

INSTRUCTION MANUAL



86000, 86106, and 86004 Sonic Anemometers

May 2015



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- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
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- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

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- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

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86000, 86106, and 86004 Ultrasonic Anemometers

1. Introduction

The 86000-series ultrasonic anemometers are 2-axis, no moving-parts wind sensor. They are ideal for general meteorological applications that require accurate and reliable measurement. The sensors feature wide operating range, compact size, easy installation, and low power consumption.

The 86000-series measure wind speed and direction based on the transit time of ultrasonic pulses between three transducers.

Measurement results are available as calibrated analog output signals, or serial data using RS-232 or RS-485. Continuous serial output or polled operation may be used. Serial format options include direct connection to RM Young Wind Tracker displays, marine NMEA systems, dataloggers, or other compatible serial communication devices.

Operating parameters are easily set up using the 86SETUP program provided. All 86000-series parameter settings are stored internally in non-volatile memory.

The sensors are constructed using ultraviolet-stabilized thermoplastic for superior environmental resistance. They are easily mounted on standard 1 inch (IPS) pipe. An orientation ring preserves the mounting position when the sensor is removed.

86000-series ultrasonic anemometers are manufactured by RM Young.

Before using the ultrasonic anemometers, please study:

- Section 2, *Initial Inspection*

2. Initial Inspection

- The 86000-series ultrasonic anemometers ships with an orientation ring and bird wire (86004 option).
- Upon receipt of the 86000-series ultrasonic anemometers inspect the packaging and contents for damage. File any claims with the shipping company. Contact Campbell Scientific to facilitate repair or replacement.
- Immediately check package contents against shipping documentation. Thoroughly check all packaging material for product that may be trapped inside. Contact Campbell Scientific immediately about any discrepancies. Model numbers are found on each product. On cables, the model number is often found at the connection end of the cable. Check the correct lengths of cables are received.

3. Specifications

Table 3-1 86000-series Specifications				
Specification		86000	86106	86004
Wind Speed	Range	0-70 m/s (156 mph)		
	Resolution	0.01 m/s		
	Accuracy	0 to 30 m/s $\pm 2\%$ or 0.1 m/s 30 to 70 m/s $\pm 3\%$		
Wind Direction	Azimuth Range	0-360 degrees		
	Resolution	0.1 degrees		
	Accuracy	± 2 degrees		
Serial Output (Selectable)	Interface Type	RS-232 or RS-485/422		
	Formats	ASCII Text (polled and continuous) RMYT (YOUNG Wind Tracker) NMEA		
	Baud Rates	1200, 4800, 9600, and 38400		
Analog Output (Selectable)	Polar Speed	0-5000mV or 4-20 mA (0 to 100 m/s)		
	Polar Direction	0-5000mV or 4-20 mA (0 to 360° or 0 to 540°)		
	Cartesian UV	0-5000mV or 4-20 mA (-100 m/s to +100 m/s)		
General	Output Rate	0.1-20 Hz, 1 Hz typical		
	Power Supply	10 to 30 VDC, 20 mA typical, 85 mA max		
	Protection Class	IP65		
	Dimensions	34 cm high x 17 cm wide		
	Weight	0.7 kg (1.5 lb.)		
	Shipping Weight	1.6 kg (3.5 lb.)		
Heater	Power Supply			24 VDC, 2.5 A

4. Installation

4.1 Siting

Proper instrument placement is important. Eddies from buildings, trees, or other structures can influence measurements. For most applications, locate the sensor well above or upwind of obstructions. As a general rule, air flow around a structure is distributed to 2 times the height of the structure upwind, 6 times the height downwind, and up to 2 times the height of the structure above ground.

4.2 Mounting

Mount the sensor to standard 1-inch (IPS) pipe that has an outside diameter of 1.34 inches (34 mm).

Most applications require aligning the sensor to geographic north (0 degrees). In this orientation, the sensor junction box faces south (180 degrees). See figures 4-1 and 4-2.

1. Place orientation ring over pipe with guide pin up.
2. Place sensor mounting post over pipe.
3. Using the transducers as a sighting aid, align the sensor with a feature on the horizon that represents the proper orientation. After alignment, tighten the mounting post band clamp to secure the position.

Note

Do not over tighten.

4. Slide the orientation ring up so its guide pin is fully engaged in the sensor mounting post notch. Tighten the orientation ring band clamp to secure its position.

Note

Do not over tighten.

If the sensor needs to be removed later, leave the orientation ring on the pipe to preserve sensor alignment.

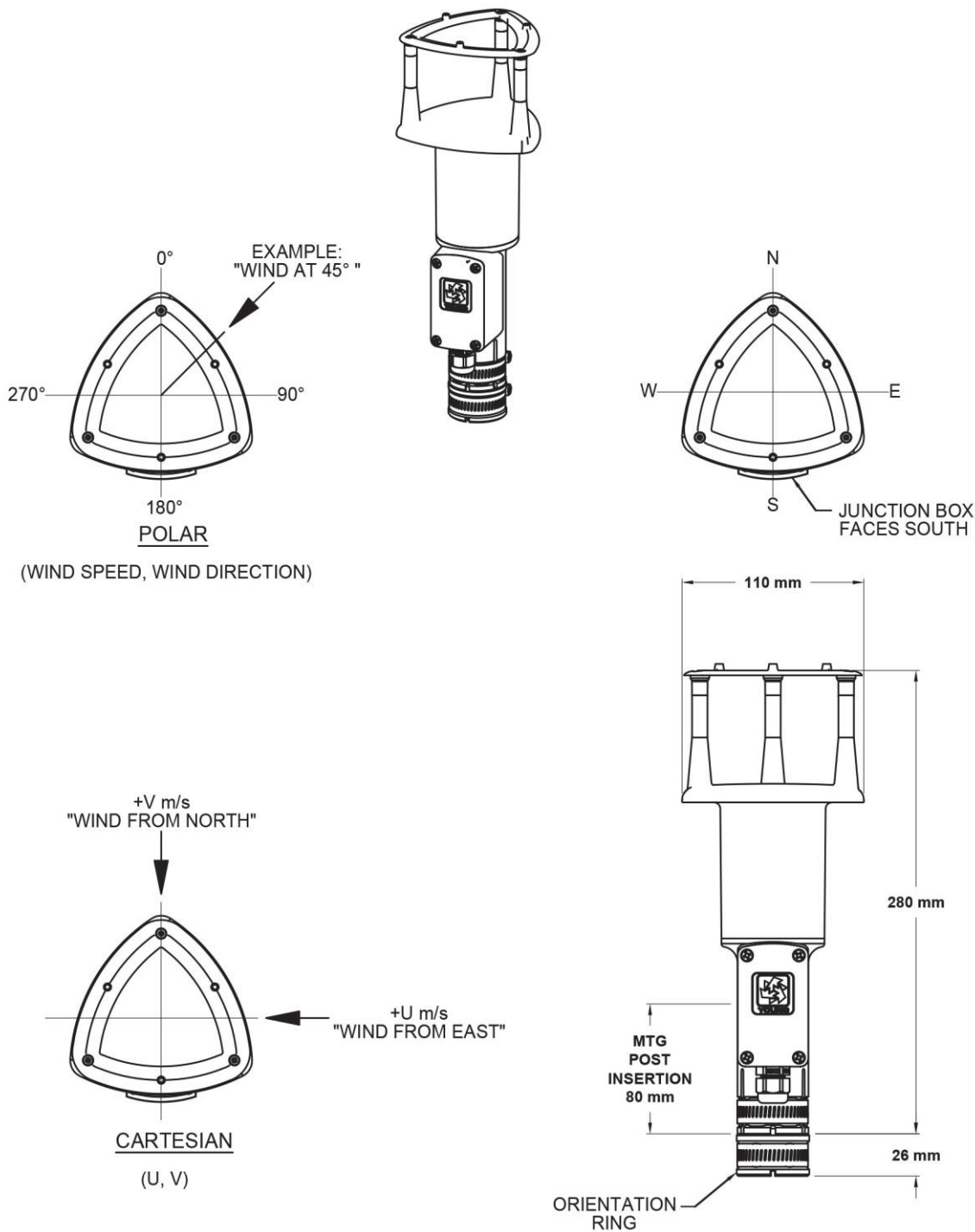


Figure 4-1 86000 and 86106 Sensor Orientation

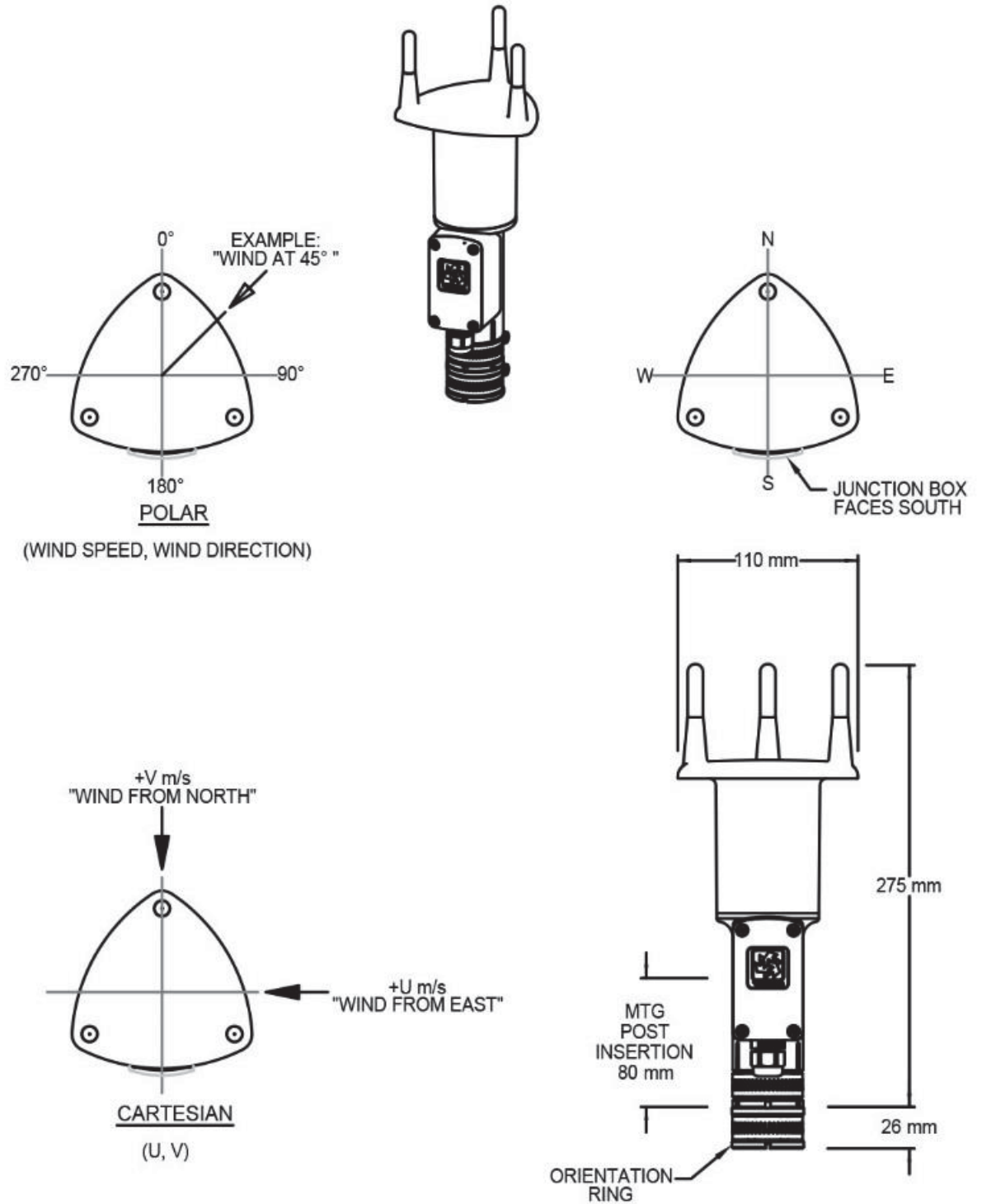


Figure 4-2 86004 Sensor Orientation

4.3 Wiring

Table 4-1 86000 and 86106 Connections to Campbell Scientific Dataloggers - Voltage and RS-232 Outputs				
	Voltage Output		RS-232 Output	
Color	Function	CR1000 CR800 CR3000	Function	CR1000 CR800 CR3000
Red	Power +	+12 V	Power +	+12 V
Black	Power ground	G	Power ground	G
Green	Wind speed	SE Analog	TX Transmit data	Control Port C (even)
Blue	Reference signal	⏏	Reference signal	⏏
White	Wind direction	SE Analog	RX Receive data	Control Port C (odd)
Clear	Shield	⏏	Shield	⏏
Anemometer jumper settings: VI1.Y, VI2.Z, TX, RX				

Table 4-2 86000 and 86106 Connections to Campbell Scientific Dataloggers; RS-485 Output			
Color	Function	CR1000 CR800 CR3000	SDM-SI01 Device
Red	Power +	+12 V	-
Black	Power ground	G	-
Blue	Sensor TX (z non-inverted signal)	-	B
Yellow	Sensor TX (y non-inverted signal)	-	A
Green	Sensor RX (b non-inverted signal)	-	Z
White	Sensor RX (a non-inverted signal)	-	Y
	Signal Reference	-	⏏
Clear	Shield	⏏	-
Anemometer jumper Settings: Z, Y, A, B			

Table 4-3 86004 Connections to Campbell Scientific Dataloggers - Voltage and RS-232 Outputs

Voltage Output			RS-232 Output	
Color	Function	CR1000 CR800 CR3000	Function	CR1000 CR800 CR3000
Red	Power +	+24 V	Power +	+24 V
Black	Power ground	G	Power ground	G
White	Wind speed	SE Analog	TX Transmit data	SE Analog
Brown	Reference signal	⏏	Reference signal	⏏
Green	Wind direction	SE Analog	RX Receive data	SE Analog
Clear	Shield	⏏	Shield	⏏
Anemometer jumper settings: VI1.Y, VI2.Z, TX, RX				

Table 4-4 86004 Connections to Campbell Scientific Dataloggers; RS-232 Output

Color	Function	CR1000 CR800 CR3000	Function
Red	Power +	+24 V	-
Black	Power ground	G	-
White	Sensor TX (z non-inverted signal)	-	B
Blue	Sensor TX (y non-inverted signal)	-	A
Green	Sensor RX (b non-inverted signal)	-	Z
Orange	Sensor RX (a non-inverted signal)	-	Y
Brown	Signal Reference	-	⏏
Clear	Shield	⏏	
Jumper Setings: Z, Y, A, B			

4.3.1 Configuring 86000-series to RS-232/RS-485 ASCII for Polled and Continuous Modes

Download 86SETUP software from RM Young Website:

<http://www.youngusa.com/products/6/71.html>

To configure connect a C2096 interface cable from sensor to the computer

Green wire - TX

White wire - RX

Black wire - Ref

Connect power from logger:

"+" on sensor - Red - 12V on logger

"-" on sensor - Black - G

Open 86SETUP, Select 38400 Baud and correct COM port for communication

Hit the Acquire Sensor Button THEN turn power on

Once sensor has been acquired go to the SET-UP tab

Use drop down menu to select either ASCII or ASCII POLLED

Note ASCII POLLED must use the full duplex output mode to receive polling.

Set Baud rate to 38400

Send Parameters and disconnect from software, wire RX and TX to datalogger

Note You may need to reboot power to the sensor and re-open LoggerNet to re-establish communication to the datalogger.

4.4 Datalogger Programming

4.4.1 86000 and 86106

4.4.1.1 Voltage Output

```
'=====Constants=====
'To change constants go to TOOLS --> CUSTOMIZED CONSTANTS

'Start of Constants Customization Section
'Program Scan Rate
Const Scan_Rate = 5
'End of Constants Customization Section

'===== Declarations=====
Public Battery_Voltage      'Battery Voltage
Units Battery_Voltage = Volts

Public Panel_Temperature    'Panel Temperature
Units Panel_Temperature =Deg C

Public Wind_Speed
Units Wind_Speed = m/s

Public Wind_Direction
```

```

Units Wind_Direction= Deg

'===== Data Tables=====

' One minute data table
DataTable(Minute,True,-1)
  DataInterval(0,1,Min,10)
WindVector (1,Wind_Speed,Wind_Direction,FP2,False,0,0,0)
FieldNames ("Wind_Speed_m_s,Wind_Direction_deg,_Wind_Dir_STD")
EndTable

'=====Main Program=====
BeginProg
  'Main Scan
  Scan(Scan_Rate,Sec,1,0)
  'Default Datalogger Battery Voltage measurement 'BattV'
  Battery(Battery_Voltage)
  'Default Wiring Panel Temperature measurement 'PTemp_C'
  PanelTemp(Panel_Temperature,_60Hz)
  VoltSe (Wind_Speed,1,mV5000,1,1,0,_60Hz,0.02,0)
  VoltSe (Wind_Direction,1,mV5000,2,1,0,_60Hz,0.072,0)
  'Call Data Tables and Store Data
  CallTable(Minute)

  NextScan
EndProg

```

4.4.1.2 RS-232 Output

```

'RM Young 86000/86106 Wind Anemometer, SN: ***, RS-232, Address: 0

'=====Constants=====
'To change constants go to TOOLS --> CUSTOMIZED CONSTANTS

'Start of Constants Customization Section
'Program Scan Rate
Const Scan_Rate = 5
'End of Constants Customization Section

'===== Declarations=====

Public Battery_Voltage      'Battery Voltage
Units Battery_Voltage = Volts

Public Panel_Temperature    'Panel Temperature
Units Panel_Temperature =Deg C

Public RMY86000 (4) As Float
'Note: The first value returned from string is the Sensors Address, defaulted at 0
Alias RMY86000(2) = Wind_Speed
Alias RMY86000(3) = Wind_Direction
Alias RMY86000(4) = Status86004
Units Wind_Speed = m/s
Units Wind_Direction= Deg

Public Serial86000 As String *25
Public NBytesReturned

'===== Data Tables=====

```



```

' One minute data table
DataTable(Minute,True,-1)
  DataInterval(0,1,Min,10)
  Sample (4,RMY86000(),IEEE4)
EndTable

'=====Main Program=====
BeginProg

  SerialOpen (Com1,38400,0,0,10000)

  'Main Scan
  Scan(Scan_Rate,Sec,1,0)
  'Default Datalogger Battery Voltage measurement 'BattV'
  Battery(Battery_Voltage)
  'Default Wiring Panel Temperature measurement 'PTemp_C'
  PanelTemp(Panel_Temperature,_60Hz)

  'Serial Instruction for ASCII polled mode, do not use SerialOut instruction is using
  'in continuous mode
  'M0! is the command to tell the sensor to poll, where M is the Measurement Command
  ' and the default address but can be changed if desired using the RM Young 86SETUP
  'software
  'CHR(13) is ASCII code for carriage return signifies end of string
  SerialOut (Com1,"M0!" + CHR(13)," ",0,100)
  'SerialIn instruction is used for both polled and continuous mode
  SerialIn (Serial86000,Com1,10,CHR(13),200)
  'Split the values returned from the sensor into their own locations
  'splits wind speed, wind dir, and status into their own places
  SplitStr (RMY86000(),Serial86000," ",4,0)
  'SerialFlush clears the buffer. It is important to clear the buffer, if this instruction
is
  'not included NAN values will occur once the maximum number of characters is reached
  SerialFlush (Com1)

  'Call Data Tables and Store Data
  CallTable(Minute)

  NextScan
EndProg

```

4.4.1.3 RS-485 Output with SBD-SI01

```

'SDM-SI01, RS-485- RS-232 Converter, Address: 0, Serial Port: 32

'=====Constants=====
'To change constants go to TOOLS --> CUSTOMIZED CONSTANTS

'Start of Constants Customization Section
'Program Scan Rate
Const Scan_Rate = 5

Const SensorPort = 32 'Declare the serial port the sensor is set to
'The sensors address switch should be set to position 0 which correlates to SensorPort 32
'End of Constants Customization Section

'===== Declarations=====

Public Battery_Voltage      'Battery Voltage
Units Battery_Voltage = Volts

Public Panel_Temperature    'Panel Temperature
Units Panel_Temperature =Deg C

Public ChkValReturned 'value returned by the SerialInChk function
Public AvailableData 'amount of data in the SDM-SI01s buffer at present

```

```

Public Serial86000 As String * 100 'string where the data from the logger is stored
'Public ConvertedValue As Float 'floating point value returned by sensor

Public RMY86000 (4) As String
'Note: The first value returned from string is the Sensors Address, defaulted at 0
Alias RMY86000(2) = Wind_Speed
Alias RMY86000(3) = Wind_Direction
Alias RMY86000(4) = Status86004
Units Wind_Speed = m/s
Units Wind_Direction= Deg

'===== Data Tables=====

' One minute data table
DataTable(Minute,True,-1)
    DataInterval(0,1,Min,10)
    Sample (4,RMY86000()),IEEE4)
EndTable

'=====Main Program=====
BeginProg
'Open serial port to RS-485 mode, 115200bps, 8-bit data, 1 stop bit and no parity
'note that the 'SerialOpenFormat' parameter is 19 for RS-485 mode
SerialOpen (SensorPort,38400,19,0,10000)

'Main Scan
Scan(Scan_Rate,Sec,1,0)
'Default Datalogger Battery Voltage measurement 'BattV'
Battery(Battery_Voltage)
'Default Wiring Panel Temperature measurement 'PTemp_C'
PanelTemp(Panel_Temperature,_60Hz)

'Serial Instruction for ASCII polled mode, do not use SerialOut instruction is using
'in continuous mode
'M0! is the command to tell the sensor to poll, where M is the Measurement Command
' and the default address but can be changed if desired using the RM Young 86SETUP
'software
'CHR(13) is ASCII code for carriage return signifies end of string
SerialOut (SensorPort,"M0!" + CHR(13)," ",0,100)
'wait for the sensor to respond using a loop this time - this may be useful if there
'is not a predictable response from the sensor.
Do
    ChkValReturned = SerialInChk (SensorPort) 'Get available data
    AvailableData = ChkValReturned AND 4095 'mask off the input pin flag (bit 16)
Loop Until AvailableData <> 0 'wait until data is available

'SerialIn instruction is used for both polled and continuous mode
SerialIn (Serial86000,SensorPort,60,CHR(13),200)
'Split the values returned from the sensor into their own locations
'splits wind speed, wind dir, and status into their own places

'Now there would be code to read the data out of the ReturnedData string and either
store
'it as strings or convert the string into number(s).
SplitStr (RMY86000(),Serial86000," ",4,0)
'SerialFlush clears the buffer. It is important to clear the buffer, if this instruction
is
'not included NAN values will occur once the maximum number of characters is reached
SerialFlush (SensorPort)

'Call Data Tables and Store Data
CallTable(Minute)

NextScan
EndProg

```

4.5 Setting Outputs and Operating Parameters

Note	The Young 86SETUP 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.
-------------	--

4.5.1 Sensor Configuration with 86SETUP Program

The Young 86SETUP 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 PC and follow instructions that appear on the program screen to retrieve current sensor settings or send new settings

4.5.2 Sensor Configuration using a General Purpose Communication 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 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 A-3, Appendix A).

Factory default sensor baud rate is 9600, but may be set to 1200, 4800, or 38400. Configure the serial communications program for NO handshaking and 1 start, 8 data, 1 stop bit.

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 ESC characters, re-check wiring and communication program setup. If the sensor baud rate is unknown, try sending the ESC characters at each of the four available baud rates (1200, 4800, 9600, 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.

4.5.3 Command Overview

After the '>' prompt appears, send '??' to display a list of available commands. Sent 'RPTV' to report current settings.

Note

Some of the 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.

4.5.4 Command Details

SET01nn	Set OUTPUT Mode
01	Enable voltage output
03	Enable current output
04	Enable RS-232
08	Enable RS-485 output only
16	Enable RS-485 half duplex
24	Enable RS-485 full duplex
SET02n	Set OUTPUT FORMAT
1	RMYT
2	ASCII
3	ASCII POLLED
4	NMEA
SET03nn	Set BAUD RATE
12	1200
48	4800
96	9600
38	38400
SET04n	Set ASCII WS UNITS
1	MPH
2	KNOTS
3	KMPH
4	M/S
SET05c	ASCII character sensor address (0-9, A-Z, a-z)
SET06nnnn	Wind speed threshold for polar output (cm/s)
SET07nnnnn	Wind speed scale (nnnnn/10000)
SET08nnnnn	Direction offset (\pm nnnnn degrees x 10)
SET09nn	Damping Factor

SET10nnnn	Output interval (0-9999 milliseconds)
SET11nn	Direction (VOUT) (36=0-360, 54=0-540 degrees)
SET12nnn	Sample count (3 to 200)
SET13n	Wind output format (0/1=Polar/UV)
SET14n	Analog error code (1/2/3=None/Lo/Hi)
SET15n	ASCII serial resolution (0/1=Lo/Hi)
SET16n	Force analog out (0/1/2=Lo/Mid/Hi)
SET77	SAVE SETTINGS
XX	Go to OPERATE MODE
RPT	Report parameter settings
??	Command Help list

4.5.4.1 SET01nn Set Output Mode

This enables and disables 0-5000 mV output, 4-20 mA current output, RS-232, and RS-485. Only one of the two analog output types (voltage or current) may be enabled at one time. Both RS-232 and RS-485 can be enabled at the same time, but only one serial output may be used.

Add together values shown in Section 6.5.4 *Command Details* (SET01) to configure multiple compatible modes. For example, to enable voltage output and RS-232, add the code for each one: 01 + 04 = 05, SET0105. To enable only RS-232, SET0104.

To conserve power, enable only those modes that are needed.

4.5.4.2 SET02n Output Format

This parameter determines the serial output format.

4.5.4.3 SET03nn Baud Rate

Sets the baud rate for RS-232 and RS-485 serial communication. Make sure this baud rate is the same as the connected device.

4.5.4.4 SET04n ASCII and NMEA Wind Speed Units

Sets wind speeds for polar ASCII, ASCII POLLED, and NMEA serial outputs.

4.5.4.5 SET05c Poll Address Character

Sets the sensor address for ASCII POLLED serial format. The default is '0' (ASCII 48). This is the address recognized when the 'Ma!' polling command is received ('a' is the address character). Valid address characters include 0-9, A-Z, and a-z.

4.5.4.6 SET06nn Wind Speed Threshold

Sets the wind speed threshold for polar outputs (wind speed and direction) to minimize erratic wind direction indications at very low wind speeds. This allows the sensor output to mimic a mechanical wind vane that retains its orientation when there is no wind.

Wind below the threshold is reported as zero, while the wind direction angle is held at the last value when wind speed was above threshold. Set threshold in centimeters per second (m/s x 100). The default setting is 25 cm/s (0.25 m/s, 0.56 mph).

4.5.4.7 SET07nnnnn Wind Speed Multiplier

All wind speed measurements are multiplied by this parameter. The default value is 10000 for a multiplier of 1.0000.

4.5.4.8 SET08nnnnn Wind Direction Offset

Use this parameter to add or subtract a wind direction offset. Value is degrees x 10 and may be positive or negative. Wind direction is always re-scaled to a 0-360 range after offset is applied. The default value is 00000.

4.5.4.9 SET09nn Damping Factor

Wind measurement outputs are damped using the following formula:

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

where:

S_{damped}	= New or last damped wind speed
S_{sample}	= New wind speed speed
d	= Damping factor

The 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.

4.5.4.10 SET10nnnn Output Interval

Sets the time interval between measurements in one millisecond increments. Lower values increase power consumption when continuous measurements are taken.

4.5.4.11 SET11nn Analog Direction Scale

Sets wind direction analog output scale to 0-360 or 0-540 degrees. Use the 0-540 scale whenever possible to avoid full-scale analog output swings between 0 and 360 in variable north wind. (Data loggers or display systems may otherwise obtain samples midpoint during these transitions causing erroneous readings.)

Logged data in 0-540 form may be re-scaled to 0-360 by subtracting 360 degrees from any value greater than or equal to 360. The default parameter setting is 0-360 for systems that cannot re-scale the 0-540 output.

4.5.4.12 SET12nnn 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.

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.

4.5.4.13 SET13n ASCII and Analog Output Format

This setting determines whether ASCII and ASCII POLLED serial outputs and analog outputs provide wind data in either Polar (speed and direction) or Cartesian (UV) form.

4.5.4.14 SET14n Analog Output Status

Serial ASCII and ASCII POLLED formats report a STATUS CODE where non-zero values indicate insufficient samples or measurement error. SET14n determines how the STATUS CODE is indicated by the analog output.

4.5.4.15 SET15n ASCII Resolution

Sets low or high wind speed and direction resolution.

4.5.4.16 SET16n Force Analog Output

This command forces both analog output channels to LO, MID, or HI scale. This may be used to calibrate or check the operation of externally connected analog measurement devices.

4.5.4.17 SET77 Save Settings

Use this command to save current parameter 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.

4.5.4.18 XX, RPTV, and ??

XX	Returns the sensor to OPERATE MODE.
RPT	Reports the current parameter settings.
??	Shows a list of commands.

5. Operation

5.1 Analog Outputs

As supplied, the sensor is configured for VOLTAGE OUTPUT, Wind Speed, and Wind Direction. The sensor may also be set up for 4-20 mA CURRENT output by changing internal settings. See Section 6.5 for details.

Analog VOLTAGE or 4-20 mA CURRENT outputs may be connected to a datalogger or other device such as a YOUNG 26800 Meteorological Translator. See Appendix A for connection details.

Analog outputs may be used simultaneously with RS-232 serial connection. RS-485 serial output may not be used simultaneously with analog outputs since they share connection terminals in the junction box.

Analog outputs may be configured for either Polar (speed and direction) or Cartesian (UV) output format.

For voltage output with cable lengths greater than 3 m (10 ft.), measure the signal differentially. Current output signals may be measured single-ended.

5.2 Use with Young Wind Tracker Display (86000 and 86004)

The factory default serial output format is RMYT, which is compatible with the YOUNG Model 06201 Wind Tracker display. Set the Wind Tracker input to 'INP 09' and connect as shown in the wiring diagram (Figure A-5 – Appendix A). Note that jumpers need to be moved so the RS-485 output is available at the connection terminals. Wind speed and direction measurements appear on the Wind Tracker display. See the Wind Tracker manual for display options and other details.

5.3 Use with Young 06206 Marine Wind Tracker Display (86103)

The NMEA serial output format is compatible with the YOUNG Model 06206 Marine Wind Tracker display. Set the Wind Tracker input to 'INP SER' and connect as shown in the wiring diagram (Figure A-6, Appendix. A). Note jumper configuration: Wind speed and direction measurements appear on the Wind Tracker display. See the Wind Tracker manual for display options and other details.

5.4 Serial Output Formats

Available serial output formats include RMYT, ASCII, ASCII polled, and NMEA. The factory default format for 86000 and 86004 is RMYT for use with the YOUNG Wind Tracker display. The factory default format for 86106 is NMEA. Other formats may be selected using the 86SETUP program described in Section 6.5.

5.4.1 RMYT

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

5.4.2 ASCII

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

ASCII out appears either in POLAR (default) or CARTESIAN (UV) format. With POLAR format, the wind speed threshold, wind speed units, and resolution 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.w ddd ss*cc<CR>	Low resolution
a www.ww ddd.d ss*cc<CR>	High resolution

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.

5.4.3 ASCII Polled

ASCII POLLED is like ASCII format described above, except only 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).

5.4.4 NMEA

NMEA format provides continuous wind measurements in standard NMEA marine sentences at 4800 baud. Use RS-485 OUTPUT ONLY serial output mode with YOUNG Model 06206 Marine Wind Tracker or other NMEA-capable device.

NMEA Format

\$WIMWV,ddd,R,www.w,N,A*cc<CR><LF>

where

ddd

=Wind direction (degrees)

www.w

=Wind speed (knots)

*

=Asterisk (ASCII 42)

cc

=Checksum

<CR><LF>

=Carriage return, line feed (ASCII 13, 10)

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

5.5 Low Power Operation

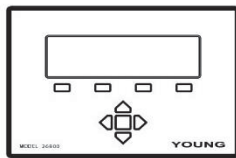
Average current consumption with default settings is about 20 mA. This configuration uses minimal power and enables all features even though they may not be used. This is suitable for many low power applications.

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.

Appendix A. Wiring Connections

A.1 86000 Wiring Connections

Fig. A1: VOLTAGE OUTPUT



Model 26800 Translator, Datalogger, or other voltage measuring device

SETTINGS

Output Mode:

VOUT

WD Output Scale: 0-360 or 0-540 degrees

Wind Format: Polar or UV

Analog Output Error Code: None, Low, or High

CALIBRATION:

Polar Wind Speed: 0 to 5000 mV

0 to 100 m/s

Wind Direction: 0 to 360° or 0 to 540°

U or V: -100 m/s to +100 m/s

For best accuracy measure output voltage differentially as shown. Use shielded cable. Connect cable shield to earth ground as shown.



Model 86000 / 86106 Ultrasonic Anemometer

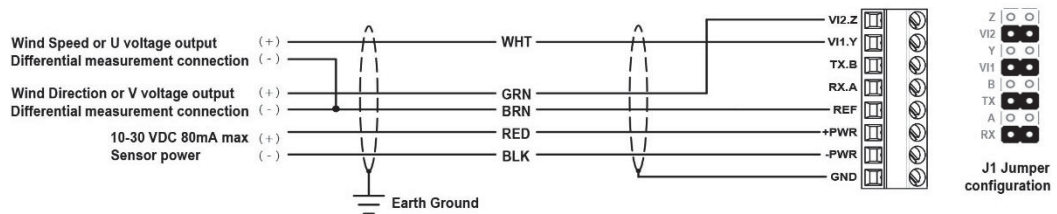
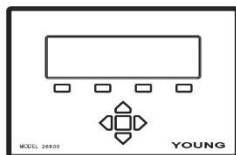


Fig. A2: 4-20 mA CURRENT OUTPUT



Model 26800 Translator, Datalogger, or other current measuring device

SETTINGS

Output Mode:

IOUT

WD Output Scale: 0-360 or 0-540 degrees

Wind Format: Polar or UV

Analog Output Error code: None, Low, or High

CALIBRATION:

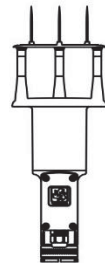
Polar Wind Speed: 4.00 to 20.00 mA

0 to 100 m/s

Wind Direction: 0 to 360° or 0 to 540°

U or V: -100 m/s to +100 m/s

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



Model 86000 / 86106 Ultrasonic Anemometer

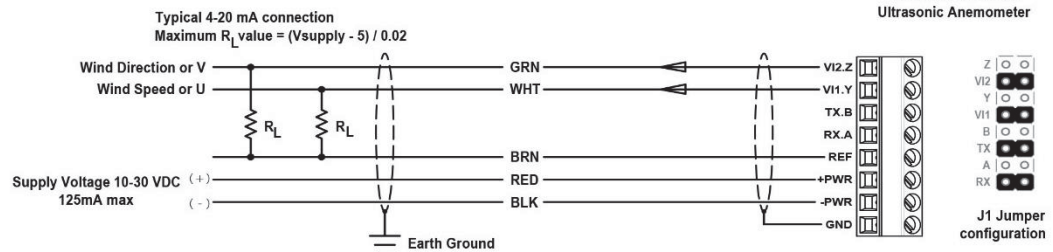


Fig. A3: RS-232 SERIAL CONNECTION

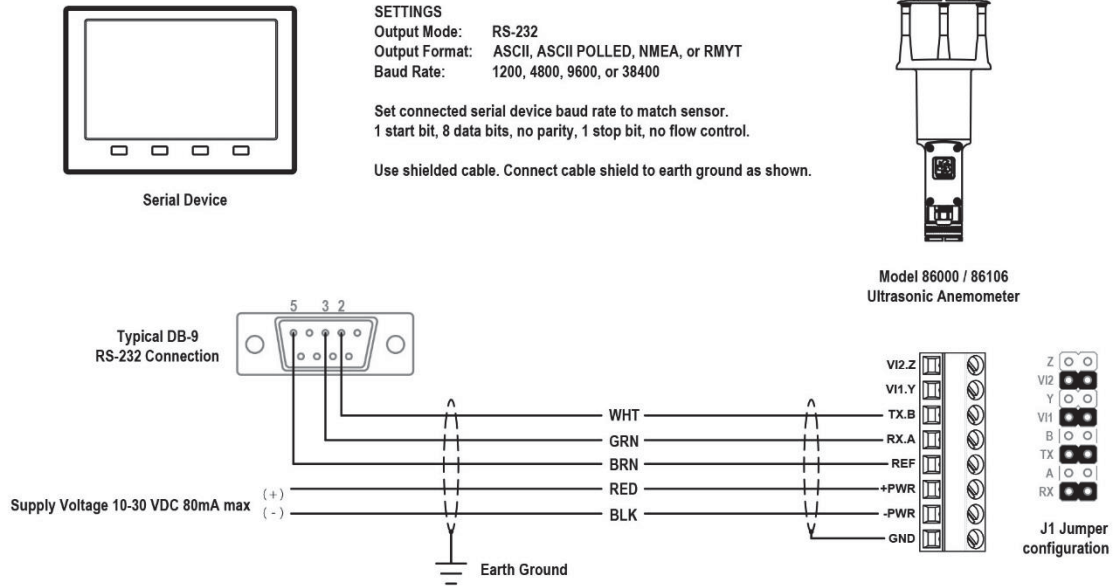
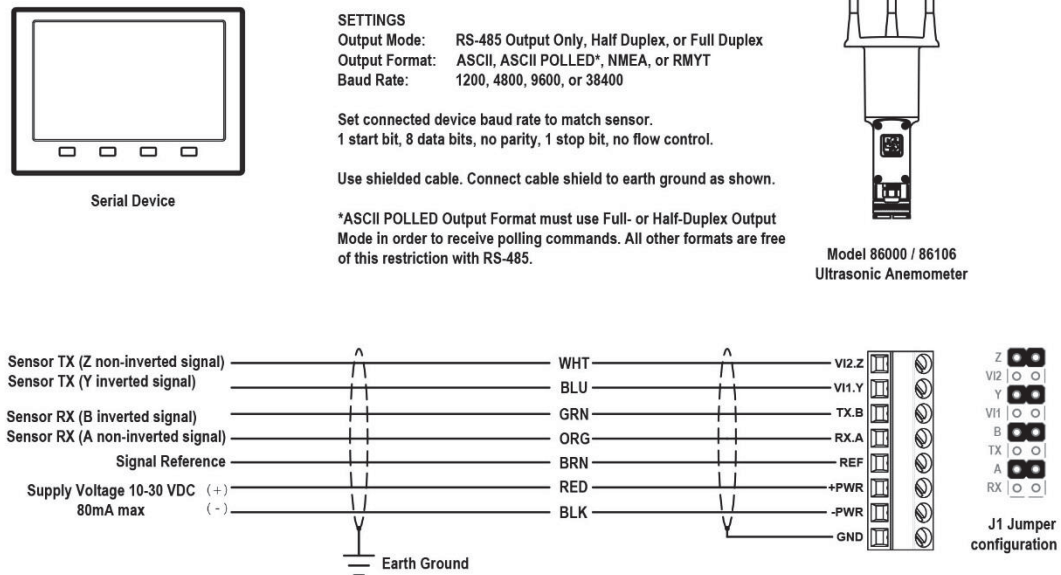


Fig. A4: RS-485 SERIAL CONNECTION



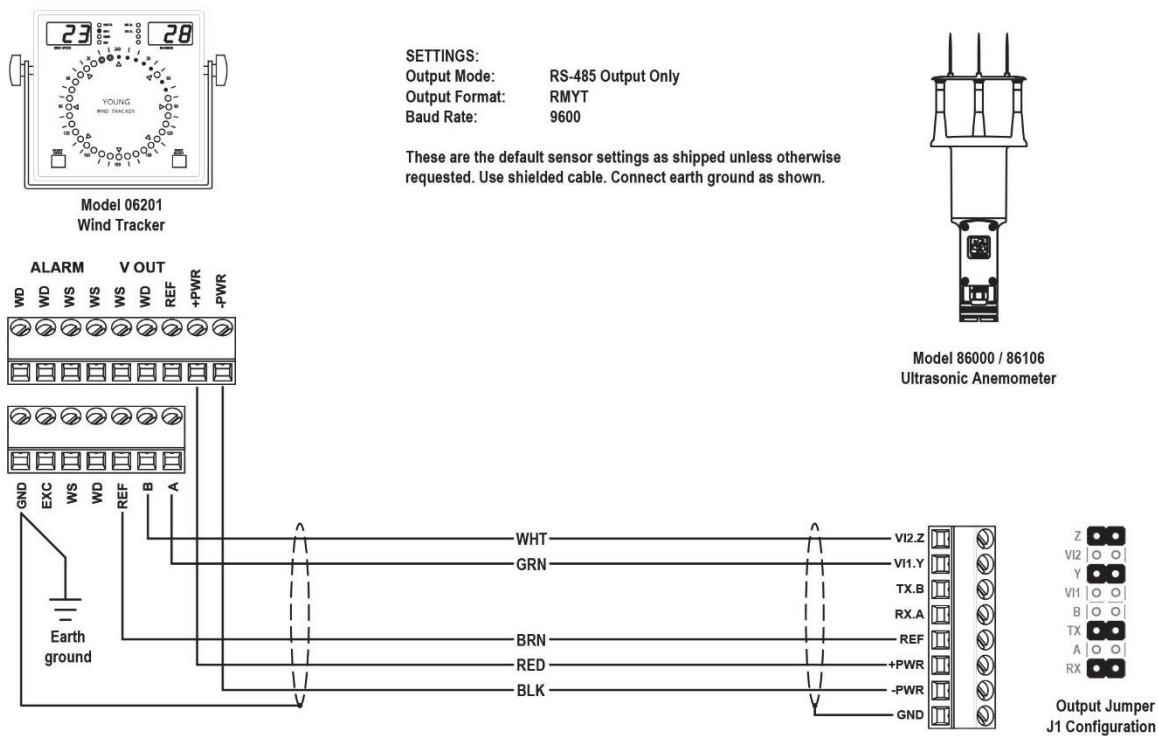
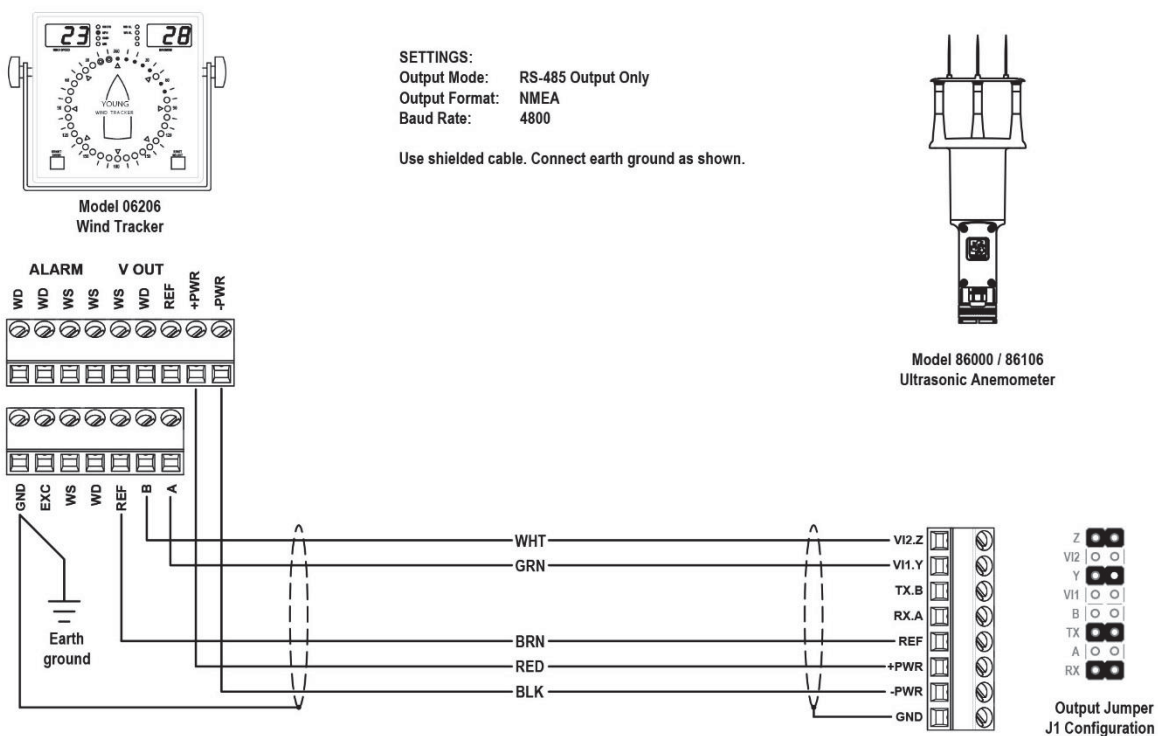
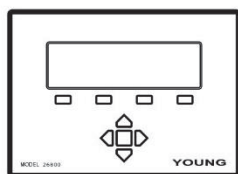


Fig. A6: 06206 MARINE WIND TRACKER



A.2 86004 Wiring Connections



Model 26800 Translator, Datalogger,
or other voltage measuring device

SETTINGS

Output Mode:

VOUT

WD Output Scale: 0-360 or 0-540 degrees

Wind Format: Polar or UV

Analog Output Error Code: None, Low, or High

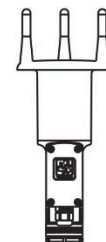
CALIBRATION: 0 to 5000 mV

Polar Wind Speed: 0 to 100 m/s

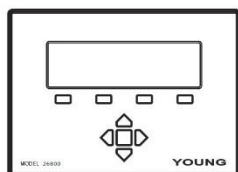
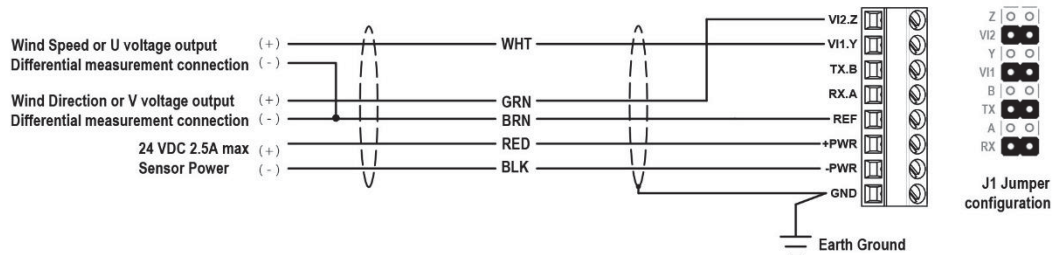
Wind Direction: 0 to 360° or 0 to 540°

U or V: -100 m/s to +100 m/s

For best accuracy measure output voltage differentially as shown. Use shielded cable. Connect cable shield to earth ground as shown.



Model 86004
Ultrasonic Anemometer



Model 26800 Translator, Datalogger,
or other current measuring device

SETTINGS

Output Mode:

IOUT

WD Output Scale: 0-360 or 0-540 degrees

Wind Format: Polar or UV

Analog Output Error code: None, Low, or High

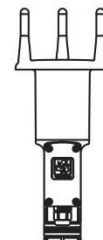
CALIBRATION: 4.00 to 20.00 mA

Polar Wind Speed: 0 to 100 m/s

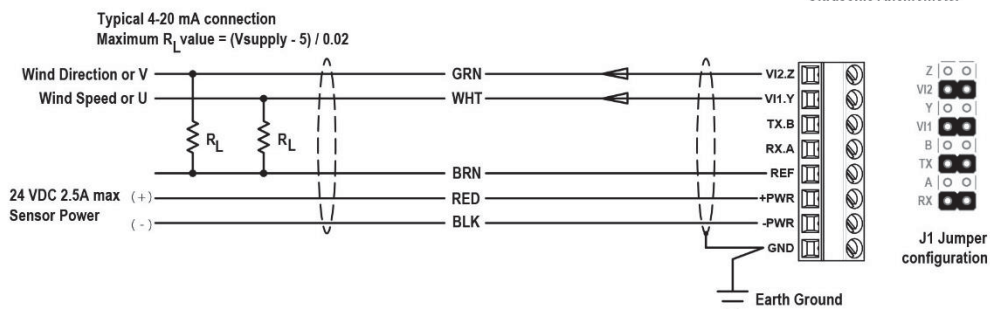
Wind Direction: 0 to 360° or 0 to 540°

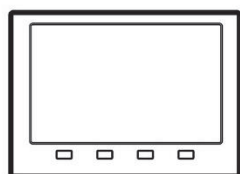
U or V: -100 m/s to +100 m/s

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



Model 86004
Ultrasonic Anemometer





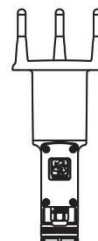
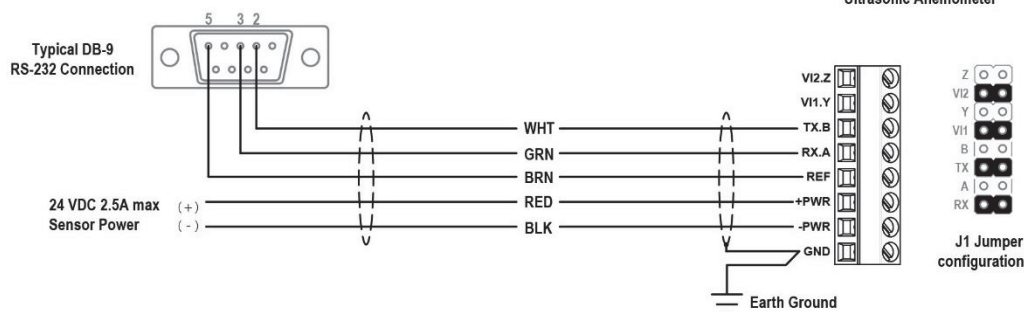
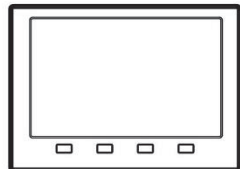
Serial Device

SETTINGS

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

Set connected serial device baud rate to match sensor.
 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.

Model 86004
Ultrasonic Anemometer**Fig. A4: RS-485 SERIAL CONNECTION**

Serial Device

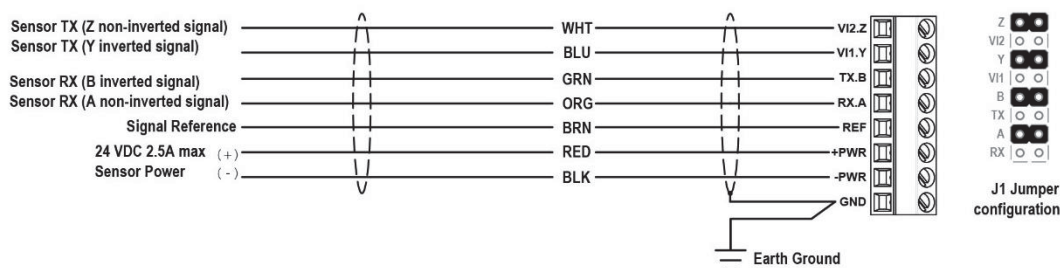
SETTINGS

Output Mode: RS-485 Output Only, Half Duplex, or Full Duplex
 Output Format: ASCII, ASCII POLLED*, NMEA, or RMYT
 Baud Rate: 1200, 4800, 9600, or 38400

Set connected device baud rate to match sensor.
 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.

*ASCII POLLED Output Format must use Full- or Half-Duplex Output Mode in order to receive polling commands. All other formats are free of this restriction with RS-485.

Model 86004
Ultrasonic Anemometer

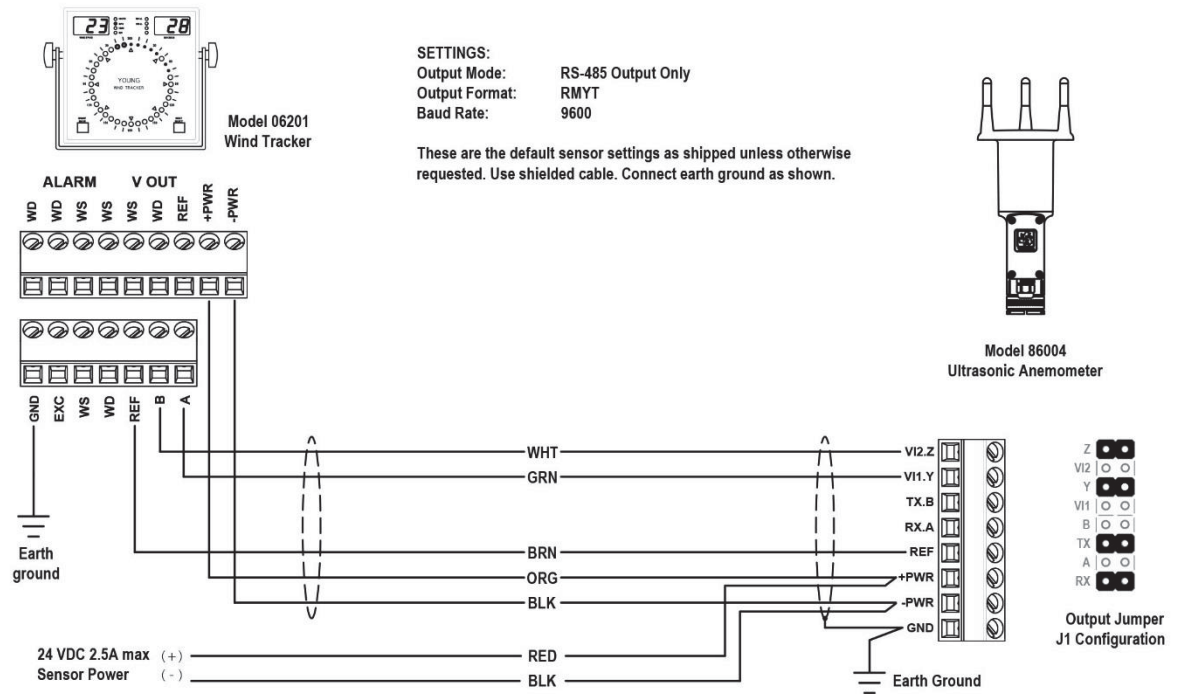
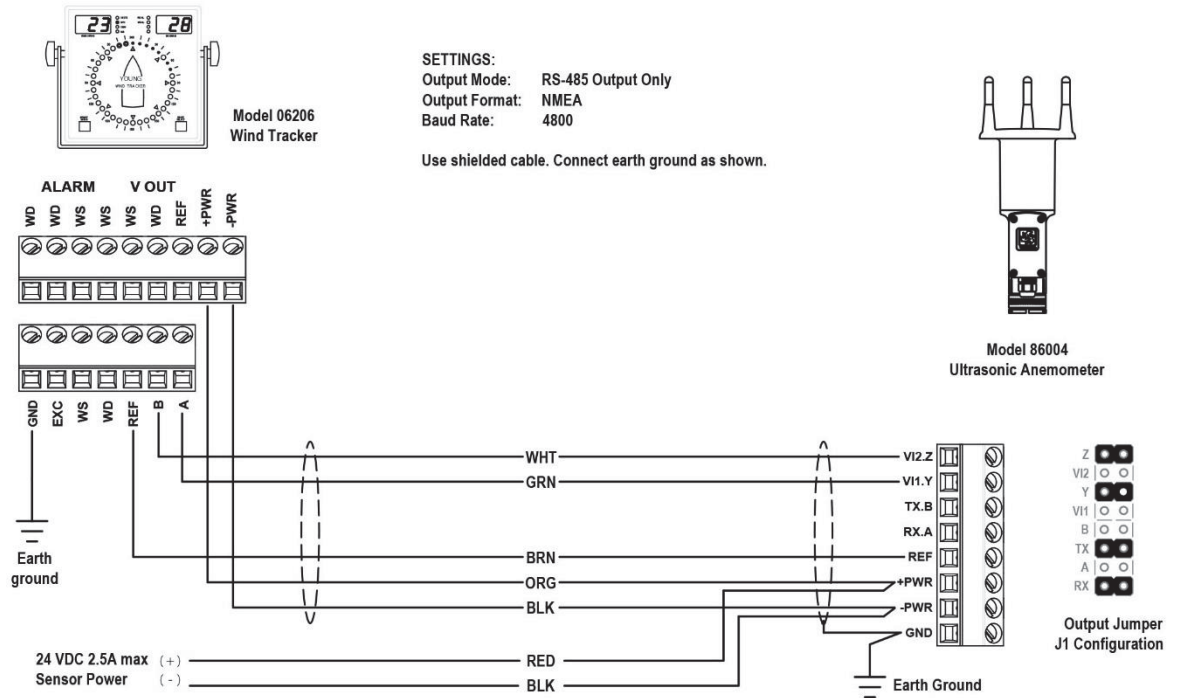


Fig. A6: 06206 MARINE WIND TRACKER



Appendix B. Example Settings

Suggested settings. Not all possible setting combinations are shown. Using YOUNG 86SETUP program for changing parameters is recommended.

86000:

Factory Default

RS-232	Enabled
RS-485 Output Only	Enabled
Voltage Output:	Enabled
Current Output:	Disabled
Serial Output Format:	RMYT
Output Interval:	250
Sample Count:	16

Minimum Power

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

4-20 mA Output

RS-232	Enabled
RS-485	Disabled
Voltage Output:	Disabled
Current Output:	Enabled
Output Interval:	1000
Sample Count:	50

RS-485 Polled ASCII Output

RS-232	Enabled
RS-485	Enabled
Voltage Output:	Disabled
Current Output:	Disabled
Serial Output Format:	ASCII Polled
Sample Count:	50

High Winds

Output Delay:	1000
Sample Count:	200

