User's Manual

DPharp EJX™

EJX Series
HART Communication Type

IM 01C25T01-01E

YOKOGAWA
Yokogawa Electric Corporation

IM 01C25T01-01E
3rd Edition

CONTENTS

1. INTRODUCTION

Thank you for purchasing the DPharp EJX electronic pressure transmitter.

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

This manual describes the HART protocol communication functions of the EJX series and explains how to set the parameters for EJX series pressure transmitters using the 275 HART Communicator. For information on the installation, wiring, and maintenance of EJX series pressure transmitters, please refer to the user's manual of each model.

WARNING

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

■ Regarding This Manual

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

WARNING

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

CAUTION

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

IMPORTANT

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

NOTE

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

1.1 Safe Use of This Product

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

(a) Installation

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

(b) Wiring

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

(c) Operation

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

(d) Maintenance

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

(e) Modification

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

1.2 Warranty

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

1.3 ATEX Documentation

This setion is only applicable to the countries in the European Union.

GB

All instruction manuals for ATEX Ex related products are available in English, German and French. Should you require Ex related instructions in your local language, you are to contact your nearest Yokogawa office or representative.

DK

Alle brugervejledninger for produkter relateret til ATEX Ex er tilgængelige på engelsk, tysk og fransk. Skulle De ønske yderligere oplysninger om håndtering af Ex produkter på eget sprog, kan De rette henvendelse herom til den nærmeste Yokogawa afdeling eller forhandler.

I

Tutti i manuali operativi di prodotti ATEX contrassegnati con Ex sono disponibili in inglese, tedesco e francese. Se si desidera ricevere i manuali operativi di prodotti Ex in lingua locale, mettersi in contatto con l'ufficio Yokogawa più vicino o con un rappresentante.

E

Todos los manuales de instrucciones para los productos antiexplosivos de ATEX están disponibles en inglés, alemán y francés. Si desea solicitar las instrucciones de estos artículos antiexplosivos en su idioma local, deberá ponerse en contacto con la oficina o el representante de Yokogawa más cercano.

NL

Alle handleidingen voor producten die te maken hebben met ATEX explosiebeveiliging (Ex) zijn verkrijgbaar in het Engels, Duits en Frans. Neem, indien u aanwijzingen op het gebied van explosiebeveiliging nodig hebt in uw eigen taal, contact op met de dichtstbijzijnde vestiging van Yokogawa of met een vertegenwoordiger.

SF

Kaikkien ATEX Ex -tyyppisten tuotteiden käyttöhjeet ovat saatavilla englannin-, saksan- ja ranskankielisinä. Mikäli tarvitsette Ex -tyyppisten tuotteiden ohjeita omalla paikallisella kielellännne, ottakaa yhteyttä lähimpään Yokogawa-toimistoon tai -edustajaan.

P

Todos os manuais de instruções referentes aos produtos Ex da ATEX estão disponíveis em Inglês, Alemão e Francês. Se necessitar de instruções na sua língua relacionadas com produtos Ex, deverá entrar em contacto com a delegação mais próxima ou com um representante da Yokogawa.

F

Tous les manuels d'instruction des produits ATEX Ex sont disponibles en langue anglaise, allemande et française. Si vous nécessitez des instructions relatives aux produits Ex dans votre langue, veuillez bien contacter votre représentant Yokogawa le plus proche.

D

Alle Betriebsanleitungen für ATEX Ex bezogene Produkte stehen in den Sprachen Englisch, Deutsch und Französisch zur Verfügung. Sollten Sie die Betriebsanleitungen für Ex-Produkte in Ihrer Landessprache benötigen, setzen Sie sich bitte mit Ihrem örtlichen Yokogawa-Vertreter in Verbindung.

S

Alla instruktionsböcker för ATEX Ex (explosionssäkra) produkter är tillgängliga på engelska, tyska och franska. Om Ni behöver instruktioner för dessa explosionssäkra produkter på annat språk, skall Ni kontakta närmaste Yokogawakontor eller representant.

GR

Όλα τα εγχειρίδια λειτονργίας των προϊόντων με ATEX Ex διατίθενται στα Αγγλικά, Γερμανικά και Γαλλικά. Σε περίπτωση που χρειάζεστε οδηγίες σχετικά με Ex στην τοπική γλώσσα παρακαλούμε επικοινωνήστε με το πλησιέστερο γραφείο της Yokogawa ή αντιπρόσωπο της.

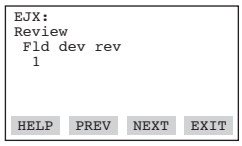
1.4 Matching of Communicator DD and Instrument DD

CAUTION

Before using the 275 HART Communicator, make that the device description(DD) installed in the communicator matches that of the instrument that is being set up. To check the DD of the instrument and the HART communicator, follow the steps below. If the correct DD is not installed in the communicator, you must upgrade the DD at an authorized facility. For communication tools other than the 275 HART Communicator, contact the vendor for upgrade information.

1. Checking the DD of the instrument
   1) Connect the communicator to the instrument that is being set up.
   2) Call **Device setup** and press [→].
   3) Call **Review** and press [→].
   4) Press [NEXT] or [PREV] to display **Fld dev rev** to show the DD of the instrument.

[Example]



The instrument DD version is 1.

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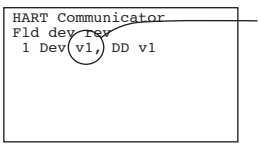
2. Checking the DD of the 275 HART Communicator
   1) Turn on only the communicator.
   2) Call **Utility** from the main menu and press [→].
   3) Call **Simulation** and press [→].
   4) Select **YOKOGAWA** from the list of manufacturers by pressing [↓] and press [→].
   5) Select the model name of the instrument(i.e. EJX) by pressing [↓] and press [→] to show the DD of the communicator.

[Example]



Version 1.

The communicator DD supports Version 1.

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2. CONDITIONS OF COMMUNICATION LINE

The HART communication signal is superimposed onto the 4 to 20 mA DC analog signal. Since the modulated wave is a communication signal, superimposing it on the normal signal will, from basic principles, cause no error in the DC component of the analog signal. Thus, monitoring can be performed via the 275 HART Communicator while the transmitter is on-line.

2.1 Interconnection Between DPharp and the HART Communicator

The HART communicator can interface with the transmitter from the control room, the transmitter site, or any other wiring termination point in the loop, provided there is a minimum of 250 Ω between the connection and the power supply. To communicate, it must be connected in parallel with the transmitter; the connections are non-polarized. Figure 2.1 illustrates the wiring connections for direct interface at the transmitter site for the DPharp. The HART communicator can be used for remote access from any terminal strip as well.

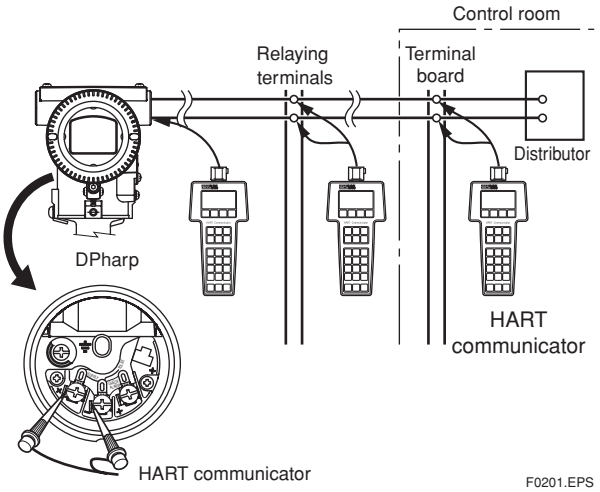

Figure 2.1 Connecting the HART Communicator

2.2 Communication Line Requirements

Specifications for communication line:

Supply voltage (general use type): 16.6 to 42 V DC

Load resistance: 250 to 600 Ω (including cable resistance)

Minimum cable size: 24 AWG, (0.51 mm diameter)

Cable type: single pair shielded or multiple pair with overall shield

Maximum twisted-pair length: 10,000 ft (3,048 m)

Maximum multiple twisted-pair length: 5,000 ft (1,524 m)

Use the following formula to determine cable length for a specific application:

$$L = \frac{65\times10^6}{(R\times C)} - \frac{(C_f+10{,}000)}{C}$$

Where: L = length in feet or meters
R = resistance in ohms, current sense resistance plus barrier resistance
C = cable capacitance in pF/ft, or pF/m
C_f = maximum shunt capacitance of field devices in pF

2.3 Power Supply Voltage and Load Resistance

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

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

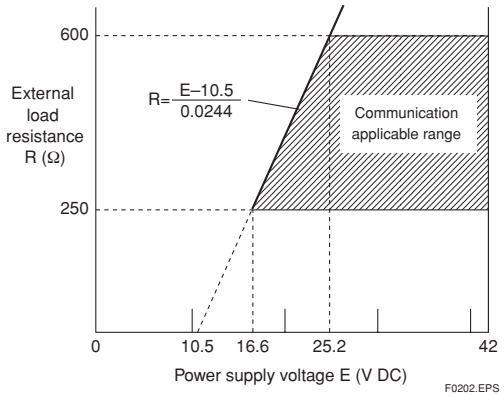

Figure 2.3 Relationship between Power Supply Voltage and External Load Resistance

3. OPERATION

3.1 Basic Operation of the 275 HART Communicator

3.1.1 Keys and Functions

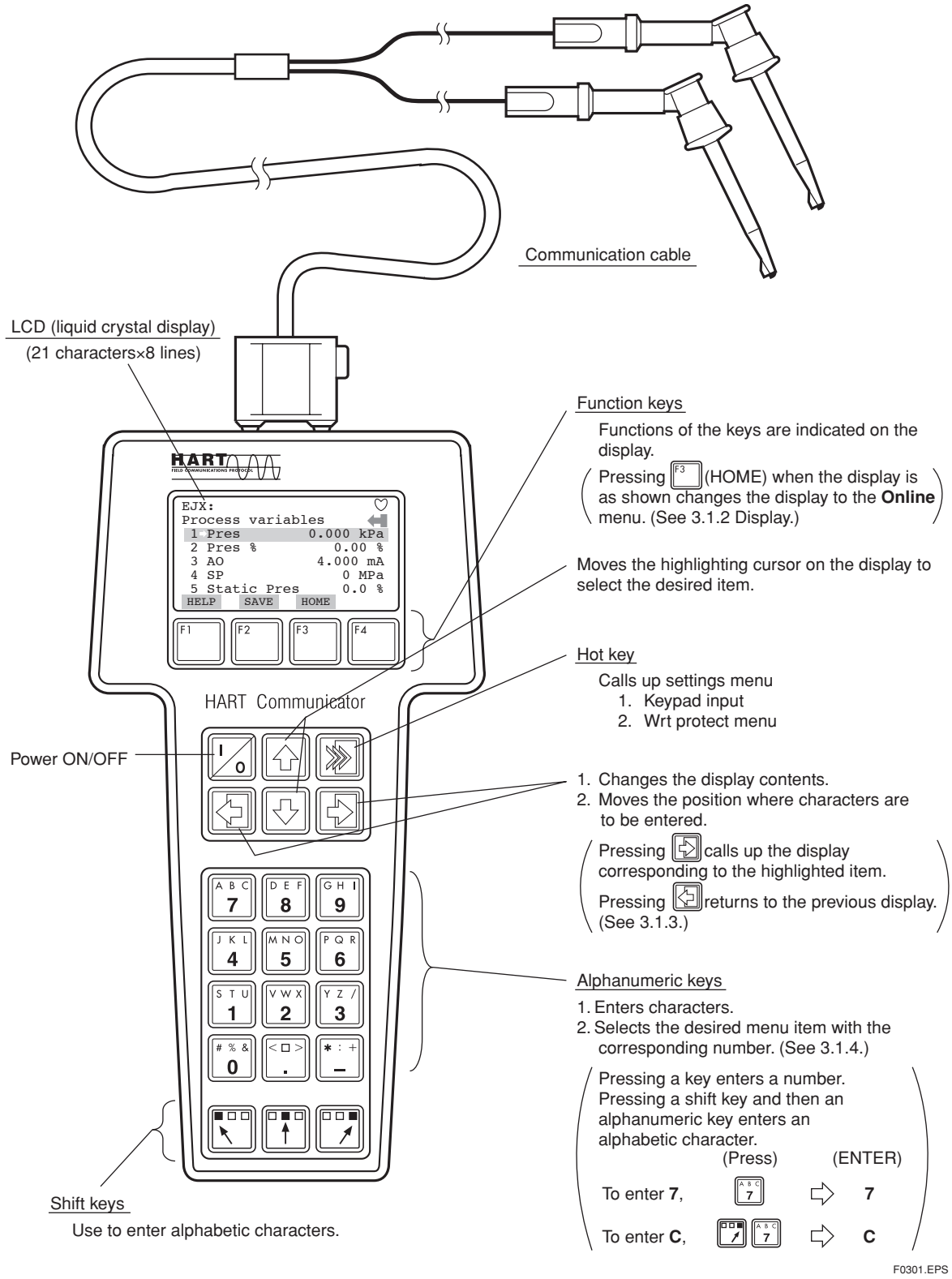

Figure 3.1.1 HART Communicator

3.1.2 Display

The HART communicator searches for a transmitter on the 4 to 20mA loop when it is turned on. When the HART communicator is connected to the transmitter, the **Online** menu (Top menu) is started automatically and the following display appears. If no transmitter is found, select the **Online** menu.

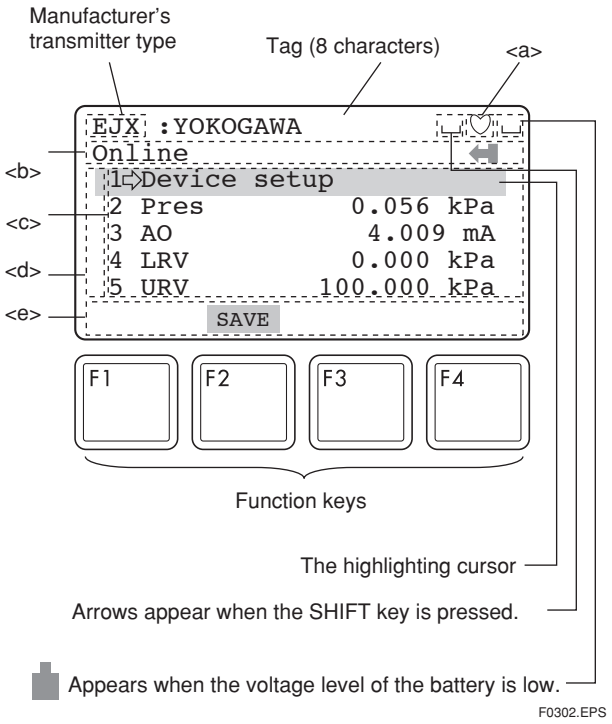

Figure 3.1.2 Display

<a> ♡ appears and flashes during communication between the HART communicator and the transmitter. At Burst mode, ♥ appears.
<b> The item selected from the previous menu.
<c> The available items in the menu of <b>.
<d> ↑ or ↓ appears when the item is scrolled out of the display.
<e> Function labels corresponding to specific function keys are displayed. These labels indicate the currently available choices.

Function Key Labels

F1	F2	F3	F4
HELP access on-line help	**ON/OFF** activates or deactivates a binary variable	**ABORT** terminate current task	**OK** acknowledge information on screen
RETRY try to re-establish communication	**DEL** delete current character or Hot Key Menu item	**ESC** leave value unchanged	**ENTER** accept user-entered data
EXIT leave the current menu	**SEND** send data to device, or mark data to send	**QUIT** terminate session because of a comunication error	**NEXT** leave the current menu
YES answer to yes/no question	**PGUP** move up one help screen	**PGDN** move down one help screen	**NO** answer to yes/no question
ALL include current Hot Key item on Hot Key Menu for all devices	**PREV** go to previous message in a list of messages	**NEXT** go to next message in the list of messages	**SKIP** do not mark variable to be sent in off-line configuration
		HOME go to the top menu in the device description	**ONE** include Hot Key item for one device
SAVE save information to communicator	**EDIT** edit a variable value		
SEND send data to device, or mark data to send	**ADD** add current item to Hot Key Menu	**BACK** go back to menu from which HOME was pressed	

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3.1.3 Calling Up Menu Addresses

Subsection 3.3 Menu Tree shows the configuration of all menu items available with the HART communicator. The desired item can be displayed with ease by understanding the menu configuration.

When the HART communicator is connected to the transmitter, the **Online** menu will be displayed after the power is turned on. Call up the desired item as follows:

Key operation

There are two choices to select the desired menu item.

1. Use the ⇩ or ⇧ key to select the desired item, and then press the ⇨ key.
2. Press the number displayed for the desired item.

To return to the previous display, press the key. If ABORT, ESC and EXIT are displayed, press the desired function key.

Example: Call up the **Tag** to change the tag number.

Check to see where **Tag** is located in the menu configuration. Then, call up the **Tag** on the display according to the menu tree (See section 3.3 Menu Tree).

Display **Operation**

1

```
EJX:YOKOGAWA
Online
 1 Device setup
 2 Pres
 3 AO
 4 LRV
 5 URV
```

or (S T U 1)

Display 1 appears when the HART Communicator is turned on. Select **Device setup**.

2

```
EJX:YOKOGAWA
Device setup
 1 Process Varlables
 2 Diag/Service
 3 Basic Setup
 4 Detailed Setup
 5 Review
          HOME
```

×2

or (Y Z / 3)

Select **Basic setup**.

3

```
EJX:YOKOGAWA
Basic Setup
 1 Tag              YOKOGAWA
 2 Unit                  kPa
 3 Re-range
 4 Device information
 5 Xfer fnctn       Linear
HELP  SAVE  HOME
```

Select **Tag**.

4

```
EJX:YOKOGAWA
Tag
 YOKOGAWA
 YOKOGAWA

HELP  DEL  ESC  ENTER
```

The display for the Tag setting appears.

See 3.1.4 for data entry.

5

```
EJX:YOKOGAWA
Tag
 YOKOGAWA
 FI1-1A
HELP  DEL  ESC  ENTER
```

F4 (ENTER)

After entering the data, set the HART communicator with the data entered by pressing **ENTER (F4)**.

6

```
EJX:YOKOGAWA
Basic setup
 1 Tag
 2 Unit
 3 Re-range
 4 Device information
 5 Xfer fncth
HELP  SEND  HOME
```

F2 (SEND)

Send the data to the transmitter by pressing **SEND (F2)**.

7

```
EJX:FI1-1A
Basic Setup
 1 Tag
 2 Unit
 3 Re-range
 4 Device information
 5 Xfer fncth
HELP        HOME
```

* ♡ flashes during communication.
When SEND disappears, the transmission is complete.

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3.1.4 Entering, Setting, and Sending Data

Data entered using the keys is set in the HART communicator by pressing **ENTER (F4)**. Then, by pressing **SEND (F2)**, the data is sent to the transmitter. Note that the data is not set in the transmitter if **SEND (F2)** is not pressed. As all the data that has been set in the HART communicator is held in memory unless the power is turned off, all the data can be sent to the transmitter at once.

Operation

Entering data on the **Tag** setting display.

Example: To change from Tag **YOKOGAWA** to **FI1-1A**.

Call up the **Tag** setting display.

1. Device setup
3. Basic setup
1. Tag

```
EJX:YOKOGAWA
Tag
 YOKOGAWA
 YOKOGAWA
HELP  DEL  ESC  ENTER
```

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When the setting display shown above appears, enter the data as follows:

Character to be entered	Operation	Display
F	(DEF 8)	F O K O G A W A
I	(GHI 9)	F I K O G A W A
1	(STU 1)	F I 1 O G A W A
-	(*:+ –)	F I 1 - G A W A
1	(STU 1)	F I 1 - 1 A W A
A	(ABC 7)	F I 1 - 1 A W A
Deletes characters.	F2 (DEL)	F I 1 - 1 A

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3.2 Parameter Usage and Selection

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

IMPORTANT

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

Table 3.2.1 Parameter Usage and Selection

Item		HART communicator	Description	Page
Memory		Tag	Tag number, up to 8 characters	P. 3-6
		Descriptor	Up to 16 characters	
		Message	Up to 32 characters	
		Date	xx/yy/zz	
Transmitter	Unit	Unit	Sets a pressure unit for the measured pressure	P. 3-6
	Range	LRV/URV	Sets the calibration range by the keypad	P. 3-7
		Apply values	Range for 4 to 20 mA DC signal is set with actual input applied	P. 3-8
	Output mode	Xfer fnctn	Sets mode for output signal to “linear mode” (proportional to input differential pressure) or to “Square root mode” (proportional to flow)	P. 3-9
	Damping time constant	Pres Damp	Adjust the output response speed for the input pressure of differential pressure	
	Output signal low cut mode	Low Cut	Used mainly to stabilize output near 0 if output signal is the square root mode. Two modes are available: forcing output to 0% for input below a specific value, or changing to proportional output for input below a specific value	P. 3-10
		Low cut mode	Linear or Zero	
	Bi-directional flow measurement mode	Bi-dir mode	Used to measure bi-directional flows	P. 3-11
	Unit for displayed temperature	Temp Unit	Sets a temperature unit displayed on HART communicator	P. 3-14
	Unit for displayed static pressure	SP Unit	Sets a pressure unit for the static pressure displayed on HART communicator	
	Impulse line connection orientation	H/L Swap	Used where installation conditions make it imperative to connect high pressure side impulse line to low pressure side of transmitter	P. 3-10
Display	Integral indicator display mode	Disp Pres % fnctn	Sets mode for integral indicator to “linear mode” (proportional to input differential pressure) or to “Square root mode” (proportional to flow)	P. 3-11
		Disp select	Sets the following 5 types of integral indicator scale ranges and unit: input pressure, % of range, user set scale, input static pressure, % of static pressure range, and alternating among any four of the above	P. 3-12
	Integral indicator scale	Engr disp range	Sets Engr Unit/Modify Engr Unit/Engr LRV/Engr URV/Engr point/Engr exp	P. 3-13
	Burst mode	Burst option	Selection of the data to be sent continuously (PV, % range/current, or Process vars/crnt)	P. 3-20
		Burst mode	ON/OFF switching of burst mode	
	Process alarm	Process Alerts	Used for alarm generation on the integral indicator	P. 3-25
HART output	Multidrop mode	Poll addr	Sets the polling address (1 to 15)	P. 3-21
		Polling	ON/OFF switching of multidrop mode	
Monitoring		Pres and Pres %	Pressure variable and % output variable	—
		AO	4 to 20 mA output variable	
		Snsr temp	Sensor temperature	
		SP and SP %	Static pressure variable and % static pressure variable	
		Engr Disp/exp/Unit	Displays the output of user setting engineering information	
Maintenance	Test output	Loop test	Used for loop checks. Output can be set freely from –2.5% to 110% in 1% steps	P. 3-15
	Self-diagnostics	Self test and Status	Check using the self-test and status command. If an error is detected, the corresponding message is displayed	P. 4-1
	Output when CPU error has occurred	AO Alm typ	Display the status of 4 to 20 mA DC output when a failure occurs	P. 3-22
	External volume switch	Ext SW	Display/set the external volume protect/permit for LRV (URV) setting	
	Software write protect	Write protect	Displays the permit/protect status of setting changes depending on communications	P. 3-23
		Enable wrt 10min	Write protect status is released for 10 minutes when the password is entered	
		New password	Sets a new password	
Adjustment	Zeroing	Zero trim	Sets the current input value to 0 kPa	P. 3-16
	Sensor trim	Pres and SP sensor trim	Adjust the measured differential pressure and static pressure variables	
	Analog output trim	D/A trim, Scaled D/A trim	Adjust the output value at the points of 4 mA and 20 mA	P. 3-18
	Signal characterizer	S.C. menu	Used for compensate the output for the non-linear application	P. 3-24
	Capillary fill fluid density compensation	T.Z. Cmp mode	Compensates the zero shift by the ambient temperature effect on the capillary tubes.	P. 3-27

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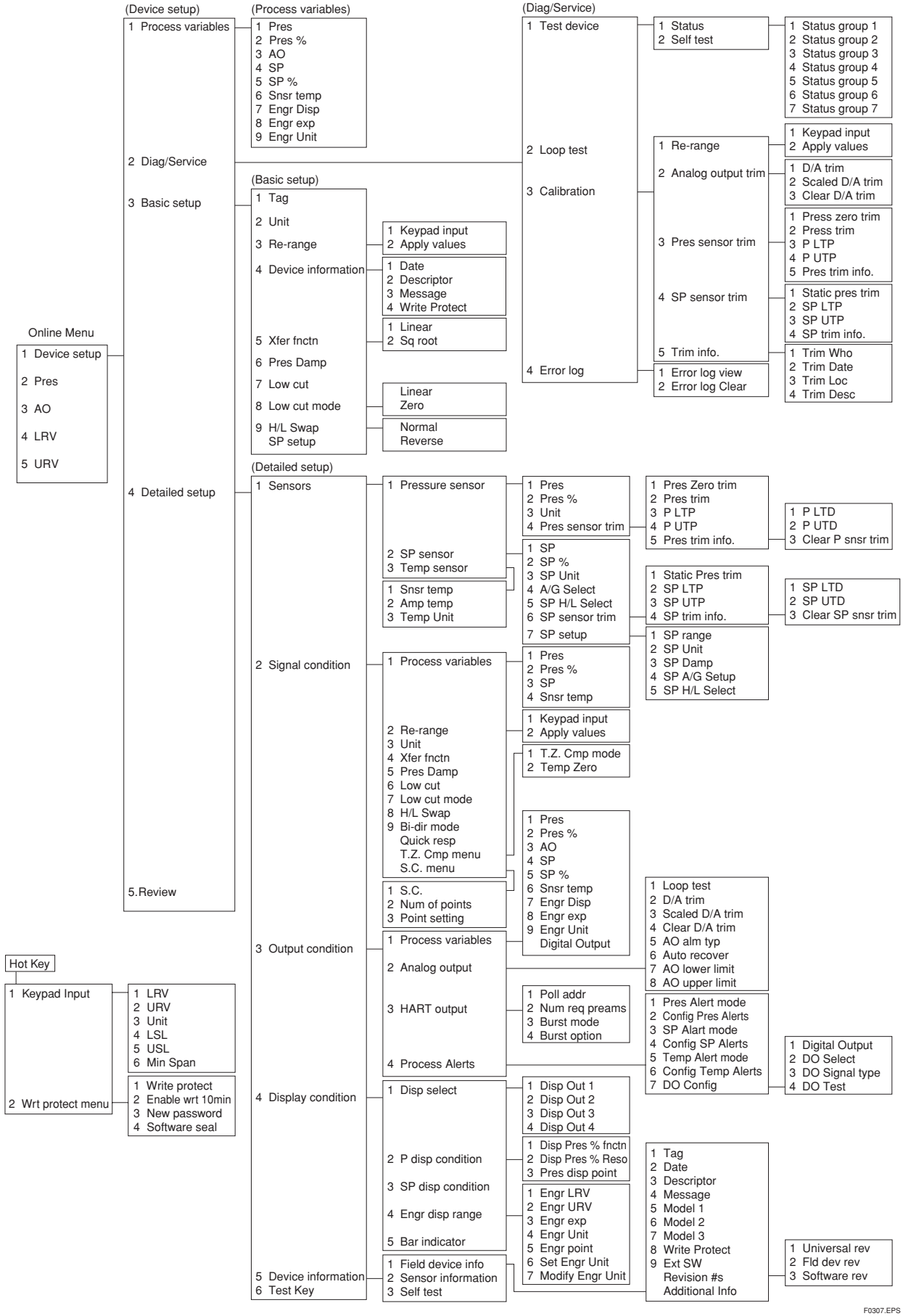
3.3 Menu Tree



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3.4 Basic Setup

3.4.1 Tag and Device Information

To change the Tag No., see section 3.1.4 Entering, Setting, and Sending Data.

Up to 8 characters can be set with **Tag**. The maximum number of characters to be set for other items is as shown below.

Item	Number of characters
Tag	8
Descriptor	16
Message	32
Date	2/2/2

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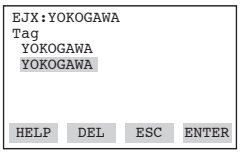
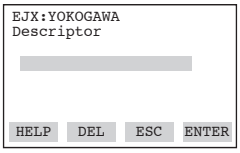
(1) Tag

1. Device setup
3. Basic setup
1. Tag



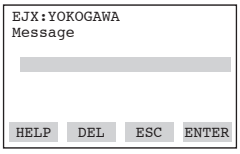
(2) Descriptor

1. Device setup
3. Basic setup
4. Device information
2. Descriptor



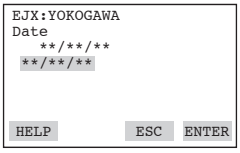
(3) Message

1. Device setup
3. Basic setup
4. Device information
3. Message



(4) Date

1. Device setup
3. Basic setup
4. Device information
4. Date



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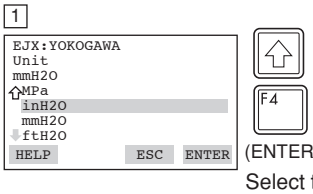
3.4.2 Unit

The unit parameter is set at the factory before shipment if specified at the time of order. Follow the procedure below to change the unit parameter.

Example: To change the unit from **mmH$_2$O** to **inH$_2$O**

1. Device setup
3. Basic setup
2. Unit

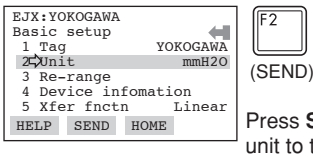
1



(ENTER)

Select the desired unit and press **ENTER (F4)**.

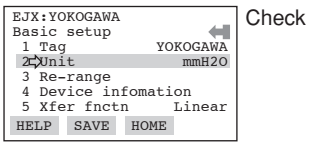
2



(SEND)

Press **SEND (F2)** to send the new unit to the transmitter memory.

3



Check that SEND becomes SAVE.

F0309.EPS

Note that the Yokogawa default setting for the standard temperature is 4°C (39.2°F). For the units of mmH$_2$O, inH$_2$O, and ftH$_2$O, the pressure varies according to the standard temperature definition. Select the appropriate unit with @68degF when a standard temperature of 20°C (68°F) is required.

Available pressure units are shown below.

inH$_2$O@68degF	**mbar**	**MPa**
inHg	**g/cm^2**	**inH$_2$O**
ftH$_2$O@68degF	**kg/cm^2**	**mmH$_2$O**
mmH$_2$O@68degF	**Pa**	**ftH$_2$O**
mmHg	**kPa**	**hPa**
psi	**torr**	
bar	**atm**	

FX0301.EPS

3.4.3 Range Change

The range values are factory-set as specified by the customer. To change the range, follow the steps below.

(1) Keypad input — LRV and URV

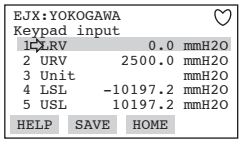
- The measurement span is determined by the upper and lower range values. In this method, the upper and lower range values can be set independently, and the span changes according to the range limit values sent to the transmitter.

Example: To change the range from **0 to 2500 mmH_2O** to **500 to 3500 mmH_2O**

Call up the **Keypad input** display.

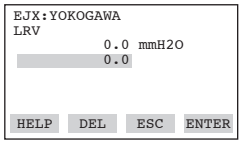
1. Device setup
3. Basic setup
3. Re-range
1. Keypad input

1



To change the Lower Range Value, select the **LRV** item.

2

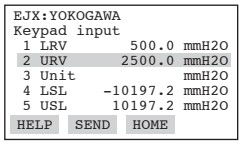


'5 0 0'

(ENTER)

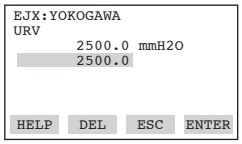
Enter **500**, and press **ENTER (F4)**.

3



To change the Upper Range Value, select the **URV** item.

4

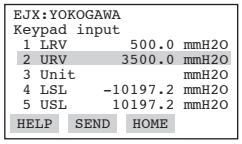


'3 5 0 0'

(ENTER)

Enter **3500**, and press **ENTER (F4)**.

5



(SEND)

Press **SEND (F2)** to send the changed data to the transmitter. Check that SEND disappears.

F0310.EPS

NOTE

The calibration range can be set as LRV > URV under the following conditions, reversing the 4 to 20 mA output signal.

$LSL \leq LRV \leq USL$
$LSL \leq URV \leq USL$
$|URV - LRV| \geq$ Min. Span

(2) Apply values — changing the ranges while applying an actual Input

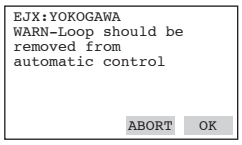
- This feature allows the lower and upper range values to be setup automatically with the actual input applied. If the upper and lower range values are set, URV and LRV are changed at the same time.

Example: To change the range from **0 to 2500 mmH_2O** to **500 to 3000 mmH_2O**

Call up the **Apply values** display.

1. Device setup
↓
3. Basic setup
↓
3. Re-range
↓
2. Apply values

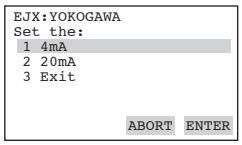
1



F4 (OK)

Press **OK (F4)**.

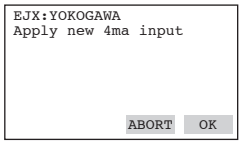
2



F4 (ENTER)

To set the lower range value, select **4mA** and press **ENTER (F4)**.

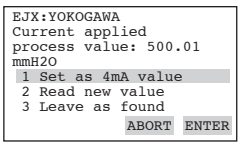
3



F4 (OK)

Apply the pressure of 500mmH_2O. After obtaining a stable pressure, press **OK (F4)**.

4



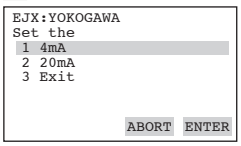
F4 (ENTER)

The LRV to be changed is 500.01 mmH_2O.

- Selecting item 1 sets LRV to 500.01 mmH_2O.
- Selecting item 2 reads LRV again.

To set LRV = 500.01, select item 1 and press **ENTER (F4)**.

5



↓ ×2

F4 (ENTER)

Select **Exit** and press **ENTER (F4)**. Check the value after completing the range change with **URV** and **LRV**.

* The span is maintained the same as when changing LRV with **Apply values**. In this case, if LRV is changed from 0 to 500, URV is changed automatically to 3000.

F0311.EPS

- The measurement span is determined by the upper and lower range values. Changing the lower range value causes the upper range value to change automatically, keeping the span constant. If a change in the lower range value causes the upper range value to exceed the measuring limit of the transmitter, an error message appears and the transmitter holds the output signal right before the error occurred. Enter the correct values within the range of the sensor limits.
- Note that changing the upper range value does not cause the lower range value to change. Thus, changing the upper range value also changes the span.

3.4.4 Output Mode

The mode setting for the output signal and the integral indicator can be performed independently.

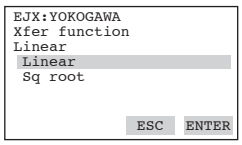
The output mode for the output signal is set as specified in the order when the instrument is shipped. Follow the procedure below to change the mode.

Example: To change the mode from **Linear** to **Sq root**.

Call up the **Xfer fnctn** display.

1. Device setup
↓
3. Basic setup
↓
5. Xfer fnctn

1



(ENTER)

(SEND)

[1] Select **Sq root**, and press **ENTER (F4)**.
[2] Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0312.EPS

3.4.5 Damping Time Constant Setup

The damping time constant is set as specified in the order when the instrument is shipped. Follow the procedure below to change the damping time constant. The damping time constant for the amplifier assembly can be set here. The damping time constant for the entire transmitter is the sum of the values for the amplifier assembly and the capsule assembly.

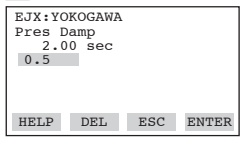
Any number from 0.00 to 100.00 can be set for the damping time constant. Note that setting the quick response parameter ON enables you to set the time constant between 0.00 and 0.49 seconds.

Example: To change from **2.0** seconds to **0.5** seconds

Call up the **Pres Damp** display.

1. Device setup
↓
3. Basic setup
↓
6. Pres Damp

1

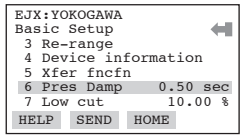


'0 . 5'

(ENTER)

Enter **0.5** and press **ENTER (F4)**.

2

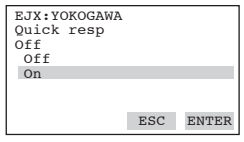


Press **SEND (F2)** to send the data to the transmitter.

Call up the **Quick resp** display to set the value to less than 0.5 seconds.

1. Device setup
↓
4. Detailed setup
↓
2. Signal condition
↓
Quick resp

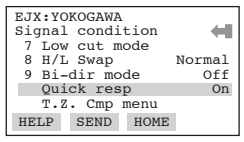
1



(ENTER)

Select **On** and press **ENTER (F4)**.

2



Press **SEND (F2)** to send the data to the transmitter.

F0313.EPS

3.4.6 Output Signal Low Cut Mode Setup

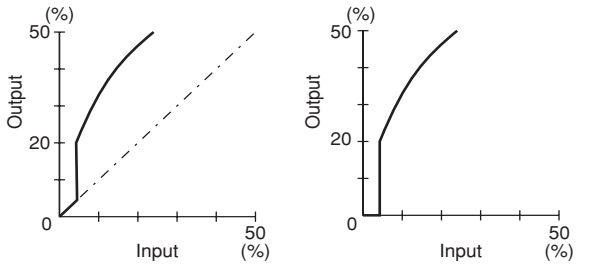
Low cut mode can be used to stabilize the output signal near the zero point.

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

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

Note that when the output modes of the output signal and the display are selected as **Sq root** and **Linear** accordingly, the low cut function is not available for the display value.

Example: To set the low cut range to 20% and the cut mode to ZERO in the **Sq root** output mode, proceed as follows:



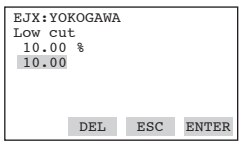
For low cut in linear mode ⇨ **For low cut in zero mode**

F0314.EPS

Figure 3.4.6 Low Cut Mode

1. Device setup
3. Basic setup
7. Low Cut and 8. Low cut mode

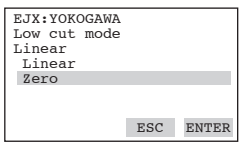
1



'2 0' F4 (ENTER)

Call up **Low cut**, and set to 20%.

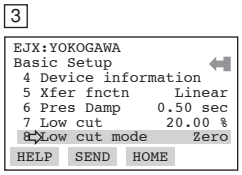
2



↓ F4 (ENTER)

Select the **Low cut mode**, and set to **Zero**.

3



F2 (SEND)

Press **SEND (F2)** to send the date, then check to confirm that SEND disappears.

F0315.EPS

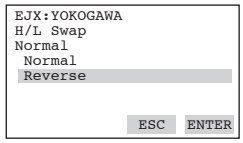
3.4.7 Impulse Line Connection Orientation Setup

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

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

1. Device setup
3. Basic setup
9. H/L Swap

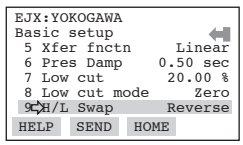
1



↓ F4 (ENTER)

Call up the **H/L Swap** Display Select **Reverse**, and press **ENTER (F4)**.

2



F2 (SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0316.EPS

3.5 Detailed Setup

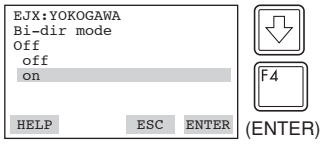
3.5.1 Bi-directional Flow Measurement

(a) **Bi-dir mode** enables selection of 50% output at an input of 0 mmH_2O.

Example: If measurement range is 0 to 3000mmH_2O (LRV = 0 mmH_2O, URV = 3000 mmH_2O)

1. Device setup
4. Detailed setup
2. Signal condition
9. Bi-dir mode

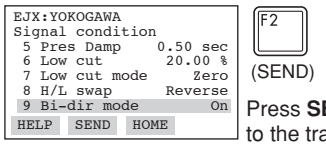
1



(ENTER)

Call up the **Bi-dir mode** display Select **on**, and press **ENTER (F4)**.

2



(SEND)

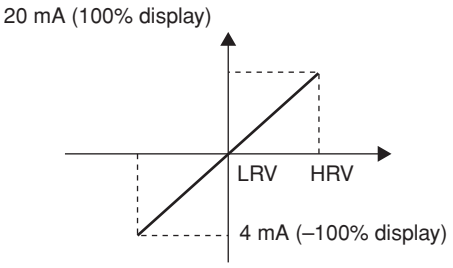
Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

Note: The measurement range changes to −3000 to 0 to 3000 mmH_2O, corresponding the output of 0% to 50% to 100%. Note that LRV and URV values are not changed.

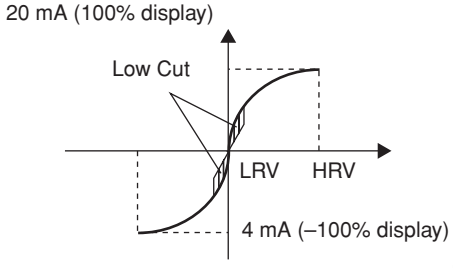
F0317.EPS

(b) Combining **Bi-dir mode** with **Xfer fnctn** provides a square root output computed independently for 0% to 50% output and for 50% to 100% output.

● Output mode “LINEAR”



● Output mode “SQUARE ROOT”



F0318.EPS

3.5.2 Integral Indicator Display Mode

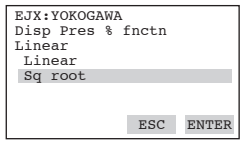
The mode setting for the output signal and the integral indicator can be performed independently.

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.

Example: Change from **Linear** to **Sq root**.

1. Device setup
4. Detailed setup
4. Display condition
2. P disp condition
1. Disp Pres % fnctn

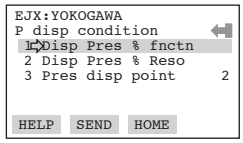
1



(ENTER)

Call up the **Disp Pres % fnctn** Display. Select **Sq root**, and press **ENTER (F4)**.

2



(SEND)

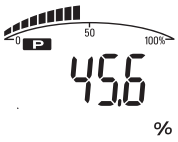
Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0319.EPS

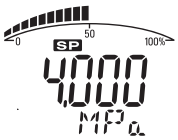
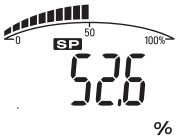
If the instrument is equipped with an integral indicator and the transfer function is sq root, “$\sqrt{\ }$” is displayed on the integral indicator.

3.5.3 Integral Indicator Scale Setup

The following five displays are available for integral indicators: input pressure, % of range, user set scale, input static pressure*1, and % of static pressure range*1. A cycle of up to four displays can be shown by assigning variables to the parameters at **Disp select**.

Available displays	Description and related parameters
Input pressure (PRES) 	Indicates values of input pressure with the indication limits −99999 to 99999. `PRES 456 kPa`
% of range (PRES %) 	Indicates input pressure in −2.5 to 110% range depending on the set range (**LRV** and **URV**). `PRES % 45.6 %`

User set scale (ENGR. PRES) 	Indicates values depending on the engineering range (**Engr LRV** and **Engr URV**) with the unit (**Engr Unit**).
	`Engr LRV 0.0`
	`Engr URV 45.0`
	`Engr exp ×100`
	`Engr Unit m3/min`
	`Engr point 1`

Input static pressure (SP)*1 	Indicates input static pressure with the indication limits –99999 to 99999. Reference pressure is factory-set in absolute. `SP 4.000 MPa`
% of static pressure range (SP %)*1 	Indicates input static pressure in –10 to 110% range depending on the set range (**SP LRV** and **SP URV**). `SP % 52.6 %`

T0303.EPS

*1: Available for differential pressure transmitter.

See (a.) through (d.) for the setting procedures.

a. Display Selection

At **Disp select**, select the variable that the parameter **Disp Out 1** will display on the integral indicator.

Example: Change from **PRES %** to **PRES** for the display.

1. Device setup
↓
4. Detailed setup
↓
4. Display condition
↓
1. Disp select
↓
1. Disp Out 1

1

```
EJX:YOKOGAWA
Disp Out 1
PRES %
 PRES %
 ENGR. PRES
 SP
 SP %
            ESC  ENTER
```

(ENTER)

Call up the **Disp Out 1** display. Select **PRES**, and press **ENTER (F4)**.

2

```
EJX:YOKOGAWA
Disp select
 1 Disp Out 1        PRES
 2 Disp Out 2    Not Used
 3 Disp Out 3    Not Used
 4 Disp Out 4    Not Used
HELP  SEND  HOME
```

(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0320.EPS

b. Cyclic Display

In addition to the display set at **Disp Out 1**, displays can be set at **Disp Out 2**, **Disp Out 3**, and **Disp Out 4** for cyclic display in the order of the parameter number.

c. Setting Static Pressure Scale

Static pressure can be displayed as a measured input or as a percentage, independent from the 4-20 mA output signal for measured pressure or differential pressure. The **SP setup** parameters under **SP sensor** allow the setting of the range, unit, and damping time constant for the static pressure as well as the pressure management range for PV.

Note that either the high or low pressure side of the capsule can be selected to monitor the static pressure by means of the **H/L Select** parameter under **SP setup**.

d. User Setting of Engineering Unit and Scale

Enter disp range parameters allow the engineering unit and scale to be displayed. At **Set Engr Unit**, the following engineering units can be selected from a list. Alternately, up to eight alphanumeric characters, spaces or slashes (/) can be input on the keypad at **Modify Engr Unit**; only the first six are displayed on the integral indicator.

Select the unit from the **Set Engr Unit** list.

kPa	ftH2O	Nl/min
MPa	gf/cm2	Nm3/h
mbar	kgf/cm2	Nm3/min
bar	kg/cm2G	ACFH
psi	kg/cm2A	ACFM
psia	atm	SCFH
mmH2O	kg/h	SCFM
mmHg	t/h	GPH
mmHgA	m3/h	GPM
mmAq	m3/min	m
mmWG	l/h	mm
Torr	l/min	in
inH2O	kl/h	ft
inHg	kl/min	kg/m3
inHgA	Nl/h	g/cm3

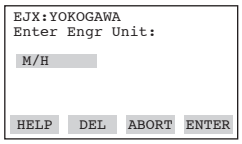
FX0302.EPS

Follow the procedure below to set your own unit.

Example: Set the engineering unit as **M/h**.

1. Device setup
↓
4. Detailed setup
↓
4. Display condition
↓
4. Engr disp range
↓
7. Modify Engr Unit

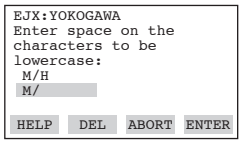
1

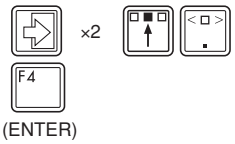


(ENTER)

Call up the **Modify Engr Unit**. Set **M/H**, and press **ENTER (F4)**.

2





(ENTER)

Enter a space instead of a character to display the character in lowercase, and press **ENTER (F4)**.

F0321.EPS

Note that following symbols are not available:

% & < > . * : + -

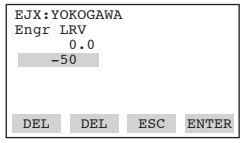
The integral indicator shows "-- -- -- -- -- --" when these are entered.

Engr LRV and **Engr URV** are used to set the lower and upper range values for the engineering unit display. When the insrument is shipped, these are set as specified in the order.

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

1. Device setup
↓
4. Detailed setup
↓
4. Display condition
↓
4. Engr disp range
↓
1. Engr LRV and **2. Engr URV**

1

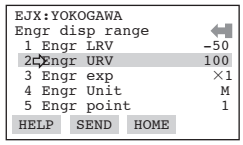


'– 5 0'

(ENTER)

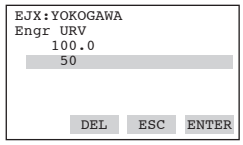
Call up the **Engr LRV** Display.Set **–50**, and press **ENTER (F4)**.

2



Press V W X 2 to select engr disp URV.

3



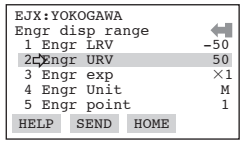
'5 0'

(ENTER)

(SEND)

Set **50**, and press **ENTER (F4)**.

4



(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0322.EPS

3.5.4 Unit for Displayed Temperature

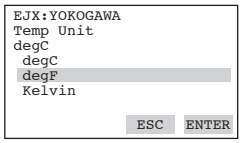
When the instrument is shipped, the temperature units are set to **C** (Centigrade). Follow the procedure below to change this setting.

When this parameter is set, it also changes the temperature unit for **Snsr temp** at **Process variables** and **Amp temp** at **Temp sensor**.

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

1. Device setup
4. Detailed setup
1. Sensors
3. Temp sensor
3. Temp Unit

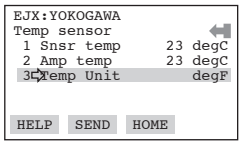
1



(ENTER)

Select **degF** (Fahrenheit), and Press **ENTER (F4)**.

2



(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0323.EPS

3.5.5 Unit for Displayed Static Pressure

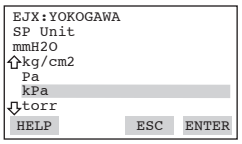
Follow the procedure to change the static pressure unit.

Changing this parameter also changes the unit for the static pressure display.

Example: Change the static pressure unit from **mmH_2O** to **kPa**.

1. Device setup
4. Detailed setup
1. Sensors
2. SP sensor
3. SP Unit

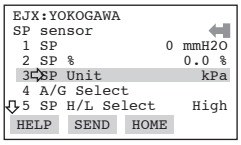
1



(ENTER)

Select **kPa** and Press **ENTER (F4)**.

2



(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0324.EPS

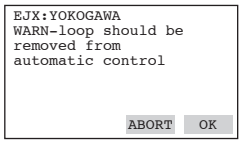
3.5.6 Test Output

This feature can be used to output a fixed current for loop checks. The available range for test output depends on the settings for the **AO lower limit** and **AO upper limit** parameters, whose limit is from 3.6 mA (-2.5%) to 21.6 mA (110%) .

Example: To output 12 mA (50%)

1. Device setup
↓
2. Diag/Service
↓
2. Loop test

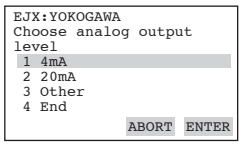
1



F4 (OK)

Set the control loop in manual mode, and press **OK (F4)**.

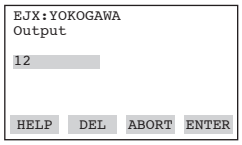
2



↓ ×2
F4 (ENTER)

Select **Other,** and press **ENTER (F4)**.
Supplementary explanation.
1. 4 mA:
   Outputs a 4 mA current signal
2. 20 mA:
   Outputs a 20 mA current signal
3. Other:
   Sets a desired output using the alphanumeric keys
4. End: Exits

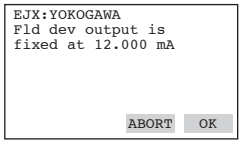
3



'1 2'
F4 (ENTER)

Enter **12**, and press **ENTER (F4)**.
A fixed current of 12 mA is output.

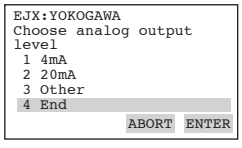
4



F4 (OK)

Press **OK (F4)**.

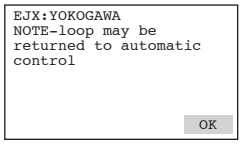
5



↓ ×3
F4 (ENTER)

To finish the loop test, select **End**, and press **ENTER (F4)**.

6



F4 (OK)

Press **OK (F4)**.

F0325.EPS

⚠ CAUTION

Test output continues for approximately 10 minutes, then is released automatically. Even if the HART communicator power supply is turned off or the communication cable is disconnected, test output will continue for approximately 10 minutes.

3.5.7 Sensor Trim

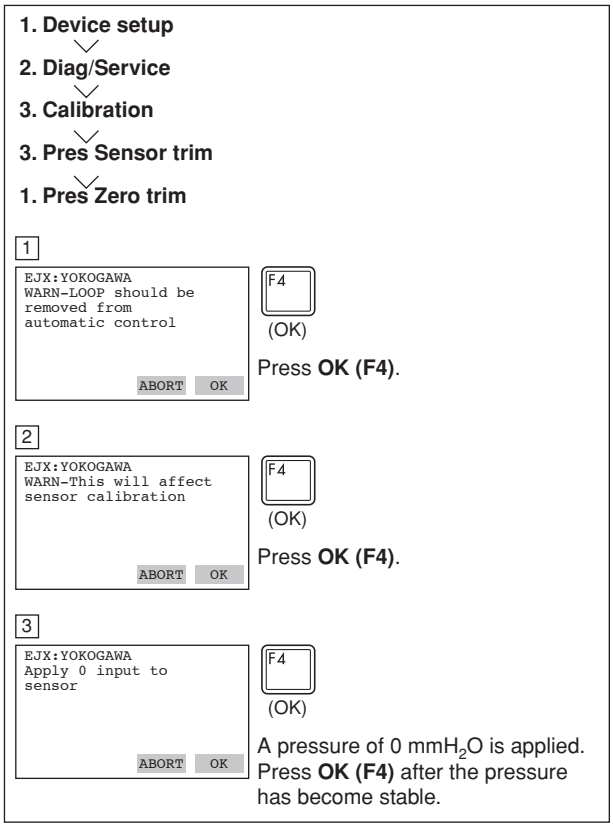
Each DPharp EJX series transmitter is factory characterized. Factory characterization is the process of comparing a known pressure input with the output of each transmitter sensor module over the entire pressure and temperature operating range. During the characterization process, this comparison information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

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

(1) Zero Trim

a. Zeroing—Pres Zero trim

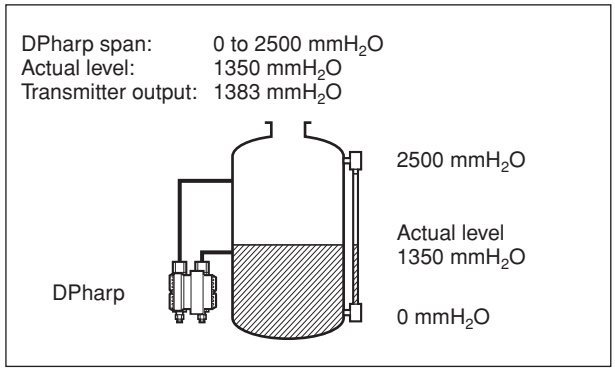
Pres Zero trim carries out the zero adjustment and automatically sets the applied "0" input values to the output value of "0," keeping the span constant. Use this setting when the LRV is known to be 0 mmH_2O.



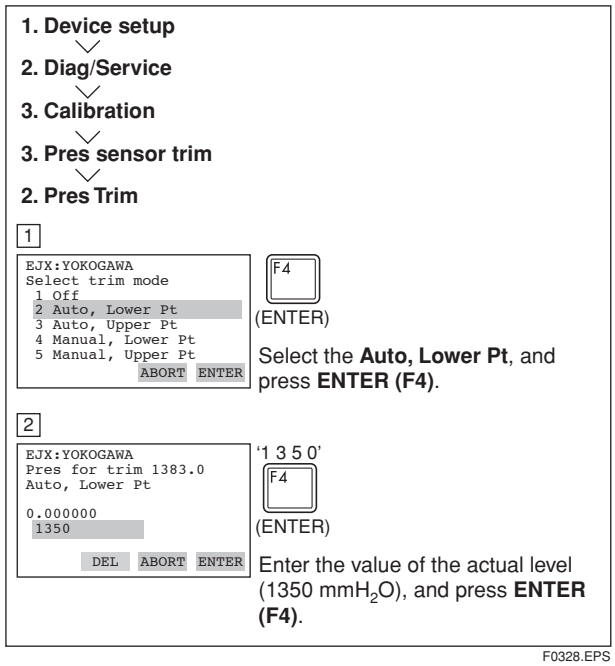
F0326.EPS

b. Level Adjustment—Auto, lower Pt

This zero adjustment calibrates the transmitter output corresponding to the actual tank level. To perform this adjustment, first use a glass gauge or the like to determine the actual tank level, then enter the correct data as shown below.



F0327.EPS



F0328.EPS

c. Using External Zero-adjustment Screw

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

Note that the parameter of **Ext SW** must be **Enabled** to perform this adjustment. See section 3.5.11 for the setting procedure.

(2) Full Sensor Trim—Auto Trim and Manual Trim

Full sensor trim is carried out with a series of the procedure of **Auto, Lower Pt** and **Auto, Upper Pt**. Also, you can manually perform the trimming procedure in **Manual, Lower Pt** and **Manual, Upper Pt**.

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

In the manual method, the reference pressure should also be applied to the transmitter at both lower and upper point of trim ends. Without the reference pressure, **P LTD** and **P UTD** may not represent the correct value of adjustment point for each.

a. Auto Sensor Trim

Example: For the range of 1000 to 3000 mmH_2O

1. Device setup
↓
2. Diag/Service
↓
3. Calibration
↓
3. Pres sensor trim
↓
2. Pres Trim

1

```
EJX:YOKOGAWA
Select trim mode
 1 Off
 2 Auto, Lower Pt
 3 Auto, Upper Pt
 4 Manual, Lower Pt
 5 Manual, Upper Pt
              ABORT ENTER
```

↓ F4 (ENTER)

Select **Auto , Lower Pt**, and press **ENTER (F4)**.

2

```
EJX:YOKOGAWA
Pres for trim 994.0
Auto, Lower Pt

1000.000000
 1000
        DEL ABORT ENTER
```

'1000' F4 (ENTER)

Apply a standard pressure of 1000 mmH_2O to the transmitter. After obtaining a stable pressure, press **ENTER (F4)**.

3

```
EJX:YOKOGAWA
Select trim mode
 1 Off
 2 Auto, Lower Pt
 3 Auto, Upper Pt
 4 Manual, Lower Pt
 5 Manual, Upper Pt
              ABORT ENTER
```

↓ ×2, F4 (ENTER)

Select **Auto, Upper Pt**, and press **ENTER (F4)**.

4

```
EJX:YOKOGAWA
Pres for trim 3015.0
Auto, Upper Pt

3000.000000
 3000
        DEL ABORT ENTER
```

'3000' F4 (ENTER)

Apply a standard pressure of 3000 mmH_2O to the transmitter. After obtaining a stable pressure, press **ENTER (F4)**.

F0329.EPS

b. Manual Sensor Trim

Example: For the range of 1000 to 3000 mmH_2O
P LTD = −4.0 mmH_2O
P UTD = −3.0 mmH_2O

1. Device setup
↓
2. Diag/Service
↓
3. Calibration
↓
3. Pres sensor trim
↓
2. Pres Trim

1

```
EJX:YOKOGAWA
Select trim mode
 1 Off
 2 Auto, Lower Pt
 3 Auto, Upper Pt
 4 Manual, Lower Pt
 5 Manual, Upper Pt
              ABORT ENTER
```

↓ ×3, F4 (ENTER)

Select **Manual, Lower Pt**, and press **ENTER (F4)**.

Suppose that a standard pressure of 1000 mmH_2O is applied and the value of the Pres for Trim in 2 is 994.0. Correct for this output error of 6 mmH_2O by adding 6 mmH_2O to **P LTD**.

−4.0+6.0=+2.0

2

```
EJX:YOKOGAWA
Pres for trim 994.0
Manual, Lower Pt
−4.000000
 2
        DEL ABORT ENTER
```

'2' F4 (ENTER)

Enter the correction value of 2. Then press **ENTER (F4)**.

3

```
EJX:YOKOGAWA
Select trim mode
 1 Off
 2 Auto, Lower Pt
 3 Auto, Upper Pt
 4 Manual, Lower Pt
 5 Manual, Upper Pt
              ABORT ENTER
```

↓ ×4, F4 (ENTER)

Select **Manual, Upper Pt**, and press **ENTER (F4)**.

Suppose that a standard pressure of 3000 mmH_2O is applied and the value of the Pres for Trim in 4 is 3015.0. Firstly, obtain the slope error for the span as follows;

$$\text{Slope Error} = \frac{\text{Applied Pressure Value} - \text{Value of Pres for Trim}}{\text{Applied Pressure Value}} \times (\text{URV} - \text{LRV})$$

$$= \frac{3000-3015}{3000} \times (3000-1000) = -10$$

Then correct for this slope error of −10 by adding −10 to **P UTD**.

−3.0+(−10.0)=−13.0

4

```
EJX:YOKOGAWA
Pres for trim 3015.0
Manual, Upper Pt
−3.000000
 −13
        DEL ABORT ENTER
```

'−13' F4 (ENTER)

Enter the correction value of −13. Then press **ENTER (F4)**.

F0348.EPS

(3) Sensor Trim for Static Pressure

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

(4) Reset Trim Adjustment to Factory Setting

The **Clear P snsr trim** and **Clear SP snsr trim** commands can reset the trim adjustment to the initial calibrated values that were set. The amount of the adjustment by the external zero-adjustment screw is returned to the initial setting as well.

3.5.8 Trim Analog Output

Fine current output adjustment is carried out with **D/A trim** or **Scaled D/A trim**.

- **D/A Trim**
  D/A trim is to be carried out if the calibration digital ammeter does not exactly read 4.000 mA and 20.000 mA with an output signal of 0% and 100%.
- **Scaled D/A Trim**
  Scaled D/A trim is to be carried out if the output is adjusted using a voltmeter or a meter whose scale is 0 to 100%.

Example 1: For an adjustment using an ammeter (±1μA is measurable)

1. Device setup
↓
2 Diag/Service
↓
3. Calibration
↓
2. Analog output trim
↓
1. D/A trim

1

```
EJX:YOKOGAWA
Analog output trim
 1 D/A trim
 2 Scaled D/A trim
 3 Clear D/A trim

HELP  SAVE  HOME
```

Select the **D/A trim** item.

2

```
EJX:YOKOGAWA
WARN-Loop should be
removed from
automatic control

          ABORT  OK
```

F4 (OK)

Press **OK (F4)**.

3

```
EJX:YOKOGAWA
Connect reference
meter

          ABORT  OK
```

F4 (OK)

Connect the ammeter (±1μA is measurable), and press **OK (F4)**.

4

```
EJX:YOKOGAWA
Setting fld dev
output to 4mA

          ABORT  OK
```

F4 (OK)

Press **OK (F4)**, and the transmitter outputs a 0% output signal.

5

```
EJX:YOKOGAWA
Enter meter value
     4.000
     4.115

HELP  DEL  ESC  ENTER
```

'4 . 1 1 5'

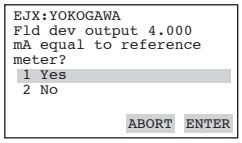
F4 (ENTER)

Ammeter reading: 4.115

Enter the read value **4.115** of the ammeter, and press **ENTER (F4)**. (The output of the transmitter changes.)

F0330.EPS

6

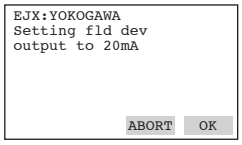


F4 (ENTER)

Ammeter reading: 4.000

If the reading on the ammeter is 4.000 mA, select **YES** and press **ENTER (F4)**.
If the reading is not 4.000 mA, select item 2. **NO**. Repeat steps 4 and 5 until the ammeter reads 4.000 mA.

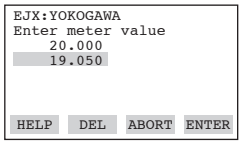
7



F4 (OK)

Press **OK (F4)**, and the transmitter outputs a 100% output signal.

8



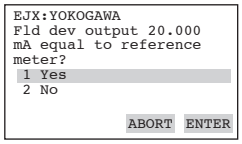
'1 9.0 5 0'

F4 (ENTER)

Ammeter reading: 19.050

Carry out the same procedures as those described under 4 and 5.

9

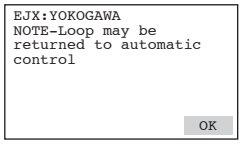


F4 (ENTER)

Ammeter reading: 20.000

Returning fld dev to original output appears.

10



F4 (OK)

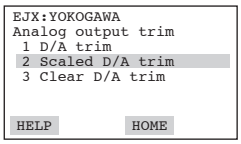
Press **OK (F4)**.

F0331.EPS

Example 2: To adjust using a voltmeter

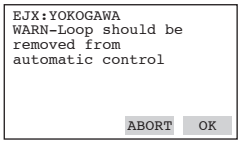
1. Device setup
2 Diag/Service
3. Calibration
2. Analog output trim
2. Scaled D/A trim

1



Select the **Scaled D/A trim** item.

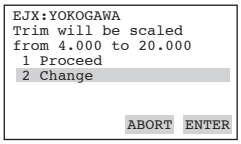
2



F4 (OK)

Press **OK (F4)**.

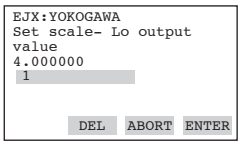
3



V W X 2

Select **Change**, and press **ENTER (F4)**.
When item 3. **Proceed** is selected, **D/A trim** must be carried out.

4

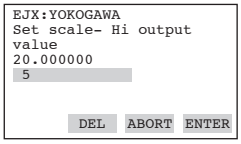


'1'

F4 (ENTER)

Enter the value read on the meter when the signal is 4 mA. In this case, Enter the value of the voltage across a 250 Ω resistor (1 V), and press **ENTER (F4)**.

5

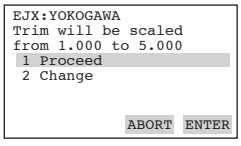


'5'

F4 (ENTER)

Enter the value read on the meter when the signal is 20 mA. Then, enter **5**, and press **ENTER (F4)**.

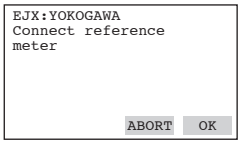
6



F4 (ENTER)

Select **Proceed** and press **ENTER (F4)**.

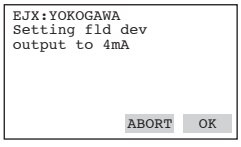
7



F4 (OK)

Connect the voltmeter, and press **OK (F4)**.

8



F4 (OK)

Press **OK (F4)**. A 0% output signal is output.

F0332.EPS

9

```
EJX:YOKOGAWA
Enter meter value
1.000000
 1.010

          DEL  ABORT  ENTER
```

'1 . 0 1'

F4 (ENTER)

Voltmeter reading: 1.010

Enter the reading of the voltmeter (1.010), and press **ENTER (F4)**. (The output of the transmitter changes.)

10

```
EJX:YOKOGAWA
Scaled output: 1.000
equal readout
device?
 1 Yes
 2 No

               ABORT  ENTER
```

F4 (ENTER)

Voltmeter reading: 1.000

If the reading on the voltmeter is 1.000, select **Yes** and press **ENTER (F4)**.
If the reading is not 1.000, select **No**. Repeat steps 8 and 9 until the voltmeter reads 1.000 V.

11

```
EJX:YOKOGAWA
Setting fld dev
output to 20mA


               ABORT  OK
```

F4 (OK)

Press **OK (F4)**. A 100% output signal is output.

12

```
EJX:YOKOGAWA
Enter meter value
5.000000
 5.210

     HELP  DEL  ABORT  ENTER
```

'5 . 2 1'

F4 (ENTER)

Voltmeter reading: 5.210

Enter the reading of the voltmeter (5.210), and press **ENTER (F4)**.

13

```
EJX:YOKOGAWA
Scaled output: 5.000
equal readout
device?
 1 Yes
 2 No

               ABORT  ENTER
```

F4 (ENTER)

Voltmeter reading: 5.000

Select **Yes** and press **ENTER (F4)**.

"Returning fid dev to original output"

14

```
EJX:YOKOGAWA
NOTE-Loop may be
returned to automatic
control


                     OK
```

F4 (OK)

Press **OK (F4)**.

F0333.EPS

3.5.9 Burst Mode

When the burst mode is set on, the transmitter continuously sends stored data. Either the pressure value, % range/current value, or current/process variables can be selected and sent. The data is sent approximately three times per second as a digital signal when the transmitter is set in burst mode. When data is being sent in burst mode, other operations can be performed with the HART communicator.

Setting of Burst Mode

1. Device setup
↓
4. Detailed setup
↓
3. Output condition
↓
3. HART output
↓
3. Burst mode and **4. Burst option**

1

```
EJX:
Burst option
PV
 PV
 % range/current
 Process vars/crnt

               ESC  ENTER
```

F4 (ENTER)

Call up the **Burst option**, and set the data to be sent.
- PV: Primary variable (Pressure value)
- % range/current: Output in % and mA
- Process vars/crnt: Output in mA and process variables (pressure value, static pressure value, and sensor temp value)

2

```
EJX:
Burst mode
Off
 On
 Off

               ESC  ENTER
```

⇧ F4 (ENTER)

Call up the **Burst mode** and set to **On**.

3

```
EJX:
HART output                 ◄┘
 1 Poll addr                 0
 2 Num req preams            5
 3 Burst mode               On
 4⇨Burst opiton             PV

HELP  SEND  HOME
```

F2 (SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0334.EPS

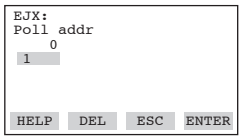
To release Burst Mode, call up the **Burst mode** display and set it to **Off**.

3.5.10 Multidrop Mode

"Multidropping" transmitters refers to the connection of several transmitters to a single communications transmission line. Up to 15 transmitters can be connected when set in the multidrop mode. To activate multidrop communication, the transmitter address must be changed to a number from 1 to 15. This change deactivates the 4 to 20 mA analog output, sending it to 4 mA. The alarm current is also disabled.

Setting of Multidrop Mode

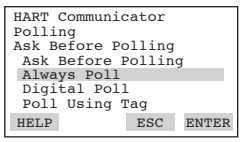
1. Device setup
↓
4. Detailed Setup
↓
3. Output condition
↓
3. HART Output
↓
1. Poll addr

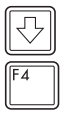


Call up the **Poll addr** and set the polling address. (a number from 1 to 15)
And press **SEND (F2)** to send the data.

• Then make sure the communicator setting is as follows.

2. Online
↓
4. Utility
↓
1. Configure Communication
↓
1. Polling





(ENTER)

Confirm that **Always Poll**, **Ask Before Polling**, or **Digital Poll** is specified, and press **ENTER (F4)**.

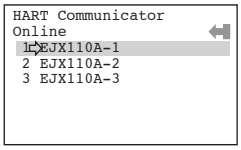
F0335.EPS

NOTE

1. When the polling option is set as **Never Poll** or **Poll Using Tag**, the online menus cannot be called up and displayed. Be sure to select a polling option such as **Ask Before Polling**.
2. When the same polling address is set for two or more transmitters in multidrop mode, communication with these transmitters is disabled.

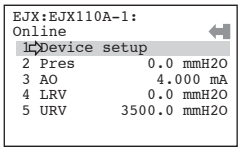
Example: Communication when set in multidrop mode

1



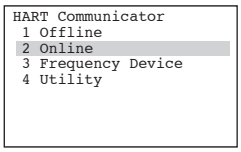
(1) The HART communicator searches for a transmitter that is set in multidrop mode when it is turned on.
When the HART communicator is connected to the transmitter, the polling address and the tag will be displayed (display 1).

2



(2) Select the desired transmitter. After that, normal communication to the selected transmitter is possible. However, the communication speed will be slow (display 2).

3



(3) To communicate with another transmitter, turn off the power once and then turn on it again, or call up display 3 and select **Online**.

(4) Display 1 will appear. Select the desired transmitter.

F0336.EPS

To release multidrop mode, follow the procedure below.

1. Call up the **Poll addr** display and set the address to 0.
2. Call up the **Polling** display and set **Ask Before Polling**.

3.5.11 External Switch Mode

Follow the procedure below to enable or inhibit zero point adjustment by means of the zero-adjustment screw on the transmitter.

This is set to **Enabled** when the instrument is shipped.

Example: Set the mode to inhibit zero adjustment by means of the external zero-adjustment screw.

1. Device setup
4. Detailed setup
5. Device information
1. Field device info
9. Ext SW

1

```
EJX:
Ext SW
Enabled
 Disabled
 Enabled

                ESC  ENTER
```

(ENTER)

Select **Disabled** and press **ENTER (F4)**.

2

```
EJX:
Field device info
 5 Model 1
 6 Model 2
 7 Model 3
 8 Write Protect      No
 9 Ext SW         Disabled
HELP  SEND  HOME
```

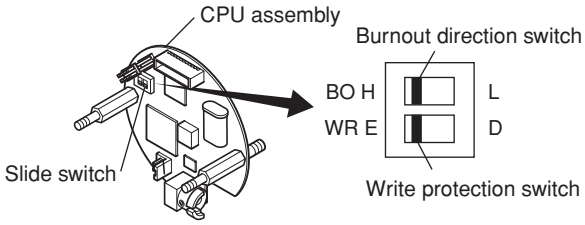
(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0337.EPS

3.5.12 CPU Failure Burnout Direction and Hardware Write Protect

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



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

Hardware write protection switch (WR)		
Write Protection Switch Position	H E L D	H E L D
Write Protection	NO (Write enabled)	YES (Write disabled)

F0340.EPS

The parameter of **AO alm typ** parameter displays the status of 4-20 mA DC output if a CPU failure occurs. In case of a failure, communication is disabled.

Standard specifications

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

Option code /C1

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

Example: Confirming the burnout direction at the CPU failure.

1. Device setup
4. Detailed setup
3. Output condition
2. Analog output
5. AO alm typ

```
EJX:
Analog output
 1 Loop test
 2 D/A trim
 3 Scaled D/A trim
 4 Clear D/A trim
 5 AO alm typ          High
HELP  SAVE  HOME
```

F0341.EPS

3.5.13 Software Write Protect

EJX configured data is saved by using a write protect function. The write protect status is set to "Yes" when 8 alphanumeric characters are entered in the **New password** field and transferred to the transmitter. When write protect is set to "Yes," the transmitter does not accept parameter changes. When the same eight alphanumeric string entered in the **New password** field is also entered in the **Enable wrt 10min** field and transferred to the transmitter, it will be possible to change transmitter parameters during a 10 minute period.

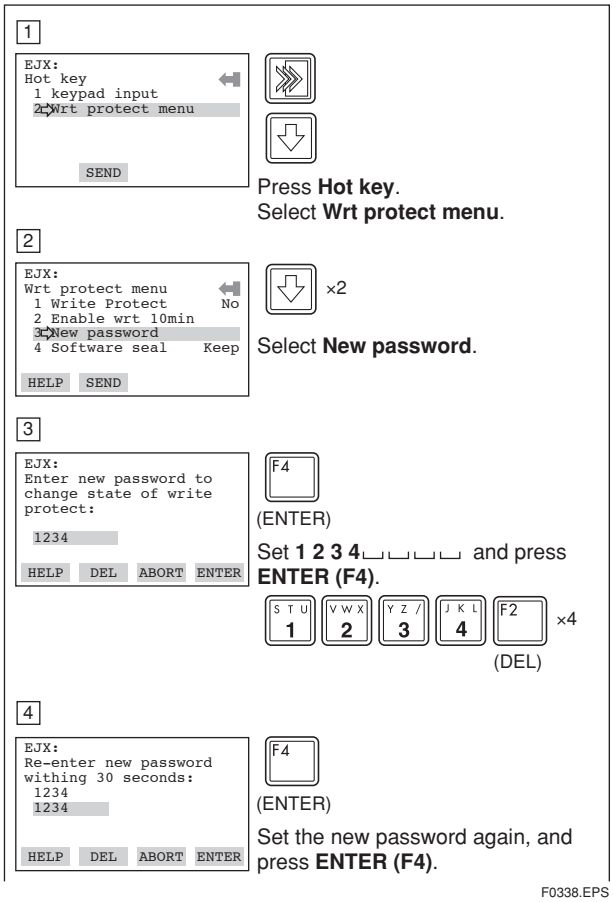
To change the transmitter from the write protect "Yes" status back to Write protect "No" status, use **Enable wrt 10min** to first release the write protect function and then enter eight spaces in the **New password** field.

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

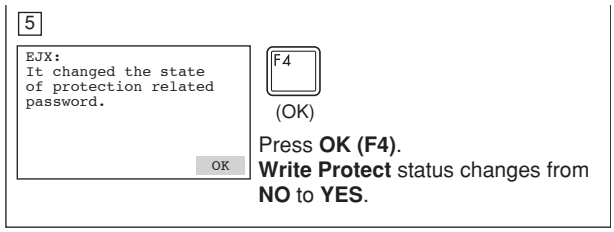
To disable the external zero adjustment screw, select Disabled in the Ext SW field before activating the software write protection. Refer to subsection 3.5.11.

(1) Setting Password

Example: Set the password to **1 2 3 4**␣␣␣␣.



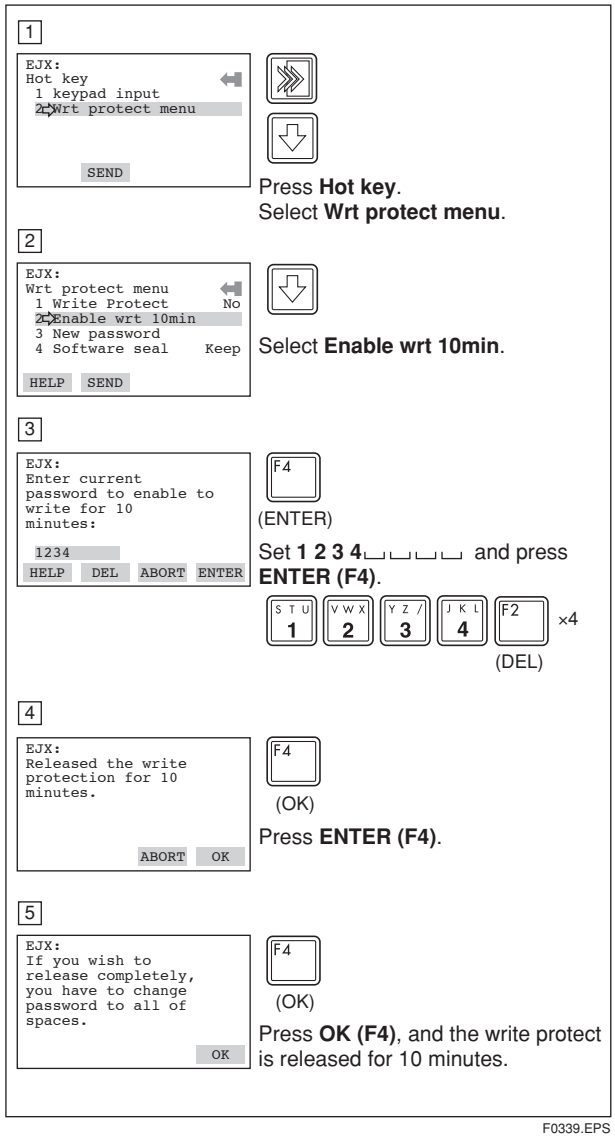
F0338.EPS



F0355.EPS

(2) Entering Password to Enable the Parameter Changes

Example: Enter the password of **1 2 3 4**␣␣␣␣.



F0339.EPS

(3) Releasing Password

To release the password completely, enter spaces in the **New password** field while the write protect function is released.

(4) Software Seal

When you lose the password that has been registered, it is possible to release the **Write Protect** mode by using the general use password: "YOKOGAWA." When the password is used, the status shown in the parameter of **Software seal** is changed from "KEEP" to "BREAK." The status returns to "KEEP" by entering a newly set password at **Enable wrt 10min**.

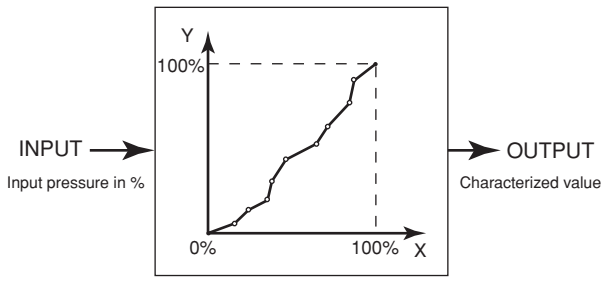
3.5.14 Signal Characterizer

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

To apply the settings to the output, set the **S.C.** parameter to **Enabled**.

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

- When the specified coordinates of x and y are not incremental as the input increases.
- When the output mode of the output signal is set as **Sq root**; at the same time, the low cut mode is set to **Linear**.

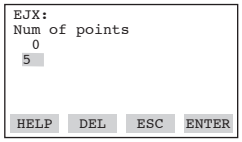


F0342.EPS

Example: Set the number of coordinates on the line graph to 5.

1. Device setup
4. Detailed setup
2. Signal condition
S.C. menu
2. Num of points

1



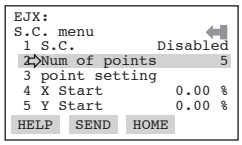
'5'

F4 (ENTER)

Enter 5 and press **ENTER (F4)**.

F0343.EPS

2



F2 (SEND)

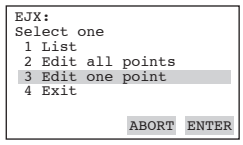
Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0356.EPS

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

1. Device setup
4. Detailed setup
2. Signal condition
S.C. menu
3. Point setting

1

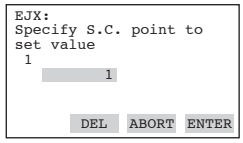


×2

F4 (ENTER)

Select **Edit one point**, and press **ENTER (F4)**.

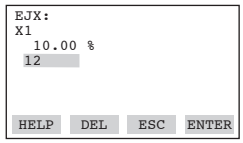
2



F4 (ENTER)

Press **ENTER (F4)**.

3

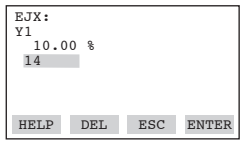


'12'

F4 (ENTER)

Enter 12 and press **ENTER (F4)**.

4



'14'

F4 (ENTER)

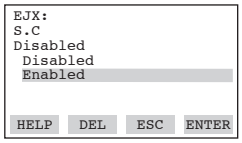
Enter 14 and press **ENTER (F4)**.

F0344.EPS

Example: Set the signal characterizer to **Enabled**.

1. Device setup
4. Detailed setup
2. Signal condition
S.C. menu
1. S.C.

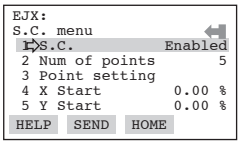
1



(ENTER)

Select **Enabled**, and press **ENTER (F4)**.

2



(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0345.EPS

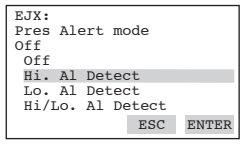
3.5.15 Process Alarm

The function is used to display the alarm codes when the input pressure exceeds the specified value within the calibration range. The same is available for the input static pressure and the capsule temperature on the pressure sensor. Refer to table 4.2.1 Alarm Message Summary for the specific alarm code to be generated.

Example: Set the alert mode from **OFF** to **Hi. Al Detect** for the input pressure.

1. Device setup
4. Detailed setup
3. Output condition
4. Process Alerts
1. Pres Alert mode

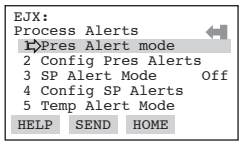
1



(ENTER)

Select **Hi. Al Detect**, and press **ENTER (F4)**.

2



(SEND)

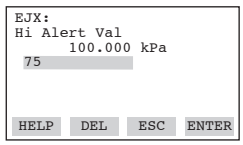
Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0346.EPS

Example: Set the higher alert value of 75 for alarm generation.

1. Device setup
4. Detailed setup
3. Output condition
4. Process Alerts
2. Config Pres Alerts
1. Hi Alert Val

1

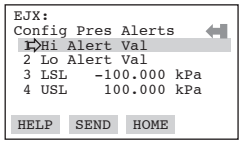


'75'

(ENTER)

Enter 75, and press **ENTER (F4)**.

2



(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

F0347.EPS

3.5.16 Status Output (option code AL)

This feature is used for a transistor output (open collector) of an on/off signal according to the status of high and low alarm limits, which are user-configurable values as shown in 3.5.15 Process Alarm. The status output can be assigned as any combination of the high or low limits of the input pressure, input static pressure, or capsule temperature.

NOTE

No status output signal has been defined for a CPU failure or hardware error. Use a 4-20 mA signal to indicate a transmitter's failure.

Example: Set the status output to output an off signal when the input pressure exceeds 75 kPa with the alert mode of Hi. Al Detect.

1. Device setup
↓
4. Detailed setup
↓
3. Output condition
↓
4. Process Alerts
↓
7. DO Config
↓
2. DO Select and **3. DO Signal type**

1

```
EJX:
DO Select
Pres
 Off
 Pres
 SP
 Temp
              ESC  ENTER
```

(ENTER)

Select **Pres**, and press **ENTER (F4)**.

2

```
EJX:
DO Config
 1 Digital Output    Off
 2 DO Select         Pres
 3 DO Signal type
 4 DO Test

HELP  SEND  HOME
```

(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

3

```
EJX:
DO Signal type
ON WHEN AL. DETECT
 ON WHEN AL. DETECT
 OFF WHEN AL. DETECT

              ESC  ENTER
```

(ENTER)

Select **OFF WHEN AL. DETECT**, and press **ENTER (F4)**.

4

```
EJX:
DO Config
 1 Digital Output    Off
 2 DO Select         Pres
 3 DO Signal type
 4 DO Test

HELP  SEND  HOME
```

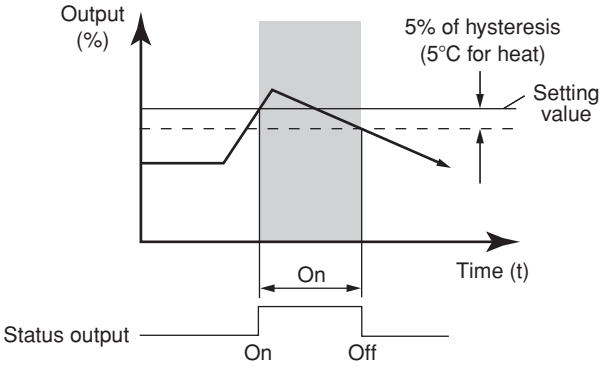
(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

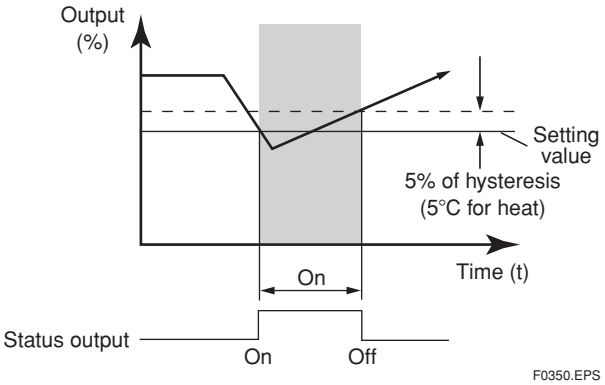
F0349.EPS

Example: Status output operation of **ON WHEN AL. DETECT**

● Status output for higher alert value



● Status output for lower alert value



F0350.EPS

3.5.17 Capillary Fill Fluid Density Compensation

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

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

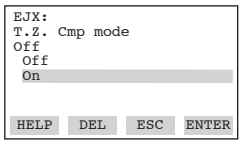
Compensated output=output+K×Tamb

(1) Temperature Compensation Mode Setup
When using this function, set **T.Z. Cmp mode** to *ON* to enable or *OFF* to disable. To set to *ON*, follow the procedure below.

Example: Set the temperature compensation mode to **ON**.

1. Device setup
↓
4. Detailed setup
↓
2. Signal condition
↓
T.Z. Cmp menu
↓
1. T.Z. Cmp mode

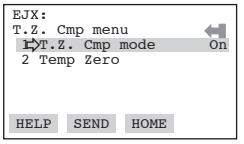
1



(ENTER)

Select **On**, and press **ENTER (F4)**.

2



(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

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(2) Zero Shift Compensation Setup
Obtain the K compensating value from the equation (a) below, and enter the value to **Temp Zero**.

$$K = -\frac{h \times B}{Span} \times 100 \cdots\cdots\cdots\cdots (a)$$

where,

B: Constant value of fill fluid (See Table A.)

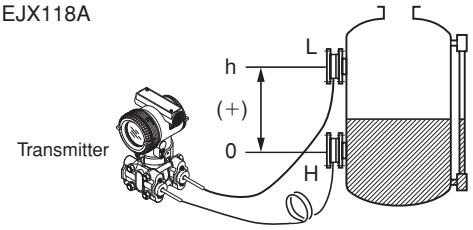
span: |URV–LRV|

h: Distance from high pressure side to low pressure side (m)

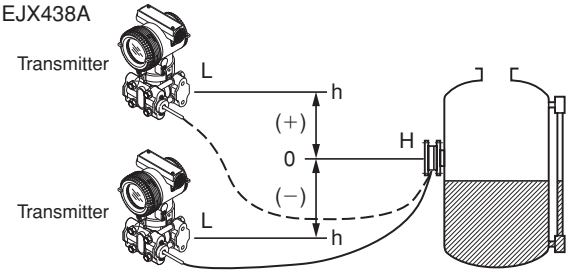
EJX118A: Distance from high side of diaphragm seal to low side of diaphragm seal.

EJX438A: Distance from diaphragm seal (high side) to position of transmitter (low side).

● EJX118A



● EJX438A



Note: When the transmitter is positioned lower than the diaphragm seal part, the value of "h" must have a negative sign (−).

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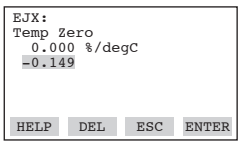
Example: Enter K value obtained from the equation (a). A value haivng up to 3 decimal places may be specified.

When h=+3 m, Fill fluid code A, span=15 kPa,
K=−(+3)×0.00745÷15×100=−**0.149**

1. Device setup
↓
4. Detailed setup
↓
2. Signal condition
↓
T.Z. Cmp menu
↓
2. Temp Zero

1

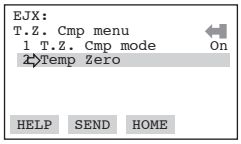


'−0.149'

(ENTER)

Enter −0.149 and press **ENTER (F4)**.

2



(SEND)

Press **SEND (F2)** to send the data to the transmitter, then check to confirm that SEND disappears.

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

Note 2: When the span changes, reenter the newly obtained value of K to **Temp Zero**.

Table A. Constant value [B] of fill fluid

	Fill fluid code	A, C	B	D	E
Constant value [B]	mmH_2O	0.76	0.87	1.45	0.75
	kgf/cm^2	0.000076	0.000087	0.000145	0.000075
	kPa	0.00745	0.00853	0.01422	0.00736
	mBar	0.07453	0.08532	0.14220	0.07355
	atm	0.000074	0.000084	0.000140	0.000073
	inH_2O	0.02992	0.03425	0.05709	0.02953
	psi	0.00108	0.00124	0.00206	0.00167
	mmHg	0.05592	0.06401	0.10669	0.05518

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Note 3: Select the unit of constant value of [B] from the actual unit used for the transmitter in operation.

4. SELF-DIAGNOSTICS

4.1 Self-Diagnostics

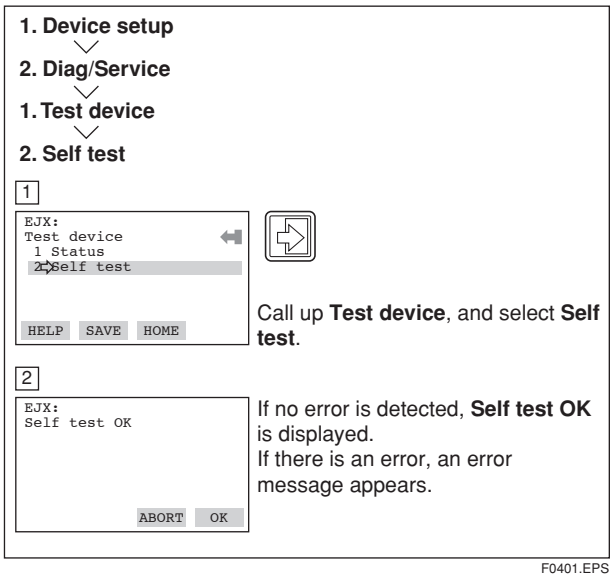
4.1.1 Identify Problems by Using the Communicator

The HART communicator can be used to run self-diagnostics on a transmitter and check for incorrect data settings.

The **Self test** and **Status** commands are available for self-diagnostics. When **Self test** is run, the integral indicator shows an error code and alarm message if the transmitter detects any illegal parameter settings and functional faults. See table 4.2.1 Alarm Message Summary for probable causes and countermeasures. If the specific diagnostic item is known for the check, you can directly call up the item by using the **Status** command. See table 4.2.1 to determine the status group.

The HART communicator diagnoses every command you make. When a faulty command or keypad input is performed, an error message appears. See table 4.2.2 HART Commnicator Error Messages for the details.

Diagnostic by "self test"



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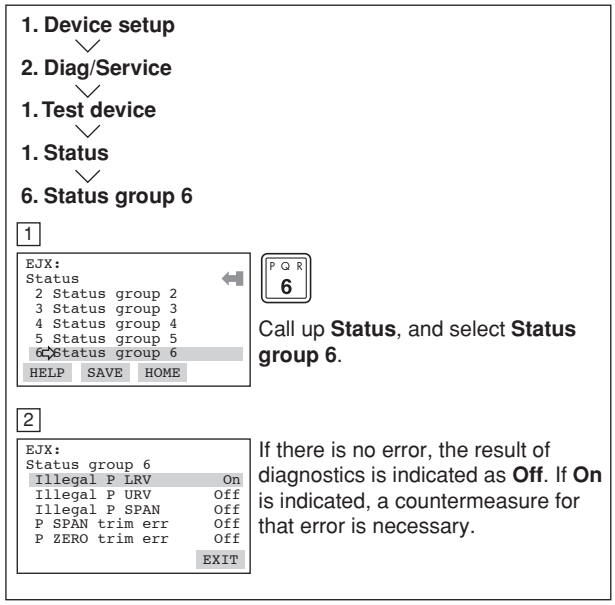
Diagnostic by "status"



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4.1.2 Checking with Integral Indicator

NOTE

If an error is detected by running self-diagnostics, an error number is displayed on the integral indicator. If there is more than one error, the error number changes at three-second intervals. See table 4.2.1 regarding the alarm codes.

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Figure 4.1.2 Integral Indicator

4.2 Alarms and Countermeasures

Table 4.2.1 Alarm Message Summary

Integral indicator	HART communicator display	Cause	Output operation during error	Countermeasure	Status group
AL. 01 CAP. ERR	**P sensor error**	Sensor problem.	Outputs the signal (High or Low) set with burnout direction switch. [status output: undefined]	Replace capsule when error keep appearing error even after restart.	1
	CT sensor error	Capsule temperature sensor problem.		Replace capsule.	
	Cap EEPROM error	Capsule EEPROM problem.			
AL. 02 AMP. ERR	**AT sensor error**	Amplifier temperature sensor problem.		Replace amplifier.	
	Amp EEPROM error	Amplifier EEPROM problem.			
	CPU board error	Amplifier problem.			2
——	**No device ID**	No device ID is found.	Continues to operate and output.		
AL. 10 PRESS	**P outside limit**	Input is outside measurement range limit of capsule.	Outputs AO upper limit or AO lower limit.	Check input or replace capsule when necessary.	3
AL. 11 ST. PRSS	**SP outside limit**	Static pressure exceeds limit.	Continues to operate and output.		
AL. 12 CAP. TMP	**CT outside limit**	Capsule temperature is outside range (–50 to 130°C).		Use heat insulation or make lagging to keep temperature within range.	
AL. 13 AMP. TMP	**AT outside limit**	Amplifier temperature is outside range (–50 to 95°C).			
AL. 30 RANGE	**P over range**	Output is outside upper or lower range limit value.	Outputs AO upper limit or AO lower limit.	Check input and range setting, and change them as needed.	4
AL. 31 SP. RNG	**SP over range**	Static pressure exceeds specified range.	Continues to operate and output.		
AL. 35 P. HI	**P high alarm**	Input pressure exceeds specified threshold.		Check input.	5
AL. 36 P. LO	**P low alarm**				
AL. 37 SP. HI	**SP high alarm**	Input static pressure exceeds specified threshold.			
AL. 38 SP. LOW	**SP low alarm**				
AL. 39 TMP. HI	**CT high alarm**	Detected temperature exceeds specified threshold.		Check capsule temperature.	
AL. 40 TMP. LO	**CT low alarm**				
AL. 50 P. LRV	**Illegal P LRV**	Specified value is outside of setting range.	Holds output immediately before error occurred.	Check settings and change them as needed.	6
AL. 51 P. URV	**Illegal P URV**				
AL. 52 P. SPN	**Illegal P SPAN**				
AL. 53 P. ADJ	**P SPAN trim err**		Continues to operate and output.	Adjust settings and change them as needed.	
	P ZERO trim err				
AL. 54 SP. RNG	**Illegal SP LRV**		Continues to operate and output holding static pressure in %.	Check settings and change them as needed.	
	Illegal SP URV				
	Illegal SP SPAN				
AL. 55 SP. ADJ	**SP SPAN trim err**		Continues to operate and output.	Adjust settings and change them as needed.	7
	SP ZERO trim err				
AL. 60 SC. CFG	**SC config error**	Specified values or settings do not meet the conditions.	Continues to operate and output without signal characterizing.	Check settings and change them as needed.	
AL. 79 OV. DISP	————	Displayed value exceeds limit.	Continues to operate and output.		—

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Table 4.2.2 HART Communicator Error Messages

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 senser limit	The shift of URV according to the new LRV setting exceeds USL.	Change the URV setting within the range of USL.
Excess correction attempted	Amount of correction is too much.	Adjust the amount.
Lowercase 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	Set value is outside lower or upper range limit.	Change the setting.

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5. PARAMETER SUMMARY

Function	Label	Item	Contents	Default value	Handling	Fast key sequences
Analog output	AO alm typ	Analog output alarm type	High or Low		R	1, 4, 3, 2, 5
	AO lower limit	Lower limit of analog output	3.6000 to 21.6000 mA	3.6000 mA	W	1, 4, 3, 2, 7
	AO upper limit	Upper limit of analog output	3.6000 to 21.6000 mA	21.6000 mA	W	1, 4, 3, 2, 8
	Auto recover	Auto-recover from hardware error	Off or On	On	W	1, 4, 3, 2, 6
Analog output trim	Clear D/A trim	Reset analog output trim			M	1, 2, 3, 2, 3
	D/A trim	Analog output trim with ammeter			M	1, 2, 3, 2, 1
	Scaled D/A trim	Analog output trim with voltmeter			M	1, 2, 3, 2, 2
Bi-directional mode	Bi-dir mode	Bi-directional mode	Off or On	Off	W	1, 4, 2, 9
Burst mode	Burst mode	Burst mode	Off or On	Off	W	1, 4, 3, 3, 3
Burst operation option	Burst option	Burst option	PV, % range/current, or Process vars/cmt		W	1, 4, 3, 3, 4
Damping	Pres Damp	Damping time constant at amplifier	0.00 to 100.00 sec	As specified or 2.00 sec	W	1, 3, 6
	Quick resp	Quick response	On or Off	Off	W	1, 4, 2, ↓
Date	Date	Date	**/**/**		W	1, 3, 4, 1
Descriptor	Descriptor	Descriptor	16 alphanumerics	As specified	W	1, 3, 4, 2
Device information	Dev id	Device ID			R	1, 4, 5, 1, ↓, 6
	Distributor	Yokogawa			R	1, 4, 5, 1, ↓, 7
	Drain vent matl	Drain and vent plug material			W	1, 4, 5, 2, 5
	Extra No.	Customization number			R	1, 4, 5, 1, ↓, 4
	Ext SW	External zeroing permission	Disabled or Enabled	Enabled	W	1, 4, 5, 1, 9
	Fill fluid	Fill fluid			W	1, 4, 5, 2, 2
	Final asmbly num	Final assembly number			W	1, 4, 5, 1, ↓, 5
	Fld dev rev	Field device revision			R	1, 4, 5, 1, ↓, 2
	Gasket matl	Gasket material			W	1, 4, 5, 2, 3
	Isoltr matl	Capsule material			W	1, 4, 5, 2, 1
	LSL	Lower sensor limit			R	1, 3, 3, 1, 4
	Mftr Date	Manufactured date			R	1, 4, 5, 1, ↓, 3
	Min Span	Minimum span			R	1, 3, 3, 1, 6
	Model 1	Memo field for MS code 1	16 alphanumerics		W	1, 4, 5, 1, 5
	Model 2	Memo field for MS code 2	16 alphanumerics		W	1, 4, 5, 1, 6
	Model 3	Memo field for MS code 3	16 alphanumerics		W	1, 4, 5, 1, 7
	Num of RS	Number of remote seal			W	1, 4, 5, 2, 9
	Process Conn matl	Process connection material			W	1, 4, 5, 2, 4
	Process Conn size	Process connection size			W	1, 4, 5, 2, 8
	Process Conn type	Process connection type			W	1, 4, 5, 2, 6
	RS fill fluid	Fill fluid of remote seal			W	1, 4, 5, 2, ↓
	RS Isoltr matl	Remote seal material			W	1, 4, 5, 2, 7
	RS type	Remote seal type			W	1, 4, 5, 2, ↓
	Serial No.	Serial number			R	1, 4, 5, 1, ↓, 2
	Software rev	Software revision			R	1, 4, 5, 1, ↓, 3
	Style No.	Style number	Style number of product		R	1, 4, 5, 1, ↓, 1
	Universal rev	Universal revision			R	1, 4, 5, 1, ↓, 1
	USL	Upper sensor limit			R	1, 3, 3, 1, 5
Display setup	Bar indicator	Bar indicator	Off or On	On	W	1, 4, 4, 5
	Disp Out 1	LCD output 1	Pres, Pres %, Engr Pres, SP, or SP %	Pres %	W	1, 4, 4, 1, 1
	Disp Out 2	LCD output 2	Pres, Pres %, Engr Pres, SP, SP %, or Not used	Not used	W	1, 4, 4, 1, 2
	Disp Out 3	LCD output 3	Pres, Pres %, Engr Pres, SP, SP %, or Not used	Not used	W	1, 4, 4, 1, 3
	Disp Out 4	LCD output 4	Pres, Pres %, Engr Pres, SP, SP %, or Not used	Not used	W	1, 4, 4, 1, 4
	Disp Pres % fnctn	% display mode	Linear or Sq root	As specified or Linear	W	1, 4, 4, 2, 1
	Disp Pres % Reso	% display resolution	Normal or High resolution	Normal	W	1, 4, 4, 2, 2
	Engr exp	Exponents	---, ×10, ×100, or ×1000	As specified or ---	W	1, 4, 4, 4, 3
	Engr LRV	User set lower range value	−32000 to 32000, unit specified in Set Engr Unit	As specified	W	1, 4, 4, 4, 1
	Engr point	Decimal place for user set	0 to 4	2	W	1, 4, 4, 4, 5
	Engr URV	User set upper range value	−32000 to 32000, unit specified in Set Engr Unit	As specified	W	1, 4, 4, 4, 2
	Modify Engr Unit	User set engineering unit		As specified	M	1, 4, 4, 4, 7
	Pres disp point	Decimal place for pressure	0 to 4	2	W	1, 4, 4, 2, 3
	Set Engr Unit	Engineering unit select	See section 3.5.3d		M	1, 4, 4, 4, 6
	SP disp point	Decimal place for static pressure	0 to 4	2	WD	1, 4, 4, 3, 1
Error log	Error log Clear	Clear error records			M	1, 2, 4, 2
	Error log view	Error records	Log1 (latest) to log4		M	1, 2, 4, 1
Loop test	Loop test	Test output setting	Within AO lower and upper limits		M	1, 2, 2
Low cut	Low cut	Low cut	0.00 to 20.00%	10.00%	W	1, 3, 7
	Low cut mode	Low cut mode	Linear or Zero	Linear	W	1, 3, 8
Message	Message	Message	32 alphanumerics	As specified	W	1, 3, 4, 3
Number of requested preambles	Num req preams	Number of requested preambles			R	1, 4, 3, 3, 2
Piping orientation	H/L Swap	Impulse piping accessing direction	Normal or Reverse	Normal	WD	1, 3, 9
Poll address	Poll addr	Poll address for multidrop use	0 to 15	0	W	1, 4, 3, 3, 1
Process Alert	Digital Output	Display of contact output	Off or On	Off	RA	1, 4, 3, 4, 7, 1
	DO Select	Contact output select	Off, P Alarm, SP Alarm, P or SP Alarm	Off	WA	1, 4, 3, 4, 7, 2
	DO Signal type	Signal type select	On When AI Detect or Off When AI Detect	On When AI Detect	WA	1, 4, 3, 4, 7, 3
	DO Test	Test output contact	Off, On, or Exit		MA	1, 4, 3, 4, 7, 4
	Hi Alert Val	High side alert value of pressure	LSL−10% to USL+10% minus 5% hysteresis		W	1, 4, 3, 4, 2, 1
	Lo Alert Val	Low side alert value of pressure	LSL−10% to USL+10% plus 5% hystereis		W	1, 4, 3, 4, 2, 2
	Pres Alert mode	Alert mode for pressure	Off, Hi AI Detect, Lo AI Detect, or Hi/Lo AI Detect	Off	W	1, 4, 3, 4, 1
	SP Alert mode	Alert mode for static pressure	Off, Hi AI Detect, Lo AI Detect, or Hi/Lo AI Detect	Off	WD	1, 4, 3, 4, 3
	SP Hi Alert Val	High side alert value of static pressure	SP LSL−10% to SP USL+10% minus 5% hysteresis		WD	1, 4, 3, 4, 4, 1
	SP Lo Alert Val	Low side alert value of static pressure	SP LSL−10% to SP USL+10% plus 5% hystereis		WD	1, 4, 3, 4, 4, 2
	Temp Alert mode	Alert mode for temperature	Off, Hi AI Detect, Lo AI Detect, or Hi/Lo AI Detect	Off	W	1, 4, 3, 4, 5
	Temp Hi Alert Val	High side alert value of temperature	−50 to 130	120 degC	W	1, 4, 3, 4, 6, 1
	Temp Lo Alert Val	Low side alert value of temperature	−50 to 130	−40 degC	W	1, 4, 3, 4, 6, 2

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*1: Handling: **R**=Read only, **W**=Read & Write, **M**=Method, **A**=Applicable for option code AL, **D**=Applicable for differential pressure transmitters. Do not change these parameters for pressure transmitters.

Function	Label	Item	Contents	Default value	Handling	Fast key sequences
Process variables	AO	Analog output current	3.6000 to 21.6000 mA		R	1, 1, 3
	Engr Disp	User scaled value	−32000 to 32000, unit specified in Set Engr Unit		R	1, 1, 7
	Engr Unit	User set engineering unit	Unit specified in Set Engr Unit		R	1, 1, 9
	Pres	Measured pressure	−32000 to 32000, unit specified in Unit		R	1, 1, 1
	Pres %	Measured pressure in %	−2.50 to 110.00%		R	1, 1, 2
	Snsr temp	Capsule temperature	Unit specified in Temp Unit		R	1, 1, 6
	SP	Measured static pressure	−32000 to 32000, unit specified in SP Unit		RD	1, 1, 4
	SP %	Measured static pressure in %	−10.0 to 110.00%		RD	1, 1, 5
Rerange	Apply values	Rerange for measured pressure	4 mA, 20 mA, or Exit		M	1, 3, 3, 2
	LRV	Lower range value	−32000 to 32000 within measurement range	As specified	W	1, 3, 3, 1, 1
	URV	Upper range value	−32000 to 32000 within measurement range	As specified	W	1, 3, 3, 1, 2
Self test	Self test	Self-diagnostics	See Chapter 4		M	1, 2, 1, 2
Sensor trim	Clear P snsr trim	Reset pressure trim to factory setting			M	1, 2, 3, 3, 5, 3
	Clear SP snsr trim	Reset SP trim to factory setting			MD	1, 2, 3, 4, 4, 3
	P LTD	Lower pressure trim deviation			R	1, 2, 3, 3, 5, 1
	P LTP	Lower temperature trim point			R	1, 2, 3, 3, 3
	P UTD	Upper pressure trim deviation			R	1, 2, 3, 3, 5, 2
	P UTP	Upper temperature trim point			R	1, 2, 3, 3, 4
	Pres trim	Pressure trim			M	1, 2, 3, 3, 2
	Pres Zero trim	Zeroing			M	1, 2, 3, 3, 1
	SP LTD	Lower SP trim deviation			RD	1, 2, 3, 4, 4, 1
	SP LTP	Lower SP trim point			RD	1, 2, 3, 4, 2
	SP UTD	Upper SP trim deviation			RD	1, 2, 3, 4, 4, 2
	SP UTP	Upper SP trim point			RD	1, 2, 3, 4, 3
	Static Pres trim	Static pressure trim			MD	1, 2, 3, 4, 1
	Trim Date	Trim information	**/**/**		W	1, 2, 3, 5, 2
	Trim Desc	Trim information	16 alphanumerics		W	1, 2, 3, 5, 4
	Trim Loc	Trim information	8 alphanumerics		W	1, 2, 3, 5, 3
	Trim Who	Trim information	8 alphanumerics		W	1, 2, 3, 5, 1
Signal characterizer	Num of points	Number of coordinates	0 to 9	9	W	1, 4, 2, ↓, 2
	Point setting	Coordinates editor			M	1, 4, 2, ↓, 3
	S.C.	Signal characterizer permission	Disabled or Enabled	Disabled	W	1, 4, 2, ↓, 1
	X End	End point of X	100.00%		R	1, 4, 2, ↓, 6
	X Start	Start point of X	0.00%		R	1, 4, 2, ↓, 4
	Y End	End point of Y	100.00%		R	1, 4, 2, ↓, 7
	Y Start	Start point of Y	0.00%		R	1, 4, 2, ↓, 5
Static pressure setup	A/G Select	Gauge/abs select for static pressure	Gauge or Absolute	Absolute	WD	1, 4, 1, 2, 7, 4, 1
	Atm. Pres value	Conversion coefficient		101.3 kPa	WD	1, 4, 1, 2, 7, 4, 2
	SP H/L Select	H/L select for static pressure	High or Low	High	WD	1, 4, 1, 2, 7, 5
	SP Apply values	Rerange for static pressure	"0%, 100%, or Exit"		MD	1, 4, 1, 2, 7, 1, 2
	SP Damp	Damping time constant for SP	0.00 to 100.00 sec	2.00 sec	WD	1, 4, 1, 2, 7, 3
	SP LRV	Lower range value for static pressure	−32000 to 32000 within measurement range	0.0 MPa	WD	1, 4, 1, 2, 7, 1, 1, 1
	SP LSL	Lower sensor limit for static pressure			RD	1, 4, 1, 2, 7, 1, 1, 4
	SP Min Span	Minimum span for static pressure			RD	1, 4, 1, 2, 7, 1, 1, 6
	SP URV	Upper range value for static pressure*2	−32000 to 32000 within measurement range		WD	1, 4, 1, 2, 7, 1, 1, 2
	SP USL	Upper sensor limit for static pressure			RD	1, 4, 1, 2, 7, 1, 1, 5
Status	Status group 1	Device status information for hardware			R	1, 2, 1, 1, 1
	Status group 2	Device status information for hardware			R	1, 2, 1, 1, 2
	Status group 3	Device status information for process			R	1, 2, 1, 1, 3
	Status group 4	Device status information for process			R	1, 2, 1, 1, 4
	Status group 5	Device status information for process			R	1, 2, 1, 1, 5
	Status group 6	Device status information for settings			R	1, 2, 1, 1, 6
	Status group 7	Device status information for settings			R	1, 2, 1, 1, 7
Tag	Tag	Tag number	8 alphanumerics	As specified	W	1, 3, 1
Temperature compensation	T.Z. Cmp mode	Temperature compensation mode	Off or On	Off	W	1, 4, 2, ↓, 1
	Temp Zero	Zero shift compensation	−99.999 to 99.999%/degC	0.000%/degC	W	1, 4, 2, ↓, 2
Temperature sensor	Amp temp	Amplifier temperature			R	1, 4, 1, 3, 2
	Snsr temp	Capsule temperature			R	1, 4, 1, 3, 1
	Temp Unit	Temperature setting unit	degC, degF, or Kelvin	degC	W	1, 4, 1, 3, 3
Test key	Test Key	Special maintenance parameter			M	1, 4, 6
Transfer function	Xfer fnctn	Output mode	Linear or Sq root	As specified or Linear	W	1, 3, 5
Unit	Unit	Measurement range unit	See section 3.4.2	As specified or kPa	W	1, 3, 2
	SP Unit	Static pressure unit	See section 3.5.5	MPa	WD	1, 4, 1, 2, 3
Write protect menu	Enable wrt 10min	Write protect release	8 alphanumerics		M	Hot key, 2, 2
	New password	User set password for write protect	8 alphanumerics		M	Hot key, 2, 3
	Software seal	Software seal	Keep or Break	Keep	R	Hot key, 2, 4
	Write protect	Write protect indicator	Yes or No	No	R	Hot key, 2, 1

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*1: Handling: **R**=Read only, **W**=Read & Write, **M**=Method, **A**=Applicable for option code AL, **D**=Applicable for differential pressure transmitters. Do not change these parameters for pressure transmitters.

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

APPENDIX 1. SAFETY INSTRUMENTED SYSTEMS INSTALLATION

WARNING

The contents of this appendix are cited from exida.com safety manual on the EJX series pressure transmitters specifically observed for the safety transmitter purpose. When using the EJX 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 EJX 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 EJX for an SIS Application

A1.2.1 Safety Accuracy

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

A1.2.3 Setup

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

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

A1.2.4 Required Parameter Settings

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

Table A1.2.4 Required Parameter Settings

Item	Description
Burnout direction switch	To specify if the output should go 21.6 mA or higher or 3.6 mA or lower upon detection of an internal failure.
Write protection switch	The write function should be disabled.

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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 A1.2.5 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 EJX 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, EJX transmitter maintenance, and company management of change procedures.

Table A1.2.5 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/BRAIN command to send value to high alarm (21.5 mA) and verify that current has reached this level. 3. Execute HART/BRAIN 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	Proof Test Coverage =52%	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.	• Handheld terminal • Calibrated pressure source	Proof Test Coverage =99%	

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A1.2.6 Repair and Replacement

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

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

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

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

A1.2.7 Startup Time

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

A1.2.8 Firmware Update

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

A1.2.9 Reliability Data

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

The EJX 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 EJX 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 EJX is 50 years. The reliability data listed the FMEDA report is only valid for this period. The failure rates of the EJX may increase sometime after this period. Reliability calculations based on the data listed in the FMEDA report for EJX 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 EJX are specified in the user's manual IM 01C25.

A1.2.12 Application Limits

The application limits of the EJX 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

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