

Metso Total Solids Transmitter

Manual for PA model
OUL00485 VB EN

- supplement to
manual OUL00489



Table of Contents

1	INTRODUCTION.....	3
1.1	Metso TS PA total solids content transmitter.....	3
2	STRUCTURE.....	3
2.1	Transmitter Central Unit	3
3	INSTALLATION.....	3
3.1	General Principles.....	3
3.2	Electric Connections.....	3
4	SETTING UP.....	4
4.1	Mechanical Inspection.....	4
4.2	Installation.....	4
4.3	Inspection of Cabling.....	4
4.4	Electrical Inspection	4
4.5	Configuration and Calibration	4
5	DEVICE DATABASE FILE (GSD), MEASUREMENT STATUS AND DIAGNOSTICS	5
5.1	Introduction, Installation and Overview of GSD file.....	5
5.1.1	Installation of GSD file	5
5.2	GSD Modules.....	5
5.2.1	Cyclical data exchange.....	5
5.2.2	GSD modules	5
5.2.3	Cyclical data	6
5.2.4	Cyclical value status	6
5.2.4.1	Meaning of individual bits in the status byte	7
5.2.4.2	Good.....	7
5.2.4.3	Bad	7
5.3	DDLML_Slave_diag Diagnostics Services	8
6	USER INTERFACE AND OPERATION	10
7	TROUBLESHOOTING AND MAINTENANCE	10
8	RECYCLING AND DISPOSING OF A DEVICE REMOVED FROM SERVICE	10
TECHNICAL SPECIFICATION		
DELIVERY SPECIFICATION		

Warnings & safety information



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



Always check input voltage & frequency before making any connections. Incorrect connections will damage the equipment! Always follow the applicable electric safety regulations 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 Metso TS PA total solids content transmitter

Metso TS PA is a PROFIBUS PA compatible total solids content transmitter which conforms to the PROFIBUS-PA Profile for Process Control Devices Version 3.0.

Metso TS uses the Metso MCA Profibus PA command base. Metso MCA's %Cs corresponds Metso TS's %TS.

For further information regarding device structure, installation, configuration and calibration of the device, please refer to manual id OUL00489 "Metso TS Installation, operating & service manual".

2 Structure

The difference between Metso TS PA and Metso TS total solids content transmitter is in the Transmitter Central Unit (TCU). Sensor structure remains similar to the mA version. (See OUL00489 Metso TS Installation, operating & service manual, Structure)

Fieldbus communication board is added to the TCU. The only way to differentiate between the Profibus version and mA version is by looking at the Identification Plate:

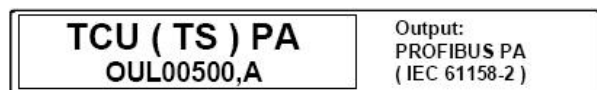


Figure 1. Identification Plate

2.1 Transmitter Central Unit

Fieldbus communication board is connected to the TCU Board connector behind the keyboard.

When the Fieldbus communication board is connected, the current output is disabled.

3 Installation

3.1 General Principles

Metso TS PA total solids content transmitter is installed in the same way as the mA version. (See OUL00489 Metso TS Installation, operating & service manual, Installation). However, the electric connections of these two versions are different.

3.2 Electric Connections

NOTE: When connecting the power supply cables, make sure that the cables are de-energized.

NOTE: Make and check all connections before connecting the power supply to the cables.

NOTE: If the TCU has been switched off for a long time, it may take a few minutes before text appears on the display. This is caused by the charging of the internal back-up battery of the device.

Connect Sensor Cable and Power supply cable according to OUL00489 Metso TS Installation, operating & service manual, Electric connections.

There is no current output (4 – 20 mA) in Metso TS PA.

Metso TS PA uses IEC 61158-2 transmission technology. PROFIBUS devices are supplied by two-wire cables, and process data from the sensor is transmitted digitally.

Reverse polarity protection permits the connection of bus cables in any order.

The cable shield can be grounded by connecting it to the SC SHIELD terminal (Fig. 3, no. 6). According to PROFIBUS PA User and Installation Guideline (Version 2.2, Release Feb03) this method provides optimum electromagnetic compatibility and protection of personnel, and can be used as desired in systems with optimum equipotential bonding.

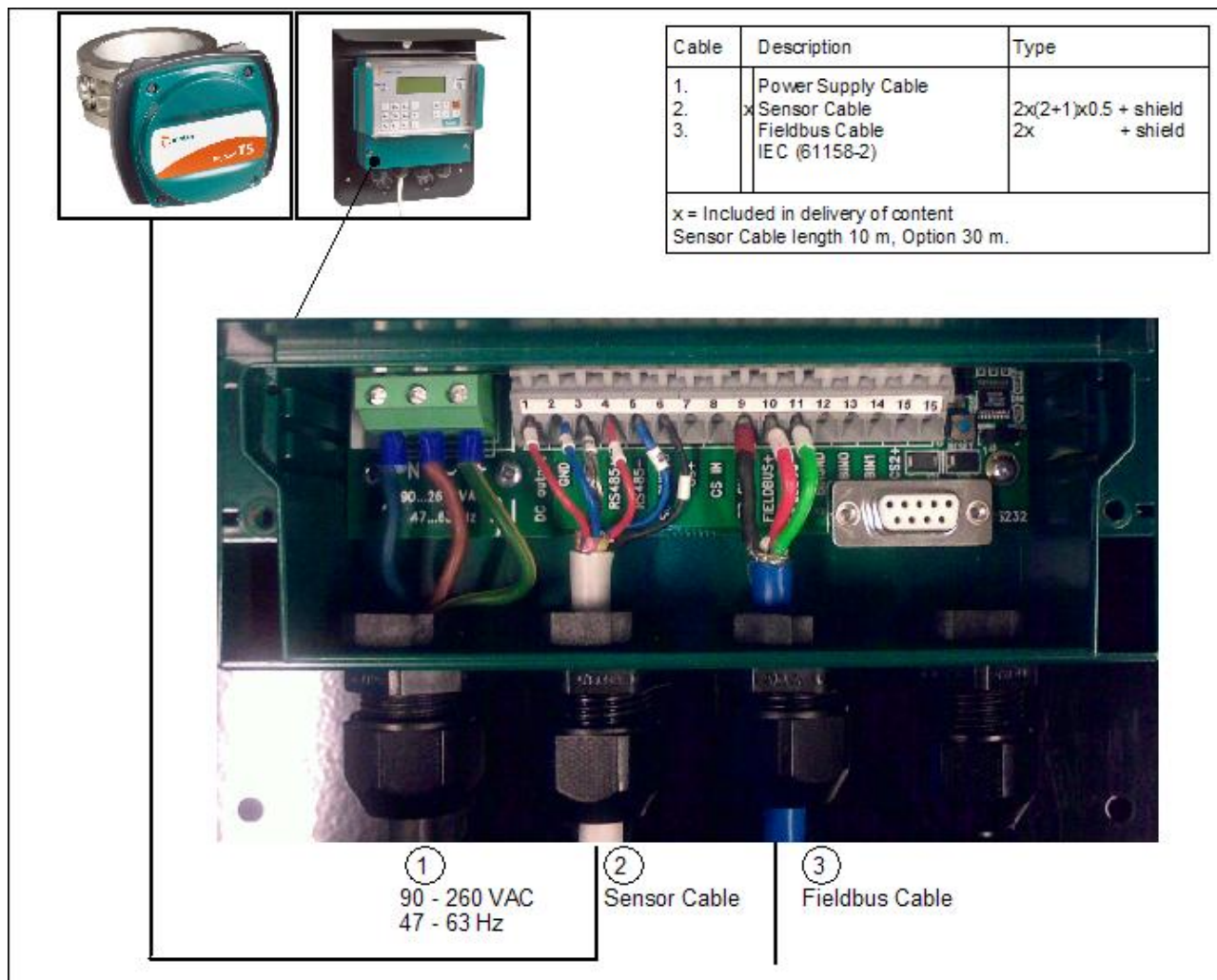


Figure 3. Electric connections in TCU

4 Setting Up

4.1 Mechanical Inspection

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

4.2 Installation

Install the sensor and TCU according to the installation instructions (OUL00489 Metso TS Installation, operating & service manual, Installing)

4.3 Inspection of Cabling

1. Check that the Power Supply is connected correctly.
2. Check that the Fieldbus Cable 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. Make sure that text appears on the TCU display. Usually the main display shows up, but when

replacing a device you may be asked to select calibration. In such a case, select the calibration of the unit (Sensor Electronics/TCU) that has not been changed.

3. Allow the device to warm up for one hour before start-up.

4.5 Configuration and Calibration

1. Select the language and temperature unit (Celsius/Fahrenheit) according to Chapter User settings in OUL00289 Metso TS Installation, operating & service manual.
2. Set the device date and time according to Chapter Setting date & time.
3. Perform total solids content calibration according to Chapter Calibration.
4. Set PA Address:
 - In main display, press **ESC**.
 - Select **2=Configuration**
 - Select **5=Address**
 - Press **Edit/Save** to start editing.
 - Insert the correct PA address. Default address is 126.
 - Press **Edit/Save** to save changes.
 - Press **ESC** to return to the menu.

After these steps the Metso TS PA is ready to measure total solids content.

5 Device Database File (GSD), Measurement Status and Diagnostics

5.1 Introduction, Installation and Overview of GSD file

Metso TS PA is a PROFIBUS PA compatible total solids content transmitter, which conforms to the PROFIBUS-PA Profile for Process Control Devices Version 3.0.

Data exchange between a slave device such as Metso TS PA and a master can be either cyclical or acyclical.

Cyclical communications are the primary type of communications and are handled by a **class-1 master**, normally a DCS or PLC.

Acyclical communications are handled by a **class-2 master**. This type of communications is typically used for device configuration and diagnostics, and the class-2 master is often a laptop computer running configuration software such as Metso Automation Field Care.

Cyclical data exchange between a class-1 master and slave device to are configured with a device database file (GSD).
Metso TS use same GSD-file with Metso MCA.

The GSD is loaded into the class-1 master during commissioning of the device.

This document explains the GSD file supplied with the Metso Automation Metso TS PA device.

In addition this document also explains the meaning of the measurement status byte which is included in the cyclical data transfer with a class-1 master.

More detailed information regarding GSD file in "Specification for PROFIBUS Device Description and Device Integration" by PROFIBUS Nutzerorganisation.

5.1.1 Installation of GSD file

The GSD for Metso TS PA is called MET_098D.GSD and can be found from www.metso.com/Metso TS - Support Files PROFIBUS-PA.

The exact procedure for installation of the GSD file will depend on the system you are using, so please refer to that systems documentation for further details.

5.2 GSD Modules

5.2.1 Cyclical data exchange

Cyclical communications between the PROFIBUS class-1 master (PLC/DCS) and Metso TS PA slave device works essentially as follows,

1. At a regular interval PLC/DCS sends a read command to the Metso TS PA device.
2. Metso TS PA responds with the current total solids content measurement and measurement status.

This communication is configured using GSD modules. During DCS/PLC configuration of cyclical data exchange, the configuration software reads the GSD file and asks the user to select which module should be used.

5.2.2 GSD modules

Metso TS PA is a modular device which uses only one type of Function Block (Analog Input (AI)). The following modules are supported:

1. Total Solids
2. Process Temperature
3. Conductivity

Every module has a Short and Extended identifier available,

- ❑ Short identifier format: "AI Short ID" 0x94

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- ❑ Extended identifier format: "AI Long ID" 0x42, 0x84, 0x08, 0x05

Short format is provided for compatibility with older PROFIBUS DP PLCs. This format only configures the number of input/output data bytes.

Extended identifier format provides additional information about the data types. For example bytes 0x08 and 0x05 indicate that data consists of a float value followed by one byte unsigned integer value (data type 8 is "Floating Point", data type 5 is "Unsigned8" according to the DPV1 specification).

5.2.3 Cyclical data

Profile 3.0 AI function block devices support only one cyclical parameter called OUT. In the case of in Metso TS PA this value is dependent on the selected module.

The data type of value OUT is a **Value & Status Floating point**. This data structure consists of a four byte floating-point value, and a one byte status value which indicates the quality of the floating point value.

GSD module	Control system output	Control system input
AI (short) Total Solids	Read command	Bytes 1-4: VALUE. Total Solids value in AI Block AUTO mode (default mode), Float IEEE-754 Byte 5 : STATUS. The status of the Total Solids value. Unsigned Integer 8. See table 3.
AI (Long) Total Solids	Read command	Bytes 1-4: VALUE. Total Solids value in AI Block AUTO mode (default mode), Float IEEE-754 Byte 5 : STATUS. The status of the Total Solids value. Unsigned Integer 8. See table 3.
AI (short) Process Temperature	Read command	Bytes 6-9: VALUE. Process Temperature value in AI Block AUTO mode (default mode), Float IEEE-754 Byte 10 : STATUS. The status of the Process Temperature value. Unsigned Integer 8. See table 3.
AI (Long) Process Temperature	Read command	Bytes 6-9: VALUE. Process Temperature value in AI Block AUTO mode (default mode), Float IEEE-754 Byte 10 : STATUS. The status of the Process Temperature value. Unsigned Integer 8. See table 3.
AI (short) Conductivity	Read command	Bytes 11-14: VALUE. Conductivity value in AI Block AUTO mode (default mode), Float IEEE-754 Byte 15 : STATUS. The status of the Conductivity value. Unsigned Integer 8. See table 3.
AI (Long) Conductivity	Read command	Bytes 11-14: VALUE. Conductivity value in AI Block AUTO mode (default mode), Float IEEE-754 Byte 15 : STATUS. The status of the Conductivity value. Unsigned Integer 8. See table 3.

Table 1. List of elements of Value & Status Floating Point data structure

5.2.4 Cyclical value status

The status byte described in section 5.3 for OUT provides information about the quality of the process value.

The status information below also applies to the temperature sensor values, which are also of type Value & Status Floating point. These values are only available through acyclical communications.

Primary status values are **good, uncertain, and bad**.

5.2.4.1 Meaning of individual bits in the status byte

All possible status byte values and their meanings are shown in the table below. Values actually used in Metso TS PA are shown in bold text. Explanations of what the status value indicates are given in sections 5.2.4.2 – 5.2.4.3.

The status byte is defined according to the table below, where value x = don't care (can be 0 or 1).

Value when limit bits zero	Quality bits		Additional bits				Limit bits		Meaning	Used
	7	6	5	4	3	2	1	0		
0x00	0	0	0	0	0	0	x	x	bad	Yes
0x04	0	0	0	0	0	1	x	x	bad, configuration error	No
0x08	0	0	0	0	1	0	x	x	bad, not connected	No
0x0C	0	0	0	0	1	1	x	x	bad, device failure	No
0x10	0	0	0	0	0	0	x	x	bad, sensor failure	No
0x14	0	0	0	0	0	1	x	x	bad, no communication (last usable value)	No
0x18	0	0	0	0	1	0	x	x	bad, no communication (no usable value)	No
0x1C	0	0	0	0	1	1	x	x	bad, out of service	No
0x40	0	1	0	0	0	0	x	x	uncertain	Yes
0x44	0	1	0	0	0	1	x	x	uncertain, last usable value	Yes
0x48	0	1	0	0	1	0	x	x	uncertain, substituted value	No
0x4C	0	1	0	0	1	1	x	x	uncertain, initial value	No
0x50	0	1	0	1	0	0	x	x	uncertain, sensor conversion not accurate	No
0x54	0	1	0	1	0	1	x	x	uncertain, engineering unit violation (unit not in valid set)	No
0x58	0	1	0	1	1	0	x	x	uncertain, sub-normal	No
0x5C	0	1	0	1	1	1	x	x	uncertain, configuration error	No
0x60	0	1	1	0	0	0	x	x	uncertain, simulated value	No
0x64	0	1	1	0	0	1	x	x	uncertain, sensor calibration	No
0x80	1	0	0	0	0	0	x	x	good	Yes
0x84	1	0	0	0	0	1	x	x	good, update event (change of parameters)	No
0xA0	1	0	1	1	0	0	x	x	good, go into failsafe position (command)	No
0xA4	1	0	1	1	0	1	x	x	good, maintenance required	No
	x	x	x	x	x	x	0	0	value is not limited	Yes
	x	x	x	x	x	x	0	1	value is low limited	Yes
	x	x	x	x	x	x	1	0	value is high limited	Yes
	x	x	x	x	x	x	1	1	value is constant	Yes

Table 2. Meaning of bits in Status byte

5.2.4.2 Good

If the measurement status is good this means the following,

- ☐ No device error is detected by the internal diagnostics.
- ☐ The total solids content value is correct according to the device calibration.

5.2.4.3 Bad

If the total solids content measurement status is bad this means the following,

- ☐ The internal diagnostics of Metso TS PA has detected one of the following critical errors
 - Communications error between TCU display unit and sensor electronics
 - TCU display unit eeprom read error
 - Sensor measurement level out of range
 - Sensor reference measurement level out of range
 - Sensor measurement stability out of range
 - Sensor reference measurement stability out of range
 - Sensor electronics drift out of range

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- Sensor VCO drift out of range
- Board to board communications error between TCU display unit and field bus interface board

5.2.4.4 Uncertain

- Status is uncertain after sensor startup or restart until the sensor is operating normally.

5.3 DDLm Slave diag Diagnostics Services

If the class-1 master supports the **DDLm_Slave_Diag** service then specific diagnostics are available from the device in the event of a failure.

Diagnostics information is accessed through two parameters of the physical block as follows,

- The **DIAGNOSIS** parameter consists of four bytes of standard diagnostics information from the device. The meaning of each bit of each byte is defined within the PROFIBUS PA Profile for Process Control Devices Version 3.0 specification.
- The **DIAGNOSIS_EXTENSION** parameter from the Physical block consists of six bytes of manufacturer specific diagnostics information from the device. The meaning of each bit of each byte is defined by the manufacturer and is specific to the device. This parameter is included in the DDLm_Slave_Diag service only if the *PROFIBUS Ident Number* is selected to be manufacturer specific (Hexadecimal 98D).

The meaning of the DIAGNOSIS bytes is given in table 4 below. In the case of the standard DIAGNOSIS bytes those actually used in Metso TS PA shown in bold text.

The meaning of the indication class in tables 4 and 5 is as follows,

Indication class	Explanation
A	Bit reset automatically after 10 seconds
R	Active as long as the reason for the message exists

Table 3. Indication classes

Byte	Bit	Description	Indication class	Used
1	0	Hardware failure, electronic	R	Yes
	1	Hardware failure, mechanical	R	No
	2	Motor temperature too high	R	No
	3	Electronics temperature too high	R	No
	4	Memory error	R	No
	5	Failure in measurement	R	No
	6	Device not initialized	R	No
	7	Device self calibration failed	R	No
2	0	Zero point error	R	No
	1	Power supply failure (electrical, pneumatic)	R	No
	2	Configuration not valid	R	Yes
	3	Warm boot carried out	A	No
	4	Cold boot carried out	R	No
	5	Maintenance required	R	No
	6	Characterization invalid	R	No
	7	Set to 1 if the ident number of the running cyclic data transfer and the value of Physical Block IDENT_NUMBER_SELECTOR parameter are different	R	No
3	0..7	Reserved for use with PNO		No
4	0..6	Reserved for use with PNO		No
4	7	More diagnosis information is available		Yes

Table 4. Diagnosis parameter bit-enumeration.

The meaning of the DIAGNOSIS_EXTENSION bytes is given in table 5 below. All of these are implemented in Metso TS PA.

Byte	Bit	Description	Indication class
1	0	Reserved	R
1	1	Reserved	R
1	2	Reserved	R
1	3	Reserved	R
1	4	Reserved	R
1	5	Reserved	R
1	6	Reserved	R
1	7	Reserved	R
2	0	Warning: Write Failed. Wrong Block Mode	R
2	1	Reserved	R
2	2	Warning: Write Failed. Invalid Value	R
2	3	Reserved	R
2	4	Error: FBI to TCU Communication Timeout	R
2	5	Warning: Write Failed. Wrong Data Type	R
2	6	Warning: Unexpected Device Response	R
2	7	Error: FBI To TCU Checksum Fault	R
3	0	Warning: Real Time Clock Error	R
3	1	Error: Sensor Electronics Communication Error	R
3	2	Error: Configuration Data Error	R
3	3	Warning: Sensor Cabin Temperature Too High	R
3	4	Error: Measurement Signal Level Too Low	R
3	5	Error: Reference Signal Level Too Low	R
3	6	Error: Process Temperature Out Of Range	R
3	7	Reserved	R
4	0	Error: Measurement Signal Stability Error	R
4	1	Error: Reference Signal Stability Error	R
4	2	Error: Sensor Electronics Drift Too High	R
4	3	Error: VCO Drift Too High	R
4	4	Warning: Config Changed From TCU	R
4	5	Warning: Primary variable out of limits	R
4	6	Reserved	R
4	7	Reserved	R

Table 5. Diagnosis Extension parameter bit-enumeration.

6 User Interface and Operation

See OUL00489 Metso TS Installation, operating & service manual, Chapter User Interface and Operation.

Profibus address is added to the configuration menu:

- 1=Output signal
- 2=User settings
- 3=Device info
- 4=Set Clock
- 5=Address**

7 Troubleshooting and Maintenance

See OUL00489 Metso TS Installation, operating & service manual, Chapter Troubleshooting and Maintenance.

8 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. Alternatively, you can return the device to the manufacturer for recycling and disposal (will be invoiced).

Technical Specification

See OUL00489 Metso TS Installation, operating & service manual, Technical Specification.

Output Signal

PROFIBUS - PA Slave
IEC 61158-2

- | | |
|-------------------------|---|
| • Profibus power supply | Taken from bus |
| • Bus Voltage | 9 to 32 V DC, reverse polarity protection |
| • Max basic current | 14.2 mA |

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