# Thermowell with flange Model TW10

WIKA data sheet TW 95.10

## **Applications**

- Petrochemical industry, on-/offshore, plant construction
- For high process loads
- For high chemical demands

#### **Special features**

- Heavy-duty design
- Coating for corrosive or abrasive process loads
- Possible thermowell forms: tapered, straight, stepped
- Design TW10-F: Full penetration weld version
  - Design TW10-P, TW10-R: With double weld seam Design TW10-S, TW10-B: Screw-welded design
  - Design TW10-W: Forged version without welded

joint



#### Thermowell with flange, model TW10

#### **Description**

Each thermowell/protection tube is an important component of any temperature measuring point. It is used to separate the process from the surrounding area, thus protecting the environment and operating personnel and keeps aggressive media, high pressures and flow rates from the temperature sensor itself and thereby enables the thermometer to be exchanged during operation.

Based on the almost limitless application possibilities, there are a large number of variants, such as thermowell/protection tube designs or materials. The type of process connection and the basic method of manufacture are important design differentiation criteria. A basic differentiation can be made between threaded and weld-in thermowells/protection tubes, and those with flange connections.

Furthermore, one can differentiate between protection tubes and thermowells. Protection tubes are constructed from a tube, that is closed at the tip by a welded solid tip. Thermowells are manufactured from bar stock or forgings.

The TW10 series of thermowells with flange connection are suitable for use with numerous electrical and mechanical thermometers from WIKA.

Due to the heavy-duty design, these international design thermowells are the first choice for use in the chemical and petrochemical industries and in plant construction.



## **Specifications**

Basic information	
Thermowell form	<ul> <li>Tapered</li> <li>Straight</li> <li>Stepped</li> <li>ScrutonWell design per SP 05.16 (selectable)</li> </ul>
Versions	
Design TW10-F	Full penetration weld version
Design TW10-P	With double weld seam (weld seam strength 3 mm)
Design TW10-R	With double weld seam (weld seam strength 6 mm)
Design TW10-S	Screw-welded design, weld seam does not come into direct contact with the medium
Design TW10-B	Screw-welded design, additional weld seam on the process side (sealing joint)
Design TW10-W	Forged version without welded joint
Material (wetted)	<ul> <li>Stainless steel 304/304L</li> <li>Stainless steel 316/316L</li> <li>Stainless steel 1.4571</li> <li>Stainless steel 1.4404</li> <li>A105</li> <li>Alloy C4</li> <li>Alloy C276</li> <li>Alloy 400</li> <li>Titanium grade 2 ¹)</li> <li>Tantalum sheet for wetted parts</li> <li>Restricted choice of materials with TW10-W</li> </ul>
	→ Other materials on request
Coating	
Hardfacing for abrasive process loads with Stellite® 6	<ul> <li>Laser cladding         Layer thickness 1.6 mm [0.062 in] (standard)         Higher layer thickness on request</li> <li>Plasma Transfer Arc (PTA)         Layer thickness 1.6 mm [0.062 in] (standard) up to 3.2 mm [0.125 in]</li> <li>Air Plasma Spraying (APS)         Layer thickness max. 1.6 mm [0.062 in]</li> <li>High Velocity Oxide Fuel (HVOF)         Layer thickness 0.5 mm [0.02 in]</li> </ul>
Corrosion protection for high chemical loads	■ PFA Layer thickness min. 0.4 mm [0.015 in] (standard) or min. 0.6 mm [0.024 in] (special design) ■ ECTFE (Halar®) Layer thickness min. 0.6 mm [0.024 in]
	→ Other resistant coatings on request

<sup>1)</sup> For titanium grade 2 material in a washer disc construction, the blind flange is designed to be removable.
2) Post weld heat threatment: Depending on the selected material of the thermowell and flange as well as the design of the thermowell, heat treatment of the welded joint may be a technical requirement. Any annealing colour that occurs during this treatment on the thermowell are process-related with carbon steel and do not affect the function of the thermowell.

## **Examples for coatings**



Process connection			
Type of process connection			
Flange	■ Per ASME B16.5 ■ Per EN 1092-1 ■ Per DIN 2527		
	→ Other flanges on request		
TW10-W	<ul> <li>Dimensions in accordance with ASME B16.5</li> <li>Dimensions in accordance with EN 1092-1</li> <li>Dimensions in accordance with DIN 2527</li> </ul>		
Connection to thermometer N	<ul> <li>½ NPT female thread</li> <li>G ½ female thread</li> <li>M20 x 1.5</li> </ul>		
	→ Other dimensions on request		
Bore size B	<ul> <li>6.2 mm [0.244 in]</li> <li>6.6 mm [0.260 in]</li> <li>7.0 mm [0.276 in]</li> <li>8.2 mm [0.323 in]</li> <li>8.5 mm [0.355 in]</li> <li>9.0 mm [0.354 in]</li> <li>9.8 mm [0.385 in]</li> <li>10.2 mm [0.402 in]</li> <li>12.2 mm [0.480 in]</li> </ul>		
Insertion length U	<ul> <li>■ 150 mm [5.9 in]</li> <li>■ 6 in [152 mm]</li> <li>■ 200 mm [7.87 in]</li> <li>■ 7 in [178 mm]</li> <li>■ 250 mm [9.84 in]</li> <li>■ 10 in [254 mm]</li> <li>■ 300 mm [11.81 in]</li> <li>■ 13 in [330 mm]</li> <li>■ 350 mm [13.78 in]</li> <li>■ 16 in [406 mm]</li> <li>■ 400 mm [15.75 in]</li> <li>→ Other insertion lengths on request</li> </ul>		
Min. insertion length	Depending on the selected version		
Max. insertion length 1)	800 mm [31.5 in]		
Connection length H	<ul> <li>45 mm [1.77 in]</li> <li>57 mm [2.25 in]</li> <li>60 mm [2.36 in]</li> <li>83 mm [3.25 in]</li> <li>108 mm [4.25 in]</li> <li>133 mm [5.25 in]</li> </ul>		
Mr. O ii. I. ii	→ Other connection lengths on request		
Min. Connection length	Depending on the selected version		
Max. Connection length	250 mm [10 in]		

Process connection				
Tip thickness	6.4 mm [0.25 in]	6.4 mm [0.25 in]		
	→ Other tip thicknes	→ Other tip thicknesses on request		
Suitable stem lengths I <sub>1</sub> (dial thermometer)	with tip thickness 6.4 n	nm [0.25 in]		
Connection design S, 4 or 5	Parallel thread	I <sub>1</sub> = U + H - 10 mm [0.4 in]		
	Tapered thread	I <sub>1</sub> = U + H - 2 mm [0.08 in]		
Connection design 2	$I_1 = U + H - 30 \text{ mm}$	I <sub>1</sub> = U + H - 30 mm [1.2 in]		

<sup>1)</sup> Longer insertion lengths in one-piece design are dependent on the geometry and material, and are possible up to 1575 mm (62 in) on request.

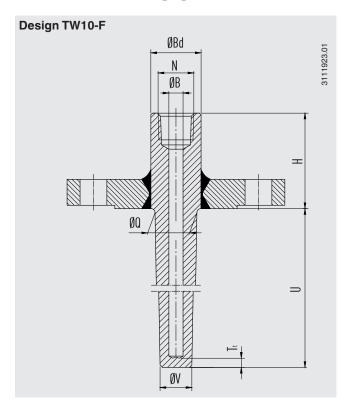
Basically, from an insertion length of 800 mm (31.5 in), a multi-part assembly in accordance with IN 00.16 is carried out, unless otherwise requested.

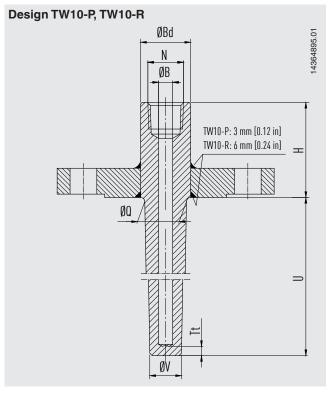
A wake frequency calculation in accordance with ASME PTC 19.3 TW-2016 requires compliance with the requirements of the above-mentioned standard.

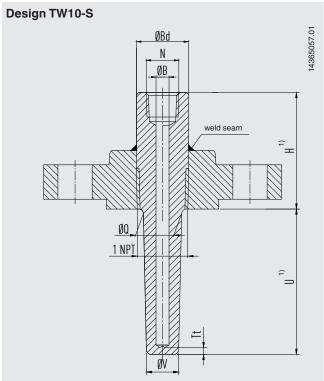
Further details on: Process connection					
	Version	AARH in µinch	Ra in µm	Rz in µm	
Sealing face roughness					
ASME B16.5	Stock finish	125 250	3.2 6.3	-	
	Smooth finish	< 125	< 3.2	-	
	RTJ	< 63	< 1.6	-	
	Tongue/groove	< 125	< 3.2	-	
EN 1092-1	Form B1	-	3.2 12.5	12.5 50	
	Form B2	-	0.8 3.2	3.2 12.5	
DIN 2527	Form C	-	-	40 160	
	Form E	-	-	< 16	

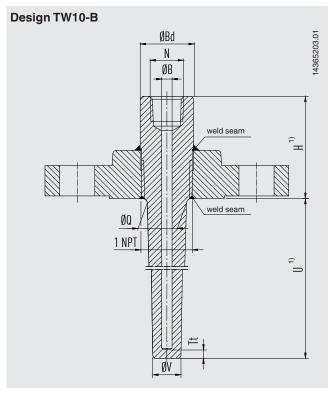
Operating conditions	Operating conditions					
Max. process temperature, process pressure	Depending on:  Thermowell design Dimensions Material Coating Flange pressure rating Process conditions Flow rate Density of medium					
Wake frequency calculation (option)	The calculation in accordance with ASME PTC 19.3 TW-2016 of individual thermowells minimises the risk of dynamic damage that can be caused by the vortex shedding of a Kármán vortex street (Vortex Induced Vibration; VIV).  In addition, the static loads due to lateral flow and the process pressure are calculated depending on the temperature.  The calculation can be carried out independently using an online tool or as a WIKA engineered service (subject to charges).  → For further information see Technical information IN 00.15 "Wake frequency calculation".					

## Dimensions in mm [in]

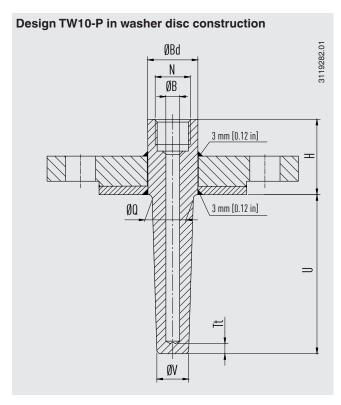


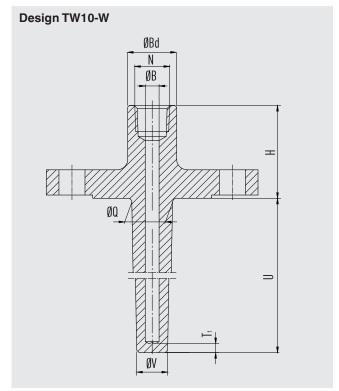






<sup>1)</sup> For technical reasons around the 1 NPT thread, the connection length, H, and also the insertion length, U, can move with a tolerance of ±5 mm [±0.02 in] to the specified nominal dimension. A flush connection of the thread with the flange sealing face can therefore not be guaranteed.





#### Legend:

- H Connection length
- U Insertion length
- N Connection to thermometer
- Ø B Bore size, see table "Process connection" page Seite 3
- Ø Q Root diameter, see table "Process connection" page Seite 3
- Ø V Tip diameter
- Ø Bd Bar diameter (depending on selected root diameter or customer specification. Note 1: Tolerance of up to ±1 mm [±0.04 in], depending on design and dimensions)
- Tt Tip thickness (6.4 mm [0.25 in])

#### ASME flanges, tapered thermowell form

DN	PN	Dimensions in mm [in]		Weight in kg [lbs] (approx.)			
	in lbs	Н	ØQ	Øν	U = 4"	U = 13"	U = 22"
1"	150	approx. 57 [2 1/4]	22 [0.875]	16 [0.625]	1.4 [3.086]	1.9 [4.188]	2.3 [5.070]
	300	approx. 57 [2 1/4]	22 [0.875]	16 [0.625]	2.1 [4.629]	2.6 [5.732]	3.0 [6.613]
	600	approx. 57 [2 1/4]	22 [0.875]	16 [0.625]	2.3 [5.070]	2.8 [6.172]	3.2 [7.054]
	1,500	approx. 83 [3 1/4]	22 [0.875]	16 [0.625]	4.3 [9.479]	4.8 [10.582]	5.2 [11.464]
	2,500	approx. 83 [3 1/4]	22 [0.875]	16 [0.625]	5.6 [12.345]	6.1 [13.448]	6.5 [14.330]
1 ½"	150	approx. 57 [2 1/4]	25 [1.000]	19 [0.750]	1.8 [3.968]	2.4 [5.291]	3.0 [6.613]
	300	approx. 57 [2 1/4]	25 [1.000]	19 [0.750]	3.3 [7.275]	3.9 [8.598]	4.5 [9.920]
	600	approx. 57 [2 1/4]	25 [1.000]	19 [0.750]	4.0 [8.818]	4.7 [10.361]	5.3 [11.684]
	1,500	approx. 83 [3 1/4]	25 [1.000]	19 [0.750]	6.4 [14.109]	7.1 [15.652]	7.7 [16.975]
	2,500	approx. 83 [3 1/4]	25 [1.000]	19 [0.750]	12.0 [26.455]	12.6 [27.778]	13.3 [29.321]
2"	150	approx. 57 [2 1/4]	25 [1.000]	19 [0.750]	2.5 [5.511]	3.1 [6.834]	3.7 [8.157]
	300	approx. 57 [2 1/4]	25 [1.000]	19 [0.750]	3.7 [8.157]	4.3 [9.479]	4.9 [10.802]
	600	approx. 57 [2 1/4]	25 [1.000]	19 [0.750]	4.2 [9.259]	4.9 [10.802]	5.5 [12.125]
	1,500	approx. 83 [3 1/4]	25 [1.000]	19 [0.750]	11.0 [24.250]	11.6 [25.573]	12.3 [27.116]
	2,500	approx. 108 [4 1/4]	25 [1.000]	19 [0.750]	17.0 [37.478]	17.6 [38.801]	18.3 [40.344]

#### EN and DIN flanges, tapered thermowell form - only for design TW10-P and TW10-R

(only for welding version with weld seam, 3 mm [0.12"] or 6 mm [0.24"] on both sides)

DN	PN	Dimensions in mm	imensions in mm [in]		Weight in kg [lbs] (approx.)	
	in bar	Н	Ø Q	øν	U = 160 mm	U = 500 mm
25	40	45 [1.771]	22 [0.875]	16 [0.625]	1.9 [4.188]	2.6 [5.732]
	63/64	45 [1.771]	22 [0.875]	16 [0.625]	3.2 [7.054]	3.9 [8.598]
	100	45 [1.771]	22 [0.875]	16 [0.625]	3.2 [7.054]	3.9 [8.598]
40	40	45 [1.771]	25 [1.000]	19 [0.750]	3.1 [6.834]	4.0 [8.818]
	63/64	45 [1.771]	25 [1.000]	19 [0.750]	4.8 [10.582]	5.7 [12.566]
	100	45 [1.771]	25 [1.000]	19 [0.750]	4.8 [10.582]	5.7 [12.566]
50	40	45 [1.771]	25 [1.000]	19 [0.750]	3.9 [8.598]	4.8 [10.582]
	63/64	45 [1.771]	25 [1.000]	19 [0.750]	5.2 [11.464]	6.1 [13.448]
	100	45 [1.771]	25 [1.000]	19 [0.750]	6.6 [14.550]	7.5 [16.534]
80	40	60 [2.362]	25 [1.000]	19 [0.750]	6.6 [14.550]	7.5 [16.534]
	63/64	60 [2.362]	25 [1.000]	19 [0.750]	7.6 [16.755]	8.5 [18.739]
	100	60 [2.362]	25 [1.000]	19 [0.750]	10.2 [22.487]	11.1 [24.471]
100	40	60 [2.362]	25 [1.000]	19 [0.750]	8.3 [18.298]	9.2 [20.282]
	63/64	60 [2.362]	25 [1.000]	19 [0.750]	10.9 [24.030]	11.8 [26.014]
	100	60 [2.362]	25 [1.000]	19 [0.750]	15.0 [33.069]	15.9 [35.053]

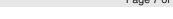
#### **Ordering information**

Model / Thermowell form / Thermowell material / Flange material / Head diameter / Connection to the thermometer / Bore size Ø B / Nominal diameter DN / Pressure rating PN / Sealing face / Wall thickness of flange nozzle / Insertion length U / Connection length H / Coating / Assembly with thermometer / Certificates / Options

Stellite® is a registered trademark of the company Kennametal Stellite. Halar® ECTFE is a registered trademark of the company Solvay Solexis

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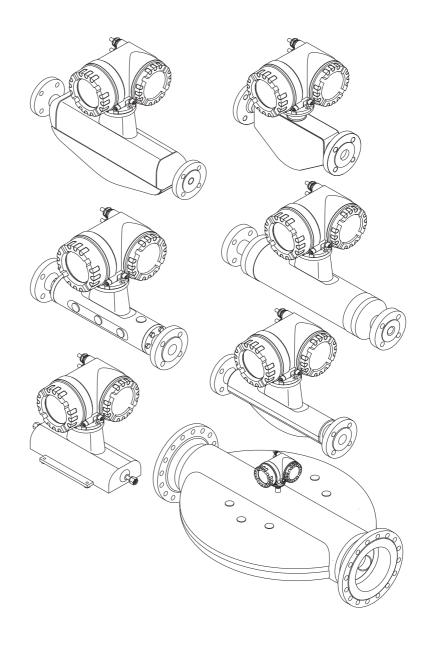


## Operating Instructions

# Proline Promass 83 FOUNDATION Fieldbus

Coriolis mass flow measuring system







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## 1 Safety instructions

## 1.1 Designated use

The measuring device described in these Operating Instructions is to be used only for measuring the mass flow rate of liquids and gases. At the same time, the system also measures fluid density and fluid temperature. These parameters are then used to calculate other variables such as volume flow. Fluids with widely differing properties can be measured.

#### Examples:

- Oils, fats
- Acids, alkalis, lacquers, paints, solvents and cleaning agents
- Pharmaceuticals, catalysts, inhibitors
- Suspensions
- Gases, liquefied gases, etc.
- Chocolate, condensed milk, liquid sugar

Resulting from incorrect use or from use other than that designated the operational safety of the measuring devices can be suspended. The manufacturer accepts no liability for damages being produced from this.

## 1.2 Installation, commissioning and operation

Note the following points:

- Installation, connection to the electricity supply, commissioning and maintenance of the device must be carried out by trained, qualified specialists authorized to perform such work by the facility's owner-operator. The specialist must have read and understood these Operating Instructions and must follow the instructions they contain.
- The device must be operated by persons authorized and trained by the facility's owner-operator. Strict compliance with the instructions in these Operating Instructions is mandatory.
- Endress+Hauser will be happy to assist in clarifying the corrosion-resistant properties of materials wetted by special fluids, including fluids used for cleaning. However, minor changes in temperature, concentration or in the degree of contamination in the process may result in variations in corrosion resistance. For this reason, Endress+Hauser does not accept any responsibility with regard to the corrosion resistance of materials wetted by fluids in a specific application. The user is responsible for the choice of suitable wetted materials in the process.
- If carrying out welding work on the piping, the welding unit may not be grounded by means of the measuring device.
- The installer must ensure that the measuring system is correctly wired in accordance with the wiring diagrams. The transmitter must be earthed unless special protection measures have been taken e.g. galvanically isolated power supply SELV or PELV (SELV = Save Extra Low Voltage; PELV = Protective Extra Low Voltage).
- Invariably, local regulations governing the opening and repair of electrical devices apply.

## 1.3 Operational safety

Note the following points:

- Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of these Operating Instructions. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory. The symbol on the front of this supplementary Ex documentation indicates the approval and the certification body (e.g. © Europe, → USA, © Canada).
- The measuring device complies with the general safety requirements in accordance with EN 61010-1, the EMC requirements of IEC/EN 61326, and NAMUR Recommendation NE 21, NE 43 and NE 53.
- For measuring systems used in SIL 2 applications, the separate manual on functional safety must be observed.
- External surface temperature of the transmitter can increase by 10 K due to power consumption of internal electronical components. Hot process fluids passing through the measuring device will further increase the surface temperature of the measuring device. Especially the surface of the sensor can reach temperatures which are close to process temperature. Additionally safety precautions are required when increased process temperatures are present.
- The manufacturer reserves the right to modify technical data without prior notice. Your Endress+Hauser distributor will supply you with current information and updates to these Operating Instructions.

#### 1.4 Return

- Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.
- Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.
- Please note the measures on  $\rightarrow$   $\stackrel{\triangle}{=}$  96

## 1.5 Notes on safety conventions and icons

The devices are designed to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures". The devices can, however, be a source of danger if used incorrectly or for other than the designated use. Consequently, always pay particular attention to the safety instructions indicated in these Operating Instructions by the following icons:



Warning!

"Warning" indicates an action or procedure which, if not performed correctly, can result in injury or a safety hazard. Comply strictly with the instructions and proceed with care.



Caution!

"Caution" indicates an action or procedure which, if not performed correctly, can result in incorrect operation or destruction of the device. Comply strictly with the instructions.



Note!

"Note" indicates an action or procedure which, if not performed correctly, can have an indirect effect on operation or trigger an unexpected response on the part of the device.

## 2 Identification

The following options are available for identification of the measuring device::

- Nameplate specifications
- Order code with breakdown of the device features on the delivery note
- Enter serial numbers from nameplates in *W@M Device Viewer* (www.endress.com/deviceviewer): All information about the measuring device is displayed.

For an overview of the scope of the Technical Documentation provided, refer to the following:

- The chapters "Supplementary documentation"  $\rightarrow$  🖹 152
- Der *W@M Device Viewer*. Enter the serial number from the nameplate (www.endress.com/deviceviewer)

#### Reorder

The measuring device is reordered using the order code.

Extended order code:

- The device type (product root) and basic specifications (mandatory features) are always listed.
- Of the optional specifications (optional features), only the safety and approval-related specifications are listed (e.g. LA). If other optional specifications are also ordered, these are indicated collectively using the # placeholder symbol (e.g. #LA#).
- If the ordered optional specifications do not include any safety and approval–related specifications, they are indicated by the + placeholder symbol (e.g. 8E2B50–ABCDE+).

## 2.1 Device designation

The "Promass 83" flow measuring system consists of the following components:

- Promass 83 transmitter.
- Promass F, Promass M, Promass E, Promass A, Promass H, Promass I, Promass S, Promass P, Promass O or Promass X sensor.

Two versions are available:

- Compact version: transmitter and sensor form a single mechanical unit.
- Remote version: transmitter and sensor are installed separately.

## 2.1.1 Nameplate of the transmitter

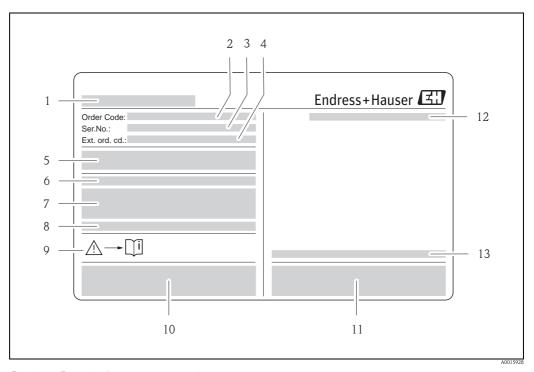


Fig. 1: Example of a transmitter nameplate

- 1 Name of the transmitter
- 2 Order code
- 3 Serial number (Ser. no.)
- 4 Extended order code (Ext. ord. cd.)
- 5 Power supply, frequency and power consumption
- 6 Additional function and software
- 7 Available inputs / outputs
- 8 Reserved for information on special products
- 9 Please refer to operating instructions / documentation
- 10 Reserved for certificates, approvals and for additional information on device version
- 11 Patents
- 12 Degree of protection
- 13 Ambient temperature range

8

## 2.1.2 Nameplate of the sensor

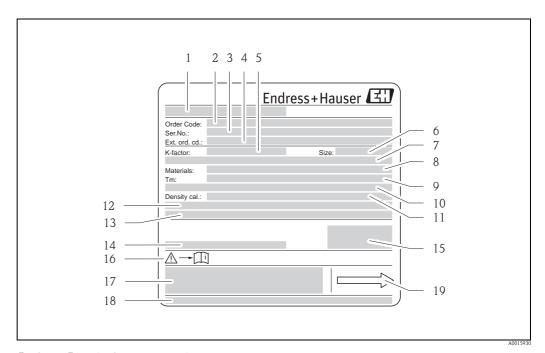


Fig. 2: Example of a sensor nameplate

- 1 Name of the sensor
- 2 Order code
- 3 Serial number (Ser. no.)
- 4 Extended order code (Ext. ord. cd.)
- 5 Calibration factor with zero point (K-factor)
- 6 Nominal diameter device (Size)
- 7 Flange nominal diameter/Nominal pressure
- 8 Material of measuring tubes (Materials)
- 9 Max. fluid temperature (Tm)
- 10 Pressure range of secondary containment
- 11 Accuracy of density measurement (Density cal.)
- 12 Additional information
- 13 Reserved for information on special products
- 14 Ambient temperature range
- 15 Degree of protection
- 16 Please refer to operating instructions / documentation
- 17 Reserved for additional information on device version (approvals, certificates)
- 18 Patents
- 19 Flow direction

## 2.1.3 Nameplate for connections

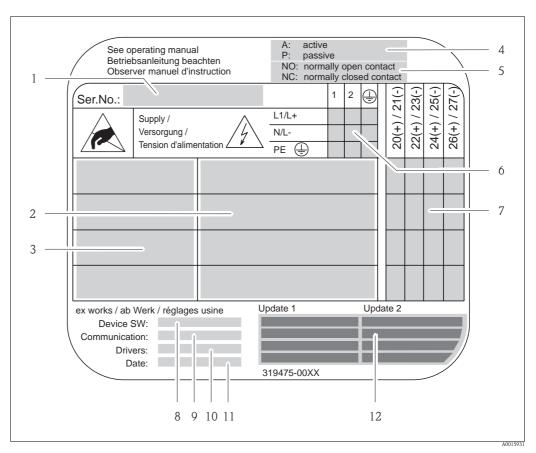


Fig. 3: Example of a connection nameplate

- 1 Serial number (Ser.No.)
- 2 Possible inputs and outputs
- 3 Signals present at inputs and outputs
- 4 Possible configuration of current output
- 5 Possible configuration of relay contacts
- 6 Terminal assignment, cable for power supply
- 7 Terminal assignment and configuration (see point 4 and 5) of inputs and outputs
- 8 Version of device software currently installed (Device SW)
- 9 Installed communication type (Communication)
- 10 Information on current communication software (Drivers: Device Revision and Device Description),
- 11 Date of installation (Date)
- 12 Current updates to data specified in points 8 to 11 (Update1, Update 2)

10

## 2.2 Certificates and approvals

The devices are designed in accordance with good engineering practice to meet state-of-the-art safety requirements, have been tested, and left the factory in a condition in which they are safe to operate. See also "Certificates and approvals"  $\rightarrow \stackrel{\triangle}{=} 151$ .

The devices comply with the applicable standards and regulations in accordance with EN 61010-1 "Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures" and with the EMC requirements of IEC/EN 61326.

The measuring system described in these Operating Instructions thus complies with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.

The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".

#### 2.3 FOUNDATION Fieldbus device certification

The flowmeter has passed all the test procedures implemented and has been certified and registered by the Fieldbus FOUNDATION. The flowmeter thus meets all the requirements of the specifications listed below:

- Certified to FOUNDATION fieldbus specification
- The flowmeter meets all the specifications of the FOUNDATION Fieldbus-H1.
- Interoperability Test Kit (ITK), revision 5.01: The device can also be operated in conjunction with other-make certified devices.
- Physical Layer Conformance Test by Fieldbus Foundation

## 2.4 Registered trademarks

KALREZ® and VITON®

Registered trademarks of E.I. Du Pont de Nemours & Co., Wilmington, USA

TRI-CLAMP®

Registered trademark of Ladish & Co., Inc., Kenosha, USA

SWAGELOK®

Registered trademark of Swagelok & Co., Solon, USA

FOUNDATION<sup>TM</sup> Fieldbus

Registered trademark of the Fieldbus FOUNDATION, Austin, USA

HistoROM<sup>TM</sup>, S-DAT<sup>®</sup>, T-DAT<sup>TM</sup>, F-CHIP<sup>®</sup>, FieldCare<sup>®</sup>, Fieldcheck<sup>®</sup>, Applicator<sup>®</sup> Registered or registration-pending trademarks of Endress+Hauser Flowtec AG, Reinach, CH

## 3 Installation

## 3.1 Incoming acceptance, transport and storage

#### 3.1.1 Incoming acceptance

On receipt of the goods, check the following points:

- Check the packaging and the contents for damage.
- Check the shipment, make sure nothing is missing and that the scope of supply matches your order.

## 3.1.2 Transport

The following instructions apply to unpacking and to transporting the device to its final location:

- Transport the devices in the containers in which they are delivered.
- The covers or caps fitted to the process connections prevent mechanical damage to the sealing faces and the ingress of foreign matter to the measuring tube during transportation and storage. Consequently, do not remove these covers or caps until immediately before installation.
- Do not lift measuring devices of nominal diameters > DN 40 (>  $1\frac{1}{2}$ ") by the transmitter housing or the connection housing in the case of the remote version ( $\rightarrow \square 4$ ). Use webbing slings slung round the two process connections. Do not use chains, as they could damage the housing.
- Promass X, Promass O and Promass M / DN 80 (3") sensor: see special instructions for transporting  $\rightarrow \stackrel{\triangle}{=} 13$



#### Warning!

Risk of injury if the measuring device slips. The center of gravity of the assembled measuring device might be higher than the points around which the slings are slung.

At all times, therefore, make sure that the device does not unexpectedly turn around its axis or slip.

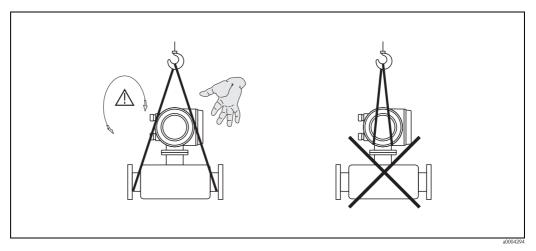


Fig. 4: Instructions for transporting sensors with  $> DN 40 (> 1\frac{1}{2})$ 

#### Special instructions for transporting Promass X, O and M



Warning!

- For transporting use only the lifting eyes on the flanges to lift the assembly.
- The assembly must always be attached to at least two lifting eyes.

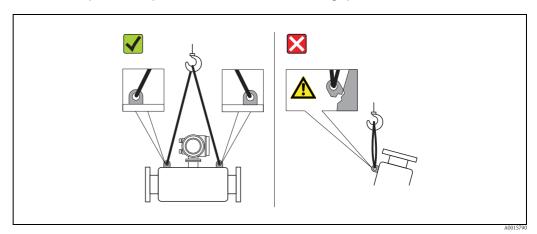


Fig. 5: Instructions for transporting Promass O, M

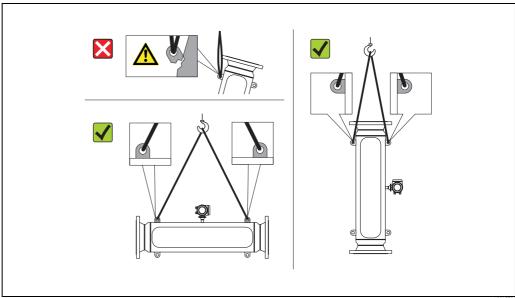


Fig. 6: Instructions for transporting Promass X

#### 3.1.3 **Storage**

Note the following points:

- Pack the measuring device in such a way as to protect it reliably against impact for storage (and transportation). The original packaging provides optimum protection.
- The permissible storage temperature is -40 to +80 °C (-40 °F to +176 °F), preferably +20 °C
- Do not remove the protective covers or caps on the process connections until you are ready to install the device.
- The measuring device must be protected against direct sunlight during storage in order to avoid unacceptably high surface temperatures.

## 3.2 Installation conditions

Note the following points:

- No special measures such as supports are necessary. External forces are absorbed by the construction of the instrument, for example the secondary containment.
- The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations.
- No special precautions need to be taken for fittings which create turbulence (valves, elbows, T-pieces, etc.), as long as no cavitation occurs.
- For mechanical reasons and in order to protect the pipe, it is advisable to support heavy sensors.

#### 3.2.1 Dimensions

All the dimensions and lengths of the sensor and transmitter are provided in the separate documentation "Technical Information"

## 3.2.2 Mounting location

Entrained air or gas bubbles forming in the measuring tube can result in an increase in measuring errors.

**Avoid** the following locations in the pipe installation:

- Highest point of a pipeline. Risk of air accumulating.
- Directly upstream of a free pipe outlet in a vertical pipeline.

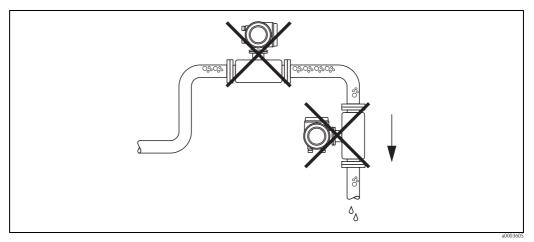


Fig. 7: Mounting location

#### Installation in a vertical pipe

The proposed configuration in the following diagram, however, permits installation in a vertical pipeline. Pipe restrictors or the use of an orifice plate with a smaller cross-section than the nominal diameter prevent the sensor from running empty during measurement.

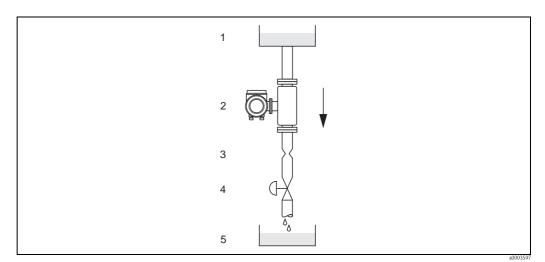


Fig. 8: Installation in a vertical pipe (e.g. for batching applications)

1 =Supply tank, 2 =Sensor, 3 =Orifice plate, pipe restrictions (see Table), 4 =Valve, 5 =Batching tank

		Ø Orifice plate,	, pipe restrictor
DN		mm	inch
1	1/24"	0.8	0.03
2	1/12"	1.5	0.06
4	1/8"	3.0	0.12
8	3/8"	6	0.24
15	1/2"	10	0.40
15 FB	1/2"	15	0.60
25	1"	14	0.55
25 FB	1"	24	0.95
40	1 ½"	22	0.87

		Ø Orifice plate	, pipe restrictor
DN		mm	inch
40 FB	1 ½"	35	1.38
50	2"	28	1.10
50 FB	2"	54	2.00
80	3"	50	2.00
100	4"	65	2.60
150	6"	90	3.54
250	10"	150	5.91
350	14"	210	8.27

FB = Full bore versions of Promass I

#### System pressure

It is important to ensure that cavitation does not occur, because it would influence the oscillation of the measuring tube. No special measures need to be taken for fluids which have properties similar to water under normal conditions.

In the case of liquids with a low boiling point (hydrocarbons, solvents, liquefied gases) or in suction lines, it is important to ensure that pressure does not drop below the vapor pressure and that the liquid does not start to boil. It is also important to ensure that the gases that occur naturally in many liquids do not outgas. Such effects can be prevented when system pressure is sufficiently high.

For this reason, the following installation locations are preferred:

- Downstream from pumps (no danger of vacuum)
- At the lowest point in a vertical pipe.

#### 3.2.3 Orientation

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

#### **Orientation Promass A**

#### Vertical:

Recommended orientation with upward direction of flow. When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube. The measuring tubes can be completely drained and protected against solids buildup.

#### Horizontal:

When installation is correct the transmitter housing is above or below the pipe. This arrangement means that no gas or solid deposits can accumulate in the curved measuring tube (single-tube system).

Do not install the sensor in such a way that it is suspended in the pipe, in other words without support or attachment. This is to avoid excessive strain at the process connection. The base plate of the sensor housing is designed for mounting on a tabletop, wall or post.

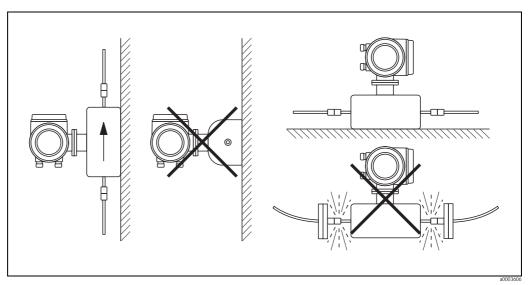


Fig. 9: Vertical and horizontal orientation (Promass A)

## Orientation Promass F, M, E, H, I, S, P, O, X

Make sure that the direction of the arrow on the nameplate of the sensor matches the direction of flow (direction in which the fluid flows through the pipe).

#### Vertical:

Recommended orientation with upward direction of flow (Fig. V). When fluid is not flowing, entrained solids will sink down and gases will rise away from the measuring tube.

The measuring tubes can be completely drained and protected against solids buildup.

Horizontal (Promass F, M, E, O):

The measuring tubes of Promass F, M, E and O must be horizontal and beside each other. When installation is correct the transmitter housing is above or below the pipe (Fig. H1/H2). Always avoid having the transmitter housing in the same horizontal plane as the pipe. See next chapter – special installation instructions.

Horizontal (Promass H, I, S, P, X):

Promass H, I, S, P and X can be installed in any orientation in a horizontal pipe run.

Promass H, I, S, P: See next chapter - special installation instructions

		Promass F, M, E, O Standard, compact	Promass F, M, E Standard, remote	Promass F High-temperature, compact	Promass F High-temperature, remote	Promass H, I, S, P	Promass X
<b>Abb. V:</b> Vertical orientation	#0004572	v	v	v	v	v	v
Abb. H1: Horizontal orientation Transmitter head up	2004576	v	~	<b>x</b> TM > 200 °C ( 392 °F)	TM > 200 °C ( 392 °F)	v	v
Abb. H2: Horizontal orientation Transmitter head down	a0004580	v	~	V	~	v	v
Abb. H3: Horizontal orientation Transmitter head to the side	A0015445	x	×	×	×	v	<b>v</b> 1)

 $\checkmark$  ■ Recommended orientation;  $\checkmark$  = Orientation recommended in certain situations;  $\mathbf{X}$  = Impermissible orientation  $\odot$  The measuring tubes are curved. Therefore the unit is installed horizontally, adapt the sensor position to the fluid properties:

- Suitable to a limited extent for fluids with entrained solids. Risk of solids accumulating
- Suitable to a limited extent for outgassing fluids. Risk of air accumulating

In order to ensure that the permissible ambient temperature range for the transmitter ( $\rightarrow 130$ ) is not exceeded, we recommend the following orientations:

- For fluids with very high temperatures we recommend the horizontal orientation with the transmitter head pointing downwards (Fig. H2) or the vertical orientation (Fig. V).
- For fluids with very low temperatures, we recommend the horizontal orientation with the transmitter head pointing upwards (Fig. H1) or the vertical orientation (Fig. V).

## 3.2.4 Special installation instructions

## Promass F, E, H, S, P and O



#### Caution!

If the measuring tube is curved and the unit is installed horizontally, adapt the sensor position to the fluid properties.

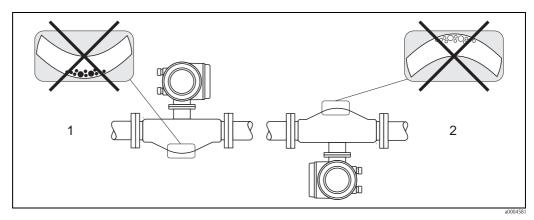


Fig. 10: Horizontal installation of sensors with curved measuring tube.

- 1 Not suitable for fluids with entrained solids. Risk of solids accumulating.
- 2 Not suitable for outgassing fluids. Risk of air accumulating.

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#### Promass I and P with Eccentric Tri-clamps

Eccentric Tri-Clamps can be used to ensure complete drainability when the sensor is installed in a horizontal line. When lines are pitched in a specific direction and at a specific slope, gravity can be used to achieve complete drainability. The sensor must be installed in the correct position with the tube bend facing to the side, to ensure full drainability in the horizontal position. Markings on the sensor show the correct mounting position to optimize drainability.

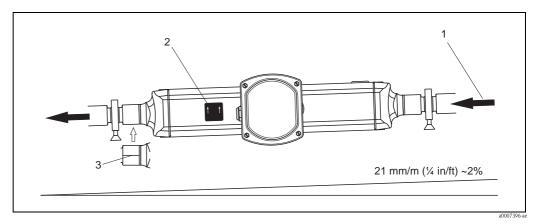


Fig. 11: Promass P: When lines are pitched in a specific direction and at a specific slope: as per hygienic guidelines (21 mm/m or approximatley 2%). Gravity can be used to achieve complete drainability.

- 1 The arrow indicates the direction of flow (direction of fluid flow through the pipe).
- 2 The label shows the installation orientation for horizontal drainability.
- 3 The underside of the process connection is indicated by a scribed line. This line indicates the lowest point of the eccentric process connection.

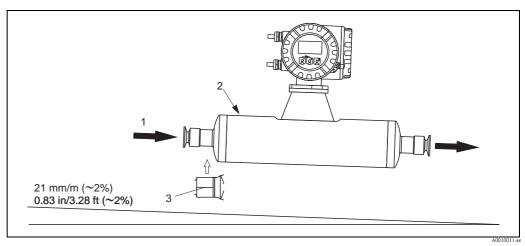


Fig. 12: Promass I: When lines are pitched in a specific direction and at a specific slope: as per hygienic guidelines (21 mm/m or approximatley 2%). Gravity can be used to achieve complete drainability.

- 1 The arrow indicates the direction of flow (direction of fluid flow through the pipe).
- 2 The label shows the installation orientation for horizontal drainability.
- 3 The underside of the process connection is indicated by a scribed line. This line indicates the lowest point of the eccentric process connection.

# Promass I and P with hygienic connections (mounting clamp with lining between clamp and instrument)

It is not necessary to support the sensor under any circumstances for operational performance. If the requirement exists to support the sensor the following recommendation should be followed.

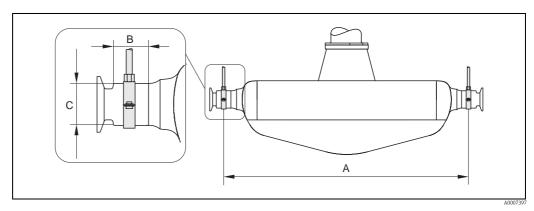


Fig. 13: Promass P, mounted with mounting clamp

DN	8	15	25	40	50
A	298	402	542	750	1019
В	33	33	33	36.5	44.1
С	28	28	38	56	75

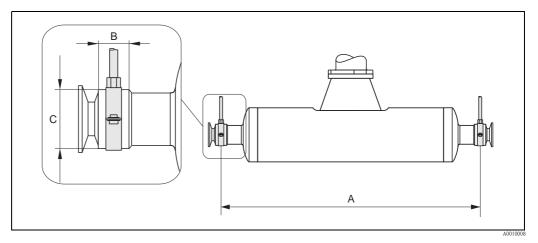


Fig. 14: Promass I, mounted with mounting clamp

DN	8	15	15FB	25	25FB	40	40FB	50	50FB	50FB	80	80
Tri-Clamp	1/2"	3/4"	1"	1"	1 ½"	1 ½"	2"	2"	2 ½"	3"	2 ½"	3"
A	373	409	539	539	668	668	780	780	1152	1152	1152	1152
В	20	20	30	30	28	28	35	35	57	57	57	57
С	40	40	44.5	44.5	60	60	80	80	90	90	90	90

## 3.2.5 Heating

Some fluids require suitable measures to avoid loss of heat at the sensor. Heating can be electric, e.g. with heated elements, or by means of hot water or steam pipes made of copper or heating jackets.



#### Caution!

- Risk of electronics overheating! Make sure that the maximum permissible ambient temperature for the transmitter is not exceeded. Consequently, make sure that the adapter between sensor and transmitter and the connection housing of the remote version always remain free of insulating material. Note that a certain orientation might be required, depending on the fluid temperature  $\rightarrow \blacksquare$  16. For fluid temperature of 150°C (302°F) or above the usage of the remote version with separate connection housing is recommended.
- With a fluid temperature between 200 °C to 350 °C (392 to 662 °F) the remote version of the high-temperature version is preferable.
- When using electrical heat tracing whose heat is regulated using phase control or by pulse packs, it cannot be ruled out that the measured values are influenced by magnetic fields which may occur, (i.e. at values greater than those permitted by the EC standard (Sinus 30 A/m)). In such cases, the sensor must be magnetically shielded (except for Promass M).

The secondary containment can be shielded with tin plates or electric sheets without privileged direction (e.g. V330-35A) with the following properties:

- Relative magnetic permeability  $\mu_r \ge 300$
- Plate thickness d ≥ 0.35 mm (0.014")
- Information on permissible temperature ranges  $\rightarrow \stackrel{\triangle}{=} 131$
- Promass X: Especially under critical climatic conditions it has to be ensured that the temperature difference between environment and measured medium does not exceed 100 K. Suitable measures, such as heating or thermal insulation, are to be taken.

Special heating jackets which can be ordered as accessories from Endress+Hauser are available for the sensors.

#### 3.2.6 Thermal insulation

Some fluids require suitable measures to avoid loss of heat at the sensor. A wide range of materials can be used to provide the required thermal insulation.

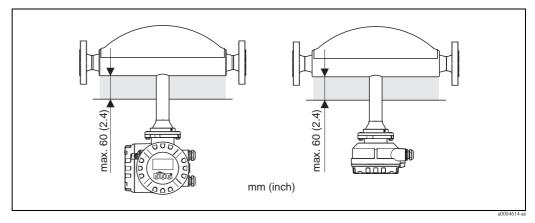


Fig. 15: In the case of the Promass F high-temperature version, a maximum insulation thickness of 60 mm (2.4") must be observed in the area of the electronics/neck.

If the Promass F high-temperature version is installed horizontally (with transmitter head pointing upwards), an insulation thickness of min. 10 mm (0.4") is recommended to reduce convection. The maximum insulation thickness of 60 mm (2.4") must be observed.

### 3.2.7 Inlet and outlet runs

There are no installation requirements regarding inlet and outlet runs. If possible, install the sensor well clear of fittings such as valves, T-pieces, elbows, etc.

#### 3.2.8 Vibrations

The high oscillation frequency of the measuring tubes ensures that the correct operation of the measuring system is not influenced by pipe vibrations. Consequently, the sensors require no special measures for attachment.

## 3.2.9 Limiting flow

#### 3.3 Installation

## 3.3.1 Turning the transmitter housing

#### Turning the aluminum field housing



#### Warning!

The turning mechanism in devices with EEx d/de or FM/CSA Cl. I Div. 1 classification is not the same as that described here. The procedure for turning these housings is described in the Ex-specific documentation.

- 1. Loosen the two securing screws.
- 2. Turn the bayonet catch as far as it will go.
- 3. Carefully lift the transmitter housing as far as it will go.
- 4. Turn the transmitter housing to the desired position (max. 2 x 90° in either direction).
- 5. Lower the housing into position and reengage the bayonet catch.
- 6. Retighten the two securing screws.

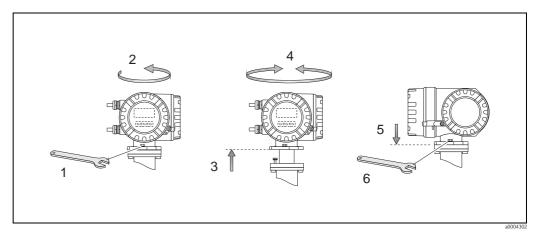


Fig. 16: Turning the transmitter housing (aluminum field housing)

#### Turning the stainless steel field housing

- 1. Loosen the two securing screws.
- 2. Carefully lift the transmitter housing as far as it will go.
- 3. Turn the transmitter housing to the desired position (max.  $2 \times 90^{\circ}$  in either direction).
- 4. Lower the housing into position.
- 5. Retighten the two securing screws.

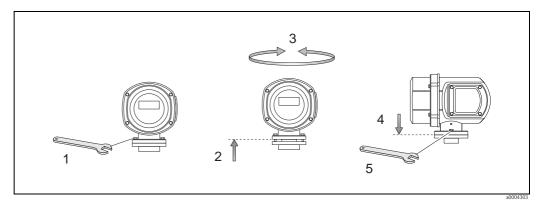


Fig. 17: Turning the transmitter housing (stainless steel field housing)

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## 3.3.2 Installing the wall-mount housing

There are various ways of installing the wall-mount housing:

- Mounted directly on the wall
- Installation in control panel (separate mounting set, accessories)  $\rightarrow \stackrel{\triangle}{=} 25$
- Pipe mounting (separate mounting set, accessories)  $\rightarrow \stackrel{\triangle}{=} 25$



#### Caution

- Make sure that ambient temperature does not go beyond the permissible range (-20 to +60 °C (-4 to + °140 F), optional -40 to +60 °C (-40 to +140 °F)). Install the device in a shady location. Avoid direct sunlight.
- Always install the wall-mount housing in such a way that the cable entries are pointing down.

#### Mounted directly on the wall

- 1. Drill the holes as illustrated in the diagram.
- 2. Remove the cover of the connection compartment (a).
- 3. Push the two securing screws (b) through the appropriate bores (c) in the housing.
  - Securing screws (M6): max. Ø 6.5 mm (0.26")
  - Screw head: max. Ø 10.5 mm (0.41")
- 4. Secure the transmitter housing to the wall as indicated.
- 5. Screw the cover of the connection compartment (a) firmly onto the housing.

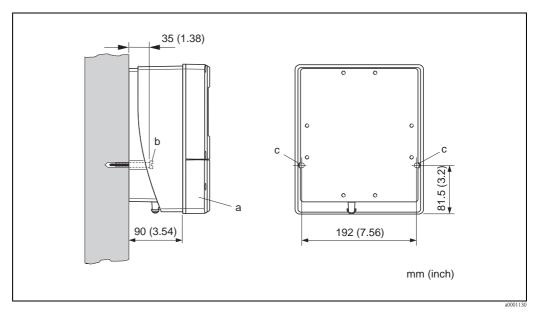


Fig. 18: Mounted directly on the wall

#### Installation in control panel

- 1. Prepare the opening in the panel as illustrated in the diagram.
- 2. Slide the housing into the opening in the panel from the front.
- 3. Screw the fasteners onto the wall-mount housing.
- 4. Screw threaded rods into holders and tighten until the housing is solidly seated on the panel wall. Afterwards, tighten the locking nuts.

  Additional support is not necessary.

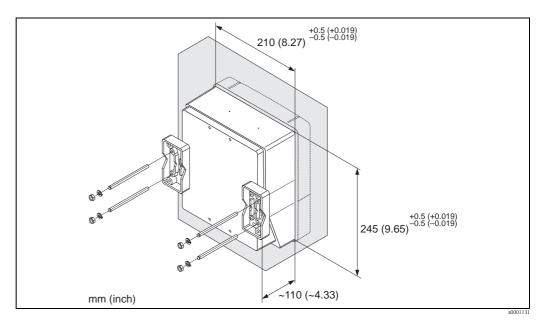


Fig. 19: Panel installation (wall-mount housing)

#### Pipe mounting

The assembly should be performed by following the instructions in the diagram.



#### Caution!

If a warm pipe is used for installation, make sure that the housing temperature does not exceed the max. permitted value of +60  $^{\circ}$ C (+140  $^{\circ}$ F).

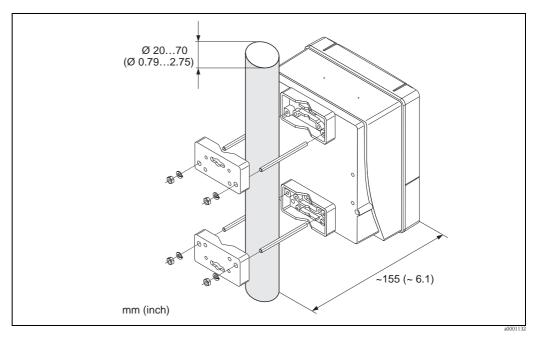


Fig. 20: Pipe mounting (wall-mount housing)

## 3.3.3 Turning the local display

- 1. Unscrew cover of the electronics compartment from the transmitter housing.
- 2. Press the side latches on the display module and remove the module from the electronics compartment cover plate.
- 3. Rotate the display to the desired position (max.  $4 \times 45$ ° in both directions), and reset it onto the electronics compartment cover plate.
- 4. Screw the cover of the electronics compartment firmly back onto the transmitter housing.

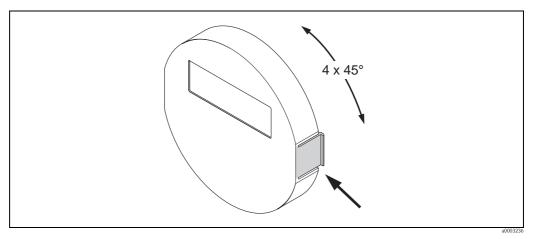


Fig. 21: Turning the local display (field housing)

## 3.4 Post-installation check

Perform the following checks after installing the measuring device in the pipe:

Device condition and specifications	Notes
Is the device damaged (visual inspection)?	-
Does the device correspond to specifications at the measuring point, including process temperature and pressure, ambient temperature, measuring range, etc.?	→ 🖹 5
Installation instructions	Notes
Does the arrow on the sensor nameplate match the direction of flow through the pipe?	-
Are the measuring point number and labeling correct (visual inspection)?	-
Is the orientation chosen for the sensor correct, in other words suitable for sensor type, fluid properties (outgassing, with entrained solids) and fluid temperature?	→ 🖹 14
Process environment / process conditions	Notes
Is the measuring device protected against moisture and direct sunlight?	-

## 4 Wiring



Warning!

When connecting Ex-certified devices, see the notes and diagrams in the Ex-specific supplement to these Operating Instructions. Please do not hesitate to contact your Endress+Hauser sales office if you have any questions.



Note!

The device does not have an internal splitter. For this reason, assign the device a switch or power-circuit breaker which can be used to disconnect the power supply line from the power grid.

## 4.1 FOUNDATION Fieldbus cable specification

## 4.1.1 Cable type

Twin-core cable is recommended for connecting the flowmeter to the FOUNDATION Fieldbus H1. By analogy with IEC 61158-2 (MBP) protocol four different cable types (A, B, C, D) can be used with the FOUNDATION Fieldbus Protocol, only two of which (cable types A and B) are shielded.

- Cable types A or B are particularly preferable for new installations. Only these types have cable shielding that guarantees adequate protection from electromagnetic interference and thus the most reliable data transfer. With cable type B more than one fieldbus (with the same degree of protection) may be operated in a cable. No other circuits are permissible in the same cable.
- Practical experience has shown that cable types C and D should not be used due to the lack of shielding, since the freedom from interference generally does not meet the requirements described in the standard.

The electrical data of the fieldbus cable has not been specified but determines important characteristics of the design of the fieldbus, such as distances bridged, number of participants, electromagnetic compatibility, etc.

	Type A	Туре В	
Cable structure	twisted pair, shielded	one or more twisted pairs, fully shielded	
Wire size	0.8 mm2 (AWG 18)	0.32 mm2 (AWG 22)	
Loop resistance (DC)	44 Ω/km	112 Ω/km	
Impedance at 31.25 kHz	$100 \Omega \pm 20\%$	$100 \Omega \pm 30\%$	
Attenuation at 39 kHz	3 dB/km	5 dB/km	
Capacitive asymmetry	2 nF/km	2 nF/km	
Envelope delay distortion (7.9 to 39 kHz)	1.7 μs/km	*	
Shield coverage	90%	*	
Max. cable length (inc. spurs >1 m)	1900 m (6233 ft)	1200 m (3937 ft)	
* not specified			

Suitable fieldbus cables (Type A) from various manufacturers for the non-hazardous area are listed below:

■ Siemens: 6XV1 830-5BH10

■ Belden: 3076F

■ Kerpen: CeL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

## 4.1.2 Maximum overall cable length

The maximum network expansion depends on the type of ignition protection and the cable specifications. The overall cable length is made up of the length of the main cable and the length of all spurs >1 m (3.28 ft).

Note the following points:

- The maximum permissible overall cable length depends on the cable type used  $\rightarrow \stackrel{\triangle}{=} 27$ .
- If repeaters are used the maximum permissible cable length is doubled!

  A maximum of three repeaters are permitted between user and master.

## 4.1.3 Maximum spur length

The line between distribution box and field unit is described as a spur.

In the case of non Ex-rated applications the max. length of a spur depends on the number of spurs >1 m (3.28 ft):

Number of spurs	1 to 12	13 to 14	15 to 18	19 to 24	25 to 32
Max. length per spur	120 m (393 ft)	90 m (295 ft)	60 m (196 ft)	30 m (98 ft)	1 m (3.28 ft)

#### 4.1.4 Number of field devices

According to IEC 61158-2 (MBP) a maximum of 32 field devices may be connected per fieldbus segment. However, this number may be restricted in certain circumstances (type of ignition protection, bus power option, current consumption of field device).

A maximum of four field devices can be connected to a spur.

## 4.1.5 Shielding and grounding

The optimum electromagnetic compatibility of the fieldbus system is guaranteed only when system components and in particular lines are shielded and the shielding provides the most complete coverage possible. Shield coverage of 90% is ideal.

Shielding should be connected as often as possible with the reference ground. The national regulations and guidelines governing the installation of electrical equipment also apply where relevant!

Where there are large differences in potential between the individual grounding points, only one point of the shielding is connected directly with the reference ground. In systems without potential equalization, cable shielding of fieldbus systems should therefore only be grounded on one side, for example at the fieldbus supply unit or at safety barriers.



#### Caution!

If the cable shielding is grounded at more than one point in systems without potential equalization, network frequency equalization currents can occur that damage the bus cable or the bus shielding and substantially affect signal transmission.

#### 4.1.6 Bus termination

The start and end of each fieldbus segment are always to be terminated with a bus terminator. With various junction boxes (not Ex-rated) the bus termination can be activated via a switch. If this is not the case a separate bus terminator must be installed. Note the following points in addition:

- In the case of a branched bus segment the device furthest from the segment connector represents the end of the bus.
- If the fieldbus is extended with a repeater then the extension must also be terminated at both ends.

#### 4.1.7 Further information

General information and further notes on connections can be found on the website (www.fieldbus.org) of the Fieldbus Foundation or in the Operating Instructions "FOUNDATION Fieldbus Overview" (acquired at:  $\rightarrow$  www.endress.com  $\rightarrow$  Download).

# 4.2 Connecting the remote version

# 4.2.1 Connecting the connecting cable for sensor/transmitter



#### Warning!

- Risk of electric shock. Switch off the power supply before opening the device.
   Do not install or wire the device while it is connected to the power supply.
   Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective ground to the ground terminal on the housing before the power supply is applied.
- You may only connect the sensor to the transmitter with the same serial number. Communication errors can occur if this is not observed when connecting the devices.
- 1. Remove the cover  $(\mathbf{d})$  from the connection compartment or the sensor housing.
- 2. Feed the connecting cable (**e**) through the appropriate cable runs.
- 3. Establish the connections between sensor and transmitter in accordance with the wiring diagram ( $\rightarrow \square$  22 or wiring diagram inside cover).
- 4. Seal the connection compartment or the transmitter housing again.

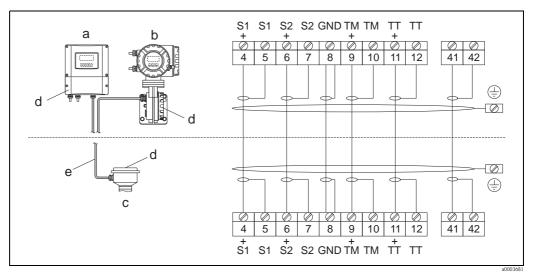


Fig. 22: Connecting the remote version

- Wall-mount housing: non-hazardous area and ATEX II3G / Zone  $2 \rightarrow$  see separate Ex documentation
- b Wall-mount housing: ATEX II2G / Zone 1 /FM/CSA  $\rightarrow$  see separate Ex documentation
- c Remote version (sensor)
- d Cover of the connection compartment or connection housing
- e Connecting cable

*Terminal No.:* 4/5 = gray; 6/7 = green; 8 = yellow; 9/10 = pink; 11/12 = white; 41/42 = brown

# 4.2.2 Cable specification, connecting cable

The specifications of the cable connecting the transmitter and the sensor of the remote version are as follows:

- 6 x 0.38 mm² (PVC cable with common shield and individually shielded cores)
- Conductor resistance:  $\leq 50 \Omega/\text{km}$
- Capacitance: core/shield: ≤ 420 pF/m
- Cable length: max. 20 m (65 ft)
- Permanent operating temperature: max. +105 °C (+221 °F)



Note!

The cable must be installed securely to prevent movement.

# 4.3 Connecting the measuring unit

Field instruments can be connected to the FOUNDATION Fieldbus in two ways:

- Connection via conventional cable gland  $\rightarrow \stackrel{\triangle}{=} 31$
- Connection using prefabricated fieldbus connector (option) → 🖹 33

## 4.3.1 Terminal assignment



Note!

The electrical characteristic quantities are listed in the "Technical data" section.

	Terminal No. (inputs/outputs)			
Order characteristic for "inputs/outputs"	20 (+) / 21 (-)	22 (+) / 23 (-)	24 (+) / 25 (-)	26 = FF + 1) 27 = FF - 1)
G	-	-	-	FOUNDATION Fieldbus Ex i
K	-	-	-	FOUNDATION Fieldbus

<sup>1)</sup> With integrated reverse polarity protection

# 4.3.2 Connecting the transmitter



Warning!

- Risk of electric shock. Switch off the power supply before opening the device. Do not install or wire the device while it is connected to the power supply. Failure to comply with this precaution can result in irreparable damage to the electronics.
- Risk of electric shock. Connect the protective ground to the ground terminal on the housing before the power supply is applied (not required for galvanically isolated power supply).
- Compare the specifications on the nameplate with the local supply voltage and frequency. The national regulations governing the installation of electrical equipment also apply.

Procedure ( $\rightarrow \square 23$ ):

- 1. Unscrew the connection compartment cover (a) from the transmitter housing.
- 2. Feed the power supply cable  $(\mathbf{b})$  and the fieldbus cable  $(\mathbf{d})$  through the appropriate cable entries.

Note!

The device can also be supplied with the option of a ready-mounted fieldbus connector. More information  $\rightarrow \stackrel{\text{\tiny b}}{=} 33$ .

3. Perform wiring in accordance with the respective terminal assignment and the associated wiring diagram.

### Caution!

- Risk of damage to the fieldbus cable!

  Observe the information about shielding and grounding the fieldbus cable  $\rightarrow \stackrel{\triangle}{=} 28$ .
- We recommend that the fieldbus cable not be looped using conventional cable glands. If you
  later replace a measuring device, the bus communication will have to be interrupted.

## Note!

- The terminals for the fieldbus connection (26/27) have integrated reverse polarity protection. This ensures correct signal transmission via the fieldbus even if lines are confused.
- Cable cross-section: max. 2.5 mm<sup>2</sup>
- Between the stripped fieldbus cable shielding and the ground terminal ( $\mathbf{e}$ ), the cable shielding should not exceed a length of 5 mm (0.20 in)
- 4. Screw the cover of the connection compartment (a) back onto the transmitter housing.

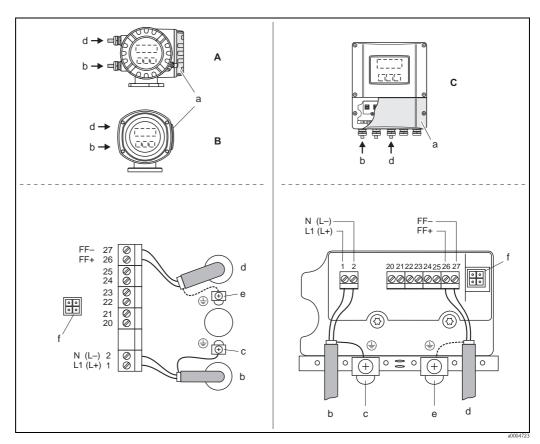


Fig. 23: Connecting the transmitter; cable cross-section: max. 2.5 mm<sup>2</sup>

- A View A (field housing)
- B View B (stainless steel field housing)
- C View C (wall-mount housing)
- a Connection compartment cover
- b Cable for power supply: 20 to 260 V AC, 20 to 64 V DC Terminal No. 1: L1 for AC, L+ for DC Terminal No. 2: N for AC, L- for DC
- c Ground terminal for protective ground
- d Fieldbus cable:

*Terminal No. 26: FF* + (with reverse polarity protection) *Terminal No. 27: FF* – (with reverse polarity protection)

e Fieldbus cable shield ground terminal

Observe the following:

- The shielding and grounding of the fieldbus cable  $\rightarrow \stackrel{ all}{=} 28$
- Make sure the stripped and twisted lengths of cable shield do not exceed a length of 5 mm (0.20 in) up to the ground terminal.
- f Service adapter for connecting service interface FXA193 (Fieldcheck, FieldCare)

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## 4.3.3 Fieldbus connector

The connection technology of FOUNDATION Fieldbus allows measuring devices to be connected to the fieldbus via uniform mechanical connections such as T-boxes, junction boxes, etc.

This connection technology using prefabricated distribution modules and plug-in connectors offers significant advantages over conventional wiring:

- Field devices can be removed, replaced or added at any time during normal operation. Communication is not interrupted.
- This simplifies installation and maintenance significantly.
- Existing cable infrastructures can be used and expanded instantly, e.g. when constructing new star distributors using 4-channel or 8-channel junction boxes.

The device can therefore be supplied with a ready-mounted fieldbus connector. Fieldbus connectors for retrofitting can be ordered from Endress+Hauser as a spare part  $\rightarrow 2$  74.

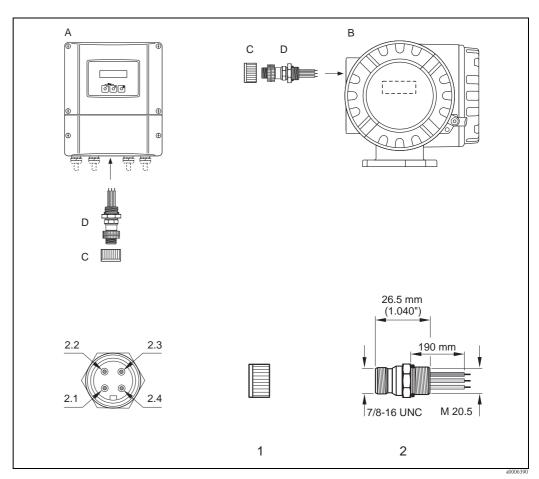


Fig. 24: Connector for connecting to the FOUNDATION Fieldbus

- A Wall-mount housing
- B Field housing
- C Protective cap for connector
- D Fieldbus connector
- 1 Protective cap for connector
- 2 Fieldbus connector (pin assignment/color codes)
- 2.1 Brown wire: FF + (terminal 26)
- 2.2 Blue wire: FF- (terminal 27)
- 2.3 Not assigned
- 2.4 Green/yellow: ground (notes on connection  $\rightarrow 28, \rightarrow 31$ )

Technical data, connector:

- Degree of protection IP 67
- Ambient temperature range: -40 to +150 °C (-40 to +302 °F)

# 4.4 Degree of protection

The measuring device fulfill all the requirements for IP 67.

Compliance with the following points is mandatory following installation in the field or servicing, in order to ensure that IP 67 protection is maintained:

- The housing seals must be clean and undamaged when inserted into their grooves. The seals must be dried, cleaned or replaced if necessary.
- The threaded fasteners and screw covers must be firmly tightened.
- The cables used for connection must be of the specified outside diameter  $\rightarrow \stackrel{\triangle}{=} 107$ , cable entries.
- The cable entries must be firmly tighten (point  $\mathbf{a} \to \square \mathbf{b}$  25).
- The cable must loop down in front of the cable entry ("water trap") (point  $\mathbf{b} \to \square$  25). This arrangement prevents moisture penetrating the entry.



The cable entries may not be point up.

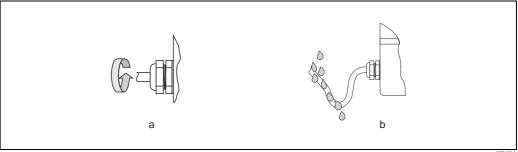


Fig. 25: Installation instructions, cable entries

a000191

- Do not remove the grommet from the cable entry.
- Remove all unused cable entries and insert plugs instead.



#### Caution!

Do not loosen the screws of the sensor housing, as otherwise the degree of protection guaranteed by Endress+Hauser no longer applies.

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# 4.5 Post-connection check

Perform the following checks after completing electrical installation of the measuring device:

Device condition and specifications	Notes
Are cables or the device damaged (visual inspection)?	-
Electrical connection	Notes
Does the supply voltage match the specifications on the nameplate?	85 to 260 V AC (45 to 65 Hz) 20 to 55 V AC (45 to 65 Hz) 16 to 62 V DC
Do the cables comply with the specifications?	→ 🖹 27
Do the cables have adequate strain relief?	-
Is the cable type route completely isolated? Without loops and crossovers?	-
Are the power supply and signal cables correctly connected?	See the wiring diagram inside the cover of the terminal compartment
Are all screw terminals firmly tightened?	-
Are all cable entries installed, firmly tightened and correctly sealed? Cables looped as "water traps"?	→ 🖹 34
Are all housing covers installed and firmly tightened?	-
Electrical connection of FOUNDATION Fieldbus	Notes
Are all the connecting components (T-boxes, junction boxes, connectors, etc.) connected with each other correctly?	-
Has each fieldbus segment been terminated at both ends with a bus terminator?	-
Has the max, length of the fieldbus cable been observed in accordance with the FOUNDATION Fieldbus specifications?	→ 🖹 28
Has the max, length of the spurs been observed in accordance with the FOUNDATION Fieldbus specifications?	→ 🖹 28
Is the fieldbus cable fully shielded (90%) and correctly grounded?	→ 🖹 28

# 5 Operation

# 5.1 Quick operation guide

You have a number of options for configuring and commissioning the flowmeter:

- 1. Local display (option)  $\rightarrow \stackrel{\triangle}{=} 37$ 
  - The local display enables you to read all important parameters directly at the measuring point, configure device-specific parameters in the field and perform commissioning.
- 2. Operating programs  $\rightarrow \stackrel{\triangle}{=} 44$

FOUNDATION Fieldbus functions and device-specific parameters are configured primarily via the fieldbus interface. You can obtain special configuration and operating programs from the various manufacturers for these purposes.

3. Jumpers for diverse hardware settings  $\rightarrow \stackrel{\triangle}{=} 46$ 

Jumpers on the I/O board provide the means of setting the following hardware parameters for the FOUNDATION Fieldbus:

- Enabling/disabling the simulation mode in the Function Blocks (e.g. AI, DO Function Block)
- Switching hardware write protection on and off

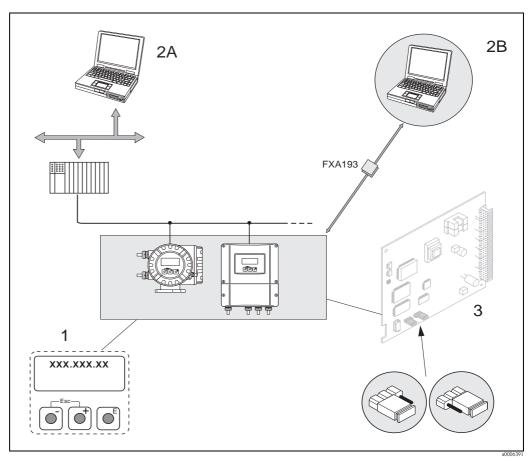


Fig. 26: FOUNDATION Fieldbus operating options

- 1 Local display for device operation in the field (option)
- 2A Configuration/operating programs for operating via the FOUNDATION Fieldbus (FF functions, device parameters)
- 2B Configuration/operating program for operating via the FXA193 service interface (e.g. FieldCare)
- 3 Jumper/miniature switches for hardware settings (write protection, simulation mode)

# 5.2 Local display

# 5.2.1 Display and operating elements

The local display enables you to read all important parameters directly at the measuring point and configure the device using the "Quick Setup" or the function matrix.

The display consists of four lines; this is where measured values and/or status variables (direction of flow, empty pipe, bar graph, etc.) are displayed. You can change the assignment of display lines to different variables to suit your needs and preferences ( $\rightarrow$  See the "Description of Device Functions" manual).

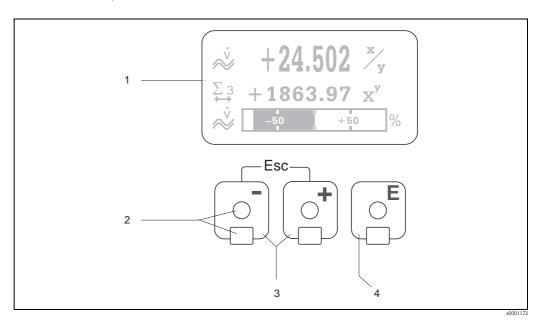


Fig. 27: Display and operating elements

1 Liquid crystal display

The backlit, four-line liquid-crystal display shows measured values, dialog texts, fault messages and notice messages. The display as it appears when normal measuring is in progress is known as the HOME position (operating mode).

Display

- Optical sensors for Touch Control
- 3 + / keys
  - HOME position  $\rightarrow$  Direct access to totalizer values and actual values of inputs/outputs
  - Enter numerical values, select parameters
  - Select different blocks, groups and function groups within the function matrix

Press the keys simultaneously to trigger the following functions:

- Exit the function matrix step by step  $\rightarrow$  HOME position
- Press and hold down the  $\exists$  keys for longer than 3 seconds  $\rightarrow$  Return directly to the HOME position
- Cancel data entry
- 4 E key
  - HOME position  $\rightarrow$  Entry into the function matrix
  - Save the numerical values you input or settings you change

# 5.2.2 Display (operating mode)

The display area consists of three lines in all; this is where measured values are displayed, and/or status variables (direction of flow, bar graph, etc.). You can change the assignment of display lines to different variables to suit your needs and preferences ( $\rightarrow$  See the "Description of Device Functions" manual).

### Multiplex mode:

A maximum of two different display variables can be assigned to each line. Variables multiplexed in this way alternate every 10 seconds on the display.

#### Error messages:

Display and presentation of system/process errors  $\rightarrow \stackrel{\triangle}{=} 43$ 

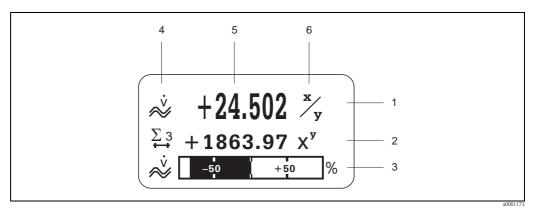


Fig. 28: Typical display for normal operating mode (HOME position)

- 1 Main line: shows main measured values
- 2 Additional line: shows additional measured variables and status variables
- 3 Information line: shows additional information on the measured variables and status variables, e.g. bar graph display
- 4 "Info icons" field: icons representing additional information on the measured values are shown in this field  $\rightarrow \stackrel{\cong}{1}$  39.
- 5 "Measured values" field: the current measured values appear in this field.
- 6 "Unit of measure" field: the units of measure and time defined for the current measured values appear in this field.



#### Note!

In the HOME position, you can use the  $\boxdot$ / $\lnot$  keys to call up a list containing the following information:

- Totalizer values (including overflow)
- Tag name (DEVICE PD-TAG)
- $\stackrel{\bullet}{=} \rightarrow View individual values in the list$  $\stackrel{\bullet}{=} (Esc key) \rightarrow Back to HOME position$

# **5.2.3** Icons

The icons which appear in the field on the left make it easier to read and recognize measured variables, device status, and error messages.

Icon	Meaning	Icon	Meaning	
S	System error	P	Process error	
4	Fault message (measuring is interrupted)	!	Notice message (measuring continues despite the message)	
Σ1 to n	Totalizer 1 to n	AI 1 (to n)	Analog Input Function Block 1 (to n), output value OUT	
PID	PID Function Block: A PID Function Block value as listed below is output, depending on the assignment of the lines in the local display:  OUT value (= manipulated variable)  IN value (= control variable)  CAS_IN value (= external set point)			
The messages listed assigned to the PID	below describe the status of the OUT v Function Block.	alue of the Analog Inp	out Function Block and the value	
OK	Status = GOOD (valid)	UNC	Status = UNCERTAIN (valid to a certain extent)	
BAD	Status = BAD (not valid)	Example:		
			#0000255	
a0001182	Measuring mode: SYMMETRY (bidirectional)	a0001183	Measuring mode: STANDARD	
a0001184	Counting mode, totalizer: BALANCE (forward and reverse flow)	a0001185	Counting mode, totalizer: forward	
a0001186	Counting mode, totalizer: reverse	<b>₩</b>	Volume flow	
<b>Ŭ1</b> ≈ 3001189	Target volume flow	V1 2001193	% Target volume flow	
ÜC1	Target corrected volume flow	2001191	Carrier volume flow	
U2/ /U	% Target volume flow	Úc 2	Carrier corrected volume flow	

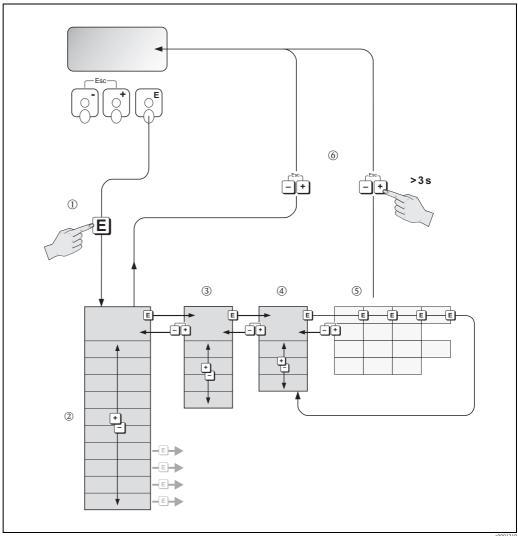
Icon	Meaning	Icon	Meaning
**************************************	Mass flow	<b>№1</b>	Target mass flow
m1 m	% Target mass flow	<b>™2</b> ≪×30001198	Carrier mass flow
m <sub>2</sub> /	% Carrier mass flow	<b>Q</b>	Fluid density
<b>Q</b> <sub>R</sub> <sub>a001208</sub>	Reference density	<b>Q</b>	Fluid temperature

#### 5.3 Brief operating instructions on the function matrix



Note!

- See the general notes  $\rightarrow$   $\stackrel{\triangle}{=}$  42
- ullet Function descriptions o See the "Description of Device Functions" manual
- HOME position  $\rightarrow \mathbb{E} \rightarrow$  Enter the function matrix
- Select a block (e.g. MEASURED VARIABLES)
- Select a group (e.g. SYSTEM UNITS)
- Select a function group (e.g. CONFIGURATION)
- Select a function (e.g. UNIT VOLUME FLOW) Change parameter / enter numerical values:  $\stackrel{\square}{\to}$  Select or enter enable code, parameters, numerical values  $\blacksquare$   $\rightarrow$  Save your entries
- Exit the function matrix:
  - Press and hold down Esc key ( ) for longer than 3 seconds  $\rightarrow$  HOME position
  - Repeatedly press Esc key  $(\Box \Box)$  Return step by step to HOME position



Selecting functions and configuring parameters (function matrix)

### 5.3.1 General notes

The Quick Setup menu contains the default settings that are adequate for commissioning. Complex measuring operations on the other hand necessitate additional functions that you can configure as necessary and customize to suit your process parameters. The function matrix, therefore, comprises a multiplicity of additional functions which, for the sake of clarity, are arranged on a number of menu levels (blocks, groups, and function groups).

Comply with the following instructions when configuring functions:

- You select functions as described on  $\rightarrow \Box$  41. Each cell in the function matrix is identified by a numerical or letter code on the display.
- You can switch off certain functions (OFF). If you do so, related functions in other function groups will no longer be displayed.
- Certain functions prompt you to confirm your data entries. Press : to select "SURE [YES]" and press : again to confirm. This saves your setting or starts a function, as applicable.
- Return to the HOME position is automatic if no key is pressed for 5 minutes.
- Programming mode is disabled automatically if you do not press a key within 60 seconds following automatic return to the HOME position.



#### Caution

All functions are described in detail, as is the function matrix itself, in the "Description of Device Functions" manual, which is a separate part of these Operating Instructions.



#### Note!

- The transmitter continues to measure while data entry is in progress, i.e. the current measured values are output via the signal outputs or the fieldbus communication in the normal way.
- If the supply voltage fails all preset and parameterized values remain safely stored in the EEPROM.

## 5.3.2 Enabling the programming mode

The function matrix can be disabled. Disabling the function matrix rules out the possibility of inadvertent changes to device functions, numerical values or factory settings. A numerical code (factory setting = 83) has to be entered before settings can be changed.

If you use a code number of your choice, you exclude the possibility of unauthorized persons accessing data ( $\rightarrow$  See the "Description of Device Functions" manual).

Comply with the following instructions when entering codes:

- If programming is disabled and the +- operating elements are pressed in any function, a prompt for the code automatically appears on the display.
- If "0" is entered as the customer's code, programming is always enabled.
- The Endress+Hauser service organization can be of assistance if you mislay your personal code.



## Caution!

- Changing certain parameters such as all sensor characteristics, for example, influences numerous functions of the entire measuring system, particularly measuring accuracy. There is no need to change these parameters under normal circumstances and consequently, they are protected by a special code known only to the Endress+Hauser service organization. Please contact Endress+Hauser if you have any questions.
- With FOUNDATION Fieldbus, programming is enabled separately in the Transducer Block.

#### 5.3.3 Disabling the programming mode

Programming mode is disabled if you do not press an operating element within 60 seconds following automatic return to the HOME position.

You can also disable programming in the "ACCESS CODE" function by entering any number (other than the customer's code).

#### 5.4 Error messages

#### 5.4.1 Type of error

Errors that occur during commissioning or measuring are displayed immediately. If two or more system or process errors are present, the error with the highest priority is the one shown on the display.

The measuring system distinguishes between two types of error:

- System error: Includes all device errors, for example communication errors, hardware errors, etc.
- Process error: Includes all application errors, e.g. fluid not homogeneous, etc.  $\rightarrow \stackrel{\triangleright}{=} 88$

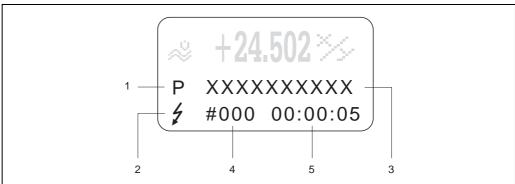


Fig. 30: Error messages on the display (example)

- *Error type:*  $P = process\ error$ ,  $S = system\ error$
- 2 Error message type:  $\frac{1}{2}$  = fault message, ! = notice message
- 3 Error designation
- 4 Error number
- Duration of most recent error occurrence (hours: minutes: seconds)

#### 5.4.2 Error message type

The measuring device always assigns system and process errors which occur to two types of error messages (**fault** or **notice messages**), resulting in different weightings  $\rightarrow \ge 80$ .

Serious system errors, e.g. module defects, are always identified and classed as "fault messages" by the measuring device.

Notice message (!)

- The error in question has no effect on measurement currently in progress.
- Displayed as  $\rightarrow$  Exclamation mark (!), type of error (S: system error, P: process error)
- Presentation on the FOUNDATION Fieldbus → Notice messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "UNCERTAIN" of the output value OUT (AI Block).

Fault message (4)

- The error in question interrupts or stops measurement currently in progress.
- Displayed as  $\rightarrow$  Lightning flash ( $\frac{1}{2}$ ), type of error (S: system error, P: process error)
- Presentation on the FOUNDATION Fieldbus → Fault messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "BAD" of the output value OUT (AI Block).

# 5.5 Operating programs

### 5.5.1 FieldCare

FieldCare is Endress+Hauser's FDT-based plant asset management tool and allows the configuration and diagnosis of intelligent field devices. By using status information, you also have a simple but effective tool for monitoring devices. The Proline flowmeters are accessed via a service interface or via the service interface FXA193.

# 5.5.2 Operating via FOUNDATION Fieldbus configuration programs

The user can obtain special configuration and operating programs offered by the different manufacturers for use in configuration. These can be used for configuring both the FOUNDATION Fieldbus functions and all the device-specific parameters. The predefined Function Blocks allow uniform access to all the network and fieldbus device data.

A step-by-step description of the procedure for commissioning the FF functions is given on  $\rightarrow 247$ , along with the configuration of device-specific parameters.

General information on FOUNDATION Fieldbus is provided in the Operating Instructions "FOUNDATION Fieldbus Overview" (BA013S) acquired at:  $\rightarrow$  www.endress.com  $\rightarrow$  Download.

#### System files

You will need the following files for commissioning and network configuration:

- Commissioning → Device description (Device Description: \*.sym, \*.ffo)
- Network configuration → CFF file (Common File Format: \*.cff)

You can obtain these files as follows:

- Free of charge via the Internet  $\rightarrow$  www.endress.com
- From Endress+Hauser stating the order number (No. 56003896)
- Via the Fieldbus Foundation Organization → www.fieldbus.org



#### Note!

Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up via the following functions/parameters:

Local display:

- HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DEVICE REVISION (6243)
- HOME  $\rightarrow$  BASIC FUNCTIONS  $\rightarrow$  FOUND. FIELDBUS  $\rightarrow$  INFORMATION  $\rightarrow$  DD REVISION (6244)

FOUNDATION Fieldbus interface

- Resource Block → Parameter DEV REV
- Resource Block → Parameter DD REV

Example (with local display):

Display in the DEVICE REVISION (6243) function  $\rightarrow$  04

Display in the DD REVISION (6244) function  $\rightarrow$  01

Device description file (DD) required  $\rightarrow$  0401.sym / 0401.ffo

# 5.5.3 Device description files for operating programs

The following section illustrates the suitable device description file for the operating program in question and then indicates where this can be obtained.

Operation via FOUNDATION Fieldbus:

Valid for device software	3.00.XX	→ Function "Device software" (8100)	
Device data FOUNDATION Fieldbus			
Manufacturer ID: Device ID:	11 <sub>hex</sub> (ENDRESS+HAUSER) 1051 <sub>hex</sub>	<ul> <li>→ Function "Manufacturer ID" (6040)</li> <li>→ Function "Device ID" (6041)</li> </ul>	
FOUNDATION Fieldbus version data	Device Revision 4/DD Revision 1		
Software release	10.2009		
Operating program	How to acquire:		
Device Description (DD) and Capability File (CFF)	<ul> <li>www.endress.com → Download</li> <li>www.fieldbus.org</li> <li>CD-ROM (Endress+Hauser order r</li> </ul>	number: 56003896)	
Device driver for FF host systems:	How to acquire:		
ABB (FieldController 800)	www.abb.com		
Allen Bradley (Control Logix)	see FF standard device driver		
Emerson (Delta V)	www.easydeltav.com		
Endress+Hauser (ControlCare)	see FF standard device driver		
Honeywell (Experion PKS)	www.honeywell.com		
SMAR (System 302)	see FF standard device driver		
Yokogawa (CENTUM CS 3000)	www.yokogawa.com		
Device drivers for additional FF operating programs:	Sources for obtaining updates:		
Handheld terminal 375	www.fieldcommunicator.com		
	Note! The device drivers can be added and terminal 375.	updated via the update function of the handheld	

Tester/simulator:	Sources for obtaining device descriptions:	
Fieldcheck	■ Update by means of FieldCare with the Flow Device FXA193/291 DTM in the Fieldflash Module	



### Note!

The Fieldcheck tester/simulator is used for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification. Contact your Endress+Hauser representative for more information.

# 5.6 FOUNDATION Fieldbus hardware settings

# 5.6.1 Switching hardware write protection on and off

A jumper on the I/O board provides the means of switching hardware write protection on or off.



Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

- 1. Switch off power supply.
- 2. Remove the I/O board  $\rightarrow \stackrel{\triangle}{=} 92$
- 3. Configure hardware write protection and simulation mode appropriately using the jumpers (see graphic).
- 4. Installation of the I/O board is the reverse of the removal procedure.

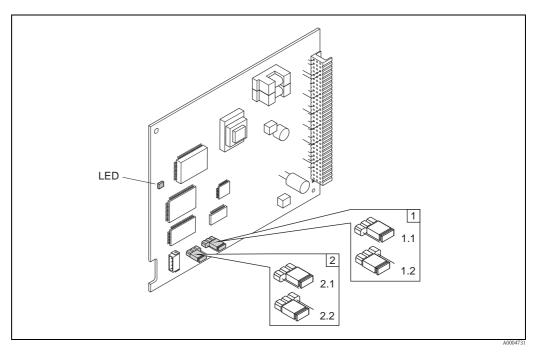


Fig. 31: Hardware configuration (I/O board)

- Jumper for enabling/disabling write protection:
- 1.1 Write protection disabled (factory setting) = it is possible to write-access the device functions via the FF interface
- 1.2 Write protection enabled = it is **not** possible to write-access the device functions via the FF interface
- 2 Jumper for simulation mode:
- 2.1 Simulation mode enabled (factory setting) = simulation in the Analog Input Function Block and in the Discrete Output Function Block is possible
- 2.2 Simulation mode disabled = simulation in the Analog Input Function Block and in the Discrete Output Function Block is **not** possible
- LED (light emitting diode):
  - $\ \textit{Continuously lit} \ \rightarrow \ \textit{Ready (no communication via FF active)}$
  - Not lit  $\rightarrow$  Not ready
  - Flashes slowly → Ready (communication via FF active)
  - Flashes quickly  $\rightarrow$  Device error present (error message type "fault message")  $\rightarrow$  🖹 76

#### Commissioning 6

#### 6.1 **Function check**

Make sure that the following function checks have been performed successfully before switching on the supply voltage for the measuring device:

- Checklist for "Post-installation check" → \( \begin{align\*} \equiv 26 \\ \equiv \text{Checklist for "Post-connection check"} \( \text{→ } \equiv 35 \)

#### 6.2 Switching on the measuring device

Once the function check has been performed successfully, the device is operational and can be switched on via the supply voltage. The device then performs internal test functions and the following messages are shown on the local display:

PROMASS 83	
START-UP RUNNING	Start-up message
Æ	
PROMASS 83	
DEVICE SOFTWARE V XX.XX.XX	Current software version
Æ	
FOUND. FIELDBUS	
Æ	
SYSTEM OK	
	Beginning of normal measuring mode
$\rightarrow$ OPERATION	
Æ	

Normal measuring mode commences as soon as startup completes. Various measured value and/or status variables appear on the display (HOME position).



Note!

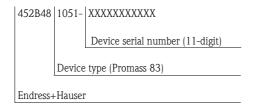
If startup fails, an error message indicating the cause is displayed.

# 6.3 Commissioning via FOUNDATION Fieldbus

Note the following points:

- The files required for commissioning and network configuration can be obtained as described on  $\rightarrow \stackrel{ o}{=} 44$ .
- The device is identified by the FOUNDATION Fieldbus in the host or configuration system via the device ID (DEVICE\_ID). The DEVICE\_ID is a combination of the manufacturer ID, device type and device serial number. It is unique and can never be duplicated.

The DEVICE\_ID of the Promass 83 is composed as follows:



## Commissioning

The following description allows step-by-step commissioning of the measuring device and all the necessary configuration for the FOUNDATION Fieldbus:

- 1. Switch on the measuring device.
- 2. Note the DEVICE\_ID on the device nameplate ( $\rightarrow \blacksquare 8$ ).
- 3. Open the configuration program.
- 4. Load the device description file or CFF file into the host system or into the configuration program. Ensure you use the correct system files. Refer to the example on  $\rightarrow \stackrel{\cong}{=} 44$ . The first time it is connected the measuring device reports as follows:
  - EH\_PROMASS\_83\_ xxxxxxxxxx (Tag name PD-TAG)
  - 452B481051- xxxxxxxxxx (Device\_ID)
  - Block structure:

Display text (xxx = serial number)	Base index	Description
RESOURCE_ xxxxxxxxxx	400	Resource Block
TRANSDUCER_FLOW_xxxxxxxxxx	1400	"Flow" Transducer Block
TRANSDUCER_DIAG_xxxxxxxxxx	1600	"Diagnosis" Transducer Block
TRANSDUCER_DISP_xxxxxxxxxxx	1800	"Display" Transducer Block
TRANSDUCER_TOT_xxxxxxxxxx	1900	"Totalizer" Transducer Block
TRANSDUCER_CDENS_xxxxxxxxxx	2000	"Calculated Density" Transducer Block
TRANSDUCER_VISC_xxxxxxxxxx	2100	"Viscosity" Transducer Block
TRANSDUCER_ADVD_xxxxxxxxxx	2200	"Advanced Diagnostics" Transducer Block
ANALOG_INPUT_1_ xxxxxxxxxx	500	Analog Input Function Block 1
ANALOG_INPUT_2_ xxxxxxxxxx	550	Analog Input Function Block 2
ANALOG_INPUT_3_ xxxxxxxxxx	600	Analog Input Function Block 3
ANALOG_INPUT_4_ xxxxxxxxxx	650	Analog Input Function Block 4
ANALOG_INPUT_5_ xxxxxxxxxx	700	Analog Input Function Block 5
ANALOG_INPUT_6_ xxxxxxxxxx	750	Analog Input Function Block 6
ANALOG_INPUT_7_ xxxxxxxxxx	800	Analog Input Function Block 7
ANALOG_INPUT_8_ xxxxxxxxxx	850	Analog Input Function Block 8
DISCRETE_OUTPUT_ xxxxxxxxxx	900	Discrete Output Function Block (DO)

Display text (xxx = serial number)	Base index	Description
PID_ xxxxxxxxxx	1000	PID Function Block (PID)
ARITHMETIC_xxxxxxxxxx	1100	Arithmetic Function Block (ARTH)
INPUT_SELECTOR_xxxxxxxxxxx	1150	Input Selector Function Block (ISEL)
SIGNAL_CHARACT_xxxxxxxxxx	1200	Signal Characterizer Function Block (CHAR)
INTEGRATOR_xxxxxxxxxx	1250	Integrator Function Block (INTG)



#### Note!

This measuring device is supplied with the bus address "250" and is thus in the address range reserved for readdressing field devices, between 248 and 251. This means that the LAS (Link Active Scheduler) automatically assigns the device a free bus address in the initialization phase.

5. Identify the field device using the DEVICE\_ID that you noted down and assign the desired field device tag name (PD\_TAG) to the fieldbus device in question. Factory setting: EH\_PROMASS\_83\_xxxxxxxxxxxx

### Configuration of the "Resource Block" (base index 400)

- 6. Open the Resource Block.
- 7. On delivery, hardware write protection is disabled so that you can access all the write parameters via FOUNDATION Fieldbus. Check this status via the parameter WRITE\_LOCK:
  - Write protection activated = LOCKED
  - Write protection deactivated = NOT LOCKED

Deactivate the write protection if necessary  $\rightarrow \triangleq 46$ .

- 8. Enter the desired block name (optional). Factory setting: RESOURCE\_ xxxxxxxxxx
- 9. Set the operating mode in the parameter group MODE\_BLK (parameter TARGET) to AUTO.

### Configuration of the "Transducer Blocks"

The individual Transducer Blocks comprise various parameter groups ordered by device-specific functions:

Transducer Block	Base index	Description
"Flow" Transducer Block	1400	Flow measurement
"Diagnosis" Transducer Block	1600	Diagnostic functions
"Display" Transducer Block	1800	Local display functions
"Totalizer" Transducer Block	1900	Totalizer 1 to 3
"Calculated Density" Transducer Block	2000	Density functions
"Viscosity" Transducer Block	2100	Viscosity measurement
"Advanced Diagnostics" Transducer Block	2200	Advanced diagnostic functions

The following description provides an example for the "Flow" Transducer Block (base index: 1400).

- 10. Enter the desired block name (optional). Factory setting: TRANSDUCER\_FLOW\_xxxxxxxxxxx
- 11. Open the "Flow" Transducer Block.
- 12. Now configure the device-specific parameters relevant for your application:

- Note!
- Note that changes to the device parameters can only be made after entering a valid access code in the parameter "Access – Code".
- The selection of the system units in the "Flow" Transducer Block has no effect on the output value OUT (AI Block). Units of the process variables which are transmitted via the FOUNDATION Fieldbus interface must be specified separately in the Analog Input Function Block via the XD\_SCALE and OUT\_SCALE parameter group.
- 13. Set the "Flow" and "Totalizer" Transducer Blocks to AUTO in the MODE\_BLK parameter group (TARGET parameter). Only then is it ensured that the process variables can be processed correctly by the downstream AI Function Block.

### Configuration of the "Analog Input Function Blocks"

The measuring device has seven Analog Input Function Blocks that can be assigned to the various process variables. The following description provides an example for the Analog Input Function Block 1 (base index: 500).

- 14. Enter the desired name for the Analog Input Function Block (optional). Factory setting: ANALOG\_INPUT\_1xxxxxxxxxx
- 15. Open the Analog Input Function Block 1.
- 16. Set the operating mode in the parameter group MODE\_BLK (parameter TARGET) to OOS, i.e. block Out Of Service.
- 17. Using the parameter CHANNEL select the process variable that is to be used as the input value for the Function Block algorithm (scaling and limit value monitoring functions). The following configurations are possible:

Process variable	Channel parameter
Mass flow	1
Volume flow	2
Corrected volume flow	3
Density	4
Reference density	5
Temperature	6
Totalizer 1	7
Totalizer 2	8
Totalizer 3	9
The following process variables are available if the "Comeasurement" add-on is installed in the measuring dev	
Target fluid mass flow	40
Target fluid % mass	41
Target fluid volume flow	42
Target fluid % volume	43
Target fluid corrected volume flow	44
Carrier fluid mass flow	45
Carrier fluid % mass	46
Carrier fluid volume flow	47
Carrier fluid % volume	48
Carrier fluid corrected volume flow	49
% Black liquor	41

Process variable	Channel parameter
°Baume	
°API	
°Plato	50
°Balling	30
°Brix	
Flexible	
The following process variables are available if the "Visinstalled in the measuring device (order option)	cosity" add-on is
Dynamic viscosity	90
Kinematic viscosity	91
Temperature-compensated dynamic viscosity	92
Temperature-compensated kinematic viscosity	93
The following process variables are available if the "Ad on is installed in the measuring device (order option)	vanced diagnostics" add-
Mass flow deviation	70
Density deviation	71
Reference density deviation	72
Temperature deviation	73
Tube damping deviation	74
Electrodynamic sensor deviation	75
Deviation of operating frequency fluctuation	76
Deviation of tube damping fluctuation	77

18. In the parameter group XD\_SCALE, select the desired engineering unit and the block input range (measurement range of the flow application) for the process variable in question (see following example).

### Caution!

Make sure that the selected unit is suitable for the measurement variable of the selected process variable. Otherwise the parameter BLOCK\_ERROR will display the error message "Block Configuration Error" and the block operating mode cannot be set to AUTO.

19. In the L\_TYPE parameter, select the mode of linearization for the input variable (Direct, Indirect, Indirect Sq Root)  $\rightarrow$  See the "Description of Device Functions" manual.

#### Caution!

Note that with the type of linearization "Direct" the configuration of the parameter group OUT\_SCALE must agree with the configuration of the parameter group XD\_SCALE. Otherwise the block operating mode cannot be set to AUTO. Such incorrect configuration is indicated via the parameter BLOCK\_ERROR with the "Block Configuration Error" message.

### Example:

- The measurement range of the sensor is 0 to 30 kg/h.
- The output range to the process control system should be 0 to 30 kg/h as well.

The following settings should be made:

- Analog Input Function Block / parameter CHANNEL (selection of input value), selection:  $1 \rightarrow$  Mass flow
- Parameter L TYPE  $\rightarrow$  Direct
- Parameter group XD\_SCALE

 $XD\_SCALE 0\% = 0$ 

XD SCALE 100% = 30

XD\_SCALE UNIT = kg/h

Parameter group OUT\_SCALE
 OUT\_SCALE 0% = 0
 OUT\_SCALE 100% = 30
 OUT\_SCALE UNIT = kg/h

- 20. Use the following parameters to define the limit values for alarm and warning messages:
  - HI\_HI\_LIM  $\rightarrow$  Limit value for the upper alarm
  - HI\_LIM → Limit value for the upper warning
  - LO\_LIM  $\rightarrow$  Limit value for the lower warning
  - LO LO LIM  $\rightarrow$  Limit value for the lower alarm

The limit values entered must be within the value range specified in the parameter group  $\overline{\text{OUT}}$  SCALE.

- 21. In addition to the actual limit values you must also specify the action taken if a limit value is exceeded using so-called "alarm priorities" (parameters HI\_HI\_PRI, HI\_PRI, LO\_PR, LO\_LO\_PRI) → See the "Description of Device Functions" manual. Reporting to the fieldbus host system only takes place if the alarm priority is higher than 2.
- 22. System configuration/connection of Function Blocks:

A concluding "overall system configuration" is essential so that the operating mode of the Analog Input Function Block can be set to AUTO and so that the field device is integrated into the system application. To do this, configuration software is used to connect the Function Blocks to the desired control strategy – generally graphically – and then the sequence of the individual process control functions is specified.

- 23. After specifying the active LAS, download all the data and parameters into the field device.
- 24. Set the operating mode in the parameter group MODE\_BLK (parameter TARGET) to AUTO. This is only possible under two conditions, however:
  - The Function Blocks are correctly connected with each other.
  - The Resource Block is in operating mode AUTO.

Configuration of the "Analog Output Function Block" (base index 2300)

The measuring device has one Analog Output Function Block that can be assigned to the various process variables.

The following example illustrates how the value for the operating density ("System Value – Fixed Density" parameter can be read in via the Analog Output Function Block of a density measuring device (e.g. Gammapilot M). The connection first has to be established between the Analog Output Function Block and the "System Value – Fixed Density" parameter in the "Flow" Transducer Block. For this purpose, the value "4" (density) must be assigned to the CHANNEL parameter.

- 25. Enter the desired name for the Analog Output Function Block (optional). Factory setting: ANALOG\_OUTPUT\_xxxxxxxxxxx
- 26. Open the Analog Output Function Block.
- 27. Set the operating mode in the parameter group MODE\_BLK (parameter TARGET) to OOS, i.e. block Out Of Service.
- 28. Using the parameter CHANNEL select "density", which is to be used as the input value for the Transducer Block algorithm (scaling function). The following configurations are possible:

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Process variable	Channel parameter
Density	4

29. In the parameter group PV\_SCALE, select the desired engineering unit and the block input range (measurement range of the density application) for the process variable in question (see following example).

## Caution!

Make sure that the selected unit is suitable for the measurement variable of the selected process variable. Otherwise the parameter BLOCK\_ERROR will display the error message "Block Configuration Error" and the block operating mode cannot be set to AUTO.

### Example:

- The measurement range of the density application is 0 to 30 kg/l.
- The output range to the process control system should be 0 to 30 kg/l as well.
- The following settings must be made:
  - Analog Output Function Block / parameter CHANNEL (selection of output value), selection  $\bf 4=$  density
  - Parameter SHED\_OPTIONS  $\rightarrow$  e.g. Normal Shed Normal Return
  - Parameter group PV SCALE
    - PV\_SCALE 0% = 0
    - PV\_SCALE 100% = 30
    - PV\_SCALE UNIT = kg/1
  - Parameter group OUT\_SCALE
    - $-OUT_SCALE 0\% = 0$
    - OUT SCALE 100% = 30
    - OUT\_SCALE UNIT = kg/l
- 30. Set the operating mode in the parameter group MODE\_BLK (parameter TARGET) to AUTO.
- 31. System configuration/connection of Function Blocks:

A concluding "overall system configuration" is essential so that the operating mode of the Analog Output Function Block can be set to AUTO and so that the device is integrated into the system application. To do this, configuration software is used to connect the Function Blocks to the desired control strategy – generally graphically – and then the sequence of the individual process control functions is specified.

# 6.4 Quick Setup

In the case of measuring devices without a local display, the individual parameters and functions must be configured via the operating program, e.g. FieldCare.

If the measuring device is equipped with a local display, all the important device parameters for standard operation, as well as additional functions, can be configured quickly and easily by means of the following Quick Setup menus.

# 6.4.1 Quick Setup "Commissioning"

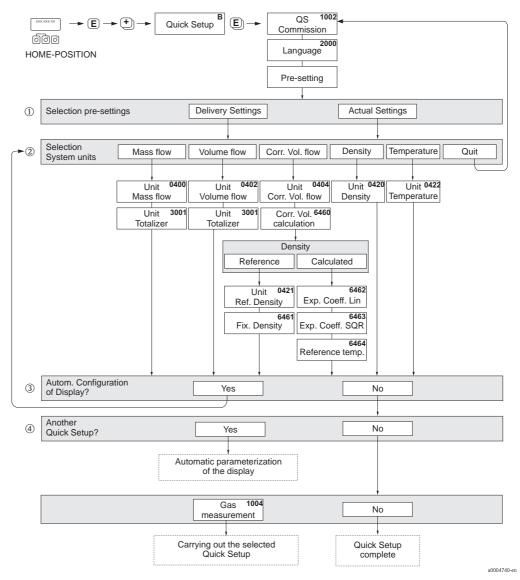


Fig. 32: Quick Setup "Commissioning" (only with local display)

Note 🗞

- The display returns to the cell SETUP COMMISSIONING (1002) if you press the ☐ key combination during parameter interrogation. The stored parameters remain valid.
- The system units selected via the Quick Setup are only valid for the local display and for parameters in the Transducer Blocks. They have no effect on the process variables which are transmitted via the FOUNDATION Fieldbus.
- The DELIVERY SETTINGS option sets every selected unit to the factory setting.
   The ACTUAL SETTINGS option accepts the units you previously configured.
- ② Only units not yet configured in the current Setup are offered for selection in each cycle. The unit for mass, volume and corrected volume is derived from the corresponding flow unit.
- 3 The YES option remains visible until all the units have been configured. NO is the only option displayed when no further units are available.
- The "automatic parameterization of the display" option contains the following basic settings/factory settings:

YES Main line = Mass flow Additional line = Totalizer 1 Information line = Operating/system conditions

NO The existing (selected) settings remain.

# 6.4.2 Quick Setup "Gas Measurement"

The measuring device is not only suitable for measuring liquid flow. Direct mass measurement based on the Coriolis principle is also possible for measuring the flow rate of gases.



#### Note!

- Before carrying out the Quick Setup "Gas measurement" the Quick Setup "Commissioning" has to be executed → 

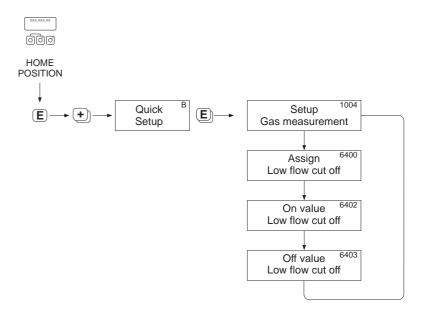
  \$\begin{align\*}
  \begin{align\*}
  \text{54}.
  \end{align\*}
  \]
- Only mass and Corrected volume flow can be measured and output with the gas measurement mode. Note that direct density and/or volume measurement is not possible!
- The flow ranges and measuring accuracy that apply to gas measurement are not the same as those for liquids.
- If corrected volume flow (e.g. in Nm³/h) is to be measured and output instead of the mass flow (e.g. in kg/h), change the setting for the CORRECTED VOLUME CALCULATION function to "FIXED REFERENCE DENSITY" in the "Commissioning" Quick Setup menu.

### Performing the "Gas Measurement" Quick Setup

The "Gas Measurement" Quick Setup menu guides the user systematically through all the device functions that have to be configured for measuring operations with gas.

The "Gas Measurement" Quick Setup menu can be called up in the function matrix via two separate functions:

- Via the QS GAS MEASUREMENT (1004) function  $\rightarrow$  🖾 33 or
- Via the OS COMMISSIONING (1002) function  $\rightarrow$   $\square$  32



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Fig. 33: Quick Setup "Gas Measurement"

Recommended settings are found on the following page.

#### Recommended settings:

#### Quick Setup "Gas Measurement" HOME position $\rightarrow \blacksquare \rightarrow MEASURED VARIABLE (A)$ MEASURED VARIABLE $\rightarrow \pm \rightarrow$ QUICK SETUP (B) QUICK SETUP $\rightarrow$ $\bigcirc$ $\rightarrow$ QS GAS MEASUREMENT (1004) Function No. Setting to be selected (1/-) **Function name** (to next function with []) 1004 OS GAS MEASUREMENT Once you confirm by pressing , the Quick Setup menu calls up all the subsequent functions in succession. 6400 ASSIGN On account of the low mass flow involved when gas flows are measured, LOW FLOW CUTOFF it is advisable not to use low flow cutoff. Setting: OFF 6402 ON-VALUE LOW FLOW If the ASSIGN LF CUTOFF function was not set to "OFF", the following applies: CUT OFF Setting: 0.0000 [unit] User input: Flow rates for gas measurements are low, so the value for the switch-on point (= low flow cutoff) must be correspondingly low. 6403 OFF-VALUE LOW FLOW If the ASSIGN LF CUTOFF function was not set to "OFF", the following applies: CUT OFF Default value: 50% User input: Enter the switch-off point as a positive hysteresis in %, referenced to the switch-on point. Back to the HOME position: ightarrow Press and hold down Esc key ightharpoonup for longer than three seconds or



#### Note!

Quick Setup automatically deactivates the function EMPTY PIPE DETECTION (6420) so that the instrument can measure flow at low gas pressures.

Corrected volume measurement with gas:

Proceed as follows if the corrected volume flow (e.g. in  $Nm^3/h$ ) should be displayed and output instead of the mass flow (e.g. in kg/h).

1. Select the "Commissioning" Quick Setup menu via the function matrix ( $\rightarrow \stackrel{\triangle}{=} 54$ ).

ightarrow Repeatedly press and release Esc key ightharpoonup Exit the function matrix step by step

2. Under "Pre-settings", select the "Corrected volume flow" system unit and configure the functions as follows:

Function No.	Function name	Setting to be selected ( $^{\circ}\!\!\!\!/\ $ ) (go to the next function with $^{\circ}\!$
0404	UNIT CORR. VOL. FLOW	Select the engineering unit required
6460	CORR. VOL. CALCUL.	FIXED REFERENCE DENSITY
0421	UNIT REF. DENSITY	Select the engineering unit required
6461	FIXED REFERENCE DENSITY	Enter the gas-dependent reference density, (i.e. the density based on the reference temperature and reference pressure).
		Example for air: Reference density = $1.2928 \text{ kg/Nm}^3$ (based on $0  ^{\circ}\text{C}$ and $1.013  \text{bar}$ )

3. Exit the "Commissioning" Quick Setup menu and return to the HOME position.

# 6.4.3 Data backup/transmission

Using the T-DAT SAVE/LOAD function, you can transfer data (device parameters and settings) between the T-DAT (exchangeable memory) and the EEPROM (device storage unit).

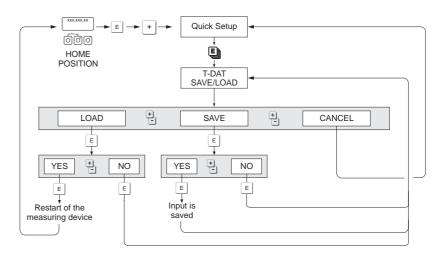
This is required in the following instances:

- Creating a backup: current data are transferred from an EEPROM to the T-DAT.
- Replacing a transmitter: current data are copied from an EEPROM to the T-DAT and then transferred to the EEPROM of the new transmitter.
- Duplicating data: current data are copied from an EEPROM to the T-DAT and then transferred to EEPROMs of identical measuring points.



#### Note!

For information on installing and removing the T-DAT  $\rightarrow \stackrel{\triangle}{=} 92$ 



a0001221-ei

Fig. 34: Data backup/transmission with the T-DAT SAVE/LOAD function

Information on the LOAD and SAVE options available:

LOAD: Data are transferred from the T-DAT to the EEPROM.



### Note!

- Any settings already saved on the EEPROM are deleted.
- This option is only available if the T-DAT contains valid data.
- This option can only be executed if the software version of the T-DAT is the same as, or more recent than, that of the EEPROM. If this is not the case, the error message "TRANSM. SW-DAT" appears after restarting and the LOAD function is then no longer available.

### SAVE:

Data are transferred from the EEPROM to the T-DAT.

# 6.5 Device configuration

### **6.5.1** Concentration measurement

The measuring device determines three primary variables simultaneously:

- Mass flow
- Fluid density
- Fluid temperature

As standard, these measured variables allow other process variables to be calculated, such as volume flow, reference density (density at reference temperature) and corrected volume flow.

The optional software package "Concentration measurement" (F-Chip, accessories) offers a multitude of additional density functions. Additional evaluation methods are available in this way, especially for special density calculations in all types of applications:  $\rightarrow \stackrel{\triangle}{=} 74$ 

- Calculating percentage contents, mass and volume flow in two-phase media (carrier fluid and target fluid),
- Converting density of the fluid into special density units (°Brix, °Baumé, °API, etc.).

### Concentration measurement with fixed calculation function

By means of the "DENSITY FUNCTION (7000)" function, you can select various density functions which use a fixed specified calculation mode for calculating the concentration:

<b>Density function</b>	Remarks
%-MASS %-VOLUME	By using the functions for two-phase-media, it is possible to calculate the percentage mass or volume contents of the carrier fluid or the target fluid. The basic equations (without temperature compensation) are:
	Mass [%] = $\frac{D2 \cdot (\rho - D1)}{\rho \cdot (D2 - D1)} \cdot 100\%$
	Volume [%] = $\frac{(\rho - D1)}{(D2 - D1)} \cdot 100\%$
	$\begin{array}{c} D1 = \mbox{density of carrier fluid (transporting liquid, e.g. water)} \\ D2 = \mbox{density of target fluid (material transported, e.g. lime powder or a second liquefied material to be measured)} \\ \rho = \mbox{measured overall density} \end{array}$
°BRIX	Density unit used for the Food & Beverage industry which deals with the saccharose content of aqueous solutions, e.g. for measuring solutions containing sugar such as fruit juice, etc.  The following ICUMSA table for Brix units is the basis for calculations within the device.
°BAUME	This density unit or scale is mainly used for acidic solutions, e.g. ferric chloride solutions.  Two Baumé scales are used in practice:  BAUME > 1 kg/l: for solutions heavier than water  BAUME < 1 kg/l: for solutions lighter than water
°BALLING °PLATO	Both units are a commonly used basis for calculating the fluid density in the brewery industry. A liquid with a value of 1° BALLING (Plato) has the same fluid density as a water/cane sugar solution consisting of 1 kg cane sugar dissolved in 99 kg of water. 1° Balling (Plato) is thus 1% of the liquid weight.
%-BLACK LIQUOR	The units of concentration used in the paper industry for black liquor in % by mass. The formula used for the calculation is the same as for %-MASS.
°API	°API (= American Petroleum Institute) Density units specifically used in North America for liquefied oil products.

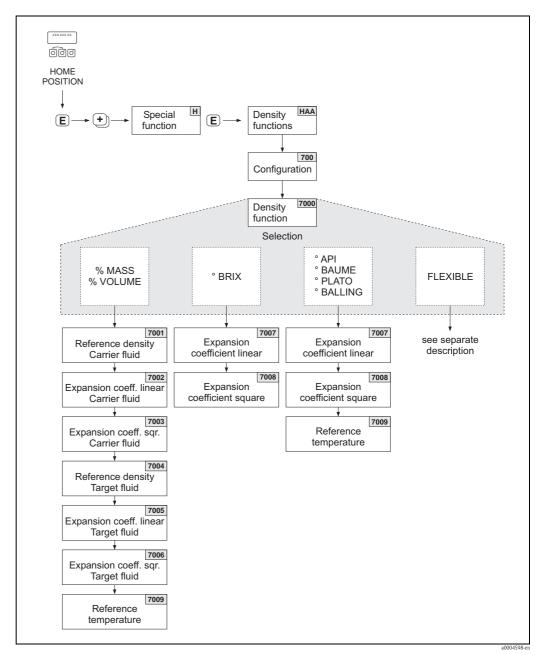


Fig. 35: Selecting and configuring different density functions in the function matrix

Brixgrade (density of hydrous saccharose solution in kg/m³)								
°Brix	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C
0	999.70	998.20	995.64	992.21	988.03	983.19	977.76	971.78
5	1019.56	1017.79	1015.03	1011.44	1007.14	1002.20	996.70	989.65
10	1040.15	1038.10	1035.13	1031.38	1026.96	1021.93	1016.34	1010.23
15	1061.48	1059.15	1055.97	1052.08	1047.51	1042.39	1036.72	1030.55
20	1083.58	1080.97	1077.58	1073.50	1068.83	1063.60	1057.85	1051.63
25	1106.47	1103.59	1099.98	1095.74	1090.94	1085.61	1079.78	1073.50
30	1130.19	1127.03	1123.20	1118.80	1113.86	1108.44	1102.54	1096.21
35	1154.76	1151.33	1147.58	1142.71	1137.65	1132.13	1126.16	1119.79
40	1180.22	1176.51	1172.25	1167.52	1162.33	1156.71	1150.68	1144.27
45	1206.58	1202.61	1198.15	1193.25	1187.94	1182.23	1176.14	1169.70

Brixgrade (density of hydrous saccharose solution in kg/m³)								
°Brix	10°C	20°C	30°C	40°C	50°C	60°C	70°C	80°C
50	1233.87	1229.64	1224.98	1219.93	1214.50	1208.70	1202.56	1196.11
55	1262.11	1257.64	1252.79	1247.59	1242.05	1236.18	1229.98	1223.53
60	1291.31	1286.61	1281.59	1276.25	1270.61	1264.67	1258.45	1251.88
65	1321.46	1316.56	1311.38	1305.93	1300.21	1294.21	1287.96	1281.52
70	1352.55	1347.49	1342.18	1336.63	1330.84	1324.80	1318.55	1312.13
75	1384.58	1379.38	1373.88	1368.36	1362.52	1356.46	1350.21	1343.83
80	1417.50	1412.20	1406.70	1401.10	1395.20	1389.20	1383.00	1376.60
85	1451.30	1445.90	1440.80	1434.80	1429.00	1422.90	1416.80	1410.50
Source: A. & L. Emmerich, Technical University of Brunswick; officially recommended by ICUMSA, 20th session 1990								

#### Concentration measurement with flexible calculation function

Under certain application conditions, it may not be possible to use density functions with a fixed calculation function (% mass, °Brix, etc.). However, user–specific or application–specific concentration calculations can be used with the "FLEXIBLE" setting in the function "DENSITY FUNCTION (7000)".

The following types of calculation can be selected in the function "MODE (7021)":

- % MASS 3D
- % VOLUME 3D
- % MASS 2D
- % VOLUME 2D

Calculation type "% MASS 3D" or "% VOLUME 3D"

For this type of calculation, the relationship between the three variables – concentration, density and temperature must be known (3-dimensional), e.g. by a table. In this way, the concentration can be calculated from the measured density and temperature values by means of the following formula (the coefficients AO, A1, etc. have to be determined by the user):

$$K = A0 + A1 \cdot \rho + A2 \cdot \rho^2 + A3 \cdot \rho^3 + A4 \cdot \rho^4 + B1 \cdot T + B2 \cdot T^2 + B3 \cdot T^3$$

a0004620

- K Concentration
- ρ Currently measured density
- A0 Value from function (COEFFICIENT A0 (7032))
- A1 Value from function (COEFFICIENT A1 (7033))
- A2 Value from function (COEFFICIENT A2 (7034))
- A3 Value from function (COEFFICIENT A3 (7035)) A4 Value from function (COEFFICIENT A4 (7036))
- B1 Value from function (COEFFICIENT B1 (7037))
- B2 Value from function (COEFFICIENT B2 (7038))
- B3 Value from function (COEFFICIENT B3 (7039))
  T Currently measured temperature in °C

60

### Example:

The following is a concentration table from a reference source.

Temperature	10°C	15°C	20°C	25°C	30°C
Density					
825 kg/m <sup>3</sup>	93.6%	92.5%	91.2%	90.0%	88.7%
840 kg/m <sup>3</sup>	89.3%	88.0%	86.6%	85.2%	83.8%
855 kg/m <sup>3</sup>	84.4%	83.0%	81.5%	80.0%	78.5%
870 kg/m <sup>3</sup>	79.1%	77.6%	76.1%	74.5%	72.9%
885 kg/m <sup>3</sup>	73.4%	71.8%	70.2%	68.6%	66.9%
900 kg/m <sup>3</sup>	67.3%	65.7%	64.0%	62.3%	60.5%
915 kg/m <sup>3</sup>	60.8%	59.1%	57.3%	55.5%	53.7%



#### Note!

To determine the coefficients for calculating the concentration for the measuring device, the unit of density and the unit of temperature have to be kg/l and °C respectively, and the concentration must be entered in decimal format (e.g. 0.5 instead of 50%). The coefficients B1, B2 and B3 must be entered in scientific notation into the matrix positions 7037, 7038 and 7039 as a product with  $10^{-3}$ ,  $10^{-6}$  or  $10^{-9}$ 

### Assume:

Density ( $\rho$ ): 870 kg/m<sup>3</sup>  $\rightarrow$  0.870 kg/l

Temperature (T): 20°C

Coefficients determined for table above:

A0 = -2.6057

A1 = 11.642

A2 = -8.8571

A3 = 0

A4 = 0

 $B1 = -2.7747 \cdot 10^{-3}$ 

 $B2 = -7.3469 \cdot 10^{-6}$ 

B3 = 0

## Calculation:

$$K = A0 + A1 \cdot \rho + A2 \cdot \rho^{2} + A3 \cdot \rho^{3} + A4 \cdot \rho^{4} + B1 \cdot T + B2 \cdot T^{2} + B3 \cdot T^{3}$$

a0004620

$$= -2.6057 + 11.642 \cdot 0.870 + (-8.8571) \cdot 0.870^{2} + 0 \cdot 0.870^{3} + 0 \cdot 0.870^{4} + (-2.7747) \cdot 10^{-3} \cdot 20 + (-7.3469) \cdot 10^{-6} \cdot 20^{2} + 0 \cdot 20^{3}$$

= 0.7604

= *76.04*%

### Calculation type "% MASS 2D" or "% VOLUME 2D"

For this type of calculation, the relationship between the two variables concentration and reference density must be known (2-dimensional), e.g. by a table. In this way, the concentration can be calculated from the measured density and temperature values by means of the following formula (the coefficients AO, A1, etc. have to be determined by the user):

$$K = A0 + A1 \cdot \rho_{\text{ref}} + A2 \cdot {\rho_{\text{ref}}}^2 + A3 \cdot {\rho_{\text{ref}}}^3 + A4 \cdot {\rho_{\text{ref}}}^4$$

a0004621

K Concentration

pref Currently measured reference density

A0 Value from function (COEFFICIENT A0 (7032))

A1 Value from function (COEFFICIENT A1 (7033))

A2 Value from function (COEFFICIENT A2 (7034))

A3 Value from function (COEFFICIENT A3 (7035))

A4 Value from function (COEFFICIENT A4 (7036))



#### Note!

The measuring device determines the reference density by means of the density and temperature currently measured. To do so, both the reference temperature (function REFERENCE TEMPERATURE) and the expansion coefficients (function EXPANSION COEFF) must be entered in the measuring system.

The parameters important for measuring the reference density can also be entered directly via the "Commissioning" Quick Setup menu.

# 6.5.2 Advanced diagnostic functions

By means of the diagnostic functions it is now possible to record various process and device parameters during operation, e.g. mass flow, density/reference density, temperature values, measuring tube damping etc.

By analyzing the trend of these measured values, deviations of the measuring system from a "reference status" can be detected in good time and corrective measures can be taken.

### Reference values as the basis for trend analysis

Reference values of the parameters in question must always be recorded for trend analysis. These reference values are determined under reproducible, constant conditions. Such reference values are initially recorded during calibration at the factory and saved in the measuring device.

Reference data can also be ascertained under customer-specific process conditions, e.g. during commissioning or at certain process stages (cleaning cycles, etc.).

Reference values are recorded and saved in the measuring system always by means of the device function REFERENCE CONDITION USER (7401).



#### Caution

It is not possible to analyze the trend of process/device parameters without reference values! Reference values can only be determined under constant, non-changing process conditions.

### Methods of ascertaining data

Process and device parameters can be recorded in two different ways which you can define in the function ACQUISITION MODE (7410):

- PERIODICAL option: Measuring device acquires data periodically. Enter the desired time interval by means of the function ACQUISITION PERIOD (7411).
- SINGLE SHOT option: The user himself acquires the data manually at different, free selectable periods.

Ensure that the process conditions always correspond to the reference status when data is being recorded. It is only in this way that deviations from the reference status can be clearly determined.



#### Note!

The last ten entries are retained in chronological order in the measuring system.

The "history" of such values can be called up via various functions:

Diagnosis parameters	Data saved (per parameter)			
Mass flow Density Reference density Temperature Measuring tube damping Sensor symmetry Operating frequency fluctuation Tube damping fluctuation	Reference value → "REFERENCE VALUE" function Lowest measured value → "MINIMUM VALUE" function Highest measured value → "MAXIMUM VALUE" function List of the last ten measured values → "HISTORY" function Deviation measured/reference value → "ACTUAL DEVIATION" function			
More detailed information can be found in the "Description of Device Functions" manual.				

### Triggering warning messages

If required, a limit value can be assigned to all the process/device parameters relevant to the diagnostic functions. A warning message is triggered if this limit value is exceeded  $\rightarrow$  function WARNING MODE (7403).

The limit value is entered into the measuring system as an absolute (+/-) or relative deviation from the reference value  $\rightarrow$  function WARNING LEVEL (74...).

Deviations arising and recorded by the measuring system can also be output via the current or relay outputs or the fieldbus.

## Data interpretation

The way the data recorded by the measuring system is interpreted depends largely on the application in question. This means that users must have a very good knowledge of their specific process conditions and the related deviation tolerances in the process, which have to be determined by the users themselves in each individual case.

For example, when using the limit function it is especially important to know the minimum and maximum deviation tolerances allowed. Otherwise there is the danger that a warning message is triggered inadvertently during "normal" process fluctuations.

There can be various reasons for deviating from the reference status. The following table provides examples and pointers for each of the six diagnosis parameters recorded:

Diagnosis parameters	Possible reasons for deviation
Mass flow	A deviation from the reference status indicates possible zero point shift.
Density	A deviation from the reference status can be caused by a change in the measuring tube resonance frequency, e.g. from deposits in the measuring tube, corrosion or abrasion.
Reference density	The reference density values can be interpreted in the same way as the density values. If the fluid temperature cannot be kept completely constant, you can analyze the reference density (density at a constant temperature, e.g. at 20 °C) instead of the density. Ensure that the parameters required for calculating the reference density have been correctly configured (functions REFERENCE TEMPERATURE and EXPANSION COEFF.).
Temperature	Use this diagnosis parameter to check the functionality of the PT 1000 temperature sensor.
Measuring tube damping	A deviation from the reference status can be caused by a change in measuring tube damping, e.g. from mechanical changes (coating buildup, corrosion, abrasion).
Sensor symmetry	Use this diagnosis parameter to determine whether the sensor signals are symmetrical.
Operating frequency fluctuation	A deviation in the operating frequency fluctuation indicates possible gas in the fluid.
Tube damping fluctuation	A deviation in the tube damping fluctuation indicates possible gas in the fluid.

# 6.6 Adjustment

## 6.6.1 Zero point adjustment

The measuring device is calibrated with state-of-the-art technology. The zero point obtained in this way is printed on the nameplate.

Calibration takes place under reference operating conditions  $\rightarrow 108$ .

Consequently, zero point adjustment is **not** necessary.

Experience shows that the zero point adjustment is advisable only in special cases:

- To achieve highest measuring accuracy also at very small flow rates.
- Under extreme process or operating conditions (e.g. very high process temperatures or very high viscosity fluids).

### Preconditions for a zero point adjustment

Note the following before you perform a zero point adjustment:

- A zero point adjustment can be performed only with fluids that contain no gas or solid contents.
- Zero point adjustment is performed with the measuring tubes completely filled and at zero flow (v = 0 m/s). This can be achieved, for example, with shutoff valves upstream and/or downstream of the sensor or by using existing valves and gates.
  - Normal operation  $\rightarrow$  Valves 1 and 2 open
  - Zero point adjustment with pump pressure  $\rightarrow$  Valve 1 open / valve 2 closed
  - Zero point adjustment without pump pressure  $\rightarrow$  Valve 1 closed / valve 2 open

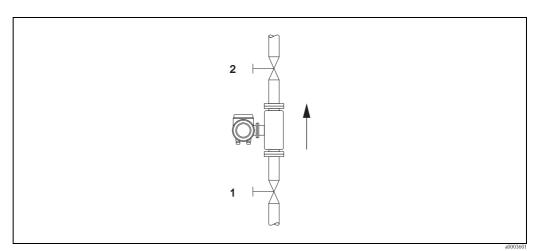


Fig. 36: Zero point adjustment and shutoff valves



#### Caution!

- If the fluid is very difficult to measure (e.g. containing entrained solids or gas) it may prove impossible to obtain a stable zero point despite repeated zero point adjustments. In instances of this nature, please contact your Endress+Hauser service center.
- You can view the currently valid zero point value using the following function:
  - Local display: HOME  $\rightarrow$   $\blacksquare$   $\rightarrow$   $\blacksquare$   $\rightarrow$  BASIC FUNCTIONS  $\rightarrow$  ADJUSTMENT ZEROPOINT
  - FOUNDATION Fieldbus interface/configuration program: Transducer Block → "Sensor Data Zeropoint" parameter



#### Notel

The zero point adjustment can be carried out as follows:

- Via the FOUNDATION Fieldbus configuration program in the Transducer Block
- Via the Discrete Output Function Block
- Via the local display (option)

# Performing zero point adjustment using the local display

- 1. Operate the system until operating conditions have settled.
- 2. Stop the flow (v = 0 m/s).
- 3. Check the shutoff valves for leaks.
- 4. Check that operating pressure is correct.
- 5. Now perform the adjustment as follows:

Key	Procedure	Display text
E	$HOME$ position $\rightarrow$ enter the operating matrix	> GROUP SELECTION < MEASURED VALUES
•	Select the "PROCESS PARAMETER" function group	> GROUP SELECTION < PROCESS PARAMETER
	Select the desired function "ZERO ADJUST".	ZERO ADJUST CANCEL
•	When you press $^{\circ}$ you are automatically prompted to enter the access code if the function matrix is still disabled.	CODE ENTRY ***
•	Enter code (80 = factory setting)	CODE ENTRY 80
E	Confirm code entry.	PROGRAMMING ENABLED
	The "ZERO ADJUST" function then appears again on the display.	ZERO ADJUST. CANCEL
•	Select "START"	ZERO ADJUST. START
E	Confirm entry with the E-key. A security query appears on the display.	SURE? NO
•	Select "YES"	SURE? YES
E	Confirm entry with the E-key. Zero point adjustment is now started. The message on the right appears on the display for 30 to 60 seconds while zero point adjustment is in progress. If the flow in the pipe exceeds 0.1 m/s, the following error message appears on the display: "ZERO ADJUST NOT POSSIBLE".	ZERO ADJUST. RUNNING
	When the zero point adjustment is completed, the "ZERO ADJUST." function reappears on the display.	ZERO ADJUST. CANCEL
Е	The new zero point value is displayed when the Enter key is pressed.	ZERO POINT
	Press <sup>9</sup> simultaneously → HOME position	

### Performing zero point adjustment with a configuration program

- 1. Operate the system until operating conditions have settled.
- 2. Stop the flow (v = 0 m/s).
- 3. Check the shutoff valves for leaks.
- 4. Check that operating pressure is correct.
- 5. Open the configuration program and then the Resource Block.
- 6. Use the WRITE\_LOCK parameter to check whether hardware write protection is deactivated:
  - Write protection activated = LOCKED
  - Write protection deactivated = NOT LOCKED

Deactivate the write protection if necessary  $\rightarrow \triangleq 46$ .

- 7. Open the Transducer Block.
- 8. Enable the programming mode:
  - Enter the enable code in the "Access Code" parameter (default = 83).
  - The "Access Status" parameter should now display "Unlocked Customer".
- 9. Start zero point adjustment:
  - In the "Zero Point Adjustment" parameter, select "START".
  - Start the adjustment procedure by sending this setting to the field device. If the flow of fluid
    in the pipe exceeds 0.1 m/s, the error message #731 (adjustment is not possible) appears in
    the "Diag. Act. Sys. Condition" parameter.
- 10. Close the configuration program.

### 6.6.2 Density adjustment

It is always advisable to perform density adjustment when optimum measuring accuracy is required for calculating density-dependent values.

1-point density adjustment (with one fluid):

This type of density adjustment is necessary under the following circumstances:

- The sensor does not measure exactly the density value that the user expects on the basis of laboratory analyses.
- The fluid properties are outside the measuring points set at the factory, or the reference operating conditions used to calibrate the measuring device.
- The system is used exclusively to measure a fluid's density which must be registered to a high degree of accuracy under constant conditions.

Example: Brix density measurement for apple juice.

2-point density adjustment (with two fluids):

This type of adjustment is always to be carried out if the measuring tubes have been mechanically altered by, e.g. material buildup, abrasion or corrosion. In such cases, the resonant frequency of the measuring tubes has been affected by these factors and is no longer compatible with the calibration data set at the factory. The 2-point density adjustment takes these mechanically-based changes into account and calculates new, adjusted calibration data.

### Performing 1- or 2-point density adjustment via the local display



Caution!

- Onsite density adjustment can be performed only if the user has detailed knowledge of the fluid density, obtained for example from detailed laboratory analyses.
- The target density value specified in this way must not deviate from the measured fluid density by more than  $\pm 10\%$ .
- An error in defining the target density affects all calculated density and volume functions.
- The 2-point density adjustment is only possible if both target density values are different from each other by at least 0.2 kg/l. Otherwise the error message #731 (adjustment is not possible) appears on the display.

- Density adjustment changes the factory density calibration values or the calibration values set by the service technician.
- The functions outlined in the following instructions are described in detail in the "Description of Device Functions" manual.
- 1. Fill the sensor with fluid. Make sure that the measuring tubes are completely filled and that liquids are free of gas bubbles.
- 2. Wait until the temperature difference between fluid and measuring tube has equalized. The time you have to wait for equalization depends on the fluid and the temperature level.
- 3. Using the local display, select the SETPOINT DENSITY function in the function matrix and perform density adjustment as follows:

Function No.	Function name	Setting to be selected (  or  ) (to next function with  )
6482	DENSITY ADJUST MODE	Use 🖰 to select a 1– or 2–point adjustment.
		Note! When you press  you are automatically prompted to enter the access code if the function matrix is still disabled. Enter the code.
6483	DENSITY SET VALUE 1	Use $\frac{1}{2}$ to enter the target density of the first fluid and press $\boxed{1}$ to save this value (input range = actual density value $\pm 10\%$ ).

▼

6484	MEASURE FLUID 1	Use do to select START and press solution. The message "DENSITY MEASUREMENT RUNNING" appears on the display for approximately 10 seconds.  During this time Promass measures the current density of the first fluid (measured density value).	Į.
		(measured density value).	

▼

### For 2-point density adjustment only:

6485	DENSITY SET VALUE 2	Use $\frac{9}{2}$ to enter the target density of the second fluid and press $\boxed{\epsilon}$ to save this value (input range = actual density value $\pm 10\%$ ).
6486	MEASURE FLUID 2	Use

▼

6487	DENSITY ADJUSTMENT	Use 🖁 to select DENSITY ADJUSTMENT and press 🗉.  Promass compares the measured density value and the target density value and calculates the new density coefficient.
6488	RESTORE ORIGINAL	If density adjustment does not complete correctly, you can select the RESTORE ORIGINAL function to reactivate the default density coefficient.

▼

Back to the HOME position:

- $\rightarrow$  Press and hold down Esc key ( ) for longer than three seconds or
- ightarrow Repeatedly press and release Esc key ( ) ightarrow Exit the function matrix step by step

### Performing 1-or 2-point density adjustment with FF configuration program:



### Caution!

- Density adjustment can be performed only if the user has detailed knowledge of the fluid density, obtained for example from detailed laboratory analyses.
- The target density value specified in this way must not deviate from the measured fluid density by more than  $\pm 10\%$ .
- An error in defining the target density affects all calculated density and volume functions.
- Density adjustment changes the factory density calibration values or the calibration values set by the service technician.
- The 2-point density adjustment is only possible if both target density values are different from each other by at least 0.2 kg/l. Otherwise the error message #731 (adjustment is not possible) appears in the "Diag. Act. Sys. Condition" parameter.
- The functions outlined in the following instructions are described in detail in the "Description of Device Functions" manual.
- 1. Fill the sensor with fluid. Make sure that the measuring tubes are completely filled and that liquids are free of gas bubbles.
- 2. Wait until the temperature difference between fluid and measuring tube has equalized. The time you have to wait for equalization depends on the fluid and the temperature level.
- 3. Open the configuration program and then the Resource Block.
- 4. Use the WRITE\_LOCK parameter to check whether hardware write protection is deactivated:
  - Write protection activated = LOCKED
- 5. Open the Transducer Block.
- 6. Enable the programming mode:
  - Enter the enable code in the "Access Code" parameter (default = 83).
  - The "Access Status" parameter should now display "Unlocked Customer".
- 7. In the "Adj. Dens.Adj.Mode" parameter, select the "1-Point" setting (for 1-point density adjustment) or "2-Point" (for 2-point density adjustment) and send this setting to the field device.
- 8. In the "Adj. Dens.Set.Value 1" parameter, enter the desired target density value (input range = current density value  $\pm 10\%$ ). Send this value to the field device.
- 9. In the "Adj. Meas.Fluid 1" parameter, select "START" and send this setting to the field device. The measuring device measures the current density of the fluid (measured density value) for ten seconds.
- 10. Only for 2-point density adjustment: In the "Adj. Dens.Set.Value 2" parameter, enter the desired target density value of the second fluid (input range = current density value  $\pm 10\%$ ). Send this value to the field device.
- 11. Only for 2-point density adjustment: In the "Adj. Meas.Fluid 2" parameter, select "START" and send this setting to the field device. The measuring device measures the current density of the second fluid (measured density value) for ten seconds.
- 12. In the "Adj. Dens. Adjustment" parameter, select "START".

  Start the density adjustment procedure by sending this setting to the field device. The measuring device compares the measured density value and the target density value of the fluid and calculates the new density coefficient.
- 13. If density adjustment does not complete correctly, you can select the "Density Adjustment Restore Original" parameter to reactivate the default density coefficients.
- 14. Close the configuration program.

### 6.7 Gas measurement

This measuring device is not only suitable for measuring liquid flow. Direct mass measurement based on the Coriolis principle is also possible for measuring the flow rate of gases.



### Note!

- Only mass flow and corrected volume flow can be measured and output with the gas measurement mode. Note that direct density and/or volume measurement is not possible.
- The flow ranges and measuring accuracy that apply to gas measurement are not the same as those for liquids.

### Function settings for gas measurement using the local display

See Quick Setup "Gas Measurement" → 🖹 55

### Function settings for gas measurement using FF configuration program:

- 1. Open the configuration program and then the Resource Block.
- 2. Use the WRITE\_LOCK parameter to check whether hardware write protection is deactivated:
  - Write protection activated = LOCKED
  - Write protection deactivated = NOT LOCKED

Deactivate the write protection if necessary  $\rightarrow \triangleq 46$ .

- 3. Open the Transducer Block.
- 4. Enable the programming mode:
  - Enter the enable code in the "Access Code" parameter (default = 83).
  - The "Access Status" parameter should now display "Unlocked Customer".
- 5. Empty pipe detection has to be disabled so that measurement can be performed even at low gas pressures.

Therefore, set the "EPD - Empty Pipe Detection" parameter to OFF.

6. On account of the low mass flow involved when gas flows are measured, it is advisable not to use low flow cutoff.

Therefore, set the "Low Flow Cut Off - Assign" parameter to OFF.

- 7. If the "Low Flow Cut Off Assign" parameter was not set to OFF, configure the following parameters as follows:
  - "Low Flow Cut Off On-Value" parameter:

Flow rates for gas measurements are low, so the value for the switch-on point (= low flow cutoff) must be correspondingly low.

Recommended setting: 0.0000 [unit]

- "Low Flow Cut Off - Off-Value" parameter:

Enter the switch-off point as a positive hysteresis in %, referenced to the switch-on point. Default value: 50%

### Corrected volume measurement with gas:

Certain other parameters have to be configured if corrected volume flow (e.g. in  $Nm^3/h$ ) is to be measured and output instead of mass flow (e.g. in kg/h). The procedure is as follows:

- 8. In the "System Unit Corr.Volume Flow" parameter, select the engineering unit for corrected volume flow.
- 9. In the "System Unit Ref. Density" parameter, select the engineering unit for reference density.
- 10. Set the "Ref.Param. Corr.Vol.Calculation" parameter to "Fixed Ref.Density".

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11. In the "Reference Param. - Fixed Reference Density" parameter, enter a value for the gas-dependent reference density (= density at reference temperature and reference pressure). Example for air: reference density =  $1.2928 \text{ kg/Nm}^3$  (at 0 °C and 1.013 bar)



Corrected volume flow can also be forwarded to other Function Blocks and higher-order process-control systems as a process variable. Please also observe the necessary settings in the Analog Input Function Block (see the "Description of Device Functions" manual).

12. Close the configuration program.

# 6.8 Rupture disk

Sensor housings with integrated rupture disks are optionally available.



### Warning!

• Make sure that the function and operation of the rupture disk is not impeded through the installation. Triggering overpressure in the housing as stated on the indication label. Take adequate precautions to ensure that no damage occurs, and risk to human life is ruled out, if the rupture disk is triggered.

Rupture disk: Burst pressure 10 to 15 bar (145 to 218 psi) (Promass X: 5,5 to 6,5 bar (80 to 94 psi))

- Please note that the housing can no longer assume a secondary containment function if a rupture disk is used.
- It is not permitted to open the connections or remove the rupture disk.



### Caution

- Rupture disks can not be combined with separately available heating jacket (except Promass A).
- The existing connection nozzles are not designed for a rinse or pressure monitoring function.



### Note!

- Before commissioning, please remove the transport protection of the rupture disk.
- Please note the indication labels.

# 6.9 Purge and pressure monitoring connections

The sensor housing protects the inner electronics and mechanics and is filled with dry nitrogen. Beyond that, up to a specified measuring pressure it additionally serves as secondary containment.



### Warning!

For a process pressure above the specified containment pressure, the housing does not serve as an additional secondary containment. If there is a danger of measuring tube failure due to process characteristics, e.g. with corrosive process fluids, we recommend the use of sensors whose housing is equipped with special pressure monitoring connections (ordering option). With the help of these connections, fluid collected in the housing in the event of tube failure can be drained off. This diminishes the danger of mechanical overload of the housing, which could lead to a housing failure and accordingly is connected with an increased danger potential. These connections can also be used for gas purging (gas detection).

The following instructions apply to handling sensors with purge or pressure monitoring connections:

- Do not open the purge connections unless the containment can be filled immediately with a dry inert gas.
- Use only low gauge pressure to purge. Maximum pressure 5 bar (72,5 psi).

# 6.10 Data storage device (HistoROM), F-CHIP

At Endress+Hauser, the term HistoROM refers to various types of data storage modules on which process and measuring device data are stored. By plugging and unplugging such modules, device configurations can be duplicated onto other measuring devices to cite just one example.

# 6.10.1 HistoROM/S-DAT (sensor-DAT)

The S-DAT is an exchangeable data storage device in which all sensor relevant parameters are stored, i.e., diameter, serial number, calibration factor, zero point.

## 6.10.2 HistoROM/T-DAT (transmitter-DAT)

The T-DAT is an exchangeable data storage device in which all transmitter parameters and settings are stored.

Storing of specific parameter settings from the EEPROM to the T-DAT and vice versa has to be carried out by the user (= manual backup function). Please refer to  $\rightarrow \stackrel{\square}{=} 57$  for a description of the related function (T-DAT SAVE/LOAD) and the exact procedure for managing data.

## 6.10.3 F-CHIP (Function-Chip)

The F-Chip is a microprocessor chip that contains additional software packages that extend the functionality and application possibilities of the transmitter.

In the case of a later upgrade, the F-Chip can be ordered as an accessory and can simply be plugged on to the I/O board. After start up, the software is immediately made available to the transmitter.

- Accessories  $\rightarrow$   $\stackrel{\triangle}{=}$  74
- Plugging onto the I/O board  $\rightarrow$   $\stackrel{\triangle}{=}$  91



### Caution!

To ensure an unambiguous assignment, the F-CHIP is coded with the transmitter serial number once it is plugged in. Thus, it cannot be reused with other measuring devices.

# 7 Maintenance

No special maintenance work is required.

# 7.1 Exterior cleaning

When cleaning the exterior of measuring devices, always use cleaning agents that do not attack the surface of the housing and the seals.

# 7.2 Cleaning with pigs (Promass H, I, S, P)

If pigs are used for cleaning, it is essential to take the inside diameters of measuring tube and process connection into account. Technical Information  $\rightarrow \stackrel{\text{\tiny le}}{=} 100$ 

# 7.3 Replacing seals

Under normal circumstances, fluid wetted seals of the Promass A and Promass M sensors do not require replacement. Replacement is necessary only in special circumstances, for example if aggressive or corrosive fluids are incompatible with the seal material.



Note!

- The period between changes depends on the fluid properties and on the frequency of cleaning cycles in the case of CIP/SIP cleaning.
- Replacement seals (accessories)

# 8 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor. Detailed information on the order code in question can be obtained from your Endress+Hauser representative.

# 8.1 Device-specific accessories

Accessory	Description	Order code
Promass 83 transmitter FOUNDATION Fieldbus	Transmitter for replacement or for stock. Use the order code to define the following specifications:	83XXX - XXXXX * * * * * *
	<ul> <li>Approvals</li> <li>Degree of protection / version</li> <li>Cable entry,</li> <li>Display / power supply / operation</li> <li>Software</li> <li>Outputs / inputs</li> </ul>	
Software package for Promass 83 FOUNDATION Fieldbus	Software add-ons on F-Chip, can be ordered individually:  - Advanced diagnostics  - Concentration measurement  - Viscosity	DK8SO - *

# 8.2 Measuring principle-specific accessories

Accessory	Description	Order code
Mounting set for transmitter	Mounting set for wall-mount housing (remote version). Suitable for:	DK8WM - *
	<ul><li>Wall mounting</li><li>Pipe mounting</li><li>Installation in control panel</li></ul>	
	Mounting set for aluminum field housing: Suitable for pipe mounting (3/4" to 3")	
Post mounting set for the Promass A sensor	Post mounting set for the Promass A	DK8AS - * *
Mounting set for the Promass A sensor	Mounting set for Promass A, comprising:  – 2 process connections  – Seals	DK8MS - * * * * *
Set of seals for sensor	For regular replacement of the seals of the Promass M and Promass A sensors.  Set consists of two seals.	DKS - * * *
Memograph M graphic display recorder	The Memograph M graphic display recorder provides information on all the relevant process variables. Measured values are recorded correctly, limit values are monitored and measuring points analyzed. The data are stored in the 256 MB internal memory and also on a DSD card or USB stick. Memograph M boasts a modular design, intuitive operation and a comprehensive security concept. The ReadWin® 2000 PC software is part of the standard package and is used for configuring, visualizing and archiving the data captured. The mathematics channels which are optionally available enable continuous monitoring of specific power consumption, boiler efficiency and other parameters which are important for efficient energy management.	RSG40 - ********

# 8.3 Service-specific accessories

Accessory	Description	Order code
Applicator	Software for selecting and sizing Endress+Hauser measuring devices:  Calculation of all the necessary data for identifying the optimum flowmeter: e.g. nominal diameter, pressure loss, accuracy or process connections  Graphic illustration of the calculation results  Administration, documentation and access to all project-related data and parameters over the entire life cycle of a project.  Applicator is available:  Via the Internet: https://wapps.endress.com/applicator	DXA80 - *
W@M	■ On CD-ROM for local PC installation.  Life cycle management for your plant  W@M supports you with a wide range of software applications over the entire process: from planning and procurement, to the installation, commissioning and operation of the measuring devices. All the relevant device information, such as the device status, spare parts and device-specific documentation, is available for every device over the entire life cycle.  The application already contains the data of your Endress+Hauser device. Endress+Hauser also takes care of maintaining and updating the data records.  W@M is available:  Via the Internet:  www.endress.com/lifecyclemanagement  On CD-ROM for local PC installation.	
Fieldcheck	Tester/simulator for testing flowmeters in the field. When used in conjunction with the "FieldCare" software package, test results can be imported into a database, printed and used for official certification.  Contact your Endress+Hauser representative for more information.	50098801
FieldCare	FieldCare is Endress+Hauser's FDT-based plant asset management tool. It can configure all intelligent field units in your system and helps you manage them. By using the status information, it is also a simple but effective way of checking their status and condition.	See the product page on the Endress+Hauser website: www.endress.com
FXA193	The FXA193 service interface connects the device to the PC for configuration via FieldCare.	FXA193 - *

### 9 **Troubleshooting**

### 9.1 Troubleshooting instructions

Always start troubleshooting with the following checklist if faults occur after commissioning or during operation. The routine takes you directly to the cause of the problem and the appropriate remedial measures.



### Caution!

In the event of a serious fault, a flowmeter might have to be returned to the manufacturer for repair. Important procedures must be carried out before you return a flowmeter to Endress+Hauser

Always enclose a duly completed "Declaration of contamination" form. You will find a preprinted form at the back of this manual.

Check the display		
No display visible. No connection to the FF host system	<ol> <li>Check the supply voltage → Terminals 1, 2</li> <li>Check device fuse →  \$\bigsize 96\$         85 to 260 V AC: 0.8 A slow-blow / 250 V         20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V</li> <li>Measuring electronics defective → order spare parts → \$\bigsize 91\$</li> </ol>	
No display visible. Connection to the FF host system established however.	<ol> <li>Check whether the ribbon-cable connector of the display module is correctly plugged into the amplifier board → □ 91</li> <li>Display module defective → order spare parts → □ 91</li> <li>Measuring electronics defective → order spare parts → □ 91</li> </ol>	
Display texts are in a foreign language.	Switch off power supply. Press and hold down both the 🖳 keys and switch on the measuring device. The display text will appear in English (default) and is displayed at maximum contrast.	
No connection can be established with the FF host system, even though measured value reading is visible.	ed with the FF host even though	



### Error messages on display

Errors that occur during commissioning or measuring are displayed immediately. Error messages consist of a variety of icons. The meanings of these icons are as follows (example):

- Type of error: S = System error, P = Process error
- Error message type: % = Fault message, ! = Notice message
- **FLUID INHOM.** = Error designation (e.g. fluid is not homogeneous)
- **03:00:05** = Duration of error occurrence (in hours, minutes and seconds)
- **#702** = Error number

Caution! See the information  $\rightarrow \stackrel{\triangle}{=} 43$ 

System error (device error) has occurred  $\rightarrow 181$ 

Process error (application error) has occurred  $\rightarrow 188$ 



Faulty connection to the fieldbus host system	
No connection can be made between the fieldbus host system and the measuring device. Check the following points:	
Supply voltage Transmitter	Check the supply voltage $\rightarrow$ terminals 1/2
	(Continued on next page)

Device fuse (continued)	Check device fuse → 🖹 96 85 to 260 V AC: 0.8 A slow-blow / 250 V 20 to 55 V AC and 16 to 62 V DC: 2 A slow-blow / 250 V	
Fieldbus connection	Check the data cable: Terminal 26 = FF + Terminal 27 = FF -	
Fieldbus connector (Option)	<ul> <li>Check pin assignment/wiring →</li></ul>	
Fieldbus voltage	Check that a min. bus voltage of 9 V DC is present at terminals 26/27. Permissible range: 9 to 32 V DC	
Network structure	Check permissible fieldbus length and number of spurs $\rightarrow$ $\stackrel{\triangle}{=}$ 28	
Basic current	Is there a basic current of min. 12 mA?	
Bus address	Check bus address: make sure there are no double assignments	
Bus termination	Is the FOUNDATION Fieldbus-H1 network correctly terminated? Each bus segment must always be terminated with a bus terminator at both ends (start and finish). Otherwise there may be interference in data transmission.	
Current consumption, permissible feed current	Check the current consumption of the bus segment: The current consumption of the bus segment in question (= total of basic currents of all fieldbus devices) must not exceed the max. permissible feed current of the fieldbus power supply.	
Device Description (DD)	Install the DD if you cannot access the manufacturer-specific parameters.  Note! Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up via the following functions/parameters:  Local display:  HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DEVICE REVISION (6243)  HOME → BASIC FUNCTIONS → FOUND. FIELDBUS → INFORMATION → DD REVISION (6244)  FF configuration program:  Resource Block → Parameter DEV_REV  Resource Block → Parameter DD_REV  Example (with local display): Display in the DEVICE REVISION (6243) function → 04 Display in the DD REVISION (6244) function → 01 Device description file (DD) required → 0401.sym / 0401.ffo	

 $\blacksquare$ 

Problems with configuration of Function Blocks	
Transducer Blocks: The operating mode cannot be set to AUTO.	On of Function Blocks  Check whether the operating mode of the Resource Block is in AUTO mode → Parameter group MODE_BLK / parameter TARGET.
	(Continued on next page)

	1	
Analog Input fct. block: The operating mode cannot be	The	ere may be several reasons for this. Check the following in sequence:
set to AUTO.	1.	Check whether the operating mode of the Analog Input Function Block is in AUTO mode → Parameter group MODE_BLK / parameter TARGET.  If not and the mode cannot be set to AUTO, first check the following.
(continued)	2.	Make sure that the CHANNEL parameter (selection process variable) is configured in the Analog Input Function Block $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $
	3.	Make sure that the XD_SCALE parameter group (input range, unit) is configured in the Analog Input Function Block $\rightarrow$ $\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \$
		Caution! Make sure that the selected unit is suitable for the process variable selected in the CHANNEL parameter. Otherwise the parameter BLOCK_ERROR will display the error message "Block Configuration Error". In this status the block operating mode cannot be set to AUTO.
Analog Input fct. block: The operating mode cannot be	4.	Make sure that the L_TYPE parameter (type of linearization) is already configured in the Analog Input Function Block $\rightarrow$ $\  \   $ 91.
set to AUTO.		Caution! Make sure that with the type of linearization "Direct" the scaling of the parameter group OUT_SCALE is identical to that of the parameter group XD_SCALE. If set incorrectly the parameter BLOCK_ERROR will display the error message "Block Configuration Error". In this status the block operating mode cannot be set to AUTO. Configuration example $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $
	5.	Check whether the operating mode of the Resource Block is in AUTO mode $\rightarrow$ Parameter group MODE_BLK/parameter TARGET
	6.	Make sure that the Function Blocks are correctly interconnected and that this system configuration has been sent to the fieldbus station $\rightarrow$ $\bigcirc$ 91.
Analog Input Function Block: The operating mode is set to AUTO but the status of the AI output	1.	Check whether the operating mode of the Transducer Blocks is set to AUTO $\rightarrow$ MODE_BLK parameter group / TARGET parameter. Using the various CHANNEL parameters ( $\rightarrow$ 103) set the Transducer Blocks to the AUTO operating mode.
value OUT is BAD or UNCERTAIN.	2.	Check whether an error is pending in the "Diagnosis" Transducer Block (base index: 1600) → "Diagnosis" Transducer Block (base index: 1600) → "Diag Act.Sys.Condition" parameter.
		Error messages → 🖹 80
Parameters cannot be	1.	Parameters that only display values or settings cannot be modified!
modified or no write access to parameters.	2.	Hardware write protection is enabled $\rightarrow$ Deactivate the write protection $\rightarrow$ $\stackrel{\triangle}{=}$ 91
to parameters.		Note! You can use the parameter WRITE_LOCK in the Resource Block to check whether hardware write protection is activated or deactivated: LOCKED = write protection enabled (activated) UNLOCKED = no write protection (deactivated)
	3.	The block operating mode is wrong. Certain parameters can only be changed in the OOS (out of service) or MAN (manual) mode $\rightarrow$ Set the operating mode of the block to the necessary mode $\rightarrow$ MODE_BLK parameter group.
	4.	The value entered is outside the specified input range for the parameter in question:  → Enter suitable value  → Increase input range if necessary
	5.	Transducer Blocks: The programming level is not enabled $\rightarrow$ Enable by entering the code in the "Access – Code" parameter or by means of the service code in the service parameters.
		(Continued on next page)

Transducer Block: The manufacturer-specific parameters are not visible.

(continued)

The device description file (Device Description, DD) has not been loaded into the host system or the configuration program  $\rightarrow$  Load the file into the configuration system.

Reference sources of the DD  $\rightarrow$   $\stackrel{\triangle}{=}$  91

### Note!

Ensure you use the correct system files for linking the field devices into the host system. Appropriate version information can be called up in the measuring device via the following functions/parameters:

### Local display:

- HOME  $\rightarrow$  BASIC FUNCTIONS  $\rightarrow$  FOUND. FIELDBUS  $\rightarrow$  INFORMATION  $\rightarrow$  DEVICE REVISION (6243)
- HOME  $\rightarrow$  BASIC FUNCTIONS  $\rightarrow$  FOUND. FIELDBUS  $\rightarrow$  INFORMATION  $\rightarrow$  DD REVISION (6244)

FF configuration program:

- Resource Block → Parameter DEV\_REV
- Resource Block  $\rightarrow$  Parameter DD\_REV

Example (local display): Display in the DEVICE REVISION (6243) function  $\rightarrow$  04 Display in the DD REVISION (6244) function  $\rightarrow$  01 Required device description file (DD)  $\rightarrow$  0401.sym / 0401.ffo

Analog Input Function Block: The output value OUT is not updated despite having a GOOD status. Simulation is active  $\rightarrow$  Deactivate simulation via parameter group SIMULATE.

### Error messages



Other error (without erro	Other error (without error message)		
Some other error has occurred.	Diagnosis and rectification $\rightarrow \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ $		

# 9.2 System/process error messages

### General notes

The flowmeter assigns current system and process errors to two error message types in accordance with a predefined algorithm and classifies them accordingly:

Error message type "Fault message":

- A message of this type immediately interrupts or stops measurement.
- Presentation on the FOUNDATION Fieldbus → Fault messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "BAD" of the AI output parameter OUT (AI Block).
- Local display  $\rightarrow$  A flashing lightning symbol ( $\frac{1}{2}$ ) is displayed

Error message type "Notice message":

- Measurement continues despite this message.
- Presentation on the FOUNDATION Fieldbus → Notice messages are transmitted to subsequent Function Blocks or higher-level process control systems by means of the status "UNCERTAIN" of the AI output parameter OUT (AI Block).
- Local display  $\rightarrow$  A flashing exclamation mark (!) is displayed.

Serious system errors, e.g. module defects, are always classed and displayed as "fault messages" by the measuring device. Simulations in the "Flow" Transducer Block and positive zero return, on the other hand, are identified as "notice messages" only.

### Error messages in the FF configuration programs $\rightarrow \blacksquare 81$

System and process errors are recognized and reported in the Transducer Blocks. Such errors are displayed via the following parameters specified in the FOUNDATION Fieldbus specification:

- BLOCK ERR
- Transducer Error

In the "Diagnosis" Transducer Block (base index: 1600), detailed reasons for errors and device status messages are displayed by means of the "Diag. - Act.Sys.Condition" parameter (manufacturer-specific)  $\rightarrow$  Table.

### Error messages on the local display $\rightarrow \blacksquare 81$

### 9.2.1 List of system error messages

No	Error messages: FOUNDATION Fieldbus	Transducer Block error messages	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 91)
	(FF)* (Local display)	"Diagnosis" Transducer Block		

- $\star$  With FOUNDATION Fieldbus, error messages are displayed in the "Diagnosis" Transducer Block (base index: 1600) by means of the "Diag. Act. Sys. Condition" parameter (manufacturer-specific).
- | S = System error | \$f\$ = Fault message (with an effect on operation)

No. #	$0xx \rightarrow Hardware\ error$			
001	Device status message (FF): Critical Failure – Err. No. 001	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: ROM/RAM error. Error when accessing the program memory (ROM) or random access
	Local display: S: CRITICAL FAILURE	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	memory (RAM) of the processor.  — Remedy:
	5: CRITICAL FAILURE 5: # 001		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Replace the amplifier board.
011	Device status message (FF): Amplifier EEPROM failure –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Measuring amplifier has faulty EEPROM
	Err. No. 011  Local display: S: AMP HW EEPROM	Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure	Remedy: Replace the amplifier board.
	5: # 011		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
012	Device status message (FF): Amplifier EEPROM data	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Error when accessing data of the measuring
	inconsistent – Err. No. 012	No. 012   Transducer_Error = Data   OUT. SUBSTATUS = Device   Failure	amplifier EEPROM  Remedy:	
	Local display: S: AMP SW EEPROM 4: # 012		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	<ul> <li>Perform a "warm start" (= start the measuring system without disconnecting main power).</li> <li>FF: "Diagnosis" Transducer Block (base index 1600) → "Sys. – Reset" parameter RESTART SYSTEM</li> <li>Local display: SUPERVISION → SYSTEM → OPERATION → SYSTEM RESET (→ RESTART SYSTEM)</li> </ul>
031	Device status message (FF): S-DAT failure / not inserted –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: 1. S-DAT is not correctly plugged into ampli
	Err. No. 031  Local display: S: SENSOR HW DAT	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	board (or is missing).  2. S-DAT is defective.
	5: # 031		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Remedy:  1. Check whether the S-DAT is correctly plugg into the amplifier board.
032	Device status message (FF): S-DAT data inconsistent –	BLOCK_ERR = Device needs maintenance now	Check whether the	Replace the S-DAT if it is defective.  Check whether the new replacement DAT is compatible with the existing electronics.
	Err. No. 032  Local display: S: SENSOR SW DAT	Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure	Check the: - Spare part set number
	5: 5ENSOR SW DAT 4: # 032		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	- Hardware revision code  3. Replace measuring electronics boards if necessary.  4. Physical Particles and Marketine and Market
				4. Plug S-DAT into amplifier board.

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🗎 91)
041	Device status message (FF): T-DAT failure –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: 1. T-DAT is not correctly plugged into amplifier
	Err. No. 041  Local display: S: TRANSM. HW DAT	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	board (or is missing).  2. T-DAT is faulty
	5: # 041		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	<ul><li><i>Remedy:</i>:</li><li>1. Check whether the T-DAT is correctly plugged into the amplifier board.</li></ul>
042	Device status message (FF): T-DAT data inconsistent –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Replace T-DAT if faulty.     Check whether the new replacement DAT is
	Err. No. 042  Local display: S: TRANSM. SW DAT	Transducer_Error = Data integrity error	OUT. SUBSTATUS = Device Failure	compatible with the existing electronics. Check the: - Spare part set number
	5: TRANSM. SW DAT 7: # 042		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	- Hardware revision code  3. Replace measuring electronics boards if necessary.  4. Plug T-DAT into amplifier board.
061	Device status message (FF): F-CHIP failure –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	<ol> <li>Replace the F-Chip.</li> <li>Plug the F-Chip into the I/O board.</li> </ol>
	Err. No. 061  Local display: S: HW F-CHIP	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	
	5: HW F-CHIP 5: # 061		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
No. #	1xx → Software error			
121	Device status message (FF): Software compatibility	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Due to different software versions, I/O board and
	problem amplifier – I/O module – Err. No. 121	Transducer_Error = I/O failure (input/output error)	OUT. SUBSTATUS = Device Failure	amplifier board are only partially compatible (possibly restricted functionality).  Note!
	Local display: S: A / C COMPATIB. 1: # 121		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	This is indicated on the display as a warning message for only 30 seconds (with entry in error history).  This situation in which the software versions differ can occur if only one electronics board has been exchanged; the extended software functionality is not available. The previously existing software functionality is still available and measurement operation is possible.

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts →   91)
No. #	$2xx \rightarrow Error in DAT / no contact $	mmunication		
205	Device status message (FF): Save to T-DAT failed –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Data backup (download)
	Err. No. 205  Local display: S: LOAD T-DAT !: # 205	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure  BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	to T-DAT failed or error when accessing the calibration values stored in the T-DAT (upload).  Remedy:  1. Check whether the T-DAT is correctly plugged into the amplifier board.  2. Replace T-DAT if faulty.
206	Device status message (FF): Restore from T-DAT failed –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Before replacing the DAT, check that the new, replacement DAT is compatible with the
	Err. No. 206  Local display: S: SAVE T-DAT	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	measuring electronics. Check the:  - Spare part set number  - Hardware revision code
	!: # 206		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Replace measuring electronics boards if necessary.
251	Device status message (FF): Communication failure	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Internal communication fault on the amplifier
	amplifier – Err. No. 251  Local display:	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	board.  **Remedy:**  — Replace the amplifier board.
	S: COMMUNICAT.AMP 7: # 251		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Replace the ampliner board.
261	Device status message (FF): Communication failure I/O – Err. No. 261	BLOCK_ERR = Device needs maintenance now Transducer_Error = I/O failure (communication problems)	OUT. QUALITY = BAD  OUT. SUBSTATUS = Device Failure	Cause: Communication error. No data reception between amplifier and I/O board or faulty internal data transfer.
	Local display: S: COMMUNICAT. I/O 4: # 261	(communication prositions)	BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Remedy: Check whether the electronics boards are correctly inserted in their holders.
No. #	÷ 3xx → System limits exceed:	ed		
379 380	Device status message (FF): Measuring tube is outside the	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: The measuring tube oscillation frequency is outside the permitted range.
	range – Err. No. 379 / 380  Local display: S: FREQ. LIM	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	Causes:  — Damaged measuring tube
	5: FREQ. LIM 4: # 379 /380		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	<ul><li>Sensor defective or damaged</li><li>Remedy:</li><li>Contact your E+H service organization.</li></ul>

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🖹 91)
381	Device status message (FF): Tube temperature sensor defect	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: The temperature sensor on the measuring tube is probably defective.
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	Remedy:  Check the following electrical connections before
	/: # 381		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	you contact your E+H service organization:  Verify that the sensor signal cable connector is correctly plugged into the amplifier board.
382	Device status message (FF): Tube temperature sensor defect	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	→ 🗎 92  - Remote version:  Check sensor and transmitter terminal
	– Err. No. 382  Local display: S: FLUIDTEMP.MAX.	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	connections No. 9 and 10. $\rightarrow$ $\stackrel{\triangle}{=}$ 30
	5: FLOID FEWIP .IVIAX. 4: # 382		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
383	Device status message (FF): Carrier tube sensor defect –Err.	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: The temperature sensor on the carrier tube is
	No. 383  Local display: S: CARR.TEMP.MIN	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	probably defective.  Remedy: Charly the following electrical connections before
	5: CARR. I EMP.MIN 5: # 383		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Check the following electrical connections before you contact your E+H service organization:     Verify that the sensor signal cable connector is correctly plugged into the amplifier board.
384	Device status message (FF): Carrier tube sensor defect –Err. No. 384 Local display:	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	<ul> <li>Remote version:</li> <li>Check sensor and transmitter terminal</li> <li>connections No. 11 and 12. →   30</li> </ul>
		Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	Connections No. 11 and 12. → ≡ 30
	S: CARR.TEMP.MAX 7: # 384		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts →   91)
385	Device status message (FF): Measuring tube coil defect –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: One of the measuring tube sensor coils is probably
	Err. No. 385  Local display:	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	defective (inlet or outlet).  **Remedy:*  Check the following electrical connections before
	S: INLET SENS 4: # 385		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	you contact your E+H service organization:  Verify that the sensor signal cable connector is correctly plugged into the amplifier board.
386	Device status message (FF): Measuring tube coil defect –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	<ul> <li>Remote version:</li> <li>Check sensor and transmitter terminal</li> <li>connections No. 4, 5, 6 and 7 →</li></ul>
	Err. No. 386	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	
	Local display: S: OUTL.SENS.DEF. 4: # 386		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
387	Device status message (FF): Measuring tube coil defect –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	
	Err. No. 387	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	
	Local display: S: SEN.ASY.EXCEED t: # 387		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
388 389	Device status message (FF): Amplifier error –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Amplifier error
390	Err. No. 388 / 389 / 390  Local display: S: AMP. FAULT	Transducer_Error = Electronics failure	OUT. SUBSTATUS = Device Failure	Remedy: Contact your E+H service organization.
	7: # 388 / 389 / 390		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	
No. #	$5xx \rightarrow Application error$			
501	Device status message (FF): Download device software active – Err. No. 501	BLOCK_ERR = Device needs maintenance now Transducer_Error =	OUT. QUALITY = BAD OUT. SUBSTATUS = Device	Cause:  New amplifier or communication software version is being loaded to the device.  Currently no other functions are possible.
	Local display:	Mechanical failure	Failure	Remedy:
	S: SWUPDATE ACT. !: # 501		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Wait until process is finished. The device will restart automatically.
502	Device status message (FF): Up-/Download device software	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Up- or downloading the device data via
	active – Err. No. 502	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Device Failure	configuration program. Currently no other functions are possible.
	Local display: S: UP-/DOWNLO. ACT. !: # 502		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	— Remedy: Wait until process is finished.

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts $\rightarrow \blacksquare 91$ )
No. #	$6xx \rightarrow Simulation mode active$	re		
601	Device status message (FF): Positive zero return active –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Positive zero return is active.
	Err. No. 601  Local display: S: POSITIVE ZERO RETURN !: # 601	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	Note! This message has the highest display priority.  **Remedy:* Deactivate positive zero return: ■ FF: "Flow" Transducer Block (base index: 1100) → "Sys Positive Zero Return" parameter → OFF ■ Local display: BASIC FUNCTIONS → SYSTEM PARAMETERS → CONFIGURATION → POS. ZERO RETURN (→ OFF)
691	Device status message (FF): Simulation failsafe active –	BLOCK_ERR = Simulation active	OUT. QUALITY = UNCERTAIN	Cause: Simulation of response to error (outputs) is active
	Err. No. 691  Local display: S: SIM. FAILSAFE !: # 691	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	Remedy: Switch off simulation:  ■ FF: "Diagnosis" Transducer Block (base index: 1600) → "Sys. – Sim.Failsafe Mode" parameter → OFF  ■ Local display: SUPERVISION → SYSTEM → OPERATION → SIM. FAILSAFE MODE (→ OFF)
692	Device status message (FF): Simulation of measuring active	BLOCK_ERR = Simulation active	OUT. QUALITY = UNCERTAIN	Cause: Simulation of measured variable is active.
	- Err. No. 692 Local display: S: SIM. MEASURAND !: # 692	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	Remedy: Switch off simulation:  FF: "Flow" Transducer Block (base index: 1400)  → "Simulation - Measurand" parameter → OFF  Local display: SUPERVISION → SYSTEM →  OPERATION → SIM. MEASURAND (→ OFF)
ı	No communication to amplifier	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Communication error. No communication with
		Transducer_Error = General Error	OUT. SUBSTATUS = Device Failure  BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	measuring amplifier.  Remedy:  1. Switch power supply off and on again.  2. Check whether the electronics boards are correctly inserted in their holders.
No. #	$8xx \rightarrow Application error$	ı		
800	Device status message (FF): Massflow deviation limit –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics: The mass flow is outside the
	Err. No. 800  Local display: S: M. FL. DEV. LIMIT 7: # 800	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	limit value, set in the corresponding diagnosis function.
801	Device status message (FF):  Density deviation limit –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics: The density is outside the
	Err. No. 801  Local display: S: DENS. DEV. LIMIT 4: # 801	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	limit value, set in the corresponding diagnosis function.

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages "Diagnosis" Transducer Block	Analog Input Function Block error messages	Reason for error/rectification (spare parts → 🗎 91)
802	Device status message (FF): Reference density deviation	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics:
	limit – Err. No. 802 Local display: S: M. FL. DEV. LIMIT 4: # 802	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	The reference density is outside the limit value, set in the corresponding diagnosis function.
803	Device status message (FF): Temperature deviation limit –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics:
	Err. No. 803  Local display: S: TEMP. DEV. LIMIT 5: # 803	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	The temperature is outside the limit value, set in the corresponding diagnosis function.
804	Device status message (FF): Tube damping deviation –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics:
	Err. No. 804  Local display: S: DAMP. DEV. LIM. 5: # 804	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	The tube damping is outside the limit value, set in the corresponding diagnosis function.
805	Device status message (FF): El. dyn. sensors limit –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics:
	Err. No. 805  Local display: S: E. D. SEN. DEV. LIM. 4: # 805	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	The electrodynamic sensor is outside the limit value, set in the corresponding diagnosis function.
806	Device status message (FF): Frequency fluctuation deviation	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics:
	limit – Err. No. 806  Local display: S: F. FLUCT. DEV. LIM. 4: # 806	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	The fluctuation of the operating frequency is outside the limit value set in the corresponding diagnosis functions.
807	Device status message (FF): Tube damping fluctuation	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = UNCERTAIN	Cause: Advanced Diagnostics:
	deviation limit – Err. No. 807 <i>Local display:</i> S: TD FLUCT. DEV. LIM. 4: # 807	Transducer_Error = General Error	OUT. SUBSTATUS = Non specific	The fluctuation of the tube damping is outside the limit value set in the corresponding diagnosis functions.

# 9.2.2 List of process error messages

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages	Analog Input Function Block error messages	Cause/remedy (Spare parts → 🗎 91)
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\* With FOUNDATION Fieldbus, error messages are displayed in the "Diagnosis" Transducer Block (base index: 1600) by means of the "Diag. – Act.Sys.Condition" parameter (manufacturer-specific).

No. ‡	$f$ 5xx $\rightarrow$ Application error			
1	Device status message (FF): No fluid continuation –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: The fluid properties do not allow a continuation
	Err. No. 586  Local display: P: OSC. AMP. LIMIT	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	the measurement.  Causes:  — Extremely high viscosity
	4: # 586		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	Process fluid is very inhomogeneous (gas or solic content)  Remedy: Change or improve process conditions.
587	Device status message (FF): Extreme process conditions –	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Extreme process conditions exist. The measuring
	Err. No. 587  Local display: P: TUBE OSC. NOT	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	system can therefore not be started.  Remedy: Change or improve process conditions.
	7: 10BE OSC. NOT 7: # 587		BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	- Change of improve process conditions.
588	Device status message (FF): Overdriving of the analog/	BLOCK_ERR = Device needs maintenance now	OUT. QUALITY = BAD	Cause: Overdriving of the internal analog to digital
	digital converter – Err. No. 588  Local display: P: GAIN RED.IMPOS 4: # 588	Transducer_Error = Mechanical failure	OUT. SUBSTATUS = Sensor Failure	converter. Causes:  — Cavitation
			BLOCK_ERR = Input Failure (faulty input value from Transducer Blocks)	<ul> <li>Extreme pressure pulses</li> <li>High gas flow velocity</li> <li>A continuation of the measurement is no longer possible!</li> </ul>
				Remedy: Change or improve process conditions, e.g. by reducing the flow velocity.
No. #	$7xx \rightarrow Application error$			
700	Device status message (FF): Empty pipe detected – Err. No. 700		OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Non specific	Cause: The fluid density is outside the upper or lower limi values set for the empty pipe detection (EPD). Causes:
	Local display: P: EMPTY PIPE DET. !: # 700			Air in the measuring tube     Partly filled measuring tube
				Remedy: 1. Ensure that there is no gas content in the process liquid.
				<ul> <li>Adapt the upper and lower limit values for empty pipe detection to the current process conditions.</li> <li>FF: "Flow" Transducer Block (base index: 1400) → "EPD - Low Value" or "EPD - Hig Value" parameter</li> <li>Local display:         <ul> <li>BASIC FUNCTIONS →</li> <li>PROCESSPARAMETER → EPD</li> <li>PARAMETER → EPD VALUE LOW or EPI VALUE HIGH</li> </ul> </li> </ul>

No.	Error messages: FOUNDATION Fieldbus (FF)* (Local display)	Transducer Block error messages	Analog Input Function Block error messages	Cause/remedy (Spare parts → 🗎 91)
701	Device status message (FF): Current of the measuring tube too high – Err. No. 701 Local display: P: EXC. CURR. LIM		OUT. QUALITY = UNCERTAIN  OUT. SUBSTATUS = Non specific	Cause: The maximum current value for the measuring tube exciter coils has been reached, since certain process fluid characteristics are extreme, e.g. high gas or solid content. The instrument continues to work correctly.
	!: # 701			<ul> <li>Remedy:</li> <li>In particular with outgassing fluids and/or increased gas content, the following measures are recommended to increase system pressure:</li> <li>1. Install the instrument at the outlet side of a pump.</li> <li>2. Install the instrument at the lowest point of an</li> </ul>
				ascending pipeline.  3. Install a valve or orifice plate downstream from the instrument.
702	Device status message (FF): Frequency control not stable due to process fluid – Err. No. 702		OUT. QUALITY = UNCERTAIN OUT. SUBSTATUS = Non specific	Cause: Frequency control is not stable, due to inhomogeneous process fluid, e.g. gas or solid content.
	Local display: P: FLUID INHOM. !: # 702			Remedy: In particular with outgassing fluids and/or increased gas content, the following measures are recommended to increase system pressure:
				<ol> <li>Install the instrument at the outlet side of a pump.</li> <li>Install the instrument at the lowest point of an</li> </ol>
				ascending pipeline.  3. Install a valve or orifice plate downstream from the instrument.
703	Device status message (FF):		OUT. QUALITY = UNCERTAIN	Cause:
	Overdriving of the control level – Err. No. 703		OUT. SUBSTATUS = Non specific	Overdriving of the internal analog to digital converter.
	Local display: P: NOISE LIM. CH0 !: # 703			Causes:  - Cavitation  - Extreme pressure pulses
704	Device status message (FF):		OUT. QUALITY = UNCERTAIN	High gas flow velocity
	Overdriving of the control level	OUT. SUBSTATUS = Non specif	A continuation of the measurement is still possil	
	Err. No. 704			Remedy: Change or improve process conditions, e.g. by
	Local display: P: NOISE LIM. CH1 !: # 704			reducing the flow velocity.
705	Device status message (FF): Massflow too high – Err. No. 705		OUT. QUALITY = BAD OUT. SUBSTATUS = Non specific	Cause: The mass flow is too high. The electronics' measuring range will be exceeded.
	Local display: P: FLOW LIMIT 4: # 705			Remedy: Reduce flow
731	Device status message (FF):		OUT. QUALITY = BAD	Cause:
	Zero point adjustment is not possible – Err. No. 731		OUT. SUBSTATUS = Non specific	The zero point adjustment is not possible or has been canceled.  Remedy:
	Local display: P: ADJ. ZERO FAIL 4: # 731			Make sure that zero point adjustment is carried out at "zero flow" only $(v = 0 \text{ m/s})$ . $\rightarrow \stackrel{\triangle}{=} 65$

# 9.3 Process errors without messages

Symptoms	Rectification
Note! You may have to change or correct certa "Description of Device Functions" manu	nin settings of the function matrix in order to rectify faults. The functions outlined below are described in detail in the al.
Measured value reading fluctuates even though flow is steady.	<ol> <li>Check the fluid for presence of gas bubbles.</li> <li>Increase the following values:         <ul> <li>Analog Input Function Block → RISING TIME</li> <li>BASIC FUNCTIONS → SYSTEM PARAMETER → CONFIGURATION → FLOW DAMPING</li> </ul> </li> <li>Increase the value for display damping:         HOME → USER INTERFACE → CONTROL → BASIC CONFIGURATION → DISPLAY DAMPING</li> </ol>
Measured value reading shown on display, even though the fluid is at a standstill and the measuring tube is full.	<ol> <li>Check the fluid for presence of gas bubbles.</li> <li>Enter or increase the value for the switching point of low flow cutoff:         BASIC FUNCTIONS → PROCESSPARAMETER → CONFIGURATION → ON-VAL. LF CUTOFF     </li> </ol>
The fault cannot be rectified or some other fault not described above has occurred. In instances of this nature, contact your E+H service organization.	The following options are available for tackling problems of this nature:  Request the services of an E+H service technician  If you contact our service organization to have a service technician sent out, please be ready with the following information:  ■ Brief description of the fault  ■ Nameplate specifications: order code and serial number →   7  Return devices to E+H  You return a measuring device to Endress+Hauser for calibration or repair.  Always enclose a duly completed "Declaration of contamination" form with the flowmeter. You will find a preprinted form at the back of this manual.  Replace transmitter electronics  Components in the measuring electronics defective → Order spare part →   91

# 9.4 Spare parts

The previous sections contain a detailed troubleshooting guide  $\rightarrow \stackrel{\triangle}{=} 76$ .

The measuring device, moreover, provides additional support in the form of continuous self-diagnosis and error messages.

Fault rectification can entail replacing defective components with tested spare parts. The illustration below shows the available scope of spare parts.



### Note!

You can order spare parts directly from your Endress+Hauser service organization by providing the serial number printed on the transmitter's nameplate  $\rightarrow \stackrel{\triangle}{=} 7$ .

Spare parts are shipped as sets comprising the following parts:

- Spare part
- Additional parts, small items (threaded fasteners, etc.)
- Mounting instructions
- Packaging

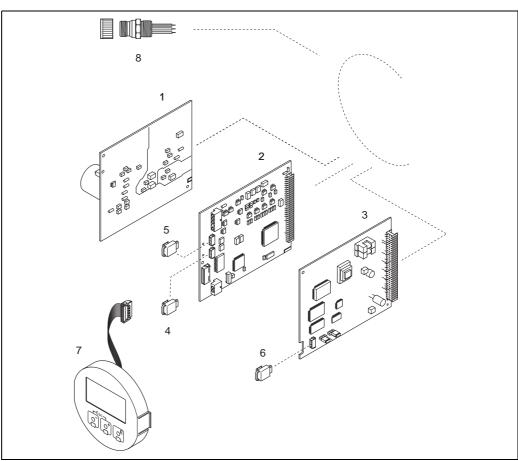


Fig. 37: Spare parts for transmitter (field and wall-mount housings)

- Power unit board (85 to 260 V AC, 20 to 55 V AC, 16 to 62 V DC)
- 2 Amplifier board
- 3 I/O board FOUNDATION Fieldbus (COM module)
- 4 S-DAT (sensor data memory)
- 5 T-DAT (transmitter data memory)
- 6 F-CHIP (function chip for optional software)
- 7 Display module
- 8 Fieldbus connector consisting of: protection cap and connector

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# 9.5 Removing and installing electronics boards

### 9.5.1 Field housing



### Warning!

- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purposely built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.



### Caution!

Use only original Endress+Hauser parts.

- $\rightarrow$  38, installation and removal:
- 1. Unscrew cover of the electronics compartment from the transmitter housing.
- 2. Remove the local display (1) as follows:
  - Press in the latches (1.1) at the side and remove the display module.
  - Disconnect the ribbon cable (1.2) of the display module from the amplifier board.
- 3. Remove the screws and remove the cover (2) from the electronics compartment.
- 4. Remove power unit board (**4**) and I/O board (**6**): Insert a thin pin into the hole (**3**) provided for the purpose and pull the board clear of its holder.
- 5. Remove amplifier board (5):
  - Disconnect the connector of the signal cable (5.1) including S-DAT (5.3) from the board.
  - Gently disconnect the connector of the excitation current cable (5.2) from the board, i.e. without moving it back and forward.
  - Insert a thin pin into the hole (3) provided for the purpose and pull the board clear of its holder.
- 6. Installation is the reverse of the removal procedure.

92

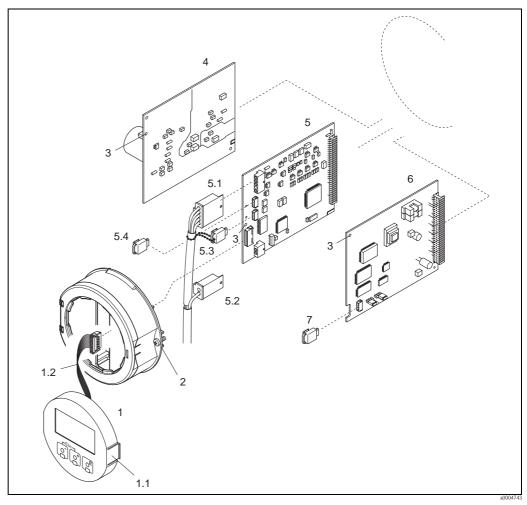


Fig. 38: Field housing: removing and installing electronics boards

- 1 Local display
- 1.1 Latch
- 1.2 Ribbon cable (display module)
- 2 Screws of electronics compartment cover
- 3 Aperture for installing/removing boards
- 4 Power unit board
- 5 Amplifier board
- 5.1 Signal cable (sensor)
- 5.2 Excitation current cable (sensor)
- 5.3 S-DAT (sensor data memory)
- 5.4 T-DAT (transmitter data memory)
- 6 I/O board (FOUNDATION Fieldbus type)
- 7 F-CHIP (function chip for optional software)

## 9.5.2 Wall-mount housing



### Warning!

- Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.
- Risk of damaging electronic components (ESD protection). Static electricity can damage electronic components or impair their operability. Use a workplace with a grounded working surface purposely built for electrostatically sensitive devices!
- If you cannot guarantee that the dielectric strength of the device is maintained in the following steps, then an appropriate inspection must be carried out in accordance with the manufacturer's specifications.



### Caution!

Use only original Endress+Hauser parts.

- $\rightarrow$  39, installation and removal:
- 1. Remove the screws and open the hinged cover (1) of the housing.
- 2. Remove the screws securing the electronics module (2). Then push up electronics module and pull it as far as possible out of the wall-mount housing.
- 3. Disconnect the following cable connectors from amplifier board (7):
  - Signal cable connector (**7.1**) including S-DAT (**7.3**)
  - Connector of exciting current cable (7.2):
     Gently disconnect the connector, i.e. without moving it back and forward.
  - Ribbon-cable connector (3) of the display module
- 4. Remove the cover (4) from the electronics compartment by loosening the screws.
- 5. Removing boards (**6**, **7**, **8**): Insert a thin pin into the hole (**5**) provided for the purpose and pull the board clear of its holder.
- 6. Installation is the reverse of the removal procedure.

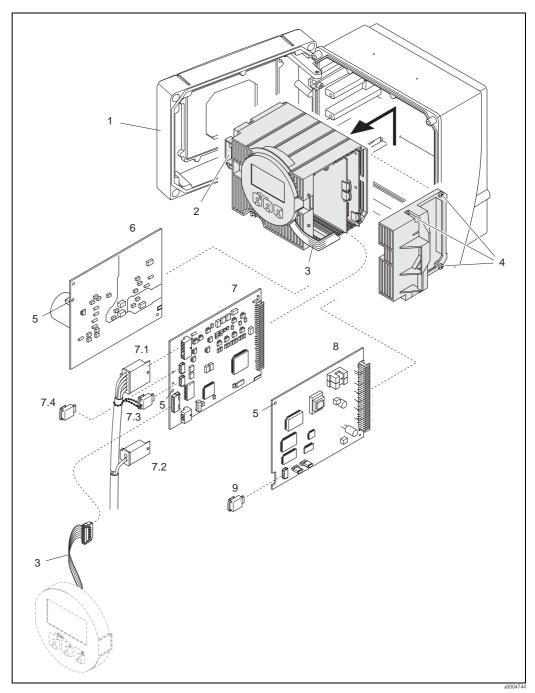


Fig. 39: Wall-mount housing: removing and installing electronics boards

- Housing cover
- Electronics module 2 3 4
- Ribbon cable (display module)
- Screws of electronics compartment cover
- 5 6 Aperture for installing/removing boards
- Power unit board
- Amplifier board
- 7.1 7.2 7.3 Signal cable (sensor)
- Excitation current cable (sensor)
- S-DAT (sensor data memory)
- 7.4 T-DAT (transmitter data memory)
- I/O board (FOUNDATION Fieldbus type)
- F-CHIP (function chip for optional software)

# 9.6 Replacing the device fuse



Warning!

Risk of electric shock. Exposed components carry dangerous voltages. Make sure that the power supply is switched off before you remove the cover of the electronics compartment.

The main fuse is on the power unit board  $\rightarrow \square 40$ . The procedure for replacing the fuse is as follows:

- 1. Switch off power supply.
- 2. Remove power unit board  $\rightarrow \stackrel{\triangle}{=} 92$
- 3. Remove cap (1) and replace the device fuse (2). Use only fuses of the following type:
  - Power supply 20 to 55 V AC / 16 to 62 V DC  $\rightarrow$  2.0 A slow-blow / 250 V; 5.2 x 20 mm
  - Power supply 85 to 260 V AC  $\rightarrow$  0.8 A slow-blow / 250 V; 5.2 x 20 mm
  - Ex-rated devices  $\rightarrow$  see the Ex documentation.
- 4. Installation is the reverse of the removal procedure.



Caution!

Use only original Endress+Hauser parts.

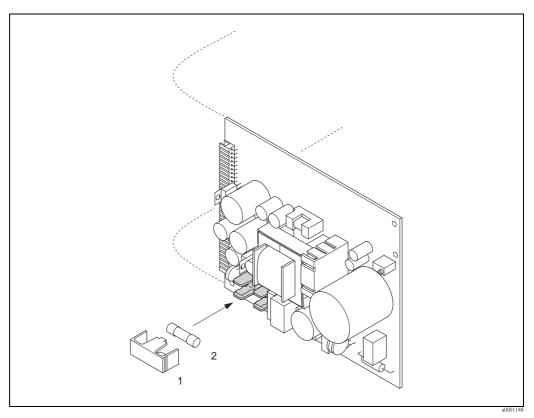


Fig. 40: Replacing the device fuse on the power unit board

- 1 Protective cap
- 2 Device fuse

## 9.7 Return



Caution!

Do not return a measuring device if you are not absolutely certain that all traces of hazardous substances have been removed, e.g. substances which have penetrated crevices or diffused through plastic.

Costs incurred for waste disposal and injury (burns, etc.) due to inadequate cleaning will be charged to the owner-operator.

The following steps must be taken before returning a flow measuring device to Endress+Hauser, e.g. for repair or calibration:

- Always enclose a duly completed "Declaration of contamination" form. Only then can Endress+Hauser transport, examine and repair a returned device.
- Enclose special handling instructions if necessary, for example a safety data sheet as per EC REACH Regulation No. 1907/2006.
- Remove all residues. Pay special attention to the grooves for seals and crevices which could contain residues. This is particularly important if the substance is hazardous to health, e.g. flammable, toxic, caustic, carcinogenic, etc.



### Note!

You will find a preprinted "Declaration of contamination" form at the back of these Operating Instructions.

# 9.8 Disposal

Observe the regulations applicable in your country!

# 9.9 Software history

Date	Software version	Software modifications	Documentation
09.2011	3.00.XX	New sensors: Promass O and Promass X	71141445/13.11
06.2010		-	71116477/06.10
10.2009	3.00.XX	Introduction of new FOUNDATION Fieldbus I/O board  Shorter execution times:  - Analog Input Function Blocks 1 to 8 (each 18 ms)  - PID Function Block (25 ms)  - Discrete Output Function Block (18 ms)  - Integrator Function Block (18 ms)  Software adaptations:	71089885/07.09
		- ITK Version: 5.01	
01.2007	2.00.XX	New sensors: Promass P and Promass S  Shorter execution times:  Analog Input Function Blocks 1 to 8 (20 ms)  Discrete Output Function Block (20 ms)  PID Function Block (50 ms)  New Function Blocks:  Arithmetic Function Block (20 ms)  Input Selector Function Block (20 ms)  Signal Characterizer Function Block (20 ms)  Integrator Function Block (25 ms)	71035080/12.06
		New Transducer Blocks:  - Advanced Diagnostics  - Viscosity  - Calculated Density  Method:  - Commissioning  - Gas measurement  Software adaptations:	
11.2005	1.01.XX	- ITK Version: 5.01 - CFF version 1.7 Software expansion - Promass I DN80, DN50FB	71008409/12.05
11.2004	1.01.XX	<ul> <li>General instrument functions</li> <li>Software expansion         <ul> <li>New sensor DN 250</li> <li>Chinese language package (English and Chinese contents)</li> </ul> </li> <li>New functionalities:         <ul> <li>Empty pipe detection via exciting current (EPD EXC.CURR. (6426))</li> <li>DEVICE SOFTWARE (8100) → Device software diployed (NAMLIP recommendation 52)</li> </ul> </li> </ul>	
10.2003	Amplifier: 1.06.XX	displayed (NAMUR recommendation 53)  Software expansion:  Language group  Adjustments to Fieldcheck and Simubox  New functionalities:  Operation hours counter  Intensity of background illumination adjustable  Counter for access code  Compatible with:  ToF-Tool FieldTool Package	50098622/05.04
03.2003	Amplifier: 1.05.XX	(the latest SW version can be downloaded under: www.tof-fieldtool.endress.com)  — Upload and download via ToF Tool - Fieldtool package  Software adjustment	

Date	Software version	Software modifications	Documentation
08.2002	Amplifier: 1.04.XX	Software expansion: Promass E	50098622/01.03
04.2002	Amplifier: 1.02.02	Software expansion: Promass H	50098622/04.02
03.2002	Communication module: 1.01.00	Software adjustments: FOUNDATION Fieldbus software merged (Prosonic Flow 93, Promag 53, Promass 83)  Device Revision 2, DD Revision 1  Certification No. IT 014800  ITK 4.0  CFF version 1.5	
11.2001	Amplifier: 1.02.01	Software adjustment	
06.2001	Amplifier: 1.02.00	Software expansion: General device functions  New functionalities: (not relevant for FOUNDATION Fieldbus)	
05.2001	Amplifier: 1.01.01	Software adjustment	
03.2001	Amplifier: 1.01.00		
12.2000	Communication module: 1.00.01	Original software  Device Revision 1, DD Revision 1  Certification No. IT 009600  ITK 4.0  CFF version 1.5	50098622/12.00
11.2000	Amplifier: 1.00.XX	Original software	

### Technical data 10

### 10.1 Technical data at a glance

### 10.1.1 **Applications**

 $\rightarrow 15$ 

### 10.1.2 Function and system design

Measuring principle Mass flow measurement by the Coriolis principle  $\rightarrow 1 7$ Measuring system 10.1.3 Input

Measured variable

- Mass flow (proportional to the phase difference between two sensors mounted on the measuring tube to register a phase shift in the oscillation)
- Fluid density (proportional to resonance frequency of the measuring tube)
- Fluid temperature (measured with temperature sensors)

Measuring range

Measuring ranges for liquids

DN		Range for full scale values	(liquids) $\dot{\boldsymbol{m}}_{min(F)}$ to $\dot{\boldsymbol{m}}_{max(F)}$
[mm]	[inch]		
1	1/24	0 to 20 kg/h	0 to 0.7 lb/min
2	1/12	0 to 100 kg/h	0 to 3.7 lb/min
4	1/8	0 to 450 kg/h	0 to 16.5 lb/min
8	3/8	0 to 2000 kg/h	0 to 73.5 lb/min
15	1/2	0 to 6500 kg/h	0 to 238 lb/min
15 FB	½ FB	0 to 18000 kg/h	0 to 660 lb/min
25	1	0 to 18000 kg/h	0 to 660 lb/min
25 FB	1 FB	0 to 45000 kg/h	0 to 1650 lb/min
40	1 ½	0 to 45000 kg/h	0 to 1650 lb/min
40 FB	1 ½ FB	0 to 70000 kg/h	0 to 2570 lb/min
50	2	0 to 70000 kg/h	0 to 2570 lb/min
50 FB	2 FB	0 to 180000 kg/h	0 to 6600 lb/min
80	3	0 to 180000 kg/h	0 to 6600 lb/min
100	4	0 to 350000 kg/h	0 to 12860 lb/min
150	6	0 to 800000 kg/h	0 to 29400 lb/min
250	10	0 to 2200000 kg/h	0 to 80860 lb/min
350	14	0 to 4100 t/h	0 to 4520 tn. sh./h
FB = Full bore ve	ersions of Promass I		

Measuring ranges for gases, general, (except Promass H (Zr))

The full scale values depend on the density of the gas. Use the formula below to calculate the full scale values:

 $\dot{\mathbf{m}}_{\max(G)} = \dot{\mathbf{m}}_{\max(F)} \cdot \rho_{(G)} : \mathbf{x} \left[ \frac{\text{kg}}{\text{m}^3} \left( \frac{\text{lb}}{\text{ft}^3} \right) \right]$ 

 $\dot{m}_{\text{max}(G)} = \text{Max.}$  full scale value for gas [kg/h (lb/min)]

 $\dot{\mathbf{m}}_{\max(F)} = \text{Max. full scale value for liquid [kg/h (lb/min)]}$ 

 $\rho_{(G)}$  = Gas density in [kg/m³ (lb/ft³)] for process conditions

Here,  $\dot{\boldsymbol{m}}_{\text{max}(G)}$  can never be greater than  $\dot{\boldsymbol{m}}_{\text{max}(F)}$ 

Measuring ranges for gases (Promass F, M, O):

DN		x
[mm]	[inch]	
8	3/8	60
15	1/2	80
25	1	90
40	11/2	90
50	2	90
80	3	110
100	4	130
150	6	200
250	10	200

Measuring ranges for gases (Promass E)

DN		x
[mm]	[inch]	
8	3/8	85
15	1/2	110
25	1	125
40	11/2	125
50	2	125
80	3	155

Measuring ranges for gases (Promass P, S, H (Ta))

DN		х	
[mm]	[inch]		
8	3/8	60	
15	1/2	80	
25	1	90	
401)	11/21)	90	
501)	21)	90	
1) only Promass I	1) only Promass P, S		

## Measuring ranges for gases (Promass A)

DN		х
[mm]	[inch]	
1	1/24	32
2	1/12	32
4	1/8	32

# Measuring ranges for gases (Promass I)

D	N	x		
[mm]	[inch]			
8	3/8	60		
15	1/2	80		
15 FB	½ FB	90		
25	1	90		
25 FB	1 FB	90		
40	1 ½	90		
40 FB	1 ½ FB	90		
50	2	90		
50 FB	2 FB	110		
80	3	110		
FB = Full bore ve	FB = Full bore versions of Promass I			

### Measuring ranges for gases (Promass X)

DN		х
[mm]	[inch]	
350	14	200

## Calculation example for gas:

- Sensor type: Promass F, DN 50
- $\blacksquare$  Gas: air with a density of 60.3 kg/m³ (at 20 °C and 50 bar)
- Measuring range (liquid): 70000 kg/h
- x = 90 (for Promass F DN 50)

Max. possible full scale value:

 $\dot{\bm{m}}_{max(G)} = \dot{\bm{m}}_{max(F)} \cdot \rho_{(G)} \div x \; [kg/m^3] = 70\,000 \; kg/h \cdot 60.3 \; kg/m^3 \div 90 \; kg/m^3 = 46\,900 \; kg/h$ 

Recommended full scale values

See  $\rightarrow$  Page 127 ff. ("Limiting flow")

Operable flow range

Greater than 1000:1. Flows above the preset full scale value do not overload the amplifier, i.e. totalizer values are registered correctly.

# 10.1.4 Output

Output signal	Physical data transmission (Physical Layer Type):	
	<ul> <li>Fieldbus interface in accordance with IEC 61158-2</li> <li>Corresponds to device version type 512 of the FOUNDATION Fieldbus specification: type 512 – standard data transfer (±9 mA, symmetrical), separate supply to field device (4-wire), intrinsically safe version of the FF interface, FISCO</li> <li>With integrated reverse polarity protection</li> </ul>	
Signal on alarm	Status messages as per FOUNDATION Fieldbus specification	
Link Master (LM) support	Yes	
Link Master	Selectable	
Basic Device	Factory setting	
Device basic current	12 mA	
Device starting current	<12 mA	
Device error current (FDE)	0 mA	
Device (lift off) min. voltage	9 V (H1-segment)	
Permissible fieldbus supply voltage	9 to 32 V	
Integrated reverse polarity protection	Yes	
ITK Version	5.01	
Number of VCRs (total)	38	
Number of link objects in VFD	40	
Device capacitance	In accordance with IEC 60079-27, FISCO/FNICO	
Galvanic isolation	All circuits for inputs, outputs and power supply are galvanically isolated from each other.	
Data transmission rate	31.25 kbit/s, voltage mode	
Signal coding	Manchester II	

Bus times

Min. idle time between two telegrams:

MIN\_INTER\_PDU\_DELAY = 6 octet time (transfer time per octet)

Block information, execution time

Block	Base index	Execution time [ms]	Functionality
Resource Block	400	-	Enhanced
"Flow" Transducer Block	1400	-	Vendor specific
"Diagnosis" Transducer Block	1600	_	Vendor specific
"Display" Transducer Block	1800	-	Vendor specific
"Totalizer" Transducer Block	1900	_	Vendor specific
"Calculated Density" Transducer Block	2000	_	Vendor specific
"Viscosity" Transducer Block	2100	_	Vendor specific
"Advanced Diagnostics" Transducer Block	2200	-	Vendor specific
Analog Input Function Block 1	500	18	Standard
Analog Input Function Block 2	550	18	Standard
Analog Input Function Block 3	600	18	Standard
Analog Input Function Block 4	650	18	Standard
Analog Input Function Block 5	700	18	Standard
Analog Input Function Block 6	750	18	Standard
Analog Input Function Block 7	800	18	Standard
Analog Input Function Block 8	850	18	Standard
Discrete Output Function Block (DO)	900	18	Standard
PID Function Block (PID)	1000	25	Standard
Arithmetic Function Block (ARTH)	1100	20	Standard
Input Selector Function Block (ISEL)	1150	20	Standard
Signal Characterizer Function Block (CHAR)	1200	20	Standard
Integrator Function Block (INTG)	1250	18	Standard

# Output data

# Transducer Blocks / Analog Input Function Blocks

Block	Process variable	Channel parameter (AI Block)
"Flow" Transducer Block	Mass flow	1
	Volume flow	2
	Corrected volume flow	3
	Density	4
	Reference density	5
	Temperature	6
"Totalizer" Transducer Block	Totalizer 1	7
	Totalizer 2	8
	Totalizer 3	9
The following measured variables device (order option)	are available if the "Concentration measurement" add	on is installed in the measuring
"Concentration" Transducer Block	Target fluid mass flow	40
	Target fluid % mass	41
	Target fluid volume flow	42
	Target fluid % volume	43
	Target fluid corrected volume flow	44
	Carrier fluid mass flow	45
	Carrier fluid % mass	46
	Carrier fluid volume flow	47
	Carrier fluid % volume	48
	Carrier fluid corrected volume flow	49
	% Black liquor	41
	°Baume	
	°API	
	°Plato	
	°Balling	50
	°Brix	
	Flexible	
The following measured variables (order option)	are available if the "Viscosity" add-on is installed in th	e measuring device
"Viscosity" Transducer Block	Dynamic viscosity	90
	Kinematic viscosity	91
	Temperature-compensated dynamic viscosity	92
	Temperature-compensated kinematic viscosity	93
The following measured variables (order option)	are available if the "Advanced diagnostics" add-on is in	nstalled in the measuring device
"Advanced Diagnostics"	Mass flow deviation	70
Transducer Block	Density deviation	71
	Reference density deviation	72
	Temperature deviation	73
	Tube damping deviation	74
	Electrodynamic sensor deviation	75
	Deviation of operating frequency fluctuation	76
	Deviation of tube damping fluctuation	77

# Input data

# Discrete Output Function Block (channel 16)

Status change	Action	
Discrete state $0 \rightarrow$ Discrete state 1	reserved	
Discrete state $0 \rightarrow$ Discrete state 2	Positive zero return ON	
Discrete state $0 \rightarrow$ Discrete state $3$	Positive zero return OFF	
Discrete state $0 \rightarrow$ Discrete state 4	Zero point adjustment	
Discrete state $0 \rightarrow$ Discrete state 5	reserved	
Discrete state 0 → Discrete state 6	reserved	
Discrete state 0 → Discrete state 7	Reset Totalizer 1, 2, 3	
Discrete state 0 → Discrete state 8	Reset Totalizer 1	
Discrete state 0 → Discrete state 9	Reset Totalizer 2	
Discrete state 0 → Discrete state 10	Reset Totalizer 3	
Discrete state 0 → Discrete state 27	Permanent storage: Off	
Discrete state 0 → Discrete state 28	Permanent storage: On	
The following measured variables are available if the "Concentration measure (order option) $\ensuremath{T}$	neasurement" add-on is installed in the measuring	
Discrete state 0 → Discrete state 60	Select concentration specification 1	
Discrete state $0 \rightarrow$ Discrete state 61	Select concentration specification 2	
Discrete state 0 → Discrete state 62	Select concentration specification 3	
Discrete state 0 → Discrete state 63	Select concentration specification 4	
The following measured variables are available if the "Advanced diagnotorder option)	ostics" add-on is installed in the measuring device	
Discrete state 0 → Discrete state 25	Warning mode: OFF	
Discrete state 0 → Discrete state 26	Warning mode: ON	
Discrete state 0 → Discrete state 70	Start determining user reference status	
Discrete state 0 → Discrete state 71	reserved	
Discrete state 0 → Discrete state 72	reserved	
Discrete state 0 → Discrete state 73	reserved	
Discrete state 0 → Discrete state 74	Acquisition mode: Off	
Discrete state 0 → Discrete state 75	Acquisition mode: Periodic	
Discrete state 0 → Discrete state 76	Acquisition mode: Manual	
Discrete state $0 \rightarrow$ Discrete state 77	Reset history	
Discrete state 0 → Discrete state 78	Start manual determination of diag. parameter	

# VCRs

VCRs (total 48)	Quantity
Permanent Entries	1
Client VCRs	0
Server VCRs	24
Source VCRs	23
Sink VCRs	0
Subscriber VCRs	23
Publisher VCRs	23

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# 10.1.5 Power supply

Electrical connections	$\rightarrow \stackrel{\triangle}{=} 27$
Supply voltage	85 to 260 V AC, 45 to 65 Hz 20 to 55 V AC, 45 to 65 Hz 16 to 62 V DC
Cable entries	Power supply and signal cables (inputs/outputs):  ■ Cable entry M20 x 1.5 (8 to 12 mm)  ■ Threads for cable entries, 1/2" NPT, G 1/2"
	Connecting cable for remote version:  ■ Cable entry M20 x 1.5 (8 to 12 mm)  ■ Threads for cable entries, 1/2" NPT, G 1/2"
Cable specifications remote version	→ 🖹 31
Power consumption	AC: <15 VA (including sensor) DC: <15 W (including sensor)
	Switch-on current:  ■ max. 13.5 A (< 50 ms) at 24 V DC  ■ max. 3 A (< 5 ms) at 260 V AC
Power supply failure	<ul> <li>Lasting min. 1 power cycle:</li> <li>EEPROM and T-DAT save measuring system data if power supply fails.</li> <li>HistoROM/S-DAT: exchangeable data storage chip with sensor-specific data (nominal diameter, serial number, calibration factor, zero point, etc.)</li> </ul>
Potential equalization No measures necessary.	

#### 10.1.6 Performance characteristics

## Reference operating conditions

- Error limits following ISO/DIN 11631
- Water, typically +15 to +45 °C (+59 to +113 °F); 2 to 6 bar (29 to 87 psi)
- Data according to calibration protocol  $\pm 5$  °C ( $\pm 9$  °F) and  $\pm 2$  bar ( $\pm 29$  psi)
- Accuracy based on accredited calibration rigs according to ISO 17025

## Performance characteristic Promass A

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output.

The additional measured error at the current output is typically  $\pm 5 \mu A$ .

Design fundamentals  $\rightarrow 109$ .

- Mass flow and volume flow (liquids): ±0.10% o.r.
- Mass flow (gases):  $\pm 0.50\%$  o.r.
- Density (liquids)
  - Reference conditions: ±0.0005 g/cm<sup>3</sup>
  - Field density calibration: ±0.0005 g/cm<sup>3</sup> (valid after field density calibration under process conditions)
  - Standard density calibration: ±0.02 g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow 131$ )
  - Special density calibration: ±0.002 g/cm<sup>3</sup> (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0.0 to 2.0 g/cm³)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

#### Zero point stability

DN		Max. full scale value		Zero point stability	
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]	[kg/h] or [l/h]	[lb/min]
1	1/24	20	0.73	0.0010	0.000036
2	1/12	100	3.70	0.0050	0.00018
4	1/8	450	16.5	0.0225	0.0008

#### Example for max. measured error

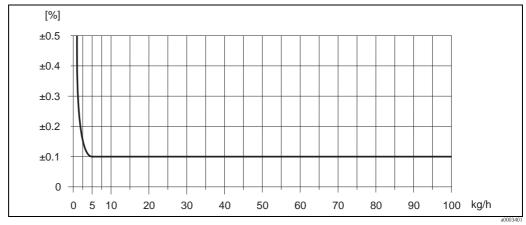


Fig. 41: Max. measured error in % o.r. (example: Promass A, DN 2)

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## Flow values (example)

Turn down	Flow		Max. measured error
	[kg/h]	[lb/min.]	[% o.r.]
250:1	0.4	0.0147	1.250
100:1	1.0	0.0368	0.500
25:1	4.0	0.1470	0.125
10:1	10	0.3675	0.100
2:1	50	1.8375	0.100

Design fundamentals  $\rightarrow 109$ 

#### Repeatability

Design fundamentals  $\rightarrow 109$ 

■ Mass flow and volume flow (liquids):  $\pm 0.05\%$  o.r.

■ Mass flow (gases):  $\pm 0.25\%$  o.r.

■ Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025$  · T °C;  $\pm 0.5$  °F  $\pm 0.0015$  · (T - 32) °F

#### Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

## Influence of medium pressure

A difference in pressure between the calibration pressure and the process pressure does not have any effect on the accuracy.

## Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error: ± (Zero point stability ÷ measured value) ⋅ 100% o.r.
  - Repeatability:  $\pm \frac{1}{2} \cdot (Zero\ point\ stability\ \div\ measured\ value) \cdot 100\%\ o.r.$

Base accuracy for		
Mass flow liquids	0.10	
Volume flow liquids	0.10	
Mass flow gases	0.50	

Performance characteristic Promass E o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output. The additional measured error at the current output is typically  $\pm 5~\mu A$ . Design fundamentals  $\rightarrow ~ \stackrel{\square}{=}~ 112$ .

- Mass flow and volume flow (liquids):  $\pm 0.25\%$  o.r.
- Mass flow (gases):  $\pm 0.75\%$  o.r.
- Density (liquids)
- Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
- Field density calibration: ±0.0005 g/cm<sup>3</sup>
   (valid after field density calibration under process conditions)
- Standard density calibration:  $\pm 0.02$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow$   $\stackrel{\triangle}{=}$  131)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

#### Zero point stability

DN		Zero point stability	
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]
8	3/8	0.20	0.0074
15	1/2	0.65	0.0239
25	1	1.80	0.0662
40	11/2	4.50	0.1654
50	2	7.00	0.2573
80	3	18.00	0.6615

#### Example for max. measured error

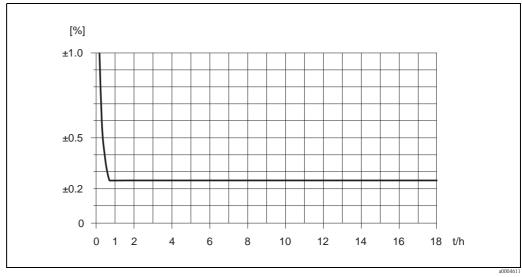


Fig. 42: Max. measured error in % o.r. (example: Promass E, DN 25)

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## Flow values (example)

Turn down	Flow		Maximum measured error
	[kg/h]	[lb/min]	[% o.r.]
250 : 1	72	2.646	2.50
100:1	180	6.615	1.00
25 : 1	720	26.46	0.25
10:1	1800	66.15	0.25
2:1	9000	330.75	0.25

Design fundamentals  $\rightarrow 112$ 

#### Repeatability

Design fundamentals  $\rightarrow$  112

■ Mass flow and volume flow (liquids):  $\pm 0.10\%$  o.r.

■ Mass flow (gases):  $\pm 0.35\%$  o.r.

■ Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025$  · T °C;  $\pm 0.5$  °F  $\pm 0.0015$  · (T - 32) °F

## Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

## Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN			
[mm]	[inch]	[% o.r./bar]	
8	3/8	no influence	
15	1/2	no influence	
25	1	no influence	
40	11/2	no influence	
50	2	-0.009	
80	3	-0.020	

## Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error: ± (Zero point stability ÷ measured value) ⋅ 100% o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · (Zero point stability ÷ measured value) · 100% o.r.

Base accuracy for		
Mass flow liquids	0.25	
Volume flow liquids	0.25	
Mass flow gases	0.75	

# Performance characteristic Promass F

o.r. = of reading; 1 g/cm $^3$  = 1 kg/l; T = medium temperature

## Maximum measured error

The following values refer to the pulse/frequency output.

The additional measured error at the current output is typically  $\pm 5~\mu A$ .

Design fundamentals  $\rightarrow 114$ .

- Mass flow and volume flow (liquids): ±0.05% o.r. (PremiumCal, for mass flow) ±0.10% o.r.
- Mass flow (gases):  $\pm 0.35\%$  o.r.
- Density (liquids)
  - Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
  - Field density calibration: ±0.0005 g/cm<sup>3</sup>
     (valid after field density calibration under process conditions)
  - Standard density calibration:  $\pm 0.01$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow \stackrel{\triangle}{=} 131$ )
  - Special density calibration:  $\pm 0.001$  g/cm<sup>3</sup> (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0.0 to 2.0 g/cm<sup>3</sup>)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

Zero point stability Promass F (standard)

D	N	Zero point stability Promass F (Standard)		
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]	
8	3/8	0.030	0.001	
15	1/2	0.200	0.007	
25	1	0.540	0.019	
40	11/2	2.25	0.083	
50	2	3.50	0.129	
80	3	9.00	0.330	
100	4	14.00	0.514	
150	6	32.00	1.17	
250	10	88.00	3.23	

## Zero point stability Promass F (high-temperature version)

DN		Zero point stability Promass F (high-temperature version)	
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]
25	1	1.80	0.0661
50	2	7.00	0.2572
80	3	18.0	0.6610

## Example for max. measured error

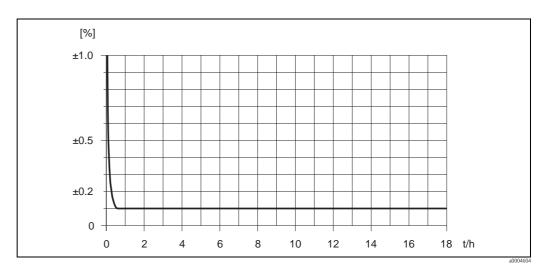


Fig. 43: Max. measured error in % o.r. (example: Promass F, DN 25)

## Flow values (example)

Turn down	Flow		Maximum measured error
	[kg/h]	[lb/min]	[% o.r.]
500:1	36	1.323	1.5
100:1	180	6.615	0.3
25:1	720	26.46	0.1
10:1	1800	66.15	0.1
2:1	9000	330.75	0.1

Design fundamentals  $\rightarrow 114$ 

## Repeatability

Design fundamentals  $\rightarrow 114$ .

- Mass flow and volume flow (liquids): ±0.025% o.r. (PremiumCal, for mass flow) ±0.05% o.r.
- Mass flow (gases):  $\pm 0.25\%$  o.r.
- Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>
- Temperature:  $\pm 0.25$  °C  $\pm 0.0025 \cdot$  T °C;  $\pm 0.5$  °F  $\pm 0.0015 \cdot$  (T 32) °F

## Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

#### Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN		Promass F (standard)	Promass F (high-temperature version)
[mm]	[inch]	[% o.r./bar]	[% o.r./bar]
8	3/8	no influence	_
15	1/2	no influence	-
25	1	no influence	no influence
40	11/2	-0.003	-
50	2	-0.008	-0.008
80	3	-0.009	-0.009
100	4	-0.007	-
150	6	-0.009	_
250	10	-0.009	_

## Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error:  $\pm$  (Zero point stability  $\div$  measured value)  $\cdot$  100% o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · (Zero point stability ÷ measured value) · 100% o.r.

Base accuracy for		
Mass flow liquids, PremiumCal	0.05	
Mass flow liquids	0.10	
Volume flow liquids	0.10	
Mass flow gases	0.35	

Performance characteristic Promass H

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output. The additional measured error at the current output is typically  $\pm 5~\mu A$ . Design fundamentals  $\rightarrow \stackrel{\cong}{=} 117$ .

- Mass flow and volume flow (liquids)
  Zirconium 702/R 60702 and Tantalum 2.5W: ±0.10% o.r.
- Mass flow (gases)
  Tantalum 2.5W: ±0.50% o.r.
- Density (liquids)

Zirconium 702/R 60702 and Tantalum 2.5W

- Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
- Field density calibration: ±0.0005 g/cm<sup>3</sup>
   (valid after field density calibration under process conditions)
- Standard density calibration:  $\pm 0.02$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow$   $\stackrel{\triangle}{=}$  131)
- Special density calibration:  $\pm 0.002$  g/cm³ (optional, valid range: +10 to +80 °C (+50 to +176 °F) and 0.0 to 2.0 g/cm³)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

## Zero point stability

DN		Zero point stability		
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]	
8	3/8	0.20	0.007	
15	1/2	0.65	0.024	
25	1	1.80	0.066	
40	11/2	4.50	0.165	
50	2	7.00	0.257	

## Example for max. measured error

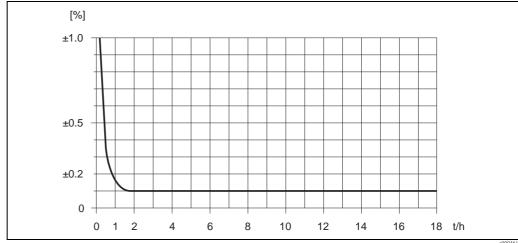


Fig. 44: Max. measured error in % o.r. (example: Promass H, DN 25)

0004611

#### Flow values (example)

Turn down	Flow		Maximum measured error
	[kg/h]	[lb/min]	[% o.r.]
250 : 1	72	2.646	2.50
100:1	180	6.615	1.00
25:1	720	26.46	0.25
10:1	1800	66.15	0.10
2:1	9000	330.75	0.10

Design fundamentals  $\rightarrow 117$ 

#### Repeatability

Design fundamentals  $\rightarrow 117$ .

Material measuring tube: Zirconium 702/R 60702

■ Mass flow and volume flow (liquids): ±0.05% o.r.

■ Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025 \cdot$  T °C;  $\pm 0.5$  °F  $\pm 0.0015 \cdot$  (T - 32) °F

Material measuring tube: Tantalum 2.5W

■ Mass flow and volume flow (liquids): ±0.05% o.r.

■ Mass flow (gases):  $\pm 0.25\%$  o.r.

■ Density (liquids):  $\pm 0.0005$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025 \cdot$  T °C;  $\pm 0.5$  °F  $\pm 0.0015 \cdot$  (T - 32) °F

## *Influence of medium temperature*

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

#### Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN		Promass H Zirconium 702/R 60702	Promass H Tantalum 2.5W
[mm]	[inch]	[% o.r./bar]	[% o.r./bar]
8	3/8	-0.017	-0.010
15	1/2	-0.021	-0.010
25	1	-0.013	-0.012
40	11/2	-0.018	_
50	2	-0.020	-

## Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error: ± (Zero point stability ÷ measured value) ⋅ 100% o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · (Zero point stability  $\div$  measured value) · 100% o.r.

Base accuracy for		
Mass flow liquids	0.10	
Volume flow liquids	0.10	
Mass flow gases	0.50	

## Performance characteristic Promass I

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output.

The additional measured error at the current output is typically  $\pm 5~\mu A$ .

Design fundamentals  $\rightarrow 119$ .

- Mass flow and volume flow (liquids):  $\pm 0.10\%$  o.r.
- Mass flow (gases):  $\pm 0.50\%$  o.r.
- Density (liquids)
  - Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
  - Field density calibration: ±0.0005 g/cm³

(valid after field density calibration under process conditions)

- Standard density calibration:  $\pm 0.02$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow \stackrel{\triangle}{=} 131$ )
- Special density calibration:  $\pm 0.004$  g/cm<sup>3</sup> (optional, valid range: +10 to +80 °C (+50 to +176 °F) and 0.0 to 2.0 g/cm<sup>3</sup>)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

## Zero point stability

D	N	Zero point stability	
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]
8	3/8	0.150	0.0055
15	1/2	0.488	0.0179
15 FB	½ FB	1.350	0.0496
25	1	1.350	0.0496
25 FB	1 FB	3.375	0.124
40	1 1/2	3.375	0.124
40 FB	1½ FB	5.250	0.193
50	2	5.250	0.193
50 FB	2 FB	13.50	0.496
80	3	13.50	0.496

 $FB = Full \ bore$ 

## Example for max. measured error

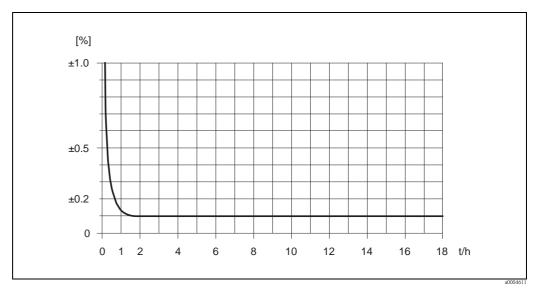


Fig. 45: Max. measured error in % o.r. (example: Promass I, DN 25)

#### Flow values (example)

Turn down	Flow		Maximum measured error
	[kg/h]	[lb/min]	[% o.r.]
250 : 1	72	2.646	1.875
100:1	180	6.615	0.750
25:1	720	26.46	0.188
10:1	1800	66.15	0.100
2:1	9000	330.75	0.100

Design fundamentals  $\rightarrow 119$ 

## Repeatability

Design fundamentals  $\rightarrow 119$ 

- Mass flow and volume flow (liquids): ±0.05% o.r.
- Mass flow (gases):  $\pm 0.25\%$  o.r.
- Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>
- Temperature:  $\pm 0.25$  °C  $\pm 0.0025 \cdot$  T °C;  $\pm 0.5$  °F  $\pm 0.0015 \cdot$  (T 32) °F

## Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

## Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN			
[mm]	[inch]	[% o.r./bar]	
8	3/8	0.006	
15	1/2	0.004	
15 FB	½ FB	0.006	
25	1	0.006	
25 FB	1 FB	no influence	
40	11/2	no influence	
40 FB	1½ FB	-0.003	
50	2	-0.003	
50 FB	2 FB	0.003	
80	3	0.003	

FB = Full bore

# Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error:  $\pm Base$  accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error:  $\pm$  (Zero point stability  $\div$  measured value)  $\cdot$  100% o.r. Repeatability:  $\pm$  ½  $\cdot$  (Zero point stability  $\div$  measured value)  $\cdot$  100% o.r.

Base accuracy for		
Mass flow liquids	0.10	
Volume flow liquids	0.10	
Mass flow gases	0.50	

# Performance characteristic Promass M

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output. The additional measured error at the current output is typically  $\pm 5~\mu A$ .

- Mass flow (liquids): ±0.10% ± [(Zero point stability ÷ measured value) · 100]% o.r.
- Mass flow (gases): ±0.50% ± [(Zero point stability ÷ measured value) · 100]% o.r.
- Volume flow (liquids):
   ±0.25% ± [(Zero point stability ÷ measured value) ⋅ 100]% o.r.
- Density (liquids)
  - Reference conditions: ±0.001 g/cm<sup>3</sup>
  - Field density calibration: ±0.001 g/cm<sup>3</sup>
     (valid after field density calibration under process conditions)
  - Standard density calibration:  $\pm 0.02$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow \stackrel{\triangle}{=} 131$ )
  - Special density calibration:  $\pm 0.002$  g/cm³ (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0.0 to 2.0 g/cm³)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

## Zero point stability

D	N	Max. full scale value		Zero poin	t stability
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]	[kg/h] or [l/h]	[lb/min]
8	3/8	2000	73.5	0.100	0.004
15	1/2	6500	238	0.325	0.012
25	1	18000	660	0.90	0.033
40	11/2	45000	1650	2.25	0.083
50	2	70000	2570	3.50	0.129
80	3	180 000	6600	9.00	0.330

#### Example for max. measured error

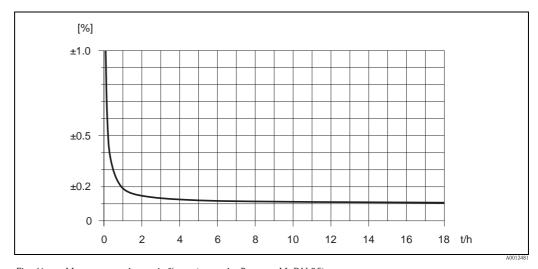


Fig. 46: Max. measured error in % o.r. (example: Promass M, DN 25)

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Calculation example (mass flow, liquids):

Given: Promass M / DN 25, measured value flow = 8000 kg/h

Max. measured error:  $\pm 0.10\% \pm [(Zero point stability \div measured value) \cdot 100]\%$  o.r.

Max. measured error:  $\pm 0.10\% \pm [(0.90 \text{ kg/h} \pm 8000 \text{ kg/h}) \cdot 100\%] = \pm 0.111\%$ 

#### Repeatability

■ Mass flow (liquids):

 $\pm 0.05\% \pm [\frac{1}{2} \cdot (Zero point stability \pm measured value) \cdot 100]\% o.r.$ 

■ Mass flow (gases):

 $\pm 0.25\% \pm [\frac{1}{2} \cdot (Zero point stability \pm measured value) \cdot 100]\% o.r.$ 

■ Volume flow (liquids):

 $\pm 0.10\% \pm [\frac{1}{2} \cdot (Zero point stability \pm measured value) \cdot 100]\% o.r.$ 

■ Density (liquids):  $\pm 0.0005$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025 \cdot$  T °C;  $\pm 0.5$  °F  $\pm 0.0015 \cdot$  (T - 32) °F

Calculation example repeatability (mass flow, liquids):

Given: Promass M / DN 25, measured value flow = 8000 kg/h

Repeatability:  $\pm 0.05\% \pm [\frac{1}{2} \cdot (Zero\ point\ stability\ \div\ measured\ value) \cdot 100]\%\ o.r.$ 

Repeatability:  $\pm 0.05\% \pm [\frac{1}{2} \cdot (0.90 \text{ kg/h} \pm 8000 \text{ kg/h}) \cdot 100\%] = \pm 0.056\%$ 

#### Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

#### Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

D	N	Promass M	Promass M high-pressure version
[mm]	[inch]	[% o.r./bar]	[% o.r./bar]
8	3/8	0.009	0.006
15	1/2	0.008	0.005
25	1	0.009	0.003
40	11/2	0.005	_
50	2	no influence	_
80	3	no influence	_

# Performance characteristic Promass O

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

## Maximum measured error

The following values refer to the pulse/frequency output.

The additional measured error at the current output is typically  $\pm 5 \mu A$ .

Design fundamentals  $\rightarrow 123$ .

- Mass flow and volume flow (liquids): ±0.05% o.r. (PremiumCal, for mass flow) ±0.10% o.r.
- Mass flow (gases):  $\pm 0.35\%$  o.r.

- Density (liquids)
- Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
- Field density calibration: ±0.0005 g/cm<sup>3</sup>
   (valid after field density calibration under process conditions)
- Standard density calibration:  $\pm 0.01$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow \stackrel{\triangle}{=} 131$ )
- Special density calibration:  $\pm 0.001$  g/cm³ (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0.0 to 2.0 g/cm³)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

## Zero point stability

DN		Zero point stability Promass F (Standard)		
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]	
80	3	9.00	0.330	
100	4	14.00	0.514	
150	6	32.00	1.17	

## Example for max. measured error

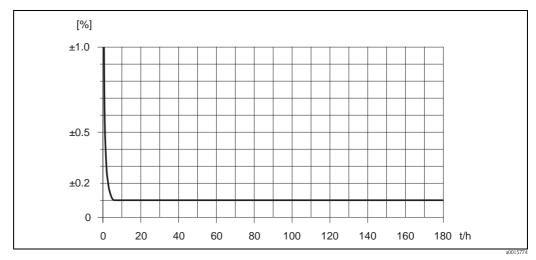


Fig. 47: Max. measured error in % o.r. (example DN 80)

## Flow values (example DN 80)

Turn down	Flow		Maximum measured error
	[kg/h]	[lb/min]	[% o.r.]
500 : 1	360	13.23	1.5
100:1	1800	66.15	0.3
25 : 1	7200	264.6	0.1
10:1	18000	661.5	0.1
2:1	90000	3307.5	0.1

Design fundamentals  $\rightarrow 123$ 

#### Repeatability

Design fundamentals  $\rightarrow 123$ .

■ Mass flow and volume flow (liquids): ±0.025% o.r. (PremiumCal, for mass flow) ±0.05% o.r.

■ Mass flow (gases):  $\pm 0.25\%$  o.r.

■ Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025 \cdot$  T °C;  $\pm 0.5$  °F  $\pm 0.0015 \cdot$  (T - 32) °F

#### Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

#### Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN		Promass F (standard)
[mm]	[inch]	[% o.r./bar]
80	3	-0.0055
100	4	-0.0035
150	6	-0.002

## Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error: ± (Zero point stability ÷ measured value) ⋅ 100% o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · (Zero point stability  $\div$  measured value) · 100% o.r.

Base accuracy for		
Mass flow liquids, PremiumCal	0.05	
Mass flow liquids	0.10	
Volume flow liquids	0.10	
Mass flow gases	0.35	

#### Performance characteristic Promass P

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output. The additional measured error at the current output is typically  $\pm 5~\mu A$ .

Design fundamentals  $\rightarrow 125$ .

- Mass flow and volume flow (liquids):  $\pm 0.10\%$  o.r.
- Mass flow (gases):  $\pm 0.50\%$  o.r.
- Density (liquids)
- Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
- Field density calibration: ±0.0005 g/cm<sup>3</sup>
   (valid after field density calibration under process conditions)
- Standard density calibration:  $\pm 0.01$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow$   $\stackrel{\triangle}{=}$  131)
- Special density calibration:  $\pm 0.002$  g/cm<sup>3</sup> (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0.0 to 2.0 g/cm<sup>3</sup>)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

#### Zero point stability

D	N	Zero point stability	
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]
8	3/8	0.20	0.007
15	1/2	0.65	0.024
25	1	1.80	0.066
40	11/2	4.50	0.165
50	2	7.00	0.257

## Example for max. measured error

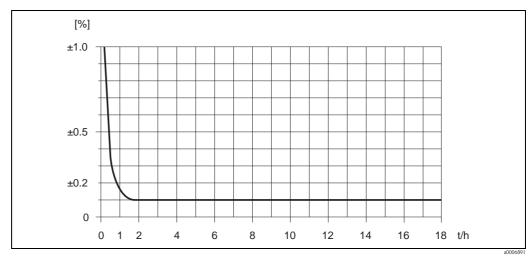


Fig. 48: Max. measured error in % o.r. (example: Promass P, DN 25)

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## Flow values (example)

Turn down	Flow		Maximum measured error	
	[kg/h] [lb/min]		[% o.r.]	
250 : 1	72	2.646	2.50	
100:1	180	6.615	1.00	
25:1	720	26.46	0.25	
10:1	1800	66.15	0.10	
2:1	9000	330.75	0.10	

Design fundamentals → 125

#### Repeatability

Design fundamentals  $\rightarrow 125$ .

■ Mass flow and volume flow (liquids):  $\pm 0.05\%$  o.r.

■ Mass flow (gases):  $\pm 0.25\%$  o.r.

■ Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025$  · T °C;  $\pm 0.5$  °F  $\pm 0.0015$  · (T - 32) °F

#### Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

#### Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN		
[mm]	[inch]	[% o.r./bar]
8	3/8	-0.002
15	1/2	-0.006
25	1	-0.005
40	11/2	-0.005
50	2	-0.005

## Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error:  $\pm$  (Zero point stability  $\div$  measured value)  $\cdot$  100% o.r.
  - Repeatability:  $\pm$  ½  $\cdot$  (Zero point stability  $\div$  measured value)  $\cdot$  100% o.r.

Base accuracy for		
Mass flow liquids	0.10	
Volume flow liquids	0.10	
Mass flow gases	0.50	

# Performance characteristic Promass S

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output. The additional measured error at the current output is typically  $\pm 5~\mu A$ . Design fundamentals  $\rightarrow ~ \stackrel{\triangle}{=}~ 127$ .

- Mass flow and volume flow (liquids):  $\pm 0.10\%$  o.r.
- Mass flow (gases):  $\pm 0.50\%$  o.r.
- Density (liquids)
- Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
- Field density calibration: ±0.0005 g/cm<sup>3</sup>
   (valid after field density calibration under process conditions)
- Standard density calibration:  $\pm 0.01$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow$   $\stackrel{\triangle}{=}$  131)
- Special density calibration:  $\pm 0.002$  g/cm<sup>3</sup> (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0.0 to 2.0 g/cm<sup>3</sup>)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

#### Zero point stability

DN		Zero point stability		
[mm]	[inch]	[kg/h] or [l/h]	[lb/min]	
8	3/8	0.20	0.007	
15	1/2	0.65	0.024	
25	1	1.80	0.066	
40	11/2	4.50	0.165	
50	2	7.00	0.257	

## Example for max. measured error

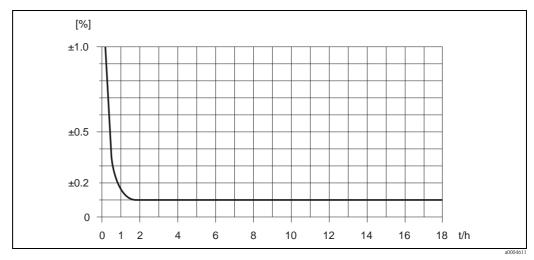


Fig. 49: Max. measured error in % o.r. (example: Promass S, DN 25)

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# Flow values (example)

Turn down	Flow		Maximum measured error	
	[kg/h] [lb/min]		[% o.r.]	
250 : 1	72	2.646	2.50	
100:1	180	6.615	1.00	
25:1	720	26.46	0.25	
10:1	1800	66.15	0.10	
2:1	9000	330.75	0.10	

Design fundamentals  $\rightarrow 127$ 

## Repeatability

Design fundamentals  $\rightarrow 127$ .

■ Mass flow and volume flow (liquids):  $\pm 0.05\%$  o.r.

■ Mass flow (gases):  $\pm 0.25\%$  o.r.

■ Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>

■ Temperature:  $\pm 0.25$  °C  $\pm 0.0025$  · T °C;  $\pm 0.5$  °F  $\pm 0.0015$  · (T - 32) °F

#### Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

#### Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN		
[mm]	[inch]	[% o.r./bar]
8	3/8	-0.002
15	1/2	-0.006
25	1	-0.005
40	11/2	-0.005
50	2	-0.005

## Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error:  $\pm$  (Zero point stability  $\div$  measured value)  $\cdot$  100% o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · (Zero point stability ÷ measured value) · 100% o.r.

Base accuracy for		
Mass flow liquids	0.10	
Volume flow liquids	0.10	
Mass flow gases	0.50	

# Performance characteristic Promass X

o.r. = of reading;  $1 \text{ g/cm}^3 = 1 \text{ kg/l}$ ; T = medium temperature

#### Maximum measured error

The following values refer to the pulse/frequency output. The additional measured error at the current output is typically  $\pm 5~\mu A$ . Design fundamentals  $\rightarrow ~ \stackrel{\triangle}{=}~ 129$ .

- Mass flow and volume flow (liquids): ±0.05% o.r. (PremiumCal, for mass flow) ±0.10% o.r.
- Density (liquids)
  - Reference conditions:  $\pm 0.0005$  g/cm<sup>3</sup>
  - Field density calibration:  $\pm 0.0005~g/cm^3$  (valid after field density calibration under process conditions)
  - Standard density calibration:  $\pm 0.01$  g/cm<sup>3</sup> (valid over the entire temperature range and density range  $\rightarrow \stackrel{\triangle}{=} 131$ )
- Special density calibration:  $\pm 0.001$  g/cm³ (optional, valid range: +5 to +80 °C (+41 to +176 °F) and 0.0 to 2.0 g/cm³)
- Temperature:  $\pm 0.5$  °C  $\pm 0.005 \cdot$  T °C;  $\pm 1$  °F  $\pm 0.003 \cdot$  (T 32) °F

## Zero point stability

DN		Zero point stability Promass F (Standard)		
[mm] [inch]		[kg/h] or [l/h] [lb/min]		
350	14	175	6.42	

## Example for max. measured error

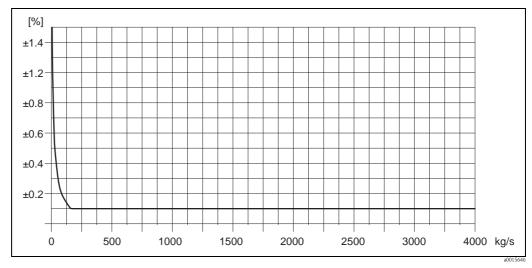


Fig. 50: Max. measured error in % o.r. (example: Promass 83X, DN 350)

## Flow values (example)

Turn down	Flow		Maximum measured error	
	[kg/h] [lb/min]		[% o.r.]	
500 : 1	8200	1.323	2.1	
100:1	41 000	6.615	0.4	
25:1	164 000	26.46	0.1	
10:1	410 000	66.15	0.1	
2:1	2 050 000	330.75	0.1	

Design fundamentals → 129

#### Repeatability

Design fundamentals  $\rightarrow 129$ .

- Mass flow and volume flow (liquids): ±0.025% o.r. (PremiumCal, for mass flow) ±0.05% o.r.
- Density (liquids):  $\pm 0.00025$  g/cm<sup>3</sup>
- Temperature:  $\pm 0.25$  °C  $\pm 0.0025 \cdot$  T °C;  $\pm 0.5$  °F  $\pm 0.0015 \cdot$  (T 32) °F

## Influence of medium temperature

When there is a difference between the temperature for zero point adjustment and the process temperature, the typical measured error of the sensor is  $\pm 0.0002\%$  of the full scale value / °C ( $\pm 0.0001\%$  of the full scale value/°F).

#### Influence of medium pressure

The table below shows the effect on accuracy of mass flow due to a difference between calibration pressure and process pressure.

DN		Promass F (standard)
[mm] [inch]		[% o.r./bar]
350	14	-0.009

#### Design fundamentals

Dependent on the flow:

- Flow  $\geq$  Zero point stability  $\div$  (Base accuracy  $\div$  100)
  - Max. measured error: ±Base accuracy in % o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · Base accuracy in % o.r.
- Flow < Zero point stability ÷ (Base accuracy ÷ 100)
  - Max. measured error: ± (Zero point stability ÷ measured value) ⋅ 100% o.r.
  - Repeatability:  $\pm \frac{1}{2}$  · (Zero point stability ÷ measured value) · 100% o.r.

Base accuracy for		
Mass flow liquids, PremiumCal	0.05	
Mass flow liquids	0.10	
Volume flow liquids	0.10	

10.1.7	Operating	conditions:	Installation
--------	-----------	-------------	--------------

	operation in the second			
Installation instructions	→ <b>1</b> 14			
Inlet and outlet runs	There are no installation requirements regarding inlet and outlet runs.			
Length of connecting cable, remote version	max. 20 m (65 ft)			
System pressure	→ 🖹 15			
	10.1.8 Operating conditions: Environment			
Ambient temperature range	Sensor and transmitter  Standard: -20 to +60 °C (-4 to +140 °F)  Optional: -40 to +60 °C (-40 to +140 °F)			
	Note! ■ Install the device at a shady location. Avoid direct sunlight, particularly in warm climatic regions. ■ At ambient temperatures below –20 °C (–4 °F) the readability of the display may be impaired.			
Storage temperature	-40 to +80 °C (-40 to +175 °F); preferably at +20 °C (+68 °F)			
Degree of protection	Standard: IP 67 (NEMA 4X) for transmitter and sensor			
Shock resistance	According to IEC 60068-2-31			
Vibration resistance	Acceleration up to 1 g, 10 to 150 Hz, following IEC 60068-2-6			
CIP cleaning	Yes			
SIP cleaning	Yes			
Electromagnetic compatibility	To IEC/EN 61326 and NAMUR Recommendation NE 21			

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(EMC)

# 10.1.9 Operating conditions: Process

## Medium temperature range

#### Sensor:

Promass F, A, P:

-50 to +200 °C (-58 to +392 °F)

*Promass F (high-temperature version):* 

-50 to +350 °C (-58 to +662 °F)

#### Promass H:

- Zirconium 702/R 60702: -50 to +200 °C (-58 to +392 °F)
- Tantalum 2.5W: -50 to +150 °C (-58 to +302 °F)

## Promass M, I, S:

-50 to +150 °C (-58 to +302 °F)

#### Promass E:

-40 to +140 °C (-40 to +284 °F)

#### Promass O

-40 to +200 °C (-40 to +392 °F)

#### Promass X

-50 to +180 °C (-40 to +356 °F)

#### Seals:

Promass F, E, H, I, S, P, O, X:

No internal seals

## Promass M:

Viton: -15 to +200 °C ( -5 to +392 °F)

EPDM: -40 to +160 °C (-40 to +320 °F)

Silicon: -60 to +200 °C (-76 to +392 °F)

Kalrez: -20 to +275 °C (-4 to +527 °F);

FEP sheathed (not for gas applications): -60 to +200 °C (-76 to +392 °F)

## Promass A

No seals inlying.

Only for mounting sets with threaded connections:

Viton: -15 to +200 °C (-5 to +392 °F)

EPDM: -40 to +160 °C (-40 to +320 °F)

Silicon: -60 to +200 °C (-76 to +392 °F)

Kalrez: -20 to +275 °C (-4 to +527 °F);

Fluid density range

0 to 5000 kg/m $^3$  (0 to 312 lb/cf)

Limiting medium pressure range (rated pressure)

Pressure ranges of secondary containment:

#### Promass A:

25 bar (362) psi

#### Promass E:

No secondary containment

#### Promass F:

DN 8 to 50 (3/8" to 2"): 40 bar (580 psi) DN 80 (3"): 25 bar (362 psi) DN 100 to 150 (4" to 6"): 16 bar (232 psi) DN 250(10"): 10 bar (145 psi)

#### Promass H:

■ Zirconium 702/R 60702: DN 8 to 15 (3/8" to ½"): 25 bar (362 psi) DN 25 to 50 (1" to 2"): 16 bar (232 psi)

■ Tantalum 2.5W: DN 8 to 25 (3/8" to 1"): 25 bar (362 psi) DN 40 to 50 (1½" to 2"): 16 bar (232 psi)

#### Promass I:

40 bar (580 psi)

#### Promass M:

100 bar (1450 psi)

## Promass P:

DN 8 to 25 (3/8" to 1"): 25 bar (362 psi) DN 40 (1½"): 16 bar (232 psi) DN 50 (2"): 10 bar (145 psi)

#### Promass S:

DN 8 to 40 (3/8" to  $1\frac{1}{2}$ "): 16 bar (232 psi) DN 50 (2"): 10 bar (145 psi)

#### Promass O:

16 bar (232 psi)

## Promass X:

Type approved, maximum allowable pressure according to ASME BPVC: 6 bar (87 psi)

#### Limiting flow

See the "Measuring range" section  $\rightarrow$  Page 101 ff.

Select nominal diameter by optimizing between required flow range and permissible pressure loss. See the "Measuring range" section for a list of max. possible full scale values.

- The minimum recommended full scale value is approx. 1/20 of the max. full scale value.
- In most applications, 20 to 50% of the maximum full scale value can be considered ideal.
- Select a lower full scale value for abrasive substances such as liquids with entrained solids (flow velocity < 1 m/s (3 ft/s)).
- For gas measurement the following rules apply:
  - Flow velocity in the measuring tubes should not be more than half the sonic velocity (0.5 Mach).
  - The maximum mass flow depends on the density of the gas: formula  $\rightarrow 101$

#### Pressure loss (SI units)

Pressure loss depends on the properties of the fluid and on its flow. The following formulas can be used to approximately calculate the pressure loss:

Pressure loss formulas for Promass F, M, E

Reynolds number	$Re = \frac{2 \cdot \dot{m}}{\pi \cdot d \cdot v \cdot \rho}$		
	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86} \label{eq:deltaparameters}$		
Re > 2.300 <sup>1</sup> )	Promass F DN 250		
Re 2 2300 /	$\Delta p = K \cdot \left[ 1 - a + \frac{a}{e^{b \cdot (v - 10^{-6})}} \right] \cdot v^{0.25} \cdot \dot{m}^{1.85} \cdot \rho^{-0.86}$		
	a0012135		
Re < 2300	$\Delta p = K1 \cdot v \cdot \dot{m} + \frac{K2 \cdot v^{0.25} \cdot \dot{m}^2}{\rho}$		
	a0004628		
$ \begin{aligned} \Delta p &= \text{pressure loss [mbar]} \\ \nu &= \text{kinematic viscosity [m2/s]} \\ \dot{\mathbf{m}} &= \text{mass flow [kg/s]} \\ \rho &= \text{fluid density [kg/m3]} \end{aligned} $	d = inside diameter of measuring tubes [m] K to $K2$ = constants (depending on nominal diameter) a = 0.3 b = 91000		
To compute the pressure loss for gases, always use the formula for Re $\geq$ 2300.			

## Pressure loss formulas for Promass H, I, S, P

Reynolds number	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot \dot{d} \cdot \dot{v} \cdot \dot{\rho}}$	a0003381	
Re ≥ 2300 <sup>1)</sup>	$\Delta p = K \cdot v^{0.25} \cdot \dot{\mathbf{m}}^{1.75} \cdot \rho^{-0.75} + \frac{K3 \cdot \dot{\mathbf{m}}^2}{\rho}$	a0004631	
Re < 2300	$\Delta p = K1 \cdot v \cdot \dot{m} + \frac{K3 \cdot \dot{m}^2}{\rho}$	a0004633	
$\begin{split} \Delta p &= \text{pressure loss [mbar]} \\ \nu &= \text{kinematic viscosity } [\text{m}^2/\text{s}] \\ \dot{\boldsymbol{m}} &= \text{mass flow } [\text{kg/s}] \end{split}$	$\begin{array}{l} \rho = \text{fluid density } [kg/m^3] \\ d = \text{inside diameter of measuring tubes } [m] \\ K \text{ to } K3 = \text{constants (depending on nominal diameter)} \end{array}$		
$^{1)}$ To compute the pressure loss for gases, always use the formula for Re $\geq$ 2300.			

# Pressure loss formulas for Promass A

Reynolds number	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot d \cdot \nu \cdot \rho}$		
	40003301		
$Re \ge 2300^{1)}$	$\Delta p = K \cdot \nu^{0.25} \cdot \dot{\mathbf{m}}^{1.75} \cdot \rho^{-0.75}$		
	a0003380		
Re < 2300	$\Delta p = K1 \cdot v \cdot \dot{m}$		
	a0003379		
$\Delta p = pressure loss [mbar]$	$\rho = \text{density } [\text{kg/m}^3]$		
$v = \text{kinematic viscosity } [\text{m}^2/\text{s}]$	d = inside diameter of measuring tubes [m]		
$\dot{\mathbf{m}} = \text{mass flow [kg/s]}$	K to $K1 = constants$ (depending on nominal diameter)		
<sup>1)</sup> To compute the pressure loss for gases, always use the formula for Re $\geq$ 2300.			

# Pressure loss formulas for Promass O, X

Reynolds number	$Re = \frac{4 \cdot \dot{m}}{\pi \cdot d \cdot v \cdot \rho \cdot n}$ A0015582
Pressure loss	$\Delta p = \left(A_0 + A_1 \cdot Re^{A_2}\right)^{1/A_3} \cdot \frac{1}{\rho} \cdot \left(\frac{2 \cdot \dot{m}}{5 \cdot \pi \cdot n \cdot d^2}\right)^2$
$\begin{split} \Delta p &= \text{pressure loss [mbar]} \\ \mathbf{v} &= \text{kinematic viscosity } [\text{m}^2/\text{s}] \\ \dot{\mathbf{m}} &= \text{mass flow } [\text{kg/s}] \\ \rho &= \text{density } [\text{kg/m}^3] \end{split}$	$d=$ inside diameter of measuring tubes [m] $A_0$ to $A_3=$ constants (depending on nominal diameter) $n=$ number of tubes

# Pressure loss coefficient for Promass F

DN	d[m]	K	K1	K2
8	5.35 · 10 <sup>-3</sup>	$5.70 \cdot 10^7$	9.60 ·10 <sup>7</sup>	1.90 · 10 <sup>7</sup>
15	8.30 · 10 <sup>-3</sup>	5.80 · 10 <sup>6</sup>	1.90 · 10 <sup>7</sup>	10.60 · 10 <sup>5</sup>
25	12.00 · 10 <sup>-3</sup>	1.90 · 10 <sup>6</sup>	6.40 · 10 <sup>6</sup>	4.50 · 10 <sup>5</sup>
40	17.60 · 10 <sup>-3</sup>	$3.50 \cdot 10^{5}$	1.30 · 10 <sup>6</sup>	1.30 · 10 <sup>5</sup>
50	26.00 · 10 <sup>-3</sup>	7.00 · 10 <sup>4</sup>	5.00 · 10 <sup>5</sup>	1.40 · 10 <sup>4</sup>
80	40.50 · 10 <sup>-3</sup>	1.10 · 10 <sup>4</sup>	7.71 · 10 <sup>4</sup>	1.42 · 10 <sup>4</sup>
100	51.20 · 10 <sup>-3</sup>	$3.54 \cdot 10^{3}$	$3.54 \cdot 10^4$	$5.40 \cdot 10^3$
150	68.90 · 10 <sup>-3</sup>	1.36 · 10 <sup>3</sup>	2.04 · 10 <sup>4</sup>	$6.46 \cdot 10^2$
250	$102.26 \cdot 10^{-3}$	$3.00 \cdot 10^2$	6.10 · 10 <sup>3</sup>	$1.33 \cdot 10^{2}$

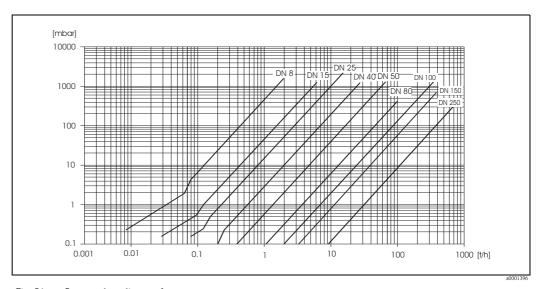


Fig. 51: Pressure loss diagram for water

# Pressure loss coefficient for Promass M

DN	d[m]	К	K1	K2	
8	5.53 · 10 <sup>-3</sup>	5.2 · 10 <sup>7</sup>	8.6 ·10 <sup>7</sup>	1.7 · 10 <sup>7</sup>	
15	8.55 · 10 <sup>-3</sup>	5.3 · 10 <sup>6</sup>	$1.7 \cdot 10^{7}$	9.7 · 10 <sup>5</sup>	
25	11.38 · 10 <sup>-3</sup>	1.7 · 10 <sup>6</sup>	5.8 · 10 <sup>6</sup>	4.1 · 10 <sup>5</sup>	
40	17.07 · 10 <sup>-3</sup>	$3.2 \cdot 10^{5}$	1.2 · 106	1.2 · 10 <sup>5</sup>	
50	25.60 · 10 <sup>-3</sup>	6.4 · 10 <sup>4</sup>	4.5 · 10 <sup>5</sup>	1.3 · 10 <sup>4</sup>	
80	38.46 · 10 <sup>-3</sup>	1.4 · 10 <sup>4</sup>	8.2 · 10 <sup>4</sup>	3.7 · 10 <sup>4</sup>	
High pressure version	High pressure version				
8	$4.93 \cdot 10^{-3}$	$6.0 \cdot 10^{7}$	1.4 · 108	$2.8 \cdot 10^{7}$	
15	$7.75 \cdot 10^{-3}$	8.0 · 10 <sup>6</sup>	2.5 ·10 <sup>7</sup>	1.4 · 10 <sup>6</sup>	
25	10.20 · 10 <sup>-3</sup>	2.7 · 10 <sup>6</sup>	8.9 · 10 <sup>6</sup>	6.3 · 10 <sup>5</sup>	

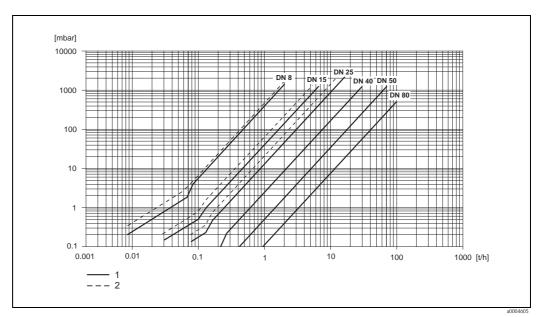


Fig. 52: Pressure loss diagram for water

- 1 Promass M
- 2 Promass M (high pressure version)

# Pressure loss coefficient for Promass E

DN	d[m]	K	K1	K2
8	5.35 · 10 <sup>-3</sup>	5.70 · 10 <sup>7</sup>	7.91 ·10 <sup>7</sup>	$2.10 \cdot 10^{7}$
15	8.30 · 10 <sup>-3</sup>	7.62 · 10 <sup>6</sup>	$1.73 \cdot 10^{7}$	2.13 · 10 <sup>6</sup>
25	12.00 · 10 <sup>-3</sup>	1.89 · 10 <sup>6</sup>	4.66 · 10 <sup>6</sup>	6.11 · 10 <sup>5</sup>
40	17.60 · 10 <sup>-3</sup>	4.42 · 10 <sup>5</sup>	1.35 · 10 <sup>6</sup>	1.38 · 10 <sup>5</sup>
50	26.00 · 10 <sup>-3</sup>	8.54 · 10 <sup>4</sup>	4.02 · 10 <sup>5</sup>	2.31 · 10 <sup>4</sup>
80	40.50 · 10 <sup>-3</sup>	1.44 · 10 <sup>4</sup>	5.00 · 10 <sup>4</sup>	2.30 · 10 <sup>4</sup>

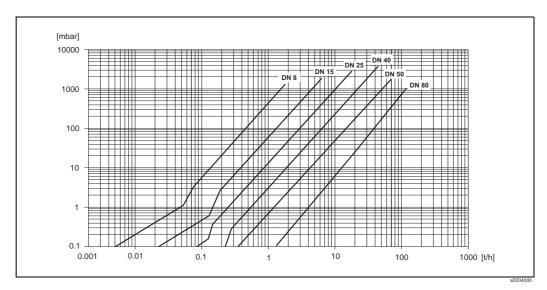


Fig. 53: Pressure loss diagram for water

# Pressure loss coefficient for Promass A

DN	d[m]	K	K1
1	1.1 · 10 <sup>-3</sup>	1.2 · 1011	1.3 ·10 <sup>11</sup>
2	$1.8 \cdot 10^{-3}$	1.6 · 10 <sup>10</sup>	2.4 · 10 <sup>10</sup>
4	$3.5 \cdot 10^{-3}$	9.4 · 10 <sup>8</sup>	2.3 · 10 <sup>9</sup>
High pressure version			
2	$1.4 \cdot 10^{-3}$	5.4 · 10 <sup>10</sup>	6.6 · 10 <sup>10</sup>
4	$3.0 \cdot 10^{-3}$	2.0 · 10 <sup>9</sup>	4.3 · 10 <sup>9</sup>

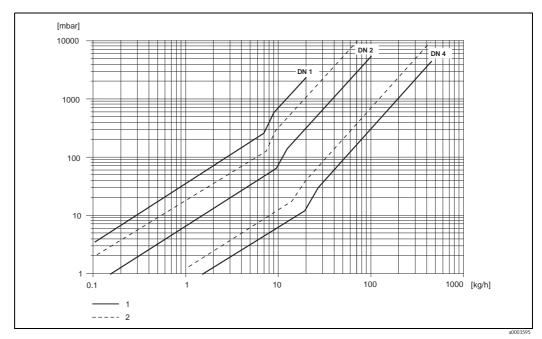


Fig. 54: Pressure loss diagram for water

- 1 Standard version
- 2 High pressure version

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# Pressure loss coefficient for Promass H

DN	d[m]	K	K1	К3					
8	8.51 · 10 <sup>-3</sup>	8.04 · 10 <sup>6</sup>	$3.28 \cdot 10^{7}$	1.15 · 10 <sup>6</sup>					
15	12.00 · 10 <sup>-3</sup>	1.81 · 10 <sup>6</sup>	9.99 · 10 <sup>6</sup>	1.87 · 10 <sup>5</sup>					
25	17.60 · 10 <sup>-3</sup>	3.67 · 10 <sup>5</sup>	2.76 · 10 <sup>6</sup>	4.99 · 10 <sup>4</sup>					
40	25.50 · 10 <sup>-3</sup>	8.75 · 10 <sup>4</sup>	8.67 · 10 <sup>5</sup>	1.22 · 10 <sup>4</sup>					
50	40.5 · 10 <sup>-3</sup>	1.35 · 10 <sup>4</sup>	1.72 · 10 <sup>5</sup>	1.20 · 10 <sup>3</sup>					
Pressure loss data inclu-	Pressure loss data includes interface between measuring tube and piping								

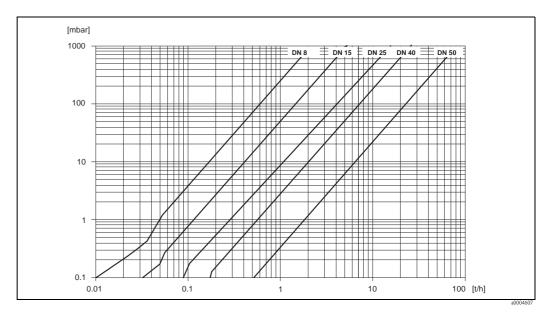


Fig. 55: Pressure loss diagram for water

# Pressure loss coefficient for Promass I

DN	d[m]	K	K1	К3
8	8.55 · 10 <sup>-3</sup>	8.1 · 10 <sup>6</sup>	3.9 ·10 <sup>7</sup>	129.95 · 10 <sup>4</sup>
15	11.38 · 10 <sup>-3</sup>	2.3 · 10 <sup>6</sup>	$1.3 \cdot 10^{7}$	23.33 · 10 <sup>4</sup>
15 <sup>1)</sup>	17.07 · 10 <sup>-3</sup>	4.1 · 10 <sup>5</sup>	3.3 · 10 <sup>6</sup>	0.01 · 10 <sup>4</sup>
25	17.07 · 10 <sup>-3</sup>	4.1 · 10 <sup>5</sup>	3.3 · 10 <sup>6</sup>	5.89 · 10 <sup>4</sup>
25 <sup>1)</sup>	26.4 · 10 <sup>-3</sup>	7.8 · 10 <sup>4</sup>	8.5 · 10 <sup>5</sup>	0.11 · 10 <sup>4</sup>
40	26.4 · 10 <sup>-3</sup>	7.8 · 10 <sup>4</sup>	8.5 · 10 <sup>5</sup>	1.19 · 10 <sup>4</sup>
40 1)	35.62 · 10 <sup>-3</sup>	1.3 · 104	2.0 · 10 <sup>5</sup>	0.08 · 10 <sup>4</sup>
50	35.62 · 10 <sup>-3</sup>	1.3 · 10 <sup>4</sup>	2.0 · 10 <sup>5</sup>	0.25 · 10 <sup>4</sup>
50 1)	54.8 · 10 <sup>-3</sup>	$2.3 \cdot 10^{3}$	5.5 · 10 <sup>4</sup>	$1.0 \cdot 10^2$
80	54.8 · 10 <sup>-3</sup>	$2.3 \cdot 10^{3}$	5.5 · 10 <sup>4</sup>	$3.5 \cdot 10^{2}$

Pressure loss data includes interface between measuring tube and piping

<sup>1)</sup> DN 15, 25, 40, 50 "FB" = Full bore versions of Promass I

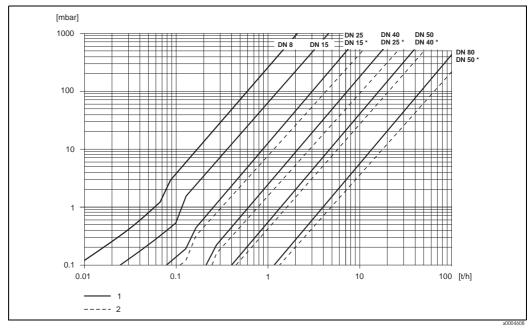


Fig. 56: Pressure loss diagram for water

- 1 Standard versions
- 2 Full bore versions (\*)

# Pressure loss coefficient for Promass S, P

DN	d[m]	K	K1	К3						
8	8.31 · 10 <sup>-3</sup>	8.78 · 10 <sup>6</sup>	3.53 ·10 <sup>7</sup>	1.30 · 10 <sup>6</sup>						
15	12.00 · 10 <sup>-3</sup>	1.81 · 10 <sup>6</sup>	9.99 · 10 <sup>6</sup>	1.87 · 10 <sup>5</sup>						
25	17.60 · 10 <sup>-3</sup>	3.67 · 10 <sup>5</sup>	2.76 · 10 <sup>6</sup>	4.99 · 10 <sup>4</sup>						
40	26.00 · 10 <sup>-3</sup>	8.00 · 10 <sup>4</sup>	7.96 · 10 <sup>5</sup>	1.09 · 10 <sup>4</sup>						
50	40.50 · 10 <sup>-3</sup>	1.41 · 10 <sup>4</sup>	1.85 · 10 <sup>5</sup>	$1.20 \cdot 10^3$						
Pressure loss data inclu-	Pressure loss data includes interface between measuring tube and piping									

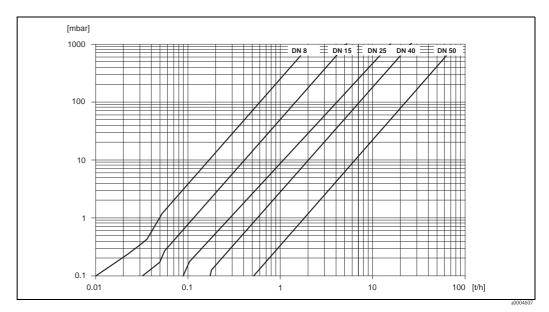


Fig. 57: Pressure loss diagram for water

# Pressure loss coefficient for Promass O

Γ	N	d[mm]	٨	٨	٨	۸	
[mm]	[inch]	ալուույ	$\mathbf{A}_0$	$\mathbf{A}_1$	$\mathbf{A}_2$	$\mathbf{A}_3$	
80	3	38.5	0.72	4.28	- 0.36	0.24	
100	4	49.0	0.70	3.75	- 0.35	0.22	
150	6	66.1	0.75	2.81	- 0.33	0.19	

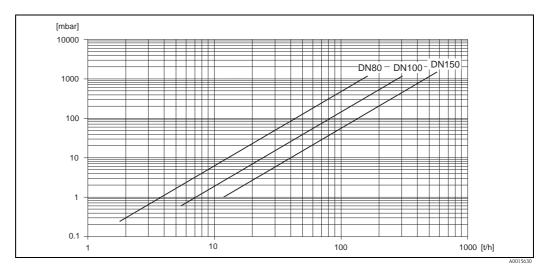


Fig. 58: Pressure loss diagram for water

# Pressure loss coefficient for Promass X

D	N	d[mm]	٨	٨	٨	٨
[mm]	[inch]	$\mathbf{a}_{0}$		$\mathbf{A}_1$	<b>A</b> <sub>2</sub>	<b>A</b> 3
350	14	102.3	0.76	3.80	- 0.33	0.23

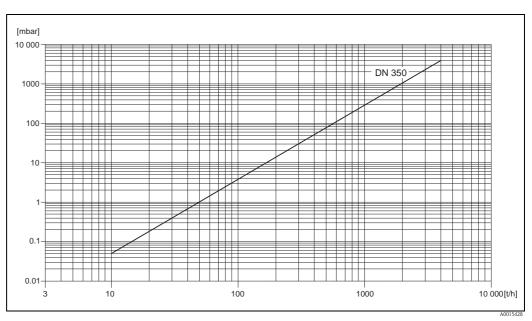


Fig. 59: Pressure loss diagram for water

Pressure loss (US units)

Pressure loss is dependent on fluid properties nominal diameter. Consult Endress+Hauser for Applicator PC software to determine pressure loss in US units. All important instrument data is contained in the Applicator software program in order to optimize the design of measuring system. The software is used for following calculations:

- Nominal diameter of the sensor with fluid characteristics such as viscosity, density, etc.
- Pressure loss downstream of the measuring point.
- Converting mass flow to volume flow, etc.
- Simultaneous display of various meter size.
- Determining measuring ranges.

The Applicator runs on any IBM compatible PC with windows.

# 10.1.10 Mechanical construction

# Design / dimensions

The dimensions and lengths of the sensor and transmitter are provided in the separate "Technical Information" document on the device in question. This can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in the "Documentation" section  $\rightarrow \stackrel{\text{\tiny le}}{\rightarrow} 152$ .

# Weight

■ Compact version: see table below

■ Remote version

- Sensor: see table below

- Wall-mount housing: 5 kg (11 lb)

Weight (SI units)

All values (weight) refer to devices with flanges according to EN/DIN PN 40. Weight data in [lb].

Promass F / DN	8	15	25	40	50	80	100	150	250*
Compact version	11	12	14	19	30	55	96	154	400
Compact version, high-temperature	=	-	14.7	=	30.7	55.7	-	-	-
Remote version	9	10	12	17	28	53	94	152	398
Remote version, high-temperature	=	-	13.5	=	29.5	54.5	-	-	-
* With 10" according to ASME B16.5 Cl 300 flanges									

Promass M / DN	8	15	25	40	50	80
Compact version	11	12	15	24	41	67
Remote version	9	10	13	22	39	65

Promass E / DN	8	15	25	40	50	80
Compact version	8	8	10	15	22	31
Remote version	6	6	8	13	20	29

Promass A / DN	1	2	4
Compact version	10	11	15
Remote version	8	9	13

Promass H / DN	8	15	25	40	50
Compact version	12	13	19	36	69
Remote version	10	11	17	34	67

Promass I / DN	8	15	15FB	25	25FB	40	40FB	50	50FB	80
Compact version	13	15	21	22	41	42	67	69	120	124
Remote version	11	13	19	20	38	40	65	67	118	122
"FB" = Full bore versions of Promass I										

Promass S / DN	8	15	25	40	50
Compact version	13	15	21	43	80
Remote version	11	13	19	41	78

Promass P / DN	8	15	25	40	50
Compact version	13	15	21	43	80
Remote version	11	13	19	41	78

Promass O / DN 1)	80	100	150
Compact version	75	141	246
Remote version	73	139	244

<sup>1)</sup> with Cl 900 flanges according to ASME

Promass X / DN 1)	350
Compact version	555
Remote version	553

<sup>1)</sup> with 12" according to ASME B16.5 Cl 150 flanges

# Weight (US units)

All values (weight) refer to devices with EN/DIN PN 40 flanges. Weight data in [lb].

Promass F / DN	3/8"	1/2"	1"	1 ½"	2"	3"	4"	6"	10"*
Compact version	24	26	31	42	66	121	212	340	882
Compact version, high-temperature	-	_	32	-	68	123	_	-	_
Remote version	20	22	26	37	62	117	207	335	878
Remote version, high-temperature 30 - 65 120									-
* With 10" according to ASME B16.5 Cl 300 flanges									

Promass M / DN	3/8"	1/2"	1	1 ½"	2"	3"
Compact version	24	26	33	53	90	148
Remote version	20	22	29	49	86	143

Promass E / DN	3/8"	1/2"	1	1 ½"	2"	3"
Compact version	18	18	22	33	49	69
Remote version	13	13	18	29	44	64

Promass A / DN	1/24"	1/12"	1/8"
Compact version	22	24	33
Remote version	18	20	29

Promass H / DN	3/8"	1/2"	1	1 ½"	2"
Compact version	26	29	42	79	152
Remote version	22	24	37	75	148

Promass I / DN	3/8"	1/2"	1/2"FB	1 ½"	1 ½"FB	3/8"	3/8"FB	1	1FB	2"
Compact version	29	33	46	49	90	93	148	152	265	273
Remote version	24	29	42	44	86	88	143	148	260	269
"FB" = Full bore versions of Promass I										

Promass S / DN	3/8"	1/2"	1	1 ½"	2"
Compact version	29	33	46	95	176
Remote version	24	29	42	90	172

Promass P / DN	3/8"	1/2"	1	1 ½"	2"
Compact version	29	33	46	95	176
Remote version	24	29	42	90	172

Promass O / DN 1)	3"	4"	6"
Compact version	165	311	542
Remote version	161	306	538

<sup>1)</sup> with Cl 900 flanges according to ASME

Promass X / DN 1)	350
Compact version	1224
Remote version	1219

 $<sup>^{1)}</sup>$  with 12" according to ASME B16.5 Cl 150 flanges

# Material

# Transmitter housing:

- Compact version
  - Compact version: powder coated die-cast aluminum  $\,$
  - Stainless steel housing: stainless steel 1.4404/CF3M  $\,$
  - Window material: glass or polycarbonate
- Remote version
  - Remote field housing: powder coated die-cast aluminum
  - Wall-mount housing: powder coated die-cast aluminum
  - Window material: glass

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# Sensor housing / containment:

## Promass F:

- Acid- and alkali-resistant outer surface
- Stainless steel 1.4301/1.4307/304L

## Promass M:

- Acid- and alkali-resistant outer surface
- DN 8 to 50 (3/8" to 2"): steel, chemically nickel-plated
- DN 80 (3"): stainless steel

# Promass E, A, H, I, S, P:

- Acid- and alkali-resistant outer surface
- Stainless steel 1.4301/304

# Promass X, O:

- Acid- and alkali-resistant outer surface
- Stainless steel 1.4404/316L

# Connection housing, sensor (remote version):

- Stainless steel 1.4301/304 (standard, not Promass X)
- Powder coated die-cast aluminum (high-temperature version and version for heating)

# Process connections

# Promass F:

- Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220 → stainless steel 1.4404/316L
- Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220 → Alloy C-22 2.4602/N 06022
- DIN 11864-2 Form A (flat flange with groove)  $\rightarrow$  stainless steel 1.4404/316L
- Threaded hygienic connections DIN 11851/ DIN 11864-1, Form A / ISO 2853 / SMS 1145 → stainless steel 1.4404/316L
- Tri-Clamp (OD-tubes) → stainless steel 1.4404/316L
- VCO connection → stainless steel 1.4404/316L

# *Promass F (high-temperature version):*

- Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220 → stainless steel 1.4404/316L
- Flanges according to EN 1092–1 (DIN 2501) / according to ASME B16.5 / JIS B2220  $\rightarrow$  Alloy C-22 2.4602 (N 06022)

#### Promass M:

- Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220
   → stainless steel 1.4404/316L, titanium grade 2
- DIN 11864-2 Form A (flat flange with groove)  $\rightarrow$  stainless steel 1.4404/316L
- PVDF connection to DIN / ASME / JIS
- Threaded hygienic connections DIN 11851/ DIN 11864-1, Form A / ISO 2853 / SMS 1145 → stainless steel 1.4404/316L
- Tri-Clamp (OD-tubes)  $\rightarrow$  stainless steel 1.4404/316L

## *Promass M (high pressure version):*

- Connector → stainless steel 1.4404/316L
- Couplings  $\rightarrow$  stainless steel 1.4401/316

#### Promass E:

- Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220
   → stainless steel 1.4404/316L
- DIN 11864-2 Form A (flat flange with groove)  $\rightarrow$  stainless steel 1.4404/316L
- VCO connection → stainless steel 1.4404/316L
- Threaded hygienic connections DIN 11851/ DIN 11864-1, Form A / ISO 2853 / SMS 1145 → stainless steel 1.4404/316L
- Tri-Clamp (OD-tubes) → stainless steel 1.4404/316L

## Promass A:

- Mounting set for flanges EN 1092-1 (DIN 2501) / ASME B16.5 / JIS B2220

   → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022.
   Loose flanges → stainless steel 1.4404/316L
- VCO coupling → stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022
- Tri-Clamp (OD-tubes) (1/2") → stainless steel 1.4539/904L
- Mounting set for SWAGELOK  $(1/4", 1/8") \rightarrow$  stainless steel 1.4401/316
- Mounting set for NPT-F (1/4")  $\rightarrow$  stainless steel 1.4539/904L1.4539/904L, Alloy C-22 2.4602/N 06022

# Promass H:

■ Flanges EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220 → stainless steel 1.4301/304, parts in contact with medium: zirconium 702/R 60702 or tantalum 2.5W

# Promass I:

- Flanges EN 1092-1 (DIN 2501) / according to ASME B16.5 / JIS B2220 → stainless steel 1.4301/304
- DIN 11864-2 Form A (flat flange with groove)  $\rightarrow$  titanium grade 2
- Threaded hygienic connection DIN 11851 / SMS 1145  $\rightarrow$  titanium grade 2
- Threaded hygienic connection ISO 2853 / DIN 11864-1  $\rightarrow$  titanium grade 2
- Tri-Clamp (OD-tubes)  $\rightarrow$  titanium grade 2

## Promass S:

- Flanges EN 1092-1 (DIN 2501) / JIS B2220 → stainless steel 1.4404/316/316L
- Flanges according to ASME B16.5  $\rightarrow$  stainless steel 1.4404/316/316L
- DIN 11864-2 Form A (flat flange with groove)  $\rightarrow$  stainless steel 1.4435/316L
- Threaded hygienic connections DIN 11851/ DIN 11864-1, Form A / ISO 2853 / SMS 1145 → stainless steel 1.4404/316L
- Tri-Clamp (OD-Tubes) → stainless steel 1.4435/316L
- Clamp aseptic connection DIN 11864-3, Form A  $\rightarrow$  stainless steel 1.4435/316L
- Clamp pipe connection DIN 32676/ISO 2852 → stainless steel 1.4435/316L

## Promass P:

- Flanges EN 1092-1 (DIN 2501) / JIS B2220 → stainless steel 1.4404/316/316L
- Flanges according to ASME B16.5  $\rightarrow$  stainless steel 1.4404/316/316L
- DIN 11864-2 Form A (flat flange with groove), BioConnect® → stainless steel 1.4435/316L
- Threaded hygienic connections DIN 11851/ DIN 11864-1, Form A / ISO 2853 / SMS 1145
  → stainless steel 1.4435/316L
- Tri-Clamp (OD-Tubes) → stainless steel 1.4435/316L
- Clamp aseptic connection DIN 11864-3, Form A→ stainless steel 1.4435/316L
- Clamp pipe connection DIN 32676/ISO 2852, BioConnect® → stainless steel 1.4435/316L

## Promass O:

Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5
 → stainless steel 25Cr duplex F53/EN 1.4410 (superduplex)

## Promass X:

Flanges according to EN 1092-1 (DIN 2501) / according to ASME B16.5
 → stainless steel 1.4404/316/316L

# Measuring tube(s):

## Promass F:

- DN 8 to 100 (3/8" to 4"): stainless steel 1.4539/904L; manifold: 1.4404/316L
- DN 150 (6"): stainless steel 1.4404/316L/1.4432
- DN 250 (10"): stainless steel 1.4404/316L/1.4432; manifold: CF3M
- DN 8 to 150 (3/8" to 6"): Alloy C-22 2.4602/N 06022

# *Promass F (high-temperature version):*

■ DN 25, 50, 80 (1", 2", 3"): Alloy C-22 2.4602/N 06022

# Promass M:

- DN 8 to 50 (3/8" to 2"): titanium grade 9
- DN 80 (3"): titanium grade 2

# Promass M (high pressure version):

■ Titanium grade 9

# Promass E, S:

■ Stainless steel 1.4539/904L

# Promass A:

■ Stainless steel 1.4539/904L, Alloy C-22 2.4602/N 06022

# Promass H:

- Zirconium 702/R 60702
- Tantalum 2.5W

# Promass I:

- Titanium grade 9
- Titanium grade 2 (flange disks)

## Promass P:

Stainless steel 1.4435/316L

## Promass O:

■ Stainless steel 25Cr Duplex EN 1.4410/UNS S32750 (superduplex)

## Promass X:

■ Stainless steel 1.4404/316/316L; manifold: 1.4404/316/316L

#### Seals:

Promass F, E, H, I, S, P, O, X:

Welded process connections without internal seals

## Promass M:

Viton, EPDM, silicon, Kalrez 6375, FEP sheathing (not for gas applications)

## Promass A:

Welded process connections without internal seals.

Only for mounting sets with threaded connections: Viton, EPDM, Silikon, Kalrez

# Material load diagram

The material load diagrams (pressure-temperature diagrams) for the process connections are provided in the separate "Technical Information" document on the device in question. This can be downloaded as a PDF file from www.endress.com. A list of the "Technical Information" documents available is provided in the "Documentation" section  $\rightarrow \blacksquare 152$ .

# Process connections

 $\rightarrow$  Page 138 ff.

# 10.1.11 Operability

# Display elements

- Liquid crystal display: illuminated, four lines with 16 characters per line
- Selectable display of different measured values and status variables
- At ambient temperatures below -20 °C (-4 °F) the readability of the display may be impaired.

# Operating elements

- Local operation with three optical sensors (-/+/=)
- Application-specific Quick Setup menus for straightforward commissioning

# Language groups

Language groups available for operation in different countries:

- Western Europe and America (WEA):
   English, German, Spanish, Italian, French, Dutch and Portuguese
- Eastern Europe and Scandinavia (EES): English, Russian, Polish, Norwegian, Finnish, Swedish and Czech.
- South and East Asia (SEA): English, Japanese, Indonesian
- China (CN): English, Chinese



## Note:

You can change the language group via the operating program "FieldCare".

	10.1.12 Certificates and approvals
CE mark	The measuring system is in conformity with the statutory requirements of the EC Directives. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
C-tick mark	The measuring system meets the EMC requirements of the "Australian Communications and Media Authority (ACMA)".
Ex approval	Information about currently available Ex versions (ATEX, FM, CSA, IECEx, NEPSI) can be supplied by your Endress+Hauser Sales Center on request. All explosion protection data are given in a separate documentation which is also available upon request.
Sanitary compatibility	<ul> <li>3A authorization (all measuring systems, except Promass H, O and X)</li> <li>EHEDG-tested (all measuring systems, except Promass E, H, O and X)</li> </ul>
Certification FOUNDATION Fieldbus	The flowmeter has passed all the test procedures implemented and has been certified and registered by the Fieldbus Foundation. The flowmeter thus meets all the requirements of the specifications listed below:
	<ul> <li>Certified to FOUNDATION Fieldbus specification</li> <li>The flowmeter meets all the specifications of the FOUNDATION Fieldbus-H1.</li> <li>Interoperability Test Kit (ITK), revision 5.01:         The device can also be operated in conjunction with other-make certified devices.     </li> <li>Physical Layer Conformance Test by Fieldbus Foundation</li> </ul>
Pressure equipment directive	■ With the identification PED/G1/III on the sensor nameplate, Endress+Hauser confirms conformity with the "Basic safety requirements" of Appendix I of the Pressure Equipment Directive 97/23/EC.
	■ Devices without this identification (without PED) are designed and manufactured according to good engineering practice. They correspond to the requirements of Art. 3, Section 3 of the Pressure Equipment Directive 97/23/EC. Their application is illustrated in Diagrams 6 to 9 in Appendix II of the Pressure Equipment Directive 97/23/EC.
Functional safety	SIL -2: In accordance with IEC 61508/IEC 61511-1 (FDIS)
Other standards and guidelines	■ EN 60529 Degrees of protection by housing (IP code).
	■ EN 61010-1 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures.
	■ IEC/EN 61326 "Emission in accordance with requirements for Class A". Electromagnetic compatibility (EMC-requirements).
	■ NAMUR NE 21 Electromagnetic compatibility (EMC) of industrial process and laboratory control equipment.
	<ul> <li>NAMUR NE 43</li> <li>Standardization of the signal level for the breakdown information of digital transmitters with analog output signal.</li> </ul>
	■ NAMUR NE 53

Endress+Hauser 151

Software of field devices and signal-processing devices with digital electronics.

# 10.1.13 Ordering information

The Endress+Hauser service organization can provide detailed ordering information and information on specific order codes on request.

# 10.1.14 Accessories

Various accessories, which can be ordered separately from Endress+Hauser, are available for the transmitter and the sensor  $\rightarrow \stackrel{\text{le}}{\rightarrow} 74$ .

# 10.1.15 Supplementary documentation

- Flow measuring technology (FA00005D)
- Description of Device Functions Promass 83
- Supplementary documentation on Ex-ratings: ATEX, FM, CSA, IECEx NEPSI
- Technical Information
  - Promass 80A, 83A (TI00054D)
  - Promass 80E, 83E (TI00061D)
  - Promass 80F, 83F (TI00101D)
  - Promass 80H, 83H (TI00074D)
  - Promass 80I, 83I (TI00075D)
  - Promass 80M, 83M (TI00102D)
  - Promass 80P, 83P (TI00078D)
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# Declaration of Hazardous Material and De-Contamination

# Erklärung zur Kontamination und Reinigung

RA No.		lease reference the I learly on the outside Bitte geben Sie die v auch außen auf der V	of the box. If this p	procedure is not f	ollowed, it may	result in the refus	al of the package	at our facility.
and De-Contamina packaging.  Aufgrund der gese	gulations and for the safety of ation", with your signature, letzlichen Vorschriften und zentamination und Reinigung	before your orderum Schutz unse	er can be handl erer Mitarbeite	ed. Please ma r und Betrieb	ike absolutely seinrichtung	y sure to attaci en, benötigen	h it to the ou wir die unte	tside of the rschriebene
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Process data/Pro		ature / <i>Temper</i> tivity / <i>Leitfähi</i>			Pressure Viscosity	/ Druck _ /Viskosität _	[psi] _ [cp] _	[ Pa ] [mm²/s]
Medium and war Warnhinweise zum	•					$\triangle$	$\triangle$	(!)
	Medium /concentration Medium /Konzentration	Identification CAS No.	flammable entzündlich	toxic giftig	corrosive ätzend	harmful/ irritant gesundheits- schädlich/ reizend	other * sonstiges*	harmless unbedenklich
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www.endress.com/worldwide



People for Process Automation

# Fisher® FIELDVUE™ DVC6000 Digital Valve Controllers

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Device Type	03	07
Device Revision	2	2
Hardware Revision	1	1
Firmware Revision	7,9&10	7, 9 & 10
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# Note

This guide provides installation, initial setup, and calibration information for DVC6000 digital valve controllers. For additional information, refer to the DVC6000 digital valve controllers instruction manual (D102794X012), available from your Emerson Process Management sales office, or from our website at www.FIELDVUE.com.

The DVC6000 digital valve controller instruction manual (D102794X012) can be found at www.FIELDVUE.com http://www.documentation.emersonprocess.com/groups/public/documents/instruction\_manuals/d102794x012.pdf

Refer to Related Documents on page 44 for other documents containing information related to DVC6000 digital valve controllers









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Drive Signal Alert Enable	1-2-3-1-2-1	10-D	

Edit Feedback Connection   1-2-6-6   3-E     End Point Control Enable   3   1-2-2-5-1     Failure Group Enable   1-2-3-6-5-1     Filmware Revision   3-7-6   2-H     Flash ROM Shutdown   1-2-3-1-3-5   12-C     Hardware Revision   3-7-7   2-H     HART Tag   1-2-5-1-1   6-F     HART Universal Revision   3-7-9   2-H     HART Universal Revision   1-2-3-3   4-C     Instrument Date and Time   1-2-4-1-2   8-G     Instrument Level   3-7-8   2-H     Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-5-1-6   6-G     Integral Limit   1-2-2-1-2   8-B     Integrator Saturated Hi Enable   1-2-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Lag Time   1-2-2-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Led/Lag   3-7-3   3-P     Low Power Write   1-2-3-3-3   3-P     Low Power Write   1-2-3-3-3   3-P     Manual Travel Calibration   1-3-1-2   4-E     Manual Travel Calibration   1-2-5-6   4-G     Miscellaneous Group Enable   1-2-4-3-2   8-H     Multi-Drop Alert Enable   1-2-4-3-2   8-H     Multi-Drop Alert Enable   1-2-3-3-3   1-2-5     Non-Critical NVM Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test Enable   1-2-3-1-3-1   12-B     Partial Stroke Test Pressure Limit   1-2-3-6-1   10-G     Total Stroke Test Pressure Limit   1-2-3-6-1   10-G	Function/Variable	Fast-Key	Coordinates <sup>(1)</sup>	
End Point Control Enable (3)         1-2-2-2-5-1         8-D           Failure Group Enable         1-2-3-6-5-1         10-1           Firmware Revision         3-7-6         2-H           Flash ROM Shutdown         1-2-3-1-3-5         12-C           Hardware Revision         3-7-7         2-H           HART Tag         1-2-5-1-1         6-F           HART Universal Revision         3-7-9         2-H           Input Characterization         1-2-2-3         4-C           Instrument Date and Time         1-2-4-1-2         8-G           Instrument Level         3-7-8         2-H           Instrument Mode         Hot Key-1         1-A           Instrument Serial Number         1-2-5-1-6         6-G           Instrument Time Invalid Enable         1-2-4-1-1         8-G           Integral Dead Zone         1-2-4-1-1         8-G           Integral Limit         1-2-4-1-1         8-G           Integral Limit         1-2-4-4-3         8-I           Integrator Saturated Hi Enable         1-2-4-4-1         8-I           Integrator Saturated Lo Enable         1-2-4-4-1         8-I           Lag Time(5)         1-2-2-5-3         5-D           Last Calibration Status         <	·			
Failure Group Enable         1-2-3-6-5-1 / 1-2-3-7-5-1         10-1           Firmware Revision         3-7-6         2-H           Flash ROM Shutdown         1-2-3-1-3-5         12-C           Hardware Revision         3-7-7         2-H           HART Tag         1-2-5-1-1         6-F           HART Universal Revision         3-7-9         2-H           Input Characterization         1-2-2-3         4-C           Instrument Date and Time         1-2-4-1-2         8-G           Instrument Level         3-7-8         2-H           Instrument Mode         1-2-4-1-2         8-G           Instrument Serial Number         1-2-5-1-6         6-G           Instrument Time Invalid Enable         1-2-4-1-1         8-G           Integral Dead Zone         1-2-4-1-1         8-G           Integral Limit         1-2-4-4-3         8-I           Integral Limit         1-2-4-4-3         8-I           Integrator Saturated Hi Enable         1-2-4-4-1         8-I           Integrator Saturated Li Enable         1-2-4-4-1         8-I           Integrator Saturated Li Enable         1-2-2-5-3         5-D           Last Calibration Status         1-2-2-5-3         5-D           Loop Current				
Failure Group Enable   1-2-3-7-5-1   10-1	End Point Control Enable <sup>(3)</sup>		8-D	
1-2-3-7-3-1   1-2-6	Failure Group Enable		10-I	
Flash ROM Shutdown	·			
Hardware Revision 3-7-7 2-H  HART Tag 1-2-5-1-1 6-F  3-7-1 2-H  HART Universal Revision 3-7-9 2-H  Input Characterization 1-2-2-3 4-C  Instrument Date and Time 1-2-5-8 4-G  Instrument Level 1-2-5-8 4-G  Instrument Mode 1-2-5-8 4-G  Instrument Serial Number 1-2-5-1-6 6-G  Instrument Time Invalid Enable 1-2-4-1-1 8-G  Integral Dead Zone 1-2-4-4-1 8-I  Integral Limit 1-2-2-1-2 8-B  Integrator Saturated Hi Enable 1-2-4-4-1 8-I  Integrator Saturated Lo Enable 1-2-4-4-1 8-I  Lag Time(5) 1-2-2-5-3 5-D  Last Calibration Status 1-2-5-9-1 6-H  Lead/Lag(3) 1-2-2-5-3 5-D  Loop Current Validation(6) 1-2-3-1-3-2 12-B  Manual Travel Calibration 1-3-1-2 4-E  Manufacturer - instrument 1-2-6-1 3-D  Manufacturer - actuator 3-7-3 2-H  Maximum Supply Pressure 1-2-5-6 4-G  Message 1-2-5-1-2 6-F  Miscellaneous Group Enable 1-2-3-1-3-6 12-C  Non-Critical NVM Alert Enable 1-2-3-1-3-1 12-B  Partial Stroke Test Pressure Limit(3) 1-2-3-6-1 10-G				
HART Tag				
HART Tag   3-7-1   2-H     HART Universal Revision   3-7-9   2-H     Input Characterization   1-2-2-3   4-C     Instrument Date and Time   1-2-4-1-2   8-G     Instrument Level   3-7-8   2-H     Instrument Mode   1-2-5-8   4-G     Instrument Mode   1-2-11   4-B     Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-4-1-1   8-B     Integral Limit   1-2-2-1-2-1   8-B     Integral Limit   1-2-4-4-3   8-I     Integrator Saturated Hi Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-2   8-I     Lag Time (5)   1-2-2-5-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Lead/Lag(3)   1-2-2-5-3   5-D     Low Power Write   1-2-3-1-3-2   12-B     Manual Travel Calibration   1-3-1-2   4-E     Manual Travel Calibration   1-3-1-2   4-E     Manual Travel Calibration   1-2-5-6   4-G     Message   1-2-5-1-2   6-F     Miscellaneous Group Enable   1-2-4-3-2   8-H     Multi-Drop Alert Enable   1-2-3-1-3-6   12-C     Non-Critical NVM Alert Enable   1-2-3-1-3-6   12-C     Number of Power Ups   3-6-9   4-H     Offline/Failed Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test Enable(3)   1-2-7-1   3-D     Partial Stroke Test Enable(3)   1-2-3-6-1   10-G	Hardware Revision			
HART Universal Revision	HART Tag	_		
Input Characterization	HART Universal Povision			
Instrument Date and Time				
Instrument Date and Time	IIIput Cilaracterization			
Instrument Level   3-7-8   2-H     Instrument Mode   Hot Key-1   1-A     Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-4-4-4   8-I     Integral Limit   1-2-2-1-2-1   8-B     Integral Limit   1-2-4-4-3   8-I     Integrator Saturated Hi Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-2   8-I     Lag Time <sup>(5)</sup>   1-2-2-5-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Lead/Lag(3)   1-2-2-5-3   5-D     Loop Current Validation <sup>(6)</sup>   1-2-3-3-3   9-E     Low Power Write   1-2-3-1-3-2   12-B     Manual Travel Calibration   1-3-1-2   4-E     Manufacturer - instrument   1-2-6-1   3-D     Manufacturer - actuator   3-7-3   2-H     Maximum Supply Pressure   1-2-5-6   4-G     Message   1-2-5-1-2   6-F     Message   1-2-5-1-2   6-F     Miscellaneous Group Enable   1-2-3-7-5-3     Model   3-7-4   2-H     Multi-Drop Alert Enable   1-2-3-1-3-6   12-C     Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C     Number of Power Ups   2-3-4   4-G     Offline/Failed Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test Enable <sup>(3)</sup>   1-2-7-1   3-D     Partial Stroke Test Pressure Limit <sup>(3)</sup>   1-2-3-6-1   10-G	Instrument Date and Time			
Hot Key-1	Instrument Lovel			
Instrument Mode	IIISTI UITIETIT LEVEI			
Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-4-4-4   8-I     Integral Limit   1-2-2-1-2-1   8-B     Integral Limit   1-2-4-4-3   8-I     Integrator Saturated Hi Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-2   8-I     Lag Time <sup>(5)</sup>   1-2-2-5-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Lead/Lag <sup>(3)</sup>   1-2-2-5-3   5-D     Loop Current Validation <sup>(6)</sup>   1-2-3-3-3   9-E     Low Power Write   1-2-3-1-3-2   12-B     Manual Travel Calibration   1-3-1-2   4-E     Manufacturer - instrument   1-2-6-1   3-D     Manufacturer - actuator   3-7-3   2-H     Maximum Supply Pressure   1-2-5-6   4-G     Message   1-2-5-1-2   6-F     Miscellaneous Group Enable   1-2-3-1-3-6   10-I     Model   3-7-4   2-H     Multi-Drop Alert Enable   1-2-3-1-3-6   12-C     Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C     Number of Power Ups   2-3-4   4-G     Offline/Failed Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test (3)   2-5   2-F     Partial Stroke Test Pressure Limit <sup>(3)</sup>   1-2-3-6-1   10-G	Instrument Mode	,		
Instrument Time Invalid Enable         1-2-4-1-1         8-G           Integral Dead Zone         1-2-4-4-4         8-I           Integral Limit         1-2-2-1-2-1         8-B           Integrator Saturated Hi Enable         1-2-4-4-3         8-I           Integrator Saturated Lo Enable         1-2-4-4-1         8-I           Integrator Saturated Lo Enable         1-2-4-4-2         8-I           Lag Time <sup>(5)</sup> 1-2-2-5-3         5-D           Last Calibration Status         1-2-5-9-1         6-H           Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C	Instrument Serial Number			
Integral Dead Zone				
1-2-2-1-2-1   8-B   1-2-4-4-3   8-I   1-2-4-4-3   8-I   1-2-4-4-3   8-I   1-2-4-4-1   8-I   1-2-2-1-2-2   8-B   Integrator Saturated Hi Enable   1-2-4-4-1   8-I   Integrator Saturated Lo Enable   1-2-4-4-2   8-I   Lag Time <sup>(5)</sup>   1-2-2-5-3   5-D   Last Calibration Status   1-2-5-9-1   6-H   Lead/Lag <sup>(3)</sup>   1-2-2-5-3   5-D   Loop Current Validation <sup>(6)</sup>   1-2-3-3-3   9-E   Low Power Write   1-2-3-1-3-2   12-B   Manual Travel Calibration   1-3-1-2   4-E   Manufacturer - instrument   1-2-6-1   3-D   Manufacturer - actuator   3-7-3   2-H   Maximum Supply Pressure   1-2-5-6   4-G   Message   1-2-5-1-2   6-F   Miscellaneous Group Enable   1-2-3-6-5-3   10-I   Model   3-7-4   2-H   Multi-Drop Alert Enable   1-2-4-3-2   8-H   No Free Time Shutdown   1-2-3-1-3-6   12-C   Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C   Number of Power Ups   2-3-4   4-G   3-6-9   4-H   Offline/Failed Alert Enable   1-2-3-1-3-1   12-B   Partial Stroke Test Enable <sup>(3)</sup>   1-2-3-6-1   10-G   10-G	Ilistrument fille lilvalid Enable			
1-2-4-4-3	Integral Dead Zone			
Integral Limit			_	
Integrator Saturated Hi Enable	Integral Limit		-	
Integrator Saturated Lo Enable  Lag Time <sup>(5)</sup> Last Calibration Status  1-2-5-9-1  Lead/Lag <sup>(3)</sup> Loop Current Validation <sup>(6)</sup> Low Power Write  1-2-3-1-3-2  Low Power Write  Manual Travel Calibration  1-3-1-2  Manufacturer - instrument  1-2-6-1  Maximum Supply Pressure  Miscellaneous Group Enable  Miscellaneous Group Enable  Model  3-7-4  Multi-Drop Alert Enable  No Free Time Shutdown  No Free Time Shutdown  1-2-3-1-3-3  12-C  Number of Power Ups  Partial Stroke Test Enable <sup>(3)</sup> Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1  1-2-3-6-1  1-2-3-6-1  1-2-3-6-1  1-2-3-6-1  1-2-3-1-3-1  12-B  Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1  10-G	Integrator Saturated Hi Enable			
Lag Time <sup>(5)</sup> 1-2-2-5-3         5-D           Last Calibration Status         1-2-5-9-1         6-H           Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Enable <sup>(3)</sup> 1-2-3-6-1         10-G			_	
Last Calibration Status         1-2-5-9-1         6-H           Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	•		_	
Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test (3)         2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	. 3			
Loop Current Validation(6)         1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G				
Low Power Write         1-2-3-1-3-2         12-8           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-3-7-5-3         12-C           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test Enable <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G				
Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	-			
Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G				
Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test (3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G		-		
Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test (3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G				
Message       1-2-5-1-2       6-F         Miscellaneous Group Enable       1-2-3-6-5-3       10-I         Model       3-7-4       2-H         Multi-Drop Alert Enable       1-2-4-3-2       8-H         No Free Time Shutdown       1-2-3-1-3-6       12-C         Non-Critical NVM Alert Enable       1-2-3-1-3-3       12-C         Number of Power Ups       2-3-4       4-G         Offline/Failed Alert Enable       1-2-3-1-3-1       12-B         Partial Stroke Test (3)       2-5       2-F         Partial Stroke Test Enable(3)       1-2-7-1       3-D         Partial Stroke Test Pressure Limit(3)       1-2-3-6-1       10-G				
Miscellaneous Group Enable       1-2-3-6-5-3       10-I         Model       3-7-4       2-H         Multi-Drop Alert Enable       1-2-4-3-2       8-H         No Free Time Shutdown       1-2-3-1-3-6       12-C         Non-Critical NVM Alert Enable       1-2-3-1-3-3       12-C         Number of Power Ups       2-3-4       4-G         Offline/Failed Alert Enable       1-2-3-1-3-1       12-B         Partial Stroke Test(3)       2-5       2-F         Partial Stroke Test Enable(3)       1-2-7-1       3-D         Partial Stroke Test Pressure Limit(3)       1-2-3-6-1       10-G				
Miscellaneous Group Enable         10-1           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	Wessage		0-1	
Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	Miscellaneous Group Enable		10-l	
Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	Model		2-H	
No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G				
Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C	-			
Number of Power Ups         2-3-4         4-G           3-6-9         4-H           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	110 Tree Time Shataonin			
Number of Power Ups         3-6-9         4-H           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G				
Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	Number of Power Ups			
Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	Offline/Failed Alert Enable			
Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1 3-D Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1 10-G				
Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1 10-G				
	Partial Stroke Test Start Point <sup>(3)</sup>	1-2-2-5-2	8-D	

NOTE: Italicized Fast-Key Sequence indicates fast-key sequence is applicable only for instrument level ODV.

1. Coordinates are to help locate the item on the menu tree on page 4 and 5.

3. Instrument level ODV only.

5. Instrument level HC, AD, and PD only.

6. Firmware 9 and 10 only.

# Fast-Key Sequence for Instrument Level HC, AD, PD, and ODV (continued)

Function/Variable	Fast-Key Sequence	Coordinates <sup>(1)</sup>
Partial Stroke Test Variables View/Edit <sup>(3)</sup>	1-2-7-2	3-D
Performance Tuner <sup>(2)</sup>	1-1-2	2-B
renormance runer-	1-2-2-1-1-5	8-A
Polling Address	1-2-5-1-7	6-G
Power Starvation Alert Enable <sup>(7)</sup>	1-2-3-1-3-2	12-B
Pressure A	3-5-1	4-G
Pressure B	3-5-2	4-G
Pressure Control Active Enable	1-2-4-3-1	8-H
Pressure Deviation Alert Enable <sup>(3)</sup>	1-2-3-6-2	10-G
Pressure Deviation Alert Point(3)	1-2-3-6-3	10-G
Pressure Deviation Time <sup>(3)</sup>	1-2-3-6-4	10-G
Pressure Differential	3-5-3	4-G
Pressure Integral Control Enable	1-2-2-1-3-2	8-C
Pressure Integral Gain	1-2-2-1-3-3	8-C
Pressure MLFB Gain	1-2-2-1-3-1-3	10-B
Pressure Proportional Gain	1-2-2-1-3-1-2	10-B
Pressure Range Hi	1-2-2-2-4-1	10-D
Pressure Range Lo	1-2-2-2-4-2	10-D
Pressure Sat Time <sup>(3)</sup>	1-2-2-2-5-4	8-D
Pressure Sensor Shutdown <sup>(2)</sup>	1-2-3-2-3	12-C
Pressure Sensors—Calibration	1-3-2-1	4-E
Pressure Set Point <sup>(3)</sup>	1-2-2-2-5-3	8-D
Pressure Tuning Set	1-2-2-1-3-1-1	10-B
Pressure Units	1-2-5-2-1	6-G
Tressure office	Hot Key-3	1-A
Protection	1-2-1-5	4-B
Raw Travel Input	3-6-7	4-H
Reference Voltage Shutdown	1-2-3-1-3-7	12-C
Relay Adjust	1-3-3	3-E
Relay Type	1-2-5-4	4-F
Restart Control Mode	1-2-1-3	4-B
Restore Factory Settings	1-3-4	3-E
Restore ructory settings	2-3-3	3-F
Run Time	3-6-8	4-H
Set Point Rate Close	1-2-2-5-2	5-D
Set Point Rate Open	1-2-2-5-1	5-D
Setup Wizard	1-1-1	2-B
Setup Wizard	Hot Key-4	1-A
Stabilize/Optimize	1-1-2 <sup>(4)</sup>	2-B
Stabilize/Optimize	1-2-2-1-1-4	8-A
Status	2-2	2-F
Stroke Valve	2-2	2-F
Scione valve	3-5-4	4-G
Supply Pressure <sup>(2)</sup>	1-2-3-3-1-2	12-D
Supply Pressure Lo Alert Enable <sup>(2)</sup>	1-2-3-3-1-2	12-D
Supply Pressure Lo Alert Point <sup>(2)</sup>	1-2-3-3-1-1	12-D
Temperature	3-6-2	4-H
remperature	3-6-3	4-H 4-H
Temperature Maximum	2-3-1	3-F
	2-3-1	3-F
Temperature Minimum	3-6-4	3-г 4-Н
	3-0-4	4-⊓

Function/Variable	Fast-Key	Coordinates <sup>(1)</sup>
	Sequence	10.0
Temperature Sensor Shutdown	1-2-3-2-2	12-C
Temperature Units	1-2-5-2-2	6-G
Travel	3-3	2-G
	1-2-3-4-1	9-E
Travel / Pressure Cutoff Hi	1-2-3-4-7-3	12-F
,	1-2-2-2-1	10-B
Travel / Pressure Cutoff Lo	1-2-3-4-7-4	10-F
	1-2-2-2-2	10-B
Travel / Pressure Select	1-2-2-2-1	5-C
Travel Accumulator	3-6-6	4-H
	1-2-3-5-3-2	12-H
Travel Accumulator Alert Enable	1-2-3-5-3-1	12-H
Travel Accumulator Alert Point	1-2-3-5-3-3	12-l
Travel Alert Dead Band	1-2-3-4-3	9-E
Travel Alert Hi Enable	1-2-3-4-6-1	10-F
Travel Alert Hi Hi Enable	1-2-3-4-5-1	12-E
Travel Alert Hi Hi Point	1-2-3-4-5-3	12-F
Travel Alert Hi Point	1-2-3-4-6-3	10-F
Travel Alert Lo Enable	1-2-3-4-6-2	10-F
Travel Alert Lo Lo Enable	1-2-3-4-5-2	12-E
Travel Alert Lo Lo Point	1-2-3-4-5-4	12-F
Travel Alert Lo Point	1-2-3-4-6-4	10-F
Travel Deviation Alert Enable	1-2-3-4-4-1	10-E
Travel Deviation Alert Point	1-2-3-4-4-2	10-E
Travel Deviation Time	1-2-3-4-4-3	10-E
Travel Integral Control Enable	1-2-2-1-1-2	8-A
Travel Integral Gain	1-2-2-1-1-3	8-A
Travel Limit / Cutoff Hi Alert Enable	1-2-3-4-7-1	12-F
Travel Limit / Cutoff Lo Alert Enable	1-2-3-4-7-2	12-F
,	1-2-3-4-7-5	12-G
Travel Limit Hi	1-2-2-3-1	10-C
	1-2-3-4-7-6	12-G
Travel Limit Lo	1-2-2-3-2	10-C
Travel MLFB Gain	1-2-2-1-1-1-4	10-A
Travel Proportional Gain	1-2-2-1-1-1-2	10-A
Travel Sensor Adjust	1-3-2-2	4-E
Travel Sensor Motion	1-2-6-5	3-E
Travel Sensor Shutdown	1-2-3-2-1	12-C
are. sense. sinatas iii.	1-2-3-4-2	9-E
Travel Set Point	3-2	2-G
Travel Tuning Set	1-2-2-1-1-1	10-A
Travel Velocity Gain	1-2-2-1-1-3	10-A
	1-2-3-6-5-2	.571
Valve Group Enable	1-2-3-7-5-2	10-I
Valve Serial Number	1-2-5-1-5	6-F
	1-2-6-2	3-D
Valve Style	1-2-6-3	3-D
Zero Power Condition	1-2-5-5	4-G

NOTE: Italicized Fast-Key Sequence indicates fast-key sequence is applicable only for instrument level ODV.

1. Coordinates are to help locate the item on the menu tree on page 4 and 5.

2. Not available in instrument level HC.

3. Instrument level ODV only.

4. Instrument level HC only.

5. Instrument level HC, AD, and PD only.6

7. Instrument level AD, PD, and ODV only.

3

**DVC6000 Digital Valve Controller Quick Start Guide** D102762X012 November 2011 Field Communicator Menu Tree for Instrument Level HC, AD, PD, and ODV 1 Instrument Mode 1-2-1-4 **►** Bu<u>rst Mode</u> 2 Control Mode 1-2-1 Mode and Protection 3 Protection 4 Stabilize/Optimize Instrument Mode 1 Burst Enable 2 Control Mode 2 Burst Command3 Cmd 3(Trending)Press Basic Setup 3 Restart Ctrl Mode 4 Burst Mode 1 Setup Wizard 2 Performance Tuner 2 2 Stabilize/Optimize 4 5 Protection Tuning 1 Travel Tuning 2 Integral Settings 1-2 ➤ Detailed Setup 3 Pressure Tuning 1 Mode and Protection Tvl/Press Control Response Control 2 Response Control 1 Tvl/Press Select 3 Alerts Tuning 2 Tvl/Press Cutoffs 4 Status Tvl/Press Control 3 Travel Limits 5 Instrument 3 Input Char Pressure Control 6 Valve & Actuator 7 SIS/Partial Stroke 4 Define Cust Char 5 End Pt Press Control 5 Dynamic Response 1-2-2-5 Dynamic Response 3 Partial Stroke 1 SP Rate Open 1 PST Enable Configure / Setup SP Rate Close 2 PST Vars View/Edit 3 Lag Time Basic Setup 3 Lead/Lag 2 Detailed Setup Valve & Actuator 3 Calibrate 1-2-3 Alerts 1 Manufacturer Valve Serial Num 1 Electronics Alerts Valve Style 2 Sensor Alerts 4 Actuator Style 3 Environment Alerts 5 Tvl Sensor Motion 4 Travel Alerts Travel Calibration 6 View/ Edit Feedback 5 Travel History Alerts Connection 1 Auto Tvl Calib 6 SIS Alerts 6 Alert Record 6 2 Man Tvl Calib Calibrate Travel Calibration 1-2-4 1-3-2 Status Sensor Calibration Sensor Calibration 3 Relay Adjust 1 Press Sensors 1 Instrument Time 4 Restore Factory Online 2 Calibration and Diagnostics Tvl Sensor Adjust Settings 3 Operational 3 Analog In Calib 1 Configure / Setup 4 Integrator Device Diagnostics 2 Device Diagnostics Device Variables 1 Alert Conditions Status Instrument 3 Device Record Device Record General General 4 Stroke Valve 1 Temp Max 2 Units 5 Partial Stroke Test 3 1 HART Tag Analog Input Range 2 Message 3 Run Time 4 Num of Power Ups 4 Relay Type 5 Zero Pwr Cond **Device Variables** 3 Descriptor 1 Analog In 2 Tvl Set Pt 6 Max Supply Press 7 Aux Term Mode 4 Date 5 Valve Serial Num 6 Inst Serial Num 3 Travel 8 Inst Date and Time HART Application (1) 4 Drive Signal 5 Pressures -7 Polling Address 9 Calib Status and Loc 1 Offline 2 Online Variables 1 Pressure A Device Information 3 Utility 1 Pressure Units 2 Pressure B 8 DD Information 4 HART Diagnostics 2 Temp Units 3 Pressure Diff 4 Supply Press 2 Device Information 3 Analog In Units 1-2-5-3 1 HART Tag ➤ Variables Analog Input Range Device ID 1 Aux Input 2 Temperature 1 Input Range Hi Manufacturer 2 Input Range Lo Model 3 Temp Max

# Notes:

- 1-1-1 indicates fast-key sequence to reach menu
- 1 This menu is available by pressing the left arrow key from the previous menu.
- 2 Not available in instrument level HC
- 3> Instrument level ODV only.
- 4 Instrument level HC only.
- 5 Instrument level HC, AD, and PD only.
- 6 Fast key sequence for Alert Record with instrument level ODV is 1-2-3-7.

Device Rev

Firmware Rev

Hardware Rev

8 Inst Level 9 HART Univ Rev

- 7 This menu item reads Power Starvation Alrt Enab in firmware 7.
- Only available in firmware 9 and 10.

6 3 5

4 Temp Min

6 Tvl Accum

8 Run Time 9 Num of Power Ups

5 Cycle Count

7 Raw Tvl Input

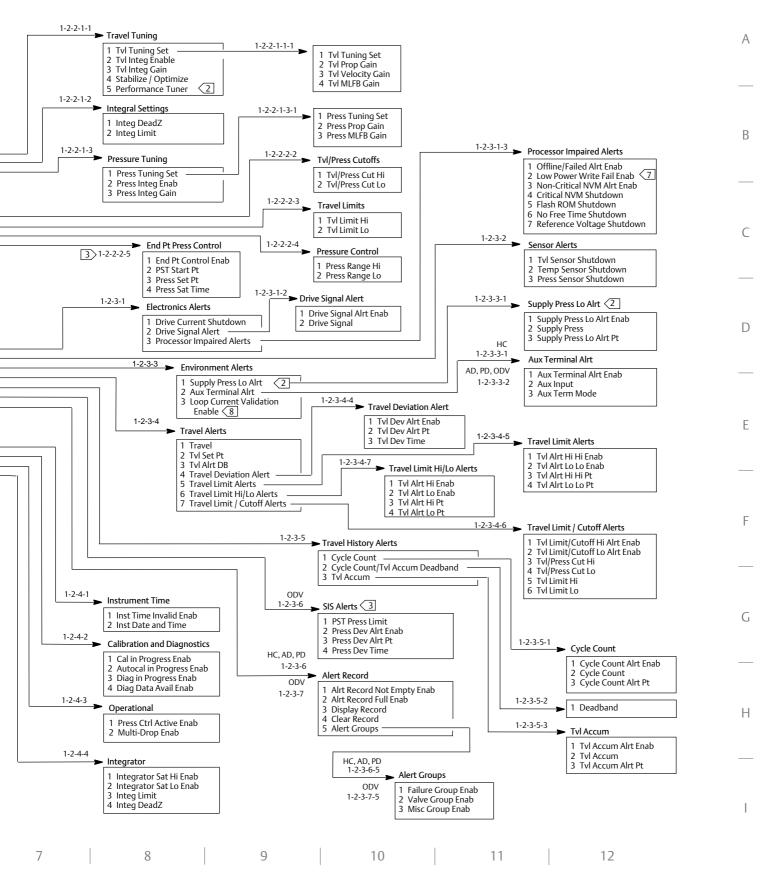
1-2-5-9

Calib Status and Loc

1 Last Calib Status

2 Calib Loc

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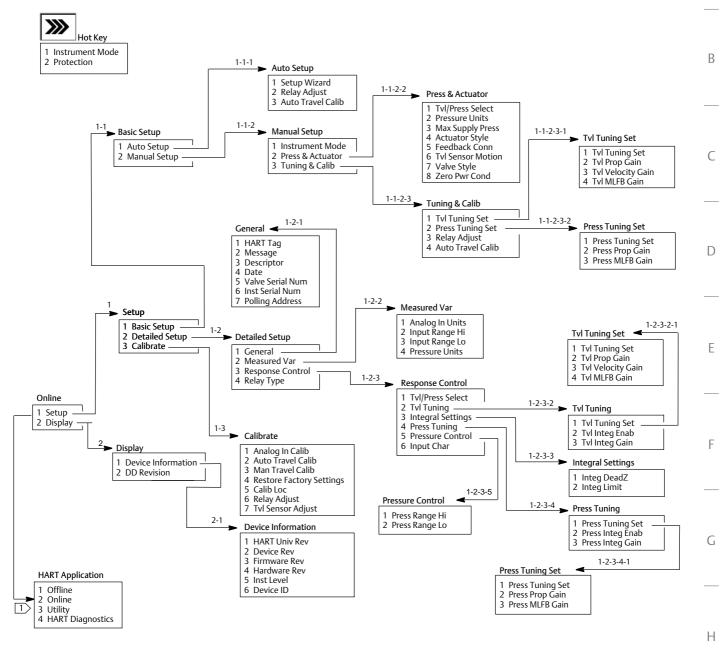
# Fast-Key Sequence for Instrument Level AC

Function/Variable	Fast-Key Sequence	Coordinates <sup>(1)</sup>
Actuator Style	1-1-2-2-4	4-C
Analog Input Calibration	1-3-1	3-F
Analog Input Range Hi	1-2-2-2	4-E
Analog Input Range Lo	1-2-2-3	4-E
Analog Input Units	1-2-2-1	4-E
	1-1-2-3-4	4-D
Auto Travel Calibration	1-3-2	3-F
	1-1-1-3	3-C
Calibration Location	1-3-5	3-G
Date	1-2-1-4	3-D
Descriptor	1-2-1-3	3-D
Device Description Revision	2-2	2-F
Device Identification	2-1-6	3-H
Device Revision	2-1-2	3-G
Feedback Connection	1-1-2-2-5	4-C
Firmware Revision	2-1-3	3-G
Hardware Revision	2-1-4	3-G
HART Tag	1-2-1-1	3-D
HART Universal Revision	2-1-1	3-G
Input Characterization	1-2-3-6	4-F
Instrument Level	2-1-5	3-H
Instrument Mode	Hot Key-1	1-B
instrument wode	1-1-2-1	3-C
Instrument Serial Number	1-2-1-6	3-D
Integral Dead Zone	1-2-3-3-1	6-F
Integral Limit	1-2-3-3-2	6-F
Manual Travel Calibration	1-3-3	3-F
Maximum Supply Pressure	1-1-2-2-3	4-C
Message	1-2-1-2	3-D
Polling Address	1-2-1-7	3-E
Pressure Integral Control Enable	1-2-3-4-2	6-G
Pressure Integral Gain	1-2-3-4-3	6-G
Pressure MLFB Gain	1-1-2-3-2-3	6-D
FIESSUIE WILFD GAIII	1-2-3-4-1-3	5-H

r ressure integral dain	1-2-3-4-3	0		
Pressure MLFB Gain	1-1-2-3-2-3	6-D		
Plessule MLFB Galli	1-2-3-4-1-3	5-H		
1. Coordinates are to help locate the item on the menu tree on page				

Function/Variable	Fast-Key Sequence	Coordinates <sup>(1)</sup>
n n .: 16 :	1-1-2-3-2-2	6-D
Pressure Proportional Gain	1-2-3-4-1-2	5-H
Pressure Range Hi	1-2-3-5-1	4-G
Pressure Range Lo	1-2-3-5-2	4-G
Durana Tania a Cat	1-1-2-3-2-1	6-D
Pressure Tuning Set	1-2-3-4-1-1	6-G
Donas de la	1-1-2-2-2	4-C
Pressure Units	1-2-2-4	4-E
Protection	Hot Key-2	1-B
	1-1-1-2	3-B
Relay Adjust	1-1-2-3-3	4-D
	1-3-6	3-G
Relay Type	1-2-4	3-E
Restore Factory Settings	1-3-4	3-F
Setup Wizard	1-1-1-1	3-D
Travel Integral Gain	1-2-3-2-3	6-F
Travel Integral Enable	1-2-3-2-2	6-F
T 14450 C 1	1-1-2-3-1-4	6-C
Travel MLFB Gain	1-2-3-2-1-4	6-E
T 1/2 C1 :	1-1-2-2-1	4-C
Travel / Pressure Select	1-2-3-1	4-F
T 10 10	1-1-2-3-1-2	6-C
Travel Proportional Gain	1-2-3-2-1-2	6-E
Travel Sensor Adjust	1-3-7	3-G
Travel Sensor Motion	1-1-2-2-6	4-C
Toward Towards on C. 1	1-1-2-3-1-1	6-C
Travel Tuning Set	1-2-3-2-1-1	6-E
T 1// 1/ 6 :	1-1-2-3-1-3	6-C
Travel Velocity Gain	1-2-3-2-1-3	6-E
Valve Serial Number	1-2-1-5	3-D
Valve Style	1-1-2-2-7	4-C
Zero Power Condition	1-1-2-2-8	4-C

# Field Communicator Menu Tree for Instrument Level AC



#### Notes:

1-1-1 indicates fast-key sequence to reach menu

This menu is available by pressing the left arrow key from the previous menu.

1 2 3 4 5 6

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# **Product Description**

DVC6000 digital valve controllers (figure 1 and 2) are communicating, microprocessor-based current-to-pneumatic instruments. In addition to the traditional function of converting an input current signal to a pneumatic output pressure, the DVC6000 digital valve controller communicate via HART® protocol.

DVC6000 digital valve controllers are designed to directly replace standard pneumatic and electro-pneumatic valve mounted positioners.

Figure 1. FIELDVUE DVC6010 Digital Valve Controller Mounted on a Fisher Sliding-Stem Valve Actuator



Figure 2. Fisher Rotary Control Valve with FIELDVUE DVC6020 Digital Valve Controller



#### Note

Do not install, operate, or maintain a DVC6000 digital valve controller without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all contents of this quick start guide, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

# Using this Guide

This guide describes how to install, setup, and calibrate DVC6000 digital valve controllers. Additional information for installing, operating, and maintaining the DVC6000 digital valve controller can be found in the related documents listed on page 44. Refer to table 1 for details on the capabilities of each diagnostic tier.

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Table 1. Instrument Level Capabilities

Diagnostic Level					
AC	HC	AD	PD	ODV	
Х	Х	Х	X	Х	
Х	Х	Х	Х	Х	
	X	X	X	Х	
	Х	Х	Х	Х	
		Х	Х	Х	
		Х	X	Х	
		Х	Х	Х	
		Х	Х	Х	
			X	Х	
			Х	Х	
				Х	
	X	X X X X X X	AC	AC         HC         AD         PD           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X	

This guide describes instrument setup and calibration using a 475 Field Communicator. For information on using the Field Communicator, see the 475 Field Communicator User's Manual, available from your Emerson Process Management sales office.

#### Note

Menu sequences for the 475 Field Communicator are found at the beginning of this guide.

These menu sequences are also applicable to the 375 Field Communicator.

You can also setup and calibrate the instrument using a personal computer and ValveLink software or AMS Suite: Intelligent Device Manager. For information on using ValveLink software or AMS Device Manager with a FIELDVUE instrument, refer to the appropriate documentation or online help.

# Displaying the Field Communicator Device Description Revision Number

Device Description (DD) revision identifies the version of the Fisher Device Description that resides in the Field Communicator. The device description defines how the Field Communicator interacts with the user and instrument. You can display the DD revision from the Offline or Online menu.

Offline Menu—To see the Field Communicator device description revision number from the Offline menu, select *Utility*, *Simulation*, *Fisher Controls*, and *DVC6000*.

Online Menu—To see the Field Communicator device description revision number from the Online menu, connect the Field Communicator to an instrument connected to a source supplying a 4-20 mA signal. From the Online menu, select *Device Variables* and *DD Information*.

# Displaying the FIELDVUE Instrument Firmware Revision Number

To view the instrument firmware revision, connect the Field Communicator to an instrument connected to a source supplying a 4-20 mA signal. From the Online menu, select *Device Variables, Device Information*, and *Firmware Rev*.

#### Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assume responsibility for the selection, use, or maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end user.

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# Installation

The DVC6000 can be used with either air or natural gas as the supply medium. If using natural gas as the pneumatic supply medium, natural gas will be used in the pneumatic output connections of the DVC6000 to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented. When using natural gas as the supply medium, in a non-hazardous location in a confined area, remote venting of the unit is required. Failure to do so could result in personal injury, property damage, and area re-classification. For hazardous locations remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and federal codes, rules and regulations. Failure to do so when necessary could result in personal injury, property damage, and area re-classification.

#### Note

Gas Certified DVC6000 digital valve controllers are approved by CSA, FM, ATEX, IECEx, and INMETRO for use with natural gas as the supply medium.

# **A** WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before proceeding with any Installation procedures:

- Always wear protective clothing, gloves, and eyewear to prevent personal injury or property damage.
- Do not remove the actuator from the valve while the valve is still pressurized.
- Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 27.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

# **A** WARNING

To avoid static discharge from the plastic cover, do not rub or clean the cover with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

# **A** WARNING

This unit vents the supply medium into the surrounding atmosphere. When installing this unit in a non-hazardous (non-classified) location in a confined area, with natural gas as the supply medium, you must remotely vent this unit to a

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safe location. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

When installing this unit in a hazardous (classified) location remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and federal codes, rules and regulations. Failure to do so when necessary could result in personal injury or property damage from fire or explosion, and area re-classification.

Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

In addition to remote venting of the unit, ensure that all caps and covers are correctly installed. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

# Special Instructions for "Safe Use" and Installations in Hazardous Locations

Certain nameplates may carry more than one approval, and each approval may have unique installation/wiring requirements and/or conditions of "safe use". These special instructions for "safe use" are in addition to, and may override, the standard installation procedures. Special instructions are listed by approval.

# **WARNING**

Failure to follow these conditions of "safe use" could result in personal injury or property damage from fire or explosion, or area re-classification.

# **A WARNING**

The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Avoid impact and friction during installation and use to prevent risk of ignition.

# **CSA**

Special Conditions of Safe Use

Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

No special conditions for safe use.

Refer to table 2 for approval information, figure 24 for the CSA loop schematic, and figure 25 for the CSA nameplate.

Table 2. Hazardous Area Classifications—CSA (Canada)

Certification Body	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
	DVC60x0 DVC60x0S (x = 1,2,3)	Ex ia Intrinsically Safe Class I,II,III Division 1 GP A,B,C,D,E, F,G per drawing GE42818 T5 Natural Gas Approved	Vmax = 30 VDC Imax = 226 mA Ci = 5 nF Li = 0.55 mH	T5(Tamb ≤ 80°C)	Type 4X, IP66 Single Seal Device
CSA		Explosion-proof Class I Division 1 GP B,C,D T6 Natural Gas Approved		T6(Tamb ≤ 80°C)	Type 4X, IP66 Single Seal Device
	(^ 1,2,3)	Class I Division 2 GP A,B,C,D T6 Class II Division 1 GP E,F,G T6 Class II Division 2 GP F,G T6 Class III Natural Gas Approved		T6(Tamb ≤ 80°C)	Type 4X, IP66 Single Seal Device

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# FM

# Special Conditions of Safe Use

# Intrinsically Safe, Explosion-proof, Non-incendive, Dust Ignition-proof

- 1. When product is used with natural gas as the pneumatic medium, the maximum working pressure of the natural gas supply shall be limited to 145psi.
- 2. When product is used with natural gas as the pneumatic medium the product shall not be permitted in a Class I, Division 2, Group A, B, C, D location without the proper venting installation as per the manufacturer's instruction manual.

Refer to table 2 for approval information, figure 26 for the FM loop schematic, and figure 27 for the FM nameplate.

Table 3. Hazardous Area Classifications—FM (United States)

Certification Body	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
		Intrinsically Safe Class I,II,III Division 1 GP A,B,C,D,E,F,G per drawing GE42819 T5 Natural Gas Approved	Vmax = 30 VDC Imax = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C)	NEMA 4X
FM	DVC60x0 DVC60x0S (x = 1,2,3)	Explosion-proof Class I Division 1 GP B,C,D T6 Natural Gas Approved		T6(Tamb ≤ 80°C)	NEMA 4X
		Class I Division 2 GP A,B,C,D T6 Class II Division 1 GP E,F,G T6 Class II Division 2 GP F,G T6 Class III Natural Gas Approved		T6(Tamb ≤ 80°C)	NEMA 4X

# **ATEX**

# Special Conditions for Safe Use

# Intrinsically Safe, Dust

- 1. This apparatus can only be connected to an intrinsically safe certified equipment and this combination must be compatible as regards the intrinsically safe rules.
- 2. The electrical parameters of this equipment must not exceed any following values:  $U_O \le 30 \text{ V}$ ;  $I_O \le 226 \text{ mA}$ ;  $P_O \le 1.4 \text{ W}$
- 3. Operating ambient temperature: -52°C or -40°C to +80°C
- 4. For the model with aluminum body: the apparatus must not be submitted to frictions or mechanical impacts.
- 5. Covered by standards EN 60079-0 (2006), EN 60079-11 (2007), EN 60079-26 (2007), EN 61241-0 (2006), and EN 61241-11 (2006).

Refer to table 4 for additional approval information, and figure 28 for the the ATEX Intrinsically Safe, Dust nameplate.

# Flameproof, Dust

Operating ambient temperature: -52°C or -40°C to +85°C

Refer to table 4 for additional approval information, and figure 29 for the ATEX Flameproof, Dust nameplate.

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# Type n, Dust

Operating ambient temperature: -52°C or -40°C to +80°C

Refer to table 4 for additional approval information, and figure 30 for the ATEX Type n, Dust nameplate.

Table 4. Hazardous Area Classifications—ATEX

Certificate	Type	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
		(ii) II 1 G & D Intrinsically Safe Gas Ex ia IIC T5/T6 Ga Dust Ex iaD 20 T100°C (Tamb ≤ 80°C) Ex iaD 20 T85°C (Tamb ≤ 75°C) Natural Gas Approved	Ui = 30 VDC Ii = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
ATEX	DVC60x0 DVC60x0S (x = 1,2,3)	(a) II 2 G & D Flameproof Gas Ex d IIC T5/T6 Dust Ex tD A21 IP66 T90°C (Tamb ≤ 85°C) Ex tD A21 IP66 T80°C (Tamb ≤ 75°C) Natural Gas Approved		T5(Tamb ≤ 85°C) T6(Tamb ≤ 75°C)	IP66
		(a) II 3 G & D Type n Gas Ex nCnL IIC T5/T6 Dust Ex tD A22 IP66 T85°C (Tamb ≤ 80°C) Ex tD A22 IP66 T80°C (Tamb ≤ 75°C) Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66

# **IECE**x

# **Conditions of Certification**

# Intrinsically Safe, Flameproof, Type n

Ex ia /Ex nC / Ex d

1. **Warning:** Electrostatic charge hazard. Do not rub or clean with solvents. To do so could result in an explosion. *Ex nC / EX d* 

2. Do not open while energized.

Refer to table 5 for additional approval information, figure 31 for the IECEx loop schematic and figure 32 for the IECEx nameplate.

Table 5. Hazardous Area Classifications—IECEx

Certificate	Type	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
		Intrinsically Safe Gas Ex ia IIC T5/T6 per drawing GE42990 Natural Gas Approved	Ui = 30 VDC Ii = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
IECEx	DVC60x0 DVC60x0S (x = 1,2,3)	Flameproof Gas Ex d IIC T5/T6 Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
		Type n Gas Ex nC IIC T5/T6 Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66

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# **NEPSI**

Notes for Safe Use of the Certified Product

# Intrinsically Safe, Dust and Flameproof, Dust

DVC6000 digital valve controllers (designated as controller hereafter) have been proved to be in conformity with the requirements specified in the national standards GB3836.1-2000, GB3836.2-2000, GB3836.4-2000, and GB12476.1-2000 through inspections conducted by National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation (NEPSI). The Ex markings for the products are Ex d II CT5 (acetylene not included), DIPA21T5 or Ex ia II CT5, DIPA21T5 respectively and their Ex certificate numbers are GYJ04504 and GYJ04505. When using the product, the user should pay attention to the items stated below:

- 1. The specific product types of approved DVC6000 digital valve controllers (covered in this quick start guide) at this time are DVC6010, DVC6020 and DVC6030.
- 2. The enclosure of the controller provides a grounding terminal, and the user should install a reliable grounding wire connected to it when mounting and using the controller.
- 3. The controller's cable entrance (1/2 NPT) must be fitted with a cable entry device which is Ex-approved through inspection of explosion protection, in conformity with relevant standards of GB3836 and has a corresponding rating of explosion protection.
- 4. The maximum operating ambient temperature range of the controller is -40°C to +80°C.
- 5. The principle of "Opening equipment's cover is allowed only after the power is off" must be abided by when using and maintaining the controller in the field.
- 6. The values for intrinsically safe parameters of the controller (Intrinsically safe type) are as follow: Ui = 30V, Ii = 226mA, Pi = 1.4W, Ci = 5nF, Li = 0.55mH
- 7. While the controller forms an intrinsically safe explosion protection system together with a corresponding associated equipment safety barrier, the following requirements must be met:

  Uo ≤ Ui, lo ≤ Ii, Po ≤ Pi, Co ≥ Ci + Cc, Lo ≥ Li + Lc

# Note

Where Cc and Lc represent distributing capacitance and inductance of the connecting cable respectively.

- 8. The safety barrier must be placed at safety location, and the instruction manuals of both the product and fitted safety barrier must be followed while conducting system wiring and using the product; The connecting cable should be a shield cable with the area of core section being greater than  $0.5 \text{mm}^2$  and its shield (or insulation screen) being grounded at a safe location and insulated from the product enclosure; The cable should be routed so that the electro-magnetic interference can be eliminated as much as possible and that the cable distributing parameters of capacitance and inductance can be controlled within  $0.06 \mu F/1 \text{mH}$ .
- 9. The user must not be allowed to replace the internal electric components of the product and change the condition of system wiring at will and on his own.
- 10. The user must follow the relevant rules specified by the product instruction manual, the "15th Section of Electric Equipment Used in Explosive Gaseous Environment: Electric Installation in Hazardous Locations (except for coal mine)" of GB3836.15-2000 standard, the "Design Code for Electric Power Installation in Explosive and Fire-hazardous Environment" of GB50058-1992 standard, and the "Safety Regulations against dust explosion" of GB15577-1995 standard while performing installation, operation, and maintenance for the product.

Refer to table 6 for additional approval information, and figure 33 for the NEPSI approvals nameplate.

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Table 6. Hazardous Area Classifications—NEPSI

Certificate	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
NEPSI	DVC60x0	Intrinsically Safe Gas Ex ia IIC T5/T6 Dust DIP A21 T5	Ui = 30 V li = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
INLESI	(x = 1,2,3)	Flameproof Gas Ex d IIC T5/T6 Dust DIP A21 T5		$T5(Tamb \le 80^{\circ}C)$ $T6(Tamb \le 75^{\circ}C)$	IP66

# **INMETRO**

Special Conditions of Safe Use

Intrinsically Safe, Flameproof

Refer to table 7 and figure 34 for approval information.

Contact your Emerson Process Management sales office for additional safe use information.

Table 7. Hazardous Area Classifications—INMETRO

Certificate	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
INMETRO DVC60x0 (x = 1,2,3)		Intrinsically Safe Gas BR-Ex ia IIC T5/T6 Ga per drawing GE42990 Natural Gas Approved	Ui = 30 VDC li = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66W
	Flameproof Gas BR-Ex d IIC T5/T6 Gb Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66W	
		Type n Gas BR-Ex nC IIC T5/T6 Gc Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66W

# **Mounting Guidelines**

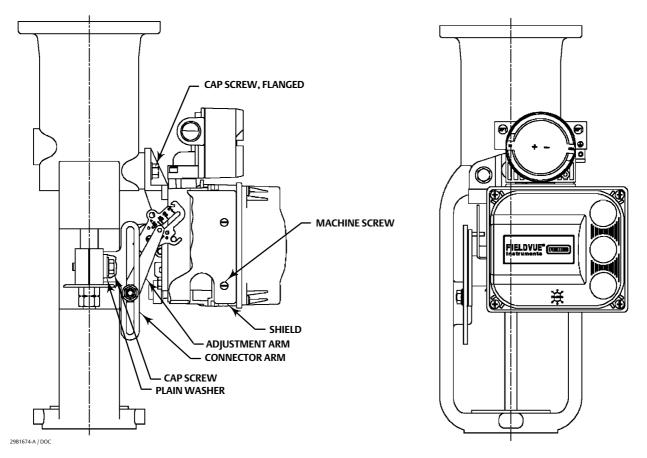
# Standard DVC6000 Digital Valve Controllers

If ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the digital valve controller separately, you will need a mounting kit to mount the digital valve controller on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the digital valve controller to a specific actuator model.

# DVC6010 on Sliding-Stem Actuators Up to 102 mm (4 Inches) of Travel

The DVC6010 digital valve controller mounts on sliding-stem actuators with up to 102 mm (4 inch) travel. Figure 3 shows a typical mounting on an actuator with up to 51 mm (2 inch) travel. Figure 4 shows a typical mounting on actuators with 51 to 102 mm (2 to 4 inch) travel. For actuators with greater than 102 mm (4 inch) travel, see the quidelines for mounting a DVC6020 digital valve controller.

Figure 3. FIELDVUE DVC6010 Digital Valve Controller Mounted on Sliding-Stem Actuators with up to 2 Inches Travel



### Note

Do not use the stainless steel DVC6010S in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator.

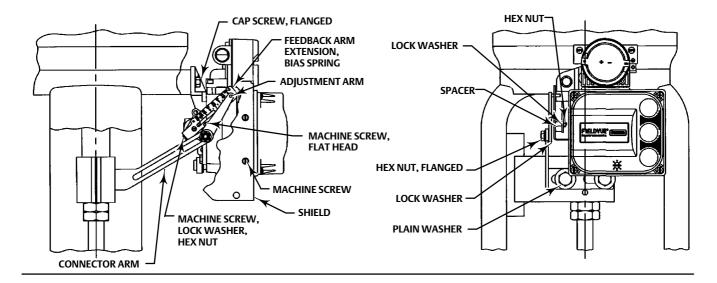
Refer to the following guidelines when mounting on sliding-stem actuators with up to 4 inches of travel.

- 1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- 2. Attach the connector arm to the valve stem connector.
- 3. Attach the mounting bracket to the digital valve controller housing.

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4. If valve travel exceeds 2 inches, a feedback arm extension is attached to the existing 2-inch feedback arm. Remove the existing bias spring from the 2-inch feedback arm. Attach the feedback arm extension to the feedback arm as shown in figure 4.

Figure 4. FIELDVUE DVC6010 Digital Valve Controller Mounted on Sliding-Stem Actuators with 2 to 4 Inches Travel



- 5. Mount the digital valve controller on the actuator as described in the mounting kit instructions.
- 6. Set the position of the feedback arm on the digital valve controller to the no air position by inserting the alignment pin through the hole on the feedback arm as follows:
  - For air-to-open actuators (i.e., the actuator stem retracts into the actuator casing or cylinder as air pressure to the casing or lower cylinder increases), insert the alignment pin into the hole marked "A". For this style actuator, the feedback arm rotates counterclockwise, from A to B, as air pressure to the casing or lower cylinder increases.
  - For air-to-close actuators (i.e., the actuator stem extends from the actuator casing or cylinder as air pressure to the casing or upper cylinder increases), insert the alignment pin into the hole marked "B". For this style actuator, the feedback arm rotates clockwise, from B to A, as air pressure to the casing or upper cylinder increases.

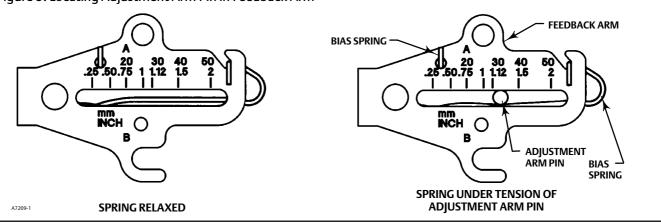
#### Note

When performing the following steps, ensure there is enough clearance between the adjustment arm and the feedback arm to prevent interference with the bias spring.

7. Apply anti-seize to the pin of the adjustment arm. As shown in figure 5, place the pin into the slot of the feedback arm or feedback arm extension so that the bias spring loads the pin against the side of the arm with the valve travel markings.

- 8. Install the external lock washer on the adjustment arm. Position the adjustment arm in the slot of the connector arm and loosely install the flanged hex nut.
- 9. Slide the adjustment arm pin in the slot of the connector arm until the pin is in line with the desired valve travel marking. Tighten the flanged hex nut.
- 10. Remove the alignment pin and store it in the module base next to the I/P assembly.
- 11. After calibrating the instrument, attach the shield with two machine screws.

Figure 5. Locating Adjustment Arm Pin in Feedback Arm



# DVC6020 on Sliding-Stem Actuators and Rotary Actuators

DVC6020 digital valve controllers use a cam (designed for linear response) and roller as the feedback mechanism. Figure 6 shows the DVC6020 mounted on rotary actuators.

#### Note

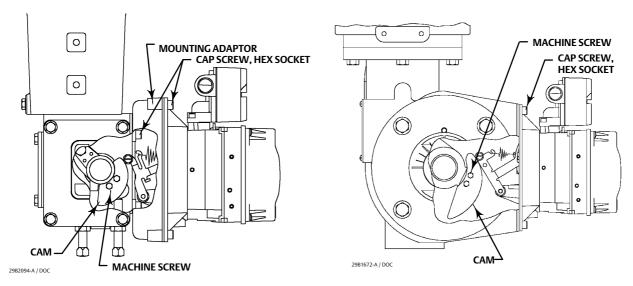
All cams supplied with FIELDVUE mounting kits are characterized to provide a linear response.

### Note

Do not use the stainless steel DVC6020S in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator.

As shown in figure 6, two feedback arms are available for the digital valve controller. Installations on Fisher 1051 size 33 and 1052 size 20 and 33 actuators use the short feedback arm [54 mm (2.13 inches) from roller to pivot point]. Most other use the long feedback arm. Make sure the correct feedback arm is installed on the digital valve controller before beginning the mounting procedure.





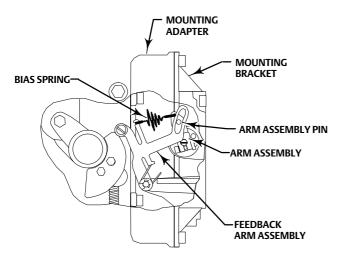
TYPICAL MOUNTING WITH SHORT FEEDBACK ARM (FISHER 1052 SIZE 33 ACTUATOR SHOWN)

TYPICAL MOUNTING WITH LONG FEEDBACK ARM (FISHER 1061 SIZE 30-68 ACTUATOR SHOWN)

Refer to figure 6 for parts locations. Refer to the following guidelines when mounting on rotary actuators:

- 1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.
- 2. If a cam is not already installed on the actuator, install the cam as described in the instructions included with the mounting kit.
- 3. If a mounting plate is required, fasten the mounting plate to the actuator.
- 4. For applications that require remote venting, a pipe-away bracket kit is available. Follow the instructions included with the kit to replace the existing mounting bracket on the digital valve controller with the pipe-away bracket and to transfer the feedback parts from the existing mounting bracket to the pipe-away bracket.
- 5. Apply anti-seize to the arm assembly pin, as shown in figure 7.





### 6. Mount the DVC6020 on the actuator as follows:

- If required, a mounting adaptor is included in the mounting kit. Attach the adaptor to the actuator as shown in figure 6. Then attach the digital valve controller assembly to the adaptor. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached.
- If no mounting adaptor is required, attach the digital valve controller assembly to the actuator or mounting plate. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached.

# DVC6030 on Quarter-Turn Actuators

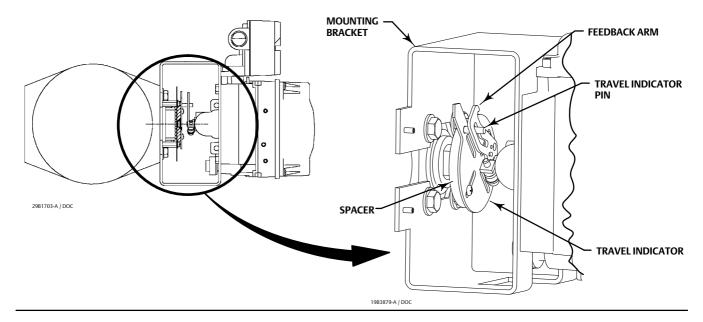
Figure 8 shows the DVC6030 digital valve controller mounted on a quarter-turn actuator. Refer to figure 8 for parts locations. Refer to the following quidelines when mounting on quarter-turn actuators:

#### Note

Due to NAMUR mounting limitations, do not use the stainless steel DVC6030S in high vibration service.

- 1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.
- 2. If necessary, remove the existing hub from the actuator shaft.
- 3. If a positioner plate is required, attach the positioner plate to the actuator as described in the mounting kit instructions.

Figure 8. Mounting a FIELDVUE DVC6030 Digital Valve Controller on a Rotary Actuator (Fisher 1032 Size 425A Shown)



4. If required, attach the spacer to the actuator shaft.

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Refer to figures 9 and 10. The travel indicator assembly can have a starting position of 7:30 or 10:30. Determine the desired starting position then proceed with the next step. Considering the top of the digital valve controller as the 12 o'clock position, in the next step attach the travel indicator, so that the pin is positioned as follows:

- If increasing pressure from the digital valve controller output A rotates the potentiometer shaft clockwise (as viewed from the back of the instrument), mount the travel indicator assembly so that the arrow is in the 10:30 position, as shown in figure 9.
- If increasing pressure from the digital valve controller output A rotates the potentiometer shaft counterclockwise (as viewed from the back of the instrument), mount the travel indicator assembly so that the arrow is in the 7:30 position, as shown in figure 10.

#### Note

ValveLink software and the Field Communicator use the convention of clockwise (figure 9) and counterclockwise (figure 10) when viewing the potentiometer shaft from the back of the FIELDVUE instrument.

- 5. Attach the travel indicator to the shaft connector or spacer as described in the mounting kit instructions.
- 6. Attach the mounting bracket to the digital valve controller.

Figure 9. Explanation of FIELDVUE DVC6030 Travel Indicator Starting Position and Movement, if <u>Clockwise</u> Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator

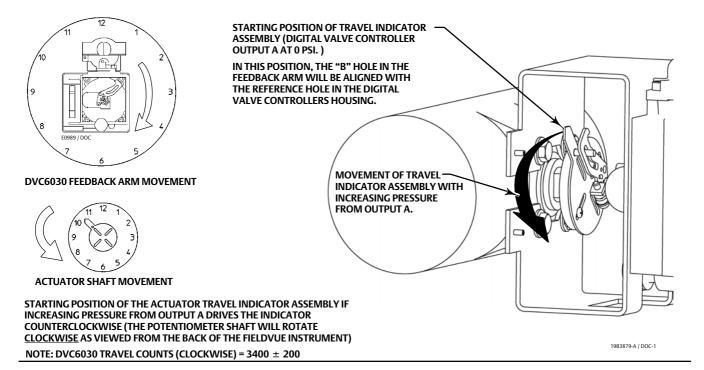
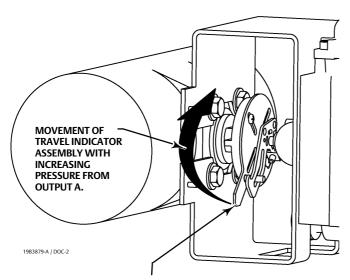


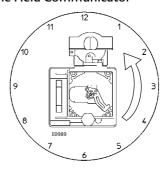
Figure 10. Explanation of FIELDVUE DVC6030 Travel Indicator Starting Position and Movement if <u>Counterclockwise</u> Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator



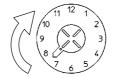
STARTING POSITION OF TRAVEL INDICATOR ASSEMBLY (DIGITAL VALVE CONTROLLER OUTPUT A AT 0 PSI).

IN THIS POSITION, THE "A" HOLE IN THE FEEDBACK ARM WILL BE ALIGNED WITH THE REFERENCE HOLE IN THE DIGITAL VALVE CONTROLLERS HOUSING.

NOTE: DVC6030 TRAVEL COUNTS (COUNTERCLOCKWISE) =  $600 \pm 200$ 



DVC6030 FEEDBACK ARM MOVEMENT

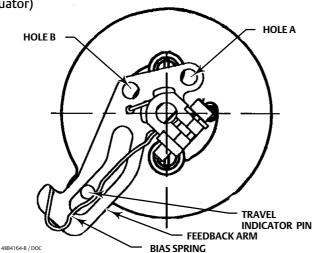


**ACTUATOR SHAFT MOVEMENT** 

STARTING POSITION OF THE TRAVEL INDICATOR ASSEMBLY IF INCREASING PRESSURE FROM OUTPUT A DRIVES THE INDICATOR CLOCKWISE THE POTENTIOMETER SHAFT WILL ROTATE COUNTERCLOCKWISE AS VIEWED FROM THE BACK OF THE FIELDVUE INSTRUMENT.

- 7. Position the digital valve controller so that the pin on the travel indicator, engages the slot in the feedback arm and that the bias spring loads the pin as shown in figure 11. Attach the digital valve controller to the actuator or positioner plate.
- 8. If a travel indicator scale is included in the mounting kit, attach the scale as described in the mounting kit instructions.

Figure 11. Positioning Travel Indicator Pin in the Feedback Arm (Viewed as if Looking from the FIELDVUE DVC6030 toward the Actuator)



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### Remote-Mount DVC6000 Instruments

Refer to the quick start guide supplement, Remote Mount Installation Guidelines (D103421X012) or the DVC6000 digital valve controller instruction manual (D102794X012).

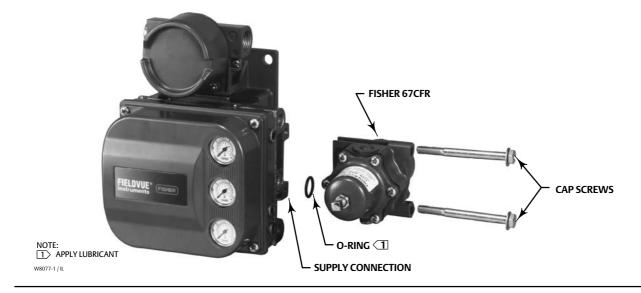
# 67CFR Filter Regulator

A 67CFR filter regulator, when used with the DVC6000 digital valve controller, can be mounted three ways.

### Integral-Mounted Regulator

Refer to figure 12. Lubricate an O-ring and insert it in the recess around the SUPPLY connection on the digital valve controller. Attach the 67CFR filter regulator to the side of the digital valve controller. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. This is the standard method of mounting the filter regulator.

Figure 12. Mounting the Fisher 67CFR Regulator on a FIELDVUE DVC6000 Digital Valve Controller



# Yoke-Mounted Regulator

Mount the filter regulator with 2 cap screws to the pre-drilled and tapped holes in the actuator yoke. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. No O-ring is required.

# Casing-Mounted Regulator

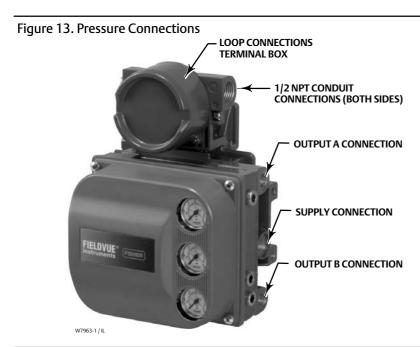
Use the separate 67CFR filter regulator casing mounting bracket provided with the filter regulator. Attach the mounting bracket to the 67CFR and then attach this assembly to the actuator casing. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. No O-ring is required.

### **Pressure Connections**

Pressure connections are shown in figure 13. All pressure connections on the digital valve controller are 1/4 NPT internal connections. Use at least 10 mm (3/8-inch) tubing for all pressure connections. If remote venting is required, refer to the vent subsection.

#### Note

Make pressure connections to the digital valve controller using tubing with at least 10 mm (3/8-inch) diameter.



# **Supply Connections**

The DVC6000 can be used with air as the supply medium. In addition, Gas Certified DVC6000 constructions can be used with natural gas as the supply medium. If using natural gas as the pneumatic supply medium, natural gas will be used in the pneumatic output connections of the DVC6000 to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented.

### **A** WARNING

Not all DVC6000 digital valve controllers are suitable for use with natural gas as the supply medium. If using natural gas as the supply medium, the DVC6000 must be Gas Certified. Using natural gas as the supply medium in a non-gas certified instrument can result in personal injury or property damage.

Gas Certified instruments can be identified by the natural gas approval label shown in figure 14. Contact your Emerson Process Management sales office for information on obtaining a Gas Certified DVC6000 digital valve controller.

### Figure 14. Label for Natural Gas Certified Terminal Box

NATURAL GAS APPROVED SINGLE SEAL DEVICE MAX SEAL PRESS: 145 PSI SEAL TEMP: -52°C TO 85°C CONDITION NOT TO EXCEED MAIN NAMEPLATE RATING

### **A WARNING**

To avoid personal injury and property damage resulting from bursting of parts, do not exceed maximum supply pressure.

### WARNING

Severe personal injury or property damage may occur from an uncontrolled process if the instrument supply medium is not clean, dry, oil-free, and noncorrosive. While use and regular maintenance of a filter that removes particles larger than 40 micrometers in diameter will suffice in most applications, check with an Emerson Process Management field office and industry instrument air quality standards for use with corrosive air or if you are unsure about the amount of air filtration or filter maintenance.

Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized.

Alternatively, natural gas may be used as the supply pressure medium. Gas must be clean, dry, oil-free, and noncorrosive.  $H_2S$  content should not exceed 20 ppm.

If you are using a 67CFR filter regulator with standard 5 micrometer filter, connect the supply line to the 1/4 NPT IN connection and attach tubing from the output connection on the filter regulator to the SUPPLY connection on the instrument. If you are using an integral mounted 67CFR filter regulator, connect the supply to the IN connection on the regulator.

# **Output Connection**

A factory mounted digital valve controller has its output piped to the supply connection on the actuator. If mounting the digital valve controller in the field, connect the 1/4 NPT digital valve controller output connection to the pneumatic actuator input connection.

### **Single-Acting Actuators**

When using a single-acting direct digital valve controller (relay A or C) on a single-acting actuator, connect OUTPUT A to the actuator pneumatic input.

When using a single-acting reverse digital valve controller (relay B) on a single-acting actuator, connect OUTPUT B to the actuator diaphragm casing.

# **Double-Acting Actuators**

DVC6000 digital valve controllers on double-acting actuators always use relay A. With no input current, OUTPUT A is at 0 pressure and OUTPUT B is at full supply pressure when the relay is properly adjusted.

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To have the actuator stem extend from the cylinder with increasing input signal, connect OUTPUT A to the upper actuator cylinder connection. Connect OUTPUT B to the lower cylinder connection. Figure 15 shows the digital valve controller connected to a double-acting piston actuator.

To have the actuator stem retract into the cylinder with increasing input signal, connect OUTPUT A to the lower actuator cylinder connection. Connect OUTPUT B to the upper cylinder connection.

Figure 15. FIELDVUE DVC6010 Digital Valve Controller Mounted on Fisher 585C Piston Actuator



W9131-1

### Vent

### **A WARNING**

Personal injury or property damage can occur from cover failure due to overpressure. Ensure that the housing vent opening is open and free of debris to prevent pressure buildup under the cover.

This unit vents the supply medium into the surrounding atmosphere. When installing this unit in a non-hazardous (non-classified) location in a confined area, with natural gas as the supply medium, you must remotely vent this unit to a safe location. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

When installing this unit in a hazardous (classified) location remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and federal codes, rules and regulations. Failure to do so when necessary could result in personal injury or property damage from fire or explosion, and area re-classification.

Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

In addition to remote venting of the unit, ensure that all caps and covers are correctly installed. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

The relay output constantly bleeds a small amount of supply medium into the area under the cover. The vent openings at the back of the housing should be left open to prevent pressure buildup under the cover. If a remote vent is required, the vent lines must be as short as possible with a minimum number of bends and elbows.

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# Wiring and Electrical Connections

### **A WARNING**

To avoid personal injury resulting from electrical shock, do not exceed maximum input voltage specified in table 10 of this quick start guide, or on the product nameplate. If the input voltage specified differs, do not exceed the lowest specified maximum input voltage.

Personal injury or property damage caused by fire or explosion may occur if this connection is attempted in a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cover before proceeding.

### **A** WARNING

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion

# 4-20 mA Loop Connections

The digital valve controller is normally powered by a control system output card. The use of shielded cable will ensure proper operation in electrically noisy environments.

#### Note

Connect the digital valve controller to a 4-20 mA current source for operation in the point-to-point wiring mode. In the point-to-point wiring mode, the digital valve controller will not operate when connected to a voltage source.

Wire the digital valve controller as follows, refer to figure 16:

- 1. Remove the loop connections terminal box cap (see figure 13).
- 2. Route the field wiring into the terminal box. When applicable, install conduit using local and national electrical codes which apply to the application.
- 3. Connect the control system output card positive wire "current output" to the LOOP + screw terminal in the terminal box. Connect the control system output card negative (or return) wire to the LOOP screw terminal in the terminal box.

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4. As shown in figure 16, two ground terminals are available for connecting a safety ground, earth ground, or drain wire. The safety ground is electrically identical to the earth ground. Make connections to these terminals following national and local codes and plant standards.

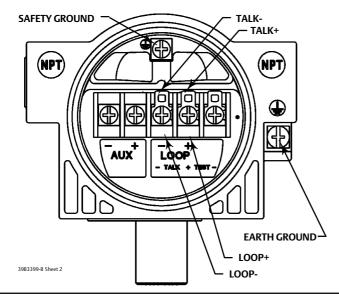
5. Replace and hand tighten the terminal box cap. When the loop is ready for startup, apply power to the control system output card.

### **A WARNING**

Personal injury or property damage, caused by fire or explosion, can result from the discharge of static electricity. Connect a 14 AWG (2.08 mm²) ground strap between the digital valve controller and earth ground when flammable or hazardous gases are present. Refer to national and local codes and standards for grounding requirements.

To avoid static discharge from the plastic cover, do not rub or clean the cover with solvents. Clean with a mild detergent and water only.

Figure 16. Loop Connections Terminal Box



# **HART Filter**

Depending on the control system you are using, a HART filter may be needed to allow HART communication. The HART filter is a passive device that is inserted in field wiring from the HART loop. The filter is normally installed near the field wiring terminals of the control system I/O (see figure 17). Its purpose is to effectively isolate the control system output from modulated HART communication signals and raise the impedance of the control system to allow HART communication. For more information on the description and use of the HART filter, refer to the appropriate separate HART filter instruction manual.

To determine if your system requires a filter contact your Emerson Process Management sales office.

# ✓ Installation Check List

Μοι	ınting
	Is the instrument correctly mounted on the actuator? If not, refer to appropriate mounting procedure and see installation instructions provided with the mounting kit.
	Is the feedback linkage properly connected? If not, see installation instructions provided with the mounting kit.
Pne	umatic Connections and Air Supply
	Is the regulator correctly mounted? If not, perform one of the regulator mounting procedures on page 24.
	Is the air supply connected and at proper pressure? If not, connect supply as described on page 25 Also see specifications on page 41.
	Is the instrument output connected to the actuator? If not, connect instrument output as described on page 26.
Wiri	ng and Electrical Connections
	If necessary, is the conduit properly installed? If not, refer to local and national electrical codes.
	Is the loop wiring properly connected to the LOOP + and - terminals in the terminal box? If not, connect loop wiring as described on page 28.
	If necessary, is the HART filter installed on your system? To determine if a HART filter is necessary, contact your Emerson Process Management sales office. For HART filter installation information, refer to the appropriate HART instruction manual.

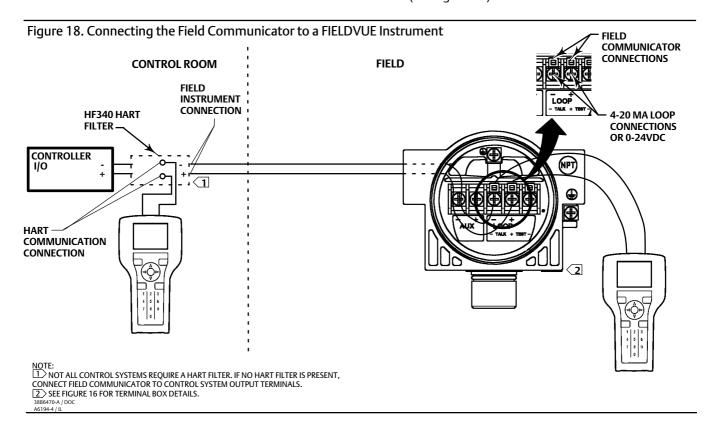
You are ready to perform Basic Setup and Calibration in the next section.

# **Basic Setup and Calibration**

# Connecting the Field Communicator to the Digital Valve Controller

The Field Communicator may be connected to the 4-20 mA loop wiring or directly to the digital valve controller (see figure 18).

If the Field Communicator is connected directly to the digital valve controller, attach the clip-on wires provided with the Field Communicator to the TALK terminals, or the LOOP + and - terminals, in the digital valve controller terminal box. The TALK terminals are the same as the LOOP + and - terminals (see figure 16).



# Basic Setup (1-1)

### **A WARNING**

Changes to the instrument setup may cause changes in the output pressure or valve travel. Depending on the application, these changes may upset process control, which may result in personal injury or property damage.

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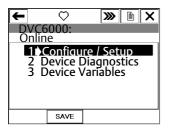
Before beginning Basic Setup, be sure the instrument is correctly mounted. Refer to the installation instructions supplied with the mounting kit.

Connect a 4-20 mA current source to the instrument. Connect the Field Communicator to the instrument and turn it on. For information on connecting the Field Communicator, see Connecting the Field Communicator to the Digital Valve Controller.

# **Typical Actuators**

The Setup Wizard determines the required setup information based upon the actuator manufacturer and model specified. Turn on the Field Communicator and start the Setup Wizard by proceeding through the menu sequence shown in figure 19 or enter the fast-key sequence 1-1-1 on the keypad. Follow the prompts on the Field Communicator display to setup the instrument. If the actuator on which the instrument is mounted is not listed by the Setup Wizard, specify OTHER as the actuator manufacturer or actuator type and refer to Non-Typical Actuators.

Figure 19. Accessing the Setup Wizard on the Field Communicator (Instrument Level HC, AD, and PD)



From the DVC6000 Online menu, select Configure / Setup



From the Configure / Setup menu, select Basic Setup.



From the Basic Setup menu, select Setup Wizard and follow the on-line instructions

### **A** WARNING

During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

After completing the setup information, travel is automatically calibrated. Follow the prompts on the Field Communicator display. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points. For additional information, refer to Auto Calibrate Travel in this section.

When travel calibration is complete, you are asked if you wish to adjust the relay (double-acting only). Select yes to adjust the relay. For additional information, refer to Relay Adjustment in this section.

# **Non-Typical Actuators**

If the actuator on which the instrument is mounted is not listed by the Setup Wizard, specify OTHER as the actuator manufacturer or actuator type. You are then prompted for setup parameters such as:

• Actuator Style (spring & diaphragm, piston double-acting without spring, piston single-acting with spring, piston double-acting with spring)

- Valve Style (rotary or sliding-stem)
- On Loss of Instrument Signal, Valve (opens or closes) This identifies whether the valve is fully open or fully closed when the input is 0%. If you are unsure how to set this parameter, disconnect the current source to the instrument. (With double-acting and single-acting direct digital valve controllers, disconnecting the current source is the same as setting the output A pressure to zero. For single-acting reverse digital valve controllers, disconnecting the current source is the same as setting the output B pressure to supply.)
- Feedback Connection (Rotary All, SStem Standard, SStem Roller). For rotary valves, enter Rotary All. For sliding-stem valves, if the feedback linkage consists of a connector arm, adjustment arm, and feedback arm (similar to figure 22), enter SStem Standard. If the feedback linkage consists of a roller that follows a cam (similar to figure 20), enter SStem Roller.

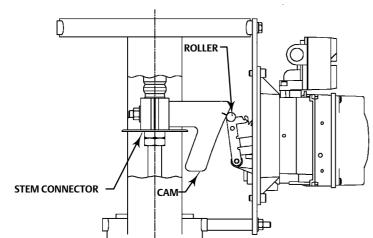


Figure 20. Feedback Connection for Typical Long-Stroke Sliding-Stem Actuator (4 to 24 inches travel)

### **A** WARNING

If you answer YES to the prompt for permission to move the valve when determining travel sensor motion, the instrument will move the valve through a significant portion of its travel range. To avoid personal injury and property damage caused by the release of pressure or process fluid, provide some temporary means of control for the process.

• Travel Sensor Motion The Setup Wizard asks if it can move the valve to determine travel sensor motion. If you answer Yes, the instrument will stroke the valve the full travel span to determine travel sensor motion. If you answer No, then you must specify the rotation for increasing air pressure: clockwise or counterclockwise. Determine rotation by viewing the end of the travel sensor shaft.

**For instruments with relay A or C.** If increasing air pressure at output A causes the shaft to turn clockwise, enter Clockwise. If it causes the shaft to turn counterclockwise, enter Cntrclockwise.

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For instruments with relay B. If decreasing air pressure at output B causes the shaft to turn clockwise, enter Clockwise. If it causes the shaft to turn counterclockwise, enter Cntrclockwise.

#### Note

Relay adjustment may be required before the Setup Wizard can determine travel sensor motion. Follow the prompts on the Field Communicator display if relay adjustment is necessary.

• Volume Booster The Setup Wizard asks if a volume booster or quick release is present.

#### A WARNING

Changes to the tuning set may cause the valve/actuator assembly to stroke. To avoid personal injury and property damage caused by moving parts, keep hands, tools, and other objects away from the valve/actuator assembly.

• Tuning Set There are twelve tuning sets from which to choose. Each tuning set provides preselected values for the digital valve controller gain and rate settings. Typically, tuning set B provides the slowest response and M provides the fastest response. For smaller actuators, use tuning set C or D. For larger actuators, use tuning set F or G.

#### Note

Tuning set B is only available in Pressure Control Mode.

In addition, you can select User Adjusted or Expert, which allows you to modify tuning of the digital valve controller. With User Adjusted you can specify the proportional gain. An algorithm in the Field Communicator calculates the other gains. With Expert you can specify not only the proportional gain but the velocity and minor loop feedback gain as well.

#### Note

Use Expert tuning only if standard tuning has not achieved the desired results.

Stabilize/Optimize or Performance Tuner may be used to achieve the desired results more rapidly than Expert tuning.

The tuning sets suggested by the Setup Wizard are only recommended starting points. After you finish setting up and calibrating the instrument, run the Performance Tuner or use Stabilize/Optimize Tuning to obtain optimum tuning.

### **Factory Defaults**

During basic setup, the Setup Wizard will ask you if you want to use factory defaults. If you select YES, the Setup Wizard sets the setup parameters to the values listed in table 8. (Yes is recommended for initial setup). If you select NO, the setup parameters listed in the table remain at their previous settings.

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**Table 8. Factory Default Settings** 

Setup Parameter	Default Setting
Analog Input Units Analog In Range High Analog In Range Low	mA 20.0 mA 4.0 mA
Control Mode	Analog
Restart Control Mode	Resume Last
Self-Test Shutdown Set Point Filter Time Input Characteristic Travel Limit High Travel Limit Low	All Failures Disabled Filter Off Linear 125% -25%
Travel Cutoff High	99.5%
Travel Cutoff Low	0.5%
Minimum Opening Time Minimum Closing Time Polling Address	0 secs 0 secs 0
Aux Terminal Mode	Aux Input Alert
Command 3 Pressure Double-acting actuators Single-acting actuators	differential output pressure actuator pressure

# Relay Adjustment

The double-acting relay can be adjusted as part of the Setup Wizard. The following is a brief description of relay adjustment. For additional information, see the Calibration section in the DVC6000 instruction manual.

#### Note

Relay B and C are not user-adjustable.

# Double-Acting Relay (Relay A)

The double-acting relay is designated relay A. For double-acting actuators, the valve must be near mid-travel to properly adjust the relay. The Field Communicator will automatically position the valve when *Relay Adjust* is selected.

Rotate the adjustment disc, shown in figure 21, until the value displayed on the Field Communicator is between 50 and 70% of supply pressure. This adjustment is very sensitive. Be sure to allow the pressure reading to stabilize before making another adjustment (stabilization may take up to 30 seconds or more for larger actuators).

If the low bleed relay option has been ordered stabilization may take approximately two minutes longer than the standard relay.

Relay A may also adjusted for use in single-acting- direct applications. Rotate the adjustment disc as shown in figure 21 for single-acting direct operation.

### **CAUTION**

Care should be taken during relay adjustment as the adjustment disc may disengage if rotated too far.

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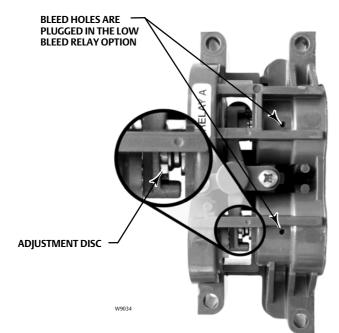
# Single-Acting Direct Relay (Relay C)

The single-acting direct relay is designated relay C, and requires no adjustment.

# Single-Acting Reverse Relay (Relay B)

The single-acting reverse relay is designated relay B. Relay B is calibrated at the factory and requires no further adjustment.

Figure 21. Relay A Adjustment (Shroud Removed for Clarity)



FOR SINGLE-ACTING DIRECT RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION UNTIL IT CONTACTS THE BEAM

FOR DOUBLE-ACTING RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION TO DECREASE OUTPUT PRESSURE



FOR DOUBLE-ACTING RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION TO INCREASE OUTPUT PRESSURE

# **Auto Calibrate Travel**

### **A** WARNING

During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

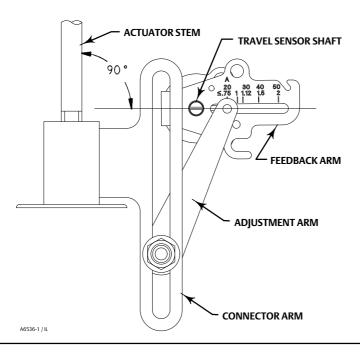
The instrument is calibrated during the Setup Wizard. Follow the prompts on the Field Communicator display to automatically calibrate instrument travel. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points.

For additional calibration information, refer to the DVC6000 instruction manual.

 If the Feedback Connection is Sliding-Stem Standard, the Field Communicator prompts you to select the method of crossover adjustment: manual, last value, or default. Manual adjustment is recommended for initial travel calibration.

2. When prompted by the Field Communicator, make the crossover adjustment by adjusting the current source until the feedback arm is 90° to the actuator stem, as shown in figure 22.

Figure 22. Crossover Point



3. The remainder of the auto-calibration procedure is automatic. After completing auto travel calibration, the Field Communicator prompts you to place the instrument In Service and verify that the travel properly tracks the current source.

If the unit does not calibrate, refer to table 9 for error messages and possible remedies.

If after completing setup and calibration the valve cycles or overshoots (unstable), or is unresponsive (sluggish), you can improve operation by selecting either *Performance Tuner* or *Stabilize/Optimize* from the *Basic Setup* menu.

Table 9. Auto Calibrate Travel Error Messages

Error Message	Possible Problem and Remedy
Input current must exceed 3.8 mA for calibration.	The analog input signal to the instrument must be greater than 3.8 mA. Adjust the current output from the control system or the current source to provide at least 4.0 mA.
Place Out Of Service and ensure Calibrate Protection is disabled before calib.	The Instrument Mode must be <i>Out of Service</i> and the Protection must be <i>None</i> before the instrument can be calibrated.
Calibration Aborted. An end point was not reached.	The problem may be one or the other of the following:  1. The tuning set selected is too low and the valve does not reach an end point in the allotted time. Press the Hot Key, select Stabilize/Optimize then Increase Response (selects next higher tuning set).  2. The tuning set selected is too high, valve operation is unstable and does not stay at an end point for the allotted time. Press the Hot Key, select Stabilize/Optimize then Decrease Response (selects next lower tuning set).
Invalid travel value. Check mounting and feedback arm adjustments, and inst supply press. Then, repeat Auto Calibration.	Verify proper mounting by referring to the appropriate mounting instructions.  Verify instrument supply pressure by referring to the specifications in the appropriate actuator instruction manual.  Making the crossover adjustment with the valve positioned at either end of its travel will also cause this message to appear.
Aborting due to response code or device status.	The instrument may have been taken out of service by a primary master. Put the instrument into service with the primary master or cycle the power off and on.

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# Performance Tuner (1-1-2)

#### Note

The Performance Tuner is not available for instrument level AC or HC.

### **A** WARNING

During performance tuning the valve may move, causing process fluid or pressure to be released. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

The Performance Tuner is used to optimize digital valve controller tuning. It can be used on most sliding-stem and rotary designs, including Fisher and other manufacturers' products. Moreover, because the Performance Tuner can detect internal instabilities before they become apparent in the travel response, it can generally optimize tuning more effectively than manual tuning. Typically, the Performance Tuner takes 3 to 5 minutes to tune an instrument, although tuning instruments mounted on larger actuators may take longer.

Access the Performance Tuner by selecting *Performance Tuner* from the *Basic Setup* menu. Follow the prompts on the Field Communicator display to optimize digital valve controller tuning.

# Stabilizing or Optimizing Valve Response ( or 1-1-2)

#### Note

Stabilize/Optimize is only available through the Basic Setup menu for instrument level HC.

### **A** WARNING

During Stabilize/Optimize the valve may move, causing process fluid or pressure to be released. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

If after completing setup and calibration the valve seems slightly unstable or unresponsive, you can improve operation by pressing the Hot Key and selecting *Stabilize/Optimize*, or select *Stabilize/Optimize* from the *Basic Setup* menu.

Stabilize/Optimize permits you to adjust valve response by changing the digital valve controller tuning.

If the valve is unstable, select *Decrease Response* to stabilize valve operation. This selects the next lower tuning set (e.g., F to E). If the valve response is sluggish, select *Increase Response* to make the valve more responsive. This selects the next higher tuning set (e.g., F to G).

If after selecting *Decrease Response* or *Increase Response* the valve travel overshoot is excessive you can adjust the damping by selecting *Decrease Damping* or *Increase Damping* the

tuning set will become Expert, and allow you to select a damping value that is not represented in a predefined tuning set. Select Decrease Damping to select a damping value that allows more overshoot. Select Increase Damping to select a damping value that will decrease the overshoot.

Basic Setup and Calibration Check List

Is basic setup complete? If not, perform Basic Setup procedure on page 32.

Does the final control element correctly respond to a setpoint change and is it stable? If not, perform Stabilizing or Optimizing Valve Response on page 39.

Final control element is ready to be placed on line.

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#### Table 10. Specifications

### **Available Configurations**

Valve-Mounted Instrument

DVC6010: Sliding-stem applications

DVC6020: Rotary and long-stroke sliding-stem applications

DVC6030: Quarter-turn rotary applications

Remote-Mounted Instrument<sup>(1)</sup>

DVC6005: Base unit for 2 inch pipestand or wall mounting

DVC6015: Feedback unit for sliding-stem applications DVC6025: Feedback unit for rotary or long-stroke

sliding-stem applications

DVC6035: Feedback unit for quarter-turn rotary applications

DVC6000 digital valve controllers can be mounted on Fisher and other manufacturers rotary and sliding-stem actuators.

### **Input Signal**

#### Point-to-Point:

Analog Input Signal: 4-20 mA DC, nominal Minimum Voltage Available at instrument terminals must be 10.5 volts DC for analog control, 11 volts DC for HART communication (see instrument instruction manual for details)

Minimum Control Current: 4.0 mA

Minimum Current w/o Microprocessor Restart: 3.5 mA

Maximum Voltage: 30 volts DC

Overcurrent Protection: Input circuitry limits current to prevent internal damage.

Reverse Polarity Protection: No damage occurs from reversal of loop current.

Multi-drop:

Instrument Power: 11-30 volts DC at approximately

8 mA

Reverse Polarity Protection: No damage occurs from

reversal of loop current.

#### **Output Signal**

Pneumatic signal as required by the actuator, up to full supply pressure.

Minimum Span: 0.4 bar (6 psiq) Maximum Span: 9.5 bar (140 psig)

Action: Double, Single direct, and Single reverse

### Supply Pressure<sup>(2)</sup>

Recommended: 0.3 bar (5 psig) higher than maximum actuator requirements, up to maximum supply pressure

Maximum: 10.0 bar (145 psiq) or maximum pressure rating of the actuator, whichever is lower

Medium: Air or Natural Gas<sup>(3)</sup>

Air: Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized

Natural Gas: Natural gas must be clean, dry, oil-free, and noncorrosive. H<sub>2</sub>S content should not exceed 20 ppm.

### Steady-State Air Consumption<sup>(4)</sup>

**Standard Relay:** At 1.4 bar (20 psig) supply pressure: Less than 0.38 normal m<sup>3</sup>/hr (14 scfh)

At 5.5 bar (80 psig) supply pressure: Less than 1.3 normal m<sup>3</sup>/hr (49 scfh)

Low Bleed Relay<sup>(5)</sup>: At 1.4 bar (20 psig) supply pressure: Average value 0.056 normal m<sup>3</sup>/hr (2.1 scfh)

At 5.5 bar (80 psig) supply pressure: Average value  $0.184 \text{ normal m}^3/\text{hr} (6.9 \text{ scfh})$ 

#### Maximum Output Capacity(4)

At 1.4 bar (20 psig) supply pressure: 10.0 normal  $m^3/hr$  (375 scfh) At 5.5 bar (80 psig) supply pressure: 29.5 normal m<sup>3</sup>/hr (1100 scfh)

### **Failure Modes**

Refer to figure 23

### Independent Linearity<sup>(6)</sup>

±0.50% of output span

-continued-

### Table 10. Specifications (continued)

### **Electromagnetic Compatibility**

Meets EN 61326-1 (First Edition)

Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 11 below

Emissions—Class A

ISM equipment rating: Group 1, Class A

Lightning and Surge Protection—The degree of immunity to lightning is specified as Surge immunity in table 11. For additional surge protection commercially available transient protection devices can be used.

### **Vibration Testing Method**

Tested per ANSI/ISA-75.13.01 Section 5.3.5. A resonant frequency search is performed on all three axes. The instrument is subjected to the ISA specified 1/2 hour endurance test at each major resonance, plus an additional two million cycles.

### Input Impedance

The input impedance of the DVC6000 active electronic circuit is not purely resistive. For comparison to resistive load specifications, an equivalent impedance of 550 ohms may be used. This value corresponds to 11V @ 20 mA.

### Operating Ambient Temperature Limits<sup>(2,7)</sup>

-40 to 85°C (-40 to 185°F) for most approved valve-mounted instruments

-60 to  $125^{\circ}$ C (-76 to  $257^{\circ}$ F) for remote-mounted feedback unit.

-52 to 85°C (-62 to 185°F) for valve-mounted instruments utilizing the Extreme Temperature option (fluorosilicone elastomers)

### **Humidity Limits**

0 to 100% condensing relative humidity with minimal zero or span shifts

#### **Electrical Classification**

#### Hazardous Area:

**CSA**— Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

FM— Intrinsically Safe, Explosion-proof, Non-incendive, Dust Ignition-proof

ATEX— Intrinsically Safe and Dust, Flameproof and Dust, Type n and Dust

IECEx—Intrinsically Safe, Flameproof, Type n

NEPSI— Intrinsically Safe, Flameproof

INMETRO — Intrinsically Safe, Flameproof, Type n

Refer to Special Instructions for "Safe Use" and Installation in Hazardous Locations, starting on page 11, for specific approval information.

Pollution Degree 2, Overvoltage Category III per ANSI/ISA-82.02.01 (IEC 61010-1 Mod).

#### **Electrical Housing:**

CSA—Type 4X, IP66

FM-NEMA 4X

ATEX-IP66

IECEx-IP66

NEPSI-IP66

INMETRO-IP66W

### Other Classifications/Certifications

TIIS-|apan

KISCO— Korea Industrial Safety Corp.

GOST-R—Russian GOST-R

FSETAN— Russian - Federal Service of Technological, Ecological and Nuclear Inspectorate

Contact your Emerson Process Management sales office for classification/certification specific information

# IEC 61010 Compliance Requirements (Valve-Mounted Instruments only)

Power Source: The loop current must be derived from a Separated Extra-Low Voltage (SELV) power source Environmental Conditions: Installation Category I

#### **Connections**

Supply Pressure: 1/4 NPT internal and integral pad for

mounting 67CFR regulator Output Pressure: 1/4 NPT internal Tubing: 3/8-inch, recommended Vent (pipe-away): 3/8 NPT internal

Electrical: 1/2 NPT internal conduit connection, M20

adapter optional

#### Stem/Shaft Travel

Linear Actuators with rated travel between 6.35 mm (0.25 inch) and 606 mm (23.375 inches)

Rotary Actuators with rated travel between 50 degrees and 180 degrees.

-continued-

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#### Table 10. Specifications (continued)

### Mounting<sup>(8)</sup>

Designed for direct actuator mounting or remote pipestand or wall mounting. Mounting the instrument vertically, with the vent at the bottom of the assembly, or horizontally, with the vent pointing down, is recommended to allow drainage of moisture that may be introduced via the instrument air supply.

#### Weight

Valve-Mounted Instruments Aluminum: 3.5 kg (7.7 lbs) Stainless Steel: 7.7 kg (17 lbs)

**Remote-Mounted Instruments** DVC6005 Base Unit: 4.1 kg (9 lbs) DVC6015 Feedback Unit: 1.3 kg (2.9 lbs) DVC6025 Feedback Unit: 1.4 kg (3.1 lbs) DVC6035 Feedback Unit: 0.9 kg (2.0 lbs)

#### **Construction Materials**

Housing, module base and terminal box: ASTMB85

A03600 low copper aluminum alloy Cover: Thermoplastic polyester Elastomers: Nitrile (standard)

#### **Options**

- Supply and output pressure gauges or Tire valves. Integral mounted filter regulator.
- Stainless steel housing, module base and terminal box ■ Low bleed relay ■ In-line 10 micron air filter
- Safety Instrumented System (SIS) Solutions
- Safety Related Nuclear Applications Natural Gas Certified ■ Feedback Assembly PTFE Sleeve Protective Kit for aluminum units in saltwater or particulate environments

#### Declaration of SEP

Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the product may bear the CE marking to indicate compliance with other applicable European Community Directives.

NOTE: Specialized instrument terms are defined in ISA Standard 51.1 - Process Instrument Terminology.

1. 3-conductor shielded cable, 22 AWG minimum wire size, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 15 meters (50 feet) maximum without performance degradation.

2. The pressure/temperature limits in this quick start guide and any applicable code or standard should not be exceeded.

3. Gas Certified DVC6000 digital valve controllers are approved by CSA, FM, ATEX, IECEX, and INMETRO for use with natural gas as the supply medium.

4. Values at 1.4 bar (20 psig) based on a single-acting direct relay; values at 5.5 bar (80 psig) based on double-acting relay.

5. The low bleed relay is offered as standard relay for DVC6000 SIS tier, used for On/Off applications.

6. Typical value. Not applicable for travels less than 19 mm (0.75 inch) or for shaft rotation less than 60 degrees. Also not applicable for DVC6020 digital valve controllers in long-stroke applications.

7. Temperature limits vary based on hazardous area approval.

8. Do not use the DVC60105 or DVC6020 in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator. Due to NAMUR mounting limitations, do not use the DVC60103 in high vibration service. the DVC6030S in high vibration service.

Table 11. EMC Summary Results—Immunity

				Performance Criteria <sup>(1)</sup>	
Port	Phenomenon	Basic Standard	Test Level	Point-to- Point Mode	Multi-drop Mode
	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A <sup>(2)</sup>	А
Enclosure	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz @ 10V/m with 1 kHz AM at 80% 1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80% 2000 to 2700 MHz @ 1V/m with 1 kHz AM at 80%	А	А
	Rated power frequency magnetic field	IEC 61000-4-8	30 A/m at 50/60 Hz	А	А
	Burst	IEC 61000-4-4	1 kV	A <sup>(2)</sup>	A
I/O signal/control	Surge	IEC 61000-4-5	1 kV (line to ground only, each)	В	В
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms	А	A

Performance Criteria: +/- 1% effect

1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.

2. Excluding auxiliary switch function, which meets Performance Criteria B.

Figure 23. FIELDVUE DVC6000 Digital Valve Controller Failure Modes



Relay Type	Loss of Power	Loss of Pneumatic Supply
Single-Acting Direct (Relay C)	Instrument goes to zero air output at port A.	Failure direction per actuator fail mode.
Double-Acting (Relay A)	Instrument goes to full supply air output at port B. A goes to zero air output.	Failure direction cannot be determined.
Single-Acting Reverse (Relay B)	Instrument goes to full supply air output at port B.	Failure direction per actuator fail mode.

# **Related Documents**

This section lists other documents containing information related to DVC6000 digital valve controllers. These documents include:

- Bulletin 62.1:DVC6000—Fisher FIELDVUE DVC6000 Digital Valve Controllers (D102758X012)
- Bulletin 62.1:DVC6000(S1)—Fisher FIELDVUE DVC6000 Digital Valve Controller Dimensions (D103308X012)
- Fisher FIELDVUE DVC6000 Digital Valve Controllers Instruction Manual (D102794X012)
- Supplement to Fisher FIELDVUE DVC6000 Digital Valve Controller Quick Start Guide—Remote Mount Installation Guidelines (D103421X012)
- Supplement to HART Communicating Fisher FIELDVUE Digital Valve Controller Instruction Manuals—FIELDVUE Digital Valve Controller Split Ranging (D103262X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—Using FIELDVUE Instruments with the Smart HART Loop Interface and Monitor (HIM) (D103263X012)
- Using FIELDVUE Instruments with the Smart Wireless THUM™ Adapter and a HART Interface Module (HIM) -Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103469X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—Audio Monitor for HART Communications (D103265X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—HART Field Device Specification (D103266X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—Using the HART Tri-Loop ™ HART-to-Analog Signal Converter with FIELDVUE Digital Valve Controllers (D103267X012)
- Supplement to Fisher FIELDVUE DVC5000 (obsolete product) and DVC6000 Digital Valve Controller Instruction Manuals—Hot Swap Procedure (D103264X012)

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- Supplement to Fisher FIELDVUE DVC6000 Digital Valve Controllers Instruction Manual—Lock-in-Last Strategy (D103261X012)
- Supplement to Fisher FIELDVUE DVC6000 and DVC6000 SIS Digital Valve Controllers Instruction Manuals—275 HART Communicator Menu Trees for Firmware 7 Digital Valve Controllers (D103273X012)
- Fisher HF340 Filter Instruction Manual (D102796X012)
- ValveLink Software Help or Documentation

All documents are available from your Emerson Process Management sales office. Also visit our website at www.FIELDVUE.com.

# **Educational Services**

For information on available courses for DVC6000 digital valve controllers, as well as a variety of other products, contact:

Emerson Process Management Educational Services, Registration P.O. Box 190; 301 S. 1st Ave. Marshalltown, IA 50158-2823 Phone: 800-338-8158 or

Phone: 641-754-3771 FAX: 641-754-3431

e-mail: education@emerson.com

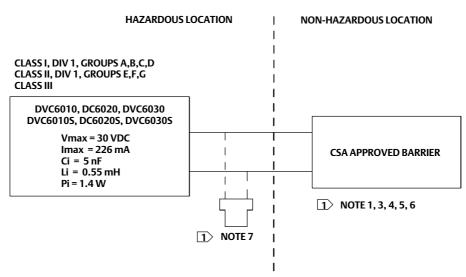
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# **Loop Schematics and Nameplates**

This section includes loop schematics required for wiring of intrinsically safe installations. It also contains the approvals nameplates. If you have any questions, contact your Emerson Process Management sales office.

Figure 24. CSA Schematic



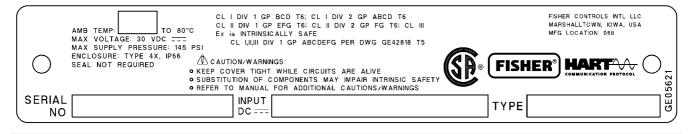
☐ THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax or Ui), THE CURRENT (Imax or Ii), AND THE POWER (Pmax or Pi) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc or Uo), AND THE CURRENT (Isc or Io), AND THE POWER (Po) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (Ci) AND MAX UNPROTECTED INDUCTANCE (Li), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (Cable) AND CABLING INDUCTANCE (Lcable) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

 $V max \ or \ Ui \geq Voc \ or \ Uo \quad Imax \ or \ Ii \geq Isc \ or \ Io \quad P max \ or \ Pi \geq Po \quad Ci + Ccable \leq Ca \quad Li + Lcable \leq La$ 

- 3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) NFPA70 AND ANSI/ISA RP12.6.01
- 4 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms
- **5** RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THE ONE OHM
- **IDENTIFY ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.**
- ☑ IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE CSA APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWING

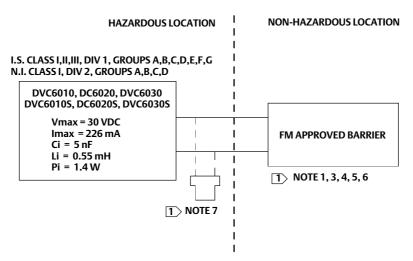
GE42818 sheets 2 and

Figure 25. CSA Nameplate



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Figure 26. FM Schematic



☐ THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax or Ui), THE CURRENT (Imax or Ii), AND THE POWER (Pmax or Pi) OF THE

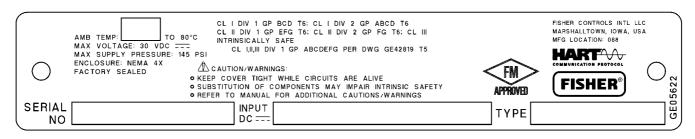
INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc or Uo), AND THE CURRENT (Isc or Io), AND THE POWER (Po) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (Ci) AND MAX UNPROTECTED INDUCTANCE (Li), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (Ccable) AND CABLING INDUCTANCE (Lable) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

 $V max \ or \ Ui \geq Voc \ or \ Uo \quad Imax \ or \ Ii \geq Isc \ or \ Io \quad P max \ or \ Pi \geq Po \quad Ci + Ccable \leq Ca \quad Li + Lcable \leq La$ 

- 3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) NFPA70 AND ANSI/ISA RP12.6.01
- 4 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
- **5** RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THE ONE OHM
- **6 LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTION**
- ☑ IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE FM APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWING

GE42819 sheets 2 and 8

Figure 27. FM Nameplate



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Figure 28. ATEX Nameplate; Intrinsically Safe, Dust

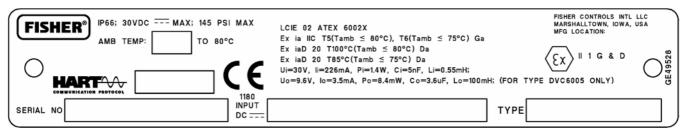


Figure 29. ATEX Nameplate; Flameproof, Dust

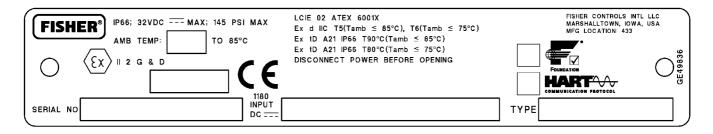
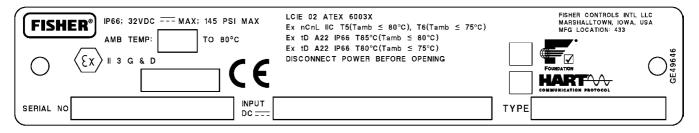
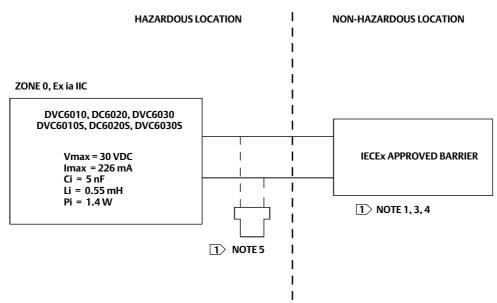


Figure 30. ATEX Nameplate; Type n, Dust



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Figure 31. IECEx Schematic



☐ THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax or Ui), THE CURRENT (Imax or Ii), AND THE POWER (Pmax or Pi) OF THE

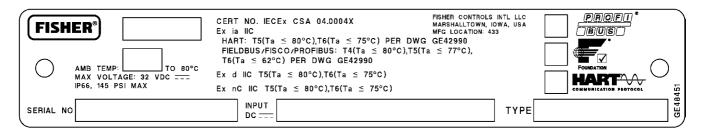
INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc OR Uo), AND THE CURRENT (Isc or Io), AND THE POWER (Po) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (Ci) AND MAX UNPROTECTED INDUCTANCE (Li), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (Ccable) AND CABLING INDUCTANCE (Lcable) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

 $Vmax \ or \ Ui \geq Voc \ or \ Uo \quad Imax \ or \ Ii \geq Isc \ or \ Io \quad Pmax \ or \ Pi \geq Po \quad Ci + Ccable \leq Ca \quad Li + Lcable \leq La$ 

- 3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL WIRING PRACTICES OF THE COUNTRY IN USE
- $\begin{tabular}{l} \blacksquare$  LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS
- **5** IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE IECEX APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURERS CONTROL DRAWING

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Figure 32. IECEx Nameplate



### Figure 33. NEPSI Nameplate

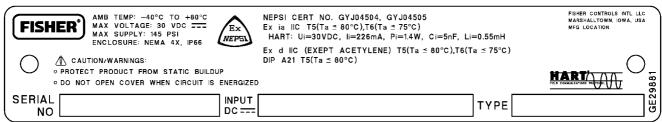


Figure 34. INMETRO Nameplate

FISH	ER°)	para T5: (-52°C≤Tamb≤80°C	-Ex d IIC T5/T6 Gb, BR-Ex nC IIC T5/T6 Gc C), para T6: (-52°C≤Tamb≤75°C) ≤ 1.4W Ci ≤ 5nF Li ≤ 0.55mH	FISHER CONTROLS INTL LLC MARSHALLTOWN, IOWA, USA MFG LOCATION: 433	COMMUNICATION PROTOCOL	
$\circ$	AMB TEMP/ TEMPERATURA DE OPERAÇÃO: MAX VOLTAGE/ MĀXIMA VOLTAGEM: 30 MAX SUPPLY PRESSURE/ MĀXIMA PRES: ENCLOSUBE/INVÔLUCRO: TYPE 4X, IP66V	VDC SÃO DE ENTRADA: 145 PSI	A CAUTION/ATENÇÃO: O DO NOT OPEN WHEN ENERGIZED NÃO ABRA QUANDO ENERGIZADO O AFTER DE-ENERGIZING DELAY 12 SECONDS BI APÓS DESENERGIZAÇÃO, AGUARDE 12 SEGUNI		Segurança  Ex	.591
SERIAL NO. NÚMERO DE SÉRIE		INPUT ENTRADA DC		TYPE TIPO		GE37

November 2011

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# Fisher® FIELDVUE™ DVC6000 Digital Valve Controllers

### **Contents**

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Basic Setup and Calibration
Specifications
Related Documents44
Loop Schematics and Nameplates 46



This guide applies to DVC6010, DVC6020, and DVC6030 digital valve controllers:

Instrument Level	HC, AD, PD	AC
Device Type	03	07
Device Revision	2	2
Hardware Revision	1	1
Firmware Revision	7,9&10	7, 9 & 10
DD Revision	3	1

#### Note

This guide provides installation, initial setup, and calibration information for DVC6000 digital valve controllers. For additional information, refer to the DVC6000 digital valve controllers instruction manual (D102794X012), available from your Emerson Process Management sales office, or from our website at www.FIELDVUE.com.

The DVC6000 digital valve controller instruction manual (D102794X012) can be found at www.FIELDVUE.com http://www.documentation.emersonprocess.com/groups/public/documents/instruction\_manuals/d102794x012.pdf

Refer to Related Documents on page 44 for other documents containing information related to DVC6000 digital valve controllers









### Fast-Key Sequence for Instrument Level HC, AD, PD, and ODV

Function/Variable	Fast-Key Sequence	Coordinates <sup>(1)</sup>
Actuator Style	1-2-6-4	3-D
Alert Conditions	2-1	2-F
Alert Record Full Enable	1-2-3-6-2 1-2-3-7-2	10-H
Alert Record Not Empty Alert Enable	1-2-3-6-1 1-2-3-7-1	10-H
Analog Input	3-1	2-G
Analog Input Calibration	1-3-2-3	4-E
Analog Input Range Hi	1-2-5-3-1	6-H
Analog Input Range Lo	1-2-5-3-2	6-H
Analog Input Units	1-2-5-2-3	6-G
Auto Travel Calibration	1-3-1-1	4-E
Autocalibration in Progress Enable	1-2-4-2-2	8-H
	3-6-1	4-H
Auxiliary Input	1-2-3-3-2-2	12-D
Auxiliary Terminal Alert Enable	1-2-3-3-2-1	12-E
	1-2-3-3-2-3	12-E
Auxiliary Terminal Mode	1-2-5-7	4-G
Burst Command	1-2-1-4-2	6-B
Burst Enable	1-2-1-4-1	6-B
Calibration in Progress Enab	1-2-4-2-1	8-I
Calibration Location	1-2-5-9-2	6-H
Cambracion Eocacion	1-2-3-6-4	011
Clear Record	1-2-3-7-4	- 10-H
Command 3 (Trending) Pressure	1-2-1-4-3	5-A
	Hot Key-2	1-A
Control Mode	1-2-1-2	4-B
Critical NVM Shutdown	1-2-3-1-3-4	12-C
6 1 6 1	1-2-3-5-1-2	12-H
Cycle Count	3-6-5	4-H
Cycle Count Alert Enable	1-2-3-5-1-1	12-H
Cycle Count Alert Point	1-2-3-5-1-3	12-H
Date	1-2-5-1-4	6-G
Dead Band (Cycle Count / Travel Accum)	1-2-3-5-2-1	12-H
Define Custom Characteristic	1-2-2-4	4-C
Descriptor	1-2-5-1-3	6-F
Device Description Information	3-8	2-G
Device ID	3-7-2	2-H
Device Revision	3-7-5	2-H
Diagnostic Data Available Enable	1-2-4-2-4	8-H
Diagnostic in Progress Enable	1-2-4-2-3	8-H
Display Record	1-2-3-6-3 1-2-3-7-3	10-H
Drive Current Shutdown	1-2-3-1-1	8-D
	3-4	2-G
Drive Signal	1-2-3-1-2-2	10-D
Drive Signal Alert Enable	1-2-3-1-2-1	10-D

Edit Feedback Connection   1-2-6-6   3-E     End Point Control Enable   3   1-2-2-5-1     Failure Group Enable   1-2-3-6-5-1     Filmware Revision   3-7-6   2-H     Flash ROM Shutdown   1-2-3-1-3-5   12-C     Hardware Revision   3-7-7   2-H     HART Tag   1-2-5-1-1   6-F     HART Universal Revision   3-7-9   2-H     HART Universal Revision   1-2-3-3   4-C     Instrument Date and Time   1-2-4-1-2   8-G     Instrument Level   3-7-8   2-H     Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-5-1-6   6-G     Integral Limit   1-2-2-1-2   8-B     Integrator Saturated Hi Enable   1-2-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Lag Time   1-2-2-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Led/Lag   3-7-3   3-P     Low Power Write   1-2-3-3-3   9-E     Low Power Write   1-2-3-3-3   9-E     Low Manual Travel Calibration   1-3-1-2   4-E     Manual Travel Calibration   1-2-5-6   4-G     Message   1-2-5-1-2   6-F     Manual Travel Shale   1-2-4-3   8-H     Multi-Drop Alert Enable   1-2-4-3   8-H     Multi-Drop Alert Enable   1-2-3-3-3   10-I     Model   3-7-4   2-H     Multi-Drop Alert Enable   1-2-3-1-3-6   12-C     Number of Power Ups   3-6-9   4-H     Offline/Failed Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test Pressure Limit   1-2-3-6-1   10-G	Function/Variable	Fast-Key	Coordinates <sup>(1)</sup>
End Point Control Enable (3)         1-2-2-2-5-1         8-D           Failure Group Enable         1-2-3-6-5-1         10-1           Firmware Revision         3-7-6         2-H           Flash ROM Shutdown         1-2-3-1-3-5         12-C           Hardware Revision         3-7-7         2-H           HART Tag         1-2-5-1-1         6-F           HART Universal Revision         3-7-9         2-H           Input Characterization         1-2-2-3         4-C           Instrument Date and Time         1-2-4-1-2         8-G           Instrument Level         3-7-8         2-H           Instrument Mode         Hot Key-1         1-A           Instrument Serial Number         1-2-5-1-6         6-G           Instrument Time Invalid Enable         1-2-4-1-1         8-G           Integral Dead Zone         1-2-4-1-1         8-G           Integral Limit         1-2-4-1-1         8-G           Integral Limit         1-2-4-4-3         8-I           Integrator Saturated Hi Enable         1-2-4-4-1         8-I           Integrator Saturated Lo Enable         1-2-4-4-1         8-I           Lag Time(5)         1-2-2-5-3         5-D           Last Calibration Status         <	·		
Failure Group Enable         1-2-3-6-5-1 / 1-2-3-7-5-1         10-1           Firmware Revision         3-7-6         2-H           Flash ROM Shutdown         1-2-3-1-3-5         12-C           Hardware Revision         3-7-7         2-H           HART Tag         1-2-5-1-1         6-F           HART Universal Revision         3-7-9         2-H           Input Characterization         1-2-2-3         4-C           Instrument Date and Time         1-2-4-1-2         8-G           Instrument Level         3-7-8         4-G           Instrument Mode         1-2-4-1-2         8-G           Instrument Serial Number         1-2-5-1-6         6-G           Instrument Time Invalid Enable         1-2-4-1-1         8-G           Integral Dead Zone         1-2-4-1-1         8-G           Integral Limit         1-2-4-4-3         8-I           Integral Limit         1-2-4-4-3         8-I           Integral Saturated Hi Enable         1-2-4-4-1         8-I           Integrator Saturated Hi Enable         1-2-4-4-1         8-I           Integrator Saturated Li Enable         1-2-2-5-3         5-D           Last Calibration Status         1-2-2-5-3         5-D           Loop Current V			
Failure Group Enable   1-2-3-7-5-1   10-1	End Point Control Enable <sup>(3)</sup>		8-D
1-2-3-7-3-1   1-2-6	Failure Group Enable		10-I
Flash ROM Shutdown	·		
Hardware Revision 3-7-7 2-H  HART Tag 1-2-5-1-1 6-F  3-7-1 2-H  HART Universal Revision 3-7-9 2-H  Input Characterization 1-2-2-3 4-C  Instrument Date and Time 1-2-5-8 4-G  Instrument Level 1-2-5-8 4-G  Instrument Mode 1-2-5-8 4-G  Instrument Serial Number 1-2-5-1-6 6-G  Instrument Time Invalid Enable 1-2-4-1-1 8-G  Integral Dead Zone 1-2-4-4-1 8-I  Integral Limit 1-2-2-1-2 8-B  Integrator Saturated Hi Enable 1-2-4-4-1 8-I  Integrator Saturated Lo Enable 1-2-4-4-1 8-I  Lag Time(5) 1-2-2-5-3 5-D  Last Calibration Status 1-2-5-9-1 6-H  Lead/Lag(3) 1-2-2-5-3 5-D  Loop Current Validation(6) 1-2-3-1-3-2 12-B  Manual Travel Calibration 1-3-1-2 4-E  Manufacturer - instrument 1-2-6-1 3-D  Manufacturer - actuator 3-7-3 2-H  Maximum Supply Pressure 1-2-5-6 4-G  Message 1-2-5-1-2 6-F  Miscellaneous Group Enable 1-2-3-1-3-6 12-C  Non-Critical NVM Alert Enable 1-2-3-1-3-1 12-B  Partial Stroke Test Pressure Limit(3) 1-2-3-6-1 10-G			
HART Tag			
HART Tag   3-7-1   2-H     HART Universal Revision   3-7-9   2-H     Input Characterization   1-2-2-3   4-C     Instrument Date and Time   1-2-4-1-2   8-G     Instrument Level   3-7-8   2-H     Instrument Mode   1-2-5-8   4-G     Instrument Mode   1-2-11   4-B     Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-4-1-1   8-B     Integral Limit   1-2-2-1-2-1   8-B     Integral Limit   1-2-4-4-3   8-I     Integrator Saturated Hi Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-2   8-I     Lag Time (5)   1-2-2-5-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Lead/Lag(3)   1-2-2-5-3   5-D     Low Power Write   1-2-3-1-3-2   12-B     Manual Travel Calibration   1-3-1-2   4-E     Manual Travel Calibration   1-3-1-2   4-E     Manual Travel Calibration   1-2-5-6   4-G     Message   1-2-5-1-2   6-F     Miscellaneous Group Enable   1-2-4-3-2   8-H     Multi-Drop Alert Enable   1-2-3-1-3-6   12-C     Number of Power Ups   3-6-9   4-H     Offline/Failed Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test Enable(3)   1-2-7-1   3-D     Partial Stroke Test Enable(10)   1-2-3-6-1   10-G	Hardware Revision		
HART Universal Revision	HART Tag	_	
Input Characterization	HART Universal Povision		
Instrument Date and Time			
Instrument Date and Time	IIIput Cilaracterization		
Instrument Level   3-7-8   2-H     Instrument Mode   Hot Key-1   1-A     Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-4-4-4   8-I     Integral Limit   1-2-2-1-2-1   8-B     Integral Limit   1-2-4-4-3   8-I     Integrator Saturated Hi Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-2   8-I     Lag Time <sup>(5)</sup>   1-2-2-5-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Lead/Lag(3)   1-2-2-5-3   5-D     Loop Current Validation <sup>(6)</sup>   1-2-3-3-3   9-E     Low Power Write   1-2-3-1-3-2   12-B     Manual Travel Calibration   1-3-1-2   4-E     Manufacturer - instrument   1-2-6-1   3-D     Manufacturer - actuator   3-7-3   2-H     Maximum Supply Pressure   1-2-5-6   4-G     Message   1-2-5-1-2   6-F     Message   1-2-5-1-2   6-F     Miscellaneous Group Enable   1-2-3-7-5-3     Model   3-7-4   2-H     Multi-Drop Alert Enable   1-2-3-1-3-6   12-C     Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C     Number of Power Ups   2-3-4   4-G     Offline/Failed Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test Enable <sup>(3)</sup>   1-2-7-1   3-D     Partial Stroke Test Pressure Limit <sup>(3)</sup>   1-2-3-6-1   10-G	Instrument Date and Time		
Hot Key-1	Instrument Lovel		
Instrument Mode	IIISTI UITIETIT LEVEI		
Instrument Serial Number   1-2-5-1-6   6-G     Instrument Time Invalid Enable   1-2-4-1-1   8-G     Integral Dead Zone   1-2-4-4-4   8-I     Integral Limit   1-2-2-1-2-1   8-B     Integral Limit   1-2-4-4-3   8-I     Integrator Saturated Hi Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-4-1   8-I     Integrator Saturated Lo Enable   1-2-4-2   8-I     Lag Time <sup>(5)</sup>   1-2-2-5-3   5-D     Last Calibration Status   1-2-5-9-1   6-H     Lead/Lag <sup>(3)</sup>   1-2-2-5-3   5-D     Loop Current Validation <sup>(6)</sup>   1-2-3-3-3   9-E     Low Power Write   1-2-3-1-3-2   12-B     Manual Travel Calibration   1-3-1-2   4-E     Manufacturer - instrument   1-2-6-1   3-D     Manufacturer - actuator   3-7-3   2-H     Maximum Supply Pressure   1-2-5-6   4-G     Message   1-2-5-1-2   6-F     Miscellaneous Group Enable   1-2-3-1-3-6   10-I     Model   3-7-4   2-H     Multi-Drop Alert Enable   1-2-3-1-3-6   12-C     Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C     Number of Power Ups   2-3-4   4-G     Offline/Failed Alert Enable   1-2-3-1-3-1   12-B     Partial Stroke Test (3)   2-5   2-F     Partial Stroke Test Pressure Limit <sup>(3)</sup>   1-2-3-6-1   10-G	Instrument Mode	,	
Instrument Time Invalid Enable         1-2-4-1-1         8-G           Integral Dead Zone         1-2-4-4-4         8-I           Integral Limit         1-2-2-1-2-1         8-B           Integrator Saturated Hi Enable         1-2-4-4-3         8-I           Integrator Saturated Lo Enable         1-2-4-4-1         8-I           Integrator Saturated Lo Enable         1-2-4-4-2         8-I           Lag Time <sup>(5)</sup> 1-2-2-5-3         5-D           Last Calibration Status         1-2-5-9-1         6-H           Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C	Instrument Serial Number		
Integral Dead Zone			
1-2-2-1-2-1   8-B   1-2-4-4-3   8-I   1-2-4-4-3   8-I   1-2-4-4-3   8-I   1-2-4-4-1   8-I   1-2-2-1-2-2   8-B   Integrator Saturated Hi Enable   1-2-4-4-1   8-I   Integrator Saturated Lo Enable   1-2-4-4-2   8-I   Lag Time <sup>(5)</sup>   1-2-2-5-3   5-D   Last Calibration Status   1-2-5-9-1   6-H   Lead/Lag <sup>(3)</sup>   1-2-2-5-3   5-D   Loop Current Validation <sup>(6)</sup>   1-2-3-3-3   9-E   Low Power Write   1-2-3-1-3-2   12-B   Manual Travel Calibration   1-3-1-2   4-E   Manufacturer - instrument   1-2-6-1   3-D   Manufacturer - actuator   3-7-3   2-H   Maximum Supply Pressure   1-2-5-6   4-G   Message   1-2-5-1-2   6-F   Miscellaneous Group Enable   1-2-3-6-5-3   10-I   Model   3-7-4   2-H   Multi-Drop Alert Enable   1-2-4-3-2   8-H   No Free Time Shutdown   1-2-3-1-3-6   12-C   Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C   Number of Power Ups   2-3-4   4-G   3-6-9   4-H   Offline/Failed Alert Enable   1-2-3-1-3-1   12-B   Partial Stroke Test Enable <sup>(3)</sup>   1-2-3-6-1   10-G   10-G	Ilistrument fille lilvalid Enable		
1-2-4-4-3	Integral Dead Zone		
Integral Limit			_
Integrator Saturated Hi Enable	Integral Limit		-
Integrator Saturated Lo Enable  Lag Time <sup>(5)</sup> Last Calibration Status  1-2-5-9-1  Lead/Lag <sup>(3)</sup> Loop Current Validation <sup>(6)</sup> Low Power Write  1-2-3-1-3-2  Low Power Write  Manual Travel Calibration  1-3-1-2  Manufacturer - instrument  1-2-6-1  Maximum Supply Pressure  Miscellaneous Group Enable  Miscellaneous Group Enable  Model  3-7-4  Multi-Drop Alert Enable  No Free Time Shutdown  No Free Time Shutdown  1-2-3-1-3-3  12-C  Number of Power Ups  Partial Stroke Test Enable <sup>(3)</sup> Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1  1-2-3-6-1  1-2-3-6-1  1-2-3-6-1  1-2-3-6-1  1-2-3-1-3-1  12-B  Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1  10-G	Integrator Saturated Hi Enable		
Lag Time <sup>(5)</sup> 1-2-2-5-3         5-D           Last Calibration Status         1-2-5-9-1         6-H           Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Enable <sup>(3)</sup> 1-2-3-6-1         10-G			_
Last Calibration Status         1-2-5-9-1         6-H           Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	•		_
Lead/Lag <sup>(3)</sup> 1-2-2-5-3         5-D           Loop Current Validation <sup>(6)</sup> 1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test (3)         2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	. 3		
Loop Current Validation(6)         1-2-3-3-3         9-E           Low Power Write         1-2-3-1-3-2         12-B           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G			
Low Power Write         1-2-3-1-3-2         12-8           Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-3-7-5-3         12-C           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test Enable <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G			
Manual Travel Calibration         1-3-1-2         4-E           Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	-		
Manufacturer - instrument         1-2-6-1         3-D           Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G			
Manufacturer - actuator         3-7-3         2-H           Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test (3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G		-	
Maximum Supply Pressure         1-2-5-6         4-G           Message         1-2-5-1-2         6-F           Miscellaneous Group Enable         1-2-3-6-5-3         10-I           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test (3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G			
Message       1-2-5-1-2       6-F         Miscellaneous Group Enable       1-2-3-6-5-3       10-I         Model       3-7-4       2-H         Multi-Drop Alert Enable       1-2-4-3-2       8-H         No Free Time Shutdown       1-2-3-1-3-6       12-C         Non-Critical NVM Alert Enable       1-2-3-1-3-3       12-C         Number of Power Ups       2-3-4       4-G         Offline/Failed Alert Enable       1-2-3-1-3-1       12-B         Partial Stroke Test (3)       2-5       2-F         Partial Stroke Test Enable(3)       1-2-7-1       3-D         Partial Stroke Test Pressure Limit(3)       1-2-3-6-1       10-G			
Miscellaneous Group Enable       1-2-3-6-5-3       10-I         Model       3-7-4       2-H         Multi-Drop Alert Enable       1-2-4-3-2       8-H         No Free Time Shutdown       1-2-3-1-3-6       12-C         Non-Critical NVM Alert Enable       1-2-3-1-3-3       12-C         Number of Power Ups       2-3-4       4-G         Offline/Failed Alert Enable       1-2-3-1-3-1       12-B         Partial Stroke Test(3)       2-5       2-F         Partial Stroke Test Enable(3)       1-2-7-1       3-D         Partial Stroke Test Pressure Limit(3)       1-2-3-6-1       10-G			
Miscellaneous Group Enable         10-1           Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	Wessage		0-1
Model         3-7-4         2-H           Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	Miscellaneous Group Enable		10-l
Multi-Drop Alert Enable         1-2-4-3-2         8-H           No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	Model		2-H
No Free Time Shutdown         1-2-3-1-3-6         12-C           Non-Critical NVM Alert Enable         1-2-3-1-3-3         12-C           Number of Power Ups         2-3-4         4-G           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G			
Non-Critical NVM Alert Enable   1-2-3-1-3-3   12-C	-		
Number of Power Ups         2-3-4         4-G           3-6-9         4-H           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test(3)         2-5         2-F           Partial Stroke Test Enable(3)         1-2-7-1         3-D           Partial Stroke Test Pressure Limit(3)         1-2-3-6-1         10-G	110 Tree Time Shataonin		
Number of Power Ups         3-6-9         4-H           Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G			
Offline/Failed Alert Enable         1-2-3-1-3-1         12-B           Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	Number of Power Ups		
Partial Stroke Test <sup>(3)</sup> 2-5         2-F           Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1         3-D           Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1         10-G	Offline/Failed Alert Enable		
Partial Stroke Test Enable <sup>(3)</sup> 1-2-7-1 3-D Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1 10-G			
Partial Stroke Test Pressure Limit <sup>(3)</sup> 1-2-3-6-1 10-G			
	Partial Stroke Test Start Point <sup>(3)</sup>	1-2-2-5-2	8-D

NOTE: Italicized Fast-Key Sequence indicates fast-key sequence is applicable only for instrument level ODV.

1. Coordinates are to help locate the item on the menu tree on page 4 and 5.

3. Instrument level ODV only.

5. Instrument level HC, AD, and PD only.

6. Firmware 9 and 10 only.

### Fast-Key Sequence for Instrument Level HC, AD, PD, and ODV (continued)

Function/Variable	Fast-Key Sequence	Coordinates <sup>(1)</sup>
Partial Stroke Test Variables View/Edit <sup>(3)</sup>	1-2-7-2	3-D
Performance Tuner <sup>(2)</sup>	1-1-2	2-B
renormance runer-	1-2-2-1-1-5	8-A
Polling Address	1-2-5-1-7	6-G
Power Starvation Alert Enable <sup>(7)</sup>	1-2-3-1-3-2	12-B
Pressure A	3-5-1	4-G
Pressure B	3-5-2	4-G
Pressure Control Active Enable	1-2-4-3-1	8-H
Pressure Deviation Alert Enable <sup>(3)</sup>	1-2-3-6-2	10-G
Pressure Deviation Alert Point(3)	1-2-3-6-3	10-G
Pressure Deviation Time <sup>(3)</sup>	1-2-3-6-4	10-G
Pressure Differential	3-5-3	4-G
Pressure Integral Control Enable	1-2-2-1-3-2	8-C
Pressure Integral Gain	1-2-2-1-3-3	8-C
Pressure MLFB Gain	1-2-2-1-3-1-3	10-B
Pressure Proportional Gain	1-2-2-1-3-1-2	10-B
Pressure Range Hi	1-2-2-2-4-1	10-D
Pressure Range Lo	1-2-2-2-4-2	10-D
Pressure Sat Time <sup>(3)</sup>	1-2-2-2-5-4	8-D
Pressure Sensor Shutdown <sup>(2)</sup>	1-2-3-2-3	12-C
Pressure Sensors—Calibration	1-3-2-1	4-E
Pressure Set Point <sup>(3)</sup>	1-2-2-2-5-3	8-D
Pressure Tuning Set	1-2-2-1-3-1-1	10-B
Pressure Units	1-2-5-2-1	6-G
Tressure office	Hot Key-3	1-A
Protection	1-2-1-5	4-B
Raw Travel Input	3-6-7	4-H
Reference Voltage Shutdown	1-2-3-1-3-7	12-C
Relay Adjust	1-3-3	3-E
Relay Type	1-2-5-4	4-F
Restart Control Mode	1-2-1-3	4-B
Restore Factory Settings	1-3-4	3-E
Restore ructory settings	2-3-3	3-F
Run Time	3-6-8	4-H
Set Point Rate Close	1-2-2-5-2	5-D
Set Point Rate Open	1-2-2-5-1	5-D
Setup Wizard	1-1-1	2-B
Setup Wizard	Hot Key-4	1-A
Stabilize/Optimize	1-1-2 <sup>(4)</sup>	2-B
Stabilize/Optimize	1-2-2-1-1-4	8-A
Status	2-2	2-F
Stroke Valve	2-2	2-F
Scione valve	3-5-4	4-G
Supply Pressure <sup>(2)</sup>	1-2-3-3-1-2	12-D
Supply Pressure Lo Alert Enable <sup>(2)</sup>	1-2-3-3-1-2	12-D
Supply Pressure Lo Alert Point <sup>(2)</sup>	1-2-3-3-1-1	12-D
Temperature	3-6-2	4-H
remperature	3-6-3	4-H 4-H
Temperature Maximum	2-3-1	3-F
	2-3-1	3-F
Temperature Minimum	3-6-4	3-г 4-Н
	3-0-4	4-⊓

Function/Variable	Fast-Key	Coordinates <sup>(1)</sup>
	Sequence	10.0
Temperature Sensor Shutdown	1-2-3-2-2	12-C
Temperature Units	1-2-5-2-2	6-G
Travel	3-3	2-G
	1-2-3-4-1	9-E
Travel / Pressure Cutoff Hi	1-2-3-4-7-3	12-F
,	1-2-2-2-1	10-B
Travel / Pressure Cutoff Lo	1-2-3-4-7-4	10-F
	1-2-2-2-2	10-B
Travel / Pressure Select	1-2-2-2-1	5-C
Travel Accumulator	3-6-6	4-H
	1-2-3-5-3-2	12-H
Travel Accumulator Alert Enable	1-2-3-5-3-1	12-H
Travel Accumulator Alert Point	1-2-3-5-3-3	12-l
Travel Alert Dead Band	1-2-3-4-3	9-E
Travel Alert Hi Enable	1-2-3-4-6-1	10-F
Travel Alert Hi Hi Enable	1-2-3-4-5-1	12-E
Travel Alert Hi Hi Point	1-2-3-4-5-3	12-F
Travel Alert Hi Point	1-2-3-4-6-3	10-F
Travel Alert Lo Enable	1-2-3-4-6-2	10-F
Travel Alert Lo Lo Enable	1-2-3-4-5-2	12-E
Travel Alert Lo Lo Point	1-2-3-4-5-4	12-F
Travel Alert Lo Point	1-2-3-4-6-4	10-F
Travel Deviation Alert Enable	1-2-3-4-4-1	10-E
Travel Deviation Alert Point	1-2-3-4-4-2	10-E
Travel Deviation Time	1-2-3-4-4-3	10-E
Travel Integral Control Enable	1-2-2-1-1-2	8-A
Travel Integral Gain	1-2-2-1-1-3	8-A
Travel Limit / Cutoff Hi Alert Enable	1-2-3-4-7-1	12-F
Travel Limit / Cutoff Lo Alert Enable	1-2-3-4-7-2	12-F
,	1-2-3-4-7-5	12-G
Travel Limit Hi	1-2-2-3-1	10-C
	1-2-3-4-7-6	12-G
Travel Limit Lo	1-2-2-3-2	10-C
Travel MLFB Gain	1-2-2-1-1-1-4	10-A
Travel Proportional Gain	1-2-2-1-1-1-2	10-A
Travel Sensor Adjust	1-3-2-2	4-E
Travel Sensor Motion	1-2-6-5	3-E
Travel Sensor Shutdown	1-2-3-2-1	12-C
are. sense. sinatas iii.	1-2-3-4-2	9-E
Travel Set Point	3-2	2-G
Travel Tuning Set	1-2-2-1-1-1	10-A
Travel Velocity Gain	1-2-2-1-1-3	10-A
	1-2-3-6-5-2	.571
Valve Group Enable	1-2-3-7-5-2	10-I
Valve Serial Number	1-2-5-1-5	6-F
	1-2-6-2	3-D
Valve Style	1-2-6-3	3-D
Zero Power Condition	1-2-5-5	4-G

NOTE: Italicized Fast-Key Sequence indicates fast-key sequence is applicable only for instrument level ODV.

1. Coordinates are to help locate the item on the menu tree on page 4 and 5.

2. Not available in instrument level HC.

3. Instrument level ODV only.

4. Instrument level HC only.

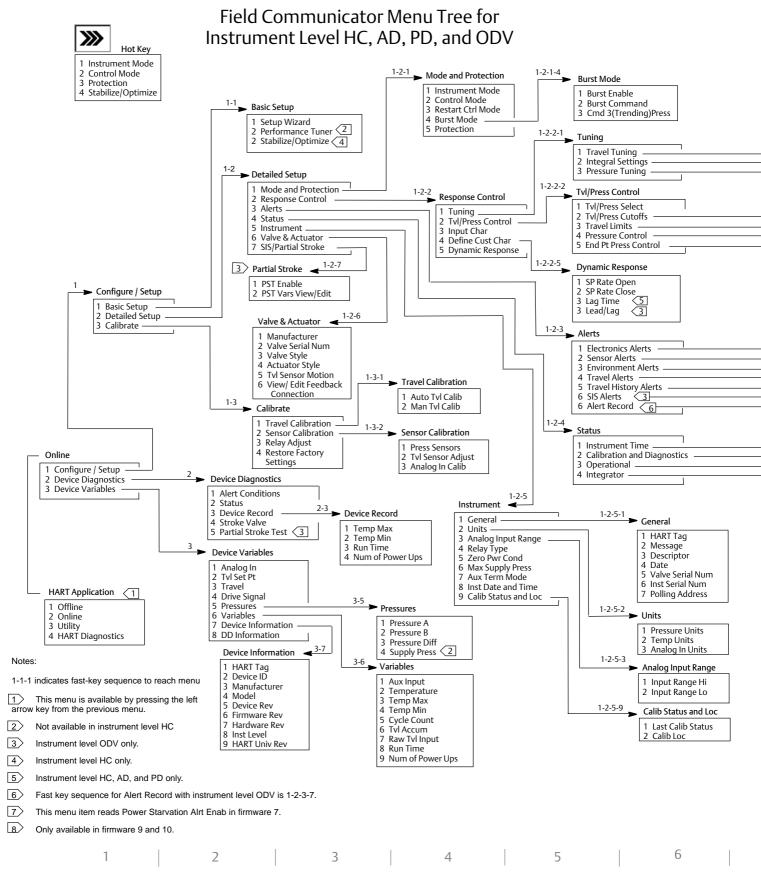
5. Instrument level HC, AD, and PD only.6

7. Instrument level AD, PD, and ODV only.

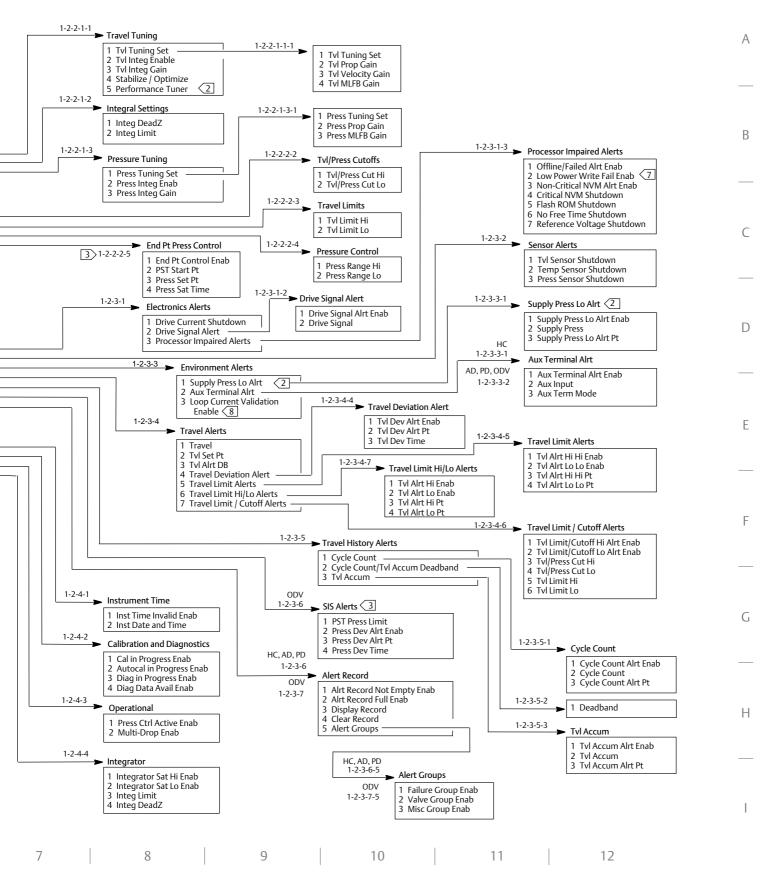
3

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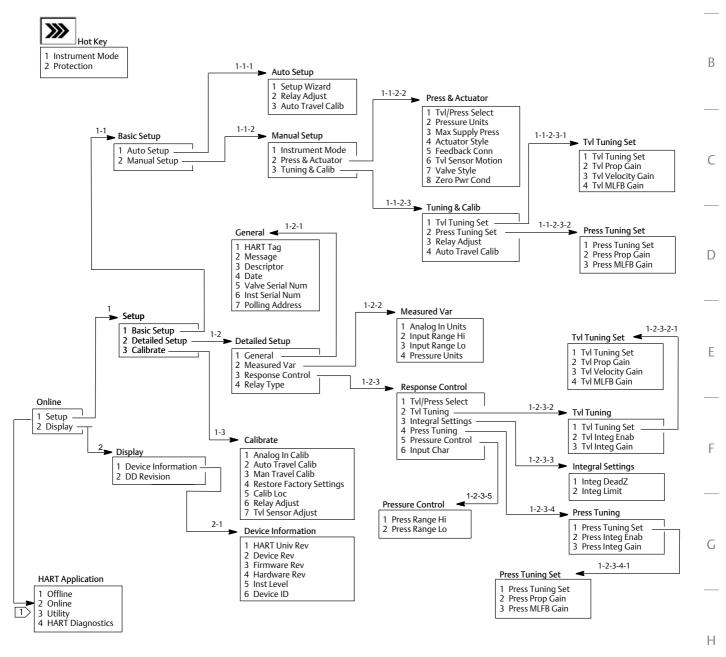
### Fast-Key Sequence for Instrument Level AC

Function/Variable	Fast-Key Sequence	Coordinates <sup>(1)</sup>
Actuator Style	1-1-2-2-4	4-C
Analog Input Calibration	1-3-1	3-F
Analog Input Range Hi	1-2-2-2	4-E
Analog Input Range Lo	1-2-2-3	4-E
Analog Input Units	1-2-2-1	4-E
	1-1-2-3-4	4-D
Auto Travel Calibration	1-3-2	3-F
	1-1-1-3	3-C
Calibration Location	1-3-5	3-G
Date	1-2-1-4	3-D
Descriptor	1-2-1-3	3-D
Device Description Revision	2-2	2-F
Device Identification	2-1-6	3-H
Device Revision	2-1-2	3-G
Feedback Connection	1-1-2-2-5	4-C
Firmware Revision	2-1-3	3-G
Hardware Revision	2-1-4	3-G
HART Tag	1-2-1-1	3-D
HART Universal Revision	2-1-1	3-G
Input Characterization	1-2-3-6	4-F
Instrument Level	2-1-5	3-H
Instrument Mode	Hot Key-1	1-B
instrument wode	1-1-2-1	3-C
Instrument Serial Number	1-2-1-6	3-D
Integral Dead Zone	1-2-3-3-1	6-F
Integral Limit	1-2-3-3-2	6-F
Manual Travel Calibration	1-3-3	3-F
Maximum Supply Pressure	1-1-2-2-3	4-C
Message	1-2-1-2	3-D
Polling Address	1-2-1-7	3-E
Pressure Integral Control Enable	1-2-3-4-2	6-G
Pressure Integral Gain	1-2-3-4-3	6-G
Pressure MLFB Gain	1-1-2-3-2-3	6-D
FIESSUIE WILFD GAIII	1-2-3-4-1-3	5-H

r ressure integral dain	1-2-3-4-3	0-0				
Pressure MLFB Gain	1-1-2-3-2-3	6-D				
Plessule MLFB Galli	1-2-3-4-1-3	5-H				
1. Coordinates are to help locate the item on the menu tree on page 7.						

Function/Variable	Fast-Key Sequence	Coordinates <sup>(1)</sup>
n n .: 16 :	1-1-2-3-2-2	6-D
Pressure Proportional Gain	1-2-3-4-1-2	5-H
Pressure Range Hi	1-2-3-5-1	4-G
Pressure Range Lo	1-2-3-5-2	4-G
Durana Tanina Cat	1-1-2-3-2-1	6-D
Pressure Tuning Set	1-2-3-4-1-1	6-G
Donas de la	1-1-2-2-2	4-C
Pressure Units	1-2-2-4	4-E
Protection	Hot Key-2	1-B
	1-1-1-2	3-B
Relay Adjust	1-1-2-3-3	4-D
	1-3-6	3-G
Relay Type	1-2-4	3-E
Restore Factory Settings	1-3-4	3-F
Setup Wizard	1-1-1-1	3-D
Travel Integral Gain	1-2-3-2-3	6-F
Travel Integral Enable	1-2-3-2-2	6-F
T 14450 C 1	1-1-2-3-1-4	6-C
Travel MLFB Gain	1-2-3-2-1-4	6-E
T 1/2 C1 :	1-1-2-2-1	4-C
Travel / Pressure Select	1-2-3-1	4-F
T 10 10	1-1-2-3-1-2	6-C
Travel Proportional Gain	1-2-3-2-1-2	6-E
Travel Sensor Adjust	1-3-7	3-G
Travel Sensor Motion	1-1-2-2-6	4-C
Toward Towards on C. 1	1-1-2-3-1-1	6-C
Travel Tuning Set	1-2-3-2-1-1	6-E
T 1// 1/ 6 :	1-1-2-3-1-3	6-C
Travel Velocity Gain	1-2-3-2-1-3	6-E
Valve Serial Number	1-2-1-5	3-D
Valve Style	1-1-2-2-7	4-C
Zero Power Condition	1-1-2-2-8	4-C

### Field Communicator Menu Tree for Instrument Level AC



#### Notes:

1-1-1 indicates fast-key sequence to reach menu

This menu is available by pressing the left arrow key from the previous menu.

1 2 3 4 5

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### **Product Description**

DVC6000 digital valve controllers (figure 1 and 2) are communicating, microprocessor-based current-to-pneumatic instruments. In addition to the traditional function of converting an input current signal to a pneumatic output pressure, the DVC6000 digital valve controller communicate via HART® protocol.

DVC6000 digital valve controllers are designed to directly replace standard pneumatic and electro-pneumatic valve mounted positioners.

Figure 1. FIELDVUE DVC6010 Digital Valve Controller Mounted on a Fisher Sliding-Stem Valve Actuator



Figure 2. Fisher Rotary Control Valve with FIELDVUE DVC6020 Digital Valve Controller



#### Note

Do not install, operate, or maintain a DVC6000 digital valve controller without being fully trained and qualified in valve, actuator, and accessory installation, operation, and maintenance. To avoid personal injury or property damage, it is important to carefully read, understand, and follow all contents of this quick start guide, including all safety cautions and warnings. If you have any questions about these instructions, contact your Emerson Process Management sales office before proceeding.

### Using this Guide

This guide describes how to install, setup, and calibrate DVC6000 digital valve controllers. Additional information for installing, operating, and maintaining the DVC6000 digital valve controller can be found in the related documents listed on page 44. Refer to table 1 for details on the capabilities of each diagnostic tier.

Table 1. Instrument Level Capabilities

Diagnostic Level					
AC	HC	AD	PD	ODV	
Х	Х	Х	X	Х	
Х	Х	Х	Х	Х	
	X	X	X	Х	
	Х	Х	Х	Х	
		Х	Х	Х	
		Х	X	Х	
		Х	Х	Х	
		Х	Х	Х	
			X	Х	
			Х	Х	
				Х	
	X	X X X X X X	AC	AC         HC         AD         PD           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X           X         X         X         X	

This guide describes instrument setup and calibration using a 475 Field Communicator. For information on using the Field Communicator, see the 475 Field Communicator User's Manual, available from your Emerson Process Management sales office.

#### Note

Menu sequences for the 475 Field Communicator are found at the beginning of this guide.

These menu sequences are also applicable to the 375 Field Communicator.

You can also setup and calibrate the instrument using a personal computer and ValveLink software or AMS Suite: Intelligent Device Manager. For information on using ValveLink software or AMS Device Manager with a FIELDVUE instrument, refer to the appropriate documentation or online help.

### Displaying the Field Communicator Device Description Revision Number

Device Description (DD) revision identifies the version of the Fisher Device Description that resides in the Field Communicator. The device description defines how the Field Communicator interacts with the user and instrument. You can display the DD revision from the Offline or Online menu.

Offline Menu—To see the Field Communicator device description revision number from the Offline menu, select *Utility*, *Simulation*, *Fisher Controls*, and *DVC6000*.

Online Menu—To see the Field Communicator device description revision number from the Online menu, connect the Field Communicator to an instrument connected to a source supplying a 4-20 mA signal. From the Online menu, select *Device Variables* and *DD Information*.

### Displaying the FIELDVUE Instrument Firmware Revision Number

To view the instrument firmware revision, connect the Field Communicator to an instrument connected to a source supplying a 4-20 mA signal. From the Online menu, select *Device Variables, Device Information*, and *Firmware Rev*.

#### Note

Neither Emerson, Emerson Process Management, nor any of their affiliated entities assume responsibility for the selection, use, or maintenance of any product. Responsibility for the selection, use, and maintenance of any product remains with the purchaser and end user.

### Installation

The DVC6000 can be used with either air or natural gas as the supply medium. If using natural gas as the pneumatic supply medium, natural gas will be used in the pneumatic output connections of the DVC6000 to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented. When using natural gas as the supply medium, in a non-hazardous location in a confined area, remote venting of the unit is required. Failure to do so could result in personal injury, property damage, and area re-classification. For hazardous locations remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and federal codes, rules and regulations. Failure to do so when necessary could result in personal injury, property damage, and area re-classification.

#### Note

Gas Certified DVC6000 digital valve controllers are approved by CSA, FM, ATEX, IECEx, and INMETRO for use with natural gas as the supply medium.

### **A** WARNING

Avoid personal injury or property damage from sudden release of process pressure or bursting of parts. Before proceeding with any Installation procedures:

- Always wear protective clothing, gloves, and eyewear to prevent personal injury or property damage.
- Do not remove the actuator from the valve while the valve is still pressurized.
- Personal injury or property damage may result from fire or explosion if natural gas is used as the supply medium and appropriate preventive measures are not taken. Preventive measures may include, but are not limited to, one or more of the following: Remote venting of the unit, re-evaluating the hazardous area classification, ensuring adequate ventilation, and the removal of any ignition sources. For information on remote venting of this controller, refer to page 27.
- Disconnect any operating lines providing air pressure, electric power, or a control signal to the actuator. Be sure the actuator cannot suddenly open or close the valve.
- Use bypass valves or completely shut off the process to isolate the valve from process pressure. Relieve process pressure from both sides of the valve.
- Vent the pneumatic actuator loading pressure and relieve any actuator spring precompression.
- Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- Check with your process or safety engineer for any additional measures that must be taken to protect against process media.

### **A** WARNING

To avoid static discharge from the plastic cover, do not rub or clean the cover with solvents. To do so could result in an explosion. Clean with a mild detergent and water only.

#### **A** WARNING

This unit vents the supply medium into the surrounding atmosphere. When installing this unit in a non-hazardous (non-classified) location in a confined area, with natural gas as the supply medium, you must remotely vent this unit to a

safe location. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

When installing this unit in a hazardous (classified) location remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and federal codes, rules and regulations. Failure to do so when necessary could result in personal injury or property damage from fire or explosion, and area re-classification.

Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

In addition to remote venting of the unit, ensure that all caps and covers are correctly installed. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

# Special Instructions for "Safe Use" and Installations in Hazardous Locations

Certain nameplates may carry more than one approval, and each approval may have unique installation/wiring requirements and/or conditions of "safe use". These special instructions for "safe use" are in addition to, and may override, the standard installation procedures. Special instructions are listed by approval.

### **WARNING**

Failure to follow these conditions of "safe use" could result in personal injury or property damage from fire or explosion, or area re-classification.

### **A WARNING**

The apparatus enclosure contains aluminum and is considered to constitute a potential risk of ignition by impact or friction. Avoid impact and friction during installation and use to prevent risk of ignition.

#### **CSA**

Special Conditions of Safe Use

Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

No special conditions for safe use.

Refer to table 2 for approval information, figure 24 for the CSA loop schematic, and figure 25 for the CSA nameplate.

Table 2. Hazardous Area Classifications—CSA (Canada)

Certification Body	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
		Ex ia Intrinsically Safe Class I,II,III Division 1 GP A,B,C,D,E, F,G per drawing GE42818 T5 Natural Gas Approved	Vmax = 30 VDC Imax = 226 mA Ci = 5 nF Li = 0.55 mH	T5(Tamb ≤ 80°C)	Type 4X, IP66 Single Seal Device
CSA	DVC60x0 DVC60x0S (x = 1,2,3)	Explosion-proof Class I Division 1 GP B,C,D T6 Natural Gas Approved		T6(Tamb ≤ 80°C)	Type 4X, IP66 Single Seal Device
	(^ 1,2,3)	Class I Division 2 GP A,B,C,D T6 Class II Division 1 GP E,F,G T6 Class II Division 2 GP F,G T6 Class III Natural Gas Approved		T6(Tamb ≤ 80°C)	Type 4X, IP66 Single Seal Device

#### FM

### Special Conditions of Safe Use

#### Intrinsically Safe, Explosion-proof, Non-incendive, Dust Ignition-proof

- 1. When product is used with natural gas as the pneumatic medium, the maximum working pressure of the natural gas supply shall be limited to 145psi.
- 2. When product is used with natural gas as the pneumatic medium the product shall not be permitted in a Class I, Division 2, Group A, B, C, D location without the proper venting installation as per the manufacturer's instruction manual.

Refer to table 2 for approval information, figure 26 for the FM loop schematic, and figure 27 for the FM nameplate.

Table 3. Hazardous Area Classifications—FM (United States)

Certification Body	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
		Intrinsically Safe Class I,II,III Division 1 GP A,B,C,D,E,F,G per drawing GE42819 T5 Natural Gas Approved	Vmax = 30 VDC Imax = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C)	NEMA 4X
FM	DVC60x0 DVC60x0S (x = 1,2,3)	Explosion-proof Class I Division 1 GP B,C,D T6 Natural Gas Approved		T6(Tamb ≤ 80°C)	NEMA 4X
		Class I Division 2 GP A,B,C,D T6 Class II Division 1 GP E,F,G T6 Class II Division 2 GP F,G T6 Class III Natural Gas Approved		T6(Tamb ≤ 80°C)	NEMA 4X

#### **ATEX**

#### Special Conditions for Safe Use

### Intrinsically Safe, Dust

- 1. This apparatus can only be connected to an intrinsically safe certified equipment and this combination must be compatible as regards the intrinsically safe rules.
- 2. The electrical parameters of this equipment must not exceed any following values:  $U_O \le 30 \text{ V}$ ;  $I_O \le 226 \text{ mA}$ ;  $P_O \le 1.4 \text{ W}$
- 3. Operating ambient temperature: -52°C or -40°C to +80°C
- 4. For the model with aluminum body: the apparatus must not be submitted to frictions or mechanical impacts.
- 5. Covered by standards EN 60079-0 (2006), EN 60079-11 (2007), EN 60079-26 (2007), EN 61241-0 (2006), and EN 61241-11 (2006).

Refer to table 4 for additional approval information, and figure 28 for the the ATEX Intrinsically Safe, Dust nameplate.

#### Flameproof, Dust

Operating ambient temperature: -52°C or -40°C to +85°C

Refer to table 4 for additional approval information, and figure 29 for the ATEX Flameproof, Dust nameplate.

#### Type n, Dust

Operating ambient temperature: -52°C or -40°C to +80°C

Refer to table 4 for additional approval information, and figure 30 for the ATEX Type n, Dust nameplate.

Table 4. Hazardous Area Classifications—ATEX

Certificate	Type	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
	DVC60x0 DVC60x0S (x = 1,2,3)	(ii) II 1 G & D Intrinsically Safe Gas Ex ia IIC T5/T6 Ga Dust Ex iaD 20 T100°C (Tamb ≤ 80°C) Ex iaD 20 T85°C (Tamb ≤ 75°C) Natural Gas Approved	Ui = 30 VDC Ii = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
ATEX		(a) II 2 G & D Flameproof Gas Ex d IIC T5/T6 Dust Ex tD A21 IP66 T90°C (Tamb ≤ 85°C) Ex tD A21 IP66 T80°C (Tamb ≤ 75°C) Natural Gas Approved		T5(Tamb ≤ 85°C) T6(Tamb ≤ 75°C)	IP66
		(ii) II 3 G & D Type n Gas Ex nCnL IIC T5/T6 Dust Ex tD A22 IP66 T85°C (Tamb ≤ 80°C) Ex tD A22 IP66 T80°C (Tamb ≤ 75°C) Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66

### **IECE**x

### **Conditions of Certification**

### Intrinsically Safe, Flameproof, Type n

Ex ia /Ex nC / Ex d

1. **Warning:** Electrostatic charge hazard. Do not rub or clean with solvents. To do so could result in an explosion. *Ex nC / EX d* 

2. Do not open while energized.

Refer to table 5 for additional approval information, figure 31 for the IECEx loop schematic and figure 32 for the IECEx nameplate.

Table 5. Hazardous Area Classifications—IECEx

Certificate	Type	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
IECEx [		Intrinsically Safe Gas Ex ia IIC T5/T6 per drawing GE42990 Natural Gas Approved	Ui = 30 VDC Ii = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
	DVC60x0 DVC60x0S (x = 1,2,3)	Flameproof Gas Ex d IIC T5/T6 Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
		Type n Gas Ex nC IIC T5/T6 Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66

### **NEPSI**

Notes for Safe Use of the Certified Product

#### Intrinsically Safe, Dust and Flameproof, Dust

DVC6000 digital valve controllers (designated as controller hereafter) have been proved to be in conformity with the requirements specified in the national standards GB3836.1-2000, GB3836.2-2000, GB3836.4-2000, and GB12476.1-2000 through inspections conducted by National Supervision and Inspection Centre for Explosion Protection and Safety of Instrumentation (NEPSI). The Ex markings for the products are Ex d II CT5 (acetylene not included), DIPA21T5 or Ex ia II CT5, DIPA21T5 respectively and their Ex certificate numbers are GYJ04504 and GYJ04505. When using the product, the user should pay attention to the items stated below:

- 1. The specific product types of approved DVC6000 digital valve controllers (covered in this quick start guide) at this time are DVC6010, DVC6020 and DVC6030.
- 2. The enclosure of the controller provides a grounding terminal, and the user should install a reliable grounding wire connected to it when mounting and using the controller.
- 3. The controller's cable entrance (1/2 NPT) must be fitted with a cable entry device which is Ex-approved through inspection of explosion protection, in conformity with relevant standards of GB3836 and has a corresponding rating of explosion protection.
- 4. The maximum operating ambient temperature range of the controller is -40°C to +80°C.
- 5. The principle of "Opening equipment's cover is allowed only after the power is off" must be abided by when using and maintaining the controller in the field.
- 6. The values for intrinsically safe parameters of the controller (Intrinsically safe type) are as follow: Ui = 30V, Ii = 226mA, Pi = 1.4W, Ci = 5nF, Li = 0.55mH
- 7. While the controller forms an intrinsically safe explosion protection system together with a corresponding associated equipment safety barrier, the following requirements must be met:

  Uo ≤ Ui, lo ≤ Ii, Po ≤ Pi, Co ≥ Ci + Cc, Lo ≥ Li + Lc

#### Note

Where Cc and Lc represent distributing capacitance and inductance of the connecting cable respectively.

- 8. The safety barrier must be placed at safety location, and the instruction manuals of both the product and fitted safety barrier must be followed while conducting system wiring and using the product; The connecting cable should be a shield cable with the area of core section being greater than  $0.5 \, \mathrm{mm}^2$  and its shield (or insulation screen) being grounded at a safe location and insulated from the product enclosure; The cable should be routed so that the electro-magnetic interference can be eliminated as much as possible and that the cable distributing parameters of capacitance and inductance can be controlled within  $0.06 \mu F/1 \, \mathrm{mH}$ .
- 9. The user must not be allowed to replace the internal electric components of the product and change the condition of system wiring at will and on his own.
- 10. The user must follow the relevant rules specified by the product instruction manual, the "15th Section of Electric Equipment Used in Explosive Gaseous Environment: Electric Installation in Hazardous Locations (except for coal mine)" of GB3836.15-2000 standard, the "Design Code for Electric Power Installation in Explosive and Fire-hazardous Environment" of GB50058-1992 standard, and the "Safety Regulations against dust explosion" of GB15577-1995 standard while performing installation, operation, and maintenance for the product.

Refer to table 6 for additional approval information, and figure 33 for the NEPSI approvals nameplate.

Table 6. Hazardous Area Classifications—NEPSI

Certificate	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
NEPSI	DVC60x0 (x = 1,2,3)	Intrinsically Safe Gas Ex ia IIC T5/T6 Dust DIP A21 T5	Ui = 30 V li = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66
NEPSI		Flameproof Gas Ex d IIC T5/T6 Dust DIP A21 T5		$T5(Tamb \le 80^{\circ}C)$ $T6(Tamb \le 75^{\circ}C)$	IP66

#### **INMETRO**

Special Conditions of Safe Use

Intrinsically Safe, Flameproof

Refer to table 7 and figure 34 for approval information.

Contact your Emerson Process Management sales office for additional safe use information.

Table 7. Hazardous Area Classifications—INMETRO

Certificate	Туре	Certification Obtained	Entity Rating	Temperature Code	Enclosure Rating
INMETRO	DVC60x0 (x = 1,2,3)	Intrinsically Safe Gas BR-Ex ia IIC T5/T6 Ga per drawing GE42990 Natural Gas Approved	Ui = 30 VDC li = 226 mA Ci = 5 nF Li = 0.55 mH Pi = 1.4 W	T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66W
		Flameproof Gas BR-Ex d IIC T5/T6 Gb Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66W
		Type n Gas BR-Ex nC IIC T5/T6 Gc Natural Gas Approved		T5(Tamb ≤ 80°C) T6(Tamb ≤ 75°C)	IP66W

### **Mounting Guidelines**

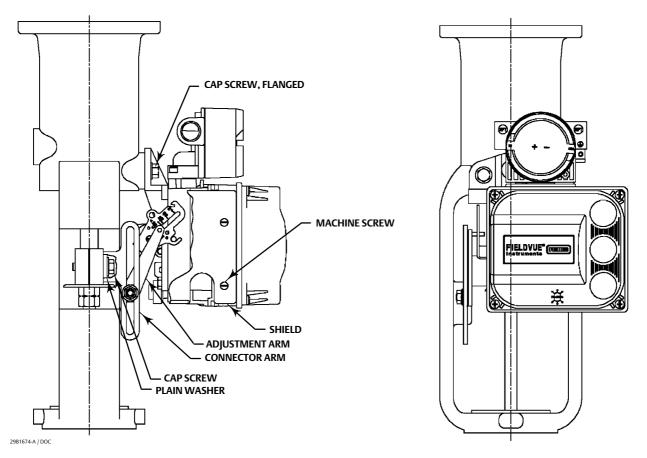
### Standard DVC6000 Digital Valve Controllers

If ordered as part of a control valve assembly, the factory mounts the digital valve controller on the actuator, makes pneumatic connections to the actuator, sets up, and calibrates the instrument. If you purchased the digital valve controller separately, you will need a mounting kit to mount the digital valve controller on the actuator. See the instructions that come with the mounting kit for detailed information on mounting the digital valve controller to a specific actuator model.

### DVC6010 on Sliding-Stem Actuators Up to 102 mm (4 Inches) of Travel

The DVC6010 digital valve controller mounts on sliding-stem actuators with up to 102 mm (4 inch) travel. Figure 3 shows a typical mounting on an actuator with up to 51 mm (2 inch) travel. Figure 4 shows a typical mounting on actuators with 51 to 102 mm (2 to 4 inch) travel. For actuators with greater than 102 mm (4 inch) travel, see the quidelines for mounting a DVC6020 digital valve controller.

Figure 3. FIELDVUE DVC6010 Digital Valve Controller Mounted on Sliding-Stem Actuators with up to 2 Inches Travel



#### Note

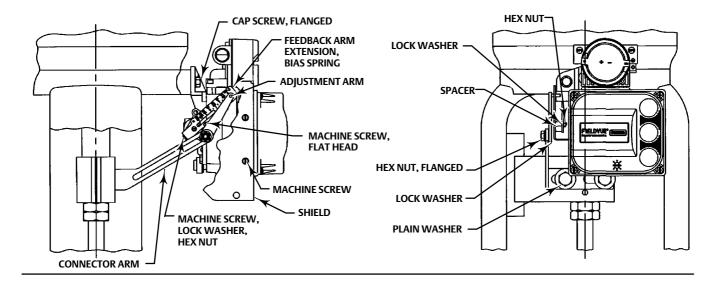
Do not use the stainless steel DVC6010S in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator.

Refer to the following guidelines when mounting on sliding-stem actuators with up to 4 inches of travel.

- 1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while you work on the equipment.
- 2. Attach the connector arm to the valve stem connector.
- 3. Attach the mounting bracket to the digital valve controller housing.

4. If valve travel exceeds 2 inches, a feedback arm extension is attached to the existing 2-inch feedback arm. Remove the existing bias spring from the 2-inch feedback arm. Attach the feedback arm extension to the feedback arm as shown in figure 4.

Figure 4. FIELDVUE DVC6010 Digital Valve Controller Mounted on Sliding-Stem Actuators with 2 to 4 Inches Travel



- 5. Mount the digital valve controller on the actuator as described in the mounting kit instructions.
- 6. Set the position of the feedback arm on the digital valve controller to the no air position by inserting the alignment pin through the hole on the feedback arm as follows:
  - For air-to-open actuators (i.e., the actuator stem retracts into the actuator casing or cylinder as air pressure to the casing or lower cylinder increases), insert the alignment pin into the hole marked "A". For this style actuator, the feedback arm rotates counterclockwise, from A to B, as air pressure to the casing or lower cylinder increases.
  - For air-to-close actuators (i.e., the actuator stem extends from the actuator casing or cylinder as air pressure to the casing or upper cylinder increases), insert the alignment pin into the hole marked "B". For this style actuator, the feedback arm rotates clockwise, from B to A, as air pressure to the casing or upper cylinder increases.

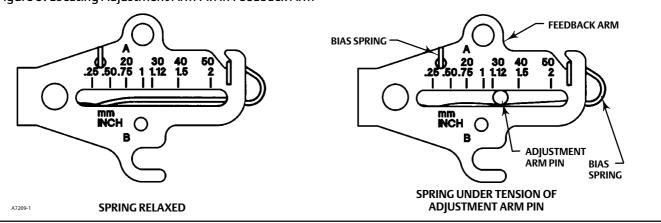
#### Note

When performing the following steps, ensure there is enough clearance between the adjustment arm and the feedback arm to prevent interference with the bias spring.

7. Apply anti-seize to the pin of the adjustment arm. As shown in figure 5, place the pin into the slot of the feedback arm or feedback arm extension so that the bias spring loads the pin against the side of the arm with the valve travel markings.

- 8. Install the external lock washer on the adjustment arm. Position the adjustment arm in the slot of the connector arm and loosely install the flanged hex nut.
- 9. Slide the adjustment arm pin in the slot of the connector arm until the pin is in line with the desired valve travel marking. Tighten the flanged hex nut.
- 10. Remove the alignment pin and store it in the module base next to the I/P assembly.
- 11. After calibrating the instrument, attach the shield with two machine screws.

Figure 5. Locating Adjustment Arm Pin in Feedback Arm



### DVC6020 on Sliding-Stem Actuators and Rotary Actuators

DVC6020 digital valve controllers use a cam (designed for linear response) and roller as the feedback mechanism. Figure 6 shows the DVC6020 mounted on rotary actuators.

#### Note

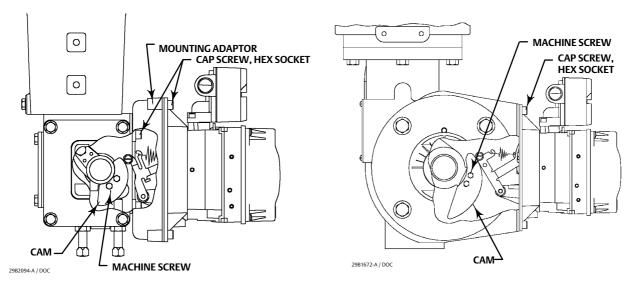
All cams supplied with FIELDVUE mounting kits are characterized to provide a linear response.

#### Note

Do not use the stainless steel DVC6020S in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator.

As shown in figure 6, two feedback arms are available for the digital valve controller. Installations on Fisher 1051 size 33 and 1052 size 20 and 33 actuators use the short feedback arm [54 mm (2.13 inches) from roller to pivot point]. Most other use the long feedback arm. Make sure the correct feedback arm is installed on the digital valve controller before beginning the mounting procedure.





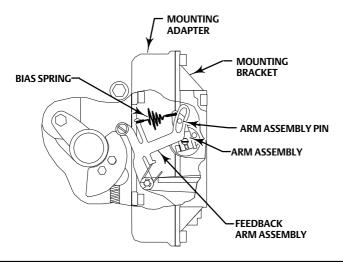
TYPICAL MOUNTING WITH SHORT FEEDBACK ARM (FISHER 1052 SIZE 33 ACTUATOR SHOWN)

TYPICAL MOUNTING WITH LONG FEEDBACK ARM (FISHER 1061 SIZE 30-68 ACTUATOR SHOWN)

Refer to figure 6 for parts locations. Refer to the following guidelines when mounting on rotary actuators:

- 1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.
- 2. If a cam is not already installed on the actuator, install the cam as described in the instructions included with the mounting kit.
- 3. If a mounting plate is required, fasten the mounting plate to the actuator.
- 4. For applications that require remote venting, a pipe-away bracket kit is available. Follow the instructions included with the kit to replace the existing mounting bracket on the digital valve controller with the pipe-away bracket and to transfer the feedback parts from the existing mounting bracket to the pipe-away bracket.
- 5. Apply anti-seize to the arm assembly pin, as shown in figure 7.





#### 6. Mount the DVC6020 on the actuator as follows:

- If required, a mounting adaptor is included in the mounting kit. Attach the adaptor to the actuator as shown in figure 6. Then attach the digital valve controller assembly to the adaptor. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached.
- If no mounting adaptor is required, attach the digital valve controller assembly to the actuator or mounting plate. The roller on the digital valve controller feedback arm will contact the actuator cam as it is being attached.

### DVC6030 on Quarter-Turn Actuators

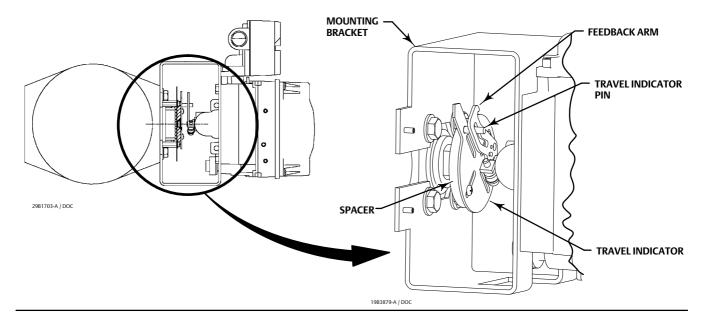
Figure 8 shows the DVC6030 digital valve controller mounted on a quarter-turn actuator. Refer to figure 8 for parts locations. Refer to the following quidelines when mounting on quarter-turn actuators:

#### Note

Due to NAMUR mounting limitations, do not use the stainless steel DVC6030S in high vibration service.

- 1. Isolate the control valve from the process line pressure and release pressure from both sides of the valve body. Shut off all pressure lines to the pneumatic actuator, releasing all pressure from the actuator. Use lock-out procedures to be sure that the above measures stay in effect while working on the equipment.
- 2. If necessary, remove the existing hub from the actuator shaft.
- 3. If a positioner plate is required, attach the positioner plate to the actuator as described in the mounting kit instructions.

Figure 8. Mounting a FIELDVUE DVC6030 Digital Valve Controller on a Rotary Actuator (Fisher 1032 Size 425A Shown)



4. If required, attach the spacer to the actuator shaft.

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Refer to figures 9 and 10. The travel indicator assembly can have a starting position of 7:30 or 10:30. Determine the desired starting position then proceed with the next step. Considering the top of the digital valve controller as the 12 o'clock position, in the next step attach the travel indicator, so that the pin is positioned as follows:

- If increasing pressure from the digital valve controller output A rotates the potentiometer shaft clockwise (as viewed from the back of the instrument), mount the travel indicator assembly so that the arrow is in the 10:30 position, as shown in figure 9.
- If increasing pressure from the digital valve controller output A rotates the potentiometer shaft counterclockwise (as viewed from the back of the instrument), mount the travel indicator assembly so that the arrow is in the 7:30 position, as shown in figure 10.

#### Note

ValveLink software and the Field Communicator use the convention of clockwise (figure 9) and counterclockwise (figure 10) when viewing the potentiometer shaft from the back of the FIELDVUE instrument.

- 5. Attach the travel indicator to the shaft connector or spacer as described in the mounting kit instructions.
- 6. Attach the mounting bracket to the digital valve controller.

Figure 9. Explanation of FIELDVUE DVC6030 Travel Indicator Starting Position and Movement, if <u>Clockwise</u> Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator

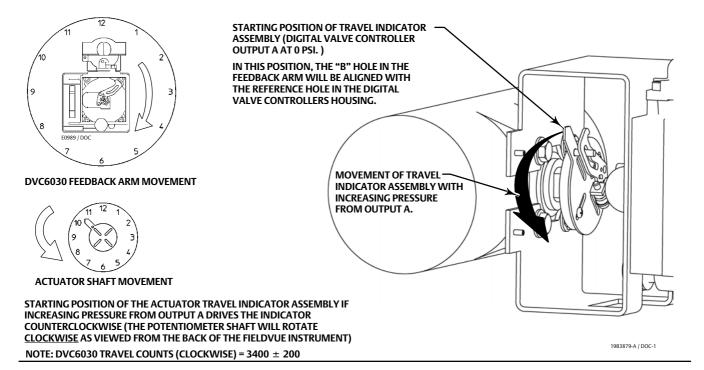
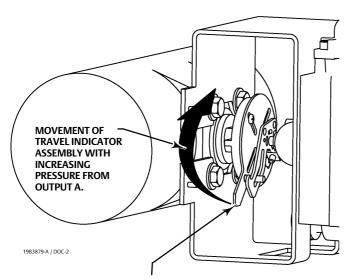


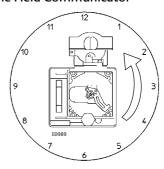
Figure 10. Explanation of FIELDVUE DVC6030 Travel Indicator Starting Position and Movement if <u>Counterclockwise</u> Orientation is Selected for "Travel Sensor Motion" in ValveLink Software or the Field Communicator



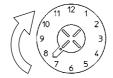
STARTING POSITION OF TRAVEL INDICATOR ASSEMBLY (DIGITAL VALVE CONTROLLER OUTPUT A AT 0 PSI).

IN THIS POSITION, THE "A" HOLE IN THE FEEDBACK ARM WILL BE ALIGNED WITH THE REFERENCE HOLE IN THE DIGITAL VALVE CONTROLLERS HOUSING.

NOTE: DVC6030 TRAVEL COUNTS (COUNTERCLOCKWISE) =  $600 \pm 200$ 



DVC6030 FEEDBACK ARM MOVEMENT

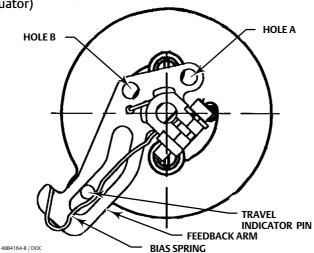


**ACTUATOR SHAFT MOVEMENT** 

STARTING POSITION OF THE TRAVEL INDICATOR ASSEMBLY IF INCREASING PRESSURE FROM OUTPUT A DRIVES THE INDICATOR CLOCKWISE THE POTENTIOMETER SHAFT WILL ROTATE COUNTERCLOCKWISE AS VIEWED FROM THE BACK OF THE FIELDVUE INSTRUMENT.

- 7. Position the digital valve controller so that the pin on the travel indicator, engages the slot in the feedback arm and that the bias spring loads the pin as shown in figure 11. Attach the digital valve controller to the actuator or positioner plate.
- 8. If a travel indicator scale is included in the mounting kit, attach the scale as described in the mounting kit instructions.

Figure 11. Positioning Travel Indicator Pin in the Feedback Arm (Viewed as if Looking from the FIELDVUE DVC6030 toward the Actuator)



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### Remote-Mount DVC6000 Instruments

Refer to the quick start guide supplement, Remote Mount Installation Guidelines (D103421X012) or the DVC6000 digital valve controller instruction manual (D102794X012).

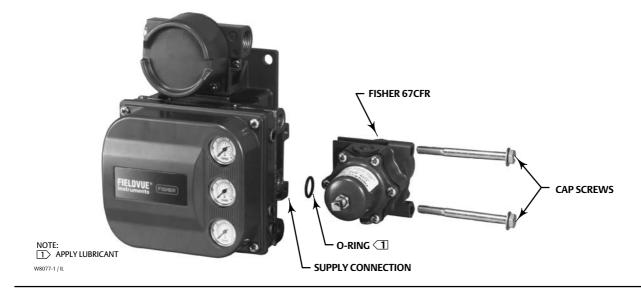
### 67CFR Filter Regulator

A 67CFR filter regulator, when used with the DVC6000 digital valve controller, can be mounted three ways.

### Integral-Mounted Regulator

Refer to figure 12. Lubricate an O-ring and insert it in the recess around the SUPPLY connection on the digital valve controller. Attach the 67CFR filter regulator to the side of the digital valve controller. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. This is the standard method of mounting the filter regulator.

Figure 12. Mounting the Fisher 67CFR Regulator on a FIELDVUE DVC6000 Digital Valve Controller



### Yoke-Mounted Regulator

Mount the filter regulator with 2 cap screws to the pre-drilled and tapped holes in the actuator yoke. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. No O-ring is required.

### Casing-Mounted Regulator

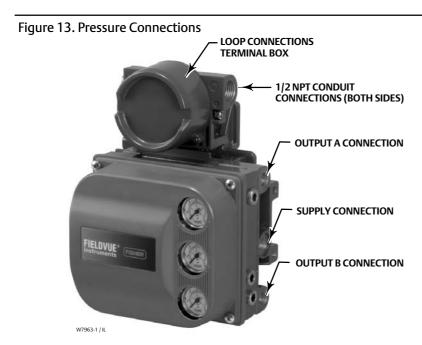
Use the separate 67CFR filter regulator casing mounting bracket provided with the filter regulator. Attach the mounting bracket to the 67CFR and then attach this assembly to the actuator casing. Thread a 1/4-inch socket-head pipe plug into the unused outlet on the filter regulator. No O-ring is required.

### **Pressure Connections**

Pressure connections are shown in figure 13. All pressure connections on the digital valve controller are 1/4 NPT internal connections. Use at least 10 mm (3/8-inch) tubing for all pressure connections. If remote venting is required, refer to the vent subsection.

#### Note

Make pressure connections to the digital valve controller using tubing with at least 10 mm (3/8-inch) diameter.



### **Supply Connections**

The DVC6000 can be used with air as the supply medium. In addition, Gas Certified DVC6000 constructions can be used with natural gas as the supply medium. If using natural gas as the pneumatic supply medium, natural gas will be used in the pneumatic output connections of the DVC6000 to any connected equipment. In normal operation the unit will vent the supply medium into the surrounding atmosphere unless it is remotely vented.

### **A** WARNING

Not all DVC6000 digital valve controllers are suitable for use with natural gas as the supply medium. If using natural gas as the supply medium, the DVC6000 must be Gas Certified. Using natural gas as the supply medium in a non-gas certified instrument can result in personal injury or property damage.

Gas Certified instruments can be identified by the natural gas approval label shown in figure 14. Contact your Emerson Process Management sales office for information on obtaining a Gas Certified DVC6000 digital valve controller.

### Figure 14. Label for Natural Gas Certified Terminal Box

NATURAL GAS APPROVED SINGLE SEAL DEVICE MAX SEAL PRESS: 145 PSI SEAL TEMP: -52°C TO 85°C CONDITION NOT TO EXCEED MAIN NAMEPLATE RATING

### **A WARNING**

To avoid personal injury and property damage resulting from bursting of parts, do not exceed maximum supply pressure.

### WARNING

Severe personal injury or property damage may occur from an uncontrolled process if the instrument supply medium is not clean, dry, oil-free, and noncorrosive. While use and regular maintenance of a filter that removes particles larger than 40 micrometers in diameter will suffice in most applications, check with an Emerson Process Management field office and industry instrument air quality standards for use with corrosive air or if you are unsure about the amount of air filtration or filter maintenance.

Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized.

Alternatively, natural gas may be used as the supply pressure medium. Gas must be clean, dry, oil-free, and noncorrosive.  $H_2S$  content should not exceed 20 ppm.

If you are using a 67CFR filter regulator with standard 5 micrometer filter, connect the supply line to the 1/4 NPT IN connection and attach tubing from the output connection on the filter regulator to the SUPPLY connection on the instrument. If you are using an integral mounted 67CFR filter regulator, connect the supply to the IN connection on the regulator.

### **Output Connection**

A factory mounted digital valve controller has its output piped to the supply connection on the actuator. If mounting the digital valve controller in the field, connect the 1/4 NPT digital valve controller output connection to the pneumatic actuator input connection.

### **Single-Acting Actuators**

When using a single-acting direct digital valve controller (relay A or C) on a single-acting actuator, connect OUTPUT A to the actuator pneumatic input.

When using a single-acting reverse digital valve controller (relay B) on a single-acting actuator, connect OUTPUT B to the actuator diaphragm casing.

### **Double-Acting Actuators**

DVC6000 digital valve controllers on double-acting actuators always use relay A. With no input current, OUTPUT A is at 0 pressure and OUTPUT B is at full supply pressure when the relay is properly adjusted.

To have the actuator stem extend from the cylinder with increasing input signal, connect OUTPUT A to the upper actuator cylinder connection. Connect OUTPUT B to the lower cylinder connection. Figure 15 shows the digital valve controller connected to a double-acting piston actuator.

To have the actuator stem retract into the cylinder with increasing input signal, connect OUTPUT A to the lower actuator cylinder connection. Connect OUTPUT B to the upper cylinder connection.

Figure 15. FIELDVUE DVC6010 Digital Valve Controller Mounted on Fisher 585C Piston Actuator



W9131-1

### Vent

### **A WARNING**

Personal injury or property damage can occur from cover failure due to overpressure. Ensure that the housing vent opening is open and free of debris to prevent pressure buildup under the cover.

This unit vents the supply medium into the surrounding atmosphere. When installing this unit in a non-hazardous (non-classified) location in a confined area, with natural gas as the supply medium, you must remotely vent this unit to a safe location. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

When installing this unit in a hazardous (classified) location remote venting of the unit may be required, depending upon the area classification, and as specified by the requirements of local, regional, and federal codes, rules and regulations. Failure to do so when necessary could result in personal injury or property damage from fire or explosion, and area re-classification.

Vent line piping should comply with local and regional codes and should be as short as possible with adequate inside diameter and few bends to reduce case pressure buildup.

In addition to remote venting of the unit, ensure that all caps and covers are correctly installed. Failure to do so could result in personal injury or property damage from fire or explosion, and area re-classification.

The relay output constantly bleeds a small amount of supply medium into the area under the cover. The vent openings at the back of the housing should be left open to prevent pressure buildup under the cover. If a remote vent is required, the vent lines must be as short as possible with a minimum number of bends and elbows.

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### Wiring and Electrical Connections

### **A WARNING**

To avoid personal injury resulting from electrical shock, do not exceed maximum input voltage specified in table 10 of this quick start guide, or on the product nameplate. If the input voltage specified differs, do not exceed the lowest specified maximum input voltage.

Personal injury or property damage caused by fire or explosion may occur if this connection is attempted in a potentially explosive atmosphere or in an area that has been classified as hazardous. Confirm that area classification and atmosphere conditions permit the safe removal of the terminal box cover before proceeding.

### **A** WARNING

Select wiring and/or cable glands that are rated for the environment of use (such as hazardous area, ingress protection and temperature). Failure to use properly rated wiring and/or cable glands can result in personal injury or property damage from fire or explosion.

Wiring connections must be in accordance with local, regional, and national codes for any given hazardous area approval. Failure to follow the local, regional, and national codes could result in personal injury or property damage from fire or explosion

### 4-20 mA Loop Connections

The digital valve controller is normally powered by a control system output card. The use of shielded cable will ensure proper operation in electrically noisy environments.

#### Note

Connect the digital valve controller to a 4-20 mA current source for operation in the point-to-point wiring mode. In the point-to-point wiring mode, the digital valve controller will not operate when connected to a voltage source.

Wire the digital valve controller as follows, refer to figure 16:

- 1. Remove the loop connections terminal box cap (see figure 13).
- 2. Route the field wiring into the terminal box. When applicable, install conduit using local and national electrical codes which apply to the application.
- 3. Connect the control system output card positive wire "current output" to the LOOP + screw terminal in the terminal box. Connect the control system output card negative (or return) wire to the LOOP screw terminal in the terminal box.

4. As shown in figure 16, two ground terminals are available for connecting a safety ground, earth ground, or drain wire. The safety ground is electrically identical to the earth ground. Make connections to these terminals following national and local codes and plant standards.

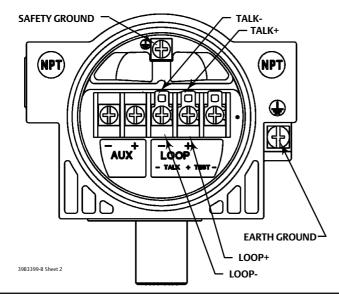
5. Replace and hand tighten the terminal box cap. When the loop is ready for startup, apply power to the control system output card.

### **A WARNING**

Personal injury or property damage, caused by fire or explosion, can result from the discharge of static electricity. Connect a 14 AWG (2.08 mm²) ground strap between the digital valve controller and earth ground when flammable or hazardous gases are present. Refer to national and local codes and standards for grounding requirements.

To avoid static discharge from the plastic cover, do not rub or clean the cover with solvents. Clean with a mild detergent and water only.

Figure 16. Loop Connections Terminal Box



### **HART Filter**

Depending on the control system you are using, a HART filter may be needed to allow HART communication. The HART filter is a passive device that is inserted in field wiring from the HART loop. The filter is normally installed near the field wiring terminals of the control system I/O (see figure 17). Its purpose is to effectively isolate the control system output from modulated HART communication signals and raise the impedance of the control system to allow HART communication. For more information on the description and use of the HART filter, refer to the appropriate separate HART filter instruction manual.

To determine if your system requires a filter contact your Emerson Process Management sales office.

### ✓ Installation Check List

Μοι	ınting
	Is the instrument correctly mounted on the actuator? If not, refer to appropriate mounting procedure and see installation instructions provided with the mounting kit.
	Is the feedback linkage properly connected? If not, see installation instructions provided with the mounting kit.
Pne	umatic Connections and Air Supply
	Is the regulator correctly mounted? If not, perform one of the regulator mounting procedures on page 24.
	Is the air supply connected and at proper pressure? If not, connect supply as described on page 25 Also see specifications on page 41.
	Is the instrument output connected to the actuator? If not, connect instrument output as described on page 26.
Wiri	ng and Electrical Connections
	If necessary, is the conduit properly installed? If not, refer to local and national electrical codes.
	Is the loop wiring properly connected to the LOOP + and - terminals in the terminal box? If not, connect loop wiring as described on page 28.
	If necessary, is the HART filter installed on your system? To determine if a HART filter is necessary, contact your Emerson Process Management sales office. For HART filter installation information, refer to the appropriate HART instruction manual.

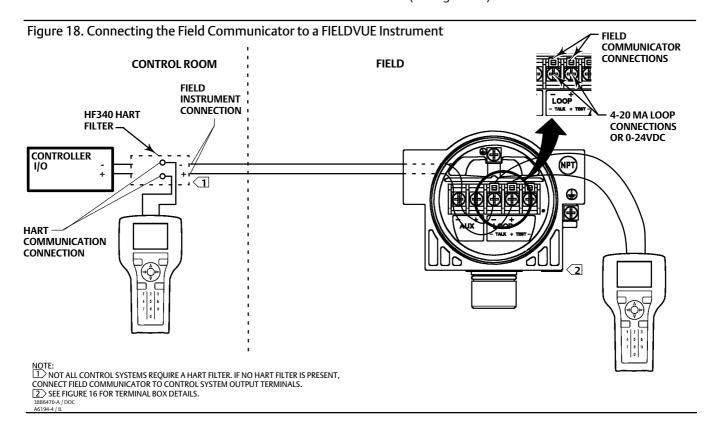
You are ready to perform Basic Setup and Calibration in the next section.

### **Basic Setup and Calibration**

# Connecting the Field Communicator to the Digital Valve Controller

The Field Communicator may be connected to the 4-20 mA loop wiring or directly to the digital valve controller (see figure 18).

If the Field Communicator is connected directly to the digital valve controller, attach the clip-on wires provided with the Field Communicator to the TALK terminals, or the LOOP + and - terminals, in the digital valve controller terminal box. The TALK terminals are the same as the LOOP + and - terminals (see figure 16).



### Basic Setup (1-1)

### **A WARNING**

Changes to the instrument setup may cause changes in the output pressure or valve travel. Depending on the application, these changes may upset process control, which may result in personal injury or property damage.

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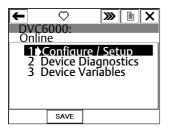
Before beginning Basic Setup, be sure the instrument is correctly mounted. Refer to the installation instructions supplied with the mounting kit.

Connect a 4-20 mA current source to the instrument. Connect the Field Communicator to the instrument and turn it on. For information on connecting the Field Communicator, see Connecting the Field Communicator to the Digital Valve Controller.

### **Typical Actuators**

The Setup Wizard determines the required setup information based upon the actuator manufacturer and model specified. Turn on the Field Communicator and start the Setup Wizard by proceeding through the menu sequence shown in figure 19 or enter the fast-key sequence 1-1-1 on the keypad. Follow the prompts on the Field Communicator display to setup the instrument. If the actuator on which the instrument is mounted is not listed by the Setup Wizard, specify OTHER as the actuator manufacturer or actuator type and refer to Non-Typical Actuators.

Figure 19. Accessing the Setup Wizard on the Field Communicator (Instrument Level HC, AD, and PD)



From the DVC6000 Online menu, select Configure / Setup



From the Configure / Setup menu, select Basic Setup.



From the Basic Setup menu, select Setup Wizard and follow the on-line instructions

### **A** WARNING

During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

After completing the setup information, travel is automatically calibrated. Follow the prompts on the Field Communicator display. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points. For additional information, refer to Auto Calibrate Travel in this section.

When travel calibration is complete, you are asked if you wish to adjust the relay (double-acting only). Select yes to adjust the relay. For additional information, refer to Relay Adjustment in this section.

### **Non-Typical Actuators**

If the actuator on which the instrument is mounted is not listed by the Setup Wizard, specify OTHER as the actuator manufacturer or actuator type. You are then prompted for setup parameters such as:

• Actuator Style (spring & diaphragm, piston double-acting without spring, piston single-acting with spring, piston double-acting with spring)

- Valve Style (rotary or sliding-stem)
- On Loss of Instrument Signal, Valve (opens or closes) This identifies whether the valve is fully open or fully closed when the input is 0%. If you are unsure how to set this parameter, disconnect the current source to the instrument. (With double-acting and single-acting direct digital valve controllers, disconnecting the current source is the same as setting the output A pressure to zero. For single-acting reverse digital valve controllers, disconnecting the current source is the same as setting the output B pressure to supply.)
- Feedback Connection (Rotary All, SStem Standard, SStem Roller). For rotary valves, enter Rotary All. For sliding-stem valves, if the feedback linkage consists of a connector arm, adjustment arm, and feedback arm (similar to figure 22), enter SStem Standard. If the feedback linkage consists of a roller that follows a cam (similar to figure 20), enter SStem Roller.

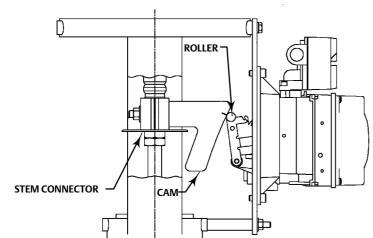


Figure 20. Feedback Connection for Typical Long-Stroke Sliding-Stem Actuator (4 to 24 inches travel)

#### **A** WARNING

If you answer YES to the prompt for permission to move the valve when determining travel sensor motion, the instrument will move the valve through a significant portion of its travel range. To avoid personal injury and property damage caused by the release of pressure or process fluid, provide some temporary means of control for the process.

• Travel Sensor Motion The Setup Wizard asks if it can move the valve to determine travel sensor motion. If you answer Yes, the instrument will stroke the valve the full travel span to determine travel sensor motion. If you answer No, then you must specify the rotation for increasing air pressure: clockwise or counterclockwise. Determine rotation by viewing the end of the travel sensor shaft.

**For instruments with relay A or C.** If increasing air pressure at output A causes the shaft to turn clockwise, enter Clockwise. If it causes the shaft to turn counterclockwise, enter Cntrclockwise.

For instruments with relay B. If decreasing air pressure at output B causes the shaft to turn clockwise, enter Clockwise. If it causes the shaft to turn counterclockwise, enter Cntrclockwise.

#### Note

Relay adjustment may be required before the Setup Wizard can determine travel sensor motion. Follow the prompts on the Field Communicator display if relay adjustment is necessary.

• Volume Booster The Setup Wizard asks if a volume booster or quick release is present.

#### A WARNING

Changes to the tuning set may cause the valve/actuator assembly to stroke. To avoid personal injury and property damage caused by moving parts, keep hands, tools, and other objects away from the valve/actuator assembly.

• Tuning Set There are twelve tuning sets from which to choose. Each tuning set provides preselected values for the digital valve controller gain and rate settings. Typically, tuning set B provides the slowest response and M provides the fastest response. For smaller actuators, use tuning set C or D. For larger actuators, use tuning set F or G.

#### Note

Tuning set B is only available in Pressure Control Mode.

In addition, you can select User Adjusted or Expert, which allows you to modify tuning of the digital valve controller. With User Adjusted you can specify the proportional gain. An algorithm in the Field Communicator calculates the other gains. With Expert you can specify not only the proportional gain but the velocity and minor loop feedback gain as well.

#### Note

Use Expert tuning only if standard tuning has not achieved the desired results.

Stabilize/Optimize or Performance Tuner may be used to achieve the desired results more rapidly than Expert tuning.

The tuning sets suggested by the Setup Wizard are only recommended starting points. After you finish setting up and calibrating the instrument, run the Performance Tuner or use Stabilize/Optimize Tuning to obtain optimum tuning.

### **Factory Defaults**

During basic setup, the Setup Wizard will ask you if you want to use factory defaults. If you select YES, the Setup Wizard sets the setup parameters to the values listed in table 8. (Yes is recommended for initial setup). If you select NO, the setup parameters listed in the table remain at their previous settings.

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**Table 8. Factory Default Settings** 

Setup Parameter	Default Setting
Analog Input Units Analog In Range High Analog In Range Low	mA 20.0 mA 4.0 mA
Control Mode	Analog
Restart Control Mode	Resume Last
Self-Test Shutdown Set Point Filter Time Input Characteristic Travel Limit High Travel Limit Low	All Failures Disabled Filter Off Linear 125% -25%
Travel Cutoff High	99.5%
Travel Cutoff Low	0.5%
Minimum Opening Time Minimum Closing Time Polling Address	0 secs 0 secs 0
Aux Terminal Mode	Aux Input Alert
Command 3 Pressure Double-acting actuators Single-acting actuators	differential output pressure actuator pressure

# Relay Adjustment

The double-acting relay can be adjusted as part of the Setup Wizard. The following is a brief description of relay adjustment. For additional information, see the Calibration section in the DVC6000 instruction manual.

#### Note

Relay B and C are not user-adjustable.

# Double-Acting Relay (Relay A)

The double-acting relay is designated relay A. For double-acting actuators, the valve must be near mid-travel to properly adjust the relay. The Field Communicator will automatically position the valve when *Relay Adjust* is selected.

Rotate the adjustment disc, shown in figure 21, until the value displayed on the Field Communicator is between 50 and 70% of supply pressure. This adjustment is very sensitive. Be sure to allow the pressure reading to stabilize before making another adjustment (stabilization may take up to 30 seconds or more for larger actuators).

If the low bleed relay option has been ordered stabilization may take approximately two minutes longer than the standard relay.

Relay A may also adjusted for use in single-acting- direct applications. Rotate the adjustment disc as shown in figure 21 for single-acting direct operation.

# **CAUTION**

Care should be taken during relay adjustment as the adjustment disc may disengage if rotated too far.

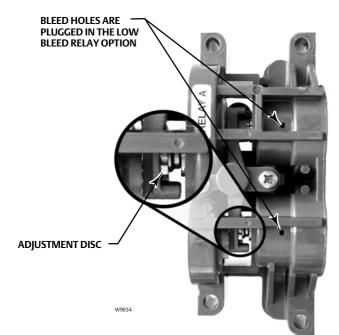
# Single-Acting Direct Relay (Relay C)

The single-acting direct relay is designated relay C, and requires no adjustment.

# Single-Acting Reverse Relay (Relay B)

The single-acting reverse relay is designated relay B. Relay B is calibrated at the factory and requires no further adjustment.

Figure 21. Relay A Adjustment (Shroud Removed for Clarity)



FOR SINGLE-ACTING DIRECT RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION UNTIL IT CONTACTS THE BEAM

FOR DOUBLE-ACTING RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION TO DECREASE OUTPUT PRESSURE



FOR DOUBLE-ACTING RELAYS: ROTATE ADJUSTMENT DISC IN THIS DIRECTION TO INCREASE OUTPUT PRESSURE

# **Auto Calibrate Travel**

# **A** WARNING

During calibration the valve will move full stroke. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

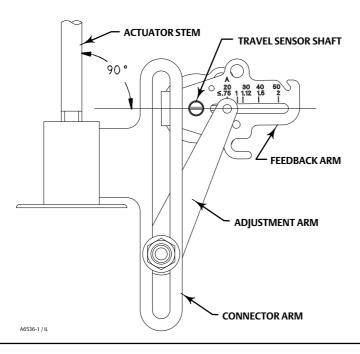
The instrument is calibrated during the Setup Wizard. Follow the prompts on the Field Communicator display to automatically calibrate instrument travel. The calibration procedure uses the valve and actuator stops as the 0% and 100% calibration points.

For additional calibration information, refer to the DVC6000 instruction manual.

 If the Feedback Connection is Sliding-Stem Standard, the Field Communicator prompts you to select the method of crossover adjustment: manual, last value, or default. Manual adjustment is recommended for initial travel calibration. November 2011 D102762X012

2. When prompted by the Field Communicator, make the crossover adjustment by adjusting the current source until the feedback arm is 90° to the actuator stem, as shown in figure 22.

Figure 22. Crossover Point



3. The remainder of the auto-calibration procedure is automatic. After completing auto travel calibration, the Field Communicator prompts you to place the instrument In Service and verify that the travel properly tracks the current source.

If the unit does not calibrate, refer to table 9 for error messages and possible remedies.

If after completing setup and calibration the valve cycles or overshoots (unstable), or is unresponsive (sluggish), you can improve operation by selecting either *Performance Tuner* or *Stabilize/Optimize* from the *Basic Setup* menu.

Table 9. Auto Calibrate Travel Error Messages

Error Message	Possible Problem and Remedy
Input current must exceed 3.8 mA for calibration.	The analog input signal to the instrument must be greater than 3.8 mA. Adjust the current output from the control system or the current source to provide at least 4.0 mA.
Place Out Of Service and ensure Calibrate Protection is disabled before calib.	The Instrument Mode must be <i>Out of Service</i> and the Protection must be <i>None</i> before the instrument can be calibrated.
Calibration Aborted. An end point was not reached.	The problem may be one or the other of the following:  1. The tuning set selected is too low and the valve does not reach an end point in the allotted time. Press the Hot Key, select Stabilize/Optimize then Increase Response (selects next higher tuning set).  2. The tuning set selected is too high, valve operation is unstable and does not stay at an end point for the allotted time. Press the Hot Key, select Stabilize/Optimize then Decrease Response (selects next lower tuning set).
Invalid travel value. Check mounting and feedback arm adjustments, and inst supply press. Then, repeat Auto Calibration.	Verify proper mounting by referring to the appropriate mounting instructions.  Verify instrument supply pressure by referring to the specifications in the appropriate actuator instruction manual.  Making the crossover adjustment with the valve positioned at either end of its travel will also cause this message to appear.
Aborting due to response code or device status.	The instrument may have been taken out of service by a primary master. Put the instrument into service with the primary master or cycle the power off and on.

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# Performance Tuner (1-1-2)

#### Note

The Performance Tuner is not available for instrument level AC or HC.

### **A** WARNING

During performance tuning the valve may move, causing process fluid or pressure to be released. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

The Performance Tuner is used to optimize digital valve controller tuning. It can be used on most sliding-stem and rotary designs, including Fisher and other manufacturers' products. Moreover, because the Performance Tuner can detect internal instabilities before they become apparent in the travel response, it can generally optimize tuning more effectively than manual tuning. Typically, the Performance Tuner takes 3 to 5 minutes to tune an instrument, although tuning instruments mounted on larger actuators may take longer.

Access the Performance Tuner by selecting *Performance Tuner* from the *Basic Setup* menu. Follow the prompts on the Field Communicator display to optimize digital valve controller tuning.

# Stabilizing or Optimizing Valve Response ( or 1-1-2)

#### Note

Stabilize/Optimize is only available through the Basic Setup menu for instrument level HC.

# **A** WARNING

During Stabilize/Optimize the valve may move, causing process fluid or pressure to be released. To avoid personal injury and property damage caused by the release of process fluid or pressure, isolate the valve from the process and equalize pressure on both sides of the valve or bleed off the process fluid.

If after completing setup and calibration the valve seems slightly unstable or unresponsive, you can improve operation by pressing the Hot Key and selecting *Stabilize/Optimize*, or select *Stabilize/Optimize* from the *Basic Setup* menu.

Stabilize/Optimize permits you to adjust valve response by changing the digital valve controller tuning.

If the valve is unstable, select *Decrease Response* to stabilize valve operation. This selects the next lower tuning set (e.g., F to E). If the valve response is sluggish, select *Increase Response* to make the valve more responsive. This selects the next higher tuning set (e.g., F to G).

If after selecting *Decrease Response* or *Increase Response* the valve travel overshoot is excessive you can adjust the damping by selecting *Decrease Damping* or *Increase Damping* the

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tuning set will become Expert, and allow you to select a damping value that is not represented in a predefined tuning set. Select Decrease Damping to select a damping value that allows more overshoot. Select Increase Damping to select a damping value that will decrease the overshoot.

Basic Setup and Calibration Check List

Is basic setup complete? If not, perform Basic Setup procedure on page 32.

Does the final control element correctly respond to a setpoint change and is it stable? If not, perform Stabilizing or Optimizing Valve Response on page 39.

Final control element is ready to be placed on line.

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#### Table 10. Specifications

### **Available Configurations**

Valve-Mounted Instrument

DVC6010: Sliding-stem applications

DVC6020: Rotary and long-stroke sliding-stem applications

DVC6030: Quarter-turn rotary applications

Remote-Mounted Instrument<sup>(1)</sup>

DVC6005: Base unit for 2 inch pipestand or wall mounting

DVC6015: Feedback unit for sliding-stem applications DVC6025: Feedback unit for rotary or long-stroke

sliding-stem applications

DVC6035: Feedback unit for quarter-turn rotary applications

DVC6000 digital valve controllers can be mounted on Fisher and other manufacturers rotary and sliding-stem actuators.

#### **Input Signal**

#### Point-to-Point:

Analog Input Signal: 4-20 mA DC, nominal Minimum Voltage Available at instrument terminals must be 10.5 volts DC for analog control, 11 volts DC for HART communication (see instrument instruction manual for details)

Minimum Control Current: 4.0 mA

Minimum Current w/o Microprocessor Restart: 3.5 mA

Maximum Voltage: 30 volts DC

Overcurrent Protection: Input circuitry limits current to prevent internal damage.

Reverse Polarity Protection: No damage occurs from reversal of loop current.

Multi-drop:

Instrument Power: 11-30 volts DC at approximately

8 mA

Reverse Polarity Protection: No damage occurs from

reversal of loop current.

#### **Output Signal**

Pneumatic signal as required by the actuator, up to full supply pressure.

Minimum Span: 0.4 bar (6 psiq) Maximum Span: 9.5 bar (140 psig)

Action: Double, Single direct, and Single reverse

# Supply Pressure<sup>(2)</sup>

Recommended: 0.3 bar (5 psig) higher than maximum actuator requirements, up to maximum supply pressure

Maximum: 10.0 bar (145 psiq) or maximum pressure rating of the actuator, whichever is lower

Medium: Air or Natural Gas<sup>(3)</sup>

Air: Supply pressure must be clean, dry air that meets the requirements of ISA Standard 7.0.01. A maximum 40 micrometer particle size in the air system is acceptable. Further filtration down to 5 micrometer particle size is recommended. Lubricant content is not to exceed 1 ppm weight (w/w) or volume (v/v) basis. Condensation in the air supply should be minimized

Natural Gas: Natural gas must be clean, dry, oil-free, and noncorrosive. H<sub>2</sub>S content should not exceed 20 ppm.

## Steady-State Air Consumption<sup>(4)</sup>

**Standard Relay:** At 1.4 bar (20 psig) supply pressure: Less than 0.38 normal m<sup>3</sup>/hr (14 scfh)

At 5.5 bar (80 psig) supply pressure: Less than 1.3 normal m<sup>3</sup>/hr (49 scfh)

Low Bleed Relay<sup>(5)</sup>: At 1.4 bar (20 psig) supply pressure: Average value 0.056 normal m<sup>3</sup>/hr (2.1 scfh)

At 5.5 bar (80 psig) supply pressure: Average value  $0.184 \text{ normal m}^3/\text{hr} (6.9 \text{ scfh})$ 

#### Maximum Output Capacity(4)

At 1.4 bar (20 psig) supply pressure: 10.0 normal  $m^3/hr$  (375 scfh) At 5.5 bar (80 psig) supply pressure: 29.5 normal m<sup>3</sup>/hr (1100 scfh)

### **Failure Modes**

Refer to figure 23

## Independent Linearity<sup>(6)</sup>

±0.50% of output span

-continued-

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#### Table 10. Specifications (continued)

### **Electromagnetic Compatibility**

Meets EN 61326-1 (First Edition)

Immunity—Industrial locations per Table 2 of the EN 61326-1 standard. Performance is shown in table 11 below

Emissions—Class A

ISM equipment rating: Group 1, Class A

Lightning and Surge Protection—The degree of immunity to lightning is specified as Surge immunity in table 11. For additional surge protection commercially available transient protection devices can be used.

### **Vibration Testing Method**

Tested per ANSI/ISA-75.13.01 Section 5.3.5. A resonant frequency search is performed on all three axes. The instrument is subjected to the ISA specified 1/2 hour endurance test at each major resonance, plus an additional two million cycles.

## Input Impedance

The input impedance of the DVC6000 active electronic circuit is not purely resistive. For comparison to resistive load specifications, an equivalent impedance of 550 ohms may be used. This value corresponds to 11V @ 20 mA.

### Operating Ambient Temperature Limits<sup>(2,7)</sup>

-40 to 85°C (-40 to 185°F) for most approved valve-mounted instruments

-60 to 125  $^{\circ}$  C (-76 to 257  $^{\circ}$  F) for remote-mounted feedback unit.

-52 to 85°C (-62 to 185°F) for valve-mounted instruments utilizing the Extreme Temperature option (fluorosilicone elastomers)

### **Humidity Limits**

0 to 100% condensing relative humidity with minimal zero or span shifts

#### **Electrical Classification**

#### Hazardous Area:

**CSA**— Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

FM— Intrinsically Safe, Explosion-proof, Non-incendive, Dust Ignition-proof

ATEX— Intrinsically Safe and Dust, Flameproof and Dust, Type n and Dust

IECEx—Intrinsically Safe, Flameproof, Type n

NEPSI— Intrinsically Safe, Flameproof

INMETRO — Intrinsically Safe, Flameproof, Type n

Refer to Special Instructions for "Safe Use" and Installation in Hazardous Locations, starting on page 11, for specific approval information.

Pollution Degree 2, Overvoltage Category III per ANSI/ISA-82.02.01 (IEC 61010-1 Mod).

#### **Electrical Housing:**

CSA—Type 4X, IP66

FM-NEMA 4X

ATEX-IP66

IECEx-IP66

NEPSI-IP66

INMETRO-IP66W

# Other Classifications/Certifications

TIIS-|apan

KISCO— Korea Industrial Safety Corp.

GOST-R—Russian GOST-R

FSETAN— Russian - Federal Service of Technological, Ecological and Nuclear Inspectorate

Contact your Emerson Process Management sales office for classification/certification specific information

# IEC 61010 Compliance Requirements (Valve-Mounted Instruments only)

Power Source: The loop current must be derived from a Separated Extra-Low Voltage (SELV) power source Environmental Conditions: Installation Category I

#### **Connections**

**Supply Pressure:** 1/4 NPT internal and integral pad for

mounting 67CFR regulator Output Pressure: 1/4 NPT internal Tubing: 3/8-inch, recommended Vent (pipe-away): 3/8 NPT internal

Electrical: 1/2 NPT internal conduit connection, M20

adapter optional

#### Stem/Shaft Travel

Linear Actuators with rated travel between 6.35 mm (0.25 inch) and 606 mm (23.375 inches)

Rotary Actuators with rated travel between 50 degrees and 180 degrees.

-continued-

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#### Table 10. Specifications (continued)

## Mounting<sup>(8)</sup>

Designed for direct actuator mounting or remote pipestand or wall mounting. Mounting the instrument vertically, with the vent at the bottom of the assembly, or horizontally, with the vent pointing down, is recommended to allow drainage of moisture that may be introduced via the instrument air supply.

#### Weight

Valve-Mounted Instruments Aluminum: 3.5 kg (7.7 lbs) Stainless Steel: 7.7 kg (17 lbs)

**Remote-Mounted Instruments** DVC6005 Base Unit: 4.1 kg (9 lbs) DVC6015 Feedback Unit: 1.3 kg (2.9 lbs) DVC6025 Feedback Unit: 1.4 kg (3.1 lbs) DVC6035 Feedback Unit: 0.9 kg (2.0 lbs)

#### **Construction Materials**

Housing, module base and terminal box: ASTMB85

A03600 low copper aluminum alloy Cover: Thermoplastic polyester Elastomers: Nitrile (standard)

#### **Options**

- Supply and output pressure gauges or Tire valves. Integral mounted filter regulator.
- Stainless steel housing, module base and terminal box ■ Low bleed relay ■ In-line 10 micron air filter
- Safety Instrumented System (SIS) Solutions
- Safety Related Nuclear Applications Natural Gas Certified ■ Feedback Assembly PTFE Sleeve Protective Kit for aluminum units in saltwater or particulate environments

#### Declaration of SEP

Fisher Controls International LLC declares this product to be in compliance with Article 3 paragraph 3 of the Pressure Equipment Directive (PED) 97 / 23 / EC. It was designed and manufactured in accordance with Sound Engineering Practice (SEP) and cannot bear the CE marking related to PED compliance.

However, the product may bear the CE marking to indicate compliance with other applicable European Community Directives.

NOTE: Specialized instrument terms are defined in ISA Standard 51.1 - Process Instrument Terminology.

1. 3-conductor shielded cable, 22 AWG minimum wire size, is required for connection between base unit and feedback unit. Pneumatic tubing between base unit output connection and actuator has been tested to 15 meters (50 feet) maximum without performance degradation.

2. The pressure/temperature limits in this quick start guide and any applicable code or standard should not be exceeded.

3. Gas Certified DVC6000 digital valve controllers are approved by CSA, FM, ATEX, IECEX, and INMETRO for use with natural gas as the supply medium.

4. Values at 1.4 bar (20 psig) based on a single-acting direct relay; values at 5.5 bar (80 psig) based on double-acting relay.

5. The low bleed relay is offered as standard relay for DVC6000 SIS tier, used for On/Off applications.

6. Typical value. Not applicable for travels less than 19 mm (0.75 inch) or for shaft rotation less than 60 degrees. Also not applicable for DVC6020 digital valve controllers in long-stroke applications.

7. Temperature limits vary based on hazardous area approval.

8. Do not use the DVC60105 or DVC6020 in high vibration service where the mounting bracket uses standoffs (spacers) to mount to the actuator. Due to NAMUR mounting limitations, do not use the DVC60103 in high vibration service. the DVC6030S in high vibration service.

Table 11. EMC Summary Results—Immunity

				Performance Criteria <sup>(1)</sup>		
Port	Phenomenon	Basic Standard	Test Level	Point-to- Point Mode	Multi-drop Mode	
	Electrostatic discharge (ESD)	IEC 61000-4-2	4 kV contact 8 kV air	A <sup>(2)</sup>	А	
Enclosure	Radiated EM field	IEC 61000-4-3	80 to 1000 MHz @ 10V/m with 1 kHz AM at 80% 1400 to 2000 MHz @ 3V/m with 1 kHz AM at 80% 2000 to 2700 MHz @ 1V/m with 1 kHz AM at 80%	А	А	
	Rated power frequency magnetic field	IEC 61000-4-8	30 A/m at 50/60 Hz	А	А	
	Burst	IEC 61000-4-4	1 kV	A <sup>(2)</sup>	A	
I/O signal/control	Surge	IEC 61000-4-5	1 kV (line to ground only, each)	В	В	
	Conducted RF	IEC 61000-4-6	150 kHz to 80 MHz at 3 Vrms	А	A	

Performance Criteria: +/- 1% effect

1. A = No degradation during testing. B = Temporary degradation during testing, but is self-recovering.

2. Excluding auxiliary switch function, which meets Performance Criteria B.

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Figure 23. FIELDVUE DVC6000 Digital Valve Controller Failure Modes



Relay Type	Loss of Power	Loss of Pneumatic Supply	
Single-Acting Direct (Relay C)	Instrument goes to zero air output at port A.	Failure direction per actuator fail mode.	
Double-Acting (Relay A)	Instrument goes to full supply air output at port B. A goes to zero air output.	Failure direction cannot be determined.	
Single-Acting Reverse (Relay B)	Instrument goes to full supply air output at port B.	Failure direction per actuator fail mode.	

# **Related Documents**

This section lists other documents containing information related to DVC6000 digital valve controllers. These documents include:

- Bulletin 62.1:DVC6000—Fisher FIELDVUE DVC6000 Digital Valve Controllers (D102758X012)
- Bulletin 62.1:DVC6000(S1)—Fisher FIELDVUE DVC6000 Digital Valve Controller Dimensions (D103308X012)
- Fisher FIELDVUE DVC6000 Digital Valve Controllers Instruction Manual (D102794X012)
- Supplement to Fisher FIELDVUE DVC6000 Digital Valve Controller Quick Start Guide—Remote Mount Installation Guidelines (D103421X012)
- Supplement to HART Communicating Fisher FIELDVUE Digital Valve Controller Instruction Manuals—FIELDVUE Digital Valve Controller Split Ranging (D103262X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—Using FIELDVUE Instruments with the Smart HART Loop Interface and Monitor (HIM) (D103263X012)
- Using FIELDVUE Instruments with the Smart Wireless THUM™ Adapter and a HART Interface Module (HIM) -Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals (D103469X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—Audio Monitor for HART Communications (D103265X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—HART Field Device Specification (D103266X012)
- Supplement to HART Communicating Fisher FIELDVUE Instrument Instruction Manuals—Using the HART Tri-Loop ™ HART-to-Analog Signal Converter with FIELDVUE Digital Valve Controllers (D103267X012)
- Supplement to Fisher FIELDVUE DVC5000 (obsolete product) and DVC6000 Digital Valve Controller Instruction Manuals—Hot Swap Procedure (D103264X012)

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- Supplement to Fisher FIELDVUE DVC6000 Digital Valve Controllers Instruction Manual—Lock-in-Last Strategy (D103261X012)
- Supplement to Fisher FIELDVUE DVC6000 and DVC6000 SIS Digital Valve Controllers Instruction Manuals—275 HART Communicator Menu Trees for Firmware 7 Digital Valve Controllers (D103273X012)
- Fisher HF340 Filter Instruction Manual (D102796X012)
- ValveLink Software Help or Documentation

All documents are available from your Emerson Process Management sales office. Also visit our website at www.FIELDVUE.com.

# **Educational Services**

For information on available courses for DVC6000 digital valve controllers, as well as a variety of other products, contact:

Emerson Process Management Educational Services, Registration P.O. Box 190; 301 S. 1st Ave. Marshalltown, IA 50158-2823 Phone: 800-338-8158 or

Phone: 641-754-3771 FAX: 641-754-3431

e-mail: education@emerson.com

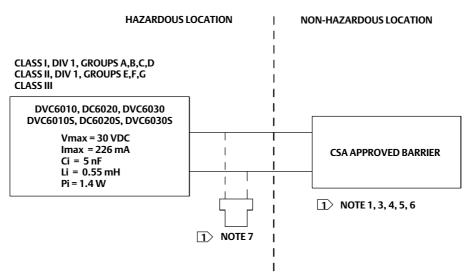
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# **Loop Schematics and Nameplates**

This section includes loop schematics required for wiring of intrinsically safe installations. It also contains the approvals nameplates. If you have any questions, contact your Emerson Process Management sales office.

Figure 24. CSA Schematic



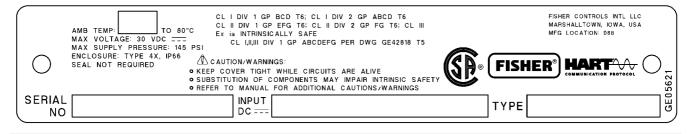
☐ THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax or Ui), THE CURRENT (Imax or Ii), AND THE POWER (Pmax or Pi) OF THE INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc or Uo), AND THE CURRENT (Isc or Io), AND THE POWER (Po) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (Ci) AND MAX UNPROTECTED INDUCTANCE (Li), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (Cable) AND CABLING INDUCTANCE (Lcable) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

 $V max \ or \ Ui \geq Voc \ or \ Uo \quad Imax \ or \ Ii \geq Isc \ or \ Io \quad P max \ or \ Pi \geq Po \quad Ci + Ccable \leq Ca \quad Li + Lcable \leq La$ 

- 3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) NFPA70 AND ANSI/ISA RP12.6.01
- 4 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms
- **5** RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THE ONE OHM
- **IDENTIFY ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS.**
- ☑ IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE CSA APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWING

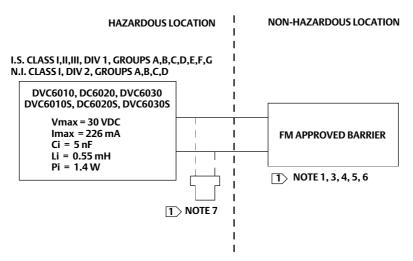
GE42818 sheets 2 and

Figure 25. CSA Nameplate



D102762X012 November 2011

Figure 26. FM Schematic



☐ THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax or Ui), THE CURRENT (Imax or Ii), AND THE POWER (Pmax or Pi) OF THE

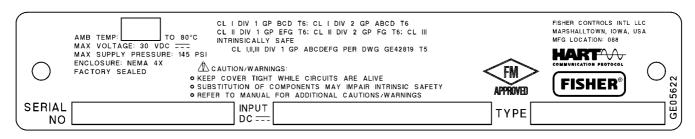
INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc or Uo), AND THE CURRENT (Isc or Io), AND THE POWER (Po) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (Ci) AND MAX UNPROTECTED INDUCTANCE (Li), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (Ccable) AND CABLING INDUCTANCE (Lable) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

 $V max \ or \ Ui \geq Voc \ or \ Uo \quad Imax \ or \ Ii \geq Isc \ or \ Io \quad P max \ or \ Pi \geq Po \quad Ci + Ccable \leq Ca \quad Li + Lcable \leq La$ 

- 3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE (NEC) NFPA70 AND ANSI/ISA RP12.6.01
- 4 MAXIMUM SAFE AREA VOLTAGE SHOULD NOT EXCEED 250 Vrms.
- **5** RESISTANCE BETWEEN INTRINSICALLY SAFE GROUND AND EARTH GROUND MUST BE LESS THE ONE OHM
- **6 LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTION**
- ☑ IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE FM APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURER'S CONTROL DRAWING

GE42819 sheets 2 and 8

Figure 27. FM Nameplate



D102762X012 November 2011

Figure 28. ATEX Nameplate; Intrinsically Safe, Dust

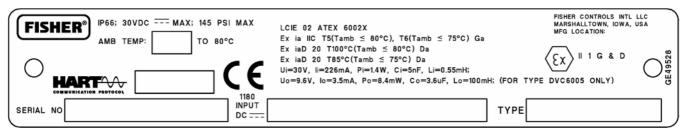


Figure 29. ATEX Nameplate; Flameproof, Dust

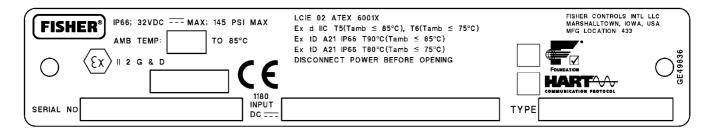
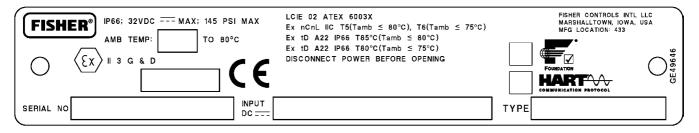
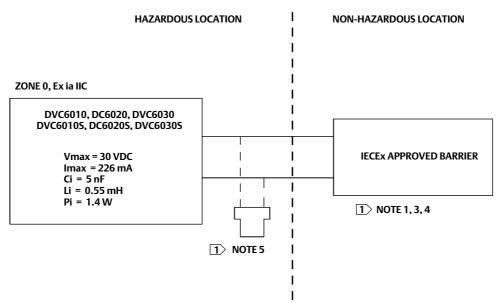


Figure 30. ATEX Nameplate; Type n, Dust



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Figure 31. IECEx Schematic



☐ THE ENTITY CONCEPT ALLOWS INTERCONNECTION OF INTRINSICALLY SAFE APPARATUS TO ASSOCIATED APPARATUS NOT SPECIFICALLY EXAMINED IN SUCH COMBINATION. THE CRITERIA FOR INTERCONNECTION IS THAT THE VOLTAGE (Vmax or Ui), THE CURRENT (Imax or Ii), AND THE POWER (Pmax or Pi) OF THE

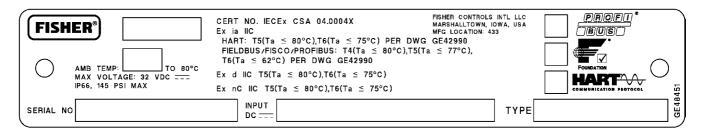
INTRINSICALLY SAFE APPARATUS MUST BE EQUAL TO OR GREATER THAN THE VOLTAGE (Voc OR Uo), AND THE CURRENT (Isc or Io), AND THE POWER (Po) DEFINED BY THE ASSOCIATED APPARATUS. IN ADDITION, THE SUM OF THE MAX UNPROTECTED CAPACITANCE (Ci) AND MAX UNPROTECTED INDUCTANCE (Li), INCLUDING THE INTERCONNECTING CABLING CAPACITANCE (Ccable) AND CABLING INDUCTANCE (Lcable) MUST BE LESS THAN THE ALLOWABLE CAPACITANCE (Ca) AND INDUCTANCE (La) DEFINED BY THE ASSOCIATED APPARATUS. IF THE ABOVE CRITERIA IS MET, THEN THE COMBINATION MAY BE CONNECTED.

 $Vmax \ or \ Ui \geq Voc \ or \ Uo \quad Imax \ or \ Ii \geq Isc \ or \ Io \quad Pmax \ or \ Pi \geq Po \quad Ci + Ccable \leq Ca \quad Li + Lcable \leq La$ 

- 3 INSTALLATION MUST BE IN ACCORDANCE WITH THE NATIONAL WIRING PRACTICES OF THE COUNTRY IN USE
- $\begin{tabular}{l} \blacksquare$  LOOPS MUST BE CONNECTED ACCORDING TO THE BARRIER MANUFACTURER'S INSTRUCTIONS
- **5** IF HAND-HELD COMMUNICATOR OR MULTIPLEXER IS USED IT MUST BE IECEX APPROVED WITH ENTITY PARAMETERS AND INSTALLED PER THE MANUFACTURERS CONTROL DRAWING

GE42990 Sheet 2 and 8 of 8

Figure 32. IECEx Nameplate



November 2011 D102762X012

## Figure 33. NEPSI Nameplate

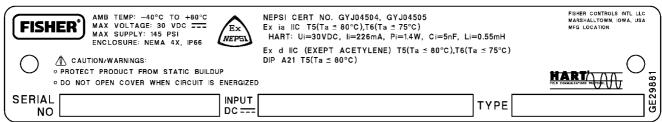


Figure 34. INMETRO Nameplate

FISH	ER°)	para T5: (-52°C≤Tamb≤80°C	1-Ex d IIC T5/T6 Gb, BR-Ex nC IIC T5/T6 Gc C), para T6: (-52°C≤Tamb≤75°C) ≤ 1.4W Ci ≤ 5nF Li ≤ 0.55mH	FISHER CONTROLS INTL LLC MARSHALLTOWN, IOWA, USA MFG LOCATION: 433	HART	
$\circ$	AMB TEMP/ TEMPERATURA DE OPERAÇÃO: MAX VOLTAGE/ MĀXIMA VOLTAGEM: 30 MAX SUPPLY PRESSURE/ MĀXIMA PRES ENCLOSUBE/INVÔLUCRO: TYPE 4X, IP66V	VDC SÃO DE ENTRADA: 145 PSI	CAUTION/ATENÇÃO: O DO NOT OPEN WHEN ENERGIZED NÃO ABRA QUANDO ENERGIZADO O AFTER DE-ENERGIZING DELAY 12 SECONDS BI APÓS DESENERGIZAÇÃO, AGUARDE 12 SEGUNI		Segurança <b>Ex</b> MMETRO OCP ODA	.591
SERIAL NO. NÚMERO DE SÉRIE		INPUT ENTRADA DC		TYPE TIPO		GE37

November 2011

November 2011 D102762X012

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www.Fisher.com



# Pneumatic rotary actuator

Type 2051 / Article Number 214520



The depiction of the products may differ from the actual specific design.

Please consider the **technical attributes and Data Sheets.** 

# Technical attributes

Aluminium   I - double-acting   90 deg   Size 15   F03/F05   11 mm   -40,00 °C - 80,00 °C	
See your specific attribute group for technical details	
Most selected All Function Properties Features Actuator	
Process Pressure / Temperature Sealing Material	
Select all attrib	utes
Function	
Valve function number of switching positions	
Control function I - double-acting	
Process Pressure / Temperature	
Control pressure min 2,5 bar	
Control pressure max 8 bar	
Temperature environment min -40 °C	
Temperature environment max 80 °C	

Sealing Material	
Piston seal material category Elastomer	
Piston seal material M-NBR	

Actuator	
Stroke limiter standard	
Actuator material Aluminium	
Actuator size Size 15	
Amount of spring packages per side None	
Control air connection type Internal thread	
Control air connection thread type G	
Control air connection diameter (inch) 1/8 inch	
Angle of rotation 90 deg	

# **Downloads**

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ΑII

**Data Sheets** 

User Manuals

**Declaration of Conformity** 

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## Data sheet Type 2051 | Pneumatically operated rotary actuator

pdf (1 MB) EN / EU

(https://www.burkert.com/en/Media/plm/DTS/DS/ds2051-standard-eu-en.pdf)

**Data Sheets** 

Type 2051 data sheet | Region US | pneumatic rotary actuator

pdf (2 MB) EN / US

(https://www.burkert.com/en/Media/plm/DTS/DS/DS2051-Standard-US-EN.pdf)

**Declaration of Conformity** 

**EU-DoCIEU Declaration** 

pdf (28 kB) EN,FR,DE

(https://www.burkert.com/en/Media/plm/ABD/EU-Declaration-of-Conformity/1000146756-e\_2051\_eu-doc.pdf)

User Manuals

Operating Instructions Type 2051 8805 | Pneumatic rotary actuator

pdf (3 MB) EN,FR,DE / EU

(https://www.burkert.com/en/Media/plm/MAN/MA/ma2051-8805-2051-eu-ml.pdf)

**Data Sheets** 

Datenblatt Typ 2051 | Pneumatischer Schwenkantrieb

pdf (1 MB) DE / DE

(https://www.burkert.com/en/Media/plm/DTS/DS/ds2051-standard-de-de.pdf)

# Helpful tools & videos



(/en/resistapp/show)

resistApp - Chemical Resistance App



(/en/calculator? embedded=true&lang=en)

# Accessories & Spare part sets

# Spare part sets

Here you will find spare and wearing parts for your item. Please note the technical features.

Sketch Spare part sets

Click to zoom

11/30/25, 7:53 AM	Pneumatic rotary actuator

# Product specific information

Please enter the serial number stated on the type label:



# K1550 range hydrogen analyser

# Thermal conductivity analysers for hydrogen analysis

- Single remote sensor
- Proven technology from the katharometer experts
- Hazardous area options
- Ranges from 0 5% upwards
- Fixed and variable compensation options
- Non-depleting remote sensor

#### **Applications**

- Syngas analysis
- Gasification
- Fuel cell research
- **Furnace atmospheres**
- Reforming gases
- **Hydrogen mixing**
- **Power generation**



The K1550 range of analysers are ideal for measuring % levels of one gas in a binary or pseudo-binary mixture. For example, air is composed of many gases but in known, fixed ratios, therefore hydrogen in air is a pseudo-binary mixture and can be measured with a K1550 hydrogen

Hydrogen analysis is well suited to this technique due to the high thermal conductivity of hydrogen. Percentage levels of hydrogen cannot be measured by a convenient dedicated sensor and so Hitech katharometers provide a cost effective analysis solution.

For hazardous area applications use the K1550FX. The sensor is mounted remotely in the hazardous area and connected through an MTL barrier to the electronics unit in a safe area. Alternatively, the electronics unit can be supplied in an EExd enclosure with remote keypad for non-intrusive calibration for full hazardous area use.

Acompensation input is available as an option, either fixed or variable via a 4-20mA input. This extends the capability of the analyser to measure the hydrogen content in more complex mixtures. The KG1550 range also features an integral oxygen sensor.

Hydrogen analysers are available with a choice of range. From 0 -5% at the low end, 0 -100% full range or 95-100% for hydrogen purity applications. Multi-range instruments are sometimes available on request and for specific applications. A completed application questionnaire enables Hitech to provide a custom solution.

Different sample conditioning systems are available, standard or bespoke, according to the process conditions. For corrosive gases a variety of sensor assemblies and fittings according to the specific gas. Eaton are ready to recommend complete systems on receipt of full gas stream specifications.



Eaton Electric Limited,

Great Marlings, Butterfield, Luton Beds, LU2 8DL, UK.

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www.mtl-inst.com

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## K1550 hydrogen analyser

February 2017

#### **SPECIFICATION**

#### Ranges available

(Depends up on measured/background gas) 0-20%, 80 – 100%, 0-100% for most gases 0-5%, for most hydrogen ranges Consult Hitech for gas type and range

# Stability

<1 % f.s.d./month

#### Accuracy

±2% f.s.d. depending upon span and gas

#### Repeatability

<1% f.s.d

#### Speed of response

T90: 20 seconds (typ.)

#### Sample flow

100-300ml/min for optimum performance

#### Sample pressure

Nominally atmospheric, set by vent pressure

#### Sample connections

Inlet and outlet: Captive seal compression suitable for 0.25inch (or 6mm) outside diameter tube

#### Display

LCD 2 or 4 lines of alphanumeric characters

### Analogue output

4-20mA

(User-programmable)

#### Outputs (alarm)

Two alarms: each user-configurable to OFF, HIGH or LOW

# Relay outputs

Rated at 30V ac or dc, 0.5A, normally energised

#### Ambient operating temperature range

Sensor: -10°C to 40°C Electronics: 0°C to 40°C (0-90% R.H. non-condensing)

#### Storage temperature range

−5°C to +55°C

(0-90% R.H. non-condensing)

#### **Supply Voltage**

110/120V or 220/240V AC, 50/60Hz

### Power consumption

12VA

### **MOUNTING**

### **Electronics unit**

Panel mounting with two clamps

### Remote sensor unit

Wall/ bulkhead (optional)

#### **MATERIALS**

### Enclosure

Glassfibre-reinforced Noryl to IP40 (IP54 locking door option)

#### Remote sensor

Supplied in IP65 housing with flowmeter and needle valve

#### K1550FX (HAZARDOUS AREA VERSION)

As above specification but with certified stainless steel sensor block and MTL zener barrier (supplied loose).

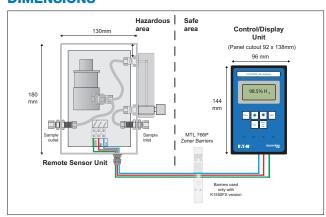
#### Option

EEx d enclosure for K1550FX electronics unit

#### **ORDERING INFORMATION**

Specify	Measured gas	Background gas	Range	Output	Supply voltage	Options	
K1550R	Hydrogen	Specify	0 - 100% 0 - 20%				Compensation input
K1550F)	Hydrogen	Specify	0 - 5% 80 - 100% 95 - 100%	4-20mA	110V or 220V	EEx enclosure	

### **DIMENSIONS**





K1550FX electronics unit in optional EEx enclosure with remote keypad

## **APPROVALS (ATEX Directive - Europe) for K1550FX version**

Authority	Product/Cert. No.	Standards	Approved for
DEMKO	210 Gas detection head DEMKO02ATEX132848X	EN50014 EN50018	(3) II 2G EEx d IIB + H <sub>2</sub> T6 -40°C ≤ T <sub>a</sub> ≤ 40°C $(3)$ II 2G EEx d IIB + H <sub>2</sub> T3 -40°C ≤ T <sub>a</sub> ≤ 150°C
BASEEFA	MTL766P barrier BAS01ATEX7202	IEC60079-0 IEC60079-11	( II 1GD [EEx ia] IIC T6 -20°C ≤ T <sub>a</sub> ≤ 60°C
ISSeP	EEx enclosure ISSeP03ATEX005	EN50014 EN50018 EN50281-1-1	



#### Eaton Electric Limited,

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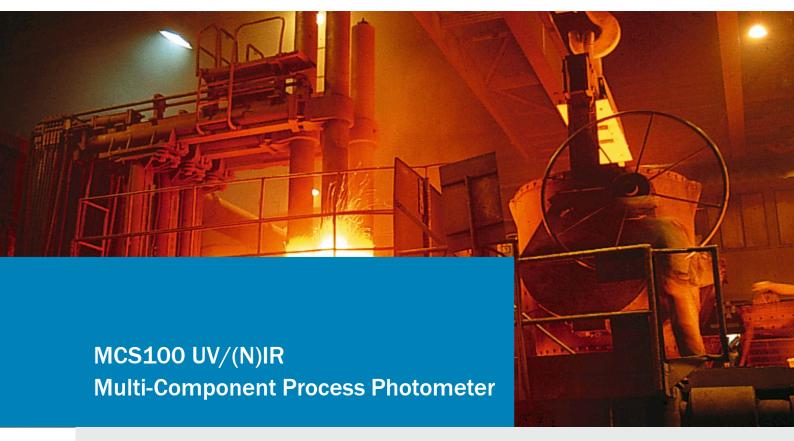
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Process analysis for top quality products Continuous measurements of many components in liquid or gases



# Online – Measuring Technology For Optimal Process Quality And Safety

In chemical processing the quality of the product The process measuring technique is vital for the quality of the product in chemical processes. Top quality products demand top quality process measuring techniques. SICK MAIHAK, provides the appropriate measuring systems as well as complete (ready to use) measuring solutions.





MCS 100 physics unit

# Numerous applications

The MCS 100 – the multi-component process photometer – is designed for continuous measurements of many components using one system, in liquid or gas, high pressure and high temperatures. A measuring system that fulfills even the most stringent process requirements.

## **Global Applications**

Process photometers from SICK MAIHAK are used all over the world for the monitoring of gaseous (from Acetaldehyde to Vinylchloride) and liquid (from Acetone to traces of water) samples. Our experienced technical laboratory provides support for the solution of specialized applications.



MCS 100 electronics unit

# High precision with an excellent price/ performance ratio

The multi-component analysis measurement is a high precision measuring method, allowing for an efficient price/ratio performance. By simultaneously analyzing numerous components with interference compensation greater accuracy than with a single component system is achieved.

### Flexibility and Safety

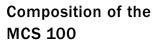
The MCS 100 is available in the UV-, the NIR-, and the IR version. A high degree of flexibility of its mechanics as well as data processing is an integral part of the design. It is therefore easy to adjust the MCS 100 for a diversity of applications . The robust design and the effective auto-check ensures high reliability and long servicing intervals.



# The Analyzer

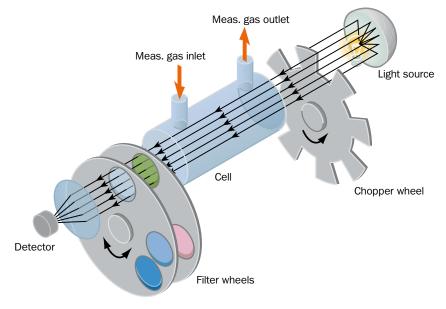
The process photometer MCS 100 is a single-beam photometer that employs simultaneously the Single Beam Dual Wavelength rate and gas filter correlation methods. It has an integral time/event guided program.

It's advanced programmable control system enables the monitoring and guidance of the system periphery. This is done via a key panel or a PC, which must be compatible for industrial use. Other technical standards of the MCS 100 are the auto check, the counterbalancing of disturbing signals and the linearization of measuring values.



The MCS 100 incorporates:

- Light source unit with light source and a chopper wheel. The choice of light source depends on the range of the wavelength.
- Cells a range of cells which are adaptable to each application.
- **Detector unit** including filter wheels and a detector. Filter wheels are equipped, depending on the measuring method being used, with an inference and/or gas filter. The physics unit and the electronics unit are, depending on the type of equipment, connected either optically or electrical. The type of equipment determines whether the connection between the physics and the electronics unit is via electric or optical means.
- 19"-electronics unit design: The relay- and analog output points are integrated in the electronics or lead over light wave conductor into special interference (fail) safe transfer units (opto box)



### Measuring principle

The light is modulated by a chopper. After exiting the cell it passes through two filter wheels which are aligned one in front of the other. Stepper-motors rotate the filters, which are designed for single beam dual wavelength- or gas filter correlation method, into the beam path. The measurement of the light intensity is determined by a detector. A variety of detectors are used for monitoring the range of the wavelength.

# Single-Beam Dual-Wavelength method

An interference filter is employed, which principally consists of one measuring- and one reference filter per component. The measuring filter selects the spectral range from the absorption strip of the measured substance, whereas the reference filter selects the spectral range, in which no absorption occurs, either through measuring components or due to noise components.

In using a pivoted measured filter the signal received correlates with the concentration of the measured substance inside the measuring cell. The signal is independent of the concentration with a pivoted reference filter. The measurand of Extinction is determined by first

creating a ratio and then a logarithm of the two signals. It is largely unrelated to changes in the optical characteristics of the photometer and enables a long term stability and reproduction of the measured values. Possible interfering noises affecting the extinction value are rectified during the following course of calculation. the linearization function transfers the signal to the concentration display or output.

# **Gas Filter Correlation Method**

Using the Gas Filter Correlation Method the reference signal, which is generated by a pivoted gas filter, is independent of the concentration. This gas filter is a miniature cell filled with the measuring component under high partial pressure. The measuring gas spectrum of the light coming from the beam source is eliminated by the gas filter. The measuring signal ,that is correlated to the concentration, is obtained by pivoting a vacant filter wheel aperture into the beam path. Pivoting an additional interference filter on the second filter during both measurements enables the restriction of the spectral range on the absorption band of the measuring component. Calculation of extinction and other signal processes are carried out by the Single-Beam Dual-Wavelength method.

# Process related System Engineering

High quality sampling and signal processing techniques play a central role in analysis. SICK MAIHAK has an extensive experience in dealing with different process conditions and offer the suitable accessory – especially for corrosive and reactive trial flows. Moreover, we develop and produce custom-made system solutions – from the analyzer on mounting plates to system solutions for operating in explosive atmospheres.



A typical configuration of an applications in an Ex area. The sample conditioning is located in the lower cabinet part – accessible within explosions harzadous conditions.

# Cells

The cells of the MCS 100 are constructed specifically for process requirements. Following features are common to all cells:

- Thermostatting
- Corrosion proof
- Customized materials

## Cells for liquids

Cells designed for liquids, distinguish themselves through their high pressure- and temperature resistance. The optical thickness of the layer is adaptable to the application. Protective windows allow for the flushing of the optical dead storage capacity.

## Short-length cell for gases

The short-length cells are usually used in conditions with high concentration or high absorption rates. Typical thickness of layers are 10 to 75 cm. Versions with the ability to flush optical dead storage capacity are available for particularly critical gases.

#### **Detailed Information**

We provide extensive information on the subject "Process cells" in a separate product information brochure; order no.: 8 009042.

### EMV and Ex

The MCS 100 fulfills the specific demand of the chemical industry for higher protection against electromagnetic noise. Modifications to suit applications in explosive atmospheres are available.

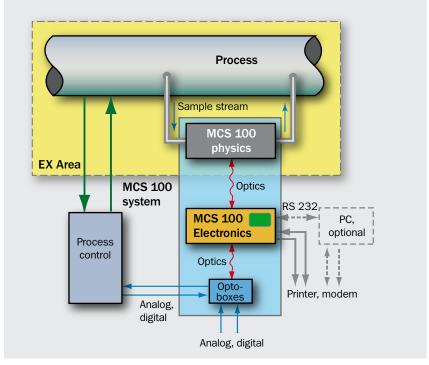
# **SystemEngineering**

In addition to pure analysis SICK MAIHAK offers the support for solutions for user specific measurements. Our comprehensive experience in the field enables SICK MAIHAK to supply complex systems that monitor in corrosive, reactive and explosive atmospheres.



# MCS 100 and Data processing

SICK MAIHAK provides equipment to deliver precise measurement and to make the data processing user friendly. The programming is kept simple and additional interfaces are offered optionally. The data processing is done via PC and a remote servicing or bus connection is available on request.



MCS 100 data flow

## **Stand-Alone-Operation**

After the calibration and installation the MCS 100 is designed to operate totally independend. The measuring values are displayed on screen and are released via optical fibre. Connected to the optical fibre is an opto box that represents the digital and analog interface to the process. Relay outputs

serve e.g. to signal limit values and the automatic alarm. External digital- and analog values may be read in as well via the opto boxes. This allows external control of the system, the reaction to sensors placed on the outside and process measuring values from external devices.

### Data processing via PC

The MCS 100 has an RS 323 interface, offering the option of control via a PC. This facilitates effortless program sequences changes of the MCS 100. In addition, it enables comprehensive processing of measuring values with the option to display the output graphically as well as allowing the output of relay- and analog exit points and storing data onto hard disk.

#### Menue of the PC software



			Moscuring range			Gasas	
Application (gas component)	Chemical	Measuring range			Gases		
·	formula	ppm	vol.%	vol.%	IR	UV	
Acetylaldehyde in Air	$C_2H_4O$	•					
Acetylene in Methane/Ethane	$C_2H_2$			•			
Ammonia in Air	NH <sub>3</sub>		•				
Ammonia in Flue gas	NH <sub>3</sub>	•					
Benzaldehyde in water vapour	C <sub>7</sub> H <sub>6</sub> O			•			
Bromine	Br <sub>2</sub>	•					
Butene in Ethylene/Hydrogen	C <sub>4</sub> H <sub>8</sub>	•					
Butene in Ethylene/Ethane	C <sub>4</sub> H <sub>8</sub>	•					
1-Butene in Hydrogen and Nitrogen	C <sub>4</sub> H <sub>8</sub>			•			
Butylamine 4N in Ammonia	$C_4H_{13}N$			•			
Chlorine	Cl <sub>2</sub>	•	•	•			
Chlorine dioxide in Air	CIO <sub>2</sub>	•					
Chloroform in Air	CHCI <sub>3</sub>	•					
Hydrocyanic acid in Air	HCN	•					
Dichlorobenzene in Air	$C_6H_4CI_2$		•				
Dichchloromethane in Air	$\mathrm{CH_2CI_2}$	•					
1.2- Dichchloroethane in Air	$C_2H_4CI_2$	•					
Dinitrogen Oxide in Air	N <sub>2</sub> 0	•					
Dinitrogen Oxide in Nitrogen	N <sub>2</sub> 0		•				
Ethane in Hydrogen and Nitrogen	$C_2H_6$			•			
Ethyl Alcohol in Air	C <sub>2</sub> H <sub>6</sub> O			•			
Ethrane in Air	C <sub>3</sub> F <sub>5</sub> CIOH	•					
Ethylene in Hydrogen and Nitrogen	$C_2H_4$			•			
Hydroflouric Acid in He/H <sub>2</sub> /UF <sub>6</sub>	HF	•					
Hydroflouric Acid in SiF <sub>4</sub>	HF			•			
Freon 12 in Hexaflouropropene	CCI <sub>2</sub> F <sub>2</sub>			•			
Freon in Air		•					
Frigen in He/H <sub>2</sub> /UF <sub>6</sub>	CCI <sub>2</sub> F <sub>2</sub>	•					
Frigen in Hexaflourpropylen	CCI <sub>2</sub> F <sub>2</sub>		•				
Frigen in Frigen mixture	F <sub>22</sub> , CHCIF <sub>2</sub>			•			
Halothane in Air	CF <sub>3</sub> CHBrCl,	•					
Hexaflourpropane	C <sub>2</sub> F <sub>3</sub> HBrCl						
Hexaflourpropaneoxyde	HFP, C <sub>3</sub> F6 HFPO, C <sub>3</sub> F <sub>6</sub> O						
Isopropanol in Air Carbonyl sulphide in Air	C <sub>3</sub> H <sub>8</sub> O						
Carbon monoxide in Phosgene	CO CO						
Carbon dioxide in Air							
Carbon dioxide in Helium	CO <sub>2</sub>			•			
Methane in Alr	CO <sub>2</sub>		•				
Nitobenzene in Air	CH <sub>4</sub> C <sub>6</sub> H <sub>5</sub> NO <sub>2</sub>						
Perchlorethylene in Air	C <sub>2</sub> Cl <sub>4</sub>						
Phosgene in CO							
	COCI <sub>2</sub>						
Propage in Air	COCI <sub>2</sub>						
Propane in Air	C <sub>3</sub> H <sub>6</sub>						
Salt acid in SiCl <sub>4</sub> Salt acid in Silane	HCI						
Sulfure dioxide in Air	SO <sub>2</sub>				ш		

	01	Mea	suring	range	Ga	ses
Application (gas component)	Chemical formula	ppm	ppm/ vol.%	vol.%	IR	UV
Sulfur Hexaflouride in HE or H <sub>2</sub>	SF <sub>6</sub>		•			
Carbon disulfide in Air	CS <sub>2</sub>	•				
Silane in Salt acid (HCI)				•		
Silicontetraflouride in HCI	SiF <sub>4</sub>			•		
Sulfan	$H_2S_2$		•			
Sulfur dioxide	SO <sub>2</sub>	•				
Hydrogen sulfide	$H_2S$	•				
Tetrachlorethylene in Air	C <sub>2</sub> CI <sub>4</sub>	•				
Tetrachloromethane in Air	CCI <sub>4</sub>	•				
Trichlorethylen in Luft	C <sub>2</sub> HCl <sub>3</sub>	•				
Triethylamine in Air	C <sub>6</sub> H <sub>15</sub> N	•				
Trimethylchlorinsilane in Air	C <sub>3</sub> H <sub>9</sub> CISi	•				
Uranium Hexaflouride in HE or ${\rm H_2}$	UF <sub>6</sub>		•			
Vinyl acetate in Ethylenes (C <sub>2</sub> H <sub>4</sub> )	C4H6O2			•		
Vinyle chloride	C <sub>2</sub> H <sub>3</sub> Cl		•			
Water in Air	H <sub>2</sub> 0	•				
Water in Helium	H <sub>2</sub> 0		•			
Water in SiF <sub>4</sub> , HF, HCI	H <sub>2</sub> 0			•		

(liquid components)       formula       ppm       ppm/vol%       vol%         1-Propylenglycol-2-monomethylether	A 11 11	0	Mea	suring ra	ange
Acetone (Dimethylketone) in water $C_3H_6O$ Benzene in water $C_6H_6$ Hydrocyanic in acetone cyanhydrine HCN  Acetic acid/Acetic acid anhydride $C_2H_4O_2/C_4H_6O_3$ Ethyl alcohol in water $C_2H_6O$ Glycerine in water $C_3H_8O_3$ Isocyanate in MCB/ODB  NCO  Carbon dioxide in $H_2O/NH_3$ CO2  Methanol in water $C_4O$ Methylchloride in Dimethylether $C_4O$ Nitroluene in Cyclohexane $C_7H_7NO_2$ Phosgene in MCB/ODB  COCl <sub>2</sub> Toluene in Triethylamine $C_7H_8$ Water in Acetone $C_3H_6O$ Water in Benzene $C_6H_6$ Water in Dimethylacetamide $C_2H_2Cl_2$ Wasser in Dimethylacetamide $C_4H_8NO$ Water in E-caprolactam $C_4O$ Water in E-caprolactam $C_4O$ Water in E-caprolactam $C_4O$ Water in E-caprolactam	Application Chemical formula		ppm		vol%
Benzene in water $C_6H_6$ $\bullet$	1-Propylenglycol-2-monomethylether				•
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Acetone (Dimethylketone) in water	C <sub>3</sub> H <sub>6</sub> 0	•		
Acetic acid/Acetic acid anhydride $C_2H_4O_2/C_4H_6O_3$ Ethyl alcohol in water $C_2H_6O$ Glycerine in water $C_3H_8O_3$ Isocyanate in MCB/ODB NCO  Carbon dioxide in $H_2O/NH_3$ CO <sub>2</sub> Methanol in water $C_4O$ Methylchloride in Dimethylether $C_4O$ Nitroluene in Cyclohexane $C_7H_7NO_2$ Phosgene in MCB/ODB COCl <sub>2</sub> Toluene in Triethylamine $C_7H_8$ Water in Acetone $C_3H_6O$ ) $C_7H_8$ Water in Ammonia $C_7O$ Water in Benzene $C_7O$ Water in Dimethylacetamide $C_7O$ Wasser in Dimethylacetamide $C_7O$ Water in E-caprolactam $C_7O$ Water in E-caprolactam	Benzene in water	$C_6H_6$	•		
Ethyl alcohol in water $C_2H_6O$	Hydrocyanic in acetone cyanhydrine	HCN	•	•	•
Glycerine in water $ C_3H_8O_3 \\ Isocyanate in MCB/ODB \\ Carbon dioxide in H_2O/NH_3 \\ CO_2 \\ Methanol in water \\ CH_4O \\ Methylchloride in Dimethylether \\ CH_3Cl \\ Nitroluene in Cyclohexane \\ C_7H_7NO_2 \\ Phosgene in MCB/ODB \\ COCl_2 \\ Toluene in Triethylamine \\ C_7H_8 \\ Water in Acetone (C_3H_6O) \\ H_2O \\ Water in Benzene (C_6H_6) \\ H_2O \\ Water in Dimethylacetamide (C_2H_2Cl_2) \\ H_2O \\ Wasser in Dimethylacetamid (C_4H_9NO) \\ H_2O \\ Water in E-caprolactam \\ H_2O \\ Water in E-caprolactam \\ H_2O \\ \\ Water in E-caprolactam \\ H_2O \\ \\ Water in E-caprolactam \\ \\ \\ Water in E-caprolactam \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	Acetic acid/Acetic acid anhydride	$C_2^{}H_4^{}O_2^{}/C_4^{}H_6^{}O_3^{}$			•
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	Ethyl alcohol in water	$C_2H_6O$			•
Carbon dioxide in $H_2O/NH_3$	Glycerine in water	$C_3H_8O_3$			•
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	Isocyanate in MCB/ODB	NCO	•		
Methylchloride in Dimethylether  CH <sub>3</sub> Cl  Nitroluene in Cyclohexane  C <sub>7</sub> H <sub>7</sub> NO <sub>2</sub> Phosgene in MCB/ODB  COCl <sub>2</sub> Toluene in Triethylamine  C <sub>7</sub> H <sub>8</sub> Water in Acetone (C <sub>3</sub> H <sub>6</sub> O)  H <sub>2</sub> O  Water in Ammonia (NH <sub>3</sub> )  H <sub>2</sub> O  Water in Benzene (C <sub>6</sub> H <sub>6</sub> )  H <sub>2</sub> O  Water in Dimethylacetamide (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> )  Wasser in Dimethylacetamid (C <sub>4</sub> H <sub>8</sub> NO)  Water in E-caprolactam  H <sub>2</sub> O	Carbon dioxide in H <sub>2</sub> O/NH <sub>3</sub>	CO <sub>2</sub>	•		
Nitroluene in Cyclohexane $C_7H_7NO_2$ Phosgene in MCB/ODB $COCl_2$ Toluene in Triethylamine $C_7H_8$ Water in Acetone $(C_3H_6O)$ $H_2O$ Water in Ammonia $(NH_3)$ $H_2O$ Water in Benzene $(C_6H_6)$ $H_2O$ Water in Dimethylacetamide $(C_2H_2Cl_2)$ $H_2O$ Wasser in Dimethylacetamid $(C_4H_9NO)$ $H_2O$ Water in $\mathcal{E}$ -caprolactam $H_2O$	Methanol in water	CH <sub>4</sub> O			•
Phosgene in MCB/ODB  COCl <sub>2</sub> Toluene in Triethylamine  C <sub>7</sub> H <sub>8</sub> Water in Acetone (C <sub>3</sub> H <sub>6</sub> O)  H <sub>2</sub> O  Water in Ammonia (NH <sub>3</sub> )  H <sub>2</sub> O  Water in Benzene (C <sub>6</sub> H <sub>6</sub> )  H <sub>2</sub> O  Water in Dimethylacetamide (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> )  Wasser in Dimethylacetamid (C <sub>4</sub> H <sub>8</sub> NO)  Water in E-caprolactam  H <sub>2</sub> O	Methylchloride in Dimethylether	CH <sub>3</sub> CI			•
Toluene in Triethylamine $C_7H_8$ Water in Acetone $(C_3H_60)$ $H_20$ Water in Ammonia $(NH_3)$ $H_20$ Water in Benzene $(C_6H_6)$ $H_20$ Water in Dimethylacetamide $(C_2H_2Cl_2)$ $H_20$ Wasser in Dimethylacetamid $(C_4H_8N0)$ $H_20$ Water in $\mathcal{E}$ -caprolactam $\mathcal{E}$	Nitroluene in Cyclohexane	C <sub>7</sub> H <sub>7</sub> NO <sub>2</sub>		•	
Water in Acetone ( $C_3H_6O$ ) $H_2O$ Water in Ammonia ( $NH_3$ ) $H_2O$ Water in Benzene ( $C_6H_6$ ) $H_2O$ Water in Dimethylacetamide ( $C_2H_2Cl_2$ ) $H_2O$ Wasser in Dimethylacetamid ( $C_4H_6NO$ ) $H_2O$ Water in $\mathcal{E}$ -caprolactam $H_2O$	Phosgene in MCB/ODB	COCI <sub>2</sub>			•
$\begin{array}{llllllllllllllllllllllllllllllllllll$	Toluene in Triethylamine	C <sub>7</sub> H <sub>8</sub>	•		
$\begin{array}{llllllllllllllllllllllllllllllllllll$	Water in Acetone (C <sub>3</sub> H <sub>6</sub> 0)	H <sub>2</sub> 0		•	
Water in Dimethylacetamide $(C_2H_2CI_2)$ $H_2O$ Wasser in Dimethylacetamid $(C_4H_5NO)$ $H_2O$ Water in $\mathcal{E}$ -caprolactam $H_2O$	Water in Ammonia (NH <sub>3</sub> )	H <sub>2</sub> 0	•		
Wasser in Dimethylacetamid ( ${\bf C_4H_9NO}$ ) ${\bf H_2O}$ ${\bf Water in }{\bf E}$ -caprolactam ${\bf H_2O}$	Water in Benzene (C <sub>6</sub> H <sub>6</sub> )	H <sub>2</sub> 0	•		
Water in $\epsilon$ -caprolactam $H_20$	Water in Dimethylacetamide (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> )	H <sub>2</sub> 0	•		
, 2	Wasser in Dimethylacetamid (C <sub>4</sub> H <sub>9</sub> NO)	H <sub>2</sub> 0	•		•
	Water in E-caprolactam	H <sub>2</sub> 0	•		
Water in Acetic Acid ( $C_2H_4O_2$ ) $H_2O$	Water in Acetic Acid (C <sub>2</sub> H <sub>4</sub> O <sub>2</sub> )	H <sub>2</sub> 0			•
Water in Methanol (CH $_4$ 0) $H_2$ 0	Water in Methanol (CH <sub>4</sub> O)	H <sub>2</sub> 0	•		
Water in Methylethylketon (C <sub>4</sub> H <sub>8</sub> O) H <sub>2</sub> O	Water in Methylethylketon (C <sub>4</sub> H <sub>8</sub> O)	H <sub>2</sub> 0	•		
Water in Methylchloride (CH <sub>2</sub> Cl <sub>2</sub> ) H <sub>2</sub> O	Water in Methylchloride (CH <sub>2</sub> Cl <sub>2</sub> )	H <sub>2</sub> 0	•		
Water in Monochloroacetic Acid H <sub>2</sub> O	Water in Monochloroacetic Acid	H <sub>2</sub> 0			•
Water in Vinylchloride (C <sub>2</sub> H <sub>3</sub> Cl) H <sub>2</sub> O	Water in Vinylchloride (C <sub>2</sub> H <sub>3</sub> Cl)	H <sub>2</sub> 0	•		

# **Technical Data of the MCS 100**

Technical Data	MCS 100 UV/NIR/IR			
	UV version	NIR version	IR version	
Spectral range	appr. 200500 nm	appr. 1,03,0 μm	appr. 1,517,0 μm	
<ul><li>Light source</li></ul>	Deuterium lamp	IR beamer	IR beamer	
<ul><li>Detector</li></ul>	SiliziumSilicon diodediode	PbS	pyroelectric	
Analyzer	General			
Measuring principle	Infrared photometer, single-bea	am dual-wavelength method, gas filt	ter correlation procedure	
No. of meas. components	max. 8	max. 8		
Measuring ranges	2 measurement ranges in each case with automatic switchover; freely programmable			
Response time T <sub>90</sub>	appr. 30120 s adjustable > 2 s (plant and component specific)			
Detection range	<2% of the relevant measurement range end value			
Limit values	2 limit values for each component; freely adjustable as "Open" and "Close" contact			
Zero and span calibration	Automatic control via Remote Control or internal clock			
Cross sensitivity	Provision for up to 4 interference varaibles, external varaibles also possible			
Barometric correction	Range from 70120 kPa atmospheric pressure (optional)			
Peripheral system control	By integrated, freely programmable run-off control via relay interfaces			
Interface	Serial : RS 232, 5 m (16.5 ft) max. distance without amplifier			
Signal outputs	Digital: max 64 channels (Opto box via optical fibre)			
Signal inputs	Analog: max 64 channels (Opto box via optical fibre)  Digital: max 64 channels (Opto box via optical fibre)			
	Analog: max 8 channels (Opto box via optical fibre)			
Standards	EN 61010-1; EN 61326			
Elektronic unit	19" cabinet with window			
Dimensions (H x W x D)	200 mm x 550 mm 380 mm (8 in x 22 in x 15 in) (width plus electr. connectors)			
Weigth	appr. 23 kg (50 lb)			
Power supply	230/115 V, ±1015%; 50/60 Hz; 125 VA consumption			
Ambient temperature	Temperature: 040 °C (32 104 °F)			
Protection class	IP 65; special designs available on request			
Display	1 x LED Display, 4.5 digits, 1 x 20 characters, alphanumericical display			
Operation	Via membrane keyboard or PC			

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component	range	power:
O2	0-21% vol	Voltage 110 ··· 230 V/50 ··· 60 Hz
VOC	0-100 mg/Nm3	Voltage 110 ··· 230 V/50 ··· 60 Hz
NO	0-1500 mg/Nm3	Voltage 110 ··· 230 V/50 ··· 60 Hz
H2O	0-20%	Voltage 110 ··· 230 V/50 ··· 60 Hz