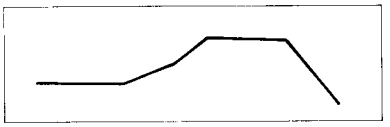
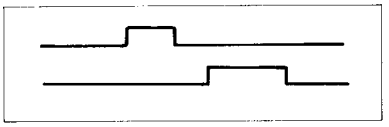
Program pattern

Map position	Segment item		1	2	3	···	···	20
A	SP	Upper display						
	Time	Lower display						

Main function (pattern data)

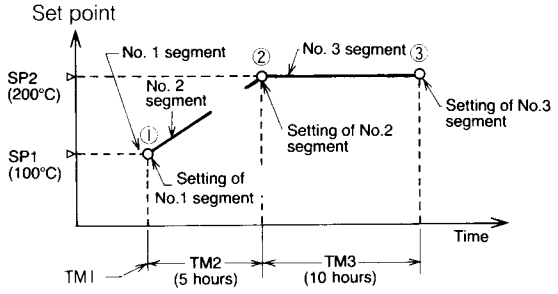


Subfunction (events and other data)



How to set a program pattern:

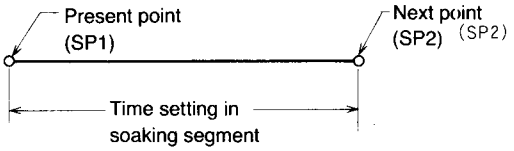
Set point



(1) Set the basic program pattern.
(2) Prepare each segment (broken line) sequentially by assigning one point as shown in ①, ②, ③ in the left figure.
(3) Assign points ① , ② , ③ by combining SP (set points) and TM (time) switch each other.
(4) The unit of TM (time) is either hour/minute or minute/second, and it can be assigned by SET UP C29.
Perform operation according to the assignment of C29 in the operation mode, irrespective of the assignment in the programming mode.

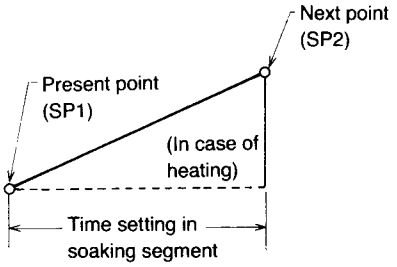
Segment No.	SP (Set point)	TM (time)	Description
1	100°C	0 hour	Start point designation. Soaking for 0 hour at 100°C
2	200°C	5 hours	Ramp segment designation. Heating for 5 hours up to 200°C
3	200°C	10 hours	Soaking segment designation. Soaking for 10 hours at 200°C

For setting the soaking segment, set the SP (set point) of the present point to the SP of the next point.

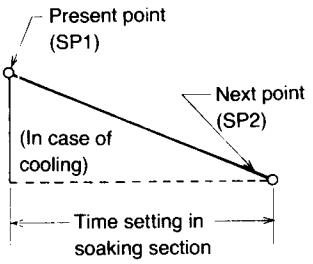


S P 1 = S P 2

For setting the ramp, make a differential between the SP (set point) at the present point and the SP at the next point.

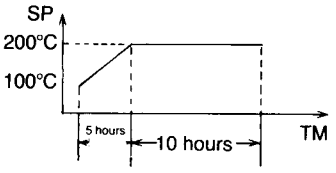


S P 1 < S P 2



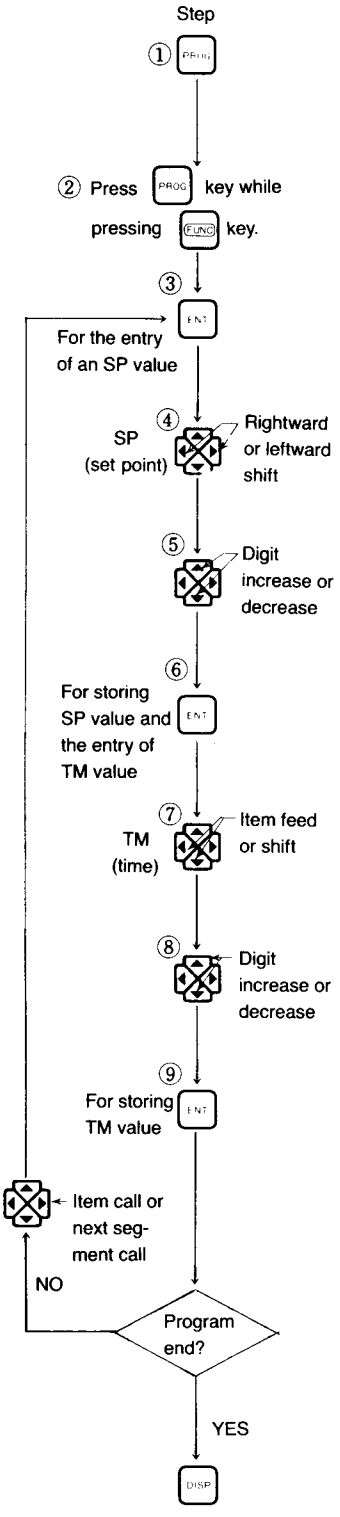
S P 1 > S P 2

Setting method



Setting range

SP	Input range. Limit range when SP limit is set.
TM	0 to 99 hours 59 minutes



Map position	Key operation	Display	Description of display	Display of profile
A 1	Press PROG key.	PROG SEG 1 1	Specifies program No. SP, TM, LED light.	
A 1	Press PROG key while pressing FUNC key.	SP — — — — TM — — — —	Sets to programming mode. PRG LED lights. PROG SEG 1. 1. decimal points light.	
A 1	Press ENT key.	SP — — — — TM — — — —	Segment 1 The last digit in SP display flashes. SP (set point) entry operation	
A 1	Press this key.	SP — — — — TM — — — —	Press this shift key (left), or continue pressing this shift key.	
A 1	Press this key.	SP 0100 TM — — — —	Increase the flashing digit by a digit increase key. Set SP=100(°C).	
A 1	Press ENT key.	SP 100 TM — — — —	The last digit in TM display flashes. TM entry operation	
A 1	Press this key.	SP 100 TM 00.00	Under this condition because TM=0 (hour)	
A 1	Press ENT key.	SP 100 TM 0.00	SP=100°C/TM=0 (hour) stored.	
A 2	Press this key.	SP — — — — TM — — — —	Segment 2 PROG SEG 1. 2.	—
A 2	Press ENT key.	SP — — — — TM — — — —	SP entry operation	—
A 2	Repeat ④ to ⑤ steps	SP 0200 TM — — — —	Set SP=200(°C).	
A 2	Press ENT key.	SP 200 TM — — — —	The last digit in TM display flashes. TM entry operation	
A 2	Repeat ⑦ to ⑧ steps	SP 200 TM 05.00	Set TM=5 (time).	
A 2	Press ENT key.	SP 200 TM 5.00	SP=200(°C)/TM=5 (hours) stored.	
A 3	Press this key.	SP — — — — TM — — — —	Segment 3 PROG SEG 1. 3.	—
A 3	Press ENT key.	SP — — — — TM — — — —	SP entry operation	—

Map position	Key operation	Display	Description of display	Display of profile
A 3	Repeat ④ to ⑤ steps	SP 200 TM ----	Set SP=200(°C).	
A 3	Press [ENT] key.	SP 200 TM ----	The first digit in TM display flashes.	
A 3	Repeat ⑦ to ⑧ steps	SP 200 TM 10.00	Set TM=10 (hours).	
A 3	Press [ENT] key.	SP 200 TM 10.00	SP=200°C/TM=10 (hours) stored.	
—	Press [DISP] key.	SP 100 TM 0.00	Programming mode ends.	

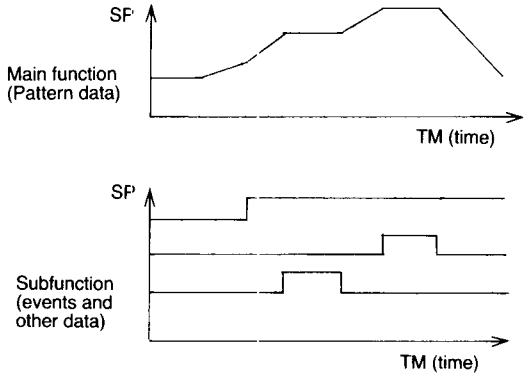
Press [ENT] key during the flashing of SP or TM data. If the [CLR] key is pressed while pressing [FUNC] key instead of setting data, all program data after the segment is deleted. Therefore, if this operation is done at the first segment, the entire program data are deleted.

(3) SUBFUNCTION SETTING

Complete the program work sheet.

Map position	Segment	1	2	3		20
A	S P . T M					
B	E V 1					
C	E V 2					
L	Cycle setting					

Map position	Segment	1	2	3		20
B	EV1 event No.1					
C	EV2 event No.2					



Finish the setting of the parameter mode items [9] [EE1] and [10] [EE2] first.

1. PV-based event circuit setting:

The PV-based event circuit is operated by comparing a PV and an event set point with each other.

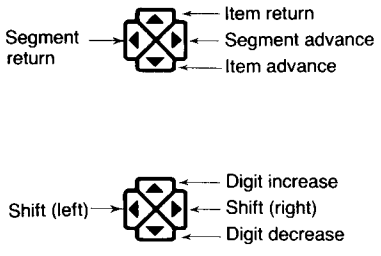
Type of event	Relay action
PV (direct) (Off in ready mode)	← F → ON, OFF, PV, △ EV
PV (reverse) (On in ready mode)	← F → ON, OFF, PV, △ EV

2. DEV-based event circuit setting:

The DEV-based event circuit is operated by comparing a deviation (PV-SP) and an event set point with each other.

Type of event	Relay action
DEV (direct)	← F → ON, OFF, PV, △ SP, △ SP+EV(EV>0)
(Off in ready mode)	← F → ON, OFF, PV, △ SP+EV(EV<0), △ SP
DEV (reverse)	← F → ON, OFF, PV, △ SP, △ SP+EV(EV>0)
(On in ready mode)	← F → ON, OFF, PV, △ SP+EV(EV<0), △ SP

Multi-keys



Map position	Keying operation	Display	Description
B 3	①Press item advance key. ②Press segment advance key.	PV	Shifts to B3 position ①PRG, EV1, and PV of display light. ②Display segment (map B3) for event setting.
B 3	Press [ENT] key.	PV	The first digit in a lower-display flashes.
B 3	①Press shift key. ②Press digit increase key.	PV 0100	Enter 100(°C).
B 3	Press [ENT] key.	PV 100	Store PV event 100°C.

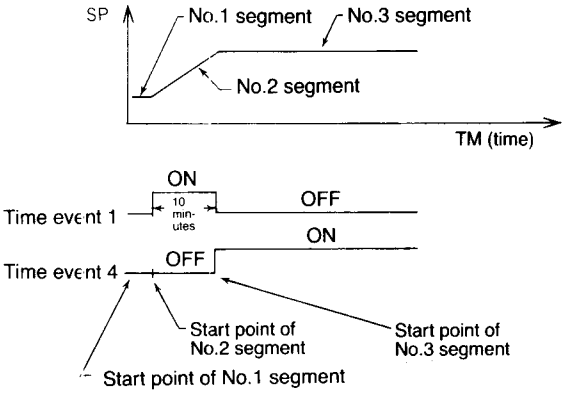
Setting range	
PV event	Input range
DEV event	0 to 50% FS of input range

(Note) Setting is deleted by pressing [CLR] key while pressing [FUNC] key instead of [ENT] key.

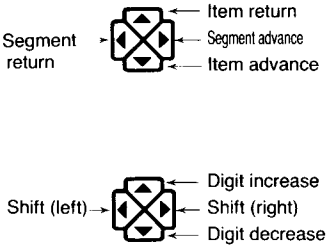
3. Time-based event circuit setting:

Map position	Segment	1	2	3		20
D	T1 time event					
E	T2 time event					
F	T3 time event					
G	T4 time event					

Time-based event circuit turns on and off with the program time, irrespective of the control output. They are specified by the time from the start point of the set segment.



Multi-keys

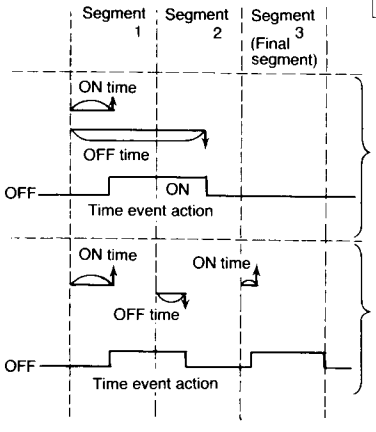


Map position	Key operation	Display	Description
D 2	①Press item advance key. ②Press segment advance key.	SP - - - - TM - - - -	Shift to D2 position ①RPG and T1 light. ②Display segment (map D2) for event setting.
D 2	Press [ENT] key.	SP - - - - TM - - - -	Press [ENT] key the first digit in upper display flashes for ON time setting.
D 2	Press ① key.	SP 0 0.0 0 TM - - - -	Set the time to turn on (0:00 in this case).
D 2	Press [ENT] key. (Note)	SP 0.0 0 TM - - - -	Press [ENT] key the first digit in a lower display flashes for OFF time setting.
D 2	①Press the shift key (left). ②Press the numeric value increase key.	SP 0.0 0 TM 0.0 0	Set the time to turn off (10:00 in this case).
D 2	Press [ENT] key. (Note)	SP 0.0 0 TM 0.0 0	Time event 1 setting {ON: 0:00 / OFF: 10:00}

(Note) Setting is cancelled by pressing [CLR] key while pressing [SHIFT] key instead of pressing [ENT] key.

Setting item	Contents
Upper display	ON time
Lower display	OFF time

Setting range	
ON time	0:00 to 99:59
OFF time	0:00 to 99:59



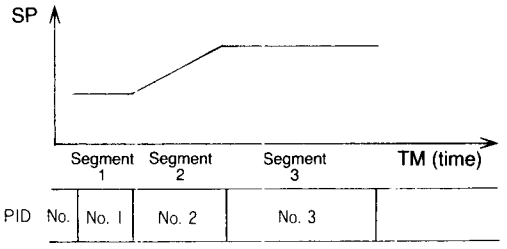
In example 1, ON time and OFF time are set as one set at segment 1. Time event setting for a time exceeding the time of one segment is also possible.

In example 2, the ON time only is set at segments 1 and 3, while the OFF time only is set at segment 2. ON and OFF can be set without combining ON and OFF time as one set. The time-based event circuit is turned off when the program ends.

4. PID group selection

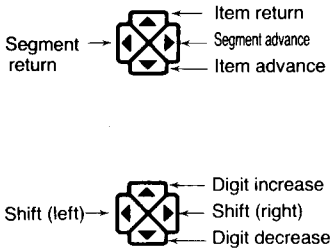
Map position	Segment	1	2	3	~	20
H	PID group selection					

PID group No. to be employed in a segment is specified out of PID1, PID2, and PID3.



Set point	Contents
1	PID 1 group is used.
2	PID 2 group is used.
3	PID 3 group is used.

Multi-keys



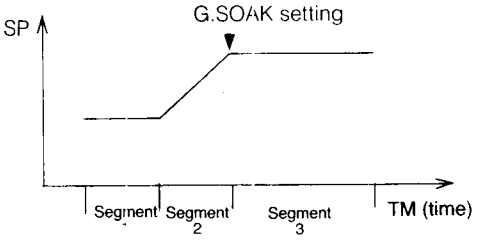
Map position	Key operation	Display	Description
H 2	①Press item advance key. ②Press segment advance key.	P i d 1	Shifts to H2 position. ① P id. 1 is displayed in the upper display. ②Display the segment (map H2) for PID setting.
H 2	Press ENT key.	P i d 0 0 0 1	1 f ickers in the lower display.
H 2	①Press digit increase key.	P i d 0 0 0 2	Increase the flashing digit to 2.
H 2	Press ENT key.	P i d 2	Store PID group No.2.

Note: PID values of each group are set by either PID tuning mode or AT action.

5. G.S (guaranteed soak) setting

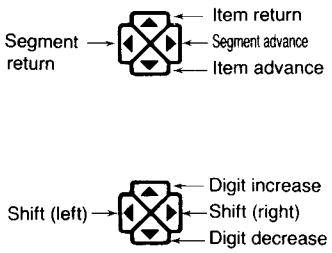
Map position	Segment	1	2	3	~	20
I	G.S setting					

Specify this item for setting G.SOAK (guaranteed soak).



Setting item	Contents
YES	G.SOAK is set.
no	G.SOAK is not set.

Multi-keys

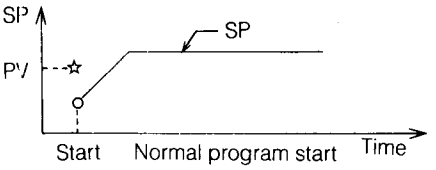


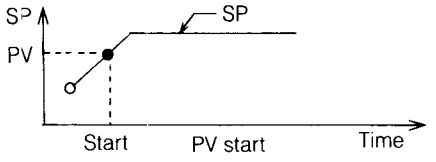
Map position	Key operation	Display	Description
I 3	①Press item advance key. ②Press segment advance key.	9.5. n o	Shifts to I3 position. ①LED lights. ②Display the segment (map I3) for G.SOAK setting.
I 3	Press ENT key.	9.5. n o	Press ENT key. no flashes.
I 3	①Press item return key.	9.5. Y E S	YES flashes.
I 3	Press ENT key.	9.5. Y E S	YES is set.

6. PV start setting

Map position	Segment	1	2	3		20
J	PV start setting					

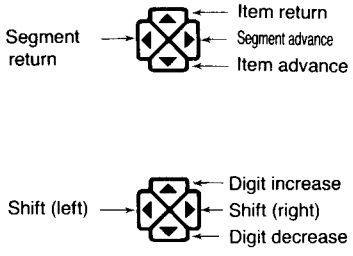
Specify this item for starting the program from the present PV.





Setting item	Contents
YES	PV start is executed.
no	PV start is not executed.

Multi-keys (nominal)

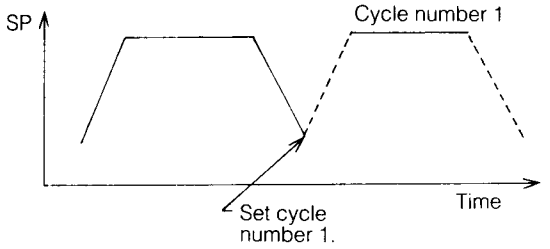


Map position	Keying operation	Display	Contents
J 1	①Press item advance key.	P.SEt A no	Data are displayed in the upper display. (Note) YES or no of PV start can be set at any optional segment.
J 1	Press ENT key.	P.SEt A no	no flashes.
J 1	①Press item return key.	P.SEt A YES	YES flashes.
J 1	Press ENT key.	P.SEt A YES	YES is set.

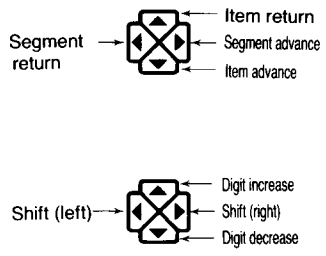
7. Cycle setting

Map position	Segment	1	2	3		20
K	Cycle setting					

Specify this item for executing the same program repeatedly.



Multi-keys (nominal)



Map position	Key operation	Display	Description
K 3	①Press item advance key. ②Press segment advance key.	CYCL 0	Shifts to K3 position. ① CYCL 0 is displayed in the upper display. ②Cycle number can be set in any optional segment.
K 3	Press ENT key.	CYCL 0	Press ENT key, 0 flashes.
K 3	①Press the digit increase key.	CYCL 1	Assume that the cycle number is 1, set the digit to 1. 1 flashes.
K 3	Press ENT key.	CYCL 1	Cycle number 1 is set.

6. PID TUNING

General

Specify and set P (proportional band), I (integral time), D (derivative time), and the upper-limit and lower-limit of manipulated variables.

Tuning is done by either manual tuning or auto tuning.

- Manual tuning (PID constants are set manually.)
- Auto tuning (PID constants are automatically set.)

Display/ setting order	Code	Tuning item	Selection or setting range	Initial value in display	Description
1	AT	Auto tuning selection	0: AT is not executed 1: Method 1 is executed by AT key. 2: Method 2 is executed by AT key.	0	Displayed only when auto tuning is provided. (Note) For methods, 1 and 2, see page 37.
2	P -1	Proportional band 1	0.0 to 999.9% (time proportional) type 0.1 to 999.9% (current output) type	100.0	
3	I -1	Integral time 1	0 to 3600 sec	0	Displayed when P≠0.
4	d -1	Derivative time 1	0 to 1200 sec	0	Displayed when P≠0.
5	oL-1	MV lower-limit 1	0.0 to upper-limit % (time proportional) type −10.0 to upper-limit % (current output) type	0.0 -10.0	Displayed when P≠0.
6	oH-1	MV upper-limit 1	Lower-limit to 100.0% (time proportional) type Lower-limit to 110.0% (current output) type	100.0 110.0	Displayed when P≠0.
7	rE-1	Manual reset 1	0.0 to 100.0%	50.0	Displayed when P≠0 and I=0.
8	P -2	Proportional band 2	0.0 to 999.9% (time proportional) type 0.1 to 999.9% (current output) type	100.0	
9	I -2	Integral time 2	0 to 3600 sec	0	Displayed when P≠0.
10	d -2	Derivative time 2	0 to 1200 sec	0	Displayed when P≠0.
11	oL-2	MV lower-limit 2	0.0 to upper-limit % (time proportional) type −10.0 to upper-limit % (current output) type	0.0 -10.0	Displayed when P≠0.
12	oH-2	MV upper-limit 2	Lower-limit to 100.0% (time proportional) type Lower-limit to 110.0% (current output) type	100.0 110.0	Displayed when P≠0.
13	rE-2	Manual reset 2	0.0 to 100.0%	50.0	Displayed when P≠0 and I=0.
14	P -3	Proportional band 3	0.0 to 999.9% (time proportional) type 0.1 to 999.9% (current output) type	100.0	
15	I -3	Integral time 3	0 to 3600 sec	0	Displayed when P≠0.
16	d -3	Derivative time 3	0 to 1200 sec	0	Displayed when P≠0.
17	oL-3	MV lower-limit 3	0.0 to upper-limit % (time proportional) type −10.0 to upper-limit % (current output) type	0.0 -10.0	Displayed when P≠0.
18	oH-3	MV upper-limit 3	Lower-limit to 100.0% (time proportional) type Lower-limit to 110.0% (current output) type	100.0 110.0	Displayed when P≠0.
19	rE-3	Manual reset 3	0.0 to 100.0%	50.0	Displayed when P≠0 and I=0.
20	Iout	PID operation Initial MV	0.0 to 100.0%	0.0	Displayed, if at least one P=0 out of 1 to 3 groups.

PID tuning procedure

Refer to the key operation note on page 15.
For the contents of PID tuning mode, see page 36.
This paragraph describes the operating procedures for the selected PID tuning items out of No. 1 to 20.

Press [PID] key.

[1] Auto tuning selection

SP display: AT
TM display: 1

Initial tuning display:
0: AT is not executed.
1: Method 1 is executed by AT key.
2: Method 2 is executed by AT key.

Auto tuning method 1 or 2 is described below.

1: Method 1
The most popular control constants can be set automatically. Overshoot may more or less occur. This method is used when the arrival time to a set point is regarded as important.

2: Method 2
This method is used when noticeable overshoot is presumable on an equipment or when it is desired to suppress overshoot. In many cases, the overshoot is restricted. However, rising is apt to be delayed.

[2] Proportional band 1

SP display: P-1
TM display: 100.0

Initial tuning display

[3] Integral time 1

SP display: I-1
TM display: 0

Initial tuning dislay

[4] Derivative time 2

SP display: d-1
TM display: 0

Initial tuning display

Setting range:

P-1, P-2, P-3 : 0.0 to 999.9% (time proportional type)
0.1 to 999.9% (current output type)

I-1, I-2, I-3 : 0 to 3600 sec

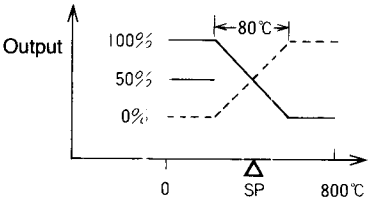
d-1, d-2, d-3 : 0 to 1200 sec

P: This constant determines the deviation ratio of a PV to a set point of a temperature, where the control output is to be set to 0 or 100. This value is set by %, and an about 10% is generally used for electric furnaces.
As this range becomes narrower, the sensitivity becomes higher. But, if the range is extremely narrow, an undulation phenomenon occurs.

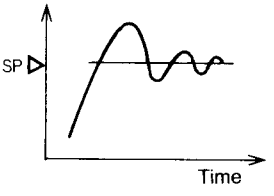
I and D: Unlike in on/off action, the P control action does not easily produce any undulation phenomenon. However, it is possible that the temperature remains deviated from a set point.
I and D control action are provided for preventing such a failure. In electric furnaces, I is generally set to 150 sec, while D is generally set to about 30 sec. As I becomes shorter, or as D becomes longer, the control function becomes stronger. However, the control function is too strong to ensure the control to be executed satisfactorily at all times.
Both I and D are off at 0.

(Examples)

In case of 10% proportional band in 0° to 800°C range, P is 80°C.



If I is short (strong), the control may often become excessive.



[5] MV lower-limit 1

SP display: oL-1
TM display: 0.0

Initial tuning display

[6] MV upper-limit 1

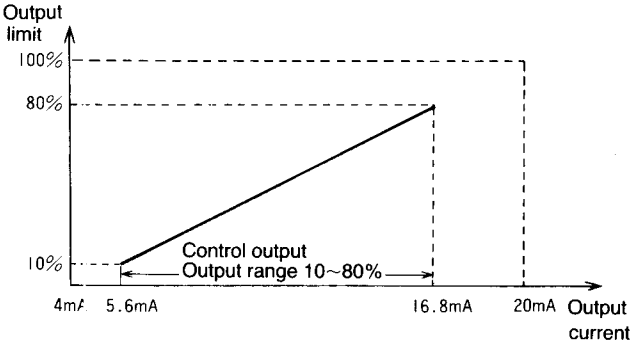
SP display: oH-1
TM display: 100.0

Initial tuning display

Setting range

oL-1, oL-2, oL-3 : 0.0 to upper-limit %
(Time proportional type)
−10.0 to upper-limit %
(Current output type)

oH-1, oH-2, oH-3 : Lower-limit to 100.0%
(Time proportional type)
Lower-limit to 110.0%
(Current output type)



7. OPERATION MODE

Check and set the following items before starting the program.

1. Is PV start executed?
   See page 19, 35.
2. Is auto tuning executed?
   See page 36, 37.
3. Are PID constants set? Is the output limiter set?
   See page 34, 36.
4. Is PV bias used?
   See page 24, 25.
5. Is SP bias used?
   See page 24.
6. Is PV filter used?
   See page 24, 25.
7. Is the MV change quantity limit set?
   See page 24, 26.
8. Is the program protect function provided?
   See page 24, 25.

Key operation

[PROG] : Specifies the program number.

[RUN/HOLD] : Change the mode from ready to RUN or from RUN to HOLD.

[DISP] : Specifies the display contents of the upper-display and lower-display.

* For resetting to the ready mode (from RUN or HOLD), press [RUN/HOLD] key while pressing [PROG] key.

* For advancing the segment by one under RUN/HOLD mode, press [DISP] key while pressing [PROG] key.

Monitoring during program run

1. The program number and segment number display contents are as shown below during run and programming check.

PROG	SEG		PROG	SEG
1	1		1.	1.
In RUN/HOLD display, "." does not appear.			During programming or programming check, "." appears.	

2. When [DISP] key is pressed, the upper- and lower-display indicator lamps indicate the contents of both upper- and lower-display by their combinations.
   The upper- and lower-display indication lamps are combined with each other as follows.

Upper- and lower-display indicator lamps

SP
DEV
OUT — Upper-display

TM
CYC
PV — Lower-display

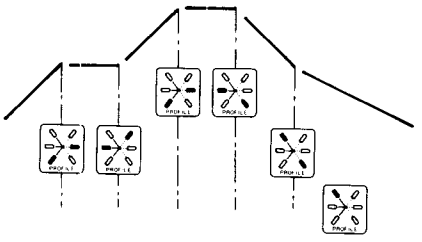
Combinations of upper- and lower-display indicator lamps

Upper-display	SP	DEV	OUT	TM	CYC	SP
Lower-display	PV	PV	PV	PV	PV	TM

3. Mode indication by mode indicator LED lamps

   RUN: Lights during run.
   HLD: Lights during hold.
   MAN: Lights in manual operation mode.
   PRG: Lights in programming mode.
   (Note) None of mode indicator lamps lights under the ready mode.

4. Running pattern conditions, easily monitorable by profile indicator LED lamps



Program status display:
- Indicates rising, soaking, and falling tendencies of program pattern.
- Indicates the present segment and next segment.

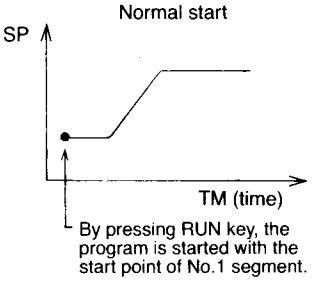
5. For identifying pattern which has already set or not, check if the upper-display shows the following contents when a program number is entered by [PROG] key.

Upper-display — — — —

Lower-display

1 Starting program

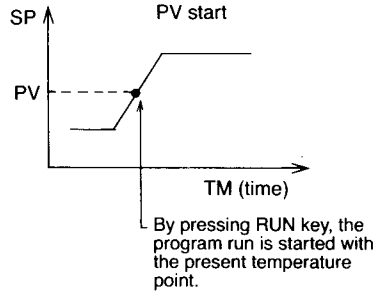
Specify the PV start no in programming. See page 35.
When PV start is set to no in programming, the normal start is done.
When PV start is set to YES in programming, the PV start is done.



Display	Key operation	Description of contents
PROG 1 SEG 1	Press PROG key.	Specify a program No. Press this key by necessary times.
PROG 1 SEG 1 SP 100 RUN TM 5.00	Press RUN/HOLD key.	Runs. •RUN LED lights. •PROFILE LED lights.

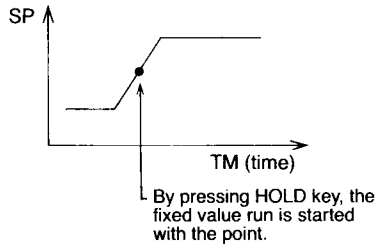
2 Starting a program from a preset temperature

Specify PV start YES in programming. See page 35.



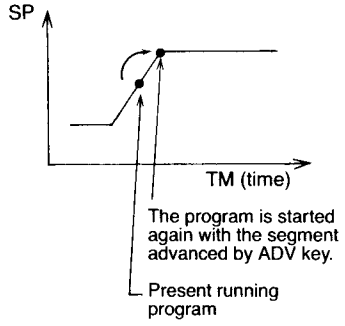
Display	Key operation	Description of contents
PROG 1 SEG 2	Press PROG key.	Specify a program No. Press this key by necessary times.
PROG 1 SEG 2 SP 150 RUN TM 4.00	Press RUN/HOLD key.	Runs. •RUN LED lights.

3 Holding a program



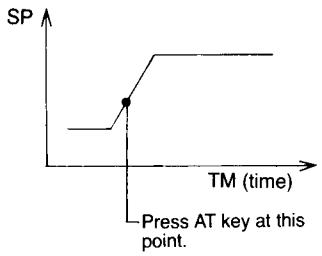
Display	Key operation	Description of contents
HLD	Press RUN/HOLD key.	Holds. •HOLD LED lights.

4 Advancing a program to a new segment



Display	Key operation	Description of contents
PROG 1 SEG 2 SP 150 RUN PV 4.00		Running.
PROG 1 SEG 3 SP 200 RUN TM 10.00	Press DISP key while pressing PROG key.	Perform ADV operation. The program proceeds to the start point of the next segment.

5 Starting auto tuning



Display	Key operation	Description of contents
PROG 1 SEG 2 SP 150 PV 4.00		During RUN or HOLD.
PROG 1 SEG 2 SP 150 PV 4.00	Press AT key.	Auto tuning is started. •AT LED lights.
		Auto tuning ends automatically.

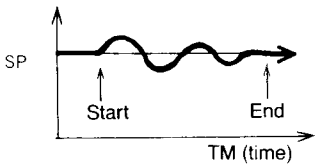
Description of auto tuning (AT) (option)

- Auto tuning is executed only when all the following conditions are satisfied.

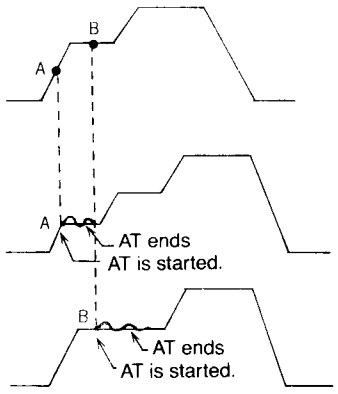
① RUN or HOLD mode
② AUTO mode
③ PID constant is set to "1" or "2".
④ PV is within the range.

- When auto tuning ends, the PID group constants used for the segment are replaced with new constants by auto tuning.
- For stopping this auto tuning, press AT key during auto tuning. The auto tuning stops, and PID constants are not rewritten.

Auto tuning method:



The on-off operation is repeated twice at about the set point of a temperature, and PID values newly calculated are used.
Whether the first control action is on or off depends upon the condition of PV and SP at that time.



Auto tuning at point A
Be careful because a stepwise pattern appears halfway in the course of ramp.

Auto tuning at point B
The program automatically stops advancing temporarily when executing auto tuning.
It is automatically restarted after the end of auto tuning.

6 Selecting manual control for the process

Display	Key operation	Description of contents
OUT 200 PV 2.00	Press A/M key.	Upper-display for main output (MV or SP). Lower-display for PV.
	Press key.	MV or SP change Set an output value by multi-keys. The value is effective, even if ENT key is not pressed.

Press A/M key when returning to the automatic operation mode.

7 Stopping a program

Display	Key operation	Description of contents
RUN SP 200 PV 2.00		Running
SP 200 PV 2.00	Press RUN/HOLD key while pressing PROG key.	Program is reset to the ready mode. •RUN and HLD LEDs are off.

8 Copying stored program data under a different program number

Display	Key operation	Description of contents
PROG 1 SEG 1 SP 100 TM 0.00	Press PROG key.	Select a program number of the copy source by PROG key in an AUTO mode.
PROG 1 SEG 1 SP COPY TM ----	Press PROG key while pressing this key. →	COPY is indicated on the upper-display, and ---- is indicated on the lower-display. No display appears, if the copy source is not available.
PROG 1 SEG 1 SP COPY TM 0003	Press this key.	Select a program number in the lower-display program number is not displayed if some program is set already for the number.
PROG 1 SEG 1 SP COPY TM 3	Press ENT key.	Press ENT key to copy the program. However, it is not copied, if the total number of preset events of the instrument exceeds 200, the lower-display indicates ---- .
	Press DISP key.	Returns to the ready mode.

9 Changing program data

Select the mode to be corrected.

Setup mode ——— SET UP

Parameter mode ——— PARA

PID tuning mode ——— PID

Programming mode ——— FUNC + PROG

Select an item to be corrected by ◁▷△▽ keys, and press ENT key.

Change program data by ◁▷△▽ keys, and press ENT key.

10 Storing the setting range limits of a program

Setup mode. ····— [SET UP]

C10 : Lower-limit value
C11 : Upper-limit value

Select C10 or C11 by [SET UP] or [◆] keys, and press [ENT] key.

Change the program data by [◆] keys, and press [ENT] key.

11 Deleting stored data

Set the ready mode.

[PROG] + [RUN/HOLD] in RUN/HOLD mode.

[A/M] in MANUAL mode.

[DISP] in other cases.

Select the program No. of the program to be deleted by [PROG] key.

Select the programming mode by pressing [PROG] key while pressing [FUNC] key.

Display the values of SP (set point) and TM (time) of segment 1 by [◆] keys.

Start changing the values of SP or TM by [ENT] key to flash the value.

The program can be deleted by pressing [CLR] key while pressing [FUNC] key.

12 Alarm code display

If a PV alarm or an instrument alarm is detected, a program segment No and its alarm code are displayed on the PROG/SEG indicator alternately every second, but the instrument run and other action are continued.
However, if A90 alarm occurs, its alarm code only is continuously displayed on the PROG/SEG indicator, and the lower-stage indicator displays the present board input/output and option type.
The instrument does not start any action.

Alarm code	Meanings	Remedial measures
A01	PV is not within a range of −10 to +110% FS	Check the sensor/disconnection.
A90	PC board is not properly mounted. (Check it only when power is turned on.)	Ask for repair.
A92	EEPROM is defective.	Ask for repair.
A94	SETUP and PARA parameter contents were broken.	Reset.
A95	PID parameter contents were broken.	
A96	Program pattern contents were broken.	
A98	RAM is defective.	Ask for repair.
A99	ROM is defective.	

13 Condition (of the DCP200) after recovery from a power failure

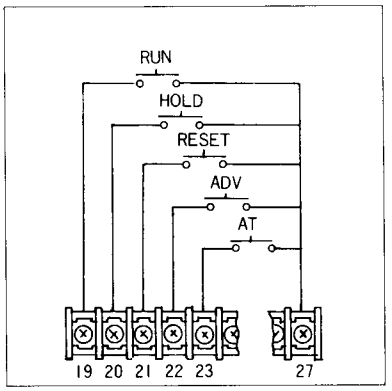
- A power failure to the DCP200 will occur when its power supply drops below 70V AC and remains below this level for longer than 100 msec.
- After sufficient power has been generated, all functions of the instrument will return to conditions existing before the failure, i.e. the display mode will continue operations from the point immediately before the failure. Operating time will also progress from the point immediately before the failure.
  However, the LED display and the EVENT operation will only reappear two to three seconds after sufficient power has been generated; upon reactivation, their timing will not coincide with the other operations' timing.

8. REMOTE OPERATION

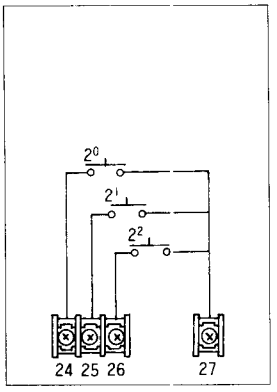
1. Remote operation

RUN, HOLD, RESET, ADV, AT, and other operations can be done by using external contacts. An automatic operation of the DCP200 can be made automatically by combining this remote operation function with a sequencer.

Remote operation terminals



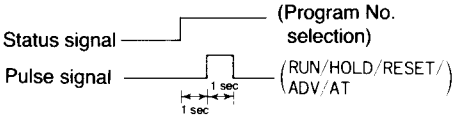
Program No. selection terminals

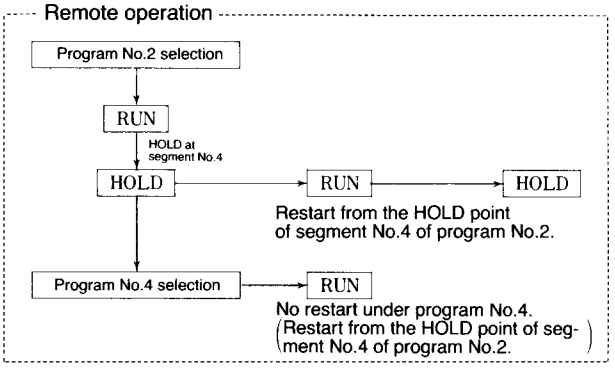


Program No.	Terminal connection
1	㉗—㉔
2	㉗—㉕
3	㉗—㉔, ㉗—㉕
4	㉗—㉖,
5	㉗—㉔, ㉗—㉖
6	㉗—㉕, ㉗—㉖
7	㉗—㉔, ㉗—㉕, ㉗—㉖

(Example) Starting program No. 1

Operation	Terminal connection
1. Program No. 1 selection	㉗ and ㉔
2. Program start	㉗ and ⑮





- The remote run start sequence is as follows:
  Turn off RUN, HOLD, RESET, ADV and AT switches, and set three program No. setting switches.
  After one second or longer, continue turning on the RUN switch for longer than 1 second.

2. Description of remote operation

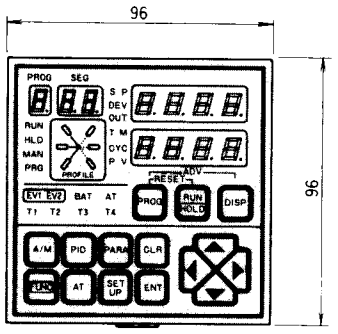
The remote input is acceptable when any one of RUN, HOLD, RESET, ADV and AT switches is turned on continuously for longer than 1 second after three switches of program No. were continued to be held for longer than 1 second with RUN, HOLD, RESET, ADV, and AT swtiches turned off. Setting of SETUP key lock does not affect any remote operation.

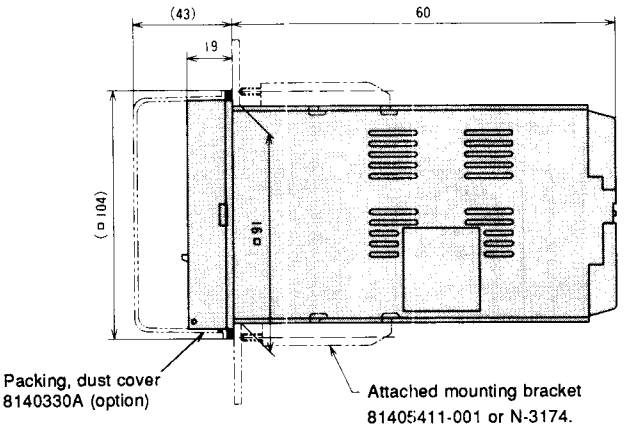
1) Remote operation
   If a program specified by three program No. switches is already programmed when none of setting operations (programming, PID, PARA, SETUP) is done in the ready mode, the program is started running.
   The program runs continuously from the HOLD point in the HOLD mode, irrespective of whether setting operations are executed or not. (The program number of the program to be run remains unchanged even if the specified program number differs from the running program number.)
2) Remote HOLD operation
   The program is set to HOLD mode during run, irrespective of whether setting operation is done or not.
3) Remote RESET operation
   The program is set to READY mode (waiting for run) in RUN or HOLD mode, irrespective of whether setting operation is done or not.
4) Remote ADV operation
   The program advances to the start point of the next segment in RUN or HOLD mode, irrespective of whether setting operation is done or not.
5) Remote AT operation (AT function is option.)
   Auto tuning is started, if AT is not being executed. Or it is stopped, if AT is being executed when setting operation is not done in RUN or HOLD mode.
6) Remote program number selection
   Select a program number (No.1 to 7) by three switches when the remote RUN operation is done in the READY mode. Program No. 0 means the designation of a program which has already been selected by the console.

9. EXTERNAL DIMENSIONS

External dimensions

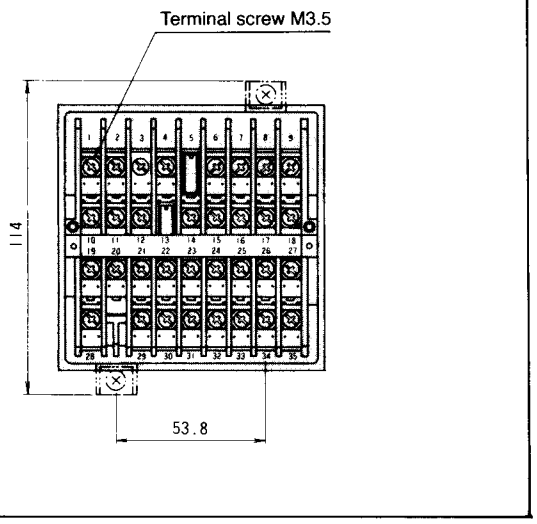
[in mm]

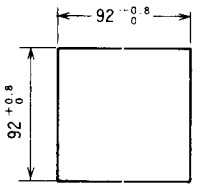




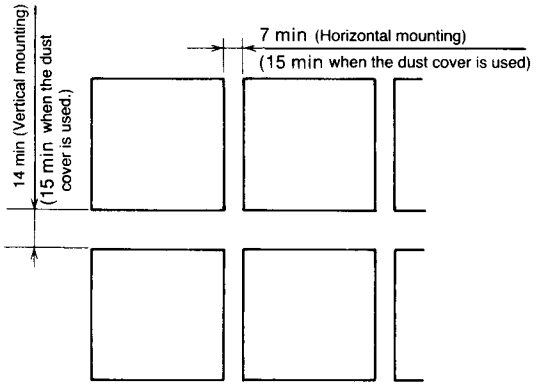
Panel cutout size

[in mm]

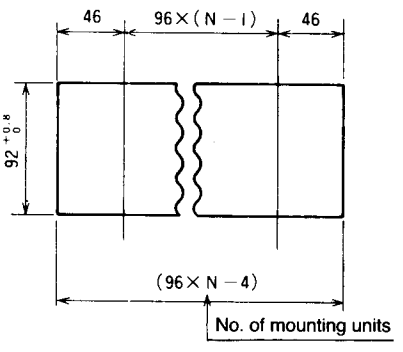




Panel cutout size



Vertical and horizontal mounting panel cutout sizes (recommendable)



Panel cutout size for closed mounting (recommendable)

10. INSTALLATION

1. Mounting place

Mount the instrument at following places in the same way as in general digital electronic instruments.

(1) A place free of any noticeable temperature change at normal temperature or so (within 0° to 50°C)
(2) A place free of a corrosive gas atmosphere
(3) A place not subjected to a low or high humidity (10 to 90% RH)
(4) A place free of mechanical vibrations (less than 2 m/s^2, 10 to 60 Hz)
(5) A place free of dust particles, soot, or the like
(6) A place where is not affected by electrical noises
(7) A place where is not subjected to a strong magnetic field
(8) A place free of any flammable liquids or vapors.

2. Mounting method

(1) Keep instrument within a mounting angle of 15°, if it is tilted down from the horizontal level on the rear side
(2) Use a steel panel having a plate thickness of thicker than 2 mm.
(3) Insert the instrument case from the panel cutout.
(4) Fix the upper and lower panels of the instrument securely by using the attached mounting brackets.
(5) Fix the panels to lower mounting bracket (1) first.
(6) When the mounting brackets are flush against both a and b (where there is no longer any play between the mounting brackets and mounting panel), tighten the screw by about one turn. Do not tighten the screws too hard. Doing so might deform the case.

The controller must be mounted on a mounting panel, and its terminals covered to prevent electrical shock.

An optional terminal cover (Part No.: **81446084-002**) is so separately.

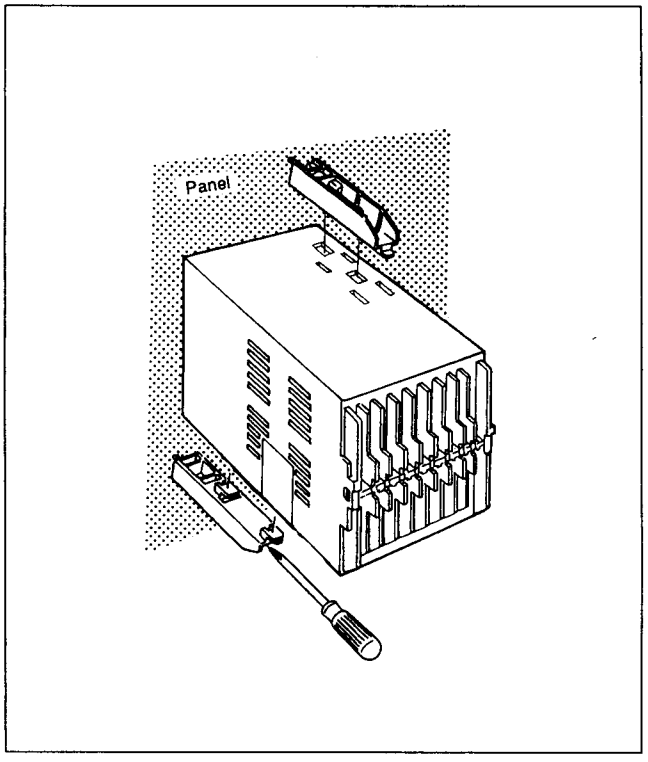


Fig. 10-1 Mounting method

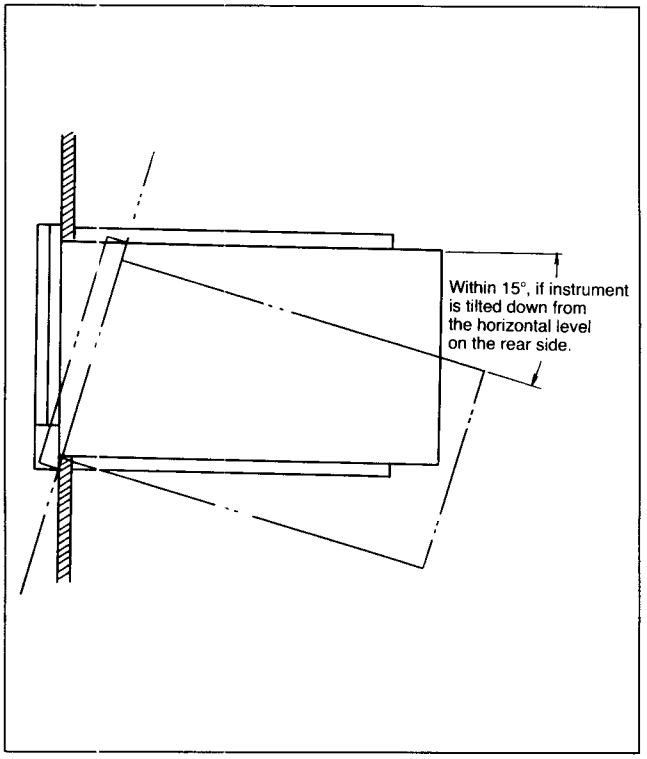


Fig. 10-2 Mounting angle

11. WIRING

Caution: Use shielded cables for the DCP200 input/output cables so as not to introduce noises.

1. Cautions on wiring

(1) Digital units are apt to be affected by electrical noises, so that a trouble and a wrong operation may be caused by those which are negligible for analog units. In order to prevent an effect of noises, connect cables with due care according to the instructions of this chapter.

(2) Use solderless terminals conforming to M3.5 screws.

(3) Connect cables according to the wiring diagram of the corresponding model number after confirming the instrument model number. After wiring, check them for normal conditions.

(4) Separate input/output signal cables from a power cable as far as possible.
Don't pass both cables through the same conduit or duct.

2. Input/output signal cables

2.1 Thermocouple input signal cable

(1) Connect a thermocouple line cable to terminals in case of a thermocouple input. Connect the thermocouple input by extending it with a compensating lead wire, if the wiring distance is long or a sensor is connected to terminals.
Use a shielded compensating lead wire.

2.2 Input signal cables for those other than thermocouples, and digital input/output signal cables

(1) Use a shielded polyethylene insulated vinyl sheathed cable for instrumentation use conforming to JCS-364 or equivalent (generally called a twisted shielded for instrumentation use).

(2) A shieldec multiconductor microphone cord (MVVS) may be used, if electromagnetic induction noises are comparatively low.

References Recommendable commercially available twisted shielded cables (JAPAN)

Fujikura Cable Co.	2 conductors	IPEV-S-0.9 mm^2×1 P
	3 conductors	ITEV-S-0.9 mm^2×1 T
Hitachi Cable Co.	2 conductors	KPEV-S-0.9 mm^2×1 P
	3 conductors	KTEV-S-0.9 mm^2×1 T

2.3 Remote switch input contact

(1) Use a no-voltage remote switch input and a micro-current contact.

(2) Hold a contact signal for longer than one second.

2.4 Signal cables for communication use (additional function)

(1) Be careful since the communication circuit may be broken, if (+) and (−) communication terminals are shorted with each other.

(2) Don't connect the DCP200 togehter with another instrument connected to the same RS-422 communication line to the same addresses.
(Zero has no communication)

3. Grounding

(1) Connect the instrument by one-point grounding to G terminal. Don't perform any jumper wiring.
Mount a grounding terminal board (earth bar) separately and connect shielded cables, etc. to ground as shown in Fig. 11-1, since only one G terminal is provided.
- Grounding type: Category 3 grounding or higher (Lower than 100Ω)
- Grounding wire: Annealed copper wire of more than 2mm^2 (AWG14)
- Grounding wire length: Max. 20 m

4. Instrument power supply

(1) Obtain the DCP200 power supply from a single-phase instrument power source in such a way as the instrument is not affected by noises as much as possible.

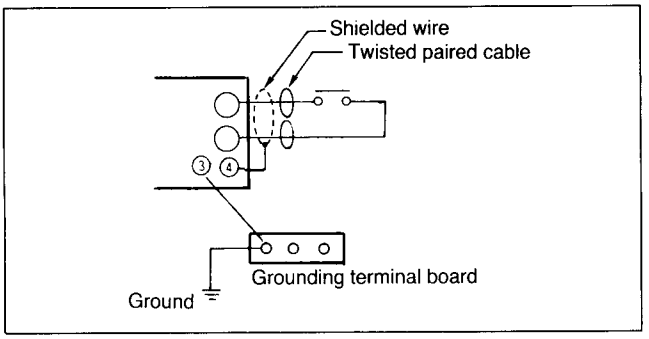


Fig. 11-1 Grounding method

(2) It is recommended to use a line filter having an additional insulation transformer, if noises are introduced noticeably from the power source.

- Line filter
  Part number 81446364-001

  Be careful not to bundle the primary and secondary of the power cable together or not to put them into the same conduit or duct after taking a countermeasure against noises.

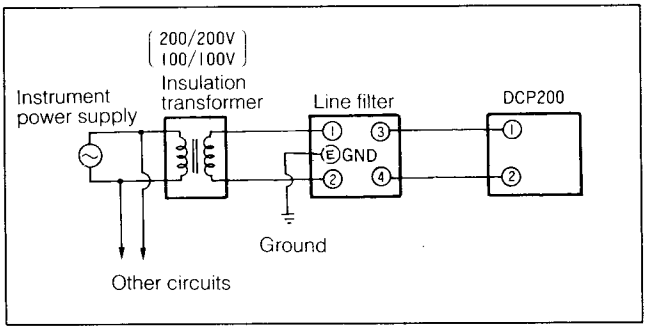


Fig. 11-2 Power noise reduction method

5. Noise generation sources and noise reduction methods

5.1 Noise generation sources

(1) The following noise generation sources are generally presumable.

① Relays and contacts
② Solenoid coils and solenoid valves
③ Power line (higher than 100 V ac, in particular)
④ Inductive load
⑤ Motor commutator
⑥ Phase angle control SCR
⑦ Radio communication equipment
⑧ Welding machine

5.2 Noise reduction method

(1) A CR filter is effective for quick-rising noises.

- Recommendable CR filter
  Part number 81446365-001
  (XEB120033 manufactured by Matsuo electric or equivalent)

(2) A varistor is effective for noises having a high crest value. Be careful since the varistor is shorted, if it becomes defective.

- Recommendable varistor
  Part number 81446366-001 for 100 V use
  81446367-001 for 200 V use.

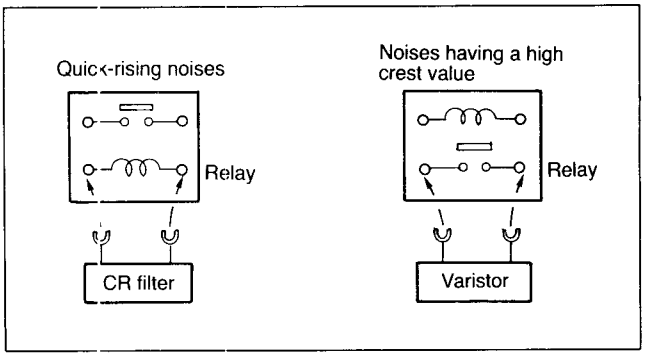
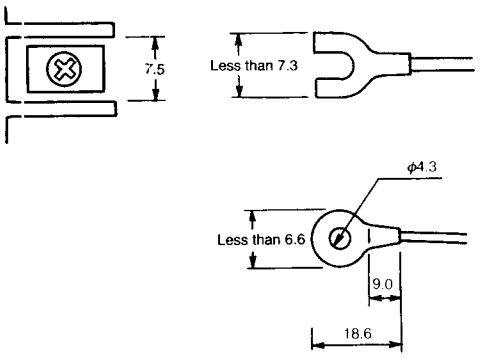


Fig. 11-3 Noise reduction method

For terminal connection, use solderless terminals conforming to M3.5 screws.

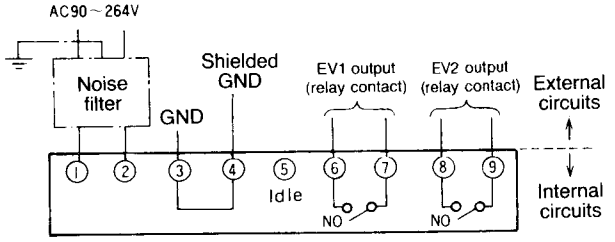


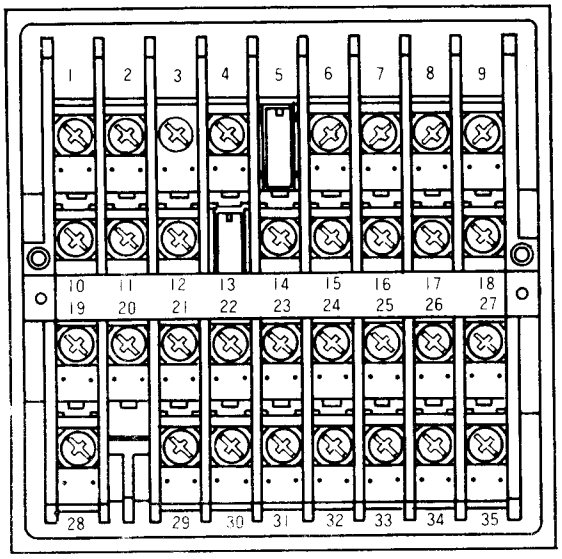
(Note) Use circular solderless terminals so that cables are not disconnected from terminals, if the instrument is mounted at a place subjected to noticeable vibrations and impacts.

12. EXTERNAL WIRING DIAGRAM

External terminal layout

Instrument power supply (*)...option





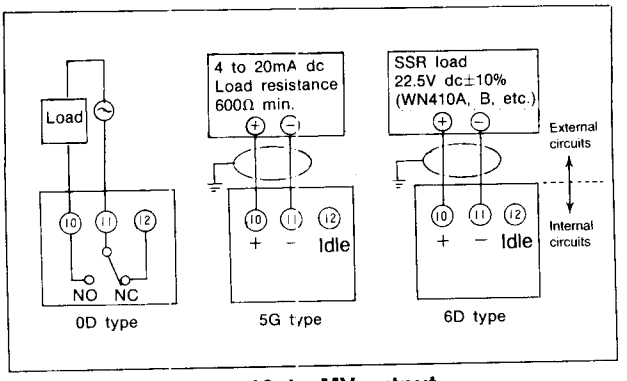
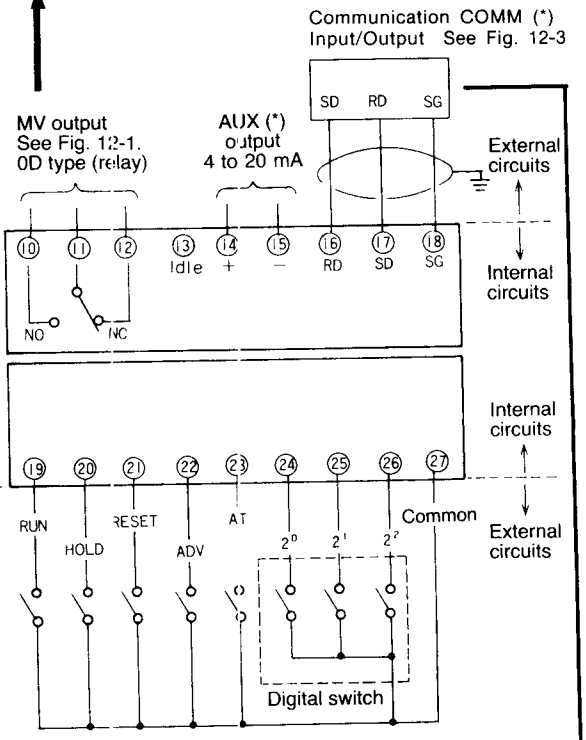
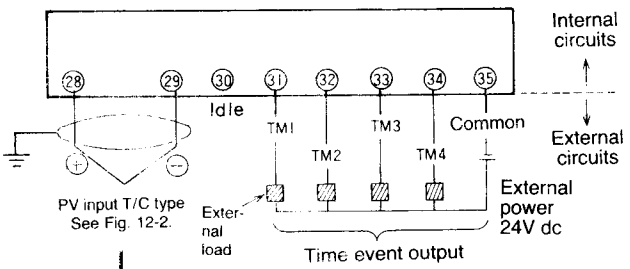


Fig. 12-1 MV output





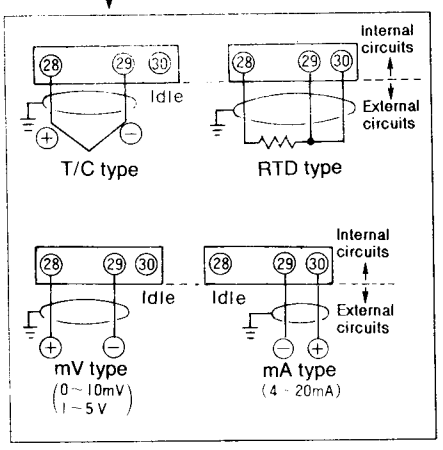


Fig. 12-2 PV input

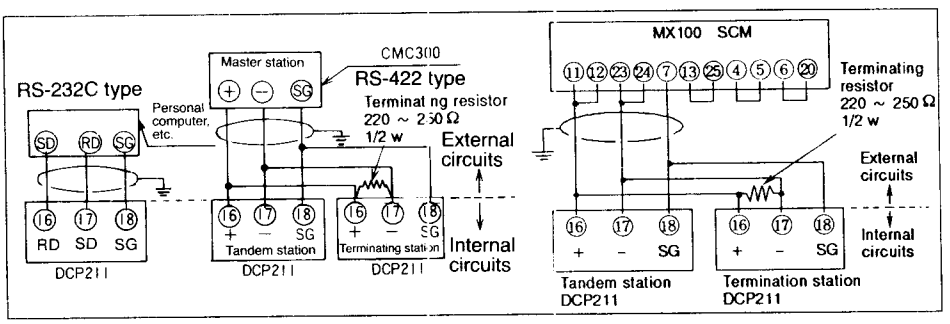


Fig. 12-3 COMM input/output (*)

- **A switch in the main supply is required near the equipment.**
- **Mains power supply wiring requires a (T) 2A, 250V fuse(s). (IEC127)**

The following table shows the meanings of symbols in the terminal wiring label on the instrument top.

Symbol	Description
	Alternating current
	Earth (ground) terminal
	Caution, risk of electric shock
	Caution (refer to accompanying documents)

13. MAINTENANCE

Cleaning: Clean the instrument with a soft, dry cloth when it becomes dirty.

Replacing Parts: Only authorized personnel are allowed to replace parts.

Replacing Fuses: When replacing fuses provided on the power supply circuit, use only standard parts specified bellow.

Standard	IEC 127
Type	Time-lag (T)
Voltage rating	250 V
Current rating	2 A

APPENDIXES

(1) Program pattern preparation example

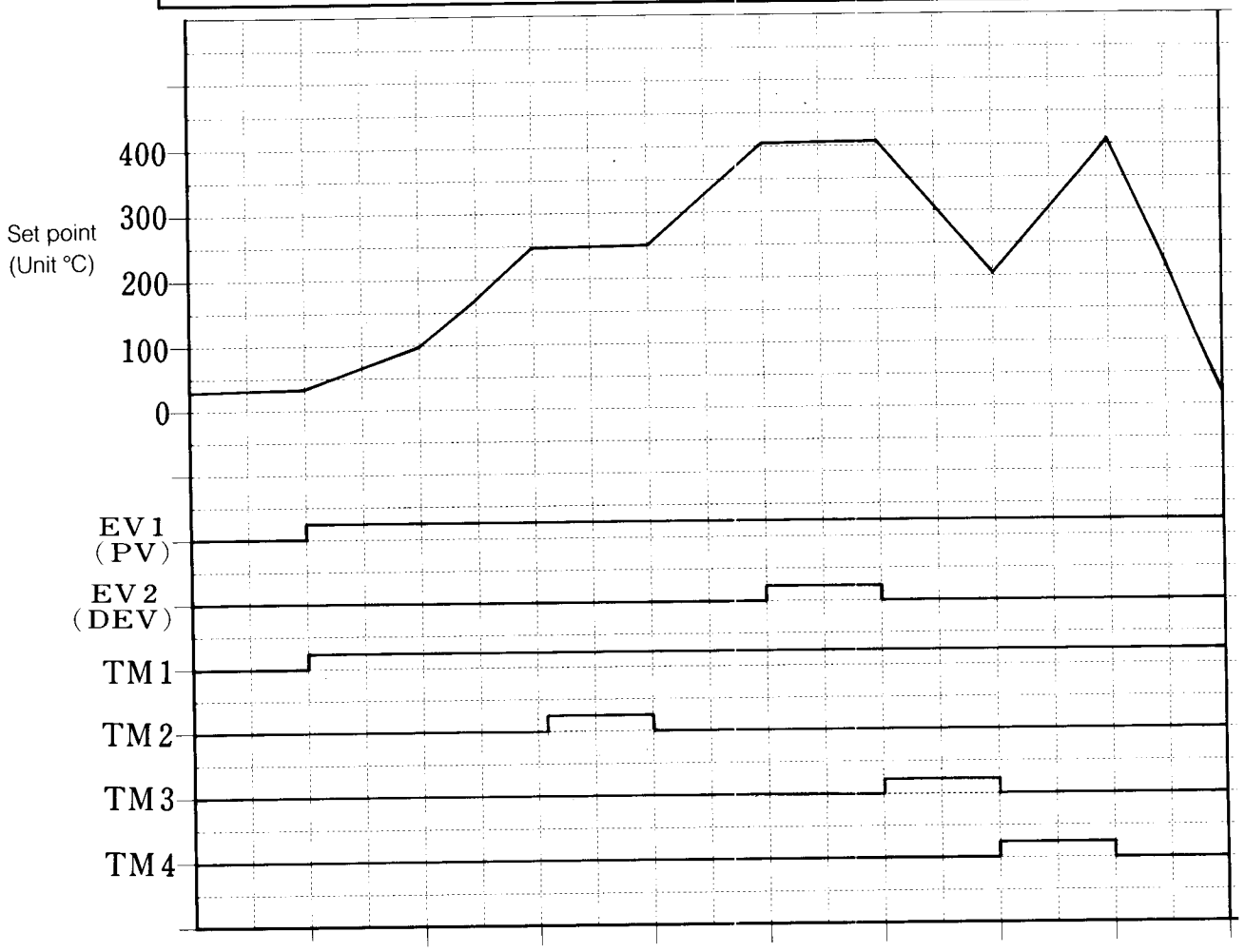
(2) Setup setting example

(3) Parameter setting example

(4) Programming example

(5) Program work sheet

(1) Program preparation example Program No.:



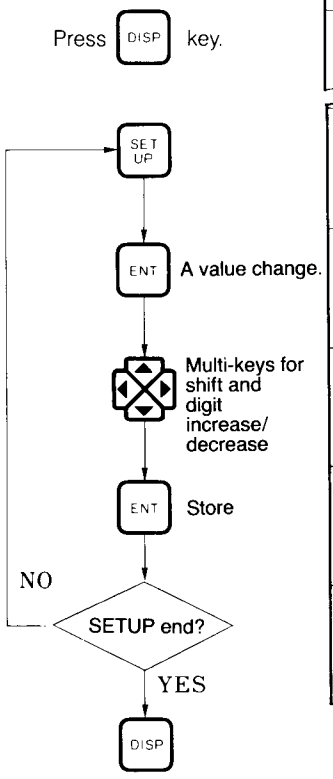
Programming map

Map position	Segment item			1	2	3	4	5	6	7	8	9
A	SP time	Upper-display	SP	30	100	250	250	400	400	200	400	30
		Lower-display	Time	2.00	4.00	3.00	7.00	4.00	7.00	4.00	4.00	4.00
B	Event No.1	Upper-display	—									
		Lower-display	Set point		(PV) 100							
C	Event No.2	Upper-display	—									
		Lower-display	Set point						(DEV) 5	(DEV) 600		
D	Time event No.1	Upper-display	ON		0.00							
		Lower-display	OFF		37.00							
E	Time event No.2	Upper-display	ON				1.00					
		Lower-display	OFF				7.00					
F	Time event No.3	Upper-display	ON							0.00		
		Lower-display	OFF							7.00		
G	Time event No.4	Upper-display	ON								0.00	
		Lower-display	OFF								4.00	
H	PID group selection	Upper-display	PId									
		Lower-display	Group No.	1	1	1	1	2	2	2	3	3
I	G.SOAK setting	Upper-display	G.S.									
		Lower-display	no or YES	no	no	no	YES	no	no	no	no	no
J	PV start setting	Upper-display	PSTR									
		Lower-display	no or YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
K	Cycle setting	Upper-display	CYCL									
		Lower-display	Cycle No.	0	0	0	0	0	0	0	0	0

(Note) Set the max value of segment 7 DEV so as not to allow EV2 to function between segments 7 to 9. −50% FS to +50% FS

(2) Setup setting example

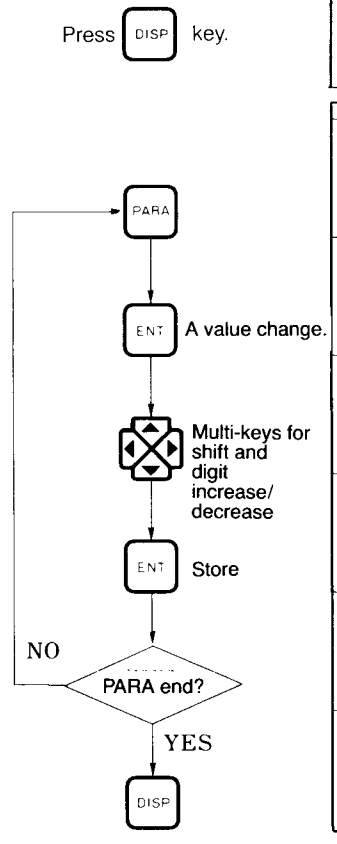
Setup setting procedure



Step	Key operation	Display	Description of display	Remarks
1	Press SET UP key.	C 1	Proceed to the next step, since the initial value is the preset value before delivery from factory.	See pages 18 and 20.
16	Press SET UP key.	C29 0	Program time unit is minute and second. (1 : Minue and second)	
17	Press ENT key.	C29 0000	0 flashes.	
18	Press this key.	C29 0001	Digit 1 is displayed.	
19	Press DISP key.	C29 1	1 is set.	
20	Press ENT key.	SP ---- TM ----	SETUP has finished.	C30 to C33 are not related to setup.

(3) Parameter setting example

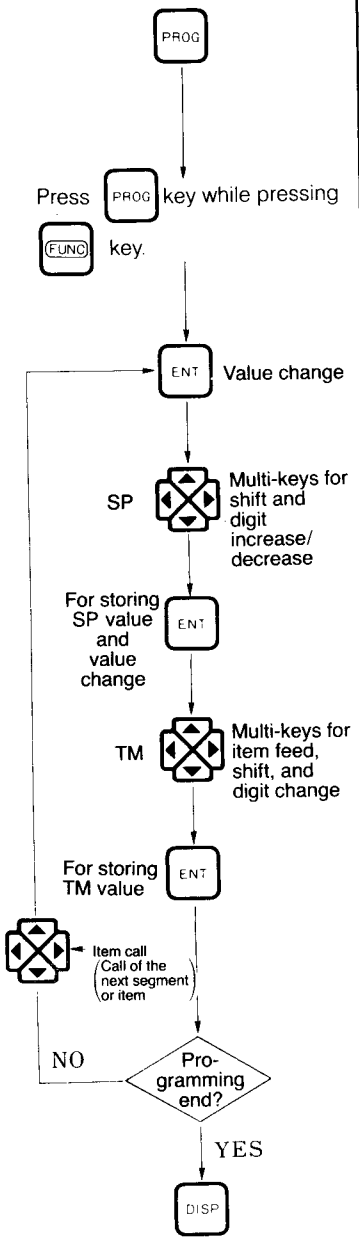
Parameter setting procedure



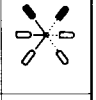
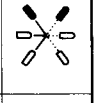
Step	Key operation	Display	Description of displays	Remarks
1	Press PARA key.	PrtC 0	Proceed t the next step, since the initial vaiue is the preset value before delivery from factory.	See pages 24 and 25.
9	Press PARA key.	Et2 0	Change initial value 0 for setting DEV of event No.2.	
10	Press ENT key.	Et2 0000	The last digit flashes.	
11	Press this key.	Et2 0002	Change the digit to 2.	Initial value 2 : Deviation
12	Press ENT key.	Et2 2	The higher side of the (+) DEV set point is on.	
13	Press PARA key.	HYS2 5	Set the DEV event on-off range to 5°C in event No.2. There is no change because the initial value is 5.	
14	Press DISP key.	SP ---- TM ----	Parameters setting has finished.	

(4) Programming example

Programming setting procedure



Step	Key operation	Display	Description of displays	Display of profile
1	Press PROG key.	PROG 1 SEG 1	A program No. is assigned. SP, TM LEDs light.	
2	Press FUNC key while pressing PROG key.	SP ---- TM ----	Programming mode is set. PRG LED lights. PROG 1. SEG 1. decimal point lights.	
3	Press ENT key.	SP ---- TM ----	**Segment 1** The last digit of SP flashes. SP value setting (Temperature is set to °C.)	
4	Press this key first, and then, press this key.	SP 0030 TM ----	After pressing shift (left) key, change the flashing digit by a digit increase key. Set SP=30 (°C).	
5	Press ENT key.	SP 30 TM ----	The last digit of TM flashes. TM value setting. (Time unit is set to minute/ second.)	
6	Press this key first, and then, press this key.	SP 30 TM 02.00	Press shift (left) key, and then, change the flashing digit by a digit increase key. Set TM=2.00 (min.)	
7	Press ENT key.	SP 30 TM 2.00	SP=30°C and TM=2 min have been stored.	
8	Press this key.	SP ---- TM ----	**Segment 2** PROG 1. SEG 2.	—
9	Press ENT key.	SP ---- TM ----	SP value setting	—
10	Repeat step 4.	SP 0100 TM ----	SP=100(°C) is set.	
11	Press ENT key.	SP 100 TM ----	TM value setting	
12	Repeat step 6.	SP 100 TM 04.00	TM=4.00 (min) is set.	
13	Press ENT key.	SP 100 TM 4.00	SP=100°C and TM=4 min have been stored.	
	Press ENT key.	SP 30 TM 4.00	**Segment 9** PROG 1. SEG 9. SP=30°C and TM=4 min have been stored.	

	Step	Key operation	Display	Description of displays	Display of profile
PV event	1	Press this key.	PV – – – –	PRG LED lights continuously. PV EV1 LED lights.	
	2	Press this key.	PV – – – –	Press an item feed (right) key continuously until SEG 2. appears.	
	3	Press ENT key.	PV – – – –	The last digit of PV value flashes.	
	4	Press this key twice.	PV – – – –	Shift	
	5	Press this key.	PV 0100	100 is displayed.	
	6	Press ENT key.	PV 100	PV event 100°C is set.	
DEV event	7	Press this key.	DEV – – – –	DEV EV2 LED lights when SEG 2. appears.	
	8	Press this key (four times)	DEV – – – –	Stop pressing the key when SEG 6. appears.	
	9	Press ENT key.	DEV – – – –	The last digit flashes.	
	10	Press this key.	DEV 0005	5 is displayed.	
	11	Press ENT key.	DEV 5	DEV event 5°C is set.	
	12	Press this key.	DEV – – – –	SEG 7. is displayed.	
	13	Press ENT key.	DEV – – – –	The last digit flashes.	
	14	Press this key first, and then, press this key.	DEV 0600	600 is displayed.	
	15	Press ENT key.	DEV 600	DEV event 600°C is set.	

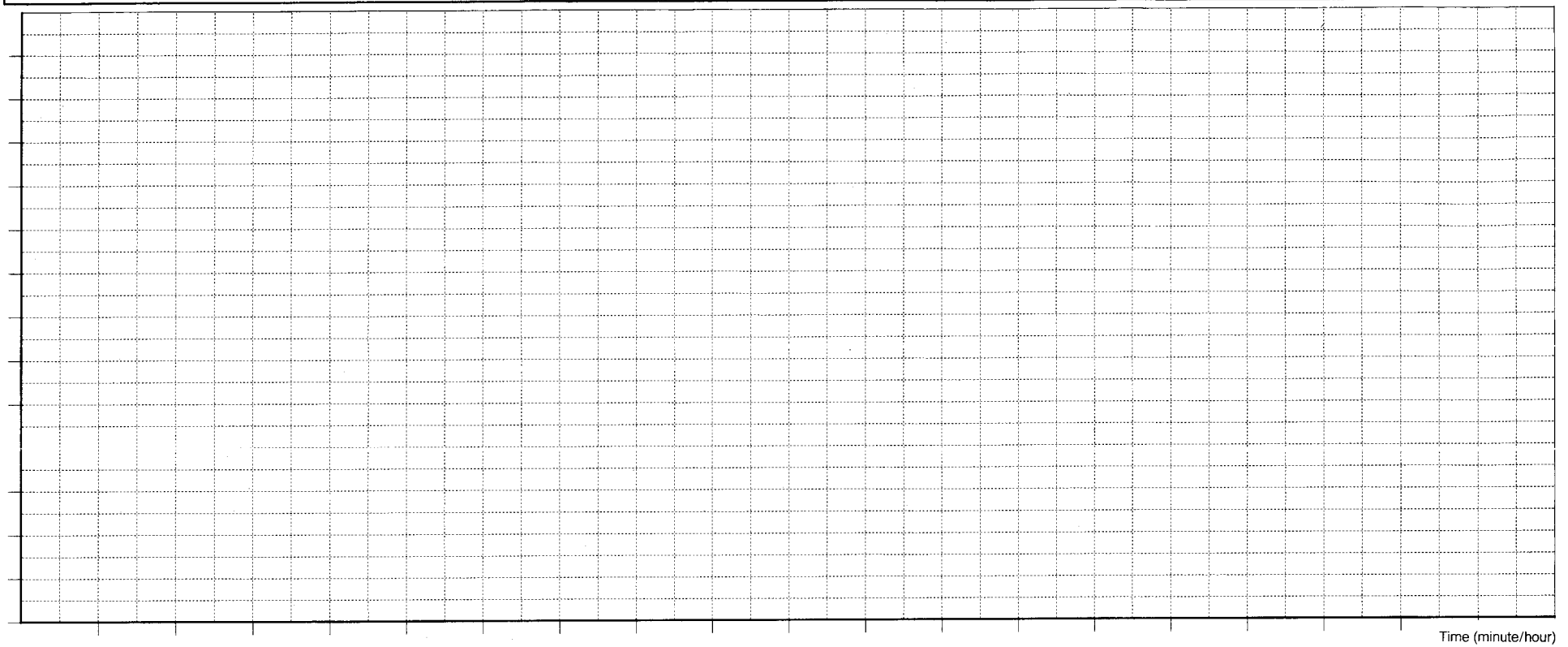
	Step	Key operation	Display	Description of display	Display of profile
Time event	16	Press this key.	— — — — — — — —	T1 LED lights in SEG 1.	
	17	Press this key. (four times)	 — — — —	Stop pressing the key when SEG 2. appears.	
	18	Press ENT key.	— — — — — — —	The last digit flashes.	
	19	Press this key first, and then, press this key.	0 0.0 0 — — — —	0.00 is displayed.	
	20	Press ENT key.	0.0 0 — — —	T1 time event ON is set to 0 min.	
	21	Press this key first, and then, press this key.	0.0 0 3 7.0 0	37.00 is displayed.	
	22	Press ENT key.	0.0 0 3 7.0 0	T1 time event OFF is set to 37 min.	
	23	Repeat 16 to 21 steps. Press ENT key.	1.0 0 7.0 0	SEG 4. T2 LED T2 time event ON is set to 1 min. OFF is set to 7 min.	
	24	Repeat 16 to 21 steps. Press ENT key.	0.0 0 7.0 0	SEG 6. T3 LED T3 time event ON is set to 0 min. OFF is set to 7 min.	
	25	Repeat 16 to 21 steps. Press ENT key.	0.0 0 4.0 0	SEG 8. T4 LED T4 time event ON is set to 0 min. OFF is set to 4 min.	
PID	26	Press this key.	P I d 1	P I d is displayed in SEG 8. Since segments 1 to 4 apply to 1 group, go to segment 5.	
	27	Press this key.	P I d 1	SEG 5. is displayed.	
	28	Press ENT key.	P I d 0 0 0 1	PID 1 flashes.	
	29	Press this key.	P I d 0 0 0 2	No.2 PID group is set to segment 5.	
	30	Repeat 27 to 30 steps. Press ENT key.	P I d 2	No.2 PID group is applied to segment 5 to 6. No.3 PID group is applied to segments 7 to 9.	

	Step		Display		Display of profile
Guaran-teed soak	31	Press this key.	9.5. no	3.5 (guaranteed soak) and no are displayed in SEG 9. .	
	32	Press this key. (four times)	9.5. no	Display SEG 4. .	
	33	Press ENT key.	9.5. no		
	34	Press this key.	9.5. YES		
	35	Press ENT key.	9.5. YES	Guaranteed soak is set in segment 4.	
PV event	36	Press this key.	P.St A no	PV start YES or NO may be set in an optional segment.	
	37	Press ENT key.	P.St A no		
	38	Press this key.	P.St A YES		
	39	Press ENT key.	P.St A YES	YES is set for PV start.	
Cycle	40	Press this key.	CYCL 0	Since no cycle is required, 0 is set.	
	41	Press DISP key.		Programming ends. After verifying with keys again, press DISP key.	

(5) DCP211 program work sheet Program No. Preparation date: Instrument name/product name

Set point

(Unit)



Time (minute/hour)

Map position	Segment item			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
A	SP time	Upper-display	SP																				
		Lower-display	Time																				
B	Event No.1	Upper-display	—																				
		Lower-display	Set point																				
C	Event No.2	Upper-display	—																				
		Lower-display	Set point																				
D	Time event No.1	Upper-display	ON																				
		Lower-display	OFF																				
E	Time event No.2	Upper-display	ON																				
		Lower-display	OFF																				
F	Time event No.3	Upper-display	ON																				
		Lower-display	OFF																				
G	Time event No.4	Upper-display	ON																				
		Lower-display	OFF																				
H	PID group selection	Upper-display	PId																				
		Lower-display	Group No.																				
I	G.SOAK setting	Upper-display	G.S.																				
		Lower-display	no or YES																				
J	PV start setting	Upper-display	PStA																				
		Lower-display	no or YES																				
K	Cycle setting	Upper-display	CYCL																				
		Lower-display	Cycle No.																				

WORKSHEET FOR DCP211 SETUP, PARAMETER AND PID VALUE SETTING

Client		Model No.			
		D C P 2 1 1		Application Engineer	
Equipment Name :	Product Name :	Tag Name		Salesman	
				Date	

1. Setup

No.	Indication, set point value at the delivery time from factory	Item	Client's set point
1	C 1 0	Key lock 0 : No key lock 1 : SETUP change is not allowable. 2 : Setting data are not changeable. 3 : DISP key only is changeable.	C 1
2	C 2 0	Temperature unit 0 : Centrigrade (℃) -1: Fahrenheit (℉) T/C and RTD inputs only are displayed.	C 2
3	C 3 0	Control action 0 : Reverse action 1 : Direct action	C 3
4	C 4	MV at PV overrange 0 : Not provided 1 : Provided	C 4
5	C 5 0.0	Setting value at PV overrange 0.0 to 100.0% (Time proportional type) -10.0 to +110.0% (Current output type) Displayed only when 1 in C4.	C 5
6	C 6	0 to 12 (T/C) 20 to 35 (RTD) 40 to 45 (Linear)	C 6
7	C 7 0	Linear PV decimal point position 0 = ____ 1 = ___. 2 = __._ 3 = .___ Linear type only displayed.	C 7
8	C 8 0	Linear PV lower-limit -1999 to upper-limit U Linear type only is displayed.	C 8
9	C 9 1000	Linear PV upper-limit Lower-limit to 9999U Linear type only is displayed.	C 9
10	C10 0	SP limit lower-limit 0% to upper-limit of range	C10
11	C11 100	SP limit upper-limit Lower-limit to100% of range	C11

No.	Indicat on, set point value at the delivery time from factory	Item	Client's set point
12	C12 0	Type of main output 0 : MV 1 : SP Current output type only is displayed.	C12
13	C13 0	Setting of SP4mA -1999 to +9999U Displayed only when 1 in C12. Current output type only is displayed.	C13
14	C14 100	Setting of SP20mA -1999 to +9999U Displayed only when 1 in C12. Current output type only is displayed.	C14
15	C15 0	Type of auxiliary output 0 : PV 1 : SP Displayed only when auxiliary output is provided.	C15
16	C16 0	Setting of auxiliary output 4mA -1999 to +9999U Displayed only when auxiliary output is provided.	C16
17	C17 100	Setting of auxiliary output 20mA -1999 to +9999U Displayed only when auxiliary output is provided.	C17
18	C18 0	Display at programming of EV1,2 0 : Displayed 1 : Not displayed	C18
19	C19 0	Display at programming of T1 to T4 0 : Displayed 1 : Not displayed	C19
20	C20 0	Display at programming of PID G.SOAK 0 : Provided 1 : Not provided	C20
21	C21 0	Display at programming of PV start, cycle, and pattern link. 0 : Not provided 1 : Provided	C21
22	C22 0	Communication address 0, 1 to 254 Displayed only when communication is provided.	C22
23	C23 0	Communication speed 0 : 9600 (BPS) 1 : 4800 2 : 2400 3 : 1200 Displayed only when communication is provided.	C23

No.	Indication, set point value at the delivery time from factory	Item	Client's set point
24	C24 0	Communication code 0 : 8 bits, even parity bit, 1 stop bit 1 : 8 bits, not parity bit, 2 stop bits Displayed only when communication is provided.	C24
26	C26 0	PV display 1 : Displayed 2 : Not displayed 3 : Not displayed when fixed at 0% of range.	C26
27	C27 0	Time display 0 : Segment remaining time 1 : Operation progress time	C27

No.	Indication, set point value at the delivery time from factory	Item	Client's set point
28	C28 0	Alarm display 0 : Displayed 1 : Not displayed	C28
29	C29	Time unit of program 0 : min/hr 1 : sec./min	C29

2. Parameter

No.	Indication, set point value at the delivery time from factory	Item	Client's set point
1	Prtc 0	Program protect 0 : Protected 1 : Not protected	Prtc
2	FILt 0.0	PV filter constant 0.0 to 120.0 sec.	FILt
3	Pb1A 0	PV bias -100 to +100U	Pb1A
4	Sb1A 0	SP bias -50 to +50% FS	Sb1A
5	9.5.bd 5	G.SOAK 0 to 100U	9.5.bd
6	cy 10	Time proportional output cycle 5 to 120 sec. (Relay type) 1 to 60 sec. (Voltage type) 0D and 6D types only are displayed.	cy
7	outL 100.0	Manipulated variable change limit 0.0 to 100.0 (Every 0.5 sec.)	outL

No.	Indication, set point value at the delivery time from factory	Item	Client's set point
8	dIFF 5	ON/OFF control differential 0 to 100U Displayed only in 0D, and 6D types.	dIFF
9	Et1 0	Selection of event 1 0 : PV (Direct) 1 : PV (Reverse) 2 : Deviation (Direct) 3 : Deviation (Reverse) 4 : RUN 5 : READY 6 : END	Et1
10	HYS1 5	Event 1 hysteresis 0 to 100U	HYS1
11	Et2 0	Selection of event 2 0 : PV (Direct) 1 : PV (Reverse) 2 : Deviation (Direct) 3 : Deviation (Reverse) 4 : RUN 5 : READY 6 : END	Et2
12	HYS2 5	Event 2 hysteresis 0 to 100U	HYS2
13	rPid 0	PID operation initialize at advance 0 : PID operation is not initialized. 1 : PID operation is initialized.	rPid

3. PID constant setting

No.	Indication, set point value at the delivery time from factory	Item	Client's set point
1	AT 0	0 : AT is not executed 1 : Method 1 is executed by AT key. 2 : Method 2 is executed by AT key. Displayed only when auto tuning is provided.	AT
2	P - 1 100.0	Proportional band 1 0.0 to 999.9% (Time proportional) 0.1 to 999.9% (Current output)	P - 1
3	I - 1 0	Integral time 1 0 to 3600 sec. Displayed when P - 1 ≠ 0	I - 1
4	d - 1 0	Derivative time 1 0 to 1200 sec. Displayed when P - 1 ≠ 0	d - 1
5	oL - 1 0.0 or -10.0	Manipulated variable lower-limit 1 0.0 to upper-limit % (Time proportional) -10.0 to upper-limit % (Current output) Displayed when P - 1 ≠ 0	oL - 1
6	oH - 1 100.0 or 110.0	Manipulated variable upper-limit 1 Lower-limit to 100.0% (Timeproportional) Lower-limit to 110.0% (Current output) Outputted when P - 1 ≠ 0	oH - 1
7	rE - 1 50.0	Manual reset 1 0.0 to 100.0% Displayed when P - 1 ≠ 0 and I ≠ 0	rE - 1
8	P - 2 100.0	Proportional band 2 0.0 to 999.9% (Time proportional) 0.1 to 999.9% (Current output)	P - 2
9	I - 2 0	Integral time 2 0 to 3600 sec. Displayed when P - 2 ≠ 0	I - 2
10	d - 2 0	Derivative time 2 0 to 1200 sec. Displayed when P - 2 ≠ 0	d - 2
11	oL - 2 0.0	Manipulated variable lower-limit 2 0.0 to upper-limit % (Time proportional) -10.0 to upper-limit % (Current output) Displayed when P - 2 ≠ 0	oL - 2

No.	Indication set point value at the delivery time from factory	Item	Client's set point
12	oH - 2 100.0 or 110.0	Manipulated variable lower-limit 2 Lower-limit to 100.0% (Time proportional) Lower-limit to 110.0% (Current output) Displayed when P - 2 ≠ 0	oH - 2
13	rE - 2 50.0	Manual reset 2 0.0 to 100.0% Displayed when P - 2 ≠ 0 and I ≠ 0	rE - 2
14	P - 3 100.0	Proportional band 3 0.0 to 999.9% (Time proportional) 0.1 to 999.9% (Current output)	P - 3
15	I - 3 0	Integral time 3 0 to 3600 sec. Displayed when P - 3 ≠ 0	I - 3
16	d - 3 0	Derivative time 3 0 to 1200 sec. Displayed when P - 3 ≠ 0	d - 3
17	oL - 3 0.0 or -10.0	Manipulated variable lower-limit 3 0.0 to upper-limit (Time proportional) -10.0 to upper-limit (Current output) Outputted when P - 3 ≠ 0	oL - 3
18	oH - 3 100.0 or 110.0	Manipulated varaible upper-limit 3 Lower-limit to 100.0 (Time proportional) Lower-limit to 110.0 (Current output) Displayed when P - 3 ≠ 0	oH - 3
19	rE - 3 50.0	Manual reset 3 0.0 to 100.0% Displayed when P - 3 ≠ 0 and I ≠ 0	rE - 3
20	iout 0.0	PID operation Initial MV 0.0 to 100.0% Displayed, if at least one P= 0 out of 1 to 3 groups.	iout

General PID Actions

1. Proportional band P

(1) When the proportional band is wide, an overshoot is difficult to occur on arrival at the set point, but an offset from the set point is produced. When the proportional band is narrow on the contrary, an overshoot occurs and the control amplitude is waved as in on-off action.

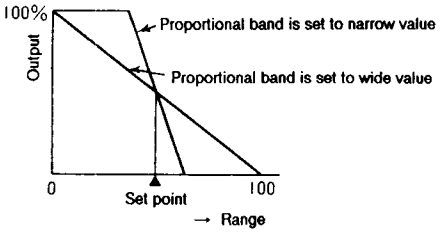
(2) When the proportional band is narrowed, the following effect appear.

- The offset is reduced.
- When the proportional band is minimized, the maximum and minimum control outputs are repeated, and the output amplitude is maximized.

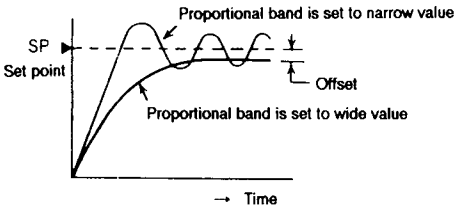
  The offset is also minimized.

(3) In electric furnaces, the proportional band may be generally set to narrower than about 10%.

P control action



P control effect



2. Ingeral I

(1) The integral time functions in such a direction that the offset caused by the proportional control is eliminated as the time elapses.

If the integral time is shortened to eliminate the offset in a short time, the derivative action is intensified and the control is disturbed on the contrary, thus causing a hunting.

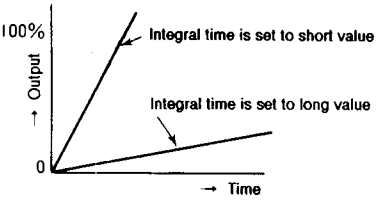
Therefore, change over the integral time from a long value to a short value, and find an optimum control constant.

(2) As the integral value is shortened, the following effects appear.

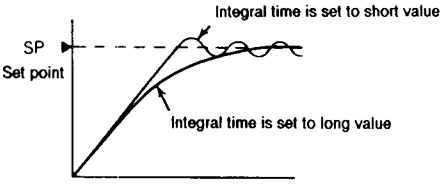
- The offset is reduced more speedily.
- The control output amplitude is increased, thus causing a hunting.

(3) In electric furnaces, the integral time may be generally set to shorter than about 150 sec.

I control action



I control effect



3. Derivative D

(1) The derivative time functions to output a large manipulated variable against a sudden disturbance, and thereby restore the control to the original.

When the derivative time is made long, the large manipulated variable is activated for a long time, and therefore the control is caused to be disturbed on the contrary.

Therefore, change over the setting of the derivative time a short value to a long value, and find an optimum control constant.

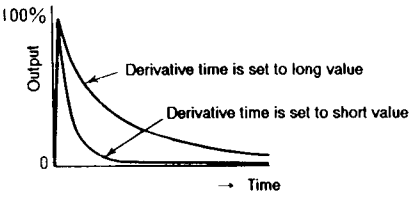
(2) As the derivative time becomes longer, the following effects appear.

- Both the control output amplitude and time become smaller little by little.
- The derivative time adjustment has no effect on the offset correction.

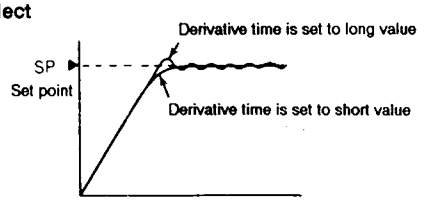
(3) In electric furnaces, the derivative time may be generally set to longer than about 30 sec.

(4) A optimum derivative value is generally about 1/4 of the integral value.

D control action



D control effect



Specifications are subject to change without notice.

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