METEOROLOGICAL INSTRUMENTS

INSTRUCTIONS

ResponseONE

MODEL 91000

ULTRASONIC ANEMOMETER

CE

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OPERATING INSTRUCTIONS

Model 91000 *ResponseONE* Ultrasonic Anemometer

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MODEL 91000
ResponseONE
ULTRASONIC ANEMOMETER



1.0 INTRODUCTION

The Model 91000 *ResponseONE*[tm] Ultrasonic Anemometer is a 2-axis, no-moving parts wind sensor. It is ideal for general meteorological applications requiring accurate and reliable measurement. The sensor features wide operating range, compact size, easy installation and low power operation.

The sensor features durable corrosion-resistant construction throughout. An internal compass provides wind direction orientation when needed.

The *ResponseONE* installs on readily-available 1 inch (IPS) pipe. Wiring connections are made in a convenient, weather-proof junction box; special connectors and custom cables are not needed.

Measured data is output in a serial format. NMEA, SDI-12, RMYT, and ASCII protocols are available to suit many applications. Continuous serial output or polled operation may be used.

RS-232 or RS-485 serial format options allows direct connection to YOUNG displays, marine NMEA systems, data loggers, or other compatible serial devices.

Operating parameters are easily reviewed and changed using the ***ResponseONE* CONFIG** program available for download at www.youngusa.com. All settings are stored internally in non-volatile memory.

2.0 SPECIFICATIONS

WIND SPEED

Range:	0 - 70 m/s (156 mph)
Resolution:	0.01 m/s
Accuracy:	0 - 30 m/s ±2% or 0.3 m/s
	30 - 70 m/s ±3%
Response Time:	<0.25 seconds

WIND DIRECTION

Azimuth Range:	0 - 360 degrees
Resolution:	0.1 degree
Accuracy:	± 2 degrees
Response Time:	<0.25 seconds

COMPASS

Range:	0 - 360 degrees
Resolution:	0.1 degrees
Accuracy:	± 2 degrees

SERIAL OUTPUT (Selectable)

Interface Type:	RS-232 or RS-485/422, SDI-12	
Formats:	ASCII Text	- polled or continuous
	NMEA	- continuous
	SDI-12	- polled
	RMYT	- continuous
Baud Rates:	1200, 4800, 9600, 19200 and 38400	

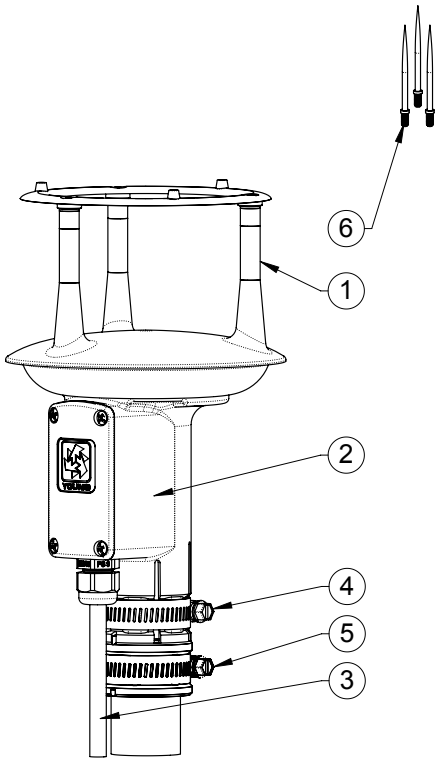
GENERAL

Output rate:	0.1 to 10 Hz
Power Supply:	10 - 30 VDC,
	7 mA typical, 80 mA max
Protection Class:	IP66
EMC Compliance:	FCC Class A digital device
	IEC standard 61326-1
Dimensions:	23 cm high x 13.5 cm wide
Weight:	0.5 kg (1.1 lb)
Shipping Weight:	1.4 kg (3.1 lb)
Operating Temperature:	-40 - +60°C

3.0 BEFORE INSTALLATION

3.0 UNPACKING THE *ResponseONE*

The *ResponseONE* comes in a custom shipping carton. Carefully inspect the instrument when first unpacking and report any visible damage to your YOUNG supplier. Be sure to retain the bird spikes and orientation ring for use.



1. Ultrasonic wind sensor array
2. Junction box / wiring terminals
3. Sensor cable (ordered separately)
4. Mounting post clamp
5. Orientation ring
6. Bird spikes

Figure 3.0 *ResponseONE* Features

The *ResponseONE* arrives fully calibrated and ready to use. As supplied, the sensor is configured as follows:

FACTORY DEFAULT CONFIGURATION

Protocol:	RS-232 ASCII Continuous
Baud Rate:	9600
Wind Format:	Polar
Wind Units:	m/s, Degrees azimuth

Default connections are shown in APPENDIX A, FIGURE A1. Other options are also described in APPENDIX A. These are accomplished using the ***ResponseONE* CONFIG** program which is available at www.youngusa.com. **Note: Always connect and bench test a complex system before installation in the field.**

4.0 INSTALLATION

4.1 PLACEMENT

Proper instrument placement is important. Eddies from buildings, trees, or other structures can influence measurements. Locate the sensor well away from obstructions. As a general rule, air flow around a structure is disturbed to 10 times the height of the structure downwind and 1-1/2 times the height of the structure above the roof.



Fig 4.1 Wind Siting Considerations

4.2 MOUNTING AND ALIGNMENT

The *ResponseONE* mounts on standard 1-inch (IPS) pipe. This is commonly available steel pipe with an outside diameter of 1.34 inches (34 mm). The pipe should be secured vertically. Place the orientation ring over pipe end with guide pin facing up. Do not tighten clamps yet.

Most applications require aligning the wind sensor array to geographic north (0 degrees). In this orientation the junction box faces SOUTH (180 degrees). See the diagram in APPENDIX B for details. Two methods are suggested below :

4.2.1 ORIENTATION USING KNOWN GEOGRAPHIC DATA (PREFERRED) Obtain accurate geographic data for the installation site, this can be a topographic map, graphical GPS map or detailed road map. Using the transducers as a sighting aid, align the sensor with a remote feature that represents the proper orientation. After alignment, tighten the mounting post band clamp to secure the position. DO NOT OVER-TIGHTEN. Engage orientation ring pin with slot (Fig 4.2.3) in sensor base (under J-box). Now tighten the band clamp on the orientation ring. If the *ResponseONE* is later removed, the orientation ring will preserve the sensor alignment. Compass is NOT enabled for this method.

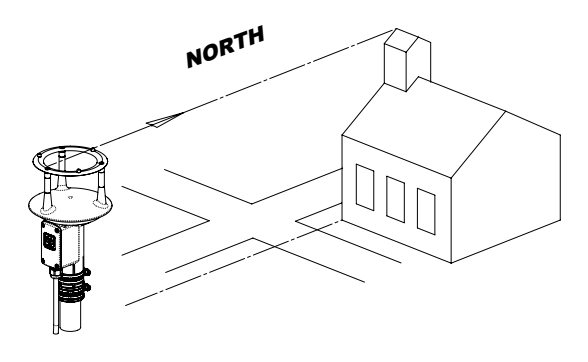


Fig 4.2.1 Sighting of Wind Sensor using Geographic Feature

4.2.2 ORIENTATION USING BUILT-IN ELECTRONIC COMPASS.

Note: Acclimate the *ResponseONE* to ambient temperature at the installation site before calibrating.

Place *ResponseONE* sensor on mounting pipe, fully seating it on the pipe and allowing for free rotation of the sensor. Connect cable as indicated in APPENDIX A and apply power to the system. (Refer to Fig 4.2.2) With junction box cover removed, press and hold the "CALIBRATE" button for 3 seconds; the indicator light will blink rapidly to indicate that calibration mode is active. Slowly rotate the sensor for 1-1/4 rotations. After completing the rotations, press and hold the "CALIBRATE" button again for 3 seconds; the indicator will double blink. Within the next 60 seconds, tighten the mounting post band clamp to secure the sensor. DO NOT OVER-TIGHTEN. At this point, the compass will lock the direction of the sensor and the *ResponseONE* will output correct wind direction data; the indicator will continue to blink once per second. Reattach J-Box cover and engage orientation ring as shown in Fig 4.2.3 Tighten the orientation ring band clamp.

Important: Be sure to allow for magnetic declination in your measurement. A declination value can be entered using the ***ResponseONE* CONFIG** program or it can be compensated in the data-logger program. Please note that declination may change if the sensor is moved to a new location. Accurate declination data can be obtained from the following website:

http://www.ngdc.noaa.gov/geomag-web/#declination

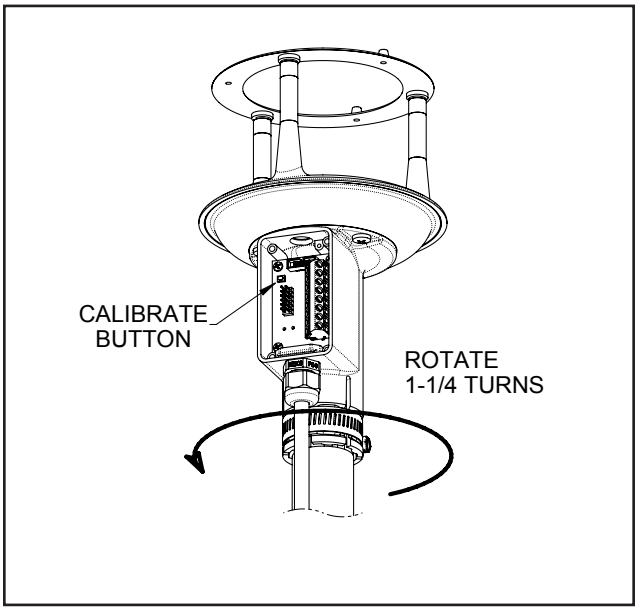


Fig 4.2.2 Orientation of Wind Sensor Using Electronic Compass

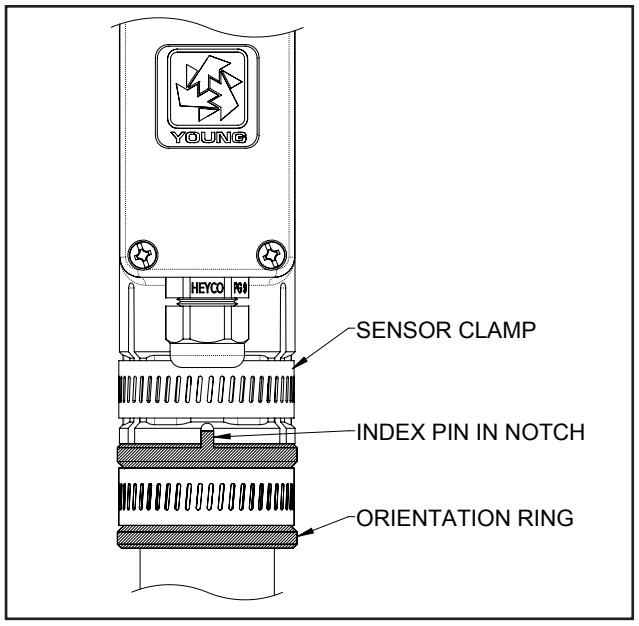


Fig 4.2.3 Proper Engagement of Orientation Ring with Sensor

4.3 WIRING CONNECTIONS

The *ResponseONE* is supplied with RS-232, RS-485 and SDI-12 signal capability. Please select the signal type desired and refer to the appropriate WIRING CONNECTIONS diagram in APPENDIX A for connecting the *ResponseONE* to your serial device. Please note, the *ResponseONE* is not equipped with analog outputs.

5.0 OPERATION

5.1 SERIAL OUTPUT FORMATS

The *ResponseONE* comes standard with the following serial output formats:

Format/Protocol	Wiring Format
ASCII Polled and Continuous	RS-232, RS-485
NMEA 0183 v3.0 Automatic	RS-232, RS-485
SDI-12 Polled	SDI-12
RMYT	RS-485

Detailed information about each protocol is in the following section.

If you wish to change settings from the factory default values shown in Section 3, this is easily done using the ***ResponseONE* CONFIG** program described in Section 6.0.

5.1.1 ASCII

ASCII output format provides continuous measurement data in text format at any of the available baud rates.

The wind measurement in ASCII output appears either in POLAR (default) or CARTESIAN UV format. With POLAR format, the wind speed threshold and wind speed units are user-selectable. With CARTESIAN the wind threshold is ignored and wind speed units are always meters per second (m/s).

ASCII POLAR FORMAT

```
a www.ww ddd.d ss*cc<CR>
```

where:

a	= Sensor address
www.ww	= Wind speed
ddd.d	= Wind direction
ss	= Status code
*	= Asterisk (ASCII 42)
cc	= Checksum
<CR>	= Carriage return (ASCII 13)

ASCII CARTESIAN (UV) FORMAT

```
a uu.uu vv.vv ss*cc<CR>
```

where:

a	= Sensor address
±uu.uu	= U-axis wind speed (m/s)
±vv.vv	= V-axis wind speed (m/s)
ss	= Status code
*	= Asterisk (ASCII 42)
cc	= Checksum
<CR>	= Carriage return (ASCII 13)

CHECKSUM is a two-character hexadecimal value (in printable ASCII format) generated by taking the exclusive-or of all characters up to the asterisk. STATUS CODE shows a non-zero value when the sensor cannot acquire sufficient samples or a measurement error has occurred. See APPENDIX C for more information on status codes.

5.1.2 ASCII POLLED

ASCII POLLED is like ASCII format described above except just one serial output string is sent for each polling command received. The polling command is `Ma!` where `'a'` is the sensor address (valid characters: 0-9, A-Z, a-z). The default address is `'0'` (ASCII 48).

5.1.3 RMYT

RMYT is a 6-byte binary data format sent at 9600 baud using RS-485 OUTPUT ONLY mode. It is for use with the YOUNG Model 06201 Wind Tracker.

5.1.4 NMEA

NMEA format provides continuous measurements in standard NMEA marine sentences at 4800 baud. The *ResponseONE* must be connected to a NMEA-capable device. Specific details of the NMEA data string are below:

NMEA FORMAT

```
$WIMWV,ddd,R,www.w,u,A*cc<CR><LF>
```

where:

WI	= Device type (weather instrument)
MWV	= Wind direction and speed
ddd	= Wind direction (degrees)
www.w	= Wind speed
u	= Wind speed units S = mph N = knots K = kmph M = m/s
A	= Data status code: A=valid, V=invalid
*	= Asterisk (ASCII 42)
cc	= Checksum
<CR><LF>	= Carriage return,Line feed (ASCII 13,10)

CHECKSUM is the two-character printable hexadecimal value generated by taking the exclusive-or of all characters between `'$'` and `'*'`.

5.2 SDI-12

SDI-12 stands for serial data interface at 1200 baud. It is often used to interface battery powered data recorders with microprocessor based devices designed for environmental data acquisition. SDI-12 is typically used when low power usage is required. The SDI-12 device normally remains in a low power, standby state until it is polled at which time a measurement is sent. SDI-12 can effectively address multiple sensors on the same cable.

5.2.1 SDI-12 MEASUREMENT COMMANDS

Model 91000 uses the SDI-12 (v1.3) serial communication protocol to initiate measurements and set sensor operation parameters. The default sensor address is 0 (zero), and can be changed to any valid single-character value if needed. Additional details about the SDI-12 protocol may be found at **www.sdi-12.org**.

After initial power-up with 12 VDC, the sensor is in a low-power standby state with a quiescent current of 4.2 mA. A valid and properly addressed SDI-12 command wakes the sensor to initiate a measurement, set or check operating parameters. After command processing has finished, the sensor returns to the low-power standby state.

SDI-12 'M' or 'C' commands initiate a measurement. The sensor response message indicates the maximum time needed before the measurement is ready, and data values will be available. The maximum time ranges from 1 to 5 seconds depending on the Sample Count.

If an 'M' command initiates a measurement, the sensor sends a Service Request when the measurement is ready to be retrieved. When the polling device receives the Service Request it then sends a 'D' command to request measurement results from the sensor. With 'C' commands, no Service Request is sent, and the polling device must wait the full delay time before sending the 'D' command to request the measurement.

SDI-12 Measurement commands and responses are listed below.

COMMAND	RESPONSE	DESCRIPTION
aM!	attts<CR><LF>	Take a measurement
aMC!	attts<CR><LF>	Take a measurement with CRC checksum
aC!	atttss<CR><LF>	Take a concurrent measurement
aCC!	atttss<CR><LF>	Take a concurrent measurement with CRC checksum
aD0!	a+www.ww+ddd.d<CRC><CR><LF> (Polar) a±uu.uu±vv.vv<CRC><CR><LF> (Cartesian)	

where:

a	= Sensor address
ttt	= Delay time (seconds)
s/ss	= Number of samples to collect
www.ww	= Wind speed (selected units)
ddd.d	= Wind direction (degrees)
±uu.uu	= U-axis wind speed (m/s)
±vv.vv	= V-axis wind speed (m/s)
<CRC>	= CRC checksum (only where requested)
<CR><LF>	= Carriage return, line feed (ASCII 13, 10)

Wind data format depends on the sensor Output Format parameter setting (Polar or Cartesian).

5.2.2 SDI-12 NON-MEASUREMENT COMMANDS

The SDI-12 protocol includes standard commands for identifying the sensor and changing its address.

COMMAND	RESPONSE	DESCRIPTION
?!	a<CR><LF>	Address Query
a!	a<CR><LF>	Acknowledge Active
aI!	a13 YOUNG C091000 vvvnnnnnn<CR><LF>	Send Identification vvv = Firmware Version nnnnnn = Serial Number
aAb!	b<CR><LF>	Change Address a = Sensor address b = New sensor address
aV!	a0000<CR><LF>	Start Verification

5.2.3 EXTENDED COMMANDS

The SDI-12 command set may be customized with Extended Commands to accommodate manufacturer settings and other functions. Extended Commands are listed below. Where two responses are shown, one is for a valid command, the other is for an invalid (ERR) command.

COMMAND	RESPONSE	DESCRIPTION
aXB!	aXB, OK<CR><LF>	Save parameter settings to flash.
aXFn!	aXF, F=n<CR><LF> aXF,ERR F=0/1<CR><LF>	n = Output Format code. 0 or 1 (Polar or Cartesian)
aXPn!	Parameter report, 4 reports needed for all parameters aXP1,F=f,UW=uw,T=t,S=s,W=w,CE=ce<CR><LF> a = Sensor address f = Wind Format uw = Polar wind speed units 1=mph 2=knots 3=km/h 4=m/s t = Threshold, polar only (0-150 cm/s) s = Sample count, internal (1-800) w = Wait (seconds) ce=Compass Enable	
	aXP2,OD=od,M=m,CD=cd,PWR=v VDC<CR><LF> od=WD Offset m=WS Multiplier cd=Compass Declination v=Supply Voltage	
	aXPn,ERR n=1/2/3/4 ONLY<CR><LF>	
aXSnnn!	nnn = Sample Count (001-800 samples) aXS,S=nnn<CR><LF> aXS,ERR S=001-800 ONLY<CR><LF>	
aXMnnnnn!	nnnnn=WS multiplier x 10000 (00000 - 30000) aXM,M=nnnnn<CR><LF> aXM,ERR M=00000-30000 ONLY<CR><LF>	
aXTnnn!	nnn = Wind Speed Threshold (000 - 150 cm/s) aXT,T=nnn<CR><LF> aXT,ERR T=000-150 ONLY<CR><LF>	
aXUWn!	n = Wind Speed Units (1=mph, 2=knots, 3=kmph, 4=m/s) aXUW,UW=n<CR><LF> aXUW,ERR UW=1/2/3/4 ONLY<CR><LF>	
aXOD±nnnn!	±nnnn = Wind Direction Offset x 10 (-3600 to 3600) aXOD,OP=±nnnn<CR><LF> aXOD,ERR OD=-3600 - +3600 ONLY<CR><LF>	
aXCEn!	n = Compass Enable (0=Disable, 1=Enable) aXCE,CE=n<CR><LF> aXCE,ERR CE=0/1 ONLY<CR><LF>	
aXCDnddmm!	nddmm = Declination (n=E/W/0,dd=DEG, mm=MIN) aXCD,CD=nddmm<CR><LF> aXCD,ERR CD=nddmm n=E/W/0, dd=00-90, mm=00-60 ONLY<CR><LF>	

IMPORTANT! PARAMETER CHANGES MUST BE STORED IN FLASH MEMORY USING THE aXB! COMMAND OR THEY WILL REVERT TO PREVIOUSLY STORED VALUES AT POWER UP. The aXB! command may be sent after all changes have been made, or not sent at all if the changes are temporary.

SAMPLE COUNT (aXSnnn!)
Each wind measurement is calculated from the median of multiple wind samples. Each sample requires a power pulse so more samples consume more power. The default sample count of 16 is a good balance of low power consumption and robust performance. If winds above 30 m/s are expected, 100 samples may be more suitable. Winds reaching the performance limit of the sensor (70 m/s) may require a setting of up to 800 samples.

THRESHOLD (aXTnnn!)
Threshold sets the minimum wind speed needed before a new polar wind direction is calculated. The default value is 25 cm/s (0.25 m/s). A greater-than-zero threshold can help provide more meaningful scalar wind direction averages. The threshold for Cartesian (UV) output format is automatically zero regardless of this setting.

5.3 LOW POWER OPERATION

Average current consumption with default settings is about 7.5 mA. This configuration uses minimal power and enables all features even though they may not be used. This is suitable for many low power applications.

To reduce current consumption further, additional strategies include disabling unused outputs, using polled serial operation, increasing the output interval, and limiting the sample count to the minimum optimal number. Faster baud rates also reduce power by limiting transmit duration.

6.0 SETTING OUTPUTS AND OPERATING PARAMETERS

6.1 SENSOR CONFIGURATION WITH *ResponseONE* CONFIG PROGRAM (RECOMMENDED)

The YOUNG ***ResponseONE* CONFIG** program is available from the factory web site: www.youngusa.com. It provides an easy method for checking and configuring sensor operation. Install the program on a Windows 7 or higher PC and follow instructions that appear on the program screen to retrieve current sensor settings or send new settings.

6.1.1 Opening the Program

After installing the program on your PC, click the desktop icon to open the program. The following screen should appear:

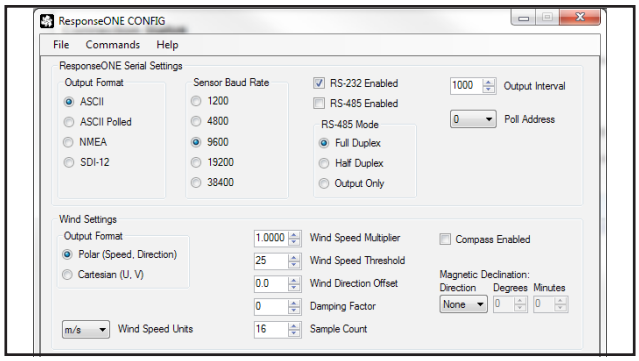


Fig 6.1 ***ResponseONE* CONFIG** program opening screen

If you are using the *ResponseONE* for the first time, the default settings will appear. For reference these are:

FACTORY DEFAULT CONFIGURATION

Protocol:	RS-232 ASCII Continuous
Baud Rate:	9600
Wind Format:	Polar
Wind Units:	m/s, Degrees azimuth

If these settings are correct for your application, then you may proceed with operation of the device. If you wish to change any settings, available options can be selected from menu items visible. After changes are made, the ***ResponseONE* CONFIG** program automatically saves the new settings in flash memory

6.2 SENSOR CONFIGURATION USING A GENERAL PURPOSE COMMUNICATIONS PROGRAM

A general purpose text-based serial communications program like **HyperTerminal** may be used to manually configure the sensor by sending simple text commands. The following guidelines apply:

The YOUNG sensor and communication program must operate at the same baud rate and be properly connected. Sensor RS-232 mode must be enabled. See the RS-232 wiring diagram, FIGURE A1, in APPENDIX A.

Factory default sensor baud rate is 9600, Configure the serial communications program for NO handshaking and 1 start, 8 data, 1 stop bit, no parity, no flow control.

The sensor must be in COMMAND MODE in order to set parameters. Enter COMMAND MODE by sending three ESC characters (ASCII 27) in quick succession while the sensor is running. When the sensor is in COMMAND MODE, it sends a '>' prompt character indicating that it is ready to accept commands.

If the prompt does not appear after sending three indicating characters, re-check wiring and communication program setup. If the sensor baud rate is unknown, try sending the ESC characters at each of the five available baud rates (1200, 4800, 9600, 19200 and 38400). It is also possible that sensor parameters have been purposely configured to disable RS-232 mode. If this is the case, the following method must be used.

In order to provide access under all conditions, the sensor always begins operation at power up with serial communications set to 38400 baud and RS-232 connections enabled. Immediately after power up, there is a short time window in which to send the ESC characters and enter COMMAND MODE.

To use this feature, set your serial communication program baud rate to 38400. Remove power then wait 5 seconds. Re-apply power to the sensor. The sensor will transmit four asterisks immediately after power up. After the asterisks appear, send three ESC characters. The COMMAND MODE '>' prompt should appear. To do this using ***ResponseONE* CONFIG**, connect the *ResponseONE* to your computer, open the program (make sure the correct serial port is selected), then go to the 'COMMANDS' menu and select 'ACQUIRE *ResponseONE*'.

A window will come up telling you that the serial port will be set to 38400 baud. Click 'OK' to continue. Then simply apply power to the *ResponseONE* and the program will connect automatically.

6.3 COMMAND OVERVIEW

After the '>' prompt appears, send '??' to display a list of available commands. Send 'RPTV' to report current settings. (Note that some values in the report are for factory settings and cannot be changed by the user.)

Commands are case sensitive and the exact format must be used. For example, the SET01nn command requires two digits for the serial format code. If you send SET014 instead of SET0104 the sensor will reject the command and indicate an error. End all commands with a carriage return (ASCII 13). In HyperTerminal, do this by pressing the ENTER key.

After receiving the carriage return, the sensor will evaluate the command. Valid commands will be executed. Current settings can be evaluated at any time by sending RPTV to get a new report.

IMPORTANT NOTE:
The YOUNG ***ResponseONE*** **CONFIG** program automatically saves all settings to flash memory when they are sent to the sensor. Settings that are changed manually must be saved to flash with the SET77 command.

COMMAND	DESCRIPTION
SET01nn	Set output mode
SET02n	Set output format
SET03nn	Set baud rate
SET04n	Set wind speed units
SET05a	Set sensor address
SET06nnn	Set wind speed threshold
SET07nnnnn	Set wind speed multiplier
SET08±nnnn	Set direction offset
SET09dd	Set damping factor
SET10nnnn	Set output interval
SET12nnn	Set sample count
SET13n	Set wind output format
SET25n	Turn compass on/off
SET26nddmm	Set compass declination
SET77	Save settings
XX	Operate mode
RPTV	Report current settings
??	Display command list
HELP	Display command list

6.4 COMMAND DETAILS

COMMAND — **DESCRIPTION**

SET01nn — Enable RS-232 and RS-485 output modes. Default value is 04.
- Where nn=04 Enable RS-232
- 08 Enable RS-485 output only
- 16 Enable RS-485 half duplex
- 24 Enable RS-485 full duplex

Usage example:
- >SET0104 Enables RS-232 only.

SET02n — Set the serial output format. Default value is 2.
- Where n= 1 RMYT
- 2 ASCII
- 3 ASCII POLLED
- 4 NMEA
- 5 SDI-12

Usage example:
- >SET022 Sets output to ASCII continuous. Note: If SDI-12 is selected, save settings (SET77) then power must be cycled off, then on again to operate properly. SDI-12 automatically sets baud rate to 1200 and disables RS-232 and RS-485.

SET03nn — Set the baud rate for RS-232/RS-485 serial communication. Default value is 96. Note: Baud rate must be the same as connected device.
- Where nn=12 1200 baud
- 48 4800 baud
- 96 9600 baud
- 19 19200 baud
- 38 38400 baud

Usage example:
- >SET0338 Sets baud rate to 38400.

SET04n — Set wind speed units (ASCII, ASCII POLLED, NMEA and SDI-12). Default value is 4.
- Where n= 1 mph
- 2 knots
- 3 mph
- 4 m/s

Usage example:
- >SET044 Sets wind speed to m/s.

SET05a — Set sensor address for ASCII POLLED and SDI-12. Note: This is the address when polling with the “aM!” command (SDI-12) and ‘Ma!’ command (ASCII Polled) where 'a' is the address. Default value is 0.
- Where a= 0-9, A-Z, or a-z

Usage example:
- >SET052 Sets polling address to number 2.

SET06nnn — Set the wind speed threshold. Minimizes erratic wind direction indications at very low wind speeds. In polar mode, this allows the sensor output to mimic a mechanical wind vane that retains its orientation when there is no wind. Default value is 25.
- Where nnn= 000-150 cm/s

Usage example:
- >SET06025 Sets wind speed threshold to 25 cm/s.

SET07nnnnn — Set wind speed multiplier. Value is x10000. All wind speed measurements are multiplied by this parameter. Default value is 10000 for a multiplier of 1.0000.
- Where nnnnn= 00000-30000

Usage example:
- >SET0709909 Sets multiplier to 0.9909
- >SET0710023 Sets multiplier to 1.0023

SET08±nnnn — Set wind direction offset. Value is degrees x10 and may be positive or negative. Wind direction is always re-scaled to a 0-360 range after offset is applied. Default value is 00000.
- Where ±nnnn= -3600 to +3600

Usage example:
- >SET08-0012 Offsets wind direction reading by -1.2 degrees
- >SET08+0005 Offsets wind direction reading by +0.5 degrees

SET09dd — Set damping factor. Default value is 00. This means no damping is applied. High damping values at long output intervals can slow the rate at which indicated wind values change. Wind measurement outputs are damped using the following formula:

$S_{damped} = [(dd-1) * S_{damped} + S_{sample}] / dd$

- Where dd= Damping factor (00-99)

S_{damped} = New or last damped wind speed

S_{sample} = New wind speed

Usage example:
- >SET0905 Sets damping factor to 5 (Note: Damping factor only applies to wind reading.)

SET10nnnn	Set output interval. Sets the time interval between measurements in one millisecond increments. Lower values increase power consumption when continuous measurements are taken. Default is 1000.
Where nnnn=	0000-9999
Usage example:	
>SET101000	Sets output interval to 1000 milliseconds (1 second) (Note: If output interval is set too low, the *ResponseONE* will automatically calculate the minimum output interval.)
SET12nnn	Set sample count. The rate at which the sensor internally takes complete sonic wind samples is greater than 200 times per second. This command sets the number of internal samples used to calculate the median measurement result. Default is 16.
Where nnn=	000-800
Usage example:	
>SET12016	Sets sample count to 16. More internal samples consume more power while providing greater immunity to conditions like turbulent high-speed wind. Fewer samples consume less power while providing less immunity to disruptive conditions. This command interacts with the OUTPUT INTERVAL setting. More samples may require a longer output interval.
SET13n	Set ASCII output format. Determines whether ASCII and ASCII POLLED serial outputs provide wind data in either Polar (speed and direction) or Cartesian (UV) form. Default is Polar.
Where n= 0	Polar
1	Cartesian (UV)
Usage example:	
>SET130	Sets output format to polar.
SET25n	Turn compass on or off. Default is 0.
Where n= 0	Off
1	On
Usage example:	
>SET251	Turns compass on. Note: This command should only be used if the sensor has been calibrated at current location. Calibration automatically turns on compass.
SET26nddmm	Set compass (magnetic) declination. Magnetic declination is the angle between magnetic north and true north.
Where n=	E, W, or 0 (East, West, or none)
dd=	00 to 90 degrees
mm=	00 to 60 minutes
Usage example:	
>SET26W0606	Set declination to West 6° 6' (zip code 49686)
SET77	Save all settings to non-volatile memory. Any settings which have not been saved will be lost when power is removed. Saved settings are loaded at power up. This command may be used any time the sensor is in COMMAND MODE. Note: ***ResponseONE* CONFIG** program automatically sends this command when <Send Parameters> button is pressed.
XX	Returns the sensor to OPERATE MODE
RPTV	Report current settings
??	Display command list
HELP	Display command list

7.0 EXAMPLE SETTINGS

Suggested settings. Not all possible setting combinations are shown. The ***ResponseONE* CONFIG** program is recommended for changing setup parameters. See wiring diagrams for jumper settings.

7.1 FACTORY DEFAULT

RS-232	Enabled
RS-485	Disabled
Serial Output Format:	ASCII
Output Interval	1000
Sample Count:	16

7.2 MINIMUM POWER

RS-232	Enabled
RS-485	Disabled
Serial Output Format:	ASCII
Output Interval	1000
Sample Count:	16

7.3 HIGH WIND

Output Delay:	1000
Sample Count:	200

AVERAGE CURRENT DRAW AT 12V

Output Format	Output Interval	Sample Count	Baud Rate (bps)	Average Current Draw (mA)
SDI-12 (polled)	5 minutes	16	1200	4.5
	5 minutes	100	1200	4.5
ASCII	1 second	16	9600	8.4
	1 second	100	38400	20.7
ASCII Polled	5 minutes	16	9600	5.8
NMEA	1 second	16	4800	7.4
	1 second	50	4800	12.4
RMYT	0.25 second	16	9600	15.6
	1 second	200	9600	34.2

8.0 EMC COMPLIANCE

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

This ISM device complies with Canadian ICES-001.
Cet appareil ISM est conforme à la norme NMB-001 du Canada.

EN55011/CISPR 11, Group 1, Class B device.
Class B equipment is suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

9.0 WARRANTY

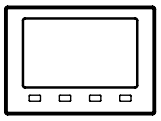
This product is warranted to be free of defects in materials and construction for a period of 12 months from date of initial purchase. Liability is limited to repair or replacement of the defective item. A copy of the warranty policy may be obtained from R. M. Young Company.

10.0 CE COMPLIANCE

This product has been tested and complies with European CE requirements for the EMC Directive. Please note that shielded cable must be used.

APPENDIX A: WIRING CONNECTIONS

Figure A1: RS-232 SERIAL CONNECTION

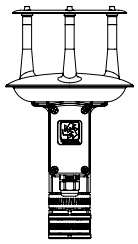


Serial Device

SETTINGS
Output Mode: RS-232
Output Format: ASCII, ASCII POLLED, or NMEA
Baud Rate: 1200, 4800, 9600, 19200 or 38400

Set connected device baud rate to match *ResponseONE*.
1 start bit, 8 data bits, no parity, 1 stop bit, no flow control.

Use shielded cable. Connect cable shield to earth ground as shown.
(Color code is for Young 18446 cable)



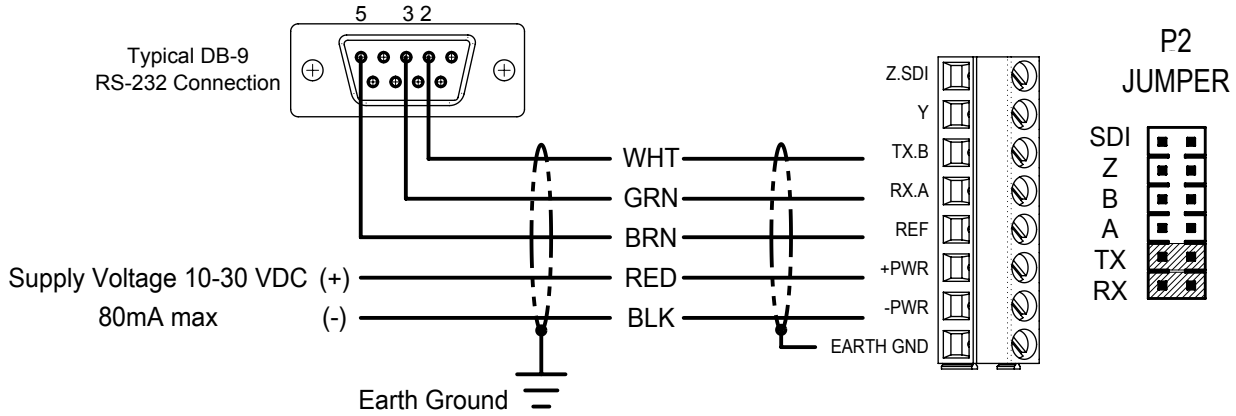
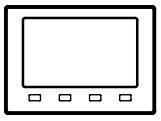


Figure A2: RS-485 SERIAL CONNECTION - FULL DUPLEX

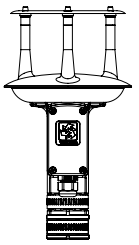


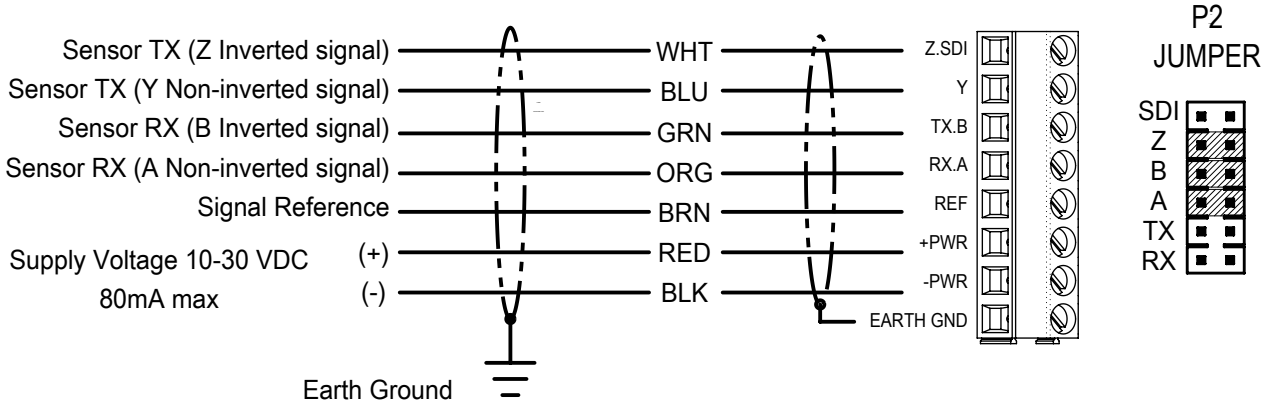
Serial Device

SETTINGS
Output Mode: RS-485 Full Duplex
Output Format: ASCII, ASCII POLLED, or NMEA
Baud Rate: 1200, 4800, 9600, 19200 or 38400

Set serial device baud rate to match *ResponseONE*.
1 start bit, 8 data bits, no parity, 1 stop bit, no flow control.

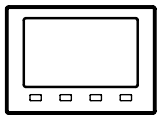
Use shielded cable. Connect cable shield to earth ground as shown.
(Color code is for Young 18660 Cable)





APPENDIX A: WIRING CONNECTIONS

Figure A3: RS-485 SERIAL CONNECTION - HALF DUPLEX

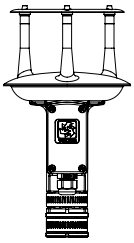


Serial Device

SETTINGS
Output Mode: RS-485 Half Duplex
Output Format: ASCII, ASCII POLLED, or NMEA
Baud Rate: 1200, 4800, 9600, 19200 or 38400

Set serial device baud rate to match *ResponseONE*.
1 start bit, 8 data bits, no parity, 1 stop bit, no flow control.

Use shielded cable. Connect cable shield to earth ground as shown.
(Color code is for Young 18446 Cable)



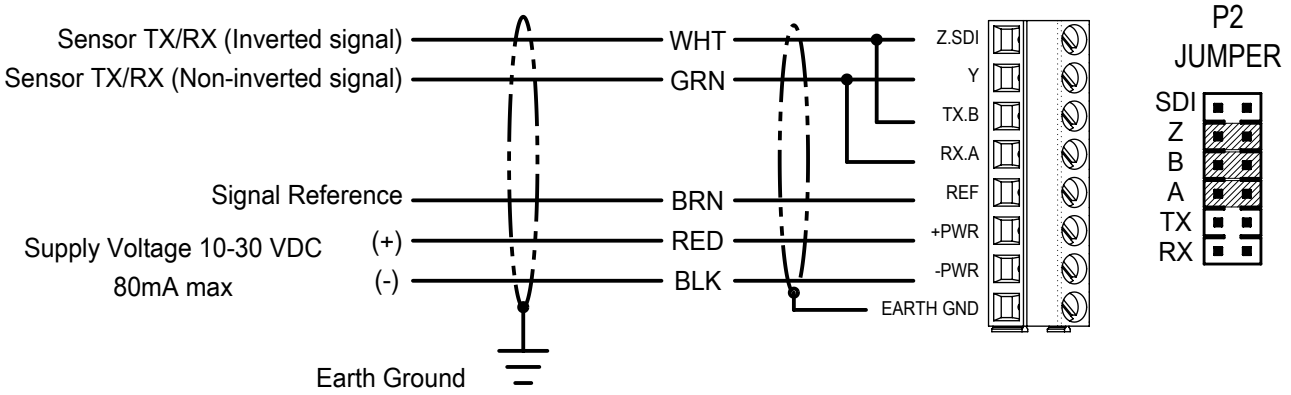
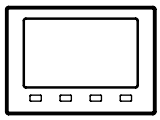


Figure A4: RS-485 SERIAL CONNECTION - OUTPUT ONLY

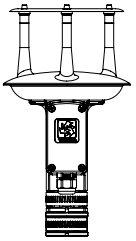


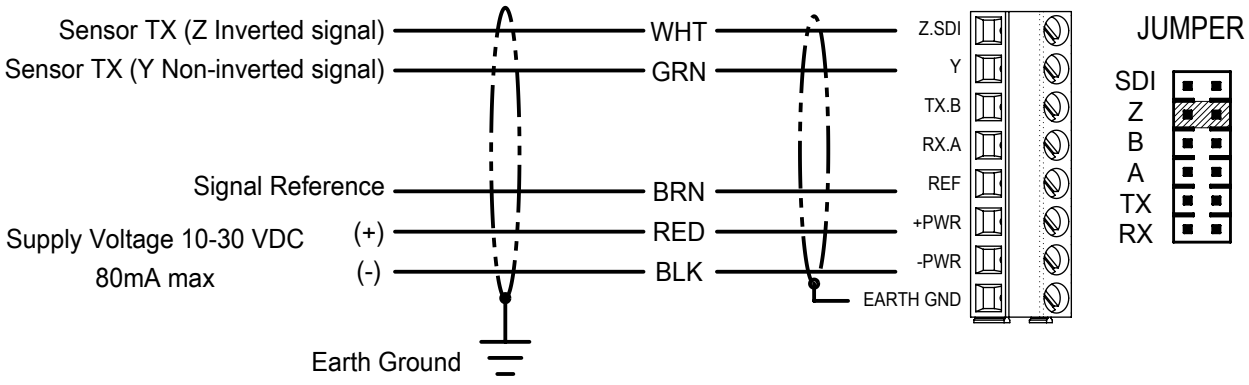
Serial Device

SETTINGS
Output Mode: RS-485 Output Only
Output Format: ASCII, or NMEA
Baud Rate: 1200, 4800, 9600, 19200 or 38400

Set serial device baud rate to match *ResponseONE*.
1 start bit, 8 data bits, no parity, 1 stop bit, no flow control.

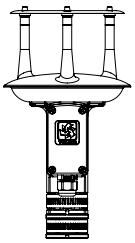
Use shielded cable. Connect cable shield to earth ground as shown.
(Color code is for Young 18446 Cable)

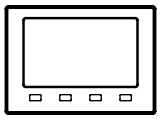




APPENDIX A: WIRING CONNECTIONS

Figure A5: SDI-12 SERIAL CONNECTION





SDI-12
Serial Device

Use shielded cable.
Connect cable shield to earth ground as shown.

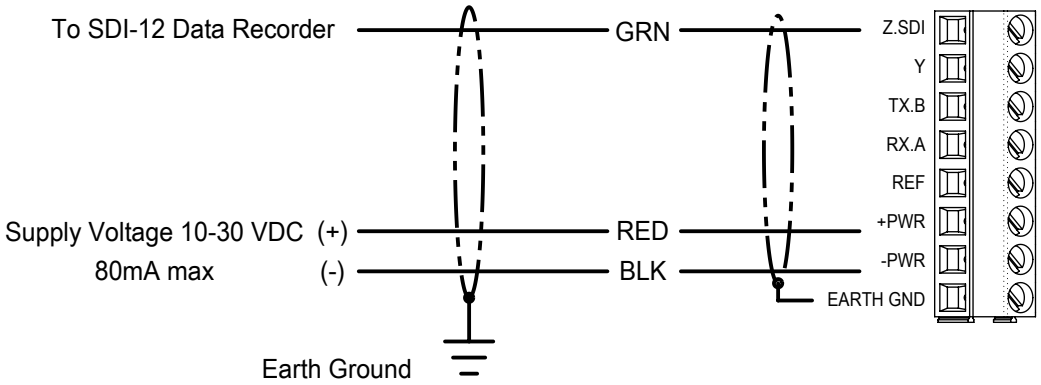
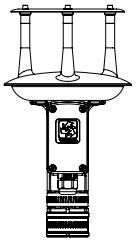
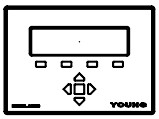


Figure A6: RS-485 SERIAL CONNECTION - FULL DUPLEX



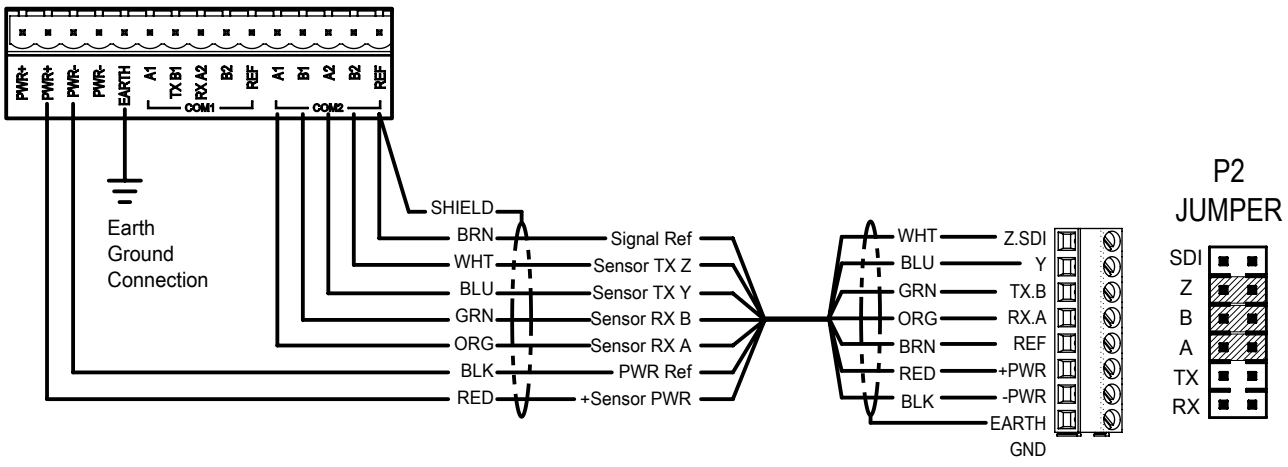


Model 26800
Translator

SETTINGS
Output Mode: RS-485 Full Duplex
Output Format: ASCII, ASCII POLLED, or NMEA
Baud Rate: 1200, 4800, 9600, 19200 or 38400

Set 26800 Translator baud rate to match *ResponseONE*.

Use shielded cable. Connect cable shield to earth ground as shown.
(Color code is for Young 18660 cable)



APPENDIX A: WIRING CONNECTIONS

Figure A7: 06201 WIND TRACKER



SETTINGS
Output Mode: RS-485 Output Only
Output Format: RMYT
Baud Rate: 9600

These are the default sensor settings as shipped unless otherwise requested.
Use shielded cable. Connect cable shield to earth ground as shown.
(Color code is for Young 18446 Cable)

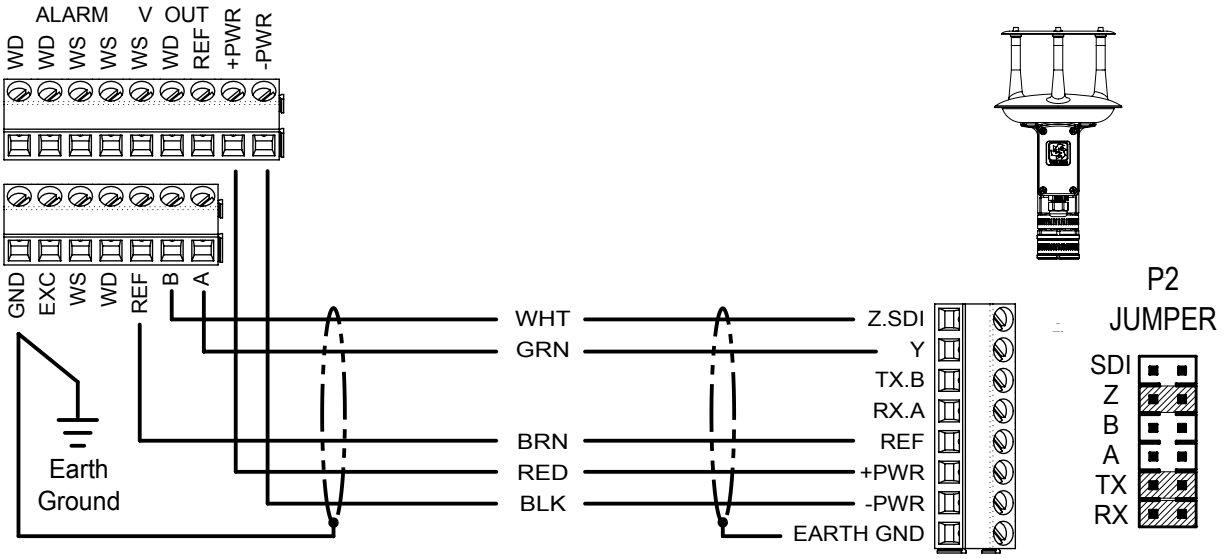
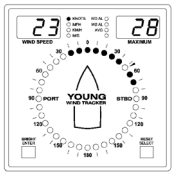
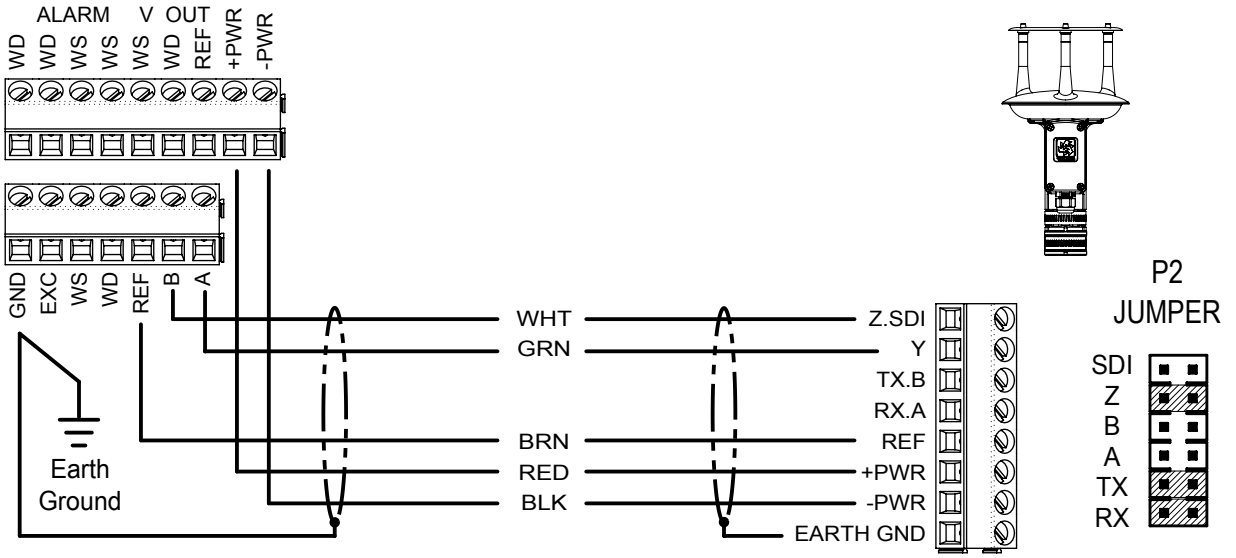


Figure A8: 06206 MARINE WIND TRACKER

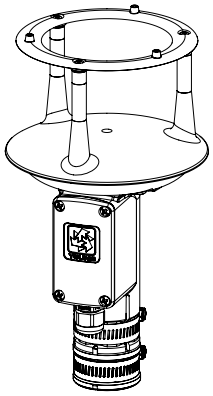


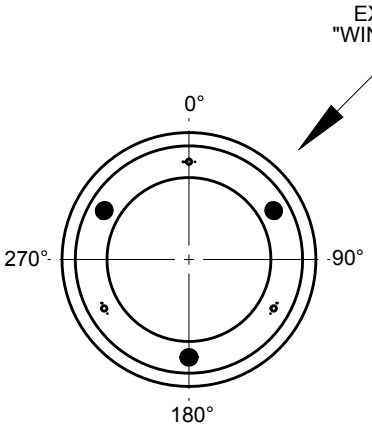
SETTINGS
Output Mode: RS-485 Output Only
Output Format: NMEA
Baud Rate: 4800

Use shielded cable. Connect cable shield
to earth ground as shown.
(Color code is for Young 18446 Cable)



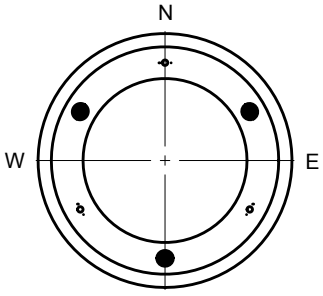
APPENDIX B: SENSOR ORIENTATION AND DIMENSIONS



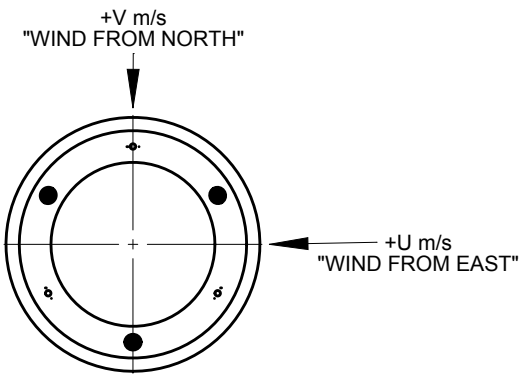


POLAR

(WIND SPEED, WIND DIRECTION)

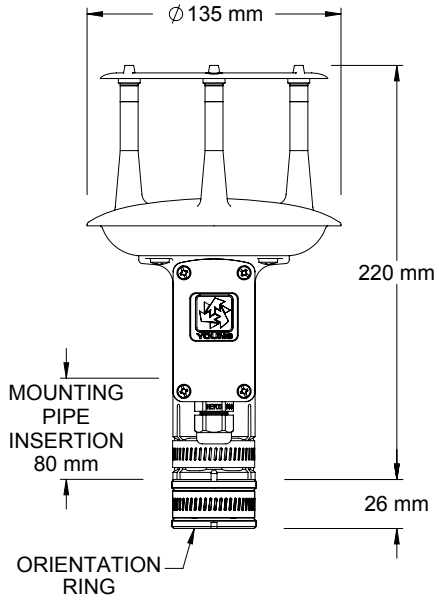


JUNCTION
BOX



CARTESIAN

(U, V)



APPENDIX C: TROUBLESHOOTING

Problem	Solution
No Output	• Check input voltage at sensor (10 – 30 VDC). • Check wiring connections. • Verify serial settings (baud rate, 1 stop bit, 8 data bits, no parity, no flow control). • 'Acquire' the sensor with the ***ResponseONE*** **CONFIG** program (see section 6.2) and verify setup mode.
One-way communication	• Check wiring connections. • 'Acquire' the sensor with the ***ResponseONE*** **CONFIG** program (see section 6.2). • Change output mode to RS-485 full or half duplex, or RS-232.
Status codes other than 00 appear	• Status codes other than 00 (or 'A' in NMEA mode) mean there is an error. See 'Status Codes' section for details.
No response to poll command	• Check power supply. • Check wiring connections. • Verify serial settings (baud rate, 1 stop bit, 8 data bits, no parity, no flow control). • Verify sensor address (if the sensor's address is '0', then the poll command is '0M!' in SDI-12 mode and 'M0! in ASCII Polled mode.). • 'Acquire' the sensor with the ***ResponseONE*** **CONFIG** program (see section 6.2) and verify setup mode.
Direction is incorrect	• If compass is off, make sure junction box is facing south. • 'Acquire' the sensor with the ***ResponseONE*** **CONFIG** program (see section 6.2) and verify settings. Enable and calibrate compass if needed, enter compass declination, and set the wind direction offset (default is 0000). • Turn compass on and calibrate if needed.

Status codes for ASCII output are hex values added together before output (a status code of 03 would be a code of 01 and 02). NMEA only allows for 'acceptable' or 'void' data. SDI-12 does not show a status code.

Status Code	Meaning
00	Valid data
01	Transducer path A blocked or dirty, clear blockage and clean transducers
02	Transducer path B blocked or dirty, clear blockage and clean transducers
04	Transducer path C blocked or dirty, clear blockage and clean transducers
A	NMEA data acceptable (NMEA wind data only)
V	NMEA data void (NMEA wind data only)