

# The multi-functional integrator Supercal 531



## Design

The Supercal 531 integrator is suitable for connecting Pt 500 or Pt 100 temperature sensor pairs with 2 or 4-conducting wire techniques. Volume inputs can be combined with mechanical, magnetic-inductive, ultrasonic or fluidic oscillators flow sensors with a maximum nominal flow rate of 10'000 m<sup>3</sup>/h. The factor of the pulse value is defined in the flow meter unit. The volume input value is defined when the unit is produced. The pulse value can be modified one single time by means of the push button. The additional pulse inputs allow the connection of hot water, cold water, gas, oil and electricity meters. Consumption values can easily be read on the LCD display, via the optical interface, RS-232, M-bus or modem.

## Temperature sensors

The standard production version of the Supercal 531 integrator is for the Pt 500, but a version for the Pt 100 can also be produced upon request. The temperature sensors are matched to one another. They are always supplied in pairs and must not be separated, extended or shortened. In the case of temperature sensor pairs with a cable longer than 3 m, we recommend the exclusive use of shielded temperature sensors. In this case, the shield must be mounted correctly. In the case of unequal cable lengths or cables longer than 6 m we recommend the use of 4-wire sensors. The temperature sensors can be alternatively installed either in protection pockets or directly in the heating or cooling medium. The active measuring temperature sensor tip must be placed in the centre of the pipe cross section. The temperature sensors in cooling systems should not be totally isolated. The isolation regulations must be observed! Extensive information about temperature sensors you can find in our Sontex temperature sensor overview.

## Measurement technique

The Supercal 531 with mains power supply records every 3 seconds the supply and the return temperature, with battery power every 20 seconds (D-type battery) or 30 seconds (C-type battery). The recording flow rate is dependant on the pulse value of the flow sensor unit and is constantly updated. From the mean flow rate, the temperature difference and the heat coefficient will be calculated the energy of the captured medium and displayed on the 8-digit LCD display.

## Main features

- Mains or battery powered
- Exchangeable integrator module, the wiring base with the connections remain in place
- Communication options and functions can be equipped later and without compromising verification of the integrator
- EEPROM for the communication setup is pre-installed in the base part
- Programming of the specific installation data over two pushbuttons
- Fast support via the Internet
- Self-recognition of options and voltage supply
- M-Bus according to EN1434 (300 – 38'400 baud) variable and fix data structure
- Two or four wire connection techniques
- Up to 4 analogue outputs, M-Bus, two open collector outputs and two pulse inputs can be simultaneously used
- Clear and customer-friendly user concept
- Accuracy better than required by EN 1434

## Ordering

The Supercal 531 disposes, as standard, over an optical interface according to IEC1107, two pulse inputs for additional meters as well as two open collector outputs. The type designation of the integrators Supercal 531 are specified as follows:

- Supercal 531 basic variant, Pt500 or Pt100
- Supercal 531 M-Bus, Pt500 or Pt100
- Supercal 531 radio, Pt500 or Pt100

When placing an order special requirements such as display unit, pulse value, glycol content, K-value, correction curves, temperature sensor resistance and mounting place (supply or return) are to be provided!

Each variant can be combined with two additional optional communication modules and with one supply voltage module.

## Power supply module Options combinations:

The flexible power supply concept of the Supercal 531 allows the following

- 6 year battery, D type
- 11 year battery, C type
- 220...240V alternating voltage 50/60 Hz
- 100...120V alternating voltage 50/60 Hz
- 12...24V alternating voltage 50/60 Hz
- 12...24V DC voltage 50/60 Hz

## Optional communication module:

All versions can be ordered with two optional galvanically separated communication modules or the two communication modules can also be equipped later on when the integrator is in operation and this without compromising verification:

- RS 232 with two additional impulse inputs
- RS 232 with two additional open collector outputs
- RS 232 with two additional relay outputs
- M-Bus-module with two additional impulse inputs
- M-Bus-module two additional open collector outputs
- M-Bus-module two additional relay outputs
- Analogue module 2 outputs 0-20 mA or 4-20 mA or 0-10V
- Analogue module 2 inputs 0-20 mA or 4-20mA or 0-10V
- Radio module
- LON module
- Internet module

## Data storage

The Supercal 531 has in case of power failure, two non-volatile EEPROM for extensive data safety storage. In both EEPROM the data are updated every hour. The first non-volatile memory is located inside on the printed circuit board of the relevant calibration and measurement part of the integrator and stores the following data:

- parameters of the integrator and configuration parameter
- cumulated energy
- cumulated volume

- customer's specific tariff
  - 15 monthly values
  - 32 maximum values
  - 32 average values
  - two set day
  - cumulated energy or volume on the set day
  - operating hours
  - date and time
  - MET serial number (integrator upper part, calibration and measurement part)
  - pulse value of the flow meter
- The second non-volatile EEPROM is located on the printed circuit board in the integrator base part and stores the following parameters:
- MIO serial number (integrator base part, printed circuit board)
  - identification number and customer number
  - pulse value of additional meters 1 and 2
  - cumulated values of additional meters 1 and 2
  - unit of additional meters 1 and 2
  - M-Bus or radio address (primary and secondary)
  - radio address
  - baud rate (M-Bus)
  - pulse value of the pulse output
  - parameter setting of the analogue outputs
  - alarm and threshold value

This EEPROM ensures a smooth exchange of the calibration and measurement relevant part, without a new entering of the configuration of the communication.

<b>Backup</b>	For examination and safety storage of the measurement results the Supercal stores once per hour all data in a non-volatile memory. With power supply failure all values are automatically updated and stored.
<b>Cumulated energy</b>	The energy can be displayed in kWh, MWh, GJ, MJ and BTU. At the factory kWh is set as a standard energy unit parameter. The maximum energy that can be displayed is 99'999'999; the number of decimals can be set at the factory or by an authorized calibration laboratory.
<b>Test segment</b>	All segments will be shown on the LCD-display.
<b>Cumulated volume</b>	Cumulated volume is displayed in m <sup>3</sup> or gallons. For special applications, a display with 0.001 m <sup>3</sup> (liter) is possible. At the factory, m <sup>3</sup> is set as a standard volume unit parameter. The maximum displayable energy, is 9'999'999.9 m <sup>3</sup> , the number of decimals can be set at the factory or by an authorized calibration laboratory.
<b>Operating hours</b>	Operating hours is displayed in hours.
<b>Error time</b>	The cumulated time, while some error was present, is indicated in minutes.
<b>Flow rate</b>	The current flow rate is displayed in m <sup>3</sup> /h or in gallon/h. At the factory, m <sup>3</sup> /h is set as a standard flow rate parameter; the number of decimals can be set at the factory or in an authorized calibration laboratory.
<b>Supply and return temperature</b>	The Temperatures are displayed with one decimal. Temperatures under 0°C are shown with a – (minus) sign. The display range is –20...200°C. The temperature indication, can upon request, also be displayed in °F.
<b>Temperature difference</b>	The temperature difference is displayed with two decimals. If the return temperature is higher than the supply temperature, a - (minus) sign will be placed in front. The temperature difference, can upon request, also be displayed in °F.

<b>Power</b>	The power can be displayed in kW, MW, GJ, MJ, KJ or BTU/h. At the factory KWh is set as a standard power unit parameter.
<b>Set day values</b>	The Supercal 531 has two set days. On set day the cumulated energy, volume and pulse inputs are stored with date.
<b>Monthly value</b>	The storage date for the 15 monthly values can be set. The cumulated energy, volume, auxiliary pulse inputs and tariff values are stored. The storage date of the monthly values can be set, if the parameter setting mode is activated.
<b>Average value</b>	For the period of the 32 average values an integration time from 1 minute to 45 days can be chosen. The average value for the actual power, flow, supply and return temperature, temperature difference, impulse A1 and impulse input A2 are displayed on the LCD display and stored.
<b>Maximum value</b>	The precise monitoring and recording of power drops can be parameterized in 1-hour cycles and cycles up to 1-year. The maximum values for the actual power, flow, supply and return temperature, temperature difference, impulse A1 and impulse input A2 is displayed on the LCD display are displayed with date and time and also stored. The maximum values are displayed with date and time.
<b>Pulse parameters</b>	The pulse values for the flow meter and for the additional meters A1 and A2 and the pulse values are displayed in the configuration menu. These data can be changed via the push buttons, if the parameter setting mode is activated
<b>Identification number</b>	The identification/customer number is displayed with 8 digits with an index Cn. The identification/customer number can be changed via the push buttons, if the parameter-setting mode is activated.
<b>Date and time</b>	The date and the time are displayed in the different menus. The date with the index DA and the time with Hr are displayed. No differentiation between summers and wintertime. Thanks to the backup function and in case of power supply loss the date and time update's it selves for several months. The date and the time can be changed via the push buttons, if the parameter setting mode is activated.
<b>Pt100 or Pt500 Resistance values</b>	The Pt100 or Pt500 resistance value is displayed. The resistance value can only set at the factory.
<b>Primary address</b>	The primary address is displayed on the LCD display. The primary address can be changed via the push buttons, if the parameter-setting mode is activated.
<b>Communication</b>	Communication is displayed by mean of an indicator. The indicator enables one to recognize whether the integrator calculates or communicates from the inside or the outside.
<b>Special functions</b>	The special functions can be customized and activated at the factory. All functions and parameters for the special functions can be set with the software.
<b>Threshold values</b>	Two threshold values can be set over the optical interface or over the display and the push buttons. The following internal values can be used for the definition of thresholds: current flow, current power, supply or return temperature, temperature difference as well as a time window consisting of date and time. A threshold can also be activated when an error appears.

**Status message transistor outputs**

The Supercal 531 allows a locking of status messages on the transistor outputs. The conditions of the status can be defined with the threshold values. Herewith, also an alarm output for fast and exact external monitoring of the operating conditions can be generated.

**Solar- and cooling installations**

The integrator units, calibrated for water ensure also with glycol mixtures a precise measurement, as the average mixing ratio can be customized over the optical interface. The Supercal 531 processes and computes also negative temperatures. The dust proof and splash water-protected housings, IP65, is especially suitable for cooling installations. For these customized mixing ratios no official approvals are possible.

**Cooling energy**

The cooling energy is cumulated, if at the same time the two following conditions are fulfilled:

- ( $\Delta t$ ) temperature difference > -0.2K,
- as well as the supply temperature < 18°C

The threshold value of the temperature is set at the factory at 18°C. The threshold value can be changed in steps of 1°C via the optical interface. The cooling energy has the same physical unit as the heat energy. If the integrator unit is used for the combined heating and cooling measurement, then cooling energy, cooling power and the temperature difference with a minus (-) displayed and the appropriate values are assigned to the tariff 1.

**Tariffs**

Beside cooling/heating tariff the Supercal 531 disposes over the most different customer specific – customized tariffs (e.g. power tariffs), which can be defined with the help of the threshold values. The tariffs can be reloaded without compromising the verification over the optical interface or M-bus.

Example of tariff types:

- tariff control by means of the current flow rate
- tariff control by means of the current power
- tariff control by means of the temperature difference
- combined cooling / heating meter
- tariff control by means of the inner tariff time switch
- tariff control by means of the M-Bus

**Open system**

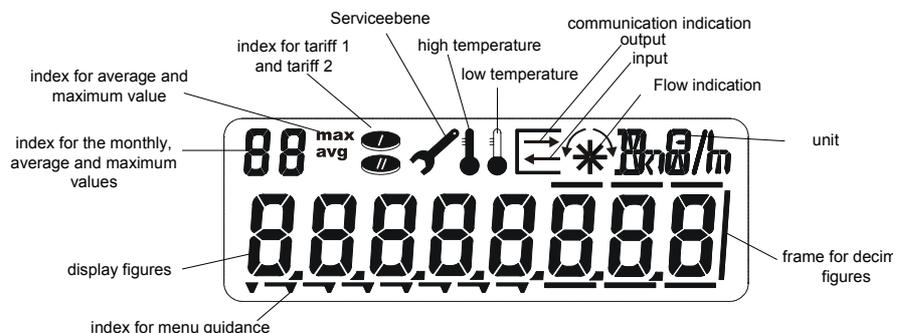
In open system installations a flow sensor is mounted in the supply pipe and another one in the return pipe. By the difference of the temperatures and the two flows the integrator unit calculates the used heat energy.

**Volume measurement**

The integrator Supercal 531 can also be used for volume measurement only. In order to ensure an accurate measurement the average water temperature is parameterized

**Display**

In consideration of the person reading the LCD display of the Supercals 531, the display was arranged clear and particularly large.



The display sequences are divided into the following menus:

- main menu
- set days
- 15 monthly values
- 32 average values
- 32 maximum values
- configuration
- service information
- test and parameter setting level

The display sequence can be customized. The two push buttons enable simple and customer friendly usage and readout of measurement data.

### Control concept



With the command push button the different display levels or the display within the display level can be selected.



By pressing the enter push button a display level or one of the submenus can be selected. Afterwards the individual displays within the display level or within the submenu can be selected with the command push button. If the command push button and the enter push button are pressed at the same time, then the display switches back again to the selection level of the different display levels.

### Operating mode

The integrator Supercal 531 works in principle in normal mode. The following additional operating modes are integrated in the integrator's software:

- test mode (without damaging the seal)
- parameterization mode (user seal to be removed)
- verification mode (verification seal to be removed)

The integrator Supercal 531 is fully parameterized at the factory and according to the country specific parameter settings. Authorized laboratories offices may modify the factory parameters.

### Test mode

In order to access to the parameter setting and test mode, it is necessary to break the user seal on the backside of the integrator cover. A connection point is located below the user seal. To activate the parameter setting and test mode a jumper must be set. On the display the test menu appears. The test results can be readout on the high-resolution display.

### Parameter set mode

In parameter mode the setting of the following parameters can be set:

- delete stored error display
- delete average values
- delete maximum values
- set integration time of the average values
- setting of set day
- set date and time
- enter customer number
- enter primary address
- set baud rate (M-Bus)
- set pulse value of the pulse- and analog module
- set pulse value of the volume pulse
- set pulse value of the pulse inputs
- set unit of the pulse inputs

The parameters can be changed via the push buttons or by the optical interface with the service software. By pulling out the jumper the integrator unit switches automatically into normal operation.

## Verification mode

The verification mode is switched on by putting the Jumpers. In addition the verification seal must be destroyed. This is only permitted by authorized laboratory. The Jumper must remain in place during the calibration. These calibration relevant functions can be activated and worked on, exclusively, via the optical interface, in connection with the service software.

In the verification mode, verification relevant data can be changed. Therefore a verification seal protects the connection junction. If the calibration seal is damaged, automatically the validity of the official verification is expired. Through pull out the Jumper the integrator unit automatically switches back into the normal operation mode.

## Test and - calibration interfaces

- NOWA (standardized integrator-test adaptor according to AGFW) *in preparation*
- Integrated integrator test program

## Error messages

The Supercal 531 displays on the LCD the Err- sign together with a number code of the occurring errors. When several errors occur at the same time the numbers the error code are summed up.

Err1	The supply sensor is short circuited or disconnected
Err2	The return sensor is short circuited or disconnected
*T-Indicator	Temperature sensor exchanged and/or temperature sensors in the colder line is higher than in the warmer line
Err8	storage error EEPROM in measuring and calibration relevant part (only after the second time active)
Err16	storage error EEPROM in the integrator unit - lower part (only after the second time active)
Err32	configuration error EEPROM in measuring and calibration relevant part
Err64	configuration error EEPROM in the integrator unit - lower part
Err128	error of internal electronic, back to the manufacturer
Err256	voltage failure (by main or bus supply)
Err512	defect of communication module, module location 1
Err1024	defect of communication module, module location 2
Err2048	error impulse input auxiliary meter A1
Err4096	error impulse input auxiliary meter A2
Err8192	error of internal electronic, back to the manufacturer

If an error stays more than one hour, then it is stored in the error memory with date and time (error beginning) and duration (in minutes). If an error stays less than 60 minutes, then it is deleted automatically and without storage.

The two temperature sensor indicators are displayed as a message with the cumulated energy display on the main menu, indicating if:

- the temperature sensors are interchanged ⇒ this condition arise with most installations during the summer time
- the temperature in the colder line is higher than in the warmer line.

All error messages are deleted automatically on the LCD display, 30 seconds after the error correction.

## Optical interfaces

The integrator Supercal 531 has an optical interface according to EN 61107. The M-Bus protocol according to EN1434. The optical interface corresponds electrically and mechanically to the ZVEI IEC 1107 standard. It allows following start-up and service work:

- readout of all values
- parameterization
- tests

## Communication Options

The Supercal 531 differentiates between standard option possibilities equipped at the factory and optional plug-in communication modules. In the Supercal 531 are two plug-in spaces for all kinds of optional communication modules

foreseen. The integrator unit recognizes the optional modules approximately 10 second after plug-in - the functions are freely available.

**Open collector outputs**

The Supercal 531 has as a standard two Open Collector outputs for energy, volume, tariff 1, tariff 2, alarm and threshold values. These outputs are not galvanically separated.

Optionally, also two galvanically separated Open Collector output modules for standard or high-speed impulse outputs are available. The high-speed impulse can be used, for example, for the control of a valve. The impulse type and pulse duration can be set over the optical interface or with the help of the control push button.

**Relay outputs**

The optional relay module with two outputs serves mainly for the connection of status messages as for example operating errors in the following range:

- temperature and flow measurement
- operation and mains supply voltage
- tariff status

**Resolution of the Impulse in and output**

The set resolution as well as the unit of the impulse in- and output are seen on the display menu - configuration

**Analog outputs**

The analogue module includes two galvanically separated power outputs, which are freely programmable. Due to the galvanic separation the analogue output needs a separate power supply of 25mA.

**M-Bus**

If the M-Bus is equipped at the factory, then exists the possibility to add two additional communication modules. If the M-Bus is realized with an optional module, then still another additional communication module can be added. There is also the possibility of using at the same time two M-Bus outputs for different applications. The two additional impulse inputs are automatically integrated into the M-Bus telegram transmitted. The M-Bus communication is realized with a variable data structure.

**RS-232 interface**

The optional serial interface module makes data exchange possible with the heat meter, reading of the data contained in the memory. The reading is affected in accordance with the M-Bus protocol EN 1434-3 and the Baud rate can be selected from 300 to 9600 Baud.

**Radio**

The optional radio module is based on the established bi-directional technology. The two additional impulse inputs are integrated automatically into the radio telegram and transmitted.

**LON**

The optional LON-module is based on the LONWORKS network. The two additional pulse inputs are automatically integrated in the radio telegram and transmitted.

## Technical Data

---

### STANDARD VERSION

---

#### Temperature measurement

Pt100 or Pt500	
2- and 4-wire	
Absolute temperature range	-20...180°C
or	0...200°C
Approved range	2...200°C
Absolute temperature difference	1...150K
Homologation range	2...150K
Response limit	0.2 K
Temperature resolution t	0.1 K
Temperature resolution Δt	0.01 K
Measuring precision better than EN1434-1 request	

#### Measuring cycle

- Temperature measurement:
- 30 seconds when battery operated (Standard Type C)
  - 20 seconds when battery operated (Type D)
  - 3 seconds when mains operated
- Volume measurement:
- Pulse volume are constantly updated

#### Medium temperature

Operation	5...55°C
Storing and transport	-25...70°C

**Display** 8 digit LCD-Display

#### Display units

Energy	kWh, MWh, GJ, MJ, BTU
Volume	m <sup>3</sup> , Gallon
Additional pulse inputs	volume or energy
Temperature	°C, °F or K

#### Voltage supply modular optional

Battery	6 + 1 year
Battery	11 + 1 year
Mains	115 or 230VAC – 45/65 Hz
Mains	24VAC 45/65 Hz or 12-24VDC

#### Data security

Verification- and measurement relevant part	EEPROM
Integrator base	EEPROM

#### Housing protection

Standard	IP54
Optional (for example for cooling measurement)	IP65

#### Test and calibration interface

- NOWA *in preparation*
- Integrated integrator test program

#### Pulse input

Input frequency	
Normal mode	max. 5 Hz
Fast mode	
Battery operation	max 5 kHz
Mains operation	max. 12 kHz
Input voltage	0 -30V
Volume pulse inputs	1-10-100-1000 l/pulse or 2.5-25-250-2500 l/pulse
Volume pulse fast	0.0001 –9999.9 pulse

#### 2 additional pulse inputs

Input frequency	
Normal mode	max. 5 Hz
Schnell mode	max. 12 kHz
Input voltage	0 -30V
Pulse values	0.0001 –9999.9 pulse/l

#### 2 pulse outputs

Output frequency	
Normal mode	max. 5 Hz (+/-20%)
Fast mode	max 10 kHz (+/-20%)
Short circuit	max 100 μA
Pulse values	0.0001 –9999.9 pulse/l

#### Optical interface

Hardware according to DIN IEC1107  
Protocol according to M-BUS EN1434

---

### OPTIONS

---

#### M-Bus (mounted fix at work)

Fix or variable Data structure  
Potential free, reverse battery proof  
Baud rate 300...9600 baud

#### Radio module (mounted fix at work)

Mode	FM, bi-directional
Frequency	433,82 MHz
Transmitting power	< 10mW
Range	ca. 300 m (open filed)

---

## OPTIONAL COMMUNICATION MODULE

---

The communication module can be adapted afterwards and when in operation without damaging the verification validity.

### Standard Open Collector module with two outputs

Voltage	maximal 30V
Power	maximal 40 mA
Voltage drop	approx.. 1.3 V at 20 mA
Voltage strength	500 V eff against mass
Pulse width repetition rate	1 : 1
Pulse duration	100 ms transmitting
Max. pulse frequency	5 Hz

### Fast Open Collector module with two outputs

Voltage	maximal 30V
Power	maximal 40 mA
Voltage drop	ca. 1.3 V at 20 mA
Voltage strength	500 V eff against mass
Pulse duration	0.1 – 100 ms in 1 ms step
Max. pulse frequency	100 Hz

### Relay output module with two outputs

Contact potential maximal	100V AC/DC, 50/100mA
Cutt-off voltage	500 mA
Voltage to ground	maximal 100V AC/DC, 50/100mA
Cable length	max. 25 m
Maximal pulse frequency	1 Hz

### Passive analog module with two outputs

Power supply	5...15VDC (external power supply)
Power range	4...20mA or 0...20mA
Resistance RL	(Ohm) max. at 24V = 950 Ω
Resolution	12 bit
Max. converter error	0.15% from meas. value + 0.15% from end value

### LON module

Network	LONWORKS
Transmitting mean	2-twisted wire, FTT-10A
Power supply bus interface	24VDAC, max. 50 mA
Connection	4-Pol-terminal screw

### RS-232 module

Fix or variable data structure	
Potential free, reverse battery proof	
Baud rate 300...38'400 baud	

### M-Bus module

Fix or variable data structure	
Potential free, reverse battery proof	
Baud rate 300...38'400 baud	

### Radio module

Mode	FM, bi-directional
Frequency	433,82 MHz
Transmitting power	< 10mW
Transmitting range	approx. 300 m (open field)

## Projects

### Safety

The integrator Supercal 531 is produced reliable by using state-of-the-art techniques and according to heat meter standards. If the integrator unit is operated outside of the specifications described herein or is not handled in accordance with regulation, then all service and guaranty claims towards the company Sontex are void.

### Local prescriptions

Following muss be observed:

- Local regulations for electrical installations
- Local regulations for the use of energy meters
- Mounting information for the installation of energy meters and temperature sensors according to EN1434-2 and EN1434-6.

### Power supply

In the case of mains operated integrators an uninterruptible power supply must be provided.

- local regulations for electrical installations must be guaranteed.
- over voltage or under voltage are unacceptable

### Lightening protection

Preventive measures against lightening must be taken within the mains supply or bus system.

### Bus installations

With all bus installation a galvanic separation must be ensured on the part of the flow sensors. Otherwise the integrator unit can be destroyed!

### Cooling installations

Isolation regulations must be observed. Generally the integrator is to be mounted away from the cooling pipe.

### Mounting

As standard, the mounting instructions are delivered with the integrator and must be observed for the installation and the start up. With temperature sensor cable with a length over 3 m, generally shielded cables are to be used. The shielding must be connected appropriately with the enclosed fixing clips to the mass.

### Security seals

All integrator units are to be provided with the necessary seals, so that the equipment is protected against an unauthorized access. Calibration relevant seals may not be damaged or removed! Otherwise, all guarantees and service warranties will no longer apply, as well as the validity of the calibration. Authorized personnel for service purposes and to be afterwards renewed may only remove user security seals.

### Service and repairs

Laboratories authorized by Sontex may only carry out the service and repair work.

### Dimension diagram

