User's
Manual

DPharp EJX™

Digital Remote Sensor

IM 01C25W05-01EN

DPharp
FOR THE DIGITAL WORLD

YOKOGAWA
Yokogawa Electric Corporation

IM 01C25W05-01EN
6th Edition

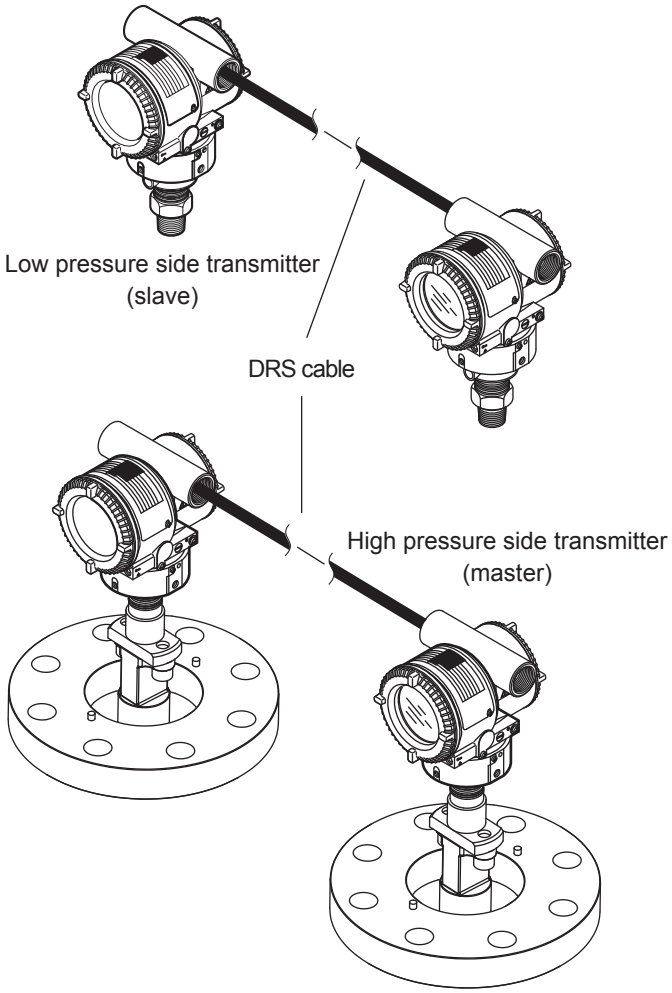
Digital Remote Sensor

IM 01C25W05-01EN 6th Edition

Contents

1. Introduction

Thank you for purchasing the DPharp Digital Remote Sensor (DRS).
Your transmitter was precisely calibrated at the factory before shipment.
To ensure both safety and efficiency, please read this manual carefully before you operate the instrument.
This manual describes the Digital Remote Sensor. The model and suffix codes for the Digital Remote Sensor consist a transmitter body section and a diaphragm seal section for the high pressure side transmitter (master) and low pressure side transmitter (slave). Check the model and the transmitter body section style code written on the product nameplate.



Screw mounting:

Digital remote sensor EJXC40A
- High pressure side transmitter (master)
- Low pressure side transmitter (slave)

With diaphragm seals:

Digital remote sensor EJXC40A
- High pressure side transmitter (master)
- Low pressure side transmitter (slave)
- High pressure side diaphragm seal
- Low pressure side diaphragm seal
- High pressure side flushing connection ring
- Low pressure side flushing connection ring

F0101.ai

	Product Name	Model	GS No.	IM No.
Transmitter body section	Pressure transmitter	EJX530A	GS01C25F01-01EN	IM 01C25F01-01E
		EJX630A	GS01C25F05-01EN	

Model	Style code
EJXC40A	S1
EJX530A	S2
EJX630A	S1

WARNING

Digital Remote Sensor

Combination Model	Applicable Transmitter
EJXC40A	EJX530A, EJX630A

The models for combination, applicable transmitter and accessories represent a diaphragm seal system.
CE and other certification are acquired for the applicable transmitter model.
See section “Model and Suffix Codes” of this document.

NOTE

This manual describes the hardware configurations, installation, operation and maintenance of the EJXC40A digital remote sensor.
For detailed information specific to a gauge pressure transmitter EJX530A or EJX630A, as well as these information as “EMC conformity standards”, “Pressure Equipment Directive(PED)” and “Safety Requirement Standards”, please refer to the transmitter’s users’ manual IM 01C25F01-01E.
The manuals in pdf format are available on our website (http://www.yokogawa.com/).

WARNING

Installing and operating the instruments in a place that requires explosion-proof certifications is subject to stringent restrictions defined in each certification. Those who install or operate the digital remote sensor in a hazardous locations must read the relevant precautions described in this manual and the following manual especially in the “Handling Cautions” chapter before handling the instruments and follow them.
IM 01C25A01-01E Installation Manual or
IM 01C25F01-01E Hardware Manual for EJX530A and EJX630A.

NOTE

When describing the model name like EJ□530□, it shows the applicability for EJX530A.

■ Regarding This Manual

- This manual and the identification tag attached on the packing box are essential parts of the product. Please keep hem in a safe place for future reference.
- This manual should be provided 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.
- Yokogawa assumes no responsibility for this product except as stated in the warranty.
- If the customer or any third party is harmed by the use of this product, Yokogawa assumes no responsibility for any such harm owing to any defects in the product which were not predictable, or for any indirect damages.

- 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.

⎓ Direct current

⏚ Functional grounding terminal

⚠ Caution
This symbol indicates that the operator must refer to an explanation in the user's manual in order to avoid the risk of injury or death of personnel or damage to the instrument.

■ Trademarks

- 'DPharp', 'EJX' and 'FieldMate' are registered trademarks of Yokogawa Electric Corporation. Company names and product names used in this material are registered trademarks or trademarks of their respective owners.
- In this manual, trademarks or registered trademarks are not marked with ™ or ®.

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:

(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 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) Explosion Protected Type Instrument

- Users of explosion proof instruments should refer first to the section of “Installation of an Explosion Protected Instrument” of IM 01C25A01-01E or IM 01C25F01-01E.
- The use of this instrument is restricted to those who have received appropriate training in the device.
- Take care not to create sparks when accessing the instrument or peripheral devices in a hazardous location.

(f) Modification

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

(g) Product Disposal

- The instrument should be disposed of in accordance with local and national legislation/ regulations.

(h) Authorized Representative in EEA

- In relation to the CE Marking, The authorised representative for this product in the EEA (European Economic Area) is: Yokogawa Europe B.V. Euroweg 2, 3825 HD Amersfoort,The Netherlands

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.

2. Handling Cautions

The transmitters are thoroughly tested at the factory before shipment.
When taking delivery of an instrument, visually check them to make sure that no damage occurred during shipment. Also check that all transmitter mounting hardware shown in figure 2.1 is included. If the transmitter is ordered without the mounting bracket or with diaphragm seals, the transmitter mounting hardware will not be included. This chapter provides important information on how to handle the transmitter. Read this carefully before using the transmitter.

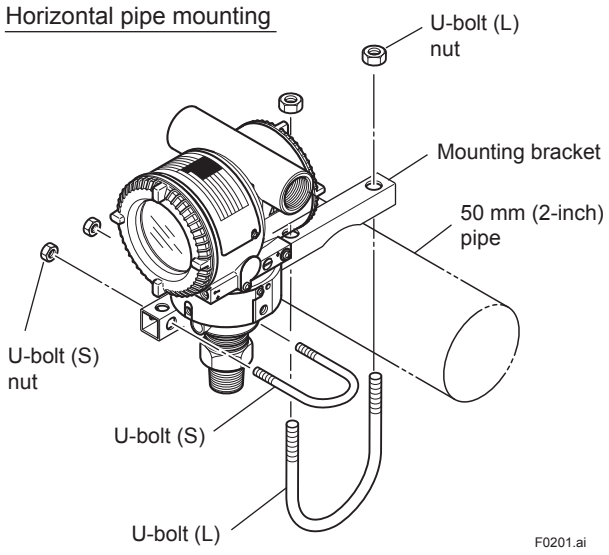


Figure 2.1 Transmitter Mounting Hardware

2.1 Model and Specifications Check

The model name and specifications are written on the name plate attached to the case. Look up the GS (See Chapter 10) for model and suffix codes and check that specifications are as you ordered. When contacting Yokogawa, please also inform us of this information.

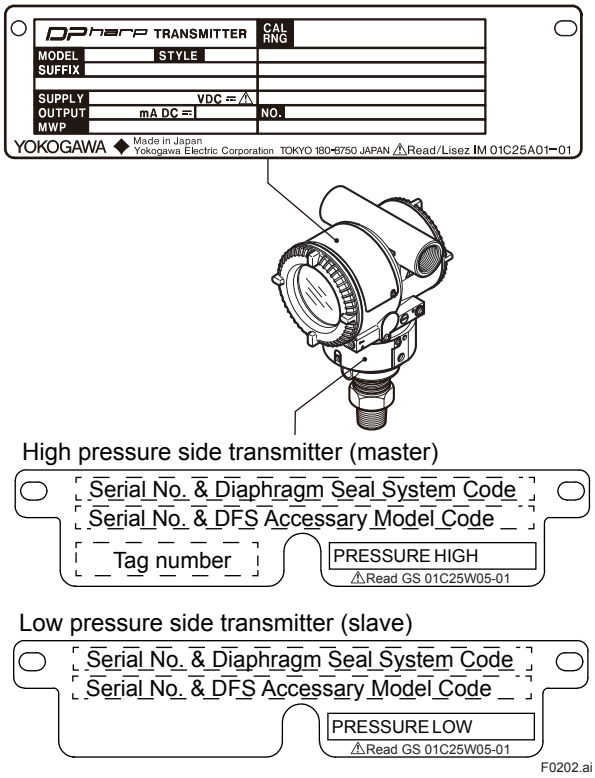


Figure 2.2 Name plate

2.2 Unpacking

Keep the transmitter in its original packaging to prevent it from being damaged during shipment. Do not unpack the transmitter until it reaches the installation site.

2.3 Storage

The following precautions must be observed when storing the instrument, especially for a long period.

(1) Select a storage area which meets the following conditions:

- It is not exposed to rain or subject to water seepage/leaks.
- Vibration and shock are kept to a minimum.
- It has an ambient temperature and relative humidity within the following ranges. Room temperature and humidity (around 25°C, 65%) are preferred.

  Temperature:

  –40 to 85°C without integral indicator
  –30 to 80°C with integral indicator
  or a temperature range defined by various specifications

  Humidity: 0 to 100%RH

(2) When storing the transmitter, repack it carefully in the packaging that it was originally shipped with.

(3) If the transmitter has been used, thoroughly clean the diaphragm surface (pressure-detector section), so that there is no process fluid remaining on them.
Before placing it in storage, also make sure that the pressure-detector is securely connected to the transmitter section.

2.4 Selecting the Installation Location

The transmitter is designed to withstand severe environmental conditions. However, to ensure that it will provide years of stable and accurate performance, take the following precautions when selecting the installation location.

■ Ambient Temperature

Avoid locations subject to wide temperature variations or a significant temperature gradient. If the location is exposed to direct sunlight or radiant heat from plant equipment, provide adequate shade, thermal insulation and/or ventilation. Also, avoid locations subject to prolonged high temperature and high humidity.

■ Ambient Atmosphere

Do not install the transmitter in a corrosive atmosphere. If this cannot be avoided, there must be adequate ventilation as well as measures to prevent the leaking of rain water and the presence of standing water in the conduits.

■ Shock and Vibration

Although the transmitter is designed to be relatively resistant to shock and vibration, an installation site should be selected where this is kept to a minimum.

■ Installation of Explosion-protected Transmitters

An explosion-protected transmitters is certified for installation in a hazardous area containing specific gas types.

2.5 Pressure Connection

WARNING

- Since the accumulated process fluid may be toxic or otherwise harmful, take appropriate steps to prevent the contact of such fluids with the skin or eyes and the inhalation of vapors from these fluids even after dismounting the instrument from process line for maintenance. Avoid draining or releasing gas while the instrument is running as doing so will disturb the measured pressure.
- On models with diaphragm seals, never loosen the process flange bolts when an instrument is installed in a process. The device is under pressure, and a loss of seal can result in a sudden and uncontrolled release of process fluid.

The following precautions must be observed in order to safely operate the transmitter under pressure.

(1) Make sure that there are no leaks in the impulse piping or process connections.

(2) Make sure that the transmitter process connections are securely fastened.

(3) Never apply a pressure higher than the specified maximum working pressure.

2.6 Waterproofing of Cable Conduit Connections and DRS Cable

Apply a non-hardening sealant to the threads to waterproof the transmitter cable conduit connections. (See figures 5.6 and 5.7.)

2.7 Restrictions on Use of Radio Transceivers

IMPORTANT

Although the transmitter has been designed to resist high frequency electrical noise, if a radio transceiver is used near the transmitter or its external wiring, the transmitter may be affected by high frequency noise pickup. To test this, start out from a distance of several meters and slowly approach the transmitter with the transceiver while observing the measurement loop for noise effects. Thereafter use the transceiver outside the range where the noise effects were first observed.

2.8 Insulation Resistance and Dielectric Strength Test

(1) Do not perform such tests more frequently than is absolutely necessary. Even test voltages that do not cause visible damage to the insulation may degrade the insulation and reduce safety margins.

(2) Never apply a voltage exceeding 100 V DC for the insulation resistance test, nor a voltage exceeding 100 V AC for the dielectric strength test.

(3) Before conducting these tests, disconnect all signal lines from the transmitter terminals. The procedure for conducting these tests is as follows:

■ Insulation Resistance Test

1. Perform the insulation resistance test separately for the high pressure side transmitter (master) and low pressure side transmitter (slave).
2. Remove the DRS cable from the high pressure side transmitter (master) and low pressure side transmitter (slave).
3. Short-circuit the + and – SUPPLY terminals in the terminal box.
4. Turn OFF the insulation tester. Then connect the insulation tester plus (+) lead wire to the shorted SUPPLY terminals and the minus (–) leadwire to the grounding terminal.
5. Turn ON the insulation tester power and measure the insulation resistance. The voltage should be applied as briefly as possible to verify that the insulation resistance is at least 20 MΩ.
6. After completing the test and being very careful not to touch exposed conductors disconnect the insulation tester and connect a 100 kΩ resistor between the grounding terminal and the short-circuiting SUPPLY terminals. Leave this resistor connected at least one second to discharge any static potential. Do not touch the terminals while it is discharging.
7. Connect the DRS cable to the high pressure side transmitter (master) and low pressure side transmitter (slave).

■ Dielectric Strength Test

1. Perform the dielectric strength test separately for the high pressure side transmitter (master) and low pressure side transmitter (slave).
2. Remove the DRS cable from the high pressure side transmitter (master) and low pressure side transmitter (slave).
3. Short-circuit the + and – SUPPLY terminals in the terminal box.
4. Turn OFF the dielectric strength tester. Then connect the tester between the shorted SUPPLY terminals and the grounding terminal. Be sure to connect the grounding lead of the dielectric strength tester to the ground terminal.
5. Set the current limit on the dielectric strength tester to 10mA, then turn ON the power and gradually increase the test voltage from ‘0’ to the specified voltage.
6. When the specified voltage is reached, hold it for one minute.
7. After completing this test, slowly decrease the voltage to avoid any voltage surges.
8. Connect the DRS cable to the high pressure side transmitter (master) and low pressure side transmitter (slave).

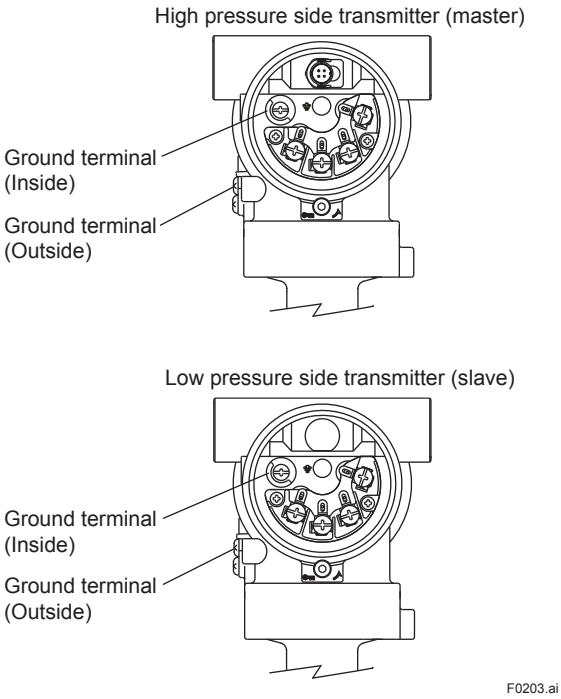


Figure 2.3 Ground terminal

2.9 Installation of an Explosion-Protected Instrument

If a customer makes a repair or modification to an intrinsically safe or explosionproof instrument and the instrument is not restored to its original condition, its intrinsically safe or explosionproof construction may be compromised and the instrument may be hazardous to operate. Please contact Yokogawa before making any repair or modification to an instrument.

CAUTION

This instrument has been tested and certified as being intrinsically safe or explosionproof. Please note that severe restrictions apply to this instrument's construction, installation, external wiring, maintenance and repair. A failure to abide by these restrictions could make the instrument a hazard to operate.

WARNING

Maintaining the safety of explosionproof equipment requires great care during mounting, wiring, and piping. Safety requirements also place restrictions on maintenance and repair. Please read the following sections very carefully.

WARNING

The range setting switch must not be used in a hazardous area.

IMPORTANT

For combined approval types
Once a device of multiple approval type is installed, it should not be re-installed using any other approval types. Apply a permanent mark in the check box of the selected approval type on the certification label on the transmitter to distinguish it from unused approval types.

IMPORTANT

All the blind plugs which accompany the EJX/EJA-E transmitters upon shipment from the factory are certified by the applicable agency in combination with those transmitters. The plugs which are marked with the symbols "◊ Ex" on their surfaces are certified only in combination with the EJX/EJA-E series transmitters.

2.9.1 FM Approval

a. FM Intrinsically Safe Type

Caution for FM intrinsically safe type. (Following contents refer "DOC. No. IIE028-A101")
Certification information
Warning:
A modification of the equipment would no longer comply with the construction described in the certificate documentation.

Note 1. EJX/EJA-E Series Differential, gauge and absolute pressure transmitters with optional code /FS14 are applicable for use in hazardous locations.

- Applicable Standard:
  FM 3600, FM 3610, FM 3611, FM 3810, ANSI/UL 60079-0:2019, ANSI/UL 60079-11:2014, ANSI/UL 61010-1, ANSI/UL 121201, NEMA 250, ANSI/IEC 60529
- Intrinsically Safe for
  Class I, Division 1, Groups A, B, C, D;
  Class II, Division 1, Groups E, F, G;
  Class III, Division 1;
  Class I, Zone 0, Group IIC, AEx ia

- Nonincendive for
  Class I, Division 2, Groups A, B, C, D;
  Class II, Division 2, Groups F, G;
  Class III, Division 1;
  Class I, Zone 2, Group IIC
- Enclosure: IP66/IP67 and Type 4X
- Temperature Class: T4
- Ambient temperature: –50 to 60°C

Note 2. Electrical Parameters

- [EJX****-P, EJA****-P]
  Supply/Output Circuit (Terminals: +, –)
  Ui: 30 V Ii: 200 mA Pi: 0.9 W
  Ci: 27.6 nF Li: 0 mH
  Ii and Pi: not applicable to nonincendive field wiring
  Communication Circuit (Connector)
  Uo: 8.2 V Io: 160 mA Po: 0.3 W
  Co: 7.6 µF Lo: 1 mH
- [EJX****-S, EJA****-S]
  Ui: 8.2 V Ii: 200 mA Pi: 0.4 W
  Ci: 6 µF Li: 0 mH

Note 3. Installation

- No revision to this drawing without prior approval of FM.
- Installation must be in accordance with the National Electric Code (NFPA70), ANSI/ISA-RP12.06.01, and relevant local codes.
- The Associated Apparatus must be an FM-approved linear power supply.
- The following conditions must be satisfied for each circuit.
  Voc (or Uo) ≤ Ui
  Isc (or Io) ≤ Ii
  Po ≤ Pi
  Ca (or Co) ≥ Ci + Ccable
  La (or Lo) ≥ Li + Lcable
- Control equipment connected to the Associated Apparatus must not use or generate a voltage more than Um of the control equipment.
- The control drawing of the Associated Apparatus must be followed when installing the equipment.
- In case Nonincendive Field Wiring Concept is used for the interconnection, FM-approved Associated Nonincendive Field Wiring Apparatus, which meets the following conditions, must be used as the Power Supply / Control Equipment.
  Voc (or Uo) ≤ Ui
  Ca (or Co) ≥ Ci + Ccable
  La (or Lo) ≥ Li + Lcable
- Dust-tight conduit seals must be used when installed in Class II or Class III environments.
- WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD – WHEN THE EQUIPMENT IS USED IN HAZARDOUS LOCATIONS, AVOID ANY ACTIONS WHICH GENERATE ELECTROSTATIC CHARGES, SUCH AS RUBBING WITH A DRY CLOTH.
- WARNING – SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY AND SUITABILITY FOR HAZARDOUS LOCATIONS

Note 4. Maintenance and Repair

WARNING

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Note 5. Specific Conditions of Use

WARNING

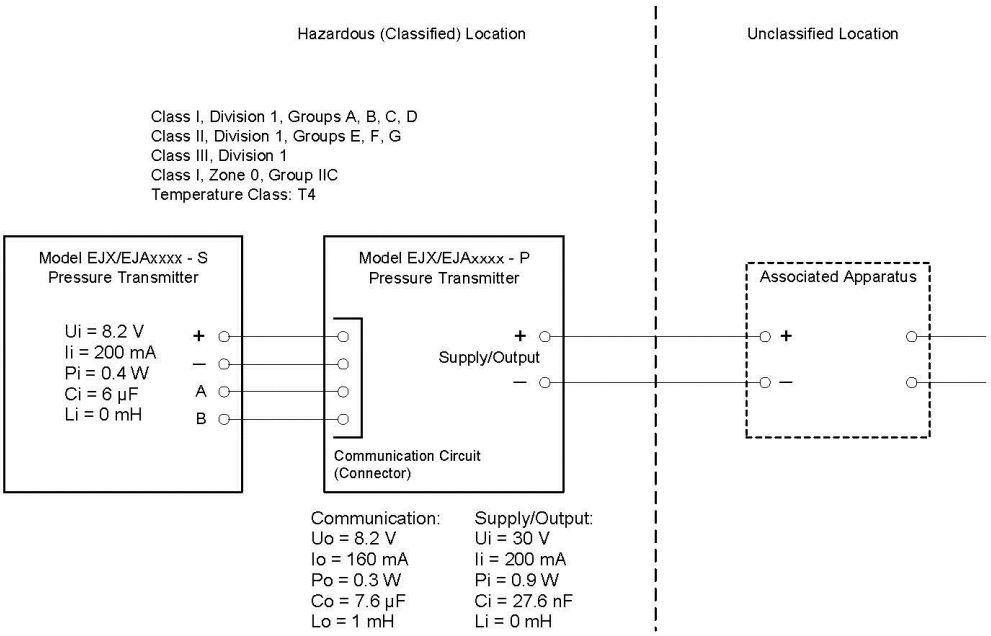
- Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts.
- When the enclosure of the Pressure Transmitters is made of aluminum alloy, if it is mounted in Zone 0, it must be installed such that, even in the event of rare incidents, an ignition source due to impact and/or friction sparks is excluded.
- Model EJX****-P and EJA****-P series pressure transmitters are not capable of withstanding the dielectric strength of 500 V r.m.s. between the intrinsically safe circuit and the enclosure.

Note 6. Control Drawing

Model: EJX Series Date: June 30, 2015

Control Drawing (US)

Intrinsically Safe Installation

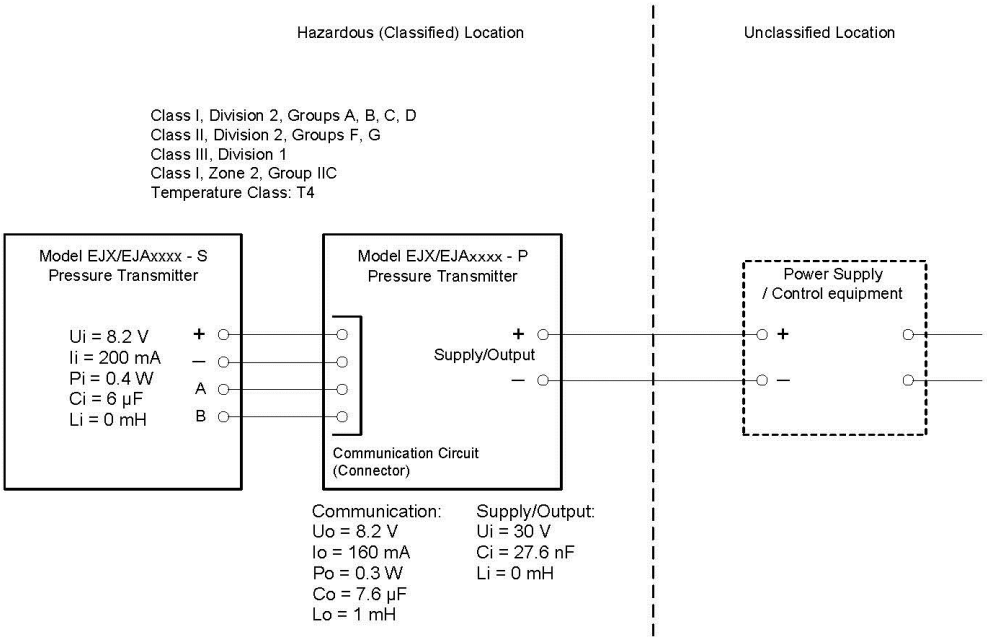


Rev. Doc. No.: IIE028-A101 P.1

Yokogawa Electric Corporation

Model: EJX Series Date: June 30, 2015

Division 2 Installation



Rev. Doc. No.: IIE028-A101 P.2

Yokogawa Electric Corporation

Model: EJX Series Date: June 30, 2015

Specific Conditions of Use:
- Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts.
- When the enclosure of the Pressure Transmitters is made of aluminum alloy, if it is mounted in Zone 0, it must be installed such that, even in the event of rare incidents, an ignition source due to impact and/or friction sparks is excluded.
- Model EJX****-P and EJA****-P series pressure transmitters are not capable of withstanding the dielectric strength of 500 V r.m.s. between the intrinsically safe circuit and the enclosure.

Notes:

1. No revision to this drawing without prior approval of FM.

2. Installation must be in accordance with the National Electric Code (NFPA70), ANSI/ISA-RP12.06.01, and relevant local codes.

3. The Associated Apparatus must be an FM-approved linear power supply.

4. The following conditions must be satisfied for each circuit.

   Voc (or Uo) ≤ Ui
   Isc (or Io) ≤ Ii
   Po ≤ Pi
   Ca (or Co) ≥ Ci + Ccable
   La (or Lo) ≥ Li + Lcable

5. Control equipment connected to the Associated Apparatus must not use or generate a voltage more than Um of the control equipment.

6. The control drawing of the Associated Apparatus must be followed when installing the equipment.

7. In case Nonincendive Field Wiring Concept is used for the interconnection, FM-approved Associated Nonincendive Field Wiring Apparatus, which meets the following conditions, must be used as the Power Supply / Control Equipment.

   Voc (or Uo) ≤ Ui
   Ca (or Co) ≥ Ci + Ccable
   La (or Lo) ≥ Li + Lcable

8. Dust-tight conduit seals must be used when installed in Class II or Class III environments.

9. WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD – WHEN THE EQUIPMENT IS USED IN HAZARDOUS LOCATIONS, AVOID ANY ACTIONS WHICH GENERATE ELECTROSTATIC CHARGES, SUCH AS RUBBING WITH A DRY CLOTH.

10. WARNING – SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY AND SUITABITY FOR HAZARDOUS LOCATIONS

Rev. Doc. No.: IIE028-A101 P.3

Yokogawa Electric Corporation

b. FM Explosionproof Type

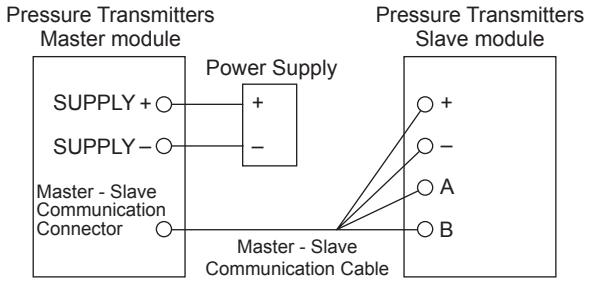
Caution for FM explosionproof type.

Note 1. EJX/EJA-E Series pressure transmitters with optional code /FF1 are applicable for use in hazardous locations.

- Applicable Standard:
  FM3600, FM3615, FM3810,
  NEMA 250, ANSI/UL 61010-1,
  ANSI/UL 61010-2-30
- Explosionproof for Class I, Division 1, Groups B, C and D.
- Dust-ignitionproof for Class II/III, Division 1, Groups E, F and G.
- Enclosure: Type 4X
- Temperature Class: T6
- Ambient Temperature: –40 to 60°C
- Supply Voltage:
  42 V dc max. (signal code “P”)
  7.14 Vdc max, 20 mW (signal code “S”)

Note 2. Wiring

- All wiring shall comply with National Electrical Code ANSI/NFPA70 and Local Electrical Codes.
- When installed in Division 1, “FACTORY SEALED, CONDUIT SEAL NOT REQUIRED.”



Master module and Slave module Connection F0204.ai

Note 3. Operation

- Keep the “WARNING” nameplate attached to the transmitter.
  WARNING: OPEN CIRCUIT BEFORE REMOVING COVER. FACTORY SEALED, CONDUIT SEAL NOT REQUIRED. INSTALL IN ACCORDANCE WITH THE USERS MANUAL IM 01C25.
- Take care not to generate mechanical sparking when accessing to the instrument and peripheral devices in a hazardous location.

Note 4. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void Factory Mutual Explosionproof Approval.

c. FM Intrinsically Safe Type/FM Explosionproof Type

Optional code /FU14 can be selected the type of protection (FM Intrinsically Safe or FM Explosionproof) for use in hazardous locations.

Note 1. For the installation of this transmitter, once a particular type of protection is selected, any other type of protection cannot be used. The installation must be in accordance with the description about the type of protection in this instruction manual.

Note 2. In order to avoid confusion, unnecessary marking is crossed out on the label other than the selected type of protection when the transmitter is installed.

2.9.2 ATEX Certification

(1) Technical Data

a. ATEX Intrinsically Safe

Caution for ATEX Intrinsically safe type.
Certification information
Warning:
A modification of the equipment would no longer comply with the construction described in the certificate documentation.

Note 1. EJX/EJA-E Series pressure transmitters with optional code /KS24 for potentially explosive atmospheres:

- No. FM 16ATEX0014 X
- Applicable Standard:
  EN IEC 60079-0, EN 60079-11
- Type of Protection and Marking code:
  Ⓔx II 1 G ☐ Ex ia IIC T4 Ga
- Ambient Temperature: –50 °C to +60 °C
- Maximum Process Temperature: 120 °C
- Enclosure: IP66/IP67 in accordance with only IEC (EN) 60529

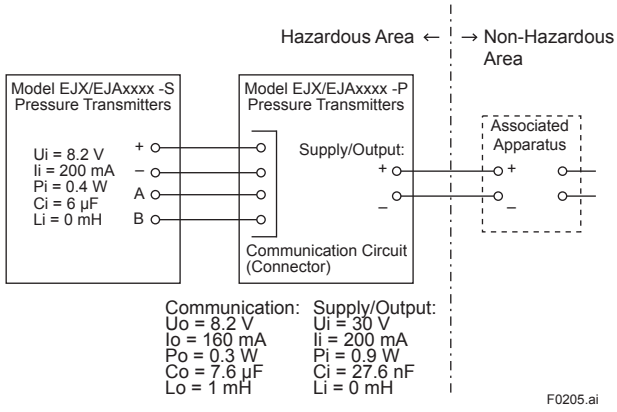
Note 2. Electrical Parameters

- [EJX****-P, EJA****-P]
  Supply/Output Circuit (Terminals: +, –)
  Ui: 30 V Ii: 200 mA Pi: 0.9 W
  Ci: 27.6 nF Li: 0 mH

  Communication Circuit (Connector)
  Uo: 8.2 V Io: 160 mA Po: 0.3 W
  Co: 7.6 µF Lo: 1 mH
- [EJX****-S, EJA****-S]
  Ui: 8.2 V Ii: 200 mA Pi: 0.4 W
  Ci: 6 µF Li: 0 mH

Note 3. Installation

- Refer to the control drawing. All wiring shall comply with local installation requirements.



- WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD – WHEN THE EQUIPMENT IS USED IN HAZARDOUS LOCATIONS, AVOID ANY ACTIONS WHICH GENERATE ELECTROSTATIC CHARGES, SUCH AS RUBBING WITH A DRY CLOTH.
- Note: The Associated Apparatus must be a linear power source.

Note 4. Maintenance and Repair

WARNING

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Note 5. Specific Conditions of Use

WARNING

- Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts.
- When the enclosure of the Pressure Transmitters is made of aluminum alloy, if it is mounted in a potentially explosive atmosphere requiring apparatus of equipment category 1 G, it must be installed such that, even in the event of rare incidents, an ignition source due to impact and/or friction sparks is excluded.
- Model EJX****-P and EJA****-P series pressure transmitters are not capable of withstanding the dielectric strength of 500 V r.m.s. between the intrinsically safe circuit and the enclosure.

b. ATEX Flameproof Type

Caution for ATEX flameproof type.

Note 1. EJX/EJA-E Series pressure transmitters with optional code /KF22 for potentially explosive atmospheres:

- No. KEMA 07ATEX0109 X
- Applicable Standard:
  EN IEC 60079-0, EN 60079-1, EN 60079-31
- Type of Protection and Marking Code:
  Ex db IIC T6...T4 Gb, Ex tb IIIC T85°C Db
  II 2 G Ex db IIC T6...T4 Gb
  II 2 D Ex tb IIIC T85°C Db
- Enclosure: IP66 / IP67
- Temperature Class for gas-poof:
  T6, T5, and T4
- Ambient Temperature for gas-proof:
  –50 to 75°C (T6), –50 to 80°C (T5), and –50 to 75°C (T4)
- Process Temperature (Tp.) for gas-proof:
  –50 to 85°C (T6), –50 to 100°C (T5), and –50 to 120°C (T4)
- Maximum Surface Temperature for dust-proof:
  T85°C (Tamb.: –30* to 75°C, Tp.: –30* to 85°C)
  * –15°C when /HE is specified.

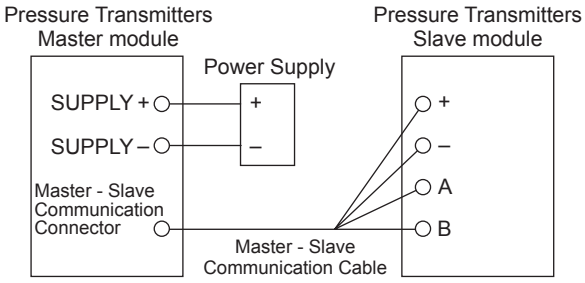
Note 2. Electrical Data

- Supply voltage: 42 V dc max.
- Slave module type, output signal code “S”, is only to be connected to Master module type, output signal code “P”, for power supply and communication by a 4-wire connection.

Note 3. For combined approval types Once a device of multiple approval type is installed, it should not be re-installed using any other approval types. Apply a permanent mark in the check box of the selected approval type on the ertification label on the transmitter to distinguish it from unused approval types.

Note 4. Installation

- All wiring shall comply with local installation requirement.
- In order to prevent the earthing conductor from loosening, the conductor must be secured to the terminal, tightening the screw with appropriate torque. Care must be taken not to twist the conductor.
- Cable glands, adapters and/or blanking elements with a suitable IP rating shall be of Ex d IIC/Ex tb IIIC certified by ATEX and shall be installed so as to maintain the specific degree of protection (IP Code) of the equipment.



Master module and Slave module Connection

F0204.ai

Note 5. Operation

WARNING: AFTER DE-ENERGIZING, DELAY 10 MINUTES BEFORE OPENING. WHEN THE AMBIENT TEMP.≥65°C, USE HEAT-RESISTING CABLE AND CABLE GLAND ≥90°C.

- Take care not to generate mechanical sparking when accessing to the instrument and peripheral devices in a hazardous location.

Note 6. Maintenance and Repair

WARNING

- When maintenance and repair are performed, confirm the following conditions and the then perform works. Confirm the power supply is cut off and the voltage of power supply terminal is not supplied.
- Only personnel authorized by Yokogawa Electric Corporation can repair the equipment in accordance with the relevant standards: IEC / EN 60079-19 (Equipment repair, overhaul and reclamation) and IEC / EN 60079-17 (Electrical installation inspection and maintenance); otherwise the certification will be voided

Note 7. Specific Conditions of Use

WARNING

- Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of the product.
- In the case where the enclosure of the Pressure Transmitter is made of aluminium, if it is mounted in an area where the use of category 2D apparatus is required, it shall be installed in such a way that the risk from electrostatic discharges and propagating brush discharges caused by rapid flow of dust is avoided.
- The flame paths differ from the standard values in EN 60079-1. Repair of the equipment is only allowed when done by the manufacturer or an authorised representative.
- The fasteners used to fasten the transmitter enclosure onto the sensor capsule is special fastener, and the property class of it is A2-50(A4-50) or more.
- For transmitters with a membrane made of titanium, ignition hazard due to impact and friction on the membranes shall be avoided.
- Maximum Surface Temperature for dust-proof:T85°C (Tamb.: –30* to 75°C, Tp.: –30* to 85°C)

  * –15°C when /HE is specified.

c. ATEX Intrinsically Safe Type/ATEX Flameproof Type

EJX/EJA-E Series pressure transmitters with optional code /KU24 can be selected the type of protection ATEX Flameproof or Intrinsically Safe. Ex ia for use in hazardous area.

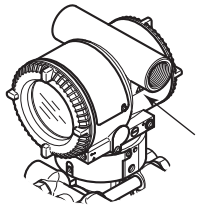
Note 1. For the installation of this transmitter, once a particular type of protection is selected, any other type of protection cannot be used. The installation must be in accordance with the description about the type of protection in this user's manual.

Note 2. For combined approval types, once a device of multiple approval type is installed, it should not be re-installed using any other approval types. Apply a permanent mark in the check box of the selected approval type on the certification label on the transmitter to distinguish it from unused approval types.

(2) Electrical Connection

A mark indicating the electrical connection type is stamped near the electrical connection port. These marks are as followed.

Screw Size	Marking
ISO M20 × 1.5 female	⚠M
ANSI 1/2 NPT female	⚠N or ⚠W



(3) Installation

WARNING

All wiring shall comply with local installation requirements and the local electrical code.

(4) Operation

WARNING

- OPEN CIRCUIT BEFORE REMOVING COVER. INSTALL IN ACCORDANCE WITH THIS USER'S MANUAL
- Take care not to generate mechanical sparking when access to the instrument and peripheral devices in a hazardous location.

2.9.3 IECEx Certification

a. IECEx Intrinsic safety

Caution for IECEx Intrinsic safety.
Certification information
Warning:
A modification of the equipment would no longer comply with the construction described in the certificate documentation.

Note 1. EJX/EJA-E series pressure transmitters with optional code /SS24 are applicable for use in hazardous locations

- No. IECEx FMG 16.0013 X
- Applicable Standard:
  IEC 60079-0, IEC 60079-11
- Type of Protection and Marking code:
  Ex ia IIC T4 Ga
- Ambient Temperature: –50 °C to +60 °C
- Maximum Process Temperature: 120 °C
- Enclosure: IP66/IP67 in accordance with only IEC (EN) 60529.

Note 2. Electrical Parameters

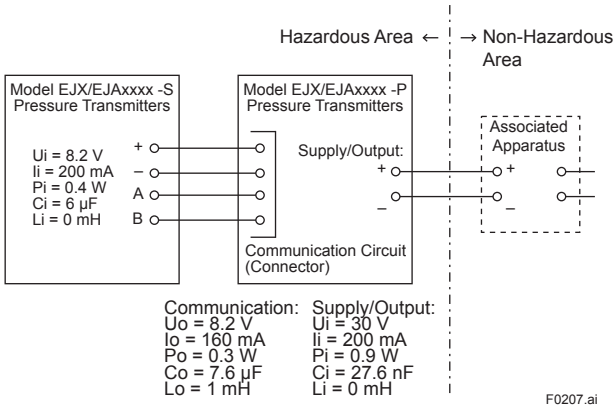
- [EJX****-P, EJA****-P]
  Supply/Output Circuit (Terminals: +, –)
  Ui: 30 V Ii: 200 mA Pi: 0.9 W
  Ci: 27.6 nF Li: 0 mH

  Communication Circuit (Connector)
  Uo: 8.2 V Io: 160 mA Po: 0.3 W
  Co: 7.6 µF Lo: 1 mH

- [EJX****-S, EJA****-S]
  Ui: 8.2 V Ii: 200 mA Pi: 0.4 W
  Ci: 6 µF Li: 0 mH

Note 3. Installation

- Refer to the control drawing. All wiring shall comply with local installation requirements.



- WARNING – POTENTIAL ELECTROSTATIC CHARGING HAZARD – WHEN THE EQUIPMENT IS USED IN HAZARDOUS LOCATIONS, AVOID ANY ACTIONS WHICH GENERATE ELECTROSTATIC CHARGES, SUCH AS RUBBING WITH A DRY CLOTH.
- Note: The Associated Apparatus must be a linear power source.

Note 4. Maintenance and Repair

WARNING

Only personnel authorized by Yokogawa Electric Corporation can repair the equipment.

Note 5. Specific Conditions of Use

WARNING

- Precautions shall be taken to minimize the risk from electrostatic discharge of painted parts.
- When the enclosure of the Pressure Transmitters is made of aluminum alloy, if it is mounted in a potentially explosive atmosphere requiring apparatus of equipment EPL Ga, it must be installed such that, even in the event of rare incidents, an ignition source due to impact and/or friction sparks is excluded.
- Model EJX****-P and EJA****-P series pressure transmitters are not capable of withstanding the dielectric strength of 500 V r.m.s. between the intrinsically safe circuit and the enclosure.

b. IECEx Flameproof Type

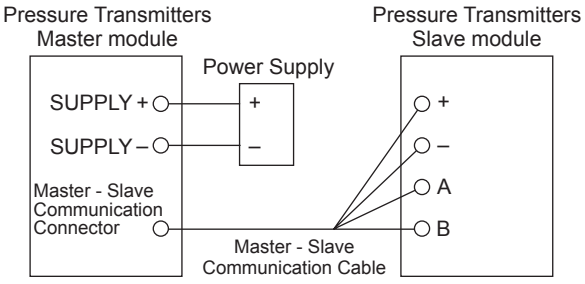
Caution for IECEx flameproof type.

Note 1. EJX/EJA-E Series pressure transmitters with optional code /SF2 are applicable for use in hazardous locations:

- No. IECEx CSA 07.0008
- Applicable Standard: IEC60079-0:2011, IEC60079-1:2007-4
- Flameproof for Zone 1, Ex d IIC T6...T4 Gb
- Enclosure: IP66/IP67
- Maximum Process Temperature: 120°C (T4), 100°C (T5), 85°C (T6)
- Ambient Temperature: –50 to 75°C (T4), –50 to 80°C (T5), –50 to 75°C (T6)
- Supply Voltage:
  42 V dc max.
  32 V dc max. (FOUNDATION Fieldbus and PROFIBUS PA type)
  9 to 28 V dc, 27 mW (Low Power type)
  7.14 Vdc max, 20 mW (Slave module type)
- Output Signal:
  4 to 20 mA dc
  15 mA (FOUNDATION Fieldbus and PROFIBUS PA type)
  1 to 5 V (Low Power type)

Note 2. Wiring

- In hazardous locations, the cable entry devices shall be of a certified flameproof type, suitable for the conditions of use and correctly installed.
- Unused apertures shall be closed with suitable flameproof certified blanking elements.



Master module and Slave module Connection

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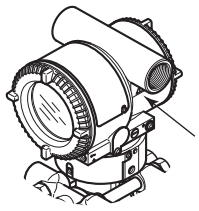
Note 3. Operation

- WARNING: AFTER DE-ENERGIZING, DELAY 10 MINUTES BEFORE OPENING.
- The fasteners used to fasten the transmitter enclosure onto the sensor capsule is special fastener, and the property class of it is A2-50(A4-50) or more.
- WARNING: WHEN THE AMBIENT TEMP.≥65°C, USE HEAT-RESISTING CABLE AND CABLE GLAND ≥90°C.
- Take care not to generate mechanical sparking when accessing to the instrument and peripheral devices in a hazardous location.
- Electrostatic charge may cause an explosion hazard. Avoid any actions that cause the generation of electrostatic charge, such as rubbing with a dry cloth on coating face of the product.

Note 4. Maintenance and Repair

- The instrument modification or parts replacement by other than authorized representative of Yokogawa Electric Corporation is prohibited and will void IECEx Certification.
- Electrical Connection
  A mark indicating the electrical connection type is stamped near the electrical connection port. These marks are as followed.

Screw Size	Marking
ISO M20 × 1.5 female	⚠M
ANSI 1/2 NPT female	⚠N or ⚠W



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c. IECEx Intrinsically Safe Type/IECEx Flameproof Type

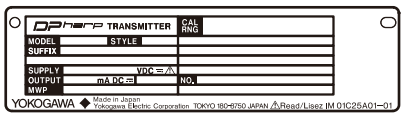
EJX/EJA-E Series pressure transmitters with optional code /SU24 can be selected the type of protection IECEx Flameproof or Intrinsically Safe. Ex ia for use in hazardous area.

Note 1. For the installation of this transmitter, once a particular type of protection is selected, any other type of protection cannot be used. The installation must be in accordance with the description about the type of protection in this user's manual.

Note 2. For combined approval types, once a device of multiple approval type is installed, it should not be re-installed using any other approval types. Apply a permanent mark in the check box of the selected approval type on the certification label on the transmitter to distinguish it from unused approval types.

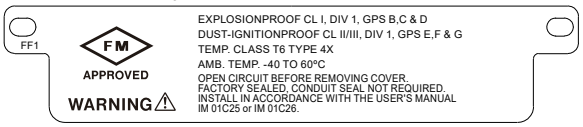
2.9.4 Name Plate

● Name plate

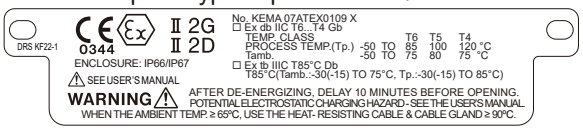


● Tag plate

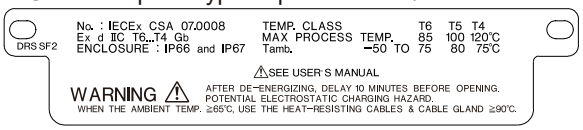
FM flameproof type optional code /FF1



ATEX flameproof type optional code /KF22

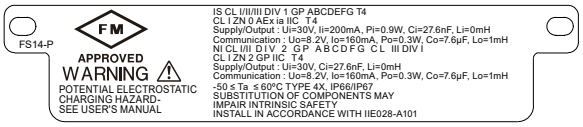


IECEx flameproof type optional code /SF2

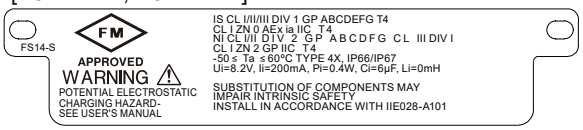


FM Intrinsically safe type optional code /FS14

[EJX****-P, EJA****-P]

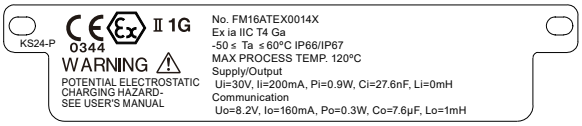


[EJX****-S, EJA****-S]

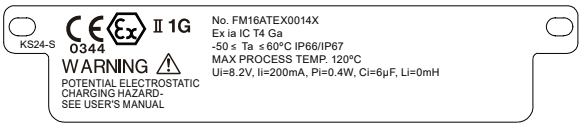


ATEX intrinsically safe type optional code /KS24

[EJX****-P, EJA****-P]

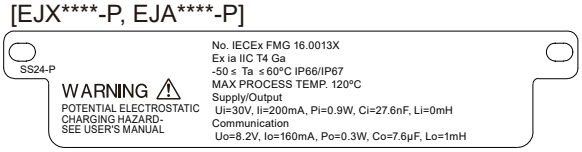


[EJX****-S, EJA****-S]

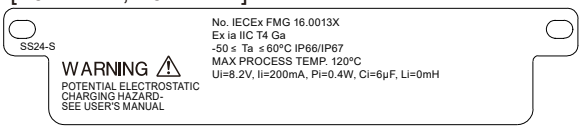


IECEx Intrinsic safety type optional code /SS24

[EJX****-P, EJA****-P]



[EJX****-S, EJA****-S]



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MODEL: Specified model code.
STYLE: Style code.
SUFFIX: Specified suffix code.
SUPPLY: Supply voltage.
OUTPUT: Output signal.
MWP: Maximum working pressure.
CAL RNG: Specified calibration range.
NO.: Serial number and year of production*1.

TOKYO 180-8750 JAPAN:
The manufacturer name and the address*2.

*1: The first digit in the three numbers next to the nine letters of the serial number appearing after "NO." on the nameplate indicates the year of production. The following is an example of a serial number for a product that was produced in 2010:

91K819857 032

The year 2010

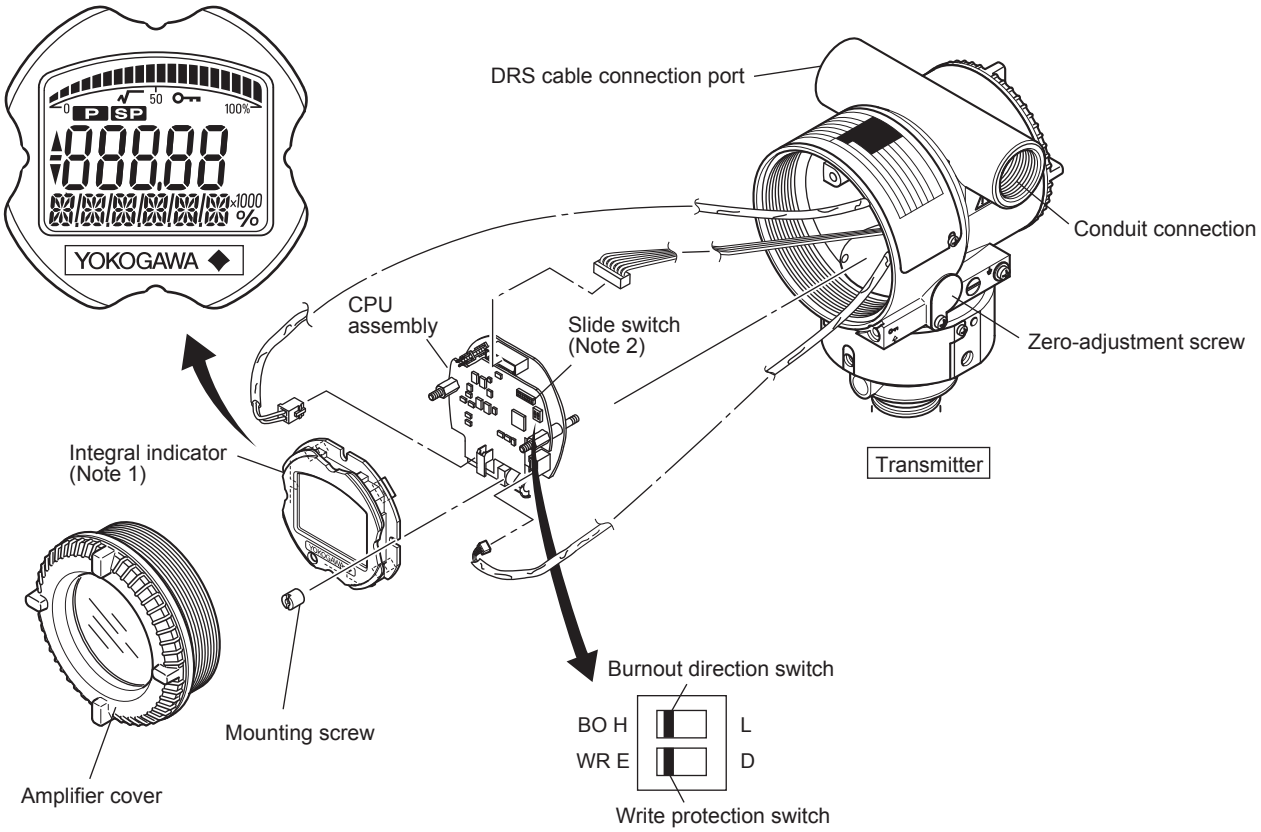
*2: "180-8750" is a zip code which represents the following address.

2-9-32 Nakacho, Musashino-shi, Tokyo Japan

*3: The identification number of Notified Body.

3. Component Description

3.1 High Pressure Side Transmitter (Master)



Burnout direction switch (BO)		
Switch position (Note 2)	H E L D	H E L D
Burnout direction	HIGH	LOW

Hardware write protection switch (WR)		
Switch position (Note 2)	H E L D	H E L D
Write protection	NO (Write enabled)	YES (Write disabled)

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Figure 3.1 Component Names of the High Pressure Side Transmitter (Master)

Note 1: See GS for details.
Note 2: Set the switches (BO, WR) as shown in the figure above to set the burn-out direction for CPU errors and write protection. The Burnout switch is set to the H side for delivery (unless option code /C1 or /C2 is specified in the order), and the hardware write protection switch is set to E side.
- The setting of the switches can be confirmed using the HART configuration tool. See subsections 7.2.3.12, “CPU Error Burnout Switch and Hardware Write Protection, and 7.2.3.13, “Software Write Protection.”
- To disable zero point adjustment using the external zero-adjustment screw, see subsection 7.2.3.11, “External Switch Mode.”

Table 3.1 Display Symbol

Display Symbol	Remarks
√	Display mode is ‘square root’. (Display is not lit when ‘linear’ mode.)
▲	The output signal being zero-adjusted is increasing.
▼	The output signal being zero-adjusted is decreasing.
🔑	Write protect function is enabled.

T0301.ai

3.2 Low Pressure Side Transmitter (Slave)

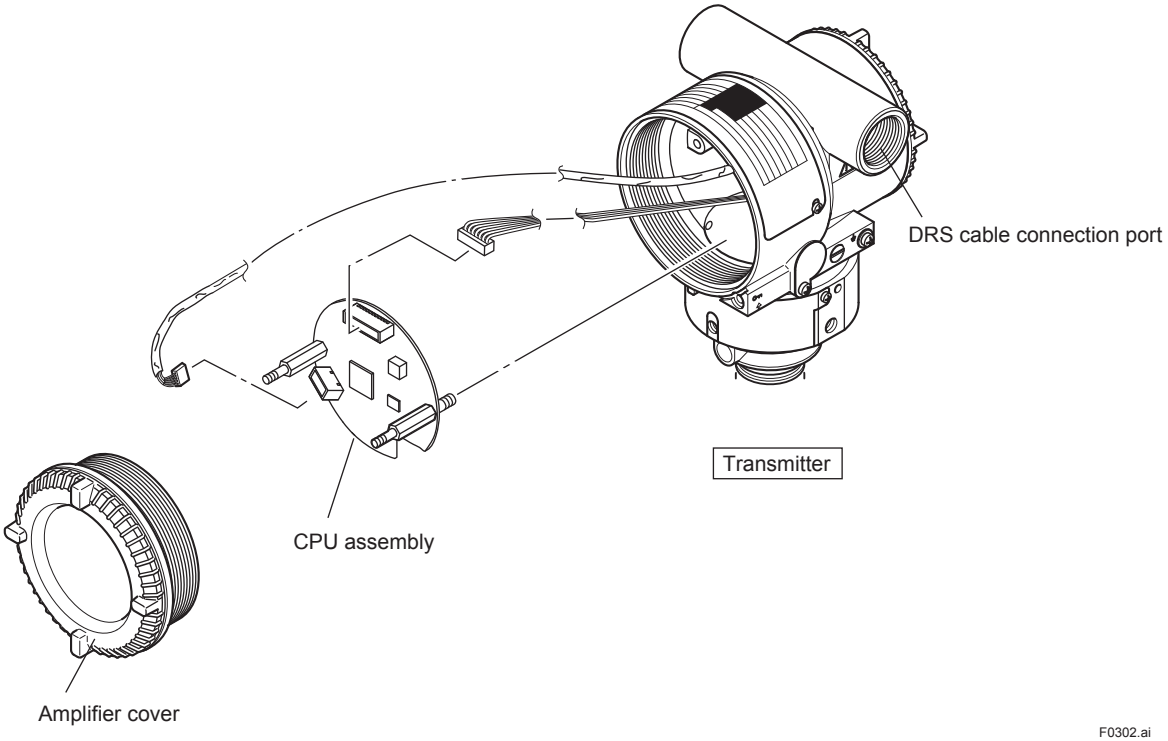


Figure 3.2 Component Names of the Low Pressure Side Transmitter (Slave)

4. Installation

4.1 Precautions

Before installing the transmitter, read the cautionary notes in Section 2.4, “Selecting the Installation Location.” For additional information on the ambient conditions allowed at the installation location, refer to GS. (See Chapter 10.)

IMPORTANT

- When welding piping during construction, take care not to allow welding currents to flow through the transmitter.
- Do not step on this instrument after installation.
- Rainwater and the like must be kept from entering through the atmosphere release hole and zero adjustment screw. Do not install the transmitter with this hole facing up. In addition, make sure that the pipe is connected to the atmosphere release hole. Using the transmitter without connecting the pipe may affect the transmitter’s performance.
- When installing a diaphragm seal, make sure that no foreign matter has adhered to the seal surface of the gasket or O-ring before assembling. If foreign matter adheres, it may lead to leaks.

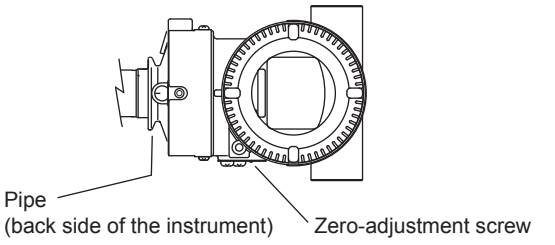


Figure 4.1 Pipe and Zero-Adjustment Screw

4.2 Mounting

IMPORTANT

As the pressure-detector diaphragm is thin and prone to damage, do not press on it or hit it against something.

- In the case of screw mounting, remove the dustproof plastic cap that is inserted in the impulse line connection of the transmitter before connecting the piping. When removing the cap, make sure not to damage the threads. Do not insert a screwdriver or the like to remove the cap.
- The transmitter can be mounted on a nominal 50 mm (2-inch) pipe using the mounting bracket supplied, as shown in Figure 4.2.
- If you specified A for the process connection code, prepare the necessary gasket shown in Figure 4.3.
- For models with flange mounted diaphragm seals, mount the transmitter to the process using flanges as shown in Figure 4.5. The mating flange, gasket, stud bolts and nuts are to be procured by the customer.
- For models with hygienic seals, mount the transmitter to the process as shown in figure 4.6 and 4.7.
  When mounting hygienic, extended type seal, tank spud is required. For information of a tank spud and other parts for mounting, see 4.6.

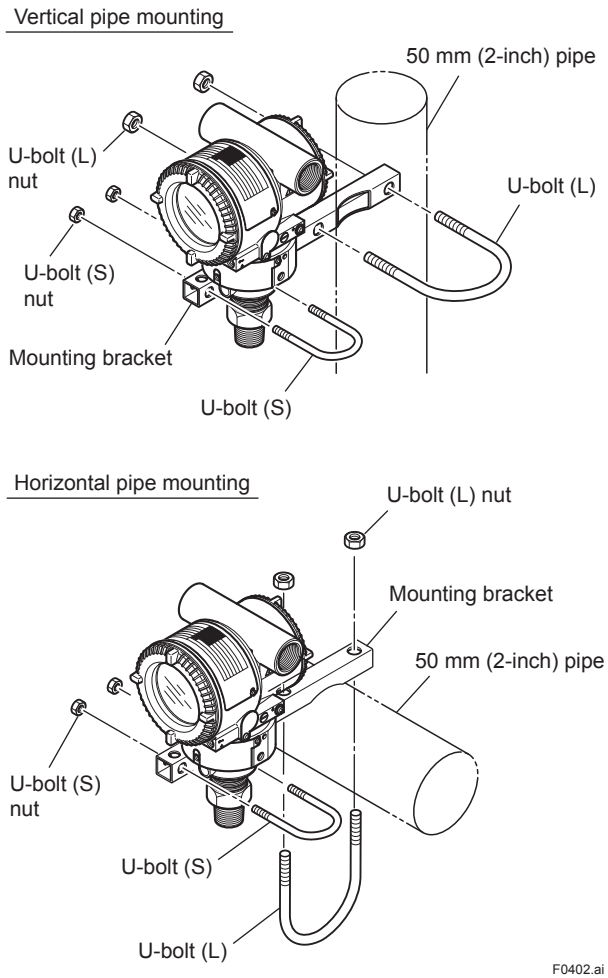


Figure 4.2 Transmitter Mounting

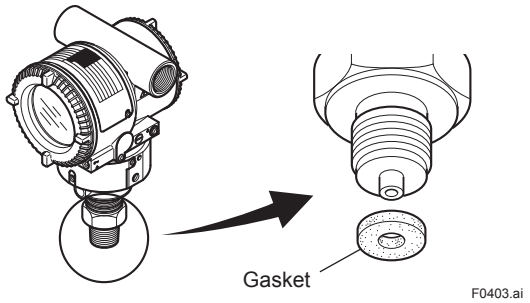


Figure 4.3 Gasketing

IMPORTANT

Tighten the hexagonal nut part of the capsule assembly. See Figure 4.4.

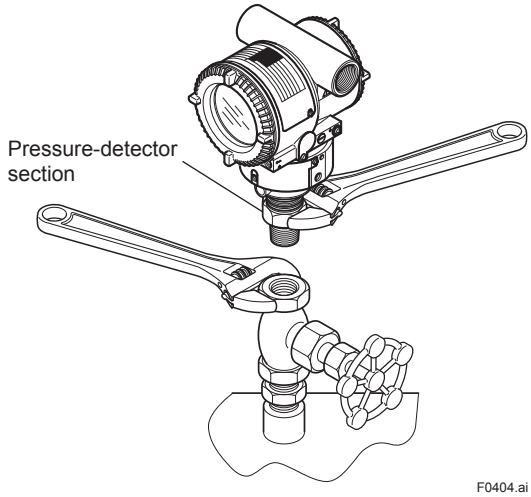


Figure 4.4 Tightening Transmitter

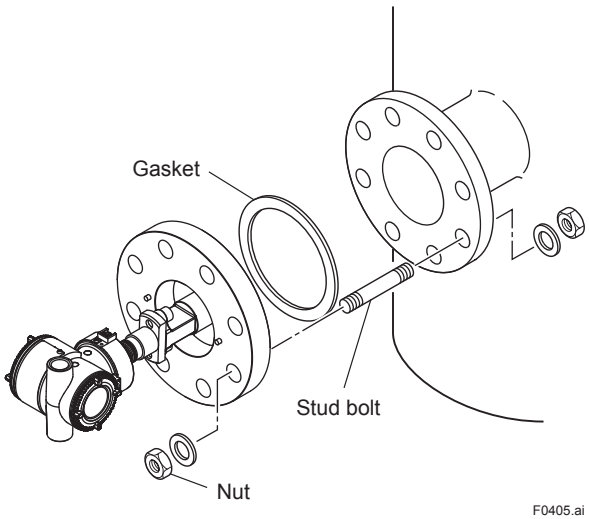


Figure 4.5 Mounting Flanged Seals

IMPORTANT

Please use a gasket with an inside diameter (ød) that is greater than the diameter of the diaphragm seal. If a gasket with a smaller inside diameter is used, the diaphragm may not function correctly.

C20FW	Flange size	80A(3B)	50A(2B)	40A(1 1/2B)
	ød (mm)	90	61	44*

* Combination with C10FR is necessary.

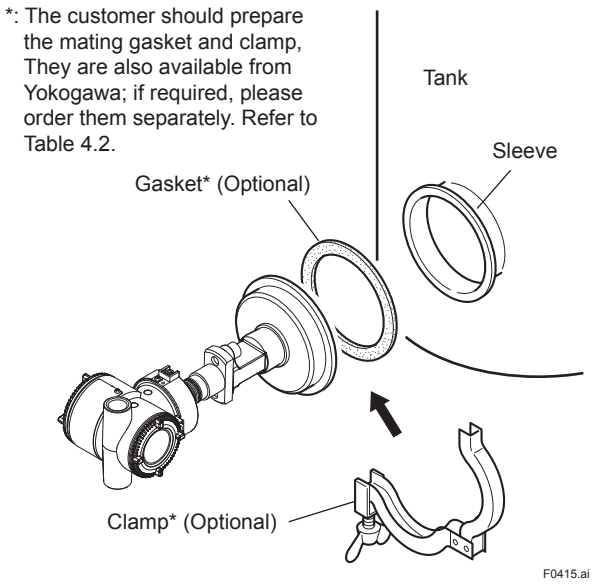


Figure 4.6 Mounting Hygienic Seals (Flush Type) (Hygienic, flush type)

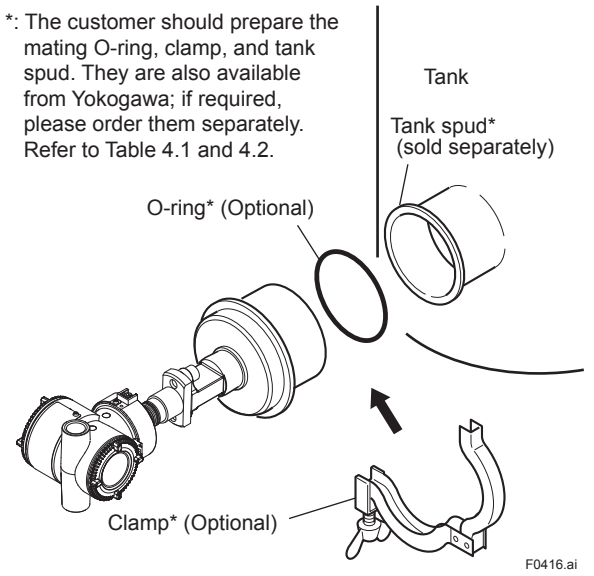


Figure 4.7 Mounting Hygienic Seals (Extended Type)

IMPORTANT

- When measuring the liquid level of the tank, the minimum liquid level (zero point) must be set to a level at least 50 mm above the center of the high pressure side diaphragm seal (see Figure 4.9).
- Correctly install the diaphragm seal part on the tank, checking the label “PRESSURE HIGH” or “PRESSURE LOW” on each seal.
- Exercise care so as not to damage diaphragm surfaces. For models with diaphragm seals, since the diaphragm protrudes approx. 1 mm from the flange surface, do not place the pressure detector section face down on a surface as this can damage the diaphragm.
- Fix the DRS cable in place to keep it from moving due to wind or vibration. If the DRS cable is too long, loosely coil the extra tube portion (coil diameter of 250 mm or more) and secure the coiled tube with a clamp.

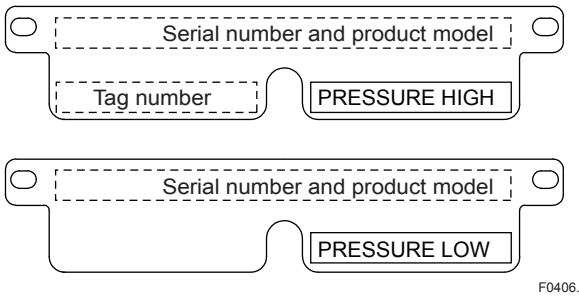


Figure 4.8 Master/Slave Nameplate Description

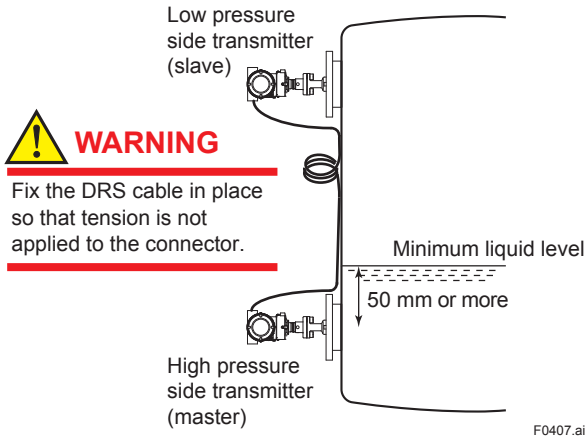


Figure 4.9 Example of Mounting to a Tank

4.3 Connecting the DRS Cable

Connect the DRS cable to the high pressure side transmitter (master) and low pressure side transmitter (slave). Be careful of the termination when connecting.

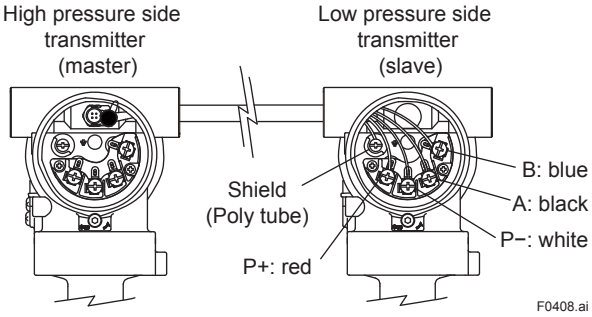


Figure 4.10 DRS Cable Connection

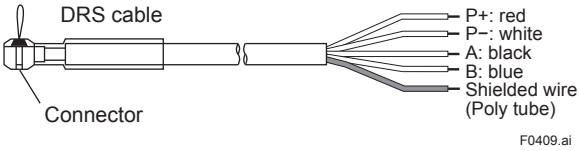


Figure 4.11 DRS Cable Specifications

CAUTION

To shorten the cable, cut the side opposite to the connector end.
When terminating the DRS cable, be sure to completely insulate each wire to keep them from making contact as each wire has independent electric potential.
To prevent the shielded wire from making contact with each terminal, cover each shielded wire with a vinyl tube or wrap vinyl tape around it.
Do not connect the power directly to the low pressure side transmitter (slave). If you connect the power supply directly, it may damage the equipment.

4.4 Mounting the C10FR Flushing Connection Ring

4.4.1 Mounting to Pressure Detector Section

The C10FR flushing connection ring is mounted to the pressure detector section as shown in Figure 4.12. At the factory shipment, the flushing connection ring is enclosed with the diaphragm seal section without being tightly attached to the pressure detector section with screw, bolt/nut or welding. Therefore, when taking it out, please handle it with care not to damage the diaphragm with ring holder or vent/drain plugs of the flushing connection ring.

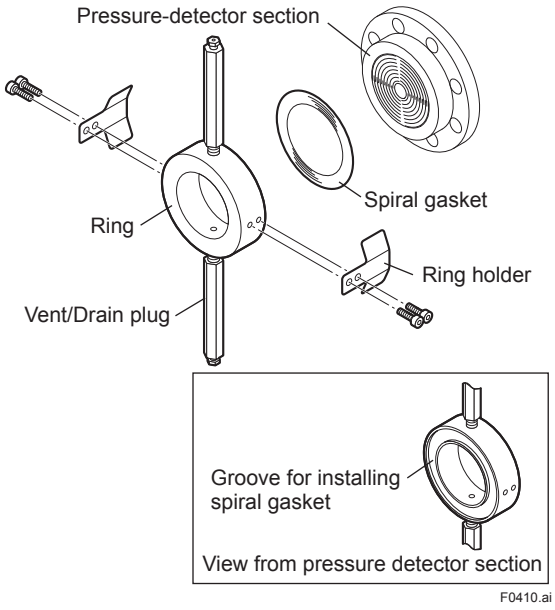


Figure 4.12 Mounting to Pressure Detector Section

1. Mount the ring holder on the ring and loosely tighten the mounting screws.
2. Place the spiral gasket in the ring groove. With the ring correctly aligned and flush with the face of the pressure detector, securely tighten each ring holder's mounting screws.
3. Position the ring so that the vent/drain plugs are aligned straight up and down.

4.4.2 Mounting to Process Flange

Tighten the bolts to completely close the gap between the ring and the pressure detector section. The mating flange, gasket, stud bolts and nuts are to be procured by the customer.

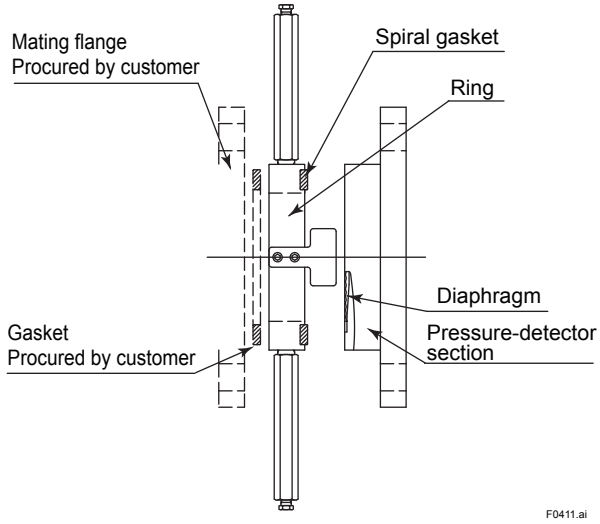


Figure 4.13 Mounting to Process Flange

IMPORTANT

- Confirm that there is no gap between the ring and the process-detector section after they are mounted on the process flange. A gap can lead to a sudden, explosive release of process fluids.
- When mounting or removing the ring, take care not to tilt the pressure detector downward as the ring can slip off and cause injury.
- When re-mounting the ring, use the new spiral gasket as shown in below table.

Table 4.1 Spiral Gasket for Pressure Detector Section Side*

			Hoop material/Part number		
Gasket size	Description		SUS316	SUS316L	Hastelloy C-276
ø100 × ø120 × t4.5	For 3-inch flange	General use	F9350SV	F9350SW	F9990BR
ø100 × ø120 × t4.5	For 3-inch flange	High temperature use	F9990BK	F9990BN	--------
ø100 × ø120 × t4.5	For 3-inch flange	Oil-prohibited use**	F9970XF	F9970XG	--------
ø70 × ø90 × t4.5	For 2-inch flange	General use	F9350ST	F9350SU	F9990BQ
ø70 × ø90 × t4.5	For 2-inch flange	High temperature use	F9990BJ	F9990BM	--------
ø70 × ø90 × t4.5	For 2-inch flange	Oil-prohibited use**	F9970XD	F9970XE	--------
ø60 × ø75 × t4.5	For 1 1/2-inch flange	General use	F9346ZH	F9970XA	F9990BP
ø60 × ø75 × t4.5	For 1 1/2-inch flange	High temperature use	F9990BH	F9990BL	--------
ø60 × ø75 × t4.5	For 1 1/2-inch flange	Oil-prohibited use**	F9970XB	F9970XC	--------

*: Filler material
General use, oil-prohibited use: PTFE
High temperature use: Inorganic paper
**: When option code /K31 or /K35 is specified

4.5 Affixing the Teflon Film

The FEP Teflon option includes a Teflon film and fluorinated oil. Before mounting the diaphragm seal to the process flange, affix the Teflon film as follows:

IMPORTANT

1) Position the diaphragm seal so that the diaphragm is in a upward position.
2) Pour the fluorinated oil on the diaphragm and gasket area covering it completely and evenly. Be careful not to scratch the diaphragm or change the its shape.
3) Affix the Teflon film over the diaphragm and gasket area.
4) Next, carefully inspect the cover and try to identify any entrapped air between the diaphragm and the Teflon film. The air must be removed to ensure optimum performance. If air pockets are present, use your fingers to remove the air by starting at the center of the diaphragm and work your way out. However, do not lay too much stress on the diaphragm, as it may cause a deform of the diaphragm.
5) Position the gasket on the Teflon film, and mount the transmitter onto the process flange.

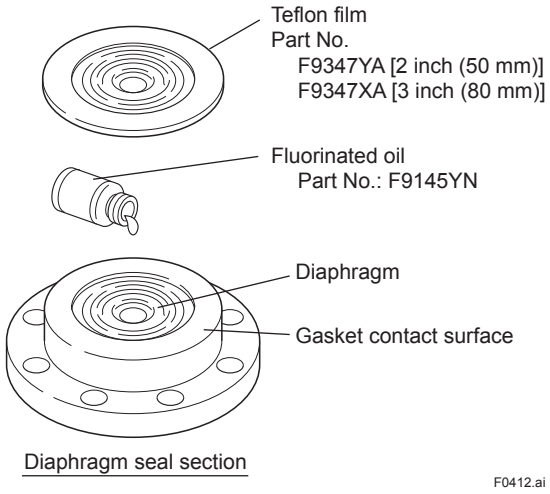


Figure 4.14 Affixing the Teflon Film

4.6 Tank Spud Mounting Method

A tank spud is used to joint a tank and an extended diaphragm.
It is imperative for sanitary use that the contact parts of the transmitter and the tank are securely and tightly sealed in order to avoid the process fluid spouting and the decomposition by stagnant fluid. The construction of the tank spud using a O-ring eliminates the clearance between the contact parts and ensures the tightness.

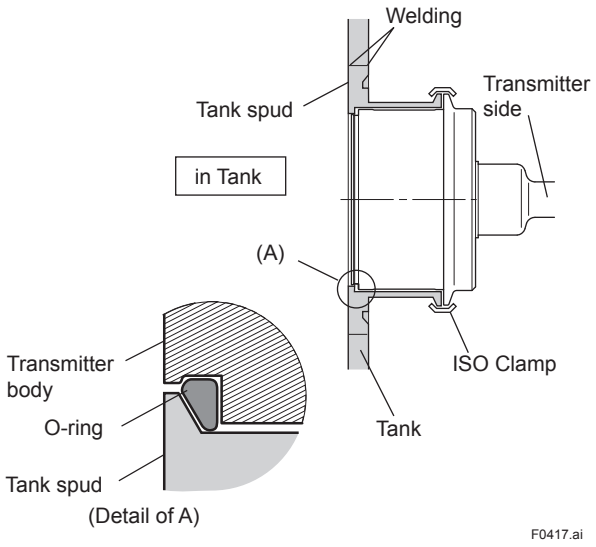


Figure 4.15 Details of Transmitter Mounting

■ Welding

When welding a tank spud to a tank, take great care not to change its shape by heat. The deformation of the shape eventually makes a dead space between the transmitter and the tank spud, resulting in the process fluid spouting and the decomposition the coupling by stagnant fluid.

■ Mounting Position

Set the center of the tank spud to a level at least 50mm above the minimum liquid level (zero point).

IMPORTANT

- Clean thoroughly the tank after the welding the tank spud to the hole on a tank.
- Be sure that the surface is finished smoothly by using a grinder except the hole is made by the machinery cutting.

■ Mounting Direction

Fit the tank spud onto the tank so that the drain outlet faces downward. Then carry out the temporary welding at four points outside the spud, making sure to keep the boundary of the inside surface of the tank wall and spud flat. Also, set the spud vertical against the tank wall, in order for the transmitter to be installed correctly.

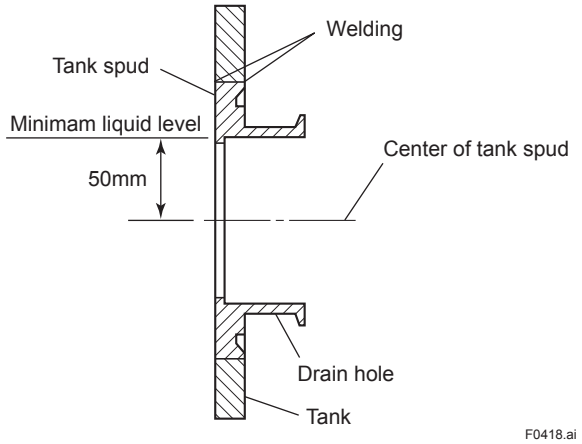


Figure 4.16 Mounting Tank Spud

■ Welding method and Cautions

- Welding work should start with the inside of tank, then continue to outside.
- Before starting the welding work, cool the welding part with dry ice and so on. The welded part should be cooled down one welding part after another.
- Set the welding heat level as low as possible to avoid the deformation of the spud.
- Since the tank spud materials used are SUS304, SUS316, and SUS316L, use the welding stick material as follows;
  Covered arc welding: D316L
  Tig or Mig welding: Y316L
- Take care not to damage the O-ring sealing part.

■ Finishing Welding Surface

Make sure that all the welded parts are ground smooth and flat in a way that no dust is stuck to the surface.

[Special Tools for Tank Spud Welding]

Yokogawa provides special tools exclusively designed for the tank spud welding to make the installation easily and effectively. These tools can be ordered separately.

- Cooling tool.....reduces the strain on the spud during welding process.
  For extension length L = 52 mm:
  Part No. 1J833A063-31
  For extension length L = 102 mm:
  Part No. 1J833A063-32
- Strain check gauge.....determines whether the transmitter can be mounted.
  For extension length L = 52 mm:
  Part No. 1J833A063-41
  For extension length L = 102 mm:
  Part No. 1J833A063-42

Table 4.1 Tank Spud model code

Model	Suffix Code	Description
TS	**. . . . . .**	Tank spud
Extension length	**-E . . . . . .**	2 inch (50 mm) for ISO101.6 Clamp
	-F	4 inch (100 mm) for ISO101.6 Clamp
	-J	2 inch (50 mm) for ISO76.1 Clamp
	-K	4 inch (100 mm) for ISO76.1 Clamp
Material	**U. . . . . .**	304 SST
	V.	316 SST
	W	316L SST
Welding part plate thickness	**A. . . . .**	16 mm
	B.	12 mm
	C.	8 mm

*: For the overview of the tank spud, refer to Subsection 4.7.3.

Table 4.2 Mounting tool, Gasket, and o-ring

Item	Part No.	Description
Clamp	G9726AE	for ISO101.6 clamp
	G9726AD	for ISO76.1 clamp
Gasket	F9500DZ	for ISO101.6 clamp
	F9500DY	for ISO76.1 clamp
O-ring	F9271QK	for ISO101.6 clamp
	F9995CB	for ISO76.1 clamp

*: Observe the condition of the gasket when unscrewing the clamp. If the gasket is worn away or changed its shape, it must be replaced with new one.

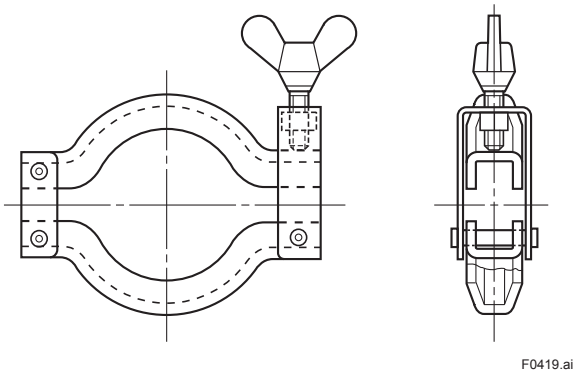


Figure 4.17 Clamp Overview

4.7 Rotating Transmitter Section

WARNING

For the flameproof type, as a general rule, do not rotate the transmitter while it is on. If you must do so, use a gas detector or the like to check that there is no explosive gas.

The transmitter section can be rotated approximately 360° and can be fixed at any angle within the above range. (The direction of the rotation is depending on the configuration of the instrument.) Note that there is a stopper which prevents the transmitter section from being rotated more than 360°.

1. Using the Allen wrench, loosen the two setscrews securing the transmitter section to the capsule assembly.
2. Rotate the transmitter section slowly to the desired position.
3. Tighten the two setscrews to a torque of 1.5 N·m {15 kgf·cm}.

IMPORTANT

Do not rotate the transmitter section more than the above limit.

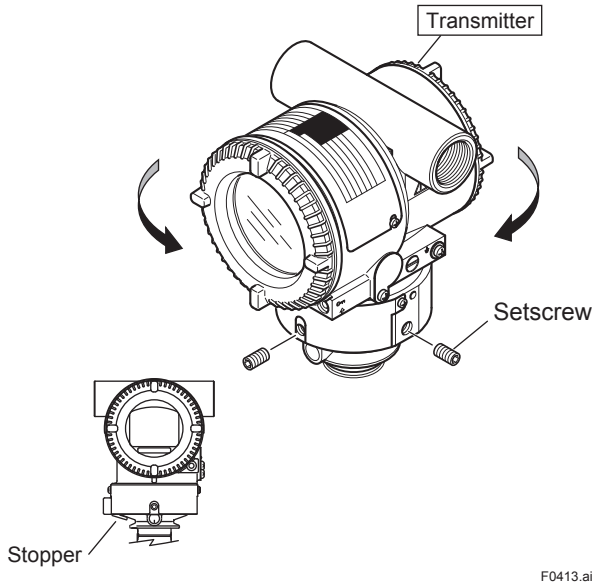


Figure 4.18 Rotating Transmitter Section

4.8 Changing the Direction of Integral Indicator

IMPORTANT

Always turn OFF power, release pressure and remove a transmitter to non-hazardous area before disassembling and reassembling an indicator.

An integral indicator can be installed in the three directions. Select the direction that is easy for you to see. Follow the instructions in section 8.4 for removing and attaching the integral indicator.

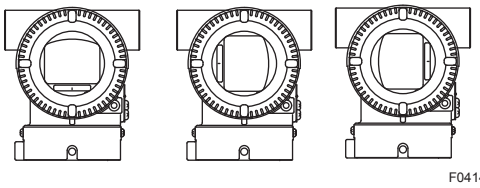


Figure 4.19 Integral Indicator Direction

5. Wiring

5.1 Wiring Precautions

IMPORTANT

- Lay wiring as far as possible from electrical noise sources such as large capacity transformers, motors, and power supplies.
- Remove electrical connection dust cap before wiring.
- All threaded parts must be treated with waterproofing sealant.
  (A non-hardening silicone group sealant is recommended.)
- To prevent noise pickup, do not pass signal and power cables through the same ducts.
- Explosion-protected instruments must be wired in accordance with specific requirements (and, in certain countries, legal regulations) in order to preserve the effectiveness of their explosion-protected features.
- For flameproof types, turn the Allen head bolt clockwise to unlock the cover, and then remove the cover. See Subsection 8.4 “Disassembly and Reassembly” for details.

5.2 Selecting the Wiring Materials

- Use stranded leadwires or cables which are the same as or better than 600 V grade PVC insulated wire (JIS C3307) or equivalent.
- Use shielded wires in areas that are susceptible to electrical noise.
- In areas with higher or lower ambient temperatures, use appropriate wires or cables.
- In environment where oils, solvents, corrosive gases or liquids may be present, use wires or cables that are resistant to such substances.
- It is recommended that crimp-on solderless terminal lugs (for 4 mm screws) with insulating sleeves be used for leadwire ends.

5.3 Connections of External Wiring to Terminal Box

5.3.1 Power Supply Wiring Connection

IMPORTANT

Be sure to use a DC power supply with the appropriate specifications.
The instrument will malfunction if it is connected to a commercial AC power supply.

Connect the power supply wiring to the SUPPLY + and – terminals.

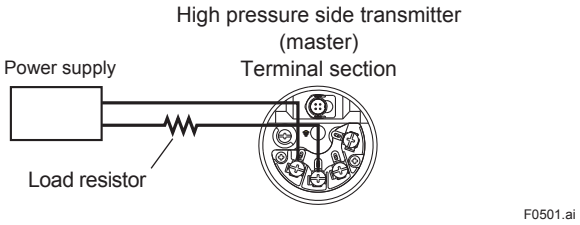


Figure 5.1 Power Supply Wiring Connection

5.3.2 External Indicator Connection

Connect wiring for external indicators to the CHECK A (+) and SUPPLY – terminals.

IMPORTANT

Use an external indicator whose internal resistance is 10 Ω or less.

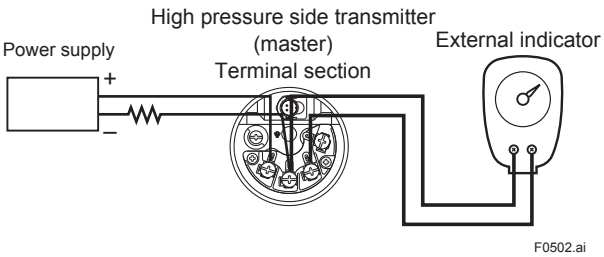


Figure 5.2 External Indicator Connection

5.3.3 Connecting the HART Configuration Tool

Connect the HART configuration tool to the SUPPLY + and – terminals (use hooks) of the high pressure side transmitter (master). Polarity does not matter. A connection example is shown below.

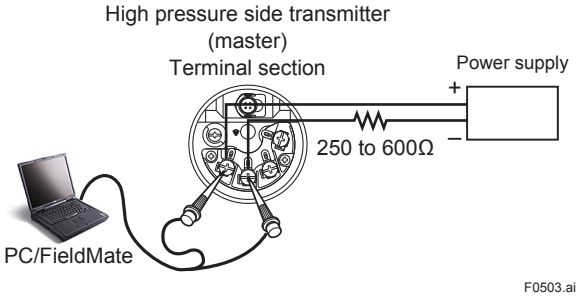


Figure 5.3 Connecting the HART Configuration Tool

5.3.4 Check Meter Connection

Connect the check meter to the CHECK A (+) and SUPPLY – terminals (use hooks).

- A 4 to 20 mA DC output signal output from the CHECK A (+) and SUPPLY – terminals.

IMPORTANT

- Use a check meter whose internal resistance is 10 Ω or less.

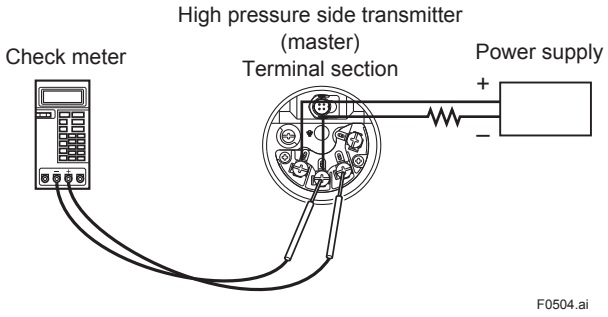


Figure 5.4 Check Meter Connection

5.4 Wiring

5.4.1 Loop Configuration

Since the DPharp uses a two-wire transmission system, signal wiring is also used as power wiring. DC power is required for the transmitter loop. The transmitter and distributor are connected as shown below.
For details of the power supply voltage and load resistance, see section 5.7.

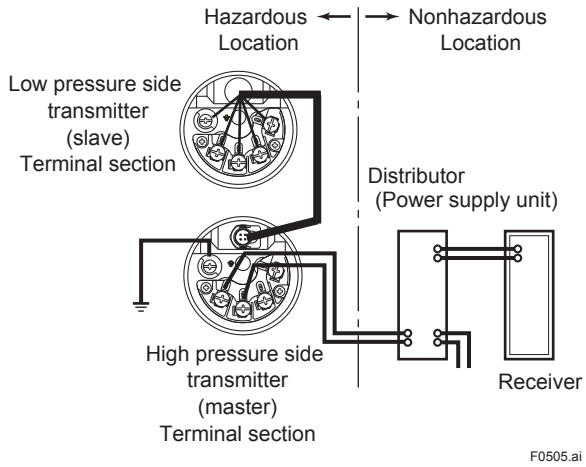


Figure 5.5 Connection between Transmitter and Distributor

5.4.2 Wiring Installation

(1) General-use Type

With the cable wiring, use a metallic conduit or waterproof glands.

- Apply a non-hardening sealant to the terminal box connection port and to the threads on the flexible metal conduit for waterproofing.

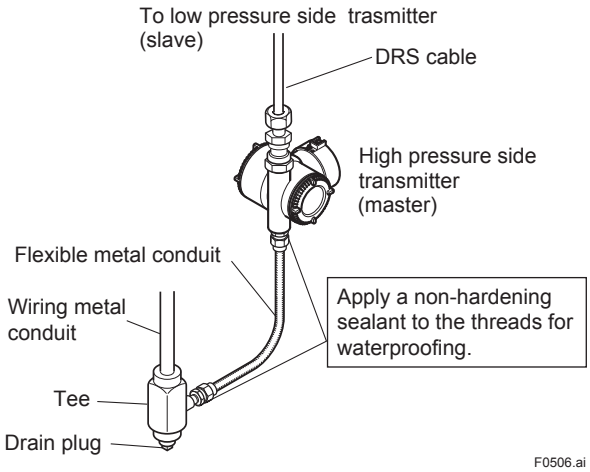


Figure 5.6 Typical Wiring Using Flexible Metal Conduit

(2) Flameproof Type

Wire cables through a cable gland or using a flameproof metal conduit.

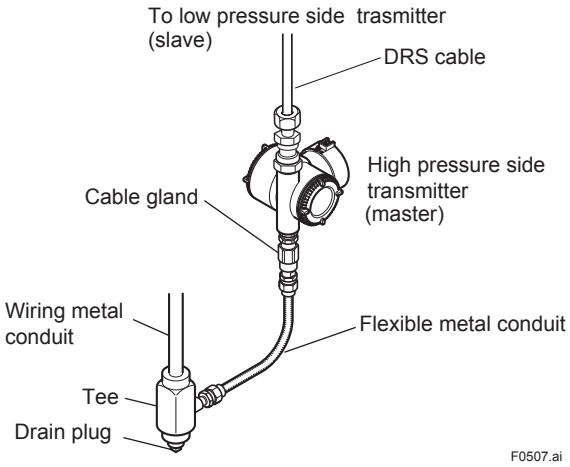


Figure 5.7 Typical Cable Wiring Using Flameproof Packing Adapter

■ Flameproof metal conduit wiring

- A seal fitting must be installed near the terminal box connection port for a sealed construction.

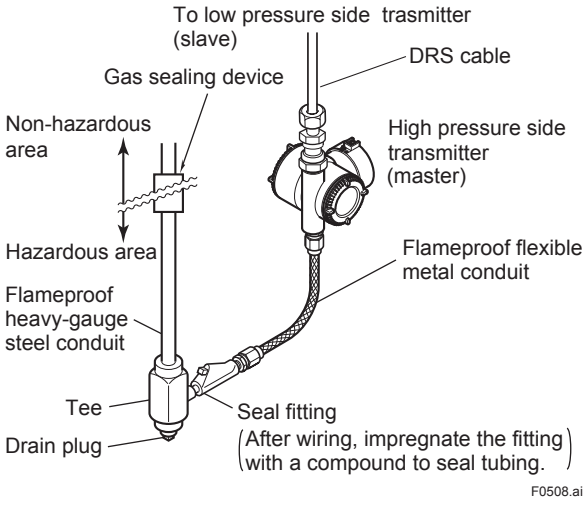


Figure 5.8 Typical Wiring Using Flameproof Metal Conduit

5.5 DRS Cable Connection

Connect the DRS cable between the high pressure side transmitter (master) and low pressure side transmitter (slave). Wires can be run through a cable gland or a wiring metal conduit. In either method, follow the procedure below to connect and disconnect wiring.

CAUTION

- In the case of the flameproof type, running the wires through a cable gland is the only method allowed for the DRS cable connection. As such, refer to subsection 5.5.1, and connect the wiring.
- Because the high pressure side transmitter (master) and low pressure side transmitter (slave) are not insulated, do not turn on the power until all wiring is complete.
- When the option code: FF1, FU14, PF22, PF23, NF2, NF21, UF1, GF12 and GU14 is selected, cable glands for DRS cable are not attached.
- For these options, prepare the cable gland conform to the cable of ø8.5 mm diameter. In the case to insert the DRS cable into cable gland from the side of DRS connector, inner diameter of the cable gland must be larger than ø13 mm. If the inner diameter of selected cable gland is smaller than ø13 mm, insert the DRS cable from the oposit side of the DRS connector before laying DRS cable.

5.5.1 Wiring through a Cable Gland

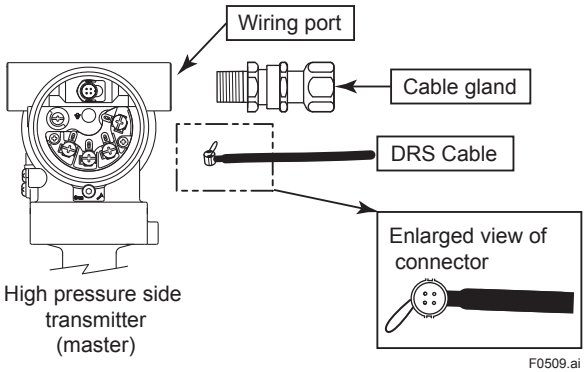


Figure 5.9 Mounting the Cable Gland for the DRS Cable

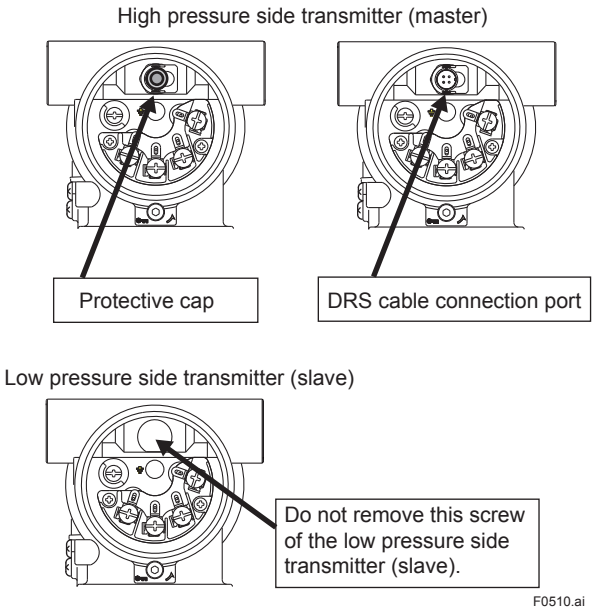


Figure 5.10 Removing the Protective Cap

A dustproof protective cap is attached to the DRS cable connection port of the high pressure side transmitter (master). Do not remove this cap until you connect a cable. Do not remove the screw located at the same location on the low pressure side transmitter as doing so will affect the product performance.

- **In The Case of Electrical Connection Code 2, 7, C (1/2 NPT Female) or 4, 9, D (M20 Female)**

- Components of the cable gland
  This cable gland consists of an entry, seal, running coupler, and back nut. Check that the wiring port thread standard and the cable gland entry's thread standard are matched.

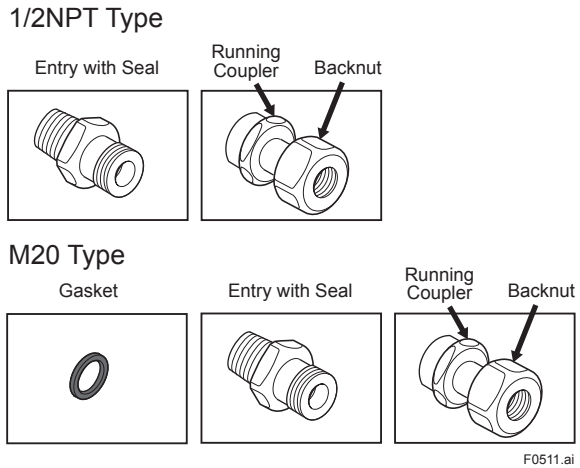


Figure 5.11 Components of the Cable Gland

- Installing the cable gland
  1. Disassemble the cable gland: loosen the running coupler to separate the backnut from the entry.
  2. Remove the protection cap over the transmitter electrical connection and install the entry on the electrical connection. Note that a sealant should be applied to the threads for a 1/2 NPT connection and a gasket should be used for an M20 connection.

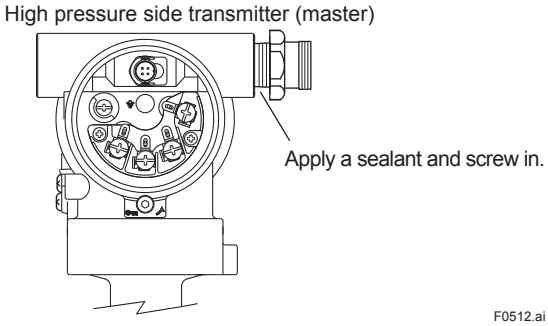


Figure 5.12 Applying Sealant

3. Pass the DRS cable through the running coupler and back nut assembly component.

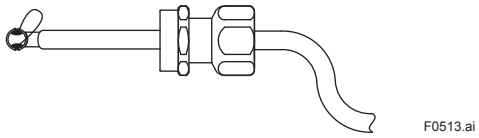


Figure 5.13 Running Coupler and Back Nut

4. Insert the DRS cable through the entry mounted on the wiring port, and insert the connector into the DRS connection port.

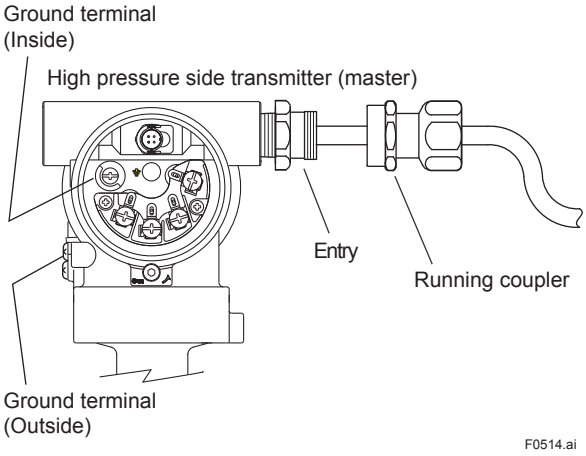


Figure 5.14 DRS Cable Connection 1 (Cable Gland)

5. Position the running coupler so that it is along a straight line with the entry.
6. Screw the running coupler until the seal touches the DRS cable.

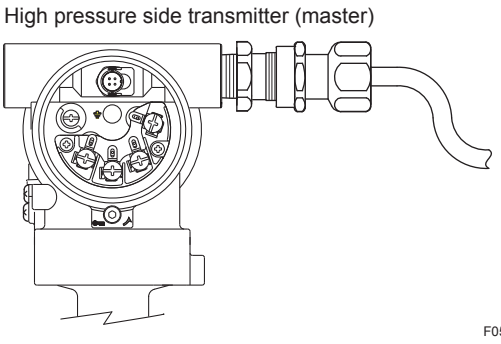


Figure 5.15 DRS Cable Connection 2 (Cable Gland)

7. After the seal touches the DRS cable, turn the running coupler another half turn to securely tighten.
8. If a wiring metal conduit for cable protection is necessary, run the DRS cable through the conduit, and then screw it into the back nut.

CAUTION

After fixing the DRS cable in place, do not apply excessive mechanical shock to the DRS connector section, such as by screwing the running coupler further or pulling on the cable.

- **In the case of electrical connection code 5, 9, F (G1/2 female).**

- Components for the cable gland
  The cable gland assembly consists of an adapter body, packing box, rubber packing, washer, gland, clamp ring, clamp nut, union coupling, and union cover.
  Refer to (2) and (3) shown below.
  DRS cable gland is accompanied by two kinds of rubber packing.
  Since the outside diameter of the DRS cable is 8.5 mm, use the rubber packing with identification mark “16 8-10” on it.

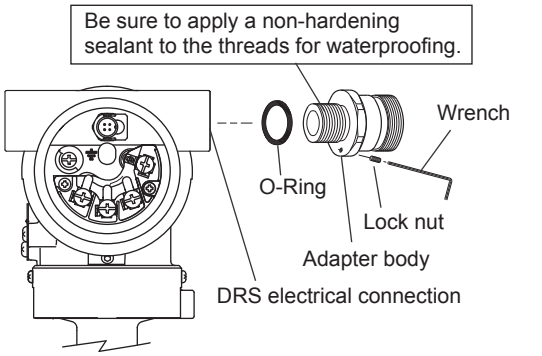
NOTE

The DRS cable can not let through the cable gland from the connector side.
Insert the cable through the cable gland from the wire rods side (opposite side of DRS connector) before laying the cable.

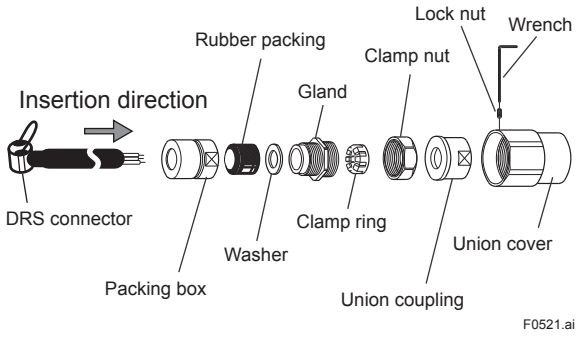
Procedure

(1) Disassemble the cable gland: loosen the all parts

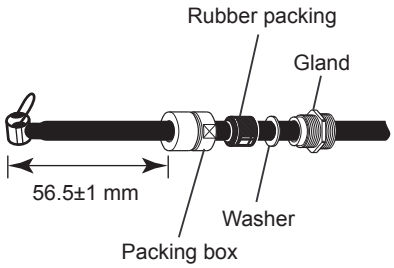
(2) Remove the protection cap on the DRS electrical connection and DRS connecting port, and screw the adapter body to the DRS electrical connection.
Screw the adapter body into the DRS electrical connection until the O-ring touches the DRS electrical connection (at least 6 full turns), and firmly tighten the lock nut by the wrench.



(3) Insert the DRS cable in order of a packing box, rubber packing, washer, gland, clamp ring, clamp nut, union coupling, union cover from the cable end of the wire rods side (opposite side of DRS connector).
Since the internal diameter of rubber packing has restriction, DRS connector can not pass through it, please keep this order.



(4) Secure the DRS cable to the packing box by screwing the gland into the packing box at the position where the distance from the connector tip of the DRS cable to the packing box will be 56.5±1mm.
Tighten approximately 1 more turn surely after the cable can not move.
The quantity of this tightening is very important. It leads to wiring disconnection fault when tighten too much.
After that, tighten the clamp nut.



(5) Insert the DRS cable and firmly plug its connector into the connecting port in the transmitter's terminal box.
(6) Screw the union cover to the adaptor body which has fixed to the DRS electrical connection at procedure (2).
Screw the union cover at least 6 full turns, and tighten the rock nut.
(7) If the conduit piping is necessary, screw the conduit to the union coupling after passing the DRS cable through the conduit.
(8) Finally, confirm whether the connector is plugged securely.

CAUTION

After the cable is plugged as explained above, do not pull the cable or subject it to excessive mechanical shock.

5.5.2 Wiring through a Wiring Metal Conduit

- **Wiring Procedure**

1. Remove the protective cap from the DRS connection port. Run the DRS cable from the connector end through the wiring port.

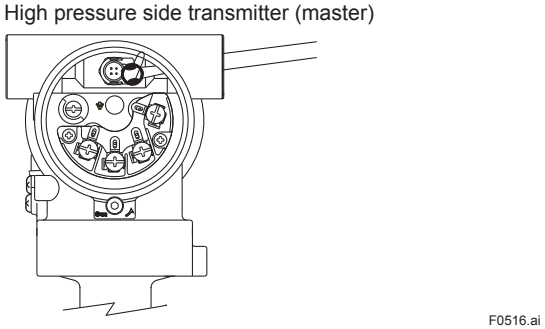


Figure 5.16 DRS Cable Connection (Wiring Metal Conduit)

2. Insert the connector securely into the connection port.
3. Run the DRS cable through the wiring metal conduit, and screw the conduit into the wiring port.

CAUTION

Do not pull on the cable or apply excessive mechanical shock to it.

5.5.3 Removing DRS Cable with Cable Gland

1. Slowly remove the connector from the connection port.
2. When using 1/2NPT or M20 cable gland, loosen the running coupler so that the seal is exposed.
In the case of using G1/2 Type cable gland, loosen the lock nut screwed into the union cover and remove the union cover. DRS cable can be pulled out together with the packing box.
Loosen the clamp nut and the gland if necessary.
3. Slowly remove the DRS cable.
4. When using 1/2NPT or M20 cable gland, you can simply turn the entry (not the lock nut) to remove the adapter.
In the case of G1/2 Type cable gland, loosen the lock nut screwed into the adapter body and remove the adapter body.

NOTE

In the case of G1/2 Type cable gland, remove the rubber packing, washer, gland, clamp ring clamp nut, union coupling and union cover from the opposite side of DRS connector in order to take out the cable gland from the DRS cable.

5.5.4 Removing DRS Cable Running through a Wiring Metal Conduit

1. Slowly remove the connector from the connection port.
2. Remove the wiring metal conduit from the wiring port.
3. Slowly remove the DRS cable.

5.5.5 Fixing the DRS Cable

WARNING

If the DRS cable is 15 m or longer or if the flameproof packing adapter (cable gland) is not tightened sufficiently, the weight of the cable itself may cause tension on the connector and make the cable come off. Refer to the user's manual of the flameproof packing adapter (cable gland), and fix the DRS cable in place so that tension is not applied to the connector.

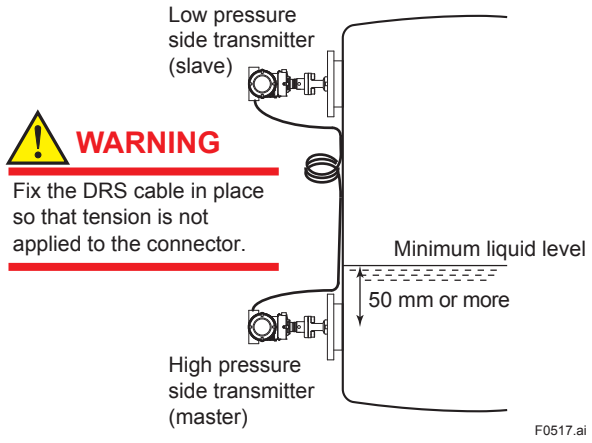


Figure 5.17 Fixing the DRS Cable

5.6 Grounding

WARNING

For flameproof types, grounding is a must.

Grounding is always required for the proper operation of transmitters. Follow the domestic electrical requirements as regulated in each country. Ground terminals are located on the inside and outside of the terminal box. Either of these terminals may be used.

CAUTION

For a transmitter with built-in lightning protector, ground as shown in the following figure. Grounding should be furnished on the lighting protector side and should satisfy Class C requirements (ground resistance of 10 Ω or less).

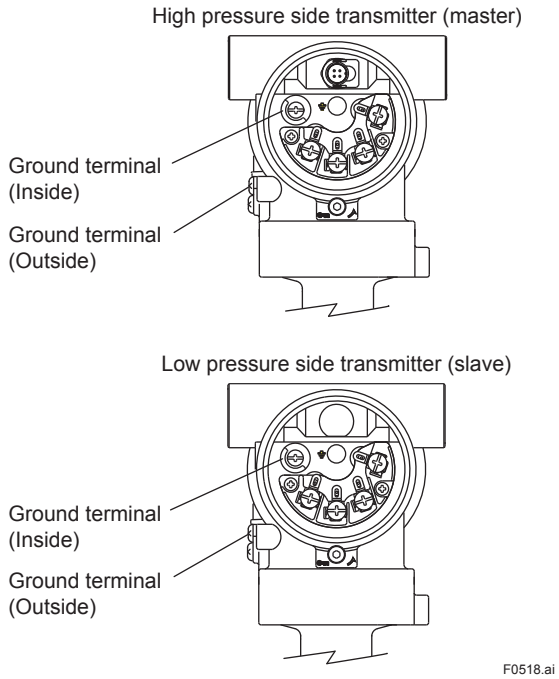


Figure 5.18 Ground terminal

5.7 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.

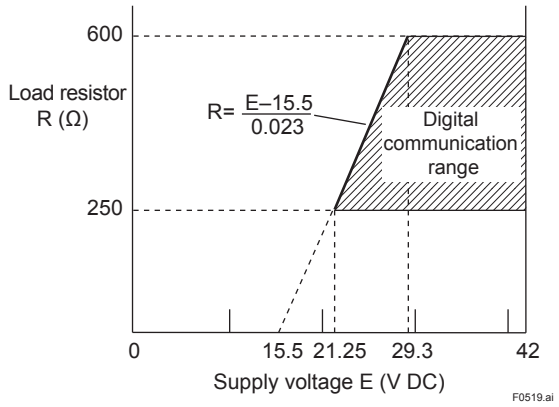


Figure 5.19 Power Supply Voltage and Load Resistance

6. Operation

6.1 Preparation for Starting Operation

This section describes the operation procedure for measuring the liquid level of a closed tank shown in Figure 6.1 using an EJXC40A digital remote sensored diaphragm seal system.

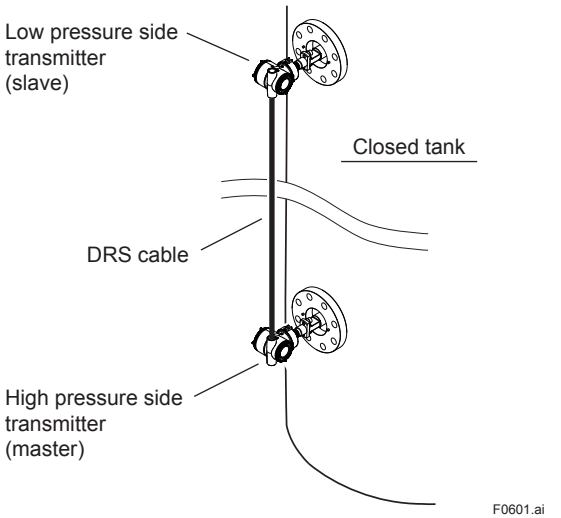


Figure 6.1 Liquid Level Measurement of a Closed Tank

(1) Checking Leaks from Wetted Parts

Check that there are no leaks from the connected areas of the flange.

(2) Connecting the HART Configuration Tool

Turn the power on, and connect the HART configuration tool. Open the terminal box cover, and connect the HART configuration tool to the SUPPLY + and – terminals (see subsection 5.3.3).

(3) Transmitter Operation Check

Using the HART configuration tool, confirm that the transmitter is operating properly. Check parameter values or change the setpoints as necessary. See chapter 7 for the operating procedure of the HART configuration tool. If the transmitter is equipped with an integral indicator, its indication can be used to confirm that the transmitter is operating properly.

■ Checking with the integral indicator

- If the wiring system is faulty, the display stays blank.
- If the transmitter is faulty, an error code will appear on the display according to the nature of the error.

Self-diagnostic error (faulty transmitter)

Figure 6.2 Integral Indicator Error Display

NOTE

If any of the error indications above appears on the display of the integral indicator, refer to Subsection 8.5.3 for corrective action.

■ Verify and Change Transmitter Parameter Setting and Values

The following parameters are the minimum settings required for operation. The transmitter has been shipped with specified parameter values. If necessary, confirm or change the values.

- Measuring range (low limit, high limit, and unit)
- Output/integral indicator mode (linear/square root)

6.2 Zero Point Adjustment

IMPORTANT

Do not turn off the power to the transmitter immediately after a zero adjustment.
Powering off within 30 seconds after a zero adjustment will return the adjustment back to the previous settings.

Adjust the zero point after operating preparation is completed. The zero point adjustment can be made in the following way.

Adjustment Method	Description
Using the HART configuration tool	a) Set the present input to 0%. Adjust for 0% output at input level of 0%.
	b) 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.
Using the external zero-adjustment screw	c) Adjust zero point using the zero-adjustment screw on the transmitter Zero point adjustment is possible without using the HART configuration tool. Accurately adjust the output current to 4 mA or other target output value using an ammeter that accurately reads output currents.

a) Set the present input to 0% (4 mA).

In this case, follow the procedure below.
This method can be used when the pressure corresponding to the low limit of the measuring range is zero.

- **Recalling and setting the zero point adjustment parameter (DP Zero trim)**

Recall parameters	[Root menu] (refer to section 7.2.1) → Maintenance → DP trim →
DP Zero trim (method)	Confirm the value after it has stabilized.

On the DP Zero trim method screen, check that the applied zero pressure has stabilized and confirm the value.

b) Adjust output to the reference value obtained using other means.

In tank level measurement, if the actual level cannot be brought to zero for zero adjustment, then the output can be adjusted to correspond to the actual level obtained using another measuring instrument such as a sight glass.
An example of a differential pressure transmitter whose span is 0 to 25.00 kPa, current level is 13.50 kPa, and the current output is 13.83 kPa is shown below.

- **Recalling and setting the zero point adjustment parameter (DP trim)**

Recall parameters	[Root menu] → Maintenance → DP trim → DP trim (method)
Auto, Lower Pt	Set the target value.

On the DP trim method screen, select Auto, Lower Pt, and enter the actual level 13.50 kPa on the display screen. This will change the current output from 13.83 kPa to 13.50 kPa.

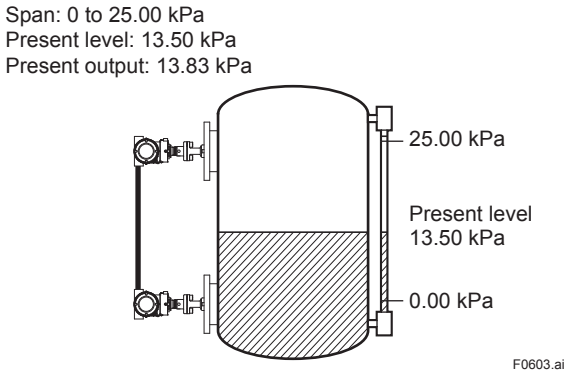


Figure 6.3 Tank Level Measurement

c) Using the external zero-adjustment screw

The zero-adjustment screw is only available on the high pressure side transmitter (master). Parameter Ext SW can be used to enable or disable the zero point adjustment using the external zero-adjustment screw on the transmitter.
To use the external zero-adjustment screw, select Enabled (the factory default setting is Enabled).
For the setting procedure, see subsection 7.2.3.11.
While viewing the output value, turn the zero-adjustment screw on the outside of the transmitter case using a slotted screwdriver so that the output value is set to zero. Turn the screw clockwise to increase the output or counterclockwise to decrease the output. The zero point adjustment can be made with a resolution of 0.01% of the setting range.

Since the degree of zero adjustments varies with the screw turning speed, turn the screw slowly for fine adjustment and quickly for coarse adjustment.

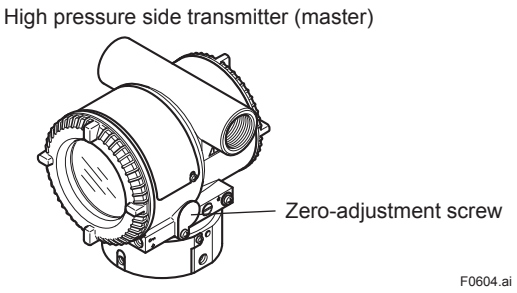


Figure 6.4 Zero-adjustment Screw

6.3 Starting Operation

The transmitter starts operating as soon as zero point adjustment is completed. Follow the procedure below.

1. Confirm the operating status. If the output signal exhibits wide fluctuations (hunting) due to periodic variation in the process pressure, use the HART configuration tool to dampen the transmitter output signal. Confirm the hunting using a receiving instrument or the integral indicator, and set the optimum damping time constant.
2. After confirming the operating status, perform the following:

IMPORTANT

- Remove the HART configuration tool from the terminal box, and confirm that none of the terminal screws are loose.
- Close the terminal box cover and the amplifier cover. Screw each cover in tightly until it will not turn further.
- There are two covers that must be locked on the ATEX Flameproof type transmitters. An Allen head bolt (shrouding bolt) under the edge of each cover is used to lock the cover. When the shrouding bolt is driven counterclockwise with an Allen wrench, the bolt rotates upward and locks the cover. (See page 7-3.) After locking the covers, confirm that they are secure and cannot be opened by hand.
- Tighten the zero-adjustment cover mounting screw to secure the cover.

6.4 Shutting Down Operation

To shut down operation, turn off the power.

NOTE

Whenever shutting down the transmitter for a long period, detach the transmitter from the tank.

6.5 Venting or Draining Transmitter Process-Detector Section

If condensate (or gas) collects in the transmitter process-detector section, the measured pressure may be in error. If a flushing connection ring is mounted, loosen the ring's drain (vent) screw to completely drain (vent) the liquid (gas). Then, re-tighten the drain (vent) screw.

IMPORTANT

Since draining condensate or bleeding off gas gives the pressure measurement disturbance, this should not be done when the loop is in operation.

6.5.1 Draining Condensate from C10FR Flushing Connection Ring

1. Gradually open the drain screw to drain from the flushing connection ring.
2. When the flushing connection ring is completely drained, close the drain screw. Tighten the drain screw to a torque of 10 N·m {1 kgf·m}.

WARNING

If the process fluid is toxic or harmful, take appropriate care to avoid contact with the body.

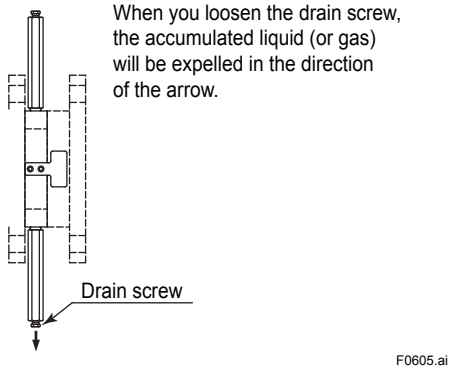


Figure 6.5 Draining Condensate from C10FR Flushing Connection Ring

6.5.2 Venting Gas from C10FR Flushing Connection Ring

1. Gradually open the vent screw to vent gas from the flushing connection ring.
2. When the flushing connection ring is completely vented, close the vent screw. Tighten the vent screw to a torque of 10 N·m {1 kgf·m}.

WARNING

If the process fluid is toxic or harmful, take appropriate care to avoid contact with the body.

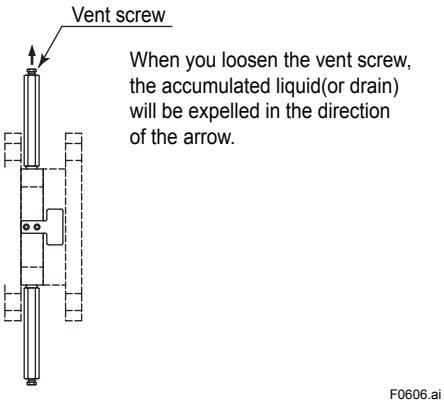


Figure 6.6 Venting Gas from C10FR Flushing Connection Ring

6.6 Local Parameter Setting

WARNING

The local push button on the integral indicator must not be used in a hazardous area. When it is necessary to use the push button, operate it in a non- hazardous location.

IMPORTANT

- Do not turn off the power to the transmitter immediately after performing parameter setting. Powering off within 30 seconds of performing this procedure will return the parameter to its previous setting.
- The parameter of Ext SW must be“Enabled” to perform this configuration. See subsection 7.2.3.11 for the setting procedure.
- LCD update will be slower at low ambient temperature, and it is recommended to use LPS function at temperatures above -10°C.

6.6.1 Local Parameter Setting (LPS) Overview

Parameter configuration by the zero-adjustment screw and push button (integral indicator code E) offers easy and quick setup for parameters of Tag number, Unit, LRV, URV, Damping,Output mode (linear/square root/signal characterizer), Display out 1, and Re-range by applying actual pressure (LRV/ URV). There is no effect on measurement signal (analog output or communication signal) when Local Parameter Setting is carried out.

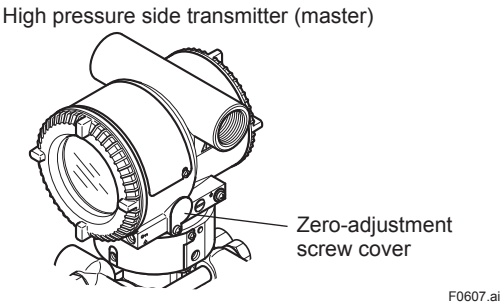


Figure 6.7 External Adjustment Screw

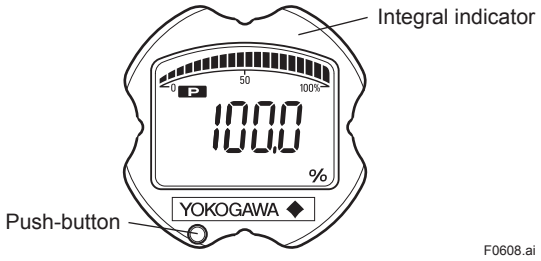


Figure 6.8 Range Setting Switch (push button)

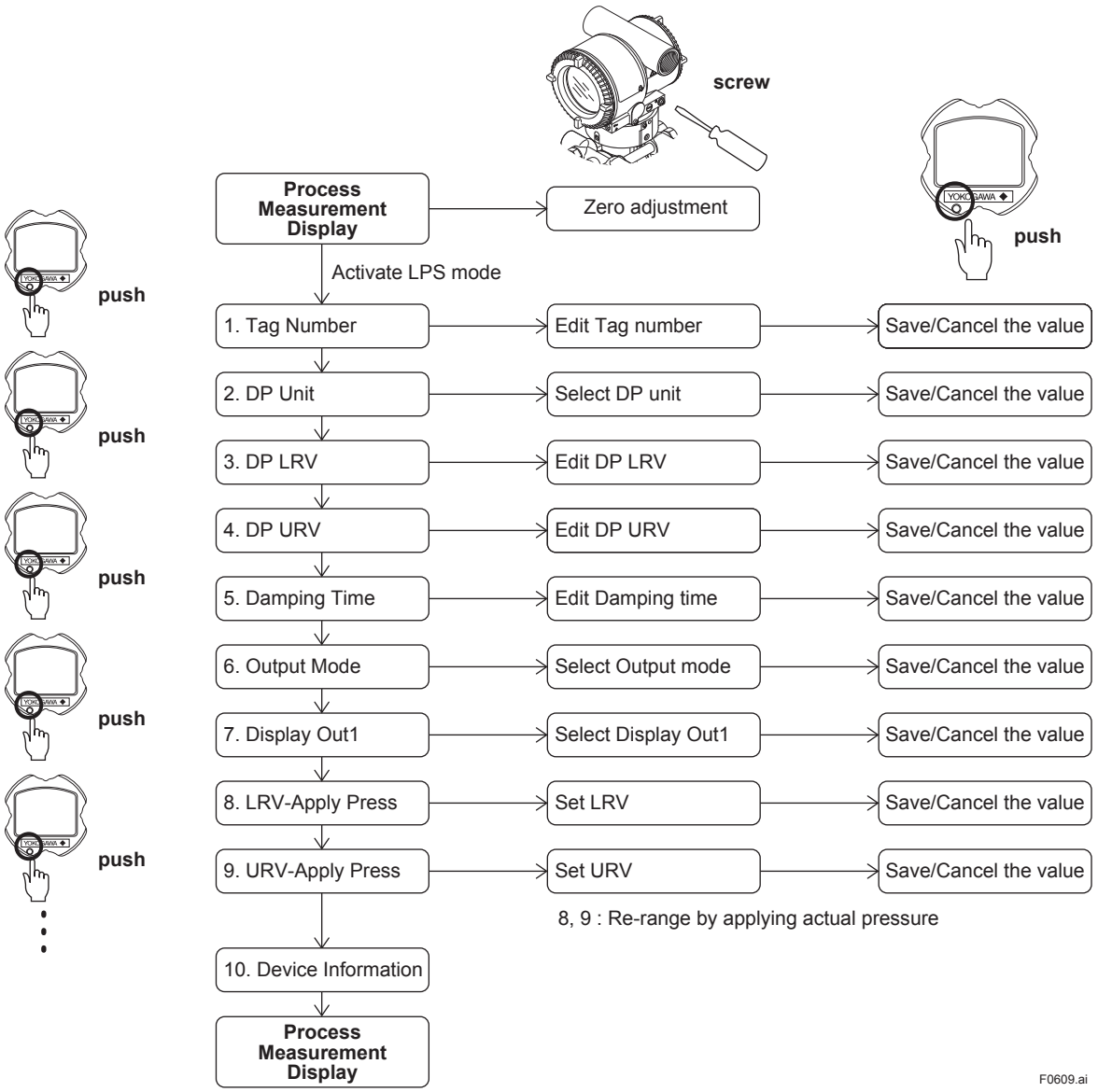

screw
Process Measurement Display
Zero adjustment
push
Activate LPS mode
push
1. Tag Number
Edit Tag number
Save/Cancel the value
push
2. DP Unit
Select DP unit
Save/Cancel the value
push
3. DP LRV
Edit DP LRV
Save/Cancel the value
push
4. DP URV
Edit DP URV
Save/Cancel the value
push
5. Damping Time
Edit Damping time
Save/Cancel the value
push
6. Output Mode
Select Output mode
Save/Cancel the value
7. Display Out1
Select Display Out1
Save/Cancel the value
8. LRV-Apply Press
Set LRV
Save/Cancel the value
9. URV-Apply Press
Set URV
Save/Cancel the value
8, 9 : Re-range by applying actual pressure
10. Device Information
Process Measurement Display
F0609.ai

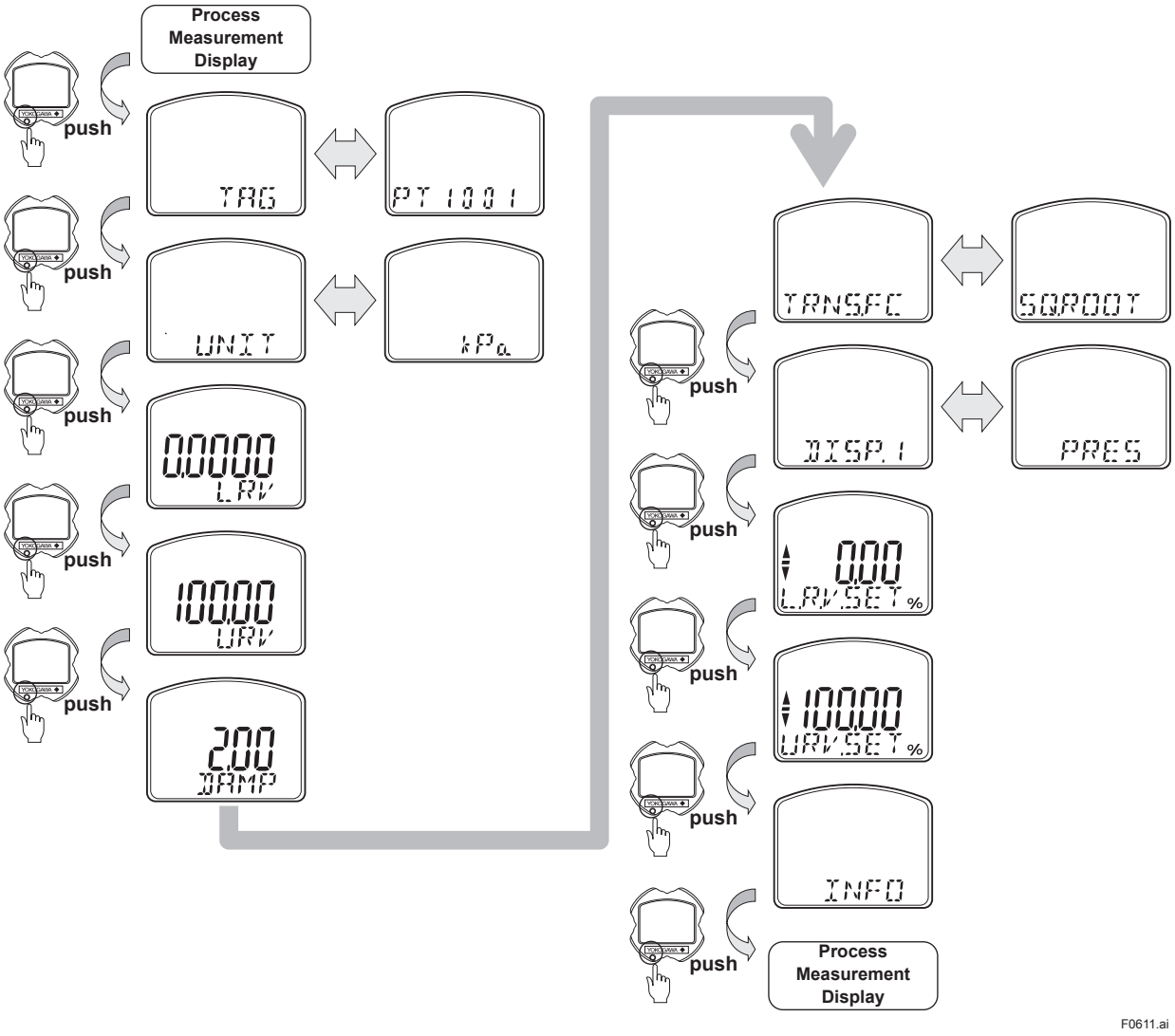
Figure 6.9

6.6.2 Activating Local Parameter Setting

Press the push button on the integral indicator to activate the Local Parameter Setting mode. The transmitter will exit automatically from the Local Parameter Setting mode if no operation is carried out for 10 minutes.

6.6.3 Parameter Setting Review

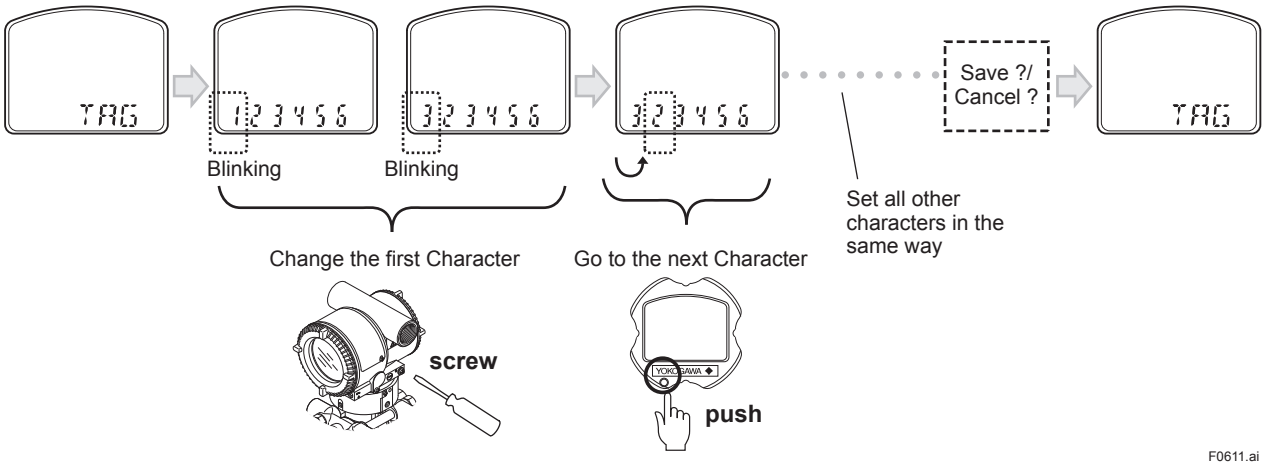
Current setting value for the below parameters are shown sequentially by each press of the push button.
Tag number, Unit, LRV, URV, Damping,Output mode (linear/square root/signal characterizer), Display out 1.



To configure each parameter value, turn the external adjustment screw on each parameter screen after activating the Local Parameter Setting mode.
To cancel the Local Parameter Setting configuration, please refer to 6.6.11 Save or Cancel and 6.6.12 Abort Configuration.

6.6.4 Tag Number Configuration

Tag Number is edited by turning the external adjustment screw. Up to 8 alphanumeric characters can be set.



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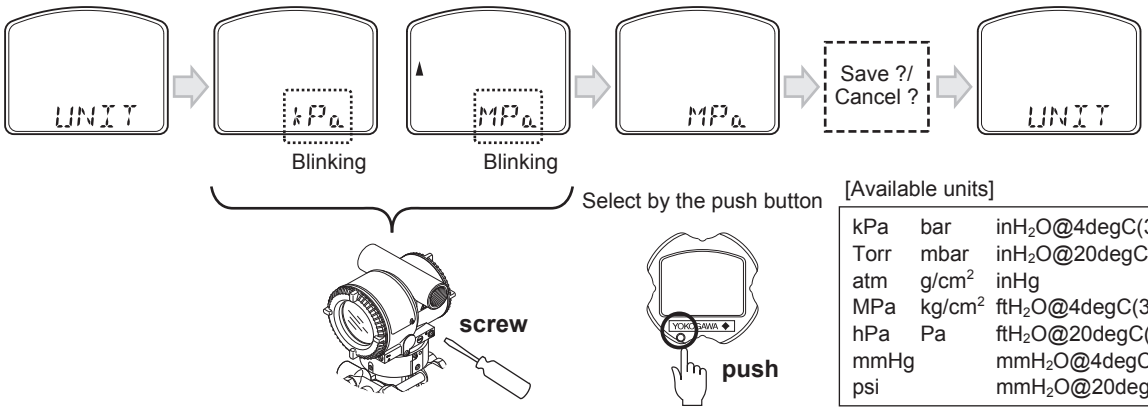
6.6.5 Differential Pressure Unit Configuration

Differential pressure unit for the below table can be changed as below. By turning the external adjustment screw, user can scroll between the various available pressure units.



[Available units]

kPa	bar	inH_2O@4degC(39.2degF)
Torr	mbar	inH_2O@20degC(68degF)
atm	g/cm^2	inHg
MPa	kg/cm^2	ftH_2O@4degC(39.2degF)
hPa	Pa	ftH_2O@20degC(68degF)
mmHg		mmH_2O@4degC(39.2degF)
psi		mmH_2O@20degC(68degF)

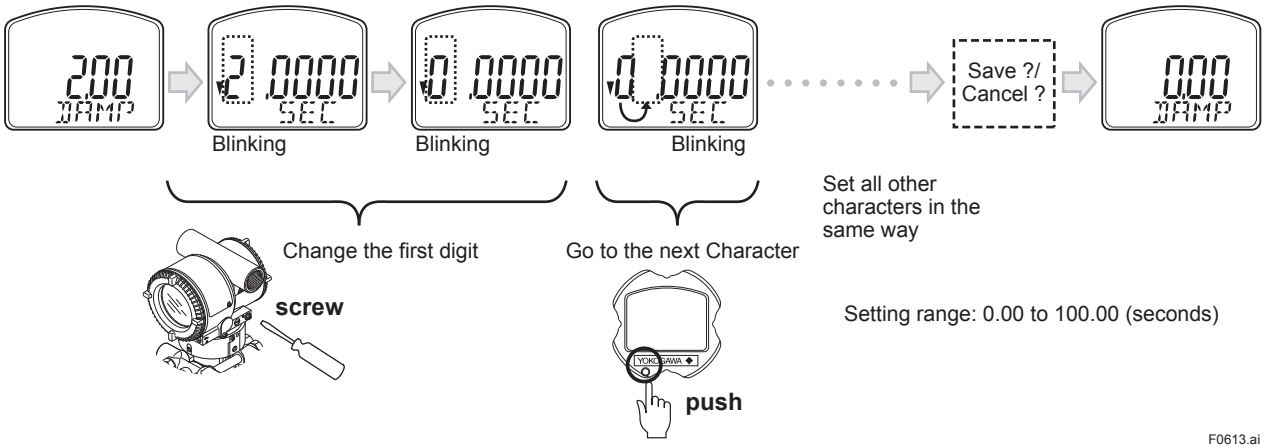
F0612.ai

6.6.6 Differential Pressure LRV/URV Configuration

Differential prressure LRV and URV can be set. The number for each digit is changed by turning the external adjustment screw and set by pressing the push button. Please refer to 6.6.7 Damping Time Constant Configuration for how to change the numerical value.
When the setting is out of the limit, an alarm will be generated.

6.6.7 Damping Time Constant Configuration

The damping time constant for the differential prressure transmission part can be set. Damping time constant is rounded off to two decimal places.



6.6.8 Output Mode Configuration

Differential pressure Output Mode (“TRNS.FC” shown on the integral indicator) can be selected by turning the external adjustment screw. Please refer to 6.6.5 Pressure Unit Configuration for how to select and set the enumerated value.

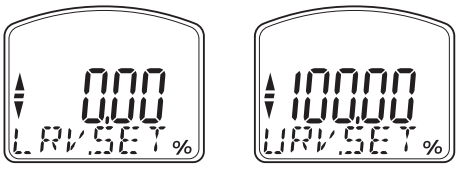
value	display
linear	LINEAR
square root	SQ.ROOT
signal characterizer (spcl curve)	SC.TABL

6.6.9 Display Out 1 Configuration

Display Out1 can be selected by turning the external adjustment screw. Please refer to 6.6.5 Pressure Unit Configuration for how to select and set the enumerated value.

6.6.10 Re-range by applying actual pressure (LRV/URV).

This feature allows the lower and upper range values to be setup with the actual input applied.



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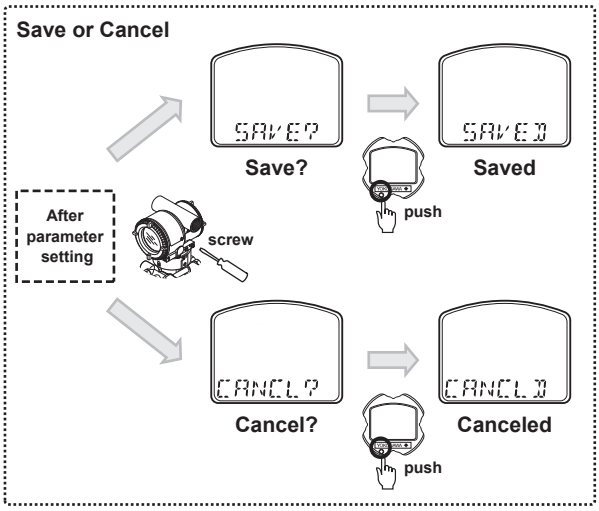
Follow the procedure below to change the LRV and URV settings.
[Example]
Rerange LRV to 0 and URV to 3 MPa.

1) Connect the transmitter and apparatus as shown in Figure 7.1 and warm it up for at least five minutes.
2) Press the push-button. The integral indicator then displays “LRV.SET.”
3) Apply a pressure of 0 kPa (atmospheric pressure) to the transmitter. (Note 1)
4) Turn the external adjustment screw in the desired direction. The integral indicator displays the output signal in %. (Note 2)
5) Adjust the output signal to 0% (1 V DC) by rotating the external adjustment screw. Press the push button to save the value. Doing so completes the LRV setting. (Note 3)
6) Press the push-button. The integral indicator then displays “URV.SET.”
7) Apply a pressure of 3 MPa to the transmitter. (Note 1)
8) Turn the external adjustment screw in the desired direction. The integral indicator displays the output signal in %. (Note 2)
9) Adjust the output signal to 100% (5 V DC) by rotating the external adjustment screw. Press the button to save the value.Doing so completes the URV setting.
10) Press the push-button. The transmitter then switches back to the normal operation mode with the measurement range of 0 to 3 MPa.

Note 1: Wait until the pressure inside the pressure-detector section has stabilized before proceeding to the next step.
Note 2: If the pressure applied to the transmitter exceeds the previous LRV (or URV), the integral indicator may display error number “AL.30” (In this case, the output signal percent and “AL.30” are displayed alternately every two seconds). Although “AL.30” is displayed, you may proceed to the next step. However, should any other error number be displayed, take the appropriate measure in reference to , “Errors and Countermeasures” in each communication manual.
Note 3 : Changing the lower range value (LRV) also automatically changes the upper range value (URV), keeping the span constant. New URV=previous URV+(new LRV–previous LRV)

6.6.11 Save or Cancel

At the end of each parameter setting, select “Save” or “Cancel” by the external adjustment screw and press the push button to save or cancel the configuration.



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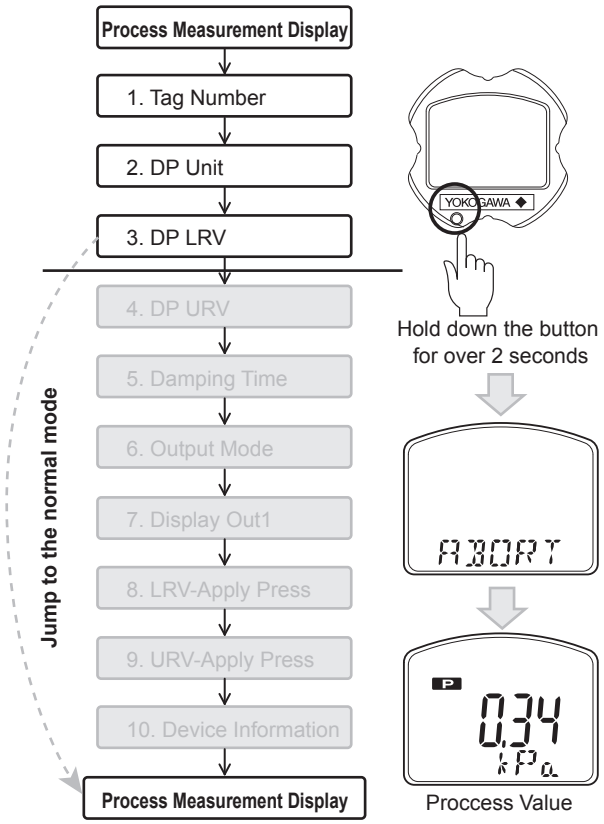
6.6.12 Abort Configuration

6.6.12.1 Abort Configuration (Menu)

Hold down the push button for over 2 seconds to exit the Local Parameter Setting mode.



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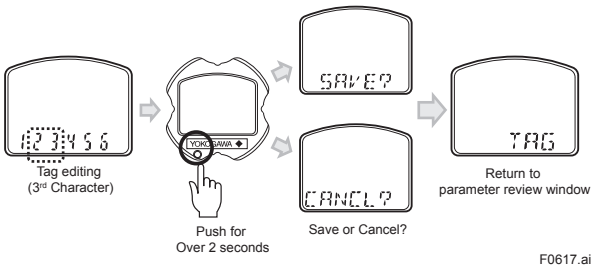
6.6.12.2 Abort Configuration (Parameter)

To exit the configuration while editing the value, hold down the button for over 2 seconds and select “Save” or “Cancel”.



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6.6.13 Local Parameter Setting Lock

To disable parameter changes by the Local Parameter Setting there are three different ways.

	Locked features
Communication Parameter Ext SW =disable	• External Zero Adjustment • Local Parameter Setting
Communication Parameter Write Protect = On	• Local Parameter Setting • All Communication Parameters *
Hardware write protection switch on CPU assembly = D (Disable)	• Local Parameter Setting • All Communication Parameters *

*External Zero Adjustment is unlocked.

The above parameter setting is carried out by using HART configuration tool. See subsection 7.2.3.11 to 13 for the setting procedure.
Reviewing local parameter setting by push button on the integral indicator is available at any time even when the Local Parameter Setting is locked.

6.6.14 Others

- The degree of adjustment depends on the speed of turning the adjustment screw. Turn the screw slowly for fine tuning and turn the screw fast for quick tuning.

7. HART Communication

In the explanation of HART communication, each of the digital remote sensor modules will be as follows.

Master transmitter: Module 1

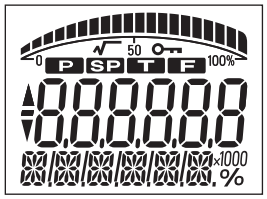
Slave transmitter: Module 2

By factory default, the master transmitter is configured for high pressure side measurement and the slave transmitter for low pressure side measurement.

7.1 Connection

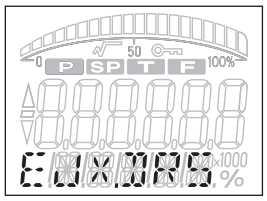
7.1.1 Integral Indicator Display at Power-On

If the transmitter is equipped with the integral indicator, when the EJXC40A digital remote sensor transmitter is turned on, the entire LCD screen lights, and the following screens will appear in sequence.



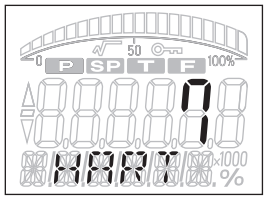
All on

↓



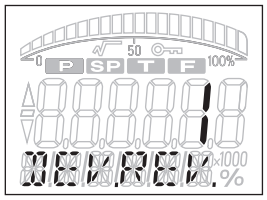
Model name (3 s)

↓



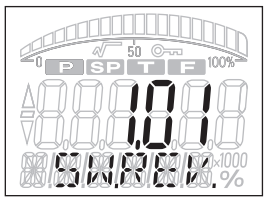
Communication protocol (3 s)

↓



Device revision (3 s)

↓



Software revision (3 s)

F0701.ai

On the communication protocol screen, the protocol is displayed as “HART” and the revision number as “7.”

NOTE

You can set the following parameter to display only the all-lit screen.

- **Recalling screen settings at power-on**

Recall parameters	[Root menu] (See subsection 7.2.1.) → Detailed setup → Display condition → Disp condition → Power on info
On	The entire screen lights at power-on, and the screen switches in order to model name, communication protocol, device revision and software revision.
Off	Only the all-lit screen is displayed at power-on.

7.1.2 Aligning Configuration Tool DD and Device Revision

Before using the HART configuration tool, check that the device description (DD) of the transmitter you will use is installed in the configuration tool. Use the appropriate DD according to the device type, device revision, and DD revision shown in Table 7.1.1.

Table 7.1.1 HART Protocol Revision, Device Revision, and DD Revision

HART protocol revision	DPharp digital remote sensor transmitter			
	Model	Device type	Device revision	DD revision
7	EJXC40	EJX-DRS (0x3755)	1	1 or later

You can check the device revision of the transmitter and DD by following steps (1) and (2).
If the appropriate DD is not installed in the configuration tool, download it from the official HART Association website, or contact the configuration tool distributor.

(1) Checking the transmitter's device revision

- To check using the integral indicator, (when the suffix code for integral indicator (D) is specified), see subsection 7.1.1.
- Checking with the configuration tool
  1) Connect the configuration tool to the transmitter.
  2) Select the root menu (see section 7.2.1). Display the Review screen.
  3) The transmitter's device revision is shown by Fld dev rev.

(2) Checking the device revision of the configuration tool DD

Follow the prescribed procedure for the configuration tool, and check the device revision from the name of the installed DD file.
The upper two digits of the DD file name represents the device revision and the lower two the DD revision.

01 0 1. X X X
- **DD revision**
- **Device revision**

NOTE

The device revision of the DD file uses hexadecimal notation.

7.1.3 Setting Parameters Using the DTM

To use FieldMate (Versatile Device Management Wizard) to set parameters, use the Device Type Manager (DTM) shown in the following table.

Table 7.1.2 DTM

DTM Name	Revision
EJX DRS FDT2.0 HART 7 DTM	5.1.0.24 or later

NOTE

You can check the DTM revision using DTM setup.
Device Files are included in FieldMate.
The latest update program for Device Files is available at the registered user website. (registered user website URL: https://voc.yokogawa.co.jp/PMK/)
To update the DTM, you need to perform the following operations using DTM setup.
- Update the DTM catalog
- Register the DTM in the corresponding device

For details, see the FieldMate user's manual.

7.1.4 Connecting DPharp and Configuration Tool

If there is a load resistance of at least 250Ω between the connection terminal of the configuration tool and the power supply, you can connect to any relay terminal in the instrument room, transmitter terminal box, and transmission loop.
The configuration tool is connected in parallel with the transmitter, but the polarity does not matter.
A connection example is shown below.

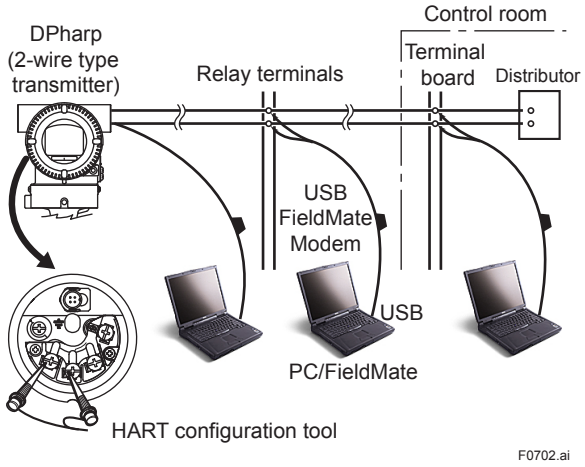


Figure 7.1.1 Connection Example

7.2 Setting Parameters

7.2.1 Menu Tree

7.2.1.1 DD and DTM Menu Tree

When the configuration tool with the DD or FieldMate (Versatile Device Management Wizard) with the DTM is used to set parameters, the menu tree is as follows.

Root menu (DD)

• Process variables
• Diag/Service
• Maintenance
• Device setup
  Basic setup
  Detailed setup
  Review

Root menu (DTM)

• Device setup
  Basic setup
  Detailed setup
  Review
• Diag/Service
• Process variables
• Maintenance

There are two ways to set parameters; directly entering value in each parameters or using method in which users are guided to follow the instructions to set values.

7.2.2 Basic Setup

IMPORTANT

After setting and sending data with the HART configuration tool, wait at least 30 seconds before turning off the transmitter.
If it is turned off too soon, the settings will not be stored in the transmitter.

7.2.2.1 Tags and Device Information

If specified at the time of order, the specified tag number and device information are set before shipment.
To check the tag number and device information, follow the procedure below.

- **Recalling parameters**

Tag	[Root menu] → Basic setup → Device Information → Tag
Long tag	[Root menu] → Basic setup → Device Information → Long tag
Descriptor	[Root menu] → Basic setup → Device information → Descriptor
Message	[Root menu] → Basic setup → Device information → Message
Date	[Root menu] → Basic setup → Device information → Date

To change the tag number or device information, enter the information directly within the limitation on the number of characters.

Item	Limitation on the number of characters
Tag	Up to 8 alphanumeric characters*1
Long tag	Up to 32 alphanumeric characters*2
Descriptor	Up to 16 alphanumeric characters*1
Message	Up to 32 alphanumeric characters*1
Date	mm/dd/yyyy • mm: month (2-digit number) • dd: date (2-digit number) • yyyy: year (4-digit number)

*1: The symbols, characters, and numbers enclosed by bold lines in the following table can be used.
*2: All the symbols, characters, and numbers in the following table can be used.

SP	!	“	#	$	%	&	‘	(	)	*	+	,	-	.	/
0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	

* “SP” represents one-byte space.

7.2.2.2 Setting Process Variables

The transmitter can handle five types of data (these are called device variables): differential pressure (DP), module 1 side pressure (Pres 1), module 2 side pressure (Pres 2), module 1 side capsule temperature (Temp 1), and module 2 side capsule temperature (Temp 2). Of these, four are assigned to PV (Primary Variable), SV (Secondary Variable), TV (Tertiary Variable), and QV (quaternary variable). These are called process variables. The variable assigned to PV becomes the current output ranging from 4 to 20 mADC. As such, module 1 side capsule temperature and module 2 side capsule temperature cannot be assigned to PV. The factory default assignments are as follows:

PV: differential pressure (DP)
SV: module 1 side pressure (Pres 1)
TV: module 2 side pressure (Pres 2)
QV: module 1 side capsule temperature (Temp 1)

- **Recalling and setting parameters**

Recall PV parameters	[Root menu] → Process variables → Output vars → PV is →
PV is	Displays the device variable assigned to PV
Change PV Assgn (method)	Select the device variable to assign to PV. DP, Pres 1, Pres 2

Recall SV parameters	[Root menu] → Process variables → Output vars → SV is →
SV is	Displays the device variable assigned to SV
Change SV Assgn (method)	Select the device variable to assign to SV. DP, Pres 1, Pres 2, Temp1, Temp2

Recall TV parameters	[Root menu] → Process variables → Output vars → TV is →
TV is	Displays the device variable assigned to TV
Change TV Assgn (method)	Select the device variable to assign to TV. DP, Pres 1, Pres 2, Temp1, Temp2

Recall QV parameters	[Root menu] → Process variables → Output vars → QV is →
QV is	Displays the device variable assigned to QV
Change QV Assgn (method)	Select the device variable to assign to QV. DP, Pres 1, Pres 2, Temp1, Temp2

7.2.2.3 Unit

The unit is set at the factory before shipment if specified at the time of order.
To check or change the unit, follow the procedure below.

- **Recalling the differential pressure unit parameter (DP Unit)**

Recall parameters	[Root menu] → Detailed setup→ Sensors→ DP setup→ DP unit
Settings	Available pressure units are shown below.

inH_2O@68degF	mbar	MPa
inHg	g/cm^2	inH_2O
ftH_2O@68degF	kg/cm^2	mmH_2O
mmH_2O@68degF	Pa	ftH_2O
mmHg	kPa	hPa
psi	torr	
bar	atm	

- **Recalling the module 1 side pressure unit parameter (Pres 1 Unit)**

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 1 setup → Pres 1 unit
Settings	Refer to DP unit

- **Recalling the module 2 side pressure unit parameter (Pres 2 Unit)**

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 2 setup→ Pres 2 unit
Settings	Refer to DP unit

In addition, the unit of the process variable assigned to PV can be recalled and set by following the procedure below.

- **Recalling and setting PV setting parameters**

PV is	Recall parameters (DTM)*	[Root menu] → Basic setup → PV keypad input →
DP	DP unit	Refer to DP unit
Pres 1	Pres 1 unit	
Pres 2	Pres 2 unit	

*: PV unit for DD.

NOTE

When using DTM to set range value and its unit, an error message may appear to show the inconsistency of significant figures.
In such case, set the unit first and then set the range value.

7.2.2.4 Measuring Range

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

You can enter the low limit (LRV) and high limit (URV) independently to set the measuring range. To enter the low limit and high limit, follow the procedure below.

- **Recalling and setting differential pressure range setting parameters (LRV/URV)**

Recall parameters	[Root menu] → Detailed setup → Sensors → DP setup →
LRV	Differential pressure range 0%
URV	Differential pressure range 100%

- **Recalling and setting module 1 side pressure range setting parameters (Pres 1 LRV/Pres 1 URV)**

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 1 setup→
Pres 1 LRV	Module 1 side pressure range 0%
Pres 1 URV	Module 1 side pressure range 100%

- **Recalling and setting module 2 side pressure range setting parameters (Pres 2 LRV/Pres 2 URV)**

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 2 setup→
Pres 2 LRV	Module 2 side pressure range 0%
Pres 2 URV	Module 2 side pressure range 100%

In addition, the range of the device variable assigned to PV can be recalled and set by following the procedure below.

- **Recalling and setting PV range setting parameters**

PV is	Recall parameters (DTM)*	[Root menu] → Basic setup → PV keypad input →
DP	LRV	Differential pressure range 0%
	URV	Differential pressure range 100%
Pres 1	Pres 1 LRV	Module 1 side pressure range 0%
	Pres 1 URV	Module 1 side pressure range 100%
Pres 2	Pres 2 LRV	Module 2 side pressure range 0%
	Pres 2 URV	Module 2 side pressure range 100%

*: PV LRV and PV URV for DD.

NOTE

It is possible to set LRV to a value greater than URV. In such a case, the 4 to 20 mA output signal will be inverted.

Setting conditions: LSL ≤ LRV ≤ USL
LSL ≤ URV ≤ USL
|URV – LRV| ≥ Min Span

If you set the values as shown above, change the scale settings of the indicator so that they match with the 4 to 20 mA output signal.

LSL: Range setting low limit
USL: Range setting high limit

7.2.2.5 Output Mode

The mode setting for the output signal and the integral indicator (see subsection 7.2.3.6) can be performed independently.
The output mode for the output signal is set as specified in the order when the instrument is shipped.
Follow the procedures below to change the mode.

- **Recalling the output mode parameter (Xfer fnctn)**

Recall parameters	[Root menu] → Basic setup → DP Signal setup →
Xfer fnctn	Select linear (Linear), square root (Sq root), or signal characterizer (Spcl curve).

7.2.2.6 Differential Pressure Damping Time Constant

When the instrument is shipped, the differential pressure damping time constant is set at 2.0 seconds.

If suffix code /CA is specified in the order, the differential pressure damping time constant may be set as specified at the time of order.
You can set the damping time constant to any value within the 0.00 to 100.00 range.
To change the damping time constant, follow the procedure below.

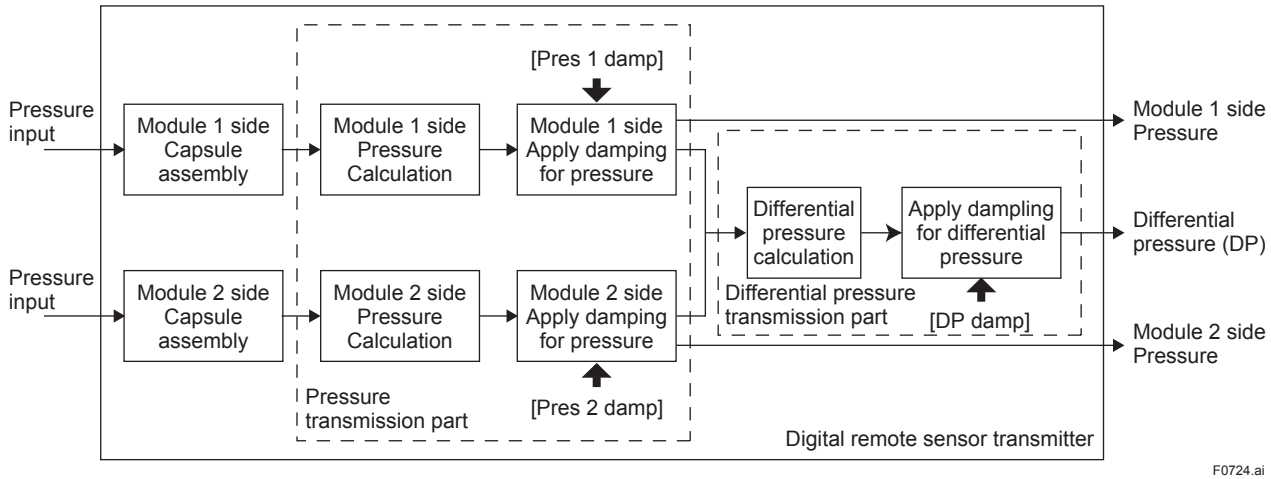
- **Recalling the damping time constant parameter (DP damp)**

Recall parameters	[Root menu] → Detailed setup → Sensors → DP setup → DP damp

Enter a valid time constant in the DP damp parameter.

NOTE

The damping time constant set here is only for the differential pressure transmission part.
The damping time constant for the differential pressure (DP) is the sum of the damping time constants for the differential pressure transmission part, pressure transmission part, and the capsule assembly.
The diagram in below shows the relationship of each part. Upon shipment from the factory, the differential pressure is assigned to PV which shall be output via 4 to 20 mA. To change the assignment of PV, refer to subsection 7.2.2.2.
To change the damping time constant for the pressure of each module, refer to subsection 7.2.3.2. Refer to GS(General Specifications) or User's Manual of each transmitter for the damping time constant of capsule assembly.



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7.2.2.7 Output Signal Low Cut

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 for the cut point: ±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.
The default value of Low cut is set according to the combination of the output mode (Xfer fnctn) and integral indicator display mode (Disp DP % fnctn). See below table.

Table 7.2.1 Default Low-Cut Value and Low-Cut Value for Output and Display

Combination of output and display mode			Factory default low-cut value	Low-cut value for output signal and display
#	Output mode	Display mode		
1)	Linear	Linear	10%	10%/10%
2)	Sq root	Sq root	10%	10%/10%
3)	Linear	Sq root	10%	1%/10%
4)	Sq root	Linear	10%	10%/No low cut

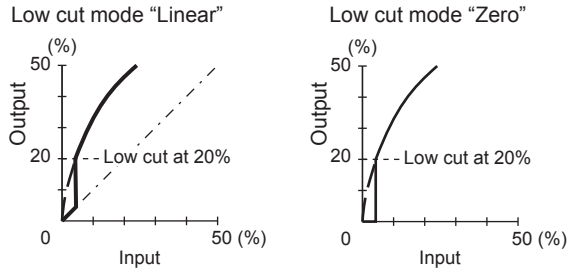
Normally, the factory default value is 10%, but if the output mode is set to Linear and display mode is set to Sq root, the factory default low cut value is 1%.
In this case, the low-cut value for the output signal is 1%, and that for the integral indicator display is 10%, which is equivalent to the square root of the low-cut value.
Note that if the output mode is set to Sq root and display mode is set to Linear, the low cut function is applied to the output signal but does not to the integral indicator display.
To change the low-cut value or low cut mode, follow the procedure below.

- **Recalling and setting low cut parameters**

Recall parameters	[Root menu] → Basic setup → DP signal setup →
Low cut	Set the value in the range of 0 to 20% of the output.
Low cut mode	Select Linear or Zero.

Because of hysteresis, the actual operation is as shown in the figure below.
Example: When using linear output, zero low cut mode, and 20% low-cut value

[For square root output]



[For linear output]

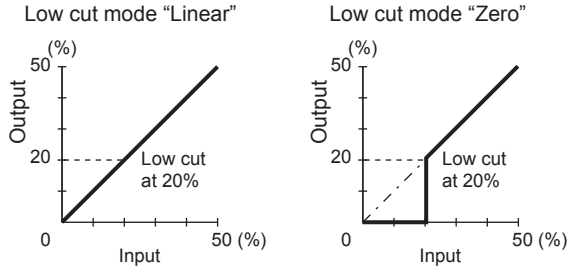
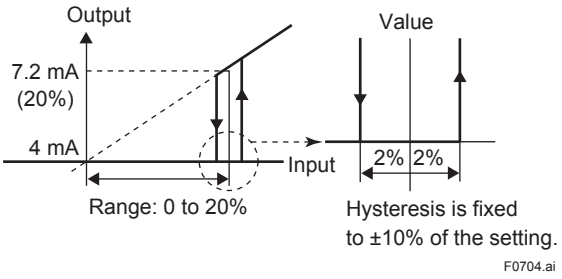


Figure 7.2.1 Low Cut Mode

Because of hysteresis, the actual operation is as shown in the figure below.
Example: When using linear output, zero low cut mode, and 20% low-cut value



7.2.3 Detail Setup

7.2.3.1 Pressure Signal Setup

On the digital remote sensor transmitter, high pressure side pressure and low pressure side pressure can be measured and displayed.

IMPORTANT

The impulse line connection direction can be changed.
For details on changing the impulse line connection direction, see subsection 7.2.3.3, Impulse Line Connection Orientation Setup.

When the transmitter is used with the impulse line connection direction set to Normal (factory default setting), each module is as follows.
Module 1: High pressure side transmitter (master)
Module 2: Low pressure side transmitter (slave)

When the transmitter is used with the impulse line connection direction set to Reverse, each module is as follows.
Module 1: Low pressure side transmitter (master)
Module 2: High pressure side transmitter (slave)

(1) Setting the pressure unit

To check or change the pressure unit, follow the procedure below.

- **Recalling and setting pressure unit parameters (Pres 1 unit, Pres 2 unit)**

Module 1 side pressure

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 1 setup → Pres 1 unit
Settings	Available pressure units are shown below.

Module 2 side pressure

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 2 setup → Pres 2 unit
Settings	Available pressure units are shown below.

inH_2O@68degF	mbar	MPa
inHg	g/cm^2	inH_2O
ftH_2O@68degF	kg/cm^2	mmH_2O
mmH_2O@68degF	Pa	ftH_2O
mmHg	kPa	hPa
psi	torr	
bar	atm	

(2) Setting the low limits (Pres 1 LRV, Pres 2 LRV) and high limits (Pres 1 URV, Pres 2 URV) of the pressure range

You can enter the low limits (Pres 1 LRV, Pres 2 LRV) and high limits (Pres 1 URV, Pres 2 URV) of the pressure to set the measuring range.
To enter the low limit and high limit, follow the procedure below.

Module 1 side pressure

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 1 setup →
Pres 1 LRV	Module 1 side pressure range 0%
Pres 1 URV	Module 1 side pressure range 100%

Module 2 side pressure

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 2 setup →
Pres 2 LRV	Module 2 side pressure range 0%
Pres 2 URV	Module 2 side pressure range 100%

7.2.3.2 Pressure Damping Time Constant

When the instrument is shipped, the module 1 side pressure and module 2 side pressure damping time constants are set at 2.0 seconds.
You can set the pressure damping time constants to any values within the 0.00 to 100.00 range.
To change the pressure damping time constants, follow the procedure below.

- **Recalling the damping time constant parameters (Pres 1 damp, Pes 2 damp)**

Module 1 side pressure

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 1 setup → Pres 1 damp

Module 2 side pressure

Recall parameters	[Root menu] → Detailed setup → Sensors → Pres 2 setup→ Pres 2 damp

Enter valid time constants in the Pres 1 damp and Pres 2 damp parameters.

NOTE

The damping time constant set here is only for the pressure transmission part.
The damping time constant for the differential pressure(DP) is the sum of the damping time constants for the differential pressure transmission part, pressure transmission part, and the capsule assembly.
The diagram in subsection 7.2.2.6 shows the relationship of each part. Upon shipment from the factory, the differential pressure is assigned to PV which shall be output via 4 to 20 mA. To change the assignment of PV, refer to subsection 7.2.2.2. To change the damping time constant for the differential pressure, refer to subsection 7.2.2.6. Refer to GS(General Specifications) or User's Manual of each transmitter for the damping time constant of capsule assembly.

7.2.3.3 Impulse Line Connection Orientation Setup

This parameter allows the impulse line connections to be reversed. This function is used when the low pressure side and high pressure side line connections are reversed when the digital remote sensor transmitter is installed.
To change the impulse line connection direction of the digital remote sensor transmitter, follow the procedure below.

- **Recalling and setting Pres 1/2 Swap parameters**

Recall parameters	[Root menu] → Detailed setup → Signal condition →
Pres 1/2 Swap	Select Normal or Reverse.

7.2.3.4 Bi-directional Flow Measurement Setup

This parameter enables output whose positive and negative outputs and displays are symmetrical about the low limit set at the center of the measuring range. This is used to measure both the forward and reverse flow rates using the digital remote sensor transmitter with the output for 0% input set to 50% (12mA).
To set the bi-directional flow measurement, follow the procedure below.

- **Recalling bi-directional flow mode (Bi-dir mode) parameters**

Recall parameters	[Root menu] → Detailed setup → Signal condition →
Bi-dir mode	Select On or Off.

Set the Bi-dir mode parameter to On.
The factory default setting is Off.
Example: If the bi-directional flow measurement is enabled for the measurement range of 0 to 10 kPa, the measuring range is changed to –10 to 0 to 10 kPa (output 0 to 50 to 100%). However, the LRV and URV values are not changed.

- Combining this with square root output mode provides a square root output computed independently for 0% to 50% output and for 50% to 100% output.
- The low cut function works symmetrically on the positive and negative sides with the 0% point at the center.

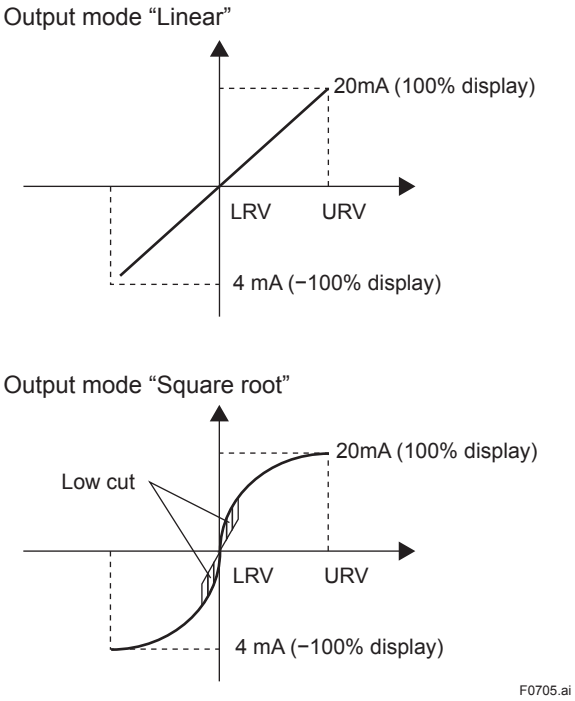


Figure 7.2.2 Bi-directional Flow Measurement Setup

7.2.3.5 Analog Signal Variable Range Setup

The following table shows the factory default output range during normal operation, and the output is limited within this range.

	Lower limit	Upper limit
Standard specifications Option code /C1	3.8 mA	21.6 mA
Option code /C2 Option code /C3	3.8 mA	20.5 mA

This output range can be changed within the allowable range (3.8 to 21.6 mA) to match the output to the receiving device or for other reasons. Set the output range's lower limit with the AO lower limit parameter and the upper limit with the AO upper limit parameter.
To set the lower and upper output limits, follow the procedure below.

- **Recalling and setting parameters**

Recall parameters	[Root menu] → Detailed setup → Output condition → Analog output →
AO lower limit	Set the lower limit (unit: mA).
AO upper limit	Set the upper limit (unit: mA).

Note: Make sure that the upper limit and lower limit satisfy the following relationship.
Lower limit < Upper limit

7.2.3.6 Integral Indicator Display Mode

The mode setting for the output signal (see subsection 7.2.2.5) and the integral indicator can be performed independently.
The output mode for the integral indicator is set as specified in the order when the instrument is shipped.
Follow the procedure below to change the mode.

- **Recalling the display mode parameter (Disp DP % fnctn)**

Recall parameters	[Root menu] → Detailed setup → Display condition → Disp condition →
Disp DP % fnctn	Select linear (Linear) or square root (Sq root).

If the transmitter is equipped with an integral indicator and the display mode is "square root", "$\sqrt{\ }$" is displayed on the integral indicator.

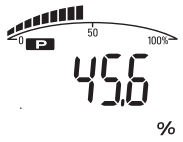
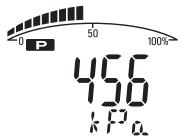
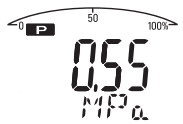
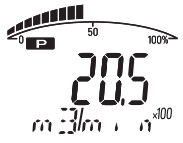
7.2.3.7 Integral Indicator Setup

The following 7 displays are available for integral indicators.

- PV percentage
- Differential pressure
- Module 1 side pressure
- Module 2 side pressure
- Module 1 side capsule temperature
- Module 2 side capsule temperature
- User set scale PV value

Up to four variables can be displayed on the integral indicator.

Table 7.2.2 Integral Indicator Display

Integral Indicator Display	Description and Related Parameters
PV percentage (PV%) 	Displays percentage according to the set PV range PV % 45.6% The bottom area shows the percentage and “device variable type” assigned to PV alternately.
Differential pressure (DP) 	Displays the differential pressure in the display range of -99999 to 99999 in the specified unit. The bottom area shows the differential pressure unit and DIFF.P alternately.
Module 1 side pressure (Pres 1) 	Displays the module 1 side pressure in the display range of -99999 to 99999 in the specified unit. The bottom area shows the module 1 side pressure unit and PRESS1 alternately.
Module 1 side capsule temperature (Temp 1) 	Displays the module 1 side capsule temperature in the display range of -99999 to 99999 in the specified unit. The bottom area shows the temperature unit and TEMP1 alternately.
Module 2 side pressure (Pres 2) 	Displays the module 2 side pressure in the display range of -99999 to 99999 in the specified unit. The bottom area shows the module 2 side pressure unit and PRESS2 alternately.
Module 2 side capsule temperature (Temp 2) 	Displays the module 2 side capsule temperature in the display range of -99999 to 99999 in the specified unit. The bottom area shows the temperature unit and TEMP2 alternately.
User set scale PV value (Engr Disp) 	Displays using the range and unit according to the user set PV scale. Engr LRV 0.0 Engr URV 45.0 Engr exp ×100 Engr Unit m3/min Engr point 1

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NOTE

For user set scale PV value, the process value assigned to PV is applied to the user set scale. If you change the PV, set the low limit (Engr LRV) and high limit (Engr URV) of the user set scale according to the new PV range.

To configure the integral indicator, follow steps (1) to (4) below.

(1) Selecting the displayed content

The display content set with the Disp Out 1 parameter under Disp select is shown on the integral indicator.

- **Recalling and setting parameters**

Recall parameters	[Root menu] → Detailed setup → Display condition → Disp select →
Disp Out 1	From the aforementioned seven types, select the display content.

Disp Out 2 to 4 can be set in the similar manner. Set them if necessary. In addition to the above options, “Not used” is also available.

(2) Cyclic display

Up to four LCD screens are displayed cyclically. The content set in each LCD screen parameter (Disp Out 1, Disp Out 2, Disp Out 3, Disp Out 4) are displayed in the parameter number order.

(3) Display resolution

Change the decimal place of displayed values.

- **Recalling and setting the decimal place parameter of PV%**

Recall parameters	[Root menu] → Detailed setup → Display condition → Disp condition →
Disp PV % reso	Set the decimal place to one of the following two types. Normal: Displays down to the first decimal place High Resolution: Displays down to the second decimal place

- **Recalling and setting the differential pressure/ pressure decimal place parameters**

Recall parameters	[Root menu] → Detailed setup → Display condition → Disp condition →
DP disp point	Set the decimal place for differential pressure to 0, 1, 2, 3, or 4.
Pres 1 disp point	Set the decimal place for module 1 side pressure to 0, 1, 2, 3, or 4.
Pres 2 disp point	Set the decimal place for module 2 side pressure to 0, 1, 2, 3, or 4.

(4) Setting the user set PV scale unit and range

The Engr disp range parameter can be used to select a unit from registered units or the user's original unit.

Recall parameters	[Root menu] → Detailed setup → Display condition → Engr disp range →
Set Engr Unit (method)	Select the unit from the table below.
Modify Engr Unit (method)	Create a unit symbol using alphanumeric characters. See the notes below.
Engr LRV	Lower range value
Engr URV	Upper range value
Engr exp	Exponents for user scale display
Engr point	Decimal place for user scale display. (0, 1, 2, 3 or 4)

The following units are registered.

kPa	ftH_2O	Nl/min
MPa	gf/cm^2	Nm^3/h
mbar	kgf/cm^2	Nm^3/min
bar	kg/cm^2G	ACFH
psi	kg/cm^2A	ACFM
psia	atm	SCFH
mmH_2O	kg/h	SCFM
mmHg	t/h	GPH
mmHgA	m^3/h	GPM
mmAq	m^3/min	m
mmWG	l/h	mm
Torr	l/min	in
inH_2O	kl/h	ft
inHg	kl/min	kg/m^3
inHgA	Nl/h	g/cm^3

If you specify Modify Engr Unit and create your original unit, note the following when entering the unit directly.
Up to eight characters can be set using alphanumeric characters and a slash, but only the first six characters are displayed. If two or more slashes or any of the following characters are used, "-- -- -- -- -- --" is displayed.

% & < > . * : + - , ' ( )

7.2.3.8 Display Temperature Unit Setup

When the instrument is shipped, the temperature units are set to deg C.
To check the display temperature unit, follow the procedure below.

- **Recalling the display temperature unit parameter (Temp Unit)**

Recall parameters	[Root menu] → Detailed setup → Sensors → Temp setup →
Temp unit	Select deg C, deg F or K (Kelvin).

Check that °C (deg C) is selected with the Temp unit parameter.

7.2.3.9 Zero Point Adjustment and Span Adjustment

The transmitter is adjusted accurately according to specifications at the factory before shipment, but minute errors may appear depending on the installation environment or mounting position. Zero adjustment and span adjustment are available for finely adjusting these errors. Zero point adjustment is a single point adjustment for aligning the low limit of the measuring range to 0% output. It is used to correct differential pressure errors caused by the mounting position of the transmitter body section or pressure. Span adjustment defines the input/ output characteristics between two points with one of the two being the zero point reference. This is used to align the transmitter with customer's original pressure standards. It is also used when span drift is suspected or when a zero condition cannot be created such as in absolute pressure.

(1) Zero Point Adjustment for Differential Pressure

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

Adjustment Method	Description
Using the HART configuration tool	a) Set the present input to 0%. Adjust for 0% output at input level of 0%.
	b) 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.
Using the external zero-adjustment screw	c) Adjust zero point using the zero-adjustment screw on the transmitter Zero point adjustment is possible without using the HART configuration tool. Accurately adjust the output current to 4 mA or other target output value using an ammeter that accurately reads output currents.

a) Set the present input to 0% (4 mA).
In this case, follow the procedure below.
This method can be used when the pressure corresponding to the low limit of the measuring range is zero.

- **Recalling and setting the zero point adjustment parameter (DP Zero trim)**

Recall parameters	[Root menu] → Maintenance → DP trim →
DP Zero trim	Confirm the value after it has stabilized.

ON the DP Zero trim method screen, check that the applied zero pressure has stabilized and confirm the value.

b) Adjust output to the reference value obtained using other means.
In tank level measurement, if the actual level cannot be brought to zero for zero adjustment, then the output can be adjusted to correspond to the actual level obtained using another measuring instrument such as a sight glass.
An example of a digital remote sensor transmitter whose span is 0 to 25.00 kPa, current level is 13.50 kPa, and the current output is 13.83 kPa is shown below.

- **Recalling and setting the zero point adjustment parameter (DP trim)**

Recall parameters	[Root menu] → Maintenance → DP trim → DP trim (method)
Auto, Lower Pt	Set the target value.

On the DP trim method screen, select Auto, Lower Pt, and enter the actual level 13.50 kPa on the display screen. This will change the current output from 13.83 kPa to 13.50 kPa.

Span: 0 to 25.00 kPa
Present level: 13.50 kPa
Present output: 13.83 kPa

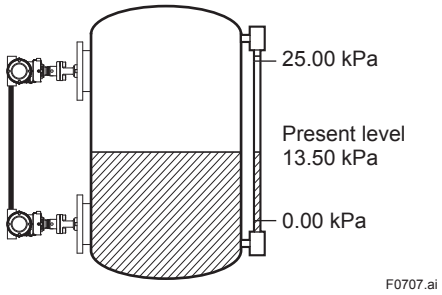


Figure 7.2.4 Tank Level Measurement

c) Using the external zero-adjustment screw
Parameter Ext SW can be used to enable or disable the zero point adjustment using the zero-adjustment screw on the transmitter.
To use the zero-adjustment screw, select Enabled (the factory default setting is Enabled). For the setting procedure, see subsection 7.2.3.11.
While viewing the output value, turn the zero-adjustment screw on the outside of the transmitter case using a slotted screwdriver so that the output value is set to zero. Turn the screw clockwise to increase the output or counterclockwise to decrease the output.
The zero point adjustment can be made with a resolution of 0.01% of the setting range.
Since the degree of zero adjustments varies with the screw turning speed, turn the screw slowly for fine adjustment and quickly for coarse adjustment.

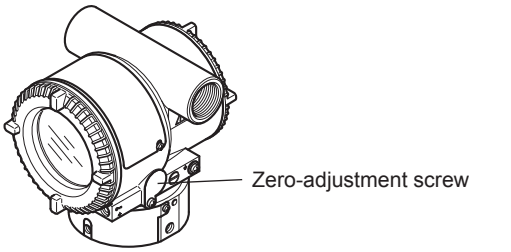


Figure 7.2.5 Zero-adjustment Screw

(2) Span Adjustment for Differential Pressure

Span adjustment changes the input/output characteristics with the low limit of the measuring range (zero point) as the reference. Therefore, be sure to perform span adjustment (high limit adjustment) after zero point adjustment (low limit adjustment). There are two adjustment methods: automatic and manual.

a) Automatic adjustment
If you apply pressure for the point you want to adjust and enter the pressure value in a parameter, the transmitter automatically calculates the adjustment value and makes appropriate adjustments.

- **Recalling and setting automatic adjustment parameters**

Recall parameters	[Root menu] → Maintenance → DP trim → DP trim (method)
Auto, Lower Pt	Set the low limit value you want to adjust.
Auto, Upper Pt	Set the high limit value you want to adjust.

Select Auto, Lower pt. parameter to adjust the lower limit.
Apply the reference pressure that corresponds to the low limit of the transmitter's measuring range, and confirm the value when the reference pressure stabilizes.
Next, select the high limit adjustment parameter "Auto, Upper Pt," apply the reference pressure that corresponds to the high limit of the transmitter's measuring range, and confirm the value when the reference pressure stabilizes.

b) Manual adjustment
Manually calculate the zero point and span adjustment value from the actually applied pressure and the transmitter output. Then, set parameters "Manual, Lower Pt" and "Manual, Upper Pt" to those values. Assume that adjustment for the 10 to 30 kPa range was made in the past, and that the following zero and span adjustments were used.
P LTD = −0.04 kPa, P UTD = −0.03 kPa
The settings for this example are indicated below.

1. Recall low limit adjustment parameter Manual, Lower Pt.

Recall parameters	[Root menu] → Maintenance → DP trim → DP trim (method) → Manual, Lower Pt

2. Apply the low limit reference pressure of 10 kPa to the transmitter. We assume that the output display at this point is 9.94 kPa.
3. The output difference (10 – 9.94 = 0.06 kPa) at that point is added to the past adjustment value (−0.04 kPa) to calculate the zero adjustment value.
−0.04 + 0.06 = 0.02 kPa
4. Enter 0.02 for P LTD.
5. Next, recall high limit adjustment parameter Manual, Upper Pt.

Recall parameters	[Root menu] → Maintenance → DP trim → DP trim (method) → Manual, Upper Pt

6. Apply the high limit reference pressure of 30 kPa to the transmitter. We assume that the output display at this point is 30.15 kPa.
7. Calculate the output error.

$$\text{Output error} = \frac{\text{Standard pressure value} - \text{transmitter output value}}{\text{Standard pressure value}} \times (\text{URV} - \text{LRV})$$

$$= \frac{30.00 - 30.15}{30.00} \times (30.00 - 10.00) = -0.1$$

8. The output difference (−0.1 kPa) is added to the past adjustment value (−0.03 kPa) to calculate the span adjustment value.
   −0.03 + (−0.1) = −0.13 kPa
9. Enter −0.13 for P UTD.

(3) Zero and Span Adjustment for Pressure

Zero and span adjustment can be made for pressure (Pres 1, Pres 2). Like the previous section, use the HART configuration tool to make the adjustment.

- **Recalling pressure zero span adjustment parameters**

Recalling parameters	Pres 1	[Root menu] → Maintenance → Pres 1 trim → Pres 1 trim (method)
	Pres 2	[Root menu] → Maintenance → Pres 2 trim → Pres 2 trim (method)
Auto, Lower Pt		Automatic zero adjustment
Auto, Upper Pt		Automatic span adjustment
Manual, Lower Pt		Manual zero adjustment
Manual, Upper Pt		Manual span adjustment

(4) Adjustment Reset

This parameter can be used to reset various adjustment values to factory default conditions. The value adjusted with the zero-adjustment screw can also be reset to the default value using Clear DP trim.

- **Recalling and setting adjustment value clear parameters**

Differential pressure parameter	
Recall parameters	[Root menu] → Maintenance → DP trim→ Clear DP trim (method)

Pressure parameter		
Recalling parameters	Pres 1	[Root menu] → Maintenance → Pres 1 trim→ Clear Pres 1 trim (method)
	Pres 2	[Root menu] → Maintenance → Pres 2 trim→ Clear Pres 2 trim (method)

7.2.3.10 Analog Output Adjustment

This function adjusts the analog output value. Two adjustment methods, D/A output adjustment and scaled D/A output adjustment, are available. The outputs at 4 mA and 20 mA are adjusted.

(1) D/A output adjustment (D/A trim)

To make adjustments, set D/A trim, connect a precision ammeter for calibration according to the displayed message, and set the output values when 4 mA and 20 mA constant current is generated in parameters.

- **Recalling the D/A output adjustment parameter (D/A trim)**

Recall parameters	[Root menu] → Maintenance → Analog output trim → D/A trim (method)

(2) Scaled D/A output adjustment (Scaled D/A trim)

The output value can be scaled to any value of your choice, displayed, and set. Messages will be displayed, so follow them.
Example: Scaling (voltage)
When a 250Ω input resistance is connected to the current output loop and the voltage across the terminals is measured with a digital voltmeter
4 mA DC → 1 V
20 mA DC → 5 V
Connect a calibration instrument that measures the scaled measurements, measure the output values when a 4 mA and 20 mA constant current is generated, and set the readout values to make the adjustment.

- **Scaled D/A output adjustment procedure**

Step	Analog output parameters	
1	Recall parameters	[Root menu] → Maintenance → Analog output trim → Scaled D/A trim (method)
2	Select scaling	Select Change.
3	Set the low side	Set the value to be scaled (example: 1)
4	Set the high side	Set the value to be scaled (example: 5)
5	Adjust the output	Select Proceed.
6	Execute low side trim	Set the readout value.
7	Execute high side trim	Set the readout value.

7.2.3.11 External Switch Mode

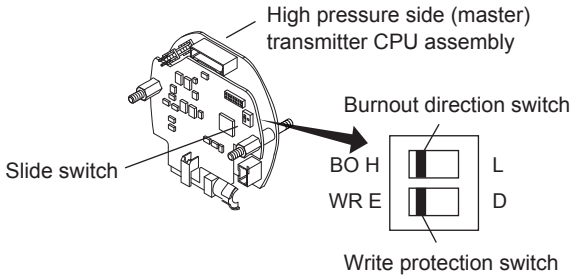
This function is used to enable or inhibit zero point adjustment from the zero-adjustment screw on the transmitter. The factory default setting is Enabled. To change the setting, follow the procedure below.

- **Recalling the external switch mode parameter (Ext SW)**

Recall parameters	[Root menu] → Maintenance → DP trim → Ext SW
Enabled	External zero adjustment enabled
Disabled	External zero adjustment disabled

7.2.3.12 CPU Error Burnout Switch and Hardware Write Protection

There are two slide switches on the transmitter CPU assembly. One is used to set the burnout direction for when CPU errors occur, and the other is used to enable or disable the write-protect function.
If either the hardware write protection switch or software write protection (see subsection 7.2.3.13) is set to write-disable, writing is not possible.



Burnout direction switch (BO)		
Switch position	H E L D	H E L D
Burnout direction	HIGH	LOW

Write protection switch (WR)		
Switch position	H E L D	H E L D
Write protection	NO (Write enabled)	YES (Write disabled)

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Figure 7.2.6 Output Setting for Errors

- **For models with standard specifications or optional code /C3**

The burnout direction switch is set to high (H). If an error occurs, the transmitter outputs a 110% or higher signal.

- **For models with optional code /C1 and /C2**

The switch is set to low (L). If an error occurs, the transmitter outputs a −2.5% or lower signal.
The 4 to 20 mADC burnout direction for when CPU errors occur is displayed in the AO alm typ parameter. Note that if an error occurs, communication is not possible.
To check the 4 to 20 mADC output state for when CPU errors occur, follow the procedure below.

- **Recalling the analog output burnout direction (AO alm typ) parameter**

Recall parameters	[Root menu] → Detailed setup → Output condition → Analog output → AO alm typ
Hi	Set to off the scale on the high side
Lo	Set to off the scale on the low side

7.2.3.13 Software Write-Protect

This function can be used to set a password to prohibit parameter writing through communication and protect the data set in the transmitter.
If a password (8 alphanumeric characters) is entered and the write protection is set to Yes, the transmitter cannot change the parameters.
To disable write protection, on the new password input screen, enter eight spaces.
Note that the write protection can be disabled temporarily in the following manner.

If a password is set, you can enter the password in Enable wrt 10min to disable the protection for 10 minutes allowing the parameters to be changed.

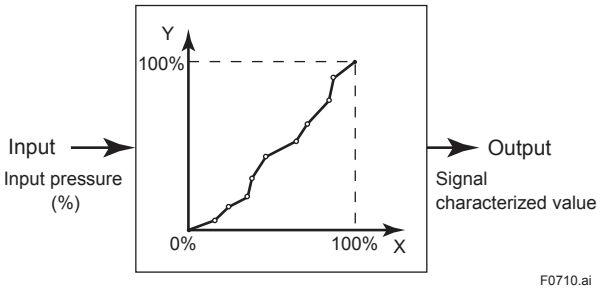
- **Recalling and setting software write protection parameters**

Recall parameters	[Root menu] → Detailed setup → Wrt protect menu →
Write protect	Protection mode display Yes: Write protection enabled No: Write protection disabled
Enable wrt 10 min (method)	Write protection disabled for 10 minutes
New password (method)	Set a new password.

7.2.3.14 Signal Characterizer Setup

This feature performs signal characterizer calculation for differential pressure percentage values and outputs the result. This is used to obtain linear output in liquid level measurement of irregular shaped tanks. The coordinates of up to 30 points can be set in the range or 0 to 100%. Confirm that parameter “Xfer fnctn” is set to “Linear” or “Sq root” when you set coordinates.
Set this to “Spcl curve” when you finish setting the coordinates to apply signal characterizer to the output.
Note that in the following conditions, the transmitter rejects the application of this function.

- **When the X-Y coordinates of the setpoints are not increasing linearly**



To set the signal characterizer function, follow the procedure below.

1. Set the setpoint coordinates.

- **Recalling the parameter for the number of coordinates (Num of points)**

Recall parameters	[Root menu] → Detailed setup → Signal condition → S.C.menu →
Num of points	Set the number of setpoints (0 to 30).

Set the number of setpoints in the range of 0 to 30 using the Num of points parameter.

2. Set the coordinate value

- **Recalling the coordinate setting parameter (XY values).**

Recall parameters	[Root menu] → Detailed setup → Signal condition → S.C.menu → XY values →
X1 to X30 Y1 to Y30	Set the X and Y coordinate values

Enter the values to assign to the X and Y coordinates using the Point setting parameter.

3. Apply the signal characterizer function
After setting the coordinate values, setting parameter “Xfer fnctn” to “Spcl curve” enables the signal characterizer and disables the changing of data.

- **Recalling the signal characterizer parameter (Xfer fnctn)**

Recall parameters	[Root menu] → Detailed setup → Signal condition
Xfer fnctn	Select Spcl curve.

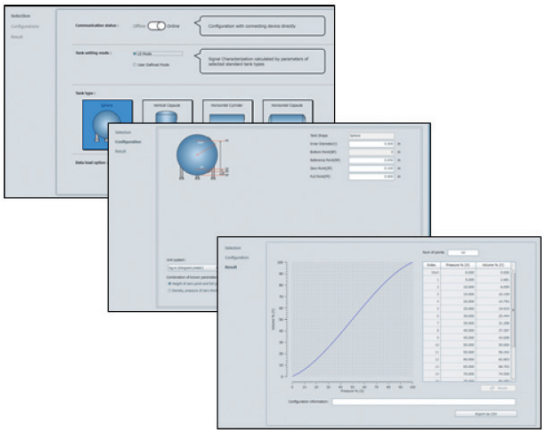
Select Spcl curve with the Xfer fnctn parameter. The factory default setting is Linear or Sq root.

NOTE

By selecting [Device]→[Additional Functions]→[Signal Characterization] at DTM menu bar, you can reach the following setting screen to set the coordinate values which corresponds to the shape of the tank.

1. Select Online(set the coordinate value in the transmitter) or Offline (make a data file of coordinate values).
2. Select input mode from “UI mode” in which you can follow the user interface according to the tank shape and automatically generate the coordinate values or “User defined mode” in which you can manually input coordinate values.
3. In case of UI mode, select tank shape in the first screen, and enter the parameters for each part of the tank in the next screen. By pushing [Calculate] button, the coordinate values will be generated.
4. A graph and the table of coordinate values will be shown. You can edit the valuee in the table. In UI mode, you can change the number of the setpoints and re-caluculate it. Download the data to the transmitter or the data base with [apply] button. Save it in the file by [Exports as CSV] button.

- Setting screen of DTM
  Menu:[Device]→[Additional Functions]→[Signal Characterization]



7.2.3.15 Alarm Setup

An alarm can be indicated on the display when the input value (device variable) exceeds the threshold. Differential pressure, pressure and capsule temperature can be assigned.
For the displayed alarm information, see Table 8.3, “Error Message Summary.”

(1) Setting the alarm source

Select the alarm source using the Process Alert parameter, and set the alarm mode for that source.

- **Recalling and setting alarm parameters**

Recall parameters	[Root menu] → Detailed setup → Output condition → Process Alerts →
Select the alarm source.	DP Alert → DP alert mode: Differential pressure
	Pres 1 Alert → Pres 1 alert mode: Module 1 side pressure
	Pres 2 Alert → Pres 2 alert mode: Module 2 side pressure
	Temp 1 Alert → Temp 1 alert mode: Module 1 side capsule temperature
	Temp 2 Alert → Temp 2 alert mode: Module 2 side capsule temperature
Select the alarm mode.	Off: Disable alert detection
	Hi. Al Detect: Detect high side alerts
	Lo. Al Detect: Detect low side alerts
	Hi/Lo. Al Detect: Detect both high side and low side alerts

(2) Setting the threshold

Set the upper and lower threshold levels for generating alarms.

- **Recalling threshold parameters**

Recall parameters	[Root menu] → Detailed setup → Output condition → Process Alerts →
DP Alert →	Select differential pressure, and set the threshold.
Pres 1 Alert →	Select module 1 side pressure, and set the threshold.
Pres 2 Alert →	Select module 2 side pressure, and set the threshold.
Temp 1 Alert →	Select module 1 side capsule temperature, and set the threshold.
Temp 2 Alert →	Select module 2 side capsule temperature, and set the threshold.

For the selected source, assign thresholds for the parameters shown below.

Parameter	Description
DP Hi alert val	Set the threshold for the high limit side alarm for differential pressure.
DP Lo alert val	Set the threshold for the low limit side alarm for differential pressure.
Pres 1 Hi alert val	Set the threshold for the high limit side alarm for module 1 side pressure.
Pres 1 Lo alert val	Set the threshold for the low limit side alarm for module 1 side pressure.
Pres 2 Hi alert val	Set the threshold for the high limit side alarm for module 2 side pressure.
Pres 2 Lo alert val	Set the threshold for the low limit side alarm for module 2 side pressure.
Temp 1 Hi alert val	Set the threshold for the high limit side alarm for module 1 side capsule temperature.
Temp 1 Lo alert val	Set the threshold for the low limit side alarm for module 1 side capsule temperature.
Temp 2 Hi alert val	Set the threshold for the high limit side alarm for module 2 side capsule temperature.
Temp 2 Lo alert val	Set the threshold for the low limit side alarm for module 2 side capsule temperature.

7.2.3.16 Test Output, Simulation, and Squawk

IMPORTANT

Test output,device variable simulation and status simulation are held for a certain time period and then released automatically.
Even if the HART configuration tool is closed or the communication cable is disconnected while executing the above test, they are held for a certain time period.

	Retention time
Factory default	10 minutes
Changeable time period	Select from 10 minutes, 30 minutes, 60 minutes, 3 hours, 6 hours, 12 hours.
Recalling configuration change parameters	
Recall parameters	[Root menu] → Diag/Service → Test device → Test Auto Release Time

(1) Test output/loop test

It is possible to output constant current that follows the analog signal output's low limit (AO lower limit) and the analog signal output's high limit (AO upper limit) settings within the 3.8 mA (–1.25%) to 21.6 mA (110%) range for loop checking. (For setting the analog signal's high and low limits, see subsection 7.3.3.5.)
While this function is running, "TEST" is shown in the lower part of the integral indicator.
To perform test output, recall the test output parameter (Loop Test), and select from the following three types.

- **Recalling constant current output parameters**

Recall parameters	[Root menu] → Diag/Service → Test device → Loop test (method)
4 mA	Outputs a 4 mA DC constant current
20 mA	Outputs a 20 mA DC constant current
Other	Outputs a specified current
End	End

To perform test output from the DTM, recall Loop Test from Hot key menu, select manual test or auto test in the figure on the screen, and set the value.

(2) Device variable simulation

A value and status of your choice can be assigned to a device variable, and its output can be confirmed.
When the parameter is recalled, a message is displayed, so follow them. When step 5 is completed, simulation begins. This reading and alarm (AL.91) are displayed alternately on the integral indicator.

- **Device variable simulation execution procedure**

Step		
1	Recall parameters	[Root menu] → Diag/Service → Test device → Device vars simulate (method)
2	Select Device Variable.	Select from the following parameters. Off Differential pressure (DP) Module 1 side pressure (Pres 1) Module 2 side pressure (Pres 2) Module 1 side capsule temperature (Temp 1) Module 2 side capsule temperature (Temp 2) Percentage (PV % range) Current (Loop current)
3	Set Value.	Enter the simulation value. The preset unit is used.
4	Set Data quality.	Select from the following parameters. Bad Poor accuracy Manual / Fixed Good
5	Set Limit status.	Select from the following parameters. Not limited Low limited High limited Constant

NOTE

- The differential pressure, pressure, and capsule temperature simulation is applied to the output. Current output value, integral indicator display value, and communication output value are those that correspond to the simulation values. If alarms are set, alarms are output according to the simulation values.
- For differential pressure and pressure simulations, the damping setting is applied. If a value changes, the value changes according to the damping time constant.

(3) Squawk

This is used to determine with which transmitter communication is currently taking place.
There are two squawk modes; “once” mode in which the squawk display below is shown for 10 seconds and automatically cleared, and “continuous” mode in which the display below will keep showing until “OFF” is input. Follow the procedures to set squawk mode.

- **Executing the squawk display**

Recall parameter	[Root menu] → Diag/Service → Test device → Squawk (method)
Continuous	Squawk display will keep showing
Once	Squawk display is shown for 10 seconds, and automatically cleared.

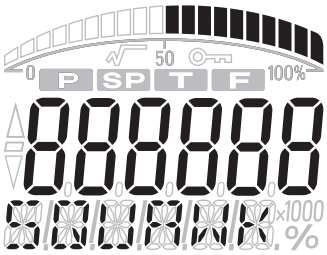


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Figure 7.2.9 Display during Squawk Execution

7.2.3.17 Burst Mode

If burst mode is enabled, the transmitter can continuously send three of the data shown in Table 7.2.4 through HART communication.
For details on the function, see the item (1), “Burst messages and settings.”
Further, if burst mode is enabled, alarm signals can be continuously sent by detecting configuration changes and self-diagnosis changes.
For details on this function, see item (2), “Event notification.”
Note that when changing the burst mode setting, check that the Burst mode parameter is set to Off.

(1) Burst messages and settings

Up to three burst messages can be sent.
For each burst message, the following settings are possible.

- Burst mode target command parameter
- Send period
- Send condition (set with Burst Msg Trigger Mode)

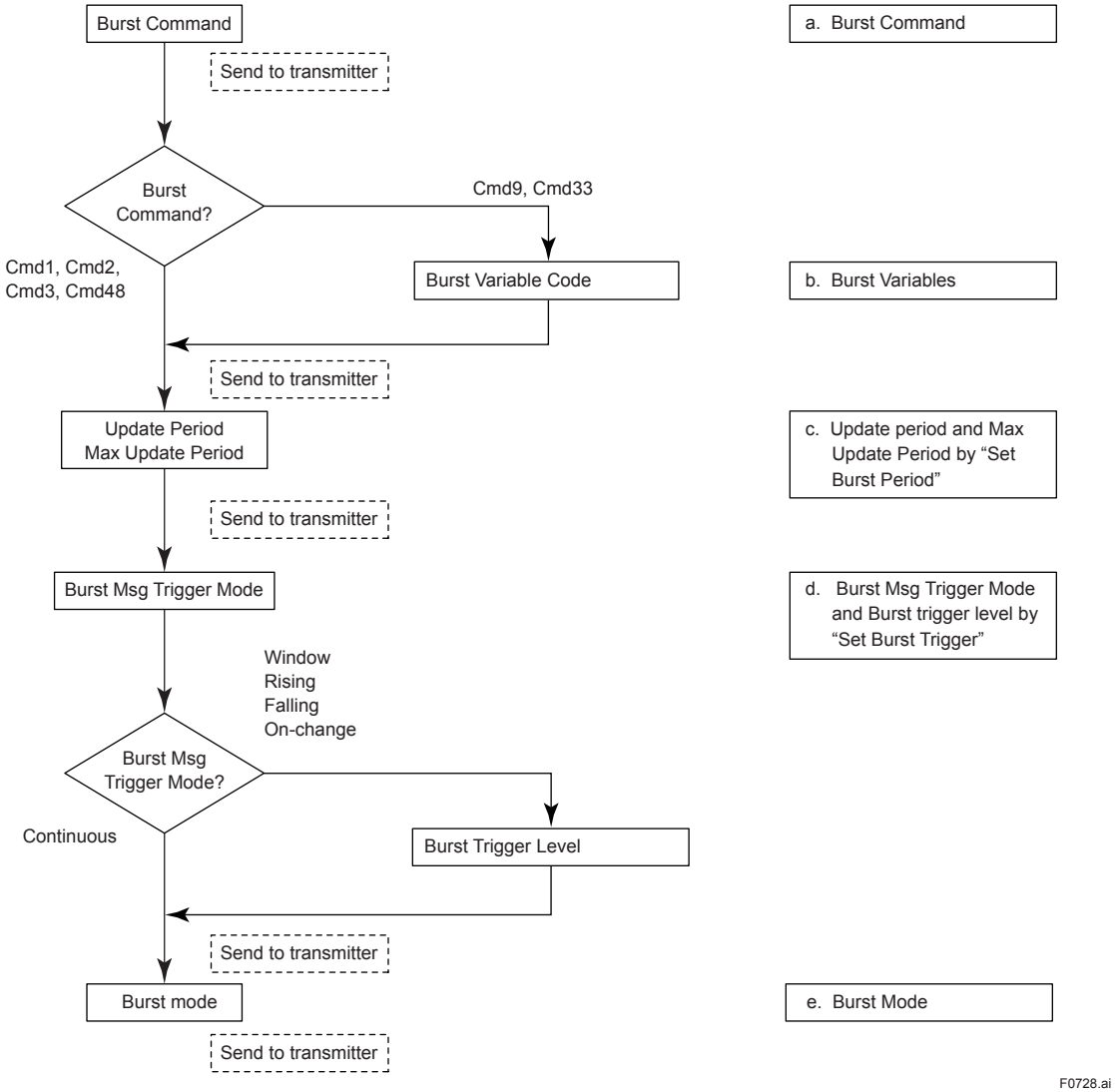
Table 7.2.3 Burst mode target command parameters

Command parameter	Burst Command	Burst Msg Trigger Mode	Burst Trigger Source	Burst Trigger Units
PV	Cmd1:PV	Continuous	—	—
		Window	PV	Depends on PV assignment
		Rising		
		Falling		
		On-change		
% range/current (percent of range, Loop current)	Cmd2:% range/ current	Continuous	—	—
		Window	% range	%
		Rising		
		Falling		
		On-change		
Process vars/current (Loop current, PV, SV, TV, and QV)	Cmd3:Dyn vars/ current	Continuous	—	—
		Window	PV	Depends on PV assignment
		Rising		
		Falling		
		On-change		
Device vars/%range/ current with status*1 (Select up to 8 from differential pressure, pressure, capsule temperature, percent of range, and Loop current *2)	Cmd9:Device vars w/status	Continuous	—	—
		Window	Process variable assigned to the head of Burst Variables	Depends on Burst Variables
		Rising		
		Falling		
		On-change		
Device variables (Select up to 4 from differential pressure, pressure, capsule temperature, percent of range, and Loop current *2)	Cmd33:Device variables	Continuous	—	—
		Window	Process variable assigned to the head of Burst Variables	Depends on Burst Variables
		Rising		
		Falling		
		On-change		
Self diagnosis information (self-diagnostics)	Cmd48:Read Additional Device Status	Continuous	—	—
		On-change	All statuses	—

*1: A value is output with time and status information when a burst is output from the device.
*2: Select from Burst Variables.

(2) Setting the burst mode

Recall a burst mode parameter, Burst Message 1, 2, or 3, and set the parameter according to the following flow chart.



- **Recalling a burst mode parameter**

[Root menu] → Detailed setup → Output Condition → HART Output → Burst Condition → Burst Message 1, 2, or 3 → Burst Command

1. Set the send data.
   Set the send data using burst command parameters.

Burst Command	Command parameter
Cmd1:PV	Parameters to be sent PV (fixed)
Cmd2:% range/ current	% range/current (percent of range, Loop current; fixed)
Cmd3:Dyn vars/ current	Process vars/current (Loop current, PV, SV, TV, and QV; fixed)
Cmd9:Device vars w/Status	Device vars/%range/currentwith status (user assigned DeviceVariable, upto 8 values.)
Cmd33:Device variables	Device vars/%range/current (user assigned DeviceVariable, upto 4 values.) excluding status
Cmd48:Read Additional Device Status	Self diagnosis information (Self-diagnosis; fixed)

2. Set the burst variable.
   If Burst Command is set to Cmd9:Device vars w/Status, up to eight variables can be set.
   If Burst Command is set to Cmd33: Device variables, up to four variables can be set.

- **Recalling burst variable parameters and variables**

Recall parameters	Burst Condition → Burst Message1, 2, or 3 → Burst Variables → Burst Variable Code
DP	Select the differential pressure.
Pres 1	Select the module 1 side pressure.
Pres 2	Select the module 2 side pressure.
Temp 1	Select the module 1 side capsule temperature.
Temp 2	Select the module 2 side capsule temperature.
%rnge	Select the percentage output.
Loop current	Select the current.
PV	Select the Primary Variable.
SV	Select the Secondary Variable.
TV	Select the Tertiary Variable.
QV	Select the Quaternary Variable.
Not used	Not selected.

   In the case of a burst command with send conditions, the first assigned device variable becomes the trigger source.

3. Set the send period.
   Set Update Period and Max Update Period.

NOTE

If a period shorter than the computation period of each process value is specified, it is automatically set so that it is greater than the transmitter's computation period. Update Period for Burst Message 1 should be fixed at 0.5 s.

Set Update Period to a value smaller than Max Update Period.

- **Recalling send period parameters**

Recall parameters	Burst Condition → Burst Message1, 2 or 3 → Set Burst Period (method)
Update Period/Max Update Period	0.5 s
	1 s
	2 s
	4 s
	8 s
	16 s
	32 s
	1 min
	5 min
	10 min
	15 min
	30 min
	45 min
	60 min

4. Set send conditions.
   Set the burst send conditions.
   Select a value for the Burst Msg Trigger Mode from the following table of parameters.
   If Burst Msg Trigger Mode is set to Window, Rising, or Falling, set Burst Trigger Level.

- **Recalling send condition parameters and variables**

Recall parameters	Burst Condition → Burst Message1, 2, or 3 → Set Burst Trigger (method)
Continuous	Burst Message is transmitted continuously.
Window	In “Window” mode, the Trigger Value must be a positive number and is the symmetric window around the last communicated value.
Rising	In “Rising” mode, the Burst Message must be published when the source value exceeds the threshold established by the trigger value.
Falling	In “Falling” mode, the Burst Message must be published when the source value fall below the threshold established by the trigger value.
On-change	In “On-change” mode, the Burst Message must be published when the source value on change established by the trigger value.

5. Set the start of burst transmission.
   Enable the burst mode setting.
   When the Burst mode parameter is set to “Wired HART Enabled”, burst transmission starts.

- **Recalling and setting the burst mode**

[Root menu] → Detailed setup → Output condition → HART output → Burst Condition → Burst Message 1, 2, or 3 → Burst mode → Wired HART Enabled

(3) Event notification

Changes to device settings and changes to the device status through self-diagnosis can be detected as events, and alarm signals can be sent continuously.
Up to four events that occur are saved as history.
To use this function, enable the burst mode setting.

(3-1) Setting event notification

- **Recalling event notification settings**

Step	Recall parameters	[Root menu] → Detailed setup → Output condition → HART output → Event Notification →
1	Event Mask	Set the device status to detect as events
2	Event Condition → Set Event Notification Timing (method)	
	Event Notification Retry Time	Set the retry time for when events occur.
	Max Update Time	Set the update time for when there are no events.
	Event Debounce Interval	Set the minimum event retention time.
3	Event Condition → Event Notification Control	Disable event monitoring: Off Enable event monitoring: Enable event notification on token-passing data link layer

1. Set the device status to detect as events.
   Set the device status to detect in the Event Mask parameter.

Device Status Mask
Ext dev status Mask
Diagnostic Status 0 Mask
Diagnostic Status 1 Mask
Status group 0 Mask to 5 Mask, 14 Mask to 23 Mask

When a device setting is changed, the Configuration changed (0x40) flag of Device Status (see Table 8.5) is set, and Cfg chng count (see subsection 7.3.1.3(5)) is updated. The detection of the Configuration changed flag can be masked with Device Status Mask, but Cfg chng count cannot be masked. As such, changes to device settings are always detected as events regardless of the device status setting.

2. Set the send time and minimum event retention time.
   Set the retry time for when events occur (Event Notification Retry Time), the update time for when there are no events (Max Update Time), and the minimum event retention time (Event Debounce Interval).
   Set Event Notification Retry Time to a value smaller than Max Update Time.

Event Notification Retry Time/Max Update Time	Event Debounce Interval
—	Off
0.5 s	0.5 s
1 s	1 s
2 s	2 s
4 s	4 s
8 s	8 s
16 s	16 s
32 s	32 s
1 min	1 min
5 min	5 min
10 min	10 min
15 min	15 min
30 min	30 min
45 min	45 min
60 min	60 min

3. Enable event monitoring.
   Set Event Notification Control to Enable event notification on token-passing data link layer.

(3-2) Acknowledging events (DTM only)

When the host device acknowledges an event, event transmission stops.
To acknowledge events, follow the procedure below.

- **Recalling event acknowledge**

Recall parameters	[Root menu] → Detailed setup → Output condition → HART output → Event Notification → Acknowledge→
Acknowledge Event Notification (method)	Get and acknowledge an event number.

1. Get the event number.
   Get the latest event number.
   Execute the Acknowledge Event Notification method.
   1) Enter 0 in Read Event Notification.
   2) OK
   3) Confirm Event Number and contents of event.
2. Acknowledge the event.
   Get the latest event with the event number and acknowledge the event.
   Execute the Acknowledge Event Notification method.
   1) Set Send Acknowledge.
   2) OK
   3) Confirm that Event Status is cleared.

(3-3) Checking the event history (DTM only)

Event numbers can be used to view the past status history of events that have occurred.

- **Recalling event history**

Recall parameters	[Root menu] → Detailed setup → Output condition → HART output → Event Notification→ Acknowledge →
Acknowledge Event Notification (method)	Get an event number and check the history.

1. Get the event number.
   Get the latest event number by following the procedure below.
   Execute the Acknowledge Event Notification method.
   1) Enter 0 in Read Event Notification.
   2) OK
   3) Check Event Number.
2. Check the event history.
   View four events that have occurred including the history of the event number that you checked in step 1.
   Execute the Acknowledge Event Notification method.
   1) Enter the event number that you checked in step 1.-3) in Enter Event Number.
   2) OK
   3) History is displayed.
   Example: If the event number that you checked in 1.-3)is 123

Event Number	Description
123	Last event
122	Second to the last event
121	Third to the last event
120	Fourth to the last event

7.2.3.18 Multidrop Mode

Up to 63 devices that have been set to multidrop mode can be connected to a single communication line.
To enable multidrop communication, the device address must be set to any number ranging from 1 to 63.
When set to multidrop mode, all data are sent digitally. Therefore, the 4 to 20 mA analog signal output setting needs to be changed.
To set multidrop, follow the procedure below.

(1) Setting the polling address

Enter a value between 1 and 63 in the Poll addr parameter.

- **Recalling the polling address parameter (Poll addr)**

Recall parameters	[Root menu] → Detailed setup → Output condition → HART output →
Poll addr	Set a number between 1 and 63 for the address.

CAUTION

If the same polling address is assigned to two or more transmitters in multidrop mode, communication with these transmitters will not be possible.

(2) Setting the analog output signal

Set Loop current mode to Disabled on the transmitter side, and fixe the analog output signal to 4 mA DC. In this case, burnout output can no longer be used. However, in the case of an application that receives analog output signals to control devices, analog output signals can be used on a single unit for a single loop. In this case, set Loop current mode to Enabled.

- **Recalling Loop current mode and variables**

Recall parameters	[Root menu] → Detailed setup → Output condition → Analog output → Loop current mode →
Enabled	4 to 20 mA analog signal output mode
Disabled	4 mA DC fixed mode

(3) Enabling multidrop communication on the configuration tool side

Refer to the configuration tool manual, and configure the receiver side polling settings.

(4) Communication in multidrop mode

1. When the power is turned on, the HART configuration tool searches for devices set to multidrop mode.
   If the HART configuration tool is connected to devices, their polling addresses and tags are displayed.
2. Selecting the device of your choice enables communication with the selected device.
   However, communication in this mode will be slow.

(5) Clearing multidrop mode

To clear multidrop mode, display the Poll addr parameter by following the procedure in step (1), “Setting the polling address,” and set the address to 0.
And, set Loop current mode back to Enabled.

7.3 Diagnostics

7.3.1 Self-Diagnostics

7.3.1.1 Checking Using the HART Configuration Tool

HART configuration tool can be used to check the self-diagnostics and configuration errors of transmitters.
Self-diagnostics includes self test and status.
If a self test is executed and the transmitter detects configuration errors or device errors, an error message is displayed in the configuration tool. (See Table 8.3, “Errors and Messages.”)

- **Recalling self-diagnostics (Self test) parameters**

[Root menu] → Diag/Service → Test device → Self test (method)

If an error is not detected, Self test OK is displayed in the configuration tool.
If you want to check a specific item, you can specify it in the Status parameter to check the item directly.
Status is divided into device status(accumulated status which includes extended and diagnostics status) and status group(status group according to diagnostic group).

- **Recall status parameters**

Call parameters	[Root Menu] → Diag/ Service → Status	Refer to
Device status	Device status	Table 8.5
Ext dev status	Extended device status	Table 8.6
Diagnostic status 0, 1	Device Diagnostic status	Table 8.6
Status group 0,1	Module 1 side hardware status	Table 8.3
Status group 2, 3, 4	Module 1 side process status	
Status group 5,14	Module 1 side setting status	
Status group 15,16	Diagnostic status	
Status group 17	Simulation status	
Status group 18	Module 2 side hardware status	
Status group 19, 20, 21	Module 2 side process status	
Status group 22, 23	Module 2 side setting status	

When any abnormalities are detected, refer to Table 8.3 and take necessary measure.
HART configuration tool performs diagnostics every communication transaction. If an inappropriate operation is performed, an error message will be displayed. (See Table 8.4, “HART Communication Error Messages.”)

7.3.1.2 Checking with Integral Indicator

NOTE

If an error is detected in the self-diagnostic, an error number is displayed on the integral indicator.
If there is more than one error, the error number changes at 3-second intervals.
See Table 8.3 regarding the error numbers.

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Figure 7.3.1 Identifying Problems Using the Integral Indicator

7.3.1.3 Status information

(1) Device status

The device status indicates the device’s current operating status. Table 8.5 provides the details and Table 8.8 the relationship with alarms.

- **Recalling the device status**

Recall parameters	[Root menu] → Diag/Service → Status → Device Status

(2) Extended device status

The extended device status includes the normal device information. Table 8.6 provides the details and Table 8.8 the relationship with alarms.

- **Recalling the extended device status**

Recall parameters	[Root menu] → Diag/Service → Status → Ext dev status

(3) Data quality and limit status

This transmitter can handle differential pressure (DP), module 1 side pressure (Pres 1), module 2 side pressure (Pres 2), module 1 side capsule temperature (Temp 1), module 2 side capsule temperature (Temp 2), PV % value (PV % rnge), and current signal (Loop current). Each variable includes data quality and limit status, which provide useful information about data values. Data quality is normally “Good.” However, if the sensor is bad or if measurements are outside the range, data quality changes to “Bad” or “Poor Accuracy.” Limit status indicates whether data values exceed certain limits (example no response to process). If the limit status is “Constant,” this indicates that the value does not change. For details, see Tables 8.7.

- **Recalling data quality and limit status**

Recall parameters	[Root menu] → Process variables → Device Vars and Status →
DP Data Quality	Good, Poor Accuracy, Manual/Fixed, or Bad is displayed.
DP Limit Status	Constant, Low Limit, High Limit, or Not Limited is displayed.
The same holds true for Pres 1, Pres 2, Temp 1, Temp 2, PV % rnge, and Loop current.	

(4) Timestamp

Date and time information that the transmitter retains after power-on is displayed. It is used as additional information for process values and events.

- **Recalling timestamps**

Recall parameters	[Root menu] → Diag/Service → Status → Time Stamp
Current Date	The number of running days is displayed. (January 1, 1970 is the operation start date.)
Current Time	The running time is displayed.

NOTE

Timestamps are reset when the power is turned on.

(5) Number of configuration changes

When you change parameters or perform calibration, the event is counted as a configuration change and saved as history. This value is never reset or written to when the power is turned off.

- **Recalling the number of configuration changes**

Recall parameters	[Root menu] → Diag/Service → Status →
Cfg chng count	The number of configuration changes is displayed. This value cannot be reset.

(6) Resetting the configuration change flag

This method can be used to reset the configuration change flag.

NOTE

The configuration change flag is Configuration Changed (0x40) of the device status. See Table 8.5.

- **Recalling configuration change flag reset**

Recall parameters	[Root menu] → Diag/Service → Status → Reset Cfg chng flag (method)

7.3.1.4 NE107 Status Information

Alarm information is divided into four groups on the basis of NE107. The status is displayed on the alarm screen of the HART configuration tool.

NE107 Status Group		Device Status
F	Failure	Part failure, device failure, total failure
C	Function Check	Output signal temporarily invalid due to local operation, manual value input, etc.
S	Out of specification	The device is operating outside the specifications. The measured value is undefined due to improper process or environment.
M	Maintenance required	Maintenance is required in the near future or in a certain amount of time.

The following symbols are displayed on the configuration tool.

F(Failure)
C(Function Check)
S(Out of Specification)
M(Maintenance Required)
N(No Effect)

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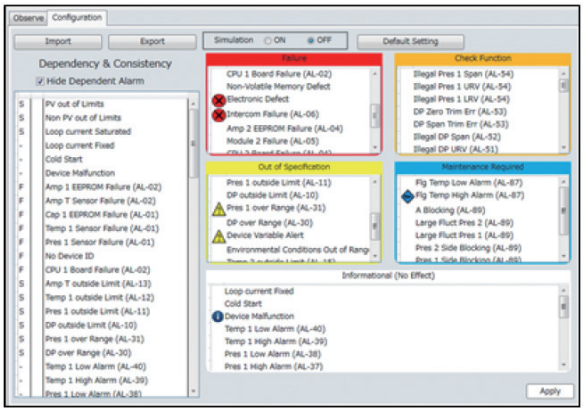
Table 8.3 shows the factory default settings.

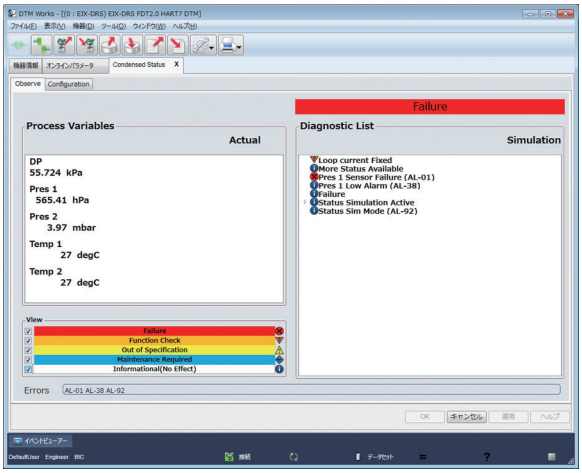
The four groups can be edited using the HART configuration tool.

Recall parameters	[Root menu] → Diag/Service → Condensed status map →
Device Status	See table 8.5.
Ext dev status	See table 8.6.
Diagnostic Status 0, 1	
Status group 0 to 5, 14 to 23	See table 8.3

By selecting [Device]→[Additional Functions]→[Condensed Status] from the DTM menu bar, four groups can be edited with using the setting screen in below. Drag and drop an each alarm in a designated group.



By using a simulation, display of an alarm according to the setting can be confirmed. During a status simulation, the status showing that the simulation is on-going and the status of four groups are displayed simultaneously.



7.3.2 Advanced Diagnostics

7.3.2.1 What Is the Multi Sensing Process Monitoring Function?

The multi sensing process monitoring function (optional code: /DG6) is a function for detecting errors in a process environment such as impulse line and piping using EJX multi sensing (differential pressure, pressure, and temperature measurement) and Yokogawa's original diagnostic algorithm. The following two functions are available.

■ Impulse line blockage detection

Fluctuation in differential pressure and pressure is monitored using silicon resonant sensors to detect the blockage condition of impulse line. For digital remote sensor transmitters, it is possible to obtain at which end of the impulse line blockage has occurred.

■ Heat trace monitoring (for module 1 side only)

This function calculates the flange temperature based on the capsule temperature and amplifier temperature measured with the sensors on the module 1 side transmitter in order to detect errors in steam traces and electric heaters used to prevent freezing in piping and impulse lines.

7.3.2.2 Impulse Line Blockage Detection

Impulse Line Blockage Detection (ILBD) is performed by statistically processing the measured values of pressure fluctuation existing in the fluid. The diagnostic results (blockage occurrences) can be confirmed with the alarm indications on the LCD or with analog alerts. For differential pressure transmitters, the measurement of three signals (differential pressure, high pressure side pressure, and low pressure side pressure) enables the determination of which side, high pressure side or low pressure side, the blockage is occurring. The blockage detection results are displayed using the following four types of messages.
Digital remote sensor transmitter is shipped with its module 1 side transmitter for high pressure side measurement and it module 2 side transmitter for low pressure side measurement. Please read “high pressure” as “module 1 side”, and “low pressure side” as “module 2 side” in the following explanations.

(1) A Blocking, B Blocking

The blockage detection result determined by the fluctuation in the differential pressure or pressure. A Blocking and B Blocking is used to indicate whether the impulse line on one side or on both sides has been blocked.

NOTE

A blocking is not used on the digital remote sensor.

(2) Pres 2 Side Blocking

The blockage detection result of the module 2 side determined by the fluctuation in the BlkF* values or module 2 side fluctuation.

(3) Pres 1 Side Blocking

The blockage detection result of the module 1 side determined by the fluctuation in the BlkF* values or module 1 side fluctuation.

*: The blockage level obtained by statistically comparing the pressure fluctuation between the module 1 side and module 2 side. For details, see subsection 7.3.2.2.1.

IMPORTANT

- The basic element of impulse line blockage detection is the monitoring of fluctuation. If sufficient fluctuation needed for determination cannot be obtained, blockage detection does not work properly.
- If not enough fluctuation is detected when reference data is acquired, the reference will be invalid, and blockage detection will not be executed.
- After fluctuation monitoring is started, fluctuation may decrease due to factors other than blockage depending on the plant operating conditions. If this occurs, an alarm may be generated on the assumption that impulse line blockage has occurred. Determine the validity of the blockage detection result by taking the plant operating conditions into consideration.

■ Notes on pressure measurements and liquid level measurements

In pressure measurements and level measurements, fluctuation may decrease particularly in the following cases.
Determine the validity of the blockage detection result by taking the plant operating conditions into consideration.

- **Pressure measurement**
  - In pressure measurement, if the pressure goes outside the ILBD diagnostic range.
  - If the flow rate decreases relative to the rate that was present at the time the reference data was acquired even when the pressure remains constant
  - If the pressure fluctuation source (pump, compressor, blower, etc.) stops
- **Liquid level measurement**
  - If the liquid inflow or outflow from the tank stops
  - If the agitator inside the tank stops
  - If the pressure fluctuation source (e.g., compressor) that controls the inner pressure of the closed tank stops

■ Block Diagram

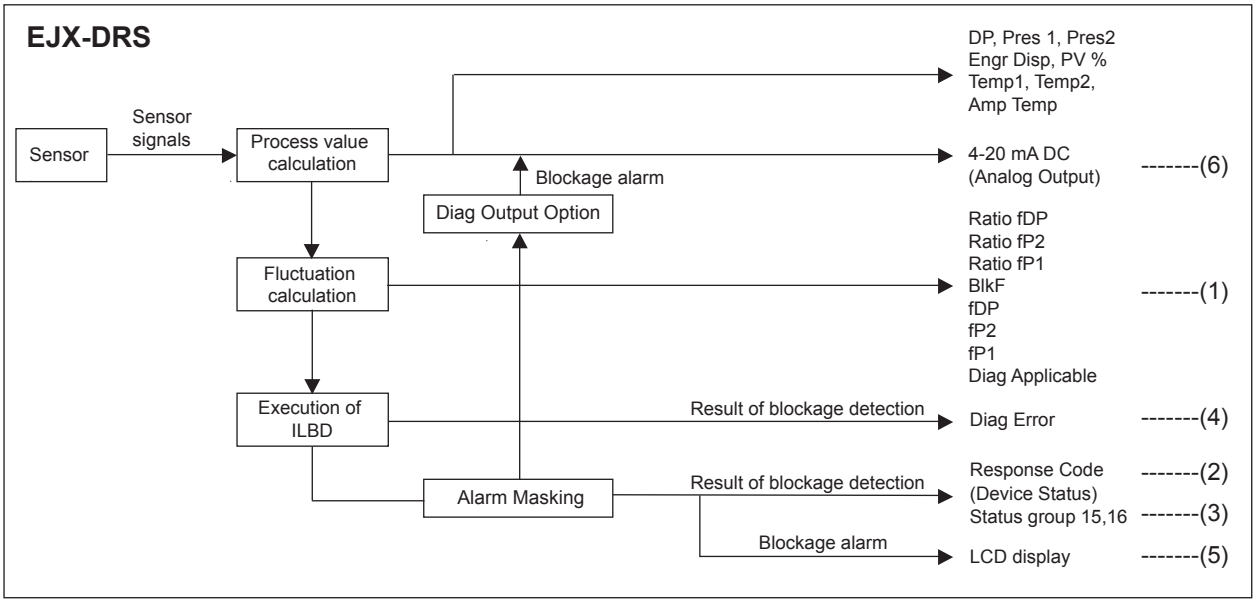


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Figure 7.3.2 Block Diagram of the ILBD Function

The following ILBD outputs (1) to (6) can be obtained.

Table 7.3.1 ILBD Outputs

#		
(1)	Ratio fDP	A value obtained by comparing the root mean square (RMS) of the differential pressure fluctuation. It is used for blockage detection. Two types of output, which you can select with Diag DPComp (flow rate compensation flag), are available. [When Diag DPComp is set to Non-Compensation] Ratio fDP = SQRT(fDP / Ref fDP) [When Diag DPComp is set to Compensation] Ratio fDP = SQRT(fDP / Ref fDP) × Ref DPAvg / DPAvg
	Ratio fP2	A value obtained by comparing the root mean square (RMS) of the module 2 side pressure fluctuation. It is used for blockage detection. Ratio fP2 = SQRT(fP2 / Ref fP2)
	Ratio fP1	A value obtained by comparing the root mean square (RMS) of the module 1 side pressure fluctuation. It is used for blockage detection. Ratio fP1 = SQRT(fP1 / Ref fP1)
	BlkF	A value indicating the blockage level, which is characterized by comparing the module 1 side pressure fluctuation and module 2 side pressure fluctuation. It is used for blockage detection.
	fDP	A value obtained by averaging the sum of squares of the differential pressure fluctuation.
	fP2	A value obtained by averaging the sum of squares of the module 2 side pressure fluctuation.
	fP1	A value obtained by averaging the sum of squares of the module 1 side pressure fluctuation.
	Diag Applicable	After the reference value is acquired, detectable blockage and fluctuation error status is displayed.
(2)	Response code Device status	When a blockage is detected, More Status Available is displayed under Response Code Device Status.
(3)	Status group 15, 16	When a blockage is detected, the blockage detection results (alarm information) are displayed in Status group 15 and 16.
(4)	Diag Error	When a blockage is detected, the blockage detection result is displayed in Diag Error.
(5)	Display on LCD	When a blockage is detected, the blockage detection results (alarm information) are displayed on the Integral indicator.
(6)	Analog Output	When a blockage is detected, the blockage detection result is reflected in the 4 to 20 mA analog output according to the settings.

7.3.2.2.1 Blockage Determination

■ Limit parameter

When a parameter based on pressure fluctuation exceeds a preset threshold, a blockage is assumed to have occurred in the transmitter, and an alarm is generated. The threshold used for determination is set in the Limit parameter shown in the following table.

Limit parameter

#	Parameter	Threshold value
[1]	Lim fDPmax	Threshold for detecting “A Blocking” using Ratio fDP.
[2]	Lim fDPmin	Threshold for detecting “B Blocking” using Ratio fDP.
[3]	Lim fP2max	Threshold for detecting “ Large Fluct Pres 2” using Ratio fP2
[4]	Lim fP2min	Threshold for detecting “Pres 2 Side Blocking” using Ratio fP2.
[5]	Lim fP1max	Threshold for detecting “ Large Fluct Pres 1” using Ratio fP1.
[6]	Lim fP1min	Threshold for detecting “Pres 1 Side Blocking” using Ratio fP1.
[7]	Lim BlkFmax	Threshold for detecting “Pres 1 Side Blocking” using BlkF.
[8]	Lim BlkFmin	Threshold for detecting “Pres 2 Side Blocking” using BlkF.
[9]	Lim DPAvgmax	Threshold for detection “ILDB over Range” using DPAvg and “Invalid Ref DP” using Ref DPAvg.
[10]	Lim DPAvgmin	Threshold for detection “ILDB over Range” using DPAvg and “Invalid Ref DP” using Ref DPAvg.

Table 7.3.2 shows the factory default values.

Table 7.3.2 Factory Default Limit Parameter Value

#	Parameter	Value
[1]	Lim fDPmax	3.00
[2]	Lim fDPmin	0.30
[3]	Lim fP2max	3.00
[4]	Lim fP2min	0.30
[5]	Lim fP1max	3.00
[6]	Lim fP1min	0.30
[7]	Lim BlkFmax	0.60
[8]	Lim BlkFmin	−0.60
[9]	Lim DPAvgmax	1.00
[10]	Lim DPAvgmin	−1.00

CAUTION

If you are using this for the first time, use the default values. If not enough pressure fluctuation can be detected in valve simulation tests or in actual operation or if alarms occur frequently, refer to subsection 7.3.2.2.10, “Tuning,” and change the Limit parameter, which will be used as the threshold.

■ Determination of A Blocking and B Blocking

A Blocking and B Blocking are blockage detection results determined by the blockage level based on the difference in the pressure fluctuation between the high pressure side and low pressure side.
Ratio fDP, which is the square root of fDP relative to SQRT (fDP / Ref fDP), is used to determine blockage.
Ref fDP is an average of the sum of squares of the differential pressure fluctuation acquired during steady state operation. It is a reference value used in the comparison with the value obtained during diagnostic execution (fDP).
If Ratio fDP exceeds the Lim fDPmax value, “A Blocking” is detected. If it falls below the Lim fDPmin value, “B Blocking” is detected.
If blockage progresses both in the high pressure side and low pressure side simultaneously in a digital remote sensor transmitter, fDP decreases. If blockage occurs in both sides, “B Blocking” is detected.
If blockage progresses in the impulse line on high pressure side or low pressure side, “A Blocking” or “B Blocking” is detected.

CAUTION

In a condition in which the difference in the pressure fluctuation between the high pressure side and low pressure side becomes extremely large, a blockage in the impulse line on one side may be detected as “B Blocking.”

Note that if the transmitter is used for pressure measurement or liquid level measurement, only “B Blocking” detection is performed.

■ Determination of Pres 1 Side Blocking and Pres 2 Side Blocking

In differential pressure measurement, it is possible to detect which side, high pressure side or low pressure side, of the impulse line has been blocked. To determine blockage on one side of the impulse line, the BlkF value is used.
BlkF is the blockage level expressing the relative blockage of the high pressure side and low pressure side of the impulse line. The value varies in the range of –1.0 to 1.0. The value approaches 1.0 when a blockage occurs in the high pressure side and –1.0 when a blockage occurs in the low pressure side.

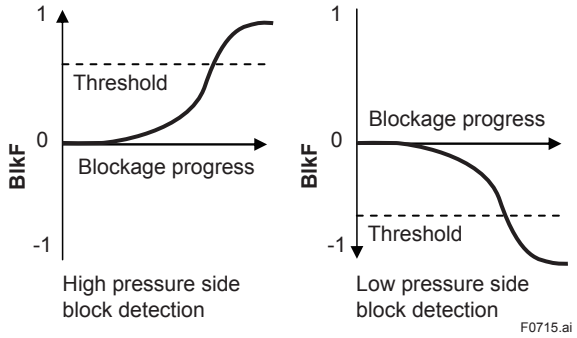


Figure 7.3.3 Relationship between blockage progress and BlkF

When the BlkF value exceeds the Lim BlkFmax value, “Pres 1 Side Blocking (high pressure side blockage)” is detected.
When the BlkF value falls below the Lim BlkFmin value, “Pres 2 Side Blocking (low pressure side blockage)” is detected.

■ Determination of Pres 2 Side Blocking

The BlkF value is prioritized in the determination of low pressure side blockage. However if the BlkF blockage level is insufficient, Ratio fP2—the square root of fP2 relative to Ref fP2 or SQRT (fP2/Ref fP2)—is used in the determination of the low pressure side blockage.
Ref fP2 is an average of the sum of squares of the low pressure side pressure fluctuation acquired during steady state operation. It is a reference value used in the comparison with the value obtained during diagnostic execution (fP2).
When Ratio fP2 falls below the Lim fP2min value, “Pres 2 Side Blocking” is detected.
On the other hand, when Ratio fP2 exceeds the Lim fP2max value “Large Fluct Pres 2 (low pressure side pressure fluctuation error)” is detected.

■ Determination of Pres 1 Side Blocking

The BlkF value is prioritized in the determination of high pressure side blockage. However if the BlkF blockage level is insufficient, Ratio fP1—the square root of fP1 relative to Ref fP1 or SQRT (fP1/Ref fP1)—is used in the determination of the high pressure side blockage.
Ref fP1 is an average of the sum of squares of the high pressure side pressure fluctuation acquired during steady state operation. It is a reference value used in the comparison with the value obtained during diagnostic execution (fP1).
When Ratio fP1 falls below the Lim fP1min value, “Pres 1 Side Blocking” is detected.
On the other hand, when Ratio fP1 exceeds the Lim fP1max value “Large Fluct Pres 1 (high pressure side pressure fluctuation error)” is detected.

■ Determination of Large Fluctuation

If the process status changes drastically such as when pumps or compressors start, pressure fluctuation suddenly increases. If the pressure fluctuation is too large, it will affect the blockage detection results. If “Large Fluct Pres 2” or “Large Fluct Pres 1” occurs, you need to check the process status to determine whether the impulse line blockage detection is operating properly.
The threshold for detecting abnormally large pressure fluctuation is set in Lim fP2max and Lim fP1max. As these values are set sufficiently large for detecting large pressure fluctuations, they seldom need to be changed.

7.3.2.2.2 Combination of the Reference Value and Blockage Detection Result

■ Diag Applicable

When all the appropriate reference values are measured, the transmitter can detect four types of blockages (one-side blockage, both-side blockage, low pressure side blockage, and high pressure side blockage) and fluctuation errors.
If some of the reference values are invalid, the combination of blockages that can be detected is limited. The following figure shows the combination of blockage detection functions that can be used.

CAUTION

- Ref fDP must be a value larger than the level specified in Table 7.3.2 of subsection 7.2.2.6. If sufficiently large Ref fDP cannot be obtained, blockage detection will not be possible.
- The blockage detection function must be verified through blockage simulation test. A blockage simulation test is performed using a valve (see subsection 7.3.2.2.8).

[Differential pressure measurement]

Reference fluctuation Parameter result		Simulation test		Blockage detection that can be used
Ref fDP: OK Ref fP2: OK Ref fP1: OK Ref BlkF: OK	→	• Low pressure side blockage simulation test • High pressure side blockage simulation test • Both side blockage simulation test	➔	• A/B Blocking (detection based on fDP and Ref fDP) • Pres 2 Side Blocking (detection based on fP2 and Ref fP2) • Pres 1 Side Blocking (detection based on fP1 and Ref fP1) • Pres 1/Pres 2 Side Blocking (detection based on BlkF)
Ref fDP: OK Ref fP2: OK Ref fP1: OK Ref BlkF: NG	→	• Low pressure side blockage simulation test • High pressure side blockage simulation test • Both side blockage simulation test	➔	• A/B Blocking (detection based on fDP and Ref fDP) • Pres 2 Side Blocking (detection based on fP2 and Ref fP2) • Pres 1 Side Blocking (detection based on fP1 and Ref fP1)
Ref fDP: OK Ref fP2: NG Ref fP1: OK Ref BlkF: NG	→	• High pressure side blockage simulation test	➔	• A Blocking (detection based on fDP and Ref fDP) • Pres 1 Side Blocking (detection based on fP1 and Ref fP1)
Ref fDP: OK Ref fP2: NG Ref fP1: NG Ref BlkF: NG	→	• Both side blockage simulation test	➔	• B Blocking (detection based on fDP and Ref fDP)

[liquid level measurements]

Reference fluctuation Parameter result		Simulation test		Blockage detection that can be used
Ref fDP: OK	→	• Blockage simulation test	➔	• B Blocking (detection based on fDP and Ref fDP)

7.3.2.2.3 Operation Parameters

■ Diag Mode

The impulse line blockage detection function is performed by specifying three modes (Stop, Calculation, Reference) using the Diag Mode parameter.

- **Recalling the operation parameter (Diag Mode)**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Set Diag Mode (method)

Diag Mode

Mode	Description
Stop	Stops blockage detection operation.
Calculation	Executes blockage detection operation. Alarms are generated on the basis of blockage detection results.
Reference	Acquires pressure fluctuation reference data needed for blockage detection and updates the reference data. After reference data is acquired, the mode automatically switches to Calculation.

To start blockage detection, select Calculation.
To change the alarm or threshold settings, select Stop as you need to stop the diagnostics.
To acquire or reacquire the pressure fluctuation reference value, select Reference.

NOTE

If the impulse line blockage detection (ILBD) parameter is set using the online parameter Hotkey's ILBD of the DTM Diag Mode is automatically set to Stop. When parameter setting is complete, Diag Mode returns to the original mode.

NOTE

If the impulse line blockage detection (ILBD) parameter is set using the "Download to device" of the DTM, Diag Mode is automatically set to Stop.

■ Diag Period

Values such as fDP and BlkF are average values based on several hundred pressure fluctuation values obtained in a given time period. The Diag Period parameter is used to specify the sampling period.

- **Recalling the sampling period parameter (Diag Period)**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Diag Period →

The factory default setting is 180 seconds.
For details on situations that require the sampling period to be changed, see subsection 7.3.2.2.10.

■ Diag Supp Count

Impulse line blockage is detected when values such as Ratio fDP and BlkF exceed the threshold consecutively several times. Diag Supp Count defines the detection count.

- **Recalling the detection count parameter (Diag Supp Count)**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD Parameters → Configuration → Diag Supp Count →

If Diag Supp Count is set to 3, at point A in Figure 7.3.4, an alarm does not occur because the blockage detection parameter (e.g., Ratio fDP) exceeds the threshold only the first two times. However, at point B in Figure 7.3.4, an alarm occurs because the blockage detection parameter exceeds the threshold three consecutive times.

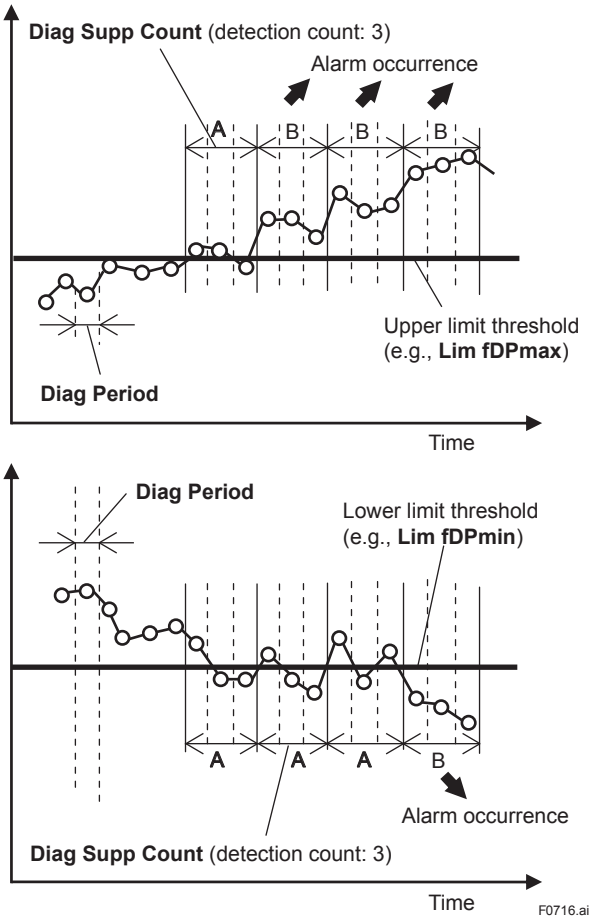


Figure 7.3.4 Relationship between Diag Supp Count and alarms

The detection count applies to all error alarms. The factory default setting is 3.
If the fluctuation parameter wavers near the threshold or if alarms occur frequently, change the threshold or sampling period to increase the blockage detection accuracy (see subsection 7.3.2.2.10).

7.3.2.2.4 Operating Procedure

The basic ILBD operating procedure is provided below.

1) Initial setup
2) Condition confirmation
3) Startup
4) ILBD execution

If alarms occur frequently or if the process conditions change during ILBD execution, change the alarm trigger conditions or reacquire the reference data.

In addition, when using the ILBD, record the settings and verifications made in each step in the ILBD check list of appendix 1.

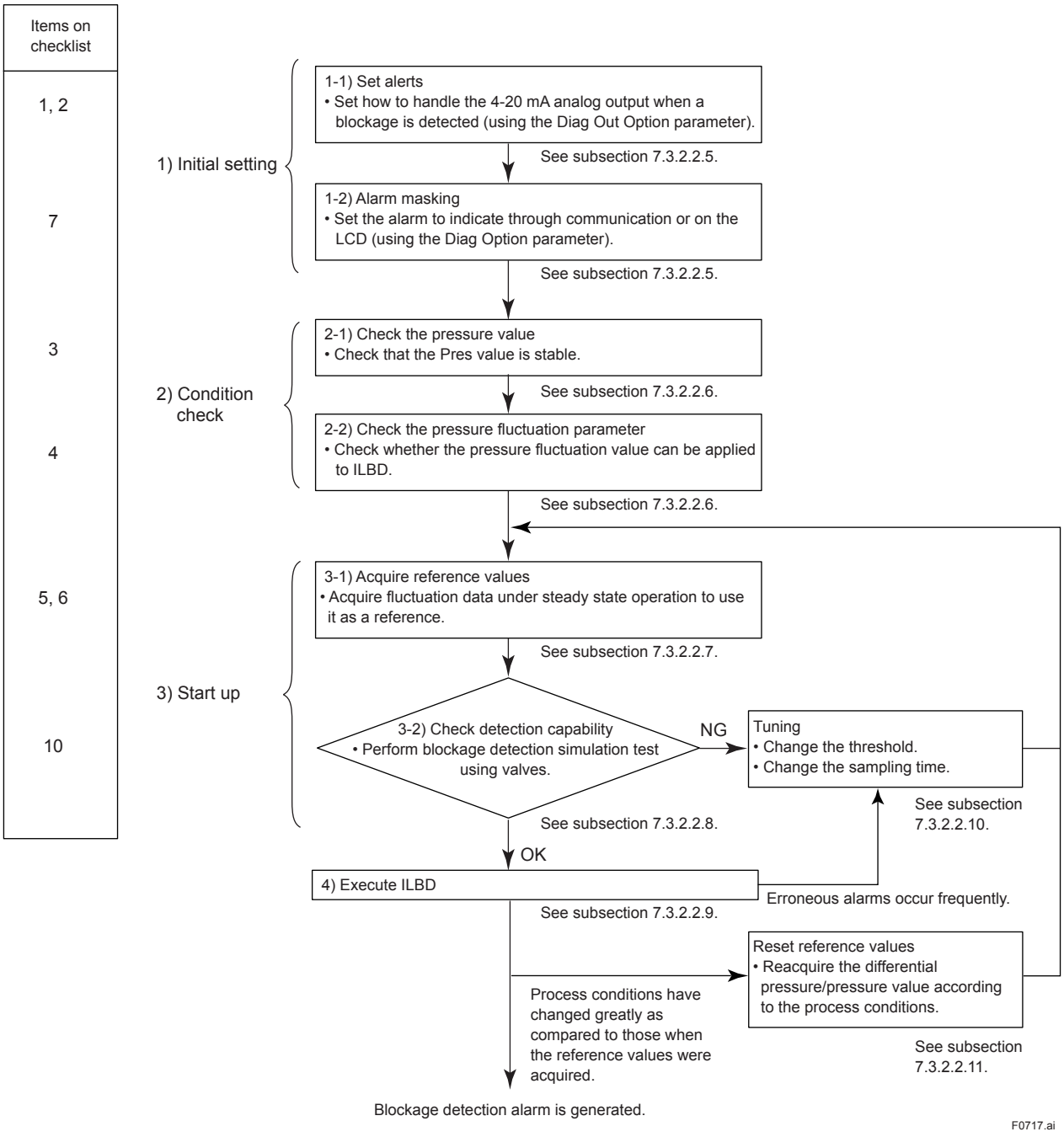


Figure 7.3.5 ILBD Operation Flowchart

7.3.2.2.5 Alert and Alarm Setup

Diagnostic results such as blockage detection and flange temperature error (heat trace monitoring) can be confirmed with analog alerts and alarm indications on the LCD. To display and output these results, configure the alarm and alert settings by following the procedure below.

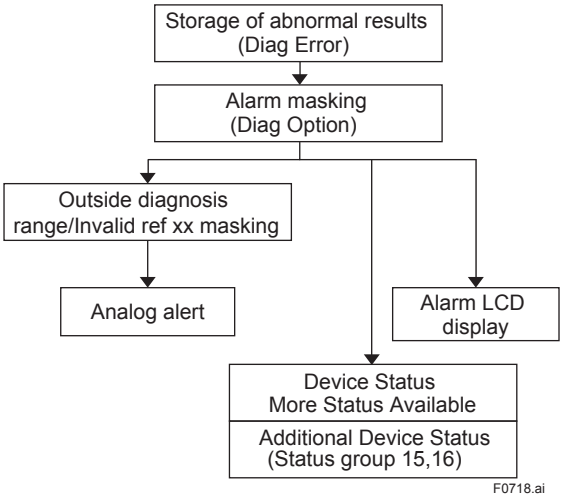


Figure 7.3.6 Alert and Alarm Setup

■ Alarm information

Error results detected by ILBD and heat trace monitoring are stored in the Diag Error parameter. Detected alarm information is displayed in the Diag Error parameter.

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → Diag Error

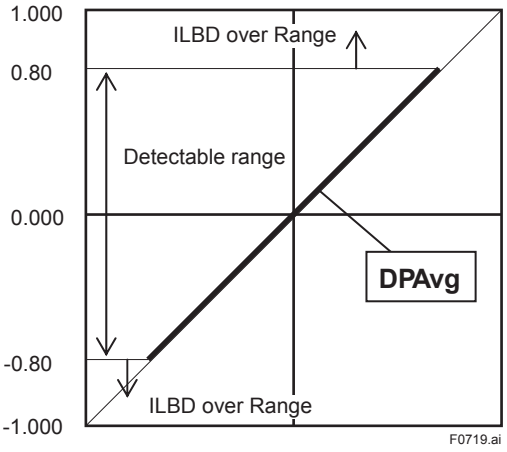
Bit	Assignment	Group
0	Not used	
1	Not used	
2	A Blocking	ILBD
3	Large Fluct Pres 2	
4	Large Fluct Pres 1	
5	Pres 2 Side Blocking	
6	Pres 1 Side Blocking	
7	B Blocking	
8	Invalid Ref BlkF	
9	Invalid Ref Pres 1	
10	Invalid Ref Pres 2	
11	Invalid Ref DP	
12	ILBD over Range	
13	Flg Temp Low Alarm	Heat trace monitoring
14	Flg Temp High Alarm	
15	Not used	

■ ILBD over range

1) Lim DPAvgmax
   The Lim DPAvgmax parameter indicates the upper limit of the detectable range of ILBD. The value can be changed when ILBD is stopped (when the Diag Mode parameter is set to Stop). DPAvg is a ratio representation of the average of the measured differential pressure when the maximum measurement span of the transmitter is assumed to be 1.
   When DPAvg exceeds the upper limit threshold, an “ILBD over Range” alarm occurs, and ILBD detection operation is no longer possible.
2) Lim DPAvgmin
   The Lim DPAvgmin parameter indicates the lower limit of the detectable range of ILBD. The value can be changed when ILBD is stopped (when the Diag Mode parameter is set to Stop). When DPAvg falls below the lower limit threshold, an “ILBD over Range” alarm occurs, and ILBD detection operation is no longer possible.

<Example>
If the range that can be measured by a transmitter whose maximum measurement span is 100 kPa is –80 kPa to 80 kPa, the upper and lower detection limits are set as follows.

- Lim DPAvgmax: 0.80
- Lim DPAvgmin: -0.80



- **Invalid Ref BlkF, Pres 1, Pres2, or DP**

  This alarm indicates that the reference value acquired under normal process conditions is invalid. If the Ref BlkF value is invalid as a reference value, only the blockage detection that excludes the BlkF detection algorithm is executed. If you need blockage detection that uses the BlkF algorithm, reacquire Ref BlkF. If Ref DPAvg falls below the Lim DPAvgmin threshold or exceeds the Lim DPAvgmax threshold, all reference values will be invalid. If this occurs, alarms for all reference values (Invalid Ref DP, Invalid Ref Pres 2, Invalid Ref Pres 1, and Invalid Ref BlkF) will be generated.

■ Alarm masking

- **Diag Option**

  Select which alarms will be reflected in analog alerts and LCD display using the Diag Option parameter.

- **Recalling the Diag Option parameter**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → Diag Option

Each bit of the Diag Option parameter corresponds one-to-one to the bits of the Diag Error parameter.

By factory default, the following alarms are enabled (hexadecimal notation: 0x08f8).

Bit	Assignment
3	Large Fluct Pres 2
4	Large Fluct Pres 1
5	Pres 2 Side Blocking
6	Pres 1 Side Blocking
7	B Blocking
11	Invalid Ref DP

To reflect alarms in analog alerts and LCD display, follow the procedure below.

1) Set the Diag Mode parameter to Stop.
2) From the alarms assigned to bits 2 to 14, select the check boxes of the required alarms.

■ Analog alert setup

- **Diag Out Option**

  If impulse line blockage error or high-temperature/low-temperature flange temperature error occurs, the 4-20 mA analog output can be shifted according to the specified settings.

- **Recalling the Diag Out Option parameter**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → Diag Output → Diag Out Option

Mode	Function
Off	The PV measurement is held, and alarm occurrences are not reflected in the output.
Burnout	When an alarm occurs, the analog output is shifted to the value specified in the AO upper limit parameter or AO lower limit parameter. The direction in which the output is shifted depend s on the Burnout switch setting.
Fall back	When an alarm occurs, the output is held at a certain value. The shift value can be specified using the Diag Fixed Out Val parameter.

- **Diag Fixed Out Val**

  This is used when the Diag Output Option parameter is set to Fall back.
  When an alarm occurs, the output is held at the value specified with this parameter. You can enter the value in the range of 3.8 to 21.6 mA.

- **Recalling the Diag Fixed Out Val parameter**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → Diag Output → Diag Fixed Out Val →

■ Alarm LCD display

If ILBD detects an error, the detection result information is indicated in alarm number AL.88 or AL.89 and on the LCD.
AL.88 indicates a condition in which errors cannot be detected, and AL.89 indicates that an error has been detected.

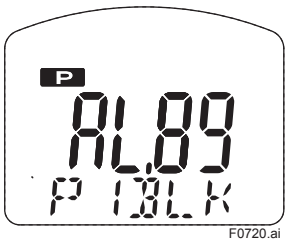


Figure 7.3.7 Display example of Pres 1 Side Blocking

For the advanced diagnostic alarm display information shown on the LCD, see Table 8.3.

CAUTION

"Invalid Ref xx" and "ILBD over Range" alarms are not reflected in analog alerts.

7.3.2.2.6 Condition Confirmation

After the transmitter is installed, confirm that the DP value is normal and stable and that the pressure fluctuation is sufficient for blockage detection.

■ Stable pressure value

Under normal operating conditions, monitor the DP value fluctuation for 10 minutes, and confirm that the variation is less than 10%.

- **Recalling the DP parameter**

Recall parameters	[Root menu] → Process variables →View device vars → DP

If the DP variation is 10% or higher, blockage detection will not be possible because errors will appear in the statistically processed pressure fluctuation values. Review the process conditions.

■ Pressure fluctuation value

CAUTION

- If the liquid's pressure fluctuation is small, blockage detection does not work properly.
- The pressure fluctuation may be small in the case of level measurement or pressure measurement of tanks or when gases are measured.

Check that the fDP, fP2, fP1, and BlkF values meet the conditions shown in the following table.

- **Recalling the pressure fluctuation parameters (fDP, fP1, fP2)**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD parameters → Status → Fluct Variables → fDP/fP2/ fP1

- **Recalling the blockage level parameter (BlkF)**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD parameters → Status → Diag Variables → BlkF

Table 7.3.3 Pressure fluctuation parameter values required for blockage detection

Parameter	Condition
fDP	7×10^{-10} or higher
fP2	1×10^{-10} or higher
fP1	1×10^{-10} or higher
BlkF	–0.5 to 0.5

- fDP is insufficient.
  If fDP does not meet the condition, none of the blockage detection algorithms will be executed.
- Only fDP meets the condition.
  If fP2 and fP1 do not meet their conditions, only "A Blocking" and "B Blocking" can be detected.
- fDP and fP1 meet the conditions.
  If fP1 does not meet the condition, "Pres 1 Side Blocking" and "Large Fluct Pres 1" cannot be detected.
- fDP and fP2 meet the conditions.
  If fP2 does not meet the condition, "Pres 2 Side Blocking" and "Large Fluct Pres 2" cannot be detected.
- fDP, fP2, and fP1 meet the conditions.
  All ILBD results can be detected even when BlkF does not meet the condition.

7.3.2.2.7 Reference Value Acquisition

When the impulse line is blocked, the pressure fluctuation value decreases. To detect this change, a pressure fluctuation that can be used as a reference for the damping rate is necessary.

IMPORTANT

- If blockage has already progressed when the reference value is acquired, blockage cannot be detected correctly. Clean the impulse line before acquiring the reference value.
- If liquid is filled in the impulse line, check that there are no bubbles or the like in the liquid.
- Acquire the reference under steady state operating conditions.

■ Starting to sample

The reference value is acquired over 180 seconds, a default value set in the Diag Period parameter.

1) Check that the sampling period (Diag Period parameter) is set to 180 seconds.
2) Set the Diag Mode parameter to Reference (start the reference value acquisition immediately after it is set).

IMPORTANT

- A reference value is acquired for each ILBD detection parameter. If the Diag Mode parameter is set to Reference again, new reference values are acquired overwriting the previous reference values.
- If the transmitter turns off when the Diag Mode parameter is set to Reference, ILBD will be in a stopped state when the power returns (the Diag Mode is set to Stop). Set Diag Mode to Reference, and acquire the reference values again.

■ Ending sampling

After 180 seconds, the acquisition of the reference values automatically ends, and the Diag Mode parameter switches automatically from Reference to Calculation.
Check that the sampling has finished by confirming that the Diag Mode has changed to Calculation.

■ Checking the reference values

The latest reference values are stored in the following parameters.

- Ref fDP
- Ref fP2
- Ref fP1
- Ref BlkF
- Ref DPAvg

- **Recalling parameters**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD parameters → Status → Diag Reference → Ref fDP/ Ref fP2/Ref fP1/Ref BlkF/Ref DPAvg

After sampling is finished, check that the values have been updated.

■ Checking invalid reference values

If pressure fluctuation used as the reference cannot be acquired, an alarm occurs for the relevant pressure fluctuation parameters, and a portion of ILBD is not executed.
Check that such alarms (Invalid Ref xx) are not indicated in the Diag Error parameter.
If such alarms have occurred, review the process conditions once again, and reacquire the reference values.

CAUTION

Even when such alarms occur, the Diag Mode parameter will be set to Calculation, but ILBD will not be executed.

7.3.2.2.8 Checking the Blockage Detection Operating Capacity

Before executing an actual ILBD operation, check the blockage detection capacity by using a valve. Check that when a blockage is created artificially by closing the valve, an alarm occurs.

CAUTION

In pressure measurement or liquid level measurement, if one side is released to the atmosphere and there is hardly any pressure fluctuation, close the valve on the other side (high pressure side or low pressure side) to perform a blockage detection simulation test.

■ High pressure side blockage simulation test

1) Close the valve on the high pressure side.
2) Check that the Pres 1 value is not changing greatly. If it does, open the valve slightly.
3) Set the Diag Mode parameter to Calculation, and start the ILBD operation.
4) After the total time specified in the Diag Period and Diag Supp Count parameters elapses, check that “Pres 1 Side Blocking” is indicated in the Diag Error parameter.
5) If the analog output is configured to shift in response to the alarm occurrence, check also the behavior of the output.
6) Open the valve fully, and check that the alarm clears.

■ Low pressure side blockage simulation test

1) Close the valve on the low pressure side.
2) Check that the Pres 2 value is not changing greatly. If it does, open the valve slightly.
3) Set the Diag Mode parameter to Calculation, and start the ILBD operation.
4) After the total time specified in the Diag Period and Diag Supp Count parameters elapses, check that “Pres 2 Side Blocking” is indicated in the Diag Error parameter.
5) If the analog output is configured to shift in response to the alarm occurrence, check also the behavior of the output.
6) Open the valve fully, and check that the alarm clears.

■ Both-side blockage simulation test

1) Close all valves.
2) Check that the DP value is not changing greatly. If it does, open the valve slightly.
3) Set the Diag Mode parameter to Calculation, and start the ILBD operation.
4) After the total time specified in the Diag Period and Diag Supp Count parameters elapses, check that “Pres 1 Side Blocking” and “Pres 2 Side Blocking” are indicated in the Diag Error parameter.
5) If the analog output is configured to shift in response to the alarm occurrence, check also the behavior of the output.
6) Open the valve fully, and check that the alarm clears.

7.3.2.2.9 ILBD Execution

After checking the conditions and blockage detection capacity, start the actual blockage detection operation.

1) Check the sampling period (Diag Period parameter).
2) Check the setting that specifies how many times the pressure fluctuation parameter is to exceed the threshold for an impulse line blockage to be detected (the Diag Supp Count parameter). The factory default setting is 3.
3) Set the Diag Mode parameter to Calculation, and start the ILBD operation.
   If reference values have not been acquired, set the Diag Mode parameter to Reference. After they are acquired, the transmitter automatically switches to ILBD operation.
   (At the same time, the Diag Mode parameter also switches to Calculation.)

7.3.2.2.10 Tuning

If not a large enough pressure fluctuation can be detected or if alarms occur frequently, change the blockage detection threshold or change the sampling period in order to increase the blockage detection accuracy.
To perform tuning, the Diag Mode parameter must be set to Stop.

■ Changing the threshold

The following figure uses a monochrome bar to illustrate the effect of tuning.

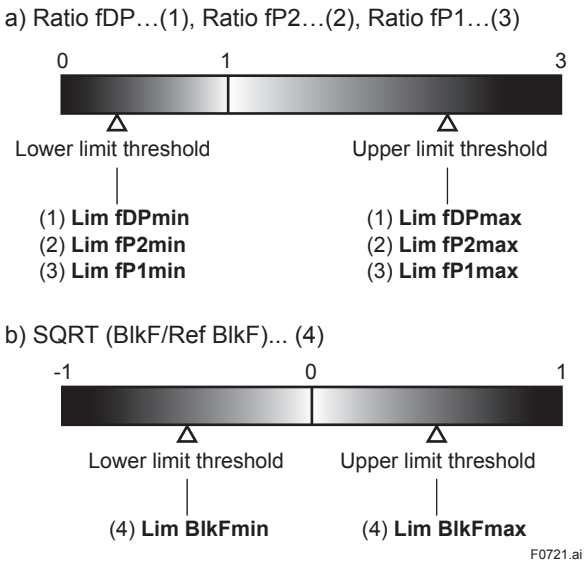


Figure 7.3.8 Illustration of Threshold Tuning

Move the threshold toward the white.
- It becomes increasingly likely to give a false alarm due to the disturbance from environment change.

Move the threshold toward the black.
- Impulse line blockage detection becomes possible with less effect from environment change.
- Alarms occur after the blockage has progressed to a certain degree.

- **Recalling threshold parameters**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD parameters → configuration → Diag Lim →

Table 7.3.2 shows the factory default threshold values.
Change the threshold according to the following procedure while considering the effects mentioned above.
1) Set the Diag Mode parameter to Stop.
2) Change the Diag Lim parameter values.

Limit parameter

Parameter	Threshold value
Lim fDPmax	Threshold for detecting “A Blocking” using Ratio fDP
Lim fDPmin	Threshold for detecting “B Blocking” using Ratio fDP
Lim fP1max	Threshold for detecting “ Large Fluct Pres 1” using Ratio fP1
Lim fP1min	Threshold for detecting “Pres 1 Side Blocking” using Ratio fP1
Lim fP2max	Threshold for detecting “ Large Fluct Pres 2” using Ratio fP2
Lim fP2min	Threshold for detecting “Pres 2 Side Blocking” using Ratio fP2
Lim BlkFmax	Threshold for detecting “Pres 1 Side Blocking” using BlkF
Lim BlkFmin	Threshold for detecting “Pres 2 Side Blocking” using BlkF

■ Adjusting the sampling period

If the pressure fluctuation parameter value fluctuates around the threshold, alarm will be generated frequently. If this happens, increase the sampling period to increase the blockage detection accuracy.
To change the sampling period, follow the procedure below.
1) Set the Diag Mode parameter to Stop.
2) Set the Diag Period parameter value in the range of 20 to 65535 (seconds).

In addition, increasing the detection count, a condition for generating alarms, with the Diag Supp Count parameter may also increase the blockage detection accuracy.

■ Setting the ILBD detection range

If DPAvg exceeds DPAvgmax or falls below DPAvgmin, the transmitter generates an “ILBD over Range” alarm.
If flow/differential pressure is less than the default threshold value of Lim DPAvgmin, pressure fluctuation is not large enough to detect the blockage. This may cause erroneous alarms that have nothing to do with blockage.
To prevent such errors, change the threshold to a larger value.
1) Set the Diag Mode parameter to Stop.
2) Change Lim DPAvgmin or Lim DPAvgmax.

- **Recalling the threshold (Lim DPAvgmin/Lim DPAvgmax)**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD parameters → Configuration → Diag Lim →

■ Ratio fDP compensation

When the flow change is too large or small, alarms that have nothing to do with blockage may be generated. In such a case, pressure fluctuation parameter Ratio fDP can be compensated to suppress such alarms.
If the Diag DPComp parameter is set to Compensation, pressure fluctuation parameter CRatio fDP based on the following formula can be used in place of Ratio fDP to monitor the value.

$$\text{CRatio fDP} = \sqrt{\text{fDP / Ref fDP}} \times \left|\text{Ref DPAvg / DPAvg}\right|$$

If compensation is not necessary, set the Diag DPComp parameter to Non-compensation. In this case, Ratio fDP is treated as NRatio fDP for monitoring purposes.

- **Recalling the differential pressure fluctuation parameter (CRatio fDP/NRatio fDP)**

Recall parameters	[Root menu] → Diag/Service → Diag Parameters → ILBD parameters → Status → Diag Vriables → CRatio fDP/ NRatio fDP

7.3.2.2.11 Resetting the Reference Value

If the flow rate is changed greatly or if the fluid is changed during plant operation, acquire the reference value again. If the flow rate changes by 25% or more relative to the flow rate that was present when the reference value was acquired, acquire the reference value again.
When resetting the reference value, perform impulse line block purging as much as possible.

7.3.2.2.12 ILBD Parameter List

#	Parameter name	Factory default value	Description
1	Diag Error	0x0000	The results detected by ILBD or heat trace monitoring are stored in this parameter. Also the condition abnormality in the diagnostic process is stored as an error.
2	Diag Option	0x08f8	Use this parameter to select the error messages and status to reflect in the LCD and output signals. The errors assigned to each bit correspond to the bits of Diag Error. This parameter is selectable only when Diag Mode is set to Stop.
3	Diag Out Option	Off	Error status can be output with the 4 to 20 mA analog signal. The available three output modes are Off, Burnout, and Fall back.
4	Diag Fixed Out Val	21.6 mA	A parameter for the fall back function in Diag Out option. This specifies the output value of the 4 to 20 mA analog signal when alarms occur. The value can be entered in the range of 3.8 to 21.6 mA.
5	Diag Mode	Stop	This parameter sets the ILBD operation mode. Stop: Blockage detection is stopped. Calculation: Block detection is executed. Alarms are generated on the basis of detection results. Reference: The reference values are set to the latest blockage detection data. When the reference values are updated, the mode automatically switches to Calculation.
6	Diag Period	180 (sec)	This parameter sets the data sampling period for ILBD in the range of 20 to 65535 seconds. If the process fluctuation values are unstable, increasing the sampling period may improve the diagnostic accuracy. This parameter can be entered only when Diag Mode is set to Stop.
7	Diag Supp Count	3	Detection count to generate an alarm.
8	Diag Description		Memo field. Up to 32 alphanumeric characters can be entered.
9	fDP		Average value of the sum of squares of differential pressure fluctuation.
10	fDP Status		Status of fDP
11	fP2		Average value of the sum of squares of module 2 side fluctuation.
12	fP2 Status		Status of fP2
13	fP1		Average value of the sum of squares of module 1 side fluctuation.
14	fP1 Status		Status of fP1
15	BlkF		The blockage level obtained by comparing the pressure fluctuation between the module 1 side and module 2 side.
16	BlkF Status		Status of BlkF
17	DPAvg		Ratio of the average of differential pressure to the maximum span
18	DPAvg Status		Status of DPAvg
19	Ratio fDP		Differential pressure RMS compare value
20	Ratio fDP Status		Status of Ratio fDP
21	Ratio fP2		Module 2 side pressure RMS compare value This is used to detect blockage in the module 2 side impulse line.
22	Ratio fP2 Status		Status of Ratio fP2
23	Ratio fP1		Module 1 side pressure RMS compare value This is used to detect blockage in the module 1 side impulse line.
24	Ratio fP1 Status		Status of Ratio fP1
25	Ref fDP		Value of fDP obtained under steady state operation used as a reference for blockage detection.
26	Ref fDP Status		Status of Ref fDP

#	Parameter name	Factory default value	Description
27	Ref fP2		Value of fP2 obtained under steady state operation used as a reference for blockage detection.
28	Ref fP2 Status		Status of Ref fP2
29	Ref fP1		Value of fP1 obtained under steady state operation used as a reference for blockage detection.
30	Ref fP1 Status		Status of Ref fP1
31	Ref BlkF		Value of BlkF obtained under steady state operation used as a reference for blockage detection.
32	Ref BlkF Status		Status of Ref BlkF
33	Ref DPAvg		Value of DPAvg obtained under steady state operation
34	Ref DPAvg Status		Status of DP Avg
35	Lim fDPmax	See Table 7.3.2.	Upper limit of differential pressure fluctuation (Ratio fDP) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
36	Lim fDPmin		Lower limit of differential pressure fluctuation (Ratio fDP) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
37	Lim fP2max		Upper limit of module 2 side pressure fluctuation (Ratio fP2) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
38	Lim fP2min		Lower limit of module 2 side pressure fluctuation (Ratio fP2) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
39	Lim fP1max		Upper limit of module 1 side pressure fluctuation (Ratio fP1) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
40	Lim fP1min		Lower limit of module 1 side pressure fluctuation (Ratio fP1) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
41	Lim BlkFmax		Upper limit of one-side blockage level (BlkF) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
42	Lim BlkFmin		Lower limit of one-side blockage level (BlkF) used for impulse line blockage detection. This parameter can be entered only when Diag Mode is set to Stop.
43	Lim DPAvgmax		Upper limit of DPAvg. This parameter can be entered only when Diag Mode is set to Stop.
44	Lim DPAvgmin		Lower limit of DPAvg. This parameter can be entered only when Diag Mode is set to Stop.
45	Ref Lim fDPmin	7.0E-10	Lower limit of the average value of the sum of squares of differential pressure fluctuation (Ref fDP) obtained in reference value measurement. This is used to decide whether the reference value for impulse line blockage detection is applicable. This parameter can be entered only when Diag Mode is set to Stop.
46	Ref Lim fPmin	1.0E-09	Lower limit of the average value of the sum of squares of pressure fluctuation (Ref fP2, fP1) obtained in reference value measurement. This is used to decide whether the reference value for impulse line blockage detection is applicable. This parameter can be entered only when Diag Mode is set to Stop.
47	Ref Lim BlkFmax	0.5	Upper limit of the F value (Ref BlkF) obtained in reference value measurement. This is used to decide whether the reference value for impulse line blockage detection is applicable. This parameter can be entered only when Diag Mode is set to Stop.
48	Status group 15		Device status information related to the process
49	Status group 16		Device status information related to the process
50	CRatio fDP		Compensated value of fDP used to make the monitoring of Ratio fDP easier when the flow rate change is extremely large or small. Sqrt (fDP / Ref fDP) X | (Ref DPAvg / DPAvg) | Diag DP Comp Compensation must be selected.

#	Parameter name	Factory default value	Description
51	CRatio fDP Status		Status of CRatio fDP
52	NRatio fDP		When Non-compensation is selected in Diag DP Comp, NRatio fDP is used as the monitoring value. NRatio fDP = Sqrt (fDP / Ref fDP)
53	NRatio fDP Status		Status of NRatio fDP
54	Diag DPComp	Compensation	Flow rate compensation flag. Sets whether Ratio fDP is monitored using CRatio fDP or NRatio fDP.
55	Diag Applicable		After the reference value is acquired, detectable blockage and fluctuation error status is displayed.

7.3.2.3 Heat Trace Monitoring

The heat trace monitoring function calculates the flange temperature based on the capsule temperature and amplifier temperature measured with the sensors on the transmitter and generates alarms when the preset temperature threshold is exceeded.
The flange temperature is calculated using the following parameters and formula.

[Parameters]

Parameter name	Description
Temp 1 (CT)	Module 1 side capsule temperature (actual measured value using transmitter's temperature sensor)
Amp temp (AT)	Module 1 side amplifier temperature (actual measured value using transmitter's temperature sensor)
Flg temp (FT)	Flange temperature (calculated value)
Flg temp coef (Cf)	Flange temperature coefficient
Flg temp hi alert val	High temperature error detection threshold
Flg temp lo alert val	Low temperature error detection threshold

[Formula]

Flg temp (FT) = CT + Cf × (CT – AT)

CAUTION

The flange temperature is calculated with the formula on the assumption that the capsule part (pressure-detector section) of the module 1 side transmitter is heated or kept warm by an electrical heater or steam. In room temperature or less, a slight error (approximately 3 to 4 °C) may occur because the amplifier temperature is higher than the capsule temperature.

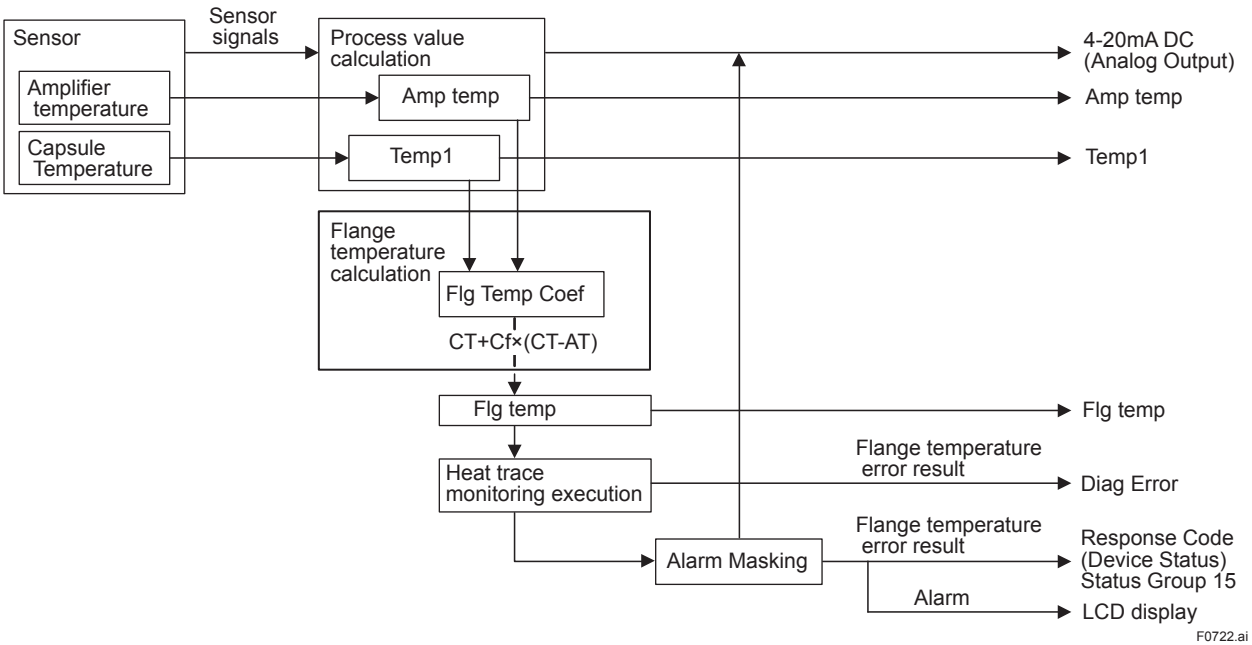


Figure 7.3.9 Block Diagram of Heat Trace Monitoring

7.3.2.3.1 Flg temp coef Setting

The value calculated according to the following procedure is set to Flg temp coef.

- To improve the calculation accuracy of the flange temperature, the actual flange temperature is measured using a temperature sensor or the like.
- Obtain the capsule temperature and amplifier temperature measured with the transmitter.
- Using the measured flange and the ratio obtained by the above formula, calculate Flg Temp Coef using the following formula.

$$\text{Flg Temp Coef (Cf)} = \frac{(\text{Actual measured value of flange temperature}) - \text{CT}}{\text{CT - AT}}$$

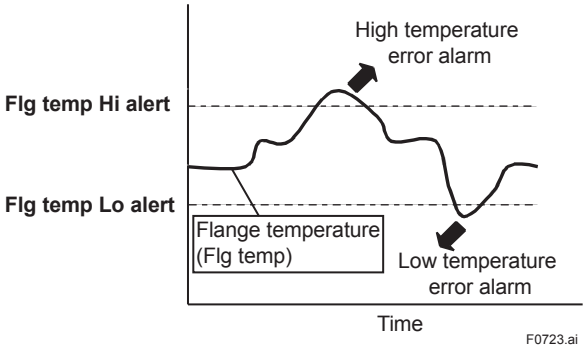
In the case of DTM, the tuning function can be used to set Flg temp coef.
Enter the measured flange temperature to calculate Flg temp coef using the capsule temperature and amplifier temperature measured with the transmitter.

- **Recalling tuning**

Hotkey → ILBD → Advanced Diag Configuration→ Heat Trace → Tuning

7.3.2.3.2 Alarm Generation

Alerts and alarms can be generated when the flange temperature goes outside the preset measuring range.
For the procedure to set alerts and alarms, see subsection 4.2.2.5.
The measuring range is set by specifying the upper limit (Flg temp Hi alert val) and lower limit (Flg temp Lo alert val). They can be set in the range of –50 to 130°C.



7.3.2.3.3 Heat Trace Monitoring Parameter List

#	Parameter name	Factory default value	Description
1	Diag Error	0x0000	The results detected by ILBD or heat trace monitoring are stored in this parameter. Also the condition abnormality in the diagnostic process is stored as an error.
2	Diag Option	0x08f8	Use this parameter to select the error messages and status to reflect in the LCD and output signals. The errors assigned to each bit correspond to the bits of Diag Error. This parameter is selectable only when Diag Mode is set to Stop.
3	Diag Out Option	Off	Error status can be output with the 4 to 20 mA analog signal. The available three output modes are Off, Burnout, and Fall back.
4	Diag Fixed Out Val	21.6 mA	A parameter for the fall back function in Diag Out option. This specifies the output value of the 4 to 20mA analog signal when alarms occur. The value can be entered in the range of 3.8 to 21.6 mA.
5	Temp 1		Measured Module 1 side capsule temperature value
6	Amp temp		Measured Module 1 side amplifier temperature value
7	Flg temp	(*1)	Calculated flange temperature value
8	Flg temp coef	0	Coefficient to calculate flange temperature (Cf: Rt1/Rt2) Rt1: Thermal resistance between the flange and capsule. Rt2 : Thermal resistance between the capsule and amplifier.
9	Flg temp Hi alart val	120 degC	Upper limit of flange temperature
10	Flg temp Lo alart val	–40 degC	Lower limit of flange temperature

(*1): By factory default, Flg Temp Coef is set to 0, so the flange temperature indicates the same temperature as the capsule temperature.

8. Maintenance

8.1 Overview

WARNING

- Since the accumulated process fluid may be toxic or otherwise harmful, take appropriate care to avoid contact with the body or inhalation of vapors when draining condensate or venting gas from the transmitter process-detector section.
- If the process fluid is harmful to the human body, take appropriate precautions to prevent contact of toxic process fluids and inhalation of harmful vapors even after the transmitter is removed from the line, such as for maintenance purposes.

Maintenance of the transmitter is easy due to its modular construction. This chapter describes the procedures for calibration, adjustment, and the disassembly and reassembly procedures required for component replacement. Transmitters are precision instruments. Please carefully and thoroughly read the following sections for information on how to properly handle them while performing maintenance.

IMPORTANT

- As a rule, maintenance of this transmitter should be done in a shop that has all the necessary tools.
- CPU assembly handling
  The CPU assembly contains sensitive parts that can be damaged by static electricity. Take precautions such as using a grounded wrist strap when handling electronic parts or touching the board circuit patterns. Also be sure to place the removed CPU assembly into a bag with an antistatic coating.

8.2 Calibration Instrument Selection

Table 8.1 lists the instruments that can be used to calibrate a transmitter. When selecting an instrument, consider the required accuracy level. Exercise care when handling these instruments to ensure they maintain the specified accuracy.

Table 8.1 Instruments Required for Calibration

Name	Yokogawa-recommended Instrument	Remarks
Power supply	Model SDBT or SDBS distributor	4 to 20 mA DC signal
Load resistor	Model 2792 standard resistor [250 Ω ±0.005%, 3 W]	
	Load adjustment resistor [100 Ω ±1%, 1 W]	
Voltmeter	Model 2501 A digital multimeter Accuracy (10V DC range): ±(0.002% of rdg + 1 dgt)	
Digital manometer	Model MT220 precision digital manometer 1) For 10 kPa class Accuracy: ±(0.015% of rdg + 0.015% of F.S.). . . . for 0 to 10 kPa ±(0.2% of rdg + 0.1% of F.S.). . . . . for -10 to 0 kPa 2) For 130 kPa class Accuracy: ±0.02% of rdg. . . . . for 25 to 130 kPa ±5 digits . . . . . for 0 to 25 kPa ±(0.2% of rdg + 0.1% of F.S.). . . . . for -80 to 0 kPa 3) For 700 kPa class Accuracy: ±(0.02% of rdg + 3digits) . . . . . for 100 to 700 kPa ±5 digits . . . . . for 0 to 100 kPa ±(0.2% of rdg + 0.1% of F.S.). . . . . for -80 to 0 kPa 4) For 3000 kPa class Accuracy: ±(0.02% of rdg + 10 digits). . . . . for 0 to 3000 kPa ±(0.2% of rdg + 0.1% of F.S.). . . . . for -80 to 0 kPa 5) For 130 kPa abs class Accuracy: ±(0.03% of rdg + 6 digits). . . . . for 0 to 130 kPa abs	Select a manometer having a pressure range close to that of the transmitter.
Pressure generator	Model 7674 pneumatic pressure standard for 200 kPa {2 kgf/cm^2}, 25 kPa {2500 mmH$_2$O} Accuracy: ±0.05% of F.S.	Requires air pressure supply. Select the one having a pressure range close to that of the transmitter.
	Dead weight gauge tester Accuracy: ±0.03% of setting	
Pressure source		Prepare the vacuum pump for negative pressure ranges.

8.3 Calibration

Use the procedure below to check instrument operation and accuracy during periodic maintenance or troubleshooting.

1. Connect the instruments as shown in Figure 8.1 and warm up the instruments for at least five minutes.

IMPORTANT

1. To adjust the transmitter for highest accuracy, make adjustments with the power supply voltage and load resistance including leadwire resistances set close to the conditions under which the transmitter is installed. In addition, place the process connections of both high and low pressure side on the same level.
2. If the measurement range 0% point is 0 kPa or shifted in the positive direction (suppressed zero), the reference pressure should be applied to the high pressure side as shown in the Figure. (The low pressure side is released to the atmosphere.) If the measurement range 0% point is 0 kPa or shifted in the positive direction (suppressed zero), the reference pressure should be applied to the low pressure side in the case of a differential pressure transmitter. (The high pressure side is releases to the atmosphere.) In the case of a pressure transmitter, use a vacuum pump to apply the negative reference pressure.

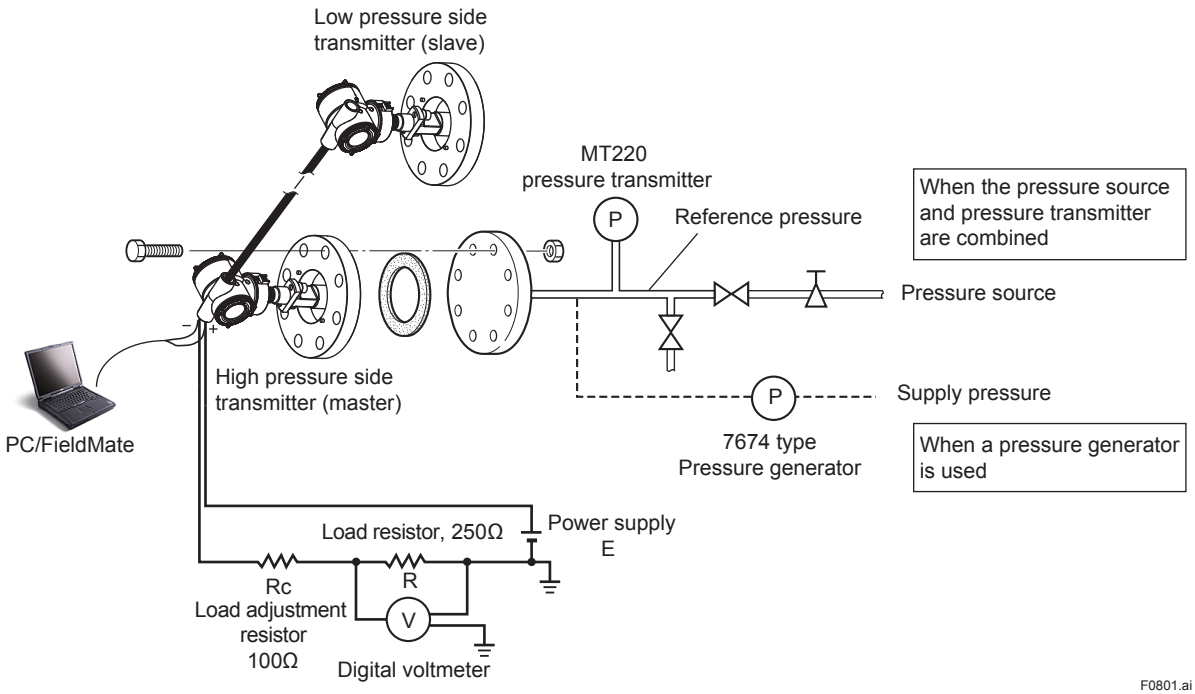


Figure 8.1 Instrument Connections

2. Apply reference pressures of 0%, 50%, and 100% of the measurement range to the transmitter. Calculate the errors (differences between digital voltmeter readings and reference pressures) as the pressure is increased from 0% to 100% and is decreased from 100% to 0%, and confirm that the errors are within the required accuracy.

Note: If the output mode is square root, apply reference pressures of 0%, 6.25%, 25%, 56.25%, and 100% of the measurement range to the transmitter.

8.4 Disassembly and Reassembly

CAUTION

Precautions regarding Frameproof Type Instruments

1. Flameproof type transmitters must be, as a rule, removed to a non-hazardous area for maintenance and be disassembled and reassembled to the original state.
2. For flameproof type transmitters, turn the Allen head bolt clockwise with an Allen wrench to unlock the cover, and then remove the cover. When a cover is closed it should be locked by a shrouding bolt without fail. Tighten the shrouding bolt to a torque of 0.7 N·m {7 kgf·cm}.

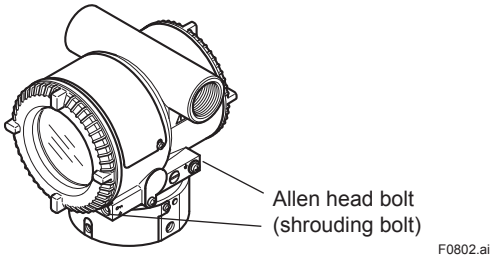


Figure 8.2 Allen head bolts

This section describes procedures for disassembly and reassembly for maintenance and component replacement.

CAUTION

Always turn OFF power and shut off and release pressures before disassembly. Use proper tools for all operations.

Table 8.2 shows the tools required.

Table 8.2 Tools for Disassembly and Reassembly

Tool	Quantity	Remarks
Phillips screwdriver	1	JIS B4633, No. 2
Slotted screwdriver	1	
Allen wrenches	3	JIS B4648 One each, nominal 3, 4 and 2.5 mm Allen wrenches
Wrench	1	Width across flats, 17 mm
Torque wrench	1	
Adjustable wrench	1	
Socket wrench	1	Width across flats, 16mm
Socket driver	1	Width across flats, 5.5mm
Tweezers	1	

8.4.1 Replacing the Integral Indicator

This subsection describes the procedure for replacing an integral indicator. (See Figure 8.3.)

CAUTION

Users are prohibited modifying the construction of a flameproof type transmitter. As such, the user is prohibited from using a flameproof type transmitter with its integral indicator removed, or from adding an integral indicator to a transmitter. If such modification is absolutely required, contact Yokogawa.

■ Removing the Integral Indicator

1. Remove the cover.
2. While supporting the integral indicator with one hand, loosen its two mounting screws.
3. Dismount the LCD board assembly from the CPU assembly. When doing this, carefully pull the LCD board assembly straight forward so as not to damage the connector pins between it and the CPU assembly.

■ Attaching the Integral Indicator

1. Align both the LCD board assembly and CPU assembly connectors and engage them.
2. Insert and tighten the two mounting screws.
3. Replace the cover.

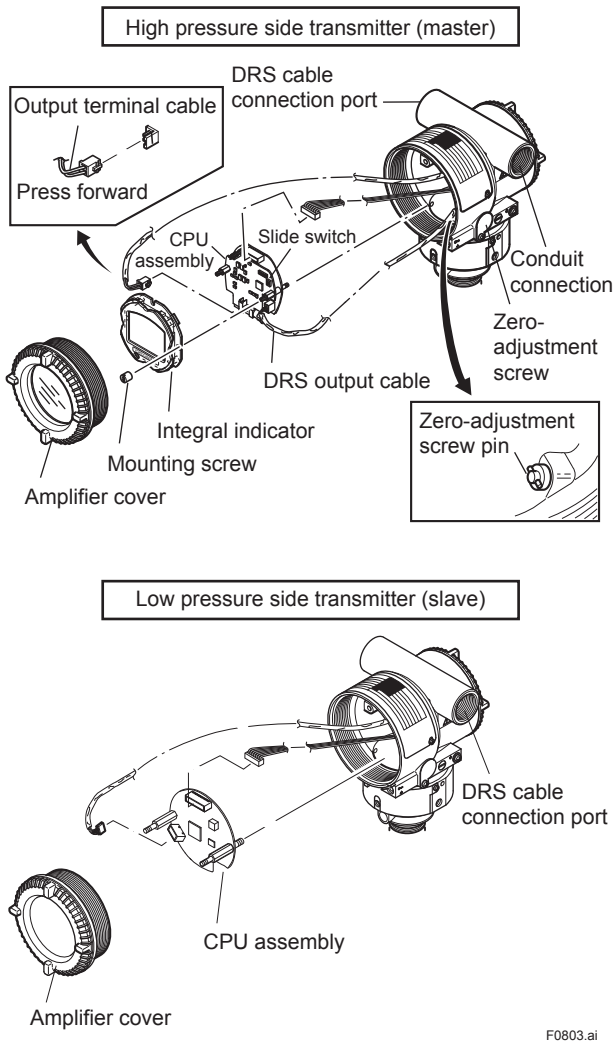


Figure 8.3 Removing and Attaching LCD Board Assembly and CPU Assembly

8.4.2 Replacing the CPU Board Assembly

This subsection describes the procedure for replacing the CPU assembly. (See Figure 8.3.)

■ Removing the CPU Assembly

1. Remove the cover. If an integral indicator is mounted, refer to subsection 8.4.1 and remove the indicator.
2. Turn the zero-adjustment screw to the position as shown in Figure 8.3.
3. Disconnect the output terminal cable (cable with brown connector at the end). When doing this, lightly press the side of the CPU assembly connector and pull the cable connector to disengage. (See the upper left of Figure 8.3.)
4. Disconnect the DRS output cable (cable with white connector at the end).
5. Use a socket driver (width across flats, 5.5mm) to loosen the two bosses.
6. Carefully pull the CPU assembly straight forward to remove it.
7. Disconnect the flat cable (cable with white connector at the end) that connects the CPU assembly and the capsule.

NOTE

Be careful not to apply excessive force to the CPU assembly when removing it.

■ Mounting the CPU Assembly

1. Connect the flat cable (with white connector) between the CPU assembly and the capsule.
2. Connect the output terminal cable (with brown connector).

NOTE

Make certain that the cables do not get pinched between the case and the edge of the CPU assembly.

3. Align and engage the zero-adjustment screw pin with the groove on the bracket on the CPU assembly. Then insert the CPU board assembly straight onto the post in the amplifier case.
4. Tighten the two bosses. If the transmitter is equipped with an integral indicator, refer to subsection 8.4.1 to mount the indicator.

IMPORTANT

Confirm that the zero-adjustment screw pin is placed properly in the groove on the bracket prior to tightening the two bosses. If it is not, the zero-adjustment mechanism will be damaged.

5. Replace the cover.

8.4.3 Cleaning and Replacing the Capsule Assembly

CAUTION

Precautions regarding Frameproof Type Transmitters

Users are prohibited from modifying the construction of a flameproof type transmitter. If you want to replace the capsule assembly with another with a different measurement range, contact Yokogawa.
If you want to replace the capsule assembly with another with the same measuring range, only do so after checking the following items.

- Replace the capsule assembly with another with the same specifications.
- The section connecting the transmitter and capsule assembly is a critical element in preservation of flameproof performance, and must be checked to verify that it is free of dents, scratches, and other defects.
- After completing maintenance, be sure to securely tighten the shrouding bolts that fasten the transmitter section and pressure-detector section together.

The procedure for cleaning or replacing the capsule assembly is provided below.

■ **Removing the Capsule Assembly**

IMPORTANT

When cleaning the capsule assembly, note the following items.

- Handle the capsule assembly with care, and be especially careful not to damage or distort the diaphragms that contact the process fluid.
- Do not use a chlorinated or acidic solution for cleaning.
- Rinse thoroughly with clean water after cleaning and dry completely.

1. Remove the CPU assembly according the instructions in subsection 8.4.2.
2. Remove the two setscrews that connect the transmitter section and pressure-detector section, and remove the stopper set screws and the stopper. (See Figure 8.4.)
3. Separate the transmitter section from the pressure-detector section.
4. Clean or replace the capsule assembly.

■ **Assembling the Capsule Assembly**

1. Attach the transmitter section to the pressure-detector section.
2. Fasten the stopper's setscrews. Fasten the two shrouding bolts. (Tighten to a torque of 1.5 N·m {1 kgf·m}.)
3. Attach the CPU assembly according the instructions in subsection 8.4.2.
4. After assembly, be sure to perform zero point adjustment and check the parameters.

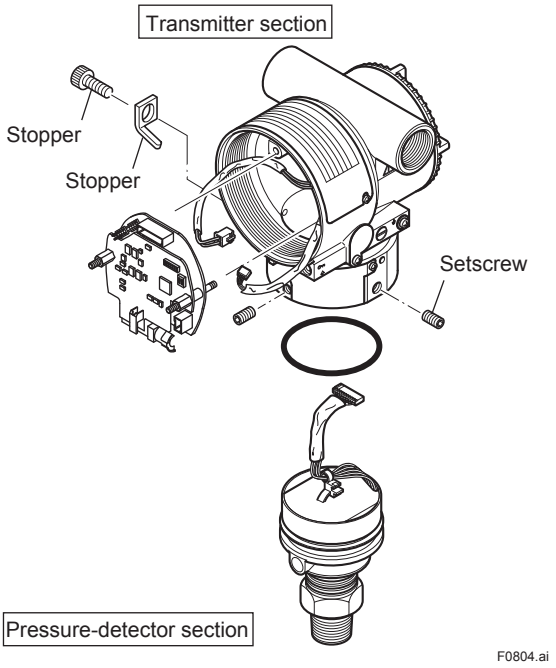


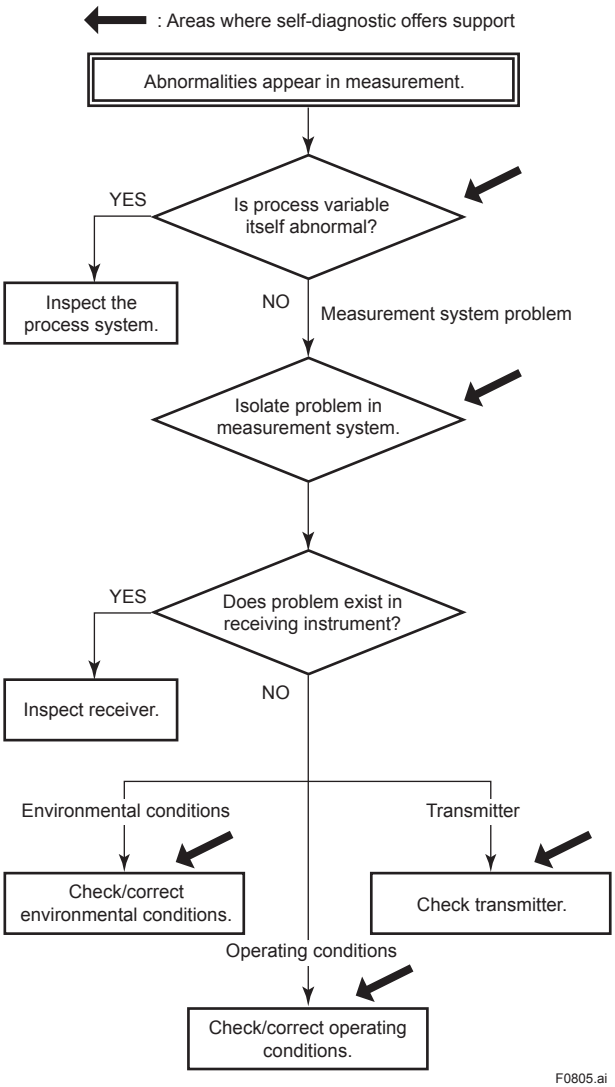
Figure 8.4 Attaching and Removing the Pressure-Detector Section

8.5 Troubleshooting

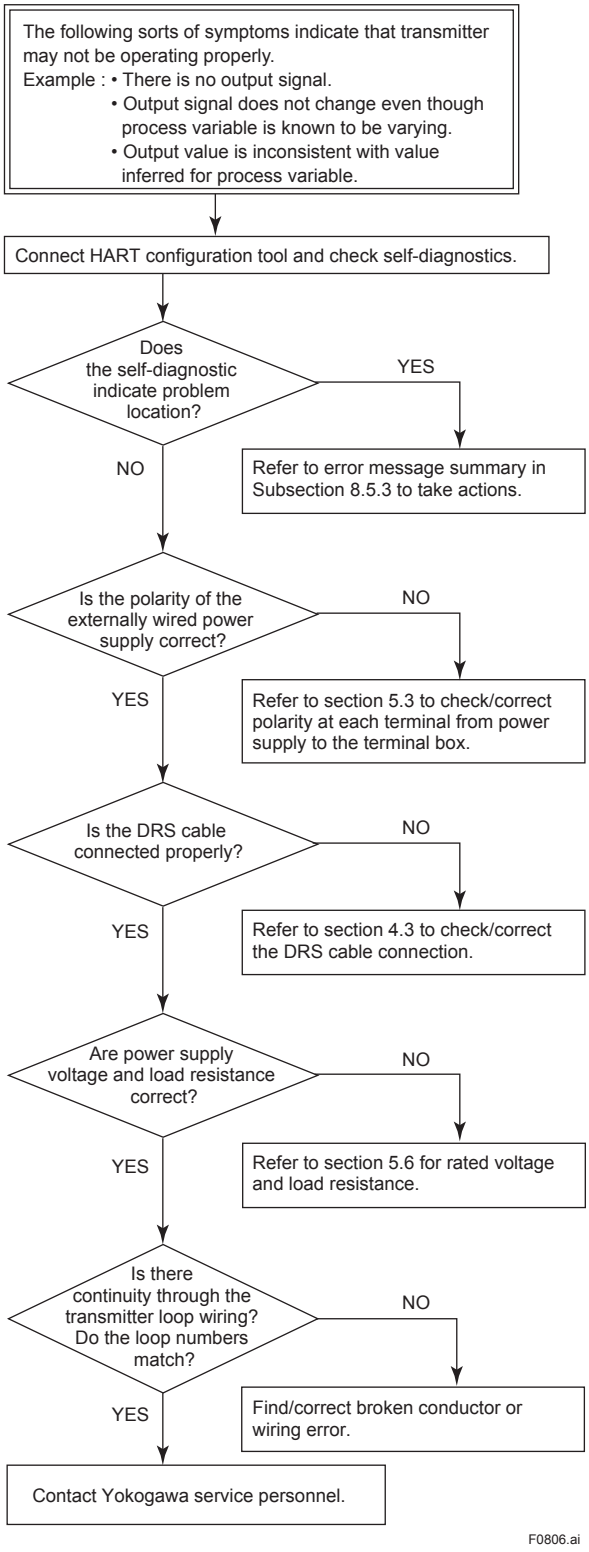
If any abnormality appears in the measured values, use the troubleshooting flow chart below to isolate and remedy the problem. Since some problems have complex causes, these flow charts may not identify all. If you have difficulty isolating or correcting a problem, contact Yokogawa service personnel.

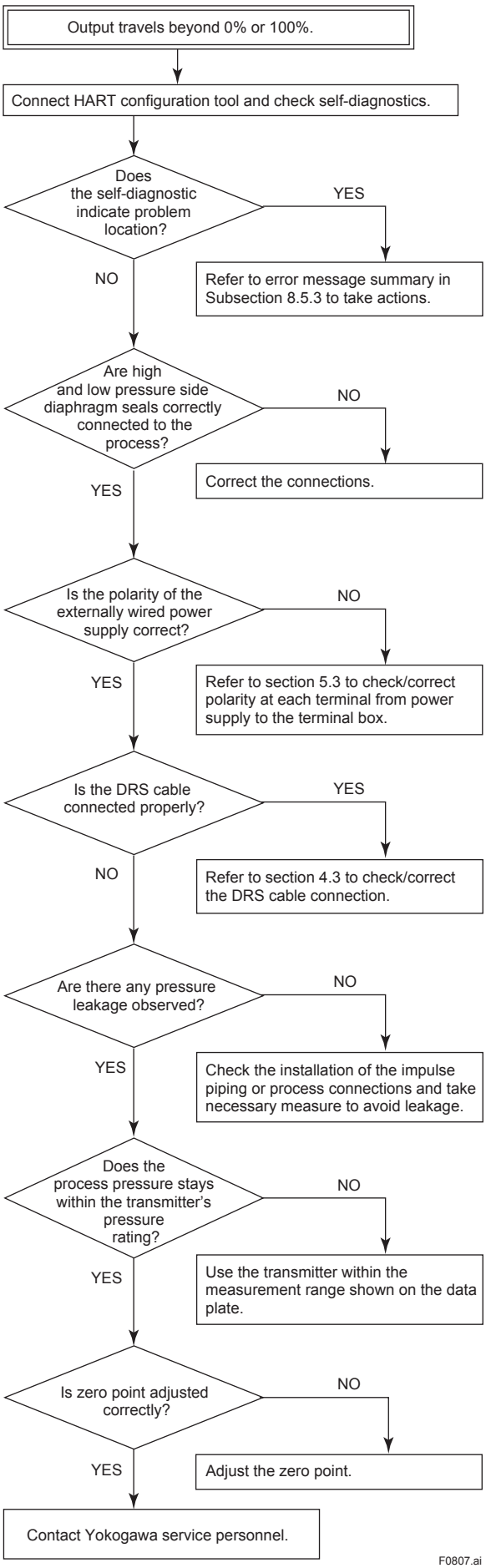
8.5.1 Basic Troubleshooting

First determine whether the process variable is actually abnormal or a problem exists in the measurement system. If the problem is in the measurement system, isolate the problem and decide what corrective action to take.
This transmitter is equipped with a self-diagnostic function which will be useful in troubleshooting. Refer to subsection 8.5.3 for details.



8.5.2 Troubleshooting Flowcharts




Output travels beyond 0% or 100%.
Connect HART configuration tool and check self-diagnostics.
Does the self-diagnostic indicate problem location?
YES
Refer to error message summary in Subsection 8.5.3 to take actions.
NO
Are high and low pressure side diaphragm seals correctly connected to the process?
NO
Correct the connections.
YES
Is the polarity of the externally wired power supply correct?
NO
Refer to section 5.3 to check/correct polarity at each terminal from power supply to the terminal box.
YES
Is the DRS cable connected properly?
YES
Refer to section 4.3 to check/correct the DRS cable connection.
NO
Are there any pressure leakage observed?
NO
Check the installation of the impulse piping or process connections and take necessary measure to avoid leakage.
YES
Does the process pressure stays within the transmitter's pressure rating?
NO
Use the transmitter within the measurement range shown on the data plate.
YES
Is zero point adjusted correctly?
NO
Adjust the zero point.
YES
Contact Yokogawa service personnel.
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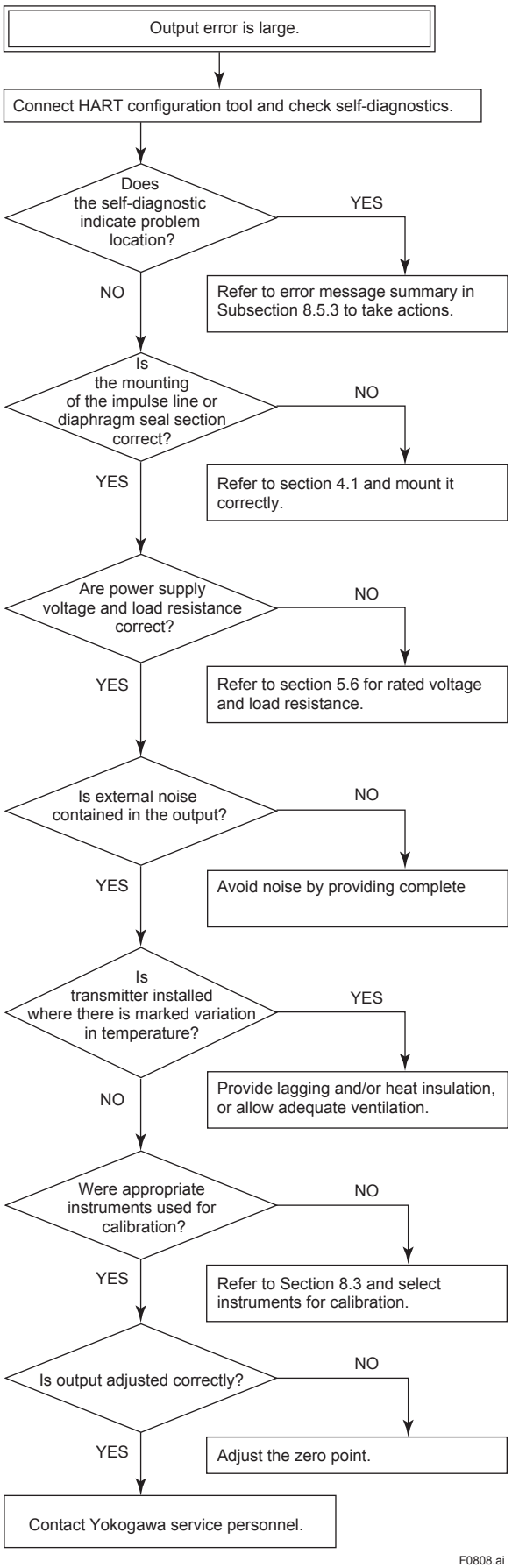
Output error is large.
Connect HART configuration tool and check self-diagnostics.
Does the self-diagnostic indicate problem location?
YES
Refer to error message summary in Subsection 8.5.3 to take actions.
NO
Is the mounting of the impulse line or diaphragm seal section correct?
NO
Refer to section 4.1 and mount it correctly.
YES
Are power supply voltage and load resistance correct?
NO
Refer to section 5.6 for rated voltage and load resistance.
YES
Is external noise contained in the output?
NO
Avoid noise by providing complete
YES
Is transmitter installed where there is marked variation in temperature?
YES
Provide lagging and/or heat insulation, or allow adequate ventilation.
NO
Were appropriate instruments used for calibration?
NO
Refer to Section 8.3 and select instruments for calibration.
YES
Is output adjusted correctly?
NO
Adjust the zero point.
YES
Contact Yokogawa service personnel.
F0808.ai

8.5.3 Alarms and Countermeasures

Table 8.3 Errors Message Summary

Indicator	NE107 (Default Value)	Display on Configuration Tool	Cause	Output Operation during Error	Countermeasure	Status Group	Diagnostic List Group
AL. 01 CAP1.ER	F	Pres 1 Sensor Failure (AL-01)	Module-1: Pressure sensor failed. (AL-01)	The output is shifted to the extreme end (upper limit or lower limit) in the direction set by the burnout direction switch. For details on setting the burnout direction, see subsection 3.3.9.	Contact the nearest sales office or service center.	0	Hardware Failure
		Temp 1 Sensor Failure (AL-01)	Module-1: Capsule temperature sensor failed. (AL-01)				
		Cap 1 EEPROM Failure (AL-01)	Module-1: Capsule EEPROM failed. (AL-01)				
AL. 02 AMP1.ER	F	Amp T Sensor Failure (AL-02)	Module-1: Amplifier temperature sensor failed. (AL-02)				
		Amp 1 EEPROM Failure (AL-02)	Module-1: Amplifier EEPROM failed. (AL-02)				
		CPU 1 Board Failure (AL-02)	Module-1: CPU board failed. (AL-02)			1	
AL.03 CAP2.ER	F	Pres 2 Sensor Failure (AL-03)	Module-2: Pressure sensor failed. (AL-03)			18	
		Temp 2 Sensor Failure (AL-03)	Module-2: Capsule temperature sensor failed. (AL-03)				
		Cap 2 EEPROM Failure (AL-03)	Module-2: Capsule EEPROM failed. (AL-03)				
AL.04 AMP2.ER	F	Amp 2 EEPROM Failure (AL-04)	Module-2: Amplifier EEPROM failed. (AL-04)				
		CPU 2 Board Failure (AL-04)	Module-2: CPU board failed. (AL-04)		1) Check the cable and connection. 2) Take measures to reduce communication noise. 3) Contact the nearest sales office or service center.		
AL.05 MDL2.ER	F	Module 2 Failure (AL-05)	Module-2: Start-up sequence, power supply failed. (AL-05)				
AL.06 COMM. ER	F	Intercom Failure (AL-06)	Module-2: Internal communication failed. (AL-06)				
—	F	No Device ID	Module-1: No Device ID is found.	Continues to output the current value.	Contact the nearest sales office or service center.	1	

Indicator	NE107 (Default Value)	Display on Configuration Tool	Cause	Output Operation during Error	Countermeasure	Status Group	Diagnostic List Group
AL.10 DIFF.P	S	DP outside Limit (AL-10)	Differential pressure exceeds limit. (AL-10)	Continues to output the current value. If the relevant signal is assigned to PV, the analog signal is limited within the variable range. For limit values, see subsection 3.3.1.	Check the input. Contact the nearest sales office or service center, if necessary.	2	Transducer Status
AL.11 PRESS1	S	Pres 1 outside Limit (AL-11)	Module-1: Input pressure is outside measurement range limit of capsule.(AL-11)	Continues to output the current value. If the relevant signal is assigned to PV, the analog signal is limited within the variable range. For limit values, see subsection 3.3.1.			
AL.12 TEMP1	S	Temp 1 outside Limit (AL-12)	Module-1: Capsule temperature is outside range (–50 to 130 degC).(AL-12)	Continues to output the current value.	Use heat insulation or make lagging to keep temperature within range.		
AL.13 AMP. TMP	S	Amp T outside Limit (AL-13)	Module-1: Amplifier temperature is outside range (–50 to 95 degC). (AL-13)				
AL.14 PRESS2	S	Pres 2 outside Limit (AL-14)	Module-2: Input pressure is outside measurement range limit of capsule.(AL-14)	Continues to output the current value. If the relevant signal is assigned to PV, the analog signal is limited within the variable range. For limit values, see subsection 3.3.1.	Check the input. Contact the nearest sales office or service center, if necessary.	19	
AL.15 TEMP2	S	Temp 2 outside Limit (AL-15)	Module-2: Capsule temperature is outside range (–50 to 130 degC).(AL-15)	Continues to output the current value.	Use heat insulation or make lagging to keep temperature within range.		

Indicator	NE107 (Default Value)	Display on Configuration Tool	Cause	Output Operation during Error	Countermeasure	Status Group	Diagnostic List Group
AL.30 DP.RNG	S	DP over Range. (AL-30)	Differential pressure exceeds specified range. (AL-30)	Continues to output the current value. If the relevant signal is assigned to PV, the analog signal is limited within the variable range. For limit values, see subsection 3.3.1.	Check input and range setting, and change them as needed.	3	Transducer Status
AL.31 P1.RNG	S	Pres 1 over Range (AL-31)	Module-1: Input pressure exceeds specified range. (AL-31)				
AL.32 P2.RNG	S	Pres 2 over Range (AL-32)	Module-2: Input pressure exceeds specified range. (AL-32)			20	
AL.35 DP. HI	N	DP High Alarm (AL-35)	Differential pressure exceeds the specified upper limit threshold. (AL-35)	Continues to output the current value.	Check the input value.	4	
AL.36 DP. LO	N	DP Low Alarm (AL-36)	Differential pressure exceeds the specified lower limit threshold. (AL-36)				
AL.37 P1. HI	N	Pres 1 High Alarm (AL-37)	Module-1: Input pressure exceeds the specified upper limit threshold. (AL-37)				
AL.38 P1. LO	N	Pres 1 Low Alarm (AL-38)	Module-1: Input pressure exceeds the specified lower limit threshold. (AL-38)				
AL.39 TMP1.HI	N	Temp 1 High Alarm (AL-39)	Module-1: Capsule temperature exceeds the specified upper limit threshold. (AL-39)				
AL.40 TMP1.LO	N	Temp 1 Low Alarm (AL-40)	Module-1: Capsule temperature exceeds the specified lower limit threshold. (AL-40)				
AL.41 P2. HI	N	Pres 2 High Alarm (AL-41)	Module-2: Input pressure exceeds the specified upper limit threshold. (AL-41)			21	
AL.42 P2. LO	N	Pres 2 Low Alarm (AL-42)	Module-2: Input pressure exceeds the specified lower limit threshold. (AL-42)				
AL.43 TMP2.HI	N	Temp 2 High Alarm (AL-43)	Module-2: Capsule temperature exceeds the specified upper limit threshold. (AL-43)				
AL.44 TMP2.LO	N	Temp 2 Low Alarm (AL-44)	Module-2: Capsule temperature exceeds the specified lower limit threshold. (AL-44)				

Indicator	NE107 (Default Value)	Display on Configuration Tool	Cause	Output Operation during Error	Countermeasure	Status Group	Diagnostic List Group
AL.50 DP. LRV	C	Illegal DP LRV (AL-50)	Specified value is outside of setting range. (AL-50)	Holds output immediately before error occurred.	Check setting and change them as needed.	5	Configuration
AL.51 DP. URV	C	Illegal DP URV (AL-51)	Specified value is outside of setting range. (AL-51)		Check setting and change them as needed.		
AL.52 DP. SPN	C	Illegal DP Span (AL-52)	Specified value is outside of setting range. (AL-52)		Check setting and change them as needed.		
AL.53 DP. ADJ	C	DP Zero Trim Err (AL-53)	Specified value is outside of setting range. (AL-53)	Continues to output the current value.	Adjust so that it is within the specification range.		
		DP Span Trim Err (AL-53)	Specified value is outside of setting range. (AL-53)		Adjust so that it is within the specification range.		
AL.54 P1. RNG	C	Illegal Pres 1 LRV (AL-54)	Module-1: Specified value is outside of setting range. (AL-54)	Holds output immediately before error occurred.	Check setting and change them as needed.		
		Illegal Pres 1 URV (AL-54)	Module-1: Specified value is outside of setting range. (AL-54)		Check setting and change them as needed.		
		Illegal Pres 1 Span (AL-54)	Module-1: Specified value is outside of setting range. (AL-54)		Check setting and change them as needed.		
AL.55 P1. ADJ	C	Pres 1 Zero Trim Err (AL-55)	Module-1: Specified value is outside of setting range. (AL-55)	Continues to output the current value.	Adjust so that it is within the specification range.	14	
		Pres 1 Span Trim Err (AL-55)	Module-1: Specified value is outside of setting range. (AL-55)		Adjust so that it is within the specification range.		
AL.56 P2. RNG	C	Illegal Pres 2 LRV (AL-56)	Module-2: Specified value is outside of setting range. (AL-56)	Holds output immediately before error occurred.	Check setting and change them as needed.	22	
		Illegal Pres 2 URV (AL-56)	Module-2: Specified value is outside of setting range. (AL-56)		Check setting and change them as needed.		
		Illegal Pres 2 Span (AL-56)	Module-2: Specified value is outside of setting range. (AL-56)		Check setting and change them as needed.		
AL.57 P2. ADJ	C	Pres 2 Zero Trim Err (AL-57)	Module-2: Specified value is outside of setting range. (AL-57)	Continues to output the current value.	Adjust so that it is within the specification range.	23	
		Pres 2 Span Trim Err (AL-57)	Module-2: Specified value is outside of setting range. (AL-57)		Adjust so that it is within the specification range.		
—	C	Pres 2 Fixed Mode	Module-2: Under pressure and temperature fix mode.	Continues to output the current value. If PV = module 2 side pressure, 4 mA fixed output.	Check fixed value mode.		
AL.60 SC. CFG	C	S.C. Config Error (AL-60)	Set points of signal characterization do not increase monotonically. (AL-60)	Continues to output the current value.	Check settings and change them.	14	
AL.79 OV.DISP	—	—	Displayed value is outside the −99999 to 99999 range.	Continues to output the current value.	Change the setting.	—	—

Indicator	NE107 (Default Value)	Display on Configuration Tool	Cause	Output Operation during Error	Countermeasure	Status Group	Diagnostic List Group
AL.87 FLG. HI	M	Flg Temp High Alarm (AL-87)	Module-1: Flange temperature exceeds the specified upper limit threshold. (AL87)	Follows the Diag Out Option settings. Off: Continues to output the current value. Burnout: Shifts the output to the AO upper limit or AO lower limit parameter value. Fall back: Outputs the value specified by the Diag Fixed Out Val parameter.	1) Check heater malfunction and disconnection. 2) Check the capsule temp. and amplifier temp. 3) Adjust flange temperature coefficient(Flg temp coef).	15	Transducer Status
AL.87 FLG. LO	M	Flg Temp Low Alarm (AL-87)	Module-1: Flange temperature exceeds the specified lower limit threshold. (AL87)				
AL.88 INVR.DP	C	Invalid Ref DP (AL-88)	Differential pressure fluctuation does not reach the reference level required to blockage detection so that no blockage detection is carried out.(AL-88)	Continues to output the current value.	1) Check process condition. 2) Obtain the reference fluctuation values again.	15	
AL.88 INVR.P1	C	Invalid Ref Pres 1 (AL-88)	Module-1: Pressure fluctuation does not reach the reference level required to blockage detection. (AL-88)				
AL.88 INVR.P2	C	Invalid Ref Pres 2 (AL-88)	Module-2: Pressure fluctuation does not reach the reference level required to blockage detection. (AL-88)				
AL.88 INVR.F	C	Invalid Ref BlkF (AL-88)	Blocking factor can not be used for blockage detection.(AL-88)				
AL.89 ILBD.OV	N	ILBD over Range (AL-89)	Process value is outside the applicable range of blockage diagnostics. (AL-89)		Check the process conditions.	15	
AL.89 B BLK	M	B Blocking (AL-89)	B blocking (both-side blockage) has been detected. (AL-89)	Follows the Diag Out Option settings. Off: Continues to output the current value. Burnout: Shifts the output to the AO upper limit or AO lower limit parameter value. Fall back: Outputs the value specified by the Diag Fixed Out Val parameter.	1) Check the process and impulse line conditions. 2) If there are large flow change or the change of fluid under the measured process conditions, obtain the reference value again.	16	
AL.89 P1 BLK	M	Pres 1 Side Blocking (AL-89)	Module 1 side blockage has been detected. (AL-89)				
AL.89 P2 BLK	M	Pres 2 Side Blocking (AL-89)	Module 2 side blockage has been detected. (AL-89)				
AL.89 P1 LRG	M	Large Fluct Pres 1 (AL-89)	Module-1: Pressure fluctuation amplitude is large. (AL-89)				
AL.89 P2 LRG	M	Large Fluct Pres 2 (AL-89)	Module-2: Pressure fluctuation amplitude is large. (AL-89)				
AL.89 A BLK	M	A Blocking (AL-89)	A blocking (one-side blockage) has been detected. (AL-89)				

Indicator	NE107 (Default Value)	Display on Configuration Tool	Cause	Output Operation during Error	Countermeasure	Status Group	Diagnostic List Group
AL.91 DP. SIM	C	DP Simulate Mode (AL-91)	Under simulation mode for differential pressure. (AL-91)	Outputs the Simulate-Value value.	Check the simulation mode.	17	Transducer Status
AL.91 P1. SIM	C	Pres 1 Simulate Mode (AL-91)	Under simulation mode for module 1 side pressure. (AL-91)				
AL.91 P2. SIM	C	Pres 2 Simulate Mode (AL-91)	Under simulation mode for module 2 side pressure. (AL-91)				
AL.91 T1. SIM	C	Temp 1 Simulate Mode (AL-91)	Under simulation mode for module 1 side capsule temperature. (AL-91)				
AL.91 T2. SIM	C	Temp 2 Simulate Mode (AL-91)	Under simulation mode for module 2 side capsule temperature. (AL-91)				
AL.91 PCT.SIM	C	PV % rnge Sim Mode (AL-91)	Under simulation mode for percent of range output. (AL-91)				
AL.91 AO. SIM	C	Loop current Sim Mode (AL-91)	Under simulation mode for current output. (AL-91)				
AL.92 STS.SIM	N	Status Sim Mode (AL-92)	Under simulation mode for status. (AL-92)				

Table 8.4 HART Configuration Error Message

Error message	Probable cause	Countermeasure
Invalid selection	—	Change the setting.
Value was too high	Set value is too high.	
Value was too low	Set value is too low.	
Too few data bytes received	—	—
In write protect mode	Operation is set in the Write Protect mode.	—
Lower range value too high	LRV set point is too high.	Change the range.
Lower range value too low	LRV set point is too low.	
Upper range value too high	URV set point is too high.	
Upper range value too low	URV set point is too low.	
Span too small	Set span is too small.	
Applied process too high	Applied pressure is too high.	Adjust the applied pressure.
Applied process too low	Applied pressure is too low.	
New lower range value pushed upper range value over upper sensor limit	The shift of URV according to the new LRV setting exceeds USL.	Change the URV setting within the range of USL.
Excess correction attemted	Amount of correction is too much.	Adjust the amount.
Lower conversion not succeeded	Characters are not convertible. e.g. %	Correct the setting.
Not in fixed current mode	The fixed current mode is desired but not set in that mode.	Set in the fixed current mode.
In multidrop mode	Operation is set in the multi-drop mode.	—
Not write protect mode	Operation is set without a password.	—
Lower range value and upper range value out of limits	URV and LRV are out of range limits.	Change the setting.

Table 8.5 Device status

Item	NE107 (Default Value)	Description
Device Malfunction (0x80)	N	Field device has malfunctioned due to a hardware error or failure.
Configuration Changed* (0x40)	N	A modification has been made to the configuration of the field device.
Cold Start (0x20)	N	A reset or self test of the field device has occurred, or power has been removed and reapplied.
More Status Available (0x10)	N	Field device has more status available.
Loop Current Fixed (0x08)	N	Analog output and its digital representation are in fixed mode, and not responsive to input changes.
Loop Current Saturated (0x04)	S	Analog output and its digital representation are outside the operating range limits, and not responding to input.
Non-PV Out of Limits (0x02)	S	Process applied to the non-primary variable is outside the operating limits of the field device.
PV Out of Limits (0x01)	S	Process applied to the primary variable is outside the operating limits of the field device.

*: This flag can be reset.
For the procedure, see subsection 7.3.1.3.

Table 8.6 Extended Device Status and Diagnostic Status 0, 1

Extended device status (Ext dev Status)	NE107 (Default Value)	Description
Maintenance Required (0x01)	N	Field device requires maintenance.
Device Variable Alert (0x02)	S	Any device variable is in an alarm or warning state.
Critical Power Failure (0x04)	F	Not used
Failure (0x08)	N	One or more device variables are invalid due to a malfunction in the field device.
Out of Specification (0x10)	N	Deviations from the permissible ambient or process conditions have been detected that may compromise measurement or control accuracy.
Function Check (0x20)	N	One or more device variables are temporarily invalid due to ongoing work on the device.

Diagnostic Status 0	NE107 (Default Value)	Description
Device Variable Simulation Active(0x01)	C	The device is in simulation mode and one or more of its device variables are not representative of the process.
Non-Volatile Memory Defect(0x02)	F	The Non-Volatile memory check is invalid or maybe corrupt.
Volatile Memory Defect(0x04)	F	Not used
Watchdog Reset Executed (0x08)	F	Not used
Power Supply Conditions Out of Range(0x10)	S	Not used
Environmental Conditions Out of Range(0x20)	S	An internal or environmental condition is beyond acceptable limits.
Electronic Defect(0x40)	F	A hardware problem not related to the sensor has been detected.
Device Configuration Locked(0x80)	N	Device is in write-protect or is locked.

Diagnostic Status 1	NE107 (Default Value)	Description
Status Simulation Active(0x01)	N	Status simulation mode has been enabled and the device status and status bits are fixed and may not represent the current state of the device.
Discrete Variable Simulation Active(0x02)	C	Not used
Event Notification Overflow(0x04)	N	Not used

Table 8.7 Data Quality and Limit Status

Data Quality	Description
Good	The value may be used in control.
Poor Accuracy	The quality of the value is less than normal, but the value may still be useful.
Manual / Fixed	The value is manually fixed.
Bad	The value is not useful.

Limit Status	Description
Constant	The value cannot be changed, no matter what the process does.
Low Limited	The value is out of the high or low limit.
High Limited	
Not Limited	The value is free to change.

Table 8.8 Relationship between Alarm and Value/Status

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL. 01 CAP1. ER	Pres 1 Sensor Failure (AL-01)	Device Malfunction (0x80)	Failure (0x08)	F	Value: Hold value Status: Bad, Constant		Value: Measured value Status: Good, Not Limited	Value: Measured value Status: Good, Not Limited		Value: Hold value Status: Bad, Low Limited/High Limited*1	
	Temp 1 Sensor Failure (AL-01)			F	Value: Measured value Status: Poor Accuracy, Not Limited		Value: Measured value Status: Bad, Not Limited				
	Cap 1 EEPROM Failure (AL-01)			F	Value: Hold value Status: Bad, Constant		Value: Measured value Status: Bad, Not Limited				
AL. 02 AMP1. ER	Amp T Sensor Failure (AL-02)			F	Value: Measured value Status: Good, Not Limited						
	Amp 1 EEPROM Failure (AL-02)			F	Value: Hold value Status: Bad, Constant		Value: Measured value Status: Bad, Not Limited				
	CPU 1 Board Failure (AL-02)			F			Value: Held value Status: Bad, Constant/ Value: Measured value Status: Good, Not Limited/ Value: Measured value Status: Bad, Not Limited				

*1: Depends on the setting of hardware switch

*2: Depends on the direction of rangeover (high or low)

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL.03 CAP2. ER	Pres 2 Sensor Failure (AL-03)	Device Malfunction (0x80)	Failure (0x08)	F	Value: Hold value Status: Bad, Constant	Value: Measured value Status: Good, Not Limited		Value: Hold value Status: Bad, Constant	Value: Measured value Status: Good, Not Limited	Value: Hold value Status: Bad | Low Limited/High Limited*1	
	Temp 2 Sensor Failure (AL-03)			F	Value: Measured value Status: Poor Accuracy, Not Limited			Value: Measured value Status: Poor Accuracy, Not Limited	Value: Measured value Status: Bad, Not Limited		
	Cap 2 EEPROM Failure (AL-03)			F	Value: Hold value Status: Bad, Constant			Value: Hold value Status: Bad, Constant	Value: Measured value Status: Bad, Not Limited		
AL.04 AMP2. ER	Amp 2 EEPROM Failure (AL-04)			F					Value: Measured value Status: Bad, Not Limited		
	CPU 2 Board Failure (AL-04)			F					Value: Hold value Status: Bad, Constant/ Value: Measured value Status: Bad, Not Limited		
AL.05 MDL2. ER	Module 2 Failure (AL-05)			F					Value: Hold value Status: Bad, Constant		
AL.06 COMM. ER	Intercom Failure (AL-06)			F							
—	No Device ID	—		F	Value: Measured value Status: Good, Not Limited						

*1: Depends on the setting of hardware switch
*2: Depends on the direction of rangeover (high or low)

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL.10 DIFF.P	DP outside Limit (AL-10)	[In the case of PV] PV Out of Limits (0x01) [In the case of other than PV] Non-PV Out of Limits (0x02)	Device Variable Alert (0x02) Out of Specification (0x10)	S	Value: Measured value Status: Poor Accuracy, Not Limited	Value: Measured value Status: Good, Not Limited	Value: Measured value Status: Good, Not Limited	Value: Measured value Status: Good, Not Limited		[In the case of PV] Value: Measured value Status: Poor Accuracy, Not Limited [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
AL.11 PRESS1	Pres 1 outside Limit (AL-11)			S		Value: Measured value Status: Poor Accuracy, Not Limited				[In the case of PV] Value: Measured value Status: Poor Accuracy, Not Limited [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
AL.12 TEMP1	Temp 1 outside Limit (AL-12)	Non-PV Out of Limits (0x02)		S			Value: Measured value Status: Poor Accuracy, Not Limited				
AL.13 AMP. TMP	Amp T outside Limit (AL-13)			S	Value: Measured value Status: Good, Not Limited						
AL.14 PRESS2	Pres 2 outside Limit (AL-14)	[In the case of PV] PV Out of Limits (0x01) [In the case of other than PV] Non-PV Out of Limits (0x02)		S	Value: Measured value Status: Poor Accuracy, Not Limited	Value: Measured value Status: Good, Not Limited		Value: Measured value Status: Poor Accuracy, Not Limited	Value: Measured value Status: Good, Not Limited	[In the case of PV] Value: Measured value Status: Poor Accuracy, Not Limited [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
AL.15 TEMP2	Temp 2 outside Limit (AL-15)	Non-PV Out of Limits (0x02)		S					Value: Measured value Status: Poor Accuracy, Not Limited		
AL.30 DP.RNG	DP over Range (AL-30)	[In the case of PV] Loop Current Saturated (0x04)		S	Value: Measured value Status: Good, Not Limited					[In the case of PV] Value: Hold value Status: Bad, Low Limited/High Limited*2 [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
AL.31 P1.RNG	Pres 1 over Range (AL-31)			S							
AL.32 P2.RNG	Pres 2 over Range (AL-32)			S							

*1: Depends on the setting of hardware switch

*2: Depends on the direction of rangeover (high or low)

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL.35 DP. HI	DP High Alarm (AL-35)	—	—	N	Value: Measured value Status: Good, Not Limited						
AL.36 DP. LO	DP Low Alarm (AL-36)			N							
AL.37 P1. HI	Pres 1 High Alarm (AL-37)			N							
AL.38 P1. LO	Pres 1 Low Alarm (AL-38)			N							
AL.39 TMP1.HI	Temp 1 High Alarm (AL-39)			N							
AL.40 TMP1. LO	Temp 1 Low Alarm (AL-40)			N							
AL.41 P2. HI	Pres 2 High Alarm (AL-41)			N							
AL.42 P2. LO	Pres 2 Low Alarm (AL-42)			N							
AL.43 TMP2.HI	Temp 2 High Alarm (AL-43)			N							
AL.44 TMP2. LO	Temp 2 Low Alarm (AL-44)			N							

*1: Depends on the setting of hardware switch

*2: Depends on the direction of rangeover (high or low)

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL.50 DP. LRV	Illegal DP LRV (AL-50)	—	Function Check (0x20)	C	Value: Measured value Status: Good, Not Limited					[In the case of PV] Value: Hold value Status: Bad, Constant [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
AL.51 DP. URV	Illegal DP URV (AL-51)			C							
AL.52 DP. SPN	Illegal DP Span (AL-52)			C							
AL.53 DP. ADJ	DP Zero Trim Err (AL-53)			C	Value: Measured value Status: Poor Accuracy | Not Limited	Value: Measured value Status: Good, Not Limited				[In the case of PV] Value: Measured value Status: Poor Accuracy, Not Limited [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
	DP Span Trim Err (AL-53)			C							
AL.54 P1. RNG	Illegal Pres 1 LRV (AL-54)			C	Value: Measured value Status: Good, Not Limited					[In the case of PV] Value: Hold value Status: Bad, Constant [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
	Illegal Pres 1 URV (AL-54)			C							
	Illegal Pres 1 Span (AL-54)			C							
AL.55 P1. ADJ	Pres 1 Zero Trim Err (AL-55)			C	Value: Measured value Status: Poor Accuracy, Not Limited	Value: Measured value Status: Good, Not Limited				[In the case of PV] Value: Measured value Status: Poor Accuracy, Not Limited [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
	Pres 1 Span Trim Err (AL-55)			C							
AL.56 P2. RNG	Illegal Pres 2 LRV (AL-56)			C	Value: Measured value Status: Good, Not Limited					[In the case of PV] Value: Hold value Status: Bad, Constant [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
	Illegal Pres 2 URV (AL-56)			C							
	Illegal Pres 2 Span (AL-56)			C							

*1: Depends on the setting of hardware switch

*2: Depends on the direction of rangeover (high or low)

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL.57 P2. ADJ	Pres 2 Zero Trim Err (AL-57)	—	Function Check (0x20)	C	Value: Measured value Status: Poor Accuracy, Not Limited	Value: Measured value Status: Good, Not Limited		Value: Measured value Status: Poor Accuracy, Not Limited	Value: Measured value Status: Good, Not Limited	[In the case of PV] Value: Measured value Status: Poor Accuracy, Not Limited [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
	Pres 2 Span Trim Err (AL-57)			C							
—	Pres 2 Fixed Mode	[In the case of PV] Loop Current Fixed (0x08)		C	Value: Measured value Status: Good, Not Limited			Value: Measured value Status: Good , Constant		[In the case of PV] Value: Hold value Status: Good, Constant [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
AL.60 SC. CFG	S.C. Config Error (AL-60)	—	Function Check (0x20)	C	Value: Measured value Status: Good, Not Limited					Value: Measured value Status: Bad, Not Limited	
AL.79 OV.DISP	—	—	—	N	Value: Measured value Status: Good, Not Limited						

*1: Depends on the setting of hardware switch

*2: Depends on the direction of rangeover (high or low)

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL.87 FLG. HI	Flg Temp High Alarm (AL-87)	—	Maintenance Required (0x01)	M	Value: Measured value Status: Good, Not Limited					In the case “Off” is set to Diag Out Option Value: Measured value Status: Good and Not Limited In the case “Burnout” is set to Diag Out Option Value: Low Limited/High Limited Status: Bad and Low Limited/High Limited*1 In the case “Fall back” is set to Diag Out Option Value: Fixed value Status: Bad and Constant	
AL.87 FLG. LO	Flg Temp Low Alarm (AL-87)			M							
AL.88 INVR.DP	Invalid Ref DP (AL-88)		Function Check (0x20)	C	Value: Measured value Status: Good, Not Limited						
AL.88 INVR.P1	Invalid Ref Pres 1 (AL-88)			C							
AL.88 INVR.P2	Invalid Ref Pres 2 (AL-88)			C							
AL.88 INVR.F	Invalid Ref BlkF (AL-88)			C							
AL.89 ILBD.OV	ILBD over Range (AL-89)		—	N	Value: Measured value Status: Good, Not Limited						
AL.89 B BLK	B Blocking (AL-89)		Maintenance Required (0x01)	M	Value: Measured value Status: Good, Not Limited					In the case “Off” is set to Diag Out Option Value: Measured value Status: Good and Not Limited In the case “Burnout” is set to Diag Out Option Value: Low Limited/High Limited Status: Bad and Low Limited/High Limited*1 In the case “Fall back” is set to Diag Out Option Value: Fixed value Status: Bad and Constant	
AL.89 P1 BLK	Pres 1 Side Blocking (AL-89)			M							
AL.89 P2 BLK	Pres 2 Side Blocking (AL-89)			M							
AL.89 P1 LRG	Large Fluct Pres 1 (AL-89)			M							
AL.89 P2 LRG	Large Fluct Pres 2 (AL-89)			M							
AL.89 A BLK	A Blocking (AL-89)			M							

*1: Depends on the setting of hardware switch

*2: Depends on the direction of rangeover (high or low)

Integral Indicator Display	Display on Configuration Tool	Device Status	Extended Device Status	NE107 (Default Value)	Value and Status (Data Quality, Limit Status)						
					Differential pressure	Module 1		Module 2		% Range	Current Output
						Pressure	Capsule Temperature	Pressure	Capsule Temperature		
AL.91 DP. SIM	DP Simulate Mode (AL-91)	[In the case of PV] Loop Current Fixed (0x08)	Function Check (0x20)	C	Value and Status: Simulated value	Value: Measured value Status: Good, Not Limited				[In the case of PV] same as PV Value and Status [In the case of other than PV] Value: Measured value Status: Good, Not Limited	
AL.91 P1. SIM	Pres 1 Simulate Mode (AL-91)			C	Value: Measured value Status: Good, Not Limited	Value and Status: Simulated value	Value: Measured value Status: Good, Not Limited				
AL.91 P2. SIM	Pres 2 Simulate Mode (AL-91)			C	Value: Measured value Status: Good, Not Limited			Value and Status: Simulated value	Value: Measured value Status: Good, Not Limited		
AL.91 T1. SIM	Temp 1 Simulate Mode (AL-91)	—		C	Value: Measured value Status: Good, Not Limited		Value and Status: Simulated value	Value: Measured value Status: Good, Not Limited			
AL.91 T2. SIM	Temp 2 Simulate Mode (AL-91)			C	Value: Measured value Status: Good, Not Limited				Value and Status: Simulated value	Value: Measured value Status: Good, Not Limited	
AL.91 PCT.SIM	PV % rnge Sim Mode (AL-91)	Loop Current Fixed (0x08)		C	Value: Measured value Status: Good, Not Limited					Value and Status: Simulated value	
AL.91 AO. SIM	Loop current Sim Mode (AL-91)			C	Value: Measured value Status: Good, Not Limited					Value and Status: Simulated value	
AL.92 STS.SIM	Status Sim Mode (AL-92)	—	—	N	Value: Measured value Status: Good, Not Limited						

*1: Depends on the setting of hardware switch

*2: Depends on the direction of rangeover (high or low)

9. Parameter Summary

Table 9.1 Parameter Summary

Function	Label	Item	Description	Factory Default Value	R/W*1
Analog output	AO Alrm typ	Output during hardware failure	Indicates the output level during hardware errors (including CPU errors) (Hi, Lo)	Depends on the hardware switch	R
	AO lower limit	Lower limit of analog output	Sets the lower limit of output current. (3.80 to 21.60 mA)	3.80 mA	W
	AO upper limit	Upper limit of analog output	Sets the upper limit of output current. (3.80 to 21.60 mA)	21.60 mA	W
	Auto recover	Auto recover from hardware error	Specifies the action to take when the cause of sensor error is removed. (On, Off)	On	W
Analog output trim	Clear D/A trim	Output adjustment clear	Clears the analog output adjustment level.		M
	D/A trim	D/A output adjustment	Performs analog output adjustment for 4 mA and 20 mA.		M
	Scaled D/A trim	Scaled D/A output adjustment	Performs current output adjustment for 4 mA and 20 mA. Scales and displays the output value.		M
	Channel flags	Analog channel flag	Indicates the analog channel flag.	0x00	R
Bi-direction mode	Bi-dir mode	Bidirectional mode	Sets bidirectional flow mode on or off. (On, Off)	Off	W
Burst mode	Burst mode	Burst mode	Switches to or out of burst mode. (Wired HART Enabled, Off)	Off	W
	Burst Command	Burst Command	Cmd 1: PV Cmd 2: % range/current Cmd 3: Dyn vars/current Cmd 9: Device vars w/ status Cmd 33: Device Variables Cmd 48: Read Additional Device Status.	Cmd 1: PV	W
	Burst Variable Code	Device variable of burst message	Sets the device variable of burst message. Up to 8 slots.		W
	Set Burst Trigger	Burst trigger setting	Sets the burst trigger mode and trigger value.		M
	Set Burst Period	Burst period setting	Sets the burst period and longest burst update time.		M
	Burst Msg Trigger Mode	Burst message trigger mode	Indicates the burst message trigger mode. (Continuous, Window, Rising, Falling, On-change)	Continuous	R
	Burst Trigger Level	Trigger value	Indicates the trigger value.	0.000000	R
	Update Period	Update period for Burst mode	Indicates the shortest burst update time.	Burst Message 1: 0.500 s 2: 60.000 s 3: 60.000 s	R
	Max Update Period	Longest update period for Burst mode	Indicates the longest burst update time.	3600.000 s	R

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Event notification	Event Notification Control	Event Notification	Switches to or out of event monitoring mode. This can be set to On only when burst mode is set to Wired HART Enabled.	Off	W
	Device status Mask	Event masking	Sets the device status to detect as events.		W
	Status group 0 Mask to 5 Mask, 14 Mask to 23 Mask				
	Ext dev status Mask				
	Diagnostic status 0 Mask				
	Diagnostic status 1 Mask				
	Set Event Notification Timing	Event notification time setting	Sets the retry time for when events occur, the update time for when there are no events, and the minimum event retention time.		M
	Event Notification Retry Time	Event Notification Retry Time	Indicates the retry time for when events occur.	60.000 s	R
	Max Update Time	Update time for when there are no events	Indicates the update time for when there are no events.	60.000 s	R
	Event Debounce Interval	Minimum event retention time	Indicates the reference time for detecting events.	off	R
	Acknowledge Event Notification	Acknowleding events	Get the latest event number, and acknowledge the event.		M
	Event Status	Event Status	0x00 Event acknowledged or no event 0x10 Setting change event unacknowledged 0x20 Device status event unacknowledged 0x40 Other status event unacknowledged		R

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Device information	Date	Date	Date		W
	Descriptor	Description	Description. Up to 16 alphanumerics.	As specified	W
	Message	Message	Free text. Up to 32 alphanumerics.		W
	Country	Country code	Country code	JP	W
	Dev id	Device ID	Device ID		R
	Distributor	Distributor	Distributor	YOKOGAWA	R
	Drain vent matl	Drain/Vent plug material	Drain/Vent plug material		W
	Extra No.	Customization number	Customization number		R
	Fill fluid	Fill fluid material	Fill fluid material		W
	Final asmbly num	Final assembly number	Final assembly number		W
	Fld dev rev	Field device revision	Device-specific command revision		R
	Gasket matl	Gasket material	Gasket material		W
	Isoltr matl	Capsule material	Capsule material		W
	Mftr Date	Manufacturing date	Manufacturing date		R
	MS code 1	Memo field of MS Code 1	32 alphanumerics		W
	MS code 2	Memo field of MS Code 2	32 alphanumerics		W
	MS code 3	Memo field of MS Code 3	32 alphanumerics		W
	Module rev	Module 2 software revision	Indicates the module 2 software revision.		R
	Num of RS	Diaphragm seal quantity	Stores or indicates diaphragm seal quantity information.		W
	Process Conn matl	Process Connection material	Stores or indicates process Connection material information.		W
	Process Conn size	Process Connection size	Stores or indicates process Connection size information.		W
	Process Conn type	Process Connection type	Stores or indicates process Connection type information.		W
	RS fill fluid	Diaphragm seal Fill fluid material	Stores or indicates diaphragm seal fill fluid material information.		W
	RS isoltr matl	Diaphragm seal material	Stores or indicates diaphragm seal fluid material information.		W
	RS type	Diaphragm seal type	Stores or indicates diaphragm seal type information.		W
	Serial No.	Instrument serial number	Indicates the device's serial number. (Up to 16 alphanumerics)		R
	Software rev	Software revision	Indicates the transmitter software revision.		R
	Style No.	Style number	Indicates the product's style number.	1.00	R
	Universal rev	Universal command revision	Indicates the HART protocol's universal command revision.	7	R
	Device Profile	Device profile	Indicates the device profile.	Process automation device	R
	Max dev vars	Maximum value of device variable	Indicates the maximum value of device variable.	4	R
	Model	Model	Indicates the model and capsule range. Example: EJX530 A		R

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Display setup	Bar indicator	Bar graph display setting	Specifies bar indicator (bar graph) on or off. (On, Off)	On	W
	Power on info	Screen at power-on	Sets how to display the screen at power-on. (On, Off)	On	W
	Disp Out 1	Integral indicator display selection (1)	Specifies the contents to display on the LCD. (PV %, DP, Pres 1, Pres 2, Temp 1, Temp2, Engr Disp)	PV %	W
	Disp Out 2 Disp Out 3 Disp Out 4	Integral indicator display selection (2), (3), (4)	Specifies the contents to display on the LCD. (PV %, DP, Pres 1, Pres 2, Temp 1, Temp2, Engr Disp, Not used)	Not used	W
	Disp DP % fnctn	Differential pressure percent of range display mode	Specifies the computation mode for the differential pressure value displayed on the LCD. (Linear, Sq root)	Linear or as specified	W
	Disp PV % reso	PV percent of range display resolution	Selects the PV percent of range display resolution. (Normal, High Resolution)	Normal	W
	Engr exp	User set scale PV exponent display	Displays the exponent of the user set scale PV value. (..., X10, X100, X1000)	... or as specified	W
	Engr disp	User set scale PV value	Indicates the user set scale PV value.		R
	Engr unit	Engineering unit display	Indicates the user set scale PV value unit. Up to 8 alphanumeric characters	As specified	R
	Engr LRV	Lower range value of the user set PV scale	Sets the lower range value of the user set PV scale.	As specified	W
	Engr point	Decimal point of the user set PV scale	Specifies the decimal place of user set scale value on the LCD. (0, 1, 2, 3, 4)	2 or as specified	W
	Engr URV	Upper range value of the user set PV scale	Sets the upper range value of the user set PV scale.	As specified	W
	Modify Engr unit	User set PV scale value unit	Edits the user set PV scale unit string.		M
	DP disp point	Decimal point of the differential pressure display	Specifies the decimal place of the differential pressure on the LCD. (0, 1, 2, 3, 4)	2	W
	Set Engr unit	User set PV scale unit selection	Selects the user set PV scale value unit.		M
	Pres 1 disp point	Decimal point of the module 1 side pressure display	Specifies the decimal place of the module 1 side pressure on the LCD. (0, 1, 2, 3, 4)	2	W
	Pres 2 disp point	Decimal point of the module 2 side pressure display	Specifies the decimal place of the module 2 side pressure on the LCD. (0, 1, 2, 3, 4)	2	W
	Squawk	Squawk	Identifies the device in communication (turns on the LCD).		M
DP setup	DP damp	Differential pressure damping time constant	Specifies the differential pressure damping time constant. (0.00 to 100.00 s)	2.00 s or as specified	W
	Min span	Minimum span of differential pressure	Indicates the minimum span of differential pressure.		R
	LRV	Lower range value of differential pressure	Sets the lower range value of differential pressure.	As specified	W
	LSL	Lower range limit of differential pressure	Indicates the lower range limit of differential pressure.		R
	URV	Upper range value of differential pressure	Sets the upper range value of differential pressure.	As specified	W
	USL	Upper range limit of differential pressure	Indicates the upper range limit of differential pressure.		R
	Xfer fnctn	Output mode	Selects the differential pressure output mode. (Linear, Sq Root, Spcl curve)	Linear or as specified	W
Error log	Error log clear	Error log clear	Clears the error log.		M
	Error log view	Error log view	Displays the error log. (Log1 (last error) to Log4 (fourth to the last error))		M

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Loop test	Loop test	Test output	Outputs a 4-20 mA test signal. Set in unit of mA. (3.8 to 21.6 mA)		M
	Test Auto Release Time	Auto test release time	Sets the auto release time for loop test, device variable simulation and status simulation. (10 min, 30 min, 60 min, 3 hour, 6 hour, 12 hour)	10 min	W
Low cut	Low cut	Low-cut value setting	Indicates or sets the low-cut reference value for the output. (0.00 to 20.00%)	10.00%	W
	Low cut mode	Low cut mode	Set the output operation for low cut. (Linear, Zero)	Linear	W
Number of preambles	Num req preams	Number of requested preambles	Indicates the number of requested preambles of HART communication.	5	R
	Num resp preams	Number of response preambles	Indicates the number of response preambles.	5	R
Impulse line connection orientation swap	Pres 1/2 Swap	Pres 1/2 swap	Selects the software input Pres 1/Pres 2 swap function. (Normal, Reverse)	Normal	W
Polling address	Poll addr	Polling address	Indicates or sets the polling address for multidrop connection. (0 to 63)	0	W
	Loop current mode	Loop current mode	Sets current output to fixed or variable in multidrop connection. (Disabled, Enabled)	Disabled	W
Process alerts	DP alert mode	Hi/Lo alert mode for differential pressure	Sets the operation mode of the Hi/Lo alarm for differential pressure. (Off, Hi. Al Detect, Lo. Al Detect, Hi/Lo. Al Detect)	Off	W
	DP Hi alert val	High alert value for differential pressure	Set the threshold for the high limit side alarm for differential pressure.		W
	DP Lo alert val	Low alert value for differential pressure	Set the threshold for the low limit side alarm for differential pressure.		W
	Pres 1 alert mode	Hi/Lo alert mode for module 1 side pressure	Sets the operation mode of the Hi/Lo alarm for module 1 side pressure. (Off, Hi. Al Detect, Lo. Al Detect, Hi/Lo. Al Detect)	Off	W
	Pres 1 Hi alert val	High alert value for module 1 side pressure	Sets the threshold for the high limit side alarm for module 1 side pressure.		W
	Pres 1 Lo alert val	Low alert value for module 1 side pressure	Sets the threshold for the low limit side alarm for module 1 side pressure.		W
	Pres 2 alert mode	Hi/Lo alert mode for module 2 side pressure	Sets the operation mode of the Hi/Lo alarm for module 2 side pressure. (Off, Hi. Al Detect, Lo. Al Detect, Hi/Lo. Al Detect)	Off	W
	Pres 2 Hi alert val	High alert value for module 2 side pressure	Sets the threshold for the high limit side alarm for module 2 side pressure.		W
	Pres 2 Lo alert val	Low alert value for module 2 side pressure	Sets the threshold for the low limit side alarm for module 2 side pressure.		W
	Temp 1 alert mode	Hi/Lo alert mode for module 1 capsule temperature	Sets the operation mode of the Hi/Lo alarm for module 1 side capsule temperature. (Off, Hi. Al Detect, Lo. Al Detect, Hi/Lo. Al Detect)	Off	W
	Temp 1 Hi alert val	High alert value for module 1 side capsule temperature	Sets the threshold for the high limit side alarm for module 1 side capsule temperature.	120°C	W
	Temp 1 Lo alert val	Low alert value for module 1 side capsule temperature	Sets the threshold for the low limit side alarm for module 1 side capsule temperature.	–40°C	W
	Temp 2 alert mode	Hi/Lo alert mode for module 2 capsule temperature	Sets the operation mode of the Hi/Lo alarm for module 2 side capsule temperature. (Off, Hi. Al Detect, Lo. Al Detect, Hi/Lo. Al Detect)	Off	W
	Temp 2 Hi alert val	High alert value for module 2 side capsule temperature	Sets the threshold for the high limit side alarm for module 2 side capsule temperature.	120°C	W
	Temp 2 Lo alert val	Low alert value for module 2 side capsule temperature	Sets the threshold for the low limit side alarm for module 2 side capsule temperature.	–40°C	W

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Device variable status	DP Limit Status	Device variable limit status	Indicates the limit status of the differential pressure. (Table 8.7)		R
	DP Data Quality	Device variable data quality	Indicates the quality status of the differential pressure. (Table 8.7)		R
	Pres 1 Limit Status	Device variable limit status	Indicates the limit status of the module 1 side pressure.		R
	Pres 1 Data Quality	Device variable data quality	Indicates the quality status of the module 1 side pressure.		R
	Pres 2 Limit Status	Device variable limit status	Indicates the limit status of the module 2 side pressure.		R
	Pres 2 Data Quality	Device variable data quality	Indicates the quality status of the module 2 side pressure.		R
	Temp 1 Limit Status	Device variable limit status	Indicates the limit status of the module 1 side capsule temperature.		R
	Temp 1 Data Quality	Device variable data quality	Indicates the quality status of the module 1 side capsule temperature.		R
	Temp 2 Limit Status	Device variable limit status	Indicates the limit status of the module 2 side capsule temperature.		R
	Temp 2 Data Quality	Device variable data quality	Indicates the quality status of the module 2 side capsule temperature.		R
	PV % rnge Limit Status	Device variable limit status	Indicates the limit status of the percentage value.		R
	PV % rnge Data Quality	Device variable data quality	Indicates the quality status of the percentage value.		R
	Loop current Limit Status	Device variable limit status	Indicates the limit status of the current (mA).		R
	Loop current Data Quality	Device variable data quality	Indicates the quality status of the current (mA).		R
	DP update time period	Differential pressure update period	Indicates the differential pressure update period.	90 ms	R
	Pres update time period	Pressure update period	Indicates the pressure update period.	90 ms	R
	Temp update time period	Temperature update period	Indicates the temperature update period.	1s	R
Self-diagnostics	Self test	Self-diagnostics	Executes self-diagnostics.		M
	Master test	Master test	Executes a self-test after performing a software reset.		M

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Sensor	Clear DP trim	Differential pressure adjustment level clear	Clears the differential pressure adjustment level.		M
	Cler Pres 1 trim	Module 1 side pressure adjustment level clear	Clears the module 1 side pressure adjustment level.		M
	Cler Pres 2 trim	Module 2 side pressure adjustment level clear	Clears the module 2 side pressure adjustment level.		M
	DP LTD	Differential pressure lower trim deviation	Indicates the lower limit side (zero) adjustment level.		R
	DP LTP	Differential pressure lower trim point	Indicates the lower limit side (zero) adjustment point.		R
	DP UTD	Differential pressure upper trim deviation	Indicates the upper limit side (span) adjustment level.		R
	DP UTP	Differential pressure upper trim point	Indicates the upper limit side (span) adjustment point.		R
	DP trim	Differential pressure adjustment	Adjusts the differential pressure. (auto adjustment, manual adjustment)		M
	DP Zero trim	Differential pressure Zero point adjustment	Performs zero point adjustment under uniform pressure.		M
	Ext SW	External adjustment SW	External adjustment screw permission enabled/disabled	Enabled	W
	Pres 1 LTD	Module 1 side pressure lower trim deviation	Indicates the module 1 side pressure's lower limit side (zero) adjustment level.		R
	Pres 1 LTP	Module 1 side pressure lower trim point	Indicates the module 1 side pressure's lower limit side (zero) adjustment point.		R
	Pres 1 UTD	Module 1 side pressure upper trim deviation	Indicates the module 1 side pressure's upper limit side (span) adjustment level.		R
	Pres 1 UTP	Module 1 side pressure upper trim point	Indicates the module 1 side pressure's upper limit side (span) adjustment point.		R
	Pres 1 trim	Module 1 side pressure adjustment	Performs module 1 side pressure adjustment. (auto adjustment, manual adjustment)		M
	Pres 2 LTD	Module 2 side pressure lower trim deviation	Indicates the module 2 side pressure's lower limit side (zero) adjustment level.		R
	Pres 2 LTP	Module 2 side pressure lower trim point	Indicates the module 2 side pressure's lower limit side (zero) adjustment point.		R
	Pres 2 UTD	Module 2 side pressure upper trim deviation	Indicates the module 2 side pressure's upper limit side (span) adjustment level.		R
	Pres 2 UTP	Module 2 side pressure upper trim point	Indicates the module 2 side pressure's upper limit side (span) adjustment point.		R
	Pres 2 trim	Module 2 side pressure adjustment	Performs module 2 side pressure adjustment. (auto adjustment, manual adjustment)		M
	Trim Date	Adjustment execution date	Sets or displays the adjustment execution date. (**/**/**)		W
	Trim Desc	Description about the adjustment (memo)	Memo field for entering information about the adjustment. Up to 16 alphanumeric characters		W
	Trim Loc	Adjustment execution location	Stores the adjustment execution location. Up to 8 alphanumeric characters		W
	Trim Who	Adjustment execution person	Stores the name of the person who performed the adjustment. Up to 8 alphanumeric characters		W

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Signal characterizer	Num of points	Number of points	Set the number of points for signal characterizer.(0 to 30)	19	W
	Tank memo	Description about the tank settings	Stores description about the tank settings. Up to 32 alphanumeric characters		W
	X1 to X30	X coordinate	Segment characterizer point		W
	Y1 to Y30	Y coordinate	Segment characterizer point		W
	X End	X coordinate end point	Segment characterizer end point	100.000%	R
	X Start	X coordinate start point	Segment characterizer start point	0.000%	R
	X Y initialize	X, Y coordinate initialization	Set all X,Y in 0%, Divide X,Y into 20 (5%/div)		M
	Y End	Y coordinate end point	Segment characterizer end point	100.000%	R
	Y Start	Y coordinate start point	Segment characterizer start point	0.000%	R
Pres 1 setup	Pres 1 damp	Module 1 side pressure damping setting	Sets the module 1 side pressure damping constant. (0.00 to 100.00 s)	2.00 s	W
	Pres 1 LRV	Lower range value of module 1 side pressure	Sets the lower range value of the module 1 side pressure.	0.000000 MPa	W
	Pres 1 LSL	Lower sensor limit of module 1 side pressure	Indicates the lower limit of the module 1 side pressure that can be set.		R
	Pres 1 Min span	Module 1 side minimum span	Indicates the minimum span information of the module 1 side pressure.		R
	Pres 1 URV	Upper range value of module 1 side pressure	Sets the upper range value of the module 1 side pressure.		W
	Pres 1 USL	Upper sensor limit of module 1 side pressure	Indicates the upper limit of the module 1 side pressure that can be set.		R
Pres 2 setup	Pres 2 damp	Module 2 side pressure damping setting	Sets the module 2 side pressure damping constant. (0.00 to 100.00 s)	2.00 s	W
	Pres 2 LRV	Lower range value of module 2 side pressure	Sets the lower range value of the module 2 side pressure.	0.000000 MPa	W
	Pres 2 LSL	Lower sensor limit of module 2 side pressure	Indicates the lower limit of the module 2 side pressure that can be set.		R
	Pres 2 Min span	Module 2 side minimum span	Indicates the minimum span information of the module 2 side pressure.		R
	Pres 2 URV	Upper range value of module 2 side pressure	Sets the upper range value of the module 2 side pressure.		W
	Pres 2 USL	Upper sensor limit of module 2 side pressure	Indicates the upper limit of the module 2 side pressure that can be set.		R
	Fixed value	Module 2 side pressure fixed mode	Sets the module 2 side pressure mode. (No, Yes, Fall Back)	No	W
	Pres 2 fixed val	Module 2 side pressure fixed value	Sets the fixed value of the module 2 side pressure.	0.000000 MPa	W

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Status	Device status	Field device status	Indicates the status.		R
	Diagnostic status 0	Diagnostic status	Indicates device diagnostic status		R
	Diagnostic status 1	Diagnostic status	Indicates device diagnostic status		R
	Status group 0	Hardware status information	Indicates module 1 side hardware failure errors.		R
	Status group 1	Hardware status information	Indicates module 1 side hardware failure errors.		R
	Status group 2	Process status information	Indicates module 1 side process errors (outside-the-specification-range error)		R
	Status group 3	Process status information	Indicates module 1 side process errors (outside-the-specification-range error)		R
	Status group 4	Process status information	Indicates module 1 side process errors (outside-the-measuring-range error)		R
	Status group 5	Configuration status information	Indicates module 1 side configuration errors.		R
	Status group 14	Configuration status information	Indicates module 1 side configuration errors.		R
	Status group 15	Process status information	Indicates diagnostic alarms.		R
	Status group 16	Process status information	Indicates diagnostic alarms.		R
	Status group 17	Process status information	Indicates the simulation status.		R
	Status group 18	Hardware status information	Indicates module 2 side hardware failure errors.		R
	Status group 19	Process status information	Indicates module 2 side process errors (outside-the-specification-range error)		R
	Status group 20	Process status information	Indicates module 2 side process errors (outside-the-specification-range error)		R
	Status group 21	Process status information	Indicates module 2 side process errors (outside-the-measuring-range error)		R
	Status group 22	Configuration status information	Indicates module 2 side configuration errors.		R
	Status group 23	Configuration status information	Indicates module 2 side configuration errors.		R
	Ext dev status	Extended field device status	Indicates the status.		R
	Cfg chng count	Configuration change counter	Indicates the number of times parameter configuration has changed.	0	R
	Reset Cfg chng flag	Reset configuration change flag	Resets the configuration change flag.		M
	Current Date	Data timestamp	Indicates the UTC year, month, and day when data was read. The reference date is set from a host system.	1970/01/01	R
	Current Time	Data timestamp	Indicates the UTC time when data was read. The reference date is set from a host system.	00:00:00	R
Tag number	Tag	Tag number	Indicates or sets the tag number. Up to 8 alphanumeric characters	As specified in order	W
	Long tag	Long tag number	Indicates or sets the long tag number. Up to 32 alphanumeric characters	As specified in order	W

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Temperature compensation	T.Z. Cmp mode 1	Module 1 side temperature zero compensation mode	Selects the module 1 side temperature zero compensation mode (On, Off)	Off	W
	T.Z. Cmp mode 2	Module 2 side temperature zero compensation mode	Selects the module 2 side temperature zero compensation mode (On, Off)	Off	W
	Temp 1 zero	Module 1 side temperature zero compensation coefficient	Sets the temperature gradient of the module 1 side temperature zero compensation coefficient. (–99.999 to 99.999%/°C)	0.000%/degC	W
	Temp 2 zero	Module 2 side temperature zero compensation coefficient	Sets the temperature gradient of the module 2 side temperature zero compensation coefficient. (–99.999 to 99.999%/°C)	0.000%/degC	W
Temperature sensor	Amp temp	Module 1 side amplifier temperature	Indicates the amplifier (amplifier assembly) temperature.		R
	Temp 2 fixed val	Module 2 side capsule temperature fixed value	Sets the module 2 side capsule temperature fixed value.	23 degC	W
Unit	DP unit	Differential pressure unit	Sets the differential pressure unit.		W
	Pres 1 unit	Module 1 side pressure unit	Sets the module 1 side pressure unit.		W
	Pres 2 unit	Module 2 side pressure unit	Sets the module 2 side pressure unit.		W
	Temp unit	Temperature unit	Sets the temperature unit.		W
Write protection	Enable wrt 10min	Write protection release	Temporarily releases write protection (10 minutes). (Enter an 8 alphanumeric character parameter.)		M
	New password	Password setting	Sets the write protection release password and enables or disables the function. (8 alphanumeric characters)		M
	Write protect	Communication writing enabled/disabled	Indicates the write protection status. (Yes, No)	No	R
Device variable	Loop current	Output current	Indicates the 4 to 20 mA output current.		R
	PV % rnge	Percentage output	Indicates the 4 to 20 mA output as a percentage.		R
	DP	Differential pressure	Indicates the differential pressure.		
	Pres 1	Module 1 side pressure	Indicates the module 1 side pressure.		R
	Pres 2	Module 2 side pressure	Indicates the module 2 side pressure.		R
	Temp 1	Module 1 side capsule temperature	Indicates the temperature at the module 1 side capsule temperature sensor.		R
	Temp 2	Module 2 side capsule temperature	Indicates the temperature at the module 2 side capsule temperature sensor.		R
Device variable simulation	Device vars simulate	Device variable simulation execution	Execute the simulation.		M

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Process variables	Change PV Assgn	PV assignment	Specifies the variable to assign to PV (primary variable). (DP, Pres 1, Pres 2)		M
	PV is	PV assignment	Indicates the variable currently assigned to PV.	DP	R
	Change SV Assgn	SV assignment	Specifies the variable to assign to SV(secondary variable).(DP, Pres 1, Pres 2, Temp 1, Temp 2)		M
	SV is	SV assignment	Indicates the variable currently assigned to SV.	Pres 1	R
	Change TV Assgn	TV assignment	Specifies the variable to assign to TV(Teritary variable).(DP, Pres 1, Pres 2, Temp 1, Temp 2)		M
	TV is	TV assignment	Indicates the variable currently assigned to TV.	Pres 2	R
	Change QV Assgn	QV assignment	Specifies the variable to assign to QV(Quaternary variable).(DP, Pres 1, Pres 2, Temp 1, Temp 2)		M
	QV is	QV assignment	Indicates the variable currently assigned to QV.	Temp 1	R

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Advanced diagnostic (ILBD)	Diag Applicable	Detectable diagnostic	Indicates the available blockage detection functions after acquiring the reference values.		R, G
	Diag DPComp	Ratio fDP compensation selection	Enables or disables Ratio fDP compensation. Compensation or Non-Compensation	Compensation	W, G
	Diag Error	Results detected by ILBD or heat trace monitoring	Display a result of alarm for impulse line blocking and flange temperature		R, G
	Lim fDPmax	Ratio fDP upper limit threshold	Threshold for detecting “A Blocking” using Ratio fDP.	3.00	W, G
	Lim fDPmin	Ratio fDP lower limit threshold	Threshold for detecting “B Blocking” using Ratio fDP.	0.30	W, G
	Lim fP2max	Ratio fP2 upper limit threshold	Threshold for detecting “ Large Fluct Pres 2” using Ratio fP2	3.00	W, G
	Lim fP2min	Ratio fP2 lower limit threshold	Threshold for detecting “Pres 2 Side Blocking” using Ratio fP2.	0.30	W, G
	Lim fP1max	Ratio fP1 upper limit threshold	Threshold for detecting “ Large Fluct Pres 1” using Ratio fP1.	3.00	W, G
	Lim fP1min	Ratio fP1 lower limit threshold	Threshold for detecting “Pres 1 Side Blocking” using Ratio fP1.	0.30	W, G
	Lim BlkFmax	Blkf upper limit threshold	Threshold for detecting “Pres 1 Side Blocking” using BlkF.	0.60	W, G
	Lim BlkFmin	Blkf lower limit threshold	Threshold for detecting “Pres 2 Side Blocking” using BlkF.	–0.60	W, G
	Lim DPAvgmax	DPAvg upper limit threshold	Threshold for detection “ILDB over Range” using DPAvg and “Invalid Ref DP” using Ref DPAvg.	1.00	W, G
	Lim DPAvgmin	DPAvg lower limit threshold	Threshold for detection “ILDB over Range” using DPAvg and “Invalid Ref DP” using Ref DPAvg.	–1.00	W, G
	Set Diag Mode	ILBD operation mode	Stop, calculation, reference		M, G
	Diag Mode	ILBD operation mode	Stop, calculation, reference	Stop	R, G
	Diag Option	Alarm masking	Sets the alarms to output or display.	0x08f8	W, G
	Diag Out Option	4 to 20 mA output mode for when advanced diagnostic alarms occur	Select from Off, Burnout, and Fall back.	Off	W, G
	Diag Fixed Out Val	Current output value for when advanced diagnostic alarms occur	Set the output value (3.80 to 21.60 mA) when Diag Out Option is set to Fall back.	21.60 mA	W, G
	Diag Period	Sampling period	Sampling period per count (Diag Supp Count)	180 s	W, G
	Diag Description	Memo field	Up to 32 alphanumeric characters		W, G
	fDP	Average value of the sum of squares of differential pressure fluctuation.			R, G
	fDP Status	Status of fDP			R, G
	fP2	Average of the sum of squares of the module 2 side pressure fluctuation			R, G
	fP2 Status	Status of fP2			R, G
	fP1	Average of the sum of squares of the module 1 side pressure fluctuation			R, G
	fP1 Status	Status of fP1			R, G
	Ref fDP	fDP reference value			W, G
	Ref fDP Status	Status of Ref fDP			R, G
	Ref fP2	fP2 reference value			W, G
	Ref fP2 Status	Status of Ref fP2			R, G
	Ref fP1	fP1 reference value			W, G

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

Function	Label	Item	Description	Factory Default Value	R/W*1
Advanced diagnostic (ILBD)	Ref fP1 Status	Status of Ref fP1			R, G
	Ref BlkF	BlkF reference value			W, G
	Ref BlkF Status	Status of Ref BlkF			R, G
	Ref DPAvg	DPAvg reference value			W, G
	Ref DPAvg Status	Ref DPAvg status			R, G
	Ref Lim fDPmin	Minimum fDP reference threshold	Minimum Ref fDP needed to execute blockage detection	7.000E-10	W, G
	Ref Lim fPmin	Minimum fP1, fP2 reference threshold	Minimum Ref fP1, fP2 needed to execute blockage detection	7.000E-10	W, G
	Ref Lim BlkFmax	Maximum BlkF reference threshold	Maximum Ref BlkF needed to execute blockage detection	0.50	W, G
	Diag Supp Count	Detection count to generate an alarm	Sets how many times the differential pressure/pressure fluctuation parameter is to exceed the threshold for the error alarm to be generated.	3	W, G
	Ratio fDP	SQRT (fDP/Ref fDP)	A value obtained by comparing the root mean square (RMS) of the differential pressure fluctuation		R, G
	Ratio fDP Status	Status of Ratio fDP			R, G
	Ratio fP2	SQRT (fP2/Ref fP2)	A value obtained by comparing the root mean square (RMS) of the module 2 side pressure fluctuation		R, G
	Ratio fP2 Status	Status of Ratio fP2			R, G
	Ratio fP1	SQRT (fP1/Ref fP1)	A value obtained by comparing the root mean square (RSM) of the module 1 side pressure fluctuation		R, G
	Ratio fP1 Status	Status of Ratio fP1			R, G
	BlkF	A value obtained by comparing module 1 side pressure and module 2 side pressure	A value indicating the blockage level, which is characterized by comparing the module 1 side pressure fluctuation and module 2 side pressure fluctuation		R, G
	BlkF Status	Status of BlkF			R, G
	DPAvg	Average differential pressure	Ratio of the average of differential pressure to the maximum span		R, G
	DPAvg Status	Status of DPAvg			R, G
	CRatio fDP	Compensated fDP	fDP value compensated with average differential pressure		R, G
	CRatio fDP Status	Status of CRatio fDP			R, G
	NRatio fDP	Non-compensated fDP	Non-compensated fDP		R, G
	NRatio fDP Status	Status of NRatio fDP			R, G
Advanced Diagnostic (heat trace monitoring)	Flg temp coef	Flange temperature coefficient		0	W, G
	Flg temp Hi alert val	Upper limit of flange temperature	Sets the upper limit threshold for detecting high temperature error.	120 degC	W, G
	Flg temp Lo alert val	Lower limit of flange temperature	Sets the upper limit threshold for detecting low temperature error.	–40 degC	W, G
	Flg temp	Flange temperature			R, G
Optional specification addition	Option Password	Function addition password for software option	Sets the password that enables the software option.	(Space)	W

*1: R:read only, W:read and write, M:method, G:applicable for option code /DG6.

10. General Specifications

Please refer to the following General Specifications list for the specifications, model, suffix and option codes, and external dimensions of each product.
For the specifications specific to the Digital Remote Sensor, refer to the General Specification GS 01C25W05-01EN, and GS 01C25W01-01EN if flange mounted type is specified.
For those specifications which are common with the original transmitters, refer to the General Specifications of each transmitter(EJX530A or EJX630A.)
The General Specifications can be downloaded from the website of Yokogawa.
Website address: https://www.yokogawa.com/solutions/products-platforms/field-instruments/

■ General Specifications List

Model	Document Title	Document No.
EJX110A	Differential Pressure Transmitter	GS 01C25B01-01EN
EJX120A	Differential Pressure Transmitter	GS 01C25B03-01EN
EJX130A	Differential Pressure Transmiter	GS 01C25B04-01EN
EJX210A	Flange Mounted Differential Pressure Transmitter	GS 01C25C01-01EN
EJX310A	Absolute Pressure Transmitter	GS 01C25D01-01EN
EJX430A	Gauge Pressure Transmitter	GS 01C25E01-01EN
EJX440A	Gauge Pressure Transmitter	GS 01C25E02-01EN
EJX510A, EJX530A	Absolute and Gauge Pressure Transmitters	GS 01C25F01-01EN
EJX610A, EJX630A	Absolute and Gauge Pressure Transmitters	GS 01C25F05-01EN
EJX118A	Diaphragm Sealed Differential Pressure Transmitter	GS 01C25H01-01EN
EJX118A	Diaphragm Sealed Differential Pressure Transmitter (Inner Diaphragm type)	GS 01C25H01-11EN
EJX438A	Diaphragm Sealed Gauge Pressure Transmitter	GS 01C25J03-01EN
EJX438A	Diaphragm Sealed Gauge Pressure Transmitter (Inner Diaphragm type)	GS 01C25J03-11EN
EJX115A	Low Flow Transmitter	GS 01C25K01-01EN
EJX910A	Multivariable Transmitter	GS 01C25R01-01EN
EJX930A	Multivariable Transmitter	GS 01C25R04-01EN
EJXC50A, EJXC40A, EJAC50E, C20FE, C20FW, C10FR, EJXC80A, EJAC80E, C81FA, C82FA, C81FD, C82FD, C30SW, C30SE, C80FW, C80FE, EJXC81A, EJAC81E, C70SE, C70SW	Diaphragm Seal System	GS 01C25W01-01EN
EJXC40A	Digital Remote Sensor	GS 01C25W05-01EN
EJX110A, EJX130A	Differential Pressure Transmitter High Damping Capsule (Option Code: /HD)	GS 01C25V01-01EN
EJX110A	Differential Pressure Transmitters High Damping Capsule (General) (Option Code: /HD2)	GS 01C25V02-01EN
EJX-A, EJA-E	Explosion Protected Type and Marine Certificate Type	GS 01C25A20-01EN
EJA110E	Differential Pressure Transmitter	GS 01C31B01-01EN
EJA120E	Differential Pressure Transmitter	GS 01C31B03-01EN
EJA130E	Differential Pressure Transmitter	GS 01C31B04-01EN
EJA210E	Flange Mounted Differential Pressure Transmitter	GS 01C31C01-01EN
EJA310E	Absolute Pressure Transmitter	GS 01C31D01-01EN
EJA430E	Gauge Pressure Transmitter	GS 01C31E01-01EN
EJA440E	Gauge Pressure Transmitter	GS 01C31E02-01EN
EJA510E, EJA530E	Absolute Pressure Transmitter and Gauge Pressure Transmitter	GS 01C31F01-01EN
EJA118E	Diaphragm Sealed Differential Pressure Transmitter	GS 01C31H01-01EN
EJA118E	Diaphragm Sealed Differential Pressure Transmitter (Inner Diaphragm type)	GS 01C31H01-11EN
EJA438E	Diaphragm Sealed Gauge Pressure Transmitter	GS 01C31J03-01EN
EJA438E	Diaphragm Sealed Gauge Pressure Transmitter (Inner Diaphragm type)	GS 01C31J03-11EN
EJA115E	Low Flow Transmitter	GS 01C31K01-01EN
EJAC60E, EJA560E	Hygienic Adapter System (Fluidless Type) Hygienic Gauge Pressure Transmitter (Fluidless Type)	GS 01C31Y01-01EN
EJA110E, EJA130E	Differential Pressure Transmitter High Damping Capsule (Option Code: /HD)	GS 01C31V01-01EN
EJA110E	Differential Pressure Transmitters High Damping Capsule (General) (Option Code: /HD2)	GS 01C31V02-01EN

If you cannot find it on our website, please contact YOKOGAWA office.

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 10 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 A1.1 Required Parameter Settings

Item	Description
Burnout direction switch	To specify if the output should go 21.6 mA or higher or 3.8 mA or lower upon detection of an internal failure.
Write protection switch	The write function should be disabled.

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

Testing method	Tools required	Expected outcome	Remarks
Functional test: 1. Follow all Management of Change procedures to bypass logic solvers if necessary. 2. Execute HART command to send value to high alarm (21.5 mA) and verify that current has reached this level. 3. Execute HART command to send value to low alarm (3.6 mA) and verify that current has reached this level. 4. Restore logic solvers operation and verify.	• Handheld terminal • Calibrated pressure source	Proof Test Coverage =68%	The output needs to be monitored to assure that the transmitter communicates the correct signal.
Perform three point calibration along with the functional test listed above.			

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 10 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

The failure rate and failure mode are the following values.

Device	λ_{SD}	λ_{SU}	λ_{DD}	λ_{DU}	SFF
EJX DRS	---	161	977	95	92.4%

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 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 transmitter 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

Appendix 2. ILBD Check List

Fill out the below checklist according to the operation flow of the ILBD in order to keep the important information for the blockage detection.

Checklist (1/5)

No.	Items	Parameters	Result	Example
1	4-20 mA Analog Signal Setting • Select the output mode when an alarm is generaed.	Diag Out Option	Off: ☐	☑
			Burnout: ☐	☐
			Fall back: ☐	☐
		Diag Fixed Out Val	mA	21.6 mA
2	Stability of Pres (differential pressure) under normal condition • Check that the status of **DP** is “GOOD”. • Check the maximum and minimum values of **DP**.	Status		Good
		DP	Max.: Min.:	Max.: 12.3 kPa Min.: 12.1 kPa
3	**fDP** under normal condition • Check that the value of **fDP** is more than $7x10^{-10}$.	fDP	☐	☑
4	Start to obtain Reference values • Set "Reference" to **Diag Mode**.	Diag Mode	☐	☑
5	End of Reference Value Sampling • Check that **Diag Mode** is “Calculation” after the time set to "Diag Period" passed.	Diag Mode	☐	☑
6	Alarm setting • Record the status of Checkbox in **Diag Option**.	Diag Option		
		A Blocking	☐	☑
		Large Fluct Pres 2	☐	☑
		Large Fluct Pres 1	☐	☑
		Pres 2 Side Blocking	☐	☑
		Pres 1 Side Blocking	☐	☑
		B Blocking	☐	☑
		Invalid Ref BlkF	☐	☑
		Invalid Ref Pres 1	☐	☐
		Invalid Ref Pres 2	☐	☐
		Invalid Ref DP	☐	☑
		ILBD over range	☐	☐

Checklist (2/5)

No.	Items	Parameters	Result	Example
7	Alarm status • Check the alarm status shown in **Diag Error**. • Check that the alarm status of “ILBD over range” is not shown in **Diag Error**.	Diag Error		
		A Blocking	☐	☐
		Large Fluct Pres 2	☐	☐
		Large Fluct Pres 1	☐	☐
		Pres 2 Side Blocking	☐	☐
		Pres 1 Side Blocking	☐	☐
		B Blocking	☐	☐
		Invalid Ref BlkF	☐	☑
		Invalid Ref Pres 1	☐	☐
		Invalid Ref Pres 2	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
8	ILBD parameters • Record the values of parameters for ILBD operation. • Check the status of parameters for ILBD operation. *: Record the value after checked that the status of each parameter is “GOOD”.	Diag Period		180
		Lim fDPmax		3.000000
		Lim fDPmin		0.300000
		Lim fP2max		5.000000
		Lim fP2min		0.500000
		Lim fP1max		5.000000
		Lim fP1min		0.500000
		Lim BlkFmax		0.600000
		Lim BlkFmin		-0.600000
		Lim DPAvgmax		1.000000
		Lim DPAvgmin		0.050000
		Diag Supp Count		3
		Ref fDP*		7.43245E-09
		Ref fSPl*		7.25765E-09
		Ref fSPh*		7.18374E-09
		Ref DPAvg*		5.36425E+00
		fDP*		7.48562E-09
		fP2*		7.23277E-09
		fP1*		7.14085E-09
		BlkF*		-0.287259
		DPAvg*		0.055957

Checklist (3/5)

Go to the following step according to the result of "Invalid Ref xx" shown in the **Diag Error** of 8th check item.

Diag Error				Check item
Invalid Ref Pres 1	Invalid Ref Pres 2	Invalid Ref DP		
☐	☐	☐	→	9-a
☑	☑	☐	→	9-b

☑: The alarm is generated.
☐: The alarm is not generated.

No.	Items	Parameters	Result	Example
9-a	Simulation of Blockage detection operation • Pres 1 Side Blocking: 9-a-1 • Pres 2 Side Blocking: 9-a-2 • Both Side Blocking: 9-a-3			
9-a-1	Pres 1 Side Blocking • Close the high-pressure side valve completely.			
	• Record the values of **fDP**, **fP1**, **fP2**, and **BlkF** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		3.74856E-08
		fP2*		6.23277E-09
		fP1*		1.51409E-10
		BlkF		0.8658873
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “A Blocking” and “Pres 1 Side Blocking” are set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☑
		Large Fluct L	☐	☐
		Large Fluct H	☐	☐
		Pres 2 Side Blocking	☐	☐
		Pres 1 Side Blocking	☐	☑
		B Blocking	☐	☐
		Invalid Ref BlkF	☐	☐
		Invalid Ref Pres 1	☐	☐
		Invalid Ref Pres 2	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “Pres 1 Side Blocking” is generated. • Check that the alarm of “Pres 2 Side Blocking” is not generated.	Diag Error		
		Pres 2 Side Blocking	☐	☐
		Pres 1 Side Blocking	☐	☑

Checklist (4/5)

No.	Items	Parameters	Result	Example
9-a-2	L Side Blocking • Close the low-pressure side valve completely.			
	• Record the values of **fDP**, **fP2**, **fP1**, and **BlkF** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		6.48562E-08
		fP2*		2.23277E-10
		fP1*		7.01528E-09
		BlkF		-0.827259
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “A Blocking” and “L Side Blocking” are set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☑
		Large Fluct Pres 2	☐	☐
		Large Fluct Pres 1	☐	☐
		Pres 2 Side Blocking	☐	☑
		Pres 1 Side Blocking	☐	☐
		B Blocking	☐	☐
		Invalid Ref BlkF	☐	☐
		Invalid Ref Pres 2	☐	☐
		Invalid Ref Pres 1	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “Pres 2 Side Blocking” is generated. • Check that the alarm of “Pres 1 Side Blocking” is not generated.	Diag Error		
		Pres 2 Side Blocking	☐	☑
		Pres 1 Side Blocking	☐	☐
9-a-3	Both Side Blocking • Close the both-pressure side valves completely.			
	• Record the values of **fDP**, **fP2**, **fP1**, and **BlkF** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		1.48562E-10
		fP2*		1.72328E-10
		fP1*		1.14085E-10
		BlkF		-0.387451
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “Pres 1 Side Blocking”, “Pres 2 Side Blocking”, and “B Blocking” are set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☐
		Large Fluct Pres 2	☐	☐
		Large Fluct Pres 1	☐	☐
		Pres 2 Side Blocking	☐	☑
		Pres 1 Side Blocking	☐	☑
		B Blocking	☐	☑
		Invalid Ref BlkF	☐	☐
		Invalid Ref Pres 1	☐	☐
		Invalid Ref Pres 2	☐	☐
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “B Blocking” is generated.	Diag Error		
		B Blocking	☐	☑

Checklist (5/5)

No.	Items	Parameters	Result	Example
9-b	Simulation of Blockage detection operation • Close completely the valve for the side where the alarm of Invalid Reference Value is not generated.			
	For the case that the high-pressure side value is closed; • Record the values of **fDP** and **fP1** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		5.48562E-08
		fP1*		7.14085E-11
	For the case that the low-pressure side value is closed; • Record the values of **fDP**and **fP2** after the certain time, (**Diag Period X Diag Supp Count**), passed. *: Record the value after checked that the status is “GOOD”.	fDP*		3.48562E-08
		fP2*		1.12328E-10
	• Record the status of Checkbox in **Diag Option**. • Check that the alarms status of “B Blocking” is set. Note: If the alarm of “ILBD over range” is generated, the valve may be closed too much tightly. Open valve a little and record the updated status of the parameters.	Diag Option		
		A Blocking	☐	☐
		Large Fluct Pres 2	☐	☐
		Large Fluct Pres 1	☐	☐
		Pres 2 Side Blocking	☐	☐
		Pres 1 Side Blocking	☐	☐
		B Blocking	☐	☑
		Invalid Ref BlkF	☐	☑
		Invalid Ref Pres 1	☐	☐
		Invalid Ref Pres 2	☐	☑
		Invalid Ref DP	☐	☐
		ILBD over range	☐	☐
	• Check that the alarm of “B Blocking” is not generated.	Diag Error		
		B Blocking	☐	☑

Revision Information

- Title : Digital Remote Sensor
- Manual No. : IM 01C25W05-01EN

Edition	Date	Page	Revised Item
1st	June 2016	—	New publication
2nd	Dec. 2016	—	Add hygienic type direct mounted seal. Add /FS14, /FU14, /KS24, /KU24, /SS24 and /SU24.
		1-2	1. Add WARNING for the digital remote sensor's model structure. Modify NOTE.
		2-1	2.1 Modify figure 2.2
		2-4	Add 2.9.
		4-1	4.2 Add information for hygienic seals.
		4-2	Add figures 4.6 and 4.7.
		4-4	4.4.1 Add handling note for C10FR.
		4-5	4.5 Add notes to 4) in 'IMPORTANT.'
		4-6	Add 4.6
		5-2	5.3.3 Add load resistance value.
		10-1, 10-4 to 10-6	10.1 Add information for hygienic seals.
		10-7, 10-8	10.2 Change "Model" to "Combination Model"
		10-11 to 10-23	10.2 Update the codes. Add C30SE and C30SW. Add a tank spud.
		10-27, 10-28	10.3 Add explosion protected type. Add C30SW and C30SE.
		10-31 to 10-34	10.4 Update the dimensions. Add C30SW and C30SE.
3rd	Jan. 2019	—	Approved to IEC61508 by Notification body.
		1-2	Add notes for keeping the manual and tag.
		2-4, 2-5	2.9.1 Add "certification information." Update applicable standards. Add WARNING for repair.
		2-9 to 2-11	2.9.2 a and b. Add "certification information." Update applicable standards and type of protection.
		2-11	2.9.2 b. Add three items in the Note 6.
		2-12	2.9.3 Add "certification information." Update applicable standards.
		2-13	Modify Note 4.
		2-15	2.9.4 Update type of protection for /KF22.
		4-5	4.4.2 Correct parts number in the table 4.1.
		4-8	4.7 Modify description for rotation.
		5-3 to 5-6	5.4.2 to 5.5.3 Modify explanations.
		10-6	10.1 Add EU RoHS Directive and SIL Certification. Modify Housing.
		10-25	10.3 Add descriptions for cable.
		A1-1 to A1-3	Add "Appendix 1. Safety Instrumented Systems Installation"
4th	Nov. 2019	2-9	2.9.1 Updates applicable standards for FM explosionproof.
		4-1	4.1 Add notes for foreign item in IMPORTANT.
		4-2	4.2 Add table for ød.
		5-3	5.5 Add CAUTION for cable glands.
		10-1	10. Delete Standard Specifications and add guide to GS.
5th	April 2020	2-4	2.9.1 a. Update applicable standards.
		2-9 to 2-10	2.9.1 b. Update applicable standards. 2.9.2 a. Update applicable standards.
		2-10 to 2-11	2.9.2 b. Update applicable standards. Update Note 3, 4 and 6.
		2-12	2.9.3 a. Update applicable standards.
		2-15	2.9.4 Update ATEX flameproof nameplate.
6th	July 2021	2-9	2.9.2 a. Update type of protection and marking code.
		2-10	2.9.2 b. Update type of protection and marking code.