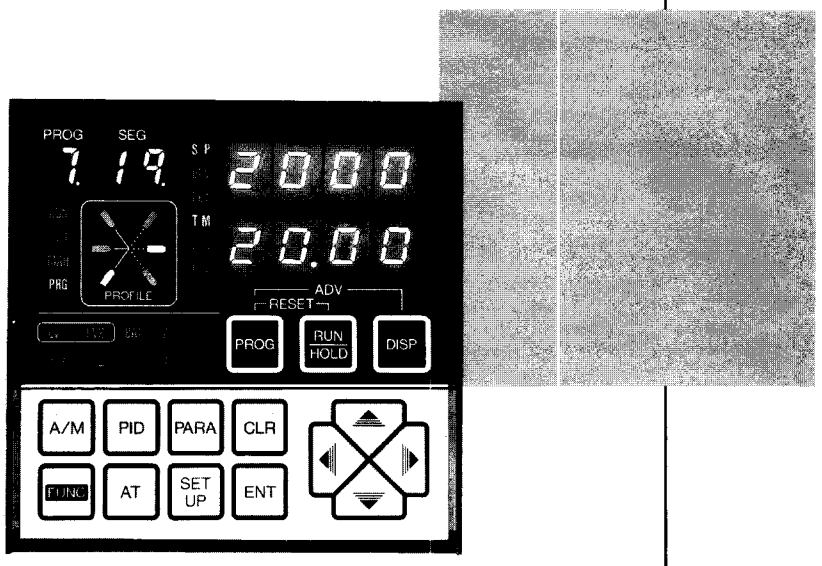
YAMATAKE

No. CP-UM-1205E

DigitroniK
Digital Program Controller
DCP211

User's Manual



Yamatake Corporation

RESTRICTIONS ON USE

When using this product in applications that require particular safety or when using this product in important facilities, pay attention to the safety of the overall system and equipment. For example, install fail-safe mechanisms, carry out redundancy checks and periodic inspections, and adopt other appropriate safety measures as required.

REQUEST

Make sure that this Instruction Manual is handed over to the user before the product is used.

Copying or duplicating this Instruction Manual in part or in whole is forbidden. The information and specifications in this Instruction Manual are subject to change without notice.

Considerable effort has been made to ensure that this Instruction Manual is free from inaccuracies and omissions.
If you should find any inaccuracies or omissions, please contact Yamatake Corporation.

In no event is Yamatake Corporation liable to anyone for any indirect, special or consequential damages as a result of using this product.

To Ensure Safe Use of This Product

– Safety Precautions –

This manual describes how to use this product. Before using this product, thoroughly read and understand the descriptions in this manual to ensure correct use.

After you have read this manual, store the manual a safe place nearby so that it can be referred whenever needed.

⚠ WARNINGS

- Before connecting or disconnecting wiring to or from this product, be sure to turn the mains power supply OFF. Inadvertently touching terminals or other electrically live parts might cause electrical shock.
- Before connecting this product to the measurement target or external control circuits, make sure that it is connected to an earth. Failure to do so might cause electrical shock or fire.

⚠ CAUTIONS

- Wire this product properly in accordance with predetermined wiring standards, instruction described in this manual and generally accepted wiring methods. Failure to do so might result in electrical shock, fire or malfunction.
- Use this product only within the recommended operating conditions (temperature, humidity, voltage, vibration, shock, atmosphere, etc.) described in the specifications.
- Do not cover the ventilation holes on this product. Doing so might result in fire or malfunction.
- Do not disassemble this product, or touch parts inside. Doing so might result in electrical shock or malfunction.
- Some parts in this product become hot while the power is turned ON or are hot immediately after the power is turned OFF. Do not touch these parts. Doing so might result in burns.
- Do not operate the operation keys on this product with the top of a propelling pencil or other sharp-tipper object. Doing so might result in malfunction.

SAFETY REQUIREMENTS

To reduce risk of electrical shock which could cause personal injury, follow all safety notices in this documentation.

This symbol warms the user of a potential shock hazard where hazardous live voltages may be accessible.

* If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment must be impaired.
* Do not replace any component (or part) not explicitly specified as replaceable by your supplier.
* All wiring must be in accordance with local norms and carried out by authorized experienced personnel.
* The ground terminal must be connected before any other wiring (and disconnect last).
* A switch in the main supply is required near the equipment.
* Mains power supply wiring requires a (T) 2A, 250V fuse(s).

Installation category : Category II (IEC664-1, IEC1010-1)
Specification of common mode voltage : The common mode voltages of all I/O except for main supply and relay outputs are less than 30Vrms, 42.4Vpeak and 60Vdc.

EQUIPMENT RATINGS

Supply voltage	90 - 264 V~
Frequency	50/60Hz
Power or current ratings	17.5VA maximum

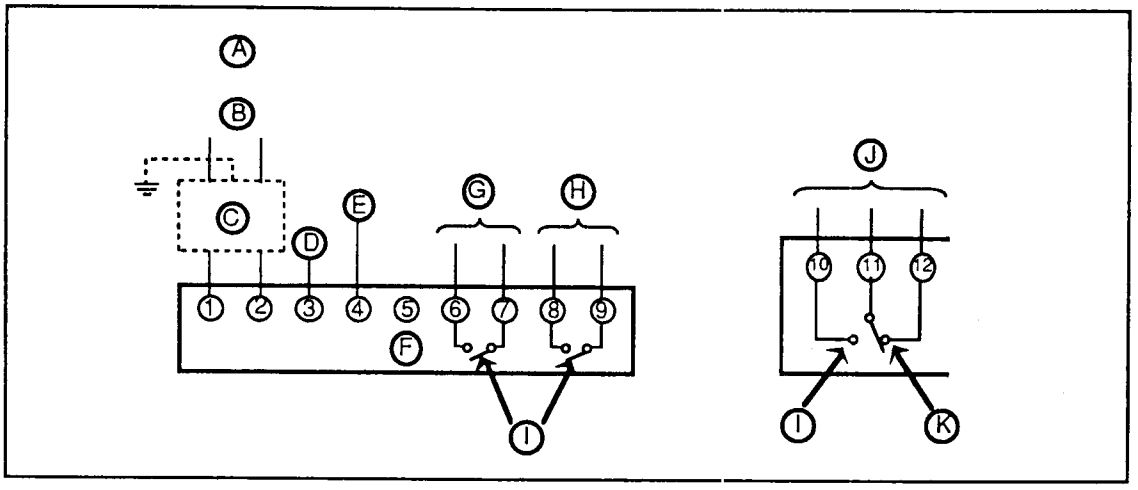
EQUIPMENT CONDITIONS

Do not operate the instrument in the presence of flammable liquids or vapors. Operation of any electrical instrument in such an environment constitutes a safety hazard.

Temperature	0 to 50℃	
Humidity	10 to 90% RH	
Vibration	Frequency	10 to 60Hz
	Acceleration	2 m/s^2 maximum

EQUIPMENT INSTALLATION

The controller must be mounted into a panel to limit operator access to the rear terminals.



Ⓐ	Instrument power supply
Ⓑ	90 to 264 V AC
Ⓒ	Noise filter
Ⓓ	GND
Ⓔ	Shielded GND
Ⓕ	Idle
Ⓖ	Event 1 output (relay contact)
Ⓗ	Event 2 output (relay contact)
Ⓘ	Normaly open
Ⓙ	Relay output
Ⓚ	Normaly close

TABLE OF CONTENTS

I. MODEL SELECTION GUIDE AND SPECIFICATIONS

Model selection guide | I | II | III | IV | V | VI |

Example :

I	II	III	IV	V	VI
DCP216	5G	K09	A	007	00

Code No.	Model No.		Specifications					
I	Basic model number	DCP 216	Digital program controller					
II	Output type Control mode	0D	Relay output SPDT (ON-OFF) Time proportional PID					
		5G	Current output 4 to 20mA DC Continuous proportional PID					
		6D	Voltage output 22.5V DC + 10% (ON-OFF) Time proportional PID					
III	Type of input range		Type of input	Range		PV range code	Accuracy	Range change
		T44	Thermocouple T (CC)	-199.9 to +300.0°C	-300 to +700°F	6	+0.2% FS	Possible
		J08	Thermocouple J (IC)	0 to 800°C	0 to 1600°F	2		
		E08	Thermocouple E (CRC)	0 to 800°C	0 to 1800°F	1		
		K04	Thermocouple K (CA)	0.0 to 400.0°C	0 to 750°F	12		
		K08	Thermocouple K (CA)	0 to 800°C	0 to 1600°F	11		
		K09	Thermocouple K (CA)	0 to 1200°C	0 to 2400°F	3		
		U13	Thermocouple N	0 to 1300°C	32 to 2372°F	9		
		Y13	Thermocouple PL II	0 to 1300°C	32 to 2372°F	10		
		R16	Thermocouple R (PR13)	0 to 1600°C	0 to 3100°F	4		
		S16	Thermocouple S (PR10)	0 to 1600°C	0 to 3100°F	5		
		B18	Thermocouple B (PR30-6)	0 to 1800°C	0 to 3300°F	0		
		D19	Thermocouple PR40-20	0 to 1900°C	(0 to 3400°F)	8	+0.3% FS	
		W23	Thermocouple W (Wre5-26)	0 to 2300°C	0 to 4200°F	7	+0.2% FS	
		Z13	Thermocouple Ni=NiMo	0 to 1300°C	32 to 2372°F	16	+0.2% FS	Impossible
		F01	Pt100 (IEC, DIN and JIS)	0.0 to 100.0°C	0.0 to 200.0°F	34	+0.2% FS	Possible
		F03	Pt100 (IEC, DIN and JIS)	0.0 to 300.0°C	0.0 to 500.0°F	33		
		F05	Pt100 (IEC, DIN and JIS)	0.0 to 500.0°C	0 to 900°F	29		
		F32	Pt100 (IEC, DIN and JIS)	-100.0 to +150.0°C	-150.0 to +300.0°F	32		
		F33	Pt100 (IEC, DIN and JIS)	-40.0 to + 60.0°C	-40.0 to +140.0°F	30		
		F36	Pt100 (IEC, DIN and JIS)	-50.0 to +200.0°C	-50.0 to +400.0°F	31		
		F46	Pt100 (IEC, DIN and JIS)	-199.9 to +200.0°C	-300.0 to +400.0°F	21		
		F50	Pt100 (IEC, DIN and JIS)	-200 to +500°C	-300.0 to +900.0°F	20		
		P01	JPt100 (JIS Pt100)	0.0 to 100.0°C	0.0 to 200.0°F	28		
		P03	JPt100 (JIS Pt100)	0.0 to 300.0°C	0.0 to 500.0°F	27		
		P05	JPt100 (JIS Pt100)	0.0 to 500.0°C	0 to 900.0°F	23		
		P32	JPt100 (JIS Pt100)	-100.0 to +150.0°C	-150.0 to +300.0°F	26		
		P33	JPt100 (JIS Pt100)	-40.0 to + 60.0°C	-40.0 to +140.0°F	24		
		P36	JPt100 (JIS Pt100)	-50.0 to +200.0°C	-50.0 to +400.0°F	25		
		P46	JPt100 (JIS Pt100)	-199.9 to +200.0°C	-300.0 to +400.0°F	22		
		C01	Current 4 to 20mA DC linear	Programmable	-1999 to 9999	40	+0.2% FS	Possible
		M01	Voltage 0 to 10mV DC linear	Programmable	-1999 to 9999	41		
		V01	Voltage 1 to 5V DC linear	Programmable	-1999 to 9999	45		
		L02	Voltage -10 to 10mV DC linear	Programmable	-1999 to 9999	42		
IV	Power	A	90 to 264V AC 50-60Hz					

Code No.	Model No.		Specifications			
V	Optional function (1)		Auxiliary output (4 to 20mA DC)	Auto tuning	RS-422 Communication	RS-232C Communication
		000	—	—	—	—
		001	O	—	—	—
		002	—	O	—	—
		003	O	O	—	—
		004	—	O	O	—
		005	—	O	—	O
		006	O	O	O	—
		007	O	O	—	O
VI	Optional function (2)	01	Data are not attached			
		D1	Data are attached			
		T1	Tropical treatment			
		B1	Data are attached plus tropical treatment			
		Y1	Traceability prover compatibility product			

(Note) Mark O shows that the corresponding funciton is provided.

SPECIFICATIONS

Program storage capacity	No. of programs	7 programs			
	No. of segments per program	20 segments			
	No. of segments for all programs	140 segments			
	No. of events for all programs	200 event settings (total number of PV, deviation, RUN, READY, END, and time-based events circuits)			
Indication and setting	Indication and setting ranges	See the model selection guide.			
	Indication accuracy	±0.2% FS ±1U ±5.0% FS at 260°C max. in case of T/C B type. (U: Industrial unit)			
	Indication and setting resolution	See the model selection guide			
	Time units	**0 to 99 h 59 min, or 0 to 99 min 59 s**			
Input	Input sampling cycle	**500 ms**			
	Type of input	Thermocouple	RTD (100 ohm pt)	Current	Voltage
	Impedance	1MΩ min.	—	100Ω	1MΩ min.
	Allowable wiring resistance	250Ω max.	4Ω max.	—	—
	Input circuit failure indication	Upscale (Regarded as 110%)	Upscale (When the element was broken)	Downscale (Regarded as −10%)	—
	Digital filter	System: First-order lag filter Time constant: 0.0 to 120.0 sec variable (0.0: filter off.)			
	PV bias	**−100 to +100U variable**			
Control	Control system	PID control system, deviation value derivative type			
	Proportional band (P)	0.1 to 999.9% FS, Resolution 0.1%, (ON-OFF control at P=0)			
	Integral time (Reset time) (I)	**0 to 3600 s, Resolution 1 s, (PD control at I=0)**			
	Derivative time (Rate time) (D)	**0 to 1200 s, Resolution 1 s, (PI control at D=0)**			
	Direct/reverse action	Selectable by set-up			
	Output type	Relay output	Voltage output	Current output	
	Control mode	Time proportional PID PD+MR or ON-OFF	Time proportional PID PD+MR or ON-OFF	Current proportional PID or PD+MR	
	Output ratings	SPDT 250 V ac 5 A resistive load	22.5 V dc ±10% Lower than 75 mA	4 to 20 mA dc (2.4 to 21.6 mA dc)	
	Cycle time	**5 to 120 s**	**1 to 60 s**	—	
	Allowable load resistance	—	—	600Ω max.	
	Scaling	—	—	For SP output, −1999 to 9999. settable	
	Output sampling cycle	**Renewed every 500 ms**			
Remote operation Switch ass'y (Contact input)	No. of inputs	8 contacts Dry contact input			
	Program selection	3 contacts Program number selection (2^0, 2^1, 2^2) No. 1 to 7 program selection			
	Program operation	5 contacts (Operation start ... 1, Hold ... 1, Reset ... 1, Advance ... 1, Auto tuning ... 1)			
Event output	Setting type	PV, deviation, RUN, READY, END, time			
	Setting range	PV: 0 to 100% FS Deviation: −50 to +50% FS Time: 0 to 99.59 (in time unit)			
	Differential gap	0 to 100U			
	Output	PV, deviation: Relay contact (reversible) SPST×2 Time: Transistor open collector ... 4 outputs (Power supply: 24 V dc, 100 mA dc max user-supplied)			
	Relay contact ratings	250 V ac, 5 A resistive load (PV, deviation)			
Auxiliary output (Optional function)	Output	PV or SP: 4 to 20 mA			
	Scaling	PV and SP: Settable **−1999 to +9999**			
	Allowable load resistance	600Ω max.			

Communication function RS-422 (Optional function)	Communication system	Network	Multidrop system 1-to-16 units max. (Instrument serves as a slave station only)
		Information direction	Half-duplex
		Synchronous system	Start-stop synchronization
	Interface system	Transmission type	Balancing (differential) type
		Data line	Bit serial
		Signal line	3 transmitting/receiving lines
		Transmission speed	1200, 2400, 4800, 9600 bps
		Communication distance	300 m max.
		Others	Conforms to RS-422
	Message character	Character configuration	11 bits/character
		Format	1 start, 2 stop bits (standard)
		Data code	8-bit binary code
Communication function RS-232C (Optional function)	Communication system	Network	1-to-1 (Slave station function only)
		Information direction	Half-duplex
		Synchronous system	Start-stop synchronization
	Interface system	Transmission type	Unbalanced type
		Data line	Bit seria
		Signal line	3 transmitting/receiving lines
		Transmission speed	1200, 2400, 4800, 9600 bps
		Communication distance	15 m max.
		Others	Conforms to RS-232C
	Message character	Character configuration	11 bits/character
		Format	1 start, 2 stop bits (standard)
		Data code	8 bit, ASCII code
Common specifications	Rated supply voltage/Frequency	100 to 240 V ac • 50/60 ± 2 Hz	
	Supply voltage/Frequency	90 to 264 V ac • 50/60 ± 4 Hz	
	Power consumption	Max. 17.5 VA	
	Insulation resistance	Higher than 50MΩ, 500 V dc megger (between power terminal and case)	
	Dielectric strength	**1500 V ac for 1 min, or 1800 V ac for 1 s (between power terminal and case)**	
	Mass	Approx. 1.0 kg	
	Allowable ambient temperature	0 to 50°C	
	Allowable ambient humidity	10 to 90%RH (No dew condensation is allowable)	
	Vibration resistance	4.9m/s^2 max. **(10 to 60 Hz XYZ directions 2 h each)**	
	Shock resistance	490m/s^2 max. (3 times each in vertical direction, in packed state)	
	Memory backup	Lithium battery (for longer than 5 years)	
	Environmental condition	Permanently connected equipment, indoor use, Panel mounted equipment	
	Conformed standard	EN61010-1, EN50081-2, EN50082-2	
	Installation category (Over voltage category)	Category II (IEC664-1, EN61010-1)	
	Pollution degree	Pollution degree 2	

II. FUNCTION

1. GENERAL

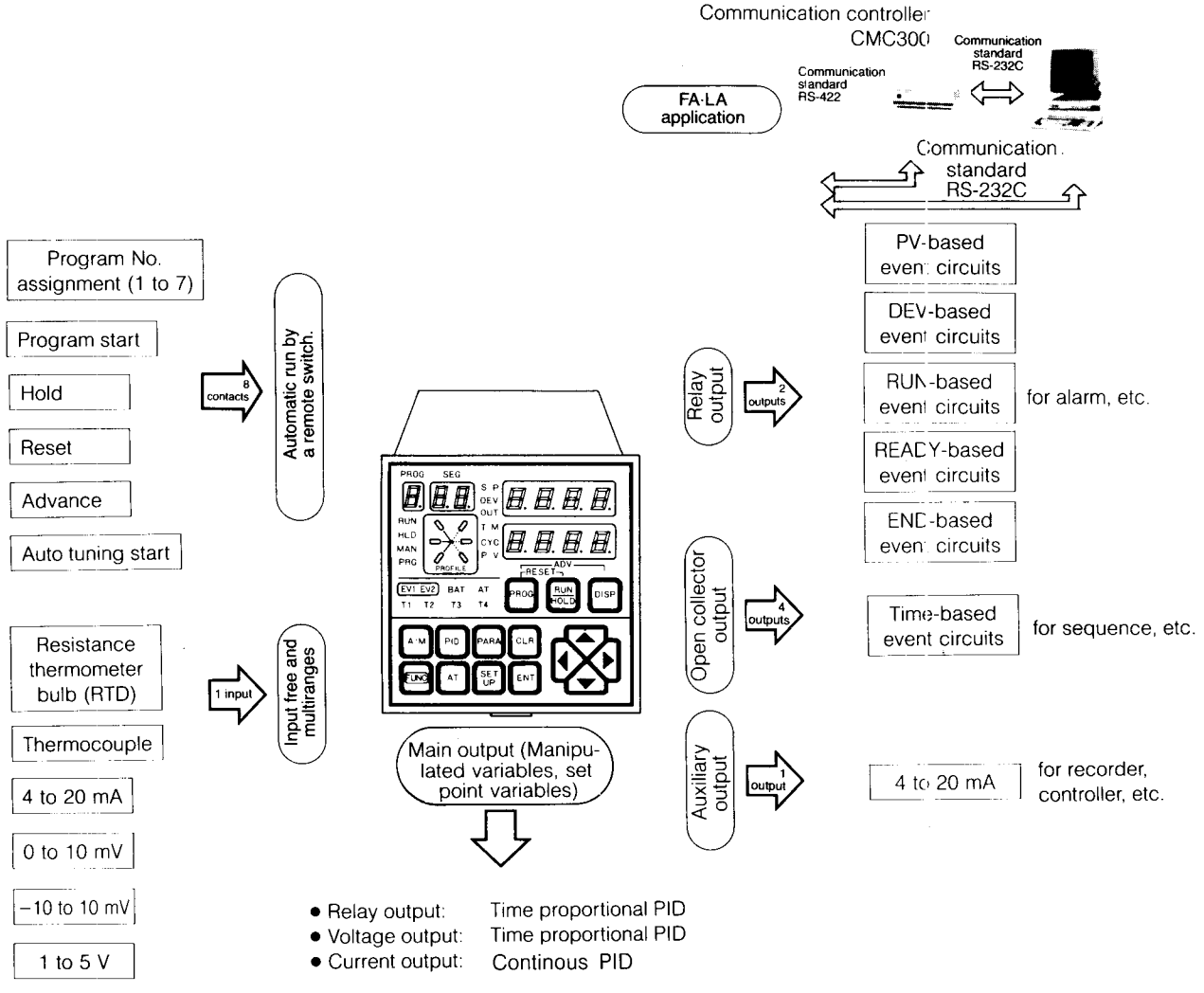
1. General

The DCP211 is a microprocessor-based program controller (96 mm×96 mm in size) which executes program control of temperature, humidity, pressure, flow, and other process variables.

2. Features

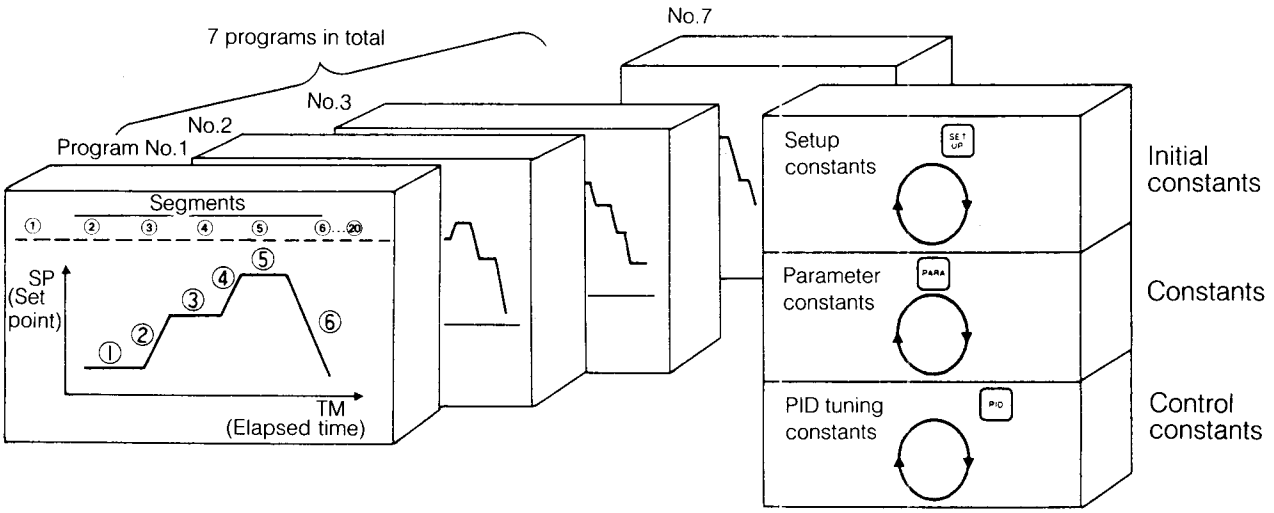
- ○ Multiranges
  Sensors can be replaced without any need of adjustment in each group of thermocouples, resistance thermometer bulbs, and linear inputs (current, voltage).
- ○ SP limit
  Since the DCP211 can limit a data setting range, it can prevent troubles due to wrong setting.
- ○ Profile display
  The DCP211 displays present segment conditions (rising, soaking. falling), and the next segment conditions during program run.
- ○ Auto tuning (option)
  Since the DCP211 automatically calculates PID constants at the start-up time, you can entrust the DCP211 with troublesome tuning.
- ○ Free power supply.
  Since the DCP211 is applicable to 90 to 264 V ac, it can be operated with any of 100, 110, 120, 200, 220, and 240 V ac power supply without reconnecting power terminals.

3. Outline of functions



2. CONSTANTS AND PROGRAMMING

1. Content of program:
DCP211 constants and programming



For running the DCP211, the above setting is necessary.
Respective setting modes are provided.

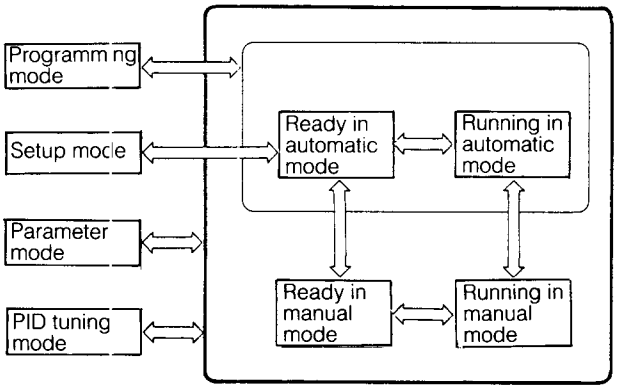
(1) Setting of constants
Constants are divided into three groups, and operated by SET UP, PARA, and PID keys, respectively.

(a) Setup constants
Setup constants are initially set as a program controller. After setting, the constants are not changed frequently.

(b) Parameter constants
These constants are changed comparatively frequently.

(c) PID tuning constants
These constants are provided for PID control.

(2) Programming
Programs No.1 to 7 can be programed.
Max. 20 segments per program can be set.



Operation mode

2. Programming:

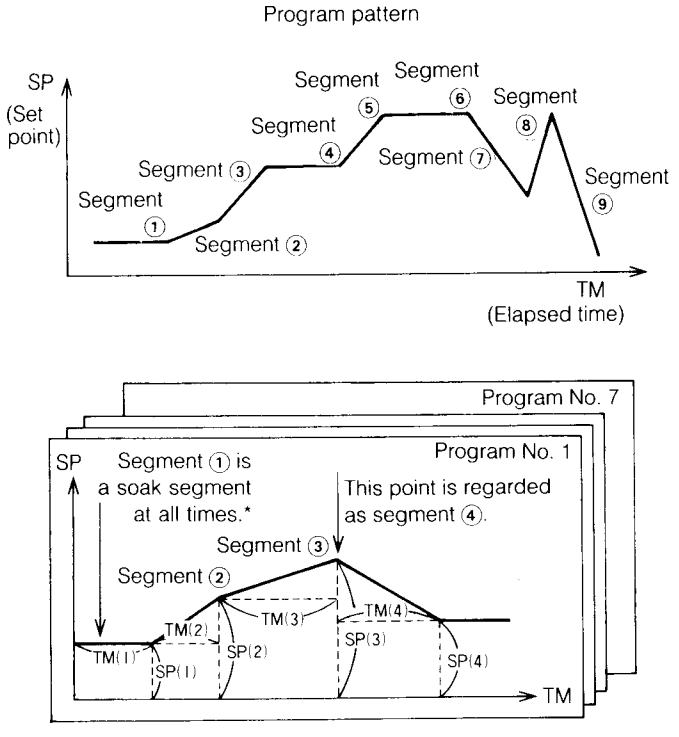
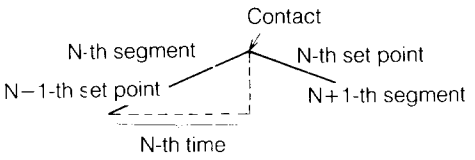


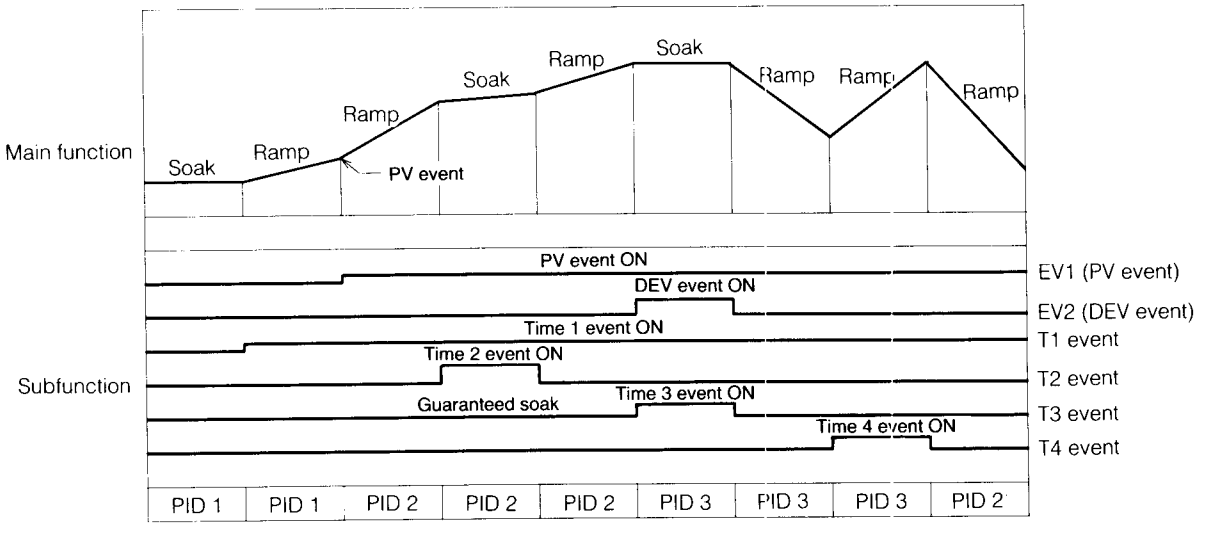
Fig. 2-1 Program concept

A broken line determined by set points of industrial values (temperature, humidity, pressure,flow, rotating speed, and other variables) to the time is called program pattern (or simply program or pattern).
Program patterns are identified from each other by program numbers (1 to 7).
Individual straight lines comprising a program pattern are called segments, which are identified from each other by segment numbers (1 to 20).
A "—" portion of a segment is called soak (soaking), while a "/" portion is called ramp (rising or falling).
In the following figure, the n-th segment is specified by a set point of the N−1-th segment, N-th set point, and N-th time setting; provided that the first segment is regarded to be set constant.
The constant of the N-th segment and the N+1-th segment is regarded as the N+1-th start point.



Program No. 1					
Segment 1		Segment 2		Segment 3	
Main function	Subfunction	Main function	Subfunction	Main function	Subfunction

(1) Main function ..... Sets a program pattern by set points and time.
① Soak ..... Setting of soaking section (every segment)
② Ramp ..... A rising or falling section to be set by the next aimed set point and arrival time (every segment).
(2) Sub function ..... Adds events and other functions.
① Event (EV1, EV2) ..... PV-based event circuits: Used for sending a sequence output by PV (every segment)
DEV-based event circuits: Used for sending a sequence output by a deviation between a set point and PV (every segment).
② Time-based event circuits (T1, T2, T3, T4) ..... Used for sending a sequence output by time (every segment).
③ P id ..... Specifies the PID group number (every segment).
④ Guaranteed soak (9.5.) Stops the progress of time until a process variable enters within the guaranteed soak band at the segment start point (every segment).
⑤ PV start (P.SEA) ..... Used for adjusting the start point to the point where PV is equal to a set point (every program).
⑥ Cycle (CYCL) ..... Used for repeating the same program.

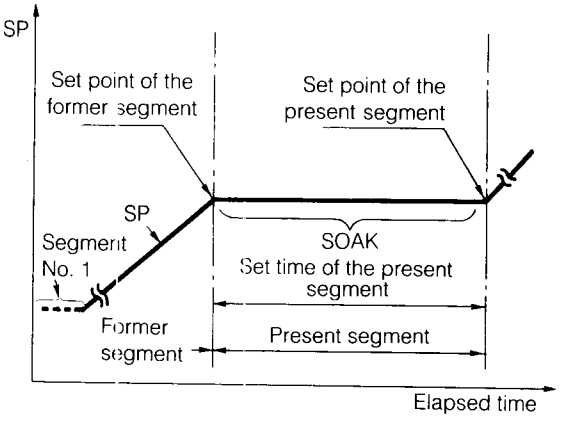


3. CONTENT OF PROGRAM

A. Main function

(1) SOAK SEGMENT

- The soak means a section where SP is kept constant irrespective of the lapse of time.
- A program is set by specifying a set point and time of each segment. It is set by specifying an aimed set point in the segment and the time required to arrive at the aimed set point.

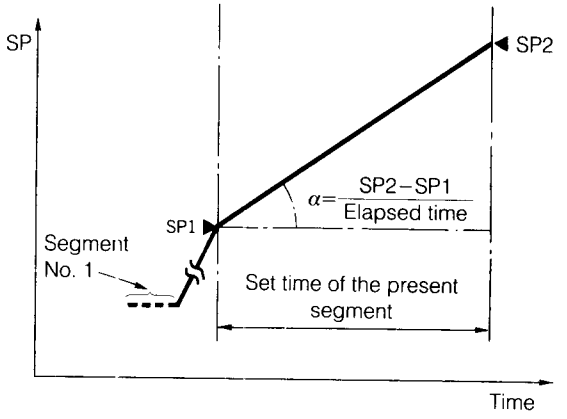


If the set point of the former segment is equal to that of the present segment in the program mode, the soak is set, and its time is set by the present segment time.

A set point and time of the first segment (segment No.1) of a program are set to soak at all times.
If the time is set to zero, the set point becomes a point.

(2) RAMP SEGMENT

- The ramp means a section where a set point changes at a constant ratio with time.
- The first segment (segment No.1) of a program cannot be set to any ramp segment.



The ramp angle α is obtained by dividing a difference between set point SP1 of the former segment and set point SP2 of the present segment by the preset set time in the programming mode.

B. Subfunction

(1) Process variable-based event circuits

The PV event means an PV-based event circuit (signal) which turns on (or off) when a PV is more than a certain value (PV event set point) or which turns off (or on) when the PV is less than the certain value, irrespective of the control output.
The PV event can be set in any segment.

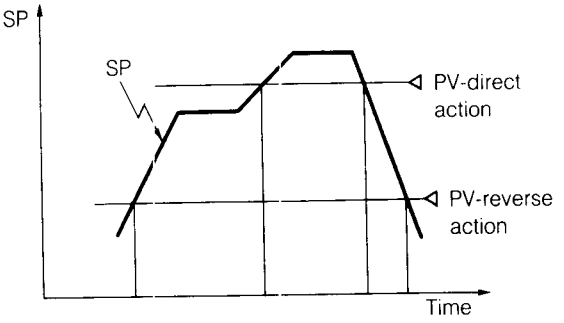
- The PV event functions in RUN/HOLD mode.

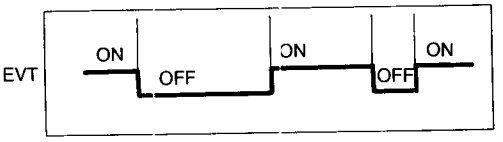
- The PV event functions as follows.
  Direct action setting
  A direct action set point turns on when PV increases.
  (A direct action set point−hysteresis) turns off when PV decreases.
  Reverse action setting
  A reverse action set point turns on when PV decreases.
  (A reverse action set point+hysteresis) turns off when PV increases.

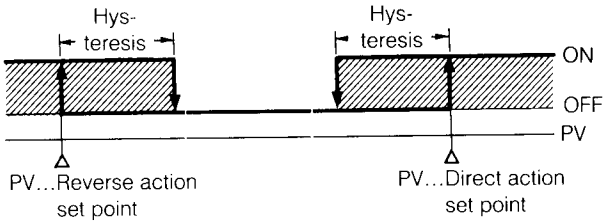
- PV event setting remains effective after it has been set once until the next PV event is set in a segment. Accordingly, set the next segment as follows, if you want to use the PV event in a certain segment and make the event ineffective in and after the next segment.
  PV ... Set the direct action set point to the upper limit of input range.
  PV ... Set the reverse action set point to the lower limit of input range.

- If the PV bias is set, a PV value obtained by adding or subtracting a PV bias value becomes effective to the PV event.

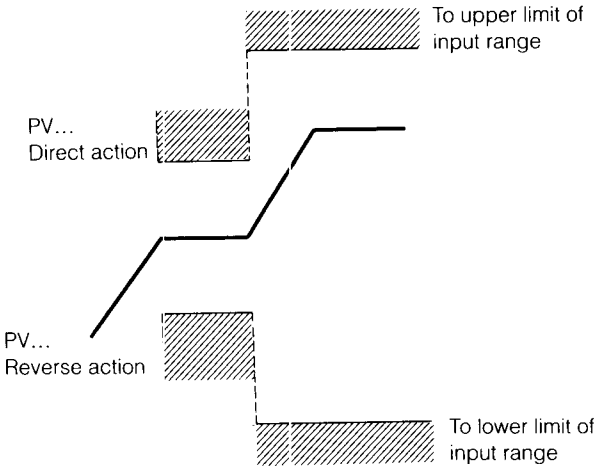
1. Set the PV event in the set up mode to the item to be displayed at the programming.
2. In parameter mode:
   PV event of EV 1 ... 0 (direct action) setting
   1 (reverse action) setting
   PV event of EV 2 ... 0 (direct action) setting
   1 (reverse action) setting
3. Set a PV event value in programming mode.







Set in parameter mode.
PV:Direct action, reverse action
H: Event, hysteresis
Set in programming mode.
PV set point



(2) Deviation-based event circuits

The DEV event (signal) circuit turns on if a PV value from a set point is deviated more than a certain value (DEV event set point), irrespective of the control output. The DEV event can be specified in any segment.

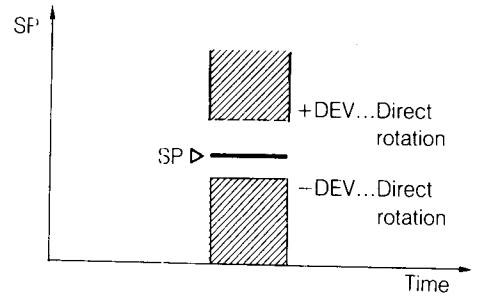
- The DEV event functions in RUN/HOLD mode.

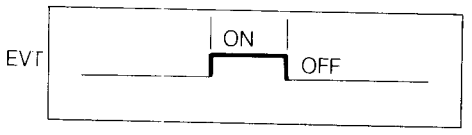
- The DEV functions as follows.
  Assume that DEV is set to be plus as viewed from SP;
  The DEV event circuit turns on at (SP+DEV) point in direct action and turns off at (SP+DEV) point in reverse action as PV increases.
  The DEV event circuit turns off at (SP+DEV −hysteresis) point in direct action, and turns on at (SP+DEV−hysteresis) point in reverse action as PV decreases.
  Assume that DEV is set to the minus side as viewed from SP.
  The DEV event circuit turns on at (SP−DEV) point in direct action, and turns off at (SP−DEV) point in reverse action as PV decreases.
  The DEV event circuit turns off at (SP−DEV +hysteresis) point in direct action and turns on at (SP−DEV+hysteresis) point in reverse action as PV increases.

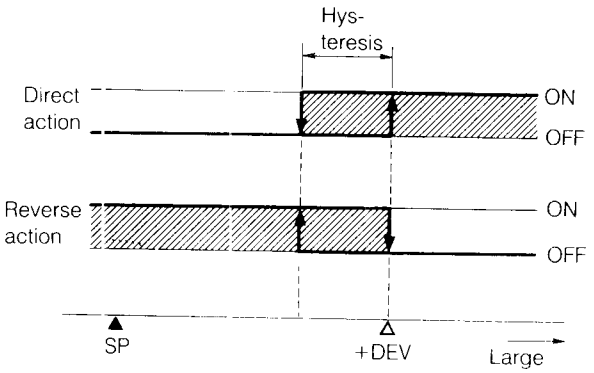
- The DEV event remains effective after it has been set once until the DEV event of the same event number is set again next. Accordingly, set the DEV event in the next segment as follows when you want to use this DEV event in a certain segment and make it ineffective in the next segment.
  Set the direct action set point of +DEV to the upper limit of the input range.
  Set the reverse action set point of −DEV to the upper limit of the input range.
  Set the reverse action set point of +DEV to the lower limit of the input range.
  Set the reverse action set point of −DEV to the lower limit of the input range.

- When the PV bias is set, a PV value obtained by adding or subtracting the PV bias value becomes effective to the DEV event.

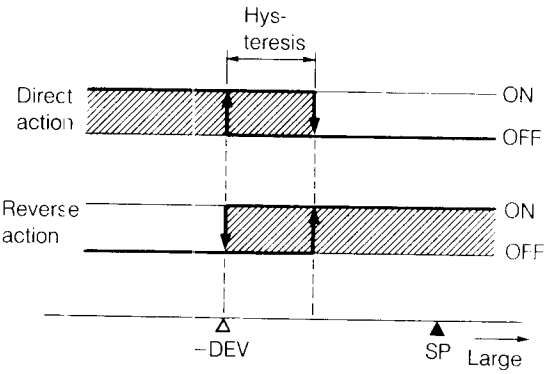
1. Set the DEV event in the set up mode to the item to be displayed at the programming.
2. In parameter mode;
   DEV event of
   EV 1 ..... 2 (direct action) setting
   3 (reverse action) setting
   DEV event of
   EV 2 ..... 2 (direct action) setting
   3 (reverse action) setting
3. Set a DEV range value in programming mode.





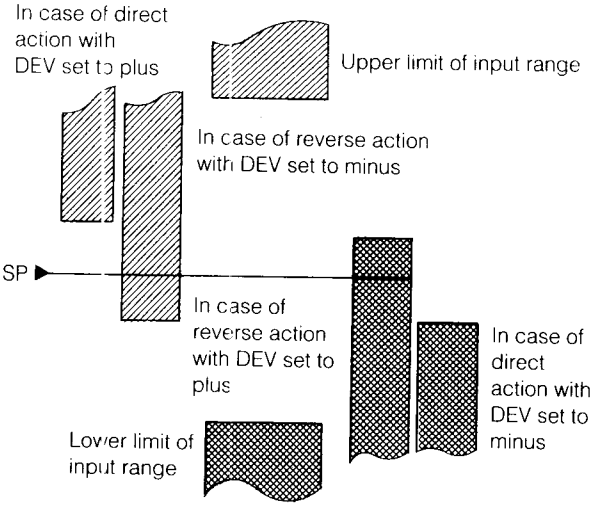


Assume that DEV is set to the plus side as viewed from SP.



Assume that DEV is set to the minus side as viewed from SP.

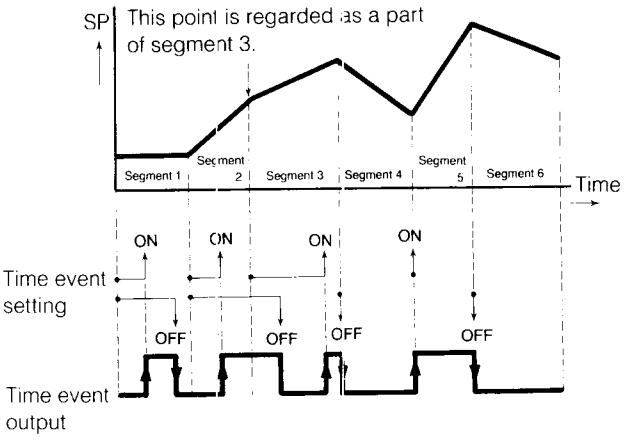
Set in parameter mode.
DEV: Direct action, reverse action
H: Event, hysteresis
Set in programming mode.
DEV: DEV set point



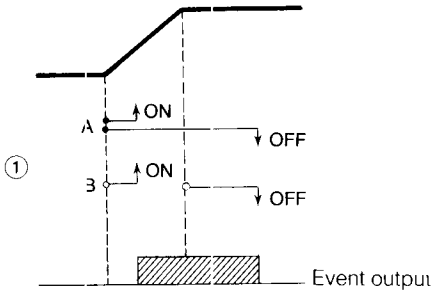
For making the DEV event ineffective in the next segment

(3) Time-based event circuits

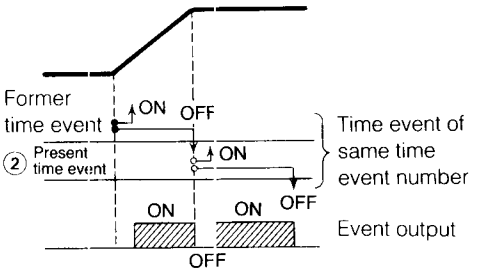
- This time event circuit is a 4-channel transistor open collector output, and it turns on and off according to the lapse of the program time.
- The time event is settable in any segment. The on/off operation of each channel can be set by the time from the start point of the segment or the time exceeding the segment time can also be set. (If the time is set in excess of the final segment, the program is in READY mode after the program end, and the output turns off.)
- The ON and OFF action can be set once in one segment for each channel. Either on or off action only is also settable.
- The ON or OFF action is set independently each other.
- If the same setting (ON setting if the ON action is in progress, or OFF setting if the OFF action is in progress) is set in a subsequent segment again, the former setting becomes ineffective, while the latter setting becomes effective.



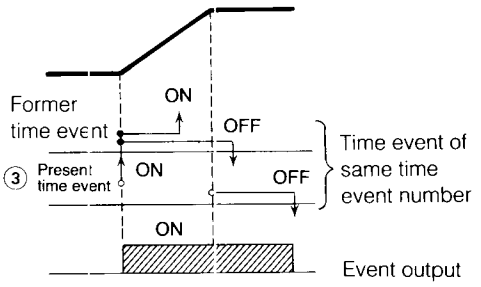
- The right figure No. ① shows that either A or B method is used to set the event output for the time event crossing a segment.



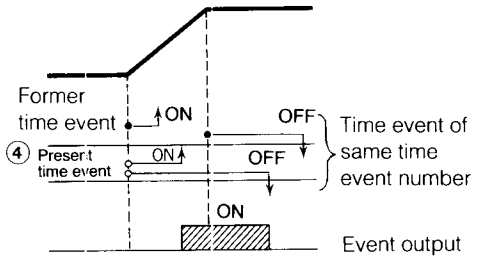
- The right figures ②, ③, ④, and ⑤ show the examples of the event output that the present time event is newly set to the former time event.
- Time event timer stops in HOLD mode.
- The switching point of two segments is regarded to belong to the latter segment.
- The time event is off in READY mode.

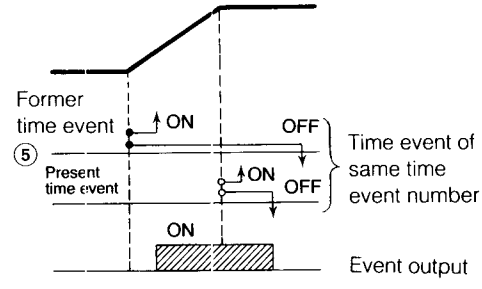


1. Set the time event in setup mode to the item to be displayed at the programming.
2. Set the ON time and OFF time of the time event in each segment in the programming mode.



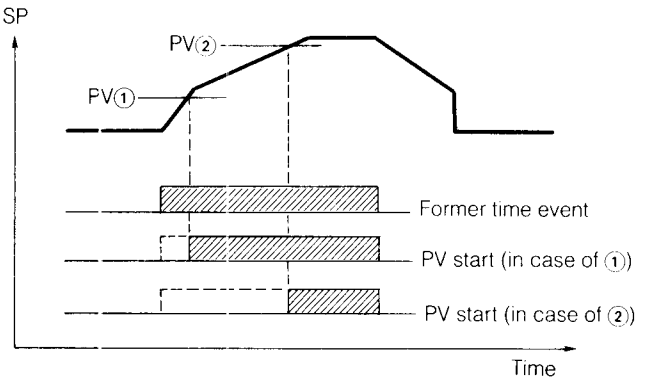
- When a segment is advanced to the next segment by the segment advance operation, the timer of the time event is corrected so that the same results can be obtained as in normal advance to the next segment without segment advance operation.





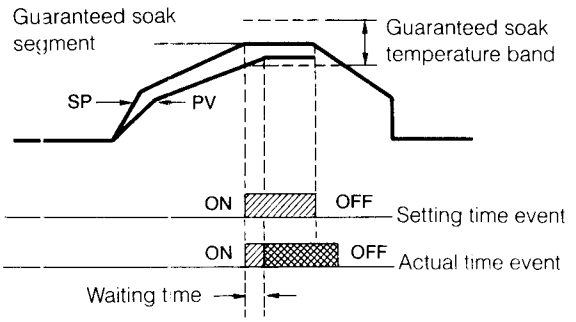
- If a power failure occurred, the time event is continued after recovery from the state just before the occurrence of the power failure.
- The time event turns off momentarily at the cycle switching point when cycle action is applied.
- When a program is transferred to segment 01 by cycle action, the time event setting and timer are cleared once, and they are reset and corrected to the same results as in normal start of the program with segment 01.

- **Time event in PV start**
  If a program is started halfway in the course of a certain segment by the PV start operation, the time event setting and timer action are executed to be the same results as in the transfer to the halfway (the point found by the PV start) of the segment by normal start with segment 01 without PV start operation.



The time event at PV start is automatically corrected.

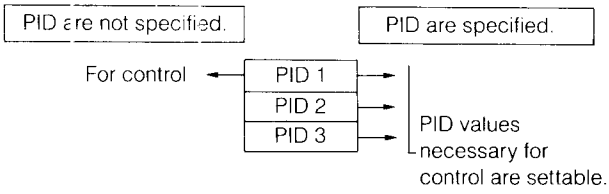
- **Time event in guaranteed soak**
  The time event circuit turns on simultaneously when an SP enters the guarantee soak segment of a program when the ON time is "0", and the time measurement stops until the PV reaches the guaranteed soak temperature band. The time measurement is started with the time the PV has reached the guaranteed soak temperature band. Thus, the time compensation of the guaranteed soak segment can be synchronized with the time event time.



(4) PID group selection

- Three groups of PID parameters can be used for control operation, assuming that one group consists of P.I.D. and output limiters.
- A PID parameter group to be used for each segment is selectable during programming.
- PID groups are assignable in any segment.

1. Set PID in setup mode to the item to be displayed at the programming.
2. Set a PID group to be used in the programming mode.

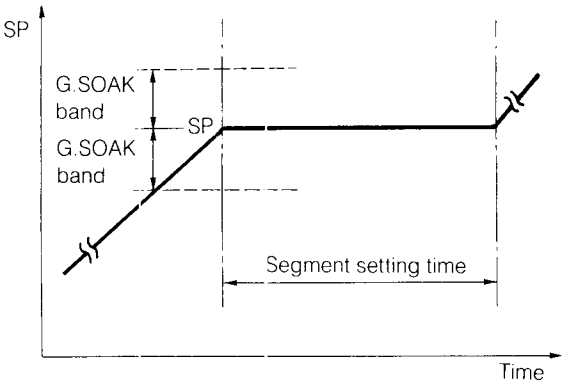


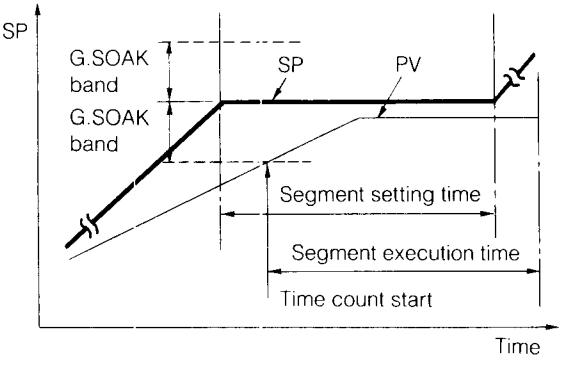
- One group of PID constant groups is selected at the delivery from factory.

(5) G.SOAK (guaranteed soak)

- The guaranteed soak means a section where the segment setting time is guaranteed without starting the segment setting time count until PV enters a predetermined band of SP.
- The G.SOAK time is started counting after a PV value has entered the soak band for more than one second. This is also applicable to the advance mode.
- Unlike events, the action is judged at the entry of the segment in which G.SOAK is set.
  This decision is irrespective of whether a PV value gets out of the G.SOAK band or not after it has entered the G.SOAK band once.
  This G.SOAK can also be set at the RAMP segment point. The action is judged at the entry of a RAMP segment in the same way as described above, and it is not executed during the RAMP segment time until PV enters a certain band of SP.

1. Set G.SOAK in the setup mode to the item to be displayed at the programming.
2. Set the G.SOAK band (numeric value) in the parameter mode.
3. Set whether G.SOAK is used or not in each segment of the programming mode.





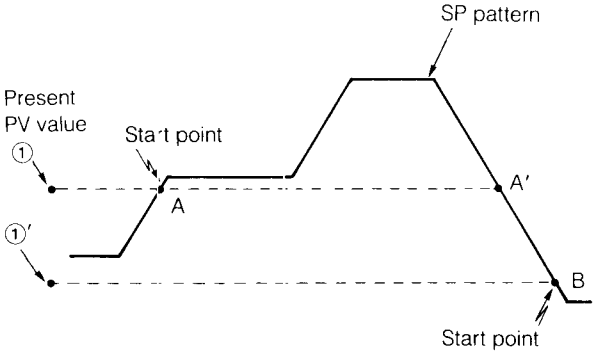
(6) PV start

Operation start from a PV value point on a program pattern

PV start function

- The PV start is made by normal RUN operation, if the PV start is set during programming.
- A program is started with the first point where the PV coincides with the SP of the program (PV and SP include a bias).
- A program is started with the beginning of No.1 segment, if PV and SP don't coincide with each other.
- After PV start, the event action and time event time are automatically corrected.

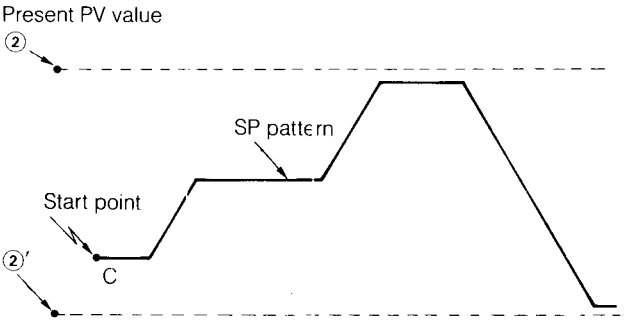
1. Set the PV start in the setup mode to the item to be displayed at the programming.
2. Set YES or NO to determine whether the program is PV started or not in the programming mode.



PV start point

① A program is started with the point (A) where a PV value coincides with an SP pattern first.

①'Since the point (B) where a PV value coincides with an SP pattern first is positioned at the end of this program, the residual pattern only is program-controlled.



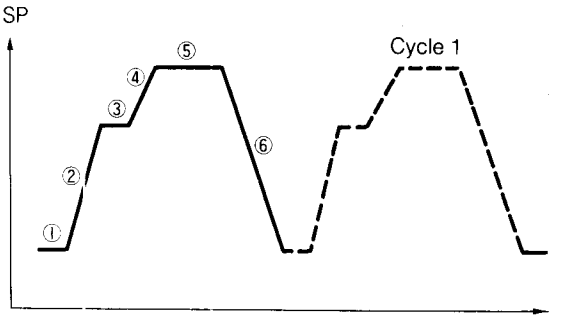
PV start point

②, ②'Since a PV value and an SP pattern don't coincide with each other, a program pattern is started with No.1 segment (C).

(7) Automatic cycling of a program

- This function repeats the program from No.1 segment of a complete program to the final segment by the number of preset cycles. The number of cycles is settable to max. 99 cycles every program.
- If No. of cycles is set to n, the program is repeated by n+1 times.
- Cycle run is restarted under the cleared condition of each event setting of PV, DEV, and time without running at the end point of the final segment.
- This run is started with segment 1 without executing any PV start, even if the PV start function is preset.

1. Set No. of cycles in the setup mode to the item to be displayed at the programming.
2. Set No. of cycles in the programming mode.



- No. of cycles to repeat the entire program can be set from any segment (① to ⑥).
- No. of cycles set is displayed in all segments.

III. PROGRAMMING AND OPERATION

1. CONTENTS OF DISPLAYS AND FUNCTIONS OF KEYS

Contents of dispalys

PROG **Program No. display:** Displays a selected program No. Displays A, if an alarm occurs.

SEG **Segment No. display:** Displays a selected segment No. Displays an alarm code, if an alarm occurred.

Upper display: Displays SP, DEV, OUT, TIME, etc.

Upper and lower display indicators: Indicates the contents of the upper and lower displays.

RUN HLD MAN PRG **Mode indicator LED lamps:** Indicates RUN, HOLD, MAN, and programming modes.

Profile indicator LED lamp: Indicates the rising, soaking, and falling tendencies of a program pattern by 2 segments.

Lower display: Displays PV, TIME, CYC, etc.

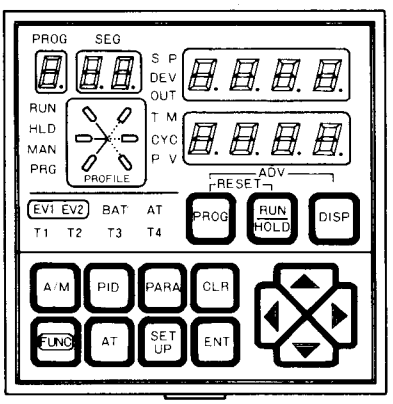
EV1 EV2 BAT AT T1 T2 T3 T4

EV (event) indicator LED lamp: Indicates the event action. Indicates an event setting in programming mode.

BAT (battery) alarm LED lamp: Flickers when the battery voltage becomes lower than specified.

AT (atuo tuning) indicator LED lamp: Flickers during the execution of auto tuning.

T1, T2, T3, T4 (time event) indicator LED lamps: Indicates the event action. Indicate an event setting in programming mode.



Functions of keys

PROG **Program key:** Selects and assigns a program number.

RUN/HOLD **RUN/HOLD key:**
- Sets the mode from READY to FUN.
- Selects RUN or HOLD.

DISP **Display key:**
- Changes the display selection.
- Interrupts the setting action, and other action.

A/M **AUTO/MANUAL key:** Selects AUTO or MANUAL mode.

PID **PID key:** Changes the setting of PID constants.

PARA **Parameter key:** Sets and changes parameter constants.

CLR **Clear key:** Deletes program data with FUNC key combined.

Multi-keys:
- One of these 4 keys is used for data setting and programming item shift.
- These keys increase or decrease a flashing digit, or select a flashing digit for change.

FUNC **Function key:** Used together with other keys.

AT **Auto tuning key:** Starts or interrupts the execution of auto tuning.

SET UP **Set up key:** Sets setup constants.

ENT **Enter key:**
- Used to change data.
- Enters data in memory.

Key operation

Simultaneous pressing of two keys:

In the case of key operation like [FUNC] + [PROG], press [PROG] key while pressing [FUNC] key.

Two keys are pushed together at a time in 5 ways as shown in the right table. Press a key in column B while pressing a key in column A in such a case.

Operation	A	B
Reset (RESET)	PROG	RUN / HOLD
Advance (ADV)	PROG	DISP
Programming start	FUNC	PROG
Program data erase	FUNC	CLR
Program copy	▲	PROG

Operation of specific keys

1. [SET UP] · [PARA] · [PID] operation

⟹ Press [DISP] key when you want to complete the set-up, parameter mode, or PID tuning.

① Select an operation mode by [SET UP], [PARA], or [PID] key.

② Select each mode item by ▽, △, [SET UP], [PARA], or [PID] key.

③ Specify by [ENT] key, if you want to change data. Data flushes.

④ Change data by ◁▷ key.

⑤ Store data by [ENT] key.

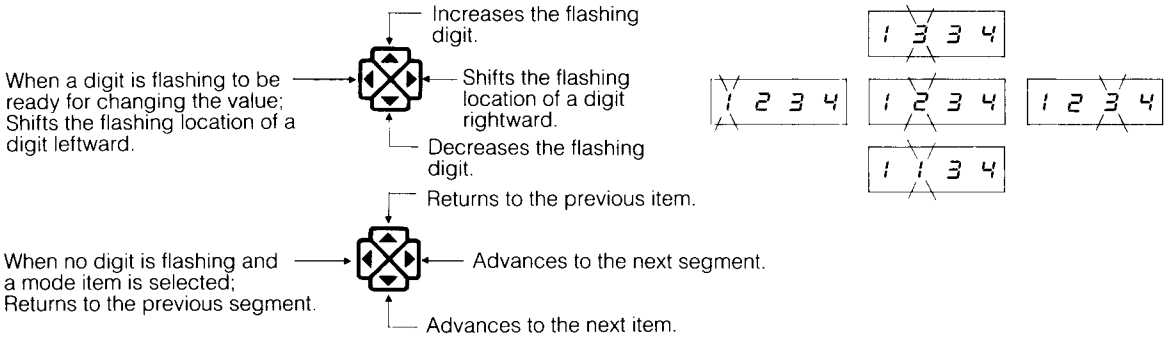
2. Key operation in programming mode

⟹ Press [DISP] key when you want to complete the programming mode.

① Select program No. by [PROG] key.

② Press [FUNC] + [PROG] keys, and PRG (PROG) LED lamp lights.

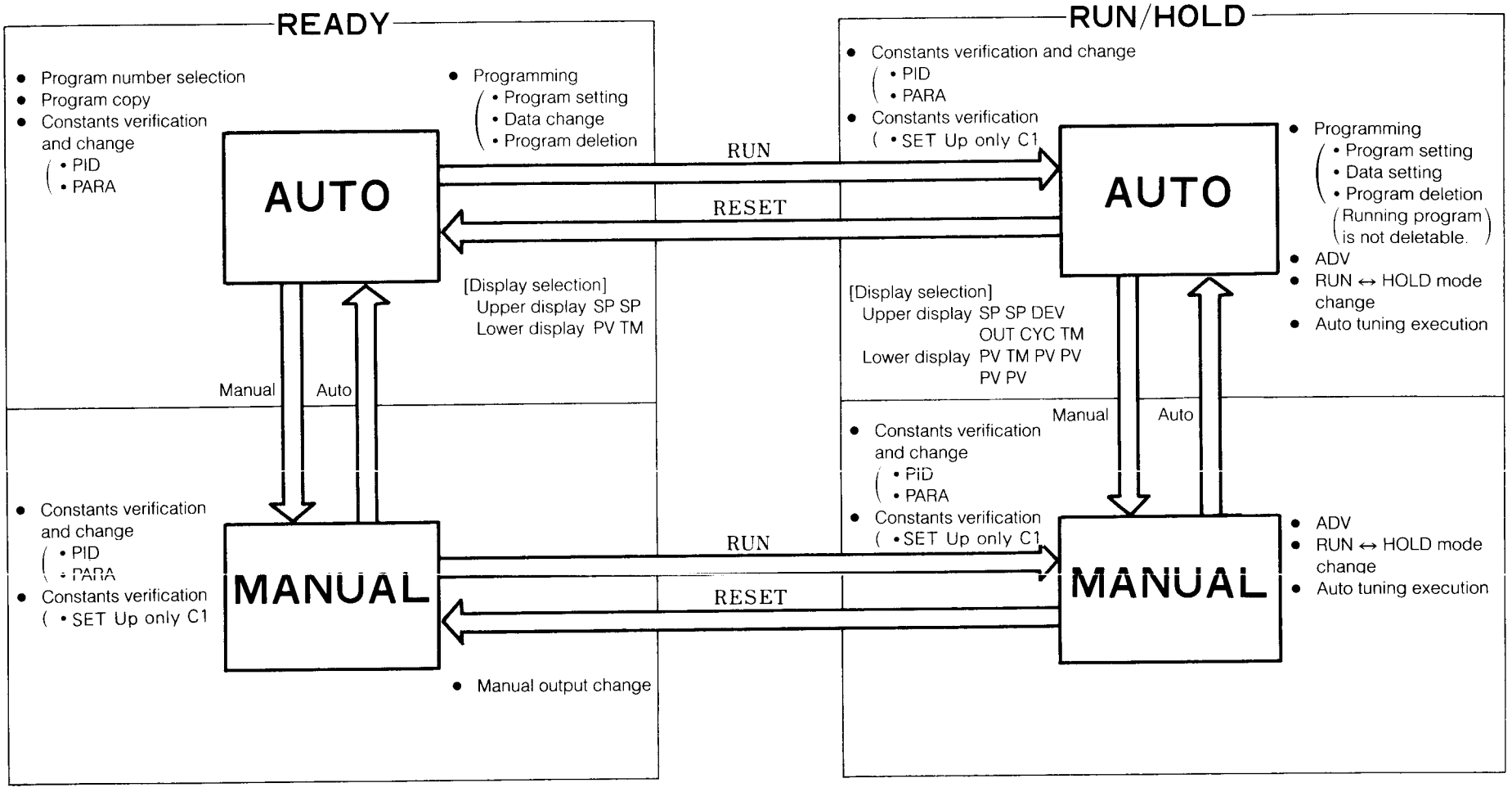
③ Operate ◁▷ keys according to the lighting condition of PRG (PROG) lamp as follows.



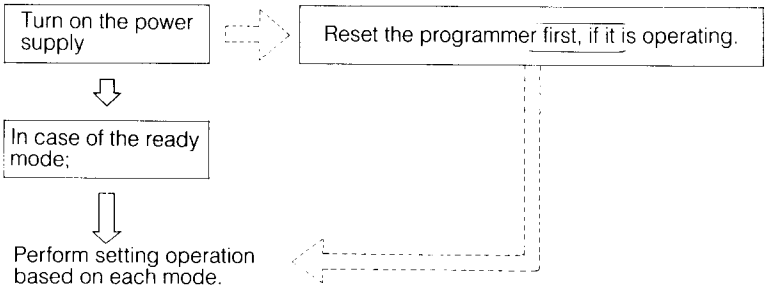
By pressing [ENT] key when no digit is flashing, the digit will start to flash to be ready for changing the value.

By pressing [ENT] key when a digit is flashing, the data can be stored in memory.

MODE TRANSITION DIAGRAM



2. OUTLINE OF PROGRAMMING



Resetting method

Press [RUN/HOLD] key while pressing [PROG] key.

Instruction pages of modes	Display at the start of mode	Setting example in a specified mode	Operation methods
[SET UP] Setup mode (Initialization) See page 18.	Press [SET UP] key. (SP) C 1	Key lock → °C/°F selection; Auxiliary output upper-limit/ lower-limit ← SP limit upper-limit/ lower-limit	○Each code from C 1 to C 33 appears in a display when [SET UP] key is pressed sequentially. ○If C 1 is not displayed, press [DISP] key and then, press [SET UP] key again.
[PARA] Parameter mode (Constant value setting) See page 24.	Press [PARA] key. (SP) P r t c	Program protect → G.SOAK range; SP bias ← Control cycle	○Each code from P r t c to HY S2 appears in a display when [PARA] key is pressed sequentially. ○If P r t c is not displayed, press [DISP] key and then, press [PARA] key again.
[PROG] Programming mode (Program setting) See page 29. (Note) Set the program mode first.	Press [ENT] key. SP — — — — TM — — — — PROG 1. SEG 1. PRG	Press either key. SP 0 0 0 0 TM — — — — → Change value → [ENT]; SP 10 TM — — — —; SP 10 TM 00.01; [ENT] Next segment ← Press this key.	○Select the programming mode by pressing [PROG] key while pressing [FUNC] key. ○PRG LED lights.
[PID] Tuning mode (PID constants setting) See page 36.	Press [PID] key. (SP) A t	Auto tuning → Proportional band → Rate time 1; Manual	○Each code from A t to I o u t appears in a display when [PID] key is pressed sequentially. ○If A t is not displayed, press [DISP] key and then, press [PID] key again.
[RUN/HOLD] Operation mode (Running operation) See page 38.	Press [RUN/HOLD] key. PROG 1 SEG 1 SP 211 TM 0.10	PROG 1. SEG 1. RUN HLD MAN PRG PROFILE ○ RUN LED lights. ○ LED lights on PROFILE to indicate the progress of a program.	○Press [DISP] key, and then press [RUN/HOLD] key.

3. SETUP MODE

① General

The setup mode decides the specifications as a program controller. The upper display shows a setup code representing a setup item, while the lower display shows setup data. This mode is executed in ready (ready for run) mode.
If an initial value satisfies the required specifications, the setup data change is not necessary. Proceed to the parameter mode on page 24 in such a case.

(Note) Initial values in the display show those set before the delivery from the factory.

Display/ setting order	Codes	Setup item	Selection or setting range	Initial value in display	Description
1	C 1	Key lock	0: No keylock 1: Setup change is not allowable. 2: Data are not changeable. 3: DISP only is changeable.	0	No key lock
2	C 2	Temperature unit	0: °C (Centigrade) −1: °F (Fahrenheit)		Indicated in case of a thermocouple or resistance thermometer bulb input.
3	C 3	Control action	0: Reverse action 1: Direct action	0	Not indicated, if the main output of the current output model is SP. If initial value 0 is changed to 1 in C4, C5 appears.
4	C 4	Setting of manipulated variable (MV) in case of PV overrange.	0: Not provided 1: Provided	0	
5	C 5	Manipulated variable (MV) in case of PV overrange.	0.0 to 100.0% (Time proportional model) −10.0 to +110.0% (Current output model)	0.0 (%)	
6	C 6	Type of PV range	0 to 12 (T/C) 20 to 34 (RTD) 40 to 45 (Linear)		
7	C 7	Linear PV decimal point position	0 to 3	0	Displayed for a linear input model.
8	C 8	Linear PV lower limit	−1999 to upper-limit U	0	
9	C 9	Linear PV upper limit	Lower limit 9999U	1000	
10	C 10	SP limit lower-limit	0% FS to upper limit of range	0	Different depending upon the type of PV range code.
11	C 11	SP limit upper-limit	Lower-limit to 100% FS of range	100	Different depending upon the type of PV range code.
12	C 12	SP main output 4mA setting	0: MV 1: SP	0	Displayed in case of a current output model MV: Control output SP: Set point output for controller
13	C 13	SP main output 4mA setting	−1999 to +9999U	0 (%FS)	Displayed when initial value 0 is changed to 1 in C12 in case of a current output model.
14	C 14	SP main output 20mA setting	−1999 to +9999U	100 (%FS)	
15	C 15	Type of auxiliary output	0: PV 1: SP	0	Displayed when an auxiliary output is provided PV: Process variable SP: Set point
16	C 16	Auxiliary output 4mA setting	−1999 to +9999U	0 (%FS)	
17	C 17	Auxiliary output 20mA setting	−1999 to +9999U	100 (%FS)	

Display/ setting order	Codes	Setup item	Selection or setting range	In tial value in display	Description
18	C18	EV1, 2 programming	0: Item is displayed at the programming. 1: Item is not displayed at the programming.	0	
19	C19	T1-T4 programming	0: Item is displayed at the programming. 1: Item is not displayed at the programming.	0	
20	C20	PID group, G.SOAK programming	0: Item is displayed at the programming. 1: Item is not displayed at the programming.	0	
21	C21	PV start, cycle programming	0: Item is displayed at the programming. 1: Item is not displayed at the programming.	0	
22	C22	Communication address	0 to 254	0	Displayed when the communication function is provided. Designates communication address when the communication function is provided.
23	C23	Transmission speed	0: 9600 1: 4800 2: 2400 3: 1200 (BPS)	0	
24	C24	Communication code	0: 8-bit even parity, 1 stop 1: 8-bit parity is not provided, 2 stop	0	
25	C25	Transmitting codes	0: Binary (for CMC300/400, MA500 DIM) 1: ASCII (for MX100 SCM)	0	See when communication function is provided
26	C26	PV	0: Displayed 1: Not displayed 2: Not displayed, but fixed to 0% of the range.	0	
27	C27	Time display	0: Residual segment time 1: Elapsed run time	0	
28	C28	Alarm display	0: Displayed 1: Not displayed	0	
29	C29	Program time unit	0: Hour, minute 1: Minute, second	0	
30	C30	Input/output type, option type	(Hexadecimal number)	—	Not rewritable. (*1) Initial value is E.4.0.0. in the display in case of K09 (0 to 1200°C), for example.
31	C31	Instrument code	135	135	Not rewritable.
32	C32	ROM ID	2049	2049	
33	C33	ROM version	—	—	

(*1) Table of combinations of initial values in the display for the item 30.

No. 1 digit	No. 2 digit	No. 3 to 4 digits
Model number optional function (1) 0.: 0 0 0 8.: 0 0 1 4.: 0 0 2 C.: 0 0 3 6.: 0 0 4 5.: 0 0 5 E.: 0 0 6 d.: 0 0 7	1. : Voltage output 2. : Relay outtput 4. : Current output	0.0. : Thermocouple input 0.1. : RTb input 0.2. : Linear input

Setup mode setting procedure

Refer to the key operation on page 18. For the setup contents, see page 15. Although there are setup items from No.1 to No.33, the setup setting procedures for the selected setup items will be described here.

Press [SET UP] key first.

[1] Key lock

SP C 1
TM 0

Initial setup display:
0: Indicates that no key lock function is provided.

Set the number in the lower display to 2 when specifying the data to be unchangeable.

C 1
0 0 0 0

The digit flashes when pressing [ENT] key.

C 1
0 0 0 2

Increase the number to 2 by pressing this key.

C 1
2

Press [ENT] key.

[2] Temperature unit

SP C 2
TM 0

Temperature unit is initially set to °C (centrigrade).
Initial setup display:
0: Indicates centrigrade (°C).

For changing the temperature unit to °F (Fahrenheit), set the number in the lower display to −1.

SP C 2
TM 0 0 0 0

The digit flashes when pressing [ENT] key.

SP C 2
TM − 0 0 1

Increase the number to 1 by pressing this key.

SP C 2
TM − 1

Press [ENT] key.

[3] Control action

SP C 3
TM 0

Initial setup display:
0: Indicates the reverse control action.

Set the number in the lower display to 1 for changing the control action to direct control action.

SP C 3
TM 0 0 0 0

The digit flashes flickers when pressing [ENT] key.

SP C 3
TM 0 0 0 1

Increae the number to 1 by pressing this key.

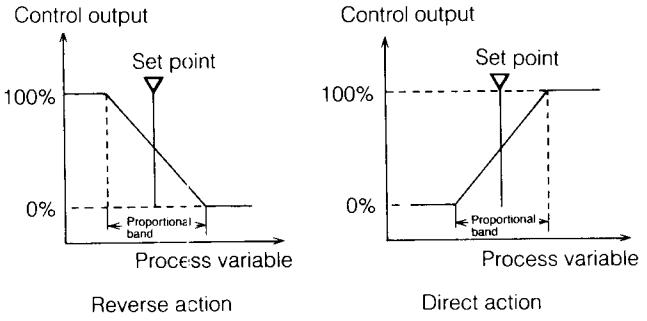
SP C 3
TM 1

Press [ENT] key.

o This item selects either reverse action or direct action of the control output.
The control output is initially set to the reverse action. Switch the control output by this item if the direct action is necessary.

0: Reverse action — As process variable increases, the control output decreases. This action is generally used for heating control, etc.

1: Direct action — As process variable increases, the control output increases. This action is generally used for cooling control, etc.



[4] Setting of manipulated variable in case of PV overrange

SP C 4
TM 0

Initial setup display:
0: Not provided. Not designated.

Set the number of the lower display to 1 for changing to "Provided, Designated".

This item specifies the control output when an input exceeds the upper/lower-limit values of the range. This item is utilized for specifying the control output to safety when an input signal is interrupted.

[5] Manipulated variable in case of PV overrange

SP C 5
TM 0.0

Proceed to when 1 is selected at C 4.
Initial setup display:
0 0: 0.0 to 100.0% (0D, 6D models)
−10.0 to 110.0% (5G model)

Set the value in the lower display to 50.0 for changing the setting range to 50.0.

SP C 5
TM 0 0 0.0

The digit flashes when pressing [ENT] key.

SP C 5
TM 0 5 0.0

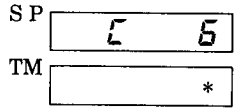
Shift the flashing location of a digit by pressing this key.

Increase the flashing digit to 5 by pressing this key.

SP C 5
TM 5 0.0

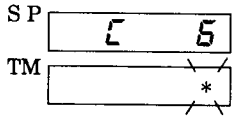
Pressing [ENT] key.

6 PV range type

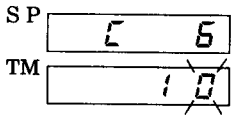


Initial setup display:
*: Indicates No. corresponding to input type/range of model No.

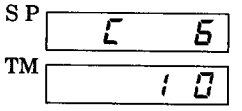
To change the input type/range from * to 10, set the lower display to 10.



Press [ENT] key. * flashes.



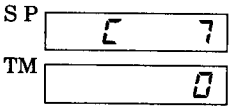
Increase the number to 10 by pressing this key or this key.



Press [ENT] key.

Note: With thermocouple types, only 0 to 12 can be selected. With RTD types, only 20 to 34 can be selected. With linear types, only 40 to 45 can be selected. On the Z13 model, other input types/ranges cannot be changed to.

7 Linear PV decimal point position



Initial setup display:
0: Indicates that the decimal point is not used.

This item determines the decimal point position for the linear input (C01: 4 to 20mA dc, M01: 0 to 10mA dc, V01: 1 to 5V dc) range designation.
Select a number from the following table for a suitable decimal point position.

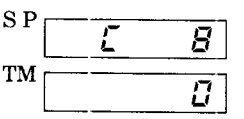
Decimal point position	Initial value selection range
X X X X	0
X X X.X	1
X X.X X	2
X.X X X	3

For displaying a 4 to 20mA dc input as a 0 to 1000 range, the following setting is made.

Decimal point position	0
Lower-limit value	0
Upper-limit value	1000

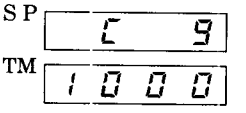
If you want to set the unit to PPM, the unit can be set and indicated to 0 to 1000 PPM by labeling the attached industrial unit to the right of the upper- and lower-displays.

8 Linear PV lower-limit



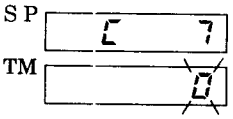
Initial setup display:
0: –1999 to upper-limit U

9 Linear PV upper-limit

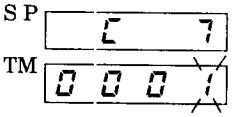


Initial setup display:
1000: Lower-limit to 9999

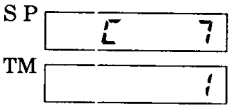
(Example)
Perform the following operation for setting the linear input to 0 to 200.0. (Example of 7, 8, 9 items)



The digit flashes when pressing [ENT] key.

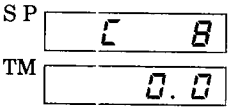


Increase the number to 1 by pressing this key.



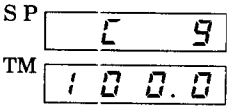
Press [ENT] key.

Press [SET UP] key for proceeding to the lower limit item.

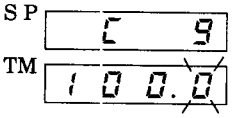


The initial setup display: 0.0.

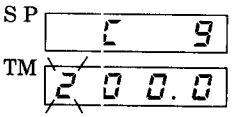
Press [SET UP] key for proceeding to the lower limit item.



The initial setup display shows 1000. However, since the decimal point position is the 2nd from the right, it is indicated as 100.0.

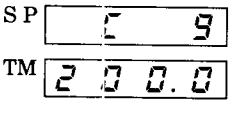


Press [ENT] key.



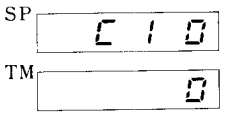
Shift the flashing location of a digit by pressing this key.

Increase the flashing digit to 2 by pressing this key.



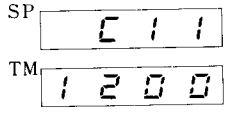
Press [ENT] key.

[10] SP limit lower-limit



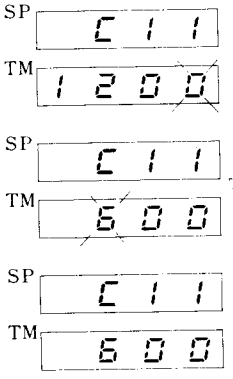
The initial setup display shows 0% FS. This is the low end value of the range. (Depends upon range).

[11] SP limit upper-limit



The initial setup display shows 100% FS. This is the high end value of the range. (Depends upon range) (1200 in case of 0 to 1200°C range, for example).

- This item restricts the setting range of a program. If the temperature limit of an equipment is 600°C, for example, this item does not allow the equipment to be set to higher than 600°C, so that the equipment is protected or prevented from being set to be higher than the temperature limit, or, 800°C, for example, by mistake.
  The SP limit restricts the SP setting range in programming, and it is not effective for a preset SP, a running SP in which an SP bias is added, and a manual SP.



Since the digit of C 1 0 is 0, the lower-limit remains unchanged, but the upper-limit value is changed.

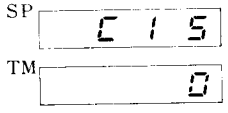
By pressing the [ENT] key, the digit flashes.

Shift the flashing location of a digit by pressing this key.

Change the flashing digit to 6 by pressing these keys.

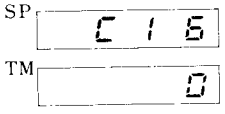
Press [ENT] key.

[15] Type of auxiliary output



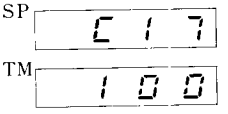
Initial setup display:
0: Specifies whether PV is set or not.
1: Specifies whether SP is specified or not.

[16] Auxiliary output 4 mA setting



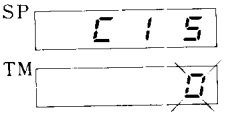
Initial setup display shows 0% FS.
It differs according to the type of PV range code.

[17] Auxiliary output 20 mA setting



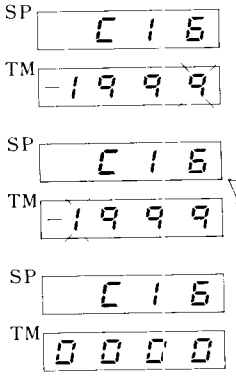
Initial setup display shows 100% FS.
It differs according to the type of PV range code.

(Example) [15], [16], [17]
When a PV value is an auxiliary output as 0 to 100 to a recorder.



This digit remains unchanged.
Proceed to the next item.

Press [SET UP] key for proceeding to the next item, "auxiliary output 4 mA setting".



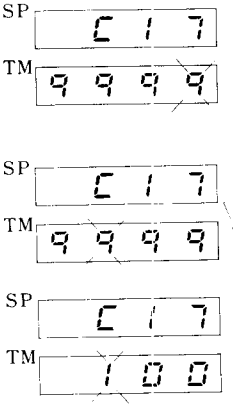
The digit flashes when pressing [ENT] key,

Shift the flashing location of a digit by pressing this key.

Change all digits to 0 by pressing these keys.

Press [ENT] key.

Press [SET UP] key for proceeding to the next item, "auxiliary output 20 mA setting".



The digit flashes when pressing [ENT] key.

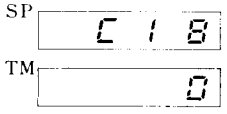
Shift the flashing location of a digit by pressing this key.

Change the value to 100 by pressing these keys.

Press [ENT] key.

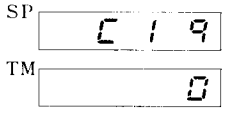
Items [18] to [21] are used not to display unnecessary items so that the programming mode is free of items where setting is not changed usually.
Make unnecessary items not to be displayed by [18] to [21], because all items appear in initialization. (See the following table)
These items are not displayed, but the set points remain effective. Make sure again before setting these items that all set points are correct and their display is not necessary.

[18] EV1, 2 programming



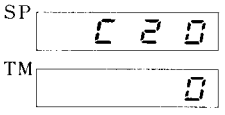
Initial setup display:
0: Displays the item.
1: Does not display the item.

[19] T1 to T4 programming



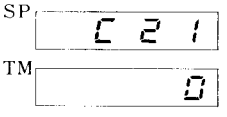
Initial setup display:
0: Displays the item.
1: Does not display the item.

[20] PID group, G.SOAK programming



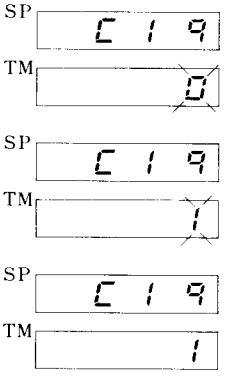
Initial setup display:
0: Displays the item.
1: Does not display the item.

[21] PV start, cycle programming



Initial setup display:
0: Displays the item.
1: Does not display the item.

(Example) [18], [19], [20], [21]
When the display of the time events T1 to T4 is not required;



The digit flahes when pressing [ENT] key.

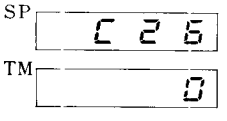
→Change the number to 1 by pressing this key.

Press [ENT] key.

The shaded portion consisting of the line of every programming item and the row of every segment (see the table on page 28) is not displayed.

Segment item		1	2	3	...	20
SP time	Upper display	SP				
	Lower display	Time				
Event No. 1	Upper display	(Goes out)				
	Lower display	Event set point				
Event No. 2	Upper display	(Goes out)				
	Lower display	Event set point				
Time event No.1	Upper display	ON time				
	Lower display	OFF time				
Time event No.2	Upper display	ON time				
	Lower display	OFF time				
Time event No.3	Upper display	ON time				
	Lower display	OFF time				
Time event No.4	Upper display	ON time				
	Lower display	OFF time				
PID group selection	Upper display	"PId"				
	Lower display	Group No.				
G.SOAK setting	Upper display	"G.S"				
	Lower display	no.YES				
PV start setting	Upper display	"P.StA"				
	Lower display	no.YES				
Cycle setting	Upper display	"CYCL"				
	Lower display	Cycle				

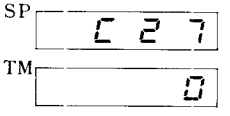
[26] PV



Initial setup display:

0: Input signal from thermocouple, resistance thermometer bulb, or linear input sensor is processed as PV.
1: The same PV input as described above is not displayed as PV on the console.
2: The value of the 0% FS of the range is processed as PV, irrespective of the input from sensor. A PV overrange alarm is not indicated.

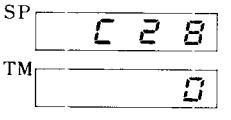
[27] Time display



A time (TM) to be displayed in the RUN or HOLD mode is selectable.

0: Displays the residual time of a running segment by rounding down the portion below the selected time unit.
1: Displays the lapsed time from the running start by rounding down the portion below the selected time unit.

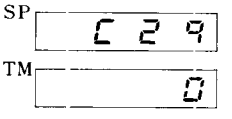
[28] Alarm display



Initial setup display:

0: Displays an alarm.
Displays alarms sequentially, if two or more alarms occur concurrently.
1: Does not indicate any alarm.
An alarm condition can be read by means of communication.

[29] Program time unit



Initial setup display
0: Hour, minute
1: Minute, second

Specifies either hour/minute unit or minute/second unit to set the program pattern time (TM) and time even on-off.

4. PARAMETER MODE

General

Parameters are provided to decide constants as the program controller. The parameter code indicating an item is displayed in the upper display, while a setting value is displayed in the lower display.
The setting in this parameter mode is not necessary, if an initial value satisfies the required specifications.
Proceed to the programming mode on page 27 in such a case.

Display/ setting order	Codes	Parameter item	Selection or setting range	Initial value in display	Description
1	Prtc	Program protect	0: Not provided 1: Provided	0	
2	FILt	PV filter constant	0.0 to 120.0 sec	0.0	Not displayed when PV=0% fixed in SET UP C26.
3	Pbi A	PV bias	−100 to +100U	0 (U)	
4	Sbi A	SP bias	–50 to 50%FS	0 (U)	
5	G.SbA	G.SOAK band	0 to 100U	5 (U)	
6	cY	Time proportional Output cycle	5 to 120 sec (relay output model) 1 to 60 sec (voltage output model)	10	Displayed in 0D, 6D (time proportional) model, but not displayed in 5G (current output) model.
7	outL	MV change limit	0.0 to 100.0% (every 0.5 sec)	100.0	Not displayed, if main output of 5G (current output) is set (SP).
8	diFF	ON/OFF control differential	0 to 100U	5 (U)	Displayed in 0D, 6D (time proportional) model, but not displayed in 5G (current output) model.
9	Et 1	Event 1 type	0: PV (direct action) 1: PV (reverse action) 2: Deviation (direct action) 3: Deviaiton (reverse action) 4: RUN 5: READY 6: END 7: PV lower limit (ON) 8: PV lower limit (OFF)	0	The relay turns to NO in PV direct action, and it turns to NC in PV reverse action. Turn "ON" at below PV lower limit Turn "OFF" at below PV lower limit
10	HYS 1	Event 1 hesteresis	0 to 100U	5 (U)	specifies an on-off differential of event.
11	Et2	Event 2 type	0: PV (direct action) 1: PV (reverse action) 2: Deviation (direct action) 3: Deviaiton (reverse action) 4: RUN 5: READY 6: END 7: PV lower limit (ON) 8: PV lower limit (OFF)	0	Turn "ON" at below PV lower limit Turn "OFF" at below PV lower limit
12	HYS2	Event 2 hesteresis	0 to 100U	5 (U)	specifies an on-off differential of event.
13	rPid	PID argorism AT advance	0: Not initialize 1: Initialize	0	

Parameter mode setting procedure

Refer to the key operation on page 15. For the parameter mode contents, see page 24.
Ths paragraph describes the operation procedure for the selected parameter items out of No.1 to 11.

Press [PARA] key first.

[1] Program protect

SP PrtC
TM 0 — Initial parameter display: 0: Does not protect any program.

Set the number in the lower display to 1 for protecting a program.

SP PrtC
TM 0000 — The digit flashes when pressing [ENT] key.

SP PrtC
TM 1 — Increase the number to 1 by pressing this key.

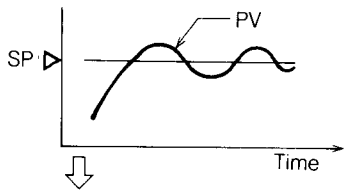
SP PrtC
TM 1 — Press [ENT] key.

(1) This item inhibits the reset of programmed data.
(2) When selecting 1 "Protects a program" after programming, none of all program data can be reset until 0 "Does not protect any program" is selected.

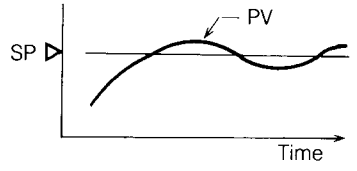
[2] PV filter constant

SP FILt
TM 0.0 — Initial parameter display: 0.0: 0.0 to 120.0 sec

PV filter effect:



PV filter: Setting range 0.0 to 120.0 sec

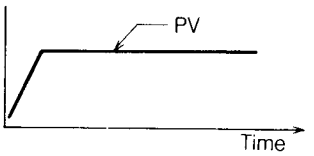


(1) This item is used to set a PV filter constant.
(2) The PV filter is used to filter the erratic input signal to the degree needed to get a stable.
The filter effect increases as the numeric filter setting value increases.

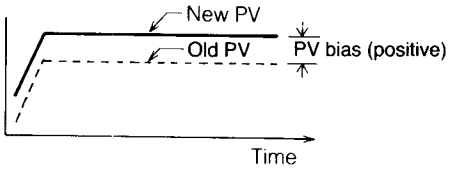
[3] PV bias

SP Pbia
TM 0 — Initial parameter display: 0: −100 to 100U

PV bias effect:



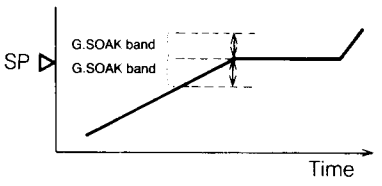
PV bias effect:



(1) This item sets a PV bias value.
(2) The PV bias is used to compensate for input such as the compensation of the drift of an input value due to deterioration of a sensor or other causes.
A new PV value is obtained by adding a bias value.

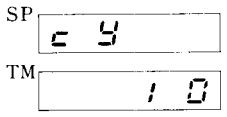
[5] G.SOAK band

SP 3.5.bd
TM 5 — Initial parameter display: 5U: 0 to 100U

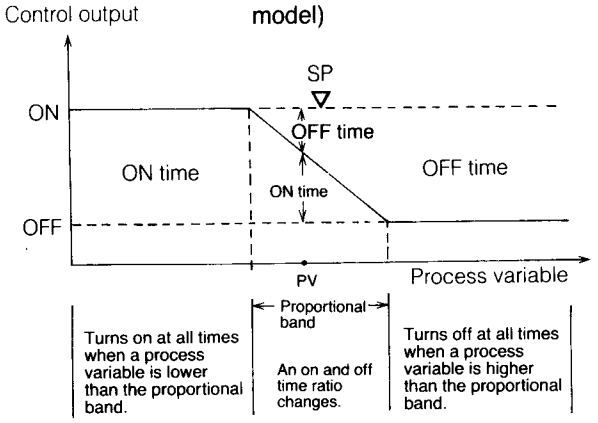


(1) This item sets a G.SOAK band value.
(2) G.SOAK shows the segment start point specified in programming, and the time is stopped until the absolute value of a deviation between PV and SP becomes smaller than the G.SOAK band.
(3) G.SOAK is settable for every segment, irrespective of soaking, rising, or falling of segments.

6 Time proportional output cycle

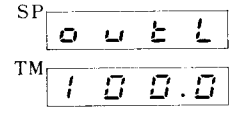


Initial parameter display:
5 to 120 sec (Relay output, 0D model)
1 to 60 sec (Voltage output, 6D model)



(1) This item specifies the cycle time (control cycle) of the time proportional output.
(2) If the cycle time (one cycle of on and off time) is set to 10 seconds, for example, the on time is 7 seconds when a process variable (PV) is lower than a set point (SP) in the proportional, and it becomes longer than off time (3 seconds).

7 Manipulated variable change limit



Initial parameter display:
100.0: 0.0 to 100.0% (every 0.5 sec)

This item specifies the limit of a change quantity of the former arithmetic value and present arithmetic value of the control output.
This limit is determined by the following calculation formulas.

A=Former arithmeric value (%)
B=Present arithmetic value (%)
C=Manipulated variable change limit (%)
D=Actual output value (%)

(Example 1) Assume that A+20, B=50 and C=20.

$\boxed{B-A}=50-20$
$=30$
$\boxed{\geqq}\ 20=\boxed{C}$
thus, $D=20+20$
$=40$

$D=A\pm C$, if $|B-A|\geqq C$

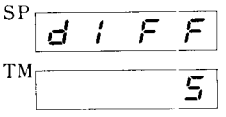
(Example 2) Assume that A=20, B=50 and C=40.

$\boxed{B-A}=50-20$
$=30$
$\boxed{<}\ 40=\boxed{C}$
thus, $D=20+30$
$=50$

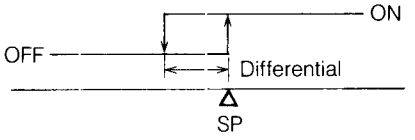
$D=B$, if $|B-A|<C$

(1) This item controls a control output change quantity.
(2) The output arithmetic value is updated once every output update cycle 0.5 sec (twice every second). If the manupulated variable change quantity limit is 0.5%, an output is changeable 60% per minute.

8 on/off control differential

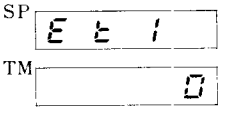


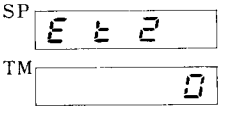
Initial parameter display:
5U: 0 to 100U



This item specifies the on/off control differntial.

9 Event 1 type — 10 Event 2 type

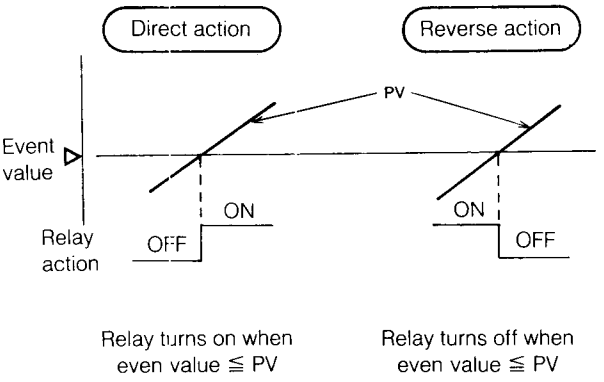




Initial parameter 1
0: PV direct action
1: PV reverse action
2: DEV (deviation) direct action
3: DEV (deviation) reverse action

This item specifies whether an event is set to PV or DEV (deviation).

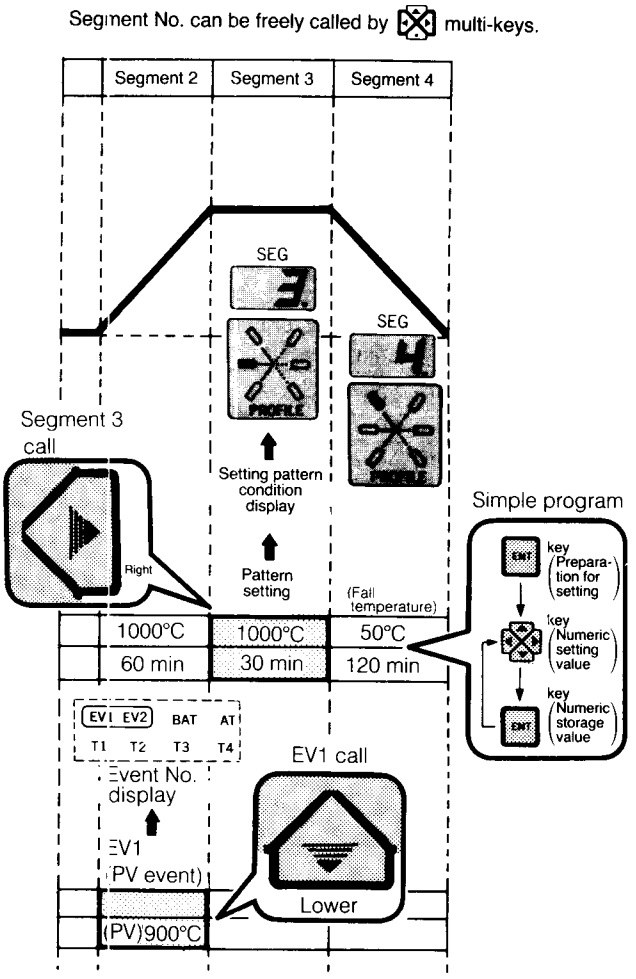
(Example) In case of PV event;



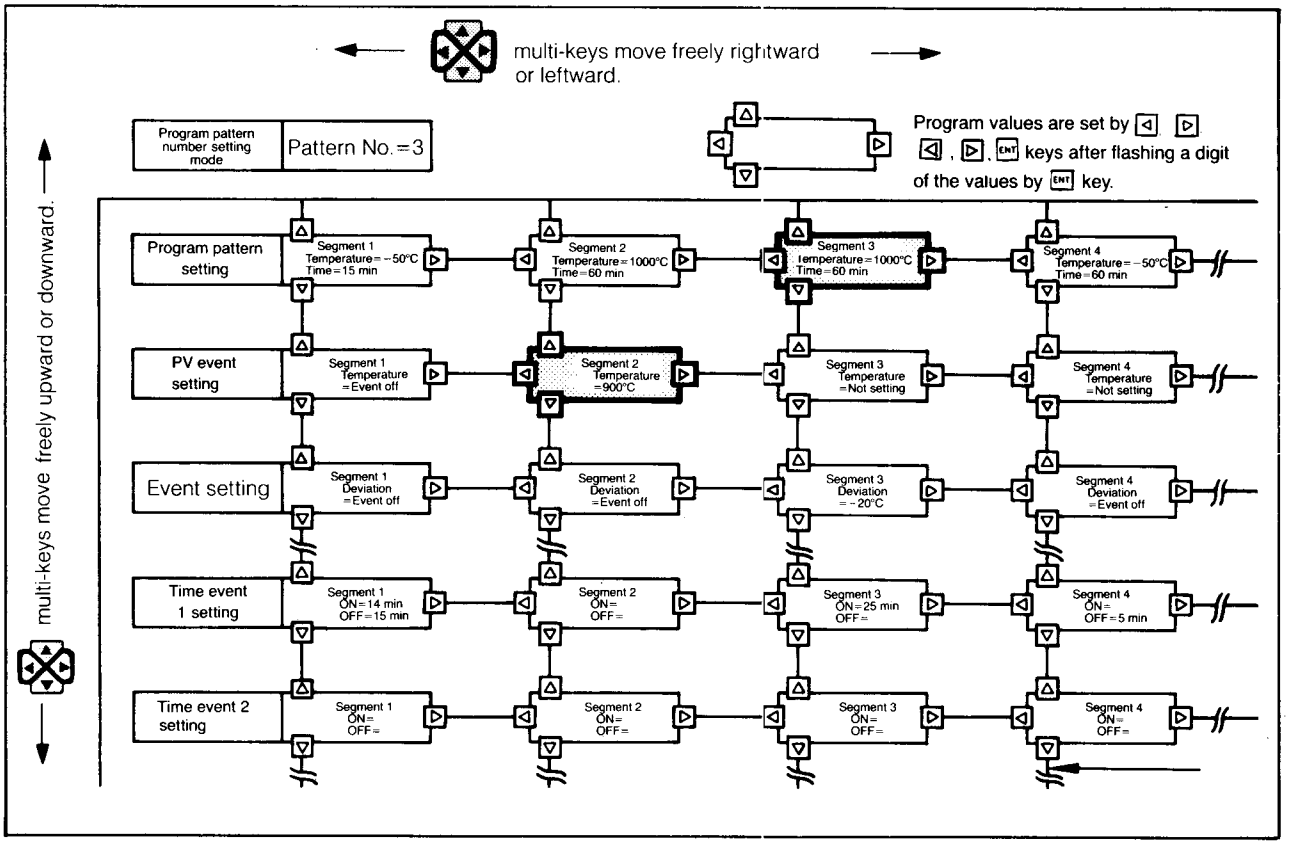
5. PROGRAMMING. MODE

Map type programming

1. Set the segments (patterns) on the abscissa first.
2. Set EV_1, EV_2, T_1 to T_4, PID, guaranteed soak, PV start, and cycle number on the ordinate.
3. Set the ordinate for every segment.
4. The ◈ keys freely move on the map.
5. The present segment conditions (soaking, rising, falling) are indicated by LED lamps on the profile indicator.



PROGRAMMING MAP



(1) PROGRAMMING MAP

This table consists of lines of each programming item and row of each segment.

Map position	Item display position \ Segment			1	2	.....	20	Lighting lamp
A	SP and time	Upper display	SP *1	A1	A2			SP, TM
		Lower display	Time *1	A1	A2			
B	No. 1 event	Upper display	Event set point *1		B2 position			PV or DEV EV1
C	No. 2 event	Lower display	Event set point *1					PV or DEV EV2
D	No. 1 time event	Upper display	ON time *1					T1, TM
		Lower display	OFF time *1					
E	No. 2 time event	Upper display	ON time *1					T2, TM
		Lower display	OFF time *1					
F	No. 3 time event	Upper display	ON time *1					T3, TM
		Lower display	OFF time *1					
G	No. 4 time event	Upper display	ON time *1					T4, TM
		Lower display	OFF time *1					
H	PID group selection	Lower display	Group No.					"PI d"
I	G.SOAK setting	Lower display	no : Not set YES : Set					"G.S."
J	PV start setting	Lower display	no : Not set *2 YES : Set					"P.StA"
K	Cycle setting	Lower display	Cycle number *2					"CYCL"

(Note) *1: "— — —" is displayed, if not set.
*2: One data only is settable for every program, and data are equal for every segment.

- The frame position is specified by combining the alphabetic characters (A to K) showing program map items with the numbers (1 to 20) showing segments. The frame of event No. 1 of segment 2 is represented as B2.

- Program setting, change, check, and other programming operations are executed by displaying the contents of each frame of the above programming map on the displays. The vertical move (items) and horizontal move (segments) of the frame of the programming map are executed by  multi-keys when displayed data are not flashing. If setting or change is not required, press [ENT] key once or twice to flash the aimed data and change data by  keys. Then, store the data by pressing [ENT] key.

*** Since a blank programming map is attached to this manual at the last page, it is recommended to fill each item before starting the programming work for correct setting with a reduced setting time.**