kamstrup

Technical Description

ULTRAFLOW® 54 (H)/(J)

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Contents

1 General description

ULTRAFLOW® is a static flow sensor based on the ultrasonic principle. It is primarily used as a volume flow sensor for energy meters such as MULTICAL®. ULTRAFLOW® 54 has been designed for use in heating installations where water is the heat-bearing medium. The variants ULTRAFLOW® 54 (H)/(J) comprises all flow sensors with type numbers 65-5-XXHX-XXX / 65-5-XXJX-XXX, respectively. Both variants of these flow sensors consist of threaded hot forged meter housings, and we distinguish between two different types of electronic boxes and corresponding interface connectors for e.g. communicating with the meter by means of METERTOOL or NOWA. Type (H) corresponds to the nominal flow q_p 0.6…2.5 m^3/h, while type (J) corresponds to q_p 3.5…10 m^3/h.

Flow measuring in ULTRAFLOW® is based on ultrasonic measuring and microprocessor technique. A single-board construction comprises all calculating and flow measuring circuits, which provides 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, proven a long-term stable and accurate measuring principle. Two ultrasonic transducers are used to send sound signals with as well as against the flow. The ultrasonic signal travelling with the flow reaches the opposite transducer first, and the time difference between the two signals can be converted into average flow velocity and thereby to volume flow rate and volume.

A three-wire pulse cable is used to connect ULTRAFLOW® to the calculator. The cable transfers the signal to the calculator and supplies the flow sensor. The transmitted signal corresponds to the flow and consists of a number of pulses, which is proportional to the quantity of water having passed through the sensor (volume).

When ULTRAFLOW® is used as volume flow rate sensor for MULTICAL®, ULTRAFLOW® can be direct connected to MULTICAL® at cable lengths up to 10 m. In this case, ULTRAFLOW® is supplied by MULTICAL® directly.

ULTRAFLOW® must be connected to MULTICAL® via a Pulse Transmitter if you want to use another calculator than MULTICAL®. If ULTRAFLOW® is connected to a foreign calculator with a different pulse factor than the one supplied by ULTRAFLOW®, a Pulse Divider must be used instead. Pulse Transmitter and Pulse Divider are available as accessories with built-in supply for ULTRAFLOW® and galvanic separated pulse output. Furthermore, they allow a cable length of more than 10 m between ULTRAFLOW® and the calculator, which is required in some installations.

When ULTRAFLOW® is connected to MULTICAL® a Cable Extender Box can be utilized as an alternative in order to extend the cable length between ULTRAFLOW® and MULTICAL® up to 30 m. Note, that in this case ULTRAFLOW® and MULTICAL® are not galvanically separated.

2 Data

ULTRAFLOW® 54 (H)/(J)

2.1 Electrical data

Supply voltage	3.6 VDC ± 0.1 VDC	
Battery (Pulse Transmitter/ Pulse Divider)	3.65 VDC, D-cell lithium	
Replacement interval	6 years @ t_{BAT} < 30 °C	With output module (Y=3)
Mains supply (Pulse Transmitter/ Pulse Divider)	230 VAC +15/-30 %, 50 Hz 24 VAC ±50 %, 50 Hz	
Power consumption, mains supply	< 1 W	
Backup mains supply	Integral SuperCap eliminates interruptions due to short-term power failures	
Cable length		
Flow sensor	Max. 10 m	
Pulse Transmitter/ Pulse Divider	Depends on calculator. Max. 100 m when connected to MULTICAL® (Y = 2).	
Cable Extender Box	Depends on calculator. Max. 30 m when connected to MULTICAL® 603.	
EMC data	Fulfils EN 1434:2015 class C, MID E1 and E2	

2.2 Mechanical data

Metrological class	2 or 3	
Environmental class	Fulfils EN 1434 class C	
Mechanical environment	MID M1 and M2 (flow sensor type 65-5-XXHX-XXX only)	
Ambient temperature	5…55 °C, non-condensing, closed location (installation indoors)	
Protection class		
Flow sensor	IP65	When properly installed. See *paragraph 7 Installation*
Pulse Transmitter/ Pulse Divider	IP67	
Cable Extender Box	IP65	
Humidity		
ULTRAFLOW® 54:	Non-condensing, < 93 % RH	
Medium in flow sensor	Water – recommended water quality as in CEN TR 16911 and AGFW FW510	
Medium temperature	15…130 °C or 15…90 °C	At medium temperatures above 90 °C calculator and Pulse Transmitter/Pulse Divider must not be mounted on the flow sensor. Instead wall mounting is recommended.
Storage and transport temperature, empty flow sensor	-25…60 °C	
Pressure stage	PN16, PS16 and PN25, PS25	

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. cutoff [l/h]
0.6	DN15/DN20	300	100:1	2:1	1.5	0.03	2
1.5	DN15/DN20	100	100:1	2:1	4.5	0.09	3
2.5	DN20	60	100:1	2:1	7.5	0.09	5
3.5	DN25	50	100:1	2:1	9	0.07	7
6	*DN25 [3]*	*25*	*100:1*	*2:1*	*18*	*0.20*	*12*
6	DN25/DN32	25	100:1	2:1	18	0.06	12
10	DN40	15	100:1	2:1	30	0.06	20

[1] *The meter factor appears from the type label.*

[2] *Saturation flow 125 Hz. Max. pulse frequency is maintained at higher flow.*

[3] *Types 65-5-CHJ6-XXX and 65-5-CHJ7-XXX.*

Table 1. Flow data.

2.4 Materials

Wetted parts, ULTRAFLOW® 54 (H)/(J)

Housing, coupling	DZR brass (dezincification resistant brass), CW602N
Transducer	Stainless steel, W. no. 1.4401
Gaskets	EPDM
Reflectors	Thermoplastic, PES 30 % GF and stainless steel, W. no. 1.4301/ Stainless steel, W. no. 1.4301 (q_p 3.5 m³/h)
Measuring tube	Thermoplastic, PES (q_p 0.6…2.5 m³/h)/ PES 30% GF ($q_p \geq$ 3.5 m³/h)

Electronics box, ULTRAFLOW® 54 (H)/(J)

Base	Thermoplastic, PES 30 % GF (q_p 0.6…2.5 m³/h)/ PC 10% GF ($q_p \geq$ 3.5 m³/h)
Cover	Thermoplastic, PC 10 % GF (q_p 0.6…2.5 m³/h)/ PC 20% GF ($q_p \geq$ 3.5 m³/h)

Housing, Pulse Transmitter/Pulse Divider

Base, cover	Thermoplastic, PC 10 % GF

Signal cable

Silicone cable (3 x 0.5 mm²)

Mains supply cable 24/230 VAC (optional when selecting mains supplied Pulse Transmitter/Pulse Divider)

Cable with PVC-mantle (2 x 0.75 mm²)

Housing, Cable Extender Box

Base, cover	ABS

3 Type overview

Nom. flow q_p [m³/h]	Installation dimensions				
0.6	G¾Bx110 mm	G1Bx130 mm	*(G1Bx190 mm)*		
1.5	G¾Bx110 mm	G¾Bx165 mm	G1Bx130 mm	G1Bx190 mm	*(G1Bx110 mm)*
2.5	G1Bx190 mm	*(G1Bx130 mm)*			
3.5	G1¼Bx260 mm	*(G1 ¼Bx135 mm)*	*(G1 ¼Bx150 mm)*		
6	G1¼Bx260 mm	G1½Bx 260 mm	*(G1 ¼Bx135 mm)*	*(G1 ¼Bx150 mm)*	
10	G2Bx300 mm	*(G2x200 mm)*			

(...) Country specific variants

Table 2. Type overview.

Thread EN ISO 228-1

4 Ordering details

4.1 ULTRAFLOW® 54 (H)/(J)

Type number *			q_p [m³/h]	q_i [m³/h]	q_s [m³/h]	Dynamic range q_p:q_i	Connection	PN	Length [mm]	Meter factor [pulses/l]	Material (Housing)
65-5-	CAHA	-XXX	0.6	0.006	1.2	100:1	G¾B (R½)	16/25	110	300	Brass
65-5-	CAHD	-XXX	0.6	0.006	1.2	100:1	G1B (R¾)	16/25	130	300	Brass
(65-5-	*CAHF*	*-XXX)*	0.6	0.006	1.2	100:1	G1B (R¾)	16/25	190	300	Brass
65-5-	CDHA	-XXX	1.5	0.015	3	100:1	G¾B (R½)	16/25	110	100	Brass
65-5-	CDHC	-XXX	1.5	0.015	3	100:1	G¾B (R½)	16/25	165	100	Brass
(65-5-	*CDH1*	*-XXX)*	1.5	0.015	3	100:1	G1B (R¾)	16	110	100	Brass
65-5-	CDHD	-XXX	1.5	0.015	3	100:1	G1B (R¾)	16/25	130	100	Brass
65-5-	CDHF	-XXX	1.5	0.015	3	100:1	G1B (R¾)	16/25	190	100	Brass
(65-5-	*CEHD*	*-XXX)*	2.5	0.025	5	100:1	G1B (R¾)	16/25	130	60	Brass
65-5-	CEHF	-XXX	2.5	0.025	5	100:1	G1B (R¾)	16/25	190	60	Brass
65-5-	CGJG	-XXX	3.5	0.035	7	100:1	G1¼B (R1)	16/25	260	50	Brass
(65-5-	*CGJ6*	*-XXX)*	3.5	0.035	7	100:1	G1¼B (R1)	16/25	135	50	Brass
(65-5-	*CGJ7*	*-XXX)*	3.5	0.035	7	100:1	G1¼B (R1)	16/25	150	50	Brass
65-5-	CHJG	-XXX	6	0.060	12	100:1	G1¼B (R1)	16/25	260	25	Brass
65-5-	CHJH	-XXX	6	0.060	12	100:1	G1½B (R1¼)	16/25	260	25	Brass
(65-5-	*CHJ6*	*-XXX)*	6	0.060	12	100:1	G1¼B (R1)	16/25	135	25	Brass
(65-5-	*CHJ7*	*-XXX)*	6	0.060	12	100:1	G1¼B (R1)	16/25	150	25	Brass
65-5-	CJJJ	-XXX	10	0.100	20	100:1	G2B (R1½)	16/25	300	15	Brass
(65-5-	*CJJ8*	*-XXX)*	10	0.100	20	100:1	G2B (R1½)	16/25	200	15	Brass

* *XXX - code for final assembly, approvals etc. - determined by Kamstrup. A few variants may not be available in national approvals.*

Table 3. Type numbers of ULTRAFLOW® 54 (H)/(J).

When ordering ULTRAFLOW® and MULTICAL® separately, please also consult the respective Technical descriptions of MULTICAL® 602/603/801 (5512-931_GB/5512-2029_GB/5512-571_GB) for flow meter coding.

4.2 Accessories for ULTRAFLOW®

Couplings				
Size	Nipple	Union	Type No.	
			1 pc.	2 pcs.
DN15	R ½	G ¾	-	6561-323
DN20	R ¾	G 1	-	6561-324
DN25	R 1	G 5/4	6561-325	-
DN32	R 5/4	G 1½	6561-314	-
DN40	R 1½	G 2	6561-315	-

Table 4. Couplings including gaskets (PN16).

Gaskets for couplings	
Size (union)	Type No.
G ¾	2210-061
G 1	2210-062
G 5/4	2210-063
G 1½	2210-064
G 2	2210-065

Table 5. Gaskets.

4.3 Pulse Transmitter / Pulse Divider and Cable Extender Box

4.3.1 Introduction

Depending on the application of ULTRAFLOW®, galvanic separation, adaptation of meter factor to a foreign calculator or longer cables between ULTRAFLOW® and MULTICAL® might become necessary. Pulse Transmitter, Pulse Divider and Cable Extender Box are electronic devices, which are mounted between ULTRAFLOW® and the calculator, and which can provide different technical solutions for these purposes, respectively.

Pulse Transmitter and Pulse Divider are delivered with built-in supply for ULTRAFLOW®. By default Pulse Transmitter/Pulse Divider is powered by a built-in battery. Alternatively, Pulse Transmitter/Pulse Divider is externally powered by 24 VAC or 230 VAC.

Pulse Transmitter and Pulse Divider are delivered with galvanic separated output module. See *paragraph 4.3.3* below.

Galvanic separation is used in the following situations:

1) For flow sensor no. 2 in connection with MULTICAL®. If two flow sensors are used together with MULTICAL®, one must be galvanic separated.

   For further info, see *paragraph 7.7.3 Calculator with two flow sensors*.

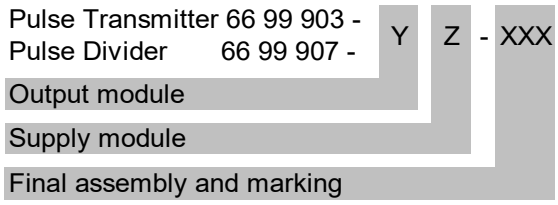
2) If ULTRAFLOW® is connected to other equipment/foreign calculators.

Note: Due to galvanic separation flow-info is not possible if Pulse Transmitter or Pulse Divider is used.

When a Pulse Transmitter or Pulse Divider is connected between ULTRAFLOW® and MULTICAL®, the cable length can be extended depending on the calculator up to 100 m. For further info, *see paragraphs 4.3.2 and 4.3.3*.

In cases, where galvanic separation is not necessary, and flow-info is desired, the Cable Extender Box allows prolongation of the cable length between ULTRAFLOW® and MULTICAL® of up to max. 30 m. For further info, *see paragraph 4.3.7*.

4.3.2 Type number composition of Pulse Transmitter and Pulse Divider



4.3.3 Output module and supply module

Y	Output module	Corresponding supply module
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	2, 3
2	Battery, D-cell	3
7	230 VAC supply module	2, 3
8	24 VAC supply module	2, 3

Table 6. Output module (Y) and supply module (Z) for Pulse Transmitter and Pulse Divider.

Pulse Transmitter and Pulse Divider are available with one of two different galvanically separated output modules.

Output module (Y=2) is used when extra long cables are needed. When connected to MULTICAL® this requires a DC supply as shown in *Figure 22* and *Figure 23* at page 30. (Please also refer to the MULTICAL® Technical description, Flow sensor with active 24 V pulse output). For output module (Y=2) battery supply is not an option.

Output module (Y=3) is intended for battery supply with a battery lifetime of minimum 6 years. Output module (Y=3) is selected by default.

When Pulse Transmitter and Pulse Divider are mains supplied (24 VAC or 230 VAC) and connected with a 3-wire connection to MULTICAL®, both output modules can be used. See *Figure 20* and *Figure 21* at page 29 and 30, respectively.

For further info, see *paragraph 7.6.2 Electrical connection of Pulse Transmitter and Pulse Divider*.

4.3.4 Pulse Divider configuration CCC-DD-E-MMM

The Pulse Divider must, in accordance with *Table 7*, be configured for ULTRAFLOW® meter factor (CCC), which is unambiguously linked to the nominal flow q_p, as well as the meter factor (DD) and pulse duration (E) required for the Pulse Divider. MMM indicates selection of customer label.

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	

Table 7. Configuration variants of meter factor (DD) and pulse duration (E) for Pulse Divider for ULTRAFLOW® 54 (H)/(J), q_p 0.6…10 m³/h.

Based on a q_p-value one of the meter factor options for the Pulse Divider is selected from *Table 7*. The pulse duration options appear from the same line as the selected meter factor.

Example: For ULTRAFLOW® 54 (H) with q_p 1.5 m³/h (100 imp/l, CCC=119) a pulse factor of 1 l/pulse (DD=33) for the Pulse Divider is required. Based on this pulse factor you have the options of pulse durations 20 (E=4), 50 (E=5) or 100 (E=6) milliseconds.

Default values in *Table 7* indicate meter factors and pulse durations of ULTRAFLOW® 54 (H)/(J).

4.3.5 Accessories for Pulse Transmitter and Pulse Divider

Please note that not all article numbers in *Table 8* can be directly ordered, some must be ordered via our service department.

Article number	Description	Note (when ordering Pulse Transmitter/Pulse Divider)
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
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
6699-012	Output module (Y=2), galvanically separated 5550-1062	
6699-013	Output module (Y=3), galvanically separated, “Low power” 5550-1219	
5000-333	2.5 m silicone cable (3-wire)	Optional
5000-259	5 m silicone cable (3-wire)	Optional
5000-270	10 m silicone cable (3-wire)	Optional
3026-207	Bracket for wall munting	Optional

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

[2)] *Including 5000-290.*

Table 8. Accessories for Pulse Transmitter and Pulse Divider.

4.3.6 Cables

Pulse Transmitter and Pulse Divider are available with signal cable lengths 2.5; 5 or 10 m. The signal cable is mounted from the factory.

If 24/230 VAC supply module is selected, Pulse Transmitter and Pulse Divider are optionally available with mains supply cable. The cable is mounted from the factory.

4.3.7 Cable Extender Box

The Cable Extender Box (Type 6699-036) allows a signal cable length of up to max. 30 m between ULTRAFLOW® and MULTICAL®. The device supports flow-Info, but it does not provide galvanic separation (for further details see *paragraph 4.3.1*). The Cable Extender Box (Type 6699-036) must be ordered separately.

Kamstrup offers signal cables with a length of 2.5 m (Type 5000-333), 5 m (Type 5000-259) and 10 m (Type 5000-270), which can be ordered separately. In combination with the signal cables of 2.5m, 5 m or 10 m typically delivered with ULTRAFLOW®, different total length of up to 20 m between ULTRAFLOW® and MULTICAL® can be achieved. With signal cables of different length but equal quality as Kamstrup’s signal cables, it is possible to find individual solutions for the cable extension up to max. 30 m between ULTRAFLOW® and MULTICAL®. For electrical connection, see *paragraph 7.6.3*.

5 Dimensioned sketches

All measurements are in mm, unless otherwise stated.

5.1 ULTRAFLOW® 54 (H)

ULTRAFLOW® 54 (H), G¾B and G1B

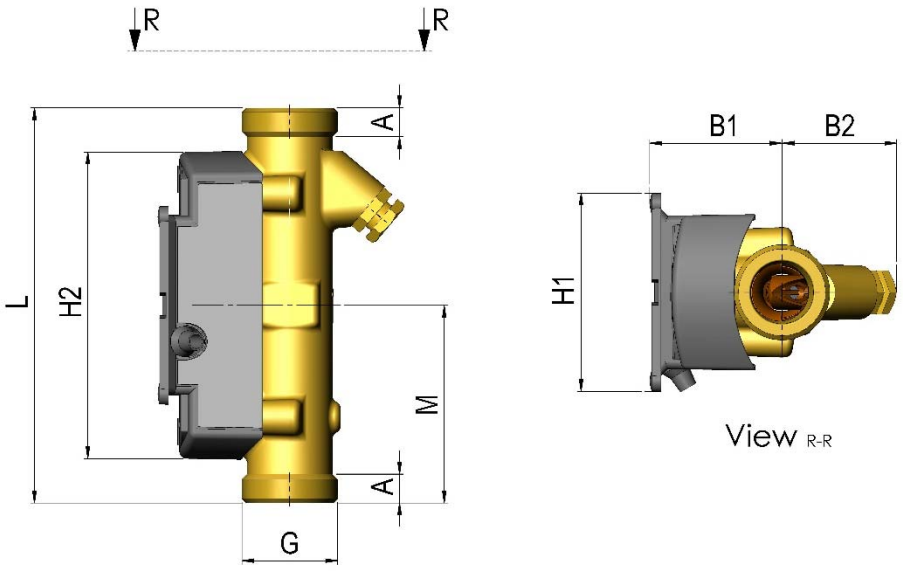


Figure 1

Thread EN ISO 228-1

Thread	L	M	H2	A	B1	B2	H1	Approx. weight [kg]
G¾B (q_p 0.6;1.5)	110	L/2	86	8	37	32	55	0.41
G1B (q_p 1.5)	110	L/2	86	12	37	32	55	0.46
G1B (q_p 0.6;1.5)	130	L/2	86	12	37	32	55	0.51
G1B (q_p 2.5)	130	L/2	86	12	40	35	55	0.53
G¾B (q_p 1.5)	165	L/2	86	8	37	32	55	0.51
G1B (q_p 0.6;1.5)	190	L/2	86	12	37	32	55	0.61
G1B (q_p 2.5)	190	L/2	86	12	40	35	55	0.67

Table 9

5.2 ULTRAFLOW® 54 (J)

ULTRAFLOW® 54 (J), G1¼B, G1½B and G2B

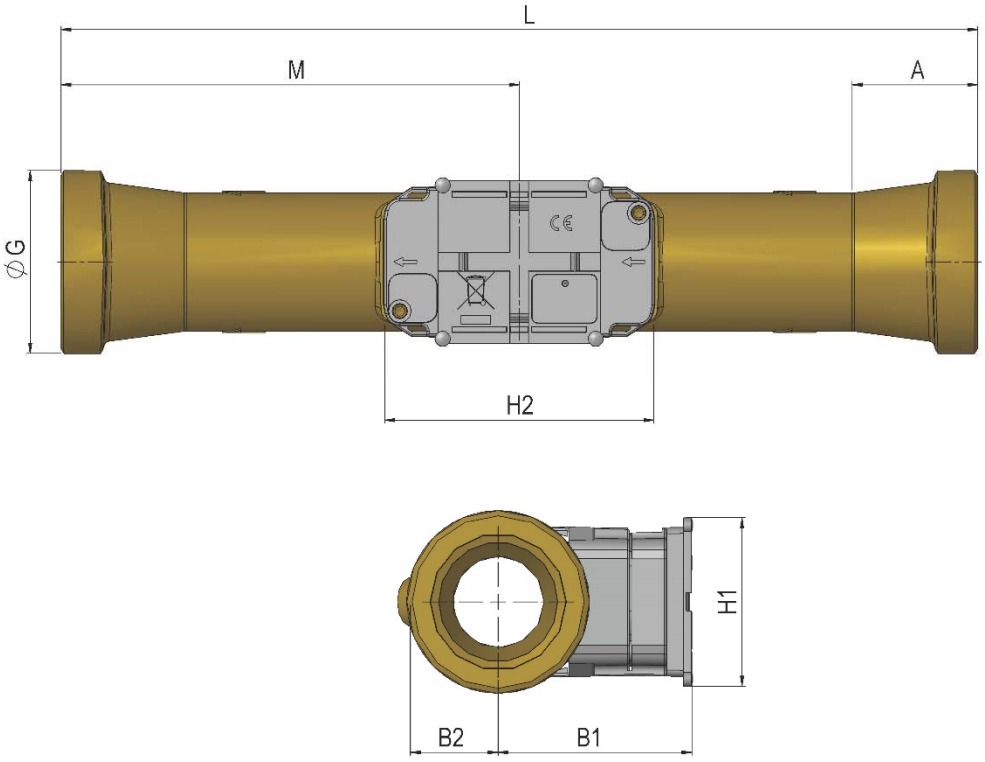


Figure 2

Thread EN ISO 228-1

Thread	L	M	H2	A	B1	B2	H1	Approx. weight [kg]
G1¼ (q_p 3.5; 6.0)	135	63	89	14	58	20	55	0.9
G1¼ (q_p 3.5; 6.0)	150	71	89	14	58	20	55	1.0
G1¼ (q_p 3.5)	260	L/2	89	16	58	20	55	1.5
G1¼ (q_p 6.0)	260	L/2	89	16	60	20	55	1.6
G1½ (q_p 6.0)	260	L/2	89	31	60	24	55	1.7
G2 (q_p 10)	200	85	89	33	63	29	55	1.8
G2 (q_p 10)	300	L/2	89	40.2	63	29	55	2.5

Table 10

5.3 Pulse Transmitter and Pulse Divider

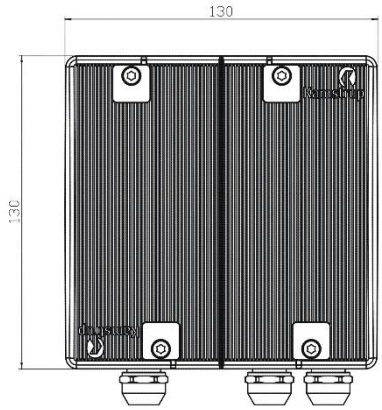


Figure 3. Pulse Transmitter/Pulse Divider seen from the front.

Figure 4. Pulse Transmitter/Pulse Divider seen from the side.

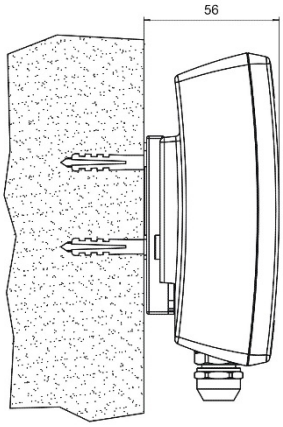


Figure 5. Wall mounted Pulse Transmitter/Pulse Divider.

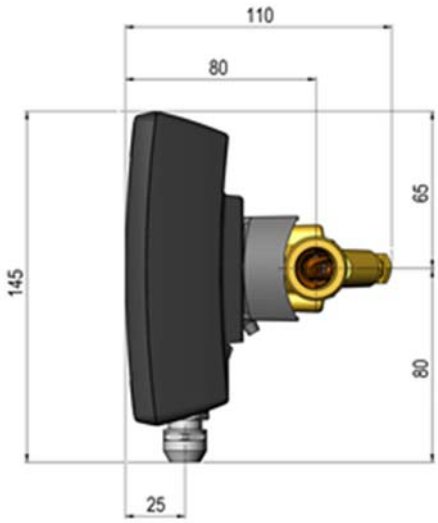
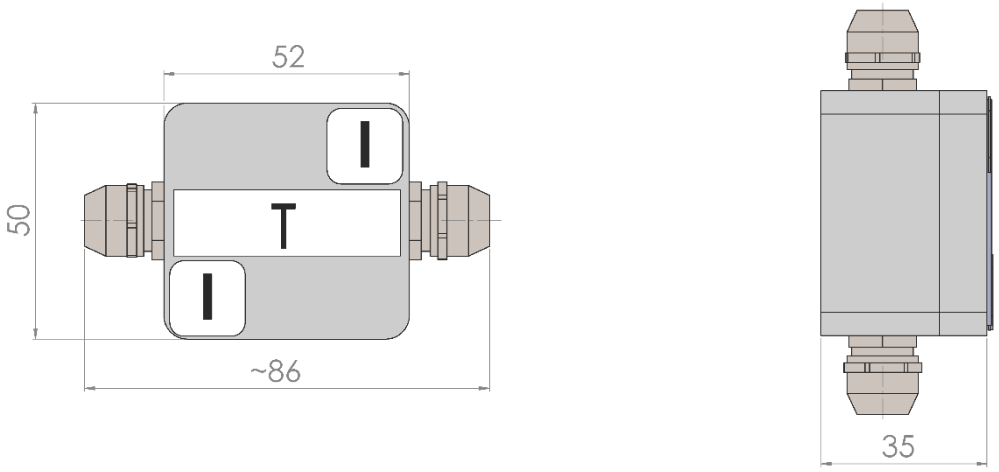


Figure 6. Pulse Transmitter/Pulse Divider mounted on ULTRAFLOW® 54 (H).

5.4 Cable Extender Box



(a) (b)

Figure 7. Cable Extender Box seen from the front (a) and the side (b).

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 sensor increases with the square of the flow and is usually stated as a direct proportionality between the flow and the square root of the pressure loss:

$$\Delta p = \frac{1}{k_v^2} q^2 \Leftrightarrow q = k_v \times \sqrt{\Delta p}$$

where:

q = volume flow rate $\left[\frac{m^3}{h}\right]$

k_v = volume flow rate at 1 bar pressure loss $\left[\frac{m^3}{h \cdot \sqrt{bar}}\right]$

Δp = pressure loss $[bar]$; $[1bar = 10^5 Pa]$

Graph	q_p [m³/h]	Nom. diameter [mm]	$\Delta p@q_p$ [bar]	kv	q@0.25 bar [m³/h]
A	0.6	DN15/DN20	0.03	3.46	1.7
B	1.5	DN15/DN20	0.09	4.89	2.4
C	2.5	DN20	0.09	8.15	4.1
D	3,5	DN25	0.07	13.42	6.8
D	*6*	*DN25**	*0.20*	*13.42*	*6.8*
E	6	DN25/DN32	0.06	24.50	12.3
F	10	DN40	0.06	40.83	20.4

** Types 65-5-CHJ6-XXX and 65-5-CHJ7-XXX.*

Table 11. Pressure loss table.

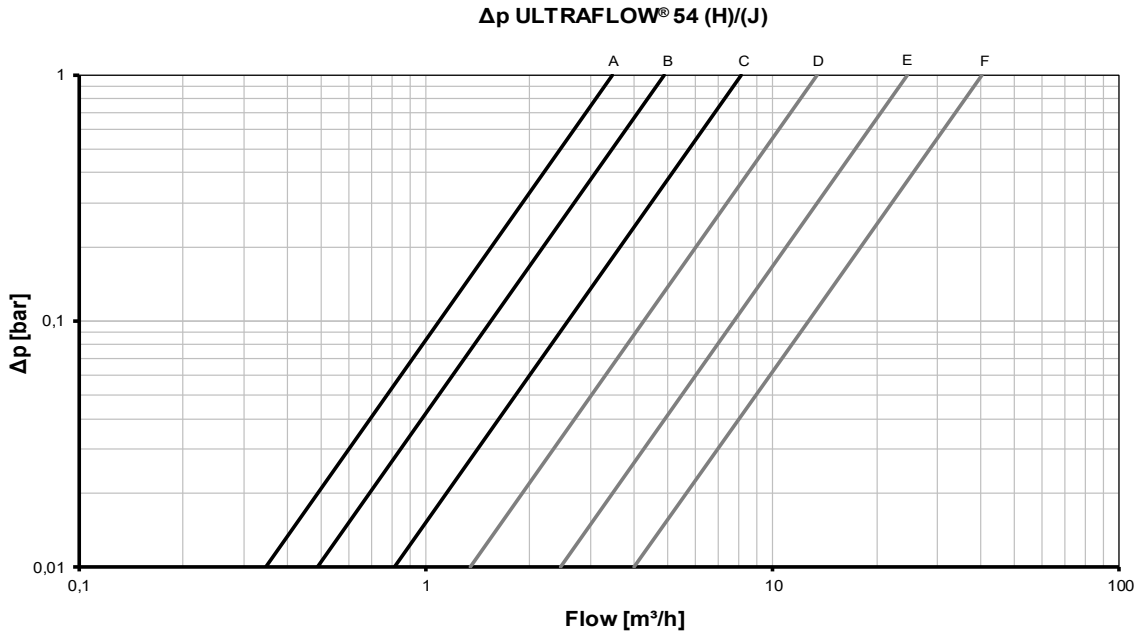


Figure 8. Pressure loss graphs of ULTRAFLOW® 54 (H)/(J).

7 Installation

Prior to installation of the flow sensor, the system should be flushed and protection plugs/plastic diaphragms removed from the flow sensor.

Correct flow sensor position (flow or return) appears from the front label of MULTICAL®. The flow direction is indicated by an arrow on the flow sensor. Couplings and gaskets are mounted as shown in *Figure 9*.

Pressure stage ULTRAFLOW®: PN16/PN25, see marking. Flow sensor marking does not cover included accessories.

Temperature of medium, ULTRAFLOW® 54: 15…130 °C/15…90 °C, see marking.

Mechanical environment: M1 - fixed installation with minimum vibration - and M2 - fixed installation with considerable or high vibration level (flow sensor type 65-5-XXHX-XXX only).

Electromagnetic environment: E1 and E2 (housing / light industry and industry). The meter's control cables must be drawn at min. 25 cm distance from other installations.

Climatic environment: Must be installed in environments with non-condensing humidity (‹ 93% RH) 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.

Direct connection of ULTRAFLOW® is only permitted to Kamstrup calculators on terminals 11-9-10, as shown in *paragraph 7.6 Electrical connections*. Connection to different calculator types requires the use of a Pulse Transmitter or Pulse Divider.

Replacement of supply and change of supply type is permitted in Pulse Transmitter/Pulse Divider. For battery supply a lithium battery with connector from Kamstrup A/S must be used. Lithium batteries must be correctly handled and disposed (see Kamstrup document 5510-408, "Lithium batteries - Handling and disposal").

It is permissible to replace output modules of Pulse Transmitter/Pulse Divider too.

Other repairs require subsequent reverification in an accredited laboratory.

Note: Please make sure that meter factors of flow sensor and calculator are identical.

At medium temperatures above 90 °C calculator and Pulse Transmitter/Pulse Divider must not be mounted on the flow sensor. Instead wall mounting is recommended.

In order to prevent cavitation the back pressure at ULTRAFLOW® must be min. 1.0 bar (1.5 bar) at q_p and min. 2.0 bar (2.5 bar) at q_s for qp 0.6…2.5 m^3/h (qp ≥ 3.5 m^3/h). This applies to temperatures up to approx. 80°C.

ULTRAFLOW® must not be exposed to pressure lower than the ambient pressure (vacuum).

ULTRAFLOW® 54 ought neither to be insulated nor wrapped as natural ventilation of the sensor is thereby prevented.

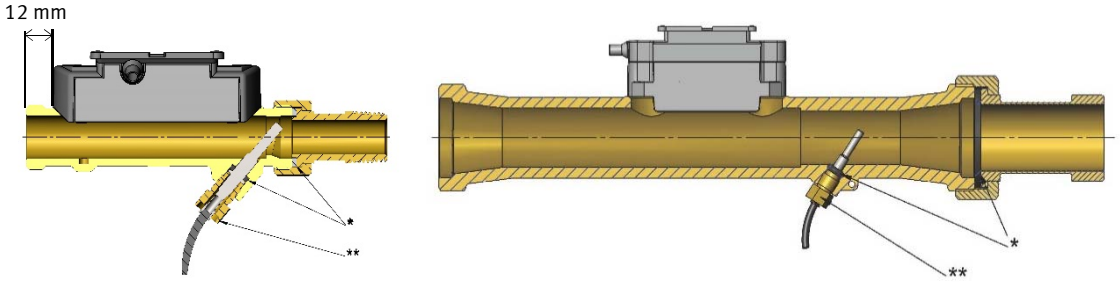
Should you after careful consideration decide to insulate ULTRAFLOW® after all, the electronics box must remain uninsulated.

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

Mounting of couplings, and short direct sensor mounted in ULTRAFLOW® – see *Figure 9* below.

The short direct sensor from Kamstrup may be installed in PN16 installations only. The blind plug, which is mounted in ULTRAFLOW® from the factory, can be used in connection with both PN16 and PN25.
The flow sensor can be used in both PN16 and PN25 installations and is available with either PN16 or PN25 marking as required.
Enclosed couplings, if any, are only intended for PN16. Suitable PN25 couplings must be used in PN25 installations.

In connection with G3/4x110 mm and G1x110 mm it must be checked that the thread run-out is sufficient.



Type 65-5-XX**H**X-XXX Type 65-5-XX**J**X-XXX

Figure 9. ULTRAFLOW® 54 (H)/(J) with coupling and short direct sensor

*(*Gaskets; **Torque value approx. 4 Nm).*

7.1 Mounting of ULTRAFLOW® 54 (H)/(J) (separately mounted)

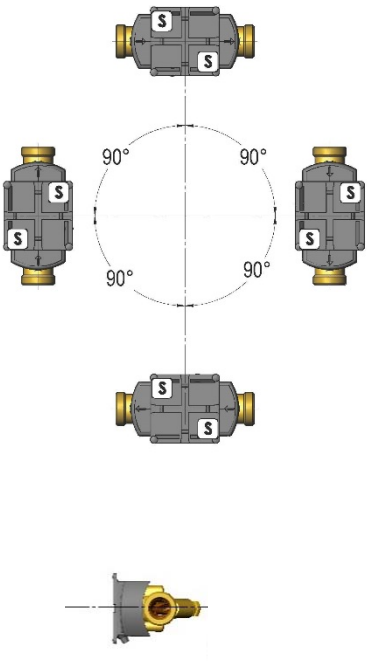


Figure 10

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

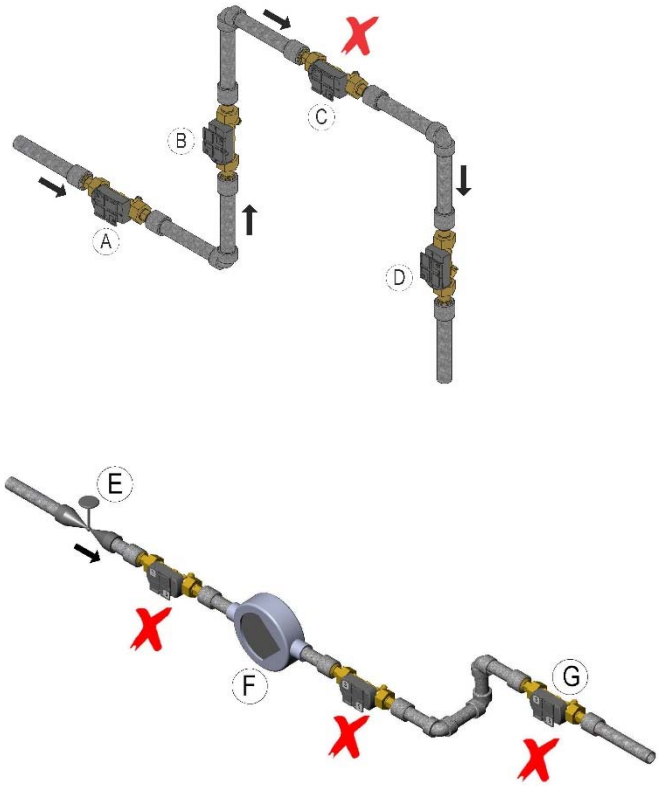
Important!

The plastic casing ought to be placed on the side (when installed horizontally).

7.2 Inlet requirements

ULTRAFLOW® requires neither straight inlet nor straight outlet to meet the Measuring Instruments Directive (MID) 2014/32/ EU, OIML R75:2002 and EN 1434:2015. A straight inlet section will only be necessary in case of heavy flow disturbances before the sensor. It is recommended to follow the guidelines based on CEN CR 13582.

Optimal position can be obtained if you take the below-mentioned installation methods into consideration:



A Recommended flow sensor position.

B Recommended flow sensor position.

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

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

E A flow sensor ought not be placed immediately after a valve, except for block valves (ball valve type), which must be fully open when not used for blocking.

F A flow sensor ought not be placed directly before (suction side) or directly after (outlet side) a pump.

G A flow sensor ought not be placed immediately after a double bend in two levels.

Figure 11

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

7.3 Operating pressure

In order to prevent cavitation the back pressure (the pressure at the flow meter outlet) at ULTRAFLOW® must be for q_p 0.6…2.5 m^3/h ($q_p \geq 3.5$ m^3/h) min. 1.0 bar (1.5 bar) at q_p and min. 2.0 bar (2.5 bar) at q_s. This applies to temperatures up to approx. 80 °C. ULTRAFLOW® must not be exposed to pressure lower than the ambient pressure (vacuum). For further information on operating pressure, see *paragraph. 8.4 Guidelines for dimensioning ULTRAFLOW®*.

7.4 Humidity and condensation

Wires/cables must in general hang freely downwards after cable connections to form a drip nose for drainage of water and condensation.

7.4.1 Orientation of Pulse Transmitter and Pulse Divider

Mounting Pulse Transmitter and Pulse Divider, 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 moist environments.

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

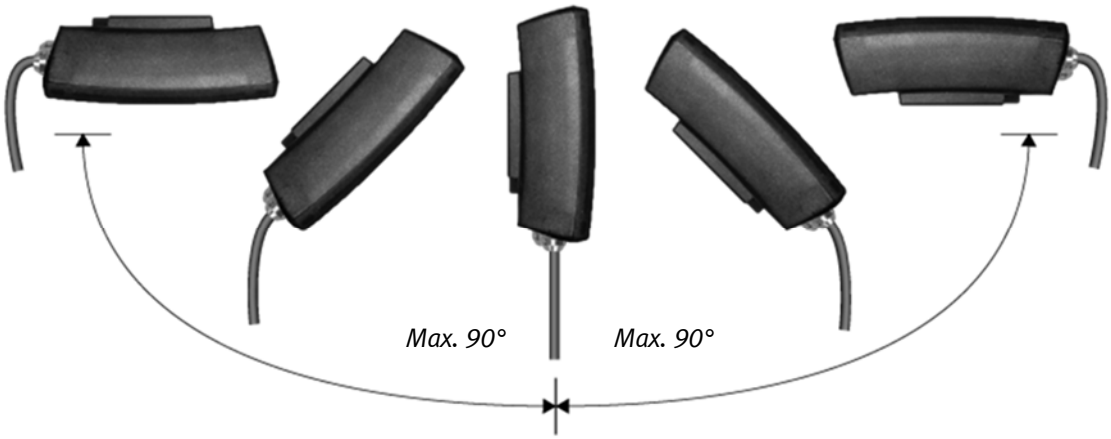


Figure 12. Orientation of Pulse Transmitter/Pulse Divider

7.5 Installation examples (mechanical)

MULTICAL® 602/6L2/603 and by means of installation fitting 3026-857 even MULTICAL® 801 can all directly be mounted on top of ULTRAFLOW® 54 (H)/(J).

7.5.1 MULTICAL® mounted on ULTRAFLOW® 54 (H)

7.5.1.1 Installation on an ascending pipe

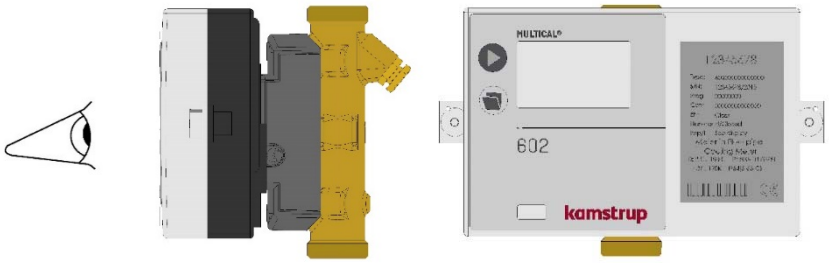


Figure 13. MULTICAL® mounted on ULTRAFLOW® mounted on an ascending pipe.

When installing ULTRAFLOW® on an ascending pipe, it can be of advantage to turn ULTRAFLOW® ±360° around the pipe axis to optimize the readability of the MULTICAL® display at direct mounting of MULTICAL® on ULTRAFLOW®.

7.5.1.2 Installations at eye level or higher

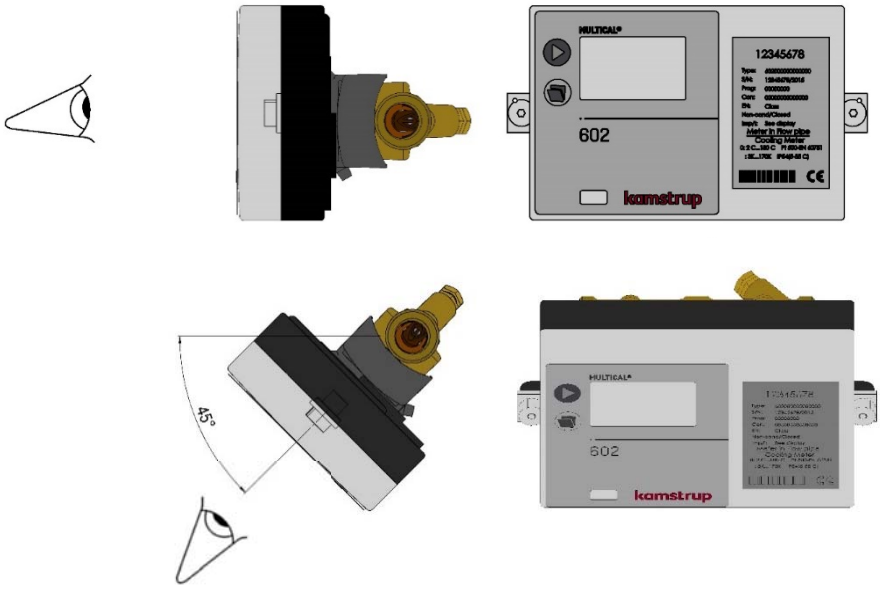


Figure 14. MULTICAL® mounted on ULTRAFLOW® when installed at eye level or higher.

In case of installations above eye level, it can be of advantage to turn ULTRAFLOW® -45° downwards to optimise the readability of the MULTICAL® display at direct mounting of MULTICAL® on ULTRAFLOW®.

7.5.1.3 Installations at ground level

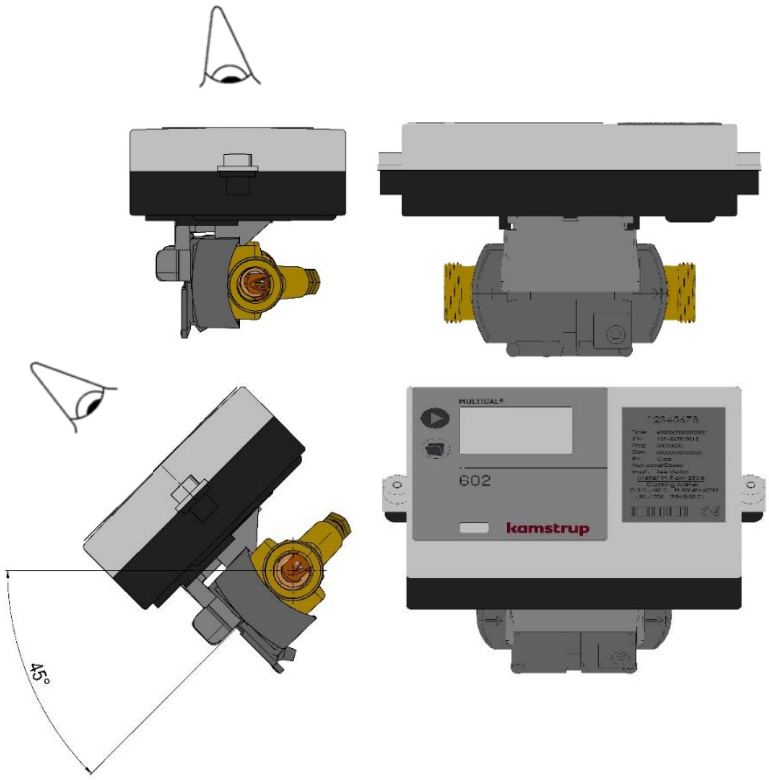


Figure 15. MULTICAL® mounted on ULTRAFLOW® 54 (H) when installed at ground level.

In case of installations at ground level, it can be of advantage to mount MULTICAL® directly on ULTRAFLOW® by means of the provided angle fitting. ULTRAFLOW® can be turned -45° downwards to optimise the readability of the MULTICAL® display.

7.5.1.4 Mounting of angle fitting

The included angle fitting can easily be mounted on both sides of the electronics case as shown in *Figure 16*, and if necessary, it can be removed again:

A Adjust and join the corners of the angle fitting as indicated with their hitches (see detail) below the edge of one side of the flow sensor's electronics box. Note that both sides of the electronics box are in principle suitable for mounting of the angle fitting. Although the type label is sufficiently robust, we recommend handling it carefully when mounting the angle fitting on that side. The signal cable on the other side is flexible enough in order to be guided between the side of the electronics box and the angle fitting.

B Rotate the angle fitting around the edge towards the cover of the electronics box.

C Press the angle fitting against the cover of the electronics box at the indicated positions and lock it. The locking is acoustically indicated by a "Click". Note that there is still a sufficiently large opening for sealing wires to be guided between the angle fitting and the electronics box. In case one wants to remove the angle fitting again, open the snap fit with your fingers and pull it back.

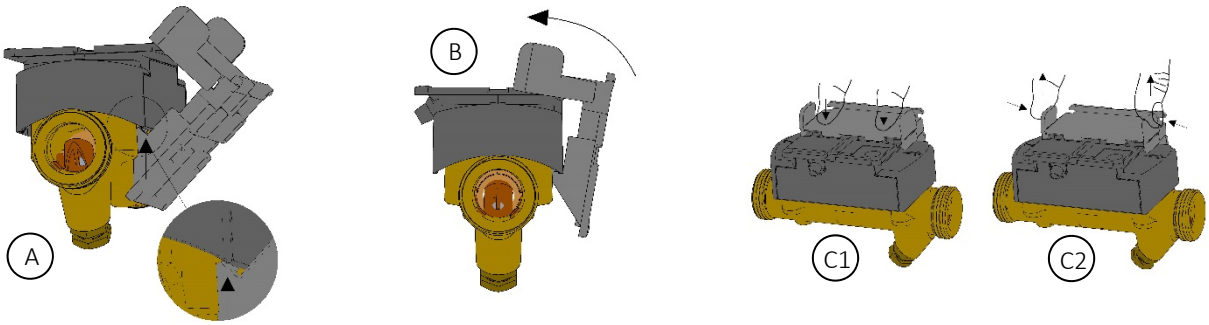
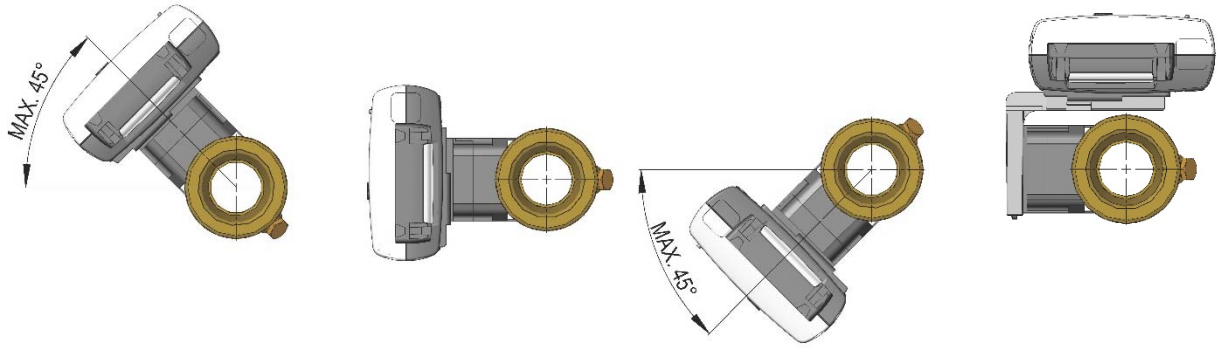


Figure 16. Mounting of the included angle fitting on ULTRAFLOW® 54 (H): (A) Adjustment, (B) Rotation and (C) Closing (Opening) of the angle fitting

7.5.2 MULTICAL® mounted on ULTRAFLOW® 54 (J)

ULTRAFLOW® 54 (J) can be rotated ±45° around the pipe axis in order to improve the readability of a MULTICAL® mounted directly on ULTRAFLOW® (see *Figure 17 (a)*). In some installations at ground level it can be of advantage to mount MULTICAL® directly on top of ULTRAFLOW® 54 (J) by means of angle fitting 3026-252 (see *Figure 17 (b)*). The angle fitting 3026-252 is ordered separately.



(a) (b)

Figure 17. MULTICAL® 603 mounted on ULTRAFLOW® 54 (J). (a) The flow sensor can be rotated ±45° around the pipe axis in order to improve the readability of the MULTICAL® display. (b) In some cases the angle fitting 3026-252 might improve the readability of the MULTICAL® display.

7.5.3 Pulse Transmitter/Pulse Divider

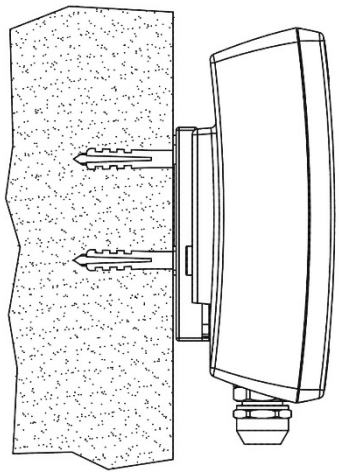


Figure 18. Wall mounted Pulse Transmitter/Pulse Divider

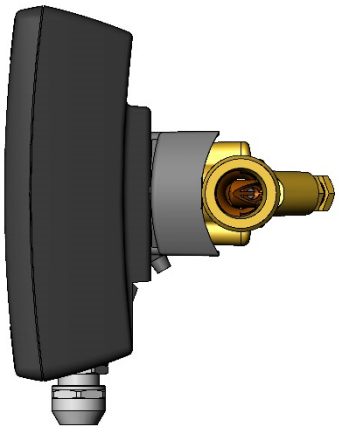


Figure 19. Pulse Transmitter/Pulse Divider mounted on ULTRAFLOW® 54 (H).

Note: At medium temperatures above 90 °C calculator and Pulse Transmitter/Pulse Divider must not be mounted on the flow sensor. Instead wall mounting is recommended.

7.6 Electrical connections

7.6.1 Electrical connection of ULTRAFLOW® and MULTICAL®

ULTRAFLOW®	→	MULTICAL®
Blue (ground)	→	11
Red (supply)	→	9
Yellow (signal)	→	10

Table 12. Connection of ULTRAFLOW® and MULTICAL®.

Using long control cables careful consideration is required in connection with installation. With a view to EMC there must be a distance of min. 25 cm between control cables and all other cables.

7.6.2 Electrical connection of Pulse Transmitter and Pulse Divider

If ULTRAFLOW® and MULTICAL® are connected via a Pulse Transmitter, ULTRAFLOW® is galvanically separated from MULTICAL®.

Note: Flow-info is not possible if Pulse Transmitter is used.

If ULTRAFLOW® is connected to other equipment than MULTICAL®, always connect ULTRAFLOW® via Pulse Transmitter or Pulse Divider.

ULTRAFLOW®	→	Pulse Transmitter/ Pulse Divider *)		→	MULTICAL®
		Input	Output		
Blue (ground)	→	11	11A	→	11
Red (supply)	→	9	9A	→	9
Yellow (signal)	→	10	10A	→	10

Table 13. Connection of ULTRAFLOW® and MULTICAL® via Pulse Transmitter/Pulse Divider.
**) Pulse Divider is not normally used together with MULTICAL®.*

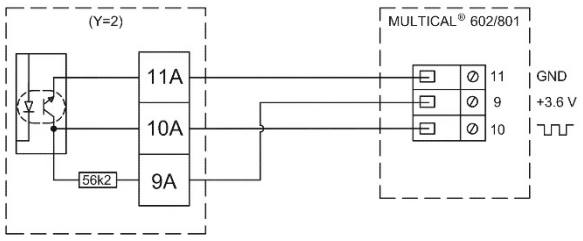


Figure 20. Three-wire connection of Pulse Transmitter with output module (Y=2) to MULTICAL® 602/801.

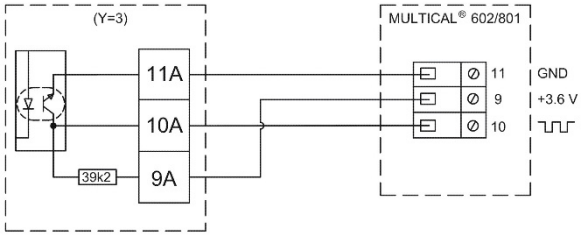


Figure 21. Three-wire connection of Pulse Transmitter with output module (Y=3) to MULTICAL® 602/801.

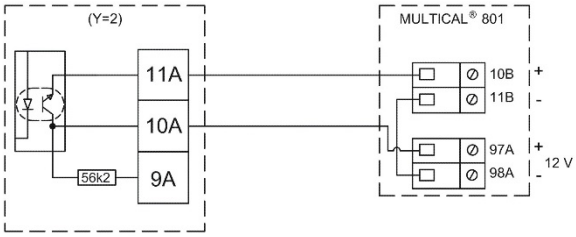


Figure 22. Three-wire connection of Pulse Transmitter with output module (Y=2) to MULTICAL® 801.

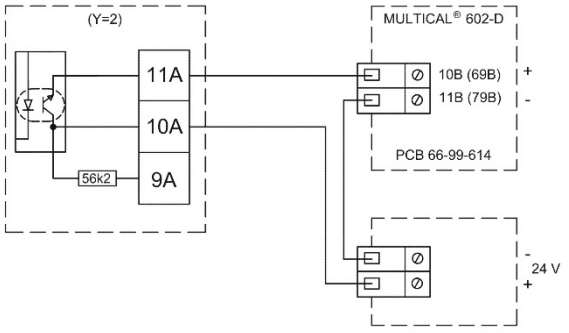


Figure 23. Two-wire connection of Pulse Transmitter with output module (Y=2) to MULTICAL® 602-D and external 24 VDC supply.

Examples of connection of Pulse Transmitter appear from *paragraph 7.7.2*.

For connection of Pulse Transmitter and Pulse Divider to other calculators, please see *paragraph 8.6 Pulse output of Pulse Transmitter and Pulse Divider*.

7.6.2.1 Cable length

Maximum allowable cable length between Pulse Transmitter/Pulse Divider and MULTICAL® depends on the output module used in Pulse Transmitter/Pulse Divider as well as how the MULTICAL® calculator is connected. Please refer to the calculator's Technical description.

Please note that using long signal cables requires careful consideration in connection with installation. There must be a distance of **min.** 25 cm between signal cables and all other cables to prevent electrical disturbance.

7.6.2.2 Connection of power supply

If ULTRAFLOW® is connected via Pulse Transmitter or Pulse Divider, ULTRAFLOW® is powered by the supply module/battery mounted in Pulse Transmitter/Pulse Divider.

7.6.2.2.1 Battery supply

Pulse Transmitter/Pulse Divider is fitted with a D-cell lithium battery with connector. The battery is connected to the output module.

Optimal battery lifetime is obtained by keeping the battery temperature below 30 °C, e.g. by wall mounting of Pulse Transmitter/Pulse Divider.

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 must 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").

7.6.2.2.2 Mains supply modules

The mains supply modules are protection class II and are connected to the interface module via a short two-wire cable with connector. The modules are powered via a two-wire mains supply cable (without earth connection) through the cable connector of Pulse Transmitter/Pulse Divider. Use supply cable with an outer diameter of maximum 10 mm and ensure correct stripping of insulation as well as correct tightening of cable connection. (See *paragraph 7.6.2.2.4*)

Max. permitted fuse: 6 A

230 VAC

This PCB module is galvanic separated from the mains supply and is suitable for direct 230 V mains installation. The module includes a double-chamber safety transformer, which fulfils double insulation requirements when the cover is mounted on Pulse Transmitter/Pulse Divider. Power consumption is less than 1 W or 1 VA.

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 V installation in the meter panel must be carried out by an authorized electrician.

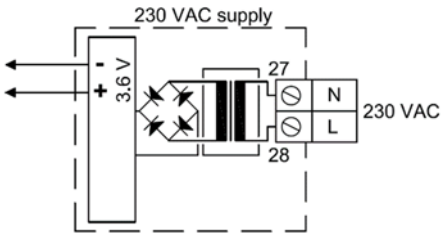


Figure 24.

24 VAC

This PCB module is galvanic 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 V safety transformer in the main electrical panel. The module includes a double-chamber safety transformer, which fulfils double insulation requirements when the cover is mounted on Pulse Transmitter/Pulse Divider. Power consumption is less than 1 W or 1 VA.

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 V installation in the main electrical panel must be carried out by an authorized electrician.

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

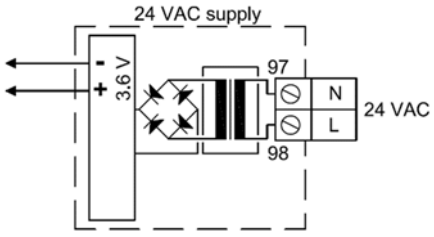


Figure 25.

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 6699-403, 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 26

7.6.2.2.3 Mains supply cable

Pulse Transmitter/Pulse Divider is available with mains supply cable H05 VV-F for either 24 VAC or 230 VAC (L=1.5 m).

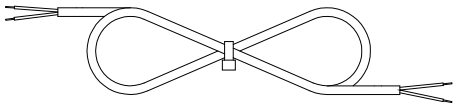


Figure 27. Mains supply cable (2 x 0.75 mm²), max. 6 A fuse

"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.

7.6.2.2.4 Cable connections

Cable dimension of control cable connections: 2…6 mm

Cable dimension of mains cable connections: 4.5…10 mm

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

Note: In connection with battery supply, the unused cable connection must be sealed off as shown in *Figure 30 on page 35*.

7.6.2.2.5 Change of supply unit

The supply unit of Pulse Transmitter/Pulse Divider 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 change mains supplied Pulse Transmitters/Pulse Dividers to battery supplied Pulse Transmitters/Pulse Dividers, e.g. in connection with buildings under construction where the mains supply can be unstable or periodically missing.

Please note that the supply type appears from the label of Pulse Transmitter/Pulse Divider. If the original supply type is changed, it will no longer be in accordance with the label.

7.6.3 Electrical connection of Cable Extender Box

The extender box is built up with transient transorbs diodes, making it possible to extend the cable between ULTRAFLOW® and MULTICAL® with up to 30 m in total, while the cable length without the extender box can be maximum up to 10 m.

Fix Cable Extender Box to the wall or the like close to ULTRAFLOW®. Connect the 3 wires in the cable from ULTRAFLOW® to one of the terminals in Cable Extender Box. You can select any of the terminals. Use a 3-wire extension cable with a length of up to 27.5 m with the same wire diameter and of the same quality as the cable from ULTRAFLOW®, and connect the 3 wires to the other terminal in Cable Extender Box. Connect the opposite end of the extension cable to the terminal (V1) in MULTICAL®. Use the following combination when connecting the wires: 10: Yellow, 9: Red and 11: Blue. This colour combination applies to both Cable Extender Box and MULTICAL®. Perform a function check, and complete by sealing Cable Extender Box with the included void-labels of the utility.

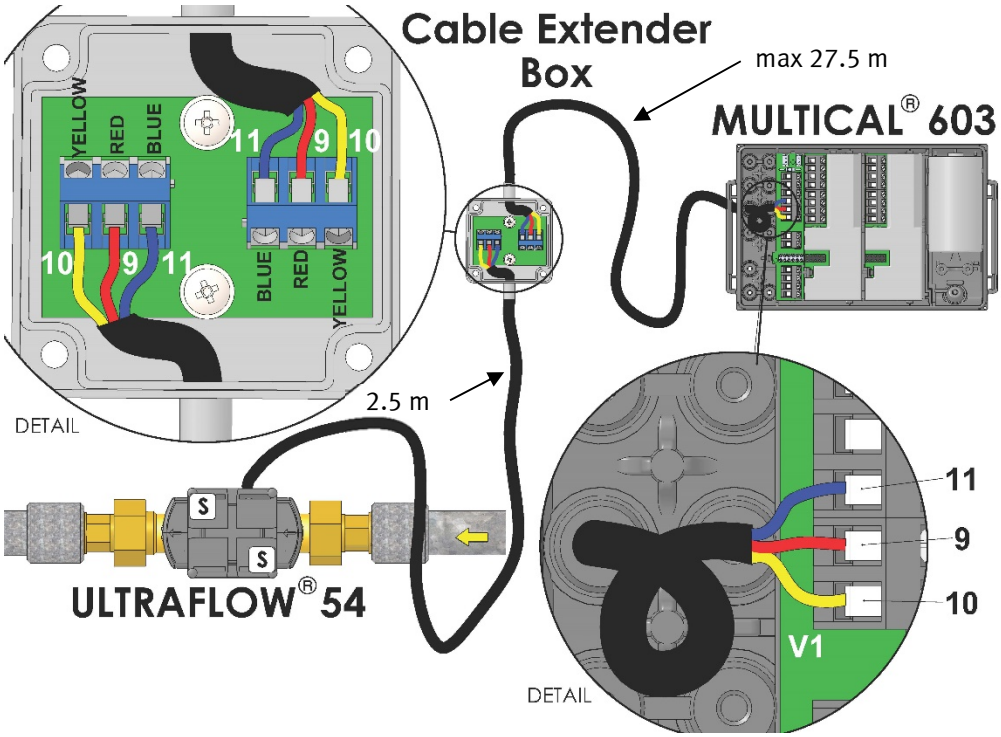


Figure 28. Electrical connection of ULTRAFLOW® to MULTICAL® via Cable Extender Box. The example illustrates a standard 2.5 m cable from ULTRAFLOW® to Cable Extender Box. In this case, the cable length between Cable Extender Box and MULTICAL® can be up to max. 27.5 m.

7.7 Installation examples (electrical)

7.7.1 Example of connection of ULTRAFLOW® and MULTICAL®

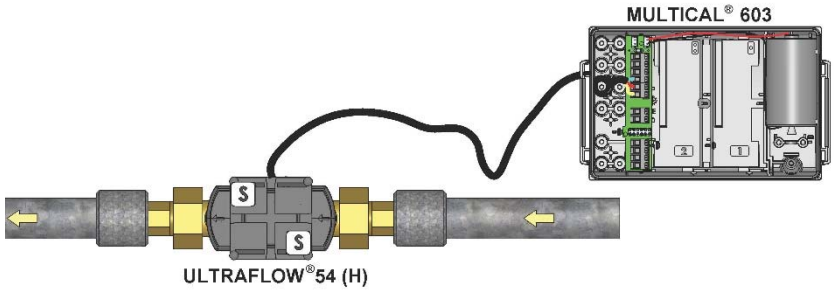


Figure 29. ULTRAFLOW® 54 (H) connected to MULTICAL® 603.

See *paragraph 7.6* for electrical wiring.

7.7.2 Example of connection of Pulse Transmitter

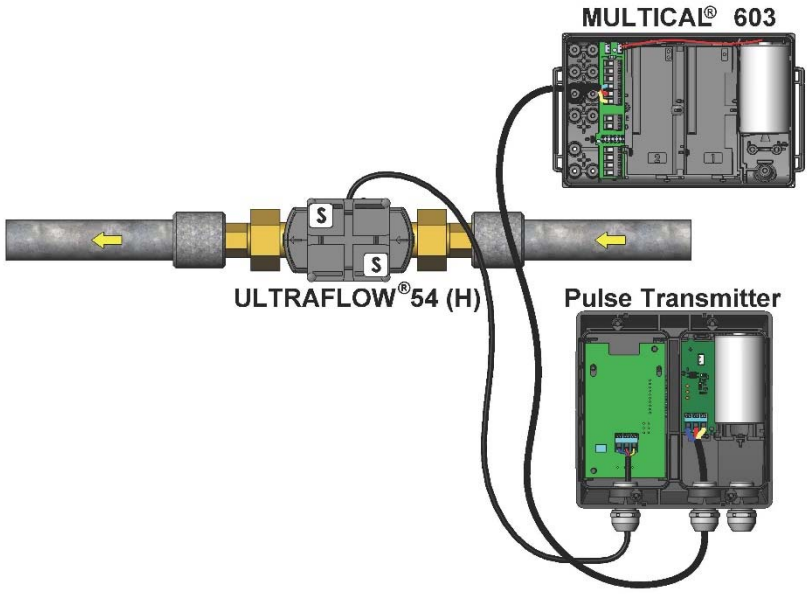


Figure 30. ULTRAFLOW® 54 (H) connected to battery supplied Pulse Transmitter. MULTICAL® 603 is connected to the Pulse Transmitter's output module (Y=3).

Note: If battery supplied, the right cable connection of the Pulse Transmitter is plugged.

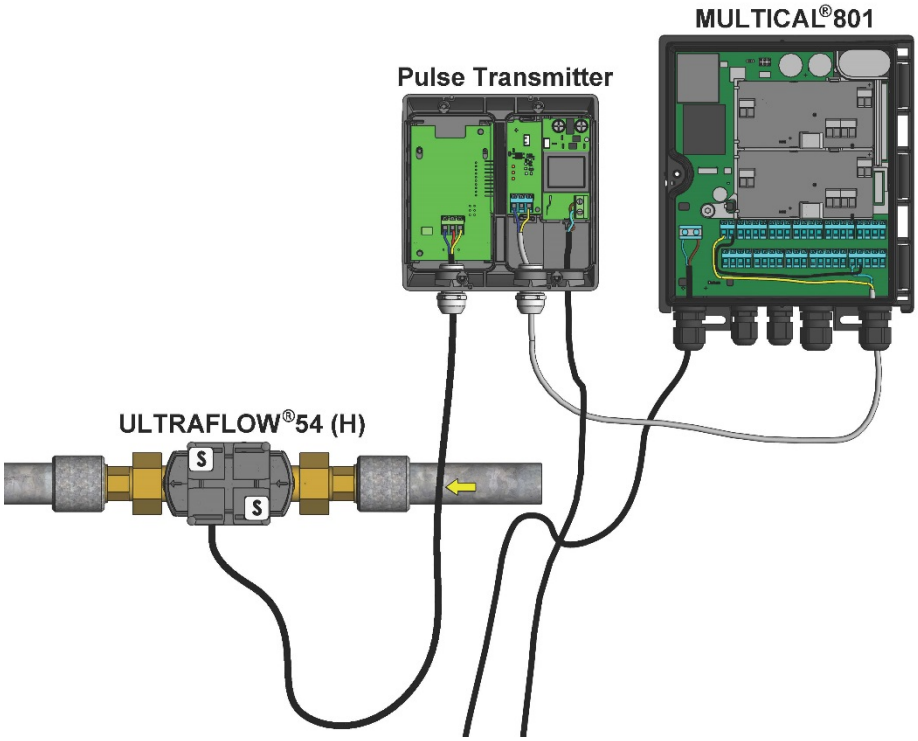


Figure 31. ULTRAFLOW® 54 (H) connected to Pulse Transmitter with 230 VAC supply. MULTICAL® 801 is connected to the Pulse Transmitter's output module (Y=2).

See *paragraph 7.6.2* for electrical wiring.

7.7.3 Calculator with two flow sensors

MULTICAL® 602/603 and 801 can be used in various applications with two flow sensors, e.g. leak monitoring or open systems. When two ULTRAFLOW® sensors 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*.

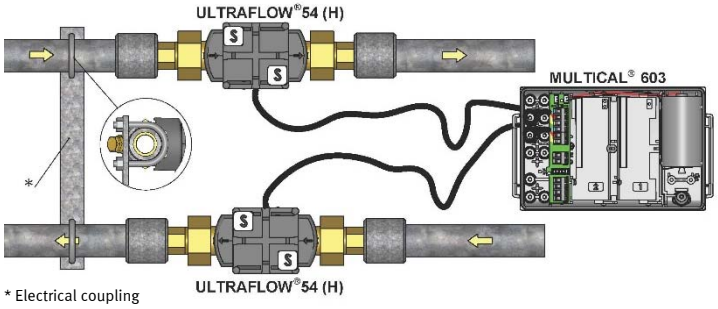


Figure 32. Forward and return pipes are closely electrically coupled
Electric welding does not occur*

In installations where the electric coupling is not possible or welding in the pipe system can occur, the cable from one ULTRAFLOW® must go through a Pulse Transmitter with galvanic separation before the cable enters MULTICAL®.

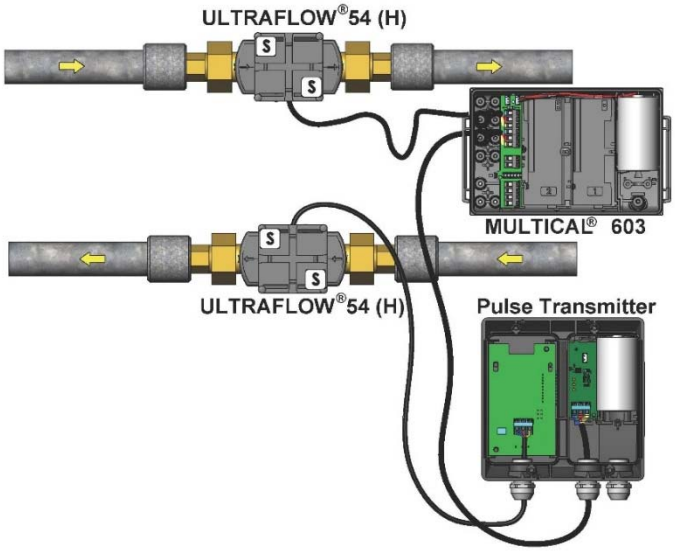


Figure 33. Forward and return pipes are not necessarily closely coupled.
*Electric welding *) can occur.*

*) 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.

7.8 Testing the function

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

8 Functional description

Within the field of heat, cooling and water meters manufacturers have been working on alternative techniques to replace flow sensors based on 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.

8.1 Flow measuring with ultrasound

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. You experience this effect when a car drives by. The sound (the frequency) decreases when the car passes by. The transient 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.

A piezo ceramic element is used for transmitting and receiving ultrasound. The thickness of the element changes when exposed to an electric field (voltage) and thereby it functions as a transmitter of ultrasound. When the element is mechanically influenced, it generates a corresponding electric voltage, and thus functions as a receiver of ultrasound.

8.2 Signal path, flow calculation and flow profiles

As it is outlined by the calculations below, the average flow velocity is directly proportional with the transit time difference of ultrasound signals, which are sent with or against the flow. *Figure 34* shows the main elements of the signal path inside ULTRAFLOW® 54 (H): Piezo-electric elements transmit and receive the ultrasound signal, which is reflected into and through the measuring tube to the receiver via reflectors. Due to superposition of velocities of water and sound signal, ultrasound spreads faster with the flow than against the flow.

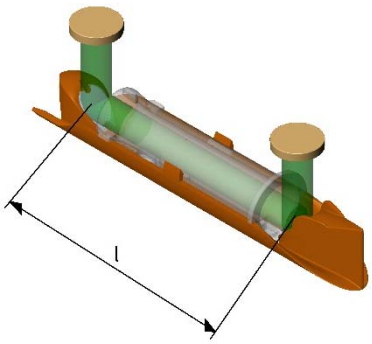


Figure 34. Signal path inside ULTRAFLOW® 54 (H) (q_p 0.6…2.5 m^3/h). Sound signals are transmitted by the transducers via 2 reflectors. The signal's transit times with and against the flow vary for the significant sound path distance (parallel with the measuring tube). The flow is in this case from right to left.

For the calculation of the transit time difference, the signal path along the flow is crucial, and the transit time to the measuring distance is calculated as:

$$t = \frac{l}{c \pm v}$$

where:

t is the transit time from sender to receiver of the sound signal along the measuring distance l [s]

l is the measuring distance [m]

c is the sound propagation velocity in stagnant water [m/s]

v is the average flow velocity of water [m/s]

The transit time difference can be expressed as the difference between the absolute time of the signal sent against the flow (-) and the signal sent with the flow (+).

$$\Delta t = \frac{l}{c - v} - \frac{l}{c + v}$$

which can also be written as:

$$\Delta t = l\frac{(c+v)-(c-v)}{(c-v)(c+v)} \quad \Rightarrow \quad \Delta t = l\frac{2v}{c^2 - v^2}$$

As $c^2 \rangle\rangle v^2$, v^2 can be omitted and the formula reduced as follows:

$$v = \frac{\Delta t \cdot c^2}{2l}$$

Thus, we know the basic connection between the average flow velocity and the transit time difference.

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

Furthermore, the influence of the temperature of the sound velocity of water must be taken into account. In ULTRAFLOW® the velocity of ultrasound c is measured by means of a number of absolute time measurements between the two transducers. As the geometry of the flow sensor is known the measured velocity of ultrasound is thus a measurand for the water temperature, which is further utilized in the built-in ASIC in connection with flow calculations.

The flow (volume flow rate) is then determined by measuring the transit time difference, calculating the average flow velocity and multiplying it by the area of the measuring tube:

$$q = v \cdot A$$

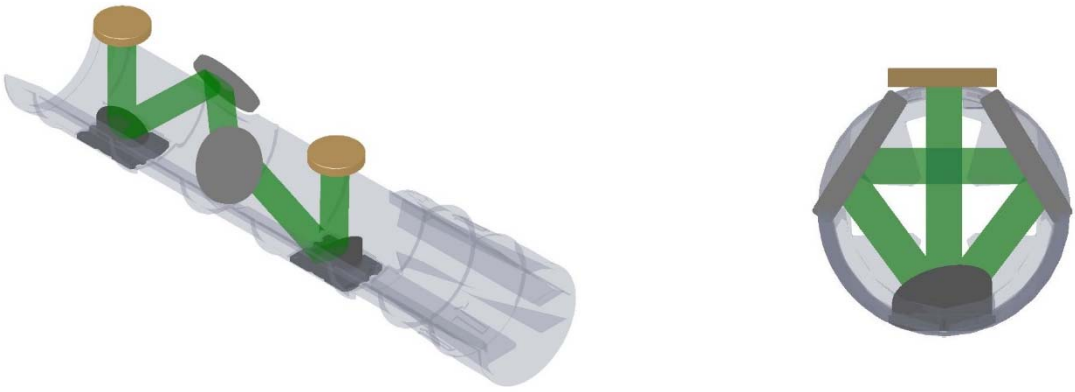
where:

q is the flow (volume flow rate) $\left[\frac{m^3}{h}\right]$

A is the area of the measuring pipe $\left[m^2\right]$

The volume V passing through is finally calculated as time integration over the flow (multiplication of (cross section constant) flow by time).

The calculation above is simplified, as it does not consider flow profiles. Flow profiles generally influence the measurand, which, in our case, is the transit time difference. Flow sensors are therefore properly adjusted according to different Reynolds numbers characterizing the flow, i.e. in praxis for different flow (volume flow rate) and temperature. However, in order to cover different flow profiles with the ultrasonic signal as best as possible Kamstrup utilizes a triangular sound path as illustrated in *Figure 35* from 2 perspectives, for larger ULTRAFLOW® 54 flow sensors (qp 3.5…10 m^3/h).



(a) (b)

Figure 35: Signal path inside ULTRAFLOW® 54 (J) (q_p 3.5…10 m^3/h) shown from the side (a) and when looking into the measuring pipe (b). Sound signals are transmitted by the transducers via 4 reflectors. When looking into the measuring pipe (b) the signal is reflected along a triangular path.

8.3 Function of ULTRAFLOW®

During flow measurement ULTRAFLOW® passes 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.

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

In the meter's working range from min. cut off to saturation flow there is a linear connection between the flow rate and the number of pulses being emitted. The below figure shows an example of the connection between flow and pulse frequency for ULTRAFLOW® q_p 1.5 m³/h (see *Figure 36*).

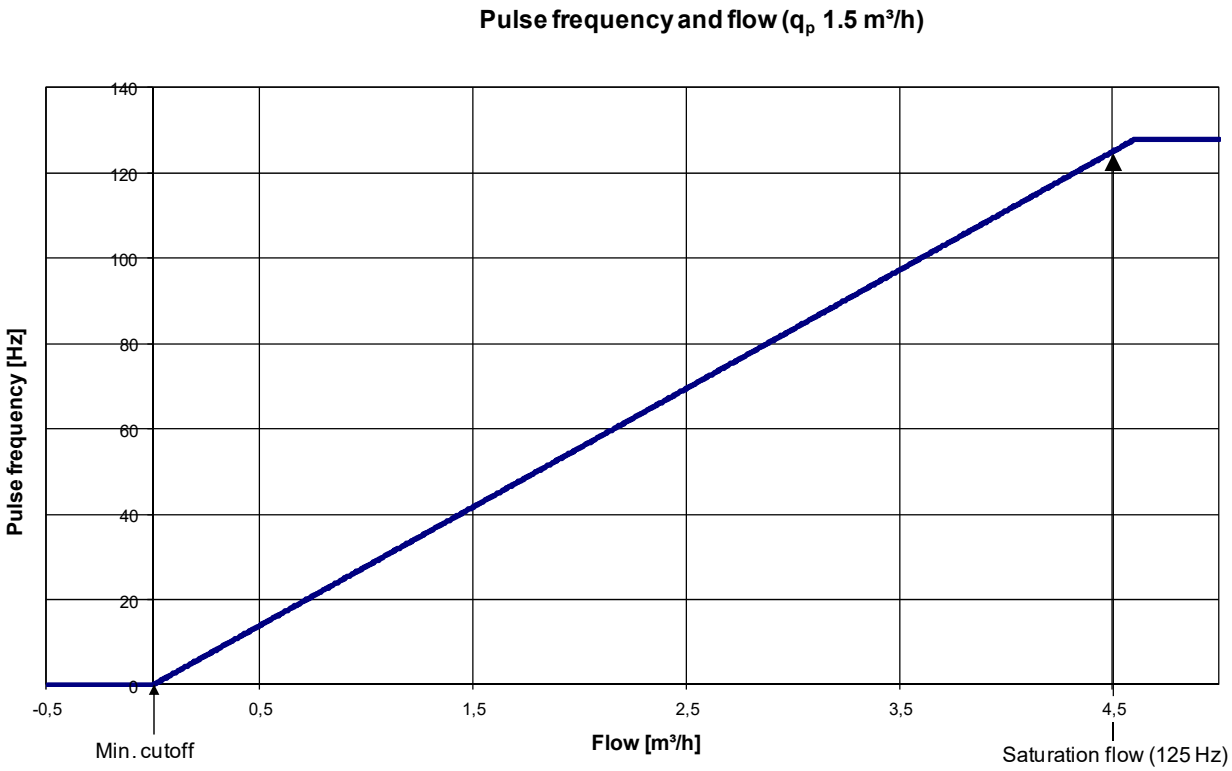


Figure 36. Pulse frequency as a function of flow q_p 1.5 m³/h.

If the flow is lower than min. cut off or negative (backward flow), ULTRAFLOW® sends no pulses.

At flows exceeding the flow corresponding to pulse emission at max. pulse frequency, the max. pulse frequency will be maintained.

Table 14 overleaf shows the saturation flows at pulse frequency of 125 Hz of the different flow sizes and meter factors.

q_p [m³/h]	Meter factor [imp/l]	Flow at 125 Hz [m³/h]
0.6	300	1.50
1.5	100	4.50
2.5	60	7.50
3.5	50	9.00
6	25	18.00
10	15	30.00

Table 14. Flow at saturation (125 Hz).

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, <200h/year) without exceeding the max. permissible error. ULTRAFLOW® has no functional limitations during the period, when the meter operates above q_p.

Please note, however, that high flow velocities may cause cavitation, especially at low static pressure. See *paragraph 8.4 Guidelines for dimensioning ULTRAFLOW®*.

8.4 Guidelines for dimensioning ULTRAFLOW®

In connection with installations it has proven practical to work with a back pressure (the pressure at the flow meter outlet) of min. 1.0 bar (1.5 bar) at q_p and min. 2.0 bar (2.5 bar) at q_s for q_p 0.6…2.5 m^3/h ($q_p \geq 3.5$ m^3/h) at ULTRAFLOW®. This minimises the risk of 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, which is 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 system.

In relation to the recommended back pressure, the steam pressure at current temperature must also be considered. The recommended back pressure applies to temperatures up to approx. 80°C. Furthermore, it must be taken into account that the above-mentioned pressure is the back pressure at the sensor, which has typically been measured as a static pressure, 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 Bernoulli's equation and the continuity equation. Based on Bernoulli's equation the total pressure of the flow will be the same for any cross section. It can be reduced to: $P_{stat.} + P_{dynam.} = P_{stat.} + \frac{1}{2}\rho v^2 = \text{constant}$ ($P_{stat.}$ = static pressure; $P_{dynam.}$ = dynamic pressure; ρ = density of water; v = flow velocity of water). The continuity equation determines that the product of pipe cross sectional area A and average flow velocity v, which corresponds to the volume flow rate passing through, is constant for an incompressible fluid like e.g. water. Therefore, the flow velocity is increased in a contraction and the static pressure falls.

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 major pipe contractions.

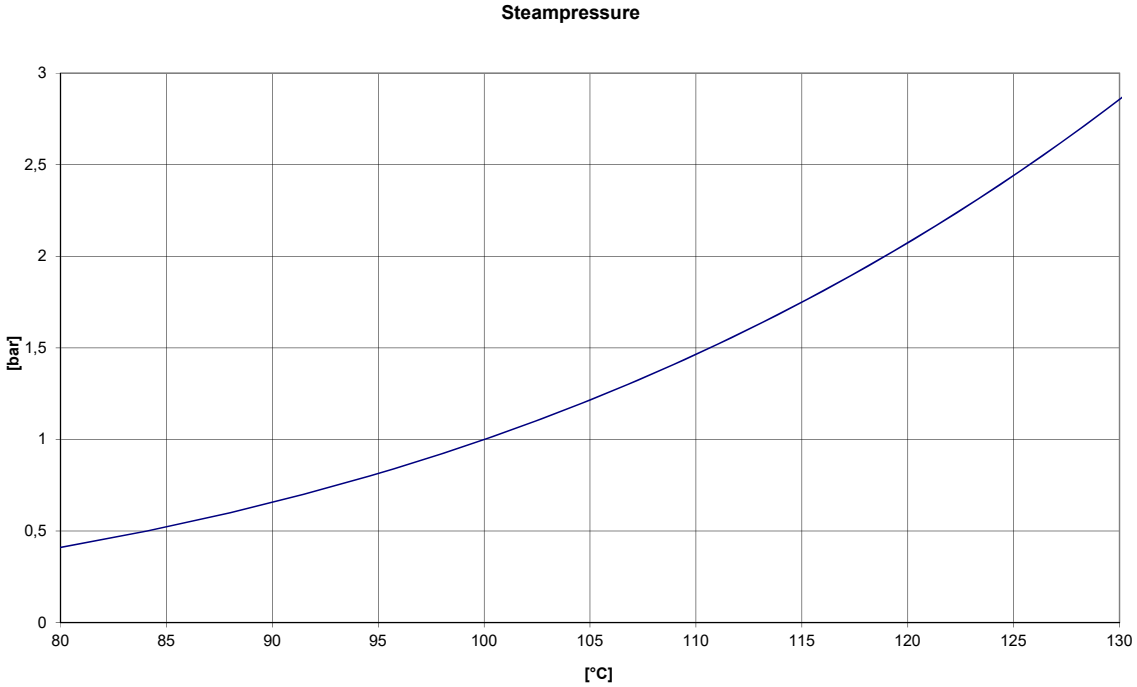


Figure 37. Steam pressure of water.

8.5 Pulse output of ULTRAFLOW®

ULTRAFLOW®

Type	Push-Pull
Output impedance	~10 kΩ
Pulse duration	2...5 ms
Duration of pause	Depending on actual pulse frequency

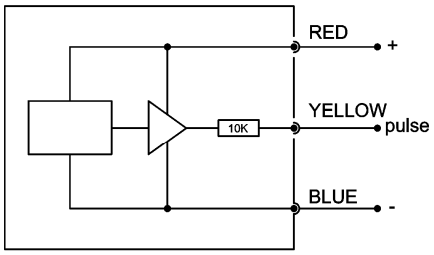


Figure 38. Block diagram for ULTRAFLOW®.

8.6 Pulse output of Pulse Transmitter and Pulse Divider

8.6.1 Galvanic separated output module (Y=2)

Pulse Transmitter/Pulse Divider is powered by the built-in supply module (Z=7 or 8).

Cable length to Pulse Transmitter/Pulse Divider depends on calculator.

To calculator:

Type: Open collector.

Connection: Two-wire or three-wire connection via the built-in 56.2 k 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 15

Concerning meter factors and pulse duration see *paragraph 4.3.4*.

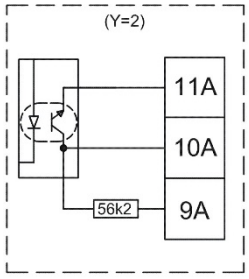


Figure 39. Block diagram for galvanic separated output module (Y=2).

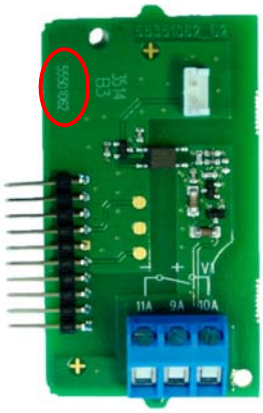


Figure 40. Galvanic separated output module (Y=2). Note the PCB number 5550-1062 in the encircled area.

8.6.2 Galvanic separated output module (Y=3).

Pulse Transmitter/Pulse Divider is powered by the built-in supply module (Z=2, 7 or 8).

Cable length to Pulse Transmitter/Pulse Divider depends on calculator.

To calculator:

Type: Open collector.

Connection: Three-wire connection is possible via the built-in 39.2 k 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 16

Concerning meter factors and pulse duration see *paragraph 4.3.4*.

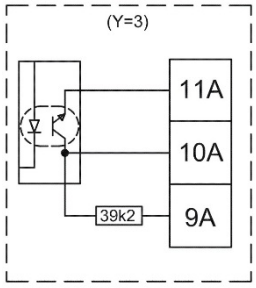


Figure 41. Block diagram for galvanic separated output module (Y=3).

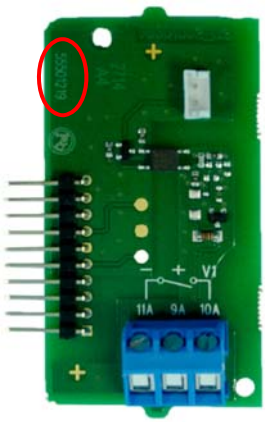


Figure 42. Galvanic separated output module (Y=3). Note the PCB number 5550-1219 in the encircled area.

8.7 Pulse emission

Pulses are emitted at 1-sec. intervals. The number of pulses to be emitted is calculated every second. Pulses are emitted in bursts with pulse duration 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 s. in case of sudden hold.

8.8 Accuracy

ULTRAFLOW® 54 has been developed as a volume flow rate sensor for energy meters according to EN 1434. The tolerances permitted according to EN 1434 for flow sensors with a dynamic range of 1:100 (q_i:q_p) and q_p 1.5 m^3/h are shown in *Figure 43*. The tolerances are defined for class 2 and class 3 with following formulas:

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

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

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

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 the 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±5) °C for ULTRAFLOW® as a heat meter.

Further requirement is 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® will typically do better than half of the permitted tolerance according to EN 1434 class 2.

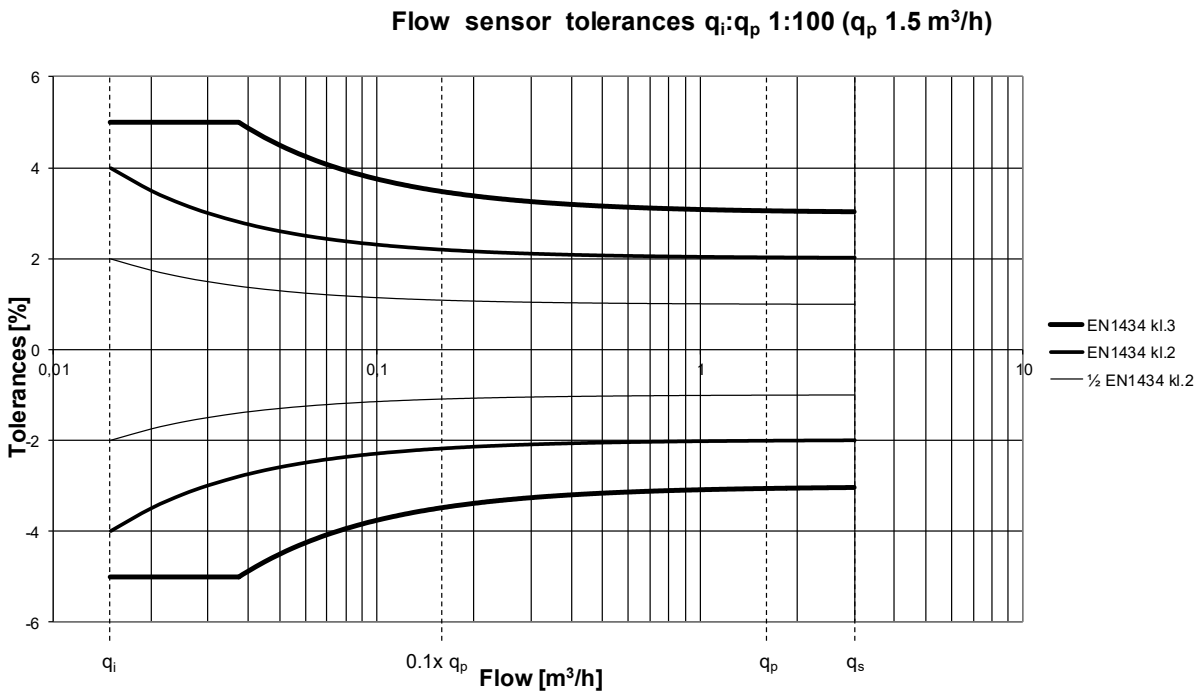


Figure 43. Flow sensor tolerances q_i:q_p 1:100 for q_p 1.5 m³/h.

8.9 Power consumption

The current consumption of ULTRAFLOW® is as follows:

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

8.10 Interface connector/serial data

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

The connector is used for:

- Meter programming, including adjustment of flow charts 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

Due to different physical print layouts the interface connectors of the flow sensors q_p 0.6…2.5 m³/h (Type (H)) are slightly different from the ones of the flow sensors $q_p \geq 3.5$ m³/h (Type (J)). The interface connectors are constructed as shown in *Figure 44*. Note, that the general function of the connectors is identical, but the positioning of single functions is different.

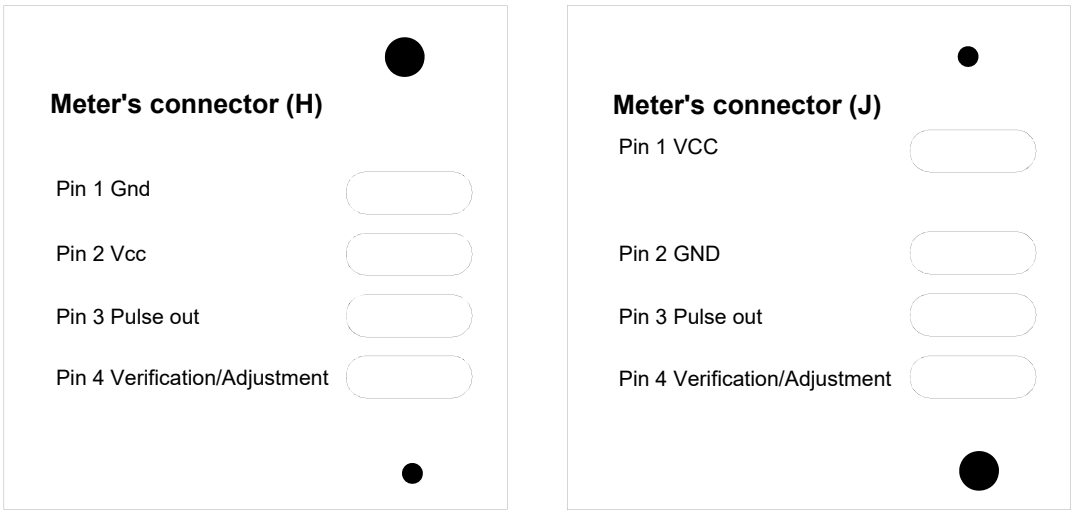


Figure 44. Interface connectors, ULTRAFLOW® 54 (H)/(J).

8.11 Test mode

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

In order to bring ULTRAFLOW® into test mode, pin 4 of the internal connector is connected to frame (*Figure 44*) followed by connecting the meter to supply. After approx. 1 sec. the sensor goes into test mode and the connection between pin 4 and frame is disconnected again.

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

Note: An ULTRAFLOW® 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 as the total duration of ULTRAFLOW® in test mode is negligible compared to the operating time of ULTRAFLOW® outside test mode.

8.12 Externally controlled start/stop

In connection with calibration by means of serial data, e.g. in connection with NOWA, ULTRAFLOW® 54 can be monitored by an external signal when it is in verification mode (see *paragraph 8.11 Test mode*). This is done by setting pin 4 of the internal plug on logic High when starting the test and setting it on logic Low again 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 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 and calculates volume at fixed intervals as illustrated by *Figure 45*.

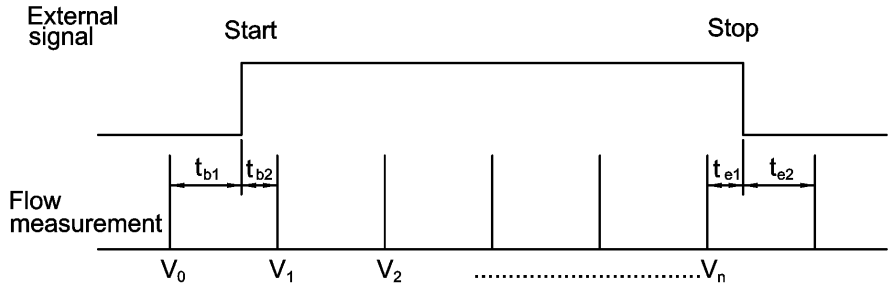


Figure 45

The excess quantity of water in connection with start is the water volume that passes through the sensor in 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 in the time t_{e1} after the last accumulation V_n until stop.

The volume accumulated during the test can be stated as:

$$V_{Test} = \frac{t_{b2}}{t_{b1} + t_{b2}} V_1 + V_2 ... + V_n + \frac{t_{e1}}{t_{e1} + t_{e2}} V_n$$

8.13 Calibration using serial data and externally controlled start/stop

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

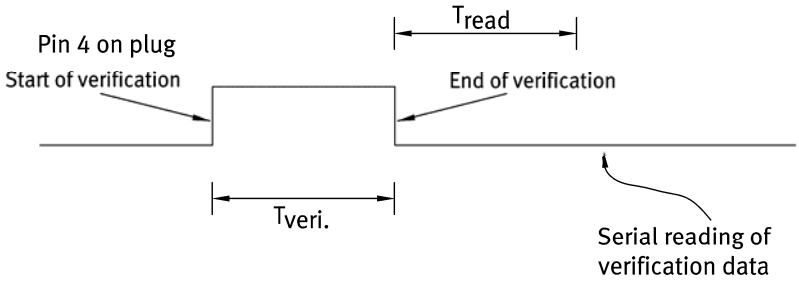


Figure 46

The sensor must be in test mode (see *paragraph 8.11 Test mode*).

Calibration is started by setting pin 4 of the internal connector on logical High (see *Figure 46*) and at the same time starting the test in a flow stand. This might e.g. take place at the same time as the master meter starts accumulating pulses or the diverter of the weighing system is changed. Now ULTRAFLOW® accumulates water volume until pin 4 is set to logical Low again 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 sec. must pass (Tread). Communication with ULTRAFLOW® during test is not allowed.

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

9 Calibrating ULTRAFLOW®

Calibration can be based on:

- Pulses in standard mode
- Pulses in test mode
- Pulses using Pulse Tester type 6699-279
- Serial data with the meter in test mode (e.g. used in connection with NOWA).

9.1 Technical data of ULTRAFLOW®

q_p [m³/h]	Meter factor [imp/l]	Flow at 125 Hz [m³/h]
0.6	300	1.50
1.5	100	4.50
2.5	60	7.50
3.5	50	9.00
6	25	18.00
10	15	30.00

Table 17. Output signal

Output ULTRAFLOW®

Type	Push-Pull
Output impedance	~10 kΩ
Pulse duration	2...5 ms
Duration of pause	Depending on actual pulse frequency

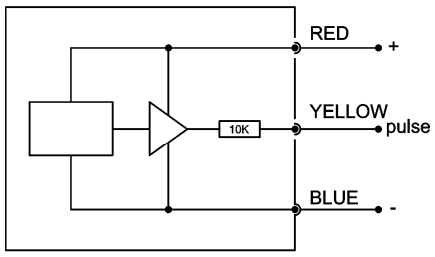


Figure 47. Block diagram for ULTRAFLOW®.

Note: From start-up it takes minimum 16 seconds until true flow reading has been reached and calibration can start. Furthermore, the duration of calibration must be minimum 2 minutes in order to obtain correct flow measurement but we recommend a minimum test time of 3 minutes. See *paragraph 9.3* for further details about suggested test points.

9.2 Electrical Connection

Connection via three-wire cable from ULTRAFLOW®

Yellow	Signal
Red	Supply
Blue	Ground
Supply	3.6 VDC ± 0.1 VDC

Output using Pulse Transmitter/Pulse Divider with galvanic separated output module (Y=2)

Type Open collector. Two-wire or three-wire connection is possible via the built-in 56.2 kΩ. pull-up resistor.

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 18

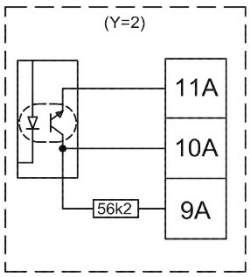


Figure 48. Block diagram for galvanic separated output module (Y=2).

Output using Pulse Transmitter/Pulse Divider with galvanic separated output module (Y=3)

Type Open collector. Three-wire connection via the built-in 39.2 kΩ. pull-up resistor.

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 19

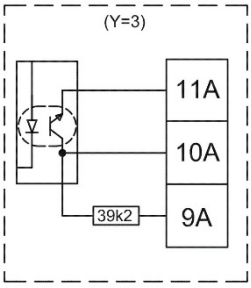


Figure 49. Block diagram for galvanic separated output module (Y=3).

9.3 Suggested test points

Nom. flow	Meter factor	Test point			Test duration			Test quantities		
q_p [m³/h]	[imp/l]	q_p [m³/h]	q_i [m³/h]	$0.1xq_p$ [m³/h]	q_p [min]	q_i [min]	$0.1xq_p$ [min]	q_p [kg]	q_i [kg]	$0.1xq_p$ [kg]
0.6	300	0.6	0.006	0.06	3	20.0	6	30	2	6
1.5	100	1.5	0.015	0.15	3	20.0	6	75	5	15
2.5	60	2.5	0.025	0.25	3	20.2	4.8	125	8.4	25
2.5	50	2.5	0.025	0.25	3	24	6	125	10	25
3.5	50	3.5	0.035	0.35	3	17,1	6	175	10	35
6	25	6	0.06	0.6	3	20,0	6	300	20	60
10	25	10	0.1	1	3	12,0	6	500	20	100

Table 20. Suggested test points, test durations and test quantities for ULTRAFLOW®.

The suggested test parameters are based on EN 1434-5 and q_i:q_p 1:100.

The test set-ups have been selected on the basis of the following requirements:

Minimum test duration of 3 minutes

Water volumes at q_i and $0.1xq_p$ of minimum 10 % of the water volume per hour

Water volume at $0.1xq_p$ corresponding to minimum 1000 pulses

Water volume at q_i corresponding to minimum 500 pulses

These suggested test points can be optimised for the rig as well as for the test purpose.

9.4 Optimisation in connection with calibration

To make a rational test of ULTRAFLOW® it must be possible to reproduce test results. This is also very important if the tested sensors are to be adjusted.

Experience shows that ULTRAFLOW® operates with standard deviations of 0.3…0.4 % at q_i and 0.2…0.3 % at q_p. These are standard deviations at 300…500 pulses at q_i, 3000…5000 at q_p, and flying start/stop.

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

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

Temperature: Calibration temperature according to EN 1434-5 is (50±5) °C for heat meters.

Water quality: Recommended water quality as in CEN TR 16911 and AGFW FW 510.

Installation (mechanical conditions):

To facilitate easy purging during meter testing, we recommend to mount ULTRAFLOW® with the electronics (transducers) facing downwards. Note, that ULTRAFLOW® must **NOT** be evacuated (subjected to vacuum). If you focus on testing the recommended installation angle, rotate the electronics (transducers) to the side as shown in *Figure 10*. However, experience with ULTRAFLOW® has shown that the error curve is not significantly influenced by the orientation of the flow sensor.

To avoid flow disturbances, the inlet pipes and distance pieces must have the same nominal diameter as the sensors (see *Table 21*). There should be min. 5 x DN between the sensors. In connection with bends etc. there should be a minimum 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 caused by 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 minimised. 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.

The diameter of the distance pieces must be:

Connection	Distance piece	Gland
G¾ (R½) DN15	ø15	ø14
G1 (R¾) DN20	ø20	ø19.5
G5/4 (R1) DN25	ø25	ø25.5
G1½ (R5/4) DN32	ø32	ø32
G2 (R1½) DN40	ø40	ø39

Table 21. Distance pieces.

Installation (electrical conditions):

To avoid external disturbances and to achieve an electrical interface as that of MULTICAL®, we recommend to use a Pulse Tester (see *paragraph 9.5*) or to connect a Pulse Transmitter between ULTRAFLOW® and the respective test equipment, which is counting pules, in order to achieve galvanic separation. If the test equipment supports NOWA, see *paragraph 9.6* for further information.

9.5 Pulse Tester

During a calibration process, it is often practical to use Pulse Tester type no. 6699-279, which has the following functions:

Galvanic separated pulse outputs

Integral supply for ULTRAFLOW®

LC-Display with counter

Externally controlled ”Hold” function

Can be mounted directly in a MULTICAL® connection base

9.5.1 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

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

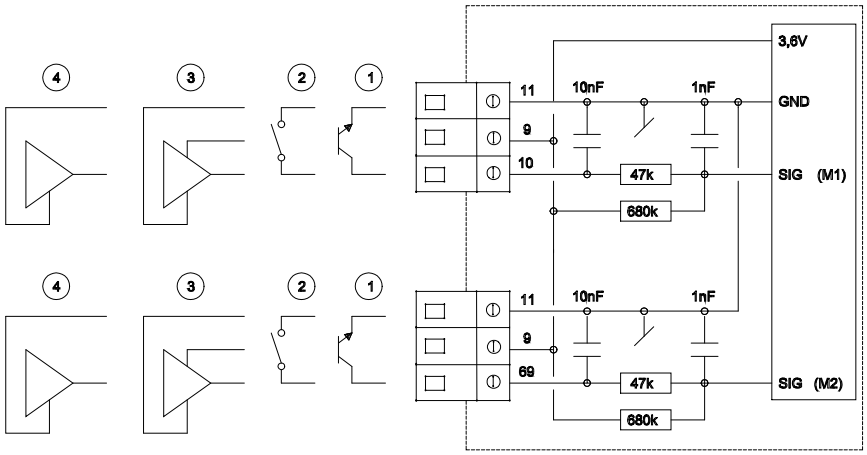


Figure 50

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 flow sensor M1 and terminals 69 and 11 for flow sensor 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 relay output from e.g. MID-meters. This type of transmitter should not be used as the quick pulse input may cause bounce problems.

3 **Flow sensor with active pulse output, powered by 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 22

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

Flow sensors with active signal output are connected as shown in *Figure 51*. The signal level must be between 3.5 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)

Two-wire connection:

Voltage	< 24 V
Load	> 1.5 kΩ

Three-wire connection:

Voltage	5...30 V
Load	> 5 kΩ

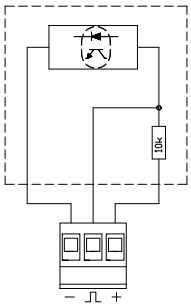


Figure 51

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

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

9.5.2 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	Galvanic isolated
Input protection	Against reversed polarity
"Open input"	Count (see *Figure 52*)

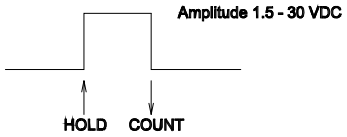


Figure 52

9.5.3 Push-button functions

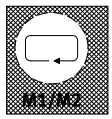


Figure 53. The left push-button shifts between readings/counts of the two flow sensor inputs. In the display, M1 and M2 respectively indicate the currently displayed flow sensor inputs/counters.

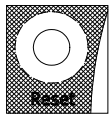


Figure 54. The right push-button resets both counters (M1 and M2).

9.5.4 Use of 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).

9.5.5 Spare parts

Description	Type No.
Battery D-cell	66-00-200-100
Cable retainer (secures the battery)	1650-099
2-pole plug (female)	1643-185
3-pole plug (female)	1643-187
Base PCB (66-R)	5550-517

Table 23. Spare parts for Pulse Tester.

9.5.6 Battery replacement

If the Pulse Tester is used continuously, we recommend replacing the battery once a year.

Connect 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 (unplugged).

9.6 NOWA

NOWA describes a standardized interface between heat meters laboratory test equipment (e.g. flow bench) and is mainly common in laboratories in Germany and Austria. NOWA testing of ULTRAFLOW® 54 is supported in combination with MULTICAL®. For further details about testing ULTRAFLOW® with NOWA see Kamstrup documentation 5585-703 (Hardware) and 5585-706 (Software).

9.7 Sealing

ULTRAFLOW® is sealed from the factory. Verified sensors will be supplied with security seals and a year mark as shown below.

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

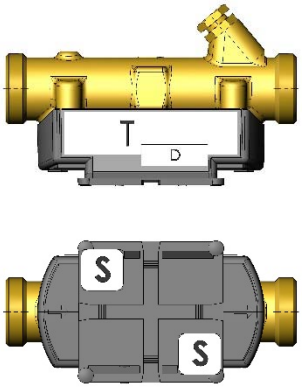


Figure 55. MID-sealing of ULTRAFLOW® 54 (H).

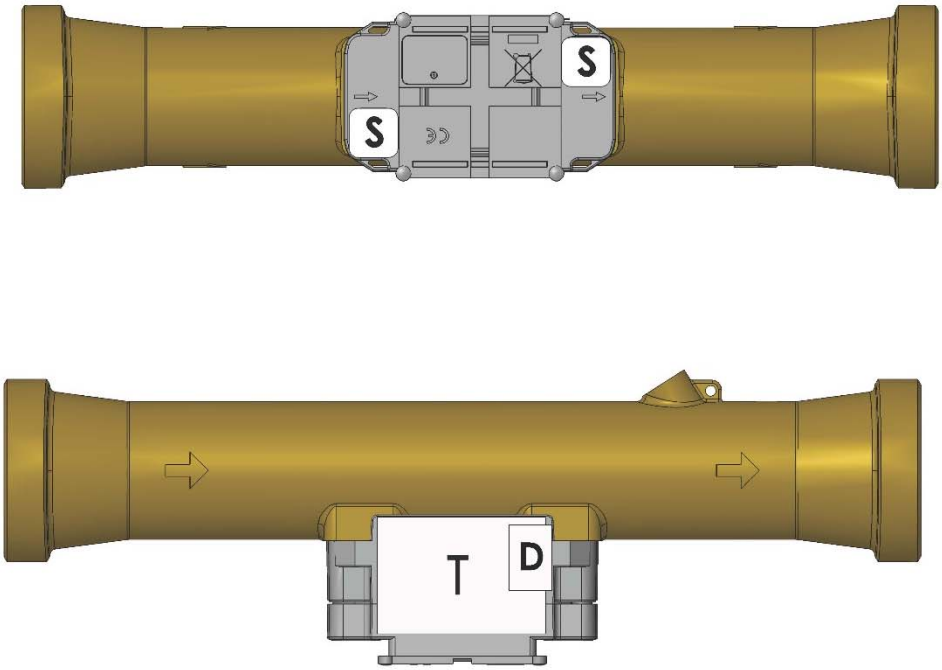
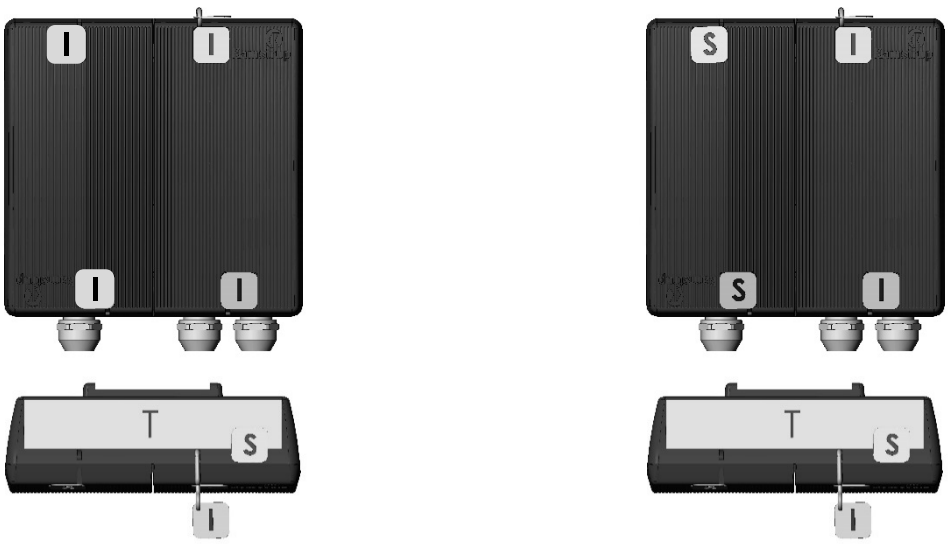


Figure 56. MID-sealing of ULTRAFLOW® 54 (J).



(a) (b)

Figure 57. MID-sealing of Pulse Transmitter (a)/ Pulse Divider (b).

(a) (b)

Figure 58. MID-sealing of Cable Extender Box seen from an angle (a) and from the front (b).

Sealing is divided into the following groups in the drawings:

D	Module D/F label or sealing label (depending on type label).
S	Laboratory marking. Sealing of screw.
T	Type label (as void label or with security seal D).
I	Installation seal (wire and seal or sealing label).

Note: Sealing requirements may vary as a consequence of national regulations.

10 METERTOOL

10.1 Introduction

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

"METERTOOL for ULTRAFLOW® X4" is 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 with 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 and 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 subsequently using 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 connector for ULTRAFLOW® 54 and Pulse Divider 66-99-907.
ULTRAFLOW® 54 (H)	66-99-024	Cable with USB connection for PC and 4-pole connection for ULTRAFLOW® 54 (H).
ULTRAFLOW® 14/24	66-99-002	Adapter for connection of ULTRAFLOW® 14/24. Plugged onto 66-99-141.
ULTRAFLOW® 34	66-99-006	Adapter for connection of 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 24. Interfaces for communication

Note: The supply to ULTRAFLOW® and/or Pulse Divider, if any, must be disconnected during programming. The meter is 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 for 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 re-verify and reseal the sensor before it is remounted. The positions of laboratory labels and year marks appear from *paragraph 9.7*.

Figure 59. Location of the four-pole connector in ULTRAFLOW® 54.

Figure 60. Location of the four-pole connector in ULTRAFLOW® 54 (J).

Figure 61. Location of the four-pole connector in ULTRAFLOW® 54 (H).

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

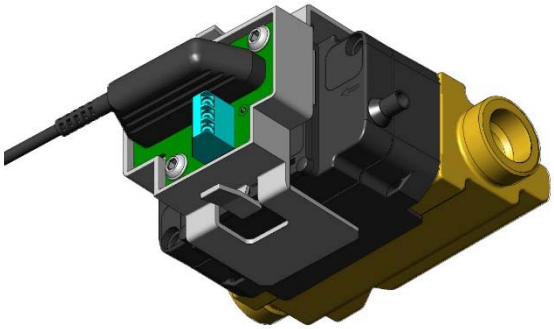


Figure 63. Location of the four-pole connector incl. ULTRAFLOW® 34 adapter in ULTRAFLOW® 34.

Figure 64. Location of the four-pole connector in ULTRAFLOW® 54 DN150…300.

Figure 65. Location of the eight-pole connector in Pulse Divider 66-99-607.

Figure 66. 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 installation.

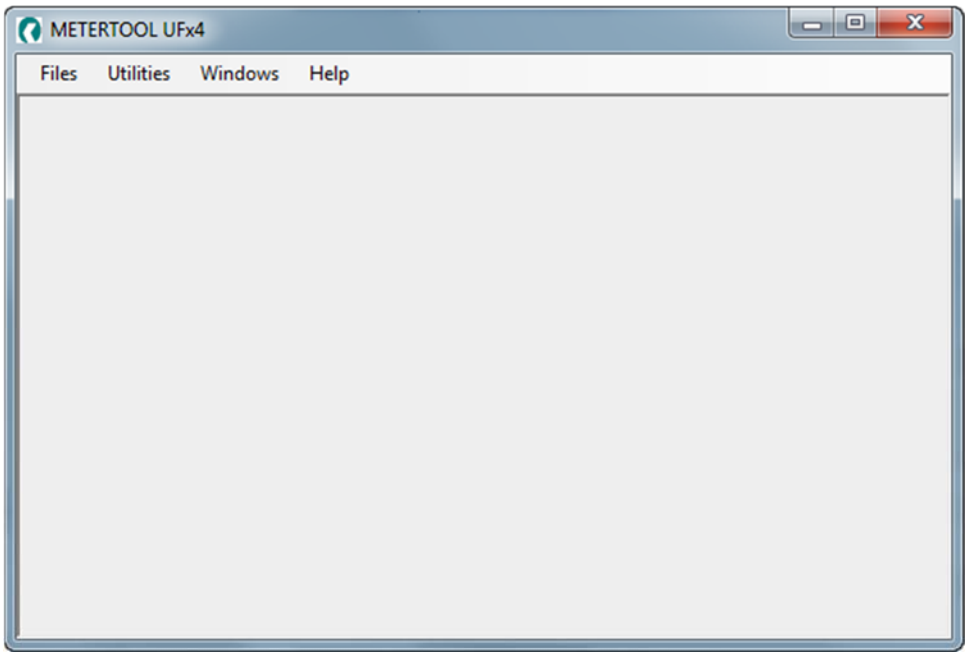
Note: The files used for installation must be saved on a CD or in a local folder in the PC. Installation is not possible using files from a USB-stick or an external drive.

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".

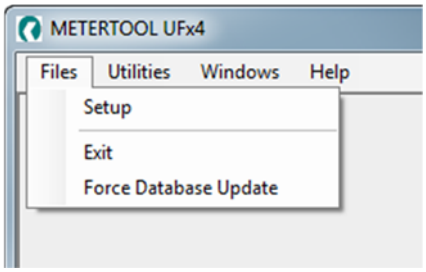
10.3 METERTOOL for ULTRAFLOW® X4

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



10.3.1 Files

The menu "Files" includes:



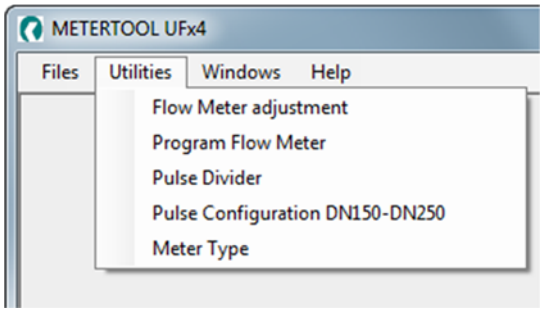
Setup Update of program and database (internet connection required) and setup of COM-port for interface of flow sensor and Pulse Divider.

Exit: Terminates METERTOOL.

Force Database Update: Forced online-update of 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 DN150-300: Programming of meter factor and pulse duration for ULTRAFLOW® 54 DN150-300.

Meter Type: Information on flow sensor and equipment.

10.3.3 Windows

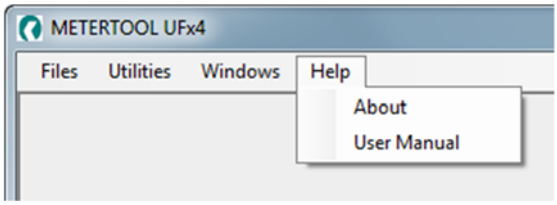
The function makes it possible to change between the open dialog boxes of the program.

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 per cent, the sensor is probably defective, or has a different error, and should not be adjusted.

10.4.1 Choice of COM-port

Open ”Setup”

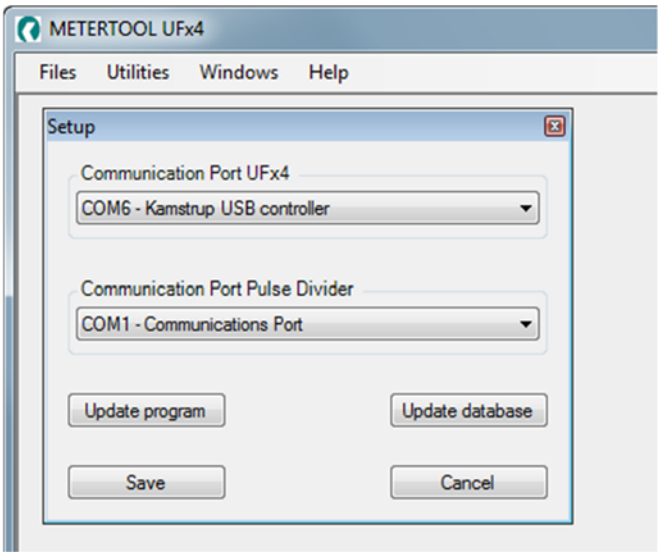
Select a COM-port for ULTRAFLOW® X4.

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.

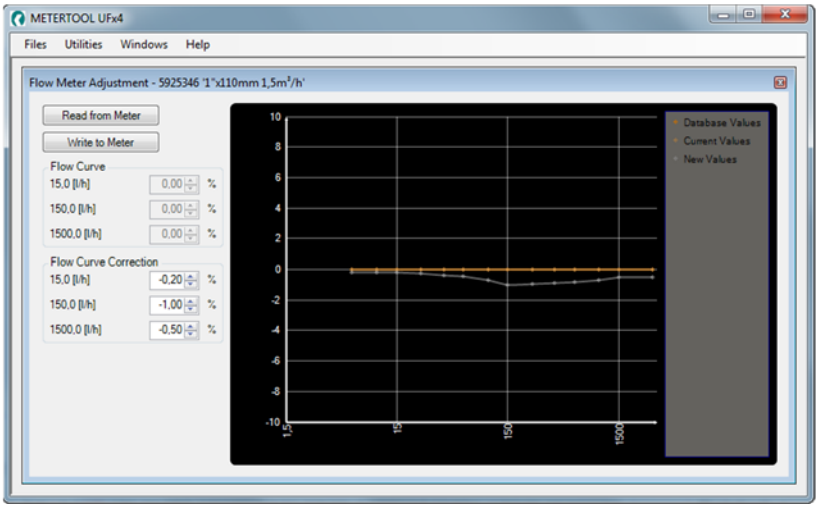
Select COM-Port for Pulse Divider.

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.

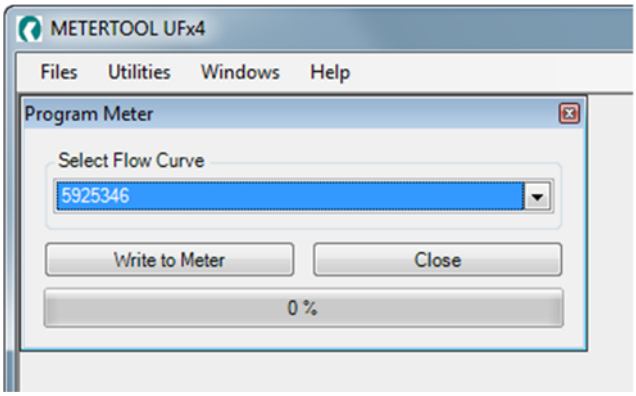
10.4.3 Programming of standard flow curve

Open "Program Flow Meter"

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.

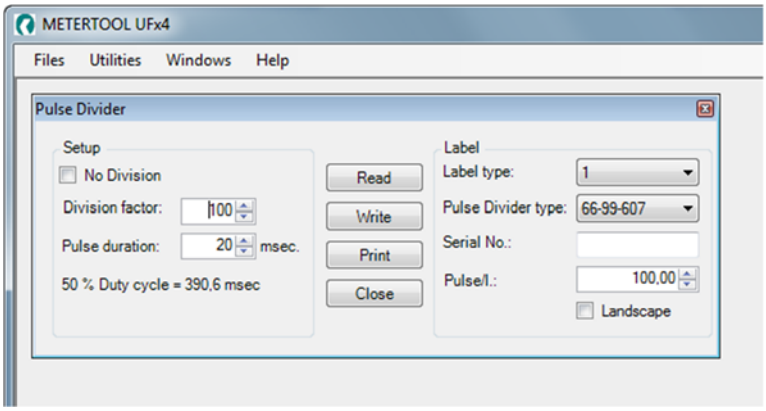


*) METERTOOL automatically configures ULTRAFLOW® 54 DN150...300 for Kamstrup default meter factor (*Table 27* page 75). If an alternative meter factor is required, please refer to *paragraph 10.4.6 Pulse Configuration DN150-DN300*.

10.4.4 Pulse Divider type no. 6699-607

Setting up and programming Pulse Divider type no. 6699-607: A Pulse Divider is used for adapting the flow signal to a calculator, e.g. if a “foreign” calculator is connected to Kamstrup ULTRAFLOW® and the coding (number of pulses CCC 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]	Pulse factor [imp/l]	Pulse factor [l/imp]	Divider	Pulse factor [l/imp]	Divider	Pulse factor [l/imp]	Divider	Pulse 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 25. Pulse division table (pulse duration of divided pulses 100 ms default)

ULTRAFLOW®		Pulse Divider & 11EVL (pulse duration 50 ms)		Pulse Divider & 1EVL (pulse duration 100 ms	
q_p [m³/h]	Pulse factor [imp/l]	Pulse factor [l/Pulse]	Divider	Pulse factor [l/Pulse]	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 26. 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).

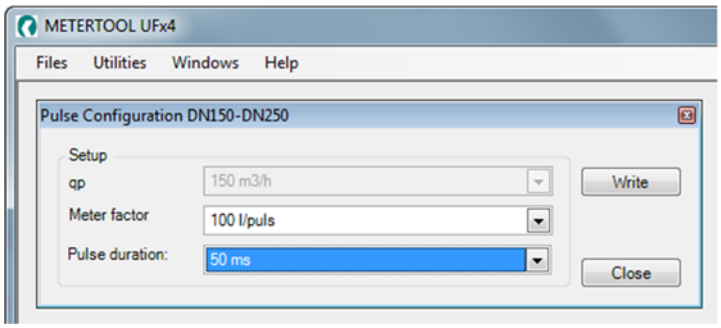
Instead we refer to METERTOOL HCW. See *paragraph 11*.

10.4.6 Pulse Configuration DN150-DN300

Programming of meter factor and pulse duration for ULTRAFLOW® 54 DN150-300. ”Pulse Configuration DN150-DN250” is used for adapting the pulse signal to match calculator and other equipment, e.g. if ULTRAFLOW® is connected to a calculator, which does not support Kamstrup's quick pulses. See *Table 27* 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/pulse]	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 27. Programming options as to meter factor (CC) and pulse duration (E) for ULTRAFLOW® 54 DN150...300.

Based on a q_p value a meter factor in *Table 27* is chosen. The valid pulse durations are listed in the same line as the chosen meter factor.

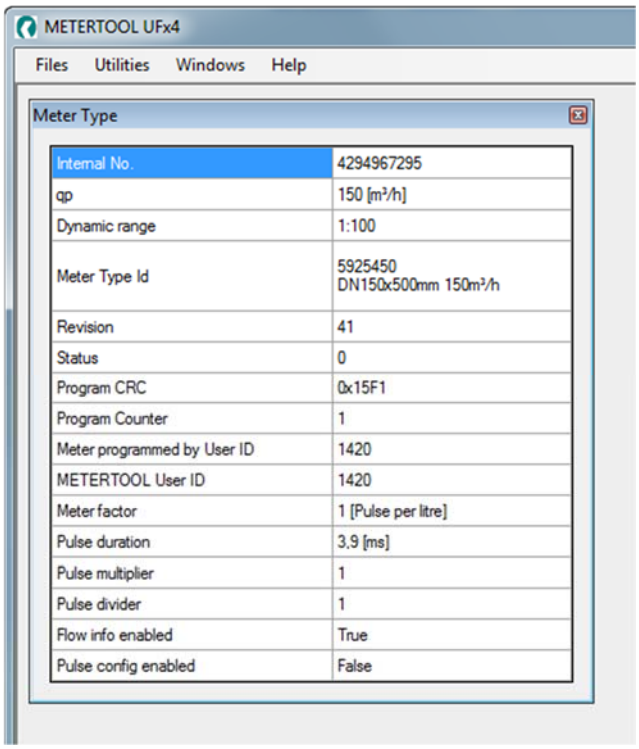
Example: For ULTRAFLOW® 54, q_p 400 m³/h, meter factor, 100 l/pulse (CC=35) is required. Based on this meter factor, pulse durations 20 (E=4) or 50 (E=5) milliseconds can be selected.

Default values in *Table 27* are programming values for ULTRAFLOW® 54 DN150...300 when connected to a Kamstrup MULTICAL® calculator.

10.4.7 Meter type

Open ”Meter type”:

Reads out 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”

Select ”Update program”

”Update”: If a new version of METERTOOL is available on Kamstrup's server, it is possible to update the program online.

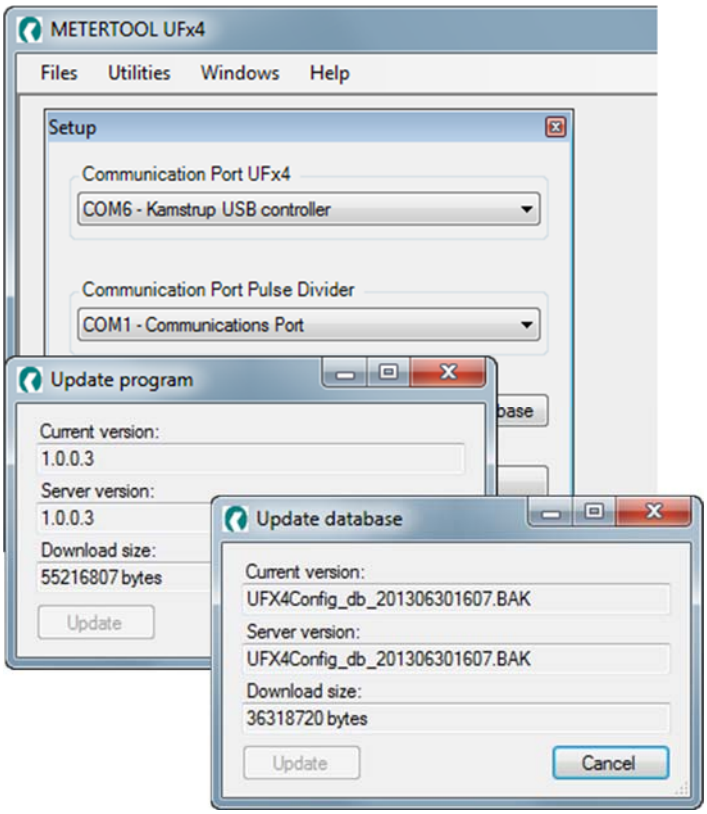
(Internet connection required.)

Select ”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.

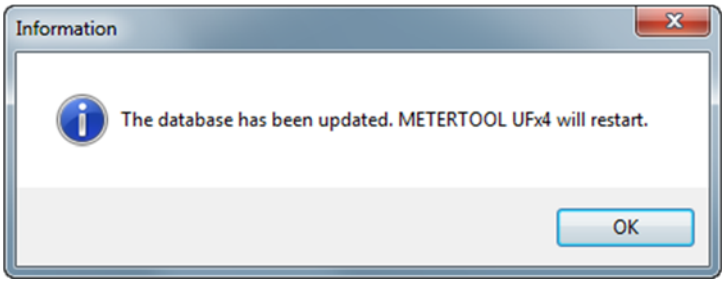
(Internet connection required.)

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 for 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 67. 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.

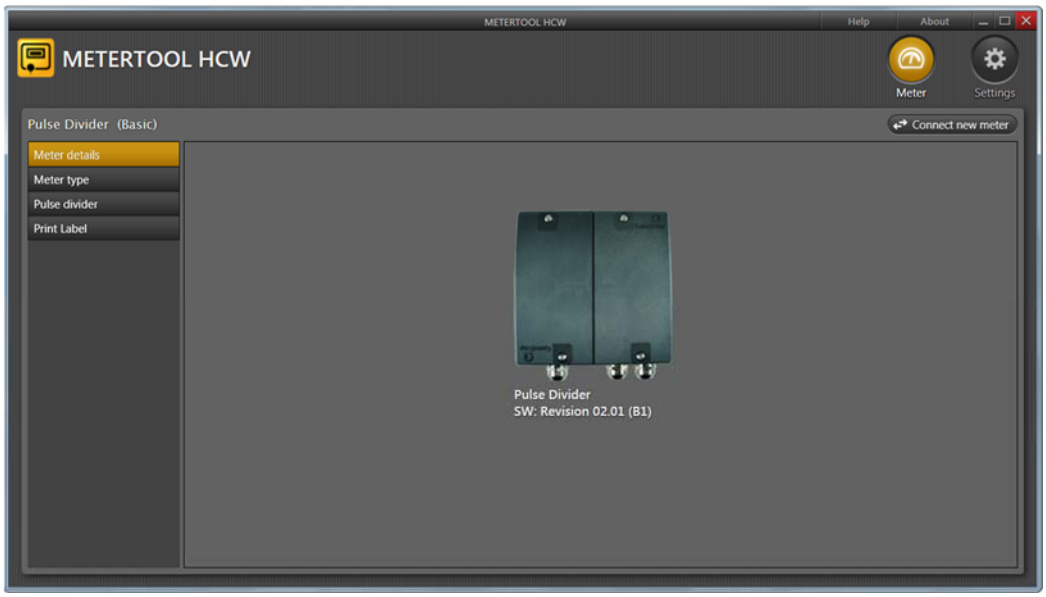


Figure 68. Meter details.

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.

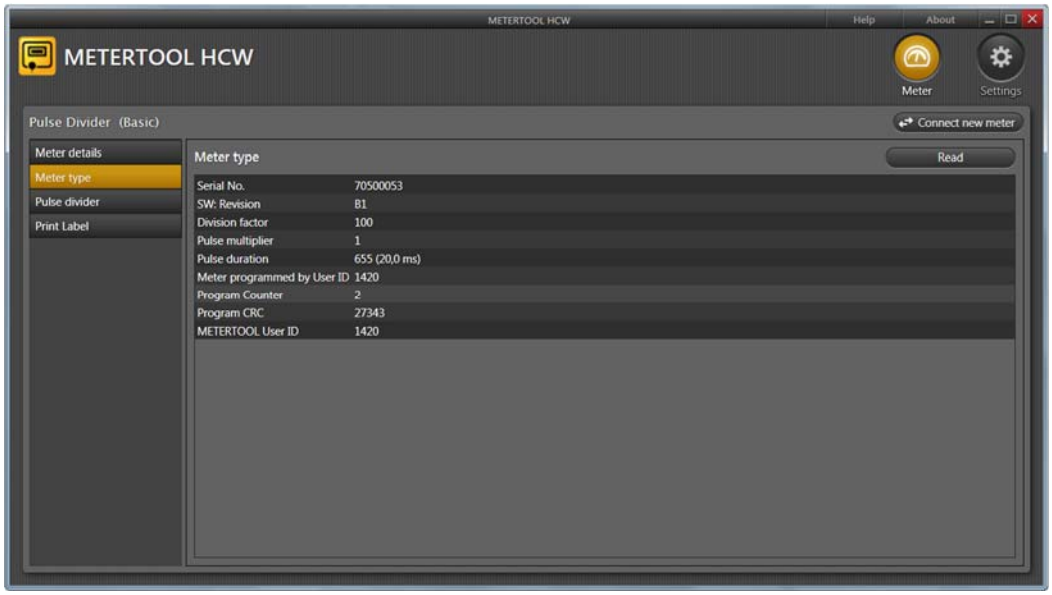


Figure 69. Meter type.

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® pulse factor (CCC)“:	Based on ULTRAFLOW® pulse factor. Appears from ULTRAFLOW® type label.
”Pulse Divider pulse factor (DD)”:	Only valid pulse 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.

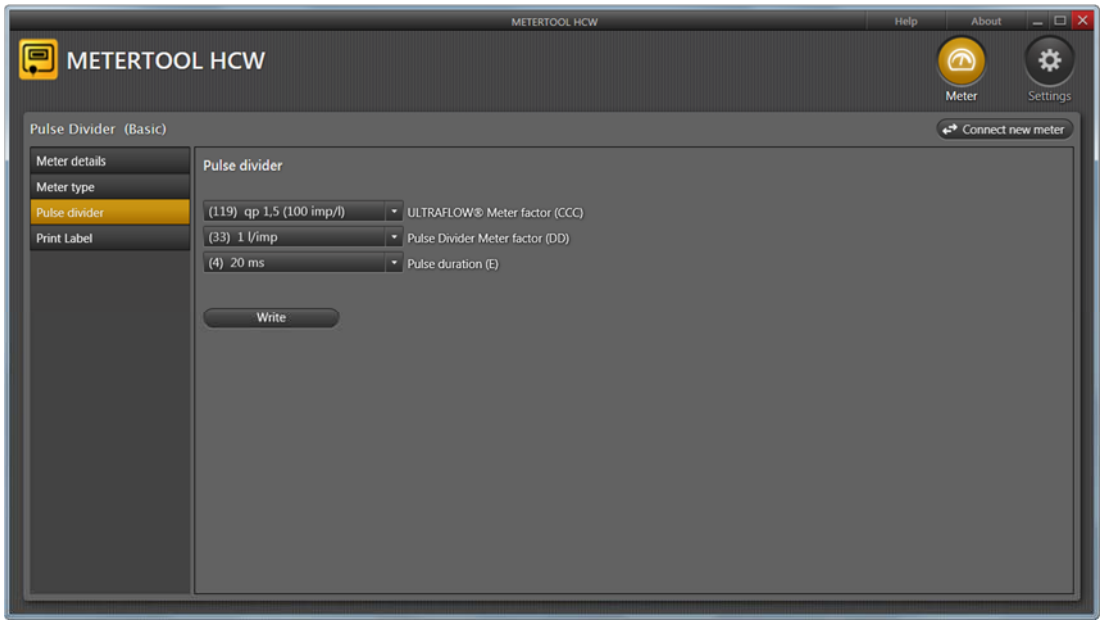


Figure 70. Pulse divider.

See *Table 28* and *Table 29* 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 28. 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 29. 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 meter factor options for the Pulse Divider is selected from *Table 27* or *Table 29*. The pulse duration options appear from the same line as the selected meter factor.

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

For older types of ULTRAFLOW® (e.g. ULTRAFLOW® type 65) which do not have the same direct and unique connection between q_p and meter factor (CCC), correct configuration can be ensured by starting from the meter factor of the flow sensor [imp/l].

Default values in *Table 27* and *Table 29* indicate meter factors and pulse durations of ULTRAFLOW® 54 and 34.

11.2.5 Print Label

This menu point 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® pulse factor (CCC)“:	Select ULTRAFLOW® pulse factor. Appears from Pulse Divider type label.
”Pulse Divider pulse 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).
”Example”:	Shows examples of Pulse Divider type label with selected values.
”Print”:	Prints type label on selected printer.
”Select label printer”:	Select printer.

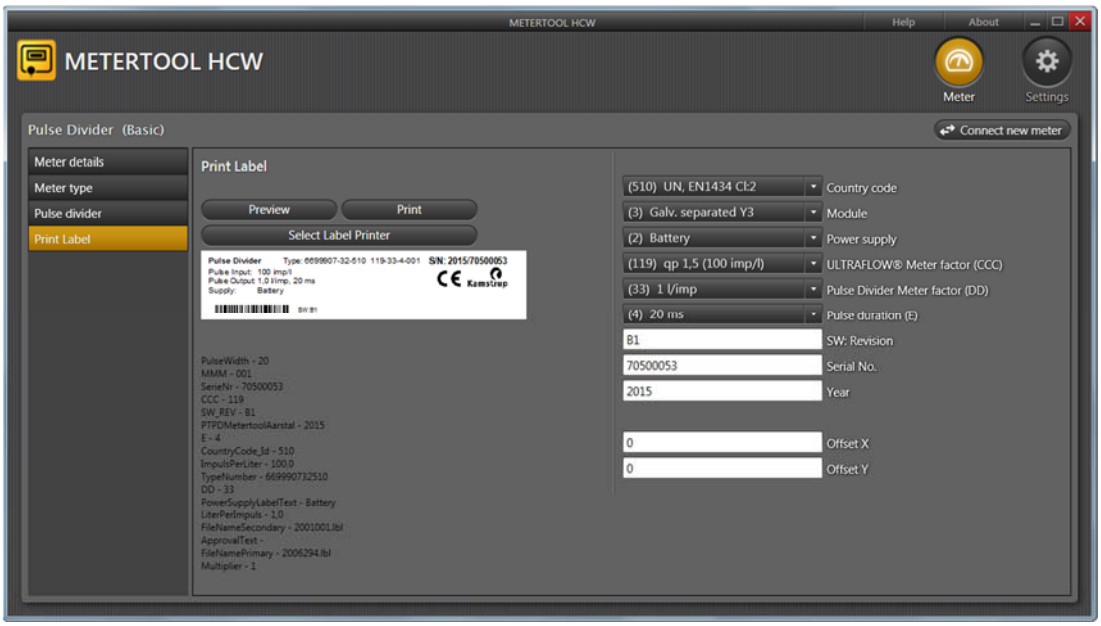


Figure 71. Print label.

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:

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

Figure 72. Select language.

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

Figure 73. Select COM-port.

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

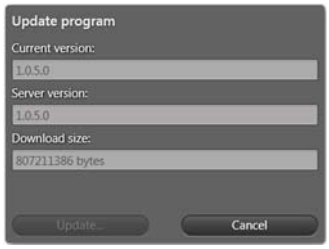


Figure 74. Update program.

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

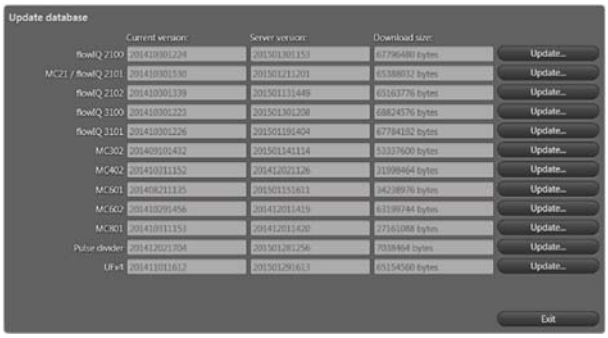


Figure 75. Update database.

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

”Install the 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 The Measuring Instruments Directive

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

B-Module: DK-0200-MI004-033

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 connected to mains supplied Pulse Transmitter or Pulse Divider)

12.3 EU-declaration of conformity

With each ULTRAFLOW® 54 DN15-125 supplied from Kamstrup an EU-declaration of conformity according to Kamstrup document no. 5518-308 is included, respectively.

13 Troubleshooting

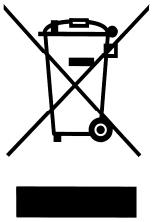
Before sending in the sensor for repair or testing, please use the error detection table below to help you clarify the possible cause of the problem.

Symptom	Possible cause	Proposal for correction
No updating of display values	No power supply	Replace battery or check mains supply
No display function (blank display)	No voltage 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 is 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 the flow sensor/Send meter for repair.
Erroneous accumulation of m³	Erroneous programming	Check that meter factors of calculator and flow sensor correspond.
	Air in sensor/cavitation	Check the 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 the flow sensor/Send meter for repair.

14 Disposal

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

- **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.

Lithium cells and meters including lithium cells must, therefore, be forwarded as dangerous goods. (See Kamstrup document 5510-408, "Lithium batteries - Handling and disposal").

Meter part	Material	Recommended disposal
Lithium cells in Pulse Transmitter/ Pulse Divider (D-cell)	Lithium and thionyl chloride > UN 3091 < D-cell: 4.9 g lithium	Approved deposit of lithium cells
PCBs in Pulse Transmitter, Pulse Divider and ULTRAFLOW®	Coppered epoxy laminate, components soldered on	PCB scrap for concentration to noble metals
Flow sensor cables	Copper with silicone mantle	Cable recycling
Plastic parts, cast	PES, PC and ABS. See material data	Plastic recycling
ULTRAFLOW® meter case	DZR brass	Metal recycling
Packing	Recycled cardboard and EPS	Cardboard recycling (Resy) and EPS recycling

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	5512-1553	5512-1554	5512-1555	5512-1556
Data sheet	5810-1546	5810-1547	5810-1548	5810-1549
Installation guide	5512-2069	5512-2070	5512-2071	5512-2076

Table 30