



OPERATING INSTRUCTIONS

KATflow 200

Hand-Held Clamp-On Ultrasonic Flowmeter



KATflow 200

Operating Instructions

Katronic Technologies Ltd.
Earls Court
Warwick Street
Coventry CV5 6ET
United Kingdom

Tel. +44 (0)2476 714 111
Fax +44 (0)2476 715 446
E-mail info@katronic.co.uk
Web www.katronic.co.uk

TABLE OF CONTENTS

1 SAFETY INSTRUCTIONS, LEGAL REQUIREMENTS, WARRANTY, RETURN POLICY	4	4.3.2 Display icons and functions	21
1.1 Symbols	4	4.4 Quick Setup Wizard	23
1.2 Safety instructions	4	4.5 Measurement	26
1.3 Warranty	5	4.5.1 Main process value display	26
1.4 Return policy	5	4.5.2 Three-line display	26
1.5 Legislative requirements	5	4.5.3 Totaliser	26
2 INTRODUCTION	6	4.5.4 Diagnostic display	27
2.1 Clamp-on transit-time flowmeter	6	4.5.5 Data logger	28
2.2 Measuring principle	6	5 COMMISSIONING	29
3 INSTALLATION	7	5.1 Menu structure	29
3.1 Unpacking and storage	7	5.2 Output settings	36
3.1.1 Unpacking	7	5.2.1 Serial interface RS 232	36
3.1.2 Storage	7	5.3 Wall thickness measurement	36
3.1.3 Identification of components	7	5.3.1 Wall Thickness Calibration	36
3.2 Clamp-on sensor installation	8	5.4 Scope function	37
3.2.1 Acoustic propagation	8	5.5 KATdata+ software	37
3.2.2 Straight pipe lengths	8	6 MAINTENANCE	38
3.3 Installation location	9	6.1 Service/Repair	38
3.4 Pipe preparation	11	7 TROUBLESHOOTING	39
3.5 Sensor mounting configurations and separation distance	12	7.1 Measurement difficulties and error messages	39
3.5.1 Reflection Mode	12	7.2 Data download difficulties	41
3.5.2 Diagonal Mode	12	8 TECHNICAL DATA	42
3.5.3 Transducer separation distance	12	8.1 Sound speed of selected pipe materials	42
3.6 Flowmeter installation	13	8.2 Technical data of selected fluids	43
3.6.1 Outline dimensions	13	8.3 Dependence between temperature and sound speed in water	46
3.6.2 Electrical connections	14	9 SPECIFICATION	49
3.7 Clamp-on sensor mounting	15	9.1 General	49
3.7.1 Acoustic coupling gel	15	9.2 Flowmeter	49
3.7.2 Correct positioning of the sensors	16	9.3 Quantity and units of measurement	50
3.7.3 Sensor mounting with fixtures and chains	17	9.4 Internal data logger	50
4 OPERATION	18	9.5 Communication	50
4.1 Switching On/Off	18	9.6 KATdata+ software	50
4.2 Battery charging	18	9.7 Sensors: K1L, K1N, K1E	51
4.3 Keypad and display	19	9.8 Sensors: K4L, K4N, K4E	51
4.3.1 Keypad key functions	19	10 INDEX	52
		11 APPENDIX A – Certificate of Conformity	53
		12 APPENDIX B – Customer Return Note (CRN)	54

1 SAFETY INSTRUCTIONS, LEGAL REQUIREMENTS, WARRANTY, RETURN POLICY

1.1 Symbols



Danger

This symbol represents an immediate hazardous situation which could result in serious injury, death or damage to the equipment. Where this symbol is shown, do not use the equipment further unless you have fully understood the nature of the hazard and have taken the required precautions.



Attention

This symbol indicates important instructions which should be respected in order to avoid damaging or destroying the equipment. Follow the precautions given in these instructions to avoid the hazard. Call our service team if necessary.



Call service

Where this symbol is shown call our service team for advice if necessary.



Note

This symbol indicates a note or detailed setup tip.

ESC

Operator key

Operator keys are printed in bold typeface.

1.2 Safety instructions

- Do not install, operate or maintain this flowmeter without reading, understanding and following these operating instructions, otherwise injury or damage may result.
- Study these operating instructions carefully before the installation of the equipment and keep them for future reference.
- Observe all warnings, notes and instructions as marked on the packaging, on the equipment, and detailed in the operating instructions.
- Do not use the instrument under wet conditions with the battery cover removed or opened.
- Follow the unpacking, storage and preservation instructions to avoid damage to the equipment.
- Install the equipment and cabling securely and safely according to the relevant regulations.
- If the product does not operate normally, please refer to the service and troubleshooting instructions, or contact Katronic for help.

SAFETY INSTRUCTIONS, LEGAL REQUIREMENTS, WARRANTY, RETURN POLICY

1.3 Warranty

- Any product purchased from Katronic is warranted in accordance with the relevant product documentation and as specified in the sales contract provided. This is subject to the condition that it has been used for the purpose for which it has been designed and operated as outlined in these operating instructions. Misuse of the equipment will immediately revoke any warranty given or implied.
- Responsibility for suitability and intended use of this ultrasonic flowmeter rests solely with the user. Improper installation and operation of the flowmeter may lead to a loss of warranty.
- Please note that there are no operator-serviceable parts inside the equipment. Any unauthorised interference with the product will invalidate the warranty.

1.4 Return policy

If the flowmeter has been diagnosed to have a problem, it can be returned to Katronic for repair using the Customer Return Note (CRN) attached to the Appendix of this manual. Katronic regret that for health and safety reasons we cannot accept the return of the equipment unless accompanied by the completed CRN.

1.5 Legislative requirements



CE Marking

The flowmeter is designed to meet the safety requirements in accordance with sound engineering practice. It has been tested and has left the factory in a condition in which it is safe to operate. The equipment is in conformity with the statutory requirements of the EC directive and complies with applicable regulations and standards for electrical safety EN 61010 and electromagnetic compatibility EN 61326. A CE Declaration of Conformity has been issued in that respect, a copy of which can be found in the Appendix of these operating instructions.



WEEE Directive

The Waste Electrical and Electronic Equipment Directive (WEEE Directive 2012/19/EU) aims to minimise the impact of electrical and electronic goods on the environment by increasing re-use and recycling and by reducing the amount of WEEE going to landfill. It seeks to achieve this by making producers responsible for financing the collection, treatment, and recovery of waste electrical equipment, and by obliging distributors to allow consumers to return their waste equipment free of charge. Katronic offers its customers the possibility of returning unused and obsolete equipment for correct disposal and recycling. The dustbin symbol indicates that when the last user wishes to discard this product, it must be sent to appropriate facilities for recovery and recycling. By not discarding this product along with other household-type waste, the volume of waste sent to incinerators or landfills will be reduced and natural resources will be conserved. Please use the Customer Return Note (CRN) in the Appendix for return to Katronic.



RoHS Directive

All products manufactured by Katronic are compliant with the relevant aspects of the RoHS Directive.

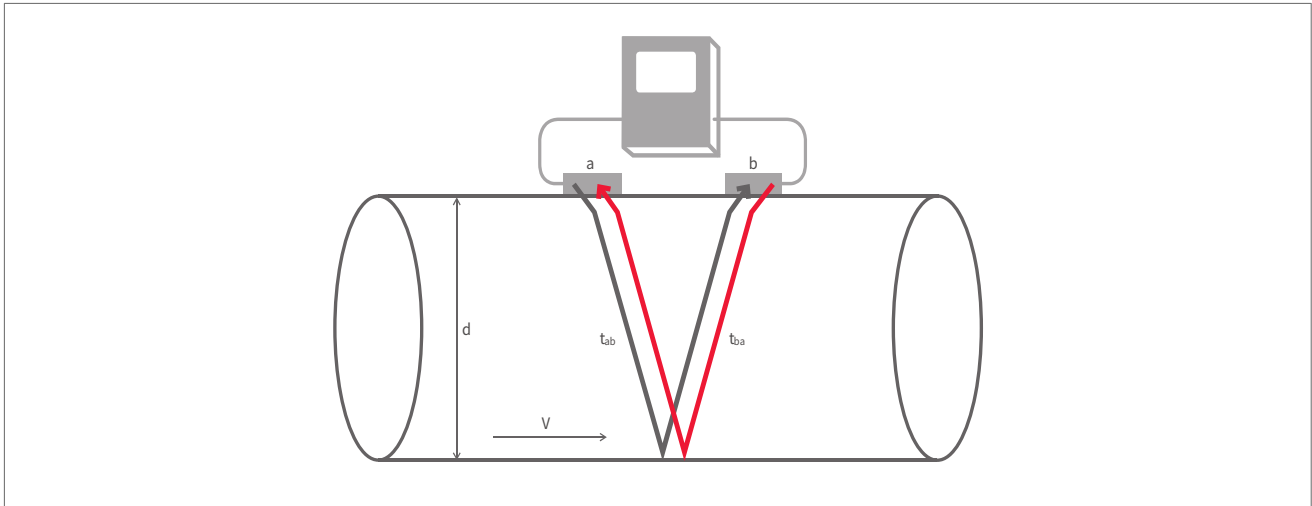
KATflow 200

INTRODUCTION

2 INTRODUCTION

2.1 Clamp-on transit-time flowmeter

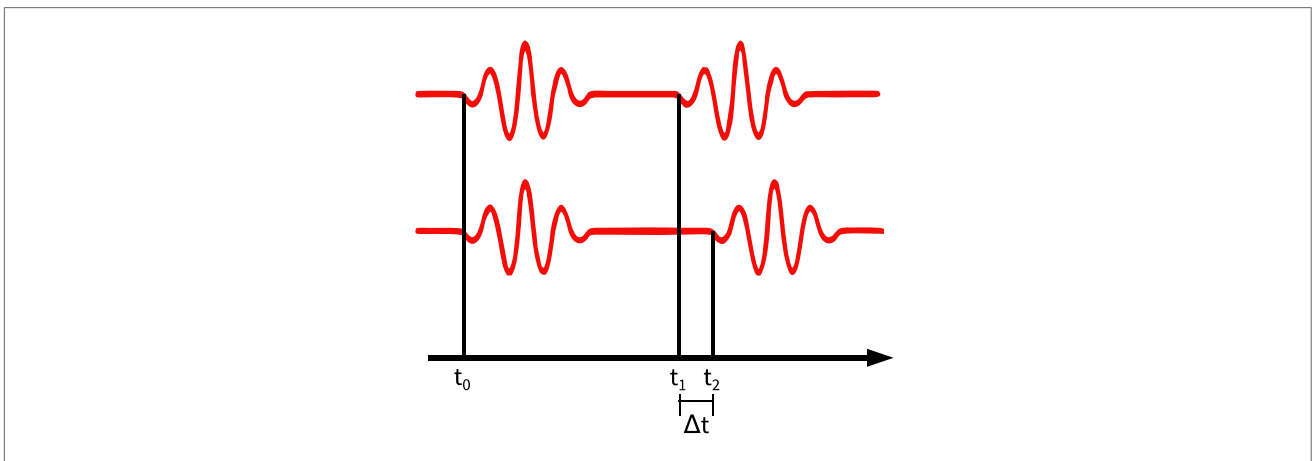
The KATflow 200 is a hand-held, battery operated ultrasonic flowmeter employing clamp-on sensors for the measurement of liquids in full, enclosed pipes. Flow measurements can be undertaken without interruption of the process or interference with the integrity of the pipeline. The clamp-on sensors are attached to the outside of the pipes. The KATflow 200 uses ultrasonic signals for measurement of the flow, employing the transit-time method.



Picture 1: Clamp-on ultrasonic flowmeter configuration

2.2 Measuring principle

Ultrasonic signals are emitted by a transducer installed on a pipe and received by a second transducer. These signals are emitted alternately in the direction of flow and against it. Because the medium is flowing, the transit time of the sound signals propagating in the direction of flow is shorter than the transit time of the signal propagating against the direction of flow. The transit-time difference Δt is measured and allows the determination of the average flow velocity along the path of acoustic propagation. A profile correction is then performed to obtain the average flow velocity over the cross-sectional area of the pipe, which is proportional to the volumetric flow rate.



Picture 2: Transit-time measuring principle

3 INSTALLATION

3.1 Unpacking and storage

3.1.1 Unpacking

Care should be taken when opening the box containing the flowmeter, any markings or warnings shown on the packaging should be observed prior to opening. The following steps should then be taken:

- Unpack the flowmeter in a dry area.
- The flowmeter should be handled with care and not left in an area where it could be subject to physical shocks.
- If using a knife to remove packaging care should be taken not to damage the flowmeter or cables.
- The flowmeter package and contents should be checked against the delivery note supplied and any missing items reported immediately.
- The flowmeter package and contents should be checked for signs of damage during transport and any problems reported immediately.
- The vendor accepts no responsibility for damage or injury caused during the unpacking of the instrumentation supplied.
- Excess packing materials should be either recycled or disposed of in a suitable way.

3.1.2 Storage

If storage is necessary, the flowmeter and sensors should be stored:

- in a secure location,
- away from water and harsh environmental conditions,
- in such a way as to avoid damage,
- small items should be kept together in the bags and small plastic boxes provided to avoid loss.

3.1.3 Identification of components

The following items are typically supplied (please refer to your delivery note for a detailed description):

- KATflow 200 hand-held flowmeter,
- Clamp-on sensors (usually one or two pairs depending on pipe sizes to be measured),
- Sensor extension cable(s) (optional),
- Sensor mounting accessories,
- Coupling component,
- Measuring tape,
- Operating instructions,
- Wall thickness measurement probe (optional),
- Calibration certificate(s) (optional).

3.2 Clamp-on sensor installation

The correct selection of the sensor location is crucial for achieving reliable measurements and high accuracy. Measurement must take place on a pipe in which sound can propagate (see Section 3.2.1 Acoustic propagation) and in which a rotationally symmetrical flow profile is fully developed (see Section 3.2.2 Straight pipe lengths).

The correct positioning of the transducers is an essential condition for error-free measurements. It ensures that the sound signal will be received under optimal conditions and evaluated correctly. Because of the variety of applications and the different factors influencing the measurement, there can be no standard solution for the positioning of the transducers.

The correct position of the transducers will be influenced by the following factors:

- diameter, material, lining, wall thickness and general condition of the pipe,
- the medium flowing in the pipe,
- the presence of gas bubbles and solid particles in the medium.



Check that the temperature at the selected location is within the operating temperature range of the transducers (see Chapter 9).

3.2.1 Acoustic propagation

Acoustic propagation is achieved when the flowmeter is able to receive sufficient signal from the transmitted ultrasonic pulses. The signals are attenuated in the pipe material, the medium and at each of the interfaces and reflections. External and internal pipe corrosion, solid particles and gas content in the medium contribute heavily to signal attenuation.

3.2.2 Straight pipe lengths

Sufficient straight lengths of pipe on the inlet and outlet of the measuring location ensure an axi-symmetrical flow profile in the pipe, which is required for good measurement accuracy. If insufficient straight lengths of pipe are available for your application measurements are still obtainable, but the certainty of the measurement can be reduced.

3.3 Installation location

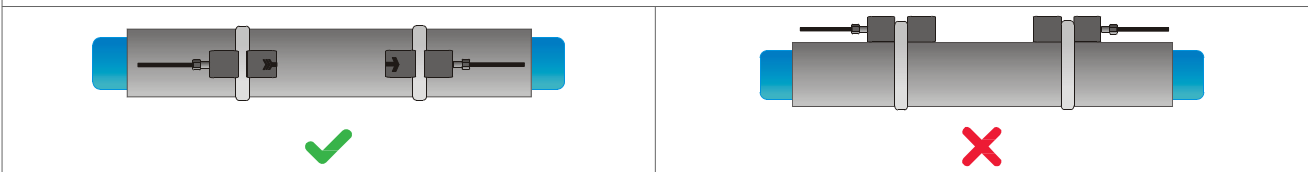
Select an installation location following the recommendations in Table 1 and try to avoid measuring:



- in the vicinity of deformations and defects of the pipe,
- near welding seams,
- where deposits could be building up in the pipe.

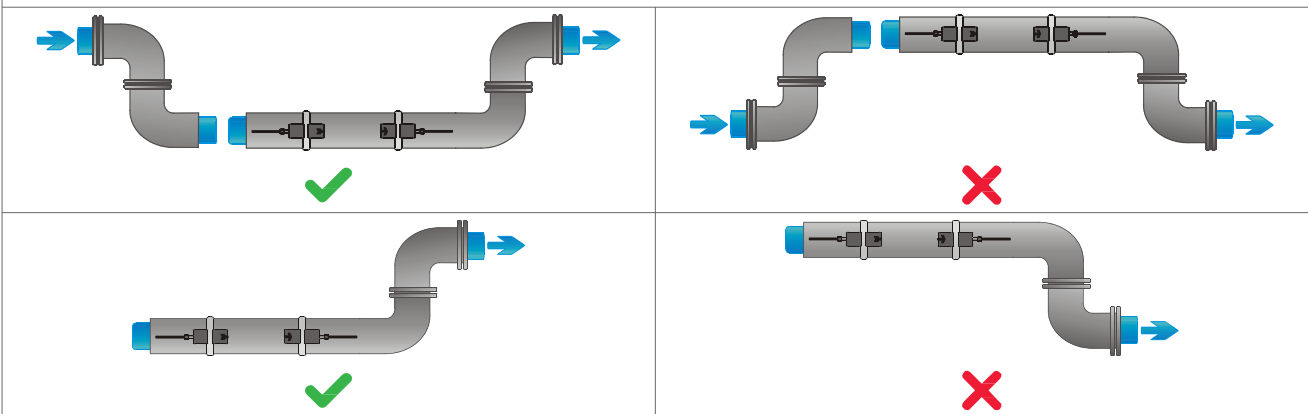
For a horizontal pipe:

Select a location where the transducers can be mounted on the side of the pipe, so that the sound waves emitted by the transducers propagate horizontally in the pipe. In this way, the solid particles deposited on the bottom of the pipe and the gas pockets developing at the top will not influence the propagation of the signal.



For a free inlet or outlet pipe section:

Select the measuring point at a location where the pipe cannot run empty.



For a vertical pipe:

Select the measuring point at a location where the liquid flows upward to ensure that the pipe is completely filled.

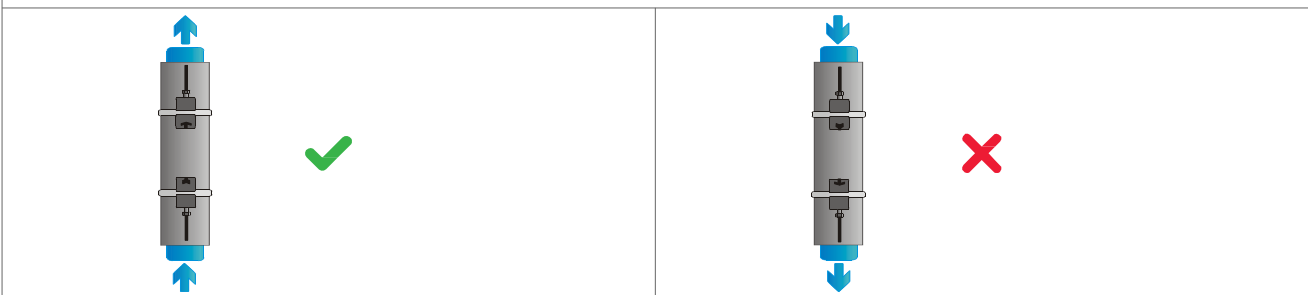


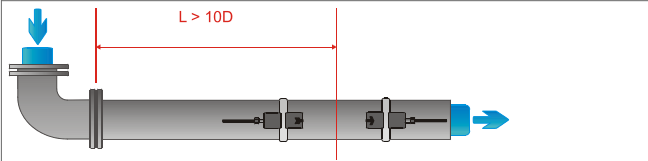
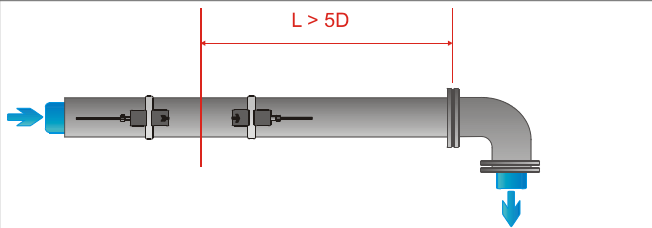
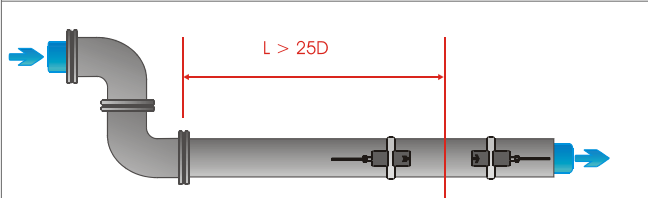
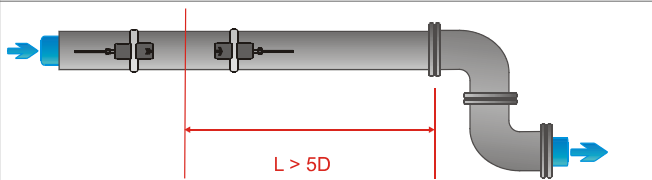
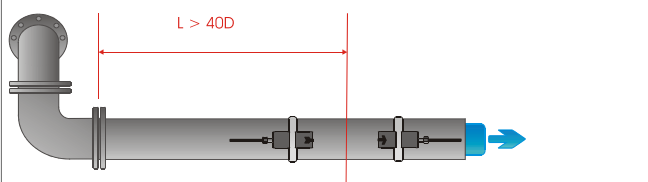
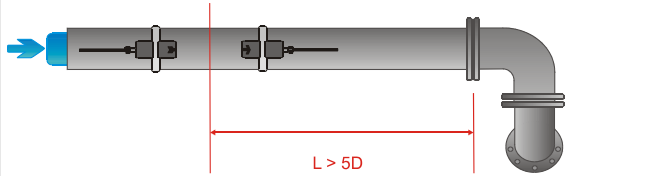
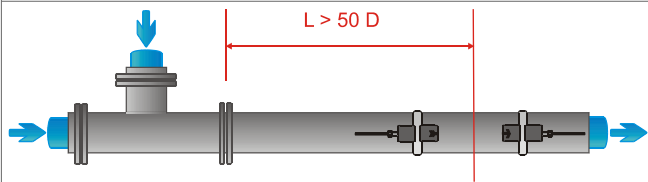
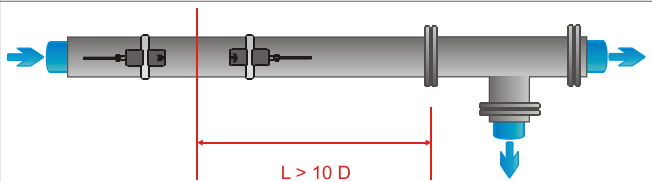
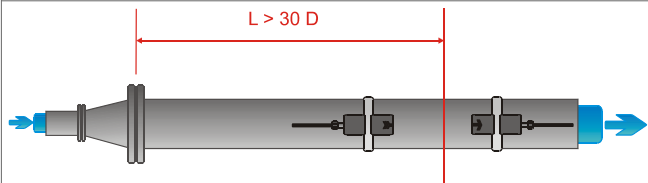
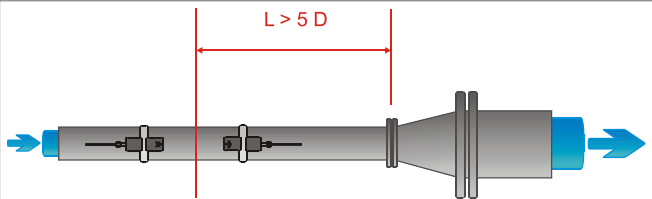
Table 1: Recommendations for sensor mounting location



Look for a sensor installation location with sufficient straight pipe to obtain accurate measurements. Please refer to Table 2 as a guideline for recommended distances from disturbance sources.

KATflow 200

INSTALLATION

Disturbance source: 90°-elbow Inlet $L \geq 10D$ 	Outlet $L \geq 5D$ 
Disturbance source: 2 x 90°-elbow in one plane Inlet $L \geq 25D$ 	Outlet $L \geq 5D$ 
Disturbance source: 2 x 90°-elbow in different planes Inlet $L \geq 40D$ 	Outlet $L \geq 5D$ 
Disturbance source: T-section Inlet $L \geq 50D$ 	Outlet $L \geq 10D$ 
Disturbance source: diffuser Inlet $L \geq 30D$ 	Outlet $L \geq 5D$ 

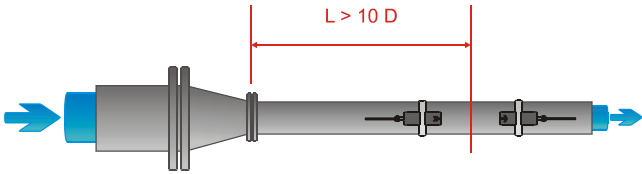
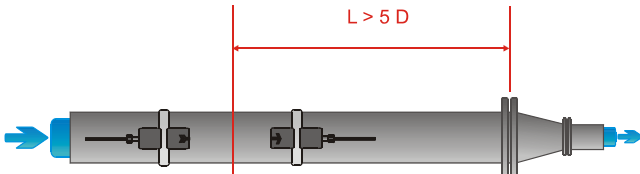
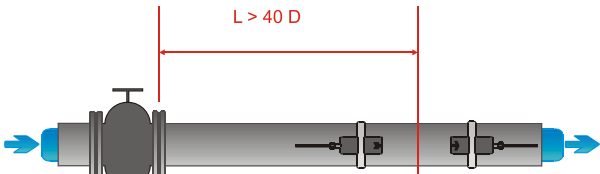
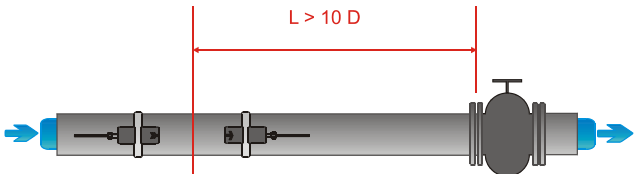
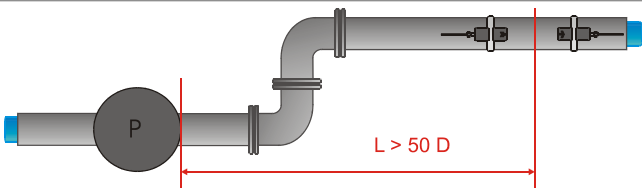
<p>Disturbance source: reducer</p> <p>Inlet</p> <p>$L \geq 10D$</p>	<p>Outlet</p> <p>$L \geq 5D$</p>
	
<p>Disturbance source: valve</p> <p>Inlet</p> <p>$L \geq 40D$</p>	<p>Outlet</p> <p>$L \geq 10D$</p>
	
<p>Disturbance source: pump</p> <p>Inlet</p> <p>$L \geq 50D$</p>	
	

Table 2: Recommended distances from disturbance sources

3.4 Pipe preparation

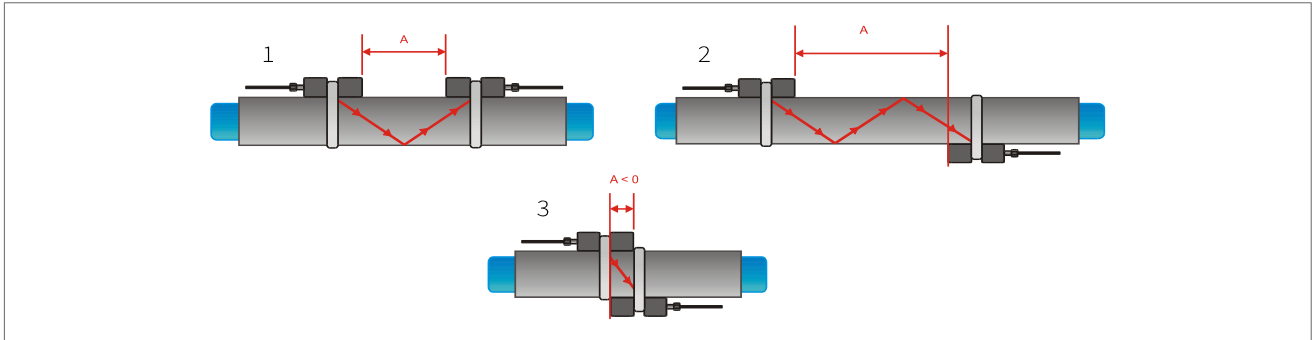


- Clean dirt and dust from around the area of the pipework where the sensors are to be placed.
- Remove loose paint and rust with a wire brush or file.
- Firmly bonded paint does not necessarily need to be removed provided the flowmeter diagnostics indicate sufficient signal strength.

3.5 Sensor mounting configurations and separation distance

3.5.1 Reflection Mode

The most common clamp-on sensor mounting configuration is the Reflection Mode, sometimes known as V-Mode (see Picture 3, sketch 1). Here, the ultrasonic signal passes twice through the medium (two signal passes). The Reflection Mode is the most convenient mounting method as the transducer separation distance can be measured easily and the sensors can be accurately aligned. This method should be used whenever possible.



Picture 3: Clamp-on sensor mounting configurations and sensor spacing

3.5.2 Diagonal Mode

An alternative mounting configuration (see Picture 3, sketch 3) is the Diagonal Mode (Z-Mode). The signals travel only once through the pipe. This method is often used for larger pipes where greater signal attenuation might occur.

Further variation of the Reflection and the Diagonal Modes are possible by altering the number of passes through the pipe. Any even number of passes will require mounting the sensors on the same side of the pipe, while with an odd number of passes, the sensors must be mounted on opposite sides of the pipe. Commonly, for very small pipes, sensor mounting configurations such as four passes (W-Mode) or three passes (N-Mode) are used (see Picture 3, sketch 2).

3.5.3 Transducer separation distance

The transducer separation distance A is measured from the inside edges of the sensor heads as shown (see Picture 3). It is automatically calculated by the flowmeter based on the parameter entries for pipe outside diameter, wall thickness, lining material and thickness, medium, process temperature, the sensor type and the selected number of signal passes.

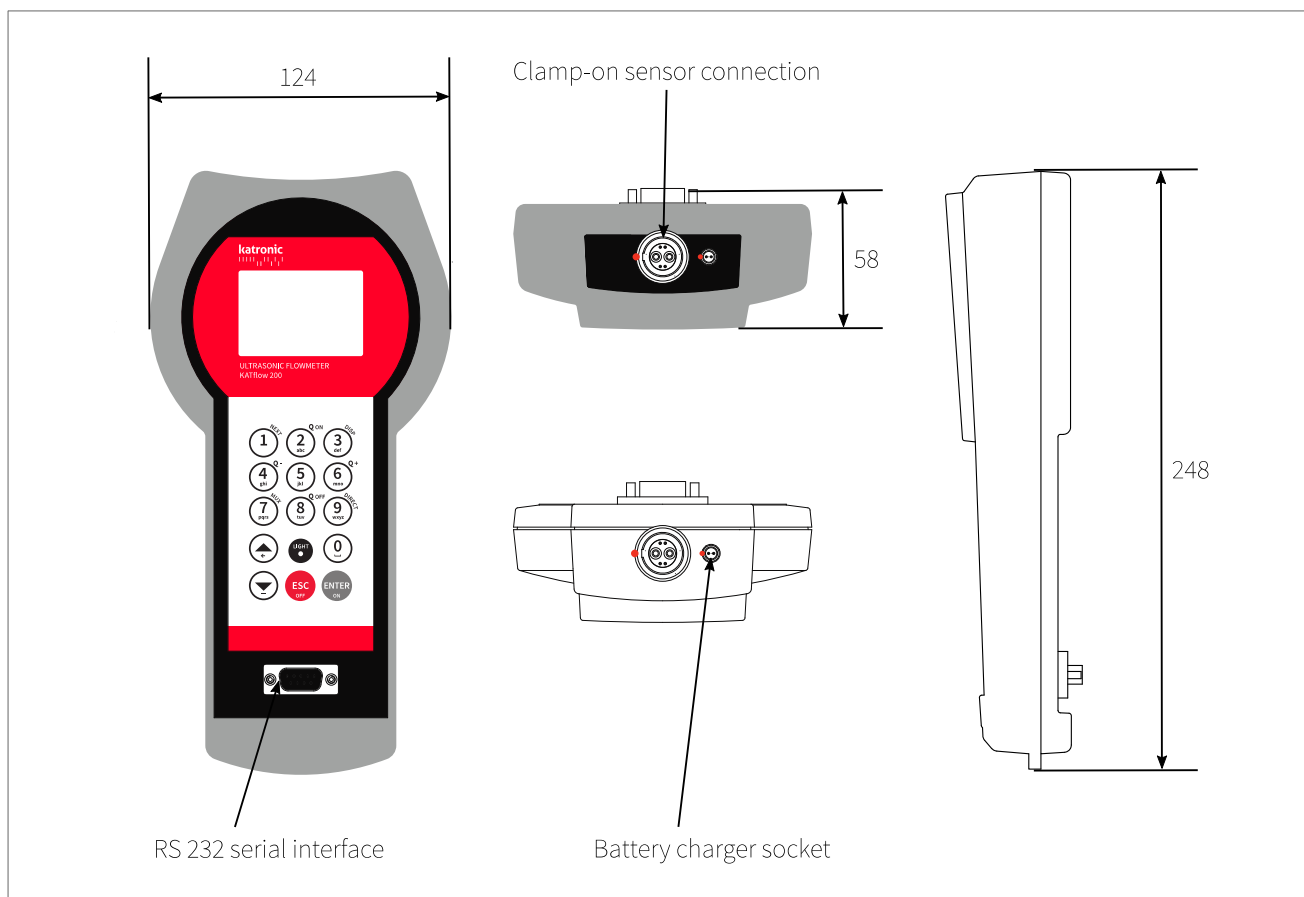


A negative separation distance $A < 0$ can occur for mounting configurations on small pipes where Diagonal Mode operation has been selected (see Picture 3, sketch 3). Negative separation distances may be suggested for Reflection Mode installations, but are not possible. In these cases, use Diagonal Mode or a larger number of passes.

3.6 Flowmeter installation

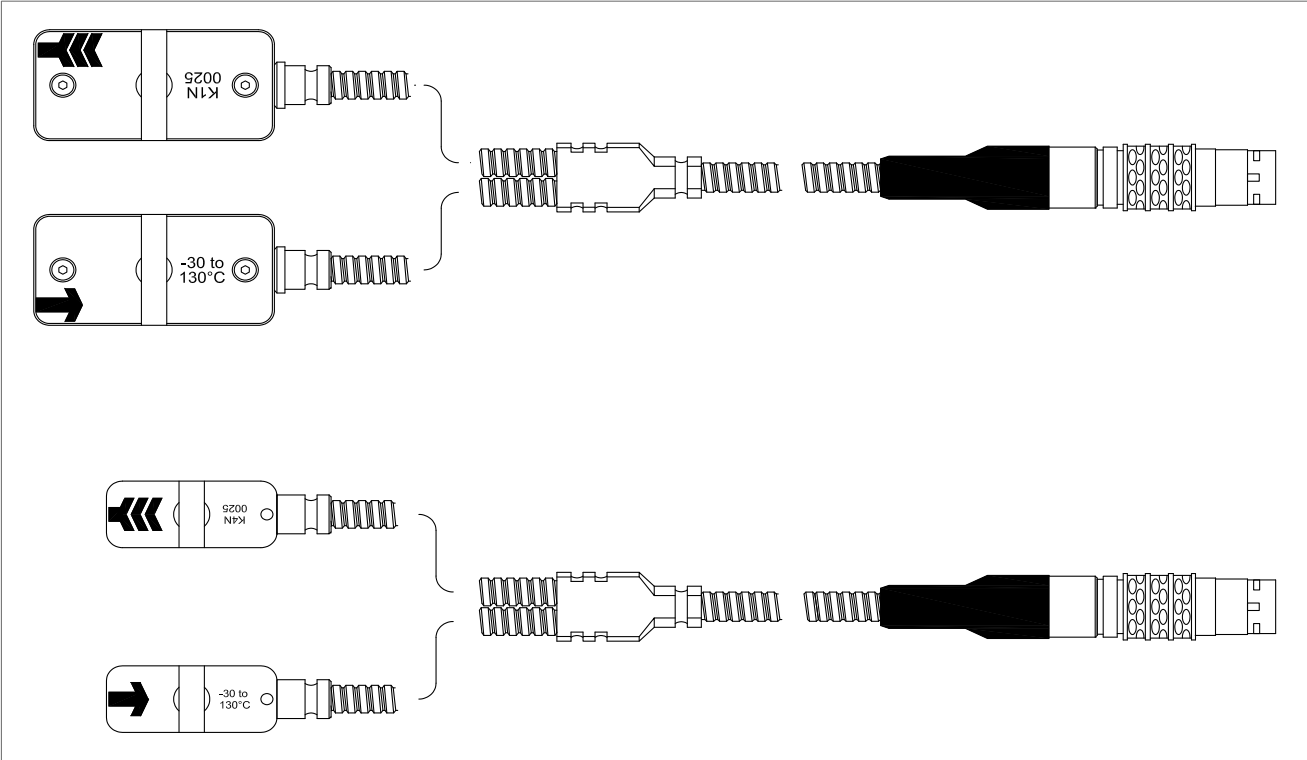
3.6.1 Outline dimensions

The KATflow 200 is a hand-held, battery operated device with the following outline dimensions (Picture 4).



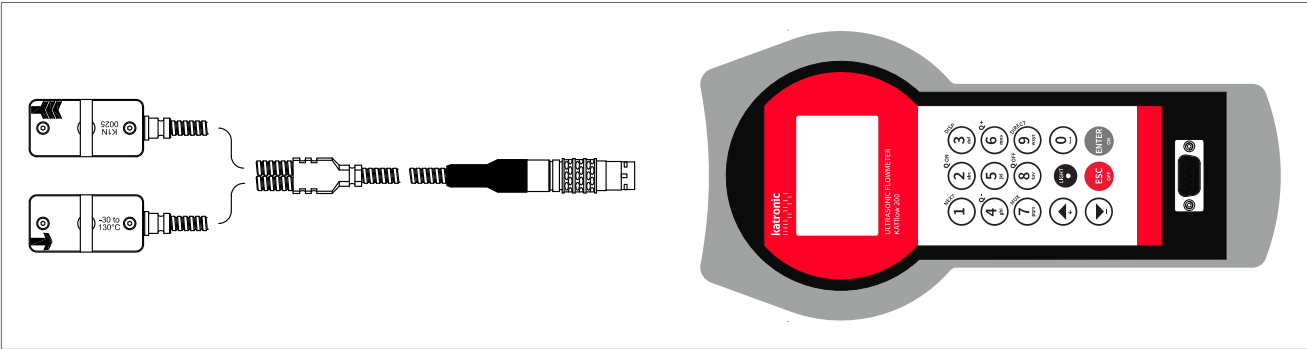
Picture 4: Outline dimensions KATflow 200

KATflow 200
INSTALLATION



Picture 5: K1 and K4 type transducers

3.6.2 Electrical connections



Picture 6: Electrical connection diagram

3.7 Clamp-on sensor mounting

Before the sensors can be mounted

- the installation location should have been determined,
- a sensor mounting method should be chosen,
- the flowmeter batteries must be sufficiently charged,
- the sensors must be connected to the transmitter.

Depending on which sensor mounting method is being used, the clamp-on sensors are either mounted on the same side of the pipe (Reflection Mode) or on opposite sides of the pipe (Diagonal Mode). The sensor spacing is calculated by the flowmeter from the pipe parameters entered (see Section 3.5).

3.7.1 Acoustic coupling gel



In order to obtain acoustical contact between the pipe and the sensors, apply a bead of acoustic coupling gel lengthwise down the centre of the contact area of the sensors.



Picture 7: Application of acoustic coupling gel

KATflow 200

INSTALLATION

3.7.2 Correct positioning of the sensors

Always mount the transducer pair so that the free front edges of the sensors face each other. There is a different engraving on the top of each transducer. The transducers are mounted correctly if the engravings on the two transducers form an arrow. The transducer cables should point in opposite directions. Later, the arrow, in conjunction with the indicated measured value, will help to determine the direction of flow (see Section 3.3).



The sensor separation distance is automatically calculated by the flowmeter based on the parameter entries for pipe outside diameter, wall thickness, lining material and thickness, medium, process temperature, the sensor type and the selected number of signal passes. The sensor positioning screen (see Section 4.4) allows fine adjustment of the sensor location.



Picture 8: Correct positioning of the sensors

3.7.3 Sensor mounting with fixtures and chains



- Insert the retaining clip into the groove on the top of the transducer and secure it using the screw knob.
- Apply some acoustic coupling component to the contact surface of the transducer.
- Place the transducer on the side of the pipe or alternatively up to 45 degrees from the horizontal plane through the pipe. This is advisable to establish the best acoustic contact since on top of the pipe air pockets could develop and deposits could accumulate at the bottom of the pipe.
- Take the spring end of the chain in one hand and insert the last ball element in the vertical slot of the retaining clip. Mount the chain around the pipe.
- Pull the chain firmly around the pipe and fasten it in the lateral slot of the retaining clip. There should be no air pockets between the transducer surface and the pipe wall.
- Mount the second transducer the same way.
- Using a measuring tape, adjust the sensor separation distance as suggested by the flowmeter. When the sensor positioning screen is displayed, the middle bar allows fine adjustment of the sensor location.



Picture 9: Sensor mounting with clips and chains



Picture 10: Metallic mounting clip

4 OPERATION

4.1 Switching On/Off

The flowmeter is switched on by holding the **ON** key for more than two seconds continuously. Equally it can be switched off by pressing the **OFF** key for more than two seconds.

When switching on, the flowmeter will perform a hardware and software check, including the data logger space. Progress will be indicated by a series of dashes above and a black bar below.

4.2 Battery charging

The internal batteries can be recharged with the external battery charger supplied.

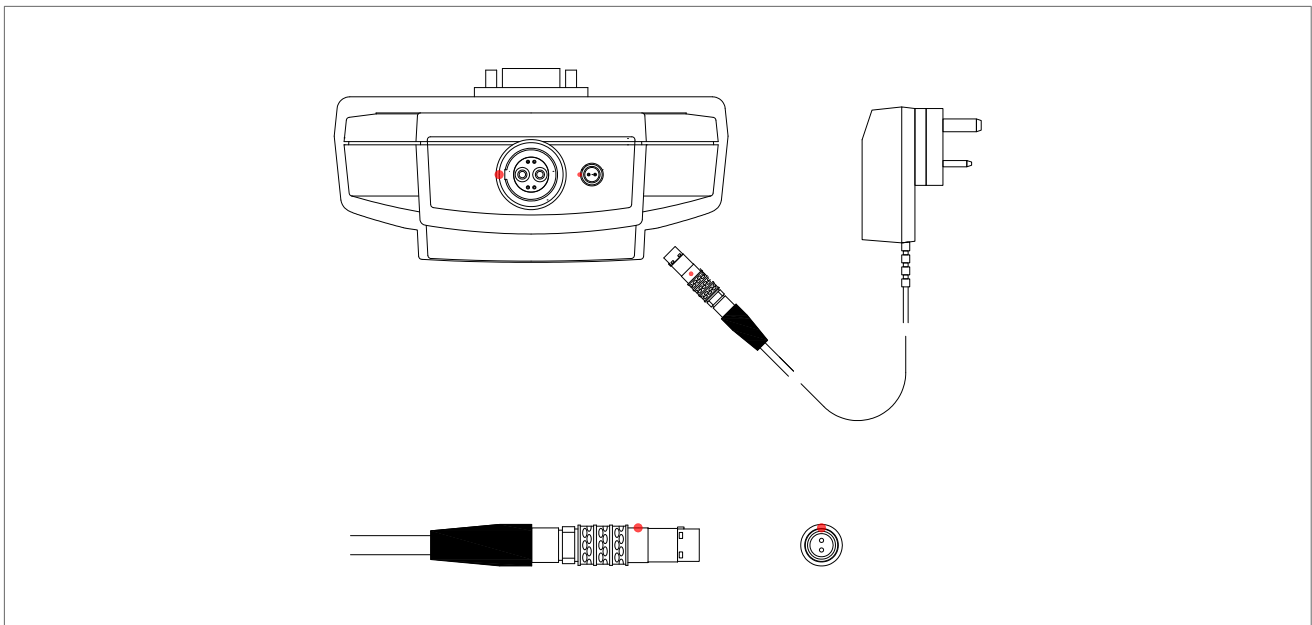


Important: Ensure that only Nickel Metal Hydride (NiMH) AA size rechargeable batteries are installed – attempting to recharge other battery types is dangerous and may cause damage.

Connect the battery charger to the charging socket of the flowmeter and to the mains supply 100 ... 240 V AC, 50/60 Hz. The battery charger mains plug is supplied for specific countries as shown in the order code.

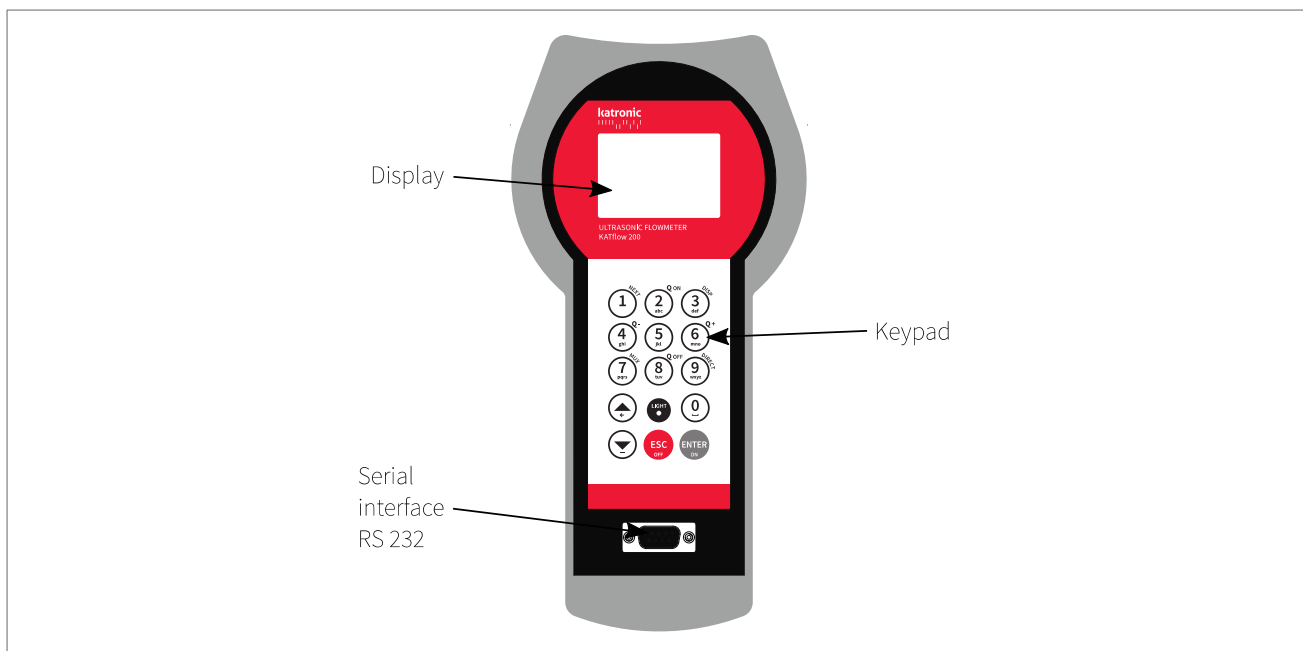
The red mark on the plug aligns with the mark on the socket. Remove plug by sliding the outer casing away from the socket to release the latch.

During the charging process, the battery icon will blink. For a fully charged battery all segments of the battery icon will be filled. Battery charge level is also shown in the diagnostic displays.



Picture 11: Battery charging

4.3 Keypad and display






Picture 12: Keypad and display KATflow 200










Customer-specific settings for data to be displayed can be achieved by using the appropriate menu items.

4.3.1 Keypad key functions

Used keys	Main function/Character entry	Secondary function
	1 (1 short key stroke) , (2 short key strokes) . (3 short key strokes) — (4 short key strokes)	In measurement mode: Show NEXT available item Direct Access: Keypad sound off/on In sensor positioning screen: Toggles diagnostic values
	A B C 2 /	In measurement mode: Q_{ON} = Start/reset totaliser function In menus: Increase brightness/contrast (long key stroke) Direct Access: Language selection
	D E F 3 ?	In measurement mode: DISP = Change between measurement display and diagnostic displays Direct Access: Comm. baud rate selection

KATflow 200

OPERATION

Used keys	Main function/Character entry	Secondary function
	G H I 4 <	In measurement mode: Q- = Reset negative total value Direct Access: Software version
	J K L 5 >	In measurement mode: Activate auto sequence in process value display Direct Access: Start scope function
	M N O 6 \$	In measurement mode: Q+ = Reset positive total value Direct Access: Histogram for sensor zero offset test
	P O R S 7	–
	T U V 8 *	In measurement mode: QOFF = Stop totaliser function In menus: Reduce brightness/contrast (long key stroke)
	W X Y Z 9	In menus: DIRECT = Quick access to device functions A code can be used to switch directly to important device functions. Codes: 1: Keypad sound off/on 2: Language selection 3: Comm. baud rate selection 4: Software version 5: Scope function 6: Histogram for sensor zero offset test 9: Trend curve In sensor positioning screen: 9 = Start scope function (Note: This applies to ultrasonic board version 5.0 or higher)
	0 ␣ (Space character) + = #	–






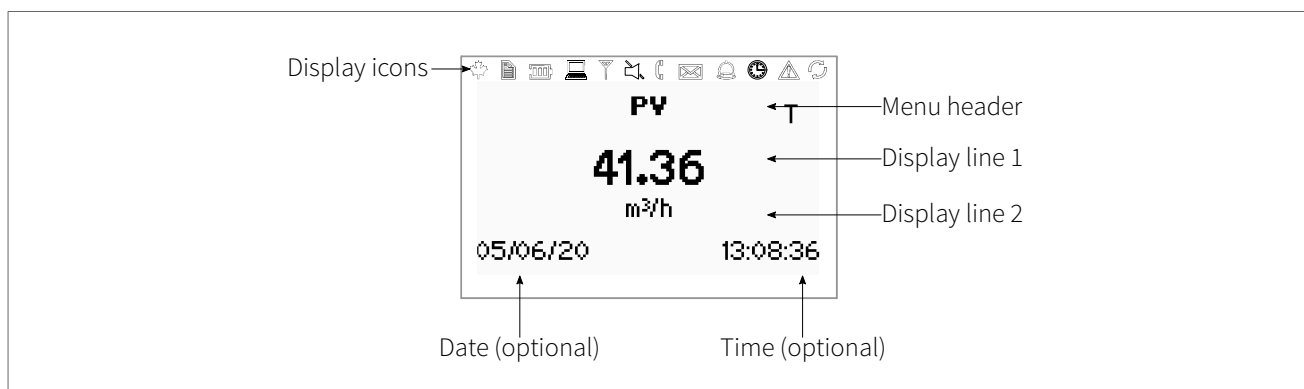
Used keys	Main function/Character entry	Secondary function
	Move menu/list selection item UP	Character entry: ← (backspace) clear
	Move menu/list selection item DOWN	Character entry: - (minus sign)
	. (decimal point)	Switch LCD backlight on/off
	ESCape menu item	Abort entry without saving Switches the instrument off if pressed for more than 2 s
	ENTER menu item	Confirm entry with saving Switches the instrument on if pressed for more than 2 s

Table 3: Keypad key functions

4.3.2 Display icons and functions



Picture 13: Display overview

KATflow 200

OPERATION

























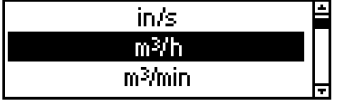



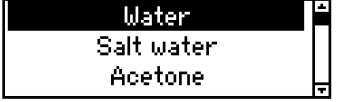






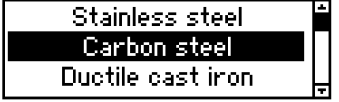
Display icon	Function	
	On Off Flashing	Display of the transmission voltage: 75 V 10 V 150 V
	On Off Flashing	Data logger recording Data logger switched off Data logger full
	Off Outline flashing	< 5 % battery power available Battery charging
	Flashing On	1 segment = 10 % battery power available 1 segment = 33 % battery power available
	On	2 segments = 66 % battery power available
	On	3 segments = 100 % battery power available
	On Off	LCD backlight switched on LCD backlight switched off
		Function not used on KATflow 200
	On Off	Speaker on Speaker off
	On Off	Coupling error Sensor operating correctly
		Function not used on KATflow 200
		Function not used on KATflow 200
	On Off	Time/date set Clock error
	On Off	Error recorded in error log No error detected
	On Off	Serial output RS 232 switched on Serial output RS 232 switched off
L, T or LT		Displays whether flow is L aminar, T urbulent or L aminar- T urbulent
Q	On Off	Totaliser for the active channel switched on Totaliser for the active channel switched off

Table 4: Display icon functions













4.4 Quick Setup Wizard

The Quick Setup Wizard allows for a speedy setup of the most important parameters in order to achieve successful measurements in the shortest possible time:

Used keys	Display screen	Operation
  		At first power on and the boot sequence, the “Main Menu” is displayed. Use the UP ▲ and DOWN ▼ cursor keys to select “Quick Start” and confirm by pressing ENTER.
		Use cursor keys to select “Setup Wizard”. Confirm by pressing ENTER. If the sensors are recognised, the serial number will be shown. If not, the type can be selected.
  		Select the main measurement unit using the cursor keys and confirm with ENTER. This unit will be displayed in the middle of the measurement screen. Selecting OFF deactivates the measurement channel.
  		Select the fluid using cursor keys. Confirm by pressing ENTER.
 		Enter the fluid temperature using the keypad. Confirm by pressing ENTER. Use UP ▲ key as a backspace to correct for entry errors.
  		Select pipe material using the cursor keys and confirm with ENTER.

KATflow 200

OPERATION

Used keys	Display screen	Operation
	OUTSIDE DIAMETER 76.1 mm	Enter the outer pipe diameter using the alphanumeric keys and confirm with ENTER . Use UP ▲ key as backspace to correct for entry errors. If 0 is entered and confirmed, an additional screen appears that allows entry of the circumference.
	PIPE CIRCUMFERENCE 0.0 mm	Enter the circumference using the alphanumeric keys. Press ENTER to confirm.
	WALL THICKNESS 3.6 mm	Enter pipe wall thickness using the alphanumeric keys and confirm with ENTER . Use UP ▲ key as a backspace to correct for entry errors.
  	LINER MATERIAL <div> None Epoxy Rubber </div>	Select pipe liner material using cursor keys and confirm by pressing ENTER . If a liner material is chosen, an additional screen appears that allows entry of liner thickness.
  	PASSES <div> Auto 1 2 </div>	Select number of sound passes (sound paths) using cursor keys. Auto: Automatically 1: 1 pass (Diagonal Mode) 2: 2 passes (Reflection Mode) 3: 3 passes (Diagonal Mode) 4: 4 passes (Reflection Mode) etc. Confirm with ENTER .
  	QUICK START WTG Calibration Stored Setup Totaliser Start Measurement	Select "Start Measurement" and confirm with ENTER to start the sensor positioning procedure.


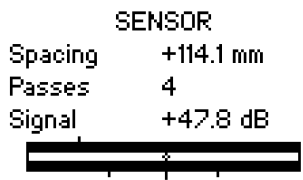
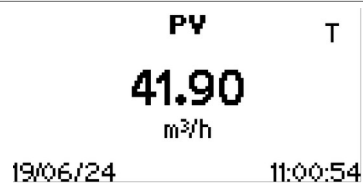

Used keys	Display screen	Operation
		<p>Sensor positioning screen:</p> <p>Mount transducers with suggested spacing and use middle bar for fine adjustment of position (central position is desired). Observe signal-to-noise (upper bar) and quality (lower bar). These should be of identical length.</p> <p>Note: NEXT switches between different signal diagnostic data. With 9 the scope function can be selected for further diagnosis. Confirm by pressing ENTER to obtain measurements.</p> <p>Note: Numbers shown for indication only.</p>
		<p>Success!</p>

Table 5: Quick Setup Wizard

4.5 Measurement

4.5.1 Main process value display

Measurement is started using “Start Measurement” in the Quick Start Wizard.

 The main process value (PV) is the primary measurement data and is usually displayed as the middle unit. User-specific settings for the main process value display can be made using the corresponding options in the menu. The process value can be selected from a list of available values.



Used keys	Display screen	Operation
		<p>The main process value can be changed in the “Quick Start” or “Installation” menus. Press ESC at any time to return to the “Main Menu”. View totalisers by pressing NEXT. Change to the diagnostic display by pressing DISP.</p> <p>5 = Switches the display sequence on/off which automatically cycles through the various process value or diagnostic displays. Can only be activated if a value not equal to 0 has been set in the display menu for display sequence.</p>

Table 6: Main process value display

 The sequence of the process value displays is: Main process value display, three-line display, totaliser display.

4.5.2 Three-line display


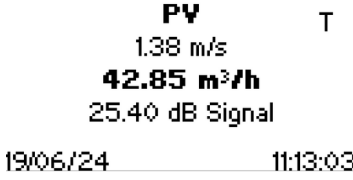

Used keys	Display screen	Operation
		<p>The three-line display screen is configurable to show flow, totalisers and diagnostic functions. Change to diagnostic displays by pressing DISP and to totaliser screens by pressing NEXT. Cycle through display screens using NEXT.</p>

Table 7: Main process value display in three-line display format

4.5.3 Totaliser

 The totaliser displays will only be shown when the totalisers are activated and a volume flow, mass flow or heat flow is selected as process value (middle line).








Used keys	Display screen	Operation
 	<div> <div>Q</div> <div>PY</div> <div>(Q+) 0.54 m³</div> <div>42.88 m³/h</div> <div>(Q-) 0.00 m³</div> <div>T</div> </div> <div>19/06/2411:16:55</div>	<p>The flow totaliser can be started or reset by pressing Q_{ON} when a volume measurement is selected as one of the displayed units.</p> <p>Totaliser screens are viewed by pressing NEXT from the measurement screen. When top and bottom display lines are set to a volume measurement, the first totaliser screen displays cumulative totals and the second screen shows separate positive and negative totals. Pressing NEXT again will return to the main measurement screen.</p>
 		<p>Pressing Q₊ resets the total accumulated flow in the positive flow direction.</p> <p>Pressing Q₋ resets the total accumulated flow in the negative flow direction.</p>
		<p>The totalisers can be stopped by pressing Q_{OFF}.</p>
 		<p>Pressing Q_{ON} again will reset to zero. Change to other displays or revert to the totaliser screen without resetting by pressing DISP or NEXT.</p>

Table 8: Totaliser display

4.5.4 Diagnostic display




Used keys	Display screen	Operation
  	<div> <div>DIAGNOSTICS</div> <div>38.3 dB Gain</div> <div>25.3 dB Signal (US)</div> <div>-6.2 dB Noise</div> </div> <div>19/06/2411:18:30</div>	<p>Line 1 shows the amplifier gain.</p> <p>Line 2 displays the signal strength.</p> <p>Line 3 indicates the noise.</p> <p>Change to more diagnostic displays by pressing NEXT.</p> <p>Press DISP to switch to the process value displays.</p> <p>ENTER changes between signal strength in flow direction (D) and against flow direction (U). (Note: This applies to ultrasonic board version 5.0 or higher).</p> <p>Refer to Customer Support for the meanings of each diagnostic screen.</p>

Table 9: Diagnostic display



Diagnostic displays can be viewed directly during measurement. Other diagnostic functions are available in the menu structure.

KATflow 200

OPERATION

4.5.5 Data logger

- The data logger is enabled from the “Main Menu” and operates when a non-zero value is entered for the interval.
- Items to be logged are selected from the “Selection” screen. **ENTER** selects items, **0** deselects.
- Up to ten items may be selected.
- When “dB Signal” and “dB SNR” are selected, two variables are stored, since one measurement is carried out with the flow direction (D – downstream) and one against the flow direction (U – upstream) (Note: This applies to ultrasonic board version 5.0 or higher).
- If no items are selected the logger will record blank space.
- Send logger by serial port to a terminal program by selecting “Log Download”.
- Clear the logger by selecting “Log Erase”.
- Remaining logger space can be seen in the diagnostic displays.



5 COMMISSIONING

5.1 Menu structure

Main menu	Menu level 1	Menu level 2	Description/settings
Quick Start			
	Setup Wizard		
			•
		Middle Units (Main Displayed)	<p>Select from list where available ↑↓</p> <ul style="list-style-type: none"> • Off (disable channel) • m/s, ft/s, in/s (flow velocity) • m³/h, m³/min, m³/s, l/h, l/min, l/s USgal/h, USgal/min, USgal/s, bbl/d, bbl/h, bbl/min (volume flow) • g/s, t/h, kg/h, kg/min (mass flow) • m³, l, USgal, bbl (volume, totaliser volume flow) • g, t, kg (mass, totaliser mass flow) • W, kW, MW (heat flow, HQM) • J, kJ, MJ (heat, totaliser heat flow) • m³(D), m³(M), m³(Y) (period totaliser: daily, monthly, yearly) • kg (D), kg (M), kg (Y) • J (D), J (M), J (Y) <p>Diagnostic data:</p> <ul style="list-style-type: none"> • dB Signal (signal), dB Noise (noise), db SNR (signal-to-noiseratio) • m/s c (speed of sound), CU (housing temperature) • K (correction factor), Re (Reynolds number) • V (battery voltage) • SOS (calculated speed of sound), Density, Kin. Vis. (kinematic viscosity), Dyn. Vis. (dynamic viscosity), SHC (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) • V Sensor (sensor voltage) • Other (assignable input or calculated value)
		Default Sensor	<p>Indication of sensor type and serial number if automatically detected, otherwise select from list ↑↓</p> <ul style="list-style-type: none"> • K1L, K1N, K1E, K1Ex, K1P • K4L, K4N, K4E, K4Ex • K0L, K0N, K2T4, M, Q, Special (see “Start Measurement” below)
		Fluid	<p>Select from list ↑↓</p> <ul style="list-style-type: none"> • 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 (kinematic viscosity, density, medium sound speed)
		Temperature	-30 ... +300 °C
		Kinematic Viscosity	<p>(Only if user fluid selected)</p> <p>0.001 ... 30 000 mm²/s</p>

KATflow 200

COMMISSIONING

Main menu	Menu level 1	Menu level 2	Description/settings
		Density	(Only if user fluid selected) 100 ... 2 000 kg/m ³
		Medium Sound Speed	(Only if user fluid selected) 100 ... 3 500 m/s
		Heat Capacity	(Only if user fluid selected) 0 ... 10 J/(g*K)
		Pipe Material	Select from list ↑↓ <ul style="list-style-type: none"> Stainless steel, Carbon steel, Ductile cast iron, Grey cast iron, Copper, Lead, PVC, PP, PE, ABS, Glass, Cement User (pipe sound speed)
		Pipe Sound Speed	(Only if user pipe material selected) 600 ... 6 553.5 m/s
		Outside Diameter	6 ... 6 500 mm
		Circumference	(Only if 0.0 is selected for outer diameter) 18.8 ... 20 420.4 mm
		Wall Thickness	0.5 ... 80 mm
		Liner Material	Select from list ↑↓ <ul style="list-style-type: none"> None Epoxy, Rubber, PVDF, PP, Glass, Cement User (liner sound speed)
		Liner Sound Speed	(Only if lining material selected) 500 ... 5 000 m/s
		Liner Thickness	(Only if lining material selected) 1 ... 99.0 mm
		Passes	Select from list ↑↓ Auto, 1 ... 16
	WTG Calibration		
		Reference Thickness	Enter reference thickness 0.5 ... 80.0 mm
		Calibration	Calibration of the wall thickness sensor
	Stored Setup		“Load”, “Save” or “Delete” stored sets of parameters (Names for different measurement points can be entered on “Save” using the keypad)
	Totaliser		Totaliser function <ul style="list-style-type: none"> Off, On Reset Reset Day, Reset Month, Reset Year
	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

Main menu	Menu level 1	Menu level 2	Description/settings
		SP2 – Wedge Angle	Only for special, unrecognised sensors
		SP3 – Wedge Sound Speed 1	Only for special, unrecognised sensors
		SP4 – Wedge Sound 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
		Sensor Placement	Adjust sensor position (see sensor positioning screen, Section 4.4)
Installation			
	Pipe		
		Material	Select from pipe material list ↑↓
		Outside Diameter	6 ... 6 500 mm (outside diameter)
		Wall Thickness	0.5 ... 80 mm (wall thickness)
		Transv. Sound Velocity	(Transverse sound velocity) 600 ... 6 553,5 m/s
		Long. Sound Velocity	(Longitudinal sound velocity) 600 ... 8 000 m/s
		Circumference	18.8 ... 20 420.4 mm (pipe circumference)
		Roughness	0 ... 10 mm
	Medium		
		Fluid	Select from fluid list ↑↓
		Temperature	-30 ... +300 °C
		Kinematic Viscosity	0.001 ... 30 000 mm ² /s
		Dynamic Viscosity	0 ... 30 000 g/ms
		Density	100 ... 2 000 kg/m ³
		Transv. Sound Velocity	(Transverse sound velocity) 100 ... 3 500 m/s
	Lining		

KATflow 200

COMMISSIONING

Main menu	Menu level 1	Menu level 2	Description/settings
		Material	Select from material list ↑↓
		Thickness	1 ... 99 mm
		Transv. Sound Velocity	(Transverse sound velocity) 600 ... 6 553 m/s
	Passes		Select from list ↑↓
	Thermobuffer		Select from list ↓→
Output			
	Display		
		Top Line	Select unit from list ↑↓
		Middle Line	Select unit from list ↑↓
		Bottom Line	Select unit from list ↑↓
		Damping	Reduces fluctuations in the display output: 1 ... 255 s
		Metric/Imperial	Use metric or imperial units for entered data
		Auto Seq. Timer	Set automatic change of display 0 ... 60 measurements (0 deactivates automatic change of display)
	Data Logger		
		Interval	Enter logging interval in seconds: 0 ... 3 600 s
		Selection	Select from list ↑↓ ENTER selects, 0 deselects Up to ten variables may be logged Note: When “dB Signal” and “dB SNR” are selected, two variables are stored in each case, since one measurement is performed with the flow direction (D – downstream) and one against the flow direction (U – upstream) (Note: This applies to ultrasonic board version 5.0 or higher).
		Low Memory	Warning output 4 ... 100 %
		Log Download	Sends all logger data using serial port
		Log Erase	Clears the logger
	Serial Communication		
		Mode	Select from list ↑↓ <ul style="list-style-type: none"> • None • Printer (output every second of selected values) • Diagnostic • Download (send logger data using serial port) • Calibration Test (laboratory calibration, not recommended for field or customer use)

Main menu	Menu level 1	Menu level 2	Description/settings
		Baud	Select from list ↑↓ <ul style="list-style-type: none"> • 9 600 (default) • 19 200 • 38 400 • 57 600 • 115 200 • 230 400
		Parity	Select from list ↑↓ <ul style="list-style-type: none"> • None • Even (default) • Odd
System			
	Instrument Info		
		Model Code	KATflow 200
		Serial No.	(Serial number) Example: 20005555
		HW Revision	Example: 3.00, 1.72
		SW Revision	Example: 6.06.06.5, 5.2 KAT-IT_DS2745-DA
	Calculation		
		Low Flow Cut-Off	± Low flow velocity cut-off: 0 ... 1 m/s
		High 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 m/s
		PV Scaling	Calibration process variable gradient scaling: -10.0 ... 10.0 m/s
		Zero Calibration	Zero calibration settings Adjust: <ul style="list-style-type: none"> • 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
		Window Offset	Manual delay of the measuring window: -25 ... 25 µs
		Missed Measurements	<ul style="list-style-type: none"> • Setting for the behaviour of the output values when too many unsuccessful measurements occur: • Hold Value: Output value of the last successful measurement • Go to Zero: Output value becomes 0 • User Value: User-specific error value: -1 ... 300 000 m/s
	User		
		Identifier	Example: Pump P3A (9 character string possible)
		Tag No.	(Tag number) Example: 1FT-3011 (9 character string possible)

KATflow 200

COMMISSIONING

Main menu	Menu level 1	Menu level 2	Description/settings
	Test		
		Installation	Control system simulation 60 second ramping up of flow velocity in m/s from 0 to programmed High 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
	Settings		
		Date	Example: 17/06/2024
		Time	Example: 09:27
		Date Format	Select from list ↑↓ <ul style="list-style-type: none"> • dd/mm/yy • mm/dd/yy • yy/mm/dd
		Language	Select from list (as available) ↑↓ English, German, French, Spanish, Russian
		Keypad	Enable keypad sound: Yes/No
		Battery	Low warning: Yes/No Auto off time 1 ... 59 min Battery full: Set battery level counter to 100 % Saver Mode: Yes/No (activation of an energy saving mode in which the measurement cycle (depending on the setting) is increased from seconds to minutes. The ultrasonic board is set to a power-down state between measurements to save energy)
	Timer Mode		Device starts measurement for the set measuring period <ul style="list-style-type: none"> • Activate Timer Mode: Yes/No • Input: Start Time • Input: End Time Note: Measurement does not start automatically The programmed measurement must be activated once via “Start Measurement” Device confirms the set time interval
	Load Defaults		Load default settings (except date and time): Yes/No
	Measurement Mode		Selection of the measuring method: <ul style="list-style-type: none"> • Normal: Standard measuring mode • Doppler: Doppler measurement mode • Auto: Automatic selection of standard or Doppler measurement mode • Fast: Fast mode (Measuring mode with the smallest possible measuring cycle time. No indication of the measured value on the display. Output via serial interface and/or by storing the measured values in the internal data logger)

Main menu	Menu level 1	Menu level 2	Description/settings
	Measurement Period		Selection of the waiting time between two measurements: 1 ... 3 600 s Note: If the Saver Mode is activated, the measurement period changes automatically from seconds to minutes.
Diagnostics			Shows internal error messages (error flags), measured temperature, available logger memory, battery charge level, battery voltage (V), remaining battery capacity (mAh). Acknowledge error message with ENTER or quit the error display with ESC .
Scope			Scope function can be accessed in the sensor positioning screen by pressing 9 or in Direct Access (DIRECT) by pressing 5 .
			Shows the received acoustic pulse and further data to evaluate the signal quality as a scope function (upstream and downstream) (see Section 5.4). <ul style="list-style-type: none"> Exit screen: ESC Sampling window +6 µs: UP Sampling window -6 µs: DOWN Switching the display flow direction: ENTER
Sensor Histogram			Show histogram display of the sensor zero offset test in Direct Access (DIRECT) by pressing 6 .
			Displays a histogram of the measured time difference (dT value) of the sensor <ul style="list-style-type: none"> Exit the histogram display: Press any key (Pressing 9 writes the measured average time difference into the sensor EEPROM).
TrendGraph			Show Trend Graph of the sensor in Direct Access (DIRECT) by pressing 9 .
			Displays a trend of the measured time difference (dT value) of the sensor <ul style="list-style-type: none"> Exit Trend Graph: ESC

Table 10: Menu structure KATflow 200

KATflow 200

COMMISSIONING

5.2 Output settings

5.2.1 Serial interface RS 232

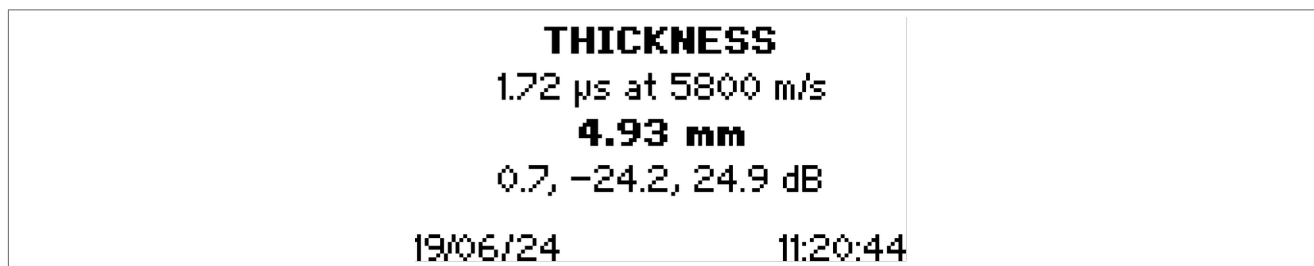
The RS 232 serial interface can be used to transmit data online or to download the integral data logger content. The settings can be found in the “Serial Communication” submenu.

5.3 Wall thickness measurement

Optional sensor probes to measure pipe wall thickness (WTG) are available. The KATflow 200 will recognise a connected probe when entering the Setup or “WTG Calibration”, the measurement mode or the scope function. Use the Setup Wizard or “Installation” menu to set the pipe material. Select “Start Measurement”.

The KATflow 200 will recognise the probe and display the measurement screen. Wall thickness will be shown when the sensor is in good acoustic contact with the pipe.

The first display line shows the measured signal arrival time [μ s] at the set sound velocity of the metal [m/s], if the engineering units are set to metric, or in [in/s], if units are set to imperial. The second display line indicates the calculated wall thickness [mm]/[in]. The third display line shows the diagnostic values of signal, noise and SNR [dB].



Picture 14: Screen for measuring pipe wall thickness

5.3.1 Wall Thickness Calibration

This function can be used to determine the precise pipe wall thickness of a known material or when the pipe material is unknown. A sample of the pipe material with a known thickness is required, which can be measured accurately with a caliper gauge.

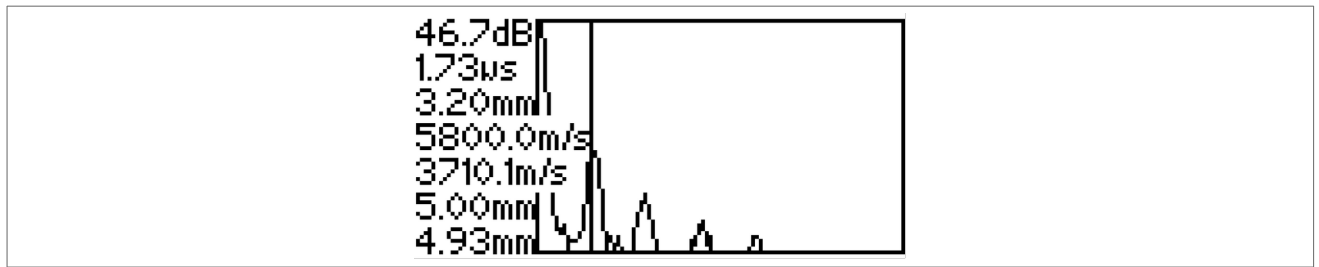
Select either the known pipe material or “User” from the list in the Setup Wizard if the pipe material is unknown. Make sure that the wall thickness gauge is connected to the sensor connection so that the device can detect the probe.

Enter the previously measured thickness of the sample material as “Reference Thickness” and then select “Calibrate”.

The screen displays the received acoustic pulse and values for the signal strength, the transit time, the reference thickness, the expected sound speed, the measured sound speed, the measured thickness at the reference sound speed and the measured sound speed at the reference thickness (top to bottom).

On leaving this screen using the **ESC** key, the flowmeter will ask if you wish to store the recorded value of longitudinal sound speed (“Long. Sound Velocity” in the “Pipe” menu).

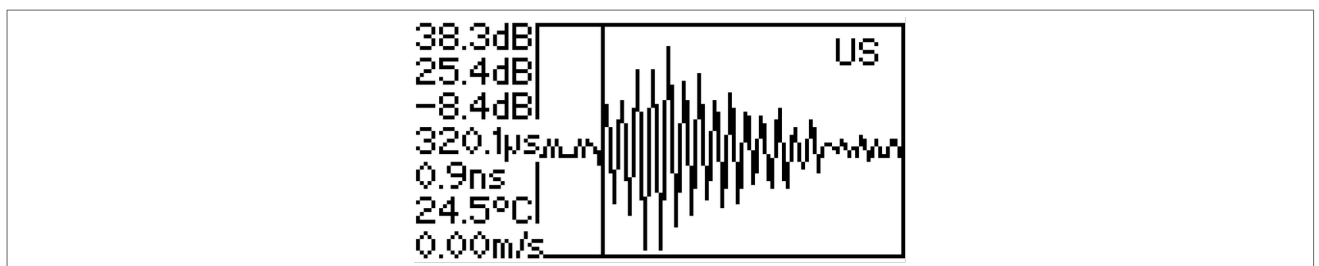
The wall thickness calibration (WTG) screen shows the following diagnostic data: Signal SNR [dB], arrival time [μ s], WTG-reference material thickness [mm or in], measured material sound velocity [m/s or in/s], calibrated material sound velocity [m/s or in/s], thickness calculated with calibrated sound velocity [mm or in], thickness calculated with measured sound velocity [mm or in].



Picture 15: Wall Thickness Gauge (WTG) calibration screen

5.4 Scope function

Katronic flowmeters have an additional scope function which shows a representation of the pulse received by the sensors on channel 1. The measuring direction (with or against the flow direction) can be selected. The measuring direction can be switched with **ENTER** and is indicated by an abbreviation (e. g. 1U = channel 1, upstream) at the top right of the graph. In addition to displaying the received pulse, this screen lists the data given from top to bottom: gain, signal, noise, transit time, time difference, device temperature, process value (see Picture 16).



Picture 16: Scope function display

5.5 KATdata+ software

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

6 MAINTENANCE

KATflow flowmeters are maintenance free concerning the flow measurement functions. Within the scope of periodic inspections, regular inspection for signs of damage or corrosion is recommended for the transducers, the junction box (if installed) and the flowmeter housing.

6.1 Service/Repair

KATflow flowmeters have been carefully manufactured and tested. If installed and operated in accordance with the operating instructions, no problems are usually experienced.

Should you nevertheless need to return a device for inspection or repair, please pay attention to the following points:



- Due to statutory regulations on environmental protection and safeguarding the health and safety of our personnel, the manufacturer may only handle, test and repair returned devices that have been in contact with products without risk to personnel and environment.
- This means that the manufacturer can only service this device if it is accompanied by a Customer Return Note (CRN) confirming that the device is safe to handle.

If the device has been operated with toxic, caustic, flammable or water-endangering products, you are kindly requested:



- To check and ensure, if necessary by rinsing or neutralising, that all cavities are free from such dangerous substances,
- to enclose a certificate with the device confirming that is safe to handle and stating the product used.

7 TROUBLESHOOTING

7.1 Measurement difficulties and error messages

Most problems with measurement are due to poor signal strength or quality. Initial checks should include:

- Has sufficient acoustic coupling paste been applied?
- Can the number of sound passes be changed? As a general rule, more passes will improve accuracy, fewer passes will give better signal strength.
- Are there any nearby sources of noise or disturbance?
- Can the signal be improved by moving the sensors around the circumference of the pipe?
- Are the application parameters correct?

Should there be the need to call Customer Service, please let us know the following details:



- Model code,
- Serial number,
- SW, HW revision,
- Error log list.

Possible error messages may include the following:

Error message	Group	Description	Error handling
ULTRASONIC FAIL REMOVE BATTERY	Hardware	Internal ultrasonic board communication error at power up	Power off/on, otherwise call Customer Support
NO SERIAL NUMBER REMOVE BATTERY	Hardware	Failed to read from system memory	Power off/on, otherwise call Customer Support
NO VERSION NUMBER REMOVE BATTERY	Hardware	Failed to read the ultrasonic board's version number	Power off/on, otherwise call Customer Support
PARAMETER XX READ ERROR	Hardware	Failed to read from system memory	Load defaults, otherwise call Customer Support
PARAMETER XX WRITE ERROR	Hardware	Failed to write to system memory	Call Customer Support
MEASUREMENT STOPPED REASON: COM ERRORS RESTARTING	Hardware	Too many internal ultrasonic board communication errors	Call Customer Support
LOADING FAILED	Hardware	Failed to read a stored setup from system memory	Call Customer Support
MENU ERROR	Hardware, Software	Failed to load a menu	Call Customer Support
PLEASE LOAD KF-TABLES DATA VERSION X.X.X XXX	Software	The external system memory is empty or an incompatible dataset was detected	Power off/on, otherwise call Customer Support

KATflow 200

TROUBLESHOOTING

Error message	Group	Description	Error handling
TRANSLATION FAILED	Hardware, Software	Failed to load the chosen language from the system memory	Call Customer Support
BAD SENSOR COUPLING	Application	Weak sensor coupling, low SNR	Recouple sensors, check installation, reduce number of passes, look for other location, then have a cup of tea and call Customer Support!

Table 11: Error list

For all other error messages, please turn off and restart the flowmeter and if messages continue call Customer Support.

7.2 Data download difficulties

If difficulties are encountered downloading the logger data:

- Check that the flowmeter is switched on and not in measurement mode.
- Check that the same number COM port is allocated in the “Device Manager” (or equivalent) as is set in the KATdata+ software.
- Check that the settings (baud, parity, word length, stop bits) are identical.
- Use the supplied connectors – whether connecting to a 9-pin COM port or converting from serial communication to a Universal Serial Bus (USB).

KATflow 200

TECHNICAL DATA

8 TECHNICAL DATA

8.1 Sound speed of selected pipe materials

Material	Sound speed* shear wave (at +25 °C)	
	m/s	ft/s
Steel, 1 % Carbon, hardened	3 150	10 335
Carbon steel	3 230	10 598
Mild steel	3 235	10 614
Steel, 1 % Carbon	3 220	10 565
302 Stainless steel	3 120	10 236
303 Stainless steel	3 120	10 236
304 Stainless steel	3 141	10 306
304L Stainless steel	3 070	10 073
316 Stainless steel	3 272	10 735
347 Stainless steel	3 095	10 512
“Duplex” stainless steel	2 791	9 479
Aluminium	3 100	10 171
Aluminium (rolled)	3 040	9 974
Copper	2 260	7 415
Copper (annealed)	2 325	7 628
Copper (rolled)	2 270	7 448
CuNi (70 % Cu 30 % Ni)	2 540	8 334
CuNi (90 % Cu 10 % Ni)	2 060	6 759
Brass (Naval)	2 120	6 923
Gold (hard-drawn)	1 200	3 937
Inconel	3 020	9 909
Iron (electrolytic)	3 240	10 630
Iron (Armco)	3 240	10 630
Ductile iron	3 000	9 843
Cast iron	2 500	8 203
Monel	2 720	8 924
Nickel	2 960	9 712
Tin (rolled)	1 670	5 479
Titanium	3 125	10 253
Tungsten (annealed)	2 890	9 482
Tungsten (drawn)	2 640	8 661
Tungsten carbide	3 980	13 058
Zinc (rolled)	2 440	8 005
Glass (pyrex)	3 280	10 761
Glass (heavy silicate flint)	2 380	7 808
Glass (light borate crown)	2 840	9 318
Nylon	1 150	3 772
Nylon, 6-6	1 070	3 510
Polyethylene (LD)	540	1 772
PVC, CPVC	1 060	3 477
Acrylic resin	1 430	4 690
PTFE	2 200	7 218

Table 12: Technical data pipe material

*Note these values are to be considered nominal. Solids may be inhomogeneous and anisotropic. Actual values depend on exact composition, temperature, and to a lesser extent, on pressure and stress.

8.2 Technical data of selected fluids

All data given at +25 °C (+77 °F) unless otherwise stated				Sound speed				Change of sound speed per °C		Viscosity (kinematic)			
Substance	Chemical formula	Density g·cm ⁻³		m·s ⁻¹		ft·s ⁻¹		m·s ⁻¹ ·°C ⁻¹		mm ² ·s ⁻¹		10 ⁻⁶ ·ft ² ·s ⁻¹	
Acetic acid, anhydride	(CH ₃ CO) ₂ O	1.082	20 °C	1 180.0		3 871.4		2.50		0.769		8.274	
Acetic acid, nitrile	C ₂ H ₃ N	0.783		1 290.0		4 232.3		4.10		0.441		4.745	
Acetic acid, ethyl ester	C ₄ H ₈ O ₂	0.901		1 085.0		3 559.7		4.40		0.467		5.025	
Acetic acid, methyl ester	C ₃ H ₆ O ₂	0.934		1 211.0		3 973.1				0.407		4.379	
Acetone	C ₃ H ₆ O	0.791		1 174.0		3 851.7		4.50		0.399		4.293	
Acetylene dichloride	C ₂ H ₂ Cl ₂	1.260		1 015.0		3 330.1		3.80		0.400		4.304	
Acetylene tetrachloride	C ₂ H ₂ Cl ₄	1.595		1 147.0		3 763.1		3.80		1.156	15 °C	12.440	15 °C
Alcohol	C ₂ H ₆ O	0.789		1 207.0		3 960.0		4.00		1.396		15.020	
Ammonia	NH ₃	0.771		1 729.0	-33 °C	5 672.6	-27 °C	6.68		0.292	-33 °C	3.141	-27 °F
Benzene	C ₆ H ₆	0.879		1 306.0		4 284.8		4.65		0.711		7.650	
Benzol	C ₆ H ₆	0.879		1 306.0		4 284.8		4.65		0.711		7.650	
Bromine	Br ₂	2.928		889.0		2 916.7		3.00		0.323		3.475	
n-Butane (2)	C ₄ H ₁₀	0.601	0 °C	1 085.0	-5 °C	3 559.7	23 °C	5.80					
2-Butanol	C ₄ H ₁₀ O	0.810		1 240.0		4 068.2		3.30		3.239		34.851	
sec-Butylalcohol	C ₄ H ₁₀ O	0.810		1 240.0		4 068.2		3.30		3.239		34.851	
n-Butyl bromide (46)	C ₄ H ₉ Br	1.276	20 °C	1 019.0	20 °C	3 343.2	68 °F			0.490	15 °C	5.272	59 °C
n-Butyl chloride (22,46)	C ₄ H ₉ Cl	0.887		1 140.0		3 740.2		4.57		0.529	15 °C	5.692	59 °F
Carbon tetrachloride	CCl ₄	1.595	20 °C	926.0		3 038.1		2.48		0.607		6.531	
Carbon tetrafluoride (Freon 14)	CF ₄	1.750	-150 °C	875.2	-150 °C	2 871.5	-238 °F	6.61					
Chloroform	CHCl ₃	1.489		979.0		3 211.9		3.40		0.550		5.918	
Dichlorodifluoromethane (Freon 12)	CCl ₂ F ₂	1.516	40 °C	774.1		2 539.7		4.24					
Ethanol	C ₂ H ₆ O	0.789		1 207.0		3 960.0		4.00		1.390		14.956	
Ethyl acetate	C ₄ H ₈ O ₂	0.901		1 085.0		3 559.7		4.40		0.489		5.263	
Ethyl alcohol	C ₂ H ₆ O	0.789		1 207.0		3 960.0		4.00		1.396		15.020	
Ethyl benzene	C ₈ H ₁₀	0.867	20 °C	1 338.0	20 °C	4 890.8	68 °F			0.797	17 °C	8.575	63 °F
Ether	C ₄ H ₁₀ O	0.713		985.0		3 389.8		4.87		0.311		3.346	
Ethyl ether	C ₄ H ₁₀ O	0.713		985.0		3 231.6		4.87		0.311		3.346	
Ethylene bromide	C ₂ H ₄ Br ₂	2.180		995.0		3 264.4				0.790		8.500	
Ethylene chloride	C ₂ H ₄ Cl ₂	1.253		1 193.0		3 914.0				0.610		6.563	
Ethylene glycol	C ₂ H ₆ O ₂	1.113		1 658.0		5 439.6		2.10		17.208	20 °C	185.158	68 °F
Fluorine	F	0.545	-143 °C	403.0	-143 °C	1 322.2	-225 °F	11.31					
Formaldehyde, methyl ester	C ₂ H ₄ O ₂	0.974		1 127.0		3 697.5		4.02					
Freon R12				774.2		2 540.0		6.61					
Glycol	C ₂ H ₆ O ₂	1.113		1 658.0		5 439.6		2.10					
50 % Ethylene glycol/ 50 % Water				1 578.0		5 177.0							
Isopropanol	C ₃ H ₈ O	0.785	20 °C	1 170.0	20 °C	3 838.6	68 °F			2.718		29.245	
Isopropyl alcohol (46)	C ₃ H ₈ O	0.785	20 °C	1 170.0	20 °C	3 838.6	68 °F			2.718			

KATflow 200

TECHNICAL DATA

All data given at +25 °C (+77 °F) unless otherwise stated				Sound speed				Change of sound speed per °C	Viscosity (kinematic)			
Substance	Chemical formula	Density g · cm ⁻³		m · s ⁻¹		ft · s ⁻¹		m · s ⁻¹ · °C ⁻¹	mm ² · s ⁻¹		10 ⁻⁶ · ft ² · s ⁻¹	
Kerosene		0.810		1 324.0		4 343.8		3.60				
Methane	CH ₄	0.162	-89 °C	405.0	-89 °C	1 328.7	-128 °F	17.50				
Methanol	CH ₄ O	0.791	20 °C	1 076.0		3 530.2		292.00		0.695		7.478
Methyl acetate	C ₃ H ₆ O ₂	0.934		1 211.0		3 973.1				0.407		4.379
Methyl alcohol	CH ₄ O	0.791		1 076.0		3 530.2		292.00		0.695		7.478
Methyl benzene	C ₇ H ₈	0.867		1 328.0	20 °C	4 357.0	68 °F	4.27		0.644		7.144
Milk, homogenised				1 548.0		5 080.0						
Naphtha		0.760		1 225.0		4 019.0						
Natural gas		0.316	-103 °C	753.0	-103 °C	2 470.5	-153 °F					
Nitrogen	N ₂	0.808	-199 °C	962.0	-199 °C	3 156.2	-326 °F			0.217	-199 °C	2.334
Oil, Car (SAE 20a.30)		1.740		870.0		2 854.3				190.000		2 045.093
Oil, Castor	C ₁₁ H ₁₀ O ₀	0.969		1 477.0		4 845.8		3.60		0.670		7.209
Oil, Diesel		0.800		1 250.0		4 101.0						
Oil, Fuel AA gravity		0.990		1 485.0		4 872.0		3.70				
Oil (Lubricating X200)				1 530.0		5 019.9						
Oil (Olive)		0.912		1 431.0		4 694.9		2.75		100.000		1 076.365
Oil (Peanut)		0.936		1 458.0		4 738.5						
Propane (-45 to -130 °C)	C ₃ H ₈	0.585	-45 °C	1 003.0	-45 °C	3 290.6	-49 °F	5.70				
1-Propanol	C ₃ H ₈ O	0.780	20 °C	1 222.0	20 °C	4 009.2	68 °F					
2-Propanol	C ₃ H ₈ O	0.785	20 °C	1 170.0	20 °C	3 838.6	68 °F			2.718		29.245
Propene	C ₃ H ₆	0.563	-13 °C	963.0	13 °C	3 159.4	9 °F	6.32				
n-Propylalcohol	C ₃ H ₈ O	0.780	20 °C	1 222.0	20 °C	4 009.2	68 °F			2.549		27.427
Propylene	C ₃ H ₆	0.563	-13 °C	963.0	-13 °C	3 159.4	9 °F	6.32				
Refrigerant 11	CCl ₃ F	1.490		828.3	0 °C	2 717.5	32 °F	3.56				8.500
Refrigerant 12	CCl ₂ F ₂	1.516	-40 °C	774.1	-40 °C	2 539.7	-40 °C	4.24				
Refrigerant 14	CF ₄	1.750	-150 °C	875.2	-150 °C	2 871.6	-268 °F	6.61				
Refrigerant 21	CHCl ₂ F	1.426	0 °C	891.0	0 °C	2 923.2	32 °F	3.97				
Refrigerant 22	CHClF ₂	1.491	-69 °C	893.9	50 °C	2 923.2	32 °F	4.79				
Refrigerant 113	CCl ₂ F- CClF ₂	1.563		783.7	0 °C	2 571.2	32 °F	3.44				
Refrigerant 114	CClF ₂ - CClF ₂	1.455		665.3	-10 °C	2 182.7	14 °F	3.73				
Refrigerant 115	C ₂ ClF ₅			656.4	-50 °C	2 153.5	-58 °F	4.42				
Refrigerant C318	C ₄ F ₈	1,620	-20 °C	574.0	-10 °C	1 883.2	14 °F	3.88				
Sodium nitrate	NaNO ₃	1.884	336 °C	1 763.3	336 °C	5 785.1	637 °F	0.74		1.370	336 °C	14.740
Sodium nitrite	NaNO ₂	1.805	292 °C	1 876.8	292 °C	6 157.5	558 °F					
Sulphur	S			1 177.0	250 °C	3 861.5	482 °F	-1.13				
Sulphuric Acid	H ₂ SO ₄	1.841		1 257.6		4 126.0		1.43		11.160		120.081
Tetrachloroethane	C ₂ H ₂ Cl ₄	1.553	20 °C	1 170.0	20 °C	3 838.6	68 °F			1.190		12.804
Tetrachloroethene	C ₂ Cl ₄	1.632		1 036.0		3 399.0						
Tetrachloromethane	CCl ₄	1.595	20 °C	926.0		3 038.1				0.607		6.531
Tetrafluoromethane (Freon 14)	CF ₄	1.750	-150 °C	875.2	-150 °C	2 871.5	-283 °F	6.61				

All data given at +25 °C (+77 °F) unless otherwise stated				Sound speed				Change of sound speed per °C	Viscosity (kinematic)			
Substance	Chemical formula	Density $\text{g} \cdot \text{cm}^{-3}$		$\text{m} \cdot \text{s}^{-1}$		$\text{ft} \cdot \text{s}^{-1}$		$\text{m} \cdot \text{s}^{-1} \cdot ^\circ\text{C}^{-1}$	$\text{mm}^2 \cdot \text{s}^{-1}$		$10^{-6} \cdot \text{ft}^2 \cdot \text{s}^{-1}$	
Toluene	C ₇ H ₈	0.867	20 °C	1 328.0	20 °C	4 357.0	68 °F	4.27	0.644		6.929	
Toluol	C ₇ H ₈	0.866		1 308.0		4 291.3		4.20	0.580		6.240	
Trichlorofluoromethane (Freon 11)	CCl ₃ F	1.490		828.3	0 °C	2 717.5	32 °F	3.56				
Turpentine		0.880		1 255.0		4 117.5			1.400		15.064	
Water, distilled	H ₂ O	0.996		1 498.0		4 914.7		-2.40	1.000		10.760	
Water, heavy	D ₂ O			1 400.0		4 593.0						
Water, sea		1.025		1 531.0		5 023.0		-2.40	1.000		10.760	

Table 13: Technical data of fluids

KATflow 200

TECHNICAL DATA

8.3 Dependence between temperature and sound speed in water

Temperature		Sound speed in water	
°C	°F	m/s	ft/s
0	32.0	1 402	4 600
1	33.8	1 407	4 616
2	35.6	1 412	4 633
3	37.4	1 417	4 649
4	39.2	1 421	4 662
5	41.0	1 426	4 679
6	42.8	1 430	4 692
7	44.6	1 434	4 705
8	46.4	1 439	4 721
9	48.2	1 443	4 734
10	50.0	1 447	4 748
11	51.8	1 451	4 761
12	53.6	1 455	4 774
13	55.4	1 458	4 784
14	57.2	1 462	4 797
15	59.0	1 465	4 807
16	60.8	1 469	4 820
17	62.6	1 472	4 830
18	64.4	1 476	4 843
19	66.2	1 479	4 853
20	68.0	1 482	4 862
21	69.8	1 485	4 872
22	71.6	1 488	4 882
23	73.4	1 491	4 892
24	75.2	1 493	4 899
25	77.0	1 496	4 908
26	78.8	1 499	4 918
27	80.6	1 501	4 925
28	82.4	1 504	4 935
29	84.2	1 506	4 941
30	86.0	1 509	4 951
31	87.8	1 511	4 958
32	89.6	1 513	4 964
33	91.4	1 515	4 971
34	93.2	1 517	4 977
35	95.0	1 519	4 984
36	96.8	1 521	4 984
37	98.6	1 523	4 990
38	100.4	1 525	4 997
39	102.2	1 527	5 010
40	104.0	1 528	5 013
41	105.8	1 530	5 020
42	107.6	1 532	5 026
43	109.4	1 534	5 033
44	111.2	1 535	5 036
45	113.0	1 536	5 040
46	114.8	1 538	5 046
47	116.6	1 538	5 049
48	118.4	1 540	5 053
49	120.2	1 541	5 056
50	122.0	1 543	5 063

Temperature		Sound speed in water	
°C	°F	m/s	ft/s
51	123.8	1 543	5 063
52	125.6	1 544	5 066
53	127.4	1 545	5 069
54	129.2	1 546	5 072
55	131.0	1 547	5 076
56	132.8	1 548	5 079
57	134.6	1 548	5 079
58	136.4	1 548	5 079
59	138.2	1 550	5 086
60	140.0	1 550	5 086
61	141.8	1 551	5 089
62	143.6	1 552	5 092
63	145.4	1 552	5 092
64	147.2	1 553	5 092
65	149.0	1 553	5 095
66	150.8	1 553	5 095
67	152.6	1 554	5 099
68	154.4	1 554	5 099
69	156.2	1 554	5 099
70	158.0	1 554	5 099
71	159.8	1 554	5 099
72	161.6	1 555	5 102
73	163.4	1 555	5 102
74	165.2	1 555	5 102
75	167.0	1 555	5 102
76	167.0	1 555	5 102
77	170.6	1 554	5 099
78	172.4	1 554	5 099
79	174.2	1 554	5 099
80	176.0	1 554	5 099
81	177.8	1 554	5 099
82	179.6	1 553	5 095
83	181.4	1 553	5 095
84	183.2	1 553	5 095
85	185.0	1 552	5 092
86	186.8	1 552	5 092
87	188.6	1 552	5 092
88	190.4	1 551	5 089
89	192.2	1 551	5 089
90	194.0	1 550	5 086
91	195.8	1 549	5 082
92	197.6	1 549	5 082
93	199.4	1 548	5 079
94	201.2	1 547	5 076
95	203.0	1 547	5 076
96	204.8	1 546	5 072
97	206.6	1 545	5 069
98	208.4	1 544	5 066
99	210.2	1 543	5 063
100	212.0	1 543	5 063
104	220.0	1 538	5 046
110	230.0	1 532	5 026
116	240.0	1 524	5 000

KATflow 200

TECHNICAL DATA

Temperature		Sound speed in water	
°C	°F	m/s	ft/s
121	250.0	1 516	5 007
127	260.0	1 507	4 944
132	270.0	1 497	4 912
138	280.0	1 487	4 879
143	290.0	1 476	4 843
149	300.0	1 465	4 807
154	310.0	1 453	4 767
160	320.0	1 440	4 725
166	330.0	1 426	4 679
171	340.0	1 412	4 633
177	350.0	1 398	4 587
182	360.0	1 383	4 538
188	370.0	1 368	4 488
193	380.0	1 353	4 439
199	390.0	1 337	4 387
204	400.0	1 320	4 331
210	410.0	1 302	4 272
216	420.0	1 283	4 210
221	430.0	1 264	4 147
227	440.0	1 244	4 082
232	450.0	1 220	4 003
238	460.0	1 200	3 937
243	470.0	1 180	3 872
249	480.0	1 160	3 806
254	490.0	1 140	3 740
260	500.0	1 110	3 642

Table 14: Temperature and sound speed in water

9 SPECIFICATION

9.1 General

Measuring principle	Ultrasonic time difference correlation principle
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: $\pm 1 \dots 3$ % 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
Gaseous and solid content of liquid media	< 10 % of volume

9.2 Flowmeter

Enclosure type	Hand-held
Degree of protection	IP65 according EN 60529
Operating temperature	-10 ... +60 °C (+14 ... +140 °F)
Housing material	ABS (UL 94 HB)
Measurement channels	1
Power supply	Internal rechargeable batteries: 4 x NiMH AA 2850 mAh (daily discharge rate approx. 2 % per day, operating range 0 ... +30 °C) or external power supply 9 V DC
Operating time	Up to 24 h with fully charged internal batteries
Display	LCD graphic display, 128 x 64 dots, backlit
Dimensions	228 (h) x 72/124 (w) x 58 (d) mm (without cable glands)
Weight	Approx. 650 g
Power consumption	< 3 W
Signal damping	0 ... 99 s
Transit time measurement rate	100 Hz (standard)
Output update time	1 s, faster rates on application
Operating languages	Czech, Dutch, English, French, German, Italian, Romanian, Russian, Spanish, Turkish (others on request)

KATflow 200

SPECIFICATION

9.3 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, bbl/s
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
Speed of sound	c in m/s
Signal quality	Signal in dB, Noise in dB, SNR (signal-to-noise ratio)

9.4 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
Logging data	All measured and totalised values, parameter sets

9.5 Communication

Serial interface	RS 232
Data	Instantaneous measured value, parameter set and configuration, logged data

9.6 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 10, 11, Linux

9.7 Sensors: K1L, K1N, K1E

Sensor type	K1L	K1N	K1E
Pipe diameter range	50 ... 6 500 mm	50 ... 3 000 mm	50 ... 3 000 mm
Temperature range	-30 ... +80 °C (-22 ... +176 °F)	-30 ... +130 °C (-22 ... +266 °F)	-30 ... +250 °C (-22 ... +482 °F) (for short periods up to +300 °C (+572 °F))
Material of cable conduits	PVC	Stainless steel	Stainless steel
Standard cable lengths	5.0 m, 10.0 m	4.0 m	4.0 m
Dimensions of sensor heads	60 (h) x 30 (w) x 34 (d) mm		
Material of sensor heads	Stainless steel		
Degree of protection	IP66 according to EN 60529 (IP67 and IP68 on request)		

9.8 Sensors: K4L, K4N, K4E

Sensor type	K4L	K4N	K4E
Pipe diameter range	10 ... 250 mm	10 ... 250 mm	10 ... 250 mm
Temperature range	-30 ... +80 °C (-22 ... +176 °F)	-30 ... +130 °C (-22 ... +266 °F)	-30 ... +250 °C (-22 ... +482 °F) (for short periods up to +300 °C (+572 °F))
Material of cable conduits	PVC	Stainless steel	Stainless steel
Standard cable lengths	5.0 m, 10.0 m	2.5 m	2.5 m
Dimensions of sensor heads	43 (h) x 18 (w) x 22 (d) mm		
Material of sensor heads	Stainless steel		
Degree of protection	IP66 according to EN 60529 (IP67 and IP68 on request)		

10 INDEX

Acoustic coupling gel	15	Pipe material selection	30, 31
Battery charging	18, 22	Pipe parameters	15
Certificate of Conformity	53	Pipe preparation	11
Chains (sensor mounting)	17	Process value	26
Commissioning	29	Quick Start	23, 26, 29
Contrast	19, 20	Retaining clip (sensor mounting)	17
Customer Return Note (CRN)	5, 38, 54	Return Policy	4, 5
Data logger	18, 22, 28, 32, 36, 37, 50	RS 232	22, 36
Diagnostic displays	18, 26-28	Safety	4, 5, 38
Diagnostics	11, 35	Scope function	37
Diagonal Mode	12, 15, 24	Sensor configuration	12
Dimensions	13, 49, 51	Sensor location	8, 16, 17
Display	19, 21-23, 26, 27, 32, 34, 37, 49	Sensor mounting	7, 9, 12, 15, 17
Display icons	21	Sensor positioning screen	16, 17, 25
Disturbance sources	9, 11	Sensor separation	16, 17
Electrical connections	14	Serial interface	36, 50
Error messages	39	Setup Wizard	23, 25, 29
Fluid selection	23	Software KATdata+	37, 41, 50
Fluid temperature	23, 29	SOS (speed of sound)	29
Identification of components	7	Sound passes	24, 39
Installation	4, 5, 7-9, 13, 15, 26, 31, 34	Specification	49
Keypad	19, 21, 23, 30, 34	Switching on/off	18
Legislative requirements	5	Three-line display	26
Liner material	24, 30	Totaliser	19, 20, 26, 27, 30
Maintenance	38	Transit-time method	6
Measurements	6, 8, 9, 23, 25, 50	Troubleshooting	4, 39
Measuring principle	6, 49	Units of measurement	50
Menu structure	27, 29, 35	Wall thickness	7, 8, 12, 16, 24, 30, 31, 36, 37
Negative separation distance	12	Wall thickness measurement	7, 36
Outer pipe diameter	24	Warranty	4, 5
Packaging	4, 7	Wizard (Quick Setup Wizard)	23, 25, 29
Passes	30		

11 APPENDIX A – CERTIFICATE OF CONFORMITY



Declaration of Conformity

We, Katronic Technologies Ltd., declare under our sole responsibility that the product listed below to which this declaration relates are in conformity with the EU directives and other mentioned standards:

- Directive 2014/30/EU for Electromagnetic Compatibility (EMC)
- Low Voltage Directive 2014/35/EU for Electrical Safety (LVD)
- Directive 2011/65/EU on the Restriction of Hazardous Substances (RoHS)
- ISO 2406:2023 – Measurement of fluid flow in closed conduits - Clamp-on ultrasonic transit-time meters for liquids and gases
- ASME MFC-5.1:2011 – Measurement of Liquid Flow in Closed Conduits Using Transit-Time Ultrasonic Flowmeters

Name of Product	Description
KATflow 100, 150, 200, 210 and 230	Ultrasonic flowmeter with associated KATRONIC transducers

The mentioned products are in conformity with the following European Standards:

Class	Standard	Description
EMC Directive	EN 61326-1:2022	Electrical equipment for measurement, control and laboratory use – EMC requirements
Immunity	EN 61000-4-2:2009	Electrostatic discharge
	EN 61000-4-3:2021	RF field
	EN 61000-4-4:2013	Electric fast transient/burst
	EN 61000-4-5:2019	Surge
	EN 61000-4-6:2014	RF conducted
Emission	EN 61000-4-11:2021	AC mains voltage dips and interruption
	EN 61326-1:2022	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements
	EN 55022:2010	Disturbance voltage Class A
Low Voltage Directive	EN 61010-1:2020	Safety requirements for electrical equipment for measurement, control and laboratory use

Coventry, 20 June 2024

For and on behalf of Katronic Technologies Ltd.

Yours sincerely,

Andrew Sutton
Managing Director

Page 1 of 1

Katronic Technologies Ltd.
Earls Court
Warwick Street
Coventry CV5 6ET
United Kingdom

Tel. +44 (0)2476 714 111
Fax +44 (0)2476 715 446
E-mail info@katronic.co.uk
Web www.katronic.co.uk

VAT No. GB 688 0907 89
Registered in England
Number 3298028
Registered office as shown



Cert. No. 23ISO0338

12 APPENDIX B – CUSTOMER RETURN NOTE (CRN)



Company	<input type="text"/>
Name	<input type="text"/>
Tel. No.	<input type="text"/>
E-mail	<input type="text"/>
Address	<input type="text"/>
Instrument model	<input type="text"/>
Serial number	<input type="text"/>
Katronic contract number (if known)	<input type="text"/>
Sensor type(s)	<input type="text"/>
Sensor serial number(s)	<input type="text"/>

The enclosed instrument has been used in the following environment (please mark):

- ☐ Nuclear radiation
- ☐ Water-endangering
- ☐ Toxic
- ☐ Caustic
- ☐ Biological
- ☐ Other (please specify)

We confirm that (please mark),

- ☐ we have checked the instrument and sensors are free of any contamination,
- ☐ we have neutralised, flushed and decontaminated all parts which have been in contact with hazardous substances and/or environments,
- ☐ there is no risk to man or environment through any residual material.

_____	_____	_____
Date	Signature	Company Stamp