Digital Pressure Sensor

E8F2

Pressure Sensor with Easy-to-Read LED Display

- Pressure status can be checked at a glance from the red digital pressure value and analog bar displays.
- Measurement pressure is averaged by the chattering prevention function to prevent incorrect outputs due to momentary pressure changes.
- The automatic teaching function teaches pressure values for good and bad products.
- Industry's smallest models at just 28 × 28 × 29 mm.

⚠ Be sure to read *Safety Precautions* on page 6.

Ordering Information

Sensors

Pressure range		ON/OFF output	Linear output	Model	
				NPN output	PNP output
Positive pressure	0 to 100 kPa	Open collector (two independent outputs)	1 to 5 V	**E8F2-A01C**	**E8F2-A01B**
	0 to 1 MPa			**E8F2-B10C**	**E8F2-B10B**
Negative pressure	0 to −101 kPa			**E8F2-AN0C**	**E8F2-AN0B**

Accessories (Order Separately)

Appearance	Name	Model	Remarks
	Mounting Bracket	**E89-F3**	Provided with the E8F2.
	Panel-mounting Bracket	**E89-F4**	Spacer provided.

Ratings and Specifications

Sensor

Item \ Model: NPN output / PNP output	E8F2-A01C / E8F2-A01B	E8F2-B10C / E8F2-B10B	E8F2-AN0C / E8F2-AN0B
Power supply voltage	12 to 24 VDC±10% with a ripple (p-p) of 10% max.		
Current consumption	70 mA max. *1		
Pressure type	Gauge pressure		
Rated pressure range	0 to 100 kPa	0 to 1 MPa	0 to −101 kPa
Pressure setting range	0 to 100 kPa	0 to 1 MPa	0 to −101 kPa
Withstand pressure	400 kPa	1.5 MPa	400 kPa
Applicable fluid	Non-corrosive gas and non-flammable gas		
Operating mode	Hysteresis mode, window mode, and automatic teaching mode		
Repeat accuracy (ON/OFF output)	±1%FS max.		
Linearity (linear output)	±1%FS max.		
Response time (ON/OFF output)	5 ms max.		
Linear output	1 to 5 V with an output impedance of 1 kΩ and a permissible resistive load of 500 kΩ.		
ON/OFF outputs	NO or NC open collector (depending on whether the output configuration is NPN or PNP)		
ON/OFF outputs – Load current	30 mA max.		
ON/OFF outputs – Output applied voltage	30 VDC max.		
ON/OFF outputs – Residual voltage	NPN open collector output: 1 V max. with 30 mA load current PNP open collector output: 2 V max. with 30 mA load current		
Display *2	3.5-digit red LED Green LED bar indicator The orange LED is lit for two independent outputs with output transistor turned ON. Green unit indicator		
Display accuracy	±3%FS±1 digit max.		
Protection circuits	Reverse polarity protection, load short-circuit protection		
Ambient temperature range	Operating: 0 to 55°C Storage: −10 to 60°C (with no icing)		
Ambient humidity range	Operating/Storage: 35% to 85% (with no condensation)		
Temperature influence	±3%FS max.		
Voltage influence	±1.5%FS max.		
Insulation resistance	100 MΩ min. (at 500 VDC) between current-carrying parts and case		
Dielectric strength	1,000 VAC at 1 min		
Vibration resistance	Destruction: 10 to 500 Hz, 1.0-mm double amplitude or 150 m/s^2, three times each for 11 min in the X, Y, and Z directions		
Shock resistance	Destruction: 300 m/s^2 3 times each in the X, Y, and Z directions		
Degree of protection	IP50 (IEC)		
Pressure port	R (PT) 1/8 taper screw and M5 female screw		
Connection method	Pre-wired (standard length: 2 m)		
Cable	Approved by UL		
Weight (packed state)	Approx. 110 g		
Material – Pressure port	Aluminum die-cast		
Material – Case	Heat-resistive ABS		
Accessories	Mounting Bracket, Instruction manual		

*1. The current consumption is approximately 43 mA in energy-saving mode.
*2. Display Example of Digital Indicator

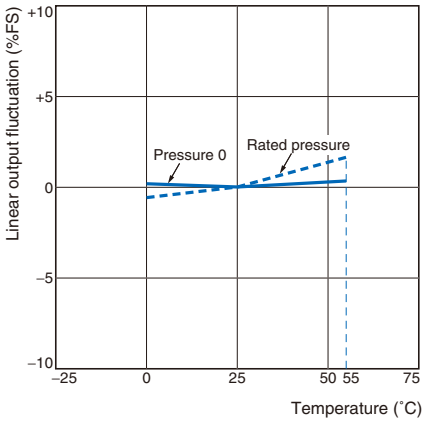
Model	Setting unit: kPa					
	Applied pressure	Digital display				
E8F2-A01C	100	1	0	0	•	0
E8F2-B10C	1000	1	0	0		0
E8F2-AN0C	−101	−1	0	1	•	0

Note: The period (•) in the display indicates the decimal point.
Its position will not change unless the setting unit is changed.

Engineering Data (Typical)

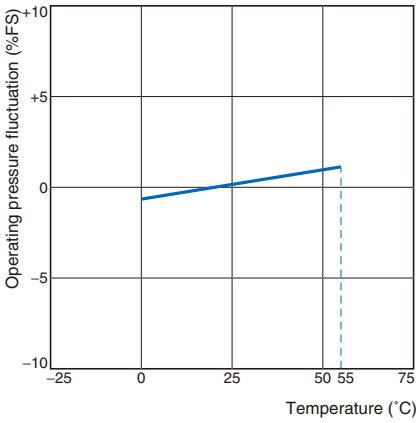
Temperature vs. Linear Output Current Fluctuation

E8F2-A01□



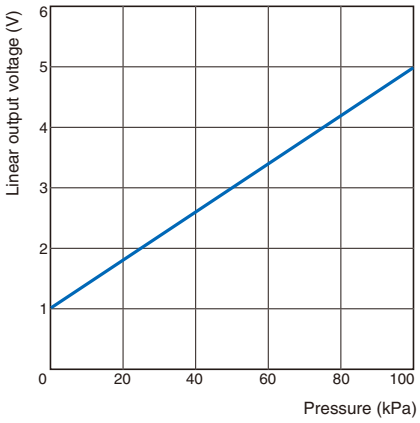
Temperature vs. Operating Pressure Fluctuation

E8F2-A01□



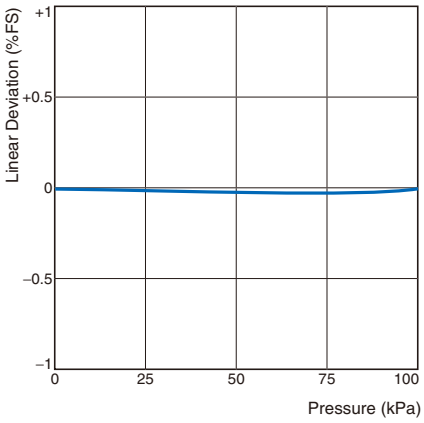
Pressure vs. Linear Output

E8F2-A01□



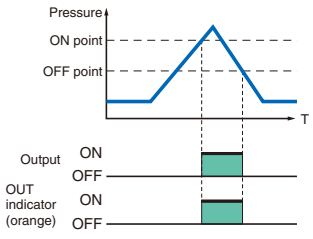
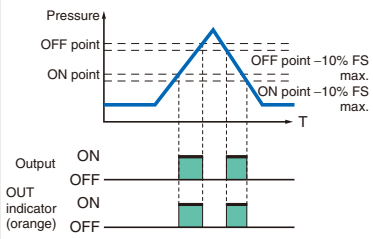
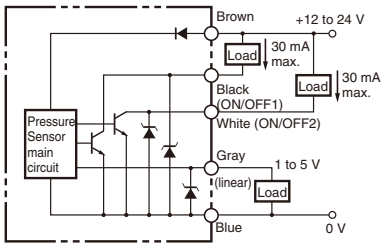
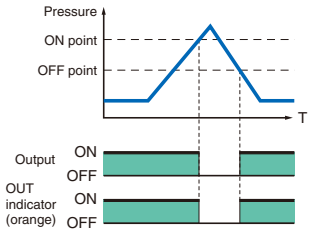
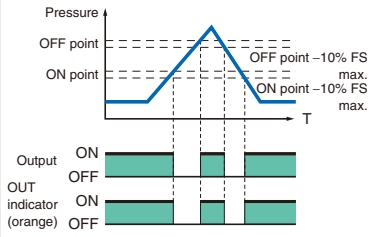
Linearity

E8F2-A01□

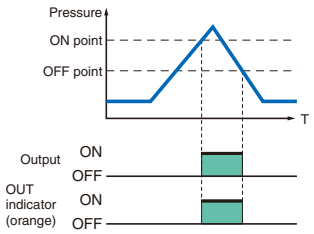
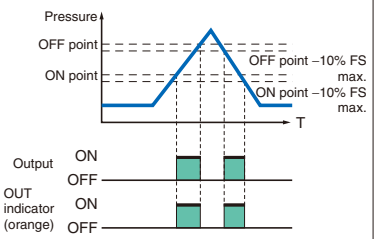
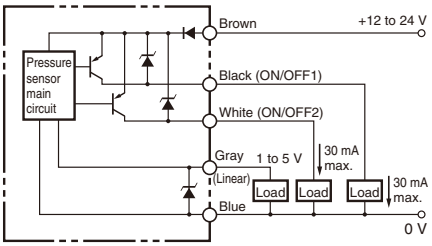
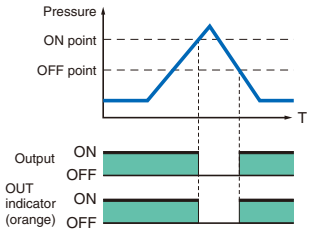
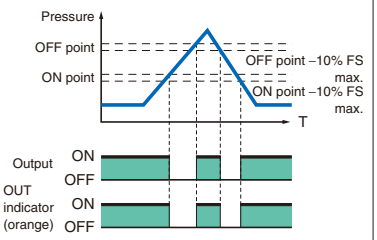


I/O Circuit Diagrams

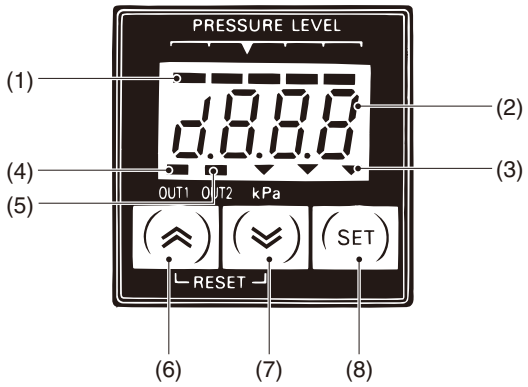
NPN Output

Operating mode	Model	Timing chart: Hysteresis mode	Timing chart: Window mode	Output circuit
NO	E8F2-A01C E8F2-B10C E8F2-AN0C			
NC				

PNP Output

Operating mode	Model	Timing chart: Hysteresis mode	Timing chart: Window mode	Output circuit
NO	E8F2-A01B E8F2-B10B E8F2-AN0B			
NC				

Nomenclature



Display Panel

(1) Bar Indicator (Green)
Indicates the degree of measured pressure in relation to the set pressure.

(2) Numeric and Menu Display (Red)
Indicates measurement values and setting menu items.

(3) Unit indicator (Green)
Indicates the unit used for detection. The unit indicated on the indicator is the one currently set.

(4) OUT1 Indicator (Orange)
Lit when OUT1 is turned ON.

(5) OUT2 Indicator (Orange)
Lit when OUT2 is turned ON.

Operation Keys

(6) ⌃ Up Key, (7) ⌄ Down Key

- Used to select or change the set items, set contents, and set values in setting mode.
- Press either key to check the ON and OFF points in measurement mode. The values are reset by pressing both keys simultaneously.
- Use together with the SET Key for setting the Sensor to a special setting mode or energy-saving mode.

(7) SET Key

- Used for entering the set contents and set values in setting mode.
- Used for setting the Sensor to basic setting mode or pressure setting mode.

Safety Precautions

Refer to *Warranty and Limitations of Liability*.

⚠ WARNING

This product is not designed or rated for ensuring safety of persons either directly or indirectly.

Do not use it for such purposes.

Precautions for Correct Use

Do not use this product in atmospheres or environments that exceed product ratings.

● Installation

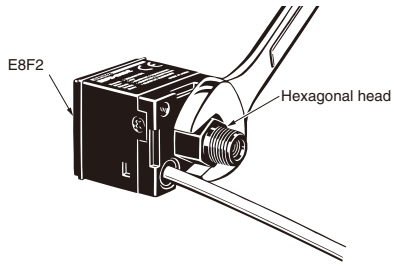
Do not use the Sensor in an environment subject to corrosive or combustible gas.

● Wiring

If no linear output is used, cut the gray lead wire short and apply insulating tape to the lead wire so that it will not come into contact with any other terminal.

● Mounting

- Do not apply a tensile strength in excess of 50 N to the cables or connectors.
- The pressure port (made of aluminum die-cast) is fixed with tapered R(PT) 1/8 male screws and M5 female screws. When using tapered screws, use tapered Rc(PT) 1/8 female screws.
- Wrap the tapered R(PT) 1/8 male screws with sealing tape to prevent any leakage. Tighten the male screws to a torque of 10 N·m max.
- Tighten M5 female screws to a torque of 2 N·m max.
- Tighten each male screw by using a 12-mm wrench to hold its hexagonal head, not its body.



- When attaching the Mounting Bracket to the Sensor, make sure that each M3 screw is tightened to a torque of 0.5 N·m max.

● Adjustments

- Filter the gas with an appropriate air filter so that the applied gas will be free of moisture or oil.
- Be sure to use the Sensor under the rated pressure.
- When setting the set pressure of the ON or OFF point of the output transistor by pressing the mode selection key, use a manometer if precise pressure settings are required. The Sensor has a display error of ±3% FS±1 digit at room temperature. Refer to *Display accuracy* in *Ratings and Specifications*.
- Turning ON the power
  The Sensor is ready to operate 0.5 s after it is turned ON. When the load and Sensor are connected to separate power supplies, be sure to turn ON the Sensor first.

● Others

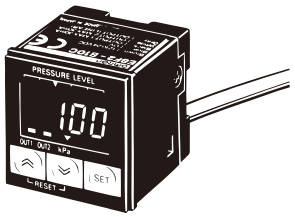
Make sure the Sensor does not get wet.

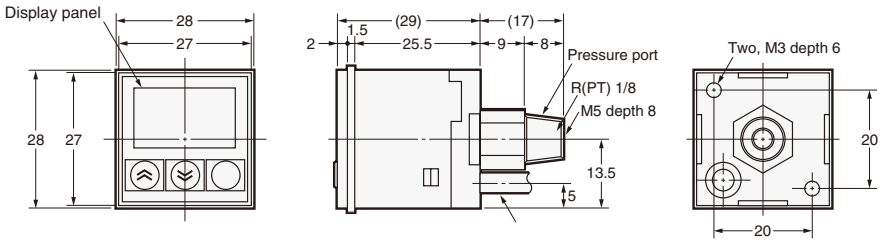
Dimensions

(Unit: mm)

Sensors

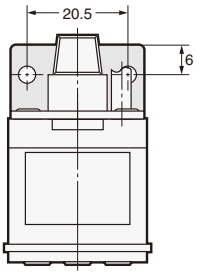
E8F2



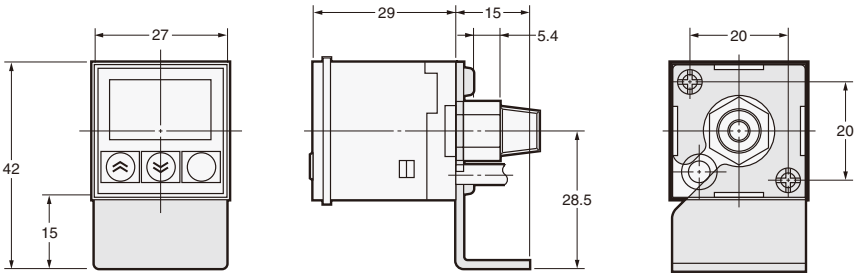


4-dia. vinyl-insulated round cable with 5 conductors
(Conductor cross-section: 0.15 mm^2, Insulator diameter: 0.9 mm),
Standard length: 2 m

With Mounting Bracket Attached



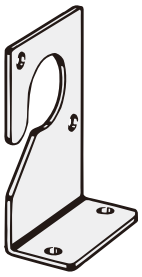
Mounting Hole Dimensions



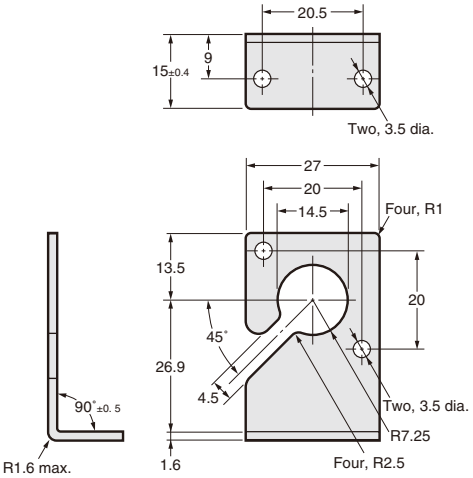
Accessories

Mounting Bracket

E89-F3

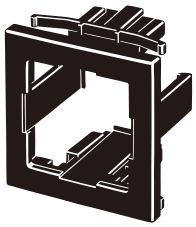


Note: Provided with the E8F2.

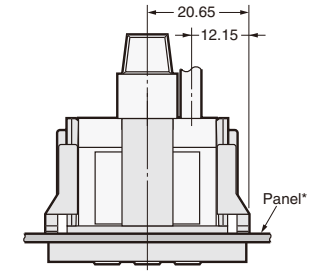


Panel-mounting Bracket

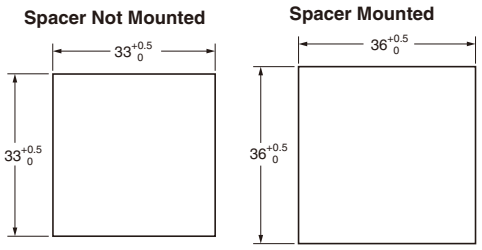
E89-F4

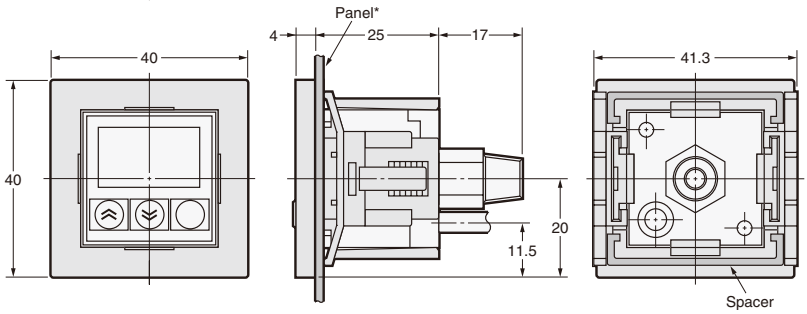


Note: Spacer provided.



Panel Cutout Dimensions





* Applicable panel thickness: 1.2 to 4 mm

Note: The spacer can be removed from the Panel-mounting Bracket. The panel cutout dimensions can be adjusted as shown above by attaching or detaching the spacer.

E8F2

Reading the Digital Display

The E8F2 displays alphanumeric characters, such as measurement values and menu items, on a 7-segment display. Examples are shown below.

Display	Meaning
oPE	Output type: Operation
kPA	Unit: kPa
WID	Width

The following abbreviations are used by the digital display.

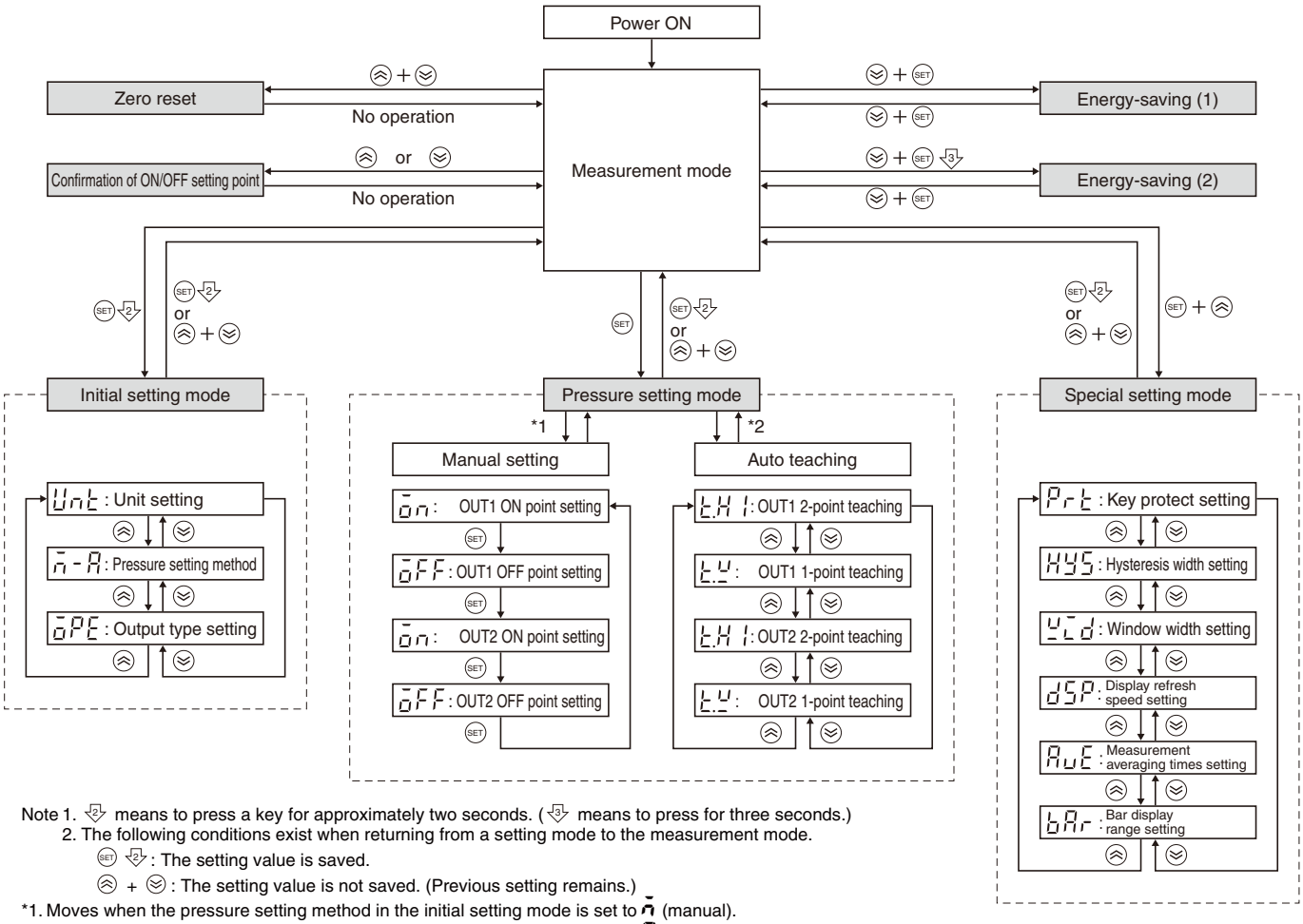
Abbreviation	Meaning
Unt	Unit
M-A	Manual/Auto
OPE	Operation
PRT	Protect
HYS	Hysteresis
WID	Width

Abbreviation	Meaning
DSP	Display
AVE	Average
BAR	Bar
AUT	Auto
ECO	Echo

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

Modes

The E8F2 has a variety of functions in addition to a measurement value display function. These functions are divided in four modes, with the measurement mode branching into three subordinate modes. The relationship among each mode and switching methods is shown in the following figure.

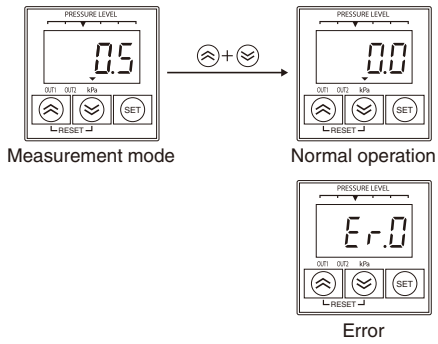


Note 1. ② means to press a key for approximately two seconds. (③ means to press for three seconds.)
2. The following conditions exist when returning from a setting mode to the measurement mode.
(SET) ②: The setting value is saved.
(▲) + (▼): The setting value is not saved. (Previous setting remains.)

*1. Moves when the pressure setting method in the initial setting mode is set to M (manual).
*2. Moves when the pressure setting method in the initial setting mode is set to A (auto teaching).

Zero Reset

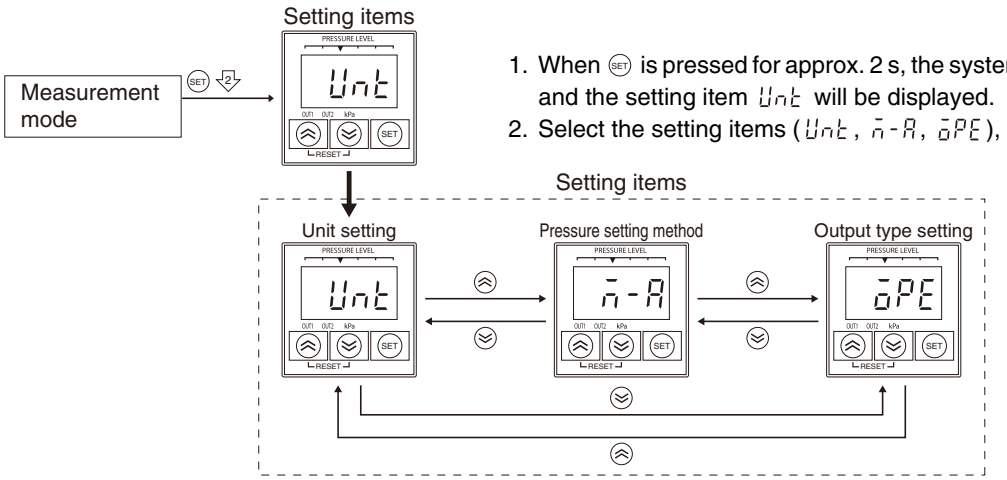
Note: Perform the zero reset with the Sensor open to atmospheric pressure.



Press ▲ and ▼ at the same time to reset the displayed measurement value to zero. The zero reset must be within ±5% FS of the rated pressure. If this range is exceeded, the zero reset will be invalid.

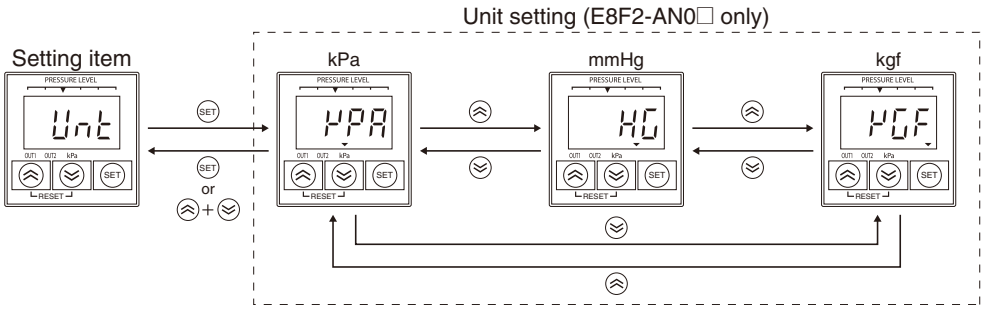
Initial Setting Mode

Set the unit, pressure setting method, and output type in the initial setting mode.



1. When SET is pressed for approx. 2 s, the system will enter initial setting mode, and the setting item Unt will be displayed.
2. Select the setting items (Unt, A-A, oPE), using ▲ and ▼.

Unit Setting (Reference)

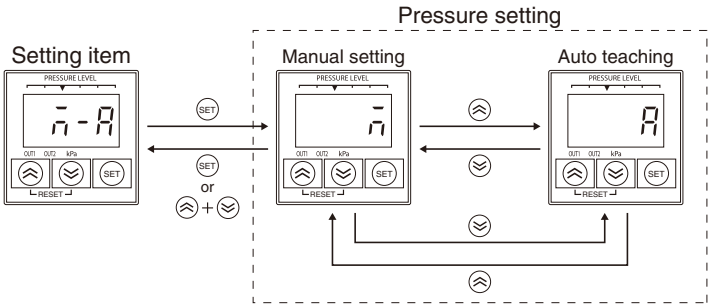


1. Press SET when Unt is displayed, and the set unit will be displayed.
2. Select the unit using ▲ and ▼.
3. Press SET to select the displayed unit, and the system will return to the setting item display (Unt).
4. Press ▲ and ▼ at the same time to return to the setting item display (Unt) without changing the selection.

Note: The unit mmHg can be set only with he E8F2-AN0□.

Note: This menu item is prohibited in Japan due to revisions to the Measurement Law that prohibit the use of non-SI units. Leave the setting at the initial setting of kPA (kPa) and do not change the setting to other units.

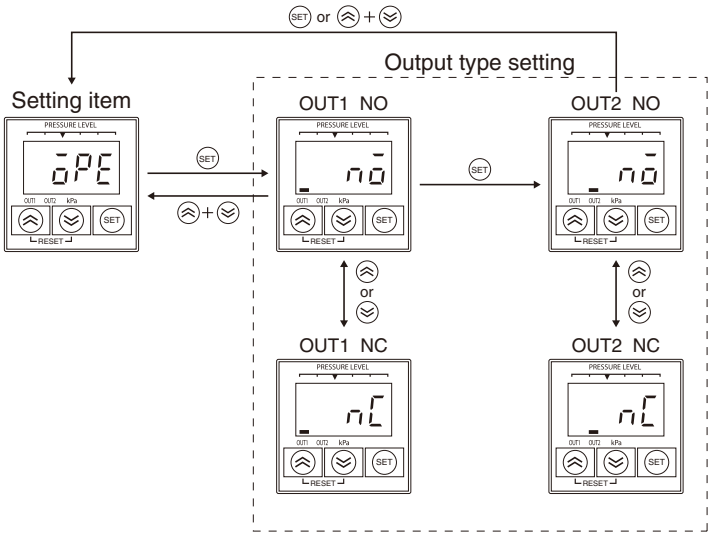
Pressure Setting Method



n : Manual setting (The ON point and OFF point are set manually.)
A : Auto teaching (The ON point and OFF point are automatically set to match the actual object.)

1. Press SET when n-A is displayed, and the set pressure setting method will be displayed.
2. Select the pressure setting method using ▲ and ▼.
3. Press SET to select the displayed pressure setting method, and the system will return to the setting item display (n-A).
4. Press ▲ and ▼ at the same time to return to the setting item display n-A without changing the selection.

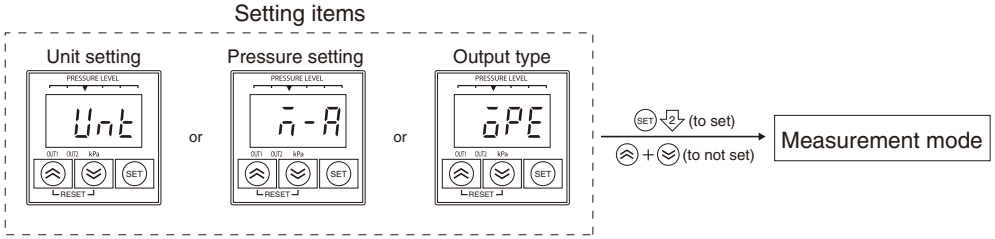
Output Type Setting



no : Normally open
nc : Normally closed

1. Press SET when oPE is displayed, and the set output type for OUT1 will be displayed.
2. Select the output type using ▲ and ▼.
3. Press SET to select the displayed output type, and the set output type for OUT2 will be displayed.
4. Select the output type using ▲ and ▼.
5. Press SET to select the displayed output type for OUT2, and the system will return to the setting item display (oPE).
6. Press ▲ and ▼ at the same time to return to the setting item display (oPE) without changing the selection.

Returning to Measurement Mode

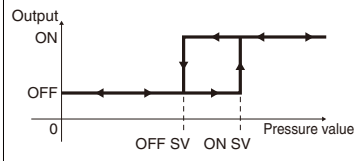
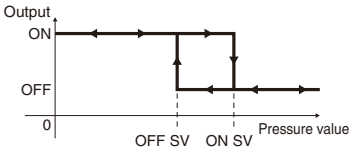
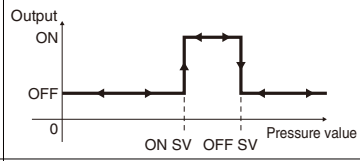
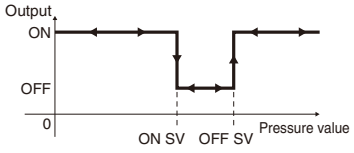


To save the setting:
Press the SET for approx. 2 s when the setting item is displayed.

To not save the setting:
Press ▲ and ▼ at the same time when the setting item is displayed.

Pressure Setting Mode

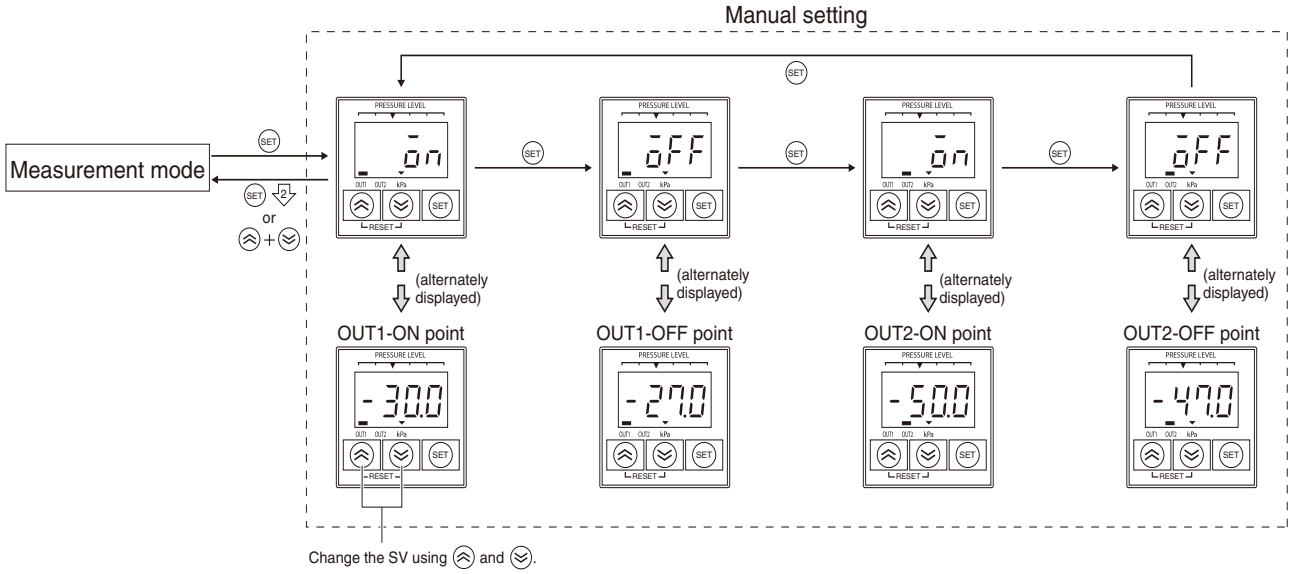
The E8F2 outputs signals based on the measurement values and can be used to control external devices, such as valves and vacuum equipment.
To control external devices, a reference value is set, and settings are made so that the output turns ON if the measurement value exceeds the reference value, and OFF if it falls below the reference value. (This relationship can also be reversed.)
Pressure setting mode is used to set the point at which output turns ON (ON point) and the point at which output turns OFF (the OFF point). There are two setting methods: manual and auto-teaching.
This section describes these setting methods for the ON points and OFF points. (Note: The following description applies when the output type is set to normally open.)
Also, the hysteresis mode and window mode are determined by the relation between the ON point and the OFF point. (Refer to the following table for details.)

Mode	Relation between ON/OFF set values	Operating mode	
		Normally open	Normally closed
Hysteresis mode	ON-point set value > OFF-point set value		
Window mode	ON-point set value < OFF-point set value		
	ON-point set value = OFF-point set value	The output will be unstable. Use hysteresis mode or window mode.	

Note: Standard default settings: ON point = (-)30 kPa, OFF point = (-)27 kPa. Negative values are for the E8F2-AN0C only.

Manual Setting

Note: Manual setting can be performed if $\bar{n}$ is selected for the pressure setting method in the initial settings.



1. Press SET to enter the pressure setting mode, and $\bar{o}n$ and the set ON point for OUT1 will be alternately displayed.
2. Change the ON point (for OUT1) using and .
3. Press SET to select the displayed ON point, and $\bar{o}FF$ and the set OFF point for OUT1 will be alternately displayed.
4. Change the OFF point (for OUT1) using and .
5. Press SET to select the displayed OFF point, and $\bar{o}n$ and the set ON point for OUT2 will be alternately displayed.
6. Change the ON point (for OUT2) using and .
7. Press SET to select the displayed ON point, and $\bar{o}FF$ and the set OFF point for OUT2 will be alternately displayed.
8. Change the OFF point (for OUT2) using and .
9. Press SET to select the displayed OFF point, and $\bar{o}n$ and the set ON point for OUT1 will be alternately displayed.

Returning to Measurement Mode

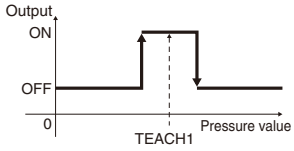
Saving the set value·····Press SET for approx. 2 s. (Valid for any set value display.)
Not saving the set value·····Press and at the same time. (Valid for any set value display.)

Auto Teaching

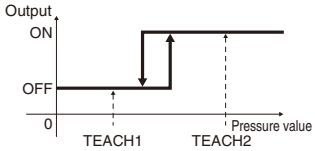
By using auto teaching, measurement values can be input as set values for the ON point and OFF point rather than by using key entry. There are two types of teaching: one-point teaching to set one point and two-point teaching to set two points.

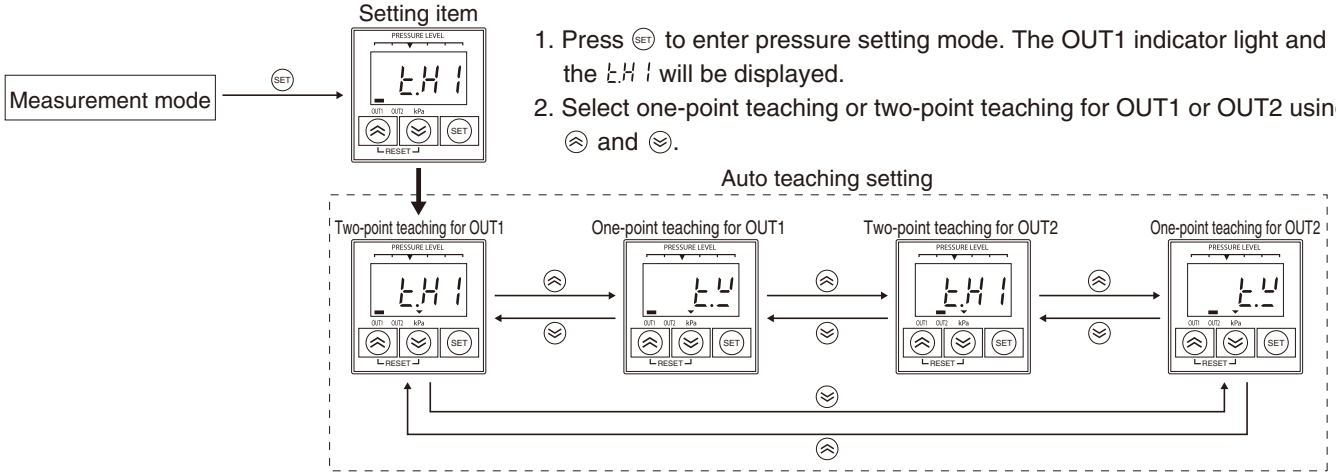
Note: Auto-teaching can be performed if A is selected for the pressure setting method in the initial settings.

One-point Teaching



Two-point Teaching



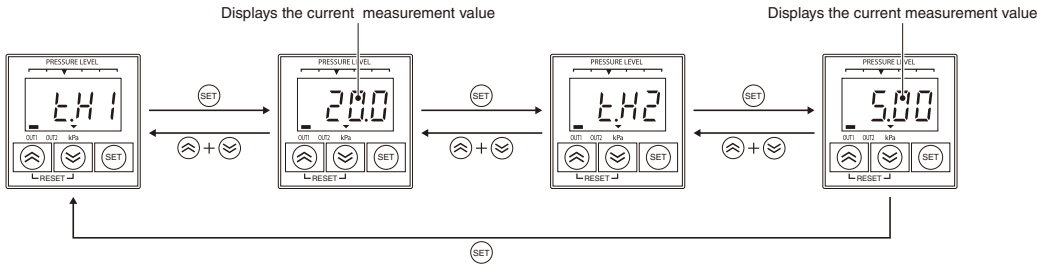


1. Press SET to enter pressure setting mode. The OUT1 indicator light and the t.H1 will be displayed.
2. Select one-point teaching or two-point teaching for OUT1 or OUT2 using ▲ and ▼.

t.H1: Teaching, hysteresis mode, first point
t.U: Teaching, window mode

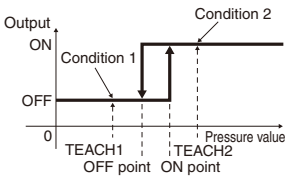
• Two-point Teaching (Hysteresis Mode Teaching)

OUT1



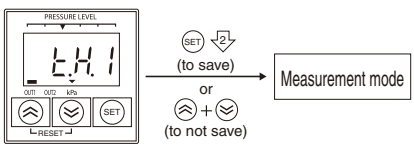
1. Press SET at condition 1 in the following figure when t.H1 is displayed, and the present measurement value will be displayed.
2. Check the measurement value, and press SET. Teaching for the first point will be completed when teaching is executed.
3. Press SET at condition 2 in the following figure to display the present measurement value.

Two-point Teaching



There will be no problem if the order or size of TEACH 1 and TEACH 2 are reversed.

ON point = (TEACH1 + TEACH2) ÷ 2
OFF point = ON point − 3% FS
Default: 3% FS (Can be changed.)



4. Check the measurement value, and press SET. Teaching for the second point will be completed when teaching is executed.
5. Press SET for approx. 2 s when t.H1 is displayed, the set value will be set using teaching, and the system will return to measurement mode.
6. Press ▲ and ▼ at the same time to return to measurement mode without changing the selection.

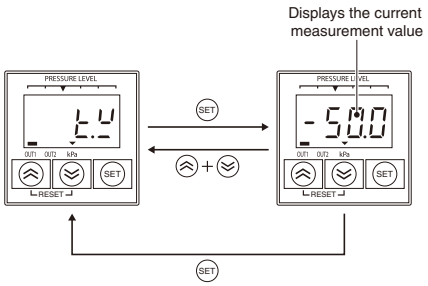
Note: Hysteresis mode will be set automatically if 2-point teaching is performed.

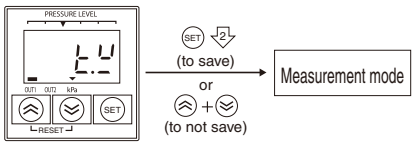
This function is convenient for applications for checking a vacuum pressure.

Auto Teaching

• One-point Teaching (Window Mode Teaching)

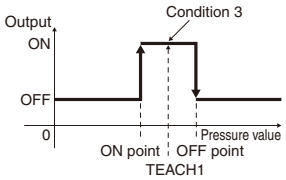
OUT1





1. Press (SET) at condition 3 in the following figure when t.y is displayed, and the present measurement value will be displayed.

One-point Teaching



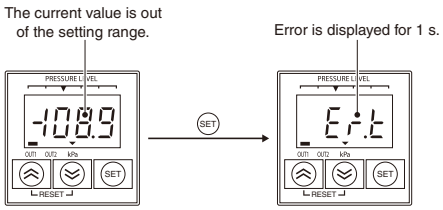
ON point = TEACH1 - 30% FS
OFF point = TEACH1 + 30% FS
Default: 10% FS (Can be changed)

2. Check the measurement value and press (SET). Teaching will be completed when teaching is executed.
3. Press (SET) for approx. 2 s when t.y is displayed. The set value will be set using teaching, and the system will return to measurement mode.
4. Press (▲) and (▼) at the same time to return to measurement mode without changing the selection.

Note: Window mode will be set automatically if 1-point teaching is performed.

This function is convenient for applications to confirm source pressure.

• Teaching Errors

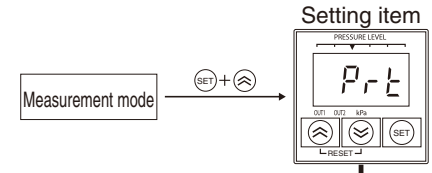


Meaning of display: Er.t (error teaching)

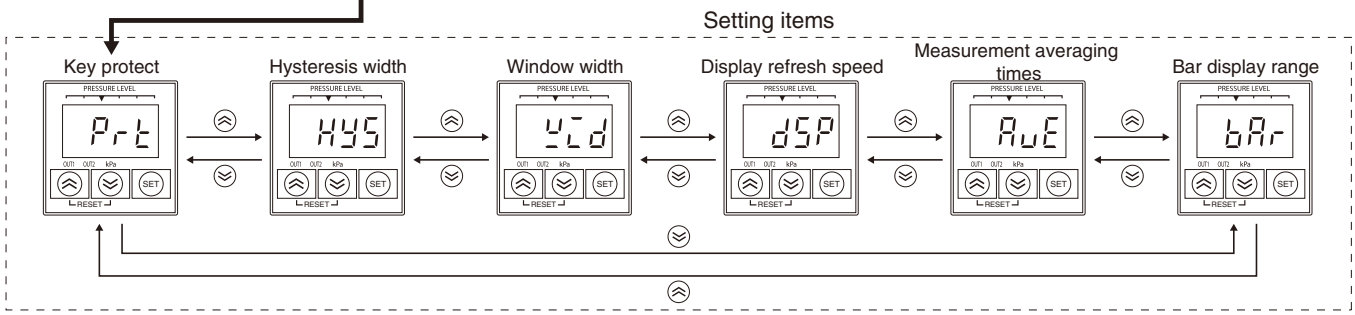
- Pressing (SET) will not be enabled if the present value is outside the setting range or the calculation result after teaching is outside the setting range. In that case, an error message will be displayed for 1 s if teaching is executed.

Special Setting Mode

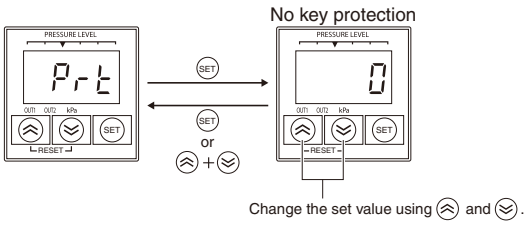
Set the key protection, hysteresis width, window width, display refresh speed, measurement averaging times, and bar display range in special setting mode.



1. Press SET and ▲ at the same time. The system will enter special setting mode, and setting item Prt will be displayed.
2. Select the setting items (Prt, HYS, YCd, dSP, AuE, and bAr) using the ▲ and ▼.



Key Protect Setting



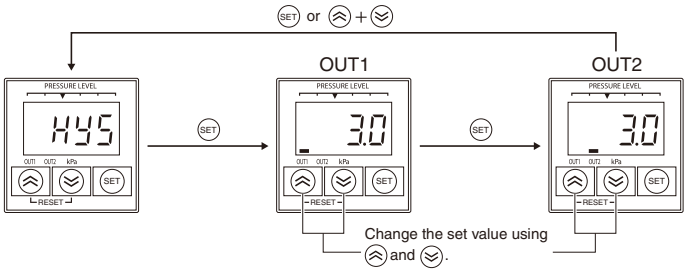
1. Press SET when Prt is displayed, and the set key protect set value will be displayed.
2. Change the set value using ▲ and ▼.
3. Press SET to select the displayed set value, and the system will return to the setting item display (Prt).
4. Press ▲ and ▼ at the same time to return to the setting item display (Prt) without changing the selection.

Key Protection Status

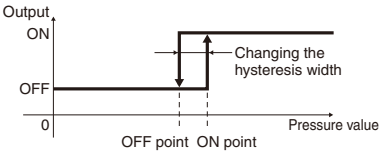
0: No key protection will be set.
1: Initial setting and pressure setting will be prohibited.
2: Moving to any function other than pressure setting confirmation, special settings, and the energy saving function will be prohibited.

Hysteresis Width Setting

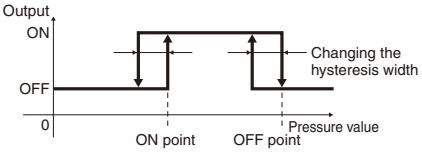
The hysteresis width can be changed as shown in the following figure.
(The hysteresis mode, however, can be changed only if it is set using teaching.)



Hysteresis mode



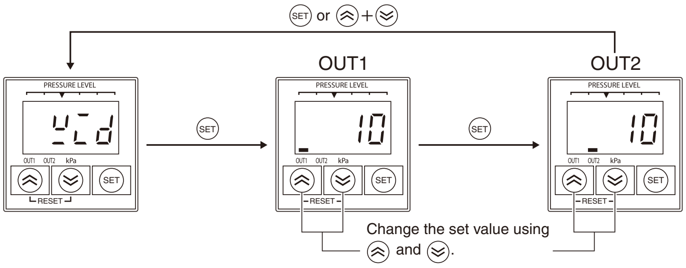
Window mode

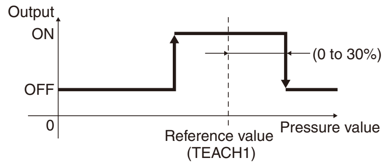


1. Press SET when HYS is displayed, and the hysteresis width set value set for OUT1 will be displayed.
2. Change the set value using ▲ and ▼. The setting range is 0% to 10% FS.
3. Press SET to select the displayed set value, and the hysteresis width set value set for OUT2 will be displayed.
4. Change the set value using ▲ and ▼.
5. Press SET to select the displayed set value, and the system will return to the setting item display (HYS).
6. Press ▲ and ▼ at the same time to return to the setting item display (HYS) without changing the selection.

Note 1. **Hysteresis Mode**
The hysteresis width setting is not valid if the set values were set manually. It is valid only if auto-teaching was used.
Window Mode
The hysteresis width setting is valid for the measurement values.
2. In hysteresis mode, the width between the ON point and OFF point becomes the hysteresis width. It cannot be changed with the hysteresis mode setting.

Window Width Setting



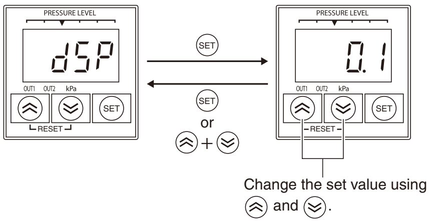


1. Press (SET) when wCd is displayed, and the window set value set for OUT1 will be displayed.
2. Change the set value using ▲ and ▼. The setting range relative to the reference value is 0% to 30% FS.
3. Press (SET) to select the displayed set value, and the window width set value set for OUT2 will be displayed.
4. Change the set value using ▲ and ▼.
5. Press (SET) to select the displayed set value, and the system will return to the setting item display (wCd).
6. Press ▲ and ▼ at the same time to return to the setting item display (wCd) without changing the selection.

Note: This setting is not valid if hysteresis mode is used.

Display Refresh Speed Setting

The following refresh speeds can be set.
0.1: Displays the average of a 0.1-s interval.
0.5: Displays the average of a 0.5-s interval.
1.0: Displays the average of a 1.0-s interval.

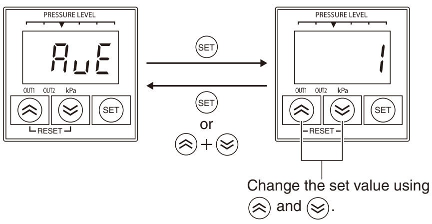


1. Press (SET) when dSP is displayed, and the set value set for the display refresh speed will be displayed.
2. Change the set value using ▲ and ▼.
3. Press (SET) to select the displayed set value, and the system will return to the setting item display (dSP).
4. Press ▲ and ▼ at the same time to return to the setting item display (dSP) without changing the selection.

Note: The number of measurements to average is set with the Measurement Averaging Times Setting (AVE).

Measurement Averaging Times Setting

Any of the following number of measurement times can be set: 1, 8, 32, or 256.

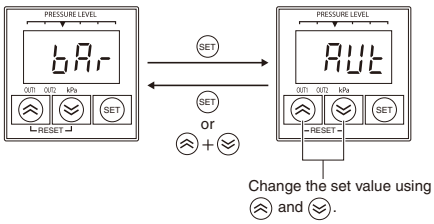


1. Press (SET) when AvE is displayed to display the set value set for the measurement averaging times.
2. Change the set value using ▲ and ▼.
3. Press (SET) to select the displayed number of times, and the system will return to the setting item display (AvE).
4. Press ▲ and ▼ at the same time to return to the setting item display (AvE) without changing the selection.

Note: If the Display Refresh Speed is set to 0.5 s and the Measurement Averaging Times is set to 32, 32 measurements will be averaged as one block and then the block average over 0.5 s will be displayed. This will be repeated every 0.5 s.

Bar Display Range Setting

The setting range for set values is 1% to 20% FS of the display range per bar.
If the setting is AUT, the best display range will be calculated from the set ON point, and that will be used as the set value.



1. Press (SET) when bAr is displayed, and the set value set for the bar display range will be displayed.
2. Change the set value using (▲) and (▼).
3. Press (SET) to select the displayed set value, and the system will return to the setting item display (bAr).
4. Press (▲) and (▼) at the same time to return to the setting item display (bAr) without changing the selection.

Note: The bar display function only for output 1. This setting is valid only in Hysteresis Mode.

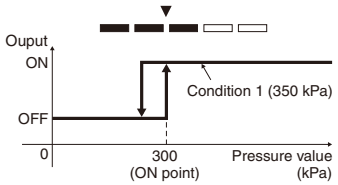
Bar Display

The bar display enables intuitively reading the level of the measured pressure relative to the ON point and OFF point. The bar displays shows data only for OUT1. Also, the display method is different in hysteresis mode and window mode.

• Hysteresis Mode

The size of the present measurement value is expressed using five bars with the point between the second and third bars from the left as the ON point.

1-MPa Model, ON Point: 300 kPa



Display range per bar:

$300\ \text{kPa} \le 1\ \text{MPa} \times \frac{1}{2}$, so,

$300\ \text{kPa} \times \frac{1}{3} = 100\ \text{kPa}$

At condition 1, all three bars on the left will be lit.
The display range per bar will be the set value for the bar display range in the special setting mode. The range will be as follows if the set value is AUt.

If ON point ≤ Rated pressure $\times \frac{1}{2}$:

Display range per bar = ON point $\times \frac{1}{3}$

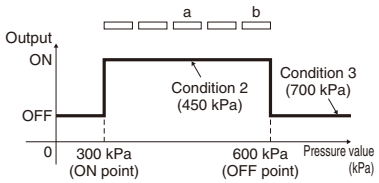
If ON point > Rated pressure $\times \frac{1}{2}$:

Display range per bar = (Rated pressure − ON point) $\times \frac{1}{3}$

• Window Mode

The space between the ON point and the OFF point is divided into five parts, and the position of the present measurement value is expressed using one lit bar. Also, if the measurement value is at or below the ON point or at or above the OFF point, the left and right bars will flash.

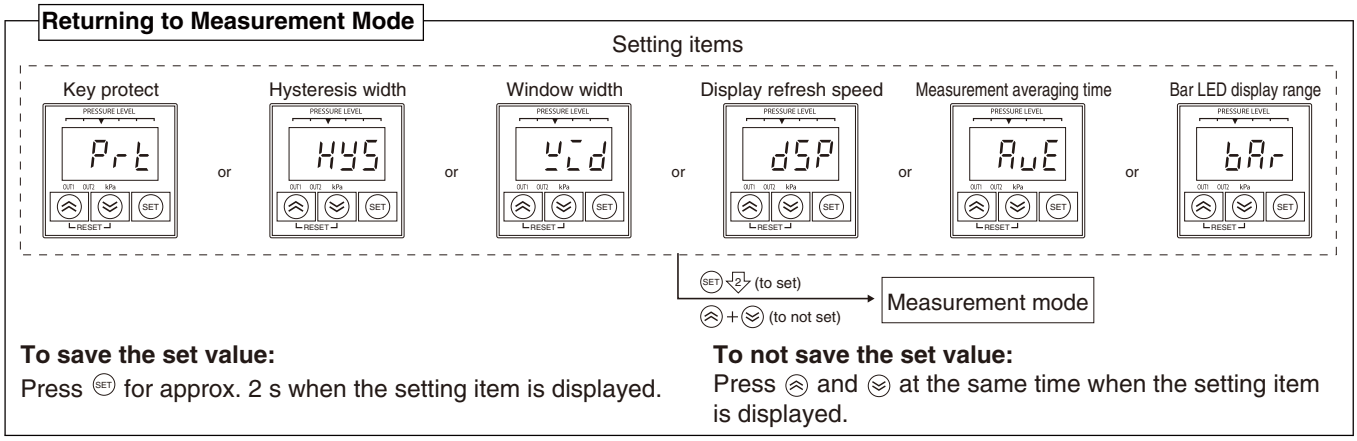
1-MPa Mode, ON Point: 300 kPa, OFF Point: 600 kPa



At condition 2, only bar (a) will be lit.
At condition 3, only bar (b) will be lit.
The display range per bar:
(Difference between ON point and OFF point) $\times \frac{1}{5}$

Note: Setting the bar display range for special setting mode is invalid.

Returning to Measurement Mode



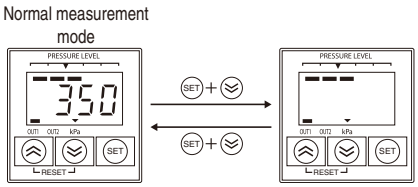
To save the set value:
Press (SET) for approx. 2 s when the setting item is displayed.

To not save the set value:
Press (▲) and (▼) at the same time when the setting item is displayed.

Energy-saving Function

The E8F2 has a function to reduce power consumption by displaying the pressure measurement value with the bars only (i.e., turning OFF the digital display).

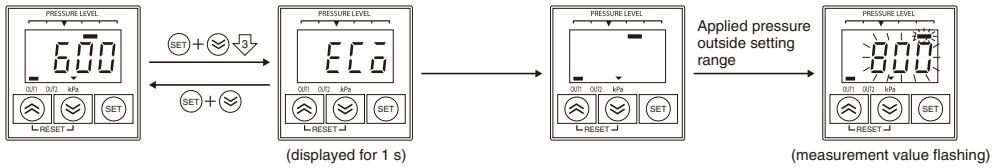
Energy-saving 1



1. Press SET and ⌄⌄ at the same time in measurement mode, to turn OFF the digital display.
2. Press SET and ⌄⌄ again at the same time to return to the normal display.

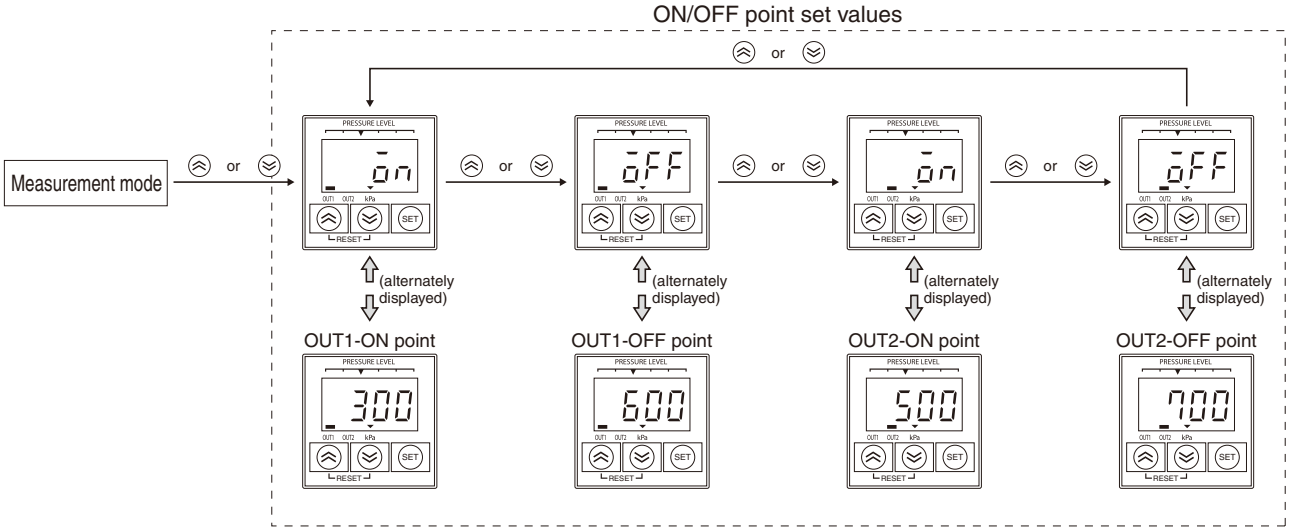
Energy-saving 2

In window mode, the measurement value (digital display) will flash to signify an alarm if the measurement value is outside the setting range.



1. Press SET and ⌄⌄ at the same time for approx. 3 s to display EC0, and after 1 s only the digital display will turn OFF.
2. The digital display will flash along with the bars if the measurement value is at or below the ON point or at or above the OFF point only if the system is set to window mode.
3. Press SET and ⌄⌄ at the same time to return to the normal display.

Confirmation of ON/OFF Point Set Value



The currently set ON point and OFF point can be checked.
Press ⏫ or ⏬ in measurement mode, and ōn and ON point set for OUT1 will be displayed alternately.
Press the buttons again to alternately display ōFF and the OFF point set for OUT1.
After OUT1 is displayed, press ⏫ or ⏬ to proceed to displaying OUT2.
The display will automatically return to the measurement value if there is no key input for approx. 2 s while the set value is displayed.

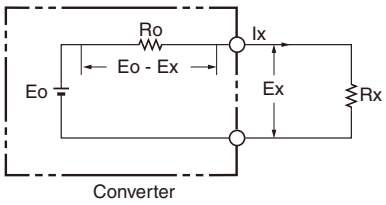
Error Display

LED display	Error	Reset method
Err (flashing)	Sensor error	Contact OMRON.
Er5 (flashing)	Sensor error	
Pressure value flashing	Input upper limit error	Set the applied pressure to the rated pressure or lower.
	Input lower limit error	Do not apply a reverse pressure. Apply pressure within the rated range.
Er.ō	Output load short-circuit	The load is short-circuited or incorrect wiring is causing overcurrent to flow. Check the wiring and attach an appropriate load if required.
Er.t	Teaching input out of range	Perform teaching at pressure within the rated range. If required, change the hysteresis width and window width in special setting mode so that the ON/OFF set values are within the rating.
Er.0	Zero reset error	Set the applied pressure to 0 (i.e., atmosphere released).

Output Impedance

1. Measuring the Output Impedance of Voltage Output Models

Figure 1



Ro : Output impedance
Rx : Load resistance
Eo : Output voltage (terminals open)
Ex : Output voltage (with load Zx connected)
Ix : Load current (with load Zx connected)

In Figure 1, the current (Ix) that flows when the load resistance (Rx) is connected is calculated as follows:

$$Ix = \frac{Ex}{Rx} = \frac{Eo - Ex}{R0} \quad .....(1)$$

The output impedance (Ro) in Equation (1) is calculated as follows:

$$Ro = Rx \left(\frac{Eo - Ex}{Ex} \right) .....(2)$$

The voltage (Eo) is measured when the output is open, followed by the voltage (Ex) when a load resistance (for example, the minimum value of the permitted load resistance of a transducer) is connected. The measured values Eo and Ex and the connected load resistance (Rx) are inserted into Equation 2 to calculate the output impedance (Ro) of the transducer.

2. Measuring the Output Impedance of Current Output Models

In Figure 2, the voltage (Ex) of the output terminals when the load resistance (Rx) is connected is calculated as follows:

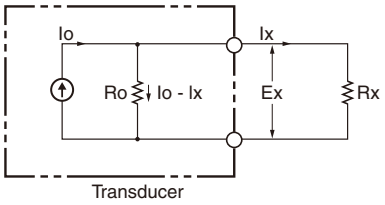
$$Ex = IxRx = (Io - Ix)\,Ro \quad .....(3)$$

The output impedance in Equation (3) is calculated as follows:

$$Ro = Rx \left(\frac{Ix}{Io - Ix} \right) .....(4)$$

Here, the current (Io) is measured with the output short-circuited.

Figure 2



Ro : Output impedance
Rx : Load resistance
Io : Output current (output terminal short-circuited)
Ix : Output current (with load Rx connected)
Ex : Output voltage (with load Rx connected)

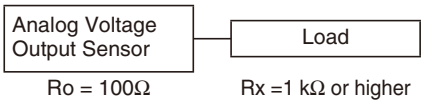
Next, the output current (Ix) is measured when a load resistance (for example, the maximum value of the permitted load resistance of a transducer) is connected. The measured values Io and Ix and the value of the connected load resistance (Rx) are inserted into Equation 4, and the output impedance (Ro) of the transducer is calculated. The output impedance of the transducer introduced here is the value for normal operation.

3. Desirable Output Impedance

In general, it is best to make the output impedance of a voltage output transducer as small as possible, i.e., as close to 0 W as possible, to minimize the effects of load fluctuations on the transducer.
For a current output transducer, the opposite is true: the higher the impedance (the closer to infinite impedance), the better.

4. Example of Calculation Using Impedance

$$\text{Error in analog voltage output} = \left(1 - \frac{Rx}{Ro + Rx} \right) \times 100\%$$



Rx	Error
1kΩ	Approximately 10%
10Ω	Approximately 1%

General Precautions

For precautions on individual products, refer to the *Safety Precautions* in the individual product information.

⚠ WARNING

These products cannot be used in safety devices for presses or other safety devices used to protect human life. These products are designed for use in applications for sensing workpieces and workers that do not affect safety.

Precautions for Safe Use

Withstand Pressure

Do not apply a pressure higher than the rated withstand pressure. Applying a pressure higher than this may cause damage.

Operating Environment

Do not use the products in an environment where there are explosive or inflammable gases.

Power Supply Voltage

Do not use a voltage that exceeds the power supply voltage range. Using a voltage that exceeds the range may cause burning.

Load Short-circuiting

Do not short-circuit the load. Doing so may cause explosion or burning.

Incorrect Wiring

Be sure that the power supply polarity and other wiring is correct. Incorrect wiring may cause explosion or burning.

Precautions for Correct Use

- When using a Sensor that supports non-corrosive gas as the applicable fluid, use an air filter to remove moisture and oil from the gas.
- Do not insert any wire or other object into the pressure port. Doing so may damage the pressure elements and cause a malfunction.
- Do not use the Sensor alongside high-voltage lines or power lines.
- Mount the Sensor so that it is not subject to ultrasonic vibration.
- Do not apply a tensile force higher than 30 N to the cable or connector.
- The cable can be extended to a maximum of 10 m. For details, see the output impedance section on the previous page.

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2007.12

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