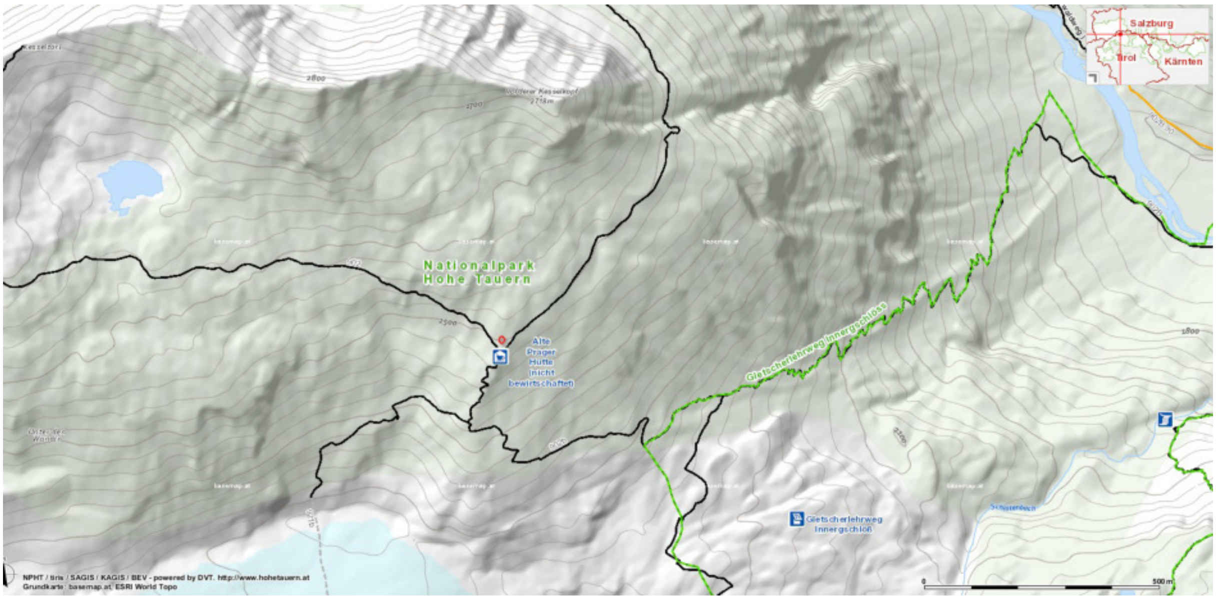
WETTERSTATION ALTE PRAGER HÜTTE
ALLGEMEINE INFORMATION & TECHNISCHE SPEZIFIKATION

Allgemeines

- Betriebsbeginn: 1. November 2018

Lage

- Nationalpark Hohe Tauern Tirol – nähe Alte Prager Hütte / Gemeinde 9971 Matrei i.O. (Austria)
- Koordinaten: 47,120669N 12,408358E / Höhe: 2.500m üNN
- Lageplan:



1. Abbildung: Lage der Wetterstation (roter Punkt) nahe der Alten Prager Hütte

Messparameter/Geräte

Die technischen Parameter (Whitepapers) zu den verwendeten Messgeräten finden sich im Anhang.

Parameter		Device
Temperatur(LT) & Luftfeuchte(LF) [°C, %]	15 Minuten-Intervall (LT & LF)	OTT TR2O
Wind [m/sec] Wingeschwindigkeit (WG) Windgeschwindigkeit Böe (WG.BOE) Windrichtung (WR)	5-Minuten Intervall (WG, WG.BOE, WR)	Windmonitor Young 05103VM-45
Globalstrahlung (GS) [Wm^{-2}]	5-Minuten Intervall	SP-230 Apogee

Stand: 16.10.2018/Jur

		Pyranometer
Kamera (Sicht auf Schlatenkees)	Alle 8 Stunden (9h MESZ, 17h MESZ, 1h MESZ)	D-Link DCS 7110 IP Cam

Datenanfragen/Kontakt

Folgende Daten können online abgerufen werden:

- Letztes Webcam-Bild auf Schlatenkees: https://apps.tirol.gv.at/hydro/intranet/webcam/altepragerhuette.jpg
- Temperatur online: https://apps.tirol.gv.at/hydro/#/Lufttemperatur/?station=197192

Weitere Daten und lange Zeitreihen können angefordert werden:

Nationalpark Hohe Tauern
Verwaltung Tirol
Kirchplatz 2
9971 Matrei
+43 4875 5161 0
npht@tirol.gv.at

Bei den zur Verfügung gestellten Daten handelt es sich um Rohdaten, die nicht auf Richtigkeit und Vollständigkeit überprüft werden. Der Datenempfänger akzeptiert, dass der Datenlieferant keine Haftung für die Vollständigkeit, Richtigkeit und Aktualität der zur Verfügung gestellten Daten übernimmt.

Spezifikationen Messgeräte (Whitepapers)

Siehe Anhang.

2. Abbildung: Wetterstation Stand: 10/2018 © NPHT

Sensor für relative Feuchtigkeit und Temperatur mit Schutzgehäuse OTT TRH

- **Messparameter**
  Lufttemperatur und relative Luftfeuchte (gemessen), absolute Luftfeuchte, Taupunkt und Mischungsverhältnis (berechnet)

- **Messtechnologie**
  PT1000, Kapazitiv

- **Produkt Highlights**
  Geringe Stromaufnahme, sehr langzeitstabil, für extreme Temperaturen geeignet, mit Schutzgehäuse

- **Schnittstellen**
  SDI-12

Der kompakte, langzeitstabile Wettersensor OTT TRH ist für die Messung von relativer Luftfeuchte und Temperatur zuständig. Darüber hinaus kann er die Werte absolute Luftfeuchte, Taupunkt und Mischungsverhältnis berechnen und über die SDI-12-Schnittstelle ausgeben. Die Sensorik ist durch eine Schutzkappe vor Staub und Verunreinigungen geschützt. Zusätzlich wird der Sensor mit einem Schutzgehäuse ausgeliefert, das Strahlungs- und Wetterschutz bietet.

Sensor TR2O

Ausgabe-Parameter	
gemessen	Temperatur in °C oder °F, Relative Luftfeuchte in %

We reserve the right to make technical changes and improvements without notice. V-15.10.2018
OTT Hydromet GmbH, Germany

berechnet	Absolute Luftfeuchte in g/m^3, Taupunkt in °C oder °F, Mischungsverhältnis in g/kg

Relative Luftfeuchte	
Messbereich	0 ... 100 % rF
Genauigkeit bei 25 °C und 4,5 V DC ...15 V DC* (inklusive Wiederholbarkeit, Hysterese und Kalibrierunsicherheit)	max. ±2 % rF bei 0 ... 90 % rF**; max. ±3 % rF bei 90 ... 100 % rF** *Bei einer Versorgungsspannung >15 V DC gelten hiervon abweichende Genauigkeiten **Temperaturabhängigkeit: < ±2 % @ –10 °C ... 60 °C
Auflösung	0,1%
Wiederholbarkeit	±0,1 % rF
Hysterese	<1 % rF
Langzeitstabilität	typ. < ±1,5 % pro Jahr
Reaktionszeit mit Schutzkappe	rF90 typ. <15 s bei 0,35 m/s

Temperatur	
Sensor	PT1000 DIN A
Messbereich	-40 °C ... +80 °C
Genauigkeit bei 4,5 V DC ...15 V DC*	±0,1 °C bei 20 °C; ±0,5 °C bei -40 °C, 80 °C Linearität *Bei einer Versorgungsspannung >15 V DC gelten hiervon abweichende Genauigkeiten
Auflösung	0,01 °C
Reaktionszeit mit Schutzkappe	T90 <300 s bei 1 m/s Luftströmung; T90 <250 s bei 2 m/s Luftströmung

Absolute Luftfeuchte	
Messbereich	0 ... 1000 g/m^3
Auflösung	0,1 g/m^3

Taupunkt	
Messbereich	-40 °C ... +80 °C
Auflösung	0,01 °C

Mischungsverhältnis	
Messbereich	0 ... 1000 g/kg
Auflösung	0,1 g/kg
Schnittstelle	SDI-12 V1.3

Versorgungsspannung	4,5 V DC ... 28 V DC

Stromaufnahme	
Ruhezustand	< 20 µA @ 12 V
Temperaturmessung	typ. 550 µA

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OTT ADCON TELEMETRY HYDROLAB SUTRON Lufft

Feuchtemessung	typ. 260 µA

Umgebungsbedingungen	
Betriebstemperatur	-40 °C ... +80 °C
Lagertemperatur	-50 °C ... +80 °C
Luftfeuchtigkeit (bei Betrieb)	0 ... 100 % rF

Schutzklasse	IP65

Sensorschutz	Schutzkappe mit Metallgitterfilter

Material und Abmessung	
Gehäusematerial Sensor	Polycarbonat
Abmessung Sensor	Ø 12 mm x 140 mm
Material Kabel	PUR (schwarz), angespritzt/geschirmt
Länge Kabel	3,5 m

Adernbelegung Kabel	Farbcode lt. Gehäusebeschriftung

Richtlinien	EG (2004/108/EG), EN 61326-1:2006

Wetter- und Strahlungsschutz OTT RS7	

Anzahl Lamellen	7

Betriebstemperatur	-40 °C ... +80 °C

Material und Abmessung	
Lamellen	2 Komponenten (PS, PA)
Halterung	Edelstahl
Höhe inkl. Halterung	230 mm

Gewicht (ohne Sensor)	700 g

Mast-/Rohrdurchmesser für Montage	horizontal (Rohr): 27 mm ... 43 mm (3/4"... 5/4"), vertikal (Mast/Rohr): 27 mm ... 60 mm (1" ... 2")

We reserve the right to make technical changes and improvements without notice. V-15.10.2018
OTT Hydromet GmbH, Germany

apogee
INSTRUMENTS

OWNER'S MANUAL

PYRANOMETER

Models SP-110 and SP-230

(including SS models)

APOGEE INSTRUMENTS, INC. | 721 WEST 1800 NORTH, LOGAN, UTAH 84321, USA
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CERTIFICATE OF COMPLIANCE

EU Declaration of Conformity

This declaration of conformity is issued under the sole responsibility of the manufacturer:

Apogee Instruments, Inc.
721 W 1800 N
Logan, Utah 84321
USA

for the following product(s):

Models: SP-110, SP-230
Type: Pyranometer

The object of the declaration described above is in conformity with the relevant Union harmonization legislation:

2014/30/EU	Electromagnetic Compatibility (EMC) Directive
2011/65/EU	Restriction of Hazardous Substances (RoHS 2) Directive

Standards referenced during compliance assessment:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use – EMC requirements
EN 50581:2012	Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

Please be advised that based on the information available to us from our raw material suppliers, the products manufactured by us do not contain, as intentional additives, any of the restricted materials including cadmium, hexavalent chromium, lead, mercury, polybrominated biphenyls (PBB), polybrominated diphenyls (PBDE).

Further note that Apogee Instruments does not specifically run any analysis on our raw materials or end products for the presence of these substances, but rely on the information provided to us by our material suppliers.

Signed for and on behalf of:
Apogee Instruments, May 2018

Bruce Bugbee
President
Apogee Instruments, Inc.

INTRODUCTION

Solar radiation at Earth's surface is typically defined as total radiation across a wavelength range of 280 to 4000 nm (shortwave radiation). Total solar radiation, direct beam and diffuse, incident on a horizontal surface is defined as global shortwave radiation, or shortwave irradiance (incident radiant flux), and is expressed in Watts per square meter (W m^{-2}, equal to Joules per second per square meter).

Pyranometers are sensors that measure global shortwave radiation. Apogee SP series pyranometers are silicon-cell pyranometers, and are only sensitive to a portion of the solar spectrum, approximately 350-1100 nm (approximately 80 % of total shortwave radiation is within this range). However, silicon-cell pyranometers are calibrated to estimate total shortwave radiation across the entire solar spectrum. Silicon-cell pyranometer specifications compare favorably to specifications for World Meteorological Organization (WMO) moderate and good quality classifications and specifications for International Organization of Standardization (ISO) second class and first class classifications, but because of limited spectral sensitivity, they do not meet the spectral specification necessary for WMO or ISO certification.

Typical applications of silicon-cell pyranometers include incoming shortwave radiation measurement in agricultural, ecological, and hydrological weather networks, and solar panel arrays.

Apogee Instruments SP series pyranometers consist of a cast acrylic diffuser (filter), photodiode, and signal processing circuitry mounted in an anodized aluminum housing, and a cable to connect the sensor to a measurement device. Sensors are potted solid with no internal air space and are designed for continuous total shortwave radiation measurement on a planar surface in outdoor environments. SP series sensors output an analog voltage that is directly proportional to total shortwave radiation from the sun. The voltage signal from the sensor is directly proportional to radiation incident on a planar surface (does not have to be horizontal), where the radiation emanates from all angles of a hemisphere.

SENSOR MODELS

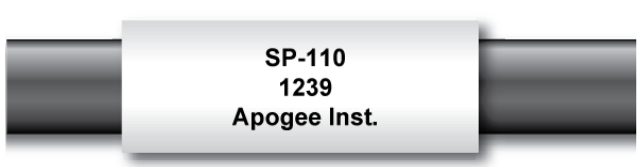
This manual covers the unamplified models SP-110 and SP-230 pyranometer sensors that provide millivolt signals. Additional models are covered in their respective manuals.

Model	Signal
SP-110	**Self-powered**
SP-230*	**Self-powered**
SP-212	0-2.5 V
SP-214	4-20 mA
SP-215	0-5 V
SP-420	USB
SP-421	SDI-12
SP-422	Modbus

*Pyranometer model SP-230 is similar to model SP-110, but includes internal heaters designed to keep the diffuser free of precipitation events such as dew or frost.

SP-110

SP-230



Sensor model number and serial number are located near the pigtail leads on the sensor cable. If you need the manufacturing date of your sensor, please contact Apogee Instruments with the serial number of your sensor.

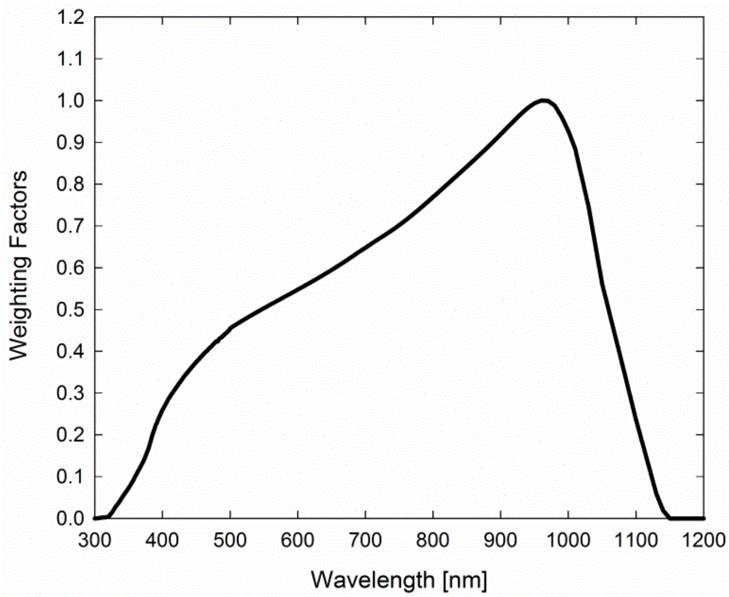
SPECIFICATIONS

	SP-110-SS	SP-230-SS
Heater	N/A	780 Ω, 15.4 mA current draw and 185 mW power requirement at 12 V DC
Sensitivity	0.2 mV per W m^{-2}	
Calibration Factor (Reciprocal of Sensitivity)	5 W m^{-2} per mV	
Calibration Uncertainty	± 5 % (see Calibration Traceability below)	
Calibrated Output Range	0 to 400 mV	
Measurement Repeatability	Less than 1 %	
Long-term Drift (Non-stability)	Less than 2 % per year	
Non-linearity	Less than 1 % (up to 2000 W m^{-2})	Less than 1 % (up to 1750 W m^{-2})
Response Time	Less than 1 ms	
Field of View	180°	
Spectral Range	360 to 1120 nm (wavelengths where response is 10 % of maximum; see Spectral Response below)	
Directional (Cosine) Response	± 5 % at 75° zenith angle (see Cosine Response below)	
Temperature Response	0.04 ± 0.04 % per C (see Temperature Response below)	
Operating Environment	-40 to 70 C; 0 to 100 % relative humidity; can be submerged in water up to 30 m	
Dimensions	24 mm diameter, 33 mm height	
Mass	90 g (with 5 m of lead wire)	
Cable	5 m of two conductor, shielded, twisted-pair wire; TPR jacket (high water resistance, high UV stability, flexibility in cold conditions); pigtail lead wires; stainless steel (316), M8 connector located 25 cm from sensor head	

Calibration Traceability

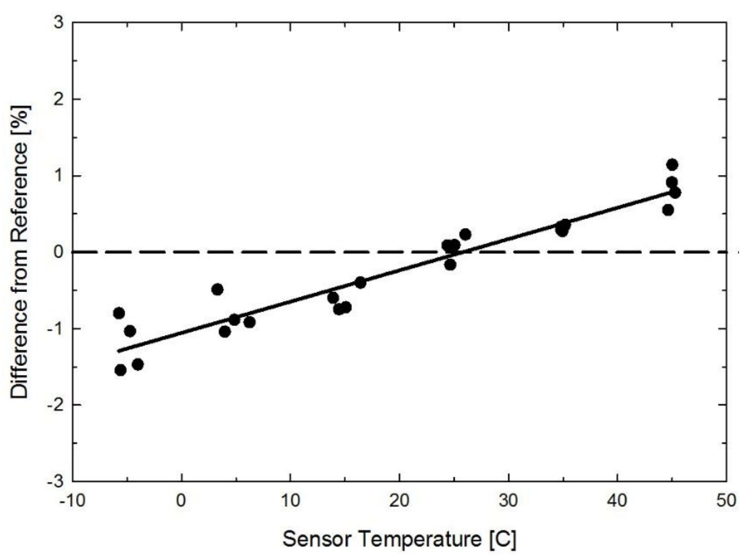
Apogee Instruments SP series pyranometers are calibrated through side-by-side comparison to the mean of four Apogee model SP-110 transfer standard pyranometers (shortwave radiation reference) under high intensity discharge metal halide lamps. The transfer standard pyranometers are calibrated through side-by-side comparison to the mean of at least two ISO-classified reference pyranometers under sunlight (clear sky conditions) in Logan, Utah. Each of four ISO-classified reference pyranometers are recalibrated on an alternating year schedule (two instruments each year) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. NREL reference standards are calibrated to the World Radiometric Reference (WRR) in Davos, Switzerland.

Spectral Response



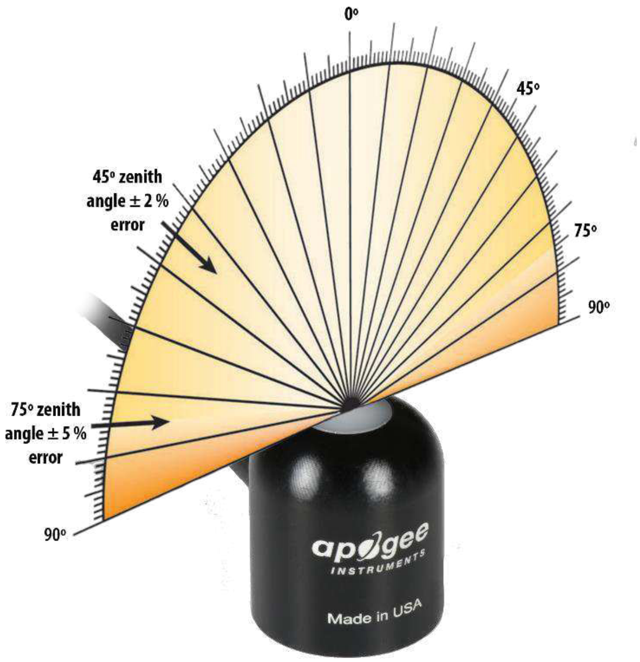
Spectral response estimate of Apogee silicon-cell pyranometers. Spectral response was estimated by multiplying the spectral response of the photodiode, diffuser, and adhesive. Spectral response measurements of diffuser and adhesive were made with a spectrometer, and spectral response data for the photodiode were obtained from the manufacturer.

Temperature Response

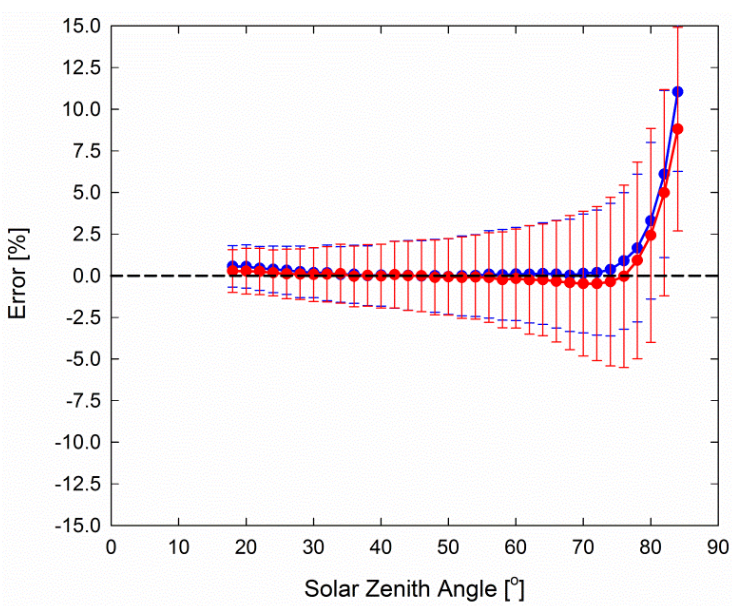


Mean temperature response of four Apogee silicon-cell pyranometers. Temperature response measurements were made at approximately 10 C intervals across a temperature range of approximately -10 to 50 C under sunlight. Each pyranometer had an internal thermistor to measure temperature. At each temperature set point, a reference blackbody pyranometer was used to measure solar intensity.

Cosine Response



Directional, or cosine, response is defined as the measurement error at a specific angle of radiation incidence. Error for Apogee silicon-cell pyranometers is approximately ± 2 % and ± 5 % at solar zenith angles of 45° and 75°, respectively.



Mean cosine response of eleven Apogee silicon-cell pyranometers (***error bars represent two standard deviations above and below mean***). Cosine response measurements were made during broadband outdoor radiometer calibrations (BORCAL) performed during two different years at the National Renewable Energy Laboratory (NREL) in Golden, Colorado. Cosine response was calculated as the relative difference of pyranometer sensitivity at each solar zenith angle to sensitivity at 45° solar zenith angle. The blue symbols are AM measurements, the red symbols are PM measurements.

DEPLOYMENT AND INSTALLATION

Mount the sensor to a solid surface with the nylon mounting screw provided. To accurately measure PPFD incident on a horizontal surface, the sensor must be level. An Apogee Instruments model AL-100 Leveling Plate is recommended to level the sensor when used on a flat surface or being mounted to surfaces such as wood. To facilitate mounting on a mast or pipe, the Apogee Instruments model AL-120 Solar Mounting Bracket with Leveling Plate is recommended.

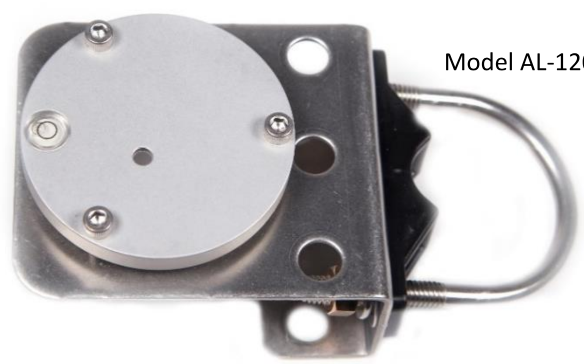
Pyranometer model SP-230 comes with a plastic standoff which should be placed between the sensor head and the leveling plate. The standoff allows for more efficient use of the internal heaters by minimizing possible heating losses through conduction.

Important: Only use the nylon screw provided when mounting to insulate the non-anodized threads of the aluminum sensor head from the base to help prevent galvanic corrosion. For extended submersion applications, more insulation may be necessary. Contact Apogee tech support for details.

Nylon Screw: 10-32x3/8

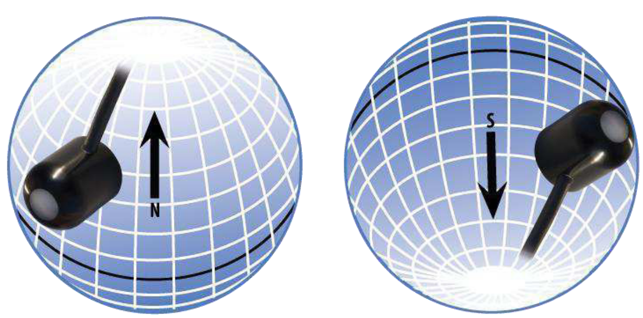
Model AL-100

Nylon Screw: 10-32x3/8



Model AL-120

To minimize azimuth error, the sensor should be mounted with the cable pointing toward true north in the northern hemisphere or true south in the southern hemisphere. Azimuth error is typically less than 1 %, but it is easy to minimize by proper cable orientation.



In addition to orienting the cable to point toward the nearest pole, the sensor should also be mounted such that obstructions (e.g., weather station tripod/tower or other instrumentation) do not shade the sensor. **Once mounted, the green cap should be removed from the sensor.** The green cap can be used as a protective covering for the sensor when it is not in use.

CABLE CONNECTORS

Apogee started offering in-line cable connectors on some bare-lead sensors in March 2018 to simplify the process of removing sensors from weather stations for calibration (the entire cable does **not** have to be removed from the station and shipped with the sensor).

The ruggedized M8 connectors are rated IP68, made of corrosion-resistant marine-grade stainless-steel, and designed for extended use in harsh environmental conditions.

Inline cable connectors are installed 30 cm from the head
(pyranometer pictured)

Instructions

Pins and Wiring Colors: All Apogee connectors have six pins, but not all pins are used for every sensor. There may also be unused wire colors inside the cable. To simplify datalogger connection, we remove the unused pigtail lead colors at the datalogger end of the cable.

If you ever need a replacement cable, please contact us directly to ensure ordering the proper pigtail configuration.

A reference notch inside the connector ensures proper alignment before tightening.

Alignment: When reconnecting your sensor, arrows on the connector jacket and an aligning notch ensure proper orientation.

Disconnection for extended periods: When disconnecting the sensor for an extended period of time from a station, protect the remaining half of the connector still on the station from water and dirt with electrical tape or other method.

When sending sensors in for calibration, only send the short end of the cable and half the connector.

Tightening: Connectors are designed to be firmly finger-tightened only. There is an o-ring inside the connector that can be overly compressed if a wrench is used. Pay attention to thread alignment to avoid cross-threading. When fully tightened, 1-2 threads may still be visible.

Finger-tighten firmly

OPERATION AND MEASUREMENT

Connect the sensor to a measurement device (meter, datalogger, controller) capable of measuring and displaying or recording a millivolt (mV) signal (an input measurement range of approximately 0-250 mV is required to cover the entire range of total shortwave radiation from the sun). In order to maximize measurement resolution and signal-to-noise ratio, the input range of the measurement device should closely match the output range of the pyranometer.

SP-110: The sensor is self-powered and applying voltage will damage the sensor.

VERY IMPORTANT: Apogee changed all wiring colors of our bare-lead sensors in March 2018 in conjunction with the release of inline cable connectors on some sensors. To ensure proper connection to your data device, please note your serial number or if your sensor has a stainless-steel connector 30 cm from the sensor head then use the appropriate wiring configuration below.

Wiring for SP-110 Serial Numbers range 0-60050

Red: Positive (signal from sensor)

Black: Negative (signal from sensor)

Clear: Shield/Ground

Wiring for SP-110 Serial Numbers 60051 and above or with a cable connector

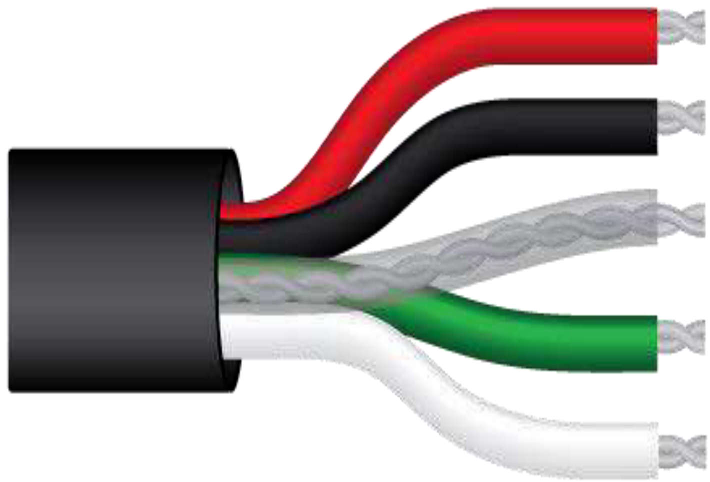
Black: Negative (signal from sensor)

Clear: Shield/Ground

White: Positive (signal from sensor)

SP-230: Only apply voltage to the integrated heaters. The sensor is self-powered and applying voltage will damage the sensor.

Wiring for SP-230 Serial Numbers range 0-9897



Red: High side of differential channel (positive lead for sensor)

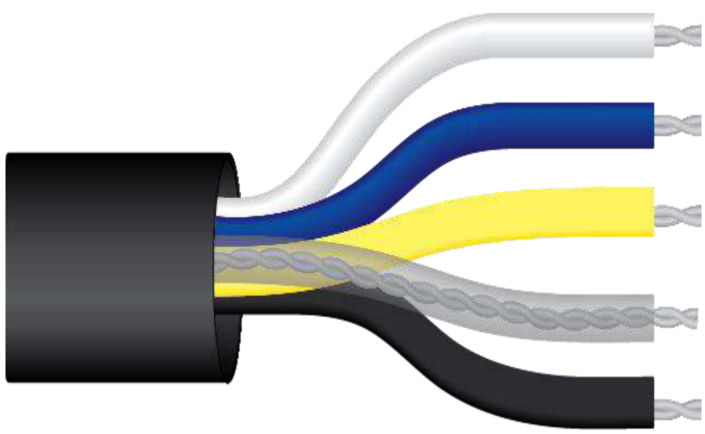
Black: Low side of differential channel (negative lead for sensor)

Clear: Analog ground (shield wire)

Green: Ground (negative lead for heater)

White: 12 V DC (positive lead for heater)

Wiring for SP-230 Serial Numbers 9898 and above or with a cable connector



White: Positive (signal from sensor)

Blue: Ground (negative lead for heater)

Yellow: 12 V DC (positive lead for heater)

Clear: Shield/Ground

Black: Negative (signal from sensor)

Sensor Calibration

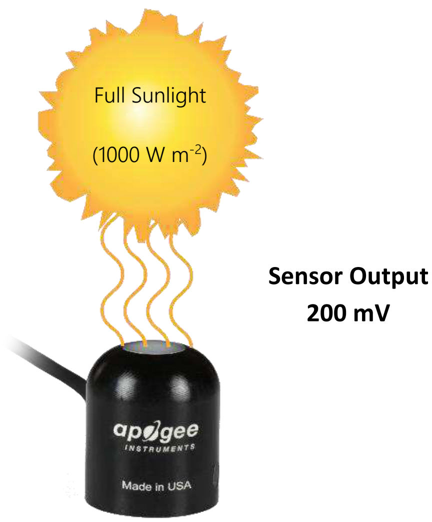
All Apogee un-amplified pyranometer models have a standard calibration factor of exactly:

$5.0\ W\ m^{-2}$ per mV

Multiply this calibration factor by the measured mV signal to convert sensor output to shortwave radiation in units of $W\ m^{-2}$:

Calibration Factor ($5.0\ W\ m^{-2}$ per mV) * Sensor Output Signal (mV) = Total Shortwave Radiation ($W\ m^{-2}$)

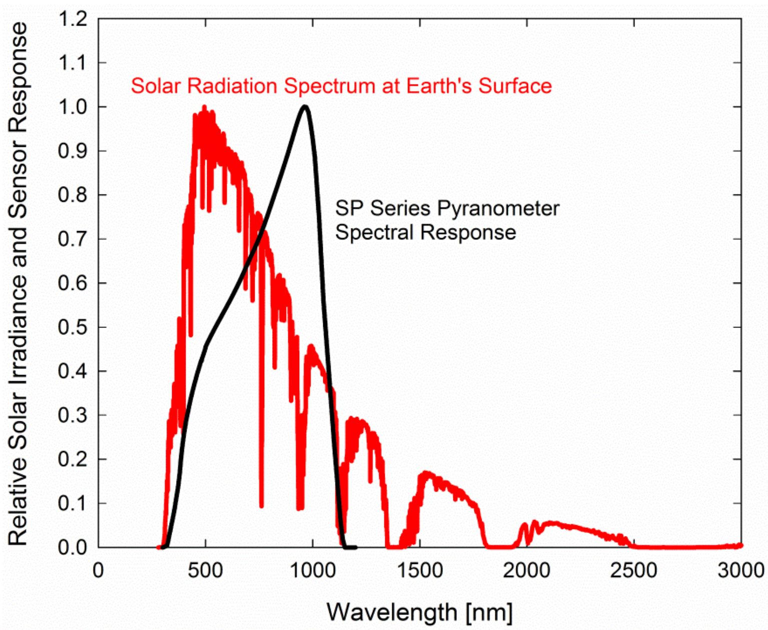
5.0 * 200 = 1000



Example of total shortwave radiation measurement with an Apogee SP-110 pyranometer. Full sunlight yields total shortwave radiation on a horizontal plane at the Earth's surface of approximately $1000\ W\ m^{-2}$. This yields an output signal of 200 mV. The signal is converted to shortwave radiation by multiplying by the calibration factor of $5.0\ W\ m^{-2}$ per mV.

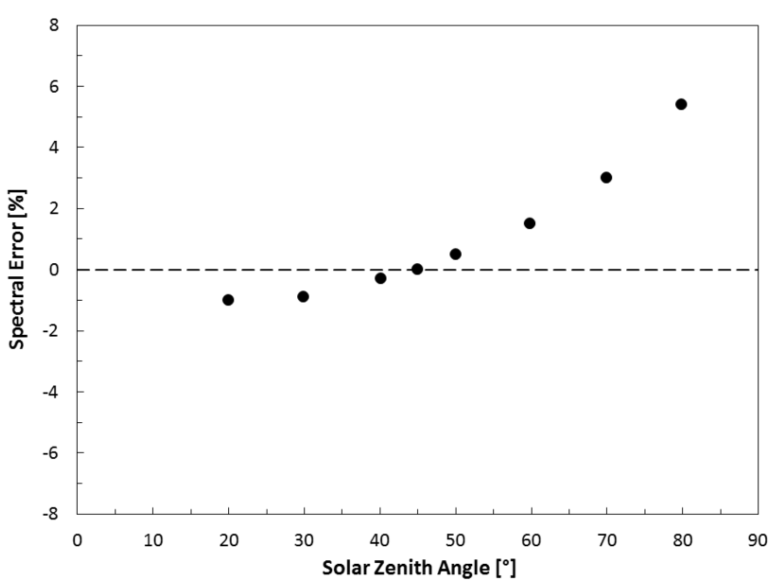
Spectral Errors for Measurements with Silicon-cell Pyranometers

Apogee SP series pyranometers are calibrated under electric lamps in a calibration laboratory. The calibration procedure simulates calibration under clear sky conditions at a solar zenith angle of approximately 45°. However, due to the limited spectral sensitivity of silicon-cell pyranometers compared to the solar radiation spectrum (see graph below), spectral errors occur when measurements are made in conditions that differ from conditions the sensor was calibrated under (e.g., the solar spectrum differs in clear sky and cloudy conditions, thus measurements in cloudy conditions result in spectral error because sensors are calibrated in clear sky conditions).

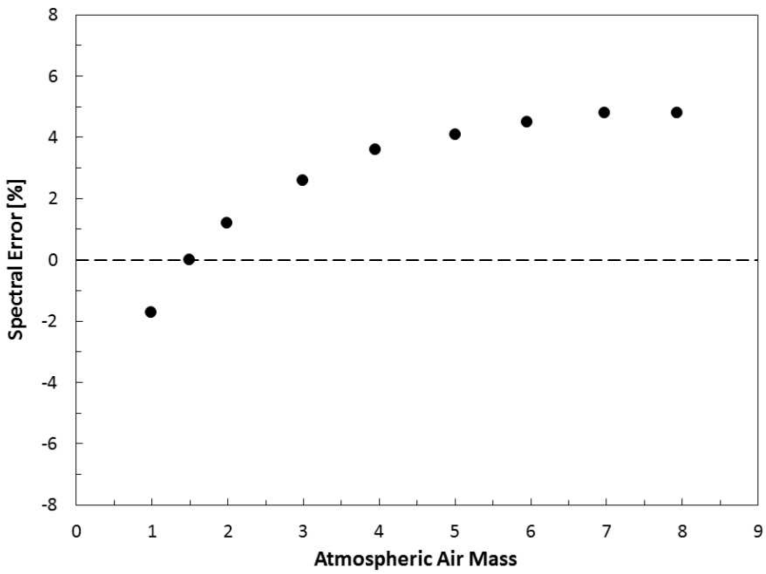


Spectral response of Apogee SP series pyranometers compared to solar radiation spectrum at Earth's surface. Silicon-cell pyranometers, such as Apogee SP series, are only sensitive to the wavelength range of approximately 350-1100 nm, and are not equally sensitive to all wavelengths within this range. As a result, when the spectral content of solar radiation is significantly different than the spectrum that silicon-cell pyranometers were calibrated to, spectral errors result.

Silicon-cell pyranometers can still be used to measure shortwave radiation in conditions other than clear sky or from radiation sources other than incoming sunlight, but spectral errors occur when measuring radiation with silicon-cell pyranometers in these conditions. The graphs below show spectral error estimates for Apogee silicon-cell pyranometers at varying solar zenith angles and varying atmospheric air mass. The diffuser is optimized to minimize directional errors, thus the cosine response graph in the Specifications section shows the actual directional errors in practice (which includes contributions from the spectral shift that occurs as solar zenith angle and atmospheric air mass change with time of day and time of year). The table below provides spectral error estimates for shortwave radiation measurements from shortwave radiation sources other than clear sky solar radiation.



Spectral error for Apogee SP series pyranometers as a function of solar zenith angle, assuming calibration at a zenith angle of 45°.



Spectral error for Apogee SP series pyranometers as a function of atmospheric air mass, assuming calibration at an air mass of 1.5.

Spectral Errors for Shortwave Radiation Measurements with Apogee SP Series Pyranometers

Radiation Source (Error Calculated Relative to Sun, Clear Sky)	Error [%]
Sun (Clear Sky)	0.0
Sun (Cloudy Sky)	9.6
Reflected from Grass Canopy	14.6
Reflected from Deciduous Canopy	16.0
Reflected from Conifer Canopy	19.2
Reflected from Agricultural Soil	-12.1
Reflected from Forest Soil	-4.1
Reflected from Desert Soil	3.0
Reflected from Water	6.6
Reflected from Ice	0.3
Reflected from Snow	13.7

Operation of Heater (SP-230)

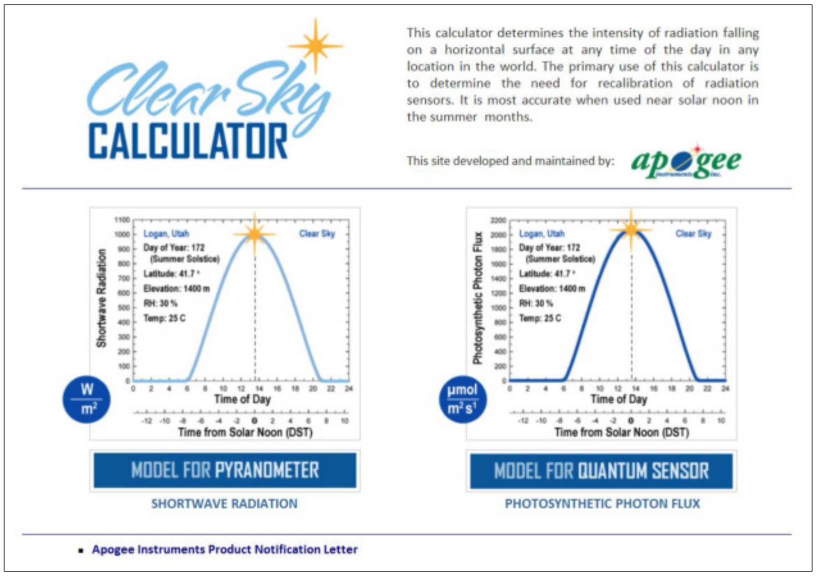
Apogee model SP-230 pyranometers have an internal heater to allow for sensor heating during precipitation events or under conditions of dew, frost, and snow deposition. The heater is designed to keep the water (liquid and frozen) off the diffuser, though it does not need to be used in order to make measurements of shortwave radiation. However, if the diffuser has water on the surface, errors can result. Continuously powering the heater under conditions that do not require heating will not damage the sensor or influence measurements.

MAINTENACE AND RECALIBRATION

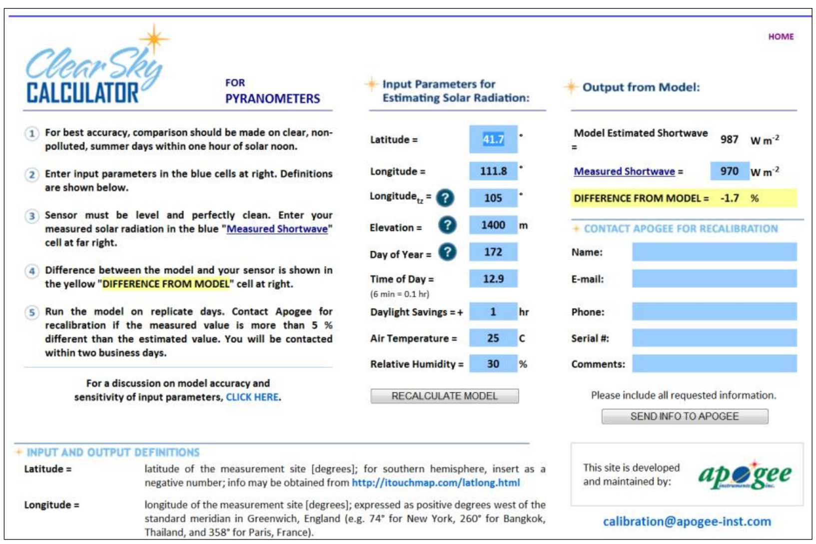
Moisture or debris on the diffuser is a common cause of low readings. The sensor has a domed diffuser and housing for improved self-cleaning from rainfall, but materials can accumulate on the diffuser (e.g., dust during periods of low rainfall, salt deposits from evaporation of sea spray or sprinkler irrigation water) and partially block the optical path. Dust or organic deposits are best removed using water or window cleaner and a soft cloth or cotton swab. Salt deposits should be dissolved with vinegar and removed with a soft cloth or cotton swab. **Never use an abrasive material or cleaner on the diffuser.**

The Clear Sky Calculator (www.clearskycalculator.com) can be used to determine the need for pyranometer recalibration. It determines total shortwave radiation incident on a horizontal surface at any time of day at any location in the world. It is most accurate when used near solar noon in spring and summer months, where accuracy over multiple clear and unpolluted days is estimated to be ± 4 % in all climates and locations around the world. For best accuracy, the sky must be completely clear, as reflected radiation from clouds causes incoming radiation to increase above the value predicted by the clear sky calculator. Measured values of total shortwave radiation can exceed values predicted by the Clear Sky Calculator due to reflection from thin, high clouds and edges of clouds, which enhances incoming shortwave radiation. The influence of high clouds typically shows up as spikes above clear sky values, not a constant offset greater than clear sky values.

To determine recalibration need, input site conditions into the calculator and compare total shortwave radiation measurements to calculated values for a clear sky. If sensor shortwave radiation measurements over multiple days near solar noon are consistently different than calculated values (by more than 6 %), the sensor should be cleaned and re-leveled. If measurements are still different after a second test, email calibration@apogeeinstruments.com to discuss test results and possible return of sensor(s).



Homepage of the Clear Sky Calculator. Two calculators are available: One for pyranometers (total shortwave radiation) and one for quantum sensors (photosynthetic photon flux density).



Clear Sky Calculator for pyranometers. Site data are input in blue cells in middle of page and an estimate of total shortwave radiation is returned on right-hand side of page.

TROUBLESHOOTING AND CUSTOMER SUPPORT

Independent Verification of Functionality

Apogee models SP-110 and SP-230 pyranometers are self-powered devices and output a voltage signal proportional to incident shortwave radiation. A quick and easy check of sensor functionality can be determined using a voltmeter with millivolt (mV) resolution. Connect the positive lead wire from the voltmeter to the white wire from the sensor and the negative (or common) lead wire from the voltmeter to the black wire from the sensor. Direct the sensor diffuser toward a light source and verify the sensor provides a signal. Increase and decrease the distance from the sensor head to the light source to verify that the signal changes proportionally (decreasing signal with increasing distance and increasing signal with decreasing distance). Blocking all radiation from the sensor should force the sensor signal to zero.

The heaters inside Apogee model SP-230 are designed to mitigate effects from snow, frost, and dew by warming the sensor body temperature approximately 3 C above ambient air temperature, while under conditions of no solar loading or radiant heating. A quick and easy check of heater functionality can be accomplished with an ohmmeter. Connect the lead wires of the ohmmeter to the yellow and blue wires from the sensor. The resistance should read approximately 780 Ω ± 1%.

Compatible Measurement Devices (Dataloggers/Controllers/Meters)

Models SP-110 and SP-230 pyranometers are calibrated with a standard calibration factor of 5.0 W m^{-2} per mV, yielding a sensitivity of 0.2 mV per W m^{-2}. Thus, a compatible measurement device (e.g., datalogger or controller) should have resolution of at least 0.2 mV, in order to provide shortwave radiation resolution of 1 W m^{-2}.

An example datalogger program for Campbell Scientific dataloggers can be found on the Apogee webpage at http://www.apogeeinstruments.com/content/Pyranometer-Unamplified.CR1.

Effect of Cable Length

When the sensor is connected to a measurement device with high input impedance, sensor output signals are not changed by shortening the cable or splicing on additional cable in the field. Tests have shown that if the input impedance of the measurements device is 1 mega-ohm or higher then there is negligible effect on the pyranometer calibration, even after adding up to 100 m of cable. Apogee model SP series pyranometers use shielded, twisted pair cable, which minimizes electromagnetic interference. This is particularly important for long lead lengths in electromagnetically noisy environments.

Modifying Cable Length

See Apogee webpage for details on how to extend sensor cable length (http://www.apogeeinstruments.com/how-to-make-a-weatherproof-cable-splice/).

RETURN AND WARRANTY POLICY

RETURN POLICY

Apogee Instruments will accept returns within 30 days of purchase as long as the product is in new condition (to be determined by Apogee). Returns are subject to a 10 % restocking fee.

WARRANTY POLICY

What is Covered
All products manufactured by Apogee Instruments are warranted to be free from defects in materials and craftsmanship for a period of four (4) years from the date of shipment from our factory. To be considered for warranty coverage an item must be evaluated either at our factory or by an authorized distributor.

Products not manufactured by Apogee (spectroradiometers, chlorophyll content meters) are covered for a period of one (1) year.

What is Not Covered
The customer is responsible for all costs associated with the removal, reinstallation, and shipping of suspected warranty items to our factory.

The warranty does not cover equipment that has been damaged due to the following conditions:

1. Improper installation or abuse.

2. Operation of the instrument outside of its specified operating range.

3. Natural occurrences such as lightning, fire, etc.

4. Unauthorized modification.

5. Improper or unauthorized repair.

Please note that nominal accuracy drift is normal over time. Routine recalibration of sensors/meters is considered part of proper maintenance and is not covered under warranty.

Who is Covered
This warranty covers the original purchaser of the product or other party who may own it during the warranty period.

What We Will Do
At no charge we will:

1. Either repair or replace (at our discretion) the item under warranty.

2. Ship the item back to the customer by the carrier of our choice.

Different or expedited shipping methods will be at the customer’s expense.

How To Return An Item

1. Please do not send any products back to Apogee Instruments until you have received a Return Merchandise Authorization (RMA) number from our technical support department by calling (435) 792-4700 or by submitting an online RMA form at www.apogeeinstruments.com/tech-support-recalibration-repairs/. We will use your RMA number for tracking of the service item.

2. Send all RMA sensors and meters back in the following condition: Clean the sensor's exterior and cord. Do not modify the sensors or wires, including splicing, cutting wire leads, etc. If a connector has been attached to the cable end, please include the mating connector – otherwise the sensor connector will be removed in order to complete the repair/recalibration.

3. Please write the RMA number on the outside of the shipping container.

4. Return the item with freight pre-paid and fully insured to our factory address shown below. We are not responsible for any costs associated with the transportation of products across international borders.

5. Upon receipt, Apogee Instruments will determine the cause of failure. If the product is found to be defective in terms of operation to the published specifications due to a failure of product materials or craftsmanship, Apogee Instruments will repair or replace the items free of charge. If it is determined that your product is not covered under warranty, you will be informed and given an estimated repair/replacement cost.

Apogee Instruments, Inc.
721 West 1800 North Logan, UT
84321, USA

OTHER TERMS

The available remedy of defects under this warranty is for the repair or replacement of the original product, and Apogee Instruments is not responsible for any direct, indirect, incidental, or consequential damages, including but not limited to loss of income, loss of revenue, loss of profit, loss of wages, loss of time, loss of sales, accruement of debts or expenses, injury to personal property, or injury to any person or any other type of damage or loss.

This limited warranty and any disputes arising out of or in connection with this limited warranty ("Disputes") shall be governed by the laws of the State of Utah, USA, excluding conflicts of law principles and excluding the Convention for the International Sale of Goods. The courts located in the State of Utah, USA, shall have exclusive jurisdiction over any Disputes.

This limited warranty gives you specific legal rights, and you may also have other rights, which vary from state to state and jurisdiction to jurisdiction, and which shall not be affected by this limited warranty. This warranty extends only to you and cannot by transferred or assigned. If any provision of this limited warranty is unlawful, void or unenforceable, that provision shall be deemed severable and shall not affect any remaining provisions. In case of any inconsistency between the English and other versions of this limited warranty, the English version shall prevail.

This warranty cannot be changed, assumed, or amended by any other person or agreement.

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METEOROLOGICAL INSTRUMENTS

INSTRUCTIONS

WIND MONITOR

MODEL 05103

CE

R.M. YOUNG COMPANY 2801 AERO PARK DRIVE, TRAVERSE CITY, MICHIGAN 49686, USA
TEL: (231) 946-3980 FAX: (231) 946-4772 WEB: www.youngusa.com

PN: 05103-90
REV: M111215

MODEL 05103
WIND MONITOR

WIND SPEED SPECIFICATION SUMMARY

Range	0 to 100 m/s (224 mph)
Sensor	18 cm diameter 4-blade helicoid propeller molded of polypropylene
Pitch	29.4 cm air passage per revolution
Distance Constant	2.7 m (8.9 ft.) for 63% recovery
Threshold Sensitivity	1.0 m/s (2.2 mph)
Transducer	Centrally mounted stationary coil, 2K Ohm nominal DC resistance
Transducer Output	AC sine wave signal induced by rotating magnet on propeller shaft. 80 mV p-p at 100 rpm. 8.0 V p-p at 10,000 rpm.
Output Frequency	3 cycles per propeller revolution (0.098 m/s per Hz)

WIND DIRECTION (AZIMUTH) SPECIFICATION SUMMARY

Range	360° mechanical, 355° electrical (5° open)
Sensor	Balanced vane, 38 cm (15 in) turning radius.
Damping Ratio	0.3
Delay Distance	1.3 m (4.3 ft) for 50% recovery
Threshold Sensitivity	1.1 m/s (2.5 mph) at 10° displacement
Damped Natural Wavelength	7.4 m (24.3 ft)
Undamped Natural Wavelength	7.2 m (23.6 ft)
Transducer	Precision conductive plastic potentiometer, 10K ohm resistance (±20%), 0.25% 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 azimuth angle with regulated excitation voltage applied across potentiometer.

GENERAL

Operating Temperature: -50 to 50°C (-58 to 122°F)

INTRODUCTION

The Wind Monitor measures horizontal wind speed and direction. Originally developed for ocean data buoy use, it is rugged and corrosion resistant yet accurate and light weight. The main housing, nose cone, propeller, and other internal parts are injection molded U.V. stabilized plastic. Both the propeller and vertical shafts use stainless steel precision grade ball bearings. Bearings have light contacting teflon seals and are filled with a wide temperature range grease to help exclude contamination and moisture.

Propeller rotation produces an AC sine wave signal with frequency proportional to wind speed. This AC signal is induced in a stationary coil by a six pole magnet mounted on the propeller shaft. Three complete sine wave cycles are produced for each propeller revolution.

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 wind direction angle.

The instrument mounts on standard one inch pipe, outside diameter 34 mm (1.34"). An orientation ring is provided so the instrument can be removed for maintenance and reinstalled without loss of wind direction reference. Both the mounting post assembly and the orientation ring are secured to the mounting pipe by stainless steel band clamps. Electrical connections are made in a junction box at the base. A variety of devices are available for signal conditioning, display, and recording of wind speed and direction.

INITIAL CHECKOUT

When the Wind Monitor is unpacked it should be checked carefully for any signs of shipping damage.

Remove the plastic nut on the propeller shaft. Install the propeller on the shaft so the serial number on the propeller faces forward (into the wind). Engage the propeller into the molded ribs on the propeller shaft 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 propeller should easily rotate 360° without friction. Check vane balance by holding the instrument base so the vane surface is horizontal. It should have near neutral torque without any particular tendency to rotate. A slight imbalance will not degrade performance.

The 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. To prevent false readings, signal conditioning electronics should clamp the signal to excitation or reference level when this occurs. **NOTE: Young signal conditioning devices clamp the signal to excitation level.** Avoid a short circuit between the wind direction signal line and either the excitation or 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 instrument to an indicator as shown in the wiring diagram and check for proper wind speed and wind direction values. To check wind speed, temporarily remove the propeller and connect the shaft to an Anemometer Drive. Details appear in the CALIBRATION section of this manual.

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 for most applications locate the instrument well above or upwind 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. For some applications it may not be practical or necessary to meet these requirements.

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 mounting post assembly is made with a special antistatic 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, the following method should be used. Inside the junction box the terminal labeled EARTH GND is internally connected to the antistatic mounting post. This terminal should be connected to an earth ground (Refer to wiring diagram).

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) Refer to wiring diagram located at back of manual.

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

The Wind Monitor 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.

Accurate wind direction calibration requires a Model 18112 Vane Angle Bench Stand. Begin by connecting the instrument to a signal conditioning circuit which has some method of indicating wind direction value. This may be a display which shows wind direction values in angular degrees or simply a voltmeter monitoring the output. Orient the base so the junction box faces due south. Visually align the vane with the crossmarkings and observe the indicator output. If the vane position and indicator do not agree within 5°, adjust the potentiometer coupling inside the main housing. Details for making this adjustment appear in the MAINTENANCE, POTENTIOMETER REPLACEMENT, outline, step 7.

It is important to note that, while the sensor mechanically rotates through 360°, the full scale wind direction signal from the signal conditioning occurs at 355°. The signal conditioning electronics must be adjusted accordingly. For example, in a circuit where 0 to 1.000 VDC represents 0° to 360°, the output must be adjusted for 0.986 VDC when the instrument is at 355°. (355°/360° X 1.000 volts = 0.986 volts)

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

To calibrate wind system electronics using a signal from the instrument, temporarily remove the propeller and connect an Anemometer Drive (18802 or equivalent) to the propeller shaft. Apply the appropriate calibration formula to the calibrating motor rpm and adjust the electronics 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.

CALIBRATION FORMULAS

Model 05103 Wind Monitor w / 08234 Propeller

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

WIND SPEED vs OUTPUT FREQUENCY

m/s	=	0.0980 x Hz
knots	=	0.1904 x Hz
mph	=	0.2192 x Hz
km/h	=	0.3528 x Hz

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 and the wind direction potentiometer. 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. 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 may begin to produce noisy signals or become nonlinear. When signal noise or non-linearity becomes unacceptable, replace the potentiometer. Refer to exploded view drawing and proceed as follows:

1. REMOVE MAIN HOUSING
   a) Unscrew nose cone from main housing. Set o-ring aside for later use.
   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 WIRE
   a) Remove junction box cover, exposing circuit board.
   b) Remove screws holding circuit board.
   c) Unsolder three potentiometer wires (white, green, black), two wind speed coil wires (red, black) and earth ground wire (red) from board.

3. REMOVE POTENTIOMETER
   a) Loosen set screw on potentiometer coupling and remove it from potentiometer adjust thumbwheel.
   b) Loosen set screw on potentiometer adjust thumbwheel and remove it from potentiometer shaft.
   c) Loosen two set screws at base of transducer assembly and remove assembly from vertical shaft.
   d) Unscrew potentiometer housing from potentiometer mounting & coil assembly.
   e) Push potentiometer out of potentiometer mounting & coil assembly by applying firm but gentle pressure on potentiometer shaft. Make sure that the shaft o-ring comes out with the potentiometer. If not, then gently push it out from the top of the coil assembly.

4. INSTALL NEW POTENTIOMETER
   a) Push new potentiometer into potentiometer mounting & coil assembly making sure o-ring is on shaft.
   b) Feed potentiometer and coil wires through hole in bottom of potentiometer housing.
   c) Screw potentiometer housing onto potentiometer mounting & coil assembly.
   d) Gently pull transducer wires through bottom of potentiometer housing to take up any slack. Apply a small amount of silicone sealant around hole.
   e) Install transducer assembly on vertical shaft allowing 0.5 mm (0.020") clearance from vertical bearing. Tighten set screws* at bottom of transducer assembly.
   f) Place potentiometer adjust thumbwheel on potentiometer shaft and tighten set screw*.
   g) Place potentiometer coupling on potentiometer adjust thumbwheel. Do Not tighten set screw yet.

5. RECONNECT TRANSDUCER WIRES
   a) Using needle-nose pliers or a paper clip bent to form a small hook, gently pull transducer wires through hole in junction box.
   b) Solder wires to circuit board according to wiring diagram. Observe color code.
   c) Secure circuit board in junction box using two screws removed in step 2b. Do not overtighten.

6. REPLACE MAIN HOUSING
   a) Place main housing over vertical shaft bearing rotor. Be careful to align indexing key and channel in these two assemblies.
   b) Place main housing over vertical shaft bearing rotor until potentiometer coupling is near top of main housing.
   c) Turn potentiometer adjust thumbwheel until potentiometer coupling is oriented to engage ridge in top of main housing. Set screw on potentiometer coupling should be facing the front opening.
   d) With potentiometer coupling properly oriented, continue pushing main housing onto vertical shaft bearing rotor until main housing latch locks into position with a “click”.

7. ALIGN VANE
   a) Connect excitation voltage and signal conditioning electronics to terminal strip according to wiring diagram.
   b) With mounting post held in position so junction box is facing due south, orient vane to a known angular reference. Details appear in CALIBRATION section.
   c) Reach in through front of main housing and turn potentiometer adjust thumbwheel until signal conditioning system indicates proper value.
   d) Tighten set screw* on potentiometer coupling.

8. REPLACE NOSE CONE
   a) Screw nose cone into main housing until o-ring seal is seated. Be certain threads are properly engaged to avoid cross-threading.

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. If needed, bearings are replaced as follows.

1. REMOVE OLD BEARINGS
   a) Unscrew nose cone. Set o-ring aside for later use.
   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 both 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.
   f) Screw nose cone into main housing until o-ring seal is seated. Be certain threads are properly engaged to avoid cross-threading.

*Max set screw torque 80 oz-in

VERTICAL SHAFT BEARING REPLACEMENT

Vertical shaft bearings are much larger than the anemometer bearings. Ordinarily, these bearings require replacement less frequently than anemometer bearings. Check bearing condition using a Model 18331 Vane Torque Gauge.

Since this procedure is similar to POTENTIOMETER REPLACEMENT, only the major steps are listed here.

1. REMOVE MAIN HOUSING
2. UNSOLDER TRANSDUCER WIRES AND REMOVE TRANSDUCER ASSEMBLY
   Loosen set screws at base of transducer assembly and remove entire assembly from vertical shaft.
3. REMOVE VERTICAL SHAFT BEARING ROTOR by sliding it upward off vertical shaft.
4. REMOVE OLD VERTICAL BEARINGS AND INSTALL NEW BEARINGS. When inserting new bearings, be careful not to apply pressure to bearing shields.
5. REPLACE VERTICAL SHAFT BEARING ROTOR.
6. REPLACE TRANSDUCER & RECONNECT WIRES
7. REPLACE MAIN HOUSING
8. ALIGN VANE
9. REPLACE NOSE CONE

EMC COMPLIANCE

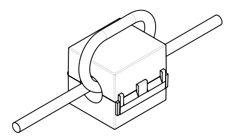
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

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.

Note:
To meet EMC Compliance, a YOUNG 18500 ferrite choke must be installed on the cable near the sensor. The cable must pass through the center hole of the choke at least 2 times, creating 1 loop around the outside as shown below.



WARRANTY

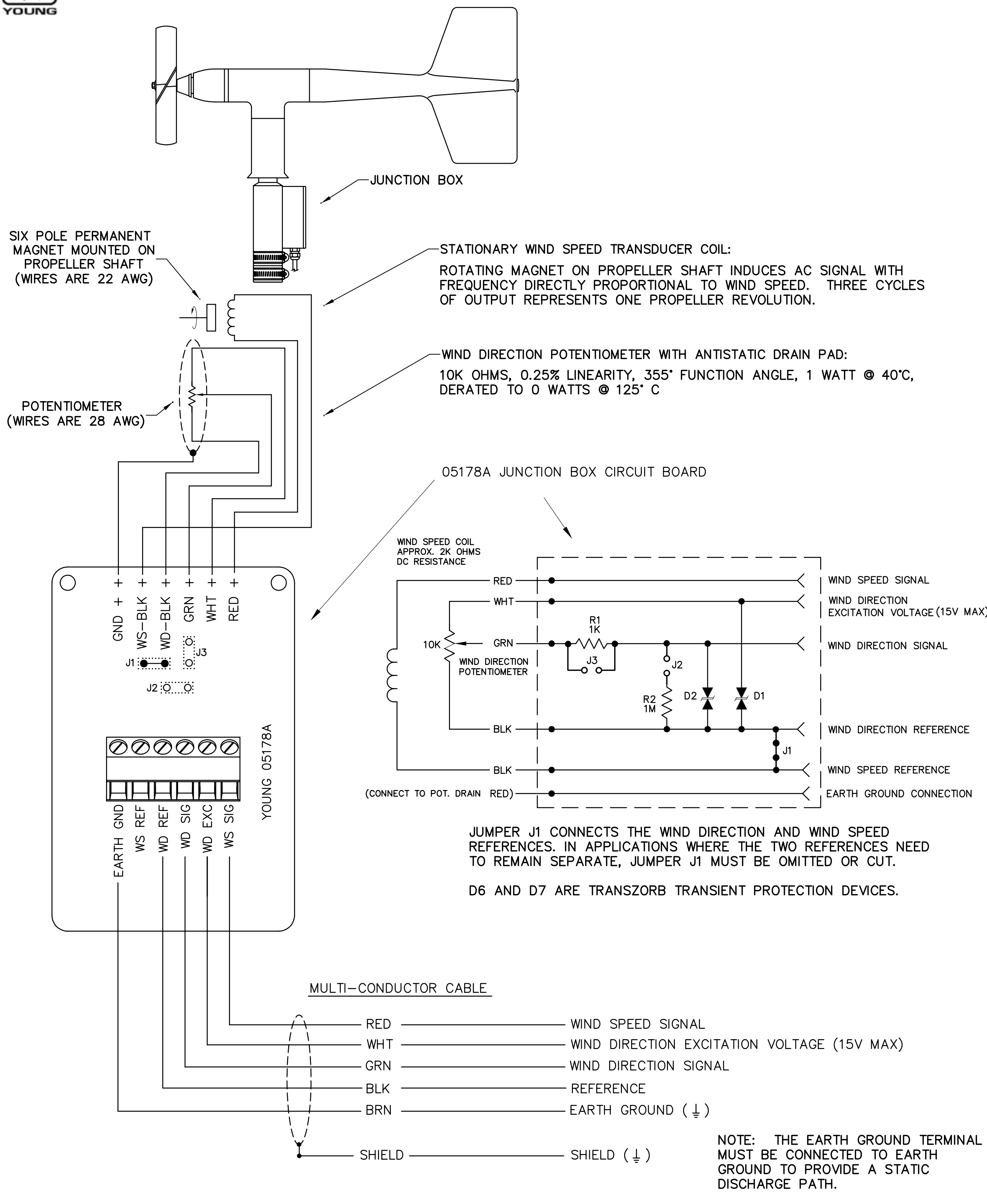
This product is warranted to be free of defects in materials and construction for a period of 12 months from date of initial purchase. Liability is limited to repair or replacement of defective item. A copy of the warranty policy may be obtained from R. M. Young Company.

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.

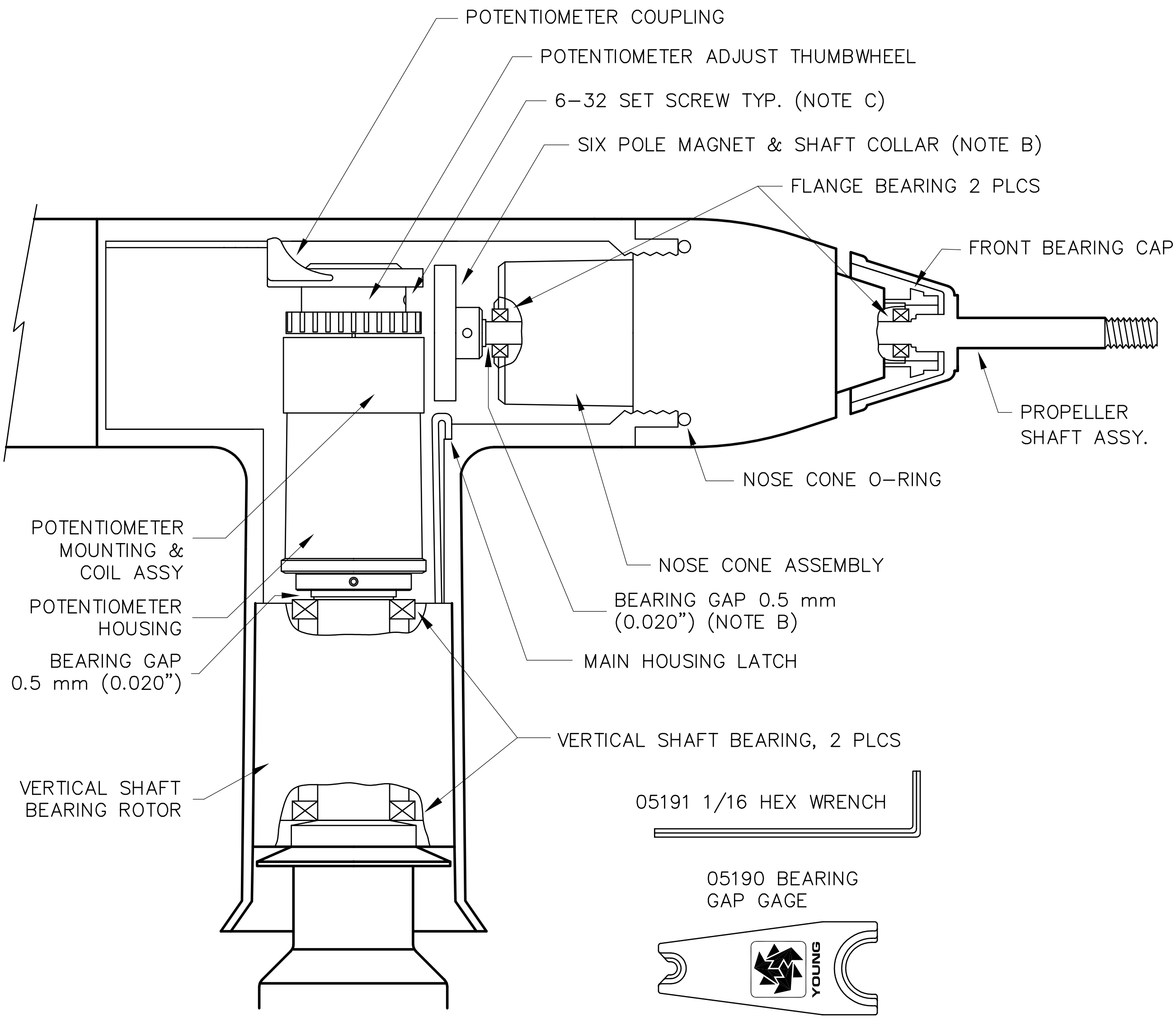
CABLE & WIRING DIAGRAM

MODEL 05103 WIND MONITOR



05103-90(M)

BEARING REPLACEMENT & POTENTIOMETER ADJUSTMENT



NOTES:

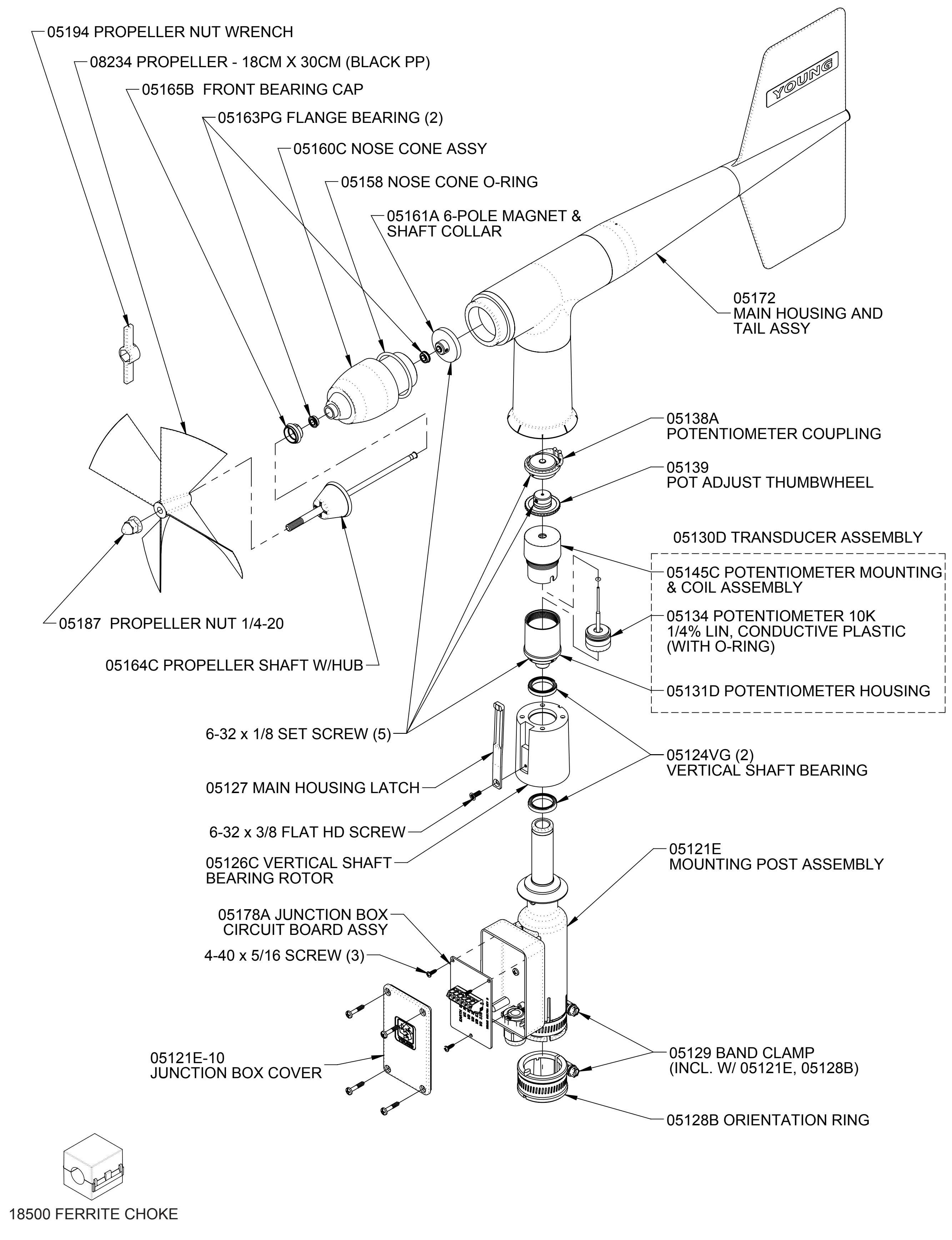
A. TO REMOVE HOUSING – UNTHREAD NOSE CONE ASSEMBLY, PUSH MAIN HOUSING LATCH, LIFT UPWARD.

B. TO REPLACE ANEMOMETER FLANGE BEARINGS – UNTHREAD NOSE CONE, REMOVE SIX POLE MAGNET, SLIDE PROPELLER SHAFT AND HUB ASSEMBLY FOREWARD, REMOVE FRONT BEARING CAP AND FLANGE BEARINGS. AFTER BEARING REPLACEMENT, SET BEARING GAP TO 0.5mm (0.020")

C. TO ADJUST POTENTIOMETER OUTPUT SIGNAL – REMOVE NOSE CONE, LOOSEN SET SCREW IN POTENTIOMETER COUPLING, ADJUST OUTPUT SIGNAL BY MEANS OF POTENTIOMETER ADJUSTMENT THUMBWHEEL, RE–TIGHTEN SET SCREW.

GENERAL ASSEMBLY & REPLACEMENT PARTS

MODEL 05103 WIND MONITOR



05103-90(M)

Calibration Accessories

Model 18802
Anemometer Drive

Model 18112
Vane Angle Bench Stand

Model 18331 Vane Torque Gauge

Model 18212
Vane Angle Fixture-Tower Mount

Model 18310
Propeller Torque Disc

Model 18301
Vane Alignment Rod

YOUNG

YOUNG — Calibration Accessories

Model 18802 Anemometer Drive provides a convenient and accurate way to rotate an anemometer shaft at a known rate. The motor may be set to rotate clockwise or counter-clockwise at any rate between 200 and 15,000 RPM in 100 RPM increments. The LCD display is referenced to an accurate and stable quartz timebase. For completely portable operation, the unit can be operated on internal batteries. For extended operation, an AC wall adapter is included.

Model 18811 Anemometer Drive is identical to Model 18802 except the drive motor incorporates a gear reducer for operation in the range of 20 to 990 RPM in 10 RPM increments. The lower range is recommended for cup anemometer calibration.

Model 18112 Vane Angle Bench Stand is used for benchtop wind direction calibration of the Wind Monitor family of sensors. The mounting post engages the direction orientation notch on the Wind Monitor. An easy to read pointer indicates 0 to 360 degrees with 1/2 degree resolution.

Model 18212 Vane Angle Fixture - Tower Mount similar to the Model 18112, the tower mount feature allows use on the tower as well as the bench top. The fixture is temporarily placed on the tower between the Wind Monitor and its tower mounting. Index keys and notches are engaged to preserve direction reference.

Model 18310 Propeller Torque Disc checks anemometer bearing torque with 0.1 gm/cm resolution. The disc temporarily replaces the propeller for torque measurement or simple yet accurate pass/fail checks. Charts included with the unit relate torque to propeller threshold with limits for acceptable bearing performance.

Model 18312 Cup-Wheel Torque Disc checks cup anemometer bearing torque.

Model 18331 Vane Torque Gauge checks vane bearing torque of the Wind Monitor family sensors. Slip the fixture over the main housing and make simple yet accurate vane torque measurements. Charts relating vane torque to vane threshold provide limits for acceptable bearing performance.

Model 18301 Vane Alignment Rod helps align the vane of a wind sensor to a known direction reference during installation. The base of the device has an index key that engages the direction orientation notch in the sensor allowing the sensor to be removed without losing wind direction reference.

Ordering Information

Ordering Information	MODEL
ANEMOMETER DRIVE *200 to 15,000 RPM*	18802
ANEMOMETER DRIVE *20 TO 990 RPM*	18811
230V / 50-60 HZ INPUT POWER	*ADD SUFFIX "H"*
VANE ANGLE BENCH STAND	18112
VANE ANGLE FIXTURE - TOWER MOUNT	18212
PROPELLER TORQUE DISC	18310
CUP-WHEEL TORQUE DISC	18312
VANE TORQUE GAUGE	18331
VANE ALIGNMENT ROD	18301

Specifications

MODEL 18802 ANEMOMETER DRIVE
(Replaces 18801)

Range:
200 to 15,000 RPM in 100 RPM increments

Rotation:
Clockwise or Counter-Clockwise

Display Resolution:
1 RPM

Quartz Timebase Reference:
0.1 RPM

Power Requirement:
2x9 V (alkaline or lithium) batteries
115 VAC wall adapter included
(230 VAC – add suffix H)

MODEL 18811 ANEMOMETER DRIVE
(Replaces 18810)

Range:
20 to 990 RPM in 10 RPM increments

Display Resolution:
0.1 RPM

MODEL 18112, 18212 VANE ANGLE CALIBRATION DEVICES

Range:
0 to 360 degrees

Resolution:
0.5 degree

MODEL 18310, 18312 TORQUE DISC DEVICES

Range:
0 to 5.4 gm-cm

Resolution:
0.1 gm-cm

MODEL 18331 VANE TORQUE GAUGE

Range:
0 to 50 gm-cm

Resolution:
5 gm-cm

Specifications subject to change without notice.

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