User manual (DI-20 SERIES)

1. Introduction

DI-20 has built-in high performance A/D converter & micro-processor which enable multi input signals, output signal transmission, communication, and alarm. As DI-20 is very sensitive measuring instrument, please acknowledge this manual enough before you start to use it.

2. Specification

2.1 Input signal: you can choose one out of below table.

Input signal group	Type	Input signal range	Display range	Symbol
TC	B (PR30%)	-	0~1800℃	Tc-B
	R (PR30%)		0~1750℃	Tc-R
	S (PR10%)		0~1750℃	Tc-S
	K (CA)		-200~1350℃	Tc-K
	E (CRC)		-200~800℃	Tc-E
	J (IC)		-200~800℃	Tc-J
	T (CC)		-200~400℃	Tc-T
	N		0~1350℃	Tc-N
RTD	DIN PT100Ω		-200~600℃	DPT1
	DIN PT(0.1)		-199.9~600.0℃	DPT2
	JIS PT100Ω		-200~600℃	JPT
DC	mV	±100.0	-1999~9999	MV
	V	±10.0 0~30V	-1999~9999	V
	mA	±20.0	-1999~9999	MA

*For input of mA, you need to connect external resistor for 250Ω/±0.05%/25ppm.

2.2 Accuracy: control ±0.2%, transmission output ±0.25% (full scale)

2.3 Cycle of measurement and display: 200ms (TC, RTD) and 100ms (mV, V, mA)

2.4 Input resistance: Volt – 400KΩ, mA - 250Ω, others - 1MΩ

2.5 Signal resistance: PT - 30Ω/Line, others - below 300Ω

2.6 C.M.R.R: over 140dB, N.M.R.R: over 50dB

2.7 Alarm: 2 or 4 channels (option)
 - Contact capacity: AC 250V/5A, DC30V/5A
 - Contact: 1b(N.O)

2.8 Communication: RS232, RS422, RS485 (option) with built-in terminal resistor

2.9 Output signal: DC4-20mA / 600Ω (Max) (option) with insulation of input and output

2.10 Environment: operating -5℃~60℃ / 10%~90%
                   storing   -20℃~70℃ / 5%~95%

2.11 Power consumption: 3.5W

2.12 Power voltage: AC85V~264V

2.13 Insulation resistance:
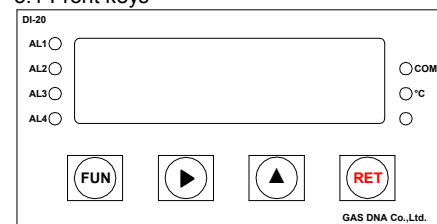   FG/INPUT, FG/PW, PW/IN(over 100MΩ/500VDC)

2.14 Weight: about 350g

2.15 Size(mm): 96(W)X48(H)X100(D)

2.16 Mounting: PLC multi or single mounting

3. Programming

3.1 Front keys

FUN Key: Start programming.

▲ ▶ Key: Transfer one menu to the other menu or adjust values.

RET Key: Store the programmed value or move to higher menu.

AL1 AL2 AL3 AL4
○ ○ ○ ○ : Light flickers when alarms on.

○COM : Light flickers during transmission output signal.

○℃ : Light on when displaying temperature unit.

○ : Light on for other display units.

3.2 Menu
3.2.1 Prime menu

Prime menu	Description
PM-2	Prime menu 2 – program system's main functions
PM-5	Prime menu 5 – program alarm functions (option)
PM-6	Prime menu 6 – program communication functions (option)
PM-8	Prime menu 8 – program (option)

3.2.2 Sub menu

Prime menu	Sub menu	Description	Digit
PM-2	INSL	Input signal	-
	UNIT	Displaying unit	-
	RD.P	Input range decimal point	-
	RG-H	Input range high limit	±DDDD
	RG-L	Input range low limit	±DDDD
	D.P	Displaying decimal point	-
	SC-H	Scale high limit	±DDDD
	SC-L	Scale low limit	±DDDD
	SADJ	Sensor adjustment	±DDDD
	HOLD	Hold values	-
	HD-R	Remove held value	-
	FUNC	Functions between range & scale	-
	FILT	Digital filter	-
PM-5	AL-F	Alarm function	-
	ALDB	Alarm hysteresis	±DDDD
	AL-1	Alarm value	±DDDD
PM-6	BPS	Bit per second - Communication speed	-
	ID	Communication address	DDD
PM-8	AO-H	Analogue output high limit	±DDDD
	AO-L	Analogue output low limit	±DDDD

*D means integer.

3.2.3 Default

Prime menu	Sub menu	Default	Remark
PM-2	INSL	TC-K	
	UNIT	℃	
	RD.P		
	RG-H		
	RG-L		
	D.P	-	
	SC-H	1350	
	SC-L	-200	
	SADJ	0	
	HOLD	NOP	
	HD-R	NOP	
	FUNC	-	
	VIEW	SV	
	FILT	FR-2	
PM-5	AL-F	PV-H	
	ALDB	1	
	AL-1	+9999	
PM-6	BPS	1920	19200
	ID	1	
PM-8	AO-H	1350	
	AO-L	-200	

▨ = no default & to be programmed by user.

3.3 Keys

Please confirm which prime menu has the function you are going to use before you program it.

3.3.1 General process of programming

3.3.1.1 Please push FUN key.

3.3.1.2 Some prime menus and sub menus are not displayed according to you selection.

3.3.1.3 Please select prime menu using ▲ ▶ keys.

3.3.1.4 After you choose the prime menu, please select sub menu using ▲ ► keys.

3.3.1.5 After you input the value, please push [RET] key to store the value. And then, the display returns to normal and start operating according to the new program.

3.3.1.6 When you don't push any key over 10 seconds during programming, it returns to normal operation mode.

3.3.2 Prime menu 2 (**PM-2**)

It is composed of major menus to operate critical functions – input signal range, displaying scale, and sensor adjustment.
Some menus are not displayed.
Please acknowledge enough on each function before programming.
When you program the unit of ℃/℉, all menus returns to default.

3.3.2.1 Programming range

| Sub menu	Input signal group	Programming range
INSL	-	Option
UNIT	TC,RTD	℃(℃), ℉(℉)
RD.P	mV,V,mA	**DDDD, DDD.D, DD.DD, D.DDD**
D.P		
RG-H		mV=±50, V=±5, mA=±20
RG-L		
SC-H	All	mV, V, mA (-1999~9999, -1.999~999.9) TC & RTD: fixed scale
SC-L		
SADJ		-9999~9999, -9.999~9.999
HOLD		Hold Off(**NOP**), High Hold(**LO-H**), Low Hold(**HI-H**)
HD-R		Off(NOP) Hold Reset(**RST** -> **NOP**)
FUNC	mV,V,mA	Linear(**LIN**), Square(**SQR**), Root(**ROT**)
FILT	All	Hold(**HOLD**), AO(**AO**), ID(ID), SV(SV)
		Off(**NOP**) Average filter(**MEAN**) Digital filter 1(**FR-1**) Digital filter 2(**FR-2**)

3.3.2.2 Programming flow chart
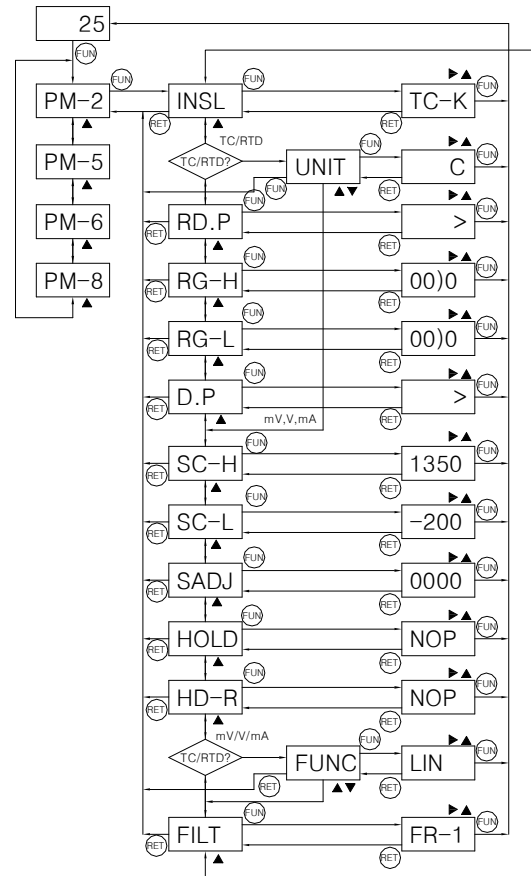
3.3.3 Prime menu 5 (**PM-5**)

It has the sub menus related with alarming. It is option and it has 2 channels / 4 channels. The alarm's decimal point is defined by [D.P] program.
Also, each channel has two (2) operating modes.

3.3.3.1 Program range

Sub menu	Input signal group	Program range
ALF	All	Present value's high/low limit(**PV-H / PV-L**) * When you change this value, all menu returns to default.
ALDB		0-9999
AL-1		Upper/lower alarm (-1999~9999)

3.3.3.2 Programming flow chart
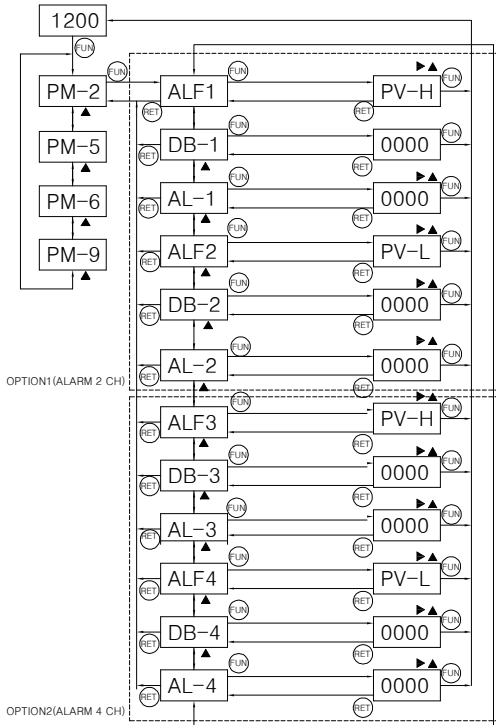
3.3.4 Prime menu 6 (**PM-6**)

It has the sub menus necessary for communication function. (option)
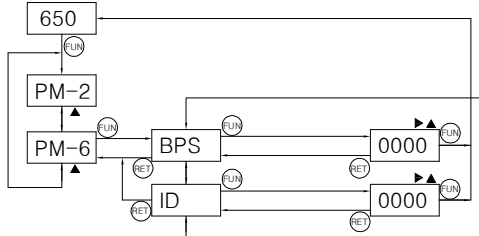
3.3.4.1 When you choose RS232, ID is fixed to '1' and you cannot change it. For more details, please refer to communication manual.

3.3.4.2 Maximum 32 nodes can be connected. (RS422/485)

3.3.4.3 Programming range

Sub menu	Input signal group	Programming range
BPS	All	4800(**480**) 9600(**960**) 19200(**1920**) 38400(**3840**) 57600(**5760**)
ID		1~127

3.3.4.4 Programming flow chart


3.3.5 Prime menu 8 (**PM-8**)

It is for programming output signal transmission. (option)

3.3.5.1 When you change the high/low limit of output signal in prime menu 2, the high/low limit of analogue output signal scale is re-programmed automatically. (Scale High/Low -> AO Scale High/Low)

3.3.5.2 Programming range

Sub menu	Input signal group	Programming range
AO-H	All	Analogue output signal high limit
AO-L		Analogue output signal low limit

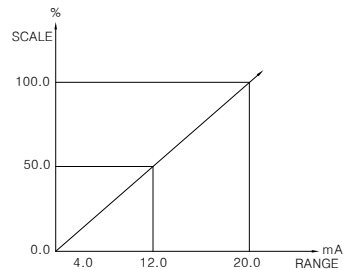### 3.3.5.3 Programming flow chart
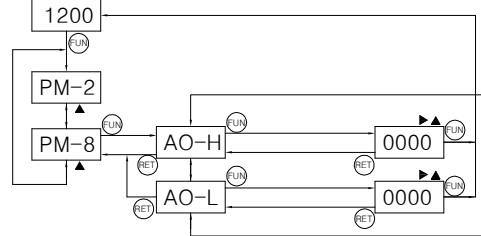
4. Programming major functions

4.1 Input signal (**PM-2 -> INSL**)
Please refer to 'Article 2.1 Input signal'.

4.2 Scale (**PM-2 -> INSL: MV, V, MA**)

INSL : MA
RG-L : 4.0
RG-H : 20.0
SC-L : 0.0
SC-H : 100.0

4.2.1 According to this program, DI-20 automatically calculates the input signal values into displaying scale values.

4.2.4 When you change scale values, all values in prime menu 5(PM-5) and prime menu 8(PM-8) return to default.

4.3 Unit: (**PM-2 -> UNIT**)
4.3.1 You can choose ℃ or ℉.
4.3.2 When you change the unit, all menus in prime menu 2(**PM-2**), 5(**PM-5**), and 8(**PM-8**) are return to default and system runs.
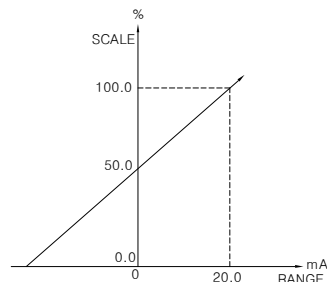
4.4 Decimal point: (**PM-2 -> RD.P, D.P**)
4.4.1 You can choose the location of decimal point.

4.4.2 Programming range

Sub menu	Input signal group	Programming range
RD.P D.P	MV V MA	D.DDD, DD.DD, DDD.D, DDDD

4.5 Input signal range (**PM-2 -> INSL : MV, V, AM -> RG-H, RG-L**)
You can define the input signal range with this function.

INSL : MA
RG-L : -2)0
RG-H : +2)0
SC-L :)0
SC-H : 10)0

4.6 Sensor adjustment: (**PM-2 -> SADJ**)

When the measured value has too much variance, you can correct the variance by adding or deducting the adjusting value on the measured value.

측정 값 : 250°C ──────○────── 결과 값 : 245°C

보정 값 : −5°C
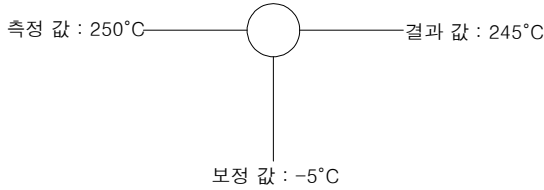
4.7 Hold measured value: (**PM-2 -> HOLD**)

The held values keep stored even during power off.

4.7.1 Hold highest value: (**PM-2 -> HOLD -> HI-H**)
If current measured value is higher than last value, always highest value is stored. (stored value = last value < current value)

4.7.2 Hold lowest value: (**PM-2 -> HOLD -> LO-H**)
If current measured value is lower than last value, always lowest value is stored. (stored value = last value > current value)

4.7.3 Remove held value: (**PM-2 -> HOLD -> HD-R**)
It deletes the held values. If you program (**PM-2 -> HOLD -> HD-R -> RST**), it automatically turns to **NOP** after deleting.

4.7.4 Displaying the held value(**PM-2 -> VIEW -> HOLD**)
When you want display the held value, please program it.

4.8 Input signal special function: (**PM-2 -> FUNC -> LIN, SQR, ROT**)

4.8.1 Linear (**LIN**) : $Y=ax+b$

4.8.2 Square (**SQR**) : $Y=X^2$
Indicating value
$=((\text{Input value} - \text{min scale})^2/(\text{max scale} - \text{min scale}))+\text{min scale}$

4.8.3 Root(**ROT**) : $Y=\sqrt{x}$ if $X\geqq0$
Indicating value(Y)
$=\sqrt{(\text{Input value} - \text{min scale})} \times (\text{max scale} - \text{min scale}) + \text{min scale}$
If $x < 0$, indicating value(Y)=0

4.9 Communication: (**PM-6 -> BPS, ID**)

Built-in RS232/422/485 communication function enables the long-distance control with computer. For more details, please refer to communication manual, (option)

4.9.1 For RS485/422, built-in terminal resistance (120Ω) for convenience. (Please refer to terminal wiring diagram)

4.9.2 Communication default:
Data 8, parity null, stop bit 1

4.9.3 Communication speed: Please refer to 3.3.4.3

4.10 Alarm: (**PM-5**)

4.10.1 LED flickers when alarm runs.

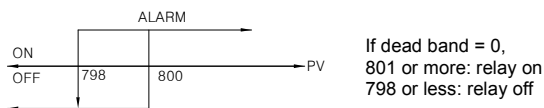4.10.2 Alarm channel
You can choose one out of below two (2):
2 channel (**AL-1, AL-2**)
4 channel (**AL-1, AL-2, AL-3, AL-4**)
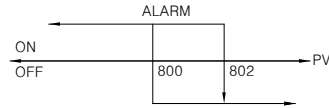
4.10.3 Alarm type: **PV-H, PV-L**

4.10.3.1 Present value high limit: (**PM-5 -> ALF1 -> PV-H**)
If the measured value is higher than alarm value, alarm runs (**AL-1 = 800, DB-1 = 2**).

If dead band = 0,
801 or more: relay on
798 or less: relay off

4.10.3.2 Present value low limit alarm: (**PM-5 -> ALF2 -> PV-L**)
If the measured value is lower than alarm value, alarm runs (**AL-2 = 800, DB-2 = 2**).

4.10.4 Alarm hysteresis: (**PM-5 -> DB-1**)

When alarm values are too close to measured values, it makes alarm on/off too frequently. In this case, this program can avoid this kind of unstable alarm on/off.

4.12 Display of transmission output: (**PM-2 -> AO**)

4.12.1 It displays the current value of transmission output.

4.12.2 Display range: 4.00~20.00mA; display accuracy: ±0.25% (full scale)

4.13 Self diagnosis:

4.13.1 Displaying high limit:
Measured value + ((Scale High-Scale Low)x0.1)

4.13.2 Displaying low limit:
Measured value - ((Scale High-Scale Low)x0.1)

4.13.3 Self diagnosis

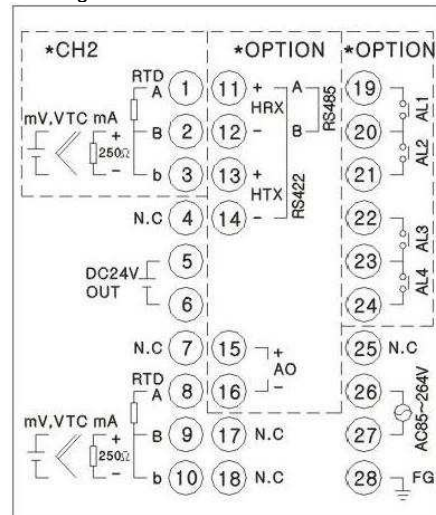| Display	Description	Action to do
OP-E	Exceeds programming range	Re-programming
H	*Measured value exceeds displaying upper limit *Short of input sensor (only for TC, RTD, and mV)	*Check the program value *Check the wiring
L	*Measured value exceeds displaying lower limit *Short of input sensor	*Check the program value *Check the wiring
EM-E	Defect in internal circuit	Ask repair service
AT-E	Exceeds the time for automatic tuning	RE-programming

4.14 Make all value default

4.14.1 Please power off.

4.12.2 Please power on while pushing ▲ ▶ keys at the same time and keep pushing ▲ ▶ keys more than 5 seconds until DA-20 starts normal operation.
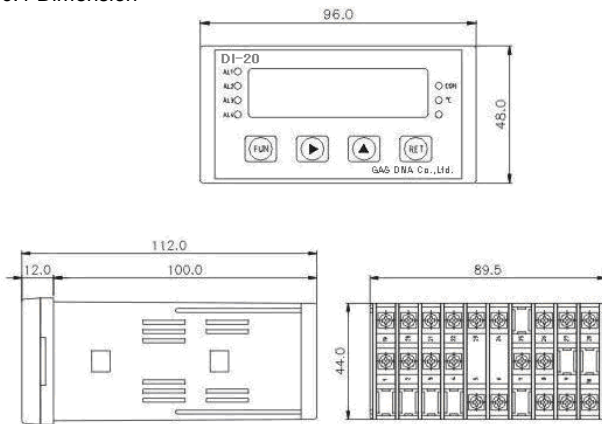
4.14.3 Please program the menus necessary for system's normal operation.
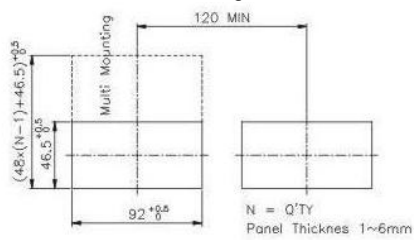
5. Terminal wiring

6. Dimension and assembly
6.1 Dimension

6.2 Dimension for multi mounting

N = Q'TY
Panel Thicknes 1~6mm

7. Ordering code

DI-20 □□□-□

MODEL	
TYPE	0:Only display 2:Display & 2 alarm 4:Display & 4 alarm
INPUT	0:Standard:MULTI 1:DC0~30V(Only)
OUTPUT	0:None 1:DC4~20mA 2:Communication(RS-485) 3:Communication(RS-422) 4:Communication(RS-232C)
POWER	1:AC110V~220V 2:DC24V(Option)