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MICROWAVE CONCENTRATION MEASUREMENT

µ-ICC 2.45 standard

- MANUAL -

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1 Safety instructions 3
1.1 Symbols and indices 3
1.2 Conventional usage 3
1.3 General safety & warning notices 3
1.3.1 Environmental conditions 4
1.3.2 Electrical treatments 4
2 System description µ-ICC 2.45 standard 5
2.1 Measuring principle 5
2.2 Components 7
2.2.1 Evaluation unit 8
2.2.2 Microwave module 9
2.2.3 Sensor with probes 9
2.2.4 Cables 10
2.3 Installation 11
2.3.1 Installation of the Evaluation unit & microwave module 11
2.3.2 Connection of the module and the compact display 11
2.4 Installation recommendations 14
3 Menu topology and operation handling 16
3.1 Standard operation of the µ-ICC 2.45 standard 16
4 First Start Up 19
4.1 Language 19
4.2 Date and Time 19
4.3 Sensor management 19
4.3.1 Check-In 19
4.3.2 Check-Out 20
4.4 System Reset 20
4.5 Display mode 20
4.6 Display illumination 20
4.7 Locking Keyboard 20
4.7.1 Changing PIN number 21
4.7.2 Keyboard locking 21
4.7.3 Keyboard unlocking 21
5 Initial Sensor Configuration 22
5.1 Measurement mode 22
5.2 Measurement 22
5.2.1 Temperature compensation 22
5.2.2 Start coefficients 23
5.2.3 Reference Point 24
5.3 Other Settings 25
5.3.1 Sensor Description 25
5.3.2 Current Interface 25
6 Calibrating 26
6.1 Sampling 26
6.2 First calibrating 27
7 Sensor Settings: save and reload 28
7.1 Sensor: Save settings, Load settings, Factory settings 28
7.1.1 How to save configuration 28
7.1.2 How to load previously saved configuration 28
7.1.3 How to reload factory settings 28
7.2 Memory allocation: Load and Delete Internal and External Memory 28

7.2.1 Copying of configuration 28
7.2.2 Deleting of configuration 29
7.2.3 Deleting of all memory 29
8 Data logging 29
9 Moving of the measuring range 30
10 Troubleshooting 31
10.1 PIN is not working 31
10.2 Constant offset 31
11 Technical specifications 32
11.1 µ-ICC 2.45 standard – Evaluation unit 32
11.2 µ-ICC 2.45 standard – microwave module 33
12 Spare parts 34
13 Declaration of Conformity 35
14 Dimensional drawings 36
14.1 Insertion sensor probes 36
14.2 Insertion sensors DN 65 and DN 80 37
14.3 Insertion sensors DN 65 and DN 80 with cleaning system 39
14.4 Flat sensor pipelines 41

1 Safety instructions

1.1 Symbols and indices

In this manual there are consecutive symbols used to indicate safety instructions.

Warning
possibility of danger for life and health

Attention
possibility of danger with light personal damages

Notice
possibility of material damage

Information
appliance tips and information

1.2 Conventional usage

The µ-ICC 2.45 standard is a measuring system based on a microwave transmission technology. Therefore the product is transmitted by a very low capacity of microwave radiation. The microwaves are completely harmless for human and the environment. So there is no change of product properties.

This measuring system is produced according the latest safety requirements for microwave devices. If there are legal regulations regarding the use of microwaves the user has the responsibility to observe it.

It is not allowed to change the frequency of the device. Furthermore other manipulation within the device could involve criminally consequences.

1.3 General safety & warning notices

The µ-ICC 2.45 standard is build with all included components according to the latest state of technology and approved safety standards.
The housing is IP 65 certified and dedicated for outdoor use. Factory-provided it is proofed and will be delivered reliably.

The safety and warning notices have to be strictly adhered to guarantee a safe operating. The operating is only allowed if the system is in good order and condition. There are only those persons allowed to operate with this system, who are briefed and qualified. Reconstructions or changes, which may have an influence on a safety operation are prohibited specifically.

1.3.1 Environmental conditions

NOTICE

All components require non-corrosive environmental conditions while transporting, stocking and operating.

1.3.2 Electrical treatments

WARNING

The power supply must be interrupted during the installation and also for technical service to avoid getting in contact with energized parts.

Before opening the evaluation unit the power supply must be interrupted! It's prohibited to work with opened device while it's energized!

NOTICE

Spare part fuses must have the manufacturer specified values. To shorten the circuit or any other manipulation are prohibited!

NOTICE

The evaluation unit must be earthed when it is mains-connected.

ATTENTION

If there has gotten fluids into the device, it has to be interrupted the power supply. Successive the device has to be controlled and cleaned by an authorized person.

NOTICE

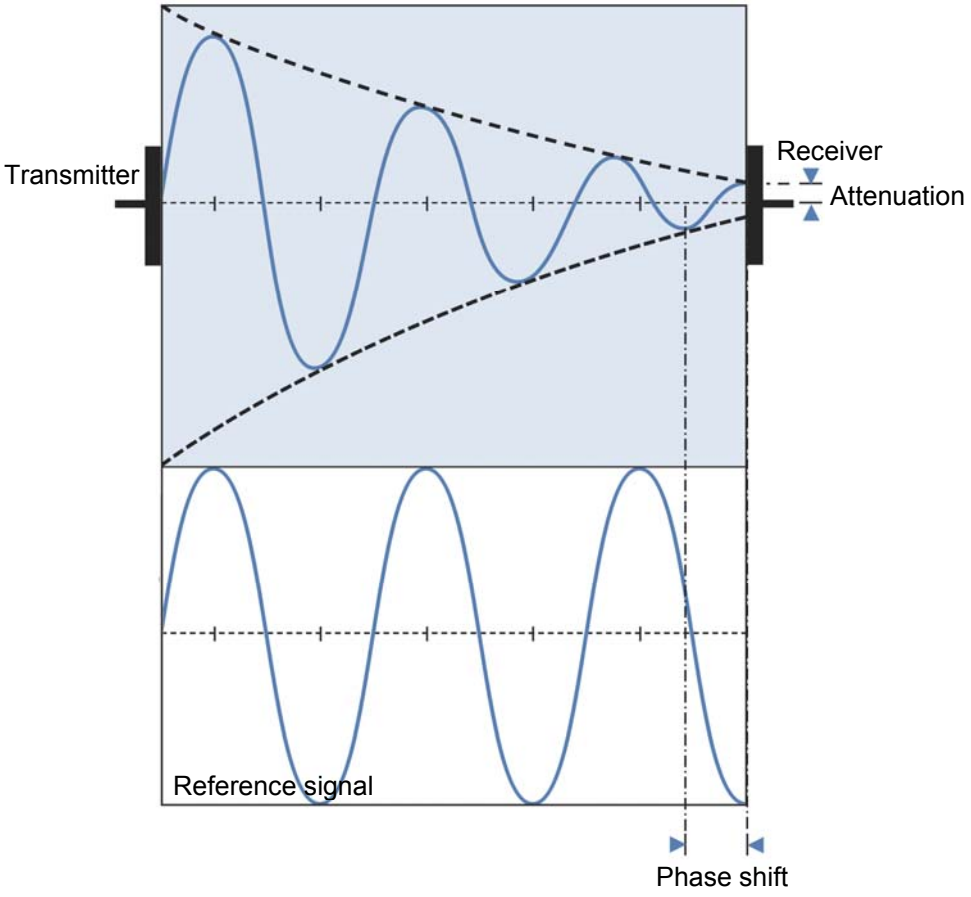
Without exact knowledge of this manual there must not be changes on the installation or on any parameter settings. In addition there has to be known the possible behaviour of the actuator and the influence on the process.

2 System description µ-ICC 2.45 standard

The µ-ICC 2.45 standard is a flexible component system, which is composed of the three components Evaluation unit, microwave module and a sensor. This configuration can be expanded to up to four measurements with one evaluation unit. It is based on long time proofed technology and experience from more than fifteen years.

2.1 Measuring principle

Precondition for a successful measurement is the dielectricity of the medium. Thus water contained products are in general good to measure, because the microwaves are absorbed by free water molecules.
Another dependency is the distance between the sensor probes. Here it is important that the signal strength is quite enough to get from the transmitter to the receiver. Therefore proMtec offers the best fitting geometry for each special application.



- The microwave signal is conducted into the medium by the transmitter. The receiver collects the alleviated microwaves.

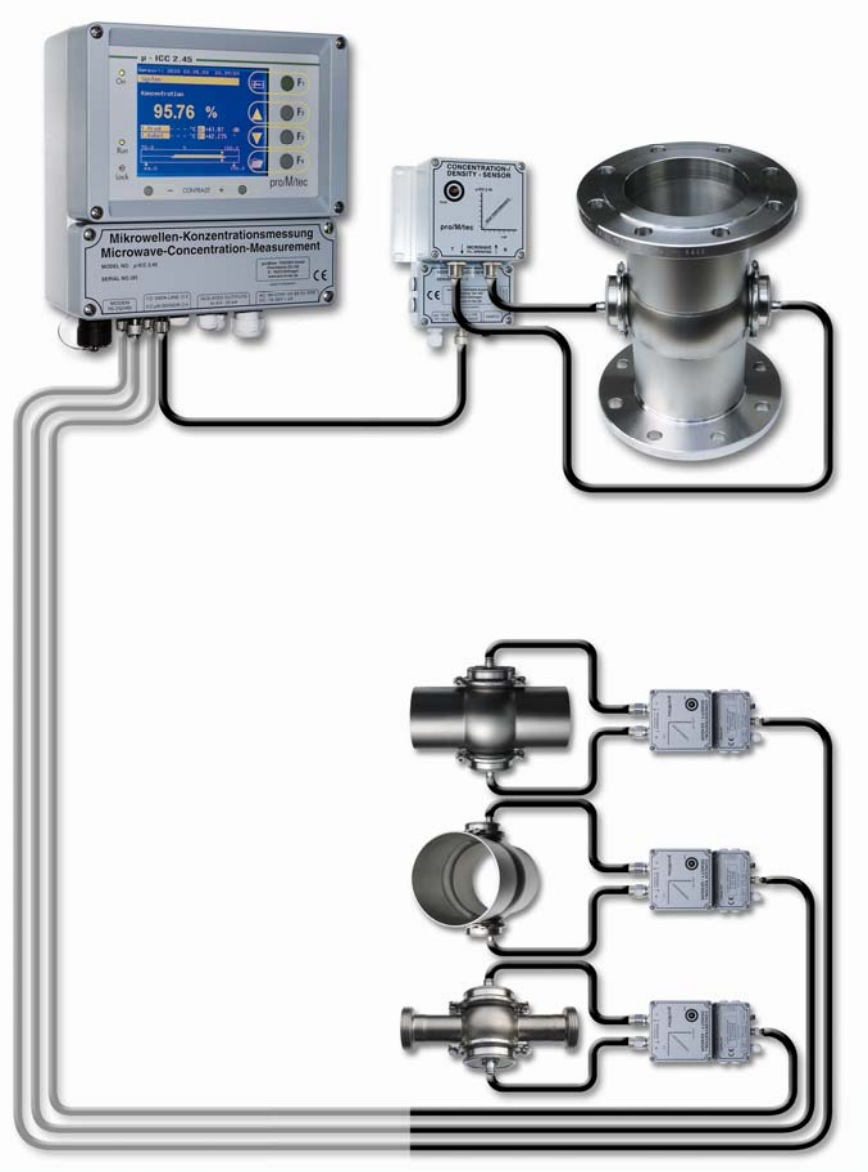
- The reference signal has the typical propagation without any influences. It is used as a comparison with the alleviated microwave signal, to calculate a phase shift (decrease of propagation velocity) or attenuation.

- The phase shift is a decrease of the propagation velocity

- With this information it is calculated a value for the water content, density or total dry matter content.

2.2 Components

The µ-ICC 2.45 standard is a very flexible, rugged microwave instrument. By default the system is based on the three components Evaluation unit (A), microwave module (B) and a sensor (C). This configuration could be expanded easily to up to four measuring points with one evaluation unit.



The system is temperature compensated. Therefore it has to be connected to a temperature sensor, which is also included within the system.

2.2.1 Evaluation unit

This controller is the central evaluation unit for between one to four measuring points. In the display you can see measurement values such as concentration, density or other concentration units with the related process temperature. All measurement values are digitally available through the RS 232 interface. The main measurement value for the concentration is transferred to the process control system by the classical 0/ 4 – 20 mA current interface. You can adapt the system parameters and the calibration data to your specific measuring task by using the well-structured multilingual menu of the controller.

2.2.2 Microwave module

The complete microwave electronics are mounted in the extraordinarily compact microwave module which is installed close to the sensor. The microwave module gets its power supply from the controller by using a coaxial cable which also guarantees the digital transmission of the measured data between module and controller.

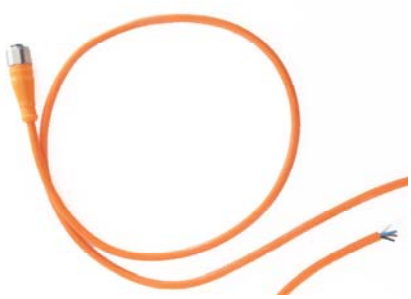
2.2.3 Sensor with probes

proMtec offers a great variety of sensor types. Standard versions are on the one hand inline pipe sections, where flat sensor probes are fitted onto the pipe. On the other hand there are insertion sensors with two probes used in a special flange for installation in vessels.
Furthermore there are insertion sensors without flange available for direct installing into a pipe or a vessel. Here you just have to weld-in the corresponding sockets.
In each case the evaluation unit is directly connected with the sensor probes via microwave cables.

2.2.4 Cables

The microwave cables attend to carry the signal directly to the measuring point and backwards to the module. These cables are produced in accordance to the newest technology and with the best available shielding and assure low-loss propagation.

The cables are delivered with a length of one to three meters (depending on the requirements). Despite the high shielding the cables should be as short as possible to avoid too much power loss.



The temperature sensor itself is already mounted into the pipeline respectively the insertion sensor tube. So you've just to connect the cable with the sensor and on the other side with the connectors inside the device (read chapter 2.3.2).

For the communication between the module and the evaluation unit there is used a TNC cable.

2.3 Installation

2.3.1 Installation of the Evaluation unit & microwave module

The evaluation unit is delivered with four holding flaps (H x W = 142.5 x 273 mm for Ø 5 mm).

i

Due to the maximum TNC-cable length of 150 m you're very flexible in choosing a dedicated mounting location. Mind that you maybe connect further modules.
The module itself should be placed nearby the measuring point in cause of the limitation of microwave cables. It is also delivered with four holding flaps (H x W = 87 x 123 mm for Ø 5 mm).

2.3.2 Connection of the module and the compact display

To get an overview about the circuit points and the way how to connect them, there is following connection list.

WARNING

Before opening the module and for connecting of any cable the power supply must be interrupted!

NOTICE

Choose a dedicated mounting location that the cables are strain-relieved!

Do not snap the microwave cables!

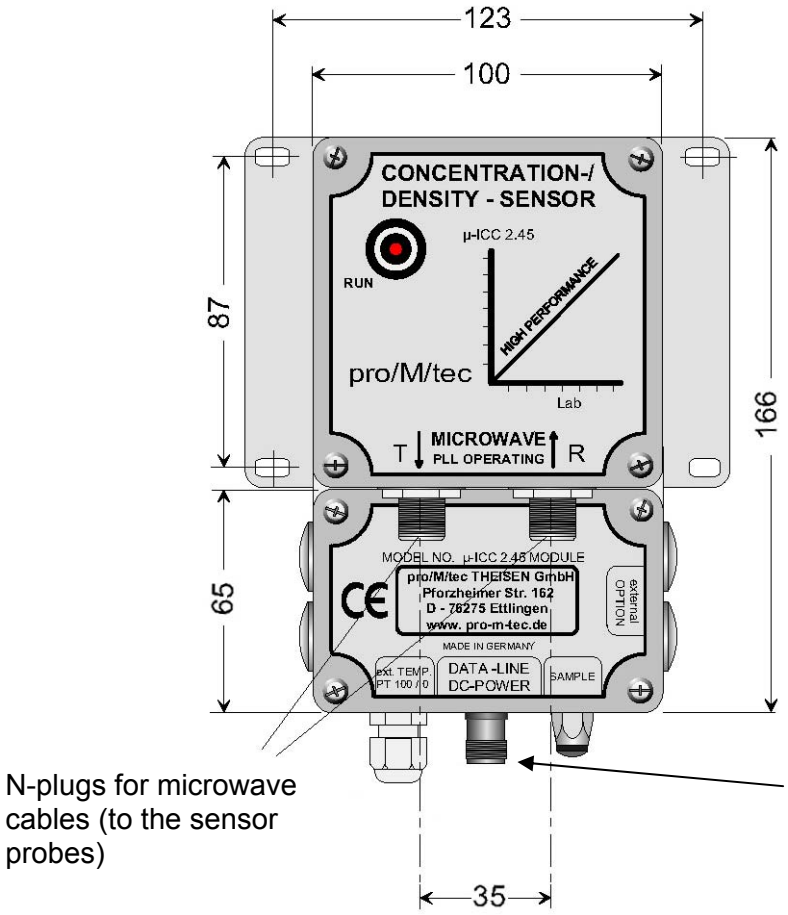
With connecting of the signal output mind the polarity! This signal output is an active current output.

Do not torque down the coupling nuts onto the module too much!

Connections:

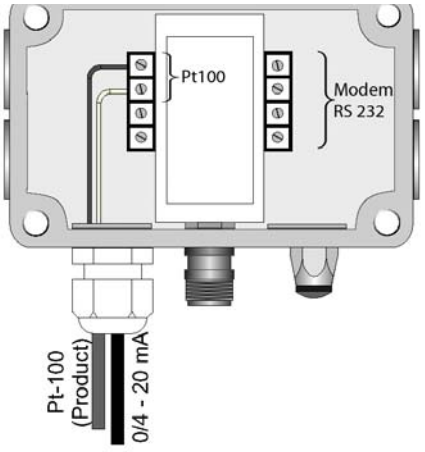
Connections of the module:

- Microwave cables: There are two identical microwave cables; one for the transmitter and one for the receiver. Both are connected with N-Plugs and it doesn't mind, which one is used for the "T"-Plug respectively the "R"-Plug.
- Pt 100 (2 wire): Cable entry (PG11)
- Data Line (compact display): TNC cable



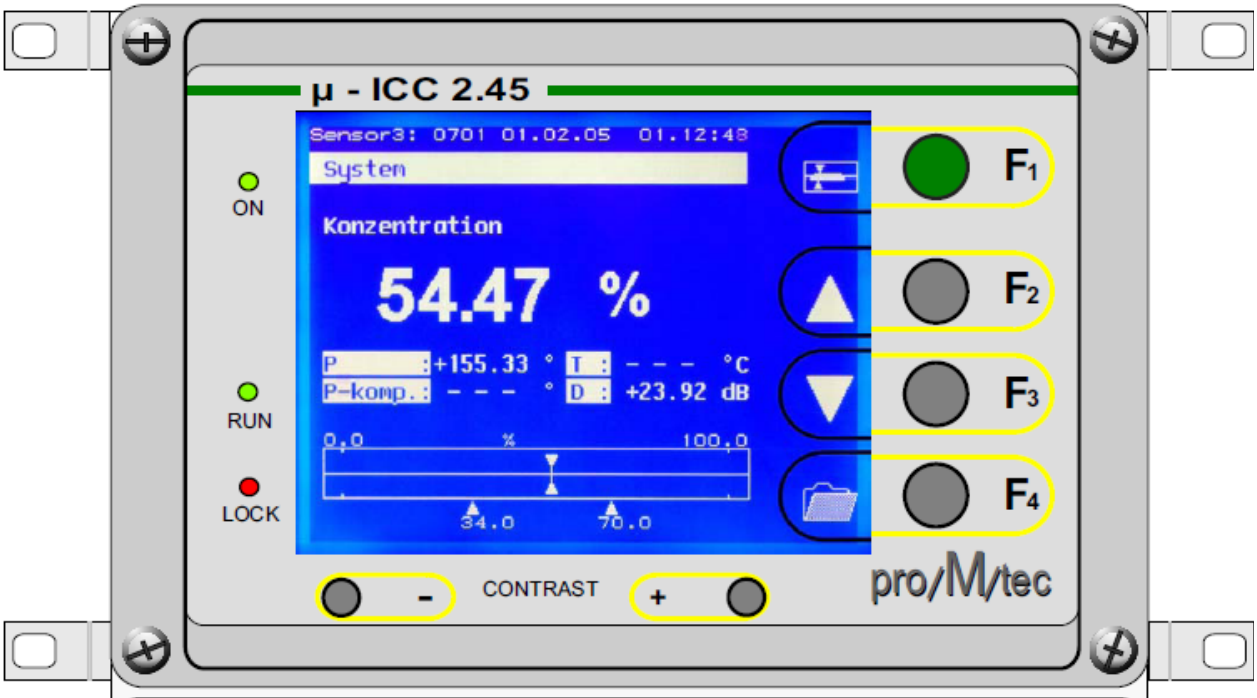
N-plugs for microwave cables (to the sensor probes)

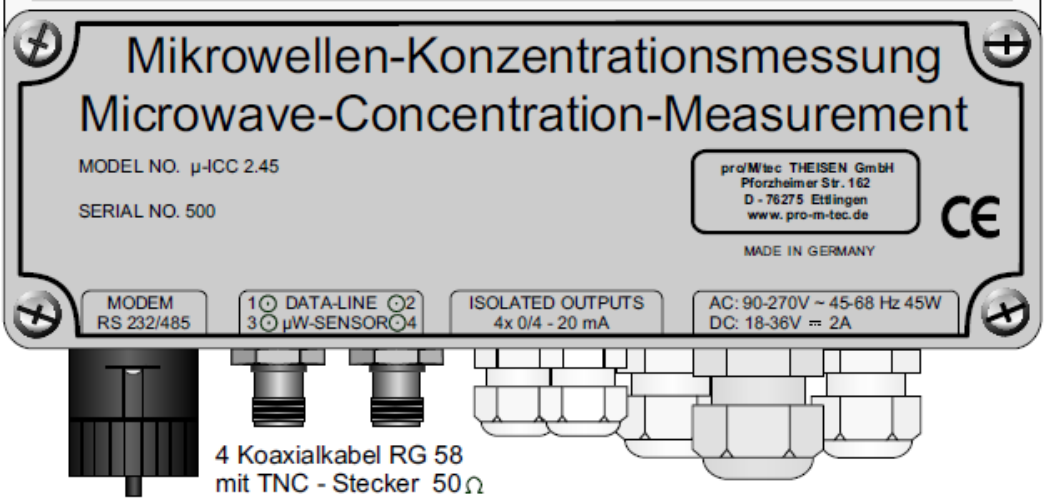
TNC cable connection (to the evaluation unit)

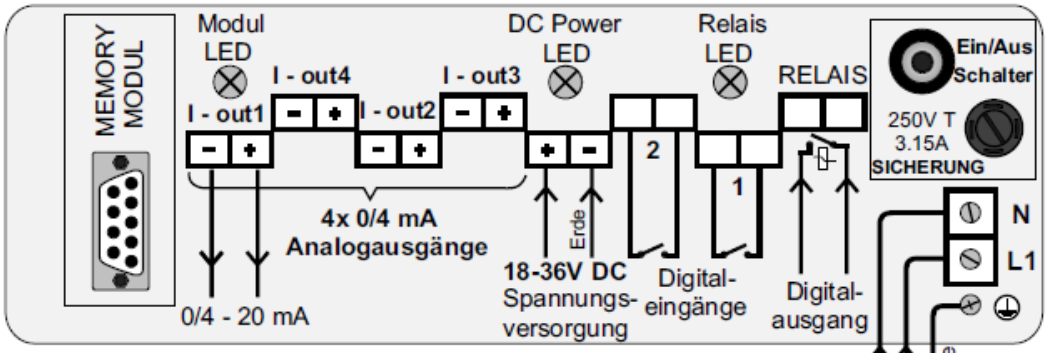


Connections of the Evaluation unit:

- Signal output (4 – 20 mA): Cable entry (PG11)
- Power supply: 18-36V DC or 90-270V AC (cable entry PG11)







ANSCHLUSSPLAN
µ - ICC 2.45 AUSWERTEGERÄT

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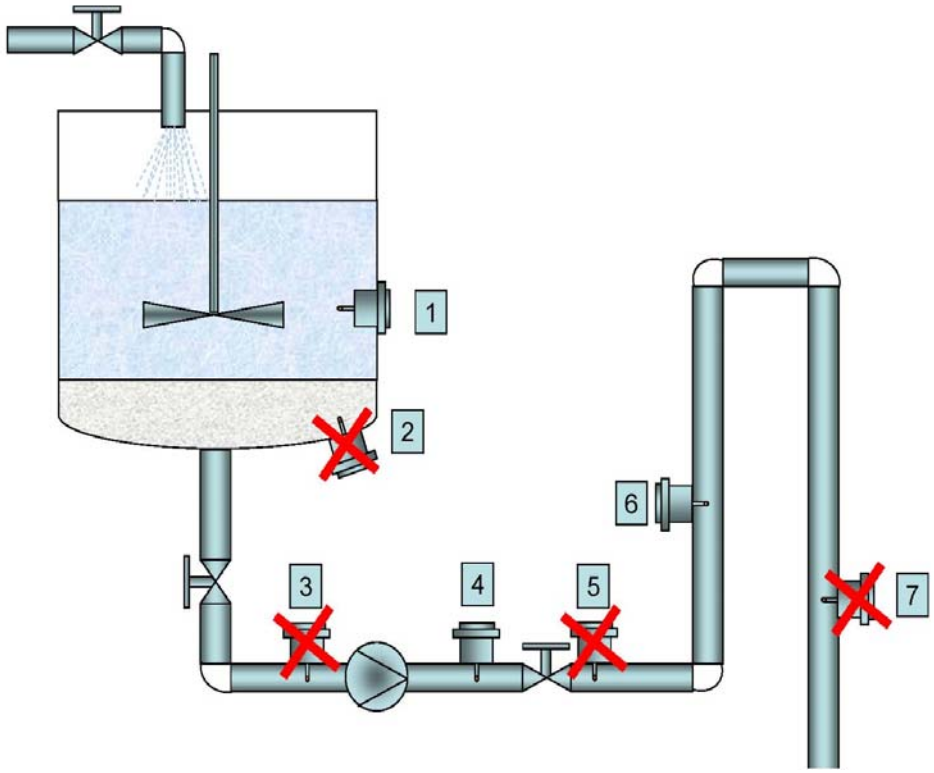
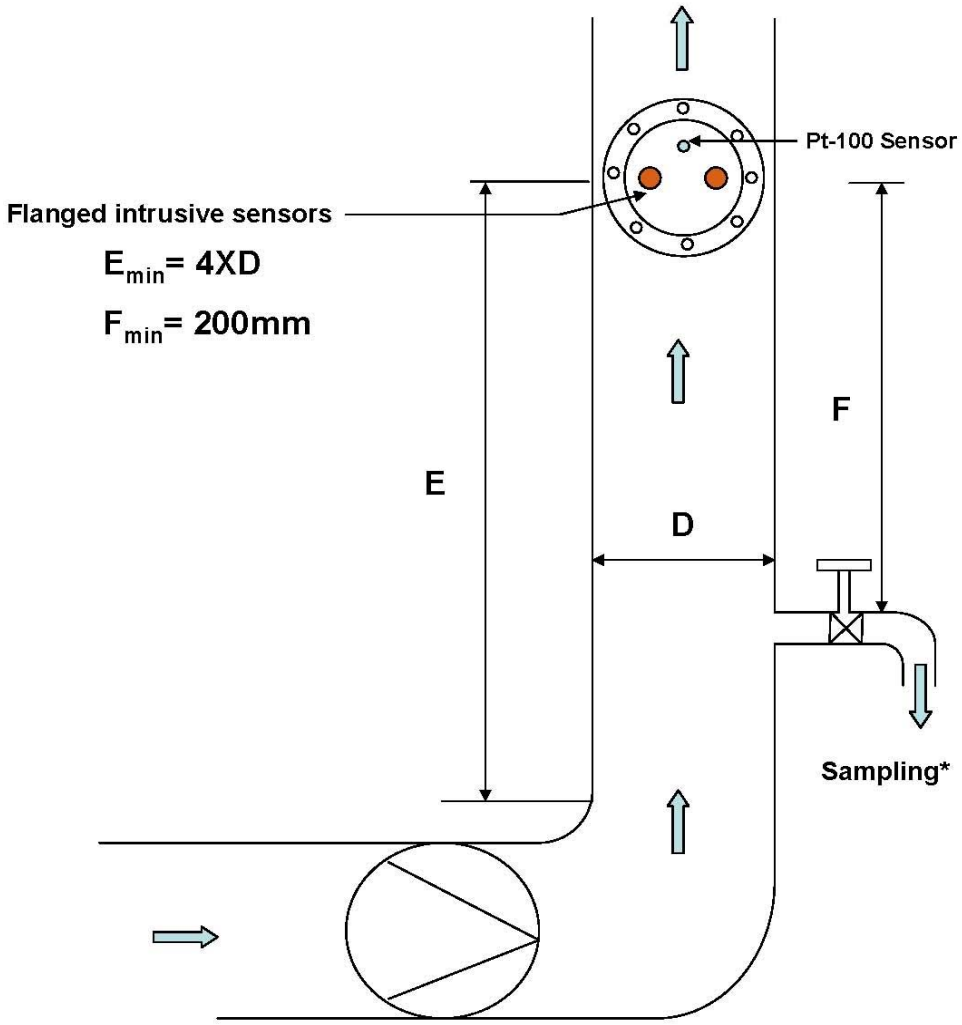
2.4 Installation recommendations

In order to get a reliable measurement it is necessary to have a good flow through the sensors. This ensures that there is no caking on the sensor probes.
If the product should contain any air or steam bubbles, there could be an influence on the measurement. In cause of air within the product there could be a not representative reflection of the microwaves and therefore an inexact concentration value.
To avoid it, it is recommended to install the sensors in an up-going pipe after a pump (pressure side). This installation ensures an air bubble-free product.
In addition, the product is more homogenized compared to a tank installation.



Possible recommended positions of sensor installation

The best installation point is in the vertical pipe and enough away from the pump. The recommended distance away from the pump is 4 times of the diameter of the pipeline. The pipe must be completely filled by the product.



Position of Insertion sensor in the pipeline

Within the installation of insertion sensors into a tank wall you have to ensure to position it below the minimum of the product level.

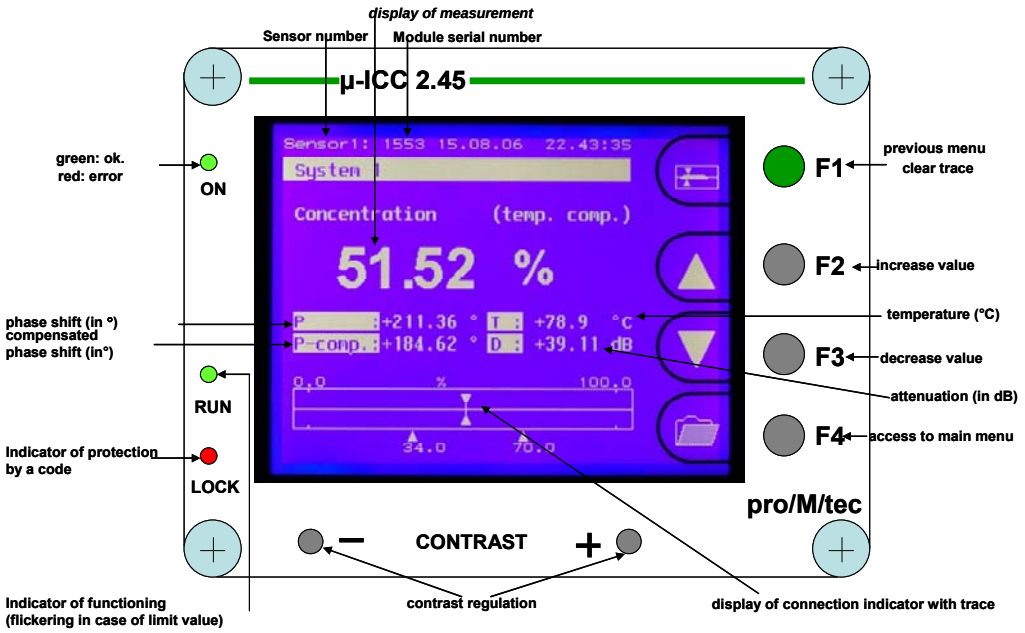
3 Menu topology and operation handling

3.1 Standard operation of the µ-ICC 2.45 standard

The evaluation unit handles the received data from microwave module. It displays different values on the screen such as the measurement, the Phase shift (raw and compensated), the temperature and the attenuation. In addition the values are supplied by a bar graph with trace (drag pointer) which visualizes the evolution of the measurement.

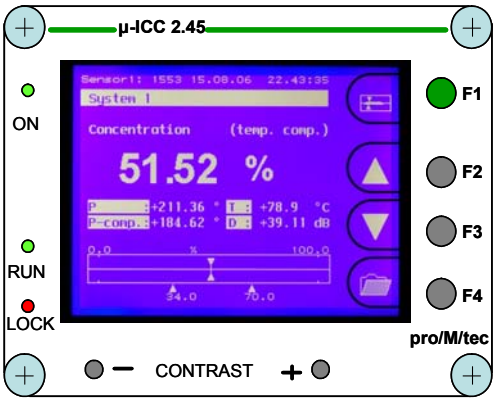
The compact display is managed by the user-friendly menu. The menu can be operated by the buttons **F1, F2, F3** and **F4** which are situated on the right side of the housing. These buttons have different functions depending on the current menu.

By default and while operating the display is in following mode:

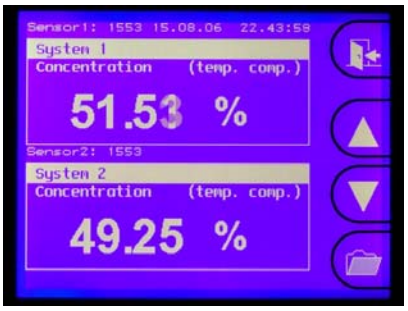


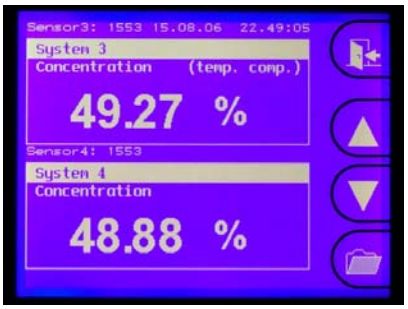
Display selection (with more than one connected measuring points):

One-channel display

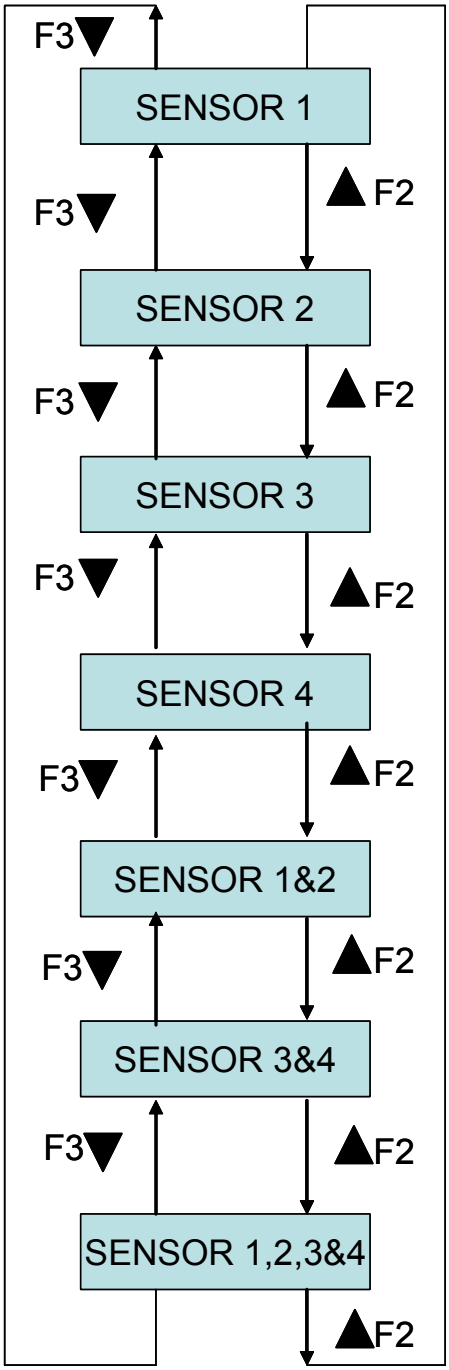


Two-channel display





Four-channel display



By selecting **F4** the main menu is selected. By selecting **F4** again you'll get into the next submenu. By selecting **F1** you'll get back to the previous menu.

The starting „**System**" main menu is structured in following submenus:

- Basis configuration: basis settings (language, date & time), memory storage options, etc.
- Sensor management: for sensor administration
- Memory allocation: storage of sensor settings and parameters
- Errorstate: overview with error number in case of any problems
- Service: only for maintenance by proMtec

Depending of the registering of modules there appears also Sensor1 up to Sensor4 in the main menu.

- Sensor1: for setting parameters during configuration and calibrating the measurement
- Sensor2:
- Sensor3:
- Sensor4:

The several submenus are also explained more precisely in the following chapters.

4 First Start Up

4.1 Language

SYSTEM / BASIS CONFIGURATION / LANGUAGE

At the beginning you can choose the language from Deutsch, English, Francais, Italiano, Español or Portugues-Standard.

→ Starting from „ **System**” main menu (by pressing F4), select „ **Basis configuration**”, then select “**Language**”. Now you can select your preferred language by "▲" and "▼" and confirm by the "**OK**" button.

4.2 Date and Time

SYSTEM / BASIS CONFIGURATION / DATE TIME

Here you can set date and time.

→ Starting from „ **System**” main menu, select „ **Basis configuration**”, then „**Date /Time**” and „**Time**” can be entered by "▲" and "►" buttons and confirmed by "**OK**" button. The „ **Date**” can be selected and entered in the same way.

4.3 Sensor management

4.3.1 Check-In

With the first start up you have to register the connected modules.

SYSTEM / SENSOR MANAGEMENT / SENSOR1

You can connect up to four modules at the same time. After connecting you have to allocate the module to one of the four channels. Therefore you just have to put in the serial number of the corresponding module.

→ Starting from „ **System**” main menu (by pressing F4), select „ **Sensor management**”, then select a free sensor (e.g. “**Sensor1**”) by the "**OK**" button and enter the serial number by "▲" and "►" and confirm by the "**OK**" button.

Now the compact display is importing all data from the module. After this procedure you can start with the actual configuration.

4.3.2 Check-Out

SYSTEM / SENSOR MANAGEMENT / SENSOR1

→ Starting from „ **System**" main menu, select „ **Sensor management**", then choose the corresponding sensor channel and press "**OK**". Then confirm the notice "**check out sensor**" by "**OK**". Choose "**YES**" and confirm it again by the "**OK**" button.

4.4 System Reset

SYSTEM / BASIS CONFIGURATION / RESET

i In case of configuration modifications it might be necessary to make a system reset (e.g. system does not work correctly after new entries).

→ Starting from „**System**" main menu, select „**Basis configuration**" and then „**Reset**". Afterwards confirm by „**YES**" button and finally confirm by „**OK**" button.

4.5 Display mode

SYSTEM / BASIS CONFIGURATION / DISPLAY MODE

In case of more than one connected module the display can automatically switch between the several sensor displays.

→ Starting from „**System**" main menu, select „ **Basis configuration**", „**Display mode**" and choose „**automatic display change**".

4.6 Display illumination

SYSTEM / BASIS CONFIGURATION / DISPLAY ILLUMINATION

i There is also the option to let the display switch off the illumination after several minutes.

→ Starting from „**System**" main menu, select „ **Basis configuration**", „**Display illumination**" and adjust the „**disengage time**". Then switch the „**automatic OFF**" to „**ON**".

4.7 Locking Keyboard

SYSTEM / BASIS CONFIGURATION / PIN-Nr.

Here you can block the keyboard. This avoids the unauthorized change of the sensor configuration parameters. Nevertheless it is still possible to have a look on some of them.

If you've lost the PIN number please get in contact with proMtec.

4.7.1 Changing PIN number

→ Starting from „**System**" main menu, select „ **Basis configuration**" then chose „**PIN-Nr. Keyboard barrier**". Afterwards change the PIN-Nr.

The initial PIN is "000000". It can be changed anytime by the operator.

4.7.2 Keyboard locking

→ Starting from „**System**" main menu, select „ **Basis configuration**" afterwards chose „**PIN-Nr. Keyboard barrier**" then „**Block Keyboard input**" and confirm it by "**OK**". Finally you have to enter „ **Pin-Nr.**" And confirm by "**OK**". The lock indicator illuminates red.

4.7.3 Keyboard unlocking

→ Starting from „**System**" main menu, select „ **Basis configuration**" afterwards selects „**PIN-Nr. Keyboard barrier**" then „**Release Keyboard input**" and confirms it by "**OK**". Finally you have to enter „ **Pin-Nr**" and confirm by "**OK**". The red lock indicator turns off.

5 Initial Sensor Configuration

Here you can adjust the initial sensor settings.

5.1 Measurement mode

SYSTEM / SENSOR1 / MEASUREMENT

With engaging first of all you have to choose a measurement mode.

There are two different measuring modes:

- Phase measuring (default setting)
- Attenuation measuring

i It strongly depends on the application, which measuring mode is the most suitable. In many cases especially in the sugar factories the phase measurement fits to the application.
If you're not getting good results with the chosen measurement, please get in contact with proMtec.

→ Starting from „**System**" main menu, select „**Sensor**" then „**Measurement**".
Now select e.g. „**Phase measuring**" and select „**OK**" and confirm it again by „**OK**".

5.2 Measurement

These settings are required to operate the measurement.

5.2.1 Temperature compensation

SYSTEM / SENSOR1 / TEMP.COMPENSATION

i The microwave signal is influenced by temperature changes of the medium. In cause of this, the phase shift has to be temperature compensated. Therefore you have to define a temperature reference **Tref** and the temperature coefficient **Tk**.

Generally for the reference temperature you should take an average temperature over the whole process.
The temperature coefficient should be **Tk=** -1.5000e+00 at the beginning, later this value can be adjusted if it is required.

In the sugar industry:
For the batch pans the **Tref** should be set at the seeding point.
The temperature coefficient for sugar products (juice, syrup, masse cuite…) we usually take
Tk = +3,0000e+00

→ Starting from „ **System**" main menu, select „**Sensor**" then „**Temperature compensation**". Select „**Temp. corr**" and switch from „**OFF**" to „**ON**" in order to activate temperature compensation, confirm by "**OK**" button. Now select „**reference temp**" and enter the chosen temperature and at last confirm by "**OK**" button.

Finally enter **Tk** like above.

5.2.2 Start coefficients

SYSTEM / SENSOR1 / CALIBRATION / COEFFICIENTS

This measuring system needs to be calibrated according to the laboratory results. For this procedure it is required to set start coefficients.
The coefficients $\mathbf{A_0}$ and $\mathbf{A_1}$ are the Offset and the slope of the following formula:

$\mathbf{Y=A_1X + A_0}$

X- Compensated Phase shift

Y- Measurement in the chosen physical unity.

$\mathbf{A_0}$ and $\mathbf{A_1}$ define the measuring range. It can be calculated as following:

Upper end of the measuring range = **A0**

Lower end of the measuring range = **(A1*360) +A0**

Usually we take the maximal measurable value (with reserve) as A0. A1 is a microwaves absorption coefficient and depends on the distance between the probes.
The measuring range appears on the display below the bargraph (drag pointer).

Example:
For an application in a batch pan whose distance between the probes is 45mm we usually have start coefficients of **A0=100** and **A1=-0.1.** They make a measuring range of 64-100 Brix.
For an application in a continuous pan with a probes distance of 60mm they are: **A0=100** and **A1=-0.075.** It corresponds to a range of 73-100Bx.

→ Starting from „**System**" main menu please select „**Sensor**", „**Calibration**" and finally „**Coefficients**". Afterwards enter coefficients A_0 and A_1 corresponding to the application.

5.2.3 Reference Point

SYSTEM / SENSOR1 / CALIBRATION

At the beginning of every start up it is necessary to position the scale of the measurement (with a reference phase value). Therefore you have to take a sample that has to be analysed and entered in the evaluation unit as quick as possible. For this operation there is no need to be accurate, a hand refractometer can be enough. But the process has to be in stable conditions.

For batch pans we usually take samples after the pan filling just before seeding.
For other applications we take samples during the nominal regime.

With the phase offset there is no need to change it manually. It's automatically adjusted from the system after setting a reference point. On the other hand, the reference point changes automatically every time we change A0.

The reference correction ("refcorr") should not be changed in general (always set 0).

→ Starting from „ **System**" main menu please select „ **Sensor**", Then „Calibration" Then „**refpoint**", select „**YES**" and confirm by **"OK"** button, finally enter the value.

Now the displayed measurement is equal to the reference point.

5.3 Other Settings

5.3.1 Sensor Description

SYSTEM / SENSOR1 / DESCRIPTION

You should set a description of the measuring according to the application.

→ Select „**Description**" and confirm by "**OK**" button. Select „**Product name**", „**Comment**", „**Phys. Measurement item**" and „**Phys. unit**" enable you to display information in relation with the application in the memory of the device.

Example: Physical Unit

SYSTEM / SENSOR1 / DESCRIPTION / PHYS.UNIT

→ Select „ **Phys. unit**" and confirm by "**OK**" button. Select desired unit (Bx, %, g/l, g/cm^3...) by "▲" and "▼" buttons and confirm by "**OK**" button.

5.3.2 Current Interface

SYSTEM /SENSOR1 / CURRENT INTERFACE

Here you are scaling the current interface to the corresponding measuring range.

→ Select „ **Current interface**" and confirm by "**OK**" button. Afterwards select „**current output**", then the required output signal (0-20 mA or 4-20 mA), shall be selected and confirmed by "**OK**" button.

Example:
Enter the output value for the selected scale (e.g. 70 on 4mA and 100 on 20mA)
This example corresponds to a measuring range of 70 to 100 (Brix). The displays this above the bargraph (drag pointer).

There is a test function of the current output. It can be activated by switching „**Test current**" from „**OFF**" to „**ON**" and by confirming by "**OK**" button. It enables to control the output in the control room.
The value of test current can be directly given in mA (e.g. Test current: 12 mA)

→ The „**Calibration"** function of „ **Current interface**" menu allows regulation of 4 mA and 20 mA by **F2** (+) and **F3** (-) buttons. In order to start regulation, a milliamperemeter must be connected to the corresponding current output.

6 Calibrating

Before calibration it is important to set the initial sensor configuration (as it is described preliminary in chapter 5).

6.1 Sampling

For calibration it is necessary to take samples during the whole process and evaluate them in the laboratory. While sampling the process has to be in stable conditions. There should be taken a minimum of 5 to 8 samples, which are coping the complete measuring range.

Example for sugar industry:
For batch pans it is recommended to take 3 samples before seeding point and at least 5 after.

→ For each sample note following data:

- Date and time of sample taking
- Displayed main value (in corresponding unit)
- Phase shift (P in °)
- Temperature (T in °C)
- Compensated phase shift (P-comp in °)
- Attenuation (in dB)

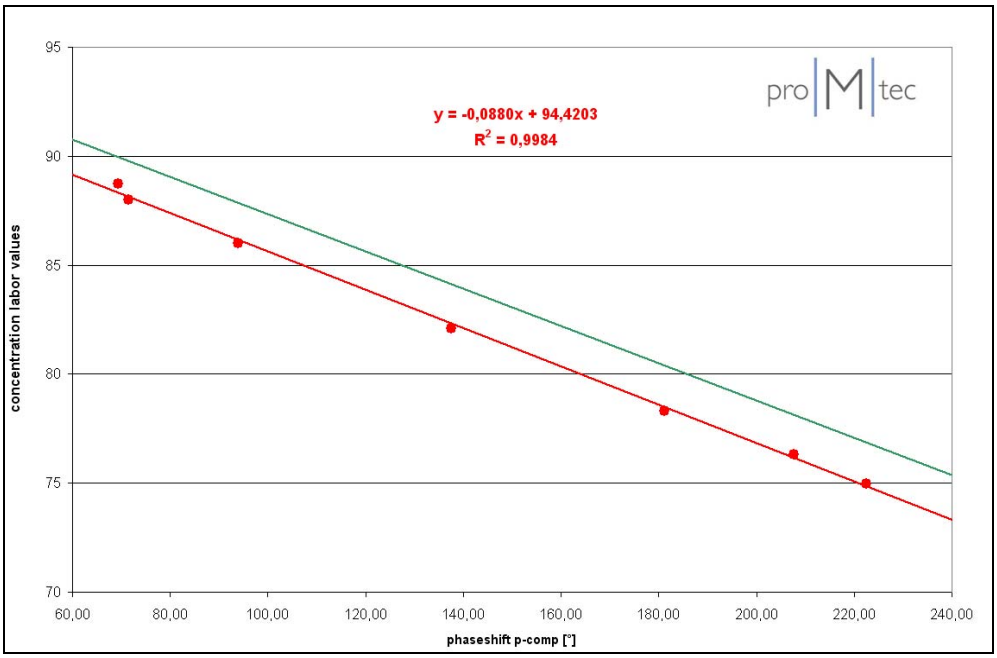
6.2 First calibrating

→ After sampling, enter these values to the excel file “IBN” in the corresponding columns and add the laboratory values to the field „labor (Y-Axis).

i With these values the new settings will be calculated. Samples which are not used for the calibration but should be removed in the field „Labor not used“. The further columns are only for the calculation and may not have to be changed. They only have to be copied downwards.
In addition you have to enter the initial settings such as A0, A1, ref-point and p-offset (previously entered settings).

i The new settings (A0, A1) are automatically calculated and can be read off in the sheet “calibration data” and also in the sheet “trend” (form: Y = a1 * x + a0 and the correlation coefficient R^2).
The correlation coefficient R^2 should be nearly 1 proving that the sampling was representative and that the new coefficients can be entered in the evaluation unit.
In the sheet „trend“, you can compare different settings graphically.

→ Now the new settings can be transferred to the evaluation unit. Therefore you have to put in the coefficients A0 and A1. Maybe the Tk also has to be readjusted.



7 Sensor Settings: save and reload

Here you can save and load your settings, and reload the factory settings. This can be done in the “Sensor” – section or in the “Memory allocation” – section.

7.1 Sensor: Save settings, Load settings, Factory settings

SYSTEM / SENSOR1 / STANDARD SETTINGS

7.1.1 How to save configuration

→ Starting from „**System**” main menu please select „**Sensor**”, then select „Standard settings” and „Save settings”.

Now you can choose one of 30 memory capacities.

→ Select the desired position. If the position is not occupied, the device displays: „ **empty memory cell**”. Select „**save data set**” and confirm by "**OK**" button.

7.1.2 How to load previously saved configuration

→ Starting from „**System**” main menu, select „**Sensor**”, then „ standard settings” and „load settings”. Select the position (from 1 to 30). If the position is free, the device displays: „**empty memory cell**”. Then select „**load data set**” and confirm by "**OK**" button.

7.1.3 How to reload factory settings

→ Starting from „ **System**” main menu please select „ **Sensor**”. Then choose „standard settings”. Afterwards select „load factory settings”. Confirm by „**YES**” button and finally confirm by "**OK**" button.

7.2 Memory allocation: Load and Delete Internal and External Memory

SYSTEM / MEMORY ALLOCATION

7.2.1 Copying of configuration

SYSTEM / MEMORY ALLOCATION / COPY DATA SET

→ Starting from „**System**” main menu please select „**Memory allocation**” and „copy data set”. Then choose the source configuration to be copied (1 to 30).

Then choose the place to be saved to the available memory cell. At last select „**start copy**” and finally confirm by "**OK**" button.

7.2.2 Deleting of configuration

SYSTEM / MEMORY ALLOCATION / DELETE DATA SET

→ Select the configuration to be deleted (1 to 30). Select „**YES**" button and finally confirm by „**OK**" button.

7.2.3 Deleting of all memory

SYSTEM / MEMORY ALLOCATION / COPY COMPLETE MEMORY

You can delete the additional memory (spaces 1 to 30).

i **This is not deleting the sensor settings.**

→ Select „**delete complete memory**", then „**delete internal memory**". Afterwards it must be confirmed by "**OK**" button. Confirm by „**YES**" button and press "**OK**".

8 Data logging

There is also the possibility to do data logging via PC. Therefore the µ-ICC 2.45 standard has a RS 232/ RS 485 interface. Here you can connect a PC and start a data log via "Hyper Terminal" (basic program with WinXP). Therefore please read your Windows manual.

9 Moving of the measuring range

SYSTEM / SENSOR / CALIBRATION

Sometimes the resulting measuring range is unsuitable for the measurement. There is a simple way to make it suitable.

Example:
There is a range from 65 to 90 %, but it is needed an upper limit of 95 %. Now you have the possibility to change it by phase offset.
Therefore you need to calculate the required phase shift for the missing 5%.

Total measuring range = 90 % – 65 % = 25 %.
Phase shift per 1 % = 360°/ 25 % =14.4° per 1%
*Offset = 14.4° per 1% * 5 % = 72.35°*

Here you get an offset of 72.35°. This value you have to add on the already existing phase offset.

→ Starting from„ **System**" main menu, select „**Sensor**", then „**Calibration**" and finally „**phase offset**" and add this calculated offset on the phase offset.

This example was to move the range upwards. The same way you can move it downwards. Therefore you have to subtract (instead of adding) the calculated offset from the existing phase offset.

10 Troubleshooting

10.1 PIN is not working

You can block the keyboard. Make sure, that third doesn't know this PIN. If you don't remember the PIN, please contact your supervisor. In emergency cases proMtec can override your PIN.

10.2 Constant offset

SYSTEM / SENSOR / CALIBRATION / COEFFICIENT

Maybe you will find a constant offset.

After saving the settings (see above), you can change the settings without any troubles.

To correct the offset, the best way is just to add the difference to a0.

This should not be given to the operator as a legal action, hence the BRIX-meter is calibrated to laboratory value and the seed point value is linked to temperature and purity. The seed point value should be set in the DCS system.

Later you can take some samples and add them to the actual spreadsheet and compare them with the old samples.

This is possible, if you haven't meanwhile

- Given a new ref-point,
- Changed ref-correction or
- Calibrated the Pt-100.

11 Technical specifications

11.1 µ-ICC 2.45 standard – Evaluation unit

Housing	Aluminium wall housing, robust design, protection IP65, Dimension 240 x 240 x 120 mm, 5.5 kg
Mounting	4 holding flaps H x W = 142.5 x 273 mm for ø 5 mm
Power supply	AC: 90 – 270 V, 45 – 68 Hz; max. 45 VA alternative DC: 18 – 36 V DC max. 1000 mA for 1 to 2 sensors DC max. 1800 mA for 3 to 4 sensors
Display	Monochrome-LC ¼ - VGA, 320 x 240 pixel, illuminated. Large display of the measurement result and drag pointer with analogue bar graph displays of deviation of the measurement in its defined scale
Handling	Foil keyboard with 4 soft keys, well-structured multilingual menu
Status display	3 LEDs for operational signal, status of the measurement and access-PIN for parameter
Outputs	4 x 0/4 – 20 mA isolated outputs for concentration, range can be set for each channel specifically. Load max. 500 ohms
Data interface	RS 232, 9600 Bd for data communication or comfortable software-update
Data memory	EEprom – data memory for 30 calibration and parameter data sets. All data are absolutely saved in case of power failure. Option: additional changeable memory module for back-up of 30 data sets
Inputs	4 x TNC-plugs for 50 ohms coaxial cable, RG 58, max. 150 m each for simultaneous running of 4 separated microwave modules. Digital data transmission on carrier frequency 10 MHz
Temperature	Environment 0 to 50 °C

11.2 µ-ICC 2.45 standard – microwave module

Housing	Aluminium wall housing, robust design, protection IP65, Dimension 166 x 100 x 81 mm, 1.4 kg
Mounting	4 holding flaps H x W = 87 x 123 mm for ø 5 mm
Power supply	DC 24V through coaxial cable from the controller
Microwave	Extremely stabile phase and attenuation measurement with PLL-synthesizer, 2.45GHz, transmission performance 10 mW, 10 dBm
Microwave cable	2 x N-plugs for highly shielded coaxial cable 50 ohms, typical 1 to 2 m (max. 3 m); 0.5 kg
Data memory	EEprom-data memory for reference point, calibration data in case of power failure all data absolutely saved
Output	1 x TNC-plug for coaxial cable 50 W, RG 58 for data transmission to the controller
Input	Pt 100/ Pt 1000 two-wire connection, Range – 50 to 200 °C
Temperature	Environment 0 to + 60 °C

12 Spare parts

Item	Order number
Evaluation unit µ-ICC 2.45 standard	ICC EU ST 4C AC
Microwave module µ-ICC 2.45 standard	ICC MO ST
Insertion sensor probes (Set with weld-in sockets)	IS A WS SET
Insertion sensor probe	IS A
Rubber cap for insertion sensor probe	IS CAP PEEK
Microwave cable 1.5 m	CA MW 1.5
Temperature sensor Pt 100 (with weld-in socket)	TS PT 2.5 PWS KU J
TNC coaxial cable 10 m	CA CO TNC 10

13 Declaration of Conformity

CE Conformity

Microwave Density Measurement Instrument µ-ICC 2.45

This instrument has been tested and found to comply with the limits of the European Council Directive on the approximation of the laws of the member states relating to electromagnetic compatibility (89/336/EEC) and in accordance with 73/23/EWG.

This instrument complies with the requirements of

- EN 50082-2, part 2: industrial area
- EN 50081-2, part 1: industrial area
- IEC 1010-1 Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use

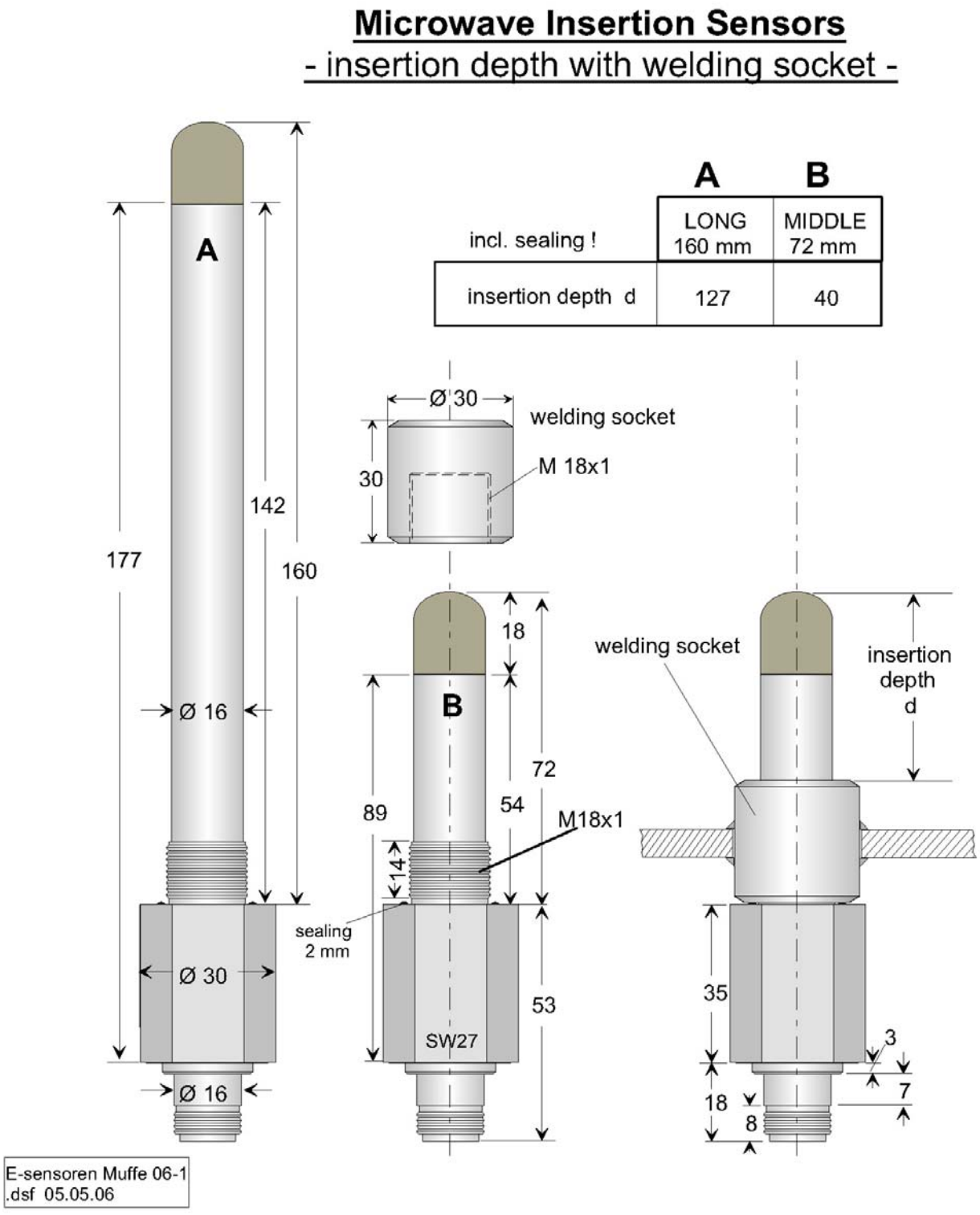
We confirm that our manufacturing and development for the instrument µ-ICC 2.45 is in accordance with the laws mentioned above.

Ettlingen, 04.06.2008

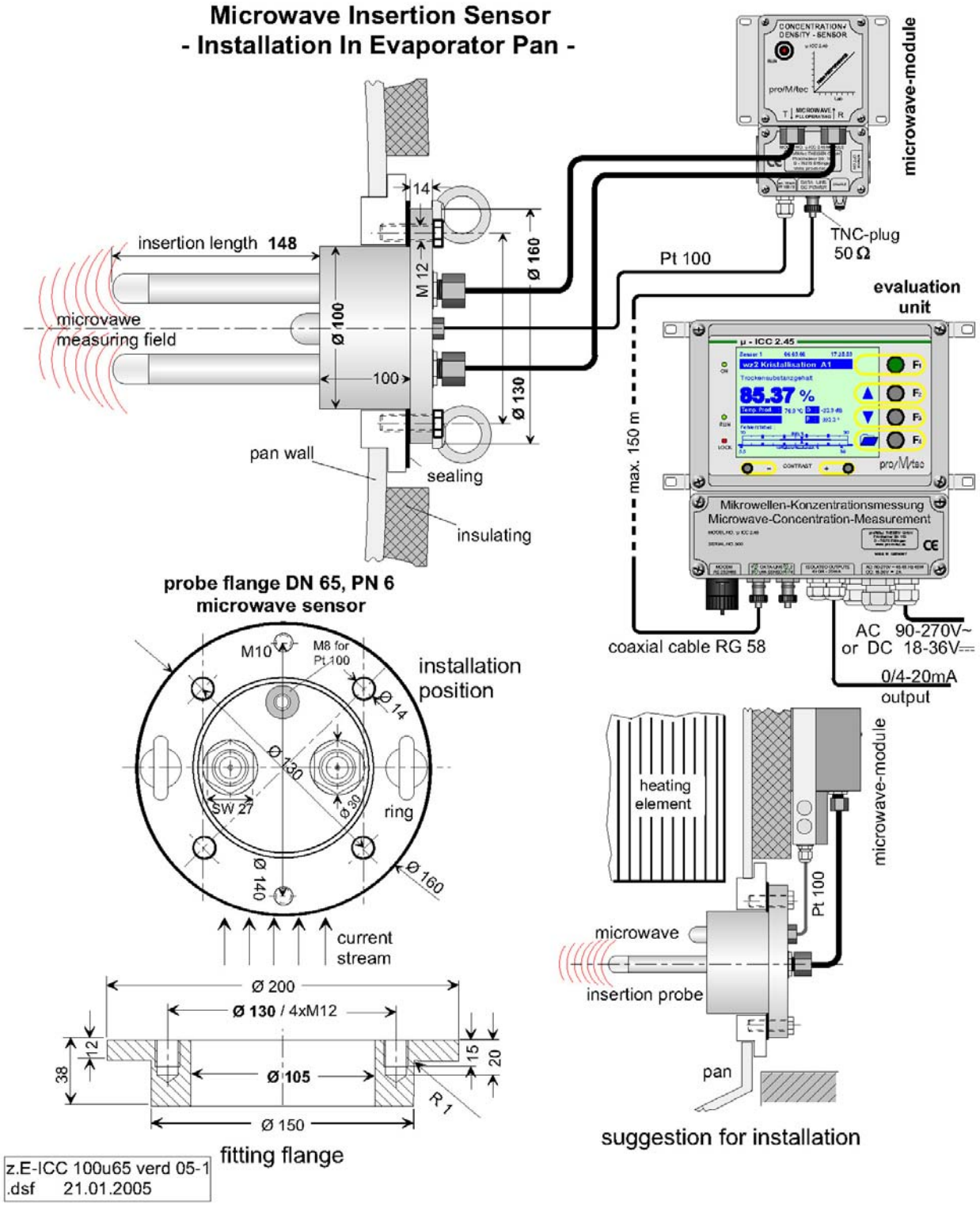
Karl-Heinz Theisen
Managing Director
pro/M/tec Theisen GmbH

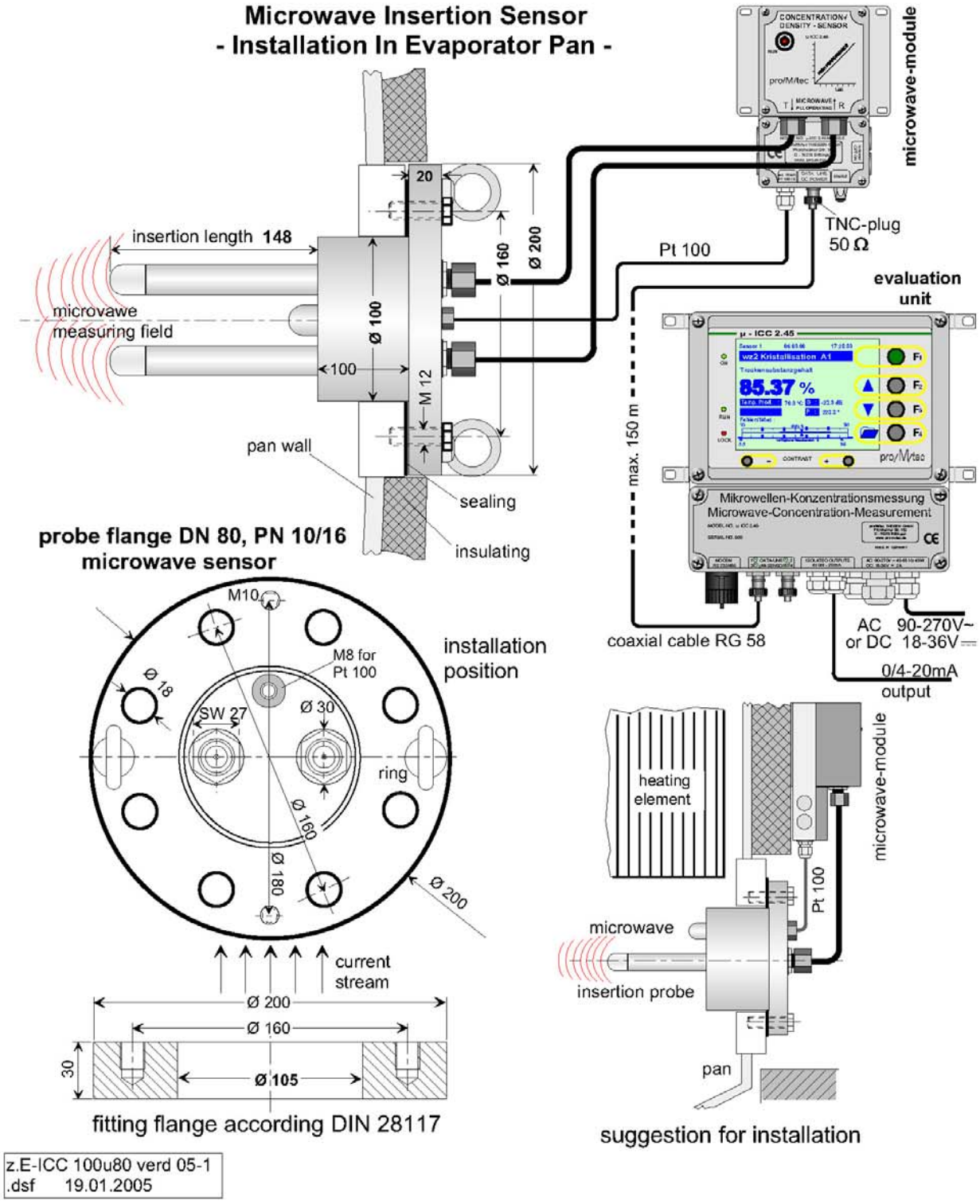
14 Dimensional drawings

14.1 Insertion sensor probes

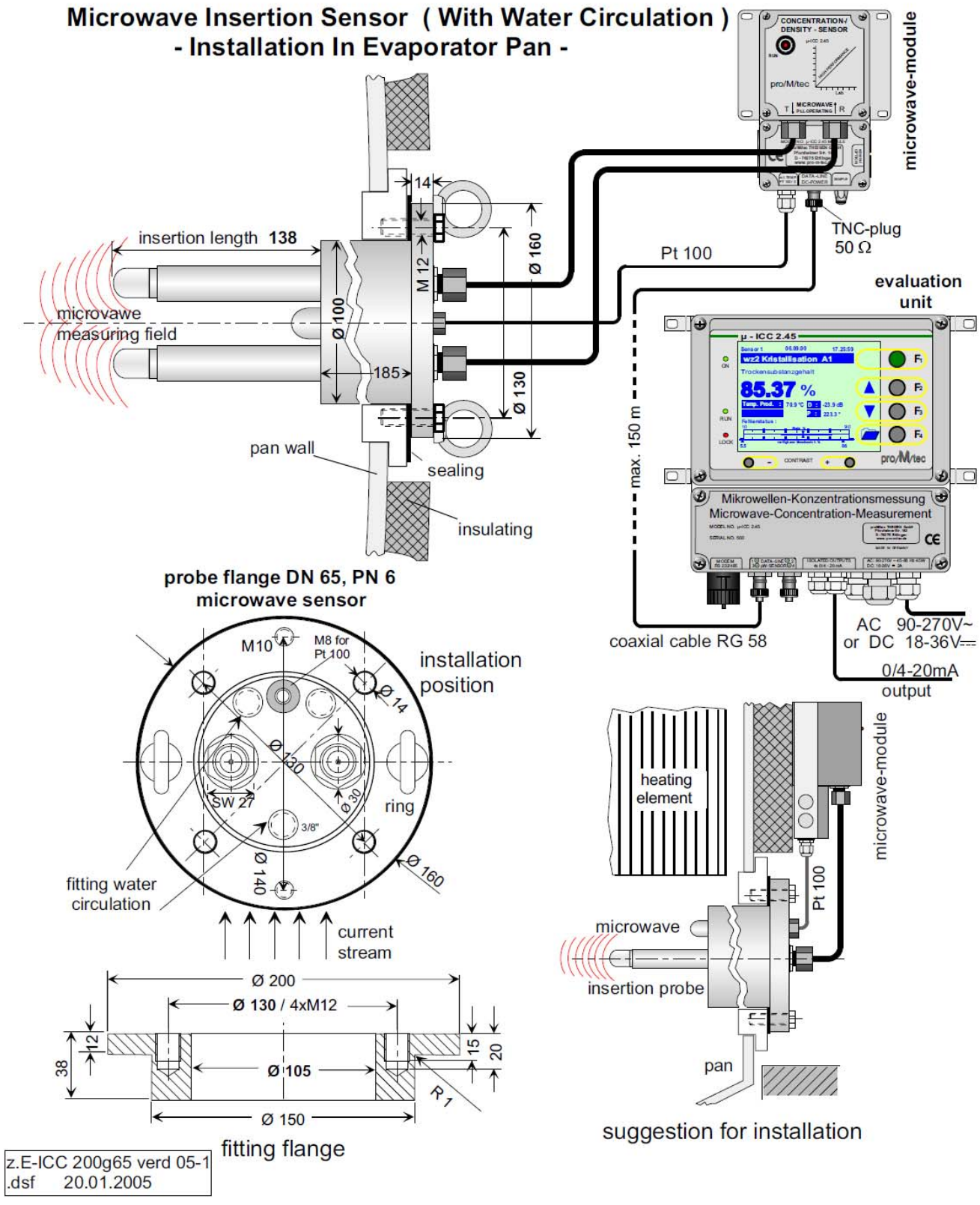


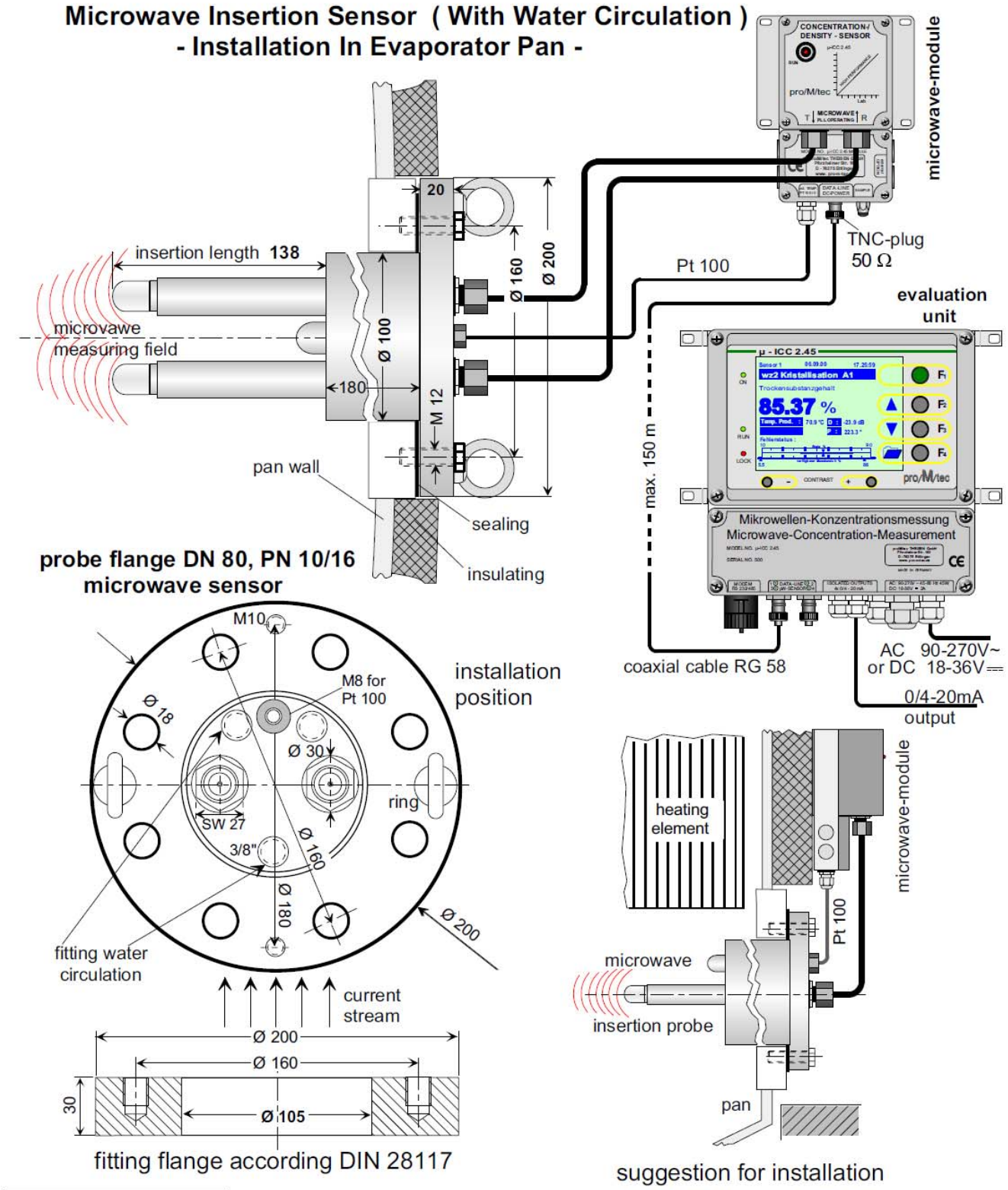
14.2 Insertion sensors DN 65 and DN 80




Microwave Insertion Sensor
- Installation In Evaporator Pan -
microwave-module
TNC-plug
50 Ω
Pt 100
evaluation
unit
insertion length 148
microwave
measuring field
Ø 100
100
M 12
20
Ø 160
Ø 200
pan wall
sealing
insulating
max. 150 m
coaxial cable RG 58
AC 90-270V~
or DC 18-36V
0/4-20mA
output
probe flange DN 80, PN 10/16
microwave sensor
M10
M8 for
Pt 100
Ø 18
SW 27
Ø 30
ring
Ø 160
Ø 180
Ø 200
installation
position
current
stream
Ø 200
Ø 160
Ø 105
30
fitting flange according DIN 28117
heating
element
microwave-module
Pt 100
microwave
insertion probe
pan
suggestion for installation
z.E-ICC 100u80 verd 05-1
.dsf 19.01.2005

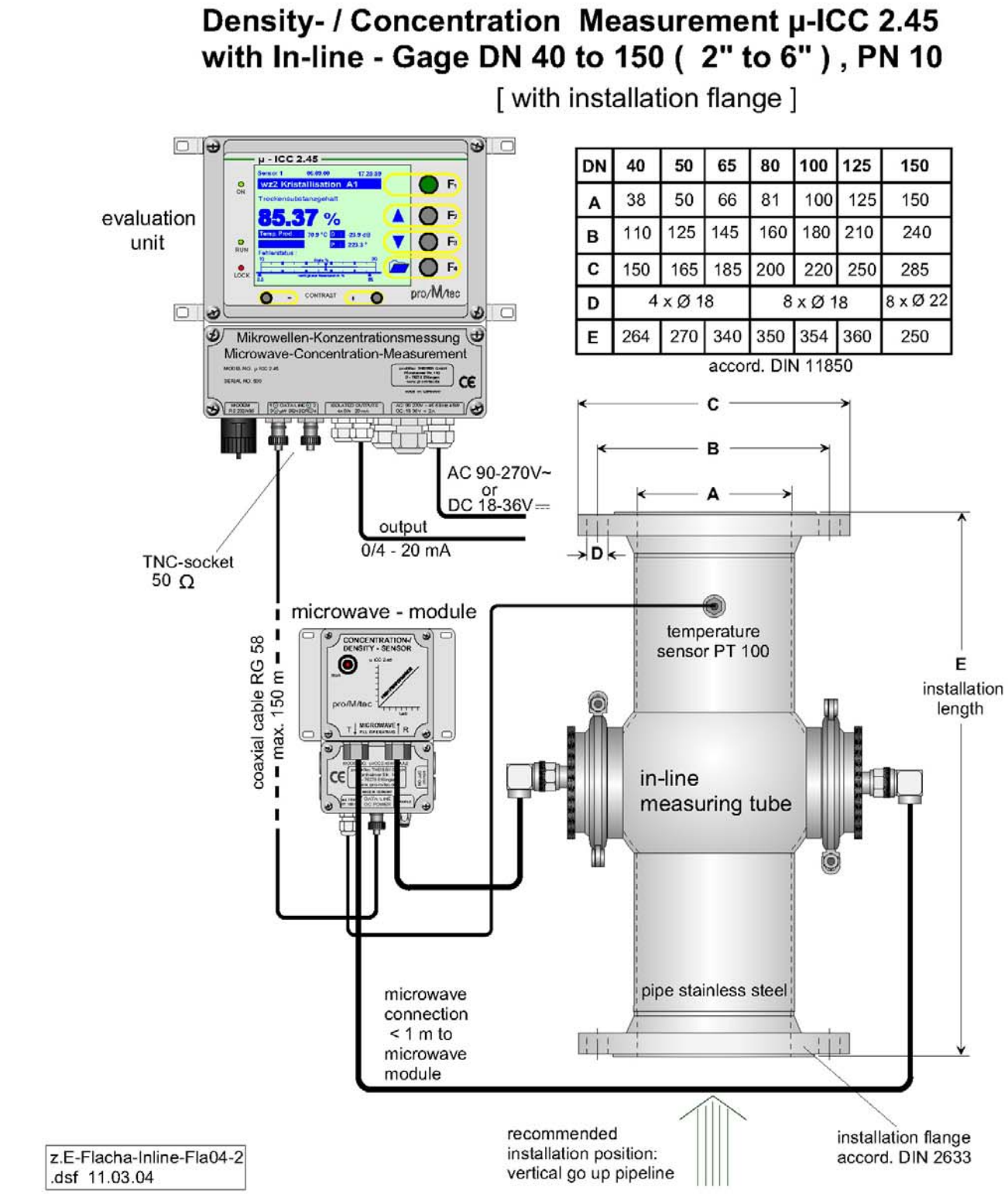
14.3 Insertion sensors DN 65 and DN 80 with cleaning system





z.E-ICC 200g80 verd 05-1
.dsf 19.01.2005

14.4 Flat sensor pipelines



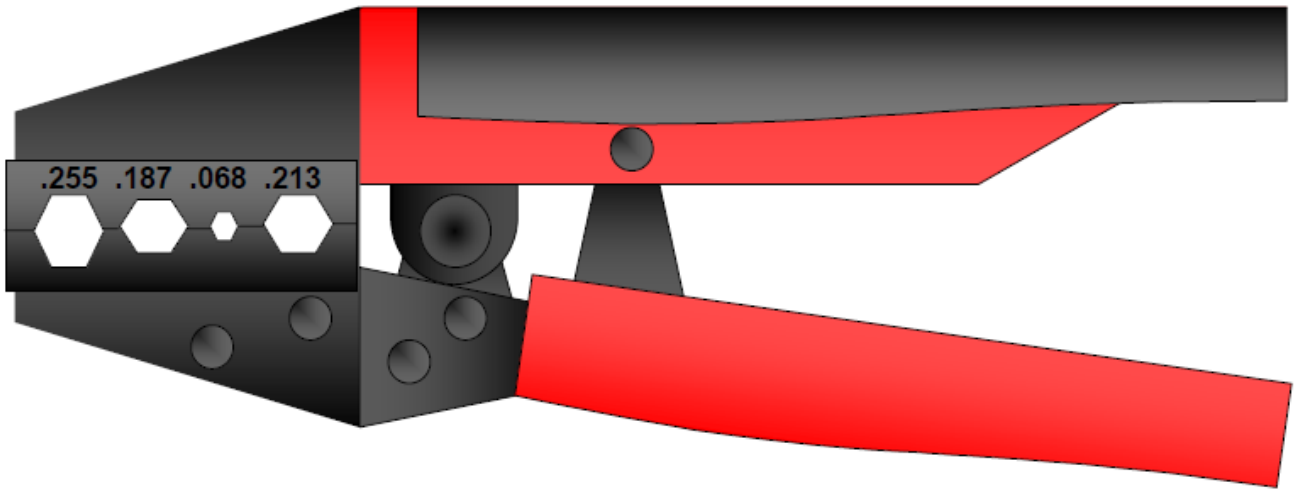
DN	40	50	65	80	100	125	150
A	38	50	66	81	100	125	150
B	110	125	145	160	180	210	240
C	150	165	185	200	220	250	285
D	4 x Ø 18			8 x Ø 18			8 x Ø 22
E	264	270	340	350	354	360	250

TNC cable Assembly instruction

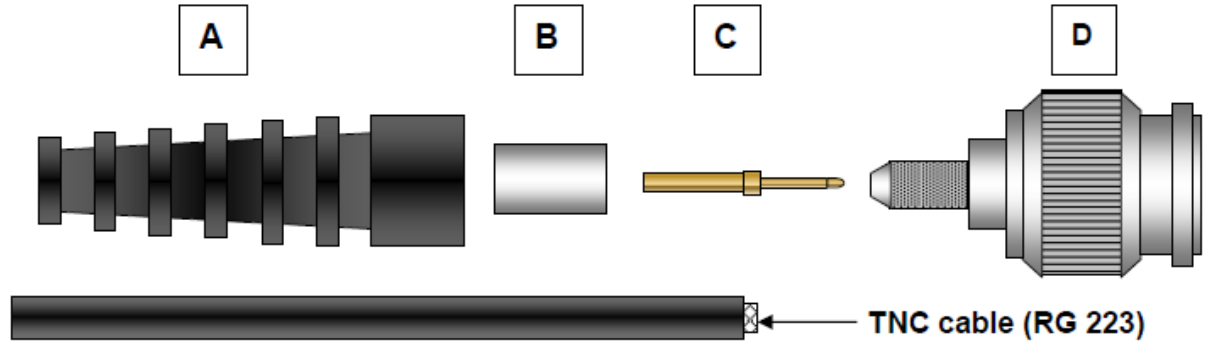
Required tools:

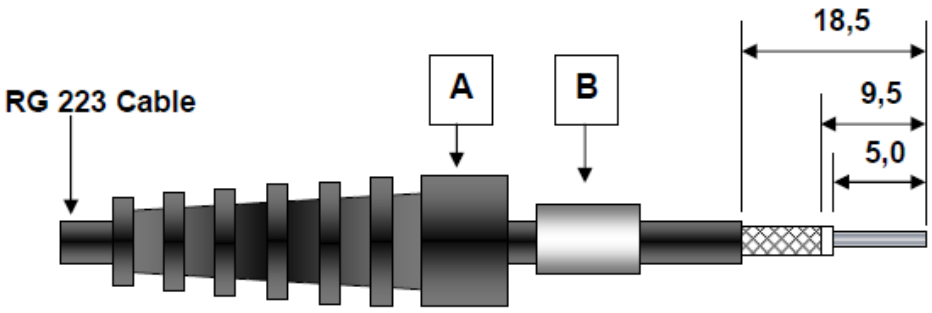
1. Stanley blade
2. Scissors
3. Crimp tool

The crimp tool

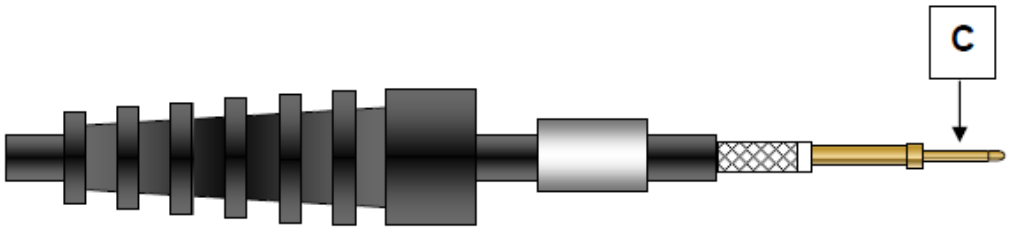


Required materials:

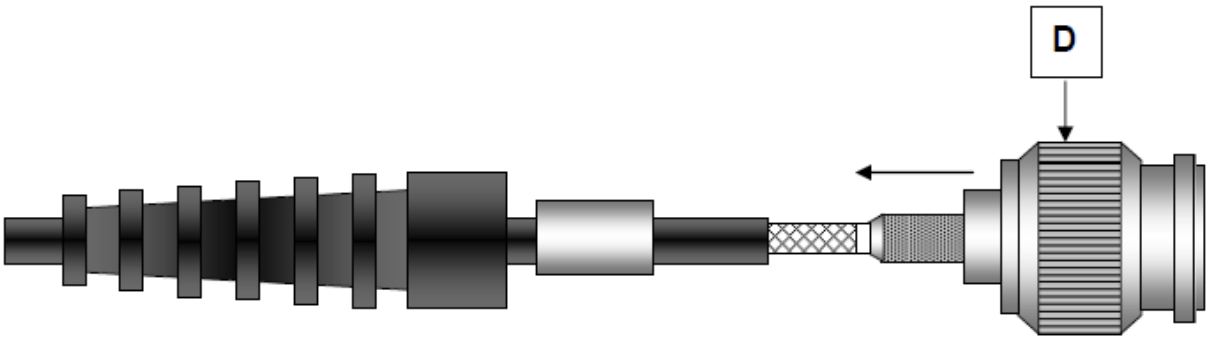




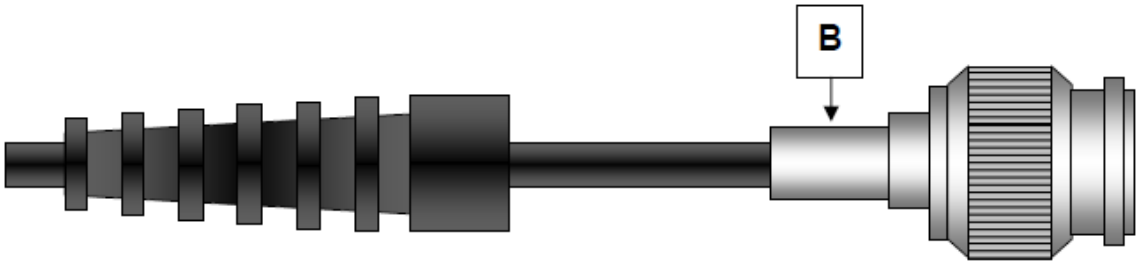
1	Slide taper sleeve A and ferrule B on to the cable. Prepare the cable according to the drawing above. Don't damage the centre contact, the dielectric and the braid.



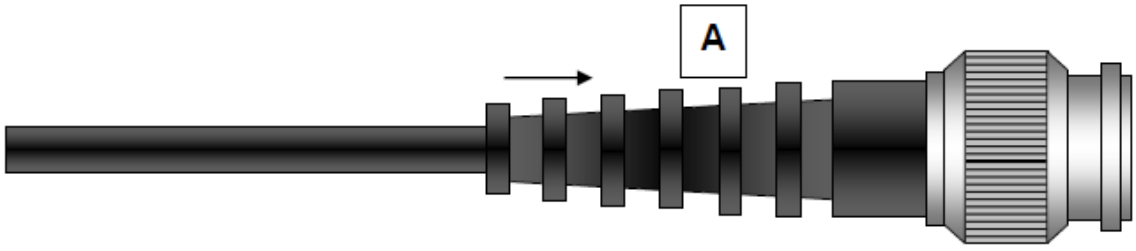
2	Push the contact C over inner conductor of the cable to abut the cable dielectric and crimp with the position **".068"** of the crimp tool. See the crimp tool drawing.



3	Splay out the braid and push the cable into the body connector **D** until contact **C** engages perceptibly.



4	Slide the ferrule **B** over the braid as close as possible to the connector body **D** and crimp with the position **".213"** of the crimp tool.



5	Slide the taper sleeve **A** over the ferrule **B** as close as possible to the connector body **D**.