

MODEL 85000
ULTRASONIC ANEMOMETER



REV B102804



OPERATING INSTRUCTIONS

Model 85000 Ultrasonic Anemometer

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MODEL 85000 ULTRASONIC ANEMOMETER



1.0 SPECIFICATIONS

WINDSPEED

Range: 0-70 m/s (156 mph)
 Resolution: 0.1 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: 1 degree
 Accuracy: ± 2 degrees

SERIAL OUTPUT

Type: RS-232
 RS-485 full and half duplex
 SDI-12
 Formats: ASCII Text (polled and continuous)
 RMYT (Wind Tracker)
 NMEA
 SDI-12 (v1.3)
 Baud Rates: 1200, 4800, 9600, and 38400 baud

ANALOG OUTPUT

Wind Speed: 0 to 5000 mV (0 to 100 m/s)
 Wind Direction: 0 to 5000 mV (0 to 360° or 0 to 540°)

GENERAL

Output rate: 1 Hz typical (selectable)
 Power Supply: 9 to 16 VDC, 30 mA average typical
 320 μ A in standby mode
 Dimensions: 34 cm high x 17 cm wide
 Weight: 0.7 kg (1.5 lb)
 Shipping Weight: 1.6 kg (3.5 lb)

2.0 INTRODUCTION

The WS-85000 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. Analog and digital signal outputs are available in several popular formats.

The 85000 measures wind based on the transit time of ultrasonic pulses between four transducers. Air flow alters the transit time which is used to calculate flow velocity. Wind direction is determined from relative velocities along each acoustic path.

Measurement results are available as calibrated voltage output signals or serial data using RS-232, RS-485, or SDI-12 connections. Continuous output or polled operation may be used. Serial formats may be selected for direct connection to YOUNG Wind Tracker displays, marine NMEA systems, SDI-12 data loggers, and ASCII serial communication programs.

Operating parameter options are selected using a simple setup program provided. All 85000 settings are stored internally in non-volatile memory.

The sensor is constructed using UV stabilized thermoplastic, stainless steel, and anodized aluminum for superior environmental resistance. It is easily mounted on standard 1-inch (IPS) pipe. An orientation ring preserves mounting position when the sensor is removed.

3.0 INITIAL CHECKOUT

Carefully unpack the unit and inspect for physical damage. Any damage should be reported to the shipper. The 85000 arrives fully calibrated and ready to use. As supplied, the sensor is configured as follows:

FACTORY DEFAULT CONFIGURATION:

Serial Output:	- RMYT Format
	- RS-232 Full Duplex & RS-485 Output Only
	- 9600 baud
Analog Voltage Outputs:	
- Channel V1: Wind Speed	0-5000 mV = 0-100 m/sec
- Channel V2: Wind Direction	0-5000mV = 0-360 Deg

These settings will permit direct serial connection to the Young Model 06201 Wind Tracker and connection of the voltage outputs to a voltage measuring device, display or datalogger. For other available serial or voltage output configurations refer to the appropriate sections of the manual.

A simple operational check of the sensor may be performed as follows:

- 3.1 Remove junction box cover and connect power and signal wires to terminals as indicated in WIRING CONNECTIONS (APPENDIX A). Power must be 9 to 16 VDC.

IMPORTANT: The Wind Tracker input option must be set to "INP 09". See the Wind Tracker manual for setting this option.

- 3.2 Apply power to the Wind Tracker and sensor. There will be a 5 second delay for initialization after which the unit will begin to send data. Wind speed and wind direction values will appear on the Wind Tracker.

The sensor wind speed threshold is preset to 0.25 m/s (0.6 mph). Wind below this level is displayed as zero. The wind direction display will show the last value that appeared when wind speed was above threshold.

- 3.3 Verify sensor response by using a small fan or gently blowing through the measuring section. Move the fan to create wind from several different directions and confirm changes on the Wind Tracker display. Small fans and gentle blowing create irregular flow patterns. This test is for general checkout only.

If the Wind Tracker display continuously shows "Ser Err" then it is not receiving data from the sensor. Remove power and check all wiring connections. If the problem cannot be corrected, contact your YOUNG representative.

If the 85000 is NOT USED with a YOUNG Wind Tracker, an alternative output must be used to check operation. For voltage output, a voltmeter may be used as an indicator. For other serial formats, use the wiring diagrams and appropriate parameter settings as a guide. See sections 5.0 and 6.0 of this manual.

IMPORTANT: RMYT, the default serial output format, transmits binary data. Most serial communications programs can only display ASCII text, not binary data. Therefore, using such a program to monitor RMYT output will show meaningless characters on the computer display. To see readable data with a program like HyperTerminal, a suitable serial output format like ASCII or NMEA must be used.

4.0 INSTALLATION

4.1 PLACEMENT

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 disturbed to 2 times the height of the structure upwind, 6 times the structure downwind, and up to 2 times the height of the structure above ground.

4.2 MOUNTING AND ALIGNMENT

The sensor mounts to standard 1-inch (IPS) pipe with an outside diameter of 1.34 inches (34 mm).

Generally, the sensor is aligned to north. In this orientation, the sensor junction box faces south (180 degrees). The transducers may be used as sighting aids. See diagram APPENDIX B.

- 4.2.1 Place orientation ring over pipe with guide pin up.
- 4.2.2 Place sensor mounting post over pipe.
- 4.2.3 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. DO NOT OVER-TIGHTEN.
- 4.2.4 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. DO NOT OVER-TIGHTEN.

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

4.4 CONNECTIONS

With long cable lengths, resistance in the power supply wires reduces the available voltage at the sensor. Power at the sensor must be in the range of 9 to 16 VDC when the sensor is operating. See WIRING DIAGRAMS in APPENDIX A.

5.0 OPERATION

5.1 WITH YOUNG WIND TRACKER DISPLAY

The default serial output format is RMYT which is compatible with the Young Model 06201 Wind Tracker display. The Wind Tracker receives measurements in the form of binary data via an RS-485 serial connection. The Wind Tracker automatically converts the data to wind values which appear on the display. Set the Wind Tracker input to 'INP 09'. See the Wind Tracker manual for display options.

5.2 VOLTAGE OUTPUTS

When the default RMYT format is used, analog voltage outputs are active. These may be connected to a data logger or other device such as the YOUNG Model 26700 Programmable Translator. See VOLTAGE OUTPUTS in APPENDIX A for connection details and calibration values.

Voltage outputs may be enabled with any serial output format (except SDI-12) even if the serial output connection itself is disabled. Polar or Cartesian Voltage output format may be selected. See section 6.4.13 and APPENDIX B for details.

When cable length between voltage output terminals and data acquisition system exceeds 3m (10 ft.), the voltage outputs should be measured differentially.

5.3 SERIAL OUTPUT FORMATS

A variety of serial output formats are available in the 85000. From the factory, it is programmed for operation with the Young Wind Tracker display (RMYT format). Other serial formats are selected using a PC and the Windows 2DSETUP program (2Dsetup.exe) provided. The following sections discuss format options available. Each command is discussed in detail in section 6.0.

5.3.1 RMYT

RMYT is a 6-byte binary data format sent at 9600 baud using the RS-485 HALF-DUPLEX output connections. This format is used with the YOUNG Model 06201 Wind Tracker. RMYT is the default setting so the sensor may be connected to a Wind Tracker without altering any other sensor parameters.

If RMYT default parameters are used (no other parameters altered), the maximum number of internal samples are always used, measurements and outputs run continuously, voltage outputs are enabled, and both RS-232 and RS-485 connections are enabled. The average current consumption is about 140 mA.

5.3.2 ASCII

ASCII output provides continuous wind measurement data in text format. Between each measurement cycle, the sensor goes into a low power mode. Parameters such as OUTPUT RATE, OUTPUT MODE, BAUD RATE, WIND SPEED UNITS, and others may be freely altered. See section 6.0.

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

5.3.7 ADDITIONAL SDI-12 INFORMATION

The 85000 sensor conforms to all aspects of the SDI-12 version 1.3 protocol and will respond to the additional commands listed below. For further information on the SDI-12 protocol, visit www.sdi-12.org on the web.

SDI-12 COMMAND	SENSOR RESPONSE
?!	a<CR><LF>
a!	a<CR><LF>
aI!	a13 YOUNG 85000 v1.00<CR><LF>
aAb!	b<CR><LF> a = Sensor address b = New sensor address
aV!	a0004<CR><LF> Retrieve V data with D command. Response listed next.
aD0!	a+sc+fmt+thresh+damp<CR><LF> a = Sensor address sc = sample count 0-99 fmt = SDI-12 format 0=CONT, 1=STANDBY thresh = Polar threshold (cm/s) damp = Damping factor
aX1nn!	None. nn = Sample count 00 or 03-31
aX2n!	None. n=SDI-12 format 0=CONT, 1=STANDBY
aX3nnn!	None. nnn = Polar threshold 0-999 cm/s
aX4nn!	None. nn = Damping factor 0-99

5.4 LOW POWER OPERATION

Average current consumption with default settings is about 140 mA. This configuration uses no power conservation and enables all features even though they may not be used. Average current consumption with continuous ASCII serial output and typical power conservation is about 30 mA. This is suitable for many low power applications.

To reduce current consumption further, additional strategies must be employed. These include disabling unused outputs, using polled serial operation, increasing the delay between samples, and limiting the sample count to the minimum optimal number. Faster baud rates reduce power by limiting transmit duration.

Lowest power consumption is realized with SDI-12 output format. However, this requires use with an SDI-12 compatible data logger. With SDI-12, the average current consumption may easily be reduced to less than 12 mA during measurements and 320 uA in standby.

6.0 SETTING OUTPUTS AND OPERATING PARAMETERS

6.1 SETUP WITH YOUNG 2D SETUP PROGRAM (RECOMMENDED)

The 2DSETUP program supplied with the sensor provides an easy method for checking and changing operating settings in the model 85000. Simply install the program on a Windows PC. Follow the instructions to get the current settings from the sensor, change settings, and send the new settings to the sensor.

6.2 SETUP USING ANOTHER COMMUNICATIONS PROGRAM

In some unusual circumstances, a serial communications program like HyperTerminal may be used. Parameters are set using simple commands. A limited number of parameters may also be set using SDI-12 commands.

For serial communication, the sensor and communication program must be at the same baud rate and the sensor must be properly connected. The default baud rate is 9600 but may be set to 1200, 4800, or 38400. Either RS-232 or RS-485 full duplex may be used. Set hardware handshaking to 'NONE' in your communications program and use 1 start, 8 data, 1 stop bit.

Except for SDI-12 format, the sensor must be in COMMAND MODE in order to set parameters. COMMAND MODE is activated by sending three ESC characters (ASCII 27) in quick succession while the sensor is running. To signify that the sensor is ready to accept commands, a '>' prompt character will appear.

If the prompt does not appear after receiving three ESC characters, re-check the 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 parameters have been set to purposefully disable RS-232 or RS-485 connections. If this 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 four second time window in which to send the ESC characters and enter COMMAND MODE.

To use this feature, set a serial communication program (such as HyperTerminal) to 38400 baud with no handshaking. Apply power to the sensor (the sensor must be off for about 30 seconds before power up). The sensor will transmit "****" (three asterisk characters) immediately after power up. Now send the three ESC characters. The COMMAND MODE '>' prompt should appear.

6.3 COMMAND OVERVIEW

At the prompt, type 'HELP' to display a list of available commands and their format. Type 'RPT' to report current settings. (Note that some values in the list cannot be set by the user.) Commands are case sensitive and the exact format must be used. For example, the SET02nn command requires two digits for the serial format code. If you send SET023 instead of SET0203, the sensor will reject the command and indicate an error. Terminate all commands with a carriage return (ASCII 13). In HyperTerminal, do this by pressing the ENTER key.

When RMYT, NMEA, or SDI-12 serial format is selected, some parameters are automatically changed. This may change the baud rate from its current setting. See section 6.4.2 for details on which parameters are altered.

Although new parameter values are stored immediately when the command is issued, they do not take effect until the sensor enters OPERATE MODE.

COMMAND	DESCRIPTION
SET01nn	Set OUTPUT MODE
01	Enable voltage output
02	Enable RS-232
04	Enable RS-485 full duplex
08	Enable RS-485 half duplex
16	Enable RS-485 output only
SET02nn	Set OUTPUT FORMAT
01	RMYT (default)
02	ASCII
03	ASCII POLLED
04	NMEA
05	SDI-12 CONTINUOUS
06	SDI-12 STANDBY
SET03nn	Set BAUD RATE

12 1200
 48 4800
 96 9600
 38 38400

SET04nn Set ASCII WS UNITS
 01 MPH
 02 KNOTS
 03 KMPH
 04 M/S

SET05c ASCII character sensor address (0-9, A-Z, a-z)
 SET06nnn Wind speed threshold for polar output (cm/s)
 SET07nnnnn Wind speed scale (nnnnn/10000)
 SET08nnnnn Direction offset (±nnnnn degrees x 10)
 SET09nn Damping factor
 SET10nnn Output delay (0-999 x 8.192 milliseconds)
 SET11nn Direction VOUT (36=0-360, 54=0-540 degrees)
 SET12nn Sample count (00=auto or 03-31)
 SET13nn ASCII and Vout format (00=polar, 01=UV)
 CALnn Force Vout (00=0V, 01=5V)

XX Goto OPERATE MODE
 RPT Report parameter settings
 ?? Help list

6.4 COMMAND DETAILS

6.4.1 SET01nn SET OUTPUT MODE

This parameter independently enables and disables voltage output, RS-232, and RS-485 connections. For example, to enable voltage output, RS-232, and RS-485 full duplex, add the code for each one: 01 + 02 + 04 = 07, SET0107. To enable only RS-232: SET0102. If RS-485 is used, choose only one RS-485 option (04, 08, or 16). See section 6.3 for codes.

To reduce power consumption, enable only those outputs that are needed. When SDI-12 format is selected with the SET02nn command, voltage output, RS-232, and RS-485 connections are disabled and SDI-12 is enabled.

6.4.2 SET02nn SET OUTPUT FORMAT

This parameter determines the serial output data format. See section 5.0 for operational details. When selecting some formats, parameters are automatically changed as listed below:

FORMAT CODE	ADDITIONAL PARAMETERS CHANGED
01 RMYT	BAUD = 9600 OUTPUT MODE = 07 THRESHOLD = 25 cm/s OUTPUT DELAY = 01 SAMPLE COUNT = 31
02 ASCII	
03 ASCII POLLED	None
04 NMEA	BAUD = 4800 OUTPUT MODE = 19 THRESHOLD = 25 cm/s OUTPUT DELAY = 122 SAMPLE COUNT = 31
05 SDI-12 CONT	
06 SDI-12 STANDBY	1200 baud THRESHOLD = 25 cm/s (polar only) OUTPUT DELAY = 122 SAMPLE COUNT = 00 (auto) WIND SPEED UNITS = 04 (m/s)

NMEA wind speed units are always KNOTS regardless of the

SET04nn parameter. Both SDI-12 settings automatically disable voltage output, RS-232, and RS-485 connections.

6.4.3 SET03nn SET BAUD RATE

All RS-232 and RS-485 communication use the baud rate set with this parameter. Power consumption is affected by this setting since it influences communication duration.

6.4.4 SET04nn SET ASCII WIND SPEED UNITS

Sets wind speed units for ASCII, ASCII POLLED, and SDI-12 polar outputs only.

6.4.5 SET05c SET POLL ADDRESS CHARACTER

Sets the sensor address for ASCII POLLED and SDI-12 formats. The default is '0' (ASCII 48).

6.4.6 SET06nn SET WIND SPEED THRESHOLD

Sets the wind speed threshold for polar outputs (wind speed and direction) to suppress scattered wind direction indications in calm air. Winds below the threshold are reported as zero, wind direction is held at 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).

6.4.7 SET07nnnnn SET WIND SPEED MULTIPLIER

All wind speed measurement are multiplied by this parameter. The default value is 10000 for a multiplier of 1.0000. This may be used to individually calibrate each sensor for improved accuracy.

6.4.8 SET08nnnnn SET 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.

6.4.9 SET09nn SET DAMPING FACTOR

Wind measurement outputs are damped using the following formula:

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

where:

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

The default value is 4. When set to 00, no damping is applied. Higher damping factors slow the rate at which the sensor indicates wind changes.

6.4.10 SET10nnn SET OUTPUT DELAY

Sets the amount of time between measurements in increments of 8.192 milliseconds. The default value is 122 (0.9994 seconds). Lower values (less delay) increase power consumption when continuous measurements are taken.

6.4.11 SET11nn SET DIRECTION VOUT

Sets wind direction voltage output scale to 0-360 or 0-540 degrees. Use the 0-540 scale if possible. When set to 0-360, wind directions fluctuating about north cause voltage output swings between zero and full scale. Data loggers or display systems may sample during

these transitions causing erroneous readings. A 0-540 scale eliminates output transitions with northerly wind.

Data in 0-540 form may be re-scaled to 0-360 by subtracting 180 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.

6.4.12 SET12nn SET SAMPLE COUNT

All measurements are calculated from the median of 3 to 31 sample sets. More samples consume more power. More samples are required at higher wind speeds or in conditions where adequate samples are difficult to acquire. If SAMPLE COUNT is set to 00, the sensor automatically uses the minimum number of sample sets needed to produce valid data. However, when powered up for the first time or when polling at intervals longer than a few seconds, the sensor may require more than one measurement cycle to determine the optimum number of sample sets.

In applications where power consumption is not an issue or where the sensor must acquire results on the first measurement cycle, the SAMPLE COUNT may be set manually to the highest anticipated wind speed (m/s) up to 31 which is the maximum SAMPLE COUNT value. Wind speeds above 31 m/s will use 31 sample sets.

6.4.13 SET13nn SET ASCII and Vout FORMAT

Serial ASCII and ASCII POLLED formats may be set to provide wind data in either Polar (speed and direction) or Cartesian (UV) form. This setting also determines the whether voltage outputs are in Polar or Cartesian format.

00= Polar, 01=Cartesian (UV).

6.4.14 CALnn FORCE VOUT

This command forces both voltage outputs channel to either 0mV or 5000 mV. This may be used to calibrate or check the operation of external data acquisition devices. 00=0 mV, 01=5000 mV

6.4.15 OPER, RPT, and HELP

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

7.0 EXAMPLE SETTINGS

Use the 2DSETUP program for the following suggested settings. Not all possible setting combinations are shown.

7.1 VOLTAGE OUTPUT ONLY, MINIMUM POWER

Serial Output Format: ASCII
RS-232 Disabled
RS-485 Disabled
Voltage Output: Enabled
Output Delay: 122
Sample Count: 0

7.2 RS-232 ONLY, CONT ASCII OUTPUT, MINIMUM POWER

Serial Output Format: ASCII
RS-232 Enabled
RS-485 Disabled
Voltage Output: Disabled
Output Delay: 122
Sample Count: 0

7.3 RS-232 ONLY, POLLED ASCII OUTPUT, MINIMUM POWER

Serial Output Format: ASCII POLLED
RS-232 Enabled
RS-485 Disabled
Voltage Output: Disabled
Sample Count: 0

7.4 RS-232 ONLY, POLLED ASCII OUTPUT

Serial Output Format: ASCII POLLED
RS-232 Enabled
RS-485 Disabled
Voltage Output: Disabled
Sample Count: Set to 0 if polling frequently. Set to highest anticipated wind speed (m/s) up to 31 if polling infrequently. Average current consumption is a function of polling rate and sample count.

7.5 SDI-12 CONTINUOUS

Serial Output Format: SDI-12 CONT
Output Delay: 122
Sample Count: 0

Set OUTPUT DELAY to larger value for less frequent measurements and lower power.

7.6 SDI-12 STANDBY

Serial Output Format: SDI-12 STANDBY
Output Delay: 122
Sample Count: Set to 0 if polling frequently. Set to highest anticipated wind speed (m/s) up to 31 if polling infrequently. Average current consumption is a function of polling rate and sample count.

8.0 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 defective item. A copy of the warranty policy may be obtained from R. M. Young Company.

9.0 CE COMPLIANCE

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

Declaration of Conformity

Standards to which Conformity is Declared:

EN 55022 Group 1 (CISPR 22 class B)
EN 50082-1:1997 using
EN61000-4-2:1995
EN61000-4-3:1995 with ENV50204: 1995
EN61000-4-4:1995
EN61000-4-6:1995

Manufacturer's Name and Address:

R. M. Young Company
Traverse City, MI, 49686, USA

Importer's Name and Address:

See Shipper or Invoice

Type of Equipment:

Meteorological Instruments

Model Number / Year of Manufacture:

85000/2004

I, the undersigned, hereby declare that the equipment specified conforms to the above Directives and Standards.

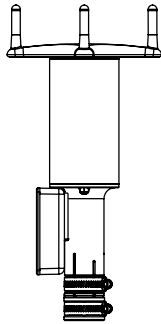
Date / Place:

Traverse City, Michigan, USA August 3, 2004

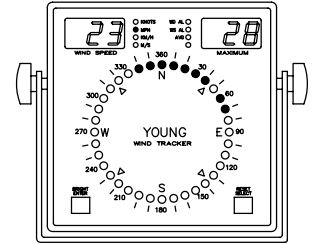


David Poinsett
R & D Manager, R. M. Young Company

APPENDIX A: WIRING CONNECTIONS

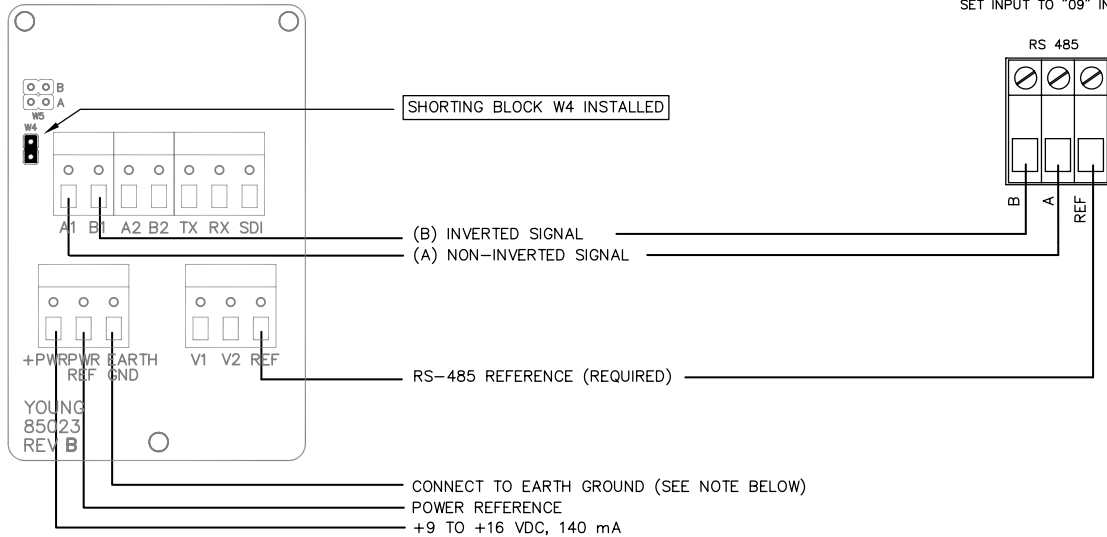


DEFAULT SERIAL OUTPUT FORMAT IS RMYT.
REFER TO SECTION 5.3.1 FOR ADDITIONAL
DETAILS.



RS-485 (OUTPUT ONLY)

WIND TRACKER
SET INPUT TO "09" IN SETUP



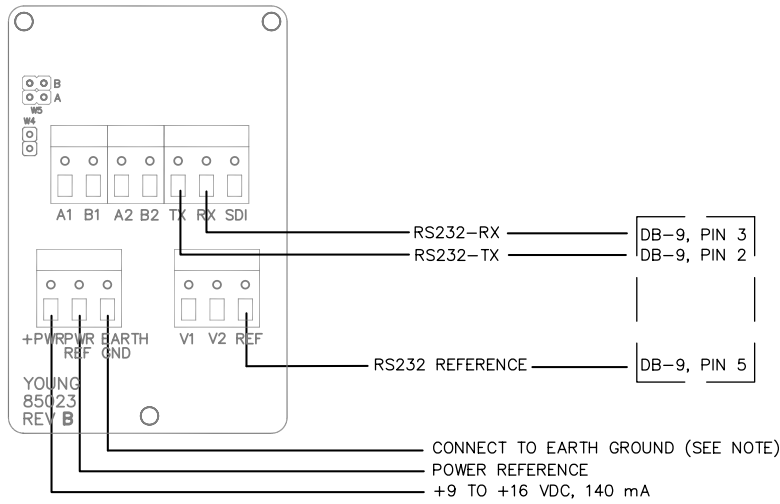
EARTH GROUND CONNECTION

EARTH GROUND CONNECTION MUST BE USED. FAILURE TO USE EARTH GROUND CONNECTION MAY RESULT IN DAMAGE TO THE SENSOR.

85000(P8).dwg

APPENDIX A: WIRING CONNECTIONS

RS-232

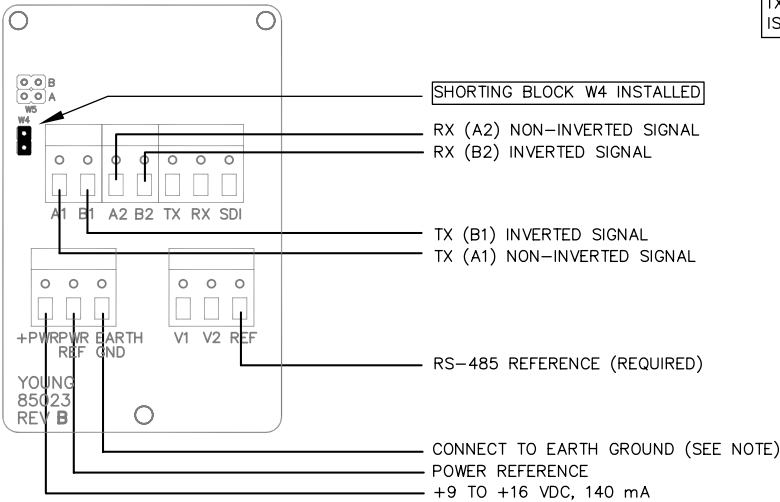


GENERAL NOTES

ALL SERIAL COMMUNICATIONS USE THE FOLLOWING SETTINGS:

- 1 START
- 8 DATA
- NO PARITY
- 1 STOP
- NO FLOW CONTROL
- BAUD RATE SET BY USER

RS-485 (FULL-DUPLEX)

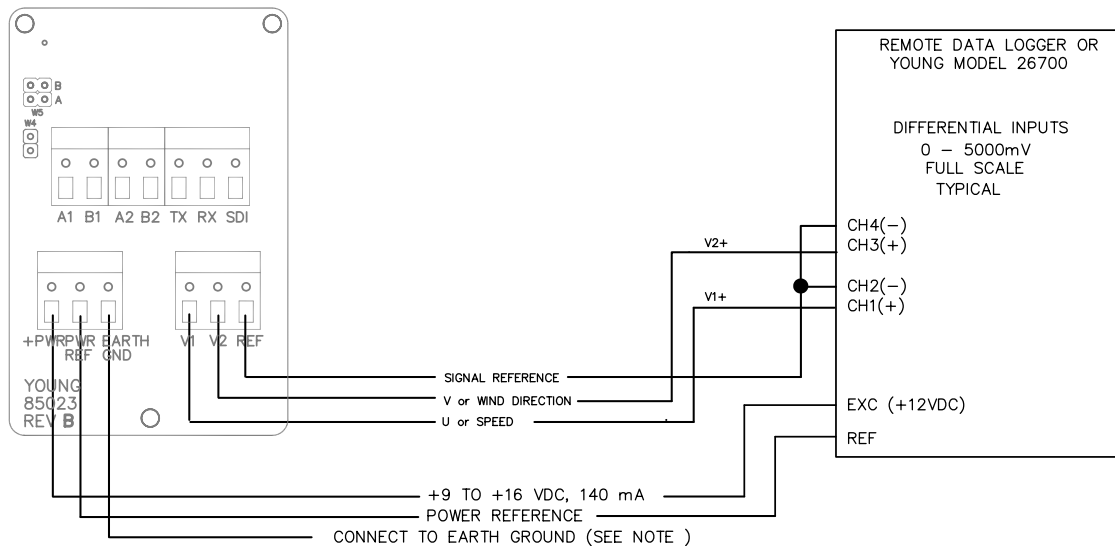


FULL DUPLEX RS-485 RX CONNECTIONS MAY BE BUSSED. TX CONNECTIONS MAY BE BUSSED IF ONLY ONE TX SIGNAL IS ACTIVE AT A TIME.

EARTH GROUND CONNECTION

EARTH GROUND CONNECTION MUST BE USED. FAILURE TO USE EARTH GROUND CONNECTION MAY RESULT IN DAMAGE TO THE SENSOR.

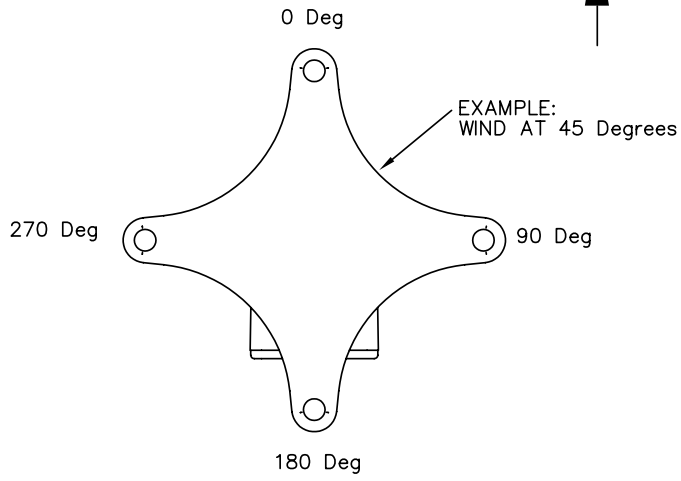
VOLTAGE OUTPUTS



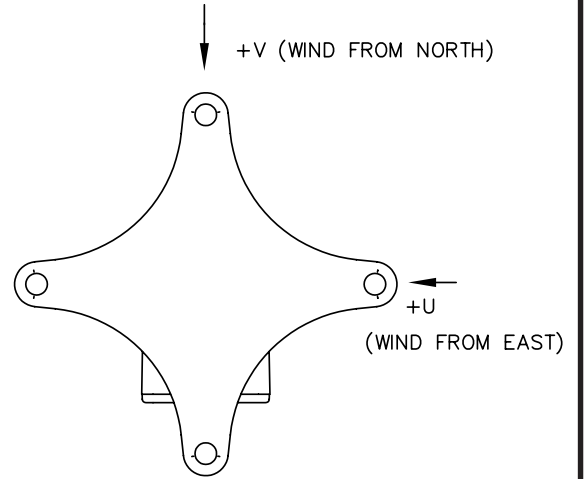
85000(P9).dwg

APPENDIX B: SENSOR PHYSICAL

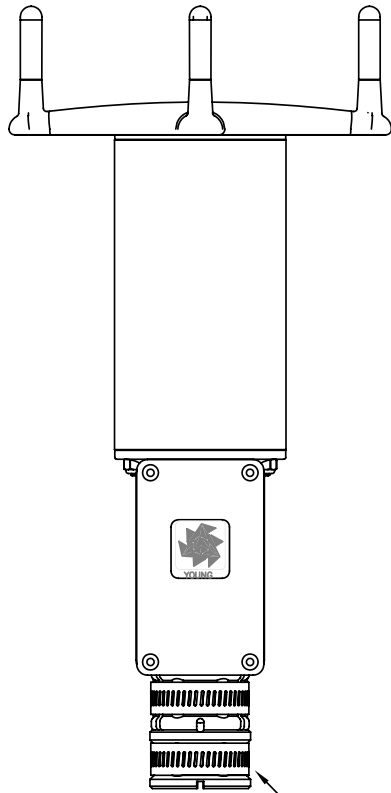
NORTH



POLAR
(SPEED, WIND DIRECTION)



CARTESIAN
(U-V)



ORIENTATION RING

MODEL 85000 ULTRASONIC ANEMOMETER
ORIENTATION KEY FOR POLAR AND
CARTESIAN MEASUREMENTS

85000(P10).dwg