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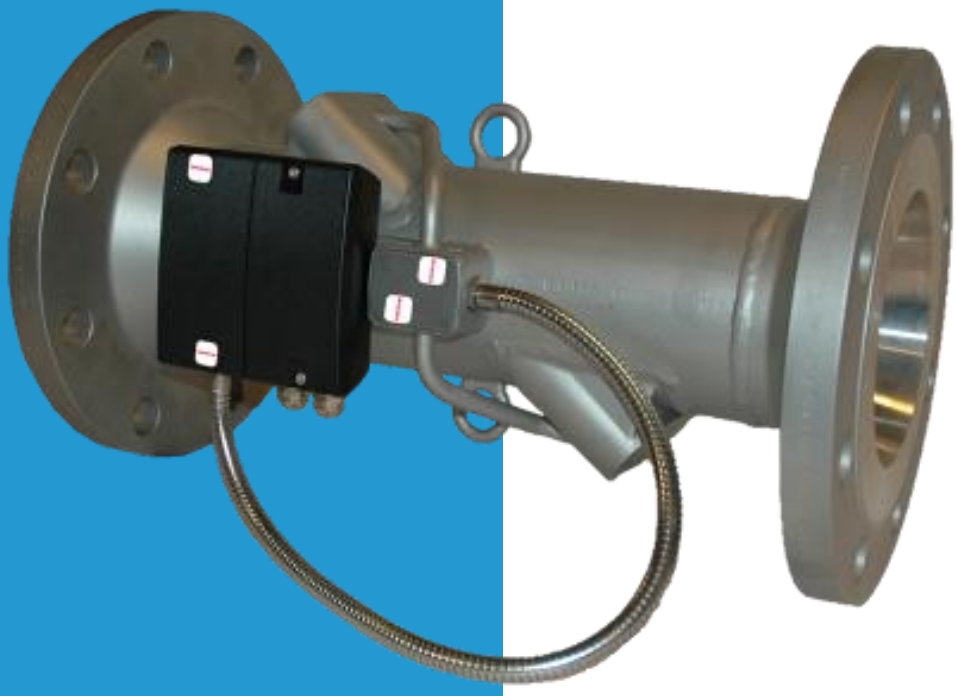
Technical Description

ULTRAFLOW® 54 DN150-300



Contents

1 General description

ULTRAFLOW® 54 DN150-300 is a static flow sensor based on the ultrasonic measuring principle. It is primarily used as a volume flow sensor for energy meters such as MULTICAL®. ULTRAFLOW® 54 DN150-300 has been designed for use in heating and cooling installations where water is the heat-bearing medium.

ULTRAFLOW® 54 employs ultrasonic measuring techniques and microprocessor technology. All calculating and flow measuring circuits are collected on one single board, thus providing a compact and rational design and, in addition, exceptionally high measuring accuracy and reliability is obtained.

The volume is measured using bidirectional ultrasonic technique based on the transit time method, with proven long-term stability and accuracy. Four ultrasonic transducers are used to send sound signals both against and with the flow. The ultrasonic signal travelling with the flow reaches the opposite transducer first. The time difference between the two signals can be converted into flow velocity and thereby also volume.

A three-wire signal cable is used to connect ULTRAFLOW® 54 to the Kamstrup MULTICAL® calculator. The cable supplies the flow sensor and also transfers the signal from sensor to calculator. A signal corresponding to the flow – or more correctly, a number of pulses proportional to the water volume flowing through – is transmitted.

ULTRAFLOW® 54 DN150-300 is available with internal supply, e.g. if the distance between MULTICAL® and ULTRAFLOW® exceeds 10 metres. If ULTRAFLOW® 54 DN150-300 is used for other equipment (e.g. other brands of calculators), the sensor must be fitted with a galvanically separated output module and a supply of its own.

2 Data

ULTRAFLOW®54 DN150-300

2.1 Electrical data

Supply voltage	3.6 VDC ± 0.1 VDC
Supply, galvanically coupled output module (Y=1)	Powered by MULTICAL®
Supply, galvanically separated output module (Y=2) [1]	
Mains supply	230 VAC +15/-30 %, 50 Hz 24 VAC ±50 %, 50 Hz
Power consumption	< 1 W
Backup	Integral SuperCap eliminates interruptions due to short-term power failures
Supply, galvanically separated output module (Y=3)	
Battery	3.65 VDC, D-cell lithium
Replacement interval	6-years @ t_{BAT} < 30 °C
Mains supply	230 VAC +15/-30 %, 50 Hz 24 VAC ±50 %, 50 Hz
Power consumption	< 1 W
Backup	Integral SuperCap eliminates interruptions due to short-term power failures
Signal cable length, from flow sensor electronics box with galvanically coupled output module (Y=1)	Max. 10 m (powered by calculator)
Signal cable length, from flow sensor electronics box with galvanically separated output module (Y=2 and 3)	Depending on calculator (use of own supply in ULTRAFLOW®). See *paragraph 7.5.2* for applications with MULTICAL®
EMC data	Fulfils EN 1434:2007 class C, MID E1 and E2

2.2 Mechanical data

Metrological class	2 or 3	
Environmental class	Fulfils EN 1434 class C	
Ambient temperature	5…55 °C (indoors)	
Protection class	IP67	When installed properly. See *paragraph* 7.2
Humidity	< 93 % RH non-condensing	
Mechanical environment	MID M1 and M2	
Temperature of medium	2…150 °C (Heat & heat/cooling meters) 2…130 °C (Heat/cooling meters) 2…50 °C (Cooling meters)	At medium temperatures above 90 °C or below ambient temperature, the electronics box must be wall mounted or mounted via the enclosed distance piece.
Storage temperature (empty sensor)	-25…60 °C	
Pressure stage	PN25, PS25 and PN16, PS16	

[1] It is possible to use battery supply in combination with output module (Y=2), e.g. for temporary supply of flow sensors installed at construction sites.

2.3 Flow data

Nom. flow q_p [m³/h]	Nom. diameter [mm]	Meter factor [1] [imp/l]	Dynamic range $q_p:q_i$	$q_s:q_p$	Flow @ 125 Hz [2] [m³/h]	Δp @ q_p [bar]	Min. Cut off [l/h]
150	DN150	1	100:1	2:1	450	0.02	300
250	DN150	0.6	100:1	2:1	750	0.055	500
400	DN150	0.4	100:1	2:1	1125	0.04	800
400	DN200	0.4	100:1	2:1	1125	0.01	800
400	DN250	0.4	100:1	2:1	1125	0.01	800
600	DN200	0.25	100:1	2:1	1800	0.022	1200
600	DN250	0.25	100:1	2:1	1800	0.022	1200
1000	DN250	0.15	100:1	2:1	3000	0.015	2000
1000	DN300	0.15	100:1	2:1	3000	0.015	2000

[1] *Standard meter factor. Appears from ULTRAFLOW® label. For other meter factors see paragraph 4.*

[2] *Saturation flow. Max pulse frequency 128 Hz is maintained at higher flow rates.*

Table 1

2.4 Material

Wetted parts

Housing	Stainless steel, W.no. 1.4307
Transducer holder	Stainless steel, W.no. 1.4308
Transducer	Titanium
Gaskets	Fibre

Electronics box

Base, cover	Thermoplastic, PC 10 % GF
Fitting hardware, distance piece for electronics box	Thermoplastic, PPS 40 % GF

Signal cable (optional for separate ULTRAFLOW® 54)

Silicone cable (3x0.5 mm²)

Power supply cable 24/230 VAC (optional when selecting supply module)

Cable with PVC-mantle (2x0.75 mm²)

3 Type overview

Nom. flow q_p [m³/h]	Installation dimensions		
150	DN150x500 mm		
250	DN150x500 mm		
400	DN150x500 mm	DN200x500 mm	DN250x600 mm
600	DN200x500 mm	DN250x600 mm	
1000	DN250x600 mm	DN300x500 mm	

Flange EN 1092-1. Flange facing type B, raised face

Table 2

4 Ordering details

4.1 Type numbers of ULTRAFLOW® 54 for MULTICAL®

The table below shows a list of type numbers for ULTRAFLOW® 54 ordered with MULTICAL®

Type number	q_p [m³/h]	q_i [m³/h]	q_s [m³/h]	Connection [mm]	PN [bar]	Length [mm]	Meter factor [imp/l]	CCC	Material flow sensor housing
65-5- FCCN -XXX	150	1.5	300	DN150	25	500	1	447 (489)	Stainless steel
65-5- FDCN -XXX	250	2.5	500	DN150	25	500	0.6	481	Stainless steel
65-5- FECN -XXX	400	4	800	DN150	25	500	0.4	491	Stainless steel
65-5- FECP -XXX	400	4	800	DN200	25	500	0.4	491	Stainless steel
65-5- FECR -XXX	400	4	800	DN250	25	600	0.4	491	Stainless steel
65-5- FFCP -XXX	600	6	1200	DN200	25	500	0.25	492	Stainless steel
65-5- FFCR -XXX	600	6	1200	DN250	25	600	0.25	492	Stainless steel
65-5- FGCR -XXX	1000	10	2000	DN250	25	600	0.15	493	Stainless steel
65-5- FGDS -XXX	1000	10	2000	DN300	16	500	0.15	493	Stainless steel

XXX, code regarding marking and final assembly.

Table 3

4.2 Type numbers of separate ULTRAFLOW® 54

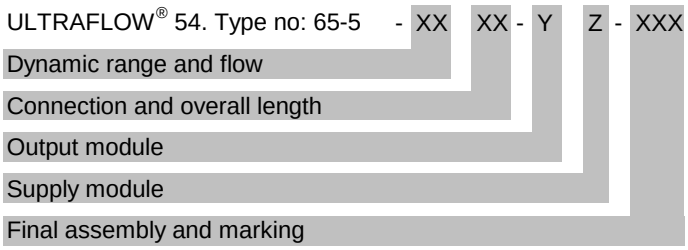
Type number	q_p [m³/h]	q_i [m³/h]	q_s [m³/h]	Connection [mm]	PN [bar]	Length [mm]	Material flow sensor chousing
65-5- FCCN -YZ -XXX	150	1.5	300	DN150	25	500	Stainless steel
65-5- FDCN -YZ -XXX	250	2.5	500	DN150	25	500	Stainless steel
65-5- FECN -YZ -XXX	400	4	800	DN150	25	500	Stainless steel
65-5- FECP -YZ -XXX	400	4	800	DN200	25	500	Stainless steel
65-5- FECR -YZ -XXX	400	4	800	DN250	25	600	Stainless steel
65-5- FFCP -YZ -XXX	600	6	1200	DN200	25	500	Stainless steel
65-5- FFCR -YZ -XXX	600	6	1200	DN250	25	600	Stainless steel
65-5- FGCR -YZ -XXX	1000	10	2000	DN250	25	600	Stainless steel
65-5- FGDS -YZ -XXX	1000	10	2000	DN300	16	500	Stainless steel

XXX, code regarding marking and final assembly.

Table 4

4.2.1 Ordering details of separate ULTRAFLOW® 54

Type number composition of separate ULTRAFLOW® 54



In addition to the basic variants listed in *Table 3*, you must select output module (Y), supply module (Z) as well as meter factor programming (CC) and pulse duration (E).

4.2.2 Type numbers of output and supply modules

Type number overview of output modules (Y) and supply modules (Z) for separate ULTRAFLOW® 54.

Y	Output module	Corresponding supply module
1	Galvanically coupled module	0 (powered by MULTICAL®)
2	Galvanically separated module	0, 7, 8
3	Galvanically separated module, low power	0, 2, 7, 8

Z	Supply module	Corresponding output module
0	No supply	1, 2, 3
2	Battery, D-cell	3
7	230 VAC supply module	2, 3
8	24 VAC supply module	2, 3

Table 5. Output modules (Y) and supply modules (Z).

The variant with galvanically coupled output module (Y=1) is solely for use together with MULTICAL®.

The variant with galvanically separated output module (Y=2 or 3) is used in the following situations:

1) More than 10 metres cable length between MULTICAL® and ULTRAFLOW® is required.

2) For flow sensor no. 2 in connection with MULTICAL®. If two flow sensors are used together with MULTICAL®, one must include a galvanically separated output module (Y=2 or 3).

   For further details see *paragraph 7.8 Calculator with two flow sensors*.

3) ULTRAFLOW® is connected to other equipment/foreign calculators.

Please note: Flow info cannot be read if output module with galvanic separation is used.

4.2.3 Programming options of meter factor and pulse durations

Overview of programming options as to meter factors (CC) and pulse durations (E) for separate ULTRAFLOW®

q_p	Meter factor			Pulse duration				
[m³/h]	[imp/l]	[l/imp]	CC	[ms] (E=1)	[ms] (E=4)	[ms] (E=5)	[ms] (E=6)	
150	**1**		**33**	**3.9**	**-**	**-**	**-**	**Default**
150		10	34	-	20	-	-	
150		25	64	-	20	-	-	
150		100	35	-	20	50	100	
150		250	65	-	20	50	100	
150		1000	36	-	20	50	100	
150		2500	66	-	20	50	100	
250	**0.6**		**43**	**3.9**	**-**	**-**	**-**	**Default**
250		10	34	-	20	-	-	
250		25	64	-	20	-	-	
250		100	35	-	20	50	100	
250		250	65	-	20	50	100	
250		1000	36	-	20	50	100	
250		2500	66	-	20	50	100	
400	**0.4**		**63**	**3.9**	**-**	**-**	**-**	**Default**
400		100	35	-	20	50	-	
400		250	65	-	20	50	100	
400		1000	36	-	20	50	100	
400		2500	66	-	20	50	100	
600	**0.25**		**14**	**3.9**	**-**	**-**	**-**	**Default**
600		100	35	-	20	50	-	
600		250	65	-	20	50	-	
600		1000	36	-	20	50	100	
600		2500	66	-	20	50	100	
1000	**0.15**		**24**	**3.9**	**-**	**-**	**-**	**Default**
1000	(0.25)	4	14	3.9	-	-	-	*)
1000		100	35	-	20	50	-	
1000		250	65	-	20	50	-	
1000		1000	36	-	20	50	100	
1000		2500	66	-	20	50	100	

**) Spare part for ULTRAFLOW® type 65-S/R/T. Configured 65-5-FGCR. No flow info.*

Table 6. Programming options as to meter factor (CC) and pulse durations (E) for ULTRAFLOW® 54 DN150-300.

Based on a q_p value a meter factor in *Table 6* is chosen. The valid possible pulse durations are listed on the same line as the chosen meter factor.

Example: For ULTRAFLOW® 54 q_p 400 m³/h a meter factor of 100 l/imp (CC=35) is required. Based on this meter factor one of the pulse durations, 20 milliseconds (E4) or 50 milliseconds (E5), is selected.

Default values in *Table 6* are programming values for ULTRAFLOW® 54 when connected to a Kamstrup MULTICAL® calculator.

4.3 Accessories

Please note that not all article numbers can be directly ordered. Some articles must be ordered via Kamstrup service department.

Article number	Description	Note (when ordering ULTRAFLOW®)
65-000-000-2000	D-cell lithium battery with two-pole connector	
3026-477 [1)]	Fitting for D-cell battery	Enclosed if battery supply or "No supply" is selected
1650-157 [1)]	Plug for cable connection	Enclosed if battery supply or "No supply" is selected

[1)] Obligatory when changing from mains supply module to battery supply.

Article number	Description	Note (when ordering ULTRAFLOW®)
65-000-000-7000 [2)]	230 VAC supply module	
65-000-000-8000 [2)]	24 VAC supply module	
5000-290	Cable between supply module and output module	Enclosed if supply module is selected
5000-286	24/230 VAC power cable	Optional

[2)] Including 5000-290.

Article number	Description	Note (when ordering ULTRAFLOW®)
66-99-011	Output module (Y=1), galvanically coupled	
66-99-012	Output module (Y=2), galvanically separated	
66-99-013	Output module (Y=3), galvanically separated, "Low power"	

Article number	Description	Note (when ordering ULTRAFLOW®)
5000-333	2.5 m silicone cable (3-wire)	Default for ULTRAFLOW® ordered with MULTICAL® Optional for separate ULTRAFLOW®
5000-259	5 m silicone cable (3-wire)	Optional
5000-270	10 m silicone cable (3-wire)	Optional

3026-207	Mounting fitting for electronics box	Enclosed (mounted)
6561-332	Short distance piece	
3026-507	Long distance piece	Enclosed
1051-006	Collar band for long distance piece	Enclosed

1150-140	Gasket, DN150 PN25 (1 pc)	Enclosed (2 pcs.)
1150-139	Gasket, DN200 PN25 (1 pc)	Enclosed (2 pcs.)
1150-141	Gasket, DN250 PN25 (1 pc)	Enclosed (2 pcs.)
1150-164	Gasket, DN300 PN16 (1 pc)	Enclosed (2 pcs.)

4.3.1 Cables

ULTRAFLOW® 54 DN150-300, when ordered with MULTICAL®, is supplied with 2.5 metres signal cable, optionally 5 or 10 metres. The cable is mounted in the ULTRAFLOW® 54 electronics box and in MULTICAL® 6xx. When ULTRAFLOW® 54 is ordered with MULTICAL® 8xx, the calculator is supplied separately. Hence the cable is only mounted in the ULTRAFLOW® 54 electronics box.

ULTRAFLOW® 54 DN150-300, when ordered as a separate flow sensor, is optionally available with signal cable in lengths of 2.5, 5 or 10 metres. The cable is mounted in the flow sensor's electronics box.

If 24/230 VAC supply module is selected, the sensor is optionally available with power supply cable. The cable is mounted in the flow sensor's electronics box from the factory.

5 Dimensional sketches

All measurements are in mm, unless otherwise stated.

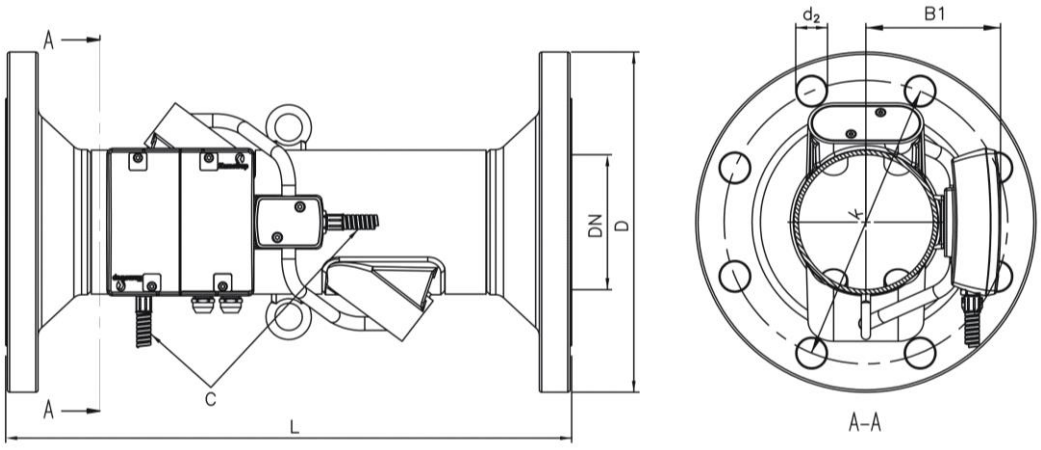


Figure 1

Nom. diameter	PN	Nom. flow q_p	L	D	k	Bolts			B1	E	Steel tube length	Approx. weight
	[bar]	[m³/h]				Quantity	Thread	d_2			C	[kg]
DN150	25	150 & 250	500	300	250	8	M24	26	119	282	650	37
DN150	25	400	500	300	250	8	M24	26	140	303	625	36
DN200	25	400 & 600	500	360	310	12	M24	26	166	329	570	49
DN250	25	400 & 600	600	425	370	12	M27	30	166	329	570	79
DN250	25	1000	600	425	370	12	M27	30	194	357	500	75
DN300	16	1000	500	460	410	12	M24	26	194	357	500	76

Flange EN 1092-1. Flange facing type B, raised face

Table 7

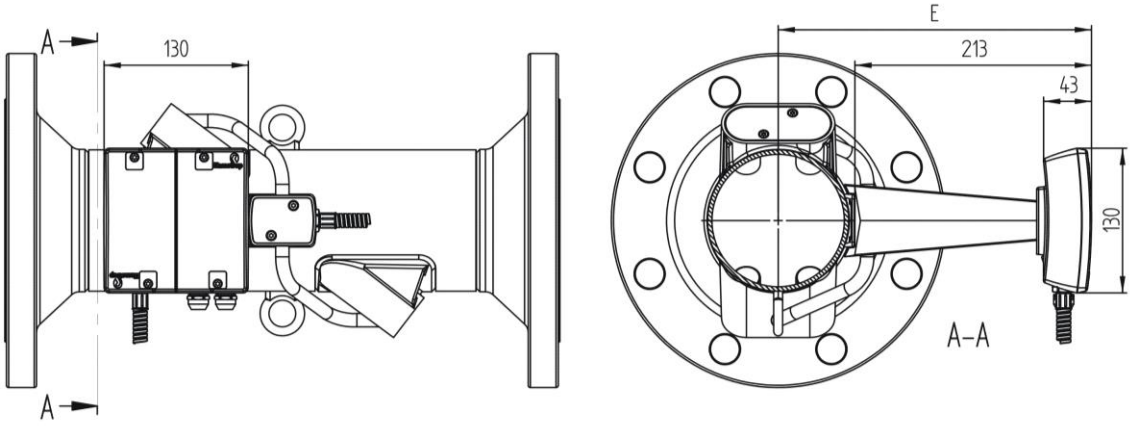


Figure 2

6 Pressure loss

Pressure loss in a flow sensor is stated as max. pressure loss at q_p.

According to EN 1434 max. pressure loss must not exceed 0.25 bar unless the energy meter includes a flow controller or functions as pressure reducing equipment.

The pressure loss in a meter increases with the square of the flow and can be stated as:

$$Q = kv \times \sqrt{\Delta p}$$

where:

Q = volume flow rate [m³/h]

kv = volume flow rate at 1 bar pressure loss

Δp = pressure loss [bar]

Graph	Nom. flow q_p [m³/h]	Nom. diameter [mm]	kv	Q@0,25 bar [m³/h]
A	150 & 250	DN150	1060	530
B	400	DN150	2000	1000
C	400 & 600	DN200 & DN250	4040	2020
D	1000	DN250 & DN300	8160	4080

Table 8. Pressure loss table.

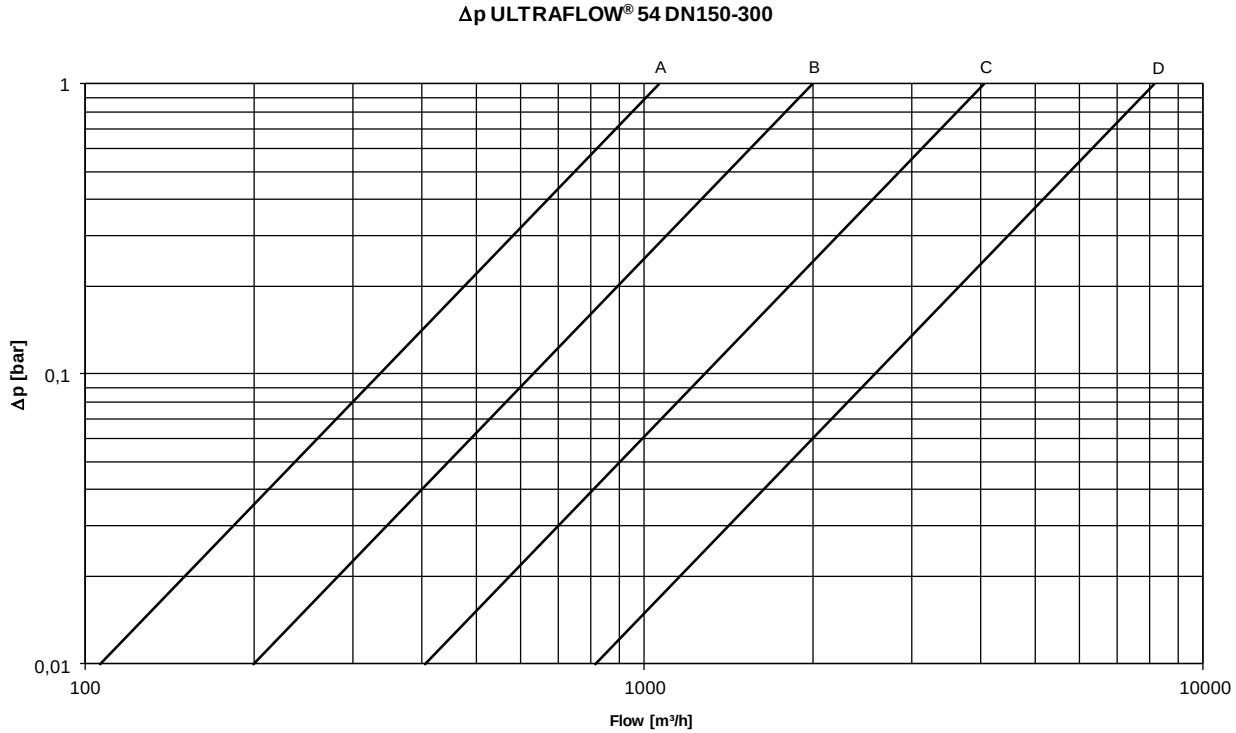


Figure 3. Pressure loss graphs.

7 Installation

Prior to installation of the flow sensor, the system should be flushed.

Correct flow sensor position (inlet or outlet) appears from the front label of MULTICAL®. The flow direction is indicated by an arrow on the flow sensor.

Please note: ULTRAFLOW® 54 may be lifted in the lifting rings only.

Pressure stage of ULTRAFLOW® 54: PN25, PS25/PN16, PS16. See marking on label.

Temperature of medium, ULTRAFLOW® 54: 2…150 °C/2…130 °C/2…50 °C. See marking on label.

Mechanical environment: M1 and M2 (fixed installation with minimum vibration and fixed installation with considerable or high vibration level respectively). See marking on label.

Electromagnetic environment: E1 and E2 (housing/light industry and industry respectively). See marking on label.

The meter's signal cables must be drawn at min. 25 cm distance to other installations.

Climatic environment: Must be installed in environments with non-condensing humidity as well as in closed locations (indoors).

The ambient temperature must be within 5…55 °C.

Maintenance and repair: The flow sensor is verified separately and can, therefore, be separated from the calculator. It is permitted to replace the supply and change the supply type. For battery supply a lithium battery with connector from Kamstrup A/S must be used. Lithium batteries must be correctly handled and disposed of (see Kamstrup document 5510-408, "Lithium batteries - Handling and disposal"). Other repairs require subsequent re-verification in an accredited laboratory.

If ULTRAFLOW® 54 is connected via a galvanically coupled output module, the flow sensor may be connected to a Kamstrup MULTICAL® calculator only.

If other calculator types are connected, ULTRAFLOW® 54 must be fitted with a galvanically separated output module and a power supply of its own.

Note: Please make sure that the meter factor is identical on flow sensor and calculator.

The steel tube between flow sensor housing and electronics box may not be disassembled.

At medium temperatures above 90 °C or below ambient temperature the flow sensor's electronics box must be mounted via the enclosed distance piece. Alternatively, the electronics box can be wall mounted at a distance of minimum 170 mm from the sensor.

In order to prevent cavitation the back pressure (pressure at the flow sensor outlet) at ULTRAFLOW® must be min. 1.5 bar at q_p and min. 2.5 bar at q_s. This applies to temperatures up to approx. 80 °C.

When the installation has been completed, water flow can be turned on. The valve on the inlet side must be opened first.

7.1 Installation angle of ULTRAFLOW® 54

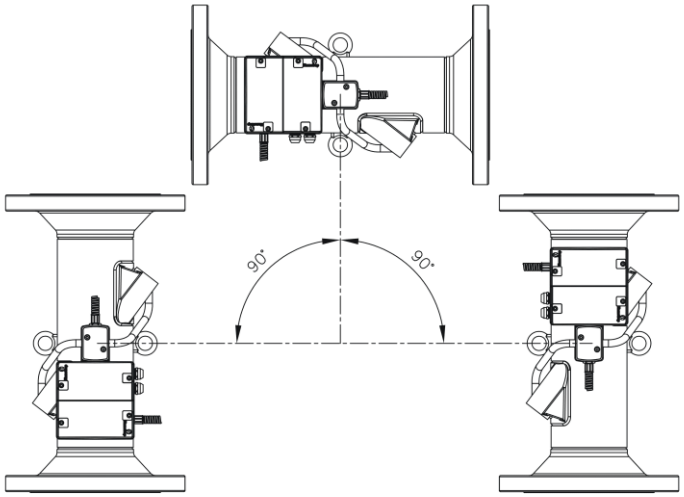


Figure 4

ULTRAFLOW® can be installed horizontally, vertically, or at an angle.

ULTRAFLOW® 54 is normally installed horizontally, with the lifting rings oriented vertically. The ultrasound paths in the flow sensor tube will thus be vertical, which is optimal in connection with possible stratification of the medium.

7.1.1 Mounting ULTRAFLOW® 54 in lifting ring

ULTRAFLOW® 54 can be mounted hanging from one of the two lifting rings depending on required flow direction. The enclosed distance piece can be used to secure optimal position of the electronics box. (See *paragraph 7.2*)

Figure 5

Figure 6

7.2 Mounting of ULTRAFLOW® 54 electronics box

At **medium temperature below 90 °C and at medium temperature above ambient temperature** the electronics box can be mounted directly on the flow sensor housing via the factory mounted fitting.

If the flow sensor is vertically mounted, the cable connections of the electronics box will be horizontally oriented. This is permitted. If the cable connections should preferably point downwards, the electronics box can be mounted via the enclosed distance piece, which moves the box approx. 170 mm away from the flow sensor housing. Alternatively, a shorter distance piece, which only moves the box approx. 45 mm away from the flow sensor housing, can be used. The short distance piece must be ordered separately (6561-332).

Figure 7

At **medium temperature above 90 °C** the temperature is too high for the electronics box to be mounted directly on the flow sensor housing.

Therefore, the electronics box must be mounted via the enclosed distance piece. The cable connections must always point downwards. (See *paragraph 7.2.1*)

Alternatively, the electronics box can be wall mounted as long as the distance to flow sensor housing and pipe installation is minimum 170 mm.

Figure 8

It can also be an advantage to use the enclosed distance piece if the flow sensor housing is insulated and the electronics box must be removed from the insulation.

If the required position of the electronics box differs from standard position, the distance piece can be mounted with the enclosed collar band around the flow sensor housing. However, please note that the cable connections must always point downwards. (See *paragraph 7.2.1*)

Figure 9

At **medium temperature below ambient temperature** (typically in cooling installations) it is important to take action to avoid condensation in the electronics box.

Therefore, the electronics box must be mounted via the enclosed distance piece.
The cable connections must always point downwards. (See *paragraph 7.2.1*).

Alternatively, the electronics box can be wall mounted as long as the distance to flow sensor housing and pipe installation is minimum 170 mm.

Furthermore, when mounting the electronics box please make sure that the cable connections on the box are at a higher level than the cable connection on the flow sensor housing.

By vertical mounting of ULTRAFLOW® 54 in a riser this can be secured by mounting the distance piece by means of the collar band as shown in *Figure 9*.

If ULTRAFLOW® 54 is mounted horizontally, the electronics box can be mounted on the distance piece by means of the collar band. The distance piece can then be turned upwards until the cable connections on the electronics box are in a higher position than the cable connection on the flow sensor housing. See *Figure 10*.

Alternatively, the electronics box can be wall mounted at a suitable distance to the installation (minimum 170 mm).

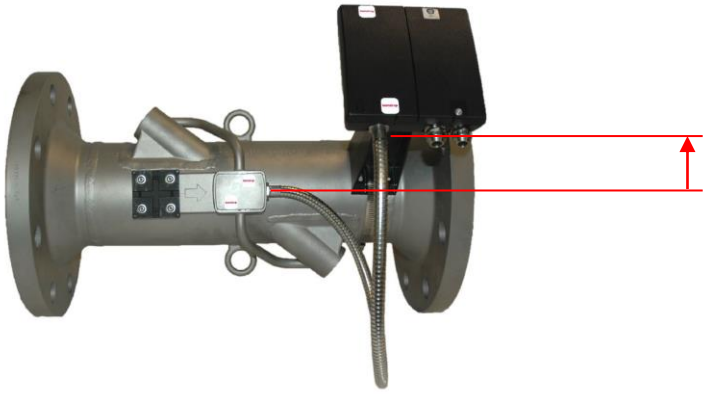


Figure 10

7.2.1 Orientation of flow sensor electronics box

Mounting the electronics box, the cable connections must always be horizontally or downwards oriented in order to avoid the risk of water and condensation being led into the electronics box via the cables.

This is especially important in humid environments, when ULTRAFLOW® 54 is used as cooling sensor or if the medium temperature can become lower than the ambient temperature.

Furthermore, steel tube and wires must in general hang freely downwards after the cable connections to form a drip nose for drainage of water and condensation.

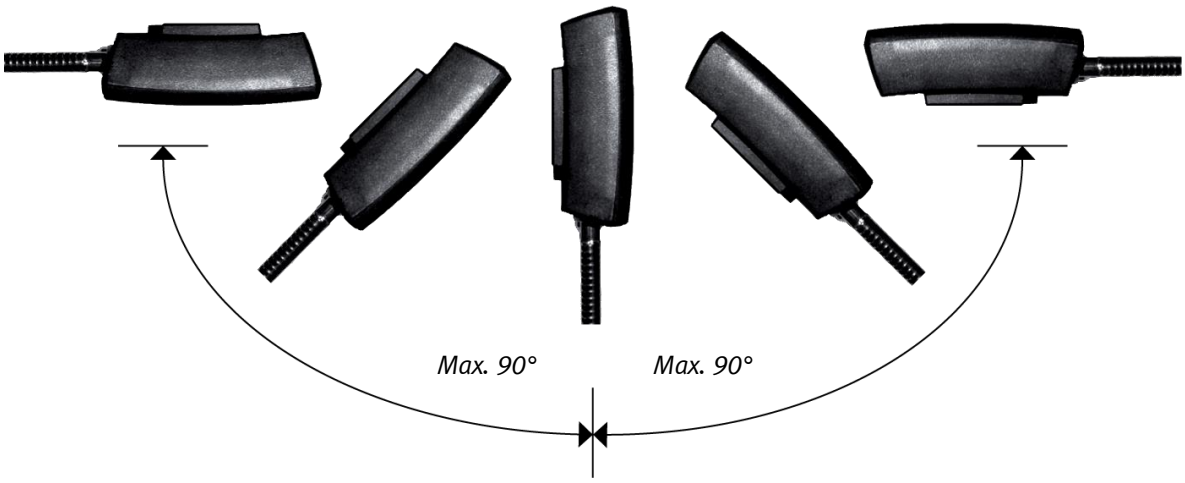


Figure 11

7.3 Straight inlet

ULTRAFLOW® 54 requires neither straight inlet nor outlet in order to fulfil the Measuring Instruments Directive (MID) 2014/32/EU and EN 1434:2015. Only in case of heavy flow disturbances before the meter will a straight inlet section be necessary. We recommend following the guidelines in CEN CR 13582.

Optimal position can be obtained by taking the below-mentioned installation methods into consideration:

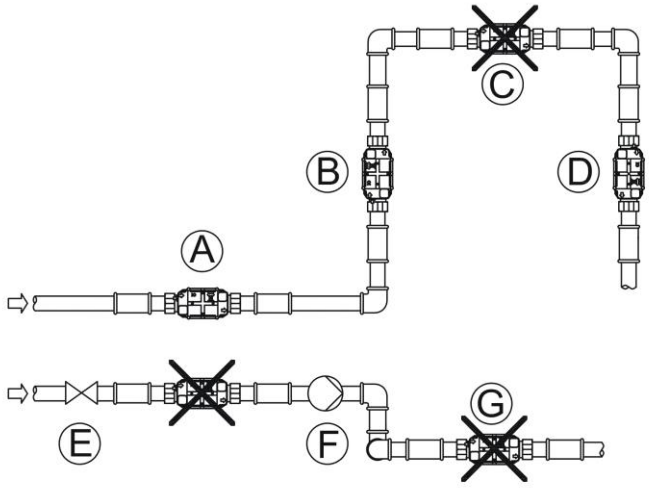


Figure 12

A Recommended flow sensor position.

B Recommended flow sensor position.

C Unacceptable position due to risk of air build-up.

D Acceptable in closed systems. Unacceptable position in open systems due to risk of air build-up.

E A flow sensor should not be placed immediately after a valve, except from closing valves (ball valve type) which must be completely open when not used for closing.

F A flow sensor should not be placed at the suction side of a pump.

G A flow sensor should not be placed after a double bend in two planes.

For general information concerning installation see CEN report *CEN CR 13582, Heat meter installation. Instructions in selection, installation and use of heat meters*.

7.4 Operating pressure

In order to prevent cavitation the back pressure (the pressure at the flow sensor outlet) at ULTRAFLOW® 54 must be min. 1.5 bar at q_p and min. 2.5 bar at q_s. This applies to temperatures up to approx. 80 °C.

For further information on operating pressure see *paragraph 8.7 Guidelines for dimensioning ULTRAFLOW®*.

7.5 Connection to MULTICAL®

7.5.1 ULTRAFLOW® 54 and MULTICAL®, galvanically coupled

If ULTRAFLOW® 54 and MULTICAL® are connected via output module (Y=1), ULTRAFLOW® is galvanically coupled with the MULTICAL® calculator and is powered by this via the three-wire signal cable (cable length up to 10 m).

Battery life time in e.g. MULTICAL® 602 is approximately 10 years depending on data communication to the calculator.

See *paragraph 8.8.1* for electrical data on output module (Y=1).

Note: It is not permitted to mount a supply module or battery in ULTRAFLOW® 54 with output module (Y=1).

ULTRAFLOW® 54	→	MULTICAL®		
11A	→	11	GND	(Blue)
9A	→	9	+3,6 V	(Red)
10A	→	10	⎍⎍	(Yellow)

Table 9

7.5.2 ULTRAFLOW® 54 and MULTICAL®, galvanically separated

If ULTRAFLOW® 54 and MULTICAL® are connected via output module (Y=2 or 3) ULTRAFLOW® 54 is galvanically separated from MULTICAL®.

See *paragraph 8.8.2* for electrical data on output module (Y=2 and 3).

Note: Flow info cannot be read.

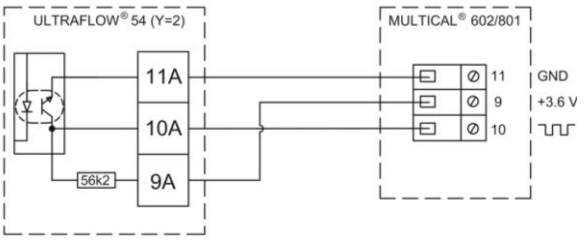


Figure 13. Three-wire connection, MULTICAL® 602/801 via output module (Y=2). Cable length up to 25 metres.

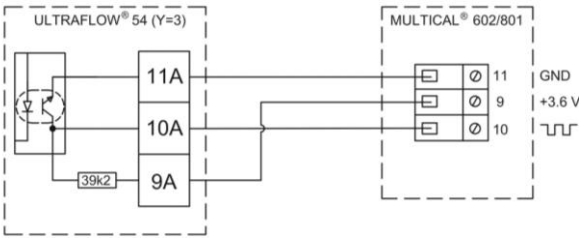


Figure 14. Three-wire connection, MULTICAL® 602/801 via output module (Y=3). Cable length up to 25 metres.

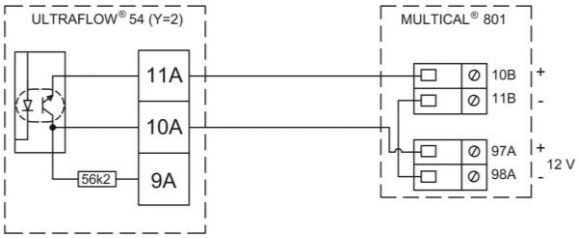


Figure 15. Two-wire connection, MULTICAL® 801 via output module (Y=2). Cable length up to 100 metres.

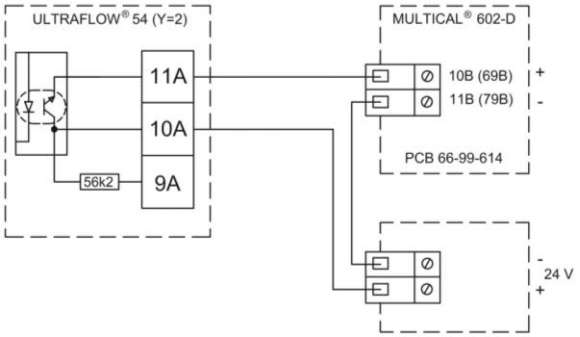


Figure 16. Two-wire connection, MULTICAL® 602-D via output module (Y=2) and external 24 VDC supply. Cable length up to 100 metres.

7.5.3 Cable length

ULTRAFLOW® 54 DN150-300 output module	MULTICAL® 602/801 2-wire connection	MULTICAL® 602/801 3-wire connection
Y=1	N/A	< 10 m
Y=2	< 100 m *)	< 25 m
Y=3	N/A	< 25 m

**) MULTICAL® 602 must have sensor connection type D and external 24 VDC supply.*

Table 10. Maximum allowable cable length depends on the output module in ULTRAFLOW® 54 DN150-300 and how the MULTICAL® calculator is connected.

If long signal cables are used, installation requires careful consideration. Due to EMC there must be a distance of min. 25 cm between signal cables and all other cables.

7.6 Connection of power supply

If ULTRAFLOW® 54 is mounted with a galvanically coupled output module and connected to MULTICAL®, the flow sensor is supplied by the calculator. Therefore, the flow sensor must not be fitted with a supply of its own.

ULTRAFLOW® 54 may be connected to other calculators via the galvanically separated output module only, and the flow sensor must, therefore, be fitted with a supply module or battery.

Supply module and battery are connected to the two-pole connector on the output module.

7.6.1 Battery supply

ULTRAFLOW® 54 is fitted with a D-cell lithium battery with connector. The battery plug is connected to the output module.

Optimal battery lifetime is obtained by keeping the battery temperature below 30 °C, e.g. by wall mounting the electronics box.

The voltage of a lithium battery is almost constant throughout the lifetime of the battery (approx. 3.65 V). Therefore, it is not possible to determine the remaining capacity of the battery by measuring the voltage.

The battery cannot and must not be charged and must not be short-circuited.

The battery supply may only be replaced by a corresponding lithium battery with connector from Kamstrup A/S. Used batteries must be handed in for approved destruction, e.g. at Kamstrup A/S. (See Kamstrup document 5510-408, "Lithium batteries - Handling and disposal").

7.6.2 Mains supply modules

The mains supply modules are protection class II and are connected to the output module via a small two-wire cable with plugs. The modules are powered via a two-wire mains supply cable (without earth connection) through the cable connector of the electronics box. Use supply cable with an outer diameter of 4.5-10 mm and ensure correct stripping of insulation as well as correct tightening of cable connection (see *paragraph 7.6.4*).

Max. permitted fuse: 6 A

230 VAC

This PCB module is galvanically separated from the mains supply and is suitable for direct 230 VAC mains installation. The module includes a double-chamber safety transformer, which fulfils double-isolation requirements when the cover is mounted on the electronics box. Power consumption is less than 1 VA or 1 W.

National regulations for electric installations must be observed. The 230 VAC module can be connected/disconnected by the district heating station's personnel, whereas the fixed 230 VAC installation to the main electrical panel must be carried out by an authorized electrician.

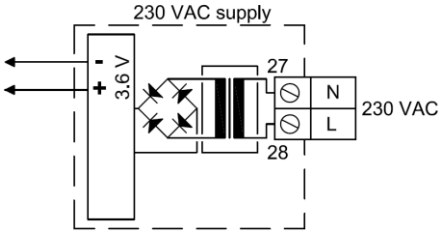


Figure 17

24 VAC

This PCB module is galvanically separated from the 24 VAC mains supply and is both suitable for industrial installations with joint 24 VAC supply and individual installations, which are supplied by a separate 230/24 VAC safety transformer in the main electrical panel. The module includes a double-chamber safety transformer, which fulfils double-isolation requirements when the cover is mounted on the electronics box. Power consumption is less than 1 VA or 1 W.

National regulations for electric installations must be observed. The 24 VAC module can be connected/disconnected by the district heating station's personnel, whereas the fixed 230/24 VAC installation in the main electrical panel must only be carried out by an authorized electrician.

Note: This module cannot be supplied by 24 VDC (direct current).

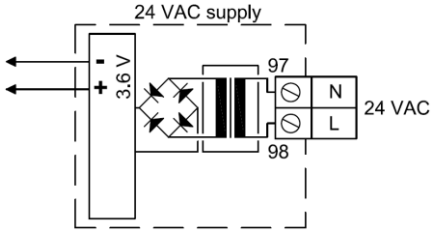


Figure 18

230/24 VAC safety transformer

The 24 VAC module is especially suited for installation together with a 230/24 VAC safety transformer, e.g. type 66-99-403, which can be installed in the main electrical panel before the safety relay. When the transformer is used, the total power consumption of the meter incl. the 230/24 VAC transformer will not exceed 1.7 W.

Figure 19

7.6.3 Mains supply cable

ULTRAFLOW® 54 is available with mains supply cable H05 VV-F for either 24 V or 230 V (l=1.5 m):

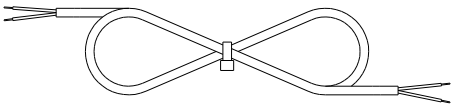


Figure 20. Mains cable (2x0.75 mm²), max. 6 A fuse.

"H05 VV-F" is the designation of a strong PVC mantle, which withstands max. 70°C. Therefore, the mains cable must be installed with sufficient distance to hot pipes etc.

7.6.4 Cable connections

Cable dimension in connections: 4.5…10 mm.

Tightening torque: Maximum 4 Nm (cable strain relief minimum 40 N according to EN 61558)

Please note: If ULTRAFLOW® 54 is mounted with a galvanically coupled output module, or if a galvanically separated output module is used in combination with battery supply the unused cable connection must be sealed off as shown in *Figure 21*.

7.6.5 Change of supply unit

The supply unit of ULTRAFLOW® 54 can be changed from mains supply to battery or vice versa as the needs of the supply company change. Thus, it can be an advantage to temporarily change mains supplied meters to battery supplied meters e.g. in case of buildings under construction where the mains supply can be unstable or periodically missing.

Please note that the supply type of some ULTRAFLOW® sensors appears from the label. If the original supply type is changed, it will no longer be in accordance with the label.

7.7 Example of connection of ULTRAFLOW® 54 and MULTICAL®

ULTRAFLOW® 54 with galvanically coupled output module (Y=1), powered by MULTICAL®. See *paragraph 7.5.1* for electrical wiring.

Note: Installed plug in the unused rightmost connector of the electronics box.

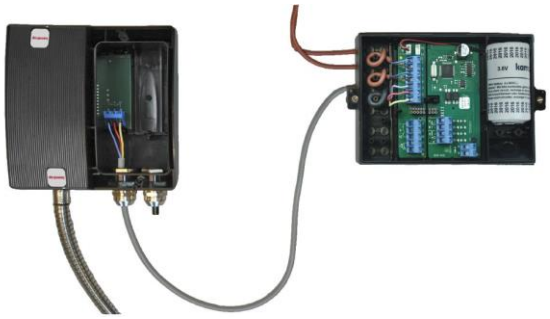


Figure 21

ULTRAFLOW® 54 with galvanically separated output module (Y=2) and 230 VAC supply of its own. See *paragraph 7.5.2* for electrical wiring.

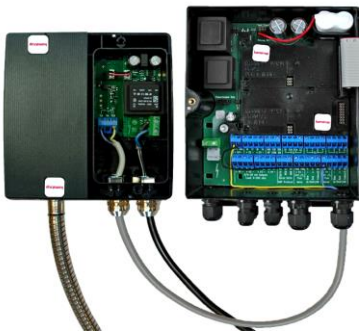


Figure 22

7.8 Calculator with two flow sensors

MULTICAL® 602/801 can be used in various applications with two flow sensors, e.g. leak surveillance or open systems. When two ULTRAFLOW® are direct connected to one MULTICAL®, a close electric coupling between the two pipes ought to be carried out as a main rule. If the two pipes are installed in a heat exchanger, close to the flow sensors, however, the heat exchanger will provide the necessary electric coupling.

- Forward and return pipes are closely electrically coupled
- No welded joints occur

In installations where the electric coupling cannot be carried out, or where welding in the pipe system can occur, one ULTRAFLOW® must be mounted with a galvanically separated output module and also a supply of its own.

- Forward and return pipes are not necessarily closely coupled
- Electric welding *) can occur

*) Electric welding must always be carried out with the earth pole closest to the welding point. Damage to meters due to welding is **not** comprised by Kamstrup's factory guarantee.

7.9 Operational check

Carry out an operational check when the complete meter (flow sensor, temperature sensors and calculator) has been installed and connected. Open thermo regulators and valves to establish water flow through the installation. Activate the top key of the calculator and check that the displayed values for temperatures and water flow are credible values.

8 Functional description

8.1 Ultrasound combined with piezo ceramics

Flow sensor manufacturers have been working on alternative techniques to replace the mechanical principle. Research and development at Kamstrup has proven that ultrasonic measuring is the most viable solution. Combined with microprocessor technology and piezo ceramics, ultrasonic measuring is not only accurate but also reliable.

8.2 Principles

The thickness of a piezo ceramic element changes when exposed to an electric field (voltage). When the element is influenced mechanically, a corresponding electric charge is generated. In this way the piezo ceramic element can function either as sender or receiver or both.

Within ultrasonic flow measuring there are two main principles: the transit time method and the Doppler method.

The Doppler method is based on the frequency change which occurs when sound is reflected by a moving particle. This is very similar to the effect you experience when a car drives by. The sound (the frequency) decreases when the car passes by.

8.3 Transient time method

The transit time method used in ULTRAFLOW® utilizes the fact that it takes an ultrasonic signal emitted in the opposite direction of the flow longer to travel from sender to receiver than a signal sent in the same direction as the flow.

The transient time difference of a flow sensor is very small (nanoseconds). Therefore, the time difference is measured as a phase difference between the two 1 MHz sound signals in order to obtain the necessary accuracy.

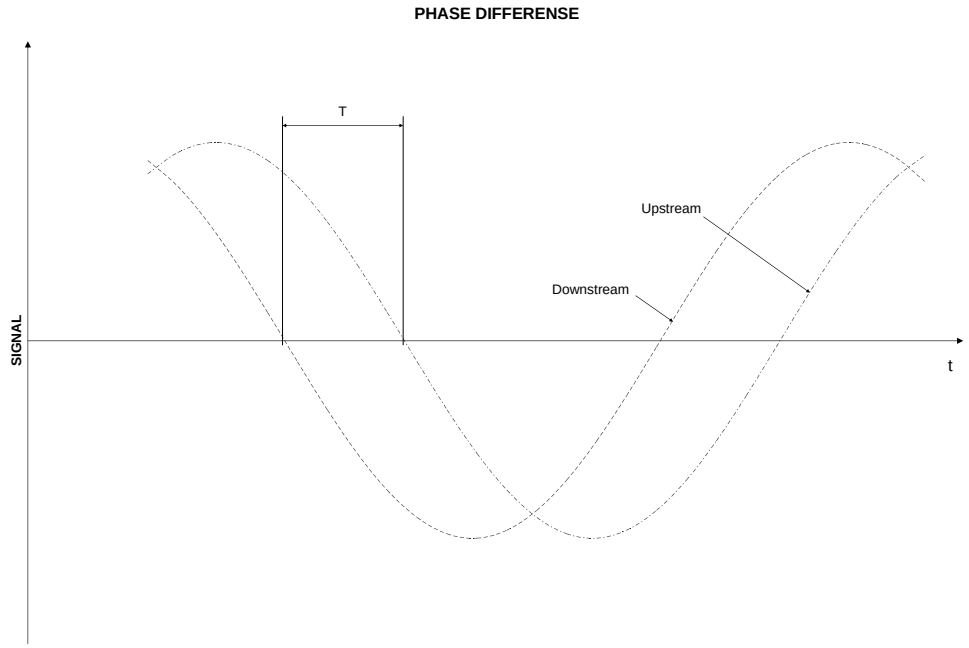


Figure 23

In principle, the flow is determined by measuring the flow velocity and multiplying it by the area of the measuring pipe:

$$Q = F \times A$$

where:

Q is the flow

F is the flow velocity

A Is the area of the measuring pipe

The area and the length, which the signal travels in the sensor, are well-known factors. The length which the signal travels can be expressed by $L = T \times V$, which can also be written as:

$$T = \frac{L}{V}$$

where:

L is the measuring distance

V is the sound propagation velocity

T is the time

The time can be expressed as the difference between the signal sent with the flow and the signal sent against the flow.

$$\Delta T = L \times \left(\frac{1}{V_1} - \frac{1}{V_2} \right)$$

In connection with ultrasonic flow sensors the velocities V_1 and V_2 can be stated as:

$V_1 = C - F$ and $V_2 = C + F$ respectively

where:

C is the velocity of sound in water

Using the above formula you get:

$$\Delta T = L \times \frac{1}{C - F} - \frac{1}{C + F}$$

which can also be written as:

$$\Delta T = L \times \frac{(C + F) - (C - F)}{(C - F) \times (C + F)} \quad \Rightarrow \quad \Delta T = L \times \frac{2F}{C^2 - F^2}$$

As $C^2 \rangle\rangle F^2$ it is reasonable to omit F^2 and the formula is reduced as follows:

$$F = \frac{\Delta T \times C^2}{L \times 2}$$

In order to minimize the influence from variations of the velocity of sound in water, the velocity is measured via a number of absolute time measurements between the two transducers. These measurements are subsequently, in the built-in ASIC, converted into the current velocity of sound which is used in connection with flow calculations.

8.4 Signal paths

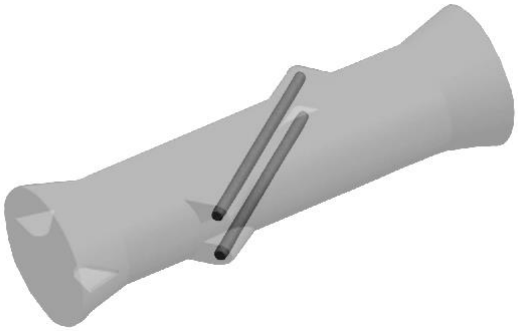


Figure 24. q_p 150…1000 m³/h, two paths. Two parallel sound paths at a slant in the measuring pipe.

8.5 Measuring sequences

During a flow measurement ULTRAFLOW® runs through a number of sequences, which are repeated at fixed intervals. Deviations only occur when the meter is in test mode and when the supply is connected during initialization/start-up.

The difference between the main routines in normal mode and fast/test mode is the frequency of the measurements on which pulse emission is based.

It may take up to 16 seconds to obtain correct function after a power-down.

8.6 Function

In the meter's working range from min. cut off to saturation flow there is linear connection between the flow rate and the number of pulses being emitted. The below diagram shows an example of the connection between flow and pulse frequency for ULTRAFLOW® q_p 150 m³/h.

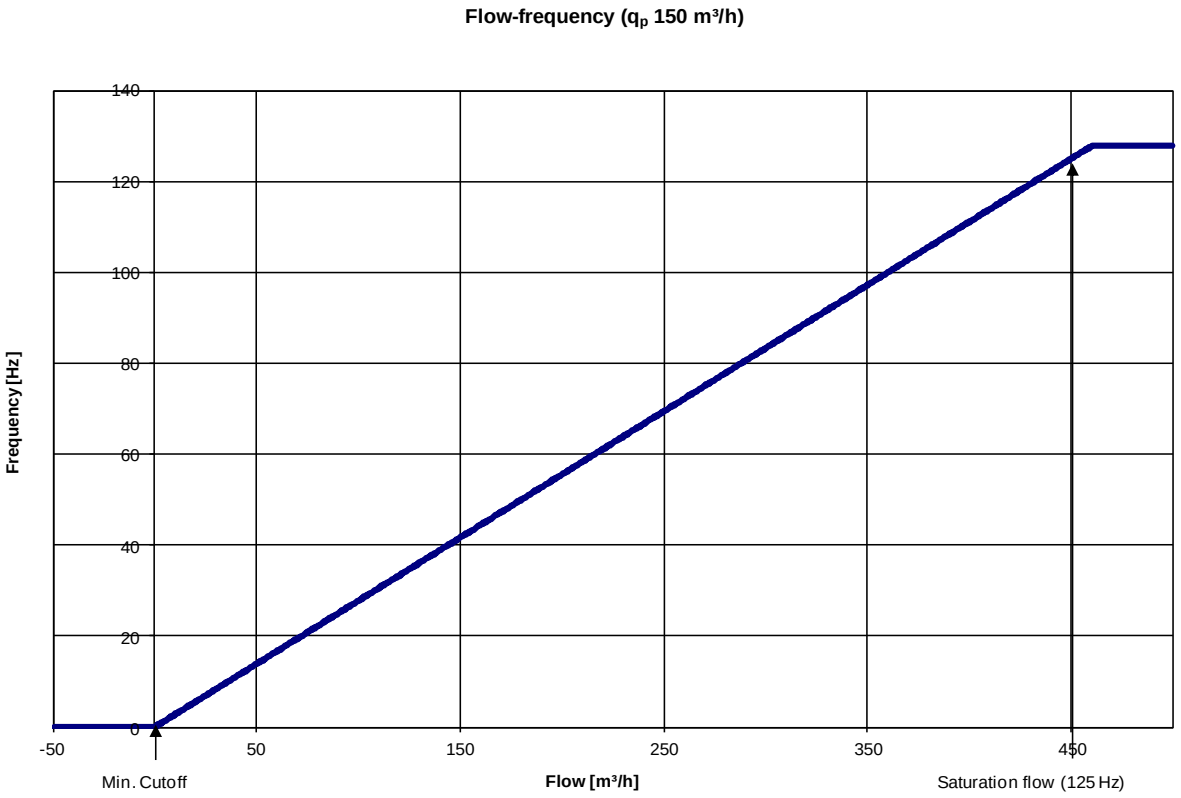


Figure 25

If the flow is lower than min. cut off or negative, ULTRAFLOW® emits no pulses. At flows exceeding the flow corresponding to pulse emission at max. pulse frequency of 128 Hz, the max. pulse frequency will be maintained.

Table 11 shows the flows of the different flow sizes at max. pulse frequency of 128 Hz.

q_p [m³/h]	Meter factor [imp/l]	Flow @ 128 Hz [m³/h]
150	1	461
250	0.6	768
400	0.4	1152
600	0.25	1843
1000	0.15	3072

Table 11

According to EN 1434 the upper flow limit q_s is the highest flow at which the flow sensor may operate for short periods of time (<1h/day, <200 h/year), without exceeding max. permissible error. ULTRAFLOW® has no functional limitations as to the duration of the period, during which the sensor operates above q_p.

Please note, however, that high flow velocities may cause cavitation, especially at low static pressure.

8.7 Guidelines for dimensioning ULTRAFLOW® 54

In connection with installations it has proved practical to work with higher pressures than those mentioned below:

Nominal flow q_p [m³/h]	Recommended back pressure [bar]	Max. flow q_s [m³/h]	Recommended back pressure [bar]
150	1	300	2
250	1.5	500	2.5
400 (DN150)	1.5	800	2.5
400	1	800	2
600	1.5	1200	2.5
1000	1.5	2000	2.5

Table 12

The purpose of recommended back pressure (the pressure at flow sensor outlet) is to avoid measuring errors as a result of cavitation or air in the water.

It is not necessarily cavitation in the sensor itself, but also bubbles from cavitating pumps and regulating valves mounted before the sensor. It can take some time until such bubbles have been dissolved in the water.

Furthermore, water can include air dissolved in the water. The amount of air which can be dissolved in water depends on pressure and temperature. This means that air bubbles can be formed due to falling pressure, e.g. caused by a velocity rise in a contraction or above the sensor.

The risk of these factors affecting accuracy is reduced by maintaining a fair pressure in the installation.

In relation to above table, the steam pressure at current temperature must also be considered. *Table* 12 Applies to temperatures up to approx. 80° C. Furthermore, it must be considered that the above-mentioned pressure is the pressure at the sensor, and that the pressure is lower after a contraction than before one (among other things cones). This means that the pressure, when measured elsewhere, might be different from the pressure at the sensor.

This can be explained by combining the continuity equation and Bernoulli's equation. The total energy from the flow will be the same at any cross section. It can be reduced to: $P + \frac{1}{2}\rho v^2 = \text{constant}$.

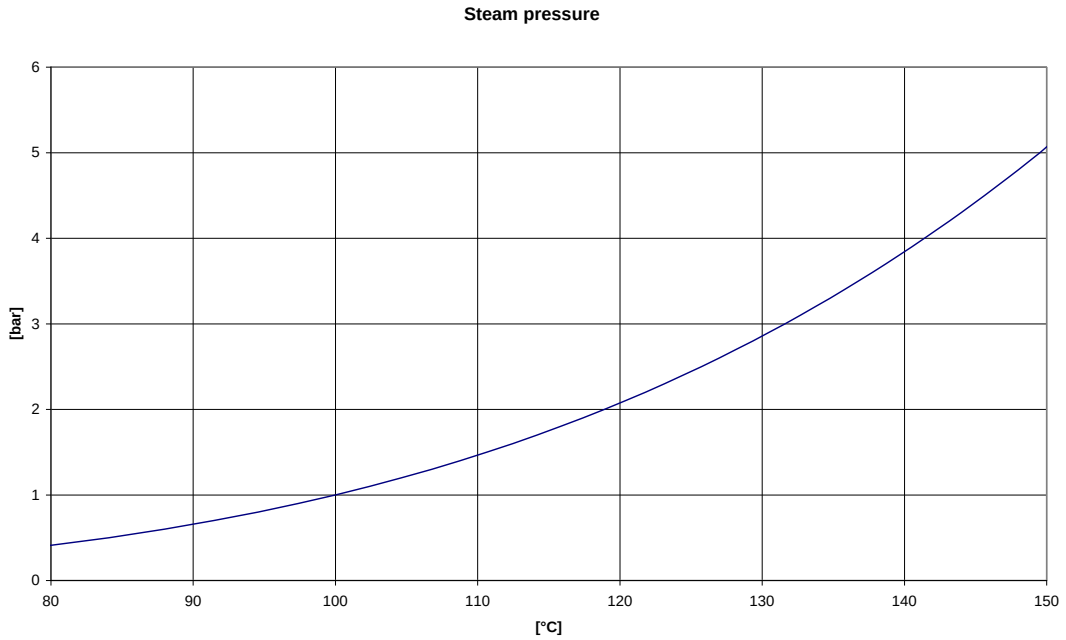


Figure 26

Dimensioning a flow sensor you must take the above into consideration, especially if the sensor is used within the scope of EN 1434 between q_p and q_s, and in case of heavy contractions of the pipe.

8.8 Pulse output

8.8.1 Galvanically coupled

Galvanically coupled output module (Y=1). ULTRAFLOW® is powered by MULTICAL®. Note: ULTRAFLOW® must not be mounted with a supply.

Cable length ULTRAFLOW® to MULTICAL® Max. 10 m

Type	Push-Pull
Output impedance	~10 kΩ

Concerning meter factor and pulse durations see *paragraph 4.2.3*

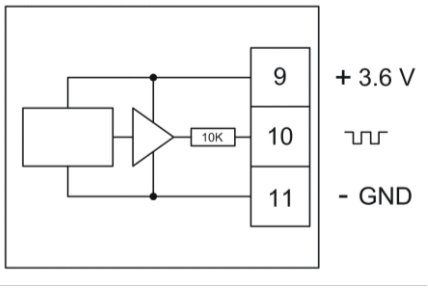


Figure 27. Block diagram of galvanically coupled output module (Y=1) in ULTRAFLOW® 54.

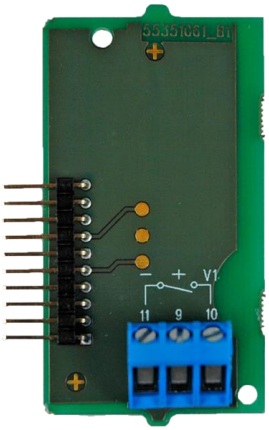


Figure 28. Galvanically coupled output module (Y=1).

8.8.2 Galvanically separated

Galvanically separated output module (Y=2). ULTRAFLOW® is powered by the built-in supply module (Z=7 or 8).

Cable length to ULTRAFLOW® depends on calculator. When connected to MULTICAL® maximum cable length is 100 metres (2-wire connection).

To calculator:

Type: Open collector.

Connection: Can be connected as two-wire or as three-wire via the built-in 56.2 kΩ pull-up.

Module Y=2	OC and OD	(OB) Kam
Max input voltage	6 V	30 V
Max input current	0.1 mA	12 mA
ON condition	U ≤ 0.3 V @ 0.1 mA	U_{CE} ≤ 2.5 V @ 12 mA
OFF condition	R ≥ 6 MΩ	R ≥ 6 MΩ

Table 13

Concerning meter factor and pulse durations, see *paragraph 4.2.3*

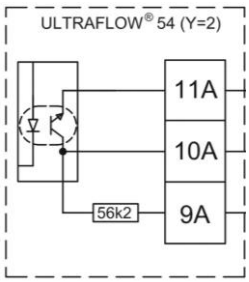


Figure 29. Block diagram of galvanically separated output module (Y=2) in ULTRAFLOW® 54.

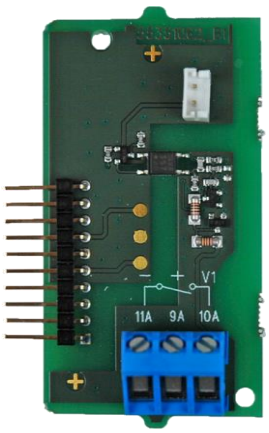


Figure 30. Galvanically separated output module (Y=2).

Galvanically separated output module (Y=3). ULTRAFLOW® is powered by the built-in supply (Z=2, 7 or 8).

Cable length to ULTRAFLOW® depends on calculator. When connected to MULTICAL® maximum cable length is 25 metres.

To calculator:

Type: Open collector.

Connection: Three-wire via the built-in 39.2 kΩ pull-up.

Module Y=3	OC and OD
Max input voltage	6 V
Max input current	0.1 mA
ON condition	U ≤ 0.3 V @ 0.1 mA
OFF condition	R ≥ 6 MΩ

Table 14

Concerning meter factor and pulse durations, see *paragraph 4.2.3*

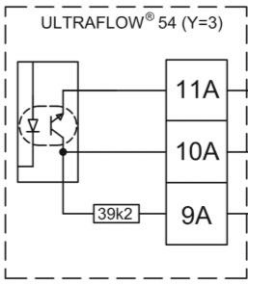


Figure 31. Block diagram of galvanically separated output module (Y=3) in ULTRAFLOW® 54.

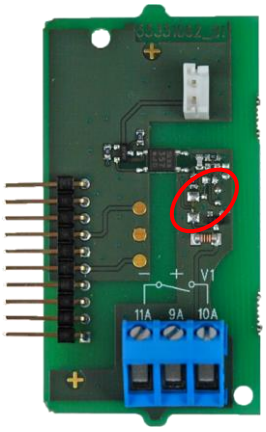


Figure 32. Galvanically separated output module (Y=3). Note the omitted components in the encircled area compared to output module (Y=2).

8.9 Pulse emission

Pulses are emitted at intervals of 1 sec. The number of pulses to be emitted is calculated every second. Pulses are emitted in bursts with a pulse duration of 2…5 ms and pauses depending on current pulse frequency. The duration of the pauses between the individual bursts is approx. 30 ms.

The transmitted pulse signal is the average determination of a series of flow measurements. This means that there will be a transient phenomenon until correct flow signal has been obtained during start-up. Furthermore, this brings about a pulse tail of up to 8 sec. in case of sudden hold.

8.10 Accuracy

ULTRAFLOW® 54 has been developed as a volume flow rate sensor for energy meters according to EN 1434. The permitted tolerances of EN 1434 for flow sensors with a dynamic range of 100:1 (q_p:q_i) are shown in the diagram below (*Figure 33*). The tolerances are defined for class 2 and class 3 with following formulas:

Class 2: $2 + 0.02 \times \frac{q_p}{q}$ but max. 5 %

Class 3: $3 + 0.05 \times \frac{q_p}{q}$ but max. 5 %

EN 1434 defines following dynamic ranges (q_p:q_i): 10:1, 25:1, 50:1, 100:1 and 250:1.

In connection with accuracies the range from q_p to q_s is defined as max. flow short-term, where tolerances are adhered to. There are no requirements as to the relation between q_p and q_s. See *Table 1* for information on q_s for ULTRAFLOW®.

To render probable that the sensors meet the tolerance requirements, EN 1434-5 specifies calibration requirements in connection with verification of sensors. It is required that flow sensors are tested at following 3 points:

q_i…1.1 x q_i, 0.1 x q_p..0.11 x q_p and 0.9 x q_p…q_p

During test the water temperature must be 50 °C ±5 °C for ULTRAFLOW® as a heat meter.

For ULTRAFLOW® as a cooling meter the water temperature must be 15 °C ±5 °C.

Further requirements are that the tolerance of the equipment used to perform the test must be less than 1/5 MPE (Max. Permissible Error) to permit the acceptance limit to be equal to MPE. If the equipment does not observe 1/5 MPE, the acceptance limit must be reduced by the tolerance of the equipment.

ULTRAFLOW® 54 will typically do better than half of the permitted tolerance according to EN 1434 class 2.

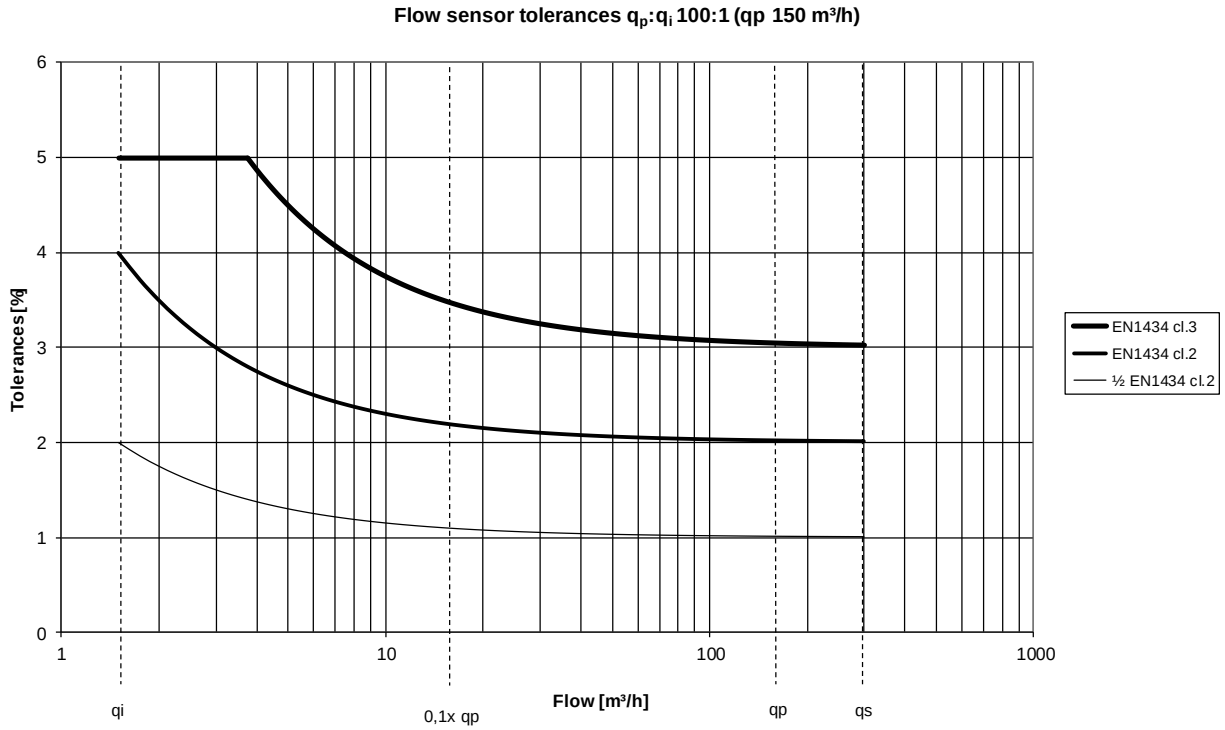


Figure 33

8.11 Power consumption

The current consumption of ULTRAFLOW® galvanically coupled is as follows:

Max. average	50 µA
Max. current	7 mA (max. 40 ms)

8.12 Interface plug/serial data

ULTRAFLOW® 54 is fitted with a four-pole connector under the cover. The cover is supplied with a factory seal, and in connection with verified sensors it will be a laboratory seal (legal seal). Thus, it is not possible to access the connector without breaking the seal.

The connector is used for:

- Meter programming, including adjustment of correction curve by means of METERTOOL
- Bringing the sensor into test mode
- Reading accumulated water quantity in connection with calibration
- External control of start/stop in connection with calibration

The interface connector is constructed as shown in *Figure 34*.

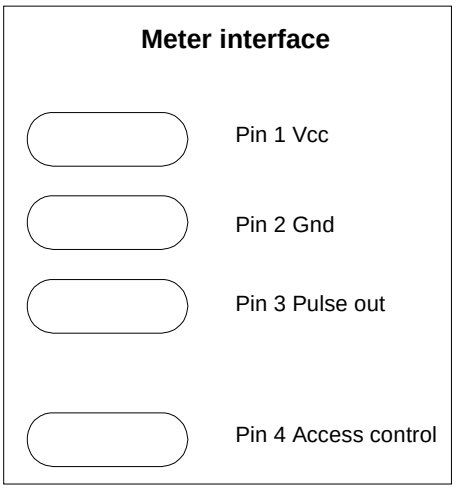


Figure 34. Interface connector.

8.13 Test mode

To minimize the time spent on calibration, ULTRAFLOW® 54 can be switched into test mode. When ULTRAFLOW® 54 is in test mode (verification mode), the measuring routines only take one fourth of the time they take in normal mode.

ULTRAFLOW® 54 is put into test mode by connecting pin 4 of the internal connector to ground (*Figure 34*) and subsequently connecting the supply. After approx. 1 sec. the sensor goes into test mode and the connection between pin 4 and ground is disconnected.

Test mode is ended by disconnecting the supply to the sensor.

Please note: An ULTRAFLOW® 54 in test mode uses approx. 3 times as much power as in normal mode. However, this does not influence the total battery lifetime of the energy meter.

8.14 Externally controlled start/stop

In connection with calibration by means of serial data, e.g. in connection with NOWA, ULTRAFLOW® 54 can in verification mode (see *paragraph 8.13*) be monitored by an external signal. This is done by grounding pin 4 of the internal connector when starting the test and removing it when the test has been completed. The volume of water that has been accumulated during the test can be read serially.

The accumulation is based on the same data as those used for calculating the number of pulses to be emitted.

In addition to accumulating water volume during the test, the sensor corrects for the excess quantity in connection with start, as well as the quantity lacking in connection with stop. These deviations are due to the fact that the sensor measures flow at fixed intervals as illustrated by *Figure 35* below.

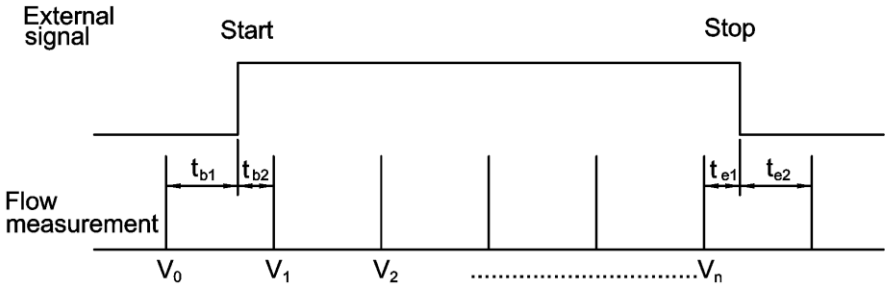


Figure 35

The excess quantity of water in connection with start is the water volume that passes through the sensor during the time t_{b1} before the first accumulation V_1 within the test period. In the same way the lacking quantity is the water volume passing through the sensor during the time t_{e1} from the last accumulation V_n until stop.

The volume accumulated during the test can be stated as:

$$\sum \frac{V_1 \times t_{b2}}{t_{b1} + t_{b2}} + V_2 ... + V_n + \frac{V_n \times t_{e1}}{t_{e1} + t_{e2}}$$

8.15 Calibration procedure using serial data and externally controlled start/stop

The routine for calibrating ULTRAFLOW® 54 using serial data is outlined below.

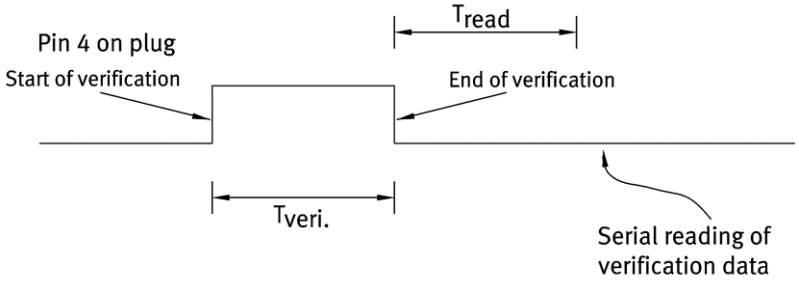


Figure 36

The sensor must be in test mode (see *paragraph 8.13*). Calibration is started by grounding pin 4 of the internal connector (see *Figure 36)* and at the same time starting the test. This might e.g. take place at the same time as the master meter is started or the diverter of the weight is changed. Now ULTRAFLOW® accumulates water volume until pin 4 is disconnected to terminate the test. Subsequently, the volume accumulated during the test can be read in consideration of start and stop. From the test has been completed and until the accumulated quantity of water can be read, minimum 2 seconds must pass (T_{read}). Communication with ULTRAFLOW® during test is not allowed.

Pulse emission stops when pin 4 is disconnected. The read water quantity and the number of emitted pulses may differ as the pulse emission is monitored at intervals of 1 second.

9 Calibrating ULTRAFLOW® 54

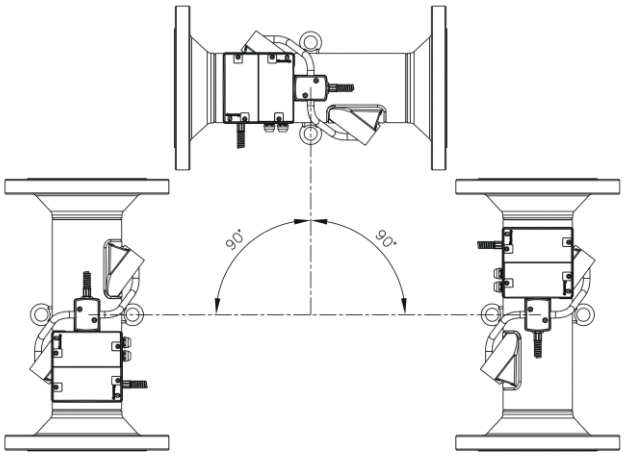
Calibration can be based on:

- Pulses in standard mode
- Pulses in test mode
- Pulses using Pulse Tester type 66-99-279
- Serial data with the sensor in test mode

9.1 Installation

Installation angle for ULTRAFLOW® 54

ULTRAFLOW® 54 DN150-300



ULTRAFLOW® 54 can be installed horizontally, vertically, or at an angle.

Figure 37

See *paragraph 7 Installation* and *9.5 Optimization in connection with calibration*.

9.2 Technical data

Supply:	3.6 VDC ±0.1 VDC
Pulse duration:	2...100 ms (depending on programming)
Meter factor:	Depends on programming. Appears from type label.
Start-up:	It takes 16 seconds from start-up until true flow reading has been obtained and calibration can start.

9.3 Connection

Galvanically coupled output module (Y=1).

Type: Push-Pull

Output impedance ~ 10 kΩ

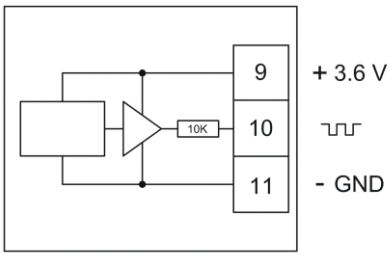


Figure 38

Galvanically separated output module (Y=2).

Open collector. Two-wire or three-wire via the built-in pull-up of 56.2 kΩ

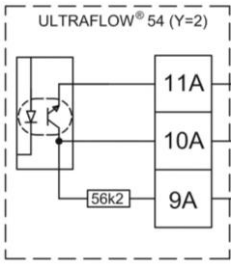


Figure 39

Module Y=2	OC and OD	(OB) Kam
Max input voltage	6 V	30 V
Max input current	0.1 mA	12 mA
ON condition	U ≤ 0.3 V @ 0.1 mA	U_{CE} ≤ 2.5 V @ 12 mA
OFF condition	R ≥ 6 MΩ	R ≥ 6 MΩ

Table 15

Galvanically separated output module (Y=3).

Open collector. Three-wire via the built-in pull-up of 39.2 kΩ

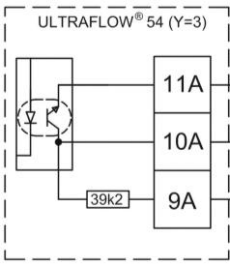


Figure 40

Module Y=3	OC and OD
Max input voltage	6 V
Max input current	0.1 mA
ON condition	U ≤ 0.3 V @ 0.1 mA
OFF condition	R ≥ 6 MΩ

Table 16

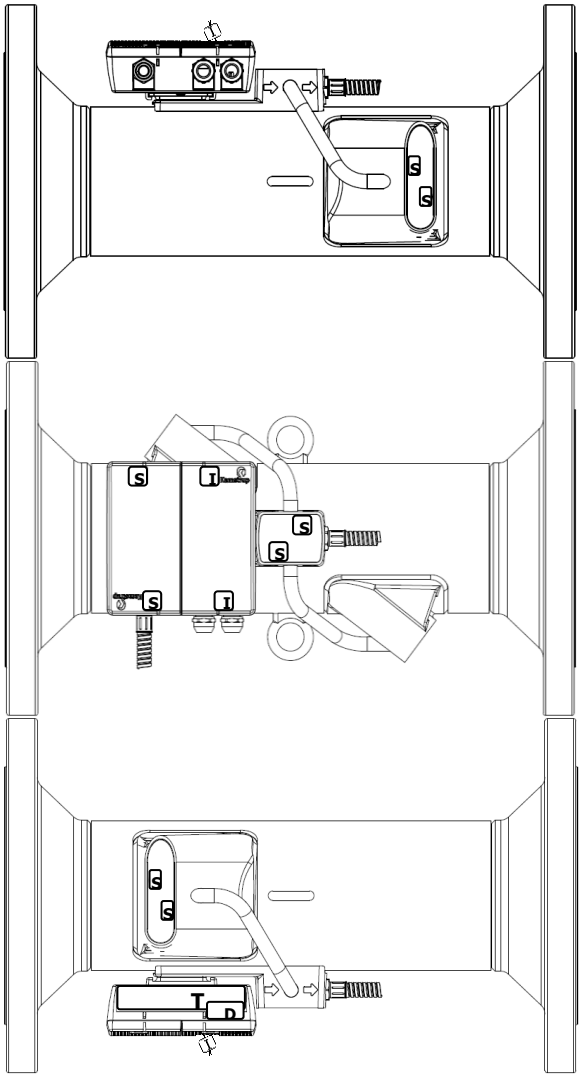
9.4 Sealing

ULTRAFLOW® is factory sealed. Verified sensors will be supplied with security seals (S) and a year mark (D).

If the seal of a verified sensor is broken, the sensor must be verified before being installed in a location demanding verification.

MID-sealing of ULTRAFLOW® 54 is shown below.

Please note: Sealing requirements may vary due to national regulations.



D	Security seal or module D/F label (Depending on type label)
S	Security seal. Covering screws
T	Type label (as void label or with security seal D)
I	Installation seal (wire and seal or sealing label)

Figure 41. MID-sealing.

9.5 Optimization in connection with calibration

To make a rational test of ULTRAFLOW® it is important that results obtained in connection with tests can be reproduced. This is also very important if the tested sensors are to be adjusted.

Experience has shown that ULTRAFLOW® operates with standard deviations of 0.3…0.4 % at q_i and 0.2…0.3 % at q_p. This is standard deviations for 300…500 pulses at q_i, 3000…5000 at q_p , and flying start/stop.

In connection with optimization of calibration the following sub-components can be considered:

Pressure: Optimal working pressure is 4…6 bar of static pressure. This minimizes the risk of air and cavitation.

Temperature: Calibration temperature according to EN 1434-5 is 50 °C ±5 °C for heat meters and 15 °C ±5 °C for cooling meters.

Water quality: No requirements

Installation - mechanical conditions:

To avoid flow disturbances the inlet pipes and distance pieces must have the same nominal diameter as the sensors. There should be min. 5 x DN between the sensors. In connection with calibration, a code of practice for distance pieces has been made on the basis of many years' experience:

The lengths of the distance pieces must be 10 x DN.

With bends etc. there should be a min. distance of 10 x DN. If tests are made at low flow with a bypass at right angles to the pipe, it will be an advantage to mount an absorber of pressure fluctuations due to the perpendicular inlet. This can be a flexible tube on the bypass. In addition, it will be an advantage to mount a flow straightener before the first distance piece. Flow disturbances such as pulsations, e.g. pump fluctuations must be minimized.

Installation - electrical conditions:

To avoid external disturbances and achieve an electrical interface like MULTICAL® we recommend using a Pulse Tester. See *paragraph 9.6*.

9.6 Pulse Tester

During a calibration process it is often practical to use Pulse Tester type No. 66-99-279 with the following functions:

Galvanically separated pulse outputs

Integral supply for ULTRAFLOW®

LCD-display with counter

Externally controlled "Hold" function

Can be mounted directly in a MULTICAL® base unit (type 66- and 602-)

9.6.1 Technical data of Pulse Tester

Pulse inputs (M1/M2)

Counter inputs	Max. frequency: 128 Hz
Active signal	Amplitude: 2.5 - 5 Vpp
Pulse duration	> 1 ms
Passive signal	Internal pull-up 680 kΩ
Internal supply	3.65 V lithium battery

Please note: Depending on the connecting base used there are one or two pulse inputs/outputs.

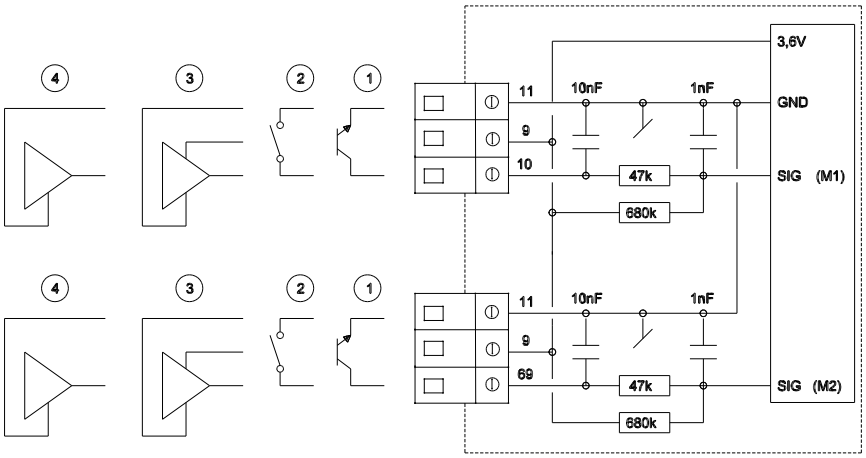


Figure 42

1 **Flow sensor with transistor output**

The transmitter is normally an optocoupler with FET or transistor output to be connected to terminals 10 and 11 for water meter M1 or terminals 69 and 11 for water meter M2.

The leak current of the transistor must not exceed 1 μA in off-state, and U_{CE} in on-state must not exceed 0.5 VDC.

2 **Flow sensor with relay or reed-switch output**

The transmitter is a reed-switch, which is normally mounted on vane wheel and Woltmann meters, or the relay output of e.g. MID-meters. This type of transmitter should not be used as the quick pulse input of the Pulse Tester may regard bounce from the transmitter as pulses.

3 **Flow sensor with active pulse output, powered by the Pulse Tester**

This connection is used together with either Kamstrup's ULTRAFLOW® or Kamstrup's electronic pick-up for vane wheel meters.

Connection (M1)	9: Red (9A)	10: Yellow (10A)	11: Blue (11A)
Connection (M2)	9: Red (9A)	69: Yellow (10A)	11: Blue (11A)

Table 17

4 **Flow sensor with active output and integral supply**

Flow sensors with active signal output are connected as shown in *Figure 43*. The signal level must be between 3.5 V and 5 V. Higher signal levels can be connected via a passive voltage divider, e.g. of 47 kΩ/ 10 kΩ at a signal level of 24 V.

Pulse outputs (M1/M2)

Pulse duration	> 4 ms
Duration of pause	Depending on the actual pulse frequency

Two-wire connection:

Voltage	< 24 V
Load	> 1.5 kΩ

Three wire connection:

Voltage	5...30 V
Load	> 5 kΩ

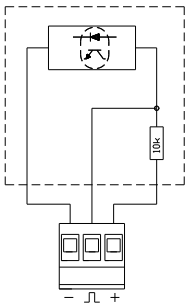


Figure 43

The outputs are galvanically separated and protected against overvoltage and reversed polarity.

Max. counter capacity before overflow is 9,999,999 counts.

9.6.2 Hold-function

When the Hold input is activated (high level applied to input), counting stops at the counted pulse figure.

When the Hold signal is removed (low level applied to input), counting restarts.

The counters can also be reset by pressing the right key on the front panel (Reset).

Hold input	Galvanically separated
Input protection	Against reversed polarity
"Open input"	Count (see *Figure 44*)

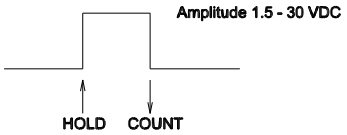


Figure 44

9.6.3 Push-button functions

Figure 45. The left push-button shifts between readings/counts of the two flow sensor inputs. In the display, M1 and M2 respectively indicate the currently displayed flow sensor inputs/counters.

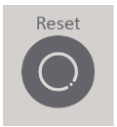


Figure 46. The right push-button resets both counters (M1 and M2).

9.6.4 Using Pulse Tester

The Pulse Tester can be used as follows:

Standing start/stop of flow sensor using the integral pulse counters.

Standing start/stop of flow sensor using the pulse outputs for external test equipment.

Flying start/stop of flow sensor using the integral counters controlled by external equipment (Sample & Hold).

Flying start/stop of flow sensor using the pulse outputs controlled by external equipment (Sample & Hold).

9.6.5 Spare parts

Description	Type No.
Battery D-cell	1606-064
Cable retainer (secures the battery)	1650-099
2-pole plug (female)	1643-185
3-pole plug (female)	1643-187
PCB (66-R)	5550-517

Table 18. Spare parts for Pulse Tester.

9.6.6 Battery replacement

If the Pulse Tester is used continuously we recommend that the battery is replaced once a year.

Remove the battery plug from the battery and strip the cable insulation before connecting the battery to the terminals marked ”Batt”, the red wire to + and the black one to -.

Current consumption:

Current consumption with no sensors connected	400 μA
Max. current consumption with two ULTRAFLOW® connected	1.5 mA

Note: If the base unit is fitted with battery or externally supplied, the Pulse Tester’s integral supply must be disconnected (plug dismounted).

10 METERTOOL

10.1 Introduction

METERTOOL is a collection of programs used for servicing Kamstrup heat meters.

"METERTOOL for ULTRAFLOW® X4" is a Windows®-based software. In combination with a PC and interface the software makes it possible to adjust ULTRAFLOW® X4.

"METERTOOL for ULTRAFLOW® X4" has been developed to provide laboratories a simple and efficient access to programming/adjusting ULTRAFLOW® X4. Furthermore, It is used for programming the Pulse Divider 66-99-607.

10.2 System Requirements for PC

METERTOOL requires minimum Windows XP SP3, Windows Vista or Windows 7 (32-bits or 64-bits) or newer as well as Microsoft Internet Explorer 5.01.

Minimum requirements:

Pentium 4 or equivalent (Atom processor/netbooks/mini PCs are not supported)

2 GB RAM

10 GB HD

Display resolution 1024 x 768

USB as well as CD-ROM drive

Printer installed

Administrator rights to the PC are required in order to install and use the programs.
The programs must be installed under the login to be subsequently used for the programs.

10.2.1 Interface

The following interfaces can be used:

Interface for	Type No.	Description
ULTRAFLOW® 54	66-99-141	Cable with USB connection to PC and 4-pole plug for ULTRAFLOW® 54 and Pulse Divider 66-99-907.
ULTRAFLOW® 54	66-99-024	Cable with USB connector for PC and 4-pole plug for ULTRAFLOW® 54 (H).
ULTRAFLOW® 14/24	66-99-002	Adapter for connecting ULTRAFLOW® 14/24. Plugged onto 66-99-141.
ULTRAFLOW® 34	66-99-006	Adapter for connecting ULTRAFLOW® 34. Plugged onto 66-99-141.
Pulse Divider	66-99-140	Cable with serial plug for PC and 8-pole plug for Pulse Divider 66-99-607.

Table 19. Interfaces for communication.

NOTE: The supply to ULTRAFLOW® and/or Pulse Divider, if any, must be disconnected during programming. The sensors are powered via the connected communication interface.

The USB Interface (66-99-141 and 66-99-024) includes a converter box which secures galvanic separation of the supply to the flow sensor.

In order to mount the plug in the flow sensor, the sealing cover must be removed. If the sensor is used where verification is required, an authorised laboratory must reverify and reseal the sensor before it is remounted. The positions of laboratory labels and year marks appear from *Figure 41*.

Figure 47. Location of the four-pole connector in ULTRAFLOW® 54.

Figure 48. Location of the four-pole connector in ULTRAFLOW® 54 (H).

Figure 49. Location of the four-pole connector incl. ULTRAFLOW® 14 adapter in ULTRAFLOW® 14/24 (MULTICAL® 61/62).

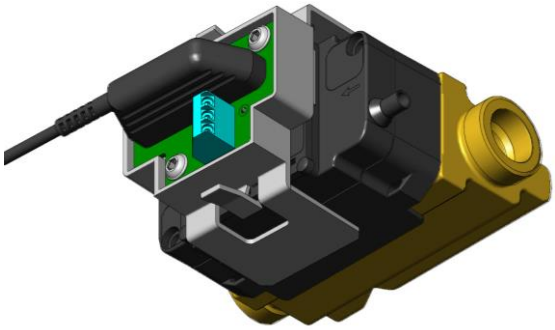


Figure 50. Location of the four-pole connector including ULTRAFLOW® 34 adapter on ULTRAFLOW® 34.

Figure 51. Location of the four-pole connector in ULTRAFLOW® 54 DN150…300.

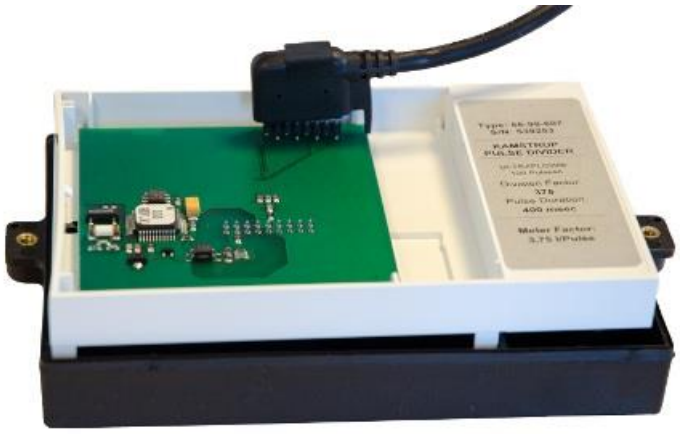


Figure 52. Location of the eight-pole connector in Pulse Divider 66-99-607.

Figure 53. Location of the four-pole connector in Pulse Divider 66-99-907.

10.2.2 Installation

Check that system requirements are fulfilled.

Close other open programs before starting the installation.

Insert the CD into the drive and follow the program's instructions during the installation.

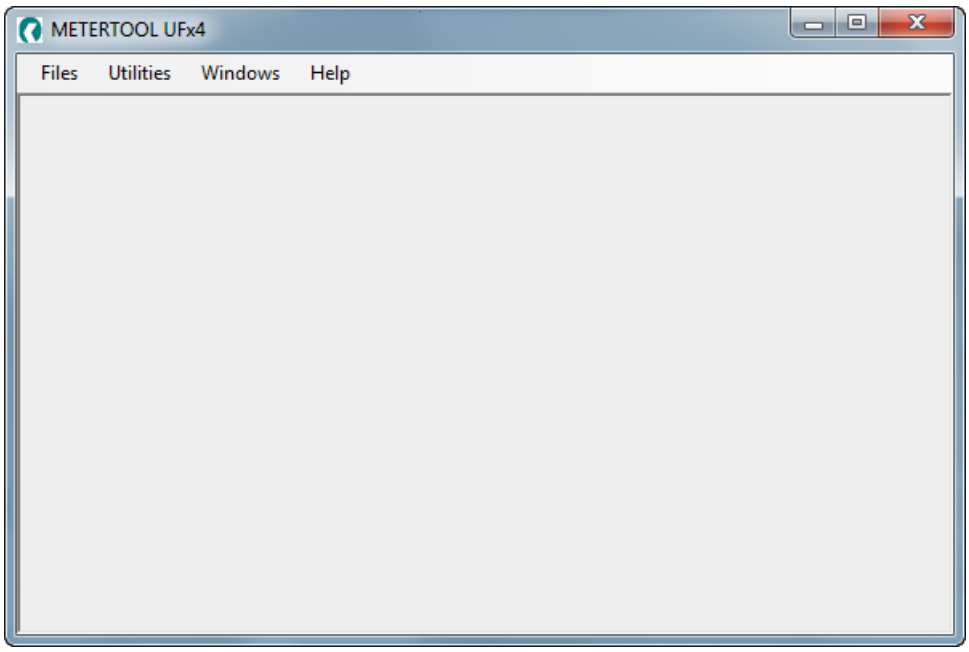
NOTE: The files used for installation must be saved on a CD or in a local folder in the PC. Installation is not possible using files from a USB-stick or an external drive.

If the installation program does not start automatically, the installation can be started by typing "D:\CD\launch.exe" under "Run" in the Start menu (provided that the drive specification of the CD is "D").

When the installation has been completed, the icon "KAMSTRUP METERTOOL" will appear from the Start menu and as a link on the desktop. Click on the new icon "KAMSTRUP METERTOOL" for the list of "METERTOOL" programs selected during installation to be displayed. Double-click on "METERTOOL UFx4" in order to start the program METERTOOL for ULTRAFLOW® X4.

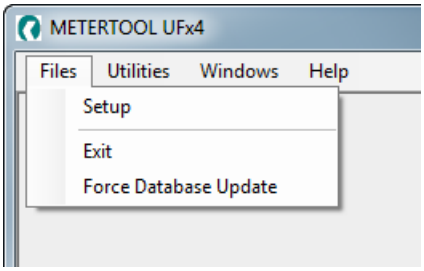
10.3 METERTOOL for ULTRAFLOW® X4

The menu structure of METERTOOL for ULTRAFLOW® X4 is as follows:



10.3.1 Files

The menu "Files" includes:



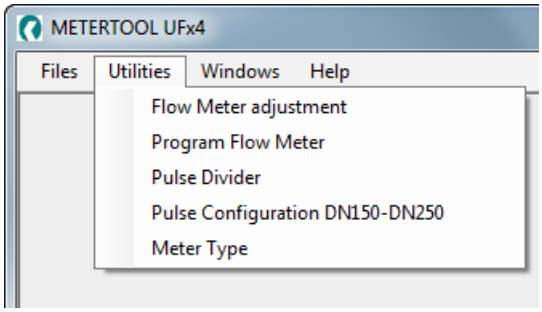
Setup: Update of program and database (internet connection required) and setup of COM-port for interface for flow sensor and Pulse Divider.

Exit: Terminates METERTOOL.

Force Database Update: Forced online-update of flow sensor database.

10.3.2 Utilities

The menu "Utilities" includes:



Flow Meter Adjustment: Reading and correction of flow curve.

Program Flow Meter: Programming standard flow curve for flow sensor.

Pulse Divider: Programming of Pulse Divider 66-99-607.

Pulse Configuration DN150-250: Programming of meter factor and pulse duration for ULTRAFLOW® 54 DN150-300.

Meter Type: Information on flow sensor and equipment.

10.3.3 Windows

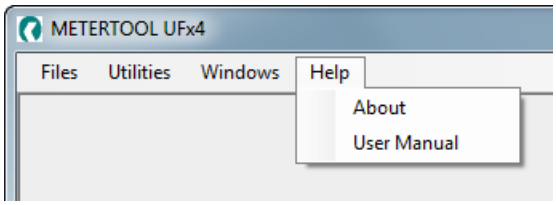
The function makes it possible to change between the open dialog boxes of the program.

10.3.4 Help

About: Includes program numbers and revisions of the various components of the installed version.

User manual: Opens web browser to Kamstrup's website with technical descriptions for heat and cooling meters, water meters and flow sensors.

(Internet connection required.)



10.4 Application

Flow sensor adjustment.

Before adjusting a sensor you must make sure that the sensor operates satisfactorily in the flow rig in question. See *paragraph 9 Calibrating ULTRAFLOW®*

If it is necessary to adjust the sensor more than a few percent, the sensor is probably defective, or has a different error, and should not be adjusted.

10.4.1 COM-port selection

Open ”Setup”:

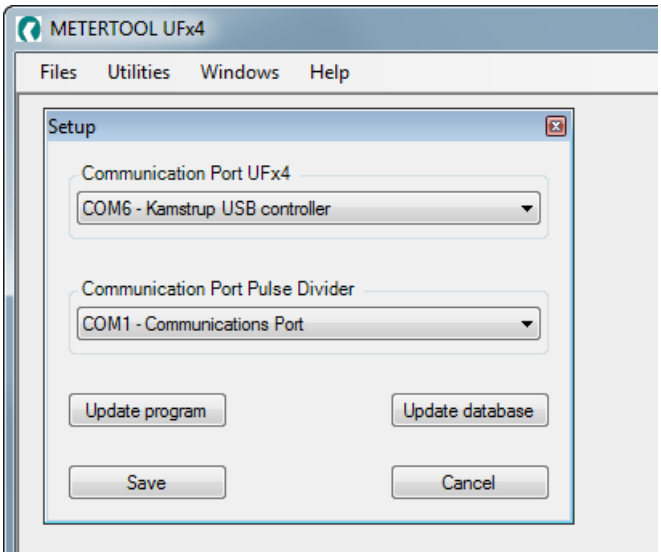
Select a COM-port for ULTRAFLOW® X4.

The USB driver must be installed before connecting the interface.

The related COM-port will not appear from the list until the USB interface has been connected.

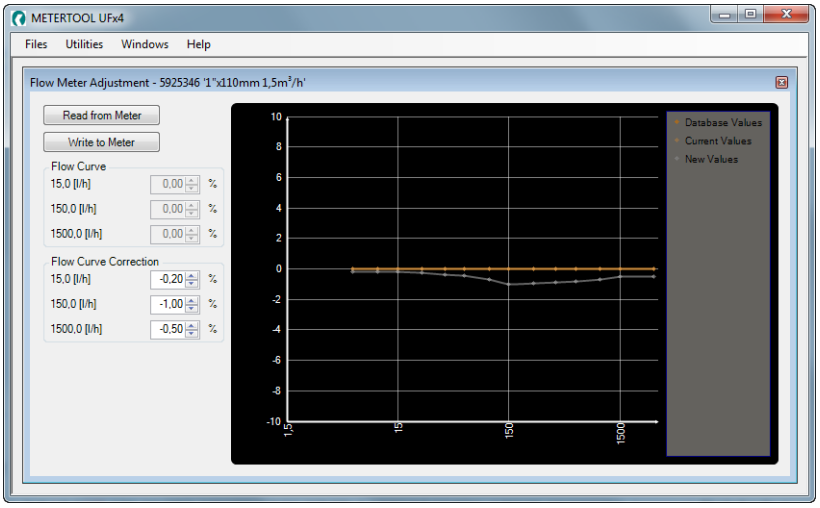
Select COM-port for Pulse Divider.

Activate ”Save” in order to save the selected ports.



10.4.2 Flow meter adjustment

Open ”Flow Meter Adjustment”:



”Read from Meter”: Reads data from the connected flow sensor.

Flow curve number - e.g. 5925346 - and meter dimensions appear from the heading. This number will also appear from the meter’s label.

The field “Flow Curve” shows the values of the sensor in question compared to the standard curve. These values are also shown in the form of a graph.

”Write to Meter”: Writes the correction to the connected flow sensor. The required correction of q_i, 0.1xq_p and q_p can be entered into the field ”Flow Curve Correction”.

After the adjustment the flow sensor is ready for renewed test.

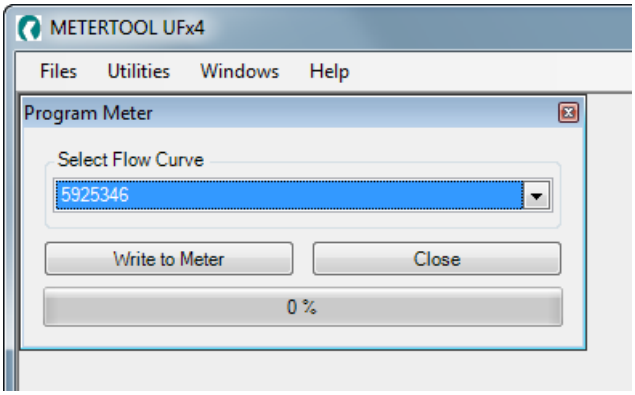
10.4.3 Programming of standard flow curve

Open ”Flow Meter Adjustment”:

The 59xxxxx number appears from the sensor's type label.

”Write to Meter”: Programs the flow sensor with the selected standard flow curve. *)

The flow sensor is now ready for test.

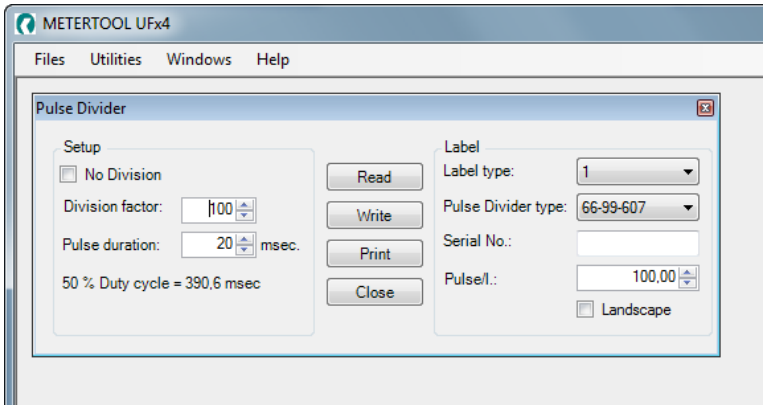


*) METERTOOL automatically configures ULTRAFLOW® 54 DN150...300 to Kamstrup default meter factor (*Table 22, page* 62). If an alternative meter factor is required, please refer to *paragraph 10.4.6 Pulse Configuration DN150-DN300.*

10.4.4 Pulse Divider type No. 66-99-607

Setup and programming of Pulse Divider type No. 66-99-607. A Pulse Divider is used for adapting flow signals to calculators, e.g. if a “foreign” calculator is connected to Kamstrup ULTRAFLOW® and the coding (number of pulses and/or pulse duration) does not correspond.

Open ”Pulse Divider”:



”Read”: Reads the current coding of the Pulse Divider.

”Write”: Programs the Pulse Divider with the entered data.

”Label type”: Makes it possible to select position on Kamstrup label sheet.

”Print”: Prints Pulse Divider Label on the standard printer selected in the PC.

”Close”: Terminates Pulse Divider.

ULTRAFLOW®		Pulse Divider							
q_p [m³/h]	Meter factor [imp/l]	Meter factor [l/imp]	Divider	Meter factor [l/imp]	Divider	Meter factor [l/imp]	Divider	Meter factor [l/imp]	Divider
0.6	300	1	300	2.5	750				
1.5	100	1	100	2.5	250	10	1000		
2.5	60	1	60	2.5	150	10	600		
3	50	1	50	2.5	125	10	500		
3.5	50	2.5	125	10	500	25	1250		
6	25	10	250	25	625				
10	25	10	250	25	625				
10	15	10	150	25	375				
15	10	10	100	25	250	100	1000	250	2500
25	10	10	100	25	250	100	1000	250	2500
25	6	10	60	25	150	100	600	250	1500
40	5	25	125	100	500	250	1250		
60	2.5	100	250	250	625				
100	1.5	100	150	250	375				
150	1	100	100	250	250	1000	1000	2500	2500
250	0.6	100	60	250	150	1000	600	2500	1500
400	0.4	250	100	1000	400	2500	1000		
600	0.25	1000	250	2500	625				
1000	0.25	1000	250	2500	625				

Table 20. Pulse division table (pulse duration for divided pulses is std. 100 ms).

ULTRAFLOW®		Pulse Divider & 11EVL (pulse duration 50 ms)		Pulse Divider & 11 EVL (pulse duration 100 ms)	
q_p [m³/h]	Meter factor [imp/l]	Meter factor [l/imp]	Divider	Meter factor [l/imp]	Divider
0.6	300	1	300	2.5	750
1.5	100	1	100	2.5	250
2.5	60	1	60	2.5	150
3	50	1	50	2.5	125
3.5	50	1	50	2.5	125
6	25	1	25	25	625
10	25	1	25	25	625
10	15	1	15	25	375
15	10	10	100	25	250
25	10	10	100	25	250
25	6	10	60	25	150
40	5	10	50	25	125
60	2.5	10	25	250	625
100	1.5	10	15	250	375
150	1	100	100	250	250
250	0.6	100	60	250	150
400	0.4	100	40	250	100
600	0.25	100	25	2500	625
1000	0.25	100	25	2500	625

Table 21. Pulse division table for use together with Kamstrup EVL.

For other variants, please see installation guide for Pulse Divider, Kamstrup document No. 5511-727.

10.4.5 Pulse Divider type No. 66-99-907

Readout and programming of Pulse Divider type No. 66-99-907 is not supported by the existing version of METERTOOL UFx4 (rev. G1).

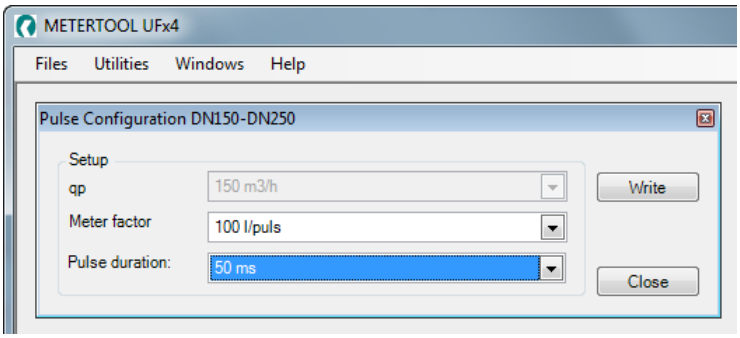
Instead we refer to METERTOOL HCW. See *paragraph 11*.

10.4.6 Pulse Configuration DN150-DN300

Programming meter factor and pulse duration for ULTRAFLOW® 54 DN150-300. ”Pulse Configuration DN150-DN250” is used to change meter factor and pulse duration to match calculator and other equipment. E.g. if ULTRAFLOW® is connected to a calculator that does not support Kamstrup’s fast pulses. See *Table 22* for valid programming options.

Open ”Pulse Configuration DN150-DN250”

”qp”:	Based on the programmed standard flow curve.
”Meter factor”:	Only the valid meter factors are available.
”Pulse duration”:	Only the valid pulse durations are available.
”Write”:	Programs ULTRAFLOW® 54 DN150-300 according to the selected values.



q_p	Meter factor			Pulse duration				
[m³/h]	[imp/l]	[l/imp]	CC	[ms] (E=1)	[ms] (E=4)	[ms] (E=5)	[ms] (E=6)	
150	**1**		**33**	**3.9**	**-**	**-**	**-**	**Default**
150		10	34	-	20	-	-	
150		25	64	-	20	-	-	
150		100	35	-	20	50	100	
150		250	65	-	20	50	100	
150		1000	36	-	20	50	100	
150		2500	66	-	20	50	100	
250	**0.6**		**43**	**3.9**	**-**	**-**	**-**	**Default**
250		10	34	-	20	-	-	
250		25	64	-	20	-	-	
250		100	35	-	20	50	100	
250		250	65	-	20	50	100	
250		1000	36	-	20	50	100	
250		2500	66	-	20	50	100	
400	**0.4**		**63**	**3.9**	**-**	**-**	**-**	**Default**
400		100	35	-	20	50	-	
400		250	65	-	20	50	100	
400		1000	36	-	20	50	100	
400		2500	66	-	20	50	100	
600	**0.25**		**14**	**3.9**	**-**	**-**	**-**	**Default**
600		100	35	-	20	50	-	
600		250	65	-	20	50	-	
600		1000	36	-	20	50	100	
600		2500	66	-	20	50	100	
1000	**0.15**		**24**	**3.9**	**-**	**-**	**-**	**Default**
1000	(0.25)	4	14	3.9	-	-	-	*)
1000		100	35	-	20	50	-	
1000		250	65	-	20	50	-	
1000		1000	36	-	20	50	100	
1000		2500	66	-	20	50	100	

**) Spare part for ULTRAFLOW® type 65-S/R/T. Configured 65-5-FGCR. No flow info.*

Table 22. Programming options as to meter factor (CC)and pulse durations (E) for ULTRAFLOW® 54 DN150-300.

Based on a q_p value a meter factor in *Table 22* is chosen. The valid pulse durations are listed on the same line as the chosen meter factor.

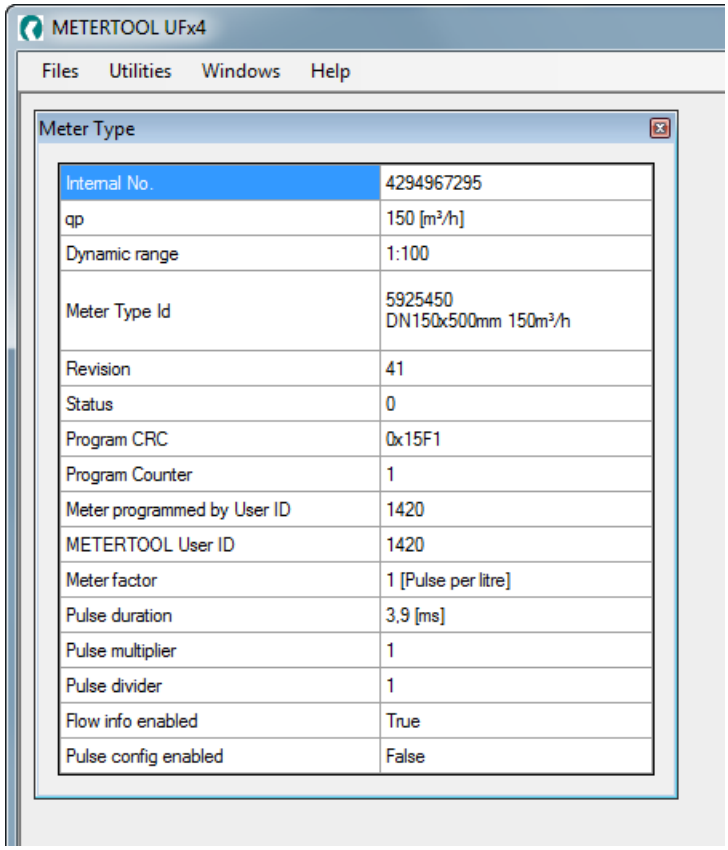
Example: For ULTRAFLOW® 54 q_p 400 m³/h a meter factor of 100 l/pulse (CC=35) is required. Based on this meter factor one of the pulse durations, 20 milliseconds (E4) or 50 milliseconds (E5) is selected.

Default values in *Table 22* are programming values for ULTRAFLOW® 54 DN150-300 when connected to a Kamstrup MULTICAL® calculator.

10.4.7 Meter type

Open ”Meter type”:

Reads flow sensor information.



Internal No.	4294967295
qp	150 [m³/h]
Dynamic range	1:100
Meter Type Id	5925450 DN150x500mm 150m³/h
Revision	41
Status	0
Program CRC	0x15F1
Program Counter	1
Meter programmed by User ID	1420
METERTOOL User ID	1420
Meter factor	1 [Pulse per litre]
Pulse duration	3,9 [ms]
Pulse multiplier	1
Pulse divider	1
Flow info enabled	True
Pulse config enabled	False

10.5 Update

The program includes a database comprising data of the variants released at the time the program was produced. Both program and database are updated regularly.

Open ”Setup”.

Choose “Update program”

“Update” If a new version of METETOOL is available on Kamstrup’s server it is possible to update the program online.

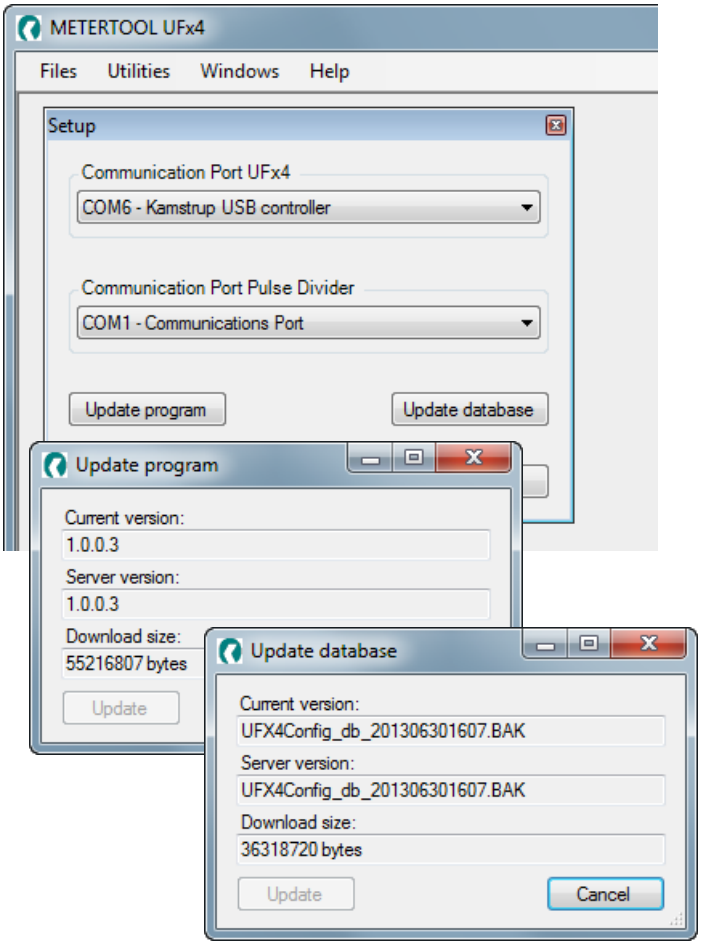
(Internet connection required).

Choose “Update database”

“Update” The database at Kamstrup is updated daily. If a newer version is available, the database can be updated online from Kamstrup’s server.

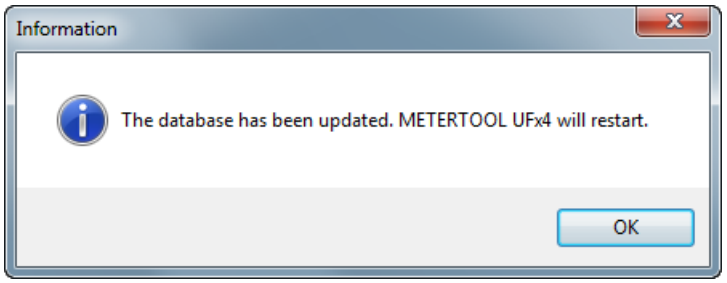
(Internet connection required).

When update is completed METERTOOL will restart.



Open ”Force Database Update”.

Forced update of the database. When update is complete METERTOOL will restart.



11 METERTOOL HCW

11.1 Introduction

Kamstrup's software product "METERTOOL HCW" (66-99-724) is used for configuration of Kamstrup heat, cooling and water meters.

The following instructions are based on version 1.0.7.0

11.1.1 System requirement

METERTOOL requires minimum Windows XP SP3, Windows 7, Home Premium SP1 or newer as well as Windows Internet Explorer 5.01 or newer.

Minimum:	1 GB RAM	**Recommended:**	4 GB RAM
	10 GB HD		20 GB HD
	Display resolution 1366 x 768		1920 x 1080
	USB		
	Printer installed		

Administrator rights to the PC are required in order to install and use the programs. The programs must be installed under the log-on of the person who is to use the programs.

11.1.2 Interface

See *paragraph 10.2.1*.

11.1.3 Installation

Check that system requirements are fulfilled.

Close other open programs before starting the installation.

Download the METERTOOL-software from Kamstrup's FTP-server and follow the program's directions.

During the installation of the METERTOOL program the USB-driver is automatically installed if it has not been installed already.

When the installation has been completed, the icon "METERTOOL HCW" will appear in the menu "All Programs" under 'KAMSTRUP METERTOOL' (or from the menu "Start" for Windows XP) and as a link on the desktop. Double-click on link or icon in order to start the program.

11.2 Pulse Divider 66-99-907

11.2.1 General information

It is important to be familiar with the Pulse Divider's functions before starting programming.

Kamstrup's software product "METERTOOL HCW" (66-99-724) is used for Pulse Divider 66-99-907. For Pulse Divider 66-99-607 see *paragraph 10.4.4*.

Before running the program, the interface cable with USB and 4-pole connector must be connected to a USB-port in the PC and the 4-pole connector in the Pulse Divider.

Note: The supply to the Pulse Divider must be disconnected during programming. The Pulse Divider is powered through the connected interface cable.

Start METERTOOL HCW and click on „Connect" in METERTOOL HCW. It is not important whether the program is in basic or advanced mode.

Figure 54. Connect to meter.

11.2.2 Meter details

Clicking ”Connect”, METERTOOL HCW opens a new window showing a picture of the Pulse Divider with information on software revision.

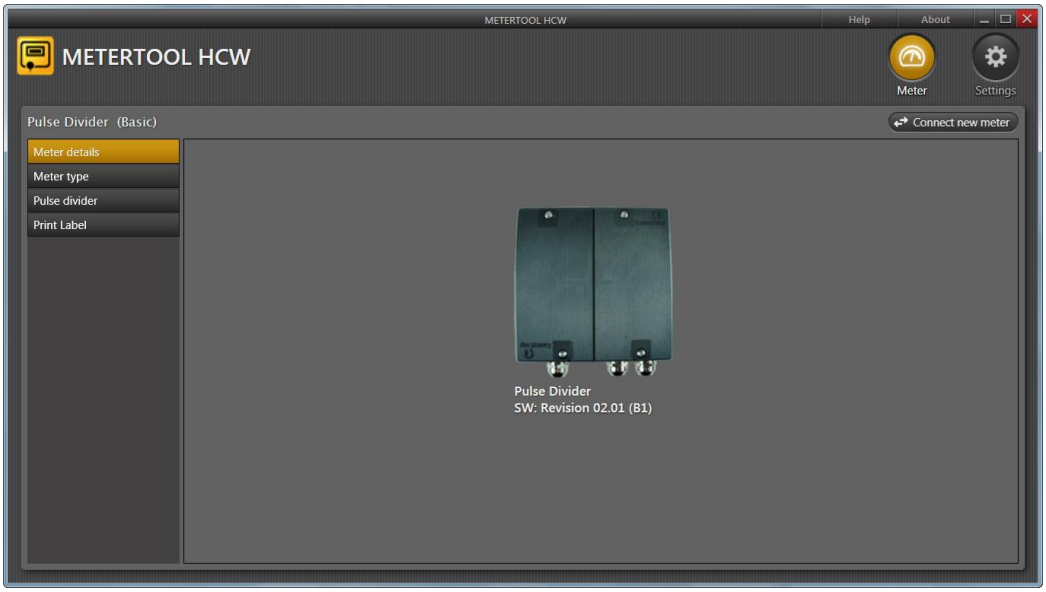


Figure 55. Meter details.

The menu in the left side of the screen includes a number of different options, which are described in detail below.

11.2.3 Meter type

”Read”: Reads out information from the Pulse Divider.

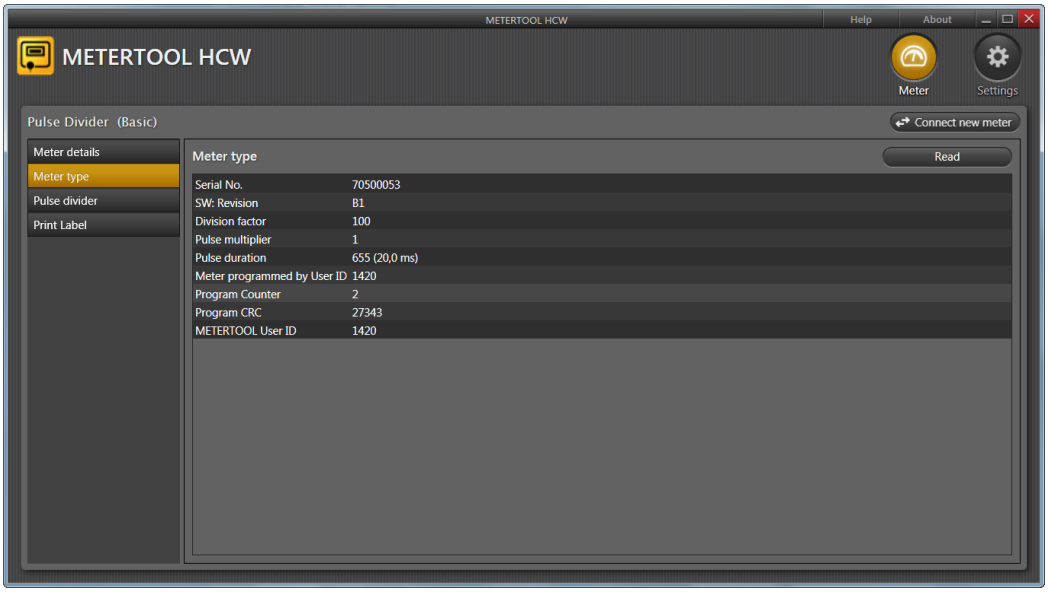


Figure 56. Meter type.

11.2.4 Pulse Divider

Configuration of Pulse Divider is used for adapting flow signals to calculators, e.g. if ULTRAFLOW® is connected to a "foreign" calculator, which does not support Kamstrup's quick pulses.

”ULTRAFLOW® Meter factor (CCC)“:	Based on ULTRAFLOW® meter factor. Appears from ULTRAFLOW® type label.
”Pulse Divider Meter factor (DD)”:	Only valid meter factors can be selected.
”Pulse duration (E)”:	Pulse Divider pulse duration. Only valid pulse durations can be selected.
”Write”:	Programs the Pulse Divider with the selected data.

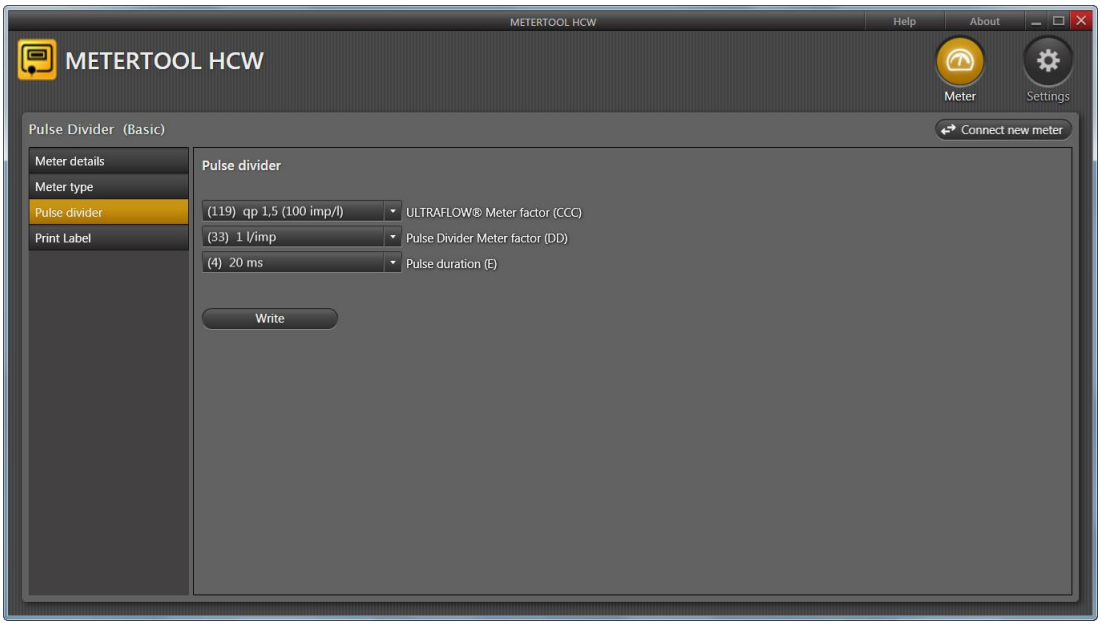


Figure 57. Pulse Divider.

See *Table 23* and *Table 24* for valid configuration variants.

q_p	CCC	Meter factor				Pulse duration				
[m³/h]		[imp/l]	[l/imp]	Divider	DD	[ms]	[ms] (E=4)	[ms] (E=5)	[ms] (E=6)	
0.6	**116**	**300**				**3.9**	-	-	-	**Default**
0.6			1	300	33	-	20	50	100	
0.6			2.5	750	63	-	-	-	100	
1.5	**119**	**100**				**3.9**	-	-	-	**Default**
1.5			1	100	33	-	20	50	100	
1.5			2.5	250	63	-	-	-	100	
1.5			10	1000	34	-	-	-	100	
2.5	**198**	**60**				**3.9**	-	-	-	**Default**
2.5			1	60	33	-	20	50	100	
2.5			2.5	150	63	-	-	-	100	
2.5			10	600	34	-	-	-	100	
3.5	**151**	**50**				**3.9**	-	-	-	**Default**
3.5			1	50	33	-	20	50	-	
3.5			2.5	125	63	-	-	-	100	
3.5			10	500	34	-	-	-	100	
3.5			25	1250	64	-	-	-	100	
6	**137**	**25**				**3.9**	-	-	-	**Default**
6			1	25	33	-	20	50	-	
6			2.5	62.5	63	-	-	-	100	
6			10	250	34	-	-	-	100	
6			25	625	64	-	-	-	100	
10	**178**	**15**				**3.9**	-	-	-	**Default**
10			1	15	33	-	20	50	-	
10			10	150	34	-	-	-	100	
10			25	375	64	-	-	-	100	
15	**120**	**10**				**3.9**	-	-	-	**Default**
15			1	10	33	-	20	-	-	
15			10	100	34	-	-	50	100	
15			25	250	64	-	-	-	100	
15			100	1000	35	-	-	-	100	
25	**179**	**6**				**3.9**	-	-	-	**Default**
25			1	6	33	-	20	-	-	
25			10	60	34	-	-	50	100	
25			25	150	64	-	-	-	100	
25			100	600	35	-	-	-	100	

Table 23. Configuration variants of meter factor (DD) and pulse duration (E) for Pulse Divider for ULTRAFLOW® 54 and 34, qp 0.6…25.

q_p	CCC	Meter factor				Pulse duration				
[m³/h]		[imp/l]	[l/imp]	Divider	DD	[ms]	[ms] (E=4)	[ms] (E=5)	[ms] (E=6)	
40	**158**	**5**				**3.9**	-	-	-	**Default**
40			10	50	34	-	20	50	-	
40			25	125	64	-	-	-	100	
40			100	500	35	-	-	-	100	
40			250	1250	65	-	-	-	100	
60	**170**	**2,5**				**3.9**	-	-	-	**Default**
60			10	25	34	-	20	50	-	
60			25	62.5	64	-	-	-	100	
60			100	250	35	-	-	-	100	
60			250	625	65	-	-	-	100	
100	**180**	**1,5**				**3.9**	-	-	-	**Default**
100			10	15	34	-	20	50	-	
100			100	150	35	-	-	-	100	
100			250	375	65	-	-	-	100	

Table 24. Configuration variants of meter factor (DD) and pulse duration (E) for Pulse Divider for ULTRAFLOW® 54 and 34, qp 40…100.

Based on a q_p-value, one of the valid meter factors for the Pulse Divider is selected from *Table 23* or *Table 24*. The valid pulse durations are listed on the same line as the selected meter factor.

Example: For ULTRAFLOW® 54 with q_p 40 m3/h (5 imp/l, CCC=158) a meter factor of 10 l/imp (DD=34) for the Pulse Divider is required. Based on this meter factor one of the pulse durations, 20 milliseconds (E=4) or 50 milliseconds (E=5) is selected.

For older types of ULTRAFLOW® (e.g. ULTRAFLOW® type 65), where the correlation between q_p and meter factor (CCC) is not ambiguous, the correct configuration is made by using the flow sensor's meter factor [imp/l].

Default values in *Table 23* and *Table 24* indicate meter factors and pulse durations of ULTRAFLOW® 54 and 34.

11.2.5 Print Label

This menu option enables you to print new type labels for Pulse Divider.

”Country code”:	Select country code for Pulse Divider. Appears from Pulse Divider type label.
”Module”:	Select output module. Appears from Pulse Divider type label.
”Power supply”:	Select power supply. Appears from Pulse Divider type label.
”ULTRAFLOW® Meter factor (CCC)“:	Select ULTRAFLOW® pulse factor. Appears from Pulse Divider type label.
”Pulse Divider Meter factor (DD)”:	Select pulse factor of Pulse Divider. Appears from Pulse Divider type label.
”Pulse duration (E)”:	Select pulse duration of Pulse Divider. Appears from Pulse Divider type label.
”SW: Revision”:	Pulse Divider software revision. Appears from Pulse Divider type label.
”Serial No.”:	Pulse Divider serial number. Appears from Pulse Divider type label.
”Year”:	Pulse Divider production year. Appears from Pulse Divider type label.
”Offset X”:	Horizontal offset for printing of label (positive value: Offset to the right).
”Offset Y”:	Vertical offset for printing of label (positive value: Offset downwards).
”Preview”:	Shows examples of Pulse Divider type label with selected values.
”Select Label Printer”:	Select printer.
”Print”:	Prints type label on selected printer.

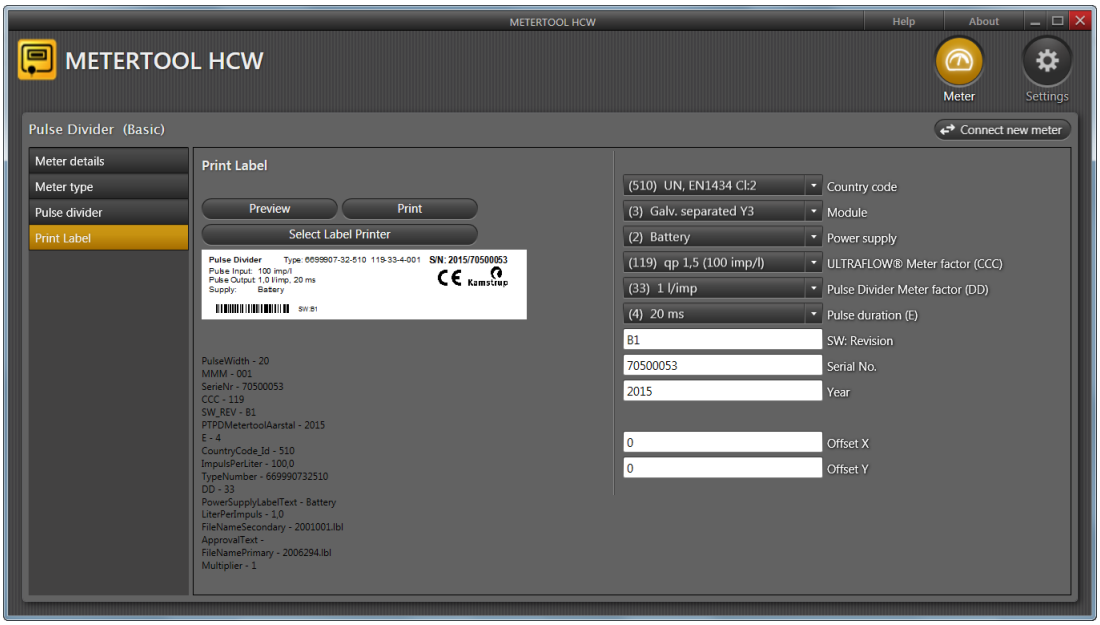


Figure 58. Print label.

Please note: Replacing type label of Pulse Divider, legal marking requirements must be taken into account.

11.3 Settings

Clicking on the button “Settings” the following parameters can be changed:

”Change Language”: The program language can be changed to 6 different languages: Danish, German, English, French, Polish and Russian.

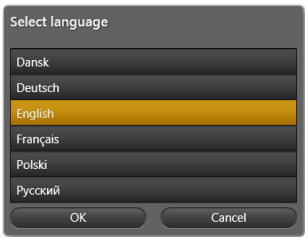


Figure 59. Select language.

”COM-port settings”: The COM-port can be selected manually instead of the automatically selected default setting.

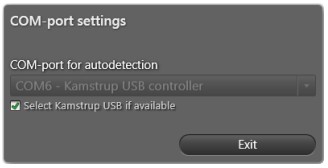


Figure 60. Select COM-port.

”Update program”: The METERTOOL program can be updated online if a newer revision is available on Kamstrup's FTP-server.

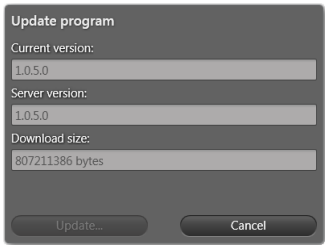


Figure 61. Update program.

”Update database”: The METERTOOL databases can be updated online if newer revisions are available on Kamstrup's FTP-server.

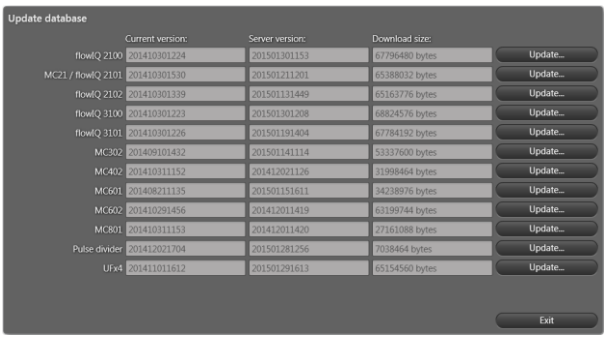


Figure 62. Update database.

”Backup or Restore databases”: This function is not used for Pulse Divider.

”Install USB driver”: This function enables (re)installation of the USB-driver, which is used for the interface cable.

11.3.1 Help button

”Contact”:	Links to Kamstrup's website and mailbox.
”Output”:	Opens a window showing the latest used functions in the program.
”User manual”:	Links to technical descriptions on Kamstrup's website.

11.3.2 About button

List of METERTOOL program versions and revision numbers as well as all sub-programs including type numbers and revision numbers for the entire METERTOOL HCW.

12 Approvals

12.1 Measuring Instruments Directive

ULTRAFLOW® 54 is available with CE-marking according to MID (2014/32/EU). The certificates have the following numbers:

B-Module: DK-0200-MI004-008

D-Module: DK-0200-MID-D-001

Please contact Kamstrup A/S for further details on type approval and verification.

12.2 CE-Marking

ULTRAFLOW® 54 is marked according to the following directives:

EMC-directive	2014/30/EU
LV-directive	2014/35/EU (when fitted with 230 VAC supply module)
PE-directive	2014/68/EU (DN150…DN300) category II

13 Troubleshooting

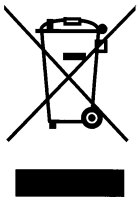
Before sending in the sensor for repair, please use the error detection table below to help you clarify the possible cause of the problem.

Symptom	Possible cause	Proposal for correction
No update of display values	No power supply	Replace battery or check mains supply
No display function (blank display)	No power supply and backup	Replace back-up cell. Replace battery or check mains supply
No accumulation of m³	No volume pulses Incorrect connection	Check flow sensor connection. (Check with Pulse Tester, if necessary)
	Flow sensor inverted	Check flow sensor direction
	Air in sensor/cavitation	Check installation angle. Check if there is air in the system or cavitation from valves and pumps. If possible, try to increase the static pressure.
	Flow sensor error	Replace flow sensor/send sensor for repair
Erroneous m³ accumulation	Erroneous programming	Check consistency between meter factor of calculator and flow sensor
	Air in sensor/cavitation	Check installation angle. Check if there is air in the system or cavitation from valves and pumps. Increase the static pressure, if possible
	Flow sensor error	Replace flow sensor/Send sensor for repair

14 Disposal

Kamstrup A/S holds an environmental certification according to ISO 14001, and as part of Kamstrup's environment policy only materials which can be environmentally correctly recovered are used to the greatest possible extent.

Kamstrup A/S has climate accounts (Carbon footprint) for all meter types.



Kamstrup's heat meters are marked according to EU Directive 2012/19/EU and the standard EN 50419.

The purpose of the marking is to inform our customers that the heat meter cannot be disposed of as ordinary waste.

- **Disposal by Kamstrup A/S**

  Kamstrup accepts worn-out meters for environmentally correct disposal according to previous agreement. The disposal is free of charge to our customers, except for the cost of transportation to Kamstrup.

- **The customer sends for disposal**

  The meters must not be disassembled prior to dispatch. The complete meter is handed in for approved national/local disposal. Enclose a copy of this page in order to inform the recipient of the contents.

Please note that lithium and meters containing lithium cells must be shipped as dangerous goods. See Kamstrup document 5510-408, "Lithium batteries - Handling and disposal".

Meter part	Material	Recommended disposal
Lithium cell (D-cell)	Lithium and thionyl chloride > UN 3091 < D-cell: 4.9 g lithium	Approved deposit of lithium cells
PCB	Coppered epoxy laminate, components soldered on	PCB scrap for concentration of metals
Signal cable for flow sensor	Copper with silicone mantle	Cable recycling
Supply cable	Copper with PVC mantle	Cable recycling
Electronics box, base	Thermoplastic, PC 10% GF	Plastic recycling
Electronics box, cover	Thermoplastic, PC 10% GF	Plastic recycling
Mounting fitting, distance piece for electronics box	Thermoplastic, PPS 40% GF	Plastic recycling
ULTRAFLOW® sensor housing	Stainless steel, W.no. 1.4307	Metal recycling
Transducer holder	Stainless steel, W.no. 1.4308	Metal recycling
Transducer	Titanium	Metal recycling
Packing	Recycled cardboard and EPS	Cardboard and EPS recycling (Resy)

Please send any questions you may have regarding environmental matters to:

Kamstrup A/S
Att.: Quality and environmental dept.
Fax: +45 89 93 10 01
info@kamstrup.com

15 Documents

	Danish	English	German	Russian
Technical description	5512-875	5512-876	5512-877	5512-878
Data sheet	5810-834	5810-835	5810-836	5810-837
Installation instructions	5512-886	5512-887	5512-888	5512-889

Table 25

Kamstrup A/S
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