Data logger and billing date recording functions

- Electrically isolated inputs and outputs

- Up to 8 active current outputs

- Up to 8 current inputs with transmitter supply

- Up to 12 voltage / current inputs without power supply

- Pulse and frequency inputs

- M-Bus, MODBUS and infrared communication

- Calibratable measurement, for flow / energy accounting and billing

- For liquids, steam, gas and compressed air

- Volume flow, mass flow or energy counter

- High-precision differential temperature measurement (for chemical processes, brine measurement, temperature monitoring)

- Mathematical combination and conversion of all I/O signals and calculating results to M-BUS, MODBUS, PROFIBUS (through converters)

- Universal device for field or control room

- PTB certificate (calibratable), international approvals

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Universal Measuring Computer
FCU200-T, FCU200-W, FCU400-G, FCU400-IR, FCU400-P, FCU400-S
(SensyCal®)

Multifunctional
Precise
Compact

ABB
Application
The FCU is a universal measurement computer designed for industrial process signal monitoring and logging. FCU combines modern communication technology with sound know-how gained through years of field metrology experience. A high-resolution multi-line graphic display indicates all physical and electrical process variables, and device data, logged data and key dates.

- FCU200-W – Caloric energy computer for water and brine
- FCU400-S – Computer for superheated and saturated steam
- FCU400-G – Computer for gas flow, gas translator
- FCU200-T – Current to pulse converter
- FCU400-P – Signal combination, e.g. high-precision ΔT measurement, summation, etc.
- FCU400-IR – Contactless temperature monitoring

Description FCU200-W (SensyCal® W) – Caloric energy computer
The FCU200-W is designed for determining industrial heat balances. It is used for recording heat, cold or flow rates of liquid media, e.g. in the field of remote heating systems or for calibrated accounting for hot water systems. The FCU200-W is a state of the art device meeting the requirements of modern microtechnology and complying with the relevant current standards (DIN EN 14341...6 as of April 1997 and OIML75). The FCU200-W can be used with all marketable flow meters, e.g. ultrasound meters, swirlmeters, vortex flowmeters, orifices, etc., transmitting a pulse (also NAMUR), frequency or mA signal. Precise temperature measurement is ensured by connecting 4-wire Pt100 temperature transmitters to the caloric energy computer. Due to its modern microprocessor technology and the integral data logger, it provides for reliable, traceable recording of operating data.

Operating principle
The heat quantity is calculated from the flow and the temperature of the warm (Tw) and cold water (Tc) at a given pressure, using the following formula:

\[ P = \rho \cdot q_v \times (h_w(T_w, p) - h_c(T_c, p)) \]

Where:
- \( P \) is the heat quantity
- \( \rho \) is the current operating density
- \( q_v \) is the volume flow
- \( h_w \) is the enthalpy in warm water flow
- \( h_c \) is the enthalpy in cold water flow
- \( T_w \) is the temperature warm water
- \( T_c \) is the temperature cold water
- \( p \) is the pressure

The temperatures Tw and Tc are measured with the Pt100 resistance thermometer.

Calibrated measurement for accounting purposes
All devices in the circuit must be approved by the PTB to meet the requirements of calibrated measurement.

Caloric energy computer
- FCU200-W (SensyCal® W)

Flowmeter
- Magnetic, ultrasonic, vortex & swirlmeter, Woltmann hydrometric vane, orifice

Temperature sensor
- Pt100, pair

Prior to starting the measurement, the setup can be tested and approved by the Verification Office in charge, if desired. For a rated power of 10 MW and higher the measurement is not subject to legal control.

Billing date recording
Two billing dates for storing all counter readings

Configurable date and time

Data logger
Storage, e.g. of 20 operating variables over 128 time periods:
- All counters
  - Power instantaneous value,
  - Flow min. and max. value over a
  - Temperature, warm configured time, average value
  - Temperature, cold Differential temperature

Counter, storage
Energy counter stops in case of
- No flow at all
- Pt100 temperature sensor break or short-circuit in the warm or cold circuit
- Temperature of warm flow is less than that in cold flow

Storage of counter readings in case of power failure.

Pulse output
FCU200-W has 2 pulse outputs

Device configuration
FCU200-W can be configured by using the FCOM200 communication program. The configuration can be made in factory or on site through the customer. For factory configuration please fill in the questionnaire attached to this data sheet. When ordering the standard configuration, a default file is downloaded into the device.
Description FCU400-S (SensyCal® S) – computer for steam

FCU400-S is a steam computer that can be used to determine thermal output of boiler systems and branch lines by calculating mass flow and thermal balance and for fiscal metering purposes. It is designed for superheated or saturated steam with or without condensate return, as flow computer and/or caloric energy computer.

FCU400-S is used together with all marketable flow meters, e.g. vortex & swirlmeters, wedge flow meters, variable area, DP, etc. transmitting a pulse, frequency or mA signal.

Split range application, flow rate correction, and expansion rate correction are possible with orifice flowmeters.

The following process signals can be connected in the standard program:

- Flow transmitter in steam
- Pressure transmitter in steam
- Temperature sensor (Pt100 or transmitter) in steam
- Flow transmitter in condensate
- Temperature sensor (Pt100 or transmitter) in condensate

The standard program range includes 5 counters and can be used in the following applications.

The density and enthalpy of steam and water are calculated in accordance with the latest industrial standard IAPWS-IF 97.

Precise temperature measurement is ensured by connecting 4-wire Pt100 temperature transmitters to the caloric energy computer. Due to its modern microprocessor technology and the integral data logger, it provides for reliable, traceable recording of operating data.
Operating principle
The mass flow is calculated from the volumetric flow rate and the density. For DP measurement the rated density is used as a reference for correcting the mass flow. The heat quantity is calculated from the mass flow and from the enthalpy (internal energy of steam or water).

The density and enthalpy of steam or water are a function of pressure and temperature, and the density and enthalpy of saturated steam are a function of pressure or temperature.

\[ q_m = q_v \times \rho(T_d, p_d) \]

\[ P = q_m \times h_d(T_d, p_d) \]

\[ E = \int P \, dt \]

With steam in flow and condensate in return

\[ P_{\text{Steam}} = q_m \times h_d(T_d, p_d) \]

\[ P_{\text{Condensate}} = q_m \times h_c(T_c, p_c = \text{Const}) \]

\[ P_{\text{Balance}} = P_{\text{Steam}} - P_{\text{Condensate}} \]

Calibrate measurement for accounting
In some countries, steam measurement is not subject to legal control. Upon special request all devices required for measurement and accounting are available as calibratable units. In this case a special calibration through the German Verification Office is ordered.

Data logger
Storage of up to 27 operating variables over 128 time periods:

- 5 counters
- E1 Steam energy
- M1 Steam mass
- \( \Delta E \) Energy balance (steam-condensate)
- E2 Energy condensate
- M2 Mass condensate

Instantaneous values of all operating variables
Determination of min. and max. values (over a configured time and average value for 4 process variables (configurable).

Counters, storage
Energy counter stands still at:
No flow at all
Storage of counter readings in case of power failure

Pulse outputs
FCU400-S has 2 pulse outputs

Device configuration
FCU400-S can be configured by using the FCOM200 communication program. The configuration can be made in factory or on site through the customer. For factory configuration please fill in the questionnaire attached to this data sheet. When ordering the standard configuration, a default file is downloaded into the device.

Billing date recording
Two billing dates for storing up to 5 counters
Configurable date and time
Description FCU400-G (SensyCal® G) – Gas flow computer, gas translator

FCU400-G is a gas flow computer and translator for industrial gas flow calculation and gas accounting measurement. The measurement computer FCU400-G is used with all marketable flow meters, e.g. orifices, swirl meters, vortex flow meters, ultrasound meters, etc., transmitting a pulse, frequency or mA signal. The split range procedure as well as compressibility factor, flow coefficient and expansion rate correction are possible with the standard program for orifice measurement.

The following process signals can be connected in the standard program:

- Flow transmitter
- Pressure transmitter
- Temperature sensor (Pt100 or transmitter)

The physical state correction or flow translation is corrected in accordance with EN ISO 5167-1 bzw. VDI/VDO 2040.

**Operating principle**

The standard volume flow is calculated from the volume flow, the operating density, and the standard density. The operating density can be calculated from the operating pressure and temperature and from the standard density in the normal state. For DP measurement the standard volume flow is corrected by using the ratio of the operating density to the design density as a reference.

\[
Q_n = Q_v \times \frac{\rho}{\rho_n}
\]

\[
\rho = \rho_n \times \frac{p}{p_n} \times \frac{T}{T_n} \times \frac{Z}{Z_n}
\]

For ΔP measurement

\[
Q_n = Q_{n, measured} \times \sqrt{\frac{\rho}{\rho_A}} \times \frac{C}{C_A} \times \frac{Z}{Z_A}
\]

\[
\rho = f(\rho, T, Z)
\]

### Billing date recording

Two billing dates for storing the counter readings
- Configurable date and time

### Data logger

- Storage up to 19 operating variables over 200 periods:
  - 1 counter
- Instantaneous values of all operating variables
- Determination of min. and max. values (over a configured time) and average values for 4 process variables (configurable)

### Counters, storage

- Counter stands still at:
  - No flow at all
- Storage of counter readings in case of power failure

### Pulse output

FCU400-G has 2 pulse outputs

### Device configuration

FCU400-G can be configured by using the FCOM200 communication program. The configuration can be made in factory or on site through the customer. For factory configuration please fill in the questionnaire attached to this data sheet. When ordering the standard configuration, a default file is downloaded into the device.
Universal Measuring Computer
FCU200-T, FCU200-W, FCU400-G, FCU400-IR, FCU400-P, FCU400-S (SensyCal®)

Description FCU200-T (SensyCal® T) – Current-to-pulse converter
FCU200-T is a two-channel energy, mass flow and volume counter, current-to-pulse converter, pulse-to-current converter

Operating principle
The device is designed to convert either direct current to a proportional pulse frequency or a proportional pulse frequency to a direct current.
The following process signals can be connected in the standard program:
- 2 active mA signals or 2 active pulse / frequency signals
- 2 pulse outputs
- M-BUS interface
Optional cards are available for mA output, power supply, and RS485 / RS232.
The following applications can be realized in the standard program:

Device configuration
FCU200-T can be configured by using the FCOM200 communication program. The configuration can be made in factory or on-site through the customer. For factory configuration please fill in the questionnaire attached to this data sheet. When ordering the standard configuration, a default file is downloaded into the device.

Pulse output
FCU200-T has 2 pulse outputs

Description FCU400-P (SensyCal® P) – Signal combination, e.g. high-precision ΔT measurement, summation, etc.
High-precision differential temperature measurement is the basis for heat balances used for further process optimization.
The FCU400-P system consists of a Sensycal computer and two high-quality, high-precision paired Pt100 sensors.
With this system a deviation of less than 100 mK is allowed, even in the lower part of the measuring range (ΔT = 1 ... 5 K). If required, the system can be calibrated and certified in our in-house DKD calibration lab.

Inputs
2 x Pt100, 4-wire

Output
M-BUS

Options
Analog outputs and RS485 / RS232 card for MODBUS protocol

Further applications (e.g. summation) and technical details for FCU400-P on request.

Billing date recording
Two billing dates for storing the counter readings
Configurable date and time

Data logger
1 or 2 counters
Storage the operating variables over 200 periods:
Instantaneous values
Determination of min. and max. values (over a configured time) and average values

Storage
Storage of counter readings in case of power failure

Pulse outputs
FCU400-P has 2 pulse outputs
Description FCU400-IR (SensyCal® IR) – Contactless temperature monitoring

FCU400-IR is a complete system for contactless temperature monitoring of contact points and power switches in MV switchgear. The contact resistance at the contact points between the conductor rails and power switches may increase due to loose screws or corrosion. As a result, power will be converted to heat (power dissipation), and the system may be damaged.

Product features
- Continuous temperature monitoring of live parts
- Monitoring of up to 12 hot spots in a switchgear with only one system
- Freely configurable values for warning and emergency limits
- Analog output for max. temperature value (Option)
- MODBUS output (Option)
- No PVC cables used
- All parts completely shielded against EMI / RFI
- Possible connection of a Pt100 temperature sensor for measuring the ambient temperature
- M-Bus and optical interfaces (IRDA, ZVEI) for data output and configuration
- All relevant parameters locally indicated on a multi-line graphic display
- Indication of all measuring points and maximum temperature values with tag numbers
- Data logger function with real-time clock for all temperature and limit values
- Error is recorded with current date and time when configured limit value is exceeded
- Compact design allows easy retrofitting

User benefits
- Lower cost
  - Eliminate need for manually survey contact points
- No measuring system maintenance
- Higher plant reliability
  - Prevention of incidents due to rapid online recognition of hot spots and disconnection of the switchgear from power
- No contact between measuring system and live parts

The system consists of the following basic components
- Infrared pyrometers for hot-spot monitoring in the conductor rail compartment
- Optional Pt100 resistance thermometers for ambient temperature measurement in the conductor rail compartment
- Measurement computer for signal processing, evaluation and indication in the secondary compartment

Technical data

Inputs
- max. 12 pyrometers
- 1 x Pt100 resistance thermometers, range 0 … 200 °C

Outputs
- 3 digital outputs, pre-alarm, Alarm and device error
- 1 MODBUS output (Option) or alternative
- 1 analog output (Option)
- 4 … 20 mA signal for highest pyrometer temperature

Optical resolution Sensor
- 10:1

Cable length between sensor and computer
- Standard: 10 m

Response time of the entire system
- < 1 second

Reproducibility of temperature measurement
- ± 0,75 % or ± 0,75 °C of rate (the larger value applies)

Degree of protection
- IP 40

Power supply
- 24 V DC ± 5 %

Max. power
- 10 VA

Max. ambient temperature
- Caloric energy computer: 55 °C
- Pyrometer: 70 °C

For technical details about FCU400-IR on request.
Technical data

FCU – Operating principle and system design
The calorific energy computer consists of a basic unit with 4 slots for extension modules.
The basic unit includes:
- Power supply unit
- Graphic display with background light
- Electronics
- 2 analog 4-wire temperature inputs (Pt100) with constant current source
- 2 digital inputs, electrically isolated, for pulse or frequency, which can also be used as digital inputs for control purposes
- 3 digital outputs (electrically isolated) for pulse output and error signaling
- M-Bus interface
- Optical interface on the front panel which can be operated in accordance with the IRDA or the ZVEI standard, as required
- The four slots are designed for plugging in the optional extension modules. The following module combinations are possible:
  - Current input module with transmitter supply
  - Current output module with alarm signalling units
  - RS485 / RS232 module for MODBUS communication
  - Power supply card for 2-wire transmitter supply

Input

2 × temperature inputs
2 x Pt100 IEC

Measuring range
-200 ... 850 °C; 20-bit resolution ± 0.0012 K

2 digital inputs EB1, EB2
Electrical isolated, 24 V, passive (optocoupler), configurable acc. to DIN 19240 as:
- Pulse
- Frequency
- Logical signal input

Output

3 digital outputs AB1, AB2 and Err
Open collector, passive

Electrical isolation through optocoupler
External power supply VDE 2188 Category 2
Max. load 24 V (± 25 %), < 100 mA
Max. separation voltage 500 V (peak-peak)
Ri in conducting state < 20 Ω
AB1: Pulse output
AB2: Error output

Interfaces

Communication using the M-Bus protocol
to EN 1434-3, IEC 870-5) and MODBUS protocol

Optical interface on the front panel
Operating mode configurable
- Opto-head (ZVEI) standard IEC EN 61107 300 ... 2400 (9600) Baud

Interface on the terminal strip
- 2-wire M-Bus interface 300 ... 38400 Baud
- RS232 / RS485 300 ... 38400 Baud

Configuration of device via configuration software (M-BUS).
Reading of data (operating variables, data logger, etc.) via the M-Bus or MODBUS.

Extension modules

101
2 current inputs EX1, EX2
0 / 4 ... 20 mA, RE = 50 Ω; 16-bit resolution ≈ 0.3 μA
max. permissible input current ± 40 mA
Electrical isolation
+ 2 × transmitter power supplies Us1, Us2
Each 16 V, 25 mA, short-circuit-proof
Electrical isolation

107
4 voltage inputs EX1, EX2, EX3, EX4
0 ... 2500 mV, RE > 1 MΩ; 16-bit resolution
max. permissible input voltage + 5 V

108
4 current inputs EX1, EX2, EX3, EX4
0 / 4 ... 20 mA, RE = 50 Ω; 16-bit resolution ≈ 0.3 μA
max. permissible input current ± 40 mA

102
2 analog outputs AX1, AX2
Signal range 0 / 4 ... 20 mA
Load max. 500 Ω
Open permitted, short-circuit-proof

+ 2 alarm signalling outputs, ABX1, ABX6
Open collector, passive
Electrically isolated via optocoupler
External power supply VDE 2188 Category 2
Max. load 24 V (+ 25 %), < 100 mA
Max. separation voltage 500 V (peak-peak)

105
RS485 / RS232 card
For MODBUS communication

106
+ 2 × transmitter power supplies Us1, Us2
Each 20 V, 25 mA, short-circuit-proof
Electrical isolation
**Universal Measuring Computer**

FCU200-T, FCU200-W, FCU400-G, FCU400-IR, FCU400-P, FCU400-S (SensyCal®)

10/18-5.22 EN

**Performance characteristics**

**Temperature inputs**

**Measuring error**
- Temperature
  - 0.3 % of upper range value

**Errors limits for ΔT:**
- 3 ... 20 K < 1.0 % of measured value
- 20 ... 250 K < 0.5 % of measured value

**Current inputs**

**Influence of ambient temperature**
- < 0.01 %/K

**Calibration error**
- < 0.2 % of final value

**Max. linearity error**
- < 0.005 % FSR

**Accuracy class of calculation unit**
- EN 1434-1 / OIML 75 Class 2

**Operating conditions**

**Environmental conditions**

**Ambient temperature**
- - 5 ... 55 °C

**Storage temperature**
- - 25 ... 70 °C

**Climate class**
- Ambient temperature class C to EN 1434-1

**Relative humidity**
- Tested in accordance with EN 1434-4, IEC 62-2-30

**Condensation**
- permitted

**Degree of protection**
- IP 65 (FCU400-IR IP 40)

**Shock resistance in operation (at 20 °C) to IEC 68-2-6 or 68-2-27**
- Vibration 2 g / 10 ... 150 Hz
- Shock 30 g / 11 ms / 3 Shocks

**Electromagnetic compatibility (EMC)**

- EMI / RFI shielding to EN 50082-2 (EN 61000-4-2, -3, -4, -5,6)
- Additionally to EN 1434-4 (Class C)
- RFI supression to EN 50081-2 (EN 55011 Class A)

**Test type**

<table>
<thead>
<tr>
<th>Test type</th>
<th>Level</th>
<th>Influence</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surge to AC supply com. diff.</td>
<td>EN 61000-4-5</td>
<td>2 kV</td>
<td>none</td>
</tr>
<tr>
<td>Burst to supply lines</td>
<td>EN 61000-4-4</td>
<td>2 kV</td>
<td>&lt; 0.2 %</td>
</tr>
<tr>
<td>Burst to signal lines</td>
<td>EN 61000-4-4</td>
<td>1 kV</td>
<td>&lt; 0.2 %</td>
</tr>
<tr>
<td>Electrostatic discharge contacts</td>
<td>EN 61000-4-2</td>
<td>6 kV</td>
<td>&lt; 0.2 %</td>
</tr>
<tr>
<td>Radiated emissions (80-1000 MHz)</td>
<td>EN 61000-4-3</td>
<td>10 V/m</td>
<td>&lt; 0.2 %</td>
</tr>
<tr>
<td>Conducted immunity (150 kHz - 80 MHz)</td>
<td>EN 61000-4-4</td>
<td>10 V</td>
<td>erfüllt</td>
</tr>
<tr>
<td>Mains failure / variation</td>
<td>EN 61000-4-411</td>
<td>10 V</td>
<td>erfüllt</td>
</tr>
<tr>
<td>RFI supression</td>
<td>Limit class met</td>
<td>10 V</td>
<td>erfüllt</td>
</tr>
</tbody>
</table>

**Human interface**

**Display**
- Grafic display
  - 120 x 32 pixel, multi-line, background light

**Data logger and billing date recording**

- Two billing dates for storage of all counter readings
  - Configurable date and time

- Data logger
  - Storage of operatig variables over 128 periods or 200 periods
  - The number of variables and periods may vary, depending on the application

**Error messages and error output**

- Recognition of internal errors through regular self-diagnostic.

**Display**
- Critical device errors, e.g. memory failure
- Process errors with date and time
- Last 10 power failures, last 10 counter stoppages

**Storage up to 10 process errors**
- Plain display with time stamp

**Error output**
- open collector, passive (see output) display

**Mechanical construction**

**Design / dimensions**

**DIN rail mounting and wall mounting**
- Dimensions 144 mm x 72 mm x 183 mm
- Weight ca. 0.7 kg
- Material polycarbonate

**Panel mounting**
- Dimensions 144 mm x 72 mm x 117 mm
- Weight ca. 0.5 kg
- Material polycarbonate
- Panel cutout 139 mm x 69 mm

**Power supply**

**DC voltage**
- 24 V DC ± 20 % (FCU400-IR ± 5 %)

**AC voltage**
- 24 V AC, 110 V AC, 230 V AC, -15 ... +10 %, 48 ... 62 Hz

**Power consumption**
- 24 V AC 1 ... 10 VA depending on extension
- 115 V AC 2 ... 10 VA depending on extension
- 230 V AC 3 ... 10 VA depending on extension
Certificates and approvals
The measurement computer has the following certificates:
- VDE certificate (electrical safety)
- PTB certificate for systems subject to legal control to EN 1434, Supplement 22 (FCU200-W - SensyCal® W)
- CSA-NRTL-C certificate
- GOST certificate

Configuration software
The PC configuration software FCOM200 for flow measurement computers is used for configuring the standard applications.
The PC configuration software FCOM200 for special applications is designed for configuring customer-specific applications. It can be installed and run on all usual commercial PCs.

The link between the PC / laptop and the measurement computer can be established in two different ways.

Useful hint for communication:
The following PC and device settings must fully match to enable proper communication:
- Interface: for opto-head / automatically
- for the M-Bus repeater / M-Bus repeater

Infrared printer
Measurement computer data can be printed on the portable infrared printer type „HP82240B Infrared Printer“ that connects to the infrared interface.
Universal Measuring Computer
FCU200-T, FCU200-W, FCU400-G, FCU400-IR, FCU400-P, FCU400-S (SensyCal®)

Dimensional drawing (dimensions in mm)

Panel mounting

Wall mounting
(on 35 mm top hat rail)
Connecting diagrams

Signal terminal assignment, basic device
Terminal assignment of FCU200-W

Signal terminal assignment, basic device FCU200-W

Notice
If the temperature transmitters are electrically connected, jumper B (between terminals 6 and 2) is not required.

Current input module
(Flow transmitter, differential pressure transmitter)

Current output module

Supply of pulse / frequency input

Transmitter with pulse / frequency output

Notice
If the temperature transmitters are electrically connected, jumper B (between terminals 6 and 2) is not required.
Terminal assignment of FCU400-S, FCU400-G

### Signal terminal assignment, basic device FCU400-S

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>US1+</td>
</tr>
<tr>
<td>2</td>
<td>EX1+</td>
</tr>
<tr>
<td>3</td>
<td>EX1-</td>
</tr>
<tr>
<td>4</td>
<td>US1-</td>
</tr>
<tr>
<td>5</td>
<td>US2+</td>
</tr>
<tr>
<td>6</td>
<td>EX2+</td>
</tr>
<tr>
<td>7</td>
<td>EX2-</td>
</tr>
<tr>
<td>8</td>
<td>US2-</td>
</tr>
</tbody>
</table>

**Notice**

If the temperature transmitters are electrically connected, jumper B (between terminals 6 and 2) is not required.

### Current input module

**Pressure and flow transmitter**

- **US1+**: 60
- **EX1+**: 61
- **EX1-**: 62
- **US1-**: 63
- **US2+**: 64
- **EX2+**: 65
- **EX2-**: 66
- **US2-**: 67

- **2-wire transmitter**
- **4-wire transmitter**

### Current output module

- **US1+**: 60
- **EX1+**: 61
- **EX1-**: 62
- **US1-**: 63
- **US2+**: 64
- **EX2+**: 65
- **EX2-**: 66
- **US2-**: 67

- **2-wire transmitter**
- **4-wire transmitter**

### Current input module (Δp₂, condensate flow)

- **US1+**: 70
- **EX1+**: 71
- **EX1-**: 72
- **US1-**: 73
- **US2+**: 74
- **EX2+**: 75
- **EX2-**: 76
- **US2-**: 77

- **2-wire transmitter**
- **4-wire transmitter**

**Notice**

If the temperature transmitters are electrically connected, jumper B (between terminals 6 and 2) is not required.

**Current output module**

- **US1+**: 70
- **EX1+**: 71
- **EX1-**: 72
- **US1-**: 73
- **US2+**: 74
- **EX2+**: 75
- **EX2-**: 76
- **US2-**: 77

- **2-wire transmitter**
- **4-wire transmitter**
Terminal assignment of FCU400-G, FCU200-T

Signal terminal assignment, basic device FCU400-G

Signal terminal assignment, basic device FCU200-T

mA output module

Notice
If the temperature transmitters are electrically connected, jumper B (between terminals 6 and 2) is not required.

Power supply of the 2-wire transmitters FCU200-W, FCU400-S, FCU400-G, FCU200-T, FCU400-P
Questionnaire FCU200-W

Technical contact person

Person responsible

Tel. / Fax

Tel. / Fax

Tag name

Language

Flow transmitter inputs

<table>
<thead>
<tr>
<th>Pulse value</th>
<th>Frequency</th>
<th>mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Pulse value</th>
<th>F min [Hz]</th>
<th>F max [Hz]</th>
<th>0 ... 20 mA</th>
<th>4 ... 20 mA</th>
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</thead>
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<table>
<thead>
<tr>
<th>qv-max</th>
<th>qv-min</th>
<th>qv-max</th>
<th>qv-min</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absolute pressure [bar]</th>
<th>(operating pressure)</th>
<th>Δp-min</th>
<th>Δp-max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Flow sensor placed in

- Warm flow
- Cold flow
- For Δp measurement: Δp transmission: Linear
- Root extracting

For differential pressure measurement (orifice, nozzle, venturi, pitot tube flow meter) please add calculation.

Temperature inputs

<table>
<thead>
<tr>
<th>Pt100 direct</th>
<th>Transmitter 0 ... 20 mA</th>
<th>4 ... 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tw min</th>
<th>Tw max</th>
<th>Tc min</th>
<th>Tc max</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pulse output 1

<table>
<thead>
<tr>
<th>Pulse value</th>
<th>Pulse value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Puls width [ms]</th>
<th>Puls width [ms]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Pulse output 2

<table>
<thead>
<tr>
<th>Pulse value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outputs (select signal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 20 mA</td>
</tr>
</tbody>
</table>

Outputs

<table>
<thead>
<tr>
<th>Physical value, start value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
</tbody>
</table>

| Physical value, final value |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| 1  | 2  | 3  | 4  |
**Questionnaire FCU400-S**

<table>
<thead>
<tr>
<th>Technical contact person</th>
<th>Person responsible</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tel. / Fax</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Tag name</th>
<th>(2 x 20 characters)</th>
<th>Language</th>
</tr>
</thead>
</table>

### Flow transmitter inputs for steam flow

<table>
<thead>
<tr>
<th>Pulse</th>
<th>Frequency</th>
<th>mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulse value</th>
<th>F min [Hz]</th>
<th>F max [Hz]</th>
<th>0 ... 20 mA</th>
<th>4 ... 20 mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>qv-max</td>
<td>qv-min</td>
<td>qv-max</td>
<td>qv-min</td>
<td>qv-max</td>
</tr>
</tbody>
</table>

For Δp measur.: Δp transm. Linear Root extracting

For differential pressure measurement (orifice, nozzle, venturi, pitot tube flow meter) please add calculation.

### Flow transmitter inputs for condensate flow

<table>
<thead>
<tr>
<th>Pulse</th>
<th>Frequency</th>
<th>mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulse</th>
<th>Frequency</th>
<th>mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>qv-max</th>
<th>qv-max</th>
<th>qv-max</th>
</tr>
</thead>
</table>

Absolute pressure (bar) (Operating pressure in the condensate)

### Pressure transmitter

<table>
<thead>
<tr>
<th>Over / Abs.</th>
<th>0 ... 20 mA</th>
<th>4 ... 20 mA</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Pressure transmitter</th>
<th>Steam temperature</th>
<th>Condensate temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>bar / MPA</td>
<td>°C</td>
<td>°C</td>
</tr>
<tr>
<td>Pt100 direct</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Pulse output 1

<table>
<thead>
<tr>
<th>Counter</th>
<th>Pulse value</th>
<th>Pulse width (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Pulse output 2

<table>
<thead>
<tr>
<th>Counter</th>
<th>Pulse value</th>
<th>Pulse width (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Counter

<table>
<thead>
<tr>
<th>Counter</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Energy (steam condensate)</td>
</tr>
<tr>
<td></td>
<td>Energy steam</td>
</tr>
<tr>
<td></td>
<td>Mass steam</td>
</tr>
<tr>
<td></td>
<td>Energy condensate</td>
</tr>
<tr>
<td></td>
<td>Mass condensate</td>
</tr>
</tbody>
</table>

### Outputs (standard: 2 outputs)

(Specify physical measuring ranges with units.)

<table>
<thead>
<tr>
<th>Outputs (select signal)</th>
<th>0 ... 20 mA</th>
<th>4 ... 20 mA</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Physical value, start value</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical value, final value</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Zero point suppression for flow

(m³/h kg/h l/h)

(applicable for calculating the flow, power, mass, volume, energy)
### Questionnaire FCU400-G

#### Technical contact person

<table>
<thead>
<tr>
<th>Tel. / Fax</th>
</tr>
</thead>
</table>

#### Person responsible

<table>
<thead>
<tr>
<th>Tel. / Fax</th>
</tr>
</thead>
</table>

#### Tag name

(2 x 20 characters)

#### Language

---

### Flow transmitter inputs

#### Pulse

<table>
<thead>
<tr>
<th>Pulse value</th>
<th>F min [Hz]</th>
<th>F max [Hz]</th>
<th>mA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>0 ... 20 mA</td>
</tr>
<tr>
<td>qv-max</td>
<td>qv-min</td>
<td>qv-max</td>
<td>qv-min</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>qv-max</td>
</tr>
</tbody>
</table>

For Δp measur.: Δp transm.  Linear      Root extracting

For differential pressure measurement (orifice, nozzle, venturi, pitot tube flow meter) please add calculation.

#### Pressure transmitter

<table>
<thead>
<tr>
<th>Gas temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 20 mA</td>
</tr>
<tr>
<td>Over / Abs.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>bar / MPA</th>
<th>°C</th>
</tr>
</thead>
</table>

#### Pulse output 1

<table>
<thead>
<tr>
<th>Counter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Nm³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulse value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pulse width (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### Outputs (optional)

(Specify physical measuring ranges with units.)

<table>
<thead>
<tr>
<th>Physical value, start value</th>
<th>Physical value, final value</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Outputs (select signal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 ... 20 mA</td>
</tr>
</tbody>
</table>

(for all outputs)
Questionnaire FCU200-T

Technical contact person

Person responsible

Tel. / Fax

Tag name

(2 x 20 characters)

Language

Inputs

Channel 1

Pulse 1 □ Frequency 1 □ mA, 1

Pulse value □ F min [Hz] □ F max [Hz] □ 0 ... 20 mA □ 4 ... 20 mA □

Max. value □ Min. value □ Max. value □ Min. value □ Max. value □

Channel 2

Pulse 2 □ Frequency 2 □ mA, 2

Pulse value □ F min [Hz] □ F max [Hz] □ 0 ... 20 mA □ 4 ... 20 mA □

Max. value □ Min. value □ Max. value □ Min. value □ Max. value □

Pulse output 1

Pulse value □

Pulse width (ms) □

Pulse output 2

Pulse value □

Pulse width (ms) □

Outputs (optional)

(Specify physical measuring ranges with units.)

Outputs (select signal)

0 ... 20 mA □ 4 ... 20 mA □ (for all outputs)

<table>
<thead>
<tr>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical value, start value</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical value, final value</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An extension board (Code No. 106 with 2 x 20 V supply) is available for power supply of the inputs (pulse, frequency or mA).
## Ordering information

<table>
<thead>
<tr>
<th>Universal Measurement Computer</th>
<th>Variant digit No.</th>
<th>1</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCU</td>
<td>Catalog No.</td>
<td>V18022-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Application

**FCU200-W (SensyCal W), caloric energy computer**
- Standard, water, cooling water, brine, oil
- Open systems, water (special applications)
- Others

**FCU400-S (SensyCal S), steam / saturated steam**
- Standard, thermal output / flow correction
- Standard, flow correction
- Others (special applications)

**FCU400-G (SensyCal G), Gas**
- Standard, flow correction (Qv, p, T)
- Standard, flow correction (Δp, p, T)
- Others (special applications)

**FCU400-P (SensyCal P), process applications**
- Summation and subtraction (max. 6 inputs)
- High-precision differential temperature measurement
- Others

**FCU200-T (SensyCal T), counting / accounting**
- Current-to-pulse converter
- Pulse-to-current converter
- Others

**FCU400-IR (SensyCal IR), temperature monitoring**
- Infrared temperature monitoring

### Power Supply

- 230 V AC
- 115 V AC
- 24 V AC / DC (FCU400-IR only with Power Supply 24 V DC)

### Approvals

- Without calibration
- With certificate from Verification Office for FCU200-W (SensyCal W)
- Special certificate for FCU400-S, FCU400-G (SensyCal S, SensyCal G)
- Calibration for high-precision differential temperature measurement
- Others (special applications)

### Configuration

- Without configuration
- With customer specific configuration

### Housing

- Housing for panel mounting and wall mounting, 144 mm x 72 mm

### Notes:

1) The standard model includes: 2 inputs for connecting Pt 100 (directly) or temperature transmitter with active mA output, 1 passive pulse / frequency input

2) Select code 101 for mA inputs and code 102 for mA outputs.
   Select code 106 for supply of passive pulse / frequency input or temperature transmitter

3) 2 inputs are available for mA signals. Select code 108 for more inputs.
   Select code 106 for power supply.

4) 2 inputs are available for active mA or pulse / frequency signals, select code 106 for supply of the signals.

5) Only with Power Supply 24 V DC

6) 19" cartridge see accessories
## Additional ordering information

<table>
<thead>
<tr>
<th>FCU Code</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Optional) extension modules ordered together with the device (max. 4)</td>
<td></td>
</tr>
<tr>
<td>2 x mA inputs and 2 transmitter supplies (2 x 16 V, 25 mA)</td>
<td>101</td>
</tr>
<tr>
<td>2 x mA outputs and 2 alarm contacts</td>
<td>102</td>
</tr>
<tr>
<td>RS 485/RS232 card for MODBUS communication</td>
<td>105</td>
</tr>
<tr>
<td>2 x transmitter supplies (2 x 20 V, 25 mA)</td>
<td>106</td>
</tr>
<tr>
<td>4 x mV inputs (special application)</td>
<td>107</td>
</tr>
<tr>
<td>4 x mA inputs (summation, special application)</td>
<td>108</td>
</tr>
</tbody>
</table>

## Accessories

<table>
<thead>
<tr>
<th>Accessories</th>
<th>Catalog No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC configuration program FCOM200, for FCU200-W, FCU400-S, FCU400-G, FCU200-T</td>
<td>7962875</td>
</tr>
<tr>
<td>Optohead, for connection to a PC via RS 232 interface</td>
<td>7962876</td>
</tr>
<tr>
<td>Optohead, for connection to a PC via USB interface</td>
<td>7962897</td>
</tr>
<tr>
<td>M-Bus micro-master with laptop adapter cable via RS 232 interface, for 10 terminal units (MR 003)</td>
<td>7962877</td>
</tr>
<tr>
<td>M-Bus level transformer with RS 232 C interface for 3 terminal units, housing for Z rails or wall mounting PW3</td>
<td>7962878</td>
</tr>
<tr>
<td>20 terminal units, housing for Z rails or wall mounting PW20</td>
<td>7962879</td>
</tr>
<tr>
<td>60 terminal units, housing for Z rails or wall mounting PW60</td>
<td>7962880</td>
</tr>
<tr>
<td>250 terminal units, housing for Z rails or wall mounting PW250</td>
<td>7962891</td>
</tr>
<tr>
<td>Handheld printer for infrared communication</td>
<td>7962882</td>
</tr>
<tr>
<td>RS 232 cable (SUB-D 1:1 9-pole socket / plug) 3 m, for M-BUS level transformer</td>
<td>7962895</td>
</tr>
<tr>
<td>Extension module for separate order, independent of the device</td>
<td></td>
</tr>
<tr>
<td>2 x mA inputs and 2 transmitter supplies (2 x 16 V, 25 mA)</td>
<td>7962870</td>
</tr>
<tr>
<td>2 x mA outputs and 2 alarm contacts</td>
<td>7962871</td>
</tr>
<tr>
<td>RS 485/RS 232 card for MODBUS communication</td>
<td>7962874</td>
</tr>
<tr>
<td>2 transmitter supplies (2 x 20 V, 25 mA)</td>
<td>7962869</td>
</tr>
<tr>
<td>4 x mV inputs (special application)</td>
<td>7962881</td>
</tr>
<tr>
<td>4 x mA inputs (special application)</td>
<td>7962868</td>
</tr>
<tr>
<td>Frontplate 19&quot;</td>
<td>7962896</td>
</tr>
<tr>
<td>Infra-red Thermometer Sensytherm IR-CS for FCU400-IR, Temperature Range 0 ... 250 °C, Spectral Sensitivity 8 ... 14 µm, Optical Resolution 10:1, Response Time 200 ms, Measurement Deviation 1.5 % of Reading, Power Supply 12 ... 28 V DC, Connecting Cable 10 m</td>
<td>7962997</td>
</tr>
<tr>
<td>Accessory for FCU400-IR (SensyCal IR) with Sensytherm IR, protection housing against electromagnetic interferences</td>
<td>7962998</td>
</tr>
</tbody>
</table>