mindman **MP70** Series CE

For your safety, please read the following before using.

① Do not use corrosive or flammable gas or liquid with this product.
② Please use within the rating pressure range. Do not apply pressure beyond recommended maximum withstand pressure, permanent damage to the pressure sensor may occur.
③ Do not drop, hit or allow excessive shock. Even if switch body appears undamaged, internal components may be broken and can cause malfunction.
④ Turn power off before connecting wiring. Wrong wiring or short circuit will damage and / or cause malfunction.
⑤ Do not use in environment containing steam or oil vapor.
⑥ This product is not explosion-proof rated. Do not use in atmosphere containing flammable or explosive gases.
⑦ Wiring for pressure sensor should avoid power source line and high voltage line. If use in the same circuit, noise may cause malfunction.
⑧ Connect the ground wire with host controllers ground.
⑨ To prevent product damage due to short circuit , MUST do RS485 line conneciton BEFORE power line connection.

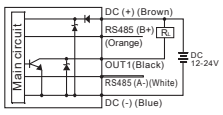
A. SPECIFICATIONS

TYPE		MP70P-□-□ (Positive)	MP70V-□-□ (Vacuum)	MP70C-□-□ (Compound)
Rated pressure range		0.000~1.000 MPa	-101.3~0.0 kPa	-100.0~100.0 kPa
Setting pressure range		-0.100~1.000 MPa	-101.3~10.0 kPa	-101.0~101.0 kPa
Withstand pressure		1.5MPa	500kPa	
Fluid		Filtered air, Non-corrosive / Non-flammable gas		
Set pressure resolution	kPa	—	0.1	
	MPa	0.001	—	
	kgf/cm²	0.01	0.001	
	bar	0.01	0.001	
	psi	0.1	0.01	
	inHg	—	0.1	
	mmHg	—	1	
Power supply voltage		12 to 24V DC ±10%, Ripple (P-P) 10% or less		
Current consumption		≤ 40mA (With no load)		
Switch output		NPN: open collector 1 output Max. load current: 125mA Max. supply voltage: 30V DC Residual voltage: ≤ 1.5V	PNP: open collector 1 output Max. load current: 125mA Max. supply voltage: 24V DC Residual voltage: ≤ 1.5V	
Repeatability(Switch output)		≤ ±0.2% F.S. ±1 digit		
Hysteresis	One point set mode / Hysteresis mode / Window comparator mode	Adjustable(*1)		
Response time		≤ 2.5ms(chattering-proof function: 25ms, 100ms, 250ms, 500ms, 1000ms, 1500ms, 2000ms and 5000ms selections)		
Output short circuit protection		Yes		
Display		4 digital, 7 segment LCD display (Red / Green / Orange) (Sampling rate : 0.2, 0.5, 1 seconds / time selectable)		
Indicator accuracy		±2% F.S. ±1 digit (ambient temperature: 25 ±3°C)		
Switch on Indicator		Orange Indicator 1 : OUT		
Environment	Enclosure	IP 40		
	Ambient temp. Range	Operation : 0 ~ 50°C, storage : -10 ~ 60°C (No condensation or freezing)		
	Ambient humidity range	Operation/Storage: 35 ~ 85% RH (No condensation)		
	Withstand voltage	1000V AC in 1-min (between case and lead wire)		
	Insulation resistance	50MΩ (at 500V DC, between case and lead wire)		
	Vibration	Total amplitude 1.5mm or 10G,10Hz-55Hz-10Hz scan for 1 minute, two hours each direction of X, Y and Z		
	Shock	100m/s² (10G), 3 times each in direction of X, Y and Z		
Temperature characteristic		±2.5% F.S. of detected pressure (25°C) at temp. Range of 0~50°C		
Communication interface		RS-485		
Port size		F1:R1/8", M5; F2:NPT1/8", #10-32UNF; F3: G1/8"(BSPP), M5		
Lead wire		Ø4 Oil-resistance cable (PVC) - 26 AWG (0.15 mm²) - 5 cores		
Weight		Approx. 80g (with 2 meter lead wire)		

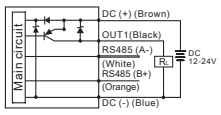
*1.Hysteresis value is adjustable within 1 ~ 8 digits for one point set mode and window comparator mode.

B. OUTPUT CIRCUIT WIRING DIAGRAMS

MP70□-02-□
1 NPN+RS485



MP70□-04-□
1 PNP+RS485



C. ORDERING INFORMATION

M P 7 0 C - 0 2 - F 1

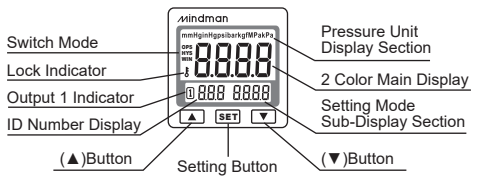
Pressure Range
C : Compound (-101.0~101.0 kPa)
V : Vacuum (-101.3~10.0 kPa)
P : Positive (-0.100~1.000 MPa)

Output Specifications
02 : 1NPN output + RS485
04 : 1PNP output + RS485

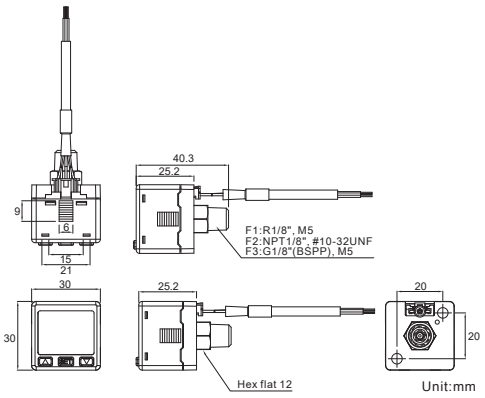
Pressure Port
F1 : R1/8", M5
F2 : NPT1/8", #10-32UNF
F3 : G1/8"(BSPP), M5

Optional Parts
MP-A12 : Mounting bracket (BT-12)
MP-A13 : Mounting bracket (BT-13)
MP-B2 : Panel adapter (PA-C)
MP-C2 : Panel adapter + Front protective lid (PA-D)

D. PANEL DESCRIPTION



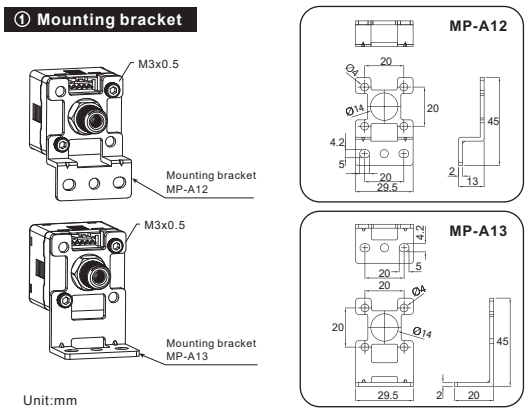
E. DIMENSIONS



Unit:mm

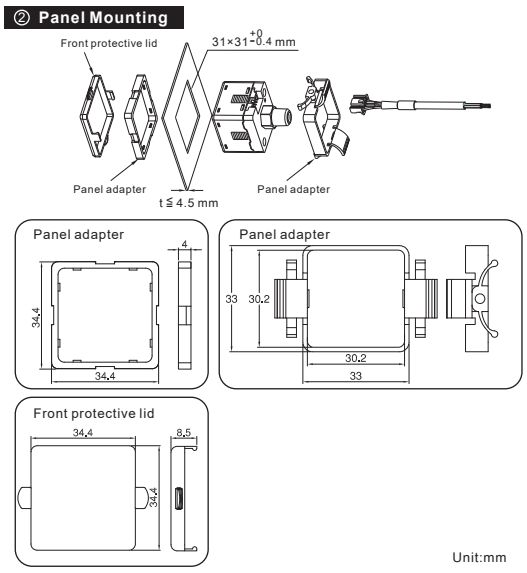
F. OPTIONAL PARTS DIMENSIONS

① Mounting bracket

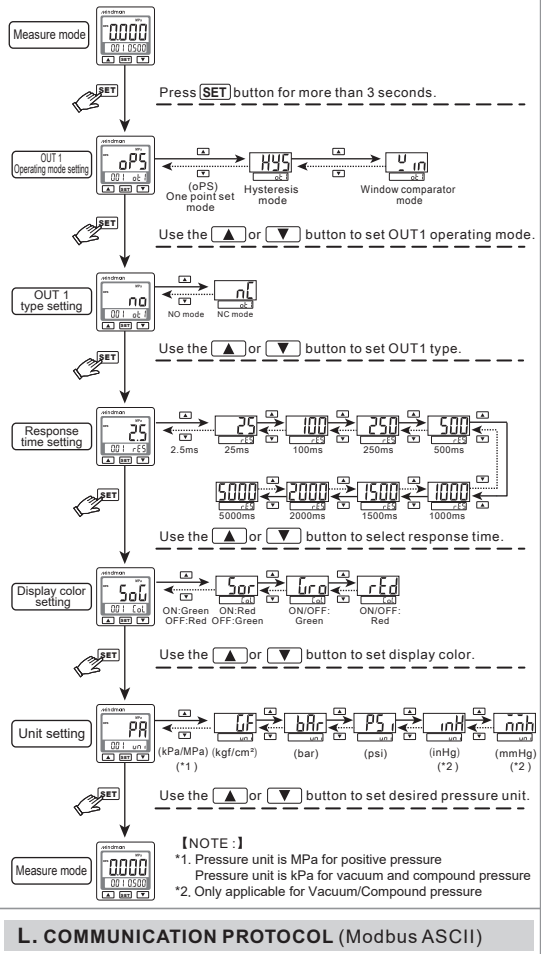


Unit:mm

② Panel Mounting

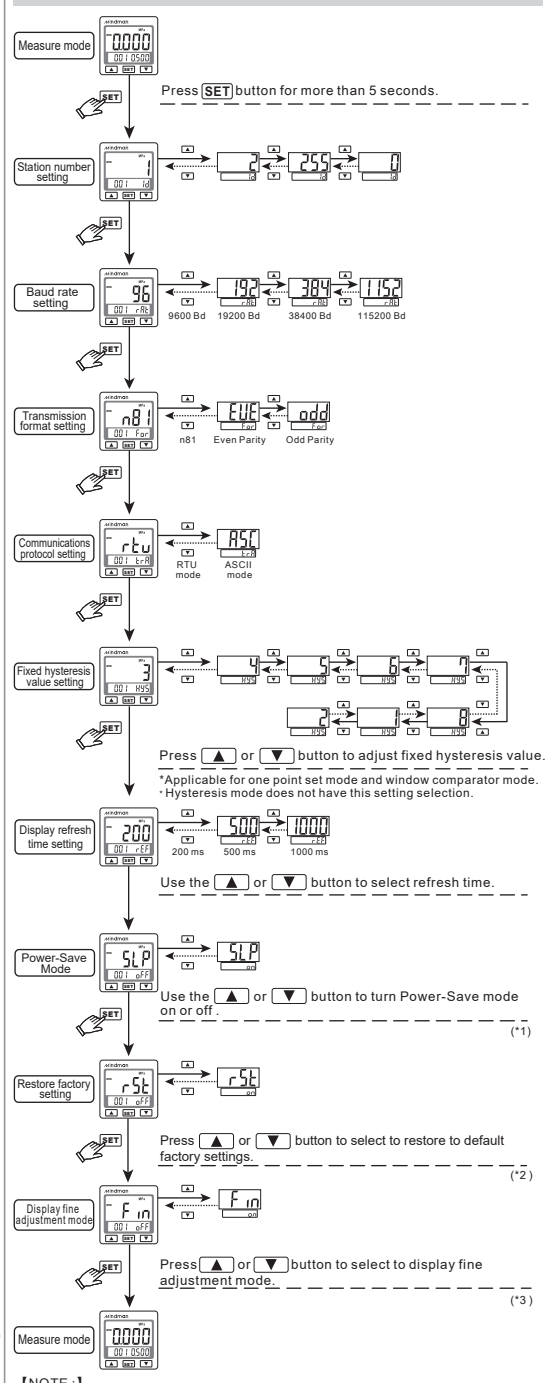


G. INITIAL SETTING MODE



【NOTE :】
*1. Pressure unit is MPa for positive pressure
Pressure unit is kPa for vacuum and compound pressure
*2. Only applicable for Vacuum/Compound pressure

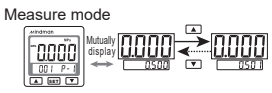
H. ADVANCE SETTING MODE



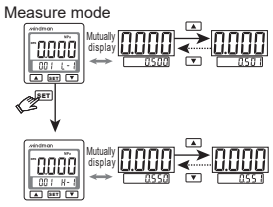
【NOTE :】
*1. When setting is "on", the power-save mode is active. Please refer to the item "M" in detailed.
*2. Restore factory default setting will not change the station number, baud rate and transmission format settings.
*3. When setting is "on", the display fine adjustment mode is active. Please refer to the item "Q" in detailed.

I. PRESSURE SETTING MODE

◎ Setting Condition 1:
OUT 1 mode setting : "oPS "(One point set mode)



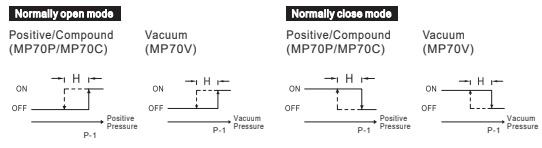
◎ Setting Condition 2 :
OUT 1 MODE SETTING : "HYS "(Hysteresis mode)
" Win "(Window comparator mode)



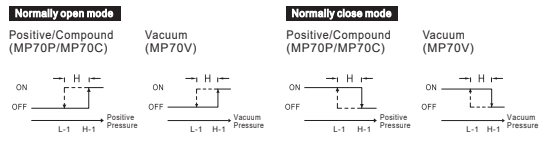
【NOTE :】
Do not disconnect power when the sub-display and setting value is flashing alternately; otherwise the system cannot store the values.

J. OUTPUT TYPE

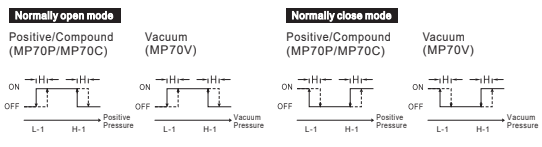
(1) One point set mode:



(2) Hysteresis mode:



(3) Window comparator mode:



【NOTE :】
*1. In case hysteresis is set at less than or equal to 2 digits, switch output may chatter if input pressure fluctuates near the set point.
*2. When using window comparator mode, the difference between two set points must be greater than the fixed hysteresis, otherwise will cause the switch output to malfunction.

K. COMMUNICATION PROTOCOL (Modbus RTU)

(1) Computer /PLC transmit data format (Master)

ID Number 1 Byte	Read 1 Byte	Function Code 2 Byte	Data Number 2 Byte	CRC CheckSum 2 Byte

(2) Pressure sensor response data format (Slave <MP70>)

ID Number 1 Byte	Read 1 Byte	Data Number 1 Byte	Data 2N Byte(*)	CRC CheckSum 2 Byte

* N is the number of data

(3) Computer /PLC transmit data format (Master)

ID Number 1 Byte	Write 1 Byte	Function Code 2 Byte	Data 2 Byte	CRC CheckSum 2 Byte

(4) Pressure sensor response data format (Slave <MP70>)

ID Number 1 Byte	Write 1 Byte	Function Code 2 Byte	Data 2 Byte	CRC CheckSum 2 Byte

(5) Pressure sensor response data format (Error)

ID Number 1 Byte	Write 1 Byte	Error Code 1 Byte	CRC CheckSum 2 Byte

(6) Read / Write Code

Read / Write Code	Description
03H	Read pressure sensor data Range 1~4 data Number , 2~8 Bytes
06H	Write pressure sensor data

(7) Example : Read pressure sensor value
Computer /PLC transmit data format (Master)

ID Number (01H)	Read (03H)	Function Code (0002H)	Data Number (0001H)	CRC CheckSum (25CAH)

Pressure sensor data format

ID Number (01H)	Read (03H)	Data Number (02H)	Data (0001H)	CRC CheckSum (7984H)

(8) Example : ID Number setting response
Computer /PLC transmit data format (Master)

ID Number (01H)	Write (06H)	Function Code (0000H)	Data (0001H)	CRC CheckSum (480AH)

Pressure sensor response data

ID Number (01H)	Write (06H)	Function Code (0000H)	Data (0001H)	CRC CheckSum (480AH)

Example : ID Number setting response error

ID Number (01H)	Write (06H)	Function Code (0000H)	Data (01FFH)	CRC CheckSum (C81AH)

Pressure sensor response error (Example : setting data is over)

ID Number (01H)	Write (86H)	Error Code (03H)	CRC CheckSum (0261H)

(When the pressure sensor is abnormal, MSB will be set to 1, so the command code is 86H)

(9)Function Code :

Function Code	Description	Operation
0000H	ID Number (Range:0~255)	Read / Write
0001H	Pressure Type (0:Vacuum 1:Compound 3:Positive)	Read
0002H	Pressure Value	Read
0003H	Unit (0:kPa 1:kgf 2:bar 3:psi 4:inHg 5:mmHg 6:MPa)	Read / Write
0004H	Decimal dot(Range:0~3 digit)	Read
0005H	Switch operation mode (0:ops 1:hys 2:win)	Read / Write
0006H	Switch operation type (0:NO 1:NC)	Read / Write
0007H	Response time (0:2.5ms 1:25ms 2:100ms 3:250ms 4:500ms 5:1000ms 6:1500ms 7:2000ms 8:5000ms)	Read / Write
0008H	Display color select (0:SOG 1:SOR 2:GRN 3:RED)	Read / Write
0009H	Fixed hysteresis value selection (Range : 1~8)	Read / Write
000AH	Power-save mode (0:OFF 1:ON)	Read / Write
000BH	Display fine adjustment mode (Range : -25%~25%) (The actual display is : -2.5%~2.5%)	Read / Write
000CH	Baud rate setting (0:9600 1:19200 2:38400 3:115200)	Read / Write
000DH	Transmission format setting (0:N,8,1 1:E,8,1 2:O,8,1)	Read / Write
000EH	Communications protocol setting (0:RTU / 1:ASC)	Read / Write
000FH	Restore factory setting(write range: 0 or 1)	Write
0010H	Operation point setting ; P-1 or L-1 (Range : According to pressure type and unit)	Read / Write
0011H	Operation point setting ; H-1 (Range : According to pressure type and unit)	Read / Write
0012H	Switch state (0:OFF 1:ON)	Read
0013H	Key lock function (0:OFF 1:ON)	Read / Write
0014H	Switch type (0:NPN 1:PNP)	Read
0015H	Display refresh time setting (0:200ms 1:500ms 2:1000ms)	Read / Write
0016H	Zero reset (If ambient pressure is over ±3% F.S. , error code shows 03H)	Write

(10)Error Code Description :

Error Code	Description
01H	Read / Write error
02H	Function Code error
03H	Illegal data or over setting value

L. COMMUNICATION PROTOCOL (Modbus ASCII)

(1) Computer /PLC transmit data format (Master)

Head 1 Byte	ID Number 2 Byte	Read 2 Byte	Function Code 2 Byte	Data Number 4 Byte	LRC CheckSum 2 Byte	Trailer CR+LF 2 Byte

(2) Pressure sensor response data format (Slave <MP70>)

Head 1 Byte	ID Number 2 Byte	Read 2 Byte	Function Code 2 Byte	Data 4N Byte(*)	LRC CheckSum 2 Byte	Trailer CR+LF 2 Byte

* N is the number of data

(3) Computer /PLC transmit data format (Master)

Head 1 Byte	ID Number 2 Byte	Write 2 Byte	Function Code 4 Byte	Data 4 Byte	LRC CheckSum 2 Byte	Trailer CR+LF 2 Byte

(4) Pressure sensor response data format (Slave <MP70>)

Head 1 Byte	ID Number 2 Byte	Write 2 Byte	Function Code 4 Byte	Data 4 Byte	LRC CheckSum 2 Byte	Trailer CR+LF 2 Byte

(5) Pressure sensor response data format (Error)

Head 1 Byte	ID Number 2 Byte	Write 2 Byte	Error Code 2 Byte	LRC CheckSum 2 Byte	Trailer CR+LF 2 Byte

(6) Read / Write Code

Read / Write Code	Description
30H33H	Read pressure sensor data Range 1~4 data Number , 4~16 Bytes
30H36H	Write pressure sensor data

(7) Example : Read pressure sensor value
Computer /PLC transmit data format (Master)

Head (3AH)	ID Number (30H31H)	Read (30H33H)	Function Code (30H30H30H32H)	Data Number (30H30H30H31H)	LRC CheckSum (46H39H)	Trailer (0DH0AH)

Pressure sensor response data format

Head (3AH)	ID Number (30H31H)	Read (30H33H)	Data Number (30H32H)	Data (30H30H30H31H)	LRC CheckSum (46H39H)	Trailer (0DH0AH)

(8) Example : ID Number setting response
Computer /PLC transmit data format (Master)

Head (3AH)	ID Number (30H31H)	Write (30H36H)	Function Code (30H30H30H30H)	Data (30H30H30H31H)	LRC CheckSum (46H38H)	Trailer (0DH0AH)

Pressure sensor response data

Head (3AH)	ID Number (30H31H)	Write (30H36H)	Function Code (30H30H30H30H)	Data (30H30H30H31H)	LRC CheckSum (46H38H)	Trailer (0DH0AH)

Example : ID Number setting response error

Head (3AH)	ID Number (30H31H)	Write (30H36H)	Function Code (30H30H30H30H)	Data (30H31H46H46H)	LRC CheckSum (46H39H)	Trailer (0DH0AH)

Pressure sensor response error (Example : setting data is over)

Head (3AH)	ID Number (30H31H)	Write (38H36H)	Error Code (30H33H)	LRC CheckSum (37H36H)	Trailer (0DH0AH)

(When the pressure sensor is abnormal, MSB will be set to 1, so the command code is 38H36H)

(9)Function Code :

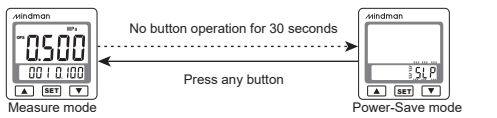
Function Code	Description	Operation
30H30H30H30H	ID Number (Range:0~255)	Read / Write
30H30H30H31H	Pressure Type (0:Vacuum 1:Compound 3:Positive)	Read
30H30H30H32H	Pressure Value	Read
30H30H30H33H	Unit (0:kPa 1:kgf 2:bar 3:psi 4:inHg 5:mmHg 6:MPa)	Read / Write
30H30H30H34H	Decimal dot(Range:0~3 digit)	Read
30H30H30H35H	Switch operating mode (0:ops 1:hys 2:win)	Read / Write
30H30H30H36H	Switch operation type (0:NO 1:NC)	Read / Write
30H30H30H37H	Response time (0:2.5ms 1:25ms 2:100ms 3:250ms 4:500ms 5:1000ms 6:1500ms 7:2000ms 8:5000ms)	Read / Write
30H30H30H38H	Display color select (0:SOG 1:SOR 2:GRN 3:RED)	Read / Write
30H30H30H39H	Fixed hysteresis value selection (Range : 1~8)	Read / Write
30H30H30H41H	Power-save mode (0:OFF 1:ON)	Read / Write
30H30H30H42H	Display fine adjustment mode (Range : -25%~25%) (The actual display is : -2.5%~2.5%)	Read / Write
30H30H30H43H	Baud rate setting (0:9600 1:19200 2:38400 3:115200)	Read / Write
30H30H30H44H	Transmission format setting (0:N,8,1 1:E,8,1 2:O,8,1)	Read / Write
30H30H30H45H	Communications protocol setting (0:RTU / 1:ASC)	Read / Write
30H30H30H46H	Restore factory setting(write range: 0 or 1)	Write
30H30H31H30H	Operation point setting ; P-1 or L-1 (Range : According to pressure type and unit)	Read / Write
30H30H31H31H	Operation point setting ; H-1 (Range : According to pressure type and unit)	Read / Write
30H30H31H32H	Switch state (0:OFF 1:ON)	Read
30H30H31H33H	Key lock function (0:OFF 1:ON)	Read / Write
30H30H31H34H	Switch type (0:NPN 1:PNP)	Read
30H30H31H35H	Display refresh time setting (0:200ms 1:500ms 2:1000ms)	Read / Write
30H30H31H36H	Zero reset (If ambient pressure is over ±3% F.S. , error code shows 30H33H)	Write

(10)Error Code Description :

Error Code	Description
01H	Read / Write error
02H	Function code
03H	Illegal data or over setting value

M. POWER SAVE MODE

◎ During Power-Save mode, the main display is off if no buttons is pressed after 30 seconds.
◎ During Power-Save mode, the output LCD may not be synchronize with the output. It is normal and will not affect output operation.
◎ Press any button to turn-on main display temporarily

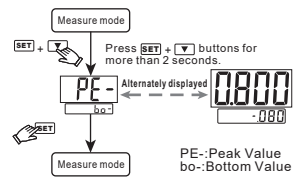


(Main display is off, sub-display will flash " SLP ")

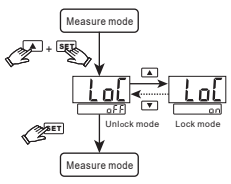
N. ZERO POINT SETTING

Press the ▲+▼ buttons at the same time until the "00" is shown.
Release the buttons to end zero setting.

O. PEAK/BOTTOM HOLD FUNCTION

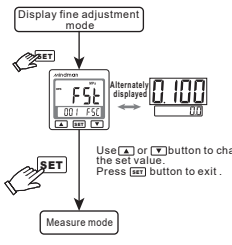


P. KEY LOCK MODE

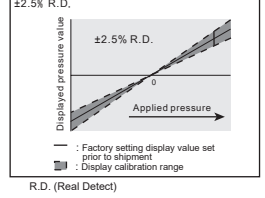


◎ Use key lock mode to prevent unauthorized or accidental tampering with the switch setting.
◎ When lock mode is selected, panel will display " ⚷ ".

Q. FINE ADJUSTMENT MODE



This function eliminates slight differences in the output values and allows uniformity in the numbers displayed.Displayed values of the pressure sensor can be calibrated to within ±2.5% R.D.



R.D. (Real Detect)

【NOTE :】1. Setting resolution is ±0.1% R.D.
2. The signal would be changed with analog output after adjusting.

R. ERROR CODE INSTRUCTION

Error Type		Error code	Error Condition	Troubleshooting
Excess load current error	out1	Er 1	Output 1 load current is more than 125 mA	Turn power off and check the cause of overload current or lower the current load under 125 mA, then restart.
Residual pressure error		Er3	During zero reset, ambient pressure is over ±3% F.S.	Change input pressure to ambient pressure and perform zero reset again.
Applied pressure error		HHH	Supply pressure exceeds the upper limit of pressure setting.	Adjust the pressure within operating pressure range.
		LLL	Supply pressure exceeds the lower limit of pressure setting.	
System error		Er4	Internal system error	Turn power off, and then restart. If error condition remains, please return to factory for inspection.
		Er5	Internal system error	
		Er6	Internal data error	
		Er7	Internal data error	

S. PRESSURE UNIT CONVERSION TABLE

From \ To	Pa	kPa	MPa	kgf/cm²	mmHg	psi	bar	inHg
1 Pa	1	0.001	0.000001	0.000010197	0.00750062	0.000145038	0.00001	0.0002953
1 kPa	1000.000	1	0.001000	0.010197	7.500616	0.145038	0.010000	0.2953
1 MPa	1000000	1000	1	10.197	7500.616	145.038	10	295.2998
1 kgf/cm²	98066.5	98.0665	0.0980665	1	735.559	14.2233	0.980665	28.95979
1 mmHg	133.32	0.13332	0.000133	0.0013595	1	0.019336	0.0013332	0.039370
1 psi	6895	6.895	0.006895	0.07031	51.7157	1	0.06895	2.036074
1 bar	100000.0	100.0000	0.100000	1.01972	750.062	14.5038	1	29.52998
1 inHg	3386.388	3.386388	0.003386	0.034530	25.40000	0.491141	0.033863	1