Sontex ■ Thermal Energy ■ Flow Metering ■

Manual

Integrator

Supercal 531

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Technical modifications subject to change

Revision

Issue	Date	Author	Description of Modification
030909	03.09.09	MS	Data copied, layout adapted
151009	15.10.09	EXT	English Translation
121109	12.11.09	MS	Completely reviewed
230410	23.04.10	SV	Remove cooling energy chap. 3.6.3
060611	06.06.11	SV	Modify Voltage tolerance for 24 VAC chap. 11.2.1

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1. Introduction

1.1 Brief description

This Supercal 531 convinces by using state-of-the-art multi-functional technologies and by its modular concept.
It can easily be adapted to our customer‘s requirements such as e.g. simplified system integration, tariff functions, data logger functions, universal data transfer or connection to existing process systems. It is mainly used in applications where a calibrated energy meter is required such as in district heating networks and heating systems, cooling systems as well as in industry installations.

1.2 Advantages of the Supercal 531

- The modular concept enables simple and low cost replacement of the meter after expiry of the validity of the calibration
- Clear and user-friendly operational concept
- EEPROM for the communication set-up in the base part as well as customer ID
- Display of date and time guaranteed by back-up battery and readout over the EEPROM with the service device
- Communication options and functions can be installed later without infringing the calibration
- Up to four analogue outputs, M-Bus, RS-232, four relay-, two open-collector- outputs and two impulse inputs can be used
- Mains- or battery-supplied
- Self-recognition of the communication options and the power supply
- Monitoring and readout of the operating modes in different levels depending on authorization
- M-bus acc. to EN1434 (300..9’600 baud)
- Connection of temperature sensors Pt500 and Pt100 in two-wire or four-wire technology
- Maximum measurement precision due to high-sensitive temperature detection
- Precision even higher than required by EN1434
- High reliability due to extensive monitoring of the operating modes
- Various possibilities to combine with mechanical, magnetic-inductive, ultrasonic- or oscillating flow sensors up to Qn 10'000 m3/h
- Meets the requirements of MID, PTB, OIML and EN1434

2. Concept of the Heat Meter

2.1 Measuring concept

- The energy of a heat transfer medium is always calculated with its flow rate and the difference between „temperature high“ and „temperature low“.
- The heat capacity and the density of the heat transfer medium are also considered in this calculation.
- The flow rate is measured with an appropriate flow sensor.
- A temperature sensor pair detects the „temperature high“ and the „temperature low“ of the heat transfer medium. As soon as ΔT > 0.2 K, the energy consumption is calculated.
- For solar- or cooling systems, the medium heat capacity of the customer’s glycol mixture is taken instead of the medium heat capacity of water (1.15 kW/m3 K).
- Thus, the cooling energy is cumulated as soon as the temperature difference reaches < - 0.2 K and the „temperature high“ is < 18° C (the threshold value can be programmed freely).

2.2 Integrator

Modern integrators are required to fulfil a variety of customized and technical requirements, such as:

- Good readability of the displays of the integrator
- Logical and clear design of the menu
- Simple handling
- Low costs in case of meter replacement
- Flexibility with regard to the technical adaptation of different flow and temperature sensors
- Modularity with regard to the device options such as data inputs and outputs etc.
- High measuring precision and data safety
- Normally, every integrator should be clearly assigned to one heat measuring point and be easily accessible/readable.

It is essential to avoid electro-magnetic disturbances and overheating at the place of installation. All wiring has to be installed with a minimum distance of 300 mm from high-voltage and high-frequency cables.

2.3 Flow sensors

Below, please find the possible / standard flow sensors:
- Fluid Oscillator flow sensors
- Impeller and turbine-type water meters
- Magnetic-inductive flow sensors
- Ultrasonic flow sensors

The following operating conditions may influence the choice of the flow sensor:
- Type of measurement (heat-/cold-metering, viscosity of the medium, etc.)
- Mounting position
- Precision requirements of flow sensor
- Existing inlet-/outlet zones (accuracy of measurement)
- Price-/performance ratio in general

Normally, a low pulse factor (output pulse of the flow sensor per flowing volume) is chosen to achieve a resolution as high as possible.
Please pay attention to where the flow sensor is installed („cold side“ or „warm side“) since the conversion from flowing volume into flowing mass is carried out on the basis of the temperature assigned to the place of installation.

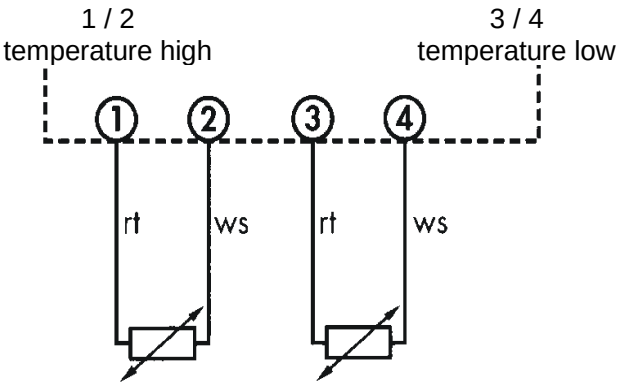
In general, the flow sensor is installed at a place where the temperature of the medium is nearer to the ambient temperature. In heating systems, this is the return line and in cooling systems, this is the supply line.
Thus a higher measuring precision and a longer service life of the flow sensor are achieved.

2.4 Temperature sensor

Please be careful when choosing and installing the temperature sensors.
Even the most intelligent integrator is not in a position to level out mistakes made here.
It is recommended to only use type-approved platinum temperature sensors in the versions Pt500 and Pt100. They are twin sensors and can be used in two-wire technology up to a cable length of 3 m. The connection cables may never be separated, extended or shortened.
If a length of more than 3 m is required, we recommend using shielded cables of the same length.
The approval for the integrator Supercal 531 allows the use of two-wire temperature sensors up to a length of maximum 15 m and of four-wire sensors up to a max. cable length of 50 m.
In low temperature heating system, it is recommended to install the temperature sensor directly and without protection pocket because of the minimal temperature difference. Thus even the slightest temperature differences and errors due to heat dissipation can be detected immediately.
In pipes up to DN 150 the temperature sensors are installed directly or with protection pocket so that the measuring-active part of the sensor tip is placed in the centre of the pipe cross section.

For more detailed information on temperature sensors, we refer you to the Sontex overview of temperature sensors.

2.4.1 2-Wire-cable sensor



Due to the fact that the exact temperature difference (and not the absolute temperature) is important for measuring the heat quantity, it is imperative that both sensor cables are of the same length (resistance). Ex works, the sensors are paired precisely by computer and may only be used in its original pairing.

EN1434-2 2004 stipulates the following maximum cable lengths for 2-wire temperature sensors:

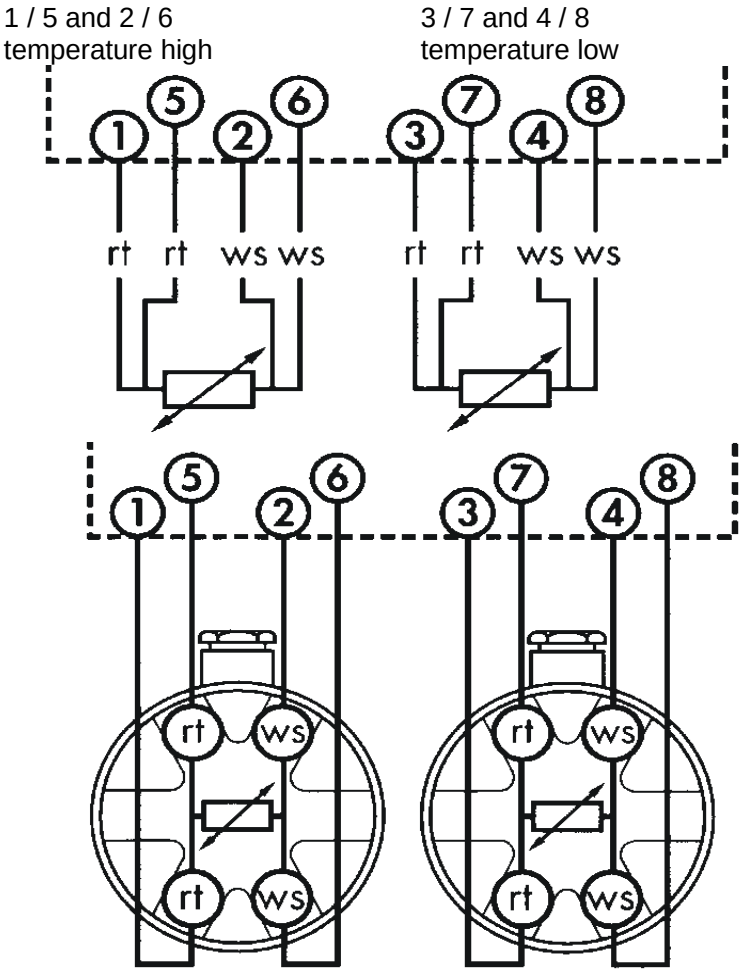
Wire cross section **Maximum cable length**

	Pt100	**Pt500**
0.22 mm2	2.5 m	12.5 m
0.50 mm2	5.0 m	25.0 m
0.75 mm2	7.5 m	37.5 m
1.50 mm2	15.0 m	75.0 m

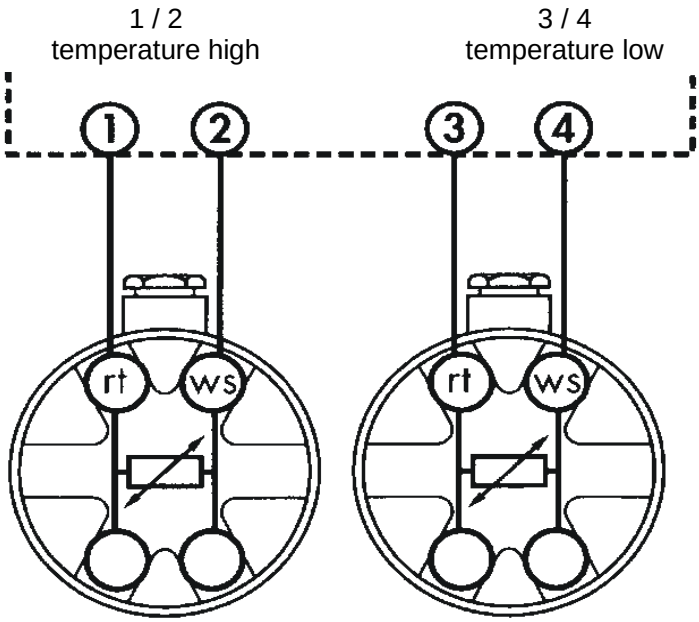
2.4.2 4-wire-cable sensor

For installations with cable lengths of more than 3 m or with different cable lengths, we recommend using 4-wire-temperature sensors. The maximum cable length of the 4-wire temperature sensors is 50 m.
The connection cable must have four wires. The wire cross section should be at least 0.5 mm2.

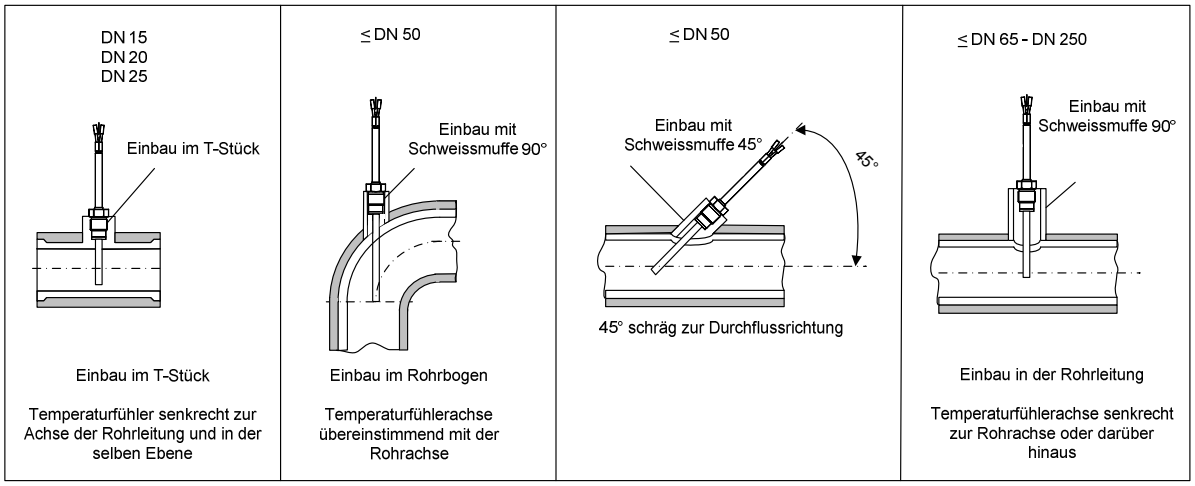
The insulation of the temperature sensor cable should be of PVC or silicone. Sontex recommends the use of silicone as insulator.



2.4.2.1 **4-wire-cable sensor with 2-wire integrator**



2.4.3 Installation guideline of temperature sensor acc. to EN1434



2.4.3.1 **Adherence to the operating conditions acc. to MID for temperature sensors**

The temperature sensors have to be installed symmetrically in the supply and return pipe and preferably directly. In case temperature sensors with protection pocket are installed, the sensor and the protection pocket have to be conformity-approved. The tips of the temperature sensors have to be inserted up to the halt. Installation points in the flow sensor can be used in case the temperature sensor is installed symmetrically.
The connection cables of firmly connected temperature sensors must not be shortened.
The connection cables of replaceable and conformity-approved temperature sensors installed in the supply and return pipe may be of a maximum length of 15 m; the cables must be of the same length.
The cable cross section must be in line with EN 1434-2.

Furthermore, attention has to be paid that the integrator is electrically compatible with the temperature sensors:
Pt100-temperature sensors must not be connected to an integrator which is designed for Pt500-temperature sensors (and vice versa).
To avoid unauthorized access, the installations points have to be sealed after installation.

2.4.3.2 **Interfering factors**

If there is a risk of electric or electro-magnetic interferences, temperature sensors in 2- and 4-wire technology with shielded cables or shielded cables on the connection heads have to be used. The shields always have to be connected to the electric mass provided in the integrator.
The risk of interfering influences rises with the length of the sensor cable.

2.4.3.3 **Security advice**

Risk of accident in case of improper dismounting of directly immersed temperature sensors!
Mounting and dismounting may only be carried out by authorized personnel.

2.5 Installation guidelines

The installation and start-up of a heat meter may only be carried out by authorized personnel and in accordance with the current standards, the local security and installation instructions.
The installation guidelines acc. to EN 1434-2 and EN 1434-6 have to be followed strictly. Please note that the heat meter will only provide the requested precision and reliability if the local regulations for electric installations and the guidelines given by the manufacturer are followed.

3. The Integrator Supercal 531

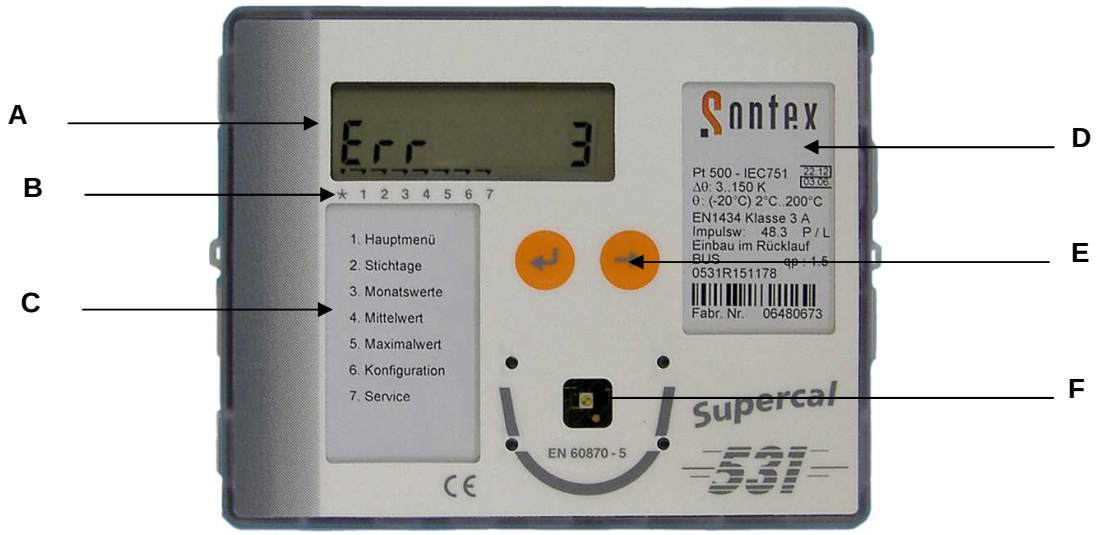
3.1 The modular concept

The integrator Supercal 531 consists of:
- Measuring- and calibration-relevant upper part
- Base part

Thanks to the modular concept of the integrator storing costs can be kept very low and replacement of the meter after expiry of the validity of the calibration is simple and reasonably-priced.

In this case only the integrator upper part is replaced. The base part with all the mechanical connections (mains, flow sensor, temperature sensor) does not need to be replaced.

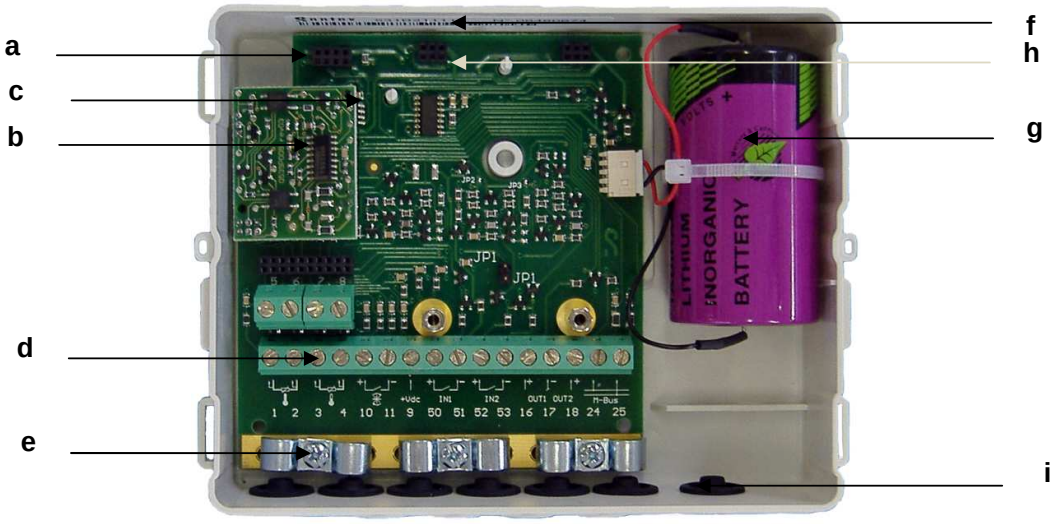
3.1.1 Integrator upper part



The following elements are incorporated in the integrator upper part:

A LCD-display
B Index for menu navigation
C Identification plate list of menu items
D Identification plate upper part of integrator with bar code
E 2 operator buttons (control and enter key)
F Optical interface
G Calibration and user seal (not visible in picture)
H EEPROM, first non-volatile memory for data storage (not visible in picture)

3.1.2 Integrator base part

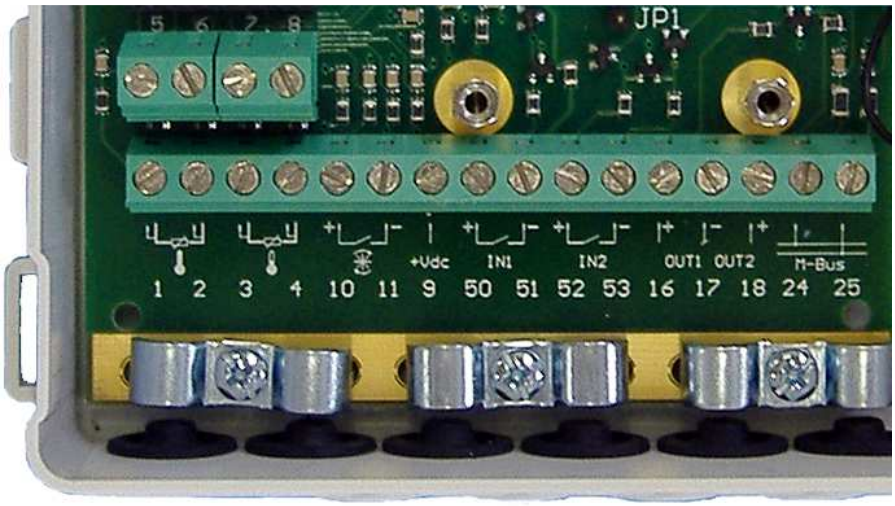


The following elements are incorporated in the base part of the integrator:

a main board
b connection point for M-Bus or radio module mounted at the factory (below b, not visible)
c EEPROM, non-volatile memory for data storage
d terminals
e strain reliefs for connection cables and grounding
f Bar code label
g Optional mains- / battery supply
h 2 slotsfor optional communication modules
i rubber grommets/splash guard for connection cables
j base plate (not visible here)
k plug-in bracket for wall or top hat rail mounting (not visible here)

3.2 Wiring diagram

The integrator upper part has to be removed to connect the inputs and outputs. The wiring has to be done as follows:



Terminal	Description
1, 2	2-wire technology, temperature high
1, 2 and 5, 6	4-wire technology, temperature high
3, 4	2-wire technology, temperature low
3, 4 and 7, 8	4-wire technology, temperature low
10	(+) pulse input flow sensor
11	(-) pulse input flow sensor
9	power supply for flow sensor
50	(+) pulse input additional pulse input 1
51	(-) pulse input additional pulse input 1
52	(+) pulse input additional pulse input 2
53	(-) pulse input additional pulse input 2
16	(+) open-collector output 1
17	(-) open-collector outputs 1 + 2
18	(+) open-collector output 2
24	M-Bus (for M-bus module mounted at the factory) *
25	M-Bus (for M-Bus module mounted at the factory) *

*Terminals 24 and 25 are only active with mounted M-bus module (mounting at manufacturer).

3.3 Flow measurement

Type-approved flow sensors with a pulse or frequency output can be connected to the integrator Supercal 531.

The integrator has the following input pulse factors:

- Up to 99'999'999 pulses/litre
- Up to 99'999'999 litre/pulse

3.4 Calculation of flow

The calculation of flow bases upon the volume pulses detected and cumulated within a certain time interval.

For the first flow calculation, the integrator always requires two volume pulses to be able to calculate the actual flow. Depending on the configuration the internal flow calculations are carried out and the actual flow is indicated immediately on the LCD-display.

Configuration:
The frequency of the flow calculation depends on:

- The number of volume pulses detected within a defined time interval (minimum/maximum holding time).
- The required precision of the flow calculation
- The parameters relevant for the flow calculation are factory-set and can only be altered by authorized laboratories.

3.4.1 Calculation of the flow rate with standard flow sensors

The pulse factor of standard flow sensors, such as e.g. mechanical flow sensors, is stated in **litre/pulse** resp. the duration of the measuring period is stated in seconds/2.
Thus, the formula for the current flow rate in litre/hour is:

Flow rate (l/h) = kw x 3600 x pulse/time

kw (litre/pulse) = pulse factor
Pulse = number of pulses per measuring interval
Time = duration of measuring interval [s]

Examples see point 8.2.2, pages 52, 53

3.4.2 Calculation of the flow with fast flow sensors

The pulse factor of fast flow sensors is stated in **pulse/litre**.
The formula is as follows:

Flow rate (l/h) = 3600/time x pulse/kw

kw (pulse/litre) = pulse factor
Pulse = number of pulses per measuring interval
Time = duration of measuring interval [s]

Examples see point 8.2.3, page 53.

3.5 Temperature measurement

3.5.1 General

In principle, the measuring range of the integrator is from - 20 ℃ to + 200 ℃.
The measuring range approved acc. to MID is from 2 ℃ to 200 ℃. There's no homologation below 2 ℃ according to the current applicable standards.

By default, the integrator Supercal 531 is designed for temperature sensors Pt500. On request, Sontex can parameterise the integrator ex works for operation with Pt100. The connection of the temperature sensors is possible in two-wire and four-wire technology. The temperature measurement is carried out acc. to the „dual slope procedure ". An integrated calibrating system guarantees

high measuring resolution and high measuring reliability. To improve the measuring reliability, a coherence test (check of the logical sequences of the values) has been implemented.

The mains-supplied integrator Supercal 531 measures the „temperature high“ and „temperature low“ every 3 seconds.
The battery-supplied (battery type C or D) integrator measures the temperatures every 30 seconds.

3.5.2 Tolerated errors and limit values

For firmly connected temperature sensors, the maximum tolerated error (in %) is calculated acc. to the following formula:

$E_t = \pm (0.5 + 3\ \Delta\vartheta_{min} / \Delta\vartheta)$

$\Delta\vartheta_{min}$ = admissible minimum temperature difference = 3 K
(Acc. to MID EC type examination certificate)

The screws of the terminals of firmly connected sensors are secured with adhesive seals. A subsequent exchange of the temperature sensors is not possible without damaging the seals.

The integrator software checks if the measured temperatures are within the admissible measuring range.

If the limits of the measuring range are exceeded the integrator indicates a measuring error.

3.6 Energy metering

3.6.1 Error limits

A heat flux can be calculated on the basis of its mass, its specific heat capacity and the temperature difference.
The difference of the enthalpy between „temperature high“ and „temperature low “during a set time t is integrated. The equation to calculate the heat energy acc. to EN 1434-1, point 8, is applied in this case.

The admissible error is calculated as follows:

$Ec = \pm (0.5 + \Delta\vartheta_{min} / \Delta\vartheta)$

The minimum temperature difference $\Delta\vartheta$min depends on the assembly of the components. If the integrator and the temperature sensors are checked as one unit, the min. temperature difference is 2 K acc. to the PTB-approval and 3 K acc. to the MID-approval.
To receive the EC-prototype test certificate, at least 3 K has to be reached.

3.6.2 Cooling energy

If an energy meter is installed in the return pipe to measure the cooling energy, the „temperature sensor low“ is installed in the supply and the „temperature sensor high“ in the return pipe.
By default, the integrator Supercal 531 is checked acc. to the metrological measuring points of EN1434 (2006) for cooling and heating energy before leaving the factory.

3.6.3 Cooling energy – combined cold-/heat meter

The combined cold-/heat meter (tariff function cooling/heat tariff) calculates the cooling energy as soon as the two following conditions are fulfilled at the same time:

- temperature difference (Δt) < - 0.2 K
- „temperature high“ < 18 ℃

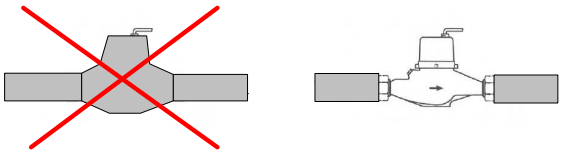
The threshold value of 18 ℃ for the switch-over of the combined cold-/heat meter is parameterised ex works. It is possible to alter this value with the software Prog531 over the optical interface.

If the integrator is used as combined heat and cold meter, the cooling capacity and the temperature difference are displayed with a minus sign (-) and the relevant data are assigned to tariff 1.

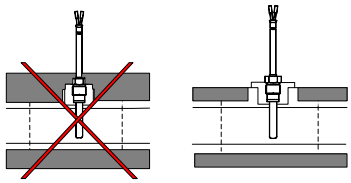
An officially attested calibration of the cold meter can only be carried out, if the cooling energy measured is within the admissible temperature range with the medium water (without glycol).

3.6.4 Insulation instruction for cooling systems

In cooling systems, the mechanical flow sensors and temperature sensors may only be insulated to the connection.



condensed water



condensed water (capillary action possible)

3.7 Calibration- and measuring-relevant data

If integrators are used for the direct billing of energy from the energy supplier to the consumer (public monetary transfers), they are subject to the calibration obligation in most European countries.
The purpose of the obligatory calibration is to protect the consumer as well as the supplier of energy against fraud and malevolent manipulations.

Only type-approved measuring devices can be calibrated. Thus the use of inappropriate systems is avoided.
The period of validity of the calibration is governed by national law. In most European countries it is 5 years.
Especially the following parameters are submitted to the obligatory calibration:

- Pulse factor/frequency and place of installation of the flow sensor
- Accumulated energy and volume with respective units
- Displays and units of performance, flow and temperature

They are defined by the measuring points planned during the parameterisation at the factory or when the parameterisation is carried out by an authorized laboratory. Thereafter, they are sealed and thus protected against unauthorized manipulation.

If these calibration-relevant seals are damaged or removed, all warranty claims / service warranty claims as well as the calibration of the integrator are void.

3.8 Possible parameterisations

The Supercal 531 is parameterised with the software Prog531 over the optical interface or the ex factory M-Bus module. Each integrator is manufactured after order and parameterised in the factory in accordance with the customer's specifications.
Adaptations and modifications of the factory parameterisation can be carried out by authorized centres (e.g. external accredited laboratories) with the necessary equipment.

Parameterisations	**Possibilities**	**Standard**	**Remarks**
Units energy display	kWh, MWh, GJ, BTU	kWh or MWh	internal calculations are based on Joule
Units volume display	m3, US-gallons, litre	m^3	internal calculations are based on m^3
Units temperature display	℃, ℉ or K (Delta T)	℃ and K	internal calculations are based on ℃
Place of installation	return pipe, supply pipe	return pipe	
Pulse factor in l / pulse	0.0001 ... 99'999'999	to customer's request	
Pulse factor in pulse / l	0.0001 ... 99'999'999	to customer's request	
Flow	m^3/l or US-Gallon/min	m^3/l	m^3/l
Power	KW or MW	KW	KW

4. Data Storage

4.1 Data storage over EEPROM

The Supercal 531 has two non-volatile EEPROMs for storing data. The data are updated every hour in the non-volatile EEPROM of the upper part of the Integrator (MET).
Thus, the data backup is kept even in case of power supply failure. All data are updated and stored automatically.

The first non-volatile memory is located on the PCB of the integrator in the calibration- and measuring-relevant upper part (MET):

Integrator upper part (MET):
- Integrator - configuration parameters
- Accumulated energy
- Accumulated volume
- Accumulated values of the additional meters A1 and A2
- Customer-specific tariff 1 (and tariff 2)
- 15 monthly values
- 32 maximum values
- 32 average values
- 2 set days
- Accumulated energy or volume on set day
- Operating hours
- Date and time
- Serial number MET*, integrator upper part
- Pulse factor of flow sensor
- Error history (last 10 errors)
- Alarm limits and threshold values
- Tariff functions

The second non-volatile memory is located on the circuit board of the integrator base part. Thus the configuration for the data communication as well as the customer ID is kept even if the calibration- and measurement-relevant upper part has to be replaced. Here, the following data are stored:

Integrator lower part (MIO):
- Serial number MIO* integrator base part
- ID number / customer ID
- Pulse factor of the additional meters A1 and A2
- Unit of the additional meters A1 and A2
- M-Bus (primary and secondary)
- Baud rate (M-bus)
- Radio address
- Pulse factor pulse output
- Parameterisation of the optional modules

* MET: Metrological
* MIO: Module Input Output

4.2 Data storage with backup-batteries in the mains modules

The mains modules:

- 230 VAC - 45/60 Hz
  (115 VAC - 45/60 Hz on request)

- 24 VAC - 45/65 Hz

- 12..24 VDC

By default, each mains module is supplied with a backup-battery which guarantees the current supply in case of a power failure. If a power failure occurs, the Supercal 531 is operated automatically in a battery-saving mode to ensure the continuity of the metrological functions.

Without AC- or DC-mains supply, the service life of the backup-battery (depending on the application and the ambient conditions) in constant operation with an autarkic flow sensor is up to 260'000 minutes (approx. 6 months).

In backup-battery mode, the following functions of the Supercal 531 are still active:

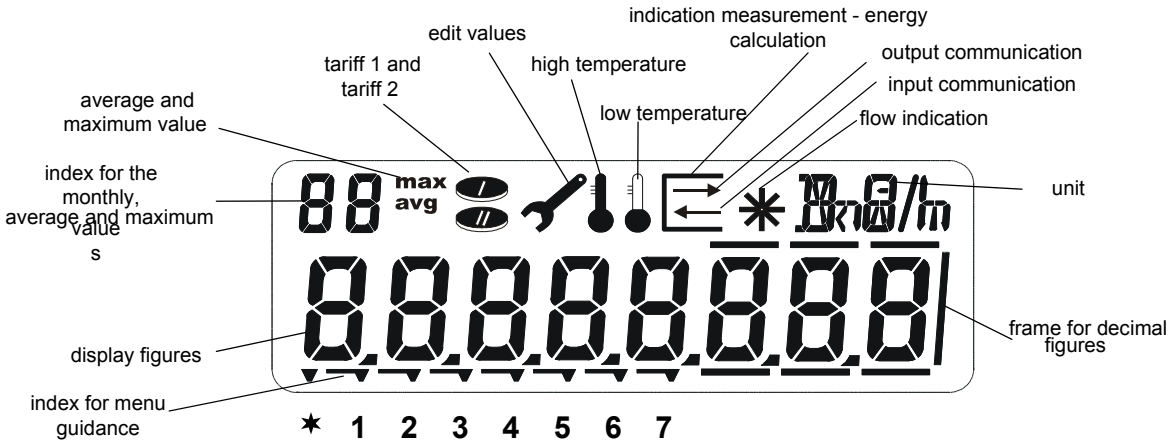
- Temperature and flow measurement, energy calculation
- Tariff- and alarm functions
- Inputs A1 and A2
- Outputs B1 and B2
- Optical interface

In battery-saving mode, all communication options are deactivated. The measuring cycle is reduced to 30 seconds.

5. Operational Concept

When designing the Supercal 531, main importance was placed on the user-friendliness. Thus, the integrator features an extremely large and clearly structured LCD-display. It has only two operator buttons to display the measuring data and for the menu navigation thus adding to the user-friendliness.

5.1 The structure of the LCD-display



Description of further indicators on the LCD-display

Communication indicator
This indicator shows if the Supercal 531 is calculating and/or communicating internally or externally.

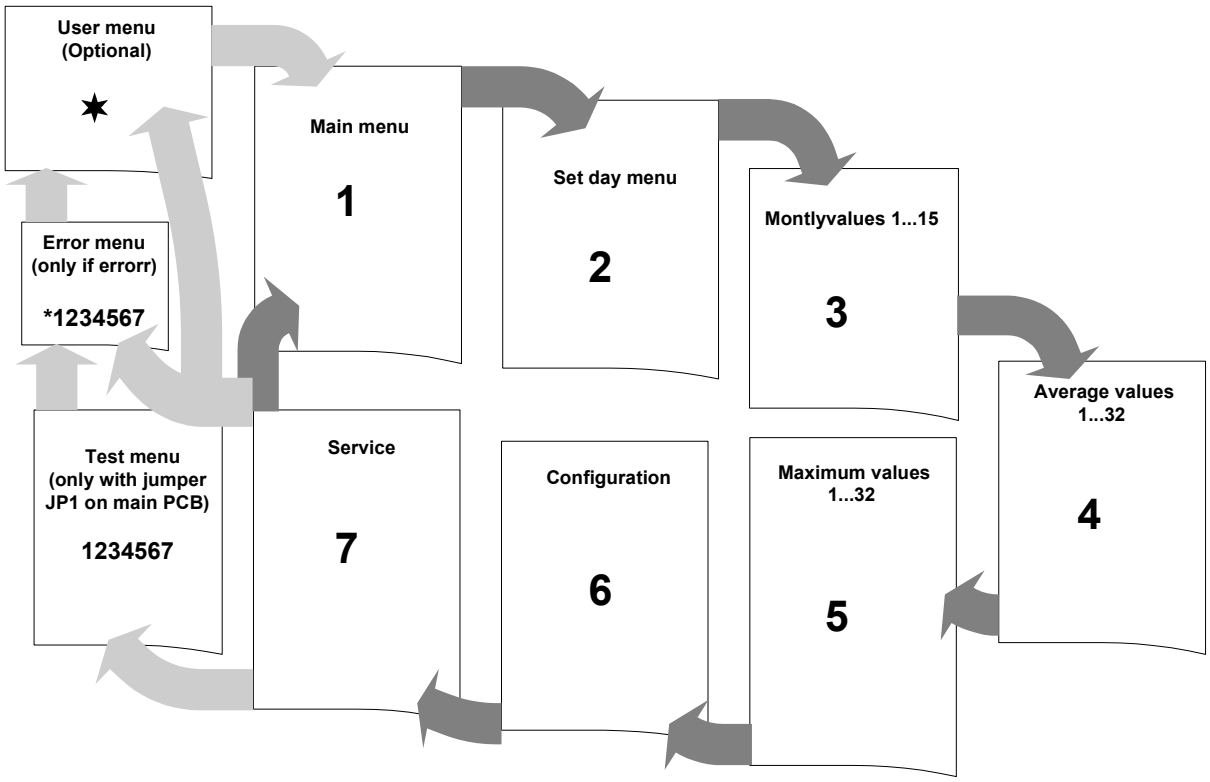
Flow indicator
If the flow indicator is displayed, the Supercal 531 is measuring the volume pulse of the flow sensor.

5.2 The display menu

The display sequences are divided into the following menus:

1 Main menu
2 Set day values
3 15 monthly values
4 32 average values
5 32 maximum values
6 Configurations
7 Service information
* Favourites menu (optional)
*1234567 Error menu
1234567 Verification menu

The display sequence can be set according to your requirements:
The menu „favourites“ can be placed on top of the main menu. Acc. to the approval regulations, the accumulated energy has to be displayed first in this menu. The display levels can be customized as to the number as well as in the order of the display sequences.



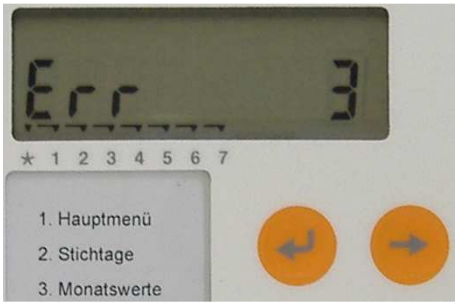
5.3 The operator buttons

The two operator buttons enable simple and customer-friendly handling of the Supercal 531.

Pressing **control key,** you move on the actual menu level.

Pressing **enter key,** you go to the next sub-menu, one level down

Pressing **enter key** and **control key** simultaneously, you go one level up in the menu tree.



Regardless in which menu you are in the Supercal 531: after 3 minutes the integrator returns automatically to the first display of the main menu.

6. The Communication Concept

For instructions on the installation and the parameterisation of the modules, we refer to „Start-up and Applications“ (point 8), as from page 50

The terminal lay-out can be taken from the „wiring diagram Supercal 531“ (point 3.2.), page 15.

The specifications of the below mentioned communication configurations are stated in „Technical Data “ (point 11.), as from page 66.

6.1 Standard configuration

By default, the Supercal 531 features an optical interface, a pulse input (terminal 10 and 11), two additional pulse inputs (A1 and A2) and two open-collector outputs (B1 and B2).

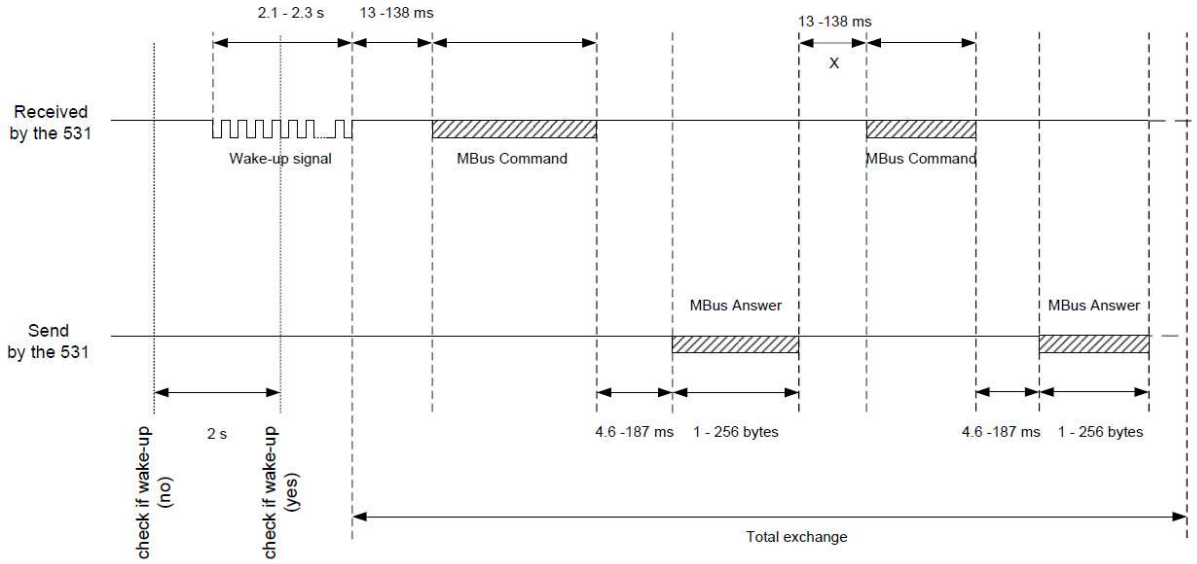
On request, a M-bus or radio module can also be integrated in the standard configuration at the factory.

6.1.1 Optical interface

The optical interface has been designed acc. to EN 61107 with the M-Bus protocol acc. to EN 1434. Its mechanical and electrical design corresponds to the ZVEI-Standard IEC 1107. This interface allows the following start-up and service jobs via the communication protocol acc. to EN 60870-5:

- Parameterisation of the optional communication modules
- Parameterisation and read out of the current and recorded values.
- Checking of the values
- Test acc. to NOWA / UNICON-standard (NOWA: standardized heat meter adapter)

6.1.1.1 **Timing of the optical interface**



Every 2 seconds the integrator Supercal 531 checks if an wake up is pending.

Alarm signal:	0101010101…
Transmission time:	2.2 seconds +/- 0.1
Total transmission time:	If the time > 40 seconds or if X > 138 ms, a new wake up is sent.

6.1.2 Pulse input for volume measurement

The Supercal 531 allows the connection of slow and fast flow sensors. To this end, two specific filters have been integrated (normal- or fast mode) which can be selected over the software Prog531.

6.1.3 Two additional pulse inputs

The Supercal 531 features two additional pulse inputs (A1 and A2) to connect additional meters for cumulated pulse counting. These two additional pulse inputs are integrated automatically in the M-Bus, radio or optical telegram and transmitted.

Thus it is possible to connect water meters, electricity meters, gas meters or oil meters.

They are parameterised (normal and / or fast mode) ex factory over hardware bridges. Unless otherwise defined in the order, the two additional pulse inputs are set to normal mode.

In case a subsequent change from normal to fast mode is necessary, the solder bridge respectively the resistance (0 Ω) JP2 (A1) / JP3 (A2) on the main board has to be removed by authorized personnel.

6.1.4 Two open-collector pulse outputs

Two open-collector outputs (B1 and B2) can be used to optionally display energy, volume, tariff 1, tariff 2, alarm values and threshold values.

Maximum current per pulse output is 100 mA; maximum voltage is 30V.
They are parameterised (both in normal or fast mode) with the service software.

Fast pulse outputs are used e.g. for controlling system processors. In this case, the maximum pulse frequency is 12 kHz.

These outputs are not isolated galvanically. When connecting to process systems, we always recommend using relay outputs.

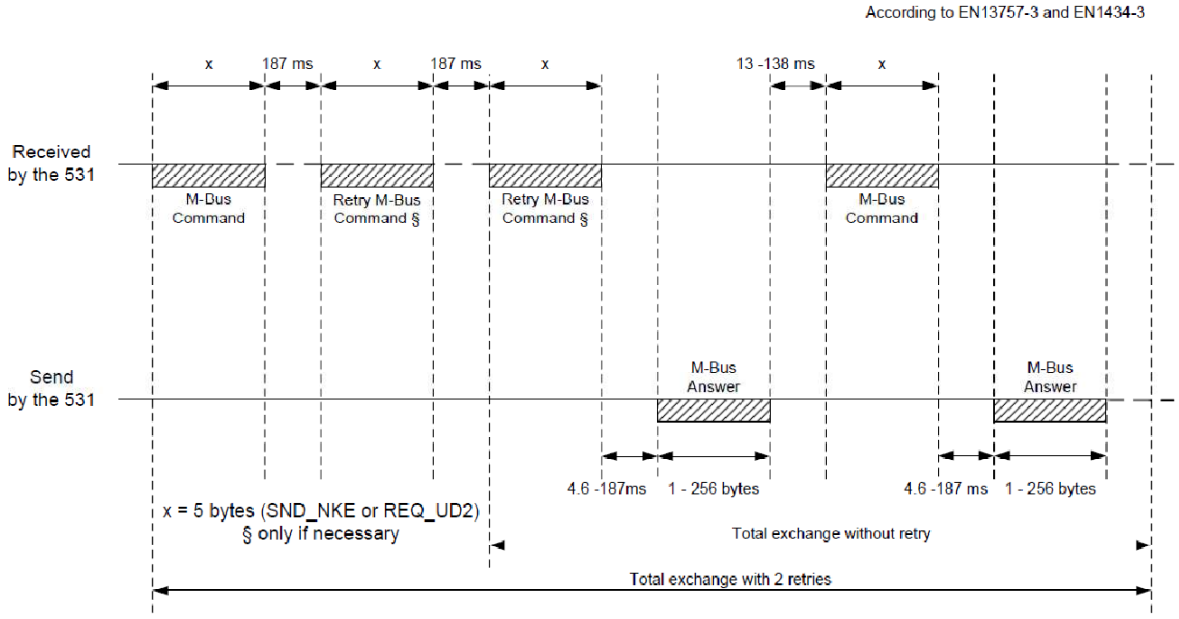
6.1.5 M-bus communication

Besides the factory-assembled M-bus module up to two further communication modules can be mounted.
The factory-assembled M-bus module is controlled by the microprocessor located in the integrator upper part. The optional communication modules are equipped with an embedded microprocessor. Thus it is ensured that up to three M-Bus inquiries for different applications can be processed and answered at the same time.
The two additional pulse inputs are automatically integrated in the M-bus telegram and transmitted. To clearly identify the two pulse inputs, it is possible to parameterise an identification or part number for each input.
The integrator Supercal 531 works with a variable data structure. For each M-bus output an individual primary address as well as a baud rate can be parameterised.

The protocol of the optional communication modules with interface RS-232 also corresponds to the M-Bus protocol.

In case of an M-Bus “application reset” the default settings are set acc. to standard EN1434.

6.1.6 Timing of M-Bus communication



6.2 Optional communication modules

The two free module connection points in the integrator base part can be used to retrofit the below mentioned optional communication modules without infringing the validity of the calibration. See „The modular concept“ (point 3.1.), page 13

After installation of the modules, they are identified automatically within 30 seconds by the Supercal 531.

All optional communication modules can be read out and parameterised over the optical interface. Due to the numerous retrofitting possibilities, the Supercal 531 allows a comprehensive transmission of the recorded data and the integration in many different process control systems and applications.

6.2.1 Analogue module with two outputs

6.2.1.1 Analogue modules with two outputs 4...20 mA

The optional analogue module with two outputs 4...20 mA enables the connection of the integrator Supercal 531 to read-out or control systems required for e.g. building management applications. The analogue module provides instantaneous values as analogue output signals. These outputs are passive and require an external power supply. The power supply is coverd over the out puts (9…24VDC). If equipped with an analogue module, the Supercal 531 must always be mains voltage-supplied.

Analogue module with two outputs 4..20 mA

An analogue module can always provide two of the below mentioned instantaneous values as galvanically isolated analogue signal for each circuit:

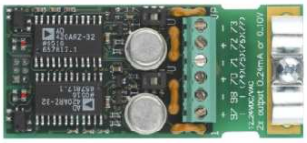
- Flow
- Power
- Temperature high
- Temperature low
- Temperature difference
- Flow additional meter A1
- Flow value additional meter A2

Up to two optional analogue modules can be operated in the integrator Supercal 531 at the same time.

6.2.1.2 **Analogue module with two outputs 0...20 mA, 4...20 mA or 0...10 VDC**

Application identical to point 6.2.1.1
For each circuit, a separate flip switch allows the independent switchover of the analogue outputs to the range 0..10 VDC.
The two red LEDs are only on if the current does not correspond to the set value of the analogue signal, e.g. in case of open circuit. In voltage-supplied mode (0..10 VDC), the LEDs are deactivated. When using the Supercal 531 with an analogue module, it must always be mains voltage supplied.
Up to two optional analogue modules can be operated at the same time in the integrator Supercal 531. The power supply is covered over the two corresponding terminals.

Analogue module with two outputs 0..20 mA, 4..20 mA, 0..10 VDC, or 2…10 VDC

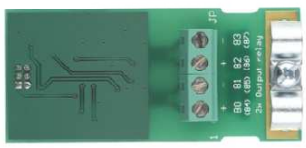


6.2.2 Relay module

The optional relay module with two outputs allows the transmission of status messages, alarms and/or errors.
The following information is available as pulse freely selectable for data readout:

- Energy
- Energy tariff 1
- Energy tariff 2
- Volume
- Volume tariff 1
- Volume tariff 2
- Volume additional meter A1
- Volume additional meter A2

Up to two optional relay modules can be operated in the integrator Supercal 531 at the same time. When equipped with a relay module, the Supercal 531 must always be mains voltage supplied.

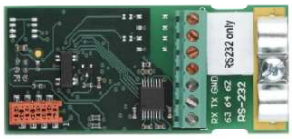


6.2.3 Module RS-232 with two relay outputs

The optional module RS-232 with two relay outputs allows the connection of the integrator Supercal 531 to a control system, a system processor, a modem or a PC.
Thus, it is possible to readout the data of the heat meter and to transmit them via RS-232 interfaces.
The module RS-232 with two relay outputs combines the advantages of the communication with a control system (or any other controllers and remote readout systems) over RS-232 with the transmission of status messages, alarm and/or errors as relay output.
The communication is based on the M-Bus protocol acc. to EN 1434-3 and IEC 870-5.
The transmission rates are freely selectable between 300 and 38'400 baud. The readout can be done with a M-Bus read-out software. If equipped with a module RS-232 with two relay outputs, the Supercal 531 must always be mains voltage supplied.
Each relay output is galvanically isolated and features two switching contacts.

6.2.4 Module RS-232

Application identical to point 6.2.3
The module RS-232 features the advantages of the communication over RS-232 with a control system or any kind of controllers, control or remote readout systems.
The communication is based on the M-Bus protocol in accordance with EN 1434-3 and IEC 870-5.
The transmission rates are freely selectable between 300 and 9'600 baud. The readout can be done with a M-Bus readout-software. In case of continuous communication of more than once a day, we always recommend mains voltage supply.



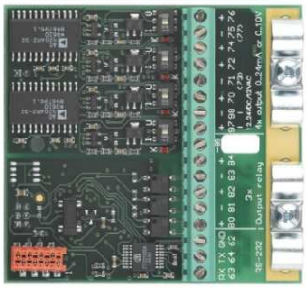
6.2.5 Combined module

RS-232 interface with three relay outputs and four freely programmable outputs 0...20 mA, 4...20 mA, 0...10 VDC or 2…10 VDC.

The optional combined module with RS-232, three relay outputs and four freely programmable outputs 0..20 mA, 4..20 mA, 0..10 VDC or 2…10 VDC combines at the same time:

- The communication over the serial interface RS-232 (with a control system or all kinds of controller or remote readout systems) with the transmission of status messages, alarm and/or errors as relay output
- the connection of the integrator Supercal 531 via the four freely selectable outputs to readout or control systems required e.g. for building management applications.

The instantaneous values of the analogue output signals are active and need an external current supply. The combined module of the Supercal 531 always requires mains voltage supply.



6.2.5.1 The RS-232 interface

Please see specification of module RS-232 with two relay outputs (point 6.2.3, page 28).

6.2.5.2 The relay outputs

Each output is galvanically isolated and contains 3 switching contacts.

6.2.5.3 The analogue outputs

They require an external current supply. Each current circuit can be set up individually as an active, galvanically isolated analogue current output or analogue voltage output.

6.2.6 M-Bus module with two relay outputs

The optional M-Bus module with two relay outputs allows the integration of the integrator Supercal 531 into a M-Bus-, control- or process system.
Thus it is possible to readout the data of the heat meter and to transmit them via M-Bus.
Therefore the M-Bus module combines the advantages of the communication via M-Bus with a data processing centre (or any kind of controller, control system and remote readout system) with the transmission of status messages, alarm and/or errors as relay output.
When equipped with an M-Bus module with two relay outputs, the Supercal 531 must always be mains voltage supplied.

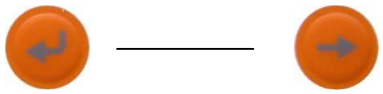
6.2.7 M-Bus module

Application identical to point 6.2.6
The M-Bus module features the advantages of the communication over M-Bus with a data processing centre or with any kind of controller, control system and remote readout system.
In case of continuous communication of more than once a day, we always recommend mains voltage supply.
For combining with other devices, please see point 6.2.6

7. The Display Menus

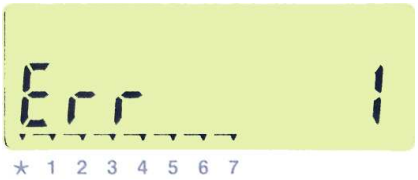
7.1 Menu control

Press the **enter key** and the **control key** simultaneously.



The last occurred error is displayed.

Press the control key:

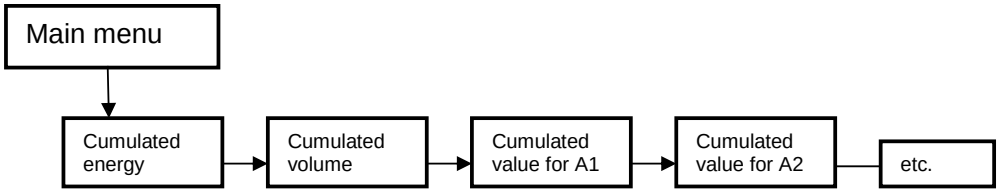


The first display of the main menu, the **cumulated energy is** indicated.
The index for the menu navigation is above the „1“.

7.2 Main menu

Confirm **menu 1 = main menu** by pressing the enter key:

The index for the menu navigation flashes. Now, the display sequence of the main menu can be accessed and display after display can be read by repeatedly pressing the control key.



Cumulated Energy
Possible energy units: kWh, MWh, MJ, GJ, BTU
Standard parameterisation ex works: kWh or MWh
Maximal displayed energy: 99'999'999 (8 digits)
The number of digits after the decimal point can be set at the factory or defined by an authorized laboratory.
The displays of the cumulated energy for tariff 1 and tariff 2 are identical.

Cumulated Volume
Possible volume units: m^3, US-gallon
Default parameterisation ex works: m^3
Maximal displayed volume: 99'999'999
The number of digits after the decimal point can be set at the factory or by an authorized laboratory.
The displays of the cumulated volumes for tariff 1 and tariff 2 are identical.

Cumulated values for the additional pulse inputs A 1 and A 2
Display in main menu: without units
Units and pulse factors are defined in the menu configuration.
In case of M-Bus- or radio readout, the units are transmitted automatically.

Temperature high and temperature low
Possible temperature units: °C or F
Default parameterisation ex works: °C
Display range: - 20 up to 200 °C
„Temperature high" and „temperature low" are displayed side by side with one digit after the decimal point.
Negative temperatures are displayed with a minus sign.

Temperature difference
Display: with two digits after the decimal point
If „temperature low" is above „temperature high", the temperature difference is displayed with a minus sign.

Power
Possible units of energy: kW, MW, or BTU/h
Default parameterisation ex works: kW
The number of digits after the decimal point can be set at the factory or by an authorized laboratory.

Flow
Possible flow units: m^3/h, US-gallon/min
Default parameterisation ex works: m^3/h
The number of digits after the decimal point can be set at the factory or by an authorized laboratory.

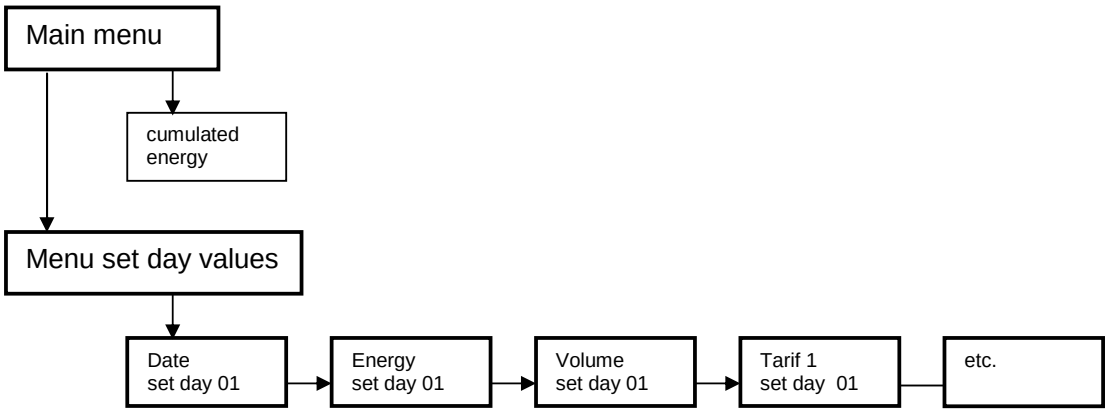
Segment test
All segments of the LCD-display appear.

7.3 Menu set day values

Two set days are possible: set day 1 = S1, set day 2 = S2.
Values recorded on set day: energy, volume, tariff values and additional pulse inputs.

The first display of the display sequence indicates the date of the set day, if occurred.

Display and presentation of the cumulated set day values are identical with those of the main menu.



Path:

Please proceed as described in 7.1.

Then, press the control key:

The index for the menu navigation goes to „2“.
Confirm the **menu 2 = menu set day values** by pressing the enter key:

The index for the menu navigation which now is above „2“ flashes and the date of the first set day 01 is displayed.

Now, the display sequence of set day 01 can be accessed and display after display can be read by repeatedly pressing the control key:

Energy on set day 01

Volume on set day 01

Energy tarif 1 on set day 01

Further data are displayed by repeatedly pressing the control key.

Selecting of set day 02:
Press enter key:

The index „S1“ for set day 01 flashes.
Press the control key:

The index goes to „S2“.

Confirm by pressing the enter key.

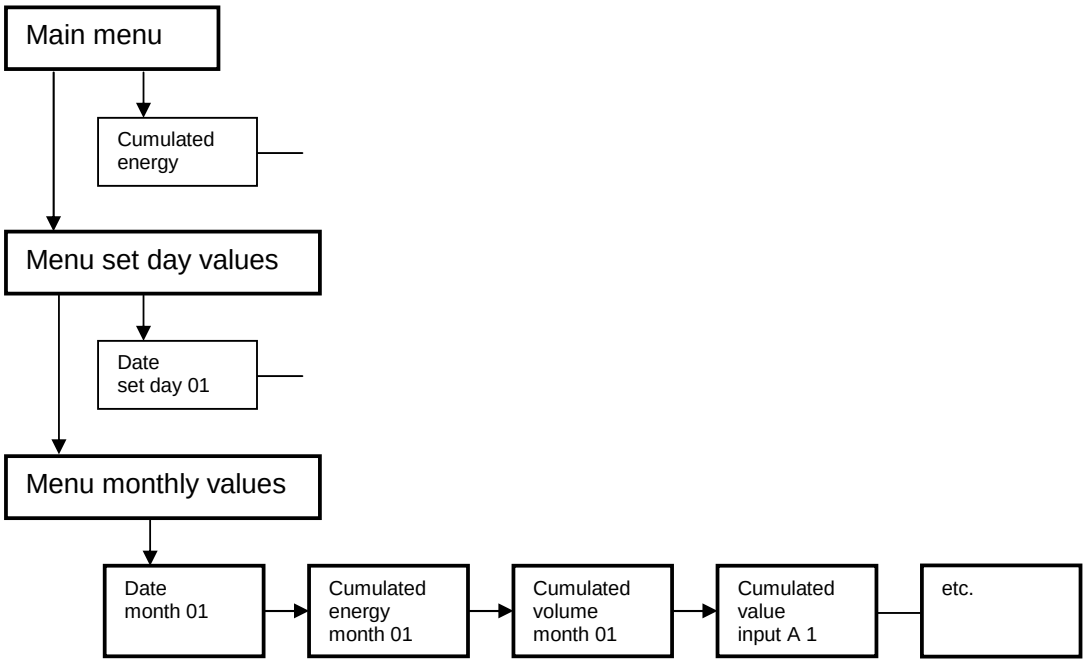
Now the display sequence for set day S2 can be accessed by pressing the control key.

7.4 Menu monthly values

The Supercal 531 records 15 monthly values, in the order 01 to 15.

Every month, the cumulated values for energy, volume, additional pulse inputs and tariffs are recorded.
Index „01“ refers to the last monthly value, index „02“ refers to the month before last, the indices „03“ to „15“ refer to the previous months.

Display and presentation of the cumulated monthly values are identical with those of the main menu.

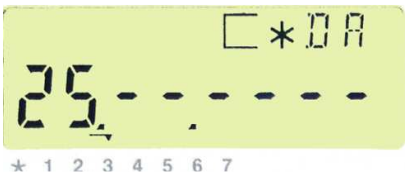


Path:
Please proceed as described in 7.1.

Then, press **control key twice**:

The index for the menu navigation goes to „3“. Confirm **menu 3 = menu monthly values** by pressing the **enter key**:

The index for the menu navigation which is above „3“ flashes and the date of the set day for the monthly values is displayed.



Press the **control key** again:

Then the first display of the display sequence for month 01 turns up, the **cumulated energy**.

By repeatedly pressing the control key, display after display for month 01 can be called: cumulated volume, cumulated values of the additional pulse inputs and tariffs.

Selecting of the monthly values 02 to 15:

Press **enter key**:
The index „01“ for the monthly value 01 flashes.

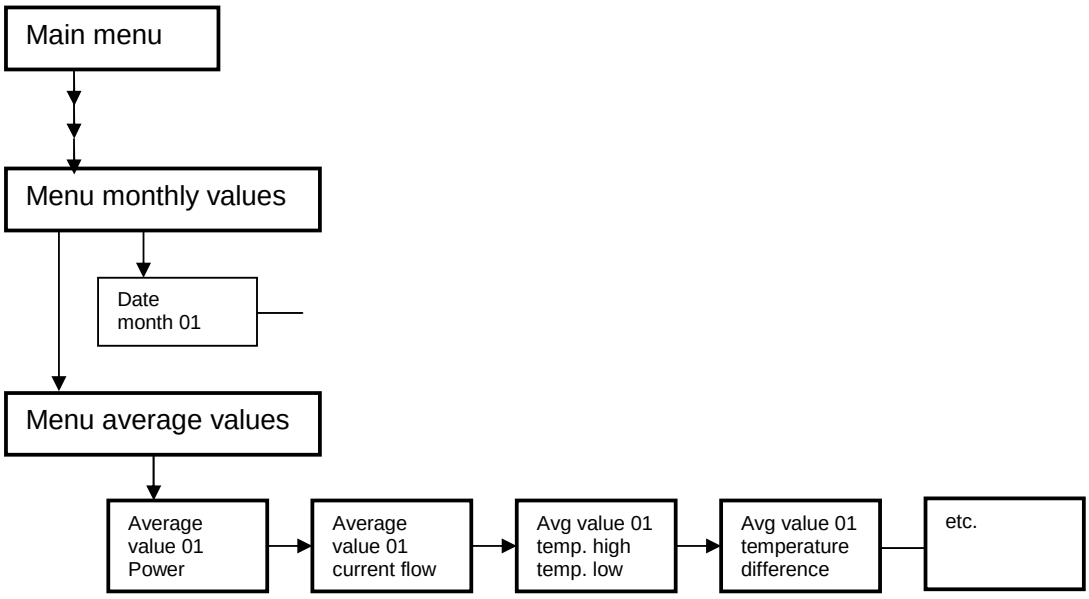
Now repeatedly press the **control key**. Thus the indices for all further monthly values (02 to 15, flashing) can be called.

Confirm the display sequence for the requested monthly value by pressing the **enter key**.

7.5 Menu average values

With the Supercal 531 a maximum of 32 average values can be readout and recorded. The average time can be set between 1 minute and 45 days.
The average values for the current power, flow, „temperature high“ and „temperature low“, temperature difference, flow A1 and flow A2 are recorded and displayed with the index „avg“.
The index „01 avg“ stands for the last recorded average value, index „02 avg“ stands for the average value before the last, the indices „03 avg“ to „32 avg“ stand for the previous average values.

Display and presentation of the average values are identical with those of the main menu.



Path:
Please proceed as described in 7.1.

Then press the **control key three times**:

The index for the menu navigation goes to „4“. Confirm the **menu 4 = menu average values** by pressing the **enter key**:

The index for the menu navigation which is above „4“ flashes and the current power of the last recorded average value with the index „01 avg“ is displayed.

By repeatedly pressing the **control key** all further recorded data of average value 01 can be called:
flow, supply and return temperature, temperature difference, flow A1 and flow A2.

To address the average values 02 to 32:

Please press the **enter key**

The index „01“ for average value „01 avg“ flashes. Now you can proceed in two different ways:

- Press the **control key** constantly.

  Thus the indices of all further average values (02 to 32, flashing) can be called. The previously selected value with the current power, flow etc. is displayed as well.

- Alternatively, the display sequence for the requested average value can be selected by pressing the **enter key**.

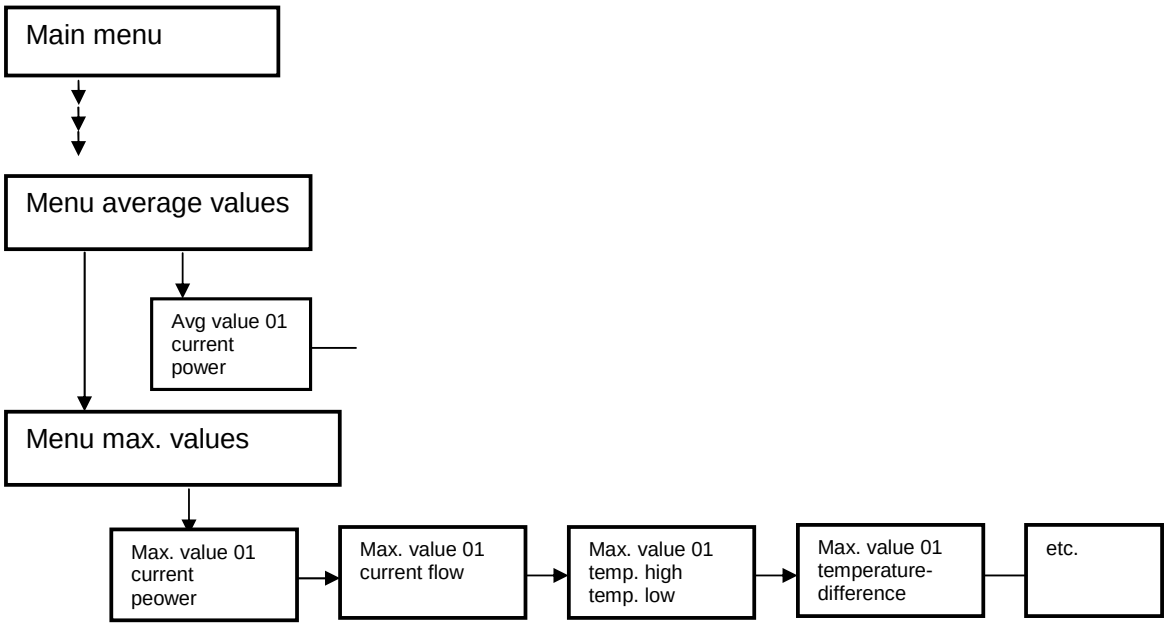
  The average values can then be called by repeatedly pressing the **control key**.

7.6 Menu maximum values

The time window for 32 maximum values can be selected freely between 1 hour and 1 year. The maximum values for performance, flow, „temperature high“ and „temperature low“, temperature difference and pulse inputs A1 and A2 are supplemented by the index „max“. Date and time of the recorded maximum values are also displayed.
Index „01 max“ refers to the last maximum value , index „02 max“ refers to the value before last month, the indices „03 max“ to „32 max“ refer to the previous maximum values.

The maximum values can be determined in two different ways:

The effective maximum values are measured and recorded during a defined average time.
The maximum values of the average values measured and recorded within the programmed average time are used.



Path:
Please proceed as described in 7.1.

Press the **control key four times**:

The index for the menu navigation goes to „5“. Confirm the **menu 5 = menu maximum values** by pressing the **enter key**:

The index for the menu navigation which is above „5“ flashes and the current performance of the last recorded maximum value with the index „01 max“ is displayed.

By repeatedly pressing the **control key** all further recorded data of maximum value 01 can be called: flow, supply and return temperature, temperature difference, pulse input A1 and pulse input A2.

To select all further maximum values 02 to 32:

Press the **enter key**

The index „01“ for maximum value „01 max“ flashes. Now you can proceed in two different ways:

- Press the **control key** repeatedly.

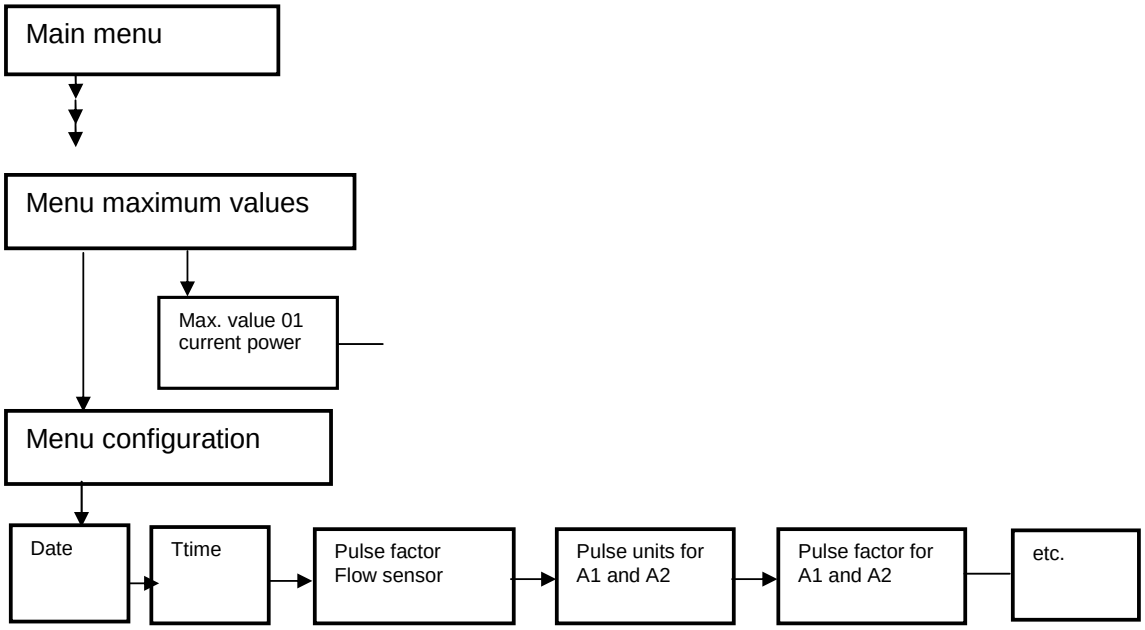
  Thus, the indices for all further maximum values (02 to 32, flashing) are called. The previously selected value with the current power, flow etc. is displayed as well.

- Alternatively, the display sequence for the requested maximum value can be selected by pressing the **enter key**.

  The maximum values can be called by repeatedly pressing the **control key**.

7.7 Menu configuration

Here, the configuration values of the Supercal 531 can be checked and altered if required.



Path:
Please proceed as described in 7.1.

Press the **control key five times**:

The index for the menu navigation goes to „6“. Confirm the **menu 6 = menu configuration** by pressing the **enter key**:

The index for the menu navigation which is above „6“ flashes and the current date (index DA) is displayed.

By repeatedly pressing the **control key** the display sequence of the menu **configuration** can be called:

Time (index Hr)
No differentiation is made between summer and winter period.

Pulse factor flow sensor (index „LP“ or PL) litre/pulse or pulse/litre

Pulse units of the additional pulse inputs A1 and A2 (indices A1 and A2)

Pulse factors of the additional pulse inputs A1 and A2 (indices A1 and A2)

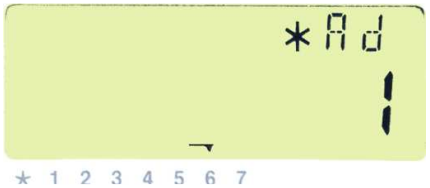
Pulse units of the additional pulse outputs B1 and B2 (indices B1 and B2)

Pulse factors of the additional pulse outputs B1 and B2 (indices B1 and B2)

Integration period for calculating the average value

Integration period for calculating the maximum value

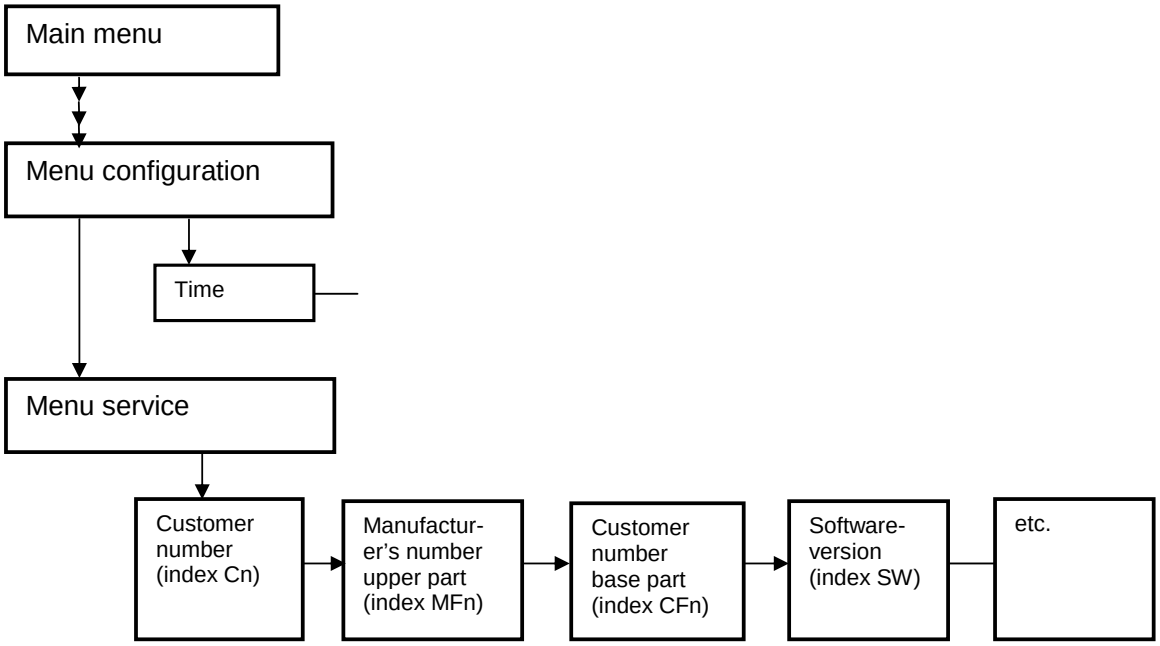
Primary address (index Ad) M-Bus



Baud rate (index Br) M-Bus

7.8 Menu service

Here, the configuration values of the Supercal 531 can be checked and altered if required.



Path:
Please proceed as described in 7.1.

Press the **control key six times**:

The index for the menu navigation goes to „7“. Confirm the **menu 7 = menu service** by pressing the **enter key**:

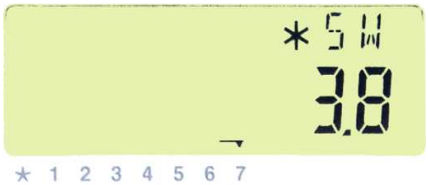
The index for the menu navigation which is above „7“ flashes and the **identification number / customer number** (index Cn), display with 8 digits, is displayed.

By repeatedly pressing the **control key** the display sequence of the menu **service** can be called:

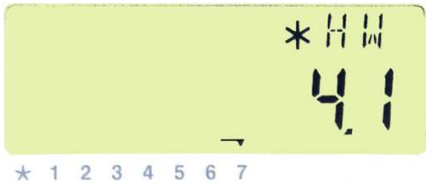
Manufacturer's numberMET (index MFn)

Manufacturer's number MIO (index CFn)

Software version (index SW)



Hardware version (index HW)



Options (index Opn)

Decoding of the options (positions numbered from left to right):

Pos 1	power supply	0 = battery 1 = mains
Pos 2	basic version	0 = standard 1 = M-Bus factory-mounted 2 = radio module
Pos 3 / 4	tariff 1 / 2	0 = off 1 = on
Pos 5 (7) & 6 (8)	communication modules	01 = analogue module only current 02 = analogue module current / voltage 03 = relay module 04 = Combined module 05 = module RS-232 relay 06 = module RS-232 07 = M-Bus module relay 08 = M-Bus module

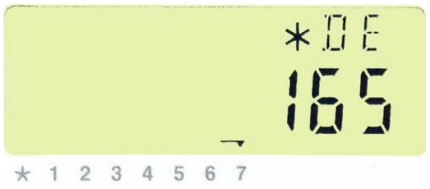
Resistance value of the sensors Pt100 or Pt500 (index Pt) to be used.

Place of installation of the flow sensor (index Ft);
0 = return pipe, 1 = supply pipe

Operating hours of the Supercal 531 (index rh); indication of the operating time in hours

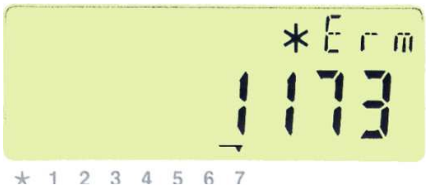
Number of days without flow (index DF)

Number of days without energy measurement (index DE)



Display of current error (Err, error number)

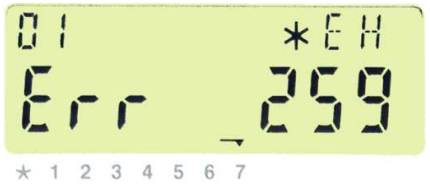
Duration of current error in minutes (index Erm)



Error messages 1 – 10 (index EH)

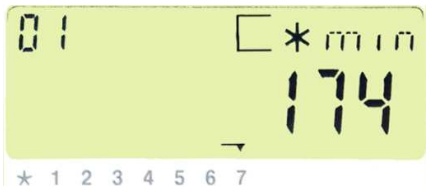
Display of the 10 last recorded errors. The error code is displayed with „Err“ and the indices „01“ to „10“.
Index „01“ stands for the last recorded error/error code, index „02“ for the error before last, the indices „03“ to „10“ for the previous recorded errors.

First, the error with index „01“ is displayed.



By pressing the **control key** again, the values are displayed in the sequence as follows:

Duration of error in minutes (min)



Date (DA)beginning of error

Time (Hr) beginning of error

By pressing the **control key** again, the display goes back to the **identification number / customer number** (index Cn) mentioned above.

To access the data of the recorded errors 02 to 10, repeat the procedure until reaching the error with index „01“.

Then press the **enter key**:

The index „01“ flashes.

Now select the error of which you want the error data to be displayed by pressing the **control key** (e.g. „02“ for the error before last).

Then press the **enter key**:

The error number of the error before last 02 is displayed.

By repeatedly pressing the **control key** the display sequence for error 02 is called:
Duration of error in minutes (min), date (DA) and time (Hr) when the error began.

Now press the **control key** again. Then the display returns to the **identification number / customer number** (index Cn) mentioned above.

8. Start-up and Applications

As already mentioned in 2.5, the installation of a heat metering point may only be carried out by authorized personnel and the directives of installation as well as the local rules have to be taken into account.

The same applies for the start-up of the metering point where an expert has to check its proper functioning. After execution of this function check, the Supercal 531 has to be provided with seals.

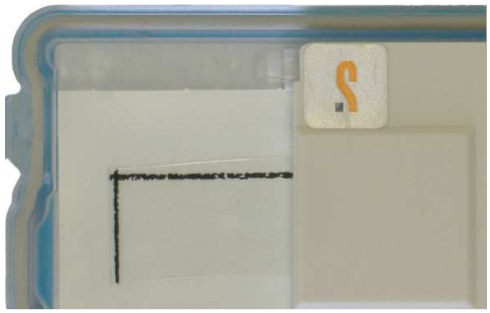
8.1 Start-up of the Supercal 531

8.1.1 Backup battery

The backup battery in the measuring- and calibration-relevant integrator upper part serves as current supply for date and time in case it is disconnected from the base part of the integrator (e.g. recalibration, replacement or service).
On request, the backup battery in its original packaging can be protected against premature discharge by applying a protective film. Remove the protective film carefully if you want to activate the battery.

ATTENTION: The protective film cannot be reapplied after removal!

The service life of the battery in activated state and without external power supply is up to 130‘000 minutes (approx. 3 months) depending on the operating and ambient conditions.



When replacing the battery, the calibration seal is damaged! Therefore, only personnel authorized and trained by Sontex may carry out the replacement.
In case of improper handling, the warranty of Sontex is void!

If the integrator upper part is removed, the LCD display indicates the total operating time of the backup battery in minutes.
Thus, the service engineer is able to decide whether the battery has to be replaced or not. After replacement of the battery, we recommend to reset the battery hour meter to zero with the software „Prog 531“.

8.1.2 Supercal 531

8.1.2.1 Checking of date and time

The correct setting of date and time is important so that the recorded data of the Supercal 531 can be allocated chronologically.
They can be set with the service software Prog531 over the optical interface.

8.1.2.2 Flow check

If the pulse factor of the flow sensor has been adjusted correctly to the Supercal 531, an existing flow will immediately be displayed (see flow indicator, point 5.1, page 21).

8.1.2.3 Checking of temperatures

If the temperature sensors are installed correctly in the heating system and connected properly to the Supercal 531, the displayed temperatures will correspond to the expected system data: Here, „temperature high“ should be above „temperature low“, and the temperature difference should be positive (see main menu, point 7.2, as from page 34).

8.2 Applications

8.2.1 Flow calculation

The parameters relevant for the calculation of the flow (precision of measurement, minimum and maximum holding time, see also 3.4, page 16) are set in our factory. On request, authorized laboratories may carry out alterations over the software Prog531.

The calculation of flow is based on three parameters:

- Precision of measurement of the flow sensor in % or the number of pulses necessary for a new calculation.
- Maximum holding time between two pulses in seconds
- Minimum holding time (battery operation / mains operation) in seconds

A new flow calculation is carried out if:

a) The defined minimum holding time between the readouts is exceeded and the measured number of volume pulses is sufficient to reach the desired accuracy.

b) The desired accuracy was achieved by a sufficient number of volume pulses within the minimum and maximum holding time.

c) The defined maximum holding time expired but the number of volume pulses measured is not sufficient.
In this case however, the flow value will not reach the desired accuracy since the precision extremely depends on the number of pulses measured.

8.2.1.1 Response time and accuracy of the flow calculation

The time period during which the Supercal 531 carries out a new flow calculation is called response time.

At the same time, the value of the current flow is updated
- on the LCD-display
- in the M-Bus protocol (if existing)
- by pulse- or analogue output (if existing)

8.2.2 The Supercal 531 in combination with standard (slow) flow sensors

Example 1:

Flow sensor:	Qn 10 m3/h, 10 litre/pulse	
Configuration 531:	requested precision	1% (100 pulses)
	Minimum holding time	10 seconds
	Maximum holding time	200 seconds

	flow [m3/h]	frequency [pulse/sec]	period [sec/pulse]	response time [sec]	specification parameter	precision [%]
Qn	10	0.278	3.6	200	maximum period b)	1.8
Qn / 2	5.0	0.139	7.2	200	maximum period b)	3.6
Qn / 10	1.0	0.028	36.0	200	maximum period c)	18.0

Example 2:

Flow sensor:	Qn 10 m3/h ,10 litre/pulse	
Configuration 531:	requested precision 4% (25 pulses)	
	Minimum holding time	10 seconds
	Maximum holding time	200 seconds

	flow [m3/h]	frequency [pulse/sec]	period [sec/pulse]	response time [sec]	specification parameter	precision [%]
Qn	10	0.278	3.6	90	achieved precision b)	4
Qn / 2	5.0	0.139	7.2	180	achieved precision b)	4
Qn / 10	1.0	0.028	36.0	200	maximum period c)	4

Example 3:

Water meter:	Qn 25 m3/h, 100 litre/pulse	
Configuration 531:	requested precision	4 % (25 pulses)
	Minimum holding time	10 seconds
	Maximum holding time	480 seconds

	flow [m3/h]	frequency [Imp/sec]	period [sec/pulse]	response time [sec]	specification parameter	precision [%]
Qn	25	0.0694	14.4	360	achieved precision b)	4
Qn / 2	12.5	0.0347	28.8	480	maximum period c)	6
Qn / 10	2.5	0.0069	144.0	480	maximum period c)	30

Example 4:

Water meter:	Qn 25 m3/h, 100 litre/pulse	
Configuration 531:	requested precision	10 % (10 pulses)
	Minimum holding time	10 seconds
	Maximum holding time	300 seconds

	flow [m3/h]	frequency [Imp/sec]	period [sec/pulse]	response time [sec]	specification parameter	precision [%]
Qn	25	0.0694	14.4	144	achieved precision b)	10
Qn / 2	12.5	0.0347	28.8	288	achieved precision b)	10
Qn / 10	2.5	0.0069	144.0	300	achieved precision c)	48

For explanations to b) and c), please see point 8.2.1, pages 51

Attention:
When setting the parameter of the maximum holding time, attention has to be paid that this value is higher than the duration between two volume pulses at mean flow of the connected flow sensor. Otherwise the displayed flow and the displayed power will be zero.

The maximum holding time always has to be adjusted specifically to the application. If, later, the heat meter is integrated into a controller application, it is important to check the setting of the maximum holding time.

8.2.3 The Supercal 531 in combination with the flow sensor Superstatic 440

Oscillating beam flow sensor Superstatic 440

The electronic output signal of the Superstatic 440 represents the oscillation frequency of the hydraulic fluid oscillator.

In the table below, please find the typical frequency at Qn (qp) as function for different nominal flows (DN):

DN [mm]	Qn (qp) [m3/h]	pulse factor [Imp/l]	f440 at Qn [pulse/sec]
25	3.5	15.18	14.758
25	6.0	8.70	14.500
40	10	5.75	15.972
50	15	3.75	15.625
65	25	2.25	15.625
80	40	0.810	9.000
100	60	0.540	9.000
125	100	0.330	9.167
150	150	0.222	9.250
200	250	0.1360	9.444
250	400	0.0865	9.611

Example of the configuration of the integrator Supercal 531 combined with a flow sensor Superstatic 440 with Qn 6 m3/h.

Configuration 531:	requested precision	2% (minimum: 50 pulses)
	Minimum holding time	5 seconds
	Maximum holding time	40 seconds

In the table below, please find the response time in dependence of the flow and the requested precision:

	flow [m3/h]	frequency [pulse/sec]	response time [sec]	specification parameter	precision [%]
Qn	6.0	14.50	5	minimum period a)	< 2
Qn / 2	3.0	7.25	7	achieved precision b)	2
Qn / 10	0.6	1.45	35	achieved precision b)	2
Qmin	0.06	0.145	40	maximum period c)	20

For explanations to a), b) and c), please see point 8.2.1, pages 51
Possible parameterisation of the integrator Supercal 531 with mains module: the flow parameters are factory-set taking into account the specific properties of the flow sensor Superstatic 440.

	basic configuration	minimum values
precision	1 %	1 %
minimum period	5 sec. (10 sec. battery-operated)	5 sec. (10 sec. battery-operated)
maximum period	200 sec.	5 sec.

For specific applications, the minimal values of the holding time are reduced:
- Minimum holding time: 1 second
- Maximum holding time: 2 seconds

Attention:
When configuring the parameter of the maximum holding time, attention has to be paid that this value is higher than the duration between two volume pulses at mean flow of the connected flow sensor. Otherwise the displayed flow and the displayed performance will be zero.

The maximum holding time always has to be adjusted specifically to the application. If, later, the heat meter is integrated into a controller application, it is important to check the setting of the maximum holding time.

8.2.4 The „cut off“- function of the Superstatic 440

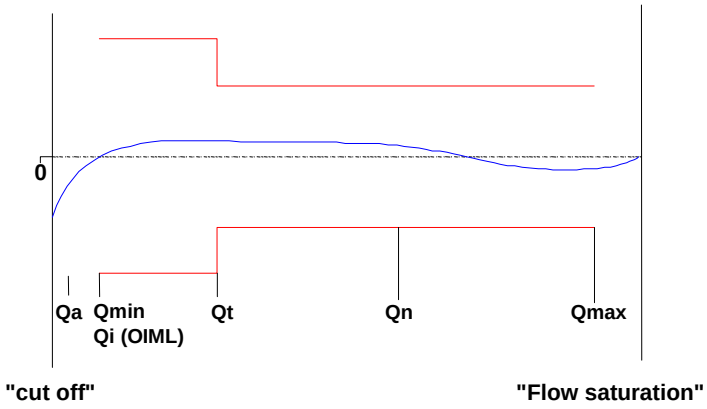
When combining the integrator Supercal 531 with the static flow sensor Superstatic 440, the possible flow measuring range is set and limited by a lower and upper threshold value („cut off“ and „flow saturation“) at the factory.

The „cut off“- function can only be integrated in the calibration- and measuring-relevant part of the Supercal 531 by damaging the calibration seal.

As soon as the flow drops below the set „cut off“, flow measurements are no longer carried out. Thus also the volume is no longer cumulated.
If the flow exceeds the flow saturation, the flow measurement stagnates at 2.4 x nominal flow and the volume is cumulated.

The „cut off“- function can also be used in case of hydraulic influences within the heating system, e.g. in case of system vibrations. Thus it is possible to limit a possible faulty measurement.

When combining the integrator Supercal 531 with the static flow sensor Superstatic 440 the threshold values „cut off“ and „flow saturation“ are programmed in the integrator Supercal 531 ex works.



Remark:
The threshold values of the „cut off"- function have to be regarded as autonomous from the other two additional threshold values.

Table with the factory-set threshold values acc. to PTB metrological class C

Length	Connection	Qn	Qt	Qmin	Qa (50°C)	Cut Off	Flow Saturation
110 mm	G 3/4"	1.0 m³/h	0.060 m³/h	0.010 m³/h	0.004 m³/h	0.003 m³/h	2.400 m³/h
110 mm	G 3/4"	1.5 m³/h	0.090 m³/h	0.015 m³/h	0.010 m³/h	0.005 m³/h	3.600 m³/h
190 mm	G1"	1.0 m³/h	0.060 m³/h	0.010 m³/h	0.004 m³/h	0.003 m³/h	2.400 m³/h
190 mm	G1"	1.5 m³/h	0.090 m³/h	0.015 m³/h	0.010 m³/h	0.005 m³/h	3.600 m³/h
190 mm	G1"	2.5 m³/h	0.150 m³/h	0.025 m³/h	0.010 m³/h	0.008 m³/h	6.000 m³/h
260 mm	G 1 1/4"	3.5 m³/h	0.210 m³/h	0.035 m³/h	0.015 m³/h	0.011 m³/h	8.400 m³/h
260 mm	DN25	3.5 m³/h	0.210 m³/h	0.035 m³/h	0.015 m³/h	0.011 m³/h	8.400 m³/h
260 mm	G 1 1/4"	6.0 m³/h	0.360 m³/h	0.060 m³/h	0.030 m³/h	0.018 m³/h	14.400 m³/h
260 mm	DN25	6.0 m³/h	0.360 m³/h	0.060 m³/h	0.030 m³/h	0.018 m³/h	14.400 m³/h
300 mm	G 2"	10 m³/h	0.600 m³/h	0.100 m³/h	0.050 m³/h	0.030 m³/h	24.000 m³/h
300 mm	DN40	10 m³/h	0.600 m³/h	0.100 m³/h	0.050 m³/h	0.030 m³/h	24.000 m³/h
270 mm	DN50	15 m³/h	0.900 m³/h	0.300 m³/h	0.075 m³/h	0.090 m³/h	36.000 m³/h
300 mm	DN65	25 m³/h	1.500 m³/h	0.500 m³/h	0.125 m³/h	0.150 m³/h	60.000 m³/h
300 mm	DN80	40 m³/h	4.000 m³/h	0.800 m³/h	0.400 m³/h	0.240 m³/h	96.000 m³/h
300 mm	DN100	60 m³/h	6.000 m³/h	1.200 m³/h	0.600 m³/h	0.360 m³/h	144.000 m³/h
250 mm	DN125	100 m³/h	10.000 m³/h	2.000 m³/h	1.000 m³/h	0.600 m³/h	240.000 m³/h
300 mm	DN150	150 m³/h	15.000 m³/h	3.000 m³/h	1.500 m³/h	0.900 m³/h	360.000 m³/h
350 mm	DN200	250 m³/h	25.000 m³/h	5.000 m³/h	2.500 m³/h	1.500 m³/h	600.000 m³/h
450 mm	DN250	400 m³/h	40.000 m³/h	8.000 m³/h	4.000 m³/h	2.400 m³/h	960.000 m³/h

Table with the factory-set threshold values acc. to OIML R75 1988

Length	Connection	Qn	Qt	Qmin	Qa (50°C)	Cut Off	Flow Saturation
110 mm	G 3/4"	1.0 m³/h	0.200 m³/h	0.010 m³/h	0.004 m³/h	0.003 m³/h	2.400 m³/h
110 mm	G 3/4"	1.5 m³/h	0.300 m³/h	0.015 m³/h	0.010 m³/h	0.005 m³/h	3.600 m³/h
190 mm	G1"	1.0 m³/h	0.200 m³/h	0.010 m³/h	0.004 m³/h	0.003 m³/h	2.400 m³/h
190 mm	G1"	1.5 m³/h	0.300 m³/h	0.015 m³/h	0.010 m³/h	0.005 m³/h	3.600 m³/h
190 mm	G1"	2.5 m³/h	0.500 m³/h	0.025 m³/h	0.010 m³/h	0.008 m³/h	6.000 m³/h
260 mm	G 1 1/4"	3.5 m³/h	0.700 m³/h	0.035 m³/h	0.015 m³/h	0.011 m³/h	8.400 m³/h
260 mm	DN25	3.5 m³/h	0.700 m³/h	0.035 m³/h	0.015 m³/h	0.011 m³/h	8.400 m³/h
260 mm	G 1 1/4"	6.0 m³/h	1.200 m³/h	0.060 m³/h	0.030 m³/h	0.018 m³/h	14.400 m³/h
260 mm	DN25	6.0 m³/h	1.200 m³/h	0.060 m³/h	0.030 m³/h	0.018 m³/h	14.400 m³/h
300 mm	G 2"	10 m³/h	2.000 m³/h	0.100 m³/h	0.050 m³/h	0.030 m³/h	24.000 m³/h
300 mm	DN40	10 m³/h	2.000 m³/h	0.100 m³/h	0.050 m³/h	0.030 m³/h	24.000 m³/h
270 mm	DN50	15 m³/h	3.000 m³/h	0.150 m³/h	0.075 m³/h	0.045 m³/h	36.000 m³/h
300 mm	DN65	25 m³/h	5.000 m³/h	0.250 m³/h	0.125 m³/h	0.075 m³/h	60.000 m³/h
300 mm	DN80	40 m³/h	8.000 m³/h	0.800 m³/h	0.400 m³/h	0.240 m³/h	96.000 m³/h
300 mm	DN100	60 m³/h	12.000 m³/h	1.200 m³/h	0.600 m³/h	0.360 m³/h	144.000 m³/h
250 mm	DN125	100 m³/h	20.000 m³/h	2.000 m³/h	1.000 m³/h	0.600 m³/h	240.000 m³/h
300 mm	DN150	150 m³/h	30.000 m³/h	3.000 m³/h	1.500 m³/h	0.900 m³/h	360.000 m³/h
350 mm	DN200	250 m³/h	50.000 m³/h	5.000 m³/h	2.500 m³/h	1.500 m³/h	600.000 m³/h
450 mm	DN250	400 m³/h	80.000 m³/h	8.000 m³/h	4.000 m³/h	2.400 m³/h	960.000 m³/h

9. Special Functions

The special functions of the Supercal 531 can either be activated at the factory or with the service software Prog531.

9.1 Status message of the transistor outputs

The Supercal 531 allows the transmission of the status messages to the transistor outputs. The displayed statuses can be defined over the threshold values.

Example: the alarm output can be used via the control system for the immediate and exact monitoring of an important operation mode of the system.

9.2 Threshold values

The threshold value is the value which is used as limit for processing a signal, e.g. for a tariff change or a control system. As soon as the value of the parameter drops below the minimum threshold value or exceeds the maximum threshold value, the signal- or alarm output is activated. Two threshold values can be parameterised over the optical interface or via the operator keys.

The following internal values/incidents can be used to define the thresholds:
- Current flow
- Current power
- „Temperature high“ or „temperature low“
- Temperature difference
- Time window (consisting of date and time)
- Occurrence of an error
- Flow additional meter A1
- Flow additional meter A2

9.3 Solar power systems and cooling systems

The Supercal 531 which originally has been calibrated for water also guarantees precise measurement of glycol mixtures. The medium to be measured and its average mixing proportion are parameterised acc. to the customer’s requirements. In this case, the integrator also processes and calculates negative temperatures.
The dust- and splash-proof housing of protection class IP65 is also suitable for cooling systems. Please follow the insulation regulations for cooling systems.
An official calibration is not possible for solar systems and cooling systems with glycol mixtures.

9.4 Tariff functions and/or status message signal

Besides the cooling-/heating tariff, the Supercal 531 disposes of various customer-specific tariffs which can be defined over the respective threshold values.
They can be programmed over the optical interface or the M-Bus interface without damaging the calibration seal.

Examples of different types of tariffs:
- Tariff control by means of the current flow
- Tariff control by means of the current power
- Tariff control by means of the temperature low or temperature high
- Tariff control by means of the temperature difference
- Tariff control by means of the inner tariff time switch
- Combined cold- /heat meter

The tariff functions are explained in detail in the annexe 16.2 Tariff Functions.

9.5 Open System (In development)

In open heating systems one flow sensor is installed in the supply- and one in the return pipe. The Supercal 531 (Supercal 533) calculates the heat energy consumption with the temperature difference and the two flow volumes.

9.6 Power Supply

Batteries or power supply modules can be used. Retrofitting is possible at any time. The Supercal 531 automatically detects the type of power supply installed.

9.7 Error Output

The error output can be used as alarm contact to signalize the freely selectable error statuses of the heat meter.
The error outputs are programmed with the service software Prog531.
An error output will be active if at least one of the selected error messages of the heat meter is triggered.

9.8 Energy-assessing hot water meter / 1 sensor system

The integrator Supercal 531 (Supercal 531) can be set at the factory as energy-assessing hot water meter.
Up to12 fixed monthly return temperatures can be set (via the tariff functions) as fixed values according to the customer's requirements and used as control elements. The temperature difference can be programmed in steps of 0.5 K.

10. Seals and Operating Modes

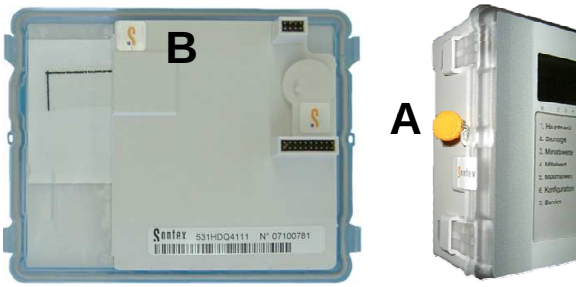
Generally, the Supercal 531 is set to normal mode. Apart from normal mode, the integrator software allows the following operating modes:

- Test mode (Damaging the seal A)
- Parameterisation mode (Damaging the seal A)
- Calibration mode (Damaging the verification seal B)

The integrator is parameterised ex factory according to the local regulations.
The factory-set parameters can only be changed by authorized personnel taking into account the official calibration regulations.

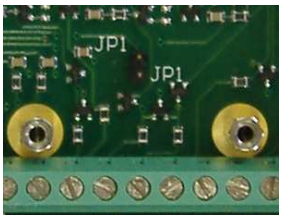
10.1 Sealing concept

The sealing concept is submitted to the local regulations. The sealing points of the Supercal 531 are designed-in as shown in the picture below.



10.2 Test and parameterisation mode

To access the test mode, the integrator upper part has to be removed. On the main board of the integrator base part you will find the jumper connection point JP1.



To activate the test and parameterisation mode, a jumper has to be plugged in. The test menu appears on the display of the Supercal 531 and the test results can be readout on the high-resolution display.
The jumper has to be removed after the test. Then the Supercal 531 goes back to normal mode automatically.

The following parameter can be modified over the operator keys:

- set date and time
- enter customer number
- enter primary address

As soon as the jumper is removed, the Supercal 531 goes back to normal mode automatically.
With the software Prog 531 via the optical interface and depending on the user rightsa big amount of parameters can be set.

10.3 Calibration Mode

The Supercal 531 may only be switched over to calibration mode by authorized personnel. To access the calibration mode, the seal (C) on the back side of the integrator cover has to be removed.

As soon as the seal is damaged or removed, the validity of the official calibration test and the warranty from Sontex are void.

A jumper connection point is located below the calibration seal (C).

The jumper for the calibration mode has to be plugged in here. The calibration-relevant functions can only be activated and set over the optical interface with the service software Prog531.

As soon as the jumper is removed, the Supercal 531 goes back automatically to measuring mode.

10.4 Nowa / Unicon

See annexe 16.1

11. Technical Data

11.1 Integrator Supercal 531

CE-Conformity:

▪ EMC-directive	89/336/EEC
▪ Electro-magnetic immunity	acc. to EN 50082-1
▪ Electro-magnetic emission	acc. to EN 50081-1
▪ Low voltage directive	73/23/EEC for power supply units protection class *)
▪ Mains 230 VAC	II acc. to EN 61558
▪ Mains 24 VAC	III acc. to EN 61558
▪ Battery	III acc. to EN 61558

*) The protection class refers to the complete unit (integrator and connected power supply module)

Housing protection class:	IP 65 acc. to EN 60529
Area class:	A acc. to EN1434
Admissible ambient temperatures:	
In operation	+ 5...55 ℃
Transport and storage	– 20...70 ℃ (dry)
Admissible ambient humidity	< 93% relative humidity
Display:	8 digits
Energy	99’999’999 (kWh, MWh, MJ, BTU or GJ)
Volume	99’999’999 (m^3, US-gallons)
Data storage	non-volatile due to EEPROM
Temperature measurement:	
Measuring element:	Pt500 and Pt100 acc. to EN 60751
Temperature ranges:	
Possible temperature range	Θmin = -20 ℃, Θmax = +200 ℃
Admissible temperature range	Θ2 ℃...200 ℃
Temperature difference	Δ Θmin = 1 K, Δ Θmax = 150 K
Admissible temperature difference	Δ Θ 2...150 K
Response limit	Δ Θ 0.2 K
Temperature resolution	0.005 K
Measurement precision	more precise than required by EN1434-1

11.2 Mains supplies

The Supercal 531 can be supplied by battery or mains modules. They can be retrofitted at any time.

The mains modules are provided with a jumper. The backup-battery can be activated or deactivated by this jumper. When commissioning the integrator 531, the jumper is plugged-in (activated).

11.2.1 Mains module with backup-battery

230 VAC – 45 / 60 Hz (on request 115 VAC)

Type	protection class II
Frequency	45 / 60 Hz
Voltage tolerance	+ 10 / - 15 %
Relative humidity	> 93 %
Fuse protection	T 200 mA

24 VAC – 45 / 60 Hz

Type	safety low voltage
Frequency	50 / 60 Hz
Voltage tolerance	+ 20 / - 20 %
Relative humidity	> 93 %
Galvanic isolation	Yes

12...24 VDC

Type	safety low voltage
Voltage tolerance	+ 10 / - 15 %
Relative humidity	> 93 %
Galvanic isolation	Yes

230 (115) VAC – 45 / 60 Hz with 12 VDC output

230 VAC	acc. to specification module 230 VAC	
12 VDC	Type	safety low voltages
	Voltage tolerance	+ 10 / - 0 %
	Relative humidity	> 93 %
	Galvanic isolation	Yes

Backup-battery

Type	½ AA (standard ANSI) with radial soldered connections
Nominal voltage	3.6 VDC
Nominal capacity	min. 1.0 Ah
Nominal current	min. 0.6 mA
Maximum ambient temperature	55 ℃

11.2.2 Battery module

The standard battery used in combination with the autarkic flow sensors is the C-cell with a service life of 6 years. When combining with the static flow sensor Superstatic, the D-cell is always used.

For flow sensors with quick pulse sequence and/or unlimited M-bus readout, we recommend to use the D-cell as battery with a service life of 6 years.

Lithium C - cell

Nominal voltage	3.6 V
Service life	up to 6 + 1 years (in combination with autarkic flow sensors)
Maximum ambient temperature	55℃

Lithium D - cell

Nominal voltage	3.6 V
Service life	up to 11 + 1 years (in combination with autarkic flow sensors)
Maximum ambient temperature	55℃

11.3 Communication features

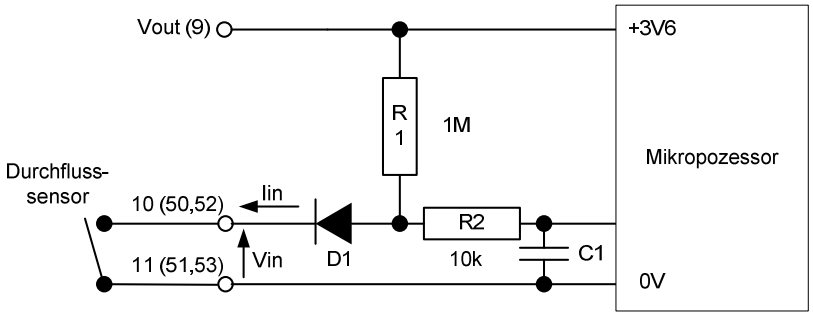
The features of the Supercal 531 (in the integrator lower part) mentioned in point 11.3.1 are standard features ex factory and the features mentioned in point 11.3.2 can be installed additionally in our factory.

11.3.1 Standard version

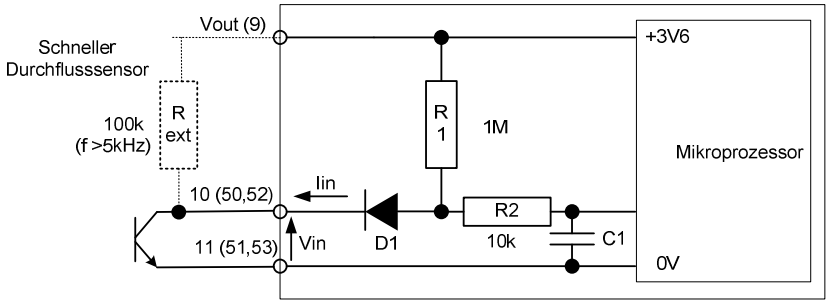
11.3.1.1 Pulse input for volume metering (see 6.1.2)

1 input	Terminal 10, flow sensor 440 white cable, Terminal 11, flow sensor 440 green cable
Input frequency:	Normal mode: max. 5 Hz Fast mode: Battery operation max. 3.5 kHz Mains operation max. 12 kHz
Input voltage	0...30 V
Slow volume pulses	0.0001 - 99'999'999 l/pulse or pulse/l
Fast volume pulses	0.0001 –99'999'999 l/pulse or pulse/l

Circuit diagramme normal mode

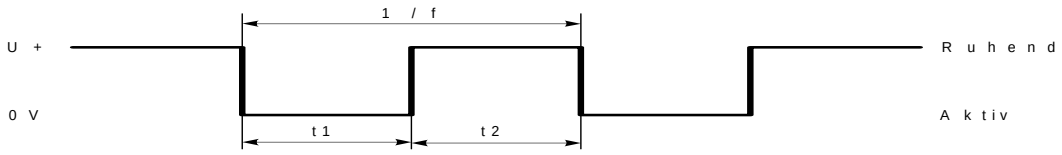


Circuit diagram fast mode



Terminal 9 is provided to supply a flow sensor with maximum Vmax = 3.7 V and Imax = 20 µA.

Circuit diagram pulse



Normal mode:	t1 = t2 min. 100 ms (pulse duty factor = 50%)
Fast mode (mains operation):	t1 = t2 min. 0.04 ms (pulse duty factor = 50%)
Vin max.	< 30 V quiescent, 0.5 V active
Vin min.	2.0 V quiescent, 0V active
Iin max.	26 µA quiescent, <100 µA active
Iin min	0 µA quiescent, 1.4 µA active

Two additional pulse inputs (see 6.1.3)

2 inputs (A1 on terminals 50 / 51, A2 on terminals 52 / 53)

Input frequency:	normal mode	max. 5 Hz
	fast mode:	battery operation: Max. 3.5 kHz
		mains operation max. 12 kHz
Input voltage	0...30 V	
Slow volume pulses	0.0001 - 99’999’999 l/pulse or pulse/l	
Fast volume pulses	0.0001 –99'999’999 l/pulse or pulse/l	

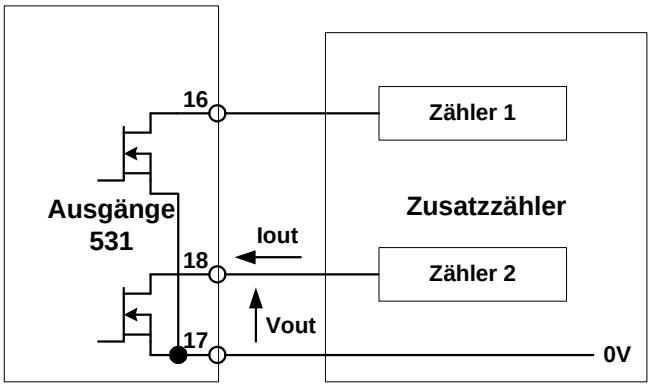
Circuit diagram see point 11.3.1

Two open-collector pulse outputs (see 6.1.4)

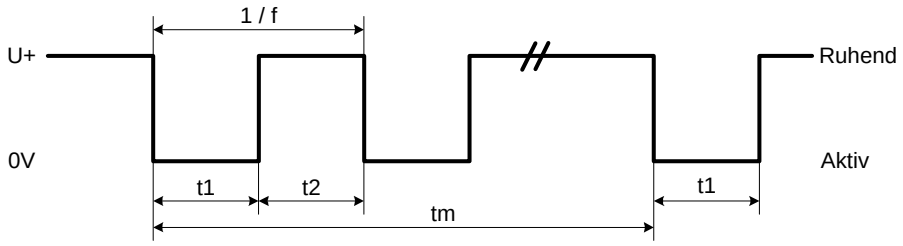
2 outputs (B1 on terminals 16 / 17, B2 on terminals 18 / 17)

Normal mode:	Voltage	max. 30 VDC
	Power	max. 100 mA
	Voltage drop	approx. 1.3 V at 20 mA
	Pulse duty factor	1:1
	Pulse duration	100 ms conductive
	Max. pulse frequency	5 Hz (+/- 20%)
Fast mode:	Voltage	max. 30 VDC
	Power	max. 100 mA
	Voltage drop	approx. 1.3 V at 20 mA
	Pulse type	linear or scaled pulses
	Max. pulse frequency	10 kHz (+/- 20%)

Circuit diagram:
Control of outputs



Control of pulse



Normal mode:	t1 = t2 100 ms (pulse duty factor = 50%)
Fast mode:	t1 = t2 0.04ms (pulse duty factor = 50%)
Vout max.	< 30 V quiescent, 0.3 V active
Vout min.	2.0 V quiescent, 0V active
Iout max.	< 5 µA quiescent at 30 V, < 100 µA active
Iout min.	0 µA quiescent, 1.65 µA active at 3,6 V

11.3.2 Options of standard setting

M-Bus module (factory-assembled)

Definition of interfaces	acc. to EN 1434-3
Interface	potential-free, protected against reverse polarity
Transmission rate	300...9'600 baud (… 4800 Baud on battery!) Modify with SW Prog531
Data structure	variable
Supply voltage:	
UMU,M(MARK)	36 V
UMU,S (SPACE)	24 V
UM,M (SPACE)	12 V
UM,S (MARK)	11,3 V
Supply current:	
IM	1,5 mA
IS	20 mA

Radio module (factory-assembled)

Method	FM, bidirectional
Frequency	433.82 MHZ
Transmission power	≤ 10 mW
Operating range	on average 30m, depending on the local conditions and the structural engineering conditions

Radio telegram:
The radio telegram of the integrator Supercal 531 is structured in accordance with the M-Bus protocol to EN1434-3.
For radio readout, the following telegrams are available:

- Current values / fast mode
  Cumulated values and current consumption values

- Monthly values energy
  Cumulated values and current consumption values
  15 monthly values energy

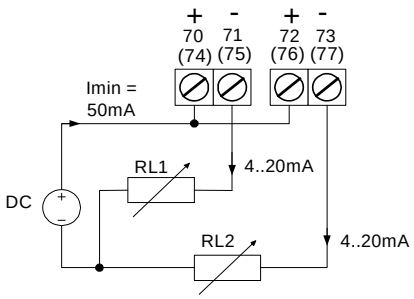
11.3.3 Optional communication modules

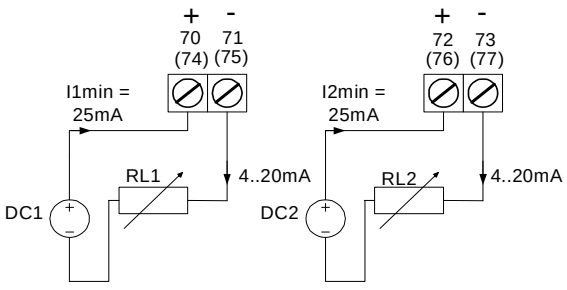
Analogue module with two outputs 4...20 mA (see 6.2.1)

2 inputs:	(external voltage supply)
Voltage supply	9..24 VDC (external) for each input
Tolerances	9 VDC (- 5%), 24 VDC (+ 35%)
2 outputs	
Analogue signal	4..20 mA (in overflow 3,5..24 mA)
Burden	RL (max.) = 580 Ω at 24 VDC RL (max.) = 180 Ω at 12 VDC RL (max.) = 82 Ω at 9 VDC
Resolution	16 Bit (in overflow 15 Bit)
Maximum converter error	0.02 % of final value

Circuit diagram:

Combined operation	stand-alone operation



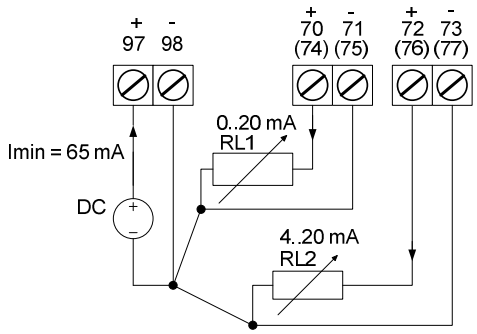


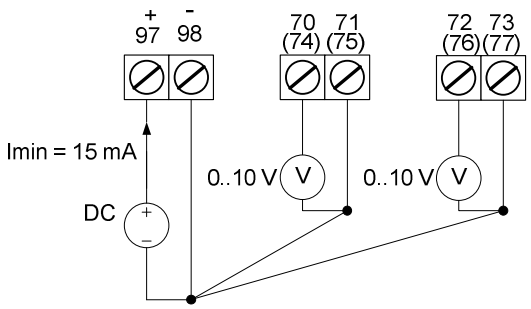
Analogue module with two outputs 0...20 mA, 4..20 mA or 0..10 VDC (see 6.2.1)

2 inputs:	2 (external voltage supply)
Voltage supply	12 VAC or 12...24 VDC (external)
Tolerances	12 VDC (0 %), 24 VDC (+ 35%)
2 outputs	
Analogue signal	0...20 mA, 4..20 mA (in overflow 3,5..24 mA)
Voltage signal	0...10 VDC, 2…10 VDC
Burden	RL (max.) = 650 Ω at 24 VDC
	RL (max.) = 350 Ω at 12 VDC
Resolution	16 Bit (15 Bit in overflow)
Maximum converter error	0.02 % of final value

Circuit diagram:

Factory setting (mains operation)	switch-over via flip switch (voltage operation)

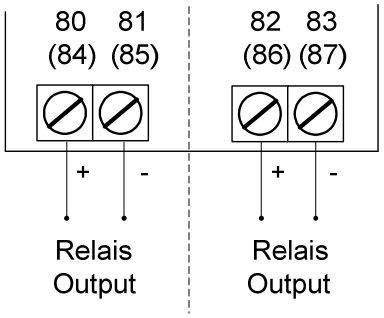




Relay module (see 6.2.2)

Outputs	2 (freely selectable)
Max. switching voltage, peak	60 V AC/DC
Max. constant current	400 mA
Surge current (100 ms)	1'000 mA
Max. power dissipation	500 mW
Max. forward resistance	2,5 Ω
Typical output capacitance	150 pF
Max. frequency	100 Hz
Pulse duration	5..400 ms possible in steps of 1ms
Error status	closed (no error)
Alarm condition	open (no alarm)

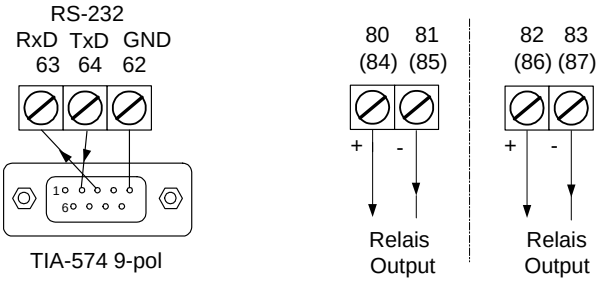
Circuit diagram:



Module RS-232 with two relay outputs (see 6.2.3)

RS-232:	
Baud rate	300..38'400 baud
Data transmission	full duplex
Protocol	M-Bus acc. to EN 1434 (half-duplex)
Relays:	
Outputs	2
Max. switching voltage, peak	60 V AC/DC
Max. constant current	400 mA
Surge current (100 ms)	1'000 mA
Max. power dissipation	500 mW
Max. forward resistance	2,5 Ω
Typical output capacitance	150 pF
Max. frequency	100 Hz
Pulse duration	5..400 ms possible in steps of 1ms
Error status	closed (no error)
Alarm condition	open (no alarm)

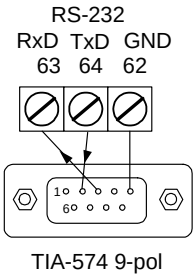
Connection diagram:



Module RS-232 (see 6.2.4)

Baud rate	300..9’600 baud
Data transmission	full-duplex
Protocol	M-Bus acc. to EN 1434 (half-duplex)

Connection diagram:



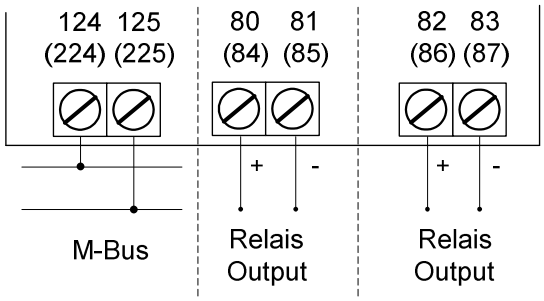
Combined module with RS-232, three relay outputs, four freely programmable outputs 0...20 mA, 4..20 mA or 0..10 VDC (see 6.2.5)

RS-232:	acc. to specification RS-232 module with two relay outputs
Relay:	acc. to specification relay module
Analogue:	acc. to specification analogue module with two outputs 0..20 mA, 4..20 mA or 0..10 VDC
Analogue inputs	4 (external voltage supply)
Analogue outputs	4

M-Bus module with two relay outputs (see 6.2.6)

M-Bus:	
Definition of interface	acc. to EN 1434-3
Interface	potential-free, protected against reverse polarity
Transmission rate	300...9’600 baud
Data structure	variable
Relay:	see specification relay module

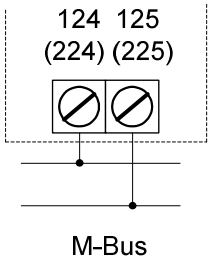
Connection diagram:



M-Bus module (see 6.2.7)

Definition of interface	acc. to EN 1434-3
Interface	potential-free, protected against reverse polarity
Transmission rate	300...9'600 baud
Data structure	variable

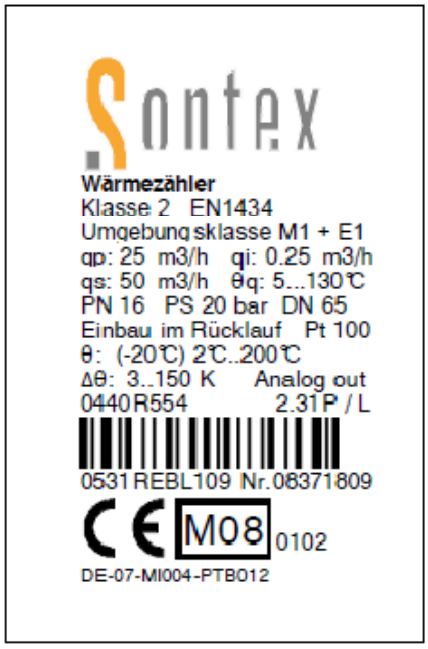
Connection diagram:



12. Identification Plate Supercal 531

In accordance with PTB / MID the following data are stated on the identification plate or on the integrator upper part:

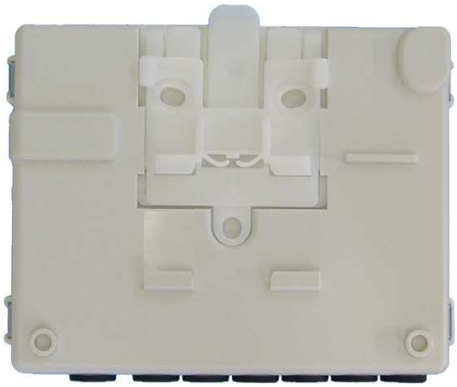
Manufacturer's logo	Sontex	standard
Ownership or metering point number		optional
Product description	Supercal 531	integrator upper part
CE-designation	CE	integrator upper part
Standard optical interface	EN 60870-5	integrator upper part
Part number	0531R001-BB00	standard
Serial number	02456789	standard
Barcode		standard
Class acc. To OIML or EN 1434	2 or 3	standard
Temperature range	2..200 ℃	standard
Temperature difference	2..150 K	standard / PTB
Pulse factor		standard
Place of installation	return pipe	standard
Resistance	Pt500 or Pt100	standard
Homologation ID	country-specific	standard
If as heat meter Superstatic 440 (sample below)	Qp, qi,qs, DN, PN, p/n flow sensor	standard



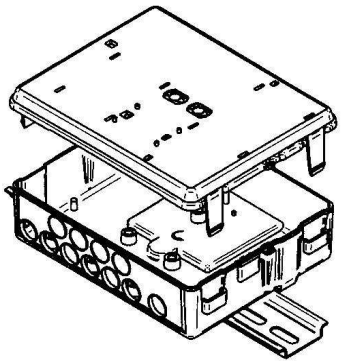
13. Mounting and Dimensional Drawing

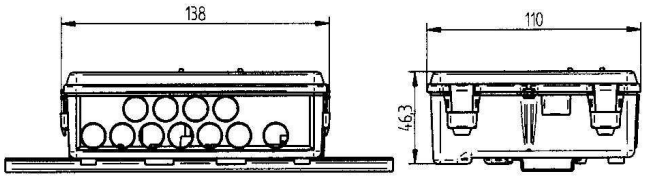
The integrator Supercal 531 can be installed in different ways:

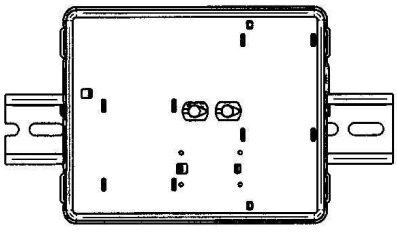
- Wall-mounting



- Compact mounting on a flow sensor
- Top hat rail mounting

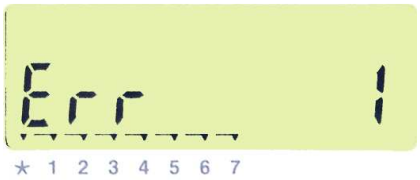






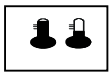
14. Error Messages

The Supercal 531 indicates an existing error on the LCD display with the designation „Err“ and a numerical code:



In case several errors occur at the same time, the numbers of error codes are listed and displayed.

Description of error messages

Err0	no error detected (service level)
Err1	the supply sensor is short-circuited or disconnected
Err2	the return sensor is short-circuited or disconnected
	The temperature sensors are interchanged or mounted incorrectly (Err3)
Err4	flow too high
Err8	storage error EEPROM in measuring- and calibration-relevant part (only active after the second time)
Err16	storage error EEPROM in the integrator base part (only active after the second time)
Err32	configuration error EEPROM MET in measuring- and calibration-relevant part
Err64	configuration error EEPROM MIO in integrator base part
Err128	short-circuit or internal error on supply and/or return sensor
Err256	voltage breakdown (mains or bus supply)
Err512	defective communication module, module location 1
Err1024	defective communication module, module location 2
Err2048	error pulse input additional meter A1
Err4096	error pulse input additional meter A2
Err8192	error of internal electronic: integrator to be returned to manufacturer

Example:

Err3	both sensors are defective or are not connected

If the error is present for more than one hour, it is recorded in the error memory with date and time (error beginning) and duration (in minutes). If the error is present less than one hour, it is deleted automatically without being stored.

15. Project Planning

Security
The integrator Supercal 531 features state-of-the-art technology and is in compliance with EN1434. If the integrator is operated outside the specifications defined in this manual or is not operated in accordance with the regulations, all service and warranty claims toward Sontex are null and void.

Local regulations
- The following regulations have to be taken into consideration:
- Local regulations for electric installations
- Local regulations for the use of heat meters
- Mounting instruction for the installation of heat meters and temperature sensors acc. to EN1434-2 and EN1434-6

Voltage supply
- If the integrator is mains-supplied, an uninterruptible power supply must be guaranteed
- Local regulations for electric installations have to be followed
- Over- under- and surge voltages are not permitted

Lightning protection
- Preventive measures for lightning protection have to be taken for the mains supply or the bus systems.

Bus-systems
- All bus-systems must have a galvanic isolation on the flow sensor side. Otherwise, the integrator may be destroyed!

Cooling systems
- The insulation regulations have to be followed
- The integrator always has to be mounted away from the cooling pipe.

Installation
- The installation instruction is always supplied along with the integrator. These instructions have to be followed for the installation and the start-up.
- With temperature sensors of a cable length of more than 3 m, shielded temperature sensor cables have to be used. The shields must be installed correctly with the attached fixing clips.
- Please pay attention that all ground contacts of the whole installation (network, external supply, chase of flow sensor and integrator) have the same potential.
- Attention has to be paid to correct grounding!

Seals
- Each integrator has to be provided with the necessary seals to avoid unauthorized manipulation.
- Calibration-relevant seals must not be damaged or removed! Otherwise, the calibration of the integrator and all warranty and service claims are void.
- User seals may only be removed by authorized personnel for service purposes and renewed afterwards.

Service and repairs
- Service and repair work may only be carried out by experts who have expressly been authorized by Sontex.

16. Annexe

16.1 Nowa / Unicon

„**NOWA**“ stands for „**NO**rmierter **W**ärmezähler-**A**dapter“ (standardized heat meter adapter).

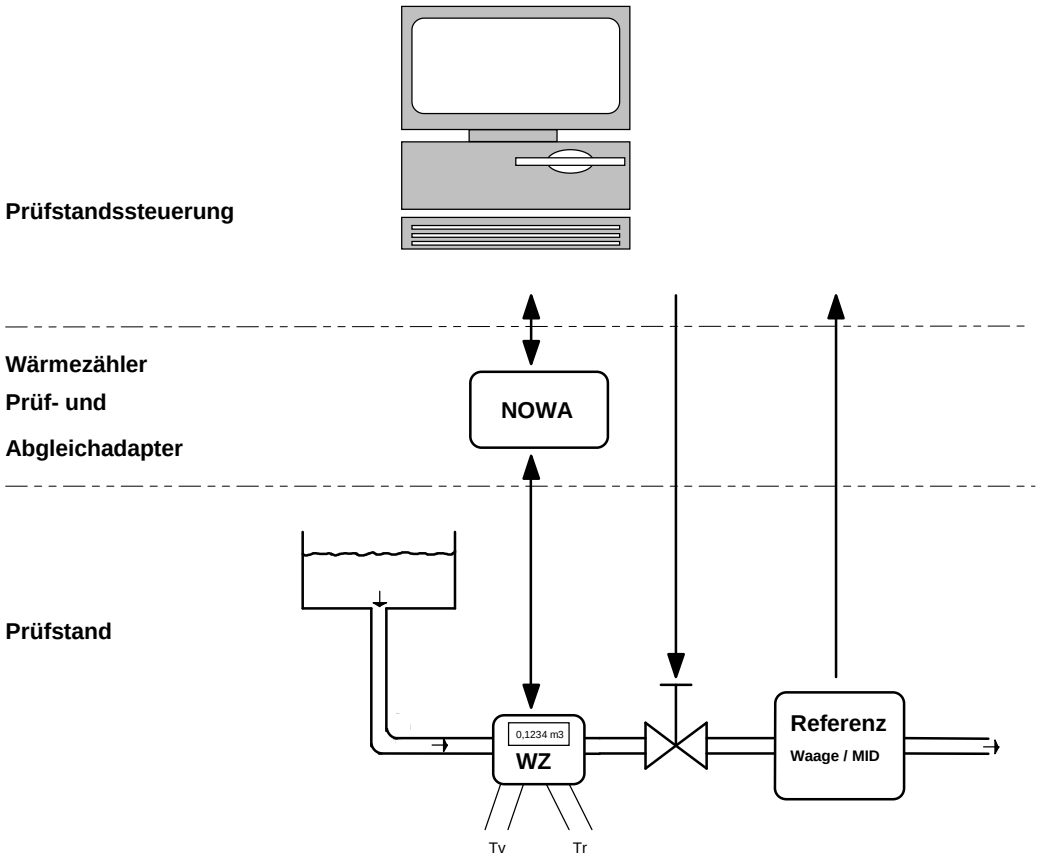
In accordance with the latest standard, it should rather say „**UNICON**“ (**UNI**versal Signal-**CON**verter).

The NOWA-interface is a standardised interface, which over the interface of a modern integrator, provides the connection to the control of the official calibration test rig.
The relevant integrator data are recorded by the official calibration test rig and all necessary adjustments, calibrations and parameterisations are carried out during this calibration test.

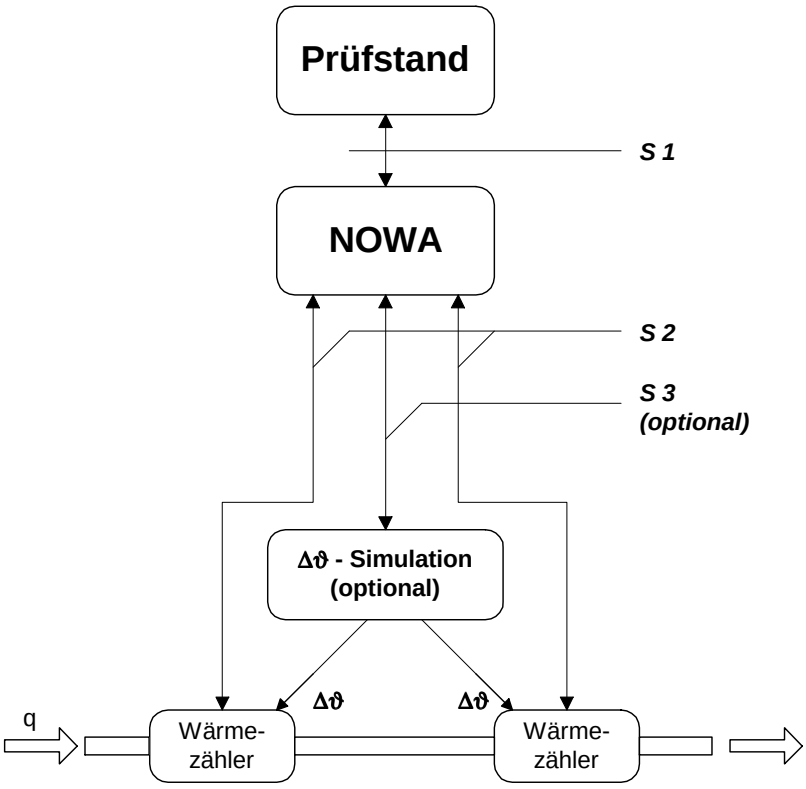
All modern integrators have so-called standardised interfaces which however are designed for the standardised readout of integrators and not for the adjustment, calibration and parameterisation of the integrator over an official calibration test rig.

Apart from this, so far it has not been possible to introduce a standardized telegramme structure of the integrator interfaces at all manufacturers of modern integrators. Therefore the development of the NOWA-adapter was necessary.

Schematic diagram of an official calibration test rig



The interfaces of the NOWA-adapter



Over the **interface S1** the test rig communicates the NOWA-function on the basis of defined specifications.
Over the **interface (s) S2** NOWA controls the integrators acc. to the function set via S1.
Over the **interface S3** NOWA controls an optional set-up to simulate the temperature sensors.

The NOWA-system can be used with manual and semi-automatic test rigs as well as with automated test rigs.
Due to the flexible concept of interface S2 up to 15 integrators can be submitted to the official calibration test at the same time. With the so-called multiplexing, it is possible to submit more than 15 process systems to the test and to guarantee further added functions (e.g. higher data transfer rates, parallel transmission etc.).

Further advantages of the NOWA-concept:

- High security with regard to errors in the handling of the test procedures
- Lower production and quality assurance costs for the integrator manufacturers
- Improved consumer protection

The NOWA.EXE file allows the adaptation to various applications and firmware configuration of modern integrators.

16.1.1 SONTEX NOWA.EXE V1.03

16.1.1.1 Key data

Manufacturer abbr.:	SON
Type of meter:	
Integrator Supercal:	SUPERCAL, SUPERCAL531 or SC
Volume measuring part:	SUPERSTATIC or SS440
Supported NOWA-test modes:	V, RKS, RTS, TK,TT
Adjustment options:	V
Parallel capability (With the respective Nowamux-hardware):	Yes

Special features:
To ensure a reliable communication, it is necessary to know if optical probes are used with or without echo.
Unless further specified, the programme assumes that optical probes with echo are used. In case optical probes without echo are used, the line ‚NoMirror' (without inverted commas!) has to be added to the text file „SON\Options.cfg" (see point 3).

To calibrate the meter correctly, the meter has to be opened. Therefore two internal jumpers (calibration seal) are plugged in the integrator upper part and the test jumpers are plugged in the lower part.

16.1.1.2 Test and calibration procedure

General information on the test and the calibration:
For each meter, the important test points for the calibration are stated in a file in clear-text format. The files are in the sub-folder with the name of the meter: SON\SC531\...

This file name is made up as follows:
File name = „Qp in l/h" with the file extensions

- '.PRF' for files with test points for the verification and
- '.ABG' for the files with test points for the adjustment.

Example: 'SON\SC531\2500.ABG' resp. ' SON\SC531\2500.PRF'

The test points are filed line by line acc. to the NOWA-convention (indexes for the different parameters).
The diverse measuring methods are identified by the special programme-internal code number '10.03' (see annotated example: '1500.ABG').

Checking of a test cycle for its suitability as adjustment reference point:
The following parameters are (depending on the measuring method) compared with the set values of the calibration data file:

Test mode V:

Qmin-measurement:	min. measurement duration:	120s
	Current flow range:	0..5% Qp
Qp-measurement:	max. error:	10% of current meter setting
	Min. measurement duration:	90s
	Max. deviation current flow:	-50% / +10%

The effective CURRENT values which are sent by the test rig at least once during the test cycle are used for the comparison.

(Command ‚l': parameter flow + tv/tr of the test items), resp. the locally defined test duration (parameter time).
For all test modes TK/TT/RKS/RTS the corresponding parameters are extracted from the command ‚r' in case the test rig PC does not send any CURRENT parameters (‚l').

Checking of several test points before carrying out the calibration:
Measuring method V (volume): minimum flow distance of the test points: 50% Qnenn
Maximum volume error of the test item: 50%

The following influences have to be taken into consideration when evaluating the precision of the detected errors or adjustment processes:

- Time measurement:
  on the basis of the PC-Timer: resolution 833ns, software rounding to 1ms, in general, stability higher than 100ppm (normal quartz)

- Jitter transmission time Nowacom:
  This is only important for the time measurement from the beginning to the end of the test (and thus for the calculation of the current flow).
  It is not possible to state an absolute deviation because the duration depends on the driver version and the response time of the programme of the test rig.

  Maximal empirically detected anomalies are at < 25ms,
  typical durations are at 0...4 ms with the combination NowaCom-driver CNOWA V1.01 / test rig programme CALRPS V4.28.

- Meter-specific influences:
  Communication times / delays at start / stop, etc., have to be considered individually for each meter type.

Parameterisation:
For each meter, the parameterisation data are filed in clear-text format in the sub-folder ‚SC531'.
The file extension is ‚.PRM'.
The parameterisation files are structured line by line.
The format is:
‚option = value'.

Example:
Parameterisation file „SC531\PT100.PRM".
First line: PT = PT100 (possible indication: PT100 or PT500)

Overview of the test sequence volume measurement ‚V':
- NowaStart
- Instantaneous values received by test rig
- NowaStop
- Readout of current ultimate meter volume
- Calculation of test volume, interim storage and transmission to the test rig
- Errors received by test rig
- Check if run is permissible value point with current test mode. If "Yes" (JA): Save under the given index.
- Request „adjustment by test rig": checking of the own measured values of the test points for suitability for the adjustment. In case of feedback signal „YES": carry out adjustment

Overview of the test sequence integrator (simulated flow) ‚RKS / RTS':

- Entry of the number of measurements of simulation pulses (1 temperature measurement per s)
- in the meter
- NowaStart
- NowaStop
- Readout of measuring data, interim storage and transmission to test rig
- Errors received by test rig

No calibration possible.

Overview of the test sequence temperature measurement ‚TK / TT':

- NowaStart
- Instantaneous values received by test rig
- NowaStop
- Readout of measurement data, calculation of temperature, interim storage and transmission to test rig
- Errors received by test rig

No calibration possible.

16.1.1.3 Programme options and call parameters

Parameters compatible with test programmes from other manufacturers:

'/DEBUG' => extended debug displays on the screen

The programme options can be selected in three ways:

- as entry in the file c:\SON\SC531\OPTIONS.CFG
- as entry in the file c:\SON\OPTIONS.CFG
- as call parameter in the command line

In the same sequence and priority, the programme searches for applicable options. If an option is set several times (and possibly differently), the last stated value applies (e.g. of the command line).

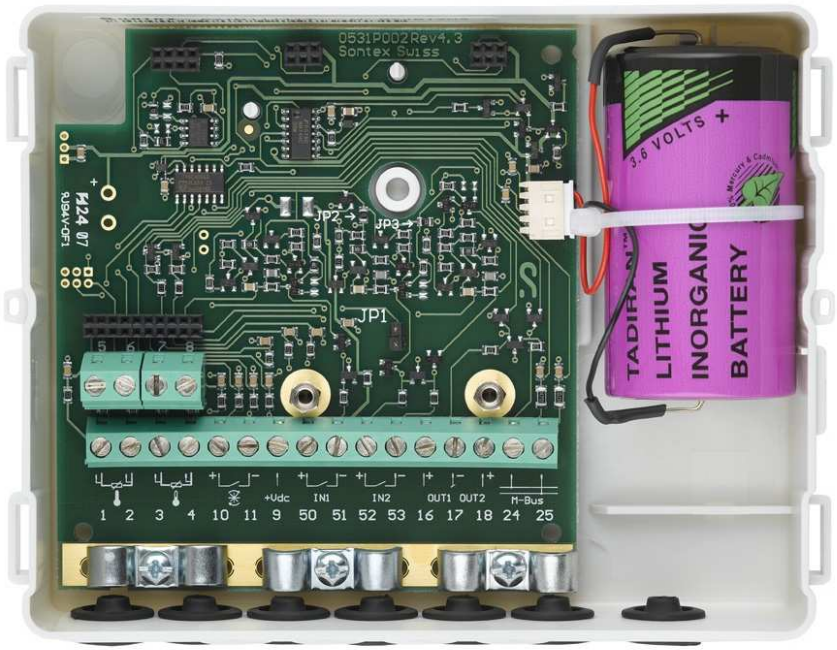
The following options are possible:

- NoMirror: Operation with optical head without echo
- NoMux: No Nowa-multiplexer hardware connected, operation directly over Com1 („standalone")
- Debug: NowaCom-protocol window active
- Detection time = value [s]: During the set time the programme searches for meters (in case they have been connected only after start of the programme)
- Cmd = command file: Instead of the NowaCom-driver, the commands are read out from the stated file („standalone")
- Prm = parameterisation file: In connection with a command file, the transfer of a file name is admitted for the parameterisation without being stated explicitly in the command file („standalone")
- RegDump: After detection of the meter, all registers stated in the register file are read out and recorded in the file ‚REGSPlatznummer.DMP' (e.g. REGS1.DMP) (may take some time)
- XP: Standalone-mode in WinXP (with the respective drivers)

In the file OPTIONS.CFG, the options can be registered line by line or within one line (with space character or put in commas). Format of the command line for options: NOWA [/SON:Option1,Option2,Option3,…etc.

16.2 Tariff Functions

Notes



Technical Support
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