TACMET II, TRV WEATHER STATION OPERATION MANUAL

102760-1-9800 TACMET II, TRV Manual Rev A

ISO 9001:2008 Certified

Technical Support

Thank you for choosing a Met One product and we sincerely appreciate your interest and expectation in using it. Should you require support during initial setup and operation, please consult this printed documentation to resolve your problem. If you are still experiencing difficulty, you may contact a Technical Service representative during normal business hours – 8:00 a.m. to 5:00 p.m. Central Time, Monday through Friday.

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Safety Notice

The contents of this manual have been checked against the hardware and software described herein. Since deviations cannot be prevented entirely, we cannot guarantee full agreement. However, the data in this manual is reviewed regularly and any necessary corrections are included in subsequent editions.

Faultless and safe operation of the product presupposes proper transportation, storage, and installation as well as careful operation and maintenance. The seller of this equipment cannot foresee all possible modes of operation in which the user may attempt to utilize this instrumentation. The user assumes all liability associated with the use of this instrumentation. The seller further disclaims any responsibility for consequential damages.

Electrical & Safety Conformity

The manufacturer certifies that this product operates in compliance with the following standards and regulations:

FDA/CDRH This product is tested and complies with 21 CFR, Subchapter J, of the Health and Safety Act of 1968

US 21 CFR 1040.10

FCC Notices

Contains FCC ID: OUR-XBEE/OUR-XBEEPRO*
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (*i.*) this device may not cause harmful interference and (*ii.*) this device must accept any interference received, including interference that may cause undesired operation.

IMPORTANT: The RF module has been certified for remote and base radio applications. If the module will be used for portable applications, the device must undergo SAR testing.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Re-orient or relocate the receiving antenna, Increase the separation between the equipment and receiver, connect equipment and receiver to outlets on different circuits, or Consult the dealer or an experienced radio/TV technician for help.

RF Exposure
WARNING: To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation. To ensure compliance, operations at closer than this distance is not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.

Warranty

All instruments are warranted against defects in parts or workmanship for a period of two (2) years from the date of shipment. Should any instrument or part prove to be defective within the warranty period, upon written notice and return of the unit (freight prepaid), Met One Instruments, Inc. will, at its option, repair or replace the defective unit, and return it, transportation prepaid via surface transportation.

Equipment abused, modified, or altered may cause cancellation of this warranty.

The above warranty applies only to items manufactured by Met One Instruments, Inc. Items not manufactured by Met One Instruments, Inc. are warranted only to the extent and in the manner warranted by the manufacturer of such items. Should emergency warranty repair be required at a customer's facility, Met One will provide such repairs and charge only the portal-to-portal Field Service rates and actual expenses in accordance with our published rates then in effect. Expendable supplies and wear items, such as bearings and lightning- related damages, are not covered under this warranty.

Table of Contents

1.0   Safety

1.1   Safety

This manual may include a **CAUTION** and a **WARNING** indication. Familiarize yourself with the following definitions for the meanings of these indicators.

A **CAUTION** indicates a hazard and calls attention to a procedure that if not correctly followed could result in damage to the instrument. Do not proceed beyond a caution indicator without understanding the hazard.

A **WARNING** indicates a hazard to you and calls attention to a procedure that if not correctly followed could result in injury or even death. Do not proceed beyond a warning without understanding the hazard.

2.0   Introduction & Overview

2.1   Overview

Met One's TACMET II, TRV Weather Station is designed as a stand-alone weather station to provide accurate measurements of wind speed, wind direction, temperature, relative humidity, and barometric pressure.   The TRV Weather Station has a built-in 2.4 GHz spread spectrum radio module with 128-bit data encryption (XBeePro). The unit has no moving parts and is ideally suited for use wherever reliable, maintenance free operation over a wide operating range under adverse operating conditions is required. The unit is built with a metal housing to offer some protection from electromagnetic interference.   The TRV Weather Station is painted CARC tan.

2.2   Specifications

PERFORMANCE
Wind Speed

Range	0-145 mph (0-65 m/s)
Accuracy *	±1.1 mph (0.5 m/s) ± 5%
Resolution	0.22 mph (0.1 m/s)

Wind Direction

Range	0 to 360°
Accuracy *	±5° @ wind speeds > 5 mph (2.2 m/s)
Resolution	0.1°

Temperature

Range	-40°C to +140°F (-40°F to 60°C)
Accuracy	± 1.8°F (±1.0°C) @ WS> 4.5 mph (2.0 m/s)
Resolution	± 0.1°C

Relative Humidity

Range	0 to 100%
Accuracy	±3%
Resolution	0.1%

Barometric Pressure

Range	14.75 to 35.50 in Hg (500 to 1200 hPa)
Accuracy	±.01 in Hg (± 0.40 hPa)
Resolution	0.1 in Hg

MTBF   80,000 hours

* This accuracy is maintained when the sensor is within ± 10 degrees of vertical.

ELECTRICAL

Measurement Format	Two orthogonal axis, North-South and East-West
Measurement Rate	Approx. 2 Hz each axis
Operating Frequency	40 kHz
Signal Output	RS-232C or RS-485 @19.2 K baud (see section 5.0)
Power Requirements	8 - 36 Vdc: 100 mA draw @ 12 Vdc

PHYSICAL

Size	12.25 inches (31.1 cm) x 4 inches (10.15 cm) dia.
Weight	5.5 lb. (2.5 kg.)
Mounting	MS3106F18-1S Connector
Finish	per MIL-DTL-64159
Color	CARC TAN 686A, 33446

3.0   Installation

Be sure to mount the TRV Weather Station in a clear, open area to minimize any turbulent effects caused by local obstructions (e.g., trees, buildings, etc.). The TRV Weather Station is installed on the Met One P/N 102709 pre-wired sensor mount. The keyway in the connector on the base of the TRV Weather Station is matched to the keyway on the mount.

Attach the TRV Weather Station to the 102709 QuickMount by inserting it into the top of the mount, attaching the latch springs to the clips on the bottom of the sensor and snapping them down to lock the sensor in place. It may be necessary to rotate the TRV Weather Station 180° to allow the keyway to seat properly.

The TRV Weather Station is supplied with an internal flux-gate compass to automatically orient the wind direction data to True North. It is not necessary to manually orient the TRV Weather Station towards North.

4.0   Input/Output Connections

The sensors' pin designations are as follows:

PIN	FUNCTION
A	Power and RS-232C Ground
B	+8 to +36 Vdc Power Input
C	N/C
D	N/C
E	N/C
F	N/C
G	RS-232C Receive Data
H	RS-232C Transmit Data
I	N/C
J	N/C

Radio Antenna Connector: TNC Jack

5.0   User Interface

The internal serial port works in parallel with the radio. The unit is set for polled operation. The output of the TACMET II is a serial data stream. Typically, the output is set for 19.2k baud (N/8/1) and outputs the data string when polled. The data can be viewed, displayed, and logged using Met One AWeather Software.

An example of the output format is shown below:

<STX>R S0011 000.6 102 +077.1 055 29.77 63<EOT>

The string consists of eight fixed length fields each separated by a space (0x20) character. Each data field contains leading zeros, temperature is preceded by a plus or minus sign.

Field 1: Start of transmission character <STX> immediately followed by an R
Field 2: Serial number of the sensor (Snnnn)
Field 3: Wind speed data in miles per hour (nnn.n)
Field 4: Wind direction data in degrees (nnn)
Field 5: Temperature data in degrees Fahrenheit (+/-nnn.n)
Field 6: Relative humidity data in percent (nnn)
Field 7: Barometric pressure data in inches of mercury (nn.nn)
Field 8: Two digit Checksum two-digit checksum immediately followed by an end of transmission character (nn<EOT>).

The Checksum is the Twos Complement (Negated) of the 8 bit sum of all the characters in the output including the <STX> character to start the message and the ending <EOT> character (not including the Checksum itself). The Checksum is inserted into the string before transmission.

The polling string must be set up by the user before deploying the system. This string is set up using terminal commands. Please refer to Appendix A for instructions on how to enter the terminal command mode and the "ST" command for details on how to set up the polling string.

6.0   Calibration

The sensor requires a wind tunnel for calibration. Met One can provide NIST traceable calibration in our wind tunnel. A portable Zero Wind Test Fixture, P/N 501506 is available for purchase. Please contact the factory for further details.

Temperature, relative humidity and pressure can be checked by co-location with a reference sensor. For formal calibration, the TACMET needs to be returned to the factory or authorized depot.

7.0   Maintenance

Because the sensor has no moving parts to wear out, periodic maintenance is not required. In extremely corrosive environments, the condition of the connector used to mount the sensor should be checked. There are no adjustments or user repairable parts located inside the sensor.

Appendix A
Terminal Mode Commands

Connect to a computer running a terminal emulator program like HyperTerminal at 19200, N, 8, 1. Power up the TACMET and hit Ctrl T within 2 seconds of powering the sensor. Terminal mode times-out after 2 minutes of inactivity.

Successful entry into Terminal Mode will return the prompt:

Command (HE for Help, QU to Quit):

HE - Display Help Menu

HE	Display the Help menu Command: HE<cr> HE - This Help Menu BV - Battery Voltage Printout Toggle On/Off CV - Compass Heading Printout Toggle On/Off MD - Set Magnetic Declination OI - Set Output Interval PU - Set Pressure Units QU - Quit command mode and save any changes SA – SDI Address SB - Set Baud rate SP - Sign-on Prompt Toggle On/Off ST - Set Serial Trigger Address SU - Set Speed Units TU - Set Temperature Units VN - Display Firmware Version Number

SU - Wind Speed Units
Read or Set output Units for Wind Speed.

COMMAND	RESULT
SU<cr>	Report Units setting
SU0<cr>	M/S
SU1<cr>	MPH
SU2<cr>	Knots
SU3<cr>	KPH

TU - Temperature Units
Read or Set output Units for Temperature.

COMMAND	RESULT
TU<cr>	Report Units setting
TU0<cr>	Celsius
TU1<cr>	Fahrenheit

PU - Pressure Units
Read or Set output Units for Pressure

COMMAND	RESULT
PU<cr>	Report Units setting
PU0<cr>	Millibars (Default)
PU1<cr>	Inches of Mercury

SB - Serial Baud Rate
Read or Set Baud Rate
Note: This command is not supported by Tracker Output.
        Tracker output is fixed at 9600 Baud.

COMMAND	RESULT
SB<cr>	Report Baud Rate setting
SB1<cr>	1200 baud
SB2<cr>	2400 baud
SB3<cr>	4800 baud
SB4<cr>	9600 baud
SB5<cr>	19200 baud

Baud rate changes take effect after cycling power to the sensor.

BV - Toggle Battery Voltage Printout in data string
Read or Set the Battery Voltage output option

COMMAND	RESULT
BV<cr>	Report option setting
BV0<cr>	Battery Voltage printout Disabled (Default)
BV1<cr>	Battery Voltage printout Enabled

CV - Toggle Compass Heading Printout in data string
Read or Set the Compass Heading output option

COMMAND	RESULT
CV<cr>	Report option setting
CV0<cr>	Compass Heading printout Disabled (Default)
CV1<cr>	Compass Heading printout Enabled

MD - Magnetic Declination
Read or Set the Magnetic Declination

COMMAND	RESULT
MD<cr>	Report Magnetic Declination setting
MDXX.X<cr>	Set Declination to XX.X Degrees

Note: West declination values are entered and reported as negative values.

ST - Serial Trigger
Read or Set the Serial Trigger character string (Poll command). This can be any alpha numeric value, limited to six digits. The serial trigger is case sensitive.
Note: ST must be immediately followed by the serial trigger string. Do not add a space between the command and trigger.

COMMAND	RESULT
ST<cr>	Report Serial Trigger string setting
STXXXXXX<cr>	Set Serial Trigger

VN - Software Version Number
Report the current Software Version Number

COMMAND	RESULT
VN<cr>	Report current Software Version

OI - Output Interval
Read or Set the Output Interval
Note: This command is not supported by CAMEO/ALOHA or Tracker Output.

COMMAND	RESULT
OI<cr>	Report Output Interval setting
OI1<cr>	Sensor Output every 1 second (Default)
OI2<cr>	Sensor Output every 2 seconds
OI3<cr>	Sensor Output every 5 seconds
OI4<cr>	Sensor Output every 15 seconds
OI5<cr>	Sensor Output every 30 seconds
OI6<cr>	Sensor Output every 60 seconds

SA – SDI Address
Read or Set the SDI Address

COMMAND	RESULT
SA<cr>	Report SDI-12 Address
SAX<cr>	Set SDI-12 Address (X may be [0-9], [A-Z], or [a-z]; case sensitive)

SP - Sign-On Prompt
Read or Set the Sign-On Prompt output option at power-up

COMMAND	RESULT
SP<cr>	Report option setting
SP0<cr>	Sign-On Prompt Disabled (Default)
SP1<cr>	Sign-On Prompt Enabled

QU - Quit

Exit the command mode and query to save any changes.

Command (HE for Help, QU to Quit): QU<cr>

To save changes type 'Y' : N<cr>

Restarting

Appendix B
Theory of Operation

Winds

Met One's sonic anemometer operates on the principal that the speed of the wind effects the time it takes for sound to travel from one point to a second point. If the sound is traveling in the direction of the wind then the transit time is decreased. If the sound is traveling in a direction opposite the wind then the transit time is increased. This principal is well known and is the basis of most sonic anemometers.

Temperature / Humidity

The temperature sensor in the P/N 102760-1 TACMET II uses a precision single-element Thermistor. This provides a highly accurate and stable temperature reading. The resistance value is 10K ohms at 25°C. This allows the TACMET II to directly interface with the temperature sensor without additional electronics; sensor compensation is handled through software.

The relative humidity sensor is a capacitive element sensor. It has a linear voltage output, which allows it to be connected directly to the TACMET II microprocessor. The humidity sensor element's construction provides excellent resistance to wetting, dust, dirt, oils, and common environmental chemicals. A heavy contaminant layer of dirt will slow down the sensor's response time because it will take longer for water vapor to equilibrate in the sensor.

Barometric Pressure

The P/N 102555 barometer uses proven silicon sensor technology with microprocessor-based signal compensation, eliminating the need to insulate or temperature-regulate the barometer. The P/N 102555 has a pressure range of 14.75 to 35.50 in Hg (500 to 1200 mbar). The P/N 102555 has a TTL output that lowers the power consumption of the barometer to 33 mW. The accuracy of the sensor is ±0.4 mbar (0.01 in Hg)