Data Sheet SS/267CS/269CS-EN Rev. 01

Model 267CS Multivariable
Model 269CS Multivariable
for mass flow

Measurement made easy

2600T Series Pressure Transmitters

Engineered solutions for all applications

Selectable maximum working pressure
— Up to 41 MPa, 5945 psi

Base accuracy
— ± 0.075 % / ± 0.04 %

Span limits
— 0.05 ... 2000 kPa; 0.2 in H_2O ... 290 psi Differential pressure
— 0.6 ... 41 MPa; 87 ... 5945 psi absolute pressure

Corrected mass flow measurement for gases, steam and fluids
— Dynamic correction of pressure and temperature changes

One transmitter replaces three separate transmitters
— Saving initial purchase costs

Reduced process penetrations
— Saves money and reduces the chance of leaks

Fewer transmitters, less wiring and fewer shut-off valves
— Reduce installation costs

Greater reliability
— Due to fewer devices and less wiring

Multiple communications protocol availability
— Provides integration into HART®, PROFIBUS PA and FOUNDATION fieldbus and Modbus platforms
— Upgrade options through interchangeable electronics with automatic configuration

Full compliance with PED category III

Power and productivity
for a better world™

Introduction

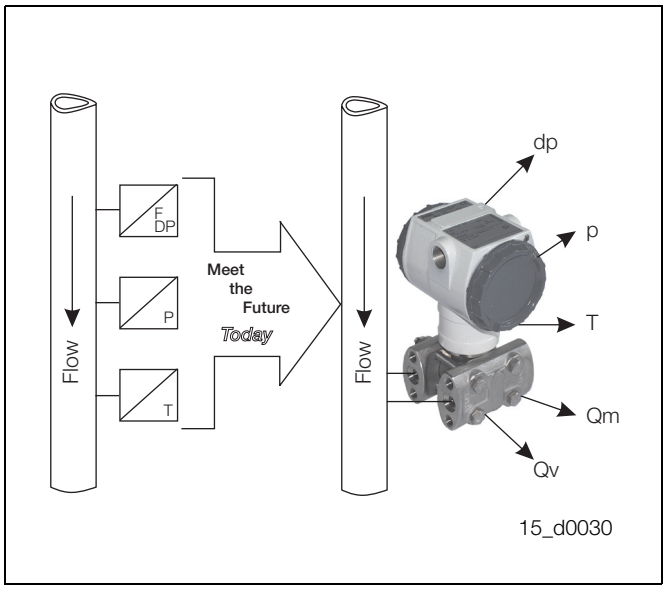
Due to its multisensor technology, the 267C./269C. permits measurement of three separate process variables simultaneously and provides dynamic calculation of fully compensated mass flowrate for steam and liquids respectively standard volume flow for gases. It measures differential pressure and absolute pressure from a single sensor and process temperature from a standard Pt 100 Resistance Temperature Detector (RTD).

The flow calculation of this transmitter includes compensation of pressure and/or temperature as well as more complex variables such as discharge coefficient, thermal expansion, Reynolds number and compressibility factor.

The 267C./269C. includes flow equations for superheated steam, saturated steam, gases and liquids so that one model is all you need in your system.

The enhanced compensation approach of 267C./269C. provides much better accuracy than the “old approach” in which three different transmitters, differential pressure, absolute pressure and temperature, report their values to a DCS, PLC or flow computer. The calculation considers changes in temperature and pressure according to the following formula:

$$Q_m \approx \sqrt{dp\frac{p}{T}}$$



The dynamic mass flow compensation of 267C./269C. is based on the following formula (according to EN ISO 5167/AGA 3:

$$Q_m \approx C \cdot E_v \cdot Y_1 \cdot d^2\sqrt{dp \cdot \rho}$$

Q_m = mass flowrate
C = discharge coefficient
E_v = velocity of approach factor
Y_1 = gas expansion factor
d = bore diameter
dp = differential pressure
ρ = fluid density

The following standards are used for flow calculation:
– AGA 3
– DIN EN ISO 5167

Discharge coefficient

This is defined as the true flowrate divided by the theoretical flowrate and corrects the theoretical equation for the influence of velocity profile (Reynolds number), the assumption of no energy loss between taps and pressure tap location. It is dependent on the primary flow element, the diameter ratio (Beta ratio) and the Reynolds number. Reynolds number is in turn dependent on the viscosity, density and velocity of the medium as well as the pipe diameter per the following equation:

$$Re = \frac{v \cdot D \cdot \rho}{\upsilon}$$

v = velocity
D = interior pipe diameter
ρ = medium density
υ = medium viscosity

Dynamic compensation for discharge coefficient provides high accuracy for flow measurement with primary flow elements.

Gas expansion factor

This corrects for density differences between pressure taps due to expansion of compressible media. It does not apply for liquids which are essentially non-compressible.
The gas expansion factor is dependent on the diameter ratio, the Isentropic exponent, the differential pressure and the static pressure of the fluid according to the following equation:

For orifices:

$$Y_1 = 1 - (0.41 + 0.35 \cdot \beta^4)\frac{dp}{p \cdot \kappa}$$

For nozzles:

$$Y_1 = \left[\left(\frac{\kappa\left(\frac{dp}{p}\right)^{\frac{2}{\kappa}}}{\kappa - 1}\right)\left(\frac{1-\beta^4}{1-\beta^4\left(\frac{dp}{p}\right)^{\frac{2}{\kappa}}}\right)\left(\frac{1-\left(\frac{dp}{p}\right)^{\frac{\kappa-1}{\kappa}}}{1-\left(\frac{dp}{p}\right)}\right)\right]^{\frac{1}{2}}$$

β = ratio of diameters (Beta ratio)
dp = differential pressure
p = static pressure
κ = Isentropic exponent

Velocity of approach factor

Is dependent on the Beta ratio as defined by the following equation:

$$E_V = \frac{1}{\sqrt{1-\beta^4}}$$

Beta ratio is dependent on bore diameter and pipe diameter which in turn are functions of temperature. The material of the process pipe and primary flow element expands or contracts with changes in temperature of the fluid being measured. The thermal expansion coefficients are dependent on the the material of the pipe and flow element and are used for calculating the change in diameters. This ensures high flowrate accuracy during low and high temperature applications.

Medium density

This directly affects the flowrate calculation. The 267C./269C. compensates for density of media resulting from changes in temperature and/or pressure as follows:

- Gases as a function of p and T per the gas law equations. Calculation of the compressibility factors for natural gas is described in the American AGA 8 standard.
- Super-heated steam as function of p and T based on steam tables
- Saturated steam as function of p based on steam tables
- Liquids as a function of T

Mass flow calculation with the 267C./269C. will be configured for the following differential flow sensors:

Orifice corner taps, ISO
Orifice flange taps, ISO
Orifice D and D/2 taps, ISO
Orifice corner taps, ASME
Orifice flange taps, ASME
Orifice D and D/2 taps, ASME
Orifice flange taps, AGA3
Orifice 2.5D and 8D taps
Small bore orifice, flange taps
Small bore orifice, corner taps
Nozzle ISA 1932
Nozzle, long radius wall tap, ISO
Nozzle, long radius wall tap, ASME
Venturi, rough cast inlet, ISO
Venturi, machined inlet, ISO
Venturi, welded inlet, ISO
Venturi, rough cast inlet, ASME
Venturi, machined inlet, ASME
Venturi, welded inlet, ASME
Venturi, nozzle, ISO
Area Averaging Meter
Pitot tube, ISO 3966
V-cone
Wedge element
Integral Orifice Assembly
Density correction (unknown primary element)

Configuration of full functionality of 267C./269C. including all data necessary for mass flow compensation will use the PC-based tool SMART VISION with DTM MV 2600T.

Functional Specifications

Measuring range and span limits

Differential pressure sensors

Sensor code	Upper range limit (URL)	Lower range limit (LRL)	Minimum span
A	1 kPa 10 mbar 4 in H_2O	0	0.05 kPa 0.5 mbar 0.2 in H_2O
C	6 kPa 60 mbar 24 in H_2O	0	0.2 kPa 2 mbar 0.8 in H_2O
F	40 kPa 400 mbar 160 in H_2O	0	0.4 kPa 4 mbar 1.6 in H_2O
L	250 kPa 2500 mbar 1000 in H_2O	0	2.5 kPa 25 mbar 10 in H_2O
N	2000 kPa 20 bar 290 psi	0	20 kPa 0.2 bar 2.9 psi

Absolute pressure sensors

Sensor code	Upper range limit (URL)	Lower range limit (LRL)	Minimum span
1	600 kPa 6 bar 87 psi	0 abs	6 kPa 0.06 bar 0.87 psi
2	2000 kPa 20 bar 290 psi	0 abs	20 kPa 0.2 bar 2.9 psi
3	10000 kPa 100 bar 1450 psi	0 abs	100 kPa 1 bar 14.5 psi
4	41000 kPa 410 bar 5945 psi	0 abs	410 kPa 4.1 bar 59.5 psi

Span limits

Maximum span = URL = upper range limit
(with the flow measurement shut off, can be adjusted up to ± URL within the measurement span.
Example: -400 ... +400 mbar)
In order to optimize performance characteristics, it is recommended to select the transmitter sensor providing the lowest turndown ratio.

Zero suppression and elevation

No suppression or elevation, but zero-based range if:
– calibrated span ≥ minimum span

Process temperature range

-50 °C to +650 °C (-58 °F to 1200 °F) with external four-wire RTD.

Damping

Adjustable time constant: 0 to 60 sec
This is in addition to sensor response time.

Warm-up period

Operation within specifications: ≤ 2.5 sec with minimal damping

Insulation resistance

> 100 MΩ at 1000 V DC (between terminals and ground)

Operating limits

Temperature limits °C (°F):

Ambient (operating temperature)

Transmitter: -40 °C to +85 °C (-40 °F and +185 °F)
LCD display: -20 °C to +70 °C (-4 °F and +158 °F)
Lower operating temperature
for Viton and PTFE gaskets. -20 °C (-4 °F)

Note:
For hazardous atmosphere applications, see the temperature range specified on the relevant certificate/approval.

Process

Lower limit
– Refer to the lower ambient temperature limits

Upper limit:
– Silicone oil: 120 °C (248 °F) for operating pressures ≥ 10 kPa abs, 100 mbar abs, 1.45 psia (1)
– Carbon fluoride: 120 °C (248 °F) for operating pressures ≥ atmospheric pressure (2)

(1) 85 °C (185 °F) for applications below 10 kPa abs, 100 mbar abs, 1.45 psia to 3.5 kPa abs, 35 mbar abs, 0.5 psia
(2) 85 °C (185 °F) for applications below atmospheric pressure up to 40 kPa abs, 400 mbar abs, 5.8 psia

Storage

Lower limit: -50 °C (-58 °F), -40 °C (-40 °F) for LCD displays
Upper limit: +85 °C (+185 °F)

Pressure limits

Overpressure limits (without damage to the transmitter)

Lower limit
– 0.5 kPa abs, 5 mbar abs, 0.07 psia for silicone oil
– 40 kPa abs, 400 mbar abs, 5.8 psia for carbon fluoride

Upper limit:
– 0.6 MPa, 6 bar, 87 psi for differential pressure sensor code A
– 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5945 psi depending upon the selected code variant for sensor code C, F, L, N

Static pressure

The 267C./269C. transmitter for mass/standard volume flow operates within specifications with the following limits:

Lower limit
– 3.5 kPa abs, 35 mbar abs, 0.5 psia for silicone oil
– 40 kPa abs, 400 mbar abs, 5.8 psia for carbon fluoride

Upper limit:
– 0.6 MPa, 6 bar, 87 psi for differential pressure sensor code A
– 2 MPa, 20 bar, 290 psi or 10 MPa, 100 bar, 1450 psi or 41 MPa, 410 bar, 5945 psi depending upon the selected code variant for sensor code C, F, L, N

Test pressure

For pressure testing purposes, the transmitter can withstand a pressure test applied simultaneously from both sides of up to 1.5 times the static pressure range of the transmitter.

Environmental limits

Electromagnetic compatibility (EMC)

Definition Class 3
RFI suppression Limit Class B
(according to EN 550011)
Meets NAMUR recommendations

Low voltage directive:

Meets 73/23/EC

Pressure equipment directive (PED)

Instruments with maximum working pressure 41 MPa, 410 bar, 5945 psi comply with 97/23/EC Category III module H.

Humidity

Relative humidity: up to 100 %
Condensation, icing: permitted

Vibration resistance

Acceleration up to 2 g at frequencies up to 1000 Hz
(according to IEC 60068-2-26)

Shock resistance (according to IEC 60068-2-27)

Acceleration: 50 g
Duration: 11 ms

Wet and dust-laden atmospheres (protection type)

The transmitter is dust and sand-tight and protected against immersion effects as defined by IEC EN60529 (1989) to IP 67 (IP 68 on request) or by NEMA to 4X or by JIS to C0920.
Protection type with plugged connection: IP 65

Hazardous atmospheres

Transmitter of protection type "Intrinsically safe EEx ia" according to Directive 94/9/EC (ATEX)

For applications in explosive areas, the connected RTD must also have the respective Ex protection class as the transmitter.

Transmitter with 4 to 20 mA output signal and HART communication
Identification: II 1/2 GD T 50 °C EEx ia IIC T6
II 1/2 GD T 95 °C EEx ia IIC T4

Power supply and signal circuit with protection type Intrinsic Safety EEx ib IIB/IIC or EEx ia IIB/IIC for connection to supply units with maximum values:
II 1/2 GD T 50 °C EEx ia or ib IIC T6
II 1/2 GD T 95 °C EEx ia or ib IIC T4

For temperature class T4:
U_i = 30 V
I_i = 200 mA
P_i = 0.8 W for T4 where Ta = -40 °C to +85 °C (-40 °F to +185 °F)
P_i = 1.0 W for T4 where Ta = -40 °C to +70 °C (-40 °F to +158 °F)

For temperature class T6:
P_i = 0.7 W for T4 where Ta = -40 °C to +40 °C (-40 °F to +104 °F)

Effective internal capacitance: $C_i \leq 10$ nF
Effective internal inductance: $L_i \approx 0$

Fieldbus transmitters (PROFIBUS PA / FOUNDATION fieldbus)
Identification: II 1/2 GD T 50 °C EEx ia IIC T6
II 1/2 GD T 95 °C EEx ia IIC T4

Power supply and signal circuit with protection type Intrinsic Safety EEx ib IIB/IIC or EEx ia IIB/IIC for connection to supply units with maximum values:

II 1/2 GD T 50 °C EEx ia or ib IIC T6	U_i = 17.5 V
II 1/2 GD T 95 °C EEx ia or ib IIC T4	I_i = 360 mA
	P_i = 2.52 W
II 1/2 GD T 50 °C EEx ia or ib IIB T6	U_i = 17.5 V
II 1/2 GD T 95 °C EEx ia or ib IIB T4	I_i = 380 mA
	P_i = 5.32 W

or connection to supply units or barriers with linear characteristics:
Maximum values:

II 1/2 GD T 50 °C EEx ia or ib IIC T6	U_i = 24 V
II 1/2 GD T 95 °C EEx ia or ib IIC T4	I_i = 250 mA
	P_i = 1.2 W

Effective internal inductance: $L_i \leq 10$ µH,
Effective internal capacitance: $C_i \approx 0$

Maximum permissible ambient temperatures depending on the temperature class:

Temperature class	ambient temperature lower limit	ambient temperature upper limit
T4	-40 °C (-40 °F)	+85 °C (+185 °F)
T5, T6	-40 °C (-40 °F)	+40 °C (+104 °F)

Transmitter of category 3 for the application in "Zone 2" according to Directive 94/9/EC (ATEX)

Transmitter with 4 to 20 mA output signal and HART communication
Identification: II 3 GD T 50 °C EEx nL IIC T6
II 3 GD T 95 °C EEx nL IIC T4

Operating conditions:
Supply and signal circuit
(terminal signal ±): U ≤ 45 V
I ≤ 22.5 mA

Connector for passive external temperature sensor:
Supply and signal circuit U ≤ 10.6 V
I ≤ 1.5 mA
P ≤ 4 mW

Ambient temperature range:
Temperat. class T4 Ta = -40 °C to +85 °C (-40 °F to +185 °F)
Temperat. class T5 and T6 Ta = -40 °C to +40 °C (-40 °F to +104 °F)

Transmitter of protection type "flameproof enclosure EEx d" according to Directive 94/9/EC (ATEX)

Transmitter with 4 to 20 mA output signal and HART communication and fieldbus transmitter (PROFIBUS PA/FOUNDATION fieldbus)
Identification: II 1/2 G EEx d IIC T6

Operating conditions:
Ambient temperature range: -40 °C to +75 °C (-40 °F to +167 °F)

Transmitter of protection type "Intrinsically safe EEx ia" according to Directive 94/9/EC (ATEX), or

protection type "flameproof enclosure EEx d" according to Directive 94/9/EC (ATEX), or

protection type "Limited energy equipment EEx nL" according to Directive 94/9/EC (ATEX) (alternate certification)

Transmitter with 4 to 20 mA output signal and HART communication
Identification: II 1/2 GD T50 °C EEx ia IIC T6
II 1/2 GD T95 °C EEx ia IIC T4;
(refer to "EEx ia" for additional data)
or

Identification: II 1/2 GD T85 °C EEx d IIC T6

Ambient temperature range:
-40 °C to +75 °C (-40 °F to +167 °F)
or

Identification: II 3 GD T 50 °C EEx nL IIC T6
II 3 GD T95 °C EEx nL IIC T4
(refer to "EEx nL" for additional data)

Factory Mutual (FM)

Transmitter with 4 to 20 mA output signal and HART communication
Intrinsically Safe: Class I; Division 1; Groups A, B, C, D;
Class I; Zone 0; Group IIC; AEx ia IIC
Degree of protection: NEMA Type 4X (indoor or outdoor)

Maximum permissible ambient temperatures depending on the temperature class:

U_{max} = 30 V, C_i = 10.5 nF, L_i = 10 µH			
Ambient temperature	**Temperature class**	**I_{max}**	**P_i**
-40 °C to +85 °C (-40 °F to +185 °F)	T4	200 mA	0.8 W
-40 °C to +70 °C (-40 °F to +158 °F)			1 W
-40 °C to +40 °C (-40 °F to +104 °F)	T5	25 mA	0.75 W
	T6		0.5 W

Fieldbus transmitters
(PROFIBUS PA / FOUNDATION fieldbus)
Intrinsically Safe: Class I, II, and III; Division 1;
Groups A, B, C, D, E, F, G;
Class I; Zone 0; AEx ia Group IIC T6, T4;
Non-incendive Class I, II, and III; Division 2;
Groups A, B, C, D, F, G

Transmitter with 4 to 20 mA output signal and HART communication and fieldbus transmitter (PROFIBUS PA/FOUNDATION fieldbus)
Explosion Proof: Class I, Division 1, Groups A, B, C, D;
Class II/III, Division 1, Groups E, F, G
Degree of protection: NEMA Type 4X (indoor or outdoor)

Canadian standard (CSA)

Transmitter with 4 to 20 mA output signal and HART communication and fieldbus transmitter (PROFIBUS PA/FOUNDATION fieldbus)
Explosion Proof: Class I, Division 1, Groups B, C, D;
Class II/III, Division 1, Groups E, F, G
Degree of protection: NEMA Type 4X (indoor or outdoor)

Standards Association of Australia (SAA)

Transmitter of protection type "Intrinsically safe Ex ia" and "Non-sparking material" Ex n

Transmitter with 4 to 20 mA output signal and HART communication
Identification:
Ex ia IIC T4 (P_i 0.8 W Ta = 85 °C) / T6 (P_i 0.7 W Ta = 40 °C)
Ex n IIC T4 (Ta = 85 °C / T6 (Ta = 40 °C)
IP 66

Intrinsically safe installation input parameters:
U_i = 30 V
I_i = 200 mA
P_i = 0.8 W for T4 where Ta = +85 °C (+185 °F) or
P_i = 0.7 W for T4 where Ta = +40 °C (+104 °F)

Effective internal capacitance: Ci = 52 nF
Effective internal inductance: Li ≈ 0 mH

Ex n installation input parameters:
U_i = 30 V

Transmitter with protection type "flameproof enclosure Ex d"

Transmitter with 4 to 20 mA output signal and HART communication and fieldbus transmitter (PROFIBUS PA/FOUNDATION fieldbus, Modbus)
Identification:
Zone 1: Ex d IIC T6 (Tamb +75 °C) IP66/IP67
Zone A21: Ex tD A21 T85 (Tamb +75 °C) IP66/IP67

Electrical Data and Options

HART digital communication and 4 to 20 mA output

Power supply

The transmitter operates from 10.5 to 45 V DC with no load and is protected against reverse polarity connection
(additional load allows operations over 45 V DC).
Minimum power supply is 14 V DC with backlit display.
For EEx ia and other intrinsically safe approval power supply must not exceed 30 V DC.

Ripple

Maximum permissible voltage ripple of power supply during communication:
7 Vss at f = 50 to 100 Hz
1 Vss at f = 100 to 200 Hz
0.2 Vss at f = 200 to 300 Hz

Load limitations

Total loop resistance at 4 to 20 mA and HART:

$$R(k\Omega) = \frac{\text{Supply voltage} - \text{minimum operating voltage (V DC)}}{22.5\ \text{m A}}$$

A minimum of 250 Ω is required for HART communication.

LCD display (optional)

19-segment alphanumeric display (2-line, 6-character) with additional bar chart display, optionally with back illumination.
User-specific display:
Output current in percent or
Output current in mA or
Freely-selectable process variable
Diagnostic messages, alarms, measuring range infringements and changes to the configuration are also displayed.

Output signal

Two-wire 4 to 20 mA, related to mass / standard volume flow, full compensation of all pressure (p) and temperature (T) effects. HART® communication provides digital process variables (%, mA or engineering units) superimposed on the 4 to 20 mA signal (protocol according to Bell 202 FSK standard).

Output function

Mass / standard volume flow calculations are performed according to the following:

$$Q_m \approx C \cdot E_v \cdot Y_1 \cdot d^2 \sqrt{dp \cdot \rho}$$ For steam/fluid

$$Q_n \approx C \cdot E_v \cdot Y_1 \cdot d^2 \sqrt{dp \cdot \rho} \cdot \frac{1}{\rho_n}$$ For gas

where:
Q_m = mass flowrate
Q_n = standard flowrate
C = discharge coefficient
E_v = velocity of approach factor
Y_1 = gas expansion factor
d = bore diameter
dp = differential pressure
ρ = fluid density
ρ_n = standard density

Output current limits (according to NAMUR standard)

Overload condition
– Lower limit: 3.8 mA (configurable down to 3.6 mA)
– Upper limit: 20.5 mA (configurable up to 22.5 mA)

Alarm current

Minimum alarm current: configurable from 3.6 to 4 mA.
Standard setting: 3.6 mA
Maximum alarm current: configurable from 20 to 22.5 mA.
Standard setting: 21 mA
Standard setting: maximum alarm current

SIL – functional safety (optional) according to IEC 61508/61511

Device with certificate of conformity for use in safety-relevant applications, including SIL 2.

PROFIBUS PA output

Type of appliance

Pressure transmitter in conformance with Profile 3.0, Class A and B; ID number 062D HEX

Power supply

The transmitter is driven with 10.2 to 32 V DC (no polarity).
The power supply must not exceed 17.5 V DC when used in EEx ia zones.
Intrinsic safety installation according to FISCO model.

Current consumption

Operating (quiescent): 11.7 mA
Fault current limiting: 17.3 mA max.

Output signal

Physical layer in compliance with IEC 1158-2/EN 61158-2 with transmission to Manchester II modulation, at 31.25 kbit/sec.

Output interface

PROFIBUS PA communication according to PROFIBUS DP50170 Part 2/DIN 19245 Part 1-3

Output cycle time

100 ms

Function blocks

3 standard analog input function blocks,
2 transducer blocks
1 multi variable function block,
1 physical block

LCD display (optional)

19-segment alphanumeric display (2-line, 6-character) with additional bar chart display, optionally with back illumination.
User-specific display:
Output value in percent or
OUT (input flow)
Diagnostic messages, alarms, measuring range infringements and changes to the configuration are also displayed.

Transmitter failure mode

Permanent self-diagnostic; possible errors indicated in diagnostic parameters and in the status of process values.

FOUNDATION fieldbus output

Power supply

The transmitter is driven with 10.2 to 32 V DC (no polarity).
The power supply must not exceed 17.5 V DC when used in EEx ia zones.
Intrinsic safety installation according to FISCO model.

Current consumption

Operating (quiescent): 11.7 mA
Fault current limiting: 17.3 mA max.

Output signal

Physical layer in compliance with IEC 1158-2/EN 61158-2 with transmission to Manchester II modulation, at 31.25 kbit/sec.

Function blocks/execution time

3 standard analog input function blocks (each 80 ms)
1 multi variable function block (100 ms),
1 standard PID function block (100 ms)

Additional blocks

1 custom pressure with calibration transducer block
1 standard resource block
1 custom temperature with calibration transducer block

Number of link objects

10

Number of VCRs

16

Output interface

FOUNDATION fieldbus digital communication protocol to standard H1, compliant with specification V. 1.5; FF registration No. IT023700.

LCD display (optional)

19-segment alphanumeric display (2-line, 6-character) with additional bar chart display, optionally with back illumination.
User-specific display:
Output value in percent or
OUT (input flow)
Diagnostic messages, alarms, measuring range infringements and changes to the configuration are also displayed.

Transmitter failure mode

Permanent self-diagnostic; possible errors indicated in diagnostic parameters and in the status of process values.

Measuring accuracy

Reference conditions according to IEC 60770 apply: ambient temperature of 20 °C (68 °F), relative humidity of 65 %, atmospheric pressure of 1013 hPa (1013 mbar), mounting position with vertical diaphragm and zero-based range for transmitter with isolating diaphragms in Hastelloy and silicone oil fill. Measurement range with HART digital trim values equal to 4 to 20 mA span end points.

Unless otherwise specified, errors are quoted as % of span.

The accuracy related to the Upper Range Limits (URL) is affected by the actual turndown (TD) as a ratio between Upper Range Limit (URL) and calibrated span (URL/span).

In order to optimize performance characteristics, it is recommended to select the transmitter sensor providing the lowest turndown ratio.

Dynamic behavior (according to IEC 61298-1)

Devices with standard configuration and turndown to 30:1
Dead time: 30 ms
Time constant (63.2 % of total step change)
– Sensors F to N: 150 ms
– Sensor C: 400 ms
– Sensor A: 1000 ms

Accuracy rating

Percentage of calibrated span including combined effects of linearity, hysteresis and reproducibility.
For fieldbus versions SPAN refers to analog input function block outscale range.

Differential pressure sensor
267CS
– ± 0.075 % for turndown from 1:1 to 10:1

– $\pm\left(0.075 + 0.005 \times \frac{\text{URL}}{\text{Span}} - 0.05\right)\%$ For turndown greater than 10:1

269CS
– ± 0.04 % for turndown from 1:1 to 10:1

– $\pm\left(0.04 + 0.005 \times \frac{\text{URL}}{\text{Span}} - 0.05\right)\%$ For turndown greater than 10:1

Absolute pressure sensor
0.1 % of the URL of the absolute pressure sensor

Process temperature measurement (Pt 100)
± 0.3 °C (0.54 °F)

The accuracy of the mass or standard volume flow is not only influenced by the accuracy of the dp, p and T measurement; rather it depends upon the primary device used (discharge coefficient), the pressure and temperature range to be compensated, as well as other parameters.
Typical applications reflect an accuracy of 0.7 % to 0.9 %.

Operating influences

Ambient temperature

(turndown to 15:1)
Per 20 K change between the limits of
-20 °C to +65 °C (-4 °F to +149 °F)

Differential pressure sensor
267CS
± (0.04 % URL + 0.065 % span)

269CS
± (0.03 % URL + 0.05 % span)

Absolute pressure sensor
± (0.08 % URL + 0.08 % span)
Limited to ± (0.1 % URL + 0.1 % span) per the complete temperature range of 120 K (216 °F)

Static pressure
(zero errors can be calibrated out at line pressure)

Measuring range	Sensor A	Sensors C, F, L, N
On zero	to 2 bar: 0.05 % URL	to 100 bar: 0.05 % URL
	> 2 bar: 0.05 % URL/bar	> 100 bar: 0.05 % URL/100 bar
On span	to 2 bar: 0.05 % span	to 100 bar: 0.05 % span
	> 2 bar: 0.05 % span/bar	> 100 bar: 0.05 % span/100 bar

Power supply

Within the specified limits for the voltage/load the total influence is less than 0.001 % of URL per volt.

Load

Within the specified load/voltage limits, the total effect is negligible.

Electromagnetic fields

Total effect: less than 0.05 % of span from 80 to 1000 MHz and for field strengths up to 10 V/m when tested with unshielded conduit, with or without meter.

Common-mode interference

No effect from 250 Veff (50 Hz) or 50 V DC

Installation position

Rotations in the plane of the transmitter diaphragm have negligible effect. A tilt from vertical causes a zero shift of sin α x 0.35 kPa (3.5 mbar, 1.4 in H_2O) of URL which can be corrected with the zero adjustment. No effect on the span.

Stability

± 0.15 % of URL over a sixty-month period

Vibration effect

± 0.10 % of URL (according to IEC 61298-3)

Technical Specification

(Refer to ordering information sheets for variant availability related to the specific model)

Materials

Process isolating diaphragms[1)]

Hastelloy C276™ stainless steel (1.4435); Monel 400™, Tantalum

Process flange, adapter, plugs and drain/vent valves[1)]

Hastelloy C276™ stainless steel (1.4404); Monel 400™; Kynar (PVDF)

Sensor fill fluid

Silicone oil, inert fill (carbon fluoride)

Sensor housing

Stainless steel

Mounting bracket

Stainless steel

Gaskets[1)]

Viton™ (FPM), Perbunan (NBR), EPDM, PTFE (for sensor C, F, L, N) or FEP coated Viton™ (for sensor A)

Bolts and nuts

Stainless steel, bolts and nuts Class A4-70 according to ISO 3506, conforming to NACE MR0175 Class II

Electronics housing and cover

Barrel version
- Aluminum alloy with low copper content, baked epoxy finish
- Stainless steel

DIN version
- Aluminum alloy with low copper content, baked epoxy finish

Covers O-ring

Viton™

Local control keys

Fiberglass-reinforced polycarbonate plastic (removable), no local control keys for stainless steel housings.

Type plate

Stainless steel (316) or plastic data plate attached to the electronics housing

Calibration

Standard: at maximum span, zero-based range, ambient temperature and pressure
Optional: at specified range and ambient conditions

Optional accessories

Mounting bracket

For vertical and horizontal 60 mm (2 in) pipes or wall mounting

LCD display

Plug-in and rotatable

Additional tag plate

Tag with wire (both stainless steel) attached to the transmitter, with a maximum of 30 characters including spaces.

Cleanliness level for oxygen application

Preparation for hydrogen application

Certificates (test, model, calibration, material traceability)

Process connections

Flange: ¼-18 NPT on the process axis, selectable with fixing threads 7/16-20 UNF or DIN 19213 connection with M10 threading for operating pressures up to 10 MPa, 100 bar, 1450 psi or M12 threading for higher operating pressures up to 41 MPa, 410 bar, 5945 psi
Adapter: ½-14 NPT on process axis
Center distance between flanges: 54 mm (2.13 in); 51, 54 or 57 mm (2.01, 2.13 or 2.24 in) as per adapter fittings

Electrical connections

Two ½-14 NPT or M20 x 1.5 threaded bores for cable glands, direct on housing, or plug connector
- HART: straight or angle Harting Han connector and one plug
- FOUNDATION fieldbus/PROFIBUS PA; plug 7/8 in / M12 x 1

Terminal blocks

HART version: four terminals for signal/external display plus four terminals for RTD connection wiring up to 2.5 mm² (14 AWG) and four connection points for test and communication purposes.
Fieldbus versions: two terminals for signal (bus connection) plus four terminals for RTD connection wiring up to 2.5 mm² (14 AWG)

Ground

Internal and external 4 mm² (12 AWG) ground termination points are provided.

Installation position

The transmitter can be mounted in any position.
The electronics housing may be rotated 360°. A positive stop prevents over-travel.

Weight (without options)

Approximately 3.5 kg (8lb), add 1.5 kg (3.4lb) for stainless steel housing. Packaging adds 650 g

Packaging

Carton approx. 230 x 250 x 270 mm (9 x 10 x 11 in)

™ Hastelloy is a Cabot Corporation trademark
™ Monel is an International Nickel Co. trademark
™ Viton is a DuPont de Nemours trademark

[1)] Wetted transmitter parts

Configuration

Transmitter with HART communication and 4 to 20 mA output current

Standard configuration

Transmitters are factory calibrated to the customer's specified range. Calibrated range and measuring point number are stamped on the type plate. If this data has not been specified, the transmitter will be delivered configured as follows:

4 mA	Zero point
20 mA	Upper range limit (URL)
Output	Square root
Damping	0.125 sec
Transmitter failure mode	21 mA
Optional LCD display	Specified flow

Any or all the above configurable parameters, including lower range value and upper range value can be easily changed by a PC running the configuration software SMART VISION with DTM MV2600. Data regarding flange type and material, O-rings and filling liquid is stored in the device.

Transmitter with PROFIBUS PA communication

Transmitters are factory calibrated to the customer's specified range. Calibrated range and measuring point number are stamped on the type plate. If this data has not been specified, the transmitter will be delivered configured as follows:

Measure profile	Pressure
Engineering unit	mbar/bar
Output scale 0 %	Lower range limit (LRL)
Output scale 100 %	Upper range limit (URL)
Output	Square root
Upper alarm limit	Upper range limit (URL)
Upper warning limit	Upper range limit (URL)
Lower warning limit	Lower range limit (LRL)
Lower alarm limit	Lower range limit (LRL)
Limit hysteresis	0.5 % of output scale
PV filter	0.125 sec
Address	126

Any or all the above configurable parameters, including lower range value and upper range value can be easily changed by a PC running the configuration software SMART VISION with DTM MV2600. Data regarding flange type and -material, O-rings and filling liquid is stored in the device.

Transmitter with FOUNDATION fieldbus communication

Transmitters are factory calibrated to the customer's specified range. Calibrated range and measuring point number are stamped on the type plate. If this data has not been specified, the transmitter will be delivered configured as follows:

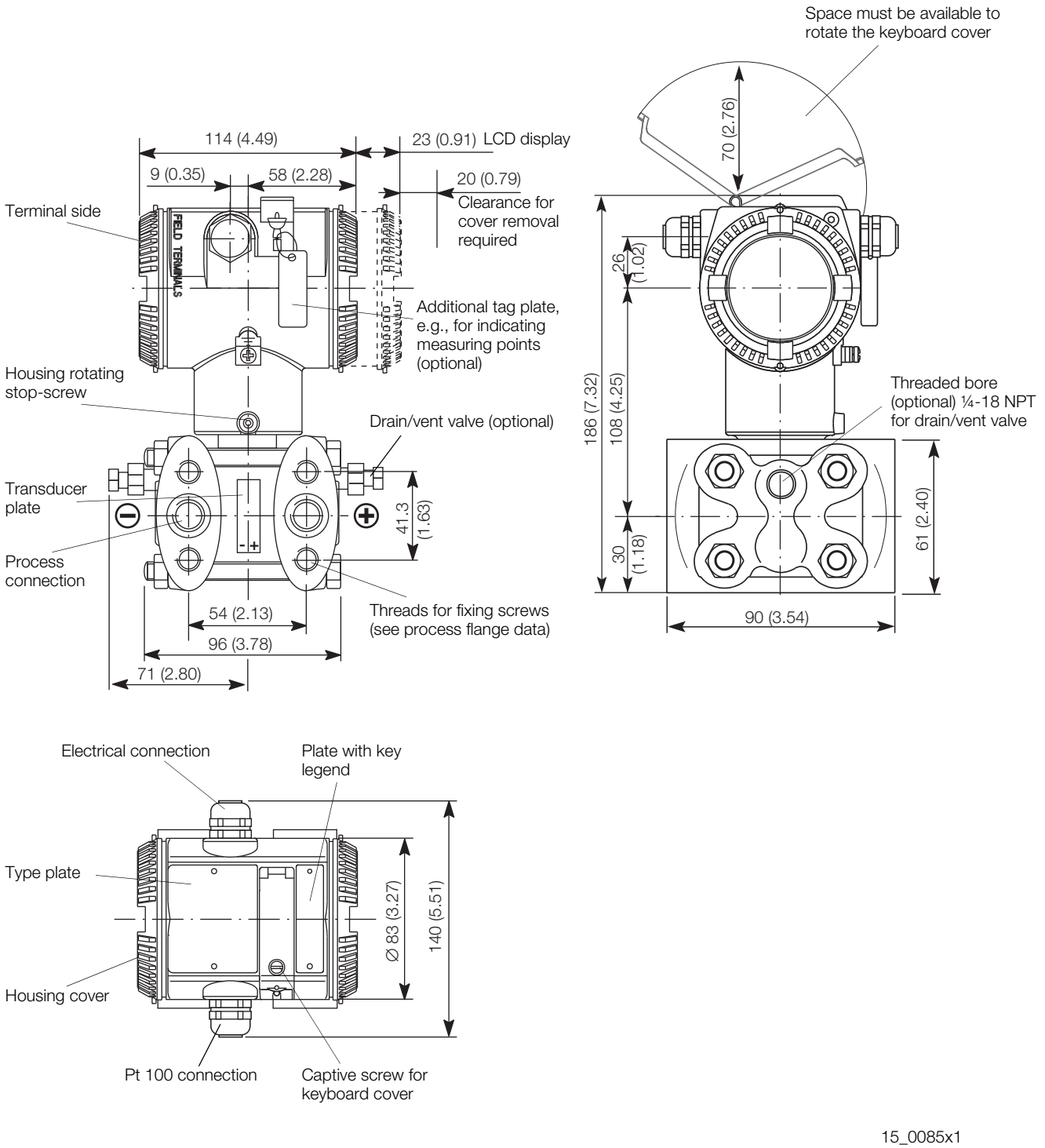
Measure profile	Pressure
Engineering unit	mbar/bar
Output scale 0 %	Lower range limit (LRL)
Output scale 100 %	Upper range limit (URL)
Output	Square root
Upper alarm limit	Upper range limit (URL)
Upper warning limit	Upper range limit (URL)
Lower warning limit	Lower range limit (LRL)
Lower alarm limit	Lower range limit (LRL)
Limit hysteresis	0.5 % of output scale
PV filter	0.125 sec
Address	not required

Any or all the above configurable parameters, including lower range value and upper range-value can be changed by any FOUNDATION fieldbus -compatible configurator. The device-specific DMA is required for changing the flow measurement. Data regarding flange type and material, O-rings and filling liquid is stored in the device.

Mounting Dimensions (not design data)

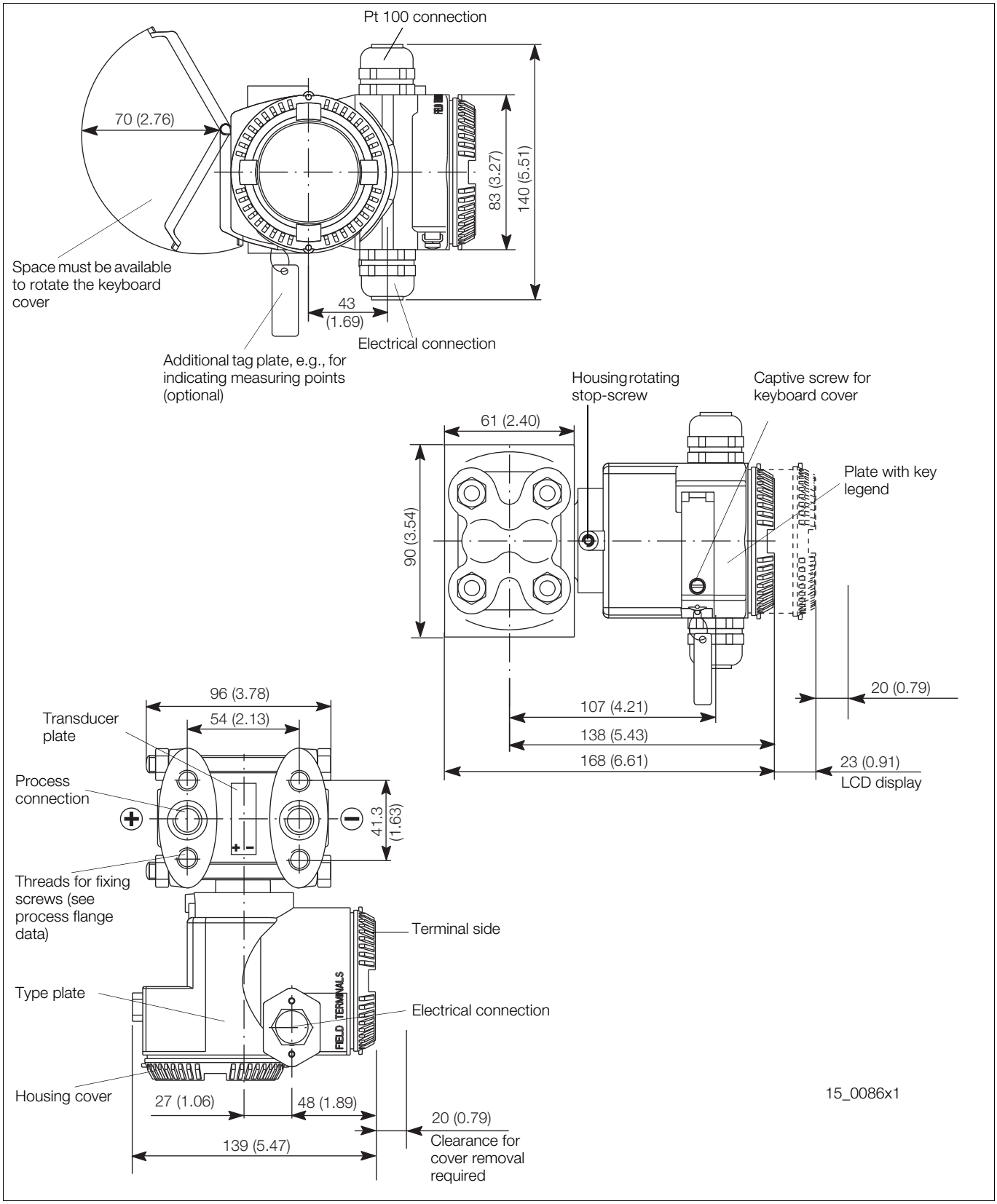
Transmitter with barrel housing

Deviations in the drawing are possible. Measurements in mm (inches)



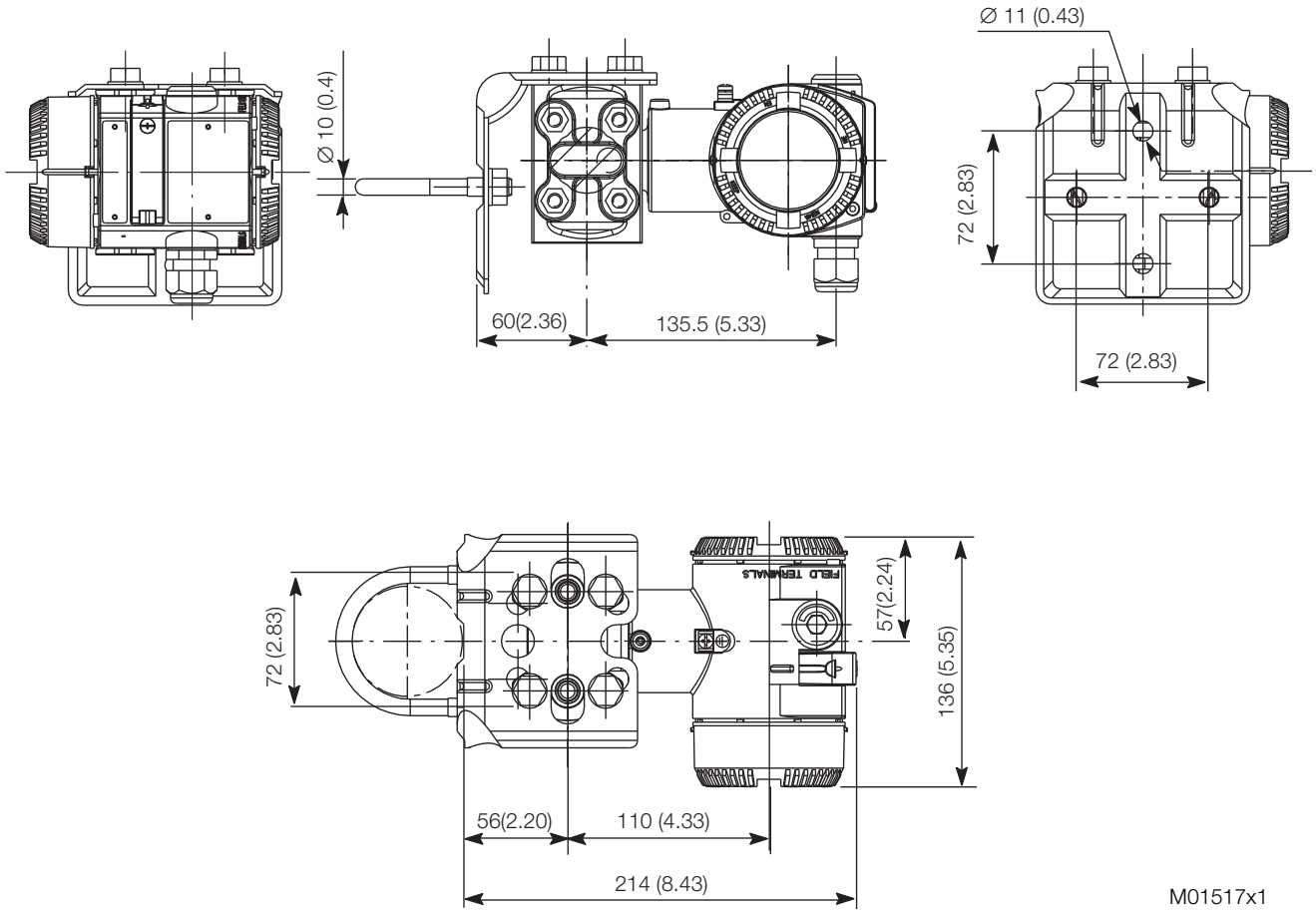
Transmitter with DIN housing

Deviations in the drawing are possible. Measurements in mm (inches)



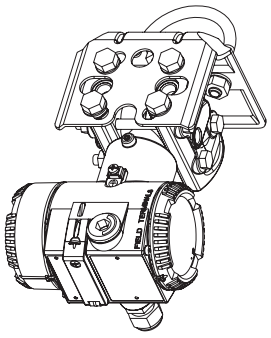
Mounting options with bracket

Deviations in the drawing are possible. Measurements in mm (inches)



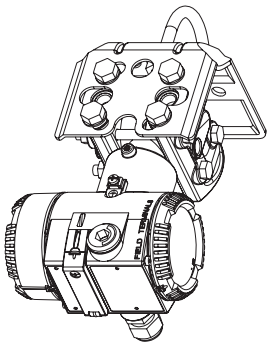
M01517x1

Vertical pipe mounting



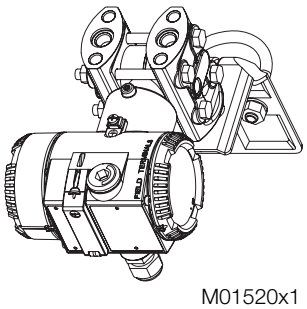
M01518x1

Horizontal pipe mounting



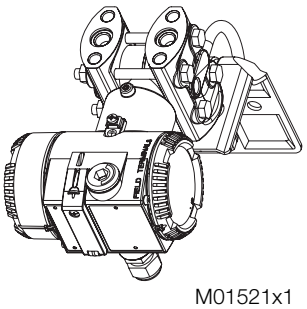
M01519x1

Vertical pipe mounting and transmitter above the mounting bracket



M01520x1

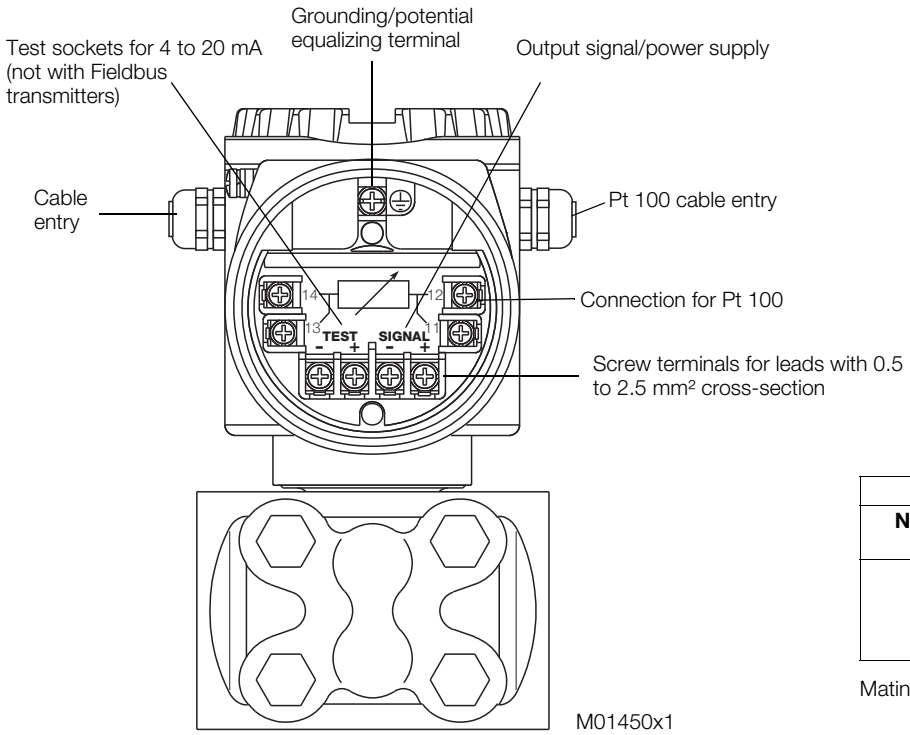
Horizontal pipe mounting and transmitter above the mounting bracket



M01521x1

Electrical connections

Standard terminal block

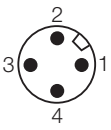


M01450x1

Fieldbus plug connector

7/8 in connector

M12 x 1 connector



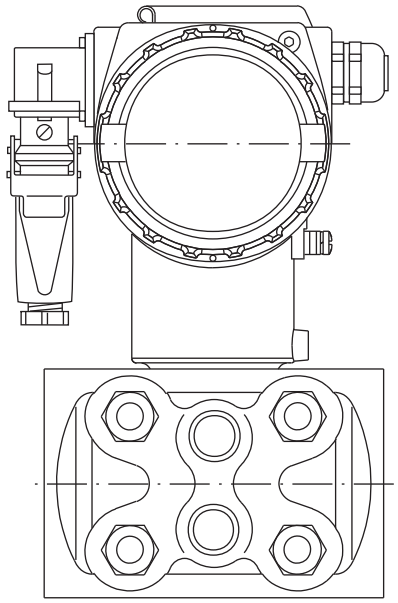
15_0066x1

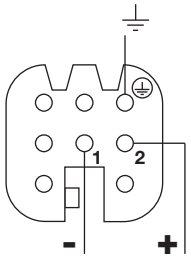
Pin (male) assignment		
Number	**FOUNDATION Fieldbus**	**PROFIBUS PA**
1	FF-	PA+
2	FF+	Ground
3	Shield	PA shield
4	Ground	

Mating plug (socket) not supplied

Harting Han 8D (8U) connector

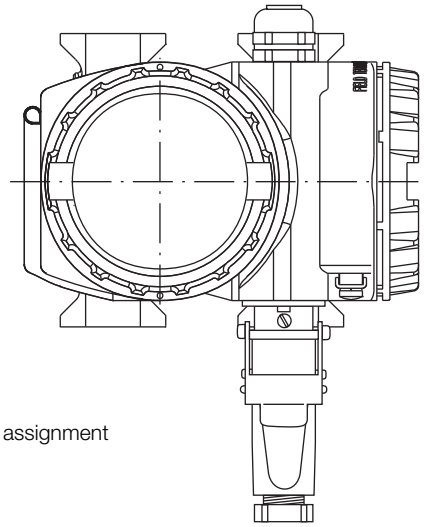
DIN housing





Harting Han 8D (8U) pin assignment (socket view)

Barrel housing



15_0079x1

Ordering information

Multivariable transmitter, for mass flow			Variant digit No.	1 - 6	7	8	9	10	11	Code			
267CS	**Base accuracy: 0.075 %**		Catalog No.	**267CS-**									
269CS	**Base accuracy: 0.04 %**		Catalog No.	**269CS-**									
Sensor - Span limits													
1 kPa	10 mbar	4 in. H_2O			A								
6 kPa	60 mbar	24 in. H_2O (45 mm Hg)			C								
40 kPa	400 mbar	160 in. H_2O (300 mm Hg)			F								
250 kPa	2500 mbar	1000 in. H_2O (1875 mm Hg)			L								
2000 kPa	20 bar	290 psi			N								
100 kPa	1000 mbar	400 in. H_2O			Y								
Static pressure													
0 ... 0.6 MPa	0 ... 6 bar	0 ... 87 psi		1)		1							
0 ... 2 MPa	0 ... 20 bar	0 ... 290 psi		2)		2							
0 ... 10 MPa	0 ... 100 bar	0 ... 1450 psi		2)		3							
0 ... 41 MPa	0 ... 410 bar	0 ... 5945 psi		2)		4							
Diaphragm material / Fill fluid													
AISI 316L SST (1.4435)	Silicone oil		NACE				S						
Hastelloy C-276	Silicone oil		NACE				K						
Monel 400	Silicone oil		NACE				M						
Monel 400 gold plated	Silicone oil		NACE				V						
Tantalum	Silicone oil		NACE				T						
AISI 316L SST (1.4435)	Inert fluid		NACE	3)			A						
Hastelloy C-276	Inert fluid		NACE	3)			F						
Monel 400	Inert fluid		NACE	3)			C						
Monel 400 gold plated	Inert fluid		NACE	3)			Y						
Tantalum	Inert fluid		NACE	3)			D						
Process connection material / Process connection													
AISI 316L SST (1.4404 / 1.4408)		1/4-18 NPT-f direct			NACE			A					
AISI 316L SST (1.4404 / 1.4408)		1/4-18 NPT-f direct (DIN 19213)			NACE			C					
AISI 316L SST (1.4404 / 1.4408)		1/2-14 NPT-f through adapter			NACE			B					
Hastelloy C-276		1/4-18 NPT-f direct			NACE			D					
Hastelloy C-276		1/4-18 NPT-f direct (DIN 19213)			NACE			F					
Hastelloy C-276		1/2-14 NPT-f through adapter			NACE			E					
Monel 400		1/4-18 NPT-f direct			NACE			G					
Monel 400		1/4-18 NPT-f direct (DIN 19213)			NACE			L					
Monel 400		1/2-14 NPT-f through adapter			NACE			H					
Kynar (PVDF)		(axial) 1/4-18 NPT-f direct (max. 1 MPa)						P					
AISI 316L SST (1.4404 / 1.4408)		(vertical) 1/4-18 NPT-f direct			NACE			Q					
Bolts / Gaskets													
AISI 316L SST	(NACE - non exposed)	Viton					4)		3				
AISI 316L SST	(NACE - non exposed)	PTFE (Max. 10 MPa)					5)		4				
AISI 316L SST	(NACE - non exposed)	EPDM					5)		5				
AISI 316L SST	(NACE - non exposed)	Perbunan					5)		6				
AISI 316L SST	FEP (Only available with Kynar [PVDF] process connection)								T				

1) Only with Sensor code A

2) Not with sensor code A

3) Suitable for oxygen applications

4) Suitable for oxygen applications / Not with Process Connection Kynar (PVDF)

5) Not with Process Connection Kynar (PVDF)

Continued on next page

Ordering Information, continued

Multivariable transmitter, for mass flow		Variant digit No.	1 - 6	9	10	11	12	13	Code			
267CS	**Base accuracy: 0.075 %**	Catalog No.	**267CS-**									
269CS	**Base accuracy: 0.04 %**	Catalog No.	**269CS-**									
Electronic housing material		**Electrical connection**										
Aluminium Alloy	(Barrel type)	1/2-14 NPT					A					
Aluminium Alloy	(Barrel type)	M20 x 1.5				6)	B					
Aluminium Alloy	(Barrel type)	Harting Han connector				7)	E					
Aluminium Alloy	(Barrel type)	Fieldbus connector				8)	G					
AISI 316L SST	(Barrel type)	1/2-14 NPT					S					
AISI 316L SST	(Barrel type)	M20 x 1.5				6)	T					
Aluminium Alloy	(DIN type)	M20 x 1.5				6)	J					
Aluminium Alloy	(DIN type)	Harting Han connector				7)	K					
Aluminium Alloy	(DIN type)	Fieldbus connector				8)	W					
Output		**Additional options**										
HART digital communication and 4 ... 20 mA		(Additional options not requested)				10)		H				
HART digital communication and 4 ... 20 mA		(Additional options to be ordered by additional ordering code)				9)		1				
PROFIBUS PA		(Additional options not requested)				10)		P				
PROFIBUS PA		(Additional options to be ordered by additional ordering code)				9)		2				
FOUNDATION fieldbus		(Additional options not requested)				10)		F				
FOUNDATION fieldbus		(Additional options to be ordered by additional ordering code)				9)		3				
Modbus RS 485		(Additional options not requested)				10)		M				
Modbus RS 485		(Additional options to be ordered by additional ordering code)				9)		5				
Modbus RS 232		(Additional options not requested)				10)		N				
Modbus RS 232		(Additional options to be ordered by additional ordering code)				9)		6				

Additional ordering information						
267CS , 269CS			Code			
Vent valve material / Position						
AISI 316L SST (1.4404)	On process axis	NACE	V1			
AISI 316L SST (1.4404)	On flanges side top	NACE	V2			
AISI 316L SST (1.4404)	On flanges side bottom	NACE	V3			
Hastelloy C-276	On process axis	NACE	V4			
Hastelloy C-276	On flanges side top	NACE	V5			
Hastelloy C-276	On flanges side bottom	NACE	V6			
Monel 400	On process axis	NACE	V7			
Monel 400	On flanges side top	NACE	V8			
Monel 400	On flanges side bottom	NACE	V9			

Continued on next page

6) Not available with FM, CSA
7) Not available with EEx nL, EEx d, FM, CSA (select connector type with additional ordering code)
8) Not available with EEx nL, EEx d, FM- / CSA- / NEPSI-Explosion Proof (select connector type with additional ordering code)
9) Additional options to be ordered by additional ordering code
10) Additional options not requested / Not available for electrical connection with connector

Additional ordering information

267CS , 269CS		Code			
Explosion protection					
ATEX Group II Category 1/2 GD - Intrinsic Safety EEx ia		E1			
ATEX Group II Category 1/2 G - Flameproof EEx d		E2			
ATEX Group II Category 3 GD - Type of Protection N EEx nL Energy Limited		E3			
IECEx ia Ga / Gb, IECEx iaD 20		E8			
IECEx d		E9			
ATEX II 1/2 GD EEx ia + ATEX II 1/2 GD EEx d + ATEX EEx nL		EW			
Factory Mutual (FM) - Intrinsically Safe		EA			
Factory Mutual (FM) - Explosion-proof	11)	EB			
Canadian Standard Association - Explosion Proof		EE			
Canadian Standard Association - Explosion Proof (Canada & USA)		EM			
NEPSI Ex ia II C T4/T6		EY			
NEPSI Ex d II C T6		EZ			
GOST Russia - EEx ia		W1			
GOST Russia - EEx d		W2			
GOST Kazakhstan - EEx ia		W3			
GOST Kazakhstan - EEx d		W4			
GOST Ukraine - EEx ia		WA			
GOST Ukraine - EEx d		WB			
GOST Belarus - EEx ia		WG			
GOST Belarus - EEx d		WL			
SAA Ex d IIC T6 and Ex td A21 IP 66 T85 °C		X1			
Integrated digital display (LCD)					
With integrated LCD display		L1			
With integrated LCD display (backlit)		L2			
Mounting bracket shape / Material					
For pipe mounting	AISI 304 SST (1.4301)	B2			
For wall mounting	AISI 304 SST (1.4301)	B4			
Operating manual					
German		M1			
French		M4			
English		M5			
Russian		MB			
Label and Tag Language					
German	Stainless steel 12)	T1			
German and English	Plastic 13)	TA			
Additional tag plate					
Stainless steel (laser printed)		I1			
Applications					
Oil- and grease-free, for oxygen applications (O_2)	14)	P1			
(Pmax = 12 MPa / 120 bar / 1740 psi, Tmax = 60 °C / 140 °F)					
Hydrogen Application (H_2) (Fluid Film)		P2			
Housing Accessories					
Integral mount manifold (Price adder just for assembling, not for manifold)		A1			
Four-wire add-on unit: Power supply 24 V UC / Output signal 0 ... 20 mA		A4			
Four-wire add-on unit: Power supply 24 V UC / Output signal 4 ... 20 mA		A6			
Four-wire add-on unit: Power supply 230 V AC / Output signal 0 ... 20 mA		A5			
Four-wire add-on unit: Power supply 230 V AC / Output signal 4 ... 20 mA		A7			
Plug upside welded		A8			
Plug bottom welded		A9			

Continued on next page

11) Only with Electrical Connection 1/2-14 NPT and Stainless Steel Tag Plate
12) Not available with DIN Electronic Housing code J, K, W
13) Not available with Factory Mutual - Explosion Proof
14) Only available with inert fill and with Viton gasket

Additional ordering information

267CS , 269CS		Code			
Connectors					
Fieldbus 7/8 in.	(without mating plug, recommended for FOUNDATION fieldbus)	U1			
Fieldbus M12 x 1	(without mating plug, recommended for PROFIBUS PA)	U2			
Harting Han 8D (8U) - Straight entry		U3			
Harting Han 8D (8U) - Angle entry		U4			
Harting Han 7D		U5			
Harting Han 8D (8U) - For four-wire add-on unit		U6			
Harting Han 7D - For four-wire add-on Unit		U7			
Material traceability					
Certificate of compliance with the order 2.1 acc. EN 10204 for process wetted parts		H1			
Inspection certificate 3.1 acc. EN 10204 of process wetted parts	15)	H3			
Test report 2.2 acc. EN 10204 of the pressure bearing and process wetted parts		H4			
Certificates					
Inspection certificate 3.1 acc. EN 10204 of calibration		C1			
Inspection certificate 3.1 acc. EN 10204 of cleanliness stage		C3			
Inspection certificate 3.1 acc. EN 10204 of helium leakage test of the sensor module		C4			
Inspection certificate 3.1 acc. EN 10204 of pressure test		C5			
Declaration of compliance with the order 2.1 acc. EN 10204 for instrument design		C6			
Calibration record		CB			
Separate calibration record		CC			
SIL2 - Declaration of Conformity		CL			
GOST Russia - Without Explosion Protection		WC			
GOST Kazakhstan - Without Explosion Protection		WD			
GOST Ukraine - Without Explosion Protection		WE			
GOST Belarus - Without Explosion Protection		WF			

15) Minor parts with factory certificate acc. EN 10204

Standard delivery items (changes possible by an additional ordering code)

- Adapters supplied singly
- Plugs for process axis (no drain/vent valves)
- General purpose (no Ex application)
- No display, no mounting bracket
- English-language manual and labels
- Type plate material: barrel electronics housing code A, B, E, G, S, T – stainless steel
  DIN electronics housing code J, K, W – plastic
- Configuration with kPa and °C units
- No test, inspection or material certificates

Important remark for all models
The selection of suitable wetted parts and filling fluid for compatibility with the process media is a customers responsibility, if not otherwise notified before manufacturing.

NACE compliance information
1. The materials of constructions comply with metallurgical recommendations of NACE MR0175/ISO 15156 for sour oil field production environments. As specific environmental limits may apply to certain materials, please consult latest standard for further details. Materials AISI 316 / AISI 316L, Hastelloy C-276, Monel 400 also conform to NACE MR0103 for sour refining environments.

2. NACE MR0175 addresses bolting requirements in two classes:
   - **Exposed bolts:** bolts directly exposed to the sour environment or buried, encapsulated or anyway not exposed to atmosphere
   - **Non exposed bolts:** the bolting must not be directly exposed to sour environments, and must be directly exposed to the atmosphere at all times.

267CS, 269CS bolting identified by “NACE” are in compliance to the requirements of NACE MR0175 when considered “non exposed bolting”

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SS/267CS/269CS-EN Rev. 01 05.2013

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