NP200

Programmable Controller

INSTRUCTION MANUAL

Thank you for the purchase of HANYOUNG product.
Please read this manual carefully.

HANYOUNG
ELECTRONIC CO., LTD.

CONTENTS

1 SAFETY INFORMATION

Before using, please read this (SAFETY INFORMATION) and then use this controller.
It is most important that the instructions in this manual are follower when using this instrument.
Please keep this manual for future reference.
Precautions are classified in WARNING and CAUTION.

⚠ WARNING	There is a possibility of death or heavy injury when handling in wrong way.
⚠ CAUTION	There is a possibility of injury or physical damage when handling in wrong way.

⚠ WARNING

1-1. Caution on wiring

- Use an external protection circuit if a fault in the control loop could possibly lead to a serious problem.

1-2. Power supply

- A fuse is fitted inside the instrument. (Fuse rating 250V, 1A)
- Use a rated voltage to prevent damage or trouble.
- To avoid electrical shock or damage, do not turn ON the power until the wiring is completed.

1-3. Prohibit use in gas atmosphere

Do not use it at a place exposed to combustible or explosive gas.

1-4. Handling of unit

- To avoid malfunction, electrical shock or fire, this unit must not be disassembled or repaired.
- Do not touch the terminals to avoid electrical shock or malfunction.

1-5. Caution on maintenance

- Turn OFF the power before mounting or removing the instrument.
- To ensure continuous and safe operation of the instrument, periodical maintenance is recommended.
  Some parts are limited in life.
- The warranty period is 1 year only if using in the correct way.

⚠ CAUTION

2-1 Caution on handing (Do not install the instrument under any of the following condltions.)

① The ambient temperature exceeds 0 ~ 50℃
② The ambient humidity exceeds 20 ~ 90%RH.
③ A place where temperature changes suddenly or icing occurs.
④ A place exposed to corrosive gas or combustible gas.
⑤ Vibration or shock is likely to be transmitted to the instrument.
⑥ A place exposed to water, oil, chemicals, steam, sunlight.
⑦ A place exposed to much dust, salt or iron.
⑧ A place with much inductive disturbance, static electricity, magnetism noise.
⑨ A place where heat such as radiant heat stays.

2-2. Installation

① Attach the brackets (2 units) on the fixed halls and tighten with a screwdriver.
② Fixing torque is about 14.7N. cm (1.5kg.cm) (Care should be taken to avoid water.)

2-3. Caution on terminal connections

① Use a compensating cable with thermocouple.
② For R.T.D input use a cable which is a small lead wire resistance and without resistance difference to 3wires.
③ If the wiring has noise, use the following step: connect a surge absorber to the conductor coil side if the conductors are connected to the load output, such as the relay contact output.
④ Use an insulating transformer with a noise filter when the power suppy has much noise.
⑤ Noise filter should be mounted on a panel which has been earthed and the wiring betweenthe noise filter output and the instrument power terminals should be shorten.
⑥ It is effective to use a twisted cable for power supply against noise.
⑦ The heater power supply and the instrument power supply should be connected using the same power suppy when a heater break alarm.
⑧ Time for preparation of contact output is required at power ON. When the output signal is used for an extenal interlock circuit, connect a delay relay.
⑨ To avoid induction noise to input wires seperate from the power and output wires.
⑩ Keep input wires away from output wires and use shielded wires.

2-4. Caution on Alarm setting and Input connection

① If alarm function is not set correctly, alarm output can not be operated at a trouble.
Be sure to check the alarm operation.
② If the input cable is disconnected, the display shows "b.oUt".
When replacing the sensor, please turn OFF the power suppy.

2-5. For load circuit connection

① Use an extra relay when the frequency of operation is rather high.
SSR output type is Recommended.
- Electromagnetic switch : Proportional cycle time is Min. 30sec
- SSR : Proportional cycle time is Min. 1 sec
- Contact output life : mechanical : 10 million times (no load)
electrical : 100 thousand times (rated load)

② SSR drive pulse voltage, DC 4~20mA are not insulated with internal circuit.

2-4. Other

① Do not use organic solvents such as alcohol, benzine when cleaning. (Use neutral detergent)
② The instrument has IP65. Use rubber packing when installing the instrument to panel.
Please attach the rubber in correct way.

● Summary

The programmable controller of NP 200 series is Equipped with the 300 Segment of 30 Pattern.
As many as 99 segments are available for 1pattern, but the total number of segments should not exceed 300.
Mounted with high-performance CPU, high precision is realized, for examlple, 0.1% of display precision, 250ms of sampling cycle etc.
Moreover, there are two kinds of auto-tuning modes, standard type and low PV type.
It is also mounted with various functions such as universal input(19 types), Universal output, Time signal, Heating/Cooling output, Fuzzy, Level PID, Emergency output, and interactive setting by liquid crystal display.

● Feature

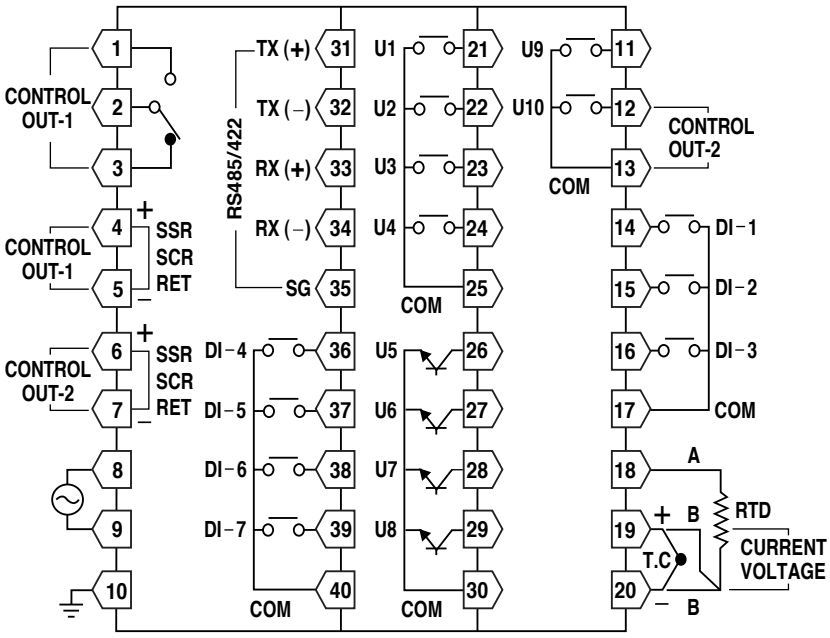
User Output Setting Function	A user can set desirable parameter satisfying his needs for various outputs as followings. ① Alarm output (1 through 4) ② Time Signal (TS1 to TS5) ③ Inner Signal (IS1 to IS5) ④ Output at Pattern End ⑤ Program Running Output. ⑥ Output at Fixed Mode ⑦ Output at Reset Mode ⑧ Output at Hold Mode ⑨ Output at Wait Mode ⑩ Manually operation Output ⑪ Output at Pattern Rising Range ⑫ Output at Pattern Falling Range ⑬ Pattern Maintaining Output. (U10 output will have priority in Cooling Output when setting the type for Heating and Cooling.)
Fuzzy Operational Function	The fuzzy operational function is an overshoot suppression method adopting fuzzy inference and exerts its effective controlling function in the following cases. • When you are going to apply the control to the point where shows significant deviation between target settings and actual measures. • When you are going to reduce the warming-up period for operation • When there is a fluctuating load variation in the usual operation. • When the setting value are often changed.
Heating/Cooling PID Control In program control	Heating/Cooling control outputs the PID operational result in two types of signal, that is, for heating and for cooling. You can choose either PID control or ON/OFF control for the output of heating side and cooling side. If you set the proportional value(P) of heating side as "0„ the ON/OFF control is selected for the heating side, while the fixing of the band(Pc) of cooling side "0„ chooses the ON/OFF control for cooling side. . Moreover, you can choose one method among heating side output, cooling side output, relay output, voltage pulse output and current output and apply the controling function with it.
Universal Input/Output	You can choose input among 19 types of input and you can choose output among 3 types of output such as relay, SSR and SCR (DC 4~20 mA)
2 Type of Auto Tuning Mode (Standard/Low PV)	This controller has two types of auto-tuning as STD(standard type) and LOW (Low PV type is the value 10% lower than the set value)
Level PID Operation	The input range is divided into four levels and differnt PID group is applied to each level. If you choose Level function, the PID group is automatically selected by Level irrespective of PID number or Set Value Number(SVNO). You can apply different PID data to different range to get an optimum PID value in wide temperatare range.

2 ORDERING INFORMATION

Model	Number	Function
NP200-	□ □	Programmable Controller (96 X 96mm)
Control Type	0	Universal Type(Heating)
	1	Heating / Cooling Type
Option	0	None
	1	RS422 / 485 (Communication Function)
	2	DI 4 Points (External Signal Input)
	3	RS422 / 485(Communication Function), DI 4 Points

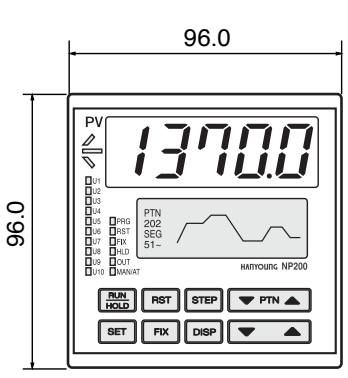
3 TERMINAL ARRANGEMENT

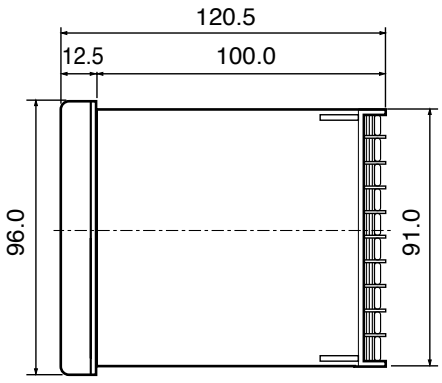
POWER: 100 - 240V~
50 / 60Hz
CONTACT OUT 1 : 3A 240V~
CONTACT OUT 2 : 1A 240V~
(Resistive load)
S.C.R OUT : 4 - 20mA DC
(Resistive load 600Ω max.)
S.S.R OUT : 24V 30mA DC
(Resistive load 600Ω min.)
USER OUT :
1A 240V~(U1~U4. U9.U10)
(Resistive load)
24V 30mA DC (U5~U8)
(Resistive load 600Ω min.)



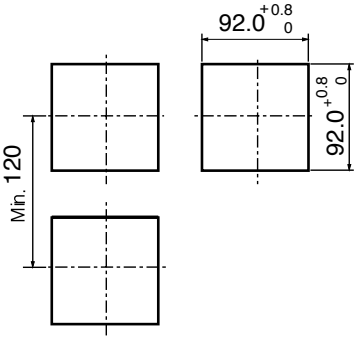
4 DIMENSION & PANEL CUTOUT

● Dimension





● Panel Cutout



(Unit: mm)

5 INPUT AND OUTPUT

● Input Signal and Measurement Range

Input Signal		Input Code	Range (℃)	Range (℉)	Accuracy
Thermocouple (T/C)	K ＊1	K1	-200.0 ～ 1370.0	-300 ～ 2500	±0.10% of F.S ±1digit
	K ＊1	K2	-200.0 ～ 1000.0	0.0 ～ 1500.0	
	J ＊1	J	-200.0 ～ 1200.0	-300 ～ 2300	
	E ＊1	E	-200.0 ～ 1000.0	-300 ～ 1800	
	T ＊1	T	-200.0 ～ 400.0	-300.0 ～ 750.0	
	R	R	0 ～ 1700	32 ～ 3100	±0.15% of F.S ±1digit
	B ＊2	B	0 ～ 1800	32 ～ 3300	
	S	S	0 ～ 1700	32 ～ 3100	
	L ＊1	L	-200.0 ～ 900.0	-300 ～ 1600	±0.1% of F.S ±1digit
	N	N	-200.0 ～ 1300.0	-300 ～ 2400	±0.2% of F.S ±1digit
	U ＊1	U	-200.0 ～ 400.0	-300.0 ～ 750.0	±0.1% of F.S ±1digit
	W	W	0 ～ 2300	32 ～ 4200	
	PlatinelII	Platinel2	-200.0 ～ 600.0	32 ～ 2500	
R.T.D	JPt100	JPT100	-200 ～ 500.0	-300.0 ～ 1000.0	
	Pt100	PT100	-200.0 ～ 640.0	-300.0 ～ 1180.0	
Direct Voltage (V)	1~5V	1/5V	Range of Scaling SL-L ～ SL-H = -19999 ～ 99999 **When using current input, use a resistor 250Ω 0.1% on input terminal (No. 19, 20) to convert 1～5 V		
	0~10V	0/10V			
Direct Voltage (mV)	-10~20mV	-10/20mV			
	0~100mV	0/100mV			
Direct Current	DC 4~20mA	1/5V**			

※ Display Range : -5% ～ +105% of Above Range　　＊1 ; 0℃ below : ±0.2% of F.S ±1digit

＊2 ; 0 ～ 400℃ range : ±5% of F.S ±2digit

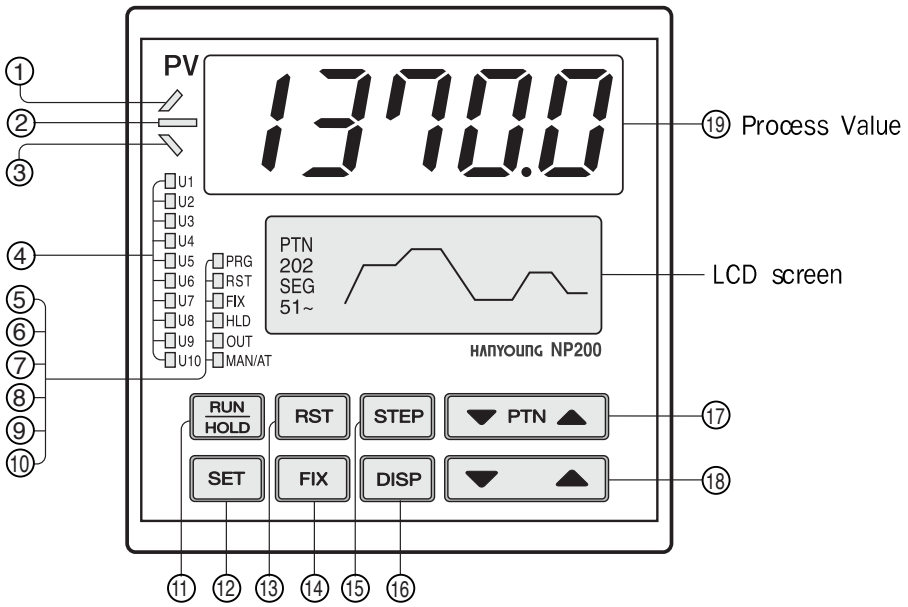
● Type of Output

Classification	Output (OUT) (Heating/Cooling side)	OUT 1		OUT2	
		Relay Output	SSR/SCR (Current Output)	U 10	SSR/SCR (Current Output)
NP200 - 0 (Universal)	RLY(Relay)	ON-OFF Control		(U10)	(Retransmission)
	SSR		SSR Output		
	SCR		4～20mA		
	RLY(Relay)	Relay Output			
NP200 - 1 (Heating / Cooling)	SSR/SSR		SSR Output	(U10)	SSR Output
	SCR/SSR		4～20mA		
	Relay/SSR	Relay Output	(Retransmission)		
	SSR/SCR		SSR Output	(U10)	4～20mA
	SCR/SCR		4～20mA		
	Relay/SCR	Relay Output	(Retransmission)		
	SSR/Relay		SSR Output	Relay Output	(Retransmission)
	SCR/Relay		4～20mA		
	Relay/Relay	Relay Output			

6 NAME AND FUNCTION

● Function Description

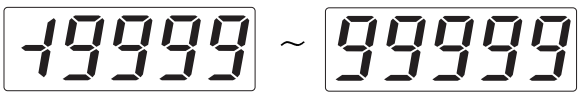
The front of Programmable Control consists of operating key, display LED, and LCD screen.



6-1. The Function of Individual LED

LED display	Function
① ◿ display lamp	Lights during the ascending section of the pattern.
② ▭ display lamp	Lights during the soak section of the pattern.
③ ◺ display lamp	Lights during the descending section of the pattern.
④ U1~ U10 display lamp	Lights in accordnce with the parameter status registered in User Output from 1 to 10.
⑤ PRG display lamp	Lights during the Program Run.
⑥ RST display lamp	Lights during the Reset condition.
⑦ FIX display lamp	Lights during the FIX control.
⑧ HOLD display lamp	Lights when Hold during the Program Run.
⑨ OUT display lamp	Lights when the contol output(OUT-1) is ON. If the output varies, flashes according to the rate.
⑩ MAN/AT display lamp	Lights during the Manual Control. Lights off during Auto tuning.

6-2. The Function of Operating key

Name	Function
⑪ [RUN/HOLD] RUN / HOLD	• Operate the current pattern number. • When the program is under way, press for 1 second or longer to hold the runing segment. • Press for 1 second or longer to release the holding and let the segment run to the end.
⑫ [SET] SET	• Input the parameter value. • Input the changed control mode. • Use when moving the Parameter. • Press 3 second or longer to alternate menu screen and operating screen.
⑬ [RST] RESET	• Exit running program and converts to stop. • Exit running FIX mode and converts to reset mode.
⑭ [FIX] FIX	• Use to convert the operating mode to FIX mode. • Convert to FIX mode when the current operating mode is program running or stop.
⑮ [STEP] STEP	• Exit the running segment while operating program and operate the next segment.
⑯ [DISP] DISPLAY	• Change the Liquid Crystal Display on the operating screen. • Select program (PROG), Operation (OPER), Function (FUNC), or Setup (STUP) on the menu screen. • Move to the previous screen from the PROG, OPER, FUNC or STUP screen.
⑰ [▼ PTN ▲] PATTERN NUMBER UP/DOWN	• Use to change the pattern number.
⑱ [▼ ▲] UP/DOWN	• Use to change the parameter value. • Use to alternate between group and sub-group. • Press UP/DOWN key to operate the key speed.
⑲ Process Value Display	• Display the Process Value on the operating screen. • Maximum display range (Minus "—"is displayed on fifth position) 

6-3. The LCD Screen Function

6-3-1. Operating Screen

The Operating Screen is made up of 5 screens.
To change an operating screen, press " DISP " key.

6-3-2. Set Value (SV) Screen

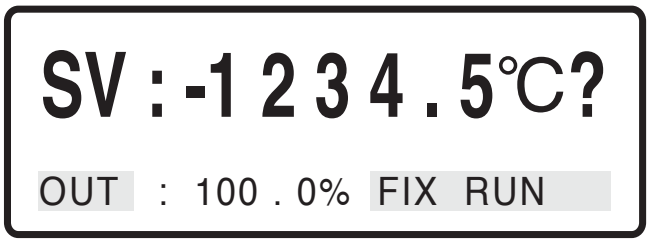
1) Program Run

① SV : Displays Current SV (Set Value)
② ℃ : Displays Current Set Unit.
DCV (Direct Current Voltage) input:
displays set unit of "U.UNIT"
Themocouple or R.T.D input:
displays set unit of "UNIT".
③ PT : Displays processing pattern number.

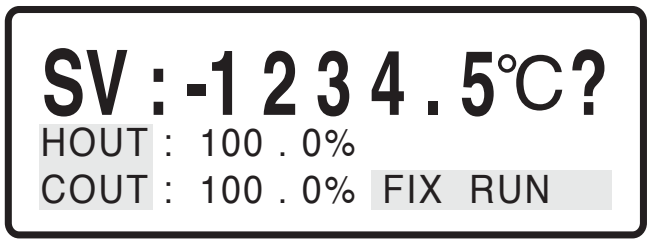
④ SEGNO : Displays processing segment and total segment that's been set up.
(Now SEG / Total SEG)
⑤ TIME : Displays remaining time of segment. (hour/minute : **h**, minute/second : **m**)
⑥ REPEAT : Displays current repeated time and total repeated time that's been set up. (Now Repeat / Total Repeat)
Displays " ∞ "for continuing Total Repeat and displays ∞ for exceeding 99 time of Now Repeat.(∞ / ∞)

2) FIX Control

[General Type on SV screen]



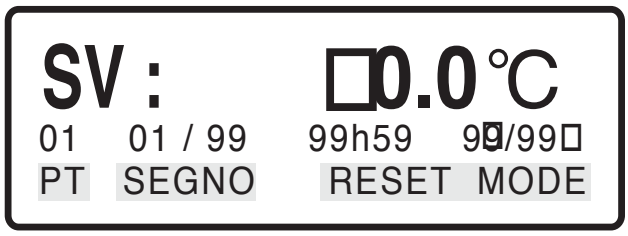
[Heating / Cooling Type on SV screen]



① SV : Displays Current SV.
② ℃ : Displays Current Set Unit.
When DCV (Direct Current Voltage) input, displays set unit of "U.UNIT".
When Thermocouple or R.T.D input, displays set unit of "UNIT".
③ ? : When modifying SV with a ▼ ▲ key, "?" sign will be blinked due to the system conflict.

3) In the Reset status

① SV : displays the minimum value of setting range.
② ℃ : displays current set unit.
③ PT : modify PT (pattern) by pressing ▼ ▲ key.
④ SEGNO : displays the number of established total segment and END. SEG.
(END.SEG / Total SEG)



※ The difference between Total SEG from END.SEG.

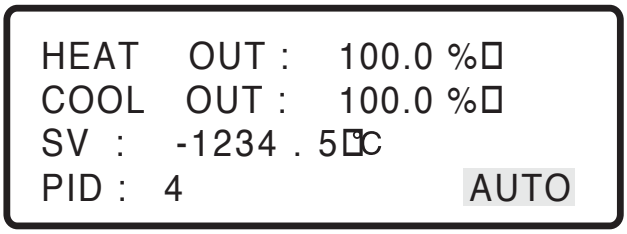
- If the programmed final SEG is larger than the 'END.SEG', it will displayed as 'Total SEG' = "END.SEG"
- If the 'END.SEG' is larger than and same as programmed final SEG, it will display 'Total SEG' = "Programmed Final SEG"

【EX 1】 program till 10SEG. If the END.SEG is 8SEG, the Total SEG is 8SEG.
【EX 2】 program till 5 SEG. If the END.SEG is 7 SEG, the Total SEG is 5SEG.
【EX 3】 program till 5 SEG. If we set the END.SEG as OFF status, the Total SEG is 5 SEG.

6-3-3. Output Screen

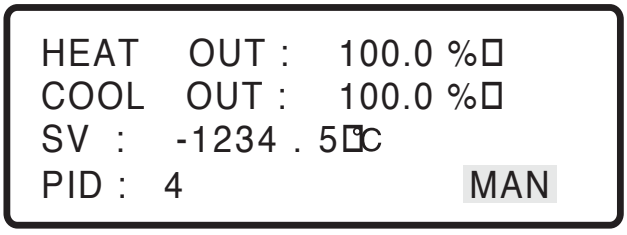
1) Automatic mode in Universal Type

2) Automatic mode in Heating/ Cooling Type



3) Manual mode in Universal Type

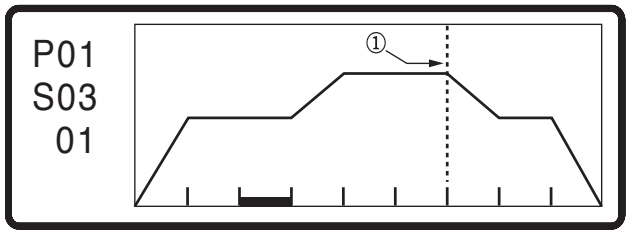
4) Manual mode in Heating/Cooling Type



1) OUT : displays output value in General type.
2) HEAT OUT : displays output value of heating side in Heating/Cooling type.
COOL OUT : displays output value of Cooling side in Heating/Cooling type.
3) SV : displays current set value in PROG and FIX MODE.
Displays the minimum value of the set range in RESET mode.
4) PID : displays PID group number that is under control.
5) "AUTO" and "MAN" will be displayed in shadow. In "MAN" condition, output value can be modified by ▼ ▲ key.

6-3-4. Graph Screen

1) Displays SV graph of pattern number that were selected in the first operating screen.
2) Total of 9 segments can be displayed at one time, and the segment in process is displayed as black bar at the bottom of Bar Graph. In the RESET mode or FIX mode, the bar graph is not displayed.



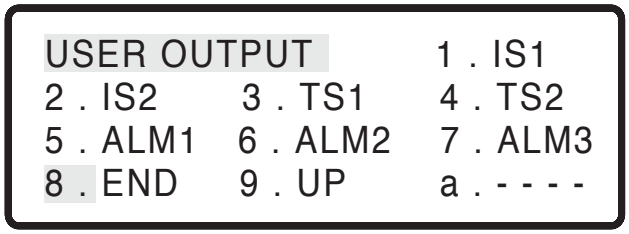
3) To adjust the segment unit, press [▼ ▲] key.
4) "P**" displays selected a FIX , RESET mode or processing (PROG) pattern number.
5) "S**" displays processing segment number.
6) For a starting segment number "01" will be displayed.
7) "◀", "▶" is displayed if there's more graph to be displayed in both sides.("▶":Right side,"◀":Left side "◀", "▶"both sides)
8) A dotted vertical line will be drawn on ENG.SEG point. (As the example ① showing in a picture.)

6-3-5. User Output Screen

1) Displays parameters of User Output mode that are set up in numbers from 1 to 10.

【Example】

- U1 is Inner Signal 1
- U2 is Inner Signal 2
- U3 is Time Signal 1
- U4 is Time Signal 2
- U5 is Alarm 1
- U6 is Alarm 2
- U7 is Alarm 3
- U8 is Pattern End Signal
- U9 is Pattern Up Signal
- U10 is not in use.



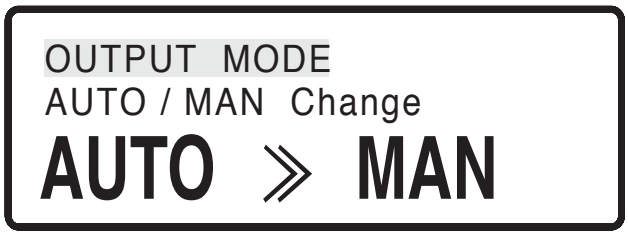
2) A current user output number will be marked in shadow. In other words, if the numder 8 is marked, the pattern has been terminated and generating Pattern End Signal. So the user output for number 8 is being turned on.

3) Parameters and displays that could be registered to the "User Output" screen.

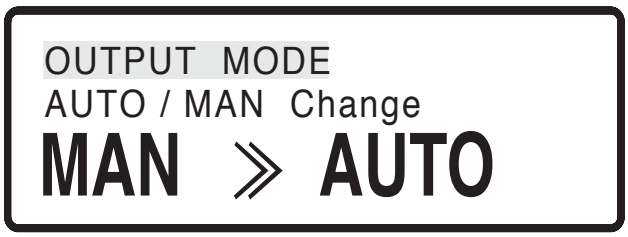
- OFF : " ---- "
- Alarm 1 ~ 4 : "ALM1" ~ "ALM4"
- Time Signal 1 ~ 5 : "TS1" ~ "TS5"
- Inner Signal 1 ~ 5 : "IS1" ~ "IS5"
- Pattern End Signal : "END"
- Pattern Up Signal : "UP"
- Pattern Down Signal : "DOWN"
- Pattern Soak Signal : "SOAK"
- Program Run : "PROG"
- Fix Run : "FIX"
- Reset : "RST"
- Hold : "HOLD"
- Wait : "WAIT"

6-3-6. Automatic/ Manual Screen

1) Automatic Output



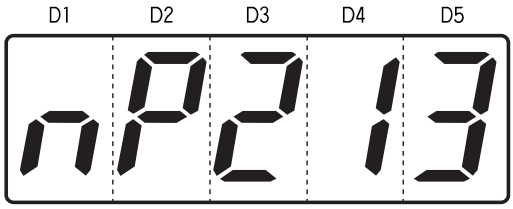
2) Manual Output



① Press [SET] key to modify output mode.
② If the current mode is automatic, it will be displayed as : "AUTO ≫ MAN" and vice versa.
③ The screen will be skipped of the LOCK = A/M was turned on.
※ for example : "AUTO ≫ MAN " will be displayed if it's in automatic output mode, and if you press the " [SET] " key, the mode will be changed into ("MAN≫AUTO")

6-3-7. Display when Power ON

1) LED displaying on PV (Process value)



① The screen displays the model name of NP200 from the D1 to D3 section.
② In D4, the control type will be displayed.
(Universal type: "0", Heating/Cooling type: "1")
③ The screen displays optional type in control in D5 section.
("0": None, "1": Communication, "2":D1 4 points, "3":Communication / DI 4 points)

2) LCD displaying on SV

① product type, adjusted type and supplementary article code will be displayed in the upper screen.
② Displays Version at the lower part.

6-3-8. Menu Screen

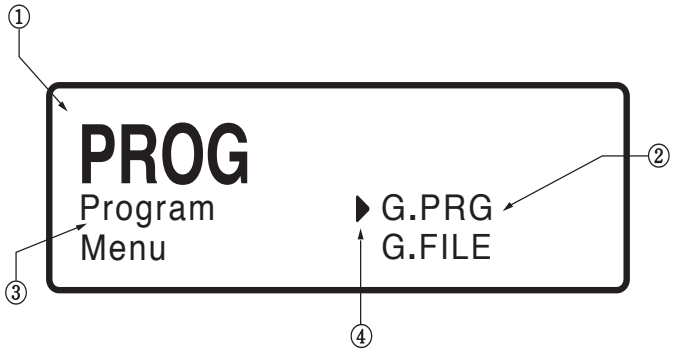
1) Menu on LCD Screen (Meun Screens are composed of as Followings.)

Menu	Group	Subordinate Group
PROG (Program)	G.PRG (Program Group) G.FILE (File Group)	INFORM (Pattern, Segment description) PT.EDIT (Pattern Editing) SEG.EDIT (Segment editing)
OPER (Operation)	G,AT (Auto Tuning Group) G.PID (PID Group) G.SV (Set Value Group) G.CONTROL (Control Group)	—
FUNC (Function)	G.IS (Inner Signal Group) G.ALARM (Alarm Group) G.UO (User Output Group) G.TRANS (Retransmission Group)	—
STUP (Set up)	G.COMM (Communication Group) G.OUT (Output Group) G.IN (Input Group) G.LOCK (Locking Group)	—

① Press [DISP] key to modify menu.
② The group belongs to current menu is displayed on the right with the "▶".
The position of "▶" can be changed by [▼ ▲] key. Press [SET] key to select.
③ Press [DISP] key to go Menu screen.

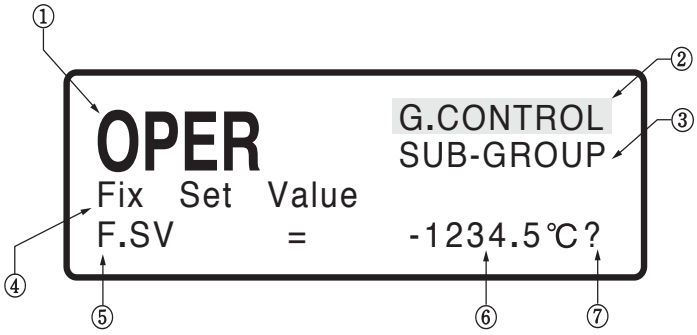
2) Parameter of Menu Screen

① States the name of menu.
② Displays the name of group.
③ Displays full menu name.
④ "▶" can be moved by pressing [▼ ▲] key to select desired group.

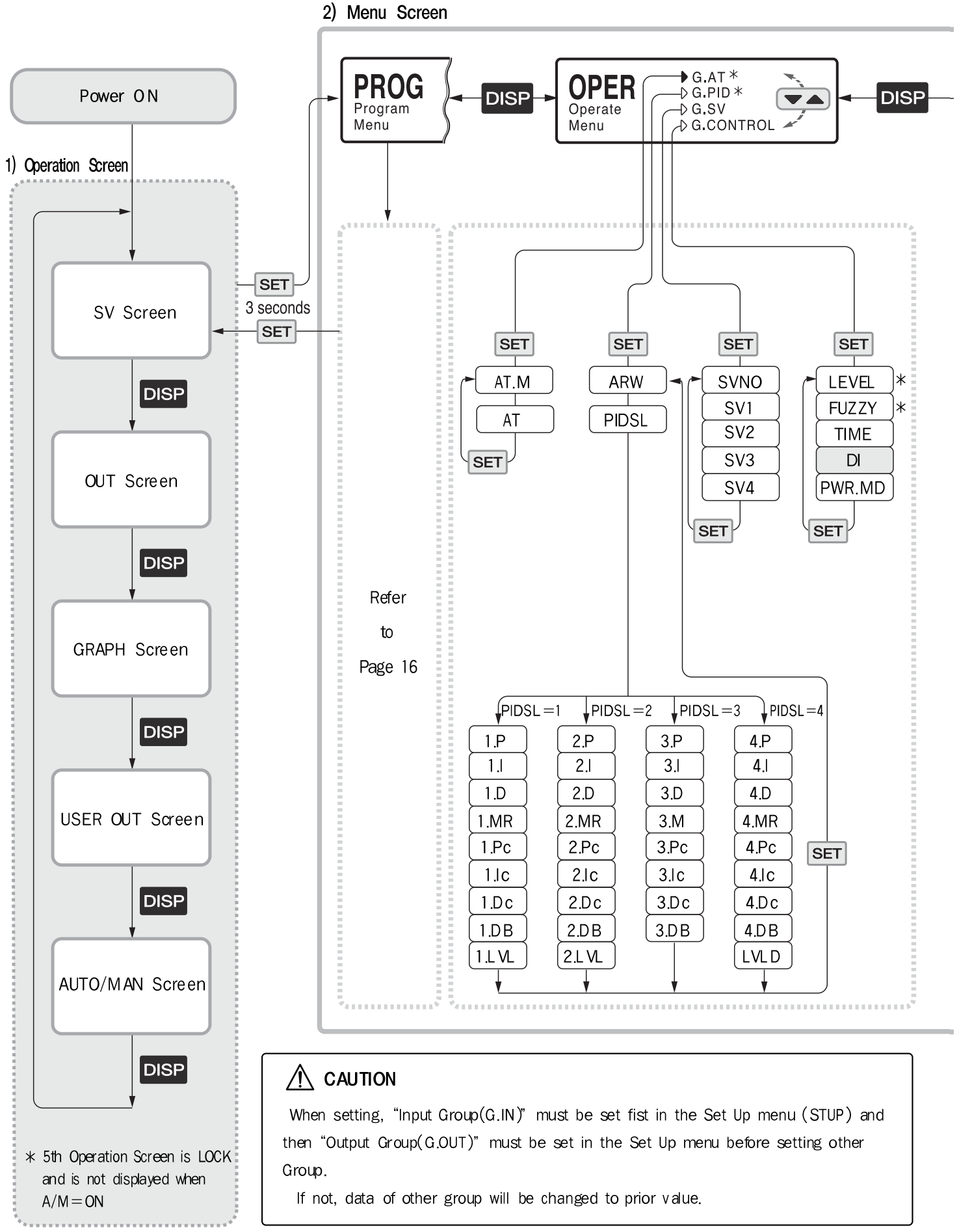


3) Parameter of Group screen

① The name of menu
② The name of group
③ The Sub-Group
④ Parameter full Name
⑤ Parameter Name
⑥ Parameter Value
⑦ press [▼ ▲] to modify parameter value, then youll get a blinking "?" mark.



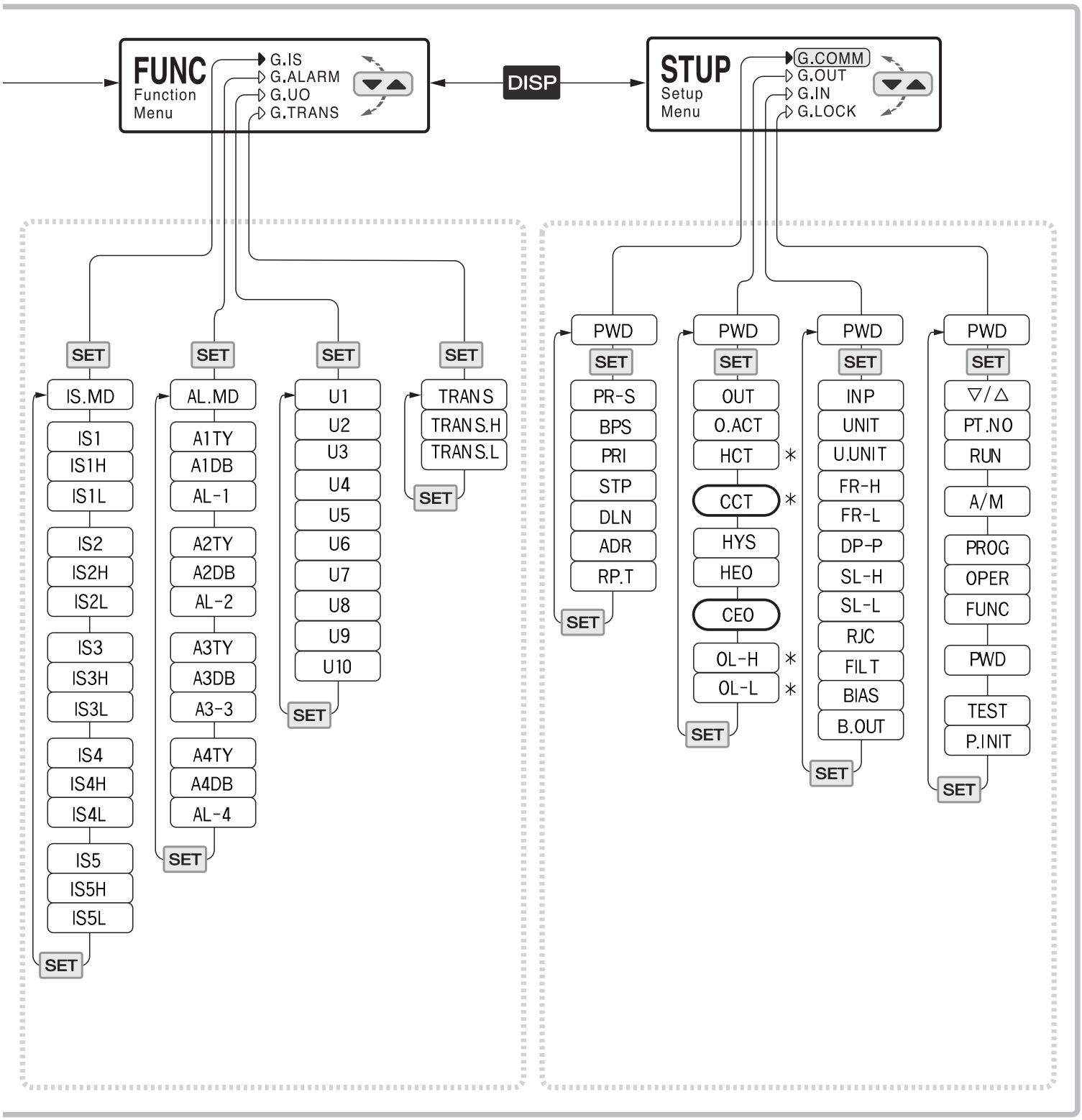
7 TABLE OF SETTING ITEMS



⚠ CAUTION

When setting, "Input Group(G.IN)" must be set fist in the Set Up menu (STUP) and then "Output Group(G.OUT)" must be set in the Set Up menu before setting other Group.

If not, data of other group will be changed to prior value.



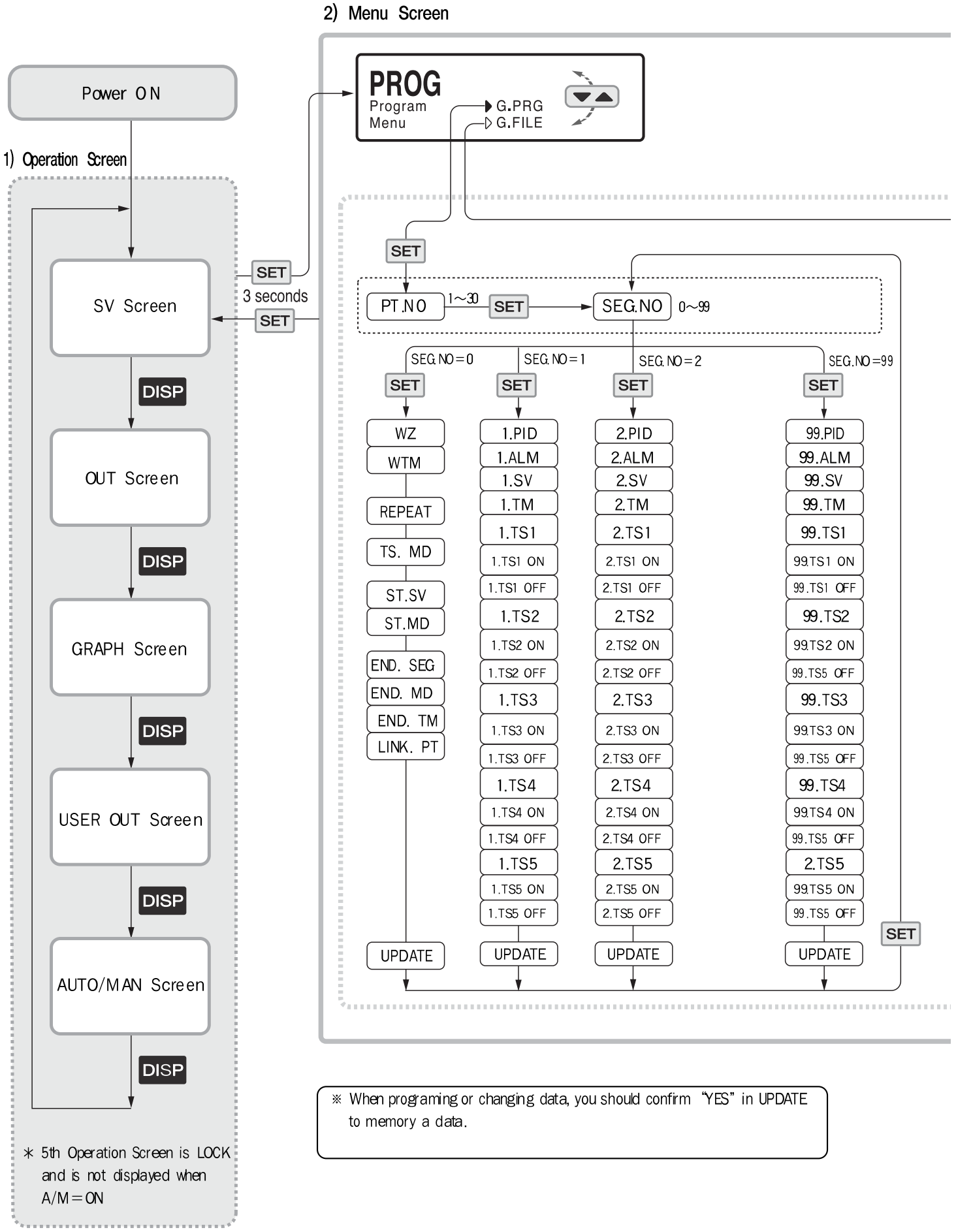
● *Operation when Power ON*

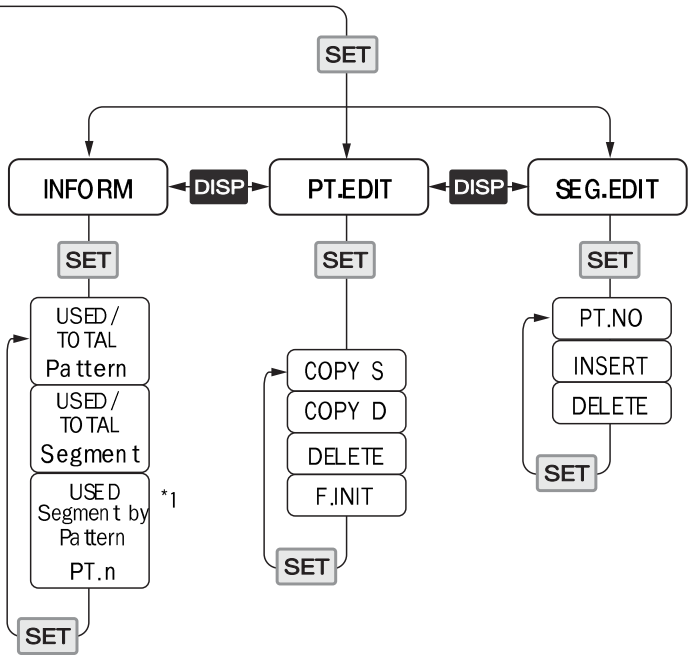
Starts operation from operation mode before Power OFF. But, in Program mode, operation will be followed by ST.MD.

: In OPTION

: In H/C TYPE

• AUTO Operation MODE : Starts control from HEO set value	In ON/OFF (OUT=0) Control, ∗ are skipped.
• MAN Operation MODE : Starts control from HEO set value	In MAN Control, AT Group is skipped.


Power ON
1) Operation Screen
SV Screen
DISP
OUT Screen
DISP
GRAPH Screen
DISP
USER OUT Screen
DISP
AUTO/MAN Screen
DISP
SET
3 seconds
SET
2) Menu Screen
PROG
Program
Menu
G.PRG
G.FILE
SET
PT.NO
1~30
SET
SEG.NO
0~99
SEG.NO=0
SEG.NO=1
SEG.NO=2
SEG.NO=99
SET
SET
SET
SET
WZ
WTM
REPEAT
TS. MD
ST.SV
ST.MD
END. SEG
END. MD
END. TM
LINK. PT
UPDATE
1.PID
1.ALM
1.SV
1.TM
1.TS1
1.TS1 ON
1.TS1 OFF
1.TS2
1.TS2 ON
1.TS2 OFF
1.TS3
1.TS3 ON
1.TS3 OFF
1.TS4
1.TS4 ON
1.TS4 OFF
1.TS5
1.TS5 ON
1.TS5 OFF
UPDATE
2.PID
2.ALM
2.SV
2.TM
2.TS1
2.TS1 ON
2.TS1 OFF
2.TS2
2.TS2 ON
2.TS2 OFF
2.TS3
2.TS3 ON
2.TS3 OFF
2.TS4
2.TS4 ON
2.TS4 OFF
2.TS5
2.TS5 ON
2.TS5 OFF
UPDATE
99.PID
99.ALM
99.SV
99.TM
99.TS1
99.TS1 ON
99.TS1 OFF
99.TS2
99.TS2 ON
99.TS5 OFF
99.TS3
99.TS3 ON
99.TS5 OFF
99.TS4
99.TS4 ON
99.TS5 OFF
2.TS5
99.TS5 ON
99.TS5 OFF
UPDATE
SET
* 5th Operation Screen is LOCK and is not displayed when A/M=ON
※ When programing or changing data, you should confirm "YES" in UPDATE to memory a data.



O P E R	F U N C	S T U P
is	is	is
on	on	on
Page14	Page15	Page15

● *Operation when Power ON*

Starts opertion from operation mode before
Power OFF. But, in Program mode, opertion will be followed by ST.MD.

- AUTO Operation MODE : Starts control from HEO set value
- MAN Operation MODE : Starts control from HEO set value

*1 Pattern number selection, by ▼, ▲ 1 through 3.

8 CONSTUCTION OF MENU SCREEN

8-1. Program Menu (PROG)

> ⚠ CAUTION
> When setting, "Input Group(G.IN)" must be set fist in the Set Up menu (STUP) and then "Output Group(G.OUT)" must be set in the Set Up menu before setting other Group.
> If not, data of other group will be changed to prior value.

8-1-1. Program Group (G.PROG)

Classification	Signal	Parameter	Set up Range	Condition	Initial
Entry	PT.NO	Pattern Number Selector	1 ~ 30	Always	1
	SEG.NO	Segment Number Selector	0 ~ 99		0
SEG. NO = 0	WZ	Wait Zone	OFF, 0 ~ 10% (EUS)		OFF
	WTM	Wait Time	OFF, 0.01 ~ 99.59 (TIME)		OFF
	REPEAT	Repeat Set	CONTINUE / 1 ~ 99		1
	TS.MD	Time Signal Mode	ON/OFF, TIME		ON/OFF
	ST.SV	Start Set Value	0 ~ 100% (EU)		EU (0%)
	ST.MD	Start Mode	SSV, PV1, PV2		SSV
	END.SEG	Pattern End Segment	OFF, 1 ~ 99		OFF
	END.MD	Pattern End Mode	RESET, HOLD, FIX, LINK		RESET
	END.TM	End Signal Time	OFF, 0.01 ~ 99.59 (TIME)		OFF
	LINK.PT	Link Pattern	1 ~ 30	END.MD = LINK	1
	UPDATE	Update Confirm	NO, YES	Always	NO
SEG. NO = 1	01. PID	01. PID NO. Select	1 ~ 4	PID Control LEVEL=OFF	1
	01. ALM	01. ALM NO.Select	OFF. 0 ~ 4	Always	OFF
	01. SV	01. Set Value	0 ~100% (EU)	Always	EU (0%)
	01. TM	01. Segment Time	OFF, 0.00 ~ 99.59 (TIME)		OFF
	01. TS1	Time Signal 1	OFF, ON	Always	OFF
	TS1 ON	01. TS1 on Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS1 = ON	00.00
	TS1 OFF	01. TS1 off Time			
	01. TS2	Time Signal 2	ON, OFF	Always	OFF
	TS2 ON	01. TS2 on Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS2 = ON	00.00
	TS2 OFF	01. TS2 off Time			
	01. TS3	Time Signal 3	ON, OFF	Always	OFF
	TS3 ON	01. TS3 on Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS3 = ON	00.00
	TS3 OFF	01. TS3 off Time			
	01. TS4	Time Signal 4	ON, OFF	Always	OFF
	TS4 ON	01. TS4 on Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS4 = ON	00.00
	TS4 OFF	01. TS4 off Time			
	01. TS5	Time Signal 5	ON, OFF	Always	OFF
	TS5 ON	01. TS5 on Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS5 = ON	00.00
	TS5 OFF	01. TS5 off Time			
	UPDATE	Update Confirm	NO, YES	Always	NO

Classification	Signal	Parameter	Set up Range	Condition	Initial
SEG. NO = 2~98					
SEG. NO = 99	99. PID	PID NO. Select	1 ~ 4	PID Control ZONE = OFF	1
	99. SV	Set Value 1	0 ~ 100% (EU)	Always	EU (0%)
	99. TM	Segment Time 1	OFF, 0.00 ~ 99.59 (TIME)	Always	OFF
	99. TS1	Time Signal 1	ON, OFF	Always	OFF
	TS1 ON	TS1 ON Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS1 = ON	00.00
	TS1 OFF	TS1 OFF Time			
	99. TS2	Time Signal 2	ON, OFF	Always	OFF
	TS2 ON	TS2 ON Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS2 = ON	00.00
	TS2 OFF	TS2 OFF Time			
	99. TS3	Time Signal 3	ON, OFF	Always	OFF
	TS3 ON	TS3 ON Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS3 = ON	00.00
	TS3 OFF	TS3 OFF Time			
	99. TS4	Time Signal 4	ON, OFF	Always	OFF
	TS4 ON	TS4 ON Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS4 = ON	00.00
	TS4 OFF	TS4 OFF Time			
	99. TS5	Time Signal 5	ON, OFF	Always	OFF
	TS5 ON	TS5 ON Time	00.00 ~ 99.59 (TIME)	TS.MD = Time 1.TS5 = ON	00.00
	TS5 OFF	TS5 OFF Time			
	UPDATE	Update Confirm	NO / YES	Always	NO

8-1-2. File Group (G.FILE)

Classification	Signal	Parameter	Set up Range	Condition	Initial
INFORM	Pattern	USED/TOTAL (30)	DISPLAY ONLY	Always	0 / 30
	Segment	USED/TOTAL (300)			0 / 300
	PT.n	Used Segment by Pattern			0 / 0
PT. EDIT	COPY. S	Copy Source	OFF / 1 ~ 30 Pattern	Always COPY. S ≠ OFF	OFF
	COPY. D	Copy Destination			
	RESULT	Result of File	-	COPY. S = 1~30	-
				COPY. D = 1~30	
	DELETE	Delete Pattern Number	OFF / 1 ~ 30 Pattern	Always	OFF
	RESULT	Result of File CMD	-	COPY. S = 1~30 COPY. D = 1~30 DELETE = 1~30	-
	F.INIT	File All Initialize	NO, YES	Always	OFF
	CONFIRM	Really File Init ?			ON

Classification	Signal	Parameter	Set up Range	Condition	Initial
SEG. EDIT	PT. NO	Pattern Number Select	1 ~ 30 Pattern	Always	1
	INSERT	Insert Segment Number	OFF / 1 ~ 98 segment	PT.NO=1~30	OFF
	RESULT	Result of File CMD	-	INSERT=1~98	-
	DELETE	Delete Segment Number	OFF / 1 ~ 99 segment	Always	OFF
	RESULT	Result of File CMD	-	DELETE=1~99	-

8-2. Operation Menu (OPER)

8-2-1. Auto tuning Group (G.AT)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	AT. MD	Auto Tuning Mode Selection	STD, LOW *1	AUTO & PID	STD
	AT	Auto Tuning	OFF, ON, Auto (*2)	AUTO & PID Control	OFF

*1 ; Low : Auto Tuning Starts as -10% of SV *2 Auto is displayed when LEVEL=ON in Control Group.

8-2-2. PID Group (G.PID)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	ARW	Anti - Reset Windup	AUTO, 50.0 ~ 200.0%	PID Control	50.0
	PIDSL	PID Group Select	0 ~ 4 (Set 1 through 4 to move to next parameter)	PID Control	0
	n.P	Proportional band	0.1 (H/C Type:0.0) ~ 999.9%	PID Control	5.0%
	n.I	Integral time	OFF / 1 ~ 6000 sec	PID Control	240 sec
	n.D	Derivative time			60 sec
	n.MR	Manual reset	-0.5 ~ 105.0%	I = OFF	50.0%
	n.Pc	Proportional band of cooling side	0.0 (ON/OFF Control) / 0.1 ~ 999.9%	HC TYPE	5.0%
	n.Ic	Integral time of cooling side	OFF / 1 ~ 6000 sec		240 sec
	n.Dc	Derivative time of cooling side	OFF / 1 ~ 6000 sec		60 sec
	n.DB	Dead band of Heating·Cooling side	-100.0 ~ 50.0%		3.0%
	n.LVL	PID Level n	EU (0) ≤ 1.RP ≤ 2.RP ≤ EU (100%) (EU)	LEVEL = ON	EU (100%)
	RDV	Reference DEV	OFF / EUS (0 ~ 100%) (EU)	LEVEL = ON	EU (0.5%)

8-2-3. Set Value Group (G.SV)

Classification	Signal	Parameter	Set up Range	Condition	Initial
FIX SV	SVNO	Set Value NO, Select	1 ~ 4	Always	1
	SV1	Set Value 1	EU (0 ~ 100%) (EU)	Always	EU (0%)
	SV2	Set Value 2			
	SV3	Set Value 3			
	SV4	Set Value 4			

8-2-4. Control Group (G.CONTROL)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	LEVEL	Level PID	OFF, ON	PID Control	OFF
	FUZZY	Fuzzy Control	OFF, ON	PID Control	OFF
	TIME	Time Unit	HH:MM, MM:SS	Always	HH.MM
	END TIME	PTEnd Time Unit	HH:HH,MM:iSS	Always	HH:MM
	DI	Digital Input Enable	OFF / ON	DI OPTION	OFF
	PWR. MD	Power ON Mode	HOT, COOL	Always	COOL

8-3. Function Menu (FUNC)

8-3-1. Inner Signal Group (G.IS)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	IS.MD	Inner Signal Mode	TSV, NSV	Always	TSV
IS1	IS 1	Inner Signal 1	OFF, ON		OFF
	IS1H	Inner Signal 1 High	IS1L + 1digit + EU (100%)	IS1 = ON	EU (100%)
	IS1L	Inner Signal 1 Low	EU (0%) ~ IS1H - 1digit		EU (0%)
IS2	IS2	Inner Signal 2	OFF, ON	Always	OFF
	IS2H	Inner Signal 2 High	IS2L + 1digit + EU (100%)	IS2 = ON	EU (100%)
	IS2L	Inner Signal 2 Low	EU (0%) ~ IS2H - 1digit		EU (0%)
IS3	IS3	Inner Signal 3	OFF, ON	Always	OFF
	IS3H	Inner Signal 3 High	IS3L + 1digit + EU (100%)	IS3 = ON	EU (100%)
	IS3L	Inner Signal 3 Low	EU (0%)~ IS3H - 1digit		EU (0%)
IS4	IS4	Inner Signal 4	OFF, ON	Always	OFF
	IS4H	Inner Signal 4 High	IS4L + 1digit + EU (100%)	IS4 = ON	EU (100%)
	IS4L	Inner Signal 4 Low	EU (0%) ~ IS4H - 1digit		EU (0%)
IS5	IS5	Inner Signal 5	OFF, ON	Always	OFF
	IS5H	Inner Signal 5 High	IS5L + 1digit + EU (100%)	IS5 = ON	EU (100%)
	IS5L	Inner Signal 5 Low	EU (0%) ~ IS5H - 1digit		EU (0%)

8-3-2. Alarm Group (G.ALARM)

Classification	Signal	Parameter	Set up Range	Condition	Initial
Alarm Mode	AL.MD	Alarm Mode	ALL, FIX & PROG, FIX, PROG	Always	ALL
Alarm Type	A1TY	Alarm 1 Type	OFF, 1 ~ 20 ※ Refer to Page 63	Always	1
	A2TY	Alarm 2 Type			2
	A3TY	Alarm 3 Type			1
	A4TY	Alarm 4 Type			2
Dead band	A1DB	Alarm 1 Dead Band	EUS (0 ~ 100%)	AnTY ≠ OFF	EUS (0.5%)
	A2DB	Alarm 2 Dead Band			
	A3DB	Alarm 3 Dead Band			
	A4DB	Alarm 4 Dead Band			
Set Value of Alarm	AL-1	Alarm 1 Point	PV:EU (-100 ~ 100%) PV:EUS (-100 ~ 100%)	AnTY ≠ OFF	EU (100%)
	AL-2	Alarm 2 Point			EU (0%)
	AL-3	Alarm 3 Point			EU (100%)
	AL-4	Alarm 4 Point			EU (0%)

8-3-3. User Output Group (G.UO)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	UO1	User Output 1	• OFF(----) • SGAL • Alarm (ALM1~ALM4) • Time Signal (TS1~TS5) • Inner Signal (IS1~IS5) • PTEND / PROG / FIX / RST / HOLD / WAIT / MAN / UP / DOWN / SOAK	Always	OFF
	UO2	User Output 2			
	UO3	User Output 3			
	UO4	User Output 4			
	UO5	User Output 5			
	UO6	User Output 6			
	UO7	User Output 7			
	UO8	User Output 8			
	UO9	User Output 9			
	UO10	User Output 10			

8-3-4. Retransmission Group (G.TRANS)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	TRANS	Retransmission Selection	PV, SV, MV, SPS	Always	PV
	TRANS.H	High value of Retransmission	T/C,RTD : FR-H ~ FR-L mV, V : SL-H ~ SL-L 〔Notice : RET.H > RET.L (EU)〕	RET=PV or SV selection	T/C,RTD :FR-H mV,V:SL-H
	TRANS.L	Low value of Retransmission			T/C,RTD :FR-L mV,V:SL-L

8-4. Setup Menu (STUP)

8-4-1. Communication Group (G.COMM)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	PWD	Password			
	PR-S	RS485, RS422 Protocol selection	PC-LINK / PC-LK-S	OPT	PC-LINK
	BPS	Communication Rate	600 --- 9600		9600
	PRI	Parity	NONE / EVEN / ODD		NONE
	STP	Stop Bit	1, 2		1
	DLN	Data Length	7, 8 (Except PC-LINK: 8)		8
	ADR	Address	1 ~ 99		1
	RP.T	Response Time	0 ~ 10		0

8-4-2. Output Group (G.OUT)

⚠ CAUTION | After setting Input Group and Output Group, other groups should be set.

Classification	Signal	Parameter	Set up Range	Condition	Initial
	PWD	Password		Always	0
	OUT	Output Type	Refer to page 6	Always	Universal type:Relay Heating·Cooling:SSR/SSR
	O.ACT	Output Action	REVERSE DIRECT	Universal type	REVERSE
	HCT	Cycle Time of Heating side	1 ~ 1000 sec	Relay or SCR output (Except of ON/OFF control)	30 sec
	CCT	Cycle Time of Cooling side	1 ~ 1000 sec	Relay or SSR output Cooling type	30 sec
	HYS	Hysteresis (ON/OFF Control)	EUS (0 ~ 100%)	ON/OFF control	EUS (0.5%)
		Heating, Cooling, Normal	0.0 ~ 100.0%	Heating·Cooling type	0.5%
	HEO	Heat Emergency output Preset Out 1, (Heat)	-0.5 ~ 105.0% Heating·Cooling: 0.0~105.0%	Always	0.0%
	CEO	Preset Out 2 Cool Emergency output	0.0 ~ 105.0%	Heating·Cooling type	0.0%
	OL-H	Output Limitation High	OL-L + 1digit ~ 105.% Heating·Cooling: 0.0~105.0%	PID control	100.0%
	OL-L	Output Limitation Low	-0.5% ~ OL-H - 1digit Heating·Cooling: 0.0~105.0%	PID control	0.0% HC:100.0%

8-4-3. Input Group (G.IN)

⚠ CAUTION | After setting Input Group and Output Group, other groups should be set.

Classification	Signal	Parameter	Set up Range	Condition	Initial
	PWD	Password	0 ~ 9999	Always	0
	INP	Input Type	Refer to page 6	Always	K1
	UNIT	Input Unit	℃, ℉	T/C, RTD	℃
	U.UNIT	User Unit	℃, ℉, %, %RH, Pa, - (None)	mV, V	℃
	FR-H	Full Range High	Refer to Input Signal and Range (Notice : FR-H > FR-L)	Always	1370.0
	FR-L	Full Range Low			-200.0℃
	DP-P	Dot Point Position	0 ~ 3	mV, V	1
	SL-H	Scale Limit High	-1999.9 ~ 9999.9 (Notice : SL-H > SL-L) Decimal point : According to DP-P	mV, V	100.0
	SL-L	Scale Limit Low			0.0
	RJC	RJC ON/OFF	ON, OFF	Thermocouple input	ON
	FILT	PV Input Filter	OFF, 1 ~ 120	Always	OFF
	BIAS	PV Input Bias	EUS (-100 ~ 100%)	Always	EUS (0%)
	B.OUT	Burn-out Select	OFF, UP, DOWN	Always	UP

8-4-4. Lock Group (G.LOCK)

Classification	Signal	Parameter	Set up Range	Condition	Initial
	PWD	Password	0 ~ 9999	Always	0
	▽ / △	Down/Up Key Lock	OFF, ON	Always	OFF
	PT.NO	Pattern Number Lock			
	RUN	Run Key Lock			
	A / M	Auto / Man Lock			
	PROG	PROG Menu Lock			
	OPER	OPER Menu Lock			
	FUNC	FUNC Menu Lock			
	PWD	Password Change	0 ~ 9999	Always	0
	TEST	TEST Mode Entry	0 ~ 9999	Always	0
	P.INIT	Parameter Initialize	NO,YES	Always	ON

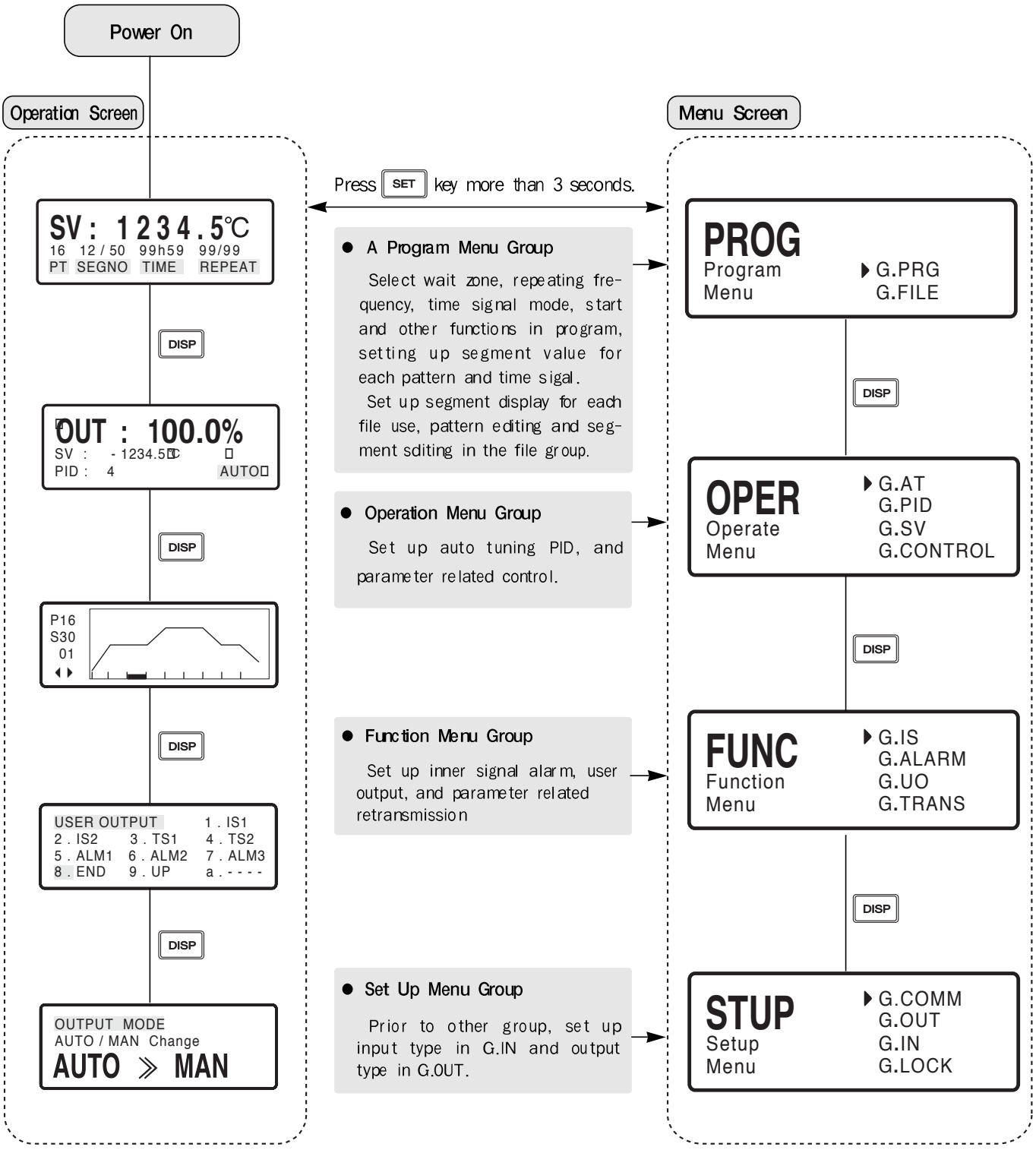
∗1 : If "PWD" Parameter is acceptable, you can move to Test Mode.

9 SET UP METHOD

● Summary

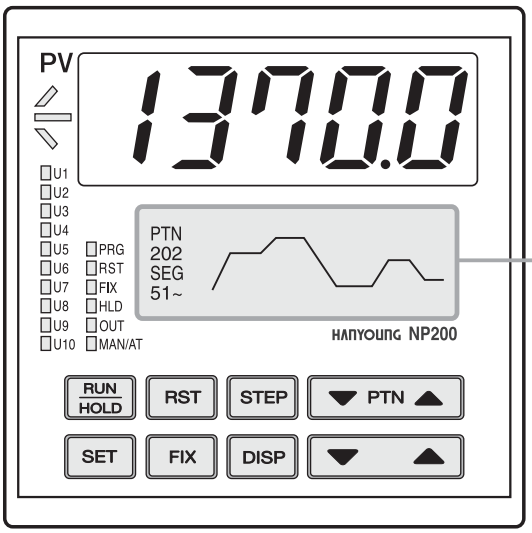
This instument is made up of 5 kinds operating screens and 4 kinds menu screen.
Refer “Set-Up Item List and Set-Up Screen Composition” during the set up process.

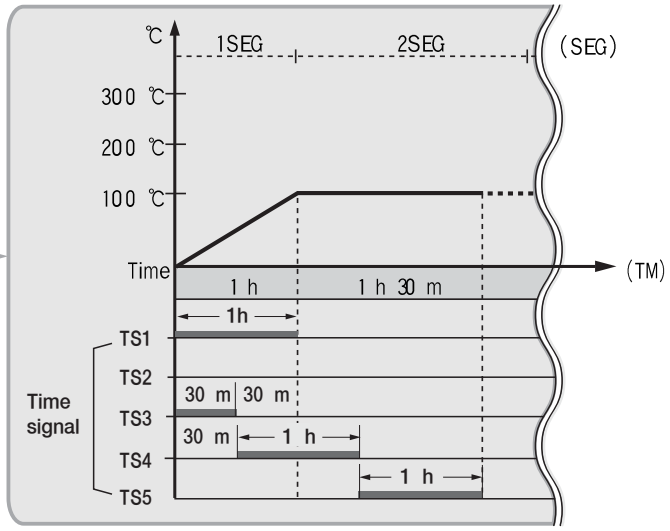
9-1. Menu Screen



◉ Setting Example

※ To set a data as below pattern graph, set a data as follow.





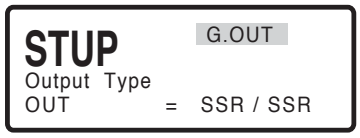
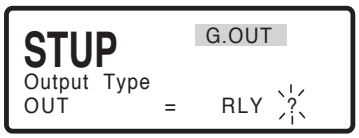
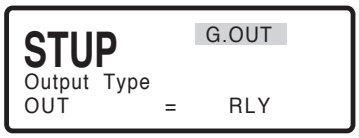
(1) Power ON

SV : 0.0℃ 00 00 / 00 PT SEGNO RESET MODE	After checking wiring, power ON. "SV screen" will be displayed in 5 kinds operating screen. Press [SET] for 3 seconds.

(2) Input type selection

PROG Program Menu ▸G.PRG G.FILE	To set input type, press [DISP] 3 times to display the setup menu.
STUP Setup Menu ▸G.COMM G.OUT G.IN G.LOCK	Using [▼ △] key, select input group. PROG → OPER → FUNC → STUP DISP
STUP Setup Menu G.COMM G.OUT ▸G.IN G.LOCK	Press [SET] key.
STUP Input Type INP = K1 type	In input type, INP=K1 type(-200.0 ~ 1370℃)is set as initial value. To change type, press [▼ ▲] key. (Refer to page 6) Press [DISP].

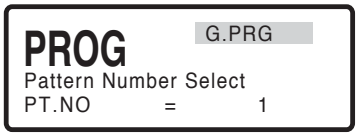
(3) Output type selection

	Using [▼ △] key, select Output group (▶G.OUT)and then press [SET] key.
	In output Type,relay output (OUT=RLY) is set as initial value, but Heating side:SSR, Cooling side:SSR(OUT=SSR/SSR) in Heating/Cooling type.
	Using [▼ △] ←key, select an output type.(Refer to page 6) To select relay output, press [▼ ▲] key to display "OUT=RLY ?" ." ?" indicates changing value. Confirm by pressing [SET].
	Relay output is selected. Press [DISP] 2 times to move to Program menu.

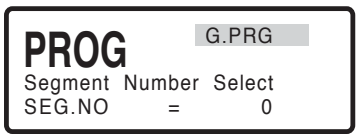
(4) Program menu entry

	Enter the Program menu. In condition of program group(▶G.PRG), press [SET] key.

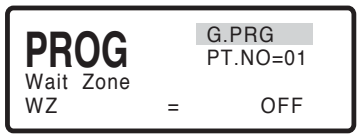
(5) Pattern 1 setting

	Using [▼ ▲] key, select pattern number 1 (PT.NO = 1). Press [SET] key.

(6) Program function setting

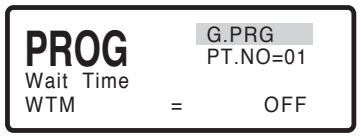
	SEG.NO=0, Press [SET]. (Refer to page 20, 9-1-1)

(7) Wait zone setting



Wait Zone (WZ) = OFF is displayed as initial value.
If you want to set "Wait time", press ▼ ▲ . Press SET .

(8) Wait time setting

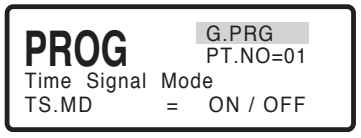


Wait Time (WTM)= OFF is displayed as initial value.
To set "Wait time", press ▽ ▲ , press SET .

(9) Repeat frequency setting

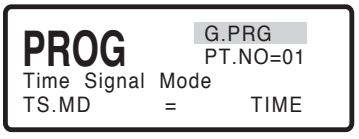
Repeat Set (REPEAT) = 1 is displayed as initial value. To change the value, press ▼ ▲ key and then press SET key.

(10) Time signal mode selection



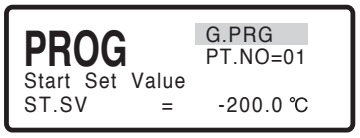
Time signal mode (TS.MD)=ON/OFF is set as initial value. To change mode to time mode, press ▼ ▲ key to select "TIME"

TS.MD = TIME ? is displayed.
? indicates changing value. Confirm by pressing SET .



TS.MD = TIME is set.
Press SET key.

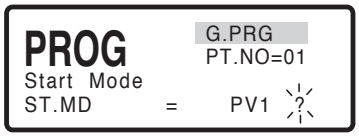
(11) Program stsrt value setting



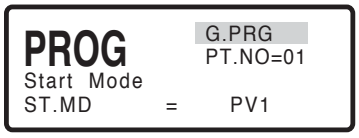
Program start value (ST.SV) = -200.0 ℃ is set as initial value. Press SET key.

(12) Program start mode selection

Program start mode (Start Mode) ST.MD = SSV is set as initial value. To select PV1, press [▽] [△] .※SSV:start set value, PV1: Process value 1, PV 2:Process value 2.

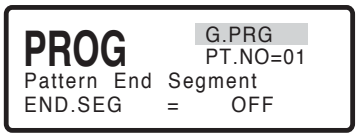


ST.MD = PV1 is displayed.(Refer to page 44, 1-1-7) Press [SET] key.



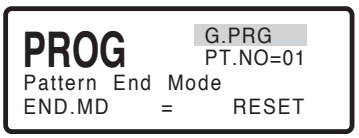
will be disappeared and selected ST.MD = PV1. Press [SET] key.

(13) Pattern end segment set value



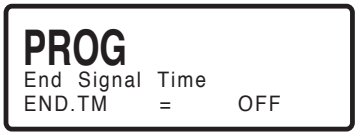
Pattern end segment (END.SEG=OFF) is displayed.
(set range: OFF, 1~99) Press [SET] key

(14) Pattern end mode selection



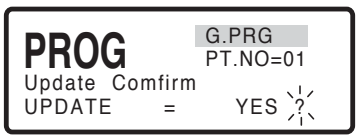
Pattern end mode (END.MD ←)= RESET is displayed as initial
(Type:RESET,HOLD,FIX,LINK) Press [SET] key.

(15) Pattern end signal time

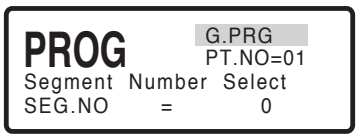
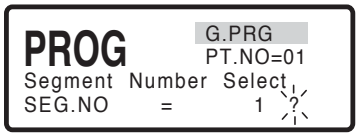
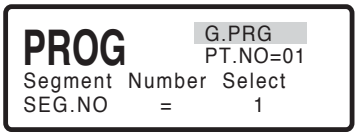
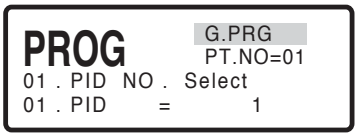


Pattern end signal time (END.TM)= OFF is displayed as initial value.
(Selection range :OFF , 0h00m) Press [SET] key.

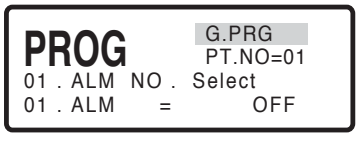
(16) Data updata

	Update Comfirm (UPDATE) = NO is displayed. To confirm the setting data, press ▽ ▲ .
	UPDATE = YES ? is displayed. Press SET key to confirm.
	Press SET key.

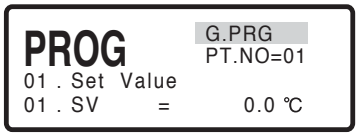
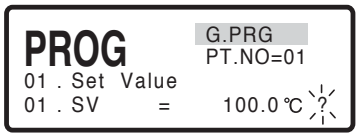
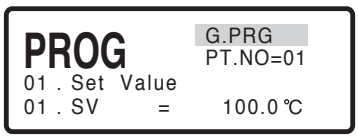
(17) 1 St segment setting

	Returned to segment that set a condition in program control. Perss ▽ ▲ .
	SEG.NO = 1 ? is displayed. Press SET key.
	SEG.NO = 1 is selected. Press SET key.
	PID number selection (PID NO. Select). 01. PID=1 is displayed. (Among 4 kinds PID group, the 1st group is set as initial value) Press SET key.

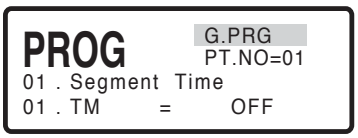
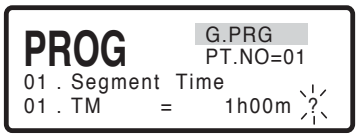
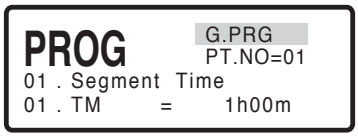
(18) Alarm number selection

	1 st segment number selection(ALM NO.select)01, ALM=OFF is displayed. (selection class:OFF, 1~4) If you don't want to change, press SET key.

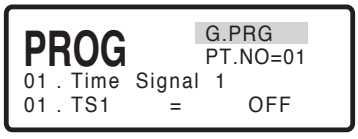
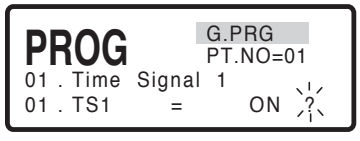
(19) 1 st segment set value

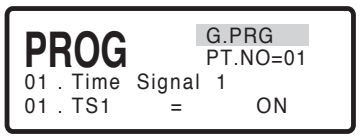
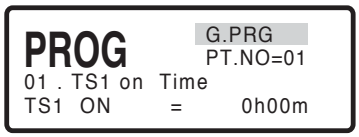
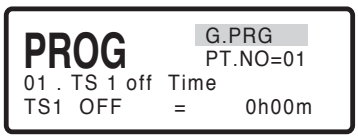
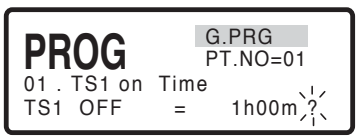
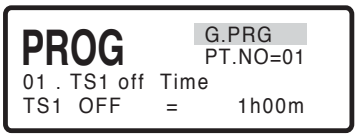
	1st pattern 1 segment set value (01. Set Value) 01. SV = 0.0 ℃ is displayed. Press ▽ ▲ to be 01. SV = 100℃
	Press SET key to confirm.
	01. SV = 100 ℃ is displayed. 1 st segment SV is 100 ℃. Press SET key.

(20) 1 st segment time setting

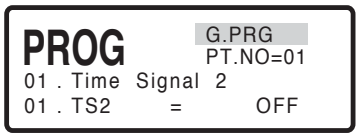
	1 st segment time (01. TM) = OFF is displayed as initial value. Press ▽ ▲ to be 01. TM= 1h00m
	Press SET key to confirm
	01. TM = 1 h 00 m is set. Press SET key.

(21) 1st time signal setting

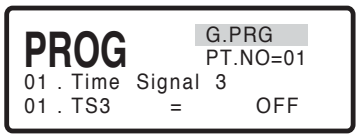
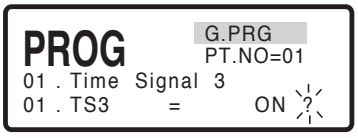
	1st segment 1st time signal (01. TS1)=OFF is displayed.(Selection class:ON, OFF) Press ▽ ▲ to be “ON”
	01. TS1 = ON is displayed. Press SET key.

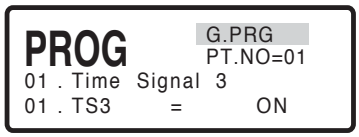
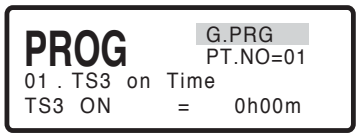
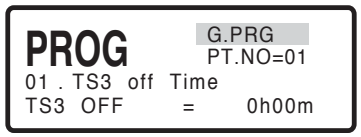
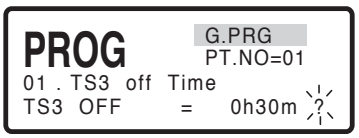
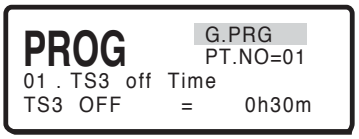
	Press SET key to confirm.
	TS 1 ON time setting (01. TS1 on Time)= 0 h 00 m is displayed. Press SET key.
	TS 1 OFF time (TS1 off)=0h00m is displayed. Press ▽ ▲ to be 1h00m
	Press SET key to confirm.
	Press SET key.

(22) 2nd time signal setting

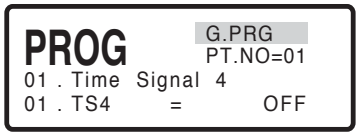
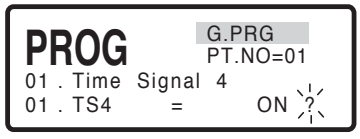
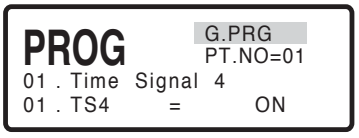
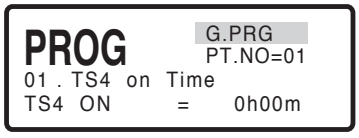
	1 st segment 2nd time signal (01. TS2)=OFF is displayed. No need to set TS2 in this example , so press SET .

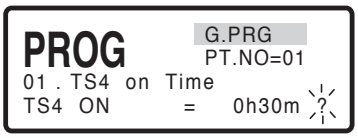
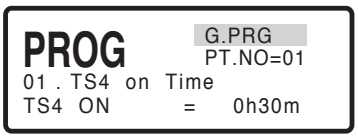
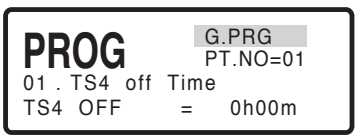
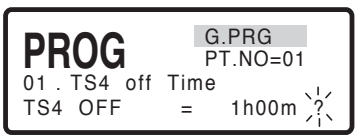
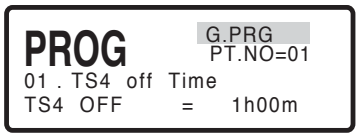
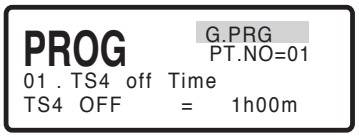
(23) 3rd time signal setting

	1 st segment 3rd time signal (01. TS3)=OFF is displayed. Press ▽ ▲ to be “ON”
	01. TS3 = ON is displayed. Press SET key to confirm

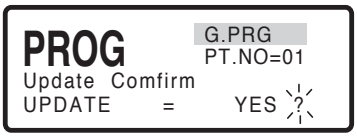
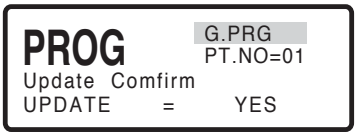
	Press [SET] key.
	TS 3 ON time setting (01.TS3 ON)=0 h 00 m is displayed. TS 3 will be started as soon as 1 st segment start. So, you don't need to set a time. Press [SET] key.
	TS 3 OFF time (TS 3 OFF)= 0 h00 m is displayed. Press [▽ ▲] to be 0 h 30 m?
	Press [SET] key to confirm.
	Press [SET] key.

(24) 4th time signal setting

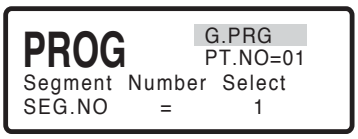
	1st segment 4th time signal (01. TS4)=OFF is displayed. Press [▽ ▲] to be "ON"
	01. TS4 = ON? is displayed. Press [SET] key to confirm.
	Press [SET] key.
	TS4 ON time setting (01.TS4 ON)=0 h 00 m is displayed. TS4 will be started after 30 minutes, so press [▽ ▲] to be "0 h 30 m?".

	Press SET key to confirm.
	Press SET key.
	TS4 OFF time (TS4 OFF)=0 h 00 m is displayed. TS4 will be off after 1hour, So press ▽ ▲ to be "1 h 00 m".
	Press SET key to confirm.
	Press SET key.
	01. TS5 = OFF is displayed. In this example, 5th TS will be set in 2nd segment. Press SET key.

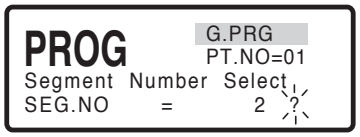
(25) Data update

	UPDATE = NO → Press ▽ ▲ →
	→ UPDATE = YES → Press SET
	→ UPDATE = YES → Press SET

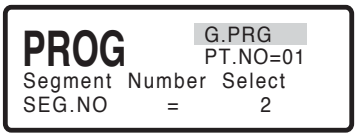
(26) 2nd segment setting



SEG. NO = 1 → Press [▽] [▲] →

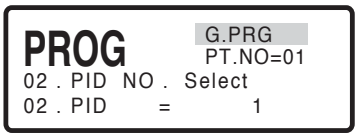


→ SEG. N = 2 → Press [SET]



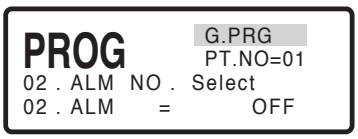
→ SEG. NO = 2 → Press [SET]

(27) PID number selection



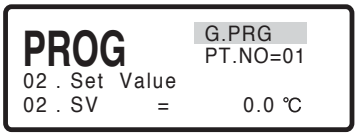
02. PID =1 (2nd segment PID select)
→Press [SET] if you don't change.

(28) Alarm number selection

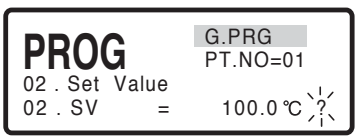


02. ALM = OFF
→Press [SET] if you don't change.

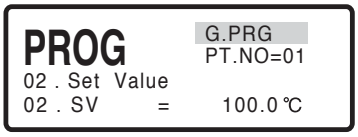
(29) 2nd segment set value



02. SV = 0.0 ℃ → Press [▽] [▲] →

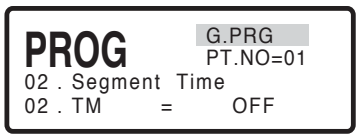
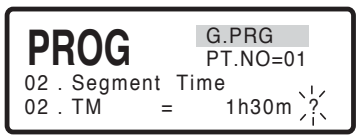
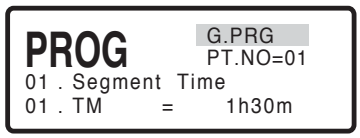


→ 02. SV = 100.0 ℃ → Press [SET]

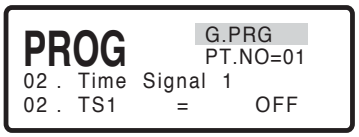


→ 02. SV = 100.0 ℃ → Press [SET]

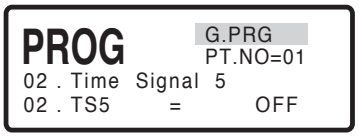
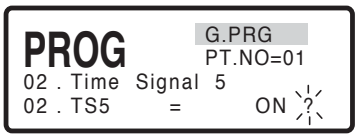
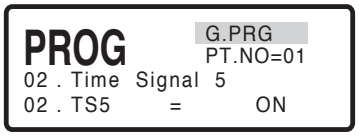
(30) 2nd segment time setting

	02. TM = OFF → Press ▽ ▲ →
	→ 02. TM = 1 h 30 m → Press SET
	→ 02. TM = 1 h 30 m → Press SET

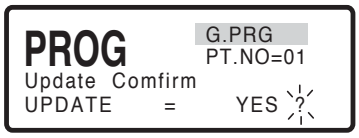
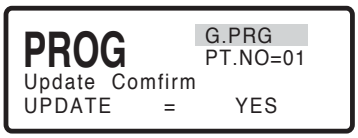
(31)1st time signal setting

	02. TS1 = OFF (Don't need to set TS1 in example) → Press SET

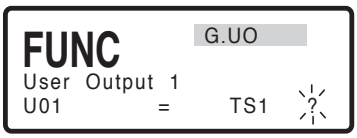
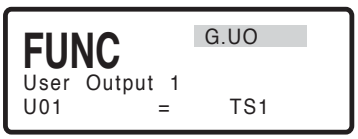
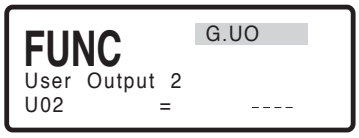
(32) 5th time signal setting

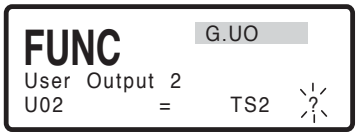
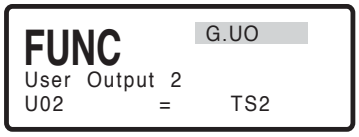
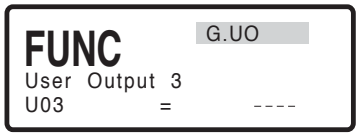
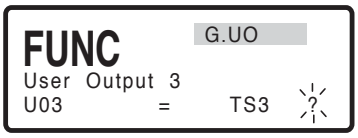
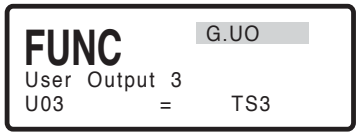
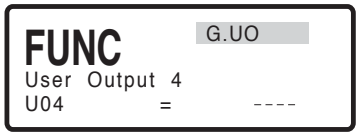
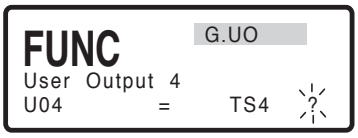
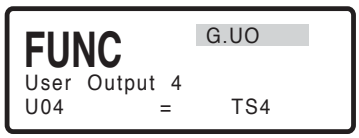
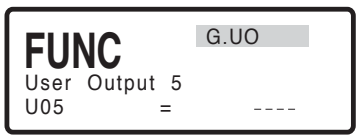
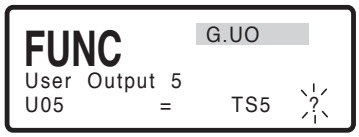
	02. TS5 = OFF → Press ▽ ▲ →
	→ 02. TS5 = ON → Press SET
	→ 02. TS5 = ON → Press SET

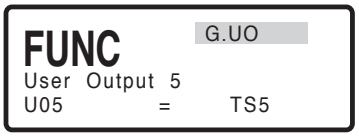
(33) Data update

	UPDATE = NO → Press ▽ △ →
	→ UPDATE = YES → Press SET
	→ UPDATE = YES → Press SET To designate user output, press DISP 3 times.

(34) User output number designation

	Function menu ▶G.IS → Press ▽ △ →
	→ ▶G.UO → Press SET
	User output grout U01 = ... → Press ▽ △ →
	U01 = TS1 → Press SET
	U01 = TS1 (TS1 is designated as U01)→ Press SET →
	U02 = ... → Press ▽ △

	U02 = TS2 → Press [SET] →
	U02 = TS2 → Press [SET] →
	U03 = ... → Press [▽ ▲] →
	U03 = TS3 → Press [SET] →
	U03 = TS3 → Press [SET] →
	U04 = ... → Press [▽ ▲] →
	U04 = TS4 → Press [SET] →
	U04 = TS4 → Press [SET] →
	U05 = ... → Press [▽ ▲] →
	U05 = TS5 → Press [SET] →

	U05 = TS5 → Press [SET] . Press [SET] key for 3 sec, to move to OPERATION screen.

(35) Set value display

	Set value is displayed at the operation screen.

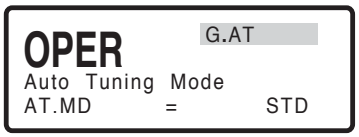
(36) Operation pattern selection

	Press [▽ PTN ▲] to be pattern number 1.

(37) Starting program operation

	Press [RUN/HOLD] key for 2 seconds.
	Current segment / Setting segment Repeat number / Total repeat number.
	Press [SET] key for 3 seconds to operate AT.
	Press [DISP] → OPERATION menu→ [SET]

(38) Auto tuning mode



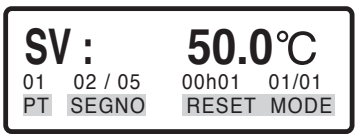
Auto tuning mode is standard type.

(39) starting auto tuning

Auto tuning = OFF.

Press ▽ ▲ → AT = ON → SET

(40) Operation screen display



→ SV screen

(41) Reset

Press RST to stop

10 GROUP SETTING FOR EACH MENU

1. Program Menu (PROG)

1-1. Program Group (G.PRG)

1-1-1. Selecting Pattern Numbers (PT.NO)

- There are 30 patterns and total of 300 segments in this controller.
- 99 numbers of segment can be used for the one pattern, but the total segment number can not excess 300. One patter have 99 segment with SEG=0

1-1-2. Selecting Segment Numbers (SEG.NO)

1) SEG=0

In the SEG=0 status, the conditions for each pattern will be set up.
SSV, STC (Starting Condition):SSV → Start set Value, STC → Start code
END.SEG, END.MOD, END.TM, LINK.PT (Finishing Condition)
WTM, WZ : conditions for WAIT
TS.MD : Time Signal Mode
Repeated Numbers : REPEAT

2) SEG=1~99

In the SEG=1~99 status, the shape of corresponding pattern will be set up.
PIDNO (operating PID group number), SV, TM (Operating Time), TS, TS.ON, TS.OFF

1-1-3. Setting WAIT ZONE

WZ(Wait Zone) : Set up the PV's deviation limit toward SV.

1-1-4. Setting up WTM (Wait Time)

If the PV can't get into the WZ, the WAIT process will not be terminated. To prevent this, set up the WTM status. If the process goes on passing the WT, the WAIT will be dismissed, and the segment will start even though the current status is in WAIT condition.

It can't guarantee that there's no deviation between SV and PV when one segment terminates and moves into the next segment.

The WAIT should start when there would be a problem with the large volume of deviation moves along to the next segment.

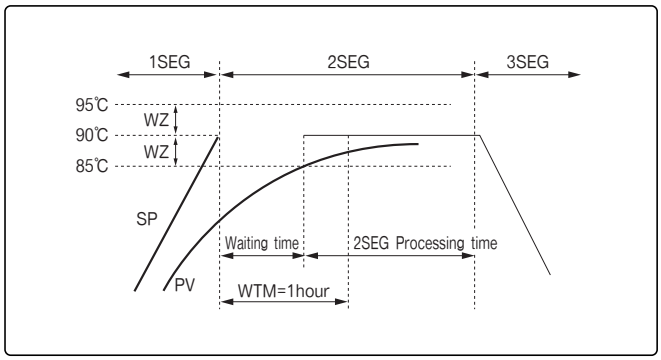
The WAIT will be only operated in SOAK Segment, not on the RAMP Segment.
Even though you set up only the WZ, the WAIT status still can start.
(In the WTM=OFF status, the WT is limitless.)

If the PV doesn't enter into the deviation approving range, which was set by WZ, toward SV, the time for that segment will not be counted.

If the time elapse longer than the WTM, the WAIT status will be dismissed, and the segment will be keep processed even though the PV or SV didn't come into the WZ.

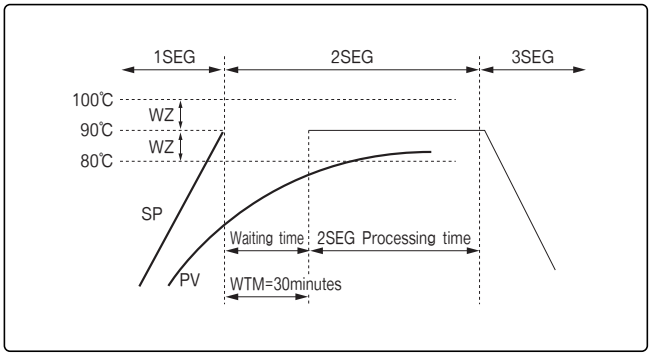
【EX1】WZ=5℃, WTM=1hour

*Because the set value for the Soak Segment : 2SEG is 90℃, the deviation approving range is 85~95℃.
If the PV arrives at the WAIT zone faster than set WTM=1hour, the WAIT will be dismissed, then the segment will go on.



【EX2】WZ=10℃, WTM=30minutes

*Because the SV=90℃, deviation approving range is 80~100℃. If the PV arrives at WAIT zone later than set WTM=30minutes, the WAIT will be extended. The segment will go on.



【EX3】WZ=OFF, WTM=1hour

Because the WZ is in OFF status, WAIT status will not be launched.

【EX4】WZ=10℃, WTM=OFF

Because the WTM is in OFF status, the process will set the WAIT status until the PV arrives into the WZ (wait zone)

1-1-5. Setting REPEAT frequency

- The frequency of repetition of program will be set in the REPEAT mode.
- The repetition can be taken place from 1to 99 times and without limit.
  〔REPEAT=1 means do not repeat.〕

1-1-6. TS.MD (Time Signal Mode)

1) For the case when TS.MD=ON/OFF
If you select the status of TS as ON/OFF, this status will be applied to every segment.
The ON/OFF status will be set in the TSn parameter in each segment.
At that time, if you select the n time signal as ON, the TSn ON TM and TSn OFF TM will not be displayed even if the TSn is in ON status.

2) When TS.MD=TIME
The time signal will set ON time and OFF time in each segment.
If you set it as TSn=ON, the TSn ON TM and TSn OFF TM will be displayed.
At this time, you set the status ON for the TSn ON TM and set the status OFF for the TSn OFF TM.

3) The operative example when the TS.MD is in ON/OFF status.

【EX: If we set the TS as following】

Segment	1	2	3	4	5
TS1	ON	OFF	OFF	OFF	OFF
TS2	OFF	OFF	OFF	ON	ON
TS3	ON	OFF	OFF	ON	OFF
TS4	ON	ON	ON	ON	ON
TS5	OFF	OFF	OFF	OFF	OFF

※ TS1 (Time Signal 1): It will be in ON status as soon as the segment number 1 starts and will be in OFF status with termination.

TS2 (Time Signal 2): It will turned ON with the starting of segment number 4 and will be continued till the finishing of segment number 5.

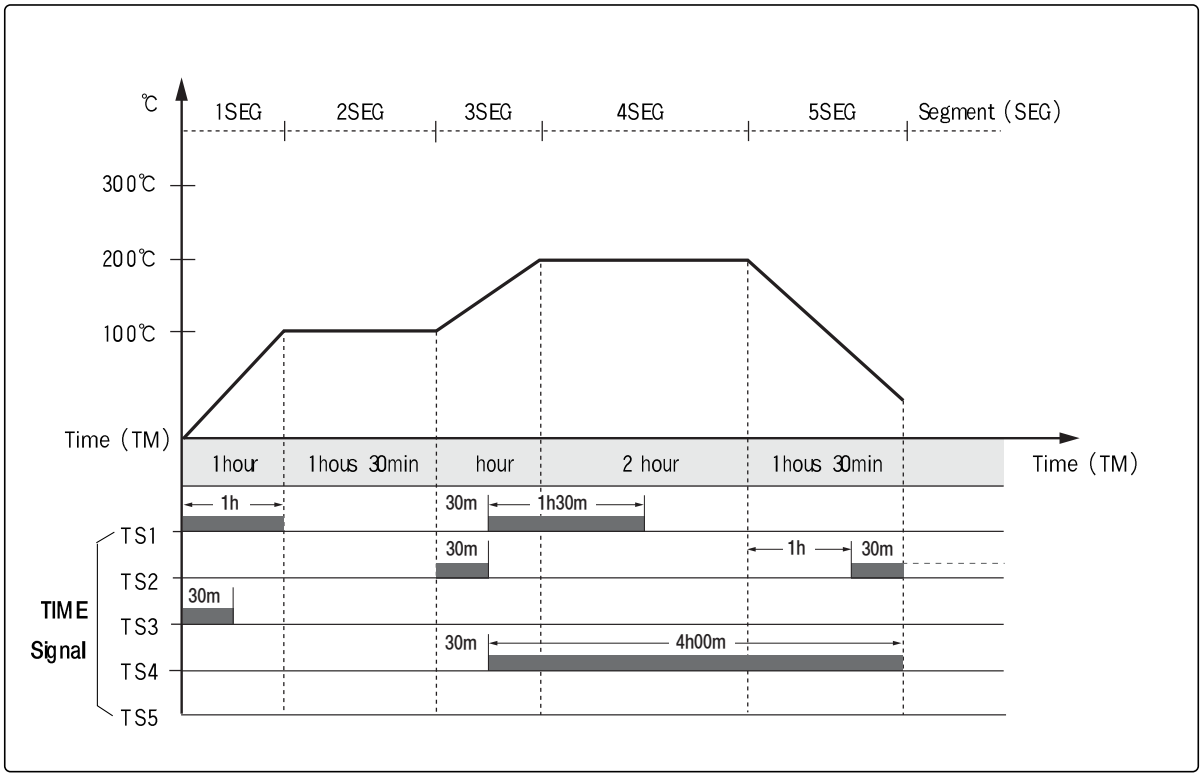
TS3 (Time Signal 3): It will be ON from the segment number 1 to 4.

TS4 (Time Signal 4): It will be ON in the whole sections.

TS5 (Time Signal 5): It will be in OFF status in whole sections, in other words, not operates.

4) The operation when selecting TIME in Time Signal Mode.

【EX: If we set the TS and Segment Elapsing Time as following.】



※ TS1 is turned ON at the start of segment 1 because the ON time is "0".
Since the TM is 1 hour, TS 1 will be in OFF status as the segment number 1 terminates.
In other words, the OFF time is the actual output elapsing time.

※ TS2 will be turned on at the start of segment 3 and will be turned off after 30minutes.
To start the TS 2, it needs an hour more after the segment 5 starts.
However, the TS will be turned off as program finished up its process even though the OFF time was set to continue regardless of program termination.

※ TS3 will be on at the start of segment 1 and will be turned off after 30 minutes.
It will stay in OFF status since it was not set for any other segments.

※ TS4 will start after 30minutes later of starting segment 3 and will be in OFF status after 4 hours.
Since the OFF time is longer than segment operating time, the output process will be continued to the next segment.

※ TS5 will not be used.

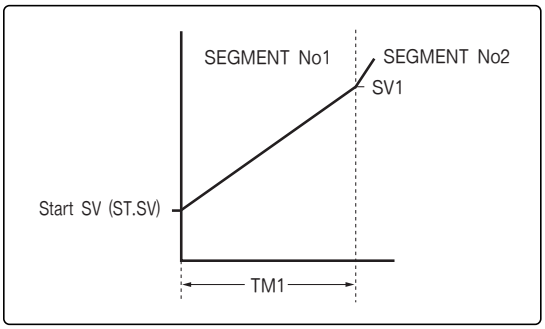
1-1-7. ST.SV (Start Set Value)

- The starting condition of program is different for the set ST.MD (Starting Mode)

ST.MD (Start Mode)	Program Operating Starting Act
SSV	Start at the SSV (Stare Set Value)
PV1	Start of PV, and pattern has priority.
PV2	Start of PV, and time has priority.

1) ST.MD=SSV : Start up process by start set value.

- If you select SSV at the ST.MD, it will start at the temperature set by ST.SV regardless of PV.
- The set value will be modified from ST.SV to SV 1 during the TM 1.

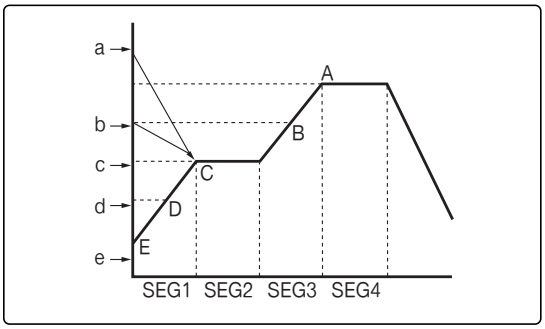


2) ST.MD = PV1 : Starting PV with priority in pattern.

- Starting from current PV states, and has a reciprocity with the ST.SV, PV, SOAK and n.TM. Refer to the picture for more information.
- If the PV is less than start set value, the process will begin at the start set value.
- When there is a SOAK SEGMENT, if the PV is higher than the SV of SOAK, it will start at the place of SOAK SEGMENT.
- If theres a pattern reversing point, it will start at that segment as long as the PV is higher than SV.
- If the program start in the middle of pattern, the time elapsed so far will be ignored.

① If the segment 2 is SOAK SEGMENT.

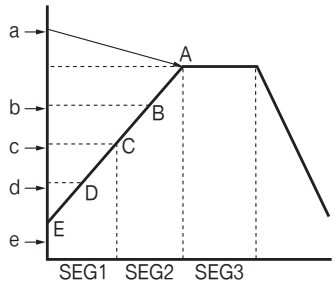
- If the PV is between a through c: Ignore segment 1 then, start from the segment 2, the first SOAK.
- If the PV at d: It will start at point D.
The time elapsed till the point D will be ignored, and the time for the range D through C will be counted.



PV at the start of Program	Program Starting Point
a	A
b	B
c	C
d	D
e	E (SSV)

② If the segment 3 is SOAK SEGMENT.

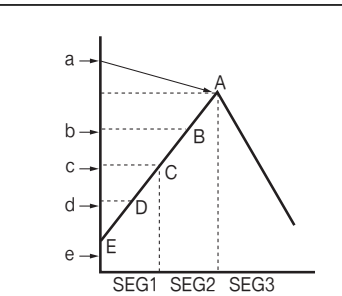
- If the PV is at a: Ignore segment 1 and 2 then, start from the first SOAK SEGMENT.
- If the PV is at the range of b through d: Start at the point where SV=PV (Point B.C.D)
  When the PV is b: The time elapsed till the point B will be ignored, and the time between A to B will be counted.
- When PV=c: The time elapsed till the point C will be ignored, then the time between A through C will be counted.
- When PV=d: The time elapsed till the point D will be ignored, then the time between C through D will be counted.
- When the PV=e (PV ≤ SSV): Start at the S.SV.



PV at the start of Program	Program Starting Point
a	A
b	B
c	C
d	D
e	E (SSV)

③ When there's no SOAK SEGMENT.

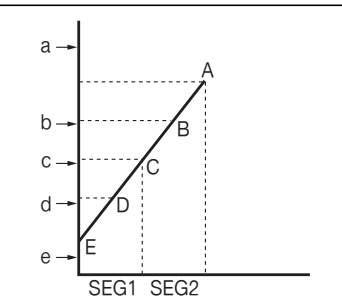
- PV=a: The segment 1 and 2 will be ignored, and start at the segment 3, the first reversing point.
- When the PV is between b through d : Start at the point where the SV=PV (Point B,C, D)
  If the PV=b: The time till the point B will be ignored, and it will operate for the time A through B.
- PV=c: The time till the point C will be ignored, and it will operate for the time A through C.
- PV=d: The time till the point D will be ignored, and it will operate for the time C through D.
- When the PV = e (PV ≤ SSV) : Start at the S.SV.



PV at the start of Program	Program Starting Point
a	A
b	B
c	C
d	D
e	E (SSV)

④ When there's only increasing pattern.

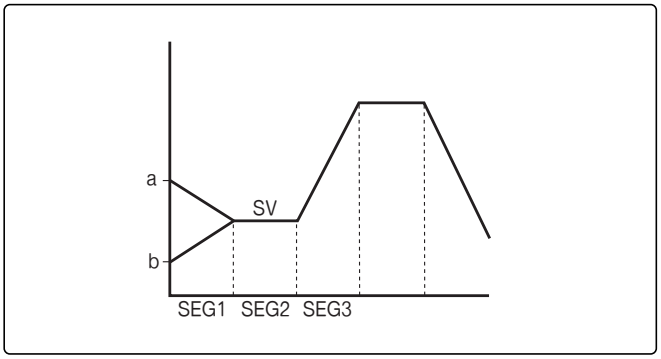
- PV=a: Do not start up the program.
- When the PV is between b through d : Start at the point where the SV = PV (Point B,C, D)
  If the PV=b: The time till the point B will be ignored, and it will operate for the time A through B.
- PV=c: The time till the point C will be ignored, and it will operate for the time A through C.
- PV=d: The time till the point D will be ignored, and it will operate for the time C through D.
- When the PV=e (PV ≤ SSV): Start at the S.SV.



PV at the start of Program	Program Starting Point
a	Do not start up the program
b	B
c	C
d	D
e	E (SSV)

3) ST.MD = PV 2 (PV start with time priority)

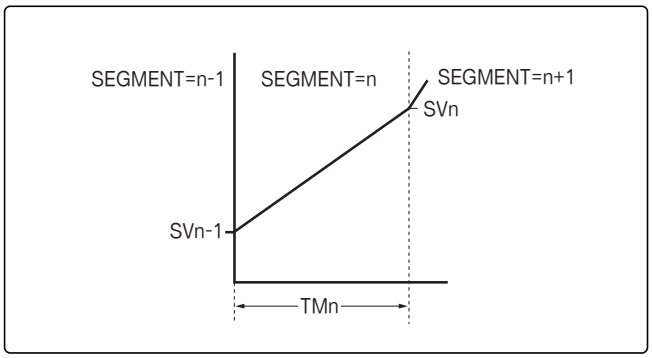
It will operate only during the user set time from the PV at the point of program starting to the SV. Pattern will be decided by the time for segment 1.



4) The shape of pattern

The SV changes with the value earned by

$$\frac{(SVn - SV_{n-1})}{TMn}$$



1-1-8. END.SEG (Pattern End Segment)

- Setting up the finishing segment.
- The program will be terminated at the end segment even though there are more segments following.
- For the END.SEG=OFF status, it will process until the last segment that was set for the pattern, then terminate the program.

【EX1】 If there are 10 segments of certain pattern, if we put as END.SEG=5, that pattern will be processed only through segment 5.

【EX2】 If there are 10 segments of certain pattern, if we put as END.SEG=OFF, that pattern will be processed to the segment number 10.

【EX3】 If there are 10 segments of certain pattern, if we put as END.SEG=15, that pattern will be processed through segment 10.

1-1-9. END.MD (Pattern end mode)

END.MD can be selected among RESET, HOLD, FIX and LINK program.
If you select LINK for the END.MD, the pattern number will be displayed at the LINK.PT (Link Pattern)

1) END.MD=RESET
- The pattern will be converted to RESET Mode after finishing up the pattern.
- Output pattern end signal when converting the mode to the RESET Mode. (The output time will follow END.TM)

2) END.MD=HOLD
- The pattern will be converted to HOLD Mode after finishing up the pattern.
- Stay at the finishing SV, the output is in normal control status.

3) END.MD=FIX
- The pattern will be converted to FIX Mode after finishing up the pattern.
- After the conversion, it will be in normal control status selecting SV according to SVNO.

4) END.MD=LINK
- After one pattern terminates, the process will go on moving to another pattern.
- After the conversion, the starting condition for operation will follow the ST.MD of corresponding pattern.

1-1-10. END.TM (Pattern End Signal Time)

- Pattern end signal will be produced when a program terminate its process.
  The pattern end signal producing time will be set at the parameter of END.TM.
  (The unit for time will follow the set up of TIME in the control group.)
- END.TM=OFF : Pattern end signal will not be produced.

1-1-11. LINK.PT (Link Pattern Numbers)

- Set up the patter number at the LINK.PT when the program terminates its process but still want to connect to the other pattern.
- The patter number could be itself.
  The is the same case of the REPEAT=CONTINUE status, constantly repeating the matching pattern endlessly.

1-1-12. UPDATE (Recording and modifying the program)

- Recording the program.
  If you want to update or modify the program between at the point of SEG=0 through SEG=1~99, you put "YES" for the "UPDATE"

  If you do not update, the previous data will not be valid. !!!

- Modifying the program.
  You can still modify the contents of program either the program is terminated or in process.
  If you modify the segment which was in progress, the program before the modification will be operated.
  The modified program will operate in the REPEAT status or when you restart the program.
  If you modify the next segment of current segment, the modification take effect after the current segment finishes.
- SEG.NO=1~99
  Set up the number of PID group of matching pattern, targeting value, elapsing time and time signal -- TS, TS.ON and TS.OFF.

1-1-13. PID NO. Select

- It has 4 kinds of PID Group.
- It set PID 1 as initial value per each segnent. but if thee control hcharactrized are different with each segment, you can control to another PID value as you nominated group NO. on PID Group as you needed select PID per each segment.
- Level PID of control group
  When the LEVEL=OFF status, the set up PID number will take effect in operation.
  When the LEVEL=ON status, the set up PID number will be ignored then, the operation will take place in LEVEL PID.

1-1-14. ALM NO. Select

- It can set 4 kinds of alarm.
- Alarm function is operated by select the setted 4 kinds of alarm to each segment on Program operation.

1-1-15. Set Value

Setting target temperature for the each segments.

1-1-16. Segment Time

Setting the time to reach the target temperature in the each segments

1-1-17. Time Signal 1 (Selecting operation for the time signal 1 in the segment number)

After selecting the time signal number 1 as ON status for the segment number , set up the TS1 ON and TS1 OFF time. (When TS.MD=TIME)
Follow the above instruction for the SEG=1~99 for each pattern as necessary.

1-1-18. Cut off of Electricity

If the electricity was cut off in the middle of process, the controller will be operated by the PWR.MD (Power Mode)/ in G.CTL (Control Group)

1-1-19. Setting up Program Time

The program time will be set by the "n.TM" (Segment Time of Program Group), and the unit is TIME (Time Unit) in G.CTL.

1-1-20. Hold Status

1) Hold in the PROGRAM RUN.

- The hold status will be put if you press the Run/Hold Key more than 1 second or turn on the DI2 while the program is running.
- The hold status will be dismissed if you put the Run/Hold key more than 1 second or turn off the DI2 (DI=Digital Input). The stopped segment will be processed again.
- To dismiss and continue the segment in the Hold status, press the STEP Key more than 1 second.
- If you press the Reset Key more than 1 second, the Hold status will be dismissed and terminating the program.
- During the Hold status, the previous fixed SV will be keep its values with normal control system.

2) To put a Hold status when terminating the program.

- The terminating process will be put a Hold status by (END.MD)=HOLD
- If you press the reset button for more than 1 second, or turn off the DI 2, the hold status will be dismissed and terminating the program.

1-1-21. Step Operation

- If you press the Step Key more than 1 second or turn on the DI 3 in the middle of Program Run operation, the processing segment will stop, starting the next segment.
- If you put step status in the WAIT or Hold status, the WAIT and Hold status will be dismissed and starting the next segment.
- If the current segment is the last segment, the step process will be operated by the END.MD in the program group.

1-2. File Group (G.FILE)

Group File is composed of total used pattern, segment displaying mode, pattern editing mode and segment editing mode.

1-2-1. Total used pattern and Segment Displaying mode (INFORM)

USED / TOTAL Pattern	Showing the number pattern used among total 30 number of patterns.
USED TOTAL Segment	Showing the number segment used among total 300 number of segments.
USED Segment by Pattern	Showing the number of used segment in each pattern. To inquire the information of the pattern number, press the " ▼ ▲ " button.

1-2-2. Pattern Edit (PT. EDIT)

Copy Source	• Input a pattern number to be copied.
Copy Destination	• Input a pattern number to be moved.
Result of File	• Indicate result of file which is moved.
Delete Pattern Number	• Input a pattern numble to be deleted.
Result of File CMD	• Indicate result of deleting
File all Initialize	• Initialize all segments (0~99 SEG)
Confirm Really File Init	• If select YES, the file will be initialized.

1-2-3. Segment Edit (SEG. EDIT)

Pattern Number Select	• A pattern number to be edited.
Insert Segment Number	• Input the segment number to be insert. • If certain segment was inserted, the following segment will automatically numbered to the backward. • The paramenter of inserted segment has the initialized value.
Result of File CMD	• Indicate result of inserted segment.
Delete Segment Number	• Input the number of the segment to be deleted. • If certain segment is deleted, the next segment will automatically numbered to the forward.
Result of File CMD	• Indicate result of deleting.

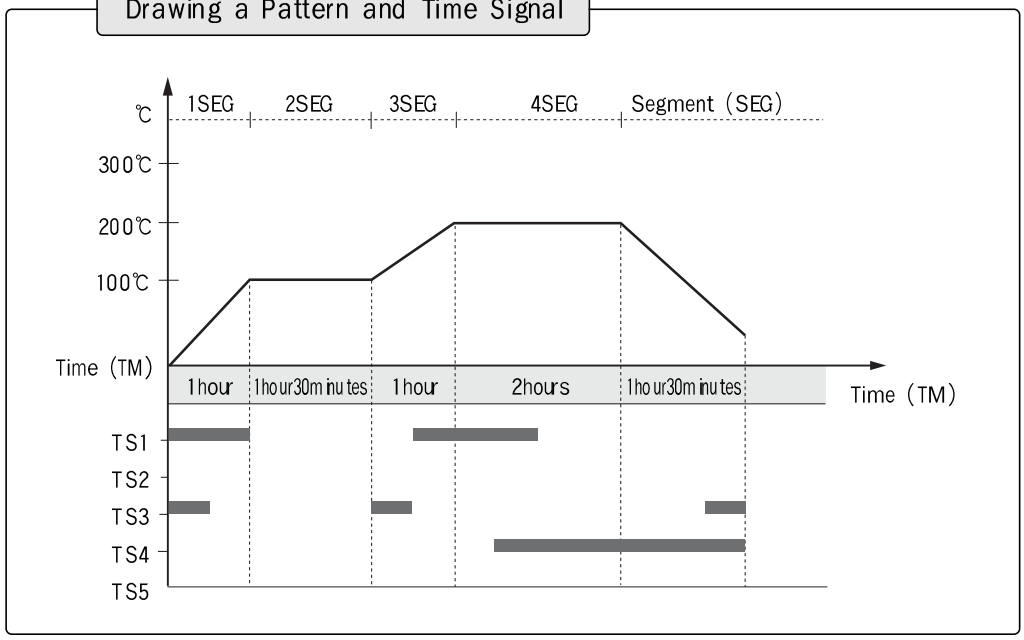
1-2-4. Error Editing (Edit Error)

NO PT	• When the pattern to be deleted has no contents. • When the pattern to be copied has no contents.
NO SEG	• When the segment to be deleted has no contents. • When the segment to be inserted has no contents.
PT USE	• When the Destination Pattern have contents when moving a pattern.
PT RUN	• If the matching pattern is in process when deleting a pattern. • When the corresponding pattern is in process when inserting a segment.

1-2-5. Drawing a Pattern Graph (Pattern1)

- Pattern at the upper part and time signal at the lower part will be indicated.
- Temperature will be put on the vertical line, and time will be put at the lower horizontal line.

Drawing a Pattern and Time Signal

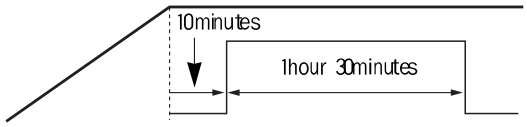


1-2-6. TS (time signal), Wait, and Hold

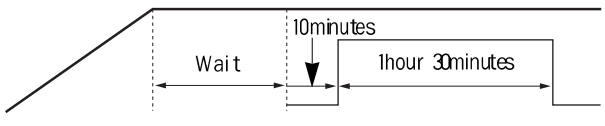
In the Wait or Hold mode, the time signal is also being stopped.

【EX】 If the Wait mode was set like the picture 1-1, time signal is stopped as of picture 1-2.

【Picture 1-1】



【Picture 1-2】

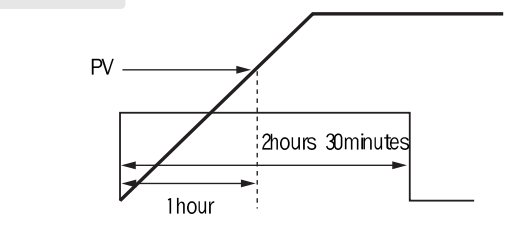


1-2-7. TS (Time Signal) and ST.MD (Start Mode)

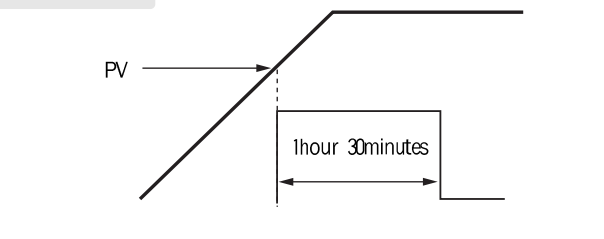
If the operation time is elapsed by PV start, the Time Signal will also display the elapsed time.

【EX1】 As for ST.MD=PV (PV START) case, if we set as of picture 1-3, elapsed time by PV START processing is also regarded as the duration time as we see in picture 1-4.

【Picture 1-3】

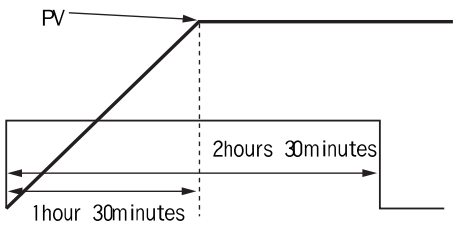


【Picture 1-4】

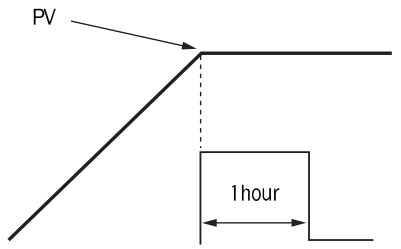


【EX 2】 As for ST.MD＝PV (PV START) case, if we set as of picture 1-5, elapsed time by PV START processing is also regarded as the duration time as we see in picture 1-6.

【Picture 1-5】



【Picture 1-6】

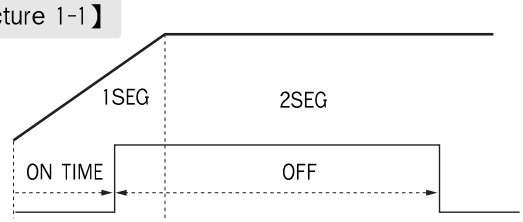


1-2-8. Various shape of Time Signal (TS)

1) Basic shape of TS

【EX1】 Normal : ON Time should be within the set up segment.

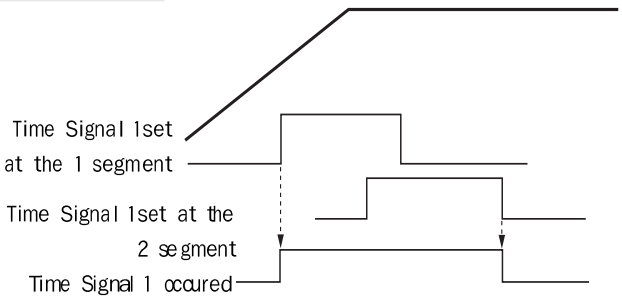
【Picture 1-1】



Time Signal set at the 1segment (TS)

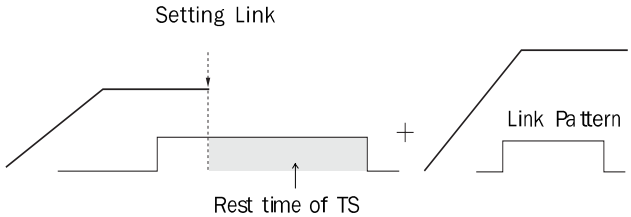
2) Overlapping Time Signal

【Picture 1-2】

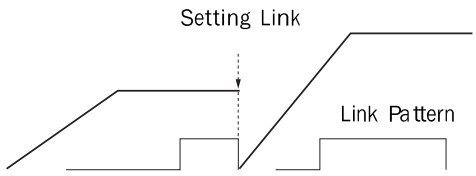


【EX2】 If we set TS as of picture 1-3, TS like the picture 1-4 occurs.

【Picture 1-3】



【Picture 1-4】



1-2-9. What to do when an Error occurs

• Operation Mode for Errors

① Fatal Error case like ADC error

The mode will be converted into RESET MODE when a fatal error such as ADC error occurs.
When it was set as automatic output mode, output will be processed as Preset out, PO which was made for an emergency purposes.

② BURN-OUT

This doesnt affect operating mode, but the mode will be converted to Preset output only it was previously set as automatic operation mode. In other words, it will only indicate the error status, but the process will be continued.
As for the Fix control, with the error notice, it will be converted into preset output only if it was previously set as automatic operation mode. The SV and TS will be processed normally.

③ Errors for the RJC, OVER, and communication system

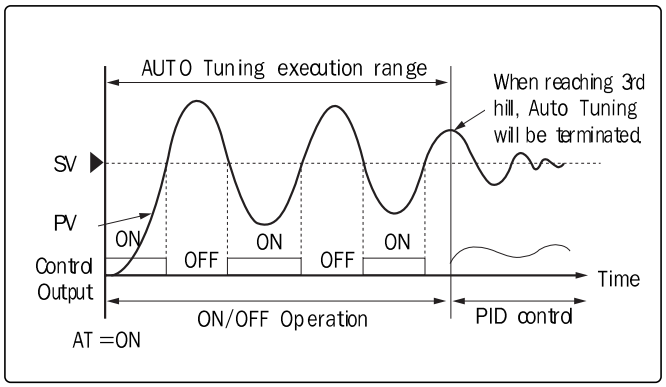
These errors affect neither operation nor output. As for the RJC errors, the notice will show up then, the RJC will be turned off keeping the normal status. For OVER and communication errors, the error notice will turn up, but the process will be continued keeping its normal status.

2. Operation Menu (OPER)

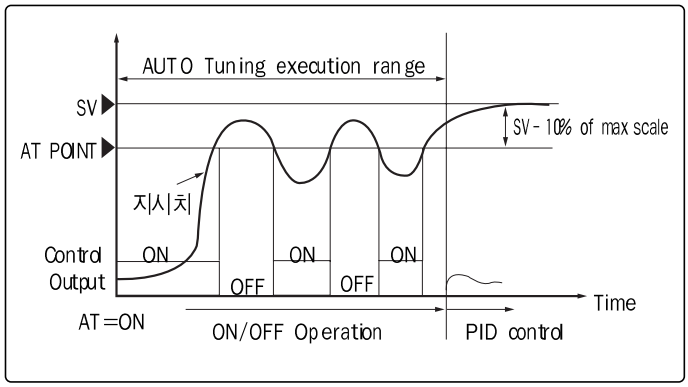
2-1. Auto-Tuning Group (G.AT)

• What is Auto Tuning?

The Controller automatically measure the characteristic of a material that's being regulated, then calculate. Based on the calculated results, the optimum PID value will be automatically set.
Auto Tuning program calculates the P, I, D value by cycle and amplitude vibration results of Limit Cycle method that was produced by on/off control output with 2.25 cycle duration. .
There are STD mode and Low PV mode for Auto Tuning mode.



【Auto tuning of standard (STD)】



【Low PV type Auto tuning (LOW)】

2-1-1. Auto Tuning mode in the standard type (AT.MD=STD)

1) LEVEL=OFF

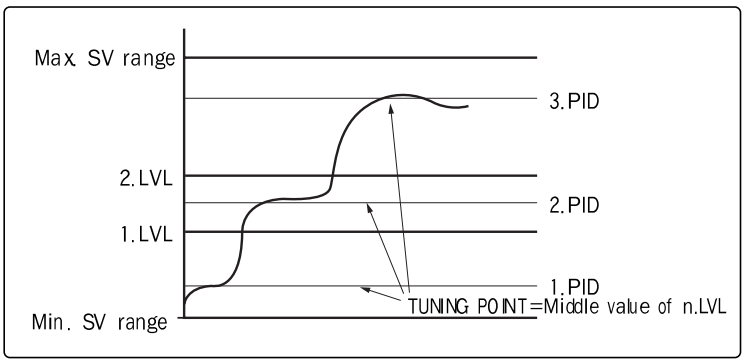
• If the AT=ON selected in the FIX, insert present SV in the PID group.
【EX】When SV=50℃ SVNO=2, it will perform AT in 50℃ and insert it to 3 PID.

• If the AT=ON is selected and execute AT with present SV, insert it to the selected PID group.
【EX】When PID number is 3 in the 3 segment, SV : 20℃,
AT will be execute at 20℃ and inserted to 3 PID group.

2) LEVEL=ON

• If the AT selected in the FIX, insert present SV in the PID group.
【EX】When SV=50℃ SVNO=2, it will perform AT in 50℃ and insert it to 3 PID.

• If the AT is selected and execute AT with present SV, insert it to the selected PID group.
【EX】When PID number is 3 in the 3 segment, SV : 20℃, AT will be execute at 20℃ and inserted to 3 PID group.



※ If AT＝Auto in the program control

AT is executed 1.LVL - RL / 2 and inserted in 1 PID group.
AT is executed 2.LVL - 1.LVL / 2 and inserted in 2 PID group.
AT is executed RH - 2.LVL / 2 and inserted in 3 PID group.
AT is executed RH - 4.LVL / 2 and inserted in 4 PID group.

2-1-2. Auto Tuning Execution in a Low PV type

It's basically same as normal auto tuning performance except the fact that the turning point range is on the SV-10% of max. scale.

2-1-3. Related to Auto Tuning

1) What happens to other functions during the AT process?

- If you start up the AT in a running on program, the elapsing time signal and the SV in the program will be stopped. Everything will be restored after AT process finishes.
  Inner signal, TS and alarm functions will be stopped. Especially, inner signal and TS keep their previous status. In other words, if they were turned on before the AT process, they will be stays on and vice versa.

2) Notices for AT

AT LED will be blinked with a 500 ms speed.

3) Changing SV in the middle of AT process

Despite of changes in SV, the turning point is not affected. After the AT process is done, starts controlling with modified SV as its target SV.

4) Changing PID parameter in the middle of AT process.

PID can be modified during the AT, but the PID value that was obtained when AT process terminates will be stored. If the AT process wasnt finished normally, it will start its controlling process with the modified PID value.

5) Abnormal termination of AT.

- If the AT process undergoes compulsory termination, the PID value will keep the value it had before the AT termination took place.
- Preset Output takes place when an ADC error such as burnout occurs, stopping the AT process.
  PID value will restore its previous value.
- Auto Tuning error notices will show up when the elapsing time of 2nd cycle of AT process is more than 24 hours.
- AT process will be stopped when it is converted to manual operation or Reset mode.

2-2. PID Group (G.PID)

2-2-1. ARW (Anti Reset Wind up)

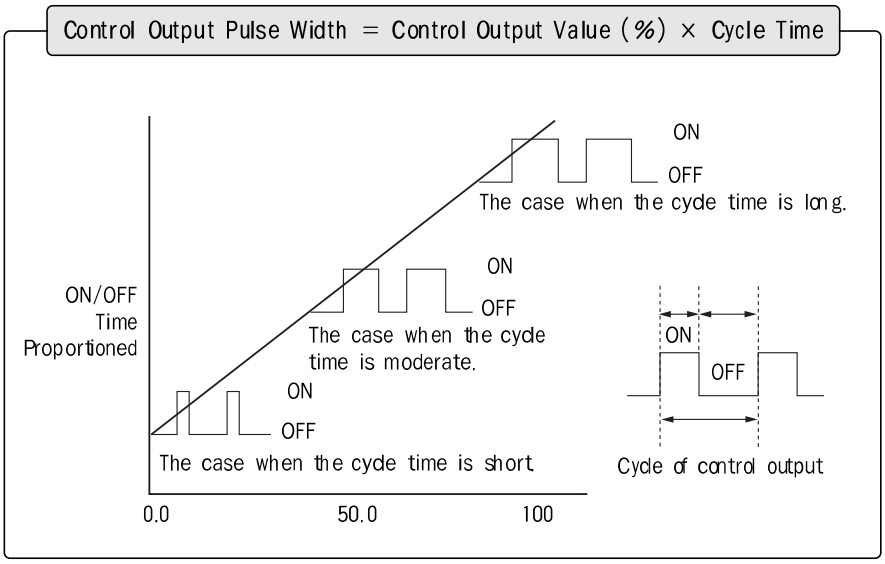
- If the output value reach the limit point (OH, OL), ARW(Anti Reset Wind Up) calculation will take place to prevent overintegration.
- Condition for ARW : when Integral time (Ⅰ)≠0 and AT=AUTO status and in the following condition, ARW will take place.
  1) DV ≥ 0 & output value upper LIMIT.
  2) DV < 0 & output value lower LIMIT.

2-2-2. Calculation Execution of CONTROL

1) Time proportioning PID control

The control output value resulted from PID calculation will be output in the width of pulse of ON/OFF status at the time proportion.
Pulse width will be calculated by control output value cycle time setting the cycle time as 100%.
You can choose either relay output or voltage pulse output.

You will have better control situation as you set the cycle time short. However, frequent ON/OFF conversion will wears out the relay.
10 to 30 seconds cycle time will be equitable.



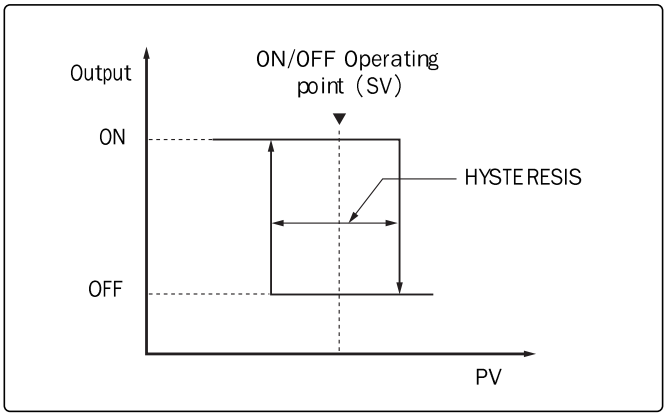
【Picture 2.1】 PID control in time proportion

2) Constant PID control

If we take the PID calculation result and make it proportioned to PID calculation value, we can output constant PID control in current value (4~20 mA)
The renewal cycle of output in control is 250 ms.

3) ON/OFF CONTROL

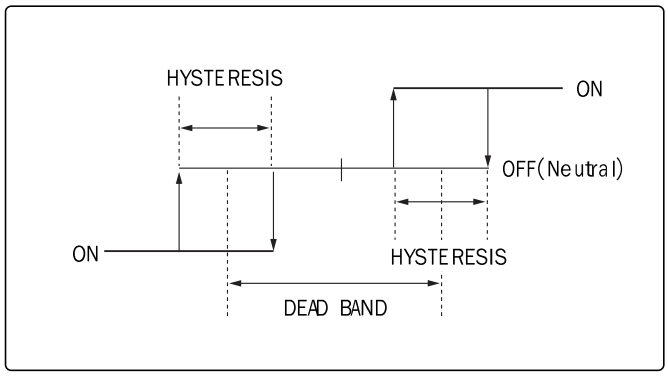
ON or OFF signal will be out according to the result of deviation between SV and PV.
(HYSTERESIS OUTPUT could be set this time.)



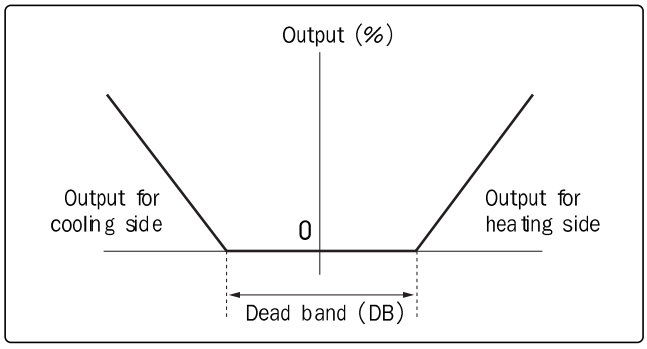
【Picture 2.2】 ON/OFF control

4) Heating / Cooling Control

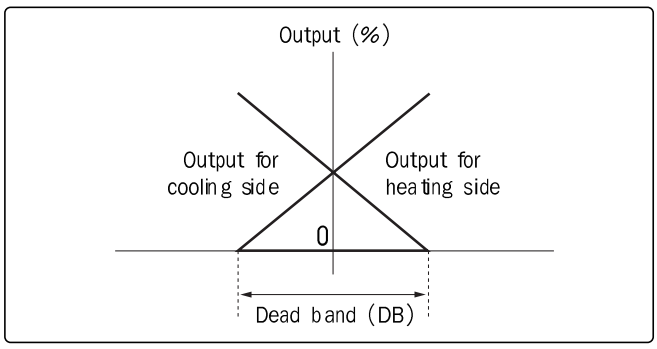
- Heating/Cooling control has two sections for calculated PID output as one for heating and another for cooling section.
  You can select heating and cooling control result output for either PID control or ON/OFF control mode.
  When you set heating P (proportion) as 0, ON/OFF control output is set for the heating side and vice versa.
  It is also possible to control the output for both heating and cooling side selecting one of relay, voltage pulse and current output.
- The Dead Band can be freely set in -100 ~50% range. The picture 2-3 shows a Dead Band for both of heating and cooling side in ON/OFF control status.



【Picture 2-3】 Dead Band in "+" Setting Value
(ON/OFF control status for both heating and cooling side)



【Picture 2-4】 Dead Band in "+" Setting Value
(PID control status for both heating and cooling side)



【Picture 2-5】 Dead Band in "-" Setting Value
(PID control status for both heating and cooling side)

5) PID control (heating and cooling control)

- Selecting PID
  For 2 Output, there are heating PID group and cooling PID group. Either one of PID will be selected according to the condition 1 or 2. PID operation will be persecuted in a same process as 1 Output.

① Output volume (MV) > 50% + 0.25% : chose Heating side PID
② Output volume(MV) < 50% - 0.25% : chose Cooling side PID. Besides above case, keep the current status quo.
③ For the first PID operation, use output value as 50% and heating side PID.
(If only P≠0 and Pc≠0) In a manual operating process, we can set up inner output value for heating and cooling side by key or communication line.
Manual operating output handles PID control output before calculating heating and cooling output.
The PID calculation output of cooling side ranges from 0 to 50%, but the earned numerical number will be converted into 0 to 100% proportion basis and vice versa.(Output of heating side range is from 50 to 100%)

2-3. Setting Group for the FIX Mode (G.SV)

2-3-1. Set Value (SV)

- Four points of SV are ready in FIX mode and can be selected through SVNO.
- This is displayed in the first operation screen in FIX mode and can be modified by ▼ ▲ button.

2-3-2. Initialize & Modifying data

1) All the parameters in all program groups will be initialized in the F.INT=ON status.
2) All the parameters except the contents of program group will be initialized in the P.INT=ON status.
3) EU or EUS unit parameter will be modified when there's a change for IN UNIT, FR-H, and FR-L.
4) All the parameters of output group will be initialized when the output of OUTPUT group is modified.
5) AnDB and AL-n will be initialized when modifying alarm type.

2-4. Control Goup (G.CTL)

2-4-1. LEVEL and PID

LEVEL PID will be used in the LEVEL=ON status.

1) LEVEL=OFF

- In the Fix Mode, control is made by the PID group that is matching the currently in use SV number.
  【EX】SVNO=3, 3.SV=50.0
  PID number 3 group will be selected since SVNO is equals to 3 with the SV=50.0 operation.
- In the PROG MODE, PID group selection is made by PIDNO, which was set up by currently in use SEG.
  【EX】if 1.PIDNO=3 in a 1SEG state and the 2.PIDNO=2 in a 2SEG state.
  If the current processing state is 1SEG, the PID group number 3 will be selected since the 1.PIDNO equals to 3. After terminating 1SEG, PID group number 2 will be selected.

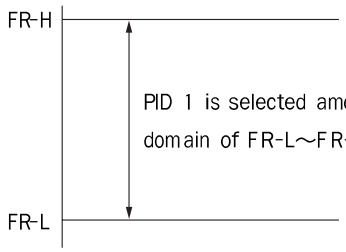
2) LEVEL=ON

- Will be divided into 4 levels from the input range. Different PID group will be applied to individual LEVEL.
- In the LEVEL=ON process, PID group will be automatically selected by LEVEL regardless of SVNO or PIDNO.
- This function makes possible to apply PID data matching domain because the optimum PID value is different in the wide PROCESS control program that has wide temperature range.

3) LEVEL PID Related Parameter

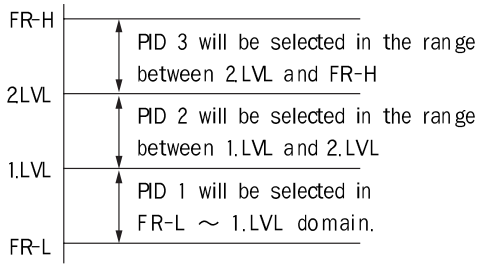
Symbols	Parameter	Contents	First Value
1.LVL	LEVEL 1	Boundary b/w PID 1 and PID 2	EU(100%)
2.LVL	LEVEL 2	Boundary b/w PID 2 and PID 3	EU(100%)
RDV	LEVEL DV	Deviation Range in PID 4 selection	OFF

【EX1】 Initial mode :1.LVL=2.LVL=FR-H, RDV=OFF



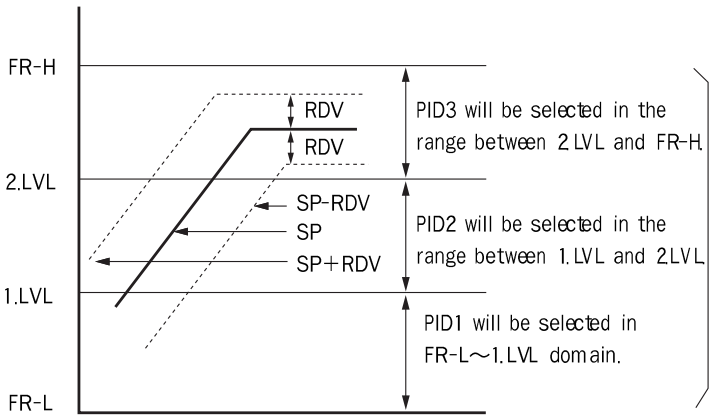
PID group number 1 will be selected in selected in the whole domain of FR-L~FR-H due to the 1.LVL=2.LVL=FR-H status.

【EX2】 LEVEL PID: FR-L< 1.LVL < 2.LVL < FR-H,RDV=OFF



※ PID 4 can't be sesected because of the RDV=OFF status.

【EX2】 LEVEL PID: FR-L < 1.LVL < 2.LVL < FR-H, RDV=ON



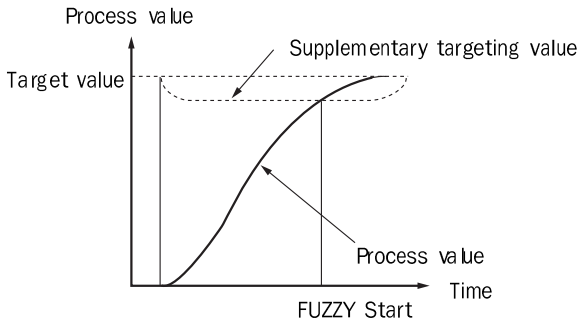
PID 1~3 will be selected in the range between SP-RDV ≤ PV ≤ SP+RDV range.

PID 4 will be selected either in the SP-RDV > PV or SP+RDV < PV range.

2-4-2. FUZZY Calculation

This is an over shoot repressing function using FUZZY ratiocination. Following control can be made.

- Starting to operate when theres a huge gap between initializing value and targeting value.
- To shorten warming up time.
- When theres an intense loaded fluctuation in usual operating process.
- When theres constant modification for set value.



【Picture 6】 Fuzzy Fuction

2-4-3. Time Unit

1) The unit in this controller is set under a TIME parameter all the time.
2) The unit hh.mm is hour and minute unit and mm.ss is minute and second unit.
3) Theres no parameter that's to be initialized when modifying TIME.
4) Parameters that are affected by TIME.

- PRG group : n.WTM, n.TM, nTS ON TM, n.TS OFF TM
- PTEND group : END.TM

2-4-4. External Contact (DI)

1) DI 1, 2, 3

① The function of DI 1, 2, 3

DI	Operation Mode	ON	OFF
DI 1	RESET / FIX / PROG	RUN	RESET
DI 2	PROG	HOLD ON	HOLD OFF
DI 3	PROG RESET/FIX	STEP PTEND OFF	× ×

2) DI 4, 5, 6, 7 (Optional)

① The function of DI 4, 5, 6, 7

PT.NO	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DI 4	X	O	X	O	X	O	X	O	X	O	X	O	X	O	X	O
DI 5	X	X	O	O	X	X	O	O	X	X	O	O	X	X	O	O
DI 6	X	X	X	X	O	O	O	O	X	X	X	X	O	O	O	O
DI 7	X	X	X	X	X	X	X	X	O	O	O	O	O	O	O	O

② The relationship between DI, operating keys and communication

- When the DI parameter in a group control is ON status (DI=ON): the pattern numbers can be modified only by DI unit 4~7. (Only DI is valid)
- When the DI parameter in a group control is in OFF status (DI=OFF): only keys or communication can modify the pattern numbers. The function of DI unit 4~7 is not valid.

2-4-5. The MODE when the power was ON

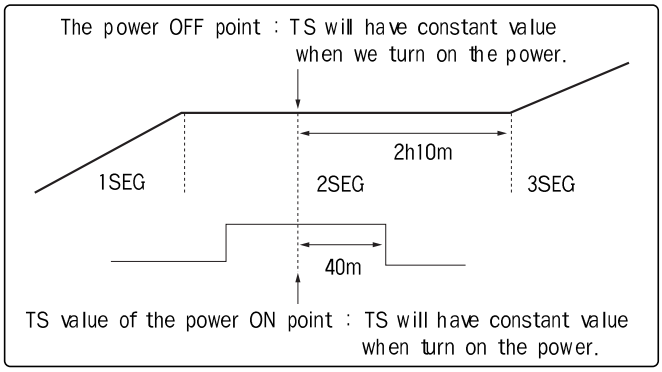
When the electric was out for a second (less than 2 seconds), the controller will start from the previous black out states.

After the 2 seconds of power on, the mode will be operated as following regardless of the state of DI parameter or "ON/OFF status of DI unit"

Mode before power OFF		Mode after power ON	
Operating Mode	Output Mode	Operating Mode	Output Mode
RESET (PWR.MD=COOL ⇔ HOT)	MAN	RESET	MAN
	AUTO		AUTO
FIX, PROG (PWR.MD=COOL)	MAN	RESET	MAN
	AUTO		AUTO
FIX, PROG (PWR.MD=HOT)	MAN	FIX, PROG	MAN
	AUTO		AUTO

【EX】 In the PROG& AUTO MODE, if you put the power on from off status when the ST.MD=CONTINUE status.

1) It stores PT#, SEG# (ex: 2SEG), REMAIN TIME (ex. 2h10) and REPEAT frequency.
2) It also saves the remaining time of TS (ex; 40m) when the TX.MD = TIME states.
   However, if the TX.MD = ON/OFF states, the controller stores information when the TS is ON/OFF states.
3) If the power was out during HOLD process → if you put the power on, it also stores HOLD.
4) If the power was out during WAIT process → if you put the power on, it also stores WAIT.
5) At the power off states → if you put the power on, it stores MV value.



6) The status of IS and ALARM will be stored but are needed to check at the starting point.
7) At the power off states → when the program starts with the power on, dont check STC.

3. Function Menu (FUNC)

3-1. Inner Signal Group (G.IS)

- There are 5 points of inner signal.
- Inner signal basically operates in the FIX and PROG mode.

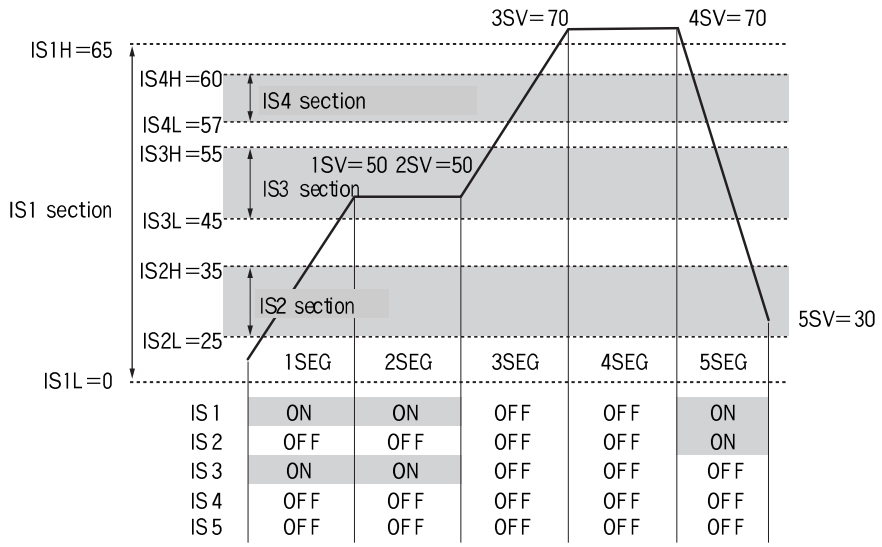
3-1-1. Inner signal mode : IS.MD

IS.MD=TSV	if the target set value of current using segment is within the Inner Signal range during the program operation, corresponding inner signal will be outputed for the whole section of current segment..
IS.MD=NSV	if the current set value of current using segment is within the Inner Signal range during the program operation, corresponding inner signal will be outputed from first inner signal point to last inner signal point.

3-1-2. Parameters related to the Inner signal

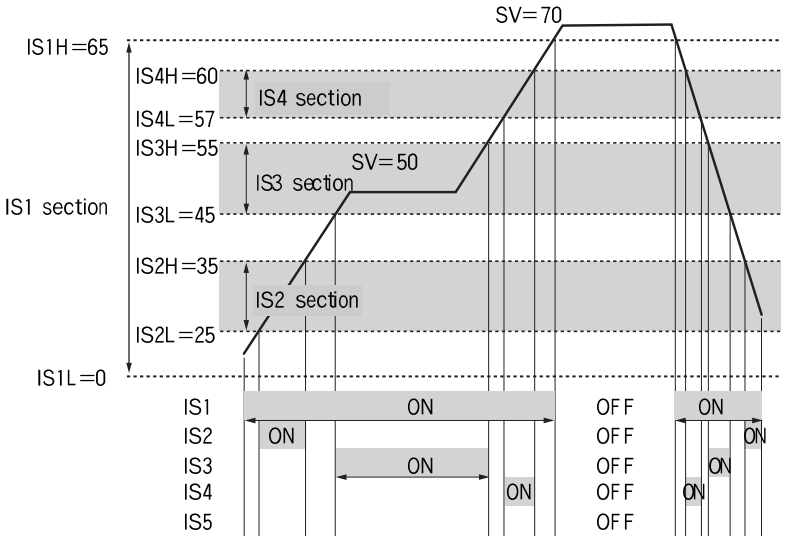
ISn (n=1～5)	set inner signal ON/OFF status.
ISnH (n=1～5)	set the maximum value of inner signal.
ISnL (n=1～5)	set the minimum value of inner signal. In other words, the range of inner signal is from ISnL to ISnH.

【EX1】 For the IS.MD＝TSV, IS5＝OFF status



In 1 Segment	• IS1 : if the 1SV＝50 is within the IS1 section (0~65) → ON • IS2 : if the 1SV＝50 is not within the IS2 section (25~35) → OFF • IS3 : if the 1SV＝50 is within the IS3 section (45~55) → ON • IS4 : if the 1SV＝50 is not within the IS4 section (57~60) → OFF • IS5 : because the IS5 is not set → OFF
In 2 Segment	• IS1 : if the 2SV＝50 is within the IS1 section (0~65) → ON • IS2 : if the 2SV＝50 is not within the IS2 section (25~35) → OFF • IS3 : if the 2SV＝50 is within the IS3 section (45~55) → ON • IS4 : if the 2SV＝50 is not within the IS4 section (57~60) → OFF • IS5 : because the IS5 is not set → OFF
In 3 Segment	• IS1 : if the 3SV＝70 is not within the IS1 section (0~65) → OFF • IS2 : if the 3SV＝70 is not within the IS2 section (25~35) → OFF • IS3 : if the 3SV＝70 is not within the IS3 section (45~55) → OFF • IS4 : if the 3SV＝70 is not within the IS4 section (57~60) → OFF • IS5 : because the IS5 is not set → OFF
In 4 Segment	• IS1 : if the 4SV＝70 is not within the IS1 section (0~65) → OFF • IS2 : if the 4SV＝70 is not within the IS2 section (25~35) → OFF • IS3 : if the 4SV＝70 is not within the IS3 section (45~55) → OFF • IS4 : if the 4SV＝70 is not within the IS4 section (57~60) → OFF • IS5 : because the IS5 is not set → OFF
In 5 Segment	• IS1 : if the 5SV＝30 is within the IS1 section (0~65) → ON • IS2 : if the 5SV＝30 is within the IS2 section (25~35) → ON • IS3 : if the 5SV＝30 is not within the IS3 section (45~55) → OFF • IS4 : if the 5SV＝30 is not within the IS4 section (57~60) → OFF • IS5 : because the IS5 is not set → OFF

【EX2】 For the IS.MD=NSV, IS5=OFF status



Conditions for ON status	• IS1 : if the current SV is within the IS1 section (0~65) → ON • IS2 : if the current SV is within the IS2 section (25~35) → ON • IS3 : if the current SV is within the IS3 section (45~55) → ON • IS4 : if the current SV is within the IS4 section (57~60) → ON • IS5 : because the IS5 is not set → OFF
Conditions for OFF status	• IS1 : if the current SV is not within the IS1 section (0~65) → OFF • IS2 : if the current SV is not within the IS2 section (25~35) → OFF • IS3 : if the current SV is not within the IS3 section (45~55) → OFF • IS4 : if the current SV is not within the IS4 section (57~60) → OFF • IS5 : because the IS5 is not set → OFF

3-2. Alarm Group (G.ALARM)

3-2-1. Alarm Mode (AL.MD)

Can select AL.MD in the alarm parameters, the kinds are as followings;

1) ALL : setting alarms for RESET, FIX CONTROL and the all modes in PROGRAM.
2) FIX & PROG : valid only for FIX and PROG MODE.
3) FIX : valid only for FIX MODE.
4) PROG : valid only for PROG MODE.

3-2-2. Conditions for waiting process

1) When power on.
2) When modifying alarm kinds.
3) Modifying SV in FIX mode. But program mode has no corresponding modification.

3-2-3. Kinds of Alarms

1) Output (Alarm time : ON)

Name	Code	ON Condition	OFF Condition
High absolute alarm	1(11)	PV≥ALM	PV〈 ALM－HYS
Low absolute alarm	2(12)	PV≤ALM	PV 〉ALM＋HYS
High deviation alarm	3(13)	DEV≥ALM	DEV〈 ALM－HYS
Low deviation alarm	4(14)	DEV≤－ALM	DEV 〉－ALM＋HYS
High · Low deviation alarm	7(17)	DEV≥ALM (DEV≤－ALM)	DEV〈 ALM－HYS (DEV 〉－ALM＋HYS)
High · Low deviation band alarm	8(18)	DEV≤ALM DEV≥－ALM	DEV 〉ALM－HYS (DEV〈 －ALM＋HYS)

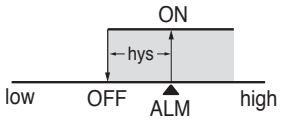
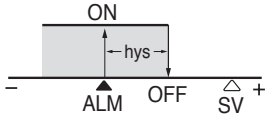
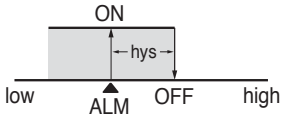
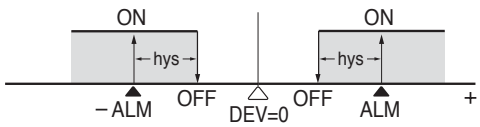
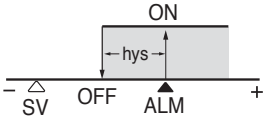
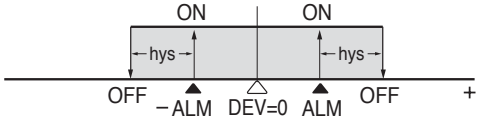
※ The numbers in ( ) are for the waiting process.
PV : Process Value, ALM : Setting Value of Alarm, DEV : Setting value of Deviation

2) Output Inverted (Alarm time : OFF)

Name	Code	ON Condition	OFF Condition
High absolute alarm	9(19)	PV≥ALM	PV〈 ALM－HYS
Low absolute alarm	10(20)	PV≤ALM	PV 〉ALM＋HYS
High deviation alarm	5(15)	DEV≥ALM	DEV〈 ALM－HYS
Low deviation alarm	6(16)	DEV≤－ALM	DEV 〉－ALM＋HYS

※ The numbers in ( ) are for the waiting process.
PV : Process Value, ALM : Setting Value of Alarm, DEV : Setting value of Deviation

3-2-4. The Function of Alarm

Type	Description	Type	Description
High of PV		Low deviation	
Low of PV		High · Low deviation	
High deviation		High · Low deviation band	

3-2-5. Range and Initial Value of Alarm Parameter

Number of Code	Name of Alarm	Initial Value	Range of Alarm Setting
1, 9, 11, 19	High absolute alarm	EU(100%)	EU(-100～100%)
2, 10, 12, 20	Low absolute alarm	EU(0%)	EU(-100～100%)
3, 5, 13, 15	High deviation alarm	EUS(0%)	EUS(－100～100%)
4, 6, 14, 16	Low deviation alarm	EUS(0%)	EUS(－100～100%)
7, 17	High · Low deviation alarm	EUS(0%)	EUS(－100～100%)
8, 18	High · Low deviation band alarm	EUS(0%)	EUS(－100～100%)

※ Dead band of Alarm output

Initial value : EUS (0.5%),
Setting range: EUS (0～100%)
In AnTY=OFF, AL-n and AnDB are not displayed.

3-3. User Output Group (G.UO)

- A user can output in the U1～10 by selecting output contents through corresponding terminals.
- But, U10 is available only if relay output for Cooling side in Heating / Cooling type.
- Regardless of the contents of U10, its used for cooling output. In other words, the selection of output is prior to the contents of U10.
- There could be an overlap of contents for user output. In other words, U1～10 can have same information.

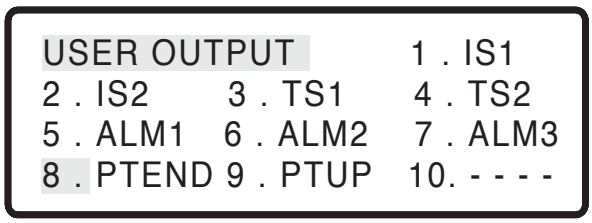
3-3-1. Parmeters that could be ragistered to User Output (UO)

OFF	The output of UO has OFF status.
ALM1～4	When the alarm number 1 to 4 happens, the corresponding output for the individual alarm output will be turned on.
TS1～TS5	When the time signal number 1 to 5 occurs, the corresponding output for the individual time signal output will be turned on.
IS1～IS5	When the inner signal number 1 to 5 happens, the corresponding output for the individual inner signal output will be turned on.
PTEND	The output will be turned ON if the PTENT BIT is in ON status when the program is terminating.
PROG	Output will be turned on when a program is in RUN status.
FIX	Output will be turned on in a FIX mode.
RESET	Output will be turned on in a RESET mode.
HOLD	Output will be turned on in a HOLD mode.
WAIT	Output will be turned on in a WAIT mode.
MAN	Output will be turned on in a MANUAL operating process.
PTUP	Output will be turned on when the pattern is in its increasing section.
PTDOWN	Output will be turned on when the pattern is in its decreasing section.
PTSOAK	Output will be turned on when the pattern is in its SOAK (maintaining current states) section.

3-3-2. User Output registersd status and output conditions can be verrified in the 4th operating screen (UO screen)

【EX:from the picture in the right】

- U1 is IS1
- U2 is IS2
- U3 is TS1
- U4 is TS2
- U5 is ALM1
- U6 is ALM2
- U7 is ALM3
- U8 is pattern end signal
- U9 is pattern up signal
- U10 is not in use



※ The current used output will be indicated as shade.
In other words, in the above picture, the number 8 is in shabe that means, the pattern is terminated producing pattern end signal (PTEND SIGNAL) eventually turning the USER OUTPUT number 8 ON.

3-4. Retransmission Group (G.TRANS)

3-4-1. Retransmission Output (RET)

RET	PV	SV	MV	SPS	비 고
Selecting retrans-mission output	PV	SV	MV OUT	Supplying Power for Sensor	Retransmission invalid in OUT=4, 5, 7, 8

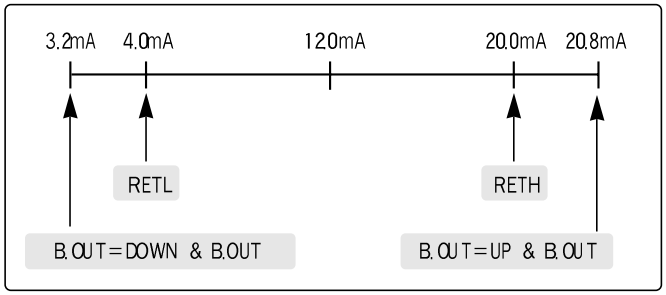
3-4-2. Retransmission Range

1) Valid for RETH (Highest limit of Retranmission output), RET=PV status and selscting tranmission of SV
Set range : T.C, RTD=RETL+1digit~FR-H, mV,V =RETL+1digit~SL-H

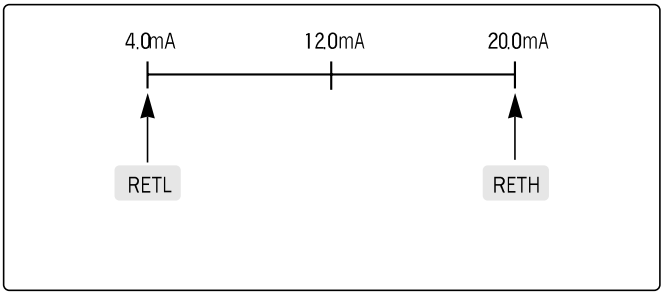
2) Valid for RETL (Lowest limit of tranmission output), RET=PV status and selscting tranmission of SV
Set range : T.C, RTD=FR-L~RETH-1 digit, mV,V =SL-L ~RETH-1digit

3-4-3. RET Output

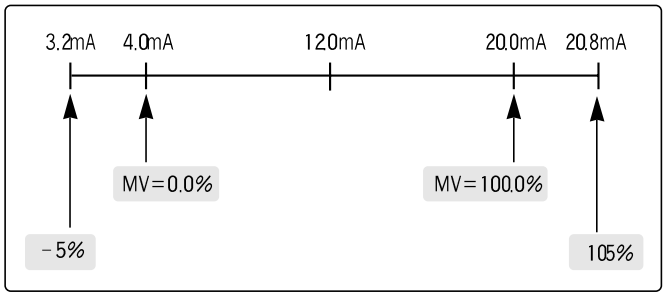
1) Process Value (PV) 3.2mA~20.8mA



2) Set Value (SV) :4.0mA~20.0mA



3) Volume of Output (MVOUT) : 3.2mA~20.8mA



4) Supplying Power for Sensor. (SPS) :
Selection made by 24V DC 20mA Max. parameter. But, selection must be made either in Power for Retransmission Output or Power for Sensor.

4. Setting Menu (STUP)

4-1. Communication Group (G.COMM)

NP200 series are equpped with 4 wire or 2 wire half-duplex the RS 485/ RS 422 communication interface.
Maximums of 31 computers are connectable.
Communication mode of communication group for setting up communication conditions are as followings.

Signal	Name	Description	Condition	Initial value
G.COMM	Communication group	Set communication mode	—	—
PR-S	RS485/RS422 Protocol	PC.LINK(Set value:0)/ PC.LINK SUM(Set value:1)	Optional	0
BPS	Communication rate (B.P.S)	600 (SV:0) / 1200 (SV:1) / 2400(SV:2) 4800(SV:3) / 9600(SV:4)		4
PRI	Parity check	NONE(SV:0) / EVEN(SV:1) / ODD(SV:2)		0
STP	Stop Bit	1bit (SV:1) / 2bit (SV:2)		1
DLN	Data length	7bit (SV:7) / 8bit (SV:8) (Except PC LINK :8)		8
ADR	Address	1~99 , maximum 31 devices		1
RP.T	Response time	0~10. response time =(handling time + response time) X 10ms		0

4-2. Output Group (G.OUT)

⚠ CAUTION	The input group then output group must be set before setting up any other groups.

4-2-1. Kinds of Output

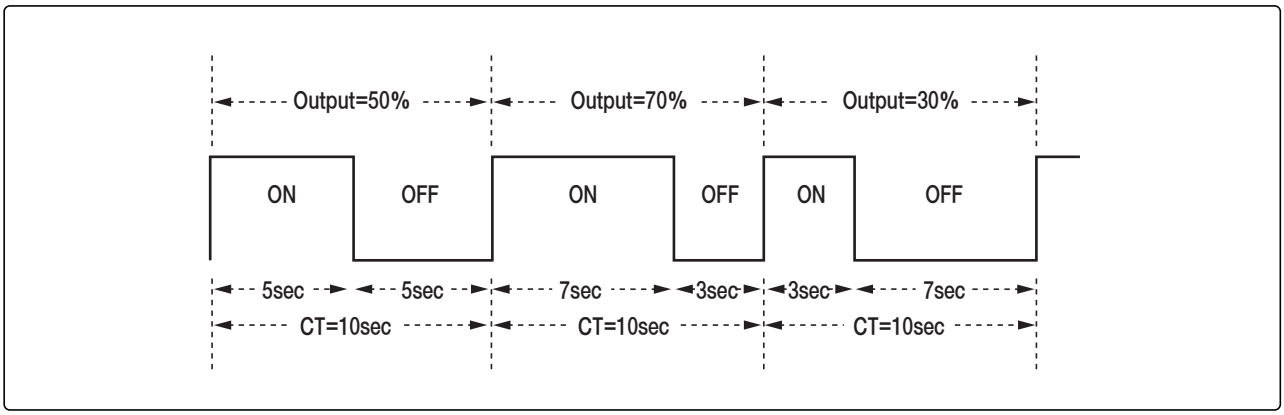
- The kinds of Output is selected by "OUT" PARA in OUT GROUP

※ Refer to the Kinds of Output List. (Page 6)

4-2-2. Output Cycle

- Output Cycle (HCT, CCT) is only valid when it's relay or SSR (Solide State Relay) Output state.
- HCT is output cycle of number 1, and CCT is output cycle of number 2.

【EX1】 When set OUT=1(SSR) and HCT=10seconds, This picture shows the time for the ON/OFF status of SSR output.



4-2-3. Output Limit (Limit)

- When the OUT=1～3, the HIGH LIMIT is indicated as OL-H and LOW LIMIT is displayed as OL-L.
  $-5.0\% \leq OL-L \leq MVOUT \leq OL-H \leq 105.0\%$
- When the OUT=4～12 (H/C TYPE), the OL-H is the highest limit of heating side output, and the OL-L is the highest limit of cooling side.
  ① $0.0\% \leq H.OUT \leq OL-H$
  ② $0.0\% \leq C.OUT \leq OL-L$

4-2-4. Output for an Emergency state

- Enter PRESET OUTPUT after cutting off the output process of PID calculation when the A/D Error and BURN OUT occurs in AUTO MODE.
- When the OUT=0～3, output OUT=0% when the value is less than HEO=0% and output OUT=100% when the value is more than HEO=0%.
- When the OUT=4～12 (H/C TYPE), PO outputs PRESET OUT for the heating side, and the CEO output that of heating side.
- In the MAN mode, output MAN output value regardless of sorts of errors or MODE.

4-2-5. O.ACT (OUTPUT Action)

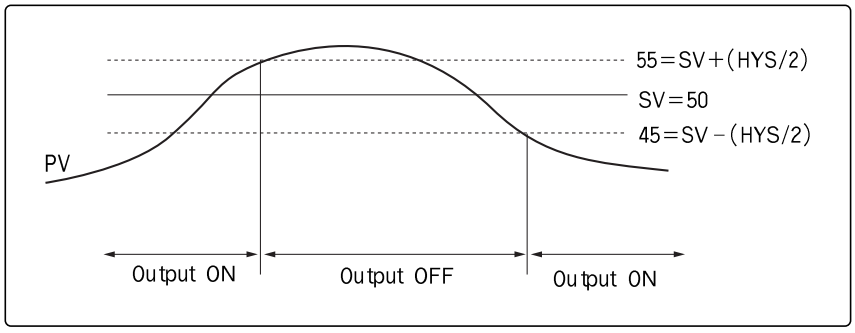
- If the deviation (PV-SV) is a positive number, the process of controlling volume increase is called as "directing action (O.ACT=DIR)" and as for the process of controlling volume is increasing but the deviation value is a negative number, it is called as " reversing action(O.ACT=REV)"
- DIR or REV can be selected only in the case of OUT=0～3.
  (When it's not a heating and cooling type as REV and cooling type as DIR.)
- AS for the OUT=4～12 case (heating/cooling type), the inner control is made upon heating side as REV and cooling side as DIR.

4-2-6. HYS (Hysteresis)

- HYS can be only set when the OUT=0 (ON/OFF) case or OUT=4～12 (heating/cooling type) case.
- When the OUT=0, the HYS is made toward the ON/OFF status, and when the OUT=4～12, the HYS is toward heating and cooling type.
- The HYS when the OUT=0 (ON/OFF status). Can be set as HYS=EUS (0～100%)
  The Output of ON/OFF status operates in the range of {SV-(HYS/2)}～{SV+(HYS/2)}

【EX】when the SV=50, HYS= 10 with O.ACT=REV case.

- As for the OUT=4～12 status (H/C TYPE), it can be set within HYS=0.0～10.0% range.
  Proportion of either or both of heating and cooling type, in other words, when either the P or Pc value is set as 0, the HYS is decided.



4-2-7. A/M Function

There are Automatic control and Manual control in output mode.
The AUTO mode is automatic output calculation process by PID.
When output is processed manually, that's MAN mode

1) Converting AUTO to MAN mode or vice versa

① Move to 5th operating screen by pressing【DISP】key and pressing【set】key to convert AUTO↔MAN.

② Conversion can take place in any mode in RESET, FIX or PROG.

③ If the LOCK=A/M status is on, the A/M conversion is not possible since the 5 operating screen is not show up.

4-3. Input Group (G.IN)

⚠ CAUTION	Set first input group, then output group, and then start to set up other groups.

4-3-1. Kinds of Input : Thermocouple, R·T·D, Direct voltage(Direct current)

- Refer to page 6 "5. Input kinds and Range"
- When modifying input kinds, the value of EU, EUS and parameters will be initialized.

4-3-2. UNIT (Input Range Unit)

If there's modification in unit, temperature range will be automatically modified with corresponding unit.
Unit is valid in TC or RTD Input Kinds.
Unit : ℃, ℉

4-3-3 U.UNIT (User Unit)

User Unit is only used in indicating a unit at the operating screen.
Unit is valid in Direct voltage Input Kinds.
Unit : ℃, ℉, %, %RH, Pa, -(no unit)

※ The difference in UNIT and U.UNIT.

UNIT is actually used as a temperature unit in the Thermocouple and R·T·D,affecting all the range of EU, EUS parameters.
On the contrary, U.UNIT is valid only in Direct voltage Input Kinds, not affecting the range of EU or EUS parameters. U.UNIT is an imaginary unit set by users, used only in operating screens.

4-3-4. Input Range

Thermocouple, R.T.D	The input range can be set based on "5. Input kinds and Range" in page 6. In this time, input range canbe adjusted by modification in FR-H and FR-L within the set range. Points numbered values are not valid. (In other words, DP-P is not valid) Not valid : SL-H, SL-L
Direct Voltage input (DCV,mV)	The range setting process is same as above. Input range can be adjusted by modification in FR-H and FR-L within the set range. The values can be scaled in a SL-H and SL-L basis. (The input code for 100% will be decided by SL-H, and the input code for 0% is decided by SL-L) At this time, the point numbers can be modified by DP0P.

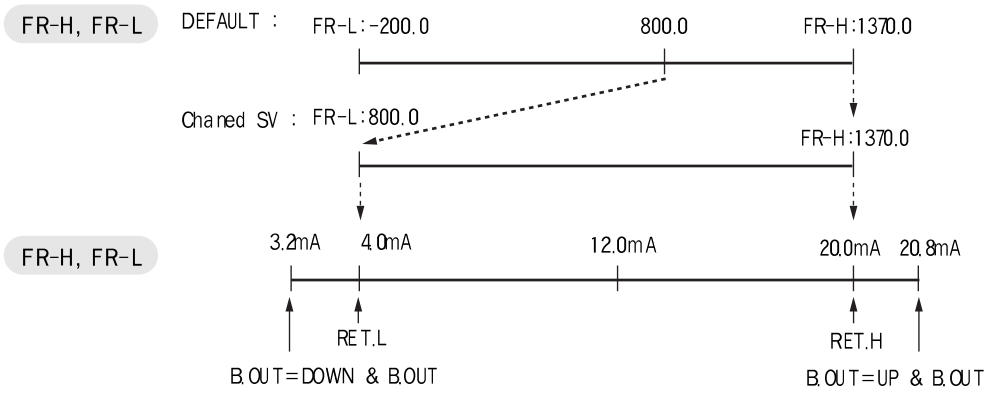
1) FR-H, FR-L (T/C, RTD, mV,V)

- Setting range : Within initial range of individual input kinds when FR-H 〉 FR-L
- When there's modification in FR-H and FR-L setting, the SL-H, SL-L, EU and EUS unit parameteters will be all initialized.

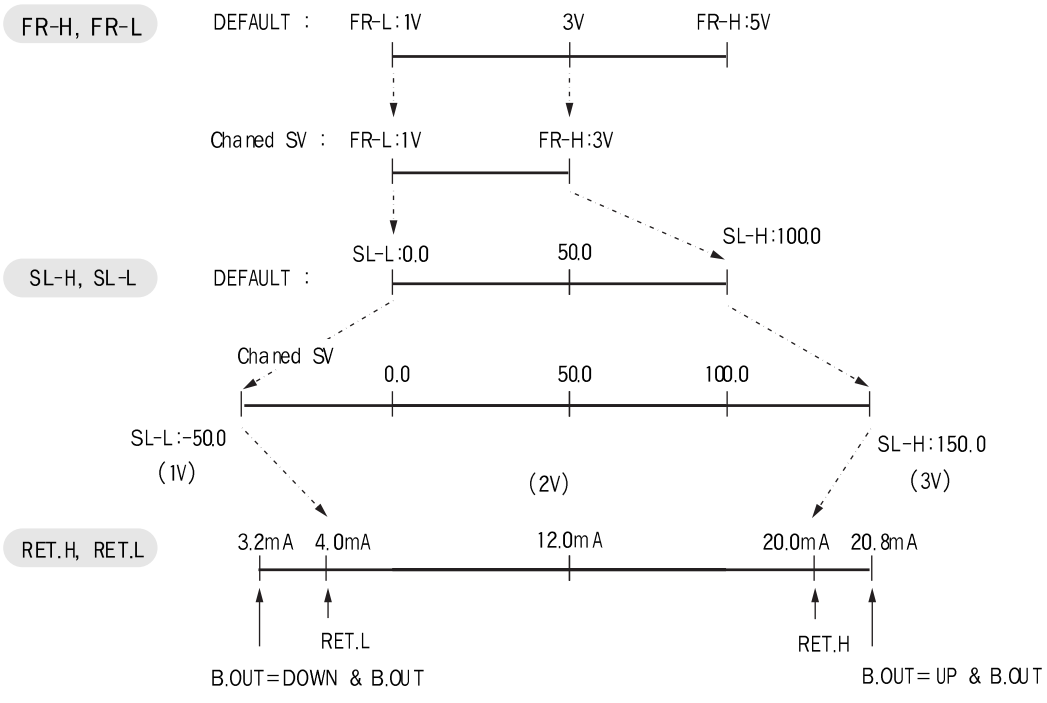
2) SL-H, SL-L, DP-P (valid for mV, V input kinds)

- DEFAULT : SL-H=100.0, SL-L=0.0
  The position of decimal point is decided by DP-P.
  Setting range : regardless of the range of FR-H~FR-L, the range can be set in -19999 ~ 99999 range.
  Only if, SL-H > SL-L
- If you modify SL-H, SL-L set up, the EU and EUS unit PARA value will go back to the initial stage.
  (Except FR-H and FR-L value)

【EX1】 IN=K1 type



【EX2】 IN = 1~5V



4-3-5. Input Filter

- Eliminate Noise from the Input.
- Setting range of FILT : OFF, 1～120 seconds.

4-3-6. BIAS

- Control the offset of Process Value.
- PV indicating value = SV + BIAS
- Setting range of BIAS : EU(-100～100%)

4-3-7. BURN-OUT Detection

When the input line of sensors were cut off, this functions decides how to handle the PV.
Control PV transmission output and alarm features' target value.
Used in the input range of Thermocouple and R·T·D.

- When detecting (B.OUT=UP, DOWN) : affects transmission output and alarms functions.
  Output is Preset Output.
- When not detecting (B.OUT=OFF) : PV is unsettled.
  As for the output, it operates normally without turning Preset Output.

B.OUT (Burn-out selection)		UP (Up Scale)	DOWN (Down Scale)	OFF (OFF)
T/C, RTD (Unvalid DCV, mV)	Detection function	○	○	X
	PV handling	105%	-5%	Unsettled
Note			RTD temporarily becomes +105%	Doesn't matter for Up, Down, OFF

4-3-8. PV LIMITER

- If the PV is less than -5% or more than 105% of input range, -OVR or OVR will be displayed with PV indicating section. The process will recover its phase with inner PV with -5% and 105%.
- PV 〉 EU(105%) : PV=105%, PV indicates = OVR
- EU(-5%) ≤ PV ≤ EU(105%) : PV= PV
- PV 〈 EU(-5%) : PV= -5%, PV indicates =-OVR

4-3-9. PV when an Error occurs

- As for the A/D error, error message will come up at the PV indicating section.
- The alarm functions and transmission output will be processed with the 105% applied PV (Takes place at inner process)

4-3-10. RJC (Remedy of Joint Temperature) Function

- When you input Thermocouple, the joint points will be automatically.
- If there's a RJC error, the notice for ERROR MESSAGE and PV value will be show up one by one by one constantly. The process recovers its phase making RJC set as 0℃.\

4-4. Lock Group (G.LOCK)

● LOCK Function

There are KEY-LOCK, banning movement to certain menus and PASSWORD functions in LOCK.

Items	Lock	Parameter	Contents
KEY LOCK	PWD	Password	Needs password to enter.
	▽/△	Down / Up Key Lock	Prohibit PARAMETER EDIT using DOWN/UP KEY
	PT.NO	Pattern Number Lock	Prohibit pattern number EDIT by locking PT.NO UP and PT.NO DOWN KEY.
	RUN	Run Key Lock	Prohibit program run by locking RUN/HOLD key.
Banning Entrance	A/M	Auto / Man Lock	Prohibit the conversion between AUTO/MAN mode by skipping Output Mode screen.
	PROG	PROG Menu Lock	Prohibit entrance to PROG MENU
	OPER	OPER Menu Lock	Prohibit entrance to OPER MENU
PASSWORD	FUNC	FUNC Menu Lock	Prohibit entrance to FUNC MENU
	PWD	Password Chage	Needs password to be in STUP menu if you set password previously.
	TEST	TEST Mode Entry	Banning entry
	P.INIT	Parameter Initialize	Initialize pattern

11 SPECIFCATION

11-1. Input List

Input Indicator · Measured Range	Mulit-range type. (Refer "Input Kinds and Range")
Sampling time	250mS
Input resolution	Basically for the numbers below the decimal point.
Input impedance	T/C, mV input : 1 MΩ min, DC V : 1 MΩ
Approving Indicating Source Resistance	Thermocouple : less than 250 Ω, mV DC/VDC :less than 2 kΩ
Lead wire tolerable resistance	R.T.D : less than 150 Ω / 1 wire
Input tolerable voltage	Direct Current voltage (mV) / Thermocouple / R·T·D: ±10 V. Direct Current (V): ±20V
Noise removal rate	NMRR: more than 40dB CMRR : more than 120dB (50 / 60Hz ±1%)
Standard	Thermocouple / R·T·D. (KS / IEC / DIN)
Burn - out	Cutting off for Thermocouple : Up Scale / Down Scale Cutting off for R·T·D : Up Scale Detected volt in above situation : around 50nA
Accuracy	0.1% of maximum scale

11-2. Output

11-2-1. Output Kinds

Relay Output	Contact capacity: 240V AC 3A, DC 30V 3A (resistance). Composition of contact: 1c Output Operation: in proportion to time or ON/OFF status. Time proportion cycle time: 1~1000 seconds. Output Limit : Setting highest value (OL-H) and lowest value (OL-L) within the range of 0.0 ~ 100.0%. (Trial for MAN / AT is possible.) ON/OFF hysteresis: 0 ~ 100% Time resolution: The small one in either 0.1% or 10ms side.
SSR Output	ON voltage: more than 25V DC. (Load resistance more than 600 Ω When cut off happened there's limit on electric current of around 30mA) OFF voltage: less than 0.1V DC. Output : Time proportioned. Cycle Time: 1 ~ 1000 seconds. Output Limit: Setting highest value (OL-H) and lowest value (OL-L) within the range of 0.0 ~ 100.0%. (Trial for MAN / AT is possible.) Time resolution: The small one in either 0.1% or 10ms side.
SCR Output (DC4~20mA)	Output current range : 4 ~ 20mA. Output Renewal Cycle : 250msec Load resistance : less than 600 Ω. Output Operation : Consecutive PID. Output ripple : less than 0.1% of F.S. (p-p) (150Hz) Accuracy : ±0.3% of F.S. (range from 4 ~ 20mA). Resolution : around 3000. Output limit : setting highest values (OL-H) and lowest value (OL-L) within the range of -0.5~105.0% . (Trial for MAN / AT is possible.)
Manual Operation	Conversion to MANUAL operation is made possible at the number 5 of operation screen and communication. A→M : Output Tracking. M→A : Bumpless.

11-2-2. Retransmission Output

Current Output	Output Current Range : 4 ~ 20mA Resistance Load : 600Ω Max. Accuracy : ±0.3% of F.S. (4 ~ 20mA) Resolution : Approx. 3000 Output Ripple : Max. 0.1% of F.S. (p-p) (150Hz) Output renewal Cycle Time : 250msec
Retransmission Output	Retransmission Signal : PV (Process Value) / SV(Set Value) / MV (Volume of Output) / SPS (Power Supply for Sensor) Scaling : PV (Process Value) / SV (Set Value)

11-3. Interface

Standard	EIA RS485
Number of devices (Max.)	31, Address setting : 1~99 range.
Communication type	2-wire or 4-wire haif-duplex.
Synchronization	Start - stop synchronous mode
Communication order	None
Communication distance	Max. 1.2Km
Communication rate	600 / 1200 / 2400 / 4800 / 9600 Bps
Start Bit	1Bit
Data length	7 or 8 Bit
Parity	None, Even, Odd
Stop Bit	1 or 2 Bit
Protocol	PC Link
Response time	Handling time + (RP.T X 10ms)

11-4. Power Supply

Power Supply Voltage	100V ~ 240V (90V ~ 250V)
Frequency	50 / 60Hz
Power Consumption	Max. 6.0 W, 10VA or below
Insulation Resistance	20MΩmin. (at 500VCD) : Between primary teminal and secondary teminal. Between primary teminal and ground. Between ground and secondary terminal.
Dielectric Strength	2300V AC 50/60Hz for 1minute : Between primary teminal and secondary teminal. Between primary teminal and ground. 1500V AC 50/60Hz for 1minute : Between F.G and secondary terminal.
Power Supply for Sensor	24V DC 20mA Max. (but, it is not available when using transmission output)

11-5. Function

Measuring Input	Bias	-100.0 ~ 100.0% for measuring input range Valid setting a correction value.
	Scaling	According to seting of SL-H, SL-L of measuring range, scaling is available.
	Filter	OFF, 1 ~ 120 sec.
Control	Fix SV	4 Kinds.
	Pattern	30 Pattern. 99 Segment are available in each pattern.
	Segment	300 Segment.
	PID Group	4 Kinds.
	Auto Tuning	According to SV, AT is operating. 〔Selection STD or Low PV〕
	Proportional Band (P)	0.1% ~ 999.9%.
	Integral Time (I)	OFF, 1 ~ 6000 sec.
	Derivative Time (D)	OFF, 1 ~ 6000 sec.
	ON, OFF Control	Select ON-OFF control in output group.
	PID Converter	Level PID / Segment PID selectable.
	Manual Reset	-0.5 ~ 105.0%. 〔Valid when I=OFF〕
	Direct/Reverse action	Select Direct or Reverse action in output group.
	Emergency	-0.5 ~ 105.0% of output value.
	NO/OFF Hysteresis	0.0 ~ 100.0% of range.
	Heating · Cooling Hysteresis	-100.0 ~ 50.0% of output value.
	Auto/Man	Convert at the 5 th opertion Screen.
	ARW	AUTO, 50.0 ~ 200.0% at the PID group.
	Fuzzy	Selection ON or OFF on the control group.
Transmission	Transmission Signal	PV, SV, MV, SPS
	Scaling	Setting PV, SV
Alarm	Setting Point	Max. 10 points.
	Type of Alarm	High / Low alarm, High / Low deviation alarm.
	Setting Range	Process alarm : 0~100% of Range. Deviation alarm : -100~100% of Range.
	Alarm Hysteresis	0.0~100.0% of instrument range.

11-6. Operation Environment

Setting Surroundings	Consecutive Vibration : Vibration width is less than 1.2mm (5 ~14Hz) Consecutive Vibration : 4.9㎨ (0.5G)max (4~150Hz) Short Time Vibration : 14.7㎨ square of second. (1.5g) Less than 15 seconds. (each 3 direction) Shock : 147㎨ (15G), Less than 11msec.
Conditions for Normal Operatione	Temperature : 0 ~ 50℃ Humidity : 20 ~ 90% RH (no icing) Magnetic Range : Less than 400AT / m Warm Up Time : more than 30 minutes.
Effects of Temperature in the Surrounding Environment	T/C, Voltage input: ±1㎶/℃ or ±0.01% of F.S. / ℃ R·T·D : less than ±0.05℃ / ℃ Analogue Output : Less than ±0.05% of F.S. / ℃ (consecutive output)
Effects of voltage Fluctuation Rate	Analogue Input : ±1 ㎶ / 10V or ±0.01% of F.S. / 10V Analogue Output : Less than ±0.05% of F.S. / 10V

11-7. Conditiond for transportation & Storage

Temperature	-25 ~ 70℃
Humidity	5 ~ 95% R.H (no, icing)
Endurance	Fall from less than 1m

11-8. Structure

Material	Plastic Case
Weight	696g (Including barckets and box)
Panel Cutout	92(W) X 92(H)

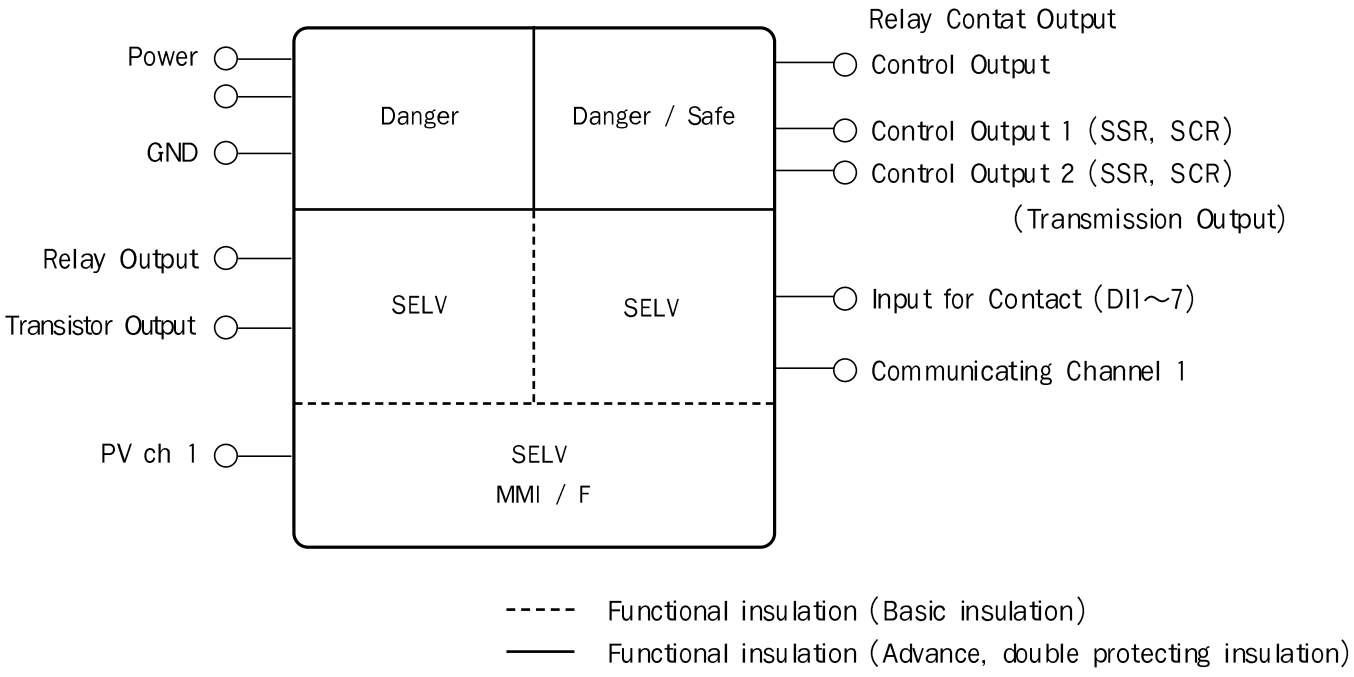
11-9. Authentication Standard

Standard / Authentication Mark	UL Approval (in process)
	C-UL Approval (in process)
	CE Mark (in process)

11-10. Operating Indicators

Display	Display process value (5 digit with 7 Segment) Set value and Paramter display (LCD) Condition display (Individual LED)		
NP200	SW1 : RUN/ HOLD	LED 1 : PROG	LED 8 : U2
	SW2 : RESET	LED 2 : RESET	LED 9 : U3
	SW3 : STEP	LED 3 : FIX	LED 10 : U4
	SW4 : PT.NO DOWN (▽)	LED 4 : HOLD	LED 11 : U5
	SW5 : PT.NO UP (△)	LED 5 : OUT	LED 12 : U6
	SW6 : SET	LED 6 : MAN / AT	LED 13 : U7
	SW6 : FIX	LED 7 : ⧸	LED 14 : U8
	SW8 : DISP	LED 5 : ▭	LED 15 : U9
	SW9 : DOWN (▽)	LED 6 : ⧹	LED 16 : U10
	SW10 : UP (△)	LED 7 : U1	

11-11. Section for Insuation



● Engineering Units

(a) EU : The value of engineering units according to the range of a material.

【EX】 EU (20%) = 80℃

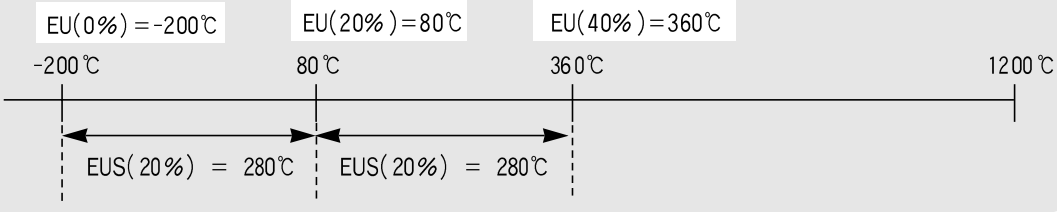
The scale from -20℃ to 1200℃ is 1400.

At this time 20% of 1400 is the point of 280. This point is 80℃ for the temperature range since the scale the scale from -200 to 80℃ is 280.

(b) EUS : Range of engineering units according to the span of a material.

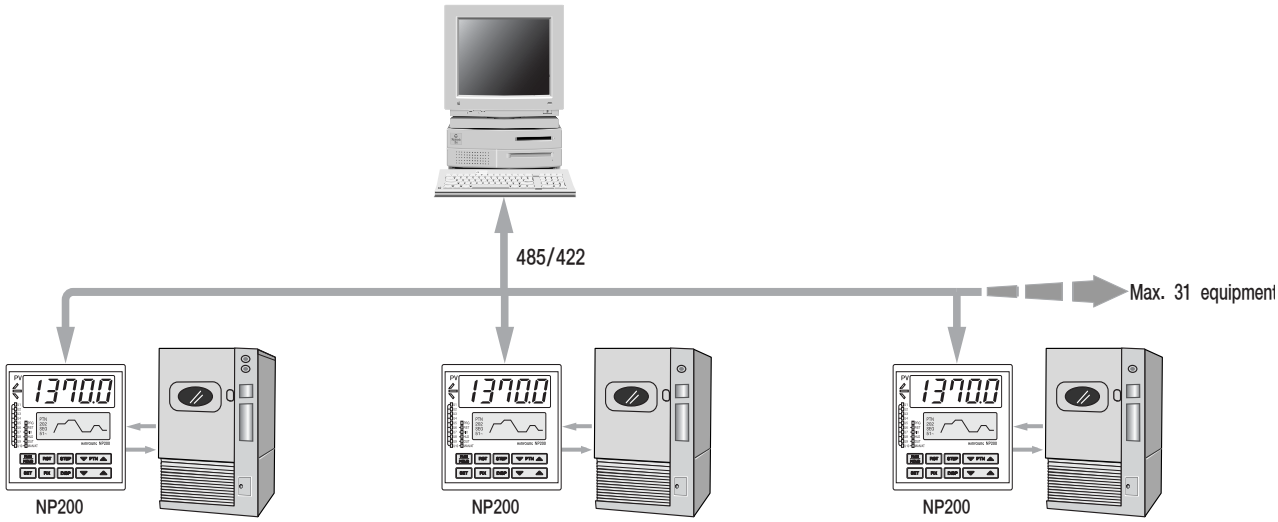
【EX】 EUS (20%) = 280℃

The span from -200℃ to 1200℃ is 1400. 20% of 1400 is 280. Therefore, if we set the 0℃ as a standard, EUS(20%)=280℃.

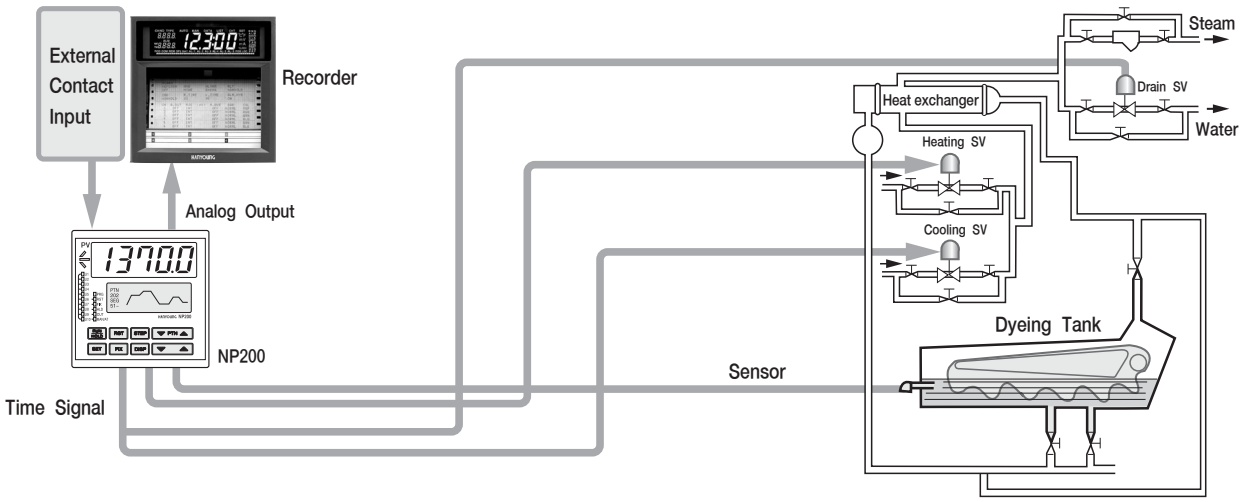


12 CONTROL METHOD AND APPLICATION

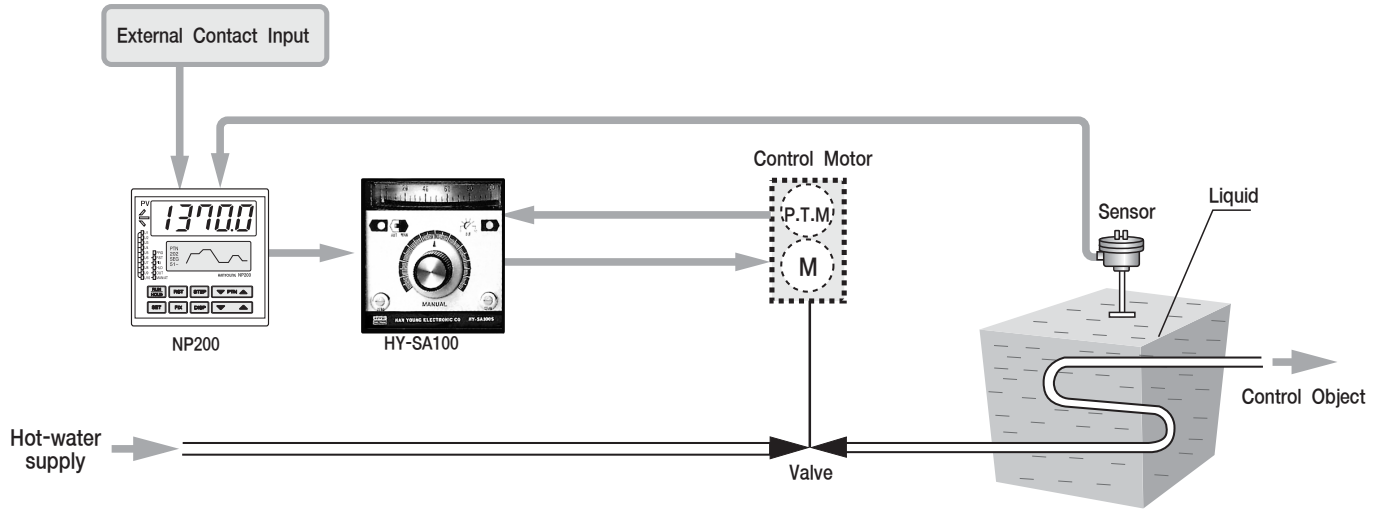
13-1. Drying Equipment · Constant Temperature Equipment



13-2. Dyeing Machine



13-3. Temperature Control by Control motor



Fuzzy

TEMPERATURE CONTROLLER

Program

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