Technical description

ULTRAFLOW® type 65-S/65-R

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1 General description

ULTRAFLOW® type 65-S/R is a static flow sensor based on the ultrasonic measuring principle. The prime area of application is as a volume flow sensor for use with heat meters such as MULTICAL® and MAXICAL. ULTRAFLOW® has been designed for use in heating installations where water is the heat-bearing medium.

ULTRAFLOW® employs ultrasonic measuring techniques and microprocessor technology. All circuits for calculating and measuring are collected on one single-board, providing a compact and rational design in addition to exceptionally high measuring accuracy and reliability.

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

A multi-plug placed beneath the seal, is used during communication and calibration.

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

In cases where ULTRAFLOW® is used as a flow sensor with built-in supply, e.g. where the distance between MULTICAL® og ULTRAFLOW® is 10 m or more, the PULSE TRANSMITTER can be supplied as an accessory. The PULSE TRANSMITTER has a built-in supply for ULTRAFLOW® and a galvanically separated pulse output.

2 Data

ULTRAFLOW® type 65-S/R

2.1 Electrical data

Supply voltage	3.6 V ± 10%
Battery (PULSE TRANSMITTER/ PULSE DIVIDER)	3.65 VDC, D-cell lithium
Replacement interval	6 years @ t_{BAT}< 35°C
Power supply (PULSE TRANSMITTER/ PULSE DIVIDER)	230 VAC +15/-30% 24 VAC ±30%
Power consumption supply	< 1 W
Back-up supply	Integral super-cap eliminates operational disturbances due to short-term power-cuts
Cable length, flow meter	Max. 10 m
Cable length, PULSE TRANSMITTER/ PULSE DIVIDER [1)]	Depending on the calculator
EMC data	Meets DS/EN 1434 class C

2.2 Mechanical data

Metrological class	2	
Environmental class	Meets DS/EN 1434 class C	
Ambient temperature	0…55°C	
Protection class		
Flow meter	IP56	
PULSE TRANSMITTER/ PULSE DIVIDER	IP54	
Medium temperature	15…130°C	At medium temperatures above 90°C use of flange meters is recommended. Additionally, MULTICAL® calculator or PULSE TRANSMITTER should be wall-mounted
Storage temp. empty sensor	-25…70°C, 60°C with mounted/enclosed battery	
Pressure stage	PN16, PN25 flange	
Time constant	6 s, fast response meter	

[1)] ***NOTE:*** *If the PULSE DIVIDER is reconfigured into an active output, the max. cable length ULTRAFLOW® → PULSE DIVIDER → Calculator, is 10 m.*

2.3 Flow data

Nom. flow q_p [m³/h]	Nom. diameter [mm]	Meter factor [2] [pulses/l]	Dynamic range q_i:q_p	q_s:q_p	Flow @125 Hz [3] [m³/h]	Δp [bar]	Min. Cut off [l/h]
0.6	DN15 & DN20	300	1:100	2:1	1.5	0.04	2
1.5	DN15 & DN20	100	1:100	2:1	4.5	0.23	3
3	DN20	50	1:100	2:1	9	0.04	6
3.5	DN25	50	1:100	2:1	9	0.06	7
6	DN25	25	1:100	2:1	18	0.16	12
10	DN40	15; 25	1:100	2:1; 1.8:1	30; 18	0.07	20
15	DN50	10	1:100	2:1	45	0.15	30
25	DN65	6; 10	1:100	2:1; 1.8:1	75; 45	0.08	50
40	DN80	5	1:100	2:1	90	0.2	80
60	DN100	2.5	1:100	2:1	180	0.01	120
100	DN100	1.5	1:100	2:1	300	0.03	200
150	DN150	1	1:100	2:1	450	0.02	300
250	DN150	0.6	1:100	2:1	750	0.055	500
400	DN150	0.4	1:100	2:1	1125	0.038	800
400	DN200	0.4	1:100	2:1	1125	0.01	800
400	DN250	0.4	1:100	2:1	1125	0.01	800
600	DN200	0.25	1:100	2:1	1800	0.022	1200
600	DN250	0.25	1:100	2:1	1800	0.022	1200
1000	DN250	0.25	1:100	1.8:1	1800	0.015	2000

[2] *Pulse figures will appear from the label placed on the side of the meter*

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

Table 1

2.4 Material

Wetted parts

ULTRAFLOW®, q_p 0.6 and 1.5 m³/h

Housing	Enkotal (alpha brass)
Transducer	AISI 316
Gaskets	EPDM
Reflectors	PES 30% GF and AISI 304
Measuring pipe	PES 30% GF

ULTRAFLOW®, q_p 3 to 100 m³/h

Housing, gland	Enkotal (alpha brass)
Housing, flange	RG5204 (red brass)
Transducer	AISI 316
Gaskets	EPDM
Measuring pipe	PES 30% GF
Reflectors	AISI 304

ULTRAFLOW®, q_p 150 to 1000 m³/h

Housing	AISI 304 (stainless steel)
Transducer	AISI 316/Enkotal
Gaskets	EPDM
Measuring pipe	Integral part of the housing

Electronic housing

Base	PBT m. 30% GF
Lid	PC m. 10% GF

Connecting cable, q_p 0.6 to 100 m³/h

Silicone cable (3x0.5□)

3 Type overview

Nom. flow q_p [m³/h]	**Installation sizes**				
0.6	G¾x110 mm	G1x130 mm			
1.5	G¾x110 mm	G¾x165 mm	G1x130 mm	G1x165 mm	G1x190 mm
3	G1x190 mm	DN20x190 mm			
3.5	G5/4x260 mm	DN25x260 mm			
6	G5/4x260 mm	DN25x260 mm			
10	G2x300 mm	DN40x300 mm			
15	DN50x270 mm				
25	DN65x300 mm				
40	DN80x300 mm				
60	DN100x360 mm				
100	DN100x360 mm				
150	DN150x500 mm				
250	DN150x500 mm				
400	DN150x500 mm	DN200x500 mm	DN250x600 mm		
600	DN200x500 mm	DN250x600 mm			
1000	DN250x600 mm				

Table 2

Thread ISO 228-1

Flange EN 1092-1/-3, PN25

4 Order survey

Below is a list of type numbers for ULTRAFLOW® type 65-S.

Type number[4)]	q_p [m³/h]	q_i [m³/h]	q_s [m³/h]	Connection	Length [mm]	Pulse figure [Pulses/l]	CCC
65-S- CAAA -XXX	0.6	0.006	1.2	G¾B (R½)	110	300	116
65-S- CAAD -XXX	0.6	0.006	1.2	G1B (R¾)	130	300	116
65-S- CDAA -XXX	1.5	0.015	3	G¾B (R½)	110	100	119
65-S- CDAC -XXX	1.5	0.015	3	G¾B (R½)	165	100	119
65-S- CDAD -XXX	1.5	15	3	G1B (R¾)	130	100	119
65-S- CDAE -XXX	1,5	0.015	3	G1B (R¾)	165	100	119
65-S- CDAF -XXX	1.5	0.015	3	G1B (R¾)	190	100	119
65-S- CFAF -XXX	3	0.03	6	G1B (R¾)	190	50	136
65-S- CFBA -XXX	3	0.03	6	DN20	190	50	136
65-S- CGAG -XXX	3.5	0.035	7	G5/4B (R1)	260	50	151
65-S- CGBB -XXX	3.5	0.035	7	DN25	260	50	151
65-S- CHAG -XXX	6	0.06	12	G5/4B (R1)	260	25	137
65-S- CHBB -XXX	6	0.06	12	DN25	260	25	137
65-S- C1AJ -XXX	10	0.1	18	G2B (R1½)	300	25	137
65-S- C1BD -XXX	10	0.1	18	DN40	300	25	137
65-S- CJAJ -XXX	10	0.1	20	G2B (R1½)	300	15[5)]	178
65-S- CJBD -XXX	10	0.1	20	DN40	300	15[5)]	178
65-S- CKBE -XXX	15	0.15	30	DN50	270	10	120
65-S- C2BG -XXX	25	0.25	45	DN65	300	10	120
65-S- CLBG -XXX	25	0.25	50	DN65	300	6[5)]	179
65-S- CMBH -XXX	40	0.4	80	DN80	300	5	158
65-S- FACL -XXX	60	0.6	120	DN100	360	2.5	170
65-S- FBCL -XXX	100	1	200	DN100	360	1.5	180
65-S- FCCN -XXX	150	1.5	300	DN150	500	1	147
65-S- FDCN -XXX	250	2.5	500	DN150	500	0.6	181
65-S- FECN -XXX	400	4	800	DN150	500	0.4	171 or 191
65-S- FECP -XXX	400	4	800	DN200	500	0.4	
65-S- FECR -XXX	400	4	800	DN250	600	0.4	
65-S- FFCP -XXX	600	6	1200	DN200	500	0.25	172 or 192
65-S- FFCR -XXX	600	6	1200	DN250	600	0.25	
65-S- F1CR -XXX	1000	10	1800	DN250	600	0.25	
65-S- FGCR -XXX	1000	10	2000	DN250	600	0.15	182 or 193

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

5) ULTRAFLOW® II users should note the new pulse figure

Table 3

ULTRAFLOW® type 65-S is supplied as standard with 2.5 m connection cable in relation to sensors ≤ DN100, but can also be supplied with 5 or 10 m cable.

When ordering ULTRAFLOW® with 5 or 10 m cable, please state the type number 65-R-????-XXX[4)] and the required cable length.

Meters ≥ DN150 are supplied **without** a cable. However, a 5 or 10 m cable can be delivered, but not mounted.

4.1 PULSE TRANSMITTER

Type no. 66-99-603. PULSE TRANSMITTER is available with a built-in supply for ULTRAFLOW®. The options are battery, 24 VAC/DC or 230 VAC supply. Please specify when placing the order.

4.2 PULSE DIVIDER

Type no. 66-99-607. PULSE DIVIDER is available with a built-in supply for ULTRAFLOW®. The options are battery, 24 VAC/DC or 230 VAC supply. Please specify when placing the order.

The pulse division for PULSE DIVIDER must also be specified when placing the order, see *Table 24* and *25* for possible pulse divisions.

4.3 Accessories

Glands including gaskets (PN16)

Size		Type no.	2 pcs.
DN15	(R½ x G¾)		65-61-321
DN20	(R¾ x G1)		65-61-322
DN25	(R1 x G5/4)	65-61-313	
DN40	(R1½ x G2)	65-61-315	

Gaskets for glands		Gaskets for flange sensors	
Size	Type no.	Size	Type no.
G¾	2210-061	DN20	2210-147
G1	2210-062	DN25	2210-133
G5/4	2210-063	DN40	2210-132
G2	2210-065	DN50	2210-099
		DN65	2210-141
		DN80	2210-140
		DN100	1150-142
		DN150	1150-140
		DN200	1150-139
		DN250	1150-141

5 Dimension sketches

ULTRAFLOW® type 65-S/R, G¾ and G1

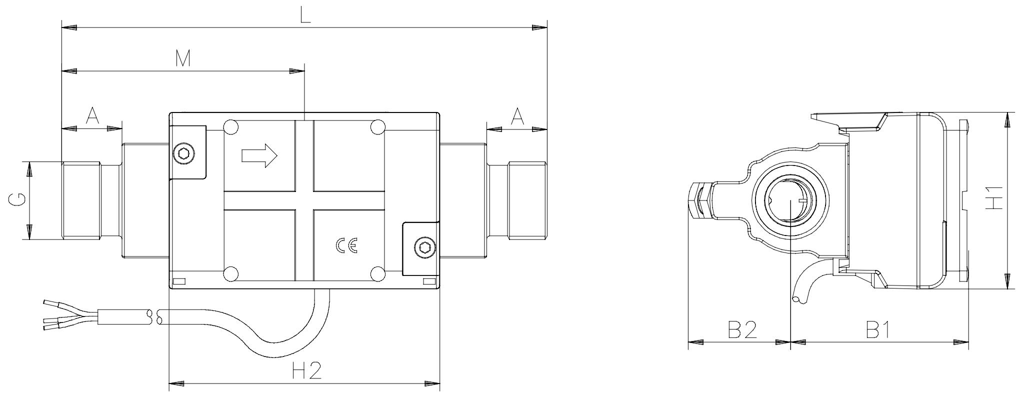


Figure 1

Thread ISO 228-1

Thread	L	M	H2	A	B1	B2	H1	Approx. weight [kg]
G¾	110	L/2	92	10.5	61	35	60	0.8
G1	130	L/2	92	20.5	61	35	60	0.9
G¾	165	L/2	92	20.5	61	35	60	1.2
G1	165	L/2	92	20.5	61	35	60	1.2
G1 (q_p 1.5)	190	L/2	92	20.5	61	35	60	1.4
G1 (q_p 3.0)	190	L/2	92	20.5	60	36	60	1.3

Table 4

(All dimensions are stated in mm)

ULTRAFLOW® type 65-S/R, G5/4 and G2

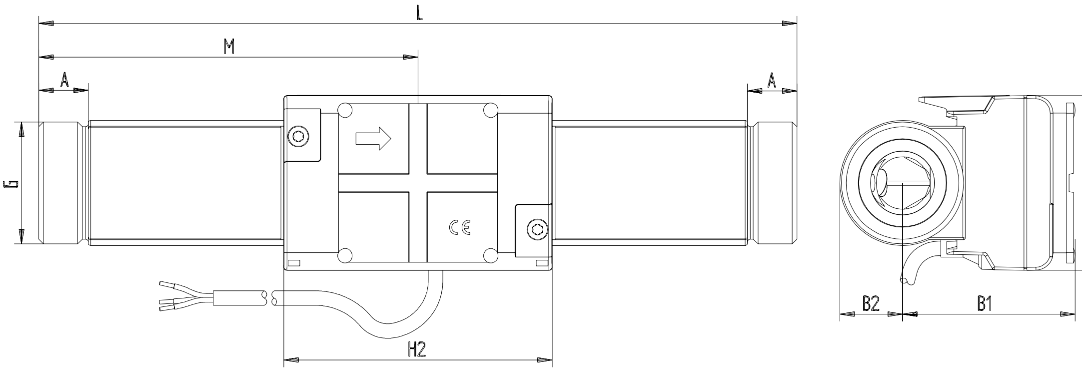


Figure 2

Thread ISO 228-1

Thread	L	M	H2	A	B1	B2	H1	Approx. weight [kg]
G5/4	260	L/2	92	17	60	22	60	2.3
G2	300	L/2	92	21	68	31	60	4.5

Table 5

(All dimensions are stated in mm)

ULTRAFLOW® type 65-S/R, DN20 to DN50

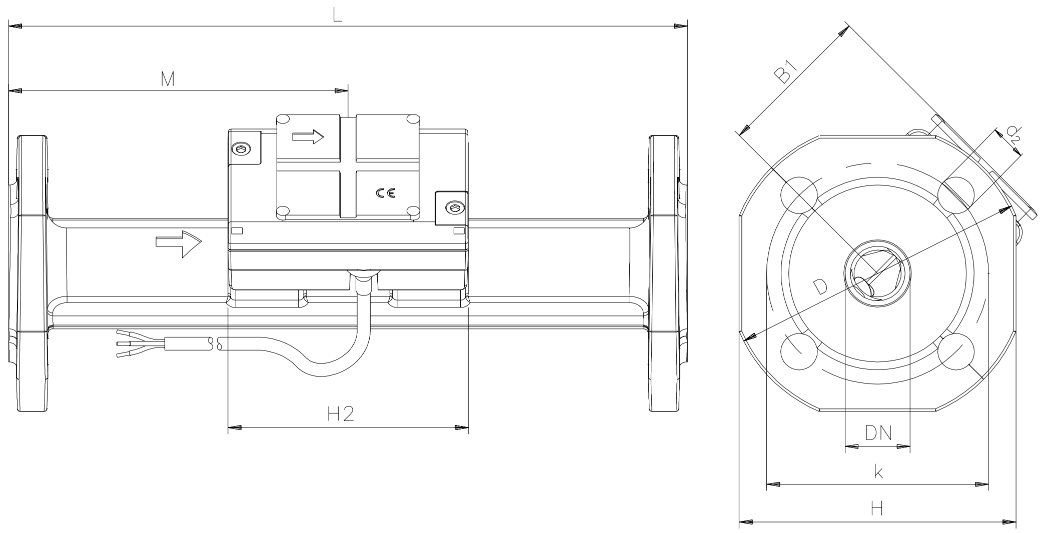


Figure 3

Flange EN 1092-3, PN25

Nom. diameter	L	M	H2	B1	D	H	k	Bolts Number	Bolts Threads	Bolts d_2	Approx. weight [kg]
DN20	190	L/2	92	60	105	95	75	4	M12	14	2.9
DN25	260	L/2	92	60	115	106	85	4	M12	14	5.0
DN40	300	L/2	92	<D/2	150	136	110	4	M16	18	8.3
DN50	270	155	92	<D/2	165	145	125	4	M16	18	10.1

Table 6

(All dimensions are stated in mm)

ULTRAFLOW® type 65-S/R, DN65 and DN80

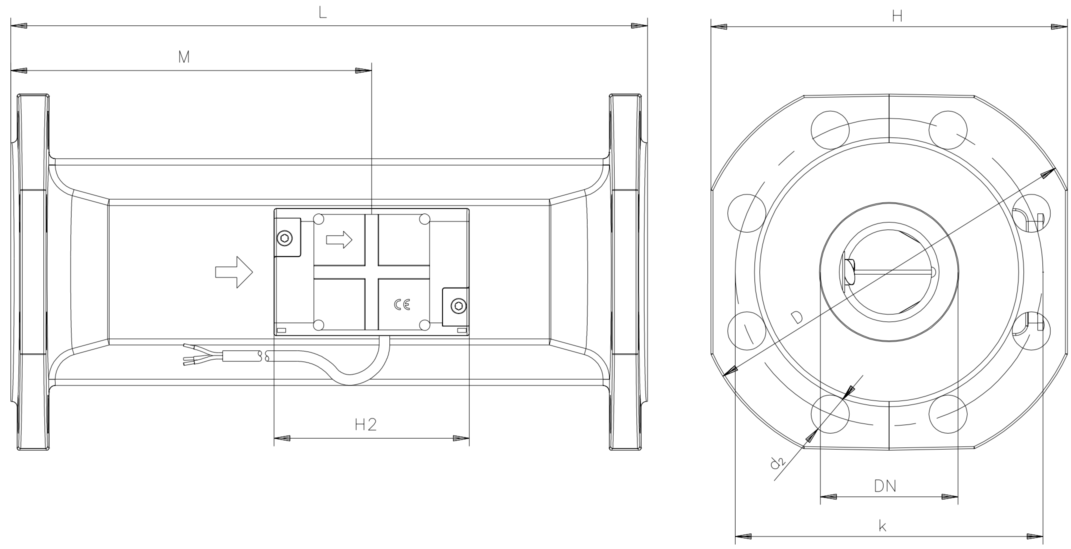


Figure 4

Flange EN 1092-3, PN25

Nom. diameter	L	M	H2	B1	D	H	k	Bolts Number	Bolts Threads	Bolts d_2	Approx. weight [kg]
DN65	300	170	92	<H/2	185	168	145	8	M16	18	13.2
DN80	300	170	92	<H/2	200	184	160	8	M16	18	16.8

Table 7

(All dimensions are stated in mm)

ULTRAFLOW® type 65-S/R, DN100

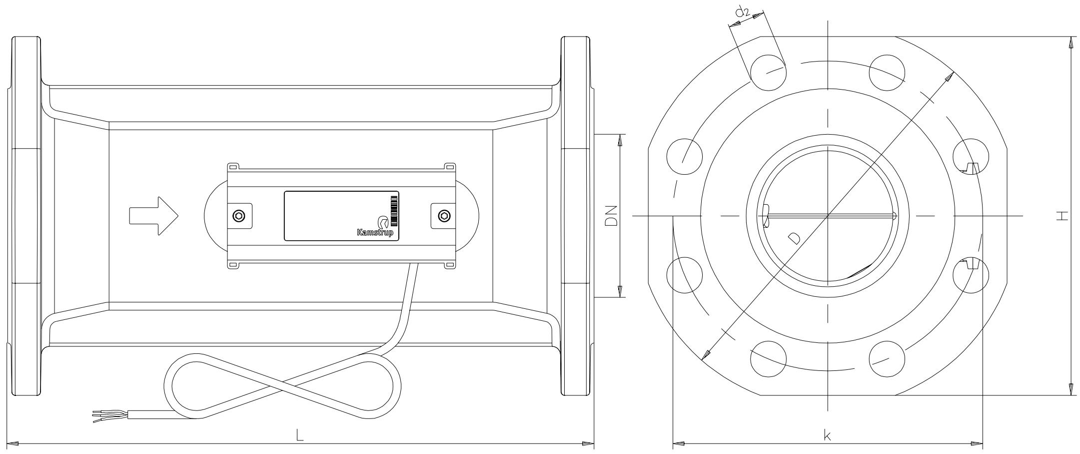


Figure 5

Flange EN 1092-3, PN25

Nom. diameter	L	D	H	k	Bolts Number	Bolts Threads	d_2	Approx. weight [kg]
DN100	360	235	220	190	8	M20	22	25.6

Table 8

(All dimensions are stated in mm)

ULTRAFLOW® type 65-S/R, DN150, DN200 and DN250

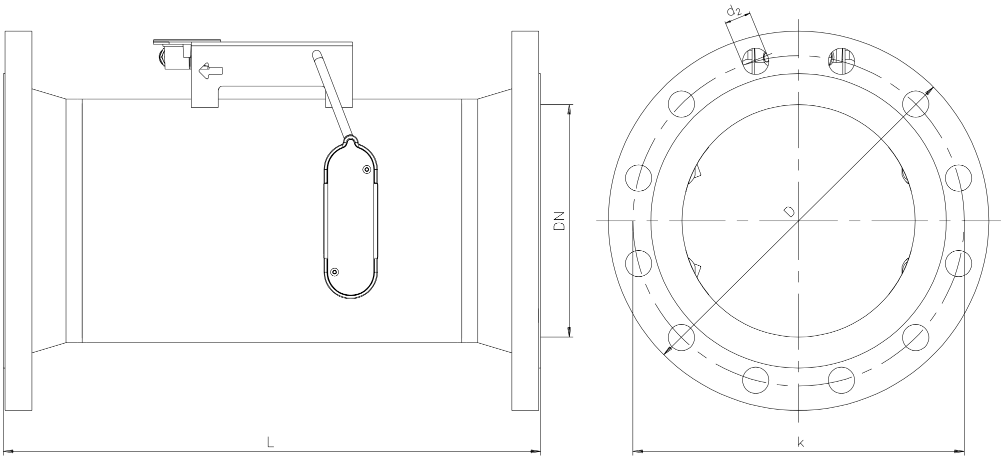


Figure 6

Flange EN 1092-1, PN25

Nom. diameter	L	D	k	Bolts Number	Threads	d_2	Approx. weight [kg]
DN150	500	300	250	8	M24	26	37
DN150 (q_p400 m³/h)	500	300	250	8	M24	26	32
DN200	500	360	310	12	M24	26	47
DN250	600	425	370	12	M27	30	68
DN250 (q_p1000 m³/h)	600	425	370	12	M27	30	65

Table 9

(All dimensions are stated in mm)

PULSE TRANSMITTER/PULSE DIVIDER

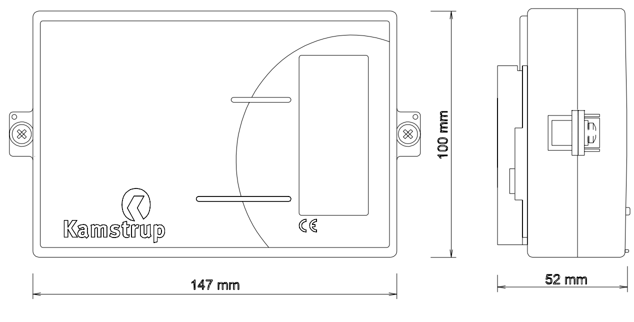


Figure 7

6 Pressure loss

The pressure loss in a flow sensor is stated as the max. pressure loss at q_p. According to EN 1434 the max. pressure loss must not exceed 0.25 bar, unless the energy meter has a flow controller or functions as pressure reducing equipment.

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

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

where:

Q =volume flow rate [m³/h]

kv=volume flow rate at 1 bar pressure loss [m³/h]

Δp=pressure loss [bar]

Pressure loss graph

Graph	q_p [m³/h]	Nom. diameter [mm]	kv	Q@0.25 bar [m³/h]
A	0.6 & 1.5	DN15 & DN20	3	1.5
B	3 & 3.5 & 6	DN20 & DN25	15	7.5
C	10 & 15	DN40 & DN50	39	19
D	25 & 40	DN65 & DN80	89	45
E	60 & 100	DN100	600	300
F	150 & 250	DN150	1060	530
G	400	DN150	2050	1025
H	400 & 600	DN200 & DN250	4040	2020
J	1000	DN250	8160	4080

Table 10

Pressure loss diagram

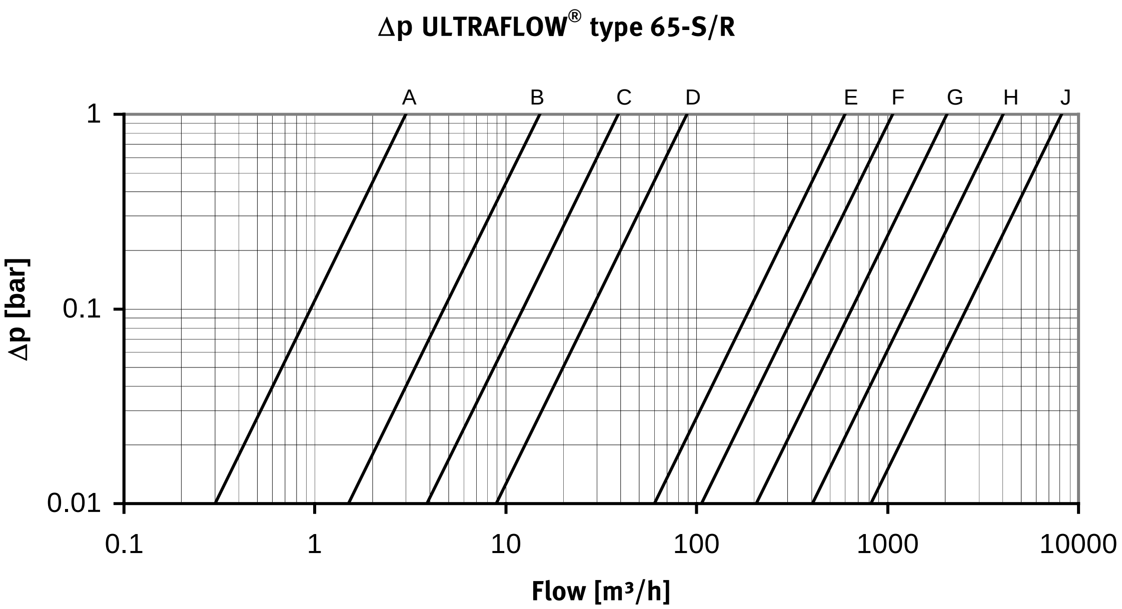
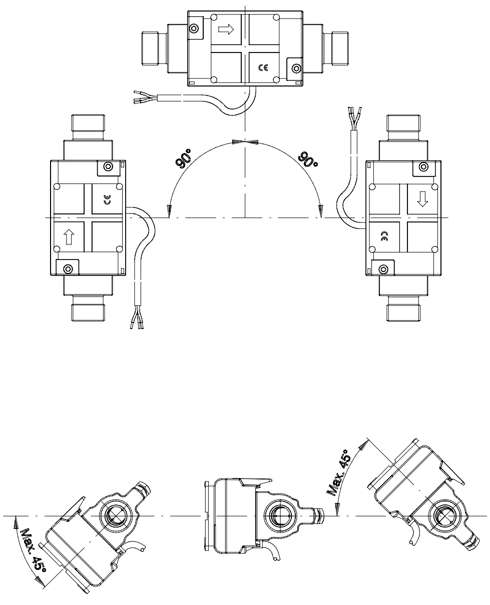


Diagram 1

7 Installation

7.1 Installation angle for ULTRAFLOW®

ULTRAFLOW® ≤ DN100



Figur 8

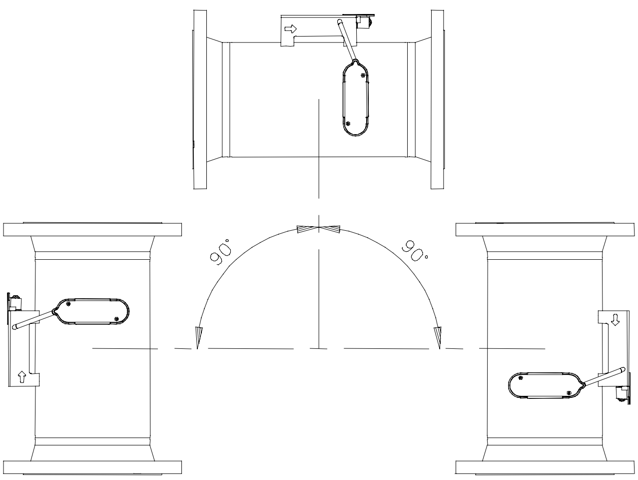
ULTRAFLOW® may be installed horizontally, vertically, or at an angle.

Important!

For ULTRAFLOW® ≤ DN100 (100 m³/h) the electronics/plastic case must be placed on the side (when installed horizontally).

ULTRAFLOW® may be turned up to ±45° in relation to the pipe axis.

ULTRAFLOW® ≥ DN150



Figur 9

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

Important!

For ULTRAFLOW® ≥ DN150 (150 m³/h) the electronics case must be placed upwards (when installed horizontally).

ULTRAFLOW® may be turned up to ±45° in relation to the pipe axis.

7.2 Straight inlet

Recommended straight inlet

ULTRAFLOW® class 3

DN15...DN20	No requirements
DN25...DN80	3...5 x DN inlet
DN100...DN250	10 x DN inlet and 3 x DN outlet

ULTRAFLOW® class 2

DN15...DN20	Min. 5 x DN
DN25...DN80	Min. 10 x DN
DN100...DN250	10 x DN inlet and 3 x DN outlet

For general information concerning installation see CEN report *DS/CEN/CR 13582, Heat meter installation – Some guidelines for selecting, installation and operation of heat meters.*

7.3 Installation examples

Gland meter with MULTICAL®/PULSE TRANSMITTER fitted on ULTRAFLOW®

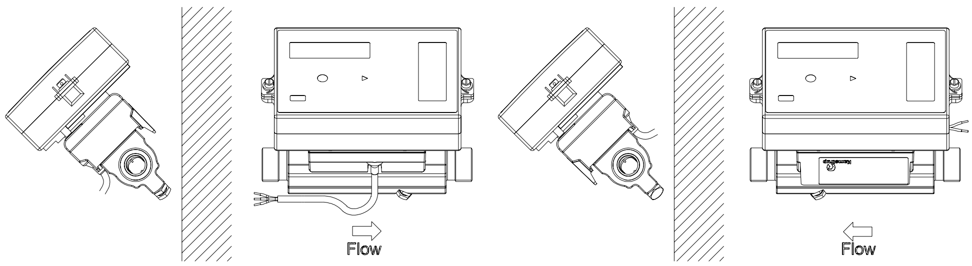


Figure 10

Glands and short direct sensor fitted into ULTRAFLOW® (only G¾ (R½) and G1(R¾)).

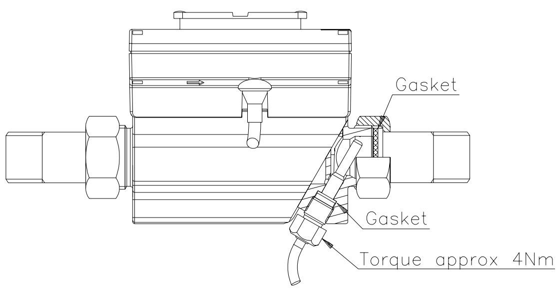


Figure 11

Flange meter with MULTICAL®/PULSE TRANSMITTER fitted on ULTRAFLOW®

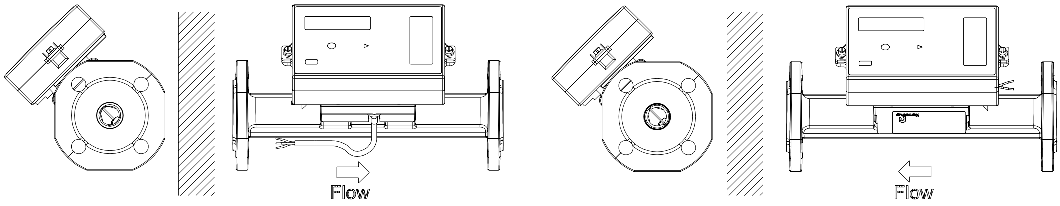


Figure 12

Please note: For meters ≥ DN100 MULTICAL® or PULSE TRANSMITTER **cannot** be fitted on the flow part.

7.4 Electrical connection

Connecting ULTRAFLOW® and MULTICAL®/MAXICAL

ULTRAFLOW®	→	**MULTICAL®/ MAXICAL III**
Blue (ground)/11A	→	11
Red (supply)/9A	→	9
Yellow (signal)/10A	→	10

Table 11

Connecting via PULSE TRANSMITTER/PULSE DIVIDER

3.65 VDC Supply. 6)	→	**PULSE TRANSMITTER/ PULSE DIVIDER**
Red (+)	→	60
Black (-)	→	61

6) *From battery or supply module*

Table 12

ULTRAFLOW®	→	**PULSE TRANSMITTER/ PULSE DIVIDER**		→	**MULTICAL®**
		In	**Out**		
Blue (ground)/11A	→	11	11A	→	11
Red (supply)/9A	→	9	9A	→	9
Yellow (signal)/10A	→	10	10A	→	10

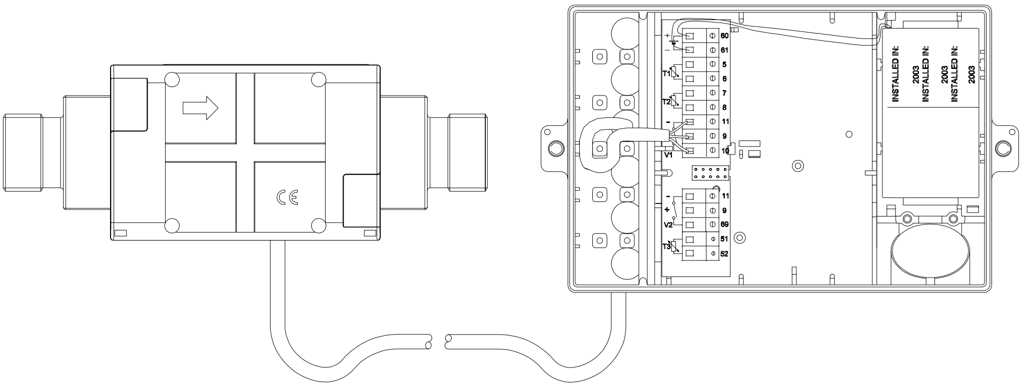
ULTRAFLOW®	→	**PULSE TRANSMITTER/ PULSE DIVIDER**		→	**MAXICAL III**
		In	**Out**		
Blue (ground)/11A	→	11	11A	→	11
Red (supply)/9A	→	9			
Yellow (signal)/10A	→	10	10A	→	10

Table 13

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

7.5 Example of connecting ULTRAFLOW® and MULTICAL®

ULTRAFLOW® type 65-S/65-R, $q_p \leq 100$ m³/h



Figur 13

ULTRAFLOW® type 65-S with terminal $q_p \geq 150$ m³/h

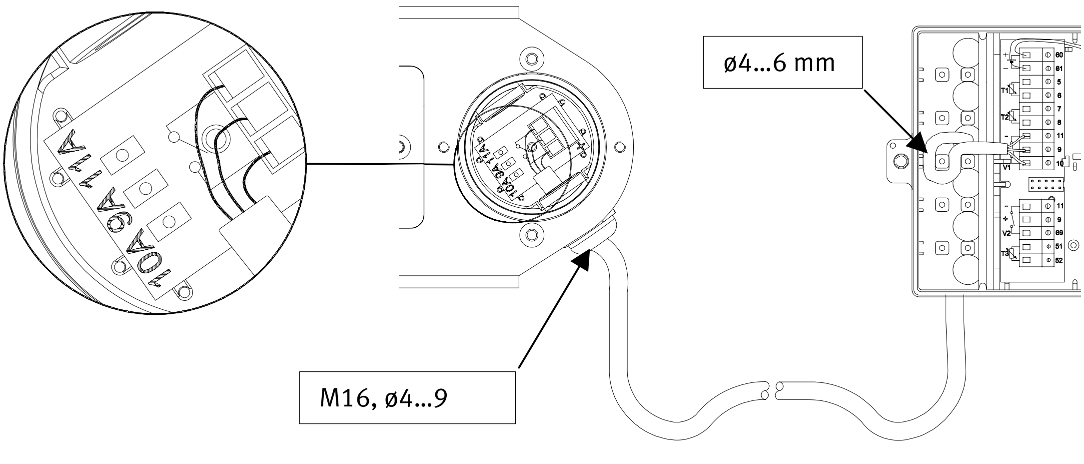


Figure 14

8 Functional description

8.1 Ultrasound combined with piezoceramics

Manufacturers of flow sensors have been working with alternative techniques to replace the mechanical principle. Research and development at Kamstrup has proved that ultrasonic measuring is the most viable solution. Combined with microprocessor technology and piezoceramics, ultrasonic measuring is not only accurate but also reliable.

8.2 Principles

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

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

The Doppler method is based on the frequency shifting which is generated when sound is reflected from a particle in the media. This is very similar to the effect you experience when a car drives by. The sound (the frequency) is reduced when the car passes by.

8.3 Transient time method

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

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

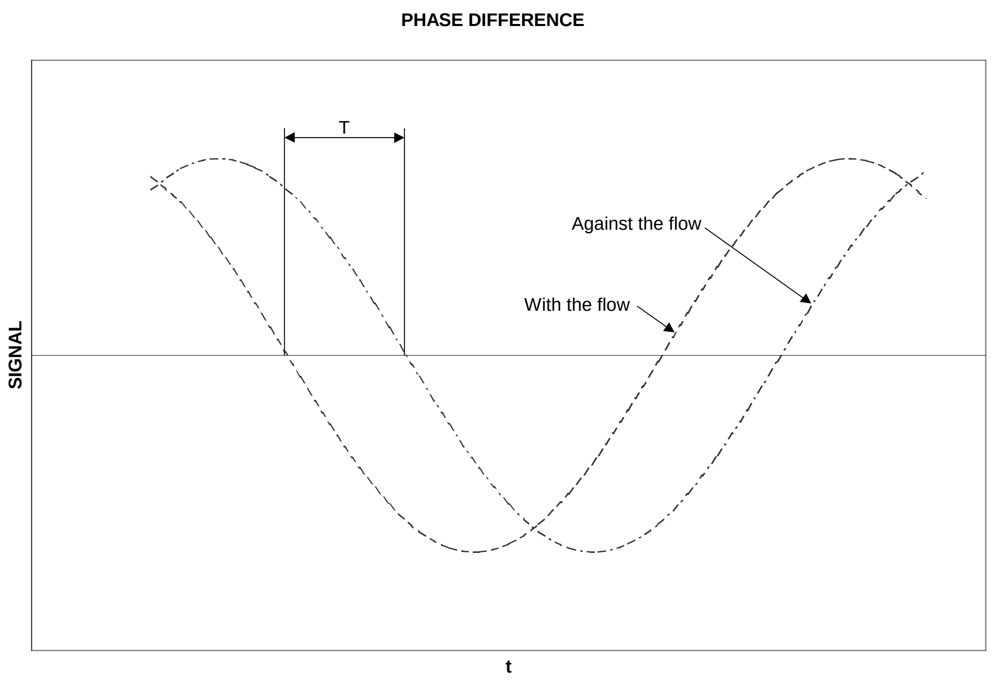


Diagram 2

In principle, flow is obtained by measuring the flow velocity and multiplying by the diameter of the measuring pipe:

$$Q = F \times A$$

where:

Q is the flow

F is the flow velocity

A the area of the measuring pipe

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

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

where:

L is the measuring distance

V is the sound radiation velocity

T is the time

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

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

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

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

where:

C is the velocity of sound in water

By using above formula following is obtained:

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

which can also be written as:

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

$$\Downarrow$$

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

As $C \rangle\rangle F, F^2$ can be omitted and the formula be written as:

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

To counteract the influence from variations in the velocity of sound in the water, this is measured. Velocity of sound in water is measured by means of the built-in ASIC. For this purpose a number of absolute time measurements are made between the two transducers. These absolute time measurements are then converted into the current velocity of sound used in connection with the flow calculations.

8.4 Signal paths

q_p 0.6…1.5 m³/h

Parallel

The sound path is parallel to the measuring pipe and is sent from the transducers via reflectors.

q_p 3…100 m³/h

Triangle

The sound path covers the measuring pipe in a triangle and is sent round from the transducers in the measuring pipe via reflectors.

q_p 150…1000 m³/h

2-tracks

Two parallel sound tracks diagonally in the measuring pipe

8.5 Measuring sequences

During flow measuring the ULTRAFLOW® is passing through a number of sequences, that are repeated at fixed intervals. These are only deviated from when the meter is in test mode and during initialization/start-up when connecting the supply.

In normal mode the routines are run through as stated in table below.

Time [s]	Operation
0	Measuring phase difference and absolute time with and against the flow - and pulse emission
1	Pulse emission
2	Pulse emission
3	Measuring phase difference and absolute time with and against the flow reference measuring - and pulse emission
4	Pulse emission
5	Pulse emission
6	Measuring phase difference and absolute time with and against the flow - and pulse emission
7	Pulse emission
8	Pulse emission
9	Measuring phase difference and absolute time with and against the flow - and pulse emission
10	Pulse emission
11	Pulse emission
12	Measuring phase difference and absolute time with and against the flow - and pulse emission

Table 14

If the meter is put into test mode the same routines are run through, but only at 1 sec. intervals between the measurings and not 3 sec. as in normal mode. See *Table 17* under test mode.

It may take as much as 16 seconds to function correctly following a power cut.

8.6 Function

In the meter's working area from min. cut off till saturation flow there is a linear connection between the water volume flowing through and the number of pulses being emitted. An example of the connection between flow and pulse frequency for ULTRAFLOW® q_p 1.5 m³/h. Is shown below (*Diagram 3)*.

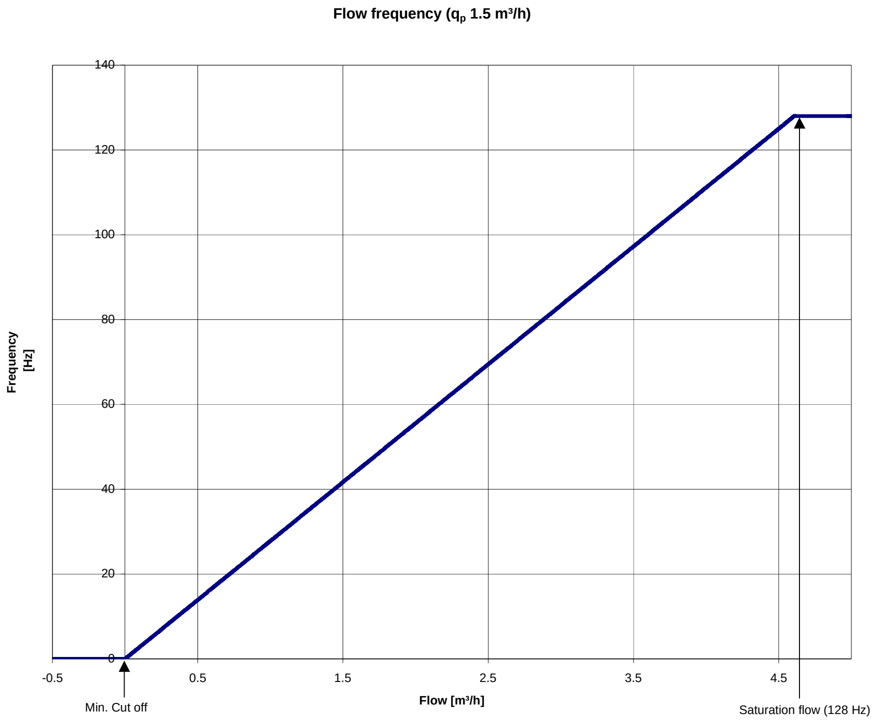


Diagram 3

If the flow is lower than min. cut off or negative, ULTRAFLOW® will not send out pulses (See *Diagram 3*).

At a flow above the saturation flow corresponding to pulse emission with a max. pulse frequency of 128 Hz, the max. pulse frequency will be maintained (See *Diagram 3*). *Tabel 15* shows the saturation flow (flow at 128 Hz) for the various flow sizes/meter factors.

q_p [m³/h]	Meter factor [pulses/l]	Flow at 128 Hz [m³/h]
0.6	300	1.54
1.5	100	4.61
3	50	9.22
3.5	50	9.22
6	25	18.4
10	25	18.4
10	15	30.7
15	10	46.1
25	10	46.1
25	6	76.8
40	5	92.2
60	2.5	184
100	1.5	307
150	1	461
250	0.5	922
400	0.4	1152
600	0.25	1843
1000	0.25	1843

Table 15

According to DS/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 errors. ULTRAFLOW® has no functional limitations during this period, when the meter operates above q_p. However, please note that high flow velocities may cause cavitation, especially at low static pressure.

8.7 Guidelines for dimensioning ULTRAFLOW®

In connection with installations it has proved to be practical to work with pressures larger than the pressures stated below:

Nominal flow q_p [m³/h]	Recommended operating pressure [bar]	Max. flow q_s [m³/h]	Recommended operating pressure [bar]
0.6	1	1.2	2
1.5	1.5	3	2.5
3	1	6	2
3.5	1	7	2
6	1.5	12	2.5
10	1	20 (18)	2
15	1.5	30	2.5
25	1	50 (45)	2
40	1.5	80	4.5
60	1	120	2
100	1.5	200	2.5
150	1	300	2
250	1.5	500	2.5
400	1	800	2
600	1.5	1200	2.5
1000	1.5	1800	2.5

Table 16

The purpose of recommended operating pressure is to avoid measuring errors as a result of cavitation or air in the water.

It is not necessarily cavitation in the sensor itself, but also bubbles from cavitating pumps or adjusting valves, that have been mounted before the sensor.

In addition, the water may contain air in the form of small bubbles or air in the water.

The risk of these factors affecting accuraccy is reduced by maintaining a fair pressure during installation.

In relation to above table, the steam pressure at actual temperatures must also be considered. Table 16 only applies to temperatures up to approx. 80° C.Furthermore, it must be considered that the above-mentioned pressure is the pressure at the sensor, and that the pressure is lower after a contraction than before (among other things cones). This means that the pressure – when measured elsewhere - might be different from the pressure at the sensor.

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

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

8.8 Pulse output

ULTRAFLOW®

Type	FET (open drain) with a pull-up resistance of 100 kΩ.
Output impedance	~10 kΩ
Pulse duration	2...5 ms
Pause	Depends on the actual pulse frequency

See also block diagram below.

Block diagram ULTRAFLOW®

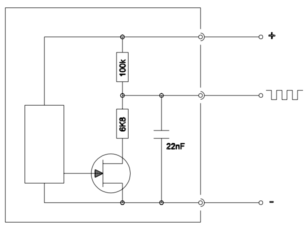


Figure 15

8.9 PULSE TRANSMITTER/PULSE DIVIDER

Type	Open collector. Can be connected as two-wire or as three-wire by means of the integral pull-up resistance of 33 kΩ
Output impedance	~2 kΩ
Imax.	0.2 mA
Supply (9A)	3...10 VDC
Pulse duration (PULSE TRANSMITTER)	2...5 ms
Pause (PULSE DIVIDER)	100 ms (standard)
Pause time	Depending on the actual pulse frequency

See also block diagram below.

Block diagram PULSE TRANSMITTER/PULSE DIVIDER (standard configuration)

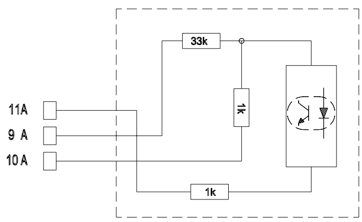


Figure 16

8.10 Pulse emission

Pulses are emitted for 1 sec. at fixed frequencies. The interval between the pulses is selected so that the sensor can transmit the measured and calculated number of pulses for each interval. This means that the pulses come in bursts, as illustrated below (See *Figure 17*).

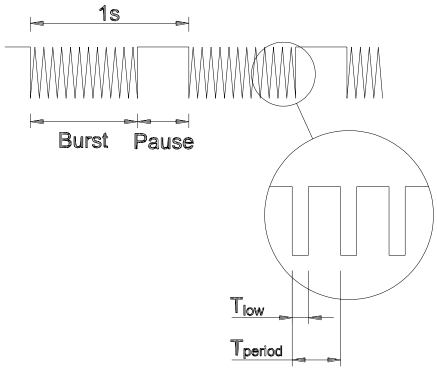


Figure 17

Below is an example of a burst frequency and max. number of pauses for an ULTRAFLOW® q_p 1.5 m³/h, both as a diagram and as a table. (See *Diagram 4* and *Tabel 17*). Furthermore, the table contains a T_{period} for the various burst frequences.

Diagram 4 also shows an example of a burst frequency. At 1.32 m³/h a limit frequency of 36.6 Hz is reached, and the pulse transmission routine changes into the next burst frequency, which is 42.7 Hz and that covers flow of up to 1.54 m³/h. In this interval the max. pause will be the difference between the number of pulses divided by the frequency. This gives a pause of 0.14 sec. immediately after the change into 42.7 Hz.

$$\frac{42.7\,pulses - 36.6\,pulses}{42.7\,pulses/\sec.} = 0.14\sec.$$

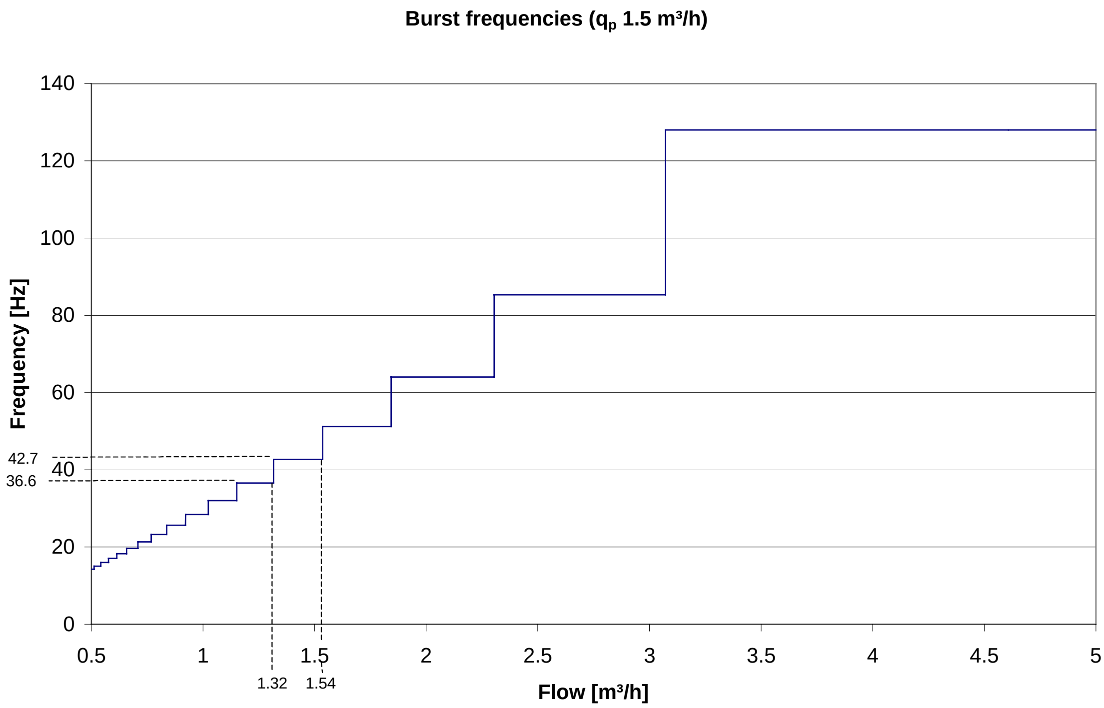


Diagram 4

Schematic outline of bursting pulses and pauses.

Flow (q_p 1.5 m³/h) [m³/h]	Burst frequencies [Hz]	Max. pause [s]	T_{period} [ms]
0.46	12.8	0.05	78
0.49	13.5	0.05	74
0.51	14.2	0.05	70
0.54	15.1	0.06	66
0.58	16.0	0.06	63
0.61	17.1	0.06	59
0.66	18.3	0.07	55
0.71	19.7	0.07	51
0.77	21.3	0.08	47
0.84	23.3	0.08	43
0.92	25.6	0.09	39
1.02	28.4	0.10	35
1.15	32.0	0.11	31
1.32	36.6	0.13	27
1.54	42.7	0.14	23
1.84	51.2	0.17	20
2.30	64.0	0.20	16
3.07	85.3	0.25	12
4.61	128	0.33	8

Table 17

8.11 Accuracy

ULTRAFLOW® type 65-S/R is a volume flow sensor specially developed for use with heat meters according to DS/EN 1434. Permitted tolerances in DS/EN 1434 for flow sensor with a dynamic range of 1:100 (q_i:q_p) are shown in the diagram below. The tolerances are defined for classes 2 and 3 with following formulas:

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

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

In DS/EN 1434 following dynamic ranges (q_i:q_p) are defined: 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 relationship between q_p og q_s. See *Table 1* for information on q_s for ULTRAFLOW®.

To ensure that the sensors meet the tolerance requirements, DS/EN 1434-5 specifies calibration requirements in connection with verification of sensors. The requirements for flow sensors are that they have to be tested at following 3 points:

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

During testing the water temperature must be 50°C ±5°C.

Further requirements are made as to the equipment used to perform the test. This must have a tolerance of less than 1/5 MPE (Max. Permissible Error) to ensure that acceptance limit is equal to MPE. If the equipment does not meet this standard, the acceptance limit must be reduced by the tolerance of the equipment.

ULTRAFLOW® type 65-S/R will typically do better than half of the permitted tolerances according to DS/EN 1434 cl.2.

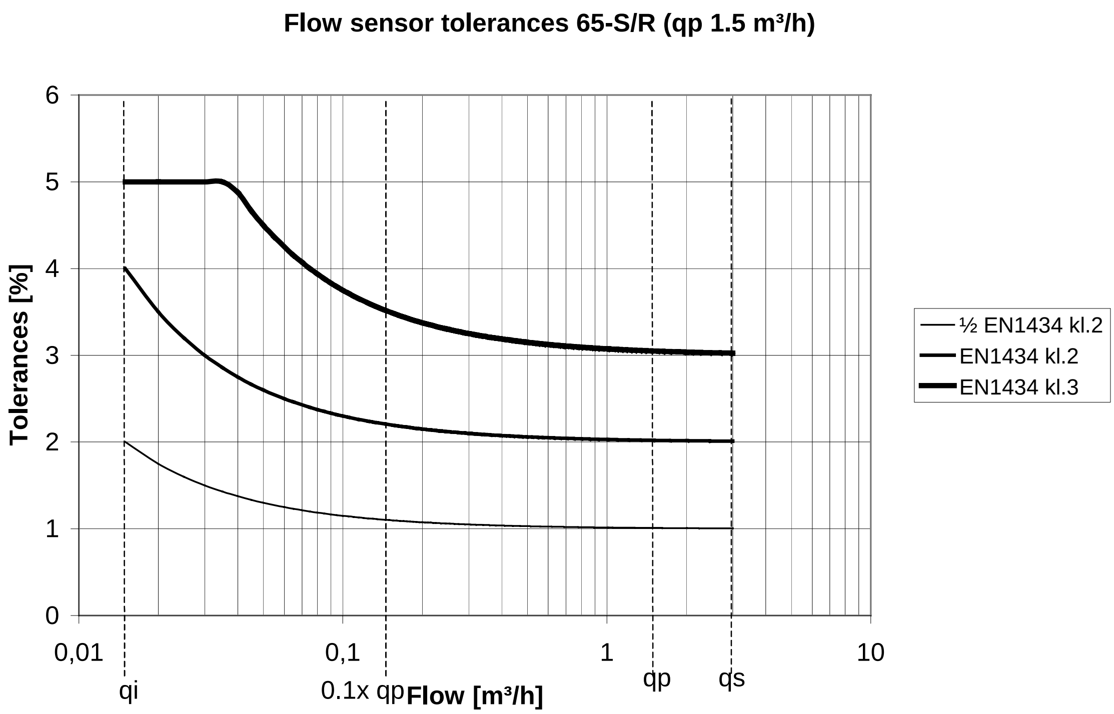


Diagram 5

8.12 Power consumption

The power consumption for ULTRAFLOW® is as follows:

Max. average	100 µA
Max. power	7 mA (max. 40 ms)

8.13 Interface plug/serial data

ULTRAFLOW® type 65-S/R is equipped with an 8 pole plug under the cover. Thus, it is not possible to access this plug without breaking the seal. On delivery, the cover will be sealed with a factory seal and in connection with verified sensors it will be a laboratory seal (legal seal).

The plug is used for:

- Programming meters, including adjusting the correction graph ready by means of METERTOOL
- Setting the sensor to test mode
- Reading accumulated water quantity in connection with calibration
- External control of start/stop in connection with calibration

The interface plug is built up as shown in sketch below (See *Fig.18*).

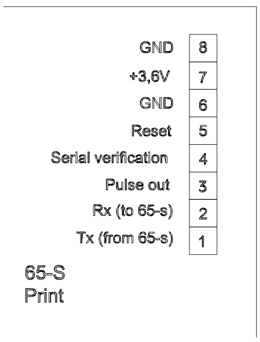


Figure 18

8.14 Test mode

To minimize the time spend on calibration, ULTRAFLOW® type 65-S/R can be put into test mode. When ULTRAFLOW® type 65-S/R is in test mode, the measuring routines only take one third of the time it takes in normal mode. The routines with ULTRAFLOW® in test mode are described in *Table 18* below. See also *Table 14* for ULTRAFLOW® in normal mode.

Time [s]	Operation
0	Phase difference- and absolute time measurement with and against the flow as well as pulse emission
1	Phase difference- and absolute time measurement with reference measurements with and against the flow as well as pulse emission
2	Phase difference and absolute time measurement with and against the flow as well as pulse emission
3	Phase difference and absolute time measurement with and against the flow as well as pulse emission
4	Phase difference and absolute time measurement with and against the flow as well as pulse emission

Table 18

ULTRAFLOW® type 65-S/R is put into test mode by connecting pin 4 of the internal plug to ground. (See *Fig. 18*).

Please note: An ULTRAFLOW® type 65-S/R in test mode uses approx. 3 times as much power as normal. However, this does not influence the total battery lifetime of the energy meter.

8.15 Externally controlled start/stop

In connection with calibration by means of serial data, e.g. in connection with NOWA, it is possible to control ULTRAFLOW® externally by means of a signal. This is done by grounding pin 4 on the internal plug, when testing is started. The ground connection should be removed when testing is completed. The volume of water that has accumulated during the test can then be read serially.

Data on which the accumulation is based is identical whith those used for calculating the number of pulses to be emitted.

In addition to accumulating water volume during testing, the sensor calculates the quantity lacking in connection with start, and the very large quantity in connection with stop. These deviations are due to the regular intervals at which the sensor measures flow as illustrated in *Fig. 19* below.

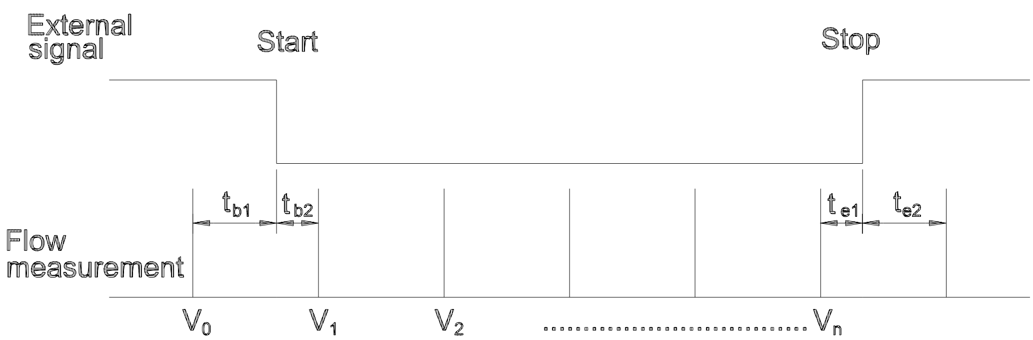


Figure 19

The missing water volume in connection with start is the water volume that runs through the sensor during the time t_{b2} before the first accumulation V_1 within the test period. In the same way the water volume for the period t_{e2} is reduced at the end after the last accumulation V_n .

The accumulated volume during the test can be stated as:

$$\sum \frac{V_{1} \times t_{b1}}{t_{b1} + t_{b2}} + V_{1} \ldots + V_{n-1} + \frac{V_{n} \times t_{e1}}{t_{e1} + t_{e2}}$$

8.16 Course of calibration by means of serial data and externally controlled start/stop

When using serial data to calibrate ULTRAFLOW® type 65-S the routine is as outlined below.

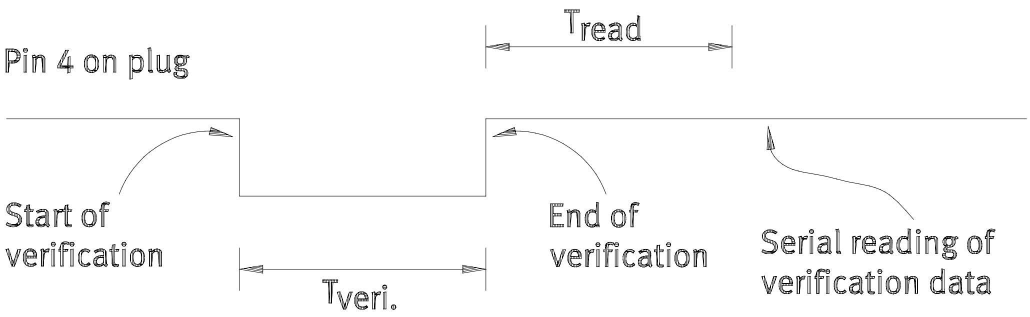


Figure 20

Start calibrating by pulling the 4th pin on the internal plug (see *Fig.18*) down, simultaneously with starting the test. E.g. this might take place at the same time as the master meter is started or at the same time as the diverter to the weights are being changed. Then ULTRAFLOW® starts accumulating the water volume, until you release pin 4 and terminate the test. Subsequently, the accumulated volume from the test can be read with respect to start and stop. From the test has been completed and until the accumulated quantity of water can be read, min. 2 sec. must pass (T_{read}). No communication must take place with ULTRAFLOW® during testing. Resolution of the water volume read is a factor 4096 larger than the sensor factor for the sensor in question.

The following has been checked in connection with the Danish type approval to ensure that various tests are equally valid:

1. That there is a satisfactory connection between the results in standard mode (pulses) and in test mode, both with respect to pulses and serial data.
2. That an externally controlled start/stop in the meter is handled satisfactorily

As a result, the Danish type approval permits verification of ULTRAFLOW® type 65-S/R on pulses in standard mode, on pulses in test mode as well as serial data in test mode when using the externally controlled accumulation register.

9 Calibrating ULTRAFLOW®

It is possible to calibrate in the following ways:

- On pulses in standard mode
- On pulses in test mode
- On pulses using PULSE TESTER type 66-99-279
- On serial data with the meter in test mode (e.g. used in connection with NOWA).

9.1 Installation

ULTRAFLOW® with flow ranges from 0.6 m³/h to 3.0 m³/h (DN15 and DN20) can be installed without considering straight inlets. Other ULTRAFLOW® sizes must be mounted with a straight inlet of min. 3...5 x DN. See paragraph 9.8 "*Optimization in connection with calibration*".

ULTRAFLOW® must be installed without considering installation angle. See the restrictions in paragraph 7 "*Installation*".

9.2 Technical data for ULTRAFLOW®

Output signal

q_p [m³/h]	Meter factor [pulses/l]	CCC code
0.6	300	116
1.5	100	119
3	50	136
3.5	50	151
6	25	137
10	25	137
10	15	178
15	10	120
25	10	120
25	6	179
40	5	158
60	2.5	170
100	1.5	180
150	1	147
250	0.6	181
400	0.4	171
600	0.25	172
1000	0.25	172

Table 19

Output ULTRAFLOW®

Type	FET (open drain) with a pull-up resistance of 100 kΩ
Output impedance	~10 kΩ
Pulse duration	2...5 ms
Pause	Depending on the actual water flow
Frequency	0 - 128 Hz, depending on flow sensor type and approval range

Block diagram ULTRAFLOW®

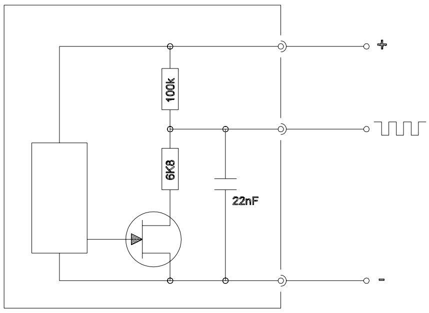


Figure 21

Connection via 3 wire cable

Yellow	Signal
Red	Supply
Blue	Ground
Supply	3.6 VDC ± 10%

Output when using PULSE TRANSMITTER

Type	Open collector. Can be connected as a two-wire or as a three-wire via the built-in pull-up resistance of 33 kΩ.
Output impedance	~2 kΩ
I_{max}	0.2 mA
Supply (9A)	3…10 VDC
Pulse duration	2…5 ms
Pause	Depending on the actual pulse frequency.

Block diagram PULSE TRANSMITTER

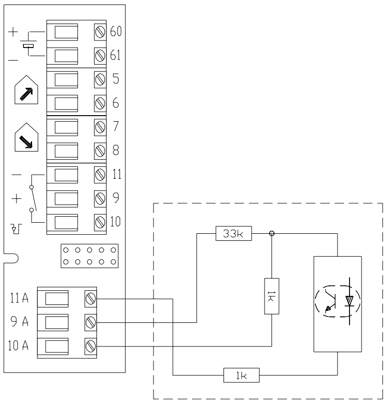


Figure 22

9.3 Starting up

16 seconds must ellapse from start up to calibration in order to allow a true reading to be reached.

9.4 Measuring flow

To obtain a correct flow measurement, calibration must take min. 2 minutes.

9.5 Evacuation

ULTRAFLOW® must NOT be evacuated (subjected to vacuum).

9.6 Suggested test points

Table showing ULTRAFLOW®, including suggested test points, test times and test quantities.

Nom. flow	Meter factor	Test point			Test time			Test quantities		
q_p [m³/h]	[pulses/l]	q_p [m³/h]	q_i [m³/h]	0.1 x q_p [m³/h]	q_p [min]	q_i [min]	0.1 x q_p [min]	q_p [kg]	q_i [kg]	0.1 x q_p [kg]
0.6	300	0.6	0.006	0.06	3	20	6	30	2	6
1.5	100	1.5	0.015	0.15	3	20	6	75	5	15
3	50	3	0.03	0.3	3	20	6	150	10	30
3.5	50	3.5	0.035	0.35	3	17.2	6	175	10	35
6	25	6	0.06	0.6	3	20	6	300	20	60
10	25	10	0.1	1	3	12	6	500	20	100
10	15	10	0.1	1	3	20.4	6	500	34	100
15	10	15	0.15	1.5	3	20	6	750	50	150
25	10	25	0.25	2.5	3	12	6	1250	50	250
25	6	25	0.25	2.5	3	20.2	6	1250	84	250
40	5	40	0.4	4	3	15	6	2000	100	400
60	2.5	60	0.6	6	3	20	6	3000	200	600
100	1.5	100	1	10	3	20	6	5000	333	1000
150	1	150	1.5	15	3	20	6	7500	500	1500
250	6	250	2.5	25	3	20	6	12500	833	2500
400	4	400	4	40	3	18.8	6	20000	1253	4000
600	0.25	600	6	60	3	20	6	30000	2000	6000
1000	0.25	1000	10	100	3	12	6	50000	2000	10000

Table 20

The suggested testing parameter is based on EN 1434-5 and q_i:q_p 1:100.

Each individual test set-up has been selected on the basis of:

Min. test times of 3 minutes.

Water volume for q_i and 0.1xq_p of min. 10% of the water volume per hour

Water volume for 0.1xq_p corresponding to min. 1000 pulses

Quantity of water for for q_i corresponding to min. 500 pulses

These suggested test points can be optimised to each individual rig and the test purposes.

9.7 Sealing

On delivery, ULTRAFLOW® is sealed by our factory. If the sensors are verified they will be supplied with laboratory marks and a year mark.

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

Sealing for:

ULTRAFLOW® type 65-S/R q_p 0.6…40 m³/h

ULTRAFLOW® type 65-S/R q_p 60 & 100 m³/h

ULTRAFLOW® type 65-S/R q_p 150…1,000 m³/h

PULSE TRANSMITTER

is shown below.

On the drawings the sealing is divided into following groups:

H	Verification year
E	Laboratory mark/seal
B	Installation seal

ULTRAFLOW® type 65-S/R q_p 0.6…40 m³/h

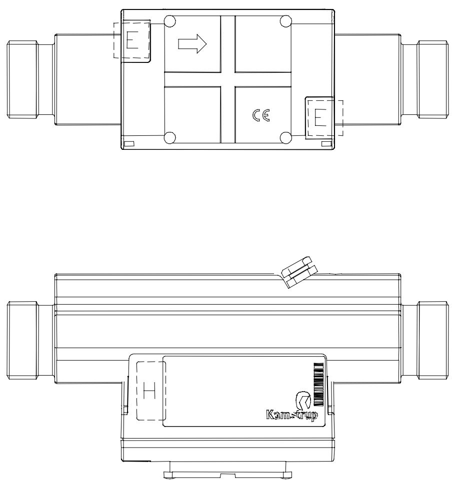


Figure 23

ULTRAFLOW® type 65-S/R q_p 60 and 100 m³/h

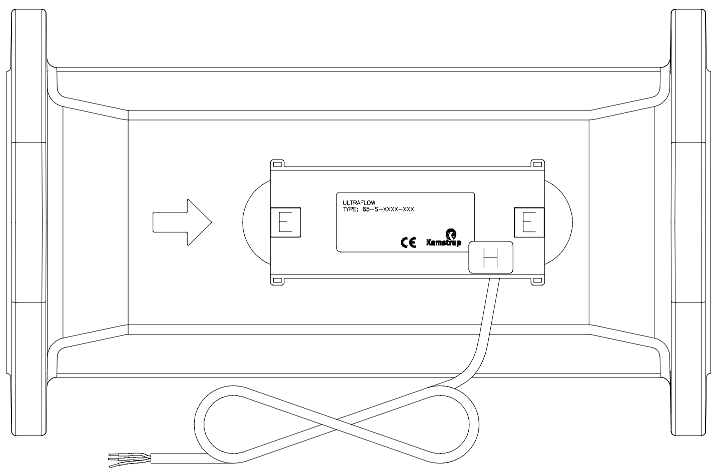


Figure 24

ULTRAFLOW® type 65-S/R q_p 150…1,000 m³/h

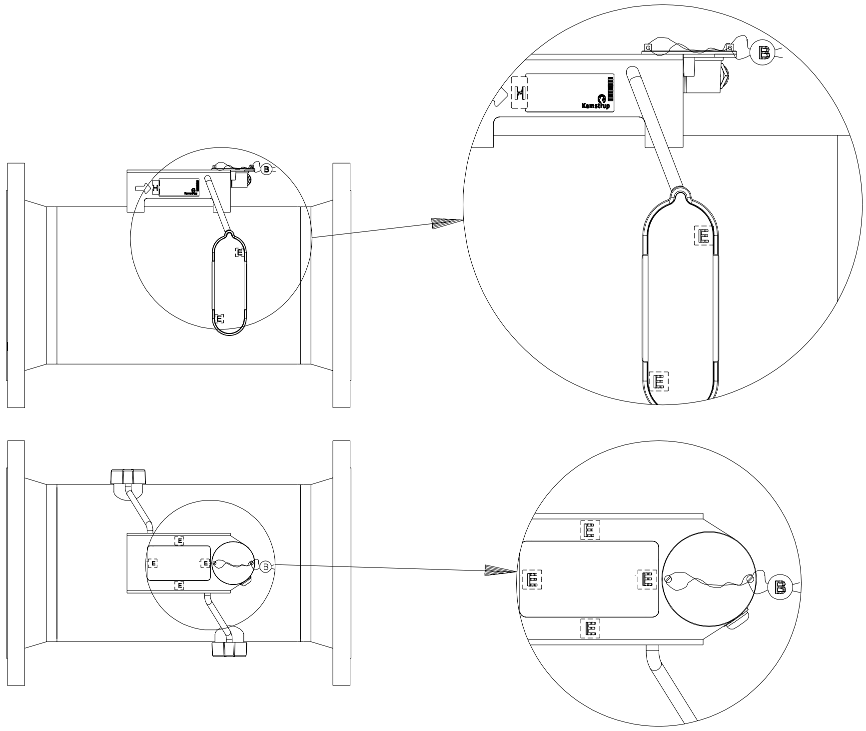


Figure 25

PULSE TRANSMITTER

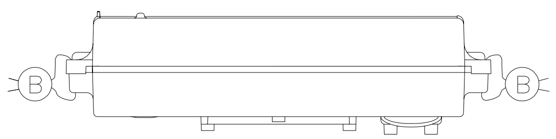


Figure 26

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

9.8 Optimizing in connection with calibration

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

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

In connection with optimization of calibration the following aspects should be taken into account:

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

Temperature: Calibration temperature according to DS/EN 1434-5 is 50°C ±5°C.

Water quality: No requirements

Installation - mechanical conditions:

To avoid flow disturbances the inlet pipes and distance pieces must have the same nominal diameter as the sensors (see *Table 21*). There should be min. 5 x DN between the sensors. With bends etc. there should be a min. distance of 10 x DN. If tests are made at low flow with a bypass at a right angle to the pipe, it would be an advantage to mount an absorber that absorbs pressure fluctations due to the angle of the inlet pipe. This can be a flexible tube on the bypass. In addition, it would be advantageous to fit a flow straightener before the first distance piece. Flow disturbances such as pulsations, e.g. pump fluctuations must be minimized. In connection with calibration, a code of practice concerning distance pieces has been made on the basis of years of experience:

The length of the distance piece must be 10 x D.

The diameter on the distance piece must be:

Connection	Distance piece dia.	Gland dia.
G¾ (R½) DN15	13	13/13.5
G1 (R¾) DN20	20	19.5
DN20	20	
G5/4 (R1) DN25	25	25.5
DN25	25	
G2 (R1½) DN40	40	39
DN40	40	
DN50	50	
DN65	65	
DN80	80	
DN100	100	
DN150	150	
DN200	200	
DN250	250	

Table 21

Installation - electrical conditions:

To avoid external disturbances and to achieve an electrical interface as that of MULTICAL®, we recommend that you use a PULSE TESTER.

9.9 PULSE TESTER

During a calibration process it is often practical to use a PULSE TESTER type no. 66-99-279, that has following functions:

Galvanically separated pulse outputs

Integral supply for ULTRAFLOW®

LC-Display with counter

Externally controlled ”Hold” function

Can be fitted directly on a MULTICAL® base unit (type 66-)

9.10 Technical data for PULSE TESTER

Pulse inputs (M1/M2)

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

Please note: There are one or two pulse inputs/outputs depending on which base unit is used.

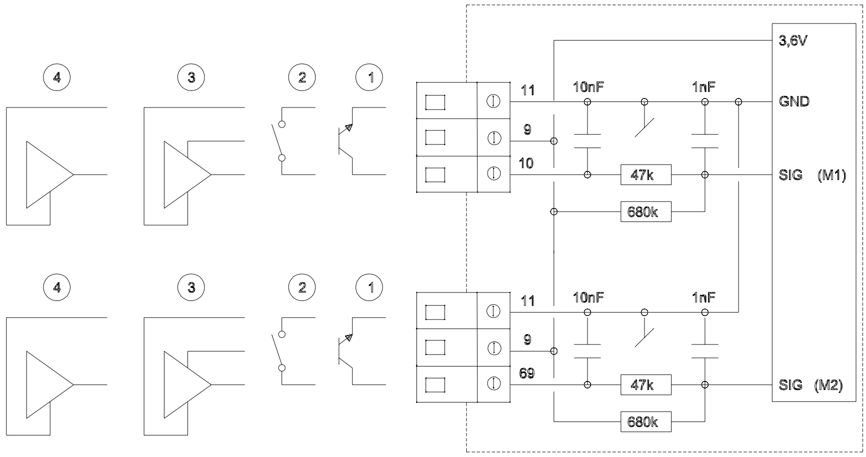


Figure 27

1 **Flow sensor with transistor output**

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

The leak current of the transister must not exceed 1 μA when switched OFF, and U_{CE} when switched ON must not exceed 0.5 VDC.

2 **Flow sensor with relay or reed contact output**

The transmitter is a reed contact, typically 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 bouncing problems.

3 **Flow sensor with active pulse output, supplied from the pulse tester**

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

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

Table 22

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

Flow sensors with active signal output must be connected as shown in *Fig. 27 point. 4*. 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)

Pulse duration	>3.9 ms
Pause	3.9 ms
Two wire connection:	
Voltage	<24 V
Load	>1.5 kΩ
Three wire connection:	
Voltage	5...30 V
Load	>5 kΩ

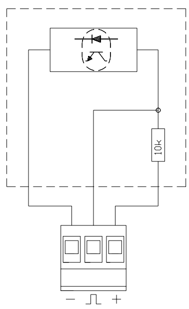


Figure 28

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

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

Hold input (HOLD)

Input	Galvanically isolated
Input protection	Against reversed polarity
"Open input"	Count (see *Fig. 29* below)

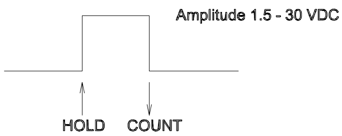


Figure 29

9.11 Hold function

When the Hold input is activated (High level added to input), the counter stops at the number of pulses counted.

When the Hold signal is deactivated (Low level added to input), the counter is restarted and new counting starts.

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

9.12 Push-button functions

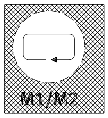


Figure 30

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

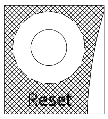


Figure 31

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

9.13 Using the PULSE TESTER

The PULSE TESTER can be used in the following ways:

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

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

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

With flying start/stop of the flow sensors using the pulse outputs controlled by external equipment (Sample & Hold).

9.14 Spare parts

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

9.15 Changing the battery

If the PULSE TESTER is used continously we recommend that the battery be replaced once a year.

Connect the battery to the terminals marked ”batt.” with the red wire to + and the black to -.

Power consumption:

Power consumption with no sensors connected	400 µA
Max. power consumption with 2 ULTRAFLOW® connected	1.5 mA

Please note: If the base unit is supplied by battery or external supply, the PULSE TESTER’s integral supply must be disconnected (the plug must be removed).

9.16 Connection examples

Pulse inputs/flow sensor inputs

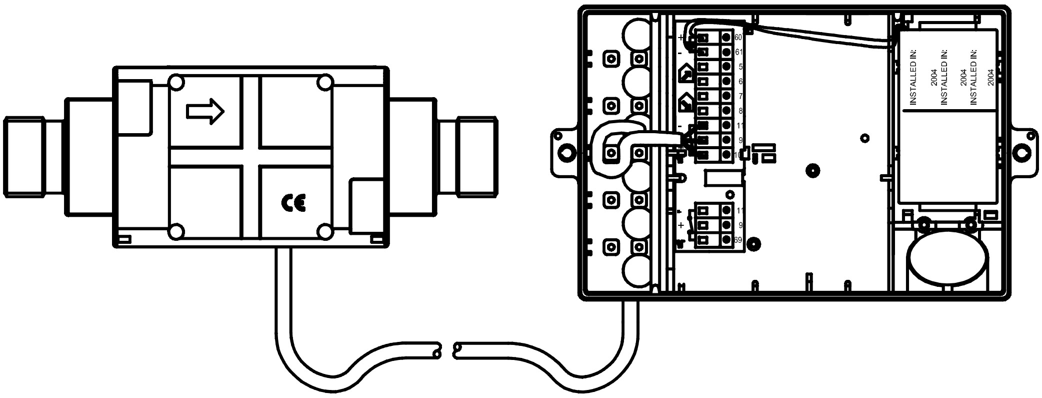


Figure 32

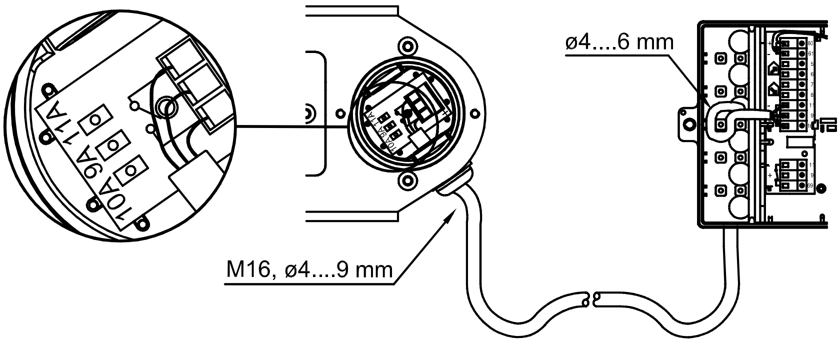


Figure 33

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

Table 23

Pulse outputs

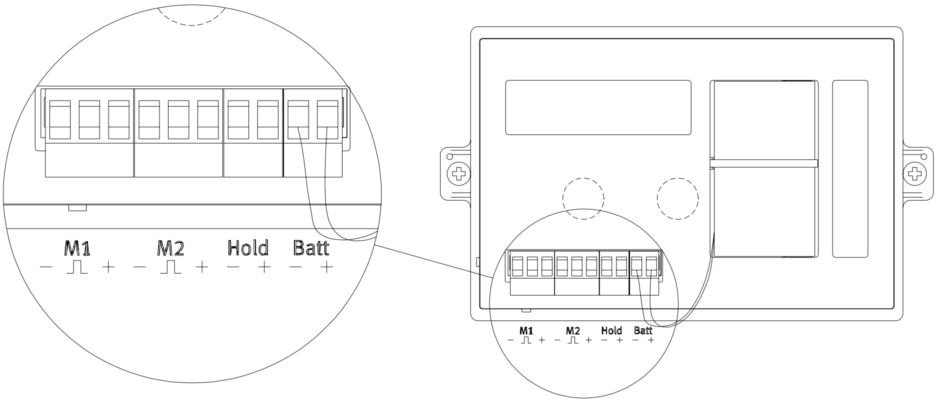


Figure 34

10 METERTOOL

10.1 Introduction

METERTOOL is a set of programs for servicing Kamstrup heat meters.

METERTOOL for ULTRAFLOW® type 65-X is a Windows software, that makes ajustment of ULTRAFLOW® type 65-S/R possible by means of a computer and an interface.

METERTOOL is developed to give laboratories simple and efficient access to programming/calibrating of ULTRAFLOW® type 65-S/R. It is also used for programming the PULSE DIVIDER and writing out labels.

10.2 Computer requirements

METERTOOL is suitable for installation under Windows 95/98/ME/NT4/2000 on Pentium-based computers with min. 16 MB RAM, 20 MB idle capacity on the hard disk and a VGA monitor min. 640 x 480. Recommended 800 x 600 or more.

To install the program, the PC must be furnished with a 680 MB CD drive.

To adjust ULTRAFLOW® type 65-S/R a serial data connection (COM port) and an interface between the flow sensor and the PC is used. The program must be set up to use COM1...8 of the PC.

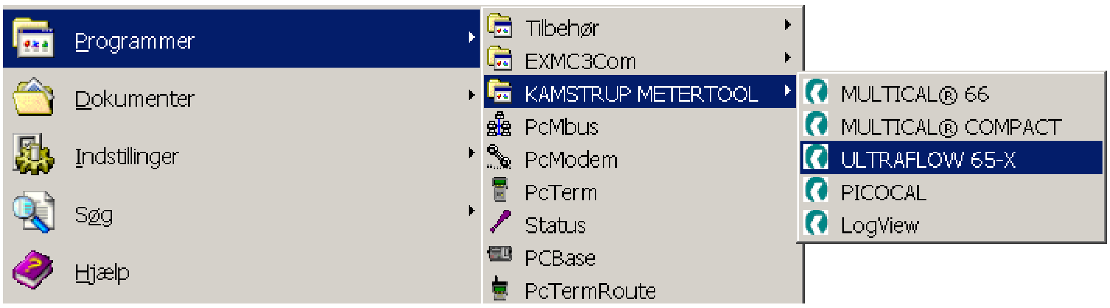
Connect the printer to the parallel port of the computer. We suggest that the printer is of the type OKI 610ex or similar.

10.3 Software installation

Make sure that the computer has an idle capacity of min. 20 MB on the hard disk, e.g. via the Windows file system. Close other open Windows programs before installing the program.

Insert the CD into your drive and follow the instructions. If “Automatic message, when the CD is inserted” is not displayed, start the installation program by selecting D:\CD\setup.exe under "Run" in the start menu (provided that the drive specification of the CD is “D”).

When installation is complete, the icon “KAMSTRUP METERTOOL” will appear in the start menu. Click on the new icon “KAMSTRUP METERTOOL”, and the list of ”METERTOOL” programs selected during installation appears. Double click on “ULTRAFLOW 65-X” to start the program METERTOOL for ULTRAFLOW® type 65-S/R.



Picture 1

10.4 Interface; Connecting ULTRAFLOW® type 65-S/R to the PC

The flow sensor is adjusted by serial data transfer between flow sensor and computer. Data transfer is made by means of an interface type 66-99-140 (PC interface for ULTRAFLOW® type 65-S).

The interface includes a 9-pole SUB-D plug to connect to the COM port of the computer, and 8-pole plug for connecting the flow sensor, and a lithium battery for supplying the flow sensor.

Please note: Never connect external voltage to a lithium battery. When external voltage supply e.g. from the PULSE TESTER or MULTICAL® is used, the internal supply must be cut off.

To mount the plug into the flow sensor, remove the sealing cover. To remove the cover unscrew the two screws at the top of the cover under the sealing labels. The sealing cover can then be taken off. If the sensor is going to be used where verification is required, reverification and sealing must be made by an authorised laboratory, before the sensor can be reinstalled. See *Figure 23…26* for placing the laboratory labels and year marks. Placing the 8-pole plug in ULTRAFLOW® is shown in *Figure 35*.

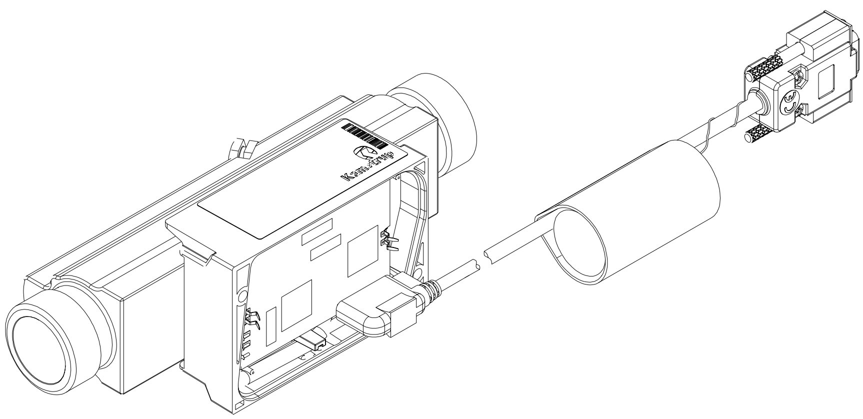


Figure 35

10.5 Using the program

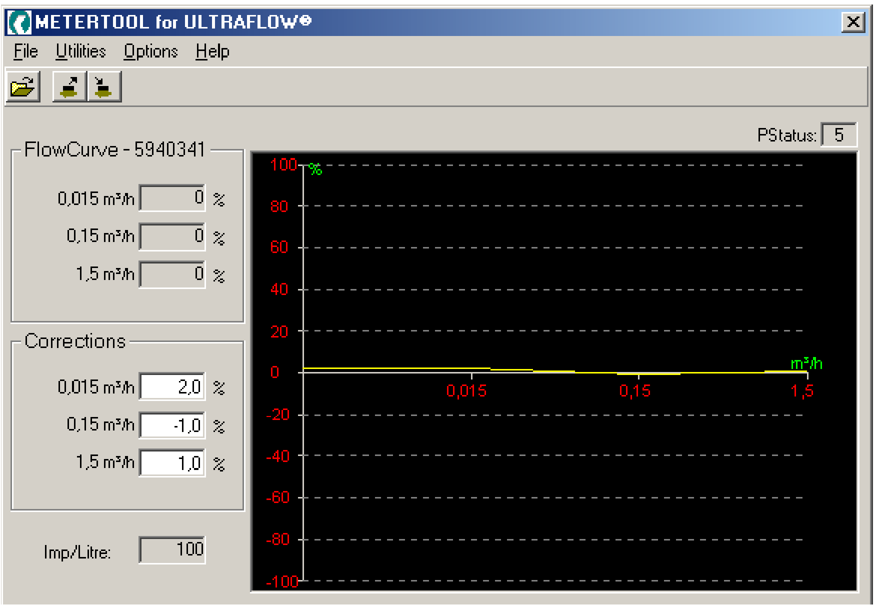
The menu structure for METERTOOL 65-X is as follows:

File	Utilities	Options	Help
Read from Meter	Pulse Divider	Change COM port	About METERTOOL…
Send to Meter			
Open from Database			
Print Setup			
Exit Crtl+X			

Comments to the menu items:

Read from Meter

Reads programming data for the connected meter. During reading the status is shown in the status field to the left of date/time. See *Picture 2* after reading.



Picture 2

After reading the following is displayed:

FlowCurve - 5940431. This is the number of the standard programming used for the sensor in question. This number will also appear on the label on the meter. In the field under the flow curve in question the sensor values are shown for the sensor in question in relation to the standard curve. These values are also shown as a curve.

Imp/Litre:
The pulse figure of the sensor.

PStatus:
Indicates the number of times the sensors has been programmed.

Send to sensor

Menu option for programming the sensor. Before programming the correction values "Corrections" can be keyed in, or the standard flow curve can be retrieved in "Open from Database".

Corrections. In this menu the requested corrections can be keyed in q_i, $0{,}1xq_p$ and q_p. The shown values appear after tests with the following results: q_i –2%, correction 2%, $0.1xq_p$ 1%, correction -1% and finally q_p-1%, correction 1%.

Open from Database

Under this option a standard flow curve for the flow sensors can be retrieved. If the sensors has been programmed several times, we recommend that you return to the standard flow curve to ensure a continuous course. The program does not prevent you from entering programming data for other sensor types.

Print setup

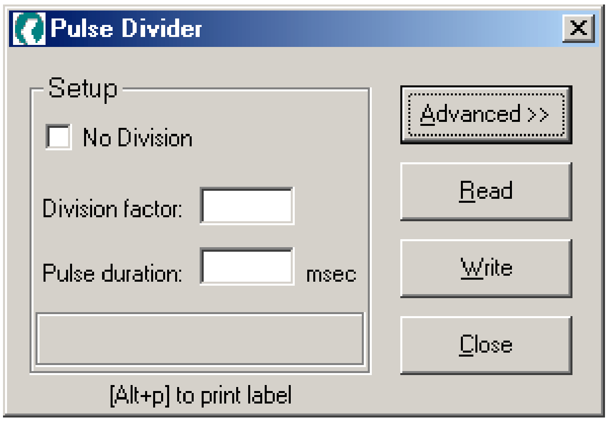
Setting up printer and print margins for printing out labels (only PULSE DIVIDER).

Exit Crtl+X

Closes METERTOOL.

PULSE DIVIDER

Setup and programming of PULSE DIVIDER. A PULSE DIVIDER is used to adapt the flow signal to the calculators. E.g. if a calculator of another make is connected to Kamstrup's ULTRAFLOW®, where the coding is not identical (number of pulses CCC or pulse duration).



Picture 3

Advanced

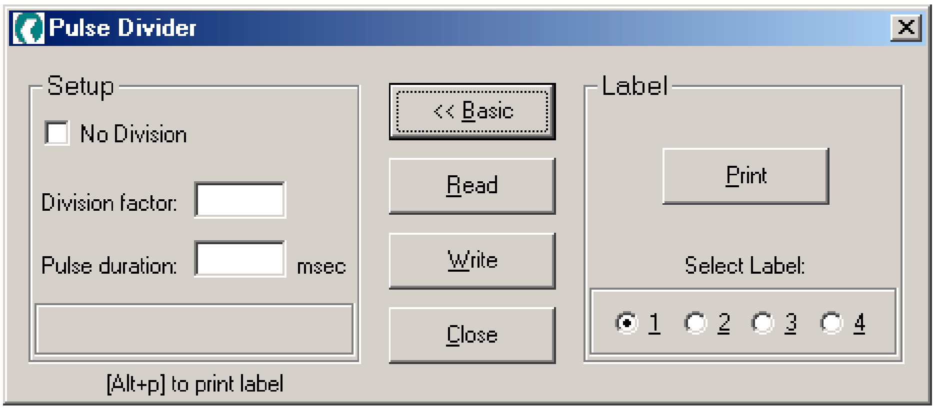
Is used for printing out labels for PULSE DIVIDER.

Select Label

Selects placing on Kamstrup label sheets.

Print

Prints out labels.



Picture 4

Read

Reads the present coding of PULSE DIVIDER.

Write

Programs the entered data into PULSE DIVIDER.

Close

Terminates PULSE DIVIDER.

Pulse division (pulse duration of divided pulses standard 100 ms)

ULTRAFLOW®		PULSE DIVIDER							
q_p [m³/h]	Meter factor [pulses/l]	Meter factor [l/pulse]	Divider	Meter factor [l/pulse]	Divider	Meter factor [l/pulse]	Divider	Meter factor [l/pulse]	Divider
0.6	300	1	300	2,5	750				
1.5	100	1	100	2,5	250	10	1000		
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 24

Pulse division table when used together with Kamstrup EVL

ULTRAFLOW®		PULSE DIVIDER & 11EVL (pulse duration 50 ms)		PULSE DIVIDER & 11EVL (pulse duration 100 ms)	
q_p [m³/h]	Meter factor [pulses/l]	Meter factor [l/pulse]	Divider	Meter factor [l/pulse]	Divider
0.6	300	1	300	2.5	750
1.5	100	1	100	2.5	250
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 25

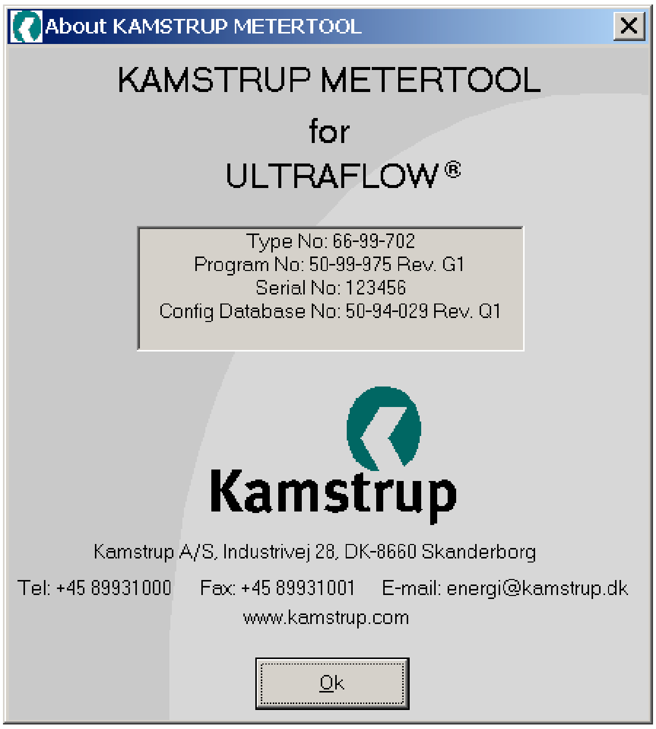
For other variants, please see installation guide for PULSE DIVIDER No. 5511-727.

Change COM port

Is used for selecting COM port for programming. Options 1...8 are possible, if available on the computer .

Picture 5

About METERTOOL...



Picture 6

Displays:

Type number of the program

Program number and revision status

Serial number of the program

Revision of the database

10.6 Update

The program is supplied with a database containing data for variants that have been released before the program was produced. If adjustments should be made to a sensor which is not in the database, it can be read and then stored automatically in the database, after which adjustments can be made. It is possible to read and automatically store programming data, if the sensor has not been programmed subsequent to production.

To update the database in METERTOOL please contact our sales department - we can provide an update via e-mail.

The update follows an installation program called “METERTOOLUPDATE”, that automatically makes the update.

The installation program is activated when “C:\UPDATE\METERTOOLUPDATE.EXE” under "Run" is started in the start menu (provided that the update is placed in the folder “C:\UPDATE”).

10.7 Requirements

Before making any adjustments to the sensor you must make sure that the sensor operates satisfactorily on the flow rig. See paragraph 9 “*Calibration of ULTRAFLOW®*”.

If the sensor has to be adjusted by more than a few percentages, it is probably defective, and should not be adjusted.

11 Approvals

11.1 Type approval

ULTRAFLOW® type 65-S and 65-R are approved by EFS according to EN 1434-4 and OIML R75.

The test report - project K286128 – forms the basis of type approvals in a number of countries, including Denmark.

TS 27.01 113	TS 27.01 109	PTB 22.56 00.03
OIML R75	DS/EN 1434	

For further details on type approval and verification, please contact Kamstrup A/S.

11.2 CE marking

ULTRAFLOW® type 65-S and 65-R are marked according to following directives

EMC directive	89/336/EEC
LV directive	73/23/EEC (together with PULSE TRANSMITTER or PULSE DIVIDER)
PE directive	97/23/EC (DN50...DN100 category I, DN150...DN250 category II)

12 Trouble shooting

Before you send in the sensor for repair or control, 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 the battery or check the net supply
No display function (blank display)	No voltage supply and backup	Replace back-up cell. Replace battery or check power supply
No accumulation of m^3	No volume pulses Incorrect connection Flow sensor is inverted Air in the sensor/cavitation Flow sensor error	 Check flow sensor connection (If necessary, use PULSE TESTER for control) Check flow sensor direction 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. Replace the flow sensor. Send in the sensor for repair.
Erroneous accumulation of m^3	Erroneous programming Air in the sensor/cavitation Flow sensor error	Check that the meter factor, the calculator and the flow sensor correspond. Check the installation angle. Check if there is air in the system or cavitation from valves and pumps.If possible, increase the static pressure. Replace the flow sensor/send in the sensor for repair.

13 Disposal

Kamstrup heat meters have been constructed for many years of reliable operation. As we know, however, all good things come to an end, and the heat meter is no exception. It must, of course, be disposed of with consideraton to the environment. During development of MULTICAL® and ULTRAFLOW® we aim at recycling as many components as possible environmentally correct.

DISPOSAL MADE BY THE SUPPLIER

Kamstrup accepts MULTICAL® and ULTRAFLOW® for environmentally correct disposal according to previous agreement. The disposal is free of charge to the customer, who must, however, pay the transportation costs to Kamstrup A/S.

IF THE CUSTOMER SENDS FOR DISPOSAL

The meter parts must not be separated prior to dispatch. Submit the entire meter for nationally/locally approved destruction of electronic scrap and attach a copy of this page. In this way the disposal facility is informed about the contents.

WHEN THE CUSTOMER DISPOSES HIMSELF

The meters should be separated as described below. The separateparts should be sent for approved destruction. The batteries must not be exposed to mechanical impact and the lead-in wires must not be short-circuited during transport.

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

Kamstrup A/S

FAO: Quality and environment department

Fax: +45 89 93 10 01

E-mail: info@kamstrup.dk

Lithium cell in the PULSE TRANSMITTER/ PULSE DIVIDER (D-cell)	Lithium and Thionyl-chloride > UN 3091 < D-cell: 4.9 g lithium	Approved destruction of lithium cells
PC boards in PULSE TRANSMITTER, PULSE DIVIDER and ULTRAFLOW®	Copper epoxy laminate, components soldered on	PC board scrap for concentration to noble metals
Flow sensor cable	Copper with silicone mantle	Cable recycling
Plastic parts, cast	PES, PBT and PC. See under material data	Plastic recycling
ULTRAFLOW® meter cases	Alpha brass/red brass and stainless steel	Metal recycling
Packing	Recycled cardboard	Card board recycling (Resy)
Packing for ULTRAFLOW® ≥ DN150	Plywood	Ordinary inflammable waste

14 Documents

	Danish	English
Technical description	5512-043	5512-044
Data sheet	5810-394	5810-395
Separate installation guide	5511-670	5511-704
Installation supplement for meters ≥ DN150	5512-052 (DK-GB-DE-SNG)	