

S2

SONIC ANEMOMETER

OPERATION MANUAL



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Thank you for choosing a Climatronics 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 – 7:30 a.m. to 4:00 p.m. Eastern 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

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), Climatronics Corporation will, at its option, repair or replace the defective unit, and return it, transportation prepaid via UPS.

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

The above warranty applies only to items manufactured by Climatronics Corporation. Items not manufactured by Climatronics Corporation 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, Climatronics 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 – S2 Sonic Anemometer

2.1 Overview

Climatronics' sonic anemometer, P/N 102779, is designed as a stand-alone sensor to provide accurate measurements of wind speed and wind direction. An internal fluxgate compass and an analog output module 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.

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

2.2 Specifications

PERFORMANCE

Wind Speed

| | |
|------------|--|
| Range | 0 to 65 m/s (0 to 145 mph) |
| Accuracy * | ±0.5 m/s (1.1 mph) or 5% of full scale |
| Resolution | 0.1 m/s (0.22 mph) |

Wind Direction

| | |
|------------|--------------------------------|
| Range | 0 to 360° |
| Accuracy * | ± 5° (Including compass error) |
| Resolution | ±1.0° |

ELECTRICAL

| | |
|---------------------|---|
| Measurement Format | Two orthogonal axes, North/South and East/West |
| Measurement Rate | 2 Hz each axis |
| Operating Frequency | 40 KHz |
| Signal Output | DIGITAL: RS-232C, 100 ft @ 9600 BPS & 50 ft @ 19.2 KBPS RS-485, 4000 ft @ 9600 BPS and SDI-12, 200 ft @ 1200 BPS ANALOG: 0 -1, 0-2.5, 0-5 or 1-5 VDC, over the measurement range selected. |
| Power Requirements | Sensor: 8 - 36 VDC @ 35 mA nominal, option dependent Heater 115 VAC/60 Hz, 100 W |

ENVIRONMENTAL

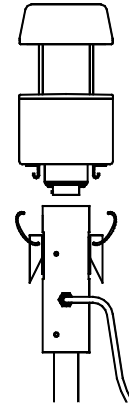
| | |
|-------------|------------------------------|
| Temperature | -40° to 60°C (-40° to 140°F) |
| Humidity | 0 to 100% |

* This accuracy is maintained when the sensor is within ± 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 installed on Climatronics P/N 102778 QuickMount. The keyway in the connector on the base of the sensor is matched to the keyway on the mount.

Attach the sensor to the 102778 QuickMount 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. You may need to rotate the sensor 180° to allow the keyway to seat properly.



If your sensor is not equipped with a fluxgate compass you will need to align the posts with the black marks towards either True North or Magnetic North depending on your application.

On the 102778 QuickMount, 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 set 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.

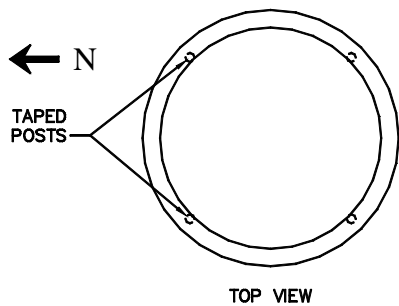


Figure 1

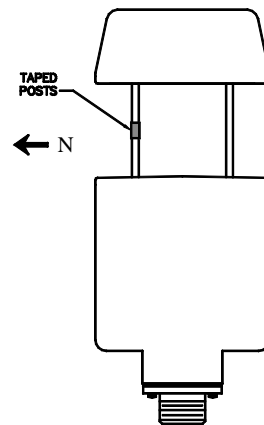
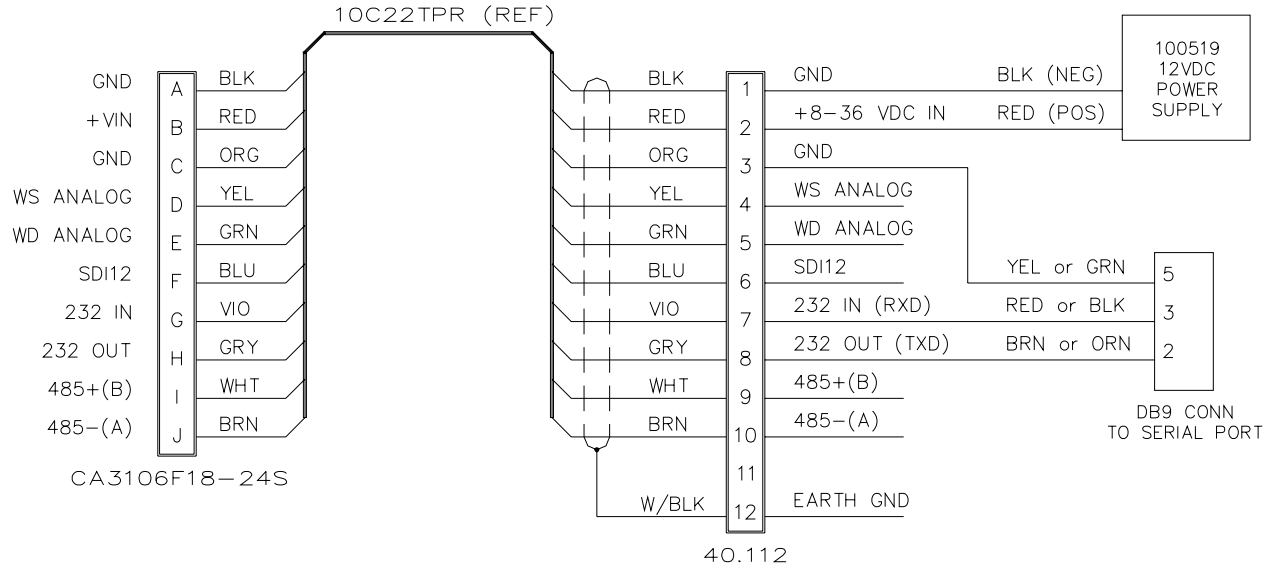


Figure 2

4.0 Input/Output Connections

The sensors' pin designations are as follows:



Warning: Do not short any of these wires to ground or to each other.

5.0 User Defined Options

Fluxgate Compass

An optional internal fluxgate compass is available with the Sonic Weather Station. Check the sensor's configuration to see if it is installed.

Note: The wind direction output will be relative to magnetic north if the fluxgate compass is selected. To change Magnetic North to True North, see *MD* command in Appendix A.

Analog Outputs

An optional analog output module is available for the Sonic Weather Station. The module is factory configured to present Wind Speed and Wind Direction in any one of four ranges (0-1, 0-2.5, 0-5, or 1-5 Volts). Check the sensor's configuration to see if it is installed.

Note: Analog output range cannot be reconfigured without returning unit to factory.

6.0 User Interface

The output of the Sonic is a fixed length, ASCII serial data stream. The serial output is factory set for 9600 baud, no parity, 8 data bits, with 1 stop bit (N, 8, 1). The output interval is factory set to once per second. Other baud rates and output intervals are available, see Appendix A for instructions on how to change these settings. The data is easily viewed and can be displayed and captured using Climatronics WeatherView Software or Windows HyperTerminal which is supplied with all Windows operating systems except Vista. To find HyperTerminal click Start, Programs, Accessories, Communications, HyperTerminal.

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

```
01+H0012 02+006.8 03+063.2CR/LF
```

The first parameter is the serial number of the sensor (H0012), the second parameter is the wind speed, and the third parameter is the wind direction. All parameters have fixed decimal points with leading zeroes and the string ends with a carriage return and line feed.

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

The default wind speed output is in m/sec, this can be changed with the SU terminal command. Please refer to Appendix A for more information.

Polled data mode (RS232 or RS485)

The sensor can be set for polled data mode instead of continuous serial output by setting the serial trigger string while in terminal mode. Refer to the ST terminal command in Appendix A. Additional help for setting this option is available in the sensor's ST menu. Type ST,↓ for help with this command.

SDI-12 Interface

In addition to the above communications methods, the sensor can be polled by an SDI-12 Master Station for data. This operates completely independent of the RS232 or RS485 communications and can be used in conjunction with those methods. Data are polled using a series of SDI-12 commands. Please see appendix A for a list of supported SDI commands. The default SDI Address for the Sonic is zero. The output format has the same basic structure as the RS232 output format, Wind Speed and Wind Direction.

7.0 Calibration

The sensor requires a wind tunnel for calibration. Climatronics can provide NIST traceable calibration in our wind tunnel.

We also offer a “Cone of Silence” Block of Acoustic Foam for field health checks as well as a portable wind tunnel in a transit case for more rigorous field audit or health checks.



8.0 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 and SDI 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 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 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 VN - Display Firmware Version Number |
|-----------|---|

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 |
| SU2<cr> | Knots |
| SU3<cr> | KPH |

SB - Serial Baud Rate

Read or Set this serial port's Baud Rate

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

SDI-12 is fixed at 1200 baud.

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 (Default) |
| SB5<cr> | 19200 baud |

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

SA - SDI-12 Address

Read or Set SDI-12 Address

| COMMAND | RESULT |
|---------|--|
| SA<cr> | Report Address setting |
| SAX<cr> | Set SDI-12 Address to x (Default = 0) Valid SDI addresses are 0-9, A-Z, a-z |

This command works like the SDI Address Change command, except it makes the process simpler than using an SDI-12 recorder to do it.

BV - Toggle Battery Voltage Printout in data string

Read or Set the Battery Voltage output option for this serial port

| 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 for this serial port

| 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)

| COMMAND | RESULT |
|---------------|--------------------------------------|
| ST<cr> | Report Serial Trigger string setting |
| ST XXXXXX<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 for this serial port

Note: This command is not supported by SDI-12, 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 for this serial port

| 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. To save changes, type 'Y' when asked, otherwise changes will not be saved.

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

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

No changes were made

Restarting

SDI-12 Commands

| NAME | SDI-12 COMMAND | SENSOR RESPONSE |
|---------------------------------------|----------------|---|
| Address Query | ?! | a<CR><LF> Where a = address |
| Acknowledge Active | a! | a<CR><LF> Where a = address |
| Send Identification | a! | a13Climo 1027790.2 0Axxxx<CR><LF> Where a=address and xxxx = S/N |
| Change Address | aAb! | b<CR><LF> Where b = new address |
| Start Measurement | aM! | a0007<CR><LF> Where a = address |
| Start Measurement with CRC | aMC! | a0007<CR><LF> Where a = address |
| Send Data | aD0! | a+bbb.b+ccc.c+ddd.d+eee.e<CR><LF> Where a = address, bbb.b = wind speed, and ccc.c = wind direction * |
| | aD1! | a+ffff.f+gg.gg+hhh.h<CR><LF> Where a = address, gg.gg = power supply voltage, and hhh.h = compass reading ** |
| Start Concurrent Measurement | aC! | a00007<CR><LF> Where a = address |
| Start Concurrent Measurement with CRC | aCC! | a00007<CR><LF> Where a = address |
| Continuous Measurements | aR0! | a+bbb.b+ccc.c+ddd.d+eee.e<CR><LF> Where a = address, bbb.b = wind speed, and ccc.c = wind direction * |
| | aR1! | a+ffff.f+gg.gg+hhh.h<CR><LF> Where a = address, gg.gg = power supply voltage, and hhh.h = compass reading ** |
| Continuous Measurements with CRC | aRC0! | a+bbb.b+ccc.c+ddd.d+eee.e{crc}<CR><LF> Where a = address, bbb.b = wind speed, ccc.c = wind direction, and {crc} = CRC * |
| | aRC1! | a+ffff.f+gg.gg+hhh.h{crc}<CR><LF> Where a = address, gg.gg = power supply voltage, hhh.h = compass reading, and {crc} = CRC ** |

*ddd.d = is reserved for temperature and eee.e is reserved for relative humidity although the 102779 Sonic does not measure these parameters

*ffff.f = is reserved for barometric pressure although the 102779 Sonic does not measure this parameter

Extended SDI-12 Commands

Note: Extended SDI-12 commands may not be available in all dataloggers.

| NAME | SDI-12 COMMAND | SENSOR RESPONSE |
|-----------------------|----------------|---|
| Report Wind Units | <i>aXSU!</i> | <i>aXSUb!</i> <CR><LF> Where <i>a</i> = address, and <i>b</i> = 0 for Meters per Second (default), or 1 for Miles per Hour |
| Set Wind Units | <i>aXSUb!</i> | |
| Report Version Number | <i>aXVN!</i> | <i>aXVNxx.x</i> <CR><LF> Where <i>a</i> = address and <i>xx.x</i> = firmware version |

Appendix B Theory of Operation

Winds

Climatronics' 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.

Fluxgate Compass

The P/N 11709 internal compass is low power and compact, and is a complete compass or magnetic sensor module that integrates easily into the Sonic. The internal compass uses two magneto-inductive sensors, which change inductance with different applied magnetic field strengths, to sense magnetic fields.

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

Appendix C

102779 SONIC Options Configuration Guide

| | | | |
|-------------------------|----------------|----|----|
| Base Part Number | 102779- | | |
| Analog Options | None | A0 | |
| | 0 - 1 Volt | A1 | |
| | 0 - 5 Volt | A2 | |
| | 0 - 2.5 Volt | A3 | |
| | 1 - 5 Volt | A4 | |
| Compass Option | None | | C0 |
| | 11709 | | C1 |

Table 1

The default units set at the factory are:

- 9600 Baud, no parity, 8 data bits, 1 stop bit
- Instantaneous Data Rate
- M/S

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| Revision | Description | Date | Approved |
|----------|------------------------|---------|----------|
| - | Released to Production | 6/20/08 | DWG |
| | | | |