Quick Manual

Temperature Measuring Digital Panel Meter, Model 451B

I-01612

1. Preface

Thank you for purchasing our digital panel meter 451B series.
Before use, read this manual carefully and thoroughly, and keep this manual available for routine reference.
Please check contents of the package you received as outlined below.
(1) 451B itself (2) packing (3) This manual (4) Unit label (5) Connector with 2m flat cable (BCD output option)

For safe use of this product, please observe the following warning and caution.
In order to help the users' safe use of the products, the following symbol marks are used in this manual.

⚠ WARNING This is the warning to avoid the danger when it is assumed that such danger as may cause fatal accident or severe injure to a user occurs in case that the product is mishandled.

⚠ CAUTION This is the caution to avoid the danger when it is assumed that such danger as may cause minor injure to a user or generate only physical obstacle occurs in case that the product is mishandled.

⚠ WARNING

● There is no power on-off switch on the model 451B. It immediately starts to operate after turning the power.
● Do not touch terminals when turning the power on.

⚠ CAUTION

Preserve followings for your safety.
● The rated data is, however, defines with more than 15 minutes warming-up times.
● When the product is installed in the cabinet, perform the appropriate heat radiation to keep less than 50°C in it.
● Avoid the close-contacted mounting of the meter. The rise of internal temperature affects the life of product.
● Do not install under the following conditions.
- **●Where it is exposed to direct sunlight, dust, corrosive gases, rain, etc.**
- **●Where ambient temperature or humidity is high.**
- **●Where it is exposed to excessive noise or static electricity.**
- **●Where there is constant vibration or shock**

● Store the instrument within the specified temperature range for storage (-20~70°C).
● When the front panel or the case becomes dirty, wipe it with soft cloth.
For heavy dirt, wipe it lightly with the soft cloth wetted with the neutral cleaner thinned by water, and finish the cleaning with dry cloth. Do not use organic solvent like benzene or paint thinner as they may deform or discolor the case.

2. Specifications

2.1 Installation Specifications

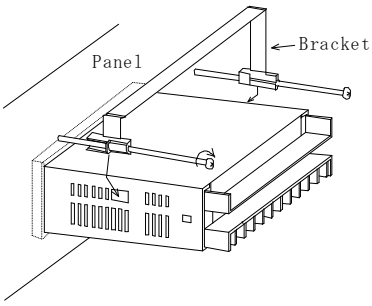
Power Supply	:	AC 100 to 240V (90-250V) 50/60Hz, DC12 to 24V (9-32V), DC110V (100-170V)
Power Consumption	:	Approx. 7VA at 100VAC, 9VA at 200VAC, 300mA at 12VDC, 150mA at 24VDC, 30mA at 110VDC.
Operating Temperature	:	0 to 50°C
Storage Temperature	:	-20 to 70°C
Weight	:	Approx. 220g
Mounting Method	:	Panel mount with the bracket

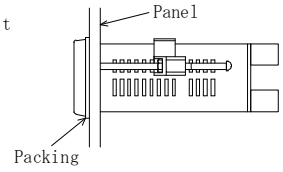
2.2 General Specifications

Display	:	0~99999, "-" polarity, with zero-suppress function. red or green LED (character height 15.2mm)
Input sensor	:	Selectable
Unit (^{o}C / ^{o}F)	:	Selectable by the parameter setting (^{o}F = ^{o}C × 9/5+32)
Over-range indication	:	Blinking with minimum or maximum value of display range
Burnout	:	RTD input: Blinking with maximum value of display range Thermocouple input: Blinking with minimum or maximum value of display range (programmable)
Resolution	:	RTD input: 0.1 ^{o}C (0.01^{o}C when Pt100Ω range 2) Thermocouple input: 0.1 ^{o}C
External resistance	:	500Ω Max. for Thermocouple input
Wire resistance	:	5Ω Max. per wire for Thermocouple input
Sampling rate	:	Approx. 5 times / sec.
Noise Rejection	:	Normal mode (NMR) - 50dB or more. Common mode (CMR) - 110dB or more.
Noise Through Power Supply Line	:	1000V (at AC voltage power supply)
Insulation Resistance	:	DC500V 100MΩ or more.
Withstanding Voltage	:	Input terminals - Case : AC2000V each for 1 min. Power supply terminals - Case : AC2000V each for 1 min. Power supply terminals - Input and output terminals : AC1500V each for 1min. Input terminals - Output terminals : AC500V each for 1 min.
Housing protection	:	IP65 for the front panel, IP20 for the rear case, IP00 for terminals

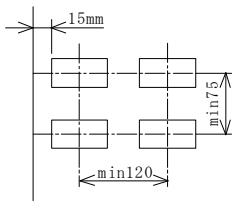
3. Mounting

Insert the case with the suitable gasket from the panel front.
Fix the case using the mounting bracket.
Cut the panel to mount the case in accordance with the illustration.





Fixing pitch



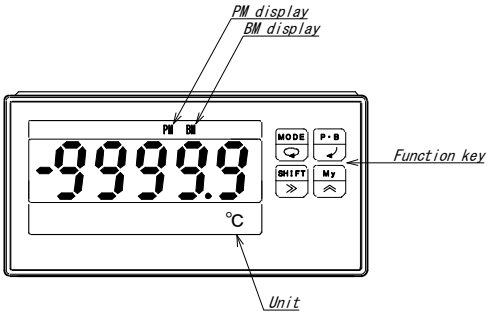
Panel cut dimension: $92^{+0.8/-0}$ × $45^{+0.6/-0}$ mm
Recommended panel thickness is 0.6 to 6mm.
For light panel, such as aluminum, should be 1.5mm or more to avoid deform.
Fasten torque of the mounting bracket is 0.2 to 0.3N·m.

⚠ CAUTION

- **Do not overtighten the mounting bracket.**
- **When plural mounting, pay attention to ventilation to cool down in the panel.**
- **However, do not apply the direct wind blow to the terminal blocks where the sensor to detect the room temperature is built in, as it causes an error.**

4. Nomenclature

4.1 Front panel



4.2 Function key

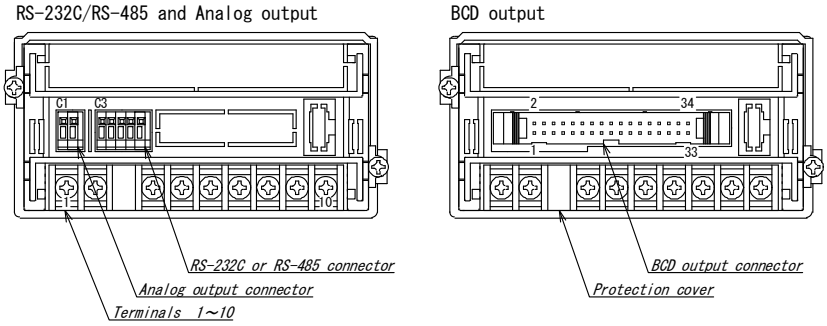
MODE ·····Switch the measuring, the parameter setting, and the calibration mode.
·····Switch modes during the parameter setting mode.

P・B ·····Switch indications during the measuring mode.
·····Enter the input value during the parameter setting mode.

SHIFT ·····Shift among the digits during the parameter setting mode.

My ·····Switch to My mode during the measuring mode.
·····Change values during the parameter setting mode.

4.3 Rear panel



5. Connections

5.1 Terminals and Connections

⚠ WARNING

- **To avoid an electrical shock, turn the power off when wiring.**
- **Do not wire with moistened hands. Locate away from the wet place.**
- **Do not touch terminals when turning the power on.**

⚠ CAUTION

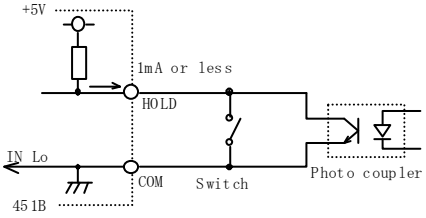
- **Power supply and load should be within the suitable range.**
- **Power supply should be rapidly reach the rated power within few seconds.**
- **When the power is turned OFF and ON again soon after, provide the downtime of 10 seconds or more.**
- **Do not miswiring.**

• Note for wiring

(1) Lay the input cable and the power cable separately.
Otherwise indication may be fluctuated.

(2) Provide appropriate noise reduction measures such as the shielded case, power line filter, isolated transformer, and so on.

(3) COM, HOLD and MR terminals are not insulated.
Terminals shall be wired to photo coupler, relay, switch, and so on.
Each meter shall be insulated when plural mounting.



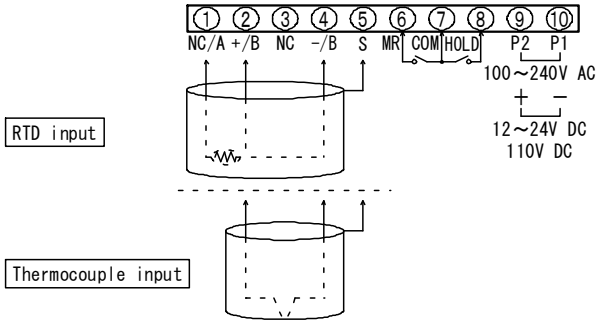
■Terminals

Terminals are not insulated from the input.

Active "L" I_{IL}≦-1mA、"L"=0～1.5V、"H"=3.5～5V

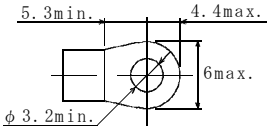
- Hold : Hold display, data output, current value, peak memory, bottom memory, and display amplitude. Hold the data when the hold input is active.
- MR : Rest peak memory, bottom memory, and jump width.

●Terminals

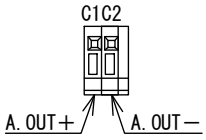


The screw is not provided on the terminal No.3.
Do not remove the protection cover on the terminal No.3.

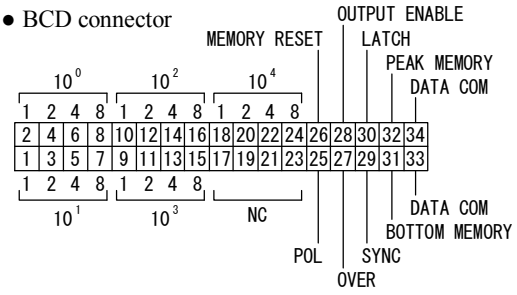
Terminal screws : M3
Fastening torque : 0.46~0.62N･m
Crimped terminal : Refer to the figure at the above.



● Analog output connector

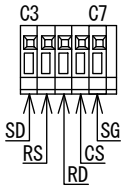


● BCD connector

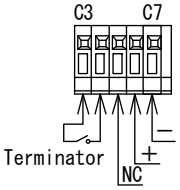


Suitable connector
XG4M-3430-T:OMRON Corp.
with 2m cable

● RS-232C output connector



● RS-485 output connector



Recommended wire { Solid wire : AWG28 to 22
Twisted wire : AWG28 to 22
O.D. 0.125 min.

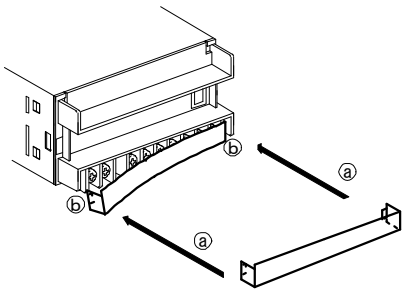
Strip-off length: 9 to 10mm

5.2 Attaching and detaching of terminal block cover

● Assemble procedures

(1) Direct the claws of the cover to the terminal blocks. “a”

(2) Insert the claw on either side of the cover as the figure shows. “b”
Insert the claw on another side until it clicks.
Thus, the attaching is completed.

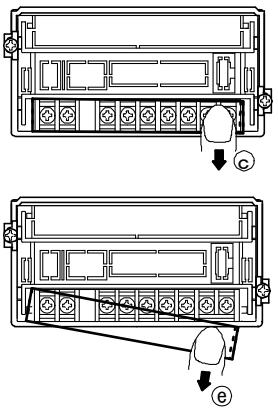


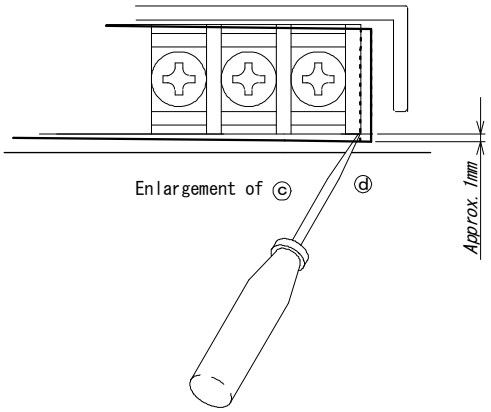
● Disassemble procedures

(1) Pressing the surface on one side of the cover, slightly slide it downwards. “c”

(2) Insert a small screwdriver into the gap made between the side wall of the terminal blocks and the claw of the cover, and stretch it outward. “d”

(3) Move whole the cover downwards, then the claw on another side is departed from the terminal blocks. “e”





6. Function

6.1 Parameter list

● Display function

No.	Function	Display	Contents	Default
04	Input sensor	SEn.	K, J, R, E, T, B, N, Pt100Ω range 1, Pt100Ω range 2, JPt100Ω	K
05	Display cycle	rATE.	200ms, 400ms, 1s, 2s, 4s, 5s	200ms (SP1)
06	Average calculation	nAuE.	OFF, ON, 2, 4, 8, 16, and 32 times	OFF
07	Unit (^{o}C / ^{o}F)	C.F.	^{o}C, ^{o}F	^{o}C
08	Burnout	bo.	+ burnout, - burnout	+ burnout
11	Display color	CoLor.	G, R	G (Green)
14	Display shutoff timer (Setting of light out time)	rUrn	ON, OFF, 0 to 99 min.	0, 01 (0: OFF)

● BCD output

No.	Function	Display	Contents	Default
70	BCD output sampling	bCdSP.	SAMP, DISP (sampling cycle or display cycle)	DISP (Display cycle)

● Analog output

No.	Function	Display	Contents	Default
75	Output switching	ASEL.	RM, PM, BM, PB	RM (current value)
76	Min. value	AnIn	-09: 0 to 9.9 V -29: 0 to 19.9mA	-09: 01.0 V -29: 04.0 mA
77	Max. value	AnAd	-09: 0.1 to 10.0 V -29: 0.1 to 20.0mA	-09: 05.0 V -29: 20.0 mA
78	Offset	AoFFS.	-9999.9 to +9999.9	0000.0
79	Full scale	AFULL.	-9999.9 to +9999.9	1999.9

NOTE: After changing parameter 76 and/or 77, analog output data at the calibration mode resets to default value.

● RS-232C / RS-485

No.	Function	Display	Contents	Default
80	Baud rate	bAUd.	4800, 9600, 19200, 38400 bps	9600 bps
81	Data length	LEnGT.	8 bit, 7 bit	8 bit
82	Parity	PArIT.	None, Odd, Even	None
83	Stop bit	SToP.	2 bit, 1 bit	1 bit
84	BCC switching	bCC.	ON, OFF	OFF
85	Unit number	rSno.	0 to 99	00

● My setting mode

No.	Function	Display	Contents	Default
99	Code registration	nY.	00 to 98 (00 for non-registration)	

● My setting mode

Registration No.	Code No.	Function
1	05	Display cycle
2	06	Average calculation
3	00	NC
4	00	NC
5	00	NC
6	00	NC
7	00	NC
8	00	NC

6.2 Explanation of function

● Display function

Parameter 04 : Select the input sensor

Display	Sensor
SEn. 0	K
SEn. 1	J
SEn. 2	R
SEn. 3	E
SEn. 4	T
SEn. 5	B
SEn. 6	N
SEn.10	Pt100Ω range 1
SEn.11	Pt100Ω range 2
SEn.12	JPt100Ω

Parameter 05 : Select the display rate.
SP1:200ms、SP2:400ms、SP3:1s、SP4:2s、SP5:4s、SP6:5s (Becomes 200ms at the moving average.)

Parameter 06 : Select the numbers of average calculation.
OFF: No average calculation
ON: Sectional average
2, 4, 8, 16, 32 : Numbers of data of moving average

Parameter 07 : Choose temperature unit, ^{o}C or ^{o}F.

Parameter 08 : FixSelect + burnout or – burnout when using thermocouple (+burnout only for RTD).

Display	burnout
bo. 0	+burnout
bo. 1	–burnout

Parameter 11 : Select the display color.

Parameter 14 : Select the shut-off time of the display after the switch operation.

● BCD output

Parameter 70 : Select the BCD data, whether display cycle or sampling rate.
Disable P-06 at the sampling rate.

● Analog output

Parameter 75 : Switch the analog output.

Parameter 76 : Set the output value at the 0% input.

Parameter 77 : Set the output value at the 100% input.

Parameter 78 : Set the display value at the 0% input.

Parameter 79 : Set the display value at the 100% input.

● RS-232C / RS-485

Parameter 80 : Select the Baud rate

Parameter 81 : Select the Data length.

Parameter 82 : Select the Parity.

Parameter 83 : Select the Stop bit.

Parameter 84 : Disable / Enable the BCC.

Parameter 85 : Select the Unit number.

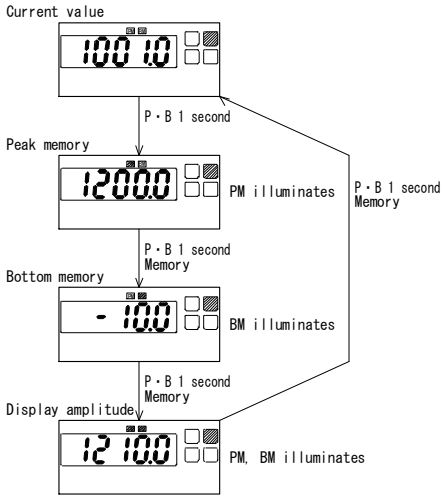
● My setting mode

Parameter 99 : Register well-used 8 code numbers in the setting mode.

7. Parameter Setting

7.1 Display switching

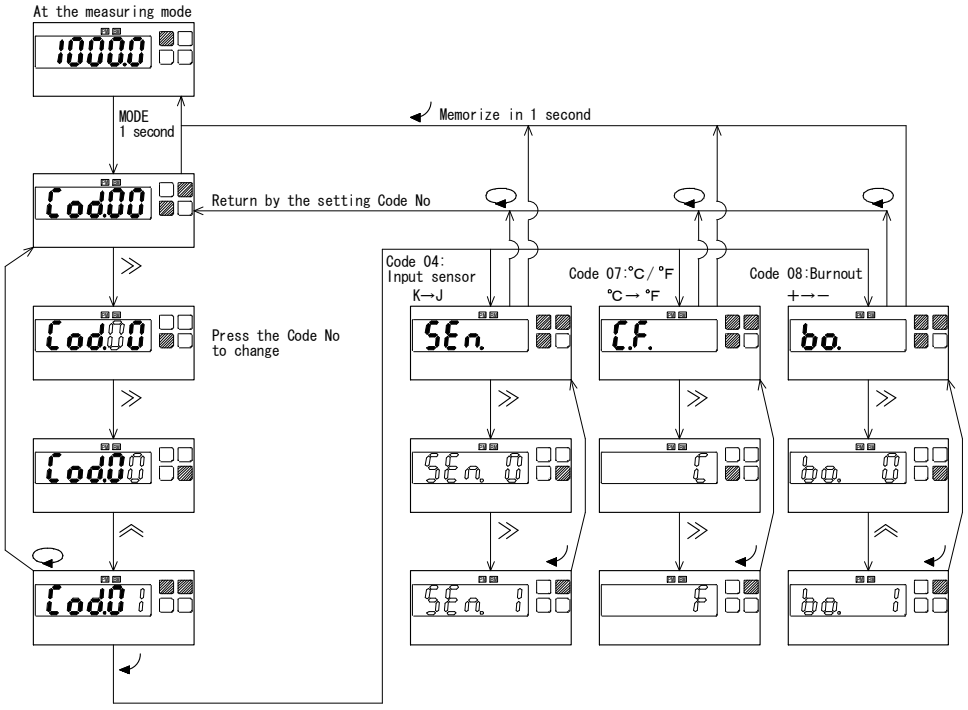
During the measuring mode, the display switches from current value to peak memory, bottom memory, display amplitude, and current value, by pushing P·B key.



※During If keep the P·B key pushing more than 3 seconds, memory will be reset after switching the display.

7.2 Parameter setting mode

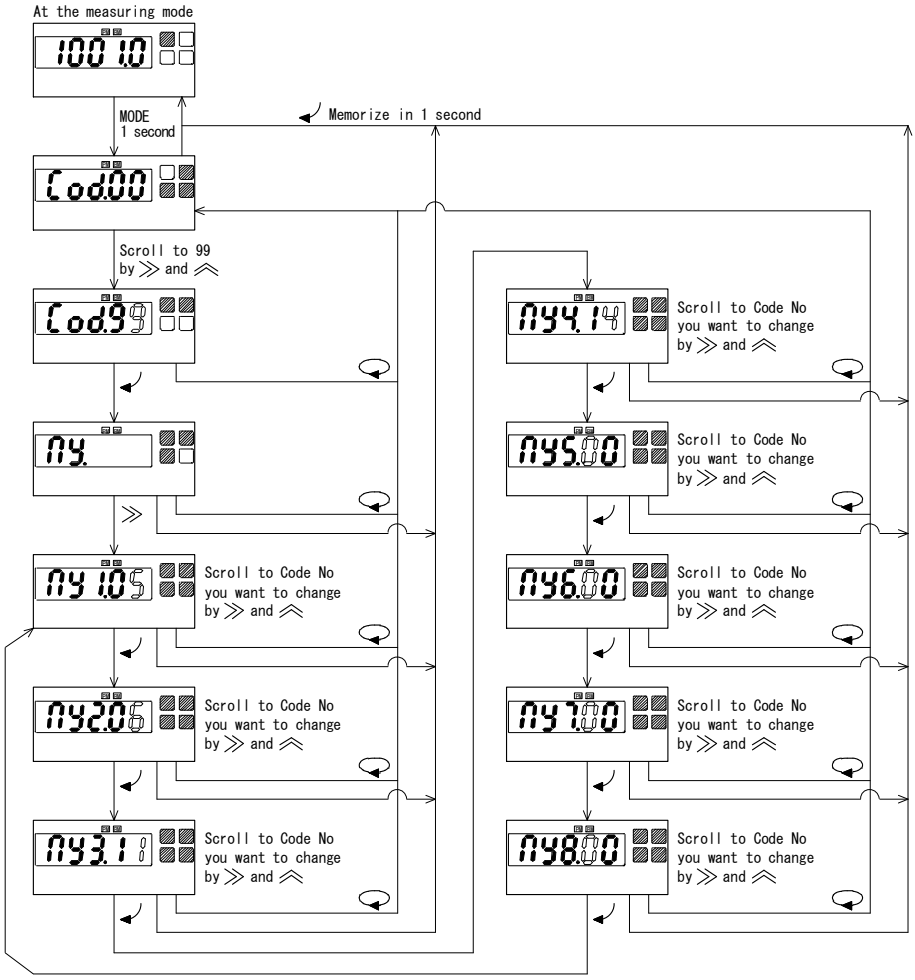
During the measuring mode, the display shows "Cod.00" and switches to the parameter setting mode, by pushing the MODE key.



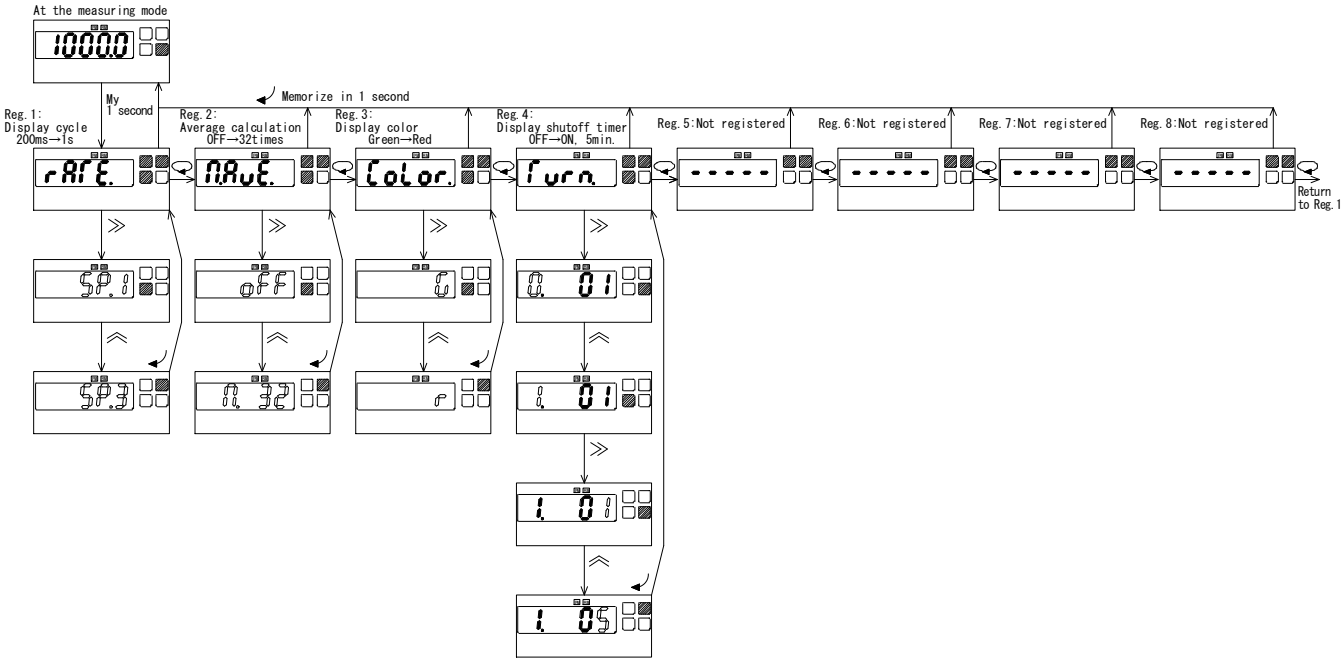
7.3 My setting mode

For your convenience, register well-used 8 code numbers in the setting mode.
During the measuring mode, the display switches the My setting mode by pushing [My] key.
The setting can be simplified by registering only the necessary function.

● How to register codes



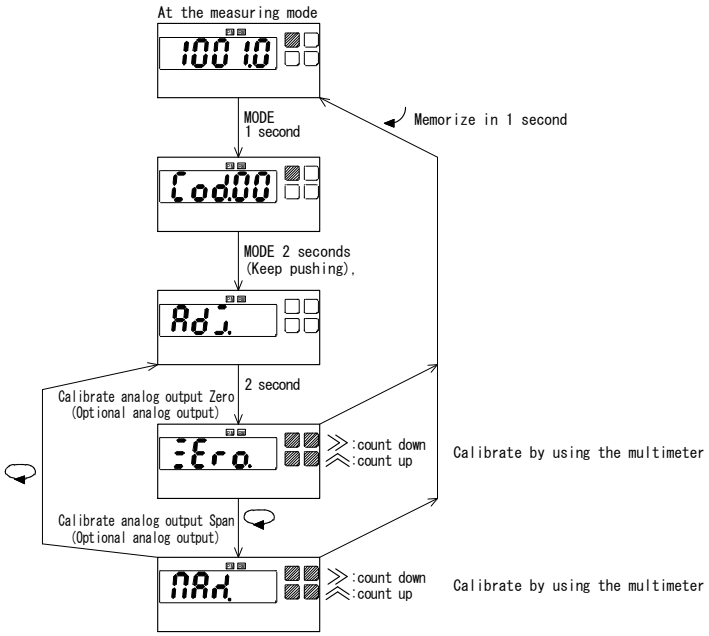
● How to change setting value



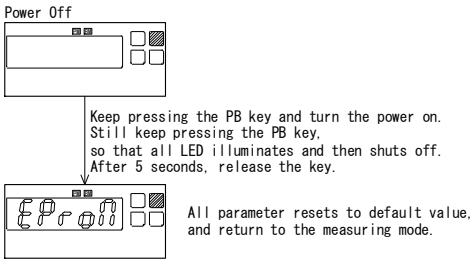
7.4 Calibration mode

This mode is ideal for fine calibration of the the optional analog output.

During the measuring mode, the display shows "Adj." and switches the Calibration mode by pushing MODE key.



7.5 Reset to Default value



7.6 Error message

Display	Cause of trouble	Countermeasure
Err 1	Entered Code No. is not applicable.	Enter correct Code No.
Err 2	Entered value is out of range.	Enter correct value

※ During the parameter setting mode and the My setting mode, return automatically to the measuring mode if you do not touch the switch more than 5 minutes. Changed value does not memorize in this case.

7.7 Verification mode

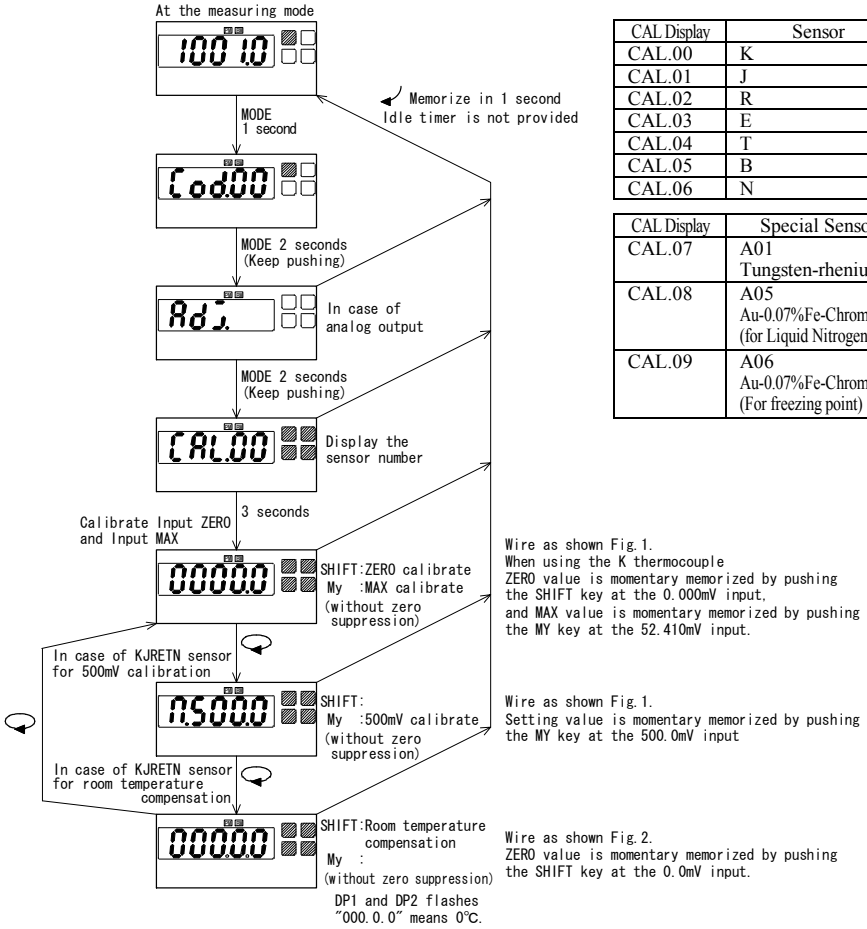
Calibrate annually to keep accuracy.

Calibration should be done under the condition of 23°C+/-5°C, 75%RH.

● Thermocouple

Prepare the voltage-base generator, the cold contact circuit, and the base thermocouple.

We recommend to make the cold contact circuit by putting ice water in the pot.



CAL Display	Sensor	ZERO		MAX	
CAL.00	K	0.0 °C	0.000mV	1300.0 °C	52.410mV
CAL.01	J	0.0 °C	0.000mV	1200.0 °C	69.553mV
CAL.02	R	0.0 °C	0.000mV	1700.0 °C	20.222mV
CAL.03	E	0.0 °C	0.000mV	1000.0 °C	76.373mV
CAL.04	T	0.0 °C	0.000mV	400.0 °C	20.872mV
CAL.05	B	0.0 °C	0.000mV	1800.0 °C	13.591mV
CAL.06	N	0.0 °C	0.000mV	1300.0 °C	47.513mV

CAL Display	Special Sensor	ZERO		MAX	
CAL.07	A01 Tungsten-rhenium	0 °C	0.000mV	2000.0 °C	33.66mV
CAL.08	A05 Au-0.07%Fe-Chromer (for Liquid Nitrogen)	77.4K	0.000mV	300.0 K	4.619mV
CAL.09	A06 Au-0.07%Fe-Chromer (For freezing point)	273.1K	0.000mV	10.0 K	-5.155mV

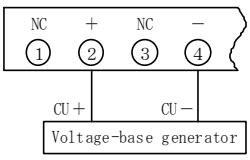


Fig.1

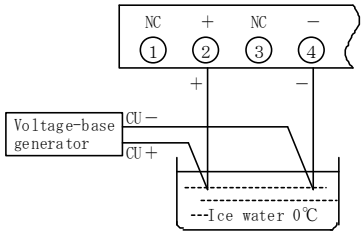
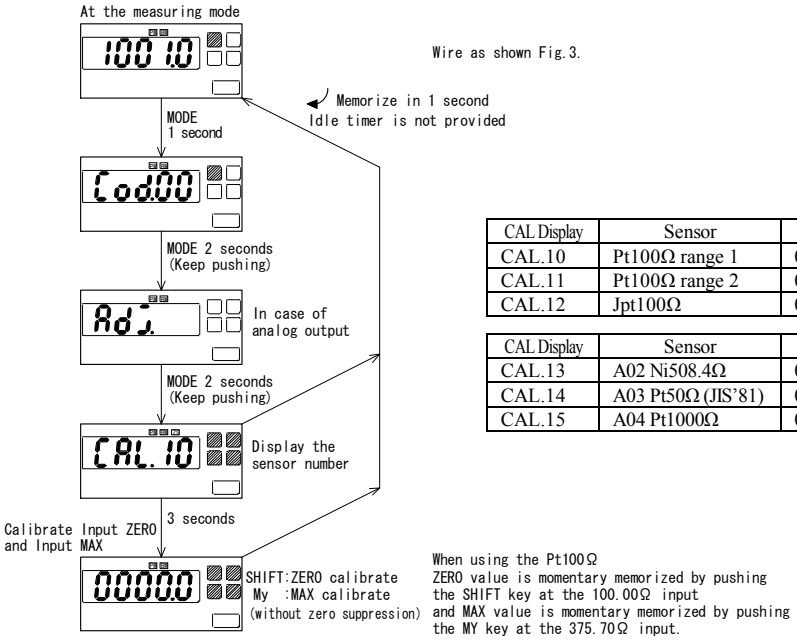


Fig.2

● RTD

Prepare the base variable resister.



CAL Display	Sensor	ZERO		MAX	
CAL.10	Pt100Ω range 1	0.0 °C	100.00Ω	800.0 °C	375.70Ω
CAL.11	Pt100Ω range 2	0.00 °C	100.00Ω	150.00 °C	157.33Ω
CAL.12	Jpt100Ω	0.0 °C	100.00Ω	600.0 °C	317.28Ω

CAL Display	Sensor	ZERO		MAX	
CAL.13	A02 Ni508.4Ω	0.0 °C	508.40Ω	280.0 °C	1440.03Ω
CAL.14	A03 Pt50Ω (JIS'81)	0.0 °C	50.00Ω	600.0 °C	158.64Ω
CAL.15	A04 Pt1000Ω	0.0 °C	1000Ω	500.0 °C	2809.8Ω

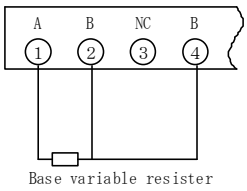
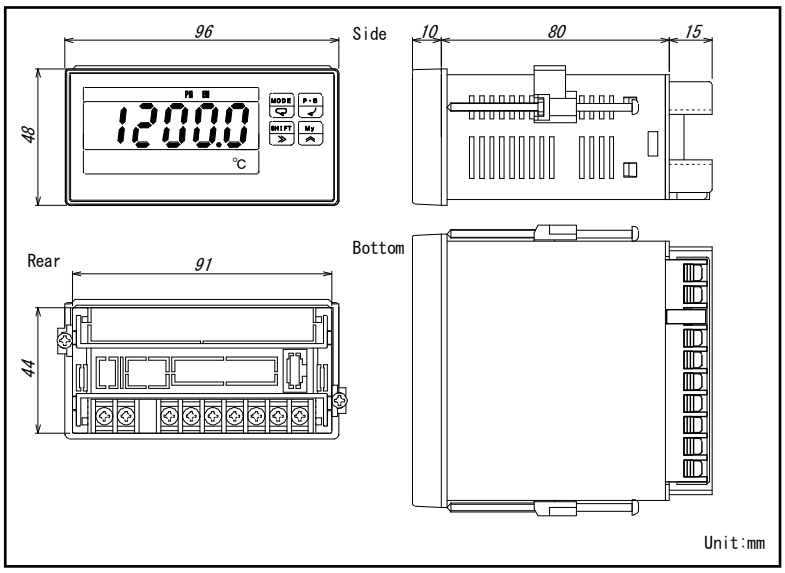


Fig.3

7.8 Numeric and Character Indications

8. External Dimensions



9. Model Numbering

451B–(1)–(2)–(3)–(4)

【1】Power Supply Voltage

Code	Power Source Voltage
A	AC100 to 240V
B	DC 12 to 24V
C	DC110V

【2】Data Output 1

Code	Specifications	Impedance	Max. Load
Null	No output		
09	Analog voltage (positive input side outputs) DC 0-10V (Available scaling, Default: 1-5V)	Max. 0.1Ω	Min. 100Ω at DC 0-1V Min. 1kΩ at DC 0-10V Min. 500Ω at DC 1-5V
29	Analog current (positive input side outputs) DC 0-20mA (Available scaling, Default: 4-20mA)	Min. 5MΩ	Max. 2.4kΩ at DC 0-5mA Max. 600Ω at DC 0-20mA Max. 600Ω at DC 4-20mA
BP	BCD output (TTL level positive logic)		
BN	BCD output (TTL level negative logic)		
DP	BCD output (transistor output, source type)		
DN	BCD output (transistor output, sink type)		
E0	RS-232C		
E1	RS-485		

【3】Data Output 2 (Available -09 and -29 of Data output 1 only)

Code	Specifications
Blank	No output
E0	RS-232C
E1	RS-485

【4】Special sensor (Optional)

Code	Special Sensor
Blank	Standard sensor
A01	Tungsten-rhenium 5% (WRe5-26, Tungsten-rhenium 26% thermocouple)
A02	Nickel RTD
A03	Pt50Ω
A04	Pt1000Ω
A05	Au-0.07%Fe-Chromer thermocouple (for Liquid Nitrogen)
A06	Au-0.07%Fe-Chromer thermocouple (for freezing point)

※ A special sensor cannot be switched.

9.1 Standard Sensor and Measuring Input

Thermocouple

Sensor	Measuring Range	Display	Error (23°C±5°C, 45~75%RH)
R	100.0 to 1700.0 °C	-50.0 to 1800.0 °C	±(0.1% of rdg + 0.6 °C) (100.0 to 500.0 °C)
			±(0.1% of rdg + 0.5 °C) (500.0 to 1700.0 °C)
K	-100.0 to 1300.0 °C	-200.0 to 1400.0 °C	±(0.1% of rdg + 0.6 °C) (-100.0 to 0.0 °C)
			±(0.1% of rdg + 0.5 °C) (0.0 to 1300.0 °C)
E	-130.0 to 1000.0 °C	-250.0 to 1050.0 °C	±(0.1% of rdg + 0.5 °C)
J	-140.0 to 1200.0 °C	-210.0 to 1250.0 °C	±(0.1% of rdg + 0.5 °C)
T	-200.0 to 400.0 °C	-250.0 to 420.0 °C	±(0.1% of rdg + 0.5 °C)
B	600.0 to 1800.0 °C	-20.0 to 1820.0 °C	±(0.1% of rdg + 0.6 °C)
N	-100.0 to 1300.0 °C	-230.0 to 1350.0 °C	±(0.1% of rdg + 0.5 °C)

Temperature coefficient: 0 to 50°C, ±50ppm/°C
Base contact compensation: 0 to 50°C, ±1.0°C
Vivificates by inputting base thermal EMF mV in conjunction with JIS C 1602-1995.

RTD

Sensor	Measuring Range	Display	Error (23°C±5°C, 45~75%RH)
Pt100Ω range 1	-200.0 to 850.0 °C	-200.0 to 870.0 °C	±(0.1% of rdg + 0.2 °C) (0.0 to 100.0 °C)
			±(0.2% of rdg + 0.3 °C) (-200.0 to 0.0 °C) (100.0 to 850.0 °C)
Pt100Ω range 2	-150.00 to 150.00 °C	-180.00 to 180.00 °C	±(0.1% of rdg + 0.2 °C) (0.00 to 100.00 °C)
			±(0.2% of rdg + 0.3 °C) (-150.00 to 0.00 °C) (100.00 to 150.00 °C)
JPt100 Ω	-200.0 to 645.0 °C	-200.0 to 660.0 °C	±(0.1% of rdg + 0.2 °C) (0.0 to 100. 0 °C)
			±(0.2% of rdg + 0.3 °C) (-200.0 to 0.0 °C) (100.0 to 645.0 °C)

Temperature coefficient: 0 to 50°C, ±50ppm/°C (±100ppm/°C when range 2)
Vivificates by base resistance in conjunction with JIS C 1602-1997.

9.2 Special Sensor and Measuring Input

Thermocouple

Sensor	Measuring Range	Display	Error (23°C±5°C, 45~75%RH)
-A01 Tungsten-rhenium	0 to 2320 °C	-20 to 2350 °C	±(0.3% of rdg + 1 °C) (0 to 2320 °C)
-A05 Au-0.07%Fe-Chromer (for Liquid Nitrogen)	-270.0 to 27.0 °C	-273.1 to 50. 0 °C	±2.0 °C (-270.0 to 27.0 °C)
-A06 Au-0.07%Fe-Chromer (for freezing point)	-270.0 to 27.0 °C	-273.1 to 50. 0 °C	±2.0 °C (-270.0 to 27.0 °C)

Temperature coefficient: 0 to 50°C, ±50ppm/°C
Base contact compensation: 0 to 50°C, ±1.0°C
No compensation of cold contact for the –A05 and –A06

RTD

Sensor	Measuring Range	Display	Error (23°C±5°C, 45~75%RH)
-A02 Ni508.4Ω	-50.0 to 280.0 °C	-50.0 to 300.0 °C	±(0.2% of rdg + 0.3 °C) (-50.0 to 280.0 °C)
-A03 Pt50Ω (JIS'81)	-200.0 to 649.0 °C	-200.0 to 660.0 °C	±(0.2% of rdg + 0. 3 °C) (-200.0 to 649. 0 °C)
-A04 Pt1000Ω	-200.0 to 550.0 °C	-200.0 to 600.0 °C	±(0.2% of rdg + 0. 3 °C) (-200.0 to 550. 0 °C)

Temperature coefficient: 0 to 50°C, ±50ppm/°C

NOTES:
1) The sensor switching by the front keys is impossible.
2) Resistance value of the –A04 Pt1000Ω is 10 times against base resistance of the Pt100Ω in conjunction with JIS C 1604-1997.
3) When using the –A05 and –A06, code No.07 changes °C/K.

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