OMRON USER'S MANUAL

Programmable Cam Switch
(CAM POSITIONER)

Type
3F88L-120A|112

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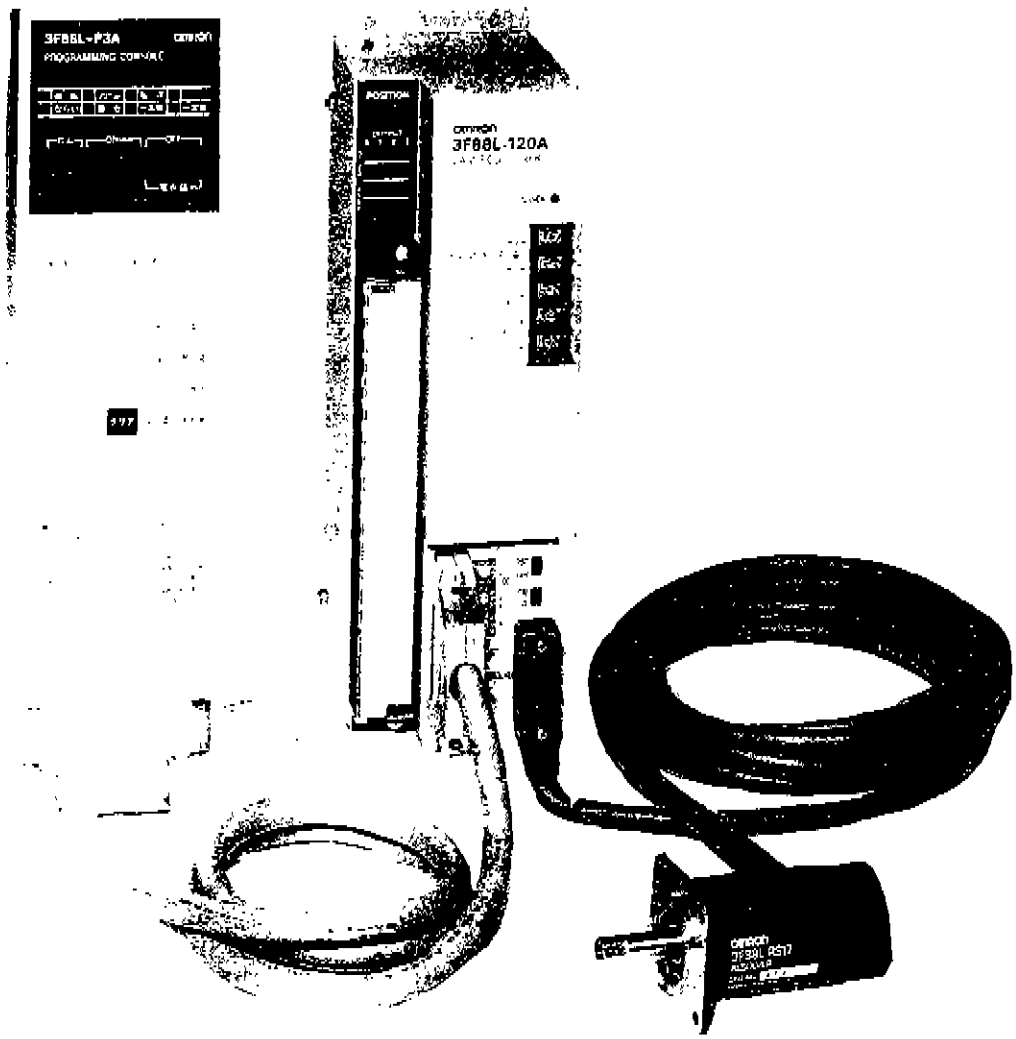
CHAPTER 1 OUTLINE



Type 3F88L-120A CAM POSITIONER
(Type 3F88L-112)

1. OUTLINE

With an absolute angle detector, CAM POSITIONER detects the angle and obtains the cam output preset by the programming console. Therefore, the unit can provide you with the same performance as conventional mechanical cam switches. This User's manual diseribes two types of CAM POSITIONER. One is 32-output type 3F88L-120A, the other is 64-output type 3F88L-112.

CAM POSITIONER has a variety of functions as follows:

(1) 32/64 output points with multi-step control

The cam output can be obtained from 32/64 points and ON/OFF can be regulated up to a maximum of 60 times per output.

(2) Excellent resistance to environment

The resolver, detecting the angle of revolution by electromagnetic method, is free from maintenance, resistant to environmental vibration and temperature, and reliable even in oily or dusty place.

(3) High resolution

CAM POSITIONER detects the angle at the resolution of 360 divisions per turn, esplsially type 3F88L-120A has high resolution of 720 divisions

(4) Quick response and absolute detection

Compared with mechanical cams, the response speed is higher. Since the unit is an absolute type, it stores the present position even during power failure.

(5) A function for zero point correction

The function for zero point correction allows you to make an easy adjustment even when the zero point of the machine is far from that of the resolver.

(6) Simple programming for cam outputs

With simple operations on the programming console, you can easily program ON/OFF outputs.

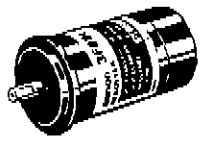
(7) Teaching function

Through the operation of the machine, you may preset the angle of ON and OFF cams.

CHAPTER 2 INTRODUCTION

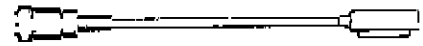
2.1 SYSTEM CONFIGURATION

Resolver



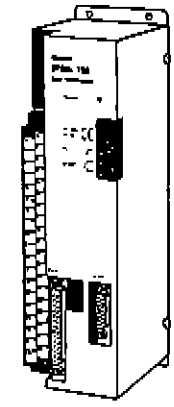
Type 3F88L-RS15

Resolver cable

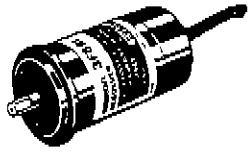


Type 8F88L-CR[ ]□□ NA

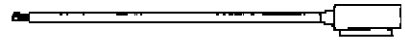
Cam positioner



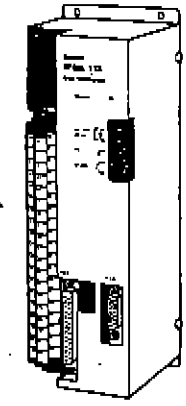
32 output points
Type 3F88L-120A



Type 3F88L-RS15W

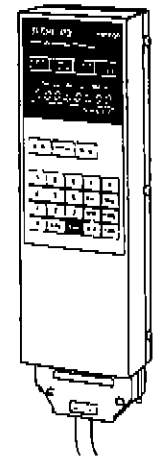


Type 3F88L-CR□□□ SA



64 output points
Type 3F88L-112

Programming console



Type 3F88L-P3A-E

2.2 INTRODUCTION OF MOTION

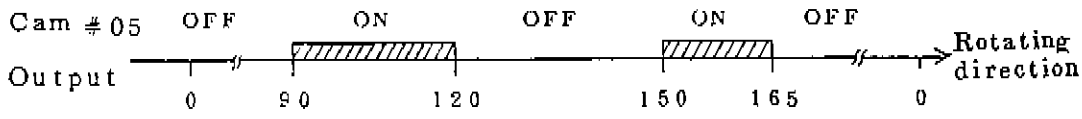
(1) Description of motion

- Imagine the same performance as mechanical cam switches.
- Enter your program in the programming console and store in the RAM of the console.
- And transfer this program to the memory (EE-PROM) of CAM POSITIONER.
- CAM POSITIONER runs by the memory (EE-PROM) of itself or by the memory (RAM) of the programming console when connected to the console.
- In ON and OFF positions (angle) programmed for a certain cam number (OUT number), the output is ON and OFF respectively.

☐ An example of running

Program

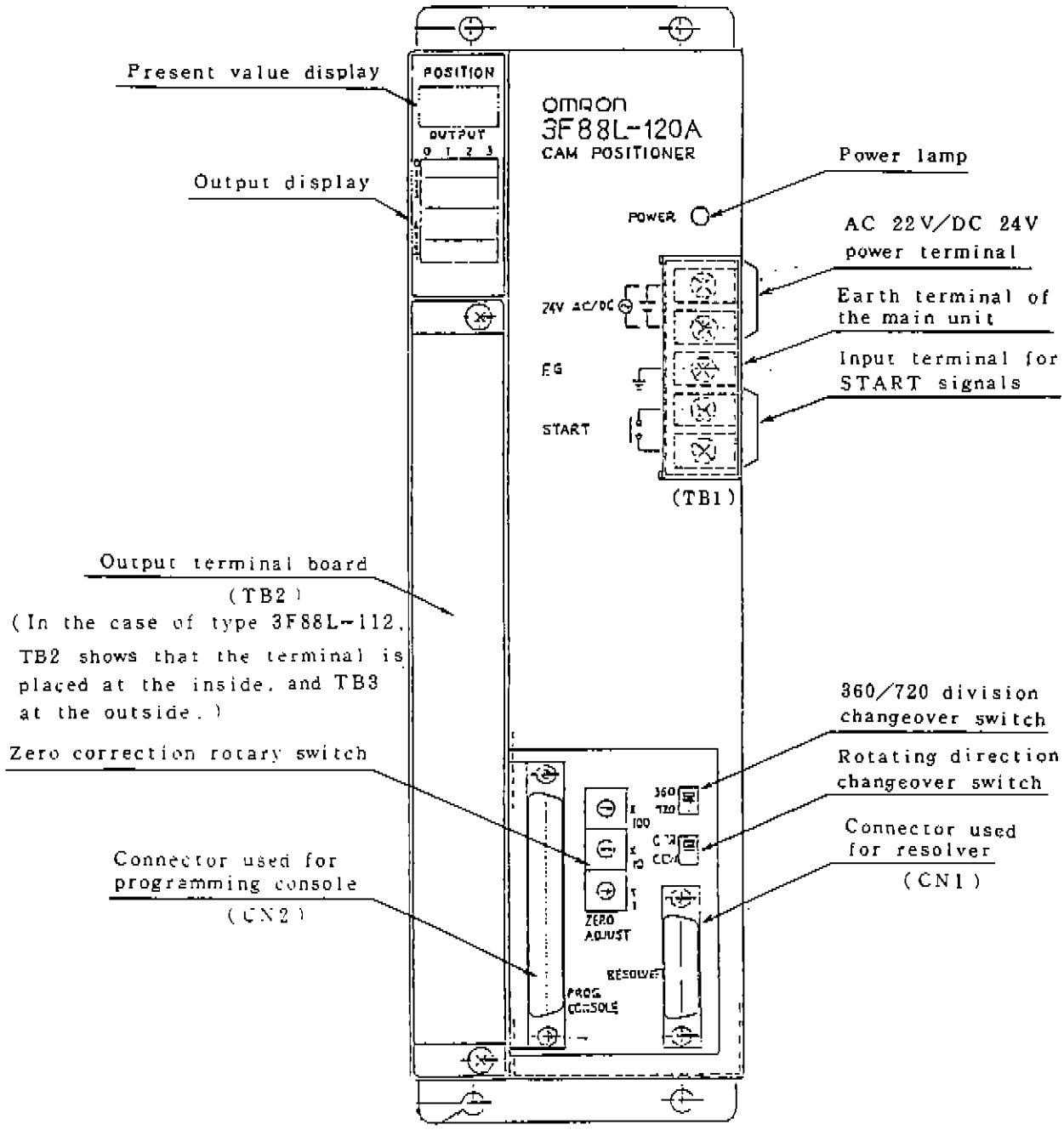
Cam #	ON setpoint	OFF setpoint
05	90	120
05	150	165



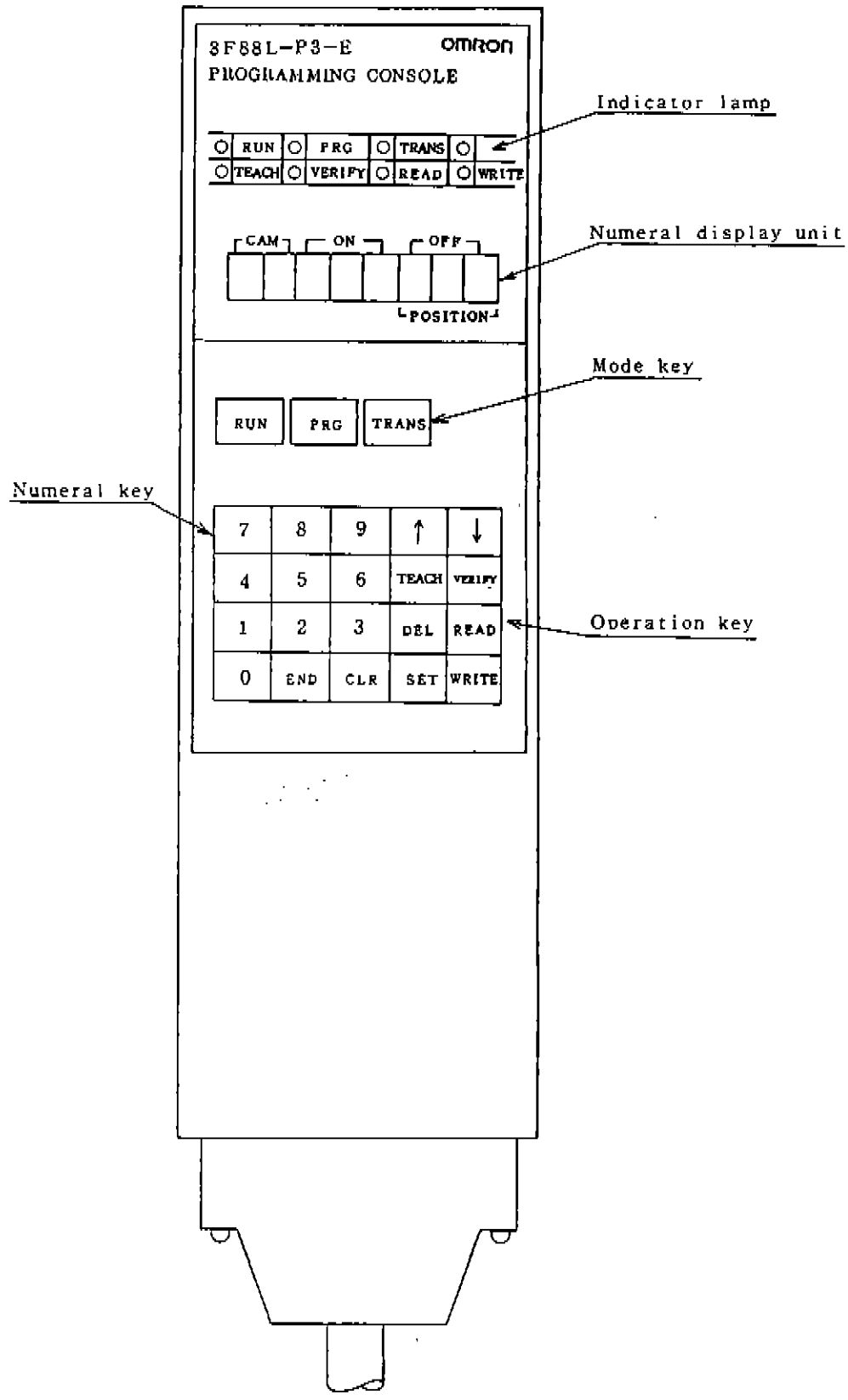
This example shows that Cam #05 is programmed to be ON at 90, OFF at 120, ON at 150 and OFF at 165.
The output is OFF up to 89, ON at 90, ON up to 119, OFF at 120 and ON at 150 ·····.

2.8 NAME OF PARTS

*Main unit (Type 3F88L-120A)

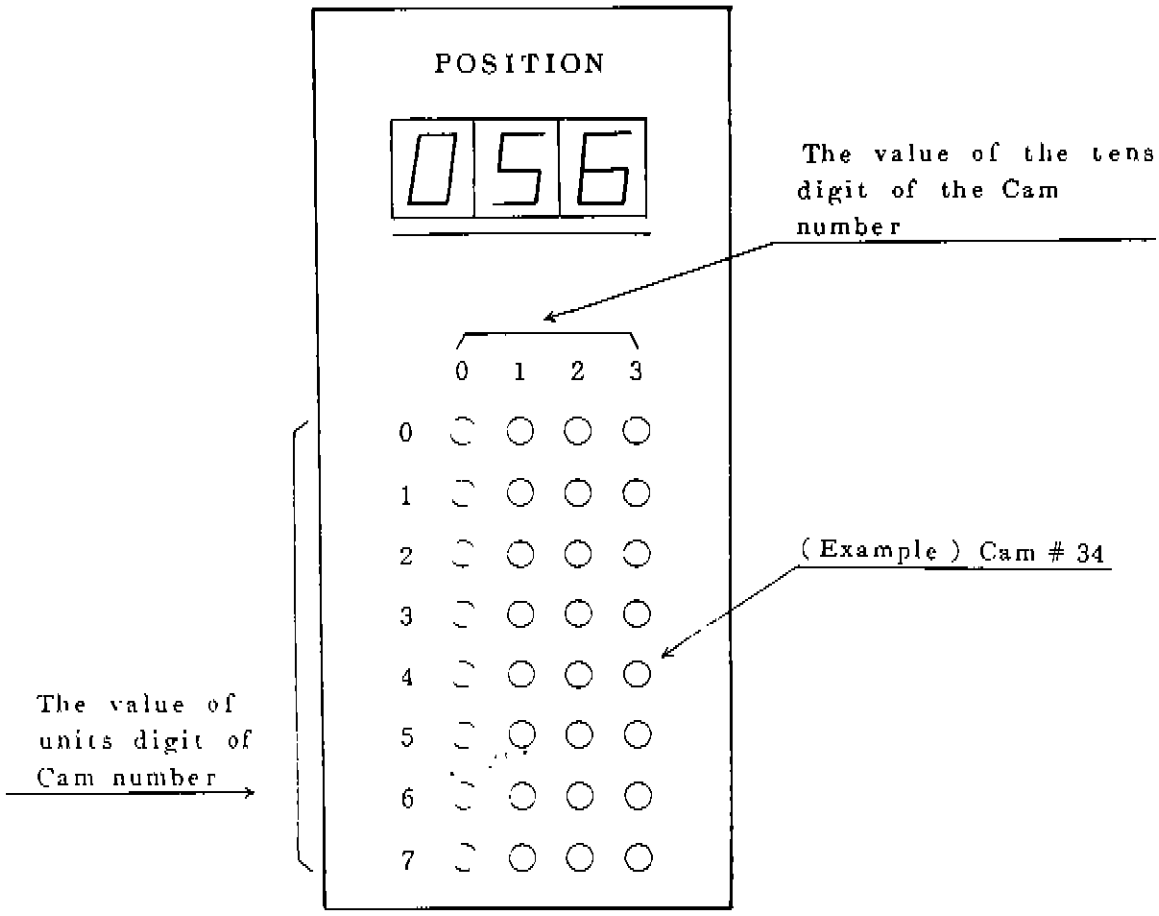


✳Programming console (Type 3F88L-P3A-E)



2.4 OUTPUT DISPLAY

The output display is provided in the front of the cam positioner. As soon as the output of a given Cam number is ON, the output display LED lights up.



CHAPTER 3 OPERATION

3.1 PROGRAM SPECIFICATIONS

1 step	Cam Number 2 digits ON setpoint 3 digits OFF setpoint 3 digits
Numeric value of the cam number	00 01 02 03 04 05 06 07 10 11 12 13 14 15 16 17 20 21 22 23 24 25 26 27 30 31 32 33 34 35 36 37 40 41 42 43 44 45 46 47 50 51 52 53 54 55 56 57 60 61 62 63 64 65 66 67 70 71 72 73 74 75 76 77 Total : 64 points Note that if the main unit is a 3F88L-120A type (32 output points), cam numbers of 40 through 77 can not be used.
Step input	For a one-step input of program, set Cam #, ON setpoint and OFF setpoint in numerals. For ON and OFF values, teaching input is possible.
The Max. number of registered steps :	Max. number of ON/OFF cycles per cam 360-division 720-division Cam No 00-07 30 steps 60 steps Cam No 10-37 16 steps 16 steps Cam No 40-77 8 steps 16 steps
Program input value	The sequence of input for each step is not specified. After input, the cam number and ON setpoint are arranged in numerical order.
Program read	A program is read out using keys ↓ and ↑.
Program memory	• A program is stored in RAM (capacitor backup) of the programming console by user program input. • A program is transferred from programming console RAM to main unit EE-PROM by a transfer operation.

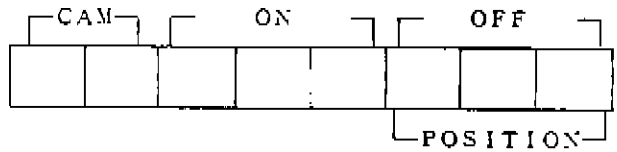
3.2 PROGRAMMING OPERATION

(1) Description of program console keyboard unit

① Indicator lamp unit (7 LED's)

Type	Lamp-ON Conditions
RUN	In RUN mode
PRG	In PROGRAM mode
TRANS	In TRANSFER mode
TEACH	When teaching ON/OFF values
VERIFY	When verifying a program in transfer mode
READ	When transferring a program from main unit to programming console
WRITE	When transferring a program from programming console to main unit

② Numeral display unit (8 digits)



Type	Function
CAM	Cam number (OUT number) display
ON	ON-position (angle) display
OFF	OFF-position (angle) display
POSITION	Display of the present angle in RUN mode

③ Operation key unit

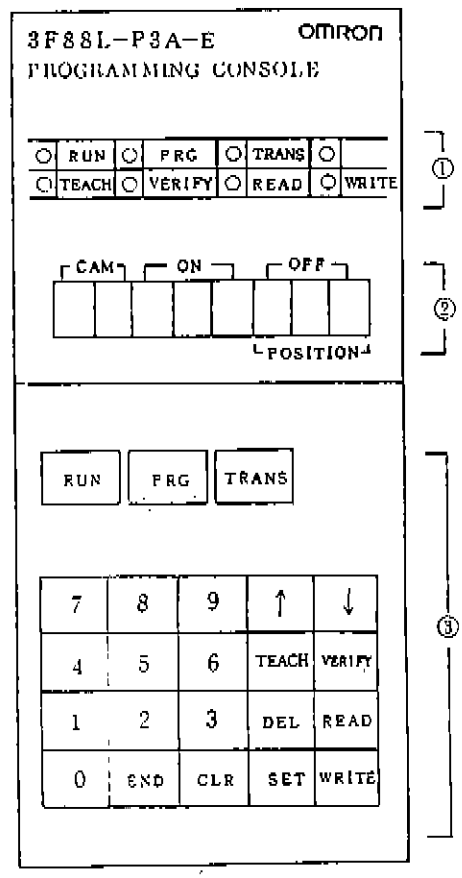
Type	Function
Mode key	These keys change the mode to RUN PROGRAM and TRANSFER. Command the function printed on the keytop
Operation key	Each of features is commanded to function.
Numeral key	The cam number and ON/OFF positions are inputted in numerals.

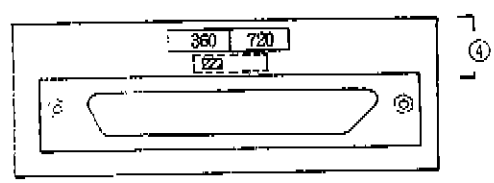
④ Division changeover switch

360/720 changeover switch (Placed at the inside of the connector : See the next page.)

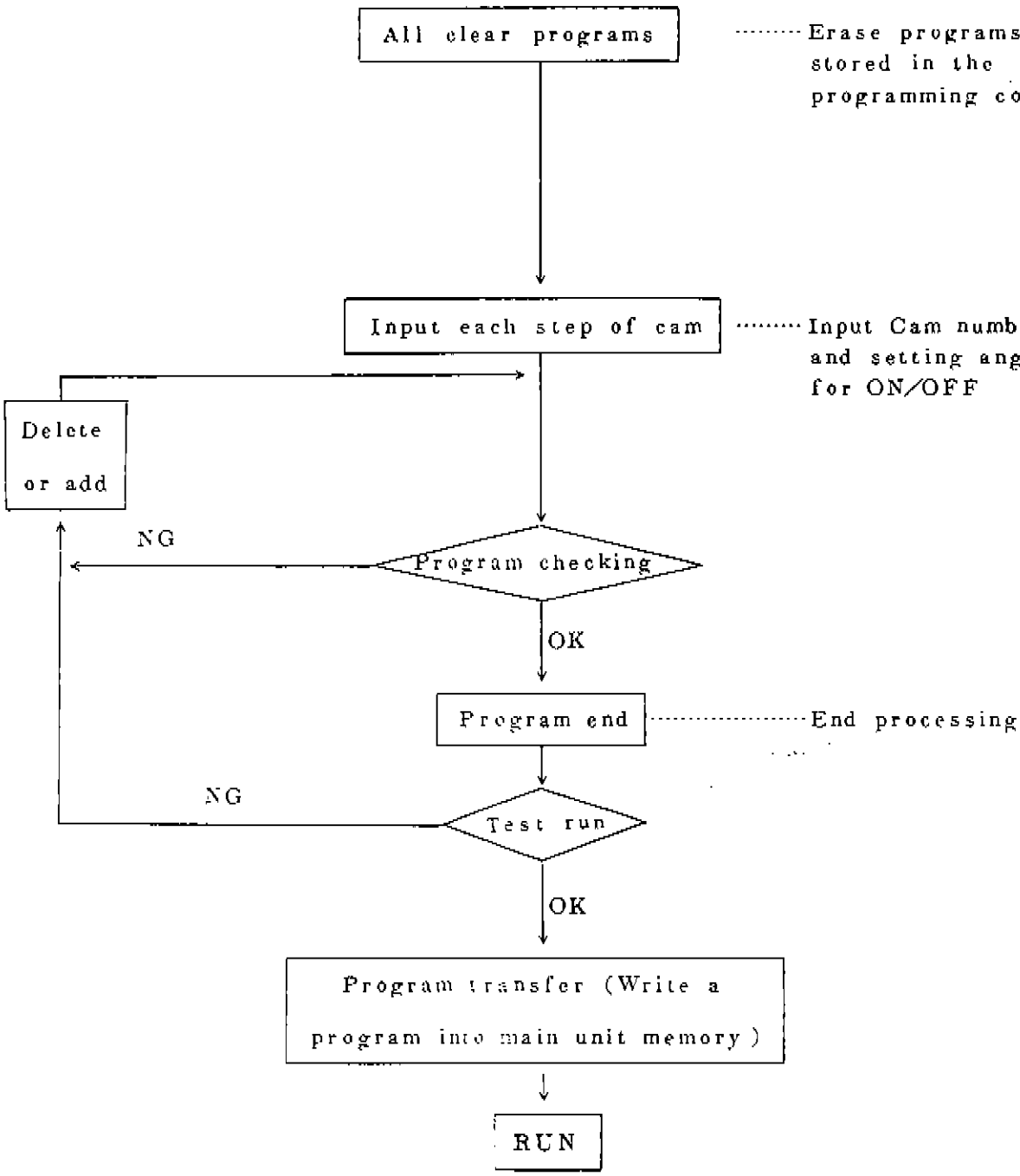
3F88L-P3A-E

Keyboard





(2) Flow chart for generating a program



(3) All clear operation of program

Before beginning to enter a new program on the programming console, erase entirely the existing program on it which is stored by means of a capacitor backup.

Key operation procedure :

Key operation	Display	Remarks
(Power ON)	CAM ON OFF	
↓		
P R G	– –	Program mode
↓		
VERIFY	– 2 –	
↓		
TEACH	– 1 –	
↓		
S E T	– – –	All clear operation is completed
↓		
C L R	– –	
(Mis-operation)	E 2 1	"E21" is displayed if mis-operation occurs during all clear procedure.
↓		
C L R	– –	

(4) Program write operation (Step writing)

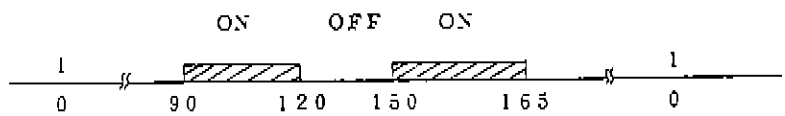
Program Cam number and ON/OFF angles.

(Note) Upon completion of program generation, be sure to execute END instruction in (9).

Sample operation:

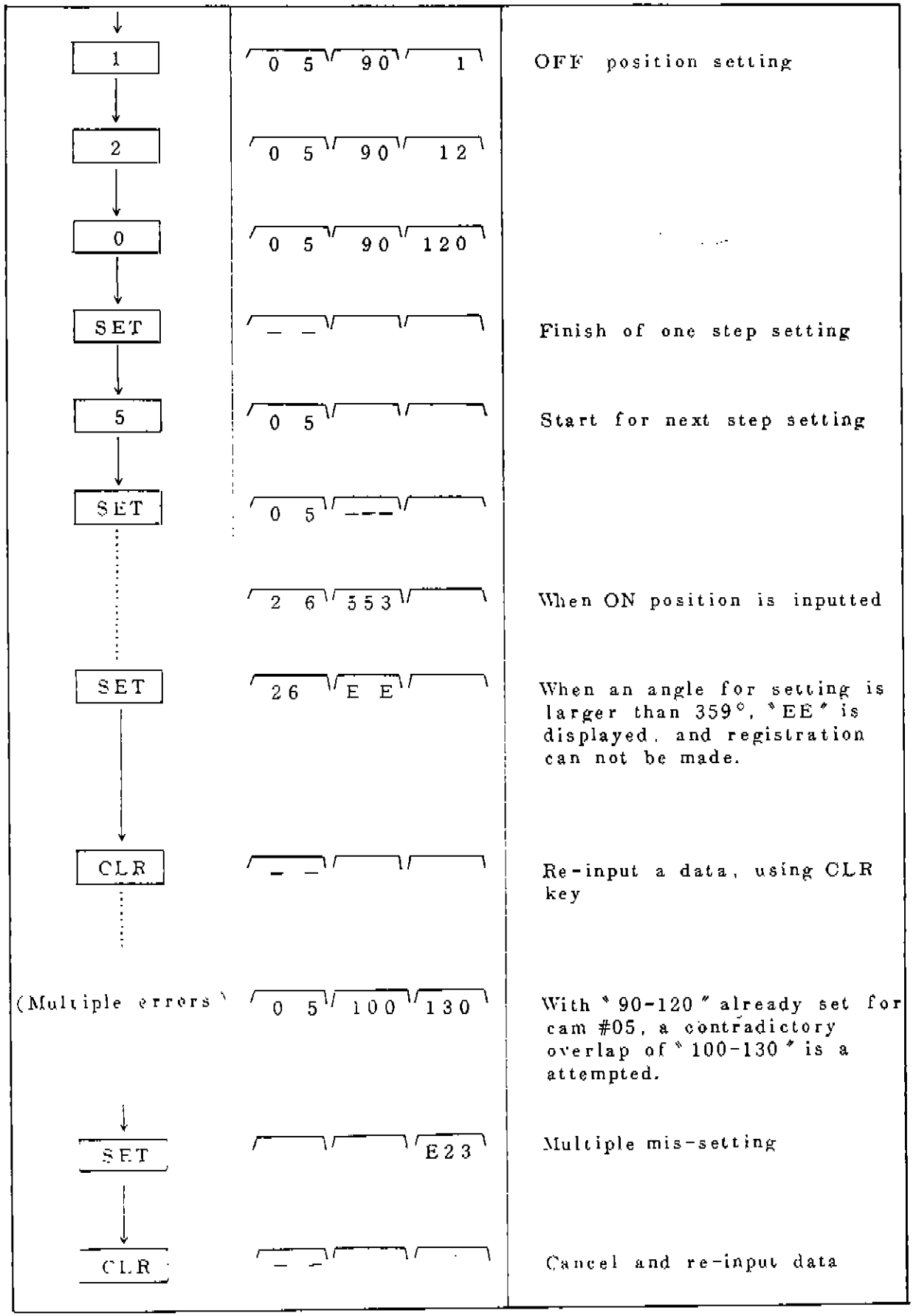
Cam #	ON	OFF
05	90	120
05	150	165

Cam #05 is programmed to be ON at 90°, OFF at 120°, ON at 150° and OFF at 165°. The output is OFF through 89°, comes ON at 90° through 119°; goes OFF at 120° and come back ON at 150°.



Key Operation Procedure:

Operation	Display	Remarks
(PROGRAM mode)	CAM ON OFF	
5	0 5	Cam number (OUT number) setting
SET	0 5 ---	
9	0 5 9	ON position setting
0	0 5 90	
SET	0 5 90 ---	


1
0 5 90 1
OFF position setting
2
0 5 90 12
0
0 5 90 120
SET
_ _
Finish of one step setting
5
0 5
Start for next step setting
SET
0 5 ---
2 6 353
When ON position is inputted
SET
26 E E
When an angle for setting is larger than 359°, "EE" is displayed, and registration can not be made.
CLR
_ _
Re-input a data, using CLR key
(Multiple errors)
0 5 100 130
With "90-120" already set for cam #05, a contradictory overlap of "100-130" is a attempted.
SET
E23
Multiple mis-setting
CLR
_ _
Cancel and re-input data

(5) Teaching input

Through the action of the resolver coupled with the mechanical system, it is possible to input the positions (angle) directly into the console as the cam conditions for ON/OFF

Operation procedure

(Example) When ON/OFF values are set for cam #15 through TEACH

Operation	Display	Remarks
	CAM ON OFF	
1	1	• First, set Cam number
5	1 5	
SET	1 5 ---	
TEACH	1 5 ×××	
(Manual rotation)		• ON-value setting Over the ON-display unit, the POSITION of the rotating unit is indicated.
(Machine stop)	1 5 100	• Make the machine rotate and stop at an angle for which you desire the cam ON.
SET	1 5 100 100	
(Manual rotation)	1 5 100 ×××	• OFF-value setting Set the OFF-value in the same manner as the ON-ON-value setting.
(Machine stop)	1 5 100 130	
SET	1 5 100 130	
CLR	---	

(6) Program read operation

Check the contents of each step of program stored in the programming console, assuming that the cam is programmed as follows:

(Example)

Cam #	ON	OFF
05	90	120
05	150	165
14	330	55
15	100	130
15	160	180

Operation procedure:

1. This is an example to check and read out in sequence from the initial step.

Operation	Display	Remarks
(PROGRAM mode)	CAM ON OFF	
↓		
↓	0 0	Since no data is programmed in Cam #00, only cam number is indicated.
↓		
↓	0 1	For cam number without any step written, only cam number is indicated.
↓		
⋮		
↓		
↓	0 5 90 120	
↓		
↓	0 5 150 165	
↓		
⋮		
↓	1 5 160 180	Key ↓ reads out steps from top to bottom.
↓		
↑	1 5 100 130	Key ↑ reads out steps from bottom to top.
↓		
↑	1 4 330 55	
↑	1 3	
⋮		

Operation procedure

2. This is an example for reading out steps of a specific cam number.

Operation	Display	Remarks
(PROGRAM mode)	CAM ON OFF _ _	
↓ [1]	0 1	Display cam number to be read out.
↓ [5]	1 5	
↓ [↓]	1 5 100 130	A display for the initial step of cam #15.
↓ [↓]	1 5 160 180	
↓ [CLR]	_ _	

Comment : 1. The steps are arranged in numerical order of the cam number, regardless of the sequence of step writing. Within one cam number, the steps are arranged by order of ON value.

(7) Program add operation

When adding a new condition for cam setting, follow the same steps as in a writing operation.

(8) Program delete operation

This function is used when you desire to erase condition of setting. Following is an example of an operation when deleting one step of cam #15 in the example of (6).

Operation procedure :

Operation	Display	Remarks
(PROGRAM mode)	_ _	
↓ 1	1	• First, read out Cam #15 to be deleted.
↓ 5	1 5	
↓ ↧ or ↥	1 5 100 130	• Display the setting condition of Cam #15 to be deleted.
↓ DEL	_ _ ___ ___	
↓ SET	1 5 120 180	• Display the setting condition of the next cam.

(9) Program end (End Processing)

This function is used to complete a program stored in memory of the programming console by step write operation. Without this operation, other modes (RUN/TRANSFER) cannot be selected. If power is turned OFF prior to end processing, an error message will appear when power is ON again.

Operation procedure :

Operation	Display	Remarks
CLR	CAM ON OFF	
END	□ □□□□□□□	Display before end processing
SET	0 0 × ×	End processing execution : Display of step numbers for each cam.
↓	0 1 × ×	Check number of steps, using keys ↓ ↑.
CLR	_ _	In this state, the mode can be modified.
RUN	×××	
None (End processing)		
RUN	E22	If other modes are selected without end processing, error display "E22" will appear due to incomplete end processing.
CLR	_ _	
END	□ □□□□□□□	Be sure to perform program end operation

(10) Program transfer (Write)

This function is for transferring a program stored in the programming console into the main unit memory. This processing allows a program to be stored in the main unit's memory (EE-PROM). If power is turned OFF during program transfer, an error display will appear when is ON again.

Operation procedure :

Operation	Display	Remark
CLR		
TRANS		Be sure that the operation is performed in the TRANSFER mode. Display at the TRANSFER mode setting.
WRITE	1	Display before program transfer from the programming console to main unit.
SET	1 □	Flashing of "□" during transfer execution.
	1 0 0	Display showing the completion of transfer.
CLR		After checking the completion of transfer, push CLR key when you want to change the mode.
(Writing error)	E 3 1	Error in writing procedure
CLR		Re-write a program.
(Power if OFF while transferring (Writing))	E 3	Display when power is turned ON again
CLR		Write operation is automatically performed, through CLR key.

Comments : 1. Once a program is stored in main unit's memory, operation can be performed by detaching the programming console.
2. Writing operation requires approximately 20 seconds.

(11) Program transfer (Read)

This function is used for transferring a program stored in the main unit's memory (EE-PROM) to the programming console.
(Please note that the data stored in the programming console is erased by this action of reading-out.)
If power is turned OFF during transfer, an error display will appear when power is ON again.

Operation procedure :

Operation	Display	Remarks
⋮	CAM ON OFF	
CLR	— —	
TRANS	□□□	Be sure that this action is done in the transfer mode. Display for transfer mode setting.
READ	□ 2	Display before transferring a program from the main unit to the programming console.
SET	□ 2 □	Flashing of "□" during transfer execution.
	□ 2 0 0	
CLR	□□□	Push [CLR] key after checking the completion of transfer. the mode can be changed.
(Read out error)	E32	Error in reading procedure
CLR	□— —	Re-read a program
(Power is OFF transfer (read)	E 4	Display when power is turned ON again.
CLR	□— —	Read a program automatically through [CLR] key.

Comment : This function is used when a program stored in the main unit is checked or corrected.

(12) Program transfer (Verify)

This function checks to see if the program contents of the main unit (cam positioner) coincide with those of the programming console.

Operation procedure :

Operation	Display	Remarks
	CAM ON OFF	
TRANSFER mode		
↓		
TRANS		
↓		
VERIFY	3	
↓	3	• Fleshing of "□" during verifying
↓	3	• "Verify" is completed.
↓		
CLR		
Verify error		
↓		
SET	3 E33	• If the program of the main unit and programming console do not coincide with each other, verify error E33 is displayed.
↓		
CLR		

(13) Error Display

Display	Contents	Processing method
E 1	Power is OFF during end processing.	Press CLR, then the console automatically execute end processing.
E 2	Power is OFF without end processing.	Press CLR, and operate processing
E 3	Power is OFF during transfer (write).	Press CLR, then the console automatically execute transferring
E 4	Power is OFF during transfer (read).	Press CLR, then the console automatically execute transferring
E 21	Mis-operation in all clear procedure	Press CLR, and make all clear operation
E 22	Incomplete end processing	Press CLR, and operate End processing
E 23	Check for overlapping	Overlapping of cam setting conditions
E 31	Writing error (procedure error)	Press CLR, and transfer (write) a program
E 32	Reading error (procedure error)	Press CLR, and transfer (read) a program
E 33	Verifying error (procedure error)	The program of cam positioner is different from that of the console. Check the program and operation procedure.
EE	Error in cam number input	Press CLR, and re-input
EE	Error in ON-value input	Press CLR, and re-input

Comment : Prior to error handling, be sure to press "CLR" key.

CHAPTER 4
MAINTENANCE AND TROUBLESHOOTING

4.1 PROTECTIVE/DIAGNOSTIC FUNCTIONS

The cam positioner is provided with a feature capable of detecting defective parts related to the resolver, answering for the position that it is an important angle detector.

In case of any trouble during operation, the cam positioner indicates □.□.□. on the present value display, and outputs a trouble signal at the output terminal A18.

(1) Resolver and the related

*Abnormality/disconnection of the resolver and resolver cable

*Abnormality of the resolver conversion circuit

(2) Power supply and the related

*Supply voltage drop

*Abnormal power circuit

4.2 Zero-point correction

*Even if both the origins of the machine and resolver do not coincide with each other, the zero point of the resolver can be corrected by aligning it with that of the machine.

*The subtraction correction ranging from 1 to 859 is applicable. (In the case of 360-division, the whole area is used, while in the case of 720 division, the calculation is made on a half an angle basis.)

4.3 Maintenance

Although there is on necessity of continual maintenance in operating the cam positioner, the following items should be checked at the periodic inspection to maintain the performance.

*Is each of secure connections of the resolver connector and the main unit connector obtained ?

*Is not any unreasonable force given to the resolver cable ?
Is not there any damage ?

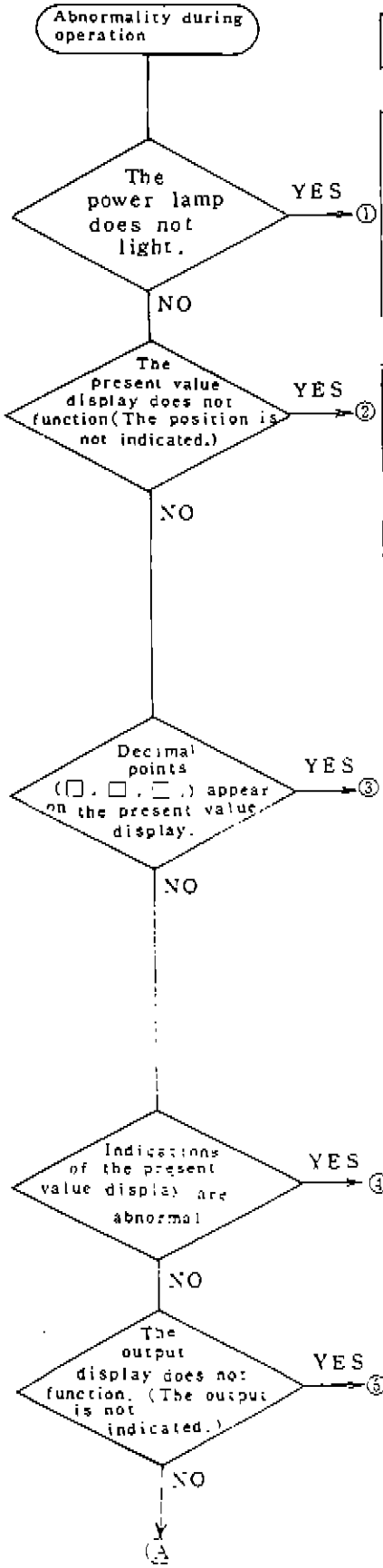
*Does the resolver rotate smoothly ?
Is not there any axial misalignment ?

*Is not any unreasonable force given to the coupling ?
Is the clamping secure ?

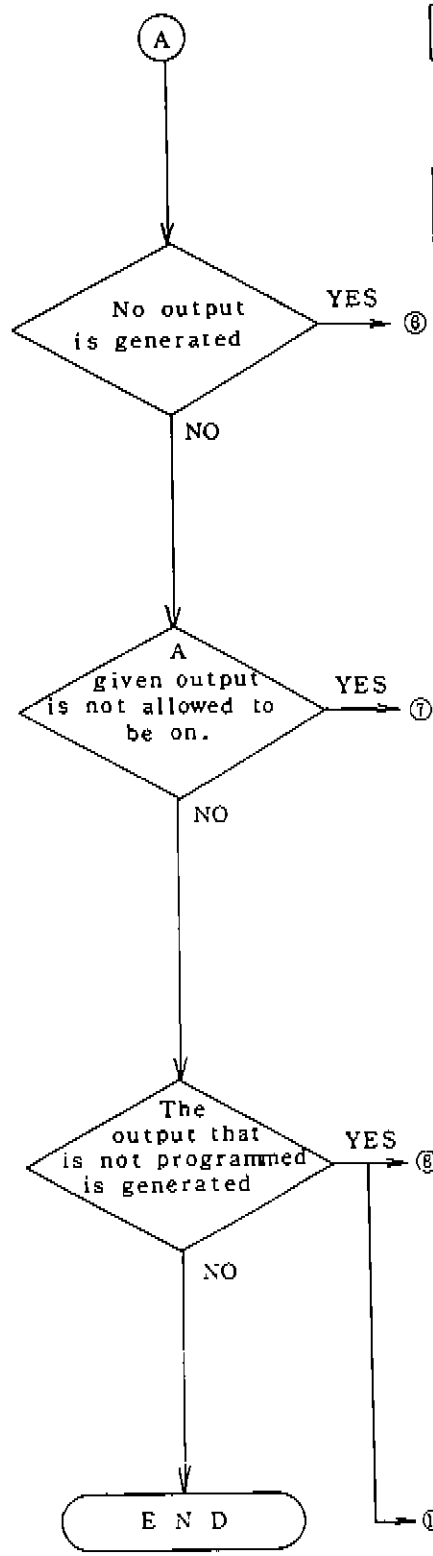
*Are the screws of the main unit terminals clamped securely ?

4.4 TROUBLESHOOTING

(1) Abnormality during operation

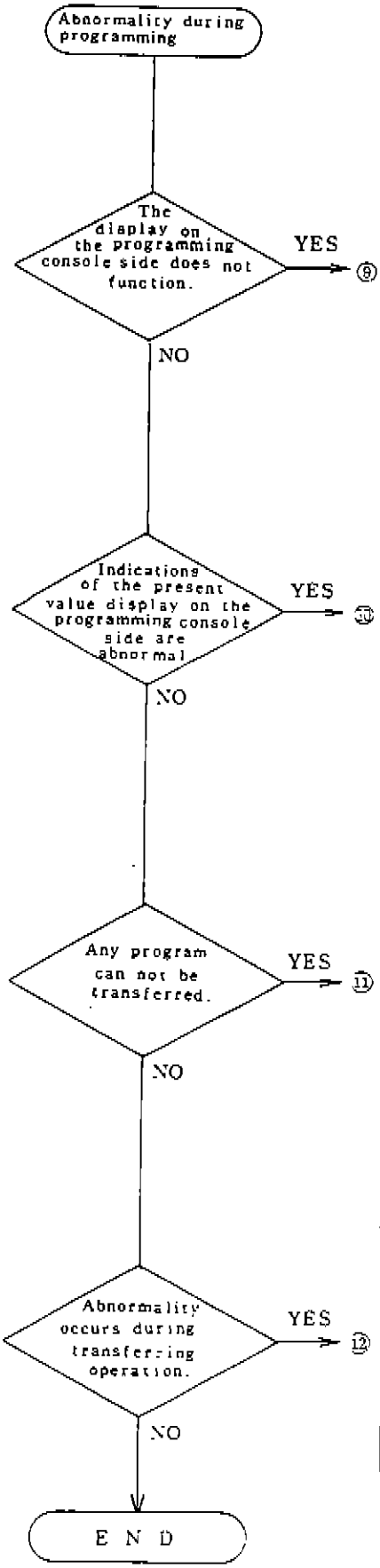


Presumptive causes	Remedies
(1) Abnormality of supplied power (2) Disconnection of the internal fuse	(1) Check the supply voltage. (2) Make a replacement of the internal fuse (2A). If the fuse is again blown, contact the service division.
The circuit is abnormal.	Contact the service division.
(1) Disconnection of the resolver cable (2) Connection failure of the resolver connector (3) Abnormality/disconnection of the resolver (4) Abnormality of the resolver conversion circuit (5) Failure of the CW/CCW switch (6) Drop of the supply voltage	(1), (2) Check the resolver connector for connection and repair the wiring. (3) Make a replacement of the resolver. (4) Contact the service division. (5) Check to see that the switch correctly contacts. (Confirm the set position.) (6) Check for the voltage. Make the connecting wire thicker. Allow the voltage to increase within the range defined by the specification.
The resolver conversion circuit is abnormal.	Contact the service division.
A program is not transferred to the main unit	Transfer the program from the programming console, and make a collating and checking operations.



Presumptive causes	Remedies
(1) The power supply for outputs is not connected (2) The START is not turned on.	(1) Connect the DC power supply (DC 12–30V) to the B18 and B17. (2) Allow the START terminals to be short-circuited.
(1) The output transistor is abnormal. (2) The external connecting parts are abnormal.	(1) Contact the service division. (2) Make a replacement of parts.
(1) The program all clear operation has not been made at beginning the program. (2) The transfer operation has not been made. (3) The program memory is abnormal.	(1) Again check for the program. (2) Transfer the program from the programming console, and make a collating and a checking operations. (3) Contact the service division.

(2) Abnormality during programming



Presumptive causes	Remedies
(1) The programming console cable is disconnected. (2) The circuit is abnormal.	(1) Check the cable for secure connection, and repair the wiring. (2) Contact the service division.
(1) The programming console cable is disconnected. (2) Defective ICs are used in the interface.	(1) Check the cable for secure connection, and repair the wiring. (2) Contact the service division.
(1) The transfer operation procedure by use of the programming console is mistaken. (2) The programming console operating key malfunctions	(1) Confirm the instruction manual. (2) Contact the service division.
(1) The programming console cable is disconnected. (2) The memory on the main unit side is abnormal.	(1) Check the cable for secure connection, repair the wiring. (2) Contact the service division.

CHAPTER 5 SPECIFICATION

5.1 RATINGS AND CHARACTERISTICS

(1) Main unit (CAM POSITIONER)

Type	3F88L-120A	3F88L-112
Number of output points	32	64
Output configuration	Transistor open collector, photo-isolation provided Switching ability : DC12V~48V, 300mA	
Input detector	Resolver (1) 3F88L-RS15 (OMRON) connector type (2) 3F88L-RS15W(OMRON) lead wire type (3) 3F88L-RS17 (OMRON)	
Response speed	800 rpm Max. (in resolver rotation)	
Memory	Electrically erasable PROM (EEPROM)	
POSITION display	Resolver Positon displayed	
Resolvtion (division/turn)	1°/0.5° (360/720)	1° (360)
Precision of repeatability	∓0.2°	
Zero-point correction	1~359 correctable	
Abnormal output	Abnormal display : Dot output for displaying present value Abnormal output : Output to output terminal A18 (contact a) Open collector output : DC12~30V 150mA	
External dimensions	H : 250 W : 80 D : 97㎜	H : 250 W : 103 D : 115㎜
Weight	1.6kg	2.5kg
Supply voltage	AC 22V/DC 24V ±15%	
Operating ambient temperature	0~55℃	
Operating ambient humidity	35~90%RH	

(2) Programming Console

(Type 3F88L-P3A-E)

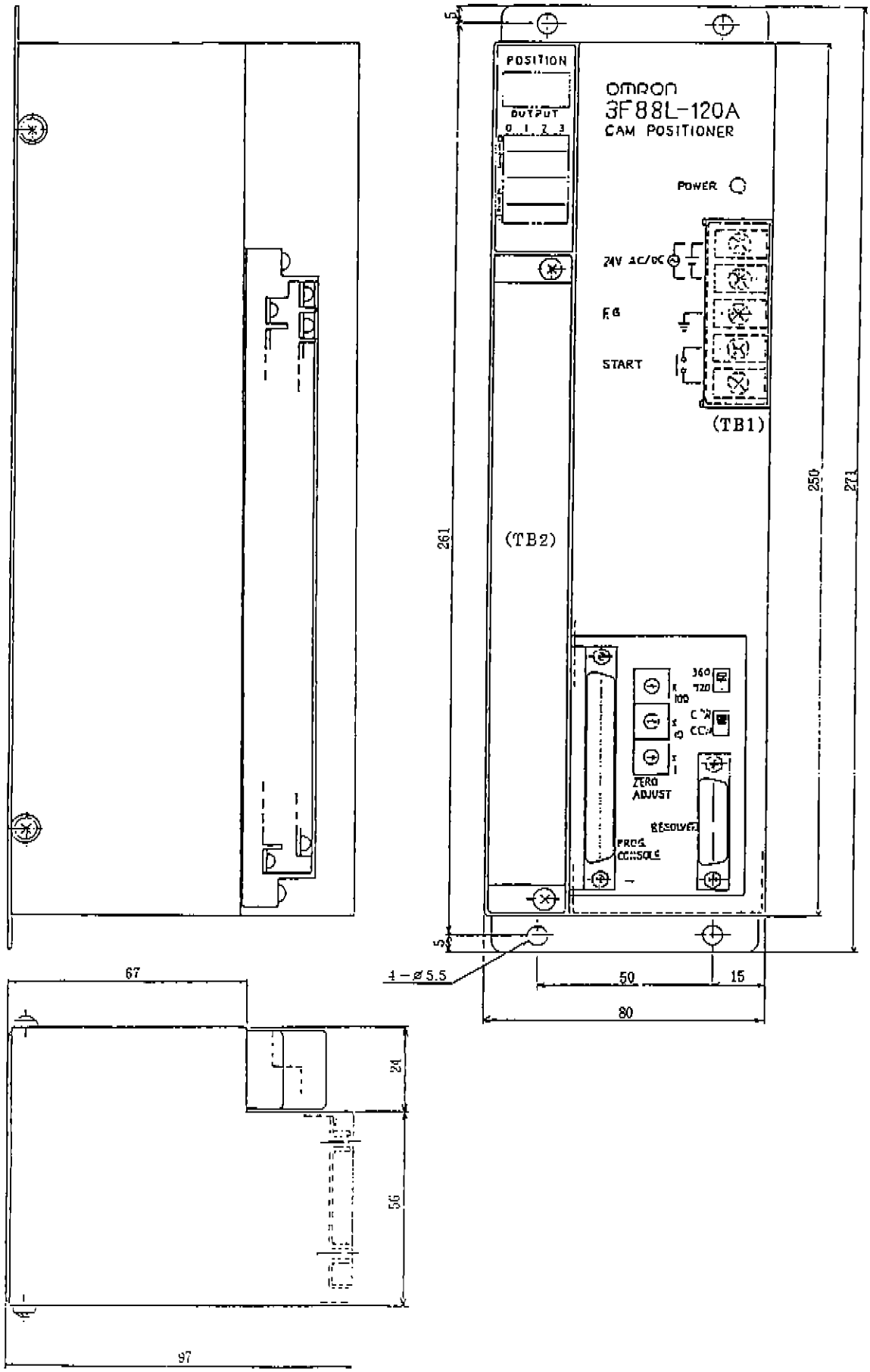
Main unit connections	Connected with connector cable for programming console (power also supplied)
Numeral display	8 digits (Cam number : 2, ON : 3, OFF : 3)
Mode display	RUN/PROGRAM/TRANSFER
Key	23 keys
Memory	CMOS-RAM 8K bytes backed up by capacitor Even after power is off, the information in the memory is stored at least for a week.
External dimensions	250 mm(H) × 80 mm(W) × 35 mm(D)
Weight	630 g

(3) Resolver

Type	3F88L-RS15/RS15W	3F88L-RS17
Axial diameter	φ 6 mm	φ 10 mm
Axial load	Radial 10kg Thrust 10kg	Radial 20kg Thrust 20kg
Frequency	5 kHz	
Primary voltage	10V	
Electrical error	10 minutes	
Maximum speed rpm	3,000 rpm (mechanical)	

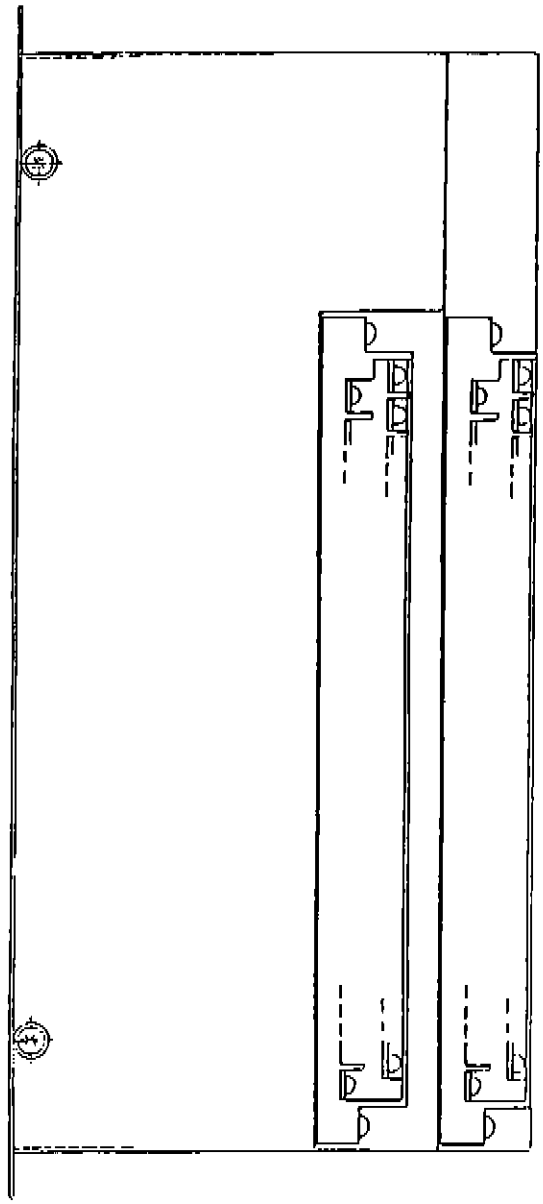
5.2 DIMENSIONS

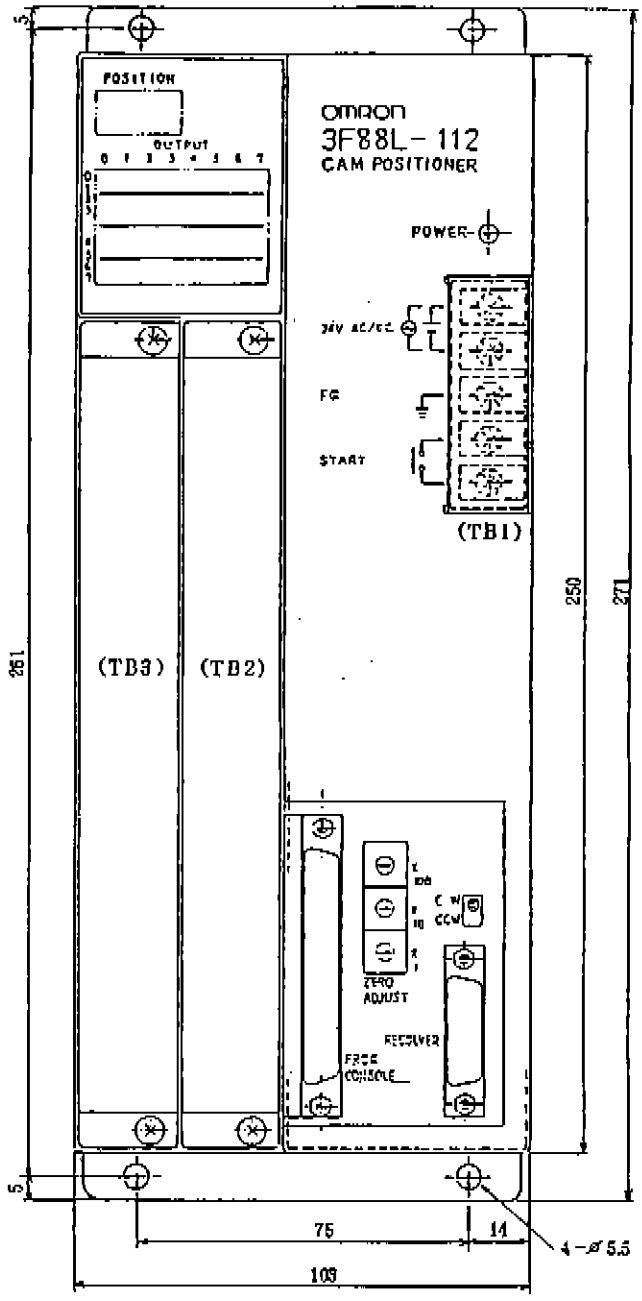
✳Main unit (3F88L-120A)

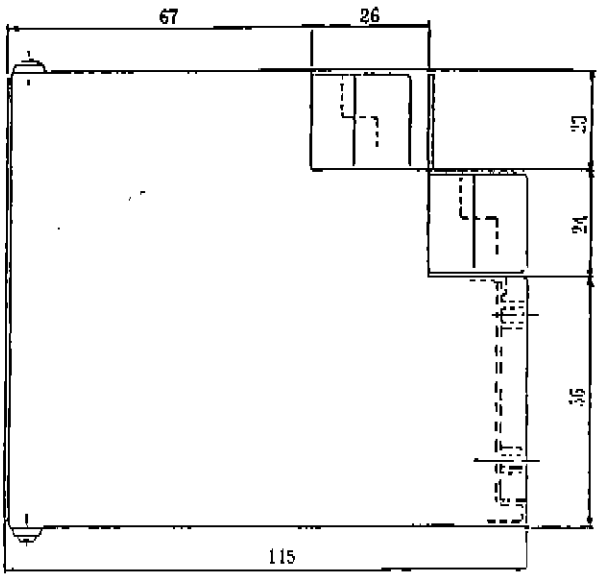


SPECIFICATION

*Main unit (3F88L-112)

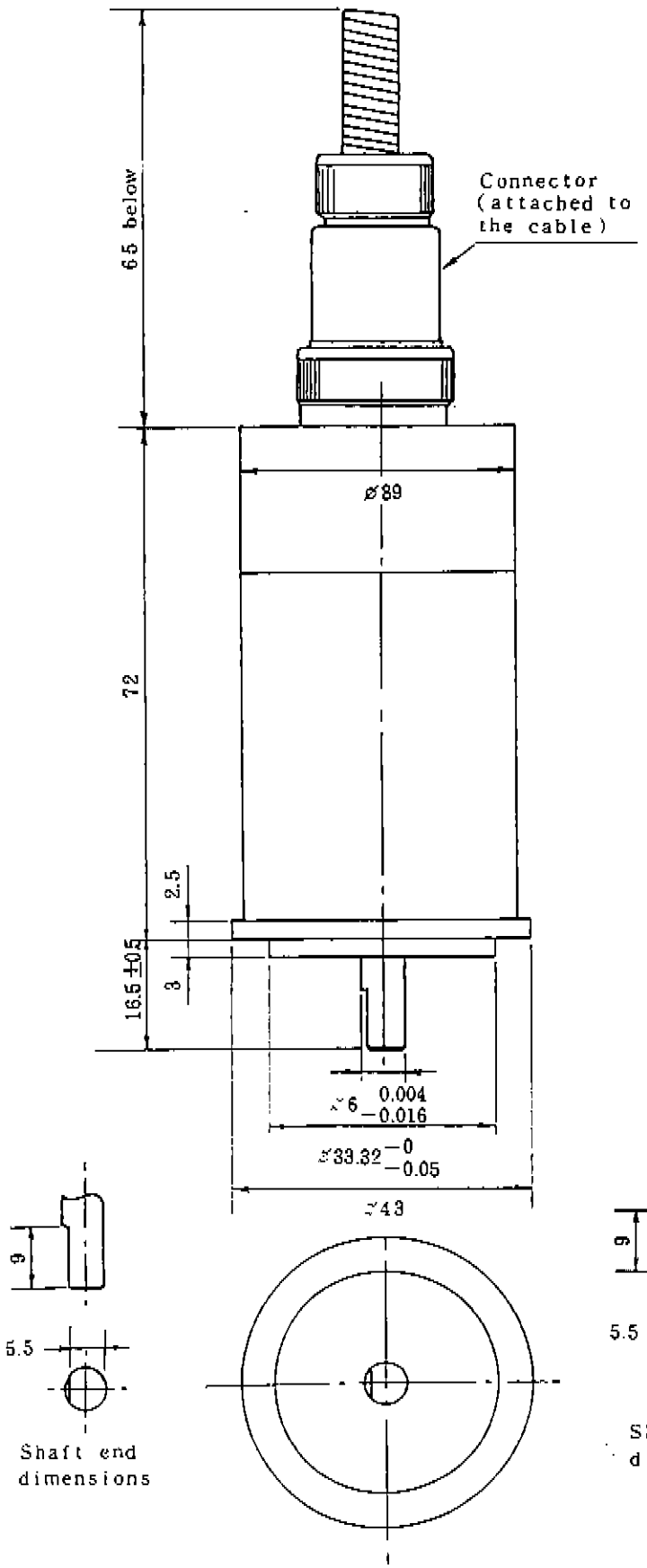




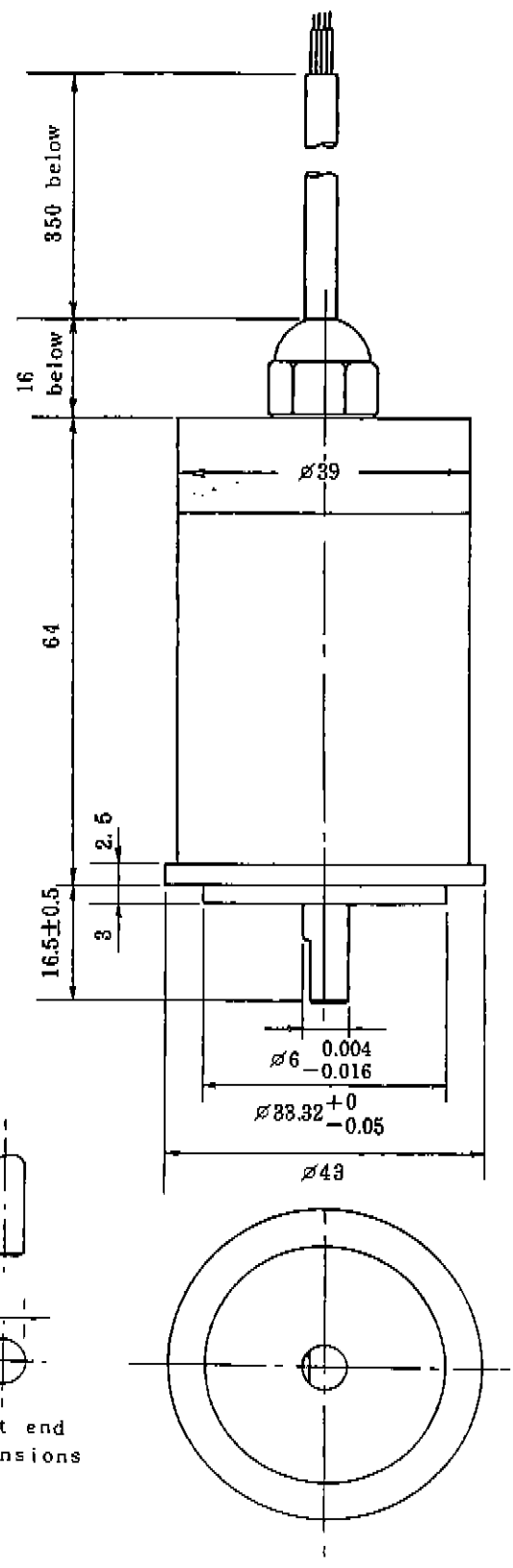


SPECIFICATION

✳Resolver (Type 8F88L-RS15)

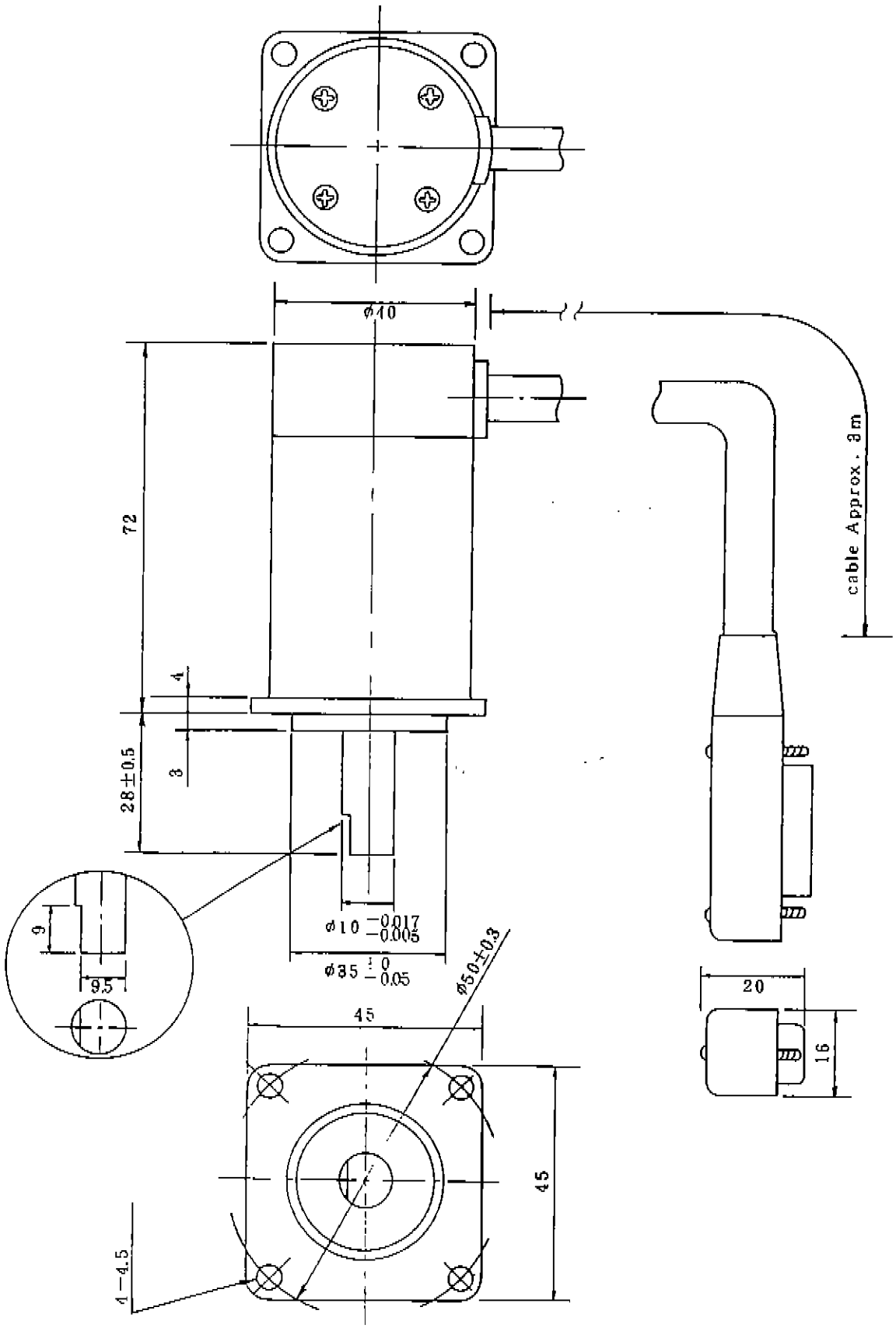


✳Resolver (Type 3F88L-RS15W)

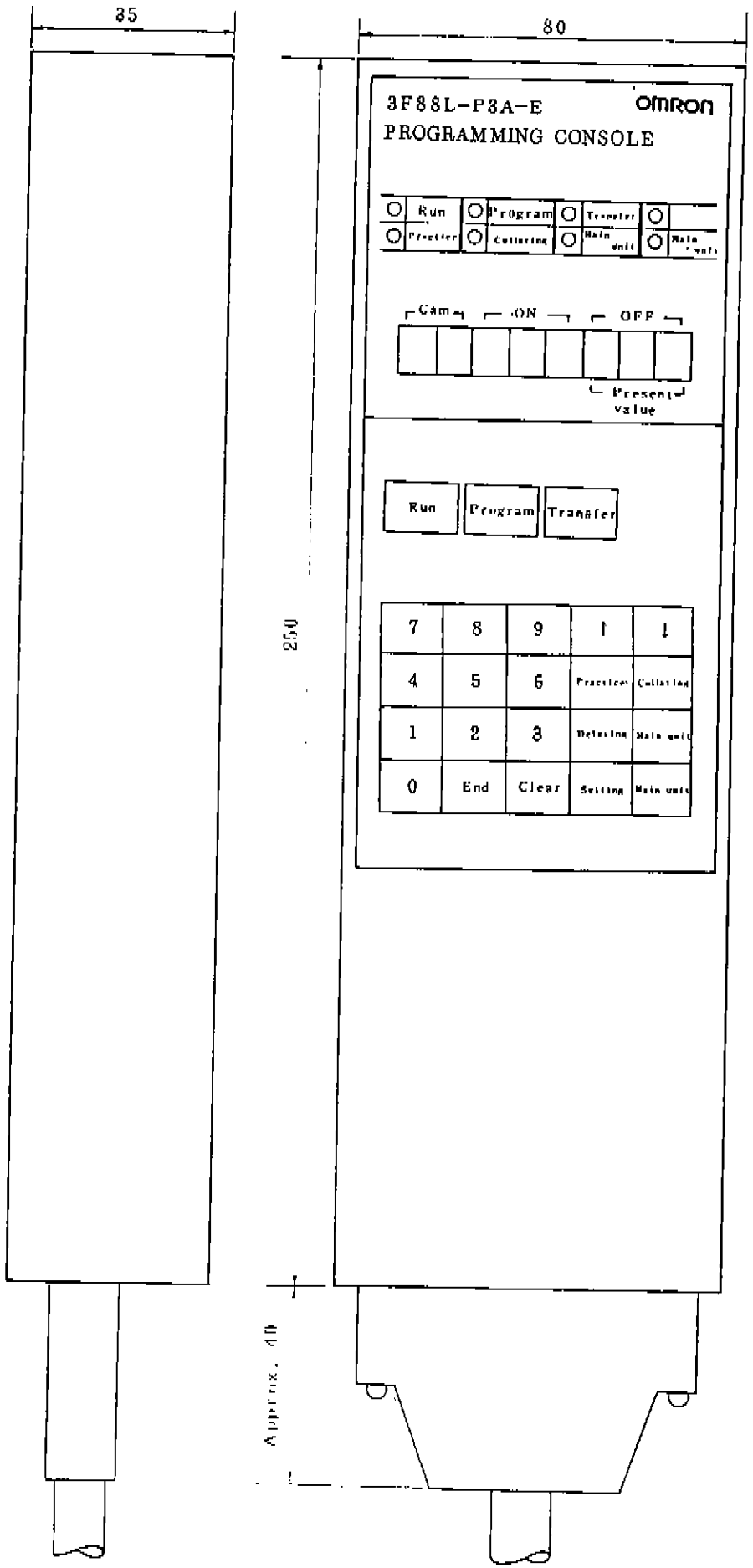


SPECIFICATION

✳Resolver (Type 3F88L-RS17)



*Programming console (Type 3F88L-P8A-E)



PROGRAM SHEET

Cam #	Signal	ON	OFF	Time chart 0 60 90 120 180 240 270 300 (0) 360 0 120 180 240 360 480 540 600 720