ZENNER

Electronic energy meter

multidata S1

Performance specification

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1. Introduction

multidata S1 is a latest-generation microprocessor-controlled calculating unit. An ingenious measuring method enables maximum measuring accuracy and stability in combination with Pt-500temperature sensors. The calculating unit is built using the most modern SMD technology. A 75X-family NEC microprocessor ensures that the energy meter keeps working perfectly for over 6 years. Both conventional volumetric measuring units with reed contact and high-frequency electronic meters can be connected to the volume inputs.

As a genuine multi-talent, **multidata S1** can, of course, work together with all sizes of volumetric measuring units. In the case of compact devices, usually volumetric measuring units designed as a single-jet meter, the calculating unit can be removed and fixed to the wall. All multi-jet and Woltman versions are designed for wall mounting only.

Operating failures and faults are automatically detected and can be shown on the display with the date and type of fault. The downtimes are stored and can be consulted for checking purposes.

A non-volatile memory backs up all determinative data at regular intervals so that it cannot be lost. All devices also have an optical interface for mobile data acquisition as well as programming the most essential parameters.

In combination with our read-out systems, an internal loop memory allows access to further data which is not retrievable on the display, e.g. the previous month's values.

Apart from the volumetric measuring unit, it is possible in the case of all standard devices to connect two additional contact makers, e.g. a cold and hot water meter, whose consumption both appears on the display and can also be determined via the read-out systems.

The additional connections however have a multi-function, i.e. they can be programmed not only as inputs but also as outputs, so that they function as remote meter outputs for energy and volume, for instance.

Due to its integrated clock with calendar, critical date data is also no problem for the **multidata S1**. Energy and volume as well as the volumes of the additional meters are written on a date specified by you, year on year, in the memory and can be read or transferred remotely via the critical date menu.

Further designs are available as an optional extra for all imaginable measuring tasks. Thus a large number of devices can, for example, be provided and read via the MBus. Here, it is just as possible to take a reading on site as it is to transfer remotely by telephone network directly to a PC. For smaller networks with up to 10 devices, a special bus - the ZR-bus - was developed which requires no additional devices or feeding devices whatsoever. For more straightforward applications, a standard RS232 version can also be supplied which, however, enables only one device to be read respectively.

The energy meter is already prepared for transferring data via radio networks too.

Irrespective of the design, with **multidata S1** you have at your disposal a perfected top-grade product which fulfils almost your every wish.

2. Technical data - Overview

Installation site	Return or forward flow, depending on version
Pulse input	maximum 1 Hz or 100 Hz optional
Sensor type	Coupled temperature sensors Pt-500
Temp. measuring range	0 - 180 °C
Temp. difference	3 - 150 K
Heat coefficient	adjustable for forward and return flow
Temperature drift	0.0025%/°C
Long-term drift	<=0.0001%/°C
Typ. error temp. difference	100%*0.02 / ?t? 0.3625%
Test output	Number of pulses Z = 100 * ?t * k
Units	Wh, MWh, KWh, MJ, GJ
Pulse valencies	0.0001 .. 65535 L/Imp. or Imp./L
Power supply	Lithium battery AA , 3 VDC /2.0 Ah or 3.6 VDC / 2.3 Ah
Battery life	>= 6 years
Supply voltage	min: 2.7 VDC max. 4.0 VDC
Current consumption	typically 8.5 up to 10 ?A
Display	LCD , 8 positions plus special characters
Data backup	EEPROM
Ambient temperature	5..50 °C in operation -15.. 60°C in storage
Additional inputs/outputs	2 pulse inputs with up to 1Hz or can be combined optionally as outputs (1Hz, 50VDC/50mA)
Interfaces	optic as standard MBus, RS232, ZR-bus optional

3. Performance specification

3.1 Principles of energy calculation

The quantity of energy is a physical type of energy as the product of heat output and time. Written with thermodynamic values, the equation looks as follows:

$$A = m (h_1 - h_2)$$

where : A = quantity of energy

m = mass of the released heat carrier

h1 = specific enthalpy in the case of forward flow temperature

h2 = specific enthalpy in the case of return flow temperature

As can be seen from the equation, the quantity of energy cannot be measured directly, but only indirectly via other physical values. Since the energy meter now measures the volume instead of the mass, and the temperature difference instead of the enthalpy difference, the equation must be expressed in a simpler form. So, in practice, the equation is as follows:

$$A = V * ?? * K$$

where

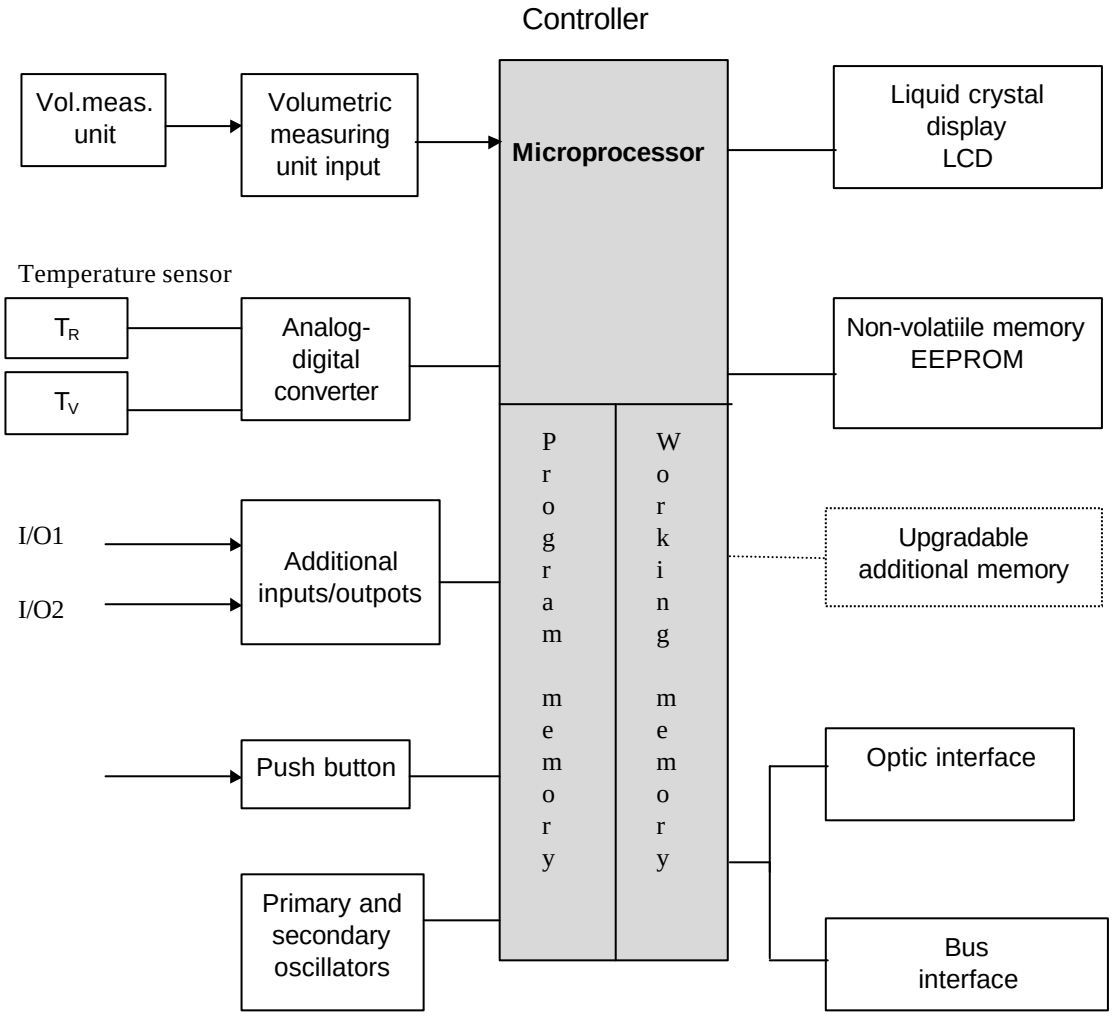
V = volume of the released heat carrier

?? = temperature difference between forward and return flow

k = heat coefficient; this takes into account the dependence on temperature of the specific density and the specific enthalpy sliding in accordance with the temperature in the volumetric measuring unit

Since the heat coefficient is an essential component for a correct calculation, it is important that the installation of the volumetric measuring unit in the forward or return flow matches the installation site indicated on the type plate. Modern calculating units can be programmed both for installation in the forward flow and for installation in the return flow at the factory.

3.2 Block diagram of calculating unit

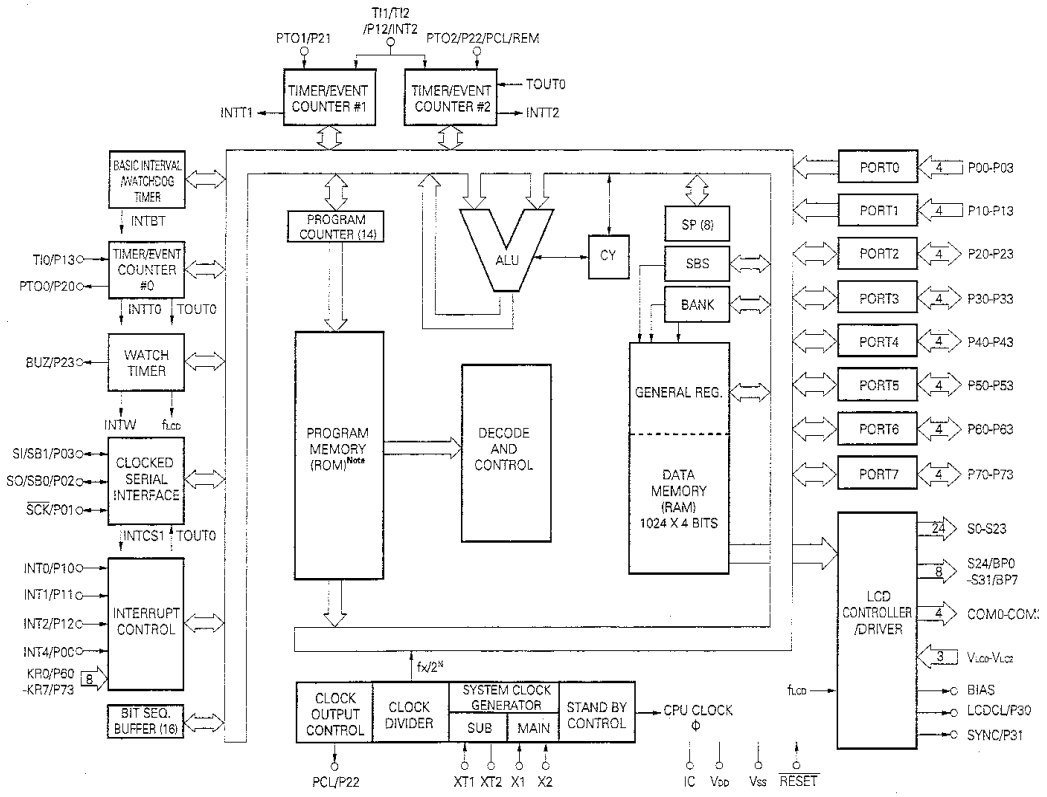


The block diagram illustrates the general structure of the calculating units. In principle, different function groups can be summarised which ensure an optimum operating sequence:

- The analog/digital converter converts the measured resistances of the temperature sensors into a digital value understandable to the processor.
- The touch button (INFO key) enables all data and settings of the energy meter to be retrieved in combination with the LC-display.
- The memory modules (EEPROM's) ensure that all important data is constantly available, in particular after a power or battery failure. Furthermore, previously specified values are stored in the memory at cyclic intervals.
- The interfaces to other devices such as PC's or hand-held computers enable a convenient read-out, function control, as well as programming the most important parameters of the calculating units.

3.3 The core component of the energy meter

The microprocessor of the multidata S1 is the actual distributing centre of the calculating units. This is an NEC-4 bit processor. It is a processor that was especially developed for measuring tasks of this kind. This is the ?PD753016 metering chip.

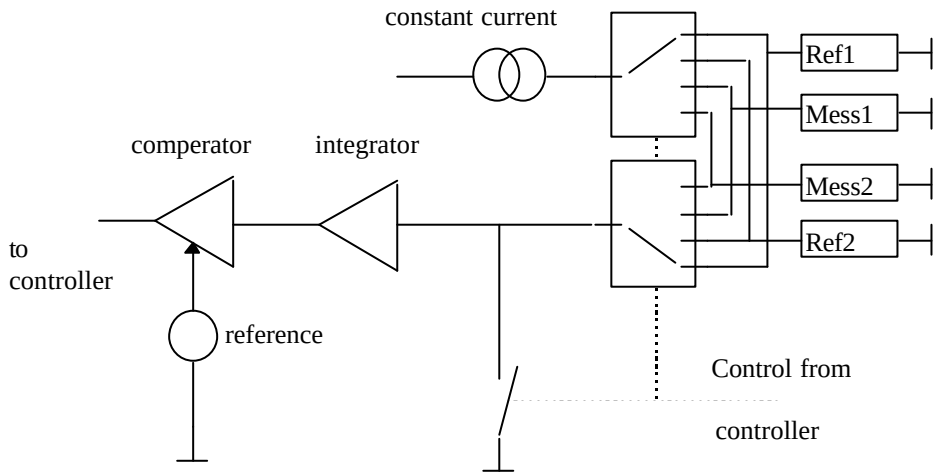


COM- 75X family
4-bit CMOS microcomputer

3.4 The analog-digital converter

The actual measurement of the temperature is performed by an analog-digital converter. This converter works using the dual slope method (double ramp integration). The system calibrates itself with each measurement process. Accuracy depends on two reference resistances only. These resistances are very accurate and have long-term stability. The dual slope method has an added advantage in that interference voltages have hardly any effect on the measurement result due to the integration principle.

A constant current is sent through the temperature sensor which is to be measured. The current flowing through the sensor is integrated for a fixed period after which the time-determining condenser of the integrator is discharged with a constant current and the associated duration of discharge is precisely measured. The time measured is then in inverse proportion to the resistance and is correspondingly evaluated by the microprocessor.



Block diagram of the analog-digital converter

3.5 The measuring cycles

Measuring process

The temperature sensor and reference resistances are measured at fixed intervals. However, these are variable within a certain range and can be changed during the phase in which the parameters of the calculating unit are set. In so-called test mode, the measurements are repeated at intervals of 2 seconds. In normal operation, times of between 2 to 254 seconds can be realised. For the normal series however, a time of 60 seconds is programmed.

The actual measurement is carried out in the following sequence:

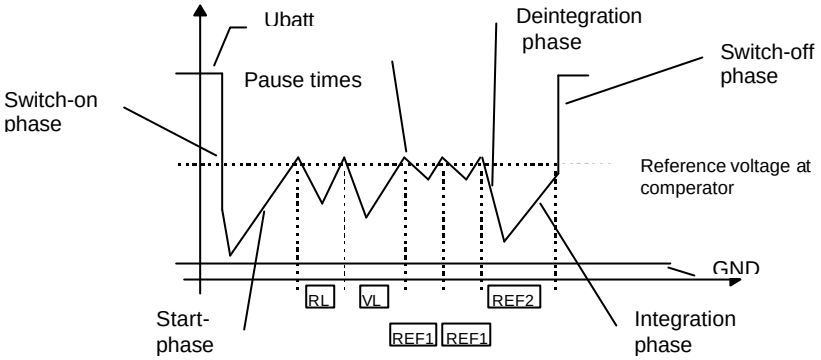
- measurement of the return flow resistance
- measurement of the forward flow resistance
- measurement of the reference resistance Rref1
- repeat measurement of the reference resistance Rref1
- measurement of the reference resistance Rref2

Corresponding waiting times are observed between the measurements.

The individual measuring phases appear as follows:

1. Measurement circuit made live
2. Zero setting
3. Charging phase : integration of the measurement current against a fixed time reference of 20 ms.
4. Discharge : disconnection of the resistors. The integrator is discharged by a constant current source. If the initial voltage becomes greater than a reference voltage, the compensator generates an interrupt signal which reaches the microprocessor.
5. Switch off measurement circuit

Voltage-time diagram of integrator output voltage:



3.6 Energy quantity calculation

The quantity of energy is basically calculated in several steps:

1. Temperature measurement of the connected temperature sensor
2. Temperature calculation and plausibility check
3. Calculation of the quantity of energy
4. Addition of quantity of energy and volume

Temperature range and limit values

The measured temperatures may only move within a certain range. This is the temperature measuring range of the energy meter. In the case of the calculating unit multidata S1, this is 0°C to 180 °C. If it is determined that a measurement falls below 0°C, the display remains at 0°C. If the temperature of 185 °C is exceeded, the meter reports this as an error. Since the calculating unit is finally not in a position to determine whether an incorrect sensor has been connected or, as in this case, the temperature is too high, a defective sensor is assumed to be the error.

It behaves similarly with the temperature differences. If the temperature difference is negative and less than -2K (Kelvin), an error message is output. By contrast, differences between zero and -2K are simply suppressed so that this does not result in unnecessary error messages during practical operation.

Temperature differences which are greater than zero are always included for calculating the quantity of energy.

3.7 Volume calculation

In each measuring cycle which, as already mentioned, is currently programmed to 60 seconds, a volume calculation is also performed. This occurs however only if pulses have also arrived from the volumetric measuring unit since the last cycle.

When parameters are set in the factory or at the testing site, a pulse valency is programmed into each calculating unit, e.g. 10 l/Imp. This must be in accordance with the volumetric measuring unit which later supplies the volume pulses,. Only in this way can it be guaranteed that the energy is also calculated correctly. Otherwise, this can under certain circumstances be too large or even too small by a factor of 10 or 100.

In the case of conventional volumetric measuring units with a reed contact, the volume is calculated by multiplying the incoming pulses by the programmed pulse value:

volume [l] = number of pulses [Imp] * pulse valency [l/Imp]

In the case of high-speed volumetric measuring units, usually newer electronic meters, the volume is calculated by dividing the number of pulses by the pulse valency, since the pulse valency is given or programmed here as a reciprocal value (Imp/l).

The values for the pulse valency may in both cases lie between 0.0001 and 65535.

In the case of standard volumetric measuring units, however, certain ranges of values have won through, usually representing decimal multiples of 1 and 2.5, e.g.:

1 ; 2.5 ; 10 ; 25 ; 100 ; 250 ; 1000 l/Imp

$$\text{volume [l]} = \text{number of pulses [Imp]} * \frac{1}{\text{pulse valency [Imp/l]}}$$

3.7.1 Slow-speed volumetric measuring units

By slow-speed volumetric measuring units we usually mean purely mechanical meters with a reed contact. For this, a pointer or a pointer disc with one or more magnets is fitted to the counter which rotate past a stationary reed contact, thereby starting off a calculating process. The pulse valencies which can be realised usually lie within the range already mentioned of between 1l and 2.5l as well as decimal multiples of this. The pulse frequency achieved in this way is relatively low and usually lies below 1 Hz.

Slow-speed volumetric measuring units should comply with the following conditions:

Minimum frequency	0.001 Hz
Maximum frequency	1 Hz
Mark-space ratio	1 : 1 ... 1 : 5

The above conditions apply correspondingly to the two additional counter inputs. Only slow-speed meters may ever be connected to these.

3.7.2 High-speed volumetric measuring units

High-speed volumetric measuring units usually measure the revolutions of the turbine directly. Most also have additional segments or pallets, so that the pulse rates delivered correspond to twice or four times the speed of the turbine.

The frequencies generated by such meters are correspondingly high and can be anything up to 100 Hz. Since systems which work electronically are chiefly involved, most are also in a position to break down the pulse frequency accordingly to avoid burdening the calculating unit unnecessarily. Due to the higher frequency, it is possible for the calculating unit to make a more exact and certain flow rate calculation, as is the case with the slow-speed volumetric measuring units. The pulse valency is given here in pulses per litre (Imp/l).

High-speed volumetric measuring units may only be connected to the input for the volumetric measuring unit. They are not suitable for the additional inputs. With the multidata S1, it is possible to power such meters by fitting a battery onto the connection board as an option.

The following conditions exist for the high-speed volumetric measuring units:

Minimum frequency	0.001 Hz
Maximum frequency	100 Hz

3.8 Flow rate calculation

Calculating operations, such as the calculation of the flow rate or instantaneous power, require a lot of time, and thus use up a relatively large amount of battery capacity. In normal operation, therefore, only an approximate calculation is performed which is perfectly adequate for a fundamental consideration of the values described. If, for example, one reaches the representation of the flow rate when switching through the menu, the first calculation displayed is only about 7% accurate.

From this time on, however, an additional function is called up which continues to allow the flow rate to be calculated more accurately until the change of day at 0.00 a.m.. This means that after the flow rate measurement has been called up once via the INFO key, the calculating operations are performed more frequently and with greater accuracy. Assuming a constant flow rate over a longer period, an accuracy of 0.5 % is achieved, which can be accepted as being completely sufficient for energy meters.

Should the flow rate change within a short time by more than 12 %, the assumed accuracies will again move in the magnitude of 7%, as greater calculating accuracy cannot be achieved with highly fluctuating flow rates. After the flow rate has changed, the accuracy of calculations again increases to the 0.5% mark.

After the change of day mentioned above, the additional function automatically switches off and is not activated again until the flow rate menu is called up via the display or key.

3.9 Instantaneous power

The same accuracies as mentioned under the flow rate calculation apply to the instantaneous power, since the instantaneous power is calculated directly from the flow rate.

3.10 The LCD display

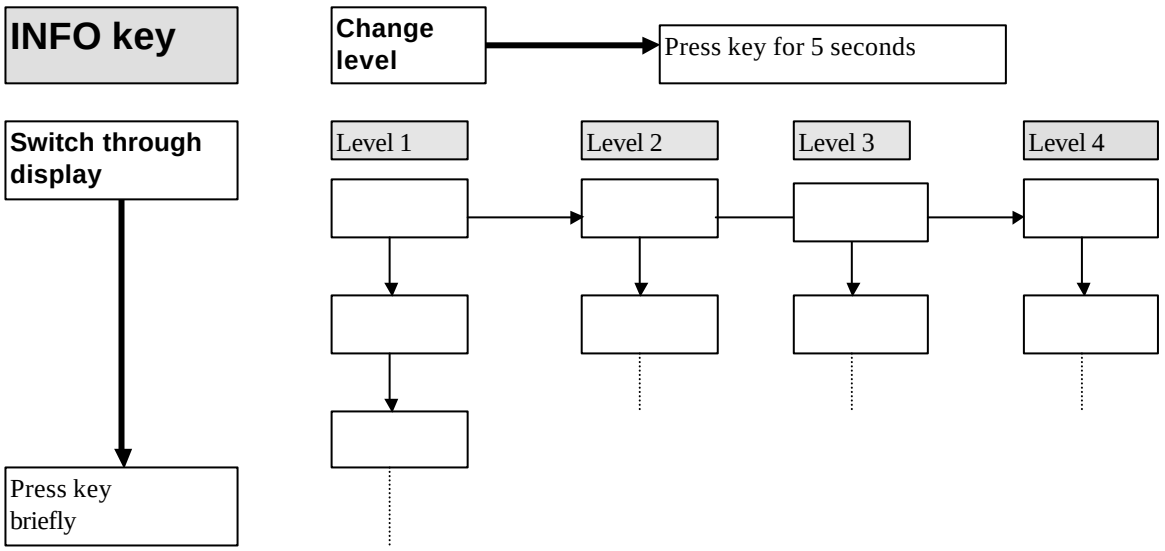
The display is a liquid crystal display with 8 positions for displaying the consumption values and many special characters for the units and state indicators.

This information can be retrieved using the INFO key. In its normal state, the meter is located in the so-called main menu and displays the quantity of energy which has been consumed. If an error has been detected by the energy meter - the main display - the energy, is replaced by the display of the detected errors. This is important for the consumer as only in this way can he recognise immediately that an error is present. By pressing the INFO key once, energy consumption returns to the display.

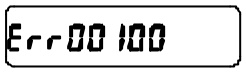
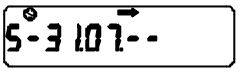
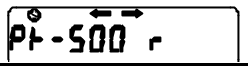
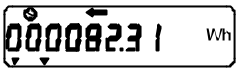
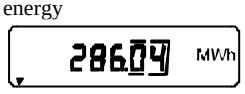
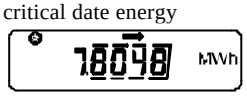
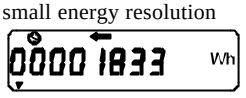
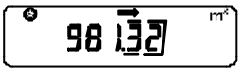
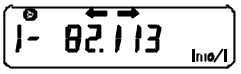
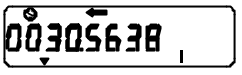
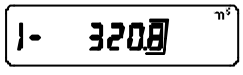
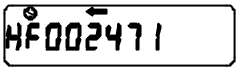
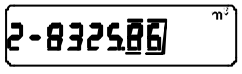
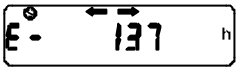
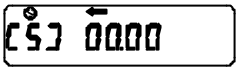
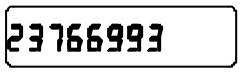
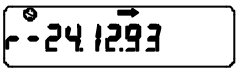
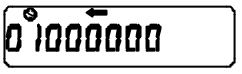
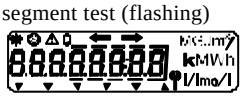
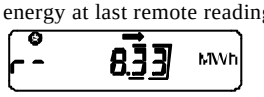
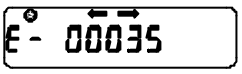
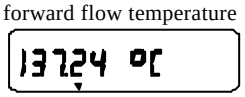
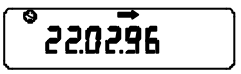
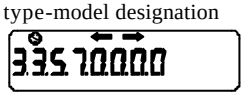
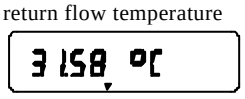
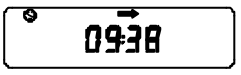
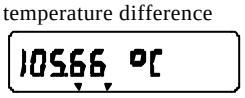
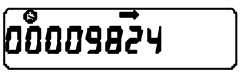
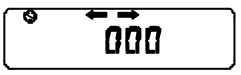
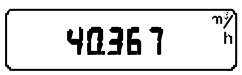
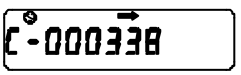
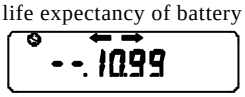
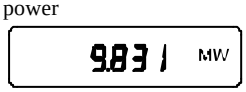
A total of 41 different pieces of consumption and information data can be brought to the display. Due to their greater clarity, these have been compiled in four different groups. A group is designated as a display level or a menu.

To get from one level to the next, hold down the INFO key for several seconds.

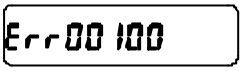
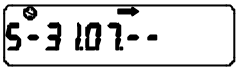
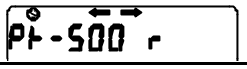
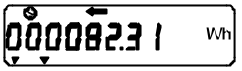
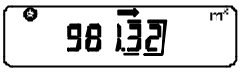
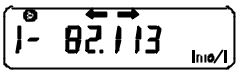
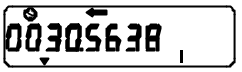
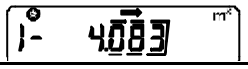
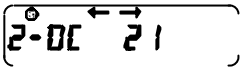
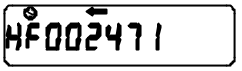
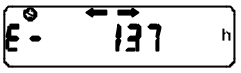
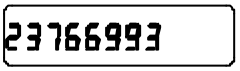
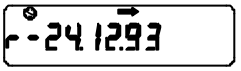
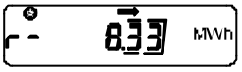
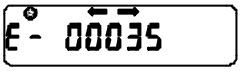
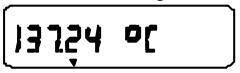
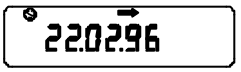
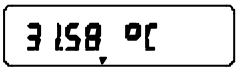
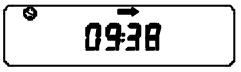
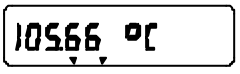
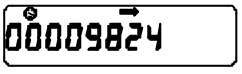
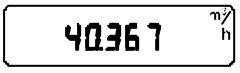
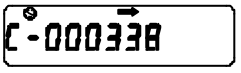
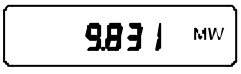
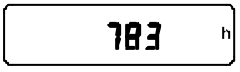
One can switch through the functions within one level by pressing the INFO key for a short time. If the end of a level has been reached, press it again to return to the start of the display sequence. If a menu option which is being viewed is not switched through, the display automatically jumps back to level 1 of the main display after approximately 30 seconds have expired.



Example 1 : standard configuration, both additional meters programmed as inputs

Main menu	**Critical date menu**	**Configuration menu**	**Test menu**
	?	? ?	?
error display (only if avail.) 	critical date data 	temperature sensor and installation site 	energy increase 
energy 	critical date energy 	pulse valency, volumetric measuring unit 	small energy resolution 
volume 	critical date volume 	pulse val. / outp. fct I/O 1 	small volume resolution 
additional I/O 1 	critical date, additional volume 1 	pulse val. / outp. fct I/O 2 	last number of HF pulses 
additional I/O 2 	critical date additional volume 2 	total hours error time 	software version 
letter code 	date the last remote reading 	date of the 1st error 	input diagnosis 
segment test (flashing) 	energy at last remote reading 	error code of this 1st error 	
forward flow temperature 	current date 	type-model designation 	
return flow temperature 	current time 	baud rate of bus 	
temperature difference 	serial number 	address of bus 	
flow rate 	customer number 	life expectancy of battery 	
power 			
operating hours 			

Example 2 : additional meter 1 programmed to input, additional meter 2 to output

Main menu	**Critical date menu** ?	**Configuration menu** ? ?	**Test menu** ?
error display (only if avail.) 	critical date data 	temperature sensor and installation site 	energy increase 
volume 	critical date volume 	pulse val. / outp. fct I/O 1 	small volume resolution 
additional I/O 1 	critical date additional volume 1 	pulse val. / outp. fct I/O 2 	last number of HF pulses 
additional I/O 2 not applicable, as programmed to output	critical date additional volume 2 not applicable, as programmed	total hours error time 	software version 
letter code 	date the last remote reading 	date of the 1st error 	input diagnosis 
segment test (flashing) 	energy on last remote reading 	error code of this 1st error 	
forward flow temperature 	current date 	type-model designation 	
return flow temperature 	current time 	baud rate of bus 	
temperature difference 	serial number 	address of bus 	
flow rate 	customer number 	life expectancy of battery 	
power 			
operating hours 			

3.10.1 The main menu

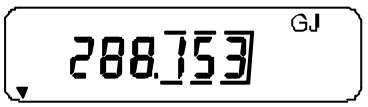
Error display

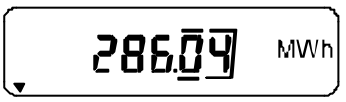
If operating errors are detected by the calculating unit, these are analysed and displayed. This occurs via a multi-character error code, where all currently active error or error codes are added and simultaneously displayed. The error display becomes the main display at that moment and is displayed constantly so that the existence of an error can also be registered directly.

If no error has been detected in the system, this display is not available, i.e. this cannot be activated also by pressing the INFO key.

The complete error description and the associated codes are described in detail further below.

Energy display



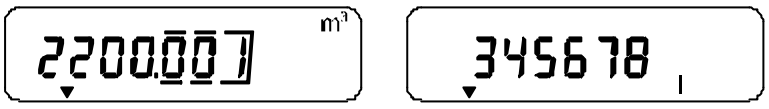


Anzeigebeispiel der Energie in MWh bzw. GJ

This is probably the energy meter's most important display. It is automatically active if the energy meter has not been operated via the key for a fairly long time. The displayed value is regularly updated and always corresponds to the total energy measured by the energy meter. For a simple heating costs bill this value alone is sufficient.

The unit of energy can be configured in the energy meter. It is possible to display readings either in watt hours or in joules. The corresponding multiplier (kilo, mega, giga), as well as the number of post-decimal positions, is automatically selected during configuration in such a way that the energy display will not overflow at maximum power until after 14 months at the soonest.

Volume



This value displays the total water volume used to calculate the energy. In a normal heating system, this value has hardly any significance, since the water circulates constantly in a circuit. The units, along with the post-decimal positions, are selected in the same way as the energy display, i.e. so that they do not overflow within a billing period.

Certain statements about the operability of the volumetric measuring units can be made from the volume of water circulating per unit time, such as determining an average flow rate.

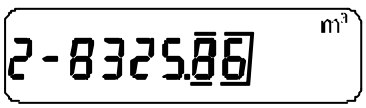
Volume, additional meter 1

Display in square metres, litres or unit-less

The energy meter features two additional counter inputs for contact water meters as standard. The volume of each additional meter is recorded and can be called up on the LC display. The meter which is connected to the input unit IO1 is represented on the LCD, as shown above, by a "1" and a hyphen. This is followed by the consumption which is recorded in m³ or in litres (l) depending on programming. It is additionally possible to also display the counter reading without units. This would, for instance, be practical if other events are to be counted.

Should these displays be missing, is the energy meter not a standard instrument, but optional for other tasks been converted. This would be the case with devices which have been programmed to output.

Volume, additional meter 2

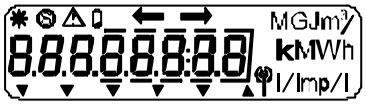


For additional meter 2, the same applies as already described under additional meter 1.

Code for letter reading

A letter reading means that the apartment owner whose heating costs are to be billed with the energy meter, who reads the energy displayed on the energy meter himself, enters it in a letter and sends it to the accounting company. To ensure that the energy reading is also sent free of errors, the accounting company can request the apartment owner to also note, apart from the energy, the code which is provided in this display and the date on the letter. This code is calculated according to a special calculating procedure from the energy reading and serves as a check sum. The accounting company can obtain a program from Zenner which uses the code to check the validity of the data which has been read.

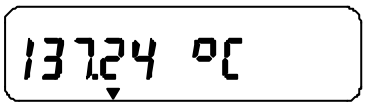
Segment test



Display of all available segments

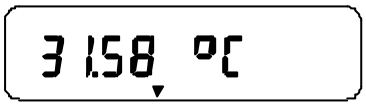
If individual segments of the LCD fail or remain on, a value could have been greatly falsified and therefore incorrectly read. For this reason, the energy meter offers this segment test. In the test, all available segments are switched on and off again so that the display flashes. It can now be checked whether the LCD is still functioning without errors.

Forward flow temperature

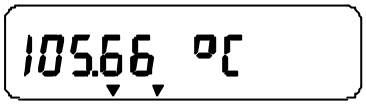


The temperature which the temperature sensor has measured in the forward flow of the heating system is displayed here. The value of the last measurement is displayed in 1/100 °C. In addition, an arrow is switched on above the forward flow symbol.

Return flow temperature



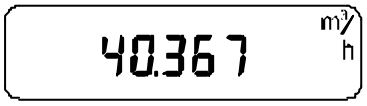
Analogous to the forward flow temperature, the temperature which the temperature sensor in the return flow of the heating system has measured is displayed here. The value of the last measurement is displayed in 1/100 °C. In addition, an arrow is switched on above the return flow symbol.



Temperature difference

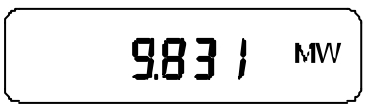
The temperature difference between the forward and return flow temperatures is likewise displayed in 1/100 °C. Simultaneously, both arrows above the temperature symbols are switched on. The temperature difference is a fundamental value for calculating the energy and is often a helpful display for checking and testing and purposes.

Flow rate



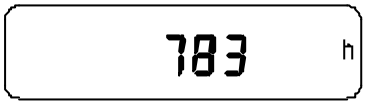
In its normal state, the flow rate calculation is not completely processed for energy-saving reasons. Thus only a result with an error of a few per cent is available. If you are located in the flow rate display though, the calculation is processed completely and after approximately 50 seconds a result is available with an error less than or equal to 1%.

Instantaneous power



The same statements apply in principle for instantaneous power as for the flow rate display, as it is calculated directly from the flow rate.

Operating hours

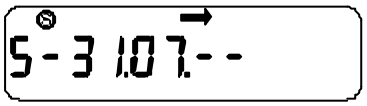


The operating hours begin to be counted when the calculating unit leaves the idle state it is in on delivery. This state is overridden by first pressing the INFO key.

3.10.2 The critical date menu

The critical date menu can be recognised by the circle with an "S" in the top left-hand corner of the display and the arrow on the right.

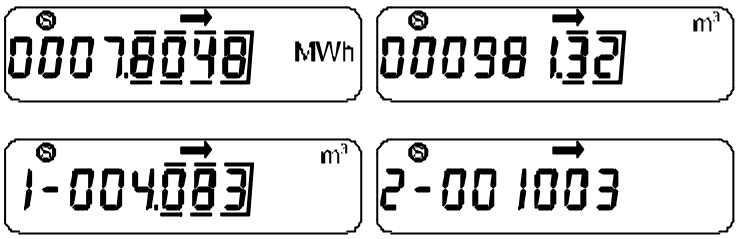
Critical date



The critical date is the point in time at which the energy consumption, the volume of the volumetric measuring units and the volumes of both additional meters are saved so that they can be retrieved at a later time. This enables billing always at the same time of year, and the reading time can be later. The date is programmed as standard to 01.08. This means that the data is stored in the transition from 31.07. to 01.08. at 0.00 a.m..

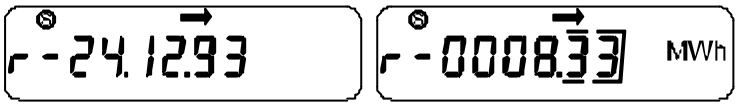
The critical date can also be programmed at the customer's request to any other day. It is also possible to carry out this change in the system on site using special software.

Energy and volumes of the hydraulic transmitter and additional meters 1 and 2 on the critical date



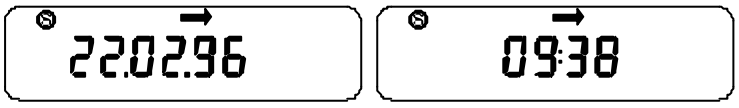
Additional meter 1 display in m³, meter 2 works without units

Date and energy of last remote reading



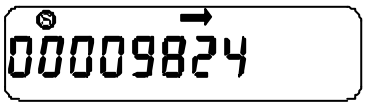
In the case of a remote reading (bus, modem, optical reading head etc.), the current date and the consumption at the time of the reading is stored. This allows the landlord to check the consumption on the day of the last remote reading when preparing invoices.

Current date and time



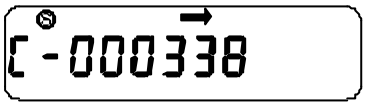
It is not possible to switch from a summer to a winter setting. The date and time can also be programmed or corrected on site as required.

Serial number



Each calculating unit is given a serial number during manufacture for clear identification. This number is also printed on the type plate. The number stored in the calculating unit is, however, the main criterion.

Customer-specific number

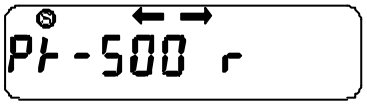


Each customer has his own number available with a maximum of 6 positions. It is stored permanently in the EEPROM. This number can be recognised by the preceding "C-". The allocation can be programmed at the factory or by means of appropriate software on site. The number is set to "0" as standard.

3.10.3 Configuration menu

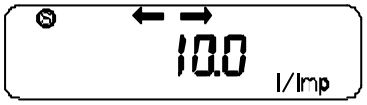
The configuration menu can be recognised by the "S" in the circle and by both arrows on the right and left.

Temperature sensor and type of mounting



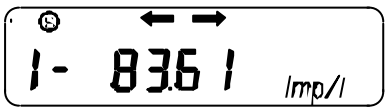
This menu option indicates temperature sensor for which the calculating unit is designed. Only "Pt-500" or "Pt-100" can ever stand here. The letter "r" after it indicates that the installation is to be carried out in the return flow. However, this is also stated on the type plate in clear text. Should the calculating unit be programmed to forward flow, a small "u" would stand here, as a "v" cannot be represented in seven-segment displays.

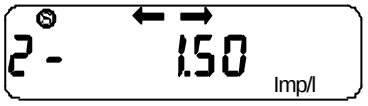
Pulse valency volumetric measuring unit



This displays the pulse valency for the volumetric measuring unit, for which the calculating unit is programmed. It is essential that this matches the volumetric measuring unit, as otherwise fatal errors can arise in the energy calculation. For this reason, the value is likewise identified on the type plate. What is decisive however, as has already been mentioned several times, is only the programmed value. This should always be checked in case of doubt. With conventional volumetric measuring units, the pulse valency displayed is given in "l/Imp". For high-speed volumetric measuring units, "Imp/l" are displayed. The display itself has 8 positions and up to a maximum of 7 post-decimal positions can be entered.

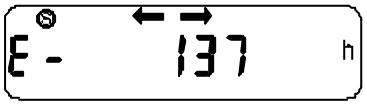
Pulse valency, additional meter





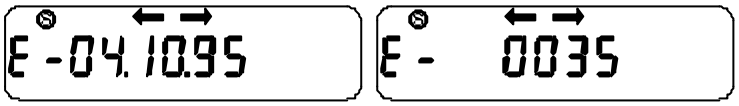
For the pulse valencies the additional meters 1 and 2 apply the same conditions as for recording the volume normally. The input is however limited to 6 positions. In addition, only a display in "L/Imp" is possible.

Total error hours



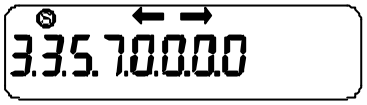
If there is a current error which is suppressing the calculation and summation of the energy, the error hours meter is increased with each hour overflow by one. One is therefore in a position to incorporate the downtime of the calculating units to extrapolate the missing energy.

Date and error code of the 1st error



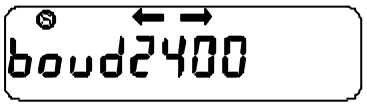
In order to be able to draw conclusions regarding the possible causes of the calculating unit failing, the registered error code and the associated date are saved and can be displayed here.

Type number



Various equipment features of the calculating units as well as software parameters are encoded in the type number which allow the calculating units type which was supplied to be identified. This is however only possible for skilled technicians.

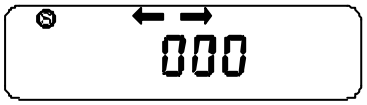
Baud rate, bus



The baud rate is an important interface parameter for all devices which want to communicate with the calculating unit via the bus. It must match for both partners. Further parameters are specified as follows:

8 data bits, 1 stop bit, parity even

Short address, bus



With this address the calculating unit can be addressed directly and used to send the read-out data. The valid addresses are limited from 1 to 250 in a bus network. The 0 means a new device which still has not received a bus address. The addresses can be individually assigned using configuration software, whereby the same address cannot be assigned in the same bus.

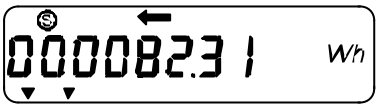
Date "battery empty"

This date corresponds to the point in time when the battery is probably so empty that operation could be impaired. This only applies, however, if the measuring instrument is used in absolutely continuous operation. Should the incoming volume pulses occur less frequently than the off-period of the temperature measurement, the discharging of the battery is less and lasts beyond this date.

3.10.4 The test menu

The test menu can be recognised by the "S" in the circle as well as the arrow on the left.

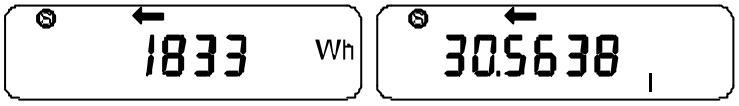
Energy increase



Delta T * K factor * ?V

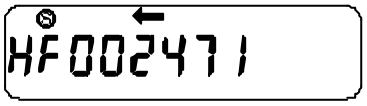
This value is determined and displayed anew with each energy calculation. It displays the product of the temperature difference, the associated heat coefficients and the increase in volume during a measuring cycle.

Energy and volume, high-resolution



This display is a high-resolution test display for the energy and the volume with which relatively fast statements can also be made on site using the measuring system. The display window is simply shifted to the right in order to display the positions which normally cannot be seen. What happens then, however, is that if the counter reading is correspondingly large, the top positions of the display can under certain circumstances no longer be seen.

Number of HF pulses

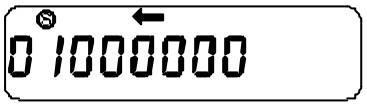


Most calculating units feature a so-called high-speed test output. Here, the HF pulses are queued by means of which the testing sites can perform an accuracy test of the calculating units. The "multidata S1" calculating unit also features such an output. The number of pulses which are output through this can be read in this display. Since the output and the display work synchronously, there is actually no need to record these pulses using an event counter.

The number of displayed or output pulses is calculated as follows:

Number of HF pulses = Delta T * K-factor * 100

Input diagnosis



This test display is actually only intended for skilled technicians. It can be used to visually represent different input states of the measuring system without any other resources.

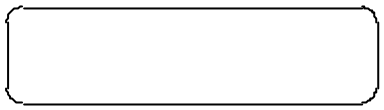
Software version

The present software version of the calculating unit is shown here. It serves to identify older calculating units. This allows the manufacturer to provide a faster service in the case of certain errors in the calculating unit.

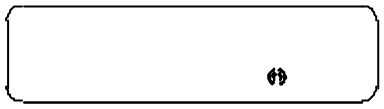
The state displays of the calculating units

The state the energy meter is currently in is made known by three segments in the display. The individual displays have the following meaning:

? These three segments are used for the state display.



? No display. The energy meter is in normal state. Currently only volume is counted and any pulses are output. No temperature measurement.

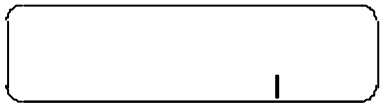


? This display appears only briefly if particular functions are carried out, such as temperature measurement, flow rate calculation, power calculation, etc.

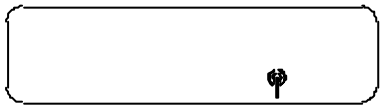
? The optical interface is scanned. If this display is visible, a connection set-up can be started via the optical interface.

? The optical interface is in receive mode. A connection set-up was detected. data can be transferred to the energy meter.

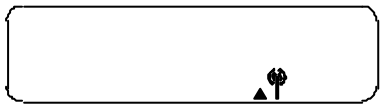
? Data is sent via the optical interface from the energy meter to the reading device.



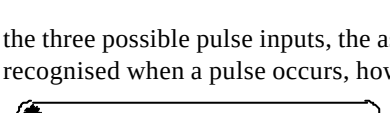
? The bus supply is active. Queries can be processed by the bus.



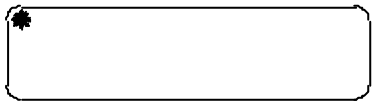
? The energy meter responds to queries from the bus.



? Test mode is active.



Apart from the actual state display, the asterisk indicates in each state whether pulses are currently being received. If a pulse is detected at one of the three possible pulse inputs, the asterisk is activated for approximately 0.5 seconds. It can also not be recognised when a pulse occurs, how long the pulse lasts or from which input the pulses have been received.



? Pulses were received.

3.11 The memory of the calculating units (EEPROM)

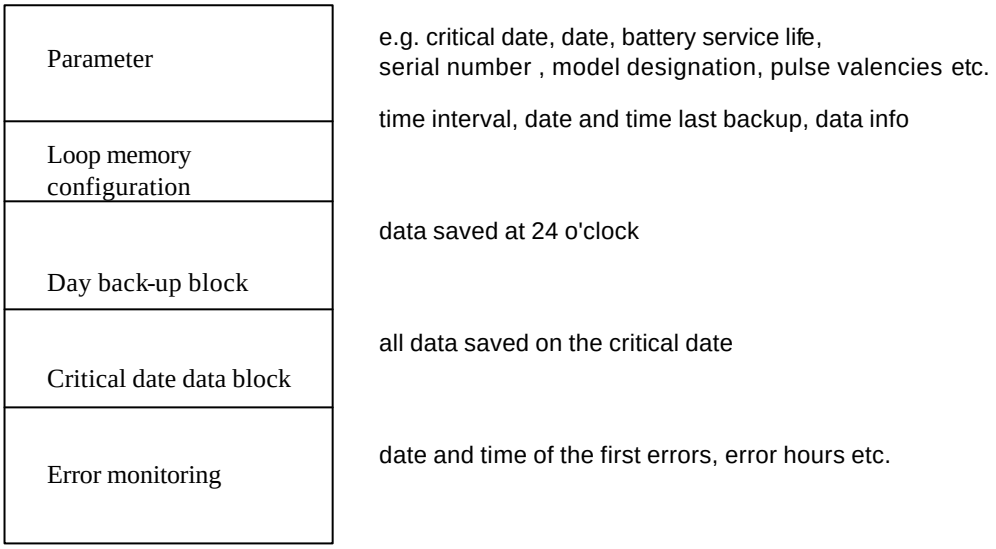
The calculating unit requires a non-volatile memory, an EEPROM, to back up of all set parameters and to temporarily store the most important data during operation.

This memory has a capacity of 512 bytes. It is described in cyclic intervals, but at least once a day.

It also contains the internal loop memory which enables 21 monthly energy values to be stored and read at any given time. These values are updated every month, so that the last 21 consumption data to the first of the month are always in the memory. The reading itself can only happen via the interfaces by means of PC or hand-held computers and not via the display.

The service life of such an EEPROM is limited to approximately 100,000 reading and writing cycles, but theoretically will last 100 years without the risk of data being lost because it is written onto so rarely.

The non-volatile memory has the following fundamental structure :



3.11.1 Additional memory modules

The standard version of the multidata S1 is equipped with a loop memory of approximately 80 bytes. With this memory, the energy (8-position per month) , for example, can be stored for 21 months. This memory is often not sufficient and therefore the multidata S1 can also operate external memory. This additional memory card is a possibility for saving the energy meter information. A maximum of up to 4 different values are stored at intervals of one minute for up to 1 year, whereby the duration of storage, until the loop memory starts again from the beginning, still only depends on the size of memory. To make effective use of the memory, the storage width of a value which is to be stored can also be selected between 2, 4, 6 and 8 positions, for the smaller the storage intervals which are selected, the fewer positions have to be stored.

After being plugged in, each memory card must be adapted to the configuration of the calculating units. To activate the memory card, quit menu level 4 by pressing the INFO key for approximately 5 seconds. A small triangle pointing downwards in the display then becomes active if the memory is detected as correct. If the loop memory is incorrectly configured, the error message "Err10000" appears or, if there are hardware problems, the error "Err20000".

?? **Possible data (max. 4 may be selected):**

?? **Energy**
?? **Volume**
?? **Additional meter 1**
?? **Additional meter 2**
?? **Temperature difference**
?? **Forward flow temperature**
?? **Return flow temperature**
?? **Flow rate**
?? **Power**
?? **Forward and return flow temperature**

Possible storage intervals:

?? **every minute**
?? **every 10, 15, 30 minutes**
?? **every hour**
?? **every day 00:00 a.m.**
?? **every week to the Monday**
?? **every Monday to the 1st**
?? **every quarter**
?? **every year**
??
??

currently available memory cards :

Item number	Memory size (Kbytes)
15ZWMZSPELB02011	2
15ZWMZSPELB08011	8
15ZWMZSPELB24011	24

3.12 Pulse input of volumetric measuring unit

The volumetric measuring unit of the energy meter is normally connected to terminals 11 and 12 of the calculating unit. Special input wiring then ensures the perfect recording of the pulses which come from the generator. Since the wiring of slow-speed and conventional volumetric measuring units looks different to that of high-speed electronic systems, there must be a corresponding conversion via software. This programming must be carried out at the factory, since the pulse valency, as already described, must also be programmed accordingly. Conversion on site to another input wiring is not permitted just because of the pulse valency alone.

3.13 Further pulse inputs and outputs

A characteristic feature of the "multidata S1" energy meter are the two further inputs and outputs. These can be used very flexibly. If the calculating units are supplied as normal standard instruments, two additional inputs are programmed with a pulse valency of 10 l/Imp in each case. Slow-speed meters with reed contact can be connected to these inputs, e.g. a cold and a hot water meter. The inputs are intended only for pulse counting. They have no influence whatsoever on the function of the energy meter itself. Only the consumption and critical date data can be retrieved or queried remotely via the display.

The display of the calculating units can now be programmed so that the unit shown can be cubic metres (m^3), litres (l) or also without a unit. The unit-less display is designed for any simple pulse counting of external events.

Each of these inputs can now be programmed be individually as an output also. This means that one can have two inputs (EE) or two outputs (AA), or also one input and one output (EA) available.

The outputs are fundamentally designed so that both battery-operated meters and PLC controls can be connected.

Battery-operated meters can have inputs with any impedance, since the supply in very high-impedance meters is adopted by the energy meter itself. C-Mos inputs with a current consumption of less than 3 ?A can be controlled directly by the energy meter.

PLC inputs are normally designed for a voltage of 24 volt and a current of 10mA. These values are completely fulfilled. It should only be noted that a LOW-switching input of the PLC is required. A user should also be aware that the output of the energy meter is not saved, as is otherwise common for PLC controls, against all possible errors.

The two inputs or outputs are designated as IO1 and IO2 to improve identification. The maximum frequency at each output is 1 Hz.

The following functions can be realised at output **IO1**:

Output for energy
volume of the volumetric measuring unit
1 Hz signal (second pulse)

For output **IO2** the following applies:

Output for energy
volume of the volumetric measuring unit
volume of the meter at IO1
continuous signal if error detected

Normally, synchronous to the further switching of the last position in the display, a pulse is also output via the output. In certain cases where the output frequency would exceed the maximum frequency of 1 Hz, the second position must be deviated to. In the case of the energy display, this would look, for example, as follows:

Megawatt hours with 3 post-decimal positions can be seen in the display (1234.223 MWh). The last position of the display would therefore be kilowatt hours, and the second would be 10 KWh. In order to now determine which valency, i.e. the last position or the last position but one, is output at the output, the configuration menu (level 3) was expanded. These menus can only be seen, however, if at least one port was programmed to output. The display menu for the outputs has the following fundamental structure:

" X - OC YZ"

X stands for the corresponding output channel
X=1 means the values for the IO1 stand here
X=2 means the values for the IO2 stand here

OC stands for Open Collector and indicates that the output functions are described here.

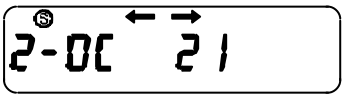
Y corresponds to the position which is output at this output.
Y=0 or 1, means that the last position is output
Y=2 means that the second-to-last position is output.

Z corresponds to the function which is output: 1 - energy
2 - volume (volumetric measuring unit)
3 - additional volume IO1
4 - second pulse
5 - error signal (continuous level)

Here are a few possibilities of both output wirings:

1 - OC 11 last position of the energy is output at IO1
1 - OC 21 second-to-last position of the energy is output at IO1
1 - OC 12 last position of the volume is output at IO1
1 - OC 22 second-to-last position of the volume is output at IO1.
1 - OC 04 1 Hz Signal is output at IO1.

2 - OC 11 last position the energy is output at IO2
2 - OC 21 second-to-last position the energy is output at IO2
2 - OC 12 last position of the volume is output at IO2
2 - OC 22 second-to-last position of the volume is output at IO2.
2 - OC 13 the last position of the additional volume from IO1 is output at IO2
2 - OC 05 IO2 is switched to if there is an error



Example display for output (IO2, second-to-last position, energy)

3.14 Recording faults

All errors are detected and recorded in the calculating unit. Here, only the first error detected is made known and displayed by the temperature measuring cycle. All other errors can occur simultaneously. Every error is assigned an error code. The codes of the individually and simultaneously detected errors are added. This addition is however a hexadecimal addition! If the energy meter has detected errors, the error display "Err", followed by a 5-character width error code, is activated. This now remains continuously in the first position of the display instead of the main energy display. Most errors can be deleted by holding the key down (see table). However, if the error still remains pending, it is again detected and displayed in the next measuring cycle.

The first error occurring is stored with the date in the EEProm. If a current error is pending for a long time, an error hour meter (total error hours in the configuration menu) is incremented every hour in the EEPROM.

Error code	**Error description**	**Error rectified by**
Err 80000	Reset error	1)
Err 40000	Hardware EEProm error (internal EEProm)	1)
Err 20000	Hardware EEProm error (external EEProm)	1)
Err 10000	External loop memory contains errors	1)
Err 04000	Internal loop memory contains errors	1)
Err 02000	Critical date data in the EEProm contains errors	1)
Err 01000	Self-test error	1)
Err 00400	Volume 3 frequency too high	1)
Err 00200	Volume 2 frequency too high	1)
Err 00100	Volume 1 frequency too high	1)
Err 00062	Forward flow sensor resistance too small	1)
Err 00063	Forward flow sensor resistance too large	1)
Err 00064	Return flow sensor resistance too small	1)
Err 00065	Return flow sensor resistance too large	1)
Err 00071	Forward and return flow sensor wrong way round	Temperature difference >= 0
Err 00077	Battery undervoltage	Replace battery
Err 00034	Short circuit at return flow sensor (and possibly forward flow)	2)
Err 00037	Interruption at return flow sensor (and possibly forward flow)	2)
Err 00044	Short circuit at forward flow sensor	2)
Err 00047	Interruption at forward flow sensor	2)
Err 000xy	x = 1 .. 5 , y = 1 .. 7 other errors during temperature measurement	2)

1) The error can be deleted by holding the key down. However, if the error continues, it reappears at the next measuring cycle. Errors frequently occur when the cables are connected in the wrong order (connect sensor first, then the volumetric measuring unit!).

2) These errors indicate incorrect temperature measurements. They disappear automatically if the temperature measurement can be performed without any errors, e.g. after a defective sensor pair has been replaced.

Error diagnosis at multidata S1 calculating unit

Fault	Check	Fault correction
Temperatures are displayed incorrectly, no energy measurement (MWh)	System must be in operation ! In the case of functions m3 and m3/h check whether switched through or whether flow is present	Volumetric measuring unit or reed contact defective Calculating unit can be checked by short circuiting with cable an terminal 11/12 m3 must now continue counting Disconnect volumetric measuring unit first!
Forward or return flow temperature incorrect, or error 00037, 00047 or other error less than 100	Examine sensor and connections for faults. Disconnect and if necessary check with ohm meter: Pt 500 values must be >500 ohm	If defects or sensor fracture is suspected the complete pair must be replaced ! Never replace individual sensors !
Error 00071; no energy measurement	Sensors wrong way round ! Forward flow must at terminal 1/2 Return flow at terminal 3/4 Warning! Sensors in system or at terminal may be wrong way round.	Connect sensor correctly Wait until m3-display switches on (1. volume pulse); delete error by holding down the INFO key.
Energy measurement implausible (too high/low)	Go into configuration menu (hold down key x 2). Pulse valency e.g. 10 l/h must match label on volumetric measuring unit	If pulse valencies do not match, remove calculating unit and send to factory for reprogramming.
Calculating unit shows no reaction or does not react to key click		Calculating unit defective or EMC problems. Replace !

3.15 Link to the outside world - the interfaces

3.15.1 The infra-red interface

In order to read the meter data quickly and with certainty, or to set individual parameters of the energy meter on site, each calculating unit is fitted with an optic interface - the infra-red interface. With the aid of an optical reading head (available as an accessory) the meter data can now be read with the widest variety of devices such as a laptop, PC or with our portable reading system, "PSION workabout". The interface is located on the front side of the calculating unit, in the bottom left corner, and can be recognised by the broken circle with the heading "Data". The reading head can be mounted here briefly. The infra-red interface serves the testing sites simultaneously as a test output for quick and certain calibration of the calculating unit.

Normally however, the infra-red interface is disconnected for in order to save energy. To quit a data transfer, only the INFO key needs to be pressed. The interface is now active. If no signal is detected, the scan is terminated 10 seconds after the key has been pressed.

If a signal is waiting at the time of scanning, the interfaces switches to optic receive. This means that the receiver remains switched on permanently and the microprocessor works at full speed in order to be able to receive and process data from the optic interface. This state remains active for 5 seconds and is extended by a further 5 seconds with each character which is detected free of errors.

The following procedure is necessary when reading:

1. Mount infra-red head in bottom left corner; cable must lead away downwards
2. Switch on reading device and prepare for reading
3. Press INFO key at energy meter
4. Start read command at reading device within 10 seconds
5. After transfer is completed, the interface becomes inactive after 5 seconds

3.15.2 The MBus interface

As an option, the "multidata S1" calculating unit is also available with a fitted MBus interface (Option BM). If the calculating unit is connected to the bus, it is possible to supply power continuously via the bus. The battery is disconnected at that moment from the meter and only becomes active again if the bus fails. Since it is now no longer necessary to check the capacity of the battery, the measuring cycle is therefore reduced to 10 seconds.

The same applies for calculating the flow rate and power which in this way can work with an error rate of less than 1%.

In the case of MBus devices, two more terminals are mounted on the connection board. The row of terminals is extended to the left by two bright blue terminals for connecting the bus.

The optical interface is not operated when in MBus state. Data can only be transferred via the connected bus. However, this interface is always in receive mode, and it is not necessary to press a key before transferring data. Further details about the bus can be found in a separate brochure.

3.15.3 RS232 interface

For pure point to point connections, i.e. only one energy meter is linked to one reading device, an RS232 variant is also available (Option BR).

With this option a few terminals are additionally placed on the left half of the connection board. The appendix contains a detailed connection diagram.

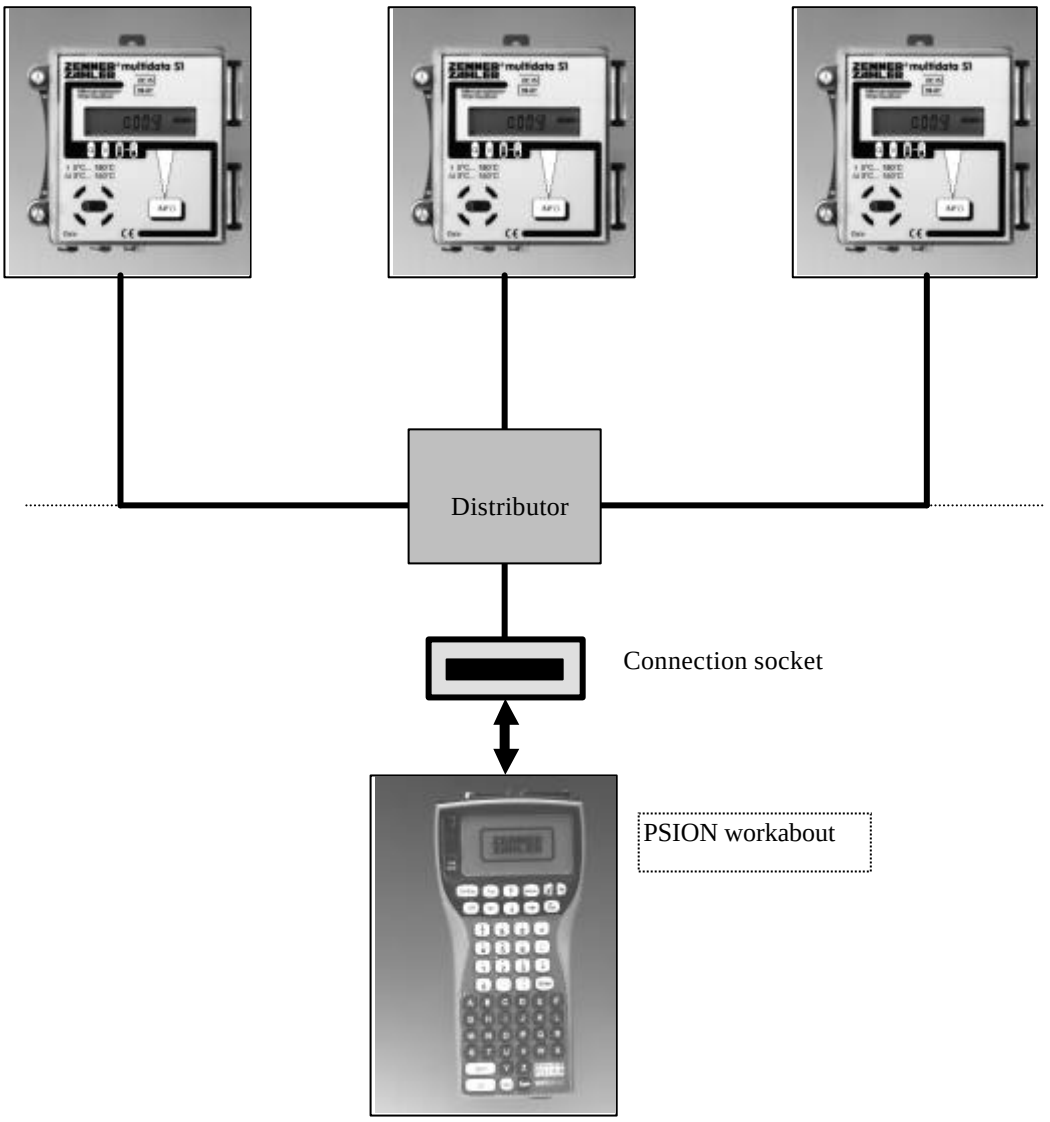
An individual information sheet can be requested for handling the communication protocol.

A point-to-point link is also possible with a standard device. The optical reading head and the MBus protocol can be used for this. Handling the telegrams which are necessary for this is described in the information sheet "MBus-protocol with point-to-point link".

3.15.4 ZR-bus

One disadvantage with MBus systems is that feeding devices or repeaters must always be used, even if only a few devices are to be networked. These feeding devices are relatively expensive. Smaller networks are therefore hardly worthwhile. To remedy this, the ZR-bus was developed. This is an RS 485 bus which requires no expensive additional devices. The meters are simply networked with each other and guided at the end to a connection socket. From this, the network can be completely read by means of our "PSION workabout" reading device. This mini-network is however only suitable for up to 10 energy meters. Since 2 water meters can be connected additionally to each energy meter, this makes it possible to record consumption from a total of 30 devices.

Our read-out software on the PSION workabout is designed in such a way that larger MBus networks can be read as well as smaller networks with a ZR-bus.



3.16 Power supply with battery

Two types of battery are basically available for supplying the energy meter. For standard devices, type AA lithium batteries with 3V rated voltage and a capacity of 2 Ah are used. The capacity of the battery is sufficient for a service life of at least 6 years.

In the case of MBus devices, a lithium thyonil chloride battery with a higher rated voltage is usually used, namely 3.6 V and approximately 2.3 Ah.

After an operating period of 6 years, the battery must be replaced on all accounts, as otherwise the calculating unit ceases to work. After 6 years, a "battery empty" symbol appears in the top left-hand corner of the display to announce that the battery must be replaced (see display menus). In addition, the end of the rated service life of the battery can be read in the configuration menu (data "battery empty").

Should the capacity of the battery be exhausted, this drop in the battery voltage is also detected by the microprocessor before 6 years have expired. In this case, the error "**Err 00077**" appears in the display. This error indicates a faulty or exhausted battery which should be replaced immediately.

3.17 External power supply

Power can be supplied in two ways. On the one hand, each calculating unit which features an MBus option can be supplied with a standard mains unit. Since in the case of the MBus the power supply and the data pass simultaneously via the bus on only two lines, only a pure power supply is feasible.

The second variant is a mains unit fully integrated into a calculating unit. The calculating units are supplied via an emergency current battery if the network breaks down. This additional battery takes over full maintenance of all the meter's functions, as in the case of the MBus. In addition, it serves to back up the data during storage.

3.18 Invariable temperatures

For certain applications, but only in the non-calibrated version, the temperatures for the forward flow or also the return flow can be programmed to a fixed value. The programming of these values can extend across the whole range of temperature.

Should, for example, a certain basic load always be operated, it is also possible to fix a minimum temperature difference. This means that if the ?t is less than the one which has been permanently programmed, it is not the actual, but the fixed ?t which is used for calculation. If the programmed value is exceeded, the meter works normally. Entries can be made up to a ?t of 50 °C.

Programming cannot be carried out on site, but only at the factory or, in the case of authorised locations, by means of special parameter-setting software.

3.19 Diagnosis of the inputs

This display reflects the current state of the most important inputs. It is resident in the test menu (level 4). Each position of the display can only show a "0" or a "1" and is assigned to one input exactly in accordance with the following table. This allows the functions of the pulse generator such as the volumetric measuring unit and additional meters to be tested. The other testing possibilities are of interest to skilled technicians only.

The display is to be interpreted as follows:

1xxxxxxx	reed switch in the volumetric measuring unit closed
0xxxxxxx	reed switch in the volumetric measuring unit open
x**1**xxxxxx	reed switch at additional input IO1 closed
x**0**xxxxxx	reed switch at additional input IO1 open
xx**1**xxxxx	reed switch at additional input IO2 closed
xx**0**xxxxx	reed switch at additional input IO2 open
xxx**1**xxxx	test mode active
xxx**0**xxxx	test mode inactive
xxxx**1**xxx	external supply active (battery disconnected)
xxxx**0**xxx	device works with battery
xxxxx**1**xx	programming block closed
xxxxx**0**xx	programming block open
xxxxxx**1**x	break level at serial data input
xxxxxx**0**x	rest level at serial data input
xxxxxxx**1**	volum. measuring unit can process max. 100 Hz (fast VMT)
xxxxxxx**0**	volum. measuring unit can work with max.1 Hz(Reed or sim.)

4. Freely programmable parameters

Analogous to the attachment of a lead seal to the hardware, which is intended to protect the device against manipulation, it is practical in the case of electronic devices to provide protection for the set parameters. This should ensure that values, such as the programmed pulse valency and similar, can no longer be changed by means of software as this could have devastating consequences for the whole system.

Two protection levels were therefore introduced. At each level, only a certain number of parameters which are stored in the EEPROM of the calculating unit can be accessed. The parameters can be read at any time.

LEVEL 1	only available at the factory during the production
LEVEL 2	accessible for servicing and authorised locations

4.1 Level 1

At level 1, which is only accessible at the factory, all parameters can be changed. The basic data and the match data are written during the production phase. The testing site carries out the necessary final tests and certification. The later application of the calculating unit is finally specified and programmed here. Level 1 is then closed by the software (calibration bit set) and only level 2 is then available. In order to be able to recognise the level 1 devices, a warning triangle appears in the display (see display menus), until level 1 has been closed.

Devices with a warning triangle in the display cannot be tested or have their parameters set and can thus not be used!

4.2 Level 2

At this level only a few parameters are still freely accessible. These are necessary in part so that the device can meet certain requirements on site.

These parameters include :

- date and time
- critical date and data
- always set optic interface to active
- customer number
- MBus address
- MBus parameter list
- error memory
- control data for loop memory
- regression block for menu

In a further software version it will also be possible to set the meter readings of both additional meters on site. The meter readings can then be synchronised by already installed meters with the display to the energy meter.

5. Connection possibilities

5.1 Connection assignment

Individual terminals are provided on the connection board for connecting the temperature sensors, the volumetric measuring unit, the additional meters etc. To test the calculating unit and to connect the additional memory, which must not always be accessible, there are additional plug-type connections on the circuit board. The calibration of the test plug, which is only used by testing sites or at the factory, is protected as a rule by an adhesive label.

Furthermore there is room on the connection board for another battery (type ½ AA), with which, for instance, electronic meters or volumetric measuring units can be supplied.

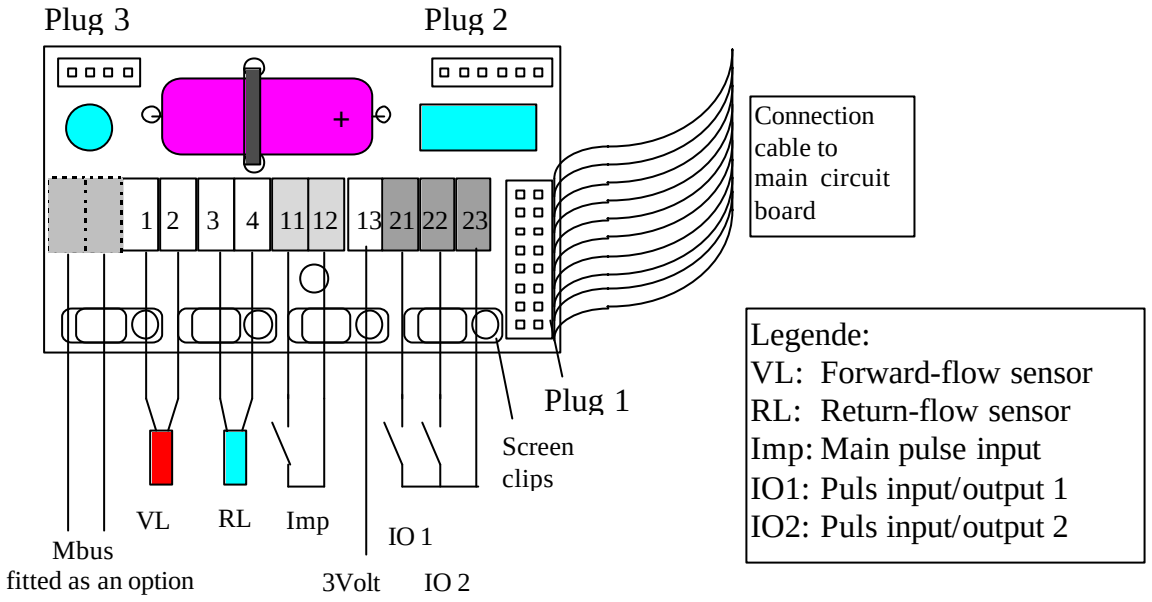
Connection terminals : (from Sept. 97 numbers in brackets are valid, conforming to EN 1434)

1	(1)	bright grey	forward flow sensor
2	(2)	"	"
3	(3)	bright grey	return flow sensor
4	(4)	"	"
11	(10)	green	volumetric measuring unit
12	(11)	dark grey	" (0 Volt)
13	(9)	orange	battery voltage (only when additional battery in use)
21	(16)	green	input/output IO1
22	(18)	green	input/output IO2
23	(17)	dark grey	shared ground for terminal 21 and 22
61	(24)	blue	MBus
62	(25)	blue	"
71	(71)	orange	RS 232 DTR / ZR bus +Ub
72	(72)	dark grey	RS 232 GND / ZR bus GND
73	(73)	white / blue	RS 232 TxD / ZR bus B
74	(74)	white / blue	RS 232 RxD / ZR bus A

In the case of net work versions :

26	PE	terminals up to 2.5 mm^2
27	N	
28	L1	

Connection board



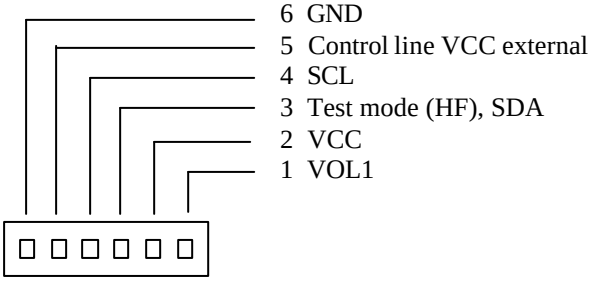
5.2 Plug-type connections

Plug 1 Connection plug to the main circuit board

Test mode(HF), SDA	1	2	VCC
Control line VCC external	3	4	SCL
BATT(+)	5	6	GND
VOL3	7	8	VOL2
RXD	9	10	VOL1
DSGND	11	12	RESET
RL-SENSOR	13	14	TXD
BUSON	15	16	VL-SENSOR

Plug 2

Function 1 : Activate test mode with 22 KOhm resistance between pins 2 and 3
Function 2 : External memory, can be plugged onto pins 2 to 6



Advice on installation

Error messages frequently occur at the calculating unit as early as the installation phase. In many cases these are not detected in time and it is only after weeks, sometimes even only at the first reading that the error is noticed and this is taken as an opportunity to complain to the manufacturer or supplier. To avoid such errors we recommend a certain procedure for the installation.

The following sequence should be followed when connecting the cables to the calculating unit:

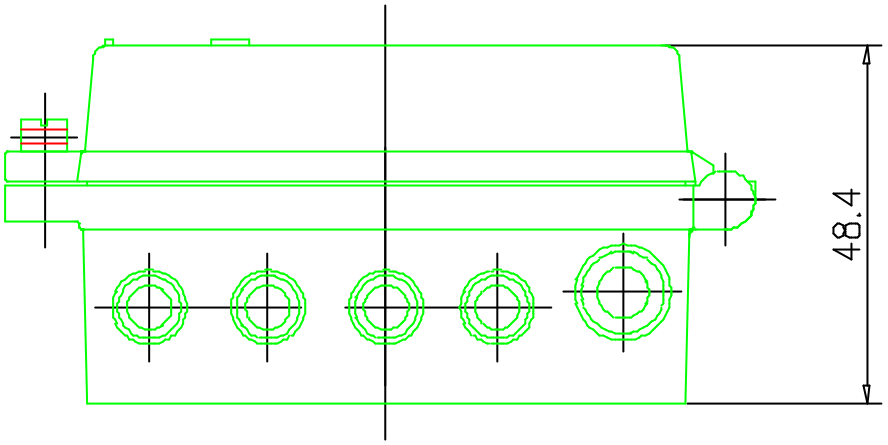
1. Connect temperature sensors, in any sequence
2. Connect volumetric measuring unit
3. If present, connect bus line.

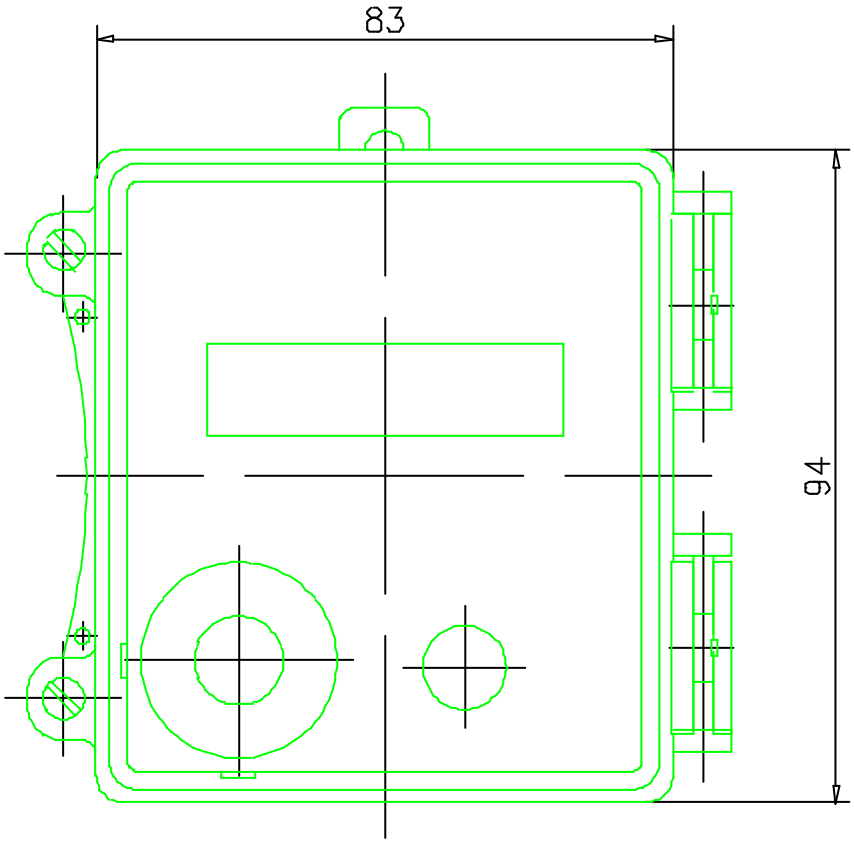
In most cases this guarantees that the installation is carried out correctly. Should error messages appear, these can, as has already been described, be deleted by pressing the INFO key, provided the error is not continuously present.

It is then practical to put the system into operation in order for any other errors to be detected, e.g. forward and return flow sensors wrong way round.

After commissioning, if the volume display switches further and the displayed temperatures are plausible (compared to the plug-in thermometer which is usually present), and if no more errors appear, it can be assumed that the energy meter is working correctly.

6. Dimensions and dimensional diagrams





7. Control and testing possibilities

7.1 Test mode

To check the calculating units quickly and efficiently at the factory or at testing sites, the so-called test mode should be activated. In this mode, the calculating unit carries out an enforced calculation every 3 seconds. The features of this test mode are in detail :

- Energy calculation every 3 seconds
- Output of pulses proportional to energy (HF pulses)
- No relapse of the display, selected menu remains
- Shifting of the energy and volume displays by 2 positions

The test mode is switched on through a pull-up resistor of 22...33 KOhm between pins 2 and 3 at plug 2 (see terminal diagram). This can be recognised on the display by switching on the segments "Radio tower", "Radio waves" and a triangle pointing upwards.

If the energy is to be tested over several volume pulses, the frequency for the volume input should be <=0.3 Hz, i.e. at an interval of 3.5 seconds, for instance.

7.2 Quick-test output

Only in test mode are energy-proportional pulse packages output via the HF output (pin 3 at plug 2). These obey the following equation :

$$N = ?t * K * 100$$

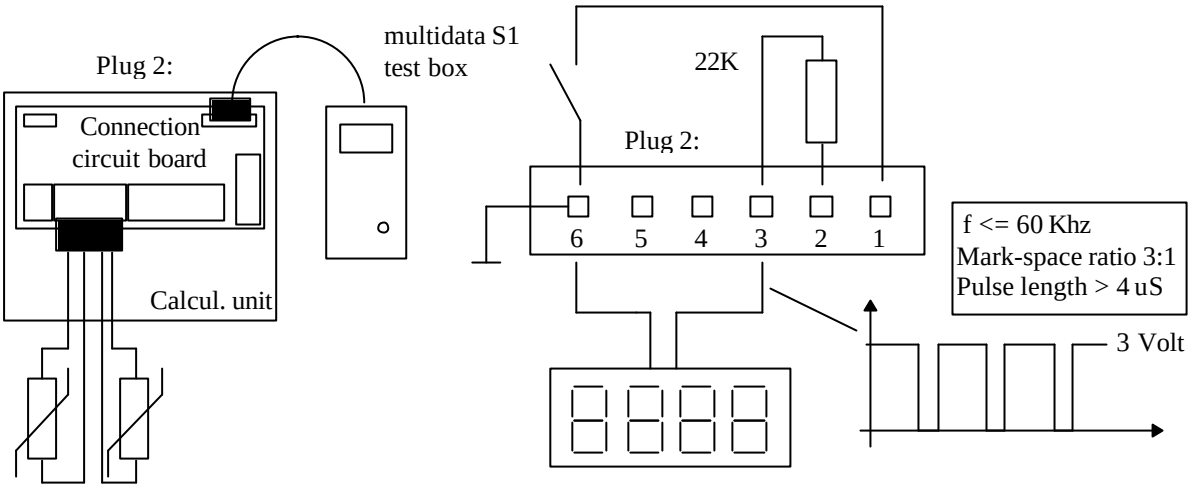
N - number of HF pulses
?t - simulated temperature difference
K - heat coefficient

The K factors used by us are taken from the book "Table of heat coefficients for water as a heat-carrying medium", by Dr. Stuck (PTB-Berlin), published by Wirtschaftsverlag NW, ISBN 3-88314-522-4.

The HF pulses can be recorded with a pulse counter. Synchronous to the output of the pulses, the number of pulses is likewise displayed in the test menu, level 4, and can be incorporated into the plausibility test.

Important!

The programmed pulse valency has no effect on the number of HF pulses !



To simulate the temperature differences, high-precision resistors must be connected which are stable over a long period. These should be exactly sized and known. Manganin resistors with an accuracy of at least 0.01%, for example, are recommended.

Test equipment for testing sites can be obtained from Zenner.

7.3 Testing via the data interfaces

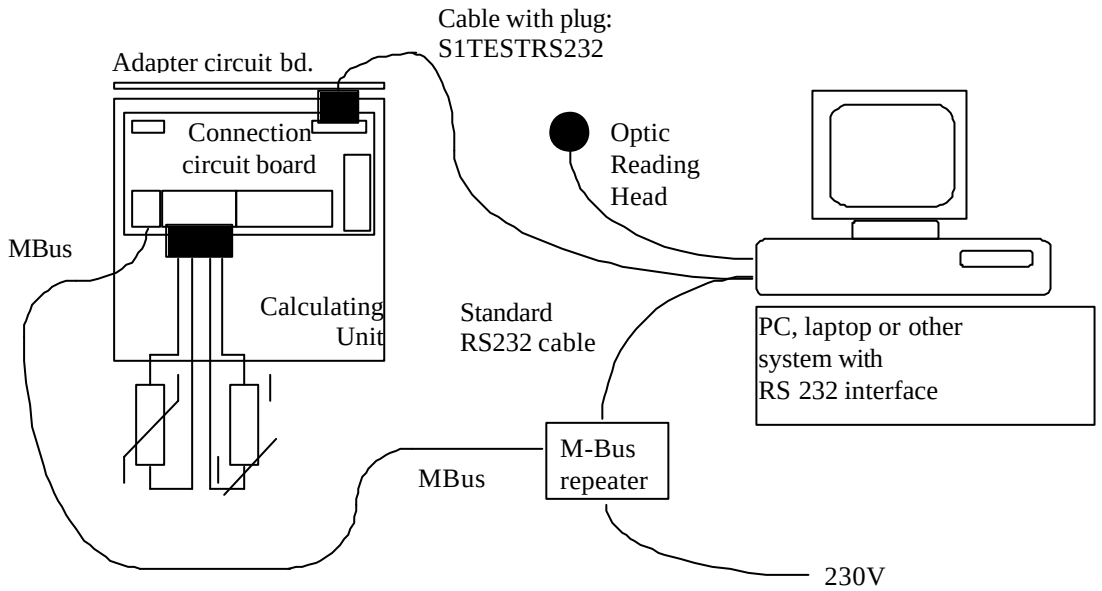
To automate testing of the calculating units, relatively expensive pulse counters with an interface would have to be used. Moreover, the pulse count is not protected from disruptive influences. Since the energy and all relevant data is present in the calculating unit, these can also be activated and read via the interface. A measurement can also be started or volume pulses can be simulated with the "multidata S1" via the interface. The method has the advantage that the transfer of data can be protected by software and is therefore free of interference. Through automation and plausibility tests, operator error can therefore almost be ruled out.

All interfaces which the calculating unit has available can be incorporated for this purpose:

- the optic interface for all devices (BS)
- the MBus interface for the MBus (BM) option
- the RS 232 interface for the RS 232 (BR) option

The Windows program "DialogS1" is available as software with which tests and checks, as well as parameter-setting can be performed. This is also obtainable from Zenner for testing sites.

More detailed explanations are to be found in the information sheets on testing the calculating units and from the description of the DialogS1 program.



8. Appendix

Design Versions

multidata S1

Design	Battery	Power(230 V)	M-Bus	RS232	ZR-Bus	Input 1	Input 2	Input 1	Input 2
BS-EE	☒					☒	☒		
BS-AA	☒							☒	☒
BS-EA	☒					☒			☒
NS-EE		☒				☒	☒		
NS-AA		☒						☒	☒
NS-EA		☒				☒			☒
BM-EE	☒		☒			☒	☒		
BM-AA	☒		☒					☒	☒
BM-EA	☒		☒			☒			☒
BR-EE	☒			☒		☒	☒		
BR-AA	☒			☒				☒	☒
BR-EA	☒			☒		☒			☒
BZ-EE	☒				☒	☒	☒		
BZ-AA	☒				☒			☒	☒
BZ-EA	☒				☒	☒			☒

☒ options which are filled are immediately available
☒ options with a filled cross are currently available uncertified or for export markets
☒ options which are not filled in are currently unavailable

valid May 97

List of Accessories **multidata S1**

Order No.	Description
OKPC	Optic reading head V24 for PC to ZVEI
OKPW	Optic erading head V24 TTL for PSION workabout
ZDR 004	Digital repeater for up to 60 'multidata S1' calculating units with RS 232 connection for PC or PSION, short circuit-proof
MR 002	MBus repeater as table-top device for PC
DialogS1	Testing location software for certifying and setting parameters of multidata S1 calculating units
WkReadS1	MBus administration and read-out software f. PSION workabout with up to 250 devices (point-to-point also possible), Reading data in file, transfer of file to PC
PcReadS1	Administration and read-out software for PC Functions such as WkReadS1, additional modem link possible, letter code check, conversion for different data base systems
SPKA2	2 KB memory card, for upgrading for logger applications
SPKA8	8 KB memory card, for upgrading logger applications
SPKA24	24 KB memory card, for upgrading for logger applications
PSIONWA	PSION workabout, hand-held computers for reading MBus systems and individual devices, EHKV reading possible
PBOX500	Check and test box for resistance simulation, resistors 0.01%, specially adapted for multidata S1 or Supercal calculating units