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

Technical Information and Operating Instructions

t-trend ATT12A

Flow monitor for air and compressed air

Applications

- Monitoring of compressed air
- Air distribution
- Air leakage detection and monitoring

Your benefits

- Nominal diameters DN50 – DN200 (insertion)
- Nominal diameters DN15 – DN40 (flowcell)
- Measurement of normal or standard volume flowrates
- Measurement of mass flowrates
- No pressure or temperature compensation required
- No moving parts, reduced maintenance
- Galvanic isolation (optional)

TI002D/22/en/09.09

Endress+Hauser

People for Process Automation

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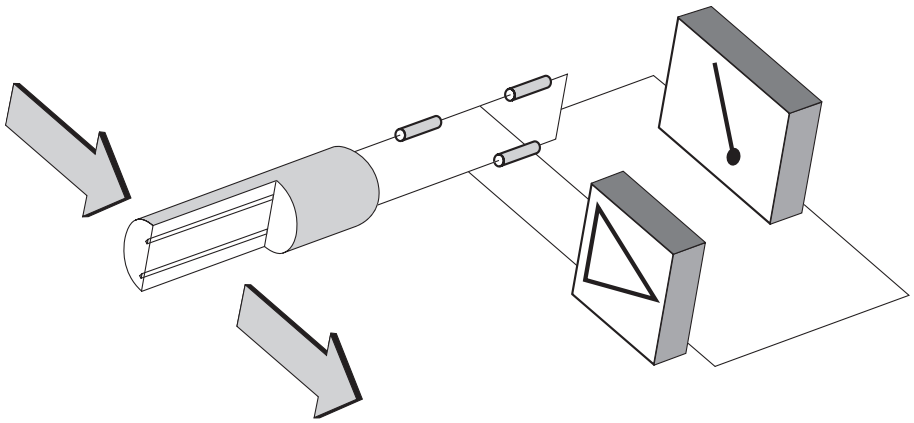
Measuring principle

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.



Safety notes

The t-trend ATT12A is designed for flow monitoring and limit detection in air. The t-trend ATT12A should be installed, connected, commissioned, operated and maintained by qualified and authorised personnel under strict observance of these operating instructions, any relevant standards or legal requirements. **Do not attempt to install or remove the instrument under pressurised conditions.**

Performance and selection – compressed air

Factory setting of full scale output (20mA)

Pipe Size	Pipe ID DIN (mm)	Flowrate (Kg/h)	Flowrate (Nm^3/h)	Flowrate (SCFM)
DN15*	17.1	70	54	34
DN25*	28.5	200	155	96
DN40*	42.7	512	396	246
DN50	54.8	871	674	418
DN80	82.8	2002	1548	962
DN100	103.2	3091	2391	1485
DN150	159.3	7364	5696	3537
DN200	206.5	12375	9572	5944

* Threaded and DIN flanged flowcell versions

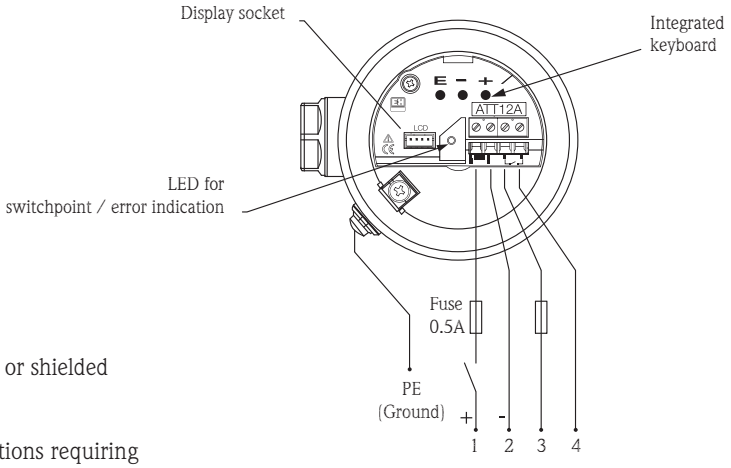
Pipe Size	Pipe ID threaded/ANSI	Flowrate (Kg/h)	Flowrate (Nm^3/h)	Flowrate (SCFM)
½"**	15.8	60	46	29
1"**	26.6	174	135	84
1½"**	40.9	470	364	226
2"	52.5	800	619	384
3"	77.9	1761	1362	846
4"	102.3	3037	2349	1459
6"	154.1	6891	5330	3310
8"	202.7	11923	9222	5727

**Threaded and ANSI flanged flowcell versions

Reference conditions
Nm^3/h = 0°C / 1.013 bar a
SCFM = 15°C / 1.013 bar a

Calculation of full range setting for other pipe diameters not listed above
Kg/h - FS (20mA) = 0.2902 x D^2 (0.2902 Constant, D pipe internal diameter in mm)
Nm^3/h - FS (20mA) = 0.2245 x D^2 (0.2245 Constant, D pipe internal diameter in mm)
SCFM - FS (20mA) = 0.1394 x D^2 (0.1394 Constant, D pipe internal diameter in mm)

Electrical connection



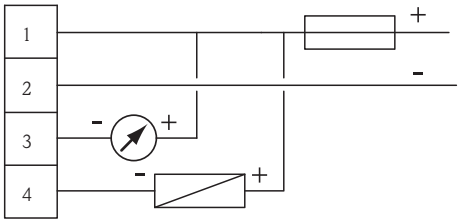
Note 1. In order to meet EMC requirements, screened or shielded cable is recommended.

Note 2. Outputs not galvanically isolated. For installations requiring galvanic isolation use RB223 galvanic isolator – see connection diagrams.

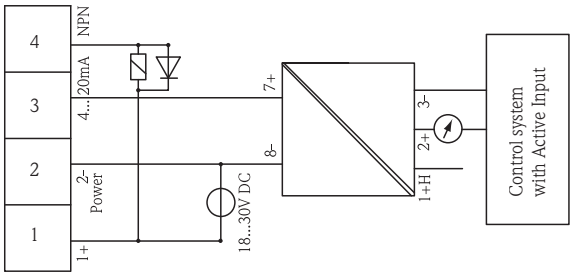
Note 3. The sensor power supply should have a limited power circuit according to NEC Class 2 for North America and CEC Class 2 for Canada.

Electrical connection examples

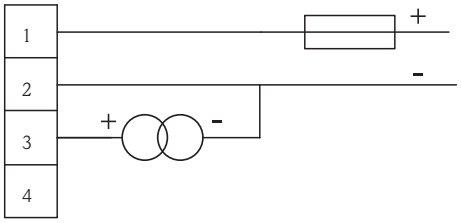
ATT12A active current output



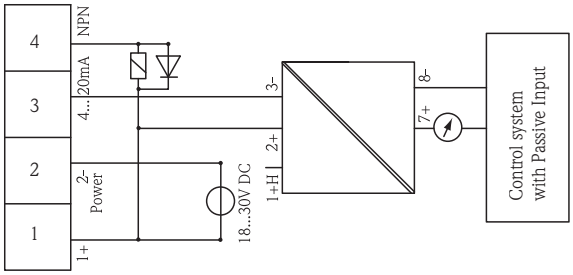
ATT12A with galvanic isolator – passive output



ATT12A passive current output



ATT12A with galvanic isolator – active output



Mounting and installation

Insertion version DN50/2" – DN200/8"

For optimum measuring performance, calculate the insertion depth using the following formula:

[0.15 x A] + B + C + D

A = The pipe internal diameter

B = The pipe wall thickness

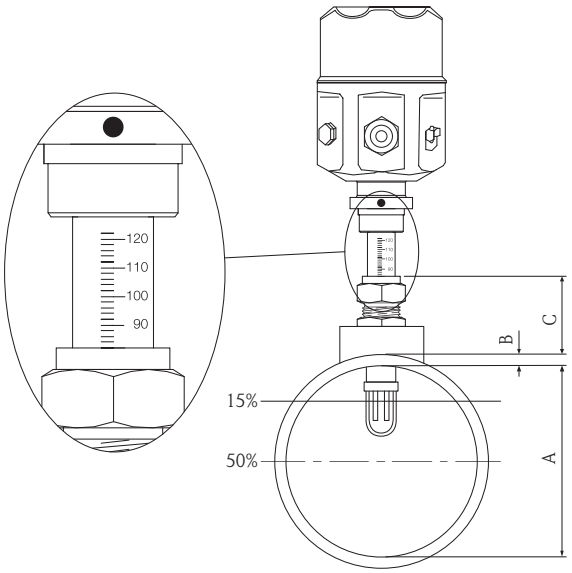
C = The total height between the outside pipe diameter and the top of the compression fitting

D = 26mm for pipe <=4", 15mm for pipe >4"

Example for a 4" pipe

[0.15 x 102] + 6 + 46 + 26 = 93

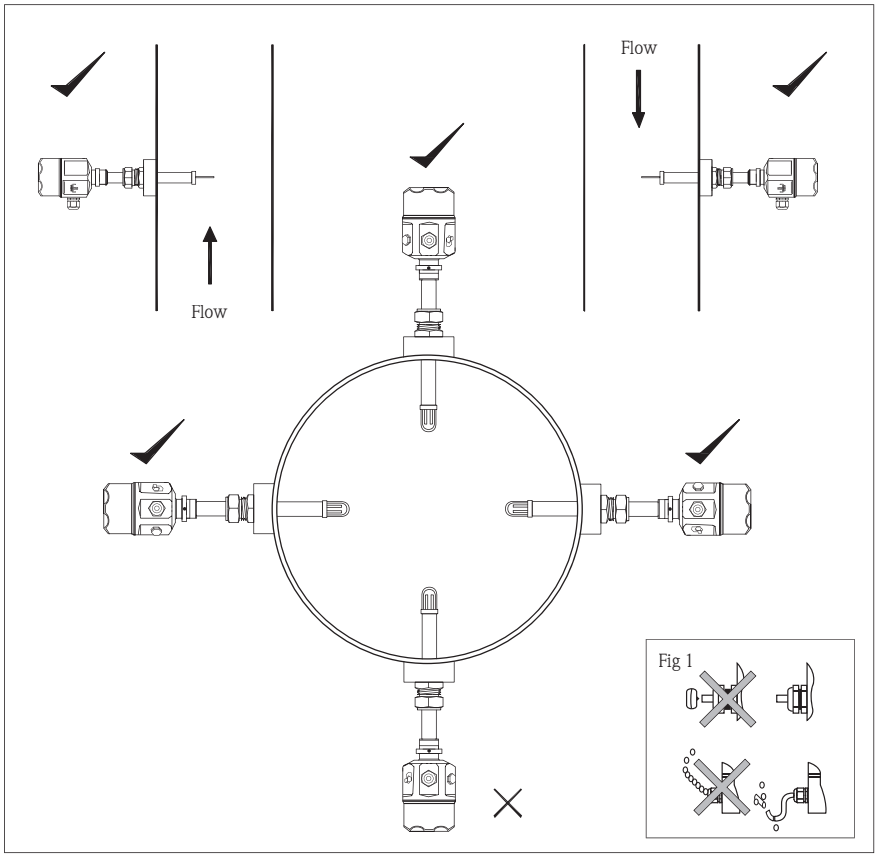
(figure adjusted to the nearest whole number)



IP protection guideline

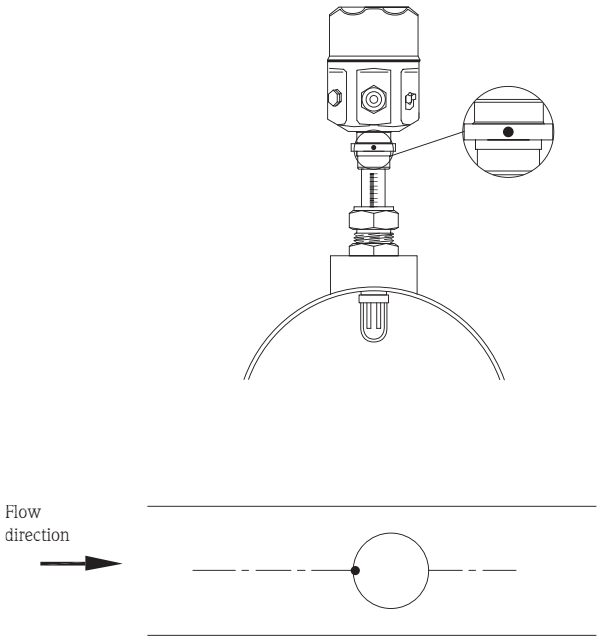
- Housing gasket must be clean and undamaged prior to tightening the lid
- The cables used for connecting must have the correct outer diameter to suit the cable gland seal
- The cable gland must be firmly tightened
- The cable must loop down before entering the cable gland to ensure that no moisture 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 (continued)

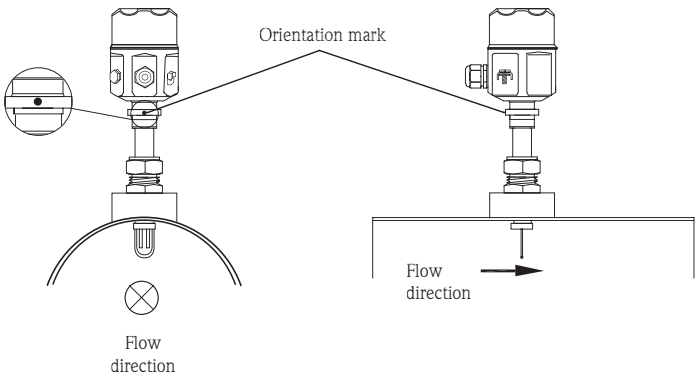
- Each process connection has a graduation line and orientation mark. This should be positioned facing the oncoming flow
- Sensor should be installed so that the sensing surface is in contact with the air flow at all times
- Avoid areas where moisture collects
- Avoid mounting the device where exposure to extreme ambient temperature change occurs i.e. direct sunlight
- Avoid applications with large process temperature changes



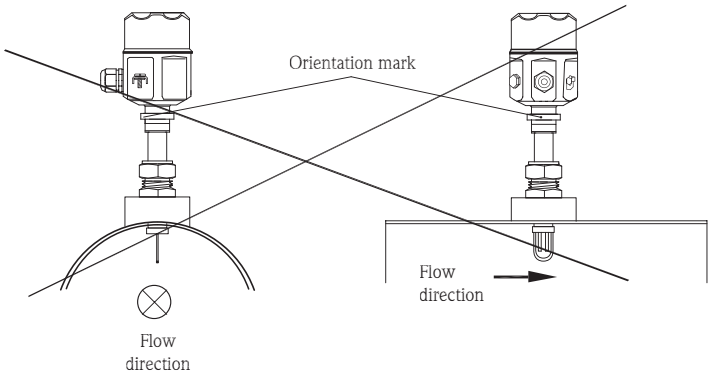
Sensor orientation and flow direction

It is important that the sensor is installed such that the orientation mark is positioned upstream to the flowing fluid. If the sensor is not installed as above it may affect the performance of the instrument.

Correct orientation



Incorrect orientation



Guidelines for insertion version

¾" BSP/G – Use appropriately sized sealing washer (supplied).

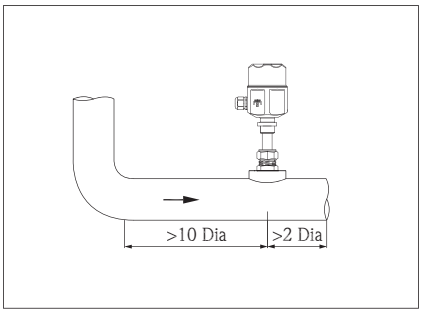
¾" NPT – Use a suitable thread tape to achieve a reliable seal.

Tighten the compression fitting. Recommended torque setting for compression fitting is 70 Nm (backnut finger tight + ~ ½ turn).
Do not use housing to turn!

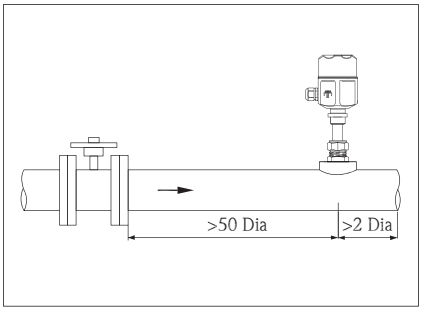
Mounting and installation (Good Engineering Practice guidelines)

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

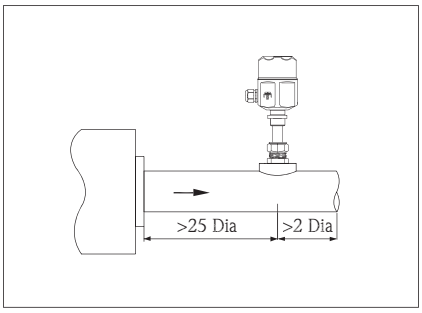
- Directly after bends or expansions/reductions



- 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.

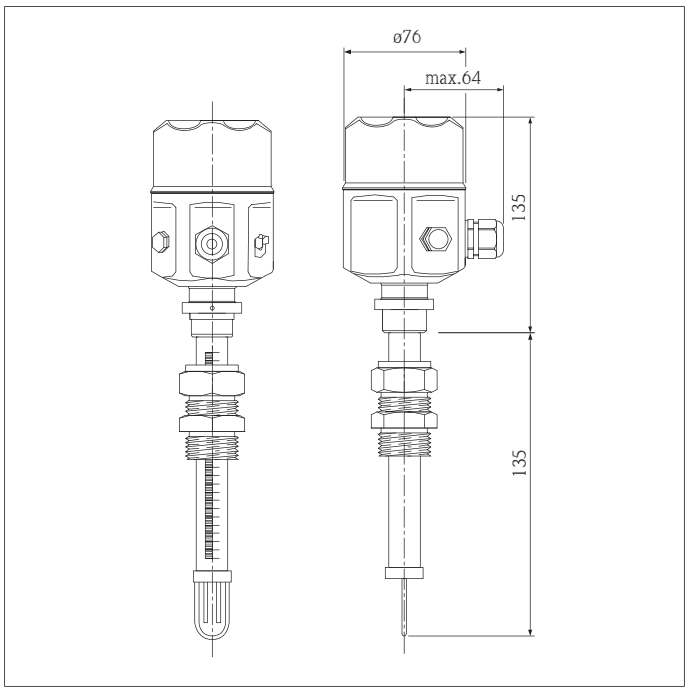
Mechanical construction

Housing: stainless steel with extended lid and LCD display.

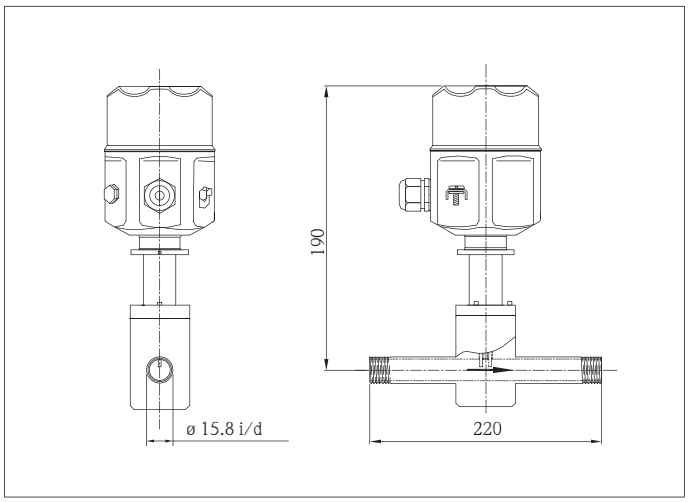
Insertion meter
DN50 – DN200

BSP (G) process connection supplied with mounting boss and seal.

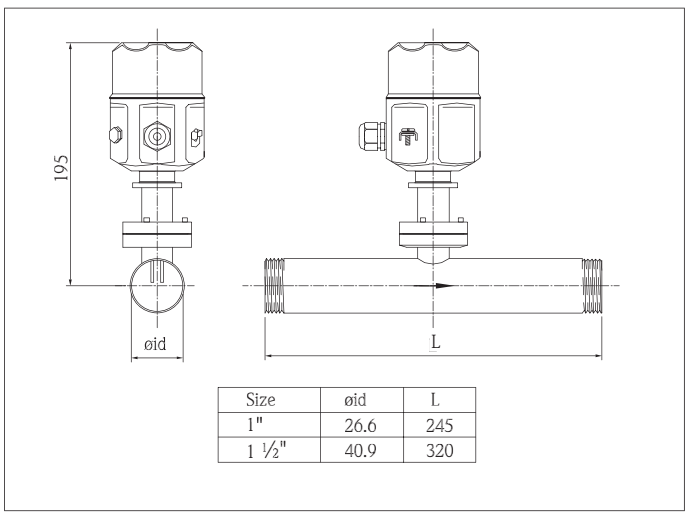
NPT process connection supplied with mounting boss.



Threaded flowcell ½"

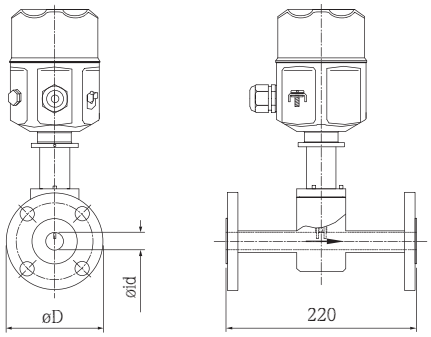


1" and 1½" threaded flowcell



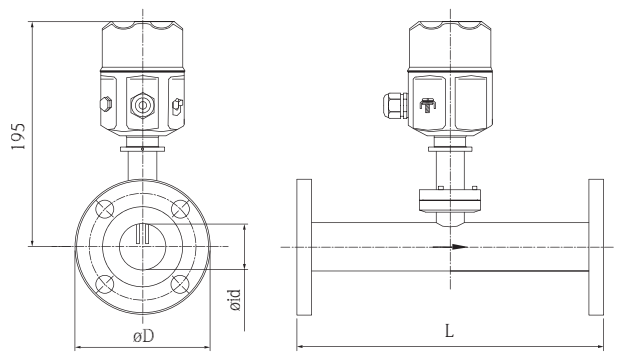
Size	øid	L
1"	26.6	245
1 ½"	40.9	320

½" flanged flowcell



Size	øid	D
DN15	17.1	95
½"	15.8	88.9

DN25 (1") and DN40 (1½")
flanged flowcell

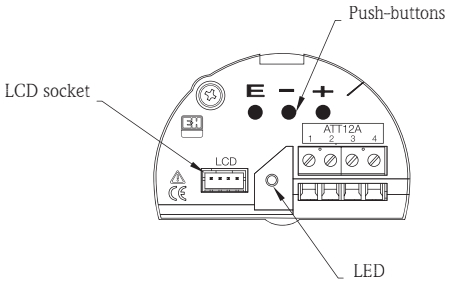


Size	øD	øid	L
DN25	115	28.5	245
DN40	150	42.7	320

Size	øD	øid	L
1"	108	26.6	245
1 ½"	127	40.9	320

Operation
Push-buttons

The push-buttons are used to navigate the menu and configure various parameters within the device.
They are as follows:
- Zero flow
- Maximum flow
- Setpoint on
- Setpoint off
- Fail-safe
- Transistor setpoint mode
- Display scaler



LED (Light Emitting Diode, switch point)
- Illuminated when measured flow above setpoint
- Off when measured flow below setpoint
- Flashes to indicate an error
- Flashes to indicate programming failure

LCD (Liquid Crystal Display)
- Used to indicate flow as a percentage of the maximum
- Also displays programming menu, values and status/error codes
- The display is essential for programming

Parameter list

Factory setting of full scale output (20mA)

Flow	FLo	Main measured flow	Read only
Temperature	tE	Process temperature	Read only
Setpoint	S.On	Setpoint on	0 - 100%, Programmable
	S.OFF	Setpoint off	0 - 100%
	Oc.Fu	Setpoint function	dE.En, EnEr
	Oc.FA	Fail-safe mode	On, OFF, HoL, run
Current output	Cu.Lo	Zero 4mA value	Programmable
	Cu.FS	Full scale 20mA value	0 -100%, Programmable
	Cu.FA	Fail-safe mode	2, 4, 20, 22, HOL, run
Sensor	ScAL	Scaler (effects display only - not Cu.FS)	00.00-99.99
	Oc.Si	Open collector simulation	OFF, dE.En, EnEr
	Cu.Si	Current output simulation	OFF, 4, 12, 20
	StAt	Status code (status and faults)	see p.11 & p.14
	U.tE	Temperature units	C, F
	F1	Function 1	A3 (ATT12A Set To A3)
	dEF	Restore factory defaults	ESc, dEF
	dAC.1	D-A conversion 4mA	Normally 201 - 206
	dAC.2	D-A conversion 20mA	Normally 33 - 36
	SoFt	Software version	2.0
	F2	Displays mV values of Cu.Lo and Cu.FS	Dependent on range

Parameter description

Flow (FLo)

This read-only parameter is the actual instantaneous flow display and is the home position within the list. It normally spans 0 - 100%, although if the scaler (ScAL) function is set to anything other than 1, then the range becomes ScAL x 100.

Process temperature (tE)

This read-only parameter displays the actual process temperature.
The units are determined by the temperature units (U.tE) setting.

Setpoint on (S.On)

This parameter is the point at which the open collector (O/C) changes state on rising flow. This can be programmed as explained on page 13. The range is normally 0 - 100%, but it must be set above setpoint off (S.OFF).

Setpoint off (S.OFF)

This parameter is the point at which the O/C changes state on falling flow. Whilst this function does not have a programming feature, it is associated with setpoint on. When setpoint on is programmed, setpoint off is automatically set 5% below it. The range is normally 0 - 100%, but it must be set below setpoint on.

Setpoint parameter (Oc.Fu)

This function selects the status of the open collector output. DE.En for de-energised or En.Er for energised.

Parameter description (continued)

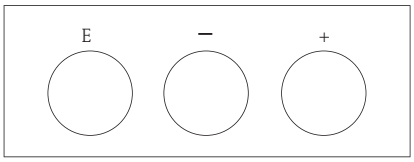
Fail-safe mode (Oc.FA)	This function selects how the O/C output should respond to a fault condition. The options are On, OFF, HoL (hold current status) or run (continue to operate).
Zero flow (Cu.Lo)	Allows the zero flow to be set accurately to actual plant conditions at operating pressures and temperatures with no flow. It is set using the programming function as described on page 13.
Full scale (Cu.FS)	Allows the user to set the current output/display maximum to any value below the limits of the device. It has the addition of a programming feature as described on page 13.
Fail-safe mode (Cu.FA)	This parameter selects how the current output will respond to a fault condition. The options are 2, 4, 20, 22, HoL (hold status), run (continue to operate).
Scaler (ScAL)	Allows the user to programme a meaningful value for the optional digital indicator e.g. actual process flowrate is 250 kg/h, set scaler to 2.5. The onboard software will multiply the scaler value by 100 (2.5 *100) and set the indicator to operate with a full scale of 250. Note: If used will also affect values set into S.On and S.OFF.
Open collector simulation (Oc.Si)	Allows user to test the open collector output. OFF, dE.En and En.Er as options.
Current output simulation (Cu.Si)	Allows user to test current output values and all downstream equipment such as recorders and data loggers. OFF, 4, 12, 20 as options.
Status code (StAt)	This parameter allows the user to view which parameters have been set via programming selection or manually. Each digit represents 1 of the 3 programmed parameters. S000 factory defaults, S100 zero flow (Cu.Lo) programmed, S010 full scale (Cu.FS) value programmed and S001 setpoint programmed. It will also display any detected error messages, see page 14.
Temperature units (U.tE)	Selection of temperature unit displayed (Centigrade or Fahrenheit).
Function 1 (F.1)	This will be set at the factory to A3 – do not change.
Restore factory defaults (dEF)	**WARNING!** The dEF function should NOT be used on factory ranged units or the range data will be lost! If used then the factory flow range will be lost and all settings will have to be repeated such as zero (Cu.Lo), full scale (Cu.FS), setpoint on (S.On) etc. On restore to default the unit will shutdown and power up displaying the software version (2.0).

Parameter description (continued)

dAC.1	Factory setting to set the digital to analogue convertor to 4mA is normally set between 201 to 206.
dAC.2	Factory setting to set the digital to analogue convertor to 20mA, is normally set between 33 to 36.
SoFt	Displays software version number (2.0).
F.2	This parameter will display the mV value at which the zero (Cu.LO) and full scale (Cu.FS) has been set. (Alternating every 2 seconds). The bar graph will display the F.S mV value as a percentage of the curve range. It is expected that the zero will be set at no flow but the full scale (Cu.FS) can be set anywhere across factory curve but cannot be set beyond. The bar graph will display the value as percentage of the curve range.
F3	Factory use only.

Programming keyboard

Description of push-buttons



'E' key	The 'E' key is used to step through the functions, enter any parameter changes and initiate programming sequences.
'-' key	The '–' key is used to enter the editing mode of a parameter and decrement the value or change the selection.
'+' key	The '+' key is used to enter the editing mode of a parameter and increment the value or change the selection.

Example 1. How to use push-buttons

To change the scaler follow these guidelines

1. Momentarily press the 'E' key to enter the menu.
2. Repeatedly depress the 'E' key, stepping through the menu until 'ScAL' is displayed.
3. Momentarily press either the '+' or '–' key to enter the editing mode.
4. Continue pressing the '+' key to increment the value or the '–' key to decrement the value until the desired value is reached (holding the key down will increase the rate of change).
5. Press the 'E' key to load the new value into memory.
6. Either press and hold both the '+' and '–' keys to return to flow, or step through the function list with the 'E' key until 'FLo' is displayed and press the '+' or '–' key to view it.

Programming keyboard (continued)

Example 2. How to reset factory pre-set values

1. Momentarily press 'E' key stepping through the menu until 'dEF' is displayed.
2. Momentarily press '+' or '-' to enter editing mode.
3. There are 2 options, 'dEF' and 'Esc'. 'Esc'exits with no change, 'dEF' resets all parameters to factory values. Press 'E' to select desired option.

Note: After 'dEF' is selected the unit will shutdown and power up displaying the software version (2.0).

Zero and full scale (20mA) adjustment

These instructions are intended to allow a first time user to set up a flow monitor to meet its basic requirements.

Step 1 – Set zero flow

Ensure that there is no flow. Use 'E' key to step to Cu.Lo then '+' or '–' to enter editing mode. When process conditions are stable press and hold down 'E' key for 3 seconds until display begins to flash, then release. The unit will programme the value and return to home position showing 0% flow.

Step 2 – Set full scale

Reprogramming the F.S. value can only be satisfactorily performed by using a separate reference meter which can provide a reading of the flow to establish the new F.S. value to be programmed.

Ensure that the flow is at its full value. Use 'E' key to step to 'Cu.FS' then '+' or '-' to enter editing mode. When flowrate is steady at 100% press and hold down 'E' key for 3 seconds until text begins to flash, then release. The unit will programme the value and return to home position showing 100% flow.

If 100% flow cannot be achieved then follow new instructions below: Set the flow to as high a value as is practical (>50%). Use 'E' key to step to 'Cu.FS' then '+' or '-' to enter editing mode. When flowrate is steady calculate its % of the maximum flow then use the '+' or '-' key until the desired value is shown in %.

Hold down 'E' key for 3 seconds until text begins to flash, then release. Unit will programme the value and automatically calculate what 100% would be and apply the full flow curve then return to the home position showing actual flow rate.

Step 3 – Set setpoint on (S.On)

Use 'E' key to step to 'S.On' then '+' or '-' to enter editing mode. Use '+' or '-' to set the display to that required i.e. 25% then press 'E' key for 3 seconds until text begins to flash, then release. This will programme the Setpoint On at 25% of the value set for full scale.

Zero and full scale (20mA) adjustment (continued)

Step 4 – set setpoint off (S.OFF)

Whilst this function does not have a programming feature, it is associated with setpoint on and is automatically set 5% below setpoint on. To alter the value use 'E' key to step to 'S.OFF' then '+' or '–' to enter editing mode. Use '+' or '–' to set the display value to that required i.e. 15% then press 'E' key. This will set the setpoint off at 15% of the value set for full scale. The setpoint output switch will now initiate at 25% and cancel at 15% of FS.

Note

If the zero flow value (Cu.Lo) or the full scale value (Cu.FS) are changed after setting the setpoint on (S.On) and the setpoint off (S.OFF) values, both set point values will default to the factory settings. (S.On = 5%, S.OFF = 0%). The sensor will measure and average the flow condition for a period of 5 seconds after which it will set zero and return to the home position. If the flow is unsteady the display will show an error message and the LED will flash. If this happens repeat the procedure.

Diagnostics / error codes

Sensor faults		**Action**
E001	Sensor open circuit	Replace sensor
E002	Sensor short circuit	Replace sensor
Output faults		Remove electronic insert check board connections
E010	Transistor not functioning	
Power faults		
E100	Internal power fault	
E200	Internal power supply out of range	
E300	E100 + E200	

Programming	**Errors**	**Cause**
Err1	Programmed zero	Zero being set is higher than FS
Err2	Programmed FS	FS being set is below zero value
Err3	Programmed setpoint	Setpoint set above or below FS or zero

LED operation (normal running)	**Cause**
LED on for 2 sec off for 0.25 sec	Measurement over-range
LED off for 2 sec on for 0.25 sec	Measurement below zero setting

Current output	**Cause**
E020	Current output out of range
E030	E020 + E010

Technical data

Process conditions

- Nominal process diameters DN15 – DN200
- Process pressure range: 40 bar
- Process temperature range: -10 to 100°C

Materials

- Meter body: 1.4401/1.4435/316L
- Transducers: 1.4404/1.4435/316L
- Housing: 1.4301 (AISI 304), seal of cover; silicone
- Cable gland: polyamide

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)
- Flowcell – flanged version ANSI 150 (B16.5) or PN25/40 (BS EN 1092-1)
- Flowcell – threaded BSP

Performance limits

- Accuracy: +/- 3% of full scale
- Time response: 15 sec. rising, < 10 sec falling
- Flow ranges: refer to chart on page 3

Human interface

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

Electrical

- Power supply: 18-30V DC
- 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 30V DC/50mA (output shares common +ve of power supply rail

Environment

- Storage temperature range: -20 to +80°C
- Ambient temperature range: -10 to +60°C
- Degree of protection: housing: IP66 to EN 60529
- Vibration resistance: 1g, 10....150Hz to IEC 60068-2-6
- Electromagnetic compatibility (EMC): IEC 61000-4-3: E=10V/m (30MHz...1GHz)

Approvals (pending)

- cCSAus general approval
  - Installation (overvoltage) category 2
  - Pollution degree 2

How to order

t-trend ATT12A air flow trend meter

10	**Approval:**							
	A	Non-hazardous area						
	C	CSA/US approval pending						
	9	Special version, TSP no. to be spec.						
20		**Sensor Shape:**						
		15	Flowcell, DN15 ½"					
		25	Flowcell, DN25 1"					
		40	Flowcell, DN40 1 ½"					
		50	Insertion, DN50 - DN200					
		99	Special version, TSP no. to be spec.					
30			**Process connection:**					
			B	Insertion G¾" BSP + mounting boss + brass fitting + nitrile seal				
			N	Insertion ¾" NPT + mounting boss + brass fitting				
			T	Flowcell, thread, G/BSP				
			F	Flowcell, flanged 150lb ANSI RF				
			D	Flowcell, flange PN25/40				
			9	Special version, TSP no. to be spec.				
40				**Output; Power Supply; Display:**				
				B	4-20mA + NPN;18-30V DC; 4 digit LCD			
				9	Special version, TSP no. to be spec.			
50					**Housing:**			
					6D	SS304 IP66 NEMA4X Gland M20		
					99	Special version, TSP-no. to be spec.		
60						**Documentation:**		
						1	Standard without certificate	
						2	EN10204-2.2 Pressure test	
						9	Special version, TSP no. to be spec.	
ATT12A-								← Order code

Accessories

RB223-A1B Single channel passive barrier
Approval: non-hazardous area

71099238 M20 - ½" NPT cable adaptor

71100102 Flow verification report to show indicated readings are within specified tolerances

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