METEOROLOGICAL INSTRUMENTS

INSTRUCTIONS

ULTRASONIC ANEMOMETER
MODEL 86004-SDI

CE

MODEL 86004-SDI
ULTRASONIC ANEMOMETER

2.0 INTRODUCTION

The YOUNG 86004-SDI Ultrasonic Anemometer is a dynamically heated 2-axis, no-moving-parts wind sensor with SDI-12 interface. The heater minimizes snow and ice accumulation in harsh cold-temperature environments where accurate and reliable measurements are required. The sensor features wide operating range, compact size, and easy installation.

The 86004-SDI measures wind speed and direction based on the transit time of ultrasonic pulses between three transducers.

Measurement results are available in either polar (speed and direction) or Cartesian (u and v) format using standard SDI-12 commands. Extended SDI-12 commands can be used to set all significant operating parameters.

The sensor uses ultraviolet-stabilized thermoplastic 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.

The 86004-SDI arrives fully calibrated and ready to use. Connect as shown in wiring diagram.

> **TEST COMPLEX CONFIGURATIONS
> BEFORE INSTALLATION IN THE FIELD.**

3.0 INSTALLATION

3.1 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 height downwind, and up to 2 times the height of the structure above ground.

3.2 MOUNTING AND ALIGNMENT

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 the diagram in APPENDIX B.

  3.2.1 Place orientation ring over pipe with guide pin up.

  3.2.2 Place sensor mounting post over pipe.

  3.2.3 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.

  3.2.4 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.

3.3 WIRING 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 22 to 26 VDC when the sensor is operating. See WIRING DIAGRAMS on following pages.

1.0 SPECIFICATIONS

WIND SPEED
Range:	0-65 m/s (145 mph)
Resolution:	0.01 m/s
Accuracy:	0 to 30 m/s ±2% or 0.1 m/s
	30 to 65 m/s ±3%

WIND DIRECTION
Azimuth Range:	0-360 degrees
Resolution:	0.1 degree
Accuracy:	± 2 degrees

SERIAL CONNECTION
Interface Type:	SDI-12 v1.3

GENERAL
Power Supply:	22 to 26 VDC 2.5A
Protection Class:	IP65
EMC Compliance:	FCC Class A digital device
	IEC standard 61326-1
Dimensions:	29 cm high x 11 cm wide
Weight:	0.4 kg (0.9 lb)
Shipping Weight:	1.6 kg (3.5 lb)
Operating Temperature:	-40 to +60°C

4.0 OPERATION

4.1 SDI-12 MEASUREMENT COMMANDS

Model 86004-SDI uses the SDI-12 (v1.3) serial communication protocol to initiate wind measurements and set sensor operation parameters. The default sensor address is 0 (zero). It can be changed to any valid single-character value if needed. Details about the SDI-12 protocol may be found at www.sdi-12.org.

There are three separate heater zones in the sensor: transducers, upper housing surface, and lower housing surface. Each zone is independently controlled with pulse-width-modulated power based on air temperature and wind speed. Colder temperatures and higher winds call for more heat. When enabled, the heaters are preset to turn on at 4°C and turn off at 8°C. Heater control values for each zone are updated after each wind measurement.

A valid and properly addressed SDI-12 command wakes the sensor to initiate a wind measurement, or set or check operating parameters.

SDI-12 'M' or 'C' commands initiate a wind measurement. The sensor response message indicates the maximum time needed before the measurement is ready, and that two 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 wind 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.

Measurement commands and responses are listed below.

SDI-12 COMMAND	RESPONSE
aM!	attt2<CR><LF>
aMC!	attt2<CR><LF>
aC!	attt02<CR><LF>
aCC!	attt02<CR><LF>
aD0!	a+www.ww+ddd.d<CRC><CR><LF> a±uu.uu±vv.vv<CRC><CR><LF>

where:

a	= Sensor address
ddd.d	= Wind direction (degrees)
www.ww	= Wind speed (selected units)
ttt	= Delay time (seconds)
±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).

4.2 SDI-12 NON-MEASUREMENT COMMANDS

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

SDI-12 COMMAND	RESPONSE
?!	a<CR><LF>
a!	a<CR><LF>
aI!	a13 YOUNG 86000 v1.00<CR><LF>
aAb!	b<CR><LF> a = Sensor address b = New sensor address

4.3 EXTENDED COMMANDS

The SDI-12 command set may be customized with Extended Commands to accommodate manufacturer settings and other functions. Extended Commands for the 86004-SDI and the sensor response are listed below. Where two responses are shown, one is for a valid command, the other is for an invalid (ERR) command. Note that only the aXP! command sends a response message.

EXTENDED COMMAND	DESCRIPTION & RESPONSE
aXB!	Burn parameter settings to flash. aXB,OK<CR><LF>
aXFn!	n = Output Format code. 0 or 1 (Polar or Cartesian) aXF,F=n<CR><LF> aXF,ERR F=0/1<CR><LF>
aXHn!	n = Heater Enable.
aXMnnnnn!	nnnnn = WS Multiplier x 10000 (00000 to 30000) aXM,M=nnnnn<CR><LF> aXM,ERR M=00000-30000 ONLY<CR><LF>
aXO±nnnn!	±nnnn = Dir Offset (-3600 to +3600 degrees) aXO,O=±nnnn<CR><LF> aXO,ERR O=-3600 - +3600 ONLY<CR><LF>

aXP!	Parameter report
	aXP,H=h,F=f,U=u,T=t,S=s,W=w,O=o,M=m,V=v<CR><LF>
	a = Sensor address
	h = Heater enable
	   0=Disabled, 1=Enabled, 2=Test
	f = Wind format 0=Polar, 1= Cartesian
	u = 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)
	o = Wind Direction Offset (degrees)
	m = Wind Speed Multiplier
	v = Supply Voltage (VDC)

aXSnnn!	nnn = Sample Count (001-800 samples) aXS,S=nnn<CR><LF> aXS,ERR S=001-800<CR><LF>
aXTnnn!	nnn = Wind Speed Threshold 000 to 150 cm/s aXT,T=nnn<CR><LF> aXT,ERR T=000-150<CR><LF>
aXUn!	n = Wind Speed Units code 1=mph 2=knots 3=kmph 4=m/s aXU,U=n<CR><LF> aXU,ERR U=1/2/3/4<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.

HEATER ENABLE (aXHn!)
This enables, disables, or tests the heater control circuit. Disabling the heaters removes power from the control circuit. If the Test option is used, limited power is continuously sent to each heater zone to test heater function at room temperature

SAMPLE COUNT (aXSnnn!)
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. Default setting is 100.

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 (u-v) output format is automatically zero regardless of this setting.

WIND SPEED MULTIPLIER (aXMnnnnn!)
All wind speed measurements are multiplied by this parameter. The default value is 10000 for a multiplier of 1.0000.

WIND DIRECTION OFFSET (aXO±nnnn!)
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.

4.4 TROUBLESHOOTING

Symptom: After using setup program, SDI-12 mode is disabled. (Note: Setup program is only for RS232 mode.)

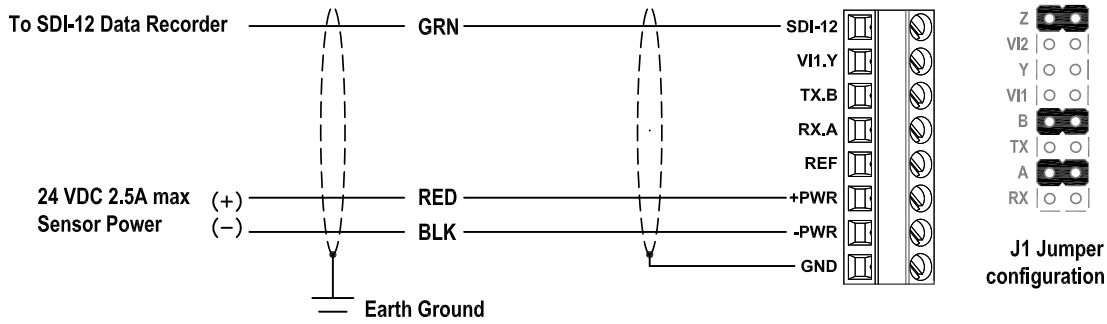Cause: Saving parameters in setup program disables SDI-12 mode.

Solution: While in RS232 command mode, send the following commands via the "Communications" tab in the setup software or via a terminal program to re-enable SDI-12 mode. (">" is the command prompt):
>SET025
>SET77
Power cycle the sensor.
Sensor will be in SDI-12 mode.

5.0 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.

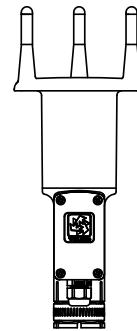EN55011/CISPR 11, Group 1, Class B device.
Class B equipment is suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes.

6.0 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.
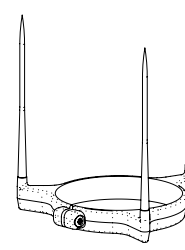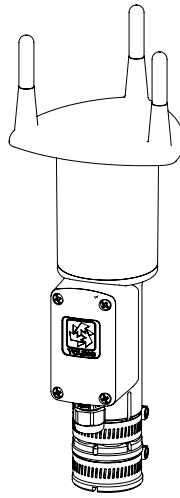
7.0 CE COMPLIANCE

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

Model 86004
Ultrasonic Anemometer

WIRING DIAGRAM

24 VDC 2.5A power required for sensor and heater.
Use shielded cable. Connect cable to earth ground as shown.

86004-SDI-90(G)

SENSOR ORIENTATION AND DIMENSIONS

86052
OPTIONAL BIRD
WIRE ASSEMBLY

0°

EXAMPLE:
"WIND AT 45° "

270° —————— 90°

180°

POLAR

(WIND SPEED, WIND DIRECTION)

N

W —————— E

S

JUNCTION BOX
FACES SOUTH

110 mm

+V m/s
"WIND FROM NORTH"

+U m/s
"WIND FROM EAST"

CARTESIAN

(U, V)

275 mm

MTG
POST
INSERTION
80 mm

26 mm

ORIENTATION
RING

86004-SDI-90(G)