process measurement solutions

KDG

4301 Intelligent pressure transmitter

Data sheet
0075

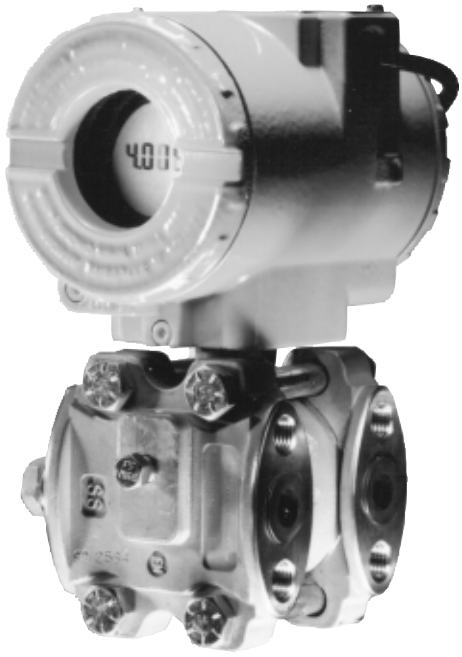
The 4301 offers an unmatched combination of simple calibration and maintenance with high performance and low cost of ownership

Application flexibility

- Ranges from 0-1.25mbar to 0-400bar
- 40 : 1 rangeability
- 4-20mA plus HART digital communication
- Conventional or multi-drop operation
- Dual certified EExd & EExia
- IP67 electronics housing
- Aluminium or stainless steel electronics housing
- Optional multi-function LCD display
- Compact and lightweight
- Fully traceable material certification (3.lb)
- Full local configuration via magnetic tool
- Configurable ouput function
- Flow totalisation
- Comprehensive PID control capability

Performance

- ±0.05% accuracy
- 0.1% stability over 24 months



Intoduction

The 4301 Series pressure transmitter uses, as its measuring principle, the well known and field proven technique of capacitance sensing, enhanced by microprocessor based electronics.

Designed for process measurement and control applications, these 2-wire transmitters generate a 4-20mA signal which is either characterised or directly proportional to the pressure applied. The HART communications protocol is standard for all versions.

The 4301 offers simple local zero and span adjustment. Full local configuration can also be made if required without the need of a separate hand held configurator.

Manufactured to ISO9001 quality standards, every 4301 is certified EExia and EExd and offers full process wetted material traceability to 3.lb requirements.

Reliability

- 85 year MTBF
- Simple, external non-interactive zero and span
- Simple configuration
- Password protection
- Single electronics board covers complete range
- Continuous self-diagnostics
- 5 year warranty option
- Ex-stock availability

Sensor

The 4301 uses differential capacitance sensing as its measurement principle. The sensor incorporates a small surface mount circuit board mounted in the 'neck' of the sensor assembly.

During manufacture, each assembly undergoes temperature cycles covering the operating range. Data from these tests is written to the circuit board and used to correct for unwanted temperature effects whilst in operation.

Electronics

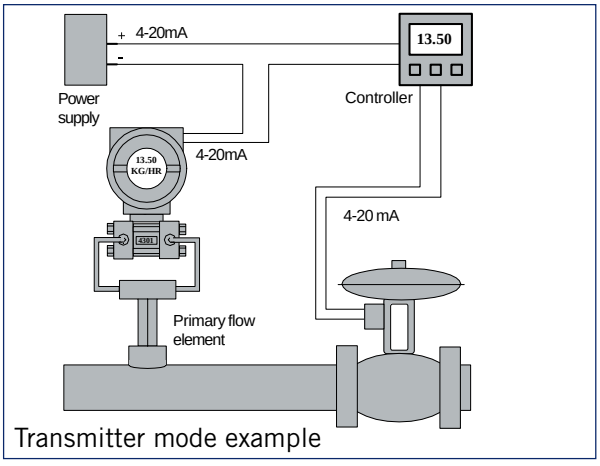
Due to the benefits of surface mount electronics, a single electronics board (module) covers the entire 4301 range, thus simplifying maintenance and reducing spares inventory.

Local Indication

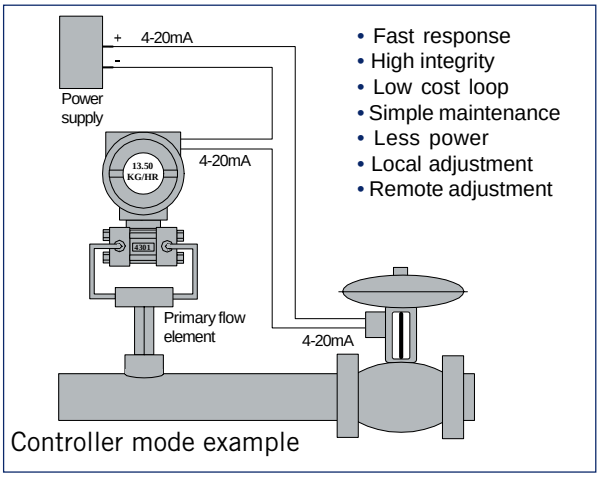
In normal operation, the multi-function LCD indicator displays either one or two variables (display alternates), these are:-

- Output %
- Ouput mA
- Scaled output and unit (eg. 0-150 l/min)
- Integrated Total (8 digit)
- Controller set point
- Controller set point / measurement deviation
- Sensor temperature

The LCD indicator can also be used, in conjunction with the configuration magnetic tool for local transmitter configuration. The indicator can be rotated through 90° steps and is field retrofittable.



Transmitter mode example



Controller mode example

Configuration

The 4301 offers three levels of adjustment. Simple, local zero and span, local configuration or remote configuration, this allows:

Storage, retrieval and manipulation of standard HART parameters:

- Tag : 8 Alpha general numerics
- Descriptor : 16 Alpha numerics
- Message : 32 Alpha numerics
- Date (eg. last or next calibration)
- Integral indicator installation
- Flange type & material
- Wetted parts materials
- Remote seal information
- Sensor range

Operational

- Linear or square root output
- 4-20mA points
- Damping time (0 to 32 seconds)
- Engineering unit

Additional 4301 functions

- 16 point user table output
- $\sqrt{x^2}$, $\sqrt{x^3}$, $\sqrt{x^5}$
- Fully selectable constant mA output
- Flow totalisation
- Indicator scaling
- Controller configuration

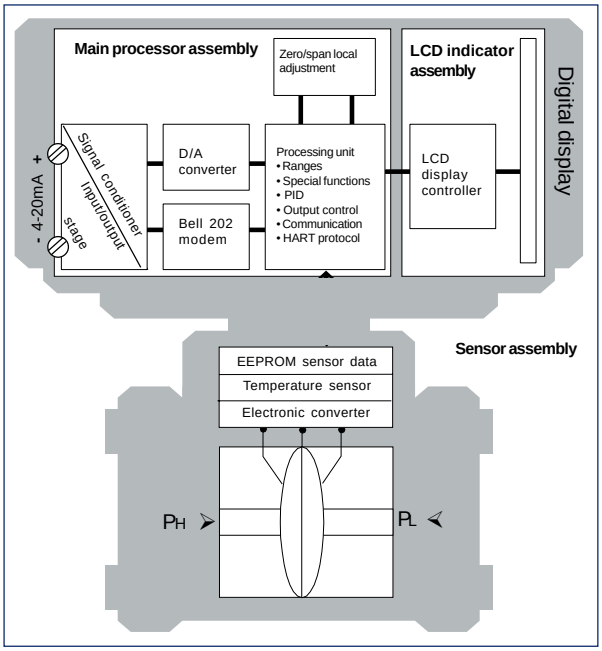
PID Control

The 4301 may be configured to operate either as a transmitter or PID controller.

Controller characteristics are:

Proportional Gain : 0 to 100
Integral time : 0.01 to 999 min/rep
Derivative time 0 to 999s
Direct / reverse action
Lower and upper output limits
Output rate of change limit : 0 to 100%/s
Power-on safety output
Anti-reset windup
Bumpless auto/manual transfer

4301 Block Diagram

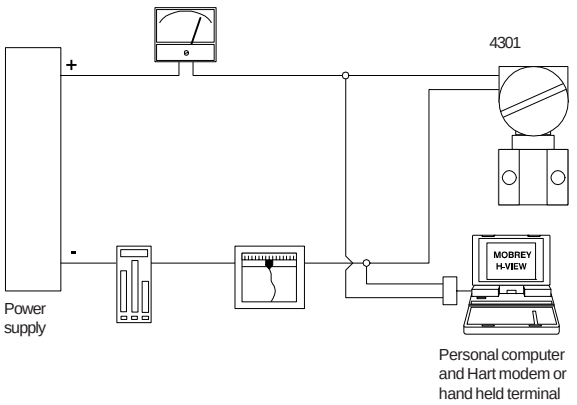


Remote Calibration and Configuration

In common with most HART based products, the 4301 can be configured via a hand held terminal (HHT), personal computer or any man/machine interface featuring the HART protocol.

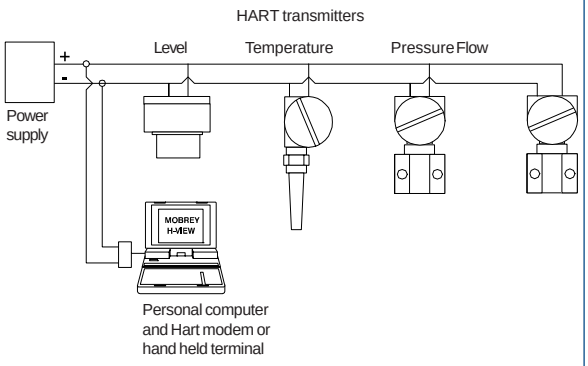
Communication with the 4301 does not interrupt the 4-20mA ouput signal and the interface can be connected anywhere on the 4-20mA loop. A magnetic tool is supplied for local calibration and configuration.

4-20mA loop, conventional connection



The HART interface is optional and only required for complex, remote configuration. Local, external zero and span adjustment is standard.

Digital mode, multi-drop connection



The 4301 may be configured as a controller and connected via the multi-drop technique whilst retaining the 4-20mA output.
(Request technical data sheet TD020)

Local Calibration and Configuration

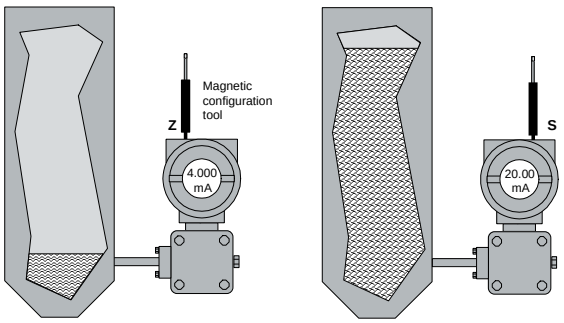
Zero pressure is applied to the instrument, the magnetic configuration tool is insterted onto the zero port of the transmitter and a zero condition is achieved (4mA). 100% pressure is then applied, the tool is inserted into the span port and the 4301 is calibrated.
Zero and span are totally non-interactive.

Local configuration

With the multifunction indicator fitted, local configuration is available. This allows alteration of most configurable functions, for example: damping time, output type, re-ranging.
Local configuration is simple to perform with each parameter displayed in plain English. Local adjustment may be disabled for increased security.

Neither local calibration or configuration require removal of housing covers therefore maintaining IP67 integrity.

Local adjustment



Zero pressure is applied, magnetic tool inserted into 'Z' hole, transmitter is zeroed.

Span pressure is applied, magnetic tool inserted into 'S' hole, transmitter is now calibrated.

If a zero or span condition cannot be achieved, the 4301 can still be calibrated by simply expressing percent above or below zero and span points. For example, vessel can only be emptied to 10% level and filled to 95% level. Simply set zero to 10% and span to 95% and the 4301 is calibrated.

Benefits

The magnetic calibration/configuration tool avoids the use of analogue rotary potentiometer adjustments (as with conventional transmitters) which can suffer from drift and reduce the IP rating of the instrument. By avoiding the use of tactile membrane push buttons phenomenons such as cracking after prolonged use are avoided.
Calibration via the magnetic tool ensures total integrity of the IP67 rating, simplifies calibration and reduces the potential for unauthorised adjustment.

Specifications

Functional specifications

Process:
Liquid, gas and vapour

Ouput Signal:
Two-wire, 4-20mA with superimposed digital communication (HART protocol)

Power Supply:
12 to 45 v DC

Indicator:
Optional 4-digit multi-function indicator

Hazardous Area Certifications:
II 2 G EExdIICT6 / II 1/2 GD EExiaIICT4

Zero and Span Adjustment:
Noninteractive, external local adjustment or HART interface

Temperature Limits:

Ambient:
-40 to +85°C

Process:
-40 to +100°C
(silicone oil with Buna N or Teflon 'O' rings)
-25 to 85°C (silicone oil with Viton 'O' rings)
0 to +85°C (fluorolube oil)
-40 to +150°C (4301-L versions)

Storage:
-40 to +100°C

Digital display:
-10 to +75°C (operation)
-40 to 85°C (without damage)

Turn-on time:
Performs within specifications in less than 5 seconds after power up

Volumetric displacement:
Less than 0.15 cm^3

Overpressure and static pressure limits:

4301-D,M,A & H

8 MPa (80 bar, 1150 psi) for range 1
16 MPa (160bar, 2300 psi) for ranges 2, 3, 4
32 MPa (320 bar, 4600 psi) for models H and A5
40 MPa (400 bar, 5800 psi) for range M5
52 MPa (520 bar, 7500 psi) for range M6

4301-L versions, max working pressure

150lb Flanges : 285 psi at 38°C
300lb Flanges : 740 psi at 38°C
PN 10 : 10 bar up to 50°C
PN 25 : 25 bar up to 50°C
PN 40 : 40 bar up to 50°C

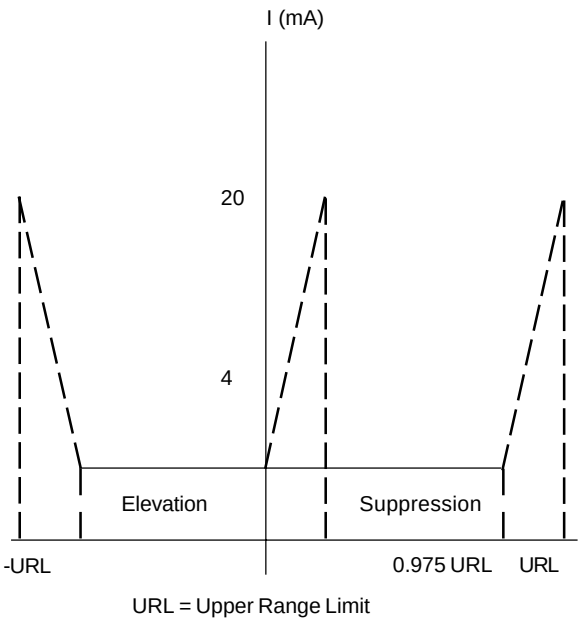
These overpressures will not damage the transmitter, but re-calibration may be necessary.

Body test pressure:
600 bar

Humidity limits: 0 to 100% RH
Electronics housing complies with IEC IP67

Hand-Held Terminal main features:
RAM memory: 32 Kbytes expendable
EPROM memory : 128 Kbytes
Display : 80 characters, 4 lines
Power Supply : 9 Vdc
Dimensions : Length 142mm, Width 78mm, Depth 29.3mm

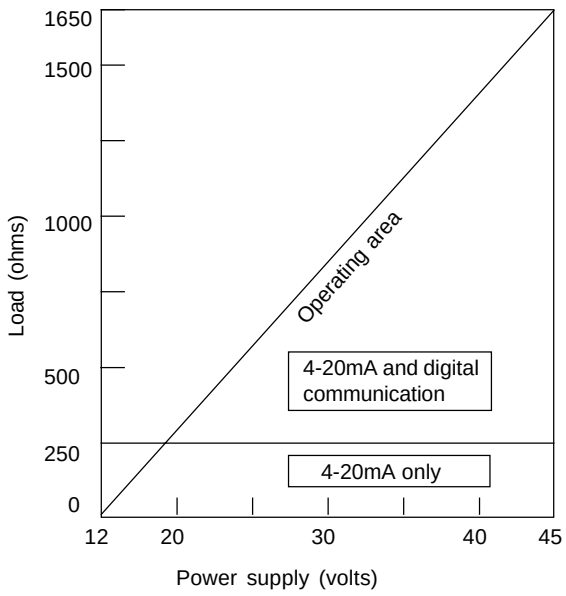
Zero Adjustment Limits



URL = Upper Range Limit

Calibrated span shall not be less than 2.5% URL and shall not exceed URL

Load Limitation



Performance Specifications

Accuracy:

± 0.05% of span (≥ 0.1 URL)
± 0.0375 (1+(0.1 URL/SPAN)) % (< 0.1 URL)

N.B. : Except for ranges 5 and 6, absolute models, diaphragms in Tantalum, Monel or fill fluid in Fluorolube.
(+/- 0.1% of span for span > or = to 10% of URL)

For absolute - range 1:
± 0.2% of span

Stability:

± 0.1% of URL for 24 months for ranges 2, 3, 4, 5 & 6
± 0.2% of URL for 12 months for range 1 and Level models
± 0.25% of URL for 5 years, at 20°C temperature change and up to 7 MPa (100psi) of static pressure

Temperature effect:

± (0.02% x URL + 0.1% x span) per 20°C for ranges 2, 3, 4, 5 and 6
± (0.05% x URL + 0.15% x span) per 20°C for range 1 and level models

Static pressure effect (differential versions):

zero error :
± 0.1% URL per 70 bar for ranges 2, 3 and 4
± 0.1% URL per 35 bar for level models
± 0.1% URL per 17 bar for range 1
This is a systematic error that can be eliminated by calibrating at the operating static pressure
Span error:
Correctable to ± 0.2% of reading per 70 bar variation for ranges 2, 3, 4, 5 and 6 and 35 bar for range 1 and level models

Power supply effect:

± 0.005% of calibrated span per volt

Mounting position effect:

Zero shift of up to 2.5 mbar which can be calibrated out. No span effect.

Electro-magnetic interference effect:

Designed to comply with IEC801 parts 3 and 4 Electro-Magnetic Compatibility (EMC) compliance

CE Marking

Meets the requirements of EMC European directive 89/336/EEC
Light industrial EN50081-1 & EN50082-1
Industrial EN50081-1 & EN50082-1

Reference conditions : range starting at zero, temperature 4°C, atmospheric pressure, power supply of 24 v DC, silicone oil fill fluid, isolating diaphragms in 316L SS and digital trim equal to lower and upper range values.

Physical Specifications

Connections:
Electrical connection (conduit entry):
M20 x 1.5 metric or PG13.5
Process connection:
¼ - 18 NPT, ½ -14 NPT (with adaptor) or via flange/chemical seal.

Wetted parts:
Isolating diaphragms:
316L SS, Hastelloy C276 or Monel or Tantalum
Drain/vent valves:
316 SS, Hastelloy C276 or Monel
Flanges:
Plated carbon steel, 316 SS, Hastelloy C276 or Monel
Wetted 'O' rings (For flanges and adaptors):
Buna N, Viton or Teflon

Non wetted parts:
Electronic housing:
Injected aluminum, polyester or epoxy painted or 316 SS, Enclosure classification IP67, NEMA 4X
Blank flange (gauge and absolute versions):
Plated carbon steel, when wetted flange is carbon steel, 316 SS in other cases
Fill fluid:
Silicone or Fluorolube oil
Cover 'O' rings:
Buna N
Mounting bracket materials:
Painted carbon steel or 316 SS
Body screws:
Plated carbon steel, grade 7 or 316 SS (on request)
Identification plate:
316 SS

Mounting arrangment:
a) Flange mounted for level models
b) Optional universal mounting bracket for surface or vertical/horizontal 2" pipe (DN50)
c) Via bracket on manifold valve
d) Directly on piping for closely coupled transmitter/orifice flange combinations
Remote seals:
Details available on request
Approximate weights:
3.15 Kg, all models, except level transmitters, 5.85 to 9 Kg (depending on flange, extension and materials)

Ordering Information

4301 Intelligent differential, gauge and absolute pressure transmitters

Code	Type & span limits (note 1)	Static pressure & overrange limit
D1	Differential 1.25 to 50mbar	80 bar
D2	Differential 12.5 to 500mbar	160 bar
D3	Differential 62.5 to 2500mbar	160 bar
D4	Differential 0.625 to 25bar	160 bar
H2	Differential 12.5 to 500mbar	320 bar
H3	Differential 62.5 to 2500mbar	320 bar
H4	Differential 0.625 to 25bar	320 bar
H5	Differential 6.25 to 250bar	320 bar
M1	Gauge 1.25 to 50mbar	80 bar
M2	Gauge 12.5 to 500mbar	160 bar
M3	Gauge 62.25 to 2500mbar	160 bar
M4	Gauge 0.625 to 25bar	160 bar
M5	Gauge 6.25 to 250bar	400 bar
M6	Gauge 10 to 400bar	520 bar
A1	Absolute 5 to 50mbar(A)	80 bar
A2	Absolute 25 to 500mbar (A)	160 bar
A3	Absolute 62.5 to 2500mbar (A)	160 bar
A4	Absolute 0.625 to 25bar (A)	160 bar
A5	Absolute 6.255 to 250bar (A)	320 bar

Code	Diaphragm(s) material and fill fluid	
1	316L SS	Silicone oil
2	316L SS	Fluorolube oil
3	Hastelloy C276	Silicone oil
4	Hastelloy C276	Fluorolube oil
5	Monel 400	Silicone oil
7	Tantalum	Silicone oil
8	Tantalum	Fluorolube oil
Z	Others - specify	

Code	Flanges, adaptors and drain/vent material
C	Nickel plated CS (drain/vent in stainless steel)
I	316 SS
H	Hastelloy C276
M	Monel 400
Z	Others - specify

Code	Wetted O-rings material
O	Without 'o' rings (remote seal)
B	Buna N
V	Viton
T	Teflon
Z	Others - specify

Code	Vent/drain position (90° to inlet)
O	Without drain
U	Top
D	Bottom

Code	Local indicator
0	Without indicator
1	With digital indicator

Code	Process connection
0	1/4-18 NPT (without adaptor)
1	1/2-14 NPT (with adaptor)
Z	Others - specify

Code	Electrical connection
A	M20 x 1.5
B	PG 13.5
Z	Others - specify

Code	Zero & span adjustments
1	With local adjustment

Code	Mounting bracket
0	Without bracket
1	Carbon steel bracket
2	316 SS bracket

Code	Special feature
0	Without special feature
Z	With special feature - specify

4301	**- D2**	**1**	**I**	**V**	**U**	**1**	**1**	**A**	**1**	**1**	**0**	**Typical ordering information**

Notes: 1. Ranges shown are maximum & minimum span limits
2. Chemical seals and other options available, consult sales office
3. Upper range limit can be extended by 1.2 x with small degradation of accuracy (Not M6)

Ordering Information

4301 — Intelligent level transmitter

Code	Type & span limits (see note 1)	
L2	Level 12.5 to 500mbar	5 to 200 inH20
L3	Level 62.5 to 2500mbar	25 to 1000 inH20
L4	Level 0.625 to 25bar	9 to 360 psi

Code	Diaphragm(s) material and fill fluid (low side)	
1	316L SS	Silicone oil
2	316L SS	Fluorolube oil
3	Hastelloy C276	Silicone oil
4	Hastelloy C276	Fluorolube oil
5	Monel 400	Silicone oil
7	Tantalum	Silicone oil
8	Tantalum	Fluorolube oil
Z	Others - specify	

Code	Low side flange, adaptor and drain/vent valve material
C	Plated CS (drain/vent in stainless steel)
I	316 SS
H	Hastelloy C276
M	Monel 400
N	316 SS with drain/vent in Hastelloy C 276
Z	Others - specify

Code	Wetted O-rings material (low side)
O	Without 'O' rings (remote seal)
B	Buna N
V	Viton
T	Teflon
Z	Others - specify

Code	Vent/drain position (90° to inlet)
O	Without drain
U	Top
D	Bottom

Code	Local indicator
0	Without indicator
1	With digital indicator

Code	Process connections (low side)
0	1/4-18 NPT (without adaptor)
1	1/2-14 NPT (with adaptor)
Z	Others - specify

Code	Electrical connection
A	M20 x 1.5
B	PG13.5
Z	Others - specify

Code	Zero & span adjustments
1	With local adjustment

Code	Process connection (mounting flange). Material 316ss
92	2" 150# (ANSI B16.5RF)
A2	2" 300# (ANSI B16.5RF)
B2	2" 600# (ANSI B16.5RF)
12	3" 150# (ANSI B16.5RF)
22	3" 300# (ANSI B16.5RF)
C2	3" 600# (ANSI B16.5RF)
32	4" 150# (ANSI B16.5RF)
42	4" 300# (ANSI B16.5RF)
D2	4" 600# (ANSI B16.5RF)
E2	DN50 PN10/40 (DIN2536-form D)
52	DN80 PN10/16 (DIN2536-form D)
62	DN80 PN25/40 (DIN2536-form D)
72	DN100 PN10/16 (DIN2536-form D)
82	DN100 PN25/40 (DIN2536-form D)
Z	Others - specify

Code	Diaphragm extension length
0	0mm
1	50mm
2	100mm
3	150mm
Z	Others - specify

Code	Diaphragm and extension material (level tap) Note: with 316SS extension
1	316L SS
2	Hastelloy C276
3	Monel 400 - note 1
4	Tantalum
Z	Others - specify

Code	Fill fluid (level tap)
1	Silicone oil
2	Flourolube oil
3	DC704 silicone oil
Z	Others - specify

Code	Special feature
0	Without special feature
Z	With special feature - specify

4301	**-**	**L2**	**1**	**I**	**B**	**U**	**0**	**0**	**A**	**1**	**92**	**0**	**1**	**1**	**-**	**0**

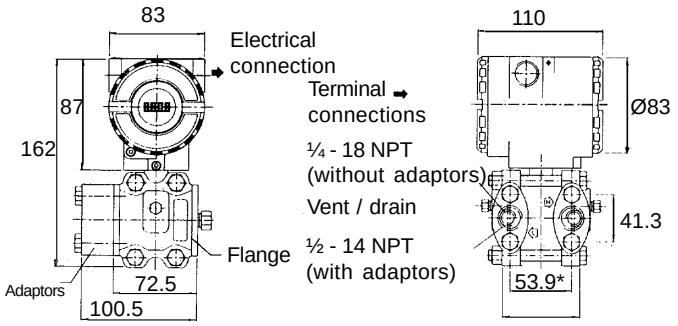
Typical ordering information

Notes:
1. Fluorolube fill not available for Monel diaphragm
2. Ranges shown are maximum & minimum span limits
3. Upper range limit can be extended by 1.2 x with small degradation of accuracy

Dimensions

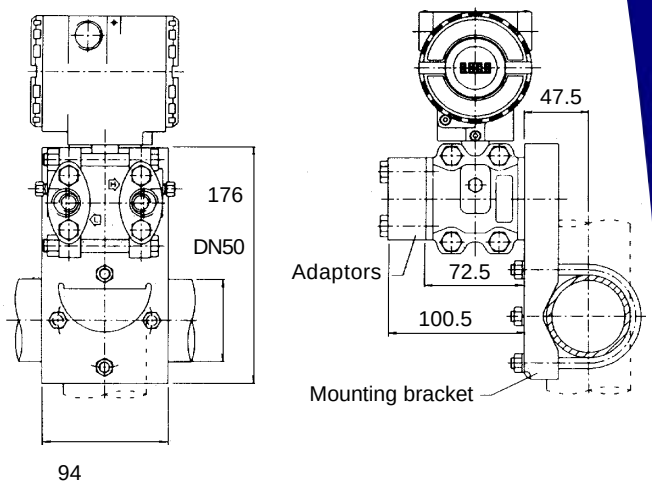
Pressure transmitter (gauge, differential & absolute)

Dimensional drawing - 4301



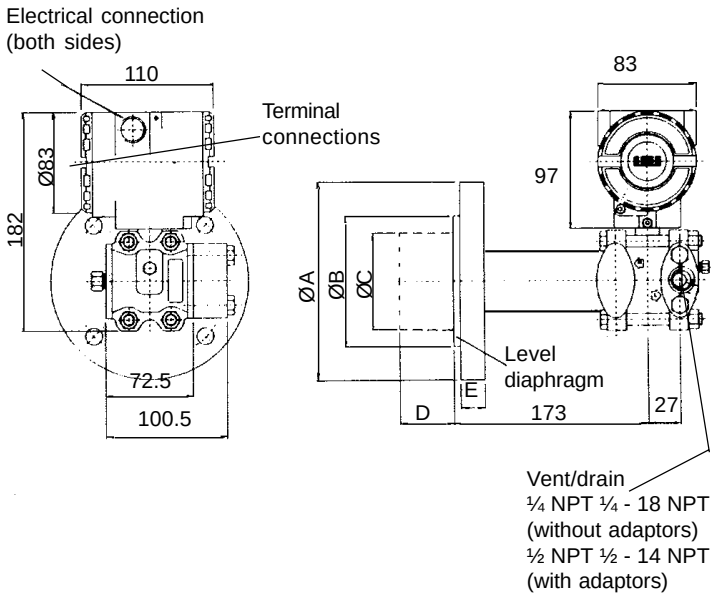
*56mm for D4 models

Mounting bracket



Level transmitter

Dimensional drawing - 4301



Dimensions for 4301

Nominal flange size	Rating	A	B	C	E	No. holes
2"	150lb	152	92	48	22	4
2"	300lb	165	92	48	23	8
2"	600lb	165	92	48	32	8
3"	150lb	190	127	73	24	4
3"	300lb	210	127	73	29	8
4"	150lb	229	157	96	24	8
4"	300lb	254	157	96	32	8
DN50	PN10/40	165	102	48	22	4
DN80	PN10/16	200	127	73	18	8
DN80	PN25/40	200	127	73	22	8
DN100	PN10/16	220	157	96	18	8
DN100	PN25/40	235	157	96	22	8

Dimension "D" extension 0, 50, 100 150 or 200mm
Note: Dimensions are in mm

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