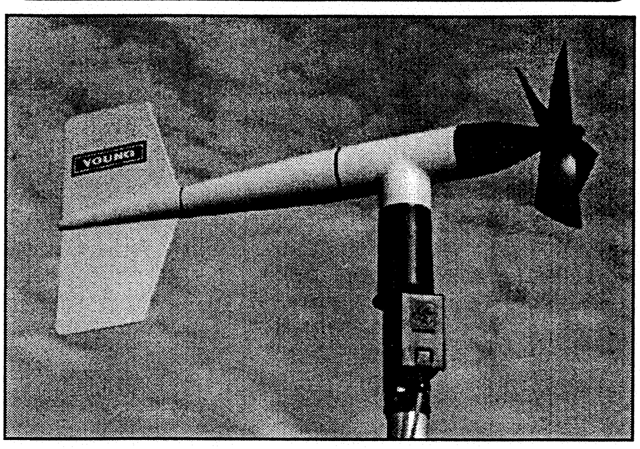
MODEL 09101
WIND MONITOR-SE



SPECIFICATION SUMMARY:

WIND SPEED:

Range:	0-60 m/s (130 mph)
Survival:	0-100 m/s (220 mph)
Accuracy:	±0.3 m/s (1 mph)
Threshold:	1.0 m/s (2.2 mph)
Distance constant:	2.7 m (8.9 ft)
Transducer:	Rotating magnet and stationary coil.

WIND DIRECTION:

Range:	0-360 degrees
Resolution:	1 degree
Threshold:	1.1 m/s (2.5 mph) @ 10° displacement
Delay distance:	1.3 m (4.3 ft)
Damping ratio:	0.25
Transducer:	Absolute encoder

GENERAL:

Power requirement:	11-24 VDC, 20 mA
Dimensions:	Overall height - 37 cm Overall length - 55 cm Propeller - 18 cm diameter Mounting - 34 mm (1.34 in) diameter (standard 1 inch pipe)
Weight:	Sensor weight - 1.0 kg (2.2 lb) Shipping weight - 2.3 kg (5.0 lb)

Available Outputs:

Voltage Output:

	WS:	0-5 VDC for 0-100 m/s
	WD:	0-5 VDC for 0-540°

Serial RS-485:

2 wire-half duplex, 1200-9600 Baud
RMY, NCAR, or NMEA protocols
Polled or continuous

NOTE: Output options are jumper selected. Some options are established by software. See text for specific details.

INTRODUCTION

The Wind Monitor-SE combines the performance and durability of the standard Wind Monitor with a unique new optical encoder direction transducer and serial output capability. The serial output signal is ideal for interfacing with modern data acquisition systems.

The wind speed sensor is a four blade helicoid propeller that turns a multi-pole magnet. Propeller rotation induces a variable frequency signal in a stationary coil; movable slip rings and brushes are not used. The raw signal is converted to a digital serial output by the on-board microprocessor circuit. A variety of serial protocols or a conventional voltage output may be selected simply by moving internal jumpers.

The wind direction sensor is a durable molded vane. An optical encoder is utilized for vane angle measurement, thereby eliminating the characteristic deadband and wear of potentiometer transducers. The encoder is an absolute type so direction output remains accurate even if power is interrupted. As with wind speed, a serial output or voltage output signal can be selected.

The Wind Monitor-SE is designed for superior environmental resistance. Housing parts are UV stabilized thermoplastic. Fittings are stainless steel and anodized aluminum. Precision grade stainless steel ball bearings are used throughout.

The instrument mounts on standard 1 inch pipe.

INITIAL CHECK-OUT

Remove the sensor from its shipping carton. Remove the plastic nut from the propeller shaft and install the propeller with the teeth on the propeller hub engaging the slots on the shaft hub. Tighten plastic propeller nut finger-tight only.

The instrument is fully balanced, aligned, and calibrated before shipment. Some simple checks can be made to verify proper function. Both windvane and propeller should rotate easily without friction. Check vane balance by holding sensor with vane surface horizontal. The vane should have no tendency to rotate. A slight imbalance will not degrade performance.

INITIAL SET-UP

The 09101 has been calibrated at the factory and requires no additional adjustments. Operation is configured by on-board jumpers and, in some cases, software commands.

The sensor is supplied with the following settings unless specified:

Continuous Serial Output
RMY Protocol
9600 Baud
Centimeters per Second

Other settings are easily selected by changing the jumper pattern. Refer to the wiring diagram for jumper J1 and J3 locations. The following table lists available features and position of each jumper.

DEC 1995

Jumper J1 Summary:

DESCRIPTION	J1 POSITION/JUMPER	
Continuous serial output	1 IN	
Polled serial output	1 OUT	
RMY protocol	2 IN	3 IN
NCAR protocol	2 IN	3 OUT
NMEA protocol	2 OUT	3 IN
1200 baud	4 IN	5 IN
2400 baud	4 IN	5 OUT
4800 baud	4 OUT	5 IN
9600 baud	4 OUT	5 OUT
Knots	6 IN	7 IN
Miles per hour	6 IN	7 OUT
Kilometers per hour	6 OUT	7 IN
Centimeters per second	6 OUT	7 OUT

Jumper J3 Summary:

DESCRIPTION	J3 POSITION/JUMPER
Calibrated 0-5 VDC output (see note)	LEFT
Serial RS-485 output	RIGHT

Note: When Voltage output is selected, set J1 for *RMY protocol* and *continuous serial output.*

SERIAL PROTOCOLS:

Details of the various operating modes are described in the following paragraphs.

When used for input/output, the serial bus must be capable of half-duplex communication. When not transmitting, the sensor remains in receive mode. After receiving a command, the sensor will wait 25 mS before transmitting. This allows the contacting device time to return to receive mode.

RMY PROTOCOL

RMY protocol is a very simple protocol suitable for use with the Young Model 26700 Translator and many dataloggers.

RMY protocol may be used with single sensors (polled or continuous output) or on a shared bus operating in polled mode.

In continuous mode, output occurs once per second. Data output format is an ASCII string as follows:

aa ddd sss<CR/LF>

where "aa" is the 09101 address, (0-15), "ddd" is direction in degrees, and "sss" is speed in units set by jumper J1.

In polled mode, there are two commands:

Ma! Where "a" is the 09101 address in hex, 0-F. This command requests the latest reading.

ADa! Where "a" is the new 09101 address in hex, 0-F. This command sets the 09101 address.

NCAR PROTOCOL

NCAR protocol uses a subset of the NCAR PAM III protocol.

For full details on the PAM III protocol, contact:

NCAR - Atmospheric Technology Division
P.O. Box 3000
Boulder, Colorado 80307-3000

Two modes are available: bussed and interactive. Bussed mode is the normal operating mode and requires a full address-command-checksum scheme for sending commands. Interactive mode omits the address and checksum requirements when issuing commands and is intended primarily for benchtop use.

When NCAR protocol is set via jumper J1, the 09101 defaults to bussed mode when powered up. A sequence of three ESC codes (ASCII 27) toggles the 09101 between bussed and interactive mode. The three ESC codes must occur within 2 seconds.

In bussed mode, the data output format is as follows:

&aaW: sss dddc<EOT>

where "aa" is the 09101 address in hex, 00-FF; "sss" is speed; "ddd" is direction in degrees, "c" is a single character pseudo-checksum; and <EOT> is the ASCII end-of-transmission character (ASCII 4).

In interactive mode, the data output format is the following:

W: sss ddd<CR/LF>

where "sss" is speed; "ddd" is direction in degrees; and <CR/LF> is the carriage return/line feed pair (ASCII 13 and 10).

Wind speed units may be set by jumper J1 or overridden (see command summary below). The zero reference for Wind direction is preset but may be reset to a new position.

Commands in bussed mode use the following general format:

#aa[...]c<EOT>

where "aa" is the 09101 address in hex, 00-FF; [...] is the command (see below); "c" is a single character pseudo-checksum; and <EOT> is the ASCII end-of-transmission character (ASCII 4).

Commands in interactive mode use this format:

[...]<CR>

where [...] is the command and <CR> is a carriage return (ASCII 13).

When operating in continuous output mode, the 09101 will still receive commands. However, because of the half-duplex serial bus, commands must be issued between data output transmissions. If commands arrive while the 09101 is transmitting, data may be garbled by the collision. In polled mode, collisions are unlikely since the 09101 responds only when commanded.

Response to commands varies depending on the command and whether the 09101 is in bussed or interactive mode.

In bussed mode, commands without the proper "#" prefix or address are ignored. Properly addressed but otherwise invalid commands are responded to as follows:

&aaNUc<EOT>	Undefined command
&aaNCc<EOT>	Bad checksum
&aaNOc<EOT>	Other error

Where "aa" is the 09101 address in hex, 00-FF; "c" is a single character pseudo-checksum; and <EOT> is the end-of-transmission character (ASCII 4).

In interactive mode, invalid commands produce this response:

NAK<CR/LF>

NCAR PAM III (SUBSET) COMMAND SUMMARY

CMD	DESCRIPTION	RESPONSE
CD	Continuous output, overrides J1	data
FC	Use calibrated speed units	&aaFC
FR	Use raw speed pulse count	&aaFR
OD	Output data	data
OS	Output status	status
PM	Polled mode, overrides J1	none
PO	Print operating parameters	parameter list
SAaa	Set address, "aa" is new hex address	&aa
ZN	Set zero direction reference	none
calib	Enter calibrate mode*	none
ratexx	Set output rate, "xx" is delay between each output in continuous mode. Delay equals xx times 32.77 mS.	none
propxxx	Set prop pitch, "xxx" is pitch in cm/rev	none
unitx	Set wind speed units, "x" is unit code. Overrides jumper J1 0 knots 1 miles per hour 2 kilometers per hour 3 centimeters per second 4 meters per second	none

Upper and lower case text must be observed with these commands.

NMEA PROTOCOL

This protocol produces a standard NMEA output sentence for wind speed and direction once per second at 4800 baud. The sentence is as follows:

$WIMWV,ddd,R,sss,N,A<CR/LF>

Where "ddd" is wind direction in degrees and "sss" is wind speed in knots.

In NMEA continuous output, 4800 baud and knots are used regardless of the jumper settings for those parameters.

VOLTAGE OUTPUTS

Voltage output mode is selected with jumper J3 in left position. J1 is normally set to *RMY protocol* and *continuous serial output.*

Wind direction voltage output is calibrated for 0-5 VDC for 0-540° range.

Wind speed voltage output is 0-5 VDC for 0-100 meters per second.

Long cable runs or small wire gauge may contribute significant voltage loss in the cable. These effects can be overcome by measuring voltage outputs differentially. With serial RS-485, voltage drop is not ordinarily an issue.

INSTALLATION

Proper placement of the instrument is very important. Eddies from trees, buildings, or other structures can greatly influence wind speed and wind direction observations. To get meaningful data, locate the instrument well away from 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 up to twice the height of the structure above ground.

FAILURE TO PROPERLY GROUND THE WIND MONITOR MAY RESULT IN ERRONEOUS SIGNALS OR TRANSDUCER DAMAGE.

Grounding the Wind Monitor is vitally important. Without proper grounding, static electrical charge can build up during certain atmospheric conditions and discharge through the transducers. This discharge can cause erroneous signals or transducer failure. To direct the discharge away from the transducers, the sensor mounting post assembly is made with a special plastic. It is very important that the mounting post be connected to a good earth ground. There are two ways this may be accomplished. First, the Wind Monitor may be mounted on a metal pipe which is connected to earth ground. The mounting pipe should not be painted where the Wind Monitor is mounted. Towers or masts set in concrete should be connected to one or more grounding rods. If it is difficult to ground the mounting post in this manner, an alternative method may be used. Inside the junction box the terminal labeled SPARE is internally connected to the anti-static mounting post. Use a wire to connect this terminal to a good earth ground as close to the instrument as possible.

Initial installation is most easily done with two people: one to adjust the instrument position and the other to observe the indicating device. After initial installation, the instrument can be removed and returned to its mounting without realigning the vane since the orientation ring preserves the wind direction reference. Install the Wind Monitor following these steps:

1. MOUNT WIND MONITOR
   a) Place orientation ring on mounting post. Do Not tighten band clamp yet.
   b) Place Wind Monitor on mounting post. Do Not tighten band clamp yet.

2. CONNECT SENSOR CABLE
   a) Remove junction box cover.
   b) Route cable thru strain relief opening at bottom of junction box. Secure cable by tightening packing nut.
   c) Connect sensor cable to terminals. See wiring diagram. Terminals A and B are used for either serial (RS-485) or voltage outputs depending on the position of jumper J3. Use a small screwdriver to make connections. Be sure to securely tighten each terminal.
   d) Replace junction box cover.

3. ALIGN VANE
   a) Connect instrument to an indicator.
   b) Choose a known wind direction reference point on the horizon.
   c) Sighting down instrument centerline, point nose cone at reference point on horizon.

d) While holding vane in position, slowly turn base until indicator shows proper value.
e) Tighten mounting post band clamp.
f) Engage orientation ring indexing pin in notch at instrument base.
g) Tighten orientation ring band clamp.

CALIBRATION

Periodic calibration checks are desirable and may be necessary where the instrument is used in programs which require auditing of sensor performance. Recalibration may be necessary after some maintenance operations.

An accurate wind direction calibration requires a Vane Angle Fixture (Young Model 18112 or equivalent). Details are listed under "VERTICAL SHAFT BEARING REPLACEMENT STEP 10. ALIGN VANE" The sensor nose cone must be removed if any adjustment is required.

Wind speed calibration is determined by propeller pitch and the output characteristics of the transducer. Calibration formulas showing propeller rpm vs. wind speed are shown on the wiring diagram. Standard accuracy is ± 0.3 m/s (0.6mph). For greater accuracy, the device must be individually calibrated in comparison with a wind speed standard. Contact the factory or your YOUNG supplier to schedule a NIST (National Institute of Standards & Technology) traceable wind tunnel calibration in our facility.

To check wind calibration using a signal from the instrument, temporarily remove the propeller and connect a Model 18801 Anemometer Drive to the propeller shaft. Apply the appropriate calibration formula to the calibrating motor rpm and check for the proper value. For example, with the propeller shaft turning at 3600 rpm adjust an indicator to display 17.6 meters per second (3600 rpm x 0.00490 m/s/rpm = 17.6 m/s).

Details on checking bearing torque, which affects wind speed and direction threshold, appear in the following section.

MAINTENANCE

Given proper care, the Wind Monitor should provide years of service. The only components likely to need replacement due to normal wear are the precision ball bearings. Only a qualified instrument technician should perform the replacement. If service facilities are not available, return the instrument to the company. Refer to the drawings to become familiar with part names and locations. Maximum torque on all set screws is 80 oz-in.

FLANGE BEARING REPLACEMENT:

If anemometer bearings become noisy or wind speed threshold increases above an acceptable level, bearings may need replacement. Check anemometer bearing condition using a Model 18310 Propeller Torque Disc. Without it, a rough check can be performed by adding an ordinary paper clip (0.5 gm) to the tip of a propeller blade. Turn the blade with the paper clip to the "three o'clock" or "nine o'clock" position and gently release it. 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. If needed, bearings are replaced as follows.

1. REMOVE OLD BEARINGS
   a) Unscrew nose cone. Do not lose o-ring seal.
   b) Loosen set screw on magnet shaft collar and remove magnet.
   c) Slide propeller shaft out of nose cone assembly.
   d) Remove front bearing cap which covers front bearing.
   e) Remove front and rear bearings from nose cone assembly. Insert edge of a pocket knife under bearing flange and lift it out.

2. INSTALL NEW BEARINGS
   a) Insert new front and rear bearings into nose cone.
   b) Replace front bearing cap.
   c) Carefully slide propeller shaft thru bearings.
   d) Place magnet on propeller shaft allowing 0.5 mm (0.020") clearance from rear bearing.
   e) Tighten set screw on magnet shaft collar. Do not overtighten.
   f) Screw nose cone into main housing until o-ring seal is seated. Be certain threads are properly engaged to avoid cross-threading.

VERTICAL SHAFT BEARING REPLACEMENT

Vertical shaft bearings are much larger than the propeller shaft bearings. Ordinarily, these bearings will require replacement less frequently. In many cases, they may last the life of the sensor. Check bearing condition using a Model 18331 Vane Torque Gauge. Without it, a rough check can be performed by holding the instrument with the vane horizontal and placing a 3 gm weight near the aft edge of the fin. A U.S. penny weighs about 3 gm and is convenient for this check. Failure of the vane to rotate downward indicates the bearings need replacement.

1. REMOVE MAIN HOUSING
   a) Unscrew nose cone from main housing. Retain O-ring for reuse.
   b) Gently push main housing latch.
   c) While pushing latch, lift main housing up and remove it from vertical shaft bearing rotor.

2. UNSOLDER TRANSDUCER WIRES
   a) Remove junction box cover.
   b) Remove 3 screws holding circuit board.
   c) Unsolder transducer wires from circuit board. 9 wires attach at upper edge of board, 1 wire attaches at bottom near cable terminals.

3. REMOVE TRANSDUCER ASSEMBLY
   a) Loosen 2 set screws at base of transducer assembly and remove assembly from vertical shaft. Use care to avoid damaging wires.

4. REMOVE BEARING ROTOR by sliding it upward off vertical shaft.

5. REMOVE OLD BEARINGS AND INSTALL NEW BEARINGS. When inserting new bearings, be careful not to apply pressure to bearing shields.

6. REPLACE BEARING ROTOR ON VERTICAL SHAFT

7. REPLACE TRANSDUCER ASSEMBLY. Tighten set screws to 80 oz-in.

8. RECONNECT TRANSDUCER WIRES
   a) Gently pull wires through hole in junction box. Needle nose pliers or a bent wire may be used.
   b) Carefully solder wires to circuit board according to wiring diagram. Observe color code.
   c) Secure circuit board in junction box using 3 screws removed in step 2b. Do not overtighten

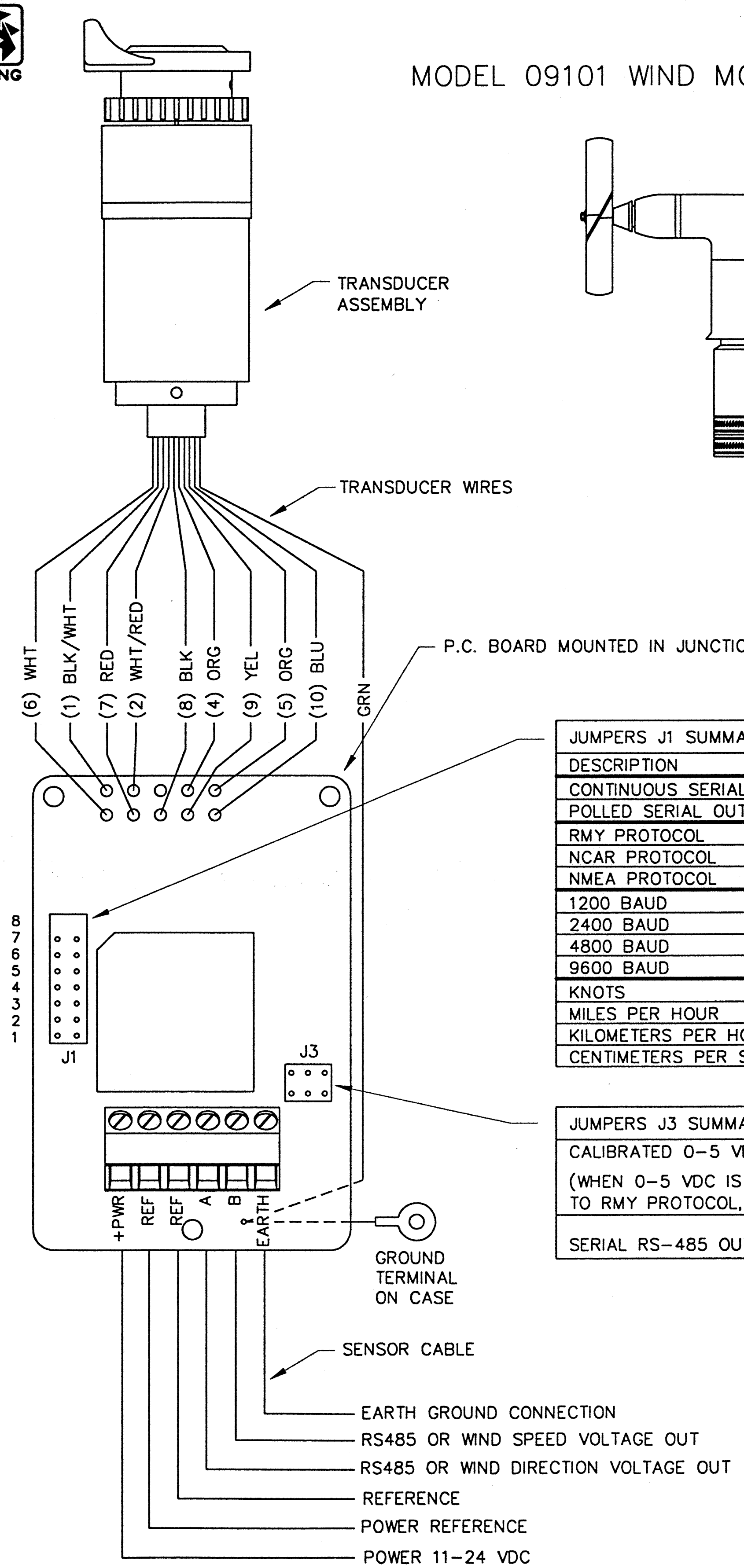
9. REPLACE MAIN HOUSING
   a) Position main housing over bearing rotor. Be careful to align indexing key inside main housing with slot in rotor.
   b) Turn direction-adjust thumbwheel until notch in coupling is away from front opening and aligned with ridge inside housing. Set screw in coupling should face the front opening.
   d) With coupling oriented, continue to push main housing onto bearing rotor until latch locks into place with a click.

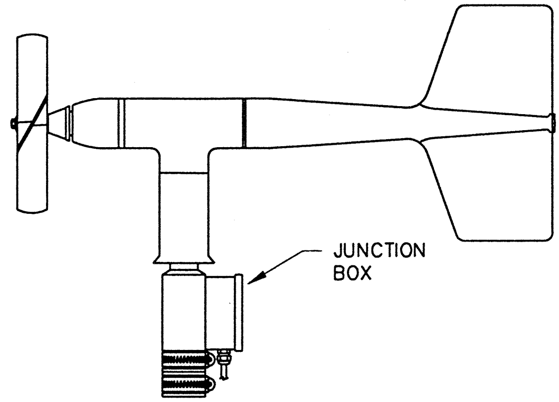
10. ALIGN VANE
   a) Connect sensor to indicator.
   b) Install sensor on vane angle fixture (Young Model 18112 or equivalent) with junction box at 180° or South position.
   c) Align sensor to known angular position. If indicator output varies more than ±1 ° from known angle, loosen setscrew in direction adjust thumbwheel and slowly turn thumbwheel until correct output value is obtained. Tighten setscrew.
   d) Verify correct angular values at other vane positions.

11. REPLACE NOSE CONE
   a) Screw nose cone into main housing until o-ring seal is seated. Be careful to avoid cross-threading.

YOUNG

MODEL 09101 WIND MONITOR-SE





JUMPERS J1 SUMMARY	
DESCRIPTION	JUMPER POSITION
CONTINUOUS SERIAL OUTPUT	1 IN
POLLED SERIAL OUTPUT	1 OUT
RMY PROTOCOL	2 IN 3 IN
NCAR PROTOCOL	2 IN 3 OUT
NMEA PROTOCOL	2 OUT 3 IN
1200 BAUD	4 IN 5 IN
2400 BAUD	4 IN 5 OUT
4800 BAUD	4 OUT 5 IN
9600 BAUD	4 OUT 5 OUT
KNOTS	6 IN 7 IN
MILES PER HOUR	6 IN 7 OUT
KILOMETERS PER HOUR	6 OUT 7 IN
CENTIMETERS PER SECOND	6 OUT 7 OUT

JUMPERS J3 SUMMARY	
CALIBRATED 0-5 VDC OUTPUT (WHEN 0-5 VDC IS SELECTED SET J1 TO RMY PROTOCOL, POLLED OUTPUT)	
SERIAL RS-485 OUTPUT	

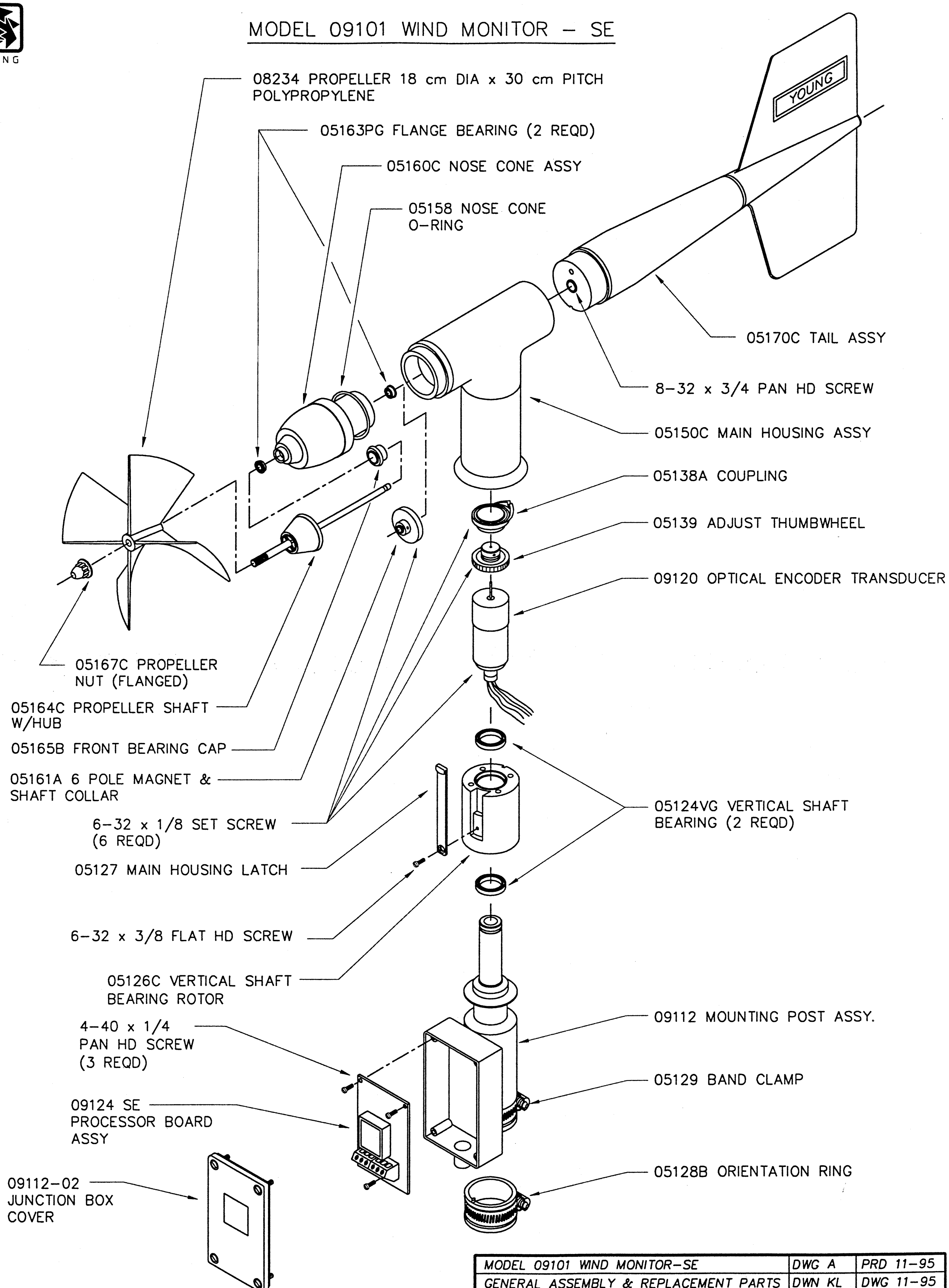
WIND SPEED vs PROPELLER RPM		
m/s	=	0.00490 x rpm
knots	=	0.00952 x rpm
mph	=	0.01096 x rpm
km/h	=	0.01764 x rpm

NOTE:
THE EARTH GROUND TERMINAL MUST BE CONNECTED TO EARTH GROUND TO PROVIDE A STATIC DISCHARGE PATH. CONNECT THIS TERMINAL TO AN EARTH GROUND NEAR THE SENSOR.

MODEL 09101	DWG A	PRD 11-95
WIND MONITOR-SE	DWN KL	DWG 11-95
WIRING DIAGRAM	CHK	W09101

R.M. YOUNG CO. TRAVERSE CITY, MI 49686 U.S.A. 616-946-3980

MODEL 09101 WIND MONITOR – SE



MODEL 09101 WIND MONITOR-SE	DWG A	PRD 11-95
GENERAL ASSEMBLY & REPLACEMENT PARTS	DWN KL	DWG 11-95
	CHK	E09101
R.M. YOUNG CO. TRAVERSE CITY, MI 49686 U.S.A. 616-946-3980		