Operating Instruction 42/18-401-EN Rev. D

SensyCal FCU200-T, FCU200-W
SensyCal FCU400-G, FCU400-P, FCU400-S
Universal Measuring Computer

Measurement made easy

Power and productivity
for a better world™

SensyCal FCU200-T, FCU200-W SensyCal FCU400-G, FCU400-P, FCU400-S
Universal Measuring Computer

Operating Instruction
42/18-401-EN

Rev. D
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Translation of the original instruction

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Contents

1 Safety

1.1 General information and notes for the reader

You must read these instructions carefully prior to installing and commissioning the device.
These instructions are an important part of the product and must be kept for future reference.
These instructions are intended as an overview and do not contain detailed information on all designs for this product or every possible aspect of installation, operation and maintenance.
For additional information or if specific problems occur that are not discussed in these instructions, contact the manufacturer.
The content of these instructions is neither part of any previous or existing agreement, promise or legal relationship nor is it intended to change the same.
This product is built based on state-of-the-art technology and is operationally safe. It has been tested and left the factory in perfect working order from a safety perspective. The information in the manual must be observed and followed in order to maintain this state throughout the period of operation.
Modifications and repairs to the product may only be performed if expressly permitted by these instructions.
Only by observing all of the safety instructions and all safety / warning symbols in these instructions can optimum protection of both personnel and the environment, as well as safe and fault-free operation of the device, be ensured.
Information and symbols directly on the product must be observed. They may not be removed and must be fully legible at all times.

1.2 Intended use

Universal measurement computer for a range of industrial measurement and automation technology applications.
The measurement computer may not be operated in hazardous areas.
Signals from sensors in potentially explosive atmospheres must be connected to the analog inputs of the measurement computer via active Ex supply isolators, in a way that is intrinsically safe.
The device is designed for use exclusively within the stated values on the name plate and in the specifications (see "Specifications" chapter).

- The maximum operating temperature must not be exceeded.
- The permissible ambient temperature must not be exceeded.
- The housing's degree of protection must be observed during operation.

1.3 Target groups and qualifications

Installation, commissioning and maintenance of the product may only be performed by trained specialist personnel who have been authorized by the plant operator to do so. The specialist personnel must have read and understood the manual and comply with its instructions.
The operators must strictly observe the applicable national regulations with regards to installation, function tests, repairs, and maintenance of electrical products.

1.4 Warranty provisions

Using the device in a manner that does not fall within the scope of its intended use, disregarding this manual, using underqualified personnel, or making unauthorized alterations releases the manufacturer from liability for any resulting damage. This renders the manufacturer's warranty null and void.

1.5 Plates and symbols

1.5.1 Safety / warning symbols, note symbols

DANGER – Serious damage to health / risk to life
This symbol in conjunction with the signal word "DANGER" indicates an imminent danger. Failure to observe this safety information will result in death or severe injury.

DANGER – Serious damage to health / risk to life
This symbol in conjunction with the signal word "DANGER" indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury.

WARNING – Bodily injury
This symbol in conjunction with the signal word "WARNING" indicates a potentially dangerous situation. Failure to observe this safety information may result in death or severe injury.

WARNING – Bodily injury
This symbol in conjunction with the signal word "WARNING" indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury.

CAUTION – Minor injuries
This symbol in conjunction with the signal word "CAUTION" indicates a potentially dangerous situation. Failure to observe this safety information may result in minor or moderate injury. The symbol may also be used for property damage warnings.

NOTICE – Property damage
This symbol indicates a potentially damaging situation.
Failure to observe this safety information may result in damage to or destruction of the product and / or other system components.

IMPORTANT (NOTE)
This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. The signal word "IMPORTANT (NOTE)" does not indicate a dangerous or harmful situation.

1.6 Name plate

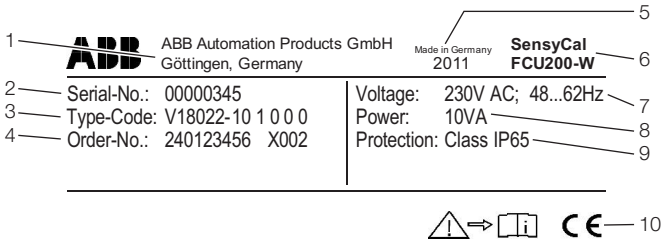


Fig. 1: Name plate (example: FCU200-W)
1 Manufacturer | 2 Serial number | 3 Order code | 4 Order number 5 Year of manufacture, country of manufacture | 6 Full type designation | 7 Power supply | 8 Maximum power consumption | 9 Degree of protection | 10 CE mark

1.7 Transport safety instructions

Observe the following instructions:

— Do not expose the device to moisture during transport. Pack the device accordingly.
— Pack the device so that it is protected against vibrations during transport, e.g., by using air-cushioned packaging.

1.8 Storage conditions

The devices must be stored in dry and dust-free conditions.
The storage temperature should be between -25 °C (-13 °F) and 70 °C (158 °F).
In principle, the devices may be stored for an unlimited period. However, the warranty conditions stipulated in the order confirmation of the supplier apply.

1.9 Safety instructions for electrical installation

The electrical connection may only be established by authorized specialist personnel and in accordance with the connection diagrams.
The electrical connection information in the manual must be observed; otherwise, the type of electrical protection may be adversely affected.
Ground the measurement system according to requirements.

1.10 Safety instructions for operation

Before switching on the device, make sure that your installation complies with the environmental conditions listed in the chapter “Technical Data” or on the data sheet.
If there is a chance that safe operation is no longer possible, take the device out of operation and secure it against unintended startup.

Prior to installation, check the devices for possible damage that may have occurred as a result of improper transport. Details of any damage that has occurred in transit must be recorded on the transport documents. All claims for damages must be submitted to the shipper without delay and before installation.

1.11 Returning devices

Use the original packaging or a secure transport container of an appropriate type if you need to return the device for repair or recalibration purposes. Fill out the return form (see the Appendix) and include this with the device.
According to the EU Directive governing hazardous materials, the owner of hazardous waste is responsible for its disposal or must observe the following regulations for shipping purposes: All devices delivered to ABB must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Please contact Customer Center Service acc. to page 2 for nearest service location.

1.12 Integrated management system

ABB Automation Products GmbH operates an integrated management system, consisting of:

- Quality management system to ISO 9001:2008
- Environmental management system to ISO 14001:2004
- Occupational health and safety management system to BS OHSAS 18001:2007 and
- Data and information protection management system

Environmental awareness is an important part of our company policy.
Our products and solutions are intended to have minimum impact on the environment and on people during manufacturing, storage, transport, use, and disposal.
This includes the environmentally-friendly use of natural resources. We conduct an open dialog with the public through our publications.

1.13 Disposal

This product is manufactured from materials that can be recycled by specialist recycling companies.

1.13.1 Information on WEEE Directive 2002/96/EC (Waste Electrical and Electronic Equipment)

This product is not subject to WEEE Directive 2002/96/EC or relevant national laws (e.g., ElektroG in Germany).
The product must be disposed of at a specialist recycling facility. Do not use municipal garbage collection points.
According to the WEEE Directive 2002/96/EC, only products used in private applications may be disposed of at municipal garbage collection points. Proper disposal prevents negative effects on people and the environment, and supports the reuse of valuable raw materials.
If it is not possible to dispose of old equipment properly, ABB Service can accept and dispose of returns for a fee.

1.13.2 RoHS Directive 2002/95/EC

With the Electrical and Electronic Equipment Act (ElektroG) in Germany, the European Directives 2002/96/EC (WEEE) and 2002/95/EC (RoHS) are translated into national law. ElektroG defines the products that are subject to regulated collection and disposal or reuse in the event of disposal or at the end of their service life. ElektroG also prohibits the marketing of electrical and electronic equipment that contains certain amounts of lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB), and polybrominated diphenyl ethers (PBDE) (also known as hazardous substances with restricted uses).
The products provided by ABB Automation Products GmbH do not fall within the current scope of regulations on hazardous substances with restricted uses or the directive on waste electrical and electronic equipment according to ElektroG. If the necessary components are available on the market at the right time, in the future these substances will no longer be used in new product development.

2 General description

The FCU is a universal measurement computer that supports a whole host of process signal processing applications. It combines the very latest communication methods with many years of expertise in the field of measurement technology. All physical and electrical process variables, as well as device data, data logger data, and billing dates, can be displayed on a high-resolution, multi-line LCD display.
The following device models are available:

Type	Function
FCU200-W	Heat quantity, cold quantity computer for water and brine
FCU400-S	Steam, saturated steam computer (flow, heat)
FCU400-G	Gas flow computer, gas translator
FCU200-T	2-channel current-pulse converter
FCU400-P	Signal combination, highly-precise ΔT measurement, totalizing, leakage measurement, boiler water-level measurement, etc.

2.1 SensyCal FCU200-W – Heat quantity computer

Description

The FCU200-W is a heat quantity computer for determining industrial thermal balances. It is used to calculate heat quantities, cold quantities and flow rates in liquids within heat supplies.
Reliable microelectronics, developed in accordance with standards DIN EN ISO 1434-1 ... 6 and OIML75.
The heat quantity computer can be used in conjunction with all standard flowmeters that provide a pulse signal, frequency signal or mA signal, such as orifice plates, ultrasound flowmeters, swirl flowmeters or vortex flowmeters.
Connecting Pt100 temperature sensors in a four-wire circuit enables precise temperature measurement.
Microprocessor technology and the integrated data logger allow for reliable, traceable acquisition of operating values.

Operating principle

The heat quantity is calculated from the volume flow or mass flow and the temperatures of the heat flow T_w and the cold flow T_k at a given pressure level, using the formulae below.

$$q_m = q_v \times \rho(T,p)$$

$$P = q_m \times [h_w(T_w,p) - h_k(T_k,p)]$$

$$V = \int_0^t q_v dt$$

$$E = V \times \rho(T,p) \times [h_w(T_w,p) - h_k(T_k,p)]$$

Element in formula	Description
E	Heat energy
V	Volume
P	Power
q_v	Volume flow
q_m	Mass flow
ρ	Current operating density
h_w	Enthalpy in heat flow
h_k	Enthalpy in cold flow
T_w	Temperature of heat flow
T_k	Temperature of cold flow
p	Pressure

Temperatures T_w and T_k can be measured using either Pt100 resistance thermometers or temperature transmitters.

IMPORTANT (NOTE)
The type of connection required (Pt100 or transmitter) for the temperature inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

Calibratable measurement for billing purposes

All devices in the circuit must be approved by the German national metrology institute (PTB) to meet the requirements of calibratable measurements for billing purposes (for water only).
Arithmetic logic unit:

— FCU200-W

Flow counter:

— Swirl flowmeter, ultrasound flowmeter, electromagnetic flowmeter, Woltmann meter, orifice plate

Temperature sensors:

— Pt100, coupled

Before the measurement process begins, acceptance by the relevant board of weights and measures is carried out if required. There is no longer a requirement for calibration in the case of rated power levels of 10 MW and up.

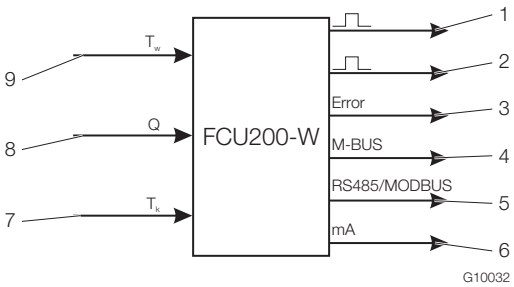


Fig. 2
1 Pulse output for heat quantity | 2 Pulse output for quantity/volume | 3 Error output | 4 Interface (M-BUS) | 5 Interface (optional, RS485 / MODBUS) | 6 Current output (optional) | 7 Temperature of cold flow | 8 Flowmeter | 9 Temperature of heat flow

Recording of billing date

Two billing dates for storing all meter readings. Date and time parameters can be adjusted.

Data logger

For storing multiple operating variables over 128 periods:

— Power
— Flow rate
— Temperature of heat flow
— Temperature of cold flow
— Temperature difference

Instantaneous values, minimum values and maximum values are all stored for the operating variables. In some cases, an average value is stored as well.

Meters and storage

Energy counter standstill in the event of:

— Flow rate = zero
— PT100 sensor break or
— Short-circuit in heat flow or cold flow
— Temperature in heat flow lower than in cold flow

Meter readings saved in the event of a power failure

Pulse output

Two pulse outputs.

Device parameterization

The device is parameterized using the FCOM200 parameterization software (ParaTool).
Parameterization can be performed at the factory or the customer's site. If parameterization is carried out at the factory, a questionnaire must be completed at the customer's site. Default values are loaded in the case of standard parameterization.

2.2 SensyCal FCU400-S – Steam computer

Description

The FCU400-S is a steam, flow, and thermal output computer designed for industrial quantity measurements, thermal balances, and measurements for accounting purposes. It is used for superheated steam or saturated steam with or without condensate reverse flow, as a flowmeter and / or a heat quantity computer.

The measurement computer can be used in conjunction with all standard flowmeters that provide a pulse signal, frequency signal, or mA signal, such as orifices, ultrasound flowmeters, swirl flowmeters, or vortex flowmeters.

The split-range procedure, flow coefficient correction, and expansion rate correction are possible in the standard program in the case of flow measurement involving orifices.

With the standard program, process signals from the following measuring devices can be processed:

- Flowmeters in steam forward flow
- Pressure transmitters in steam forward flow
- Temperature sensors (Pt100 or via transmitters) in steam forward flow
- Flowmeters in condensate reverse flow
- Temperature sensors (Pt100 or via transmitters) in condensate reverse flow

Up to 5 counter are provided in the standard program. The following applications can be realized.

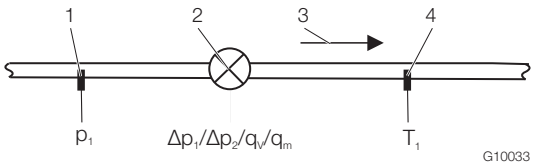


Fig. 3: Steam: flow, thermal output calculation

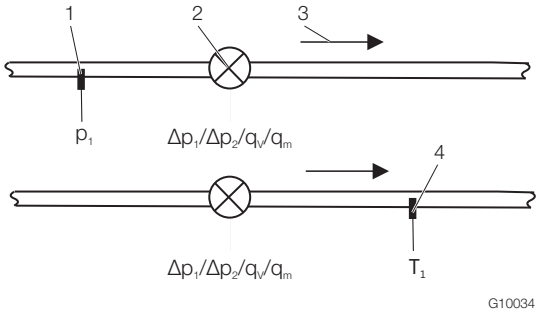


Fig. 4: Saturated steam: flow, thermal output calculation
1 Pressure transmitter | 2 Flowmeter |
3 Flow direction | 4 Temperature sensor

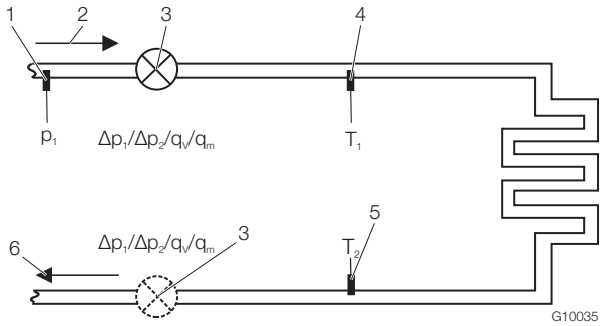


Fig. 5: Forward flow: steam / saturated steam; reverse flow: condensate
1 Pressure transmitter | 2 Forward flow |
3 Flowmeter (alternatively in condensate reverse flow) |
4 Temperature sensor (steam) |
5 Temperature sensor (condensate) | 6 Reverse flow

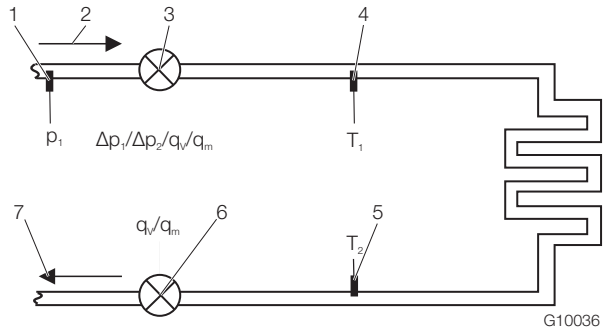


Fig. 6: Open systems
1 Pressure transmitter | 2 Forward flow | 3 Flowmeter (steam) |
4 Temperature sensor (steam) |
5 Temperature sensor (condensate) | 6 Flowmeter (condensate) |
7 Reverse flow

The physical "density" and "enthalpy" values of steam and water are calculated in accordance with the latest version of industry standard IAPWS-IF 97.

Connecting Pt100 temperature sensors in a four-wire circuit enables precise temperature measurement. Microprocessor technology and the integrated data logger allow for reliable, traceable acquisition of operating values.

Operating principle

The mass flow is calculated from the volume flow and density. When the flow is measured by means of differential pressure measurement, the mass flow is corrected on the basis of the reference density, i.e., the operating density in relation to the density for which the measurement was designed.
The heat quantity is calculated from the mass flow and enthalpy (internal energy of steam or water).
In the case of steam and water, the density and enthalpy are a function of pressure and temperature. In the case of saturated steam, they are a function of pressure or temperature.

$$q_m = q_v \times \rho(T_d, p_d)$$

$$P = q_m \times h_d(T_d, p_d)$$

$$E = \int_0^t P dt$$

For steam in the forward flow and condensate in the reverse flow, the following applies:

$$P_{Steam} = q_m \times h_d(T_d, p_d)$$

$$P_{Condensate} = q_m \times h_w(T_w, p_w = Const)$$

$$P_{Balance} = P_{Steam} - P_{Condensate}$$

Element in formula	Description
E	Heat energy
P	Power
q_v	Volume flow
q_m	Mass flow
ρ	Current operating density
h_d	Steam enthalpy
h_w	Condensate enthalpy
T_d	Steam temperature
T_w	Condensate temperature
p	Pressure

Temperatures T_d and T_w can be measured using either Pt100 resistance thermometers or temperature transmitters.

IMPORTANT (NOTE)

The type of connection required (Pt100, transmitter) for the temperature inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

Calibrated measurement for accounting purposes

In Germany, there is no requirement for calibration in the case of measurement for accounting purposes involving steam. If requested by the customer, all the devices in the circuit may be supplied as calibrated devices in order to meet the requirements of calibrated measurement for accounting purposes.
For this purpose, a calibration request for the FCU400-S measurement computer is submitted to the relevant board of weights and measures (based on the approval for official calibration for water).

Billing date recording

Two billing dates for storing up to 5 counter readings. Date and time parameters can be adjusted.

Data logger

For storing up to 27 operating variables over 128 periods.

- 5 counters (E1 energy (steam), M1 quantity (steam, EΔ energy balance (steam condensate), E2 energy (condensate), M2 quantity (condensate))
- Instantaneous values of all process variables
- Determining minimum and maximum values (over parameterizable time) and mean values for 4 process variables (parameterizable)

Counters, storage

Energy counter standstill in the event of:

- Flow = zero

Counter readings saved in the event of a power failure

Pulse output

2 pulse outputs.

Device parameterization

The device is parameterized using the FCOM200 parameterization software (ParaTool).
Parameterization can be performed at the factory or the customer's site. If parameterization is carried out at the factory, a questionnaire must be completed at the customer's site. Default values are loaded in the case of standard parameterization.

2.3 SensyCal FCU400-G – Gas flow computer, gas translator

Description

The FCU400-G is a gas flow computer and translator designed for industrial gas flow calculations and gas measurements for accounting purposes.

The measurement computer can be used in conjunction with all standard flowmeters that provide a pulse signal, frequency signal, or mA signal, such as orifices, ultrasound flowmeters, swirl flowmeters, or vortex flowmeters.

The split-range procedure, compressibility factor, flow coefficient correction, and expansion rate correction are possible in the standard program in the case of flow measurement involving orifices.

With the standard program, process signals from the following measuring devices can be processed:

— Flowmeters
— Pressure transmitters
— Temperature sensor (Pt100 or via transmitter)

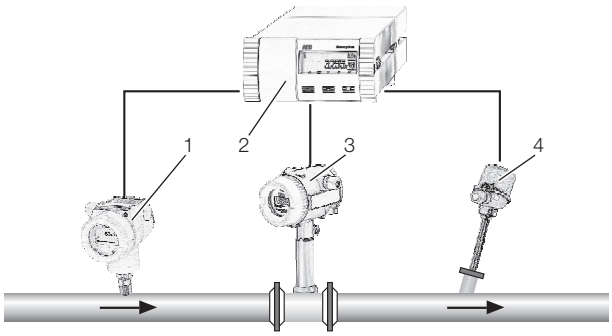


Fig. 7
1 Pressure transmitter | 2 Measurement computer | 3 Flowmeter | 4 Temperature sensor (Pt100 or via transmitter)

The physical compensation and conversion of the flow are calculated in accordance with EN ISO 5167-1 and VDI/VDO 2040.

Operating principle

The standard volume flow is calculated from the volume flow, operating density, and standard density. The operating density can be calculated from the operating pressure, operating temperature, and standard density in the standard condition. When the flow is measured by means of differential pressure measurement, the standard volume flow is corrected on the basis of the reference density, i.e., the operating density in relation to the density for which the measurement was designed.

$$Q_n = Q_V \times \frac{\rho}{\rho_n}$$

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

In the case of differential pressure measurement:

$$Q_n = Q_{n,measured} \times \sqrt{(\rho / \rho, A)} \times \frac{C}{C, A} \times \frac{\varepsilon}{\varepsilon, A}$$

$$\rho = f(p, T, Z)$$

Element in formula	Description
Q_n	Standard volume flow
Q_V	Operating volume flow
ρ	Operating density
ρ_n	Standard density
T	Temperature
p	Pressure
Z	Compressibility factor
C	Flow coefficient
ε	Expansion rate
p_n	Pressure in standard condition (1.01325 bar)
T_n	Temperature in standard condition (273.15 K)
Z_n	Flow coefficient in standard condition
A	Design specifications for orifice

The temperature T is measured using either Pt100 resistance thermometers or temperature transmitters.

IMPORTANT (NOTE)

The type of connection required (Pt100, transmitter) for the temperature inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

Data logger
For storing up to 20 operating variables over 200 periods:
— 1 counter
— Instantaneous values, mean values, and minimum and maximum values of all process variables

Counters, storage
Counter standstill in the event of:
— Flow = zero
Counter readings saved in the event of a power failure.

Pulse output
2 pulse outputs.

Device parameterization
The device is parameterized using the FCOM200 parameterization software (ParaTool).
Parameterization can be performed at the factory or the customer's site. If parameterization is carried out at the factory, a questionnaire must be completed at the customer's site. Default values are loaded in the case of standard parameterization.

2.4 SensyCal FCU200-T – Current-pulse converter
Description
The FCU200-T is a two-channel
— energy, quantity, and volume counter
— current-pulse converter
— pulse-current converter

Operating principle
The device converts either direct current into a proportional pulse frequency or a proportional pulse frequency into direct current.
With the standard program, the following process signals can be processed:
— 2 active mA signals or 2 active pulse / frequency signals
— 2 pulse output signals

The mA output card, power supply card, and RS485 / RS232 card can be supplied as an option.

The following applications can be realized with the standard program:

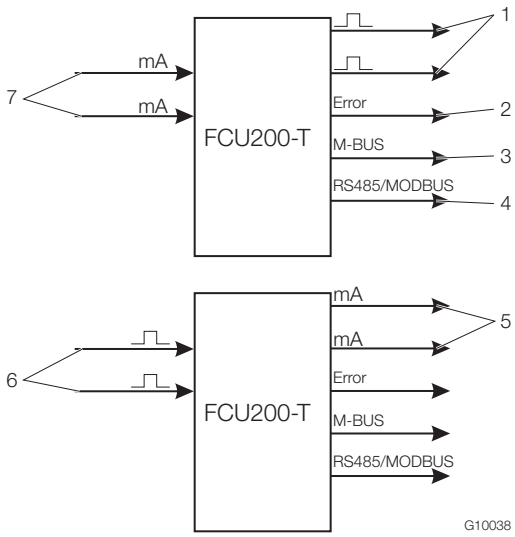


Fig. 8
1 Pulse outputs | 2 Error output | 3 Interface (M-Bus) | 4 Interface (optional, RS485 / MODBUS) | 5 Current outputs (optional) | 6 Pulse inputs | 7 Current inputs

Device parameterization
The device is parameterized using the FCOM200 parameterization software (ParaTool).
Parameterization can be performed at the factory or the customer's site. If parameterization is carried out at the factory, a questionnaire must be completed at the customer's site. Default values are loaded in the case of standard parameterization.

Pulse output
2 pulse outputs.

2.5 SensyCal FCU400-P – Signal combination, highly-precise ΔT measurement, totalizing, etc.

Description

Precise differential temperature measurement is a must wherever thermal balancing is required for additional process optimization.

The FCU400-P for highly-precise differential temperature measurement is a system consisting of a measurement computer (which serves as an evaluation unit) and 2 high-quality, precise, paired, and carefully-selected Pt100 sensors. In the lower measuring range (ΔT = 1 ... 5 K), the system also offers a measuring error of < 100 mK. If required, it can be calibrated and certified at a German Calibration Service (DKD) calibration lab.

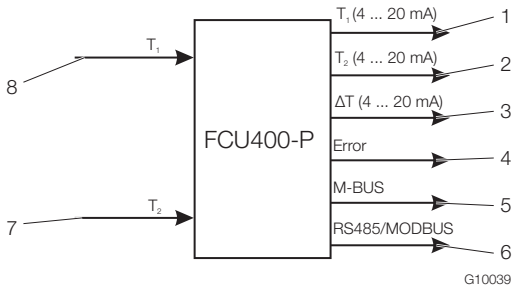


Fig. 9
1 Analog output T1 (optional) | 2 Analog output T2 (optional) | 3 Analog output ΔT (optional) | 4 Error output | 5 Interface (M-Bus) | 6 Interface (optional, RS485 / MODBUS) | 7 Input for temperature sensor T1 (forward flow) | 8 Input for temperature sensor T2 (reverse flow) |

Inputs

2 x Pt100 temperature sensors in a four-wire circuit

Either Pt100 resistance thermometers or temperature transmitters can be connected to the temperature sensor inputs.

IMPORTANT (NOTE)

The type of connection required (Pt100, transmitter) for the temperature sensor inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

Output

M-Bus, optional analog outputs and RS485 / RS232 for MODBUS protocol.

Additional applications (e.g., totalizing) and technical details for the FCU400-P available on request.

Data logger

1 or 2 counters.
Storage of process variables over 200 periods; programmable time window:

- Instantaneous values
- Minimum and maximum values
- Mean values

Saving

Counter readings saved in the event of a power failure.

Pulse output

2 pulse outputs.

3 Mounting

3.1 Operating conditions at installation site

IMPORTANT (NOTE)
Before installation, check whether the ambient conditions at the installation site are within the permissible limits.
See "Specifications" chapter.

3.2 Installation in a panel

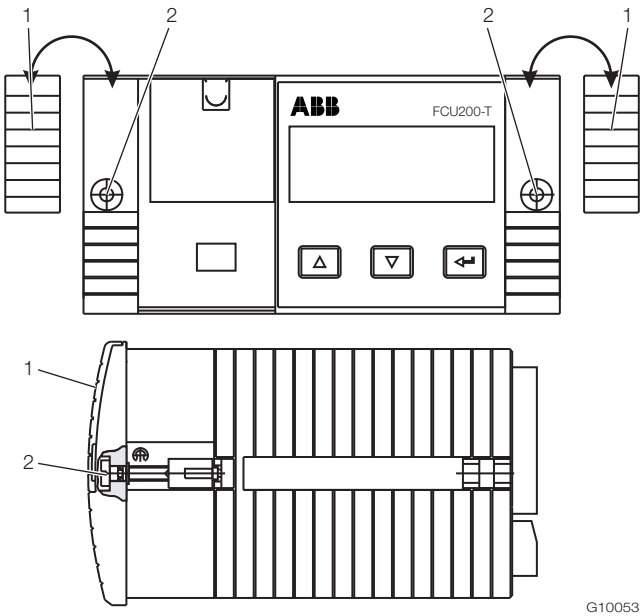


Fig. 10: Installation in panel
1 Cover | 2 Fixing screw

1. If one if not already present, create a panel cutout measuring (width x height) 139 mm x 69 mm (5.47 inch x 2.72 inch).
2. Remove the covers on both sides.
3. Insert the device in the panel cutout from the front and secure it using the fixing screws.
4. Replace the covers on both sides.

3.3 Wall mounting on a 35 mm DIN top-hat rail

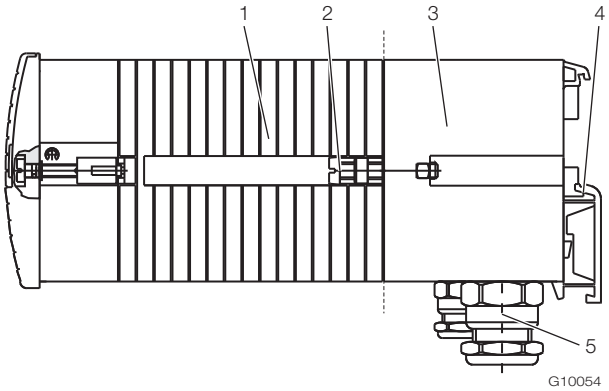


Fig. 11: Installation on DIN top-hat rail
1 Measurement computer | 2 Fixing screw | 3 Base | 4 DIN top-hat rail support | 5 Cable glands

1. Snap the base into place on the DIN top-hat rail.
2. Guide the connection lines for the signals and power supply through the cable glands and into the base (around 50 mm (approx. 2 inch) of the lines need to be in the base in order to connect them).
3. Install the plug-in terminals in accordance with the specifications in the "Electrical connections" chapter and plug the measurement computer into them.
4. Place the measurement computer on the base and secure it using the fixing screws.

NOTICE – Damage to connection lines!
Damage to connection lines due to improper installation.
During installation, make sure that the connection lines in the base are not damaged.

4 Electrical connections

4.1 General remarks

Please observe the following points:

- The line voltage and current consumption are indicated on the name plate for the measurement computer.
- A circuit breaker with a maximum rated current of 16 A must be installed in the power supply lead of the measurement computer.
- The wire cross-section of the power supply lead and the circuit breaker used must comply with VDE 0100 and must be dimensioned in accordance with the current consumption of the measurement computer. The leads must comply with IEC 227 and/or IEC 245.
- The circuit breaker should be located near the measurement computer and marked as belonging to the device.
- A suitable line switch must also be installed within reach of the installation location. The line switch must be capable of fully isolating the measurement computer from the power supply (all poles; L, N). The protective conductor must not be isolated.
- Please remember that there is a voltage drop associated with long lead lengths and small lead cross-sections. The voltage at the terminals of the device may not fall below the minimum value required.
- Complete the electrical connection according to the connection diagram.

4.2 Installing extension modules

WARNING – Live connections!
Risk due to exposed live connections when device is open.

- Before opening the device, switch off the power supply.
- Condensers in the device will be live even after the power supply has been switched off.
- Only suitably trained specialist personnel may carry out work on the device.

NOTICE – Potential damage to device!
Damage to device due to static electricity (ESD). Make sure that ESD protection measures are in place when working on the device.

The extension modules are inserted in the slots on the main board.

	Slot			
Module	1	2	3	4
101 2 x current inputs (EX1, EX2) with transmitter power supplies (Us1, Us2)	X	X	-	-
107 4 x voltage inputs (EX1 … EX4, only in the case of FCU400-IR)	X	X	X	-
108 4 x current inputs (EX1 … EX4)	X	-	-	-
102 2 x analog outputs (AX1 … AX2), 2 x limit monitors (ABX1 … ABX2)	-	X	X	X
105 RS485 / RS232 card (Modbus)	X	X	X	X
106 2 x transmitter power supplies (Us1, Us2)	X	X	X	X

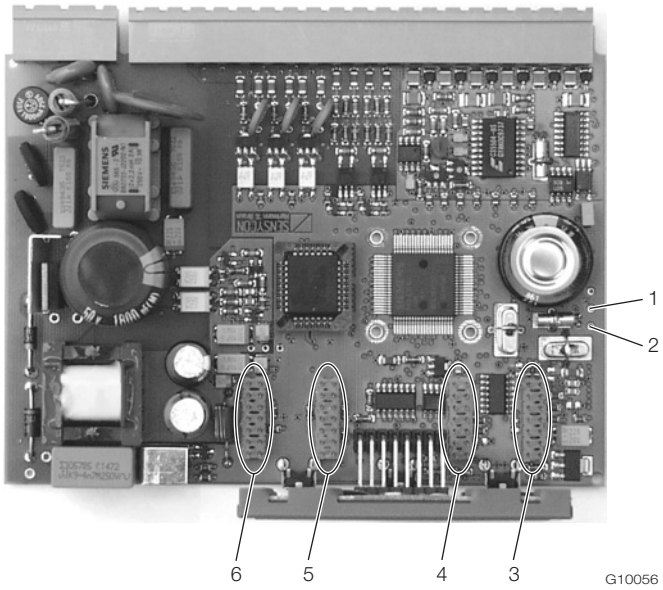


Fig. 12: Slot positions
1 RxD soldering point (red) | 2 TxD soldering point (green) | 3 Slot 1 | 4 Slot 2 | 5 Slot 3 | 6 Slot 4

1. Switch off and remove the device.
2. Separate the device from the base (only in the case of DIN top-hat rail installation).
3. Unscrew the fixing screws from the rear panel and remove the rear panel.
4. Pull out the main board.
5. Insert the extension module in the corresponding slot on the main board.

IMPORTANT (NOTE)
When installing extension module 105 (RS485/232 interface), the signal lines of the extension module must be soldered to points RxD / TxD on the main board.

6. Make an appropriate aperture in the rear panel.
7. Insert the main board together with the extension module in the housing.
8. Replace the rear wall and screw it in place.
9. Place the measurement computer on the base and secure it using the fixing screws (only in the case of DIN top-hat rail installation).
10. Install the device and connect the extension module.
11. Commission the device.

4.3 Basic device

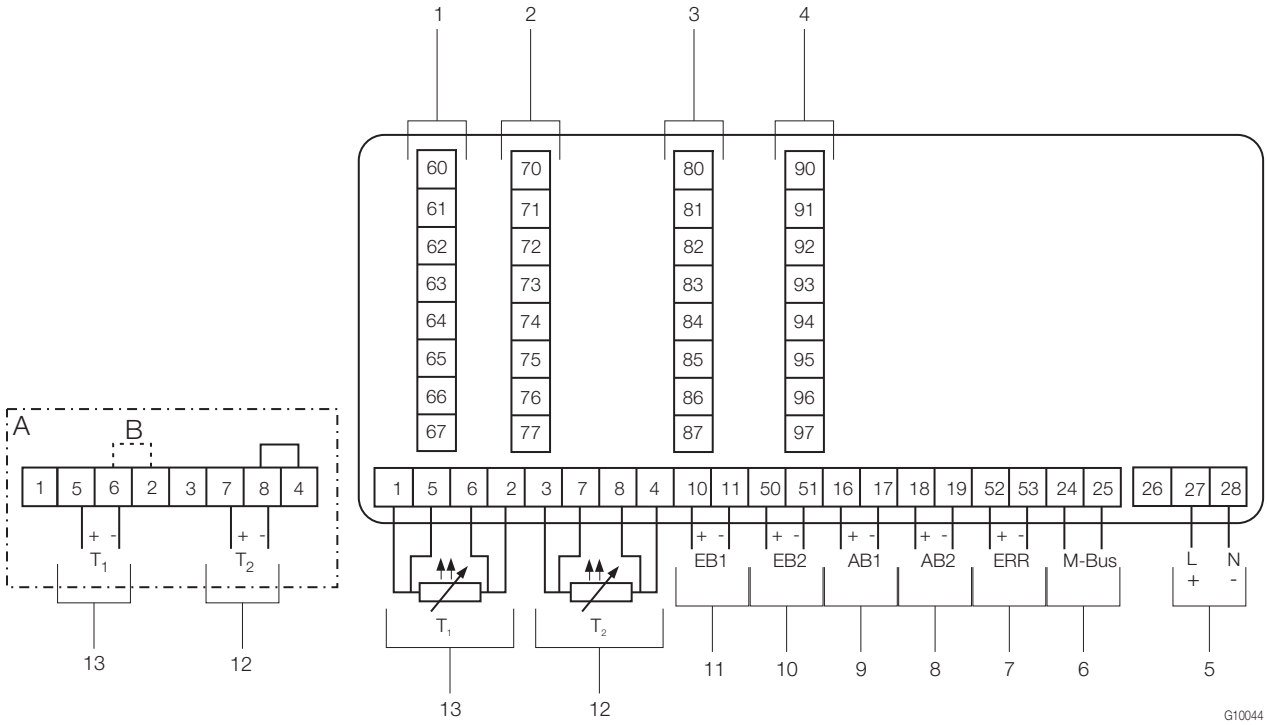


Fig. 13
A Alternative connection for temperature transmitters with active current output | B Jumper
1 Slot 1 | 2 Slot 2 | 3 Slot 3 | 4 Slot 4 | 5 Power supply | 6 Interface (M-Bus) | 7 Error output | 8 Pulse output AB2 | 9 Pulse output AB1 | 10 Pulse / frequency input EB2 | 11 Pulse / frequency input EB1 | 12 Temperature sensor input T2 (Pt100 or 0 / 4 ... 20 mA) | 13 Temperature sensor input T1 (Pt100 or 0 / 4 ... 20 mA)

IMPORTANT (NOTE)

If the temperature transmitters are electrically connected, there is no jumper B (between terminals 6 and 2).
The type of connection required (Pt100 or transmitter) for the temperature sensor inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

4.4 Supply and interface card (FCU200-W, FCU200-T, FCU400-S, FCU400-G, FCU400-P)

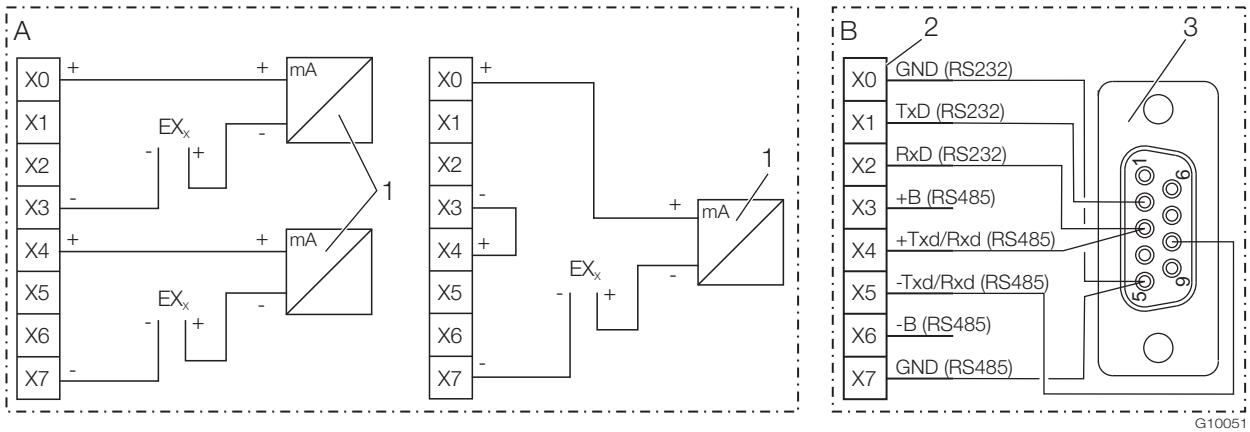


Fig. 14
A Power supply card | B Interface card RS232 / RS485
1 Transmitter in two-wire technology with current output | 2 Terminal strip for interfaces | 3 D-sub female connector, 9-pin

IMPORTANT (NOTE)

A power supply card can supply either two transmitters with 20 V or one transmitter with 40 V (jumper between X3/X4).
The X in the terminal designation of the extension cards must be replaced with 7, 8, or 9 (depending on the selected slot; see also "Electrical connections / Basic device").

4.5 FCU200-W

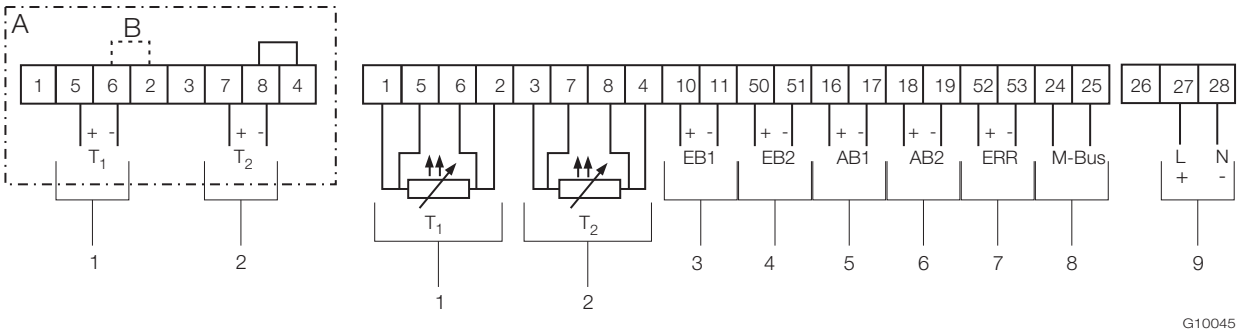


Fig. 15: Connection diagram, FCU200-W basic device
A Alternative connection for temperature transmitters with active current output | B Jumper
1 Input for temperature sensor in forward flow (heat) | 2 Input for temperature sensor in reverse flow (cold) | 3 Input for flowmeter Q_V | 4 Input for second flowmeter (DTF signal) | 5 Pulse output AB1 (energy) | 6 Pulse output AB2 (flow) | 7 Error output | 8 Interface (M-Bus) | 9 Power supply

IMPORTANT (NOTE)

If the temperature transmitters are electrically connected, there is no jumper B (between terminals 6 and 2).
The type of connection required (Pt100 or transmitter) for the temperature sensor inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

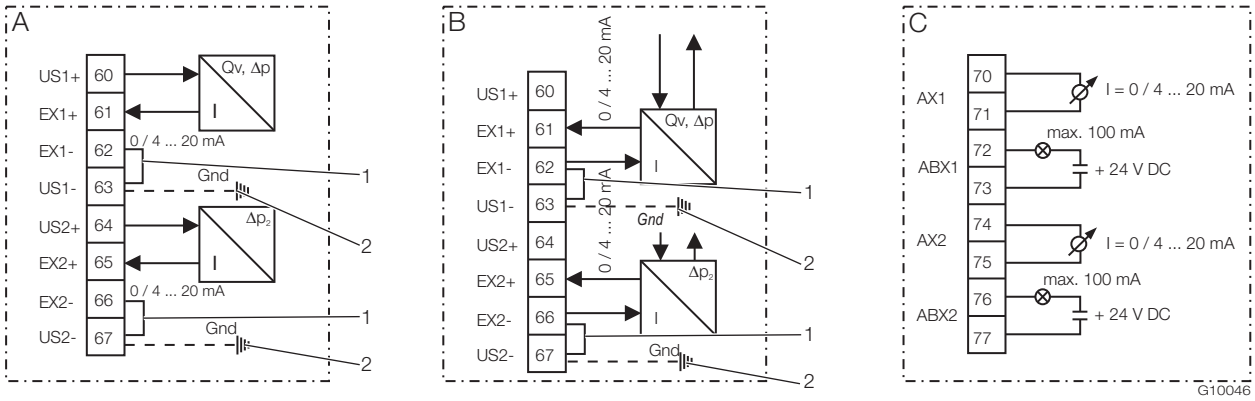


Fig. 16: Connection diagram for extension modules FCU200-W (example)
A Current input module for transmitters in two-wire technology; 16 V, 23 mA supply |
B Current input module for transmitters in four-wire technology, external supply | C Current output module
1 External jumper | 2 Optional ground connection for potential equalization rail (Gnd)

4.6 FCU400-S

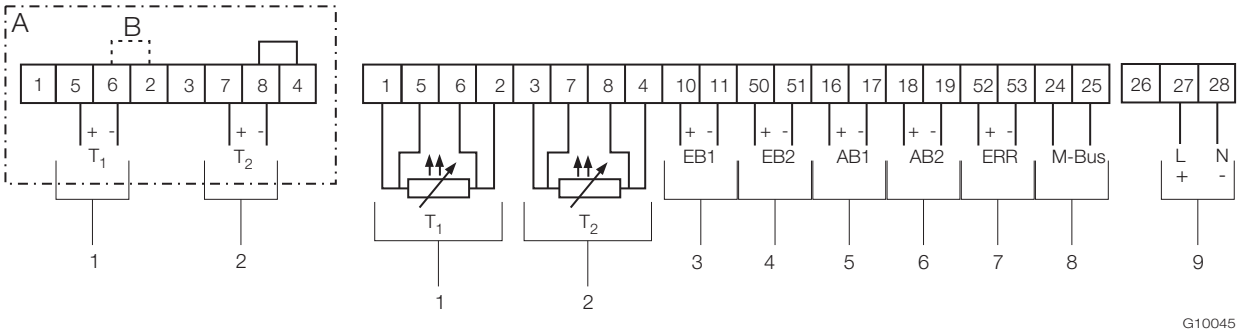


Fig. 17: Connection diagram, FCU400-S basic device
A Alternative connection for temperature transmitters with active current output | B Jumper
1 Input for temperature sensor in steam forward flow | 2 Input for temperature sensor in condensate reverse flow | 3 Pulse / frequency input EB1 (flow) | 4 Pulse / frequency input EB2 (flow) | 5 Pulse output AB1 | 6 Pulse output AB2 | 7 Error output | 8 Interface (M-Bus) | 9 Power supply

IMPORTANT (NOTE)

If the temperature transmitters are electrically connected, there is no jumper B (between terminals 6 and 2).
The type of connection required (Pt100 or transmitter) for the temperature sensor inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

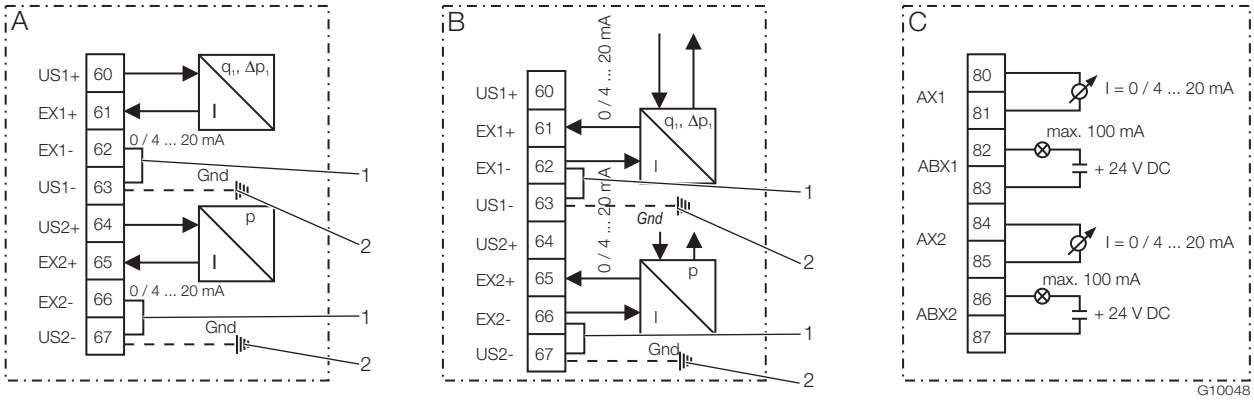


Fig. 18: Connection diagram for FCU400-S extension modules (pressure and flow transmitters)
A Current input module for transmitters in two-wire technology; 16 V, 23 mA supply |
B Current input module for transmitters in four-wire technology, external supply | C Current output module
1 External jumper | 2 Optional ground connection for potential equalization rail (Gnd)

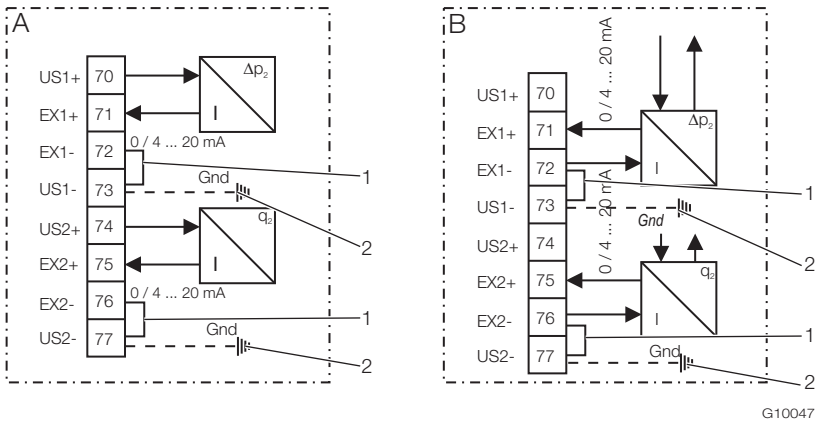


Fig. 19: Connection diagram for FCU400-S extension modules (Δp_2, condensate flow)
A Current input module for transmitters in two-wire technology; 16 V, 23 mA supply |
B Current input module for transmitters in four-wire technology, external supply | C Current output module
1 External jumper | 2 Optional ground connection for potential equalization rail (Gnd)

4.7 FCU400-G

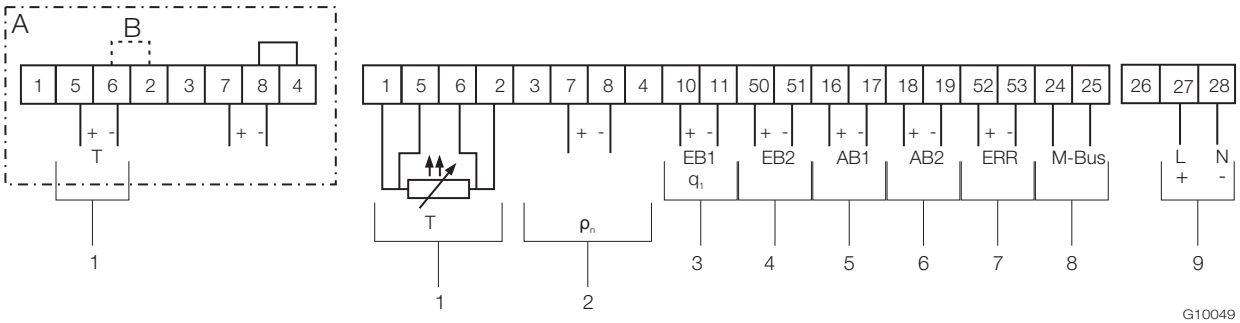


Fig. 20: Connection diagram, FCU400-G basic device
A Alternative connection for temperature transmitters with active current output | B Jumper
1 Input for temperature sensor | 2 Transmitter input for standard gas density |
3 Pulse / frequency input EB1 (flow) | 4 Pulse / frequency input EB2 | 5 Pulse output AB1 | 6 Pulse output AB2 | 7 Error output |
8 Interface (M-Bus) | 9 Power supply

IMPORTANT (NOTE)

If the temperature transmitters are electrically connected, there is no jumper B (between terminals 6 and 2).
The type of connection required (Pt100 or transmitter) for the temperature sensor inputs must be specified when ordering the device. It is not possible to change the type of connection on site.

4.8 FCU200T

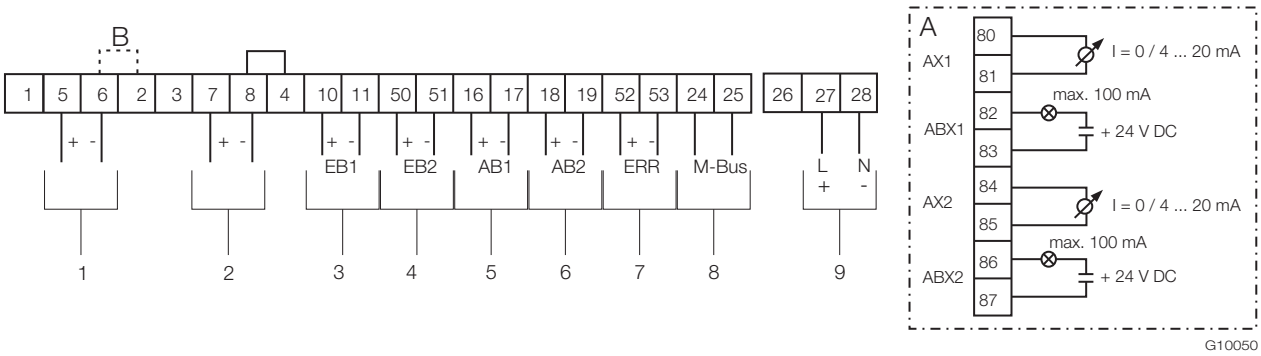


Fig. 21: Connection diagram, FCU200-T basic device
A Current output module (optional) | B Jumper
1 Input 1 for transmitters with active current output | 2 Input 2 for transmitters with active current output | 3 Pulse / frequency input EB1 |
4 Pulse / frequency input EB2 | 5 Pulse output AB1 | 6 Pulse output AB2 | 7 Error output | 8 Interface (M-Bus) | 9 Power supply

IMPORTANT (NOTE)

If the transmitters are electrically connected, there is no jumper B (between terminals 6 and 2).

5 Commissioning

5.1 Checks prior to commissioning

Before switching on the device for the first time, check the following:

- Make sure that the measurement computer has been installed correctly.
- Make sure that all electrical connections have been established correctly.
- Make sure that the power supply for the measurement computer matches the specifications (voltage, frequency) on the name plate of the measurement computer.

5.2 Switching on the device

1. Switch on the power supply.

The start menu appears on the LCD display when the power supply is switched on.

2. Select the "Date / Time" menu and set the current date and time. Please observe the information in the "Operation" and "Parameterization" chapters.
3. Select the required process display (totalizer, physical variables, electrical variables, etc.).

6 Operation

6.1 Menu navigation

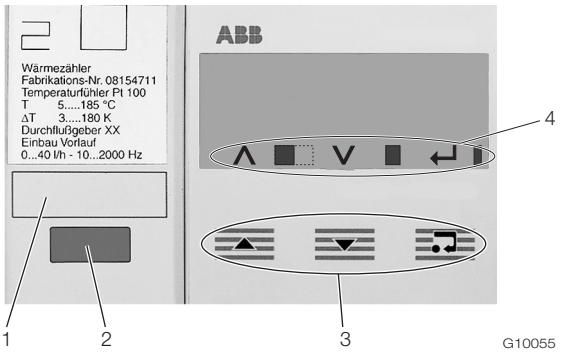


Fig. 22: LCD display

1 Label area | 2 Optical data interface | 3 Operating buttons for menu navigation | 4 Toolbar

Toolbar

The toolbar displays device functions and messages in the form of various icons.

Symbol	Meaning
Λ	Function "Increment value" active for operating button ▲.
■	Device is operating if the width of the icon is constantly changing.
V	Function "Increment value" active for operating button ▼.
■	Error messages present.
↵	Function "Enter" active for operating button ↵.
▮	Write access to EEPROM.

Control button functions

You can use the ▲ or ▼ operating buttons to browse through the menu or select/change a number or character within a parameter value.
Depending on your position in the menu, the operating buttons may have other functions.

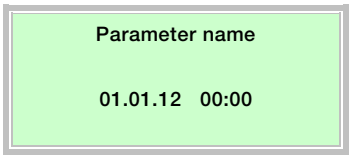
Symbol	Meaning
▲	– Go back one submenu – Increase numerical values (increment, in conjunction with icon Λ) – Select the next position for entering numerical and alphanumeric values
▼	– Go forward one submenu – Decrease numerical values (decrement, in conjunction with icon V) – Select the previous position for entering numerical and alphanumeric values
↵	– Call up submenu – Select parameter value for changing purposes – Confirm parameter value – Exit submenu

6.2 Selecting and changing parameters

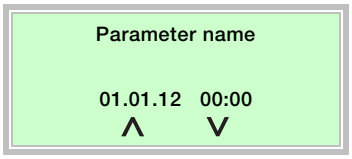
The device parameters are set by means of the FCOM200 parameterization software (ParaTool).
Only a few basic parameters (date / time, bus address, password, etc.) can be set on the device itself.

Numerical entry

When a numerical entry is made, a value is set by entering the individual decimal positions.



1. Select the parameters you want to set in the menu.
2. Use  to call up the parameter for editing. The first digit is shown flashing.

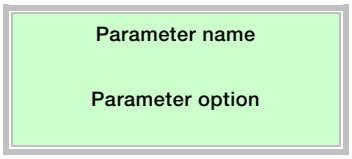


3. Use  or  to set the required value.
4. Use  to select the next decimal position.
5. If necessary, select and set other decimal positions using the same procedure as described in steps 3 and 4.
6. Use  to confirm your settings.

This concludes the procedure for changing a parameter value.

Choosing between several options

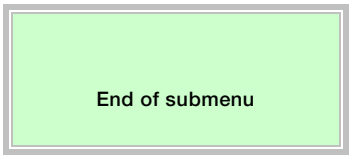
When presented with several options, you can scroll through them by pressing  repeatedly.



1. Select the parameters you want to set in the menu.
2. You can select the required parameter option by pressing  repeatedly.
3. Use  to confirm the setting and proceed to the next submenu.

Returning to the main menu

If nothing more is available in the submenu, "End of submenu" is shown on the LCD display.



Use  to call up the main menu.

6.3 Safety levels

The measurement computer parameters are protected against unauthorized access by means of various safety levels.
The safety level that is currently active is displayed in "Service / Status menu".

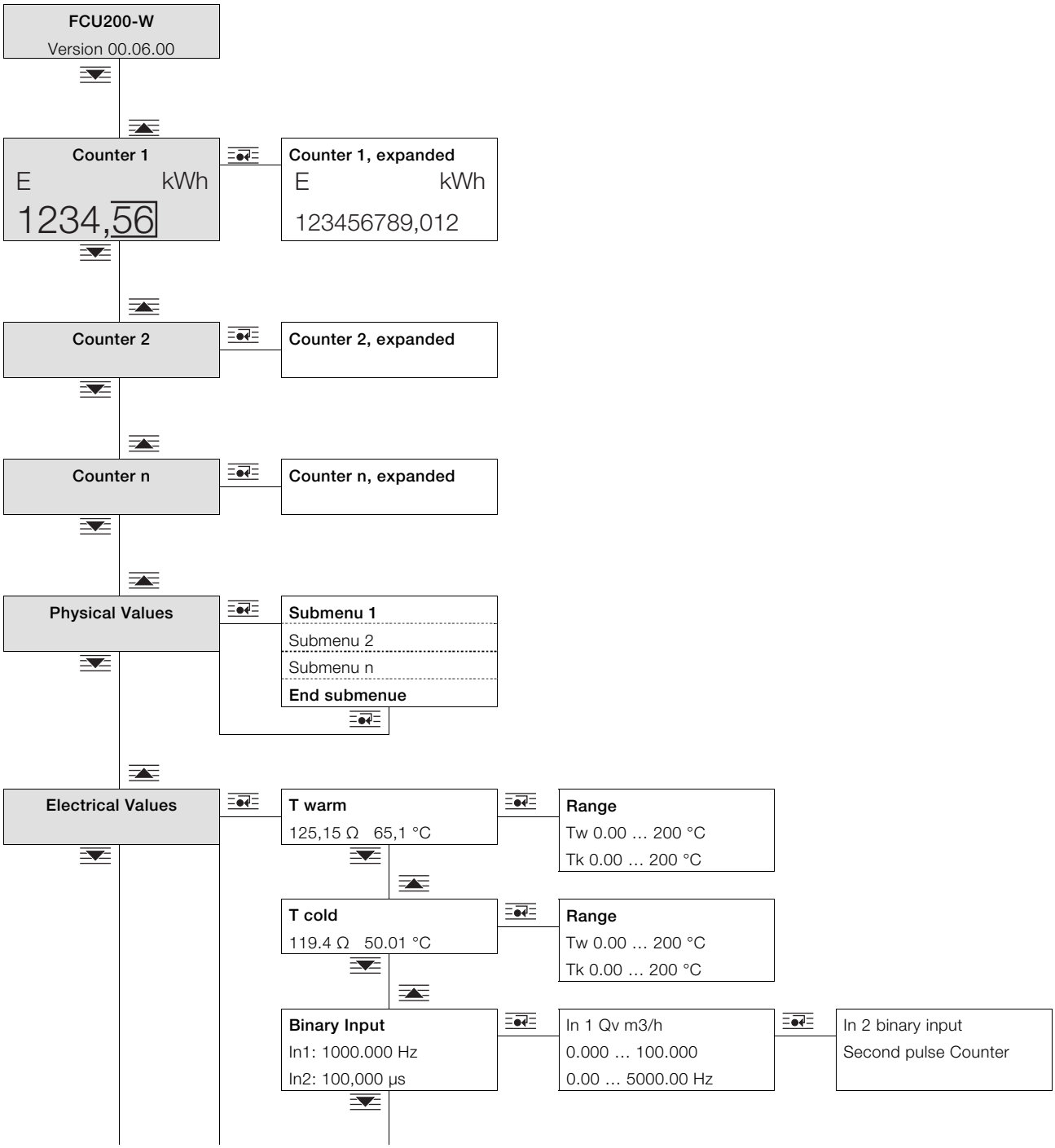
Level	Name	Description
S1	Production	For Production and Service only.
S3	Password lock	Some menus and parameters can only be accessed once the password has been entered.
S4	Free	All menus and parameters can be accessed.

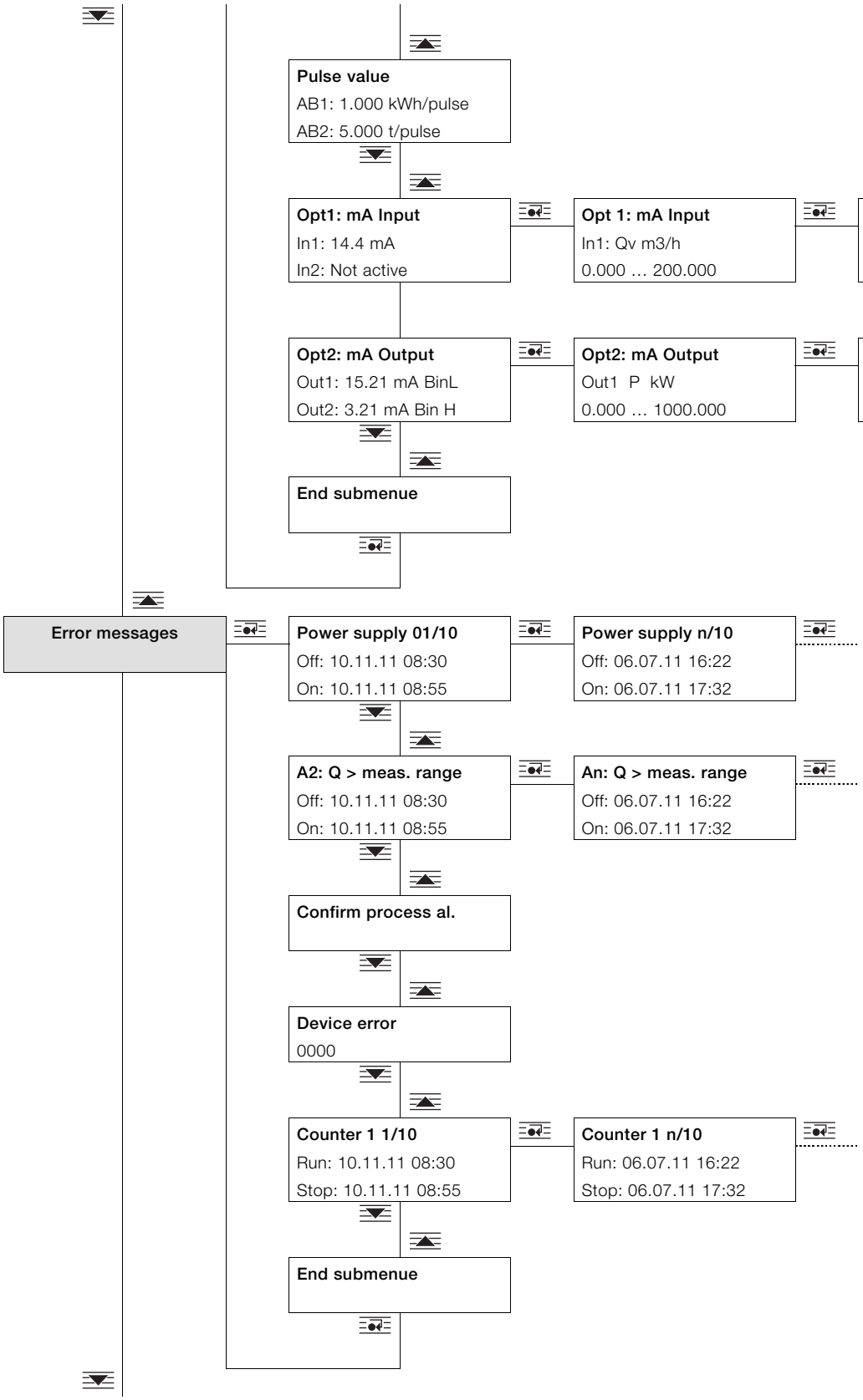
The password is entered in the "Password" menu.

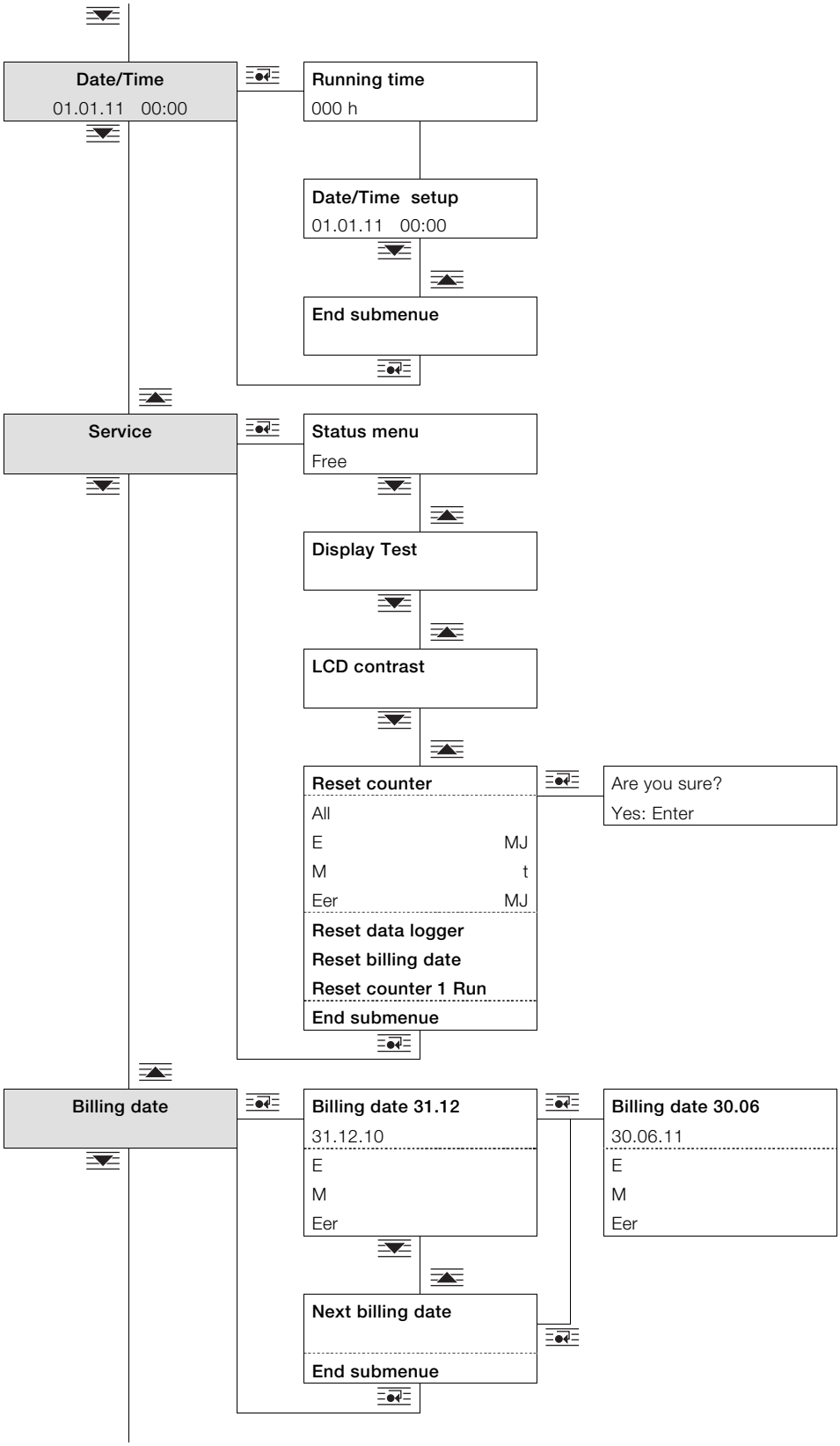
7 Configuration, parameterization

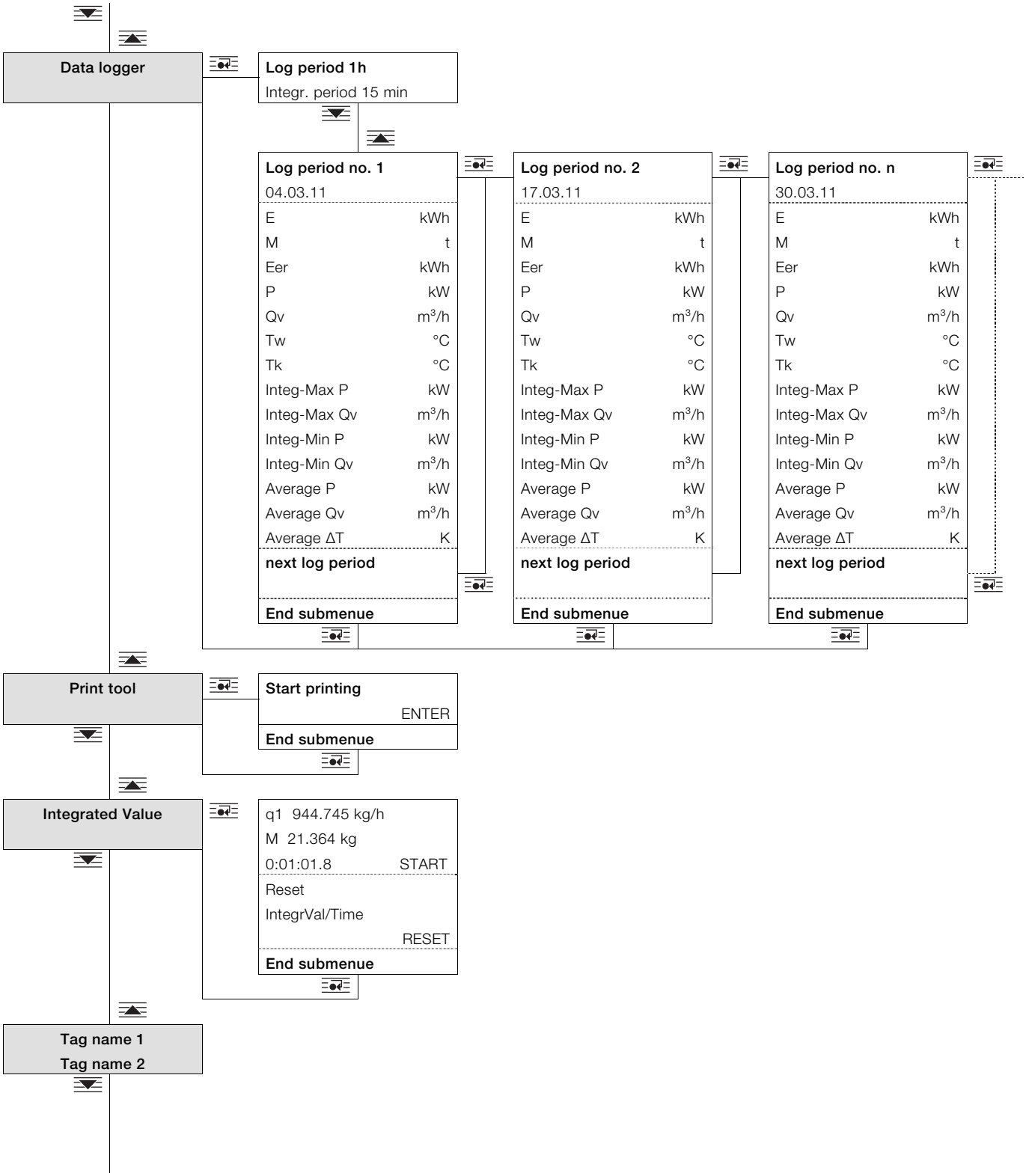
7.1 Parameter overview

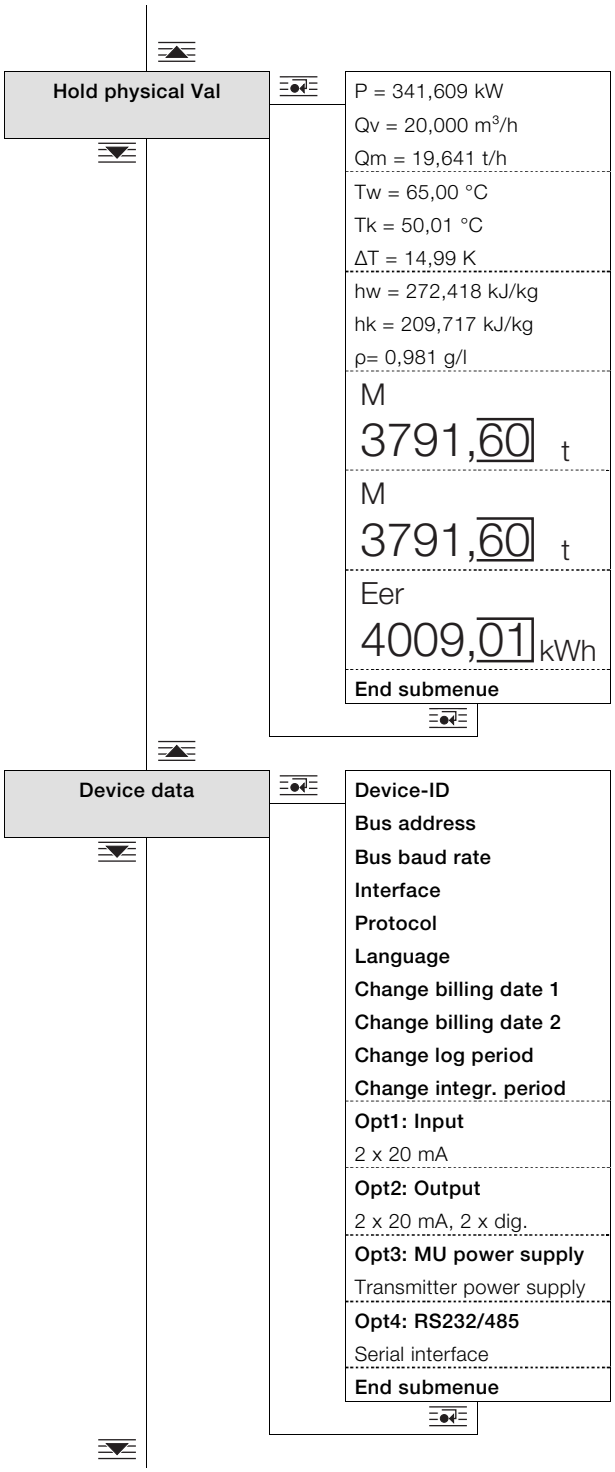
IMPORTANT (NOTE)
This overview of parameters shows all the menus and parameters available on the device. Depending on the version and configuration of the device, not all of the menus and parameters may be visible on it.

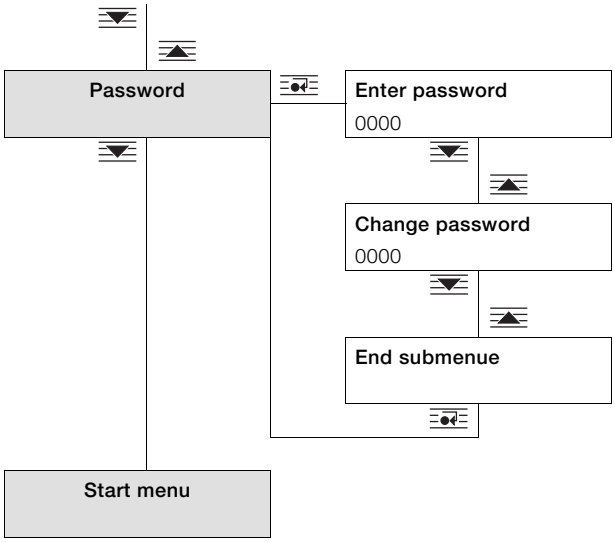



Pulse value
AB1: 1.000 kWh/pulse
AB2: 5.000 t/pulse
Opt1: mA Input
In1: 14.4 mA
In2: Not active
Opt 1: mA Input
In1: Qv m3/h
0.000 ... 200.000
Opt 1: mA Input
In2: Not active
Opt2: mA Output
Out1: 15.21 mA BinL
Out2: 3.21 mA Bin H
Opt2: mA Output
Out1 P kW
0.000 ... 1000.000
Opt2: mA Output
Out2 Qv m3/h
0.000 ... 180.000
End submenue
Error messages
Power supply 01/10
Off: 10.11.11 08:30
On: 10.11.11 08:55
Power supply n/10
Off: 06.07.11 16:22
On: 06.07.11 17:32
A2: Q > meas. range
Off: 10.11.11 08:30
On: 10.11.11 08:55
An: Q > meas. range
Off: 06.07.11 16:22
On: 06.07.11 17:32
Confirm process al.
Device error
0000
Counter 1 1/10
Run: 10.11.11 08:30
Stop: 10.11.11 08:55
Counter 1 n/10
Run: 06.07.11 16:22
Stop: 06.07.11 17:32
End submenue


Date/Time
01.01.11 00:00
Running time
000 h
Date/Time setup
01.01.11 00:00
End submenue
Service
Status menu
Free
Display Test
LCD contrast
Reset counter
All
E MJ
M t
Eer MJ
Reset data logger
Reset billing date
Reset counter 1 Run
End submenue
Are you sure?
Yes: Enter
Billing date
Billing date 31.12
31.12.10
E
M
Eer
Billing date 30.06
30.06.11
E
M
Eer
Next billing date
End submenue


Data logger
Log period 1h
Integr. period 15 min
Log period no. 1
04.03.11
E kWh
M t
Eer kWh
P kW
Qv m³/h
Tw °C
Tk °C
Integ-Max P kW
Integ-Max Qv m³/h
Integ-Min P kW
Integ-Min Qv m³/h
Average P kW
Average Qv m³/h
Average ΔT K
next log period
End submenue
Log period no. 2
17.03.11
E kWh
M t
Eer kWh
P kW
Qv m³/h
Tw °C
Tk °C
Integ-Max P kW
Integ-Max Qv m³/h
Integ-Min P kW
Integ-Min Qv m³/h
Average P kW
Average Qv m³/h
Average ΔT K
next log period
End submenue
Log period no. n
30.03.11
E kWh
M t
Eer kWh
P kW
Qv m³/h
Tw °C
Tk °C
Integ-Max P kW
Integ-Max Qv m³/h
Integ-Min P kW
Integ-Min Qv m³/h
Average P kW
Average Qv m³/h
Average ΔT K
next log period
End submenue
Print tool
Start printing
ENTER
End submenue
Integrated Value
q1 944.745 kg/h
M 21.364 kg
0:01:01.8 START
Reset
IntegrVal/Time
RESET
End submenue
Tag name 1
Tag name 2


Hold physical Val
P = 341,609 kW
Qv = 20,000 m³/h
Qm = 19,641 t/h
Tw = 65,00 °C
Tk = 50,01 °C
ΔT = 14,99 K
hw = 272,418 kJ/kg
hk = 209,717 kJ/kg
ρ= 0,981 g/l
M
3791,60 t
M
3791,60 t
Eer
4009,01 kWh
End submenue
Device data
Device-ID
Bus address
Bus baud rate
Interface
Protocol
Language
Change billing date 1
Change billing date 2
Change log period
Change integr. period
Opt1: Input
2 x 20 mA
Opt2: Output
2 x 20 mA, 2 x dig.
Opt3: MU power supply
Transmitter power supply
Opt4: RS232/485
Serial interface
End submenue


Password
Enter password
0000
Change password
0000
End submenue
Start menu

7.2 Parameter descriptions

7.2.1 Menu: Start menu

... / Start menu

Menu / Parameter	Value range	Description
FCU200-W Version 00.06.00	-	The start menu appears on the LCD display when the device is switched on. The first line shows the device name and the second line the software version.

7.2.2 Menu: Counter

IMPORTANT (NOTE)

The number and type of totalizers present depend on the device version and configuration settings.

- FCU200-W: maximum of 3 counters
- FCU400-S: maximum of 5 counters
- FCU400-G: maximum of 1 counter
- FCU200-T: maximum of 1 counter per channel
- Maximum of 6 counters in the case of customer-specific application programs.

... / counter 1...6

Menu / Parameter	Value range	Description
Counter 1 ... 6 Display versions (examples)	-	If the counter value becomes too large for the standard display, the system automatically switches to an expanded display with smaller numbers. Alternatively, you can use ⇄ to switch to the expanded display manually. The counter display is configured using the parameterization software. A maximum of 12 numbers may be displayed. Up to 9 may be displayed before the decimal point, and up to 6 after the decimal point, but the total may not exceed 12 numbers.
E kWh 1234,56	Standard	
E kWh 12345678,90	Expanded, with small numbers	
E kWh 123456789,012	Maximum display, 12 numbers	

Model	Counter	Unit	Description
FCU200-W	Counter 1	E	Energy
	Counter 2	V or M	Volume or mass
	Counter 3	Optional counter	Freely configurable
FCU400-S	Counter 1	E1	Steam energy
	Counter 2	M1	Steam mass
	Counter 3	ΔE	Energy balance (steam - condensate)
	Counter 4	E2	Condensate energy
	Counter 5	M2	Condensate mass
FCU400-G	Counter 1	Vn, Vs	Standard volume
FCU200-T	Counter 1 (channel 1)	f (E1)	Dependent on channel 1
	Counter 2 (channel 2)	f (E2)	Dependent on channel 1

7.2.3 Menu: Physical Values

... / Physical Values

Menu / Parameter	Value range	Description
Submenu 1 Submenu 2 … Submenu n	See table	Displays all physical input and output variables, plus the process variables calculated by the measurement computer. The number of submenus available, and the type and number of physical variables displayed, depend on the device version and configuration settings.

Model	Submenu	Unit (description)
FCU200-W	Submenu 1	P (power), Qm (mass flow), Qv (volume flow)
	Submenu 2	Tw (temperature warm), Tk (temperature cold), ΔT (temperature difference)
	Submenu 3	hw (enthalpy warm), hk (enthalpy cold), ρ (density)
	Submenu 4	Cpk (specific thermal capacity = f(Tk) only in the case of brine / oil), Cpw (specific thermal capacity = f(Tw) only in the case of brine / oil)
	Submenu 5	Δp1 (differential pressure), Δp2 (differential pressure), only in the case of differential pressure measurement
FCU400-S	Submenu 1	P1 (steam power), Qv1 (steam volume flow), Qm1 (steam mass flow)
	Submenu 2	T1 (steam temperature), P1a (steam absolute pressure), h1 (steam enthalpy)
	Submenu 3	ρ1 (steam density = f(P1a, T1)), Δp1 (differential pressure 1), Δp2 (differential pressure 2)
	Submenu 4	P2 (condensate power), ΔP (power balance: steam - condensate), Qm2 (condensate mass flow)
	Submenu 5	Qv2 (condensate volume flow), T2 (condensate temperature)
	Submenu 6	h2 (condensate enthalpy), ρ2 (condensate density = f(T2, p = const.))
	Submenu 7	Lcor (expansion rate correction factor), Ccor (flow coefficient correction factor), only in the case of differential pressure measurement
FCU400-G	Submenu 1	Qn (standard volume flow), Qv (operating volume flow), T (gas temperature)
	Submenu 2	p (gas pressure), Δp1 (differential pressure 1), Δp2 (differential pressure 2), only in the case of differential pressure measurement
	Submenu 3	Z (compressibility factor), Lcor (expansion rate correction factor), Ccor (flow coefficient correction factor), only in the case of differential pressure measurement
FCU200-T	Submenu 1	E1 (input variable, channel 1), E2 (input variable, channel 2)

7.2.4 Menu: Electrical values

Displays all input and output signals.

The number of submenus available, and the type and number of signals displayed, depend on the device version and configuration settings.

... / Electrical values

Menu / Parameter	Value range	Description
T warm	Ω, °C	Displays signals from temperature sensor input 1 (Pt100).
		Displays the configured measuring ranges for temperature sensor input 1.
T cold	Ω, °C	Displays signals from temperature sensor input 2 (Pt100).
		Displays the configured measuring ranges for temperature sensor input 2.
Binary Input	Hz, µS	Displays signals from pulse / frequency input EB1 (IN1) and EB2 (IN2).
	1x	Displays the configured measuring ranges for input EB1 (IN1).
	2x	Displays the configured measuring ranges for input EB2 (IN2).
Pulse Factor	kWh/Imp, t/Imp, etc.	Displays the pulse factor of pulse output AB1 and AB2.
Opt1: mA Input	Dependent on type of extension module	Displays type of extension module in slot 1.
	1x	Displays configured measuring ranges for input 1 of extension module in slot 1.
	2x	Displays configured measuring ranges for input 2 of extension module in slot 1.
Opt2: mA Output	Dependent on type of extension module	Displays type of extension module in slot 2.
	1x	Displays configured measuring ranges for input 1 of extension module in slot 2.
	2x	Displays configured measuring ranges for input 2 of extension module in slot 2.
End submenu		Back to main menu item "Electrical values".

7.2.5 Menu: Error messages

Displays device error messages.

For more detailed information about the error messages, refer to the "Error messages" chapter.

... / Error messages

Menu / Parameter	Value range	Description
Power supply 01/10 Off Date Time On Date Time	-	Displays the most recent failure and restoration of power supply together with date / time. The 10 most recent failures are stored.
		Select the previous power supply failures (2 … 10).
Process errors Off Date Time On Date Time	-	Displays the most recent process error and error resolution information (if it was resolved), plus the date / time the error occurred. The 10 most recent process errors are stored.
		Select the previous process errors (2 … 10).
Confirm process al.		Deletes the process errors (after confirmation of the prompt using).
Device error 0000	Binary-coded	Displays the internal device errors. The errors are displayed in binary-coded format.
Counter n 1/10 Run Date Time Stop Date Time	-	Displays the most recent counter standstill plus date / time and information on the counter restart. The 10 most recent counter standstills are stored.
		Select the previous totalizer standstills (2 … 10).
End submenu		Back to main menu item "Error messages".

7.2.6 Menu: Date/Time

... / Date/Time

Menu / Parameter	Value range	Description
Running time 0000h	h	Displays the operating hours.
Date/Time setup [1] 00.00.00 00:00	dd.mm.yy, hh:mm	Date and time setting (numerical entry).
End submenu		Back to main menu item "Date / Time".

1) Safety level S3: Submenu can be accessed once the password has been entered.

7.2.7 Menu: Service

... / Service

Menu / Parameter	Value range	Description
Status menu	Free, Fabrication, locked	Displays the active password level. — Free: All customer-related parameters can be changed. — Fabrication: As with "Free", except that additional menus and parameters for Production and Service can be accessed. — Locked: All customer-related parameters can be changed once the password has been entered.
Display Test		Activates the display test.
LCD contrast	1 … 15	Display contrast setting (selected from several options).
Reset counter		Deletes all counter readings (after confirmation of the prompt using).
Reset counter1 … 6 Individual counter (example)		Deletes individual counter readings (after confirmation of the prompt using). The number (1 … 6) of counter readings that can be deleted individually depends on the device version and configuration.
Reset data logger		Deletes all measured values stored by the data logger (after confirmation of the prompt using).
Reset billing date		Deletes all measured values stored for the billing dates (after confirmation of the prompt using).
Reset counter 1 Run		Deletes the filling capacity counter (only in the case of FCU200-T, after confirmation of the prompt using).
End of submenu		Back to main menu item "Service".

7.2.8 Menu: Billing date

... / Billing date

Menu / Parameter	Value range	Description
Billing date 31.12. 31.12.11	-	Displays billing date 1 with the date.
		Switches between display of billing date 2 and billing date 1.
Counter reading for counter 1 ... n		Displays the counter readings for the selected billing date. The number and type of counters present depend on the device version and configuration settings.
End submenu		Back to main menu item "Billing date".

7.2.9 Menu: Data logger

The data logger stores a range of process variables together with the date and time. The data sets are stored in a ring buffer containing 128 slots (in the case of FCU200-W, FCU400-S) or 200 slots (in the case of FCU200-T, FCU400-G). If all the slots are occupied, the oldest entry in each case is overwritten. A storage interval (log period) between 1 hour and 3 months can be configured.

... / Data logger

Menu / Parameter	Value range	Description
Log period 1h Integr. period 15 min	-	Displays the configured log period and the integration time for calculating minimum, maximum, and average values. The values can be set in the "Device Data" menu.
		
Log period no. 1 ... n 00.00.00 00:00	-	Displays the log period that is currently selected, together with the time stamp.
		Switches to the next log period.
Data display	-	Displays the data for the log period that is currently selected. Depending on the device version, the following data is stored: — Instantaneous values (all values) — Maximum and minimum values (selected values) — Mean values (selected values)
Next Log-Period		Switches to the next log period.
End submenu		Back to main menu item "Data logger".

7.2.10 Menu: Print tool

The print function is used to output current data to a printer via the infrared interface.

... / Print tool

Menu / Parameter	Value range	Description
Start printing Enter		Outputs the current data via the infrared interface. The following data is output: — Serial number — Date and time — Measuring point identification — Counters — Physical variables
End submenu		Back to main menu item "Print tool".

7.2.11 Menu: Integrated value

Only in the case of FCU200-T.

... / Integrated value

Menu / Parameter	Value range	Description
q1 999.999 kg/h M 12.345 kg 0:01:01.8 Start	-	Displays the current flow of flowmeter q1 in the first line. Displays the current values (filling capacity, total time) for flowmeter q1 in the second and third lines.
		Starts/stops the measurement.
Reset Integrated value / Time Reset		Deletes the totalizer readings (filling capacity, total time). The display returns to the previous menu.
End submenu		Back to main menu item "Integrated value".

7.2.12 Menu: Tag name 1

... / Tag name 1

Menu / Parameter	Value range	Description
Tag name 1 Tag name 1	Alphanumeric, max. 20 characters.	Displays the configured measuring point identification. The text can only be entered using the parameterization software.

7.2.13 Menu: Hold physical values

The process variables displayed here are frozen when the menu is selected. This enables the device data and calculations to be checked and, where necessary, noted down by hand.

... / Hold physical values

Menu / Parameter	Value range	Description
Submenu 1 Submenu 2 … Submenu n	-	Displays all physical input and output variables, plus the process variables calculated by the measurement computer, at the point when the menu is called. The number of submenus available, and the type and number of physical variables displayed, depend on the device version and configuration settings.
End submenu		Back to main menu item "Hold physical values".

7.2.14 Menu: Device Data

... / Device Data

Menu / Parameter	Value range	Description
Fabrication number	-	Displays the serial number of the measurement computer.
Bus address	0 … 250	Interface bus address setting (selected from several options).
Bus baud rate	300, 600, 1200, 2400, 4800, 9600, 19200, 38400	Interface bus baud rate setting (selected from several options).
Interface	Optical head, automatic, M-Bus repeater, RS232, RS485	Interface type setting (selected from several options).
Protocol	M-Bus, Modbus, Modbus (Pair of reg)	Interface protocol setting (selected from several options).
Language	English, French, German	LCD display language setting (selected from several options).
Billing date 1	Date	Date setting for billing date 1 (numerical entry).
Billing date 2	Date	Date setting for billing date 2 (numerical entry).
Log period	1, 2, 3, 4, 6, 8, 12 h 1, 2, 3, 4, 5, 6, 7, 10 days 1, 2, 3 months	Log period setting for data logger (selected from several options).
Opt: 1	-	Displays type of extension module in slot 1.
Opt: 2	-	Displays type of extension module in slot 2.
Opt: 3	-	Displays type of extension module in slot 3.
Opt: 4	-	Displays type of extension module in slot 4.
End submenu		Back to main menu item "Device Data".

7.2.15 Menu: Password

The device can be protected with a password. If a password is active, this means that parameters may only be changed once the password has been entered.

... / Password

Menu / Parameter	Value range	Description
Enter password	0000 (4-digit)	Enter password (0000 = enable, no password active).
Change password	0000 (4-digit)	Change password (numerical entry).
End of submenu		Back to main menu item "Device Data".

IMPORTANT (NOTE)

Once parameters have been changed, the password needs to be reactivated:

- By entering the password again
- By selecting "Password lock" in "Service / Status menu".

7.3 Parameterization software

The FCOM200 PC parameterization software (ParaTool) is used for setting parameters in standard applications.
The software can be installed and used on standard PCs.
Two options are available for the connection between the PC and measurement computer:

— Via the infrared interface on the front (with optical head)
— Via the M-Bus interface (with M-Bus repeater)

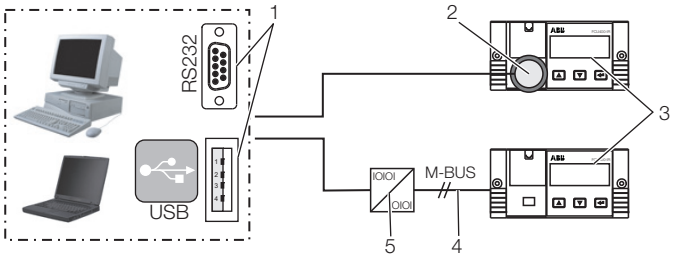


Fig. 23
1 RS232 / USB interface | 2 Optical head | 3 Measurement computer | 4 M-BUS connection (2-wire) | 5 M-BUS repeater

Note on communication:
The following settings must match on the PC and on the device (under "Device data"):
Bus address, baud rate, interface.

Interface	Setting
With optical head	Optical head / automatic
With M-Bus repeater	M-Bus repeater

7.3.1 Infrared printer

The infrared interface can be used to print out measurement computer data on the portable "HP82240B Infrared Printer".

8 Error messages

8.1 Process errors

Process errors that have a direct effect on totalizing are indicated by the flashing message "Error" and the "■" icon on the toolbar of the LCD display.
It is possible to view a plain-text description of the error in the "Error messages" menu.
The process errors that may occur depend on the type of device being used.
The table below contains a sample list of possible error messages that may appear in the case of the FCU200-W.

No.	Message	Description
1	Tw out of range	The measured temperature Twarm is outside the configured measuring range.
2	Tk out of range	The measured temperature Tkalt is outside the configured measuring range.
3	Tw sensor break	The measured temperature Twarm is outside the configured measuring range (0 … 250 °C). Check that the sensor is working correctly.
4	Tk sensor break	The measured temperature Tkalt is outside the configured measuring range (0 … 250 °C). Check that the sensor is working correctly.
5	Tw < Tk	The measured temperature Twarm is lower than Tkalt.
6	Flow sensor malfunction	Frequency at input outside the measuring range (0 … 11 kHz).
7	Flow out of range	The measured flow is outside the configured measuring range.
8	mA-Out < min. value	The value calculated for a current output is lower than the configured minimum value.
9	mA-Out > max. value	The value calculated for a current output is higher than the configured maximum value.

8.2 Device error

The internal device errors are binary-coded. The errors are displayed in the form of 4-digit numbers.

Error code	Description
0000	No error
0001	Configuration error (physical, electrical, min. / max. value)
0002	Unit configuration error
0004	Display parameter configuration error
0010	Flowmeter type error
0020	Critical process error
0100	Extension module 1 error
0200	Extension module 2 error
0400	Extension module 3 error
0800	Extension module 4 error

If multiple errors occur at the same time, each individual digit of the error codes is added together.

Error code	Errors
0004	Display parameter configuration error
0801	Extension module 4 error and configuration error (physical, electrical, min. / max. value)
0534	Extension module 1 and 3 error (1 + 4 added together at second digit), flowmeter type error, critical process error (1 + 2 added together at third digit) and display parameter error.

9 Specifications

9.1 System structure

The measurement computer consists of a basic device with four slots for extension modules.

The basic device contains:

- Power supply unit
- LCD display with backlighting
- Processing electronics
- 2 analog inputs for Pt100 temperature sensors with constant power source for four-wire circuit or 2 analog 0 / 4 … 20 mA inputs for transmitters
- 2 digital, electrically isolated inputs for pulse or frequency signals; can also be used for logic signals for control purposes
- 3 digital, electrically isolated outputs for pulse output and error signaling
- M-Bus interface
- Optical interface on front, which can also be operated in accordance with the IRDA or ZVEI standard, depending on the parameterization

IMPORTANT (NOTE)

The type of connection required (Pt100, transmitter) for the analog inputs must be specified when ordering the device. It is not possible to change the type of connection at the actual site.

The four slots are designed to accommodate extension modules. You have the option of combining the following modules:

- Current input module, 2 inputs with transmitter supply
- Current input module, 4 inputs without transmitter supply
- Voltage input module, 4 inputs
- Current output module with limit monitors
- RS485 / RS232 module for MODBUS communication
- Supply for transmitters in two-wire technology

9.2 Electrical connections

9.2.1 Analog inputs

2 x Pt100 IEC or 2 x 0 / 4 … 20 mA,
measuring range -200 … 850 °C,
resolution 20 bits ≈ 0.0012 K

9.2.2 Digital inputs EB1, EB2

2 x electrically isolated, 24 V passive (optocoupler), can be configured in acc. with DIN 19240 as:

— Pulse input 0.001 s^{-1} ... 3000 s^{-1}
— Frequency input 0.001 Hz ... 10 kHz
— Logic signal (hi / low)

9.2.3 Digital outputs AB1, AB2, and Err

3 x open collector, passive. Electrically isolated via optocoupler.

External supply	In acc. with VDE 2188, Category 2
Maximum load	24 VDC (± 25 %), < 100 mA
Maximum insulation voltage	500 V_{SS} (peak-to-peak)
Internal resistance R_i in conductive state	< 20 Ω
Function	AB1: Pulse output AB2: Pulse output Err: Error output

9.2.4 Communication interfaces

Communication takes place via the M-Bus protocol in acc. with EN 1434-3, IEC 870-5.

Optical interface on the front of the device	Electrical interface via terminal strip of device
Operating mode can be parameterized, optical head (ZVEI) standard in acc. with IEC EN 61107 (300 ... 400 (9600) baud).	— 2-wire M-Bus interface (300 ... 38,400 baud) — RS232 / RS485 (300 ... 38,400 baud)

The device is parameterized using the FCOM200 parameterization software (ParaTool).
Data (operating variables, data logger, etc.) is read out via M-Bus or MODBUS.

9.3 Power supply

DC voltage	24 V DC ± 20 % (FCU400-IR ± 5 %)
AC voltage (not in the case of FCU400-IR)	24 V AC, 110 V AC, 230 V AC, -15 ... +10 %, 48 ... 62 Hz
Power consumption 24 V AC 115 V AC 230 V AC	 1 ... 10 VA depending on extension 2 ... 10 VA depending on extension 3 ... 10 VA depending on extension

9.4 Extension modules

The extension modules are inserted in the slots on the basic device.

Module designation	Description
101 2 x current inputs (EX1, EX2) 2 x transmitter supplies (Us1, Us2)	0 / 4 ... 20 mA, R_E = 50 Ω; resolution 16 bits ≈ 0.3 µA max. permissible input current 40 mA, electrically isolated each 16 V, 25 mA, short circuit-proof, electrically isolated
107 4 x voltage inputs (EX1 … EX4)	0 ... 2,500 mV, R_E > 1 MΩ, resolution 16 bits, max. permissible input voltage + 5 V
108 4 x current inputs (EX1 … EX4)	0 / 4 ... 20 mA, R_E = 50 Ω; resolution 16 bits ≈ 0.3 µA max. permissible input current ± 40 mA
102 2 x analog outputs (AX1, AX2) 2 x limit monitors (ABX1, ABX2)	Signal range 0 / 4 ... 20 mA, load max. 500 Ω, open permitted, short circuit-proof Open collector, passive Electrical isolation via optocoupler. External supply VDE 2188, Category 2. Maximum load 24 V (+ 25 %), < 100 mA. Max. insulation voltage 500 V (peak-to-peak).
105 RS485 / RS232 card	For MODBUS communication
106 2 x transmitter supplies (Us1, Us2)	each 20 V, 25 mA, short circuit-proof, electrically isolated

9.5 Characteristic values

Temperature inputs	
Temperature measuring error	0.3 % of measuring range end value
Measuring error for differential temperature	3 … 20 K, < 1.0 % of measured value 20 … 250 K, < 0.5 % of measured value

Current outputs	
Effect of ambient temperature	< 0.01 %/K
Calibration error	< 0.2 % of end value
Maximum linearity error	< 0.005 % FSR
Accuracy class of calculator	EN 1434-1 / OIML 75 Class 2

9.6 Ambient conditions

Ambient temperature	-5 … 55 °C (23 … 131 °F)
Storage temperature	-25 … 70 °C (-13 … 158 °F)
Climate class	Ambient temperature class C acc. to EN 1434-1
Relative humidity	Checked in acc. with EN 1434-4, IEC 62-2-30
Condensation	Permissible
Degree of protection	IP 65 IP 40 (only in the case of FC400-IR)
Shock resistance during operation (at 20 °C) in acc. with IEC 68-2-6 or 68-2-27	Vibration: 2 g / 10 ... 150 Hz Shock: 30 g / 11 ms / 3 shocks

9.6.1 Electromagnetic compatibility (EMC)

Interference immunity in acc. with EN 50082-2 (EN 6100-4-2, -3, -4, -5, 6); also in acc. with EN 1434-4 (Class C), RFI suppression in acc. with EN 50081-2 (EN 55011 Class A)

Type of test	Standard	Testing accuracy	Effect
Surge on power supply (AC) com diff.	EN 61000-4-5	 2 kV 1 kV	 No effect No effect
Burst on supply lines	EN 61000-4-4	2 kV	< 0.2 %
Burst on signal lines	EN 61000-4-4	1 kV	< 0.2 %
Discharge of static electricity (contact discharge)	EN 61000-4-2	6 kV	< 0.2 %
Radiated field (80 … 1,000 MHz)	EN 61000-4-3	10 V/m	< 0.2 %
Cable-guided radiation (150 kHz … 80 MHz)	EN 61000-4-6	10 V	Requirements met
Line interruptions and fluctuations	EN 61000-4-411	-	-
RFI suppression	Limit value class adhered to		
Interference voltage on supply line	EN 55022	A	
Interference field strength	EN 55022	B	

9.7 Operation

9.7.1 Display

LCD display, 120 x 32 pixels, multi-line, with backlighting.

9.7.2 Billing date recording

Two billing dates can be determined for the purpose of storing all counter readings. The date and time parameters can be adjusted independently for each billing date.

9.7.3 Data logger

The integrated data logger features 128 or 200 slots and has a ring buffer design. The data logger stores the process variables (counter readings, instantaneous values, min. / max. and mean values).
Depending on the application concerned, the number of operating variables and slots may vary.

9.8 Error messages

The measurement computer enables internal errors to be detected thanks to regular self-diagnostics.

— Critical device errors; e.g., storage failure, process errors
— Power supply failures; meter standstill.

The 10 most recent process errors are stored and can be called up as plain text with a time stamp via the LCD display.

9.8.1 Err error output

Open collector, passive

9.9 Mounting dimensions

DIN rail mounting and wall mounting	
Dimensions (width x height x depth)	144 mm x 72 mm x 183 mm (5.67 inch x 2.83 inch x 7.2 inch)
Housing material	Polycarbonate
Weight	Approx. 0.7 kg (1.54 lb)

Panel mounting	
Dimensions (width x height x depth)	144 mm x 72 mm x 117 mm (5.67 inch x 2.83 inch x 4.61 inch)
Panel cutout (width x height)	139 mm x 69 mm (5.47 inch x 2.72 inch)
Housing material	Polycarbonate
Weight	Approx. 0.5 kg (1.1 lb)

10 Maintenance / Repair

10.1 Replacing the fuse

WARNING – Live connections!
Risk due to exposed live connections when device is open.
- Before opening the device, switch off the power supply.
- Condensers in the device will be live even after the power supply has been switched off.
- Only suitably trained specialist personnel may carry out work on the device.

NOTICE – Potential damage to device!
Damage to device due to static electricity (ESD). Make sure that ESD protection measures are in place when working on the device.

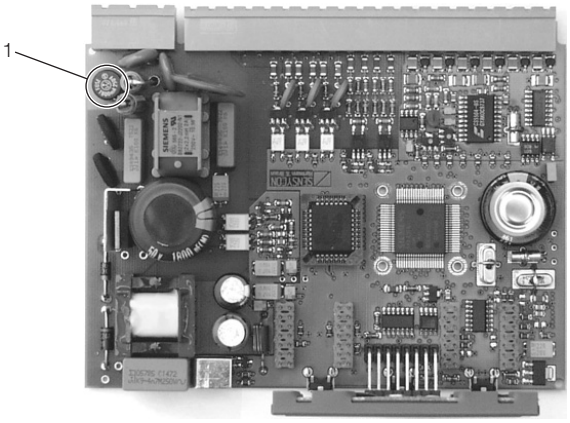


Fig. 24: Position of the fuse
1 Fuse

Power supply	Fuse
230 V AC	0.16 A
115 V AC	0.315 A
24 V AC / DC	0.8 A

1. Switch off and remove the device.
2. Separate the device from the base (only in the case of DIN top-hat rail installation).
3. Unscrew the fixing screws from the rear panel and remove the rear panel.
4. Pull out the main board.
5. Replace the fuse (making sure you are using the correct type).
6. Insert the main board in the housing.
7. Replace the rear wall and screw it in place.
8. Place the measurement computer on the base and secure it using the fixing screws (only in the case of DIN top-hat rail installation).
9. Install the device.

11 Appendix

NOTE

All documentation, declarations of conformity, and certificates are available in ABB's download area.
www.abb.com/flow

EG-Konformitätserklärung
EC-Certificate of Compliance

CE

Hiermit bestätigen wir die Übereinstimmung der aufgeführten Geräte mit den Richtlinien des Rates der Europäischen Gemeinschaft, welche mit dem CE- Zeichen gekennzeichnet sind.

Die Sicherheits- und Installationshinweise der Produktdokumentation sind zu beachten.

We herewith confirm that the listed devices are in compliance with the council directives of the European Community and are marked with the CE- marking. The safety and installation requirements of the product documentation must be observed.

Hersteller: *Manufacturer:*	ABB Automation Products GmbH, Dransfelder Straße 2, 37079 Göttingen - Germany
Gerät: *Device:*	Universeller Messrechner *Universal Measuring Computer*
Modelle.: *Models:*	SensyCal FCU200-T, FCU200-W SensyCal FCU400-G, FCU400-IR SensyCal FCU400-P, FCU400-S
Produktnummer: *Models:*	V18022-...
Richtlinie: *Directive:*	2004/108/EG * (EMV) *2004/108/EC * (EMC)*
Europäische Norm: *European Standard:*	EN 61326-1, 10/2006 * EN 61326-2-3, 05/2007 * *EN 61326-1, 10/2006 * EN 61326-2-3, 05/2007 *
Richtlinie: *Directive:*	2006/95/EG * (Niederspannungsrichtlinie) *2006/95/EC * (Low voltage directive)*
Europäische Norm: *European Standard:*	EN 61010-1, 01/2009 * *EN 61010-1, 01/2009 **

* einschließlich Nachträge / *including alterations*

Göttingen, 01. Dezember 2011

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Statement on the contamination of devices and components

Repair and / or maintenance work will only be performed on devices and components if a statement form has been completed and submitted.
Otherwise, the device / component returned may be rejected. This statement form may only be completed and signed by authorized specialist personnel employed by the operator.

Customer details:

Company:	
Address:	
Contact person:	Telephone:
Fax:	E-Mail:

Device details:

Typ:	Serial no.:
Reason for the return/description of the defect:	

Was this device used in conjunction with substances which pose a threat or risk to health?

☐ Yes ☐ No

If yes, which type of contamination (please place an X next to the applicable items)?

Biological	☐	Corrosive / irritating	☐	Combustible (highly / extremely combustible)	☐
Toxic	☐	Explosiv	☐	Other toxic substances	☐
Radioactive	☐				

Which substances have come into contact with the device?

1.
2.
3.

We hereby state that the devices / components shipped have been cleaned and are free from any dangerous or poisonous substances.

Town/city, date — Signature and company stamp

Notes

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