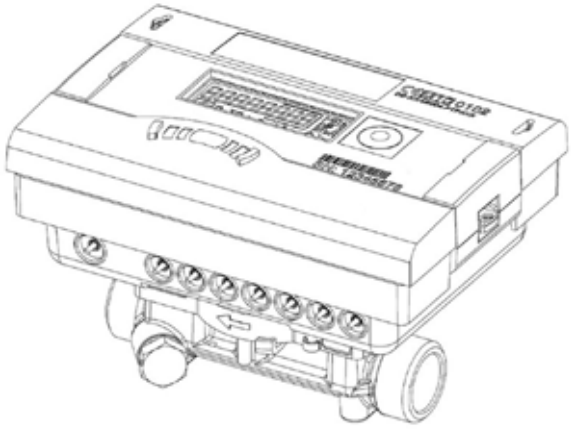
Instruction

SONOMETER™1100
Ultrasonic compact energy meter



1.0 Table of contents

2.0 Safety notes and product information

Following instructions refer to the ultrasonic energy meter.

The regulations on the use of energy meters must be observed! The meter installation is only to be performed by an installation and/or electrical contractor using personnel trained in the installation and use of electrical equipment and familiar with the Low Voltage Directive.

- Medium: water, as per AGFW Instruction Sheet FW510.If water additives are used (e.g. corrosion protection), the user must make sure that the corrosion resistance is adequate.
- The specified medium temperature is 5 ... 90°C/105°C/130°C(150°C)
- The temperature range depends on variant and nominal size
- The exact temperature range is shown on the type plate
- The encapsulated variant is to be used if condensation is expected
- The specified operating/ambient conditions are: 5…55 °C; max. 93% rel. humidity
- Protection class: calculator IP54; flow sensor IP54 (heating)/IP65 (cooling, heat/cooling)
- Ambient temperatures below 35 °C ensures typical battery lifetime

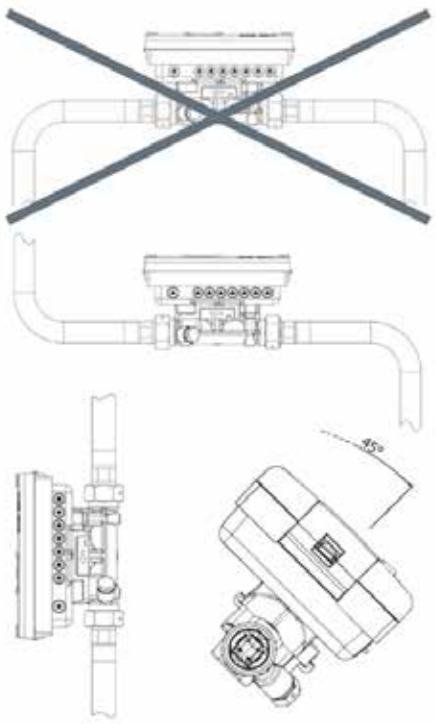
This installation guide is intended for trained personnel and does not contain any basic working steps.

If the flow sensor is insulated with the pipeline, the calculator must be accessible.

Safety Note
The seal on the energy meter must not be damaged!
A damaged seal will result in immediate invalidation of the factory warranty and verification. The cables supplied with the meter must not be shortened, extended or changed in any other way.

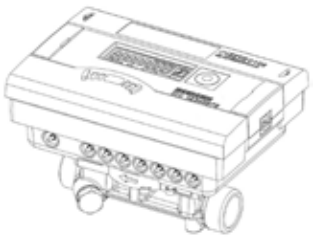
3.0 Installation of energy meter

Depending on the application (heat or cooling meter), the energy meter is installed in the forward or return pipe of the system. The installation location is printed on the meter and is also visible in the information loop in the calculator menu. The flow sensor must be installed so that the direction of flow corresponds to the direction of the arrow on the sensor. Calming sections are not needed before or after the energy meter, but calming sections of 3xDN are recommended before the meter.
The energy meter can be installed in both horizontal and vertical pipe sections, but every time so that air bubbles cannot collect in the meter. The flow sensor must always be filled with water. Avoid frost on the meter.
We recommend installing the flow sensor in a tilted (45°) position. The minimum system pressure must be 1 bar to avoid cavitation.



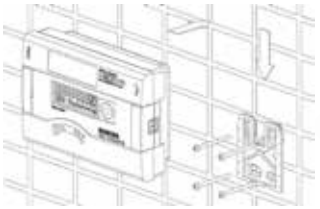
Make sure the energy meter is installed sufficiently far away from possible sources of electromagnetic interference (switches, electric motors, fluorescent lamps, etc...).
To simplify the removal of the energy meter it is recommended to install isolating valves before and after the meter.
The energy meter should be installed in an accessible position for service and operating personnel.
Initial operation is to be carried out and recorded after installation.

For medium temperatures of more than 90°C or if $T_{water} < T_{ambient}$ (for application as cooling meter or heat meter with cooling tariff), the calculator must be removed from the meter and installed a sufficient distance away from heat sources.
A wall holder (supplied with meter) or a space holder (optional) is available for this purpose.

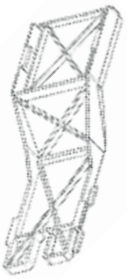


T: 5 ... 90°C
$T_{water} > T_{ambient}$

T: 5 ... 130 / 150°C
$T_{water} < T_{ambient}$



wall mounting



space holder

4.0 Installation of temperature sensors

Handle the temperature sensors carefully!
The sensor cables are fitted with coloured type labels:

Red (TH): sensor in hot line,
Blue (TC): sensor in cold line

Make sure the sensors are mounted symmetrically (both directly immersed, or both installed in a pocket). The maximum cable length is 10 m. The connecting cables must not be shortened or extended. For DN 15 and DN 20, the sensors must be directly immersed.
The free temperature sensor can be installed in a ball valve /adapter or in a conformity tested pocket for this type of sensor. Ensure that the temperature sensors are permanently connected during operation.

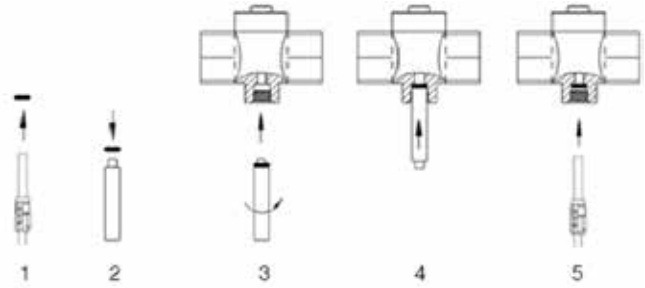
For installation in a ball valve (same for adapter), a 4-piece coupling set is enclosed in a separate bag. See procedure under item 1…5 on the right. Insert an O-ring in the sensor hole using the mounting pin supplied.
If the sensor is installed in a pocket, it must be inserted as far as the bottom of the pocket and then secured. The pockets are best installed in T-pieces with a 45° or 90° angle. The tip of the pocket must point in the opposite direction to the direction of flow and must be located in the middle of the pipe.
The temperature sensors must be sealed after installation in the pockets.

⚠

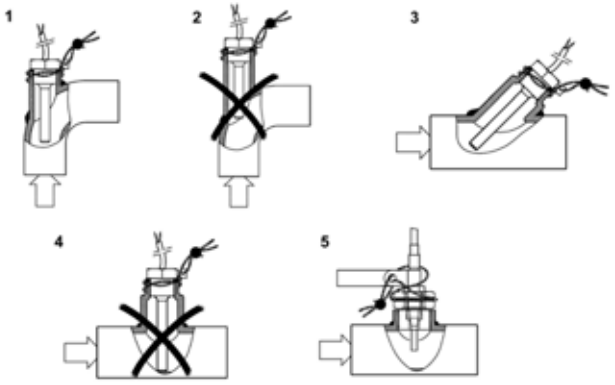
The operation of any violation of this guidance will result in immediate invalidation of the factory warranty and verification.

Installation in a ball valve:

Tighten the plug screw with a torque of approx. 12 Nm



Installation in a pocket:

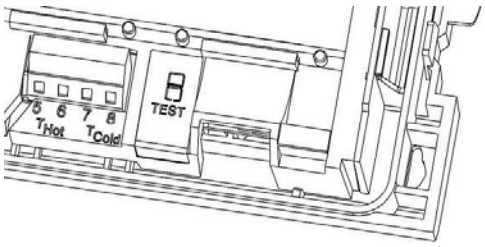


Connect the sensor cables to terminals 5-6 / 7-8 as shown in the table below.

Meter type	Sensor marking	Terminal	Installation position
Heat meter	Red	T_{Hot} (5,6)	Inlet
	Blue	T_{Cold} (7, 8)	Outlet
Heat meter with cooling tariff	Red	T_{Hot} (5, 6)	Inlet
	Blue	T_{Cold} (7, 8)	Outlet
Cooling meter	Red	T_{Hot} (5, 6)	Outlet
	Blue	T_{Cold} (7, 8)	Inlet

Cable entries:
1: Cable entry for connecting T_{Hot} (5,6)
2: Cable entry for connecting T_{Cold} (7,8)

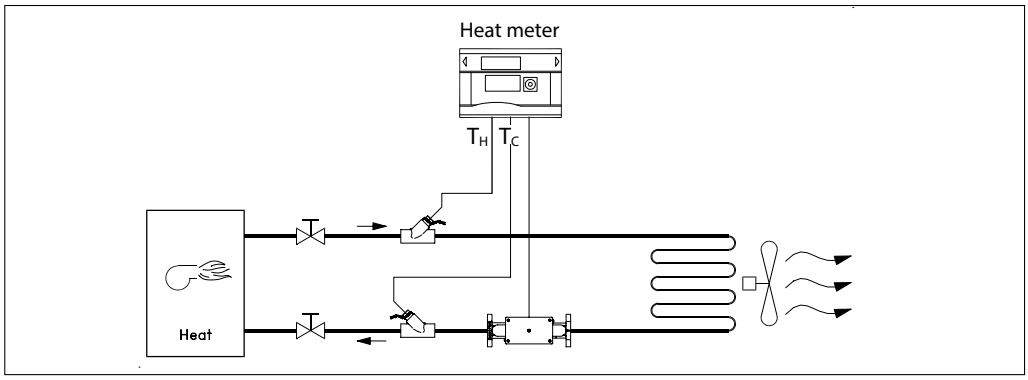
Terminals for temperature sensors:



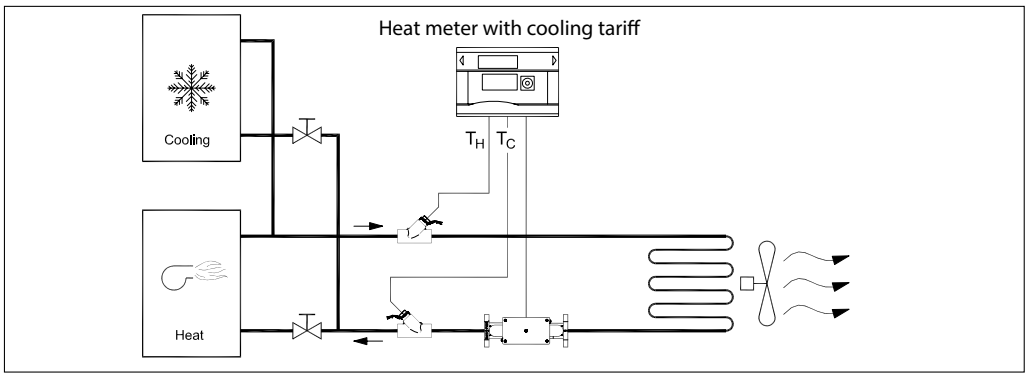
Installation of temperature sensors, continued

Installation of temperature sensors in 3 types of applications (energy meter in outlet):

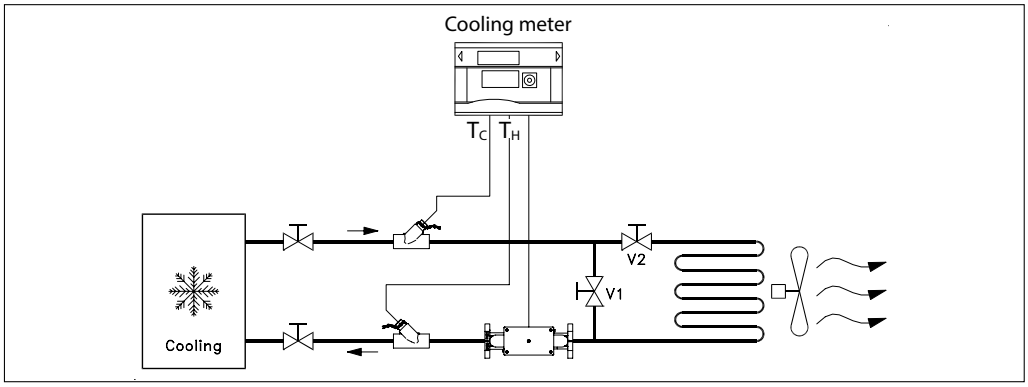
District heating/ boiler application



Combined heating/ cooling application



Chilled water application



5.0 Power supply

Sonometer™1100 can be powered from lithium battery (11 or 16 years lifetime) or 230V AC / 24V AC mains unit supply.

Battery
3.6 V DC lithium battery is fitted in the standard version. The battery is not to be charged, replaced or short-circuited. Ambient temperatures below 35°C ensure the typical life of the battery.

Mains unit
24 VAC or 230 VAC power supply units can be changed to or retrofitted at any time. The cable is to be fuse at max. 6 A and protected against manipulation. Connect the cable according the labelling of the terminal. The power supply unit notifies the meter if mains voltage is present.

If the power supply fails, the backup battery (CR2032) provides the power supply for up to 1 year. The LCD readings (on pressing button) and the date and time are still updated, but none of the measuring functions work, incl. the flow rate measurement. Communication still functions over the optional M-Bus, RS485 and RS232 modules or the optical interface, but reduces the life of the backup battery. The radio function is switched off in the event of power supply failure.

⚠

Caution
Used batteries must be disposed of at suitable waste collection points.
Risk of explosion if battery is replaced by an incorrect type.

⚠

Caution
It is strictly necessary to have protective safety cover installed at all times.
Under no circumstances connect between the two phases otherwise the power supply unit will be destroyed.

6.0 Start-up operation

Once the meter has been installed, the components (calculator, volume measuring component and both temperature sensors) must be sealed and the meter taken into operation.

Bleed the system until the flow rate display is steady.
Check the display for a plausible indication of flow rate and temperatures.

7.0 Expansion modules

The energy meter has two slots for expansion modules. The modules can be used and combined as shown in the table. The analogue module needs both slots. Integrated radio is always possible. The analog module occupies both positions.

The relevant ESD regulations (electrostatic discharge) must be observed.
No liability is accepted for damage (especially to electronic circuits) resulting from failure to comply with the ESD regulations.

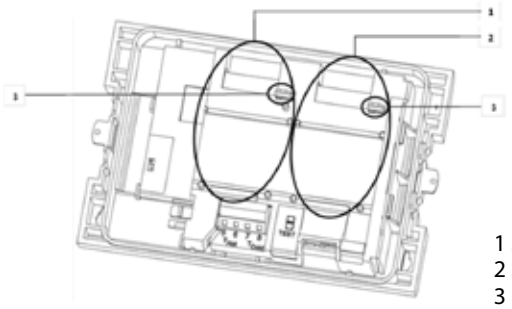
These modules have no effect on consumption recording and can be fitted retrospectively without damaging the verification mark.

		interface / slot 2					
		no module	M-Bus	RS232	RS485	pulse input	L-Bus (for external radio)
interface / slot 1	no module	•	–	–	–	–	–
	M-Bus	•	•	•	•	–	•
	RS232	•	–	–	–	–	–
	RS485	•	–	–	–	–	–
	pulsse input	•	•	•	•	–	•
	pulse output	•	•	•	•	•	•
	pulse in-/ output	•	•	•	•	–	•
	analogue output 4...20mA	•	–	–	–	–	–
	L-Bus (for external radio)	•	–	–	–	–	–

• combination is possible
– combination is not possible
* integrated radio is always possible

7.1 Installation of modules

1. Open the calculator by releasing the side fasteners
2. Lock the module into the appropriate slot and carefully connect the pre-formed ribbon cable at both ends.
3. Close the lid and check the meter for correct operation by pressing the push button (loop 3). Renew the seal of the housing lid if the meter functions correctly.



1 Slot 1
2 Slot 2
3 Fixing clips

8.0 Communication

The calculator supports three communication channels. Additional to the radio communication two wired communication modules can be used, e.g. two M-Bus modules. The protocol of the two channels can be different but is preset at factory, whereby the radio telegram will have the same content than the module 2. Customer specific requirements can be defined by using the IZAR@SET Software. Each port has its own primary address. Both ports have a common secondary address, which is set to the serial number ex works.

8.1 Communication via radio

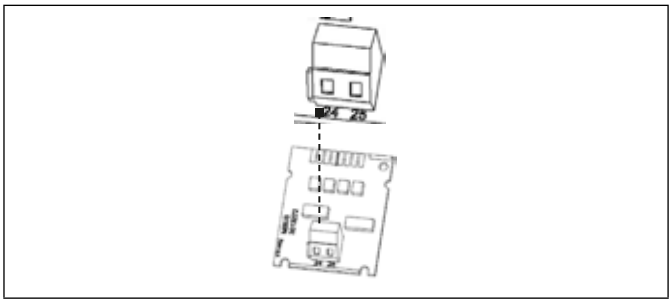
The integrated radio module is an interface for communication with OMS radio receivers.
Unidirectional communication has the following specification:

- The module sends every 12 s (send period 0.1 % of duty cycle (min. 8 s); variable, depending on protocol length and programming)
- The radio communicates the actual data register
- Transmission frequency: 868 MHz or 434 MHz
- Various Diehl Metering receivers are available for receiving the protocol (e.g. Bluetooth, GPRS, LAN, …)
- The protocol corresponds to the"Open Metering" or "DM Standard" and is encrypted
- Reading modes: Walk-By, Drive-By, Fixed-Network
- For problematic radio installations (shield) the external radio module set can also be used

8.2 M-Bus communication module

The M-Bus communication module is a serial interface for communication with external devices (M-Bus control centres), e.g. IZAR CENTER. A number of meters can be connected to a control centre. The module contains a 2-pole terminal strip with terminals marked 24, 25.

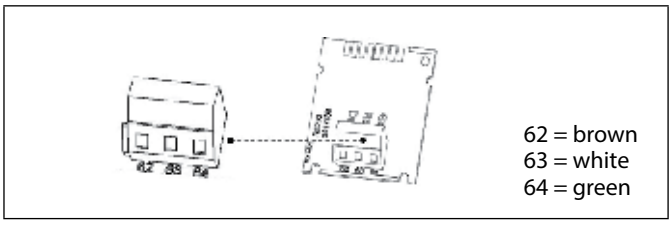
- The connection is not polarity-conscious and is electrically isolated
- M-Bus protocol to EN 1434 standard;
- 300 or 2400 baud (auto baud detect)
- Connection for 2 x 2.5 mm^2 wires
- Current drawn: one M-Bus load



8.3 RS232 Communication module

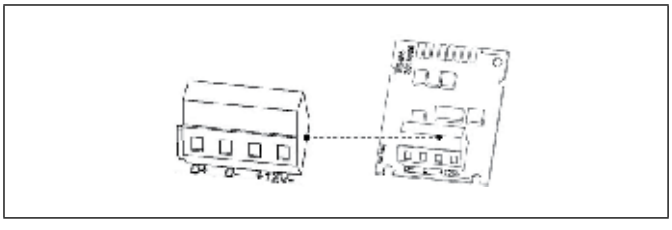
The RS232 communication module is a serial interface for communicating with external devices, e.g. PC; 300 or 2400 bauds. The module contains a 3-pole terminal strip with terminals marked 62 (Dat), 63 (Req) and 64 (GND). The used communication protocol is M-Bus.

The coloured wires are to be connected as shown:



8.4 RS485 Communication module

The RS485 communication module is a serial interface for communication with external devices, e.g. PC; 2400 bauds only. The used communication protocol is M-Bus.
The module contains a 4-pole terminal strip with terminals marked D+, D-, +12 V and GND. The module needs an external power supply of 12 VDC ±5 V.



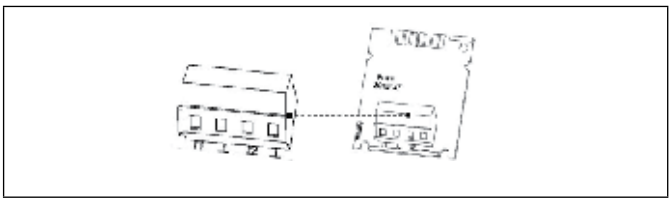
8.5 Pulse input function module

Module for two additional meters. Pulse input 1 is marked as "I1-⊥", input 2 with "I2 -⊥". Pulse inputs can be programmed (IZAR@SET) with a value: 1, 2.5, 10, 25, 100, 250, 1000, 2500 litre per pulse.

- Pulse transmitter must be electrically isolated, e.g. Reed contact
- Possible units are all the energy units available in the meter, the volume unit m^3 or no unit.

Data is accumulated separately in registers; can be read in the display as IN1 and IN2 and can be transferred via the communication modules.

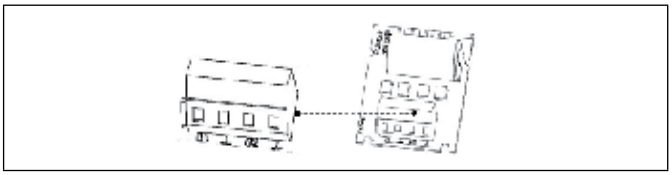
Input frequency	≤ 8 Hz
Min. pulse duration	10 ms
Input resistance	2.2 MΩ
Terminal voltage	3 VDC
Cable length	up to 10 m

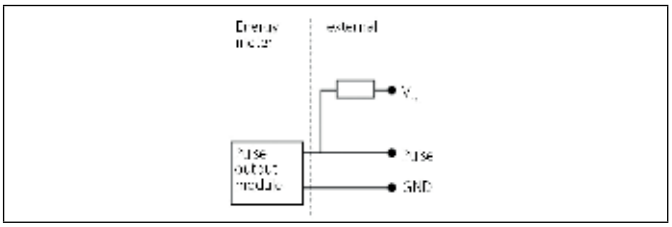


8.6 Pulse output function module

The module is equipped with 2 pulse outputs, which can be freely programmed using the IZAR@SET software. The outputs are marked as "O1 -⊥" and "O2 -⊥" on the terminal strip and as Out1 and Out2 on the display.

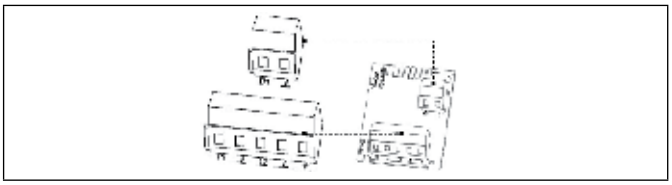
- External supply: Vcc = 3-30 VDC
- Output current ≤ 20 mA with a residual voltage of ≤ 0.5 V
- Open Collector (Drain)
- Electrically isolated
- Output 1: f ≤ 4 Hz Pulse duration: 125 ms ±10 %
  Pulse pause: ≥ 125 ms –10 %
- Output 2: f ≤ 100 Hz Pulse duration pulse/pause ~1:1
- The volume pulse rate can be freely programmed
- Standard: last digit in the display





8.7 Combined function module (IN/OUT)

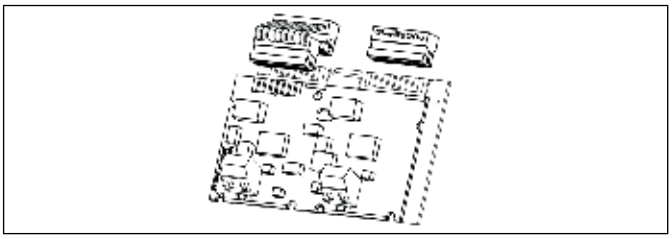
The combined module has 2 inputs and 1 output.
See chapter 8.5 for the specific characteristics on the pulse input. A 3 VDC voltage is connected to the "+" terminal and can be used as the supply for a flow sensor.
The pulse output has the same characteristics as pulse output 1 specified under 8.6. It is not, however, electrically isolated.



8.8 Analogue output function module

The module has 2 passive analogue output connections which are freely programmable using the IZAR@SET software. On the terminal strip, the electrically isolated outputs "1" and "2" are marked and the polarity is indicated ("+" and "–").

- Passive, external power supply: 10…30 VDC
- Current loop 4 … 20 mA whereat 4 mA = 0 value;
  20 mA = programmable maximum value
- Overload up to 20.5 mA, then residual current
- The module displays errors with 3.5 mA or 22.6 mA (programmable)
- Output values: power, flow, temperatures



The module is connected with the meter electronics by means of a ribbon cable. The separate plug connector on module slot 2 is necessary for the perfect functioning of the analogue outputs.

8.9 Test output

The internally located test output is intended for testing laboratories. The manufacturer supplies two special cables:
1. Volume testing pulse
2. Energy testing pulse
Please refer to the inspection and testing manual for further specifications (pulse rate, pulse duration/pause, pulse frequency).

Ensure that the temperature sensors (measurement resistances) remain in contact without interruption during energy verification.

9.0 Display

To show the data generated by the calculator in the display, various windows are provided as loop functions that can be called up in succession to display the system information associated with each window (e.g. energy amounts, water volume, running days, water amounts, current temperatures). The energy meter has 6 different display loops.

The various display windows comprise up to several displays that change at intervals of 2 – 4 s. The loops in the display are numbered 1, 2, ... and 6 to help the user find his way around quickly. The main loop is programmed with the current data as default setting, e.g. for energy, volume and flow rate.

Informative Displays (Standard)

Loop	Sequence	Window 1	Window 2	Window 3
"1" Main loop	1.1	Accumulated energy		
	1.2	Volume		
	1.3	Accumulated energy (cooling)	(Sequence will be shown only in a heat meter with cooling tariff)	
	1.4	Flow		
	1.5	Power		
	1.6	Forward/- return temperature		
	1.7	Temperature difference		
	1.8	Operating days	Error hours	
	1.9	Error status		
	1.10	Display test		
Loop	Sequence	Window 1	Window 2	Window 3
"2" Accounting date loop	2.1	Accounting date 1	Accounting date 1 energy	‚Accd 1A'
	2.2	‚Accd 1'	Future accounting date 1	
	2.3	Accounting date 1 previous year	Accounting date 1 previous year energy	‚Accd 1L'
	2.4	Accounting date 2	Accounting date 2 energy	‚Accd 2A'
	2.5	‚Accd 2'	Future accounting date 2	
	2.6	Accounting date 2 previous year	Accounting date 2 previous year energy	‚Accd 2L'
	...			
	2.14	Accounting date 2 previous year	Pulse input 2	Pulse input volume 2
Loop	Sequence	Window 1	Window 2	Window 3
"3" Info loop	3.1	Current date	Current time	
	3.2	‚SEC_Adr'	Secondary address	
	3.3	‚Pri_Adr 1'	Primary address 1	
	3.4	‚Pri_Adr 2'	Primary address 2	
	3.5	Installation position		
	3.6	‚Port 1'	No. of the mounted module at port 1	
	3.7	‚Port 2'	No. of the mounted module at port 2	
	3.8	Status integrated radio	(Sequence will be shown only in meters with integrated radio)	
	3.9	software version	Checksum	
Loop	Sequence	Window 1	Window 2	Window 3
"4" Pulse input loop	4.1	‚In1'	Accumulated value pulse input 1	‚PPI' pulse value 1
	4.2	‚In2'	Accumulated value pulse input 2	‚PPI' pulse value 2

Loop	Sequence	Window 1	Window 2	Window 3	Window 4	Window 5	Window 6
"5" Tariff loop	Only in a heat meter with cooling tariff.						
Loop	Sequence	Window 1	Window 2	Window 3	Window 4	Window 5	Window 6
"6" Monthly value loop	6.1	‚LOG'	date last month	energy	volume	max. flow rate	max. power
	6.2	‚LOG'	date month - 1	energy	volume	max. flow rate	max. power
	6.3	‚LOG'	date month - 2	energy	volume	max. flow rate	max. power
	...	...					
	6.24	‚LOG'	date month - 23	energy	volume	max. flow rate	max. power

10.0 Simple operation

The push-button is used to switch through 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 meter automatically switches off the display to save power if the button is not pressed for
approx. 4 minutes (except in the event of fault) and returns to the basic display when the button is pressed again.

11.0 Error codes

The error code is displayed in the main loop if an error occurs. All the other windows can still be selected by pressing the button. The error code display appears again automatically if the button is not pressed for approx. 4 minutes.

The error display disappears automatically as soon as the cause of the error has been cleared. All errors present longer than 6 minutes are saved in the error log.

Error code	Description
C – 1	Basic parameters saved in flash or RAM have been lost
E 1	Temperature range outside [-19.9 °C ... 199.9 °C] e.g. sensor short-circuit, sensor break
E 3**	Flow and return sensors interchanged
E 4	Hardware error US measurement, e.g. transducer or control defective or short circuit
E 5	Communication not possible (to many frequent readouts)
E 6**	Flow direction of flow meter incorrect
E 7	No plausible ultrasound receiver signal, e.g. air in the measuring path
E 8	No primary power supply (only with power supply unit); supply via backup battery
E 9	Battery nearly discharged, end of lifetime reached
E A*	Leak: Pipe break detection
E b*	Leak: Energy meter leak detection
E C*	Leak: Leak pulse input 1
E d*	Leak: Leak pulse input 2

* optional ** application dependent

Instruction SONOMETER™1100

Produced by Danfoss A/S © 12/2014