Contents

1. Introduction .............................................................................................. 1-1
   ■ Regarding This Manual ........................................................................... 1-1
   1.1 Safe Use of This Product ................................................................. 1-1
   1.2 Warranty ............................................................................................. 1-2
   1.3 ATEX Documentation ........................................................................ 1-3

2. Connection ............................................................................................... 2-1
   2.1 Connecting the BT200 ................................................................. 2-1
   2.2 Communication Line Requirements ............................................... 2-1
   2.3 Power Supply Voltage and Load Resistance .................................... 2-2
   2.4 Integral Indicator Display When Powering On ............................... 2-2

3. Operation .................................................................................................. 3-1
   3.1 BT200 Operating Procedures ...................................................... 3-1
      3.1.1 Key Layout and Screen Display ............................................. 3-1
      3.1.2 Operating Key Functions ....................................................... 3-1
         (1) Alphanumeric Keys and Shift Keys ..................................... 3-1
         (2) Function Keys ........................................................................ 3-2
      3.1.3 Calling Up Menu Addresses Using the Operating Keys .......... 3-3
      3.1.4 Printout (for BT200 printer option) ..................................... 3-3
         (1) Printout of All Parameters ................................................... 3-3
         (2) Printout by Menu Item ......................................................... 3-3
   3.2 Setting Parameters Using the BT200 ............................................ 3-4
      3.2.1 Parameter Usage and Selection ............................................. 3-4
      3.2.2 Menu Tree ................................................................................. 3-5
      3.2.3 Setting Parameters ................................................................. 3-6
         (1) Tag No. Setup ........................................................................ 3-6
         (2) Calibration Range Setup .................................................... 3-6
         (3) Damping Time Constant Setup ....................................... 3-7
         (4) Output Mode and Integral Indicator Display Mode Setup ...... 3-8
         (5) Output Signal Low Cut Mode Setup .................................. 3-8
         (6) Integral Indicator Scale Setup ............................................. 3-9
         (7) Unit Setup for Displayed Temperature .................................. 3-11
         (8) Operation Mode Setup ......................................................... 3-11
         (9) Impulse Line Connection Orientation Setup ...................... 3-11
(10) CPU Failure Burnout Direction and Hardware Write Protect .......................... 3-11
(11) Software Write Protect ............................................................................. 3-12
(12) Output Status Setup when a Hardware Error Occurs ................................. 3-13
(13) Bi-directional Flow Measurement Setup ..................................................... 3-13
(14) Range Change while Applying Actual Inputs .............................................. 3-13
(15) Sensor Trim .............................................................................................. 3-14
(16) Test Output Setup ...................................................................................... 3-17
(17) Signal Characterizer .................................................................................. 3-17
(18) Process Alarm ........................................................................................... 3-18
(19) Status Output (option code AL) .................................................................. 3-18
(20) Capillary Fill Fluid Density Compensation ................................................ 3-19
(21) Adjustment Information and User Memo Fields ........................................ 3-20

3.3 Displaying Data Using the BT200 ................................................................ 3-20
   3.3.1 Displaying Measured Data .................................................................... 3-20
   3.3.2 Display Transmitter Model and Specifications ......................................... 3-21

4. Self-diagnostics ............................................................................................. 4-1
   4.1 Checking for Problems .............................................................................. 4-1
      4.1.1 Identifying Problems with BT200 ......................................................... 4-1
      4.1.2 Checking with Integral Indicator ......................................................... 4-2
   4.2 Alarms and Countermeasures .................................................................. 4-2

5. Parameter Summary ....................................................................................... 5-1

Appendix 1. Safety Instrumented Systems Installation ........................................ A1-1
   A1.1 Scope and Purpose .................................................................................. A1-1
   A1.2 Using the Transmitter for an SIS Application ............................................ A1-1
      A1.2.1 Safety Accuracy ................................................................................ A1-1
      A1.2.2 Diagnostic Response Time ................................................................. A1-1
      A1.2.3 Setup ................................................................................................ A1-1
      A1.2.4 Required Parameter Settings ............................................................. A1-1
      A1.2.5 Proof Testing ..................................................................................... A1-1
      A1.2.6 Repair and Replacement ................................................................. A1-2
      A1.2.7 Startup Time ..................................................................................... A1-2
      A1.2.8 Firmware Update ............................................................................. A1-2
      A1.2.9 Reliability Data ................................................................................ A1-2
      A1.2.10 Lifetime Limits ............................................................................... A1-2
      A1.2.11 Environmental Limits ..................................................................... A1-2
      A1.2.12 Application Limits ........................................................................ A1-2
   A1.3 Definitions and Abbreviations ................................................................. A1-3
      A1.3.1 Definitions ...................................................................................... A1-3
      A1.3.2 Abbreviations ................................................................................ A1-3

Revision Information
1. Introduction

Thank you for purchasing the DPharp EJX series pressure transmitter/EJA series pressure transmitter ("transmitter").

The transmitters are precisely calibrated at the factory before shipment. To ensure both safety and efficiency, please read this manual carefully before operating the instrument.

This manual describes the BRAIN protocol communication functions of the transmitter and explains how to set the parameters for the transmitters using the BT200 handheld terminal. For information on the installation, wiring, and maintenance of the transmitters, please refer to the user’s manual of each model.

WARNING

When using the transmitter in a Safety Instrumented Systems (SIS) application, refer to Appendix 1 in this manual. The instructions and procedures in the appendix must be strictly followed in order to maintain the designed safety integrity of the transmitter.

Regarding This Manual

- This manual should be provided on to the end user.
- The contents of this manual are subject to change without prior notice.
- All rights reserved. No part of this manual may be reproduced in any form without Yokogawa’s written permission.
- Yokogawa makes no warranty of any kind with regard to this manual, including, but not limited to, implied warranty of merchantability and fitness for a particular purpose.
- If any question arises or errors are found, or if any information is missing from this manual, please inform the nearest Yokogawa sales office.
- The specifications covered by this manual are limited to those for the standard type under the specified model number break-down and do not cover custom-made instruments.
- Please note that changes in the specifications, construction, or component parts of the instrument may not immediately be reflected in this manual at the time of change, provided that postponement of revisions will not cause difficulty to the user from a functional or performance standpoint.
- The following safety symbols are used in this manual:

WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT

Indicates that operating the hardware or software in this manner may damage it or lead to system failure.

NOTE

Draws attention to information essential for understanding the operation and features.

1.1 Safe Use of This Product

For the safety of the operator and to protect the instrument and the system, please be sure to follow this manual’s safety instructions when handling this instrument. If these instructions are not heeded, the protection provided by this instrument may be impaired. In this case, Yokogawa cannot guarantee that the instrument can be safely operated. Please pay special attention to the following points:
<1. Introduction>

(a) Installation

- This instrument may only be installed by an engineer or technician who has an expert knowledge of this device. Operators are not allowed to carry out installation unless they meet this condition.
- With high process temperatures, care must be taken not to burn yourself by touching the instrument or its casing.
- Never loosen the process connector nuts when the instrument is installed in a process. This can lead to a sudden, explosive release of process fluids.
- When draining condensate from the pressure detector section, take appropriate precautions to prevent the inhalation of harmful vapors and the contact of toxic process fluids with the skin or eyes.
- When removing the instrument from a hazardous process, avoid contact with the process fluid and the interior of the meter.
- All installation shall comply with local installation requirements and the local electrical code.

(b) Wiring

- The instrument must be installed by an engineer or technician who has an expert knowledge of this instrument. Operators are not permitted to carry out wiring unless they meet this condition.
- Before connecting the power cables, please confirm that there is no current flowing through the cables and that the power supply to the instrument is switched off.

(c) Operation

- Wait 10 min. after the power is turned off, before opening the covers.

(d) Maintenance

- Please carry out only the maintenance procedures described in this manual. If you require further assistance, please contact the nearest Yokogawa office.
- Care should be taken to prevent the build up of dust or other materials on the display glass and the name plate. To clean these surfaces, use a soft, dry cloth.

(e) Modification

- Yokogawa will not be liable for malfunctions or damage resulting from any modification made to this instrument by the customer.

1.2 Warranty

- The warranty shall cover the period noted on the quotation presented to the purchaser at the time of purchase. Problems occurring during the warranty period shall basically be repaired free of charge.
- If any problems are experienced with this instrument, the customer should contact the Yokogawa representative from which this instrument was purchased or the nearest Yokogawa office.
- If a problem arises with this instrument, please inform us of the nature of the problem and the circumstances under which it developed, including the model specification and serial number. Any diagrams, data and other information you can include in your communication will also be helpful.
- The party responsible for the cost of fixing the problem shall be determined by Yokogawa following an investigation conducted by Yokogawa.
- The purchaser shall bear the responsibility for repair costs, even during the warranty period, if the malfunction is due to:
  - Improper and/or inadequate maintenance by the purchaser.
  - Malfunction or damage due to a failure to handle, use, or store the instrument in accordance with the design specifications.
  - Use of the product in question in a location not conforming to the standards specified by Yokogawa, or due to improper maintenance of the installation location.
  - Failure or damage due to modification or repair by any party except Yokogawa or an approved representative of Yokogawa.
  - Malfunction or damage from improper relocation of the product in question after delivery.
  - Reason of force majeure such as fires, earthquakes, storms/floods, thunder/lightening, or other natural disasters, or disturbances, riots, warfare, or radioactive contamination.
1.3 ATEX Documentation

This section is only applicable to the countries in the European Union.
2. Connection

The BRAIN communication signal is superimposed onto the 4 to 20 mA DC analog signal. Since the modulated wave is a communication signal, superimposing it on the normal signal will, from basic principles, cause no error in the DC component of the analog signal. Thus, monitoring can be performed via the BT200 while the transmitter is on-line.

2.1 Connecting the BT200

**IMPORTANT**
Analog output may change temporally in connecting with BRAIN terminal due to an initial current flowed to it. To prevent communication signal affecting the upper system, it is recommended to install a low-pass filter (approximately 0.1s).

Connection to the transmitter with the BT200 can be made by either connecting to the BT200 connection hooks in the transmitter terminal box or by connecting to a relaying terminal or a terminal board.

2.2 Communication Line Requirements

[Protocol specification] Yokogawa original protocol

[Modulation] Burst modulation
  0: 2400Hz
  1: Signal without carrier

[Baud rate] 1200bps

[Communication signal]
  host to device: +/- 0.5V (load resistance 250Ω)
  device to host: +/- 2mA

![Figure 2.2](F0202.ai)  
**Figure 2.2** Communication Line Requirements

![Figure 2.1](F0201.ai)  
**Figure 2.1** Connecting the BT200
2.3 Power Supply Voltage and Load Resistance

When configuring the loop, make sure that the external load resistance is within the range in the figure below.

(Note) With an intrinsically safe transmitter, external load resistance includes safety barrier resistance.

![Graph showing the relationship between power supply voltage and external load resistance.]

Figure 2.3 Relationship between Power Supply Voltage and External Load Resistance

2.4 Integral Indicator Display When Powering On

For models with the integral indicator code “D”, the display shows all segments in the LCD and then changes to the displays shown below sequentially.

![Display sequence showing all segments, model name, and communication protocol.]

NOTE

For output signal code “D”, this function is available for software revision 2.02 or later. Software revision can be checked by the parameter M15: SOFT REV. Refer to section 3 “Operation” how to call up the parameter.

NOTE

LCD display can be set to all segments display only by the parameter I41: POWER ON INF.

<table>
<thead>
<tr>
<th>ON</th>
<th>Show All segments display, Model name and Communication Protocol when powering on.</th>
</tr>
</thead>
<tbody>
<tr>
<td>OFF</td>
<td>Show All segments display when powering on.</td>
</tr>
</tbody>
</table>

Refer to section 3 “Operation” how to call up the parameter.
3. **Operation**

The transmitter is equipped with BRAIN communications capabilities, so that range changes, Tag No. setup, monitoring of self-diagnostic results, and zero point adjustment can be handled remotely via the BT200 BRAIN TERMINAL, the FieldMate Versatile Device Management Wizard or the CENTUM CS console. This section describes procedures for setting parameters using the BT200. For further information on the BT200, see the BT200 User’s Manual (IM 01C00A11-01E).

**IMPORTANT**

Communication signal is superimposed on analog output signal. It is recommended to set a low-pass filter (approximately 0.1s) to the receiver in order to reduce the output effect from communication signal. Before online-communication, confirm that communication signal does not give effect on the upper system.

### 3.1 BT200 Operating Procedures

#### 3.1.1 Key Layout and Screen Display

Figure 3.1 shows the arrangement of the operating keys on the BT200 keypad, and figure 3.2 shows the BT200 screen.

---

**Figure 3.1 ** BT200 Key Layout

**Figure 3.2 ** BT200 Screen

#### 3.1.2 Operating Key Functions

1. **Alphanumeric Keys and Shift Keys**

   Use the alphanumeric keys in conjunction with the shift keys to enter numbers, symbols, and alphabetic characters.

   a. **Entering Numbers, Symbols, and Spaces**

   Simply press the alphanumeric keys.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Key-in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>4</td>
</tr>
<tr>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

---

IM 01C25T03-01E
b. Entering Alphabetic Characters

Press either the left or right shift key and then an alphanumeric key to enter the desired alphabetic character. The shift key must be pressed each time an alphabetic character is entered.

- Letter on left side of the alphanumeric key
- Letter on right side of the alphanumeric key

<table>
<thead>
<tr>
<th>Entry</th>
<th>Key-in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>加</td>
</tr>
<tr>
<td>L</td>
<td>加</td>
</tr>
<tr>
<td>J. B</td>
<td>加</td>
</tr>
</tbody>
</table>

Use the function key [F2] CAPS to select uppercase and lowercase (for alphabetic characters only). The case toggles between uppercase and lowercase each time [F2] CAPS is pressed.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Key-in sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boy</td>
<td>to lower case</td>
</tr>
<tr>
<td></td>
<td>(B)</td>
</tr>
</tbody>
</table>

Use the function key [F1] CODE to enter symbols. The following symbols will appear in sequence, one at a time, at the cursor each time [F1] CODE is pressed:

/ . - , + * ( ' & % $ # " !

To enter characters next to these symbols, press [>] to move the cursor.

<table>
<thead>
<tr>
<th>Entry</th>
<th>Key-Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>l/m</td>
<td>symbol command</td>
</tr>
</tbody>
</table>
3.1.3 Calling Up Menu Addresses Using the Operating Keys

The utility screen contains the following items:
1. BT200 ID settings
2. Security code settings
3. Switching language of messages (Japanese or English)
4. LCD contrast setting
5. Adjusting printout tone (BT200-P00 only)

3.1.4 Printout (for BT200 printer option)

(1) Printout of All Parameters
Select 4. PRINT ALL DATA from the function screen to output a list of all parameters. It takes about 10 minutes to complete the printout.

(2) Printout by Menu Item
To printout the parameters for a specific screen, push the function key corresponding to screen's PRNT.
3.2 Setting Parameters Using the BT200

3.2.1 Parameter Usage and Selection

Before setting a parameter, please see the following table for a summary of how and when each parameter is used.

Table 3.1 Parameter Usage and Selection

<table>
<thead>
<tr>
<th>Setup item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tag No. setup</td>
<td>Sets the Tag No. (using 16 alphanumeric characters).</td>
</tr>
<tr>
<td>Calibration range setup</td>
<td>Sets the calibration range for 4 to 20 mA DC. Sets the following items: range unit, input value at 4 mA DC (LRV), input value at 20 mA DC (URV), and decimal point position. Note: LRV and URV can be specified with range value specifications up to 5 digits (excluding any decimal point) within the range of –32000 to 32000.</td>
</tr>
<tr>
<td>Damping time constant setup</td>
<td>Adjusts the output response speed for 4 to 20 mA DC at amplifier. Can be set from 0.50 to 100.00 s. (from 0.00 to 100.00 s with quick response mode on)</td>
</tr>
<tr>
<td>Output and integral indicator display mode setup</td>
<td>Sets modes for output signal and integral indicator to Linear mode (proportional to input differential pressure) or to Square root mode (proportional to flow).</td>
</tr>
<tr>
<td>Output signal low cut mode setup</td>
<td>Used mainly to stabilize output near 0% if the output signal is square root mode. Two modes are available: forcing output to 0% for input below a specific value, or changing to proportional output for input below a specific value.</td>
</tr>
<tr>
<td>Integral indicator display function</td>
<td>Available from the following 5 types of integral indicator scale ranges and units: input pressure, % of range, user set scale, input static pressure, % of static pressure range, and alternating among any four of the above. Configure the following when using the user set scale; user set scale setting, unit (BT200 only), display value at 4 mA DC (LRV), and display value at 20 mA DC (URV). Note: LRV and URV can be specified with range value specifications up to 5 digits (excluding any decimal point) within the range of –32000 to 32000.</td>
</tr>
<tr>
<td>Static pressure setup</td>
<td>Sets the parameters concerned with static pressure such as unit, calibration range, upper and lower range values, decimal point position, damping time constant.</td>
</tr>
<tr>
<td>Unit setup for displayed temperature</td>
<td>Sets the unit for temperatures displayed on the BT200.</td>
</tr>
<tr>
<td>Operation mode (normal/reverse signal) setup</td>
<td>Reverses the direction for 4 to 20 mA DC output relative to input. Reverse mode is used for applications in which safety requires that output be driven toward 20 mA if input is lost.</td>
</tr>
<tr>
<td>Impulse line connection orientation (higher pressure on right/left side) setup</td>
<td>Used where installation conditions make it imperative to connect high pressure side impulse line to low pressure side of transmitter. Reversal of orientation should be dealt with by reversing impulse line wherever possible. Use this function only where there is no alternative.</td>
</tr>
<tr>
<td>CPU Failure burnout direction and hardware write protect</td>
<td>Displays the status of 4 to 20 mA DC output when a CPU fails. The direction is selectable by the hardware switch on the amplifier. It also physically prevents parameter access.</td>
</tr>
<tr>
<td>Software write protect</td>
<td>Configured data can be protected by setting a password.</td>
</tr>
<tr>
<td>Output status setup when a hardware error occurs</td>
<td>Sets the status of the 4 to 20 mA DC output when an abnormal status is detected with the capsule or the amplifier as the result of self-diagnosis. Either the last held, high limit, or low limit values status, can be selected.</td>
</tr>
<tr>
<td>Bi-directional flow measurement</td>
<td>Used to measure bi-directional flows. Output at zero flow is 12 mA DC, with output range equally divided between forward and reverse flow. Can be used with square root mode.</td>
</tr>
<tr>
<td>Range change while applying actual inputs</td>
<td>Range for 4 to 20 mA DC signal is set with actual input applied. Sets 20 mA DC output precisely with respect to user’s reference instrument output. Note that the transmitter is calibrated with high accuracy before shipment, so span should be set using the normal range setup.</td>
</tr>
<tr>
<td>Sensor trim</td>
<td>Adjusts zero point and span of the sensor.</td>
</tr>
<tr>
<td>Test output (fixed current output) setup</td>
<td>Used for loop checks. Output can be set freely from –2.50% to 110.00% in 0.01% steps.</td>
</tr>
<tr>
<td>Signal characterizer</td>
<td>Used to compensate the output for the non-linear application.</td>
</tr>
<tr>
<td>Process alarm</td>
<td>Used for alarm generation on the integral indicator.</td>
</tr>
<tr>
<td>Status output</td>
<td>Outputs an on/off digital signal based on the settings of process alarm.</td>
</tr>
<tr>
<td>Capillary fill fluid density compensation</td>
<td>Compensates the zero shift by the ambient temperature effect on the capillary tubes.</td>
</tr>
<tr>
<td>User memo fields</td>
<td>Allows user to enter up to 3 items, each containing any combination of up to 16 alphanumeric characters.</td>
</tr>
</tbody>
</table>
### 3. Operation

#### 3.2.2 Menu Tree

**A: DISPLAY**

- A10: OUTPUT
- A11: PRES
- A15: OUTPUT mA
- A16: ENGR. OUTPUT
- A17: ENGR. EXP
- A20: SP %
- A21: SP*
- A22: CAPSULE TEMP
- A60: SELF CHECK

**B: SENSOR TYPE**

- B10: MODEL
- B11: STYLE NO.
- B20: PRES URL
- B21: PRES URL
- B22: P MIN SPAN
- B30: SP URL *
- B31: SP URL *
- B32: SP MIN SPAN *
- B60: SELF CHECK

**C: BASIC SETUP**

- C10: TAG NO.
- C20: PRES UNIT
- C21: PRES LRV
- C22: PRES URV
- C23: PRES POINT
- C30: AMP DAMPING
- C40: OUTPUT MODE
- C60: SELF CHECK

**D: AUX SET 1**

- D10: MODEL
- D11: STYLE NO.
- D20: PRES LRV
- D21: PRES URV
- D22: P MIN SPAN
- D30: SP LRV *
- D31: SP URV *
- D32: SP MIN SPAN *
- D60: SELF CHECK

**E: AUX SET 2**

- E10: T. ZERO CMP
- E11: TEMP ZERO
- E30: BI DIRE MODE
- E50: DO SELECT *2
- E51: DO SIG. TYPE *2
- E52: D OUTPUT *2
- E60: SELF CHECK

**F: ALARM SET**

- F10: P AL MODE
- F11: P HI. AL VAL
- F12: P LO. AL VAL
- F20: SP AL MODE *
- F21: SP HI. AL VAL *
- F22: SP LO. AL VAL *
- F50: AUTO RECOVER
- F60: SELF CHECK

**G: AUTO SET**

- G10: P AL MODE
- G11: P HI. AL VAL
- G12: P LO. AL VAL
- G20: SP AL MODE *
- G21: SP HI. AL VAL *
- G22: SP LO. AL VAL *
- G30: T AL MODE
- G31: T HI. AL VAL
- G32: T LO. AL VAL
- G50: AUTO RECOVER
- G60: SELF CHECK

**H: CHARACTERIZR**

- H10: AUTO P LRV
- H11: AUTO P URV
- H20: AUTO SP LRV *
- H21: AUTO SP URV *
- H60: SELF CHECK

**I: DISP SET**

- I09: ADJ UNIT
- I10: ADJ PRES
- I12: P SPAN ADJ
- I13: P ZERO ADJ
- I15: P ZERO DEV
- I16: P SPAN DEV
- I20: ADJ SP*
- I21: SP ZERO ADJ *
- I22: SP SPAN ADJ *
- I25: SP ZERO DEV *
- I26: SP SPAN DEV *
- I40: OUTPUT 4mA
- I45: AMP TEMP
- I50: ADJ WHO
- I51: ADJ DATE
- I52: ADJ LOC
- I53: ADJ DESC
- I55: EXT ZERO ADJ
- I60: CLEAR ADJ
- I60: SELF CHECK

**J: ADJUST**

- J09: ADJ UNIT
- J10: ADJ PRES
- J12: P SPAN ADJ
- J13: P ZERO ADJ
- J15: P ZERO DEV
- J16: P SPAN DEV
- J20: ADJ SP *
- J21: SP ZERO ADJ *
- J22: SP SPAN ADJ *
- J25: SP ZERO DEV *
- J26: SP SPAN DEV *
- J40: OUTPUT 4mA
- J45: AMP TEMP
- J50: ADJ WHO
- J51: ADJ DATE
- J52: ADJ LOC
- J53: ADJ DESC
- J55: EXT ZERO ADJ
- J60: SELF CHECK

**K: TEST**

- K10: OUTPUT X %
- K40: DO TEST *1
- K41: DO TEST *2
- K45: DO TEST *3
- K50: TEST MAX
- K51: TEST MIN
- K52: TEST KEY1
- K53: TEST KEY2
- K54: TEST KEY3
- K55: TEST KEY4
- K60: SELF CHECK

**M: DEVICE INFO**

- M10: SERIAL NO.
- M11: MFTR. DATE
- M12: EXTRN NO.
- M15: SOFT REV
- M16: BRAIN REV
- M17: MEMO1
- M18: MEMO2
- M19: MEMO3
- M20: ISO MATL
- M21: FILL FLUID
- M22: GASKET MATL
- M23: PRO CON MATL
- M24: D-VENT MATL
- M25: PRO CON TYPE
- M26: RS ISO MATL
- M27: PRO CON SIZE
- M28: NUM RS
- M29: RS FILL FLID
- M30: RS TYPE
- M50: MS CODE 1
- M51: MS CODE 2
- M52: MS CODE 3
- M53: MS CODE 4
- M54: MS CODE 5
- M55: MS CODE 6
- M60: SELF CHECK

**P: RECORD**

- P10: ERROR REC 1
- P11: ERROR REC 2
- P12: ERROR REC 3
- P13: ERROR REC 4
- P50: REC CLEAR
- P60: SELF CHECK

**T: CHARACTERIZR**

- T10: S. C. ENABLE
- T11: NUM OF POINT
- T20: X START (FIX)
- T21: Y START (FIX)
- T22: X1
- T23: Y1
- T24: X2
- T25: Y2
- T26: X3
- T27: Y3
- T28: X4
- T29: Y4
- T30: X5
- T31: Y5
- T32: X6
- T33: Y6
- T34: X7
- T35: Y7
- T36: X8
- T37: Y8
- T38: X9
- T39: Y9
- T40: X END (FIX)
- T41: Y END (FIX)
- T60: SELF CHECK

---

*1: Available for differential pressure transmitter.

*2: Available for EJX series only.

*3: Available for software revision 2.02 or later.

Software revision can be checked by the parameter M15: SOFT REV.
3.2.3 Setting Parameters
Set or change the parameters as necessary. After completing these, do not fail to use the “DIAG” key to confirm that “GOOD” is displayed for the self-diagnostic result at _60: SELF CHECK.

(1) Tag No. Setup
(C10: TAG NO)
Use the procedure below to change the Tag No. Up to 16 alphanumeric characters can be entered.

• Example: Set a Tag No. to FIC-1a

Press the (SET) key to turn on the BT200.

Connect the transmitter and BT200 using a communication cable and press the key.

Displays the model name of connected transmitter, TAG NO. and diagnostics information. Press the (OK) key after confirmation.

Press the (SET) key to display the SET menu panel.

Select C: BASIC SETUP and press the key.

Select C10: TAG NO. and press the key.

Set the new TAG NO. (FIC-1a).

Set TAG NO. and press the key.

When you have made an entry mistake, return the cursor using the key, then reenter.

(2) Calibration Range Setup

a. Setting Calibration Range Unit
(C20: PRES UNIT)
The unit parameter is set at the factory before shipment if specified at the time of order. Follow the procedure below to change the unit parameter.

• Example: Change the unit from mmH2O to kPa.

Use the or key to select kPa.

Press the key twice to enter the setting.

Press the (OK) key.

Note that the Yokogawa default setting for the standard temperature is 4°C (39.2°F). For the units of mmH2O, mmAq, mmWG, inH2O, and ftH2O, the pressure varies according to the standard temperature definition. When a standard temperature of 20°C (68°F) is required, select @20degC (68.0F) at the parameter D16:H2O UNIT SEL.

Available pressure units are shown below.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Symbol</th>
<th>Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>mmH2O</td>
<td>mmH2O</td>
<td>mmH2O</td>
</tr>
<tr>
<td>mmAq</td>
<td>mmAq</td>
<td>mmAq</td>
</tr>
<tr>
<td>mmWG</td>
<td>mmWG</td>
<td>mmWG</td>
</tr>
<tr>
<td>inH2O</td>
<td>inH2O</td>
<td>inH2O</td>
</tr>
<tr>
<td>ftH2O</td>
<td>ftH2O</td>
<td>ftH2O</td>
</tr>
<tr>
<td>Torr</td>
<td>Torr</td>
<td>Torr</td>
</tr>
<tr>
<td>kPa</td>
<td>kPa</td>
<td>kPa</td>
</tr>
<tr>
<td>Mpa</td>
<td>Mpa</td>
<td>Mpa</td>
</tr>
<tr>
<td>inHg</td>
<td>inHg</td>
<td>inHg</td>
</tr>
<tr>
<td>ftH2O</td>
<td>ftH2O</td>
<td>ftH2O</td>
</tr>
<tr>
<td>Torr</td>
<td>Torr</td>
<td>Torr</td>
</tr>
<tr>
<td>kPa</td>
<td>kPa</td>
<td>kPa</td>
</tr>
<tr>
<td>Mpa</td>
<td>Mpa</td>
<td>Mpa</td>
</tr>
<tr>
<td>inHg</td>
<td>inHg</td>
<td>inHg</td>
</tr>
</tbody>
</table>
b. Setting Calibration Range Lower Range Value and Upper Range Value
(C21: PRES LRV, C22: PRES URV)

These range values are set as specified in the order before the instrument is shipped. Follow the procedure below to change the range.

- The measurement span is determined by the upper and lower range limit values. In this instrument, changing the lower range value also automatically changes the upper range value, keeping the span constant.

**Example 1:** With present settings of 0 to 30 kPa, set the lower range value to 0.5 kPa.

```
<table>
<thead>
<tr>
<th>SET</th>
<th>C21: PRES LRV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5 kPa</td>
</tr>
</tbody>
</table>
```

Set 0.5. Press the **ENTER** key twice to enter the setting.

```
| Press the F4 (OK) key. |
```

The upper range value is changed while the span remains constant.

\[ \text{Span} = \text{Upper range value} - \text{Lower range value} \]

- Entering the range values as LRV>URV reverses the direction of the output signal of 4-20 mA to 20-4 mA corresponding to the calibration range of 0 to 100%.

- Calibration range can be specified with range value specifications up to 5 digits (excluding any decimal point) for lower or upper range limits within the range of –32000 to 32000.

- Note, however, that changing the upper range value does not cause the lower range value to change. Thus, changing the upper range value also changes the span.

**Example 2:** With present settings of 0 to 30 kPa, set the upper range value to 10 kPa.

```
<table>
<thead>
<tr>
<th>SET</th>
<th>C22: PRES URV</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 kPa</td>
</tr>
</tbody>
</table>
```

Set 10. Press the **ENTER** key twice to enter the setting.

```
| Press the F4 (OK) key. |
```

The lower range value is not changed, so the span changes.

(3) Damping Time Constant Setup
(C30: AMP DAMPING)

When the instrument is shipped, the damping time constant is set at 2.00 seconds unless otherwise specified in the order. Follow the procedure below to change the damping time constant.

Note that setting the quick response parameter (D50: QUICK RESP) ON enables you to set the damping time constant between 0.00 to 0.49 second.

**Example:** Change from 2.00 to 4.00 seconds.

```
<table>
<thead>
<tr>
<th>SET</th>
<th>C30: AMP DAMPING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4.00 sec</td>
</tr>
</tbody>
</table>
```

Enter 4. Press the **ENTER** key twice to enter the setting.

```
| Press the F4 (OK) key. |
```

Note 1: The damping time constant set here is the time constant for the amplifier assembly. The damping time constant for the entire transmitter is the sum of the values for the amplifier assembly and for the capsule assembly.

Note 2: When the damping time constant is set to less than 0.5 second, communication may occasionally be unavailable during the operation, especially while output changes dynamically.
(4) Output Mode and Integral Indicator Display Mode Setup  
(C40: OUTPUT MODE, I20: P DISP MODE)

The mode setting for the output signal and the integral indicator can be performed independently. This mode is set as specified in the order when the instrument is shipped. Follow the procedure below to change the mode.

If the instrument is equipped with an integral indicator and the display mode is SQUARE ROOT, “√” is displayed on the integral indicator.

- Output mode for 4-20 mA output

**Example: Set output mode from Linear to Square root.**

- Integral indicator display mode

**Example: Set display mode from Linear to Square root.**

(5) Output Signal Low Cut Mode Setup  
(D10: LOW CUT, D11: LOW CUT MODE)

Low cut mode can be used to stabilize the output signal near the zero point. The low cut point can be set in a range from 0 to 20%, the direct ratio corresponding to the output signal of 4 to 20 mA. (Hysteresis: ±10% of the cut point)

Either LINEAR or ZERO can be selected as the low cut mode. Unless otherwise specified, the cut mode is set to LINEAR at the factory.

Note that when the output modes of the output signal and the integral indicator are selected as SQUARE ROOT and LINEAR accordingly, the low cut function is not available for the integral indicator display.

**Example: Change the low cut setting range from 10% to 20%, and the low cut mode from LINEAR to ZERO in the SQUARE ROOT output mode.**

- Low cut mode “LINEAR”  
- Low cut mode “ZERO”
The low cut point has hysteresis so that the output around the point is behaved as below figure.

**Example**
Output mode: Linear
Low cut mode: Zero
Low cut: 20.00%

![Diagram showing output mode and low cut point with hysteresis](image)

### (6) Integral Indicator Scale Setup
The following five displays are available for integral indicators: input pressure*1, % of range, user set scale, input static pressure, and % of static pressure range*1. A cycle of up to four displays can be shown by assigning variables to the parameters I10 to I13: DISP OUT1 to DISP OUT4.

<table>
<thead>
<tr>
<th>Available displays</th>
<th>Description and related parameters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input pressure (PRES)</td>
<td>Indicates values of input pressure with the indication limits -32000 to 32000.</td>
</tr>
<tr>
<td>% of range (PRES %)</td>
<td>Indicates input pressure in -2.5 to 110% range depending on the measuring range (C21, C22).</td>
</tr>
<tr>
<td>User set scale (ENGR. PRES)</td>
<td>Indicates values depending on the engineering range (I33, I34) with the unit (I30).</td>
</tr>
<tr>
<td>Input static pressure (SP)*1</td>
<td>Indicates input static pressure with the indication limits -32000 to 32000. Reference pressure is factory-set in absolute.</td>
</tr>
<tr>
<td>% of static pressure range*(SP %)*1</td>
<td>Indicates input static pressure in -10 to 110% range depending on the measuring range (D33, D34).</td>
</tr>
</tbody>
</table>

*1: Available for differential pressure transmitter.

See (a.) through (d.) for each setting procedure.
a. Display Selection (I10: DISP OUT1)
Select the variable for the parameter I10: DISP OUT1 to display on the integral indicator.

| Example: Change the integral indicator scale from % of range to input pressure display. |
| Use the \[ \text{Up} \] or \[ \text{Down} \] key to select PRES. |
| Press the \[ \text{Enter} \] key twice to enter the setting. |

In addition to the display set at I10: DISP OUT1, displays can be set at I11: DISP OUT2, I12: DISP OUT3, and I13: DISP OUT4 for cyclic display in the order of the parameter number.

c. User Setting of Engineering Unit and Scale (I30: ENGR.UNIT, I31: EASY EU SET, I33: ENGR.LRV, and I34: ENGR.URV)
These parameters allow the entry of the engineering units and scale to be displayed. The engineering unit can be selected from the parameter I31: EASY EU SET as listed below. Alternately, up to eight alphanumerics, spaces, and a slash “/” can be input on keypad at I30: ENGR. UNIT; only first six are displayed on the integral indicator.

Select the unit from the list of I31: EASY EU SET.

<table>
<thead>
<tr>
<th>Unit</th>
<th>Unit</th>
<th>Unit</th>
<th>Unit</th>
<th>Unit</th>
<th>Unit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>kPa</td>
<td>ftH2O</td>
<td>Nl/min</td>
<td>Nm/min</td>
<td>Nm/3min</td>
<td>Nm/2min</td>
<td>Nm/2min</td>
</tr>
<tr>
<td>MPa</td>
<td>gf/cm2</td>
<td>Nm/3m</td>
<td>Nm/3m</td>
<td>Nm/3m</td>
<td>Nm/3m</td>
<td>Nm/3m</td>
</tr>
<tr>
<td>mbar</td>
<td>kg/cm2</td>
<td>ACFH</td>
<td>ACFM</td>
<td>SCFH</td>
<td>SCFH</td>
<td>SCFH</td>
</tr>
<tr>
<td>psi</td>
<td>kg/cm2G</td>
<td>ACFH</td>
<td>ACFM</td>
<td>SCFH</td>
<td>SCFH</td>
<td>SCFH</td>
</tr>
<tr>
<td>psia</td>
<td>atm</td>
<td>GPH</td>
<td>GPM</td>
<td>GPM</td>
<td>GPM</td>
<td>GPM</td>
</tr>
<tr>
<td>mmH2O</td>
<td>m</td>
<td>m</td>
<td>m</td>
<td>m</td>
<td>m</td>
<td>m</td>
</tr>
<tr>
<td>mmHg</td>
<td>t/h</td>
<td>GPH</td>
<td>GPM</td>
<td>GPM</td>
<td>GPM</td>
<td>GPM</td>
</tr>
<tr>
<td>mmHgA</td>
<td>mm/min</td>
<td>mm/min</td>
<td>mm/min</td>
<td>mm/min</td>
<td>mm/min</td>
<td>mm/min</td>
</tr>
<tr>
<td>mmAq</td>
<td>m/min</td>
<td>m/min</td>
<td>m/min</td>
<td>m/min</td>
<td>m/min</td>
<td>m/min</td>
</tr>
<tr>
<td>mmWG</td>
<td>l/min</td>
<td>in</td>
<td>ft</td>
<td>ft</td>
<td>ft</td>
<td>ft</td>
</tr>
<tr>
<td>Torr</td>
<td>kl/h</td>
<td>kg/m3</td>
<td>kg/m3</td>
<td>kg/m3</td>
<td>kg/m3</td>
<td>kg/m3</td>
</tr>
<tr>
<td>inH2O</td>
<td>kl/min</td>
<td>kg/m3</td>
<td>kg/m3</td>
<td>kg/m3</td>
<td>kg/m3</td>
<td>kg/m3</td>
</tr>
<tr>
<td>inHg</td>
<td>Nl/h</td>
<td>g/cm3</td>
<td>g/cm3</td>
<td>g/cm3</td>
<td>g/cm3</td>
<td>g/cm3</td>
</tr>
</tbody>
</table>

Follow the procedure below to change the settings.

• Example: Set an engineering unit M.

<table>
<thead>
<tr>
<th>SET</th>
<th>I30:ENGR.UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter</td>
<td>M</td>
</tr>
</tbody>
</table>

| Feed| No | OK |

Set M. Press the \[ \text{Enter} \] key twice to enter the setting.

\[ \text{ESC} \] \[ \text{F4} \]  \[ \text{OK} \]  \[ \text{ESC} \]

Note that following symbols are not available.

. , + * ) ( ' & % $ # " !

The transmitter integral indicator shows “--- --- --- --- ---” when these are entered.

• Example: Set lower range value (LRV) to –50 and upper range value (URV) to 50.

<table>
<thead>
<tr>
<th>SET</th>
<th>I33:ENGR.LRV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter</td>
<td>–50</td>
</tr>
</tbody>
</table>

| Feed| No | OK |

Set –50. Press the \[ \text{Enter} \] key twice to enter the setting.

\[ \text{ESC} \] \[ \text{F4} \]  \[ \text{OK} \]  \[ \text{ESC} \]

<table>
<thead>
<tr>
<th>SET</th>
<th>I34:ENGR.URV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter</td>
<td>50</td>
</tr>
</tbody>
</table>

| Feed| No | OK |

Set 50. Press the \[ \text{Enter} \] key twice to enter the setting.

\[ \text{ESC} \] \[ \text{F4} \]  \[ \text{OK} \]  \[ \text{ESC} \]

Follow the procedure below to change the settings.
d. Setting Static Pressure Unit and Scale
(D30: SP UNIT, D33: SP LRV, and D34: SP URV)

Static pressure can be displayed in measured input static pressure or in %, independent from the 4-20 mA output signal of measured pressure or differential pressure. These parameters allow the entry of the static pressure unit and scale to be displayed.

Note that the parameter D37: SP SELECT can be used to select either the high or low pressure side of the capsule to monitor the static pressure.

(7) Unit Setup for Displayed Temperature
(D40: TEMP UNIT)

When the instrument is shipped, the temperature units are set to degC. Follow the procedure below to change this setting. Note that changing the unit here changes the unit for A30: CAPSULE TEMP (capsule temperature) and J45: AMP TEMP (amplifier temperature).

- Example: Change the unit for the temperature display degC to degF.

(8) Operation Mode Setup
(D22: REV OUTPUT)

This parameter allows the direction of the 4-20 mA output to be reversed with respect to input. Follow the procedure below to make this change.

- Example: Change 4 to 20 mA output to 20 to 4 mA output.

(9) Impulse Line Connection Orientation Setup
(D15: H/L SWAP)

This function reverses the impulse line orientation. Follow the procedure below to make this change.

- Example: Assign the high pressure impulse line connection to the L side of the transmitter.

(10) CPU Failure Burnout Direction and Hardware Write Protect
(D25: BURNOUT)

There are two slide switches on the CPU assembly board. One sets the burnout direction at CPU failure, and the other sets a write protection function which disables parameter changes through the use of a handheld terminal or some other communication method.

- Example: Change the burnout direction switch position from HIGH to LOW.

The parameter D25: BURNOUT displays the status of 4-20 mA DC output if a CPU failure occurs. In case of a failure, communication is disabled.
Standard specifications

The burnout direction switch is set to HIGH. If a failure occurs, the transmitter outputs a 110% or higher signal.

Option code /C1

The burnout direction switch is set to LOW. If a failure occurs, a −5% or lower output is generated.

- Example: Standard specifications
  D25: BURNOUT Slide switch position: H

- Example: Option code /C1
  D25: BURNOUT Slide switch position: L

(11) Software Write Protect
(D55: WRT PROTECT, D56: WRT ENABLE, D57: NEW PASSWORD)

Transmitter configured data can be saved by the write protect function. Write protect status (D55: WRT PROTECT) is set from NO to YES when eight alphanumerics are entered in the parameter D57: NEW PASSWORD. Accordingly, the transmitter does not accept any parameter changes. When the eight alphanumerics password is entered in the parameter D56: WRT ENABLE, the transmitter accepts parameter changes during a 10 minute period.

To cancel the transmitter for the software write protection completely, use D56: WRT ENABLE to first release the write protect function and then enter eight spaces in the D57: NEW PASSWORD field.

The software write protection does not affect the function of external zero adjustment screw.

To disable the external zero adjustment screw, set the parameter J15: EXT ZERO ADJ to INHIBIT before activating the software write protection.

a. Setting Password (D57: NEW PASSWORD)

- Example: Set the password to 1234ABCD.

  SET D57:NEW PASSWORD 1234ABCD
  Enter 1234ABCD. Press the key twice to enter the setting.

  Press the (OK) key.

b. Entering Password to Enable Parameter Change (D56: WRT ENABLE)

- Example: Enter the password of 1234ABCD.

  SET D56:WRT ENABLE 1234ABCD
  Enter the password. Press the key twice to enter the setting.

  Press the (OK) key. Parameter changes are available for 10 minutes.

c. Releasing Password (D57: NEW PASSWORD)

To release the password, enter eight spaces at D57: NEW PASSWORD during the period that the parameter change is possible.

d. Software Seal (D58: SOFTWR SEAL)

When you lose the password that has been registered, it is possible to release the write protect function by using general password. Contact Yokogawa about the general password. When the password is used, the status shown in the parameter D58: SOFTWR SEAL is changed from KEEP to BREAK. The status returns to KEEP by entering a newly set password at D56: WRT ENABLE.
(12) Output Status Setup when a Hardware Error Occurs
(D26: ERROR OUT)
This parameter allows the setting of the output status when a hardware error occurs. The following selections are available.

(a) BURNOUT DIR; Outputs the corresponding values of 110% or –5% of output signals according to the setting by burnout direction switch (BO) on the CPU board.

(b) HOLD; Outputs the last value held before the error occurred.

Note: A hardware error means CAP.ERR of AL.01 or AMP.ERR of AL.02 which are shown in table 4.1 Alarm Message Summary.

- Example: Set the output status to HOLD when a hardware error occurs.

![Example 1](F0331.ai)

(13) Bi-directional Flow Measurement Setup
(E30: BI DIRE MODE)

(a) This parameter enables selection of 50% output at an input of 0 kPa.

Procedure is shown in the figure below.

(b) Combining this with C40: OUTPUT MODE provides a square root output computed independently for 0% to 50% output and for 50% to 100% output.

- Example: If measurement range is 0 to 10 kPa (LRV=0 kPa, URV=10 kPa)

![Example 2](F0332.ai)

(14) Range Change while Applying Actual Inputs
(H10: AUTO P LRV, H11: AUTO P URV)
This feature allows the lower and upper range values to be set up automatically with the actual input applied. If the lower and upper range values are set, C21: PRES LRV and C22: PRES URV are changed at the same time.

Follow the procedure in the figure below.

The measurement span is determined by the upper and lower range values. Changing the lower range value results in the upper range value changing automatically, keeping the span constant.

- Example 1: When changing the lower range value to 0.5 kPa for the present setting of 0 to 30 kPa, take the following action with input pressure of 0.5 kPa applied.

![Example 3](F0334.ai)

- Output mode “LINEAR”

- Output mode “SQUARE ROOT”
Note that changing the upper range value does not cause the lower range value to change but does change the span.

**Example 2:** When the upper range value is to be changed to 10 kPa with the present setting of 0 to 30 kPa, take the following action with an input pressure of 10 kPa applied.

![Image](F035.ai)

- Press the **ENTER** key twice. The upper range value is changed to 10 kPa.
- Press the **P4** (OK) key. The lower range value is not changed, so the span changes. Parameter C22 is changed at the same time.

### (15) Sensor Trim

Each transmitter is factory characterized. Factory characterization is the process of comparing a known pressure input with the output of each transmitter sensor module over the entire pressure and temperature operating range. During the characterization process, this comparison information is stored in the transmitter EEPROM. In operation, the transmitter uses this factory-stored curve to produce a process variable output (PV), in engineering units, dependent on the pressure input.

The sensor trim procedure allows you to adjust for local conditions, changing how the transmitter calculates process variables. There are two ways to trim the sensor: a zero trim and a full sensor trim. A zero trim is a one-point adjustment typically used to compensate for mounting position effects or zero shifts caused by static pressure. A full sensor trim is a two-point process, in which two accurate end-point pressures are applied (equal to or greater than the range values), and all output is linearized between them.

### a. Zero Trim (J11: P ZERO ADJ, J15: P ZERO DEV, J55: EXT ZERO ADJ)

The transmitter supports several adjustment methods. Select the method best suited for the conditions of your application.

<table>
<thead>
<tr>
<th>Adjustment Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Using the BT200</td>
<td>Set the present input to 0%. Adjust for 0% output at input level of 0%. Adjust output to the reference value obtained using other means. If the input level cannot easily be made 0% (because of tank level, etc.), adjust output to the reference value obtained using other means, such as a sight glass.</td>
</tr>
<tr>
<td>Using the external zero-adjustment screw</td>
<td>Adjust zero point using the zero-adjustment screw on the transmitter.</td>
</tr>
<tr>
<td></td>
<td>Accurately adjust the output current to 4 mA DC or other target output value using an ammeter that accurately reads output currents.</td>
</tr>
</tbody>
</table>

When using BT200, the output signal can be adjusted either in % or pressure unit. The unit can be selected by the parameter J09: ADJ UNIT. Output signal can be changed by displaying parameter A10: OUTPUT for % or J10: OUTPUT for pressure unit.

This section describes the zero adjustment procedure by using the pressure unit.

#### a-1. Zeroing

Setting the parameter J11: P ZERO ADJ carries out the zero adjustment and automatically sets the applied “0” input values to the transmitter’s output value of zero, keeping the span constant. Use this setting when the LRV is known to be 0 kPa.
a-2. Level Adjustment

The zero adjustment by the parameter J11: P ZERO ADJ calibrates the transmitter output corresponding to the actual tank level. To perform this adjustment, first use a glass gauge or the like to determine the actual tank level, then enter the correct data as shown below.

DPharp span: 0 to 25.00 kPa
Actual level: 13.50 kPa
Transmitter output: 13.83 kPa

a-3. Using External Zero-adjustment Screw

This method permits zero adjustment without the BT200. Use a slotted screwdriver to turn the zero-adjustment screw. See the hardware manual for details.

Note that the parameter J55: EXT ZERO ADJ must be ENABLE to perform this adjustment.

Follow the procedure below to enable or inhibit zero point adjustment from the zero-adjustment screw on the transmitter. This is set to ENABLE when the instrument is shipped.


Full sensor trim is carried out with a series of the procedure of J11: P ZERO ADJ and J12: P SPAN ADJ. Also, you can manually perform the trimming procedure by using J15: P ZERO DEV and J16: P SPAN DEV.

The full sensor trim is a two-point adjustment, and the lower point adjustment should always be performed before the upper point adjustment in order to maintain the pitch between the zero and 100% points within the calibration range.

In the manual method, the reference pressure should also be applied to the transmitter at both lower and upper point of trim ends. Without the reference pressure, J15: P ZERO DEV and J16: P SPAN DEV may not represent the correct value of adjustment point for each.
b-1. Auto Sensor Trim

• Example: For the range of 10 to 30 kPa.

Setting a lower point

Transmitter indicates 9.94 kPa as its output when applying a standard pressure of 10 kPa.

Set 10.

After obtaining a stable pressure of 10 kPa, press key twice.

Press the (OK) key.

Check the output becomes 10 kPa.

Setting an upper point

Transmitter indicates 30.15 kPa as its output when applying a standard pressure of 30 kPa.

Set 30.

After obtaining a stable pressure of 30 kPa, press key twice.

Press the (OK) key.

Check the output becomes 30 kPa.


• Example: For the range of 10 to 30 kPa.

J15: P ZERO DEV = –0.04 kPa
J16: P SPAN DEV = –0.03 kPa

Suppose that a standard pressure of 10 kPa is applied and the value of the parameter J10: ADJ PRES is 9.94 kPa. Correct for this output error of 0.06 kPa by adding 0.06 to J15: P ZERO DEV.

\[-0.04 + 0.06 = +0.02\]

Suppose that a standard pressure of 30 kPa is applied and the value of the parameter J10: ADJ PRES is 30.15 kPa. Firstly, obtain the slope error for the span as follows;

\[
\text{Slope Error} = \frac{\text{Applied Pres Value} - \text{Measured Pres Value}}{\text{Applied Pres Value}} \\
= \frac{30.00 - 30.15}{30.00} \times (30.00 - 10.00) = -0.1
\]

Then correct for this slope error of –0.1 by adding –0.1 to J16: P SPAN DEV.

\[-0.03 + (-0.1) = -0.13\]
c. Sensor Trim for Static Pressure
   (J21: SP ZERO ADJ, J22: SP SPAN ADJ, J25: SP ZERO DEV, J26: SP SPAN DEV)

For the transmitters (Except for EJX120A/EJ1A120E), zeroing and full sensor trim of the static pressure is performed in the same way as with the primary process variable (PV). Note that the static pressure sensor trim should be done only after trimming the PV.

d. Reset Trim Adjustment to Factory Setting
   (J56: CLEAR ADJ)

Use PRES or SP of J56: CLEAR ADJ parameter to reset the trim adjustment to the initial calibrated values that were set. When PRES is selected to clear the adjustment, the amount of the adjustment by the external zero-adjustment screw is returned to the initial setting as well.

• Example: Reset the trim adjustment of pressure to factory set characterization curve.

(16) Test Output Setup
   (K10: OUTPUT X %)

This feature can be used to output a fixed current for loop checks. The available range for test output depends on the setting at parameters D20: OUT LIMIT (L) and D21: OUT LIMIT (H), whose limit is from 3.6 mA (~2.5%) to 21.6 mA (110%).

• Example: Output 12 mA (50%) fixed current.

(17) Signal Characterizer

This function is used to compensate the output for non-linear applications. The characterized values are applied to the 4-20 mA output. For the measured pressure, a maximum of nine coordinates can be specified between 0-100%. Perform the coordinate settings while the T10: S. C. ENABLE parameter is INHIBIT.

To apply the settings to the output, set the T10: S. C. ENABLE parameter to ENABLE.

Note that the transmitter rejects the activation of the function by AL. 60 with the following transmitter’s status:

• When the specified coordinates of x and y are not incremental as the input increases.
• When the output mode of the output signal is set as SQUARE ROOT; at the same time, the low cut mode is set to LINEAR.
• Example: Set the number of coordinates on the line graph to 5.

Set 5.
Press the ENTER key twice to enter the setting.
Press the F4 (OK) key.

• Example: Set alarm mode from OFF to HI.AL DETECT.

Use the ▲ or ▼ key to select HI.AL DETECT.
Press the ENTER key twice to enter the setting.
Press the F4 (OK) key.
Alarm code is generated when the output goes beyond the value set at G11: P HI. AL VAL.

• Example: Set the first coordinates (X1, Y1) as (12, 14) in %.

Set 12 for X1.
Press the ENTER key twice to enter the setting.
Press the F4 (OK) key.
Set 14 for Y1.
Press the ENTER key twice to enter the setting.
Press the F4 (OK) key.

• Example: Set the signal characterizer ENABLE.

Use the ▲ or ▼ key to select ENABLE.
Press the ENTER key twice to activate the function.
Press the F4 (OK) key.

(18) Process Alarm
(G10: P AL MODE, G11: P HI.AL VAL, G12: P LO.AL.VAL)

The function is used to display the alarm codes when the input pressure exceeds the specified value within the calibration range. The same is available for the input static pressure and the capsule temperature on the pressure sensor. Refer to table 4.1 Alarm Message Summary for the specific alarm code to be generated.

(19) Status Output (option code AL)

This feature is used for a transistor output (open collector) of an on/off signal according to the status of high and low alarm limits, which are user-configurable values as shown in (18) Process Alarm. The status output can be assigned as any combination of the high or low limits of the input pressure, input static pressure, or capsule temperature.

⚠️ CAUTION

Execute DO testing by the parameter "K40: DO test" whenever turning on the transmitter or detecting the short interruption in order to check that the alarm contact output is correctly configured.

⚠️ NOTE

No status output signal has been defined for a CPU failure or hardware error. Use a 4-20 mA signal to indicate a transmitter’s failure.
(20) Capillary Fill Fluid Density Compensation
(E10: T.ZERO CMP, E11: TEMP ZERO)

For transmitters with diaphragm seals, this function is used to compensate the zero shift caused by the ambient temperature effect on the capillary tubes.

The following equation indicates the relationship between the calculated output value and the compensating constant K (%/°C) with the measured ambient temperature at the capsule module.

Compensated output = output + K × Tamb

(1) Temperature Compensation Mode Setup
(E10: T. ZERO CMP)

When using this function, set T. ZERO CMP to ON to enable or OFF to disable. To set to ON, follow the procedure below.

Example: Set the temperature compensation mode to ON.

F0352.ai

(2) Zero Shift Compensation Setup
(E11: TEMP ZERO)

Obtain the K compensating value from the equation(1) below.

\[ K = - \frac{h \times B}{\text{span}} \times 100 \quad \ldots \ldots \ (a) \]

where,

- B: Constant value of fill fluid (See Table A.)
- span: |URV–LRV|
- h: Distance from high pressure side to low pressure side (m)

EJX118A/EJA118E: Distance from high side of diaphragm seal to low side of diaphragm seal.
EJX438A/EJA438E: Distance from diaphragm seal (high side) to position of transmitter (low side).
3. Operation

3-20

(21) Adjustment Information and User Memo Fields
(J50: ADJ WHO, J51: ADJ DATE, J52: ADJ LOC, J53: ADJ DESC, M17 to M19: MEMO01 to MEMO03)

This feature provides four fields for instrument adjustment information at maintenance: inspection date, inspector, location, and description. Also three user memo fields are provided, each holding up to 16 alphanumeric characters.

- Example: Save an inspection date of October 21, 2003.

```
PARAM J50:ADJ WHO
J51:ADJ DATE
J52:ADJ LOC
J53:ADJ DESC
M17 to M19: MEMO01 to MEMO03
```

Set “10-21-2003” in the order of month, day, and year.

Press the [ENTER] key twice to enter the setting.

3.3 Displaying Data Using the BT200

3.3.1 Displaying Measured Data

The BT200 can be used to display measured data. The measured data is updated automatically every seven seconds. In addition, the display can be updated to the present data value at any time by pressing the [DATA] key. For parameters associated with the display of measured data, see chapter 5 Parameter Summary.

- Example: Display output.

```
MENU
A:DISPLAY
B:SENSOR TYPE
C:BASIC SETUP
D:AUX SET1
E:AUX SET2
G:ALARM SET
```

Display “A10: OUTPUT.”

Data is updated automatically at 7-second intervals.

```
DATA
A10:OUTPUT
0.0 %
A15:OUTPUT KPA
4.000 mA
```

Note 1: The function is performed using a built-in temperature sensor in the transmitter body. The temperature deviation between the transmitter body and capillaries should be minimized to achieve optimal performance of the function.

Note 2: When the span changes, reenter the newly obtained value of K to E11: TEMP ZERO.

Table A. Constant value [B] of fill fluid

<table>
<thead>
<tr>
<th>Fill fluid code</th>
<th>Fill fluid code</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>mmH2O</td>
<td>0.76</td>
<td>0.87</td>
<td>1.45</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>kgf/cm²</td>
<td>0.00076</td>
<td>0.00087</td>
<td>0.00145</td>
<td>0.00075</td>
<td></td>
</tr>
<tr>
<td>kPa</td>
<td>0.00745</td>
<td>0.00853</td>
<td>0.01422</td>
<td>0.00736</td>
<td></td>
</tr>
<tr>
<td>mBar</td>
<td>0.07453</td>
<td>0.08532</td>
<td>0.14220</td>
<td>0.07355</td>
<td></td>
</tr>
<tr>
<td>atm</td>
<td>0.000704</td>
<td>0.000807</td>
<td>0.001404</td>
<td>0.000736</td>
<td></td>
</tr>
<tr>
<td>mH2O</td>
<td>0.00792</td>
<td>0.00893</td>
<td>0.01461</td>
<td>0.00748</td>
<td></td>
</tr>
<tr>
<td>psi</td>
<td>0.000762</td>
<td>0.000864</td>
<td>0.001432</td>
<td>0.000756</td>
<td></td>
</tr>
<tr>
<td>mmHg</td>
<td>0.05592</td>
<td>0.06401</td>
<td>0.10669</td>
<td>0.05518</td>
<td></td>
</tr>
</tbody>
</table>

Note 3: Select the unit of constant value of [B] from the actual unit used for the transmitter in operation.
3.3.2 Display Transmitter Model and Specifications

The BT200 can be used to display the model and specifications of the transmitter.

**Example: View transmitter model name.**

Press **ENTER**.

For the associated parameters, see Chapter 5, Parameter Summary.
4. Self-diagnostics

4.1 Checking for Problems

4.1.1 Identifying Problems with BT200

The following four areas can be checked.

(a) Whether connections are good.
(b) Whether BT200 was properly operated.
(c) Whether settings were properly entered.
(d) History of the errors.

See examples below.

**Example 1: Connection errors**

Press the **[Enter]** key. When the panel shown on the left appears, press the **[Enter]** key.

Since communications will be unsuccessful if there is a problem in the connection to the BT200, the display at the left will appear. Recheck the connection.

Press the **[OK]** key.

**Example 2: Setting entry errors**

The initial data panel shows the result of current transmitter diagnostics.

Press the **[F2]** (Diag) key in the parameter panel to go to the diagnostics panel (C60: SELF CHECK).

An error message is displayed when an error occurs in the diagnostics panel.

**Example 3: Checking the history of the errors**

Connect the BT200 to the transmitter, and call item “P.”

P10: “ERROR REC 1” displays the last error.
P12: “ERROR REC 2” displays the error one time before the last error occurred.
P14: “ERROR REC 3” displays the error two times before the last error occurred.
P16: “ERROR REC 4” displays the error three times before the last error occurred.

The history of up to four errors can be stored. When the 5th error has occurred, it is stored in “P10.” The error stored in “P16” will be deleted, and then, the error in “P14” will be copied to “P16.” In this sequence, the history of the most previously occurred error will be removed from memory.

“GOOD” will be displayed if there was no previous error.

Note 1: Press the **[Enter]** key twice in the setup panel (a) to clear all error message (P10 to P16) information.

Note 2: When the error occurs, the self-diagnostic detects errors and records them in two ways depending on the types of errors. The amplifier/capsule failures are recorded immediately after the occurrence, while the minor errors such as warnings of inappropriate parameter settings are periodically recorded at an interval of minimum five minutes to twenty four hours. Note that the interval extends as the number of access counts to EEPROM increases.
### 4.1.2 Checking with Integral Indicator

**NOTE**

If an error is detected by running self-diagnostics, an error number is displayed on the integral indicator. If there is more than one error, the error number changes at three-second intervals. See table 4.1 regarding the alarm codes.

### 4.2 Alarms and Countermeasures

#### Table 4.1 Alarm Message Summary

<table>
<thead>
<tr>
<th>Indicator</th>
<th>BT200 display</th>
<th>Cause</th>
<th>Output operation during error</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>GOOD</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>AL. 01 CAP. ERR</td>
<td>01: P-SENSOR ERR</td>
<td>Sensor problem.</td>
<td>Outputs the signal (Hi or Low) set with parameter D26. [Status output: undefined]</td>
<td>Replace capsule when error keep appearing error even after restart.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL. 01</td>
<td></td>
<td>01: CT-SENSOR ERR</td>
<td>Capsule temperature sensor problem.</td>
<td>Replace capsule.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01: C-EEPROM ERR</td>
<td>Capsule EEPROM problem.</td>
<td>Replace capsule.</td>
</tr>
<tr>
<td>AL. 02 AMP. ERR</td>
<td>02: AT-SENSOR ERR</td>
<td>Amplifier temperature sensor problem.</td>
<td>Replace amplifier.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>02: CPU BOARD ERR</td>
<td>Amplifier problem.</td>
<td>Replace amplifier.</td>
</tr>
<tr>
<td>AL. 10 PRESS</td>
<td>10: P OVER SPEC</td>
<td>Input is outside measurement range limit of capsule.</td>
<td>Outputs upper range limit (URL) or lower range limit (LRL).</td>
<td>Check input or replace capsule when necessary.</td>
</tr>
<tr>
<td>AL. 11 ST. PRSS</td>
<td>11: SP OVER SPEC</td>
<td>Static pressure exceeds limit.</td>
<td>Continues to operate and output.</td>
<td>Use heat insulation or make lagging to keep temperature within range.</td>
</tr>
<tr>
<td>AL. 12 CAP. TMP</td>
<td>12: CT OVER SPEC</td>
<td>Capsule temperature is outside range (–50 to 130°C).</td>
<td>Use heat insulation or make lagging to keep temperature within range.</td>
<td>Use heat insulation or make lagging to keep temperature within range.</td>
</tr>
<tr>
<td>AL. 13 AMP. TMP</td>
<td>13: AT OVER SPEC</td>
<td>Amplifier temperature is outside range (–50 to 95°C).</td>
<td>Use heat insulation or make lagging to keep temperature within range.</td>
<td>Use heat insulation or make lagging to keep temperature within range.</td>
</tr>
<tr>
<td>AL. 30 RANGE</td>
<td>30: P OVER RANGE</td>
<td>Output is outside upper or lower range limit value.</td>
<td>Outputs upper range value (URV) or lower range value (LRV).</td>
<td>Check input and range setting, and change them as needed.</td>
</tr>
<tr>
<td>AL. 31 SP. RNG</td>
<td>31: SP OVER RANGE</td>
<td>Static pressure exceeds specified range.</td>
<td>Continues to operate and output.</td>
<td>Check input.</td>
</tr>
<tr>
<td>AL. 35 P. HI</td>
<td>35: P HIGH ALARM</td>
<td>Input pressure exceeds specified threshold.</td>
<td>Check input.</td>
<td>Check input.</td>
</tr>
<tr>
<td>AL. 37 SP. HI</td>
<td>37: SP HIGH ALARM</td>
<td>Input static pressure exceeds specified threshold.</td>
<td>Check capsule temperature.</td>
<td>Check capsule temperature.</td>
</tr>
<tr>
<td>AL. 38 SP. LO</td>
<td>38: SP LOW ALARM</td>
<td>Input static pressure exceeds threshold.</td>
<td>Check capsule temperature.</td>
<td>Check capsule temperature.</td>
</tr>
<tr>
<td>AL. 40 TMP. LO</td>
<td>40: CT LOW ALARM</td>
<td>Detected temperature exceeds specified threshold.</td>
<td>Check capsule temperature.</td>
<td>Check capsule temperature.</td>
</tr>
</tbody>
</table>
## 4. Self-diagnostics

<table>
<thead>
<tr>
<th>Indicator</th>
<th>BT200 display</th>
<th>Cause</th>
<th>Output operation during error</th>
<th>Countermeasure</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL. 50 P. LRV</td>
<td>50: P ILLEG LRV</td>
<td>Specified value is outside of setting range.</td>
<td>Holds output immediately before error occurred.</td>
<td>Check settings and change them as needed.</td>
</tr>
<tr>
<td>AL. 51 P. URV</td>
<td>51: P ILLEG URV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL. 52 P. SPN</td>
<td>52: P ILLEG SPAN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL. 53 P. ADJ</td>
<td>53: P SPAN ADJ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL. 54 SP. RNG</td>
<td>54: SP ILLEG LRV</td>
<td>Continues to operate and output holding static pressure in %.</td>
<td>Check settings and change them as needed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>54: SP ILLEG URV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>54: SP ILLEG SPAN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL. 55 SP. ADJ</td>
<td>55: SP SPAN ADJ</td>
<td>Continues to operate and output.</td>
<td>Adjust settings and change them as needed.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>55: SP ZERO ADJ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AL. 60 SC. CFG</td>
<td>60: SC CONFIG ERR</td>
<td>Specified values or settings do not meet the conditions.</td>
<td>Continues to operate and output without signal characterizing.</td>
<td>Check settings and change them as needed.</td>
</tr>
<tr>
<td>AL. 79 OV. DISP</td>
<td>—</td>
<td>Displayed value exceeds limit.</td>
<td>Continues to operate and output.</td>
<td></td>
</tr>
</tbody>
</table>
## 5. Parameter Summary

**Instruments to which applicable:**
- **F:** Differential pressure transmitters
- **P:** Absolute and gauge pressure transmitters
- **L:** Flange mounted differential pressure transmitters

### No. Parameter name | Item | *1 R/W | Content | Default value | Applicable model | Upload data |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>01 MODEL</td>
<td>Model</td>
<td>R</td>
<td>EJX (for EJX series)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>02 TAG No.</td>
<td>Tag number</td>
<td>R</td>
<td>As specified</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>03 SELF CHECK</td>
<td>Self-diagnostics</td>
<td>R</td>
<td>GOOD</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**A**
- **DISPLAY** Measured data display
- **OUTPUT** Output (in %) R -2.5 to 110%
- **PRES** Measured pressure after zero adjustment R Unit specified in C20
- **OUTPUT mA** Output current R 3.600 to 21.600 mA
- **ENGR. OUTPUT** User scaled value R Unit specified in I30
- **SP %** Static pressure (in %) R -10 to 110%
- **SP** Static pressure after zero adjustment R Unit specified in D30
- **CAPSULE TEMP** Capsule temperature R Unit specified in D40
- **SELF CHECK** Self-diagnostics R Refer to Table 4.1 Alarm Message Summary

**B**
- **SENSOR TYPE** Sensor type
- **MODEL** Model and capsule type R Model and capsule type
- **STYLE NO.** Style number R Style number of product
- **PRES LRL** Lower range limit R Unit specified in C20
- **PRES URL** Upper range limit R Unit specified in C20
- **P MIN SPAN** Minimum span R Unit specified in C20
- **SP LRL** Lower range limit for static pressure R Unit specified in D30
- **SP URL** Upper range limit for static pressure R Unit specified in D30
- **SP MIN SPAN** Minimum span for static pressure R Unit specified in D30
- **SELF CHECK** Self-diagnostics R See A60

**C**
- **BASIC SETUP** Setting data
- **TAG NO.** Tag number W 16 alphanumeric characters
- **PRES UNIT** Measurement range unit W 16 alphanumeric characters
- **PRES LRV** Lower range value W -32000 to 32000 within measurement range
- **PRES URV** Upper range value W -32000 to 32000 within measurement range
- **PRES POINT** Decimal place W 0 to 4
- **AMP DAMPING** Damping time constant at amplifier W 0.50(0.00) to 100.00 seconds, see D50
- **OUTPUT MODE** Output mode W LINEAR or SQUARE ROOT
- **SELF CHECK** Self-diagnostics R See A60

*1: R/W: R = Read only, W = Read & Write

*2: The default value shows MWP (Maximum working pressure) of the capsule.
Since the working pressure limit varies according to the Model, refer to the General Specifications section in each user’s manual.
### Parameter Summary

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter name</th>
<th>Item</th>
<th>*1</th>
<th>R/W</th>
<th>Content</th>
<th>Default value</th>
<th>Applicable model</th>
<th>Upload data</th>
</tr>
</thead>
<tbody>
<tr>
<td>D10</td>
<td>LOW CUT</td>
<td>Low cut</td>
<td></td>
<td>W</td>
<td>0.00 to 20.00%</td>
<td>10.00%</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D11</td>
<td>LOW CUT MODE</td>
<td>Low cut mode</td>
<td></td>
<td>W</td>
<td>LINEAR or ZERO</td>
<td>LINEAR</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D15</td>
<td>H/L SWAP</td>
<td>Impulse piping accessing direction</td>
<td></td>
<td>W</td>
<td>NORMAL or REVERSE</td>
<td>NORMAL</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D16</td>
<td>H2O UNIT SEL</td>
<td>H2O unit select</td>
<td></td>
<td>W</td>
<td>@4degC or @20degC (68.0F)</td>
<td>@4degC</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D20</td>
<td>OUT LIMIT (L)</td>
<td>Low side output limiter</td>
<td></td>
<td>W</td>
<td>-2.50 to 110.00%</td>
<td>-2.50%</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D21</td>
<td>OUT LIMIT (H)</td>
<td>High side output limiter</td>
<td></td>
<td>W</td>
<td>-2.50 to 110.00%</td>
<td>110%</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D22</td>
<td>REV OUTPUT</td>
<td>Output reversal</td>
<td></td>
<td>W</td>
<td>NORMAL or REVERSE</td>
<td>NORMAL</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D25</td>
<td>BURNOUT</td>
<td>CPU error</td>
<td></td>
<td>R</td>
<td>HIGH or LOW</td>
<td>O</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D26</td>
<td>ERROR OUT</td>
<td>Hardware error</td>
<td></td>
<td>W</td>
<td>BURNOUT DIR or HOLD</td>
<td>BURNOUT DIR</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D30</td>
<td>SP UNIT</td>
<td>Static pressure unit</td>
<td></td>
<td>W</td>
<td>See C20</td>
<td>MPa</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D31</td>
<td>SPA/G SLCT</td>
<td>Gauge/Abs select for static pressure</td>
<td></td>
<td>W</td>
<td>GAUGE or ABSOLUTE</td>
<td>ABSOLUTE</td>
<td>F</td>
<td>O</td>
</tr>
<tr>
<td>D32</td>
<td>ATM. PRESS</td>
<td>Coefficient for given gauge pressure</td>
<td></td>
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<td>Unit specified in D30</td>
<td>0.10133 MPa</td>
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<tr>
<td>D33</td>
<td>SP LRV</td>
<td>Lower limit of static pressure</td>
<td></td>
<td>W</td>
<td>-32000 to 32000 within measurement range</td>
<td>0.0 MPa</td>
<td>F</td>
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<tr>
<td>D34</td>
<td>SP URV</td>
<td>Upper limit of static pressure*2</td>
<td></td>
<td>W</td>
<td>-32000 to 32000 within measurement range</td>
<td>O</td>
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<td>O</td>
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<td>D35</td>
<td>SP POINT</td>
<td>Decimal place of static pressure</td>
<td></td>
<td>W</td>
<td>0 to 4</td>
<td>1</td>
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<td>O</td>
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<td>D36</td>
<td>SP DAMPING</td>
<td>Damping time constant of SP</td>
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<td>W</td>
<td>0.00 to 100.00 seconds</td>
<td>2.00 seconds</td>
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<tr>
<td>D37</td>
<td>SP SELECT</td>
<td>H/L select for static pressure</td>
<td></td>
<td>W</td>
<td>HIGH or LOW</td>
<td>HIGH</td>
<td>F</td>
<td>O</td>
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<tr>
<td>D40</td>
<td>TEMP UNIT</td>
<td>Temperature setting unit</td>
<td></td>
<td>W</td>
<td>degC, degF, or K</td>
<td>degC</td>
<td>F</td>
<td>O</td>
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<tr>
<td>D50</td>
<td>QUICK RESP</td>
<td>Quick response</td>
<td></td>
<td>W</td>
<td>OFF or ON (enable 0.00 to 0.50 seconds at C30)</td>
<td>OFF</td>
<td>F</td>
<td>O</td>
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<tr>
<td>D55</td>
<td>WRT PROTECT</td>
<td>Write protect indicator</td>
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<td>R</td>
<td>NO or YES</td>
<td>NO</td>
<td>F</td>
<td>O</td>
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<td>D56</td>
<td>WRT ENABLE</td>
<td>Write protect release</td>
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<td>D57</td>
<td>NEW PASSWORD</td>
<td>User set password for write protect</td>
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<td>SOFTWR SEAL</td>
<td>Software seal</td>
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<td>BREAK or KEEP</td>
<td>KEEP</td>
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<td>D60</td>
<td>SELF CHECK</td>
<td>Self-diagnostics</td>
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<td>See A60</td>
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<td>F</td>
<td>O</td>
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<td>E10</td>
<td>T. ZERO CMP</td>
<td>Temperature compensation mode</td>
<td></td>
<td>W</td>
<td>OFF or ON</td>
<td>OFF</td>
<td>F</td>
<td>O</td>
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<td>E11</td>
<td>TEMP ZERO</td>
<td>Zero shift compensation</td>
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<td>-99.999 to 99.999%/degC</td>
<td>0.000%/degC</td>
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<td>E30</td>
<td>BI DIRE MODE</td>
<td>Bidirectional mode</td>
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<td>OFF or ON</td>
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<td>O</td>
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<tr>
<td>E50</td>
<td>DO SELECT</td>
<td>Contact output select</td>
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<td>INHIBIT, PRES, SP, TEMP, PRES/SP, PRES/TEMP, SP/TEMP, or PRES/SP/TEMP</td>
<td>INHIBIT</td>
<td>F</td>
<td>O</td>
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<tr>
<td>E51</td>
<td>DO SIG. TYPE</td>
<td>Signal type select</td>
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<td>W</td>
<td>OFF WHEN ALARM or ON WHEN ALARM</td>
<td>ON WHEN ALARM</td>
<td>F</td>
<td>O</td>
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<tr>
<td>E52</td>
<td>D OUTPUT</td>
<td>Contact output</td>
<td></td>
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<td>OFF or ON</td>
<td>OFF</td>
<td>F</td>
<td>O</td>
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<td>R</td>
<td>See A60</td>
<td>O</td>
<td>F</td>
<td>O</td>
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</table>

*1:  R/W: R = Read only, W = Read & Write

*2:  The default value shows MWP (Maximum working pressure) of the capsule.

Since the working pressure limit varies according to the Model, refer to the General Specifications section in each user’s manual.
<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter name</th>
<th>Item</th>
<th>*1</th>
<th>R/W</th>
<th>Content</th>
<th>Default value</th>
<th>Applicable model</th>
<th>Upload data</th>
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<td>ALARM SET</td>
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<td>P AL MODE</td>
<td>Alert mode</td>
<td>R/W</td>
<td>W</td>
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<td>P HI. AL VAL</td>
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<td>R/W</td>
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<td>Low side alert value</td>
<td>R/W</td>
<td>W</td>
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<td>-100.000 kPa</td>
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<td>SP AL MODE</td>
<td>Static pressure alert mode</td>
<td>R/W</td>
<td>W</td>
<td>INHIBIT, HI. AL DETECT, LO. AL DETECT, or HI/LO. AL DETECT</td>
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<td>SP HI. AL VAL</td>
<td>High side alert value of SP*2</td>
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<td>SP LO. AL VAL</td>
<td>Low side alert value of SP</td>
<td>R/W</td>
<td>W</td>
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<td>T AL MODE</td>
<td>Temperature alert mode</td>
<td>R/W</td>
<td>W</td>
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<td>G31</td>
<td>T HI. AL VAL</td>
<td>High side alert value of temperature</td>
<td>R/W</td>
<td>W</td>
<td>-50 to 130</td>
<td>120 degC</td>
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<td>T LO. AL VAL</td>
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<td>W</td>
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<td>AUTO RECOVER</td>
<td>Auto-recover from sensor error</td>
<td>R/W</td>
<td>W</td>
<td>OFF or ON</td>
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<td>G60</td>
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<td>Self-diagnostics</td>
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<td>AUTO SP URV</td>
<td>SP upper range value auto setup*2</td>
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<td>W</td>
<td>-32000 to 32000, unit specified in D30</td>
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<td>DISP SET</td>
<td>Display setting</td>
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<td>I10</td>
<td>DISP OUT1</td>
<td>LCD output 1</td>
<td>R/W</td>
<td>W</td>
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<td>PRES %</td>
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<td>I11</td>
<td>DISP OUT2</td>
<td>LCD output 2</td>
<td>R/W</td>
<td>W</td>
<td>PRES, PRES %, ENGR. PRES, SP, SP %, or ---</td>
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<td>O</td>
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<td>I12</td>
<td>DISP OUT3</td>
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<td>R/W</td>
<td>W</td>
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<td>I13</td>
<td>DISP OUT4</td>
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<td>R/W</td>
<td>W</td>
<td>See I11</td>
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<td>I20</td>
<td>P DISP MODE</td>
<td>% display mode</td>
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<td>LINEAR or SQUARE ROOT</td>
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<td>PRES % RESO</td>
<td>% display resolution</td>
<td>R/W</td>
<td>W</td>
<td>NORMAL or HIGH RESOLUTION</td>
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<td>ENGR. EXP</td>
<td>Exponents</td>
<td>R/W</td>
<td>W</td>
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<td>ENGR. LRV</td>
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<td>User set upper range limit</td>
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<td>W</td>
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<td>I40</td>
<td>BAR INDICATR</td>
<td>Bar indicator</td>
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<td>W</td>
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<td>I41</td>
<td>POWER ON INF</td>
<td>Display when powering on</td>
<td>R/W</td>
<td>W</td>
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<tr>
<td>I60</td>
<td>SELF CHECK</td>
<td>Self-diagnostics</td>
<td>R</td>
<td>See A60</td>
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</table>

*1: R/W: R = Read only, W = Read & Write

*2: The default value shows MWP (Maximum working pressure) of the capsule.

Since the working pressure limit varies according to the Model, refer to the General Specifications section in each user’s manual.
<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter name</th>
<th>Item</th>
<th>R/W</th>
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<td>% or PRES UNIT</td>
<td>PRES UNIT</td>
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<td>ADJ PRES</td>
<td>Adjustment reference pressure</td>
<td>R</td>
<td>Unit specified in J09</td>
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<td>F O O O</td>
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<tr>
<td>J11</td>
<td>P ZERO ADJ</td>
<td>Automatic zero adjustment</td>
<td>W</td>
<td>-32000 to 32000, unit specified in J09</td>
<td>0.00000 kPa</td>
<td>F O O O</td>
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<tr>
<td>J12</td>
<td>P SPAN ADJ</td>
<td>Automatic span adjustment</td>
<td>W</td>
<td>-32000 to 32000, unit specified in J09</td>
<td>100.000 kPa</td>
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<td>J15</td>
<td>P ZERO DEV</td>
<td>Manual zero adjustment</td>
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<td>-32000 to 32000, unit specified in J09</td>
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<td>J16</td>
<td>P SPAN DEV</td>
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<td>ADJ SP</td>
<td>Adjustment reference pressure of SP</td>
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<td>Unit specified in J09</td>
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<td>J21</td>
<td>SP ZERO ADJ</td>
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<td>OUTPUT 4mA</td>
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<td>OUTPUT 20mA</td>
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<td>Unit specified D40</td>
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<td>ADJ WHO</td>
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<td>EXT ZERO ADJ</td>
<td>External zeroing permission</td>
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<td>CLEAR ADJ</td>
<td>Clear adjustment</td>
<td>W</td>
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<td>F O O O</td>
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<tr>
<td>J60</td>
<td>SELF CHECK</td>
<td>Self-diagnostics</td>
<td>R</td>
<td>See A60</td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>TEST</td>
<td>Test parameters</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>K10</td>
<td>OUTPUT X %</td>
<td>Test output % setting</td>
<td>W</td>
<td>Within a range between D20 and D21</td>
<td>0.00%</td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>K40</td>
<td>DO TEST</td>
<td>Test contact output</td>
<td>W</td>
<td>OFF or ON</td>
<td>OFF</td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>K45</td>
<td>TEST TIME</td>
<td>&quot;OUTPUT X %&quot; and &quot;DO TEST&quot; duration time selection</td>
<td>W</td>
<td>10 min, 30 min, 60 min, 3 hour, 6 hour, 12 hour</td>
<td>10 min</td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>K50</td>
<td>TEST KEY1</td>
<td>Special maintenance parameter</td>
<td>W</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>K51</td>
<td>TEST KEY2</td>
<td>Special maintenance parameter</td>
<td>W</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>K52</td>
<td>TEST KEY3</td>
<td>Special maintenance parameter</td>
<td>W</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
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<tr>
<td>K53</td>
<td>TEST KEY4</td>
<td>Special maintenance parameter</td>
<td>W</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>K60</td>
<td>SELF CHECK</td>
<td>Self-diagnostics</td>
<td>R</td>
<td>See A60</td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>DEVICE INFO</td>
<td>Device information</td>
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<td></td>
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<tr>
<td>M10</td>
<td>SERIAL NO.</td>
<td>Serial number</td>
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<td>F O O O</td>
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</tr>
<tr>
<td>M11</td>
<td>MFTR. DATE</td>
<td>Manufactured date</td>
<td>R</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
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<tr>
<td>M12</td>
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<td>Customization number</td>
<td>R</td>
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<td></td>
<td>F O O O</td>
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<tr>
<td>M15</td>
<td>SOFT REV</td>
<td>Software revision</td>
<td>R</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>M16</td>
<td>BRAIN REV</td>
<td>BRAIN protocol revision</td>
<td>R</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
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<tr>
<td>M17</td>
<td>MEMO1</td>
<td>Memo</td>
<td>W</td>
<td>16 alphanumeric characters</td>
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<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>M18</td>
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<td>Memo</td>
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<td>F O O O</td>
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<tr>
<td>M19</td>
<td>MEMO3</td>
<td>Memo</td>
<td>W</td>
<td>16 alphanumeric characters</td>
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<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>M20</td>
<td>ISOL MATL</td>
<td>Capsule material</td>
<td>W</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
<tr>
<td>M21</td>
<td>FILL FLUID</td>
<td>Fill fluid</td>
<td>W</td>
<td></td>
<td></td>
<td>F O O O</td>
<td></td>
</tr>
</tbody>
</table>

*1: R/W: R = Read only, W = Read & Write

*2: The default value shows MWP (Maximum working pressure) of the capsule. Since the working pressure limit varies according to the Model, refer to the General Specifications section in each user's manual.
### Parameter Summary

<table>
<thead>
<tr>
<th>No.</th>
<th>Parameter name</th>
<th>Item</th>
<th>R/W</th>
<th>Content</th>
<th>Default value</th>
<th>Applicable model</th>
<th>Upload data</th>
</tr>
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<tbody>
<tr>
<td>M22</td>
<td>GASKET MATL</td>
<td>Gasket material</td>
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</tr>
<tr>
<td>M23</td>
<td>PRO CON MATL</td>
<td>Flange material</td>
<td>W</td>
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<tr>
<td>M24</td>
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<td>Vent plug material</td>
<td>W</td>
<td></td>
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<td></td>
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<tr>
<td>M25</td>
<td>PRO CON TYPE</td>
<td>Process connection type</td>
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<td></td>
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<tr>
<td>M26</td>
<td>RS ISOL MATL</td>
<td>Remote seal material</td>
<td>W</td>
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<tr>
<td>M28</td>
<td>NUM RS</td>
<td>Number of remote seal</td>
<td>W</td>
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<td>M29</td>
<td>RS FILL FLUID</td>
<td>Fill fluid of remote seal</td>
<td>W</td>
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<td>RS TYPE</td>
<td>Remote seal type</td>
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<td>M50</td>
<td>MS CODE 1</td>
<td>Model and suffix code 1</td>
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<tr>
<td>M51</td>
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<td>Model and suffix code 2</td>
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<td>Model and suffix code 3</td>
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<td>SELF CHECK</td>
<td>Self-diagnostics</td>
<td>R</td>
<td></td>
<td>See A60</td>
<td></td>
<td></td>
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<tr>
<td>P10</td>
<td>ERROR REC 1</td>
<td>Last error</td>
<td>W</td>
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</tr>
<tr>
<td>P12</td>
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<td>Third recent error</td>
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<td>Forth recent error</td>
<td>W</td>
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<td>GOOD</td>
<td></td>
<td></td>
</tr>
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<td>P60</td>
<td>SELF CHECK</td>
<td>Self-diagnostics</td>
<td>R</td>
<td>See A60</td>
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<tr>
<td>T10</td>
<td>S. C. ENABLE</td>
<td>Signal characterizer permission</td>
<td>W</td>
<td>INHIBIT or ENABLE</td>
<td>INHIBIT</td>
<td></td>
<td></td>
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<tr>
<td>T11</td>
<td>NUM OF POINT</td>
<td>Number of coordinates</td>
<td>W</td>
<td>0 to 9</td>
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<tr>
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<td>Start point of X</td>
<td>R</td>
<td>0.00%</td>
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<td></td>
<td></td>
</tr>
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<td>T21</td>
<td>Y START (FIX)</td>
<td>Start point of Y</td>
<td>R</td>
<td>0.00%</td>
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<td></td>
<td></td>
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<tr>
<td>T22</td>
<td>X1</td>
<td>Coordinate 1 of X</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>10.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T23</td>
<td>Y1</td>
<td>Coordinate 1 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>10.00</td>
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<td></td>
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<tr>
<td>T24</td>
<td>X2</td>
<td>Coordinate 2 of X</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>20.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T25</td>
<td>Y2</td>
<td>Coordinate 2 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>20.00</td>
<td></td>
<td></td>
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<tr>
<td>T26</td>
<td>X3</td>
<td>Coordinate 3 of X</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>30.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T27</td>
<td>Y3</td>
<td>Coordinate 3 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>30.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T28</td>
<td>X4</td>
<td>Coordinate 4 of X</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>40.00</td>
<td></td>
<td></td>
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<tr>
<td>T29</td>
<td>Y4</td>
<td>Coordinate 4 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>40.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T30</td>
<td>X5</td>
<td>Coordinate 5 of X</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>50.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T31</td>
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<td>Coordinate 5 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>50.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T32</td>
<td>X6</td>
<td>Coordinate 6 of X</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>60.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T33</td>
<td>Y6</td>
<td>Coordinate 6 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>60.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T34</td>
<td>X7</td>
<td>Coordinate 7 of X</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>70.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>T35</td>
<td>Y7</td>
<td>Coordinate 7 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>70.00</td>
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<tr>
<td>T36</td>
<td>X8</td>
<td>Coordinate 8 of X</td>
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<td>0.00 to 100.00%</td>
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<td>T37</td>
<td>Y8</td>
<td>Coordinate 8 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>80.00</td>
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<td></td>
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<tr>
<td>T38</td>
<td>X9</td>
<td>Coordinate 9 of X</td>
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<td>0.00 to 100.00%</td>
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<td></td>
</tr>
<tr>
<td>T39</td>
<td>Y9</td>
<td>Coordinate 9 of Y</td>
<td>W</td>
<td>0.00 to 100.00%</td>
<td>90.00</td>
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<td></td>
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<tr>
<td>T40</td>
<td>X END (FIX)</td>
<td>End point of X</td>
<td>R</td>
<td>100.00%</td>
<td></td>
<td></td>
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</tr>
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<td>T41</td>
<td>Y END (FIX)</td>
<td>End point of Y</td>
<td>R</td>
<td>100.00%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T60</td>
<td>SELF CHECK</td>
<td>Self-diagnostics</td>
<td>R</td>
<td>See A60</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*1:  R/W: R = Read only, W = Read & Write
*2:  The default value shows MWP (Maximum working pressure) of the capsule.
     Since the working pressure limit varies according to the Model, refer to the General Specifications section in each user’s manual.
Appendix 1. Safety Instrumented Systems Installation

WARNING

The contents of this appendix are cited from exida.com safety manual on the transmitters specifically observed for the safety transmitter purpose. When using the transmitter for Safety Instrumented Systems (SIS) application, the instructions and procedures in this section must be strictly followed in order to preserve the transmitter for that safety level.

A1.1 Scope and Purpose

This section provides an overview of the user responsibilities for installation and operation of the transmitter in order to maintain the designed safety level for Safety Instrumented Systems (SIS) applications. Items that will be addressed are proof testing, repair and replacement of the transmitter, reliability data, lifetime, environmental and application limits, and parameter settings.

A1.2 Using the Transmitter for an SIS Application

A1.2.1 Safety Accuracy

The transmitter has a specified safety accuracy of 2%. This means that the internal component failures are listed in the device failure rate if they will cause an error of 2% or greater.

A1.2.2 Diagnostic Response Time

The transmitter will report an internal failure within 5 seconds of the fault occurrence.

A1.2.3 Setup

During installation the transmitter must be setup with engineering units parameters. This is typically done with a handheld terminal. These parameters must be verified during the installation to insure that the correct parameters are in the transmitter. Engineering range parameters can be verified by reading these parameters from the optional local display or by checking actual calibration of the transmitter.

The calibration of the transmitter must be performed after parameters are set.

A1.2.4 Required Parameter Settings

The following parameters need to be set in order to maintain the designed safety integrity.

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burnout direction switch</td>
<td>To specify if the output should go 21.6 mA or higher or 3.6 mA or lower upon detection of an internal failure.</td>
</tr>
<tr>
<td>Write protection switch</td>
<td>The write function should be disabled.</td>
</tr>
</tbody>
</table>

A1.2.5 Proof Testing

The objective of proof testing is to detect failures within the transmitter that are not detected by the diagnostics of the transmitter. Of main concern are undetected failures that prevent the safety instrumented function from performing its intended function. See table A1.2 for proof testing method.

The frequency of the proof tests (or the proof test interval) is to be determined in the reliability calculations for the safety instrumented functions for which the transmitter is applied. The actual proof tests must be performed more frequently or as frequently as specified in the calculation in order to maintain required safety integrity of the safety instrumented function.

The following tests need to be specifically executed when a proof test is performed. The results of the proof test need to be documented and this documentation should be part of a plant safety management system. Failures that are detected should be reported to Yokogawa.

The personnel performing the proof test of the transmitter should be trained in SIS operations including bypass procedures, transmitter maintenance, and company management of change procedures.
Table A1.2  Proof Testing

<table>
<thead>
<tr>
<th>Testing method</th>
<th>Tools required</th>
<th>Expected outcome</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional test:</td>
<td>• Handheld terminal</td>
<td>Proof Test Coverage =52%</td>
<td>The output needs to be monitored to assure that the transmitter communicates the correct signal.</td>
</tr>
<tr>
<td>1. Follow all Management of Change procedures to bypass logic solvers if necessary.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Execute HART/BRAIN command to send value to high alarm (21.5 mA) and verify that current has reached this level.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Execute HART/BRAIN command to send value to low alarm (3.6 mA) and verify that current has reached this level.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Restore logic solvers operation and verify.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform three point calibration along with the functional test listed above.</td>
<td>• Handheld terminal</td>
<td>Proof Test Coverage =99%</td>
<td></td>
</tr>
<tr>
<td>• Calibrated pressure source</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A1.2.6 Repair and Replacement

If repair is to be performed with the process online the transmitter will need to be bypassed during the repair. The user should setup appropriate bypass procedures.

In the unlikely event that the transmitter has a failure, the failures that are detected should be reported to Yokogawa.

When replacing the transmitter, the procedure in the installation manual should be followed.

The personnel performing the repair or replacement of the transmitter should have a sufficient skill level.

A1.2.7 Startup Time

The transmitter generates a valid signal within 1 second of power-on startup.

A1.2.8 Firmware Update

In case firmware updates are required, they will be performed at factory. The replacement responsibilities are then in place. The user will not be required to perform any firmware updates.

A1.2.9 Reliability Data

A detailed Failure Mode, Effects, and Diagnostics Analysis (FMEDA) report is available from Yokogawa with all failure rates and failure modes.

The transmitter is certified up to SIL2 for use in a simplex (1oo1) configuration, depending on the PFDavg calculation of the entire Safety Instrumented Function.

The development process of the transmitter is certified up to SIL3, allowing redundant use of the transmitter up to this Safety Integrity Level, depending the PFDavg calculation of the entire Safety Instrumented Function.

When using the transmitter in a redundant configuration, the use of a common cause factor (β-factor) of 2% is suggested. (However, if the redundant transmitters share an impulse line or if clogging of the separate impulse lines is likely, a common cause factor of 10% is suggested.)

Note that the failure rates of the impulse lines need to be accounted for in the PFDavg calculation.

A1.2.10 Lifetime Limits

The expected lifetime of the transmitter is 50 years. The reliability data listed the FMEDA report is only valid for this period. The failure rates of the transmitter may increase sometime after this period. Reliability calculations based on the data listed in the FMEDA report for the transmitter lifetimes beyond 50 years may yield results that are too optimistic, i.e. the calculated Safety Integrity Level will not be achieved.

A1.2.11 Environmental Limits

The environmental limits of the transmitter are specified in the user’s manual IM 01C25.

A1.2.12 Application Limits

The application limits of the transmitters are specified in the user’s manual IM 01C25. If the transmitter is used outside of the application limits, the reliability data listed in A1.2.9 becomes invalid.
A1.3 Definitions and Abbreviations

A1.3.1 Definitions

Safety
Freedom from unacceptable risk of harm

Functional Safety
The ability of a system to carry out the actions necessary to achieve or to maintain a defined safe state for the equipment/machinery/plant/apparatus under control of the system

Basic Safety
The equipment must be designed and manufactured such that it protects against risk of damage to persons by electrical shock and other hazards and against resulting fire and explosion. The protection must be effective under all conditions of the nominal operation and under single fault condition

Verification
The demonstration for each phase of the life-cycle that the (output) deliverables of the phase meet the objectives and requirements specified by the inputs to the phase. The verification is usually executed by analysis and/or testing

Validation
The demonstration that the safety-related system(s) or the combination of safety-related system(s) and external risk reduction facilities meet, in all respects, the Safety Requirements Specification. The validation is usually executed by testing

Safety Assessment
The investigation to arrive at a judgment -based on evidence- of the safety achieved by safety-related systems

Further definitions of terms used for safety techniques and measures and the description of safety related systems are given in IEC 61508-4.

A1.3.2 Abbreviations

FMEDA
Failure Mode, Effects and Diagnostic Analysis

SIF
Safety Instrumented Function

SIL
Safety Integrity Level

SIS
Safety Instrumented System

SLC
Safety Lifecycle
Revision Information

- **Title**: DPharp
  BRAIN Communication Type
- **Manual No.**: IM 01C25T03-01E

<table>
<thead>
<tr>
<th>Edition</th>
<th>Date</th>
<th>Page</th>
<th>Revised Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Apr. 2004</td>
<td>—</td>
<td>New publication.</td>
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<td>Oct. 2004</td>
<td>3-19</td>
<td>3.2.3(20) • Add capillary fill fluid density compensation setting procedure.</td>
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<td>Aug. 2009</td>
<td>3-8</td>
<td>3.2.3(5) • Add example for hysteresis.</td>
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<td></td>
<td>3-14</td>
<td>3.2.3(15) • Correct misprint.</td>
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<td>3-18</td>
<td>3.2.3(19) • Add CAUTION. Add note for hysteresis.</td>
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<tr>
<td>4th</td>
<td>Jun. 2012</td>
<td>2-2</td>
<td>2.4 • Add integral indicator display when powering on</td>
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<td></td>
<td>3-5</td>
<td>3.2.2 • Add parameters in the menu tree (I41, K45)</td>
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<td></td>
<td>3-6</td>
<td>3.2.3(1) • Correct errors</td>
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<td>3.2.3(11)d • Change description for SOFTWARE SEAL</td>
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<td>3.2.3(15)a-2 • Correct the figure</td>
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<td>3-17</td>
<td>3.2.3(16) • Correct the NOTE</td>
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<td>3.2.3(20) • Add EJA model name</td>
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<td>5 • Add parameter I41</td>
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<td>5 • Add parameter K45</td>
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<td>5th</td>
<td>Jun. 2013</td>
<td>3-20</td>
<td>3.2.3(20) • Add constant value of fill fluid for high vacuum use diaphragm</td>
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<td>June 2014</td>
<td>2-1</td>
<td>2.1 • Change terminal drawing.</td>
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