User's Guide

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CN3800 Series
Autotune Temperature / Process Controller

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One Omega Drive, Box 4047
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Telephone: (203) 359-1660
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SECTION 1 INTRODUCTION

1.1 GENERAL DESCRIPTION

The OMEGA® CN3800 Series Process Controllers are autotune PID controllers that offer direct or reverse acting control that can be based on many different process parameters including temperature, pressure, flow, pH, and relative humidity. Up to nine ramp and soak profiles of up to nine steps each can be stored by the controller. The nine profiles can be linked together for a maximum of 81 steps. Individual profiles can be repeated up to 9999 times. Linked profiles can be repeated up to 999 times. These controllers can display a line graph of the process variable vs. time for added visual indication. The two standard alarms can be programmed as high limit/low limit alarms or absolute/deviation alarms. Optional RS-232C or RS-422A communications are available for remote operation of the controller from a supervisory computer. The optional analog output provides the capability to re-transmit the process variable or setpoint value to a recorder or datalogger.

1.2 FEATURES

- High Accuracy, ± 0.1%
- Ramp and Soak Capability
- Universal Power Supply (90-264 Vac)
- User-Selectable Inputs and Ranges
- Programmable Scaling for Process Inputs
- Optional RS-232C/RS-422A Communications

1.3 AVAILABLE MODELS

CN3801*	Single Mechanical Relay Output
CN3802*	Single DC SSR Driver Output
CN3803*	Single 4-20 mA DC Output
CN3804*	Single 0-10 VDC Output

*Specify input code from Input Range Table, i.e.:

TC - Thermocouple	V - Voltage to 10 V
RTD - 100 Pt RTD, 3-wire	MA - Current to 20 mA
mV - Voltage to 100 mV	

ANALOG OUTPUT OPTIONS

-A01MV	0-10 mVdc/Output resistance: 10 ohms
-A01MA	4-20 mAdc/Load resistance: 500 ohms max.
-A01V	0-10 Vdc/Load current: 2 mA max.
-A02mV	0-10 mVdc/Output resistance: 10 ohms
-A02MA	4-20 mAdc/Load resistance: 500 ohms max.
-A02V	0-10 Vdc/Load current: 2mA max.

COMMUNICATIONS OPTIONS

-RS2	RS-232C
-RS4	RS-422A
-PC:	24 pin I/O connector and cable (1 meter).

Analog and Communications Options are not field installable.

The external I/O connector allows you to select but not change the values of Run/Reset, Hold, Advance, Autotune, and profiles 1 through 9. This I/O connector also provides a status signal for Guaranteed Soak, Advance, Hold, Run/Reset, Fix, Manual, and Output.

SECTION 2 INSTALLATION

2.1 UNPACKING

Remove the packing list and verify that all equipment has been received. If there are any questions about the shipment, please call OMEGA Customer Service Department .

Upon receipt of the shipment, inspect the container and equipment for any signs of damage. Take particular note of any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE

The carrier will not honor any claims unless all shipping material is saved for their examination. After examining and removing contents, save packing material and carton in the event reshipment is necessary.

2.2 INSTALLATION CONSIDERATIONS

The installation area should:

- be free from combustible gases, corrosive gases, oil, smoke, or similar dust which deteriorates insulation
- have an ambient temperature between -10 to 50°C
- have a relative humidity of under 90%
- not be subject to strong impacts or vibrations
- not be located near high power electrical circuits and electrical fields, or direct sunlight and water vapor

2.3 MOUNTING DIMENSIONS

Make mounting holes according to the panel cut views. Press the controller body in securely. The mounting panel should be 1 to 3.5mm thick.

Note: Dimensions shown in mm.

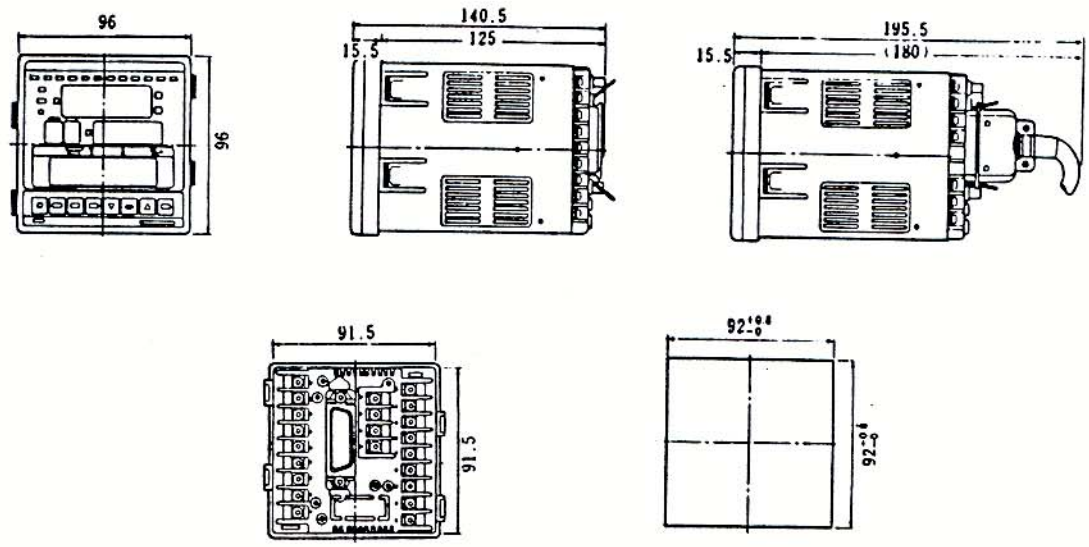


Figure 2-1. External Dimensions

2.4 WIRING

For thermocouple input, connect the specified compensating lead wire.

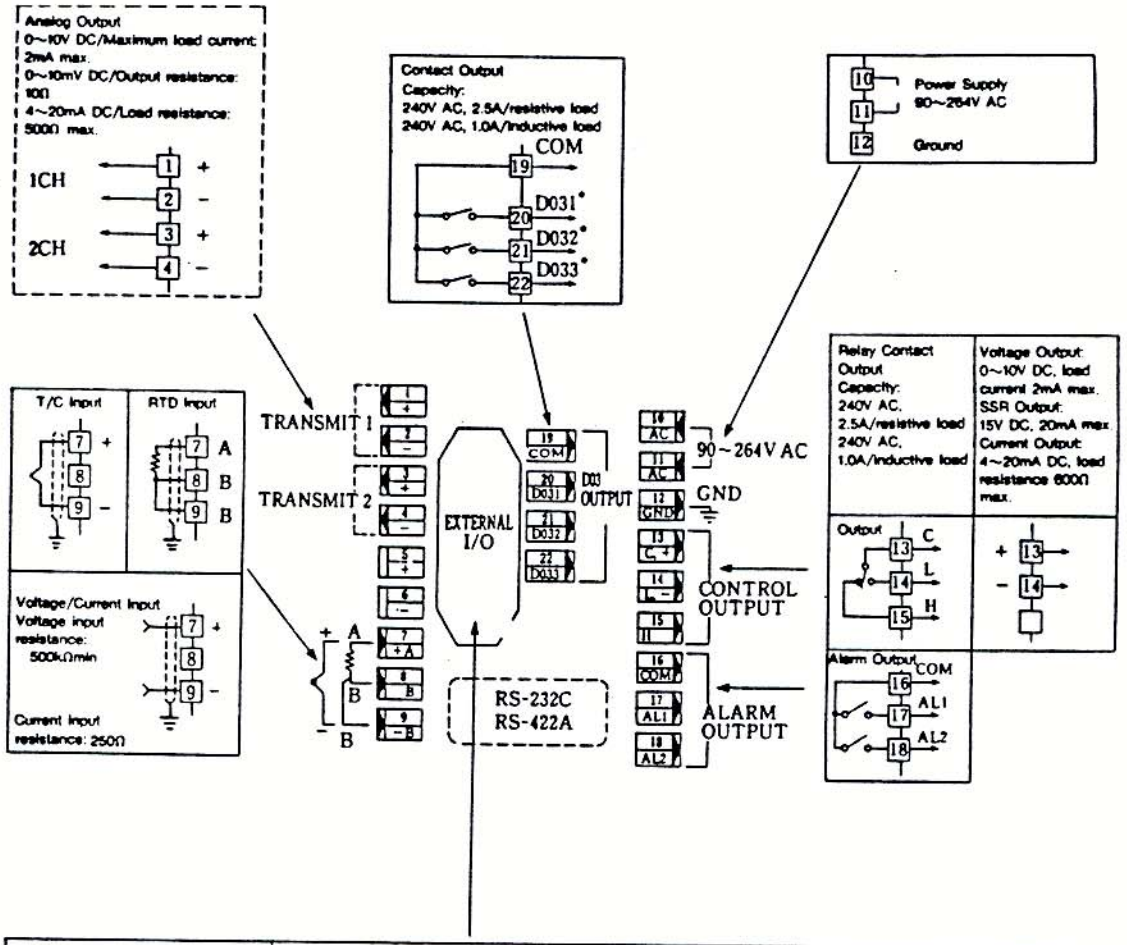
For RTD input, use a lead wire having a small resistance.

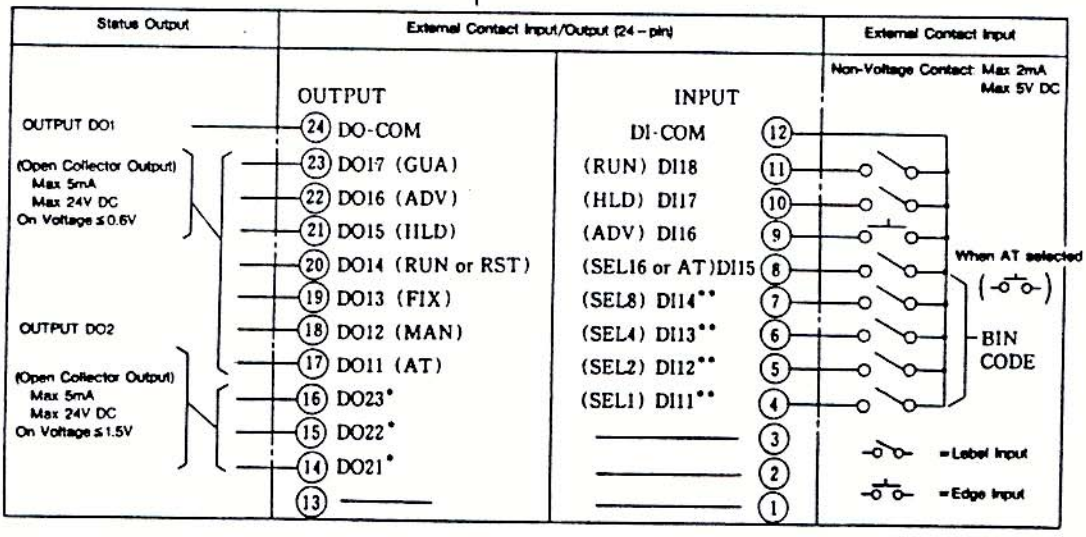
For connection to the power source, use wire or cable which is equal to or better than 600V vinyl insulated wire. Use a noise filter in the power source if needed.

To prevent a noise effect on the input signal line, lay it away from the power circuit and grounding circuit. Shielded wire is effective to prevent possible electrostatic induction noise. It should be connected to the grounding terminal of the controller body as necessary. To prevent electromagnetic induction noise, twist the input wire at short equal intervals.

For connecting wire to a terminal, the use of a solderless terminal attached with a sleeve (for the 3.5mm terminal screw) is recommended.

2.5 TERMINAL ARRANGEMENT





* On Terminals DO21, DO22, DO23, DO31, DO32, DO33, only one each Status Signal comes out selected from TS1, TS2, TS3, TS4, SO, RUN, END, EXT

** SEL1, SEL2, SEL4, SEL8 (SEL16) BIN Code Input

SECTION 3 INTIAL SET-UP

3.1 FRONT PANEL KEYS AND DISPLAYS

Figure 3-1. Front Panel Keys and Displays

DISPLAYS

RUN:	Lit during program run.
HLD:	Lit during temporary stop of program
ADV:	Lit forcibly advancing to next step during program run.
GUA:	Lit during guarantee soak.
COM:	Lit during use of interface feature.
EXT:	Lit when external control is input.
TS1-TS4:	Lit when time signal is output.
AL1:	Lit when Alarm AL1 is activated.
AL2:	Lit when Alarm AL2 is activated.
FIX:	Lit during execution of Fixed Value control.
MAN:	Lit during execution of manual control.
AT:	Lit during Auto-tuning.
PTN:	Pattern no.
STP:	Step no.
PV:	Process Value
SV:	Set Value

KEYS

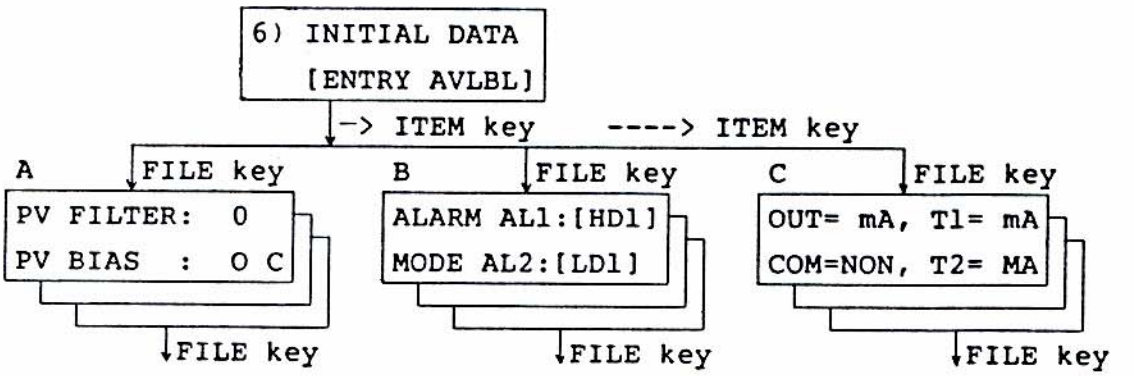
1. RVS (Reverse): Used together with other keys to reverse or limit operation. A * mark will be lit at the lower left of the screen whenever it is pressed. Pressing the RVS key with the FUNC key will return any menu group.
2. FUNC (Function): Moves menu group between (1) to (6); (horizontally between menus).
3. FILE: Move vertically between menus. Pressing the RVS key with the FILE key moves the menu upward.
4. ITEM: Moves horizontallhy between data in menu groups. Pressing the RVS key with the ITEM key can horizontally move the menu between blocks.

KEYS (Continued)

5. Down Arrow: Decreases data value. Pressing the RVS key with the Down Arrow key can indicate the minimum of the values available, and can determine it.
6. Shift Keys: Change digits, or used to move between parameters.
7. Up Arrow: Increases data value. Pressing the RVS key with the Up Arrow key can indicate the maximum of the values available, and can determine it.
8. ENT (Enter): Enters (registers) the data. When the ENT key is pressed, the "-" sign changes to ":". The ENT key moves the cursor between data in a menu. Pressing the RVS key with the ENT key can indicate the numeral determined right before. Pressing the ENT key with copy indication can determine it.

3.2 INITIALIZATION BEFORE OPERATION

To initialize the controller before operation, press the FUNC key repeatedly until the following initialization menu group appears.



The initialization menu group includes three blocks: A, B, and C.

Block A includes four check items.

A-1 No checks are made in Block A.
A-2 Checks are made.

To check Block A items, press the FILE key. The following menu will appear.

```
PV FILTER:    0
PV  BIAS:00.0°C
```

a) Will you insert the PV filter which serves as noise cutter?
b) Will you correct the sensor for possible error? (range = ±99.9°C)

Set items (a) and (b) by pressing the Up or Down Arrow key and the ENT key.

Press the FILE key. The following menu will appear.

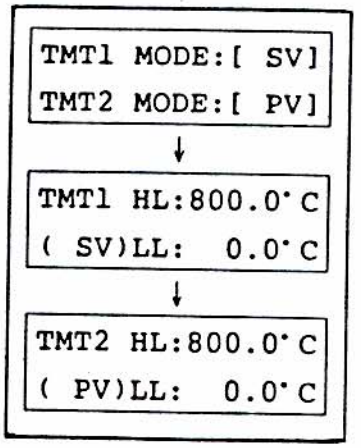
```
R/D ACTION: [R]
CYC TIME:30 sec
```

a) Select Direct Action (DA) or Reverse Action (RA). The initialization is RA (Reverse Action).
b) Set the cycle time when the controller output is for the contact (Y) or SSR drive (P).
The initialization is 30 seconds for the contact, and 3 seconds for the SSR.

Set items (a) and (b) by pressing the Up or Down Arrow key and Enter.

Press the FILE key. The analog output signal menu will appear.

(a) Is the analog output signal to SV or PV?



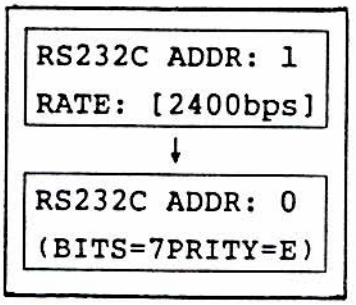
Press the FILE key until the following menu appears.

Will you set the high or low limit for the analog output signal (1)?
If so, keep pressing the Up or Down Arrow key until a desired value is obtained, and press the ENT key to enter it.

Press the FILE key until the following menu appears.
Will you set the high or low limit for the analog output signal (2)?
If so, keep pressing the Up or Down Arrow key until a desired value is obtained, and press the ENT key to enter it. The menu can be moved with the FILE key. A version having no analog output signal does not have the menu.

Press the FILE key until the interface menu (option) appears.
(a) See the instruction manual for the interface operation.

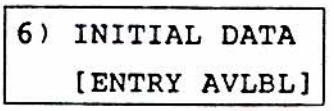
The menu can be moved with use of the FILE key. The numerals can be selected with use of the Up or Down Arrow key. The selected numeral can be entered with the ENT key. A version having no interface feature does not have this menu.



Block B includes four check items.

B-1 No checks are made in Block B.
B-2 Checks are made.

Press the FUNC key repeatedly until the following initialization menu appears.



Press the ITEM key. The following Alarm menu will appear.

```
ALARM AL1:[LD1]
MODE AL2: [HD1]
```

Select a desired mode from among ten alarm modes, by using the Up or Down Arrow keys and ENT.

Press the FILE key for the next Alarm menu to appear.
Set the sensitivity and Standby (or non-standby) for the Alarm operation in item (a).
Enter a sensitivity from the selected alarm mode between 0.1 to 5% FS. (Default is 0.2%). Enter Y for standby or N for non-standby.

```
AL1 SENS: 0.2%
    STBY:  [Y]
```

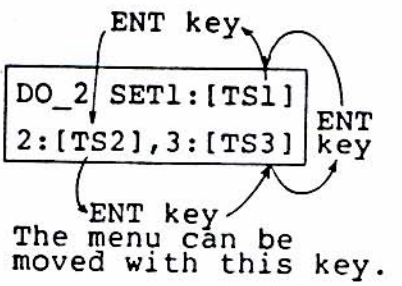
```
AL2 SENS: 0.5%
    STBY:  [N]
```

Enter the alarm operating point, set a pattern number, skip number, and temperature (°C/°F) on Menu Group 4 (CONTROL DATA).

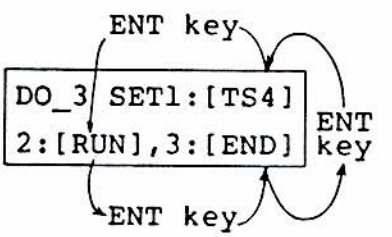
Press the FILE key. The following DI_1 menu will appear.
This menu is used for the operation mode EXT, External Control Operation.
Set the PTN and SEL items using the Up or Down Arrow keys and ENT.

```
DI_1 MODE:[PTN]
       DI:[SEL]
```

Press the FILE key for the DO_2 Event Set menu.
Select three from among the eight events shown in Table 3-1.
The open collector output signals can be fed from the 24-pin connector on the rear panel. Set using the Up or Down Arrow keys and ENTER.



Press the FILE key for the DO_3 Event Set menu.
Select three from among the eight events in Table 3-1. The contact output signals can be fed from the terminals on the rear panel.



The eight Event Outputs are as follows:

TABLE 3-1

1 TS1 Time Signal 1	5 SO Scale over
2 TS2 Time Signal 2	6 RUN In programming
3 TS3 Time Signal 3	7 END Program stop
4 TS2 Time Signal 4	8 EXT External operation

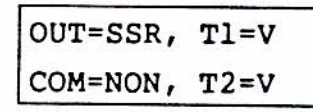
Block C includes four check items.

C-1 No checks are made in Block C.
Even if no checks are made in Block C, the following checks must be made.

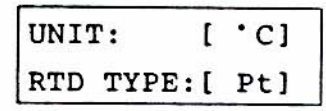
ITEM	INITIALIZATION
Is the unit used °C or °F in step 2 below?	°C
Is it used at Pt or JPt?	Pt
Are the ranges set correctly in step 3?	TC: 0-800°C Pt: 0 to 200°C mV: 0 to 10 mV V: 0 to 10 V mA: 4-20 mA
Is the program inclination period used in "Min" or "sec"?	min

C-2 Checks are made.

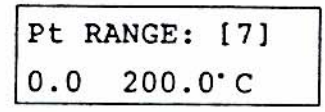
1) Press the ITEM key for the Monitor menu.
Check to ensure that the following is correct:
(a) Type of controller output signal (OUT).
(b) Type of analog output signals (T1, T2).
(c) Type of interface features



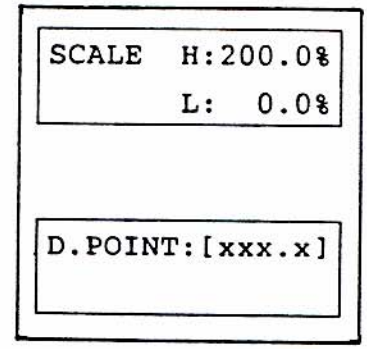
2) Press the FILE key for the following menu.
(a) Select either °C or °F.
(b) Select RTD input type.
The initialization is Pt.



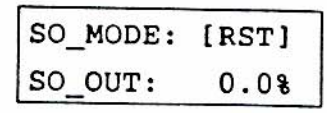
3) Press the FILE key for the following menu.
Set a desired range.



4) Press the FILE key for the Scale menu. The menu is used when the input signal is V/A. Set scale.
Press the FILE key until the menu showing decimal points appears. Set the decimal point using the Up and Down Arrow keys and ENT.



5) Press the FILE key until the Scale Over menu appears.
If the scale is over (SO), the menu is used to determine whether the output signal is to be reset to 0% or is to be fed in the range of 0 to 100%. Set using the Up and Down Arrow keys and ENT.



6) Press the FILE key for the following menu.
The menu is used to select from among the following five modes of program run when the power is turned on. Set using the Up and Down Arrow keys and ENT.

```
POWER ON MODE
   : [NORMAL]
```

Table 3-2 describes types of power supply and program operation.

TABLE 3-2

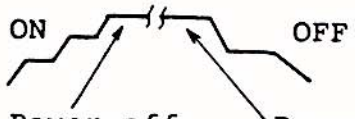
	KIND OF POWER SUPPLY	USE	POWER SUPPLY IN OPERATION MODE				SCREEN WITH POWER ON
				ON to start	State in OFF	State in ON again	
1	NORMAL	Available when the unit is used alone.	1	RUN	RST	RST	None
			2	FIX	RUN	RST	
			3	MAN	FIX	FIX	
			4		MAN	MAN	
2	ALL RST	Available when the unit is used alone.	1	RUN	RST	RST	-ALL RST ON-
			2	FIX	RUN	RST	
			3	MAN	FIX	RST	
			4		MAN	RST	
3	AUTO RUN	Available when the unit is interlocked with a sequencer, calendar timer, etc.	1	RUN	RST	RUN	-AUTO RUN ON-
			2	FIX	RUN	RST	
			3	MAN	FIX	FIX	
			4		MAN	MAN	
4	GUA RUN	Available when the unit is interlocked with a sequencer, calendar timer, etc.	1	RUN	RST	RST	-GUA RUN ON-
			2	FIX	RUN	RUN	
			3	MAN	FIX	FIX	
			4		MAN	MAN	
5	AUTO & GUA	Available when the unit is interlocked with a sequencer, calendar timer, etc.	1	RUN	RST	RUN	-AUTO & GUA ON-
			2	FIX	RUN	RUN	
			3	MAN	FIX	FIX	
			4		MAN	MAN	

In Example A that follows, the program is started with the CN3800 Series powered on, turned off in the course of operation, and turned on to the end of the program.

In Example B, the CN3800 Series is powered on to start the program to the end, turned off once, and turned on again to start the program to the end.

1) NORMAL

Example A

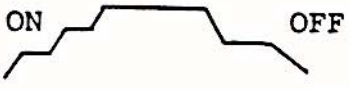


Power off
⟶ t

Power on
Not automatic restart,
but start from step 1.

Example B

⟶ Power on next day



End

Not automatic restart,
but RUN is to be pressed.

2) ALL RST

Example A

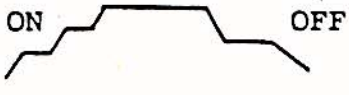
Response "- ALL RST ON -" appears.

Power off
⟶ t

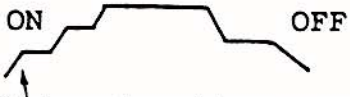
Power on
Not automatic restart,
but start from step 1.

Example B

Response "- ALL RST -" appears.
⟶ Power on next day



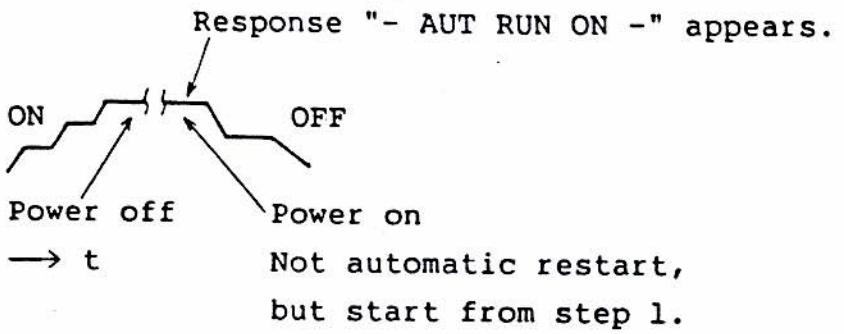
End



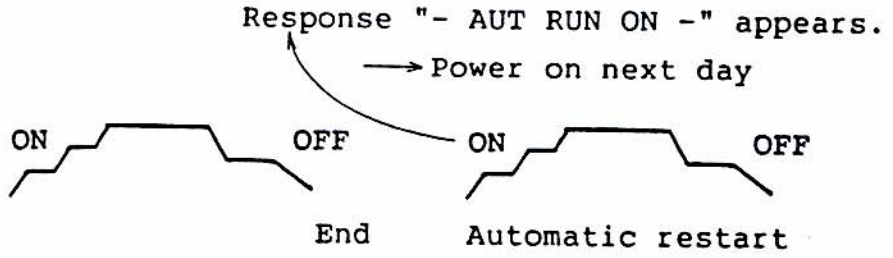
Not automatic restart,
but RUN is to be pressed.

3) AUTO RUN

Example A

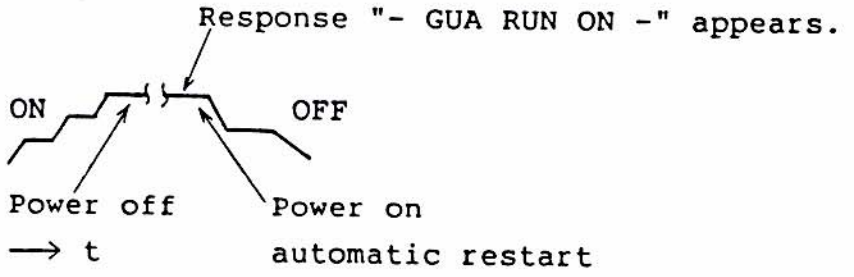


Example B

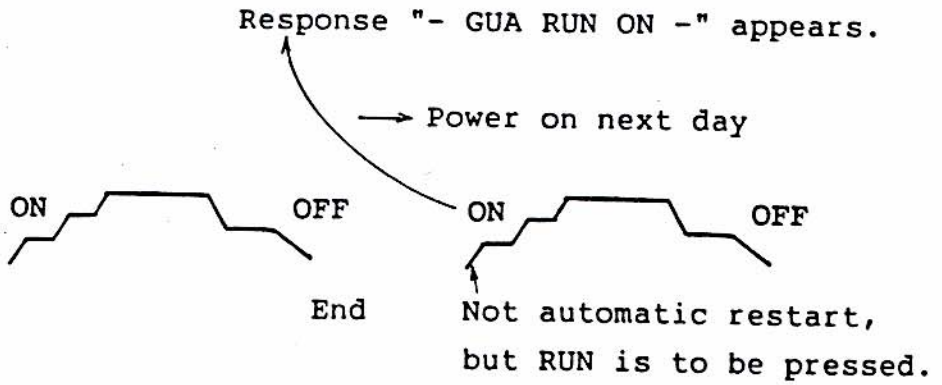


4) GUA RUN

Example A

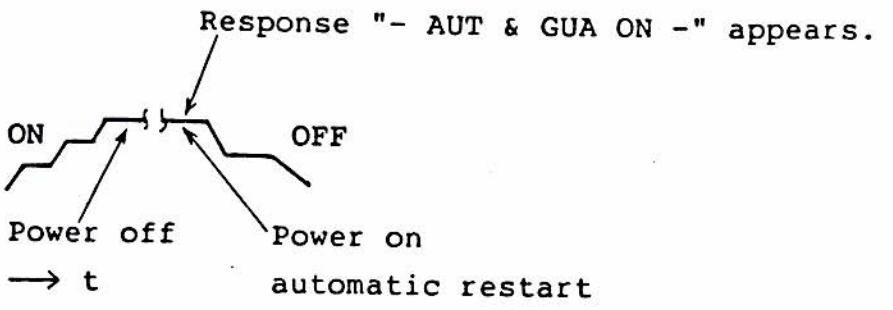


Example B

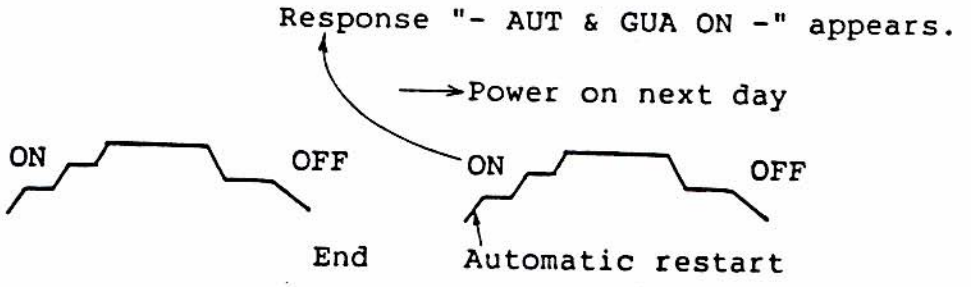


5) AUTO & GUA

Example A



Example B



7) Press the FILE key for the following menu.

TIME UNIT:[min]	.....(a)
PID: [SERIES]	.....(b)

(a) Select either "min" or "sec" in which the program Ramp period of time is expressed.

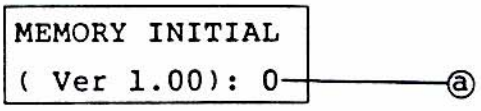
(b) Select from the following PID calculation circuits. For temperature control, the initial "SERIES" is preferable.

(i) SERIES: The controller AT circuit is prepared to allow the SERIES PID circuit to do optimum adjustment.

(ii) PARA: Used for a special control application.

(iii) D-PARA: Often used for special control systems, particularly in high speed applications.

8) Press the FILE key for the following menu.



Select (a) data initialization state "0, 1, or 2" using the Up and Down Arrow keys and ENT.

0 - No initialization

1 - Part of initialization (as entered by user).

2 - All initialization.

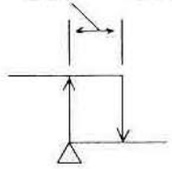
(1) The alarm mode menu should be made to appear from the No. 6 initialize menu group to determine the alarm mode.

6) INITIAL DATA	→	ALARM AL1:[LD1] MODE AL2:[HD1]

(3) In turn, enter the alarm sensitivity. Select either standby or not.

* Sensitivity

  0.1 - 5%(FS)

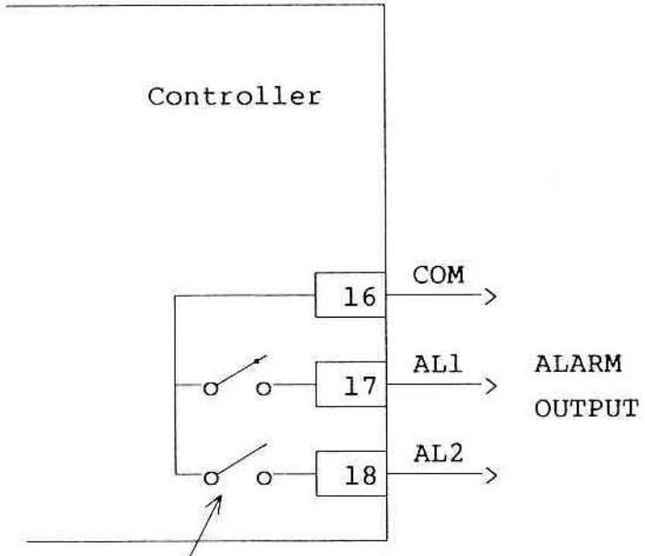


AL1 SENS: 0.2% STBY: [Y]
↓
AL2 SENS: 0.2% STBY: [N]

* Stand-by

  N....No

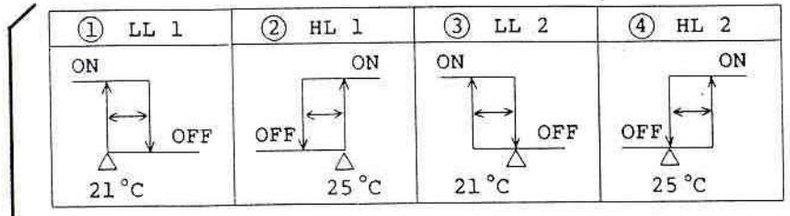
  Y....YES



The alarm output relay contact is for a resistive load of 2.0 A at 240 V AC.

(2) Select a desired one from among the following ten alarm modes.

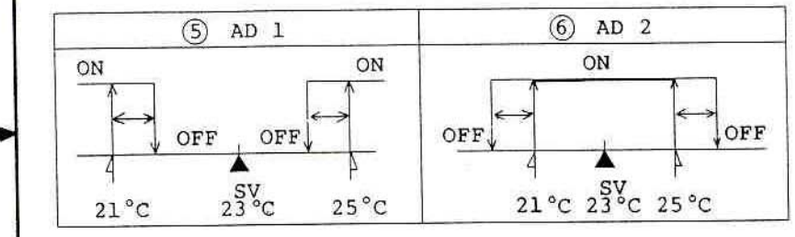
A. Absolute Value Alarm Group



For modes ① and ②, enter a temperature at which the relay contact is closed.

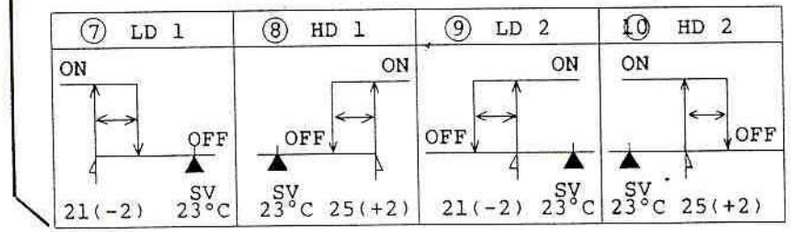
For modes ③ and ④, enter a temperature at which the relay contact is made open.
Example: The absolute alarm temperature is 23 °C.

B. Absolute Deviation Alarm Group



For modes ⑤ and ⑥, the one relay functions as wind comparator.
Example: The temperature entered is 23 °C.
For mode ⑥, the relay contact is closed (ON) at 21 °C as the temperature rises up, and is made open (OFF) at 25 °C plus the sensitivity.
It is closed at 25 °C as the temperature falls and is made open at 21 °C plus the sensitivity.

C. Deviation Alarm Group



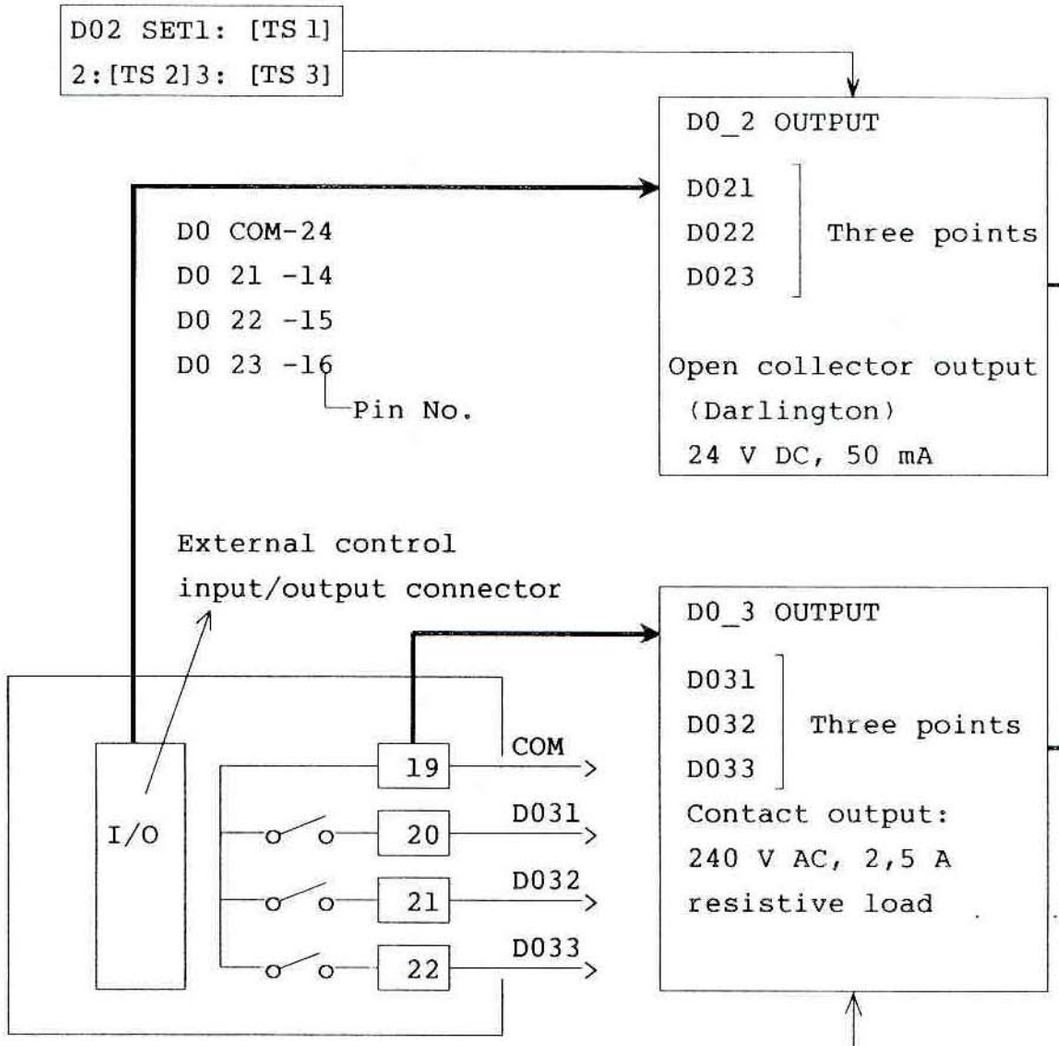
In examples of modes ⑦ ⑧, ⑨ and ⑩, the alarm temperature entered is 23 °C with its low limit of -2 °C and the high limit of +2 °C.

(4) The alarm operating point data should be entered using menu group 4) CONTROL DATA.

4)CONTROL DATA (PID ALMNO): 1 Step No. _	→	ALARM 1 [LD1] AL1 -5.0°C Step No. _
		ALARM 1 [LD1] AL2 -5.0°C Step No. _

Alarm Operation (Start with menu group 6) INITIAL DATA)

(1) Three of the eight event signals can be selected to enter as open collector signals.

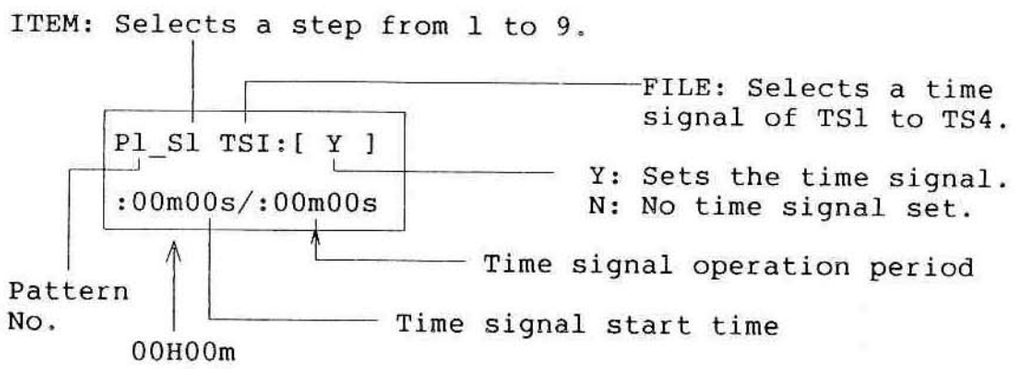


(2) Any three of the eight events can be selected to enter as contact signals.

(3) You can select up to six of the eight events to output them as signals during the program operation.

EIGHT EVENTS		
1	TS1	Feeds out TS1 (time signal 1) entered on menu group 3) PROGRAM DATA.
2	TS2	Feeds out TS2 (time signal 2) entered on menu group 3) PROGRAM DATA.
3	TS3	Feeds out TS3 (time signal 3) entered on menu group 3) PROGRAM DATA.
4	TS4	Feeds out TS4 (time signal 4) entered on menu group 3) PROGRAM DATA.
5	SO	Feeds out SO when the PV value is scale over error.
6	RUN	Feeds out RUN during the program operation.
7	END	Feeds out END when: (1) The program operation ends. (2) The CFM operation ends (for around one second) (3) Operation is forcibly stopped with RST.
8	EXT	Feeds out EXT when the external control input (EXT) is selected in the operation mode.

(4) Press the FUNC key repeatedly until menu group 3) PROGRAM DATA appears. In this menu group, enter a desired pattern No. and step No. for each of the time signals TS1, TS2, TS3 and TS4.



Eight Event Signals (Start with menu group 6) INITIAL DATA)

3.3 ENTERING THE PROGRAM PATTERN (OUTLINE)

Check steps 1 to 9 below before setting the program pattern temperature, time, alarm, etc.
Enter a program pattern by referring to the example shown in Figure 3-2.

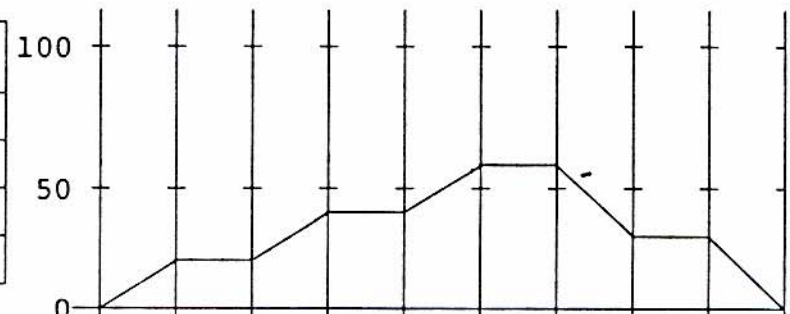
1) Press the FUNC key repeatedly until Menu Group 3) PROGRAM DATA appears.

```
3) PROGRAM DATA
   PATTERN No.: 1
```

..... Enter pattern No. 1.

PATTERN NO. 1

PROGRAM DATA	INITIAL VALUE	
START SV	0	
GUA SOAK	00	
PTN END	1	
PTN RPT	0	



STEP		1	2	3	4	5	6	7	8	9
(1)	Setting SV, °C	200	200	400	400	600	600	300	300	0
(1)	Time, H	1 H	2 H	3 H	4 H	5 H	4 H	3 H	2 H	2 H
(2)	PID No.									
(2)	Alarm No.									
(3)	Time signal TS									
	TS1 - TS4									

Figure 3-2. Program Pattern Example

2) Press the FILE key for the following menu.

```
P1  START SV
  :   0.0 °C
```

3) Press the ITEM key to set P1 through P9. Set SV using the Up and Down Arrow keys and ENT.

4) Press the FILE key to display the following menu.

```
P1  GUA SOAK
: 0.0°C,:00m00s
```

Press the ITEM key until pattern P1 is obtained. Set the Guarantee Soak time and Temperature by using the Up and Down Arrow keys and ENT. Set °C to 0.0m0s.

5) Press the FILE key to display the following menu.

```
P1 PTN END   : 9
   PTN RPT   : 0
```

Press the ITEM key until pattern P1 is obtained. Set the end step of pattern 1 to 9, and set its repeat to 0 (no) by pressing the Up and Down Arrow keys and ENT.

Press the FILE key to display the following monitor screen, which is a check screen after the program and pattern have been set.

```
P1|
s1|
```

Press the ITEM key until pattern P1 is obtained. Set SV to 0.0°C using the Up and Down Arrow keys and ENT.

6) Press the FILE key for the following menu.

```
P1 SV:    0.0°C
S1 TIME:00h00m
```

→

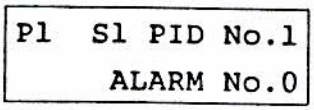
```
P1 SV:    0.0°C
S2 TIME:00h00m
```

Change with ITEM key.

7) Press FUNC key for the following screen. Set the step number to S1 using the ITEM key.

```
P1-S1  PID No:0
     ALARM No:0
```

(a) There are nine PID numbers to be set. (PID Nos. 1 through 9 had P5%, I300S and DI00S initialized at the factory.)
Set the Step number to S2 using the ITEM key.
Select a PID no. using the Up and Down Arrow keys and ENT.



(b) For example, use:
PID No. 1 for Step 1.
PID No. 2 for Step 2.
PID No. 3 for Step 3.

Each step number can have a desired PID No. determined.

(c) Be sure to enter the PID numbers for the respective steps as described above.
The PID values can be entered using the Menu Group 4) CONTROL DATA.

(d) Now set the PID values using the Menu Group 4) CONTROL DATA.

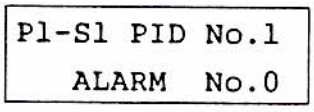
*If the PID number is entered at any of the steps mentioned above, follow the chart below.

Does the auto-tuning function normally?	Normal	The PID value obtained by the auto-tuning operation at each step is automatically stored in the corresponding PID number.
Can general PID control be made?	Normal	The PID control is made with the PID value registered in the step.

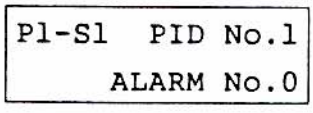
*If the PID number is not entered at any of the steps mentioned above, follow the chart below.

Does the auto-tuning function normally?	Normal	The PID value obtained by the auto-tuning operation at each step is automatically stored in the first step only.
Can general PID control be made?	Normal	The PID control is made with the initial value at each step.

8) Next, the Alarm operation should be registered.
Press the ITEM key for the following menu.



Press FUNC key for the following menu.
Set the Step number to S1 using the ITEM key.



(a) There are nine ALARM numbers to be set as in the PID value setting.
Set the Step number to S2 using the ITEM key. Select an ALARM No. using the Up and Down Arrow keys and ENT.

```
P1-S1  PID No.2
     ALARM  No.1
```

```
P1-S2  PID No.2
     ALARM No.2
```

(b) For example, use:
ALARM No. 1 for Step 1.
ALARM No. 2 for Step 2.
ALARM No. 3 for Step 3.

Each step number can have a desired ALARM No.

(c) Be sure to enter the ALARM numbers for the respective steps as described above. The ALARM values can be entered using the Menu Group 4) CONTROL DATA.

9) Setting the time signal is described in detail in Section 3.4.3.
The screen will be changed as shown below using the FILE key.
Menus (a) to (d) are used to set the time signal.

Press the FILE key.

```
P1-S1 TS1:[ N ]
: 00h00m/00h00m
```
(a)

Press the FILE key.

```
P1-S1 TS2:[ N ]
: 00h00m/00h00m
```
(b)

Press the FILE key.

```
P1-S1 TS3:[ N ]
: 00h00m/00h00m
```
(c)

Press the FILE key.

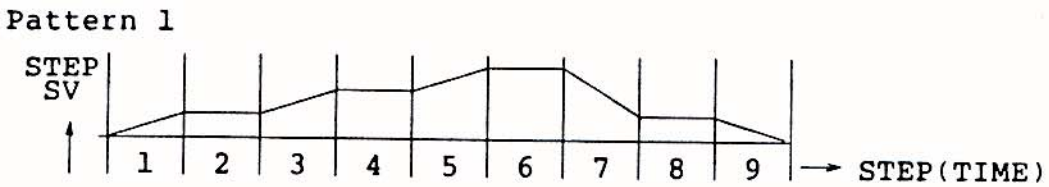
```
P1-S1 TS4:[ N ]
: 00h00m/00h00m
```
(d)

Press the FILE key.
This menu will return you to the first menu of 3) PROGRAM DATA.

```
P1    START    SV
          :  0.0°C
```

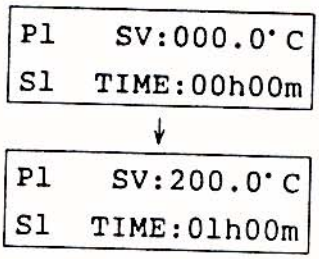
3.4 ENTERING THE PROGRAM PATTERN (DETAILS)

3.4.1 Program Setting



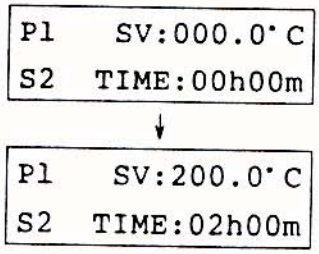
Step 1
Press the FILE key to display the Step 1 screen.

Set SV to 200°C using the Up and Down Arrow keys and ENT.
Set TIME to 1h using the same keys.



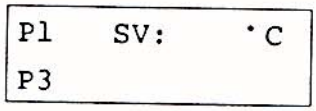
Step 2
Press the ITEM key to display the Step 2 screen.

Set SV to 200°C using the Up and Down Arrow keys and ENT.
Set TIME to 2h using the same keys.

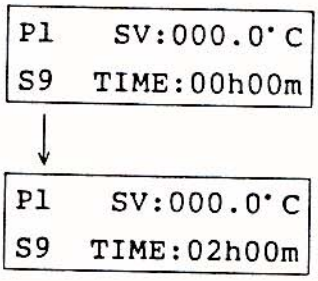


Steps 3 through 8
Press the ITEM key to display Step 3 through 8 screens.

Similarly, set the temperature and time of each step using the Up and Down Arrow keys and ENT.

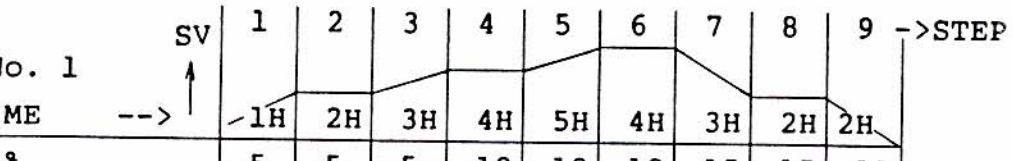


Step 9
Press the ITEM key to display the Step 9 screen.
Set SV to 0°C using the Up and Down Arrow keys and ENT.
Set TIME to 2h using the same keys.



This completes the setting of the temperature and time of each step of Pattern 1.

3.4.2 PID and ALARM Setting



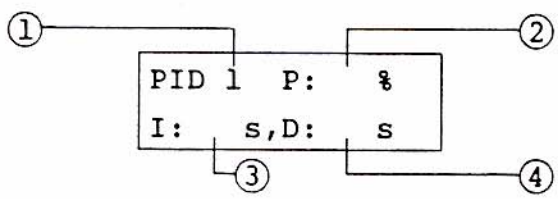
PATTERN No. 1 TIME -->	1H	2H	3H	4H	5H	4H	3H	2H	2H
PID_ 1 P: %	5	5	5	10	10	10	15	15	15
I: S	300	300	300	400	400	400	500	500	500
b: S	3	3	3	5	5	5	10	10	10
PID_ 1 OH: %	100	100	100	90	90	90	70	70	70
(OUTPUT LIMITER) OL: %	0	0	0	0	0	0	0	0	0
ALARM_ 1 (LD1)	-10	-10	-10	-5	-5	-5	-15	-15	-15
ALARM_ 1 (HD1)	+10	+10	+10	+5	+5	+5	+15	+15	+15

Press the FUNC key to display the Menu Group 4) CONTROL DATA.

```
4) CONTROL DATA
(PID,ALM No.):1
```

Set the Pattern No. 1 using the Up and Down Arrow keys and ENT.

Press the FILE key to display the following screen.

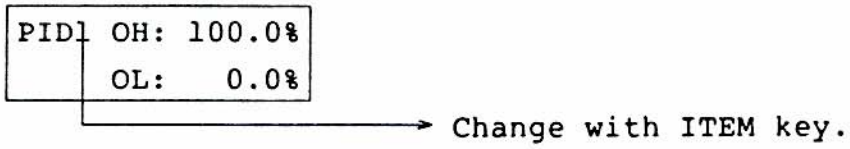


1. Press the ITEM key until a desired Step No. is obtained (from PID 1 to 9).
2. Set the proportion band (P) value using the Up and Down Arrow keys and ENT. Press ENT to move the cursor to the integral time (I).
3. Set the integral time (I) using the Up and Down Arrow keys and ENT. Press ENT to move the cursor to the derivative time (D).
4. Set the derivative time (D) value using the Up and Down Arrow keys and ENT.

NOTE: If auto-tuning is used, no PID setting is needed.

The following output limiter screen can be used to limit the control output. If it is not used, no setting is needed as the initialization high and low limits are 100% and 0% respectively.

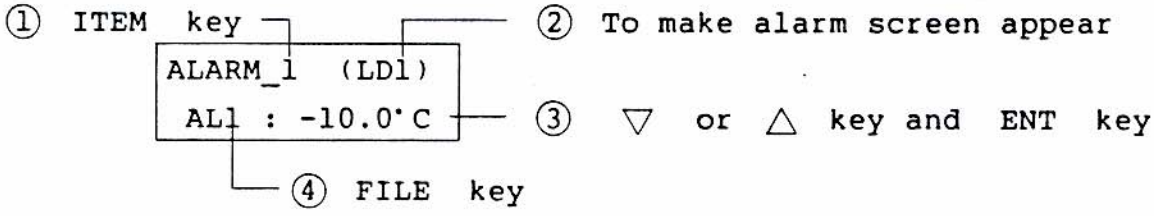
Press the FILE key to display the output limiter screen.



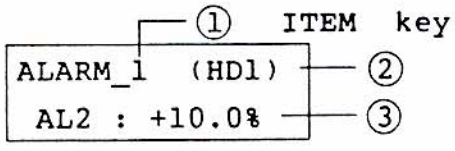
1. The output limiter high and low limits can be set from -10 to 110%.
2. In the reset (RST) state, the output is 0%.
3. In the manual (MAN) mode of operation, the output can be varied in the range of 0 to 100% regardless of the output limit setting.
4. The output limit can be set using the Up and Down Arrow keys and ENT.
5. The "PID_1" in each step should be called with the ITEM key.

To enter Alarm Values:

Press the FILE key to display the following alarm screen appear.



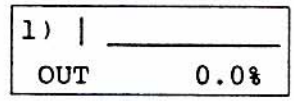
1. Select Step No.(1 to 9) using the ITEM key.
2. In the Menu Group 6) INITIAL DATA, the Alarm mode, sensitivities, and Standby or Non-standby had been entered. In the example, the Alarm mode is the high and low deviation alarm, the sensitivities are 0.3 and 0.5, and the low limit is the Standby state.
3. Set a low alarm limit using the Up and Down Arrow keys and ENT. This setting should be made for all steps 1 to 9.
4. Press the FILE key to display the following screen.



Similarly, set a high alarm limit using the Up and Down Arrow keys and ENT.
This setting should be made for all steps 1 to 9.

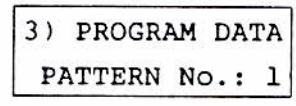
3.4.3 Time Signal Setting

The time signal should be set in each step of Pattern No. 1. The screen should be returned to the first monitor screen using the RVS and FUNC keys.

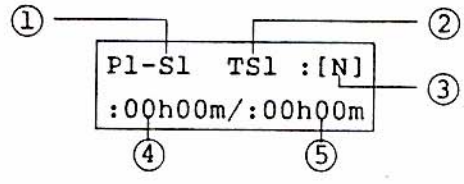


PATTERN No. 1 / TIME -->	SV	1	2	3	4	5	6	7	8	9<-STEP
		1H	2H	3H	4H	5H	4H	3H	2H	2H
TIME SIGNAL TS1		N	Y	N	N	N	N	N	N	N
START TIME ON			0 H							
STOP TIME OFF			2 H							
TIME SIGNAL TS2										
TIME SIGNAL TS3										
TIME SIGNAL TS4		N	N	Y	N	N	N	N	N	N
START TIME ON				1.5H						
STOP TIME OFF				1.5H						

Press the FUNC key to display the Menu Group 3) PROGRAM DATA.
Set the Pattern No. using the Up and Down Arrow keys and ENT.



Press the FILE key to display the following screen.



1. Press the ITEM key until a desired Step No. is obtained (1 to 9).
2. Select a desired time signal (TS1, TS2, TS3 or TS4) using the FILE key.
3. Select either Y or N for the time signal using the Up and Down Arrow keys and ENT.
4. Set the time signal start (TIME ON) using the Up and Down Arrow keys and ENT.
5. Set the time signal stop (TIME OFF) using the same keys.

Following is an example of setting the time signal.

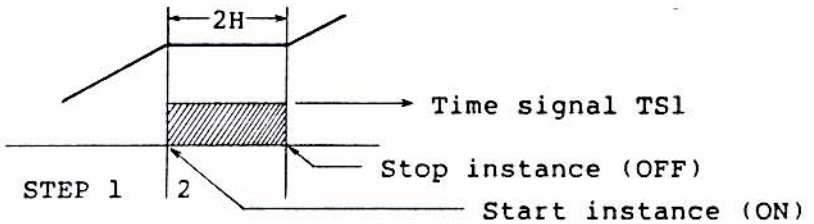
1. Step S1 cannot be set as TS1:[N]. [N] means that no setting is made; Y is that a setting is made.

```
P1-S1  TS1 :[N]
:00h00m/:00h00m
```

2. Press the ITEM key to select Step S2. Select use (Y) of the time signal using the Up and Down Arrow keys and ENT. Set the time signal TS1 start to "00h00m", and the stop signal to "02h00m" using the Up and Down Arrow keys and ENT.

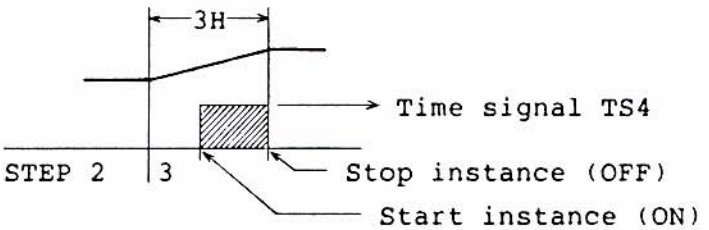
```
P1-S2  TS1 :[Y]
:00h00m/:02h00m
```

The time signal can be used as shown below.



3. Press the ITEM key to select Step S3. Press FILE until TS4 is indicated. Select use (Y) of the time signal using the Up and Down Arrow keys and ENT. Set the time signal TS4 start time to "01h30m" and the stop time to "01h30m" using the Up and Down Arrow keys and ENT.

```
P1-S3  TS4 :[Y]
:01h30m/:01h30m
```



Notes on Time Signals TS1 to TS4:

1. Even if the time signal TS1 is set to [Y], it cannot serve if the step time is 0.

```
P1-S1  TS1 :[Y]
:00h00m/:00h30m
```

2. If the time signal TS1 is set to [N], it cannot serve.

```
P1-S1  TS1 :[N]
:00h20m/:00h15m
```

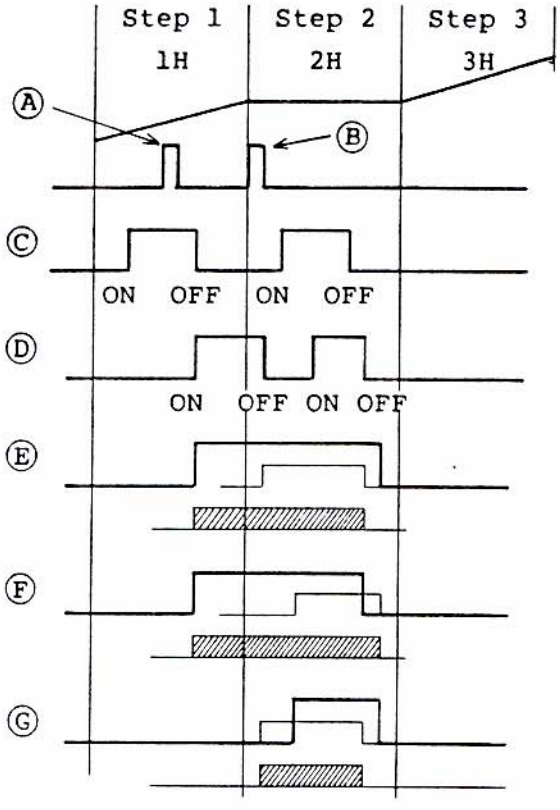
3. If the time signal TS1 is set to [Y], the start time is set to 30 seconds and the stop time to 0 minute, it can serve for one second.

```
P1-S1  TS1 :[Y]
:00h30m/:00h00m
```

4. If the time signal TS2 is set to [Y], the start time is set to 0 minute and the stop time to 0 minute, it cannot serve for one second at start and stop.

```
P1-S2  TS1 :[Y]
:00h00m/:00h00m
```

If the preceding time signal setting (⎍) and the present time signal setting (⎍) are overlapped, as shown in Figures E, F, and G, the actual time signal setting is indicated by the solid line in the following figure.



⎍ : Time signal at the preceding step

⎍ : Time signal at the present step

▨ : Actual time signal

SECTION 4 OPERATION

4.1 SETUP FOR OPERATION

Menu Group 2) EXEC KEY is an operating menu in which the controller can be started, held or stopped, and another operation can be executed.

1. Press the FUNC key until the following screen appears.

```
2) EXEC KEY:[KEY]
          (RST)
```

Press the Up or Down arrow key for one of eight commands.

1	RUN	Program start
2	FIX	Fixed value control start
3	MAN	Manual operation on
4	CFM	Pattern output on
5	RST	Program execution stop
6	ADV	Advance start or stop
7	HLD	Hold start or stop
8	AT	Auto-tuning start or stop

Set the above eight commands before executing the operation with the ENT key.

2. Press the FILE key to display the following screen.
   (a) Determine with which pattern number the program is started.
   (b) Determine with which step number the step is started.

```
START PTN No: 1
      STP No: 1
```

3. Press the FILE key to set the link format.
   (a) Determine the link order. If no link is made, no setting is needed.

```
LINK FORMAT
  :[_          ]
```

4. Press the FILE key to display the following screen.
   (a) If the link format is made, set the number of link repeats. As an example, enter "0" for no link repeat.
   (b) Determine whether the PV start is made (Y -yes; N - no) by pressing the Up or Down arrow key and the ENT key.

```
LINK EXEC : 0
PV START  :[N]
```

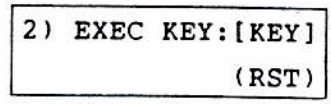
5. Press the FILE key to display the following screen.
   Select from one of the following two kinds of advance.
   (a) Determine whether STEP advance is made. If so, press the Up or Down arrow key and the ENT key to determine.
   (b) Determine whether TIME advance is made. If so, press the Up or Down arrow key and the ENT key to determine. The time advance can be made by the period of time set.

```
ADV MODE:[STEP]
 (TIME):00h01m
```

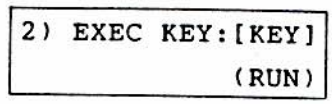
```
ADV MODE:[TIME]
  (TIME):0
```

4.2 STARTING THE OPERATION

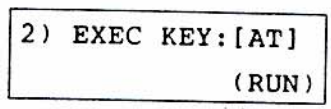
Press the FILE key until Menu Group 2) EXEC KEY appears.



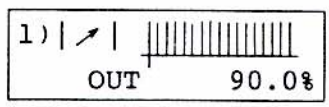
1. To start the program (RUN), press the Up or Down arrow key until RUN appears, and press the ENT key to determine. The RUN light on the front panel will light.

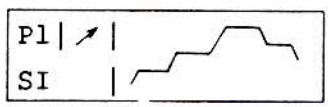


2. To start the auto-tuning (AT), press the Up or Down arrow key until AT appears, and press ENT. The AT light on the front panel will light.

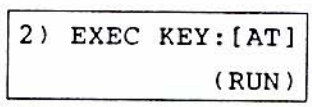


3. Press the RVS and FUNC keys to display Menu Group 1) Monitor. Press the FILE key to see the pattern.

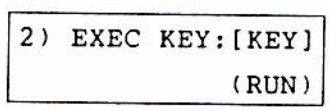




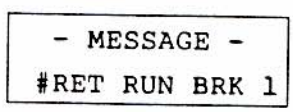
4. To stop auto-tuning, press the FUNC key to display Menu Group 2) EXEC KEY.
   Press the Up or Down arrow key until AT appears, and press ENT. The AT light on the front panel will go off.



5. To stop the program operation (RST), press the FUNC key to display Menu Group 2) EXEC KEY.



Press the Up or Down arrow key until RTS appears, and press ENT. The RUN light on the front panel will go off. The following screen will appear:

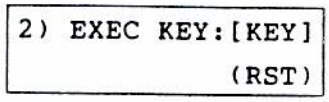


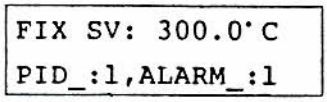
To restart (RUN), press the RVS and FUNC keys to display Menu Group 1) Monitor, and press the FUNC key for Menu Group 2) EXEC KEY.

SECTION 5 SETTING AND STARTING THE FIXED VALUE CONTROL AND OPERATION

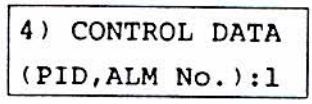
5.1. SETTING THE TEMPERATURE, PID VALUE AND ALARM VALUE FOR FIXED VALUE CONTROL

1. To set the temperature, press the FUNC key until Menu Group 2) EXEC KEY appears.
   Press the FILE key to display the Fixed Value control screen.
   Set a desired temperature (for example, 300°C) by pressing the Up or Down arrow key and ENT.

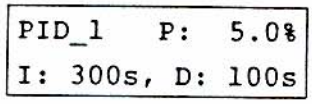




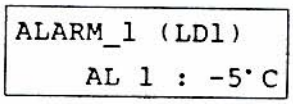
2. To set the PID value and alarm value, first determine where the PID and ALARM are stored. For example, let the PID and ALARM be stored at No. 1 each by pressing the Up or Down arrow key and ENT. Press the RVS and FUNC keys to make Menu Group 1) Monitor appear, and press the FUNC key until Menu Group 4) CONTROL DATA appears.



   Press the FILE key until the PID screen appears. Press the Up or Down arrow key to set the PID value, and ENT. If "AT" is used, no setting is needed.



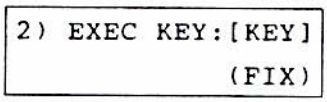
   Press the FILE key until ALARM_1 screen appears. Enter the value for AL 1 by pressing the Up or Down arrow key and ENT. Repeat for ALARM 2.



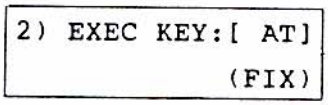
It is assumed that the alarm mode and sensitivity have already been entered on Menu Group 6) INITIAL DATA. If you want to change the Alarm Mode, sensitivity and others, refer to Section 3.4.

5.2 STARTING FIXED VALUE CONTROL OPERATION

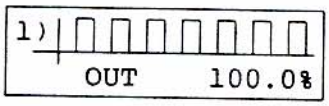
1. To start the fixed value control operation, press FUNC key until Menu Group 2) EXEC KEY appears. Press the Up or Down arrow to display the FIX screen, and ENT. The FIX light on the front panel will light.



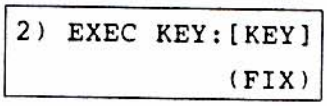
2. To start the auto-tuning (AT) run, press the Up or Down arrow key to display the AT screen, and press ENT. The AT light on the front panel will light.



3. Start the fixed value control (FIX). Press the RVS and FUNC keys to return to Menu Group 1) Monitor.

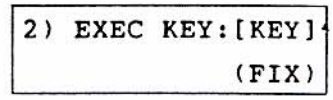


4. To halt the auto-tuning operation, press the FUNC key until Menu Group 2) EXEC KEY appears.
   Press the Up or Down arrow key to display the AT screen, and press ENT.
   The AT light on the front panel will go off.

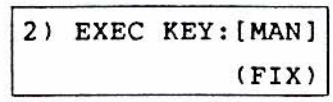


5.3 TO CHANGE FIXED OPERATION TO MANUAL

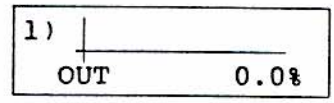
1. Press the FUNC key until the following screen appears.



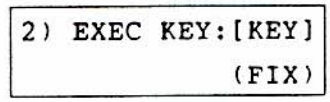
Press the Up or Down arrow key and ENT. The MAN indicator will light.



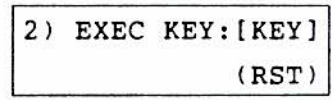
2. Manual operation should be made on the monitor screen. Press the RVS and FUNC keys until the following screen appears. Adjust the output manually by pressing the Up, and Down arrow keys.



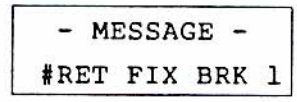
3. To return MAN operation to FIXED, press the FUNC key until the following screen appears.
   Press the Up or Down arrow key and ENT. The FIX indicator will appear.



4. To stop the fixed value control (FIX), press the FUNC key until Menu Group 2) EXEC KEY appears.
   Press the Up or Down arrow key to display the RST screen, and press ENT. The FIX light on the front panel will go off.



With the fixed value control stopped, the following message will appear.



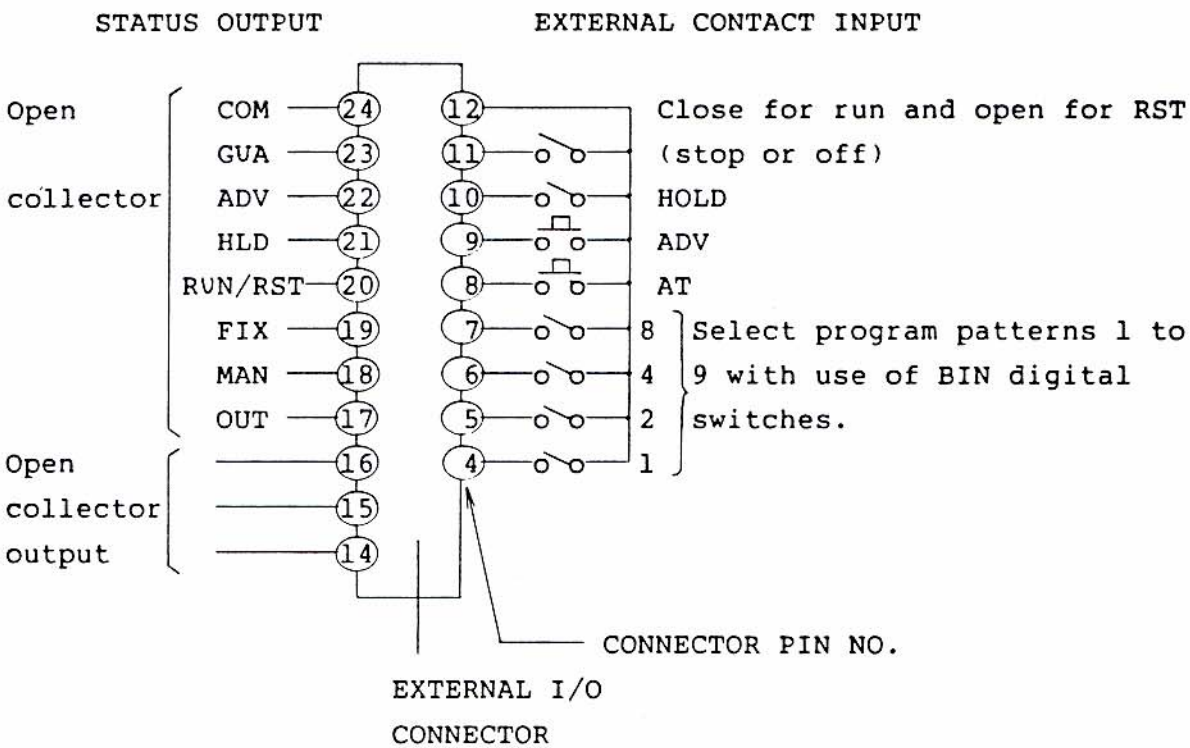
To restart the fixed value control, press the RVS and FUNC keys to display Menu Group 1) Monitor, and press the FUNC key to display Menu Group 2) EXEC KEY. Then repeat the procedures from step 1 above.

SECTION 6 PROGRAM OPERATION BY EXTERNAL CONTROL

1. Proceed as follows before calling out the operation mode, Menu Group 2) EXEC KEY.

   Set the program patterns.
   (a) Set the temperature at each step.
   (b) Set the time at each step.
   (c) Set the PID value at each step (not needed if AT is used).
   (d) Set the alarm value at each step.
   (e) Set the time signal at each step.

For external control, install switches externally, and wire as shown.



2. Switch to the external mode of control.

Press the RVS and ITEM keys to display Menu Group 1) Monitor, and press the FUNC key to display Menu Group 2) EXEC KEY (Operation Mode).

```
2) OPERATION MODE
                :(LOC)
```

Press the Up or Down arrow key to change (LOC) to EXT, and press ENT.

3. Start the external control.

Select a program pattern number using the BIN code switch. Closing the external switch RUN can start the program.

SECTION 7 SPECIFICATIONS

DIGITAL DISPLAY: 4 digit, 7-segment LED; PV (process value), red LED 0.56" high; SV (set value), green LED 0.39" high; PTN and STP, green LED 0.39" high

LCD DISPLAY: 16 alpha-numerical x 2 lines (with backlight)

DISPLAY ACCURACY: ±0.1% + 1 digit/standard accuracy at 23°C ±5°C resolution, 0.1 or 1 depending on range

INPUT (See Input Range Table): Thermocouple, up-scale break protection, input impedance 500 kohm min; RTD (alpha = 0.00385 or 0.00392), lead wire tolerance, 5 ohm max/wire; mV, up to 100 mV; V up to 10 V; input impedance 500 kohm min; current up to 20 mA, receiving impedance 250 ohms

Input Range Table

Input Code	Type	Range	
		°C	°F
TC	T Copper-Constantan	−199.9 to 200.0	−300 to 400
	J Iron-Constantan	0 to 600.0	0 to 1100
	E Chromega™-Constantan	0 to 700.0	0 to 1300
	K Chromega™-Alomega™	−100.0 to 400.0 0 to 800.0 0 to 1200	−150 to 750 0 to 1500 0 to 2200
	N Omegalloy®	0 to 1300	0 to 2300
	Platinel II	0 to 1300	0 to 2300
	R Pt-13% Rh/Pt	0 to 1700	0 to 3100
	S Pt-10% Rh/Pt	0 to 1700	0 to 3100
	B Pt-6% Rh/Pt-30% Rh*	0 to 1800	0 to 3300
	C W-5%Re/W-26%RE	0 to 2300	0 to 4200
RTD	100 ohm Pt, 3-wire	−199.9 to 600.0 −100.0 to 100.0 −100.0 to 300.0 −40.0 to 60.0 0.00 to 50.00 0 to 100.0 0 to 200.0 0 to 500.0	−300 to 1100 −150.0 to 200.0 −150.0 to 600.0 −40.0 to 140.0 0 to 120.0 0 to 200.0 0 to 400.0 0 to 1000
MV†	millivolt	−10 to 10 mV 0 to 10 mV 0 to 20 mV 0 to 50 mV 0 to 100 mV	
V†	Volt	−1 to 1 V 0 to 1 V 0 to 2 V 0 to 5 V 1 to 5 V 0 to 10 V	
MA†	Current	4 to 20 mA 0 to 20 mA	

** Effective range + 750 to 3300°F (400 to 800°C)*

† User-programmable scaling is available with scaling range of -1990 to 9999 digits.

SPECIFICATIONS (Continued)

SAMPLING CYCLE:	0.25 sec maximum
PV BIAS:	0 to ±999 units
DIGITAL FILTER:	0 to 200 times (input sampling setting)
CONTROL MODE:	Auto-tuning PID; proportional band, 0.1 to 999.9% FS; integral time, 1 to 6000 sec; derivative time, 0 to 3600 sec (PI mode at 0 setting)
AUTO/MANUAL SELECTION:	Balanceless, bumpless transfer
CONTROL OUTPUTS:	Relay contact, 240 Vac 2.5A resistive load, 1A inductive load; current, 4-20 mAdc, load resistance 600 ohm max; voltage, 0 to 10 Vdc, load current 2 mA max; dc Pulse 15 Vdc 20 mA/output rating
PROPORTIONAL CYCLE:	1 to 120 seconds variable
ALARM:	2 alarms, can be set independently hi/lo limit, absolute or deviation; rating 240 Vac 2.5A resistive load, 1 A inductive load
PROGRAM PROFILE CONTROL:	9 profiles max, 9 steps per profile, 81 steps max.
PROFILE REPEAT:	9999 times max.
PROFILE LINK:	9 patterns max.
PROFILE LINK REPEAT:	999 times max.
TIME 1:	0 to 99 hrs and 59 minutes/step
TIME 2:	0 to 99 minutes and 59 seconds/step
ANALOG OUTPUT OPTION:	2 outputs, one each for PV and SV: output signal, 0 to 10 Vdc, max. load current 2 mA; 0 to 10 mVdc, output resistance 10 ohms; 4-20 mA dc, load resistance 500 ohms max.; accuracy ± 0.01% FS vs display; resolution: 0.01% FS max.
DIGITAL COMMUNICATIONS OPTION:	RS-232C and/or RS-422A; interface speed, 1200, 2400 or 4800 bps selectable; data bit, 7-bit; stop bit, 1-bit
MEMORY PROTECTION:	Non-volatile
OPERATING AMBIENT TEMPERATURE RANGE:	14 to 122°F (-10 to 50°C), humidity 90% RH max.
POWER SUPPLY:	90 to 264 Vac, 50/60 Hz
POWER CONSUMPTION:	Approx. 17 VA
INSULATION RESISTANCE:	500 Vdc 20 Mohm between input terminal and power supply terminal; 500 Vdc 20 Mohm between power supply terminal and ground terminal
DIMENSIONS:	3.78" H x 3.78" W x 5.5.3" D (96 x 96 x 140 mm); panel depth 4.92" (125mm)
PANEL CUTOUT:	3.622" x 3.622" (92 x 92 mm)
WEIGHT:	1.65" lb (750 g)

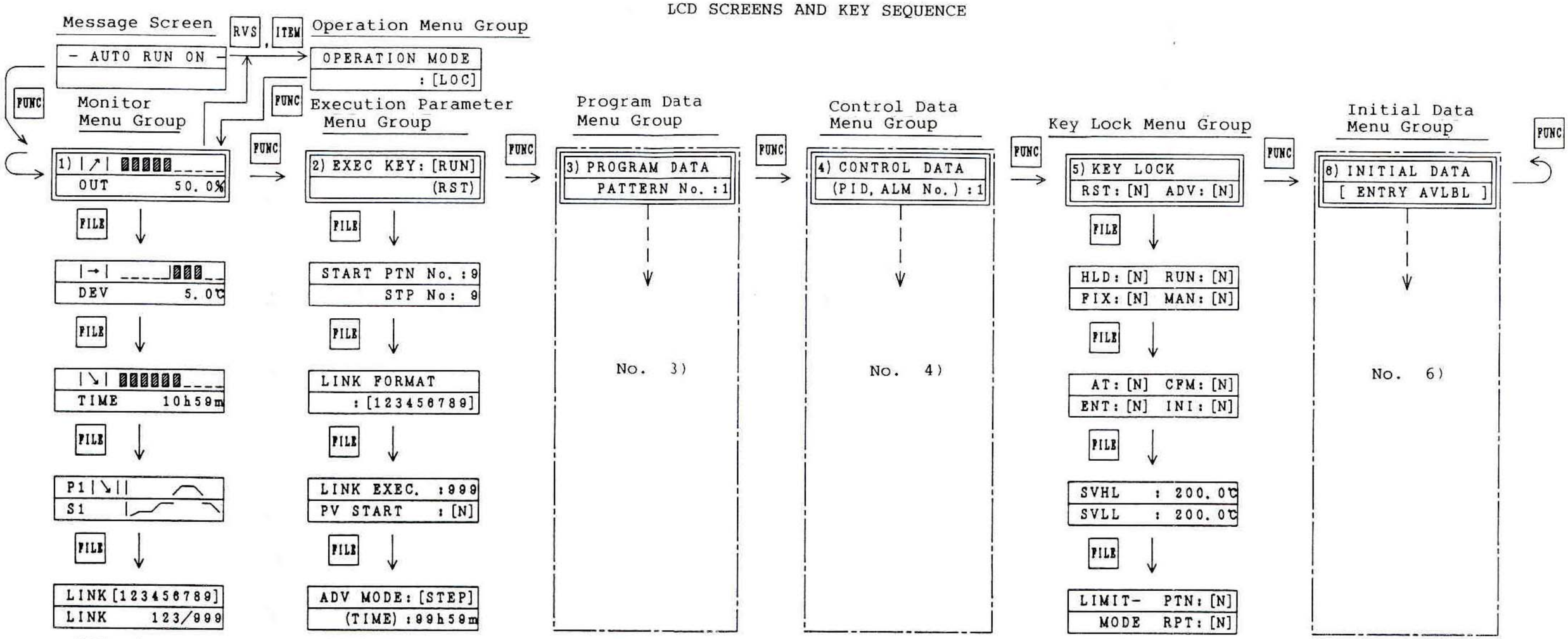
INITIALIZATION TABLE

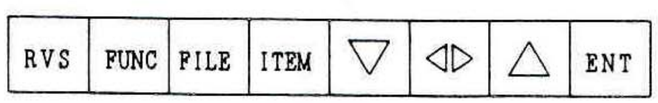
ITEM	INITIALIZATION
Operation mode screen	
OPERATION	LOC
Execute parameter menu group	
START PTN	1
	1
LINK FORMAT	No value
LINK EXEC.	0
PV START	N
ADV MODE	SILP
(TIME)	00h01m
FIX SV	0
PID	1
ALARM	1
Program data menu group	
PATTERN NO.	1
START SV	0
GUA SOAK	0
	00h00m
P1 - 9 PTN END	1
PTN RPT	0
P1 - 9 SV	0
S1 - 9 TIME	00h01m
P1 - S1 PIDNo.	0
P9 - S9 ALARMNo.	0
P1 - S1 IS1 - IS4	N
⋮ (ON TIME)	00h01m
P1 - S9(OFF TIME)	00h01m
Control data menu group	
CONTROL DATA (PID AL No.)	1
PID_1 P	5.0%
⋮ I	300S
PID_9 D	100S
PID_1 OH	100.0%
PID_9 OL	0.0%
ALARM_1	HL1
ALARM_9 AL1	100.0%IS value
ALARM_1	LL1
ALARM_9 AL2	0%IS value
Key lock menu group	
KEY LOCK RST.ADV	N.N
HLD.RUN	N.N
FIX.MAN	N.N

ITEM	INITIALIZATION
AT.CFM	N.N
ENT.INI	N.N
SV HL	100%FS value
SV LL	0%FS value
LIMIT PTN	N
-MODE RPT	N
CMF MODE	PTN
	1/60
Initial data menu group	
PV FILTER	0
PV BIAS	0
R/D ACTION	R
CYC TIME	SSR:3S 30S
TMT1.TMT2	PV.SV
TMT1 HL	100%FS value
(PV) LL	0%FS value
CMF MODE	100%FS value
	0%FS value
ALARM AL1	HL1
MODE AL2	LL1
AL1 SENS.	0.2%
AL2 SIBY	N
DI_1 MODE	PTN
DI_15	AT
DO 2 SET1	END
2, 3	TS3, TS4
DO_3 SET1	TS1
2, 3	TS2, SO
UNIT TC, Pt	°C
mV, V, mA	%
RID TYPE	Pt
RANGE TC	0.0 - 800.0°C
Pt	0.0 - 200.0°C
mV, V	0-10mV, 0-10V
mA	4 - 20mA
SCALE H	100.0%
L	0.0%
D.POINT	***.*
SO-MODE	RST
SO-OUT	0.0%
POWER ON MODE	NORMAL
TIME UNIT	min
PID	SERIES
MEMORY INITIAL	0

N = No., FS = Measuring range, h = hour, m = minute, and s = second

LCD SCREENS AND KEY SEQUENCE





(1) The RVS and FUNC keys can move the screen to the initial Monitor Menu Group (⊟)

(2) Pressing the FUNC key for any menu group other than the initial Monitor Menu Group (⊟) can move the current screen to the first screen.

(3) Pressing the RVS and FILE keys or the RVS and ITEM keys can reverse the screen.

(4) The RVS and ◁▷ keys can move the cursor among the parameters in any screen. The ◁▷ key can shift the digit place (cursor) up or down.

(5) The ▽ and △ keys can change the numeral and character data. For "=", the ENT key can determine (enter) the changed data.

(6) For ":", pressing the ENT key can move the cursor among the parameters in any screen as with the RVS and ◁▷ keys to enter the data changed upon "=".

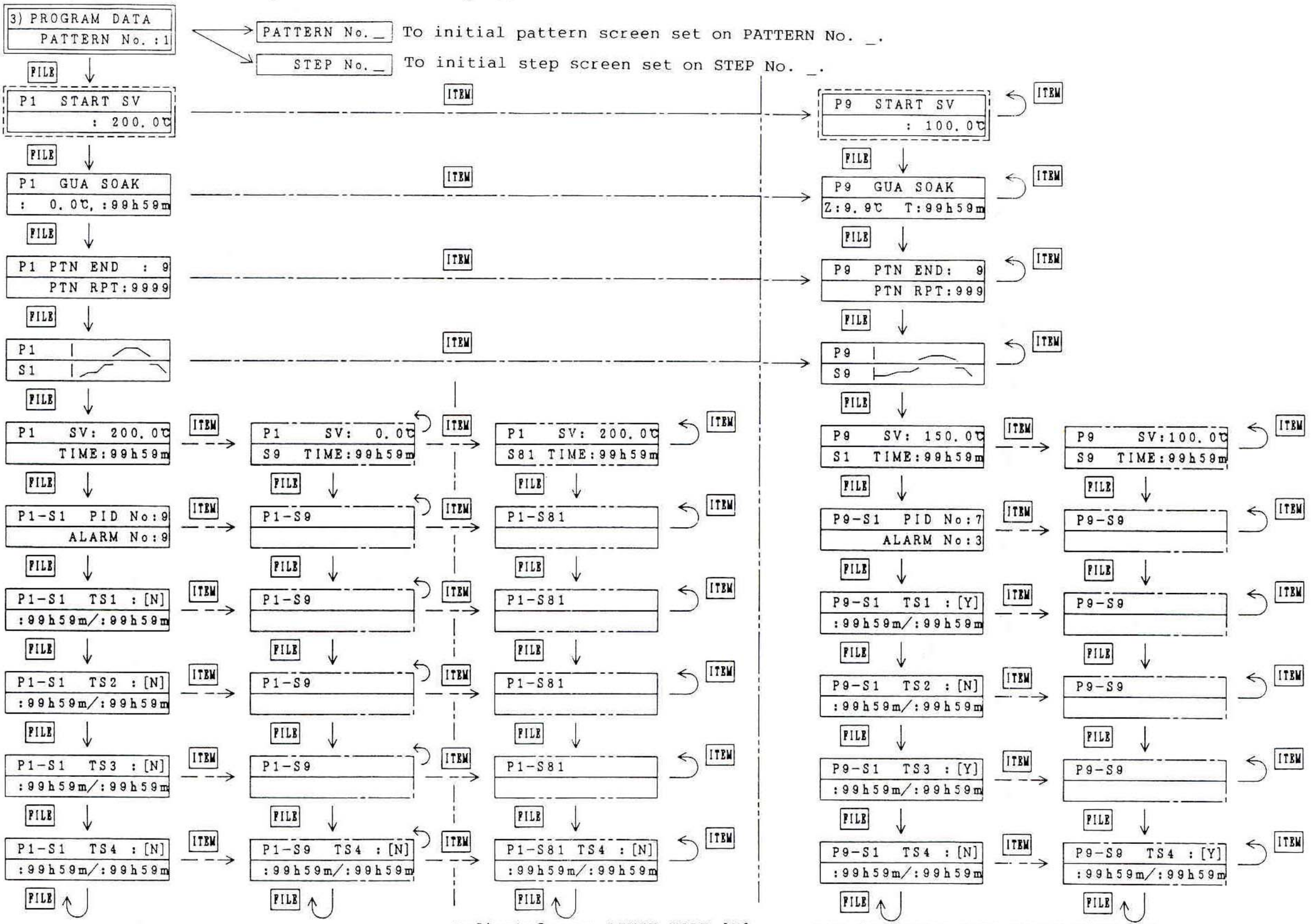
(7) The RVS and ▽ keys can indicate a lower limit to which setting can be made.

(8) The RVS and △ keys can indicate a higher limit to which setting can be made.

(9) For numerical data, the RVS and ENT keys can copy the data determined by the ENT key right before.

(10) Pressing the RVS key can indicate "□" at the lower left of the LCD screen. It will go off in around five seconds automatically to escape from the reverse state if another key is not pressed. While "□" is indicated, this can be made to go off with the RVS key pressed.

Program Data Menu Group 3)



Indicated upon LIMIT MODE [Y]

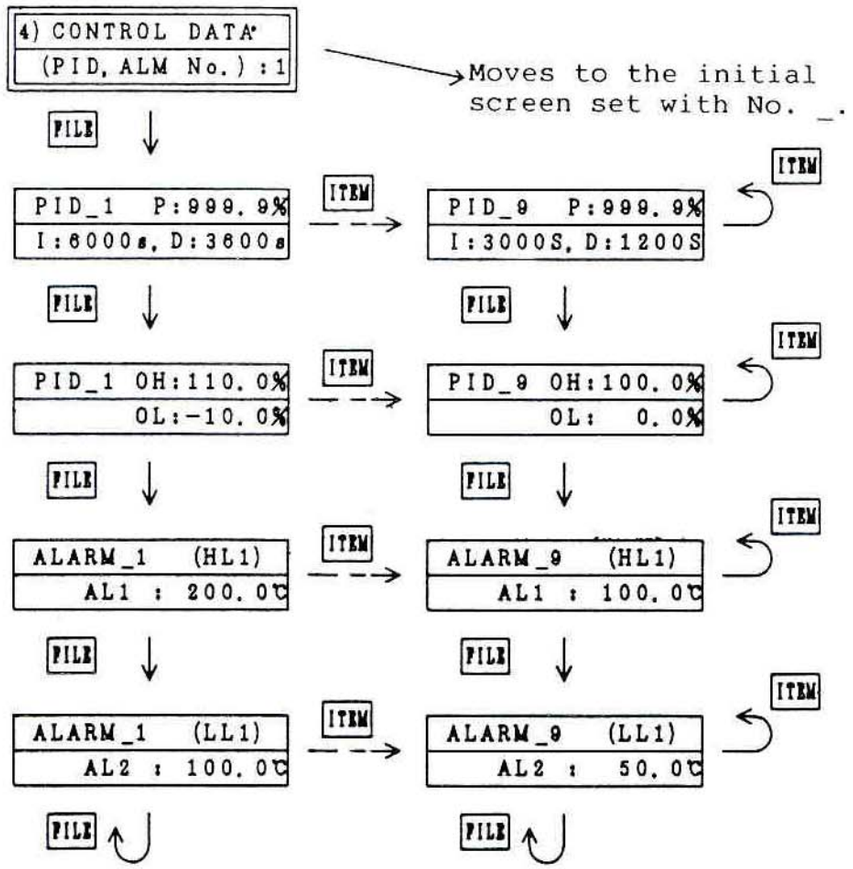
Not indicated upon LIMIT MODE [Y]

(1) In LIMIT MODE PTN [N], indication is of nine patterns and nine steps.
In LIMIT MODE PTN [Y], indication is of one pattern and 81 steps.

(2) If PATTERN No. _ is set on the initial screen ( ) upon [N], the screen moves to the initial screen ( ) of the pattern No. (P __) set.

(3) If STEP No. _ is set on the initial screen ( ) upon [Y], the screen moves to the initial screen (SV, TIME) of the step No. (Pl-S __) set.

Control Data Menu Group 4)



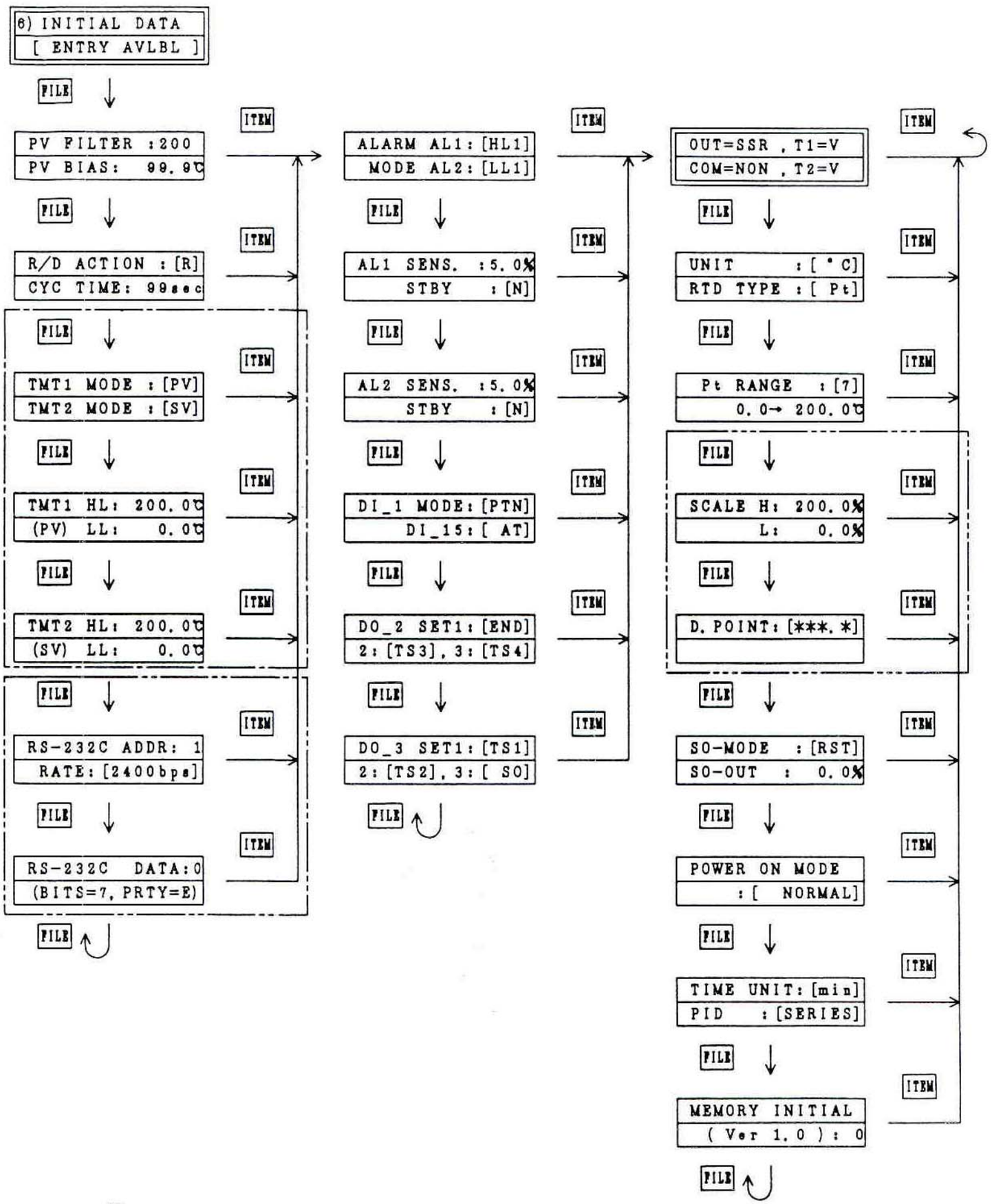
(1) The screen enclosed in [ ] is shown when an additional transmission output (option) is installed.

(2) The screen enclosed in [ ] is shown when an additional communication (option) is installed.

(3) The screen enclosed in [ ] is shown when a linear input is selected.

(4) INITIAL DATA Menu Group
The initial data cannot be changed at the time of DISPLAY ONLY.
The initial data can be changed at the time of ENTRY AVLBL.

Initial Data Menu Group 6)



WARRANTY

OMEGA warrants this unit to be free of defects in materials and workmanship and to give satisfactory service for a period of **25 months** from date of purchase. OMEGA Warranty adds an additional one (1) month grace period to the **two (2) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product. If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. However, this WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components which wear or which are damaged by misuse are not warranted. These include contact points, fuses, and triacs.

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FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATION,** consult OMEGA for current repair/calibration charges. Have the following information available BEFORE contacting OMEGA:

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2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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