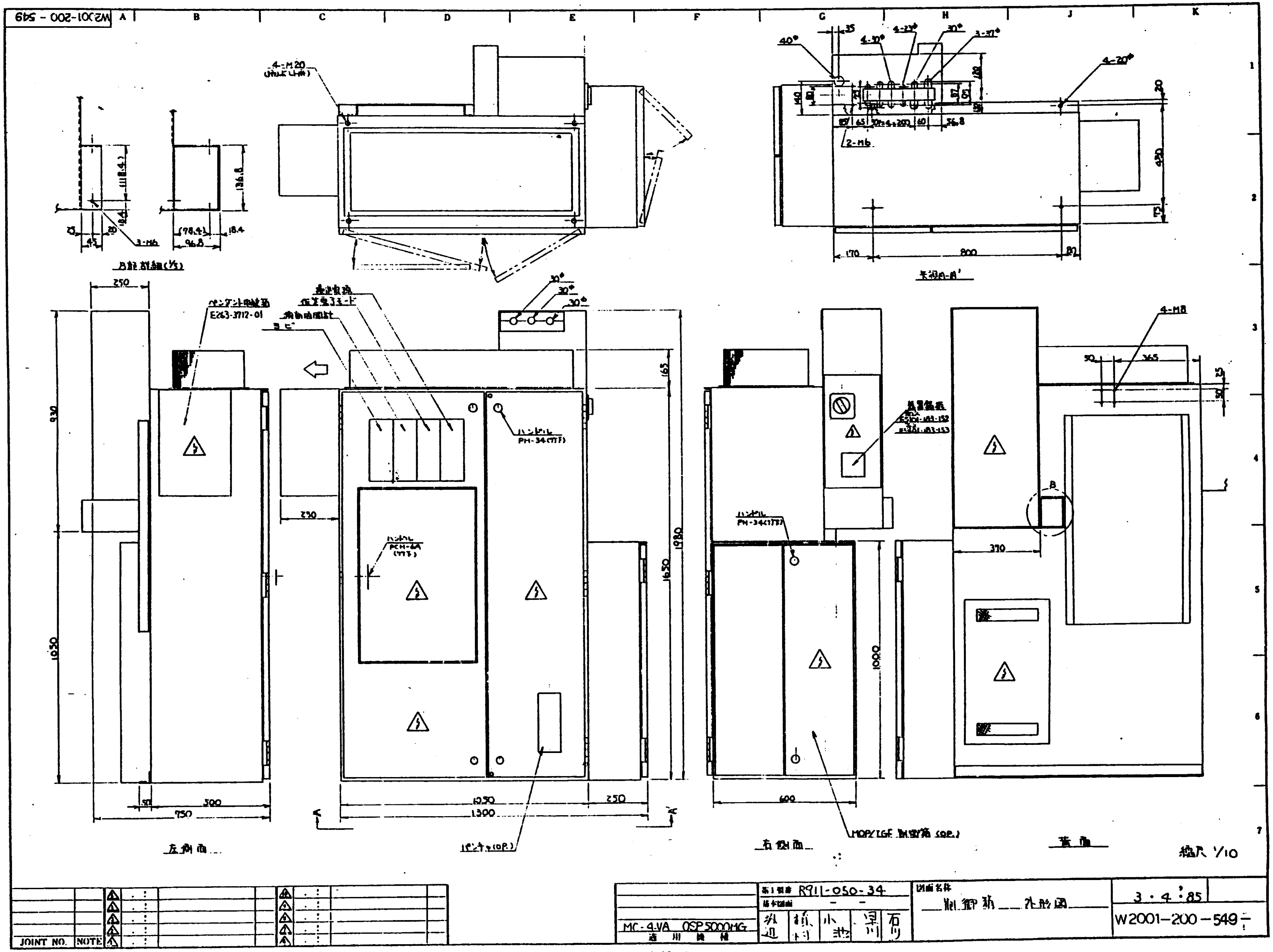
		⑤ . :			1ST MFG NO.	MACHINE&SPEC.NAME	2.Oct.'89	E 3
		④ . :			BASIC COMPOSITION TABLE	CIRCUIT DIAGRAM 1/2		
		③ . :						
		② . :	MC-4TA OSP5020M		GIFU		W6000 - 200 - 727 -	
JOINT NO	NOTE	① . :	APPLICABLE MACHINE		Taguchi Tamura	TABLE OF COMPOSITION DRAWINGS		

OKUMA MACHINERY WORKS LTD.

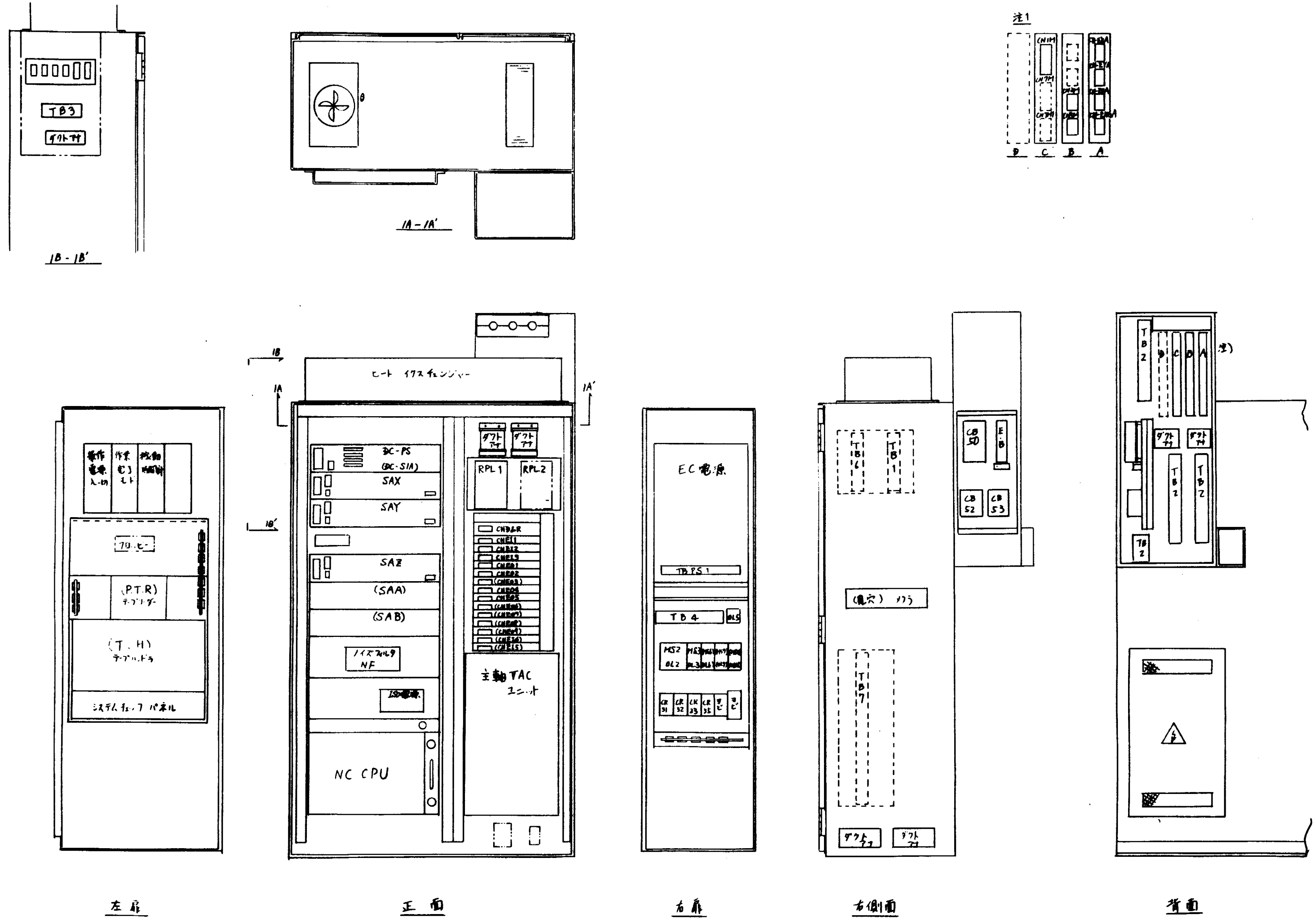
- 727 - 002 - 0009M

DRAWING NO.	DWG.SIZE	CONTENTS	PAGE	REMARKS
W1001 - 200 - 966 -	A3	PANEL CONTROL INPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (1)	F2	
- - 967 -		(2)	F3	
- - 968 -		(3)	F4	
- - 969 -		(4)	F5	
- - 970 -		(5)	F6	
- - 971 -		PANEL CONTROL OUTPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (1)	F7	
- - 972 -		(2)	F8	
- - 973 -		CIRCUIT DIAGRAM OF PANEX BUS LINE (1)	F9	
- - 974 -		(2)	F9A	
- - 975 -		CIRCUIT DIAGRAM OF OPERATION PANEL	F10	
W1002 - - 782 -		ECP BUS LINE CIRCUIT DIAGRAM	G1	
- - 974 -		EC CONTROL INPUT (1)	H1	
W1001 - - 370 -		(2)	H2	
- - 371 -		(3)	H3	
- - 976 -		EC CONTROL OUTPUT (1)	J1	
- - 373 -		(2)	J2	
- - 374 -		(3)	J3	
- - 375 -		(4)	J4	
W1002 - - 783 -		ECP CONTROL CIRCUIT (MG AXIS)	L1	
W1001 - - 377 -		TAPE READER / WINDER LOADING CIRCUIT	M1	
W1002 - - 784 -		PG. PHD. SP CONTROL CIRCUIT DIAGRAM	N1	
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				
- - -				

							1ST MFG NO.		MACHINE&SPEC.NAME		
							BASIC COMPOSITION TABLE		CIRCUIT DIAGRAM 2/2	2.Oct.'89	E
								GIFU			
JOINT NO	NOTE				MC-4VA	05P5020M			TABLE OF COMPOSITION DRAWINGS	W6000 - 200 - 727 -	
					APPLICABLE MACHINE						



OKUMA MACHINERY WORKS LTD.



JOINT NO.	NOTE

MC-4VA

適用機種

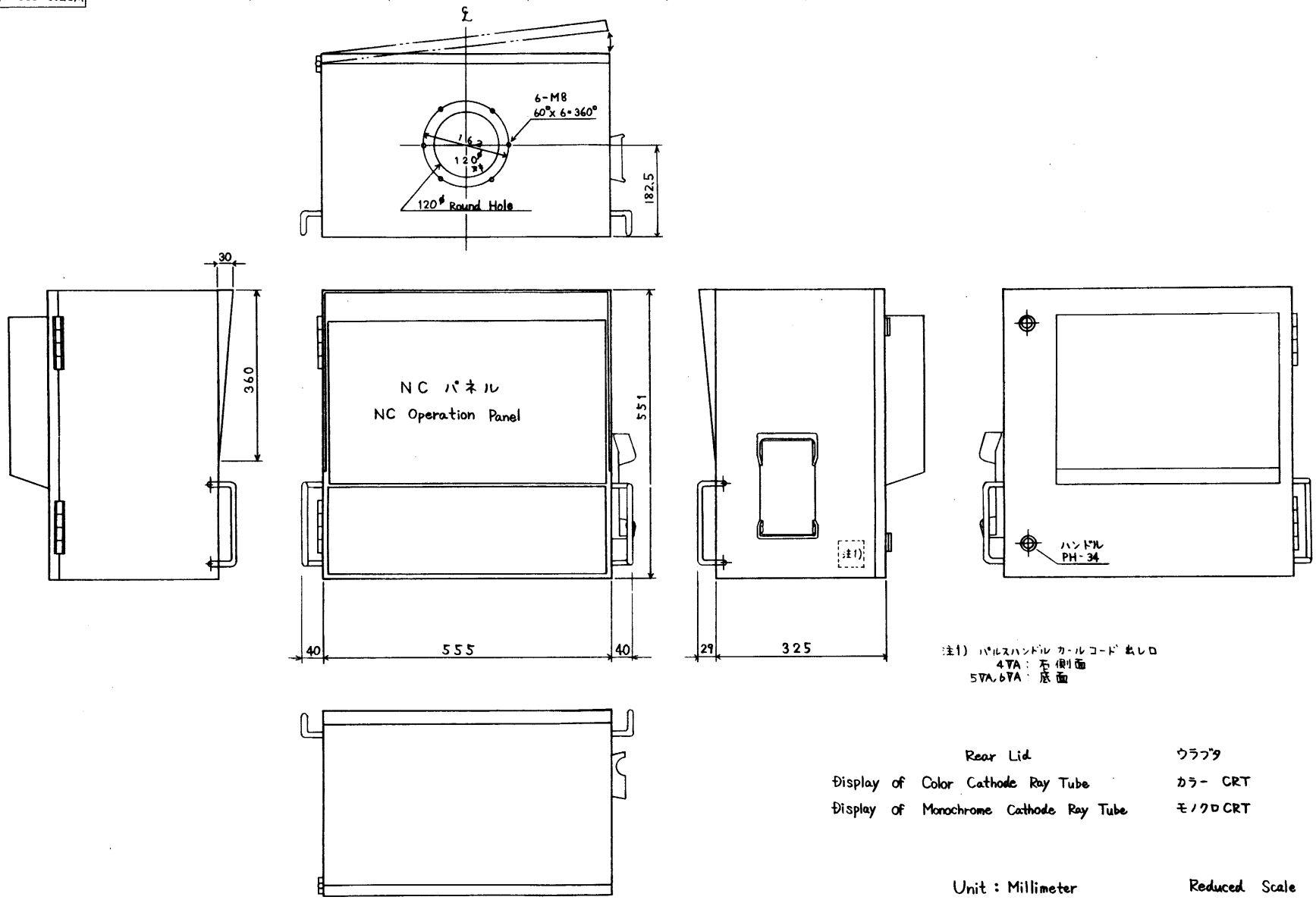
図面名称

制御箱配置図

INTERNAL LAYOUT OF CONTROL ENCLOSURE

10・2 '89

W2003-200-732



(注1) パルスハンドル カールコード 払レロ
4VA: 右側面
5VA, 6VA: 底面

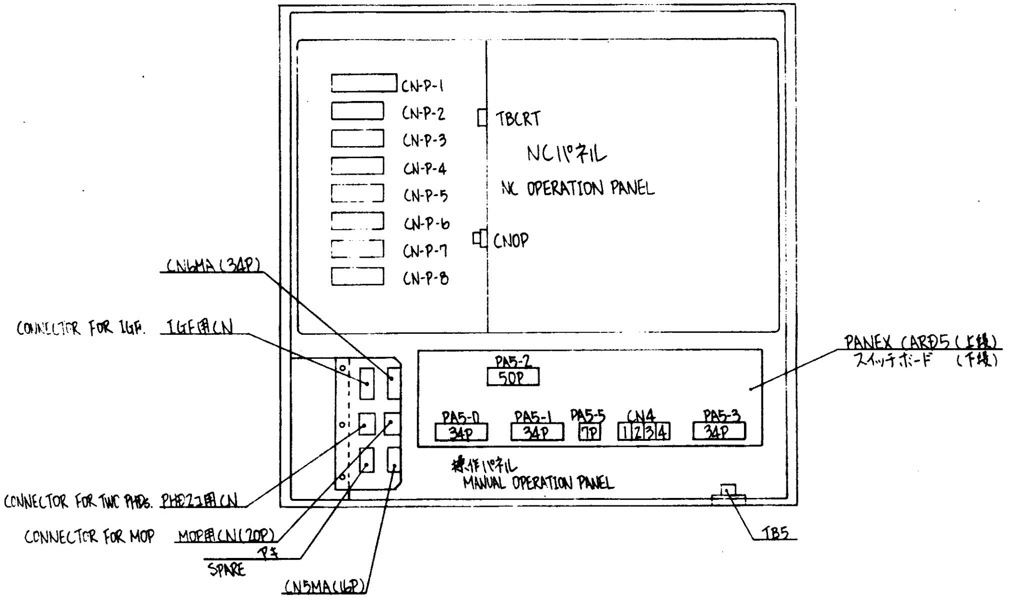
Rear Lid	ウラブタ
Display of Color Cathode Ray Tube	カラー CRT
Display of Monochrome Cathode Ray Tube	モノクロCRT

Unit : Millimeter

Reduced Scale
縮尺 1/5

JOINT NO.	NOTE	MC-V 適用機種	OSP 5020 M	第1製番 / 基本図面	図面名称: ペンダント箱 外形図 EXTERNAL VIEW OF PENDANT BOX
					8.3.'89 / W3500-200-108-

OKUMA MACHINERY WORKS LTD.

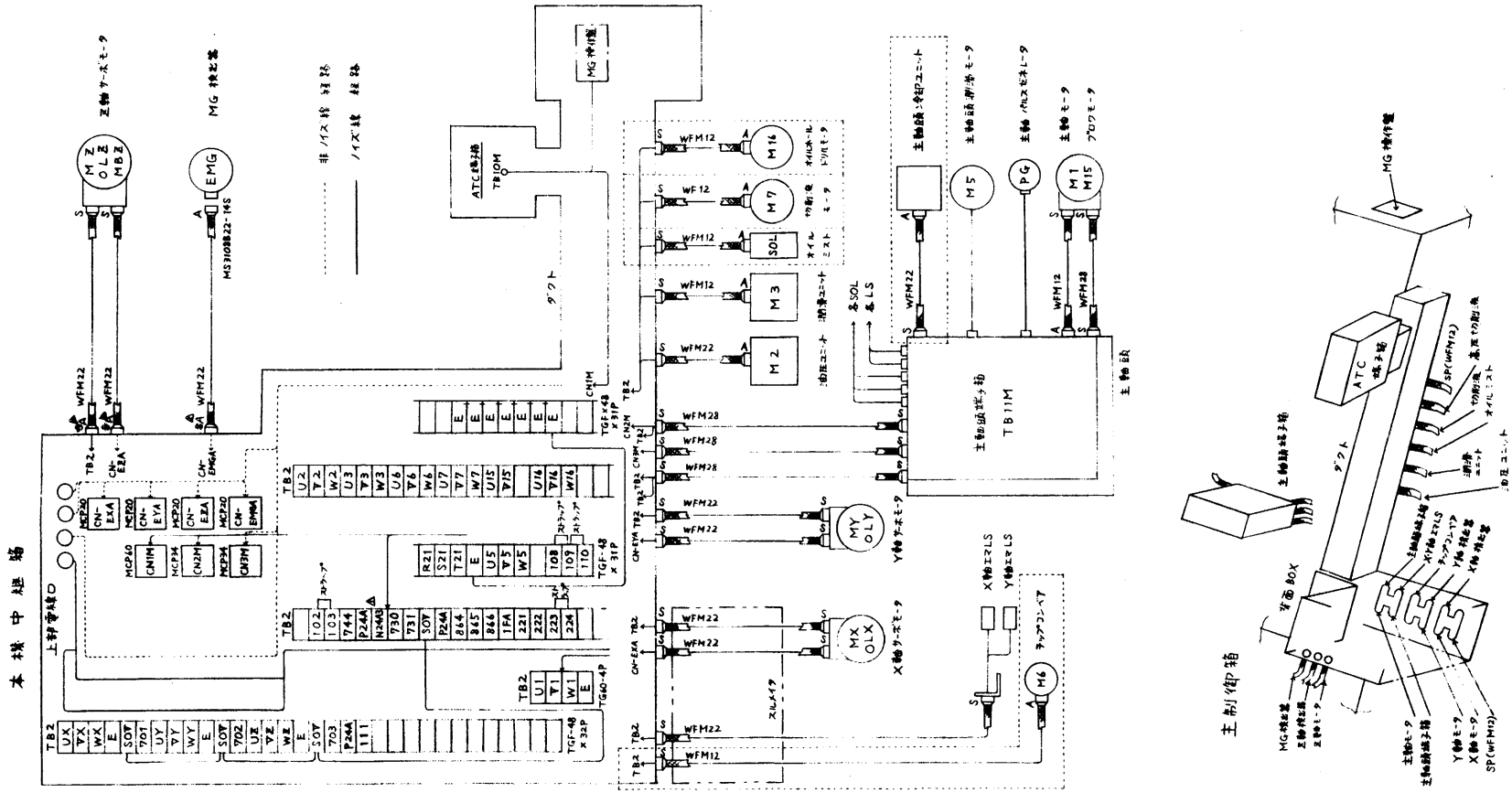


裏面内側
INSIDE SIGHT OF REAR

第1製番	8609~
基本図番	— —
適用機種	MC-V DSP 5000M-G
図面名称	ペンダント箱配置図 INTERNAL LAYOUT OF PENDANT BOX
	7.19.86
	W2002-200-298-

JOINT NO.

OKUMA MACHINERY WORKS LTD.



JOINT NO.	NOTE
	12-12 '88 主軸、M16軸 ブレーキ追加
	10-30'85 主軸ブレーキ追加

MC-47A OSP 5000M-G
適用機種

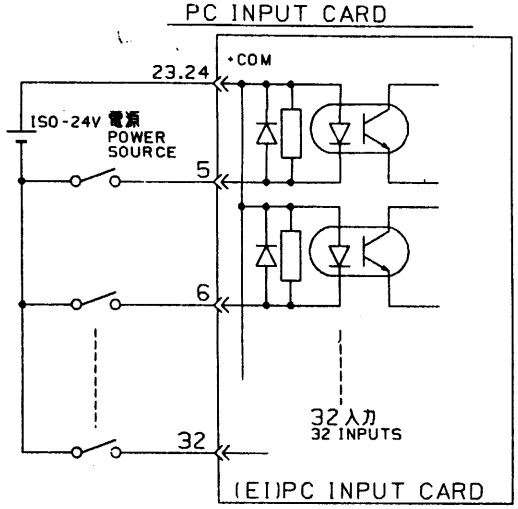
第1製番
基本図面 — —

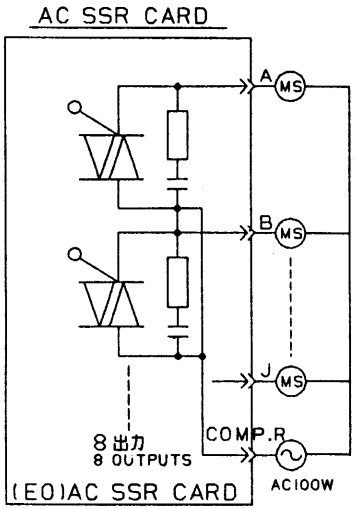
KATO 飯田 稲葉

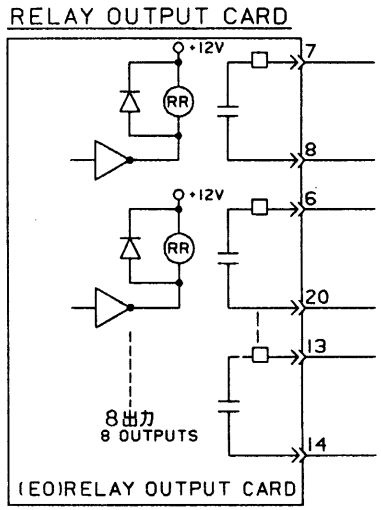
図面名称
本機系統図
GENERAL SYSTEM FIGURE OF MACHINE MOUNTED

12.2.'88
W2300 — 200 — 486 —

W1002-200-936



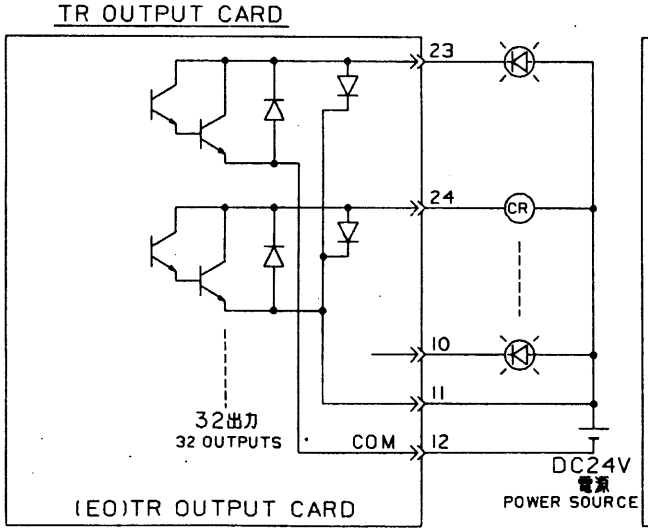


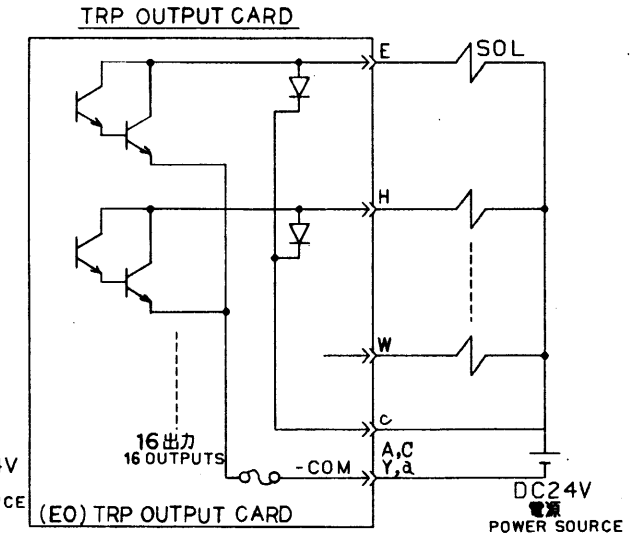


GRAY CODE 表 (ロータリースイッチ)
GRAY CODE LIST (ROTARY SWITCH)

SELECT NO. 切換段数		OUTPUT PIN NO. 出力ピン番号				
13	25	A	B	C	D	E
1	1	L	H	H	H	H
2	2	L	L	H	H	H
3	3	H	L	H	H	H
4	4	H	L	L	H	H
5	5	L	L	L	H	H
6	6	L	H	L	H	H
7	7	H	H	L	H	H
8	8	H	H	L	L	H
9	9	L	H	L	L	H
10	10	L	L	L	L	H
11	11	H	L	L	L	H
12	12	H	L	H	L	H
13	13	L	L	H	L	H
	14	L	H	H	L	H
	15	H	H	H	L	H
	16	H	H	H	L	L
	17	L	H	H	L	L
	18	L	L	H	L	L
	19	H	L	H	L	L
	20	H	L	L	L	L
	21	L	L	L	L	L
	22	L	H	L	L	L
	23	H	H	L	L	L
	24	H	H	L	H	L
	25	L	H	L	H	L

L:0V
H:入力回路電圧(24V)
H:INPUT CIRCUIT VOLTAGE(24V)

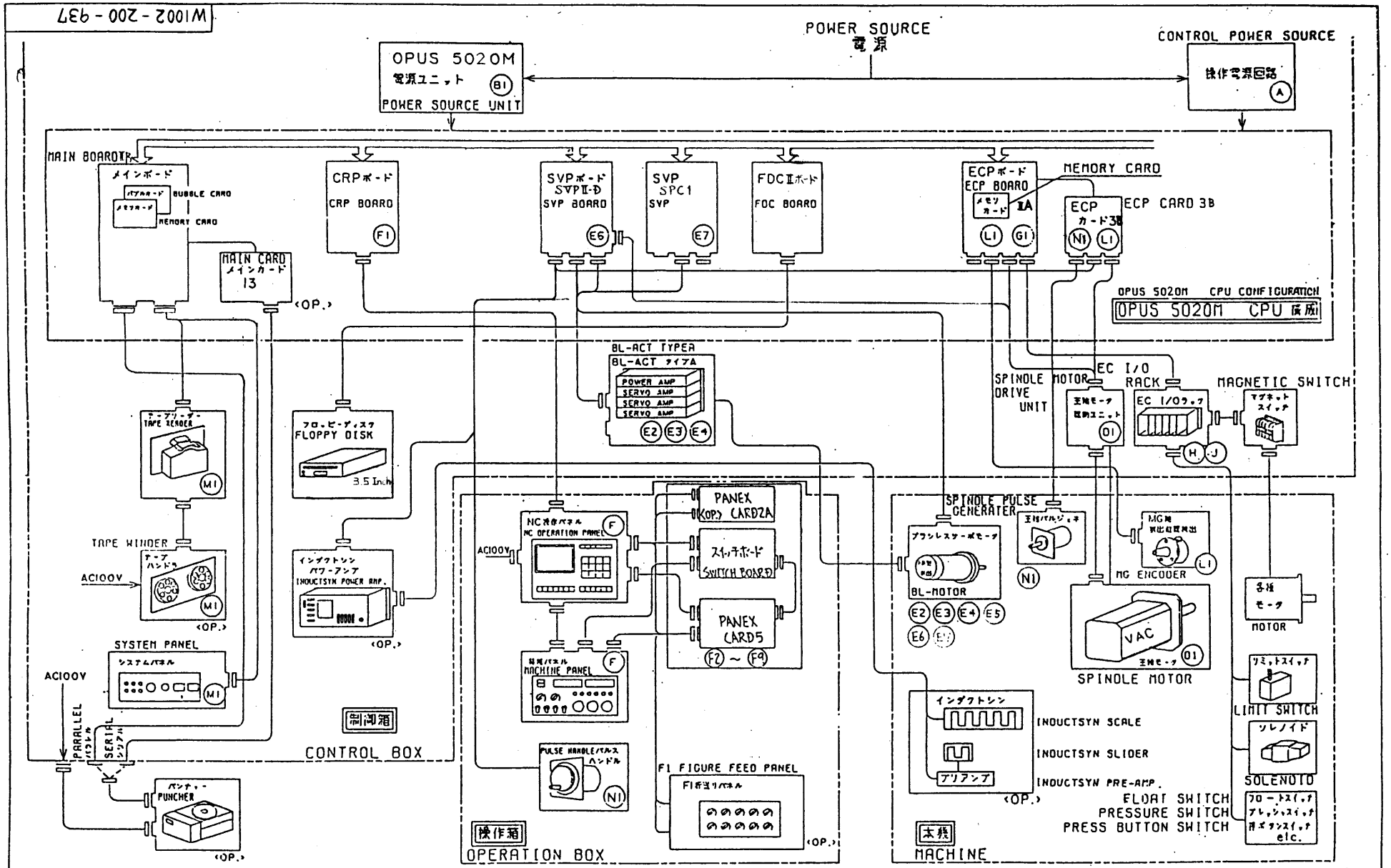




		⑤	. :			第1製番		図面名称	9.7.'89
		④	. :			基本図面 W1001-200-337		I/Oカード & GRAY CODE表 I/OCARD & GRAY CODE LIST	W1002-200-936
		③	. :		MC-V 5020M		コスモ稲葉		
JOINT NO	NOTE	②	. :		適用機種				
		①	. :						

OKUMA MACHINERY WORKS LTD.

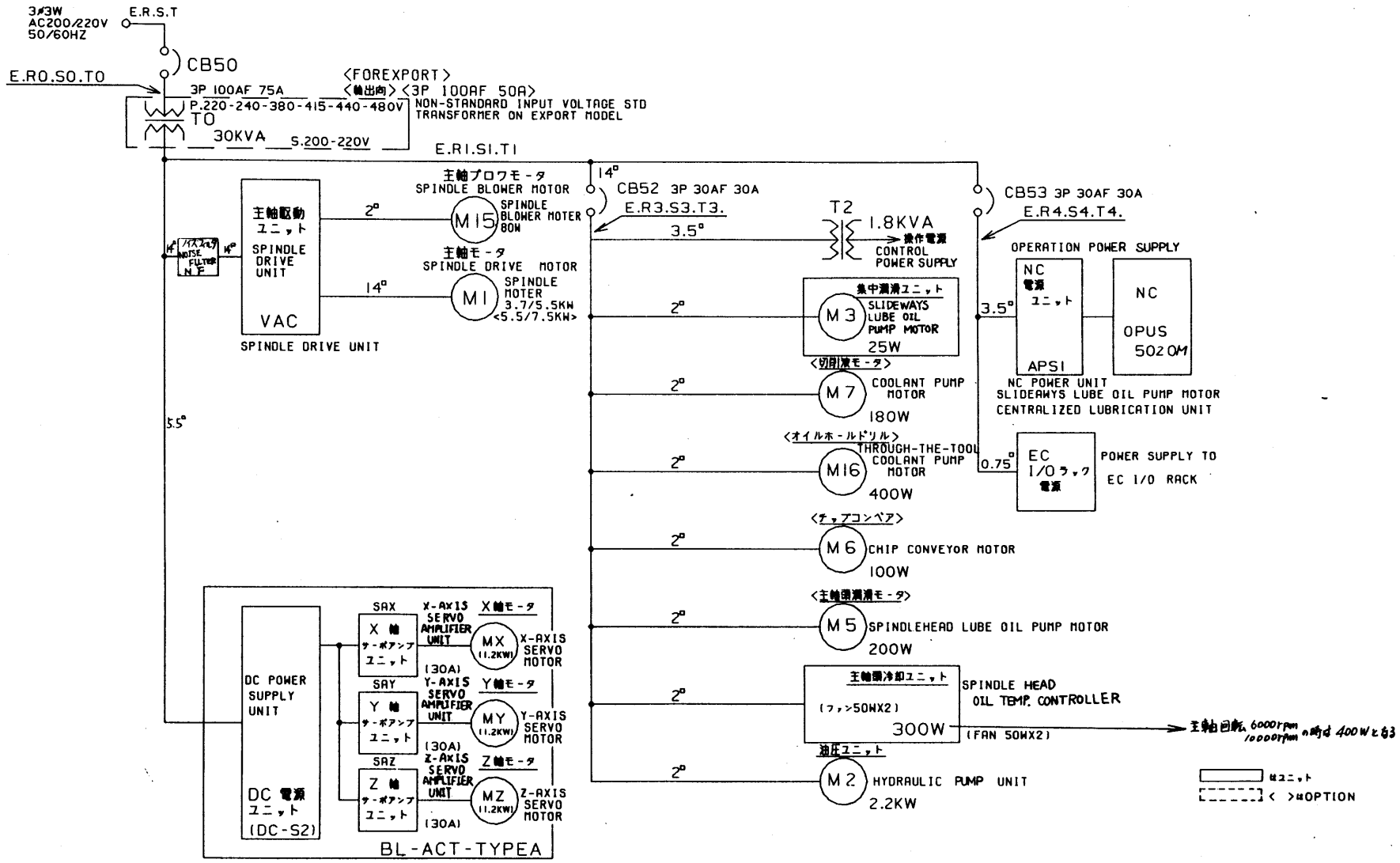
W1002-200-937



JOINT NC NOTE	Mc-V 0SP5020M 適用機種	第1製番 / 基本図面 W1002-200-732	図面名称 OSP 5020M システム構成図 / OSP 5020M CNC SYSTEM CONFIGURATION	9.7.'89	W1002-200-937

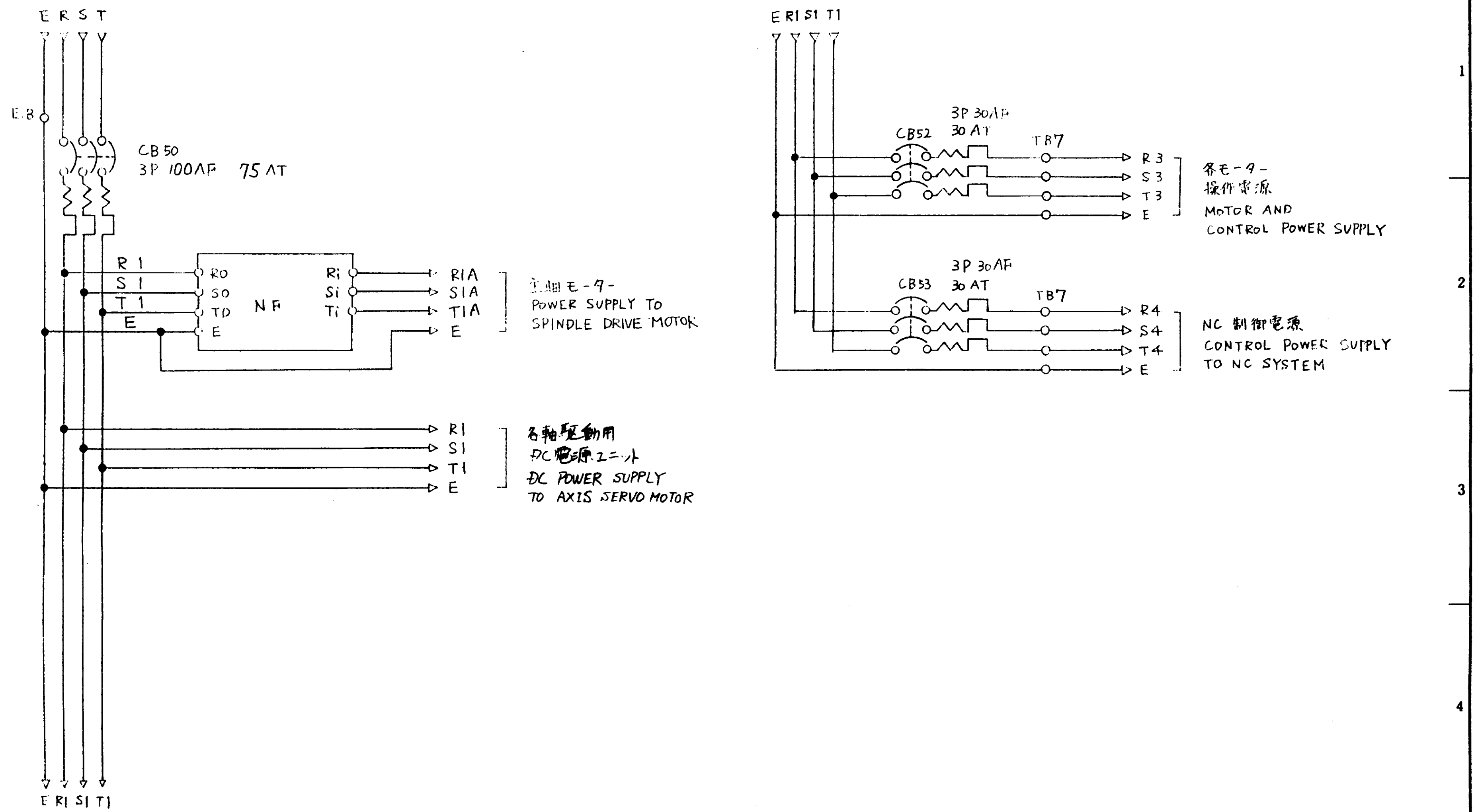
コスモ 稲葉

W1002-200-968



		⑤	. :				第1製番		図面名称	9.25'89	A0
		④	. :				基本図面 W1001-200-339		電源系統図		
		③	. :								
		②	. :	MC-4VA 5020M							
JOINT NO	NOTE	①	. :	適用機種				田口 GIFU 棚橋	POWER SUPPLY SYSTEM DIAGRAM	W1002-200-968	

W1002—200—969—



JOINT NO	NOTE	MC-4VA OSP5020M 適用機種	第1製番 / 基本図面 — —

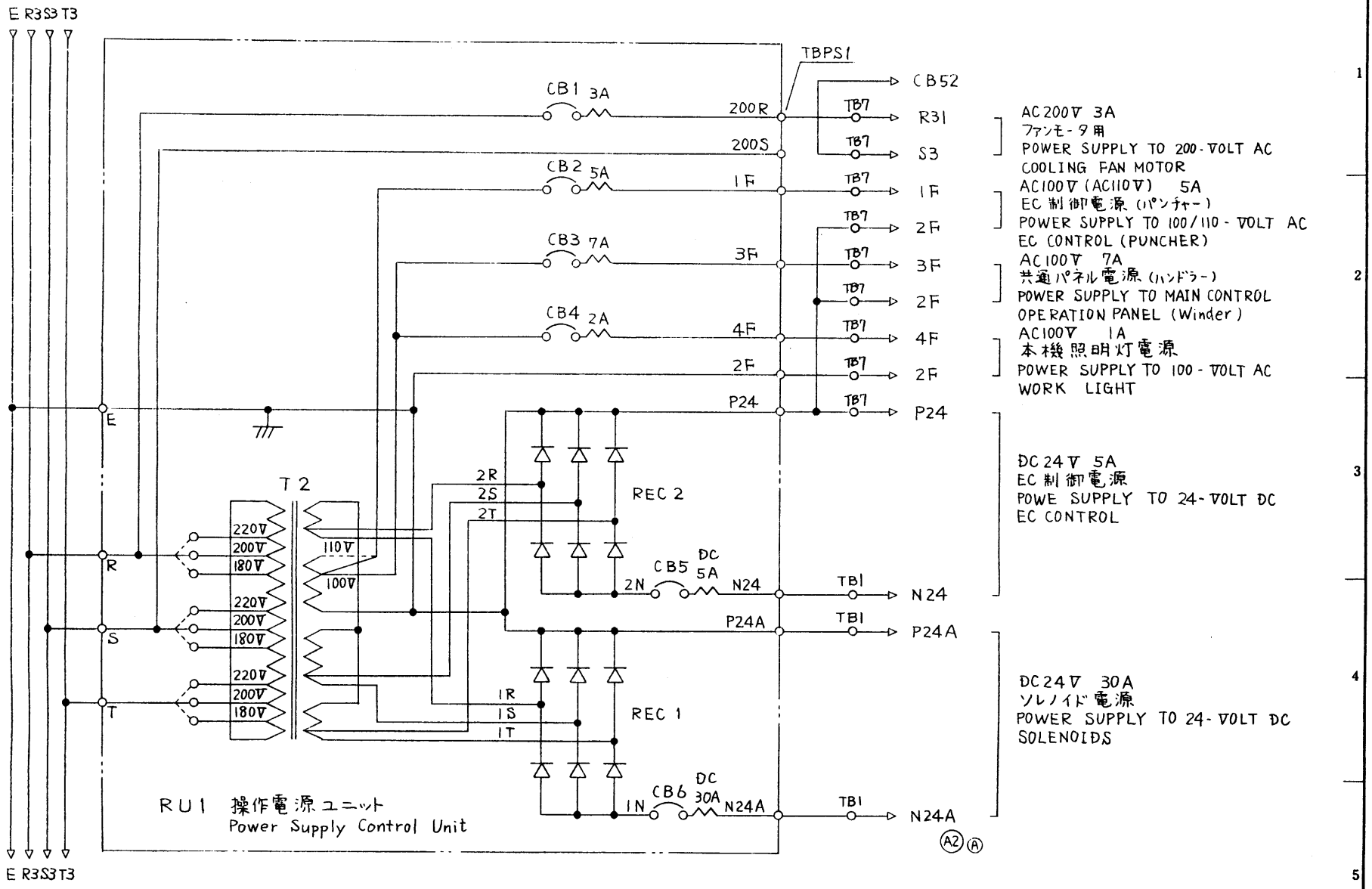
図面名称: 電源回路図 (1) Power Supply Circuit Diagram (1)

GIFU 柵瀬

9.25.'89 A1

W1002—200—969—

OKUMA MACHINERY WORKS LTD



JOINT NO	NOTE										

MC-4VA 0SP5020M
適用機種

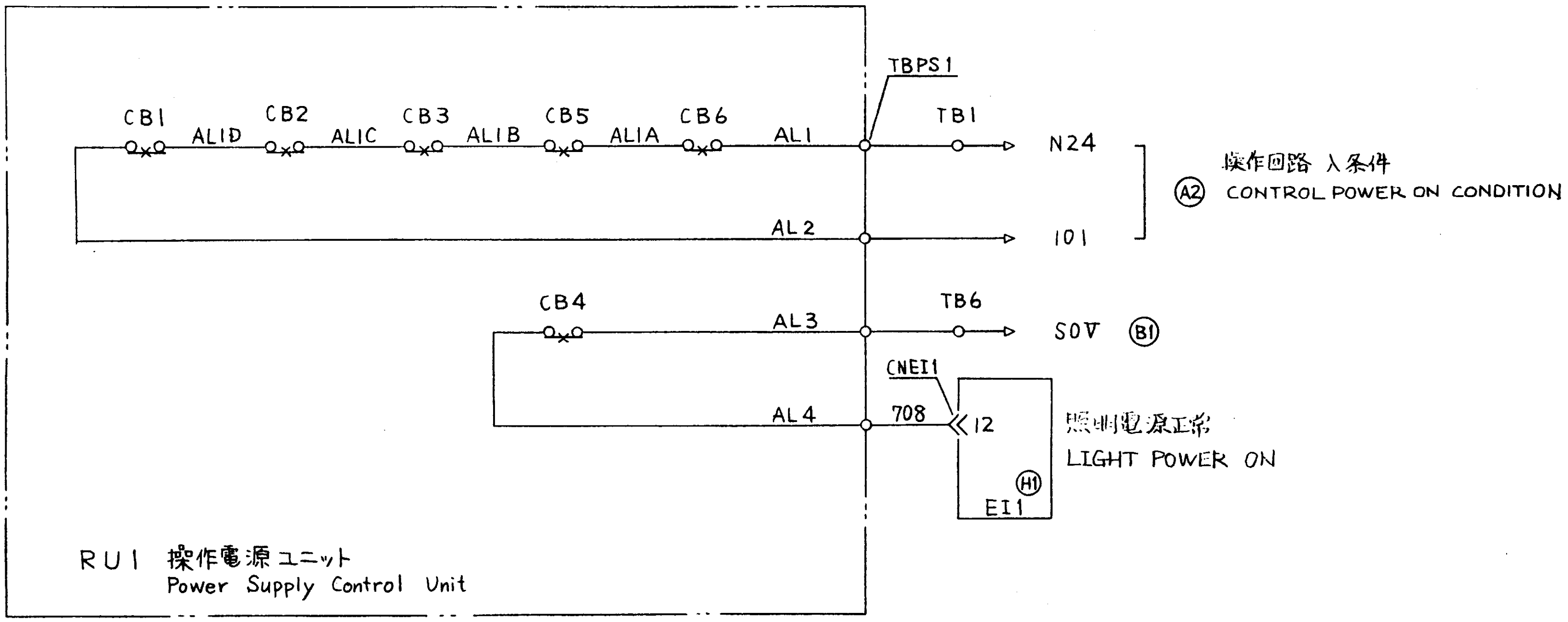
第1製番
基本図面 — —

田口 GIFU 關瀬

図面名称
電源回路図 (2)
Power Supply Circuit Diagram (2)

9.25'89 A1A

W1002-200-970-



W1002 — 200 — 971 —

JOINT NO	NOTE	MC-4VA 0SP5020M 適用機種	第1製番	基本図面	GIFU

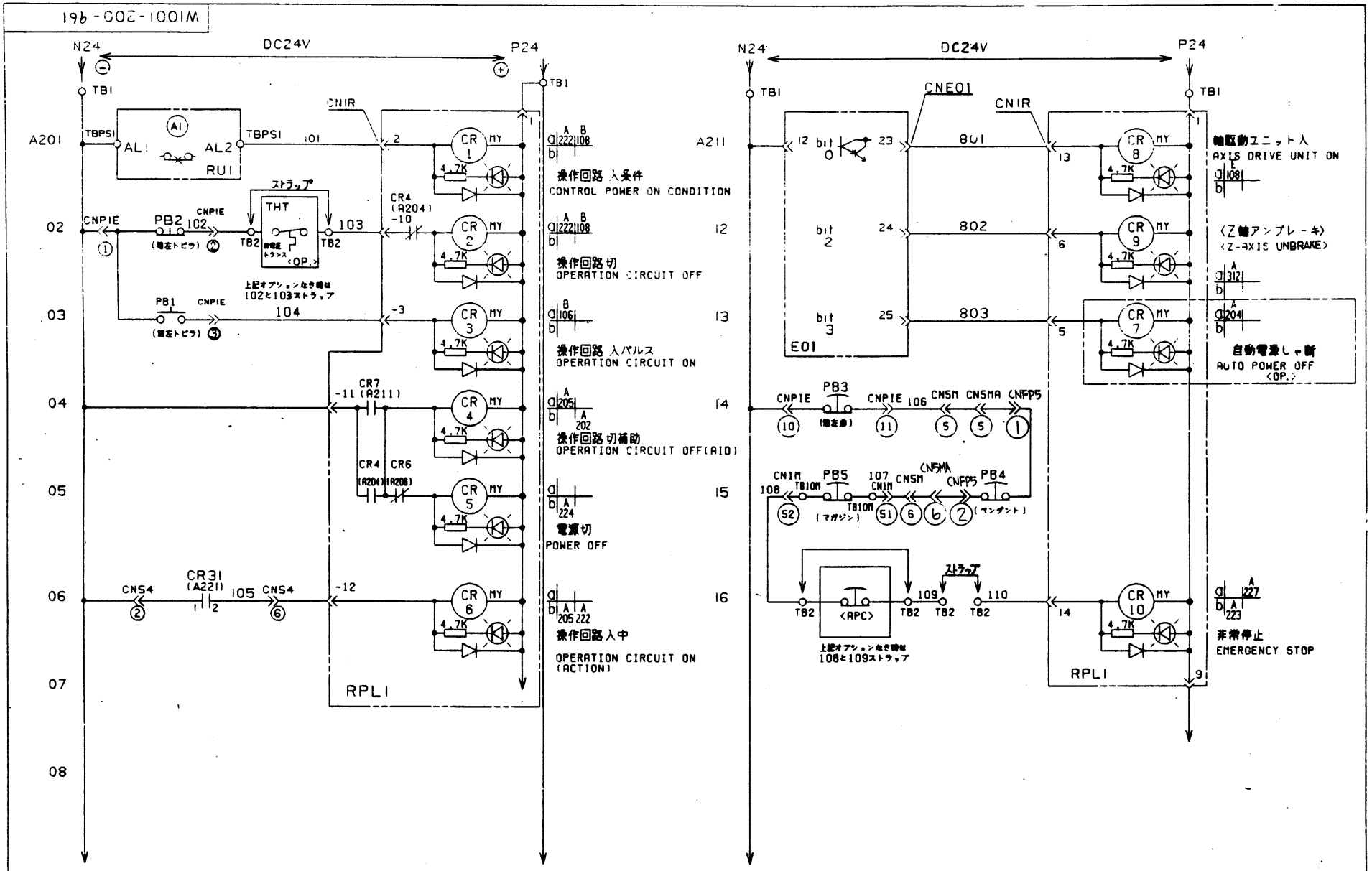
図面名称
電源回路図 (3)
Power Supply Circuit Diagram (3)

9.25.89 A1B

W1002 — 200 — 971 —

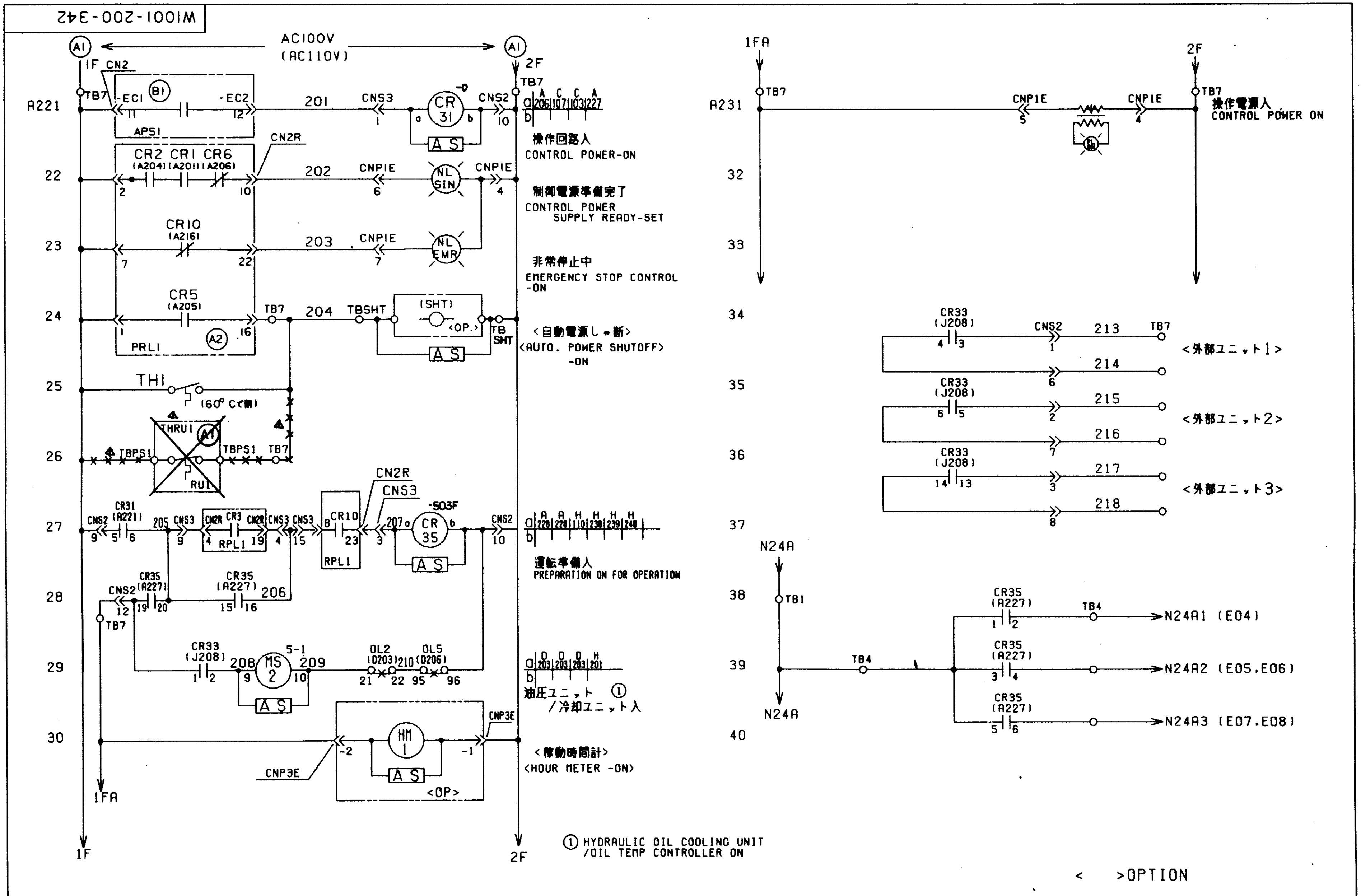
OKUMA MACHINERY WORKS LTD

W1001-200-961



JOINT NO	NOTE			MC-4VA 5000M-G	適用機種	第1製番 8609へ	基本図面	湘辺 田口	図面名称 操作電源回路図(1) CONTROL POWER CIRCUIT (1)	7.19'86 A2 W1001-200-961

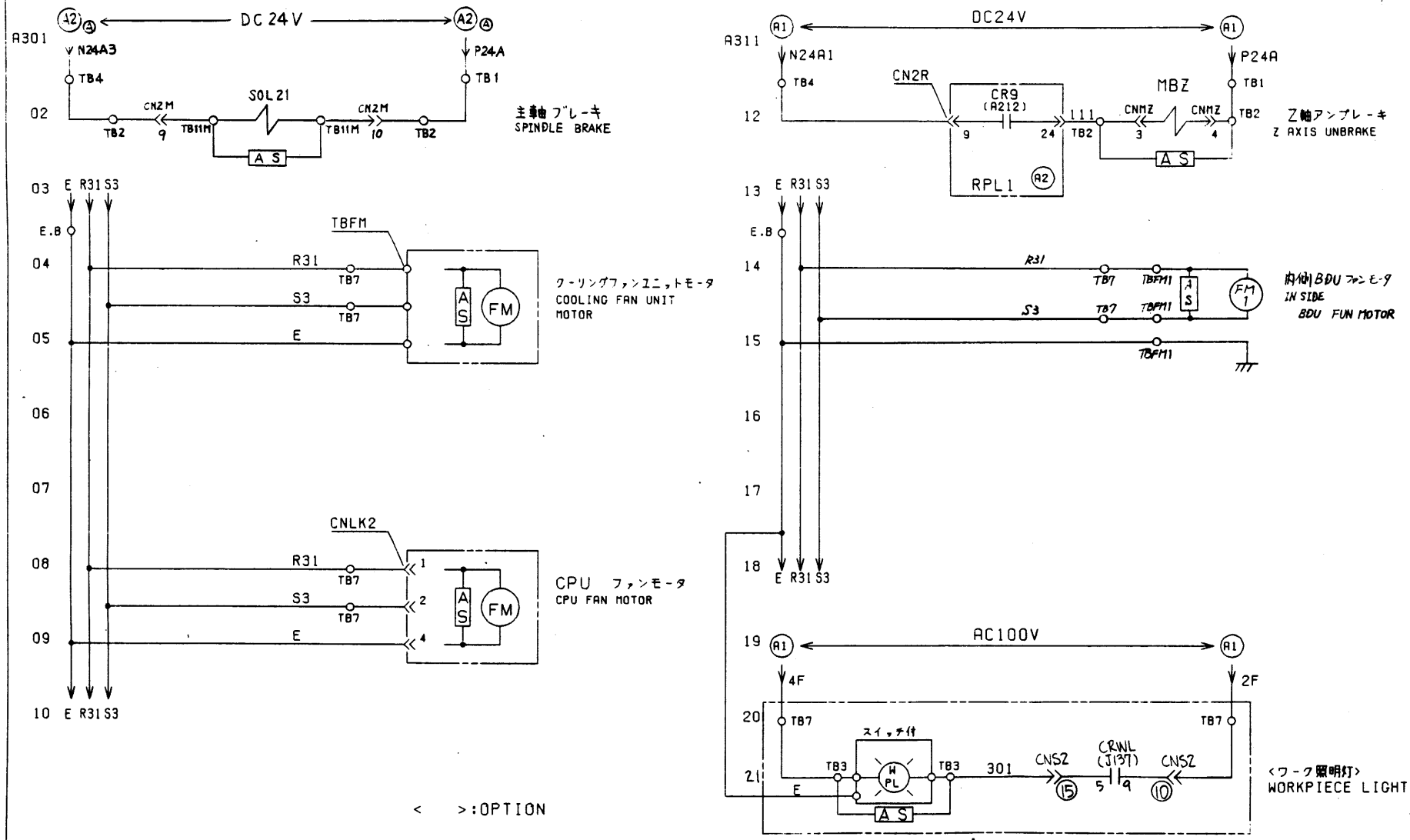
OKUMA MACHINERY WORKS LTD.



JOINT NO	NOTE	⚠ 5 28 '87		MC-4VA 5000M-G 適用機種	第1製番 R911-A050-34 基本図面	図面名称 操作電源回路図(2) CONTROL POWER CIRCUIT(2)	6.28.'84	A2 A
						W1001-200-342		

OKUMA MACHINERY WORKS LTD.

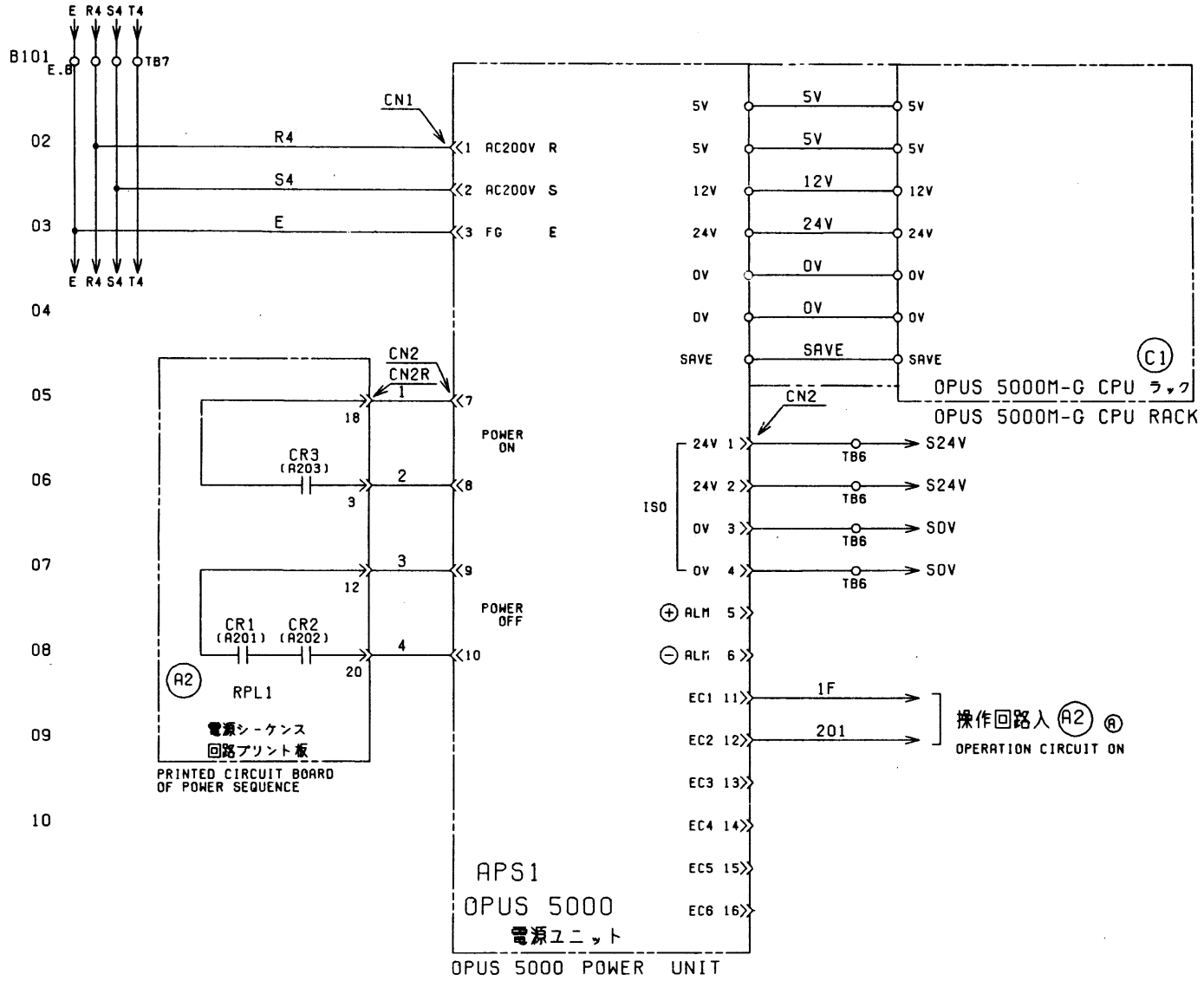
W1001-200-96Z



< >:OPTION

								第1製番 8609～	図面名称 操作電源回路図(3)	7.19'86 A3
								基本図面	CONTROL POWER CIRCUIT (3)	W1001-200-96Z
JOINT NO	NOTE					MC-4VA 5000M-G		適用機種		

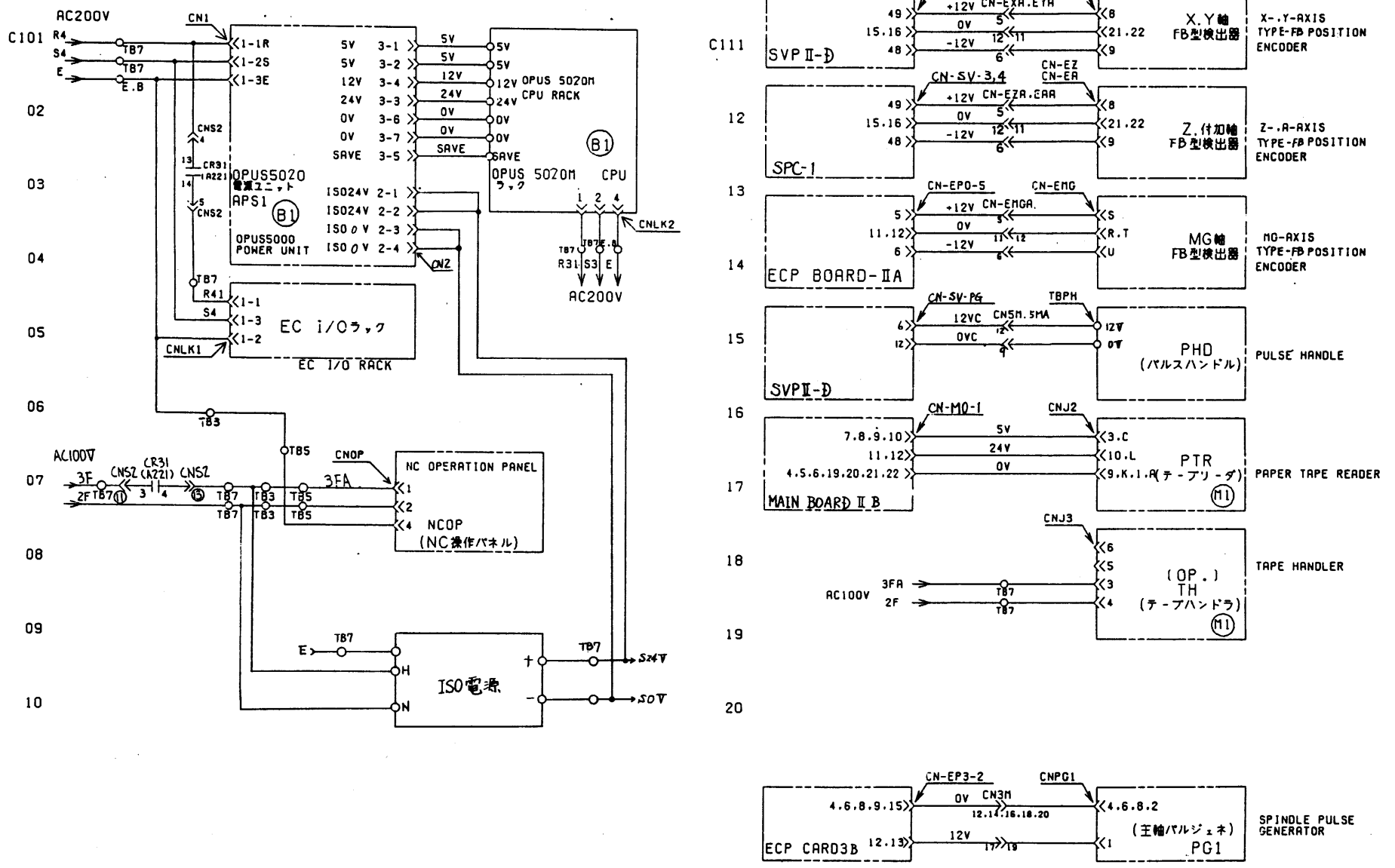
OKUMA MACHINERY WORKS LTD.



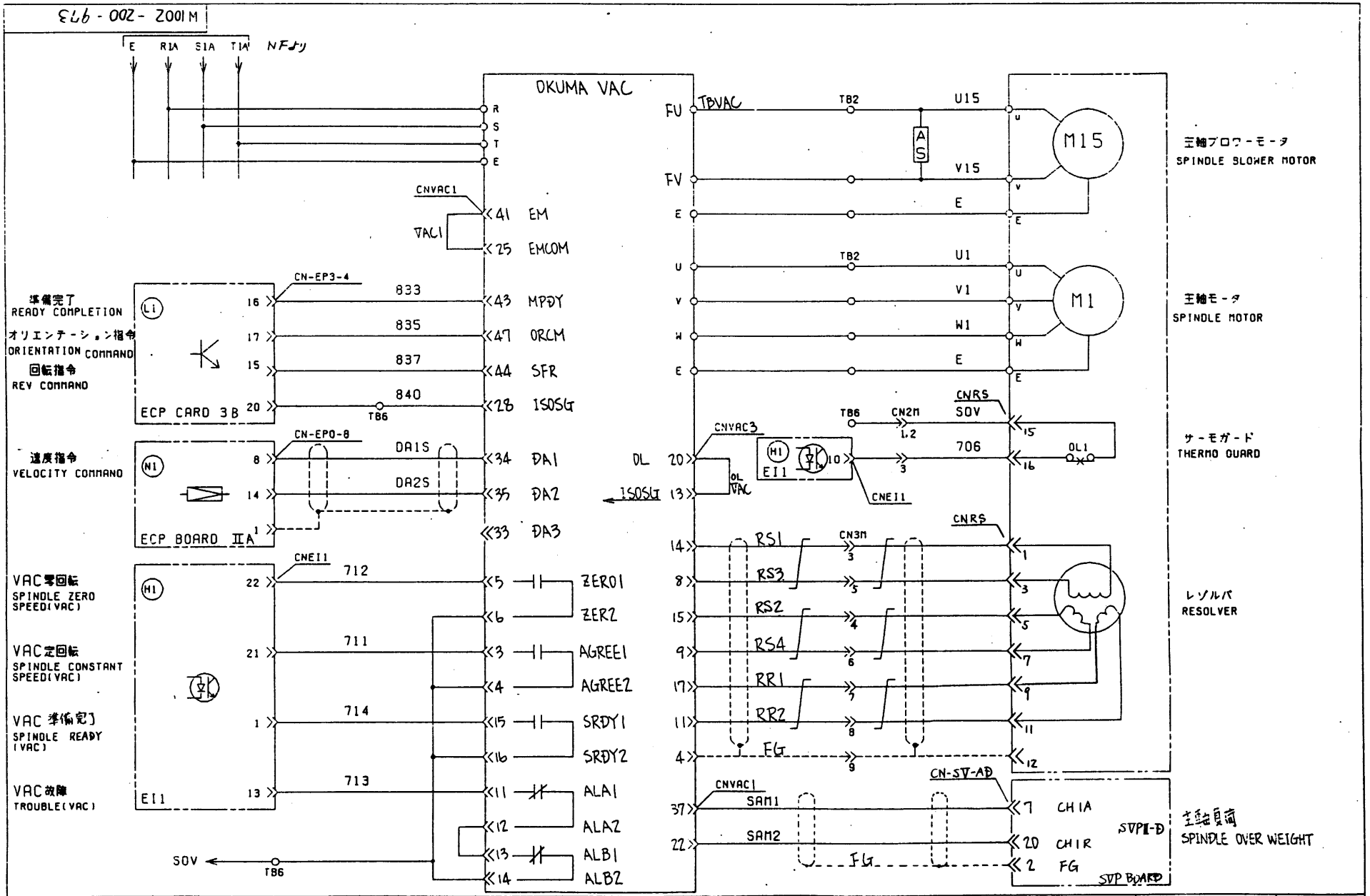
		⑤	. :			第1製番			図面名称	1.9'89	B1
		④	. :			基本図面 W1001-200-344			NC 制御電源回路図		
		③	. :						CIRCUIT DIAGRAM OF NC CONTROL POWER	W1002-200-773	
		②	. :	MC-4VA 5000M-G			田口	GIFU 棚瀬			
JOINT NO	NOTE	①	. :	適用機種							

OKUMA MACHINERY WORKS LTD.

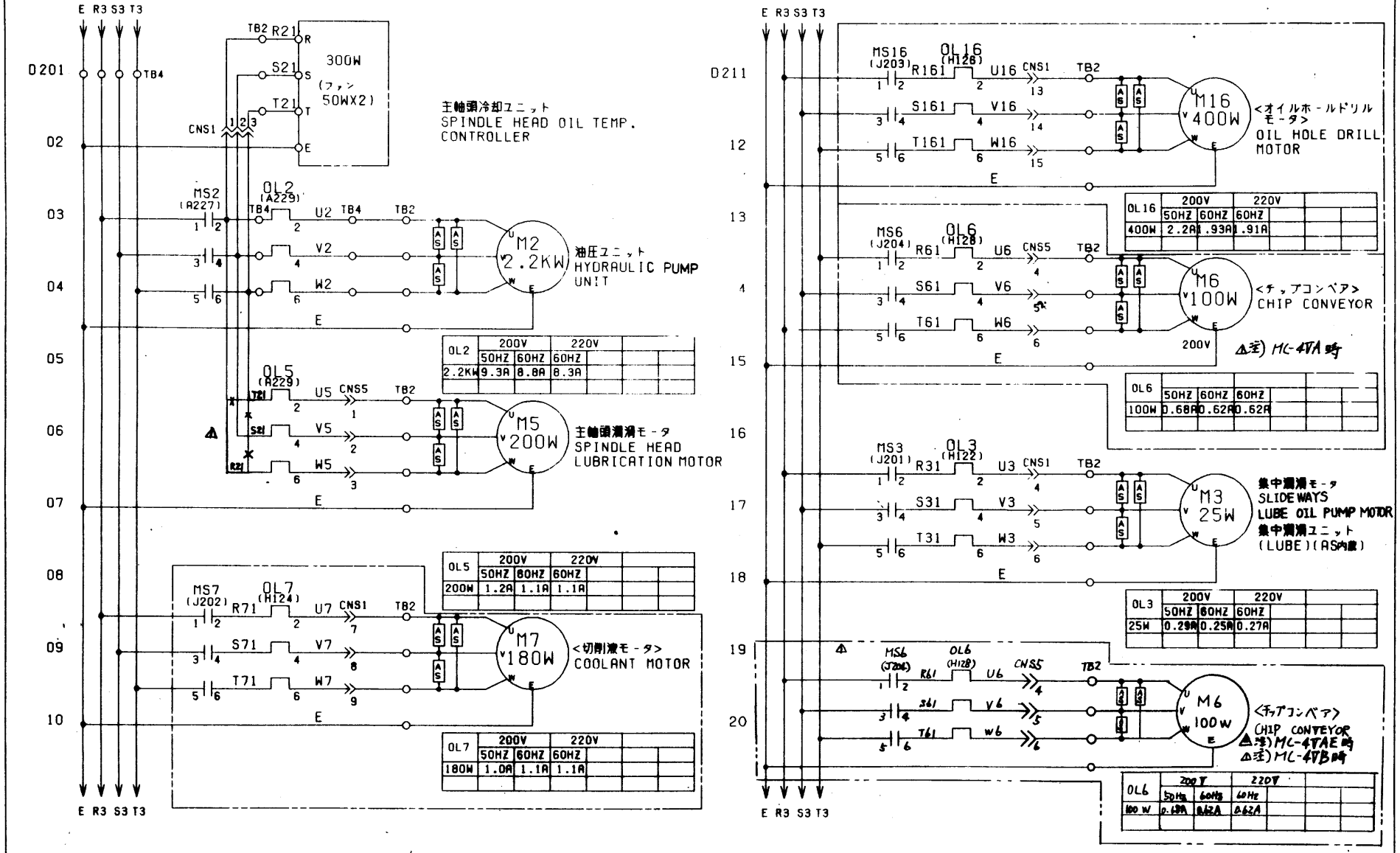
W1002-200-172M



								第1製番	図面名称	9.25'89	C1
								基本図面 W1002-200-175	ユニット間電源回路図	W1002-200-172	
									CIRCUIT DIAGRAM OF POWER BETWEEN UNIT		
JOINT NO	NOTE				MC-4VA 5020M			田	GIFU 柵瀬		
					適用機種			区			


E26 - 002 - 2001M
E R1A S1A T1A NFﾌｨﾙﾀ
OKUMA VAC
R
S
T
E
CNVAC1
41 EM
VAC1
25 EMCOM
準備完了
READY COMPLETION
オリエンテーション指令
ORIENTATION COMMAND
回転指令
REV COMMAND
CN-EP3-4
16
17
15
20
833
835
837
840
TB6
43 MPDY
47 ORCM
44 SFR
28 ISOSG
ECP CARD 3B
速度指令
VELOCITY COMMAND
CN-EP0-8
8
14
1
DA1S
DA2S
34 DA1
35 DA2
33 DA3
ECP BOARD IIA
VAC零回転
SPINDLE ZERO SPEED(VAC)
VAC定回転
SPINDLE CONSTANT SPEED(VAC)
VAC準備完了
SPINDLE READY (VAC)
VAC故障
TROUBLE(VAC)
CNEI1
22
21
1
13
712
711
714
713
EI1
5 ZERO1
6 ZERO2
3 AGREE1
4 AGREE2
15 SRDY1
16 SRDY2
11 ALA1
12 ALA2
13 ALB1
14 ALB2
SOV
TB6
FU
FV
E
U
V
W
TBVAC
TB2
U15
V15
E
U1
V1
W1
AS
M15
M1
主軸ブロワーモータ
SPINDLE SLOWER MOTOR
主軸モータ
SPINDLE MOTOR
CNVAC3
DL
ISOSG
20
13
OL VAC
HI
EI1
10
CNEI1
CNRS
SOV
706
OL1
15
16
サーモガード
THERMO GUARD
CN2M
1.2
3
CN3M
RS1
RS3
RS2
RS4
RR1
RR2
FG
14
8
15
9
17
11
4
1
3
5
4
6
7
8
9
レゾルバ
RESOLVER
CNVAC1
SAM1
SAM2
FG
37
22
CN-SV-AD
7 CHIA
20 CHIR
2 FG
SVP-D
SVP BOARD
主軸負荷
SPINDLE OVER WEIGHT
JOINT NO
NOTE
MC-4VA 5020M
適用機種
第1製番
基本図面 W1002-200-775
図面名称
主軸モータ回路図
CIRCUIT DIAGRAM OF SPINDLE MOTOR
9.25'89
D1
W1002-200-973
OKUMA MACHINERY WORKS LTD

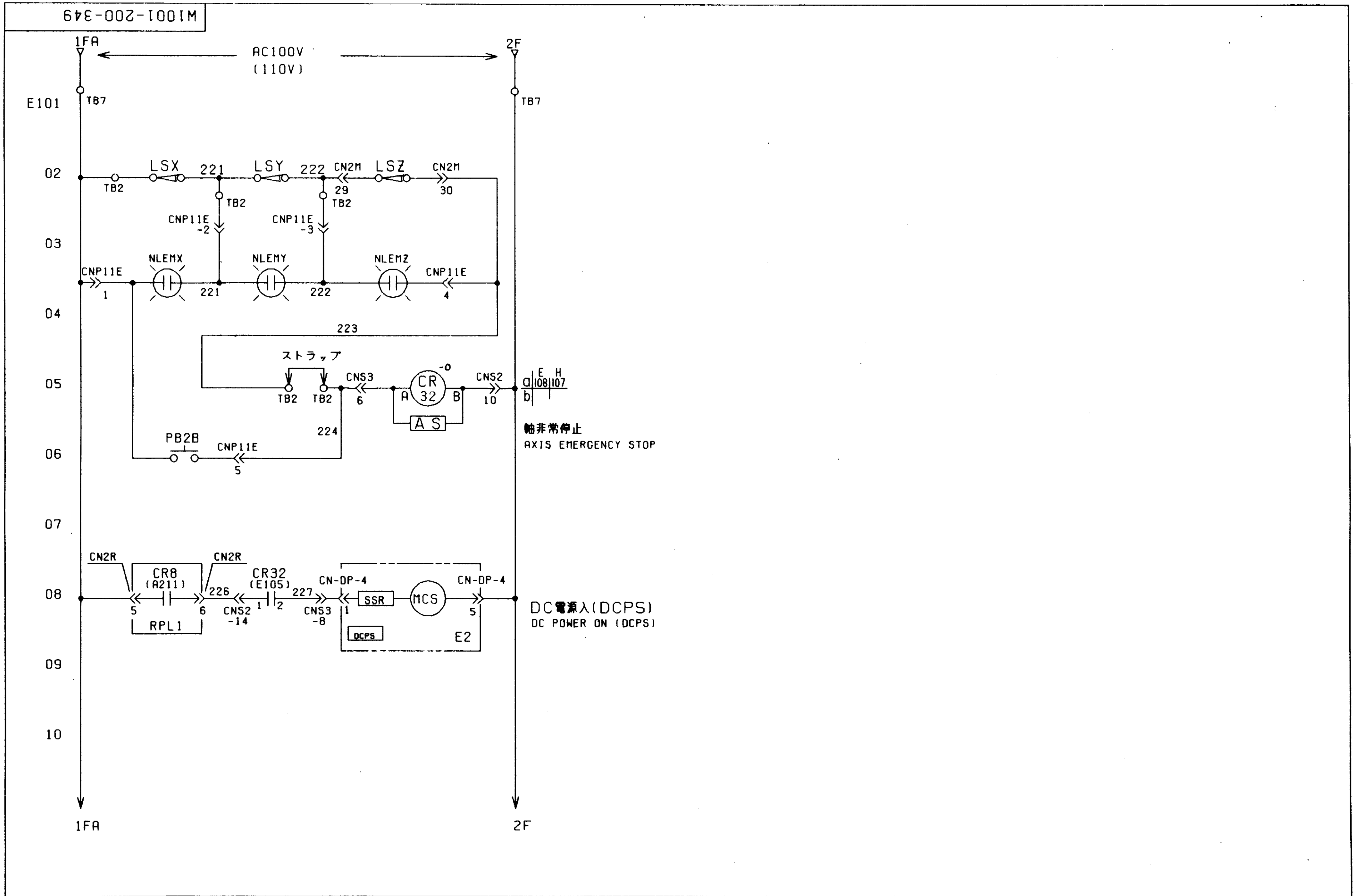
W1001-200-348



< >: OPTION

		△	. :					第1版番	R911-A050-34	図面名称	5.29'85 D2
		△	. :					基本図面		モータ回路図	
		△	. :					承認	検図	作図	日伸 I / 三好
		△	11.7'87 チップコンベア 4VAE 追記			製番	MC-4VA 5000M-G	永江	植村	小池	MOTORS CIRCUIT
JOINT NO	NOTE	△	4.18'88 チップコンベア 4VA, 4VB 追記			適用機種					W1001-200-348

OKUMA MACHINERY WORKS LTD.



JOINT NO	NOTE	△5 △4 △3 △2 △1	MC-4VA 5000M-G 適用機種

第1製番 R911-A050-34

基本図面

図面名称

軸駆動ユニット回路図

CIRCUIT DIAGRAM OF AXIS DRIVE UNIT

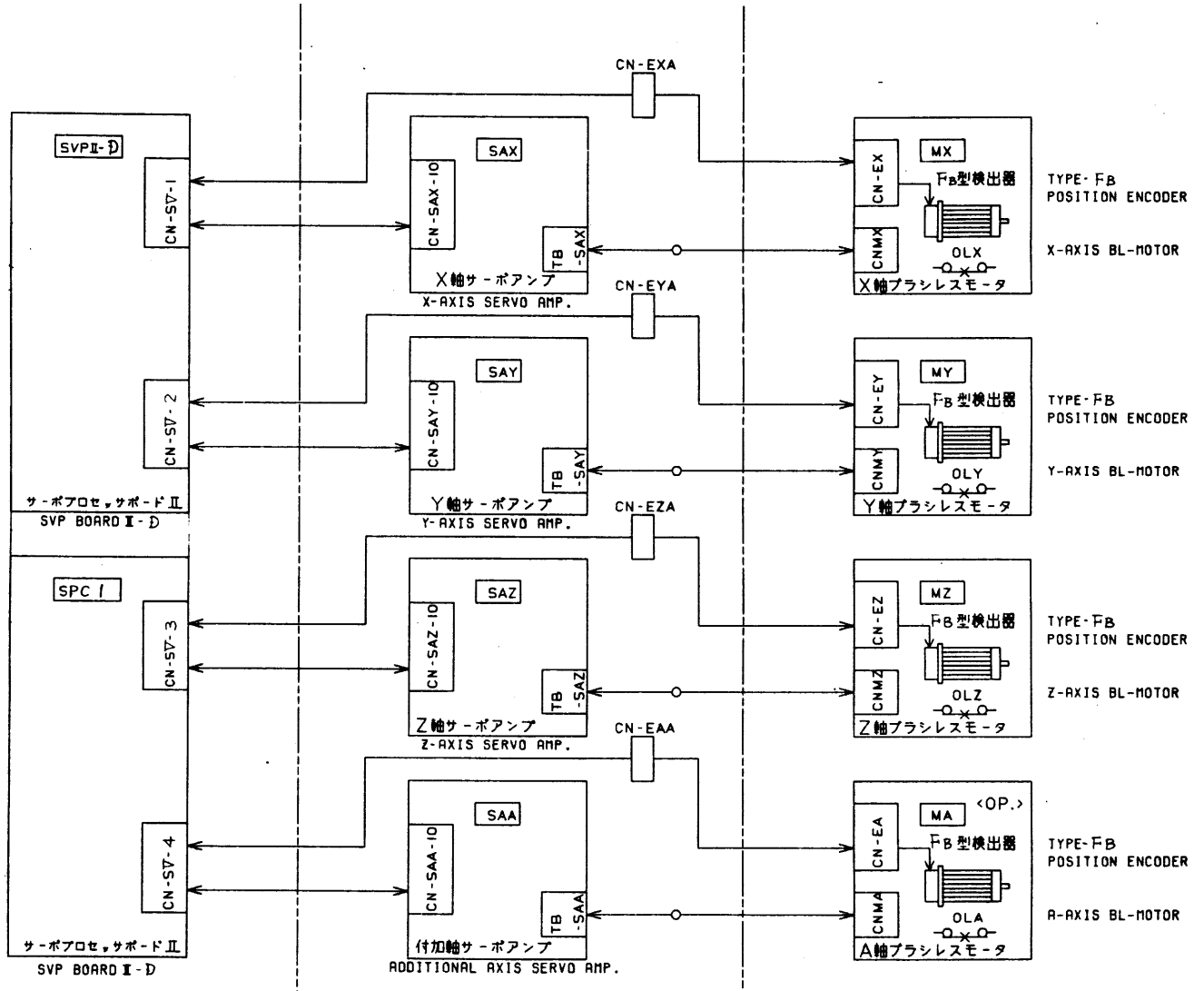
5.29.'85

E1

W1001-200-349

OKUMA MACHINERY WORKS LTD.

W1002-200-735



OPUS 5000M-G CPUラック
OPUS 5000M-G CPU RACK

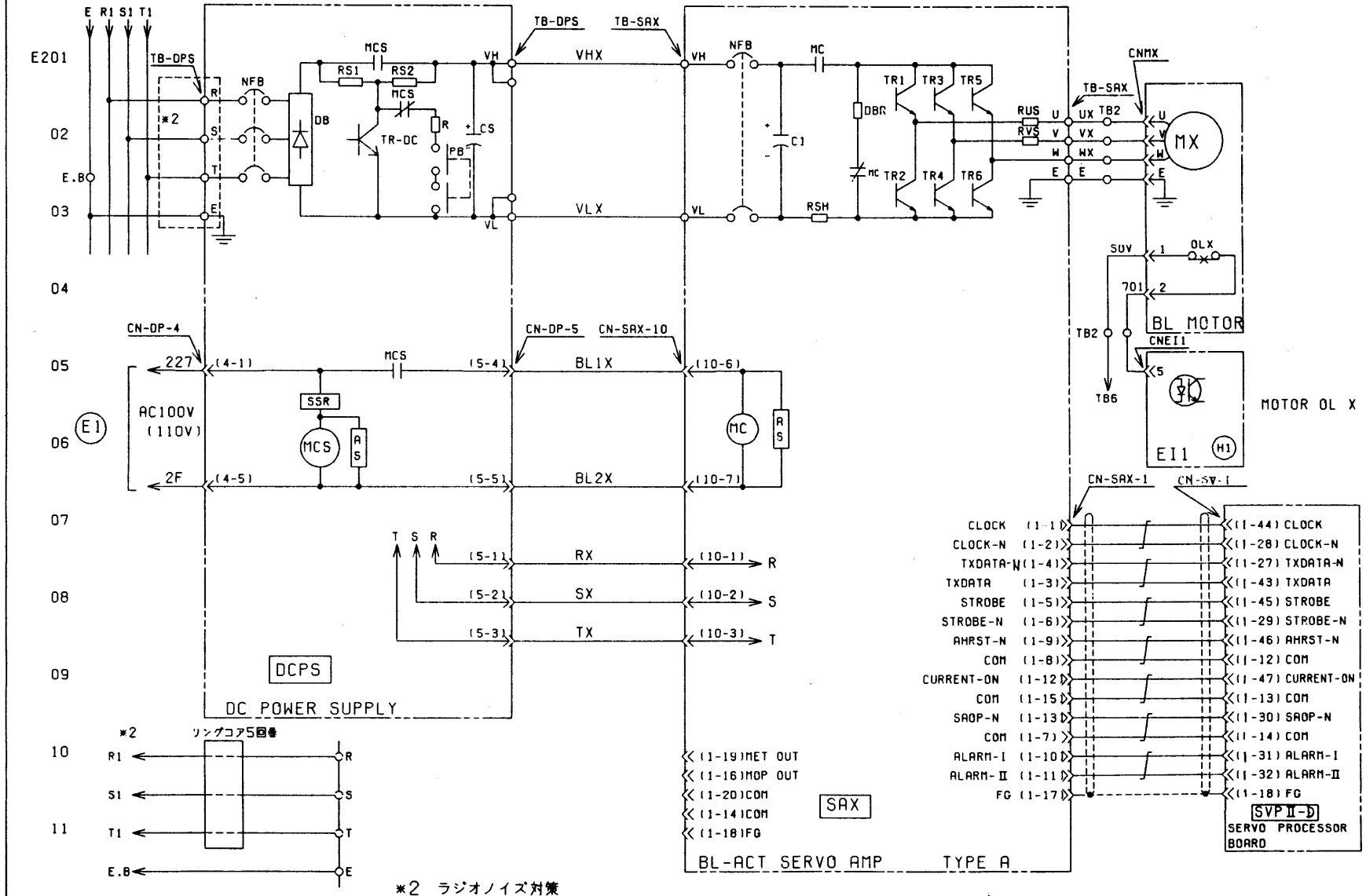
サーボアンプユニット
SERVO AMP.UNIT

本機
MACHINE

		⚠	. :			MC-6VA 5000M-G	第1製番		図面名称	2. 6. '89	EIA
		⚠	. :			MC-5VA 5000M-G	基本図面 W1001-200-350		サーボ系統図		
		⚠	. :			MC-4VA 5000M-G		田	SERVO SYSTEM DIAGRAM	W1002-200-735	
JOINT NO	NOTE	⚠	. :			適用機種		コスモ 柏葉			

OKUMA MACHINERY WORKS LTD.

W1002 - 200 - 776

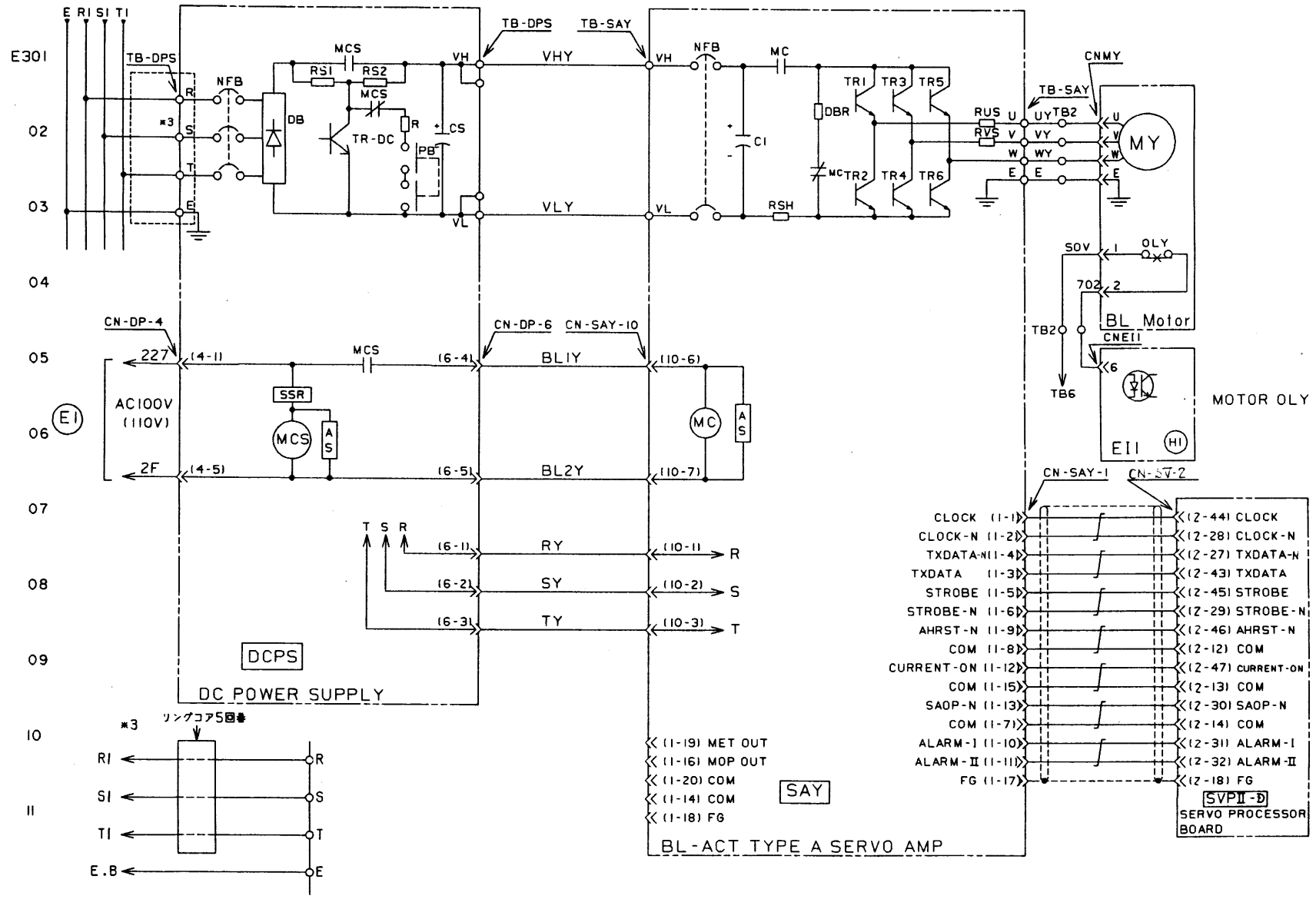


*2 ラジオノイズ対策

		⑤ . :			第1製番 - -	図面名称	1.10.'89	E2
		④ . :			基本図面 W1001-200-351	X軸駆動ユニット回路図		
		③ . :						
		② . :		MC-4VA 5000M-G	田	CIRCUIT DIAGRAM OF X-AXIS DRIVE UNIT	W1002 - 200 - 776	
JOINT NO	NOTE	① . :		適用機種	61FU 棚番			

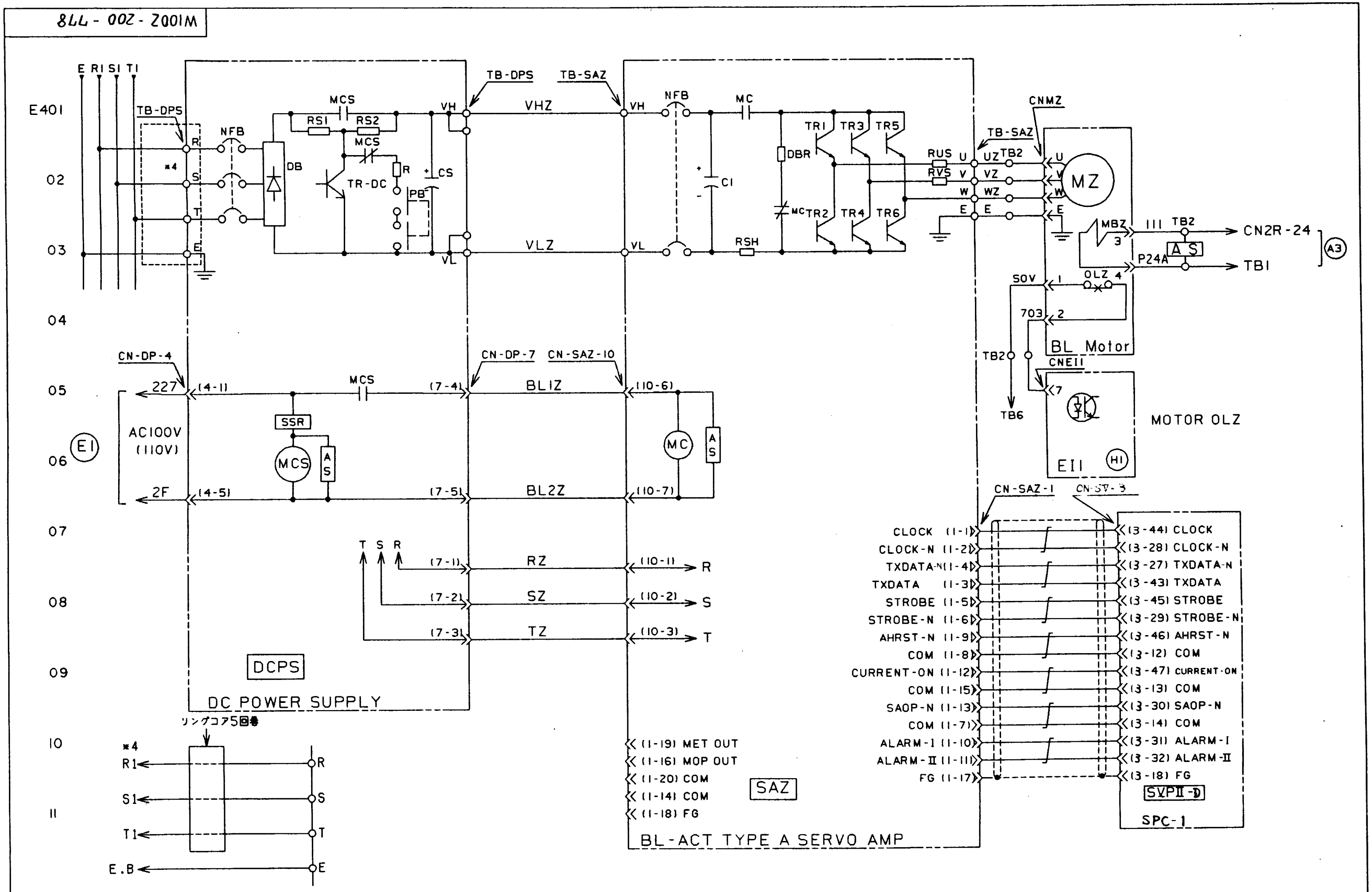
OKUMA MACHINERY WORKS LTD.

LLL - 002 - 2001M



		⑤	. :			第1製番 - -	図面名称 Y軸駆動ユニット回路図 CIRCUIT DIAGRAM OF Y-AXIS DRIVE UNIT	1.10'89	E3
		④	. :			基本図面 W 1001-200-352			
		③	. :						
		②	. :	MC-4VA 5000M-G		田	GIFU 機種	W1002-200-777	
JOINT NO	NOTE	①	. :	適用機種		区			

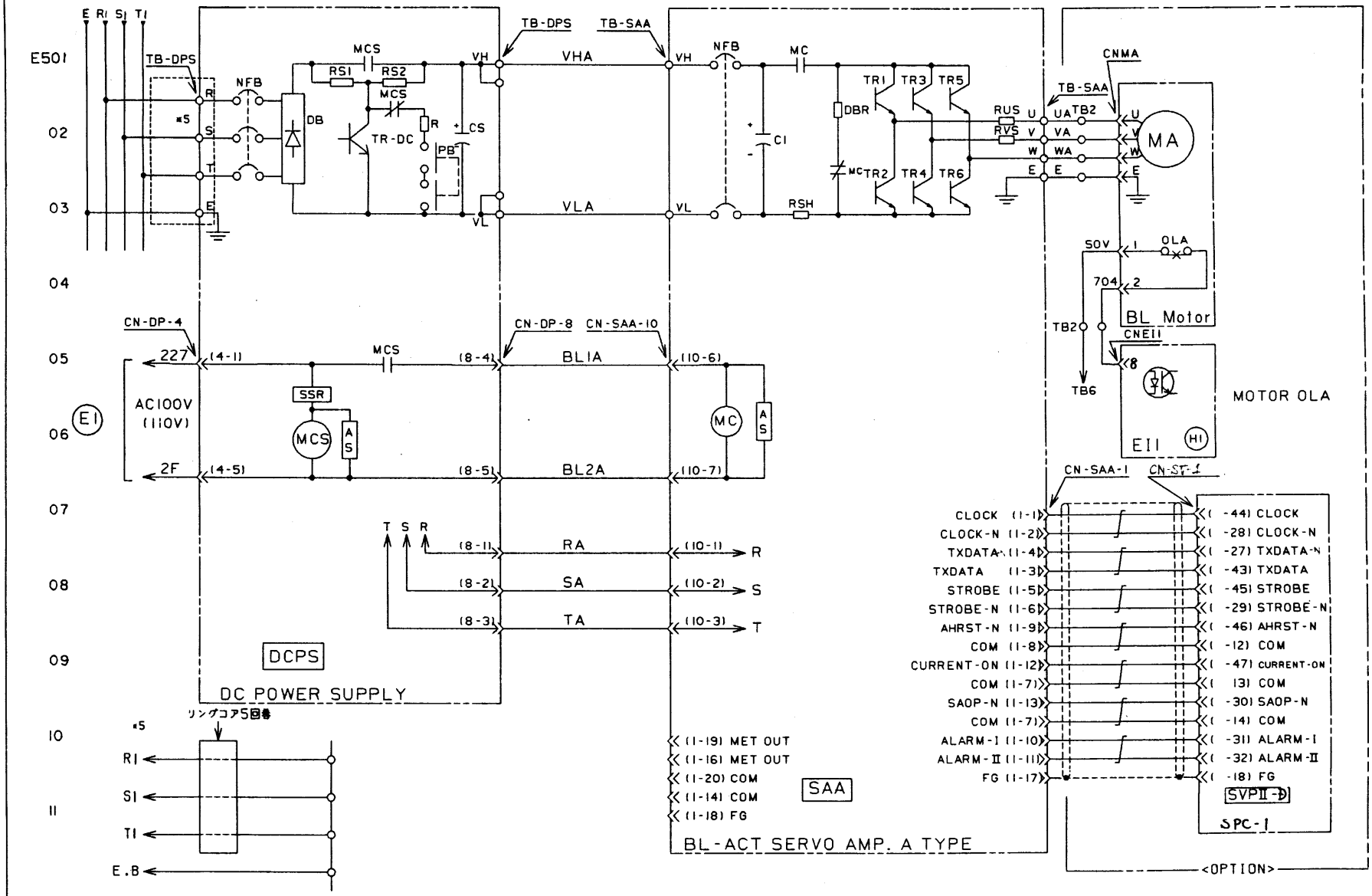
OKUMA MACHINERY WORKS LTD.



		5	. :		第1製番 - -	図面名称	1 . 11 . '89	E4
		4	. :		基本図面 W1001-200-353	Z軸駆動ユニット回路図	
		3	. :			CIRCUIT DIAGRAM OF Z-AXIS DRIVE UNIT	W1002-200-778
		2	. :	MC-4VA 5000M-G	田 GIFU		
JOINT NO	NOTE	1	. :	適用機種	口 棚瀬		

OKUMA MACHINERY WORKS LTD.

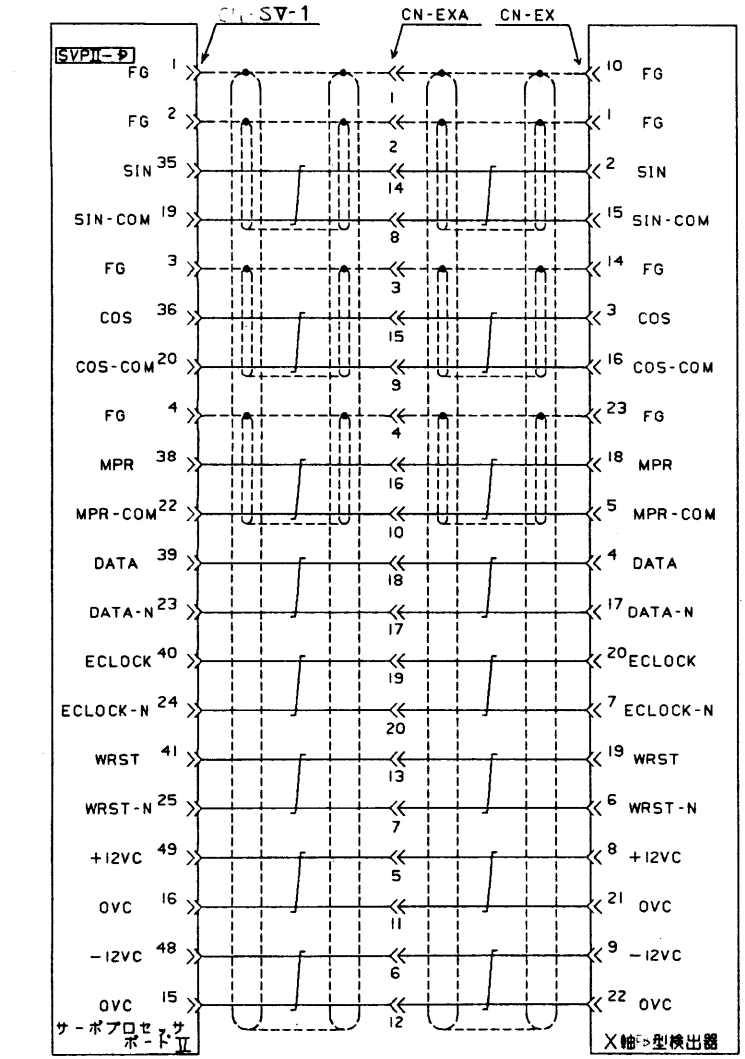
W1002-200-779

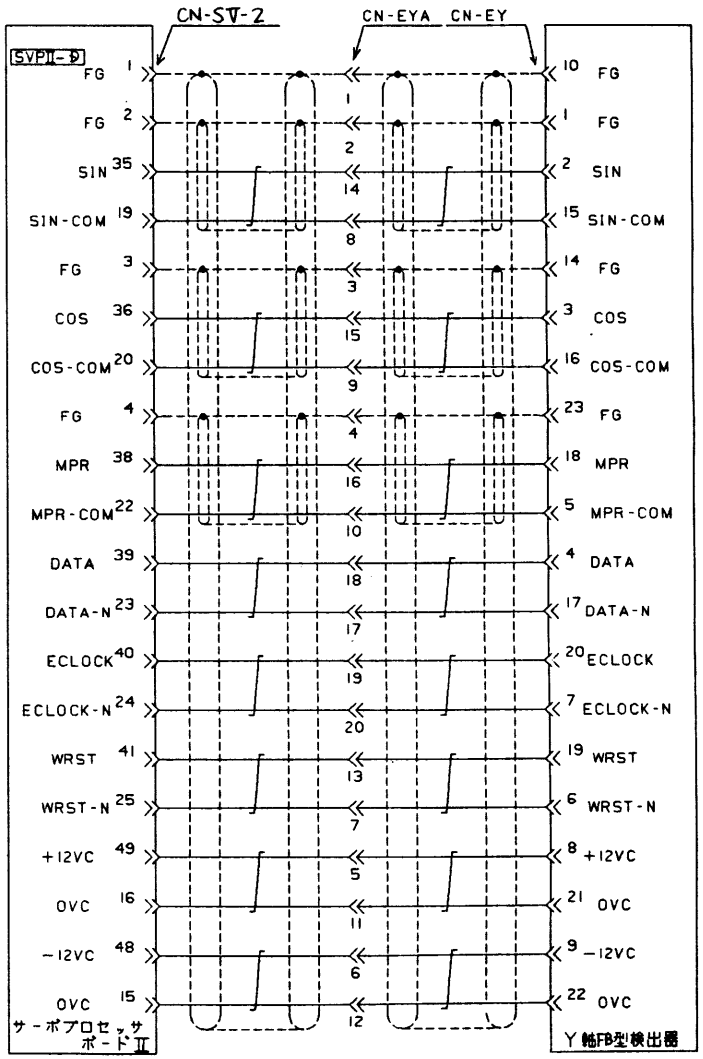


JOINT NO	NOTE		MC-4VA 5000M-G 適用機種	第1製番 - -	図面名称 付加軸駆動ユニット回路図 CIRCUIT DIAGRAM OF A-AXIS DRIVE UNIT	1.11'89	E5
				基本図面 W1001-200-354		W1002-200-779	

OKUMA MACHINERY WORKS LTD.

W1002-200-780

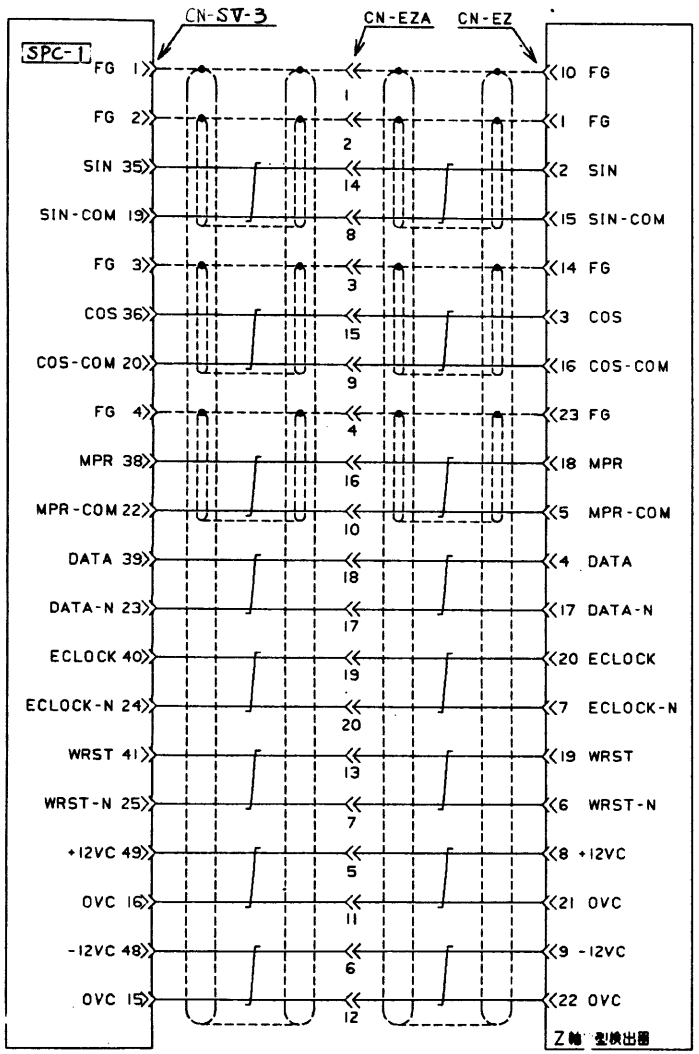




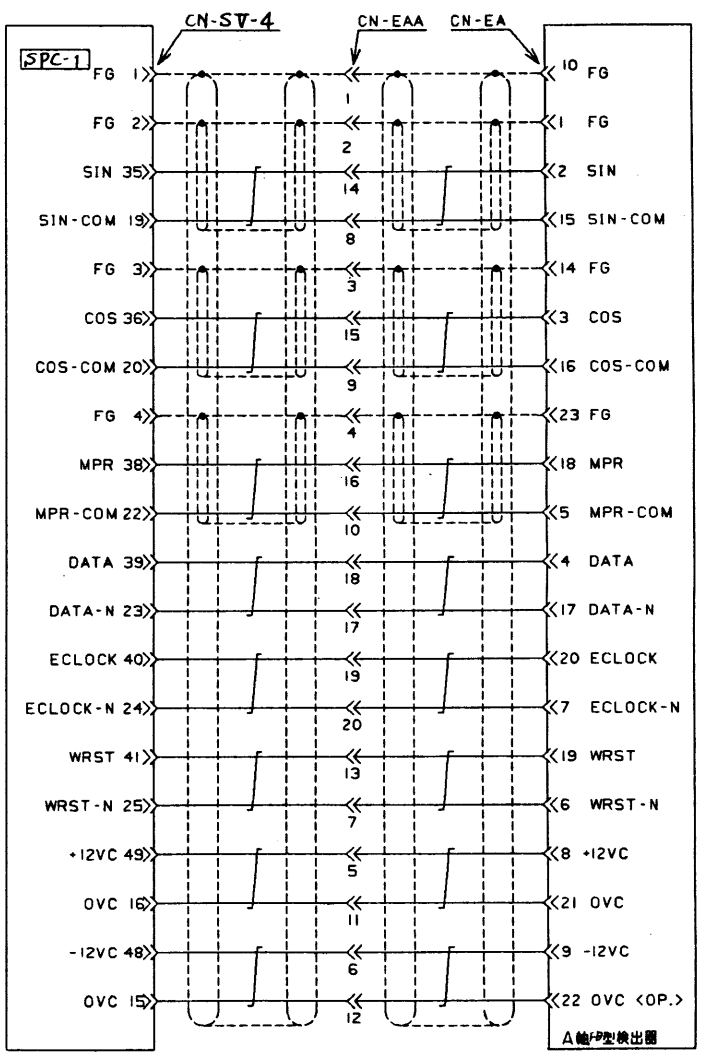
		⑤	. :			第1製番 - -	図面名称 SVPII-1コントロール回路図	1.12.'89	E6
		④	. :			基本図面 W1001-200-355	CIRCUIT DIAGRAM OF SVPII-1 CONTROL		
		③	. :					W1002-200-780	
		②	. :	MC-4VA 5000M-G		田	GIFU 柵南		
JOINT NO	NOTE	①	. :	適用機種		区			

OKUMA MACHINERY WORKS LTD.

W1002-200-781



Z-AXIS
TYPE-[illegible] POSITION ENCODER

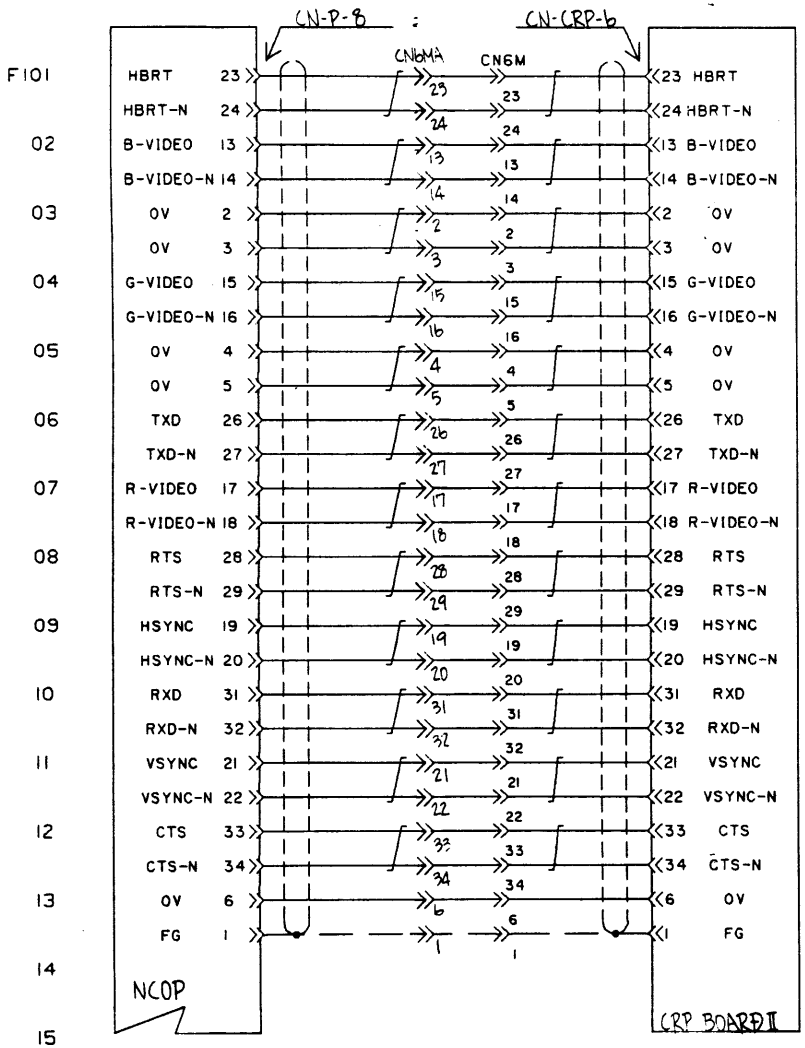


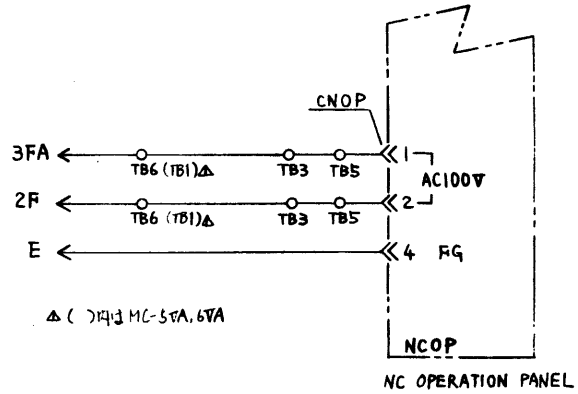
A-AXIS
TYPE-FB POSITION ENCODER

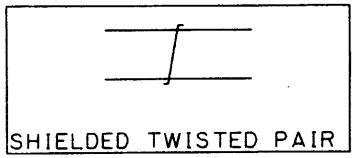
JOINT NO	NOTE	MC-4VA 5000M-G 適用機種	第1製番 - -	図面名称 SVPII-2コントロール回路図 CIRCUIT DIAGRAM OF SVPII-2 CONTROL	1.12.'89	E7
			基本図面 W1001-200-356		W1002-200-781	
			田 GIFU 柳瀬			

OKUMA MACHINERY WORKS LTD.

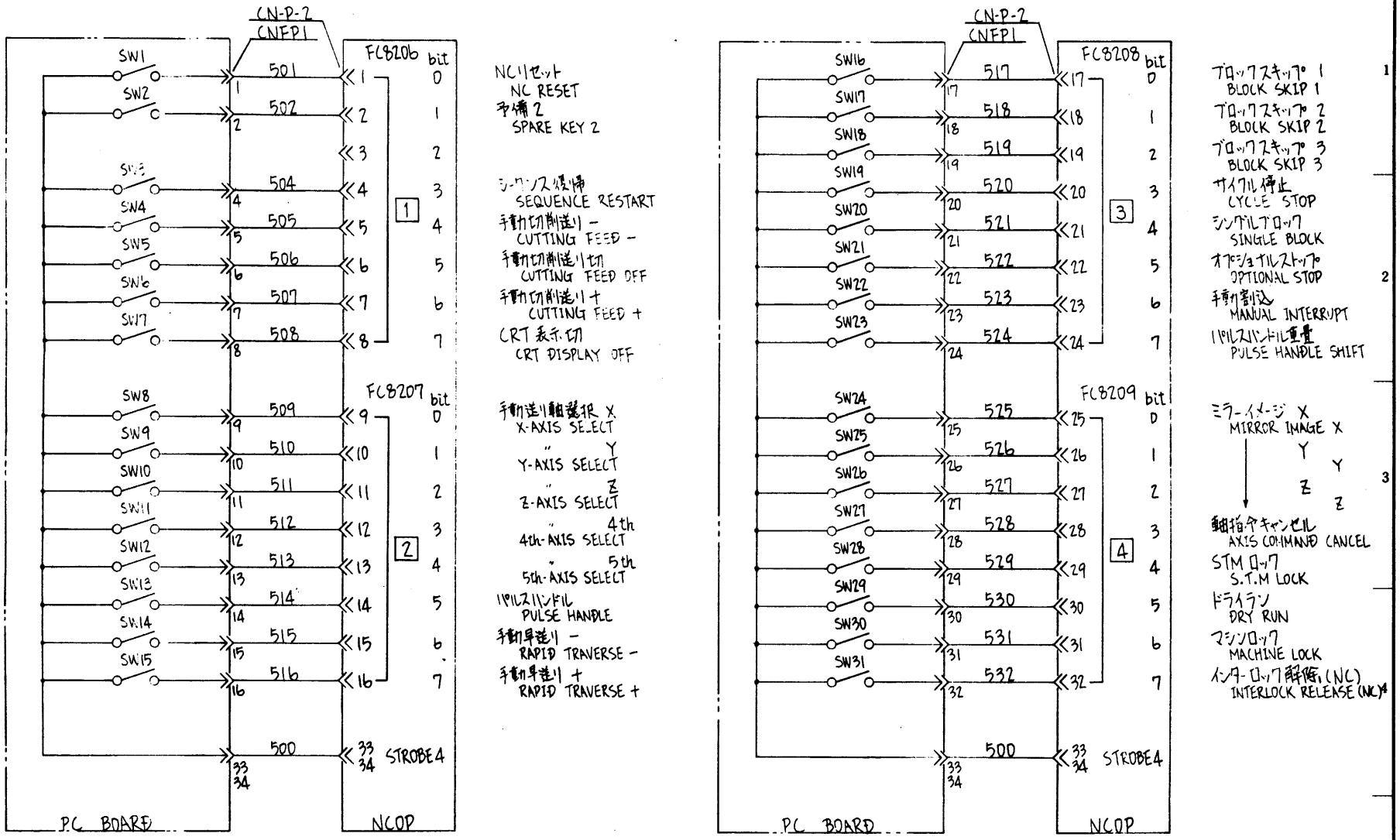
W1001-200-965







		5	. :				第1製番 8609～	図面名称	7.19'86	F1
		4	. :		MC-6VA		基本図面	NCパネル回路図		
		3	. :		MC-5VA			CIRCUIT DIAGRAM OF NC OPERATION PANEL		
		2	. :		MC-4VA 5000M-G		村辺 / 田口 / レイアウト 大原		W1001-200-965	
JOINT NO	NOTE	1	10.14'86 追記	機種	適用機種					



JOINT NO	NOTE										
		5	. :								
		4	. :								
		3	. :								
		2	. :								
		1	. :								

MC-V DSP 5000M-G
適用機種

第1製番 8609へ
基本図面 — —

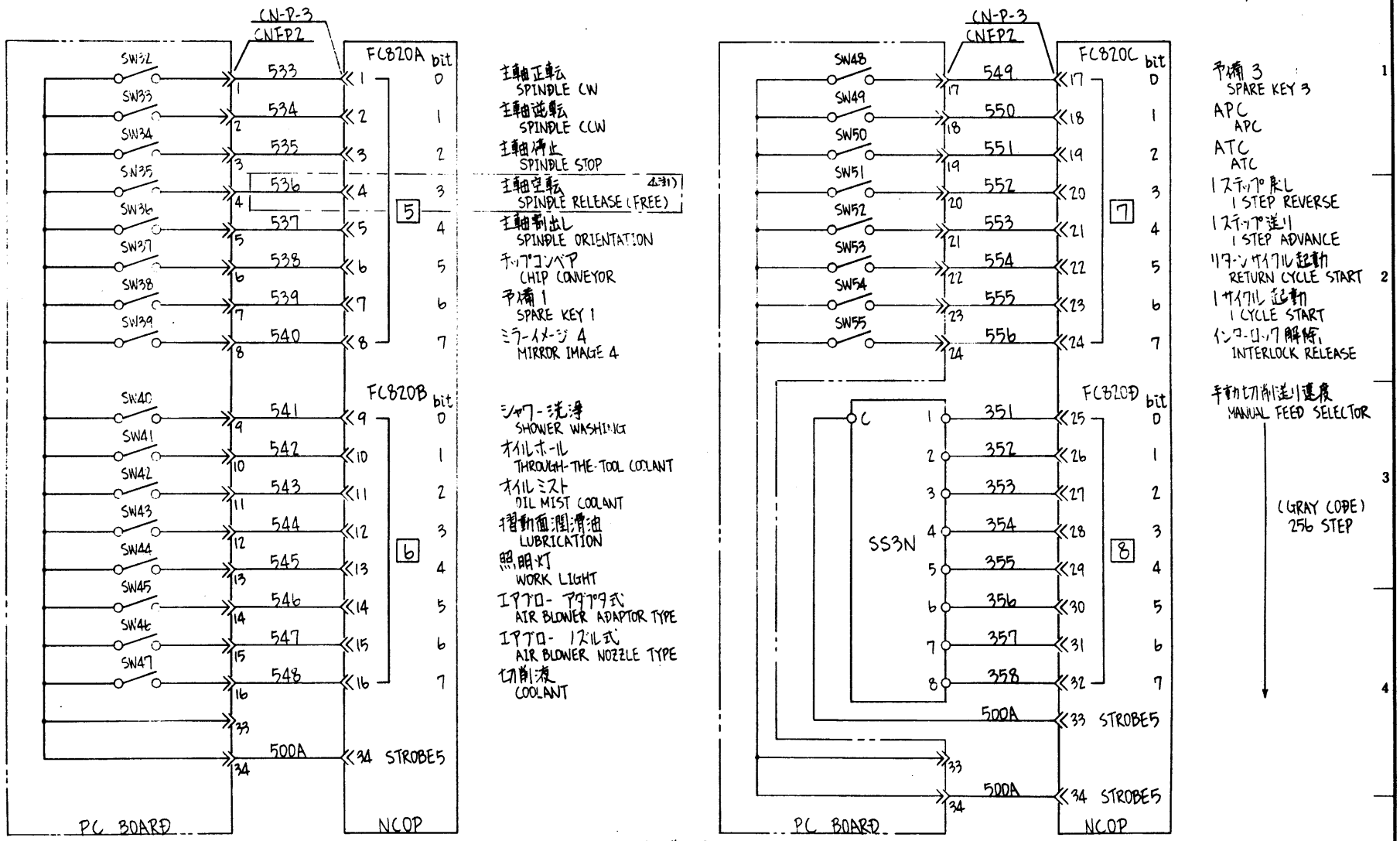
		渕辺	田口	ﾚﾎﾟｰﾄ No.

図面名称
操作パネル入力 (1)
PANEL CONTROL INPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (1)

7.19 ' 86 | F2

W1001 — 200 — 966 —

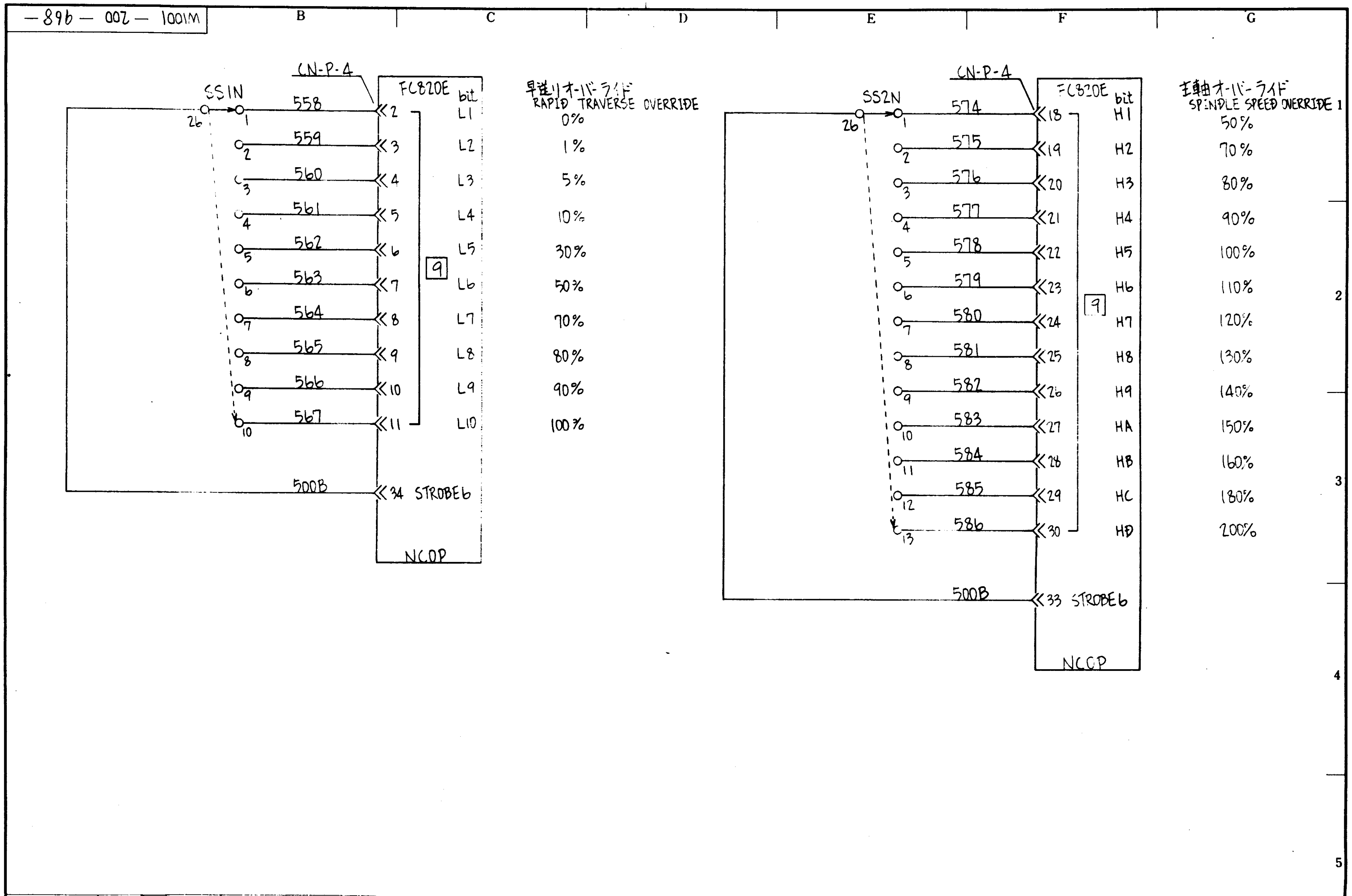
OKUMA MACHINERY WORKS LTD.



※注1) スピンドル 10,000 RPM仕様時不要
※(Useles. When Spindle 10,000 RPM)

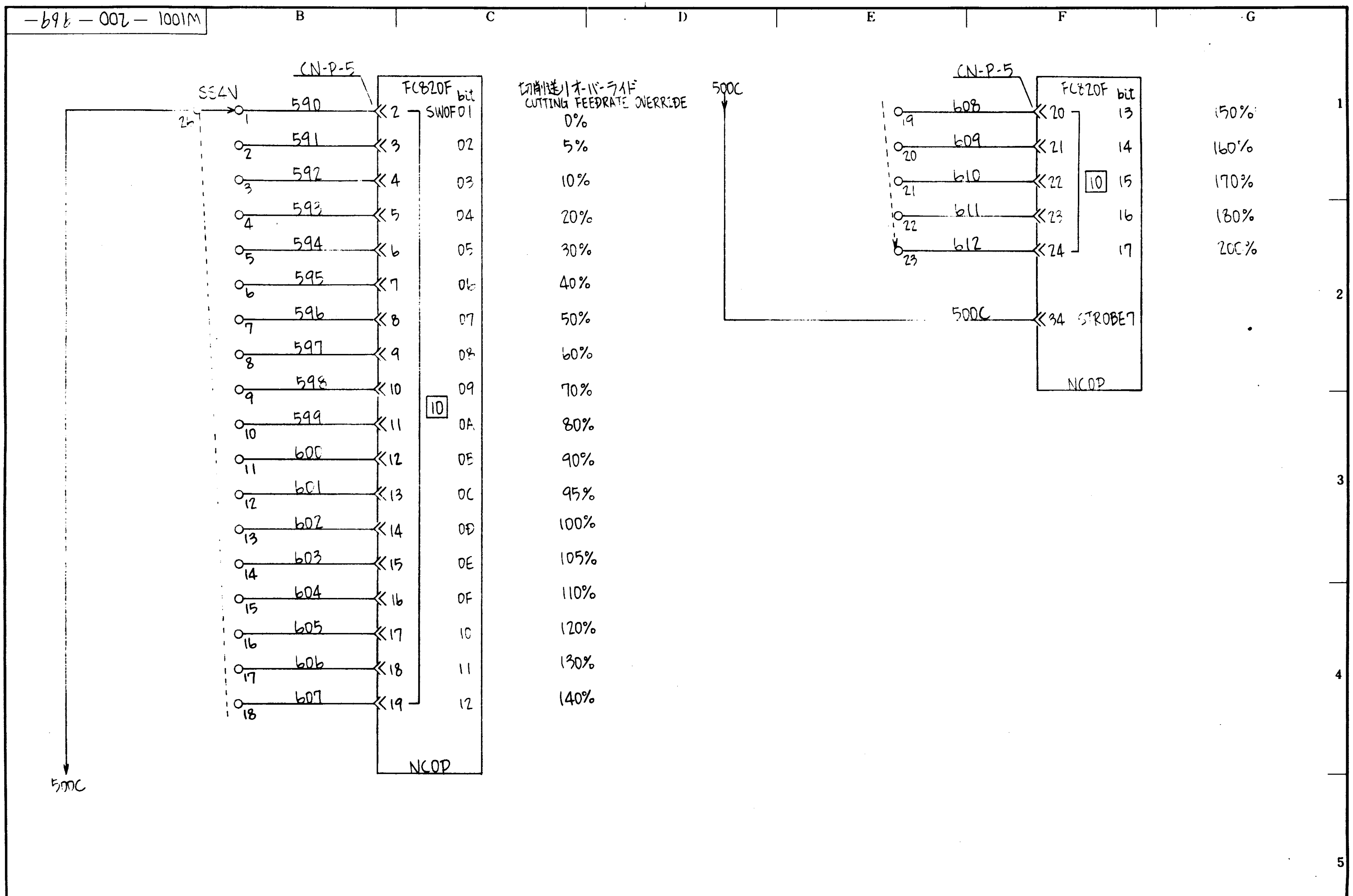
						第1製番 8609へ				図面名称	7.19:86 F3
						基本図面 — —				操作パネル入力 (2) PANEL CONTROL INPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (2)	W1001 — 200 — 967 —
		1.12:88	英文追記		MC-V DSP 5000M-は		沼辺	田口	山下		
JOINT NO	NOTE	9.2:86	10000RPM仕様追加	初期	適用機種						

OKUMA MACHINERY WORKS LTD.



JOINT NO	NOTE		
MC-V DSP 5000M-G	適用機種		
第1製番 8609〜	基本図面 − −		
図面名称	操作パネル入力 (3) PANEL CONTROL INPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (3)	7.19.86	F4
		W1001 − 200 − 968 −	

OKUMA MACHINERY WORKS LTD.



JOINT NO	NOTE		

ML-V OSP-5000M-G
適用機種

第1製番 8609～
基本図面 — —

渡辺 田口 G.Fv 杉原

図面名称
操作パネル入力（4）
PANEL CONTROL INPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (4)

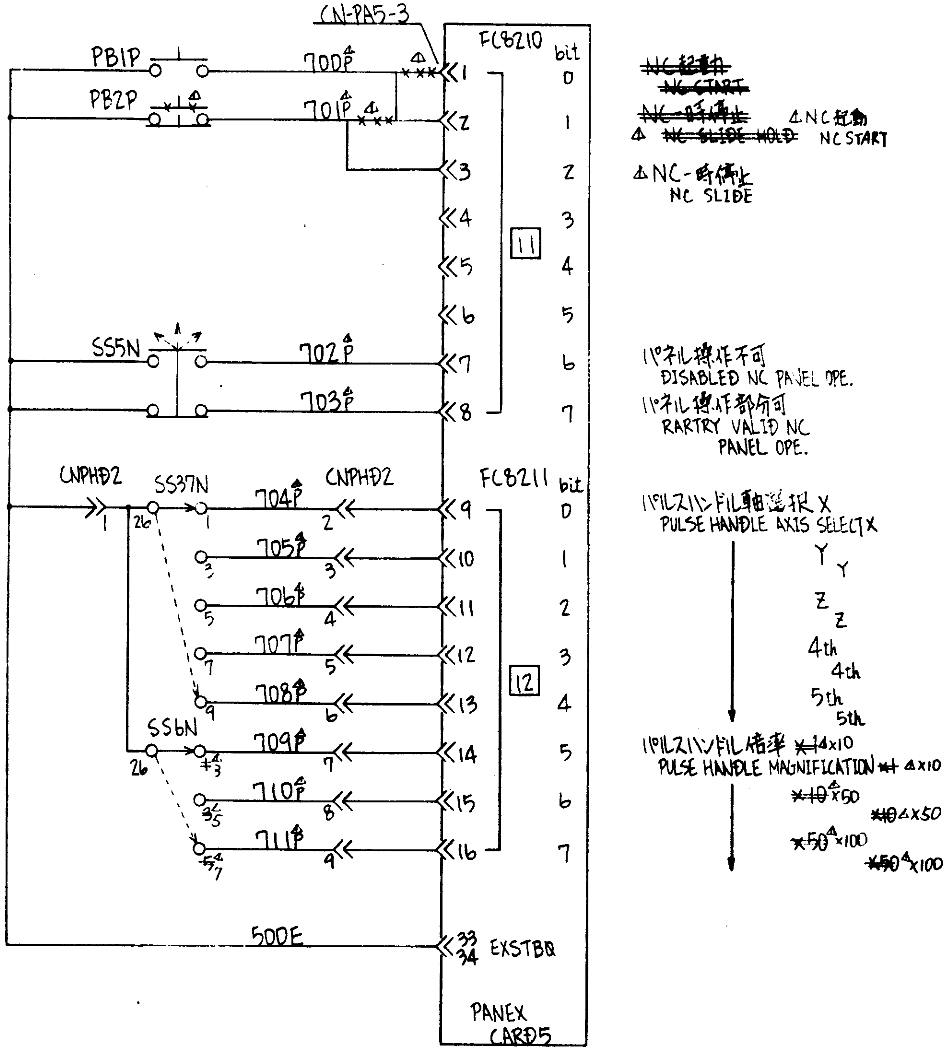
7.19.86 F5

W1001 — 200 — 969 —

OKUMA MACHINERY WORKS LTD.

W1001 — 200 — 970 —

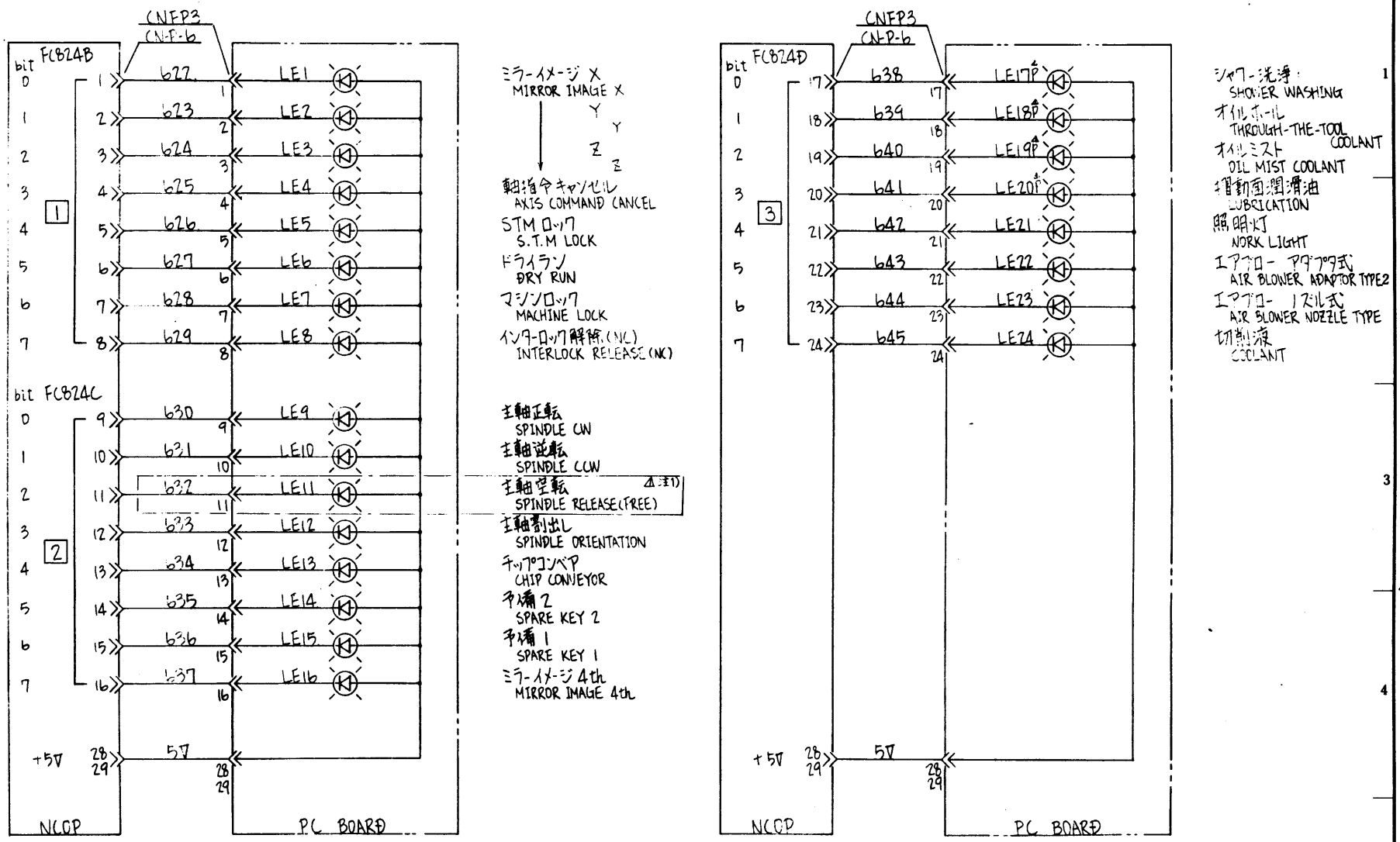
B	C	D	E	F	G



第1製番 8609～	図面名称	7.19.86	F6
基本図面 — —	操作パネル入力 (5) PANEL CONTROL INPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (5)	W1001 — 200 — 970 —	
渡辺 田口 GIFU 芳原			

JOINT NO | NOTE | △1 8.21.86 誤記訂正 及び追記 | MC-V OSP5000M-G 適用機種

OKUMA MACHINERY WORKS LTD.



⚠注1) スピンドル 10,000RPM 仕様時不要
⚠ (Useless, Whe Spindle 10,000 R.P.M)

JOINT NO	NOTE					
		⚠	1.12.'88	東文追記		
		⚠	9.1.'86	10,000RPM仕様		

MC-V DSP 5000M-G
適用機種

第1製番 8609ヘ
基本図面 — —

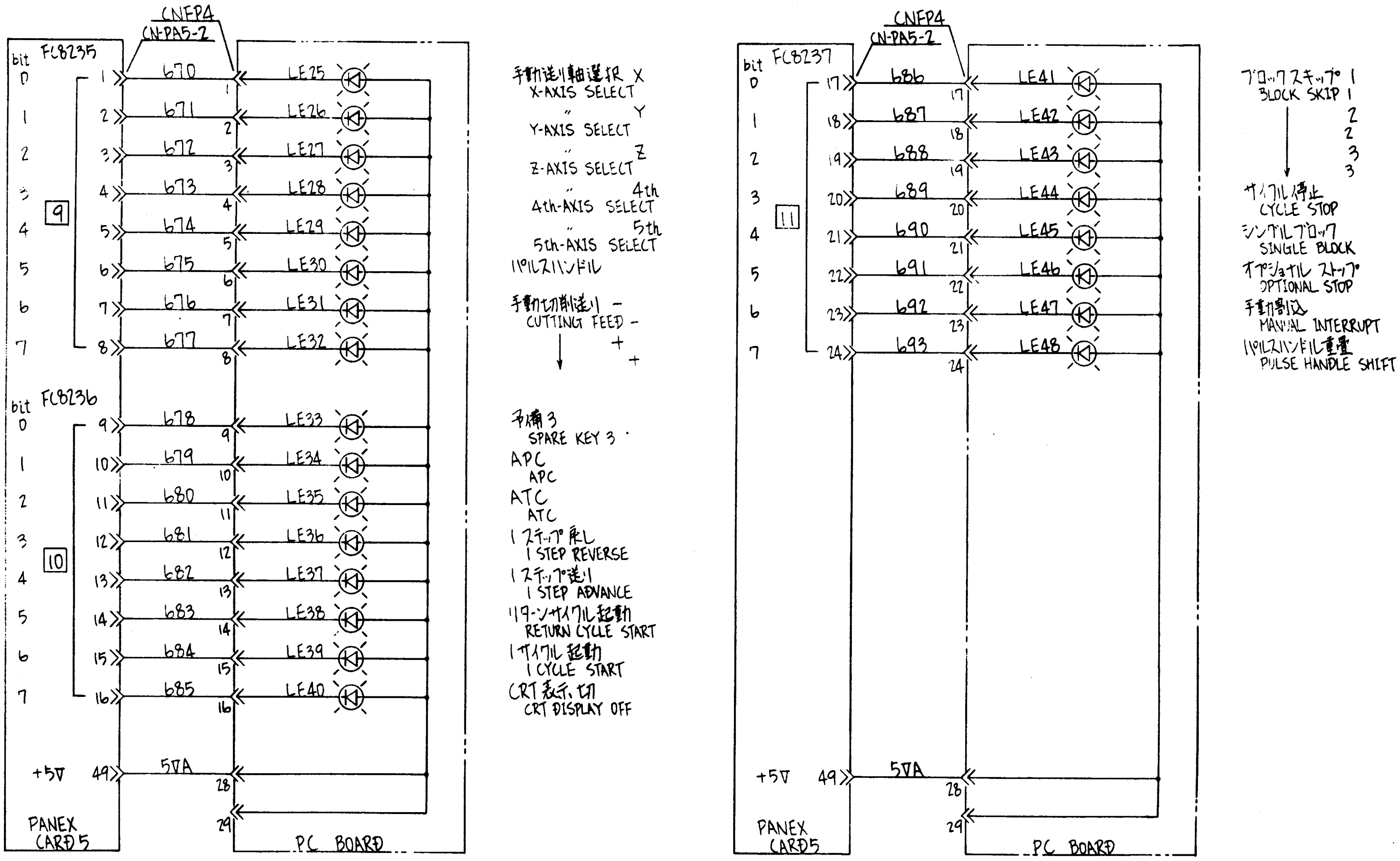
渡辺	田口	

図面名称
操作パネル出力 (1)
PANEL CONTROL OUTPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (1)

7.19'86 F7
W1001 — 200 — 971 —

OKUMA MACHINERY WORKS LTD.

B C D E F G



1 2 3 4 5

JOINT NO	NOTE		
		M/C-V OSP 5000M-G 適用機種	第1製番 8609～ 基本図面 — —

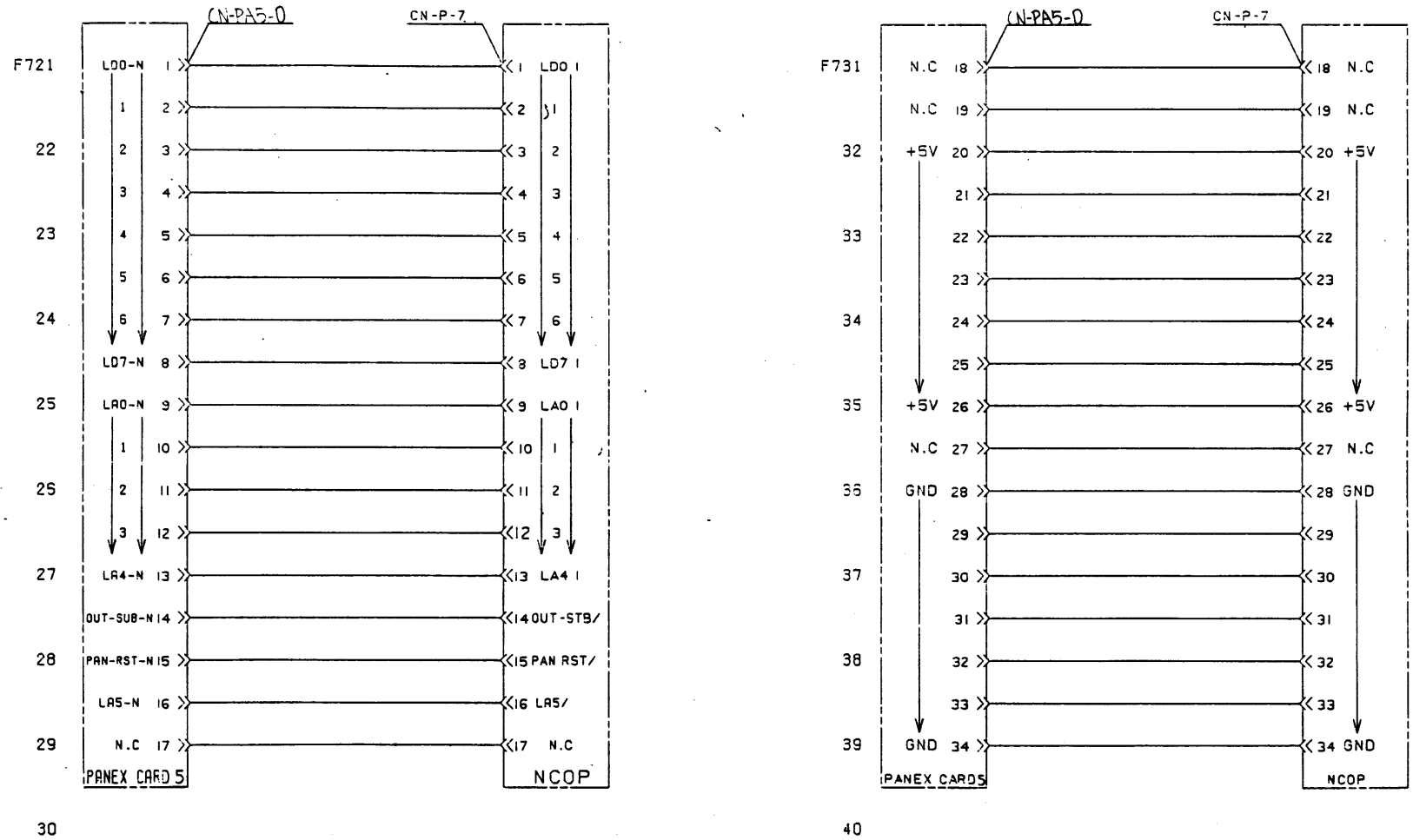
図面名称 操作パネル出力 (2)
PANEL CONTROL OUTPUT CIRCUIT DIAGRAM OF MANUAL OPERATION PANEL (2)

7.19.86 F8

W1001 — 200 — 972 —

OKUMA MACHINERY WORKS LTD.

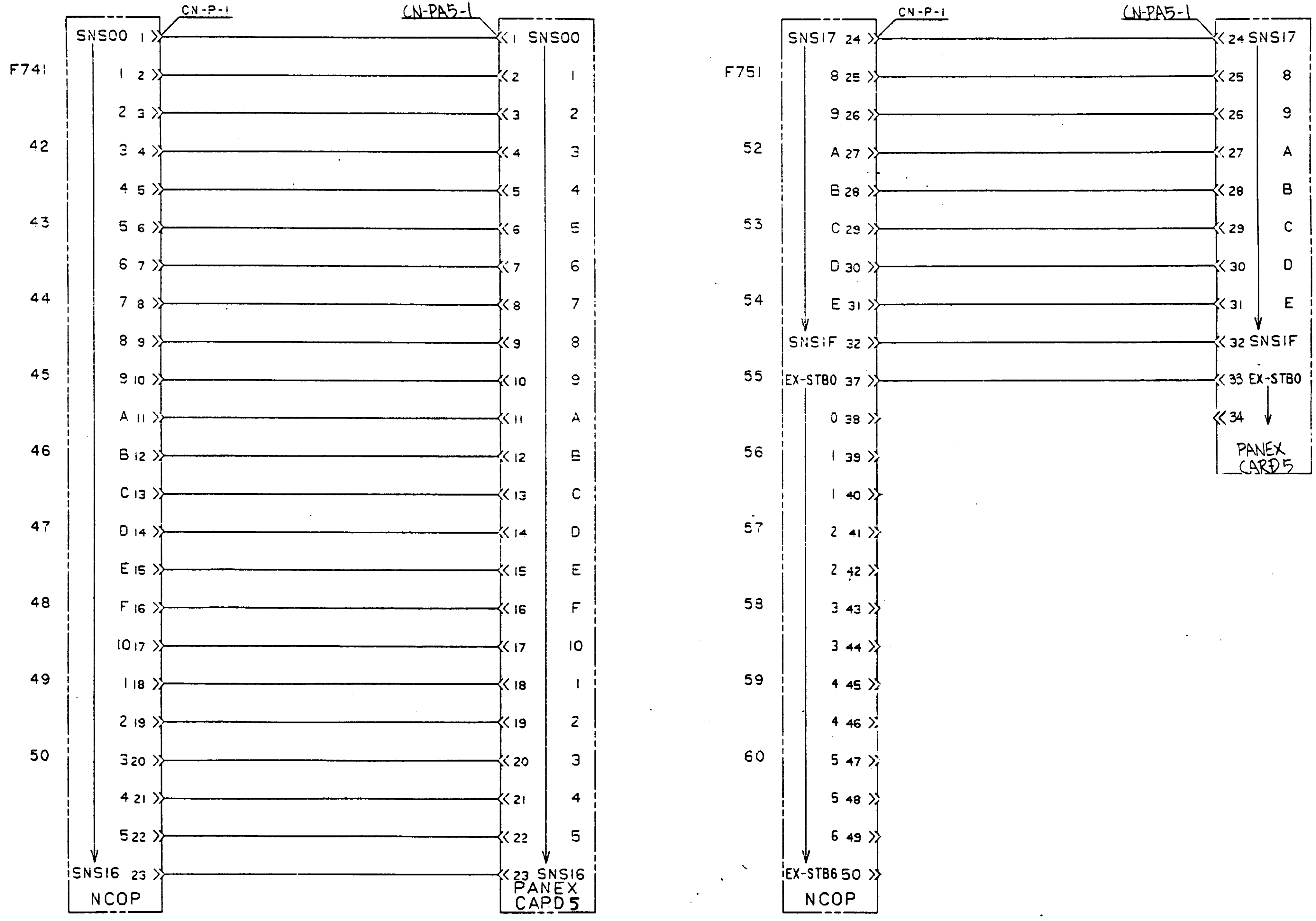
W1001-200-973



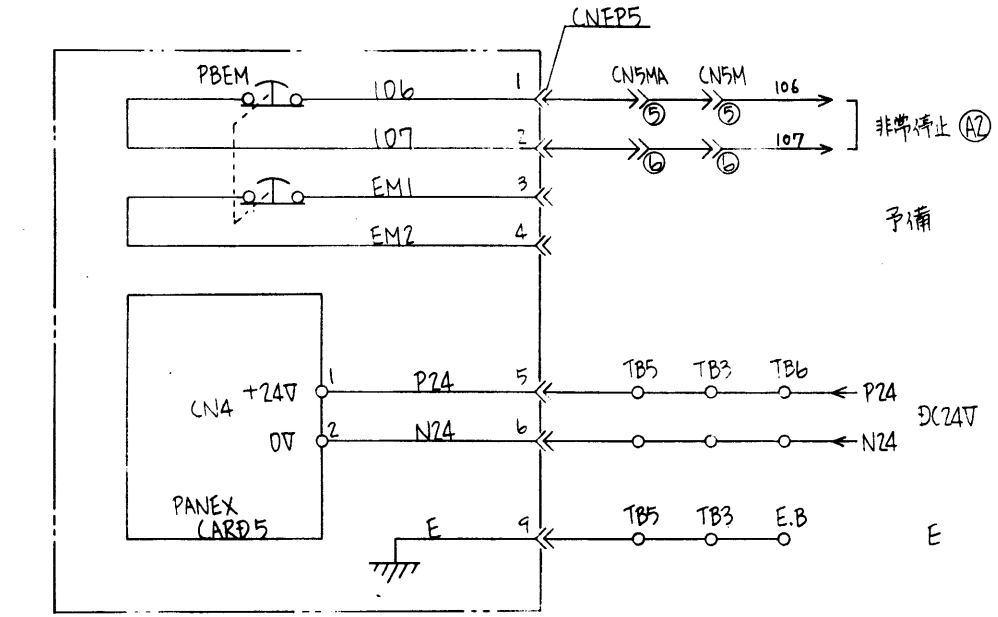
		⚠5	. :			第1製番 8609~	図面名称 PANEL CONTROL	7.19.'86	F9
		⚠4	. :			基本図面	PANEXバスライン回路図(1)		
		⚠3	. :				CIRCUIT DIAGRAM OF		
		⚠2	. :	OSP5000M-G		疫 田口	PANEX BUS LINE (1)	W1001-200-973	
JOINT NO	NOTE ⚠			適用機種					

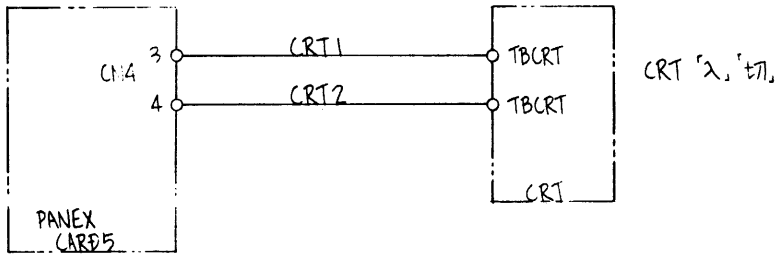
OKUMA MACHINERY WORKS LTD.

W1001-200-974



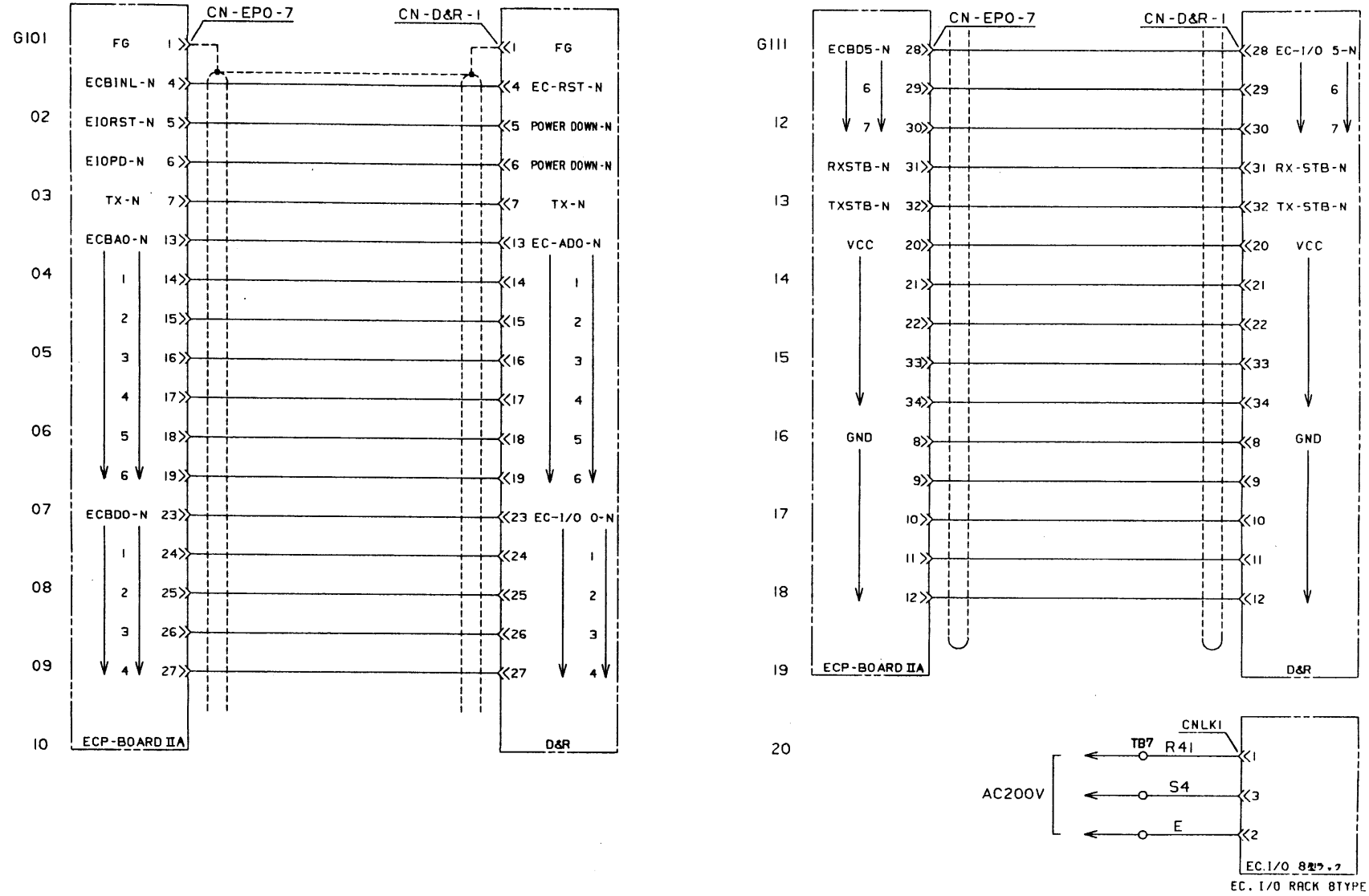
第1製番 8609～	図面名称 PANEL CONTROL	7.19.'86 F9A
基本図面	PANEX バスライン 回路図 (2)	
OSP5000M-G 適用機種	PANEX BUS LINE CIRCUIT (2)	W1001-200-974
JOINT NO / NOTE		





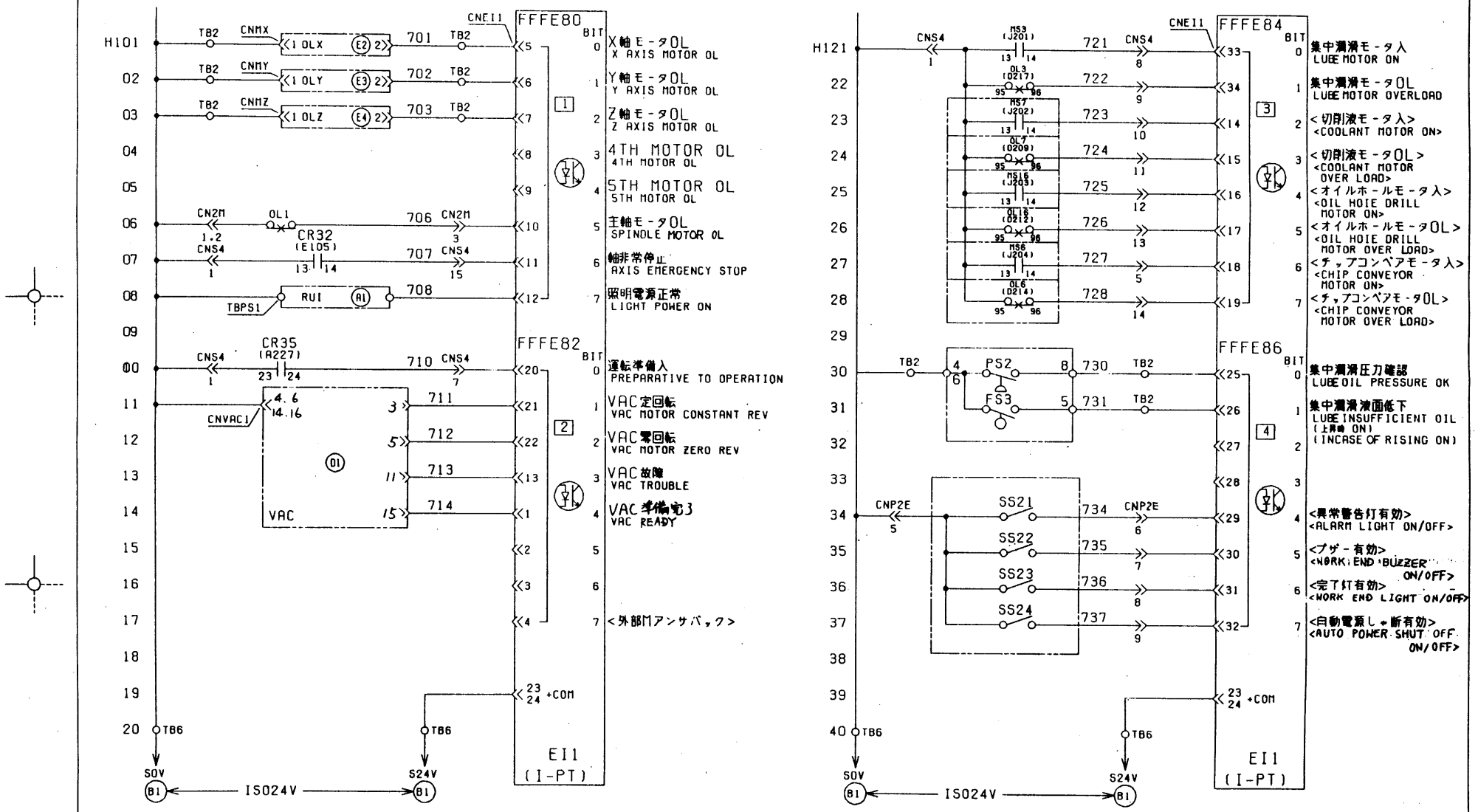
		⑤	.	:				第1製番 8609～		図面名称	7．19：86	F10
		④	.	:				基本図面	— —	操作パネル回路図 CIRCUIT DIAGRAM OF OPERATION PANEL	W1001 — 200 — 975 —	
		③	.	:					渡辺 田口			
		②	.	:		MC-V DSP5000M-LT 適用機種						
JOINT NO	NOTE	①	.	:								

W1002-200-782M



		⚠5	. :			第1製番		図面名称		1・13・89	G1
		⚠4	. :			基本図面 W1001-200-368		ECP バスライン回路図			
		⚠3	. :					ECP BUS LINE CIRCUIT DIAGRAM		W1002-200-782	
		⚠2	. :		MC-4VA 5000M-G		田 GITU 網頭				
JOINT NO	NOTE	⚠1	. :		適用機種						

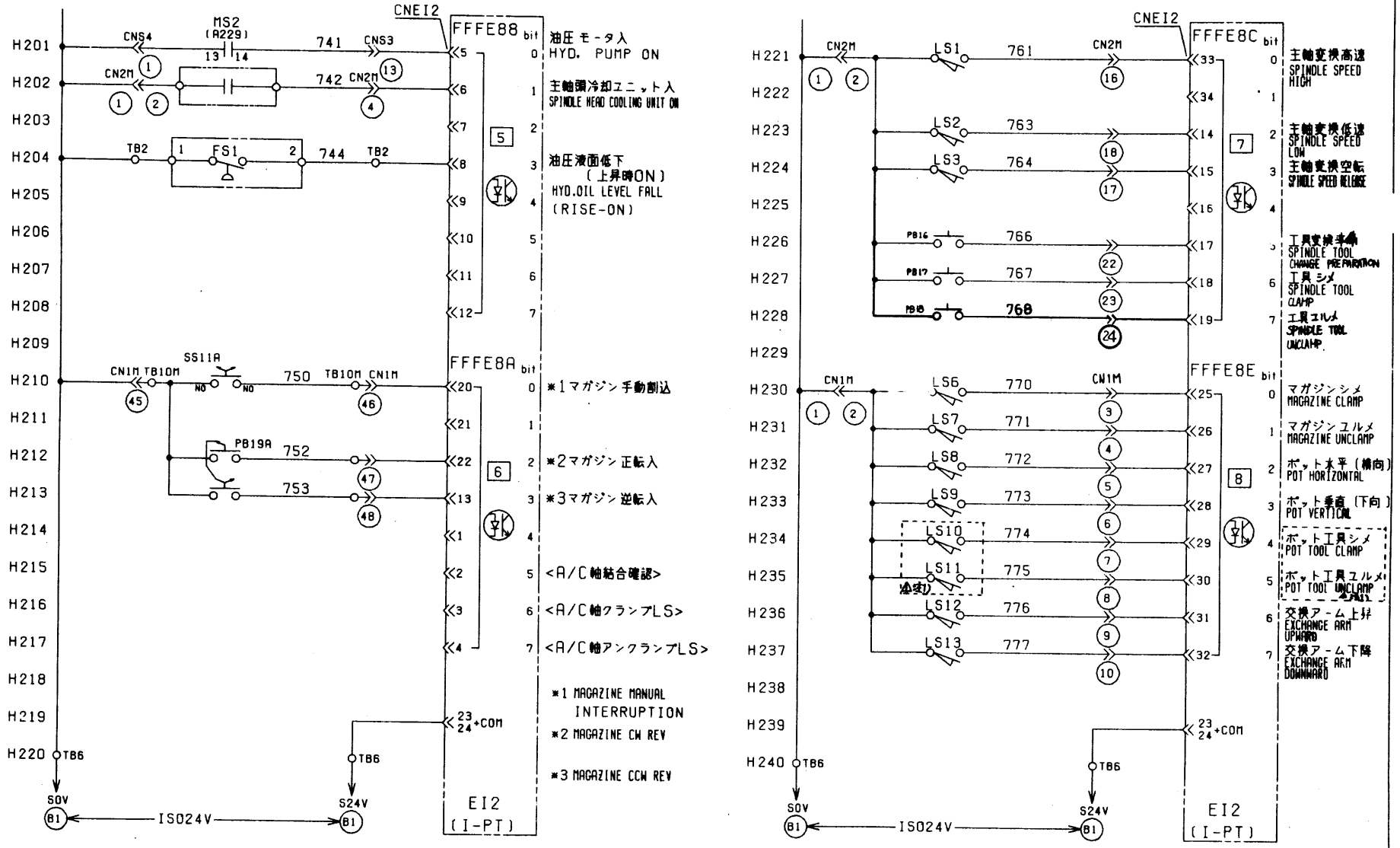
OKUMA MACHINERY WORKS LTD.



< >:OPTION

JOINT NO	NOTE	⚠5 . :			MC-4VA 5020M 適用機種	第1製番	図面名称 EC CONTROL INPUT (1) EC CONTROL 入力 (1) (1-PT-1)	9.25'89	H1
		⚠4 . :				基本図面 W1001-200-369		W1002-200- 974	
		⚠3 . :				田口 GIFU 稲沢			
		⚠2 . :							
		⚠1 . :							

W1001-200-370



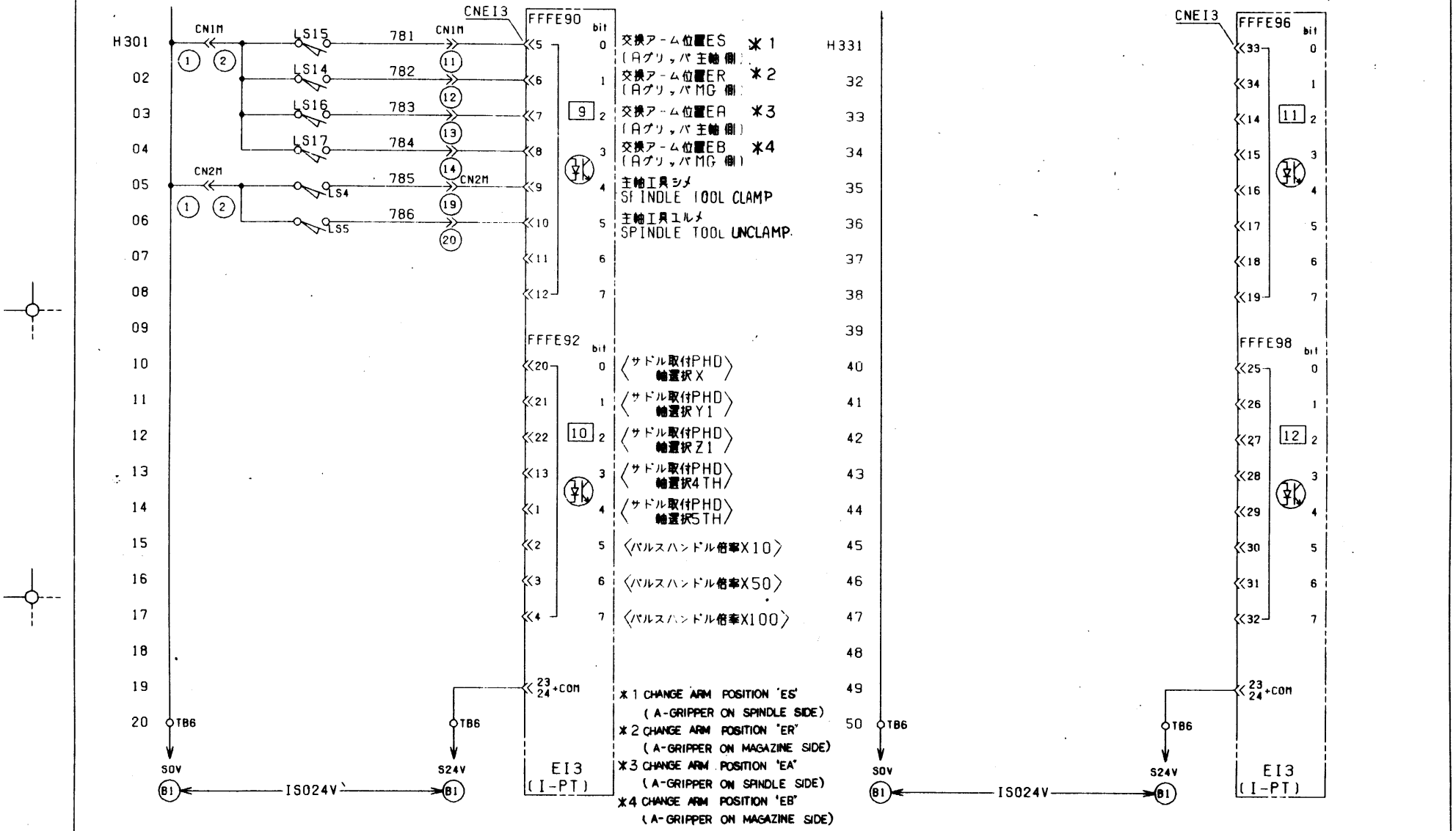
⚠注1) MC-4VB時不要

< > :OPTION

		⑤	. :			第1製番 R911-A050-34	図面名称	5.22'85	H2
		④	. :			基本図面	EC CONTROL INPUT(2)		
		③	. :		⚠MC-4VB	滝迫	祖村	小池	日俥	水野	EC CONTROL 入力(2)	W1001-200-370
		②	. :		MC-4VA 5000M-G				1		(1-PT2)	
JOINT NO	NOTE	①	8.6 '87	MC-4VB時 LS10, LS11 不要	削線	適用機種						

OKUMA MACHINERY WORKS LTD.

W1001-200-371



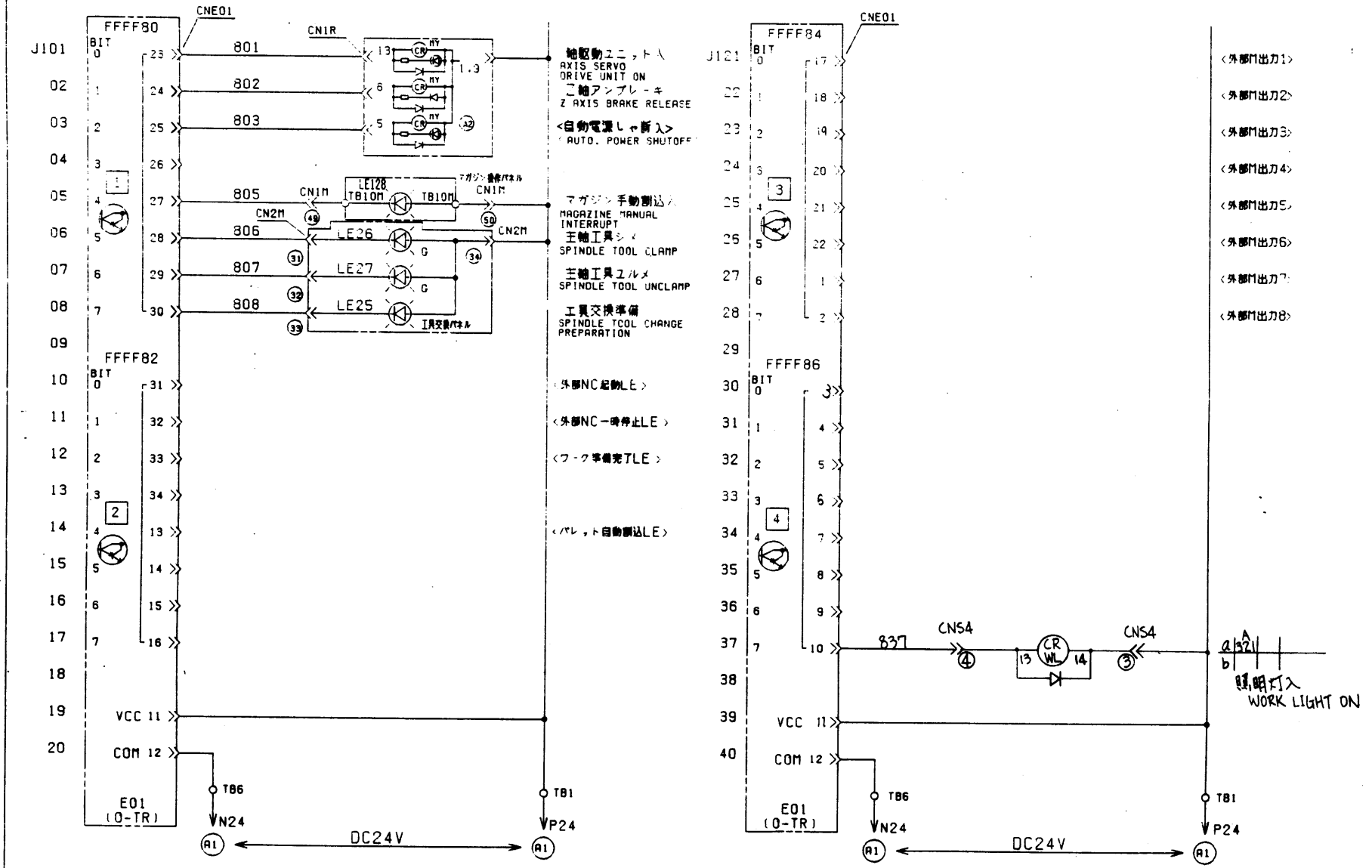
〈 〉:OPTION

		⑤	. :			第1製番 R911-A050-34				
		④	. :			基本図面				
		③	. :							
		②	. :		MC-4VA 5000M-G					
JOINT NO	NOTE	①	. :		適用機種	承認	植村	小池	白神 I	木野

図面名称
EC CONTROL INPUT (3)
EC CONTROL入力(3)
(I-PT3)

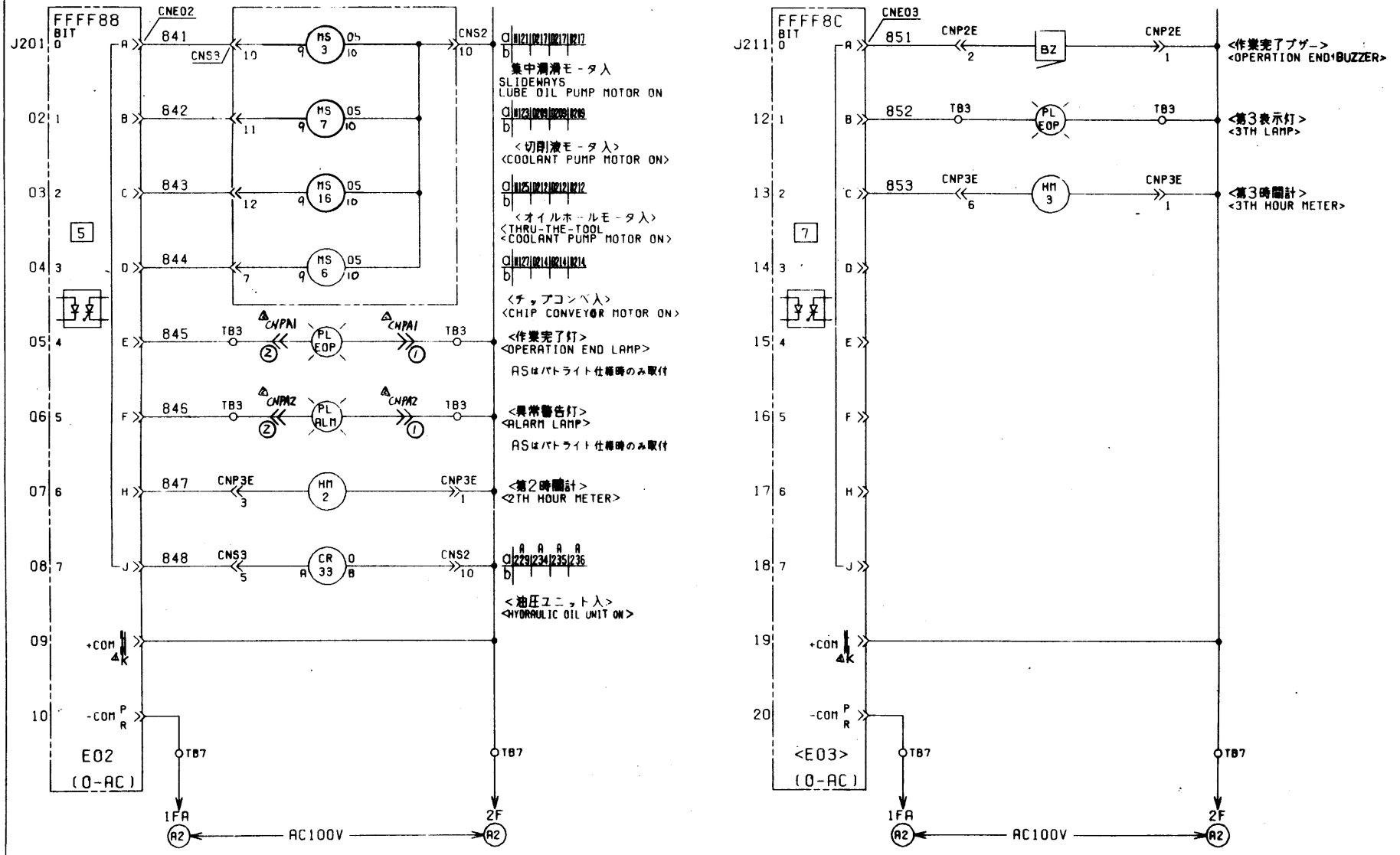
5.22.'85 | H3

W1001-200-371



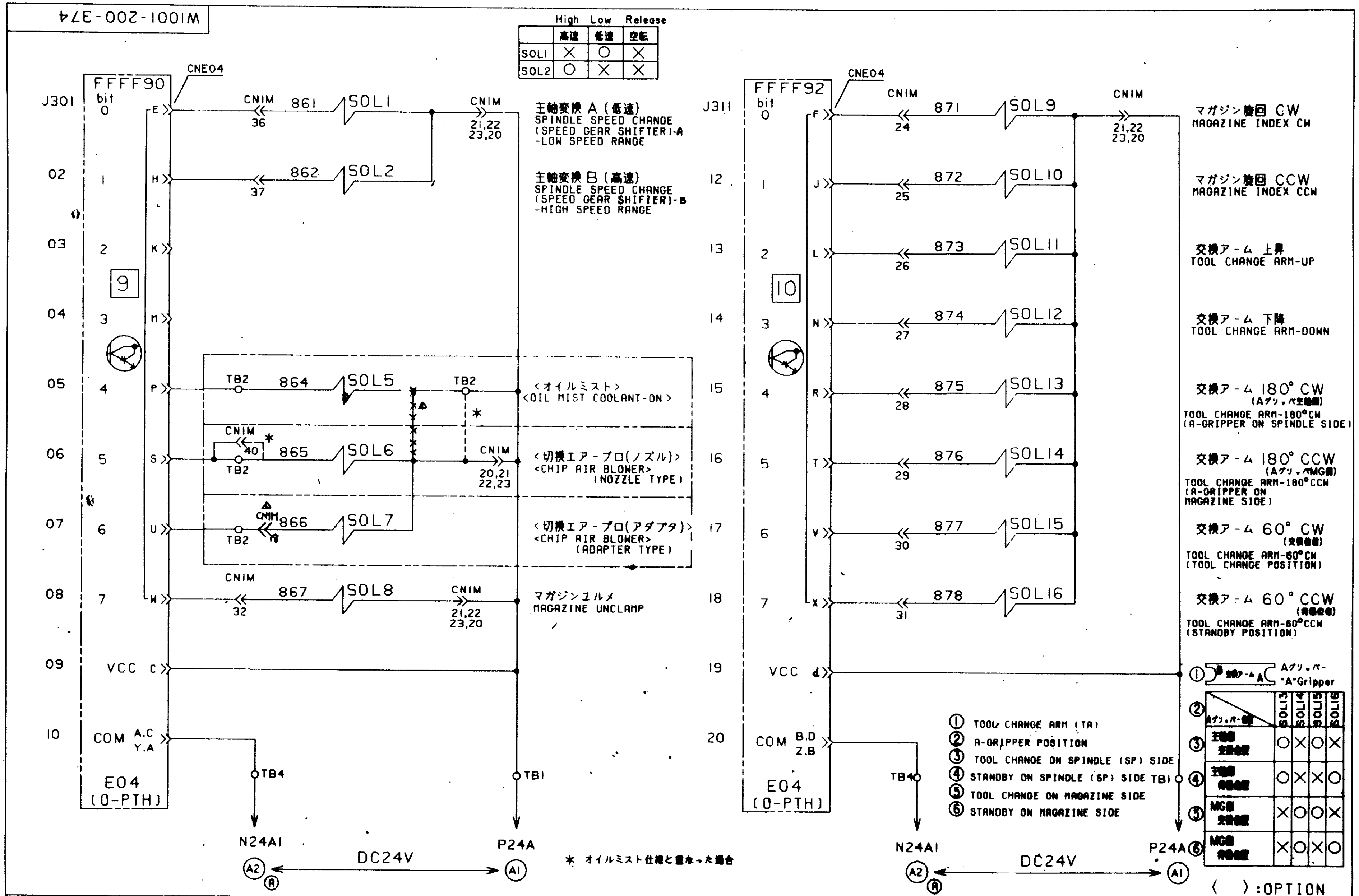
JOINT NO	NOTE			適用機種 MC-4VA 5000M-G	第1製番 8609～	図面名称 EC CONTROL OUTPUT (1) EC CONTROL 出力 (1) (TR-1)	7.19.'86 J1
					基本図面		W1001-200-476

W1001-200-373



		⚠	. :			第1製番 R911-A050-34				図面名称 EC CONTROL出力 (2) EC CONTROL OUTPUT (2) (AC-SSR)	5.24'85 J2
		⚠	. :			基本図面					
		⚠	. :								
		⚠	4.8'88	コネクタ追記	機種	MC-4VA 5000M-G					W1001-200-373
JOINT NO	NOTE	⚠	9.1 '86	誤記訂正	機種	適用機種	承認	植村	小池	日伸工	本野

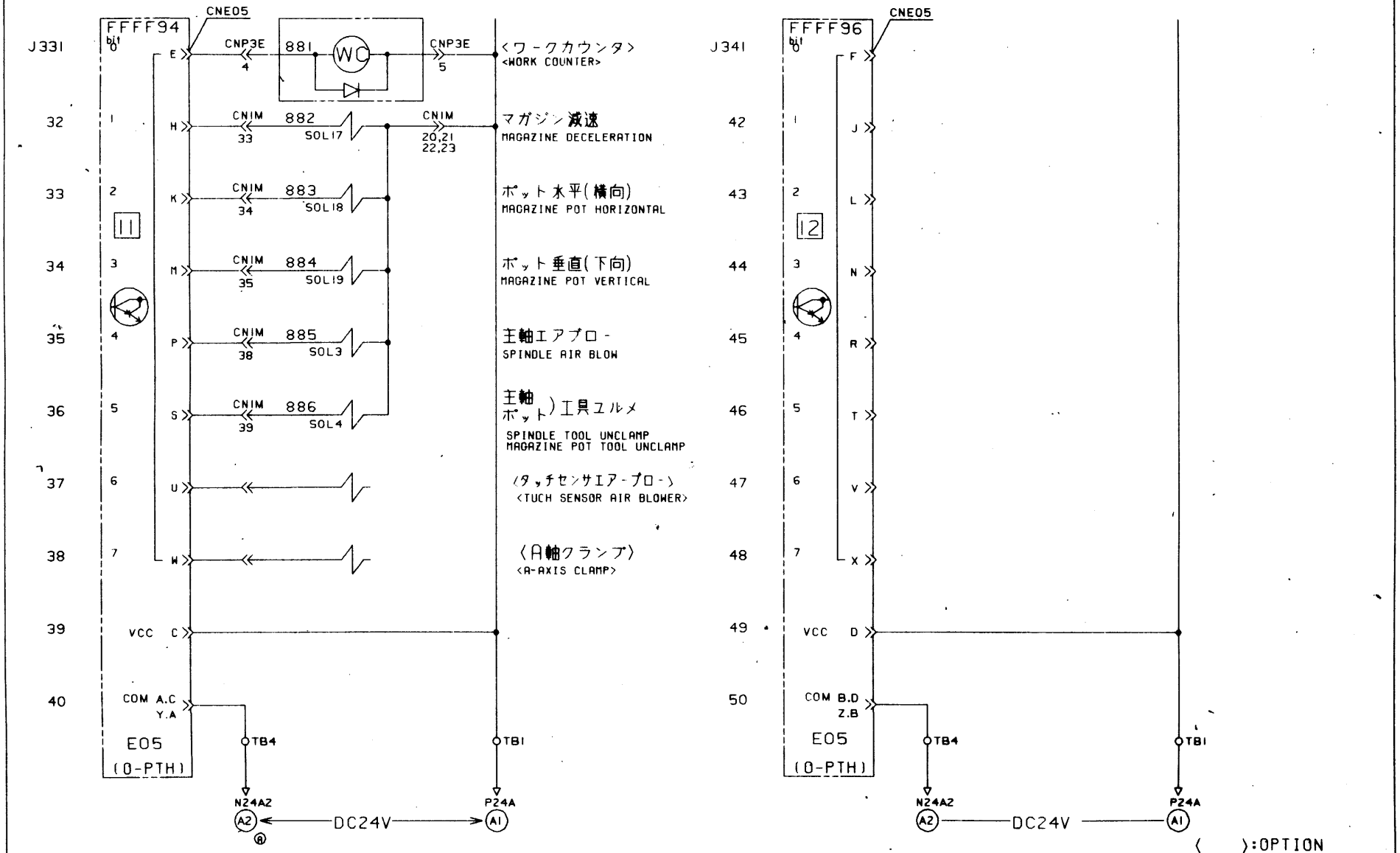
OKUMA MACHINERY WORKS LTD.



			第1製番 R911-A050-34	図面名称 EC CONTROL OUTPUT(3) EC CONTROL 出力 (3) (P.TR-3)	5.23.'85 J3
			基本図面		
		MC-4VA 5000M-G			W1001-200-374
JOINT NO	NOTE	適用機種			

OKUMA MACHINERY WORKS LTD.

W1001-200-375



		⑤	. :			第1製番 R911-A050-34					
		④	. :			基本図面					
		③	. :			報辺	遠村	小池	白神 I	本野	
		②	. :		MC-4VA 5000M-G						
JOINT NO	NOTE	①	. :		適用機種						

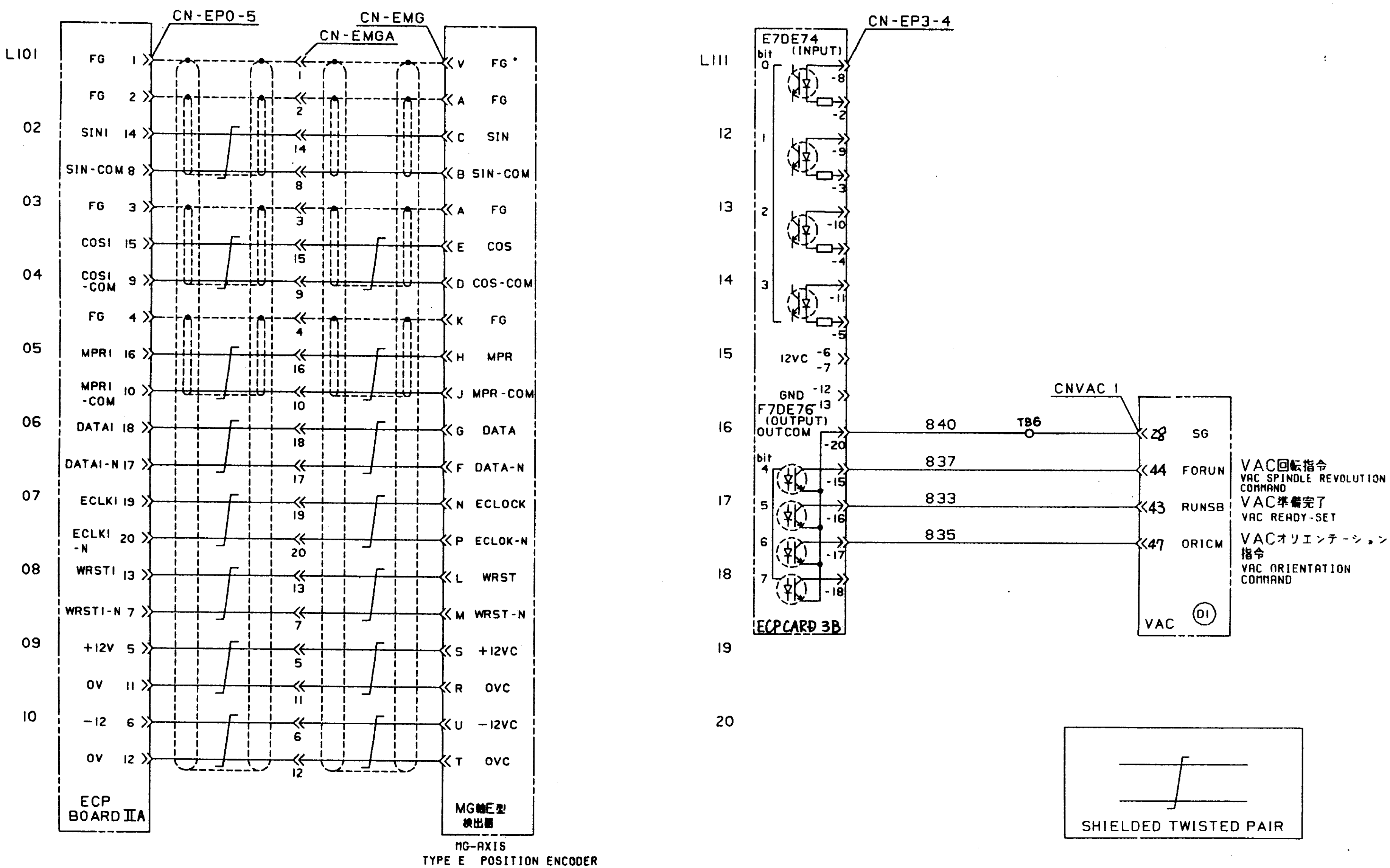
図面名称
EC CONTROL OUTPUT (4)
EC CONTROL 出力(4)
(P.TR-4)

5.23.'85 | J4

W1001-200-375

OKUMA MACHINERY WORKS LTD.

W1002-200-783



		5	. :			第1製番	
		4	. :			基本図面 W1001-200-376	
		3	. :				
		2	. :		MC-4VA 5000M-G	田	GIFU
JOINT NO	NOTE	1	. :		適用機種		

図面名称

ECP CONTROL 回路図(MG軸)

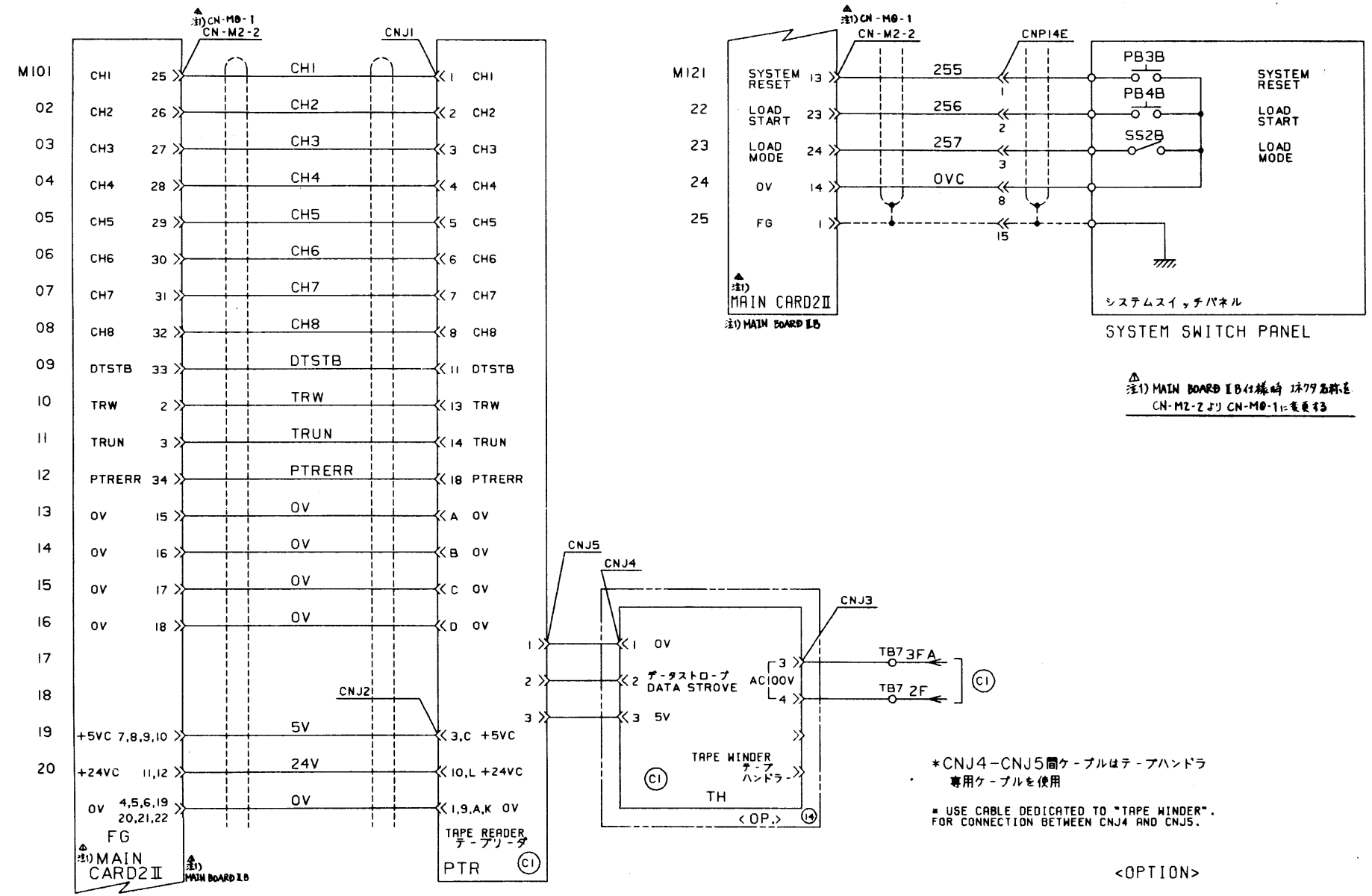
ECP CONTROL CIRCUIT (MG AXIS)

1.13.'89 (L1)

W1002-200-783

OKUMA MACHINERY WORKS LTD.

W1001-200-377



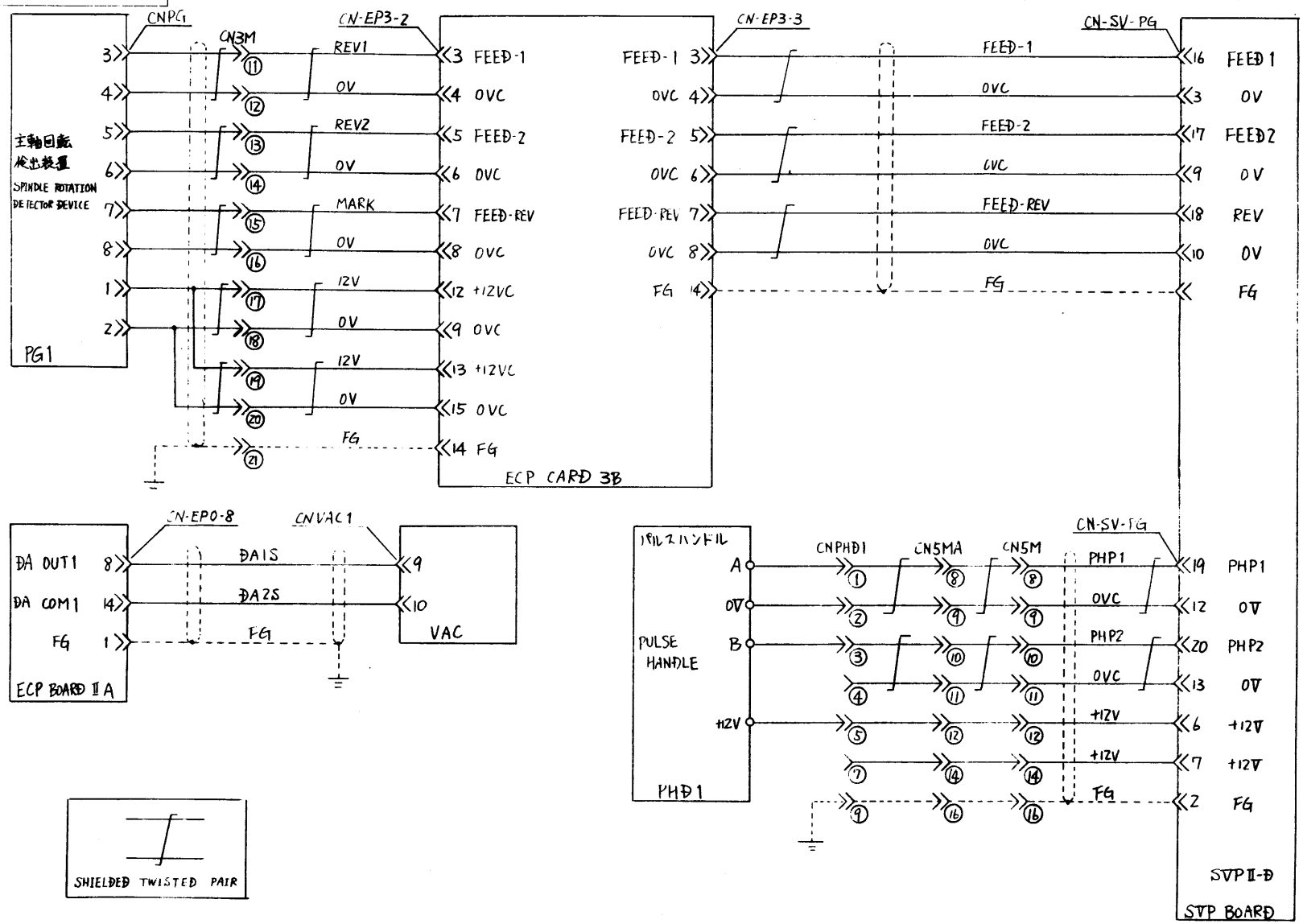
		⑤	. :				第1製番 R911-A050-34				
		④	. :				基本図面				
		③	. :				湘北	植村	小池	白神 I	木野
		②	. :			MC-4VA 5000M-G					
JOINT NO	NOTE	①	9.29:	MAIN BOARD IB対応 8710~	例機	適用機種					

図面名称
PTR.THロ-ディング回路図
TAPE READER/WINDER LOADING CIRCUIT

5.30'85 (M1)

W1001-200-377

OKUMA MACHINERY WORKS LTD.



JOINT NO	NOTE	第1製番				図面名称	12.24.'88 N1
		基本図面	—	—		PG. PHD. SP CONTROL 回路図	
MC-4TA	OSP5000H-G			田	61FU	PG. PHD. SP CONTROL CIRCUIT DIAGRAM	W1002 — 200 — 784 —
適用機種				区	棚類		

印紙824C (電) A3 63.8 3.000 (b)