

Bristol® 3808 MVT Communication Using BSAP and Modbus over RS 485

The Bristol® 3808 MVT multivariable transmitter, from Emerson Process Management is perfect for applications that require multiple transmitters spread throughout local areas such as custody transfer metering stations and process plants.

For such applications, the 3808 MVT is compatible with Emerson's "33XX" controllers and RTU products as well as ControlWave. Using the BSAP protocol, the 3808 MVT can be a global network node that is accessible to any other node up the network. ControlWave and 33XX products can be pass-thru nodes in such a global network.

An interesting benefit of global communication is that the 3808 MVT web pages, which are available with OpenBSI version 5.3 or later, operate on a PC that is direct-connected to the transmitter or is located up the network and communicates via a pass-thru node.

The Modbus protocol makes the 3808 MVT compatible with practically every RTU and SCADA system in operation, today. Modbus is your choice for most any "non Bristol" or non-BSAP network.

While all the configuration constants and measured variables are available both via BSAP and Modbus, the advantages of global communication, including use of web pages for calibration, are not available via Modbus.

Emerson has addressed this by making the 3808 MVT bilingual. That is, it will communicate both via BSAP and Modbus and allow users to take advantage of the capabilities offered by both protocols. The 3808 MVT will simply recognize and respond to messages in either protocol. Note that supporting Modbus does require configuration of the transmitter.



The Bristol® 3808 MVT is bilingual—it communicates using both BSAP and Modbus.

Implementing an RS 485 Network

Using competitive transmitters, many users opt away from multidrop networks due to reliability issues. However, 3808 MVT users can be confident in the operation of two-wire, RS 485 networks.

Emerson has put over 20 years experience with RS 422 and RS 485 networks into the 3808 MVT design. The 3808 MVT works reliably in noisy environments, where the RS 485 wiring is apt to pick up interference.

Typical physical limitations are 32 drops and 1000 feet in cable length. On small networks, those using four transmitters or less, network termination is not needed. This not only simplifies the installation but also keeps power consumption to the minimum, typically 1 mA per transmitter.

The maximum baud rate, 19.2 K, also ensures reliable transmissions and, in practice, excellent throughput for the measured variables. In custody transfer applications in the natural gas industry, for which live updates must take place at least once per second to satisfy API 21.1, the 3808 MVT meets this for eight drops. Performance is virtually the same, whether BSAP or Modbus is used.

3808 MVT BSAP Overview

In a BSAP network, the 3808 MVT will act as an immediate response BSAP Slave device. The 3808 MVT will function as a terminal node only in a BSAP Network. BSAP Global messages received with the 3808 MVT's Local Address will be processed by the 3808 MVT. Note that pass through, or routing, of BSAP Global messages, Expanded BSAP messages, and TimeSync/Node Routing Table messages are not supported.

A subset of the RDB and Peer-to-peer messages are supported. This will provide the user both RDB and Peer-to-Peer List access to the 3808 MVT Process variables and parameters. The following items are available via RDB Requests:

- Differential/Gauge Pressure
- Differential/Gauge Pressure Upper Range Limit
- Static Pressure
- Static Pressure Enable/Disable
- Static Pressure Upper/Lower Range Limit
- RTD Temperature
- RTD Temperature Enable/Disable
- Sensor Temperature
- Error Code
- BSAP Local Address
- Modbus Node Address
- Baud Rate
- Firmware Version
- Sensor Number
- Transmitter Number

3808 MVT Modbus Overview

The 3808 MVT will act as a Modbus compatible, slave device. The 3808 MVT provides support for both Modbus ASCII and Modbus Remote Terminal Unit (RTU) transmission modes, utilizing a subset of the Read/Write commands available via Modbus.

To provide support for a variety of Modbus compatible host controllers, the 3808 MVT data available via Modbus are mapped into Modbus Coils/Registers. To accommodate the different types of Modbus hosts available (i.e. standard Modbus, ENRON Modbus) floating point data items are mapped to several different Modbus Register address ranges. This provides both 16-bit and 32-bit register access using the appropriate register address and function code.

The following Modbus Function Codes are supported:

<u>Code</u>	<u>Description</u>
1	Read Coils
2	Read Input Registers
3	Read Holding Registers
4	Read Input Registers
5	Force Single Coil
6	Preset Single Register
15	Force Multiple Coils
16	Force Multiple Registers

The data type associated with a specific Read/Write request is identified by the Coil/Register Address contained in the message.

The following is the Modbus Mapping for Coils:

<u>Address</u>	<u>Attributes</u>	<u>Description</u>
0001		unused
0002	RW	Master Reset
0003	RW	Calibration Mode
0004	RO	RTD present
0031	RW	DP/P, Reset Factory Calibration
0032	RW	SP, Reset Factory Calibration
0033	RW	T, Reset Factory Calibration

The following is the Modbus Mapping for the 32-bit Floating Registers:

<u>Address</u>	<u>Attributes</u>	<u>Description</u>
7401	RO	Differential/Gauge Pressure (DP/P)
7402	RO	Static Pressure
7403	RO	Process Temperature (T)
7404		unused
7405		unused
7406		unused
7407	RO	DP/P Upper Range Limit
7408	RO	DP/P Lower Range Limit
7409	RW	DP/P Upper Operating Limit
7410	RW	DP/P Lower Operating Limit
7411	RO	SP Upper Range Limit
7412	RO	SP Lower Range Limit
7413	RW	SP Upper Operating Limit
7414	RW	SP Lower Operating Limit
7415	RO	T Upper Range Limit
7416	RO	T Lower Range Limit
7417	RW	T Upper Operating Limit
7418	RW	T Lower Operating Limit
7419	RW	DP/P Calibrated Zero
7420	RW	DP/P Calibrated Span
7421	RW	DP/P Floating Point Damping Factor
7422	RW	SP Calibrated Zero
7423	RW	SP Calibrated Span
7424		unused

7425	RW	T Calibrated Zero
7426	RW	T Calibrated Span
7427		unused
7428	RW	User Entered value for Process Temperature
7429	RO	Sensor Temperature

Calibration of Transmitters on the Network

Unlike other transmitters, for which calibration could too easily take the entire network out of service, the 3808 MVT offers two calibration methods, which minimize interruptions to network communication.

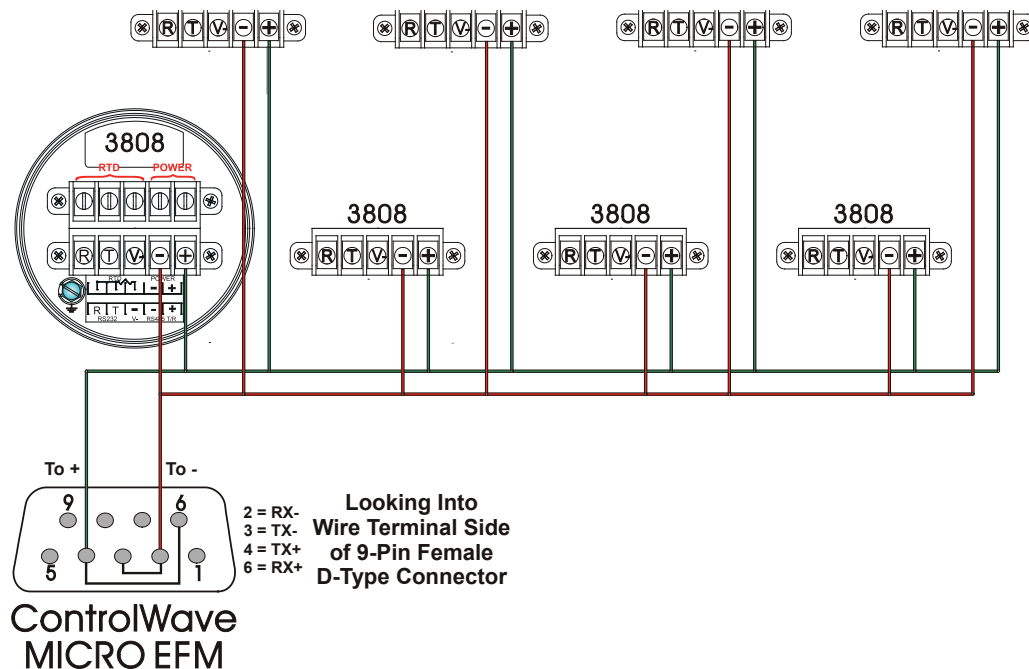
The user can connect a personal computer directly to each transmitter using RS 232. When the RS 232 connection is made, RS 485 communication stops for that transmitter, only. Communication continues for the rest of the network.

Using this method, the user need not be concerned about the RS 485 wiring. The RS 232 terminals are completely separate. When the user disconnects the RS 232 cable, communication resumes via RS 485.

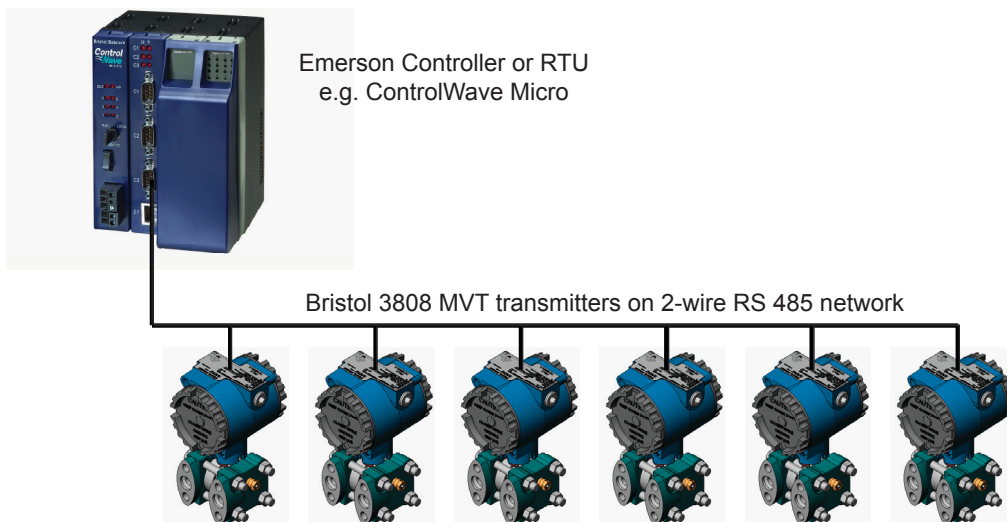
A global user, up the network, can also perform calibration by addressing the transmitter. In this case, the physical connection is made to a global RTU node and no wiring on any transmitter is affected, at all.

In Conclusion

Whether the application is custody transfer or process control, the 3808 MVT provides for simple, reliable, and cost effective systems using two-wire, RS 485 networks. Bilingual communication works with both BSAP and Modbus protocols. API 21.1-compliant multidrop networks can use as many as eight transmitters.



Above: Wiring diagram for the two-wire, multidrop network that is illustrated, below.



For natural gas custody transfer, the 3808 MVT allows you to definitively meet API Chapter 21, Section 1.4.2.1, which calls for sampling of any dynamic input variables at least once per second.

Using just a single serial port and a two-wire, multidrop network, the RS 485 interface allows controllers and RTU's, such as ControlWave Micro, to read all live inputs for six meter runs. Using two RS 485 ports, you can do the same for 12 meter runs.

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