

Portable Non-Invasive Ultrasonic Flow Meter

DXN-5P Modbus Master Protocol



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SUPPORTED FEATURES

DXN-5P flow meters include an Aux port with RS485 that is selectable for a Modbus Master on a Modbus RTU network. The handheld can be wired on a single daisy chain network and query slave devices.

For further information on the proper operation of the handheld, see the [Portable Non-Invasive Ultrasonic DXN-5P Flow Meter user manual](#).

WIRING

Modbus Master

The Modbus Master feature allows up to 4 devices to be placed on a single three-wire cable up to 4000 feet. All devices must be assigned a unique numeric address that allows all to be independently accessed. Modbus Master protocol is used to interrogate the devices. The Aux port on the handheld does not have terminating resistors. Add termination resistor if required for the network, such as long cable lengths or fast baud rates.

The Dynasonics® DXN-5P portable flow meter can log up to 4 signed, unsigned or floating variables.

Use SoloCUE® for Windows® or mobile app to set up the network and assign registers to poll.

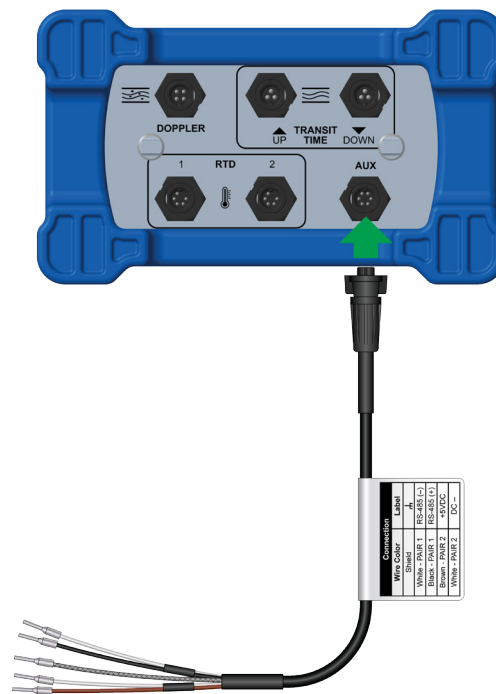


Figure 1: Typical RS485 interface

Use the Aux port cable part number 70711-001 to connect the handheld to the Modbus network.

Wire Color	Connection
Black PAIR 1	RS485 (+)
White PAIR 1	RS485 (-)

The Aux port can supply 5V DC up to 100 mA for devices on the Modbus network.

Wire Color	Power
Brown PAIR 2	5V DC
White PAIR 2	Common

COMMUNICATION SETTINGS

Up to 4 Modbus slave devices can be connected to the DXN-5P handheld to read and log the values along with flow readings from the DXN-5P flow meter.

To setup the Modbus master, use SoloCUE to enter the port settings and registers to read. Some parameters can be viewed in the *Setup > Communication > Modbus* menu on the handheld. See [Figure 2](#) and [Figure 3](#) for port and register settings. When the devices are connected to the handheld and the read is successful, the value is populated on the *Modbus Register* screen (see [Figure 2](#)).

SetupData LoggingCommunicationCalibrationDiagnosticsKeypad Lock Status

ModbusBluetooth

Settings

Port Settings

Baud Rate19200ParityNoneData Bits8 BitsStop Bits1 BitTimeout1000 ms

Modbus Settings

RoleModbus MasterPoll Delay1000 msRefresh Saved Registers

Modbus Registers

	Slave ID	Register	Description	Data Type	Value - Hex	Value - Converted	Units
	2	40001-40002	Level	Unsigned 32-bit Integer	Timeout Error	Timeout Error	meters

Figure 2: Modbus master tab

Modbus Register

Slave ID1

FunctionRead Holding Registers

Start Address0

Number of Registers2

Data TypeUnsigned 32-bit Integer

DescriptionLevel

Unitsm

SaveClose

Figure 3: Modbus register screen

M-Node Smart Sensors

If all of the slave devices are Badger Meter M-Node water quality sensors, the handheld can scan for sensors on the Modbus network and automatically configure the parameters to read the primary measurement. Select Modbus Master M-Node for the Role and Scan for devices. See [Figure 4](#) for Modbus Master M-Node port and device settings.

Figure 4: Modbus master m-node screen

After the registers or M-node sensor have been configured and wired to the handheld, press the **Refresh Saved Registers** to read the values of the devices on the Modbus network. If the handheld cannot read the device, the values on register/sensor table display a timeout error.

To setup the DXN-5P handheld to read the M-Node Smart Sensors without using SoloCUE:

1. Go to *Main Menu > Setup > Communications* menu.
2. In the *Modbus Settings > Role* menu, select **Modbus Master MNode** and verify the baud rate, parity and stop bits are set to match the M-Nodes.
3. Go to *Scan for MNodes* to start scanning for sensors on the network.

REGISTERS/STARTING ADDRESS

It is important to know whether the master device uses starting addresses or registers/coils as these numbers are offset by 1. For example, holding register 40001 is starting address 0x000 (hex).

Function Codes

DXN-5P flow meters support the following function codes, as applicable:

03 (0x03 hex) Read Holding Registers

Word Order/Endian

Each Modbus holding register represents a 16-bit integer value (2 bytes). The official Modbus standard defines Modbus as a 'big-endian' protocol where the most significant byte of a 16-bit value is sent before the least significant byte. For example, the 16-bit hex value of '1234' is transferred as '12'34'.

Beyond 16-bit values, the protocol itself does not specify how 32-bit (or larger) numbers that span over multiple registers should be handled. It is very common to transfer 32-bit values as pairs of two consecutive 16-bit registers in little-endian word order. For example, the 32-bit hex value of '12345678' is transferred as '56'78'12'34'. The register bytes are still sent in big-endian order per the Modbus protocol, but the 16-bit registers are sent in little-endian order. Alternatively, some devices store and transfer the Modbus registers in big-endian word order. For example, the 32-bit hex value of '12345678' is transferred as '12'34'56'78'.

As long as the transferring and receiving device transmit the data in the same manner, it does not matter in which order the words are sent. The word order is big-endian in the DXN-5P flow meter.

DATA LOGGING VALUES

The primary values from the M-Nodes smart sensors or registers from the slave devices can be logged on the DXN-5P handheld along with the time and date. The values are included in the dropdown list for each parameter in the *Data Logging* tab/page in SoloCUE. To log the values, the Modbus registers are listed by the order in the *Modbus Register* or *M-Node* screens, not the slave address, and the data type integer or floating point. For example, select **Modbus Generic Int 1** to log the first register as an integer.

Add *Error/AlarmCode* to the parameter list to capture any communication timeout errors in the log file.

Figure 5: Data logging tab

WARNING AND ALARM MESSAGE CODES

Code	Description	Recommended Action
S66 SLAVE ERROR		
S66 MODBUS FRAME ERROR	No response from slave device in the polling list.	Check the recommended actions listed for no communication symptom. For M-Nodes, use Scan for devices to identify devices on the network.
S67 DATA LOG ERROR	SD micro card is missing or full.	Check SD micro card. If data logging is not required, disable data logging.
S68 MODBUS TIMEOUT	No response from any slave device in the polling list.	Check that the Timeout is not too fast for the slave devices to respond. Refer to the recommended action list for no communication symptom.

TROUBLESHOOTING

Symptoms	Possible Causes	Recommended Action
No communication	Transmit and receive are wired incorrectly.	Check the network wiring from the meter.
	Baud rate does not match master.	Check the baud rate of the master and ensure the baud rate of the slave device matches the master. If it does not match, change the Baud Rate of the slave device to match the network.
	Parity and stop bits do not match the master.	Check that the settings are compatible with the master. If it does not match, change the Parity or Stop Bit setting in the <i>Port Config</i> menu.
	Slave address is not unique. Another device is on the network with the same address.	Check the addresses of the other devices on the network. Check that the slave address is not 1.
	Cable is not terminated properly.	For Modbus RTU on EIA-485 network, devices can be daisy chained together. The two devices on the end of the chain need to have terminated resistors.
	Cable or chain longer than 4000 feet.	For Modbus RTU on EIA-485 network, the full length of the network cannot exceed 4000 feet. Check the length of the cabling.
Intermittent communication	Cable is not properly shielded.	Communication cables must have shielding to protect the quality of the communication signals from electromagnetic interference (EMI). Check that the cable has a shield. Typically, one end of the shield drain is connected to a clean ground to dissipate EMI and prevent ground loops. However, depending on the ground quality, cable length and type of interference, other methods can be employed.
	Cable routed near power cables such as variable frequency drives.	Cables carrying high currents cause a high degree of electromagnetic interference that can interfere with the quality of the communication signals. Route signal cables away from power cables.
	Cable is not terminated properly.	For Modbus RTU on EIA-485 network, devices can be daisy chained together. The two devices on the end of the chain need to have terminated resistors.
	Cable or chain longer than 4000 feet.	For Modbus RTU on EIA-485 network, the full length of the network cannot exceed 4000 feet. Check the length of the cabling.
Unable to read specific parameters correctly	Word order (endian) or data type/format	In Modbus RTU, floating point, long integers and string character registers may have the word order (endian) swapped. Check the data type and endian of the master and verify that the register in the meter matches the matches. If it does not match, change the Word Order setting in the Modbus Master slave list using the SoloCUE app.
Unable to write specific parameters	Word order (endian) or data type/format	In Modbus RTU, floating point, long integers and string character registers may have the word order (endian) swapped. Check the data type and endian of the master and verify that the register in the meter matches the matches. If it does not match, change the Word Order setting in the Modbus Master slave list using the SoloCUE app.

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