Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

t-trend - ATT12

Thermal flow
Flow monitor for liquids and gases

Applications

- Dry run pump protection
- Trending of water distribution
- Monitoring of pump function
- Monitoring of air distribution

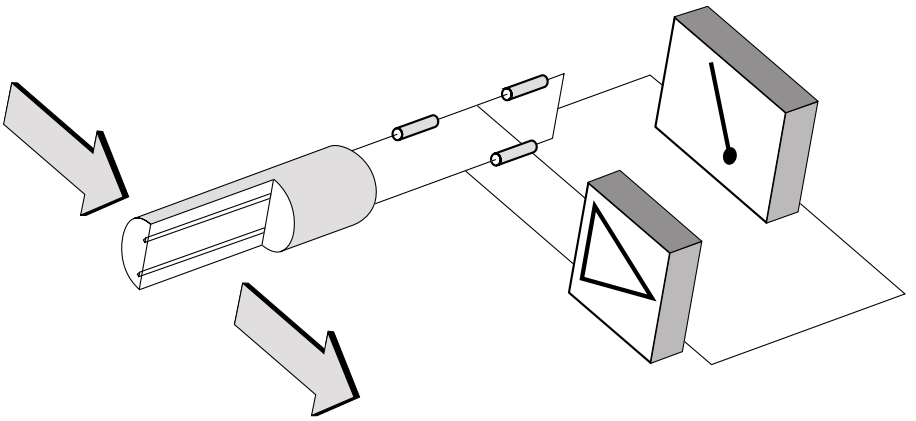
Your benefits

- Nominal diameters from DN40
- Suitable for liquids and gases
- No moving parts – reduced maintenance
- Wide selection of process connections
- Wide dynamic range
- EHEDG approved. Meets 3A requirements
- cCSAus general approval

Technical Information
TI015A/05/e/01.04

Endress+Hauser
People for Process Automation

Measuring principle
Thermal technology is a well established operating principle in the process industry used on a wide variety of applications. It operates by monitoring the cooling effect of a fluid stream as it passes over a heated transducer (RTD). The fluid flows over two RTD elements, one of which senses the actual fluid temperature and provides a reference whilst the other is heated to ensure a constant differential temperature above the fluid temperature. The applied power needed to maintain this differential is proportional to the mass flow of the fluid.



Applications

Process plant	■ Dry run protection for pumps ■ Control of cooling systems for pumps, turbines, compressors and heat exchangers
Chemical industry	■ Chemical dosing ■ Monitoring pump function
Water treatment	■ Status indication of valves in water distribution systems ■ Chemical dosing ■ Air injection
Beverage industry	■ Filter control ■ Monitoring cleaning processes
Dairy industry	■ Cooling systems in refrigeration plants

Performance and selection

Sensor type

Liquid (flat-face)
Figures referenced to water
Ranged 2m/sec or 3m/sec
Response time: 5 sec rising
< 5 sec falling
(0-66% step change)

Note:
Operates from 0.1m/sec

Gas (probe)
Figures referenced to air
Ranged 0-50Nm/sec
Response time: 15 sec rising
10 sec falling
(0-66% step change)

Conversion to Nm/sec (velocity at normalised conditions)

$$\frac{\text{Flow (Kg/hr)}}{\text{normal density of gas (Kg/m}^3\text{)}} \times \frac{353.68\ \text{(Constant)}}{d^2\ \text{pipe dia (mm)}}$$

$$= \frac{500}{1.293} \times \frac{353.68}{54^2}$$

(density of air at 0°C+1.013bar A) (Example 2" pipe)
= 46.9Nm/sec

Example: to convert 350 Nm³/hr in 50mm NB pipe to Nm/sec

$$\text{Flow (Nm}^3\text{/hr)} \quad \frac{353.68\ \text{(Constant)}}{d^2\ \text{pipe dia (mm)}}$$

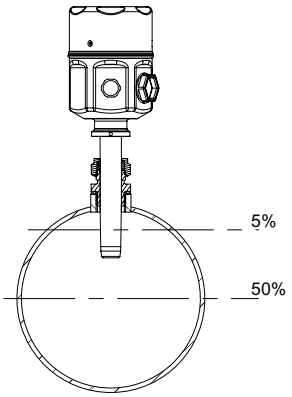
$$= 350 \quad \frac{353.68}{54^2}$$

= 44.145Nm/sec

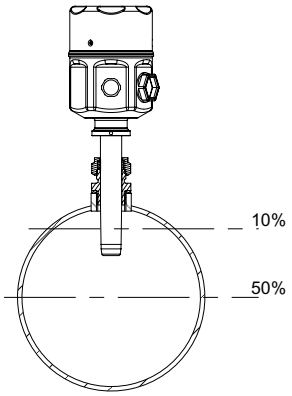
Normal = 0°C+1.013bar A

Mounting and installation

Insertion depth (gas and liquid)
For optimum measuring performance, the active area should be inserted to a depth of between 5% and 50% of the internal pipe diameter. The sensor tip should be in contact with the medium at all times.



For pipe diameters <DN250

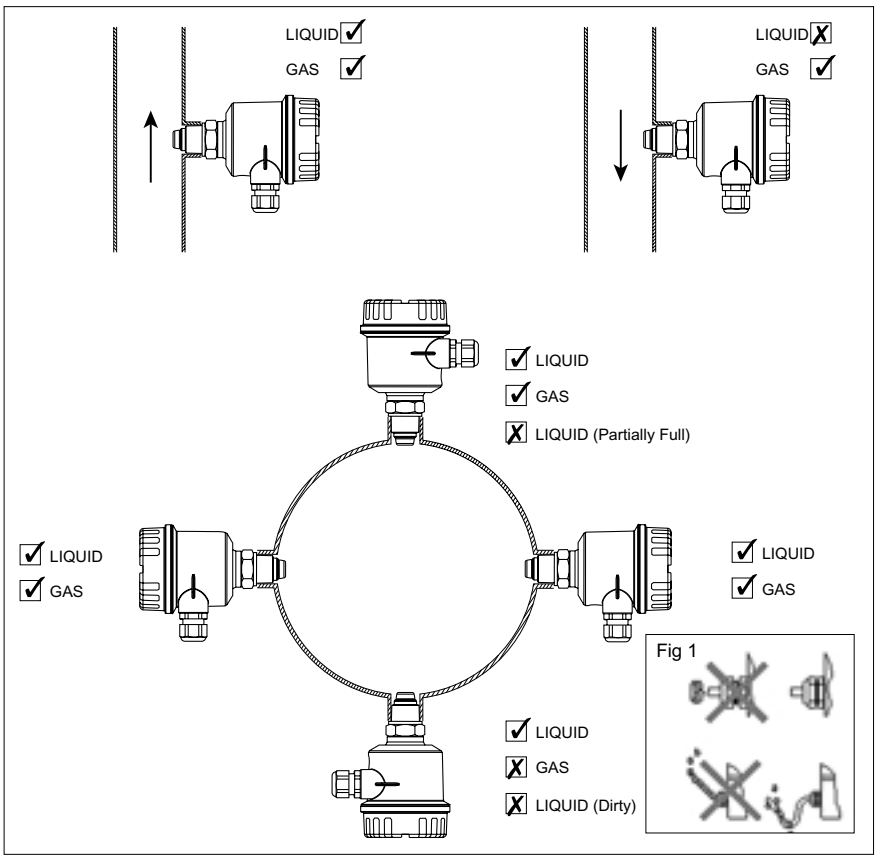


For pipe diameters >DN250

IP protection guideline

- Housing gasket must be clean and undamaged prior to tightening the lid
- The cables used for connecting must have the correct outer diameter to suit the cable gland seal
- The cable gland must be firmly tightened
- The cable must loop down before entering the cable gland to ensure that no moisture can enter it (fig 1)
- Any cable glands not used are to be replaced with a blind plug
- The protective bush should not be removed from the cable gland

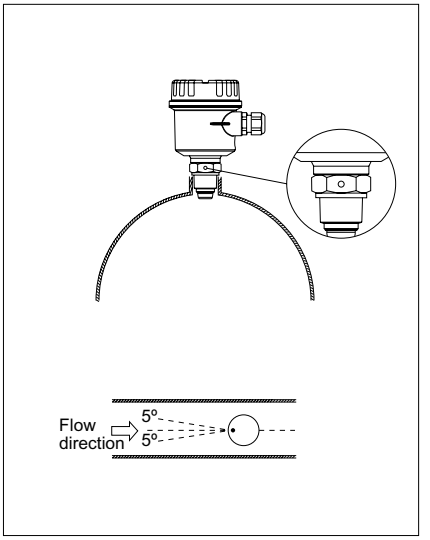
Planning and installation guidelines



Planning and installation guidelines

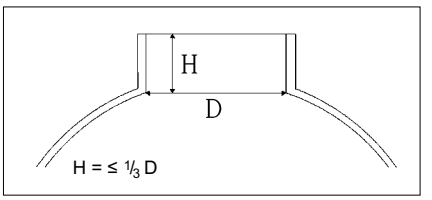
Sensor

- Each process connection has an orientation mark. This should be positioned in line facing the oncoming flow
- Sensor should be installed so that the sensing surface is in contact with the flowing medium at all times
- There is an allowed orientation tolerance of +/– 5° from centre
- For liquids, ensure full pipe
- Avoid mounting device where exposure to extreme ambient temperature change occurs, i.e. direct sunlight
- Avoid applications with large process temperature changes
- For gases, avoid areas where condensate collects



Sanitary sensor

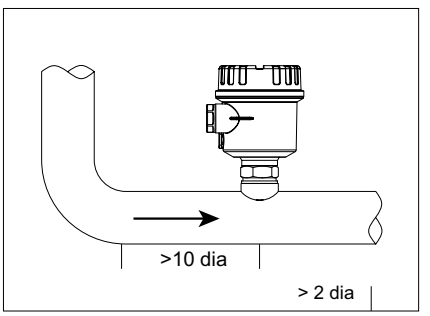
- It is the responsibility of the user to ensure that the volume enclosed by the mounting boss has sufficient dimensions to ensure adequate cleaning takes place



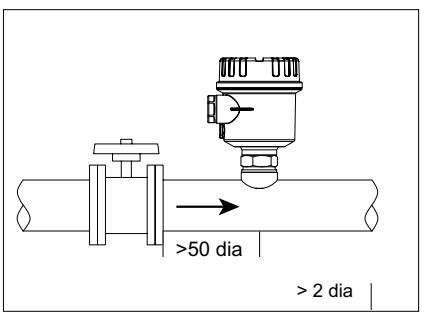
Mounting and installation (Good Engineering Practice guidelines)

Avoid installing in areas of extreme flow turbulence. For example:

- Directly after bends or expansions/reductions

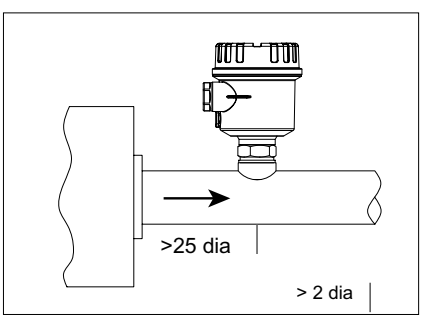


- Directly downstream of isolation and control valves
- Directly after pumps, fans and compressors



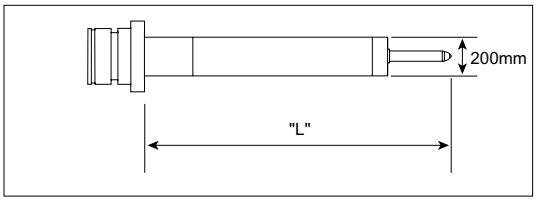
Note:

1. All downstream dimensions are provided only as a guideline and wherever possible greater dimensions should be considered
2. The devices will work if installed closer to or even on the bend but overall performance will be impaired



Insertion sensor

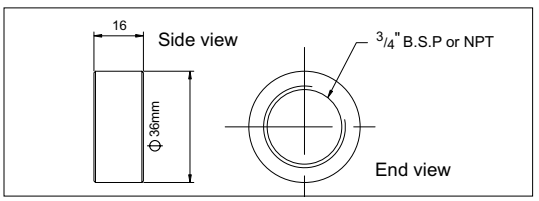
Process connection
Extended sensor



Dimensions of extended versions (L in mm)		
Sensor option	Insertion 125mm	Insertion 235mm
Flat-face	125	235
Probe	125	235

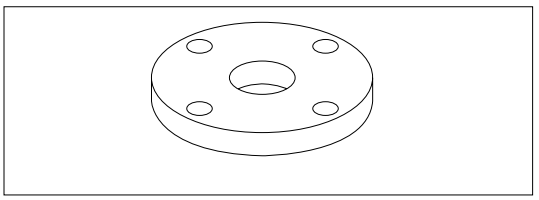
Mounting boss

For BSP and NPT threads

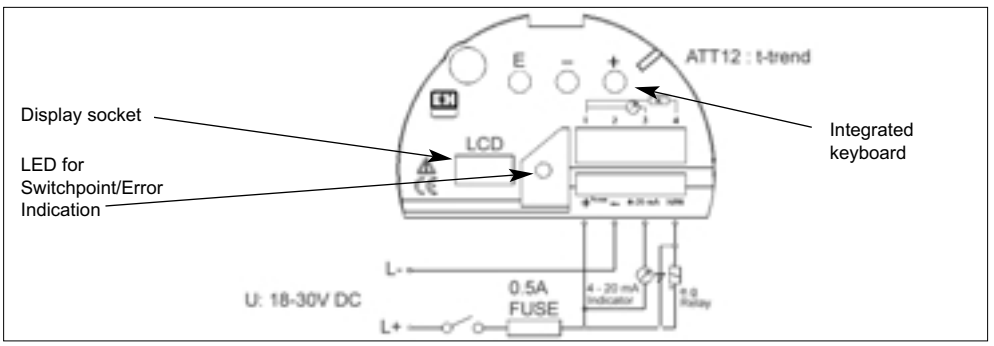


Accessories

Threaded flanges
3/4" NPT thread for mounting a t-trend.
Available sizes:
DN25 PN25
ANSI 1" 150lbs
DN40 PN25
ANSI 1 1/2" 150lbs
DN50 PN25
ANSI 2" 150lbs



Electrical connection



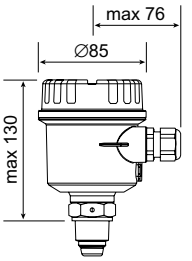
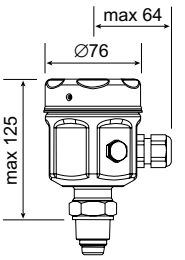
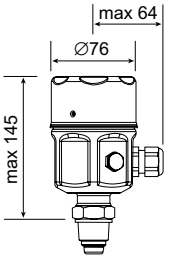
Note 1: In order to meet EMC requirements, screened or shielded cable is recommended.
Note 2: Outputs not galvanically isolated.
Note 3: The sensor power supply should have a limited power circuit according to NEC Class 2 for North America and CEC Class 2 for Canada.

Operation

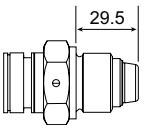
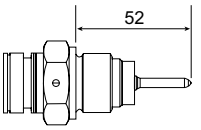
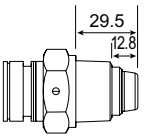
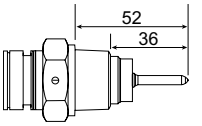
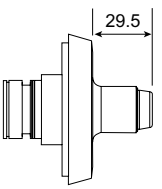
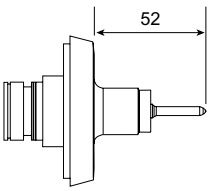
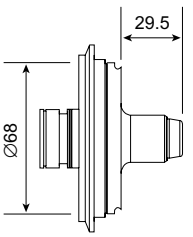
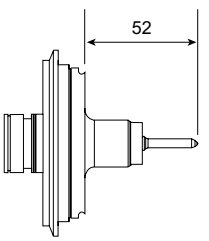
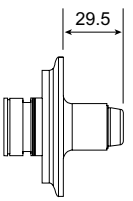
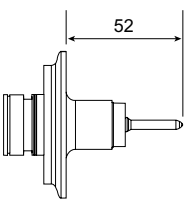
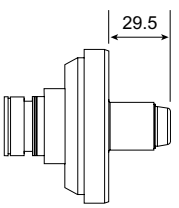
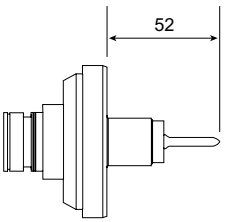
LED (Light Emitting Diode)
- Illuminates when measured flow above switchpoint
- Off when measured flow below switchpoint
- Flashes to indicate an error

LCD (Liquid Crystal Display)
- Optional display used to indicate flow as a percentage of maximum. Also displays programming information and error codes (essential for programming)

Housing and sensor

Polyester housing No display	**Steel housing** No display	**Steel housing with extended lid** With display
		

Process connection

Process connection	Dimensions with liquid sensor	Dimensions with gas sensor	Process limits
BSP ¾" (G)			max 25 bar A max 80°C
¾" NPT			max 25 bar A max 80°C
Sanitary coupling DN40 DN50 to DIN 11851			max 25 bar A max 80°C
Varivent DN50			max 10 bar A max 80°C
Triclamp 1½" 2" ISO 2852			max 16 bar A max 80°C
Aseptic coupling DN50 to DIN 11864			max 25 bar A max 80°C

All dimensions in mm
For extended insertion sensor supplied with compression fitting: 20 bar A at 20°C

Technical data

Process conditions

- Nominal process diameters from DN40
- Process pressure range: 25 Bar A (process fitting dependent)
- Process temperature range: -10 to +80°C (For temperatures in excess of 80°C please contact your local E+H representative)

Materials

- Meter body: 1.4404/1.4435/316L
- Transducers: 1.4404/1.4435/316L
- Polyester housing: PBT-FR (polyester) with cover in PBT-FR or with transparent cover in PA 12, seal of cover; EPDM
- Steel housing: 1.4301 (AISI 304), seal of cover; silicone
- Cable gland: polyamide
- Hastelloy C (available on request)
- Aluminium housing (available on request)

Process connections

- Parallel thread BSP $^{3}/_{4}$" (includes brass $^{3}/_{4}$" compression fitting for insertion sensors only)
- Tapered thread $^{3}/_{4}$" NPT (includes brass $^{3}/_{4}$" compression fitting for insertion sensors only)
- Sanitary coupling DN40, 50 to DIN 11851
- Varivent DN50 to factory standard Tuchenhagen
- Triclamp $1^{1}/_{2}$", 2" to ISO 2852
- Aseptic coupling DN50 to DIN 11864
- Optional: Stainless Steel compression fitting for insertion sensors

Performance limits

- Accuracy: ± 5% of factory full scale
- Repeatability: ± 1% of factory full scale
- Response time, flat-face: 5 sec rising, < 5 sec falling
- Response time, probe: 15 sec rising, 10 sec falling
- Flow ranges liquid: 2m/sec or 3m/sec ref. to water (see page 2)
- Flow ranges gas: 50Nm/sec ref. to air

Human interface

- Integrated keyboard.
- Red LED to indicate switching status, flashes under fault condition
- Optional display: 4 numeric characters with bar graph

Electrical

- Power supply: 18-30V AC/DC (~) 50/60 Hz
- Power consumption: <3W
- The sensor power supply should have a limited power circuit, according to NEC Class 2 for North America and CEC Class 2 for Canada
- Current output: 4-20mA active output and NPN open collector max rating 30VDC/50mA (output shares common +ve of power supply rail)

Environment

- Storage temperature range: -20 to +80°C (without LCD)
- Ambient temperature range: -10 to +60°C (without LCD)
- Degree of protection: polyester and steel housings: IP66 to EN 60529
- Vibration resistance: up to 1g, 10....150Hz to IEC 60068-2-6
- Shock resistance: to IEC 60068-2-31
- Electromagnetic compatibility (EMC): IEC 801 part3: E = 10V/m (30MHz...1GHz)

Approvals

- EHEDG, all wetted materials FDA listed. Meets the requirements of 3A
- cCSAus general approval
  - Installation (overvoltage) category 2
  - Pollution degree 2

Performance and selection

Product structure ATT12-

Approvals

A	For use in non-hazardous areas
B	FM general approval (pending)
C	CSA general approval (pending)
Y	Special – please specify

Sensor form

11	Flat-face sensor, 2m/sec (liquid)
12	Flat-face sensor, insertion 125mm, 2m/sec (liquid)
13	Flat-face sensor, insertion 235mm, 2m/sec (liquid)
21	Probe sensor, 50Nm/sec (gas)
22	Probe sensor, insertion 125mm, 50Nm/sec (gas)
23	Probe sensor, insertion 235mm, 50Nm/sec (gas)
31	Flat-face sensor, 3m/sec (liquid)
32	Flat-face sensor, insertion 125mm, 3m/sec (liquid)
33	Flat-face sensor, insertion 235mm, 3m/sec (liquid)
99	Special – please specify

Process connection

(Material 1.4435/316L unless stated)

D1	G 3/4" BSP, (boss included) (boss suitable for DN40 to DN1000)
D2	G 3/4" BSP, brass boss included (brass compression fitting, insertion sensor only)
D3	G 3/4" BSP
D4	G 3/4" BSP stainless steel boss included (stainless steel compression fitting, insertion sensor only)
F1	NPT 3/4" (boss included) (boss suitable for DN40 to DN1000)
F2	NPT 3/4", brass boss included (brass compression fitting, insertion sensor only)
F3	NPT 3/4"
F4	NPT 3/4", stainless steel boss included (stainless steel compression fitting, insertion sensor only)
J1	DN40 dairy coupling DIN 11851
K1	DN50 dairy coupling DIN 11851
L1	Varivent >=DN50
M1	Tri Clamp 1 1/2" ISO2852
N1	Tri Clamp 2" ISO2852
P1	DN50 aseptic coupling DIN 11864-1
Y9	Special – please specify
*	Stainless steel available on request

Surface finish, wetted parts

1	Standard metal finish
2	Ra<1.5 µm/120 grit
3	Ra<0.8 µm/150 grit (3A/EHEDG)
5	Ra<1.5 µm/120 grit, O_2 duty
6	Ra<0.8 µm/150 grit, O_2 duty (3A/EHEDG)
7	Standard metal finish, O_2 duty
9	Special – please specify

Electronics & outputs

A	4-20mA and NPN transistor o/p no display 18-30V DC
B	4-20 mA and NPN transistor o/p 4 digit LCD display 18-30V DC Stainless steel housing only
Y	Special – please specify

Housing & cable entry

4D	Polyester housing IP66 M20 gland
4H	Polyester housing NEMA4X NPT 1/2" entry
6D	SS304 housing IP66 M20 gland
6H	SS304 housing NEMA4X NPT 1/2" entry
9Y	Special – please specify

Documentation

1	Standard documentation
2	EN10204-2.3 pressure test 1.5 x pressure rating for 3 minutes
3	3.1b extended documentation pack
9	Special – please specify

ATT12- ← Order Code

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People for Process Automation