

Metso Microwave Consistency Transmitter

**Installation, Operating
& Service manual
OUL00298 V2.2 EN**

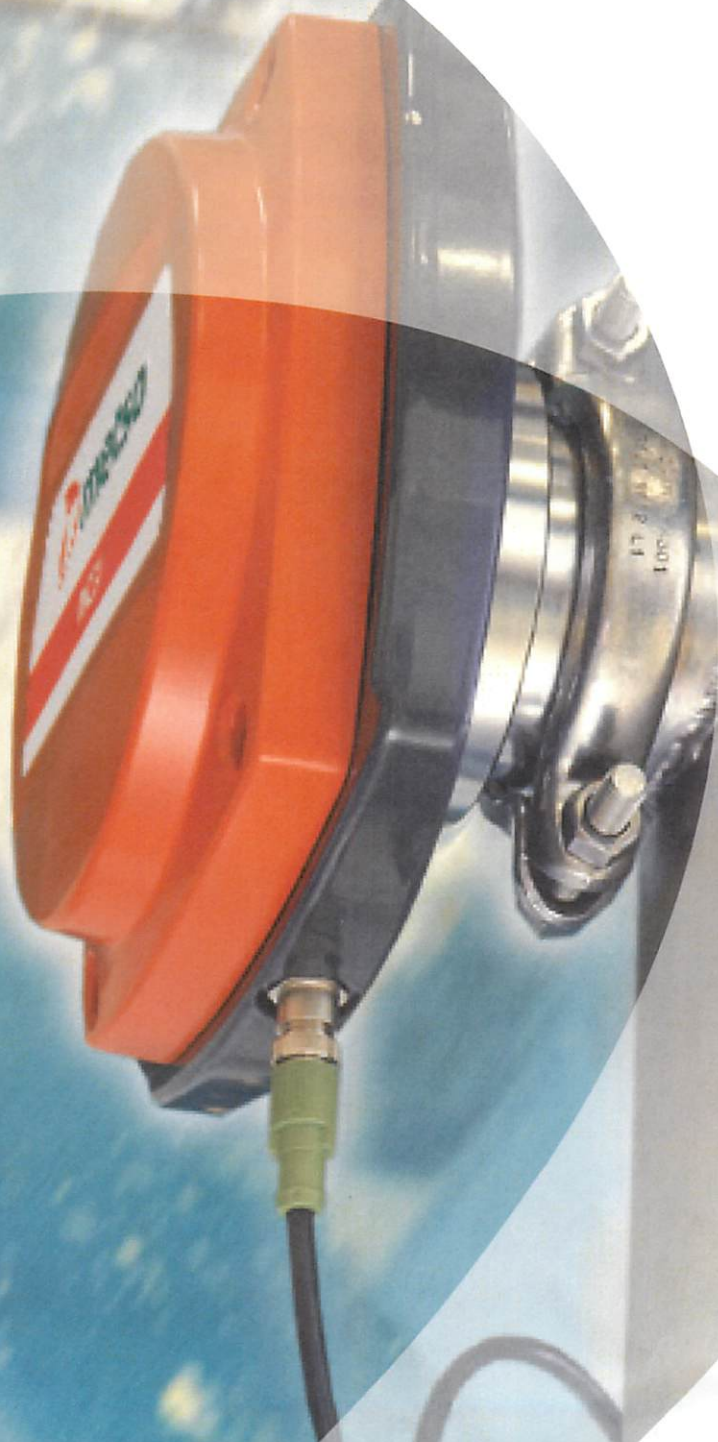


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Technical Specifications

Service kits & Spare parts

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Caution / Warning



During installation, maintenance and service operations, remember that the sample line may contain hot sample or water – be careful!



Always check that the incoming voltage & frequency are correct before making any electric connections. Wrong connection may damage the equipment! The applicable electrical safety regulations must be closely followed in all installation work!



Before any welding works in the vicinity of the devices, make sure that operating voltage is not connected!

1. Introduction

1.1. General

Metso Microwave Consistency Transmitter (Metso MCA) functions based on the measurement of microwave propagation time.

Microwaves are electromagnetic radiation; the flying time depends on the media's dielectric constant. Flying time is calculated as follows:

$$v = c / \sqrt{e_r}$$

c = speed of light in a vacuum

e_r = media's dielectric constant

In water microwaves advance at a much slower speed than in wood fiber. Therefore, consistency can be calculated based on the time it takes the microwaves to move through the measured mass.

The advantages of this measurement procedure are pulp type-independence, insensitivity to flow speed, and single-point calibration.

There are two different models of Metso MCA sensors:

- Metso MCA-F Fork sensor (figure 2).
- Metso MCA-FT Flow-through sensors (figure 3).

Metso MCA also includes a user interface known as Transmitter Central Unit (TCU) (figure 1).



Fig. 1. Transmitter Central Unit (TCU).



Fig. 2. Metso MCA-F.



Fig. 3. Metso MCA-FT.

Notes

2. Structure

Metso MCA comprises the sensor unit and a user interface called Transmitter Central Unit. There are two sensor models: MCA-F Fork Sensor and MCA-FT Flow-Through Sensor, which come in six different sizes ranging from FT-50 to FT-300. The appropriate model is selected according to the diameter of the process pipe.

2.1. MCA-F

In the fork-type MCA-F sensor, the microwave antennas are mounted on the sensor body, which is installed via a coupling into the process pipe. On the end of the sensor there is a probe antenna and on the base there is a flushmounted antenna. In addition, on the end of the sensor body there is a Pt-100 thermoelement. The antenna cables and the Pt-100 sensor cables run through the inside of the sensor to the sensor electronics. Figure 3 shows the sensor's construction drawing.

The material of the wetted metal parts is AISI316L, with options of titanium or hastelloy. The antenna material is polished ceramic.

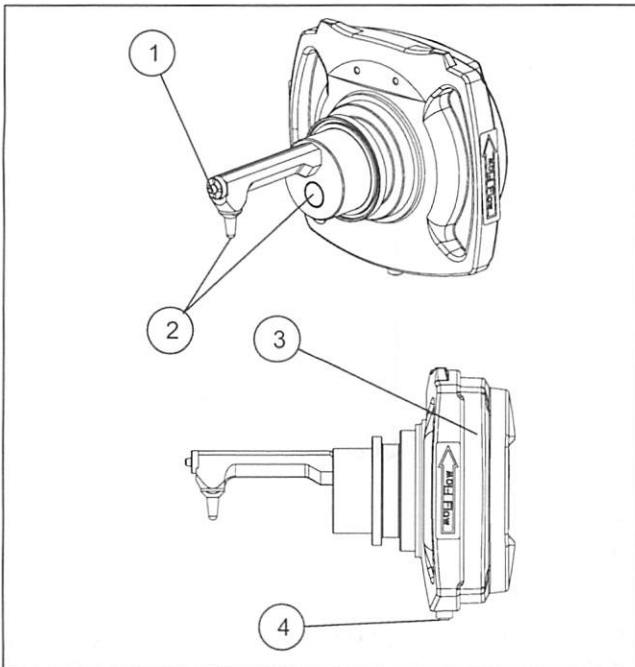


Fig. 1. Metso MCA-F: 1. Pt-100 Thermoelement, 2. Microwave Antennas, 3. Sensor Electronics, 4. Sensor Cable Connector.

2.2. MCA-FT

The body of the Flow-Through sensor is a pipe, which, when installed, replaces an identical length of process pipe. Flush-mounted antennas are installed on opposite sides of the sensor body, so measurement takes place through the pipe. The sensor electronics casing is installed on the sensor body by means of a connecting pipe. The Pt-100 sensor, which measures process temperature, is installed inside the connecting pipe. The antenna cables, which are protected within casing, run to the base plate of the electronics casing on the outside of the connecting pipe. Figure 4 shows the sensor's construction drawing.

The material of the wetted sensor and antenna bodies is AISI 316/316L. The antenna material is polished ceramic.

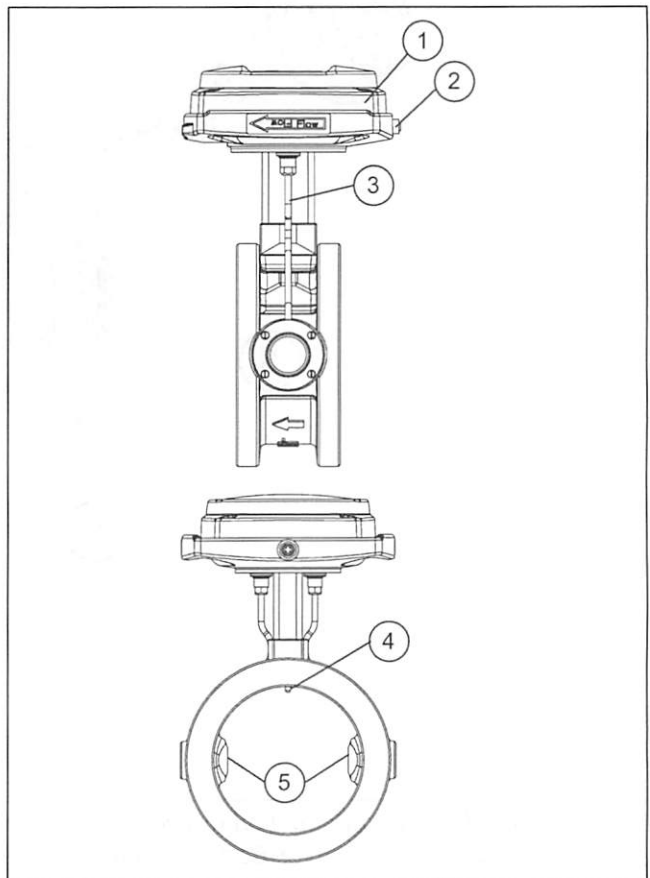


Fig. 2. Metso MCA-FT: 1. Sensor Electronics, 2. Sensor Cable Connector, 3. Antenna Cable, 4. Pt-100 Thermoelement, 5. Microwave Antennas.

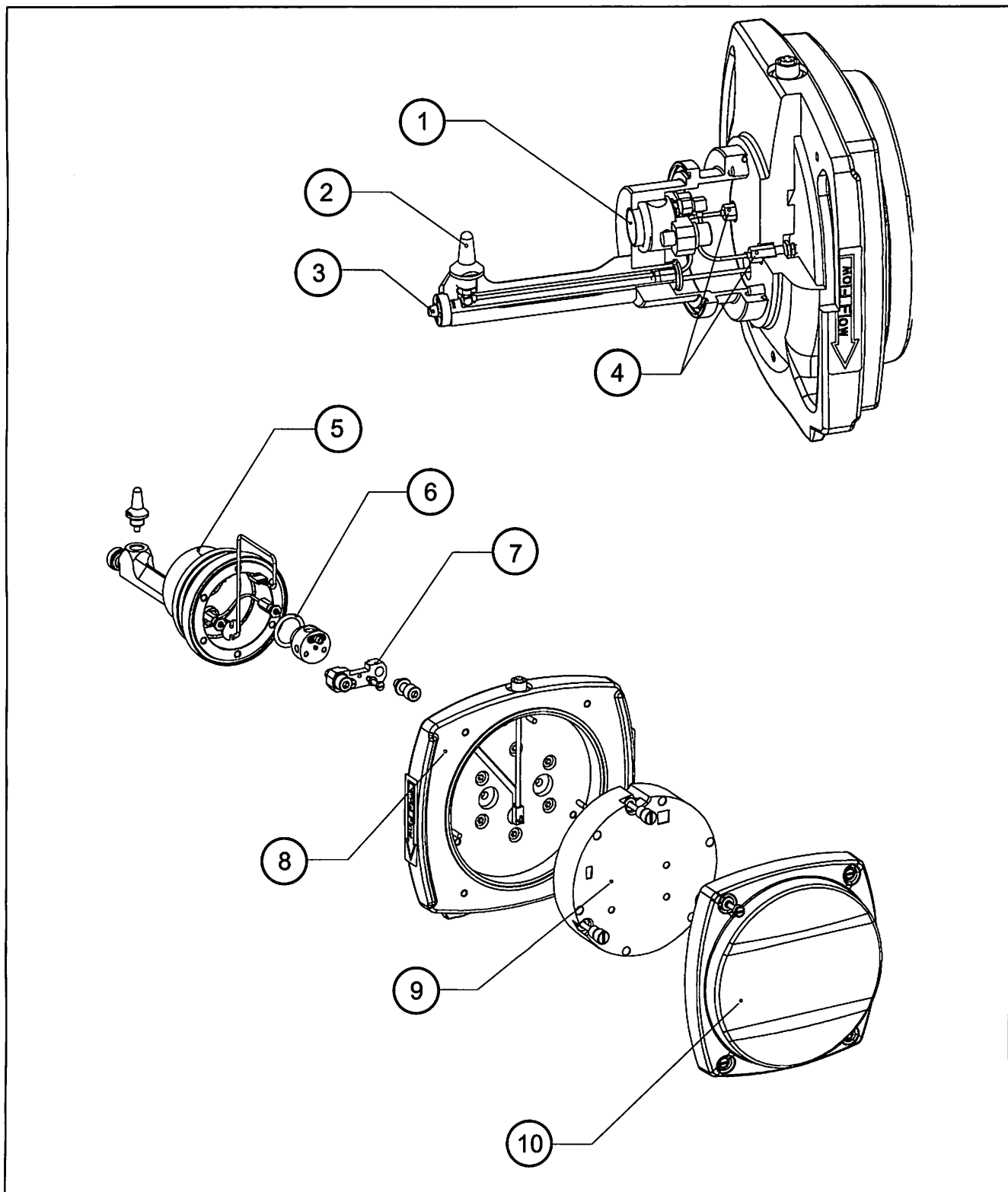


Fig. 3. Metso MCA-F construction drawing: 1. Microwave Antenna, 2. Sensor Head, 3. Pt-100 Thermoelement, 4. Antenna Cables, 5. Sensor Body, 6. Antenna Sealing, 7. Fixing Clamp, 8. Base Plate Assembly, 9. Sensor Electronics, 10. Sensor Cover.

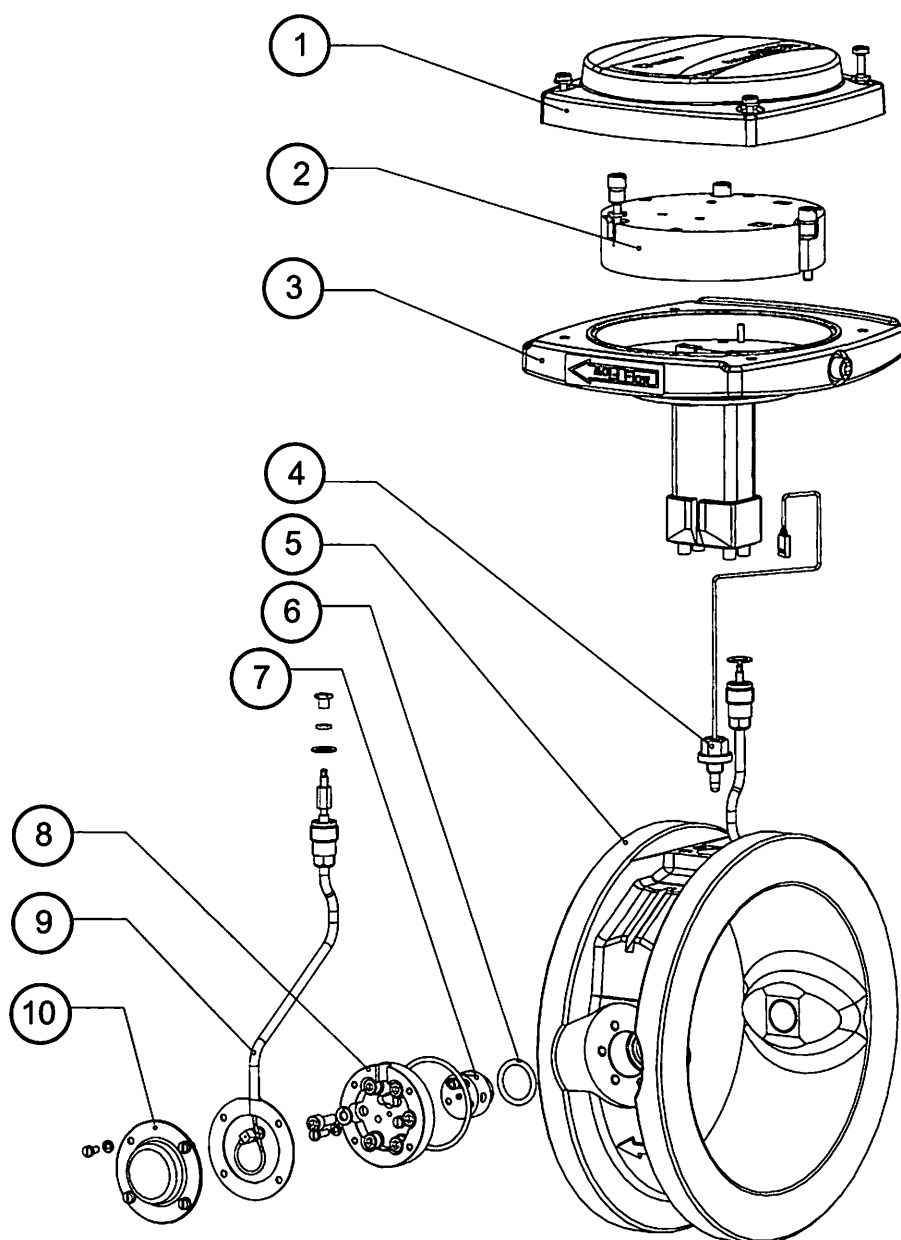


Fig. 4. Metso MCA-FT construction drawing: 1. Sensor Cover, 2. Sensor Electronics, 3. Base Plate Assembly, 4. Pt-100 Thermoelement, 5. Sensor Body, 6. Antenna Sealing, 7. Microwave Antenna, 8. Antenna Flange, 9. Antenna Cable, 10. Antenna Cover.

2.3. Sensor Electronics

Sensor electronics is the same for both Fork and Flowthrough sensors. Refer to figure 6. The sensor electronics card is installed between the round cover and base. The electronics includes the microwave transmitter and receiver as well as control, measurement and communication electronics.

On the bottom there are snap-on connectors, which connect with antenna cable connectors in the base plate when you press the electronics against the base plate. The guide pins in the base plate help guide the connectors into place. The Pt-100 connector and the supply voltage / serial communication connector are connected into the connectors located in the cover of the sensor electronics.

2.4. Transmitter Central Unit (TCU)

TCU is Metso MCA's user interface and calculator. Perform operations using the number buttons and other buttons and the four-line display. The TCU is delivered attached to the shield, as shown in figure 5.

Connectors:

- For the sensor unit, sensor electronics supply voltage and RS485 serial port connectors.
- For the current outputs (passive). From TCU Rev B, 2 current outputs.
- For HART communicator. (HART only in the current output 1.).
- For RS232 connection to a PC (for maintenance purposes).
- For network voltage.



Fig. 5. Transmitter Central unit.

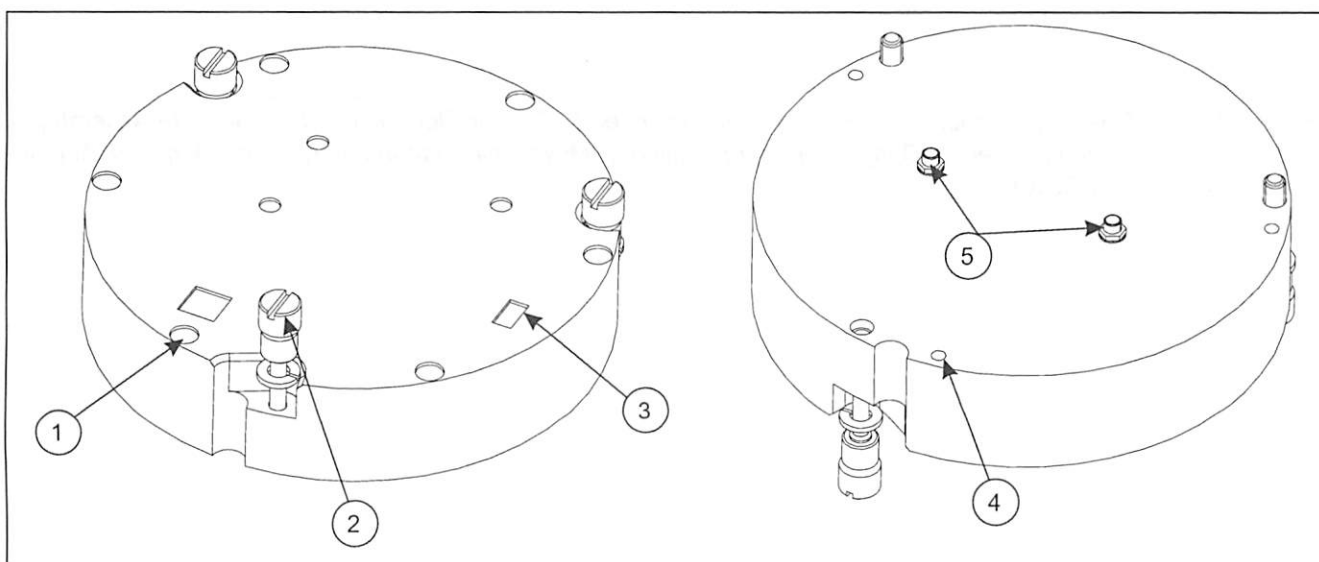


Fig. 6. Sensor Electronics: 1. Power Cable Connector, 2. Fixing Screw, 3. Pt-100 Connector, 4. Guide hole, 5. Antenna Cable Connectors.

3. Installation

3.1. General principles

The sensor model is selected according to the size of the pipe. Flow-through models are FT50/2", FT100/4", FT150/6", FT200/8", FT250/10", and FT300/12". Flowthrough models can be installed on the following pipe flanges:

- DIN PN10
- DIN PN16
- ANSI Class 150
- JIS 10K

In laboratory analysis of measurement results it is important to use a proper sampler (e.g. NOVE). Install it according to MCA installation instructions.

NOTE! Before installing the process coupling or sensor, check that the process pipe is empty and unpressurized and that installation is safe.

3.2. Choosing the installation site

The fork-type Metso MCA-F sensor can be installed on pipes with a diameter of 150 mm (6") or larger. In choosing an installation position, note the following:

- It is not recommended to install Metso MCA-F sensor in a place where the pulp may contain strings, etc., that may get wrapped around the sensor. If necessary, use a separate deflector plate.
- Do not install the sensor on the pump's suction side or in the mixing tank.
- After the sensor there should be a straight section of pipe, length at least 2 times the pipe diameter, before a change in pipe profile.
- Adjacent to Metso MCA-F sensor or one meter before it there must not be objects inserted into the pipe.
- Reserve enough space for the sensor casing. For the Metso MCA-F, reserve also space required for sensor installation.
- The TCU must be installed within 10 meters of the sensor. The sensor cable is 10m long. You also have the option of purchasing a 30m sensor cable.

In addition, you must note the following specifications:

- Process temperature under 100 °C.
- pH range 2.5...11.5.
- Conductivity according to sensor specifications.
- Recommended process pressure is 1.5 - 25 bar (Fork sensor) / 16 bar (FT sensor) to eliminate the effect of air bubbles.
- Sensor pressure tolerance:
 - Fork sensor PN25
 - FT sensor PN16

Installation checklist:

- Check that the mounting location and position are in accordance with the installation instructions.
- Check that the flow arrow on the sensor casing is pointing in the direction of flow.
- Protect the sensor and the TCU from direct heat sources and sunlight.
- Metso MCA-F: Before operating the sensor, check that the process coupling's mounting clamp is securely tightened.
- Metso MCA-FT: Before operating the sensor, check that the sealing between the MCA flanges and process flanges are properly installed and that the mounting nuts are tightened.

Sensor installation to a vertical and horizontal pipeline is illustrated in Fig. 1 - 5.

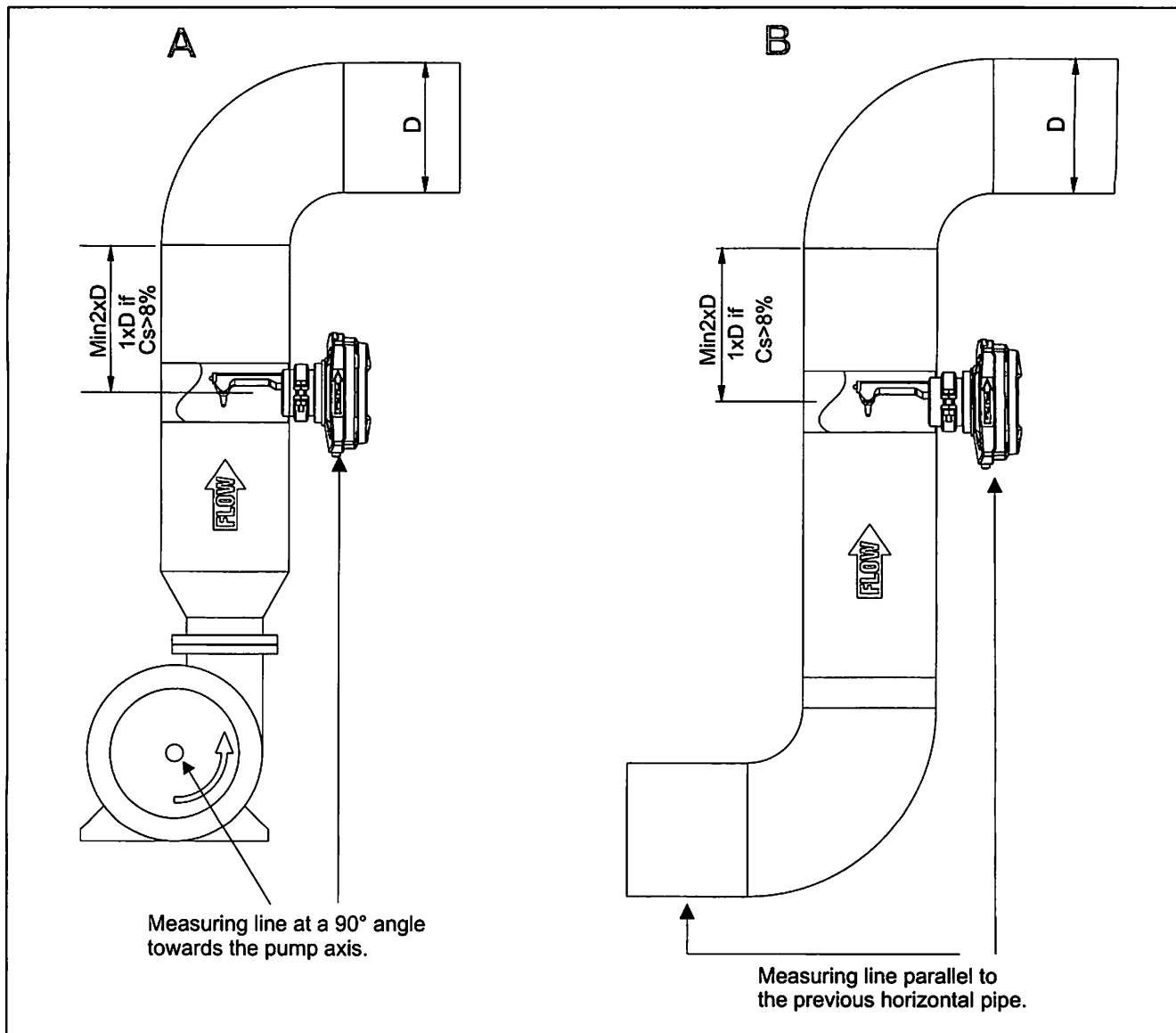


Fig. 1. Metso MCA-F Installation on a vertical pipe: A. after a pump, B. after a horizontal pipe.

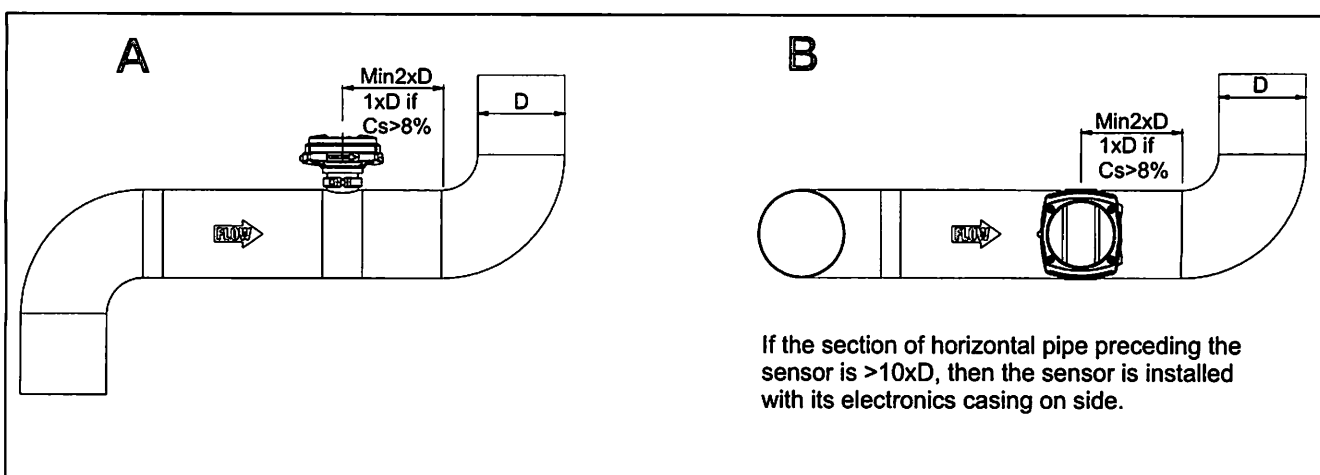


Fig. 2. Metso MCA-F Installation on a horizontal pipe: A. after a vertical pipe, B. after a bend in the pipe.

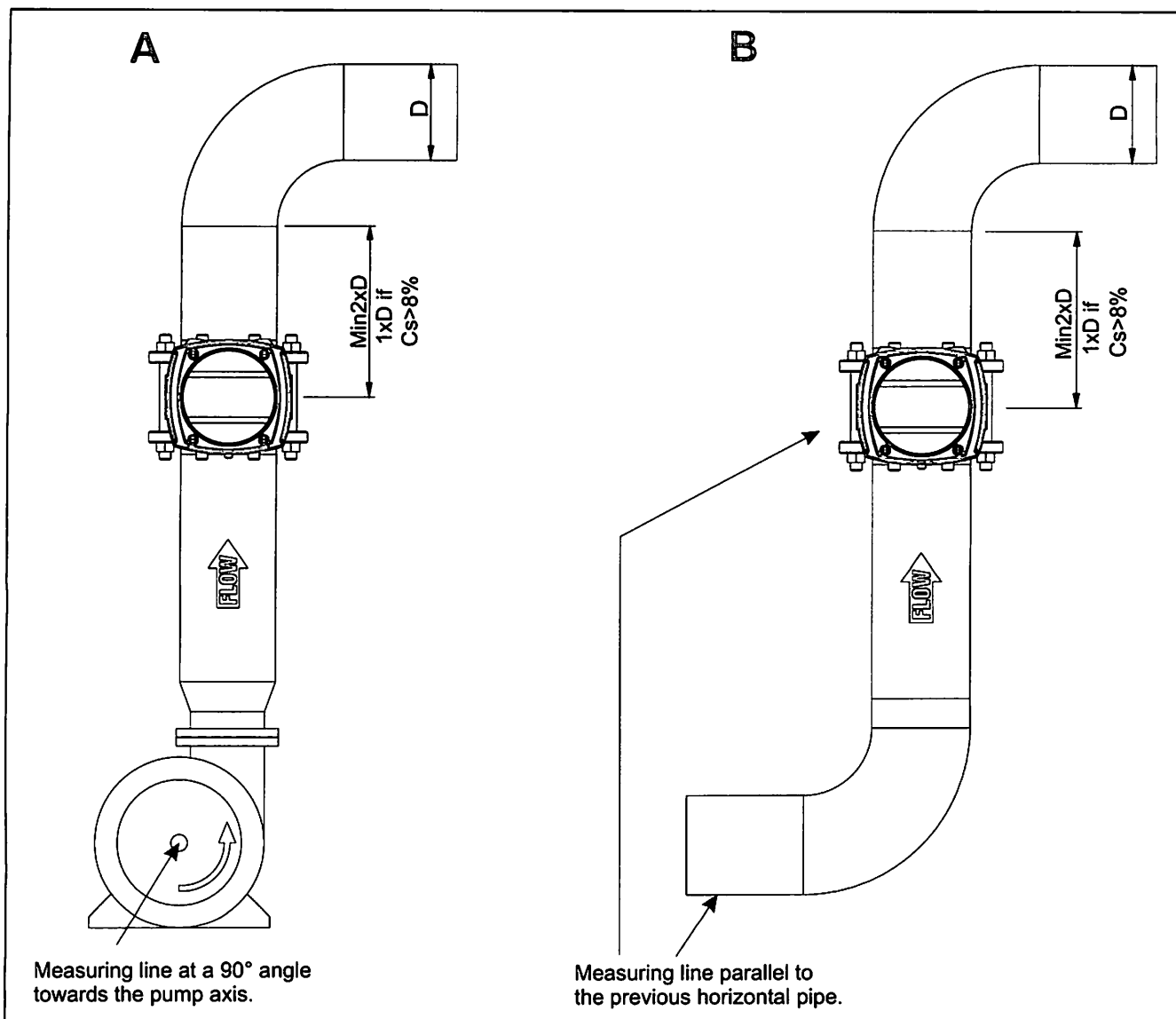


Fig. 3. Metso MCA-FT Installation on a vertical pipe: A. after a pump, B. after a horizontal pipe.

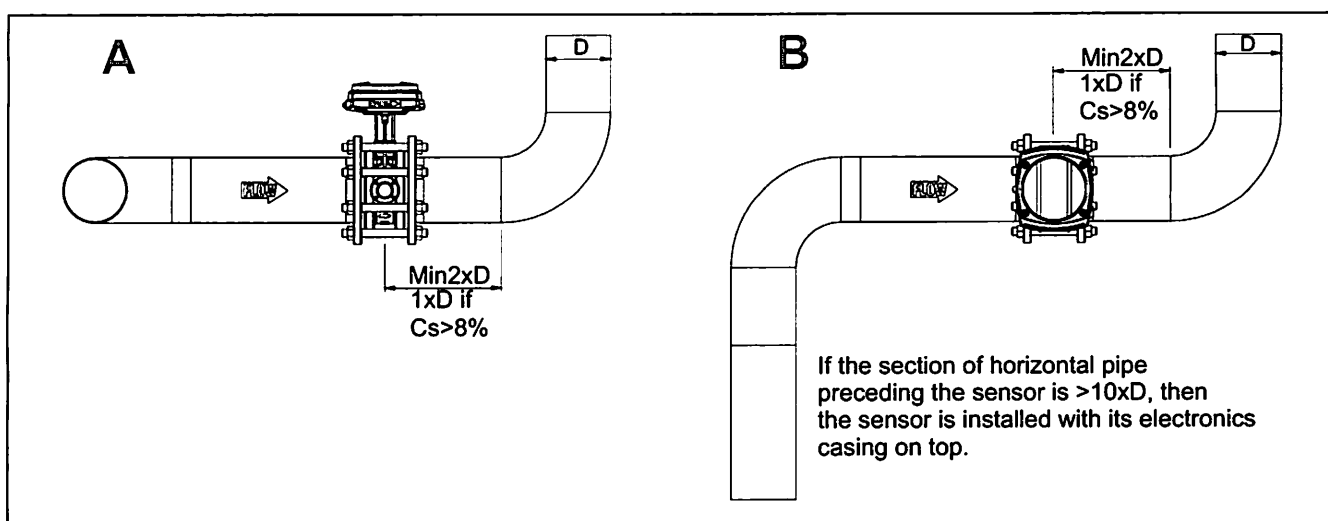


Fig. 4. Metso MCA-FT Installation on a horizontal pipe: A. after a bend in the pipe, B. after a vertical pipe.

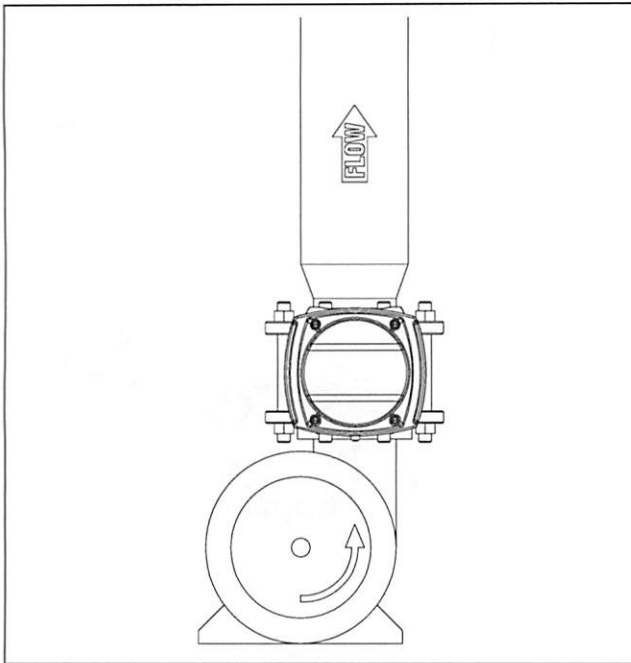


Fig. 5. Metso MCA-FT installation directly after a pump.

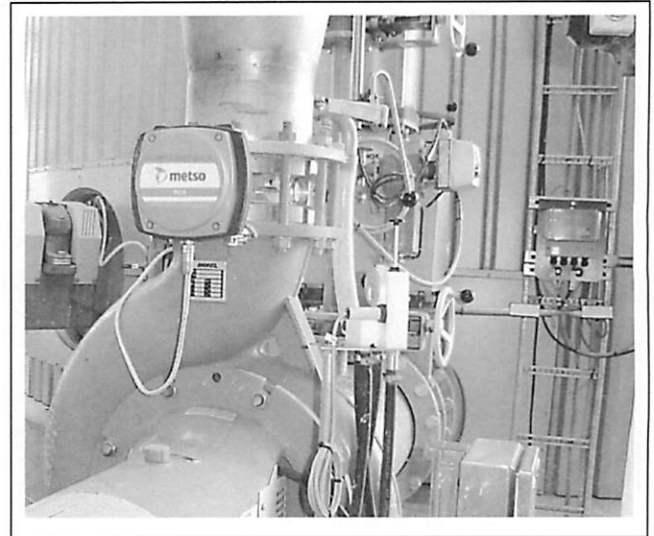


Fig. 6. Metso MCA-FT installation directly after a pump.

3.3. Sensor dimensions

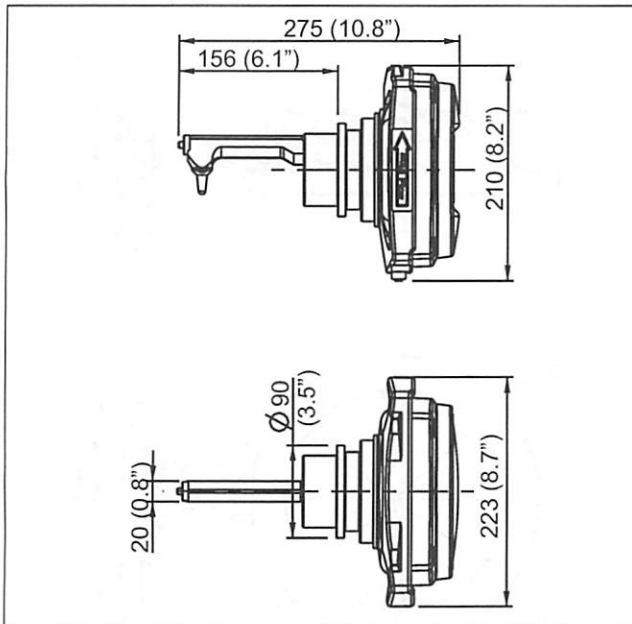


Fig. 7. Dimensions, Metso MCA-F.

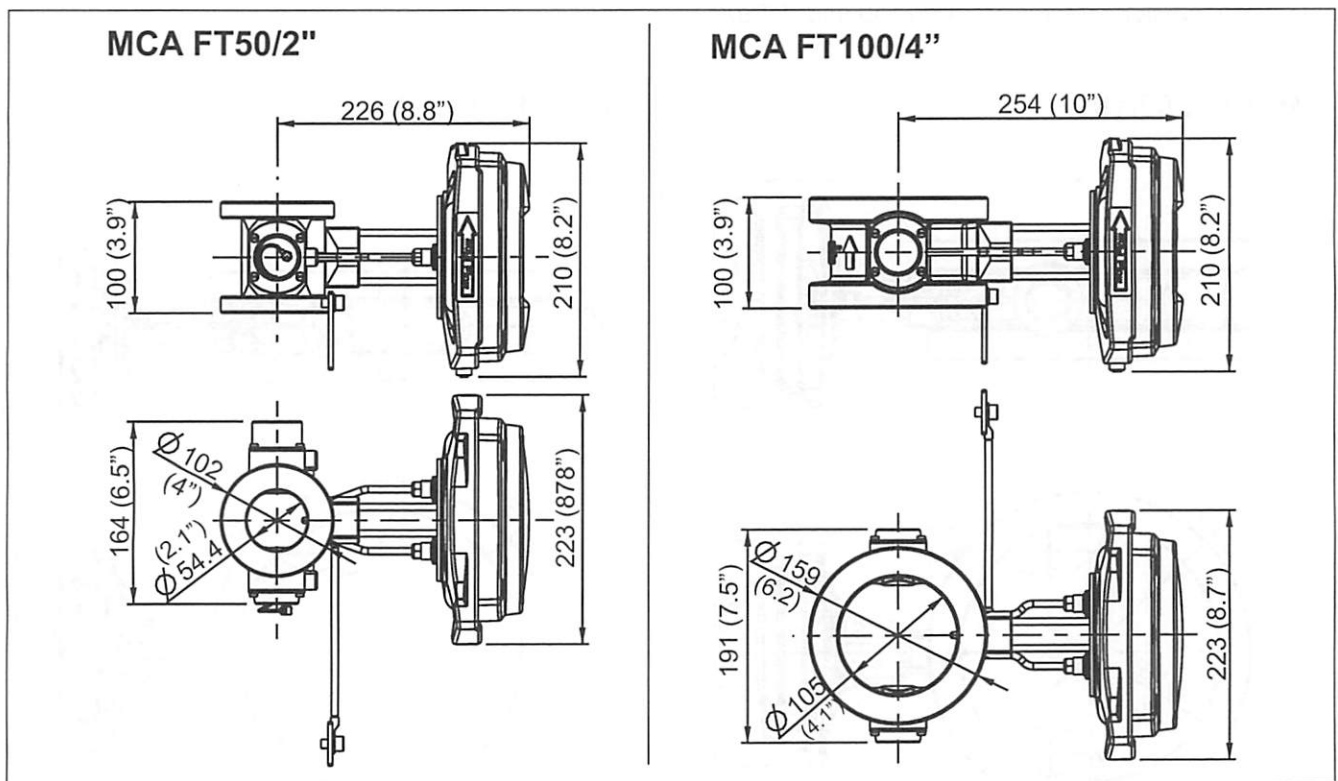


Fig. 8. Dimensions, Metso MCA-FT50 and -FT100.

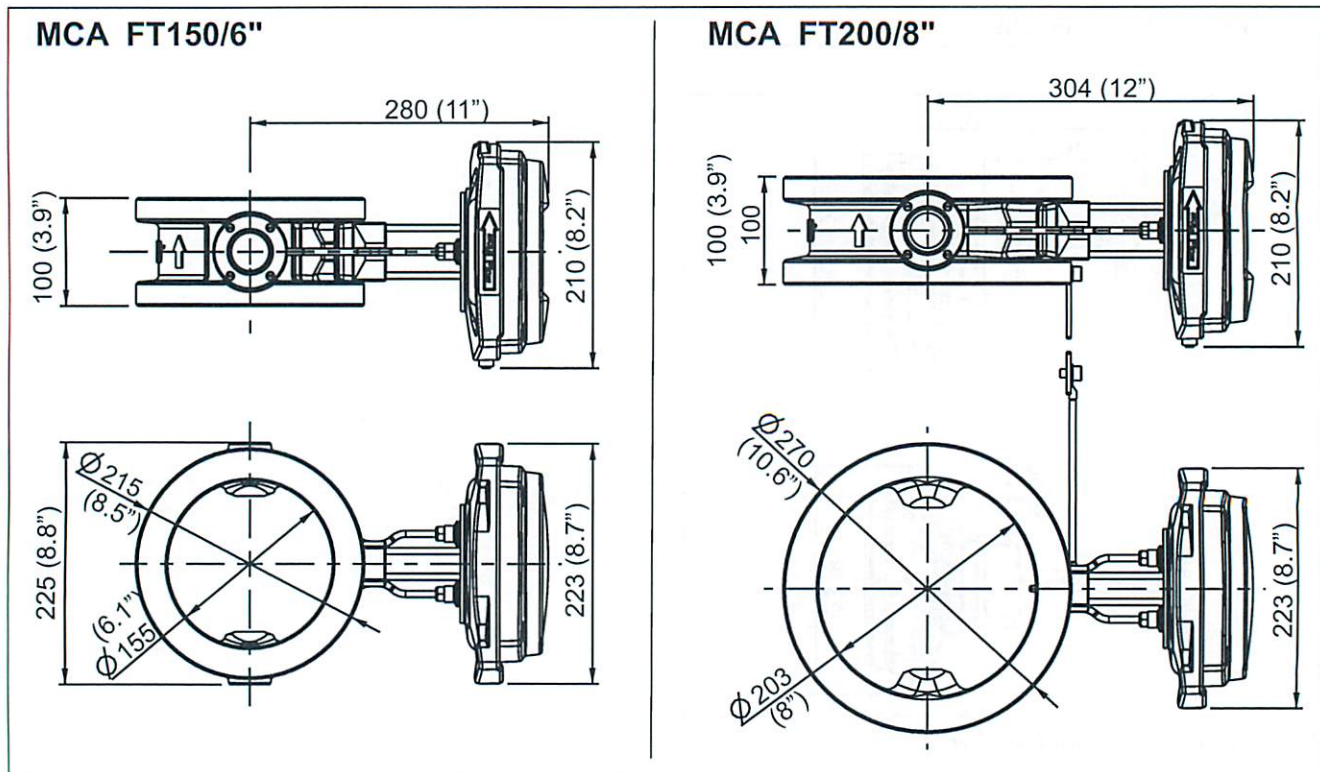


Fig. 9. Dimensions, Metso MCA-FT150 and -FT200.

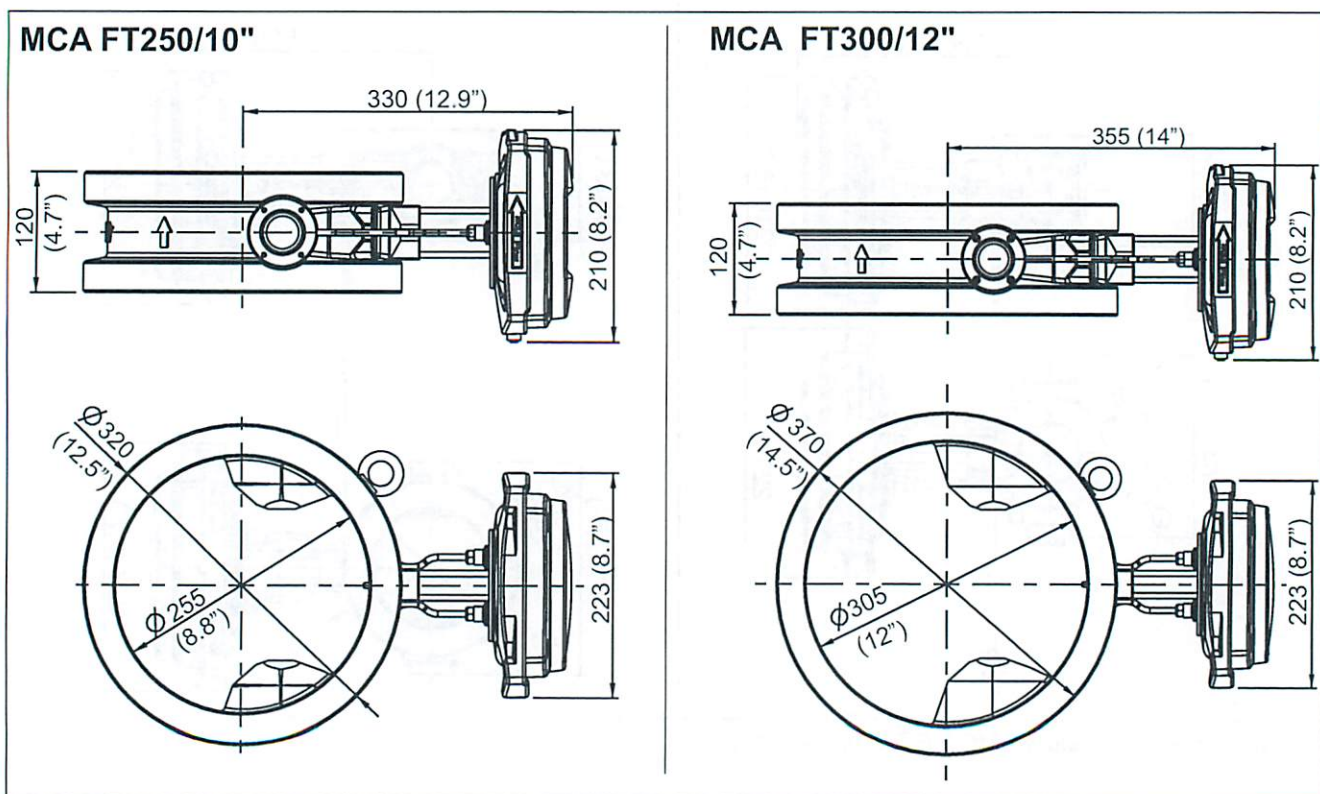


Fig. 10. Dimensions, Metso MCA-FT250 and -FT300.

3.4. Mounting dimensions

Metso MCA-F

The fork-type Metso MCA-F sensor is installed in a process coupling welded onto the side of the process pipe in such a way that the probe antenna is directed against the direction of the flow (Fig. 11). The sensor is loosely tightened into place with mounting clamps and then approximately aligned with the pipe based on the position of the electronics casing. After aligning, tighten the mounting clamps to their final tightness. The sticker on the electronics casing indicates the installation direction in relation to the direction of flow.

NOTE: The probe antenna on the end of the sensor is ceramic, so avoid denting it.

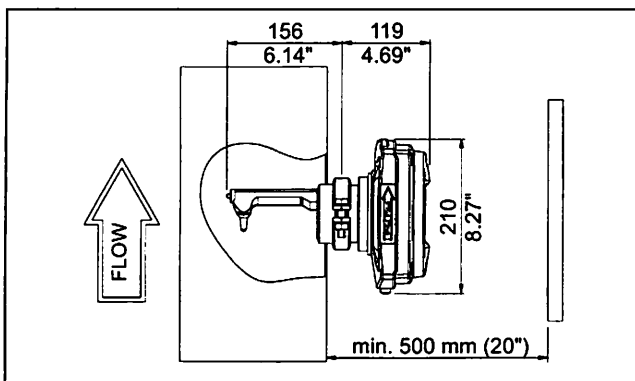


Fig. 11. Metso MCA-F Mounting dimensions.

Metso MCA-FT

When installed, the flow-through sensor replaces the corresponding length of process pipe (Fig. 12). The sticker on the electronics casing indicates the installation direction in relation to the direction of flow. The sensors do not include flanges, but rather they are tightened with stud bolts between flanges mounted on the process pipe.

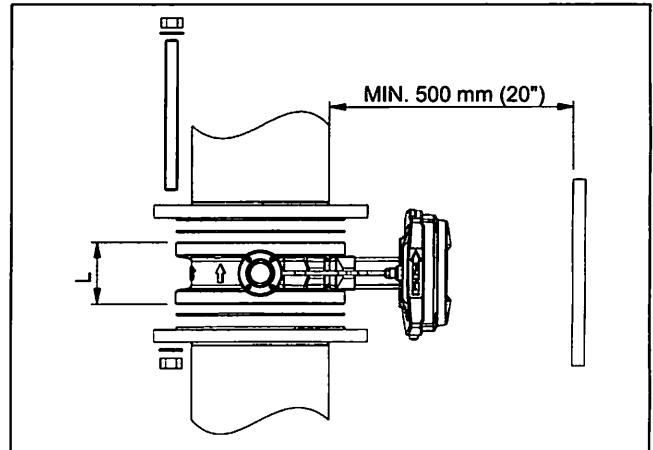


Fig. 12. Metso MCA-FT Mounting dimensions.

3.5. Transmitter Central Unit (TCU) and shield

The TCU is delivered attached to the shield. The shield is attached to the wall with three mounting screws in a place that is easily accessed.

When selecting a place for the TCU, remember that the sensor cable is 10 m long. Figure 13 shows shield mounting dimensions.

3.6. Electrical Connections

NOTE: When connecting the power supply cables, check that the cables are de-energized. Perform and check all connections before you connect the power supply to the cables.

NOTE: If the TCU has been switched off for a long time, it may take a few minutes for text to appear on the display. This is due to the charging of the device's internal back-up battery.

Sensor Cable

NOTE: In a normal delivery, the sensor cable is already connected to the TCU.

- 1. Insert the end of the sensor cable that has no connector into the TCU connector casing through the inlet and connect it as shown in Figure 15. The protective shields are connected as follows:
 - Twisted pair lines' intertwined protective shields (cable 3) are connected to adaptor GND together with cable 2.
 - The sensor cable's protective shield (cable 5) is connected to adaptor SC SHIELD (Sensor Cable Shield).
- 2. Bring the sensor cable to the sensor unit and connect its adaptor to the adaptor in the base plate of the sensor electronics.

NOTE: Do not place the sensor cable on cable shelves that contain cables of motors, pumps or other electrical cables.

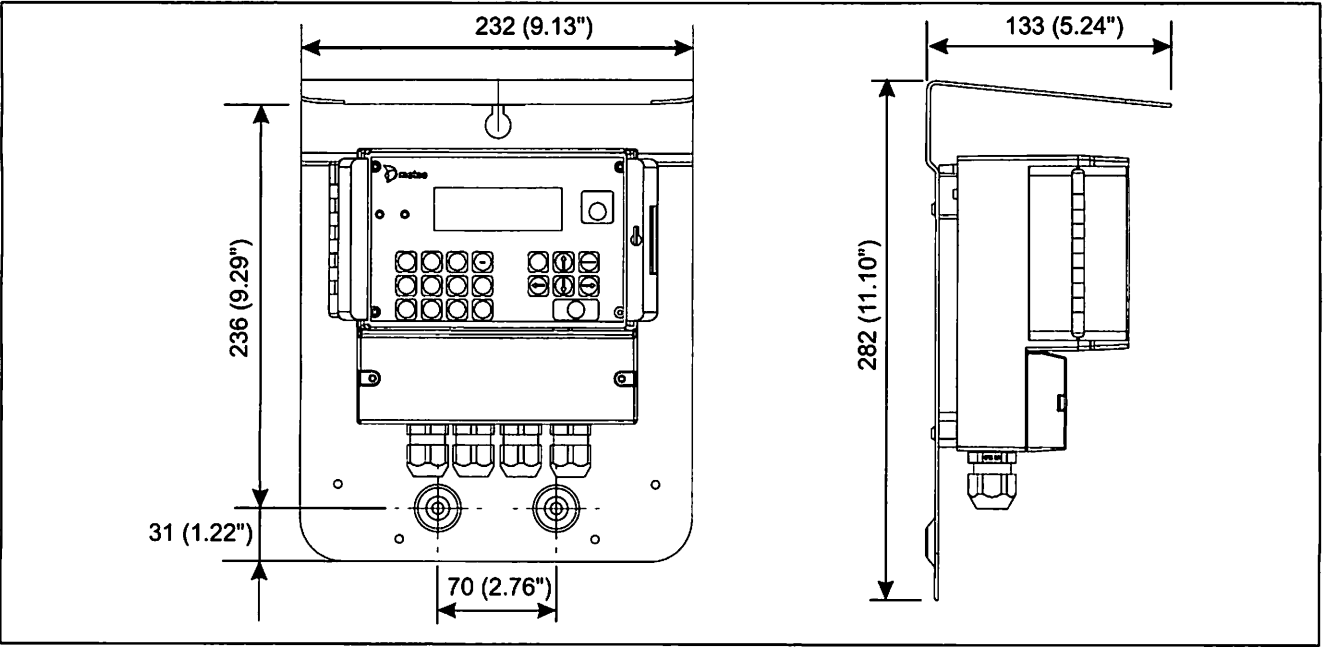


Fig. 13. TCU shield mounting dimensions.

Power Supply

Insert the power supply cable 90-260 VAC into the TCU connector casing through the inlet on the left edge and connect it to the terminal block as shown in Figure 15.

Current Signal Cables

Another current output has been added to TCU Rev B. VConsistency is hardwired in the current output 1 (CS+, CSIN). Process temperature ($^{\circ}\text{C}/^{\circ}\text{F}$) or process conductivity (mS/cm) can be chosen to the current output 2 (CS2+, CSIN2).

Insert the current signal cable into the TCU connect-
or casing through the inlet and connect to the terminal
block as shown in Figure 15:

- Connect the voltage supply line to connector CS+ or CS2+.
- Connect the current output line to connector CSIN or CSIN2.

NOTE: Metso MCA's current supply is passive and needs an external source of current. The minimum supply voltage is dependent on resistance.

NOTE: The current signal cable's protective shield must not be connected from TCU to the device in TCU Rev B. The connection is made only from the system! The cable's protective shield has been guided to be connected also to the connector 'SHIELD' in TCU Rev 0 and TCU Rev A.

Figure 14 shows resistance as a function of supply voltage. Resistance here means the sum of measurement resistance, cable resistance and power source resistance in the current loop.

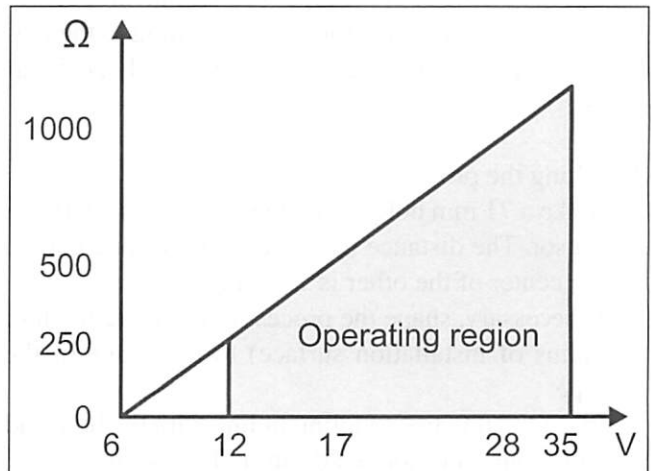


Fig. 14. TCU's Current output load capacity.

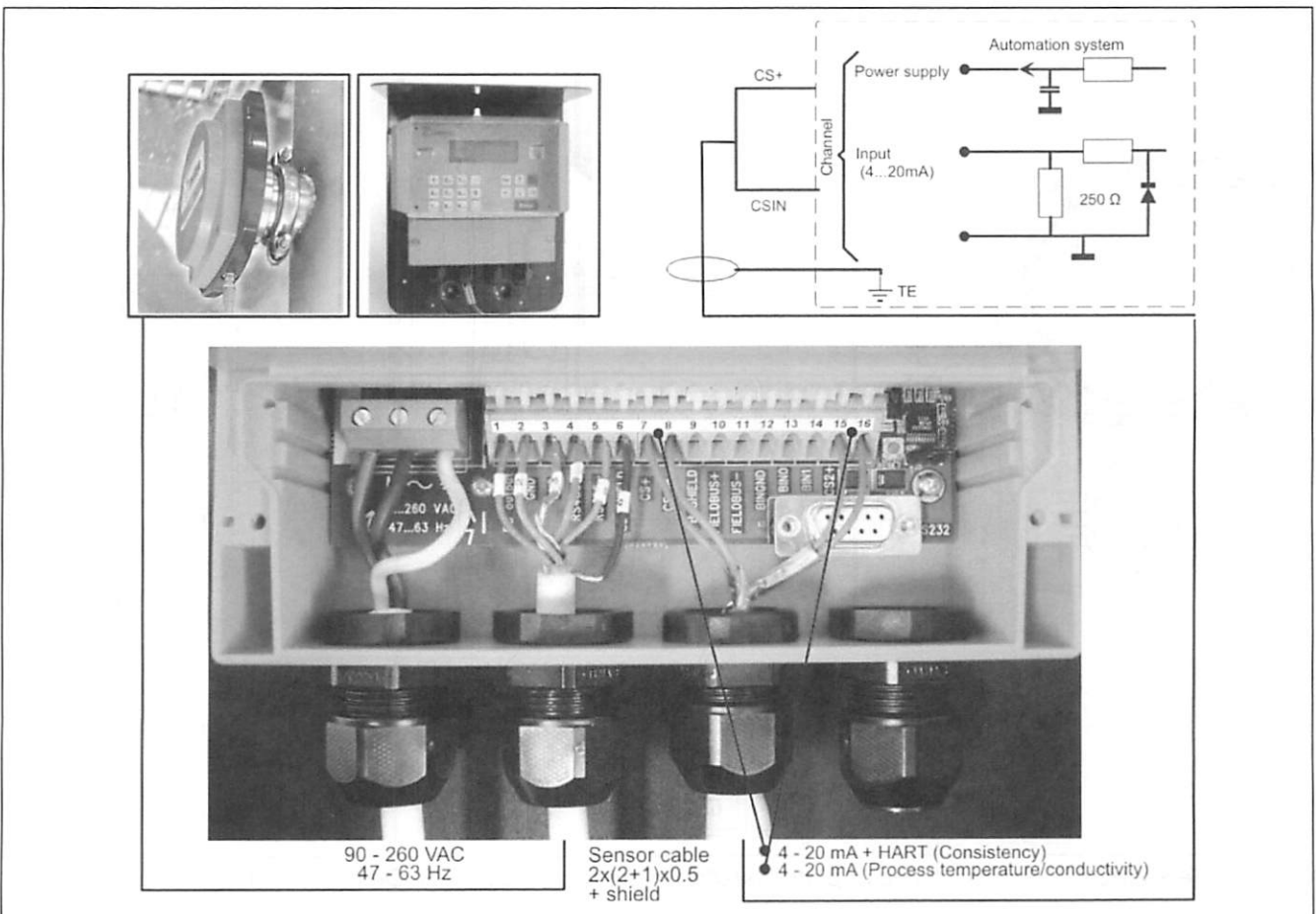


Fig. 15. Electrical connections to the TCU.

3.7. Metso MCA-F Sensor Deflector Plate Installation Guide

If the flow contains pieces of string, lumps, etc., the Metso MCA must be protected with a special deflector plate. Install the deflector plate at a distance of 170 mm before the sensor on a process unit welded in line with the sensor. After you install the process unit, position the deflector plate such that its lag side is toward the sensor.

Select the process unit according to the sensor material and the diameter of the pipe (see Technical specifications). Select the deflector plate according to the material of the sensor material (see Technical specifications).

Installing the process coupling:

- Make a 71 mm hole in the flow pipe in line with the sensor. The distance from the center of one hole to the center of the other is 170 mm.
- If necessary, shape the process coupling (curvature radius of installation surface) to the shape of the pipe.
- Place the process coupling in line with the hole and weld four adhesion welds around the seam.
- Weld a continuous weld around the seam.

Installing the deflector plate:

- Check that the sealing ring is in the groove of the flange.
- Set the deflector plate into the process coupling such that the plate curves toward the sensor.
- Put the mounting clamps, screws and nuts into place and tighten to a finger tightness.
- Point the plate toward the sensor with e.g. a monkey wrench.
- Tighten the mounting clamp screws.

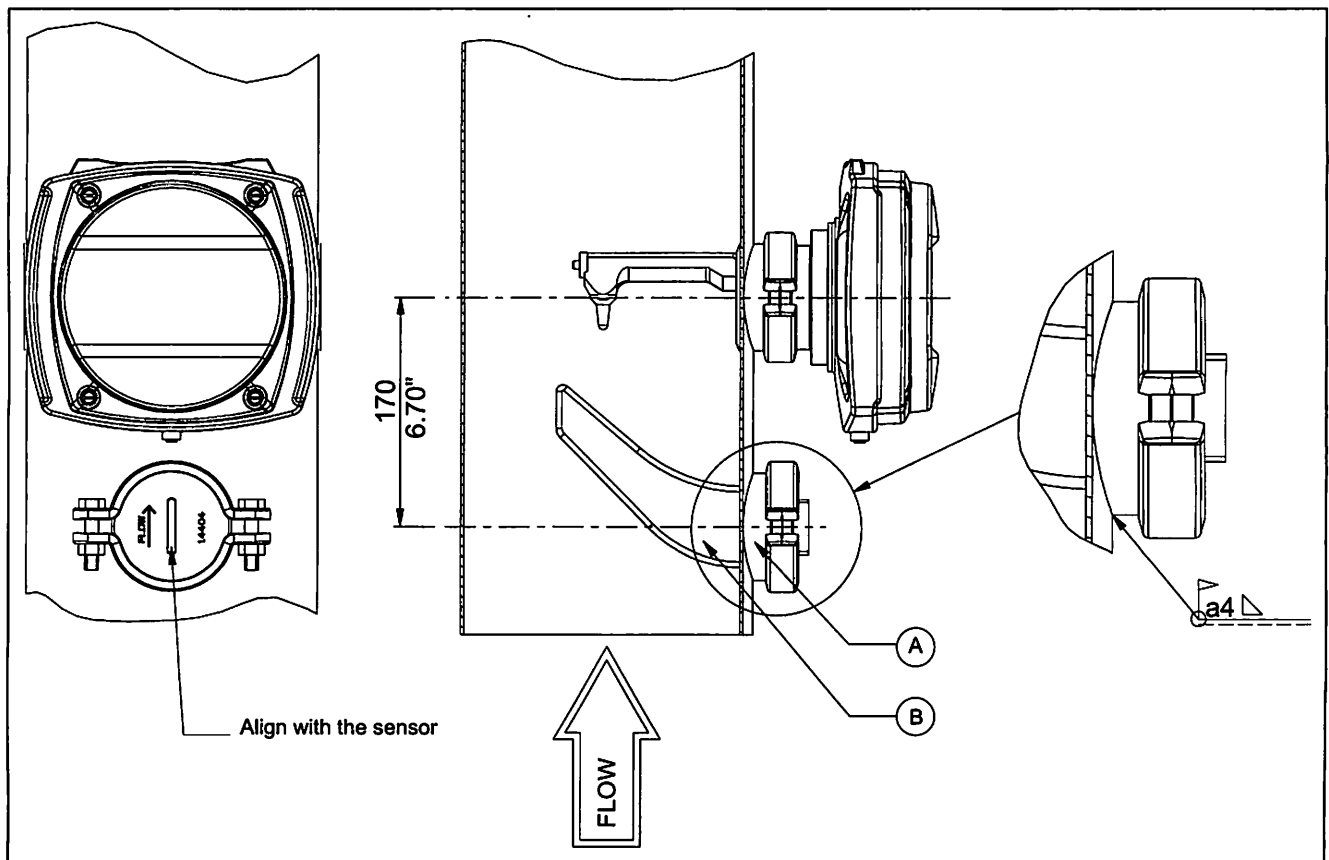


Fig. 16. Metso MCA-F Sensor deflector plate installation guide, A. Saddle, B. Deflector plate.

4. Setting Up

4.1. Mechanical Inspection

1. Check that the delivery content corresponds to what was ordered.
2. Check that the device was not damaged in transport.

4.2. Installation

Install the sensor and TCU according to the instructions in Chapter 3.

4.3. Cabling Inspection

1. Check that the power supply is connected correctly.
2. Check that the current output is connected correctly.
3. Check that the sensor cable is connected correctly.

4.4. Electrical Inspection

1. Connect the electronics to the power supply.
2. Check that text appears on the TCU display. Normally the main display appears, but in connection with replacing a device you may be asked to select calibration. In such a case, select calibration of the unit (Sensor Electronics/TCU) that was not changed.
3. Allow the device to warm up one hour before starting it up.

NOTE: If the TCU has been switched off for a long time, it may take a few minutes for text to appear on the display. This is due to the charging of the device's internal back-up battery.

4.5. Configuration and Calibration

1. Select the language and temperature unit (Celsius/Fahrenheit) according to Chapter 6.3.
2. Set the device date and time according to Chapter 6.5.
3. Scale the current output according to Chapter 6.2.
4. Calibrate the consistency according to Chapters 7.1 and 7.2.

After you have completed these procedures, Metso MCA is ready to measure consistency.

Notes

5. User Interface and Operation

5.1. Transmitter Central Unit

The operation unit of Metso MCA is the Transmitter Central Unit (TCU).

Number buttons: Use number keys to enter numerical data and choose menus. On certain displays you can also enter letters. To enter letters, press a number button several times in rapid succession and the letters on the button appear on the display one after another.

Sample: Use the Sample button to start and stop a calibration sample in the Calibration menu's Take calib. sample function. You can also use the Sample button in the main display to start and stop a monitoring sample.

Edit/Save: Use the Edit/Save button to go into Edit mode. When you are in Edit mode, use this button to save data.

ESC: Use the ESC button to exit Edit mode without saving data. You can also use the button to move between the main display and the function menu.

Enter: Use the Enter button to move between the main display and the Info display. In Edit mode, use the Enter key to jump to the next edit field.

Back arrow: Use the back arrow in an edit field to return to the previous character.

Forward arrow: Use the forward arrow in Edit mode to move to the next character.

Down arrow: Use the down arrow to scroll down if there are more than four lines. A downwards-pointing arrow in the lower right corner of the display indicates that you can scroll down. You can also use the down arrow to scroll between edit field options.

Up arrow: Use the up arrow to scroll up if there are more than four lines. An upwards-pointing arrow in the upper right corner of the display indicates that you can scroll up. You can also use the up arrow to scroll between edit field options.

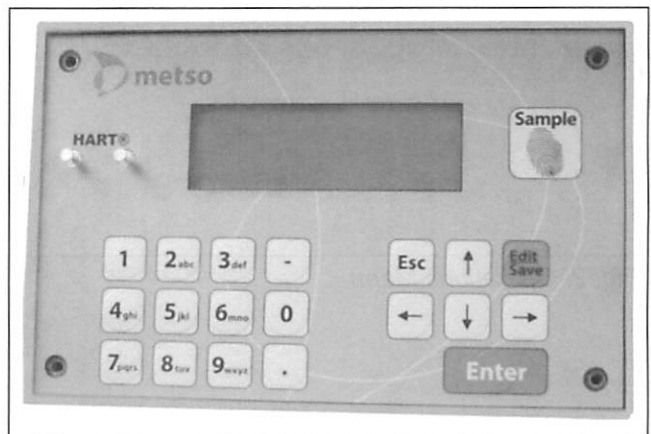


Fig. 1. TCU display.

5.2. Operations Menu

The operations menu is divided into the functions Calibration, Configuration, Diagnostics and Special Functions and their respective submenus.

Use the ESC button to access the function menu from the main display. In the menus, you can use the number of the desired function to continue.

Use the ESC button to return to the previous level. If the menu in view on the display has more than four lines, i.e. more than fits on the display at one time, an arrow appears in the upper or lower right corner of the display to indicate that you can scroll up or down with the up arrow or down arrow.

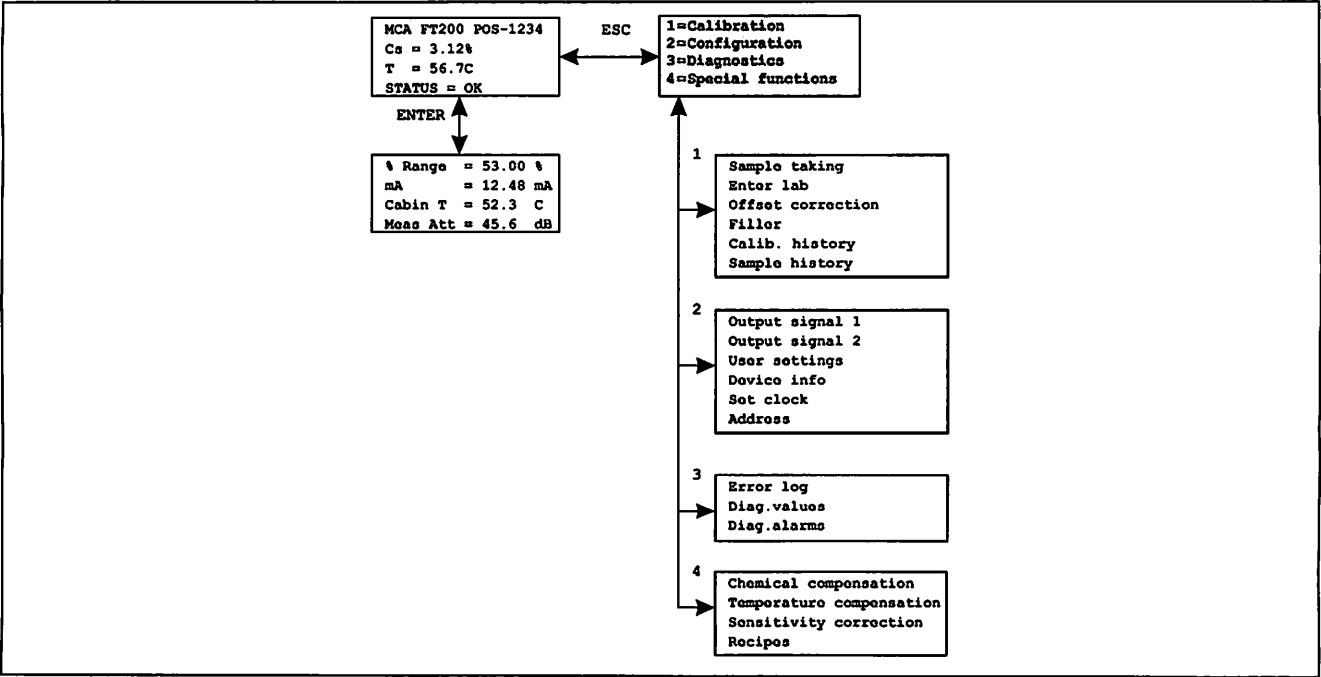


Fig. 2. Operations Menu

6. Configuration

6.1. Configuration menu

The configuration menu has the following functions:

```
1 = Output signal 1
2 = Output signal 2
3 = User settings
4 = Device info
5 = Set clock
6 = Address
```

6.2. Choosing and scaling the output signal

Press ESC button in the main display to move to Operations menu. Select 1 to configure consistency current output and you see the following display:

```
Lo (4mA) = 0.0 %Cs
Hi (20mA) = 10.0 %Cs
Damping = 1 s
Fault sig = 3.75 mA
```

Press the Edit button and enter values for the low and high consistency values. If you wish, you may also change the filtering time and behavior of the electricity source if self-diagnostics notes a fault state. Options for this include 3.75 mA, 22.5 mA and freezing.

Process temperature or process conductivity can be configured in the current output 2. Select 2 and you see the following display:

```
Selected variable:
Process temp
Lo (4 mA) = 0.00
Hi (20 mA) = 100.00
Damping = 1 s
Fault sig = 3.75 mA
```

Press EDIT/SAVE. Use the up arrow and down arrow buttons to make your selection and enter low and high values for the variable. Press EDIT/SAVE to save the selection.

6.3. User Settings

In the main display, push the ESC button to move to Operations menu. In the Operations menu, select Configuration/User settings. The following menu appears:

```
Trend Int : 10 MIN
Position : POS-1234
Language : ENGLISH
Temp unit : GEG C
Password : N
Act sigLev : ON
```

The display fits four rows at a time. Use the up arrow and down arrow buttons to scroll through all the lines. Press the EDIT button to perform the following:

Trend Int: The trend table sampling interval. Use the up arrow and down arrow buttons to change it.

Position: Sensor's mounting position. In this field you can use letters of the alphabet. To enter letters, press a number button several times in rapid succession and the letters on the button appear on the display one after another.

Language: Language selection. Use the up arrow and down arrow buttons to select the language.

Temp unit: Temperature unit °C/°F Use the up arrow and down arrow buttons to select the temperature unit.

Password: Password Yes/No. Use the up arrow and down arrow buttons to make your selection. If you select Yes, the program asks for a password when you move into Edit mode or if you intend to take a calibration sample. The password is 3121. As a default, password is not in use.

Act sigLev: Active signal level adjustment ON/OFF. Use the up arrow and down arrow buttons to make your selection. If you Select ON, program make measurement signal level adjustment automatically when it goes too low.

6.4. Device information

In the Configuration menu, select Device Info (3). The following menu appears:

1 = Sensor Electronics

2 = TCU

Select Sensor Electronics (1) to view sensor electronics information.

Type :

S/N :123456

HW Ver: 0001

SW Ver: 0001

S/N: Sensor electronics serial number.

HW Ver: Sensor electronics version number.

SW Ver: Sensor electronics software version number.

Select TCU (2) to view corresponding data for the TCU.

6.5. Setting the date and time

In the Configuration menu, select Set clock. The following menu appears:

Date 10.12.10

Time 12:14:53

Enter to accept

The date and time shown in this menu are used as a time stamp in the trend table and for calibration samples. The main display status line shows "Set clock" until you have set the time. Use the EDIT and SAVE buttons to edit and save date and time settings.

6.6. Address

Metso MCA's address on HART bus.

7. Calibration

The Metso MCA is delivered with factory calibration, which means that it will measure consistency as soon as you switch the power on. Factory calibration is performed on the device in connection with final testing using clean water.

We recommend that you calibrate the device again when setting it up. This allows the device settings to be optimized for the conditions in which it will be used. Perform calibration by taking a consistency sample and entering its laboratory value into Metso MCA. When you have performed this according to the instructions in the next chapters, the status line on the display will change from Factory Calibration to OK.

Calibration menu contains the following functions:

```
1 = Sample taking
2 = Enter lab
3 = Offset correction
4 = Filler
5 = Calib.history
6 = Sample history
```

7.1. Sample Taking

In the main display, press the ESC button to move to the Operations menu. Select Calibration/Sample taking.

Whenever a factory-calibrated device takes a sample, it adjusts the measurement signal to the optimal level before taking the sample. This may cause a small step-like change in the device's consistency measurement. For this reason, the device may not be kept on consistency control in this phase.

In addition, whenever a device that has been calibrated takes a sample, it checks whether the measurement signal level is within an acceptable area. If the signal level is outside the acceptable area, the device suggests that the signal level be adjusted. The signal level adjustment may cause a small step-like change in the consistency measurement. Therefore you must put consistency control on manual control if you allow the device to adjust the signal level. A change in chemical concentration may cause a need to adjust the signal level.

The sample-taking display is as follows:

```
Press sample-key to
start sampling.
Cs = 3.26 %
Status:WAITING
```

Press the Sample button on the right side of the display. The device begins averaging the measurement result and a message "Sampling" appears on the Status line. Go take a calibration sample, and then press the Sample button again. The device finishes averaging the measurement result and displays the result.

```
Sampling ready.
Average Cs= 3.26 %
Min= 3.20 Max= 3.33
T = 56.3 C
```

In addition to showing the consistency average, the device also shows the sampling period's minimum and maximum values as well as the process temperature. The minimum and maximum values indicate consistency fluctuation during the sampling period. This fluctuation should be small so that the consistency sample is reliable. The sample you take goes to the Enter Lab menu to await the laboratory value.

Press the ESC button to move back in the menus.

NOTE: If you press the Sample button when you are in a menu other than Take calib. sample, the device begins averaging the measurement results. A sample taken this way can not be used to calibrate the device. Rather, it is intended to be used to read the measurement result average over the desired period of time for monitoring purposes, for example.

7.2. Entering Laboratory Results

When you have determined the sample's laboratory consistency, press the ESC button to move from the main menu to the Operations menu. Select Calibration / Enter Lab, after which the following menu appears:

dd.mm.yy	hh:mm	
MCA	=00.00	%Cs
Lab	=00.00	%Cs
Filler	= 0.00	%Cs

The first row shows the sample's date and time in the following format: dd.mm.yy, hh:mm. The second row shows the consistency measured by Metso MCA. Press the Edit button to make the cursor appear in the Lab field. In the Lab field, enter the calibration sample's laboratory consistency. If the pulp contains fillers, enter in the fourth row in the Filler field the filler amount, which shows the proportional amount of filler as a percentage of the overall consistency. If the pulp does not contain filler, press the Save button to save your changes.

If you enter a value larger than zero in the Filler field, use the down arrow to move to the following lines. Enter the proportional amount of each filler component. If the filler consists, for example, entirely of kaolin, enter 100% as the value of kaolin.

Press the Save button to save your changes.

NOTE: The lines Chem, MCA con and Lab con are needed only for the chemicals compensation (chapter 9.1).

NOTE: The value for total filler sensitivity need only be entered with a 5 percentage point accuracy. The filler components can also be entered based on an estimate.

NOTE: The sum of the proportions must equal 100%.

After you press Save, the device calculates the filler sensitivity value in the Filler sens field in the bottom line. This is the factor by which the device adjusts the default sensitivity set for the wood fiber.

The laboratory value for the sample can be entered only once in the Enter Lab menu. If necessary, you can perform offset correction for the consistency calibration or change filler content as explained in the next chapters.

7.3. Offset Correction

If laboratory monitoring indicates that the Metso MCA measurement results are consistently overly high or low, you can correct this by performing offset correction on the calibration. To do so, press the ESC to move from the main display to the Operations menu. Select Calibration/ Offset correction, after which you see the following display:

Offset	=	0.00	%
Cum. offset	=	0.00	%

Press the Edit button to make the cursor appear in the Offset field. Enter the desired offset correction value. If, for example, Metso MCA shows a value that according to laboratory monitoring is 0.1% too high, enter an offset correction value of -0.1%. Press Save button to save your changes.

7.4. Fillers

In this menu you can enter Filler sensitivity changes, if the filler sensitivity of the measured mass changes considerably (>10%). Press the down arrow to scroll down the display one row at a time.

Filler	=	20.0	%
Kaolin	=	100.0	%
CaCO3	=	00.0	%
Talc	=	00.0	%
TiO2	=	00.0	%
Filler sens.	=	0.97	

Enter a new value for Filler amount in the Filler field and new values for the filler components in the respective fields. In the bottom row in the Filler sens field, the program calculates the change in sensitivity caused by filler components in proportion to the wood fiber sensitivity (wood fiber sensitivity = 1).

7.5. Calibration and sample history

Calibration history

Ten last calibration changes are stored in the calibration history table. To see the calibration history table, press the ESC button to move from the main display to Operations menu. In the Operations menu select Calibration/Calib. history. The following display appears:

```
10.12.10 12:10:48
Lab= 3.20 Cs= 3.00
Cum.offset=-00.00 %
T=47.4C att= 40.2 dB
```

The first row shows the calibration change's date and time in the following format: dd.mm.yy, hh:mm. If calibration was performed on a new sample, the second row shows the entered laboratory value (Lab) and the Metso MCA measurement result (Cs). If offset correction was performed, the second row shows the laboratory value (Lab) and the offset correction performed on it (Offs). The third row shows the cumulative change caused by offset correction. This value shows whether the calibration has continuously moved in one direction or if the change has been back and forth. The former case clearly indicates device drifting, while the latter case may be a question of a device error or of erroneous laboratory interpretation of the calibration sample and calibration performed based on that.

Sample History

The sample history table saves the 20 most recent calibration and monitoring samples. You can take a monitoring sample without performing calibration. To do so, press the Sample button when you are in the main display. (To perform calibration, you must access Take calib. sample menu.

You can also use the table as an aid if you wish to read Metso MCA values for a certain sample. To access the sample history table, select Calibration / Sample history in the Operations menu.

```
10.12.10 12:10:48
MCA= 3.00
att= 40.2 T=47.4C
...ENTER=for next
```

The first row shows the sample's date and time. The second and third rows show consistency measured by Metso MCA, the attenuation of the measurement signal, and process temperature.

Notes

8. Diagnostics

8.1. Error Table

In the Diagnostics menu, select Error table (1). If self-diagnostics has not detected any errors, the display shows "NO ERRORS". If self-diagnostics has detected errors, the first line of the display shows the timestamp when the error state began. The second row shows the timestamp when the error state ended. The third row shows the error type.

If the error state is still in effect, the ending timestamp is shown as '--'. The message 'Shutdown' in the place of the error state end time notifies, that the error state was on when the power was shut down. If the error state is still on when the power is switched on next time, the error is reported as a new error. The Error table shows the 10 most recent errors.

```
10.12.10 15:32:45
--.--.--.--
RLEV ALARM
...ENTER=for next
```

8.2. Diagnostics Values

In the Diagnostics menu, select Diag. Values (2). The following display appears:

```
Cab temp = 40.6 C
Proc temp = 42.0 C
Mlev      = 121 mV
Rlev      = 214.4 mV
Mstab     = 9.8
Rstab     = 2.1
El drift  = -2.4
VCO drift = 3.2
```

The display shows values for the following diagnostics measurements:

Cab temp: Sensor electronics temperature.

Proc temp: Process temperature.

Mlev: Measurement signal level.

Rlev: Reference channel signal level.

Mstab: Measurement channel signal stability.

Rstab: Reference channel signal stability.

El drift: Reference channel drift.

VCO drift: Signal generator drift.

Usage of this data for maintenance purposes is explained in more detail in Chapter 10, "Troubleshooting and Maintenance".

8.3. Diagnostics Limits

In the Diagnostics menu, select Diag. Limits (3). The following display appears:

```
Ctmp max = 90 /OFF
Ptmp max = 1000 /ON
Ptmp min = 0.0 /ON
M.Lev min = 10.0 /ON
R.Lev min = 100.0 /ON
Mstab max = 20.0 /ON
Rstab max = 2.0 /ON
Eldr abs = 80.0 /ON
VCOdr abs = 50.0 /ON
```

The display shows the error limit for each diagnostics measurement as well as its effect on the current signal (ON/OFF). If necessary, you can change these as follows: press the EDIT button and then enter a new error limit, or use the up arrow and down arrow buttons to change the ON/OFF setting.

Even if the effect of the limit on the current signal is blocked by an OFF setting, an error message still appears on the main display status line and error data is entered into the error table.

Notes

9. Special Functions

The Special Functions menu contains the following functions:

1	=	Chemical comp
2	=	Temperature comp
3	=	Sensitivity corr
4	=	Recipes

9.1. Chemical compensation

Large fluctuations in chemical content may cause errors in Metso MCA consistency measurements. These errors can be compensated for with chemical compensation based on microwave damping measurement.

You can use chemical compensation as described in the following two sections.

Entering Laboratory Values

1. Take a sample as described in section 7.1.
2. Determine the sample's consistency and its filtrate conductivity at room temperature.
3. Go to the menu Enter Lab.
4. Press the Edit button, and enter the laboratory consistency and filler information. Press the Enter button to scroll the display down after the last line.
5. Select the chemical type with the up and down arrow buttons. Enter the sample's conductivity in units mS/cm.

Sample	12.08-04
MCA	= 3.00 %Cs
Lab	= 0.00 %Cs
Filler	= 0 %
Kaolin	= 0 %
CaCO ₃	= 0 %
Talc	= 0 %
TiO ₂	= 0 %
Chem	= NaOH
MCA con	= 2.40 mS/cm
Lab con	= 0.00 mS/cm
Filler sens	= 1.00

If the conductivity meter shows results in units mS/m, divide the result by 100, e.g. 550 mS/m = 5.5 mS/cm.

If the conductivity meter shows results in units μ S/cm, divide the result by 1000, e.g. 5500 μ S/cm = 5.5 mS/cm.

If the conductivity meter shows results in units μ mho/in, divide the result by 2500, e.g. 25 000 μ mho/in = 10 mS/cm.

Using Chemical Compensation

After you enter the laboratory values, go to Special Functions menu and select 1 (Chemical Compensation). The following display appears:

Chem.comp	=	OFF
Comp. value	=	0.00 %
MCA con	=	0.00 mS/cm
Chem	=	NaOH
Lab cond	=	3.4 mS/cm

Press the Edit button to make the cursor appear in the Chemical Compensation field. The OFF text indicates that chemical compensation is not in use. Use the up and down arrows to change the text from OFF to ON. Press Save, after which MCA begins using chemical compensation.

The second line Comp. Value shows the chemical compensation value, or the value that chemical compensation subtracts from the measurement result. The third and fourth lines show the chemical and laboratory conductivity values entered by the user.

Temperature compensation correction curve

Metso MCA compensates for the effect of temperature on the measurement based on Pt-100 sensor measurement results. If, however, temperature dependency still exists in the measurement result, it can be eliminated by using the temperature compensation correction function. The temperature dependency must first be determined via laboratory monitoring. To ensure that the temperature dependency is accurately defined, the temperature area must be sufficiently broad.

The results of the laboratory monitoring are shown on an MCA Laboratory vs. Temperature graph. MCA - Lab graph points that are horizontal indicate that there is no temperature dependency in the measurement results. If the graph points are in a horizontal position at a level other than zero, you must perform offset correction on the calibration as explained in chapter 7.3.

MCA - Lab graph points that are in a position other than the horizontal indicate that there is temperature dependency in the measurement (figure 1). Temperature dependency is eliminated by entering into MCA the temperature compensation correction curve. To go to the Temperature Compensation menu, Select Special Functions/Temperature Comp. The following display appears:

	Temp.	MCA-Lab
1.	42.0	0.00
2.	48.1	0.10
3.	00.0	0.00
4.	00.0	0.00
5.	00.0	0.00
6.	00.0	0.00

Press the Edit button. Then enter the correction curve as pairs of points. Metso MCA then performs the correction based on lines drawn through these points. You can enter up to six pairs of points. In the example in Figure 1, two pairs of points are sufficient. The pairs of points can be selected based on the results as in the following example:

	Temp		MCA-Lab
1.	42.0	C	0.00 %
2.	48.1	C	0.10 %
3.	00.0	C	0.00 %
4.	00.0	C	0.00 %
5.	00.0	C	0.00 %
6.	00.0	C	0.00 %

Compensation is also successful outside the defined interval such that the compensation curve is continued beyond the outermost points using the same slope.

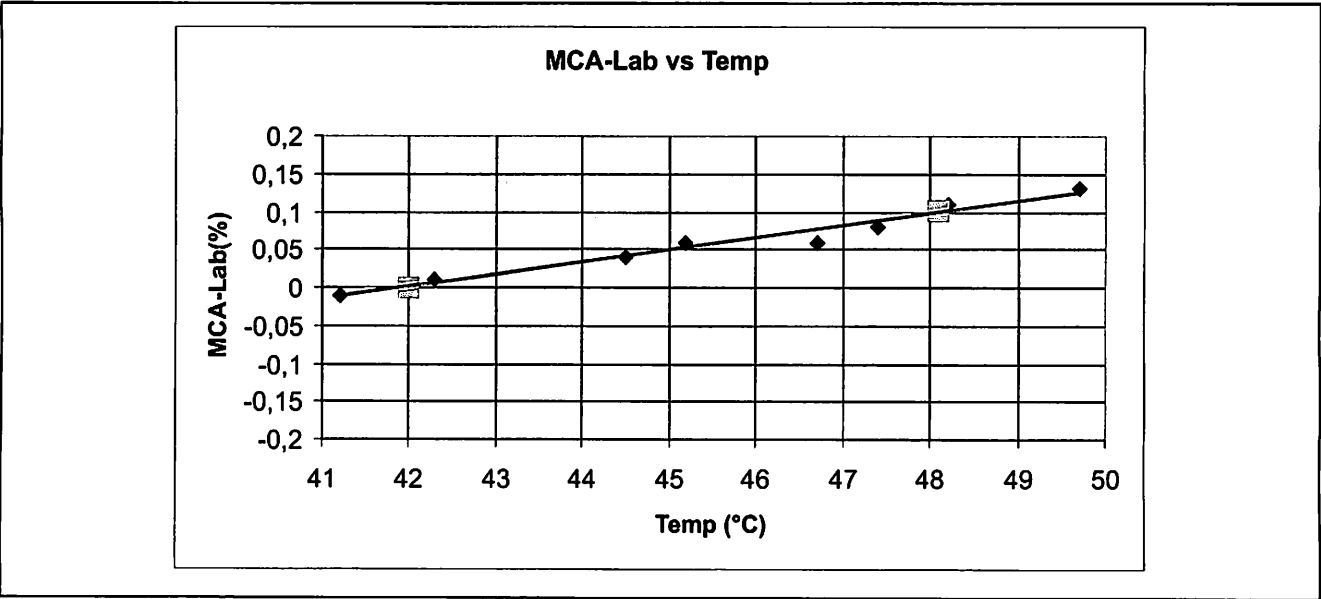


Fig. 1. Determination of temperature dependence.

The effect of a new consistency calibration

If a new consistency calibration is performed on Metso MCA by taking a new sample after temperature consistency correction is determined, the measurement program performs a level adjustment on the compensation curve.

In the level adjustment the program sets the value of the compensation curve to zero in the calibration temperature, i.e. the effect of the compensation curve is zero at the calibration temperature. If for example you performed a new consistency calibration with a sample that has a temperature of 45 °C, the program would perform a level adjustment of -0.05% on the compensation curve and the compensation curve would appear as follows.

Temp.	MCA-Lab
1. 42.0	-0.05
2. 48.1	0.05

Changing the correction

If after the correction there is still some amount of temperature dependency evident, you can most easily perform the correction by editing the existing points. In this case the size of the desired correction is added to existing correction values.

If, for example, after the temperature compensation performed above and the new consistency calibration the results appeared as shown in Figure 2. The correction value for 42°C would be increased by 0.03% and the correction value for 48.1°C would be decreased by 0.02 %, after which the correction would appear as follows:

Temp	MCA-Lab	
1. 42.0	C -0.02	%
2. 48.1	C 0.03	%

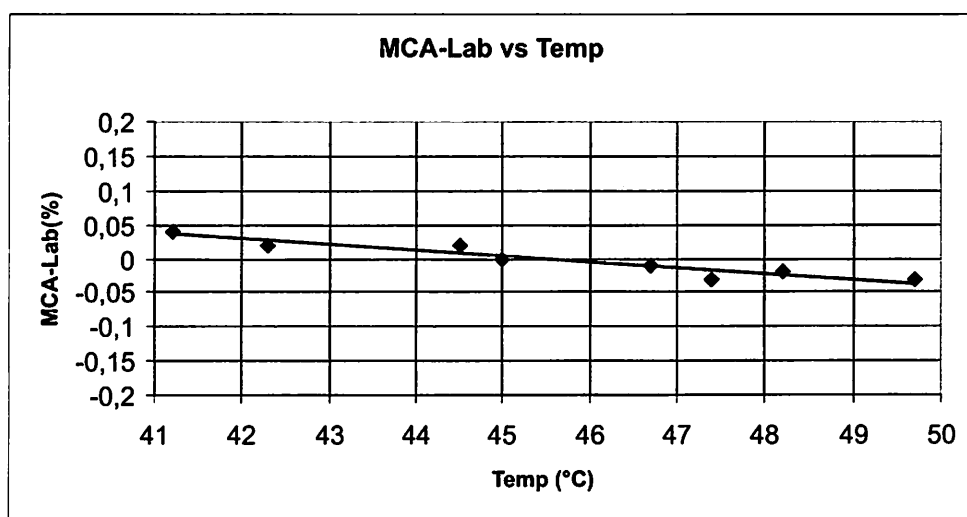


Fig. 2. Results of new consistency calibration.

9.2. Sensitivity Correction

The sensitivity of Metso MCA consistency measurement is set according to the wood fiber. If the device measures something else, the sensitivity may have to be changed.

If the sensitivity of the measured material is previously unknown, the sensitivity must be determined based on laboratory analysis. The lab results must be from a sufficiently broad consistency area in order for the sensitivity to be accurately determined. The results of the analysis are plotted on the graph MCA vs. Laboratory consistency, in which MCA is on the vertical axis and laboratory consistency is on the horizontal axis. The slope of the points on the graph is calculated and it represents the MCA consistency measurement sensitivity.

In the sample MCA vs. Lab graph in Figure 3 a linear regression curve is plotted for the points. The slope of the curve equation indicates the measurement sensitivity, which is 0.89.

To go to the Sensitivity Correction menu, select Special Functions/Sensitivity Corr. The following display appears:

Input new sens.
correction = 1.00

Press the Edit button and enter the sensitivity value you determined for sensitivity correction. Press the Save button to save the new value.

If you have to perform the sensitivity correction a second time for some reason, you have to take into account the existing sensitivity correction. This is done by multiplying the new defined sensitivity by the existing sensitivity coefficient and entering this result for the new sensitivity coefficient value. For example, if the sensitivity is defined again to be 0.9 after the correction of the previous example the new sensitivity coefficient is calculated: $0.9 \times 0.89 = 0.8$. If you want to cancel the sensitivity correction, write 1 for the sensitivity coefficient value.

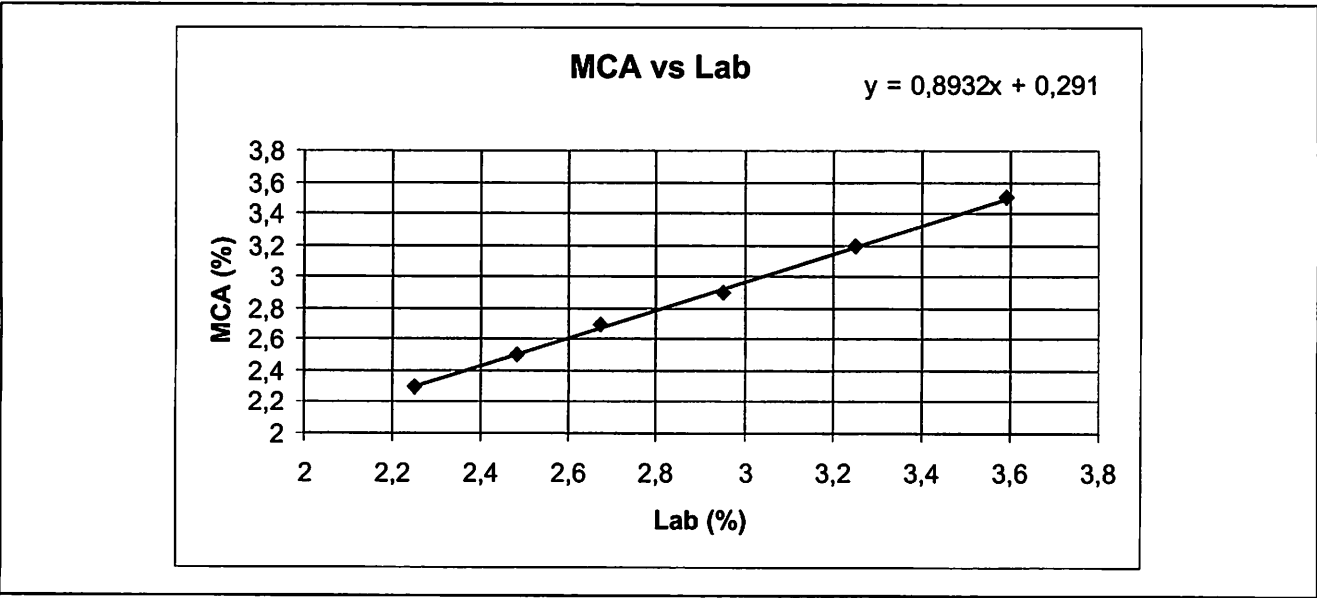


Fig. 3. Calculating MCA measurement sensitivity.

9.3. Recipes

The Recipe function may be necessary in special functions in which measurement conditions change so much that one calibration cannot cover it. Such a change may be e.g.

- A change in consistency greater than the device measurement range (± 9 - $\pm 15\%$ depending on the type of sensor),
- A change in the measured material, since different materials have different consistency sensitivity or
- A large chemical fluctuation (e.g. change of chemical type) that cannot be compensated for with chemical compensation.

In these cases, each process condition has its own calibration and configuration performed. This calibration and configuration is saved as its own recipe. In addition to consistency calibration, for each recipe you can set chemical compensation, temperature consistency correction, sensitivity correction, and current output scaling.

You can save a maximum of four recipes. If a recipe is in use, MCA indicates this by showing the name of the recipe on the main display status line instead of the OK text that is normally shown.

In Special Functions menu, select 4 (Recipes). The following display appears:

```
1=Choose recipe
2=Clear recipe
```

Using Recipes

You can select a recipe either manually using the keypad or with a binary control lines attached to the TCU. In Recipes menu, select 1 (Select recipe). The following display appears:

```
Select rec: OFF
1.-----000000
2.-----000000
3.-----000000
4.-----000000
```

Press the Edit button to make the cursor appear in the Select field in the first row. Use the up and down arrows to select the desired recipe number (1-4) or the 'Binary' selection method. If you select 'Binary', then the recipe is determined by the TCU binary inputs Bin0 and Bin1 (refer to section 9.4 subsection Selecting the Recipe with Binary Inputs).

You may name the recipe if you wish as follows. Move the cursor to the desired recipe and write the name. Successive pressing on the number keys scrolls through the letters marked on the key. If you do not name the recipe, then the program gives it a default name (RES01, etc.).

Press Save to save the recipe selection and recipe name. The date (ddmmyy) after the recipe name indicates the most recent calibration change. The text 'ON' after the date indicates that the recipe in question is in use.

```
Select rec: 1
1.REC01---150405 ON
2.-----000000
3.-----000000
4.-----000000
```

When process conditions change such that you need a new recipe, select the new recipe either manually or based on binary input according to the instructions above.

```
Select: BIN
1.REC01---150405 ON
2.REC02---220405
3.-----000000
4.-----000000
```

The program saves the recipe calibration as for the previous recipe. The date 000000 indicates that the new recipe is not calibrated with its own sample. Perform calibration with a new sample according to the instructions in section 7. After calibration, the date 000000 changes to the calibration date.

If necessary, scale the current output according to the instructions in section 6.2 and configure the special functions according to the instructions in chapter 9. Configure recipes 3 and 4 in the same way.

Clearing the Recipe

If you wish to empty the recipe, go to Recipe menu and press 2 (Clear Recipe). The following display appears.

Clear recipe: 1

Press the Edit button and use the up and down arrow buttons to select the desired recipe. Press the Save button, after which the program asks you to confirm your selection.

This action will
clear recipe 1
ENTER=Clear
ESC=Cancel

Press Enter to clear the recipe.

Note: You cannot empty the recipe that is currently in use.

Selecting the Recipe with Binary Inputs

The recipe can be selected using two digital control lines connected to the TCU connector casing. In this case, you can use up to four recipes. If only one binary input is in use, you can use two recipes.

Select 'Binary' as the recipe selection method according to the instructions in section Using Recipes.

Select: BIN
1.REC01---150405 ON
2.REC02---220405
3.-----000000
4.-----000000

Connect e.g. the automation system's digital control lines to the connector casing binary inputs BIN0 and BIN1. Connect the grounded line to BINGND. Select the recipe with the digital control lines according to the following table. The text 'ON' next to the recipe number indicates which recipe is selected.

BIN0	BIN1	Recipe
0	0	1
1	0	2
0	1	3
1	1	4

10. Troubleshooting

NOTE: Before disconnecting the sensor or the flow-through antenna, check that the process pipe is empty and unpressurized and that disconnection is safe.

Metso MCA does not require scheduled maintenance. The instructions in this chapter refer to fault conditions.

10.1. Troubleshooting

Metso MCA's self-diagnostics monitors certain internal measurements and generates error messages if the measurements exceed alarm limits. Self-diagnostics also detects definite faults, which are often caused by sensor electronics.

An erroneous measurement result may also be due to antenna leakage, contamination, a fault in the antenna cable, or a process variable that is skewing the measurement. Self-diagnostics may not detect such a fault.

The fault may also be in the current output sent by the TCU. In this case, the measurement is correct, but the current output sent to the automation system is incorrect.

The following figure 1 contains a troubleshooting chart for faults that appear in different ways.

10.2. Process Conditions

• Air

Air in the pulp is seen in measurements as an excess in consistency. Air exists as bubbles of different sizes. Small bubbles dissolve in water at pressure of approximately 1.5 bar, but large bubbles may disturb processes even at pressures higher than that. At most, the error caused by air may be in the range of several percentage points (percentage of consistency). Air causes disturbances to the process itself, so the formation of air bubbles should be avoided.

Air formation mechanisms

- Air is mixed with pulp, for example, when it is dropped into the stock tank. If the level in the stock tank is low, if the point of impact is near the pump, or if the flow-through time in the tank is low, then air is not able to escape properly from the pulp before the pulp is forced into a departing flow. The best way to put pulp in the tank is to run the input pipe under the level of pulp in the tank.
- In addition, a strong stirring at a low surface level can cause a whirl that causes air to be mixed into the pulp.
- Air may also become mixed into the pulp through a leaking joint on the pump's intake side.
- The dilution water may also contain air and cause air bubbles in the pulp.
- Air can build up in bends in dilution or pulp pipes if the bends are at the highest spot in the production line. In such cases, an air pocket is formed and continues to grow in a bend in a pipe. When the air pocket is large enough, it begins moving with the flow in the pipe. An air mass such as this may cause a momentary error in consistency measurements.
- Air may be generated in the pulp through foaming caused by chemicals as well.

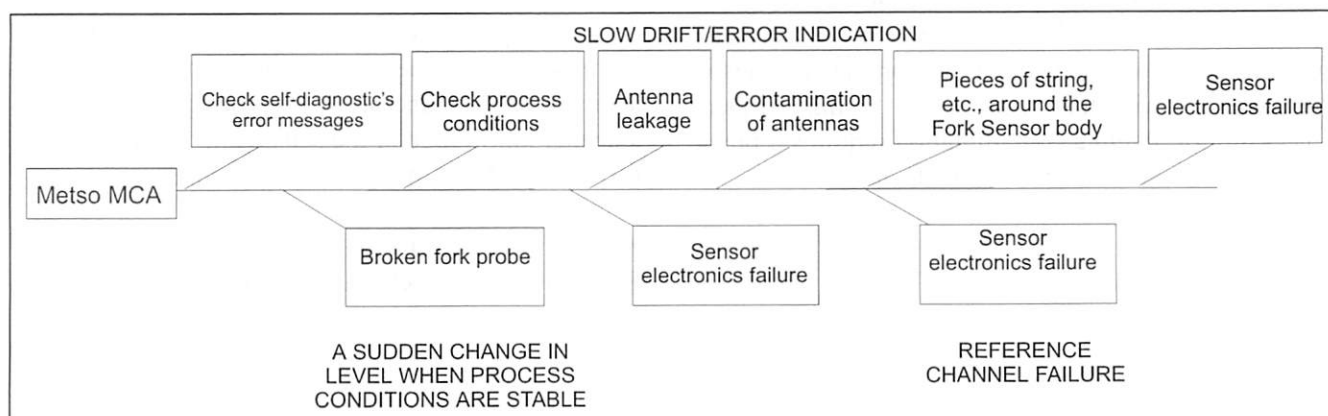


Fig. 1. Troubleshooting chart.

- Chemicals

Chemicals in the pulp weaken the measurement signal. Therefore, a maximum conductivity limit has been defined for each sensor type. If conductivity exceeds this limit, the measurement signal becomes too small and the measurement result contains noise and errors. A large overshoot in conductivity can cause the measurement signal to disappear altogether. Fluctuations in the chemical concentration may also cause small errors within the conductivity specification limits.

You can eliminate these errors by using MCA chemical compensation (See Chapter 9 Special Functions).

- Temperature

Temperature affects consistency measurement, which MCA compensates for with its own temperature measurement. If the measurement is nonetheless noted to be temperature-dependent, it can be eliminated with the help of temperature compensation (See Chapter 9 Special Functions).

- Antenna Leakage

Antenna Leakage causes a measurement error, which appears as a slow upward or downward drift. In case of leakage, you must change the antenna and the antenna cable as well because the cable may also have gotten wet.

In FT sensor models, a clear case of leakage can be detected by removing the antenna cover and checking whether water drips from between the antenna and the connector that is connected to it.

In the Fork Sensor, a clear case of leakage can be detected by removing the sensor electronics and checking whether water has accumulated in the connecting pipe.

- Antenna Contamination

Antenna Contamination causes an upward drift in the measurement. If the antenna is cleaned periodically, e.g. as a result of being washed or changing the wood species, then the error disappears. The antenna is made of polished ceramic, so contamination may be caused by some material that is adhering to this surface. Checking for antenna contamination requires a break in the process and removal of the device.

- Pieces of string, etc. wrapped around Fork Sensor body

The Fork Sensor is inserted into the pipe, and therefore it is not recommended to install it in a position in which the pulp may contain strings or other such *materials*, which could become wrapped around the Fork Sensor. If these materials do become wrapped around the sensor body, the measurement drifts upwards. The speed of the drift is directly dependent on how rapidly these materials build up around the sensor and it can even be very rapid.

Checking the Fork Sensor requires it to be removed from its process coupling.

- Broken Fork probe

The Fork Sensor is inserted into the pipe, and therefore it is not recommended to install it in a position in which the pulp may contain stones or other such materials, which can damage the ceramic antenna shield at the end of the sensor body. In order to become broken, ceramic requires a powerful blow. In such cases, the fault appears as a rapid level change upwards or downwards in the measurement, followed by drifting.

Checking for a broken fork probe requires that the sensor be removed from its process coupling.

- Sensor Electronics Failure

A typical electronics failure appears as a rapid level change in the measurement and as a rapid reduction in signal level after some component breaks. A reference channel failure indicates that the fault is in the sensor electronics. Self-diagnostics includes an alarm limit for the reference channel signal level, which detects obvious cases of broken components.

If all the aforementioned possibilities can be eliminated, then small errors or drifting in the measurement might be caused by sensor electronics. In such a case, all the self-diagnostics measurements might be within allowed limits due to which self-diagnostics does not detect the error.

To locate the error, it might help to analyze the device's internal trend and sample history table and compare these to the error results if such error data is available (e.g. in laboratory monitoring). This requires a deeper knowledge of the sensor and is typically performed by Metso maintenance personnel.

- Reference Channel Failure

Refer to Sensor Electronics Failure.

10.3. Self-diagnostics error messages

Self-diagnostics monitors the signal of the measurement channel measuring the process and the signal of device's internal reference channel. Self-diagnostics is capable of detecting clear fault states, in which case it generates an alarm by freezing the current signal or setting it to 3.75 or 22.5 mA, according to user specifications.

If, however, the fault is not a clear device fault but rather measurement drifting, then self-diagnostics may not necessarily be able to detect it. In such cases, comparing self-diagnostics measurements with device drifting and seeking correlations between these may help in locating the source of the error.

Cab temp: Shows sensor electronics temperature. A continuously high temperature reduces the average fault interval. If the electronics temperature is continuously over 75 degrees C, then it is recommended to install the Vortex cooler in the sensor base plate. Refer to chapter 11.7 for more information.

Mlev: Shows the measurement signal level in millivolts. A decrease in measurement signal level below the alarm level may be caused by an electronics failure, antenna leakage, or high conductivity of the measured pulp. If it is an electronics failure, then the reference channel signal level Rlev is usually decreased to below alarm limits.

Rlev: Shows the device's internal reference channel's signal level in millivolts. A decrease in the signal level to below alarm limits is always caused by a sensor electronics failure.

Mstab: Mstab shows the stability of the measurement channel signal. Stability reflects the effect of both electronics and the measured pulp. Assuming that the electronics are in order (see Rstab), you can determine based on the Mstab value whether or not the process contains large air bubbles that are causing measurement errors. Large air bubbles cause both a rise in the Mstab value as well as a temporary error in consistency measurement. The level of the Mstab value is also affected by consistency and sensor model. Fork Sensor typically has a slightly higher Mstab value than FT Sensor. Also, Mstab value is higher at a higher consistency than at a lower consistency.

Rstab: Rstab shows the stability of the device's reference channel signal. The smaller the value, the more stable the signal. An Rstab alarm is caused by sensor electronic failure.

El drift: El drift value shows the drift in electronic delay measured by the reference channel. This value is compensated out of the measurement channel result, so electronic drift does not cause an error in the measurement result. An El drift alarm is caused by sensor electronic failure.

VCO drift: VCO drift shows the drift in sensor electronics signal generator. A VCO drift alarm is caused by sensor electronic failure.

Notes

11. Replacing Components

11.1. Sensor Electronics

Removal (Fig. 1)

1. Disconnect the electricity by separating the sensor cable from the connector at the edge of the base plate.
2. Remove the electronics protective cover.
3. Disconnect the sensor cable and Pt-100 sensor connectors from the electronics and bend them to the side.
4. Loosen the three mounting screws and lift the sensor electronics evenly out of its position by pulling on the mounting screws.

NOTE: Sensor electronics is aligned into place by three guide pins, which keep it in place even when the mounting screws are loosened.

Installation:

1. Align the groove in the edge of the electronics with the connector on the edge of the base plate. Move the electronics and press gently until the guide pins on the base plate are aligned with the holes on the base of the electronics. Then press the electronic evenly onto the base plate.
2. Screw in the three sensor electronics mounting screws.
3. Connect the sensor cable and Pt-100 sensor connectors to the electronics.
4. Place the sensor cover into position.
5. Connect the sensor cable to its connector at the edge of the base plate.
6. If after the electricity is switched on MCA asks you to choose calibration, choose as follows;
 - TCU: if you did not replace the TCU.
 - Default calibration: if you have replaced the TCU as well.

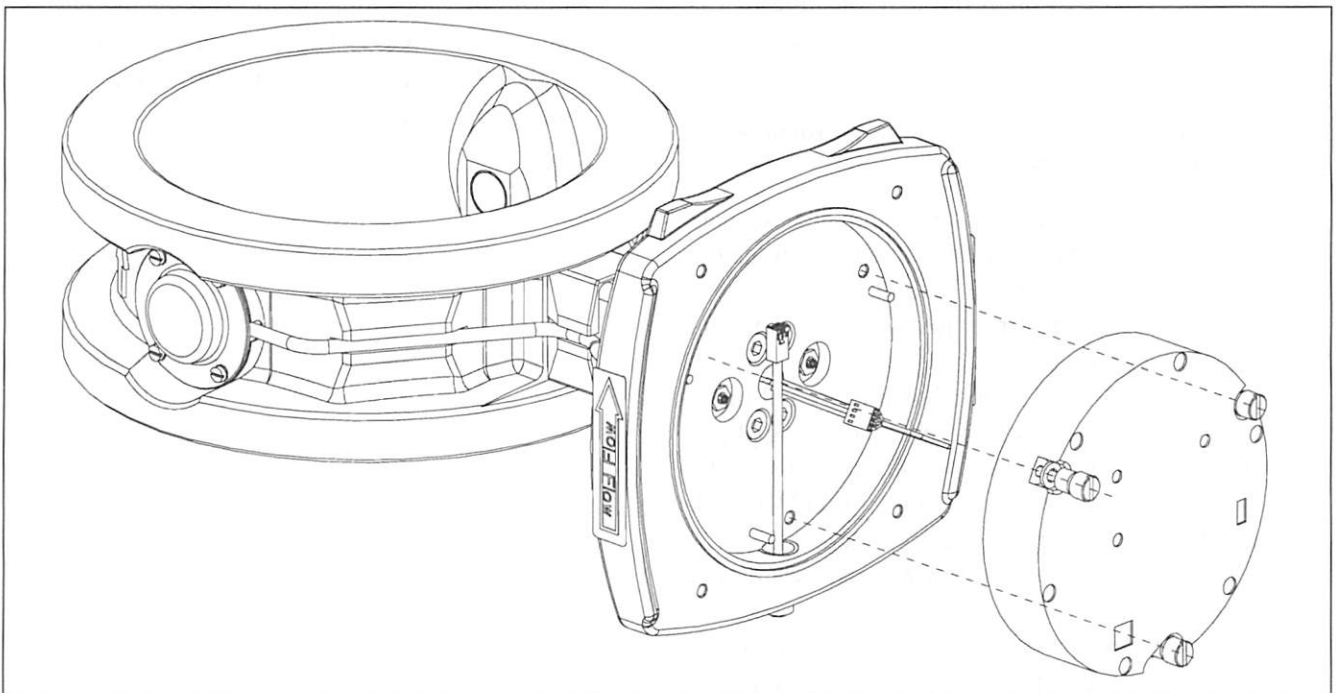


Fig. 1. Removal diagram for sensor electronics.

11.2. Antenna cables, Fork Sensor

NOTE: Before removing the sensor, check that the process pipe is unpressurized and empty and that it is safe to remove the sensor.

Removal: (Fig. 2 and 3)

1. Place the body of the sensor into a table vice such that the sensor head is on top. Use aluminum buffers in the between the vice jaws and the sensor.
2. Remove the sensor electronics according to chapter 11.1.
3. Lift the Pt-100 cable from the tape on the base plate.
4. Remove the uppermost mounting screw on the probe antenna side. Screw in a longer screw in its place, e.g. M6x50 is a suitable size. This screw will serve to hold the sensor in place when the base plate is removed.
5. Remove the five other base plate mounting screws.
6. Pull the base plate 10mm away from the sensor body.
7. Disconnect the antenna cable from the base plate by holding the connector in place with an 8mm wrench (e.g. SMA wrench) while you use a 10 mm socket key to open the lock bushing that is attached to a connector on the electronics side of the base plate.

NOTE: Don't allow the connector body to rotate while you turn the lock bushing.

8. Remove the long steering screw and the base plate from the sensor body. At the same time, guide the Pt- 100 cable through the base plate.
9. Remove the cable of the flush-mounted antenna with an SMA wrench.
10. Remove the cable support bushing by pulling it through the feed-through hole with drawing pliers.
11. Open the Pt-100 coupling on the outer edge of the sensor shaft with plug spanner OUL00323. Check that the cable also rotates during removal.
12. Pull the Pt-100 sensor about 100mm outwards and let it hang by its cables.
13. Remove the MCX connector from the probe antenna by prying with pointed pliers. Push the Pt-100 cable to the side so that the connector is able to be removed.
14. Pull the microwave cable carefully out through the feed-through hole on the shaft toward the flushmounted antenna.

Connecting:

1. Install the probe antenna's microwave cable into the MCX connector: Push the cable end with the straight angle connector through the shaft such that the connector is just opposite the probe antenna connector. Connect the connector to the end hole by prying with a 4mm screwdriver. Handle the cable with care, so that it stays in shape and eases future installation.
2. Install the flush-mounted antenna's cable into the SMA connector: Put the connector that is to be installed in the base plate on the side of the sensor body opposite the previous cable. Tighten the SMA connector with a torque wrench to 1 Nm torque. Handle the cable with care, so that it stays in shape and eases future installation.
3. Install the thermoelement on the sensor body: Check that the O-ring is in the sealing groove. Remove the old teflon tape from the thread and put two new layers of teflon tape in its place. Check that the tape does not cover the O-ring. Take care that the cable also rotates . Tighten it with plug spanner OUL00323 to 12 Nm torque.
4. Set the cable support bushing into place and put a drop of super glue on the side of the bushing before attaching it. The antenna cable should be in the upper groove, and the Pt-100 sensor cable should be in the lower groove.

5. Check that O-ring 90x3 is in the sensor body sealing groove.
6. Place the base plate close to the installation position with the current cable aligned in the same position as the probe antenna.
7. Push the thermoelement cable through the middle hole in the base plate. Place the base plate about 10 mm away from the sensor body and at the same time check that the microwave cable connectors on the base plate side are lined up with their feed-through holes.
8. Put an M6x50 screw temporarily in the uppermost mounting hole so that the base plate will stay in place while the microwave cables are being mounted.
9. Use pointed pliers to take hold of the body of the microwave cable connector that is on the base plate side. Push the threaded part of the connector far enough into the hole in the base plate so that the cable's clamping bush and O-ring start turning in the thread.
10. Hold the connector body in place with an 8mm set wrench and use a 10 mm box key attached to the Belzer Torque driver to tighten the clamping bush of the antenna cable from the opposite side of the base plate to 1 Nm torque. Repeat the same steps for the other connector.
11. Push the base plate all the way against the sealing. Apply locking medium Loctite 270 to the threads of the base plate's five free mounting holes and put M6 lock washers and M6x20 Allen screws into the threads.
12. Tighten the screws to 8 Nm torque.
13. Place the thermoelement cable into the groove in the base plate and tape it into place with thin tape.
14. Install the sensor electronics as described in Chapter 11.1.

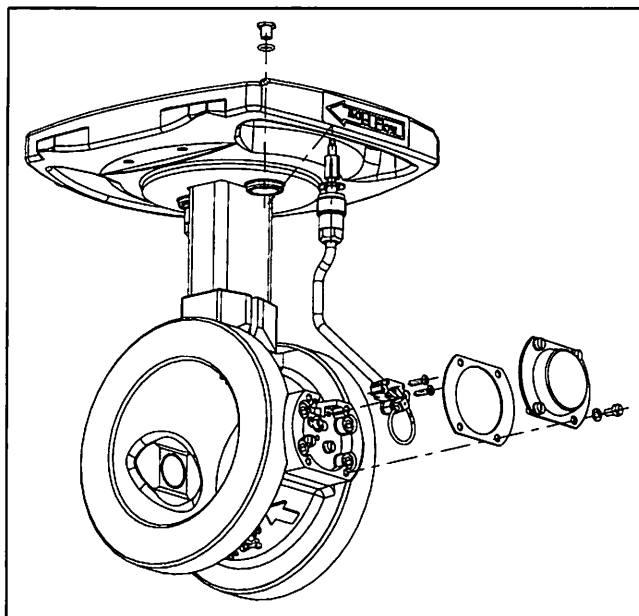


Fig. 2. Removal diagram for FT 100 antenna cables.

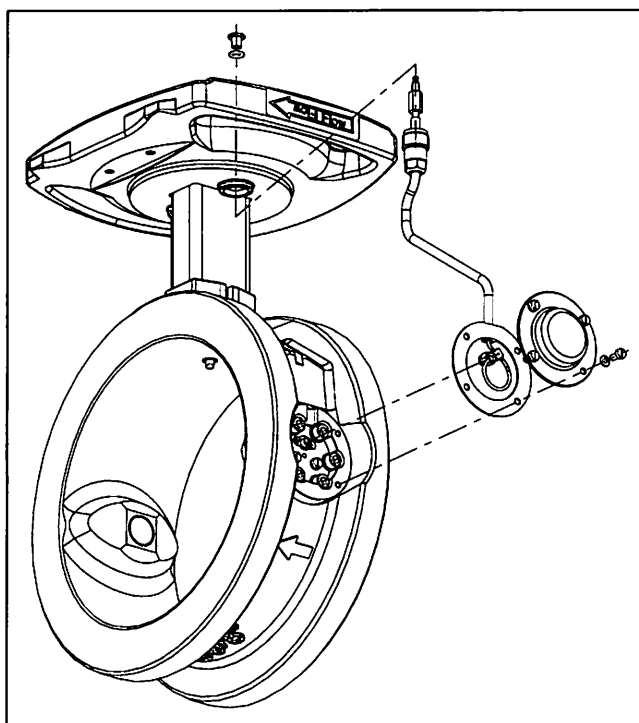


Fig. 3. Removal diagram for antenna cables of other FT Sensor models.

11.3. Antenna Cables, FT Sensor

NOTE: Before removing the sensor, check that the process pipe is unpressurized and empty and that it is safe to remove the sensor.

Removal

1. Remove sensor electronics according to the instructions in section 11.1.
2. Open the inlet bushing of the antenna cable connected to the base plate. Slide it down until the connector body at the end of the cable becomes visible.
3. Hold the connector body in place with an 8 mm wrench (e.g. SMA wrench) while you use a 10 mm box wrench to open the lock bushing that is attached to the connector on the other side of the base plate.

NOTE: Don't allow the connector body to rotate while you turn the lock bushing.

4. Loosen the four mounting screws of the sensor cover and lift the cover off.
5. Loosen the antenna cable's SMA connector from the antenna end with an SMA wrench or SMA wrench adapter. In sensor model FT 100, you must also loosen two cable feed-through mounting screws.
6. Lift the antenna cable out of its mounting groove by, for example, prying the casing tube with a screwdriver such that the cable begins to come out of the groove starting with the antenna end.
7. When the cable's casing is separated from the sensor body, pull the cable connector on the base plate carefully out of its hole.

NOTE: Lift the cable by its casing tube, not by the cable itself.

NOTE: Be careful not to dent the antenna cable connector on the base plate.

Installation:

1. Check that the nylon sealing ring is in place in the base plate at the bottom of the antenna cable feedthrough thread.
2. Place the antenna cable connector gently into the hole in the base plate and press the antenna cable casing into its mounting groove. Check that the antenna end feed-through collar fits into place.
3. Take hold of the antenna cable connector on the base plate with an 8 mm set wrench. From the other side of the base plate, screw on the antenna cable lock bushing with a 10 mm box key attached to the Beltzer Torque driver to 1 Nm torque. Do not use force in tightening the lock bushing; too much force will damage the connector.
4. Slide the antenna cable's through the inlet bushing down to the base plate and screw it into place.
5. Screw the antenna cable connector on the antenna into the antenna connector with an SMA wrench or with the SMA Torque Wrench Adapter attached into a SMA wrench to the torque indicated by the wrench. In sensor model FT-50/FT-100, you must also screw in two feed-through mounting screws.
6. Attach the antenna's cover with its four mounting screws.

11.4. Antennas, Fork Sensor

NOTE: Before removing the antennas, check that the process pipe is empty and unpressurized and that removal is safe.

Removal:

1. Remove the sensor electronics as described in Chapter 11.1.
2. Remove the antenna cable of the antenna that is being replaced as described in Chapter 11.2.

Flush-mounted antenna:

3. Unscrew two M8 Allen screws to remove the antenna from its mounting clamp.
4. Pull the antenna out of the inlet hole and remove the O-ring.
5. Unscrew two M4 screws to remove the clamp from the antenna.

Probe antenna:

6. Use socket key OUL00325 and a 13mm ring spanner to remove the probe antenna.

Installation:

Flush-mounted antenna:

1. Attach the mounting clamp to the antenna with two M4x16 screws with washers.
2. Clean the sealing surfaces of the antenna installation hole using e.g. isopropanol.
3. Place a new O-ring into the installation hole against the collar.
4. Place the antenna into position. Attach it with M8x20 Allen screws and washers using a 6mm Allen wrench. Use locking medium Loctite 270 on the threads.
5. Tighten the antenna's mounting screws to 19 Nm torque.

Probe antenna:

1. Clean the sealing surface with e.g. isopropanol.
2. Place a new O-ring into the sealing groove.
3. Put locking medium Loctite 270 on the threads.
4. Screw the probe antenna into the sensor body using socket key OUL00325 to 10 Nm torque.
5. Install the antenna cable(s) as described in Chapter 11.2.
6. Attach the sensor electronics as described in Chapter 11.1.

11.5. Antennas, FT Sensor

NOTE: Before removing the antennas, check that the process pipe is empty and unpressurized and that removal is safe.

Removal:

1. Remove the sensor electronics as described in Chapter 11.1.
2. Remove the antenna cable as described in 11.2.
3. Remove the antenna's six mounting screws with a 5mm Allen wrench. In the FT-100 model there are four mounting screws and the washers are self-sealing.
4. Pull the antenna out of the inlet hole and remove the O-ring.
5. Remove the antenna from the flange by unscrewing two M4 screws.

Installation:

1. Attach the antenna to the flange with two M4x12 screws with washers.
2. Clean the sealing surfaces of the antenna installation hole using e.g. isopropanol.
3. Place a new O-ring into the installation hole against the collar.
4. Put locking medium Loctite 270 onto the flange's six mounting threads.
5. Check that the antenna flange O-ring is in place and then insert the antenna into place in the antenna coupling.
6. Tighten the antenna's six M6x16 mounting screws and washers with a 5mm Allen wrench to 8 Nm torque. In the FT-100 model there are four screws and the washers are self-sealing.
7. Connect the sensor cable and the sensor electronics back in reverse order.

11.6. TCU

NOTE: Before removing the antennas, check that the process pipe is empty and unpressurized and that removal is safe.

Removal:

1. Disconnect the network voltage from the TCU and remove the network voltage lines from the TCU terminal block.
2. Remove the sensor cable and the factory's system cable from the TCU terminal block.
3. Remove TCU from its shield.

Installation:

1. Attach the new TCU to the shield.
2. Connect the sensor cable, network voltage cable and the factory's system cable to the TCU terminal block.
3. Switch on the network voltage.

NOTE: It may take a few minutes for text to appear on the display. This is due to the charging of the device's internal back-up battery.

4. If the program asks you to select calibration, select
 - Sensor electronics calibration if you did not replace sensor electronics.
 - Default calibration if you replaced sensor electronics as well.

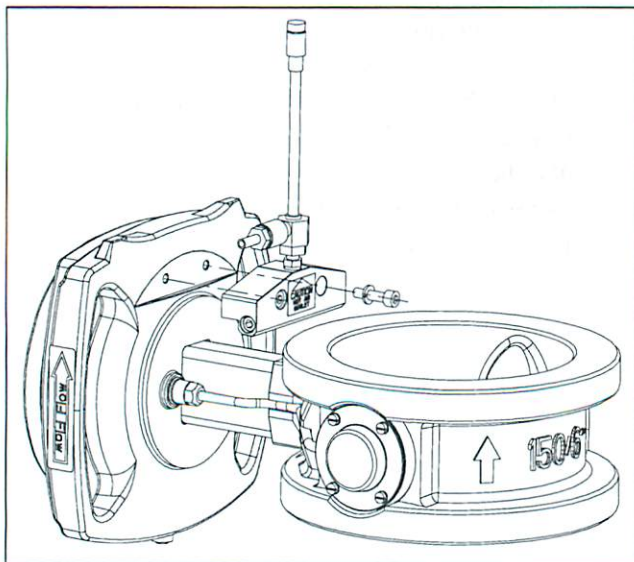


Fig. 4. Installing Vortex Cooler.

11.7. Installing Vortex Cooler

Vortex Cooler is available as an option. Its code is OUL00285 (Fig. 4).

Vortex Cooler is used to cool the sensor electronics unit. Cooling is necessary if the electronics *internal* temperature (Cab Temp) rises above 75 C (167 F) due to the effects of its surroundings. Perform installation as for FT and Fork sensors.

Vortex Cooler installation kit contains the following parts:

1. Cooler with 6 hose coupling.
2. Screws M6x25, 2 pieces.
3. Lock washers M6, 2 pieces.
4. Thermal conductivity grease.

Installation:

1. Apply thermal conductivity grease to the installation surface of the cooler's black casing.
2. Set the cooler on the base plate such that the mounting holes are in line with each other.
3. Screw in the washers and screws and tighten them with a 5mm Allen wrench.
4. Insert the air hose with internal diameter of 6 mm (1/4") into the hose nipple using a hose clamp.

During installation, note the following:

The cooler is installed between elements. If lack of available space so dictates, you can move the cooler to one end of the element by removing the plug and placing the cooler into that thread. Then put the plug in the central thread. The cooler's outlet pipe can point upwards (recommended) or to the side, but not downwards.

Cooling:

The maximum volume flow in cooling is 230 nl/min. If you do not use a flow meter, start the air flow carefully and then increase it slowly until the necessary cooling efficiency is reached.

NOTE: The outlet pipe releases hot air. Check that there are no cables that touch the outlet pipe or in its near vicinity.

12. HART® User Interface

12.1. About the interface

HART® is a registered trademark of HART Communication Foundation. HART communication is a method of transferring information digitally between field devices and host devices (e.g. HART Communicator).

In order to function properly HART requires TCU program version C or higher and a HART Communicator that contains the Metso MCA command base.

HART Communicator is connected in parallel to the current output, e.g. to the connector pins on the front panel of the TCU.

You can perform the same operations on Metso MCA HART user interface as on the device's TCU user interface. Figure 1 shows the HART Communicator operation menu.

When you connect HART Communicator to Metso MCA, the following menu appears.

```
MCA: MCA-1234
Online
1 Measurement
2 Configure
3 Calibrate
4 Diagnostics
```

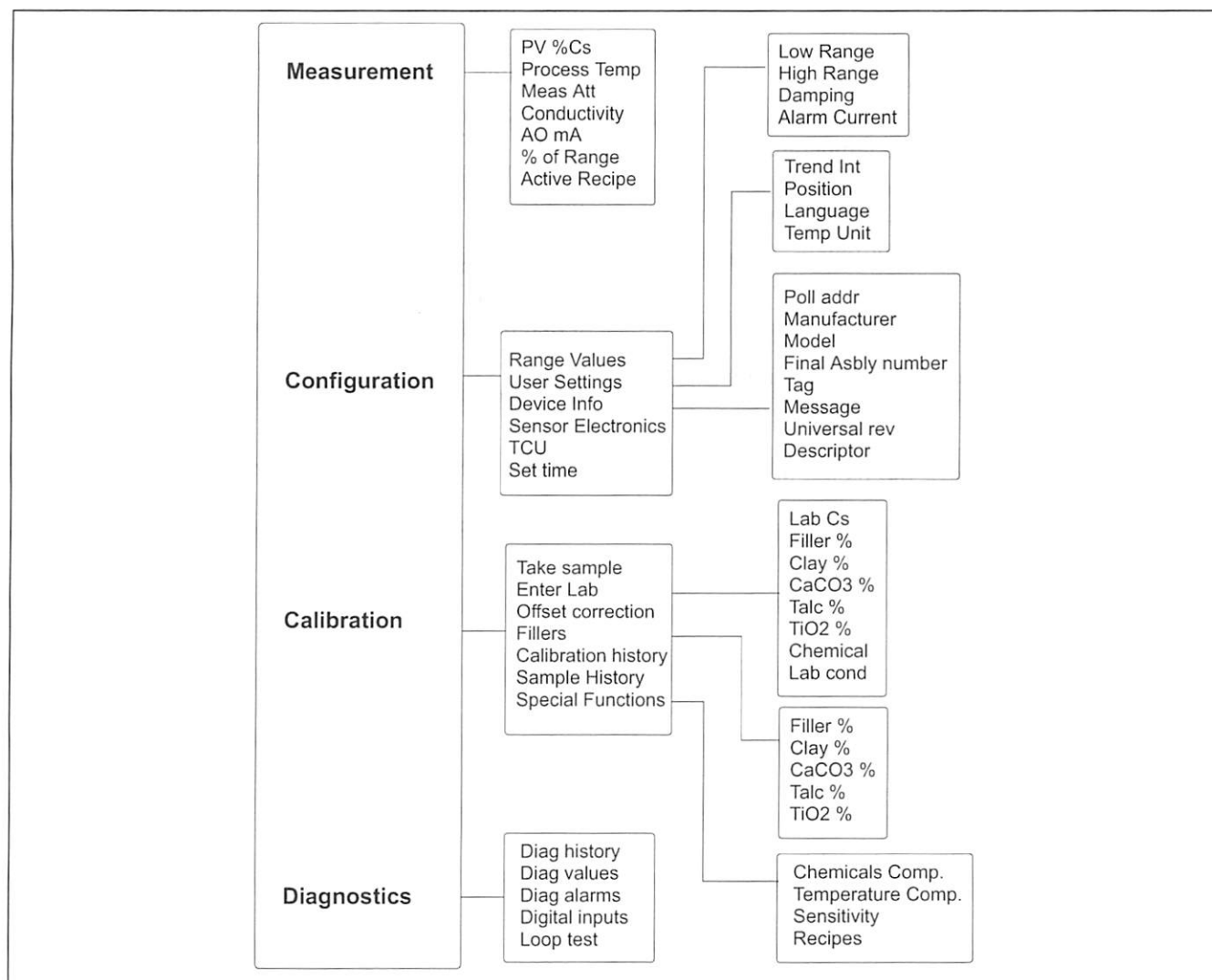


Fig. 1. HART Communicator operation menu.

12.2. Measurement

Measurement menu shows the Metso MCA measurement results.

MCA: MCA-1234	
Measurement	
1 Sensor Type	FT200
2 Cs	0.00 %Cs
3 Prc Temp	57.3 °C
4 Status	OK
5 Conductivity	2.43 mS/cm
6 % of range	36.72 %
7 mA	9.88 mA
8 meas Att	32.4 dB
Recipe # OFF	

Sensor Type:

Cs: Measured consistency.

Prc Temp: Process temperature.

Status: Device status (OK, Alarm, etc.).

Cab Temp: Sensor electronics temperature.

% of range: Consistency current output value as a percentage of the current output range.

mA: value of ... in milliamperes.

meas Att: The measured microwave damping in the process.

Recipe #: The number of the recipe in use (refer to Chapter 9.3).

12.3. Configure

In Configure menu you can configure Metso MCA's current output and certain other parameters. Configure menu also shows device information.

MCA: MCA-1234	
Configure	
1 Range Values	
2 User settings	
3 Device info	
4 SENSOR ELECTRONICS	
5 TCU	
6 Set Clock	

Range values

LowRnge: Consistency that correlates to current output lower limit 4 mA.

UppRnge: Consistency that correlates to current output upper limit 20 mA.

Damping: Damping time of the current output.

Alarm cur: How the output signal reacts to error situations detected by self-diagnostics. Options: 3.7 mA / 22.5 mA / freeze.

User settings

Trend Int: The sampling interval of the devices's internal trend table.

Pos: Device position information.

Lang: TCU language version.

Temp unit: Process temperature unit °C / °F.

Device info

Poll Addr: The device's HART address.

Manufacturer: Name of device manufacturer (Metso).

Model: Device name.

Final assembly num: Field device identification number.

Universal rev: The Universal Device Description version supported by the device.

Tag: Text entered by the user, the tag is shown at the top of the display after the device name.

Message: Text entered by the user.

Descriptor: Text entered by the user.

Sensor Electronics

Sensor type: Sensor model.

Sensor S/N: Sensor electronics serial number.

Sensor HW rev: Sensor electronics revision.

Sensor SW rev: Sensor electronics software revision.

TCU

S/N A: First part of TCU serial number.

S/N B: End part of TCU serial number.

HW rev: TCU revision.

SW rev: TCU software revision.

Cal date: TCU's final testing date.

Cal ID: Tester's initials.

Set Clock

Date: The date in mm/dd/yy.

Hours:

Minutes:

Seconds:

12.4. Calibrate

Metso MCA is calibrated with single-point calibration. Calibrate menu contains menu items for sample taking and entering the laboratory value.

In addition, you can perform a level correction on the measurement, perform various special functions and view calibration and sample history data:

```
MCA: MCA-1234
Calibrate
1 Sample taking
2 Enter Lab
3 Level corr
4 Filler
5 Lab cal History
6 Sample history
7 Special functions
```

Sample taking

This function allows you to take a sample for single-point calibration.

Move the cursor on to Sample taking and press the right arrow. The following display appears:

```
Press OK to start
sample taking

ABORT OK
```

Press F4 (OK). Metso MCA begins to average the measurement result for the sample and the following display appears:

```
Press OK to stop
sample taking

ABORT OK
```

Take the sample, and then press OK (F4) again. Metso MCA shows the results of its measurement:

```
MCA:MCA-1234
Sampling ready
Average Cs = 3.02 %
Min: 3.01 % Max: 3.03 %
T = 42.3 °C
```

ABORT OK

Select OK (F4) to return to Calibrate display.

Enter Lab

This function allows you to enter the laboratory value for the sample taken.

Move the cursor onto Enter Lab and press the right arrow. The following display appears:

```
MCA: MCA-1234
Enter lab
Lab Cs
Filler%
Kaolin
CaCO3
Talc
TiO2
Chemical
Lab Cond
```

Enter the necessary laboratory information:

Lab Cs: Laboratory consistency.

Filler %: The relative proportion of filler in the total consistency, shown as a percentage.

Kaolin%: The relative proportion of Kaolin in the filler, shown as a percentage.

CaCO3%: The relative proportion of CaCO₃ in the filler, shown as a percentage.

Talc%: The relative proportion of talc in the filler, shown as a percentage.

TiO2%: The relative proportion of TiO₂ in the filler, shown as a percentage.

Chemical: Chemical type (required only for chemical compensation).

Lab cond: Laboratory conductivity mS/cm (required only for chemical compensation).

NOTE: If the conductivity meter shows results in units μmho/in, divide the result by 2500, e.g. 25 000 μmho/in = 10 mS/cm. If the conductivity meter shows results in units mS/m, divide the result by 100, e.g. 550 mS/m = 5.5 mS/cm. If the conductivity meter shows results in units μS/cm, divide the result by 1000, e.g. 5500 μS/cm = 5.5 mS/cm.

Offset corr

This function allows you to perform level correction on the measurement.

Move the cursor onto Level corr and press the right arrow. The following display appears:

```
MCA: MCA-1234
Set the offset
correction: [-10,10]
0
0
DEL ABORT ENTER
```

Enter the desired value and press ENTER (F4). The HART Communicator sends the value to Metso MCA.

Filler

Metso MCA measures filler, but at a slightly different sensitivity than fibers. The Filler function allows you to inform the device about filler changes if the relative total filler percentage changes more than 5 percentage points.

Move the cursor onto Filler and press the right arrow. The following display appears:

```
Enter Filler %
0.0000
0.0000
DEL ABORT ENTER
```

In this field enter the relative filler percentage. For example, if the total consistency is 3 %Cs and the filler percentage of that is 0.3 %Cs absolute consistency, then the relative total filler percentage is 0.3 %Cs / 3 %Cs x 100 % = 10 %:

```
Enter Kaolin %
0.0000
0.0000
DEL ABORT ENTER
```

Enter the relative percentage of kaolin and press ENTER (F4). Repeat these steps for CaCO₃, talc, and TiO₂. The sum of the filler components must be 100 %. After you have entered the values, then the display shows the filler sensitivity compared to wood fiber, as calculated by the device.

```
MCA: MCA-1234
Sensitivity = 0.97
ABORT OK
```

Select OK (F4) to return to Calibrate display.

Lab cal History

This menu shows a history of calibrations performed on the device.

Move the cursor onto Lab cal History and press the right arrow. The following display appears:

```
MCA: MCA-1234
23-04-05 10:32:09
Lab = 3.00 MCA=3.10
Cum offset = 0.00 Cs
T=53.2 C Att=49.3 dB
```

ABORT OK

The display shows the date and time of the calibration as well as the sample's measured value and laboratory values. Press OK (F4) to browse through the calibrations. Press ABORT (F3) to exit the menu.

Sample History

This menu shows the history of samples that have been taken.

Move the cursor onto Sample History and press the right arrow. The following display appears:

```
MCA: MCA-1234
12.10.10 10:32:09
MCA = 3.04 % Cs
Att=49.3 dB T=53.2 C
```

ABORT OK

On the display you can read the date and time when the sample was taken as well as the sample's measurement values. Press OK (F4) to browse backward through the samples. Press ABORT (F3) to exit the menu.

Special functions

Special functions include chemical compensation, temperature compensation correction curve, sensitivity compensation and recipes.

Chemical Compensation

Large fluctuations in chemical content may cause errors in Metso MCA consistency measurements. These errors can be compensated for with chemical compensation based on microwave damping measurement.

You must perform operations in two menus in order to use chemical compensation. In Enter lab menu, first select the chemical, and then enter the laboratory conductivity for the sample you take. Note that the laboratory conductivity is given in unites mS/cm.

If the conductivity meter shows results in units $\mu\text{mho/in}$, divide the result by 2500, e.g. 25 000 $\mu\text{mho/in}$ = 10 mS/cm. If the conductivity meter shows results in units mS/m, divide the result by 100, e.g. 550 mS/m = 5.5 mS/cm. If the conductivity meter shows results in units $\mu\text{S/cm}$, divide the result by 1000, e.g. 5500 $\mu\text{S/cm}$ = 5.5 mS/cm.

After entering these values, go to Special Functions conductivity and select Chemical Compensation to begin using chemical compensation. The following display appears:

```
MCA: MCA-1234
Chemicals Comp
Chem. comp = OFF
Comp.value = 0.00 %
Chemical = NaOH
Lab.cond = 2.45 mS/cm
```

ABORT OK

To begin using chemical compensation, set the Chem. Comp value from OFF to ON. Comp. Value shows the chemical compensation value, which chemical compensation subtracts from the consistency results.

The lower two rows show the chemical and laboratory conductivity values entered in Enter lab menu.

Temperature Compensation Correction Curve

You can define temperature compensation correction curve for Metso MCA if you notice temperature dependency in the measurement results.

Define the correction curve by entering 2 - 6 pairs of temperature/consistency points. Based on the curve drawn from these points, Metso MCA subtracts the curve consistency from the measurement results.

Determine the correction curve pairs of points as described in section 9.1. Then enter the pairs of points in the menu Temp Comp., which appears as follows:

MCA: MCA-1234			
Temp	Comp		
1 #1	°C		0.00
2 #1	%		0.00
3 #2	°C		0.00
4 #2	%		0.00
...			
9 #5	°C		0.00
	%		0.00
	%		0.00
	%		0.00

Enter temperature and consistency values for the desired points (#1 - #6). Then press SEND (F2) to send the values to Metso MCA.

Sensitivity Correction

Metso MCA consistency sensitivity is set according to the wood fiber. The measurement sensitivity can be changed if necessary, e.g. if you are measuring some material other than wood fiber.

If you do not know the sensitivity correction of the material beforehand, you can determine it according to the instructions in section 9.2 and enter it in the Sens. Corr. menu.

MCA: MCA-1234	
Sens	Corr
1.00	
1.00	

DEL ESC ENTER

Recipes

The Recipe function may be necessary in special functions in which measurement conditions change so much that one calibration cannot cover it.

Such a change may be e.g.

- A change in consistency greater than the device measurement range (9 - 15 % depending on the type of sensor).
- A change in the measured material, since different materials have different consistency sensitivity.
- A large chemical fluctuation (e.g. change of chemical type) that cannot be compensated for with chemical compensation.

In these cases, each process condition has its own calibration and configuration performed.

This calibration and configuration is saved as its own recipe. In addition to consistency calibration, for each recipe you can set chemical compensation, temperature consistency correction, sensitivity correction, and current output scaling. You can save a maximum of four recipes.

The Recipes menu is as follows:

MCA: MCA-1234	
Recipes	
1 Choose:	OFF

In Choose, set the desired recipe number. The options are as follows:

- OFF: the recipe function is not in use (default),
- 1, 2, 3, 4: select the recipe number,
- BIN: select the recipe according to binary input.

Select the recipe. Then perform recipe calibration and current output scaling. Begin using the recipes as follows:

When you use the recipe selection method 'BIN', connect the automation system digital control lines to the TCU connector casing binary inputs BIN0 AND BIN1. Connect their grounded line to BINGND. Select the recipe with the digital output lines according to the following table:

BIN0	BIN1	Recipe
0	0	1
1	0	2
0	1	3
1	1	4

12.5. Diagnostics

Menu information and functions:

MCA:	MCA-1234
	Diagnostics
1	Diag History
2	Diag Values
3	Diag Alarms
4	Digital Inputs
5	Loop test
6	Clear Logs

Diag History: The 10 most recent self-diagnostics alarms with beginning and ending times.

Diag values: Measured values of diagnostics variables (see Chapter 8.2).

Diag Alarms: Diagnostics variables' alarm limits; switching alarms on and off (see Chapter 8.3).

Digital Inputs: The state of TCU binary inputs BIN0 and BIN1.

Loop test: Forcing the output signal to the desired value.

Master Reset: Resets the TCU. Similar to powering the TCU off, calibration is not discarded.

Status, Status nxt: State of diagnostics variables (alarm on/off).

Notes

13. Upgrade Kit for MCAi

13.1. Structure

Upgrade Kit for MCAi allows you to upgrade MCAi to contain Metso MCA's performance and diagnostics characteristics. It consists of new Metso MCA sensor electronics and the user interface, which is called Transmitter Central Unit (TCU).

The part that is connected to the sensor consists of sensor electronics and an adapter plate, with which the electronics is installed into the Metso MCA base plate.

In addition, the sensor unit includes a separate cable assembly, with which you can install the sensor cable's connector on the base plate. The sensor cable is connected to the TCU connector casing. The delivery also includes shield plugs with which to replace the removed cables in the base plate inlet bushings.

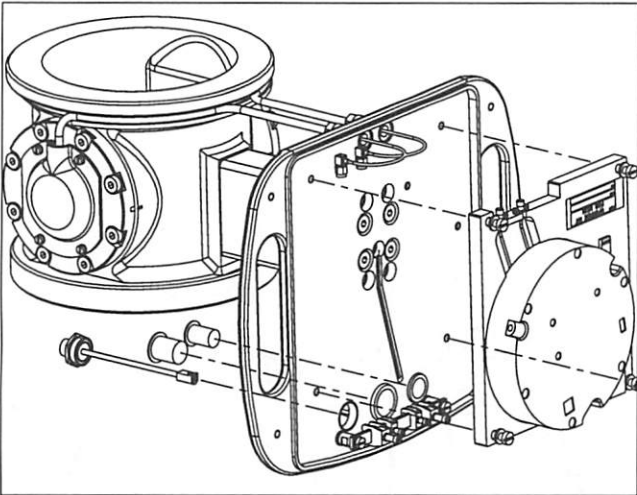


Fig. 1. Upgrade Kit for MCAi structure.

13.2. Electrical connections

NOTE: The Upgrade Kit's current output is passive and needs an external power source. In MCAi the current output is active, so in the upgrade you must also make changes to the network connection.

NOTE: When you connect power supply cables, make sure that the cables are disconnected from the power supply.

NOTE: Connect the cables to the power supply only after you have checked all connections.

Refer to Chapter 3.5.

13.3. Installation Guide - Upgrade Kit for MCAi

- MCAi Display Unit: Disconnect the power supply from the power supply cables coming into the device. Open the connector casing cover (Figure 2).

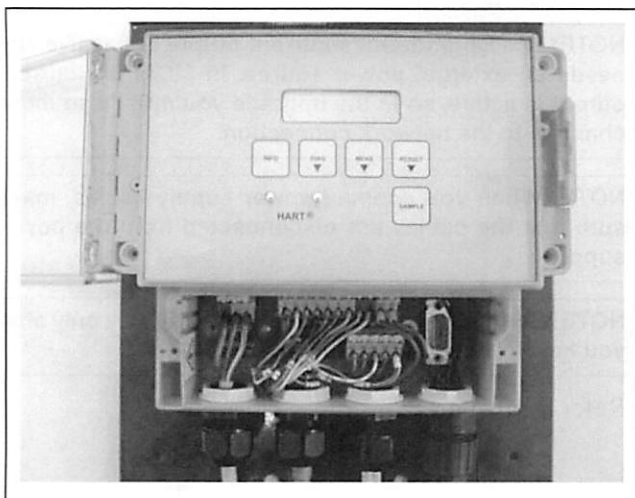


Fig. 2.

- Remove the cable connections. Pull the cables out through the inlet bushings.
- Remove the MCAi Display Unit and shield (Figure 3).

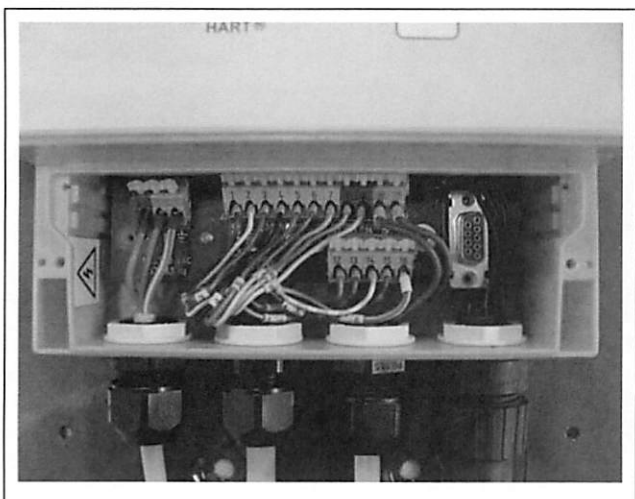


Fig. 3.

- MCAi Sensor: Remove the Sensor Cover.
- Remove the cable connections from the Field Connection Board. Pull the cables out through the inlet bushings and remove the cables (Figure 4).

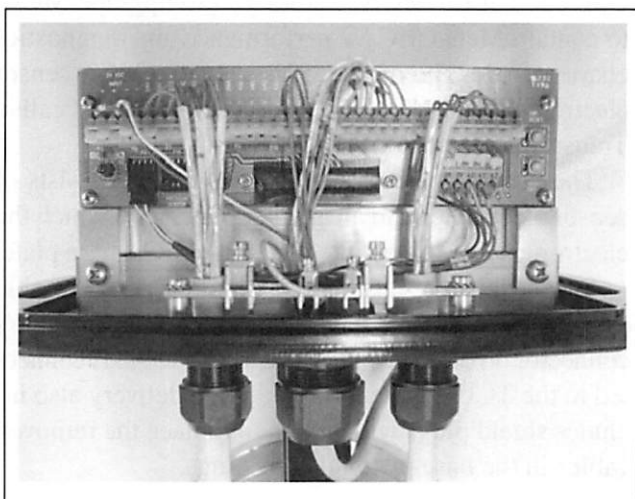


Fig. 4.

- Remove the PT-100 adapter from the Field Connection Board (Figure 5).

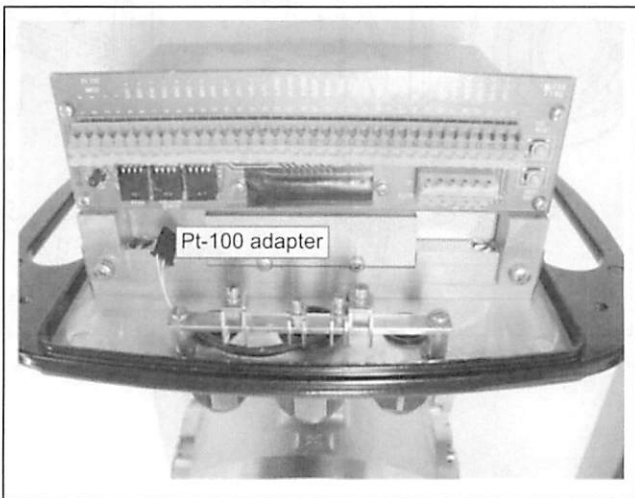


Fig. 5.

- Remove the microwave cables from the sensor electronics with an SMA wrench (figure 6).

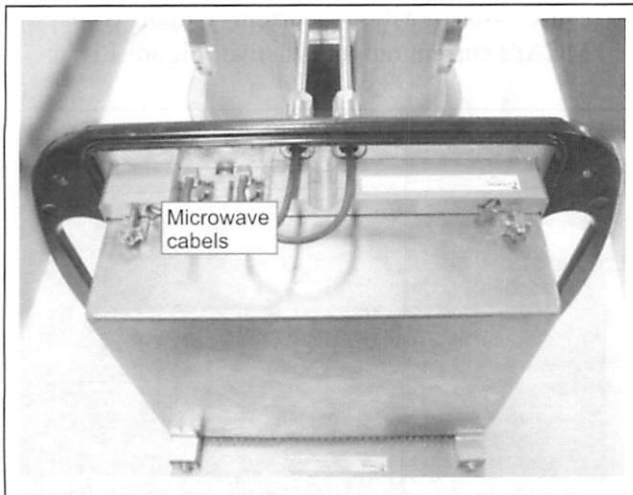


Fig. 6.

- Remove the 4 mounting screws and lift the electronics off (Figure 7).

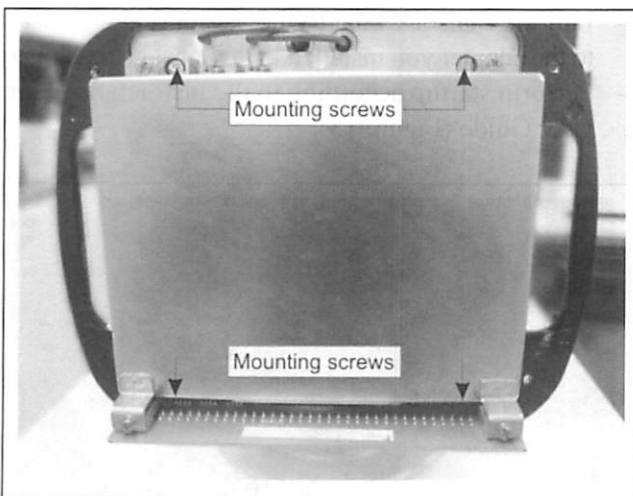


Fig. 7.

- Remove the cable inlet bushing from the base plate (Figure 8).

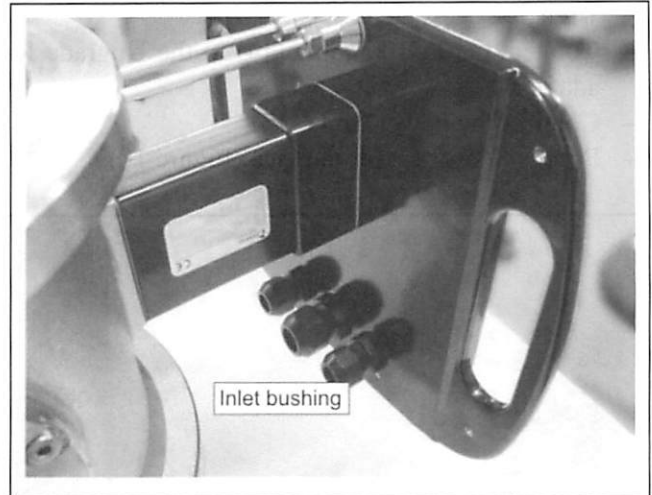


Fig. 8.

- In place of the inlet bushing insert an adapter assembly that has an adapter bushing, Metso MCA sensor adapter and power cable. Pay attention to get the adapter assembly on the right threads.
- Insert shield plugs PG16 and PG21 into the open inlet bushings (Figure 9).

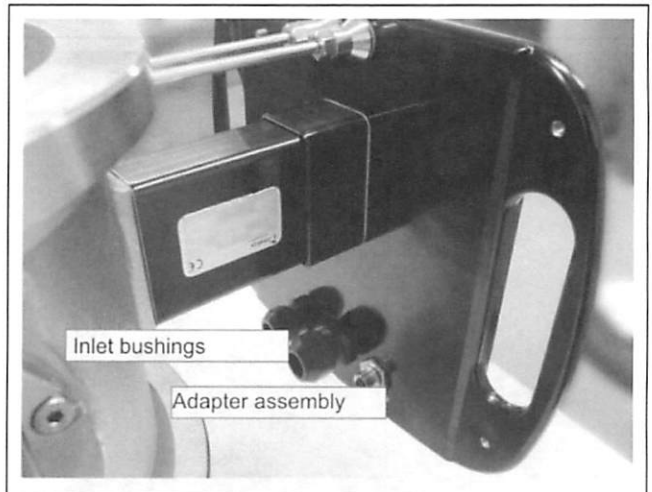


Fig. 9.

- Install the Upgrade Kit with 4 M6x20 screws (12). Use locking medium.
- Connect the microwave cables (13) with an SMA wrench.
- Connect the Pt-100 cable (14) to the Upgrade Kit adapter.
- Connect the power cable (15).
- Put the Sensor Cover in place (Figure 10).

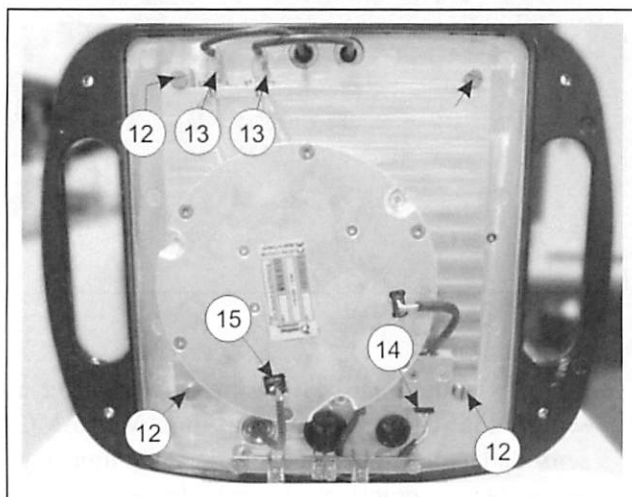


Fig. 10.

- Attach TCU (Metso MCA) to the wall (Figure 11).



Fig. 11.

- Connect the cables according to the instructions in section 3.5 of this User Guide. Note that you need an external power source to the current output because Metso MCA's current output is passive. MCAi's current output is active (Figure 12).

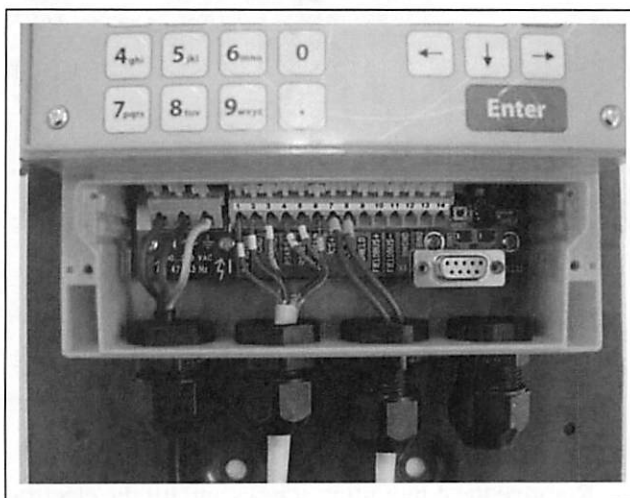


Fig. 12.

- Pull the Sensor Cable to the sensor and connect it to the adapter you installed in the sensor's base plate.
- Perform startup according to the instructions in the User Guide (Figure 13).

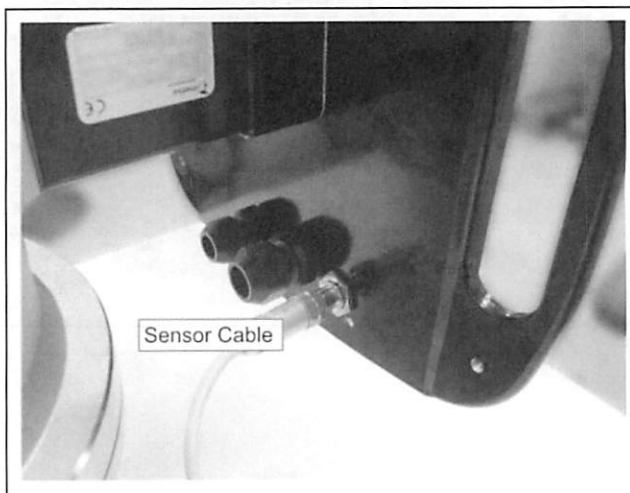


Fig. 13.

13.5. Startup

Refer to section 4.

In Upgrade Kit for MCAi startup, however, please note the following:

1. Upgrade Kit for MCAi is not factory calibrated.
2. Calibration must be performed at the installation site.
3. You must know the sensor type for which MCAi is to be installed. This information is found next to Item on the sensor plate.

13.6. Configuration and Calibration

1. Connect the electricity to the power supply feed.
2. The device asks you to select the sensor type from SET DEFAULT menu.
3. Press EDIT/SAVE button.
4. Select the sensor type using the up and down arrows. You can recognize the Upgrade Kit sensors from the UPG prefix. The options are:
UPG F
UPG FS
UPG FT-100
UPG FT-150
UPG FT-200
UPG FT-250
UPG FT-300
5. Save your selection with EDIT/SAVE button.
6. Select the language and temperature unit (°C/°F) according to the instructions in chapter 6.3.
7. Set the device date and time according to the instructions in chapter 6.5.
8. Scale the current output according to the instructions in 6.2.
9. Calibrate the consistency according to the instructions in 7.2 and 7.3.

After you perform these steps, MCAi upgraded with the Upgrade Kit is ready to measure.

13.7. User Interface

Refer to section 5.

13.8. Troubleshooting and Maintenance

For electronics issues, refer to section 10.

For sensor body, antenna and antenna cable issues, refer to section 11.

Notes

14. Recycling and disposing of a device removed from service

Most device parts are recyclable when sorted by material. A materials list must accompany the device. The device manufacturer can supply you with recycling and disposal instructions. In addition, you can return the device to the manufacturer, which will recycle and dispose of the device for a fee.

Notes

Metso MCA

Technical specification

Metso MCA sensor

Measurement

Measuring range.....	0–16 % Cs; if greater than 16 %Cs or if used in an application other than for paper or pulp, please consult Metso Automation
Repeatability	±0.01 %Cs
Sensitivity.....	0.001 %Cs
Filtering	1–99 s
Microwave power.....	15 mW

Process conditions

pH range	2.5 – 11.5
Temperature.....	0...+100 °C (32...212 °F)
Process pressure	
- Minimum	recommended: over > 1.5 bar, no free air
- Maximum, F-model.....	PN25
- Maximum, FT-model.....	DIN PN16 / ANSI Class 150 / JIS 10k
Vibration.....	max. 20 m/s ² , 10–2000 Hz

Operating environment

Temperature.....	-20...+70 °C (-4...+158 °F), protect from direct heat sources
Housing class	IP65 (NEMA 4)

Connections

Operating power,	
communication	cable from TCU

Materials, F-model

Wetted parts.....	AISI 316L (OPTION: Titanium GR2 or Hastelloy C276), Ceramic
Sealing rings	Viton, Simrit 483
Process coupling	AISI 316L (OPTION: Titanium GR2 or Hastelloy C276)
Mounting clamps, bolts	AISI 316

Materials, FT-models

Wetted parts.....	AISI 316, AISI 316L, Ceramic
Sealing rings	Viton, Simrit 483
Process coupling	AISI 316, AISI 316L

Conductivity limits and sensor weights:

Conductivity max. (mS/cm)				
	30 °C / 86 °F	50 °C / 122 °F	70 °C / 158 °F	Weight, kg / lbs
MCA-F	18	15	13	5.2 / 11.5
MCA-FT 50 / 2"	25	25	25	8.5 / 18.7
MCA-FT 100 / 4"	18	16	13	10.0 / 22.0
MCA-FT 150 / 6"	13	12	10	13.5 / 29.8
MCA-FT 200 / 8"	13	11	9	17.0 / 37.5
MCA-FT 250 / 10"	13	11	9	24.5 / 54.0
MCA-FT 300 / 12"	10	9	7	29.0 / 63.9

Operating terminal TCU

– The same TCU is used both for Metso MCA and for the upgrade model MCAi + Upgrade Kit

Connections

Cable to sensor	length 10 m / 33 ft (Option: 30 m / 98 ft)
Operating voltage	90–260 VAC / 0.1 VA

Connections to mill systems

- analog outputs.....	2 current outputs, 4–20 mA (Cs + process temperature / conductivity)
- HART®	12–36 VDC
- binary inputs.....	2 x 12–28 VDC / 10 mA, isolated

Connection to PC

Device DTM.....	HART® / Profibus PA
-----------------	---------------------

Operating environment

Temperature.....	5–50 °C (+41–122 °F)
Housing class	IP65 (NEMA 4)

Dimensions & weight

w x h x d.....	232 x 282 x 133 mm (9.13" x 11.10" x 5.24")
Weight.....	2 kg (4.4 lbs)

MCAi + Upgrade Kit

Measurement

Measuring range.....	0–16 % Cs; if greater than 16 %Cs or if used in an application other than for paper or pulp, please consult Metso Automation
Repeatability	±0.01 %Cs
Sensitivity.....	0.001 %Cs
Filtering	1–99 s
Microwave power.....	15 mW
Cv-values	
- FT 200/8"	4200 (± 7.2%)
- FT 250/10"	7800 (± 2.4%)
- FT 300/12"	9700 (± 7.2%)

Process conditions

pH range.....	2.5 – 11.5
Temperature.....	0...+100 °C (32...212 °F)
Process pressure	
- Minimum	recommended: over > 1.5 bar, no free air
- Maximum, F-model.....	PN25
- Maximum, FT-model.....	DIN PN16 / ANSI Class 150 / JIS 10k
Vibration.....	max. 20 m/s ² , 10–2000 Hz

Environment

Temperature.....	-20...+70 °C (-4...+158 °F), protect from direct heat sources
Housing class.....	IP65 (NEMA 4)

Connections

Operating power, communication	cable from TCU
-----------------------------------------	----------------

Materials, F- & FS-models

Sensor	AISI 316L (OPTION: Titanium GR2 or Hastelloy C276), Titanium, Ceramic
Process coupling	L-coupling, AISI 316L (OPTION: Titanium GR2 or Hastelloy C276)

Materials, FT-model

Sensor	AISI 316L, Titanium, Ceramic
Process coupling:	
- FT100/4"	fixed flange machined according to DIN, ANSI or JIS standard
- FT150/6", FT200/8"	no flange
- FT250/10", FT300&12"	fixed flange machined according to DIN, ANSI or JIS standard

Conductivity limits and sensor weights:

Conductivity max. (mS/cm)				
	30 °C / 86 °F	50 °C / 122 °F	70 °C / 158 °F	Weight, kg / lbs
MCAi F	17	14	12	12.0 / 26.5
MCAi FS	20	17	15	12.0 / 26.5
MCA-FT 100 /4"	18	16	13	23.0 / 50.7
MCA-FT 150 /6"	13	12	10	23.0 / 50.7
MCA-FT 200 /8"	13	11	9	28.0 / 61.7
MCA-FT 250 /10"	13	11	9	87.0 / 191.8
MCA-FT 300 /12"	9	8	6	91.0 / 200.6

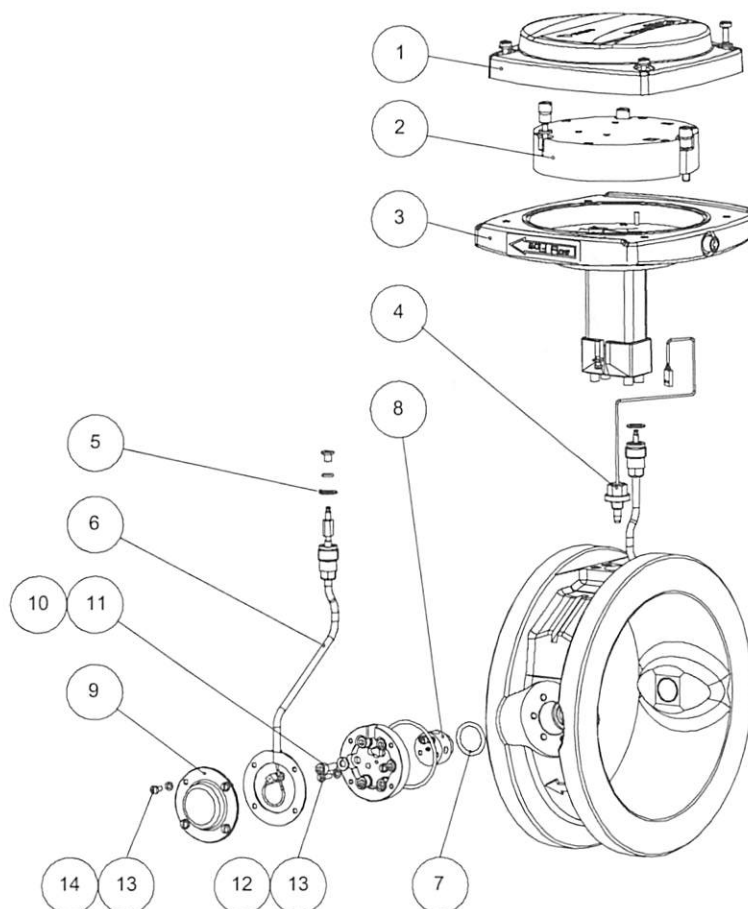
After the upgrade there is no more a conductivity low limit for the MCAi FT 100/4" sensor.

Metso MCA
Service kits & spare parts

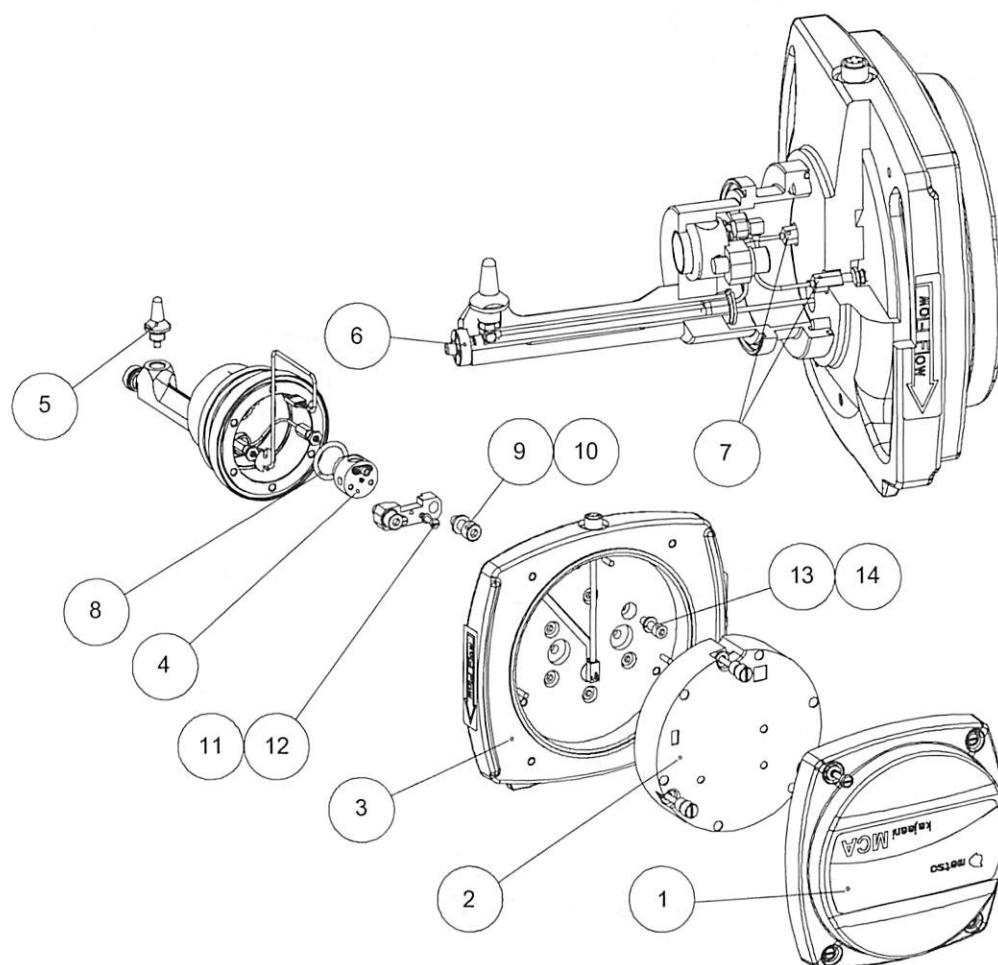
Metso MCA Service Kit OUL00335			
Order Code	Description		Qty
OUL00347	Accessory Case		1
OUL00298	Manual		1
OUL00051	Sensor Electronics		1
OUL00241	Operating Unit TCU		1
OUL00334	Simulation Cable		1
OUL00325	Tool for Sensor Head		1
OUL00323	Tool for Fork Pt-100 Cap		1
A4611042	Sma Torque Wrench Modified		1
OUL00407	Sma Torque Wrench Adapter		1
OUL00349	Torque Driver 1/4"		1
OUL00409	Box Key 10 mm		1
83200021	Thread Locking Compound Loctite 270		10 ml
8360019	Instant Glue Loctite 480		20 g
OUL00350	Thermoelement Simulator		1
OUL00351	Spare Part Set MCA F		1
	OUL00007	O-Ring 13.1x1.6 Simrit 483	5
	OUL00198	O-Ring 23.4x3.5 Viton	5
	80500860	Gasket Ptfe	5
	OUL00277	O-Ring 90x3 Epdm	5
	5060011	Lock Washer DIN127-B4 A4	5
	5060013	Lock Washer DIN127-B6 A4	5
	5060014	Lock Washer DIN127-B8 A4	5
	5160011	Slot head Screw DIN84-M4x16 A4	5
	5460041	Socket Head Screw DIN912-M6x20 A4	5
	OUL00003	Socket Head Screw DIN912-M8x20 A4	5
OUL00352	Spare Part Set MCA FT		1
	8060036	O-Ring 14.3x2.4 Simrit 483	5
	OUL00198	O-Ring 23.4x3.5 Viton	5
	OUL00182	O-Ring 33x2.62 Viton	5
	OUL00184	O-Ring 56.2x3.0 Viton	5
	OUL00294	Seal Ring 16x10x1 Polyamide	10
	OUL00183	Seal Washer U6.7x11.0x1	5
	5060011	Lock Washer DIN127-B4 A4	5
	5060013	Lock Washer DIN127-B6 A4	5
	01100364	Rec Countersunk Screw DIN965-M3x12	5
	5160025	Slot head Screw DIN84-M4x8 A4	5
	5160015	Slot head Screw DIN84-M4x12 A4	5
	OUL00185	Socket Head Screw DIN912-M6x16 A4	5

Service Kit Options, MCA-F AISI 316L	
Order Code	Description
OUL00339	Microwave Cable Set F
OUL00046	Microwave Antenna AISI 316L
OUL00010	Sensor Head AISI 316L
OUL00016	Thermoelement Assembly F AISI 316L
Service Kit Options, MCA-F Titanium Gr.2	
Order Code	Description
OUL00339	Microwave Cable Set F
OUL00259	Microwave Antenna Titanium
OUL00263	Sensor Head Titanium
OUL00267	Thermoelement Assembly F Titanium
Service Kit Options, MCA-F Hastelloy C-276	
Order Code	Description
OUL00339	Microwave Cable Set F
OUL00260	Microwave Antenna Hastelloy
OUL00264	Sensor Head Hastelloy
OUL00268	Thermoelement Assembly F Hastelloy
Service Kit Options, MCA-FT	
Order Code	Description
OUL00420	Microwave Cable FT-50/2"
OUL00114	Microwave Cable FT-100/4"
OUL00118	Microwave Cable FT-150/6"
OUL00194	Microwave Cable FT-200/8"
OUL00197	Microwave Cable FT-250/10"
OUL00216	Microwave Cable FT-300/12"
OUL00178	Thermoelement Assembly FT
OUL00046	Microwave Antenna AISI 316L

Spare parts, MCA-FT			
Part	Order Code	Description	Pcs
1	OUL00278	Sensor Cover	1
2	OUL00051	Sensor Electronics	1
3	OUL00271	Assembly Set FT	1
4	OUL00178	Thermoelement Assembly FT	1
5	OUL00294	Seal Ring	2
6	OUL00420	Microwave Cable FT-50/2"	2
	OUL00114	Microwave Cable FT-100/4"	2
	OUL00118	Microwave Cable FT-150/6"	2
	OUL00194	Microwave Cable FT-200/8"	2
	OUL00197	Microwave Cable FT-250/10"	2
	OUL00216	Microwave Cable FT-300/12"	2
7	OUL00198	O-Ring 23.4x3.5 Viton	2
8	OUL00046	Microwave Antenna AISI 316L	2
9	OUL00189	Antenna Cover (FT-150, FT-200, FT-250, FT-300)	2
	OUL00180	Antenna Cover (FT-50, FT-100)	FT-50: 1 / FT-100: 2
	OUL00422	Antenna Cover (FT-50, attenuator side)	1
	OUL00428	Attenuator 10 dB (FT-50)	1
	OUL00213	Gasket (FT-50, FT-100)	2
10	OUL00185	Screw DIN912-M6x16 A4-70	12
	233778	Screw DIN912-M6x20 A4-70 (FT-50, FT-100)	8
11	5060013	Washer DIN127-B6 A4	12
12	5160015	Screw DIN84-M4x12 A4	4
13	5060011	Washer DIN127-B4 A4	12
14	5160025	Screw DIN84-M4x8 A4	8



Spare parts, MCA-F			
Part	Order Code	Description	Pcs
1	OUL00278	Sensor Cover	1
2	OUL00051	Sensor Electronics	1
3	OUL00276	Assembly Set F	1
4	OUL00046	Microwave Antenna AISI 316L	1
	OUL00259	Microwave Antenna Titanium Gr.2	1
	OUL00260	Microwave Antenna Hastelloy	1
5	OUL00010	Sensor Head AISI 316L	1
	OUL00263	Sensor Head Titanium Gr. 2	1
	OUL00264	Sensor Head Hastelloy	1
6	OUL00016	Thermoelement Assembly AISI 316L	1
	OUL00267	Thermoelement Assembly Titanium	1
	OUL00268	Thermoelement Assembly Hastelloy	1
7	OUL00339	Microwave Cable Set F	1
8	OUL00198	O-Ring 23.4x3.5 Viton	1
9	OUL00003	Screw DIN912-M8x20 A4-70	2
10	5060014	Washer DIN127-B8 A4	2
11	5160011	Screw DIN84-M4x16	2
12	5060011	Washer DIN127-B4 A4	2
13	5460041	Screw DIN912-M6x20 A4-70	6
14	5060013	Washer DIN127-B6 A4	6



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Documentation: JT-Tieto Oy



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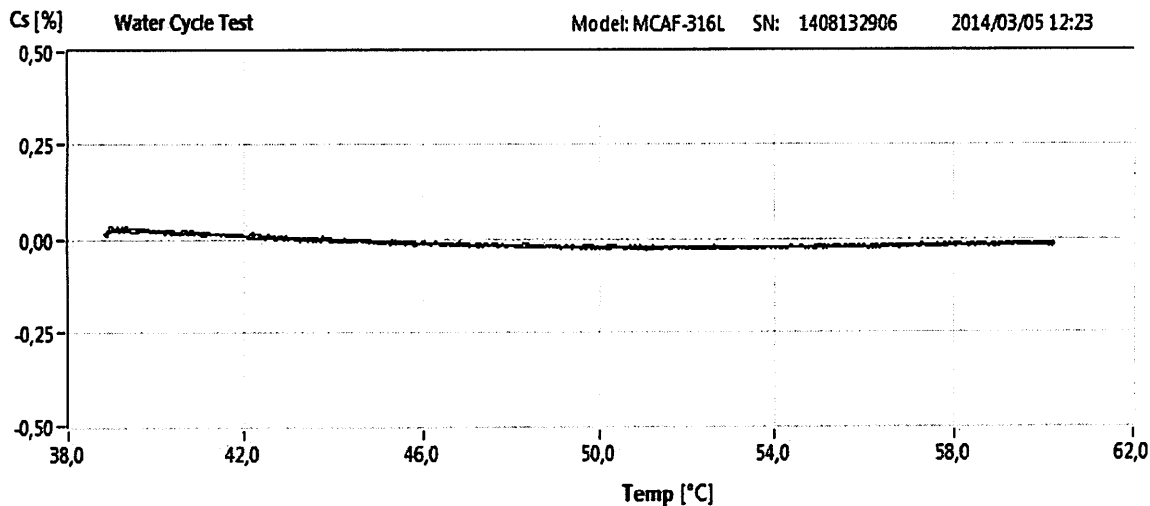
Metso MCA test report

Manufacturer: Metso Automation Inc.
Address: Kehräämöntie 3 / P.O.Box 177
FIN-87101 Kajaani, FINLAND

Tested device: MCA3G F 316L Type: OUL00288 Serial number: 1408132906 Sales order no. -

Metso MCA Sensor Electronics: OUL00051 1405113489
Microwave antenna 1: OUL00046 140606 AISI_316L
Microwave antenna 2: OUL00010 N/A
Batch number: N/A

Test information: substance water, 2 x Temperature cycle, pressure 0.1 bar, ambient temperature 23°C



Curve Analysis:

Variable	unit	tolerance limit	result	PASS/FAIL
Repeatability	%Cs	0,020	0,0030	PASS
Linearity deviation	%Cs	0,030	0,0097	PASS
Temp.dependence	%Cs/°C	0,008	0,0019	PASS
ΔCs	%Cs	0,300	0,0635	PASS

Self Diagnostics: PASS

Pressure Tests:

Variable	unit	Test Pressure	
Process Pressure	Bar	24	DONE

TEST PASSED 2014/03/05 SKo