DIQ/S 281-HART

LINKING THE DIQ/S 281-HART WITH A HART FIELD BUS

WTW

a **xylem** brand

Contents

1   DIQ/S 281-HART

**The module
M/HART**

The universal transmitter DIQ/S 281-HART provides the interface for a HART fieldbus via the M/HART module.

> For basic information on the operation and commissioning of the DIQ/S 281-MOD, refer to the operating manual DIQ/S 281.

The Modbus HART converter is a HART client that converts the Modbus data of the IQ SENSOR NET sensor being operated on the DIQ/S 281-HART into 4 HART variables.

**Data
link**

For the data link, the Modbus HART converter is connected to the Modbus interface of the DIQ/S 281-MOD.
The Modbus interface of the DIQ/S 281-MOD is configured for operation with the M/HART module.

**Power
supply**

For power supply, the Modbus HART converter is connected to the HILFSSPANNUNG or AUXILIARY VOLTAGE pin on the terminal strip of the DIQ/S 281.

> The auxiliary voltage of the DIQ/S 281-HART cannot be used by other applications.

2   Establishing a link with a HART fieldbus

1   Establishing a link with a HART fieldbus
(see section 2)

2   If required:
Configuring the Modbus HART converter
(see section 3.1)

3   Displaying the HART variables
(see section 3.2)

Materials required
- Wire end sleeves, suitable for the connecting wires, with suitable crimping tool
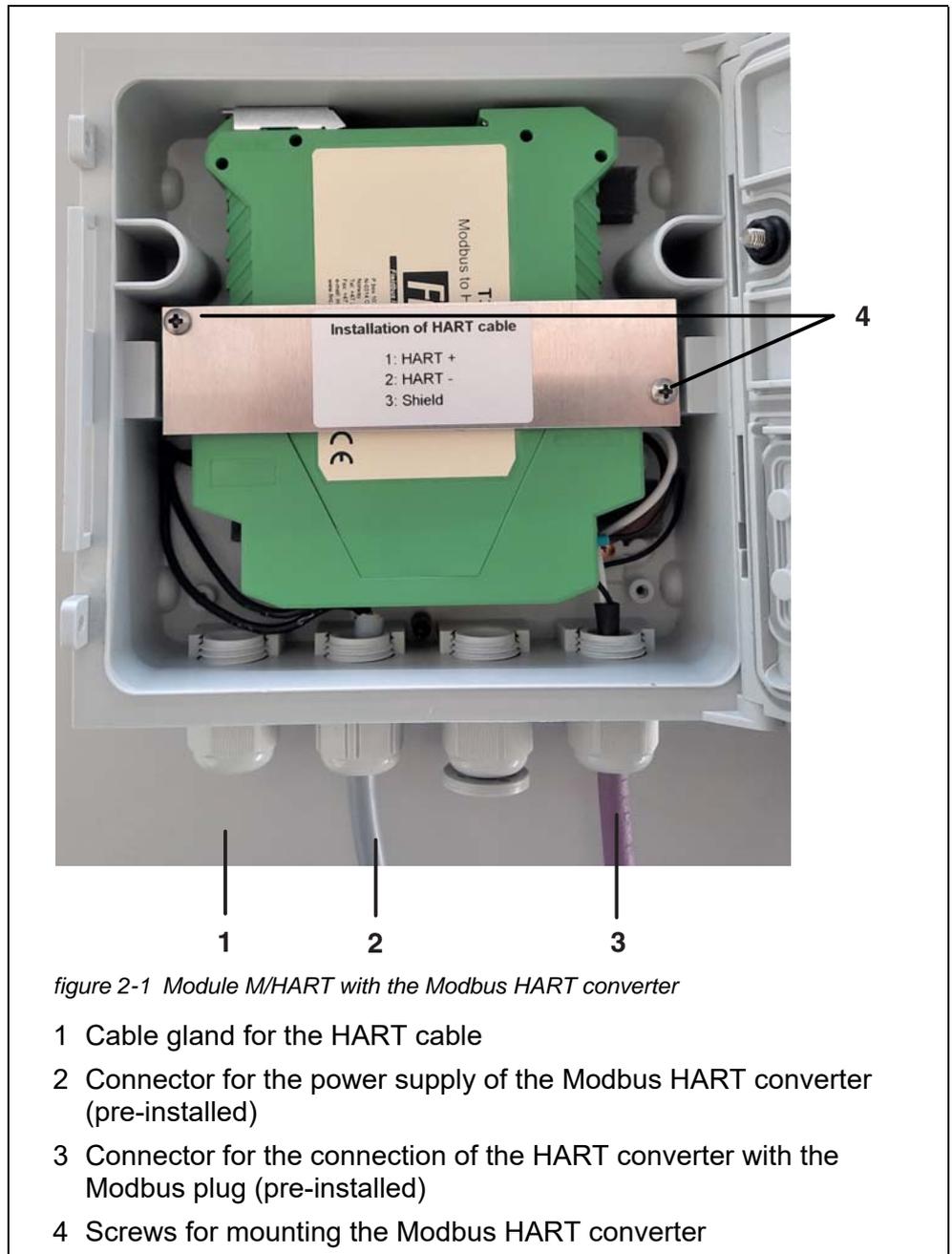- 1 x cable gland with sealing ring (scope of delivery M/HART)

Tools
- Cable stripping knife
- Wire stripper
- Phillips screw driver
- Small screw driver

Prepare the HART cable

1   Strip the cable insulation by approx. 100 mm.

2   Strip the wires and fit them with wire end sleeves.

Connect the HART cable

3   Open the M/HART module (see operating manual DIQ/S 281).

figure 2-1 Module M/HART with the Modbus HART converter

1 Cable gland for the HART cable

2 Connector for the power supply of the Modbus HART converter
   (pre-installed)

3 Connector for the connection of the HART converter with the
   Modbus plug (pre-installed)

4 Screws for mounting the Modbus HART converter

4   On the M/HART module, open the cable gland below connector (**1**).

5   Feed the HART cable through the cable gland into the module hous-
     ing.

6   Screw the cable gland (**1**) into the module housing using the sealing
     ring.

7   Unscrew the screws for mounting the Modbus HART converter.

8   Lift out the Modbus HART converter a bit.

figure 2-2 *Connectors for the wires of the HART cable at the Modbus HART converter*

1 HART+

2 HART-

3 Shield
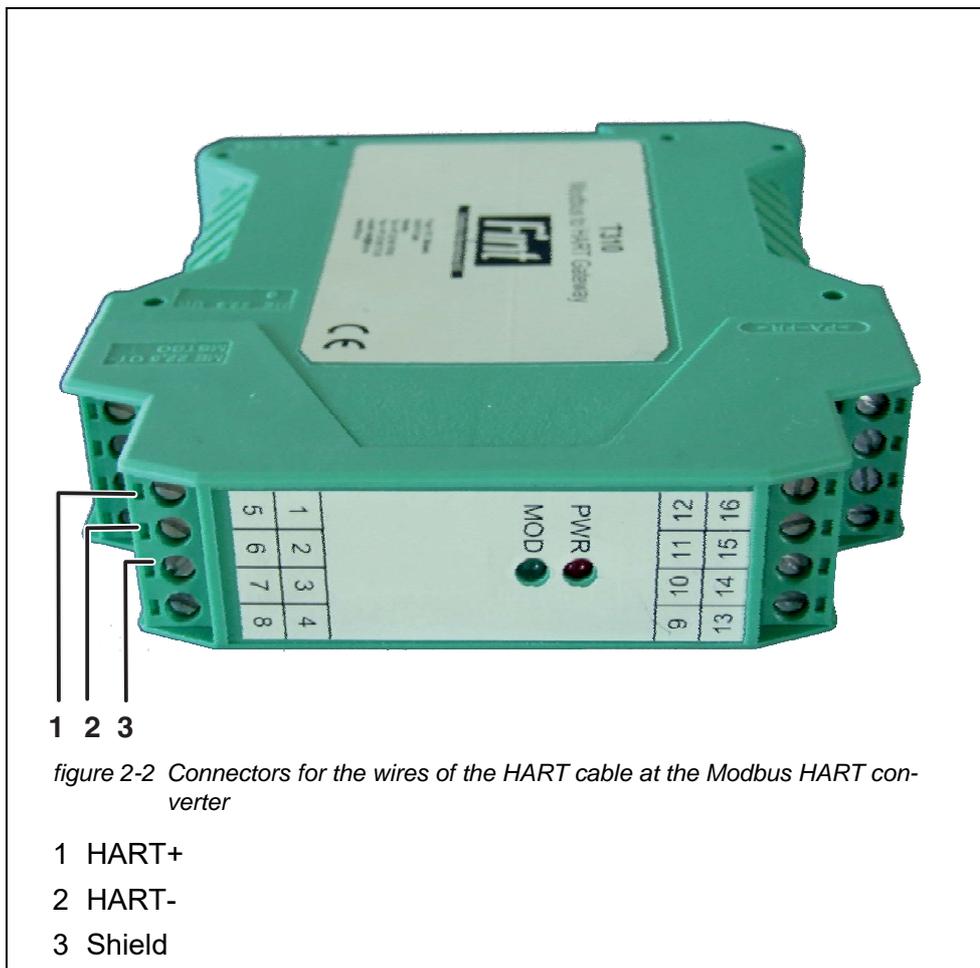
9   Connect the wires of the HART cable to the Modbus HART converter. Observe the information on the safety clip.

10   Insert the Modbus HART converter into the M/HART module.

11   Tighten the securing clip for the Modbus HART converter again.

12   Fasten the cap nut of the screwed cable gland.

13   Close the M/HART module (see operating manual DIQ/S 281).

3 Communication with the Modbus HART converter

Communication with the Modbus HART converter (HART client) is required for the following purposes, e.g.:

● Configuration of the Modbus HART converter (see section 3.1)

● Query and display of the sensor data of the Modbus HART converter (see section 3.2)

Communication with the HART client (Modbus HART converter) is required for the following purposes, e.g.:

● via field and operating devices

● via a PC.

For communication via a PC, a HART modem and HART master software for the PC are also required.

Examples of HART master software:

● FintHRT SW02
Software of the manufacturer of the Modbus HART converter
(Download e.g. www.xylemanalytics.com)

● DevCom2000
A DD file ("device description") adapts the interface to the functionality of the HART client (Modbus HART converter)
(Download of the DD file e.g. at www.xylemanalytics.com)

3.1 Configuring the Modbus HART converter

The configuration of the Modbus HART converter is only required if the data of the current interface is to be evaluated.

The current range (4 - 20 mA) is assigned a minimum and a maximum measured value within the measuring range (measuring range for the selected measured variable, see operating manual of the sensor).

3.2 Displaying the HART variables

The sensor data are converted into 4 HART variables and made available by the Modbus HART converter. The HART variables can be queried via HART commands.

Data transmission takes place via query and response telegrams.
The form of the telegrams is determined by the HART protocol.

The HART master sends a query telegram with a HART command to the

HART client (here: the Modbus HART converter of the DIQ/S 281-HART). The HART client transmits a response telegram with the requested data or an error message.

> Reference to the available HART commands for the Modbus HART converter: see "The Modbus RTU to HART gateway, T310 Reference Manual",
> download at www.xylemanalytics.com.

3.3 Data of the HART variables

The contents of the 4 HART variables are transmitted in binary form (for details see reference to the Modbus HART converter).
The following sensor data are converted to HART variables.

Measured values of the sensor

HART variable		Information
1 (PV)	Primary variable	Main measured value (IEEE-754 floating point, 32-bit)
2 (SV)	Secondary variable	Secondary measured value (IEEE-754 floating point, 32-bit)

Additional information

HART variable		Information
3 (TV)	Tertiary variable	Sensor status for the main and secondary measured value (see section 4.1)
4 (QV)	Quaternary variable	Measured value status of the main measured value (see section 4.2)

4 Sensor data for the HART field bus

The DIQ/S 281-HART monitors the current state of the sensor operated on the system. The sensor status documents sensor information (measured value status and status info of the sensor) and current processes (e.g. calibration or cleaning).

The sensor status is superordinate to the measured value status.
The influence of the sensor status on the measured value is documented with the status descriptions.

For the measured value to be evaluated, e.g. by a superordinate control system such as PLC, the sensor status and measured value status also have to be taken into account together with the measured value.
A measured value is suitable for further evaluation if both of the following conditions are met:

1   Sensor status   MEASURE

2   Measured value   VALID
    status

The meaning of the transmitted data in the HART variables is described in the following sections.

4.1   Sensor status

The sensor status applies to both the main and secondary measured value of a sensor.

Code	Status	Meaning of the status
00h	UNUSED_ID	Sensor and sensor number are not available in the DIQ/S 281-HART system.
		The measured value status of the main and secondary measured value is **MISSING** (4h) (see section 4.2 MEASURED VALUE STATUS).
		The UNUSED_ID status also occurs when the field bus interface of the DIQ/S 281-HART does not receive any data from the DIQ/S 281-HART controller for more than 2 minutes. Possible cause: Communication malfunction or controller failure. The data transmitted last remain frozen for the two minutes delay time.
01h	INACTIVE	The sensor is currently inactive. The sensor number (ID) and respective setting dataset are available in the DIQ/S 281-HART system. The sensor was removed from the DIQ/S 281-HART system or the communication does not work.
		The measured value status of the main and secondary measured value is **MISSING** (4h) (see section 4.2 MEASURED VALUE STATUS). The measured value display on the terminal indicates *Init* or *Error*.
02h	MEASURE	The sensor is in measuring mode.
		The measured value status can be VALID, OFL or INVALID. The measured value display on the terminal indicates the valid measured value, *OFL* or "----" (invalid measured value).
		For the measured value to be evaluated, e.g. by a superordinate control system, the sensor status and measured value status also have to be taken into account together with the measured value (see also section 4.2 MEASURED VALUE STATUS)
03h	CALIBRATE	The sensor is being calibrated. No measured value is available.
		The measured value status of the main and secondary measured value is **MISSING** (4h) (see section 4.2 MEASURED VALUE STATUS). The measured value display on the terminal indicates *Cal*.
04h	ERROR	The sensor is in a serious error status.
05h	MAINTENANCE	The sensor is in maintenance condition or a cleaning cycle (cleaning including adjustment phase) is active.
		The measured value display on the terminal shows a flashing measured value or *Clean*. The measured value status is frozen while the sensor is in the MAINTENANCE condition. The transmitted measured value is set to 0.

4.2   Measured value status

The measured value status is available for both the main and secondary measured value of a sensor.

Code	Status	Meaning of the status
1h	VALID	The measured value is valid. While the sensor is in the MAINTENANCE condition: ● The transmitted measured value is set to 0. ● The measured value display of the DIQ/S 281-HART shows a flashing measured value or *Clean*.
2h	OFL	The measured value lies outside the selected measuring range. The transmitted measured value is set to 0. The measured value display of the DIQ/S 281-HART indicates *OFL*.
3h	INVALID	The measured value is invalid. The transmitted measured value is set to 0. The measured value display of the DIQ/S 281-HART indicates "*----*" (invalid measured value).
4h	MISSING	The measured value cannot be determined or is not available. The transmitted measured value is set to 0. The measured value display of the DIQ/S 281-HART indicates *Cal* or *Error*.

4.3   Signaling the sensor status and measured value status in the DIQ/S 281-HART

4.3.1   Display in the measured value display on the terminal

		Measured value status			
		VALID	**OFL**	**INVALID**	**MISSING**
Sensor status	**MEASURE**	Measured value	"OFL"	"----"	-
	UNUSED_ID	-	-	-	No display (No sensor connected)
	INACTIVE	-	-	-	"Init" or "Error"
	CALIBRATE	-	-	-	"Cal"
	ERROR	-	-	"----"	-
	MAINTENANCE	Measured value flashing or "Clean"	"OFL" flashing	"----" flashing	-

-	The combination of sensor status and measured value status is not possible
"..."	Displayed text

4.3.2   Measured value transmitted on fieldbus level

		Measured value status			
		VALID	**OFL**	**INVALID**	**MISSING**
Sensor status	**MEASURE**	Measured value			
	UNUSED_ID **INACTIVE** **CALIBRATE** **ERROR** **MAINTENANCE**	0 (zero) For the measured value 0 (zero) to be evaluated by a superordinate control system, the measured value always has to be taken into account together with the sensor status and measured value status.			

5   What to do if ...

Here you will find causes and actions to take of errors concerning the HART communication only. General errors of the IQ SENSOR NET system are dealt with in the DIQ/S 281-HART system operating manual.

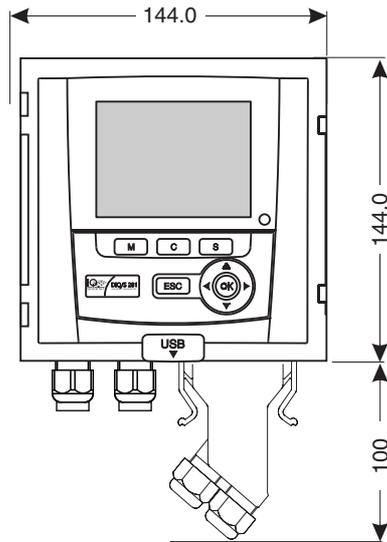**Data transmission error between the HART master and DIQ/S 281-MOD**

Cause	Remedy
– Incorrect wiring	– Check/change the connections (see section 2)
– DIQ/S 281-MOD defective	– Contact the service department
– Modbus HART converter defective	– Contact the service department

6   Technical data

6.1   DIQ/S 281-HART

**Dimensions
DIQ/S 281-HART**

Front view: Lateral view:
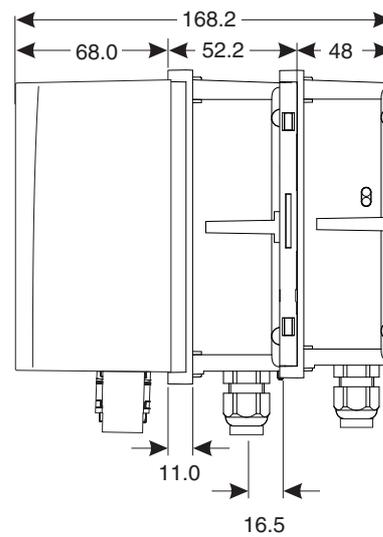

figure 6-1 Dimensional drawing DIQ/S 281-HART (dimensions in mm)

For more technical data of the DIQ/S 281,
refer to the operating manual DIQ/S 281.
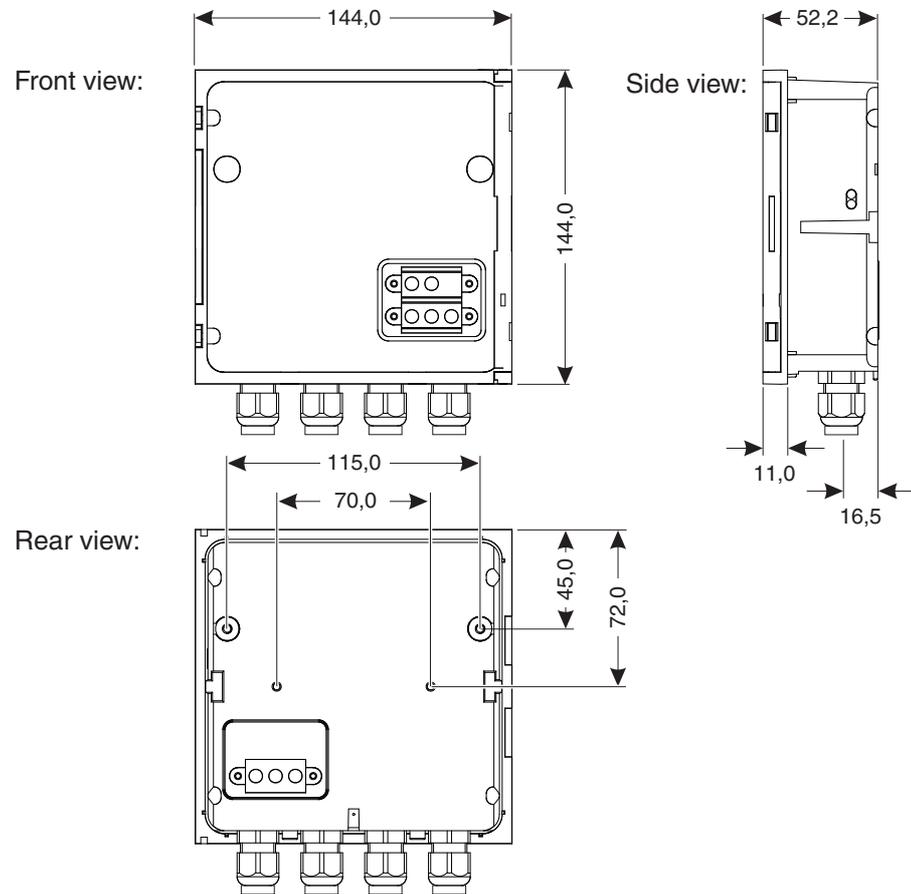
6.2   Module M/HART

Dimensions (mm)

Front view:

Side view:

Rear view:

figure 6-2 Dimension drawing of MIQ module (dimensions in mm)

Mechanical structure	Housing material	Polycarbonate with 20 % glass fiber
	Weight	Approx. 0.5 kg
	Type of protection	IP 66 (not suitable for conduit connection)

Cable glands	Suitable for cable sheath diameter	4.5 - 10 mm or 9.0 - 13 mm

Ambient conditions	Temperature	
	Mounting/Installation/ Maintenance	+ 5 °C ... + 40 °C (+ 41 ... +104 °F)

Operation	- 20 °C ... + 55 °C (- 4 ... + 131 °F)
Storage	- 25 °C ... + 65 °C (- 13 ... + 149 °F)

Relative humidity

Mounting/Installation/Maintenance	≤ 80 %
Yearly mean	≤ 90 %
Dew formation	Possible

Site altitude	Max. 2000 m above sea level

Meter safety

Applicable norms	– EN 61010-1
	– UL 61010-1
	– CAN/CSA C22.2#61010-1

EMC product and system characteristics

EN 61326	EMC requirements for electrical equipment for instrumentation and control and laboratory use
	– Equipment for industrial areas, intended for indispensable operation
	– Interference emission limits Class A equipment
FCC, class A	

Electrical data

Nominal voltage	The voltage is supplied via the "Auxiliary voltage" interface of the DIQ/S 281-MOD
Power consumption	2.5 W
Protective class	III

Module M/HART

Cable feeds	4 cable gland M16 x 1.5 at the underside of the module

Connecting terminals at the Modbus HART converter	Terminal type	Terminal strip at the Modbus HART converter, accessible by opening the module cover (M/HART)
	Clamping ranges	Solid wires: $\quad$ $0.2 ... 2.5 \text{ mm}^2$ AWG 24 ... 12 Flexible wires: $\quad$ $0.25 ... 1.5 \text{ mm}^2$

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1) The tissue in plants that brings water upward from the roots;
2) a leading global water technology company.

We're a global team unified in a common purpose: creating advanced technology solutions to the world's water challenges. Developing new technologies that will improve the way water is used, conserved, and re-used in the future is central to our work. Our products and services move, treat, analyze, monitor and return water to the environment, in public utility, industrial, residential and commercial building services settings. Xylem also provides a leading portfolio of smart metering, network technologies and advanced analytics solutions for water, electric and gas utilities. In more than 150 countries, we have strong, long-standing relationships with customers who know us for our powerful combination of leading product brands and applications expertise with a strong focus on developing comprehensive, sustainable solutions.

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