

# TACMET II WEATHER STATION, EMI OPERATION MANUAL



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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 are 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

## **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.

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## 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 – TACMET II Weather Station

### 2.1 Overview

Met One's TACMET II weather station is designed as a stand-alone weather station to provide accurate measurements of wind speed, wind direction, temperature and relative humidity. A barometric pressure sensor and an internal fluxgate compass are available as options. 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 and filtering on all input and output lines to offer some protection from electromagnetic interference.

***Please see the configuration table on the last page of this manual. Compare it to the serial label on your sensor for your exact configuration.***

### 2.2 Specifications

#### **PERFORMANCE**

##### Wind Speed:

Range: 0-65 m/s (0-145 mph)  
Accuracy \*:  $\pm 0.5$  m/s (1.1 mph) or 5%  
Resolution: 0.1

##### Wind Direction:

Range: 0-360°  
Accuracy \*:  $\pm 3^\circ$  @ wind speeds > 2.2 m/s (5 mph)  
Resolution: 1.0°

##### Optional Compass:

Accuracy:  $\pm 2^\circ$

##### Temperature:

Range: -40° to +60°C (-40° to 140°F)  
Accuracy:  $\pm 2.0^\circ\text{C}$  ( $\pm 3.6^\circ\text{F}$ ) @ WS > 2.0 m/s (4.5 mph)  
Resolution: 0.1°

##### Relative Humidity:

Range: 0 to 100%  
Accuracy:  $\pm 3\%$   
Resolution: 1.0

##### Pressure:

Range: 600-1100 hPa (17.71-32.45 inHg)  
Accuracy: Refer to Appendix C: Configuration Guide  
Resolution: 0.1 hPa (0.01 inHg)

##### MTBF:

80,000 hours

#### **ELECTRICAL**

Measurement Format: Two orthogonal axes, North-South and East-West

Measurement Rate: Approx. 2 Hz each axis

Operating Frequency: 40 kHz

Signal Output: RS-232 or RS-485 @ 19.2 K baud typical (See Section 5.0 for details)

Power Requirements: 9 - 36Vdc: 50 mA draw @ 12 Vdc

#### **PHYSICAL**

Size: 12.25 inches (311 mm) X 4 inches (101.6 mm) dia.

Weight: 5.5 lbs (2.5 kg)

Mounting: MS3102R18-1P connector interfaces to P/N 102621 Quick Mount for ¾-inch vertical pipe stub mounting

*\* This accuracy is maintained when the sensor is within  $\pm 10$  degrees of vertical.*

### 3.0 Installation

Be sure to mount the sensor in a clear, open area to minimize any turbulent effects caused by local obstructions (e.g., trees, buildings, etc.). The sensor is typically installed on Met One's P/N 102621 Quick Mount. The keyway in the connector on the base of the sensor is matched to the keyway on the mount. Other variations of this mount are available, including heavy duty and hand held applications. Please consult your Sales Representative for more information.

Attach the sensor to the 102621 Quick Mount by inserting the sensor 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 sensor 180° to allow the keyway to seat properly.

If your sensor is not equipped with a fluxgate compass, align the posts with the black marks towards either True North or Magnetic North depending on your application. (All hand-held sensors are provided with a compass.)

On the 102621 mount, loosen the thumb screws in the bottom of the mount that attach it to your vertical 3/4 inch pipe, rotate the sensor to North, then retighten the thumb screws. The connector keyways assure correct alignment if the sensor is removed and re-installed at any time.

Please refer to Figures 1 and 2 for reference.

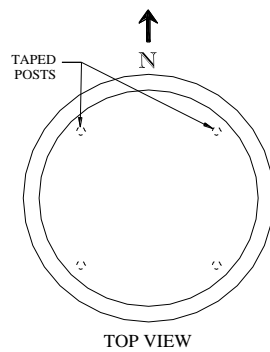


Figure 1

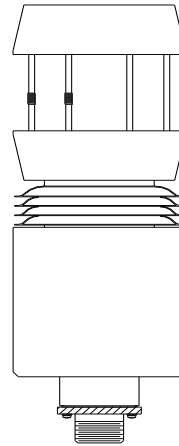


Figure 2

### 4.0 Input/Output Connections

The sensors' pin designations are as follows:

<u>PIN</u>	<u>FUNCTION</u>
A	Power Ground
B	9 - 36 Vdc
C	N/C
D	N/C
E	N/C
F	N/C
G	Receive Data RS-232 (RS-485 B(+))
H	Transmit Data RS-232 (RS-485 A(-))
I	N/C
J	N/C



## 5.0 User Interface

The output of the TACMET II is a serial data stream. Typically the output transmits at 19.2k baud (N/8/1) approximately once per second. The data is easily viewed and can be displayed and captured using Met One's WeatherView Software or a terminal emulator program, like PuTTY. An **example** of the output format is shown below:

```
01+H0123 02+000.1 03+207.8 04+023.5 05+042.3 06+1013.2 07+11.90 08+215.3
```

The first parameter is the date code/serial number of the sensor (H0123), the second parameter is wind speed, the third parameter is wind direction, the fourth parameter is temperature, the fifth parameter is relative humidity, the sixth parameter is the optional barometric pressure, the seventh parameter is battery voltage and the eighth parameter is the optional compass reading. Barometric pressure is shown in InHg, a typical format for hPa or mBar would be "06+29.91". The battery voltage and compass readings are typically not printed in the data string. These can be turned on and off through the use of terminal commands. Refer to Appendix A for these and other user defined options.

All fields are fixed length with leading zeros separated by two spaces. The string terminates with a carriage return/line feed immediately following the last parameter.

**Note: The optional wind tracker output is a special hexadecimal data string that cannot be viewed as shown in the above example.**

**Please refer to your specific sensor configuration for output ranges.**

## 6.0 Calibration

The sensor requires a wind tunnel for calibration. Met One can provide NIST traceable calibration in our wind tunnel. Please contact the factory for further details.

## 7.0 Maintenance

Because the sensor has no moving parts to wear out, the sensor does not require periodic maintenance. In extremely corrosive environments, the condition of the connector used to mount the sensor should be checked. In harsh environments, the transducer screens should be checked for dust/sand buildup. To clean the transducer screens, hold the unit upright and brush the transducer screens with an acid brush. There are no adjustments or user repairable parts located inside the sensor.

## Appendix A Terminal Mode Commands

Terminal mode is activated by entering three carriage return characters within a 2 second period. 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

<b>HE</b>	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 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
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### 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)

Note: ST must be immediately followed by serial trigger. Do not add a space between 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

### 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>

No changes were made

Restarting

## Appendix B

### Theory of Operation

#### Winds

Met One's sonic anemometer operates on the principal that the speed of the wind affects 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 102304 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. The TACMET II interfaces directly 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 is 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

There are two barometers available for use in the P/N 102304 TACMET II. This section describes each one briefly. The part number configuration should be checked to verify which barometer is included with the TACMET II being used.

The P/N 102716 is a state-of-the-art, monolithic, signal conditioned, piezoresistive silicon pressure sensor. This sensor provides an accurate, high level analog output signal that is proportional to applied pressure. The basic accuracy of the P/N 102716 barometer is  $\pm 1.5$  hPa (0.04 inHg).

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 500 to 1200 hPa. 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  $\pm 0.4$  hPa (0.01 inHg).

#### Fluxgate Compass

The internal fluxgate compass is low power and compact, and is a complete compass or magnetic sensor module that integrates easily into the TACMET II. The internal fluxgate compass uses two magneto-inductive sensors, which change inductance with different applied magnetic field strengths, to sense magnetic fields.

The TACMET II microprocessor measures the output of the internal fluxgate compass and then corrects the wind direction data for the orientation of the sensor. The output of the TACMET II wind direction is relative to magnetic North when a compass module has been specified.

## Appendix C

### 102304 TACMET II Options Configuration Guide

<b>Base Part Number</b>	<b>102304-</b>									
<b>Body Paint Options *</b>	CARC Green	A								
	CARC Tan	B								
	CLEAR ANODIZE	C								
	CARC Sand	D								
<b>Shield Paint Options *</b>	CARC Green		1							
	CARC Tan		2							
	CARC White		3							
	(C body paint option only) GLOSS WHITE		4							
	CARC Sand		5							
<b>Serial Output Options</b>	RS-232C						G			
	(RS422/485)						H			
<b>Baud / Output Options (Space delimited ASCII standard)</b>	1200							1		
	2400							2		
	4800							3		
	9600							4		
	19200							5		
	(requires option H) 485 Tracker								6	
	NMEA								7	
<b>Averaging Options</b>	Instantaneous								J	
	Running Avg								K	
<b>Speed Units</b>	MPH	0 to 145						1		
	M/S	0 to 65						2		
	Knots	0 to 125						3		
	Kilometers/Hr	0 to 234						4		
	MPH-A	0 to 100						5		
	M/S-A	0 to 50						6		
	Knots-A	0 to 100						7		
<b>Temperature Units</b>	Degrees F	-40 to +140							1	
	Degrees C	-40 to +60							2	
<b>Pressure Options</b>		None							XX	
102716 Sensor (± 0.04, 17.71-32.45 In/Hg)		In/Hg Output							M1	
102716 Sensor (± 1.50, 600-1100 hPa)		hPa Output							M2	
102555 Sensor (± 0.01, 17.71-32.45 In/Hg)		In/Hg Output							S1	
102555 Sensor (± 0.4, 600-1100 hPa)		hPa Output							S2	
<b>Compass Option</b>		None								X
		Electronic Compass								P
<b>EMI Shielding (included)</b>		Hardened EMI								1

**\* COLORS**

- FINISHED PER MIL-DTL-64159, COLOR CARC GREEN 383, 34094
- FINISHED PER MIL-DTL-64159, COLOR CARC TAN 686A, 33446
- FINISHED PER MIL-DTL-64159, COLOR CARC AIRCRAFT WHITE, 37875
- FINISHED PER MIL-DTL-64159, COLOR CARC SAND, 33531

**Table 1**