katronic

KATflow 170

Clamp-On ATEX Ultrasonic Flowmeter

RUGGED. RESISTANT. RELIABLE.

For applications where harsh environmental conditions demand a more rugged instrument, the KATflow 170 provides a corrosion-resistant option as part of a fully ATEX-certified package. The flowmeter is intended for permanent operation in Zone 1 and 2 hazardous areas and is a cost-effective choice for a variety of metering applications. The KATflow 170 demonstrates that even the most complex technical requirements can be met with straightforward solutions.

THE TECHNOLOGY BEHIND THE MEASUREMENT

The KATflow non-invasive flowmeters work on the transit time ultrasonic principle. This involves sending and receiving ultrasonic pulses from a pair of sensors and examining the time difference in the signal. Katronic uses clamp-on transducers that are mounted externally on the surface of the pipe and which generate pulses that pass through the pipe wall. The flowing liquid within causes time differences in the ultrasonic signals, which are then evaluated by the flowmeter to produce an accurate flow measurement.

The key principle of the method applied is that sound waves travelling with the flow will move faster than those travelling against it. The difference in the transit time of these signals is proportional to the flow velocity of the liquid and consequently the flow rate.

Since elements such as flow profile, type of liquid and pipe material will have an effect on the measurement, the flowmeter compensates for and adapts to changes in the medium in order to provide reliable results. The instruments can be used in a variety of locations, from measurements on submarines to installations on systems destined for use in space, and on process fluids as different as purified water in the pharmaceutical sector and toxic chemical effluent. The flowmeters will operate on various pipe materials and diameters over a range of 10 mm to 6,500 mm.
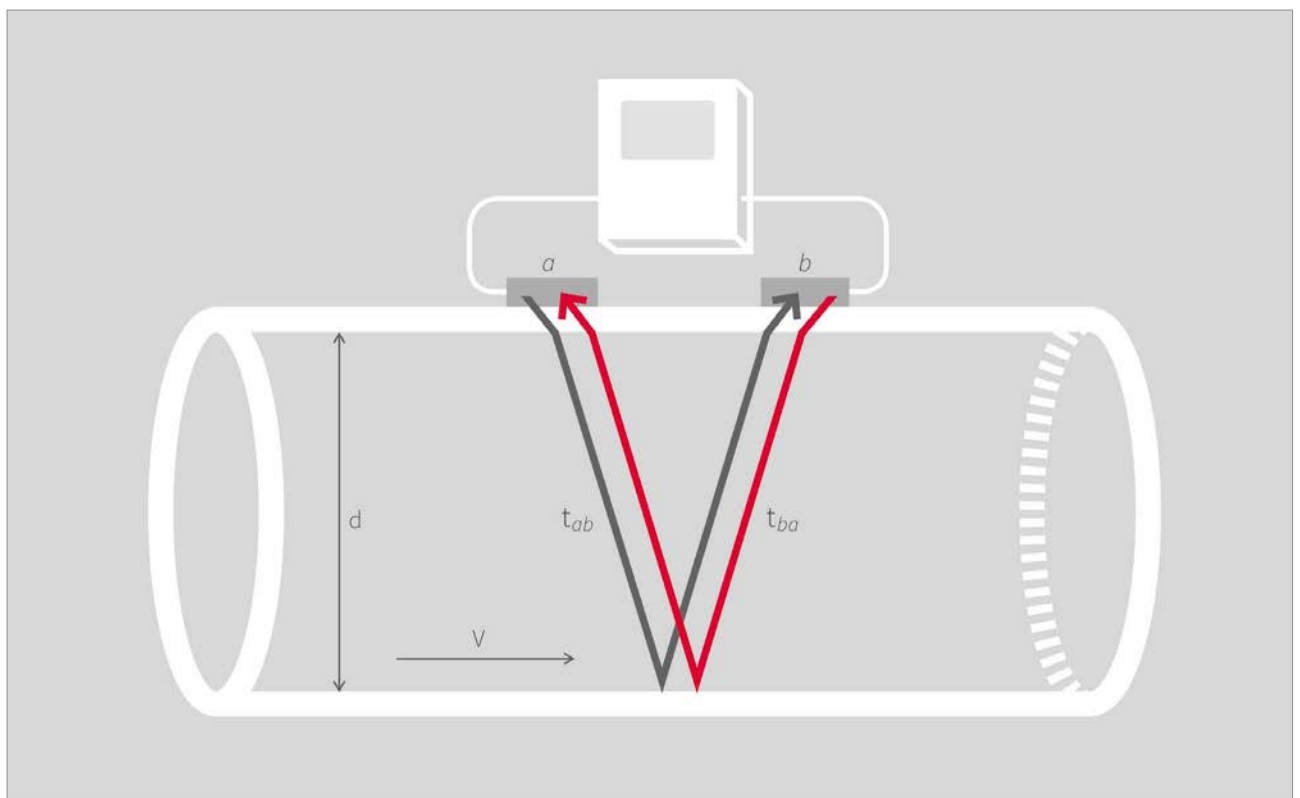
Sensors *a* and *b* work alternately to send and receive ultrasonic pulses. The sound waves *ab* travelling with the flow move faster than those travelling against it *ba*.

SPECIFICATION

- Pipe diameter range 10 mm to 3,000 mm
- Temperature range for sensors
  -50 °C to +115 °C (-58 °F to +239 °F), higher
  temperatures available on request
- Robust IP 66 unit with LCD display and
  glass-fronted keypad
- Epoxy-coated aluminium or stainless steel
  enclosure
- Magnetic pen for safe and easy programming
- Measurement of two flows simultaneously

FEATURES

- Suitable for installation in hazardous areas
- Dual flow monitoring with *sum, average,
  difference* and *maximum* calculations
- IP 68 stainless steel sensors as standard
- Process output options including current,
  open-collector, relay
- Communication options RS 485, Modbus RTU,
  Profibus PA and HART* compatible output
- ATEX-certified PT100 probe for temperature
  compensation

ACCESSORIES

- Optional sound velocity output function
- Stainless steel bracket for either pipe or wall mounting
- KATdata+ software for data evaluation

APPLICATIONS

- Produced water measurements
- Methanol and water injection systems
- Product and interface detection systems
- Measurement of refined products
- Tanker unloading systems
- Oil blending skids

FLOWMETER

Performance

Measurement principle	Ultrasonic transit-time difference
Flow velocity range	0.01 ... 25 m/s
Resolution	0.25 mm/s
Repeatability	0.15 % of measured value, ±0.015 m/s
Accuracy	Volume flow:
	±1 ... 3 % of measured value depending on application
	±0.5 % of measured value with process calibration
	Flow velocity (mean):
	±0.5 % of measured value
Turn down ratio	1/100 (equivalent to 0.25 ... 25 m/s)
Measurement rate	100 Hz (standard)
Response time	1 s (standard), 90 ms (optional)
Damping of displayed value	0 ... 99 s (selectable by user)
Gaseous and solid content of liquid media	< 10 % of volume

Images
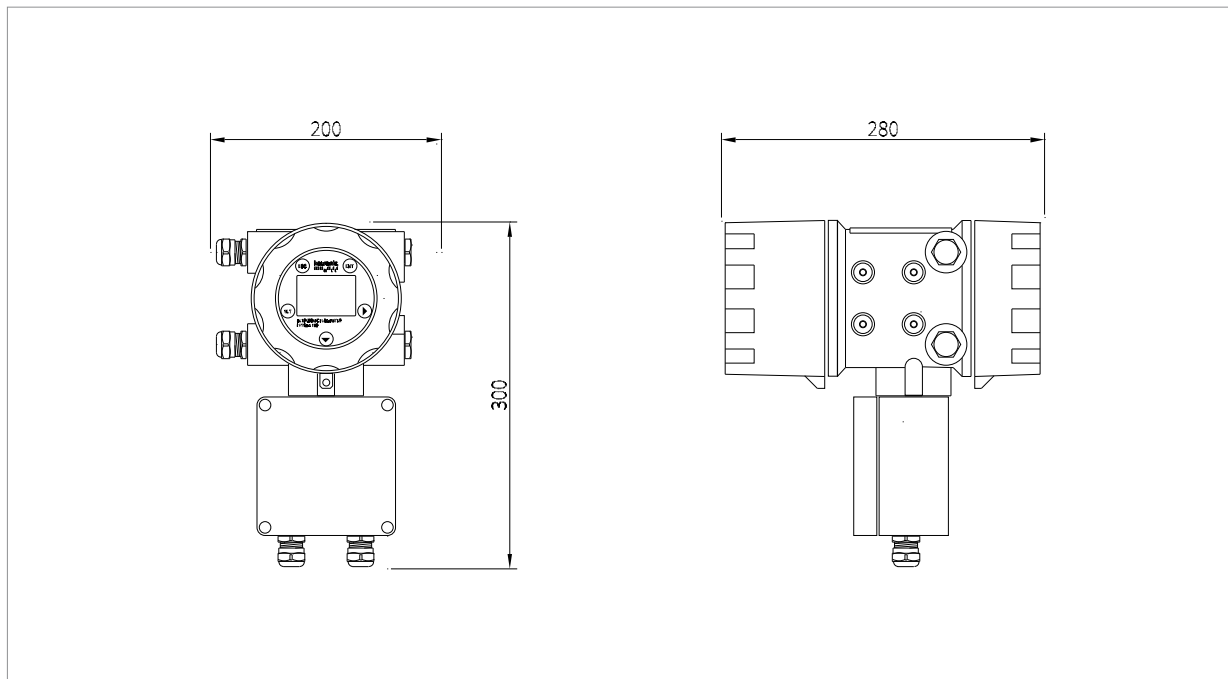
KATflow 170 (dimensions in mm)

General

Enclosure type	Explosion-proof field housing, pipe mounted
Degree of protection	IP 66 according to EN 60529
Operating temperature	-20 ... +60 °C (-4 ... +140 °F)
Housing material	Copper-free aluminium, polyurethane and epoxy-coated, stainless steel (optional)
Protection concept	Flame-proof (d), increased safety (e)
Ex-certification code	II 2G Ex de IIB T6
Ex-certification number	EPS 11 ATEX 1355 X
Measurement channels	1 or 2
Calculation functions	*Average*, *difference*, *sum*, *maximum* (dual-channel use only)
Power supply	100 ... 240 V, AC 50/60 Hz 9 ... 36 V DC Special solutions on request
Display	LCD graphic display, 128 x 64 dots, backlit
Dimensions	270 (h) x 140 (w) x 280 (d) mm (without cable glands and mounting support)
Cable glands	Power supply: M20 x 1.5 Process inputs/outputs: 2 x M20 x 1.5 Communication: M20 x 1.5 Sensors: 2 x M20 x 1.5
Weight	Approx. 4.0 kg
Power consumption	< 10 W
Operating languages	English, French, German, Dutch, Spanish, Italian, Russian, Czech, Turkish, Romanian (others on request)

Images

KATflow 170 in operation

KATflow 170 with aluminium enclosure

Communication

Type	RS 485 (optional), Modbus RTU (optional), HART* compatible output, Profibus PA (optional)
Transmitted data	Measured and totalised value, parameter set and configuration, logged data

Internal data logger

Storage capacity	Approx. 30,000 measurements (each comprising up to 10 selectable measurement units), logger size 5 MB
	Approx. 100,000 measurements (each comprising up to 10 selectable measurement units), logger size 16 MB
Logged data	All measured and totalised values, parameter sets

KATdata+ software

Functionality	Download of measured values/parameter sets, graphical presentation, list format, export to third party software, online transfer of measured data
Operating systems	Windows 8, 7, Vista, XP, NT, 2000 Linux

Quantity and units of measurement

Volumetric flow rate	m^3/h, m^3/min, m^3/s, l/h, l/min, l/s USgal/h (US gallons per hour), USgal/min, USgal/s bbl/d (barrels per day), bbl/h, bbl/min
Flow velocity	m/s, ft/s, inch/s
Mass flow rate	g/s, t/h, kg/h, kg/min
Volume	m^3, l, gal (US gallons), bbl
Mass	g, kg, t
Heat flow	W, kW, MW (with heat quantity measurement option)
Heat quantity	J, kJ, kW/h (with heat quantity measurement option)
Temperature	°C (with heat quantity measurement option)

Process inputs (galvanically isolated)

Temperature	PT100 (clamp-on sensors), three- or four-wire circuit, measurement range: -50 ... +250 °C (-58 ... +482 °F), resolution: 0.1 K, accuracy: ±0.2 K
Current	0/4 ... 20 mA active or 0/4 ... 20 mA passive, U = 30 V, R_i = 50 Ω, accuracy: 0.1 % of measured value

Process outputs (galvanically isolated)

Current	0/4 ... 20 mA active/passive (R_{Load} < 500 Ω), 16 bit resolution, U = 30 V, accuracy: 0.1 %
Digital open-collector	Value: 0.01 ... 1000/unit, width: 1 ... 990 ms, U = 24 V, I_{max} = 4 mA
Digital relay	2 x Form A SPST (NO and NC), U = 48 V, I_{max} = 250 mA
Voltage	0 ... 10 V, R_{Load} = 1000 Ω
Frequency	2 Hz ... 10 kHz, 24 V/4 mA
HART* compatible	0/4 ... 20 mA, 24 V DC, R_{GND} = 220 Ω

Images


KATflow 170 in operation

KATflow 170 with stainless steel enclosure

HAZARDOUS AREA TRANSDUCERS

K1Ex, K4Ex

Pipe diameter range	10 ... 250 mm for type K4Ex
	50 ... 3,000 mm for type K1Ex
Dimensions of sensor heads	60 (h) x 30 (w) x 34 (d) mm
Material of sensor heads	Stainless steel
Material of cable conduits	PTFE
Temperature range	-50 ... +115 °C (-58 ... + 239 °F)
Standard cable lengths	5.0 m
Degree of protection	IP 68 according to EN 60529
Ex-certification code	II 2G Ex mb IIC T4 - T6 X
	II 2D Ex mb D 21 IP68 T80 °C - T120 °C X
Ex-certification number	TRAC 09 ATEX 21226 X
Ex-protection method	Encapsulation (m), high level of protection (b)
Note	The transducers are approved for use in hazardous areas classified as Ex-Zone 1 and 2. They are connected directly to the flowmeter or via extension cables and Ex-approved junction boxes.

Images
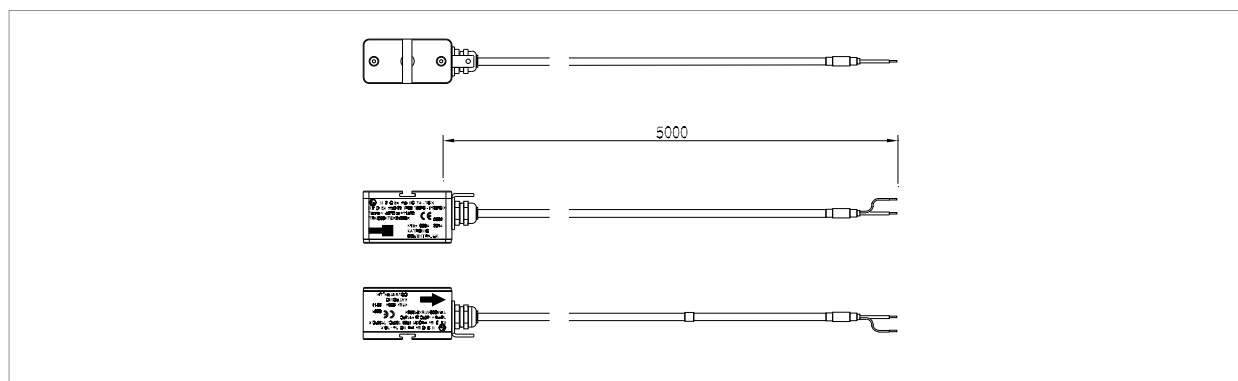
K1Ex/K4Ex transducers

K1Ex/K4Ex transducers

K1Ex transducers mounted using straps and clamps

MOUNTING ACCESSORIES

General

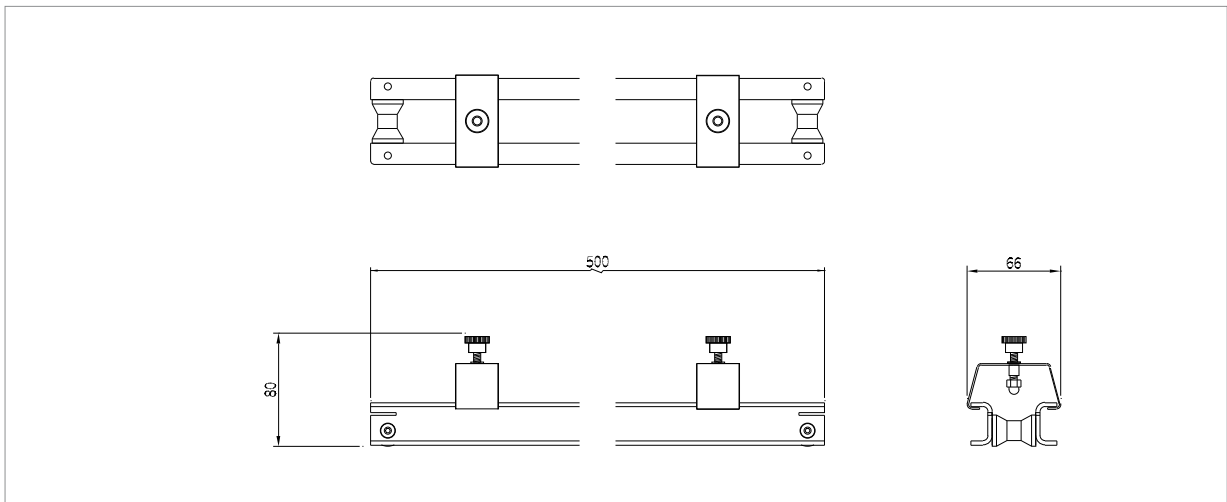Diameter range and mounting types

Clamping set (metal strap with screw), stainless steel:
DN 10 ... 40

Metallic straps and clamps: DN 15 ... 310

Metallic straps and clamps: DN 25 ... 3,000
Metallic mounting rail and straps (available on request):
DN 50 ... 250 or DN 50 ... 3,000

Images

Metallic mounting rail

Metallic mounting rail with transducers

KATflow 170 pipe mounted with 2'' mounting frame

ATEX PT100 CLAMP-ON TRANSDUCER

General

Type	PT100 (clamp-on transducer)
Degree of protection	IP 66 according to EN 60529
Protection concept	Flame-proof (d)
Ex-certification code	II 2G Ex d IIC T6 Gb
Ex-certification number	KDB 08 ATEX 135
Measurement range	-50 ... +250 °C (-58 ... +482 °F)
Circuits	4-wire (others on request)
Accuracy T	$\pm(0.15\,°C + 2 \times 10^{-3} \times T\,[°C])$, class A
Accuracy ΔT	$\leq 0.1\,K$ (3 K < ΔT < 6 K) corresponding to EN 1434-1
Response time	50 s
Dimensions of sensor heads	190 (h) x 120 (w) x 90 (d) mm
Material of sensor heads	Copper-free aluminium, polyurethane and epoxy-coated, stainless steel (optional)
Material of cable jacket	PTFE
Cable length	To suit assembly

Images

ATEX PT100 transducer
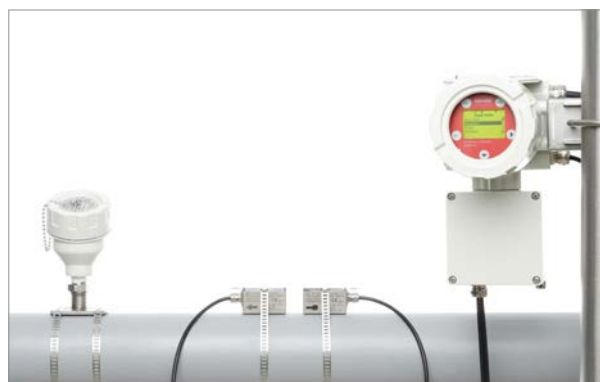
ATEX PT100 transducer fixed to pipe with KATflow 170

FLOWMETER AND ACCESSORIES

KF 170	Ultrasonic flowmeter KATflow 170, operating instructions	
	Number of measurement channels	
	1	1 measurement channel
	2	2 measurement channels [1]
	Internal code	
	03	Internal code
	Power supply	
	1	100 … 240 V AC, 50/60 Hz
	2	9 … 36 V DC
	Z	Special (please specify)
	Enclosure type	
	1	Ex-enclosure, glass-fronted, copper-free aluminium, epoxy-coated, II 2G Ex de IIB T6
	2	Ex-enclosure, glass-fronted, stainless steel, II 2G Ex de IIB T6
	Z	Special (please specify)
	Communication	
	0	Without
	1	RS 485 serial interface
	2	Modbus RTU protocol [2]
	Z	Special (please specify)
	Process inputs/outputs (select a maximum of 4 slots)	
	N	Without
	C	Current output, 0/4 … 20 mA, active (source)
	P	Current output, 0/4 … 20 mA, passive (sink)
	D	Digital output, open-collector
	R	Digital output, relay
	H	HART* compatible output, 0/4 … 20 mA [2]
	V	Voltage output, 0 … 10 V
	F	Frequency output, 2 Hz … 10 kHz
	A	1 x PT100 input for temperature compensation (select TC function) [3]
	B	Current input, 0/4 … 20 mA, active or passive
	Z	Special (please specify)
	Internal data logger	
	0	Without
	1	30,000 measurements
	2	100,000 measurements
	Z	Special (please specify)
	Temperature compensation (TC) [3]	
	0	Without
	1	With TC incl. 1 x PT100 sensor, 3 m cable
	Z	Special (please consult factory)
	Sound velocity output (SVO) [4]	
	0	Without
	1	With SVO
	PT100 cable extension	
	0	Without
	PTJ	With 1 x junction box for PT100 sensors
	PT100 extension cable (length in m)	
	000	Without
	___	With extension cable (specify length in m)
	Optional items	
		Without (leave space blank)
	PM	With 2 '' pipe mounting bracket
	TA	With stainless steel tag (specify text)
	SW	KATdata+ download software with RS 232 cable

KF170 - **1** - 03- **1** - **1** - **0** - **CD** - **0** - **0** - **0** - **0** - **000** / ☐ (example configuration)

The configuration is customised by choosing from the above-listed options and is expressed by the resulting code at the bottom of the table.

1) For simultaneous measurement on two seperate pipes or for measurement on one single pipe in a two-path sensor mounting configuration.
2) Modbus and HART* compatible outputs can not be used in conjunction with other output options. Please consult factory for more information.
3) For temperature compensation in cases of significant changes in medium temperature during measurement.
4) For contactless product recognition and interface detection.

TRANSDUCERS AND ACCESSORIES

K1	Transducer pair, pipe diameter range 50 ... 3,000 mm	
K4	Transducer pair, pipe diameter range 10 ... 250 mm	
Z	Special (please consult factory)	

Temperature range

Ex Process temperature -50 ... +115 °C, including acoustic coupling paste (II 2G Ex mb IIC T4 - T6)

Z Special (please consult factory)

Internal code

1 Internal code

Degree of protection

1 IP 66 (standard)

2 IP 67 (please consult factory)

3 IP 68 (please consult factory)

Z Special (please specify)

Transducer mounting accessories

0 Without

3 Clamping set DN 10 ... 40

4 Metallic straps and clamps DN 15 ... 310

5 Metallic straps and clamps DN 25 ... 3,000

7 Metallic mounting rail and straps DN 50 ... 250 (transducer type K4)

8 Metallic mounting rail and straps DN 50 ... 3,000 (transducer type K1)

Z Special (please specify)

Stainless steel tag

0 Without

1 With stainless steel tag (please specify text to be engraved)

Transducer connection type and extension cable length

O Without connector or junction box

    C000 Wired transducer connection to flowmeter

JX Extension via ATEX-junction box

    C005 With extension cable, 5 m length

    C010 With extension cable, 10 m length

    C___ With extension cable (specify length in m)

Z Special (please specify)

Optional items

    Without (leave space blank)

    CA 5-point calibration with certificate

K1   Ex- 1 - 3 - 5 - 0 - JX - C010 /   (example configuration)

The configuration is customised by choosing from the above-listed options and is expressed by the resulting code at the bottom of the table.

* HART® is a registered trademark of the *HART Communication Foundation*

Step 1: Introduction

- Keep your KATflow 200/230 flowmeter, the KATdata+ software CD version 2.0.424 (version written on front of CD) and the black USB converter cable ready.

- Insert the KATdata+ CD into your computer. Open the folder of your CD drive. Double-click the **KATdata+ software installer** and follow the instructions to complete the installation. Leave the CD inserted in the CD drive.

- Connect the USB cable to the flowmeter and plug it into the USB socket of your computer. A Windows message similar to the one below should occur (Pic. 1):
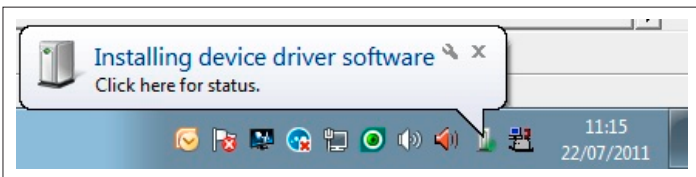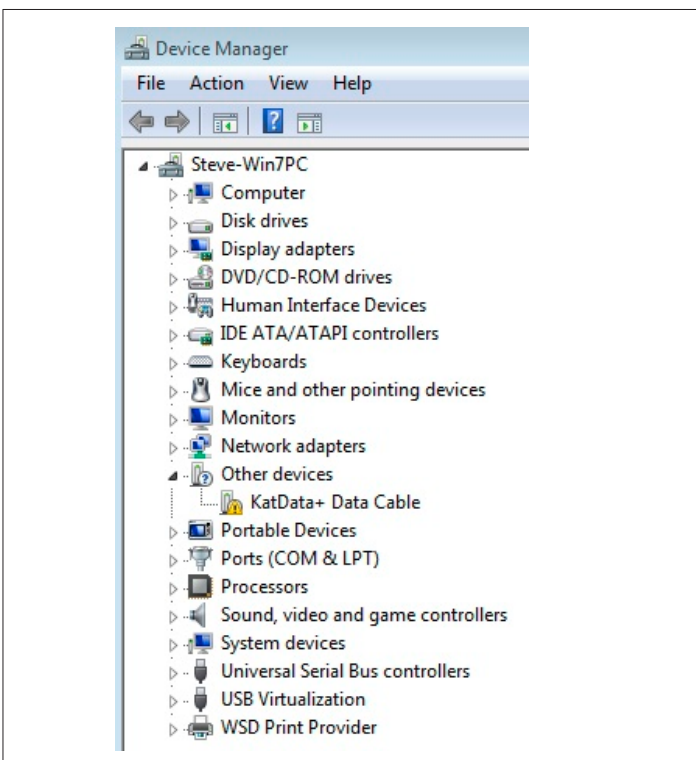

Pic. 1. Installation notice*

- This message should then turn into one similar as below (Pic. 2):
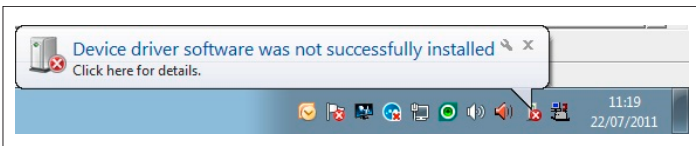
Pic. 2. Failure notice

Step 2: Updating of Driver Software

- Now go to **Start**, open **Control Panel** and start the **Device Manager**. Alternatively, search for the **Device Manager** in the search field of your Windows version.

Pic. 3. Device Manager Menu

Step 2: Updating of Driver Software (continued)

- In the **Device Manager** (Pic. 3) double-click **KATdata+ Data Cable** as found under **Other devices** to open a new window. In this new window click on **Update Driver** (Pic. 4) and select **Browse my computer for driver software** (Pic. 5).
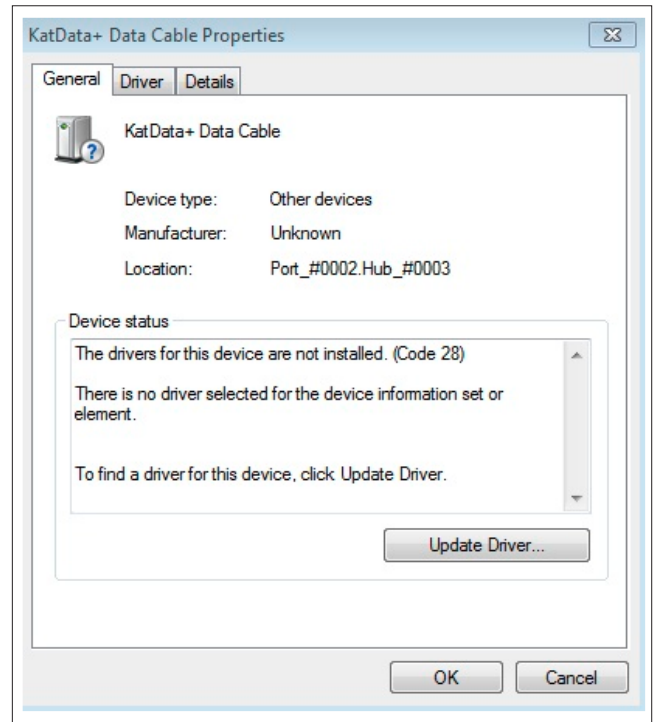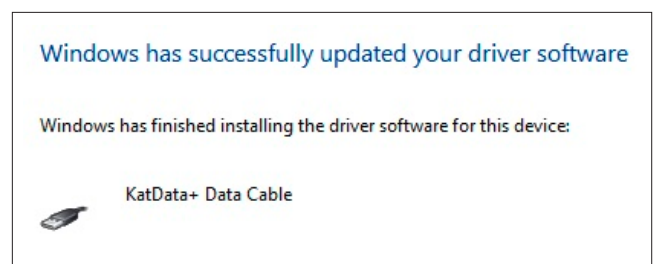

Pic 4. KATdata+ Data Cable properties

Pic. 5. KATdata+ Data Cable driver update

- Select your CD drive as source of the driver and confirm that you would like to go ahead with the installation. You will be prompted that the installation has been successful (Pic. 6).

Pic. 6. Installation notice of driver software

Step 3: Verification of Driver Software

- Go back to your **Device Manager** window (Pic. 7). The **KATdata+ Data Cable** should now be listed under **Universal Serial Bus** controllers.

Pic. 7. Device Manager Menu with installed KATdata+ Data Cable

- Now double-click on **USB Serial Port** as found under **Other devices** to open a new window. In this new window click on **Update Driver** and select **Browse my computer for driver software**.
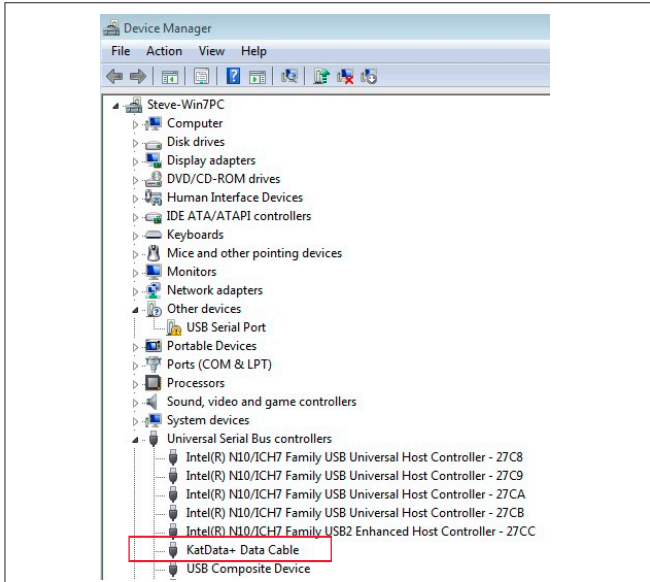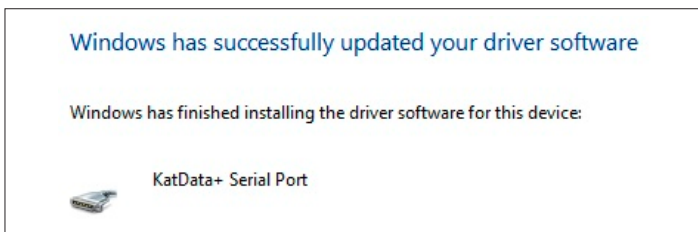- Select your CD drive as source of the driver and confirm that you would like to go ahead with the installation.
- You will be prompted that the installation has been successful (Pic. 8):

Pic. 8. Successful installation of KATdata+ Data Cable Driver

Step 4: Data Download

- Now start KATdata+ and turn on the flowmeter with the **Main Menu** displayed on its screen.
- In KATdata+ go to **Options** – **Preferences** and select the **Serial** tab. Under **Serial Port** select **KATdata+ Serial Port (COM...)**. Confirm with **OK**.
- Now press the white down-pointing arrow in the top left corner of the KATdata+ software to start the download procedure (Pic. 8):
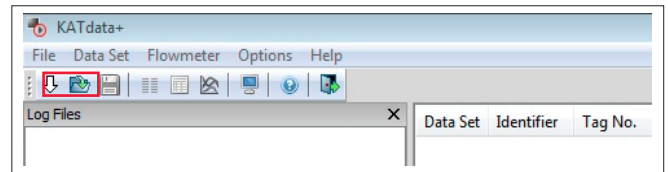
Pic. 8. KATdata+ software menu

- Select a location for the file to be saved and name the file. Make sure it ends **.kat**.
- Press **Save** to start the download. On successful connection, the flowmeter will emit a beeping noise and the download will start. A download status bar will occur on KATdata+ and the flowmeter screen.
- On successful completion of the download the measurement data can be viewed in the software window.
- Should you have questions with regards to the download procedure, please call our office on **+44 (0)2476 714 111** or send an email to **info@katronic.co.uk**.

Katronic Technologies Ltd.	E-mail	info@katronic.co.uk
Tel. +44 (0)2476 714 111	Web	www.katronic.co.uk

* All screenshots have been taken from a computer with Windows 7 operating system. The screens on other operating systems may look similar or different.

6 COMMISSIONING

6.1 Menu structure

Main menu	Menu level 1	Menu level 2	Description/settings
Quick Start			
	Setup Wizard CH1 or CH2		Select channel 1, channel 2
		Sensor type	Indication of sensor type and serial number if automatically detected, otherwise select from list ↓→ • K1N, K1L, K1E, K1Ex, K1P • K4N, K4L, K4E, K4Ex, K4P • K0, M, Q, Special
		Middle units (main displayed)	Select from list where available ↓→ • m/s, ft/s, in/s, m^3/h, m^3/min, m^3/s, l/h, l/min, l/s • USgal/h, USgal/min, USgal/s, bbl/d, bl/h, bbl/min • g/s, t/h, kg/h, kg/min, m^3, l, USgal, bbl, g, t, kg • W, kW, MW, J, kJ, MJ • Signal dB, noise dB, SNR (dB) • C m/s (sound speed), CU (housing temperature) • K (correction factor), REY (Reynolds number) • SOS, DEN, KIN, SHC (sound speed, density, kinematic viscosity, specific heat capacity from inputs/calculation) • TEMP (specified or measured fluid temperature) • PRESS (specified or measured fluid pressure) • T_{in}, T_{out} (inlet and outlet temperature) • Other (assignable input or calculated value) • Math (calculated value – see below)
		Pipe material	Select from list ↓→ • Stainless steel, Carbon steel, Ductile cast iron, Grey cast iron, Copper, Lead, PVC, PP, PE, ABS, Glass, Cement • User (pipe speed of sound)
		Pipe c-speed	(Only if user pipe material selected) 500 … 5 000 m/s
		Outside diameter	6 … 6 500 mm
		Wall thickness	0.5 … 75 mm
		Inner diameter	6 … 6 500 mm
		Fluid	Select from list ↓→ • Water, Salt water, Acetone, Alcohol, Ammonia Carbon Tet (carbon tetrachloride), Ethanol, Ethyl alcohol, Ethyl ether, Ethylene glycol, Glycol/water 50 %, Kerosene, Methanol, Methyl alcohol, Milk, Naphtha, Car oil, Refrigerant R134a, Refrigerant R22, Hydrochloric acid, Sour cream, Sulphuric acid, Toluene, Vinyl chloride • User (enter kinematic viscosity, density, medium c-speed)
		Kinematic viscosity	(Only if user fluid selected) 0 … 30 000 mm^2/s
		Density	(Only if user fluid selected) 100 … 2 000 kg/m^3

Main menu	Menu level 1	Menu level 2	Description/settings
		Medium c-speed	(Only if user fluid selected) 800 ... 3 500 m/s
		Temperature	-30 ... +300 °C
		Liner material	Select from list ↓→ • None • Epoxy, Rubber, PVDF, PP, Glass, Cement • User (liner c-speed)
		Liner c-speed	(Only if lining material selected) 500 ... 5 000 m/s
		Liner thickness	(Only if lining material selected) 1.0 ... 99.0 mm
		Passes	Select from list ↓→ Auto, 1 ... 16
	Start measurement		
		Sensor type	Indication of sensor type and serial number if automatically detected, otherwise select from list ↓→
		SP1 – Sensor frequency	Only for special, unrecognised sensors
		SP2 – Wedge angle	Only for special, unrecognised sensors
		SP3 – Wedge c-speed 1	Only for special, unrecognised sensors
		SP4 – Wedge c-speed 2	Only for special, unrecognised sensors
		SP5 – Crystal offset	Only for special, unrecognised sensors
		SP6 – Spacing offset	Only for special, unrecognised sensors
		SP7 – Zero flow offset	Only for special, unrecognised sensors
		SP8 – Upstream offset	Only for special, unrecognised sensors
		Sensor K factor	Only for special, unrecognised sensors
	Totaliser		Off, On Reset+ (positive total), Reset- (negative total) Reset both
Installation			Select channel 1, channel 2
	Pipe		
		Material	Select from pipe material list ↓→
		Outside dia	6 ... 6 500 mm (outside diameter)
		Wall thk	0.5 ... 75 mm (wall thickness)
		Inner dia	6 ... 6 500 mm (inner diameter)
		C-speed	600 ... 6 554 m/s (transverse sound speed pipe)

Main menu	Menu level 1	Menu level 2	Description/settings
		L-speed	600 … 8 000 m/s (longitudinal sound speed pipe)
		Circumfer	18.8 … 20 420 mm (pipe circumference)
		Roughness	0 … 10 mm
	Medium		
		Fluid	Select from fluid list ↓→
		Kinematic viscosity	0 … 30 000 mm^2/s
		Dynamic viscosity	0 … 60 kg s^{-1} m^{-1}
		Density	100 … 2 000 kg/m^3
		C-speed	800 … 3 500 m/s
		Temperature	-30 … +300 °C
	Lining		
		Material	Select from material list ↓→
		Thickness	0.1 … 99.9 mm
		C-speed	500 … 6 553 m/s
	Passes		Select from list ↓→
Display			Select channel 1, channel 2
		Top line	Select units from list ↓→
		Middle line	Select units from list ↓→
		Bottom line	Select units from list ↓→
		Damping	Reduces fluctuations in the display output: 1 … 255 s
		Metric/Imp.	Use metric or imperial units for entered data
In/Output			Lists available input/output slots Possible configurable settings below [where specified]
	I Out		Analogue current output (active or passive)
		Source	Select from list ↓→ Off, Channel 1, Channel 2, Math 1, Math 2, System, Test
		Units	Select from list ↓→
		Min. value	Min. process variable (PV) value that corresponds to 0 mA (only active) or 4 mA
		Max. value	Max. process variable (PV) value that corresponds to 20 mA
		Damping	Additional smoothing of the current output, the higher the damping factor: 1 … 255 s
		Span	0 … 20 mA (only active) or 4 … 20 mA
		Error	Defines output behaviour in the event of error Select from list ↓→ • Hold (hold last value, select hold time) • 3.8 mA • 21.0 mA

Main menu	Menu level 1	Menu level 2	Description/settings
	Voltage Out		Analogue voltage output
		Source	Select from list ↓→ Off, Channel 1, Channel 2, Math 1, Math 2, System, Test
		Units	Select from list ↓→
		Min. value	Min. process variable (PV) value that corresponds to 0 V
		Max. value	Max. process variable (PV) value that corresponds to 10 V
		Damping	Additional smoothing of the current output, the higher the damping factor: 1 ... 255 s
		Error	Defines output behaviour in the event of error Select from list ↓→
	Frequency Out		Analogue frequency output
		Source	Select from list ↓→ Off, Channel 1, Channel 2, Math 1, Math 2, System, Test
		Units	Select from list ↓→
		Min. value	Min. process variable (PV) value that corresponds to minimum frequency
		Max. value	Max. process variable (PV) value that corresponds to maximum frequency
		Damping	Additional smoothing of the current output, the higher the damping factor: 1 ... 255 s
	Pulse Out		Digital open-collector output
		Source	Select from list ↓→ Off, Channel 1, Channel 2, Math 1, Math 2, System, Test
		Units	Select from list ↓→
		Mode	Select from list ↓→ Alarm: PV alarm switch • On point – Value of the process variable (PV) at which the relay switches to alarm mode • Off point – Value of the process variable (PV) at which the relay interrupts the alarm mode again Pulse: Sum value of the selected process variable (PV) for which a pulse signal is generated, e. g. PV [m^3/h], pulse value = 10, a pulse is generated every 10 m^3 • Value: 0.01 ... 1 000 • Width: Duration of the pulse 30 ... 999 ms • Source (Grand, Positive, Negative) Linear: Calculated maximum number of pulses per second, i. e. the maximum pulse rate in Hz • Min. value • Max. value • Damping (in s)
	Relay Out		Digital relay output
		Source	Select from list ↓→ Off, Channel 1, Channel 2, Math 1, Math 2, System, Test
		Units	Select from list ↓→

Main menu	Menu level 1	Menu level 2	Description/settings
		Mode	Select from list ↓→ Alarm: • On point – Value of the process variable (PV) at which the relay switches to alarm mode • Off point – Value of the process variable (PV) at which the relay interrupts the alarm mode again Pulse: • Value • Width Linear: • Min. value • Max. value • Damping
	Pt 100 4 Wire		Temperature input
		Source	Select from list ↓→ Off, Channel 1, Channel 2, Math 1, Math 2, System, Test
		Type	Select from list ↓→ • User – Input of a temperature value defined by the user within the range 0 … +250 °C • Pt 100 – Temperature (in °C) determined and read in by a probe (Pt 100)
		In-Out	Select from list ↓→ • Inlet – Input of a fixed temperature value for the inlet within the range 0 … +250 °C • Outlet – Input of a fixed temperature value for the outlet within the range 0 … +250 °C • Comp. – Input of a user-defined offset within the range -100 … +100 °C
	Current In		Analogue current input (passive or active)
		Source (channel)	Select from list ↓→ Off, Channel 1, Channel 2, Math 1, Math 2, System, Test
		Source (value)	Select from list ↓→ Density, Viscosity, Temperature, Pressure, Other
		Min. Value	Minimum as on outputs
		Max. Value	Maximum as on outputs
		Span	0 … 20 mA or 4 … 20 mA
	RS 485		[where specified]
	Modbus TCP		Enter address
	HART		[HART® compatible output, where specified]
	Other In/Out types		Refer to Technical Support
System			
	Instrument info		
		Model code	KF170
		Serial number	Example: 20000003
		HW revision	Example: 3.00, 1.50

Main menu	Menu level 1	Menu level 2	Description/settings
		SW revision	Example: 4.22-7565, 3.04
	Calculation		
		Select channel	Select channel 1, channel 2
		Low flow cut off	± Low flow velocity cut off: 0 ... 0.10 m/s
		Max. flow cut off	± Maximum flow velocity cut off: 0 ... 30 m/s
		Corrected	Apply flow velocity profile correction: Yes/No
		PV offset	Calibration process variable zero offset: -30 ... +30 units
		PV scaling	Calibration process variable gradient scaling: 0 ... 1 000 units
		Zero calibration	Zero calibration settings Adjust: • Zero (Yes/No): Sets current flow as zero (Perform auto zero calibration) • Track (Yes/No): Zero follows output variations • Delta time: Zero flow offset in ns (Zero flow delta time offset in ns, read from sensor PROM or entered directly for special sensors) • Time up: Transit time offset in µs, for delays in special sensors, thermal buffers and cable extensions
		Math Function	Select from list ↑↓ None, Sum, Difference, Average (mean), Maximum
		Heat Capacity	Specify heat capacity of the medium
	User		
		Identifier	Example: Pump P3A (9 character string possible)
		Tag No	Tag Number: Example: 1FT-3011 (9 character string possible)
		Password	Set 4 character password (default 1111)
	Test		
		Installation	Control system simulation 60 second ramping up of flow velocity in m/s from 0 to programmed Max. flow cut off and subsequent 60 second ramping down All configured outputs will exhibit their programmed behaviour Test Mode: Yes/No
		Display	Display screen test routine
		Keypad	Keypad test routine
		Memory	Memory test routine Memory erase: Yes/No
		Peripherals	Unit temperature, time, date, clock
		Ultrasonics	Tests ultrasonic board and sensors
		Calibrate Pt 100s	Tests measured temperature and resistance
		Reset Pt 100s	Resets temperature inputs
	Settings		
		Date	Example: 18/11/2019
		Time	Example: 09:27:00

| Main menu	Menu level 1	Menu level 2	Description/settings
		Date format	Select from list ↓→ • dd/mm/yy • mm/dd/yy • yy/mm/dd
		Language	Select from list (as available) ↓→ English, German, French, Spanish, Russian
		Keypad	Keypad sound: Yes/ No
	Defaults		Load default settings (except date and time): Yes/No
Diagnostics			
			Shows measured temperature, available logger memory (Cycle using **ENT**)
Data logger			
		Interval	Enter logging interval in seconds: 0 … 999 s
		Selection	Select from list ↓→ **ENT** selects and deselects Up to ten variables may be logged
		Low memory	Warning output: Logger space remaining at low memory alarm 0 … 100 %
		Log download	Sends all logger data using serial port
		Log erase	Clears the logger
		Log wrap	Saves "selected" items as a continuous stream without headers (Note : this means files cannot be processed by KATdata+) Yes/No
Serial comms			Serial communication
		Mode	Select from list ↓→ • None • Printer (continuous 1 s serial ASCII output) • Diagnostic • Download (send logger data using serial port) • Cal Test (laboratory calibration, not recommended for field or customer use)
		Baud	Select from list ↓→ • 9 600 (default) • 19 200 • 57 600 • 115 200
		Parity	Select from list ↓→ • None • Even (default) • Odd
		Type	Select from list ↓→ RS 232, RS 485 etc. (as installed)
Scope			Hidden option that can be accessed by pressing **ALT** three times in the main menu

Main menu	Menu level 1	Menu level 2	Description/settings
			Shows the received acoustic pulse and further data to evaluate the signal quality as an oscilloscope function on channel 1 only (see Section 6.8)

Table 15: Menu structure KATflow 170

6.2   Output configuration

The assignment of slots is detected by the flowmeter, and will be as shown in the "In/Output" menu. The following picture shows an example assignment with a passive current input on slot 1 (line 1) and an active current output on slot 2 (line 2).
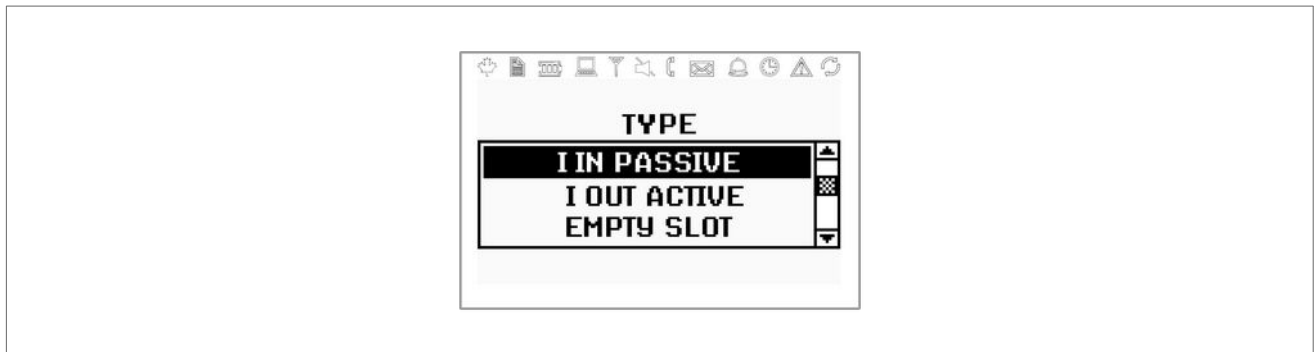
Picture 16: Display example passive current input

6.2.1   Serial interface

The RS 232 serial interface can be used to transmit data online over distances up to 15 m, to download the integral data logger content, for device configuration and maintenance tasks or to communicate with peripheral equipment. The settings can be found in the "Serial Communication" submenu.

6.2.2   Modbus RTU

The interface is used for networking up to 32 flowmeters to a centralised computer system. Each flowmeter is given an unique address to be able to communicate effectively. The communication protocol used conforms to the conventions of the Modbus RTU protocol, a description of which is given in a separate document. Please refer to Customer Support for further information.

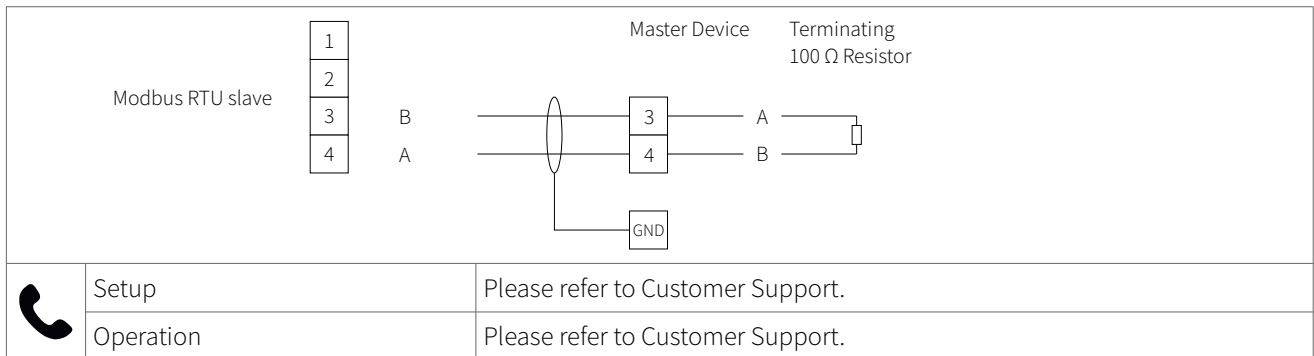|	Setup	Please refer to Customer Support.
	Operation	Please refer to Customer Support.

Table 16: Wiring Modbus RTU

6.2.3 HART® compatible output

The KATflow 170 can also be configured with an optional module which responds to output commands conforming to the HART® protocol. Please refer to Customer Support for further information.

HART® is a registered trademark of the HART Communication Foundation.

Electrical characteristics	• Galvanically isolated from main electronics and from other inputs and outputs • 4 process variables selectable (PV, SV, TV and FV) • Analogue: 4 … 20 mA passive, R_{Load} = 220 Ω, U = 24 V, accuracy: 0.1 % of measured value
Setup	Please refer to Customer Support.
Operation	Please refer to Customer Support.

Table 17: Wiring HART® compatible output

6.2.4 Analogue current output 0/4 … 20 mA

The analogue current outputs operate in a 4 … 20 mA or 0 … 20 mA span.

Current outputs may be assigned to process values in the "Mode" section of the output menu. The outputs can be programmed and scaled within the menu structure.

Electrical characteristics	• 0/4 … 20 mA active and 4 … 20 mA passive options • Galvanically isolated from main electronics and from other inputs and outputs • Active: U = 30 V, R_{Load} < 500 Ω, 16 bit resolution, accuracy: 0.1 % of measured value • Passive: U = 9 … 30 V, R_{Load} < 500 Ω, 16 bit resolution, accuracy: 0.1 % of measured value

Table 18: Wiring analogue current output 0/4 … 20 mA

6.2.5 Analogue voltage output 0 … 10 V

Voltage outputs may be assigned to process values in the "Mode" section of the output menu. The outputs can be programmed and scaled within the menu structure.

Volts out (optional)		
	1 V- —————— 2 3 V+ ——————→ 0 … 10 V DC 4	
Electrical characteristics	• Galvanically isolated from main electronics and from other inputs and outputs • Range: 0 … 10 V • $R_{Load} = 1\ k\Omega$, $C_{Load} = 200\ pF$ • Resolution: 16 bit, accuracy: 0.1 % of measured value	

Table 19: Wiring analogue voltage output 0 … 10 V

6.2.6 Analogue frequency output (passive)

Frequency outputs may be assigned to process values in the "Mode" section of the output menu. The outputs can be programmed and scaled within the menu structure.

Frequency (analogue output) (optional)		
	1 2 3 - —————— 4 + ——————	
Electrical characteristics	• Galvanically isolated from main electronics and from other inputs and outputs • 2 Hz … 10 kHz • $U = 24\ V$, $I_{max} = 4\ mA$	

Table 20: Wiring analogue frequency output (passive)

6.2.7 Digital open-collector output

Open-collector outputs may be assigned to process values in the "Mode" section of the output menu. The outputs are configured using the menu structure.

The totaliser function is enabled and controlled using the menu structure.

Optically switched relay "Open-Collector" (optional)		
	1 + —— NO —— 2 - —— NO —— 3 - —— NC —— 4 + —— NC ——	
Electrical characteristics	• Galvanically isolated from main electronics and from other inputs and outputs • Function: Alarm or Totaliser • Totaliser value: 0.01 … 1 000/unit • Width: 1 … 990 ms • $U = 24\ V$, $I_{max} = 4\ mA$ • NO and NC contacts	

Table 21: Wiring digital open-collector output

6.2.8 Digital relay output

Relay outputs may be assigned to process values in the "Mode" section of the output menu. The relay outputs are configured using the menu structure.

Relay (optional)		
	1	—— NO ——
	2	—— NO ——
	3	—— NC ——
	4	—— NC ——
Electrical characteristics	• Galvanically isolated from main electronics and from other inputs and outputs • Function: Alarm or Totaliser • Totaliser value: 0.01 … 1 000/unit • Width: 1 … 990 ms • $U = 48$ V, $I_{max} = 250$ mA • NO and NC contacts	

Table 22: Wiring digital relay output

6.3 Input configuration

6.3.1 Pt 100 inputs

Temperature input Pt 100 3-wire (optional)	1	-FEED		Pt 100 temperature sensor
	2	-R		
	3	+R		
	4	+FEED		
Temperature input Pt 100 4-wire (optional)	1	-FEED		Pt 100 temperature sensor
	2	-R		
	3	+R		
	4	+FEED		
Electrical characteristics	• Pt 100 options: three- or four-wire circuit • Galvanically isolated from main electronics and from other inputs and outputs • Measurement range: -50 … +400 °C (-58 … +752 °F) • Resolution: 0.01 K, accuracy: ±0.02 K			

Table 23: Wiring Pt 100 inputs

6.3.2 Analogue current input 0/4 … 20 mA

Active analogue input (optional)	1	-		
	2	I$_{in}$		0/4 … 20 mA, active input
	3	I$_{in}$	(A)	
	4	30 V DC		
Passive analogue input (optional)	1	-		
	2	I$_{in}$	(A)	4 … 20 mA, passive input
	3	I$_{in}$		
	4	30 V DC		
Electrical characteristics	• 0/4 … 20 mA active or 4 … 20 mA passive • U = 30 V, R$_i$ = 50 Ω, accuracy: 0.1 % of measured value			

Table 24: Wiring analogue current input 0/4 … 20 mA

6.4 Temperature compensation

With temperature compensation enabled the temperature dependency of the medium in relation to speed of sound, viscosity and density calculations will be compensated. The "In/Output" menu will then allow the user to select the temperature input source, either Pt 100 temperature sensors or via a 0/4 … 20 mA input channel.

6.5 Heat quantity measurement

Where equipped, heat quantity (energy) and heat flow (energy flow) can be measured. If a heat quantity unit is specified for the process value, the KATflow 170 will ask the user for the specific heat capacity of the medium in J/g/K (for example 4.186 J/g/K for water).

The output options menu for the Pt 100 will allow the user to select the temperature input source; either Pt 100 temperature sensors or a fixed value for measurement against a known inlet or outlet temperature. Where Pt 100 sensors are selected, the Wizard will prompt the user for a temperature offset, which may be useful where the temperature of the medium differs from the temperature of the pipe wall (for example with unlagged pipes). If a fixed value is selected, the user will be asked to specify this value.

When heat quantity units are selected, these behave as any other process value and may be totalised, logged, or applied to a process output.
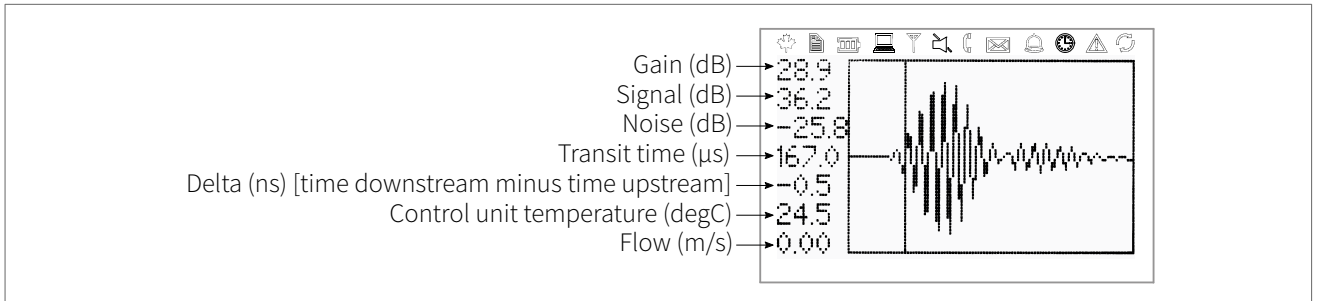
6.6 Sound velocity measurement

The measured speed of sound (SOS) is available as a diagnostic function during measurement and may be applied to a process output by selecting "C" from the appropriate output menu.

6.7 Dual-channel flow calculations

Where suitably equipped, dual-channel calculations are available from the System - Calculation - Math menu. These allow the user to select the Sum, Difference, Average (mean) or Maximum of the two flow channels. This value may be displayed or applied to a process output by selecting "Math" from the appropriate output menu.

6.8 Scope function

Katronic flowmeters have an additional scope function which shows a representation of the pulse received by the sensors on channel 1. In addition to displaying the received pulse, this screen lists the data given from top to bottom (see Picture 17).

Gain (dB) → 28.9
Signal (dB) → 36.2
Noise (dB) → −25.8
Transit time (µs) → 167.0
Delta (ns) [time downstream minus time upstream] → −0.5
Control unit temperature (degC) → 24.5
Flow (m/s) → 0.00

Picture 17: Scope function display

6.9 KATdata+ software

Software can be provided for downloading the contents of the data logger and communication with the flowmeter.