

MET STATION ONE OPERATION MANUAL



Met One Instruments, Inc
1600 Washington Blvd.
Grants Pass, Oregon 97526
Telephone 541-471-7111
Facsimile 541-471-7116

Regional Service
3206 Main St. Suite 106
Rowlett, Texas 75088
Telephone 972-412-4715
Facsimile 972-412-4716

Copyright Notice

Met Station One Operation Manual

© Copyright 2001 Met One Instruments, Inc. All Rights Reserved Worldwide. No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any other language in any form by any means without the express written permission of Met One Instruments, Inc.

Technical Support

Should you require support, please consult your printed documentation to resolve your problem. If you are still experiencing difficulty, you may contact a Technical Service representative during normal business hours—7:30 a.m. to 4:00 p.m. Pacific Standard Time, Monday through Friday.

Voice: (541) 471-7111

Fax: (541) 471-7116

E-Mail: service@metone.com

Mail: Technical Services Department
Met One Instruments, Inc.
1600 Washington Boulevard
Grants Pass, OR 97526

Table of Contents

- 1. Measurements 4**
 - 1.1. Wind Speed and Wind Direction 4
 - 1.2. Temperature and Humidity 4
 - 1.3. Barometric Pressure 4
 - 1.4. External Rain Gauge Input 4
- 2. INSTALLATION (See FIGURE 2-1)..... 4**
 - 2.1. SENSOR INSTALLATION ON HORIZONTAL BOOM/ARM..... 5
 - 2.2. SENSOR INSTALLATION ON VERTICAL MAST (picture) 6
 - 2.3. LIGHTNING AND TRANSIENT PROTECTION 6
 - 2.4. WIRING 7
- 3. Simple Serial Connections 8**
 - 3.1. MSO-232 provides RS-232 and SDI-12 outputs 8
 - 3.2. MSO-485 provides RS-485 and SDI-12 outputs 8
 - 3.3. Output String Format: 9
- 4. OPERATIONAL CHECK-OUT AND CALIBRATION 10**
 - 4.1. Wind Speed and Direction Sensor Check-Out..... 10
- 5. MAINTENANCE AND TROUBLESHOOTING..... 11**
 - 5.1. General Maintenance Schedule 11
- 6. SERIAL COMMANDS..... 12**

1. Measurements

1.1. Wind Speed and Wind Direction

The Met Station One (MSO) uses a three cup anemometer and lightweight vane tail to accurately measure the speed and direction of the wind. The rotation of the cups and vane are converted to electrical signals which are directly proportional to Wind Speed and Direction. The basic operation is based on the proven 014/024 Wind Sensors.

- Wind Speed Range 0 – 50 m/sec
- Wind Speed Resolution 0.1 m/sec
- Wind Speed Accuracy $\pm 2\%$
- Wind Direction Range 0 – 360°
- Wind Direction Resolution 1°
- Wind Direction Accuracy $\pm 5^\circ$
- Threshold, both Speed & Direction 1 m/sec

1.2. Temperature and Humidity

The Platinum Temperature and Capacitive Humidity sensors are built into the temperature shield at the bottom of the sensor. The integral shield limits errors due to solar radiation. The sensing elements are enclosed in an IP65 protective membrane.

- Temperature Range -40°C to $+60^\circ\text{C}$
- Temperature Resolution 0.1°C
- Temperature Accuracy $\pm 0.4^\circ\text{C}$
- Relative Humidity Range 0-100%
- Relative Humidity Resolution 1%
- Relative Humidity Accuracy $\pm 4\%$

1.3. Barometric Pressure

A solid state pressure sensor provides an accurate measurement of barometric pressure changes over a wide range. Electronic temperature compensation is included for highest accuracy over the operating temperature of the sensor.

- Measurement Range 500 – 1100 mbars
- Measurement Resolution 0.1 mbar
- Measurement Accuracy ± 2 mbars

1.4. External Rain Gauge Input

A contact closure rain gauge such as the Met One 360 or 370 can be connected to the MSO; the measurement is then integrated into the MSO serial data.

- Rain Gauge Resolution 0.25mm or 0.01 in of rain per tip

2. INSTALLATION (See FIGURE 2-1)

NOTE: Save all sensor packaging. Use during shipment for recommended factory servicing.



FIGURE 2-1

2.1. SENSOR INSTALLATION ON HORIZONTAL BOOM/ARM

- a) Horizontal mounting arm must be level, and aligned East/West so the sensor can be correctly aligned to North/South.
- b) Install u-bolts into sensor mounting plate vertically (see Figure 2-1).
- c) Install sensor on mounting arm. Tighten u-bolt nuts, making sure sensor is level.
- d) With shoulder alignment screw installed in sensor wind vane, use a transit or compass to ensure sensor is aligned to True North/South. Correct for magnetic declination.
- e) Remove and retain the shoulder screw from the vane hub. Check to see that the vane assembly rotates freely.
- f) Route the sensor cable to the data recording device. Secure the cable with cable ties or tape. The cable assembly contains 6 wires. Typical wiring is shown in Section 2.4.



2.2. SENSOR INSTALLATION ON VERTICAL MAST (picture)

- a) Ensure vertical mast is vertically level.
- b) Install u-bolts into sensor mounting plate horizontally (see fig 2-2)
- c) Install sensor on mounting mast. Tighten u-bolt nuts, making sure sensor is level.
- d) With shoulder alignment screw installed in vane hub, use a transit or compass to ensure sensor and vane is aligned to North/South. Correct for magnetic declination.
- e) Remove and retain the shoulder screw from the vane hub. Check to see that the vane assembly rotates freely.
- f) Route the sensor cable to the data recording device. Secure the cable with cable ties or tape. The cable assembly contains 6 wires. Typical wiring is shown in Section 2.4.

2.3. LIGHTNING AND TRANSIENT PROTECTION

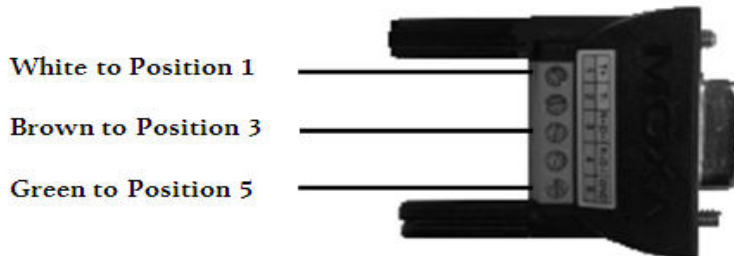
Weather sensors are sensitive to direct or nearby lightning strikes. A well-grounded metal rod or frame should be placed above the sensor installation. In addition, the shield on the signal cable leading to the recording electronics must be connected to a good earth ground at the recorder end. The cable route should not be vulnerable to lightning.

2.4. WIRING

| | |
|----------------|---|
| <u>RED</u> | <u>+8 TO +36 VOLTS DC, 10mA @ 12V typical</u> |
| <u>BLK</u> | <u>POWER COMMON</u> |
| <u>WHT</u> | <u>RS-232 TX (MSO-232) OR RS-485 + (MSO-485)</u> |
| <u>BRN</u> | <u>RS-232 RX (MSO-232) OR RS-485 – (MSO-485)</u> |
| <u>GRN</u> | <u>SIGNAL COMMON</u> |
| <u>BLU</u> | <u>SDI-12</u> |
| <u>ORN</u> | <u>EXTERNAL RAIN GAUGE INPUT</u> |
| <u>WHT/BRN</u> | <u>SHIELD (must be grounded for transient protection to function)</u> |

2.4.1. DB-9 Serial Adaptor Connections

- The included DB-9 adaptor can be used to connect the RS-232 or RS-485 signal to a compatible computer or logger.



3. Simple Serial Connections

The Met Station One platform provides several serial output formats for ease of data recovery:

3.1. MSO-232 provides RS-232 and SDI-12 outputs.

3.1.1. RS-232 Format

- Serial configuration is: 9600,8,N,1, with no flow control
- Default data output is 1 / second

3.1.2. SDI-12 Format

- Data is provided only when requested
- Default sensor address is '0'
- Conforms to SDI-12 V1.3

3.2. MSO-485 provides RS-485 and SDI-12 outputs.

3.2.1. RS-485 Format

- Serial configuration is: 9600,8,N,1, with no flow control
- Data is provided only when requested
- Default sensor address is '1'

3.2.2. SDI-12 Format

- Data is provided only when requested
- Default sensor address is '0'
- Conforms to SDI-12 V1.3

3.3. Output String Format:

SSS.S,DDD,+TTT.T,HHH,PPPP.P,RRR.RR,XXXX,VV.V,M0,*CCCCC<CR><LF>

- SSS.S = Wind Speed
- DDD = Wind Direction
- +TTT.T = Temperature
- HHH = Relative Humidity
- PPPP.P = Barometric Pressure
- RRR.RR = Rain Input
- XXXX = (Future Optional Field)
- VV.V = Battery Voltage
- M0 = Configuration & Status Bytes
- *CCCCC = Message Checksum

4. OPERATIONAL CHECK-OUT AND CALIBRATION

4.1. Wind Speed and Direction Sensor Check-Out

- A. Rotating the vane in a clockwise direction as viewed from above will increase the output up to the 360 Degree point and it will start over at 0 Degree.
- B. Spinning the anemometer cup assembly will produce a wind speed reading. Spin slowly and monitor output signal. A wind speed calibrator may be used to check operation at different RPM points. The vane and counter weight must both removed for connection to the calibrator motor drive.
- C. The 034B wind sensor should be inspected periodically for physical damage to the vane assembly and cable connections. Inspect all vane assembly parts for security and damage. Inspect the cup assembly for loose cup arms or other damage. The cup assembly cannot change calibration unless a mechanical part has loosened or has been bent or broken.

5. MAINTENANCE AND TROUBLESHOOTING

5.1. General Maintenance Schedule

6-12 month intervals:

- A. Inspect the sensor for proper operation per Section 3.0
- B. Replacement of Wind Speed Sensor bearing in extremely adverse environments.

12-24 month intervals:

- A. Replacement of Wind Speed Sensor bearings.

24-36 month intervals:

- A. Recommended complete factory overhaul of sensor.

*Schedule is based on average to adverse environments.

TABLE 4.1

TROUBLESHOOTING TABLE

| <u>Symptom</u> | <u>Possible Cause</u> | <u>Remedy</u> |
|----------------------|-----------------------|---------------------------|
| No WS Sensor output | Faulty bearings | Replace bearings. |
| No WD Sensor output | Faulty pot assy | Replace pot assy. |
| No WS Sensor output | Faulty reed switch | Replace reed switch. |
| No Temp or RH output | Faulty T/RH sensor | Replace T/RH sensor |
| No BP output | Faulty circuit board | Replace MSO circuit board |

6. SERIAL COMMANDS

RS232 / RS485 Terminal Mode Commands

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

Note: Terminal mode times-out after 2 minutes of inactivity.

Successful entry into Terminal Mode will return an asterisk prompt. Typing H,h, or ? will return a help menu:

H,h,? - Display Help Menu

```
H,h,? - This Help Menu
DC  - Calibrate Direction Sensor
ID  - View / Set Instrument ID
OI  - Set Output Interval
PU  - Set Pressure Units
SA  - SDI Address
ST  - Set Serial Trigger Address
SU  - Set Speed Units
TU  - Set Temperature Units
RV  - Display Firmware Version Number
RU  - Rain Units
ME  - Metric or English Units
QH  - Display Record Header

Q   - Quit command mode and save any changes
```

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

See the section below for SDI-12 commands.

DC – Calibrate Direction Sensor

Calibrate the Wind Direction

| COMMAND | RESULT |
|---------|---|
| DC<cr> | Displays Options: DC - Calibrate Direction Sensor DC<cr> Report Direction Offset DC1<cr> Set Direction Offset |
| DC1<cr> | Set the Wind Direction Offset by positioning the Wind Vane: Move direction sensor to the 180 degree point. Are you sure you want to continue? : Y |

ID – Read or Set the Instrument ID

Read or Set the instrument ID

| COMMAND | RESULT |
|----------|---|
| ID<cr> | Instrument ID = nn (where n = id number from 1 to 99) |
| IDnn<cr> | Instrument ID is set to nn (where nn = 1 to 99, Default = 1) |

OI - Output Interval

Read or Set the Output Interval for this serial port

Note: This command is not supported by SDI-12.

| COMMAND | RESULT |
|---------|--|
| OI<cr> | Report Output Interval setting |
| OI<cr> | Sensor Output every 1 second (Default) |

PU - Pressure Units

Read or Set this serial port's output units for Pressure

| COMMAND | RESULT |
|---------|-------------------------------|
| PU<cr> | Report Units setting |
| PU0<cr> | Millibars (mbar Default) |
| PU1<cr> | Inches of Mercury (inHg) |
| PU2<cr> | Millimeters of Mercury (mmhg) |

SA – SDI12 Address

Read or Set the SDI12 Address

| COMMAND | RESULT |
|---------|--|
| SA<cr> | SA = 0 (Default = 0) |
| SAn<cr> | SDI12 address is set to 'n' where 'n' is in the range [0-9] [A-Z] or [a-z] Case Sensitive |

ST - Serial Trigger

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

| COMMAND | RESULT |
|---------------|--|
| ST<cr> | Report Serial Trigger string setting (serial output provides help) |
| ST XXXXXX<cr> | Set Serial Trigger (Default = 1) |

SU - Speed Units

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

| COMMAND | RESULT |
|---------|----------------------|
| SU<cr> | Report Units setting |
| SU0<cr> | Speed Units m/s |
| SU1<cr> | Speed Units mph |

TU - Temperature Units

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

| COMMAND | RESULT |
|---------|----------------------|
| TU<cr> | Report Units setting |
| TU0<cr> | Celsius (Default) |
| TU1<cr> | Fahrenheit |

RV - Software Version Number

Report the current firmware version number

| COMMAND | RESULT |
|---------|--------------------------|
| RV<cr> | Current firmware version |

RU - Rain Units

Read or Set this serial port's output units for Rain

| COMMAND | RESULT |
|---------|----------------------|
| RU<cr> | Report Units setting |
| RU0<cr> | Units mm (Default) |
| RU1<cr> | Units in (inch) |

ME – Force Metric or English Units

Force Engineering Units as Metric or English

| COMMAND | RESULT |
|---------|----------------------------|
| ME<cr> | Report Units setting |
| ME0<cr> | All Units Metric (Default) |
| ME1<cr> | All Units English |

QH – Display Record Header

Report the format of the record output for the current engineering unit settings.

| COMMAND | RESULT |
|---------|---|
| QH<cr> | AT(C),RH(%),BP(mbar),ST (ST = MSO status) |

SDI-12 Commands

| NAME | SDI-12 COMMAND | SENSOR RESPONSE |
|---------------------------------------|----------------|---|
| Address Query | ?! | <i>a</i> <CR><LF> Where <i>a</i> = address |
| Acknowledge Active | <i>a</i> ! | <i>a</i> <CR><LF> Where <i>a</i> = address |
| Send Identification | <i>a</i> ! | <i>a</i> 13Met One 10463-1.0 0Axxxxx<CR><LF> Where <i>a</i> =address and xxxxx = S/N |
| Change Address | <i>aAb</i> ! | <i>b</i> <CR><LF> Where <i>b</i> = new address |
| Start Measurement | <i>aMC</i> ! | <i>a</i> 0008<CR><LF> Where <i>a</i> = address |
| Send Data | <i>aD0</i> ! | <i>a+bbb.b+ccc+ddd.d+eee</i> <CR><LF> Where <i>a</i> = address, <i>bbb.b</i> = wind speed, <i>ccc.c</i> = wind direction, <i>ddd.d</i> = temperature, and <i>eee</i> = relative humidity |
| Send Data | <i>aD1</i> ! | <i>a+bbbb.b+ccc.cc+dddd+ee.ee</i> <CR><LF> Where <i>a</i> = address, <i>bbb.b</i> = barometric pressure, <i>ccc.c</i> = rainfall, <i>ddd.d</i> = spare, and <i>ee.ee</i> = battery voltage |
| Start Concurrent Measurement | <i>aC</i> ! | <i>a</i> 0008<CR><LF> Where <i>a</i> = address |
| Start Concurrent Measurement with CRC | <i>aCC</i> ! | <i>a</i> 0008<CR><LF> Where <i>a</i> = address |
| Continuous Measurements | <i>aR0</i> ! | <i>a+bbb.b+ccc+ddd.d+eee</i> <CR><LF> Where <i>a</i> = address, <i>bbb.b</i> = wind speed, <i>ccc.c</i> = wind direction, <i>ddd.d</i> = temperature, and <i>eee</i> = relative humidity |
| Continuous Measurements | <i>aR1</i> ! | <i>a+bbbb.b+ccc.cc+dddd+ee.ee</i> <CR><LF> Where <i>a</i> = address, <i>bbb.b</i> = barometric pressure, <i>ccc.c</i> = rainfall, <i>ddd.d</i> = spare, and <i>ee.ee</i> = battery voltage |

| NAME | SDI-12 COMMAND | SENSOR RESPONSE |
|----------------------------------|-----------------------|---|
| Continuous Measurements with CRC | aRC0! | a+bbb.b+ccc+ddd.d+eee{crc}<CR><LF> Where a = address, bbb.b = wind speed, ccc.c = wind direction, dddd.d = temperature, eee = relative humidity, and {crc} = CRC |
| Continuous Measurements with CRC | aRC1! | a+bbbb.b+ccc.cc+dddd+ee.ee{crc}<CR><LF> > Where a = address, bbb.b = barometric pressure, ccc.c = rainfall, dddd.d = spare, ee.ee = battery voltage, and {crc} = CRC |
| Report Temperature Units | aXTU! | aXTUd<CR><LF> Where a = address, and |
| Set Temperature Units | aXTUd! | d = 0 for Celsius (default), or 1 for Fahrenheit |
| Report Pressure Units | aXPU! | aXPUf<CR><LF> Where a = address, and |
| Set Pressure Units | aXPUf! | f = 0 for Millibars (default), or 1 for Inches of Mercury, or 2 for mmHg |
| Report Version Number | aXRV! | aXVNxx.x<CR><LF> Where a = address and xx.x = firmware version |
| Report Rain Units | aXRU! | aXRUF<CR><LF> Where a = address, and |
| Set Rain Units | | f = 0 for mm (default), or 1 for Inches |
| Report Wind Speed Units | aXSU! | aXSUd<CR><LF> Where a = address, and |
| Set Wind Speed Units | aXSUd! | d = 0 for Mps (default), or 1 for Mph |