Bristol® 3808 MVT Multivariable Transmitter
Model 3808-30A With DP/P/T Variables

Featuring:
- Now featuring 4000 psi pressure range
- Excellent measurement performance over the full range of operating pressure and temperature conditions
- Extremely low power consumption—perfect for remote sites with battery and solar power systems
- “Bilingual” Networking via BSAP and Modbus protocols with RS 485 interface
- Two versions: RS485 with RS232 port for configuration or Analog Output with FSK signal
- Intrinsically safe and explosion proof for operation in Class I Division 1 hazardous areas
- Bidirectional DP measurement
- DP/P “wet end” sensor assembly is independent of the “top end” assembly

Introduction
The Bristol® 3808 MVT is Emerson Process Management’s answer to industry demands for a transmitter with high reliability, high performance over real world pressure and temperature conditions, ease in use, “networkability” and very low power consumption. The 3808 MVT has been designed to provide the highest value in terms of all user considerations, including purchasing, installation, operation and maintenance.

To maximize measurement accuracy, the 3808 combines a wet end with a low reference uncertainty of 0.075% URL, with a design that minimizes effects of pressure and temperature over the full range of operating conditions.

For remote sites such as those in the energy and water industries, power consumption has been a key consideration. Costs of batteries and solar panels are proportional to current draw and many users are surprised at the capital expenses associated with electronics, which have not been designed to conserve power. The sophisticated design employed by the 3808 MVT keeps current draw well below 2 mA and with a power source as low as 5 Vdc.

For remote sites, power budgeting is often very tight. Since the power consumption is so low, the 3808 MVT can even be added to existing sites, which were designed with no extra capacity for power.

While the Bristol Synchronous and Asynchronous (BSAP) protocol ensures compatibility with Emerson measurement and SCADA systems, Modbus provides compatibility with a wide variety of controllers, flow computers, RTU devices and SCADA systems from numerous suppliers.
Functionality Overview

- Emerson’s Bristol 3808 MVT provides the following basic operations:

- Conversion of sensor readings from the “wet end” DP/P sensor assembly into accurate floating point pressure values for DP and P. Conversion calculations utilize correction coefficients contained in the sensor assembly and are performed once per second for each process variable.

- Conversion of raw readings from an on-board A/D into an accurate floating point RTD value. RTD conversions are performed once per second.

- Up to 19200 baud, 2-wire RS-485 serial communications interface, or a 1200 baud, FSK modem interface via the 4-20ma current loop for Network communication.

- Local RS-232 serial communications interface fixed at 19200 baud. (Connecting to the RS-232 communications interface disables the RS-485 communications.

- A subset of the Emerson BSAP RDB and Peer-to-Peer communications interface:
  - Complete set of User/Host Interface functions for Configuration, Calibration, and Data Collection.
  - Floating point values returned individually, or in pre-defined Lists.
  - Floating point values available for DP/GP, SP, T, Sensor Temperature, and Error Status.
  - Floating point, Logical, or String values also available for other ST3808 user configuration parameters.

- Optional, 4-to-20 mA Analog Output:
  - Linear or Square Root Mode.
  - Reversible Output Action.
  - May be controlled externally to provide a remote AO.

- Optional, on-board LCD display with DP, P and T information.

Physical Overview

- Service: Flow, level, pressure, temperature measurements for liquids and gases.

- Diaphragm Material: 316 SS or Hastelloy C.

- Flange Material: 316 SS or Hastelloy C.

- Flange Bolt Material: 316 SS.

- Fill Media: DC 200 Silicone Oil.

- Process Connections: ¼” NPT on flanges 1/2” NPT with connection blocks.

- Electrical Connections: ½” NPT Conduit Connection.

- Housing: Low Copper Aluminum with epoxy paint NEMA 4X explosion proof.

- Local indication: 4-½-Digit LCD display linear or square root in engineering units.

- RTD sensor: 3-wire platinum 100-ohm per DIN 43760 25 feet max.

- User connections: 10-terminal (2-rows) tri-barrier strip for + power, -power, RTD +, RTD-, RTD-, TXD, and RXD.

Power Supply Information

- Operating Voltage Range: 5 – 42 Vdc.

Current Draw:

- With RS 485: Less than 2 mA (typically 900 mA).

- With FSK, but with 4 – 20 mA output disabled: Less than 3.2 mA.

Turn-on time:

- Measured input variables will be within specifications less than two seconds after power is applied to the 3808 MVT.
Accuracy and Performance Specifications

All specifications are for the digital, floating-point signal.

Differential Pressure and Static Pressure

Combined effects of nonlinearity, nonrepeatability and hysteresis at reference pressure and over the operating temperature range:

DP and SP linear mode: ±0.075% of Calibrated Span or 0.015% of URL, whichever is greater.
±0.035% of span or 0.015% of URL for 1000 psi static pressure only, whichever is greater.

Temperature effect on Static and Differential pressure:
±0.21%URL maximum combined shift of zero and span with an ambient temperature change of 60°C (108°F), ±0.17% URL max. for 1000 psi static pressure range.

Static Pressure Effects On Differential Pressure:
Zero error: ±0.1% URL, for a change in static pressure of 1000 psi
Span error: ±0.1% reading, for a change in static pressure of 1000 psi

Long Term Stability at Constant Conditions:
±0.1% URL/Year typical

Mounting position effect: ±2 in H2O maximum, which can be calibrated out.

Ripple and noise: Per ISA 50.1 Section 4.6

Process Temperature - RTD Interface

A three-wire platinum RTD per DIN 43760 is supported. The temperature, T, in degrees Celsius is calculated using the Resistance vs. Temperature Tables according to the DIN EN 60751 standard for Class A & B RTDs. The DIN EN 60751 equation is:

\[ R(t) = R_0 \times (1 + At + Bt^2) \]

Where:
\[ A = 3.9083 \times 10^{-3} \text{°C}^{-1} \]
\[ B = -5.775 \times 10^{-7} \text{°C}^{-2} \]
\[ R_0 = 100\text{ohms} \]

In addition, the user may enter the R0, A, and B coefficients of a custom calibrated RTD, another platinum standard or a different material (Nickel, Balco or Copper). During the RTD calibration, the User will be able to set the R0, A, and B coefficients, restore the factory default for these coefficients, and calibrate the internal Reference resistor.

Process Temperature Input Specifications (for the interface, only, not including the RTD probe or wiring)

RTD Conversion Accuracy: ±0.1°C, or ±0.1% of reading, whichever is greater

Ambient temperature effect on RTD measurement:
±0.01°C / °C max

Long Term Stability at Constant Conditions:
± 0.25°C / month max

Analog Output Specifications

Non-linearity: 0.1% max

Temperature effects: +/- 0.25% Full Scale over 60 degrees C.

Environmental Specifications

Over Pressure Limit: Equal to the static pressure upper range limit (URL).

Temperature limits:
Wet End: -40 to +85°C
Electronics: -40 to +85°C
With Display: -30 to +70°C
Storage Temperature: -40 to +100°C

Humidity limits: When covers are properly installed,
unit will withstand 0 to 100% RH (NEMA 4X enclosure)

Vibration: ±0.1%URL/g max 10-500 Hz in any axis per SAMA PMC-33-1C

Electromagnetic compatibility:

Conditions: Current output (only) twisted pair wires includes RTD. Covers installed and wiring run in grounded conduit. 10V/M, 20-500 MHZ per SAMA PMC-33-1C:

DP and SP: ±0.25%URL
RTD Temperature: ±1°C

Liquid Crystal Display (LCD)

The LCD displays the measured variables for DP, P, and T. The display will continually cycle through all measured variables. The value and Engineering Units for a particular variable will be displayed for three seconds. An annunciator indicates which pressure variable is being displayed.

The LCD provides 4 1/2 digits of display precision with a decimal point. The following Engineering Units are included:

- °C
- °F
- BAR
- psi
- in H₂O @ 60°F
- kg/cm²
- kPa

User Interface For The 3808 MVT

Using a lap-top personal computer, field personnel can quickly calibrate and configure a 3808 MVT transmitter. The personal computer interfaces to the RS 232 port. Meanwhile, the RS 485 port wiring need not be disconnected. RS 485 communication is disabled only while the PC cable is connected to the RS 232 terminals.

Emerson’s LocalView Calibration Tool includes all calibration and configuration operations. This tool will be familiar with users of Smartkit as well as all other Bristol flow computers and provides users of all Bristol measurement products, from Emerson, a consistent and compatible HMI.

A variety of User Interface features are provided by the 3808 MVT. These include:

- Set Communications Baud Rate
- Set BSAP Local Address
- Set BSAP Group Number
- Set Modbus Node Address
- Set Modbus Mode (ASCII/RTU)
- Enable/Disable Static Pressure Reading
- Enable/Disable RTD Temperature Reading
- Read current DP/GP, SP, T, Sensor Temperature, and Status values
- Read DP/GP and SP Upper Range Limits
- Calibrate Zero/Span for DP/GP and SP
- Calibrate Zero for RTD
- Configure RTD Coefficients
- Configure 4-20ma Analog Output
  - Enable/Disable
  - Select Linear/Square Root Mode
  - Select Forward/Reverse Acting
  - Select Output Variable (DP/GP, SP, User Defined, or None)
  - Calibrate Zero/Span
- Select Engineering Units for DP/GP, SP, T
- Set Floating Point Damping Factor
- Display Transmitter Information (Traceability information, Range Codes, Firmware Revision)
Communication Interface

BSAP Interface

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 Time-Sync/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.

MODBUS Interface

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.

Accessories

Emerson's Bristol OpenBSI/LocalView – Calibration and configuration software for a PC

CD part number: 395575-02-8

PC-to-3808-MVT Cable – Connects to the RS 232 port on the 3808 MVT, 10 foot, part number: 396596-01-0

Bendable RTD

The user can select a bendable RTD that attaches to the transmitter via an armored cable of 6-foot, 15-foot or 25-foot length. The individual wires connect to terminations on the termination plate. The RTD assembly also includes a fitting, which is installed in the conduit port.

If ordered along with the transmitter, the bendable RTD assembly will be shipped in the same box as the transmitter.

The bendable RTD is a “one size fits all” solution that is perfect for most applications and excellent for depot-level inventory situations in which the ultimate installation (and, therefore, thermowell depth) is not necessarily known.

The 12” probe can quickly be inserted in a thermowell, whereupon the user can tighten the included fitting to lock it in place and bend the excess length out of the way.

Note that a thermowell is required for this bendable RTD!

Note also that the bendable RTD assembly is approved only for use in Class I, Division 2 hazardous areas and is not explosion proof.
**Bristol® Multivariable Transmitter**

**Model Number:** 3808-30A - A B C - D E F - G H J - K L M - N P Q R

3808-30A

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Range Differential (inH2O)</td>
<td>Static Pressure (PSI)</td>
</tr>
<tr>
<td>10</td>
<td>0-7.5 to 0-150</td>
</tr>
<tr>
<td>10</td>
<td>0-7.5 to 0-150</td>
</tr>
<tr>
<td>10</td>
<td>0-15 to 0-300</td>
</tr>
<tr>
<td>10</td>
<td>0-15 to 0-300</td>
</tr>
<tr>
<td>10</td>
<td>0-15 to 0-300</td>
</tr>
<tr>
<td>10</td>
<td>0-15 to 0-300</td>
</tr>
<tr>
<td>10</td>
<td>0-1.25 to 0-25 PSID</td>
</tr>
<tr>
<td>10</td>
<td>0-1.25 to 0-25 PSID</td>
</tr>
<tr>
<td>10</td>
<td>0-1.25 to 0-25 PSID</td>
</tr>
</tbody>
</table>

**D** Diaphragm Material

| 20 | 316 Stainless Steel | 1 |
| 20 | Hastelloy C | 2 |

**E** Filling Media

| 30 | DC 200 Silicone | 1 |

**F** Flange Material

| 40 | 316 Stainless Steel | Match D - diaphragm material |
| 40 | Hastelloy C | 1 |

**G** Flange Vent Valve

| 50 | None | 0 |
| 50 | With Vent Valve - 316 SS | Note: Flange Material, F = 1 |
| 50 | With Vent Valve - Hastelloy C | Note: Flange Material, F = 2 |

**H** Manifold Adapter

| 60 | None | Match F - Flange |
| 60 | Stainless Steel | 0 |
| 60 | Hastelloy C | 1 |

**J** Comm / Output Options

| 70 | 4-20 mA current output / FSK | Note: Local calibration requires TIU. |
| 70 | RS 485 | Note: Local calibration requires RS 232 cable. |
**Model Number: 3808-30A - A B C - D E F - G H J - K L M - N P Q R**

### 3808-30A

**DESCRIPTION** | **CODE**
--- | ---
**K** Local Indication | X3808LIND | **K**
- None | 0
- 4 1/2 Digit LCD | 1

**L** Flange Orientation | **L**
- Standard (faces away from front) | 1
- 90 degrees (down) (Default) | 2

Note: Housing is very easy to rotate 180 degrees around in the field.

**M** Mounting Bracket | X3808MTG | **M**
- None | 0
- With "L" Flanged Mounting Bracket | 1
- Neck Mounted Bracket | 2

**N** Certification | **N**
- UL/CUL Class I, Division 1, Groups C & D; Class I, Division 2, Groups A,B,C,D | 1

**P** Warning Plate | **P**
- None | 0
- Russian | 1

**Q** RTD / Cable Assembly | **Q**
- None | 0
- With RTD and 6-foot Cable | 1
- With RTD and 15-foot Cable | 2
- With RTD and 25-foot Cable | 3

**NOTES: RTD/CABLE ASSEMBLIES**

If selected in "Q" above, the RTD/Cable assembly will be shipped in the same box as the transmitter. Due to UL restrictions, they cannot be shipped "pre-connected."

IMPORTANT: These particular RTD assemblies are not explosion-proof but are approved for Class I, Division 2 hazardous areas. For explosion-proof RTD components, please refer to "RTD Sensors and Related Accessories" in the Bristol price book.

**R** Factory Configuration Options | **R**
- Use the Standard, Defaults - Please DO NOT fill-in attachment 3800-A010 | 0
- Specify Other Configuration Settings - Please proceed to attachment 3800-A010. | 1

To specify a 3808 MVT that is approved by Industry Canada for custody transfer installations when used in conjunction with a ControlWave EFM or ControlWave XFC, please use the following model number and attachment number:

3808-30A-142-111-102-020-1000
3808-B-1

#### 3800-A

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>DESCRIPTION</th>
<th>CODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>In H2O (Default)</td>
<td>Special Note for 25 PSI DP range: If you use this attachment, &quot;In H2O&quot; become the default units. If you want &quot;PSI,&quot; you must specify that, here.</td>
<td>00</td>
<td></td>
</tr>
<tr>
<td>PSI</td>
<td></td>
<td></td>
<td>01</td>
</tr>
<tr>
<td>mmH2O</td>
<td></td>
<td></td>
<td>02</td>
</tr>
<tr>
<td>ftH20</td>
<td></td>
<td></td>
<td>03</td>
</tr>
<tr>
<td>inHg</td>
<td></td>
<td></td>
<td>04</td>
</tr>
<tr>
<td>mmHg</td>
<td></td>
<td></td>
<td>05</td>
</tr>
<tr>
<td>KPa</td>
<td></td>
<td></td>
<td>06</td>
</tr>
<tr>
<td>MPa</td>
<td></td>
<td></td>
<td>07</td>
</tr>
<tr>
<td>BAR</td>
<td></td>
<td></td>
<td>08</td>
</tr>
<tr>
<td>mBAR</td>
<td></td>
<td></td>
<td>09</td>
</tr>
<tr>
<td>g/cm2</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>kg/cm2</td>
<td></td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

#### C D

**SP Units for 3808-30A - Please note that this field is N/A for the 3808-10A**

<table>
<thead>
<tr>
<th>In H2O</th>
<th>PSI (Default)</th>
<th>mmH2O</th>
<th>ftH20</th>
<th>inHg</th>
<th>mmHg</th>
<th>KPa</th>
<th>MPa</th>
<th>BAR</th>
<th>mBAR</th>
<th>g/cm2</th>
<th>kg/cm2</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
<td>06</td>
<td>07</td>
<td>08</td>
<td>09</td>
<td>10</td>
<td>11</td>
</tr>
</tbody>
</table>

#### E

**Temperature Units for RTD Input**

<table>
<thead>
<tr>
<th>Degrees C (Default)</th>
<th>Degrees F</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

#### F

**Communications Baud Rate**

<table>
<thead>
<tr>
<th>9600 (Default)</th>
<th>1200</th>
<th>2400</th>
<th>4800</th>
<th>19,200</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
### 3800-A

<table>
<thead>
<tr>
<th>Code</th>
<th>DESCRIPTION</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>GH</td>
<td>BSAP Local Address</td>
<td>Using two digits, including a leading zero for 1 - 9, please specify the address in 'GH,' ie. &quot;01&quot; through &quot;32.&quot; For reference, the default address is 1.</td>
</tr>
<tr>
<td>J</td>
<td>BSAP Group Number</td>
<td>Please fill-in a single-digit between 1 and 8 in 'J.' Group 1 is the default.</td>
</tr>
<tr>
<td>KL</td>
<td>MODBUS Node Address</td>
<td>Using two digits, including a leading zero for 1 - 9, please specify the address in 'GH,' e.g. &quot;01&quot; through &quot;32.&quot; For reference, the default address is 1.</td>
</tr>
<tr>
<td>M</td>
<td>MODBUS Mode</td>
<td>ASCII (Default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>RTU</td>
</tr>
<tr>
<td>N</td>
<td>ENABLE / DISABLE 4 - 20 mA Output</td>
<td>ENABLE (Default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DISABLE</td>
</tr>
<tr>
<td>P</td>
<td>4 - 20 mA LINEAR or SQUARE ROOT</td>
<td>LINEAR (Default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SQUARE ROOT</td>
</tr>
<tr>
<td>R</td>
<td>4 - 20 mA FORWARD or REVERSE ACTING</td>
<td>FORWARD (Default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>REVERSE</td>
</tr>
<tr>
<td>T</td>
<td>4 - 20 mA OUTPUT VARIABLE</td>
<td>DP (in 3808-30A) or GP (in 3808-10A) (Default)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SP (3808-30A only)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TEMPERATURE</td>
</tr>
<tr>
<td>U</td>
<td>RTS DELAY</td>
<td>10 ms Bristol Default</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 ms that is known to work best for Chesapeake CW LP using Modbus</td>
</tr>
</tbody>
</table>

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Remote Automation Solutions

Website: www.EmersonProcess.com/Remote
DIMENSIONED DRAWINGS

3808 MVT with Manifold Adapters Shown
3808 MVT with “L” Flanged Mounting Bracket
3808 MVT with Neck Mounted Bracket
Simplified Diagram of 3808 MVT with 4 – 20 mA Signal
Simplified Diagram of 3808 MVT with RS 232 and RS 485 Interface
3808 MVT Wire Routing

3808 MVT Terminal Block Assignments

3808 MVT Digital Model 3808 MVT Analog Model