DynFAS
Dynamic Factory Automation Systems

BMA

Concentration Meter

DynFAS MW

Hardware Manual

User's Guide

ID No. 54877BA2

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The units supplied should not be repaired by anyone other than BMA Schaltanlagen Service engineers or technicians by BMA Schaltanlagen.

In case of operation trouble, please address to our central service department.

The complete user's guide consists of two parts, namely the hardware and software instructions.

The **hardware manual** comprises:

- mechanical components
- installation
- electrical installation
- technical data
- electrical and mechanical drawings

The **software manual** comprises:

- operation of the control unit
- parameter description
- basic setting
- calibration
- error messages

The present part is the hardware instruction.

Subject to change without prior notice.

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Chapter 1. **Safety Instructions**

1.1 Identification and warning notices

The term BMA Schaltanlagen in this User's Manual stands for the company BMA Schaltanlagen GmbH.

Please observe the warnings and safety instructions given in this User's Manual to rule out physical injury and property damage. They are identified by the following symbols: DANGER, WARNING, CAUTION or NOTICE.

DANGER

Indicates an imminently dangerous condition. Failure to follow the instructions will lead to death or serious injury.

WARNING

Indicates a potentially dangerous condition. Failure to follow the instructions may lead to death or serious injury.

CAUTION

Indicates a potentially dangerous condition. Failure to follow the instructions may lead to slight injury or a medium-degree injury.

NOTICE

Indicates a situation which may cause property damage if the instructions are not followed.

IMPORTANT

Paragraphs with this symbol provide important information on the product or how to work with the product.

Tip

Includes application tips and other useful information.

Further Symbols

Warning sign: no intervention, change nothing

Instruction: Disconnect from mains supply

Instruction: Wear safety shoes

1.2 General Instructions

The most important safety measures are summarised in this operation manual. It supplements the applicable regulations which have to be studied by the personnel in charge.

Please keep in mind:

- the national safety and accident prevention regulations
- the national installation regulations (e.g. EN 60079)
- the generally accepted engineering rules
- the information on transportation, installation, operation, service and maintenance
- the safety instructions and information in this User's Manual and the enclosed technical drawings and wiring diagrams
- the characteristic data, limit values and the information on the operating and environmental conditions on the type labels and data sheets
- the signs on the devices

1.3 General Safety Instructions

IMPORTANT
The instrument housings are protected according to protection type IP 65 and are suitable for outdoor application. The instrument has been tested by the manufacturer and is delivered in a condition that allows safe and reliable operation.

NOTICE

The measuring systems have to be protected against direct sun rays and rain during outdoor applications e. g. by a suitable protective cover.

IMPORTANT
Never change the installation and the parameter settings without a full knowledge of these operating instructions, as well as a full knowledge of the behavior of the connected controller and the possible influence on the operating process to be controlled.

NOTICE

The systems may be used only in technically good order and only according to regulations!

⚠ CAUTION

Only authorized persons who have been trained, have the proper qualification and have received the necessary instructions may work with the systems! Installations and modifications on the systems which may affect the operational safety are not permitted!

Ambient conditions

IMPORTANT
All systems components require non corrosive ambient conditions during transport, storage and starting up.

⚠ WARNING

Electrical shock hazard:

Disconnect power to rule out any contact with live parts during installation and when servicing.

Turn off power supply before opening the instrument. NEVER work on open and live instruments.

NOTICE

Attention! Possible danger, damage to property! Concerns the system type CH-200-024 Control Unit High Dynamic 24 V DC (Id.-No. 54878-02):
When connecting the 24 V DC auxiliary power, the + and – Poles should be connected correctly. There is no reverse voltage protection!

NOTICE

Spare fuses must match the rating specified by the device manufacturer. Short-circuiting or manipulation is not permitted.

IMPORTANT

The DynFAS MW and all ancillary units have to be connected to mains via grounded connection.

IMPORTANT

The concentration measuring system DynFAS MW is to be serviced and repaired solely by qualified persons.

Qualified Persons

Persons are qualified if they have acquired adequate knowledge in the area concerned in the course of their professional education, and if they are familiar with the pertinent national occupational safety regulations, accident prevention regulations, directives and acknowledged rules of technology. They must be capable of assessing the result of their work safely; moreover, they need to be familiar with the contents of this User's Manual.

IMPORTANT

If liquid gets inside the instrument, cut off the power supply. The instrument has to be checked and cleaned by an authorized service center.

Chapter 2. **General Information**

2.1 Use and Function

The DynFAS MW has been designed as a concentration measuring system and may only be used for this purpose. If it is used in any manner, which is not described in this user's manual, the protection of the device is impaired and all warranty claims are void.

BMA Schaltanlagen only guarantees that the devices comply with the published specifications. The DynFAS MW may only be installed in an undamaged, dry and clean condition. Alteration work and modification of the system components are not permitted.

The DynFAS MW does not qualify as a "safety regulated measurements.

Conformance with standards

The standards and regulations customary to the DynFAS MW are listed in the system instructions in chapter 2.2 frequency approval and in chapter 7.1 EC-conformity certificate.

Protection type

The degree of protection of the DynFAS MW according to IEC 60529 is max. IP 65.

Misuse warning

The following is contrary to the intended use and, therefore, has to be prevented:

- Use under other conditions and prerequisites than those specified by the manufacturer in the technical documents, data sheets, operating and installation instructions and in other specifications.
- Use after repair by persons who have not been authorized by BMA Schaltanlagen.
- Use in a damaged or corroded state.
- Operation with open or inadequately closed cover.
- Operation with inadequately tightened adapters and screwed cable glands.
- Operation without observing the safety precautions defined by the manufacturer.
- Tampering with or bypassing existing safety installations.

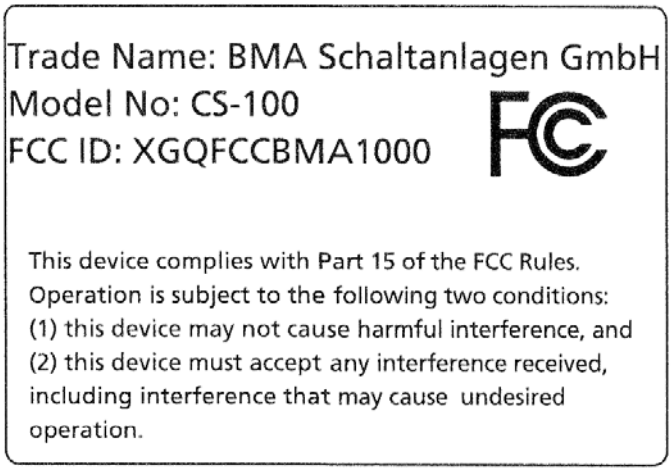
Authorized Persons

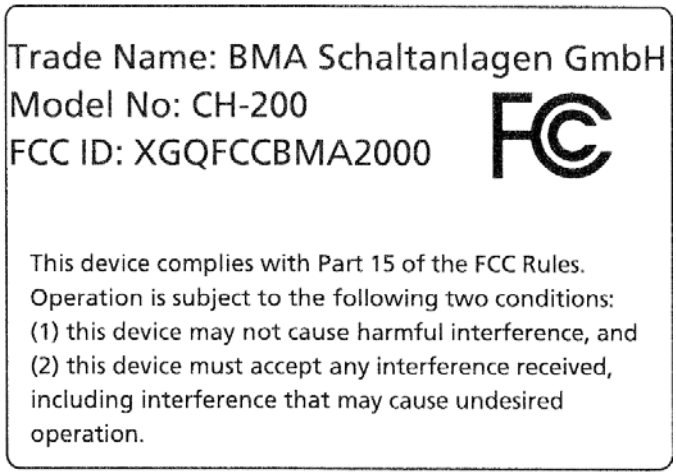
Authorized persons are persons, who are foreseen for certain activities as a consequence of statutory provisions, or who have been approved by BMA Schaltanlagen for carrying out certain activities.

2.2 Frequency approval

The DynFAS MW complies with part 15 of the FCC[1] Rules. These devices fulfill the requirements regarding immunity to interference and emitted interference and are licensed for operation.

FCC-Approval plates





[1] FCC ... Federal Communications Commission

The DynFAS MW complies with the R&TTE regulations 1999/5/EG and fulfill herein all requirements for this type of high-frequency device. The devices bear the identification of conformity according to the CE symbol, No. 0682 of the certification office. The certificate can be found in chapter *7.2 Frequency Approval*.

CE 0682

The DynFAS MW is a system for concentration measurement using microwave technology. The emitted microwaves have a very low activity and are, therefore, not at all hazardous to human beings or the environment. Also, the product is not affected at all by the microwaves.

IMPORTANT

The DynFAS MW has been manufactured in compliance with the safety requirements for microwave devices. If special legal provisions exist regarding the use of microwaves, it will be the responsibility of the user to adhere to them.

IMPORTANT

Any change in frequency or any other manipulation on the microwave device will result in a loss of the frequency approval and will be prosecuted.

The microwave modules do not include any replaceable components and must not be opened.

2.3 Intended Use

The measuring system DynFAS MW can be used to determine the concentration of nearly all materials which can be dissolved or suspended in water using microwave technology. The following sensor and control unit versions are available:

1. The container probes have been designed for installation into pipelines with a nominal width of ≥ 200 mm and in containers, for example, crystallizers. The probe is installed such that both measuring rods (transmitter and receiver) are immersed into the product being measured.

2. The Flow Cell is a tubular probe, with microwave transmitter and receiver being firmly welded onto the outside of the pipe. The inside of the pipe is Teflon-coated. The flow cell is installed into the existing pipeline system inline or into a bypass.

The control unit is available in two versions: The Standard Model CS-100 and the high dynamic version CH-200. The control unit CH-200 can only be used when sufficiently large microwave attenuation (min. 40 dB) is present. The Standard Model CS-100 should be used for lower microwave attenuation.

During operation, the concentration measuring device DynFAS MW send out electromagnetic radiation in the frequency range between 2.4 GHz and 2.5 GHz (range restrictions depending on local regulations in your country). The microwaves which emerge are not dangerous to human beings and the environment (power emission < 10 mW). The microwaves are emitted from the microwave window; the product is not changed by the microwaves.

To ensure proper function of the meter, please pay attention to the following:

Tip

- The material being measured must not be electrically conductive, i.e. the ohmic resistance is infinite.
- The product must not contain any gas bubbles, or gas bubbles have to be compressed with adequate pressure when carrying out measurements in pipelines.
- The ion concentration, e.g. salt content, has to be nearly constant.
- The total attenuation of microwave signals must be at least 40 dB for the control unit CH-200. For details, see Chapter 3.4.1 the control units

2.4 Definitions

Attenuation	Weakening of microwave signals, microwave measurement effect.
Container flush probe	Container probe with flushing device.
Factory setting	All parameters have been set to standard values by the manufacturer. In most cases this simplifies calibration of the device significantly. Despite factory setting, calibration **always** has to be performed.
Flow cell	Tubular probe for simple integration into the existing pipeline system.
HF cable	**H**igh-**f**requency cable.
Microwaves	Electromagnetic waves in a certain frequency range.
Phase	Phase or phase shift. Microwave measurement effect.
Quad cable	Combination of four HF cables of equal length in a corrugated tube.
Softkeys	Buttons associated with the software.
TC	**T**emperature **c**ompensation.

Chapter 3. **System Description**

3.1 Principle of Measurement

The microwaves that spread between the rods pass through the product being measured; their propagation speed is slowed down (= phase shift) and their intensity is damped (= attenuation). Figure 3-1 illustrates the principle of measurement: the propagation speed of microwaves passing through the product being measured is slowed down (phase shift) and their intensity (attenuation) is reduced, relative to a reference signal.

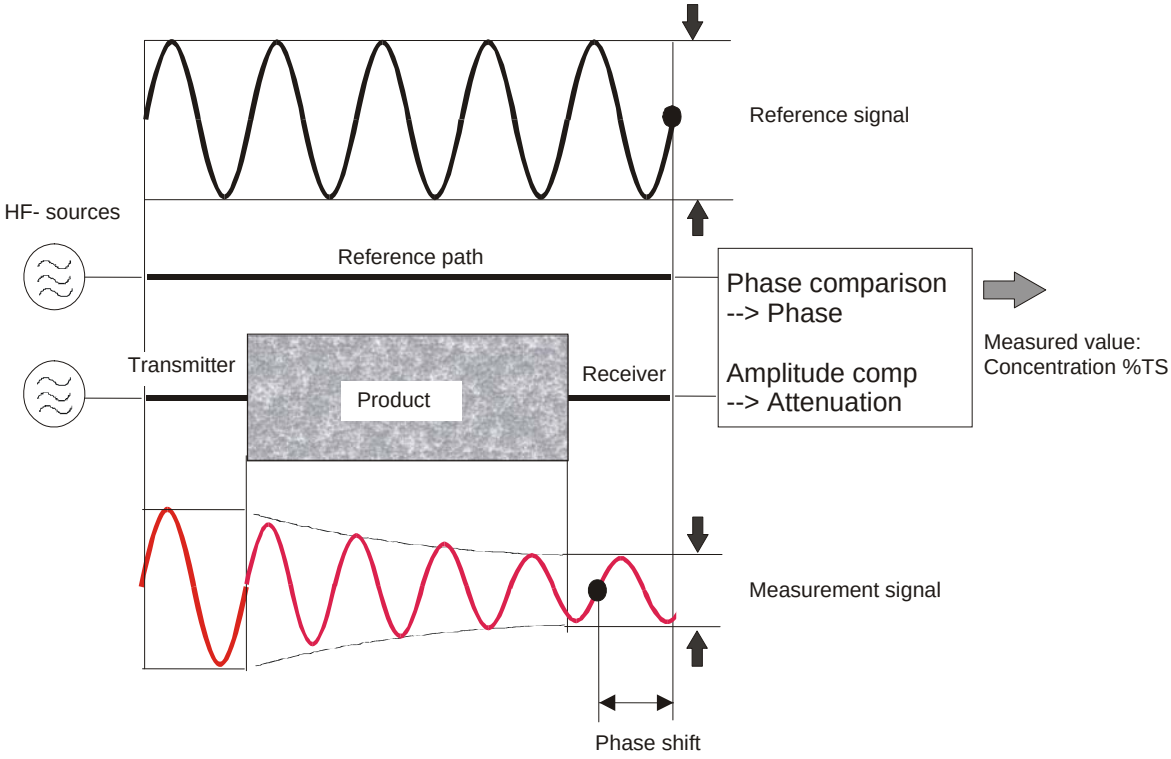


Figure 3-1: Schematic diagram: Change of microwave by product

Prerequisite is that the product being measured shows some dielectric properties. In general, water is a very distinct dielectric fluid. The water or dry mass concentration, respectively, can therefore be determined by measuring the phase shift and/or attenuation.

The concentration to be detected in the product is therefore dependent in good approximation linear on phase shift and attenuation. For this reason we can measure the concentration or the Brix content of the product using a linear calibration (see chapter 3.2 Calculation of Measured Values).

3.2 Calculation of Measured Values

The microwave measuring phase and attenuation are calibrated after an automatic plausibility analysis.

During calibration, the phase and/or the attenuation or a concentration value (or density value) are assigned by sampling. The calibration is full automatic and the sample taking is supported by the control unit.

Which of the parameters, either phase, attenuation or both are used for the calibration depends on the size and interference of the measuring effect. For example, the attenuation is significantly more sensitive to electrolytic conductivity (salt content).

In many cases, the mere phase measurement is recommended and is calculated in good approximation by a linear calibration as follows:

$$Con = A \cdot \varphi + C$$

Con	concentration
A, C	coefficients of respective calibration function
φ	phase

The DynFAS MW allows you to calibrate, display and output two concentrations Con1 and Con2. You have to enter the calibration coefficients separately for concentration 1 and 2. For more information please refer to the Software Manual.

3.3 Temperature Compensation

Temperature compensation (TC) is necessary if the product temperature varies. In general, we recommend connecting a temperature compensation, i.e. a temperature signal (0/4...20 mA or Pt 100) to the control unit and, if necessary, to enable the compensation in the control unit. The control unit is designed such that the required TC's can be calculated automatically. The variation in temperature where temperature compensation becomes absolutely essential is dependent on the product and on the water content. In first approximation, ± 2°C should be set as fluctuation limit.

Tip

TC has to be carried out whenever you are working with.

The TC corrects the phase and attenuation before the measured value calculation (calibration), in most applications according to the following formulae (linear compensation, additive).

$$\varphi_{comp} = \varphi_{meas} + C_{\varphi} \cdot \Delta\theta$$

$$D_{comp} = D_{meas} + C_{D} \cdot \Delta\theta$$

Where

φ_{meas} = measured phase
φ_{comp} = compensated phase
D_{meas} = measured attenuation
D_{meas} = compensated attenuation
C_{φ} = temperature coefficient
C_D = temperature coefficient

$\Delta\theta$ = measured temperature (T_{meas}) – reference temp. (T_{Ref})

Depending on the selected function (additive, multiplicative, linear, quadratic), the required temperature coefficients appear on the Calibration menu. Temperature coefficients that are not used are set to zero.

If you select two-range calibration (split concentration), separate TC's have to be entered for both concentration ranges. The coefficients are entered in the course of calibration.

TC can be carried out via Pt 100 or via current input. This has to be defined on the Calibration menu. The Pt 100 temperature range is between –50°C and +200°C.

How to work with the temperature compensation is described in detail in the Software Manual.

3.4 Mechanical Components

The measurement system consists of a control unit, a probe and a set of special high frequency cables (in short HF-cable). The control unit is available in two versions: the standard model CS-100 and the high dynamic version CH-200, see Figure 3-2 and 3-3.

Figure 3-2: Control Unit Standard CS-100

Figure 3-3: Control Unit High Dynamic CH-200

The probes are available in different versions, as pipeline and container probe with and without flushing device (see Figure 3-4, 3-5 and 3-6).

Abb. 3-4 left: Probe

Abb. 3-5 right: Probe with Flushing

Figure 3-6: Flow Cell nominal width 50 mm

3.4.1 Control Units

The control units consist of evaluation analyser with microwave unit. The microwaves are generated, received and analyzed by the microwave unit. Signal processing and communication take place in the evaluation computer. For simple operation, the measuring system includes a display, 4 softkeys and an alphanumeric keypad. Different functions are assigned to the softkeys on the display.

Differences between Control Unit Standard CS-100 and Control Unit High Dynamic CH-200

High Dynamic Version CH-200

The Control Unit High Dynamic CH-200, has an additional HF amplifier module in comparison to the standard model, whereby the wall housing is larger (dimensions see chapter 6.2 Technical Data control unit). Otherwise, the control units only differ in their applications.
Higher product attenuations are allowed for the high dynamic version of DynFAS MW. Therefore larger measuring paths can be irradiated, for example measuring cells of larger nominal width can be used. The application of both control units is predetermined by the product attenuation. Up to an attenuation of 50 dB, CS-100 is used and beyond, CH-200. The CH-200 generally requires an attenuation of 40 dB. If this is lower, the software indicates an error message.

An RS232 interface is included on the underside of the instrument.

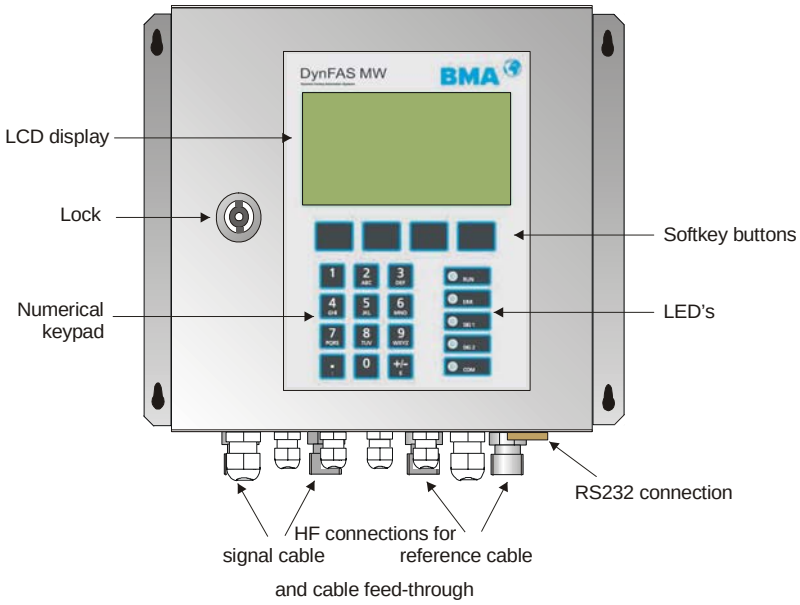


Figure 3-7: Front view of CS-100

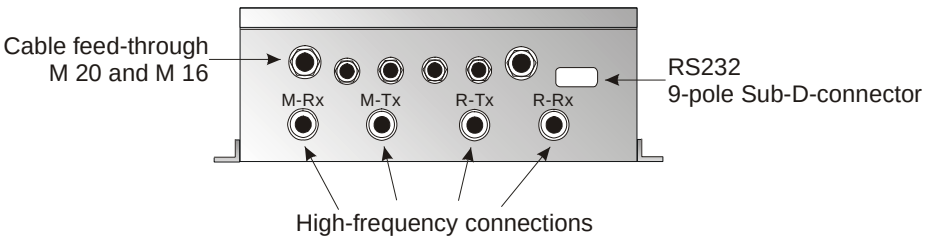


Figure 3-8: Control Unit - bottom view

LED's on the Front Panel

Five LED's on the instrument front panel indicate the instrument status.

Figure 3-9: LED's on the front panel of the Control Unit

LED	Function
RUN	Instrument in measurement mode Display is flashing when concentration average value is put on hold, e.g. if an error has occurred, if the measurement has been paused or stopped
ERR	Error Goes out after reset or if fault has been repaired
SIG 1	Display depending on the selected function of relay 1, possible functions: error, no product, limit value min., limit value max., measurement stopped
SIG 2	Display depending on the selected function of relay 2, possible functions: error, no product, limit value min., limit value max., measurement stopped.
COM	Communication active, e.g. via RS 232

Terminal Block

The electrical connections of the DynFAS MW are located on a connector strip in the wall housing. The terminal block is accessible from the front after you have opened the cover. There, you also find the power cut-off switch and the fuses. The high-frequency connections are located on the outside of the housing. All other elements, especially the live elements (on the motherboard) are provided with a protection cap.

3.4.2 Flow Cell

The flow cells are available with nominal widths from 50 to 150 mm (see Figure 3-10) and different flanges. For technical data please refer to chapter 6.2.

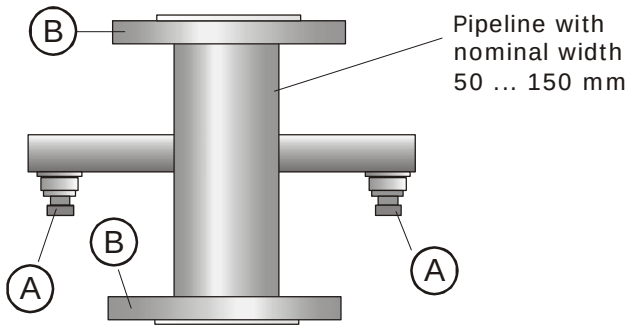


Figure 3-10: Flow Cell

A: High-frequency connections
B: Process connection, flanges of different sizes

The flow cell consists of a sturdy stainless steel body. The microwave transmitter and receiver are firmly welded to the outside of the pipe. The entire product pipe is PTFE-coated and fulfills the special requirements for use in foodstuffs.

There are not objects extending into the pipe (such as measuring sensors). The flow cell can be installed in the pipeline via flange.

The flow cell has two HF connections to feed in and output microwave signals. Input and output can be allocated as needed (M-Tx, M-Rx). The microwave signals transmit the product over the entire pipeline cross-section.

3.4.3 Container Probe

Two different container probe versions are available – either with or without flushing device (see Figure 3-11). For technical data please refer to chapter 6.2 Technical Data.

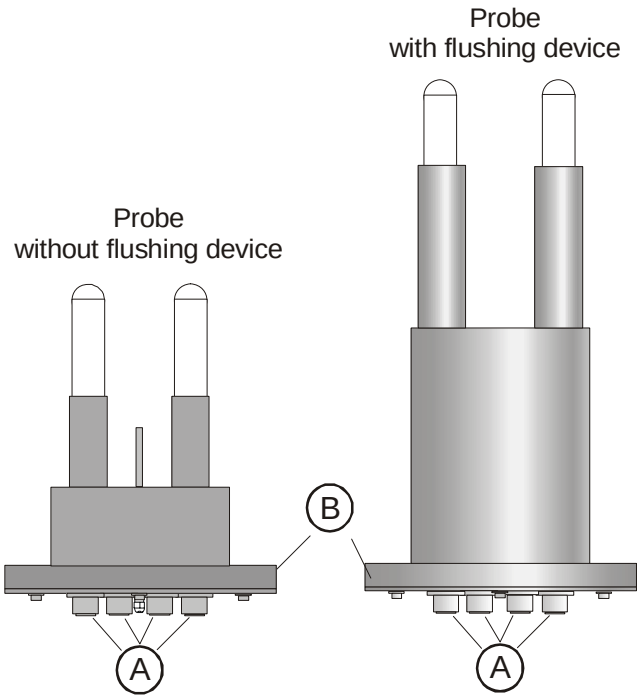


Figure 3-11: Container probes

A: High-frequency connections
B: Process connection, flanges of different sizes

The container probe has been specially designed for concentration measurements in containers. Both measuring rods are immersed into the product. Microwaves are emitted from one end of the rod and received by the other end of the rod; they are emitted only towards the opposite end of the rod. This direction characteristic of the probe minimizes the interfering influence of metal parts in the vicinity of the probe and allows installation if only little space is available. For example, the concentration of sugar strike can be measured continuously to find the suitable inoculation time.

The plastic rods meet the special requirements for application in foodstuffs.

Two different probe types are available:

- The standard type is the container probe without flushing device
- The probe with flushing is employed in processes where incrustations are likely to occur, for example, due to increased depositions. The flushing device prevents any deposition on the microwave exit windows. Long travel times are supported by continuous crystal processes (i.e. VKT).

The flow direction of the product being measured should be vertical, as shown in Figure 3-12. This ensures that the product between the measuring rods is representative, provided it is mixed thoroughly.

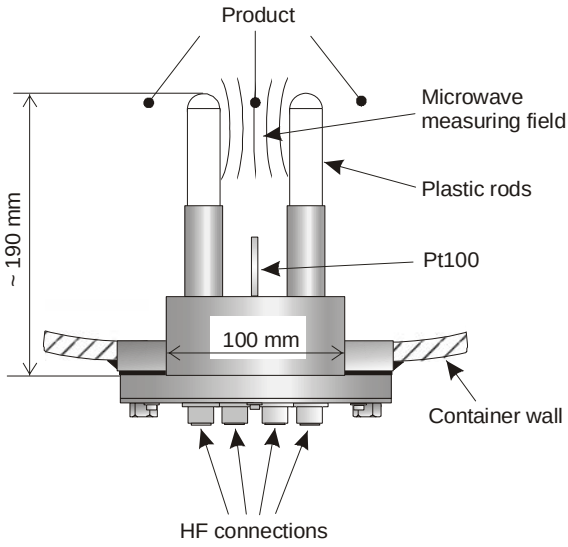


Figure 3-12: Probe

Pt 100

Only the probe without flushing is provided with a Pt 100 and is connected to the control unit via 4-wire cable. The wiring diagram for the Pt 100 is described in chapter 4.3.2 Pin Configuration of the Connector Strip. To reduce the danger of incrustation in the immediate vicinity of the measuring rods, the probe with flushing is not provided with a Pt 100.

NOTICE

Warning, possible property damages!
Do not open the cover screws on the front of the container probes, see Figure 3-13.

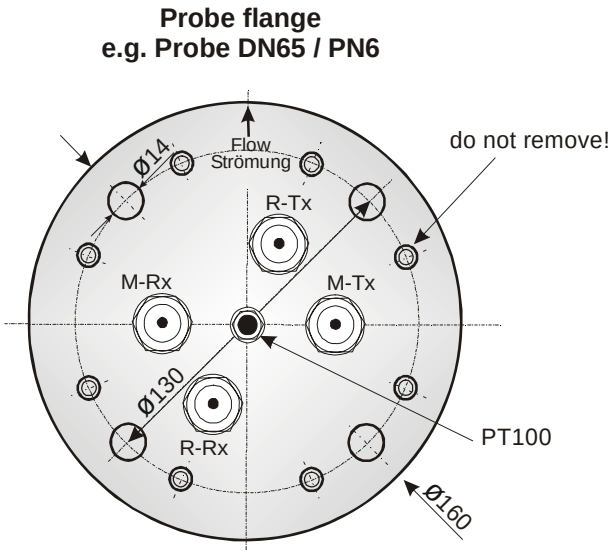


Figure 3-13:
The front of the probe

Probe with Flushing

The probe with flushing device has been designed for processes where depositions, for example, due to incrustations are likely to occur on the probe.

The flush probe has two flushing channels which keep the plastic rod free from incrustations; this ensures that the microwaves come into direct contact with the product being measured. All parts coming into contact with the product meet the specific requirements for application in foodstuffs. Figure 3-14 shows the probe design.

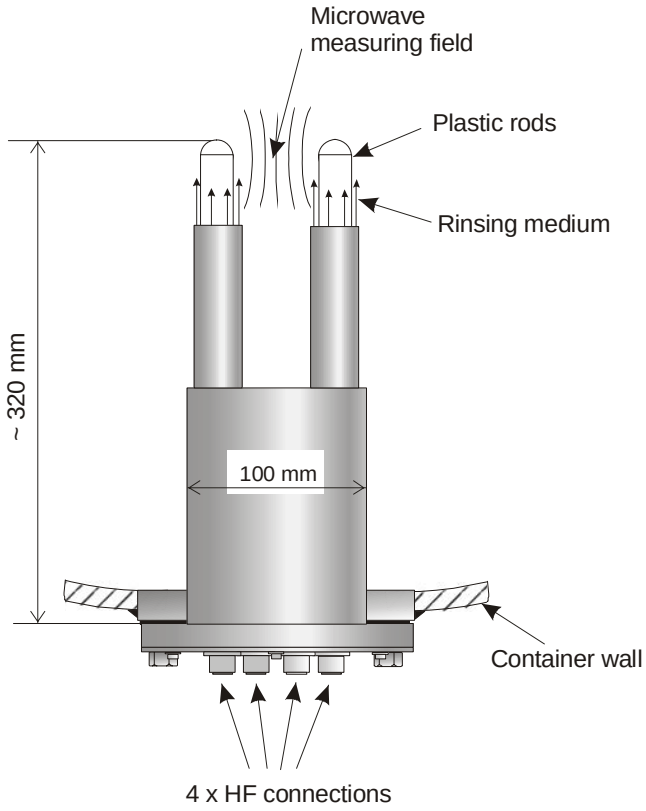


Figure 3-14:
Probe with Flushing

The flushing slit width is the same for both probe rods and shown in Figure 3-15.

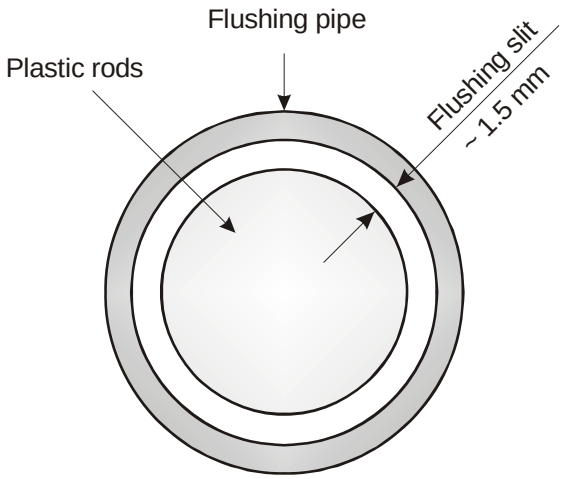


Figure 3-15:
Rod head
with flushing pipe

3.4.4 High-Frequency Cable

High-frequency cables (HF cable) are used to transmit microwaves between probe and evaluation electronics.

HF cables change their conductivity (for microwaves) relative to the temperature. Therefore, variations in the ambient temperature would create measurement errors. This error is compensated for by enabling the cable compensation. Influences of the ambient temperature on the signal cable are compensated for by means of the reference cable. The reference cable has the same length as the signal cable; during operation, it should be exposed to the same ambient temperature. Therefore, we recommend installing both cable types together in a corrugated tube; this also simplifies installation.

The HF cable quad (see Figure 3-16) consists of four individual HF cables of the same length, which each end with one HF plug connector (N-type). Available cable lengths: 2, 4, 6 and 10 m.

When connecting the Flow Cell, the reference cable is short-circuited to the probe side by means of N-connectors (see Figure 3-17).

NOTICE

Never bend HF cables! The bending radius should not be less than 100 mm. After installation, fix cables with cable binders.

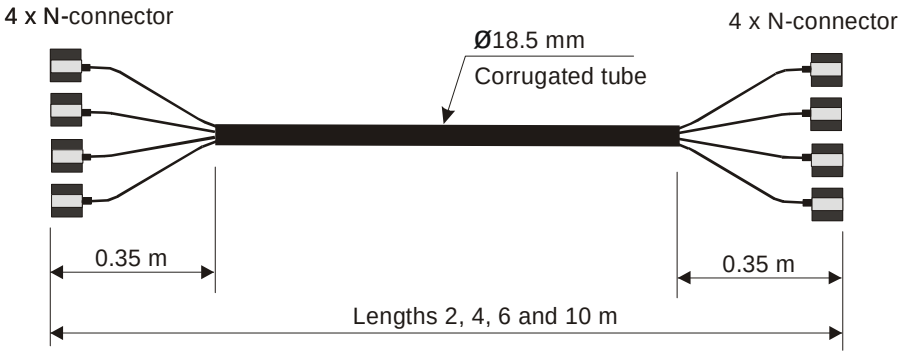


Figure 3-16: HF-cable quad

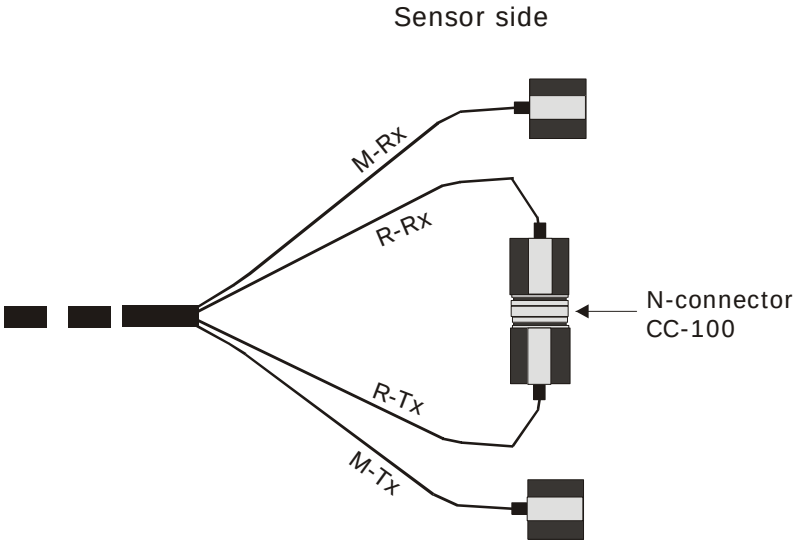


Figure 3-17: HF-cable quad, at the side of the probe

Figure 3-17: The ends of the reference cable R-Rx and R-Tx are short-circuited with an N-connector.

For further technical data see chapter 6.3 Technical Data HF-Cable.

3.5 Pipeline Measurement Configuration

The control unit is installed in the immediate vicinity of the container probe to keep the HF-cable between control unit and probe fairly short. The shorter the cable connection, the better the stability of the measurement. The standard length is 4 m and the maximum length of the HF-cables is 10 m.

The flow cell is installed into the existing pipeline system inline or into a bypass. The orientation of the flow cell may either be vertical or horizontal. To rule out sedimentary depositions, vertical installation in a riser is preferred (see Figure 3-18).

The flow cell should be installed fairly close to the sampling location to ensure representative sampling for calibration.

For possibly required product temperature compensation, a representative temperature signal (current signal or Pt 100) has to be connected to the control unit.

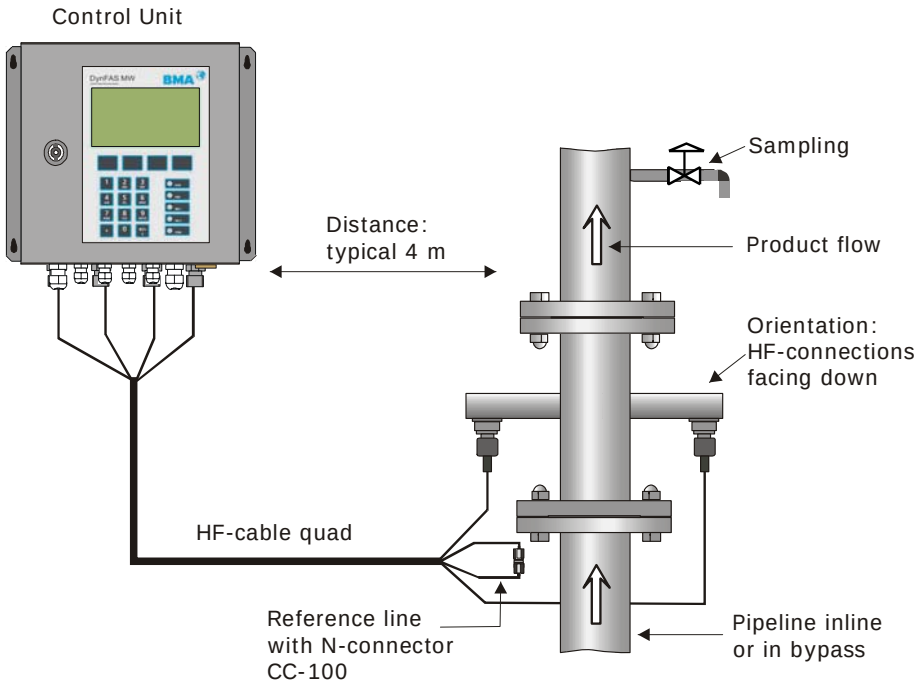


Figure 3-18: Typical measurement configuration on a pipeline

3.6 Container Measurement Configuration

The control unit is installed in the immediate vicinity of the probe to keep the HF-cable between control unit and probe fairly short. The shorter the cable connection, the better the stability of the measurement. The standard length is 2 or 4 m and the maximum length of the HF-cables is 10 m.

The control unit should be installed fairly close to the sampling location to ensure representative sampling for calibration. A representative temperature signal (current signal or Pt 100) should be connected to the control unit for possibly required product temperature compensation.

Our example below shows the measurement configuration on a discontinuous evaporation crystallizer. The probe is fixed to the container wall such that both measuring rods are immersed into the product.

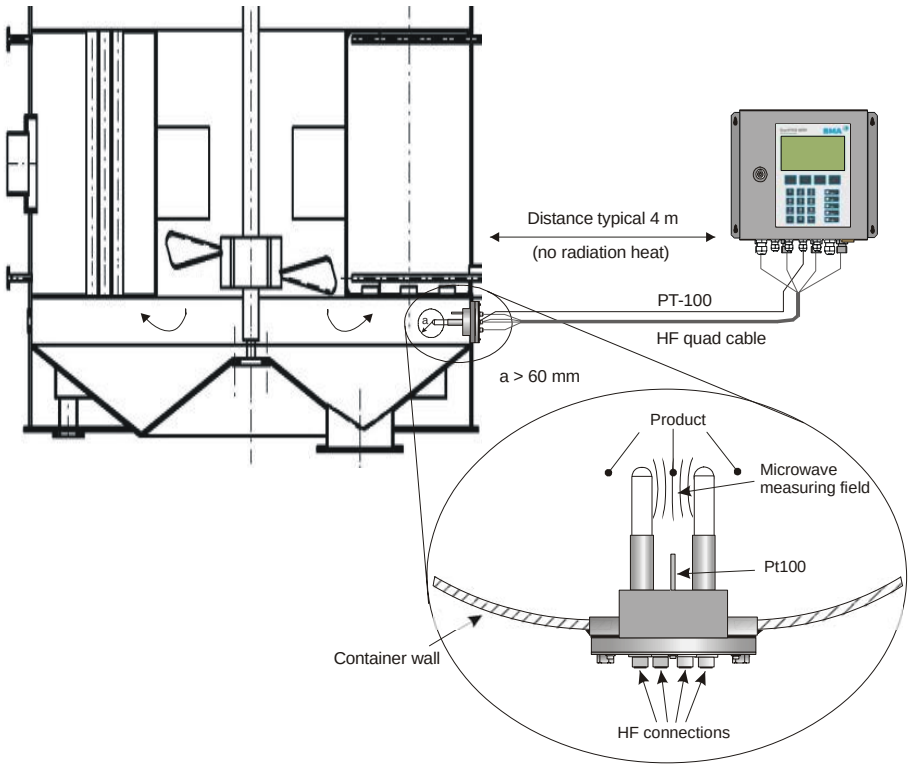


Figure 3-19: Typical system configuration on a evaporation crystallizer

Chapter 4. **Getting Started**

4.1 Transport

IMPORTANT
Risk of damage!

System parts may get damaged during transportation!

Transport probe and control unit in their original packaging. Protect parts against shocks. Especially the plastic rods of the container probes have to be protected against mechanical impact!

After unpacking, make sure all parts listed on the packing list have been delivered and show no sign of damage; if necessary, clean these parts.

If you detect any damage, please notify the forwarder and the manufacturer immediately.

The weight of the system components can amount to more than 25 kg depending on the model. You should wear safety shoes.

4.2 Installation

4.2.1 Flow Cell Installation

For installation of the flow cell please keep in mind:

- The flow cell is installed into the pipeline system. Keep in mind that material sampling should be possible for calibration directly behind the flow cell.
- The flow cell should be installed in a vertical riser, if possible. It has to be ensured that no material depositions occur on the pipe walls and no bubbles are present in the product. For horizontal installation, please observe the correct orientation of the HF-connections (see Figure 4-2).
- There should be a straight pipe section of at least 200 mm and equal nominal width before and after the flow cell to ensure a fairly homogeneous flow profile and to rule out possibly occurring microwave reflections in the pipeline.

- No gas bubbles should be present in the product. If gas bubbles cannot be ruled out, a pressure of at least 4 bar is required in the pipeline to minimize the influence of gas bubbles. Please observe the max. permissible working pressure (see chapter 6.2 Technical Data Sensors)
- The high-frequency cable should preferably be connected to the flow cell from below to prevent inflowing water from getting to the connecting sockets.
- The HF cable should not come into contact with the warm pipelines.

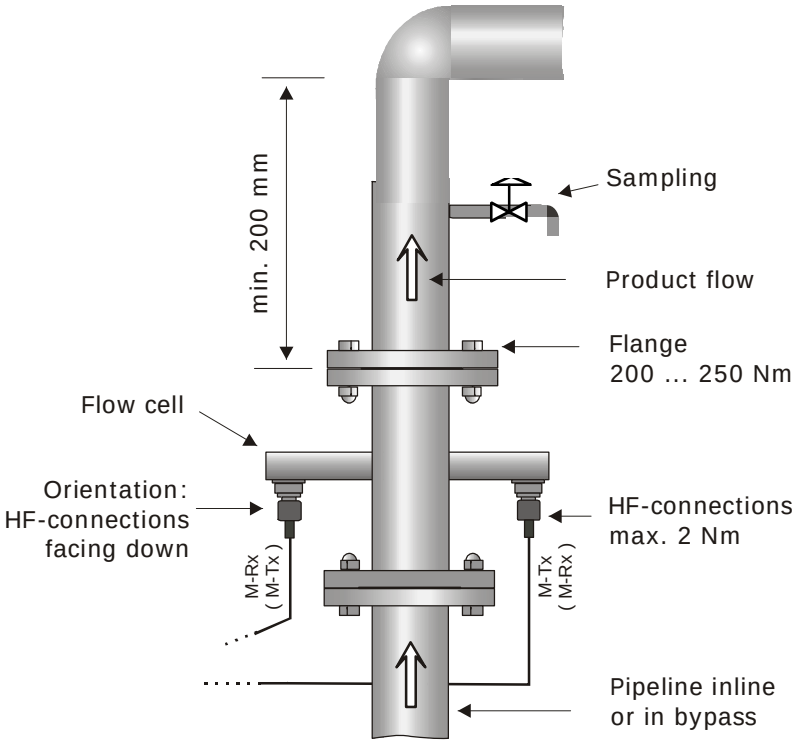


Figure 4-1: Installation in a vertical riser

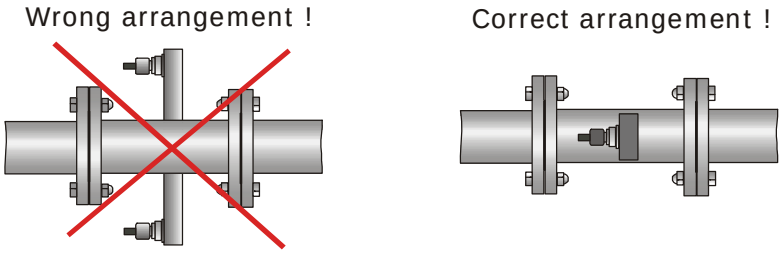


Figure 4-2: Horizontal installation: orientation of HF-connections

4.2.2 Container Probe Installation

For installation, please keep in mind:

- Select the installation site such that good mixing and a homogeneous product are ensured and no bubbles are present in the probe. A tap should be provided in the direct vicinity to allow representative sampling.
- The probe has to be flange-mounted on the container such that the product being measured flows between both measuring rods. That means the fork (both measuring rods) has to be installed at an angle of 90° to the material flow.
- The distance between the measuring rod tips and any metalized walls (heating elements, stirrer, container wall) should be at least **60 mm**.
- The following **installation hole sizes in the fitting flange** are required for installation of the probe:

Flange	Minimum installation hole size ∅ (mm)
DN 65 / PN 6	100 ± 0.2
others	102 ± 0.5

- For further installation dimensions please refer to chapter 8 (see installation sheets).
- Use the respective flat gasket (standard accessory) to compensate for minor surface tolerances in the fitting flange.

Installation on Process Containers

Figure 3-19 shows the position of the container probe on the container. This position is also valid for the container flush probe.

The assembly sheet in chapter 8 includes all the information required for installation.

Installation in Pipelines

The container probes can be installed in pipelines with a nominal width ≥ 200 mm using an adapter flange. Please observe the position and orientation of the container probe (see the technical drawings in chapters 8.4.7 and 8.5.6 Installation Situation in Pipelines).

Connection of the flushing pipes

The container probe with flushing device consists of two flushing devices with a 3/8 inch inner thread (DIN ISO 228-1). The flushing connections are subsequently sealed to this thread. A sealing to the probe cover is not permitted, for example with silicone.

Flush Parameters (only for container flush probe)

The degree of deposition or incrustation is essential for the flush parameters, i.e. flush frequency and duration. The flush parameters have to be adapted to the product and the process.

The following independent flushing parameters for products and processes have to be observed:

Flush solution	water, condensation
Temperature of flush solution	Maximum 120 °C
Pressure	≥ 3 bar, max. 8 bar
Fittings	2 x 3/8 inch female screw thread (DIN ISO 228-1)
Supply pipe	≥ 1/2 inch

Independent flushing parameters product and process, **typical starting rates**:

Interval	every 2 hours
Duration	12 seconds
Temperature of flush solution	average product temperature, mostly 65 ±5°C

For measurements on the C-product the flushing intervals can be considerably reduced, e.g. every 6 hours for 30 seconds.

The following is generally valid: the flushing devices can be flushed simultaneously or in shifts. The flushing parameters are valid for every flushing device.

Tip

The required flush duration has to take into account a possible inertness of the system, e.g. valve openings. The flush supply pipes have to be insulated well against heat to prevent that the flush solution is initially colder.

Amount of water

The amount of water per flushing connector is approx. 0.8 l/sec at a flushing pressure of 5 bars.

4.2.3 Installing the Control Unit

For installation of the control unit, please keep in mind:

- Install the control unit in the vicinity of the microwave probe, keeping in mind the length of the HF cable. HF cables are available in a length of 2, 4, 6 and 10 m; the standard cable length are 2 or 4 m.
- Protect the instrument against vibrations.
- For instrument installation you should foresee a cutoff device to allow easy and quick disconnection of the device from the power supply.
- When installing the control unit on a crystallizer, use a distance rail to minimize thermal radiation and heat conduction. See Figure 4-3.
- When the control unit is set-up outdoors, it has to be protected from direct sunshine and rain for example by means of an adequately large protective roof.

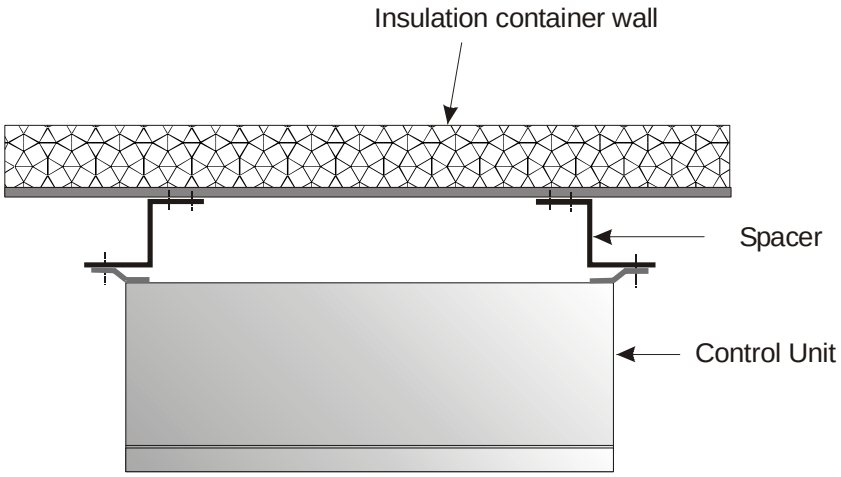


Figure 4-3: View from above: Installation of control unit on a crystallizer

4.3 Connecting the Control Unit

4.3.1 Connecting the HF Cable

For the connection of the sensor with the control unit, you will need a HF cable quad. Additionally, the flow cell requires an N-connector.

Prerequisite for a proper measurement is the correct installation of cables! Please keep in mind:

IMPORTANT

Make sure the cables do not get into contact with hot pipes over the entire length (corrugated tube and single cable section after splitting), e.g. direct contact with the device wall (not insulated). This alone guarantees that all single cables are subject to the same ambient conditions and that the compensation of the cable drift works properly.

Never bend HF cables! The bending radius should not be less than 100 mm. After installation, fix the cables with cable binders to prevent the cable from slipping!

Connecting the Flow Cell

The HF-cable quad and the HF-connections on the control unit are labeled. Connect the flow cell to the control unit as shown in Figure 4-4 and make sure that you only connect cables with equal labeling. The two connections on the flow cell are not labeled, the allocation of the cable connectors M-Tx and M-Rx is arbitrary. The cable plugs R-Tx and R-Mx are connector to the N-connector (short-circuited).

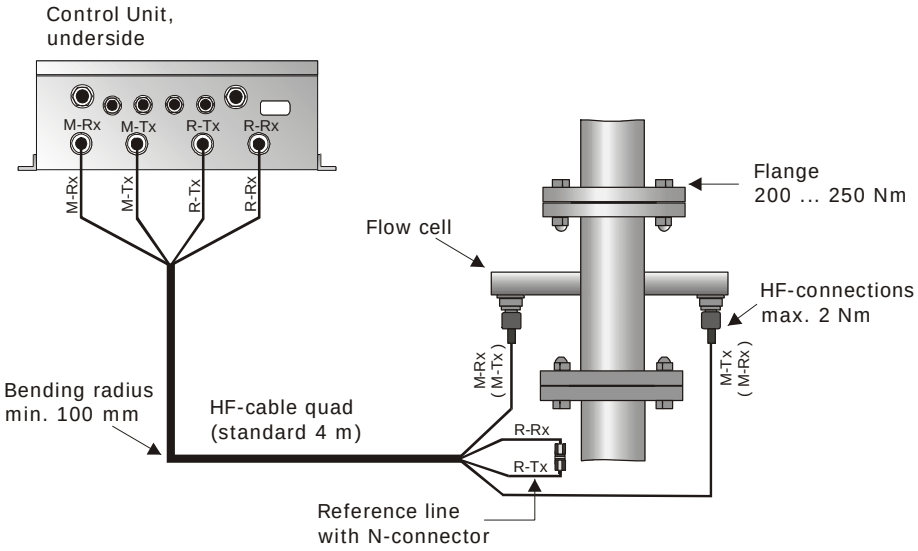


Figure 4-4: Connection of flow cell version 1

Connecting the Container Probes

The HF cables and the HF connections on the control unit and on the probe are labeled. Connect the flow cell to the control unit as shown in Figure 4-5, and make sure that you only connect cables with equal labeling.

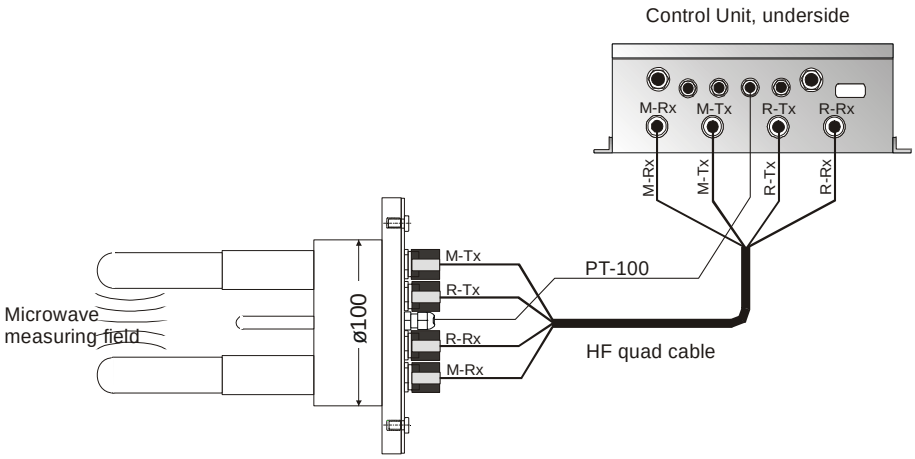


Figure 4-5: Connection of the container probe to the control unit

IMPORTANT

When tightening the 21 mm screw nut, make sure that the connector is not twisted on the cable. If the connector is twisted relative to the cable, the shielding may get damaged and this could result in mismatching and bad sealing.

Hand tighten all screwed connections of the HF cable (2 Nm = 0.2 kg/m)! Before tightening, carefully screw on the cable by hand. **Caution! Threaded joint jams easily.**

Occasionally you should check if the screwed connection is still properly tightened. If the installation is exposed to vibrations, the screwed connection may come loose and this may result in inaccurate measurements or corrosion of the connections.

As long as the cables are not connected, the coaxial sockets have to be covered immediately with plastic caps and the cable connectors have to be protected by suitable provisions against moisture and dirt.

4.3.2 Pin Configuration of the Connector Strip

⚠ WARNING

Electrical shock hazard:

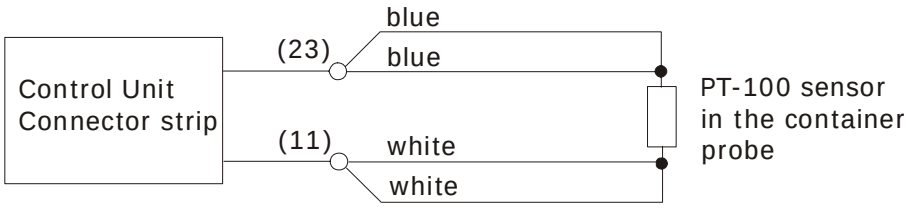
Disconnect power to rule out any contact with live parts during installation and when servicing.

Turn off power supply before opening the instrument. NEVER work on open and live instruments.

Temperature Signal Connection

A Pt 100 or a temperature current signal has to be connected to current input 1 or 2 if temperature fluctuations occur in the product and if a temperature dependence of the phase or attenuation measurement is likely to occur. The temperature sensor has to measure the material temperature in the vicinity of the microwave probe.

When taking the container probe into operation, connect the 4wire cable of the Pt 100 to the connector strip of the control unit as follows:



( ) Terminal no.

Figure 4-6: Pt 100 connection container probe

Other Connections

- Connect all desired input and output signals to the terminal strip as shown below. Use the M feed-through to maintain the degree of protection.
- Check if the voltage indicated on the type plate matches your local supply voltage.
- Connect the line cable to the terminals 3(L1), 2(N) and 1(PE).
- Check if the test switch (mains interruption) is in position „on“ (see Figure 5-1).
- Close the instrument housing and turn on the power supply.

NOTICE

Attention! Possible danger, damage to property! Concerns the system type CH-200-024 Control Unit High Dynamic 24 V DC (Id.-No. 54878-02):
When connecting the 24 V DC auxiliary power, the + and – Poles should be connected correctly. There is no reverse voltage protection!

The line cross-section for the power supply must be at least 1.0 mm^2.

On the connector strip of the control unit you find the following connections:

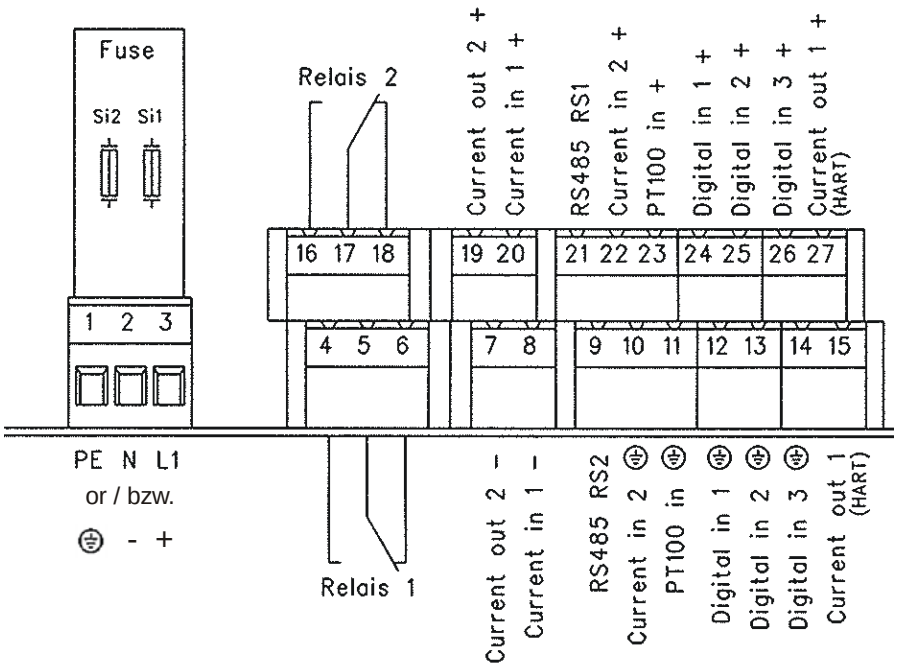


Figure 4-7: DynFAS MW wiring diagram

Power supply: Terminals 3 (L1, +), 2 (N, -) and 1 (PE, ⏚)

For CS-100, depending on instrument version, see type label on the outer wall of the housing.
1.) 90 V - 265 V AC, 45 - 65 Hz
2.) 24 V DC: 18 … 36 V
24 V AC: -20%, +5%, 40 … 440 Hz

For CH-200, depending on instrument version, see type label on the outer wall of the housing.
1.) 90 V - 265 V AC, 45 - 65 Hz
2.) 24 V DC: 18 … 36 V, no reverse voltage protection

Current input no. 1 (terminals 20+ and 8-), insulated

Input as 0/4 - 20 mA signal. e.g. for temperature compensation or reference signal recording.

Current input no. 2 (terminals 22+ and 10-), not insulated

Input as 0/4 - 20 mA signal. e.g. for temperature compensation or reference signal recording.

Current output no. 1 (terminals 27+ and 15-), insulated

Output as 4 - 20 mA signal. Output options: concentrations (1/2), current inputs signals (1 / 2) and Pt 100 signal

Current output no. 2 (terminals 19+ and 7-), insulated

Output as 0/4 - 20 mA signal. Output options: concentrations 1 and 2, current input signals 1 and 2 and Pt 100 signal

Pt 100 (terminals 23+ and 11-)

Connection for temperature measurement.

Digital input 1: DI1 (terminals 24+ and 12-)

Configuration options:

- no function
- measurement: start (closed) and stop (open)

Digital input 2: DI2 (terminals 25+ and 13-)

Configuration options:

- no function
- average value: hold (closed) and continue averaging (open)
- product selection: product 1 (open) and product 2 (closed)

Digital input 3: DI3 (terminals 26+ and 14-)

Configuration options:

- no function
- start sampling, open: no action, closed: unique measurement starts
- product selection

Relay 1: (terminals 4, 5 and 6)

Changeover contacts (SPDT), insulated, configuration option:

- no function
- error message
- stop measurement
- limit value min. and max.
- no product

Relay 2: (terminals 16, 17 and 18)

Changeover contacts (SPDT), insulated, configuration option:

- no function
- error message
- stop measurement
- limit value min. and max.
- no product

RS485 interface (terminals 21 (RS1) and 9 (RS2))

Serial data interface for output of live data (all measuring data for every sweep, measuring cycle) the setup protocol and data log.
Data format: 38400 baud, 8 data bits, 1 stop bit, no parity, no handshake.

RS232 interface (on instrument bottom)

9-pole SubD-connector. Serial data interface for output of live data (all measuring data for every sweep, measuring cycle) the setup protocol and data log.
Data format: 38400 baud (Data transfer rate), 8 data bits, 1 stop bit, no parity, no handshake.

4.3.3 Digital Outputs, Relays

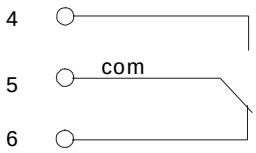
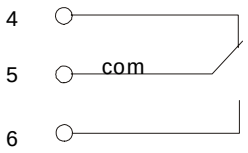
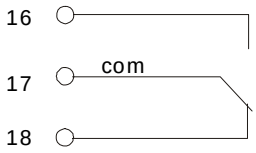
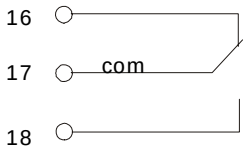
The status of the measurement is output via two relays:

- Error
- Alarm (alarm min. and max.)
- No product

  Under menu item Plausibility, you may enter a min. attenuation for pause detection (e.g. for process pause, no product present); if this value is not reached, „no product“ is signaled via a relay and the current output drops to 0 or 4 mA.
  A typical application is pause detection between the discontinuous evaporation crystal processes.

- Measurement stopped

The respective switching status is also signaled via LED’s on the front panel (LED’s: signal 1 and 2).

Relay no.	Error, alarm, no product, measurement stopped, currentless status	Normal
1		
2		

The relays with changeover contacts can either be operated as make contact, terminals 4 & 5 (open at error, alarm ...) or as break contact, terminals 5 & 6 (closed at error, alarm ...).

Chapter 5. **Service Instructions**

5.1 General Information

The control unit has no wearing parts or components requiring any special maintenance.

A malfunction of the measuring system is not always due to a defect in the instrument. Often the error is caused by incorrect operation, wrong installation, or irregularities in the product being measured.

If a malfunction occurs, anyway, the measuring system helps you to identify and eliminate errors by displaying error messages on the LCD, indicating operator errors and defects of the electronics.

Usually, faulty modules of the control unit cannot be repaired but have to be replaced. The microwave module is fixed with screws to a shielding cover and must not be opened.

5.2 Wearing Parts

The control unit consists of no wearing parts and components that need special attention.

The plastic rods of the Probes and the PTFE lining of the Flow Cell can eventually experience abrasion depending on the material being measured. A lower to middle abrasion influences inconsiderably the measurement or is compensated by calibration. Therefore, you should check the wearing parts approximately every 2 years.
The plastic rods of the Probe and the lining of the Flow Cell can be exchanged if abrasion is heavy. During excessive wear, the plastic rods of the Probe and the lining of the Flow Cells can be exchanged. These Probes and the Flow cells have to be sent back to the company. An on-site exchange is not possible.

5.3 Instrument Cleaning

Clean all system components using a moistened cloth. Do not use any chemical cleaning agent. Parts coming into contact with the product (during regular operation) can be cleaned with hot water, taking into account the temperature limits (see chapter 6.2 Technical Data Sensors).

5.4 Battery

If the measuring system DynFAS MW is without power supply (power failure or disconnected from mains), the system clock is supplied with power by the Lithium battery on the CPU. The instrument works correctly even with empty battery, only measured data which are output via one of the serial interfaces may become useless as a result of the faulty date and time information.

The service life of the battery, even under continuous load, is at least 8 years. To replace the battery, you have to disconnect the instrument from mains.

Battery type: 3 Volt Lithium cell (round cell battery), type CR2032.

5.5 Fuse Replacement

The mains fuse of the DynFAS MW is located in the wall housing. Replace the fuses only if the instrument is disconnected from mains. Be sure that the new fuses match the rating specified.

Use only fuses with correct rating:
For CS-100:
Instrument version with 90 ... 265 V AC: 2.0 A slow-blow
Instrument version with 24 V AC/DC: 2.0 A slow-blow
For CH-200:
Instrument version with 90 ... 265 V AC: 2.0 A slow-blow
Instrument version with 24 V DC: 6.3 A slow-blow

NOTICE

Spare fuses must match the rating specified by the device manufacturer. Short-circuiting or manipulation is not permitted.

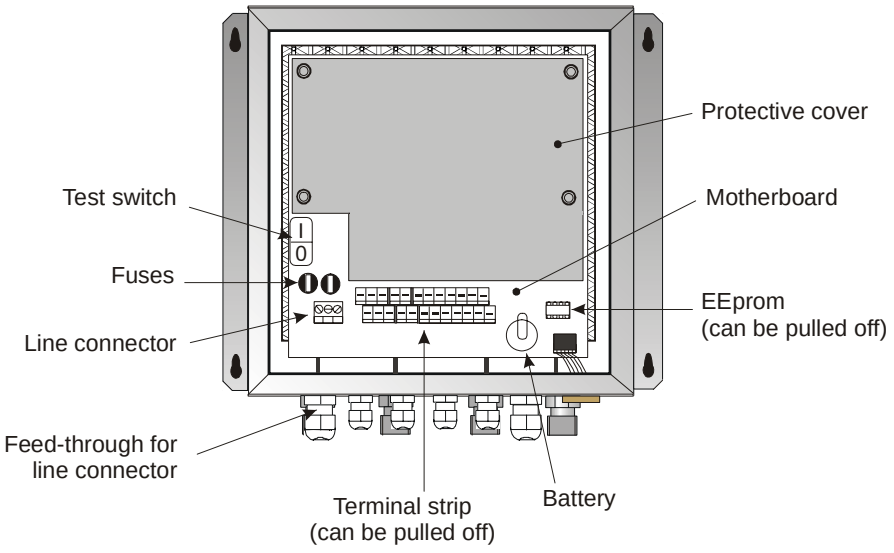


Figure 5-1: Look inside the instrument CS-100

Chapter 6. **Technical Data**

General Specifications	
Method	Microwave transmission measurement
Working frequency	2.4 – 2.5 GHz (ISM band), depending on local regulations
Transmission power	CS-100: < 0.1 mW (< -10 dBm) CH-200: < 10 mW (< 10 dBm) All coaxial line power
Applications	Concentration measurement in containers and pipes

6.1 Control Unit

Control unit	
Housing	Wall housing made of stainless steel, material 1.4571 (~316+Ti), see dimensional drawing in chapter 8. CS-100: HxWxD: 300 x 323 x 140 mm CH-200: HxWxD: 400 x 338 x 170 mm
Protection type	IP 65
Weight	CS-100: approx. 6.5 kg CH-200: approx. 8.0 kg
Operating temperature	-20 ... +60°C (253 ...333 K), Humidity 0 – 90% relatively, no condensation
Storage temperature	-20 ... +80°C (253 ...353 K), Humidity 0 – 90% relatively, no condensation
Achievable accuracy	≤ 0.2 weight % (standard deviation) depending on product and sensor
Display	Dot matrix LC display, 114 mm x 64 mm, 240 x 128 pixels, with back-lighting, automatic contrast setting
Keyboard	Freely accessible foil keypad, light-stable and weatherproof: alphanumeric keyboard and four softkeys (software-assigned buttons)
Power supply	For CS-100 depending on instrument version: 1.) 90 ... 265 V AC, 45 ... 65 Hz or 2.) 24 V DC: 18 ... 36 V 24 V AC: -20%, +5%, 40 ... 440 Hz For CH-200 depending on instrument version: 1.) 90 ... 265 V AC, 45 ... 65 Hz or 2.) 24 V DC: 18 ... 36 V, no reverse voltage protection

Power consumption	For CS-100: max. 30 VA (AC/DC), depending on configuration For CH-200: max. (48/60) VA (AC/DC), depending on configuration
Fuses	For CS-100: 2 x 2.0 A / slow-blow For CH-200: 2 x 2.0 A / slow-blow for 90 … 265 V AC or 2 x 6.3 A / slow-blow for 24 V DC
Battery type	3 V Lithium button cell, type CR2032
Measured value	e.g. concentration, dry content
Inputs and Outputs	
Cable cross-section	min. 1.0 mm² (mains supply)
Cable feed-through	2 x M20x1.5 for cable 5...14 mm (depending on application) 4 x M16x1.5 for cable 5 ...8 mm (depending on application)
Sensor connection	Inputs and outputs for signal and reference channel, 50 Ω N-socket
HF-cable	Cable lengths: 2, 4, 6 and 10 m; 50 Ω; both sides with 4 N connectors
Current input	2 x current input 0/4 ...20 mA, ohmic resistance 50 Ω, 1x insulated, 1x instrument ground e.g. for temperature compensation
Current output	Current output 1: 4...20 mA, ohmic resistance max. 800 Ω , insulated current output 2: 0/4...20 mA, ohmic resistance max. 800 Ω , insulated e.g. for measured value or temperature output
Pt 100 connection	Measuring range: -50 ... +200°C (223 ... 473 K); measurement tolerance: < 0.4°C

Digital input	3 x digital inputs (DI1..3), for floating connectors Configuration options: DI1: none, measurement start/stop DI2: none, measurement hold, product selection DI3: none, sampling, product selection Function description: 1. Measurement (Start/Stop) open: measurement stopped closed: measurement started or measurement running 2. Hold measurement open: measurement running closed: measurement stopped, i.e. average values and current output are held 3. Product selection open: product 1 (P1) closed: P2; **with two DI's:** DI2 open & DI3 open: P1, DI2 closed & DI3 open: P2, DI2 open & DI3 closed: P3, DI2 closed &DI3 closed: P4 4. Start sampling open: no actions closed: single measurement starts
Relay outputs	2 x relays, insulated Configuration options: - Collective failure message - Stop measurement - Limit value (alarm min. and max.) - No product Load capacity: AC: max. 400VA DC: max. 90W AC / DC: max. 250V, max. 2A, non-inductive ≥ 150V: voltage must be grounded The cable and insulation that are to be connected to these cables must correspond to a mains connection. Restrictions for 24 V AC/DC mains supply, if the ground conductor is not connected to terminal 1 (PE): AC: max. 50 V DC: max. 70 V
Serial interfaces	RS 232 on the underside of the instrument, RS 485 through terminal block Data type: 38400 baud, no handshake, 8 data bits, 1 stop bit, no parity

6.2 Technical Data Sensors

Flow Cells	
Application	Microwave flow cell with various nominal widths and flanges for measurement on pipelines
Material	Stainless steel, PTFE lining
Process coupling	Flange according to DIN EN 1092 Type 05 and ASA
Process pressure	Up to 20 bar (relative), depending on nominal width and flange type, see table below
Temperature range	Product temperature: +10 ... +130°C (283 … 403 K) Ambient temperature: -20 ... +60°C (253 … 333 K) Storage temperature: +10 ... +80°C (283 … 353 K)
Connections	2 x HF connections: N-socket, 50 Ω for HF-cable with max. 10 m length
Versions	Nominal pipe widths from 50 ... 150 mm
Dimensions	See dimensional drawings in chapter 8

Overview Flow Cells

Designation	ID-No.	Nominal width [mm]	Flange	Pressure [bar]
FC-050-016	54943	50	DN 50 / PN 16	16
FC-065-040	54944	65	DN 65 / PN 40	20
FC-080-016	54945	80	DN 80 / PN 16	16
FC-100-016	54946	100	DN 100 / PN 16	16
FC-150-016	54941	150	DN 150 / PN 16	16
FC-020-150	54947	50	ASA 2'' / 150 PSI	16
FC-025-300	54948	65	ASA 2.5'' / 300 PSI	20
FC-030-150	54949	80	ASA 3'' / 150 PSI	16
FC-040-150	54950	100	ASA 4" / 150 PSI	16
FC-060-150	54951	150	ASA 6'' / 150 PSI	16

Probes	
Application	Probes with and without flushing device for concentration measurement in process containers and pipelines with nominal width ≥ 200 mm.
Material	Plastic rod, stainless steel PT100 connection cable: Silicon / Teflon
Process coupling	Flange according to DIN EN 1092 Type 05 DN65 / PN6, DN 80, 100, 150 / PN16; ASA flange 2.5'', 3'' / 150 PSI
Process pressure	Up to 16 bar (relative), depending on model
Temperature range	Product temperature: +10 ... +120°C (283 ... 393 K) Ambient temperature: -20 ... +60°C (253 ... 333 K) Storage temperature: +10 ... +80°C (283 ... 353 K)
Connections	4 x HF connections: N-socket, 50 Ω for HF-cable with max. 10 m length
Dimensions	See dimensional drawings in chapter 8
Accessory sealing washer	
Material	Klingersil C-4400
Thickness	3 mm

Overview Probes

Designation	ID-No.	Flange	Pressure [bar]
P-065-006	54939-01	DN 65 / PN 6	6
P-080-016	54939-02	DN 80 / PN 16	16
P-100-016	54939-03	DN 100 / PN 16	16
P-150-016	54939-04	DN 150 / PN 16	16
P-025-150	54939-05	ASA 2.5'' / 150 PSI	16
P-030-150	54939-09	ASA 3'' / 150 PSI	16
PF-065-006	54940-01	DN 65 / PN 6	6
PF-080-016	54940-02	DN 80 / PN 16	16
PF-100-016	54940-03	DN 100 / PN 16	16
PF-150-016	54940-04	DN 150 / PN 16	16
PF-025-150	54940-05	ASA 2.5'' / 150 PSI	16

6.3 Technical Data HF-Cable

HF-Cable Quad	
Material	Corrugated tube: Polyamide (PA6) Cable sheath: Polyethylene (PE)
Protection type	IP 66
Temperature	Operating temperature: -30 ... +70°C (243 ... 343 K) Installation temperature: -20 ... +70°C (253... 343 K)

Summary HF-Cable Quad, Cable lengths	
Length [m]	Id No.
2.0	54856
4.0	54857
6.0	54858
10.0	54859

6.4 Format of Serial Data Output RS 232 and RS 485

Header

Date·Time→Flags→Status→Product→Att→Phi→R2→Tint→IN1→IN2→Pt 100→C→Cm→C2→C2m¶

Following lines

01.01.2005·00:00:00→0000→0→1→0.43→5.30→0.07→0.0→0.0→0.0→0.0→75.36→75.00→0.00→0.00¶

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Column no.	Description	Format
1	Date and time	DD.MM.YY·HH:MM:SS
2	Flags (for test purposes)	4 digits, HEX
3	Status: Information on quality of last measurement	0 : measurement OK < 0 : error
4	Product number	X (1 to 4)
5	Attenuation [dB]	X.XX
6	Phase [°/GHz]	X.XX
7	Statistical spread of phase regression	X.XX
8	Instrument temperature [temperature unit]	X.X
9	Current input 1 [unit of current input]	X.X
10	Current input 2 [unit of current input]	X.X
11	Pt 100 temperature [temperature unit]	X.X
	[...] by selection of unit g/cm^3	
12	Concentration 1 live	X.XX [X.XXXX]
13	Concentration 1 averaged	X.XX [X.XXXX]
14	Concentration 2 live	X.XX [X.XXXX]
15	Concentration 2 averaged	X.XX [X.XXXX]

Special characters

"→" Tabulation "¶" Carriage return + Line feed "·" Blank character

Chapter 7. **Certificates**

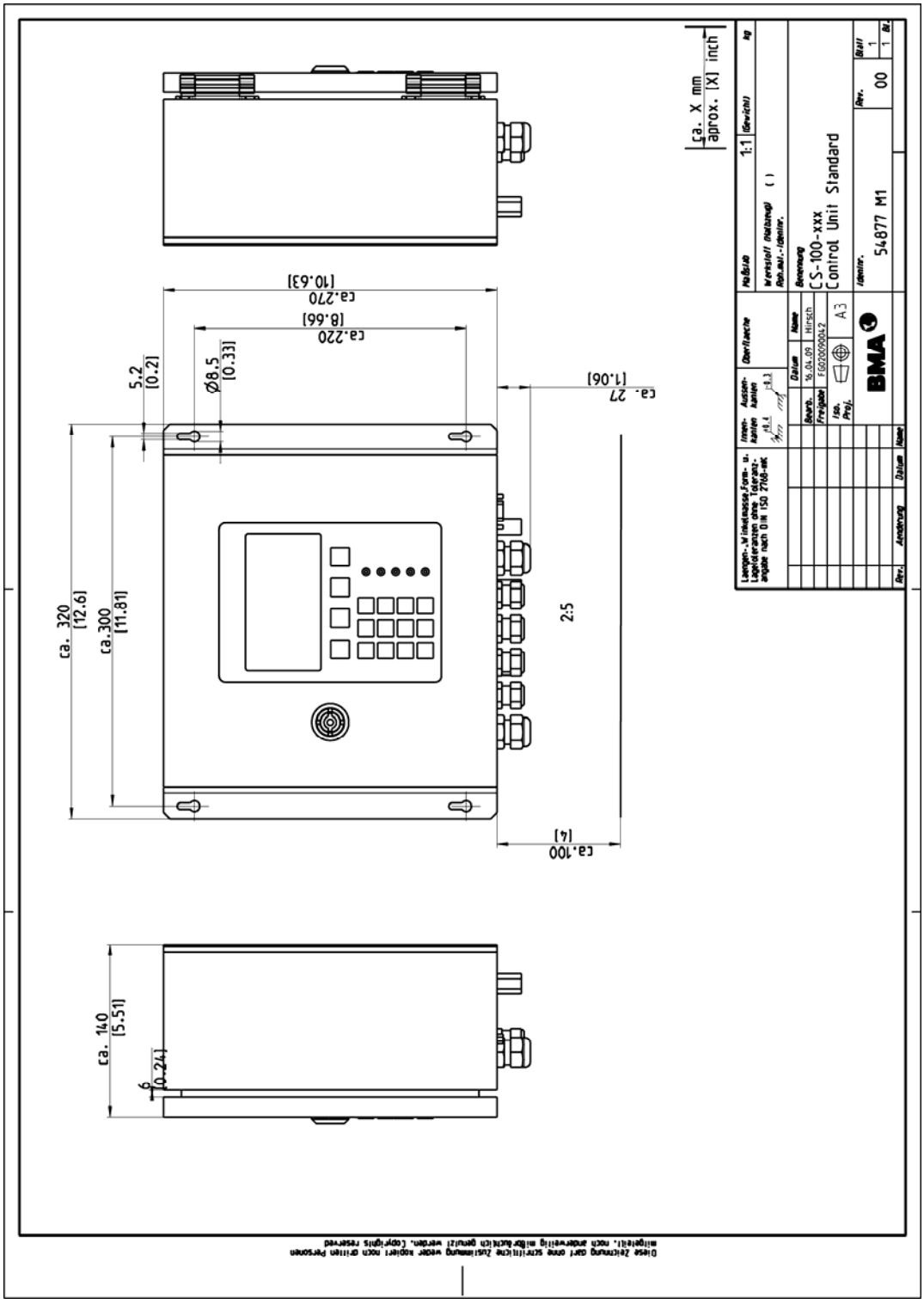
7.1 EC Declaration of Conformity

7.2 Frequency Approval

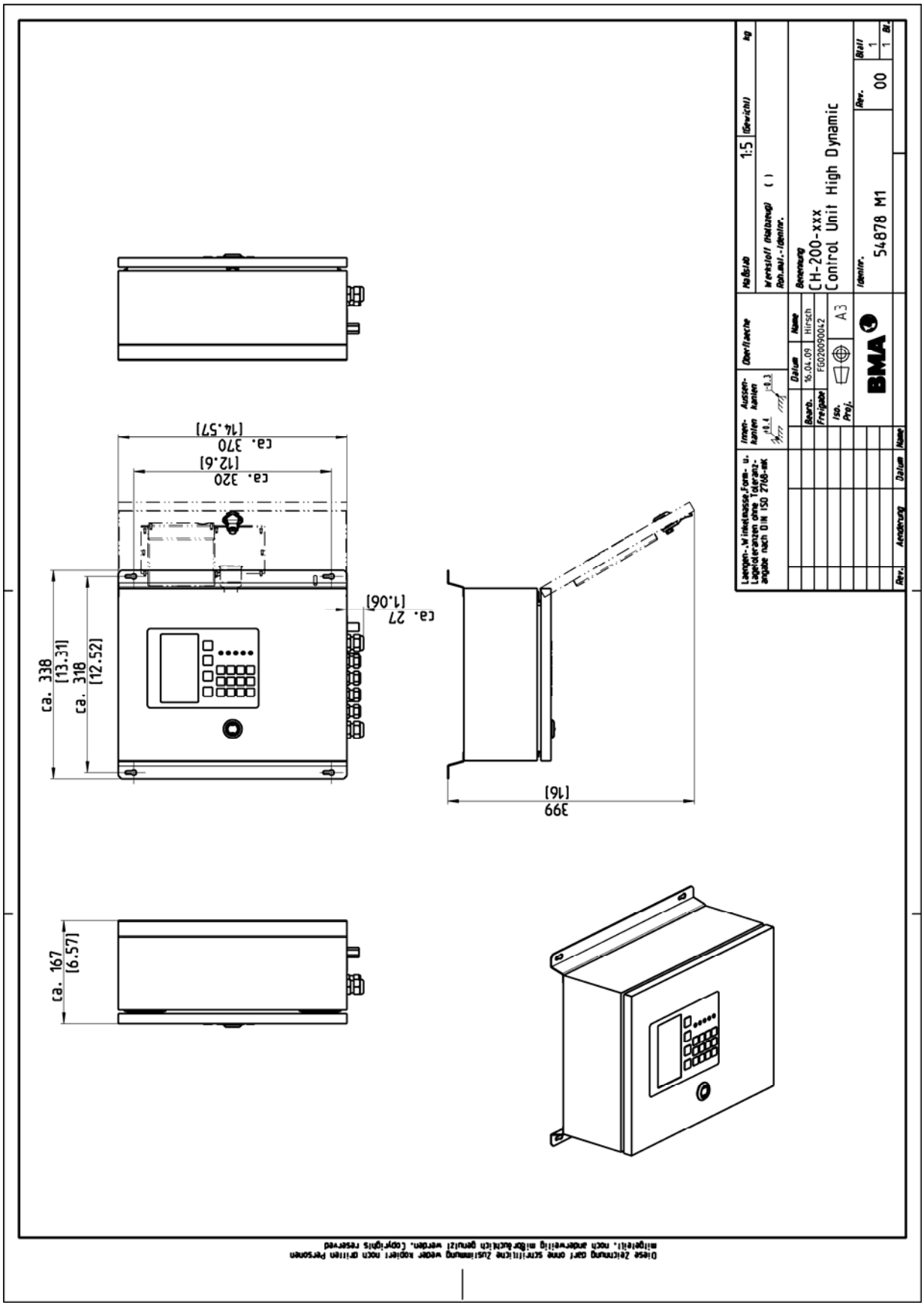
Chapter 8. **Technical Drawings**

8.1 Dimensional Drawing of Control Unit Housing

8.1.1 Control Unit Standard CS-100



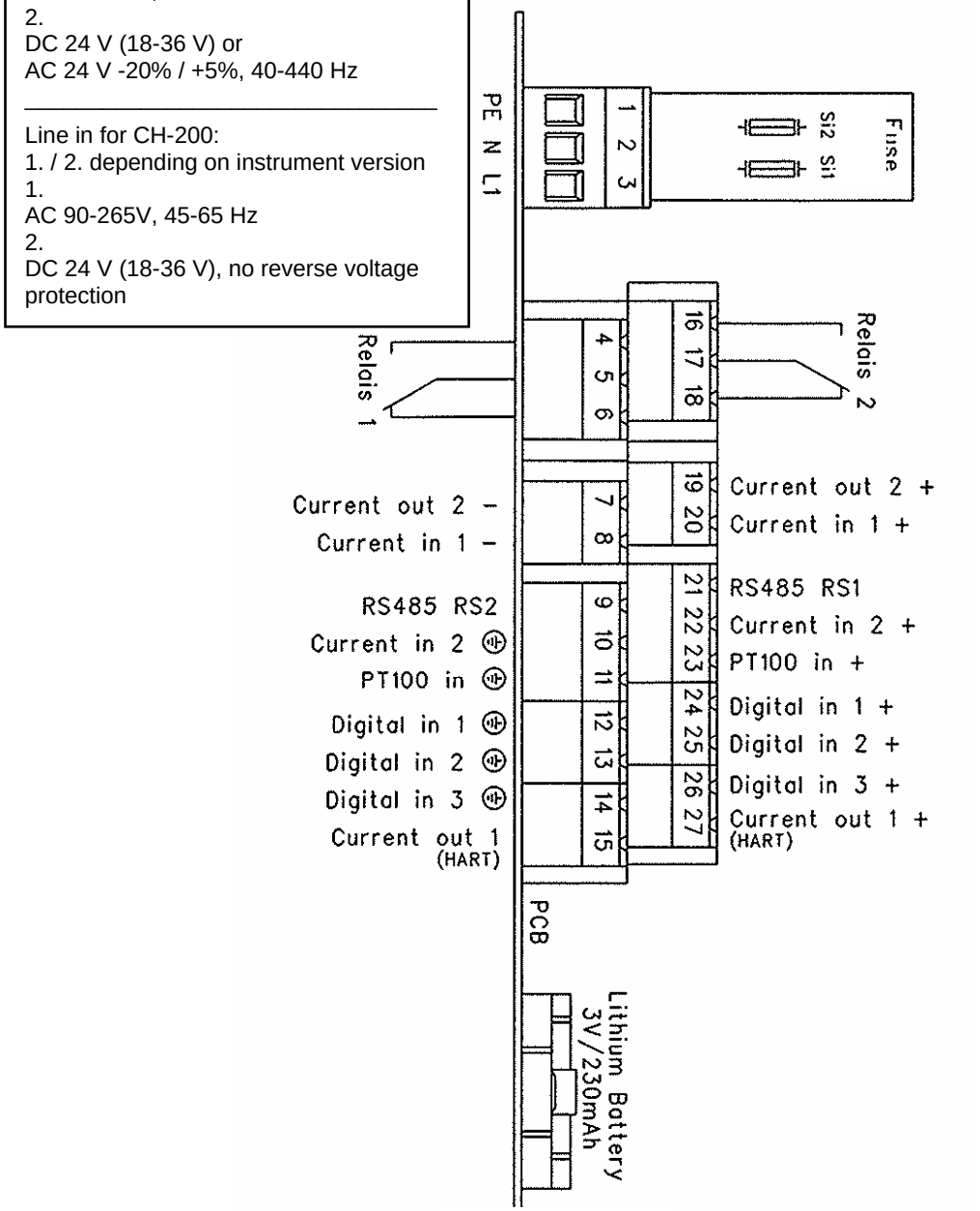
8.1.2 Control Unit High Dynamic CH-200



8.2 Electrical Wiring Diagram

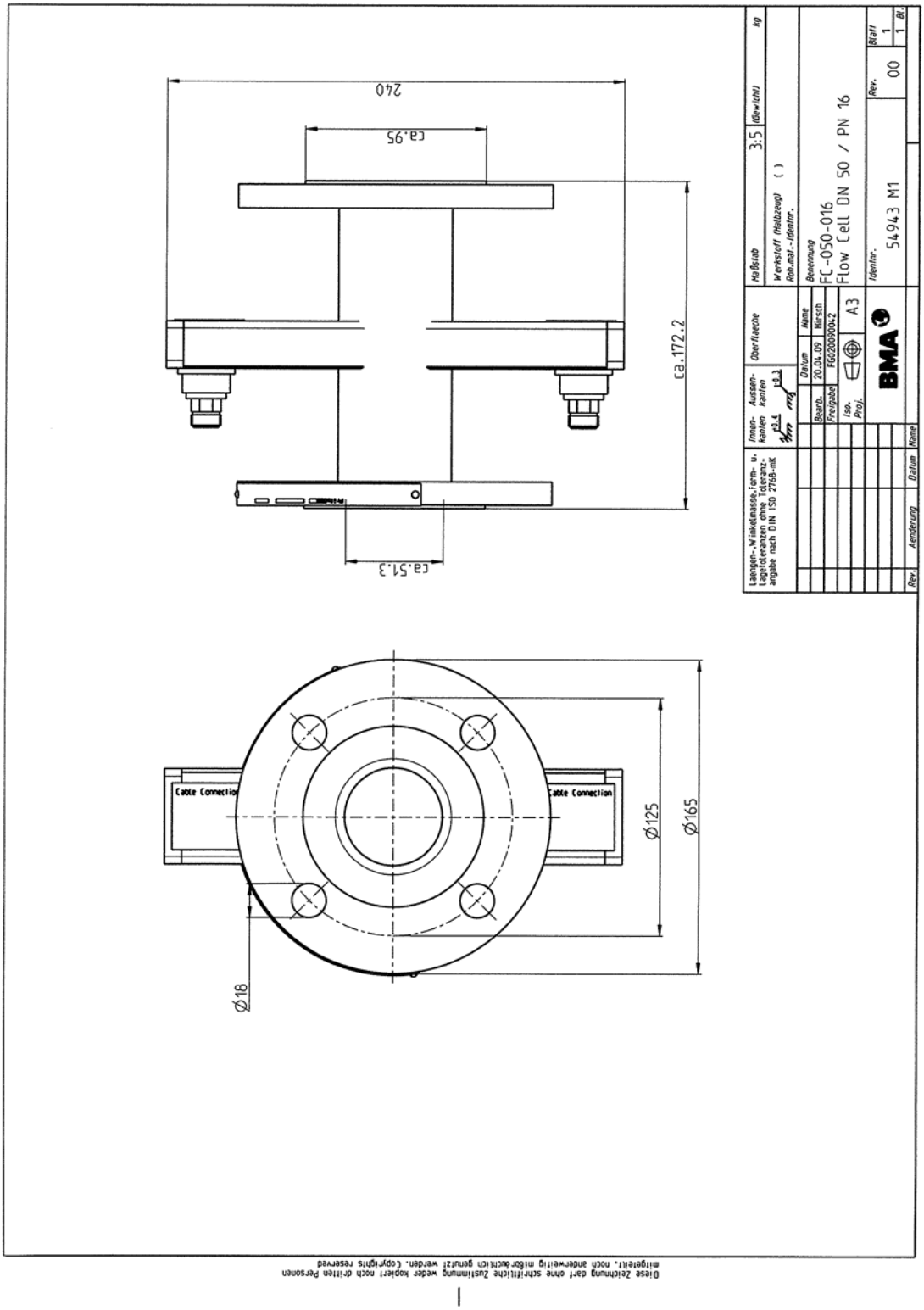
Line in for CS-100:
1. / 2. depending on instrument version
1.
AC 90-265V, 45-65 Hz
2.
DC 24 V (18-36 V) or
AC 24 V -20% / +5%, 40-440 Hz

Line in for CH-200:
1. / 2. depending on instrument version
1.
AC 90-265V, 45-65 Hz
2.
DC 24 V (18-36 V), no reverse voltage protection

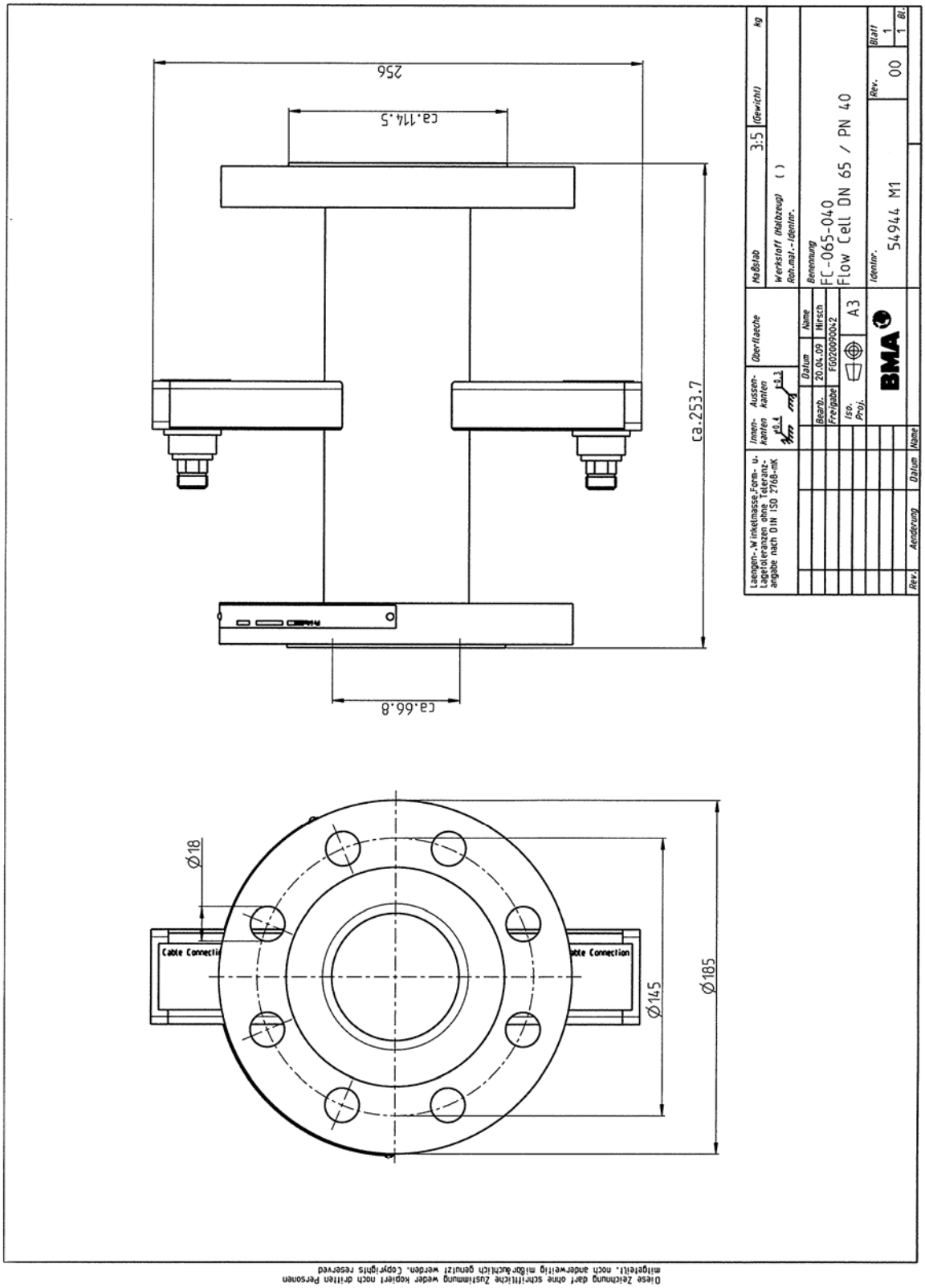


8.3 Dimensional Drawings Flow Cells

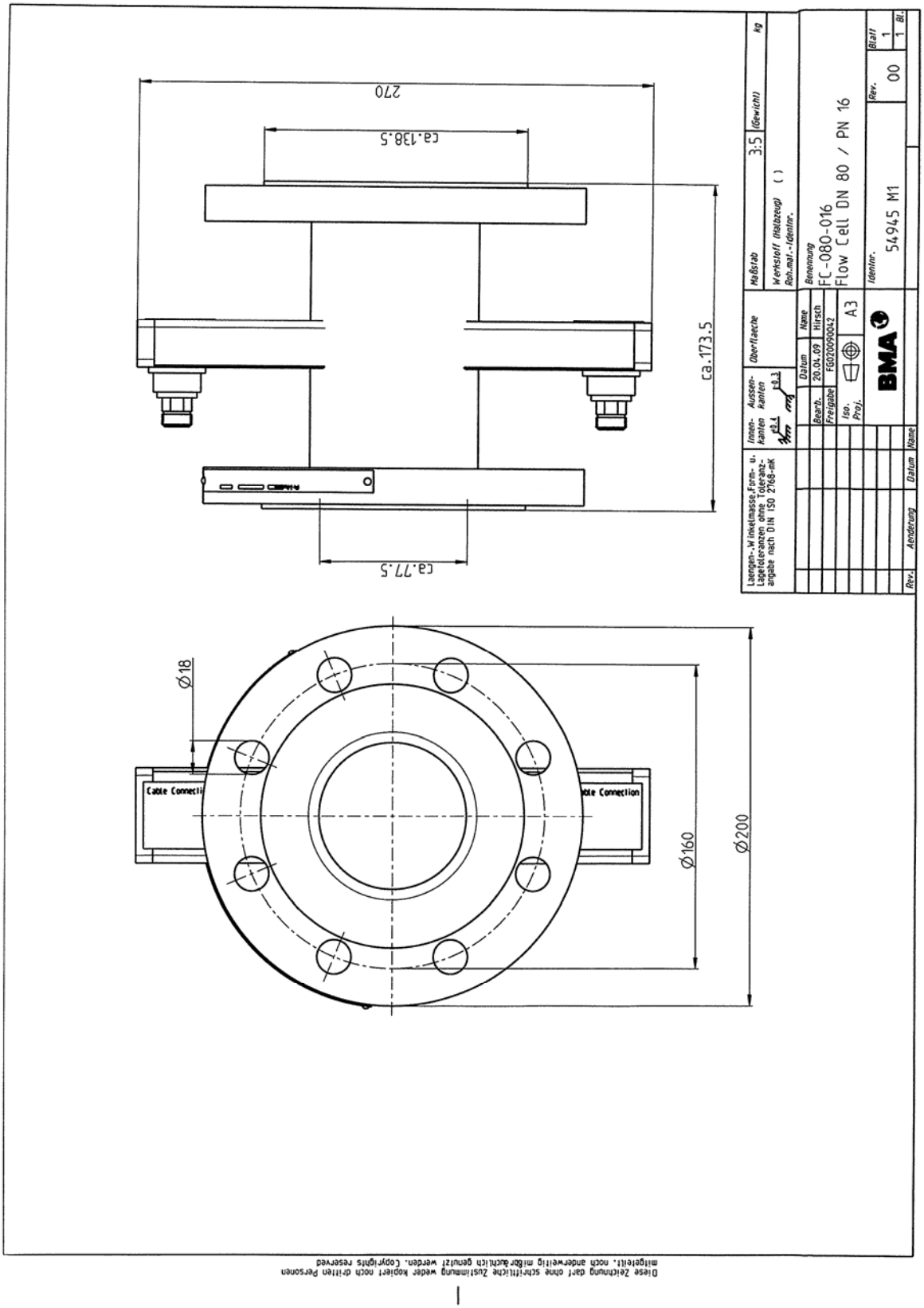
8.3.1 Type FC-050-016



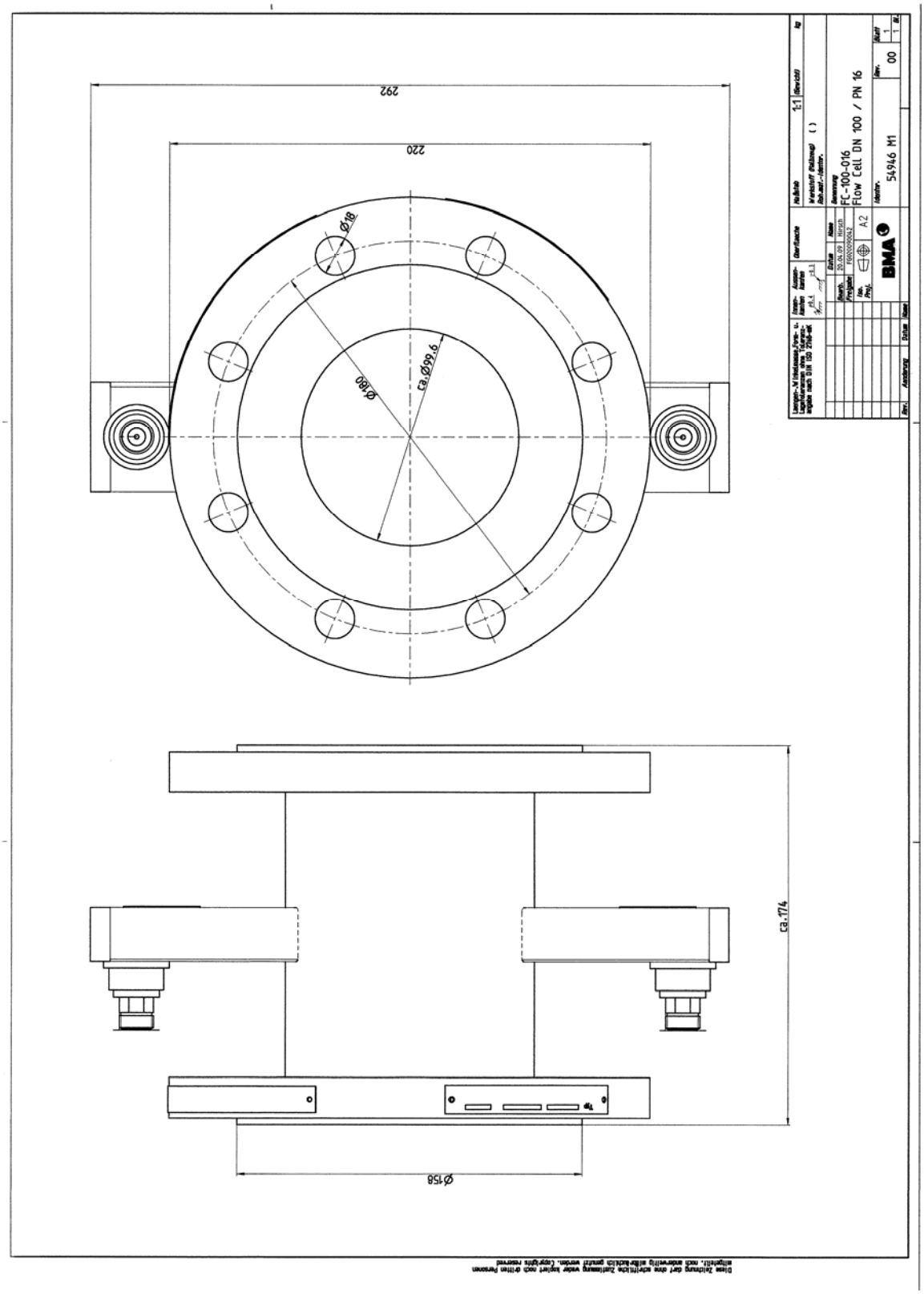
8.3.2 Type FC-065-040



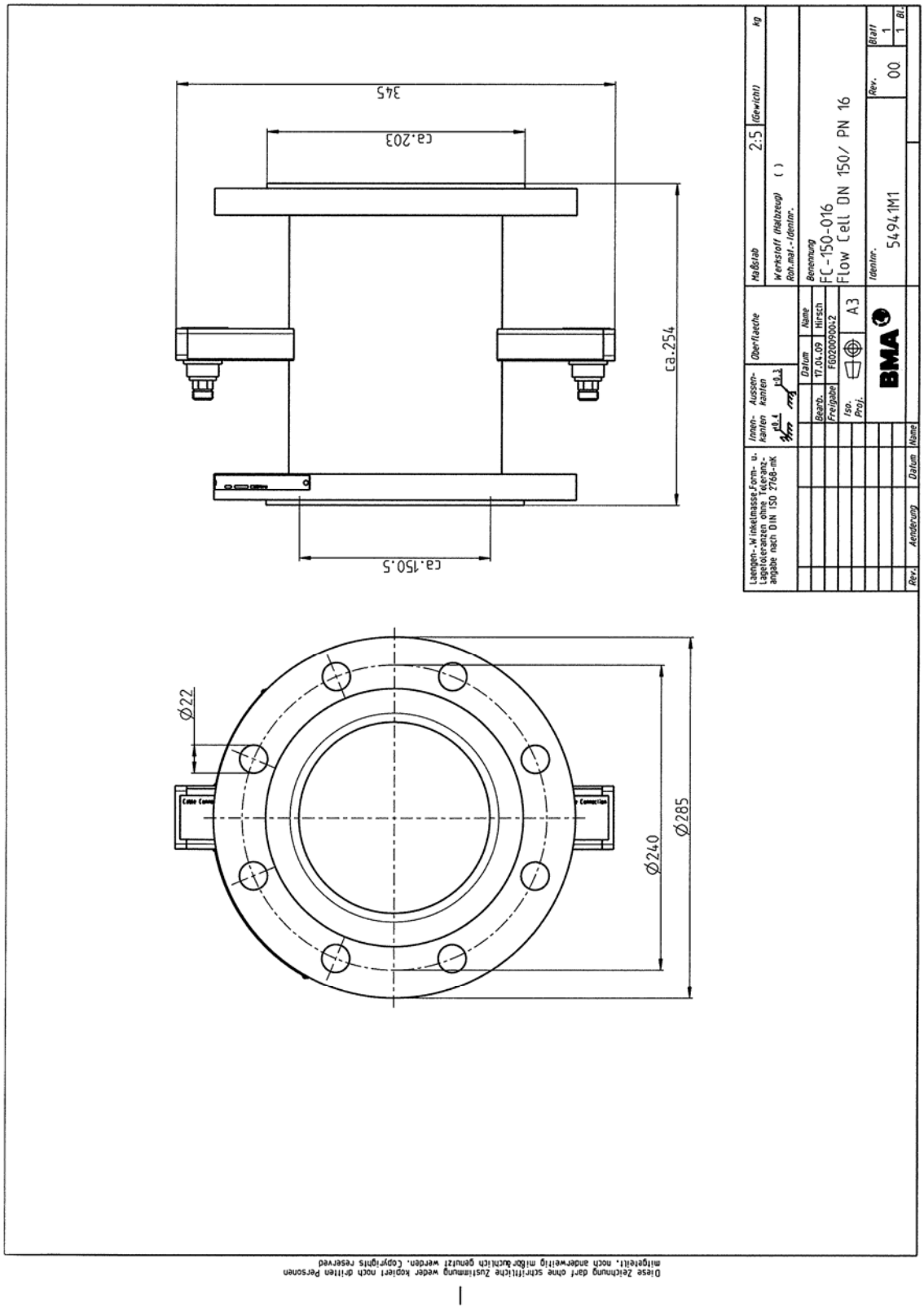
8.3.3 Type FC-080-016



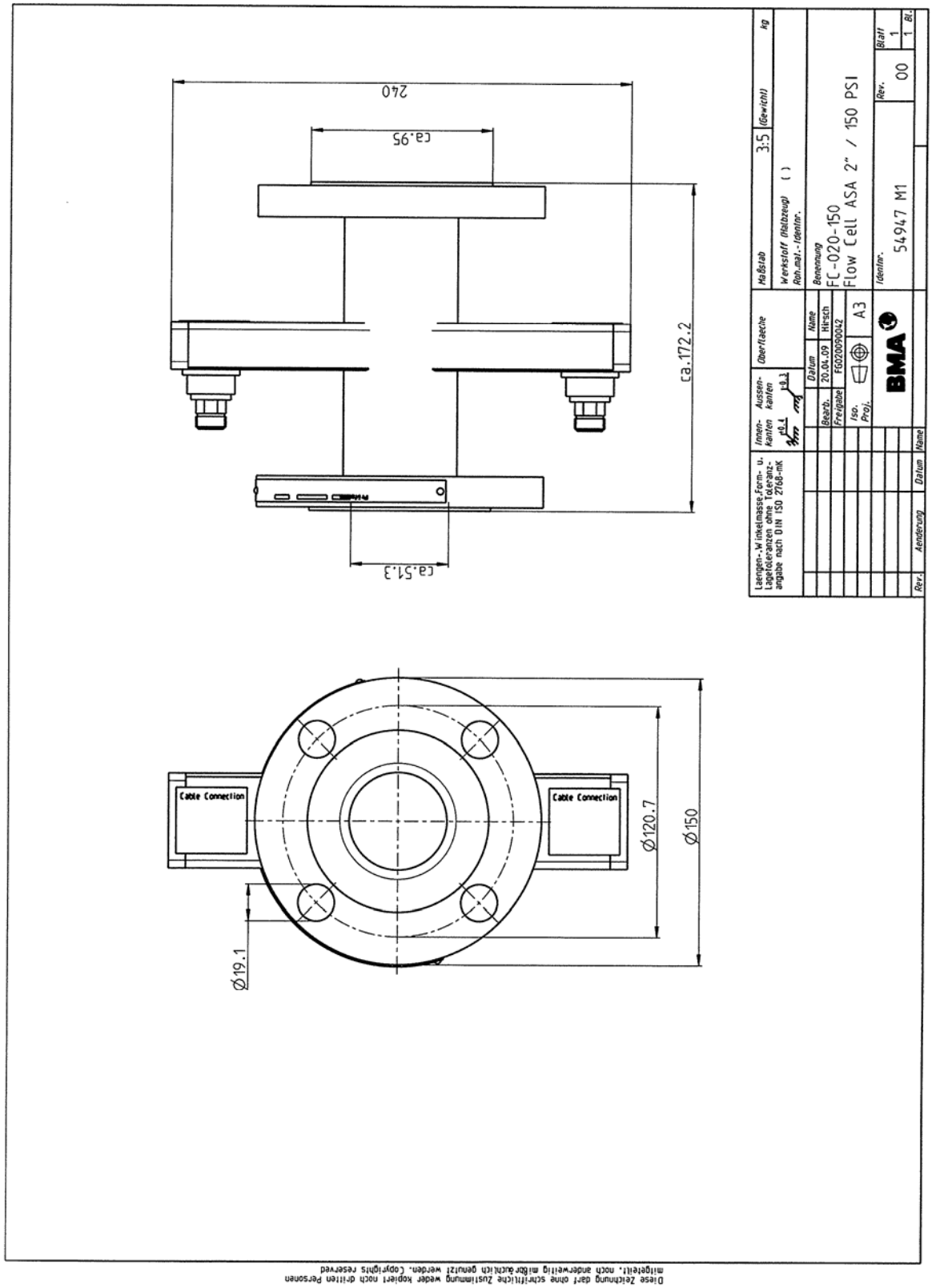
8.3.4 Type FC-100-016



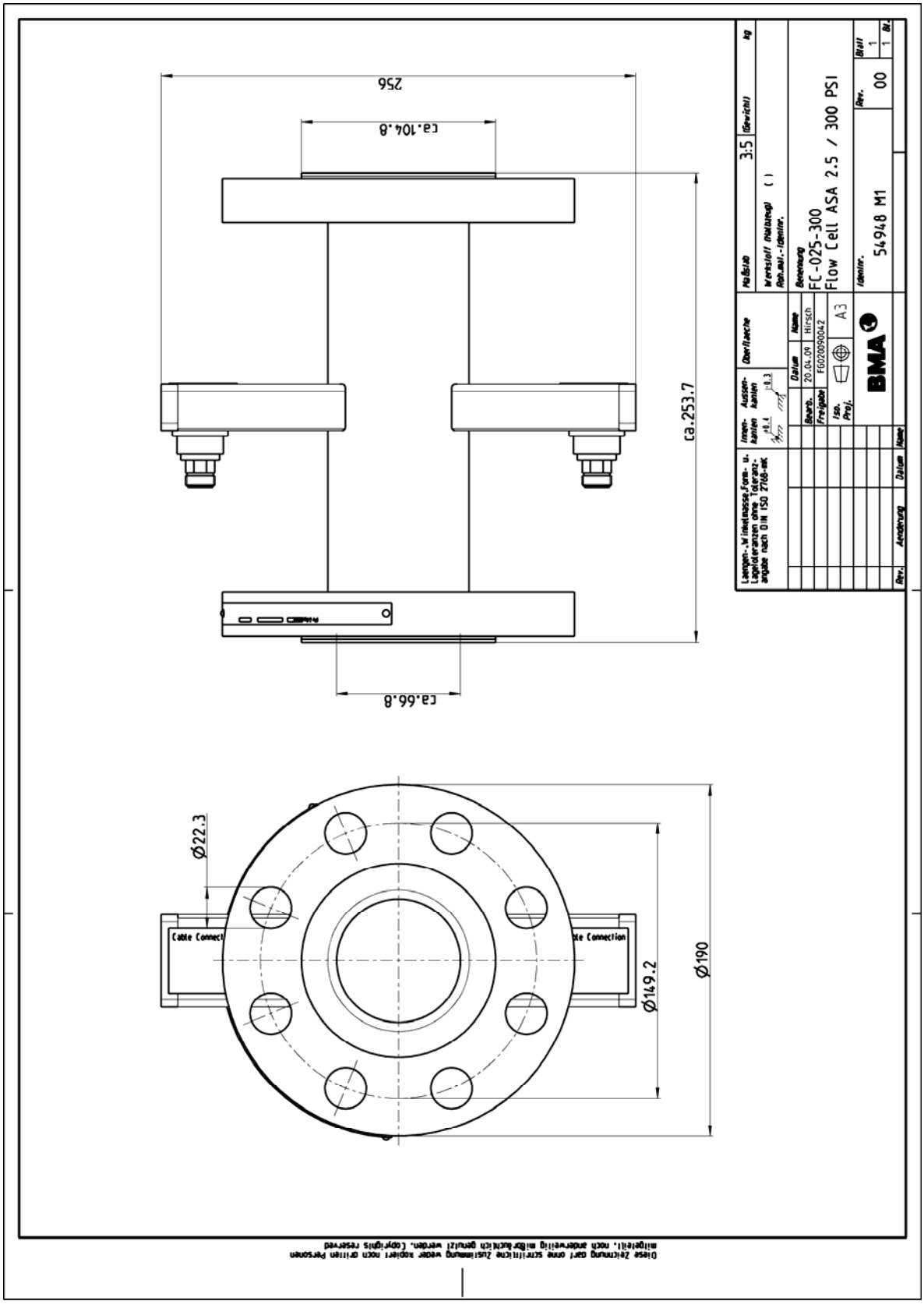
8.3.5 Type FC-150-016



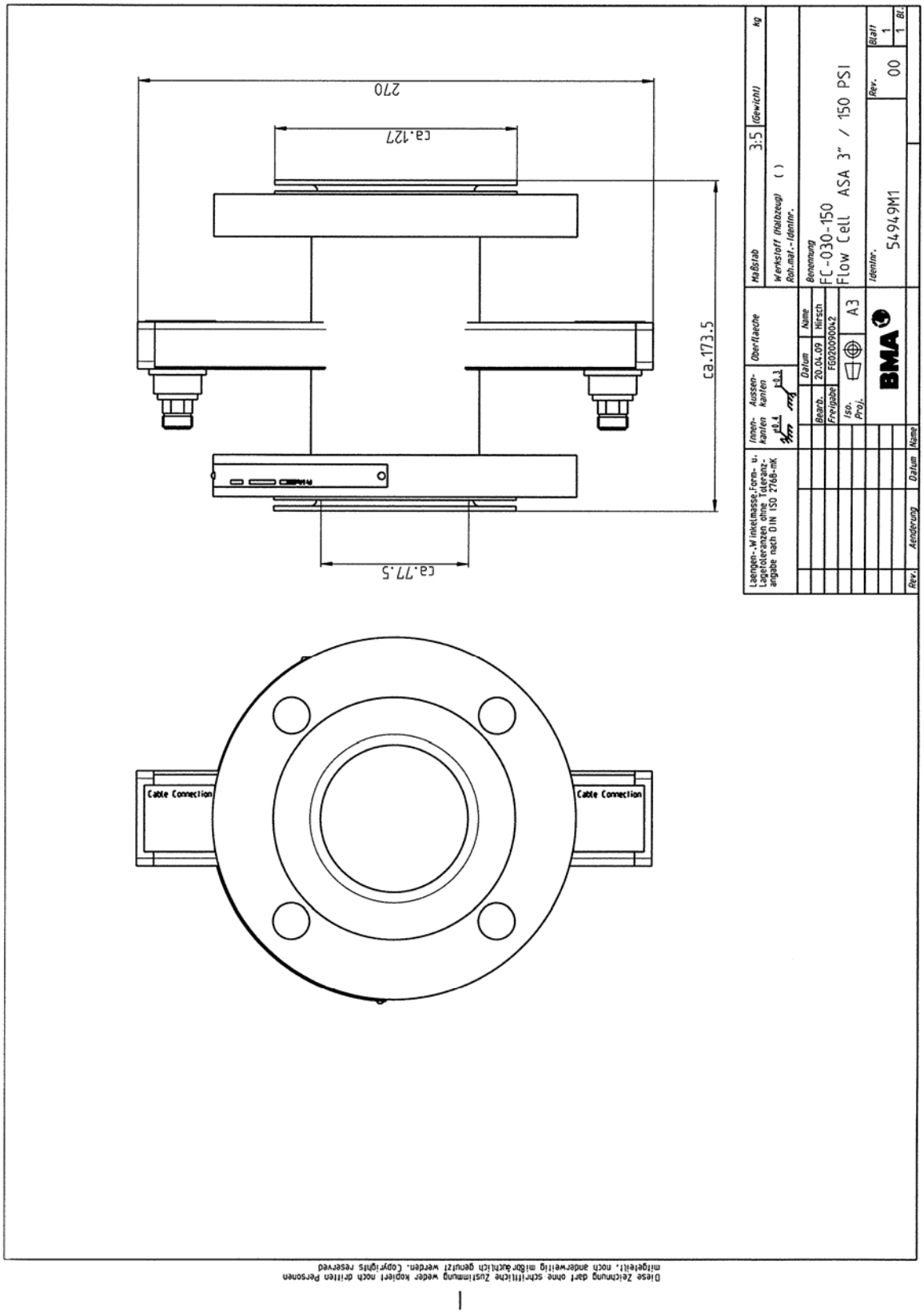
8.3.6 Type FC-020-150



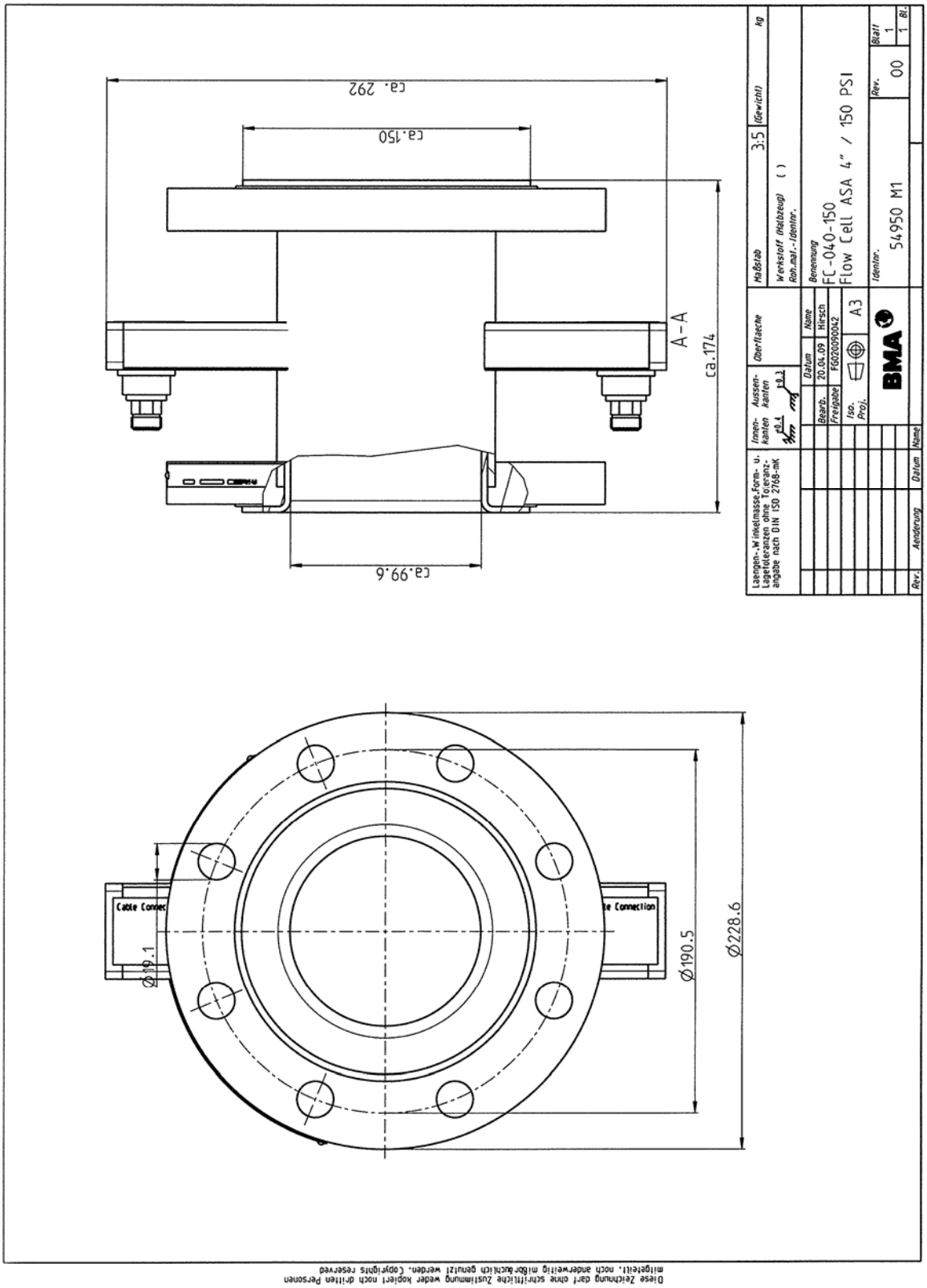
8.3.7 Type FC-025-300



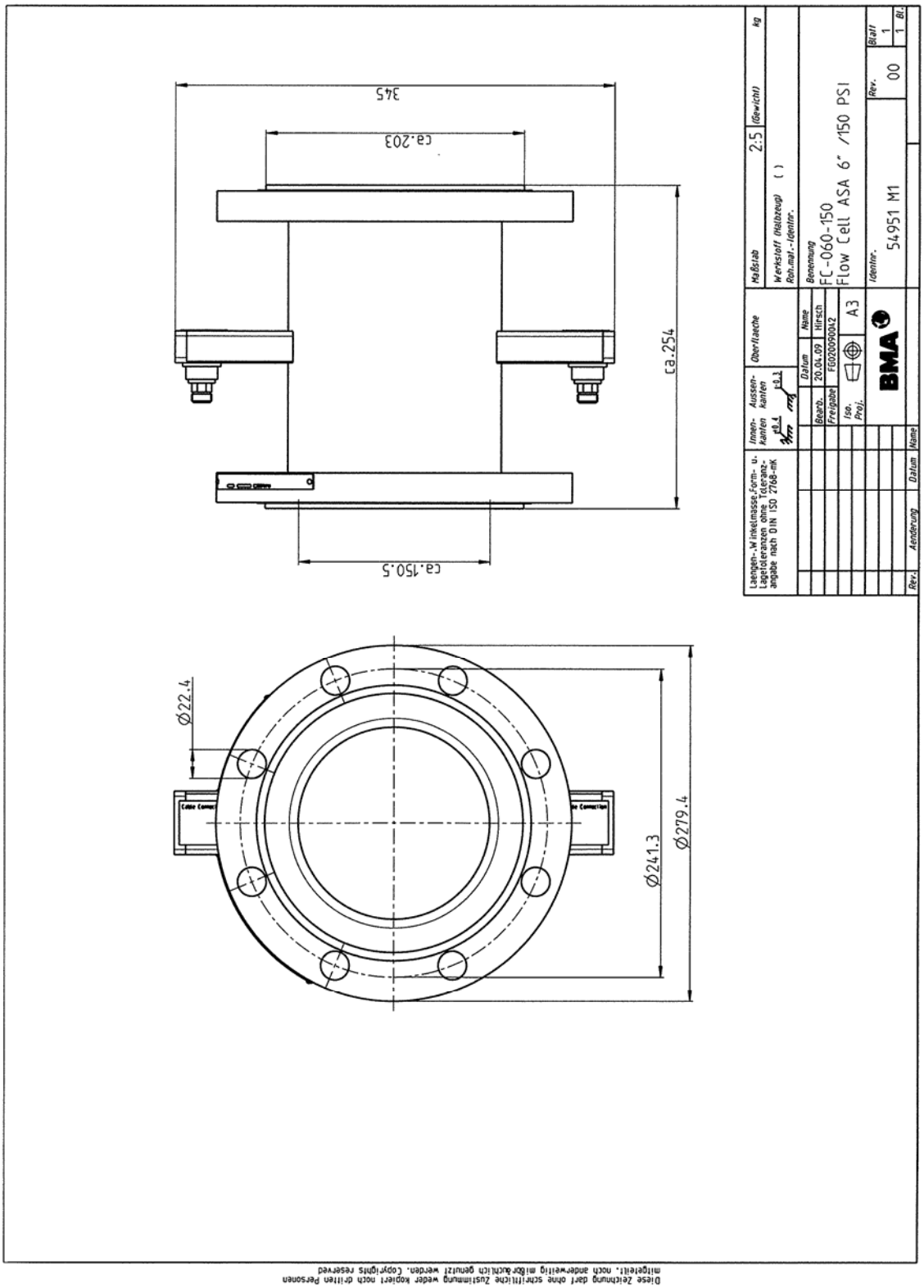
8.3.8 Type FC-030-150



8.3.9 Type FC-040-150

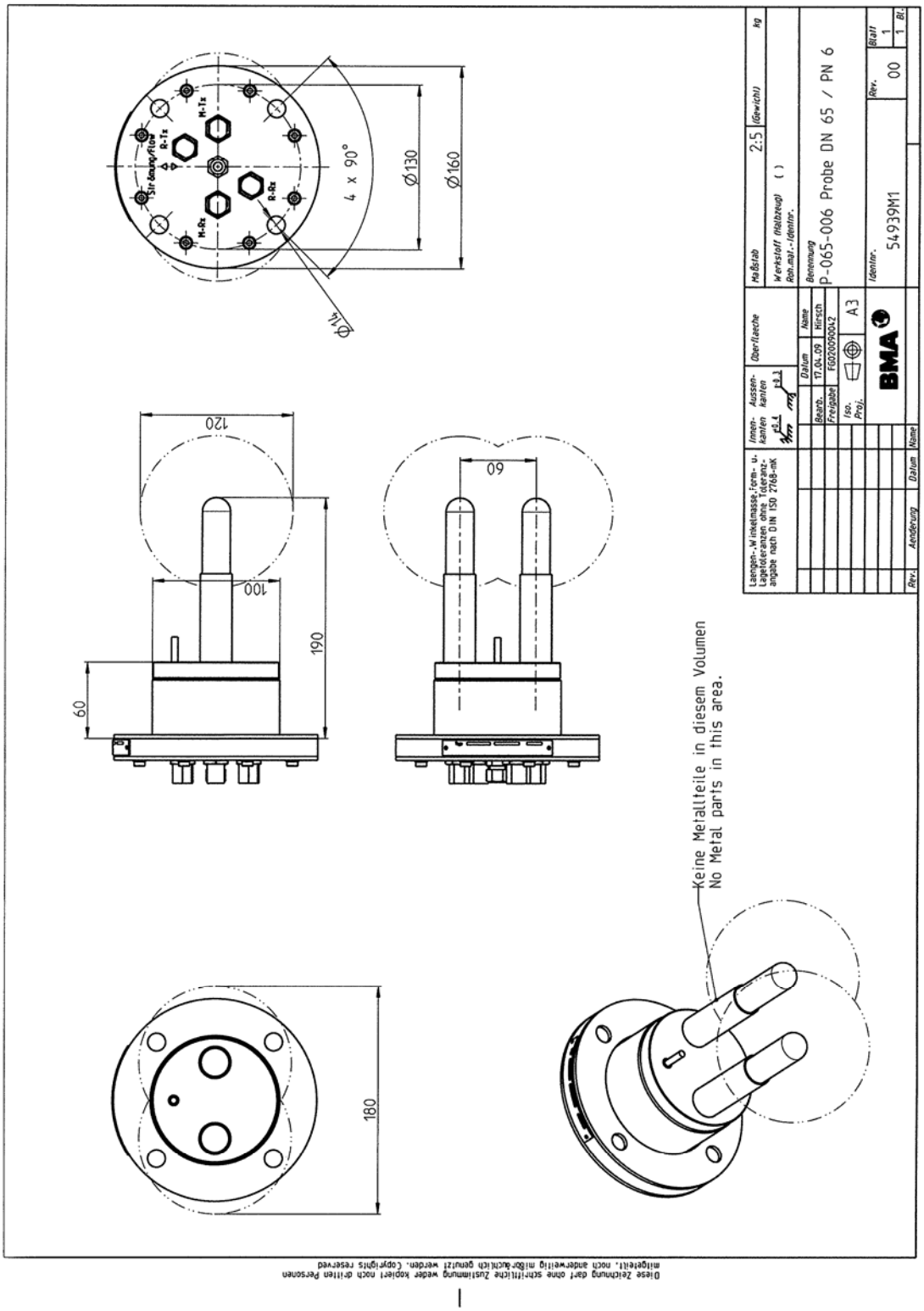


8.3.10 Type FC-060-150

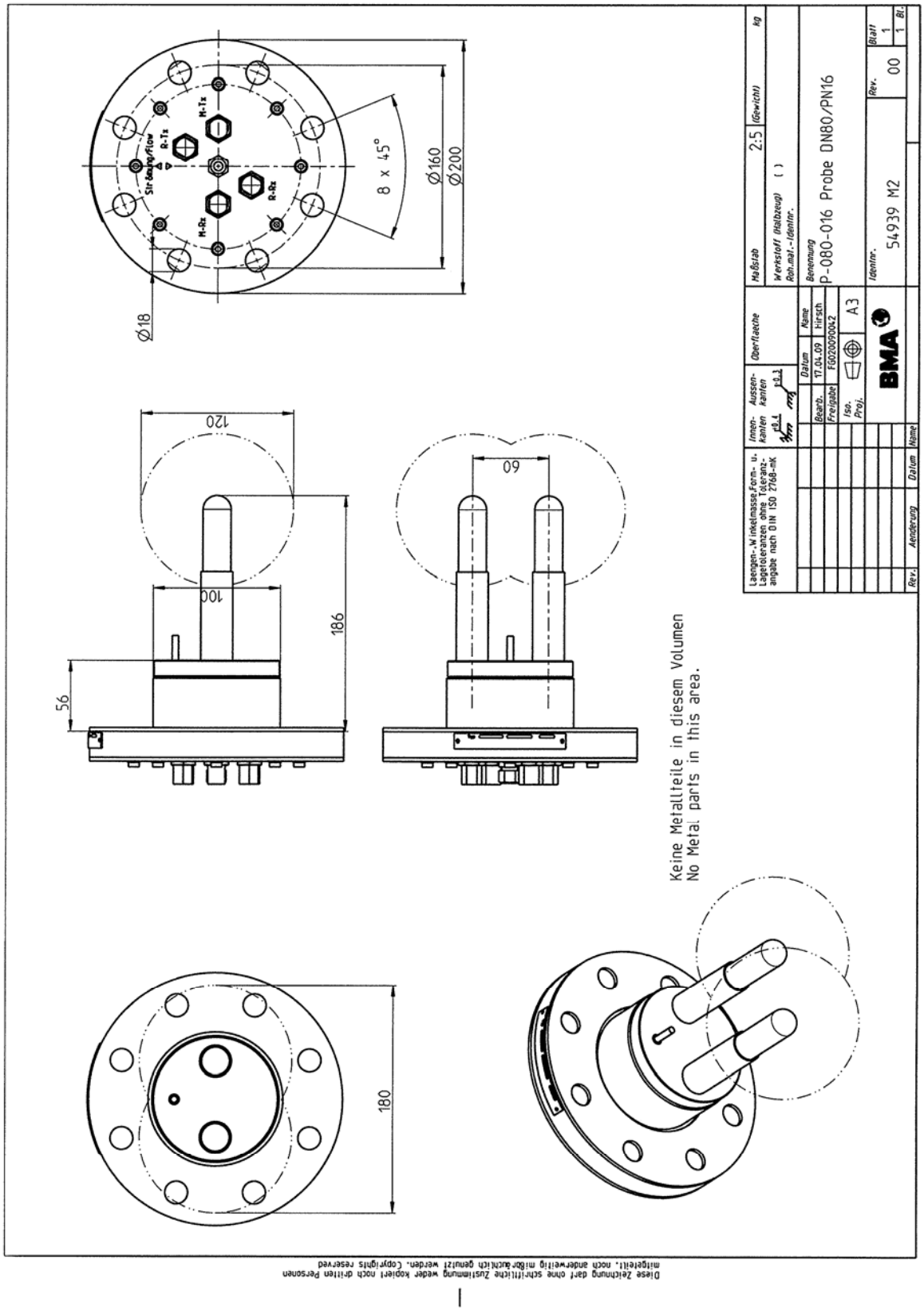


8.4 Dimensional Drawings Probes

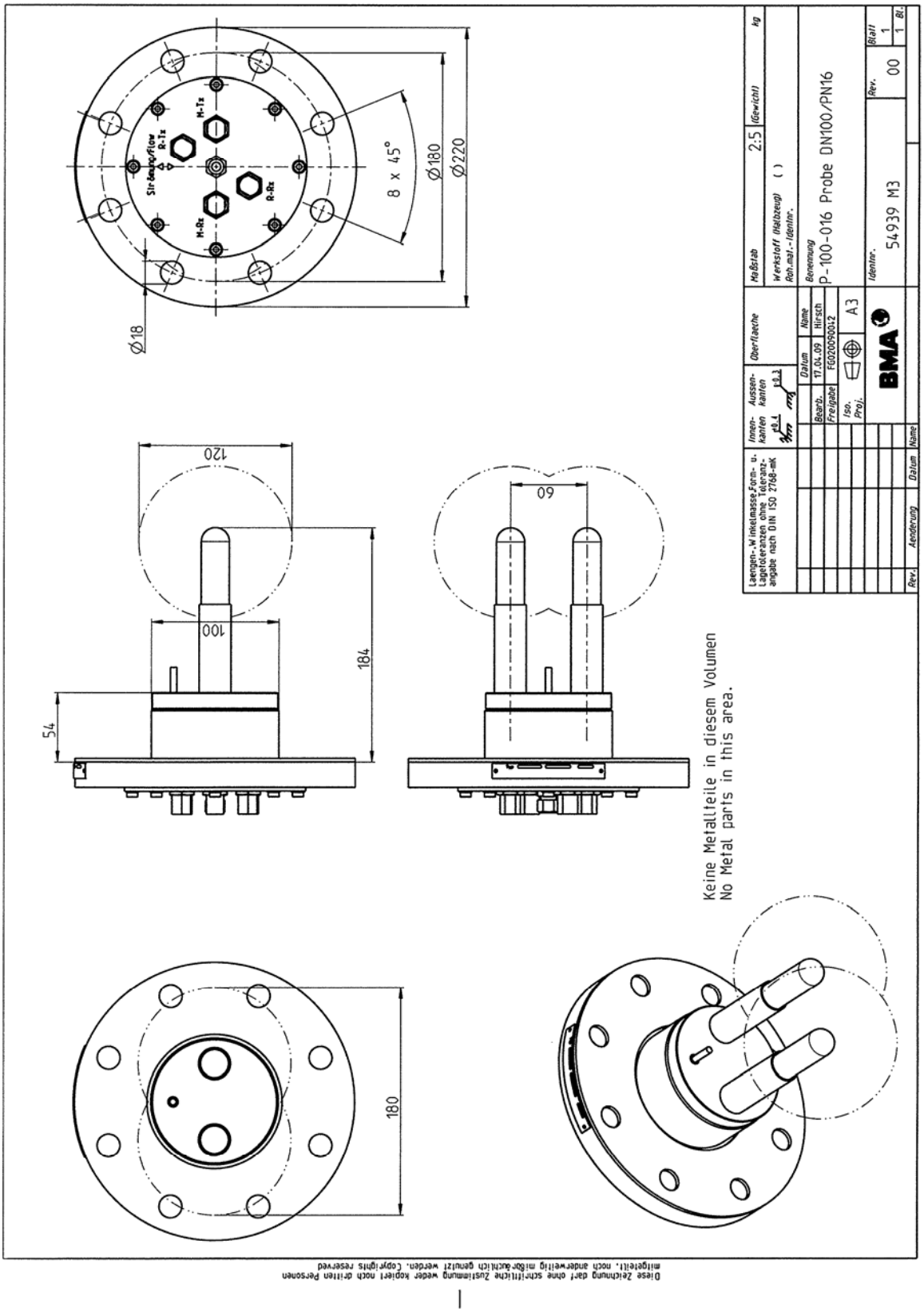
8.4.1 Type P-065-006



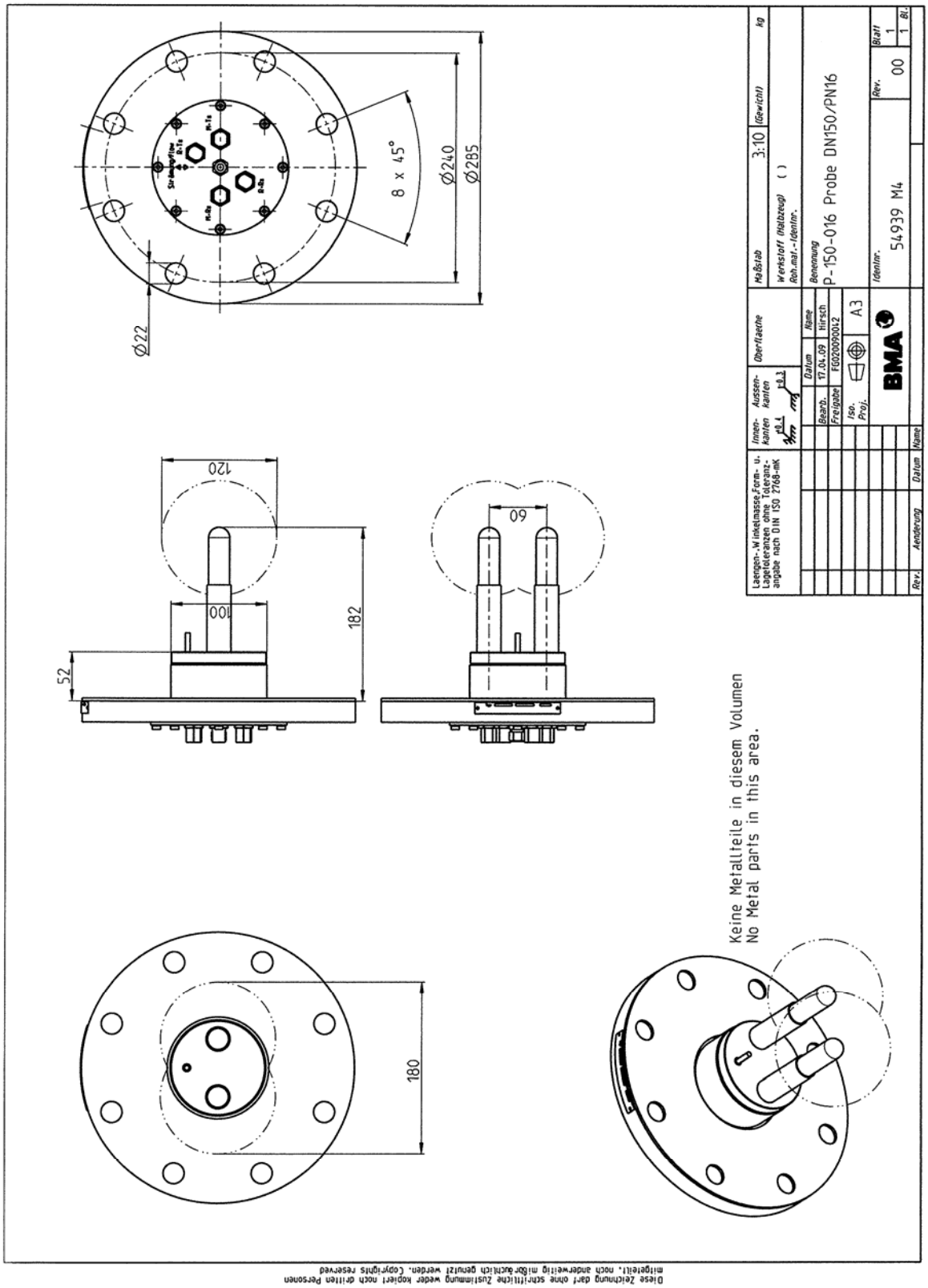
8.4.2 Type P-080-016



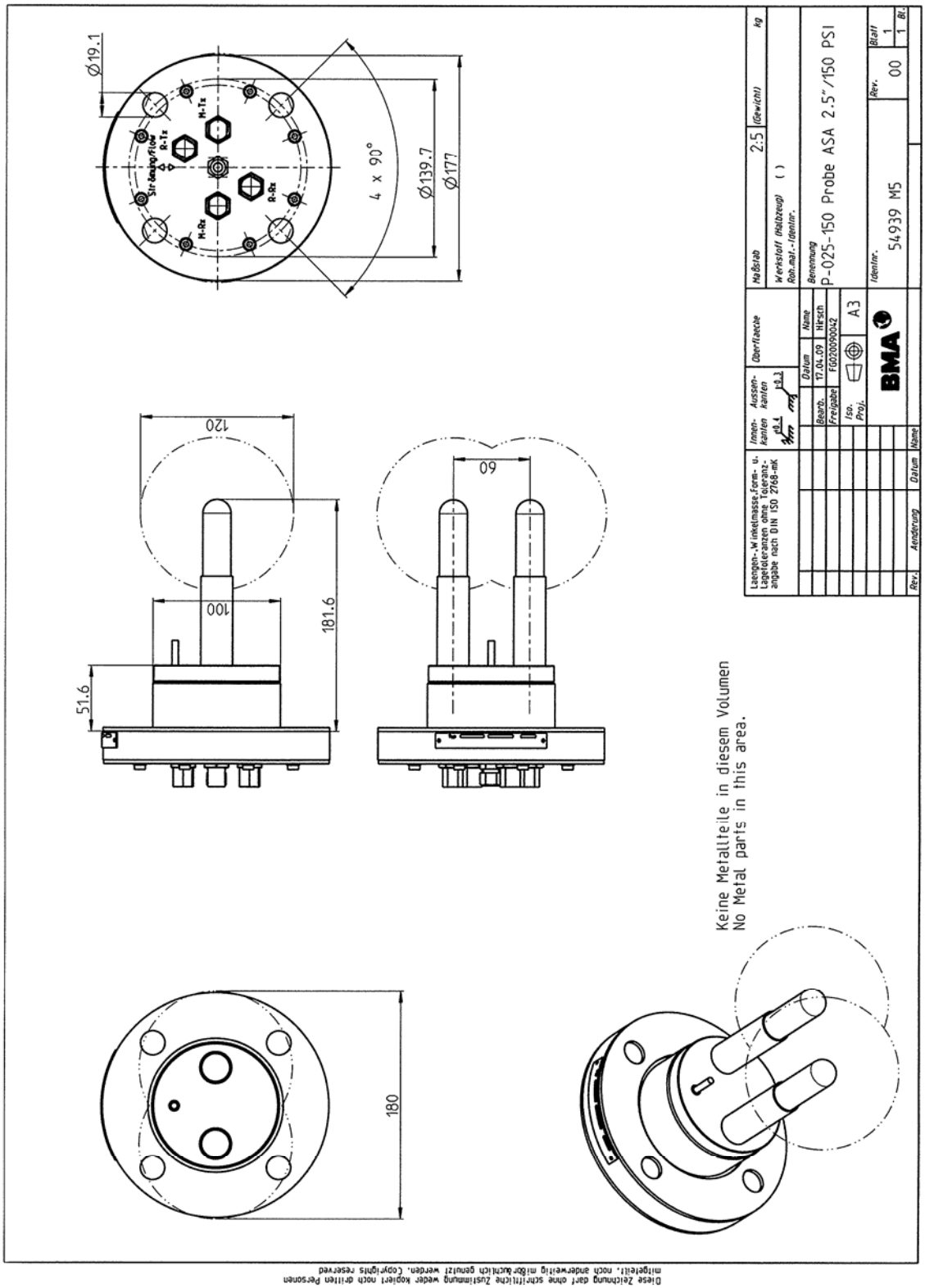
8.4.3 Type P-100-016



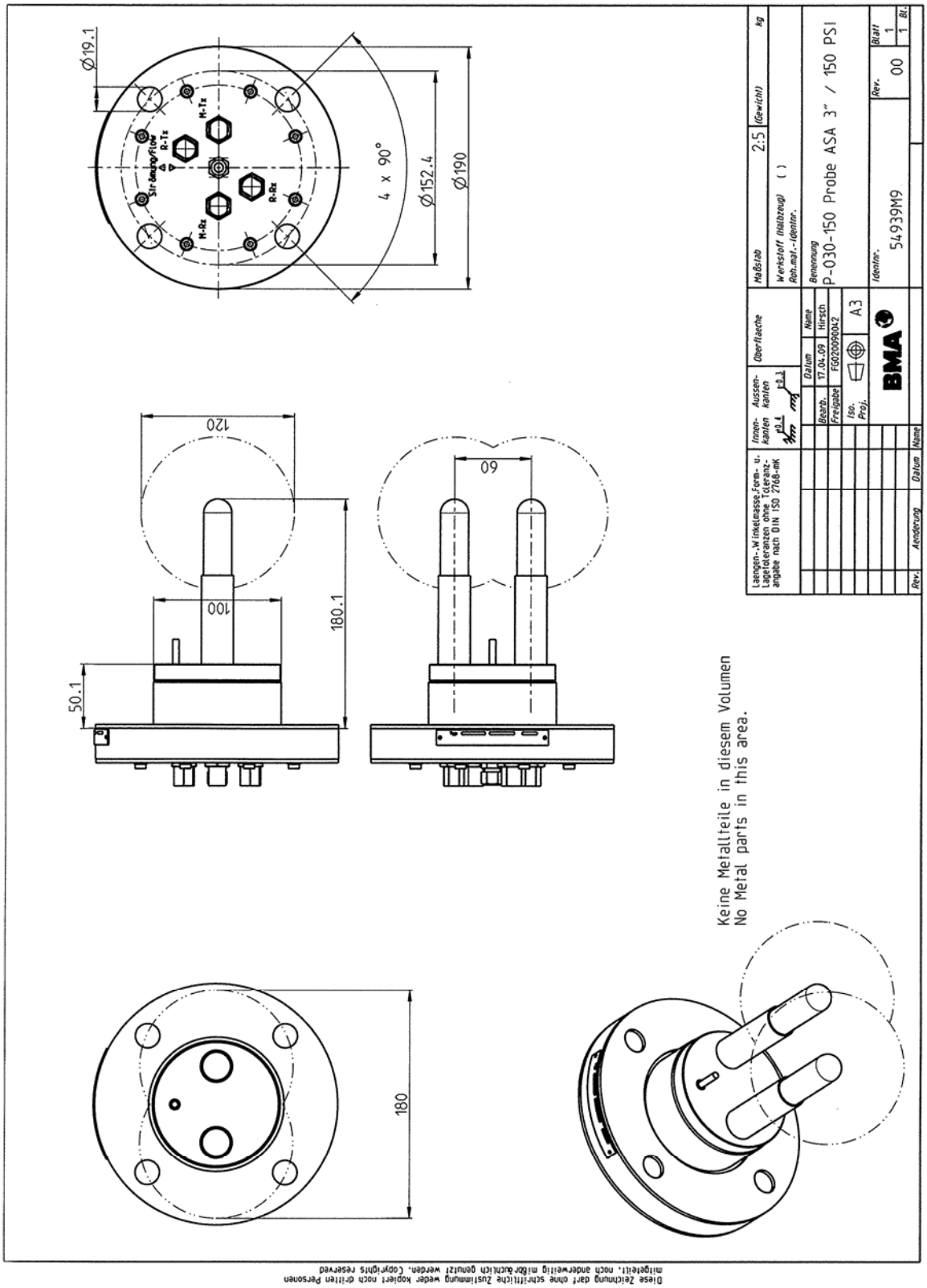
8.4.4 Type P-150-016



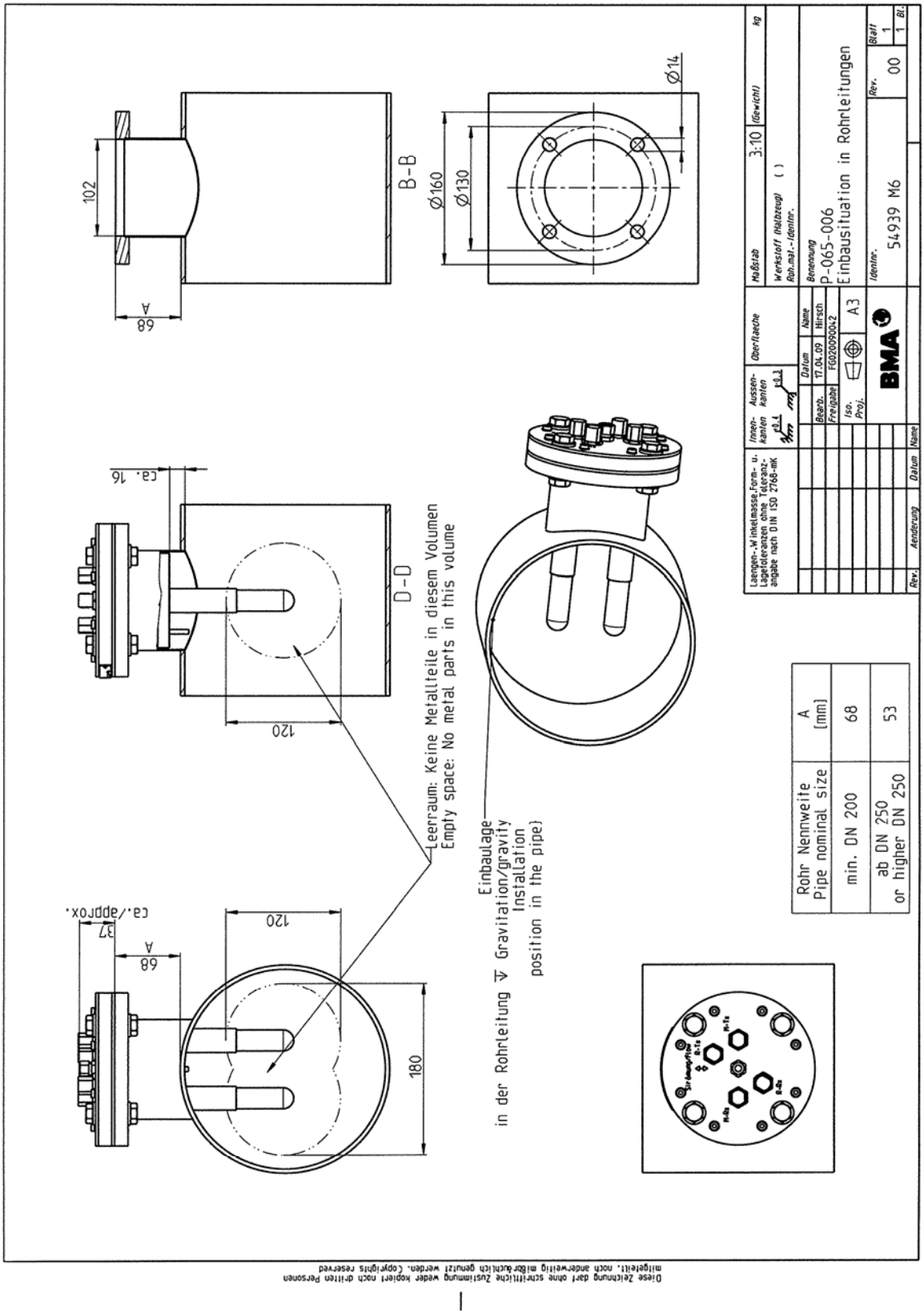
8.4.5 Type P-025-150



8.4.6 Type P-030-150

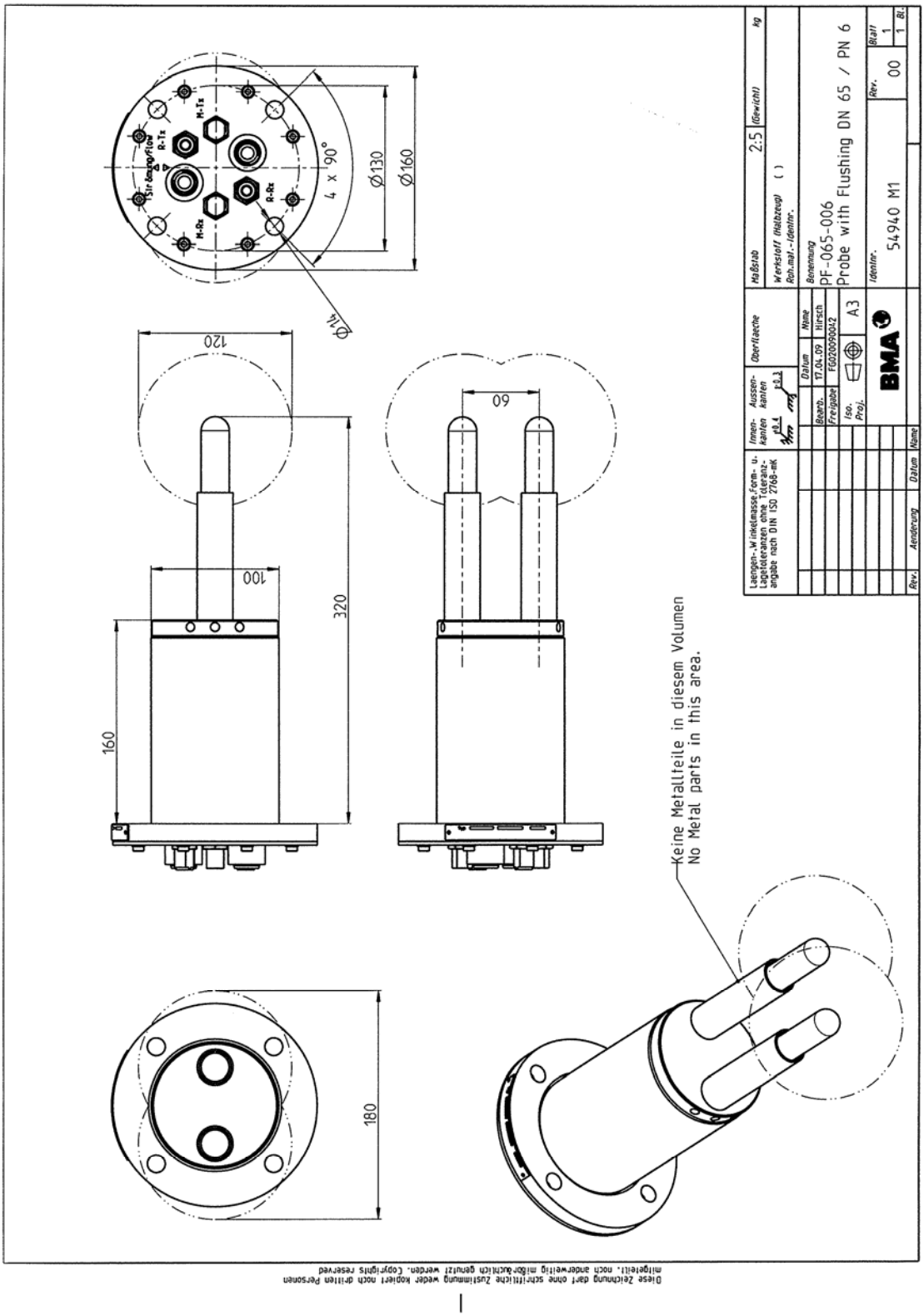


8.4.7 Installation Situation in Pipelines

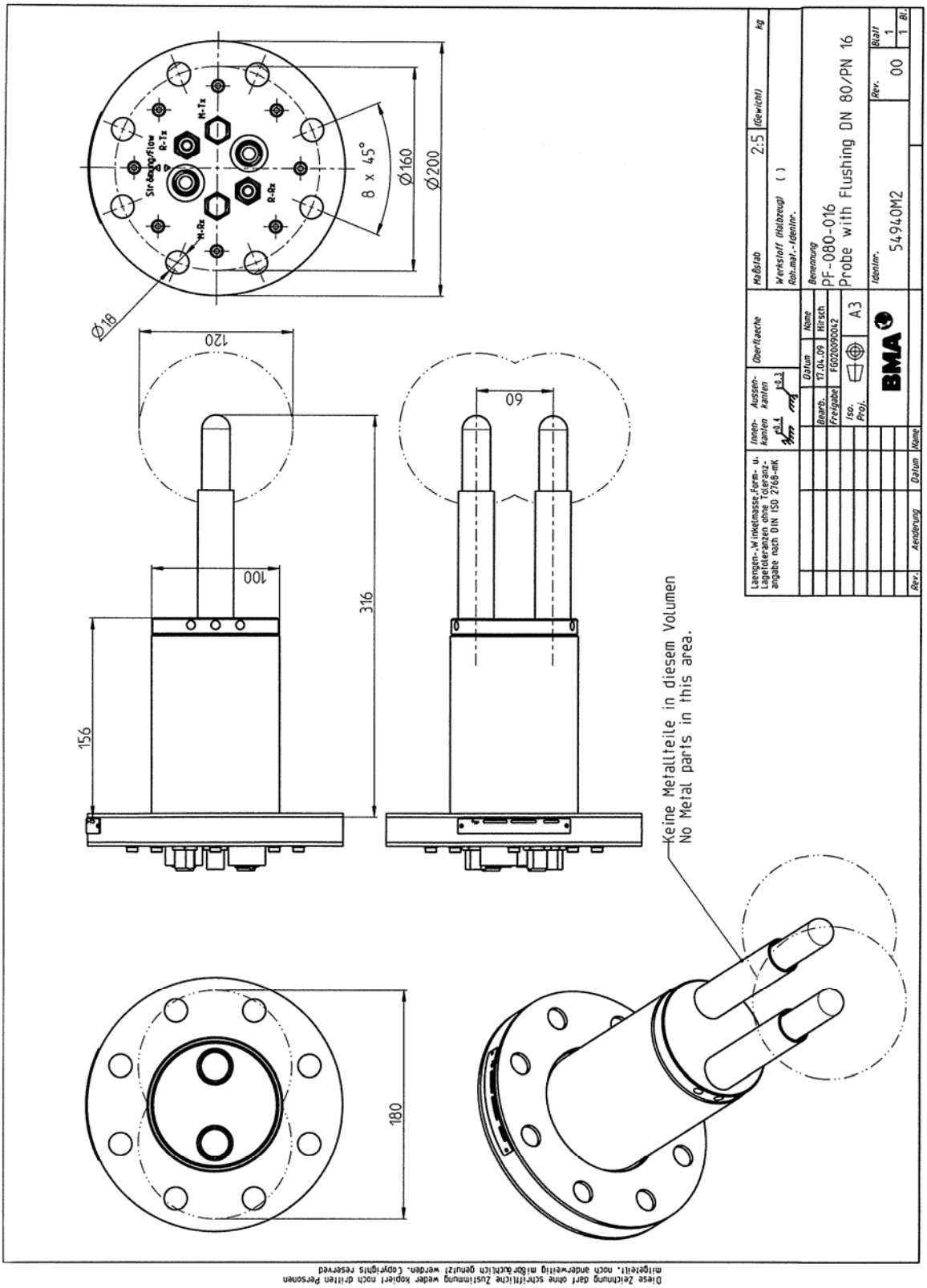


8.5 Dimensional Drawings Flush Probes

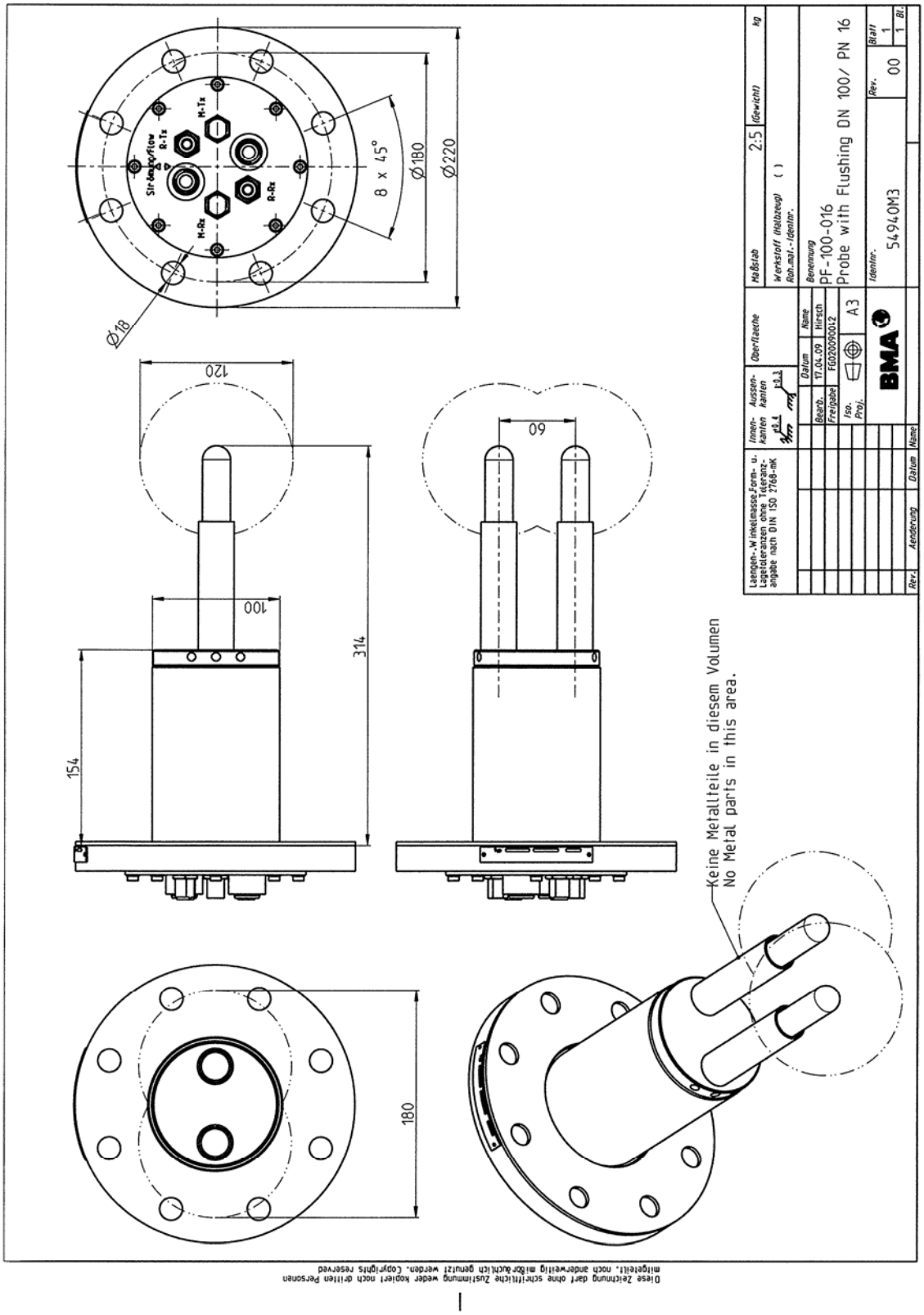
8.5.1 Type PF-065-006



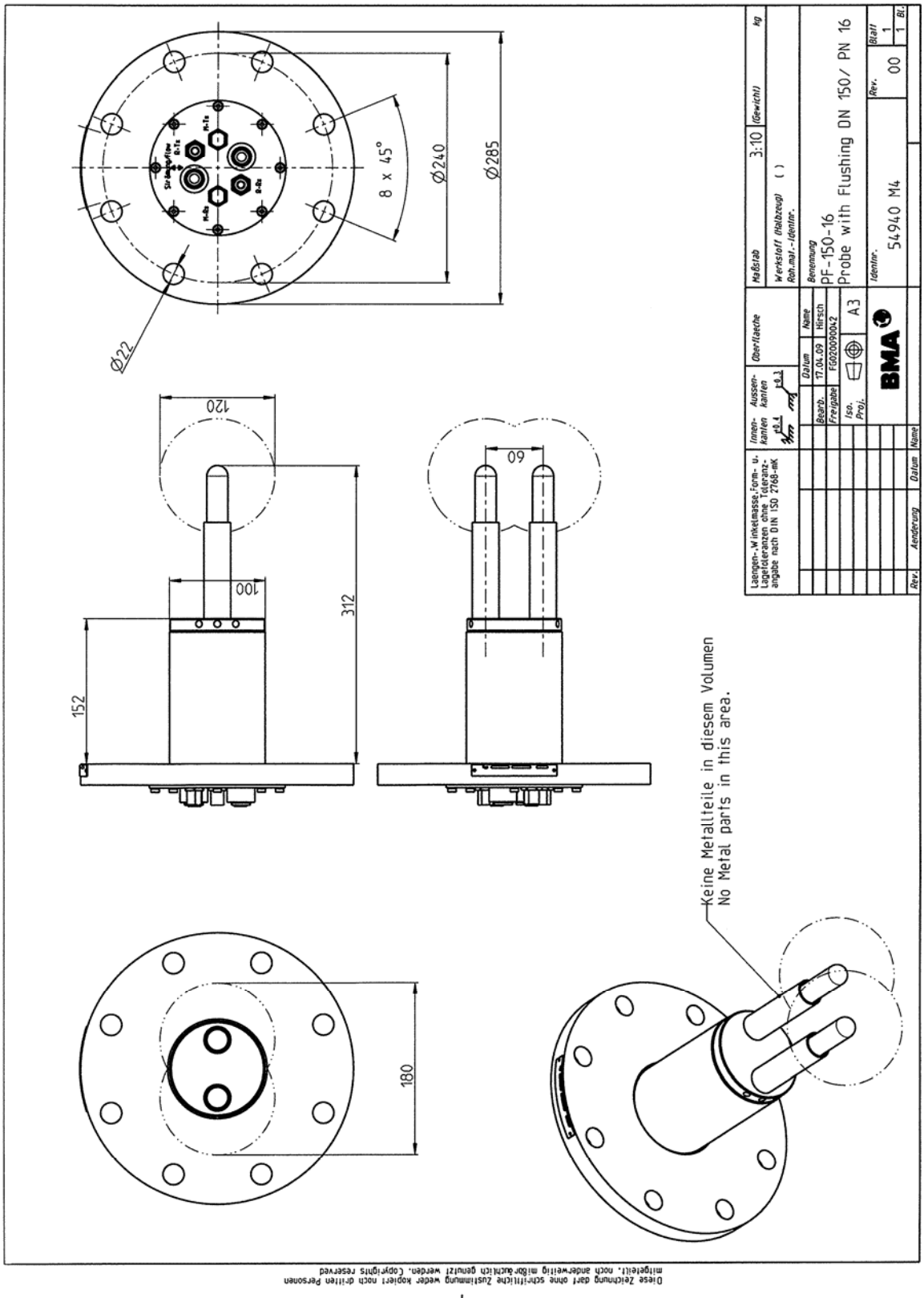
8.5.2 Type PF-080-016



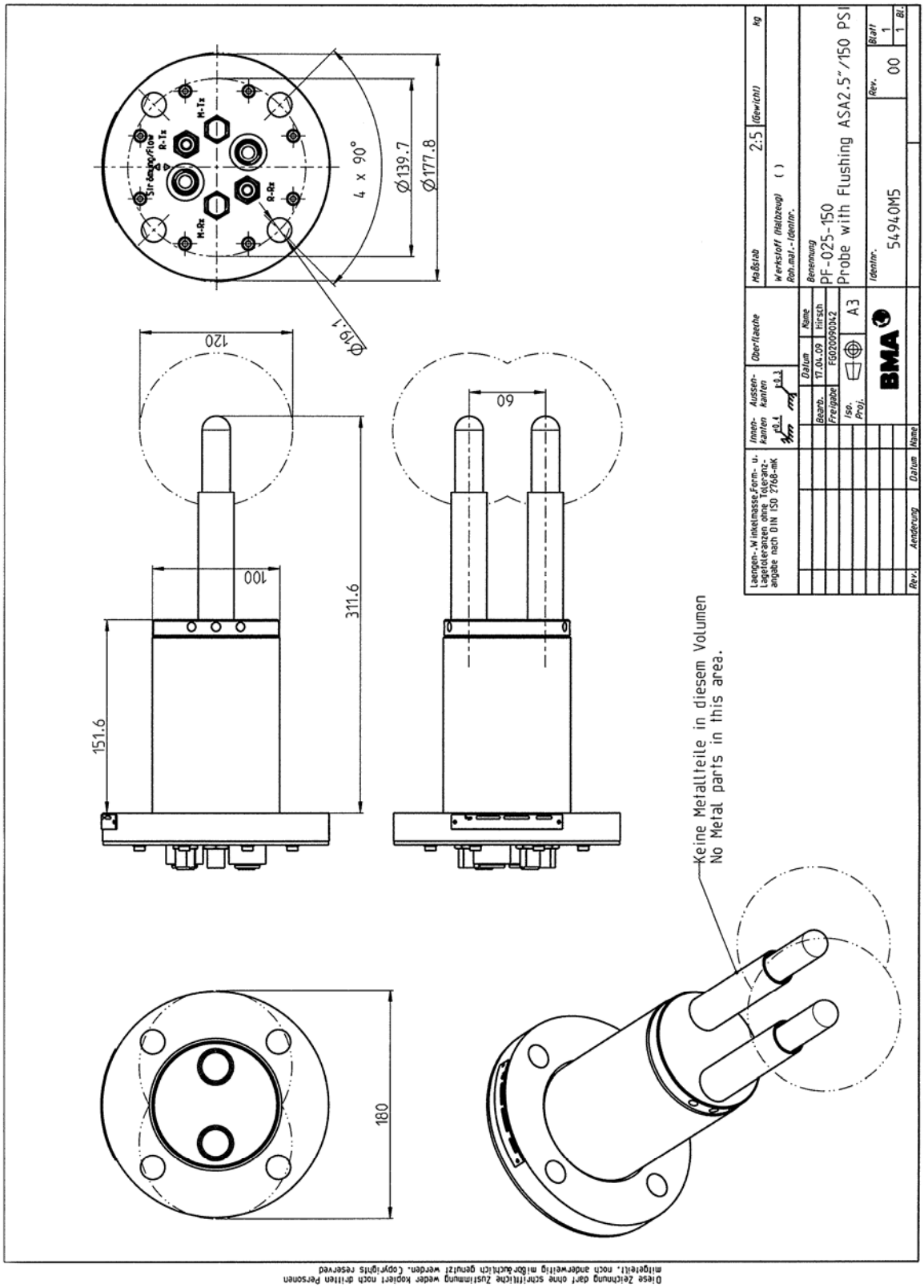
8.5.3 Type PF-100-016



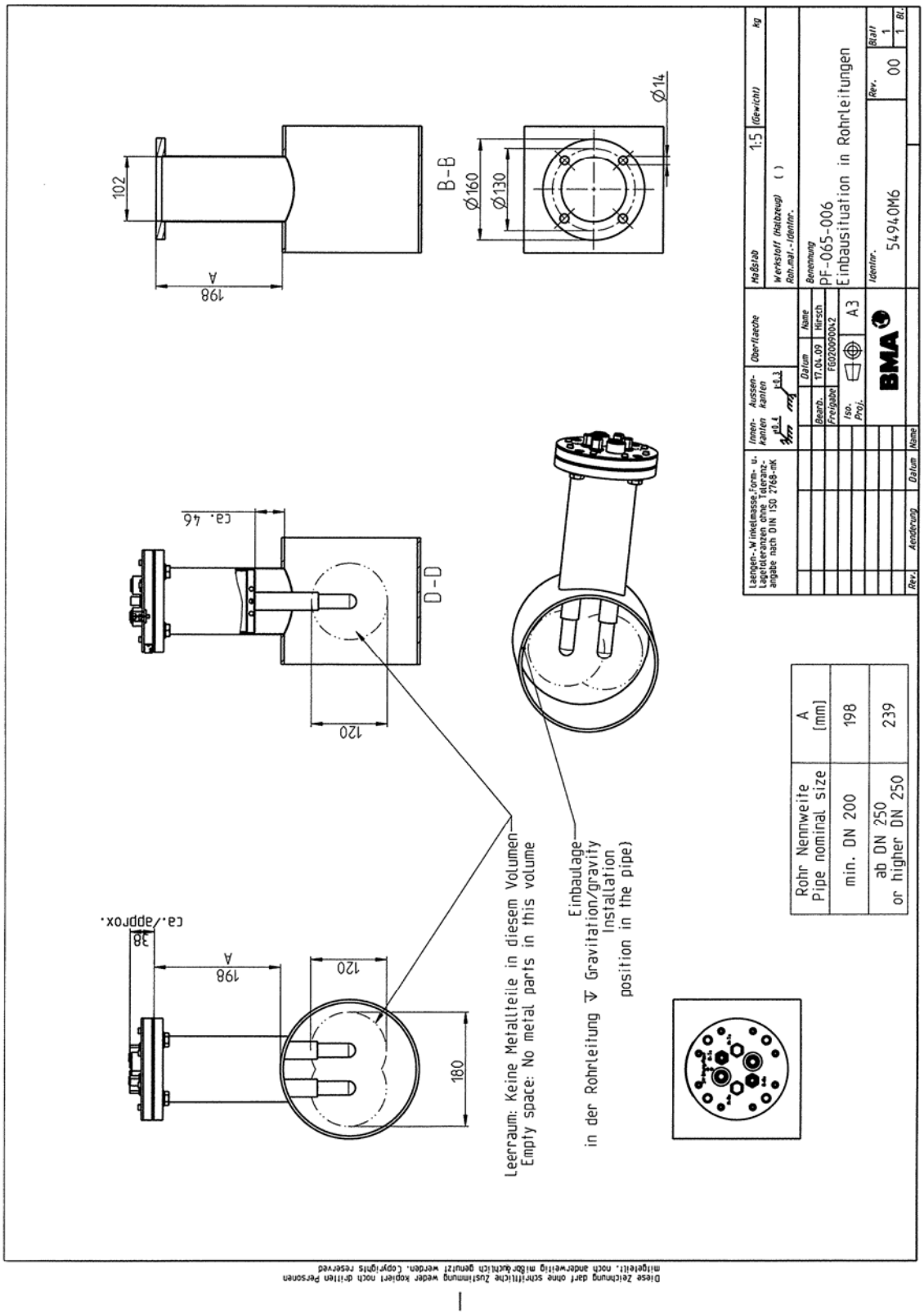
8.5.4 Type PF-150-016



8.5.5 Type PF-025-150

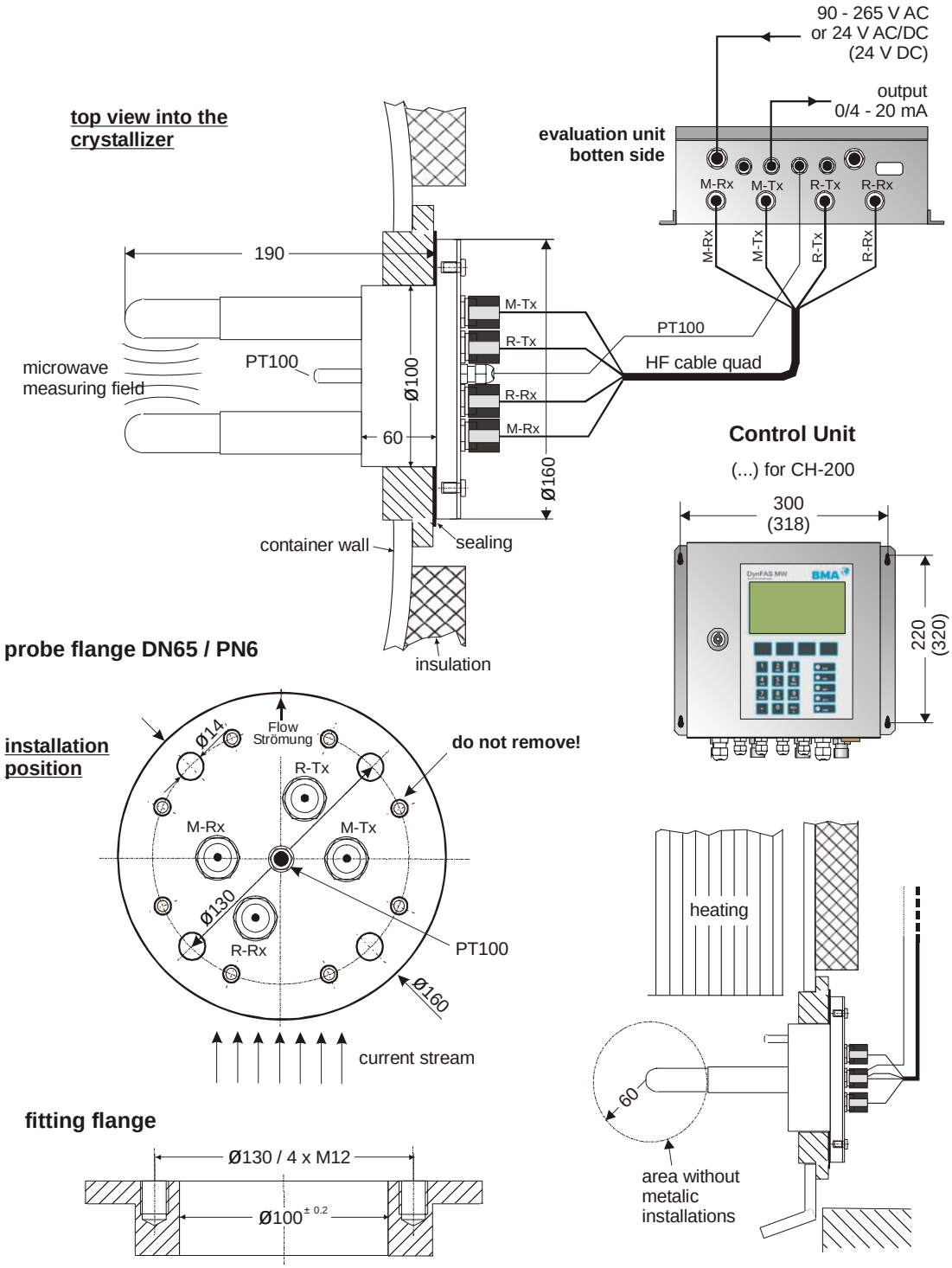


8.5.6 Installation Situation in Pipelines

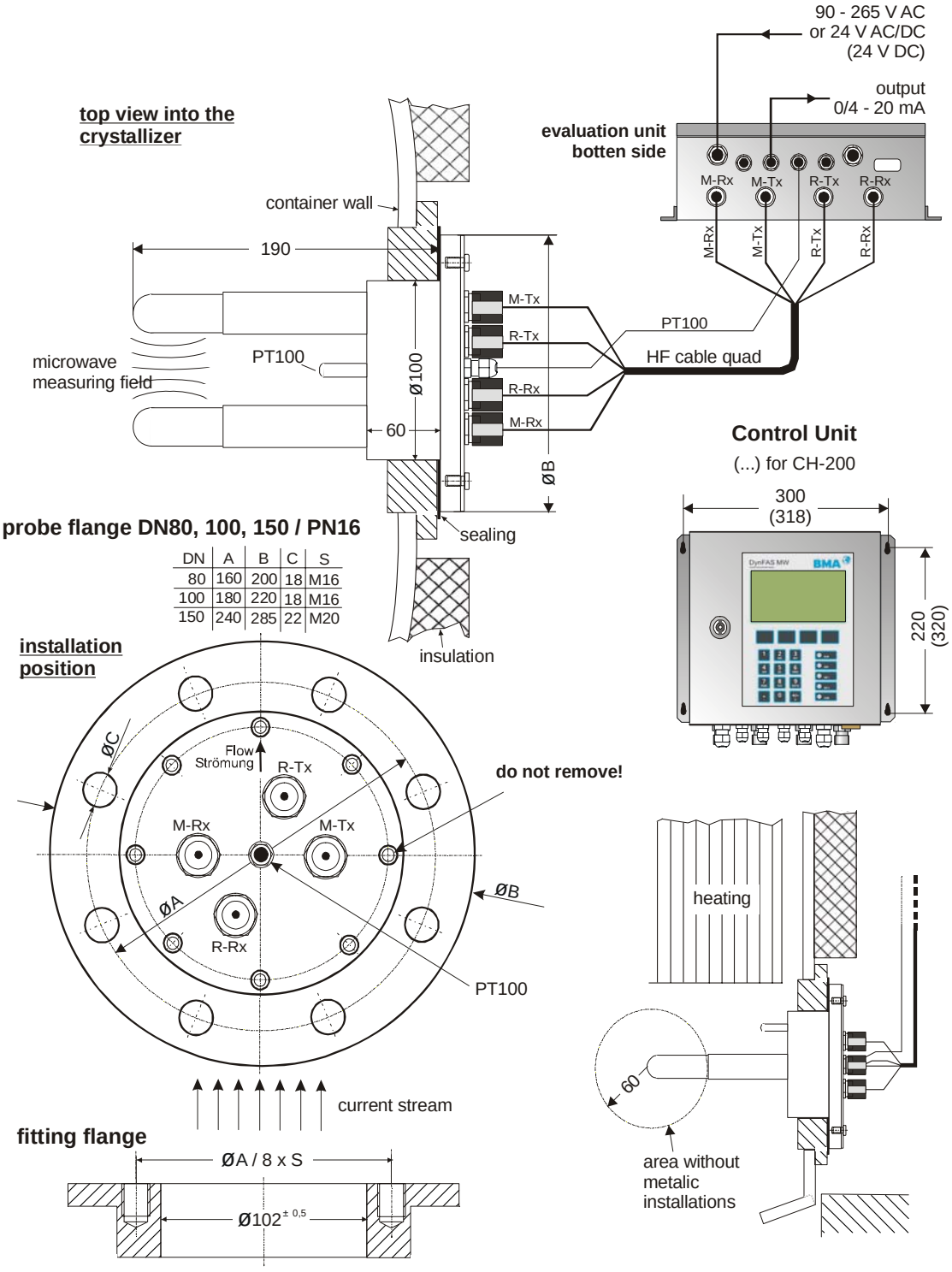


8.6 Installation Sheets for DynFAS MW (Probe)

DynFAS MW with Probe
- Installation In Crystallizer -

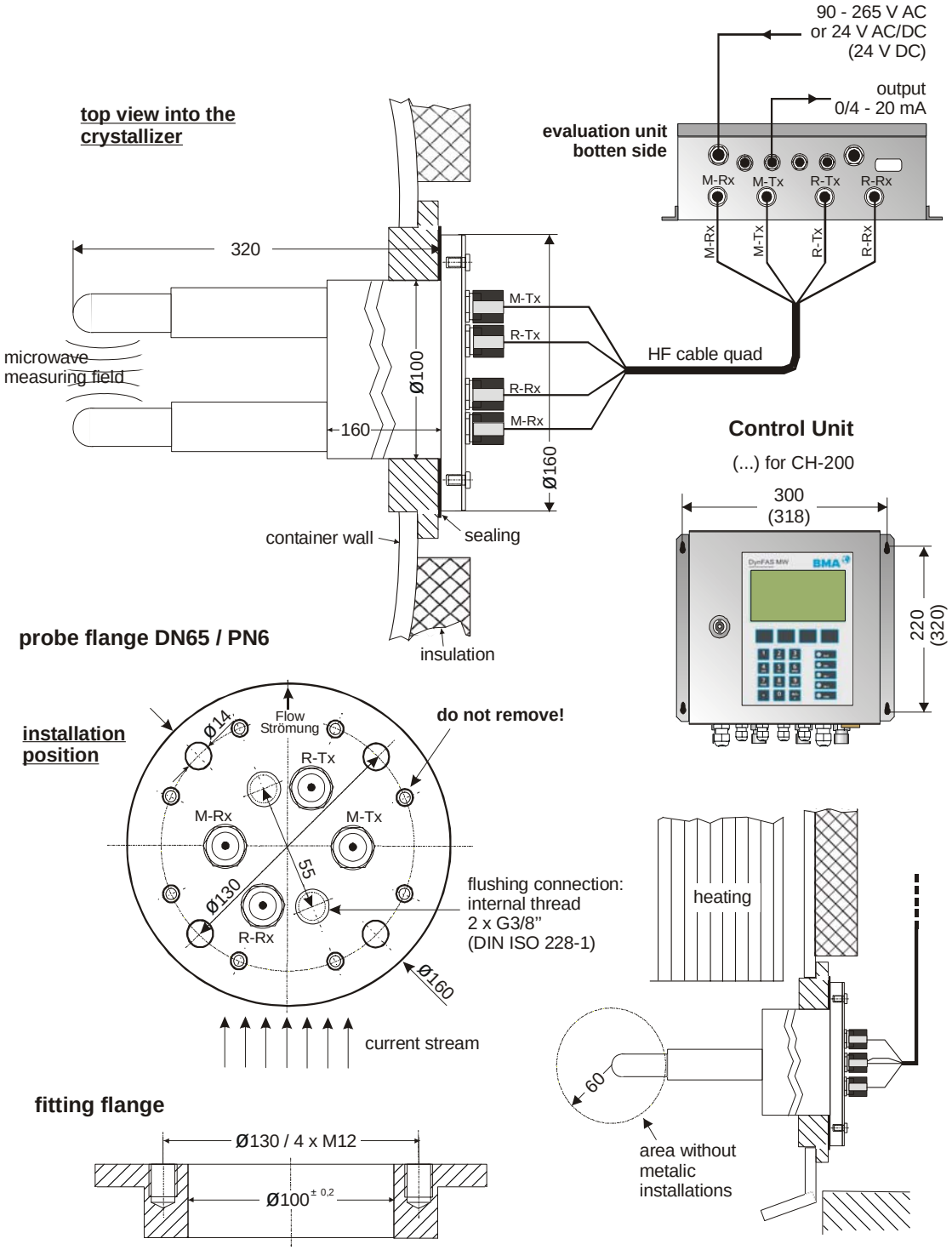


DynFAS MW with Probe
- Installation In Crystallizer -

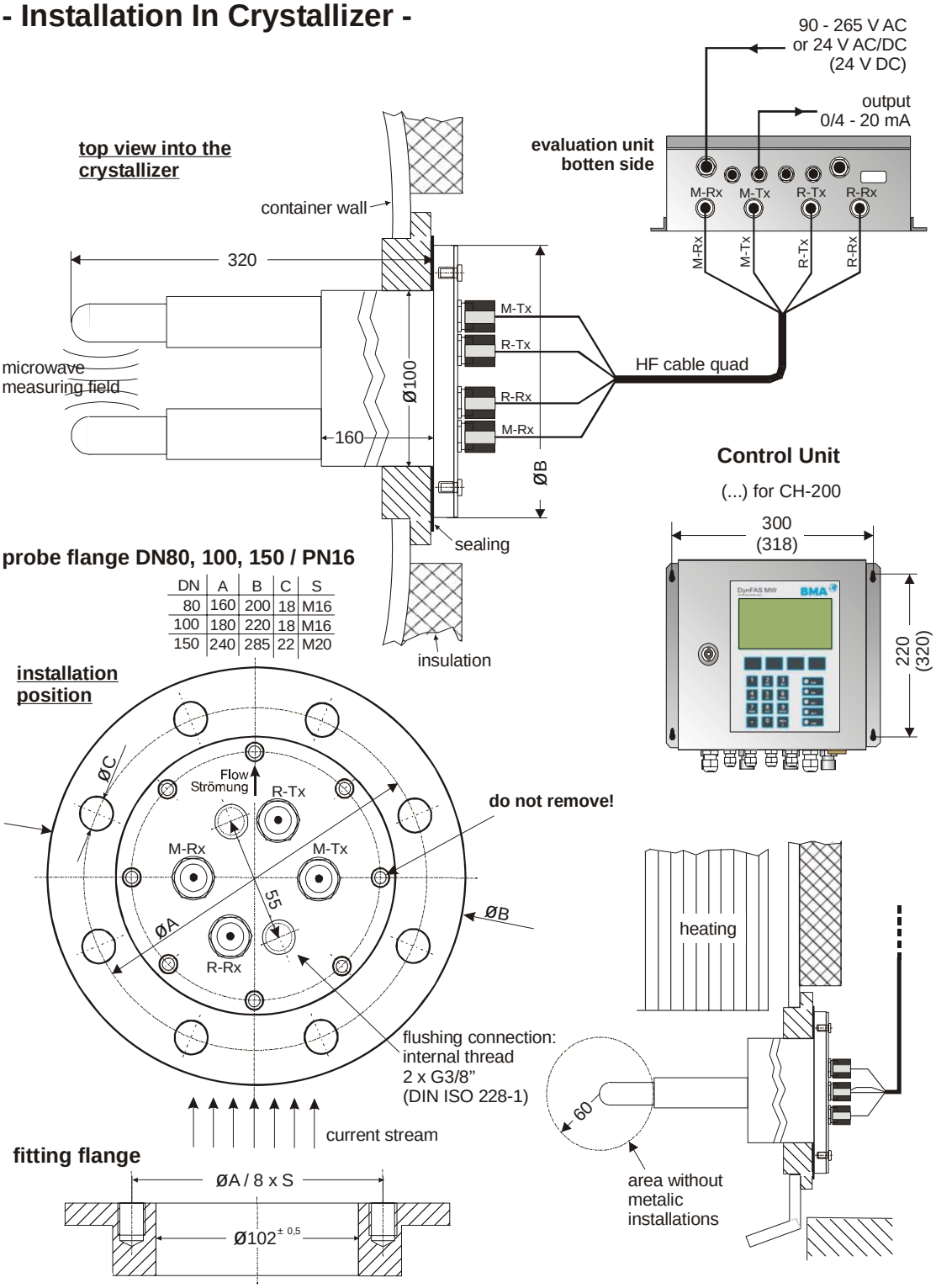


8.7 Installation Sheets for DynFAS MW (Flush Probe)

DynFAS MW with Probe with Flushing
- Installation In Crystallizer -



DynFAS MW with Probe with Flushing
- Installation In Crystallizer -



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Notes

DynFAS
Dynamic Factory Automation Systems

BMA

Concentration Meters

DynFAS MW

Software Manual

User's Guide

Id. Nr. 54877BA2

Rev. No.: 00 01.07.2009

The units supplied should not be repaired by anyone other than BMA Schaltanlagen Service engineers or technicians authorized by BMA Schaltanlagen.

In case of operation trouble, please address to our central service department.

The complete user's guide consists of two manuals, the hardware description and the software description.

The **hardware manual** comprises:

- mechanical components
- installation
- electrical installation
- radiation protection guidelines
- technical data
- electrical and mechanical drawings

The **software manual** comprises:

- operation of the evaluation unit
- parameter description
- basic setting
- calibration
- error messages

The present manual is the software description.

Subject to changes without prior notice.

BMA Schaltanlagen GmbH
Am Alten Bahnhof 5 · D-38122 Braunschweig

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schaltanlagen@bma-de.com
www.bma-worldwide.com

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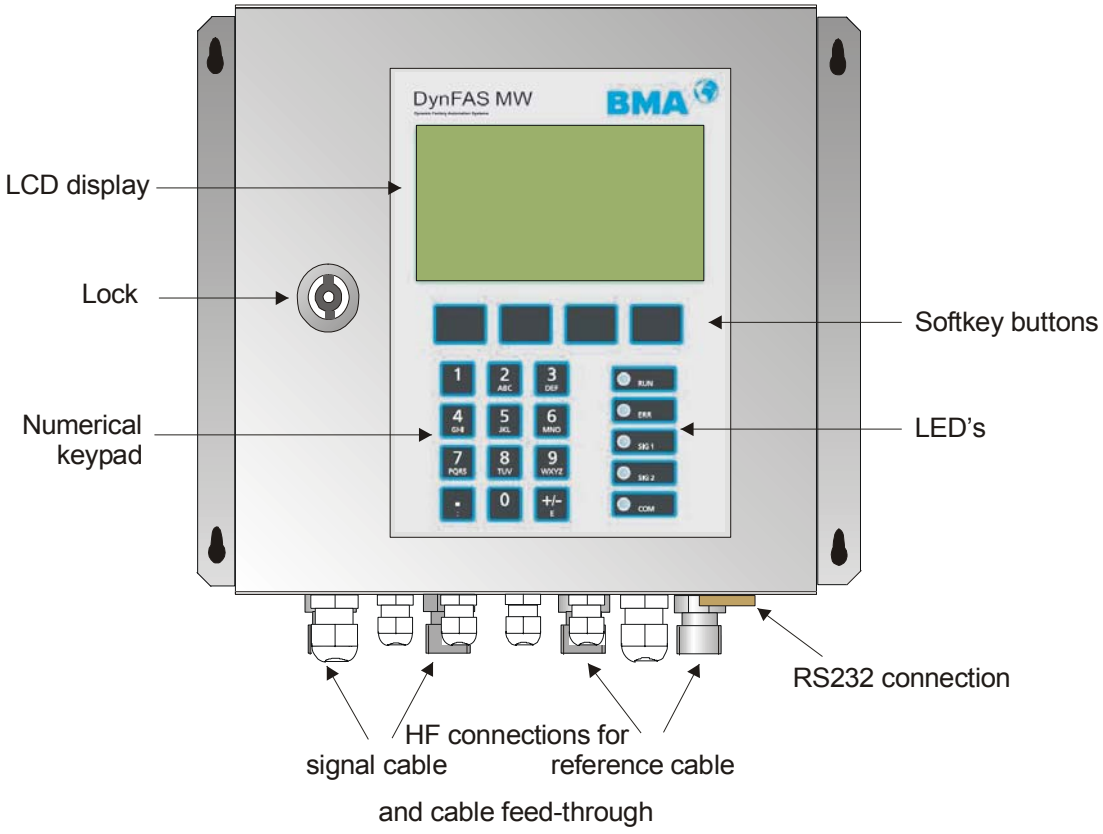
Safety Summary

GENERAL WARNINGS

Parameter settings
No changes should be made in the parameter settings without exact knowledge of the instruction manual with all instructions and detailed knowledge about the properties of a connected control unit and the possible influences to the operation process being controlled.

Chapter 1. **Communication with DynFAS MW**

The communication with DynFAS MW is carried out via 4 softkey buttons. The function of the individual buttons changes relative to the position in the menu. Values and texts are entered via an alphanumeric keyboard. The instrument status is indicated by 5 LED's.



1.1 Brief Instructions

Provided that DynFAS MW is installed correctly, after power on of the device the main menu appears automatically. To get correct measurement values, the instrument has to be configured and calibrated before running the first measurement. Go to the Profi mode.

We recommend that you use these brief instructions only if you have already performed a process measurement with the same product and you are familiar with the Phi/att ratio.

1.2 System Configuration

- Select | Setup | Configuration | General Data
- Enter the general data (date, time, tag)
- ⌂◀ Push the Home button to return to the Configuration menu and select | Measurement |
- Enter the system parameters (measurement mode, start mode, averaging, units, ...)
- ⌂◀ Push the Home button to return to the Configuration menu
- Select | Plausibility |
- Enter: 1. Process limits; 2. Phase measurement: Sigma max. = 100, Phi/att ratio = known value, Auto set = OFF; 3. Disable pause detection
- ⌂◀ Push the Home button to return to the Configuration menu
- Select | Microwave |
- Enter the cable length (reference cable length, signal cable length)
- ⌂◀ Push the Home button to return to the Setup menu
- Select | Input/Output |
- Enter the values for current output, current input, Pt100, digital out-/input
- ⌂◀ Push the Home button to return to the Setup menu.

1.3 System Calibration

- Power on the instrument at least 45 minutes prior to system calibration.
- On the main menu, select | Setup |Calibration | System Adjust | Adjust |
- Start the adjustment only if you are sure that the transducer is sufficiently covered by the product. The typical standard coefficients for your application have been set up by the manufacturer. A sample has to be taken during system calibration. The lab value of the sample is needed for calculation of the offset. Calculation: Analysis value – Display = Offset.
- Upon completion of the system calibration, push the ⌂◀ Home button three times to return to the main menu.
- Push the RUN softkey to start the measurement. The live display appears.
- Push ESC to get to the main display and enter the offset value via | Setup | Calibration | Calibrate Conc | Adjust | Offset |.
- Enter offset value.
- Push the ⌂◀ Home button 4 times to return to the main menu.
- Select | Live display |
- If the product has not changed, the reading value corresponds to the laboratory value.

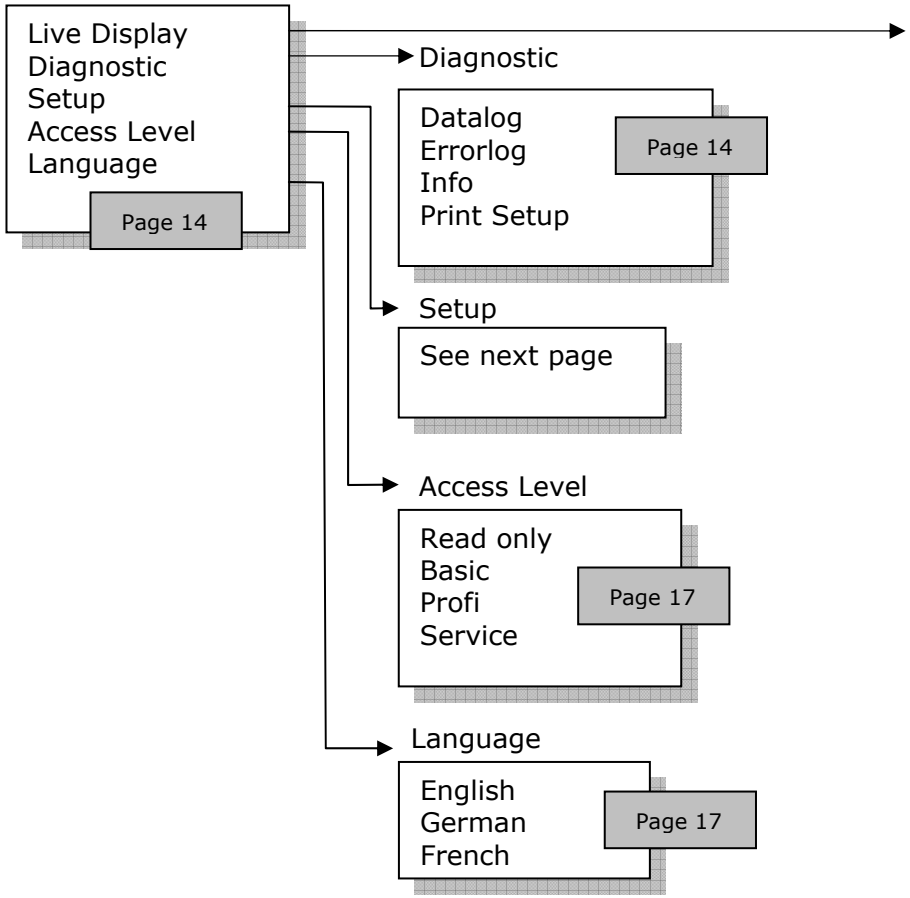
Chapter 2. **Software Functions**

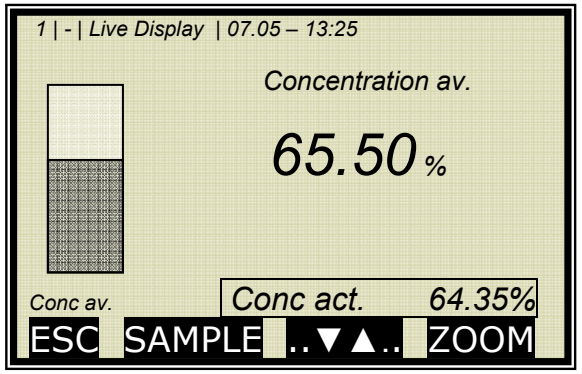
2.1 Information on Menu Structure

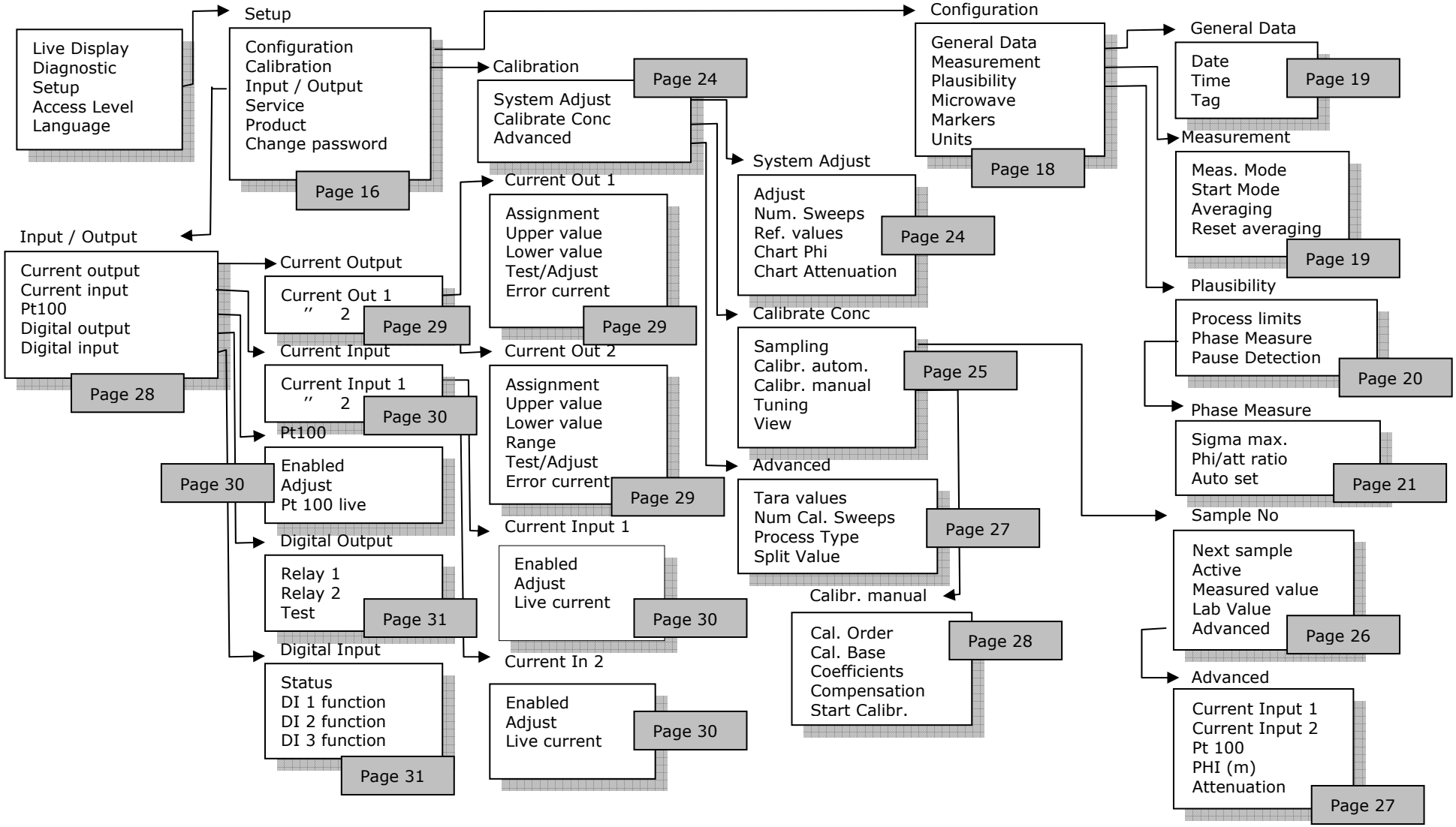
The menu structure on the following pages provides an overview of all functions of the DynFAS MW. Using the **page numbers** indicated you can look up the function of the depicted window.

Depending on the access level, some menu items are hidden. You have to enter an editable password to change from the level „**Read only**" to „**Basic**" or to „**Profi**". The „**Service level**" is not accessible due to licensing regulations.

2.2 Menu Structure






Live Display
Diagnostic
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Pt100
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Pt 100 live
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Page 30
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Current In 2
Enabled
Adjust
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Current Input 1
Current Input 2
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PHI (m)
Attenuation
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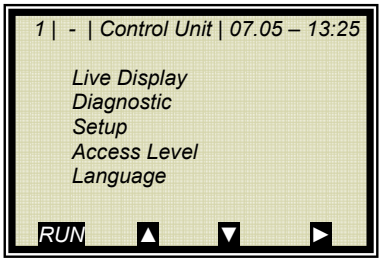
2.2.1 Start Menu



LIVE DISPLAY:
Shows the live display.

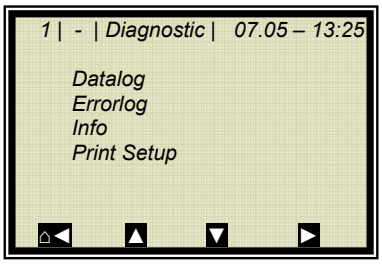
DIAGNOSTIC:
This menu item contains the submenu items data logger, error log and further instrument information.

SETUP:
All necessary inputs for operation of the measuring system can be entered here.

ACCESS LEVEL:
Areas protected by passwords can be enabled.

LANGUAGE:
Select the dialog language.

2.2.2 Diagnostic



Datalog:
The data log records the data corresponding to the content of the serial data output RS 232 and RS 485 (see hardware manual, *chapter 6.4*).

All data per measurement values (sweep) are averaged over the measuring time (see below) and stored. This time interval results from the selected logging period. The content of the log file can be accessed via the Live Display graphically, see chapter 2.3 Trend Display. Output as a text-file is also possible by using RS 232 and RS 485, or the Memory Tool instead (optional accessory).

- Log type — Disable
single
continuous
stop at error
- Log time — logging period
15 minutes to 3 days
- Restart Log — Clears the datalog and starts with the above setting
- Averaging time — Obtained from log time
- Print log — Printout of table, output via RS 232 and RS 485, format see hardware manual, *chapter 6.4*

Change datalog settings:
If you change the logtype from any to „single" the datalog will be cleared and you start again with the current setting.
If you change all other logtypes and log times, the datalog will not be cleared and you continue with the new settings.

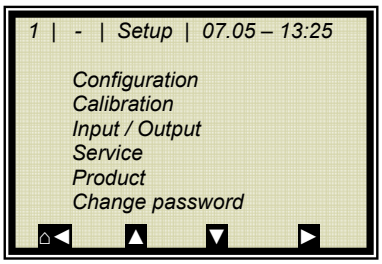
Stopped measurement:
If the measurement is stopped for a time during the data log, then the measurement pause is interpreted as log time during the data logging "single". For all other log types, the measuring pause is added to the log time.

Error log:
- Shows the logged error. The last 20 error messages will be stored with date and time.

Info:
- Tag : ...
- Device type : Control Unit
- Supplier : BMA
- Manufacturer : BMA
- Device no. : ...
- Production no. : ...-...
- Software ver. : V...
- SW release date: ...

Print Setup:
Printout of the start-up protocol via RS 232 and RS 485.
Format, content and example see chapter 9.5 Start- up protocol printout.

2.2.3 Setup



Configuration:

Setup of

- General data
- Measurement-specific data
- Plausibility data
- Microwave data
- Marker
- Units

Calibration:

- System adjut
- Concentration calibration
- Advanced setup

Input / Output:

- Current outputs
- Current inputs
- Pt 100
- Digital outputs
- Digital inputs

Service:

In the Profi mode the SERVICE menu is displayed and can be edited. The following settings are possible:

- Factory settings
- General reset
- Memory Tool (operation of Memory Tool, optional accessory)
- Data printout (via RS 232 and RS 485, data contents can be selected)

Product:

Product selection (1 – 4); if you select another product, the product-specific data will be loaded: outputs, inputs and calibration.

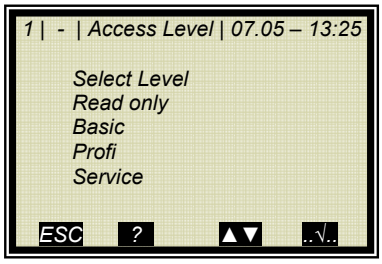
When you call the products 2 to 4 for the first time, all settings and contents (e.g. system calibration, sampling table, datalog and calibration) of the current product will be copied to the new product.

Change password:

The password for the access levels Basic / Profi can be changed here.

See for more information also chapter 5 Password.

2.2.4 Access Level



Read only:

- This mode can be selected on all levels without password.

Basic:

- No password required on higher levels. Password has to be entered for „Read only".
- Password can be changed.
- At the basic level some menu items are disabled, respectively masked, e.g. manual calibration.

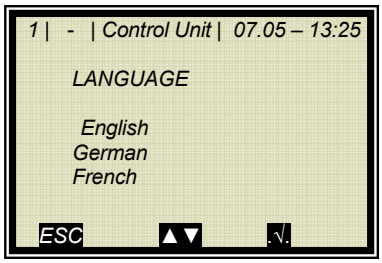
Profi:

- As described above. Should be used only if you are sufficiently familiar with the measuring system.
- Changing between basic and profi is possible without using a password.

Service:

- This level is reserved to the service personnel.

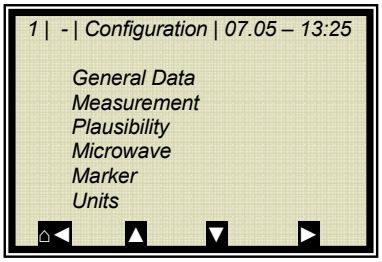
2.2.5 Language



Language:

- Select the dialog language

2.2.6 Configuration



General Data:

- Enter date, time and tag

Measurement:

- Measurement mode (batch/continuous)
- Start mode (keyboard/external)
- Averaging (number of measured values used for averaging)
- Reset average value (yes/no)

Plausibility:

- The process limits define the valid range, the current concentration has to be within this range.
- The phase measurement is subject to a plausibility analysis, which can be set here.
- Enable and define the pause detection.

For more information please see *chapter 2.2.9 Plausibility*

Microwave:

Cable (enter the reference and signal cable length). E.g. for 2 meters of HF-cable quad, 4 meters for both length has to be entered.

Marker:

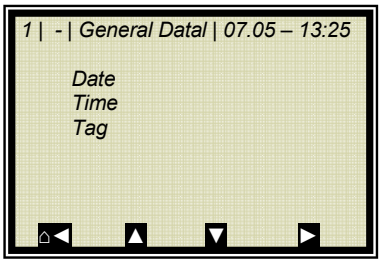
You can enter a name (max. 5 characters) and values for a marker. The graphic occurs in the live display and relates to the bar diagram. In order to deactivate the marker, choose a marker value outside of the bar diagram limits or the current output limits.

Units:

According the configuration, for the concentration, current input and temperature there are different dimensions selectable.

Selectable for concentration are: none, specific, %, %DS, °Bx, g/L and g/cm^3

2.2.7 General Data

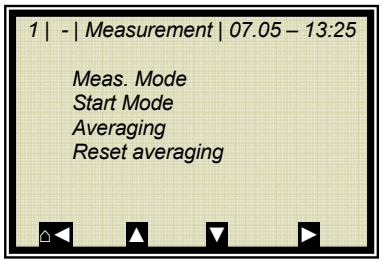


Date:
- Enter the current date

Time:
- Enter the current time

Tag:
- Enter the tag name. The tag (max. 8 characters) is displayed in the header on the display.

2.2.8 Measurement



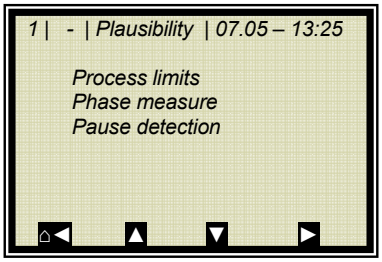
Meas. Mode:
Selection continuous or batch. In batch-mode a mean value is generated from start to stop. In continuous mode a moving average is generated, respective to the mean-rate preset.

Start Mode:
The measurement device can be started or stopped via external terminals (digital input) or via keyboard.

Averaging:
Enter the number of single measurement values over which a moving average is to be calculated. Typical: 20 sweeps. Relates only to the measuring mode continuous.

Reset Averaging:
Reset averaging (yes/no). Relates to batch or continuous.

2.2.9 Plausibility



Process Limits:

A minimum and maximum concentration has to be set. Only concentrations within the range are permitted. If the concentration exceeds the range, the concentration average is put on hold and an error message is displayed.

Phase Measure:

The phase is subject to a plausibility analysis. For more information please see *chapter 2.2.10 Phase Measurement*.

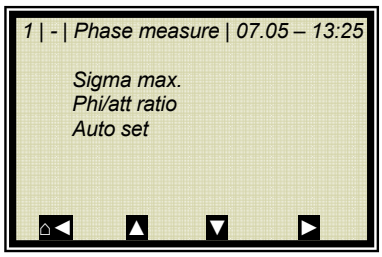
Pause Detection:

Can be enabled or disabled. Switching variable is the attenuation, if the entered min. attenuation is not reached, the evaluation unit switches to the pause mode:

- Current output drops to the lower current output limit (0/4 mA)
- Message on display
- RUN LED is flashing

Details regarding pause function see chapter 2.2.11 Pause Detection.

2.2.10 Phase Measurement



Sigma max.

Here you set the maximum sigma of the regression Phase vs. Frequency.
During normal measurement operation, sigma lies between 0 and 100.

Phi/att ratio

The correlation between Phase and Attenuation is another plausibility criterion. It has to be measured when taking the instrument into operation. The automatic ratio measurement is quite helpful (see Auto set).

Auto set

The automatic ratio measurement Phi/att can be turned on and off.
Turn it on during start-up. During measurement, please keep in mind:

- Cover the entire concentration range, if possible
- Do not stop the measurement
- Do not change the concentration erratically (max. 1 %).

Stopping the recording:

The measurement can be stopped by switching off record. The recording is frozen and only restarts when the system switched on again.

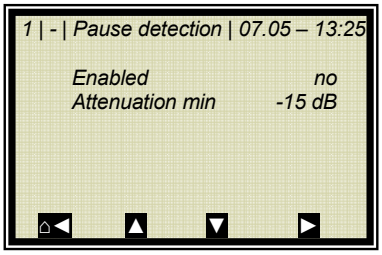
Start new recording:

Condition: Recording is switched off. Stop and start the measurement before you start a new recording. The results of old recordings are deleted by doing so.

IMPORTANT

After the measurement, the automatic measurement has to be disabled again! The ratio value is automatically stored and enabled on the PHI/ATT RATIO menu.

2.2.11 Pause Detection



Enabled

Here the pause function is activated and deactivated. Consider the measuring conditions for using the pause detection; see below.

Attenuation min

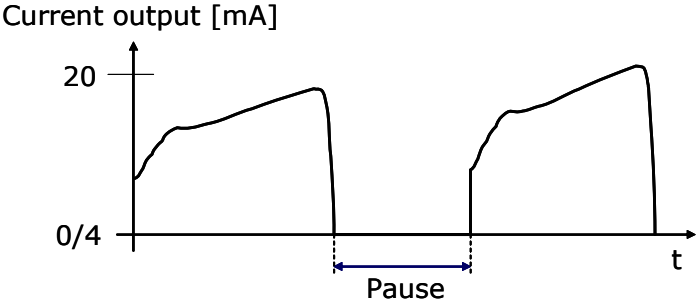
Input of the minimum attenuation, when falling below that value measurement goes into pause mode.

Conditions and discription:

The pause detection function is a software feature for pause detection between two sequential discontinuous crystallization processes. This is interesting because during the cleaning phase, the sensor indicates the lower current output value (0/4 mA). Only after restart of a crystallization process, does the sensor show the current dry substance content (Brix content) after product entry.

Condition: pure phase calibration first order. This corresponds to the default adjustment of the automatical calibration.

For example, a typical signal response from two crystallisation processes.



Necessary Software Installations

Enter under menu SETUP | CONFIGURATION | PLAUSIBILITY | the following values:

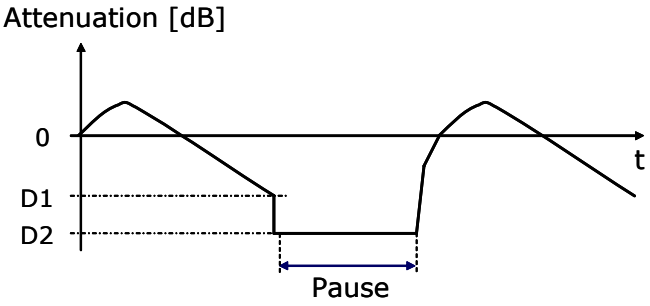
- Under PROCESS LIMITS:
  Min. Conc. and Max. Conc.
  Entry of process limits: ±5 %DS to the real process limits. Example: real process limits 70 to 90 %DS, therefore 65 to 95 %DS is entered.
- Under PAUSE DETECTION:
  The pause detection can be activated here.
  Switching variable is the attenuation; if the entered minimum attenuation is fallen short of, then the evaluation unit pauses.

Adjust these settings if applicable according to the conditions of „Quitting the pause mode" (see below).

Determination of the min. attenuation as a switching variable:

For this, the attenuation process must be observed up to the end of a crystalliza-tion process including cleaning phase. In addition, you can take the data log (see chapter 2.2.2 diagnosis) for assistance.

For example, a typical attenuation process:



D1 = smallest attenuation value in the product
D2 = Attenuation value for an empty vessel
D (min) = Switching variable = average attenuation between D1 and D2

Typical values (Sugar beet):
D1: -15 to -10 dB
D2: -25 to -20 dB
D (min): -20 to -15 dB

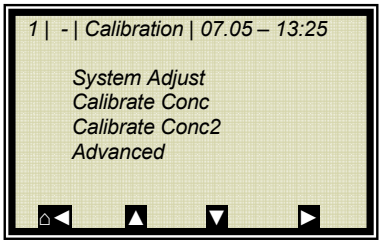
Quitting the pause mode (change to measuring mode):

Two conditions have to be met before changing the mode:

1. The attenuation has to be higher than the attenuation threshold.
2. The recent concentration (Conc act.) has to be in the following range:
   - Conc act.> min. process limit
   - Conc act.< min. process limit – A1·Faktor·146

A1:	Calibration coefficient of the phase
Factor:	From tuning (Default =1; see chapter 2.2.13 Calibr. Concentration).
Process limit:	See menu PLAUSIBILITY

2.2.12 Calibration



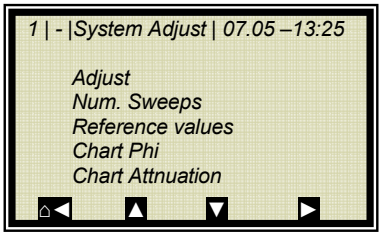
System Adjust:
The system calibration is started on this page.

Calibrate Conc:
Opens the calibration menu of concentration 1

Calibrate Conc2:
Opens the calibration menu of concentration 2

Advanced:
Here you set the Tara values, number of sweeps at sampling, process type and split value.
Details see chapter 2.2.17 Advanced.

2.2.13 System Adjust



Adjust:
System calibration is started.

Num. Sweeps:
Here you define the number of sweeps for the system calibration (arithmetic mean value).

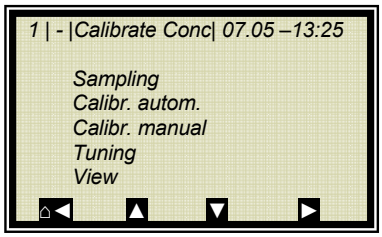
Ref. values:
Upon completion of the reference measurement, the reference values for phase, attenuation, slope and sigma can be output.

Chart Phi:
Shows the characteristic curve of Phase versus Frequency based on the regression.

Chart Attenuation:
Shows the characteristic curve of Attenuation versus Frequency based on the regression.

By means of a system calibration, the data log is not deleted (see *chapter 2.2.2 Diagnosis*).

2.2.14 Calibrate Concentration



Sampling:
Shows all measured samples.

Calibr. autom.:
Calibration can be started after measurement of two samples and input of the respective laboratory values. Moreover, compensation can be enabled if the following prerequisites have been fulfilled:
1. The respective analog input has been enabled (Pt100 or current input 1 / 2).
2. Sampling has been carried out using the previously set up compensation input.
3. The reference value has been entered on the menu COMPENSATION. The reference value is either the current product temperature at system adjustment or the average product temperature.

There are at least three samples needed for temperature compensation, otherwise the calibration error "Keeping old coefficients" appears at the evaluation unit.

Basis of automatic calibration (fixed setting):
- Linear phase calibration
- Compensation: additive and linear

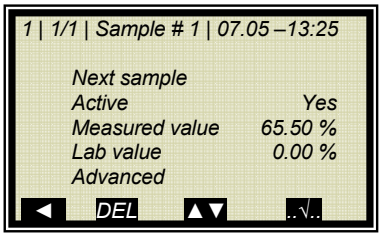
Calibr. manual:
Here you can choose the calibration order [linear/quadratic], the basis [phase/attenuation or both] and compensation temperature.

Tuning:
Subsequent correction of the reading is possible by entering a factor and an offset.
Calculation is carried out according to the following formula:

$$\text{Corrected display} = \text{display} \cdot \text{factor} + \text{offset}$$

View:
Presentation of calibration curve, display of correlation and coefficients.

2.2.15 Sample No.



The header includes the following information (starting from the left):

- Product-No.
- Current table position / Total number of entries
- Sample no. of current table position
- Date and time of sampling

Up to 20 sample entries are possible. The sample can be assigned to the lab value either via the sample no. or via date/time. The sample no. is assigned on a continuous basis. If a sample is deleted, the sample no. will not be assigned a second time. Up to 999 sample numbers are available. Only if all numbers have been assigned, you may assign a number for the second time; you will be alerted accordingly on the display.

Next sample:
Continues with the next sample.

Active:
Here you can choose if this sample should be taken into account for calibration.

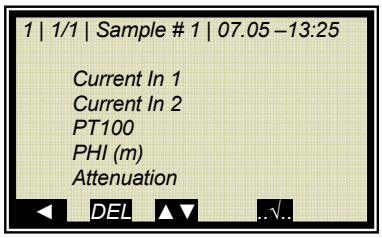
Measured value:
Display of the measured values, calculated with the actual coefficient.

Lab value:
Entry position for the laboratory value.

Advanced:
Switches to the next data page.

DEL:
The displayed sample value can be deleted by pushing briefly the corresponding soft key.
Pushing longer, all sample values are deleted at once.

2.2.16 Sample Data (expanded)



Current In 1:
Editable display of the first compensation input.

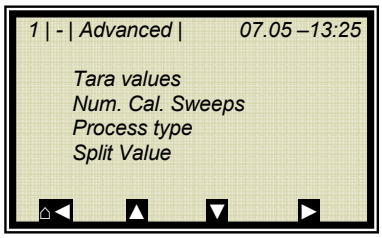
Current In 2:
Editable display of the second compensation input.

Pt 100:
Editable display of the Pt 100 input.

PHI (m):
Not editable display of the measured phase.

Attenuation:
Not editable display of the measured attenuation.

2.2.17 Advanced Settings



Tara Values:
Input option of Tara values for phase and attenuation. The Tara values are attributed to the phase or the attenuation before calibration.
The calculation is the following:

$$Phase = Phase_{meas} - Phase\ Tara$$
$$Attenuation = Attunation_{meas} - AttenuationTara$$

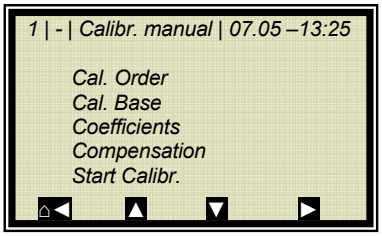
This function is not needed for the determination of dry substance, brix or density in sugar solution.

Number of Calibration Sweeps:
Freely adjustable number of sweeps over which a calibration point (in the course of automatic sample measurement) will be averaged.

Process Type:
Select the operation mode:
- one concentration [1 measuring range]
- two concentrations [2 measuring ranges]
- split concentration [1 measuring range with switching point (split value) for coefficient switchover].

Split Value:
Setting of the switching point on a value basis.

2.2.18 Calibr. manual



Cal. Order:
Here you define the calibration order [linear / quadratic]

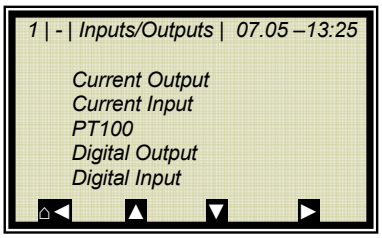
Cal. Base:
The following parameters can be set:
- Phase
- Attenuation
- Phase and attenuation

Coefficients:
Here you can edit all coefficients for phase and attenuation.

Compensation:
If at least one analog input is active, you may assign the compensation and set the compensation parameters.

Start Calibr.:
Starts the calibration using the parameters you have set earlier.

2.2.19 Input / Output



Current Output:
Both outputs can be adjusted, assigned and set up on the selected level.

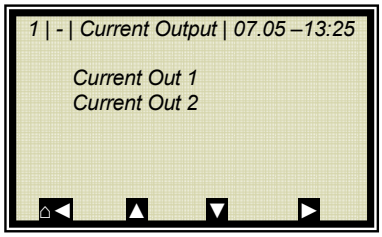
Current Input:
Activation level of current input, calibration and display of the live current signal.

Pt 100:
Here you can enable and adjust a connected Pt 100. Display of the actual temperature signal.

Digital Output:
Allocation of relays 1 and 2 and test function.

Digital Input:
Status control and assignment of the digital inputs.

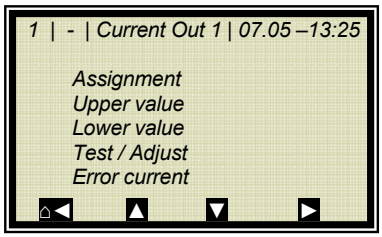
2.2.20 Current output



Current Out 1:
Selection of input dialogue for output 1.

Current Out 2:
Selection of input dialogue for output 2.

2.2.21 Current Output 1



Assignment:
The current output can be assigned to a concentration or one of the activated inputs.

Upper value:
Display value assigned to the 20mA value.

Lower value:
Display value assigned to the 4mA value.

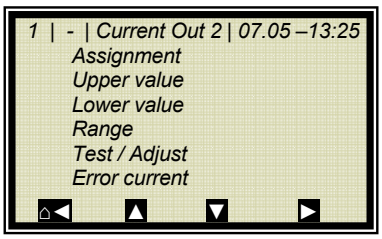
Tip
Current output 1 only 4 – 20mA possible

Test / Adjust:
Current test, calibration and display of live current.

IMPORTANT
In case of test function, the measurement should be stopped.

Error current:
Status of current output in case of error
- 22 mA
- 3.5 mA
- Hold
- Value

2.2.22 Current Output 2

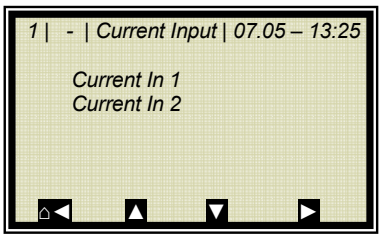


All functions same as current output 1

Tip
Current output 2 can be set from 0 – 20mA to 4 – 20mA.

Range:
Change of the current output
- 0 – 20mA
- 4 – 20 mA

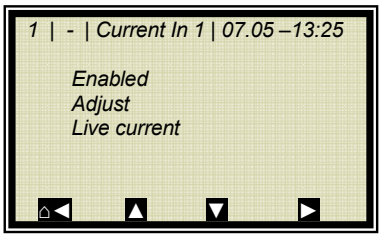
2.2.23 Current input



Current Input 1:
When selected, change to activation and calibration menu.

Current In 2:
As described above.

2.2.24 Current In 1



Enabled:
If you select yes/no, the current input is enabled or disabled.

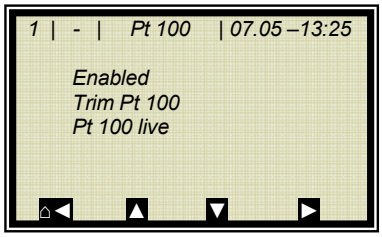
Adjust:
Follow the instructions on the display.

Live current:
Display of the live current signal.

2.2.25 Current In 2

Set and enabled same as input 1.

2.2.26 Pt 100

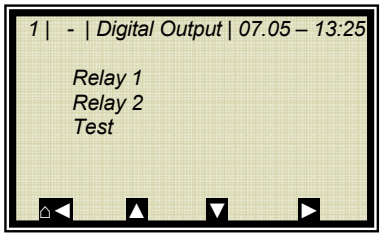


Enabled:
If a Pt 100 is connected, the input has to be enabled first.

Trim Pt 100:
You need a 100 Ohm and a 138.5 Ohm resistance. Follow the instructions on the display.

Pt 100 live:
Display of the live temperature.

2.2.27 Digital Output

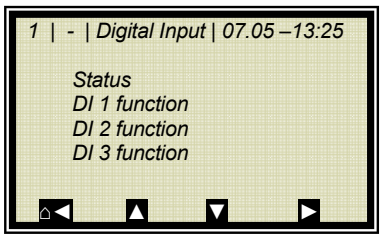


Relay 1:
Relay 1 can be assigned to different functions:
- None
- Error
- Halt
- No product
- Alarm min.
- Alarm max.

Relay 2:
Same assignments possible as above.

Test:
The switching status of the relays can be set here and checked at the respective terminals.

2.2.28 Digital Input



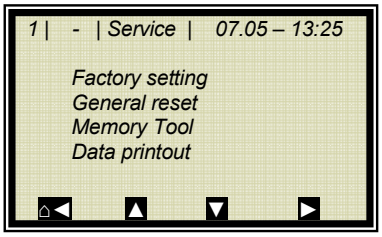
Status:
Shows the status of the input circuit
- open/closed

DI 1 Function:
The following functions can be assigned to DI 1:
- None
- Start (external start)

DI 2 Function:
The following functions can be assigned to DI 2:
- None
- Hold (averaging is stopped)
- Product (external product selection)

DI 3 Function:
Assignments for DI 3
- None
- Sample (external control of sampling)
- Product (external product selection)

2.2.29 Service



Factory Settings and general reset:
See table on next page.

Memory Tool:
Communication with the external memory unit (Memory Tool, optional accessory). Data transfer takes place via the 9-pole SubD-connector on the bottom of the instrument.

- Backup settings: all operation parameters for all products are stored in the Memory Tool.
- Upload settings: all operation parameters are loaded into the evaluation unit by the Memory Tool. With that, all parameters are deleted from the evaluation unit.
- Backup data log: the data log is stored on the Memory Tool.
- Backup setup: the start-up protocol is stored on the Memory Tool.

NOTICE

The concentration average value is put on hold during communication with the Memory Tool. With this, the measured value from the current output is also frozen!

Data Printout:
All measurement values for every single measurement (sweep) are sent by the serial interfaces RS 232 and RS 485 (also referred to as raw data).

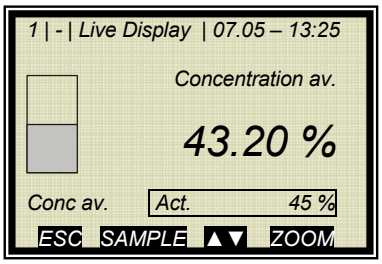
The output can be adjusted as follows:
- None (disabled)
- Row (data transfer, see Hardware Manual chapter 6.4)
- Table (microwave data for each frequency point)
- Row and table (one data row and one table are output for each sweep)

Default represents “Line”.

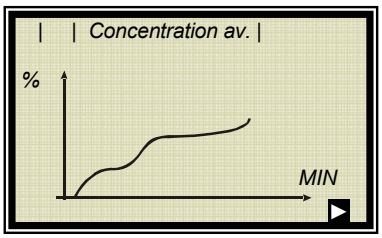
	Factory settings	General Reset
Language selection	Unchanged	Unchanged
Access level	Unchanged	Default: Basis
Measurement	Has been stopped	Has been stopped
Password	Unchanged	Default: PASS1
Product selection	Unchanged	All products deleted
Error log	Not deleted	Deleted
Data log	Not deleted, Setting default	Deleted, setting default
System calibration	Not deleted	Deleted
Cable length	Unchanged	Default
Sample table	Not deleted	Deleted
Measuring table description	Default	Default
All parameter under menu: Measurement Plausibility Marker Unit	Default	Default
Calibration coefficients	Default	Default
All calibration under the analog and digital in and outputs.	Default	Default
Adjustment of analog in and outputs	Unchanged	Deleted
Remark:	Only is effective on current product	Is effective for all products (P1 to P4)
-		

*Default: default values, see chapter *9. under „Factory settings“*

2.3 Trend Display



Push the ZOOM button to enlarge the measurement value which is surrounded by a frame.



By pushing the ZOOM button for a longer time, the enlarged measurement value will be displayed as trend over the entire display.

The trend display corresponds to the contents of the datalog. Datalog has to be enabled for the trend display.

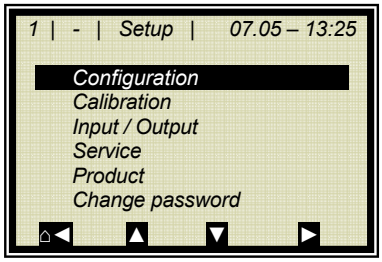
NOTICE

During the trend set up (few seconds), the measuring value or the power output is frozen.

Chapter 3. **Configuration**

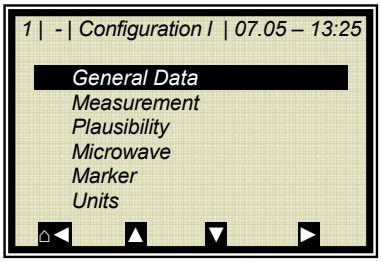
Before carrying out any calibration work, you should check the configuration setup of the measuring system and change it, if necessary.

3.1 Configuration Setup

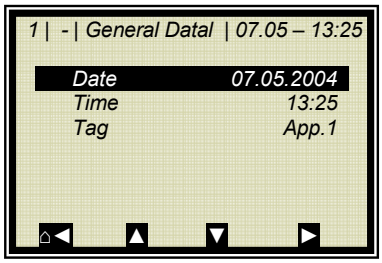


➢ CONFIGURATION

3.1.1 General Data

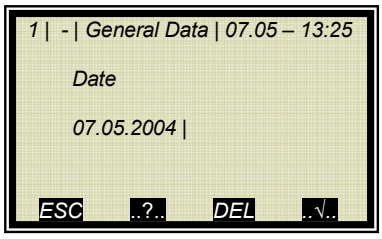


➢ GENERAL DATA



Example:
Select the respective entry, edit and store it.

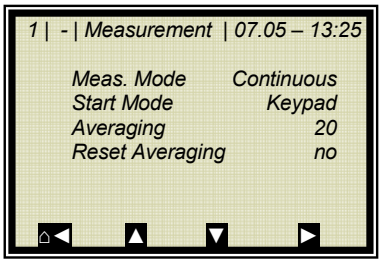
➢ DATE



Push DEL to delete the entry and then enter the new date. Push ..√.. to confirm and store the changed date.

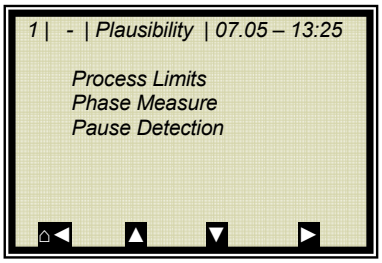
Tip
The colon for the time input (e.g. 13:25) is invoked by pushing the button [**.**].

3.1.2 Measurement



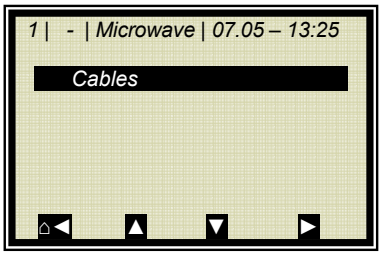
You have to check the settings on this display and adapt them to the measurement conditions.
For example, you have to adapt the measurement mode, the start mode and the averaging to the actual operating conditions.

3.1.3 Plausibility

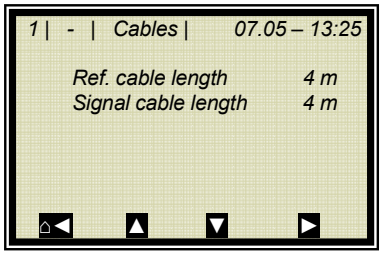


To rule out any unnecessary disturbances during calibration, the **process limits** should be set, as far as possible, below or above the measuring range.
You should keep the factory-set default values for the **phase measurement** and disable ***Pause detection***. If a default value has to be changed, you have to check all entries that are relevant for calibration and, if necessary, renew them.
Upon completion of the calibration work, you can enable *Pause detection* again.

3.1.4 Microwave



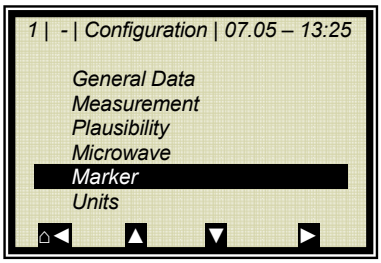
- CABLES



If the factory-set cable lengths do not match the actual geometry conditions, you have to correct the values.

Example: For a 2 m long HF quad cable, enter 4 m for the reference and signal cable length. The input value corresponds to twice the quad cable length.

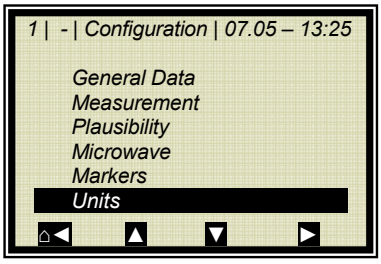
3.1.5 Marker



You can set a marker comprising max. 5 characters which identify the value set on in the live display.

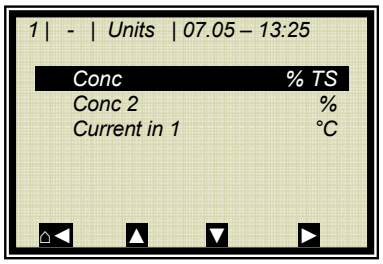
- MARKER

3.1.6 Units



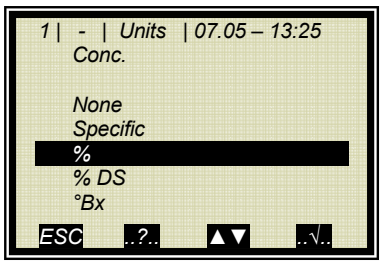
Set the units as desired.

- UNITS



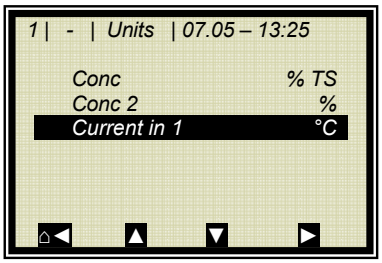
- CONC

The units of the concentrations (conc 1 and 2) and those of the enabled analog inputs can be selected.

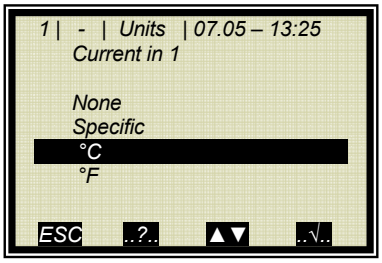


- %

Different units can be set for both concentrations.



➢ CURRENT INPUT 1

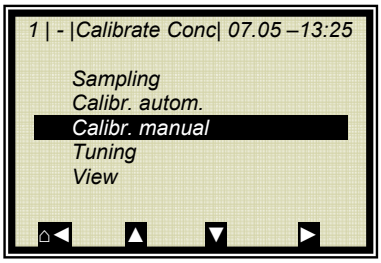


➢ °C

The temperature input can be set to °C, °F, specific or none.

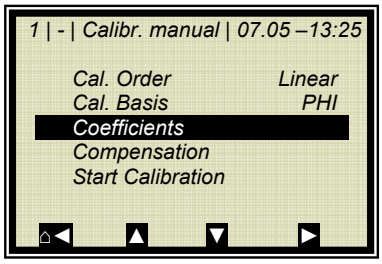
3.2 Start Calibration Coefficients

Prerequisite: You are in the Profi mode



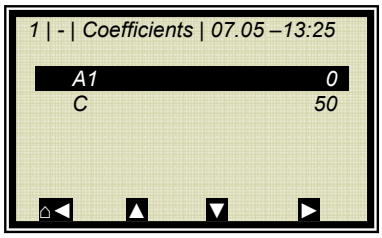
If the display depicted to the left is not visible, do the following on the live display:
ESC | SETUP | CALIBRATION | CALIBRATE CONC |

- CALIBR. MANUAL



- COEFFICIENTS

The concentration is calculated as follows:
Con = A1·φ + C with φ = Phase



Check the coefficients A1 and C and correct them, if necessary, as follows:

C = average measuring range value (concentration value)

A1 = 0

Note: With these calibration coefficients the concentration average value and thus the current output is put on hold during start-up.

Chapter 4. **Calibration**

Note: The measuring system has been connected properly and the normal operating temperature has been reached (approx. 30 to 45 min. acclimatization).

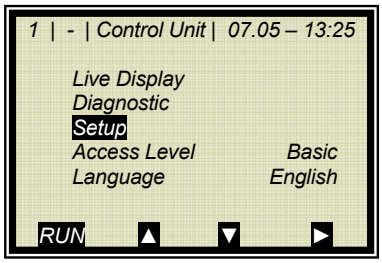
It has to be ensured that the flow cell is completely filled with product or the container probe is completely surrounded by product.

Prerequisite: Chapter

3.1 Configuration Setup

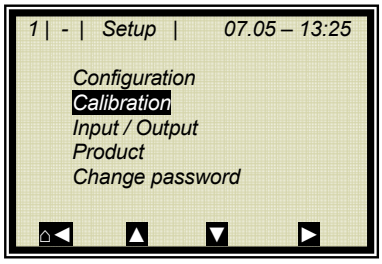
has been completed.

4.1 System Calibration

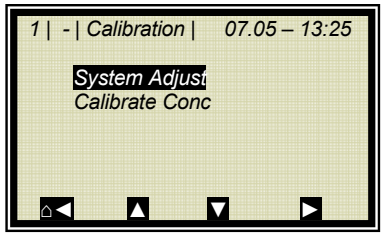


If you turn on the measuring system, the following display appears:

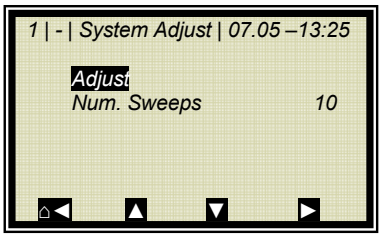
- SETUP



- CALIBRATION

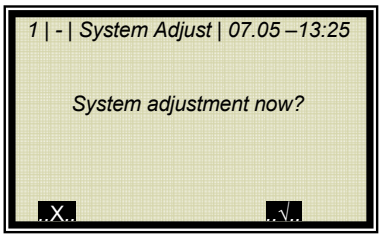


- SYSTEM ADJUST

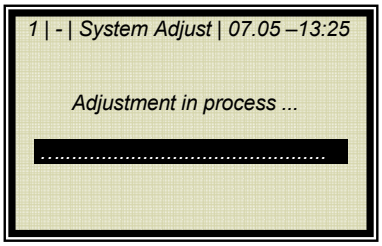


The manufacturer has set the number of measurement cycles (sweeps) to 10.

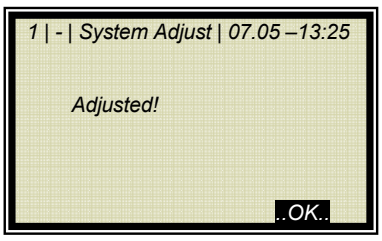
- ADJUST



Confirm



System adjustment is in process.



Push ..OK.. to confirm and push ⌂◀ three times to return to the main menu.

4.2 Start-up of CH-200

The system adjustment and the calibration shall be carried out for the high dynamic version of CH-200 as well as for the Standard Model CS-100. However, it is important to note that the CH-200 requires a minimum attenuation of 40 dB over the entire concentration range and for system adjustment. When falling below, the measurement is not precise anymore and error prompts may occur.

The complete attenuation is generated the following way:

$dB_{total} = dB_{adjust} + dB_{live} + 0.4 \times$ measuring cable length

This applies for:
dB_{total} : total attenuation
dB_{adjust}: attenuation while system adjustment
dB_{live}: actual attenuation while measuring
measuring cable length: e.g. 4 meters of HF-cable quad results into 8 meters measuring cable length (counting both ways, forward and backwards).

The software sends an error message if there is a shortfall in attenuation and the Control Unit enters error state (error No. 55).

Remedy when falling below minimum attenuation:
If the necessary attenuation is not reached, it is possible to install a 10 dB attenuator in the transmitter branch (see Figure 4-1). However when falling below significantly, the standard system CS-100 should be used instead.

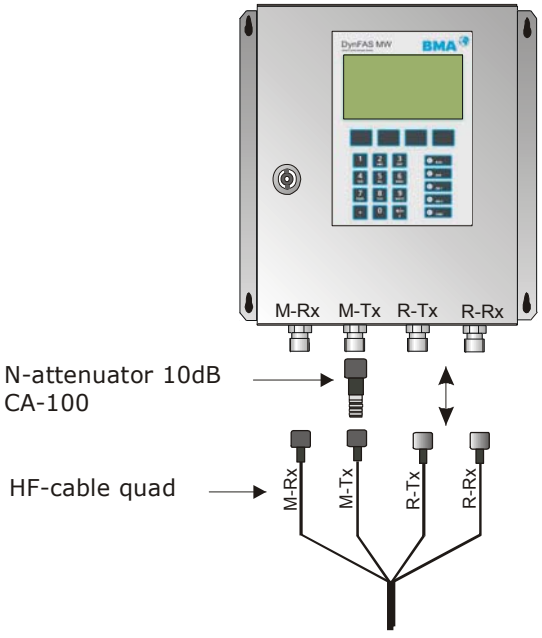
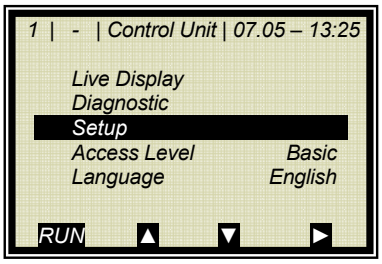
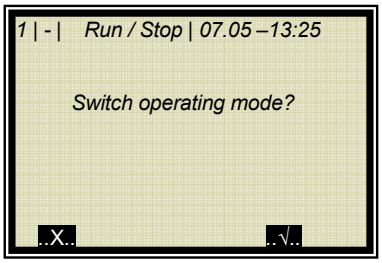


Figure. 4-1: Installation the 10 dB attenuator

4.3 Start Calibration



Push RUN to start the measuring system.



Push ..√.. to confirm this prompt and the instrument switches to the run mode.

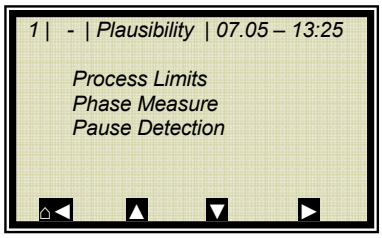
4.3.1 First Process Run

Prerequisite: You are in the Profi mode
Chapters **3.1 Configuration Setup**
3.2 Start Calibration Coefficients
4.1 System Calibration
have been completed.

The first process run is used to determine the ratio of Phase and Attenuation (Phi/att), a parameter from the plausibility analysis for correct determination of the phase.

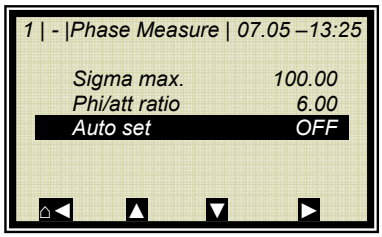
If you know the ratio already from other measurements, you may enter it directly on the PLAUSIBILITY menu (see *chapter 2.2.10 Phase Measurement*); in this case, process recording is not necessary.

IMPORTANT
The measurement takes place automatically; you only have to start and stop it again. During measurement, please keep in mind:
- Do not stop the measurement
- Do not change the concentration erratically (max. 1%).
- Cover the entire measuring range, if possible

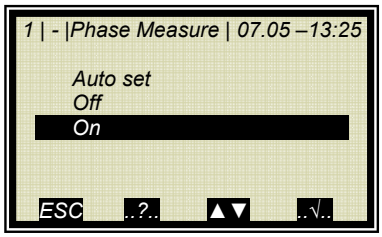


From the main menu, you get in the Advanced mode to the display to the left by selecting | SETUP | CALIBRATION | CALIBRATE CONC.

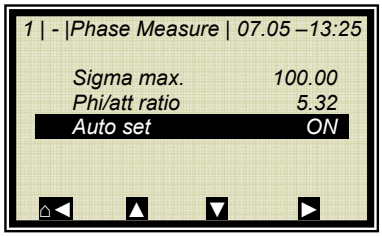
- PHASE MEASURE



- AUTO SET



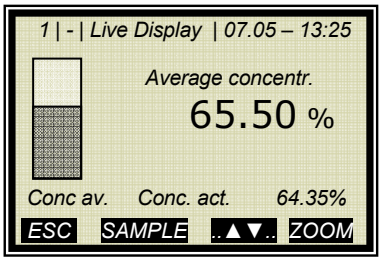
- ON



While the process recording is running, carry out sampling (see the following chapter).

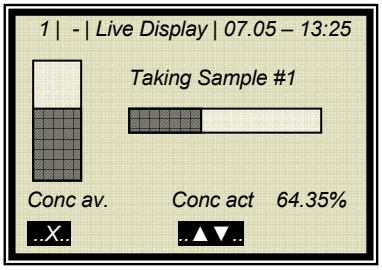
Do not forget to enable the process recording again as described above!

4.3.2 Sampling



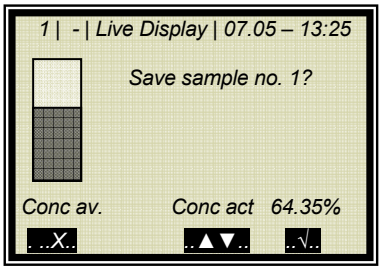
Push RUN and the display to the left will appear.

Note: Push the SAMPLE button to start measurement of the raw data. At the same time, the laboratory sample has to be taken and marked. The analysis may be performed later, provided the product is not changed by this.



Sampling is in process.....

Push the ..X.. button to stop the sampling process any time.



If the sampling process has been completed without any problem, push the ..√.. button to save the sample in the table and the measurement continues.

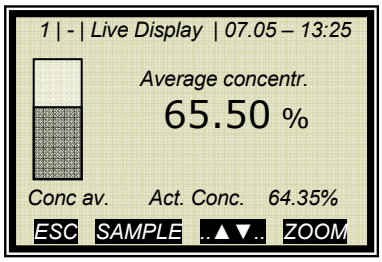
You have to repeat the process described above for each further sample.

The second sample taking should be started only when the display shows a significant difference to the first sample taking.

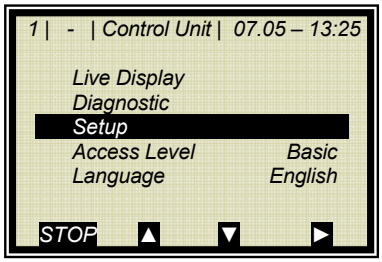
The assumed concentration of the samples should be distributed within the complete measuring range. If there is an additional temperature compensation, the temperature of the samples should be also distributed within the complete temperature range.

The minimum number of required samples is derived according to the preset calibration. In case there is not a sufficient number of samples, an error message will appear after attempted calibration.

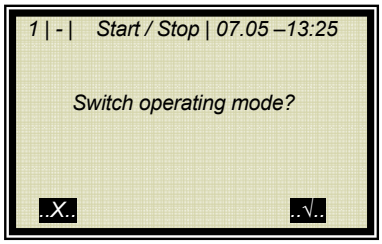
4.3.3 Entering the Lab Values



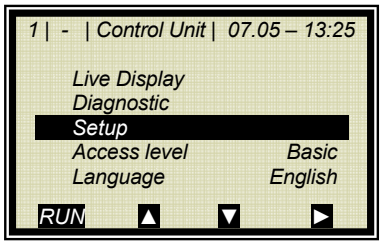
Push the ESC button to go to the main menu. A measurement can be stopped only on the main menu.



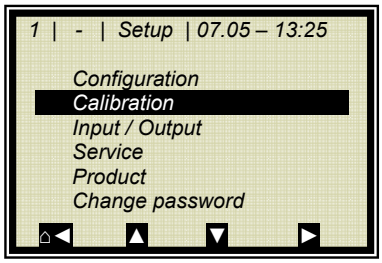
Push STOP to stop the measuring system.



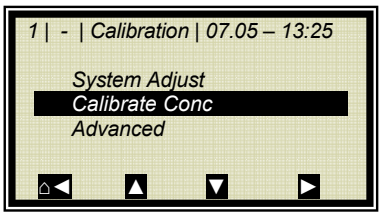
Push ..√.. to confirm the prompt and the measurement switches to the *STOP* mode.



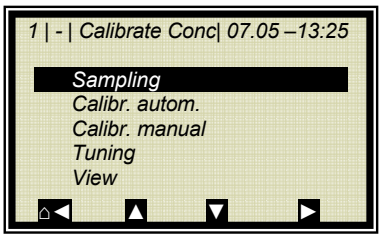
- SETUP



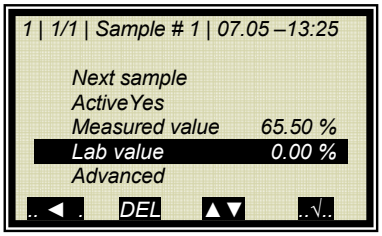
- CALIBRATION



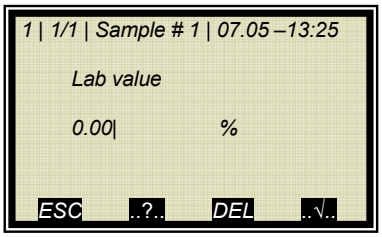
➢ CALIBRATE CONC



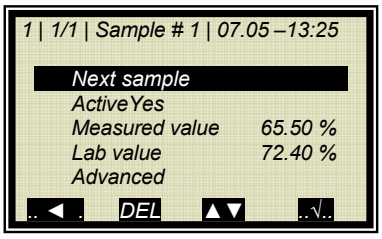
➢ SAMPLING



➢ LAB VALUE



Delete default value with DEL, enter new value and confirm with ..√..

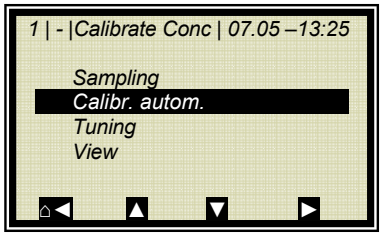


➢ NEXT SAMPLE

and repeat the step described above with the next sample.

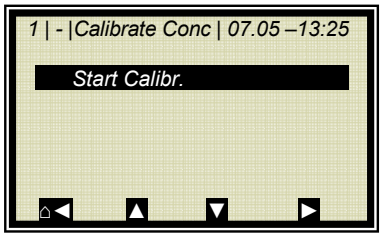
After you have entered the last sample by pushing the ◄ button you get back to the Calibration menu. (Short push – one page, longer push of the button – you get back to the Calibration menu immediately.)

4.3.4 Automatic Calibration

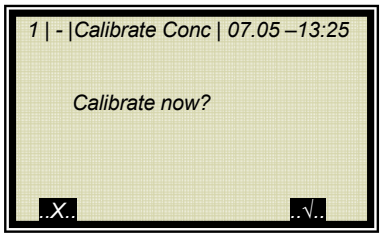


Phase calibration including the enabled compensation is carried out during automatic calibration.

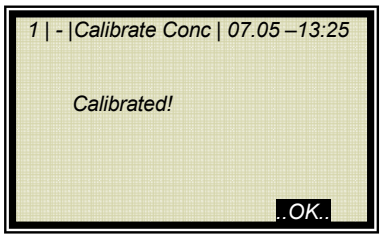
- CALIBR. AUTOM.



- START CALIBR.

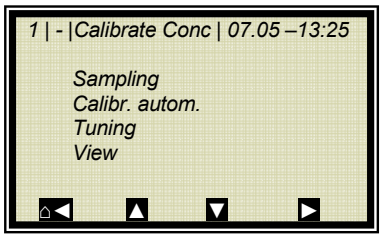


Push the ..√.. button to start the calibration.



Push the ..OK.. button to confirm calibration.

When calculating the new coefficient set, factor and offset will be reset (factor 1.00000 and offset 0.000).



Push the ⌂◀ button four times to return to the main menu.

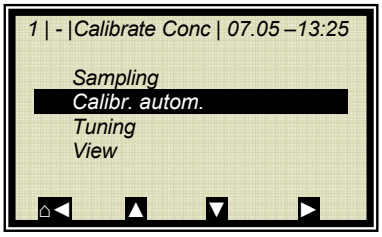
4.3.5 Automatic Calibration with Temperature Compensation

Before running a sample measurement you have to enable the desired compensation input and check the calibration. If **all** inputs are enabled, the measured values of all inputs will be stored automatically in the sample table.

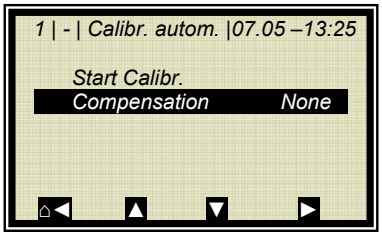
Usually, automatic calibration is sufficient and can be performed in the Basic mode.

The chapters
4.1 System Calibration
4.2.2 Sampling and
4.2.3 Entering of Lab Values
are prerequisites for automatic calibration.

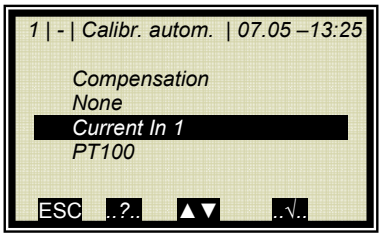
Starting from the main display, you get to the display depicted to the left by selecting | SETUP | CALIBRATION | CALIBRATE CONC. |



➢ CALIBR. AUTOMATIC

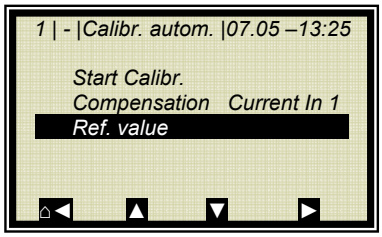


➢ COMPENSATION



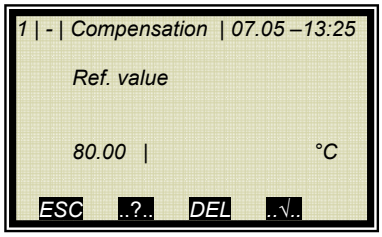
All active inputs are displayed here for compensation selection.

➢ CURRENT IN 1

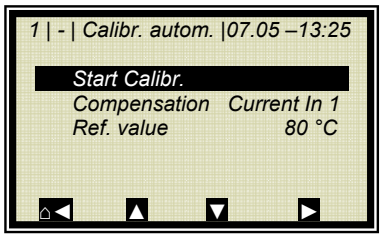


➢ REFERENCE VALUE

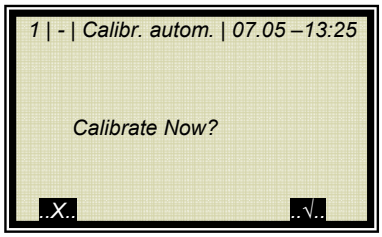
After selection of the compensation input, REFERENCE VALUE is displayed on the menu. The input of a reference value (e.g. the reference temperature) is required.



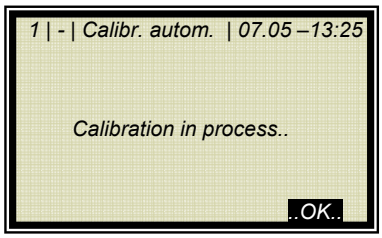
As reference value either the temperature of the product during calibration or the averaged operating temperature entered and confirmed.

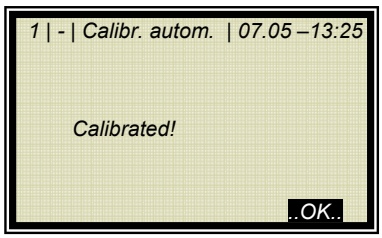


➢ START CALIBRATION



Start calibration.





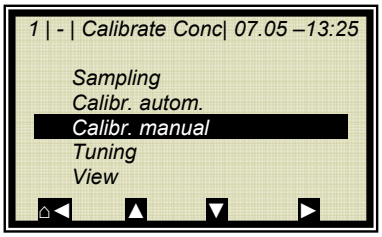
Push ..OK.. to confirm the Calibration. The calibration is finished. Push the Home button ⌂◀ four times to return to the main menu and to start a measurement.

4.4 Manual Calibration

Manual calibration is possible only on the Profi level.
Prerequisite a for manual calibration are the chapters

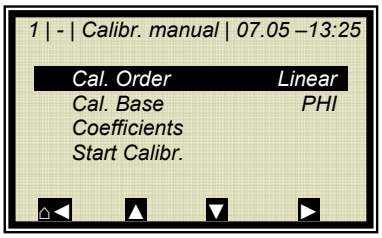
4.1 System Calibration
4.2 Start Calibration
4.2.2 Sampling and
4.2.3 Entering the Lab Values

4.4.1 Manual Calibration with one Concentration

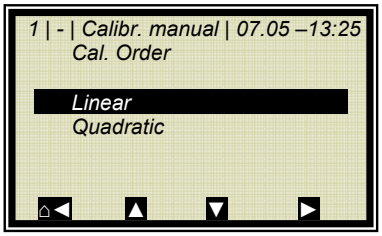


If the display depicted to the left is not visible, do the following on the live display:
ESC | SETUP | CALIBRATION | CALIBRATE CONC |

- CALIBR. MANUAL

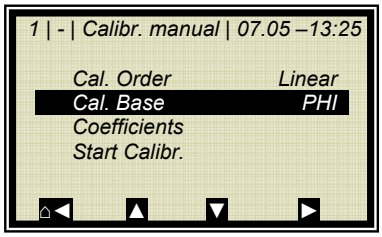


- CAL ORDER

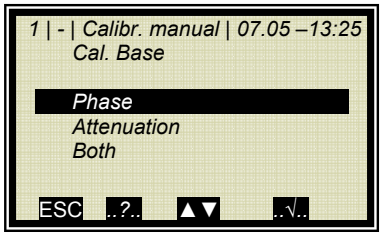


- LINEAR

Quadratic calibration is possible only for a calibration with three and more samples.

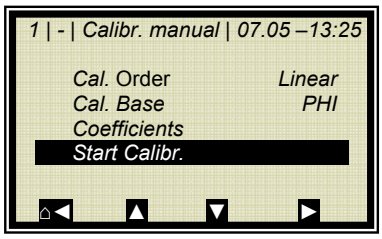


➢ CAL. BASE

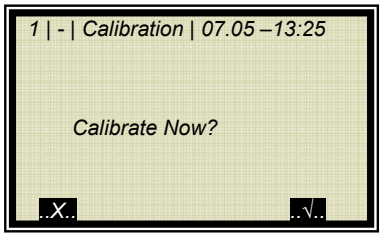


➢ PHASE (Phase measurement)

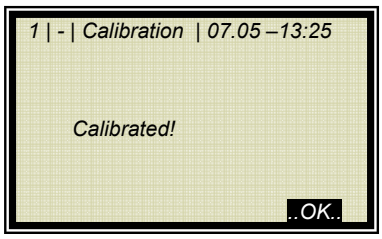
The calibration base is selected depending on the number of samples and their raw data. Initial calibration should be as simple as possible, since calibration can be optimized any time.



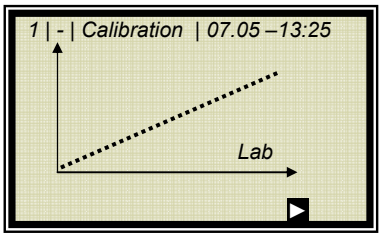
➢ START CALIBRATION



Push ..√.. to start the calibration, push ..X.. to go back one page without calibration.

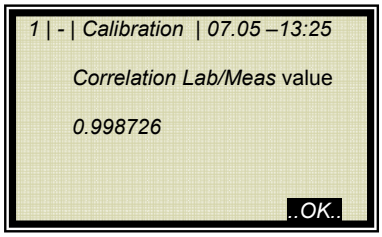


..OK.. takes over the calibration and changes to the next display.



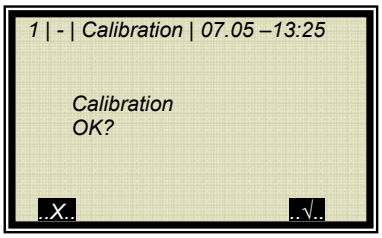
The curve to the left shows the characteristic curve lab vs. measured value.

➢ ..▶..



The correlation shows the average deviation of the characteristic curve from the sample series.

➢ ..OK..



As soon as you confirm this prompt, the calibration display appears again; from there you get back to the main menu by pushing ⌂◀ four times and you can start the measurement again.

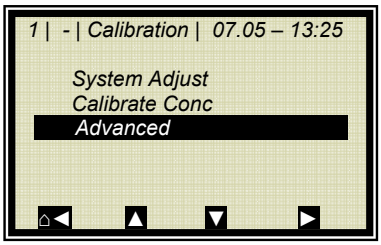
4.4.2 Calibration with Two Concentrations

Calibration for two concentrations starts by changing the process type as described below.

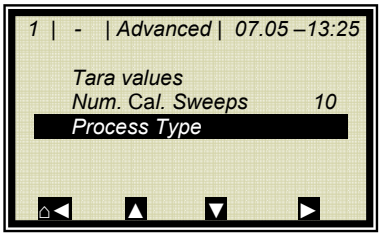
Prerequisite for calibration are the chapters

4.1 System Calibration and

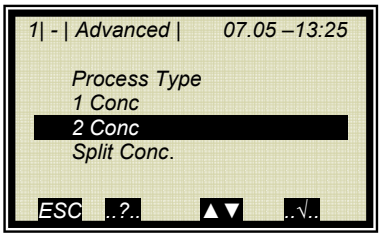
4.2.2 Sampling



- ADVANCED

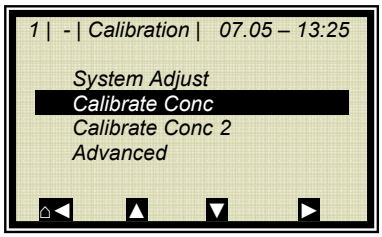


- PROCESS TYPE

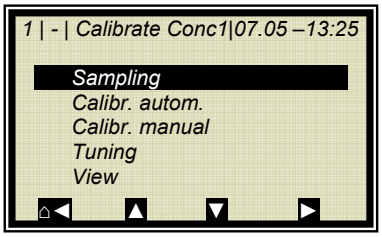


- 2 CONC

Push the ..√.. button to accept the selected process type and push the ⌂◀ button once to go to the display depicted below.



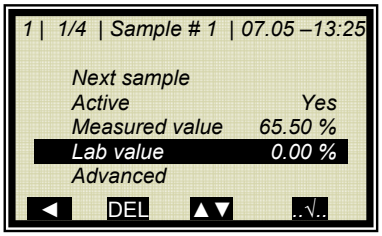
- CALIBRATE CONC 1



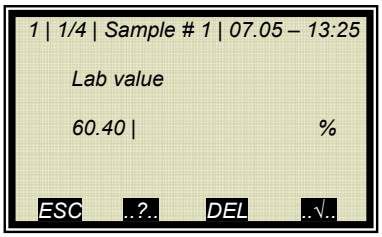
➢ SAMPLING

There is only one sample table for both calibrations.

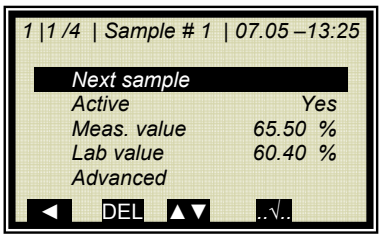
The lab values have to be entered for all samples used for calibration of concentration 1. All other samples have to be disabled (Active.... Yes/No).



➢ LAB VALUE

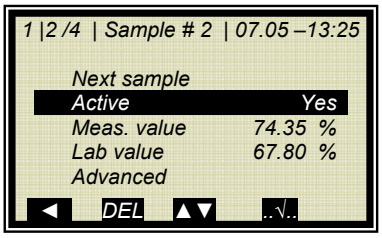


Delete default value with **DEL**, enter new value and confirm with **.√..**.



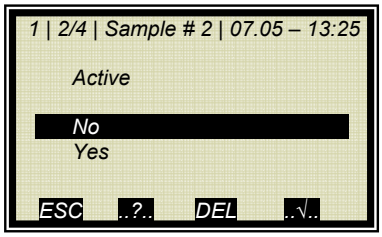
➢ NEXT SAMPLE

Continue with next sample

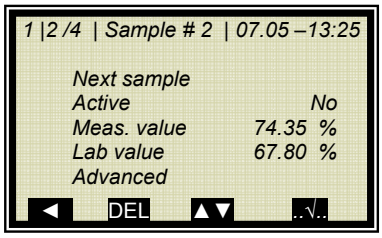


➢ ACTIVE

Disable sample

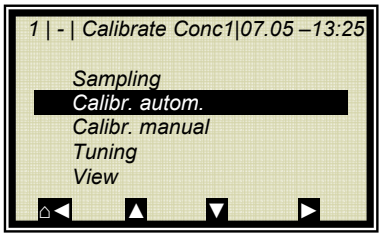


- NO

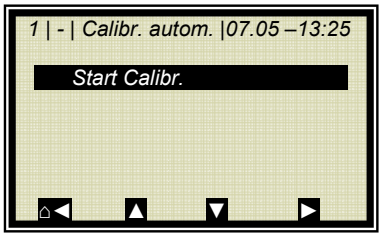


Make sure that all samples have been processed and only those samples are active which are relevant for this calibration.

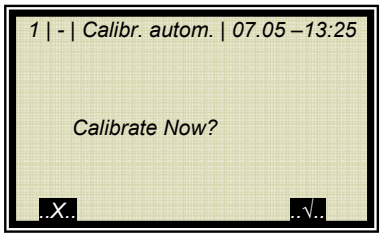
Push ◀ ESC to get to the Calibration page



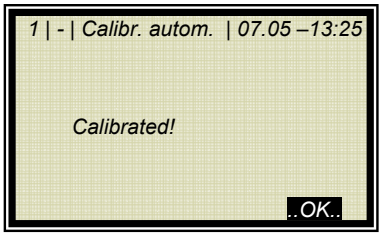
Automatic as well as manual calibration is possible in this calibration mode. We recommend the automatic mode for beginners.



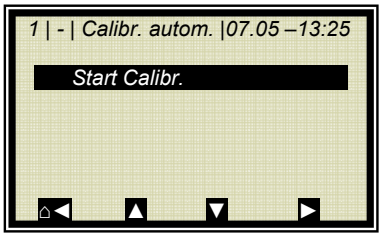
- START CALIBRATION



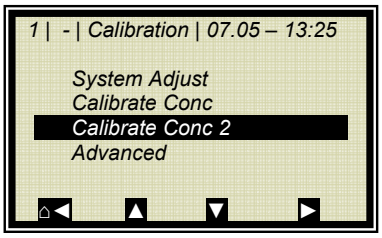
Push ..√.. to start the calibration, push ..X.. to go back one page without calibration.



..OK.. takes over the calibration and changes to the next display.

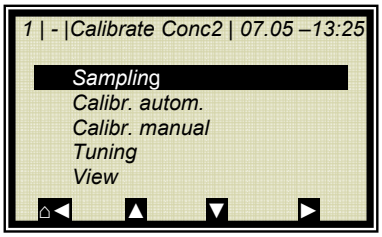


Push ⌂◀ twice to return two pages.



- CALIBRATE CONC 2

Repeat the steps as described above for concentration 2; all samples have to be enabled again in the sample table. Now you have to disable all samples which are not used for concentration 2.

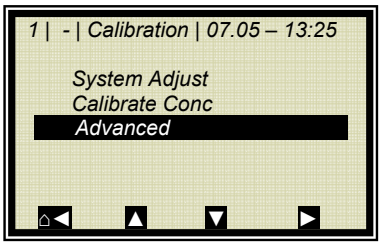


- SAMPLING

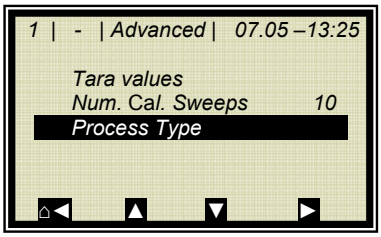
4.4.3 Calibration with Split Value

With this type of calibration, two characteristic curves (concentrations) are combined in one measuring range; their point of intersection defines the split value.

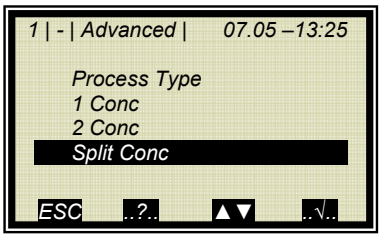
Conc 1 for the lower and conc 2 for the upper measuring range can be output only together via current output.



➢ ADVANCED



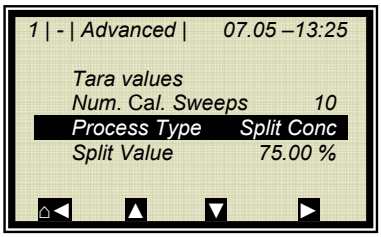
➢ PROCESS TYPE



➢ SPLIT CONC

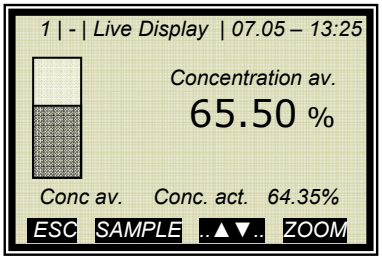
Push the ..√.. button to accept the selected process type and push the ⌂◀ button once to go to the display depicted below.

The displayed split value has been set by the manufacturer, but has to be adapted to the respective application.



The samples should be chosen that way that the last sample of the lowest concentration is as close as possible to the first sample of the highest concentration.

It is the ideal case, when the last sample of the initial concentration coincides with the first sample of the final concentration.



The sample measurement is carried out continuously over the entire measuring range with the display depicted to the left. See *chapter 4.2.2 Sampling*

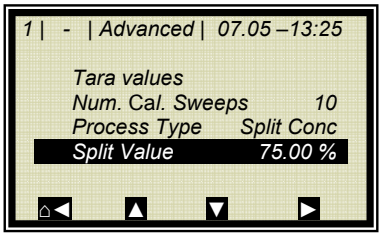
After completion of sampling, the individual samples will be enabled or disabled during input of the laboratory values, relative to the set split values. All samples smaller or equal to the split value will be assigned to the lower concentration range and all samples above to the upper concentration range.

The correlation of the samples is carried out automatically, for instance after setting the splitting value or after entering the laboratory value (e.g. after re-sampling). The correlation complies with both, the splitting value and the laboratory value.

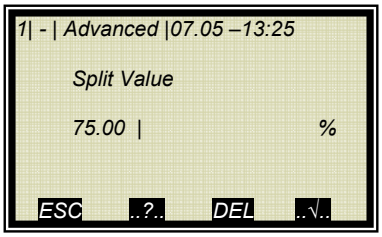
IMPORTANT

By entering a splitting value, this automatic correlation reactivates samples that had been deactivated before! In such cases the deactivated samples should be deleted or deactivated again after entering the splitting value.

The required splitting value has to comply with the intersection of the two calibration characteristic lines. After calibration it is adjusted automatically (only to a certain extend).

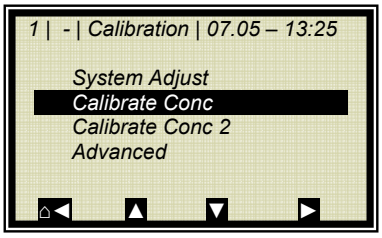


➢ SPLIT VALUE

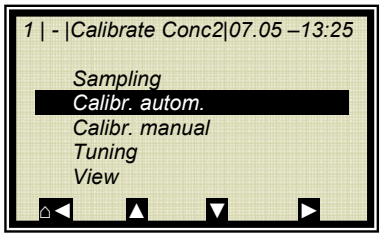


Enter the split value and confirm with ..√..

Push the Home button ⌂◀ to return to the calibration page.



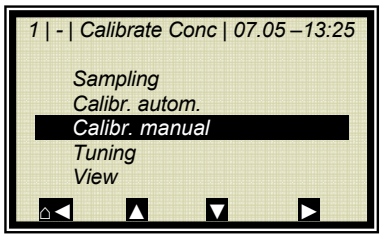
➢ CALIBRATE CONC



- CALIBR. AUTOM.

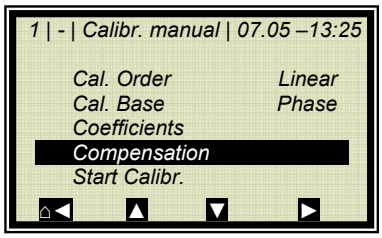
The lower concentration is now calibrated. Then select CONC 2 and repeat the calibration process.
Back to the main menu and start the measurement.

4.4.4 Calibration with Temperature Compensation

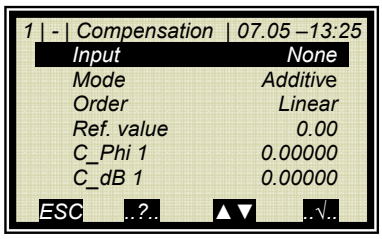


Starting from the main menu, you get to the display to the left by selecting | SETUP | CALIBRATION | CALIBRATE CONC | in the Profi mode.

- CALIBR. MANUAL

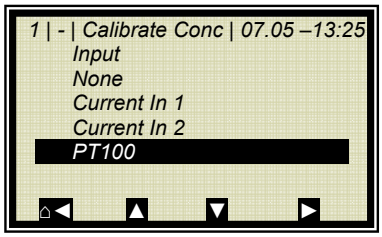


- COMPENSATION



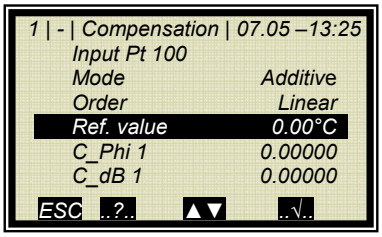
- INPUT

If all inputs have been enabled during sample measurement, you have the option to select compensation from the list, since all input values have been stored in the sample table.

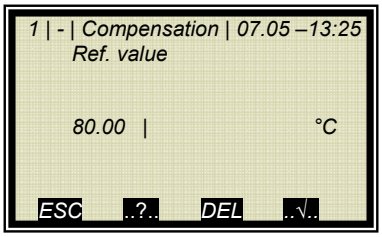


- Pt 100

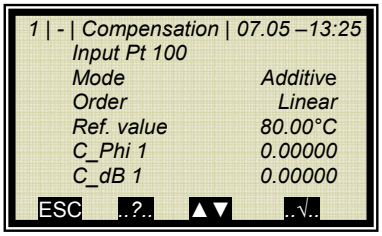
You can select additive or multiplicative **mode** and set the **order** to linear or quadratic. If you select **automatic** calibration mode, the above modes will be calculated automatically. This is recommended for non-professional users.



➢ REF VALUE



As reference value either the temperature of the product during calibration or the averaged operating temperature entered and confirmed.



The coefficients C_Phi 1 and C_dB 1 are automatically calculated during calibration.

➢ ESC

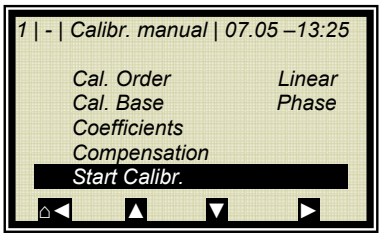
If you have completed the entries described above and have carried out the steps described in chapters

4.1 System Calibration

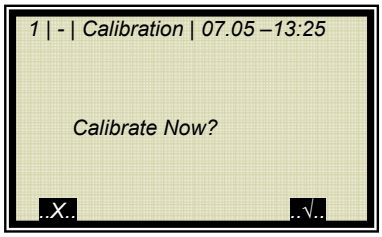
4.2.2 Sampling and

4.2.3 Entering the Lab Values

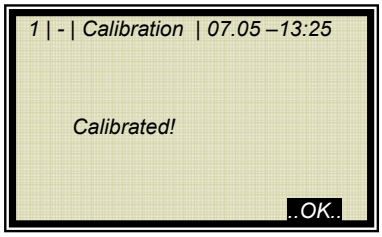
you may proceed with the calibration as described below.



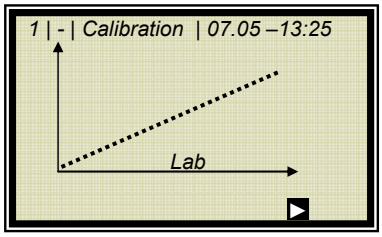
➢ START CALIBR.



Push ..√.. to start the calibration, push ..X.. to go back one page without calibration.

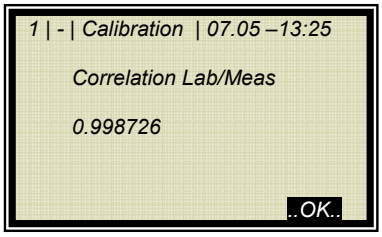


..OK.. takes over the calibration and changes to the next display.



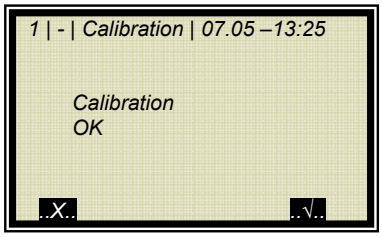
The curve to the left shows the characteristic curve lab vs. measured value.

- ..▶..



The correlation indicates the average deviation of the characteristic curve from the sample series.

- ..OK..



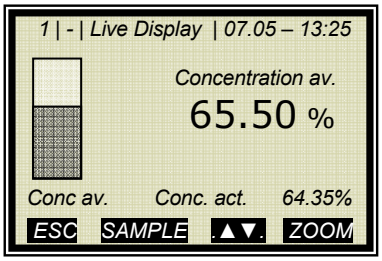
As soon as you confirm this prompt, the calibration display appears again; from there you get back to the main menu by pushing ⌂◀ four times and you can start the measurement again.

4.5 Adjusting the Calibration

A correction factor and an offset factor may be entered later to obtain subsequent adjustment of the calibration (fine calibration).

Below please find an example for an offset adjustment.

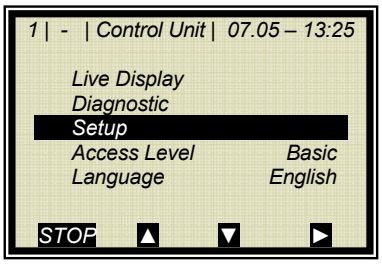
The display to the left appears if you push *RUN*.



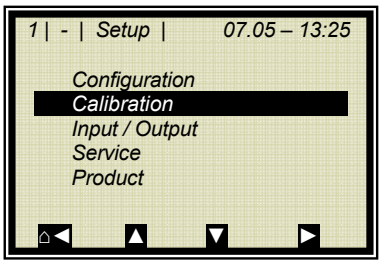
The display reading is now compared with the analysis value of the lab sample. The difference has to be entered as offset with the correct algebraic sign.

Calculation: Analysis value – display = offset

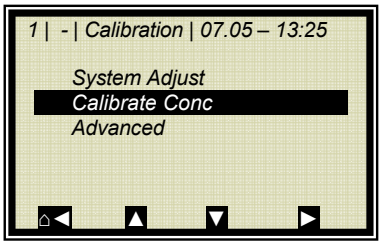
Push *ESC* to return to the main display.



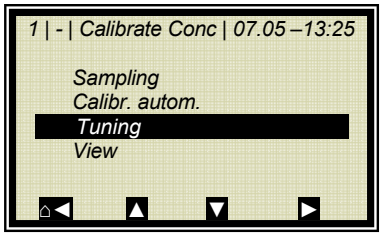
➢ SETUP



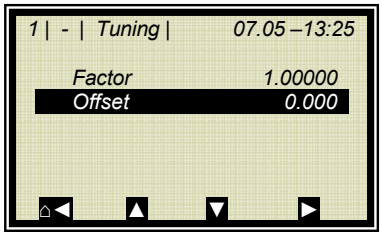
➢ CALIBRATION



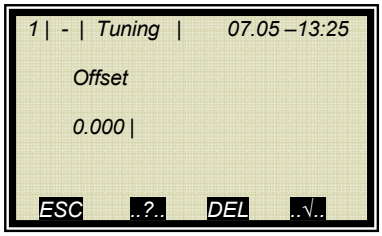
➢ CALIBRATE CONC



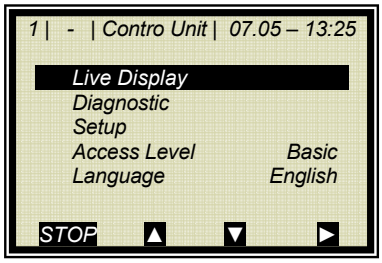
- TUNING



- OFFSET



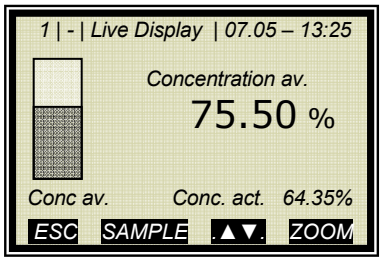
Enter the calculated offset value, confirm with ..√.. button and push ⌂◀ four times to return to the main menu.



Select with

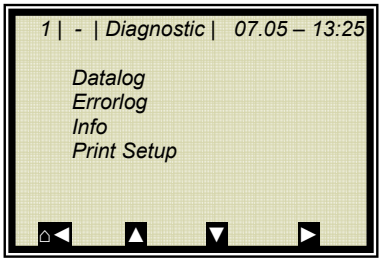
- LIVE DISPLAY

to get back to the display.



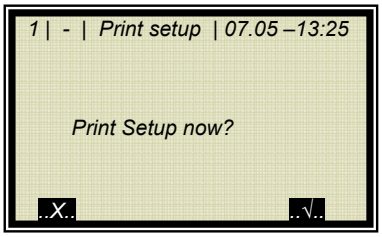
The reading value should now correspond to the actual value.

4.6 Output of the start-up protocol



Starting from the main menu, you get to the display to the left by selecting | DIAGNOSTIC | in the Profi mode.

- PRINT SETUP



Push ..√.. to start the print out by RS 232 and RS 485, push ..X.. to go back one page without sending.

The start-up protocol includes all adjustable parameters, calibration data, data of the system adjust and entries of the sample table.

Further information for instance about the format or an example of such a protocol can be found in chapter 9.5.

Chapter 5. **Password**

The measuring system can be protected by passwords against unauthorized access.

The following access levels are available:

Read only
The measuring system cannot be started and stopped. You can only switch from the live display to Diagnostic and to Access Level.

Basic
On the Basic level you can make essential entries, and stop and start the system.

Profi
The Profi mode allows additional entries in the process type menu, calibration menu and opens the Service menu.

Service
The service level is reserved to service personnel.

You have to enter a password to change from the access level „Read only" to „Basic" or „Profi".
At the time of delivery, this password is

PASS1

The password can be changed in the profi mode at: menu | SETUP | CHANGE PASSWORD.

Changing from Profi to Basic or vice versa is possible without password. You can change the password on the Profi or Basic level.

Tip
Depending on the access level, some menu items are hidden.

5.1 Forgot password

The device is in the "read only" mode and the user forgot the password. In order to carry out a "reset" of the user level, use the following way:
Switch of the device.
Switch it on again, the moment when all 5 LEDs light up while booting the 0 (zero-key) has to be pushed constantly for 8 seconds!
The device boots in basic mode now. Henceforward it can be carried out a manual "general reset" or define a new password respectively.

IMPORTANT
Caution: check your process before switching of the device. For example the power output drop to 0 mA.

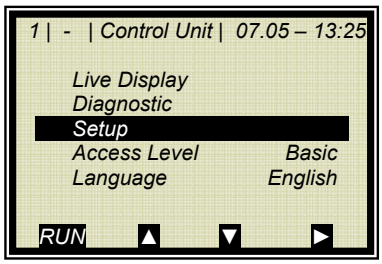
Chapter 6. **Inputs / Outputs**

The measuring system includes two separate floating current outputs.

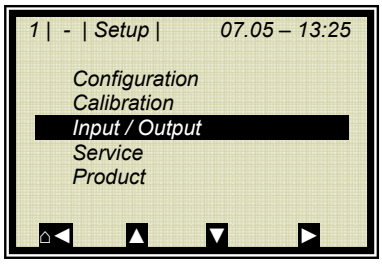
6.1 Current Outputs

Current outputs 1 and 2 can be assigned to the concentrations for calibration with two concentrations.

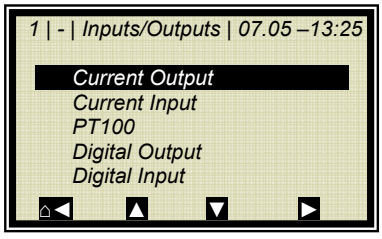
You get to the setup display as follows.



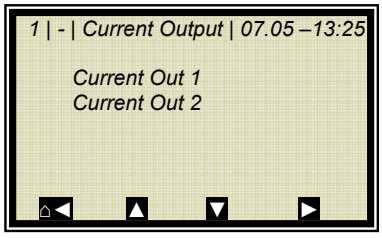
- SETUP



- INPUTS / OUTPUTS

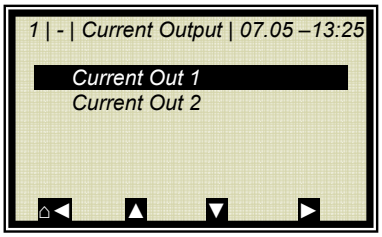


- CURRENT OUTPUT

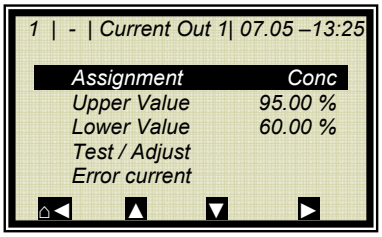


Now you can select the respective current output and assign it to the concentration after calibration.

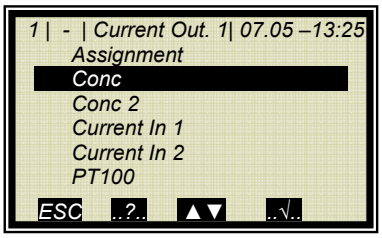
6.1.1 Current Output Setup



➢ CURRENT OUT 1



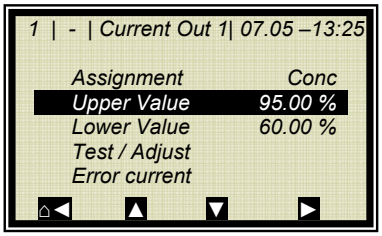
➢ ASSIGNMENT



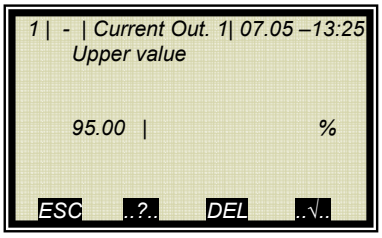
➢ CONC

Select and confirm with ..√..

In case of two concentrations and outputs enabled, the assignment can be chosen as needed.



➢ UPPER VALUE

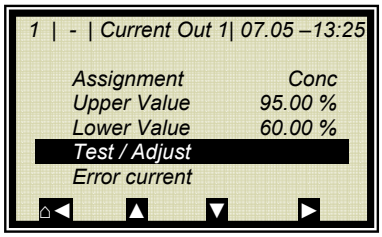


Delete the old value with DEL. Enter the new limit value and confirm with ..√.. .

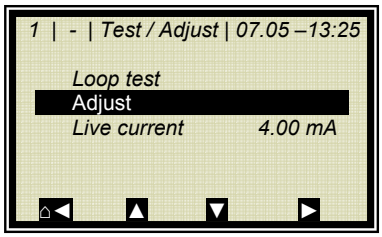
Set the lower value also as described above.

6.1.2 Test and Adjustment

Prerequisite: You are in the Profi mode

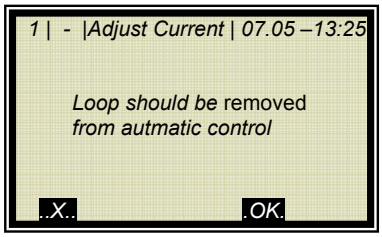


- TEST / ADJUST

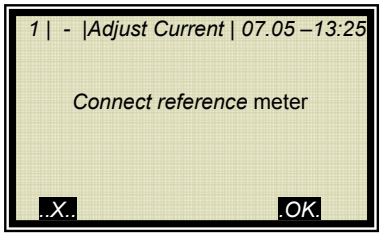


- ADJUST

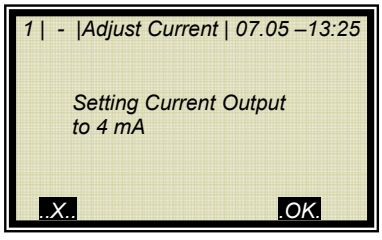
Tip
Current output 1 can only be set from 4 to 20 mA, since it is foreseen for a HART communicator



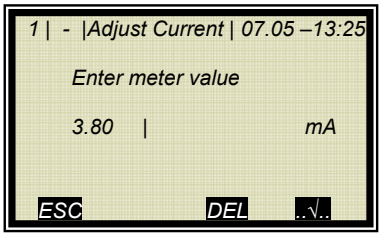
Push ..OK.. to confirm that the process is not affected by the measurement.



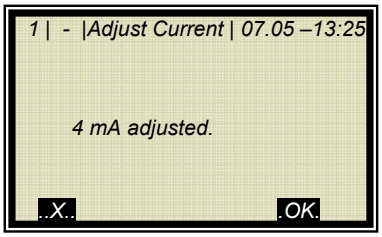
Push ..OK.. to confirm that the measuring system is connected.



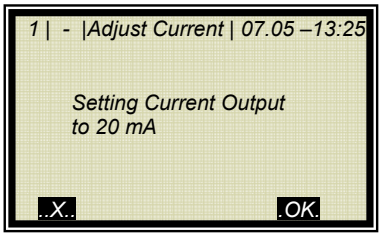
Push ..OK.. to confirm.



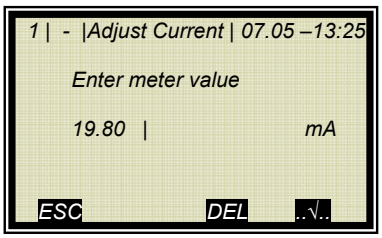
Read off display of measuring system and enter value.



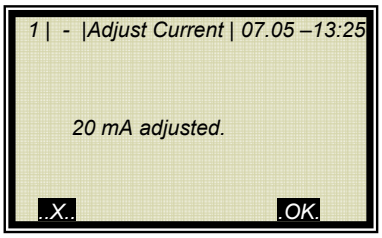
4 mA value adjusted.



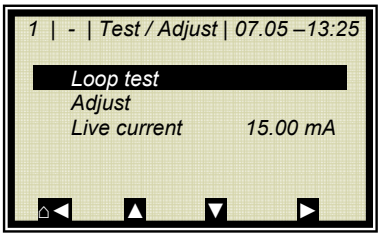
Push ..OK.. to confirm.



Read off display of measuring system and enter value.



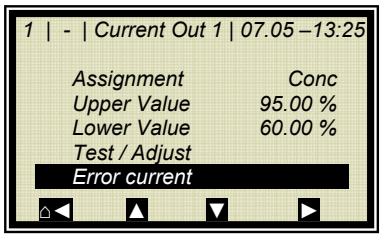
Adjustment finished.



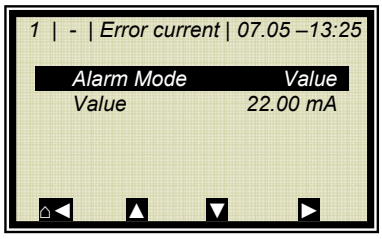
To check the current loop and possibly connected remote displays, you can set a current between 4 and 20 mA via the test function. If you quit the test function, the system automatically switches back to the live current.

6.1.3 Error Current

Different signal effects can be assigned to the output current.

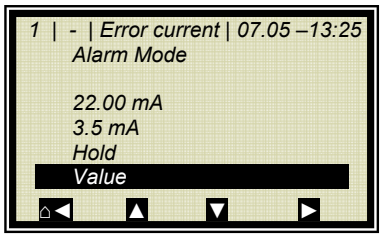


- ERROR CURRENT



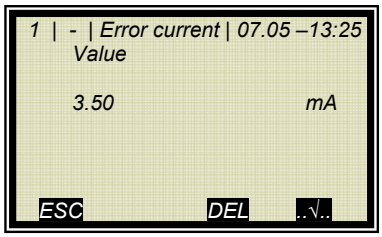
- ALARM MODE

Fixed values, Hold or freely adjustable values between 0 and 24 mA can be assigned.



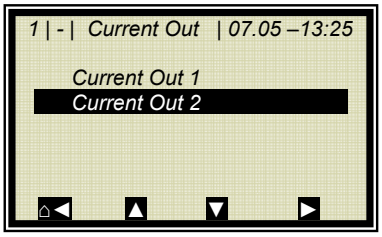
- VALUE

With this setting, you can default any current value for the error case.



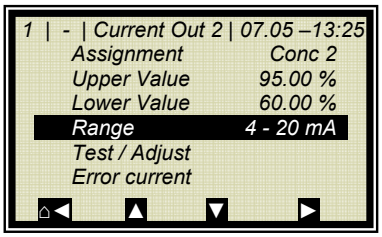
Enter value and confirm with ..√.. .

6.1.4 Current Output 2

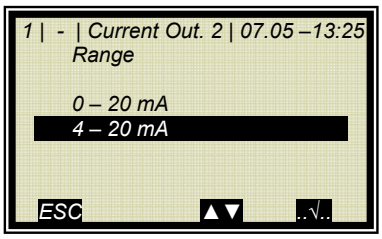


- CURRENT OUT 2

All settings for current output 2 have to be made in the same manner as for output 1, with the exception of the range setting.



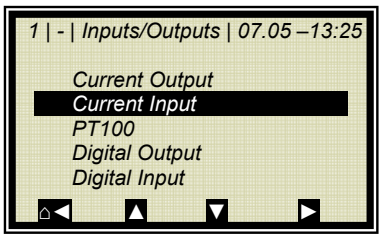
- RANGE



After selection of the required range, carry out all setting and calibration steps as described in *chapter 6.1.2*.

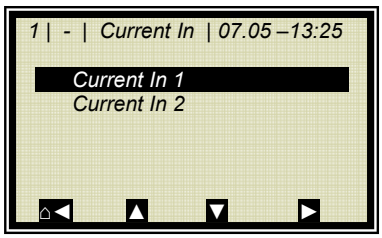
6.2 Current Inputs

If the window below is not displayed, you can invoke it on the main menu via | SETUP |INPUT/OUTPUT |

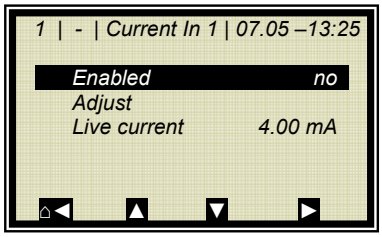


- CURRENT INPUT

6.2.1 Enabling the Current Input

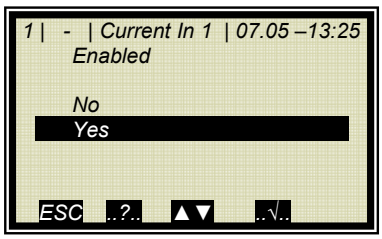


- CURRENT IN 1



- ENABLED

The menu ADJUST is only displayed at the profi mode.

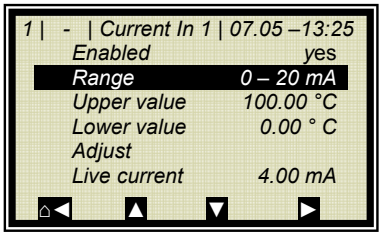


- ENABLING

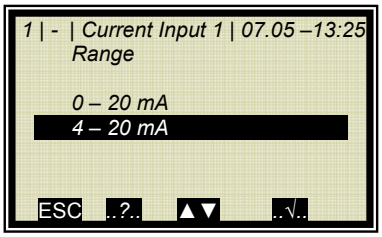
If a measurement is running, enabling an adjusted current input which is not used may cause an error.

6.2.2 Range Setting and Adjustment

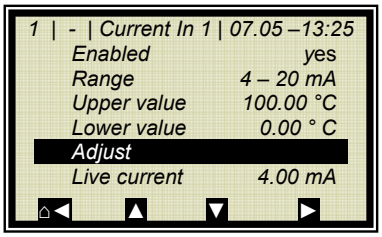
Prerequisite: You are in the Profi mode



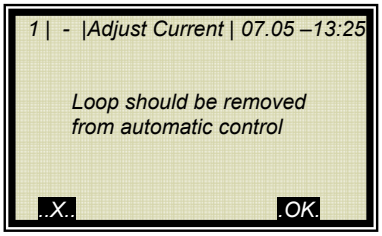
- RANGE SETTING



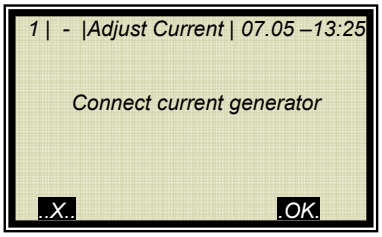
- 4 – 20 mA



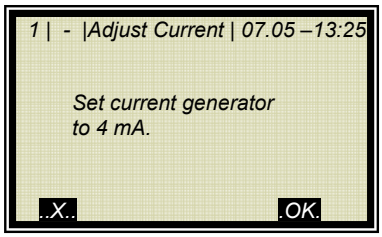
- ADJUST



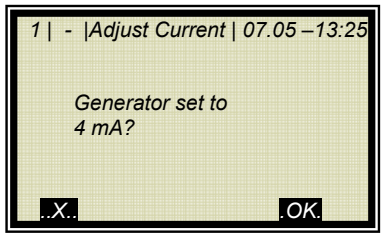
Push ..OK.. to confirm that the process is not affected by the measurement.



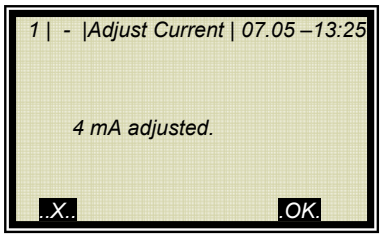
Push ..OK.. to confirm that the current generator is connected.



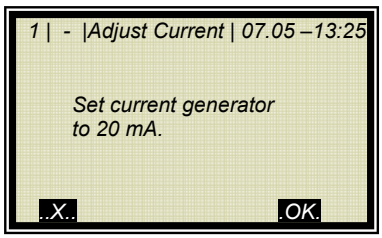
- Set current generator to 4 mA.



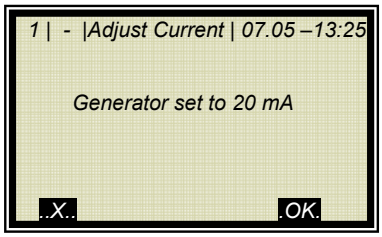
Push the ..OK.. button to confirm.



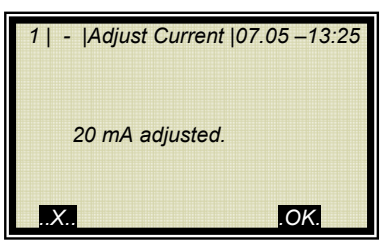
Push ..OK.. to confirm adjustment of the lower value.



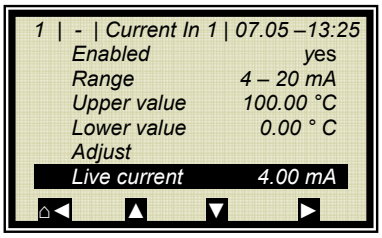
- Set current generator to 20 mA.



Push the ..OK.. button to confirm.



Push ..OK.. to confirm adjustment of the lower value.

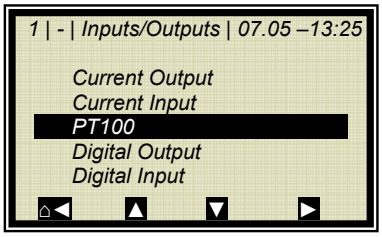


Adjustment finished. The live current is displayed.

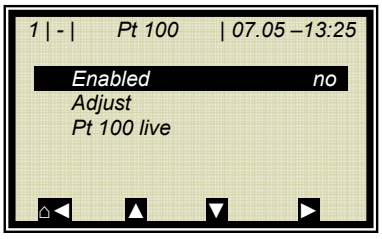
If necessary, carry out range setting and calibration of current input 2 as described above.

6.3 Pt 100

6.3.1 Pt 100 Enabling

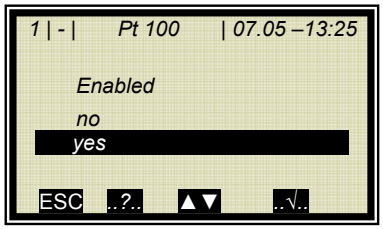


➢ Pt 100



➢ ENABLED

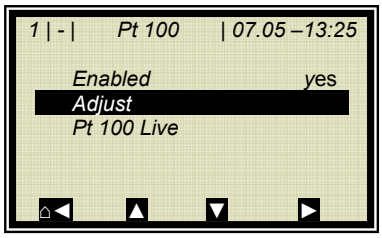
The menu ADJUST is only displayed at the profi mode.



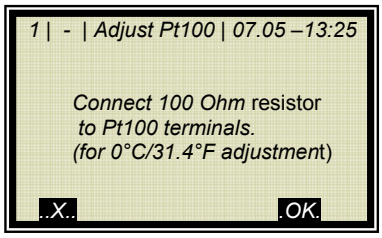
Select „yes" and push ..√.. to confirm.

6.3.2 Pt 100 Calibration

Prerequisite: You are in the Profi mode

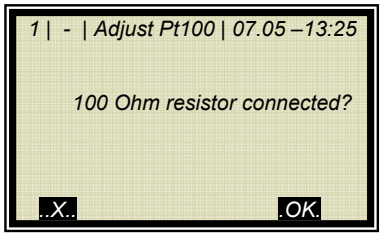


- ADJUST

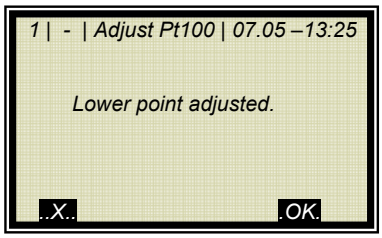


..OK..

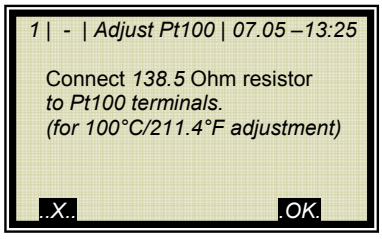
Connect 100 Ohm resistor to Pt100 terminals [11] [23].



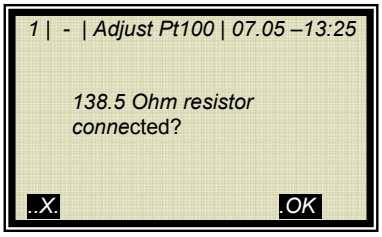
Confirm once more with ..OK..



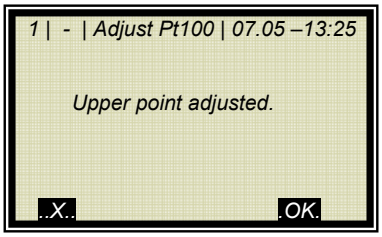
Adjustment of lower point finished.



After connection of the resistor, confirm with ..OK..



Confirm safety prompt.



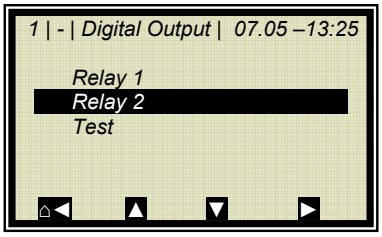
Calibration is finished.

6.4 Digital Output

The measuring system includes two changeover relay outputs which can be assigned to the respective application.

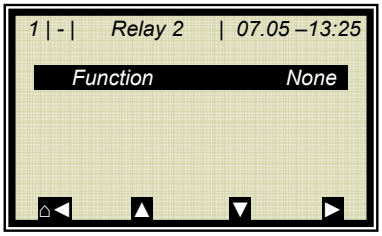
Relay 1 is associated with LED signal 1 and relay 2 with signal 2.

6.4.1 Digital Output Assignment

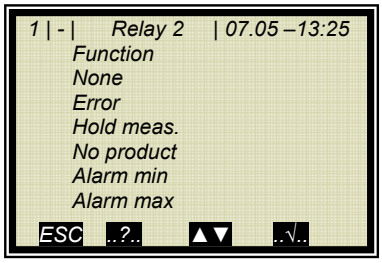


From the main menu you get to the display depicted to the left via | Setup | Input/Output | Digital Output

- Relay 2



Select the display with the arrow keys.



Push ▲▼ and then ..√.. to assign a function to the relay.

Function	Description
None	Relay and LED function disabled
Error	In case of error, relay and LED will be set.
Hold	If Hold function is enabled, relay and LED will be set.
No product	If *Pause detection* is enabled, this will be signaled via relay and LED.
Alarm min.	The relay switches if the value falls below the limit value to be set.
Alarm max.	The relay switches if the value exceeds the limit value to be set.

6.5 Digital Input

Different functions can be assigned to the digital inputs. See table below.

	Function1	Function2	Function3	Terminals
DI 1	None	Start/Stop		12/24
DI 2	None	Hold	Product	13/25
DI 3	None	Sample	Product	14/26

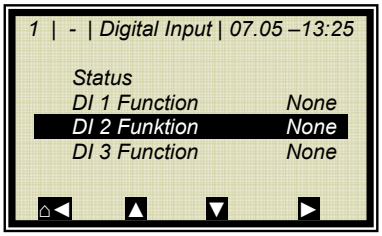
For external start function, the start function has to be set to ***external*** in the ***Measurement*** menu window.

Hold: averaging is stopped, but the measurement continues to run.

Sample: sampling is started by closing the contact.

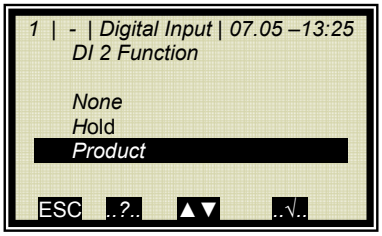
Product: by closing the contact it changes into another product (product 1 to 4). Details see chapter 6.5.1.

6.5.1 External Product Selection



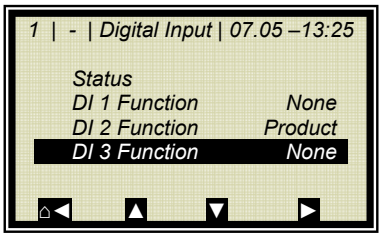
From the main menu you get to the window display depicted to the left via | SETUP | INPUT/OUTPUT | DIGITAL INPUT.

- DI 2 FUNCTION



- PRODUCT

To change all 4 products, DI 3 also has to be set to product. Please take the terminal assignment from the table below.



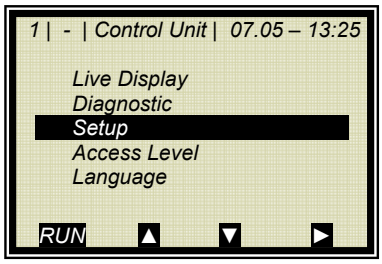
Terminals	DI 2 13 / 25	DI 3 14 / 26
Product 1	open	open
Product 2	closed	open
Product 3	open	closed
Product 4	closed	closed

Caution!
If you select a product for the first time (product 2 to 4) all adjustments and contents of the resent product are copied into the new one, including:
- Configuration data
- System calibration
- Calibration data (including sampling table)
- Input/Output definitions

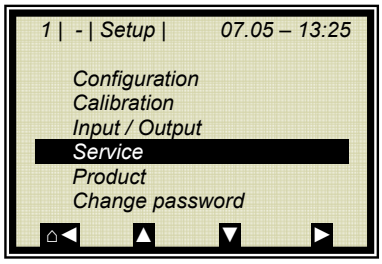
Chapter 7. **Factory Settings**

This function allows you to reset the measuring system to its original status (see *chapter 9. „Factory Settings“*).

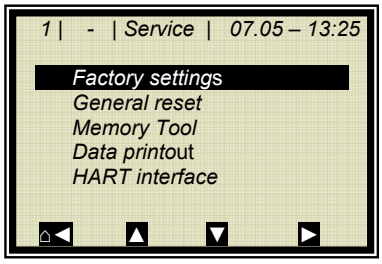
Prerequisite: You are in the Profi mode.



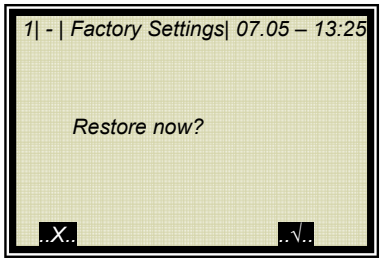
➢ SETUP



➢ SERVICE



➢ FACTORY SETTINGS



If you confirm this prompt, all parameters and configuration settings will be reset to their original status, with the exception of the sampling table and the reference measurement.

Chapter 8. **Error Lists**

8.1 Error Lists

The status of the device is signalized by LED's. After the error has been remedied, the LEDs are reset to the normal status.

8.1.1 Hardware Error

Code	*Error*	*Possible cause*
14	*Battery voltage*	*Battery is nearly empty, replace immediately. See Hardware Manual, chapter 5.4 Battery.*
20	*HF temperature out of range*	*Check the operating temperature of the control unit, allowable range: -20 to +60 °C*
21	*Attention: Ambient temperature too high!*	*Check the operating temperature of the control unit, allowable range: -20 to +60 °C*
39	*RF hardware failure*	*Faulty cable connections between mother board and HF-module. Check the plug on the motherboard. Caution: disconnect the evaluation unit from the mains beforehand!*
For all other error message, please contact the service department from BMA Schaltanlagen.		

8.1.2 Input Error

Error	*Probable Cause*
Value too large	*Input value too large*
Value too small	*Input value too small*
Table is empty	*Sampling has been selected without previous sample measurement*
Chart data faulty	*The measuring system has determined faulty chart data during calibration.*
No chart data available	*The calculated chart data have been deleted or calibration has not been completed.*
Sampling full	*You have tried to measure more then 20 samples.*

8.1.3 Measurement Error and Error Prompts

Code	*Error*	*Possible cause*
50	*Sigma of phase is too large*	*The measured phase exceeds the permissible limit value.*
52	*Attenuation too high*	*The measured attenuation exceeds the permissible max. value.*
53	*No product*	*The evaluation unit is in pause mode (“no product” is signaled).*
54	*No system calibration done*	*No system calibration has yet been carried out.*
55	*Insertion attenuation is not reached*	*Details see chapter 4.2*
60	*Current input 1 out of range*	*The enabled current input has not yet been calibrated or is not occupied.*
61	*Current input 2 out of range*	*The enabled current input has not yet been calibrated or is not occupied.*
62	*Pt 100 temperature out of range*	*The enabled Pt 100 input has not yet been calibrated or is not occupied.*
70	*Concentration out of range*	*The concentration calculated on the basis of the raw data is outside the valid measuring range.*
71	*Concentration 2 out of range*	*The concentration calculated on the basis of the raw data is outside the valid measuring range.*
80	*Current output 1 out of range*	*The concentration calculated on the basis of the current is outside the current range.*
81	*Current output 2 out of range*	*The concentration calculated on the basis of the current lies outside the current range.* .
For all other error message, please contact the service department from BMA Schaltanlagen.		

After the measurement error is remedied, the measurement returns into the status before error. There is no confirmation necessary.

Chapter 9. **Calibration Data Sheet**

9.1 Configuration

9.1.1 General Data

General Data	*Factory setting*	*Setup*
Date	*actual*	
Time	*actual*	
Tag	-	

9.1.2 Measurement

Measurement	*Factory setting*	*Setup*
Meas. mode	*continuous*	
Start mode	*keyboard*	
Averaging	*20*	
Reset averaging	*no*	

9.1.3 Plausibility

Plausibility	*Factory setting*	*Setup*
Process limits	*50.0 – 100.0*	
Phase measurement *Sigma* *Phi/att ratio*	 *100.00* *6.0*	
Auto set	*OFF*	
Pause detection	*no* *-15.0 dB*	

9.1.4 Microwave

Microwave	*Factory setting*	*Setup*
Cable *Ref. cable length* *Signal cable length*	 *4.00 m* *4.00 m*	

9.2 Product

Product	*Factory setting*	*Setup*
Product	*1*	

9.3 Inputs/Outputs

9.3.1 Current Output

Current out 1	***Factory setting***	***Setup***
Assignment	*Conc.*	
Upper value	*95.00*	
Lower value	*60.00*	
Test/Adjust	*O.K.*	
Error current	*Hold*	

Current out. 2	***Factory setting***	***Setup***
Assignment	*Keine*	
Upper value	*95.00*	
Lower value	*60.00*	
Range	*4 – 20 mA*	
Test/Adjust	*O.K.*	
Error current	*Hold*	

9.3.2 Current Input

Current in 1	***Factory setting***	***Setup***
Enabled	*no*	
Range	*4 – 20 mA*	
Upper value	*100.00*	
Lower value	*0.00*	
Adjust	*O.K.*	

Current in2	***Factory setting***	***Setup***
Enabled	*no*	
Range	*4 – 20 mA*	
Upper value	*100.00*	
Lower value	*0.00*	
Adjust	*O.K.*	

9.3.3 Pt 100 Input

Pt 100	***Factory setting***	***Setup***
Enabled	*no*	
Pt 100 Adjust	*O.K.*	

9.3.4 Digital Output

Digital output	***Factory setting***	***Setup***
Relay 1	*Error*	
Relay 2	*Hold*	

9.3.5 Digital Input

Digital input	*Factory setting*	*Setup*
DI 1 function	*none*	
DI 2 function	*none*	
DI 3 function	*none*	

9.4 Calibration Data

9.4.1 Calibration Coefficients

Calibration	*Factory setting*	*Setup*
Calibration order	*linear*	
Calibration basic	*Phase*	
Coefficients *A1* *A2* *B1* *B2* *C*	 *-0.19* *0.0* *0.0* *0.0* *75.00*	
Compensation *Mode* *Order* *Ref. temp.* *TC_Phi 1* *TC_Phi 2* *TC_Attn 1* *TC_Attn 2*	*none* *additive* *linear* *0.00* *0.00000* *0.00000* *0.00000* *0.00000*	

9.4.2 Typical Calibration Coefficients

C: Concentration value at system calibration

For applications with the container probe

A1: -0.19 for determination of the concentration or dry matter substance (Brix-content).

9.5 Start-up protocol printout

Output is possible by using RS 232 and RS 485. The output is started under menu | DIAGNOSTIC | PRINT SETUP |.

The serial interfaces RS 232 and RS 485 have the following accesses:
Data transfer rate 38400 Bd, 8 data bits, no parity, 1 stop bit.

The protocol will be saved via a terminal program into a TXT-file. To display it e.g. via Excel® the following data format has to be regarded:

Separators: tabulator
Decimal-separator: .
1000-separator: ,

The following **code-list** is for the interpretation of the start-up protocol; see an example of a protocol in chapter 9.5.1.

Parameter	Code-No.	Information
Log type		Log type:
	0	Disabled
	1	Single
	2	Continuous
	3	Stop on error
Log time		Log time:
	0	15 Minutes
	1	1 Hour
	2	4 Hours
	3	8 Hours
	4	1 Day
	5	3 Days
Measuring mode		Meas. mode:
	0	Continuous
	1	Batch
Start mode		Start mode (Start/Stop):
	0	Keypad
	1	Extern
Compensation input		Compensation input:
	0	None
	1	Current In 1
	2	Current In 2
	3	PT100

Parameter	Code-Nr.	Information
Calibration mode	0 1	Cal. order: Lineare regression Quadratic regression
Calibration variable	0 1 2	Cal. base: Phase Attenuation Both (Phase and Attenuation)
Compensation mode	0 1	Compensation mode: Additive Multiplicative
Compensation fit	0 1	Compensation order: Lineare regression Quadratic regression
Measure con-figuration	0 1 2	Process type: 1 Concentration 2 Concentrationen Split Concentration
AO Assign Code	0 1 2 3 4 5	Assignment of current output: None Concentration Concentration 2 Current In 1 Current In 2 PT100
AO Alarm select code	0 1 2 3	Error current for current output: 22 mA 3.5 mA Hold Value
Range selec-tion	0 1	Current output range: 0 … 20 mA 4 … 20 mA
AI Range se-lection	0 1	Current input range: 0 … 20 mA 4 … 20 mA
AI Enabled[2]		State current in 2, enabled yes/No
DO Function	0 1 2 3 4 5	Relay function: None Error Hold meas. No product Alarm min Alarm max
DO Assign-ment	0 1 2 3 4	Relay: the min/max alarm is as-signed to …: Concentration Concentration 2 Current In 1 Current In 2 PT100

Parameter	Code-Nr.	Information
DI Function selection		Function of digital inputs:
	0	None
	1	Start/Stop
	2	Hold
	3	Sample
	4	Product
Printout mode		Form of data printout:
	0	Disabled
	1	Line
	2	Table
	3	Line + Table
Access level		Access level:
	0	Read only
	1	Basic
	2	Profi
	3	Service
Language		Language:
	0	English
	1	German
	2	French

9.5.1 Examples of a start-up protocol

Menu:	Start of Setup:	**Examples of a start-up protocol**				**Interpretation:**
						(* Only relevant for service)
Product	Entry	Product1	Product2	Prod.3	Prod.4	
Datalog	Log type :	1				See code-list
	Log time :	2				See code-list
	Number of errors :	2				Number of entries into errorlog
	NTC temperature :	45.3 °C				*
	max. NTC temperature :	46.7 °C				*
	9V power supply :	8.94 V				*
Info	Tag :	-				
	Device Type :	Control Unit				
	Unique device ID number :	8005				
	Serial number :	1005				
	Final assembly number :	000-000				
	Software version :	1.00				
	Software release date :	02.06.2009				
	Actual date :	21.07.2009				Record date
	Actual time :	12:18				Record time
Measurement	Measuring mode :	0				See code-list
	Start mode :	0				See code-list
	Filter damping value :	20				Number of average values
	Filter damping value[2] :	20				*
	Filter damping value[3] :	20				*
	Reset average :	FALSE				
Plausibility	Lower limit :	0				Min. Concentration
	Upper limit :	100				Max. Concentration
	Max. phase sigma :	100				Sigma max.
	Correlation Phi/Att :	6				Phi/Att ratio
	Auto-set mode :	FALSE				Auto set: ON/OFF
	Pause detection :	FALSE				
	Minimum attenuation :	-15.0 dB				
Microwave	Ref. cable length :	4.00 m				
	Meas. cable length :	4.00 m				
	Wave band selection :	1				*
	Start frequency :	2				*
	Internal Attenuation :	0				*
Marker	Marker name :	Mark1				For Concentration
	Marker value :	50				For Concentration
	Marker name[2] :	Mark2				For Concentration 2
	Marker value[2] :	50				For Concentration 2
System adjust	Nbr of sweeps for reference:	10				

Calibrate concentration	Compensation input :	0	See code-list
	Compensation reference :	0	
	Calibration mode :	0	See code-list
	Calibration variable :	0	See code-list
	Phase coefficients :	-0.19	A1
	Phase coefficients[2] :	0	A2
	Attenuation coefficients :	0	B1
	Attenuation coefficients[2] :	0	B2
	Constant coefficient :	50	C
	Compensation mode :	0	See code-list
	Compensation fit :	0	See code-list
	Compensation reference :	0	
	Phase coeff. for comp. :	0	C_Ph1
	Phase coeff. for comp.[2] :	0	C_Ph2
	Attenuation coeff. for comp :	0	C_dB1
	Attenuation coeff. for comp[2]	0	C_dB2
	Adjust factor :	1	
	Adjust offset :	0	
Calibrate concentration 2	Compensation input :	0	See code-list
	Compensation reference :	0	
	Calibration mode :	0	See code-list
	Calibration variable :	0	See code-list
	Phase coefficients :	-0.19	A1
	Phase coefficients[2] :	0	A2
	Attenuation coefficients :	0	B1
	Attenuation coefficients[2] :	0	B2
	Constant coefficient :	50	C
	Compensation mode :	0	See code-list
	Compensation fit :	0	See code-list
	Compensation reference :	0	
	Phase coeff. for comp. :	0	C_Ph1
	Phase coeff. for comp.[2] :	0	C_Ph2
	Attenuation coeff. for comp :	0	C_dB1
	Attenuation coeff. for comp[2]	0	C_dB2
	Adjust factor :	1	
	Adjust offset :	0	
Advanced	Tara Phase (°/GHz) :	0.00 °/GHz	
	Tara Attenuation (dB) :	0.00 dB	
	Measure configuration :	0	Process type: see code-list
	Range split value :	75	Split value

Current out 1	AO Assign code :	1	Assignment: see code-list
	AO Upper range value :	100.00%	Upper value
	AO Lower range value :	0.00%	Lower value
	AO Current value :	4.00 mA	Live current
	AO Alarm select code :	2	Error current: see code-list
	AO Error current value :	22.00 mA	Error current value
Current out 2	AO Assign code[2] :	0	Assignment: see code-list
	AO Upper range value[2] :	100	Upper value
	AO Lower range value[2] :	0	Lower value
	Range selection[2] :	1	Range
	AO Current value[2] :	4.00 mA	Live current
	AO Alarm select code[2] :	2	Error current: see code-list
	AO Error current value[2] :	22.00 mA	Error current value
Current in 1	AI Enabled :	FALSE	
	AI Range selection :	1	Range: see code-list
	AI Upper range value :	100	Upper value
	AI Lower range value :	0	Lower value
	AI Current :	0.00 mA	Live current
Current in 2	AI Enabled[2] :	FALSE	
	AI Range selection[2] :	1	Range: see code-list
	AI Upper range value[2] :	100	Upper value
	AI Lower range value[2] :	0	Lower value
	AI Current[2] :	0.02 mA	Live current
PT100 input	AI Enabled[3] :	TRUE	
	Pt100 value :	2.8 °C	Live value
Relay 1	DO Function :	1	Function: see code-list
	DO Assignment :	0	Assignment: see code-list
	DO Threshold :	0.00%	*
	DO Hysteresis :	5.00%	*
Relay 2	DO Function[2] :	2	Function: see code-list
	DO Assignment[2] :	0	Assignment: see code-list
	DO Threshold[2] :	0.00%	*
	DO Hysteresis[2] :	5.00%	*
Digital input	DI Function selection :	0	Function digital input 1
	DI Function selection[2] :	0	Function digital input 2
	DI Function selection[3] :	0	Function digital input 3
	Printout mode :	1	
	Access level :	2	
	Language :	1	
	End of Setup		

Start of Reference Data

System adjustment data:

Product 1:

Mean Atten.:	46.8509 dB
Phase at fm:	42.6285 deg/GHz
Phase offset:	-825.586 deg
Phase slope:	380.984 deg/GHz
Phase sigma:	0.24575

Frequency[GHz]	Phase[Deg]	Atten.[dB]
2.42	96.41	46.2
2.43	100.71	46.8
2.44	103.08	47.13
2.45	108.12	46.84
2.46	111.75	47.28

Start of Sample Data:

Sample Table

Product 1: Sample Data for Concentration 1:

Sample:	Active:	Kon.(%):	Lab.(%):	AIN1(°C):	AIN2(°C):	Temp.(°C):	Phi.(°/GHz):	Att.(dB):
1|16.03 - 20:53	TRUE	50.0193	0	0	0	2.83	-0.1	-0.16
2|17.03 - 00:22	TRUE	50.1061	0	0	0	2.71	-0.56	0.18

Correlation factor between
lab and meas values: 1

End of Sample Data

Do not use following data!

9.6 Sample Table

No.	Active	Measured value	Lab value	Current In 1	Current In 2	Pt 100	Phi (m)	Attenua-tion	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

Notes

Notes