Operating manual

Digital Transmitter DTM.OCS.S / DTM.OCS.S/N

Doc. No. 10.00.0430

Version: 11.08.2015

These operating instructions must be read by the operator before operation and installation!

Translation of the original operating manual

Inhalt

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1 Introduction

1.1 Requirements/Basics

You need basic knowledge of Modbus.

1.2 Abbreviations

Abbreviation	Meaning
DTM	Digital Transmitter
OCS	Open Communication System
P	Pressure
PZP	Zero-point pressure
PN	Nominal pressure
T	Temperature
DW	Data word
DB	Data byte
PDU	Protocol Data Unit
@	at

Tab. 1: Abbreviations

1.3 Limitation of Liability

All information and notes in these instructions have been put together under consideration of the applicable standards and provisions, the state of the art and our many years of insights and experiences.

The manufacturer assumes no liability for damage due to:

- Non-observation of these instructions
- Non-intended use
- Use of untrained staff
- Unauthorized conversions
- Technical changes
- Use of unapproved spare and wear parts

The actual scope of delivery may deviate from the expectations and illustrations here in special designs, utilization of additional order options or due to the latest technical changes.

Apart from this, the obligations agreed on in the supply contract, the general terms and conditions and the delivery conditions of the manufacturer and the statutory rules applicable at the time of conclusion of the contract shall apply.

Warranty

The manufacturer guarantees for the function of the applied process technology and the indicated performance parameters.

The warranty period shall commence at the time of delivery of the device to the customer.

Components shall be excluded from the guarantee and claims for defects if the damage has been caused by wear.

1.4 Copyright Protection

The operating instructions must not be provided to any third parties without the written consent of the manufacturer.

NOTE!

The content, texts, drawings, pictures and other illustrations are copyright-protected and subject to the commercial property rights. Any abusive utilization is punishable.

Reproductions of any kind and form - even in excerpts - as well as use and/or disclosure of the contents shall not be permitted without written declaration of the manufacturer.

1.5 Spare Parts

ATTENTION!

Wrong or defective spare parts may cause damage, malfunction or total failure.

Therefore:

→ Only use genuine spare parts of the manufacturer.

Purchase spare parts through the authorized dealer or directly from the manufacturer. Address on the reverse.

1.6 Guarantee Provisions

For guarantee provisions, see "General terms and conditions".

1.7 Customer Service

Our customer service will be available for technical information.

Information on the relevant contact can be provided by phone, fax, email or online at all times; see manufacturer's address on the last page.

1.8 Registered Trademarks

Any brand and product names are registered trademarks of the respective companies and organizations.

1.9 Reference Documentation

- MODBUS over Serial Line, Specification & Implementation Guide V1.0
  http://www.modbus.org
  Modbus Standard Library section
- MODBUS Application Protocol Specification V1.1
  http://www.modbus.org
  Modbus Standard Library section
- STS Website
  http://www.stssensors.com
  Datasheets and general product information

2 Safety

2.1 Intended Use

The intended use of the Digital Transmitter DTM.OCS.S and DTM.OCS.S/N is the measuring of pressure and temperature and the transmitting of the values in real time to the interface RS485 using Modbus RTU protocol.

The use in acids / bases is only possible to a limited extent.

Application and medium compatibility must be coordinated with STS before commissioning or when ordering.

Only use the device as intended.
All information in the operating instructions must be complied with.

The operator shall be solely liable for any damage at non-intended use.

2.2 Explanation of Symbols

Warning Notes

Warning notes are marked with symbols in these operating instructions. The notes are preceded by signal words that express the scope of the danger.
Comply with the notes and act with caution to avoid accidents, injury and property damage.

ATTENTION!

… indicates a potentially dangerous situation that may cause slight or minor injury if not avoided.

CAUTION!

… indicates a potentially dangerous situation that may cause property damage if not avoided.

Advice and Recommendations

NOTE!

… highlights useful advice and recommendations, as well as information for efficient and interference-free operation.

3 Product overview

Fig. 1: Product overview Digital Transmitter DTM.OCS.S

1 Operating and safety instructions
2 Digital Transmitter

The operating manual can be downloaded from the STS homepage.

4 Commissioning of the Digital Transmitter

4.1 Unpacking

The digital transmitter is delivered in product-specific packaging that protects it outstandingly under regular transport conditions. Check the packaging for outward damage. Take out the transmitter carefully and without applying any force.

4.2 Safety Notes

CAUTION!

Check the values on the rating plate, and particularly the pressure range. These values must correspond to the required technical data. The seals are made of Viton (FPM), unless the order confirmation states differently.

ATTENTION!

Have your device installed by specialists. Observe the national safety provisions when installing and operating the digital transmitter.

CAUTION!

Excessive vibrations, impact and pressure peaks may falsify measurements and damage the digital transmitter.

CAUTION!

Protect the digital transmitter from overload and abrasion stress with titanium housing.

4.3 Notes on Installation

ATTENTION!

Connect the digital transmitter to depressurized systems only.

Do not connect to systems under pressure!

NOTE!

Some digital transmitters are delivered with a yellow protective cap for the pressure connection. Remove the flap before you use the digital transmitter.

- Do not connect the digital transmitter in the direct proximity of motors, pumps, valves, heat sources or other possible interference sources.
- Protect the membranes from damage. Do not touch the membranes.
- Digital transmitter with cable output: Avoid damage to the cable jacket. Observe the maximum permitted medium temperature of the cable in the respective data sheet.
- Do not kink/excessively bend the cable or route it over sharp edges. Avoid abrasion points.
- Reduce tension of the cable and the cable socket to the minimum.
- Observe the max. tightening torque of 30 Nm.

CAUTION!

Ensure that the connection at the digital transmitter is closed again carefully with the yellow protective cap after disconnecting the cable from the digital transmitter!

4.4 Installation

Refer to the instruction leaflet enclosed with the Digital Transmitter.

5 Communication with the DTM.OCS.S transmitter

5.1 Summary

Communication with the DTM.OCS.S is accomplished via an RS485 serial interface using Modbus protocol transfers at 9600 baud. STS specific, proprietary commands are transmitted as ASCII strings embedded in Modbus compatible data frames. Modbus standard function codes are supported as well.

The following settings apply:

Type	Setting
Transmission mode	Modbus RTU
Default address	240_{10}
Transmission rate	9600 baud
Data bits	8
Parity	None
Stop bits	2

Tab. 2: Settings

5.2 Physical interface

For communication with the DTM.OCS.S, a suitable interface such as a Modbus compatible RS485-USB converter must be employed.

5.3 Software interface

5.3.1 Modbus

- Modbus is a master-slave communication protocol.
- Slave devices will never communicate with each other.
- Modbus telegrams in the RTU mode always begin with the address (0 - 247) and a function code (FC Code). Then the data words (DW) follows. 2 bytes with the CRC checksum form the conclusion.
- The function code indicates to the device what action to perform.
- Communication states (transmit/receive/cancel) are controlled via timeouts.
- The byte sequence for transmission of data words and the CRC checksum is defined as follows:
  Data words: Hi – Lo byte
  CRC: Lo – Hi byte

For the communication with the DTM.OCS.S, standard Modbus commands (Function Codes 3, 4 and 16) and a custom STS function code (0x64 [100_{10}]) are used.

5.3.2 General Modbus message frame structure

Message frame:

Modbus message (command or response)							
Address	FC Code	DW1	DW2	DW3	……	DWn	CRC
1 byte	1 byte	2 bytes	2 bytes	2 bytes		2 bytes	2 bytes

Modbus PDU

Modbus Serial Line PDU

Tab. 3: Modbus message frame

The number of data words can be derived from the definition of the respective commands. The CRC checksum is divided into two individual bytes with the low byte being transmitted first, followed by the high byte. The CRC checksum is calculated using address, function code and the data words. If the message is faulty (e.g. an invalid CRC checksum is provided), no response is given.

5.4 Modbus STS commands

5.4.1 STS command structure

For the communication with the DTM.OCS.S, a custom STS function code is used: 0x64 (100_{10}).

FC Code	data size	STS command and its parameter(s) (ASCII encoded strings)
0x64	N	1 ≤ N ≤ 250 bytes

Modbus PDU

Tab. 4: STS command structure

The STS command and its parameter(s) are encoded as readable ASCII text strings.

As they are embedded in the PDU's payload field, the data frame remains Modbus RTU compatible.

5.4.2 Sensor response

As required to be compliant with the Modbus standard, a sensor response is carried out only upon a request from the master device. The reply is embedded in the PDU's payload, encoded as readable ASCII text strings.

Provided a valid Modbus message frame was received, the reply will contain the requested data, preceded by the received command string (without parameters). Additionally, the DTM.OCS.S returns one of the following status messages and appends it to the requested data:

Status message	Description
OK	Command has been executed successfully
FAIL	Command execution has been failed
BUSY	The device is busy, try again later
ERROR	Internal error

Tab. 5: Status messages

For a detailed example please see chapter 5.4.4.

5.4.3 List of STS commands

Listed below are the provided STS commands and their associated parameters. Commands may be called with multiple parameters combined.

5.4.3.1 MEASURE

The MEASURE command reads out the currently present pressure and temperature.

Parameter	Example	Exemplary answer	Description
	(no parameters)	MEASURE –P 2.9004 –PU mH2O –T 27.6 –TU °C	reads out currently measured values using default settings → 2.9004 mH2O, 27.6 °C)
-PU	-PU mbar	MEASURE –P 284.44 –PU mbar –T 27.6 –TU °C	returns the pressure in the requested unit → 284.44 mbar, 27.6 °C
-TU	-TU K	MEASURE –P 284.44 –PU mbar –T 300.8 –TU K	returns the temperature in the requested unit → 284.44 mbar, 300.8 K
-UO	-UO 0.1	MEASURE –P 3.0004 –PU mH2O –T 27.6 –TU °C	adds an offset to the measured pressure value (the current default unit is used) → 3.0004 mH2O, 27.6 °C
-UG	-UG 2.0	MEASURE –P 5.8008 –PU mH2O –T 27.6 –TU °C	multiplies the measured pressure value UG times (the default unit is used) NOTE! If a user offset (UO) is used then the displayed pressure p_d is calculated as follows (p_m is the measured pressure value): $p_d = UG \times (p_m + UO)$ →5.8008 mH2O, 27.6 °C
-TARE_V	-TARE_V 6.87	-	sets tare → 6.87 mH2O

Parameter	Example	Exemplary answer	Description
-DTW_V	-DTW_V 2.7	-	sets distance to water → 2.7 mH2O
-REF_V	-REF_V 0.45	-	sets the reference value tare and dtw are referring to → 0.45 mH2O
-SAVE	-SAVE	-	used to save the provided settings NOTE! Provided settings will only be saved permanently, if “-SAVE” is used along with “magic number”.
-M	-M 1234567890	-	“magic number” used for permanently saving the settings.

Tab. 6: MEASURE command parameters

Examples

Read out temperature but instead of returning the value in the default unit, return it in Kelvin:

- “MEASURE –TU K”

Change the default pressure unit to mWC:

- “MEASURE -PU mWC -M 1234567890 -SAVE”

Set distance to water to 2.7 mWC and the reference value to 0.45:

- “MEASURE -DTW_V 2.7 -REF_V 0.45 -M 1234567890 -SAVE“

Reset dtw and tare settings:

- “MEASURE -DTW_V 0 –TARE_V 0 -REF_V 0 -M 1234567890 -SAVE“

5.4.3.2 Supported pressure units

Unit	Description
mH2O	Meter of water column at 4 °C
mWS	Meter of water column at 4 °C
mWK	Meter of water column at 4 °C
mWG	Meter of water column at 4 °C
mWC	Meter of water column at 4 °C
mbar	Millibar
bar	Bar
Pa	Pascal
hPa	Hectopascal
kPa	Kilopascal
MPa	Megapascal
GPa	Gigapascal
N/m2	Newton per square meter
kN/m2	Kilonewton per square meter
MN/m2	Meganewton per square meter
GN/m2	Giganewton per square meter
N/mm2	Newton per square millimeter
kN/mm2	Kilonewton per square millimeter

Tab. 7: Pressure units

5.4.3.3 Supported temperature units

Unit	Description
°C	Degree Celsius
°F	Degree Fahrenheit
K	Kelvin

Tab. 8: Temperature units

5.4.3.4 GETPROBE

The GETPROBE command queries the available measurement channels of the addressed sensor device.

Parameter	Example	Exemplary answer	Description
-LIST	-LIST	GETPROBE -LIST “-CH” -CH0 Pressure -CH1 Temperature	lists the sensor’s available channels

Tab. 9: GETPROBE command parameters

Example

List the sensor's available channels:

- "GETPROBE -LIST"

5.4.4 STS Modbus commands under the magnifying glass

Below a very detailed example including hex codes on a byte level is presented to allow a more comprehensive understanding of the command structure.

- We use the command “MEASURE” (see chapter 5.4.3.1) as illustrating example.
- We assume the sensor address is 123_{10} and that its available channels are pressure and temperature.

The following Modbus code must therefore be sent to the sensor (numbers in hex format if not stated otherwise):

	device address	FC code	data size	---------- data ----------							--------- crc ---------	
byte code:	7B	64	07	4D	45	41	53	55	52	45	8A	B4
interpretation:	($7B_{16}$=123_{10})			‚M‘	‚E‘	‚A‘	‚S‘	‚U‘	‚R‘	‚E‘	CRC low	CRC high

transmit sequence

Now let’s say the sensor returns a pressure of 10.2500 mH2O and a temperature of 27.2 °C.

The expected answer (embedded in the Modbus frame payload) then would be:

- “MEASURE -P 10.2500 -PU mH2O -T 27.2 -TU °C OK;”

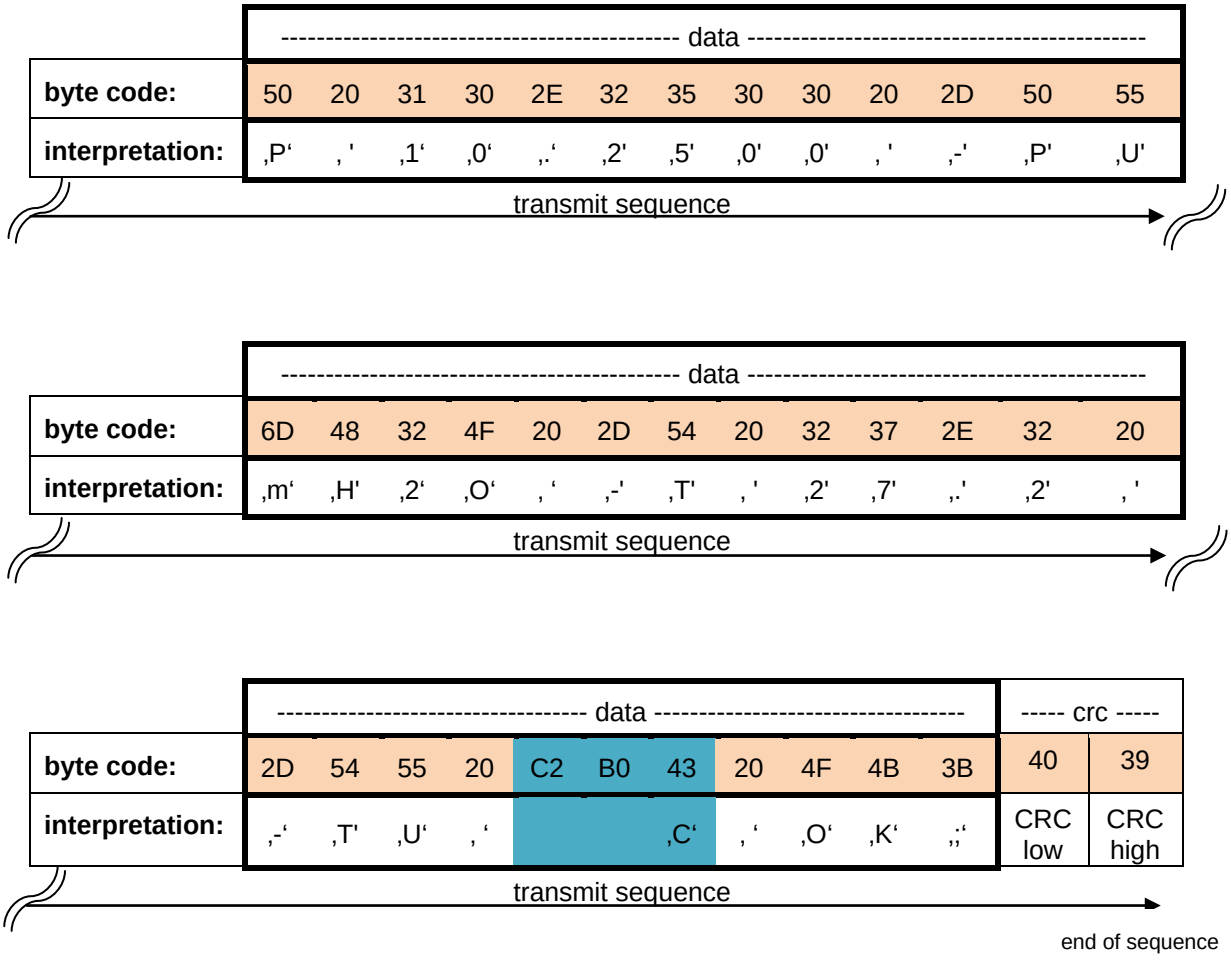
Expressed as byte code this leads to:

	device address	FC code	data size	---------- data ----------								
byte code:	7B	64	2F	4D	45	41	53	55	52	45	20	2D
interpretation:	($7B_{16}$=123_{10})			‚M‘	‚E‘	‚A‘	‚S‘	‚U‘	‚R‘	‚E‘	‚ ‘	‚-‘

start of sequence

transmit sequence

Communication with the DTM.OCS.S transmitter



Please note that UTF-8 encoding is used for the text strings. In the example above this applies to the string “°C”, resulting in the byte code 0xC2B043 (marked cyan).

6 Modbus standard commands

This chapter describes the Modbus standard command set supported by the DTM.OCS.S. Function Codes 3, 4 and 16 are used.

NOTE!
The following commands are all using the default Modbus device address 240 (0xF0)!

6.1 Read pressure value (P)

6.1.1 Command (Hex-Code, Function Code 4)

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 04 00 00 00 01 24 EB

6.1.2 Interpretation start index 0: Measured pressure value

Pressure

- Value range: 0 - 10,000 points
- Conversion:

$$P[bar] = pressure[points] * \frac{(P_{MAX}[bar] \quad P_{MIN}[bar])}{10000} + P_{MIN}[bar]$$

Value range: 16bit signed integer (-32,768…32,767), nominal 0…10,000 points (P_{MIN}…P_{MAX}).

6.2 Read temperature-value (T)

6.2.1 Command (Hex-Code, Function Code 4)

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 04 00 01 00 01 75 2B

6.2.2 Interpretation start index 1: Measured temperature value

Temperature

- Value range: 0 - 10,000 points
- Conversion:

$$T[°C] = temperature[points] * \frac{(T_{MAX}[°C] \quad T_{MIN}[°C])}{10000} + T_{MIN}[°C]$$

Value range: 16bit signed integer (-32,768…32,767), nominal 0…10,000 points (T_{MIN}…T_{MAX})

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$)

T_{MIN} = -10°C, T_{MAX} = 50°C

	Address	Function code	Start index		Length		crc	
byte code:	F0	04	00	01	00	01	75	2B
format:	byte	byte	high byte	low byte	high byte	low byte	CRC low	CRC high

transmit sequence

Example answer (in hex format) for a sensor with the address 240_{10} ($F0_{16}$).

	Address	Function code	ByteCount	Temperature [points]		crc	
byte code:	F0	04	02	15	EF	8B	F9
format:	byte	byte	byte	high byte	low byte	CRC low	CRC high

transmit sequence

Example conversion: $T = 5615 * \frac{(50-(-10))}{10000} + (-10) = 23.69°C$

6.3 Read pressure and temperature in one command

6.3.1 Command (Hex-Code, Function Code 4)

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 04 00 00 00 02 64 EA

6.4 Read maximum pressure (Nominal pressure, P_{MAX})

6.4.1 Command (Hex-Code, Function Code 3)

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 03 00 C8 00 02 50 D4

6.4.2 Interpretation start index 200+201: Nominal pressure

Data type: 32 Bit signed integer

PMax1, PMax2

- Description: Nominal pressure
- Calculation: P_{Max} = PMax2 * 65536 + PMax1
  If PMax > 2^{31}
  PMax = (PMax2 * 65536 + PMax1) - 2^{32}

$$P_{MAX}[bar] = \frac{PMax}{100000}[bar]$$

Example: PMax1 = 54464
PMax2 = 1
-> PMax = 120,000
-> P_{MAX} = 1.2 bar

Calculation example: Return value is 0x27C00009:

→ PMax1 = $27C0_{16} = 10176_{10}$ {low word}

→ PMax2 = $0009_{16} = 9_{10}$ {high word}

→ PMax = 9*2^16 + 10176 = 600000 → P_{MAX} = 6.0 bar

6.5 Read minimal pressure (Zero-point pressure, P_{MIN})

6.5.1 Command (Hex-Code, Function Code 3):

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 03 00 CA 00 02 F1 14

6.5.2 Interpretation start index 202+203: Zero-point pressure

Data type: 32 bit signed integer

PMin1, PMin2

- Description: Zero-point pressure
- Calculation: PMin = PMin2 * 65536 + PMin1
  If PMin > 2^{31}
  PMin = (PMin2 * 65536 + PMin1) - 2^{32}

$$P_{MIN}[bar] = \frac{PMin}{100000}[bar]$$

Example: PMin1 = 31072
PMin2 = 65534
-> PMin = -100,000
-> P_{MIN} = -1 bar

6.6 Read maximum temperature (end of temperature range, T_{MAX})

6.6.1 Command (Hex-Code, Function Code 3)

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 03 00 CC 00 02 11 15

6.6.2 Interpretation start index 204+205: End of temperature range

Data type: 32 bit signed integer

TMax1, TMax2

- Description: End of temperature range
- Calculation: TMax = TMax2 * 65536 + TMax1
  If TMax > 2^{31}
  TMax = (TMax2 * 65536 + Tmax1) – 2^{32}

$$T_{MAX}[°C] = \frac{TMax}{100000}[°C]$$

6.7 Read minimal temperature (start of temperature range, T_{MIN})

6.7.1 Command (Hex-Code, Function Code 3)

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 03 00 CE 00 02 B0 D5

6.7.2 Interpretation start index 206+207: Start of temperature range

Data type: 32 bit signed integer

TMin1, TMin2

- Description: Start of temperature range
- Calculation: TMin = TMin2 * 65536 + TMin1
  If TMin > 2^{31}
  TMin = (TMin2 * 65536 + TMin1) – 2^{32}

$$T_{MIN}[°C] = \frac{TMin}{100000}[°C]$$

6.8 Read P_{MAX}, P_{MIN}, T_{MAX}, T_{MIN} together in one command

6.8.1 Command (Hex-Code, Function Code 3)

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 03 00 C8 00 08 D0 D3

6.9 Change device's Modbus address

6.9.1 Command (Hex-Code, Function Code 16)

Start index is 20_{10}.

Example transmission code (in hex format) to change its address from 240_{10} ($F0_{16}$) to address 222_{10} (DE_{16}):

F0 10 00 14 00 01 02 00 DE 2C 88

Value range: 16bit unsigned integer (0...65536), nominal 1…247.

6.10 Read serial number

6.10.1 Command (Hex-Code, Function Code 3)

Start index is 210_{10}.

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 03 00 D2 00 02 71 13

Data type: 32 bit unsigned integer

SN1, SN2

- Description: serial number of device, split-up into two 16 bit values
- Calculation: SN = SN2 * 65536 + SN1

Example answer (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 03 04 6B 94 00 05 87 37

SN1 = $6B94_{16} = 27540_{10}$, SN2 = $0005_{16} = 5_{10}$

→ SN = 5*65536 + 27540 = 355220

6.11 Read Firmware version

6.11.1 Command (Hex-Code, Function Code 4)

Start index is 7_{10}.

Example transmission code (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 04 00 07 00 01 95 2A

Data type: 16 bit unsigned integer

FWU16

- Description: firmware version
- Calculation: fw = FWU16/100

Example answer (in hex format) for a sensor with the address 240_{10} ($F0_{16}$):

F0 04 02 00 70 C5 01

FWU16 = 0070_{16} = 112_{10}

→ fw = 112/100 = 1.12

7 Technical Data

Refer to the data sheet of the Digital Transmitter DTM.OCS.S.

8 Maintenance

Interval	Maintenance work
Regularly, depending on the medium that is monitored. In case of uncertainty, contact your STS distribution partner.	Clean the membrane of the Digital Transmitter in case of strong pollution.

8.1 Cleaning the Membrane

CAUTION!

Never use any pointy objects (e.g. screwdriver) to clean the membrane! They may destroy the membrane.

Screw off the screw cap to expose the membrane.

Flush the membrane under running water. Ensure that the membrane is not damaged.

CAUTION!

Remove all plastic parts before descaling (seals, safety cap). Do not use any further aids to remove scale. Otherwise, the membrane may be damaged.

In case of scale deposits, the membrane can be cleaned with commercial descaler. Flush with running water after descaling.

In case of strong contamination, the membrane can also be cleaned carefully with a cotton swab and liquid benzine. Ensure that the membrane is not pushed in or damaged.

8.2 Recalibration

Return the digital transmitter to STS for recalibration.

8.3 Disposal

Return the digital transmitter to STS for disposal.

9 Troubleshooting

9.1 Error messages when using STS Modbus commands

Fault	Possible cause	Troubleshooting
Digital Transmitter responds with BUSY	The device is busy.	Try again later.
Digital Transmitter responds with FAIL	The command execution has failed. Faulty command.	Check correctness of command and try again.
Digital Transmitter responds with ERROR	Internal error of the device.	Disconnect the power supply from the device for 10 seconds. Reconnect and try again. If this does not fix the error, contact STS customer support.
Measurements are incorrect or off	Sensor needs re-calibration.	Set an offset for the measurements. If this does not fix the problem, send the device back to STS.

9.2 Error messages when using Modbus standard commands

9.2.1 General

In Modbus Layer 7 protocol faulty accesses to a node are answered by the node with an exception.

The exception response contains the original function code increased by 128, followed by an exception code.
See chapter 9.2.2 for details.

- For example: For a function code of 3, the exception answer is received with a function code of 131. Following that is the exception code.

With the exception code, an error in the receiver can be found out.

9.2.2 Exception codes

The following exception codes are possible:

Exception code	Fault description
1	The function code used in the command is not supported by the device.
2	a) The start index used in the command is not supported by the device. b) The length used in the command is too big for the start index.
3	The length used in the command is 0.
4	a) Not enough rights (write/read) existent on an index used in the command b) The value range of the data to be written is violated.

10 Appendix

10.1 Mapping of Modbus command codes

Some Modbus implementations use a different way to address the desired data fields. The following table might be of use in these cases:

Value to get	Address	Format	Range	Description
Pressure	30001	Int16	-32768 .. +32767	Pressure in %, 5660 equals 56.6%
Temperature	30002	Int16	-32768 .. +32767	Temperature in %, 5660 equals 56.6%
Firmware Version	30008	Uint16	0 .. +65536	Firmware version number (multiplied by 100)
Modbus address	40021	Uint16	0 .. +65536	Modbus address of device (valid range: 1…247)
Max. pressure (P_{MAX})	40201	Int32	-2147483648 .. 2147483647	Maximal pressure (factory setting)
Min. pressure (P_{MIN})	40203	Int32	-2147483648 .. 2147483647	Minimal pressure (factory setting)
Max. temperature (T_{MAX})	40205	Int32	-2147483648 .. 2147483647	Maximal temperature (factory setting)
Min temperature (T_{MIN})	40207	Int32	-2147483648 .. 2147483647	Minimal temperature (factory setting)

Tab. 10: Mapping of Modbus command codes

11 Revision history

Revision date	Chapter	Page	Change	Reason for change

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