Data sheet

SONOMETER™2000
Ultrasonic heat meter

Description/Application

The SONOMETER™2000 is an ultrasonic heat meter especially designed for heating, cooling or combined heating/cooling application in local and district heating systems.
The SONOMETER™2000 consists of:
- Ultrasonic flow sensor, type **SONO 1500 CT** or **SONO 2500 CT**;
- Heat calculator, type **INFOCAL 6**;
- Temperature sensors.

The SONOMETER™2000 has been approved according to EN1434.

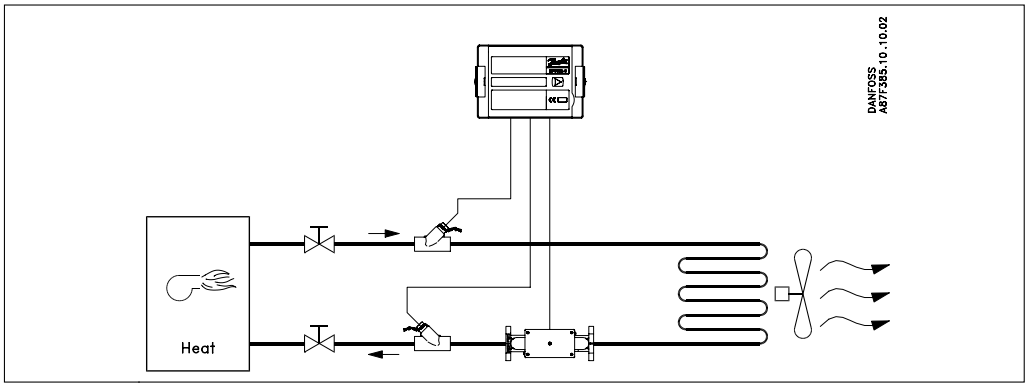
Features of SONO 1500 CT
- 1st approval in Europe for ultrasonic flow sensor with dynamic range of q_i/q_p 1:250 in class 2 (q_p 1.5 / 2.5 / 6 m^3/h);
- Complete dynamic range: ≥ 1:1500;
- Lithium battery with a lifetime of 12 years or external supply;
- Temperature range: 5 - 90 °C / 130 °C / 150 °C;
- Overload temperature up to 150 °C (sizes q_p 0.6 up to 2.5 m^3/h);
- Available in nominal sizes: q_p 0.6 / 1.0 / 1.5 / 2.5 / 3.5 / 6 m^3/h;
- Patented free-beam principle;
- Swirl-free flow around reflector;
- Robust stainless steel reflector;
- All sizes also available in PN 25;
- No calming sections necessary in the inlet and/or outlet (standard installation);
- NOWA test capability;
- Connection to calculator with pulse defined values;
- Insensitive against magnetite;
- Installation in any position;
- Free selectable pulse values from 1 ml;
- HYDRO-SET parameterization software on Windows basis guarantees optimum adaptation to the user's specific needs.

Features of SONO 2500 CT
- Available in nominal sizes: q_p 10 / 15 / 25 / 40 m^3/h
- High performance accuracy;
- Measurements are not affected by the presence of contaminating particles, chemical substances or magnetite in the district heating water;
- Static metering with no moving parts means no wear and tear;
- Wide dynamic range: q_s/q_i=200:1, q_p/q_i=100:1
- Can be mounted horizontally or vertically;
- Ultrasonic signals are insensitive to layers due to direct shot;
- NOWA test available;
- No volume pulses emitted in case of reverse flow;

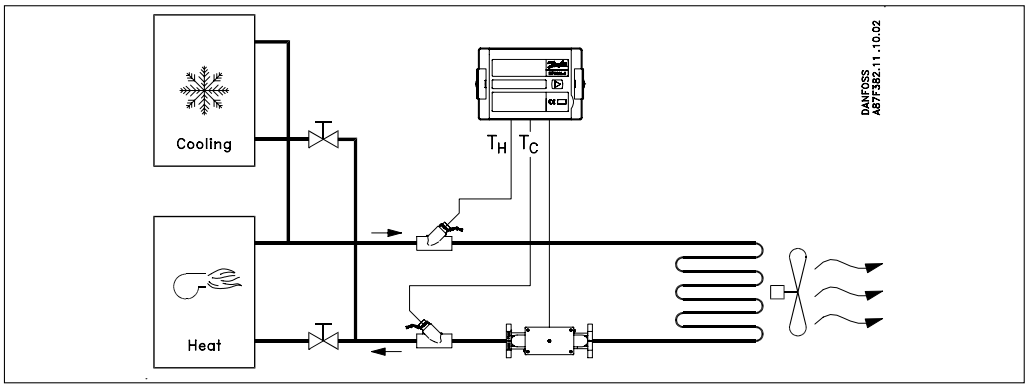
Features of INFOCAL 6
- Lithium battery with lifetime typical 12 years (depending on selected functionality and the volume meter connected to the calculator means 10 … 16 years);
- Temperature range: –10 to +190 °C;
- Power save mode;
- NOWA test capability;
- Remote reading over M-Bus, RS 232, Radio or optical interface, according to ZVEI;
- One optional module selectable out of module with two pulse outputs or module with two pulse inputs or module including two pulse inputs together with one pulse output;
- Individual tariff functions;
- History memory for 24 months;
- Extensive diagnostic displays;
- HYDRO-SET parameterization software on Windows basis guarantees optimum adaptation to the user's specific needs;
- High accuracy thermal energy metering;
- Clear representation of actual consumed values;
- Storage of volume and energy data;
- Expandable functionality with add on modules plug and play.

Description/Application, continued

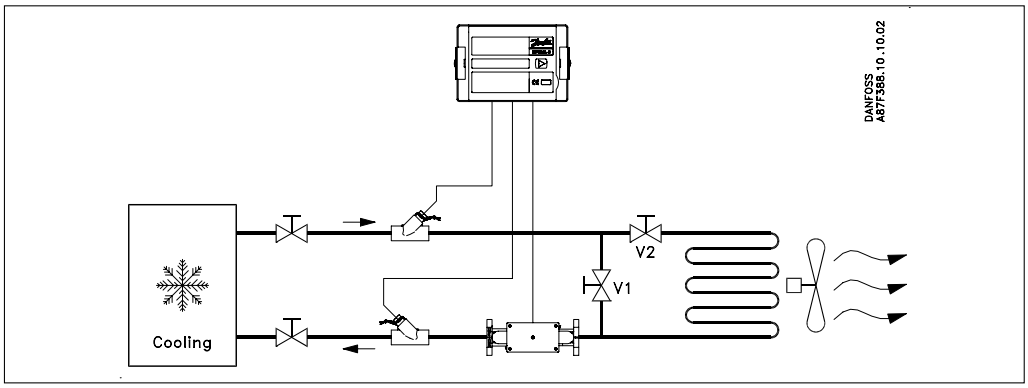
The SONOMETER™2000 is able to handle 3 types of applications:



District heating/boiler application



Combined heating/cooling application



Chilled water application

Ordering

AAA	BB	-	C	D	E	F	G	H	-	I	J	K	L	M	-	NN	O

		-							-						-		

AAA - application

accessories only	000
only temperature sensors	4TS
heat meter for heating	2HE
heat meter for cooling (only with SONO 2500CT)	2CO
heat meter for heating/cooling (only with SONO 2500 CT)	2HC
only flow sensor for heating	15H

for heat meter for cooling (heating/cooling) up to qp 6m³/h use SONOMETER™1000

BB - (for) flow sensor (type SONO 1500 CT)

not relevant / no flow sensor	00
qp 0.6 m³/h / 110mm thread / DN 15 / G¾B / 1 litre/pulse	1A
qp 0.6 m³/h / 130mm thread / DN 20 / G1B / 1 litre/pulse	1B
qp 0.6 m³/h / 190mm thread / DN 20 / G1B / 1 litre/pulse	1C
qp 1.0 m³/h / 110mm thread / DN 15 / G¾B / 1 litre/pulse	1D
qp 1.0 m³/h / 130mm thread / DN 20 / G1B / 1 litre/pulse	1E
qp 1.0 m³/h / 190mm thread / DN 20 / G1B / 1 litre/pulse	1F
qp 1.5 m³/h / 110mm thread / DN 15 / G¾B / 1 litre/pulse	1G
qp 1.5 m³/h / 130mm thread / DN 20 / G1B / 1 litre/pulse	1H
qp 1.5 m³/h / 190mm thread / DN 20 / G1B / 1 litre/pulse	1I
qp 2.5 m³/h / 130mm thread / DN 20 / G1B / 1 litre/pulse	1J
qp 2.5 m³/h / 190mm thread / DN 20 / G1B / 1 litre/pulse	1K
qp 3.5 m³/h / 260mm thread / DN 25 / G1¼B / 10 litre/pulse	1L
qp 6 m³/h / 260mm thread / DN 25 / G1¼B / 10 litre/pulse	1M
qp 0.6 m³/h / 190mm flange DN 20 / 1 litre/pulse	2A
qp 1.0 m³/h / 190mm flange DN 20 / 1 litre/pulse	2B
qp 1.5 m³/h / 190mm flange DN 20 / 1 litre/pulse	2C
qp 2.5 m³/h / 190mm flange DN 20 / 1 litre/pulse	2D
qp 3.5 m³/h / 260mm flange DN 25 / 10 litre/pulse	2E
qp 3.5 m³/h / 260mm flange DN 32 / 10 litre/pulse	2F
qp 6 m³/h / 260mm flange DN 25 / 10 litre/pulse	2G
qp 6 m³/h / 260mm flange DN 32 / 10 litre/pulse	2H

(standard: without galvanic isolation; galvanic isolation on request)

BB - (for) flow sensor (type SONO 2500 CT)

qp 10 m³/h / 300mm thread / DN 40 / G2B / 10 litre/pulse	1N
qp 10 m³/h / 300mm flange DN 40 / 10 litre/pulse	2W
qp 15 m³/h / 270mm flange DN 50 / 10 litre/pulse	2X
qp 25 m³/h / 300mm flange DN 65 / 100 litre/pulse	2Y
qp 40 m³/h / 300mm flange DN 80 / 100 litre/pulse	2Z

C - nominal pressure

not relevant	0
PN16	C
PN25	D

D - cable length between calculator and flow sensor

not relevant	0
2.5m (standard)	A
5m	B
10m	C

E - installation

not relevant	0
forward	F
return	R

F - power supply

not relevant / with external power supply [1]	0
battery 3.0V DC (C-cell) [2]	1
battery 3.6V DC (D-cell) [3]	2
mains unit 230V AC [3]	3
mains unit 24V AC [3]	4

[1] only for flow sensor [2] only for flow sensor SONO 1500 CT

[3] only for complete heat meter (power supply for calculator); only external supply (from calculator) for flow sensor; SONO 1500 CT in combination with calculator possible

GH - interface modules

modules slot 1	
not relevant / no module in slot 1	0
M-Bus module	A
RS-232 module	B
Real Data radio module	C
pulse input module (2 inputs)	D
modules slot 2	
not relevant / no module in slot 2	0
pulse output module (2 outputs)	K
pulse input module (2 inputs)	L
combined module (2 inputs / 1 output)	M

(standard setting for pulse input modules: 100 l/pulse standard setting for pulse output modules: energy and volume, pulse value is the last digit in the display)

O - verification

0	without approval mark and test protocol
1	with approval mark and test protocol
2	with approval mark and verification / declaration of conformity

NN - country code

00	Neutral code with doc's in English
BY	Belarus
BA	Bosnia
BG	Bulgaria
CN	China
HR	Croatia
CZ	Czech Republic
DK	Denmark
EE	Estonia
KZ	Kazakhstan
KG	Kirghizia
LV	Latvia
LT	Lithuania
MK	Macedonia
MD	Moldova
XM	Montenegro
PL	Poland
RO	Romania
RU	Russia
CS	Serbia
SK	Slovak Republic
SI	Slovenia
TJ	Tajikistan
TM	Turkmenistan
UA	Ukraine
UZ	Uzbekistan

M - connections (sets)

0	not relevant / without
1	screwing set R ½" x G ¾ B
2	screwing set R ¾" x G 1 B
3	screwing set R 1" x G 1¼ B
4	screwing set R 1½ x G 2 B
5	weld-on tail pieces x G 1¼ B
6	weld-on tail pieces x G 2 B

L - accessories / pocket

0	without
for 5.2 mm temperature sensors (pair)	
A	brass-pockets, 34 mm
B	brass-pockets, 50 mm
C	brass-pockets, 70 mm
D	brass-pockets, 85 mm
E	brass-pockets, 120 mm
for 6 mm temperature sensors	
K	brass-pockets, 40 mm
L	brass-pockets, 85 mm
M	brass-pockets, 120 mm
N	stainless steel-pockets, 85 mm
O	stainless steel-pockets, 120 mm
P	stainless steel-pockets, 155 mm
Q	stainless steel-pockets, 210 mm
R	ball valve DN 15 - ½" for direct sensor (1 piece)
S	ball valve DN 20 - ¾" for direct sensor (1 piece)
T	ball valve DN 25 - 1" for direct sensor (1 piece)
U	adapter for direct sensor (1 piece)

K - temperature sensor mounting

0	not relevant / only flow sensor
1	one sensor mounted in the SONO 1500CT (only for direct sensor and 5.2 mm sensor qp 0.6 to 2.5 m³/h)
2	indirect mounting (2 free sensors)

J - temperature sensors (pair)

0	not relevant / without sensors
A	Pt 500 / direct sensor ø 3.3 mm / 1.5 m cable
B	Pt 500 / direct sensor ø 3.3 mm / 3.0 m cable
C	Pt 100 / ø 5.2 mm / 2 m cable
E	Pt 500 / ø 5.2 mm / 2 m cable
F	Pt 500 / ø 5.2 mm / 3 m cable
G	Pt 500 / ø 5.2 mm / 5 m cable
H	Pt 500 / ø 5.2 mm / 10 m cable
I	Pt 500 / ø 6.0mm / 1,5m cable
J	Pt 500 / ø 6.0 mm / 3 m cable
K	Pt 500 / ø 6.0 mm / 5 m cable
L	Pt 500 / ø 6.0 mm / 10 m cable
M	Pt 500 / ø 6.0mm / 20m cable (heat meter without approval)

(standard: with EN-approval)

I - energy units

0	not relevant / only flow sensor
A	kWh (without digit after comma) only for 0.6 - 6 m³/h
B	MWh (with 1 digit after comma)
C	MWh (with 2 digits after comma)
D	MWh (with 3 digits after comma) only for 0.6 - 6 m³/h
E	GJ (with 1 digit after comma)
F	GJ (with 2 digits after comma)
G	GJ (with 3 digits after comma) only for 0.6 - 6 m³/h
H	Gcal (with 1 digit after comma)
I	Gcal (with 2 digits after comma)
J	Gcal (with 3 digits after comma) only for 0.6 - 6 m³/h
K	MBtu (with 1 digit after comma)
L	MBtu (with 2 digits after comma)
M	MBtu (with 3 digits after comma) only for 0.6 - 6 m³/h

(units with other digits after comma on request)

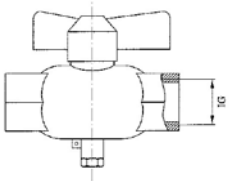
Ordering, continued

Interface modules

	Designation	Code No.
Communication	M-Bus	**542 000 01**
	RS 232	**542 000 07**
	RS 232 with data cable	**542 000 30**
	Radio-Module	**542 000 17**
	Data cable for RS-232-Module	**087H0121**
Function	Module for 2 pulse inputs	**542 000 03**
	Module for volume and energy pulse outputs (selectable out of 2 outputs)	**542 000 02**
	Module for 2 pulse inputs + 1 pulse output	**542 000 26**
Supply voltage	Mains unit 230 V AC, power pack 3.6 V only for combination SONO 1500 CT with backup battery	**542 000 04**
	Mains unit 24 V AC, power pack 3.6 V only for combination SONO 1500 CT with backup battery	**542 000 05**
	Battery 3.6V DC direct 3,6V for VMC	**300 07 83**

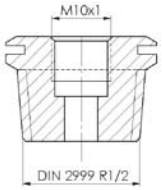
Accessories

Ball valves



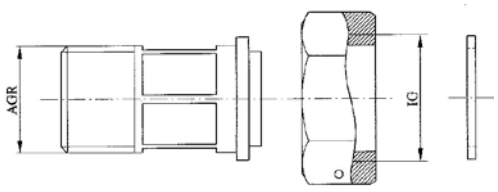
Dimention (IG)	Code No.
G ½''	**087HY004**
G ¾''	**087HY005**
G 1''	**087HY006**

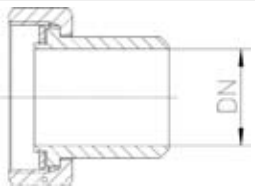
Adapter for mounting temperature sensors



Coupling thread	Sensor thread	Code No.
R½''	M10 x 1	**087HY003**

Tailpieces





	Dimension (AGR x IG)	Code No.
Threaded	R ½" x G ¾"	**803 014**
	R ¾" x G 1"	**803 016**
	R 1" x G 1¼"	**803 018**
	R 1½" x G 2"	**803 022**
Weld-on	DN 25 x G 1¼"	**816 263**
	DN 40 x G 2"	**816 264**

Software

The HYDRO-SET parameterization software based on the M-Bus is a convenient tool for handling the calculator.
The HYDRO-SET software is available on web site www.hydrometer.de.

It runs on Windows 2000/XP and is used for:
- commissioning,
- reading out measured values,
- printing out heat meter logs,
- heat meter configuration.

Technical data

INFOCAL 6

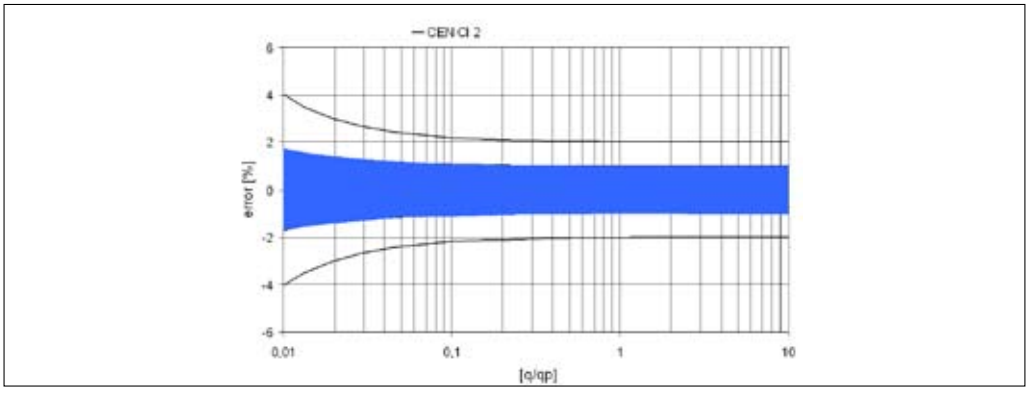
Basic data	Enviro. class		C / A
	Protect. class		IP 54
Display indication	Display		LCD, 7 digit
	Units		MWh - kWh - GJ - Gcal - MBtu - gal
	Total values		9 999 999 - 999 999.9 - 99 999.99 - 9 999.999
	Values displayed		Power - energy - flow rate - temperature
Temperature	Ambient	°C	0 - 55
	Storage		-25 - +70
Input	Temp. sensors	Type	Pt 100 / Pt 500 with 2-wire leads < 10 m
	Sensor current	mA	Pt 100 peak < 8; rms < 0.015 Pt 500 peak < 2; rms < 0.012
	Measuring cycle	T s	Mains unit supply: 2 Battery: 16
	Max. temp. difference	$\Delta\theta_{max}$ K	177
	Min. temp. difference	$\Delta\theta_{min}$ K	3
	Starting temp. difference	$\Delta\theta$ K	0.1
	Absolute temp. measuring range	θ °C	-9.9...189.9
Supply voltage	Operating voltage	U_N VDC	3.0 / 3.6 (Lithium battery)

SONO 1500 CT

Flow rate	Nominal	**q_p m³/h**	**0.6**			**1 / 1.5**			**2.5**		**3.5**			**6**		
	Maximum	q_s m³/h	1.2			2 / 3			5		7			12		
	Minimum	q_i l/h	6			10 / 6			10		35			24		
	Starting	l/h	1			2.5			4		12			12		
Diameter[3]	Nominal	DN mm	15	20	FL 20	15	20	FL 20	20	FL 20	25	FL 25	FL32	25	FL 25	FL 32
Operating pressure	Maximum	PN bar	16/25		25	16/25		25	16/25	25	25			25		
Temperature range	Flow sensor	°C	battery supply: 5 - 90 external supply: 5 - 130								battery supply: 5 - 90 external supply: 5 - 150					
Medium			circulation water (pH: 7 - 10)													
Pressure loss	At q_p	Δp mbar	95	85		42 / 95	36 / 75		100		44			128		
Zeta			21.00	59.37		3.34 / 3.36	9.05 / 8.38		4.02		2.21	5.92		2.18	5.86	
Flow ratio		k_{vs}	61.56	65.08		154.30 / 153.90	166.67 / 173.21		250.00		527.64			530.33		
Overall length		mm	110	130	190	110	130	190	130	190	260			260		
Pulse value	Volume	l/imp.	1...5000													
	Test[1]	ml/imp.	5			10			20		20			50		
Supply voltage	Operating	U_N	battery supply: 3.0 VDC external supply: 3.0...5.5 VDC[2]													
Basic data	Enviro. class		C													
	Protect. class		IP 54 (heating) / IP 64 (cooling)													
Applicable for direct mounting temp. sensor, Pt100 / 500			yes								no					

[1] The test impulse depends on digits places of indicator volumes.
[2] For medium temperatures above 90 °C, the flow sensor must be equipped with an external supply.
[3] FL - flanged connection

Measuring accuracy to EN 1434 Class 2 for SONO 1500 CT and SONO 2500 CT



Technical data, continued

SONO 2500 CT

Flow rate	Nominal	q_p m³/h	**10**		**15**	**25**	**40**
	Maximum	q_s m³/h	20		30	50	80
	Minimum[1]	q_i l/h	100		150	250	400
	Starting	l/h	20		30	50	80
Diameter[3]	Nominal	DN mm	40	FL 40	FL 50	FL 65	FL 80
Operating pressure	Maximum	PN bar	25				
Temperature range	Medium (horizontal)	°C	20 - 150				
	Medium (vertical)		20 - 120				
	Ambient		0 - 55				
	Storage		-20 - +70				
Medium			circulation water				
Humidity	Storage	%	< 80				
Pressure loss[2]	At $q_p(Q_n)$	bar	0.05		0.06	0.07	0.10
Flow resistance coefficient	Zeta		0,43		0,51	0,37	0,58
Flow ratio		k_{vs}	1414.2		1936.5	2988	4000
Overall length		mm	300		270	300	300
Pulse value	Output	l/imp.	25	100	250	250	250
	Width	ms	50	100	200	200	200
Supply voltage		U_N	3.6 V DC battery / 24/230 V AC				
Maximum frequency		Hz	128				
Power consumption		P_{max} µW	< 360				
Average current		I_{avg} µA	100				
Peak current		I_{peak} mA	10				
Starting current		I_{start} mA	< 15				
Starting time		t_{start} s	0.15 - 2.0				
Materials	Pipes		W 2.1096.01 (G-CuSn5ZnPb)				
	Transducer		Stainless steel W 1.4435				
	Flange gasket		Fibre (non-asbestos)				
	O-ring		EPDM				
Heat power	Nominal	kW	400		600	1000	1600
Basic data	Environmental class		C				
	Protection class		IP 54				

[1] The accuracy is better than 3%
[2] Acc. to EN 1434 6.17
[3] FL - flanged connection
[4] Calculated at ΔT = 40 °C and q_p

Temperature sensors (pair)

Type		Direct mounted Type DS (EN 1434)	Pocket sensor Type PS (EN 1434)
Element		Pt 500, 2-wire (EN 60751)	Pt 100/500, 2-wire (EN 60751)
Pairing	°C	10, 80, 130	
Medium temperature	°C	0...180	0...150
Medium		District heating water	
Response time t 0.5		Typically 0.8 s/0.4 m/s	acc. to sensor pocket technical data table
Pressure rating PN	bar	16	acc. to sensor pocket technical data table
Protection class		IP 67	IP 65
Pipe material		W 2.4816	W 1.4303

Temperature sensor pockets

Type		Brass	Stainless steel
Medium temperature	°C	0...180	
Medium		District heating water	
Response time t 0.5		Typically 9 s/0.4 m/s Typically 5 s/0.4 m/s with pasta	Typically 13 s/0.4 m/s Typically 5 s/0.4 m/s with pasta
Pressure rating PN	bar	25	
Material		CuZn40Pb2 (Ms 58)	W 1.4571
Adapter		CuZn40Pb2 (Ms 58)	

Design and function

The SONOMETER™2000 is an ultrasonic heat meter especially designed for heating, cooling or combined heating/cooling application in local and district heating systems.

The SONOMETER™2000 consists of:
- Ultrasonic flow sensor, type **SONO 1500 CT** or **SONO 2500 CT**;
- Thermal energy calculator, type **INFOCAL 6**;
- Temperature sensors.

INFOCAL 6

Calculator
The calculator contains all the necessary circuits for recording the flow rate and temperature as well as for calculating, logging and displaying the data. The calculator housing can be mounted directly on the flow sensor or on the wall. At application with medium temperature above 90 °C or at temperatures $T_{water} < T_{environment}$ the calculator has to be removed from the flow sensor. The calculator can be conveniently read from a single line 7-digit display with units and symbols. A push-button provides user-friendly control of the various display loops. All failures and faults are recorded automatically and shown on the LC display. To protect the reading data, all the relevant data are saved in a non-volatile memory (EEPROM). This memory saves the measured values, device parameters and types of error at regular intervals.

Temperature Sensors
Pairs of Pt 100 or Pt 500 temperature sensors with 2-wire leads are used.

Interfaces
INFOCAL 6 is equipped as a standard with a ZVEI optical interface with the M-Bus protocol acc. to EN 1434.

This interface is used, for example, for communication with the HYDRO-SET parameterization software. The calculator features 2 slots for the modules. One slot for the function modules, and one for the communication modules.

The following communication modules are available as options:
- RS232 module;
- M-Bus module acc. to EN 1434;
- Real Data Radio Module.

The RS 232 communication module is a serial interface and permits data exchange with the calculator. For this purpose a special data cable is necessary.

The M-Bus module is a serial interface for communication with external devices (M-Bus Repeater) e.g. HYDRO-CENTER. A number of calculators can be connected to a control centre.

The Radio module is an interface for communicate unidirectional over radio predefined data records. The protocol is send every 8 … 19 s. For receiving there are different Hydrometer receiver available. The transmission protocol is editable by HYDRO-SET. If battery supplied the life time is up to 8 years.

Design and function, continued

Pulse Input
Two pulse inputs are available. The pulse value and the unit is configurable for heat, water, gas or electrical energy meter by HYDRO-SET. The input frequency range is 0 – 8 Hz with pulse-length ≥ 10 ms. Data are separate cumulated in different registers and are also stored on the two accounting day's. The cable length to pulse input have to be less than 10 m.

Combined pulse input / output
Two pulse inputs combined with one pulse output are available on one module. The pulse inputs are configurable with value and the unit by HYDRO-SET. The input frequency range is 0 – 8 Hz with pulse-length ≥ 10 ms. The pulse output is also programmable using the HYDRO-SET software. The "open collector" output is supplied with external power of 3-30 VDC and has an output frequency of ≤ 4 Hz. The pulse width of the not potential separated pulses is 100-150 ms.

Pulse output
The calculator provides levels for two optional external pulse outputs, which can be freely programmed using the HYDRO-SET software. The outputs are "open collector" with external power supply of 3-30 V DC and an output frequency of ≤ 4 Hz. The pulse width of the potential separated pulses is 100-150 ms.

Possible pulse output values
- Energy (standard setting);
- Volume (standard setting);
- Tariff energy 1;
- Tariff energy 2;
- Tariff condition 1, limit switch;
- Tariff condition 2, limit switch;
- Energy error;
- Volume error;
- Volume with specific resolution (0.1 / 1.0 / 10 / 100 l) at 3 digit after volume comma;
- Energy with specific resolution (0.1 kWh) at 3 digit after volume comma;
- Leakage detection (2 channel).

Module combinations
The calculator has a group of extension modules for communication and another group of extension modules for additional functionality. These modules are available first selected within the calculator, or for retrofitting in the field. One single function module as well as one single communication module out of following modules is selectable.

Function modules:
- Pulse input module, 2 inputs;
- Pulse output module, 2 outputs;
- Combined pulse module 2 inputs, 1 output.

Communication modules:
- M-Bus or
- RS 232 or
- Real Data Radio

Event memory
Events such as changes and faults are stored in a non-volatile memory with a capacity of up to 31 entries. The following events are recorded:
- Checksum error;
- Temperature measurement error;
- Start and end of test mode.

Monthly memory
INFOCAL 6 has a history memory of 24 months. The following values are stored in the EEPROM on the programmed date 1 … 31 via (HYDRO-SET) of the actual month:
- Date / Time;
- Energy;
- Tariff energy 1;
- Tariff energy 2;
- Tariff definition 1;
- Tariff definition 2;
- Pulse input 1;
- Operation hours;
- Volume;
- Error day counter;
- Maximum monthly flow rate;
- Maximum monthly power;
- Date of maximum monthly flow rate;
- Date of maximum monthly power;
- Pulse input 2.

Log memory
The log memory is used to store consumption values. The storage frequency can be selected from various storage intervals (5. 6, 10, 12, 15, 20, 30, 60 minutes or the default setting of 24 hours, see following table). The data which are stored in Log Memory could be read out with HYDRO-SET and can be used for evaluations.

Extract of possible log memory settings

Storage interval	Values	Number of data records	Recording period
5 min.	Error status, overload time temperature, overload time flow rate, supply temperature, return temperature, date and time, energy, tariff energy 1, tariff energy 2, tariff definition 1, tariff definition 2, volume, error day counter	440	36.6 h
15 min.		440	110 h
1 h		440	18.3 days
24 h		440	440 days

Accounting date
The calculator includes two independent memories in which the accumulated energy at two programmable dates is stored.
- Last Accounting Date;
- Last but one Accounting Date;
- Values stored:
    - Energy;
    - Volume;
    - Tariff counter 1;
    - Tariff counter 2;
    - Pulse counter 1;
    - Pulse counter 2;
    - Date.

Design and function, continued

Max. Values
The calculator creates max. values for power and flow rate based on consumption time, which are stored in the EEPROM. The integration intervals are adjustable to 6, 15, 30 or 60 minutes and 24 h. Default setting is 60 minutes.

Tariff Function
The calculator offers two optional tariff memories for monitoring plant load states for limit tariffs. Here it concerns threshold value tariffs. Extensive tariff conditions make it possible to adapt the calculator individually to the required customer-specific applications.

Both tariffs are separately configurable and independent from each other. Energy or time can be measured alternatively per tariff register dependent on the tariff mode adjusted in each case.

With the "time triggered tariff function" (type Z) the switch-on time and the switch-off time are adjustable independent from each other for each day of the week in steps of 15 minutes.

The following limit types are possible:
(This example applies to the display at 3 digit after volume comma)

Leakage Function - on request

Type	Description	LIMIT	LIMIT resolution
ΔT	Temperature difference	1 ... 255 °C	1 °C
-ΔT	Negative temperature difference	1 ... 255 °C	1 °C
T_R	Return temperature (low)	1 ... 255 °C	1 °C
T_V	Supply temperature (high)	1 ... 255 °C	1 °C
P	Power	1 ... 255 kW	1 kW
Q	Flow	100 ... 25 500 l/h	100 l/h
FE	"Theoretically Supply Energy" with return temperature of 0 °C	-	-
Z	"Time triggered" counting energy	-	-
E	"External" counting energy	-	-

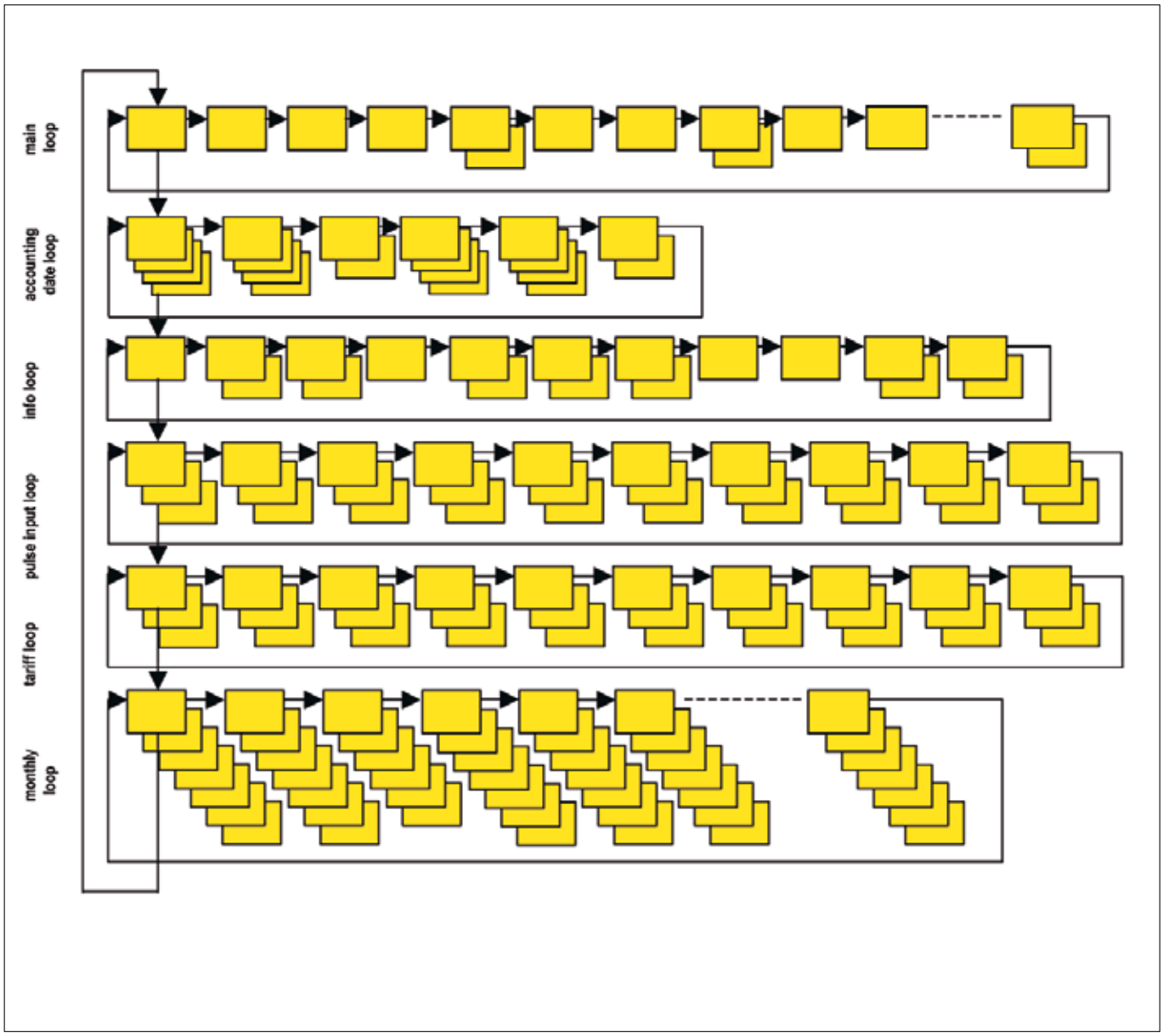
Display Control
The readings are displayed on the calculator by a 7-digit LCD with units and symbols.

Loop Structure
The INFOCAL 6 display has six loops. Some display windows consist of two (to maximum seven) displays that are shown alternately at 4-second intervals. Some pictures in loops or a complete loop can be deactivated separately.

For quick visual guidance, the loops in the display are numbered from 1 to 6.

The main loop with the current data, e.g. for energy, volume and flow rate, is programmed as default setting.
In the standard setting the loop no. 5 (tariff loop) is not activated.

Overview of Loops



Informative Displays (Standard)

Loop	Sequence	Window 1	Window 2	Window 3	Window 4
"1" Main loop	1.1	Accumulated Energy			
	1.2	Volume			
	1.3	Flow			
	1.4	Power			
	1.5	Supply temperature	Return temperature		
	1.6	Difference temperature			
	1.7	Operating hours			
	1.8 [off]	Monthly peak power	Date		
	1.9	Error code			
	1.10	Display test			
	1.11 [off]	Tariff energy 1			
	1.12 [off]	Tariff energy 2			
	1.13 [off]	Pulse input 'In 1'	Pulse input counter 1		
	1.14[off]	Pulse input 'In 2'	Pulse input counter 2		
	1.15	Leakage detection error	Leakage detection heating		
	1.16	Accounting date last time	Accounting date last time	Accounting value Energy last time	Accounting value Volume last time
	1.17	Accounting date next to last time	Accounting date next to last time	Accounting value Energy next to last time	Accounting value Volume next to last time
	1.18	Secondary address	Secondary M-Bus address		
	1.19	Actual maximal flow	Date actual maximal flow		

Loop	Sequence	Window 1	Window 2	Window 3	Window 4	Window 5	Window 6	Window 7	Window 8	Window 9	Window 10
"1" Main loop	1.20	LOG	Date of last month	Energy	Tariff energy 1	Tariff energy 2	Volume	Max. flow	Max. power	Impulse counter 1	Impulse counter 2

Loop	Sequence	Window 1	Window 2	Window 3 [off]	Window 4
"2" Accounting date loop	2.1	Accounting date 1	Accounting date 1 energy	Accounting date 1 volume	‚Accd 1'
	2.2	Accounting date 1 previous year	Accounting date 1 previous year energy	Accounting date 1 previous year volume	‚Accd 1'
	2.3	Accounting date ‚Accd 1'	Accounting date 1 in the future		
	2.4	Accounting date 2	Accounting date 2 energy	Accounting date 2 volume	‚Accd 2'
	2.5	Accounting date 2 previous year	Accounting date 2 previous year energy	Accounting date 2 previous year volume	‚Accd 2'
	2.6	Accounting date ‚Accd 2'	Accounting date 2 in the future		

Loop	Sequence	Window 1	Window 2
„3" Info loop	3.1	Current date	
	3.2	‚SEC_Adr'	Secondary address M-Bus
	3.3	‚Pri_Adr'	Primary address M-Bus
	3.4	, Pt 100 r' or , Pt 500 r' shows installation "forward or return"	
	3.5	Monthly peak flow rate	Date max. flow rate
	3.6	Monthly peak power	Date max. power
	3.7	Integration interval (maximum value)	
	3.8	Number of error day's	
	3.9	Pulse output ‚Out 1'	Pulse value and unit pulse output 1
	3.10	Pulse output ‚Out 2'	Pulse value and unit pulse output 2
	3.11	Pulse output ‚Out 3'	Pulse value interface pulse
	3.12	Software version	

[off] = not active

Loop	Sequence	Window 1	Window 2	Window 3
"4" Pulse input loop	4.1	Pulse input ‚In1'	Pulse input counter 1	Pulse value 1
	4.2	Pulse input ‚In2'	Pulse input counter 2	Pulse value 2
	4.3 [off]	Accounting date 1	Pulse input ‚In1'	Acc.date 1 Pulse value 1
	4.4 [off]	Accounting date 1	Pulse input ‚In2'	Acc.date 1 Pulse value 2
	4.5 [off]	Accounting date 1 previous year	Pulse input ‚In1'	Acc.date 1 previous year Pulse value 1
	4.6 [off]	Accounting date 1 previous year	Pulse input ‚In2'	Acc.date 1 previous year Pulse value 2
	4.7 [off]	Accounting date 2	Pulse input ‚In1'	Acc.date 2 Pulse value 1
	4.8 [off]	Accounting date 2	Pulse input ‚In2'	Acc.date 2 Pulse value 2
	4.9 [off]	Accounting date 2 previous year	Pulse input ‚In1'	Acc.date 2 previous year Pulse value 1
	4.10 [off]	Accounting date 2 previous year	Pulse input ‚In2'	Acc.date 2 previous year Pulse value 2

Loop	Sequence	Window 1	Window 2	Window 3
"5" Tariff loop	5.1 [off]	Tariff energy 1	Tariff function 1 (e.g. ‚t 01')	Limit tariff 1
	5.2 [off]	Tariff energy 2	Tariff function 2 (e.g. ‚t 02')	Limit tariff 2
	5.3 [off]	Accounting date 1	Accounting date 1 tariff energy 1	‚Accd 1'
	5.4 [off]	Accounting date 1	Accounting date 1 tariff energy 2	‚Accd 1'
	5.5 [off]	Accounting date 1 previous year	Accounting date 1 tariff energy 1	‚Accd 1'
	5.6 [off]	Accounting date 1 previous year	Accounting date 1 tariff energy 2	‚Accd 1'
	5.7 [off]	Accounting date 2 tariff energy 1	Accounting date 2 tariff energy 1	‚Accd 2'
	5.8 [off]	Accounting date 2	Accounting date 2 tariff energy 2	‚Accd 2'
	5.9 [off]	Accounting date 2 previous year	Accounting date 2 tariff energy 2	‚Accd 2'
	5.10 [off]	Accounting date 2 previous year	Accounting date 2 tariff energy 2	‚Accd 2'

Loop	Sequence	Window 1	Window 2	Window 3 [off]	Window 4 [off]	Window 5	Window 6	Window 7
"6" Monthly value loop	6.1	Last month	Energy	Tariff energy 1	Tariff energy 2	Volume	Max. flow rate	Max. power
	6.2	Month –1	Energy	Tariff energy 1	Tariff energy 2	Volume	Max. flow rate	Max. power
	6.3	Month -2	Energy	Tariff energy 1	Tariff energy 2	Volume	Max. flow rate	Max. power
	...							
	6.24	Month -23	Energy	Tariff energy 1	Tariff energy 2	Volume	Max. flow rate	Max. power

[off] = not active

Simple operation
A push-button mounted on the front of the calculator is used to switch to the various displays. The button can be pressed for a short or long time. A short press of the button (<3 seconds) switches to the next display within a loop and a long press (>3 seconds) switches to the next display loop. The "Energy" window (sequence 1.1) in the main loop is the basic display.

The calculator switches automatically to power save mode if the button is not pressed for approx. 4 minutes and returns to the basic display when the button is pressed again. The loop settings can be programmed to suit the customer's individual requirements using the HYDRO-SET software.

SONO 1500 CT

Power supply
The standard version contains a 3.0 VDC lithium battery (max. 90 °C) with a lifetime of 12 years (depends on configuration). It's also possible to use an external supply e.g. from a calculator.

Characteristic for ext. power supply:
- Power supply 3.0 ... 5.5 V DC;
- Power consumption <130 mAh per year;
- Impulse current < 10 mA.

Pulse output
The flow sensor has two pulse output.
- Volume pulse output;
- Output for testing (high resolution pulse output for test laboratories, temporary limited) and for communication.

The output for testing is a combined impulse output. That means the flow sensor can emit a high resolution test impulse or the flow sensor can communicate via the same output.
By using an adapter the flow sensor can be read out via the HYDRO-SET Software.

The electrical information for the volume pulses of the model for heating is described as follows:
The pulse output is by default not galvanic. A galvanic pulse output is as an option available.
The flow sensor has, by default, a 4-pin impulse cable with a length of 2.5 m. The maximal length is 10 m.

Specification of the pulse output:

	Battery supply		External supply
Volume impulse output	No galvanic insulation (standard)	Galvanic insulation	No galvanic insulation
Power Supply	3.0 VDC battery		3.0 – 5.5 VDC external supply
Contact load	UCE ≤ 30 V IC ≤ 20 mA with residual voltage of ≤ 0.5 V	UCE ≤ 30 V IC ≤ 1 mA with residual voltage of ≤ 0.5 V	UCE ≤ 30 V IC ≤ 20 mA with residual voltage of ≤ 0.5 V
Output frequency	≤ 20 Hz	*	≤ 150 Hz
Pulse description	Open Collector		
Pulse values	1 ml ... 5000 l (depends on qp)	*	1 ml ... 5000 l (depends on qp)
Pulse duration	1 ... 250 ms ± 10% pulse duration ≤ pulse pause	*	1 ... 250 ms ± 10% pulse duration ≤ pulse pause
Cable allocation			
White core	+ volume impulse		
Yellow core	test impulse / communication		
Blue core	GND		
Brown core	reserved	- volume impulse	+ power supply

* depends on the average flow during the lifetime of the flow sensor, on the pulse duration and on the pulse value.

SONO 2500 CT

The ultrasonic flow sensor measures with the assistance of directly transferring pulses between sounders, without necessity of pulse reflecting from mirror's surfaces. Thanks to application of this innovative principle of operation the measures are characterized by accuracy and reliability, and in connection with wide range of dynamic measures those flow sensors have assurance of more than 20 years operation stability.

The ultrasonic principle is used in measuring the flow. Two ultrasonic transducers functioning as both transmitter and receiver are positioned opposite each other at the inlet and outlet of the flow sensor.
Ultrasonic signals are transmitted between both transducers. One signal travels in the same direction as the water flow, the other travels against the flow.

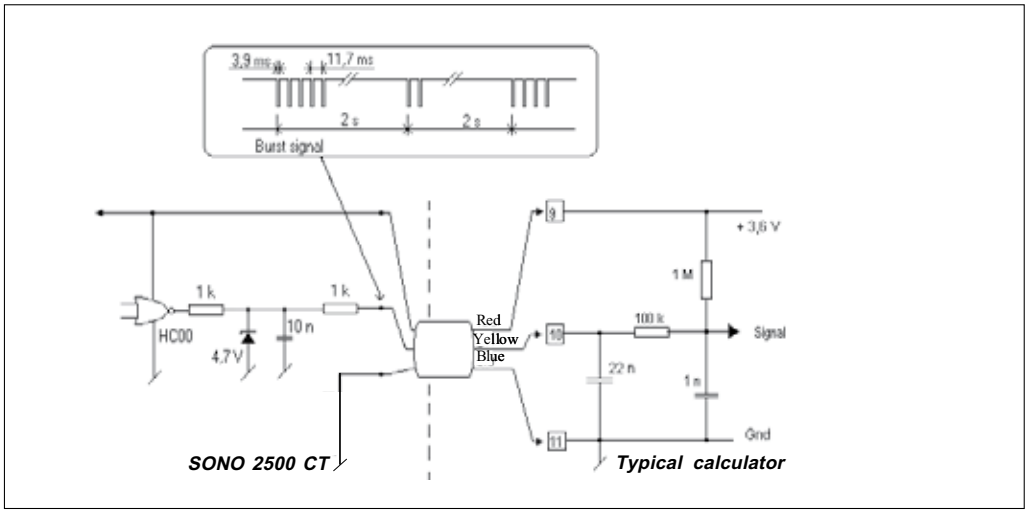
Measurement is performed by determining the time the ultrasonic signal takes to travel with and against the flow. The principle can be expressed as follows:

$$v = K \frac{t_{up} - t_{down}}{t_{up} \times t_{down}} = K \frac{\Delta t}{t^2}$$

t_{down} = Time in the flow direction
t_{up} = Time against the flow direction
v = Average flow velocity
t = Transit time
K = Proportional factor

This measuring principle offers the advantage that it is independent of variations in the actual sound velocity of the liquid.
Proportional factor K is determined by wet calibration.

Pulse output

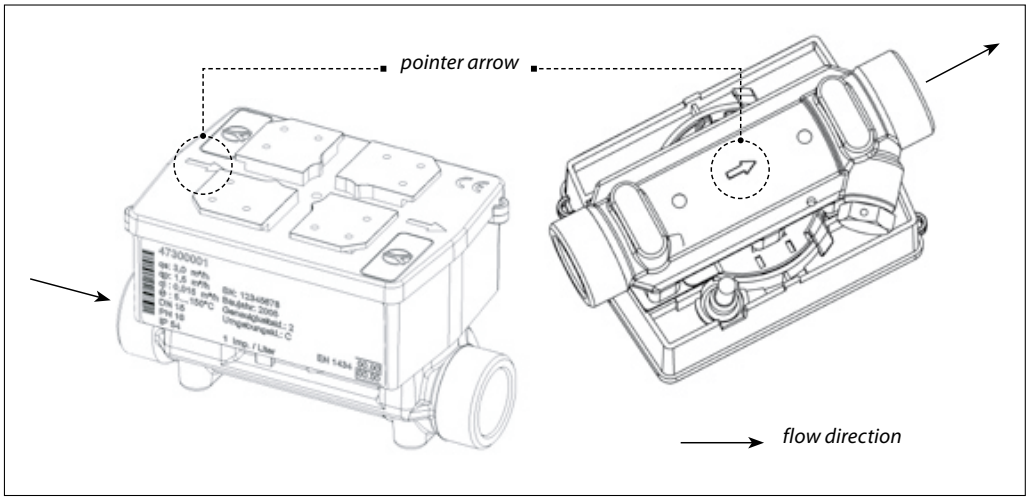


Mounting

SONO 1500 CT

The flow sensor is installed either in the high temperature pipe or low temperature pipe as indicated on the data plate. The flow sensor has to be installed so that the direction of flow corresponds to the direction of the arrow on the flow sensor housing. Ensure that the flow sensor is always filled with liquid after installation. Calming sections before and after the flow sensor are not necessary. The flow sensor can be installed in both horizontal and vertical pipe sections, but always so, that air bubbles cannot collect in the flow sensor.

Make sure the flow sensor is installed sufficiently far away from possible sources of electromagnetic interference (switches, electric motors, fluorescent lamps, etc.). It is recommended that stop valves are fitted before and after the flow sensor to simplify dismantling. The flow sensor should be installed in a convenient position for service and operating personnel.



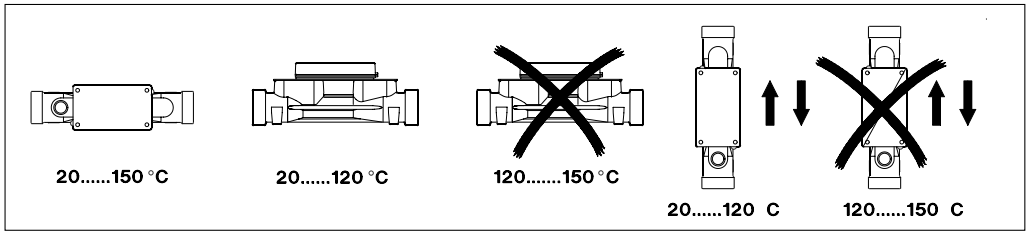
SONO 2500 CT

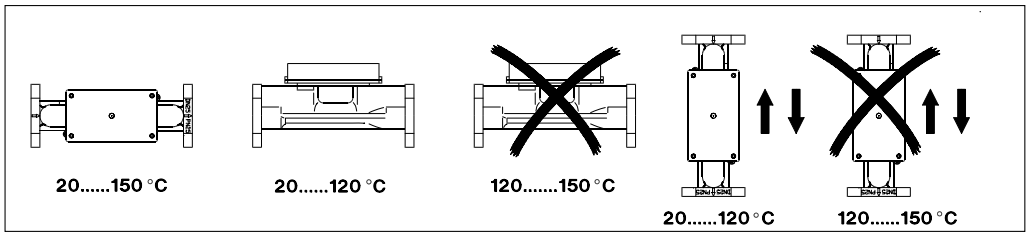
The flow sensor can be mounted in either forward or return pipes. The correct direction is indicated with an arrow on the flange or on the body. When horizontally mounted, the max. liquid temperature is 150 °C .

The electronics (black enclosure) must not be insulated.

The max. liquid temperature must be reduced to 120 °C when the electronics (black enclosure) is turned upwards. When vertically mounted, the max. liquid temperature is also 120 °C.

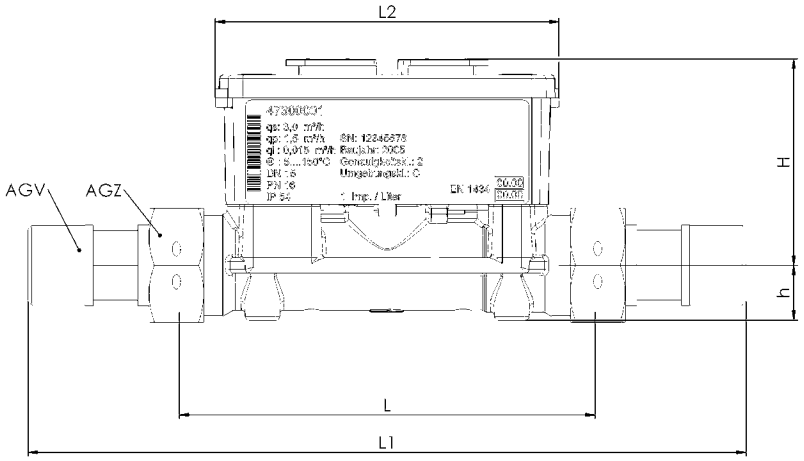
The flow sensor must be filled completely with water during measurements.
It is not necessary to use filters when using the flow sensor. Strait pipe inlet section has to be 5 times DN.

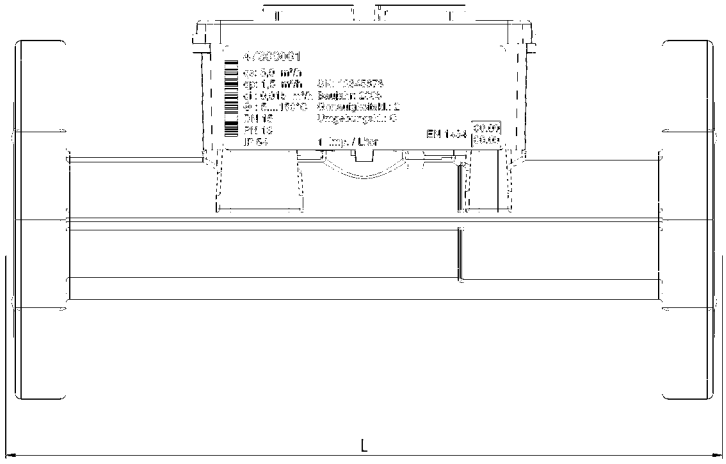


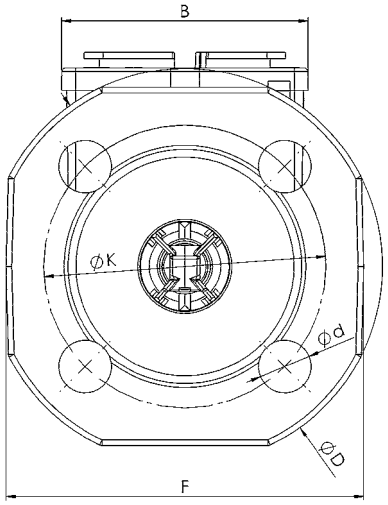


Dimensions

SONO 1500 CT





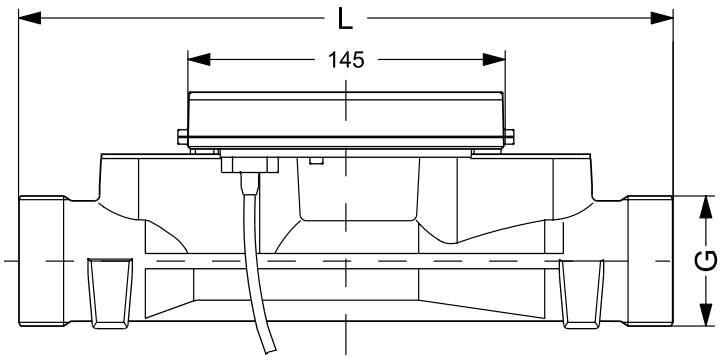


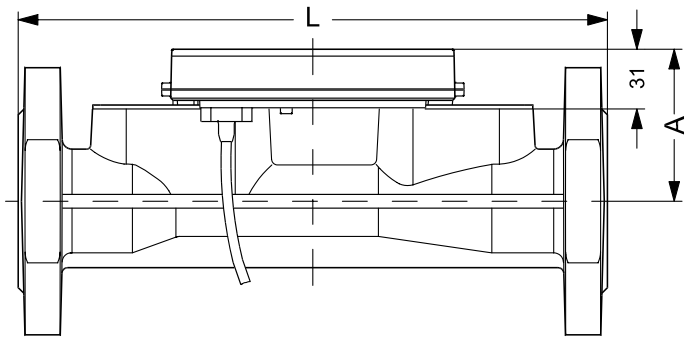
Nominal size	q_p=0.6 m³/h				q_p=1.0 / 1.5 m³/h				q_p=2.5 m³/h			q_p=3.5 m³/h			q_p=6.0 m³/h		
L [mm]	110	130	190	190	110	130	190	190	130	190	190	260	260	260	260	260	260
L1 [mm]	190	230			190	230			230			-	-	-	-	-	-
L2 [mm]	90																
B [mm]	65.5																
H [mm]	54.5	56.5	56.5	56.5	54.5	56.5	56.5	56.5	56.5	56.5	56.5	61	61	61	61	61	61
h [mm]	14.5	18	18	47.5	14.5	18	18	47.5	18	18	47.5	23	50	62.5	23	50	62.5
AGZ	G¾B DN15	G1B DN20	G1B DN20	FL DN20	G¾B DN15	G1B DN20	G1B DN20	FL DN20	G1B DN20	G1B DN20	FL DN20	G1¼B DN25	FL DN25	FL DN32	G1¼B DN25	FL DN25	FL DN 32
AGV	R½	R¾	R¾	-	R½	R¾	R¾	-	R¾	R¾	-	R1	-	-	R1	-	-
D [mm]	-	-	-	105	-	-	-	105	-	-	105	-	114	139	-	114	139
d [mm]	-	-	-	14	-	-	-	14	-	-	14	-	14	18	-	14	18
F [mm]	-	-	-	95	-	-	-	95	-	-	95	-	100	125	-	100	125
K [mm]	-	-	-	75	-	-	-	75	-	-	75	-	85	100	-	85	100
Weight [kg]	0.6	0.61	0.63	2.7	0.6	0.61	0.63	2.7	0.61	0.63	2.7	1.35	3.35	4.65	1.35	3.35	4.65

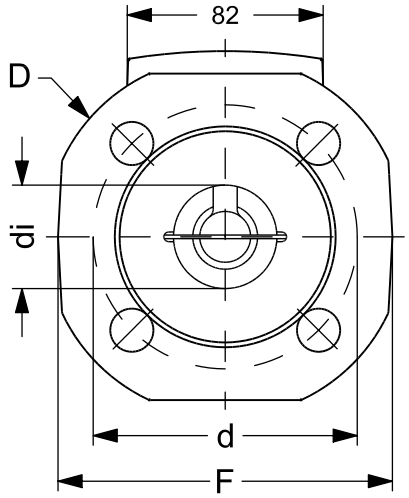
FL - flanged connection

Dimensions, continued

SONO 2500 CT







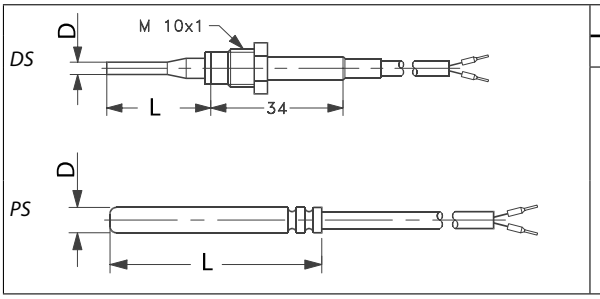
Nominal diameter	40	40	50	65	80
Nominal flow, $q_p(Q_n)$ [m³/h]	10	10	15	25	40
Flange diameter D [mm]	-	148	163	184	198
Bolt circle diameter d [mm]	-	110	125	145	160
Build in length L [mm]	300	300	270	300	300
High A [mm]	78	78	91	91	91
Weight [kg]	3.6	7.9	8.5	10.8	12.6
Flange[1] dimension F [mm]	-	138	147	170	188
Internal diameter d_i [mm]	43.4	43.4	54.5	70.3	82.5
Thread[2] connection G	G2B	-	-	-	-

[1] Flanges PN 25 acc. to ISO 7005-3

[2] Thread acc. to ISO 228

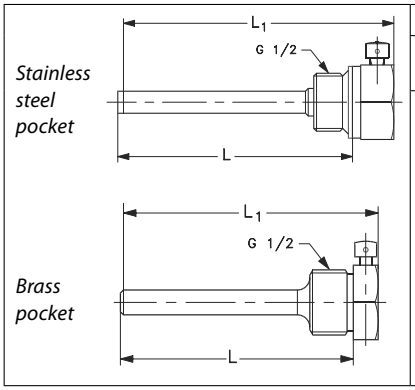
Dimensions, continued

Temperature sensors



Designation	D (mm)	L (mm)
Direct mounted (DS)	ø 3.3	27.5
Pocket sensor (PS)	ø 5.2	50
	ø 6.0	

Sensor pockets



Type		Brass								Stainless steel			
Sensor dimension	(mm)	ø 5.2					ø 6.0			ø 6.0			
Length	L_1 (mm)	42	58	78	93	128	47	98	133	92	127	168	223
	L (mm)	34	50	70	85	120	40	85	120	85	120	155	210

Dimensions, continued

INFOCAL 6