



Product specifications and ordering information

Temperature Monitoring Module



Overview

The Temperature Monitoring Module (TMM) accepts from one to six 2-, 3-, and 4-wire RTDs and/or thermocouples (both grounded and ungrounded tip) in any combination and provides six channels of temperature monitoring. It also accepts 4-20mA process variable signals. Multiple temperature channels can be grouped for differential and/or average measurements and alarming.

The module occupies a single slot in a SETPOINT® monitoring system rack and uses 24 Vdc instrument power as supplied by the SETPOINT® Rack Connection Module (RCM). Each TMM provides all necessary power¹, signal conditioning, alarm comparison, and relay² logic functions needed to provide six channels of continuous machinery monitoring and protection. It complies with the requirements of American Petroleum Institute Standard 670 for monitoring systems and is completely configurable using SETPOINT® configuration software.

Up to 15 TMM cards can reside in a single 19" SETPOINT® rack, providing up to 90 channels of continuous machinery protection. Each module provides basic status indication for its channels as required by API 670. When used with the optional rack touchscreen, real time display of temperature values, alarm statuses, and other information is available for all channels concurrently on a single screen for “at a glance” convenience.

When ordered with optional condition monitoring capabilities, the module streams high-speed (500 ms update rate) data to the rack’s System Access Module (SAM) where it is available to condition monitoring software such as SETPOINT® CMS and/or the rack’s embedded high-speed “flight recorder” on SD Card or Solid State Drive.



NOTES:

1. TMM process variable channels accept 4-20mA and 0-1.5Vdc signal formats only and do not provide loop power; UMMs accept a wider variety of process variable formats and also provide loop power. See UMM datasheet S1077787.
2. Each TMM has 4 SPDT relays (not one relay per channel).



Features and Benefits

- **Highly reliable design** utilizes just three transitional connectors from signal input to relay output – significantly reducing possible failure points in the critical machinery protection path.
- **Individually programmable 4-20mA outputs** – each of the six 4-20mA outputs on a TMM can be assigned to any parameter from any channel on that TMM.
- **Four SPDT electro-mechanical relays** on each TMM – can be voted with other channels whether in the same or different rack modules.
- **Flexible signal conditioning** – each TMM channel can be individually configured for RTD, thermocouple, or process variable inputs*. Temperature channels can be grouped and configured to return additional measurements such as pair differential, differential from group, and group average – any or all of which can be used for alarming.

* TMM process variable channels do not provide loop power, accept only 4-20mA or 0-1.5Vdc signal formats, and require a special 68-ohm External Termination Resistor (p/n 100543) when 4-20mA inputs are used. See page 6 for additional details regarding the ETR. UMM process variable channels provide 24Vdc loop power, do not require a termination resistor, and accept a wider range of proportional signal formats (4-20 mA, +1 to +5 Vdc, 0 to -10 Vdc, and 0 to +5 Vdc). Refer to UMM datasheet S1077787 for additional information.

- **Distributed power regulation for improved reliability** – each TMM converts its 24 Vdc input power to all regulated voltages needed by on-board processors and transducers, reducing the potential for rack single-point failures compared to systems that generate regulated voltages for the entire rack in a centralized power supply.
- **No jumpers or DIP switches.** Every option in the SETPOINT® system is configured via software. Cards do not have to be removed from the rack.
- **Powerful onboard processor** delivers 24-bit A-to-D resolution for highly accurate measurements – no potentiometers, no drift, no calibration required.
- **Simple, reliable, self-contained design** reduces likelihood of failures from inter-module dependencies.
- **Digital Modbus® communications** via System Access Module (SAM) can be used in lieu of (or simultaneously with) analog 4-20 mA outputs for flexibility when integrating with other instrumentation.
- **Unparalleled ease of configuration** via SETPOINT® configuration software's intuitive spreadsheet-like user interface – easily cut and paste to/from Microsoft® Excel® and most other programs.
- **Simplified spare parts requirements.** Because every measurement in the SETPOINT® system is made with just two monitoring types (UMMs and TMMs), only two module types need to be carried as spares. For systems without temperature measurements, only a single monitoring module type is used.
- **Connectivity to condition monitoring software.** When ordered with condition monitoring enabled, a TMM becomes a TMMCM and is able to stream high-speed (500 ms update rate) data to the rack's System Access Module (SAM) where it can be stored on an embedded "flight recorder" hard drive and/or SD Card, or to an external computer or OSIsoft® PI System server. The data can then be viewed with our SETPOINT® CMS Display software.
- **SIL-Capable Architecture** SETPOINT® is suitable for use as part of a SIS, to implement safety instrumented functions up to SIL 2 when configured, installed and commissioned properly as per instructions provided within the Operations and Maintenance Manual (S1079330) and safety manuals (C107577, C107576, C107578, C107579).

Specifications

All specifications are at +25 °C (+77° F) unless otherwise noted.

Inputs	
Channels	Six
Transducer Types	<p>Accepts most common industry-standard resistance temperature detectors (RTDs), thermocouples, and 4-20mA or 0-1.5Vdc signals in any combination.*</p> <p>* All channels within a TMM share the same ground. If grounded tip thermocouples are used with different ground potentials from one another, use separate TMMs for each ground potential required.</p>
Thermocouples	
Type	Range
Type E	-100 to +1000 C
Type J	0 to +760 C
Type K	0 to +1370 C
Type T	-160 to +400 C
2-, 3-, and 4-wire RTDs	
Type	Range
10 Ω Copper (α = 0.00427)	-100 to +260C
100 Ω Copper (α = 0.00427)	-100 to +260C
120 Ω Nickel (α = 0.00672)	-80 to +260C
100 Ω Platinum (α = 0.00385)	-200 to +850C
100 Ω Platinum (α = 0.00392)	-200 to +700C

	Externally Powered Process Variable Transmitters
	<p>Current: 4-20 mA</p> <p>Voltage: < 1.5Vdc</p>
Wire Sizes	16-28 AWG
Isolation	565 V pk (400 V rms) (Module-to-Chassis)
Zin	> 1 MΩ
Input Power Voltage	<ul style="list-style-type: none"> • Continuous: + 22 to +30 Vdc (SIL: +23.1 to +26 Vdc) • Transient: +18 to + 36 Vdc
Power Consumption	≤ 7W when input power voltage is 22 to 26 Vdc.



Outputs	
Relays	<ul style="list-style-type: none"> • Number: 4 per TMM • Type: SPDT, form C • Sealant: epoxy • Min. Switched Current: 10 mA • Max switched pwr (resistive): 5A @ 48 Vrms or 30 Vdc • Maximum voltage in hazardous areas: 30 Vdc • Life: > 10,000 cycles • Wire size: 14-28 AWG • Software-configurable options: <ul style="list-style-type: none"> ○ Energize or de-energize to trip ○ 4 SPDT or 2 “virtual” DPDT ○ Can be driven by alarm condition(s) of any channel(s) in the rack via user-programmable logic ○ Any logic driving a relay can be configured for latching or non-latching operation
LEDs	<ul style="list-style-type: none"> • OK LED (1 per TMM) Green – monitor operating correctly Yellow – one or more channels are faulted Red – fatal hardware error Off – monitor has lost power • Bypass LED (1 per TMM) On – one or more channels bypassed Off – No channels bypassed • Relay LEDs (1 per relay) On – Relay in alarm state Off – Relay not in alarm state

4-20 mA	<ul style="list-style-type: none"> • Number: 6 (1 per channel) • Output proportional to channel programmable full scale range • Overrange: up to 125% of full scale (24 mA) • Max Load Resistance (R^L): 950Ω with 22 Vdc power; 1350Ω with 30 Vdc power • Resolution: 16 bit • Update Rate: < 500 ms • Short-circuit protected: Yes • Wire size: 16-28 AWG* • Fault Clamp: Programmable** <p>* Connector accepts physical wire diameters from 16-28 AWG. Appropriate AWG for the application will vary depending on total cable length (resistance and capacitance). Consult manual S1079330.</p> <p>** The fault clamp value can be individually programmed for each channel as either 2 mA or a user-selected value within the full-scale range.</p>
Configuration	
Method	PC-based SETPOINT® configuration software
Connection Type	Local: Mini-B USB “on-the-go” receptacle on UMM*
	* When a System Access Module (SAM) is installed in the rack, the USB receptacle on any TMM or UMM can be used to configure every module in the rack.
Memory Location	Configuration data is stored in non-volatile RAM on each TMM and is retained until changed. Batteries or other power sources are not required to maintain a module’s configuration data.

Signal Conditioning	
A/D Resolution	24 bits
Precision	± 1° C
Accuracy	± 3° C (Ta = 25° C)
Alarms	
Types	Individual over and under Alert and Danger setpoints can be established for each channel. Alarming is selectable for Over, Under, In Band, or Out of Band. * A channel may be configured with any or all of its alarms turned off.
Configurable Settings	Time Delay
	<ul style="list-style-type: none"> Individually adjustable per alarm, per channel. Minimum Delay: 1 sec Maximum Delay: 100 sec Adj. Increments: 0.5 sec
	Latching / Non-latching
	Alert and Danger setpoints are individually configurable per alarm, per channel for latching or non-latching
	Range
<ul style="list-style-type: none"> Individually adjustable, per alarm, per channel Minimum: 0% of full scale Maximum: 100% of full scale* Adj. increments: 2 decimal points of precision, in the channel's engineering units <p>* A channel's Alert setpoint must be less than its corresponding Danger setpoint.</p>	
	Enable/Disable

	Any or all alarms for a channel may be enabled or disabled individually, allowing operation without setpoints (or with a reduced number of setpoints).
Environmental	
Operating Temperature	-20C to +65C
Storage Temperature	-40 °C to +85 °C
Operating Temperature Ramp	Do not exceed 0.5C/minute
Storage Temperature Ramp	Do not exceed 10C/minute
Humidity	5% to 95%, non-condensing
CE Mark Directive	
ESD	<ul style="list-style-type: none"> Contact: 6 kV, Criteria B Air: 8 kV, Criteria B
Radiated EMI Susceptibility	<ul style="list-style-type: none"> 80 – 1000 MHz: 20 V/m* 1.4 – 2 GHz: 6 V/m* 2 – 2.7 GHz: 3 V/m* <p>* Criteria A</p>
Magnetic Field	30 A/m, Criteria A
EFT Burst	2 kV, Criteria B
EFT Surge (Signal Lines, Power Line)	2 kV line to ground, Criteria B
Conducted RFI (Signal Lines, Power Lines)	150 kHz to 80 MHz, Criteria A
Conducted RF Common Mode Immunity (Signal Lines, Power Lines)	<ul style="list-style-type: none"> 15 Hz – 150 Hz: 10 V* 150 Hz – 1.5 kHz: 1V* 1.5 kHz – 150 kHz: 10 V* <p>* Criteria A</p>
Radiated EMI Emissions	30 dB µV/m @ 30 m, 30 MHz – 1000 MHz, Class A



Conducted Emission	60 dB μ V/m @ 30 m, 0.5 MHz – 30 MHz, Class A
AC Power Voltage Dip Immunity	One-half period, 30% reduction, Criteria B
AC Power Voltage Dip Interruption	250 periods, 95% reduction, Criteria B
DC Power Voltage Dip Immunity	<ul style="list-style-type: none"> 10 ms, 60% reduction, Criteria B
DC Power Voltage Dip Interruption	<ul style="list-style-type: none"> 30 ms, 100% reduction, Criteria B
Low Voltage Directive	Council Directive 2014/35/EU Low voltage using BK Vibro-supplied power supply (rack ordering option –CC) or other Low Voltage Directive approved supply.

Hazardous Area Approvals

SETPOINT™ by Brüel & Kjær Vibro

Minden, NV 89423 USA | www.setpointvibration.com

RoHS **CE** **UL**

Ex ATEX: $\text{II 3 G Ex nA nC IIC 160°C(T3) Gc}$; ITS16ATEX48339X; IECEx: Ex nA nC IIC 160°C(T3) Gc; IECEx ETL 17.0045X;

UL US: Class I, Zone 2, AEx nA nC IIC T3 Gc; Class I, Division 2, Groups A, B, C, D, T3C; Conforms to ANSI/UL STD. 61010-1, UL STDs. 60079-15 & 60079-0

CSA CANADA: Ex nA nC IIC T3 Gc; Class I, Division 2, Groups A, B, C, D, T3C; Certified to CAN/CSA STD. C22.2 Nos. 61010-1-12, 60079-0, 60079-15 & 213.M1987

Input: $V_{Min} = 18V$; $V_{Max} = 36V$; $P_{Max} = 160W$

See User Manual

Operating Temp.: $-20^{\circ}C \leq T_a \leq 65^{\circ}C$

Relay: $V_{Max} = 30VDC$; $I_{Max} = 5A$

PART NUMBER:
VC-8000/RCK

Recommended Passive Intrinsic Safety Barriers

MTL 760(ac) or equal	<ul style="list-style-type: none"> Thermocouples
MTL 755 or equal	<ul style="list-style-type: none"> RTDs
MTL 787+ or equal	<ul style="list-style-type: none"> 4-20 mA signals

Recommended Active Intrinsic Safety Barriers with Galvanic Isolation

Pepperl + Fuchs KFD2-VR-Ex1.50M or equal	<ul style="list-style-type: none"> Thermocouples
MTL 5582B MTL 4582B or equal	<ul style="list-style-type: none"> RTDs
Pepperl + Fuchs KFD0-CS-Ex1.50P or equal	<ul style="list-style-type: none"> 4-20 mA

Physical

Size	9.1" H x 9.0" D x 1.0" W (231 mm x 229 mm x 25 mm)
Weight	12.1 oz (343 g)
Rack Slots Required	One (may reside in rack slots 3-16)

Safety Integrity Level (SIL) Capability*

SETPOINT® is suitable for use as part of a SIS, to implement safety instrumented functions up to SIL 2 when configured, installed and commissioned properly as per instructions provided within the Operations and Maintenance Manual (doc S1079330) and safety manuals:

- VC-8000 Backplane and Rack Safety Manual (C107579)
- RCM Safety Manual (C107578)
- TMM Safety Manual (C107576)
- UMM Safety Manual (C107577)

*Hardware availability in Q4 2019.

Ordering Information

Spare TMM Cards

When ordering spare TMM cards, use the part number below. When ordering one or more TMMs as part of a system, do not order TMM cards and other rack components individually. Instead, order using part number VC-8000/RCK and refer to SETPOINT® system datasheet S1077785 to specify rack size, module types for each slot, faceplate, touchscreen, mounting style, and other options.



VC-8000/TMM-AA-BB	
Temperature Monitoring Module (spare)	

AA Type

00	TMM
01	TMM _{CM} (Condition Monitoring Enabled)
02	TMM _{CM} (firmware upgrade only) ¹

BB Agency Approvals and Certifications

00	No Approvals ²
05	Multi (ATEX, IEC, ETLc)
07	SIL & Multi (ATEX, IEC, ETLc)

NOTES:

- Used only when performing a field upgrade of existing TMMs to CM-ENABLED versions. Upgrade requires special firmware key, supplied by the factory. This option includes no hardware as a TMM will already be present.
- For AA=00 or 01, use BB=05 (spare hardware is only supplied as agency-approved). Specify BB=00 only when AA=02 (firmware only). Agency approvals pertain to the hardware itself, not the presence or absence of CM-ENABLED features. Approvals (or absence thereof) are provided at time the hardware modules are supplied and may not be altered in the field.



CAUTION

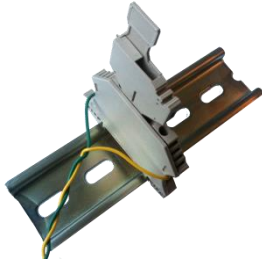
TMM cards are shipped with default factory configuration settings which are not necessarily suitable for any particular application. Before use, each TMM channel must be configured properly for the application via SETPOINT® configuration software. This software is included with each system or TMM ordered and is also available for download at www.setpoint.bkvibro.com



Accessories

External Termination Resistor (ETR)

An ETR is required when connecting a 4-20mA signal to a TMM channel, converting the proportional current to a TMM-compatible voltage level. The ETR is a 68-ohm ¼ W resistor inside a Weidmuller component holder, providing wiring terminals and 35mm DIN rail mounting (wire and DIN rail not included; shown in photo for clarity only).



100543
External Termination Resistor for Process Variable Channel

Manuals and Software

A complete set of SETPOINT® manuals and configuration software on USB memory stick* is supplied at no extra charge with each order, but must be specified at time of ordering. As languages in addition to English become available, they will be included on the memory stick. The most recent version of manuals and software can also be downloaded directly from our website. A 2m USB cable complete with ferrite beads on each end (not shown) is included and does not need to be ordered separately.



* NOTE: Manuals are published electronically in Adobe® PDF* format and may be printed and freely distributed. Adobe Reader is required and can be downloaded free-of-charge from www.adobe.com. Hardcopy versions of manuals are also available from the factory for an additional charge.

VC-8000/CSW-AA
SETPOINT® Manual and Configuration Software

AA Format

01	USB Memory Stick
02	Printed Manual

USB Cable

This cable is used to connect a computer running SETPOINT® Configuration Software to the USB port on UMM and TMM modules. The cable is included with part number VC-8000/CSW and does not need to be ordered separately. Order the item below only when replacing a lost or damaged cable.



NOTE: The cable includes ferrite beads installed on each end but are not shown in the photo.

96014-012
2m (6') USB 2.0 A / Mini-B Cable

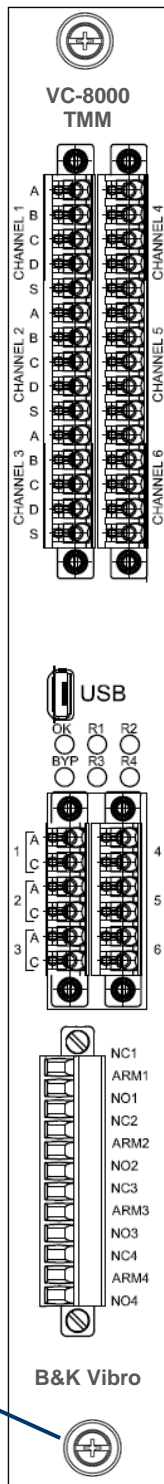
Wiring and Outline Diagrams

Sensor input connections for channels 1-3 and 4-6. Connectors are removable to facilitate ease of wiring.

Mini-B USB receptacle for connection to SETPOINT configuration software via USB cable.

4-20 mA proportional analog output connections; programmable. Connectors are removable to facilitate ease of wiring.

Captive thumbscrew for securing UMM in SETPOINT rack slot.



Captive thumbscrew for securing TMM in SETPOINT rack slot.

OK, BYPASS, and Relay status LEDs.

Mechanical relay output connections for relays 1-4. Connector is removable to facilitate ease of wiring.



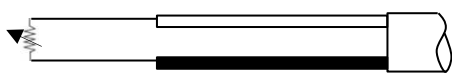
TYPICAL
4-WIRE RTD



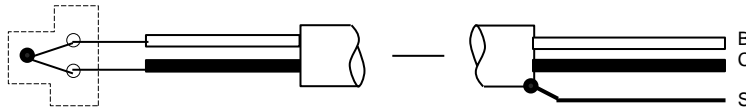
TYPICAL
3-WIRE RTD



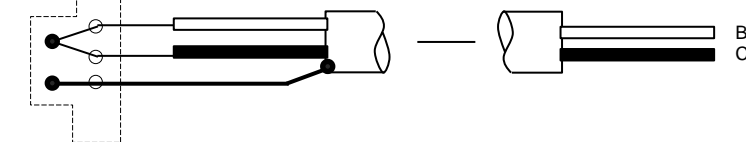
TYPICAL
2-WIRE RTD



TYPICAL
UNGROUND
THERMOCOUPLE TIP

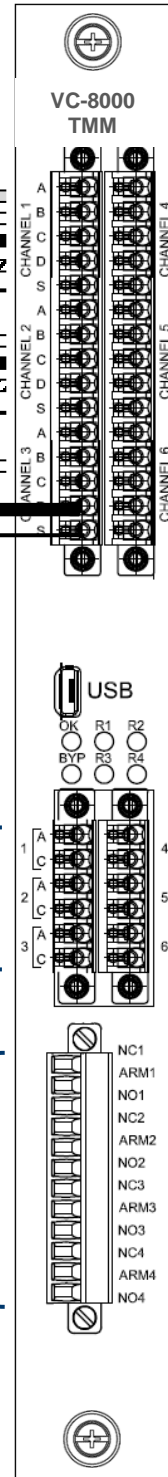


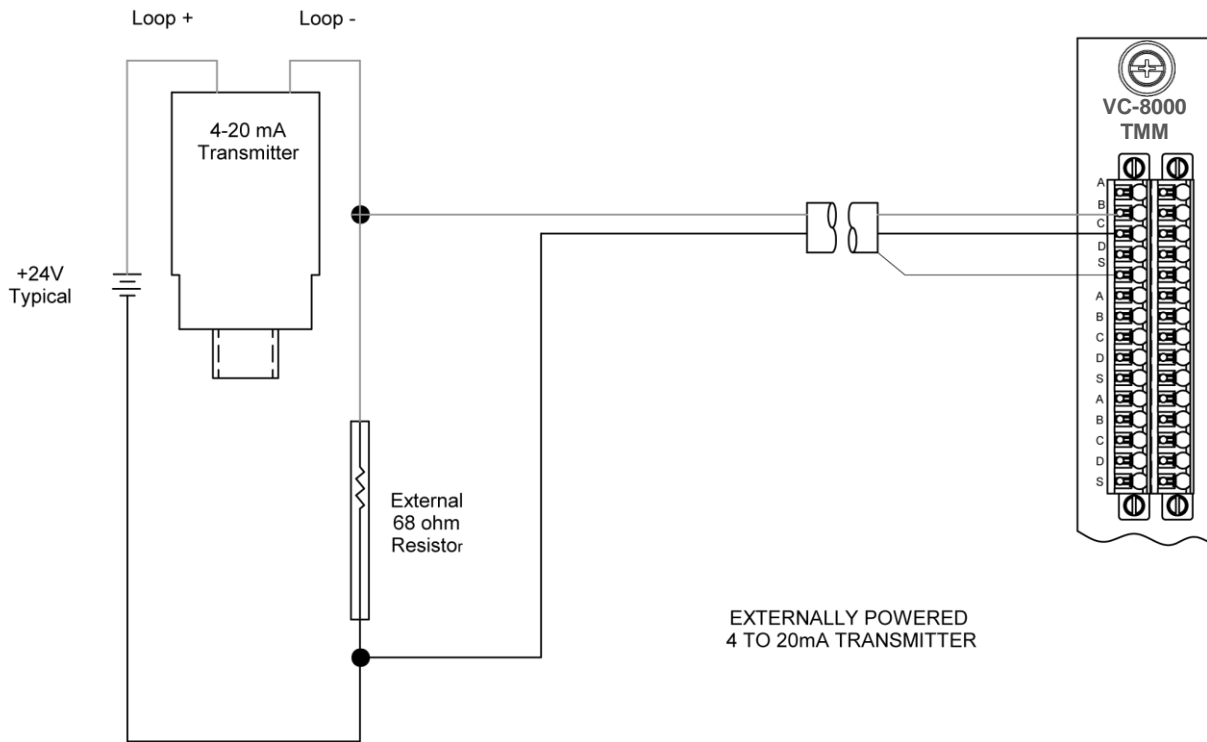
TYPICAL GROUNDED
THERMOCOUPLE TIP



STRIP CHART RECORDERS, PLCs, DCSs, OR
OTHER SYSTEMS ACCEPTING 4-20 mA
PROPORTIONAL SIGNALS

MACHINE CONTROL SYSTEMS,
SHUTDOWN SYSTEMS, MOTOR
STARTERS, PANEL ANNUNCIATORS, OR
OTHER SYSTEMS ACCEPTING DISCRETE
SIGNALS FROM RELAY CONTACTS





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