# Installation & Maintenance Manual
# Digital Pressure Switch
## *Series ZSE3 / ISE3*

## 1. Safety Instructions

- This manual contains essential information for the protection of users and others from possible injury and/or equipment damage.
- Read this manual before using the product, to ensure correct handling, and read the manuals of related apparatus before use.
- Keep this manual in a safe place for future reference.
- These instructions indicate the level of potential hazard by label of DANGER , WARNING or CAUTION , followed by important safety information which must be carefully followed.
- To ensure safety of personnel and equipment the safety instructions in this manual and the product catalogue must be observed, along with other relevant safety practices.

| | |
|---|---|
| ⚠ **DANGER** | In extreme conditions, there is a possible result of serious injury or loss of life. |
| ⚠ **WARNING** | If instructions are not followed there is a possibility of serious injury or loss of life. |
| ⚠ **CAUTION** | If instructions are not followed there is a possibility of injury or equipment damage. |

### ⚠ WARNING

- **Do not disassemble, modify (including change of printed circuit board) or repair the product.**
  An injury or product failure may result.
- **Do not operate the product beyond the specification range.**
  Fire, malfunction or equipment damage may result. Use the product only after confirming the specifications.
- **Do not use the product in the presence of flammable, explosive or corrosive gas.**
  Fire, explosion or corrosion may result. This product does not have an explosion proof construction.
- **When using the product as part of an interlocking system:**
  1) Provide a double interlocking system, for example a mechanical system.
  2) Check the product regularly to ensure proper operation.
- **Before performing maintenance, be sure of the following:**
  1) Turn off the power supply.
  2) Stop the air supply, exhaust the residual pressure and verify the release of air from the system.

### ⚠ CAUTION

- **Always perform a system check after maintenance.**
  Do not use the product if any error occurs.
  Safety cannot be assured if caused by un-intentional malfunction.
- **Provide grounding to ensure correct operation and to improve noise resistance of the product.**
  This product should be individually grounded using a short cable.
- **Follow the instructions given below when handling the product. Failing to do so may result in product damage.**
  - Maintenance space should always be provided around the product.
  - Do not remove labels from the product.
  - Do not drop, hit or apply excessive shock to the product.
  - Follow all specified tightening torques.
  - Do not bend, apply tensile force, or apply force by placing heavy loads, on the cables.
  - Connect wires and cables correctly, and do not connect while the power is ON.

## 1. Safety Instructions (continued)

- Do not route wires and cables together with power or high-voltage cables.
- Check the insulation of wires and cables.
- Take proper measures against noise, such as noise filters, when the product is incorporated in equipment or devices.
- Select the required protection (IP) rating according to the environment of operation.
- Take sufficient shielding measures when the product is to be used in the following conditions:
  (1) where noise due to static electricity is generated.
  (2) where electro-magnetic field strength is high.
  (3) where radioactivity is present.
  (4) where power lines are located.
- Do not use the product in a place where electric surges are generated.
- Use suitable surge protection when a surge generating load such as a solenoid valve are to be directly driven.
- Prevent any foreign matter from entering this product.
- Do not expose the product to vibration or impact.
- Use the product within the specified ambient temperature range.
- Do not expose the product to any heat radiation.
- Do not clean the product with chemicals such as benzene or thinners.

Follow the instructions given below when handling your digital pressure switch. Otherwise, the switch may be damaged or may fail, thereby resulting in malfunction.

- Do not pull the lead wire with force nor lift the switch by holding the lead wire. (Tensile strength: less than 49N.)
- Connect the terminal FG to ground when using a switching regulator obtained on the commercial market.
- Insert a noise filter (line noise filter and ferrite core or other elements) between the switching regulator and this digital pressure switch when analogue output is used.
- Do not use with corrosive or flammable gas or liquid.
- Do not press the setting buttons with a sharp pointed object.
- Do not rub the LCD indicator during operation (the display may change due to static electricity.)
- When performing piping, tighten the pipe by using a spanner on the hexagon section of the attachment of the digital pressure switch (Do not apply force on the switch body).
- Do not use this digital pressure switch in areas that are exposed to water, oil or chemicals (open-type specification).

### When the 0X or 0XY type (with filter) is used

- If the filter element (ZX1-FE) is clogged, stop operation and replace the element.

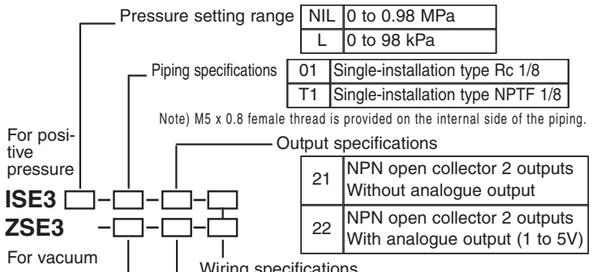
## 2. Specifications

| Model | | | Vacuum ZSE3 |
|---|---|---|---|
| Rated Pressure Range | | | 0 to -101 kPa |
| Minimum Setting Unit | | | 1 kPa |
| Fluid | | | Air, non-corrosive gas |
| Maximum Operating Pressure | | | 200 kPa (Note 1) |
| Power Supply Voltage | | | 12 to 24 Vdc (Ripple ±10 % or less) |
| Current Consumption | | | 25 mA or less |
| Switch Output | | | NPN open collector output |
| | Maximum Load Current | | 80 mA |
| | Maximum Applied Voltage | | 30 Vdc |
| Response Time | | | 5 ms. |
| Repeatability | | | ±1 %F.S. or less |
| Analogue Output (Note 2) | | | Voltage output: 1 to 5 V±5 %, Output impedance: Approx. 1 kΩ |
| Hysteresis (Note 4) | Hysteresis Mode | | Variable (0 digits or more) |
| | Window Comparator Mode | | Fixed ( 3 digits) |
| Display Method | | | 3 1/2 digits LCD (character height 5 mm). |
| Indicator Light (Note 3) | | | Lit when ON (OUT1: Green OUT2: Red) |
| Self-diagnosis Function | | | Detection of overcurrent, overpressure, data error, and pressure during 0 clear |
| Error Indication | | | Indicator: Red LED flashes. Error code displayed on LCD. |
| Temperature Characteristic | | | ±3 %F.S. or less |
| Environmental | Enclosure | | IP40 |
| | Ambient Temperature Range | | 0 to 60℃ (No condensation or freezing) |
| | Withstand Voltage | | Between external terminal and case: 1000 Vac 50/60 Hz for 1 min. |
| | Insulation Resistance | | Between external terminal and case: 2 MΩ (by 500 Vdc M) |
| | Vibration Proof | | 10 to 500 Hz 2 hours each in X, Y, and Z directions, at 10 to 500 Hz with amplitude of 1.5 mm or acceleration 98m/s², whichever smaller. |
| | Impact Proof | | 980m/s², 3 times each in X, Y, and Z directions |
| Standard | | | CE marked |
| Port Size | | | Rc1/8, M5 x 0.8, NPT F1/8, M5 x 0.8, M5 x 0.8 with suction filter, M6 x 1 (made to order) |
| Lead Wire | | Connector type | Heat resistant vinyl wire ϕ1.55 0.31 mm² 4-wire |
| | | Grommet type | Oil resistant vinyl heavy-duty cable -21,-23:ϕ3.5 0.14 mm² 4-core -22,-24:ϕ3.5 0.15 mm² 5-core |
| Weight | | | 40 g (including lead wire 0.6 m) |

| Model | | | Positive Pressure 100kPa ISE3L | Positive Pressure 1MPa ISE3 |
|---|---|---|---|---|
| Rated Pressure Range | | | 0 to 98 kPa | 0 to 0.98 MPa |
| Minimum Setting Unit | | | 1 kPa | 0.01 MPa |
| Fluid | | | Air, non-corrosive gas | |
| Maximum Operating Pressure | | | 200 kPa (Note 1) | 1 MPa |
| Power Supply Voltage | | | 12 to 24 Vdc (Ripple ±10 % or less) | |
| Current Consumption | | | 25 mA or less | |
| Switch Output | | | NPN open collector output | |
| | Maximum Load Current | | 80 mA | |
| | Maximum Applied Voltage | | 30 Vdc | |
| Response Time | | | 5 ms. | |
| Repeatability | | | ±1 %F.S. or less | |
| Analogue Output (Note 2) | | | Voltage output: 1 to 5 V ±5 %, Output impedance: Approx. 1 kΩ | |
| Hysteresis (Note 4) | Hysteresis Mode | | Variable (0 digits or more) | |
| | Window Comparator Mode | | Fixed ( 3 digits) | |
| Display Method | | | 3 1/2 digits LCD (character height 5 mm). | |
| Indicator Light (Note 3) | | | Lit when ON (OUT1: Green OUT2: Red) | |
| Self-diagnosis Function | | | Detection of overcurrent, overpressure, data error, and pressure during 0 clear | |
| Error Indication | | | Indicator: Red LED flashes. Error code displayed on LCD. | |
| Temperature Characteristic | | | ±3 %F.S. or less | |
| Environmental | Enclosure | | IP40 | |
| | Ambient Temperature Range | | 0 to 60℃ (No condensation or freezing) | |
| | Withstand Voltage | | Between external terminal and case: 1000 Vac 50/60 Hz for 1 min. | |
| | Insulation Resistance | | Between external terminal and case: 2 MΩ (by 500 Vdc M) | |
| | Vibration Proof | | 10 to 500 Hz 2 hours each in X, Y, and Z directions, at 10 to 500 Hz with amplitude of 1.5 mm or acceleration 98m/s², whichever smaller. | |
| | Impact Proof | | 980m/s², 3 times each in X, Y, and Z directions | |
| Standard | | | CE marked | |
| Port Size | | | Rc1/8, M5 x 0.8, NPTF 1/8, M5 x 0.8 | |
| Lead Wire | | Connector type | Heat resistant vinyl wire ϕ1.55 0.31 mm² 4-wire | |
| | | Grommet type | Oil resistant vinyl heavy-duty cable -21:ϕ3.5 0.14 mm² 4-core -22:ϕ3.5 0.15 mm² 5-core | |
| Weight | | | 40 g (including lead wire 0.6 m) | |

Note 1) When vacuum is used, there is no influence on the switch even if 0.5 MPa of pressure is supplied instantaneously.
Note 2) Only for the pressure switch with analogue output selected.
Note 3) In case of ZSE3-□ -23 or 24, failure predictive output: Red.
Note 4) Window Comparator Mode : Since the hysteresis is 3 digits, P1 should be separated from P2 by 7 digits or more. 1 digit is the minimum setting unit (See the table above).

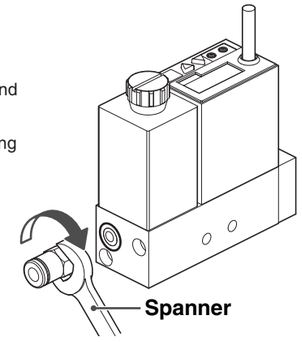
## 3. How to Order




## 4. Installation

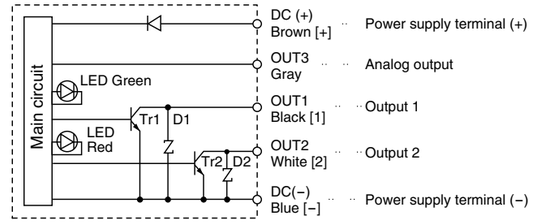
### Piping connection

- Connect the digital pressure switch to the piping with a hexagon socket head plug and a fitting.
- The tightening torque for piping port must be 8.8N•m or less.




### Wiring connection

- Be sure to turn off the power supply before performing connection work.
- Incorrect wiring will lead to digital pressure switch breakdown, failure or malfunction. Be sure to confirm the wire colour and terminal number before wiring.



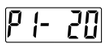

Note) The symbol shown in [ ] means the pin assignment of connector connection type.

## 5. Functions Setting

### 2-output Type

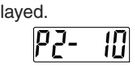
**1. Set value input mode**
Press the "SET" button to display "P1-20 (*1)".
The output OUT1 (1) set value input mode is selected.
(*1: If the set value of P1 is -20).


**2. OUT1 (1) set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.



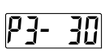

**3.** Press the "SET" button to save the set value and select OUT1 (2) set value input mode. The set value of P2 is displayed.

**4. OUT1 (2) set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.



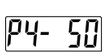

**5.** Press the "SET" button to save the set value and select OUT2 (1) set value input mode.
The set value of P3 is displayed.

**6. Output OUT2 (1) set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.




**7.** Press the "SET" button to save the set value and select OUT2 (2) set value input mode.
The set value of P4 is displayed.

**8. Output OUT2 (2) set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.



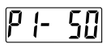

**9.** Press the “SET” button to save the set value and exit this mode.

Note) P1: Set value for OUT1 (1) P2: Set value for OUT1 (2)
P3: Set value for OUT2 (1) P4: Set value for OUT2 (2)

### 1-output Type With the Failure Predictive Function

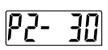
**1. Set value input mode**
Press the "SET" button to display "P1-50(*1)".
The output OUT1 (1) set value input mode is selected.
(*1: If the set value of P1 is -50.)


**2. OUT1 (1) set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.



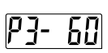

**3.** Press the "SET" button to save the set value and select the output OUT1 (2) set value input mode.
The set value of P2 is displayed.

**4. OUT1 (2) set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.



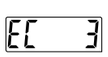

**5.** Press the "SET" button to save the set value and select the failure predictive pressure set value input mode.
The failure predictive set value is displayed.

**6. Failure predictive pressure set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.




**7.** Press the "SET" button to save the set value and select the failure predictive count set value input mode.
The failure predictive count set value is displayed.

**8. Failure predictive count set value input**
Pressing the ▲ button increases the set value.
Pressing the ▼ button decreases the set value.

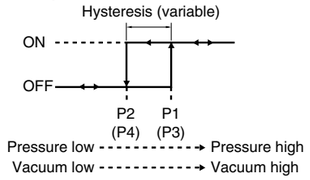



**9.** Press the “SET” button to save the set value and exit this mode.

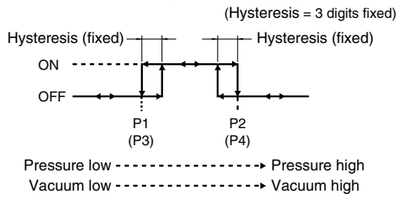
Note) P1: Set value for OUT1 (1) P2: Set value for OUT1 (2)
P3: Set value for failure predictive pressure
P4: Set value for failure predictive count

### Output Method

**Hysteresis mode (P1 P2, P3 P4)**



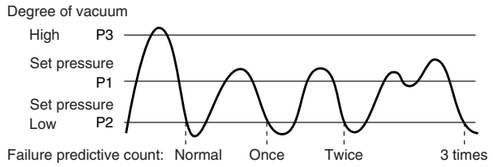

**Window comparator mode (P1<P2,P3<P4)**




Note)
- Hysteresis mode (same as for positive pressure use)
  When the value of hysteresis is set to 2 digits or less, the switching output might chatter due to fluctuation of the input pressure around its set point.
- Window comparator mode (same as for positive pressure use)
  Since the hysteresis will be 3 digits, separate P1 from P2 (in case of 2-output type, same as for P3 and P4) by 7 digits or more.

* 1 digit is the minimum setting unit.

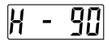
### Failure Predictive Function




The failure predictive detection counter is incremented when the switch is turned on then is turned off, without the pressure (exceeding P1) not reaching the failure predictive pressure (P3).
The failure predictive detection output is energized when the set failure predictive counter (EC) is incremented consecutively. When the switch is turned ON and the pressure (exceeding P1) exceeds the failure predictive pressure (P3), the failure predictive counter is reset. (This example shows a case in the hysteresis mode.)

## 6. Other Functions

### Peak Hold Mode




Pressing the ▲(UP) button when pressure is displayed enables the upper limit peak value (value with a high degree of vacuum) to be held. In this case, "H" is displayed on the LCD. To reset holding, press the ▲(UP) button again.

### Bottom Hold Mode


Pressing the ▼(DOWN) button when pressure is displayed enables the lower limit peak value (value with low vacuum) to be held. In this case "d" is displayed on the LCD. To return holding, press the ▼(DOWN) button again.

### Reset Function


Pressing the RESET button causes the following:

**1) Measurement mode**
- Zero adjustment
- Clearing the peak hold mode or bottom hold mode
- Clearing the failure predictive function internal counter
- Resetting the failure predictive output

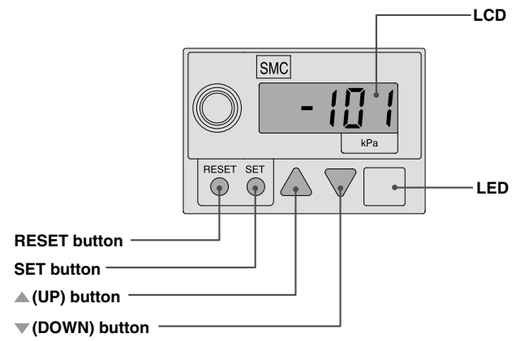
**2) Upon error occurrence**
- The data set in the setting mode is retained as is and the state when the power supply was turned on is restored (System reset is triggered).
- In case of a data error, the setting mode is selected. When you finish setting, the state when the power supply was turned on is restored (System reset is triggered).

Note) In the set value input mode, the reset function does not work.

## 7. Names / Functions of Individual Parts

### Main Unit

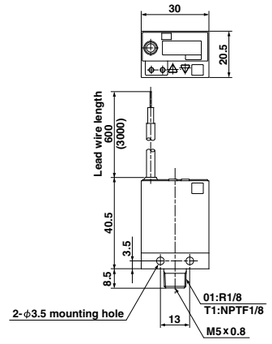
| | |
|---|---|
| RESET button | : Resets at error occurrence and for 0 clear of the display. |
| SET button | : Switches the setting mode and enters the set value. |
| LCD | : Displays pressure value, setting mode, and error code. |
| LED | : The green LED lights up when output OUT1 is ON. The red LED lights up when output OUT2 is ON. When both OUT1 and OUT2 are ON, both the green and red LEDs light up. Upon error occurrence, the red LED flashes. |
| ▲ (UP) button | : Switches to the peak display mode and increases the ON/OFF set value. |
| ▼ (DOWN) button | : Switches to the bottom display mode and decreases the ON/OFF set value. |



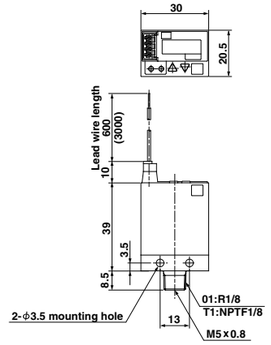

## 8. Outline dimensions (mm)

### Dimensions

Grommet Type
IZSE3-01T1-□

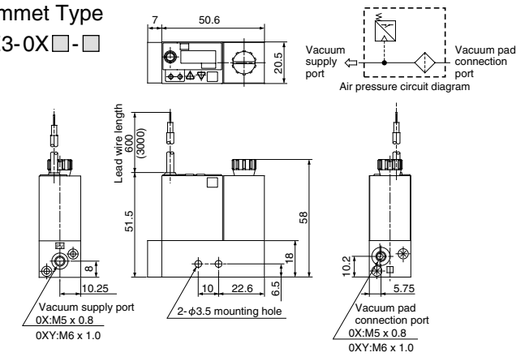



Connector Type
IZSE3-01T1-□C

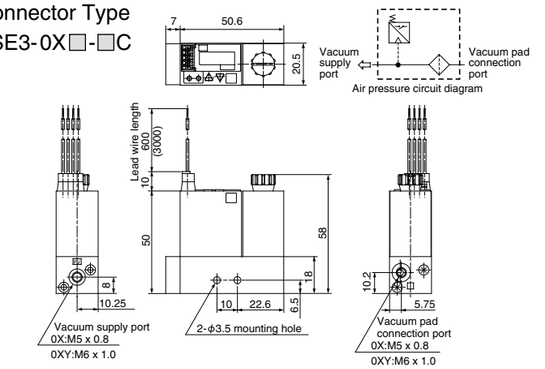



### Single-installation Type

Grommet Type
ZSE3-0X□-□



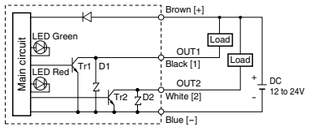

Connector Type
ZSE3-0X□-□C



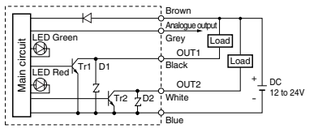
## 9. Internal Circuit and Wiring

### Output Specification

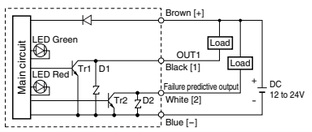
-21
Switch Output
NPN open collector output
2 outputs
Max. 30 V, 80 mA



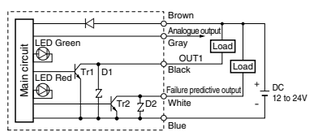

-22
Switch Output
NPN open collector output
2 outputs
Max. 30 V, 80 mA
Analogue output 1 to 5V
(±5%F.S.)
Output impedance: Approx. 1 kΩ




-23
Switch Output
NPN open collector output
1 output
Max. 30 V, 80 mA
Failure predictive output
NPN open collector output
1 output




-24
Switch Output
NPN open collector output
1 output
Max. 30 V, 80 mA
Failure predictive output
NPN open collector output
1 output
Analogue Output (±5 %F.S)
1 to 5V (±5 %F.S.)
Output impedance: Approx. 1 kΩ

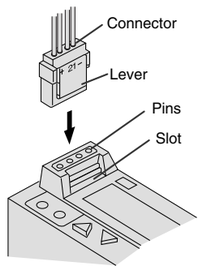



### Connector Connecting

- When connecting a connector, insert the connector straight by tightly holding its lever and body and lock it, making sure the lever hook is securely locked into the groove of the housing.

### Connector Disconnecting

- When disconnecting the connector, pull it straight away from the housing by pressing the lever and removing the lever hook from the groove.



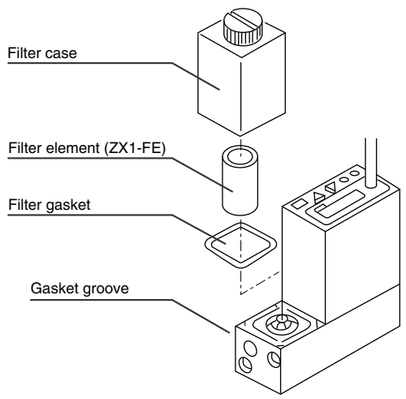

## 10. Maintenance

### Replacement of Filter Elements

If filter element clogging causes deterioration of the absorption force or slows the response time, stop operation and replace the filter element.

### Filter Element product number : ZX1-FE

Confirm that the filter gasket is seated in the groove before reassembling the parts.




### Filter Case

- The case is made of polycarbonate. Therefore, do not use it in an environment that is exposed to chemicals such as thinner, carbon tetrachloride, chloroform, acetic ester, aniline, cyclohexane, trichloroethylene, sulfuric acid, lactic acid, or water-soluble cutting oil (alkalinic).

### Connector Wiring

**Crimping of Lead Wire and Socket**

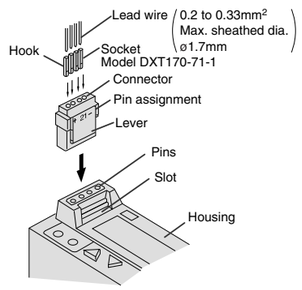
Strip 3.2 to 3.7 mm from the tip of the lead wire and fit a crimp using the recommended crimping tool. Then insert the core wires carefully into a socket.
Ensure that the cover of the lead wire does not enter the wire crimping area (Crimping tool: model no. DXT170-75-1).

**Attachment of Socket with Lead Wire**

Insert a socket into the square hole in the connector (+, 1, 2, – indication provided).
Holding by the lead wire, push it all the way in until the hook on the socket catches and locks in the seat of the connector. (When the lead wire is pushed in, the hook opens and locks it automatically.) Then pull the lead wire gently to confirm that it is locked.

**Removal of Socket with Lead Wire**

To remove a socket from the connector, pull the lead wire out while pressing in the socket's hook using a bar with a thin end (approximately 1 mm). If the socket is to be re-used, open the hook outward.




## 11. Error Indication

When an error occurs, take actions as follows.

| Error Display | Error Nature | Troubleshooting Method |
|---|---|---|
| E1 dE | The set data has been changed by some means. | Press the RESET button and set all data again. |
| E2 CE1 | Load of OUT1 has short-circuited and overcurrent has occurred. | Turn off the power supply and replace the load connected to the OUT1 (black wire). |
| E2 CE2 | Load of OUT2 has short-circuited and overcurrent has occurred. | Turn off the power supply and replace the load connected to the OUT2 (white wire). |
| E3 PE | Pressure exceeding 0.5 MPa has been applied (In case of positive pressure, pressure exceeding the rated pressure has been applied.) | Lower the pressure to 0.5 MPa or less. (In case of positive pressure, lower the pressure to the rated pressure or less.) |
| E4 HP | Compared with the ambient pressure, ±0.07 MPa (in case of 1 MPa use) or ±7 kPa or more (in case of vacuum use or 100 kPa use) has been applied during 0 clear. | After adjusting the pressure to the ambient pressure, perform RESET operation. |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