

**03001-5 R.M. YOUNG WIND SENTRY SET
03101-5 R.M. YOUNG WIND SENTRY ANEMOMETER
03301-5 R.M. YOUNG WIND SENTRY VANE
INSTRUCTION MANUAL**

REVISION: 12/96

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R.M. YOUNG WIND SENTRY

1. INTRODUCTION

These notes provide information for interfacing the R.M. Young 03001-5 Wind Sentry Wind Set to the Campbell Scientific's CR10(X), 21X, and CR7 dataloggers. The notes also apply to the 03101-5 Anemometer which can be ordered separately. Unless otherwise specified, all part numbers are Campbell Scientific's.

The accompanying R.M. Young instruction manual contains information on sensor specifications, operating principles, installation, alignment, and calibration. The multiplier and offset values given here are based on calibration data obtained from the R.M. Young instruction manual.

Upon receipt of the 03001-5 Wind Sentry, you should find:

1. 03001 Wind Sentry including
03101-5 Anemometer
03301-5 Vane
crossarm
band clamp (P/N 4919)
2. 10" x 3/4" unthreaded aluminium pipe (P/N 6332)
3. allen wrench (P/N 5201)

Upon receipt of the 03101-5 Anemometer, you should find:

1. 03101-5 Anemometer
2. 10" x 3/4" threaded galvanized pipe (P/N 1180)
3. allen wrench (P/N 5201)

2. MOUNTING

NOTE: The black outer jacket of the cable is Santoprene[®] rubber. This compound was chosen for its resistance to temperature extremes, moisture, and UV degradation. However, this jacket will support combustion in air. It is rated as slow burning when tested according to U.L. 94 H.B. and will pass FMVSS302. Local fire codes may preclude its use inside buildings.

2.1 03001-5 WIND SENTRY SET

Mount the 03001-5 directly to a vertical piece of 3/4" IPS (1.06" OD) pipe. The Wind Sentry may be mounted directly to the top of the CM10 or CM6 tripod as shown in figure 2.1. The supplied 10-inch length of unthreaded pipe is used to mount the Wind

Sentry into the 3/4" x 3/4" nurail of the 019ALU crossarm as seen in figure 2.2.

Follow the installation procedure given in the R.M. Young manual.

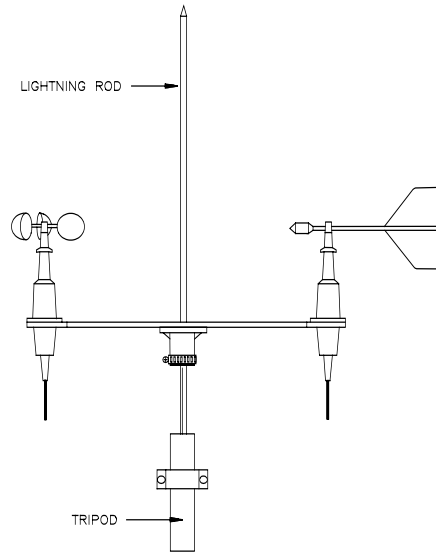


FIGURE 2.1 03001-5 Mounted to Top of Tripod

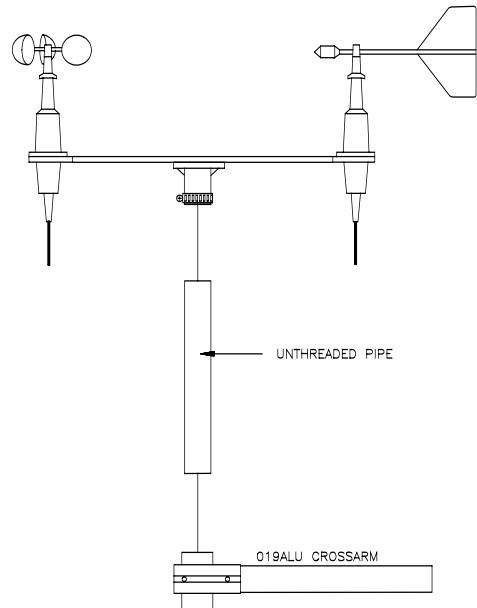


FIGURE 2.2 03001-5 Mounted to 019ALU

2.2 03101-5 ANEMOMETER

The 03101-5 screws onto the supplied 10 inch length of threaded pipe (figure 2.3). The pipe is mounted in the 3/4" x 3/4" nurail on the 019ALU crossarm.

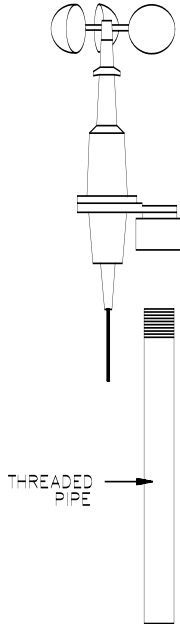


Figure 2.3 03101-5 Mounted to 019ALU

3. SENSOR TO DATALOGGER WIRING

Figures 3.1 and 3.2 show the wiring connections for the 03101-5 Anemometer and 03301-5 Vane.

4. DATALOGGER PROGRAMMING

4.1 WIND SPEED

Wind speed is measured with Instruction 3 (Pulse Count). Specify a configuration code of 21 (low level AC result in Hz). Table 4.1 lists the appropriate multipliers (M) and offsets (Off) to obtain m/s or mph when configuration code 21 is used.

TABLE 4.1. Wind Speed Multipliers & Offsets (with configuration code of 21*)

<u>m/s output</u>	<u>mph output</u>
M = 0.750	M = 1.677
Off = 0.2	Off = 0.4

* When a configuration code 11 is used, the above multiplier must be divided by the execution interval in seconds.

21Xs without OSX PROMs and CR7s without OS7 PROMS (PROMS purchased prior to March 1989 and August 1991 respectively) do not have the configuration code 21 as an option. Program Instruction 3 with a configuration code of 11 (low level AC, result in counts). The multiplier from Table 4.1 will need to be divided by the execution interval (in seconds) to obtain the correct multiplier. The offset remains the same.

4.2 WIND DIRECTION

Wind direction is measured with Instruction 4 (Excite, Delay, and Measure). In general, a delay of 2 (0.02 seconds) is sufficient when the lead lengths are less than 100 feet. If the cable is 100 to 1000 feet, use a delay of 20 (0.20 seconds). Because the wind direction potentiometer has a five degree deadband between 355 and 0 degrees, the multiplier is 355 divided by the excitation voltage.

The parameters for excitation, measurement range, multiplier, and offset of each datalogger are shown below.

	<u>CR10(X)</u>	<u>21X</u>	<u>CR7</u>
Excitation (mV)	2500	5000	5000
Measurement Range	5 (2500 mV, slow)	5 (5000 mV, slow)	18 (5000 mV, fast)
Multiplier (deg/mV)	0.142	0.071	0.071
Offset	0	0	0

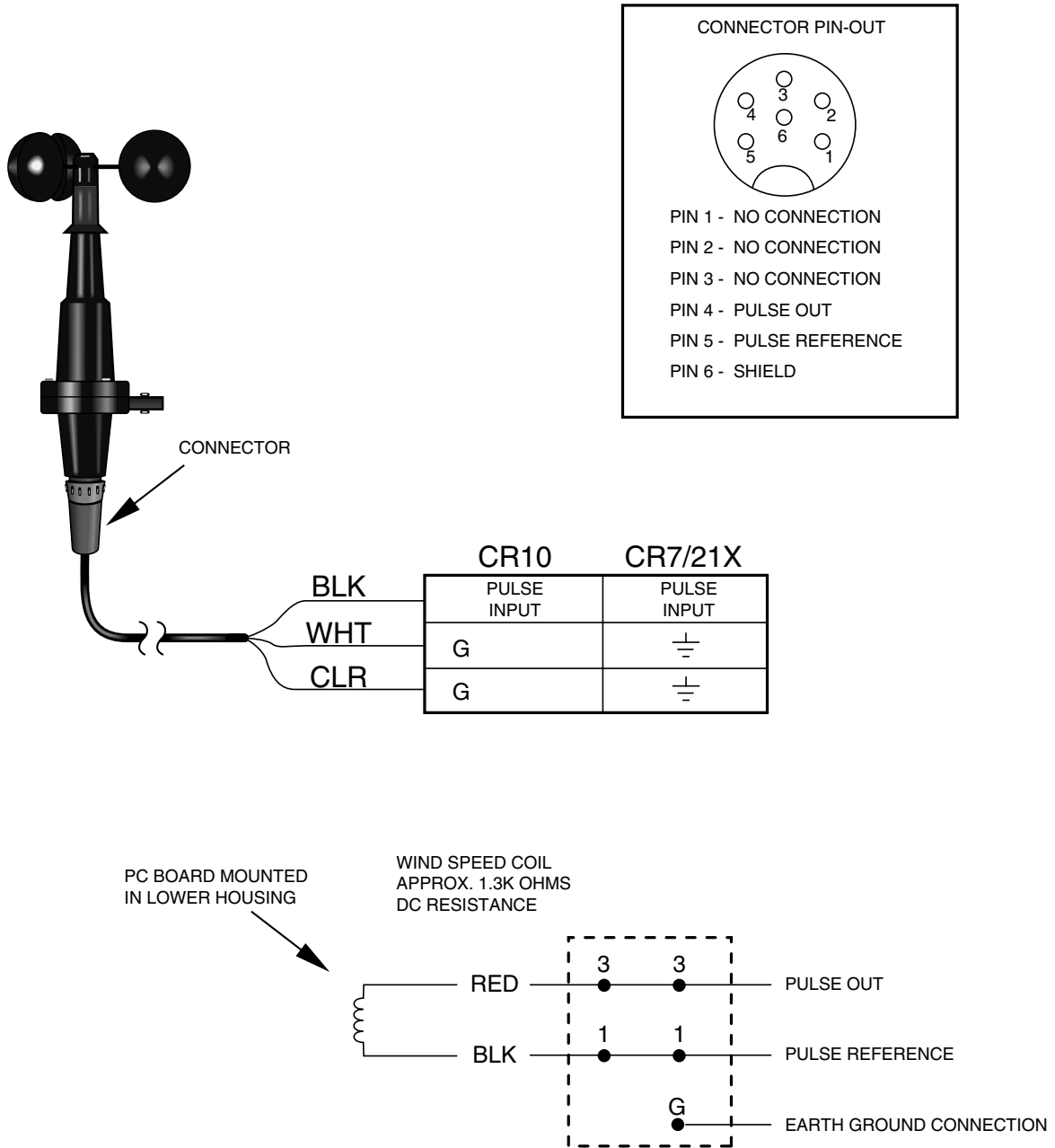


Figure 3.1 03101-5 Wind Sentry Anemometer

R.M. YOUNG WIND SENTRY

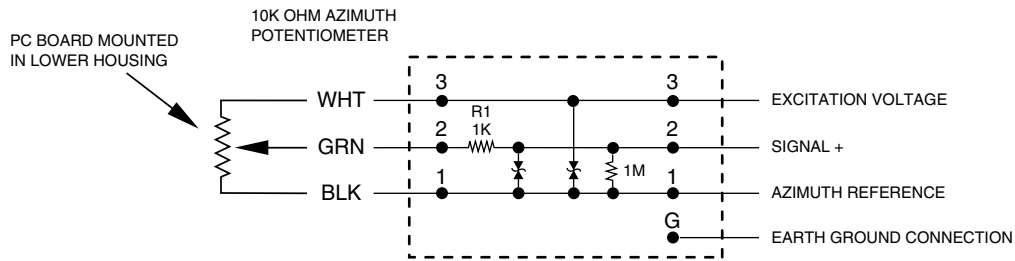
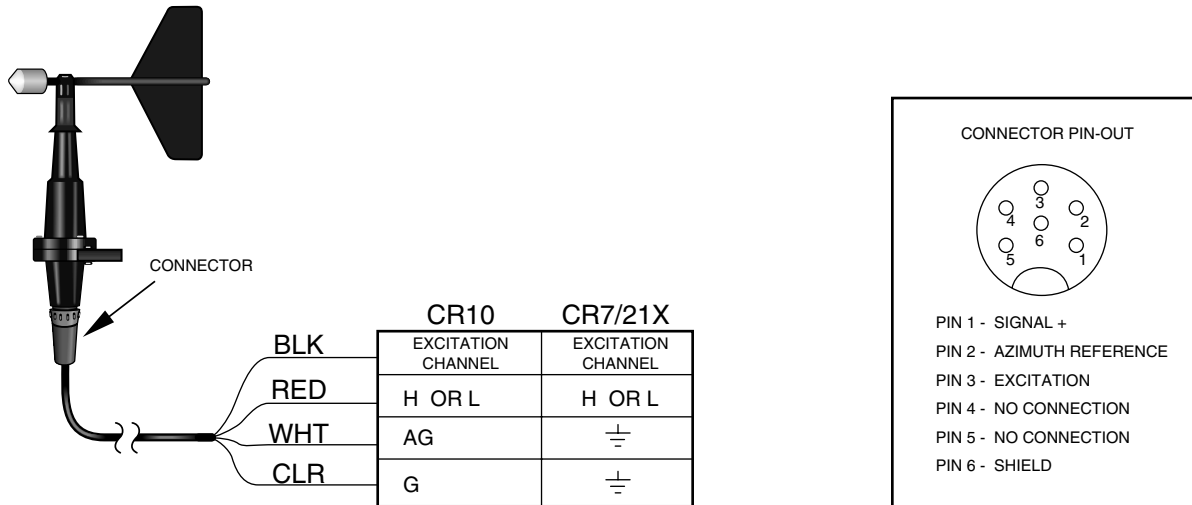


Figure 3.2 03301-5 Wind Sentry Vane

**4.3 DATALOGGER PROGRAMMING
EXAMPLE**

The following CR10(X) program measures the wind sensors every 60 seconds. The mean wind speed, unit vector mean wind direction, and standard deviation of wind direction are output in miles/hour every hour. Programs for the 21X and CR7 are similar.

-Input Locations-
1 WS_MPH
2 WD_0to360

;{CR10}

;

*Table 1 Program

01:	60	Execution Interval (seconds)
01: Pulse (P3)		
1:	1	Reps
2:	1	Pulse Input Channel
3:	21	Low Level AC, Output Hz
4:	1	Loc [WS_MPH]
5:	1.677	Mult
6:	0.4	Offset
02: Excite-Delay (SE) (P4)		
1:	1	Reps
2:	5	\pm 2500 mV Slow Range
3:	1	SE Channel
4:	1	Excite all reps w/Exchan 1
5:	2	Delay (units 0.01 sec)
6:	2500	mV Excitation
7:	2	Loc [WD_0to360]
8:	0.142	Mult
9:	0	Offset
03: If time is (P92)		
1:	0	Minutes (Seconds --) into a
2:	60	Interval (same units as above)
3:	10	Set Output Flag High
04: Wind Vector (P69)		
1:	1	Reps
2:	0	Samples per Sub-Interval
3:	0	S, θ_u , & $\sigma(\theta_u)$ Polar
4:	1	Wind Speed/East Loc [WS_MPH]
5:	2	Wind Direction/North Loc [WD_0to360]

End Program

-Input Locations-
1 WS_MPH
2 WD_0to360

* Instruction 69 Wind Vector became standard in 1990. Dataloggers with older PROMS must be programmed with Instruction 76.

5. SENSOR ALIGNMENT

The crossarm should be oriented north - south with the anemometer on the south end. Once the datalogger is programmed and the sensor connected, check alignment by slowly turning the wind vane to the south while watching the readings in *6 mode on the datalogger. When the vane is pointing south (towards the anemometer), the readings should be ± 5 degrees from 180. If the readings are not correct, look for errors in the wiring or programming (e.g., is the correct multiplier and offset applied?). Refer to the R.M. Young manual for complete alignment and troubleshooting information.

6. MAINTENANCE, REPLACEMENT PARTS, AND REPAIRS

R.M. Young suggests that the anemometer bearings be inspected at least every 24 months. Please refer to the R.M. Young manual for maintenance information.

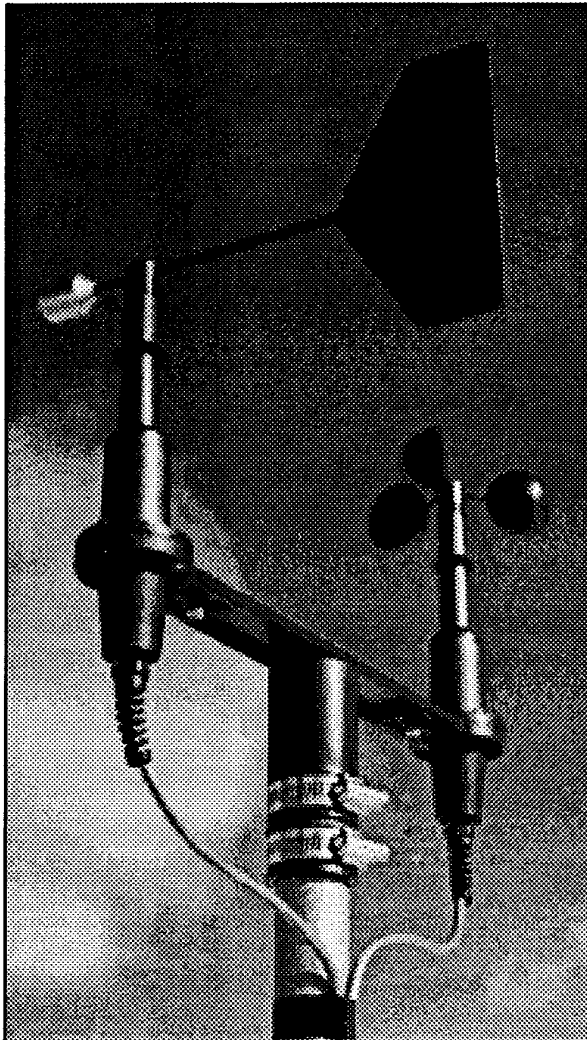
To determine if the bearings need to be replaced, you can field test the equipment using the Anemometer Bearing Torque Disk (R.M. Young P/N 18314) and Vane Torque Gauge (R.M. Young P/N 18331). The torque kits are available directly from R.M. Young.

Replacement parts for the cup wheel assembly (P/N 4609) and for the vane assembly (P/N 4610) can be ordered directly from Campbell Scientific, Inc. Refer to the accompanying manual for other replacement parts available from R.M. Young.

Contact Campbell Scientific's customer service department to obtain authorization for return of the unit. Or, to expedite the process, you may contact R.M. Young's customer service department directly to obtain repair cost estimates and return authorization. Their phone number is (616) 946-3980.



MODEL 03001-5 WIND SENTRY



WIND SPEED SPECIFICATION SUMMARY:

Range	0 to 50 m/s (112 mph), gust survival 60 m/s (134 mph)
Sensor	12 cm diameter cup wheel assembly, 40 mm diameter hemispherical cups
Turning Factor	75 cm (2.46 ft)
Distance Constant (63% recovery)	2.3 m (7.5 ft)
Threshold	0.5 m/s (1.1 mph)
Transducer	Stationary coil, 1350 ohm nominal resistance
Transducer Output	AC sine wave signal induced by rotating magnet on cup wheel shaft 100 mV p-p at 60 rpm. 6V p-p at 3600 rpm.
Output Frequency	1 cycle per cup wheel revolution. 0.75 m/s per Hz

WIND DIRECTION (AZIMUTH) SPECIFICATION SUMMARY:

Range	360° mechanical, 355° electrical (5° open)
Sensor	Balanced vane, 16 cm turning radius.
Damping Ratio	0.2
Delay Distance (50% recovery)	0.5 m (1.6 ft)
Threshold	0.8 m/s (1.8mph) at 10° displacement 1.8 m/s (4.0 mph) at 5° displacement
Transducer	Precision conductive plastic potentiome- ter, 10K ohm \pm 20% resistance 0.5% linearity, life expectancy 50 million revolutions Rated 1 watt at 40°C, 0 watts at 125°C
Transducer Excitation Requirement	Regulated DC voltage, 15 VDC max
Transducer Output	Analog DC voltage proportional to wind direction angle with regulated excitation voltage applied across potentiometer

INTRODUCTION

The Wind Sentry Anemometer and Vane measure horizontal wind speed and wind direction. The small size, simplicity, and corrosion resistant construction provide a professional quality instrument at a modest cost. The cup wheel and vane shafts use stainless steel precision instrument grade ball bearings which are lubricated with a wide temperature range high quality instrument oil. Standard bearings have metal shields to exclude contamination. Optional sealed bearings are available to help retain lubricant for longer service life. The light contacting seals result in slightly higher threshold values.

Cup wheel rotation produces an AC sine wave voltage signal with frequency directly proportional to wind speed. This AC signal is induced in a stationary coil by a two pole ring magnet mounted on the cup wheel shaft. One complete sine wave cycle is produced for each cup wheel revolution.

Wind vane position is transmitted by a 10K ohm precision conductive plastic potentiometer which requires a regulated excitation voltage. With a constant voltage applied to the potentiometer, the output signal is an analog voltage directly proportional to azimuth angle.

The sensors are normally supplied with an anodized aluminum crossarm which mounts on a vertical standard 3/4" pipe, outside diameter 27mm (1.06"). The crossarm mounting is secured to the pipe by a stainless steel band clamp. Separately supplied Sentry anemometers or windvanes normally mount on vertical 3/4" threaded pipe. A variety of devices are available for signal conditioning, display, and recording of wind speed and direction. These sensors will also interface directly with data loggers from several different manufacturers.

INITIAL CHECK-OUT

When the Wind Sentry is unpacked, check it carefully for any signs of shipping damage. Place the cup wheel on the anemometer shaft and secure it by tightening the set screw in the side of the hub. The instrument is aligned, balanced, and fully calibrated before shipment; however, it should be checked both mechanically and electrically before installation. The vane and cup wheel should easily rotate 360° without friction. Check vane balance by holding the instrument so the vane surface is horizontal. It should have near neutral torque without any particular tendency to rotate, however a slight imbalance will not degrade performance.

The wind direction potentiometer requires a stable DC excitation voltage. Do not exceed 15 volts. When the potentiometer wiper is in the 5° deadband region, the output signal is "floating" and may show varying or unpredictable values. Azimuth signal conditioning electronics should properly process this condition. (All YOUNG signal conditioning electronics meet these requirements.) Avoid a short circuit between the azimuth signal line and either the excitation or ground reference lines. Although there is a 1K ohm current limiting resistor in series with the wiper for protection, damage to the potentiometer may occur if a short circuit condition exists.

Before installation connect the Wind Sentry to a signal conditioning device and check for proper wind speed and direction values. Make electrical connections to the sensor cables supplied with the instrument as shown in the wiring diagram. Positioning the vane over the center of a sheet of paper with 35° or 45° cross markings allows easy visual alignment of the vane. To check wind speed, temporarily remove the cup wheel and connect its shaft to a Model 18810 Anemometer Drive. Details appear in the CALIBRATION section.

INSTALLATION

Proper placement of the instrument is very important. Eddies from trees, buildings, or other structures can greatly influence wind speed and direction observations. To get meaningful data for most applications, locate the instrument well above or upwind of such obstructions. As a general rule, the air flow around a structure is disturbed to twice the height of the structure upwind, six times the height downwind, and twice the height of the structure above ground. For some observations it may not be practical or necessary to meet these guidelines.

Initial installation is most easily done with two people during the vane alignment step; one to adjust the instrument position and the other to observe the indicating device. The standard Wind Sentry includes a 3 meter (10 ft.) length of cable. Additional cable may be connected by splicing or termination in a user supplied junction box. Make sure the connection is waterproof.

To install the Wind Sentry, follow these steps:

1. MOUNT WIND SENTRY
 - a) Place Wind Sentry on mounting post. Do Not tighten band clamp yet.
 - b) Connect sensor cable to indicator.
2. ALIGN VANE
 - a) Select a known azimuth reference point on the horizon.
 - b) Sighting down vane centerline, point counterweight toward azimuth reference on horizon.
 - c) While holding vane in position, slowly turn base until indicator displays proper value.
 - d) Tighten mounting post band clamp.

CALIBRATION

The Wind Sentry is fully calibrated before shipment and should require no adjustments. Recalibration may be necessary after some maintenance operations. Periodic calibration checks are desirable and may be necessary where the instrument is used in programs which require auditing of sensor performance.

For wind direction calibration, the following method can yield an accuracy of ±5° or better if carefully done. Begin by connecting the instrument to a signal conditioning circuit which has some way to indicate azimuth value. This may be an indicator which displays azimuth values in angular degrees or simply a voltmeter monitoring the output. Hold or mount the instrument so the vane center of rotation is over the center of a sheet of paper which has 30° or 45°

crossmarkings. Position the instrument so the mounting crossarm is oriented north-south with the vane on the north and the anemometer on the south. With the counterweight pointing directly at the anemometer the azimuth signal should correspond to 180° or due south. Looking from above, visually align the vane with each of the crossmarkings and observe the indicator display. It should correspond to vane position within 5°. If not, it may be necessary to adjust the relative position of the vane skirt and shaft. See step 3 in the MAINTENANCE section under potentiometer replacement.

It is important to note that while full scale azimuth on signal conditioning electronics may be 360°, full scale azimuth signal from the instrument is 355°. The signal conditioning electronics must be adjusted accordingly. For example, in a circuit where 0 to 1.00 VDC represents 0° to 360°, the output must be adjusted for 0.986 VDC when the instrument is at 355° full scale. $(355°/360° \times 1.00 \text{ volts} = 0.986 \text{ volts})$

Wind speed calibration is determined by the cup wheel turning factor and the output characteristics of the transducer. Calibration formulas showing cup wheel rpm and frequency output vs. wind speed are included in this manual. These formulas are accurate to within 2 percent.

To calibrate wind system electronics using an actual signal from the instrument, temporarily remove the cup wheel and connect a Model 18801 Anemometer Drive to the cup wheel shaft. Calculate wind speed by applying the appropriate calibration formula to the motor rpm and adjust the signal conditioning electronics for proper value. For example, with the cup wheel shaft turning at 1800 rpm trim the indicator to display 22.7 meters per second. $(0.01250 \times 1800 + 0.2 = 22.7)$

MAINTENANCE

Given proper care, the Wind Sentry should provide years of service. Constructed entirely of non-corrosive materials and using components which are conservatively rated, the instrument requires little maintenance. The only components likely to require replacement due to normal wear are the precision ball bearings and the azimuth potentiometer. Replacement of these components should only be performed by a qualified instrument technician. If service facilities are not available, return the instrument to the factory. Refer to the accompanying drawings to become familiar with part names and locations. The asterisk * which appears in the following outlines is a reminder that maximum torque on all set screws is 80 oz-in.

POTENTIOMETER REPLACEMENT:

The potentiometer has a life expectancy of fifty million revolutions. As it becomes worn, the element usually begins to produce noisy signals or become non-linear. When the signal noise or non-linearity become unacceptable, replace the potentiometer as follows:

1. REMOVE POTENTIOMETER
 - a) Remove three screws which secure upper and lower sections of main housing.
 - b) Carefully remove upper housing exposing wiring connections to circuit board.
 - c) Unsolder potentiometer wires from circuit board. Note color coding.
 - d) Using a knife blade or similar instrument, loosen potentiometer assembly from upper housing and slide it out.
2. INSTALL NEW POTENTIOMETER
 - a) Slide new potentiometer cell into upper housing. Be sure to engage cell key into housing notch.
 - b) Solder potentiometer wires to circuit board. Observe color code.
 - c) Join two sections of main housing. Secure with screws removed in step 1a.

3. ALIGN VANE

- a) Connect excitation voltage and signal conditioning electronics to instrument according to wiring diagram.
- b) Loosen set screw in side of vane hub.
- c) Position instrument so crossarm is oriented north-south with vane on north side. Orient vane to a known angular reference. (See CALIBRATION section.)
- d) While holding vane in reference position, slowly turn vane skirt until signal conditioning system indicates proper value.
- e) Tighten set screw* in side of vane hub.

ANEMOMETER FLANGE BEARING REPLACEMENT:

If anemometer bearings become noisy or wind speed threshold increases above an acceptable level, replace the bearings. Check bearing condition by hanging an ordinary paper clip (0.5 gm) on the outside edge of one cup while the instrument is held in a horizontal position. The cup should rotate downward. Failure to rotate due to the weight of the paper clip indicates anemometer bearings need replacement. Repeat this test at different positions to check full bearing rotation. Replace bearings as follows:

1. REMOVE BEARINGS

- a) Loosen set screw on side of cup wheel hub. Remove cup wheel.
- b) Remove three screws which hold two sections of main housing.
- c) Carefully separate upper and lower housing. Remove coil transducer assembly from upper housing. Do not disconnect from circuit board.
- d) Loosen screw and remove ring magnet on end of shaft inside upper housing.
- e) Slide shaft and skirt assembly out of both upper and lower bearings.
- f) Using knife blade under bearing flange, carefully remove upper bearing.
- g) Using a pencil, gently push out lower bearing from above.

2. INSTALL NEW BEARINGS

- a) Insert new upper bearing. Use care not to apply excessive pressure.
- b) Slide cup wheel shaft through upper bearing.
- c) Slide lower bearing on shaft inside upper housing.
- d) Using ring magnet assembly, push lower bearing into its seat in upper housing.
- e) Secure ring magnet to shaft using screw removed in step 1d. Use a small amount of sealant on screw to prevent it from loosening.
- f) Join two housing sections. Secure using three screws removed in step 1b.
- g) Place cup wheel on shaft. Tighten set screw* on side of hub.

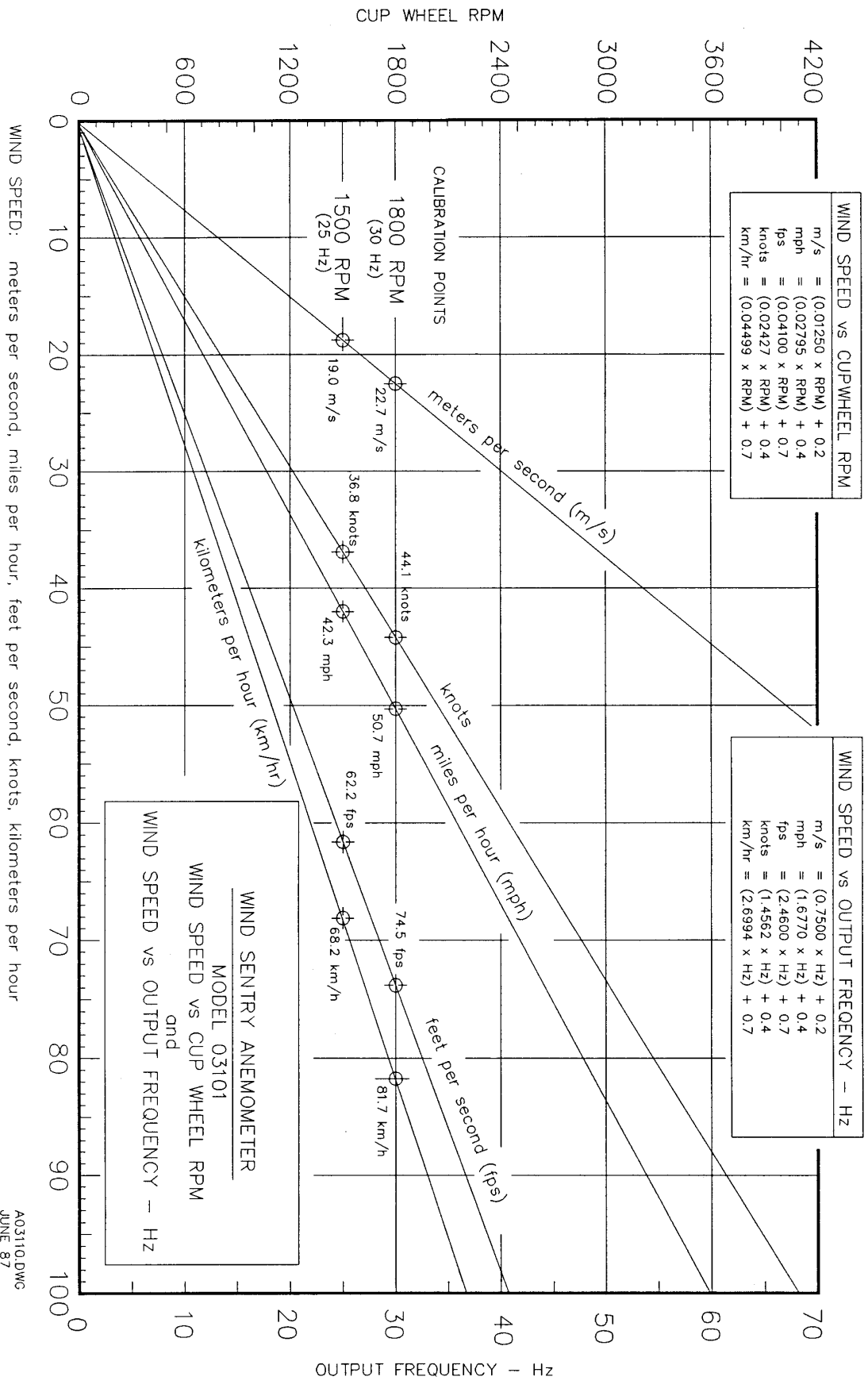
VANE FLANGE BEARING REPLACEMENT:

If vane bearings become noisy or if wind direction threshold increases above an acceptable level, replace the bearings. Check bearing condition by adding two ordinary paper clips (0.5 gm each) to the back edge of the vane fin while the instrument and vane are held in a horizontal position. Gently release the vane. It should rotate downward. Failure to do so indicates the bearings need replacement. Repeat this test at various positions to check full bearing rotation.

Since this procedure is similar to anemometer bearing replacement, only the major steps are shown here:

1. REMOVE BEARINGS (Remove coupling disc - same as ring magnet)
2. INSTALL NEW BEARINGS
3. ALIGN VANE (See CALIBRATION section)

*Max set screw torque 80 oz-in



A03110.DWG
 JUNE 87



**WIND SENTRY
MODEL 03101-5 ANEMOMETER - MODEL 03301-5 VANE
REPLACEMENT PARTS**

<u>PART NO.</u>	<u>PART NAME</u>
03011	CROSSARM - 40cm
03015-01	CROSSARM MOUNTING
03015-02	BAND CLAMP FOR 3/4" IPS
03101-5	WIND SENTRY ANEMOMETER - LESS MOUNTING
03110	CUP WHEEL ASSEMBLY
03117	SHAFT W/HUB
03120-5	MAIN HOUSING WITH COIL TRANSDUCER
03125	UPPER HOUSING
03126	FLANGE BEARING (2 REQD)
03127	LOWER HOUSING
03130	COIL TRANSDUCER ASSY .
03133	RING MAGNET ASSEMBLY W/ 3-48 X 1/2 PAN HD SCREW
03141	12 FT CABLE - 2 COND SHIELDED (BELDEN 8641)
03145	OFFSET MOUNTING 3/4" IPS
03301-5	WIND SENTRY VANE - LESS MOUNTING
03310	VANE ASSY W/ COUNTERWEIGHT
03318	POTENTIOMETER COUPLING DISC W/3-48 x 1/2 PAN HD SCREW
03320-5	MAIN HOUSING W/POTENTIOMETER TRANSDUCER
03330A	POTENTIOMETER ASSEMBLY
03341	12 FT CABLE - 3 COND SHIELDED (BELDEN 8771)
12316B	POTENTIOMETER COUPLING

R. M. YOUNG COMPANY

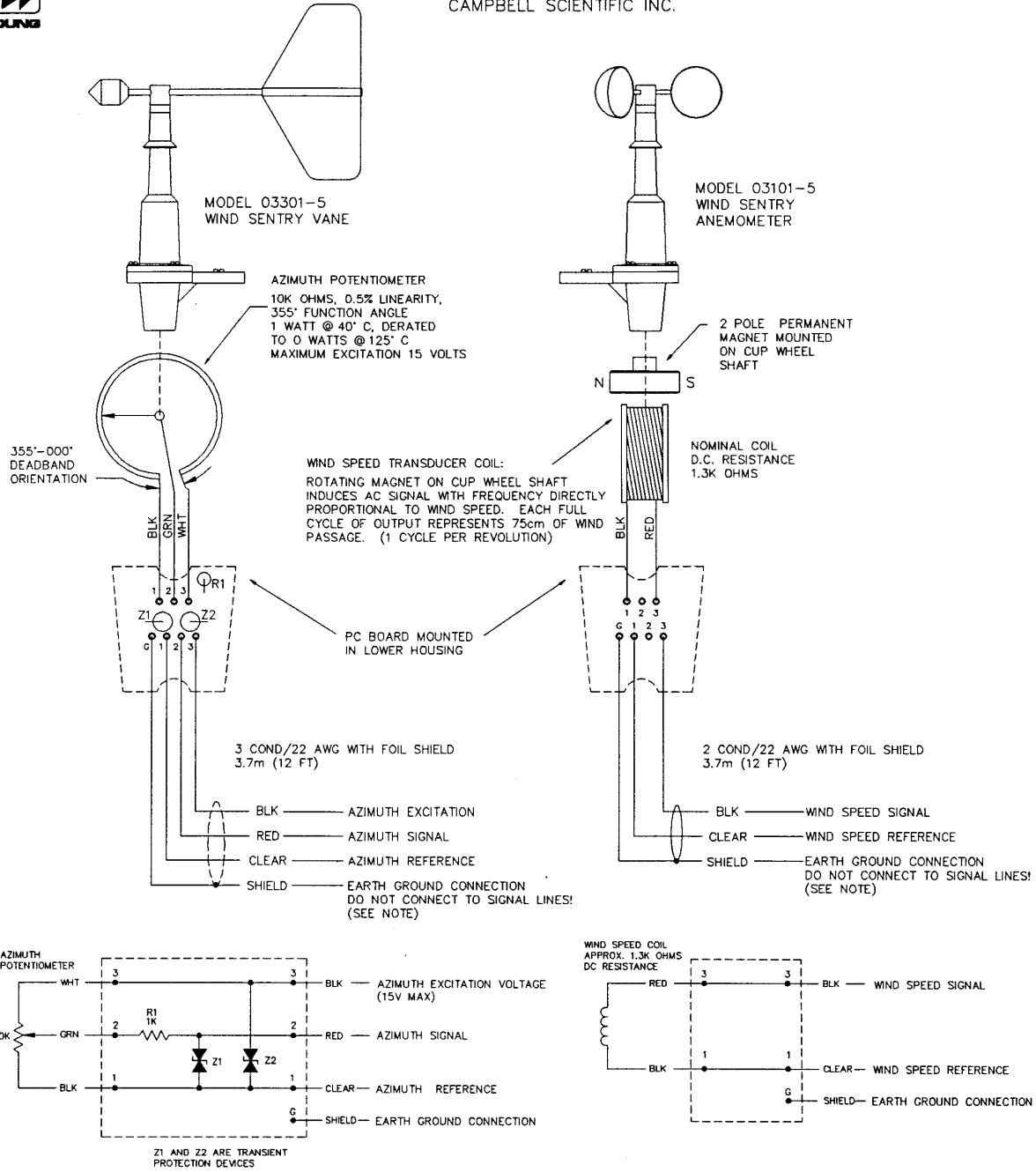
2801 AERO PARK DRIVE, TRAVERSE CITY MI 49684 USA
PHN 616-946-3980 FAX 616-946-4772 TWX 810-291-3366

OCT 1990



MODEL 03001-5 WIND SENTRY ANEMOMETER AND VANE

CAMPBELL SCIENTIFIC INC.



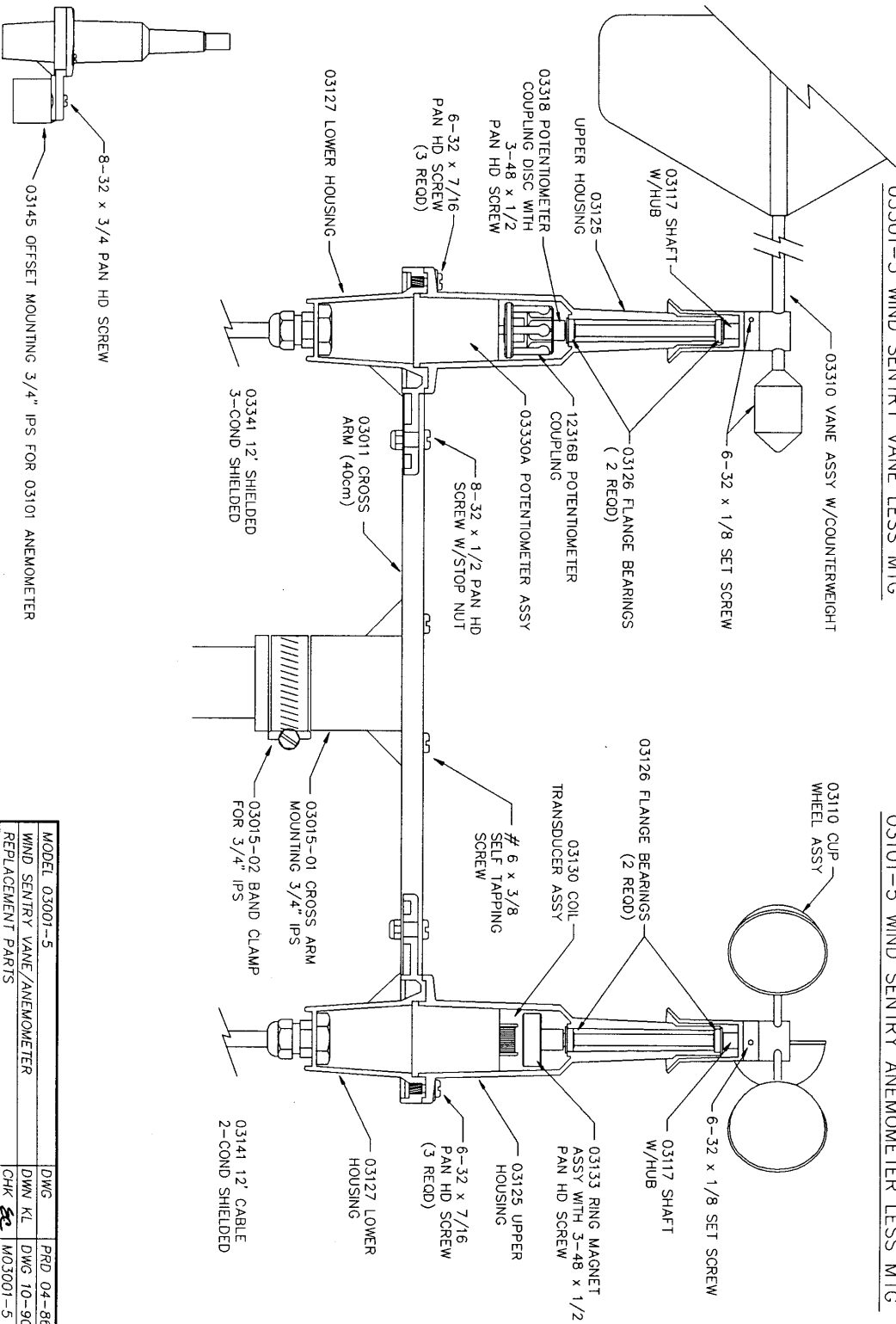
NOTE:
 THE EARTH GROUND CONNECTIONS MUST BE CONNECTED TO EARTH GROUND TO PROVIDE A STATIC DISCHARGE PATH. CONNECT THESE WIRES TO AN EARTH GROUND IN THE PROXIMITY OF THE SENSOR.

MODEL 03001-5	DWG A	PRD 08-90
WIND SENTRY CABLE & WIRING DIAGRAM	DWN KL	DWG 08-90
CAMPBELL SCIENTIFIC INC.	CHK <i>sc</i>	W03001
R.M. YOUNG CO. TRAVERSE CITY, MI 49684 U.S.A. 616-946-3980		



03301-5 WIND SENTRY VANE LESS MTG

03101-5 WIND SENTRY ANEMOMETER LESS MTG



MODEL 03001-5	DWG	PRD 04-86
WIND SENTRY VANE/ANEMOMETER	DWM KL	DWG 10-90
REPLACEMENT PARTS	CHK <i>[Signature]</i>	M03001-5
R.M. YOUNG CO. TRAVERSE CITY, MI 49684 U.S.A. 616-946-3980		

