MODEL 30.5
WIND SENSOR

OPERATION MANUAL
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30.5 Wind Sensor Manual

Technical Support

This manual is structured by customer feedback to provide the required information for setup, operation, testing, maintaining, and troubleshooting the 30.5 Weather Sensor. If additional support is required after consulting the printed documentation, please contact an expert Technical Service representative during normal business hours of 7:00 a.m. to 4:00 p.m. Pacific Time, Monday through Friday. In addition, technical information and service bulletins are often posted on www.metone.com. Please contact Met One Instruments and obtain a Return Authorization (RA) number before sending any equipment back to the factory. This allows for better tracking and scheduling of service work to expedite customer service. Please have the instrument's serial number available when contacting the manufacturer.

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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, full agreement cannot be guaranteed. However, the information 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

Table of Contents

1. Introduction & Overview – 30.5 Wind Sensor

1.1. Overview

The 30.5 Wind Sensor provides measurements of wind speed and wind direction in a single, compact, rugged unit. It integrates a folded-path, low-power sonic anemometer. It also includes an internal compass that allows for automatic alignment of wind direction to magnetic north, regardless of the sensor's orientation.

The small footprint and power efficiency of the 30.5 make it ideal for remote regions, urban environments, air quality networks, construction/remediation sites, and other network applications. The sensor works well in permanent (cooperative weather networks, schools, public information dissemination) or temporary (emergency response, audit, research program support) installations.

Designed for maximum portability and utility, the 30.5 is well suited for rapid deployment and use by one person under all conditions. The unit may be mounted on a tower, tripod, or vehicle mast. Data outputs are a serial, digital message as well as simple analog voltage outputs that can be interfaced to most data logging systems.

2. Specifications

PARAMETER	SPECIFICATION
Wind Speed Operating Range	0 to 60 m/s (0 to 134 mph)
Wind Speed Accuracy	Digital outputs: ±0.5 m/s (1.1 mph) or 5% of reading, whichever is greater Analog output: Digital accuracy +/-1mV
Wind Speed Resolution	0.1 m/s (0.1 mph)
Wind Speed Starting Threshold	0.1 m/s (0.1 mph)
Wind Direction Range	0 to 360 degrees
Wind Direction Accuracy	Digital outputs: ±5° (including Compass) Analog output: Digital accuracy +/-1mV
Wind Direction Resolution	1.0°
Alignment Compass Accuracy	±2°
Alignment Compass Resolution	1°
Measurement Rate Output	1 Hz
Signal Output Types	RS-232, RS-485, and 0-1VDC
Max Cable Lengths	RS-232: 15M (50FT) RS-485: 1230M (4000FT) Analog: 100M (325FT)
Power Supply	9-36 VDC, current draw 40mA @ 12 VDC typical
Operating Temperature	-40 to +60 °C (-40 to +140 °F)
Operating Relative Humidity	0 to 100%
Dimensions	6 inches (152 mm) diameter, 11 inches (279 mm) height
Shipping Weight	6 pounds (2.72 kg) (including packaging)

3. Unpacking & Installation

3.1. Unpacking

Any damages incurred to the equipment during shipping are the responsibility of the carrier. If any damage to the shipment is noticed before unpacking, a claim must be filed with the commercial carrier immediately. Please follow any special unpacking instructions provided by the carrier as items are carefully removed from the containers and inspected. It is recommended to document and photograph all damaged packages and items before, during, and after unpacking them.

Unpack the 30.5 and accessories and make a visual inspection of the contents; contact the supplier if anything is missing. The 30.5 Weather Sensor ships with the following items:

- 30.5 Wind Sensor.
- Calibration certificate.
- Operation manual (this document).

Optional Accessories that may be purchased include:

- 2954 ¾" IPS pipe vertical mounting adaptor
- WeatherView Software

The required 10624 signal cable is sold separately. It is available in 5M, 12M and 25M lengths. Inquire with Met One Sales or Service groups for other length cables.

Contact Met One Instruments (see the Technical Support section at the beginning of this manual) to arrange for any replacement items needed.

Please keep the carton(s) and associated packing materials for reuse.

3.2. Deployment

Tripod / Pipe top Installation:

The 30.5 can be quickly and easily deployed on top of a Met One 905 tripod or any other vertical ¾” IPS pipe using the optional 2954 vertical mount.

3.3. Input / Output Connections

10624 Cable Wire Color Designations:

RED	POWER POSITIVE (9-36VDC, 40mA nominal @ 12VDC)
BLK	POWER COMMON
BLU	ANALOG COMMON
GRN	SIGNAL COMMON
WHT	RS-232 TX
BRN	RS-232 RX
YLW	RS-485+
GRY	RS-485-
ORN	WIND SPEED ANALOG OUT 0-1VDC
VIO	WIND DIRECTION ANALOG OUT 0-1VDC
WHT/BRN	SHIELD (must be grounded for transient protection to function)

Warning: Unused wires should be isolated and tied back. Take care that wires do not touch each other while power is applied or damage to sensor may occur.

Maximum Cable Length Considerations:
The maximum recommended cable length depends on the communication protocol to be used:

RS-232	50FT maximum
RS-485	4000FT maximum
ANALOG	300FT maximum

3.4. Operational Checkout

Connect the 30.5 serial or analog signal wires to a data logger or recording device. Connect power to the sensor cable per wiring diagram in section 3.3. The 30.5 will automatically start measuring wind speed and direction and outputting data on both the serial and analog outputs. Any connected recording electronics should start displaying or recording measurements from the 30.5. Verify the data seems reasonable by comparing it to data from a local weather source. If the data looks OK, the unit is in operation. If data is questionable, contact Met One Instruments, Inc. Service Department for further guidance (see the Technical Support section at the beginning of this manual).

3.5. Maintenance

The unit has no moving parts and therefore requires no periodic maintenance for wear items. It is recommended that the data be checked every 6 -12 months to be sure there has been no failure of any of the electrical components. This can be done by placing a small container (at least 12inch diameter) over the sensor to zero check the wind measurement. The wind readings can be checked against a collocated wind sensor. The 30.5 sensor can also be returned to Met One for wind tunnel verification / calibration.

3.6. Setting Magnetic Declination

The internal compass automatically corrects the wind direction in the 30.5 to magnetic North. This means that the unit will *not* require directional alignment or orientation upon deployment.

If it is necessary to measure wind direction referenced to True North it is important to understand and know the magnetic declination of the area in which the sensor is being operated. The declination in the 30.5 is factory set at zero degrees. To change this, refer to the MD command instruction in section 7.1.10 for setting the Magnetic Declination.

4. User Selectable Options

The following User Defined Options can be set following the instructions detailed in Appendix A.

AT Ambient Temperature Printout Toggle On/Off
BV Battery Voltage Printout Toggle On/Off
CV Compass Reading Printout Toggle On/Off
ID View / Set Instrument ID
MA Set MODBUS Address
MD Set Magnetic Declination
ME Metric or English Units
OI Set Output Interval
RT Output Record Type
RV Display Firmware Version Number
ST Set Serial Trigger Address
SU Set Wind Speed Units
TU Set Temperature Units
Q Quit Terminal Mode and Save changes

5. User Interface

The output of the 30.5 is a fixed length, comma delimited, serial data stream. The serial output is factory set for 9600 baud, no parity, 8 data bits, 1 stop bit, and no flow control. The output interval default is once per second. This may be changed using the *OI* command (see Appendix A). The data is easily viewed and can be displayed and captured using Met One Instruments' Comet Software or other terminal communication program.

An ***example*** of the standard output format is shown below:

000.6,272,U0,*02257 CR/LF

Each parameter is a fixed length with leading zeros separated by a comma. The string terminates with a Carriage Return and Line Feed. Field parameters are defined as:

000.6,272,+23.1,12.7,090,U0,*02257 CR/LF
WS,WD,AT,BV,COMP,CONFIG,CheckSum

Note that
The wind speed and temperature units can be changed with the *SU* and *TU* terminal commands, respectively. Please refer to Appendix A for more information.

NOTE: Ambient Temperature, Compass reading, and Battery Voltage values are OFF by default in the output string, and can be added using the AT, CV, and BV commands, respectively.; see Section 7.1.2 for details and an output string example.

A check sum parameter is added to the end of the message (ex: ***02257**).

The check sum is the addition of all the characters from the start of the message through the first character preceding the asterisk (*). The check sum is expressed as a decimal number. This is a 16-bit sum and should not overflow past 4 digits given the number of characters in the output string.

Polled data mode (RS232 or RS485)

The sensor can be set for polled data mode instead of continuous serial output by setting the OI command to Zero and using the serial trigger string to request a data string. Refer to the *ST* terminal command in Appendix A for instructions on setting the Serial Trigger.

6. Standard Configuration

Serial Interface
The serial interface is fixed at 9600 Baud and configured for No Parity, 8 Data Bits and 1 Stop Bit, with no flow control.

Analog Interface
The analog outputs for Wind Speed and Wind Direction are fixed at 0-1VDC.

Wind Speed
The Wind Speed unit choices are m/s or mph. The default is M/S. The Speed range for M/S is 0-60. The Speed range for MPH is 0-134.

Temperature
The Temperature unit choices are Degrees C or Degrees F. The default is Degrees C. The range for Degrees C is -40 to +60, the range for Degrees F is -40 to +140.

7. Appendix A

7.1. Terminal Mode Commands

RS232 / RS485 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 an asterisk prompt:

7.1.1. H,h,? – Display Help Menu

AT - Temperature Printout Toggle On/Off
BV - Battery Voltage Printout Toggle On/Off
CV - Compass Heading Printout Toggle On/Off
ID - View / Set Instrument ID
MA - Set MODBUS Address
MD - Set Magnetic Declination
ME - Metric or English Units
OI - Set Output Interval
RT - Output Record Type
ST - Set Serial Trigger Address
SU - Set Speed Units
TU - Set Temperature Units
RV - Display Firmware Version Number
Q - Quit command mode and save any changes

NOTE: The commands noted in this appendix will change both the RS232 and RS485 outputs.

7.1.2. AT – Ambient Temperature Printout Toggle On/Off

This command enables or suppresses the Battery Voltage reading in the serial string output.

COMMAND	**RESULT**
AT<cr>	Report current setting
AT0<cr>	Ambient Temperature Measurement removed from serial output 000.0,000,M0,*02112
AT1<cr>	Ambient Temperature Measurement enabled in serial output 000.0,000**,+024.5**,M0,*02344

7.1.3. BV – Battery Voltage Printout Toggle On/Off

This command enables or suppresses the Battery Voltage reading in the serial string output.

COMMAND	RESULT
BV<cr>	Report current setting
BV0<cr>	Battery Voltage Measurement removed from serial output 000.0,000,+024.5,045,0970.5,000.00,0000,M0,*02112
BV1<cr>	Battery Voltage Measurement enabled in serial output 000.0,000,+024.5,045,0970.5,000.00, 0000,**12.0**,M0,*02344

7.1.4. CV – Compass Measurement Printout Toggle On/Off

This command enables or suppresses the Compass Reading in the serial string output.

COMMAND	RESULT
CV<cr>	Report current setting
CV0<cr>	Compass Measurement removed from serial output 000.0,000,+024.5,045,0970.5,000.00, 0000,12.0,M0,*02344
CV1<cr>	Compass Measurement enabled in serial output 000.0,000,+024.5,045,0970.5,000.00, 0000,12.0,**240**,M0,*0254

7.1.5. ID – View / Set Instrument ID

Read or Set the Instrument ID

COMMAND	RESULT
ID<cr>	Report the Instrument ID setting (provides help)
ID XX<cr>	Set Instrument ID to number from 1 to 99

7.1.6. MA – View / Set Modbus Address

Read or Set the Modbus Address

COMMAND	RESULT
MA<cr>	Report the Modbus Address setting (provides help)
MA XX<cr>	Set Instrument ID to number from 1 to 247. Setting this value to 0 will disable Modbus.

7.1.7. ME – Metric or English Units

This command will set all units in the serial port's output to Metric or English

COMMAND	RESULT
ME<cr>	Report Units setting
ME0<cr>	Set Units to Metric (Default): WS: m/s AT: Deg C
ME1<cr>	Set Units to English: WS: MPH, AT: Deg F

7.1.8. SU –Wind Speed Units

Read or Set this serial port's output Units for Wind Speed

COMMAND	RESULT
SU<cr>	Report Units setting
SU0<cr>	M/S
SU1<cr>	MPH

7.1.9. TU –Temperature Units

Read or Set this serial port's output Units for Temperature

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

7.1.10. MD –Magnetic Declination

The automatic alignment compass in the 30.5 sensor provides Wind Direction automatically adjusted to MAGNETIC north. Software in the Interface allows the setting of a declination angle to correct the Wind Direction output to TRUE north. It is recommended that this procedure be done in the lab but can be done in the field as well. Once the declination angle is set in the sensor, it is stored in non-volatile memory, and does not have to be reset each time the sensor is fielded. The declination angle must be reset only if the system is used in a different geographical location separated by many miles from the location where the declination was originally set.

It is suggested that the magnetic declination be determined before performing this calibration. Visit the following web site for help in determining the correct declination for the installation site:

www.ngdc.noaa.gov/geomag/declination.shtml

Click “Compute your declination”. On the next page, enter either zip code, or select country and city, then click “Get Location” and then “Calculate”. Alternatively, longitude and latitude can be entered, and then click “Calculate”. Declination is reported in Degrees, Minutes and Seconds. Divide minute’s value by 60 to get decimal fraction of degrees (I.E. 50 minutes = 0.8 degrees). If the declination needs to be adjusted, please use the *MD* command as shown below.

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.

7.1.11. OI –Output Interval

Read or Set the Output Interval for this serial port

COMMAND	**RESULT**
OI<cr>	Report Output Interval setting
OI0<cr>	For Serial Trigger (Address must be set with ST command).
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

7.1.12. ST – Serial Trigger

Read or Set the Serial Trigger character string (Poll command)

COMMAND	RESULT
ST<cr>	Report Serial Trigger string setting (provides help)
ST XXXXXX<cr>	Set Serial Trigger

7.1.13. RT – Output Record Type

Read or Set the Output Record type.

COMMAND	RESULT
RT<cr>	Report Output Record Type
RT1<cr>	Set Output Record Type to Met Record format (default).
RT2<cr>	Set Output Record Type to AIO format for compatibility with legacy AIO 102780 systems.

7.1.14. RV – Software Version Number

Report the current Software Version Number

COMMAND	RESULT
RV<cr>	Report current Software Version

8. Modbus

8.1. Modbus operation:

The 30.5 can be queried for data using the Modbus RTU protocol. The 30.5 will automatically detect a Modbus data request via its standard RS-232 or RS-485 interface, and will change to Modbus mode, ready to send out data as requested by a connected Modbus Master.

If the 30.5 is to be used as a Modbus device, it is recommended to set the Output Interval (OI) command to 0 (zero) to turn off the 1/second output, as shown in section 7.1.11. This will prevent any serial traffic conflicts.

The 30.5 can be assigned a Modbus address between 1 to 247, which allows it to be addressed on a multiple device network. Setting the Modbus address to 0 will disable the Modbus functionality of the 30.5.

The 30.5's current measurement data can be polled via Modbus using the 3X and 4X register addresses:

3X Registers

ModBus Name		Addr	Type	Points	
MB_123456	=	0	float	2	Known value for easier Byte Order configuration
MB_SN	=	2	Char	5	Serial Number String
MB_Revision	=	7	char	20	39 Char + Zero Terminator word aligned to 40 bytes
MB_WS	=	100	float	2	Wind Speed
MB_WD	=	102	float	2	Wind Direction
MB_AT	=	104	float	2	Ambient Temperature
MB_Batt	=	114	float	2	Supply Voltage
MB_Comp	=	116	float	2	Compass Heading

4X Registers

ModBus Name		Addr	Type	Points	
MB_Byte_Order	=	0	Int	1	1 thru 4

9. Appendix B

9.1. Theory of Operation

Wind

The Met One 30.5 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, the transit time is decreased. If the sound is traveling in a direction opposite the wind, the transit time is increased. This is used to measure air movement in two perpendicular axes, which are used to calculate Wind Speed and Wind Direction.

Ambient Temperature

The temperature sensor in the 30.5 measures air temperature for the purpose of calculating the wind measurements only. It is not designed to comply with EPA or WMO ambient temperature measurement guidelines.

Automatic Alignment Compass

The internal compass module is low power and compact. It employs a pair of magneto-resistive sensors, which change with varying magnetic field strengths, to sense the Earth's magnetic field.

The 30.5 microprocessor measures the output of the internal compass and then corrects the wind direction data for the orientation of the sensor. The output of the 30.5 wind direction is relative to magnetic North. A user programmable value of Magnetic Declination may optionally be entered through terminal mode. This enables wind direction output relative to True rather than Magnetic North.