Weather Station
AMtec Solar

Installation and Operation Manual

Model AM-WS

Date Apr 8, 2011

Copyright Information

Limited Warranty

AMTEC SOLAR IS PROVIDING THIS WARRANTY IN LIEU OF ALL OTHER EXPRESS OR IMPLIED WARRANTIES, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. THIS WARRANTY IS BUYER'S EXCLUSIVE REMEDY FOR ALL CLAIMS AGAINST AMTEC SOLAR. AMTEC SOLAR SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES. AMTEC SOLAR'S TOTAL LIABILITY FOR ALL CLAIMS SHALL BE LIMITED TO THE PRICE PAID FOR ITS PRODUCT.

AMtec Solar promises buyer that any standard product manufactured by AMtec Solar shall be free from all material defects in design, material, or manufacturing for a period of 1 year from the manufacture date; provided, however, that the warranty shall not extend to ordinary wear and tear or to normally replaceable components (e.g., batteries). During the warranty period, AMtec Solar may repair or replace (in its sole discretion) any product suffering from a warranty defect and returned freight prepaid by buyer, with no charge to buyer for any warranty repair or replacement. The warranty shall remain in full force and effect for such 1 year period, provided that the product: (1) was installed, operated, and maintained properly; (2) has not been abused or misused; (3) has not been repaired, altered, or modified outside of AMtec Solar's authorized facilities; (4) has not been sold subject to other warranty terms specified at the time of sale; and (5) is still owned by the original purchaser. This warranty provides specific legal rights that may be varied by state law. AMtec Solar's products are not designed for life or safety applications.

Product Application Limitation

AMtec Solar products are not intended for use in critical applications such as nuclear facilities, human implantable devices or life support. AMtec Solar is not liable, in whole or in part, for any claims or damages arising from such uses.

AMtec Solar strongly believes in continuous improvement, therefore we must reserve the right to change specifications and product offerings without notice. Where possible, we will substitute products with equivalent functionality when necessary.

DANGER

Hazard of Electric Shock, Explosion or Arc Flash

- Follow safe electrical work practices. See NFPA 70E in the USA, or applicable local codes.
- This equipment must only be installed and serviced by qualified electrical personnel.
- Read, understand and follow the instructions before installing this product.
- Turn off all power supplying equipment before working on or inside the equipment. Use properly rated voltage sensing device to confirm power is off. DO NOT DEPEND ON THIS PRODUCT FOR VOLTAGE INDICATION
- Only install this product on insulated conductors.

Failure to follow these instructions will result in death or serious injury.

NOTICE

- This product is not intended for life safety applications.
- Do not install this product in hazardous or classified locations.
- The installer is responsible for conformance to all applicable codes.
- Mount this product inside a suitable fire and electrical enclosure.

FCC Part 15 Information

Note: This equipment has been tested by the manufacturer and found to comply with the limits of a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against 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. Modifications of this product without the express authorization of AMtec Solar nullify this statement.

AMtec Solar
2501 Industrial Parkway West
Hayward, CA. 94545
ph: 510-887-2289
www.AMtecSolar.com

Table of Contents

Overview

The AMtec Solar weather station is designed to provide measurement options for environmental data points related to Solar/PV generation sites. The weather station can provide readings for wind speed, direction, solar radiation, air temperature, humidity, and solar panel temperature.

Installation Checklist

The installation of the AMtec Solar weather station requires a number of tools and supplies to complete the installation. The following list provides a representative sample of what may be required for installation; however site specific issues may require additional tools or supplies.

The weather station power and communications connections require a licensed electrician or similarly qualified installer.

Required:

- Adjustable Crescent wrench
- Screw Drivers: Philips and flat-head, small and medium sizes.
- Weatherproof conduit for power and communications to the weather station control box.
- Drill and bit to install conduit connectors into the control box.
- Power: 120 ~ 240VAC, and appropriate wire.
- Communications RS485 wiring: twisted pair with shield.
- Compass or GPS to align wind sensor true North.
- Mounting screws or bolts to attach the tripod to the mounting location, such as nine 2”X1/4” bolts.

Markings and Symbols

WARNING: A potential risk exists if the operating instructions are not followed

General Warning Symbol: This symbol indicates the need to consult the operating instructions provided with the product.

This symbol indicates the presence of electric shock hazards.

This symbol indicates: Do not apply to or remove from hazardous live conductors.

Direct Current symbol.

Hardware Overview

Weather Station Package Kits

The Weather station may be ordered using the following kit part numbers. These kits include a number of components that are listed below, to build a complete weather station.

AM-WS-1	Weather station with Pyranometer, Temperature, Humidity, and Cell Temperature. Includes: WS-PYRO-1 Pyranometer kit (Li-cor) WS-TEMPHUM-1 Temperature Humidity kit (Veris) WS-CELLTEMP-1 Cell Temperature kit (Veris) YWX0482 NEMA 4x control box with 120v power supply, UCLC amplifier, Flex IO, and sensor connectors. Does not include mounting kit.
AM-WS-2	Weather station with Pyranometer, Temperature Only, and Cell Temperature. Includes: WS-PYRO-1 Pyranometer kit (Li-cor) WS-TEMP-1 Temperature only kit (Veris) WS-CELLTEMP-1 Cell Temperature kit (Veris) YWX0482 NEMA 4x control box with 120v power supply, UCLC amplifier, Flex IO, and sensor connectors. Does not include mounting kit.
AM-WS-3	Weather station with Pyranometer, Temperature, Humidity, Cell Temperature and Anemometer. Includes: WS-PYRO-1 Pyranometer kit (Li-cor) WS-ANEMO-1 Anemometer kit (NovaLynx) WS-TEMPHUM-1 Temperature Humidity kit (Veris) WS-CELLTEMP-1 Cell Temperature kit (Veris) YWX0483 NEMA 4x control box with 120v power supply, UCLC amplifier, Anemometer Amplifier, Flex IO, and sensor connectors. Does not include mounting kit.
AM-WS-4	Weather station with Pyranometer, Temperature, Cell Temperature and Anemometer. Includes: WS-PYRO-1 Pyranometer kit (Li-cor) WS-ANEMO-1 Anemometer kit (NovaLynx) WS-TEMP-1 Temperature Only kit (Veris) WS-CELLTEMP-1 Cell Temperature kit (Veris) YWX0483 NEMA 4x control box with 120v power supply, UCLC amplifier, Anemometer Amplifier, Flex IO, and sensor connectors. Does not include mounting kit.

Note: Weather station kits do not include a mounting kit (mast, tripod, etc). If a mounting kit is required, be sure to order the weather station mounting kit package AM-WS-MK.

Note: The pyranometer kit is intended to be mounted vertically on the weather station. The optional kit A89WS-MP1 should be ordered separately for sites that require the pyranometer to be mounted on the solar panel to match the panel's angle.

List of sub-assemblies

Weather station sub-assemblies may be ordered from the following list of components. Each section of this manual will deal with these sub-assemblies separately as well.

WS-ANEMO-1	Anemometer kit. Includes: wind speed and direction, 40' cable, and plug. (NovaLynx 200-WS-02)
AM-WS-MK	Weather station Mounting kit. Includes: Tripod, Mast and Arm
A89WS-MP1	PV Mounting Bracket - Pyranometer
WS-PYRO-1	Pyranometer kit. Li-Cor LI-200SZ sensor with leveling mounting plate, screws, calibration certificate, 50' cable and plug adapter.
WS-CELLTEMP-1	Cell Temperature kit Includes: 10k type 2 thermistor with 50' cable and plug adapter (Veris TRASPC01331)
WS-TEMPHUM-1	Temperature/Humidity Probe kit. 4-20mA output, -40F to 122F range, 0-100% RH range, with 9ft cable, plug, and mounting screws. (Veris HO2XMSTA1-02)
WS-TEMP-1	Temperature only probe kit. 4-20mA output, -40F to 122F range, with 9ft cable, plug, and mounting screws. (Veris TOAM10-02)
YWX0482	Weather station control box- NEMA 4x, 24VDC power supply, UCLC amplifier, 2 plug receptacles- Pyranometer control box, Cell temperature, water tight gasket.
YWX0483	Weather station- NEMA 4x, 24VDC power supply, UCLC amplifier, 3 plug receptacles- Pyranometer, Anemometer, water tight gasket.

Features and Specifications

List of sub-assemblies

WS-ANEMO-1	Anemometer kit
Direction Sensor range:	0 – 360 degrees. Azimuth: 360º mechanical, 355º electrical (5º open) 360º/0º=North 90º=East 180º=South 270º=West
Direction Accuracy:	+/- 3º
Speed Sensor range:	0 – 100 MPH. Gusts up to 220 MPH
Speed Accuracy:	1 mph or +/- 3%
Operating temperature:	-50C ~ +50C
WS-PYRO-1	Pyranometer kit
Sensor range:	0 ~ 1400W/m^2
Accuracy:	+/- 5%
Operating temperature:	-40 ~ +65C
WS-CELLTEMP-1	Cell Temperature Kit
Sensor range:	-13 ~ +221F. 10K Type 2 resistive sensor.
Accuracy:	+/- 1.8°C typical; +/- 3.0°C max. over 0° to 70°C
Operating temperature:	-25 ~ +125C
WS-TEMPHUM-1	Air Temperature and Humidity Probe.
Temp Sensor range:	-40 ~ +122 degrees Fahrenheit
Temp Accuracy:	+/-1 degree F
Humidity Sensor range:	0 ~ 100 % Relative Humidity
Humidity Accuracy:	+/- 2% (replaceable sensor)
Operating temperature:	-40 ~ +122
WS-TEMP-1	Air Temperature Probe.
Sensor range:	-40 ~ +122 degrees Fahrenheit
Accuracy:	+/-1 degree F
Operating temperature:	-40 ~ +122
YWX0431, YWX0432	weather station Control Box
Control Box	
Operating Temperature:	-30 ~ +50c, 0-95% RH, non-condensing.
Power Supply:	**Weidmuller 8739140000**
Power input:	85-264VAC, 48W, 50-60Hz
Output:	24VDC
Operating temperature:	-10 ~ +70c
IO module:	**A8332-8F2D**
Accuracy:	+/- 0.25% (4-20mA mode inputs) +/- 1% for cell temperature sensor (resistive mode inputs)
Operating temperature:	-30 ~ +70c
Protocol:	Modbus/RTU, RS-485, 9600, N81

Hardware Installation

Overview

The weather station assembly takes several steps, and should be performed in the following order.

1) Assemble the mounting kit. Tripod, mast, and arm.

2) Attach the weather station control box. Run appropriate conduit for power and communications to the control box.

3) Attach individual sensors to the weather station.

4) Using a computer or laptop, configure the weather station and the AcquiSuite (or other Modbus data acquisition server).

The following sections of the manual cover hardware installation and component details for each of the steps listed above.

AM-WS-MK: weather station mounting kit

Kit contains: Tripod, Mast, and Arm.

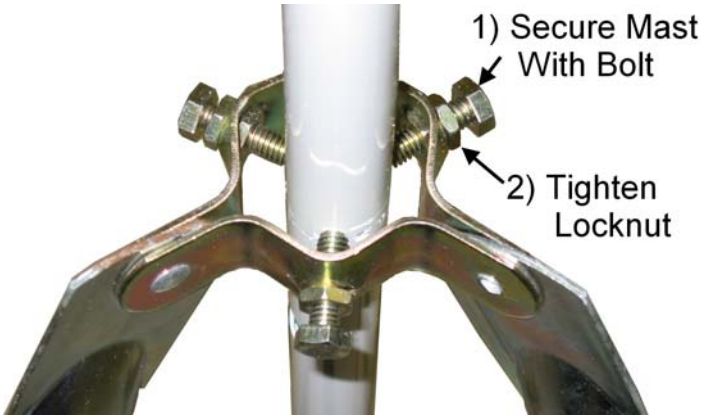
Location: Before installing the weather station, a suitable location for the sensors must be selected. Ensure that the weather station is located in as open and unobstructed area as possible such as a rooftop location or a parking lot shade structure. Use extreme care to prevent contact with electrical power lines while installing the weather station.

- The pyranometer measures solar radiation. The main concern during installation is an unobstructed view of the sky, clear of all walls, trees, or other objects which might cast a shadow over the sensor.

- The wind speed and direction sensor must be installed in a location away from walls or other objects that can obstruct the flow of the wind. Vertically position the sensor twice the height above adjacent obstructions, and horizontally position the sensor away from adjacent obstructions six times the height of the obstruction. For best performance, position the wind sensor approximately 33 feet (10 meters) above the highest obstacle within a 990 foot (300 meter) radius of the mounting location.

- It is critical to avoid placing the weather station near HVAC units, or exhaust systems from other mechanical equipment to avoid interference with the sensors.

Tripod: Remove the tripod from the packaging. Expand the tripod legs until the legs are fully extended.



Mast: Install the mast in the hole in the center of the tripod, and secure using the bolts in the tripod collars. Tighten the bolt into the mast, and the secure the bolt by tightening the lock nut against the collar. The nut and bolt require a ½" wrench.

Arm: The arm of the weather station should be positioned on the mast about 8" from the top, and pointing towards the equator to prevent the mast from casting a shadow on the pyranometer.

Use the two u-bolts provided to attach the arm to the mast. Place the u-bolt around the back of the mast, then add the metal adapter bracket. Next, pass the bolts through the back of the arm. Add the lock washer and nut on the inside of the arm.

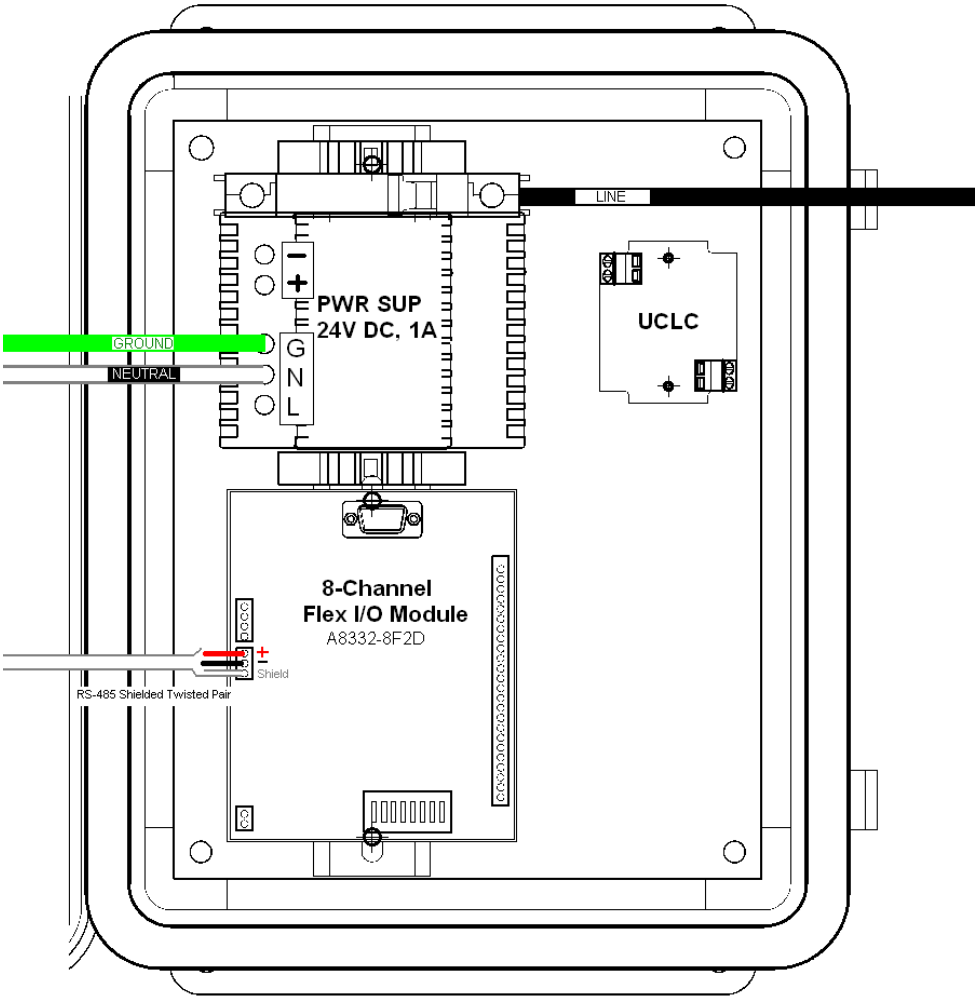
⚠ The mast and tripod should be electrically grounded to minimize the probability of any lightning damage.

YWX0482: weather station Control Box

Kit includes: control box, 2 u-bolts.

The weather station control box mounts on the back of the mast using the two u-bolts provided in the kit. The box should be mounted with the connectors on the bottom.

Separate holes will need to be drilled into the side or bottom of the box by the installer, to provide an attachment point for a weatherproof conduit or cable for power and communications. (power and communications wire and conduit are not included with the weather station.)

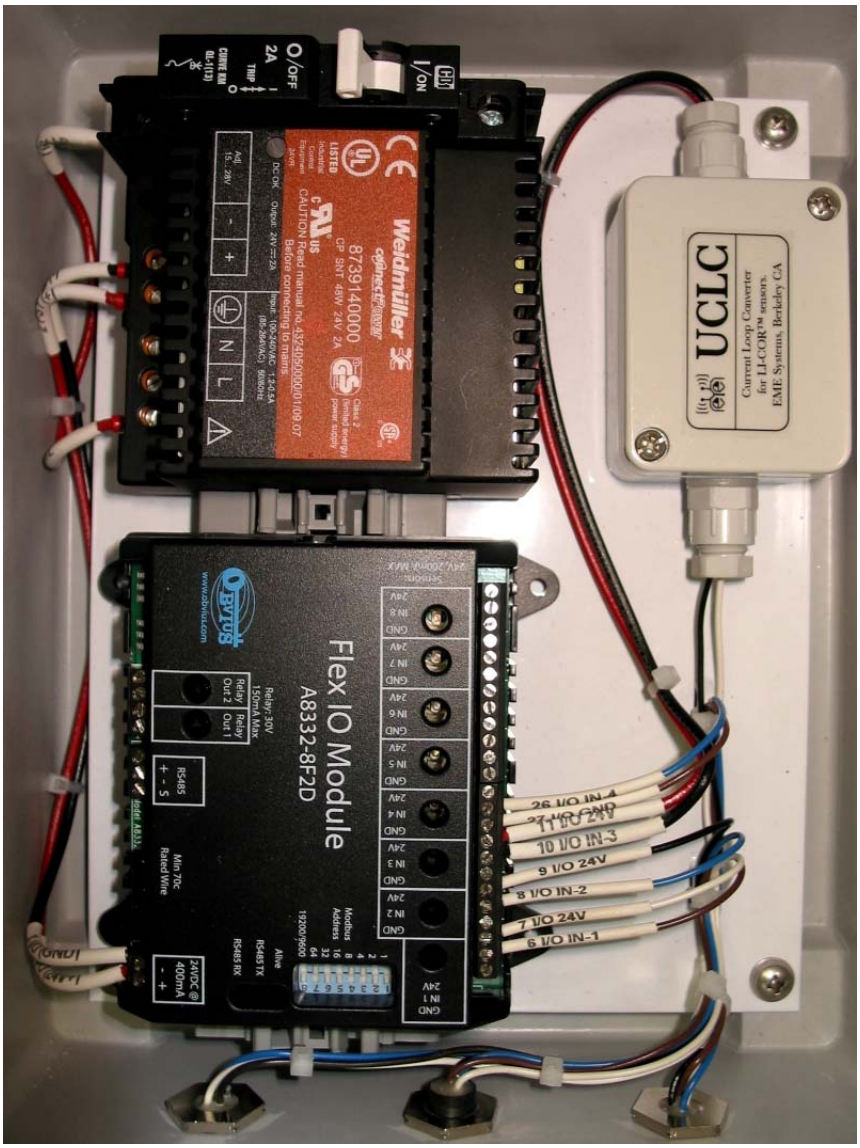


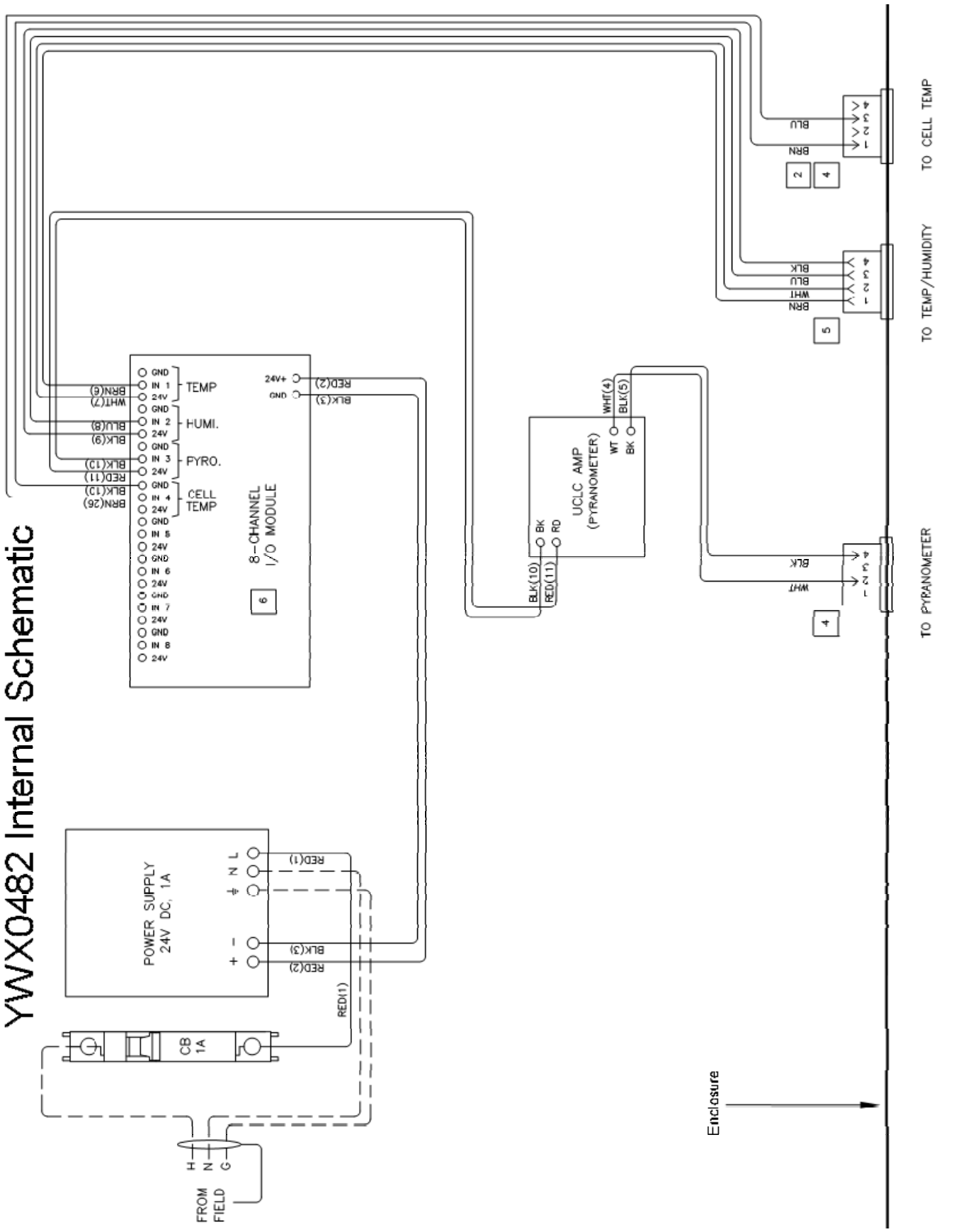
With the mains off, connect the Line, Neutral and Ground wires to the screw terminals provided. Proper grounding is required.

It is important to observe all electrical codes and safety practices when wiring the weather station.

WARNING: After wiring the system, remove all scraps of wire or foil shield from the electrical panel. This could be dangerous if wire scraps come into contact with high voltage wires.

The weather station uses RS-485 Modbus RTU to communicate with a Master device such as an AcquiSuite. Attach a suitable twisted pair cable to the RS-485 connector provided. Observe polarity markings +, - and Shield.



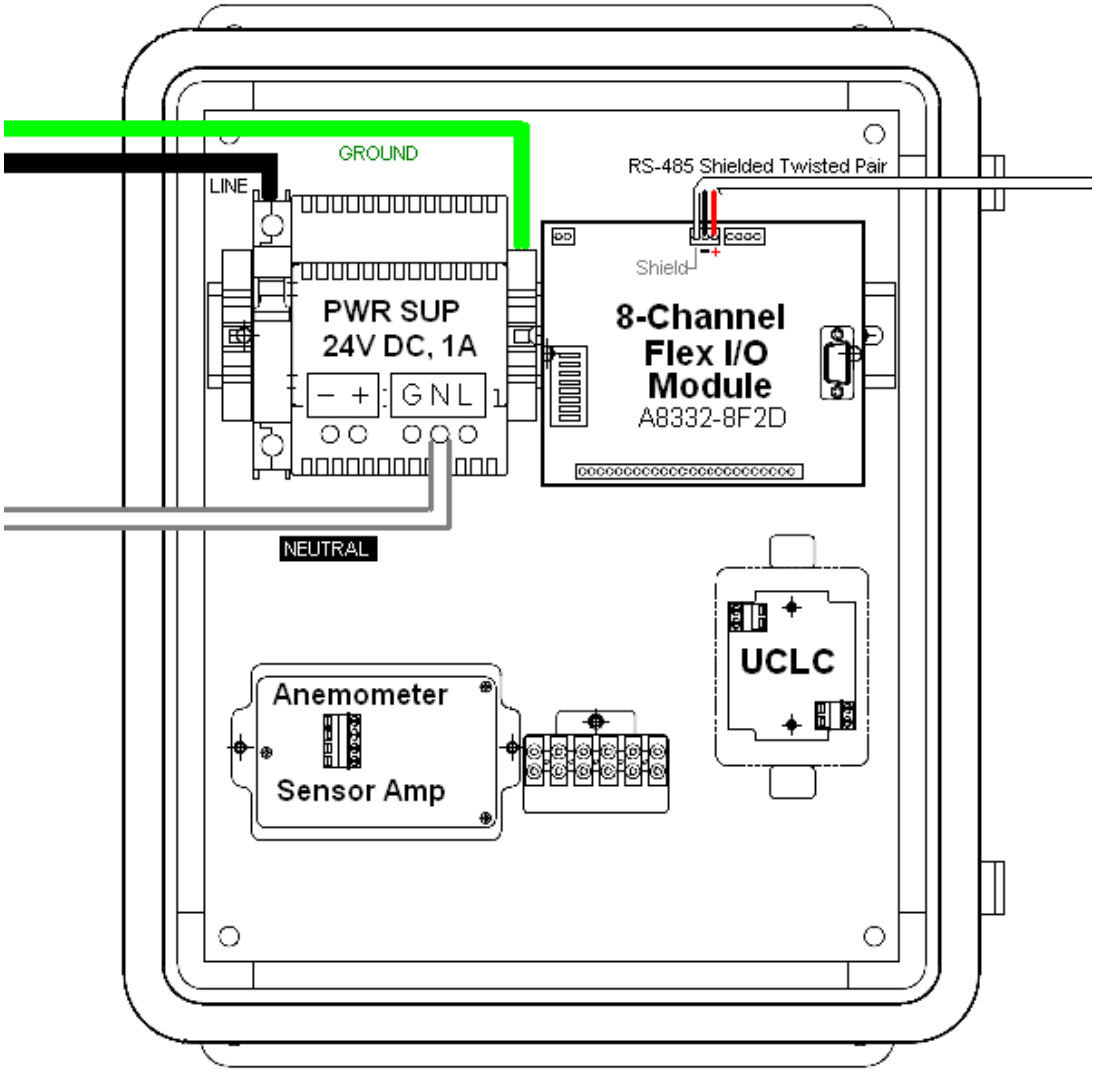

YWX0482 Internal Schematic
8-CHANNEL I/O MODULE
TEMP
HUMI.
PYRO.
CELL TEMP
UCLC AMP (PYRANOMETER)
POWER SUPPLY 24V DC, 1A
CB 1A
FROM FIELD
Enclosure
TO CELL TEMP
TO TEMP/HUMIDITY
TO PYRANOMETER

YWX0483: weather station Control Box

Kit includes: control box, 2 u-bolts.

The weather station control box mounts on the back of the mast using the two u-bolts provided in the kit. The box should be mounted with the connectors on the bottom.

Separate holes will need to be drilled into the side or bottom of the box by the installer, to provide an attachment point for a weatherproof conduit or cable for power and communications (power and communications wire and conduit are not included with the weather station).

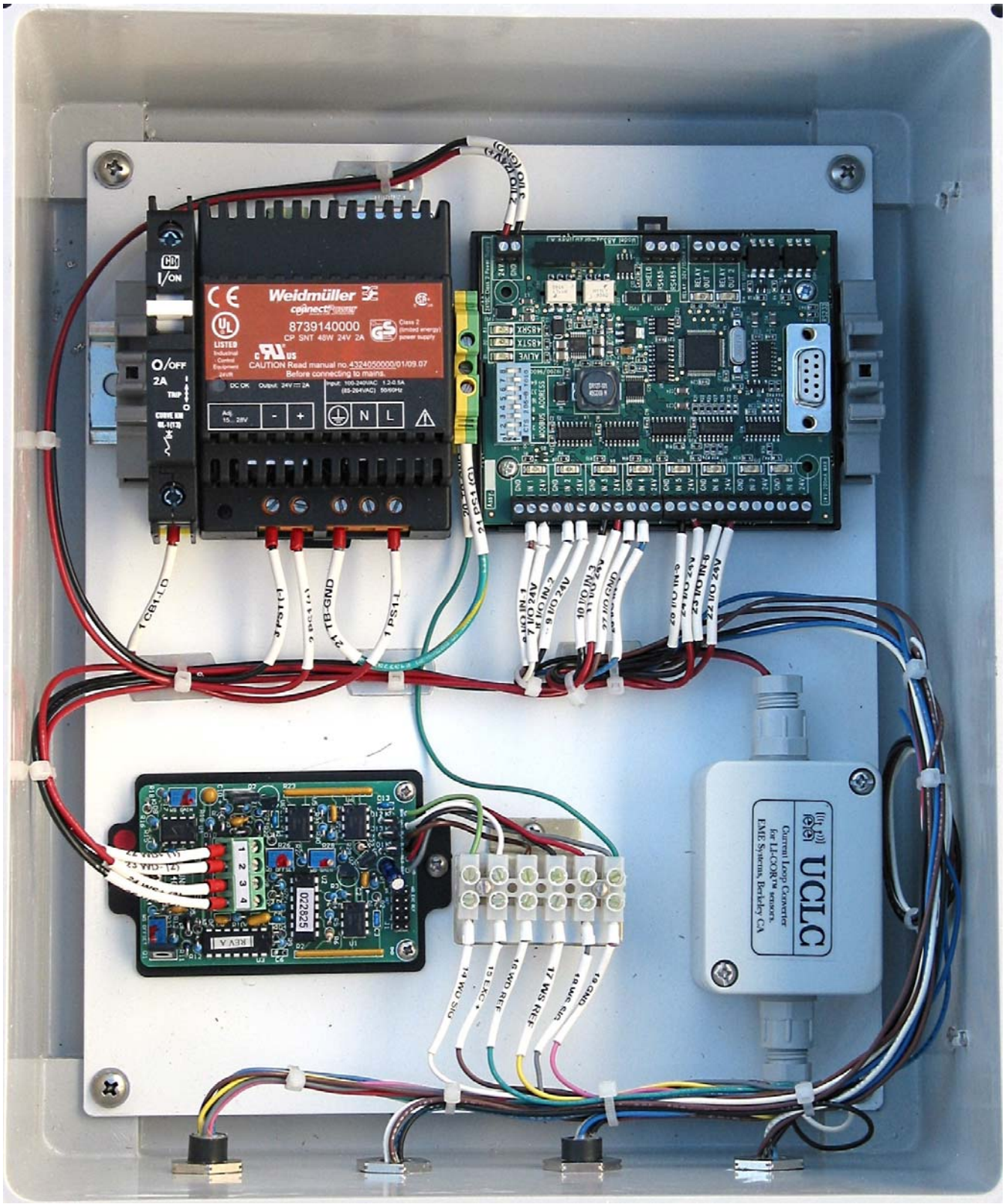


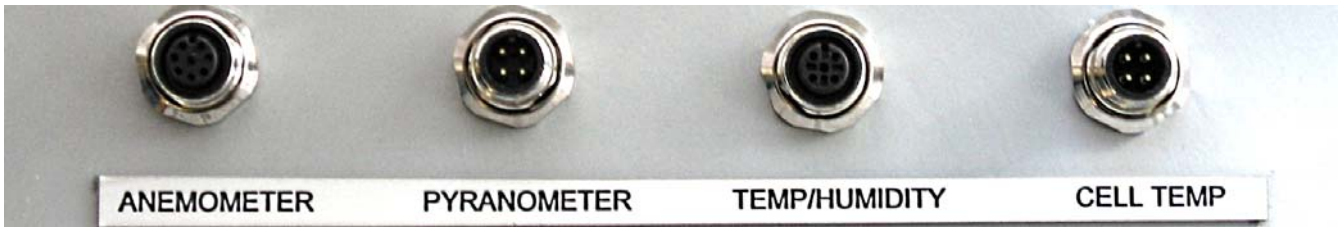
With the mains off, connect the Line, Neutral and Ground wires to the screw terminals provided. Proper grounding is required.

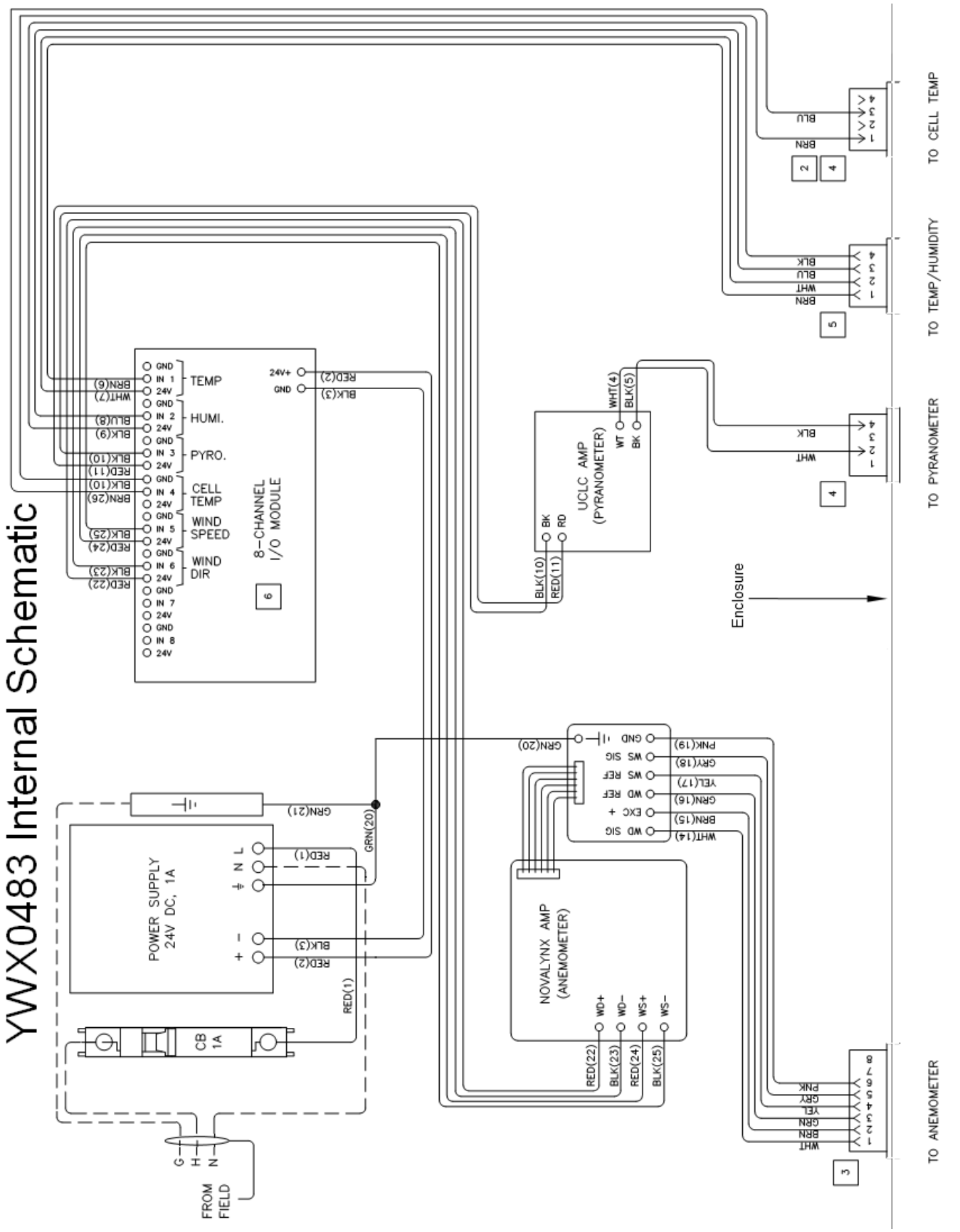
It is important to observe all electrical codes and safety practices when wiring the weather station.

WARNING: After wiring the system, remove all scraps of wire or foil shield from the electrical panel. This could be dangerous if wire scraps come into contact with high voltage wires.

The weather station uses RS-485 Modbus RTU to communicate with a Master device such as an AcquiSuite. Attach a suitable twisted pair cable to the RS-485 connector provided. Observe polarity markings +, - and Shield.


Weidmüller
8739140000
CP SNT 48W 24V 2A
CAUTION Read manual no.4324050000/01/09.07
Before connecting to mains.
UCLC
Current Loop Converter
for LI-COR™ sensors
EME Systems, Berkley CA


ANEMOMETER
PYRANOMETER
TEMP/HUMIDITY
CELL TEMP


YWX0483 Internal Schematic
TO CELL TEMP
TO TEMP/HUMIDITY
TO PYRANOMETER
TO ANEMOMETER
Enclosure
8-CHANNEL I/O MODULE
TEMP
HUMI.
PYRO.
CELL TEMP
WIND SPEED
WIND DIR
UCLC AMP (PYRANOMETER)
NOVALYNX AMP (ANEMOMETER)
POWER SUPPLY 24V DC, 1A
CB 1A
FROM FIELD

WS-ANEMO-1: Anemometer kit

Kit contains: Anemometer sensor

The WS-ANEMO-1 has a 40' cable. Inquire for custom cable lengths. The installation procedure follows.

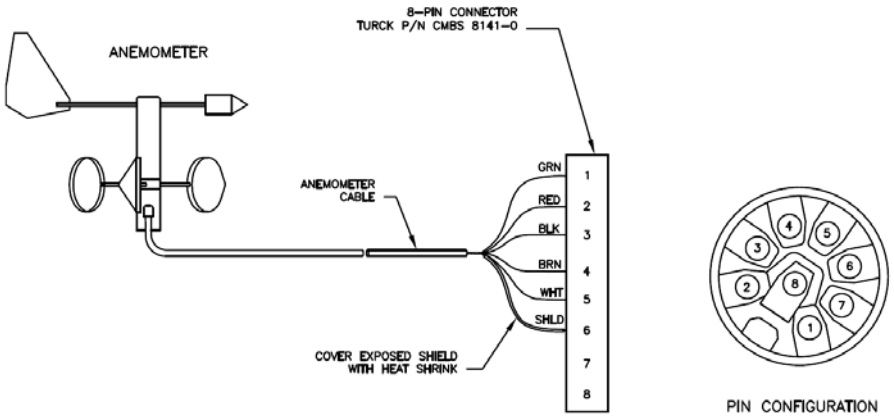
Locate the tail fin for the wind direction sensor. The tail fin must be attached to the sensor using two screws provided. Place the tail fin with the large part of the fin on the top as shown in the following picture.

Install the anemometer by placing the sensor on the top of the mast. Locate the label on the side of the sensor labeled "north". Rotate the anemometer on the pole so that label on the anemometer base is facing North. Magnetic North is adequate for most installations. Should a True North alignment be required, the magnetic declination at the sensor location must known and applied to the compass reading.

Tighten the two screws on the bottom of the sensor to secure it to the mast.

Note: do not adjust the screw in the middle of the label. This is for calibration.

Run the wire from the sensor back to the control box, and attach the wire to the connector labeled "Anemometer."



WIRING DIAGRAM

WS-PYRO-1: Pyranometer kit

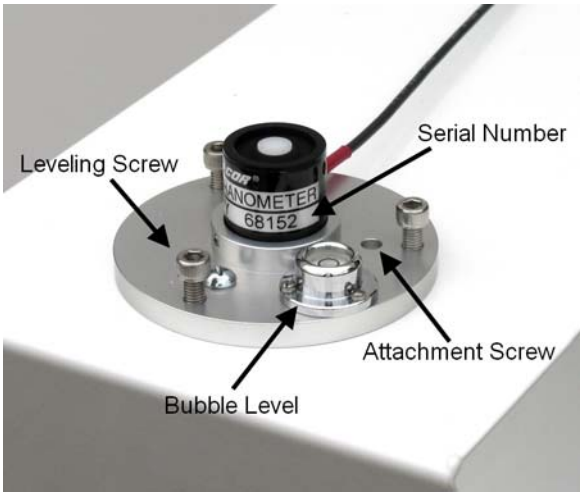
Kit contains: Pyranometer, Leveling base, 3 screws, nuts, calibration certificate.

Attach the pyranometer to the mounting base. Align the wire on the pyranometer to the slot on the mounting base before inserting it in the base. A small hex set-screw is located on the side on the mounting base to secure the pyranometer. Use the Allen wrench provided to tighten the set screw until the pyranometer is secure. Do not over-tighten the set screw or it will crack the pyranometer.

Attach the pyranometer base plate to the top of the weather station arm as shown to the left. Place the three mounting bolts in the holes, and start the bolts, but do not tighten the nuts yet.

Using the leveling screws, adjust the angle of the base plate until the bubble level shows the pyranometer to be level. Once this adjustment has been made, tighten the attachment bolts and nuts to secure the pyranometer in place. Do not over-tighten the leveling screws more than finger tight.

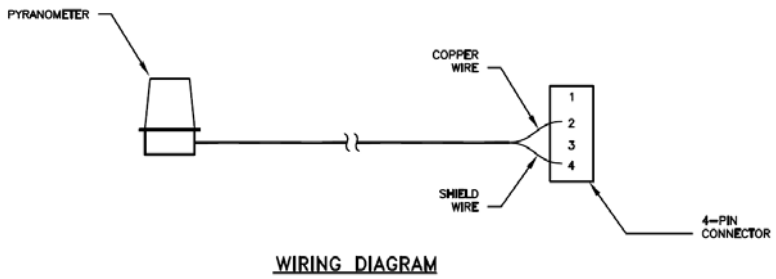
Bring the black cable down the mast and around to the control box. Plug the cable into the connector labeled “pyranometer”



Important: Locate the serial number on the pyranometer. Write this number down ----> _____

The serial number will be required later for calibration purposes.

The pyranometer kit includes a calibration certificate. Do NOT DISCARD THE CALIBRATION CERTIFICATE. Take time to verify the serial number printed on the calibration certificate matches the one on the pyranometer sensor.



WIRING DIAGRAM

A89WS-MP1: PV Mounting Bracket – Pyranometer (Optional)

Kit contains: bracket with thumbscrews.

The A89WS-MP1 mounting bracket allows the pyranometer to be mounted on the side of a solar panel or other flat object. This provides the pyranometer the same angle to the sun as the panel for measuring performance of a system.

Note: the pyranometer is not included with this bracket. The WS-PYRO-1 kit is required to use this bracket.

Attach the pyranometer to the mounting base. Align the wire on the pyranometer to the slot on the mounting base before inserting it in the base. A small hex set-screw is located on the side on the mounting base to secure the pyranometer. Use the Allen wrench provided to tighten the set screw until the pyranometer is secure. Do not over-tighten the set screw or it will crack the pyranometer.

Attach the pyranometer base plate to the top of the A89WS-MP1 mounting bracket as shown to the left. Place the three mounting bolts in the holes, and tighten the attachment bolts and nuts to secure the pyranometer in place flush against the bracket. The leveling screws and bubble level are not used with this mounting bracket.

Bring the black cable around to the control box. Plug the cable into the connector labeled “pyranometer”

Important: Locate the serial number on the pyranometer.

Write this number down ----> _____

The serial number will be required later for calibration purposes.

The pyranometer kit includes a calibration certificate. Do NOT DISCARD THE CALIBRATION CERTIFICATE. Take time to verify the serial number printed on the calibration certificate matches the one on the pyranometer sensor.

WS-CELLTEMP-1: Cell Temperature Kit

Kit contains: Cell temperature probe with cable and plug.

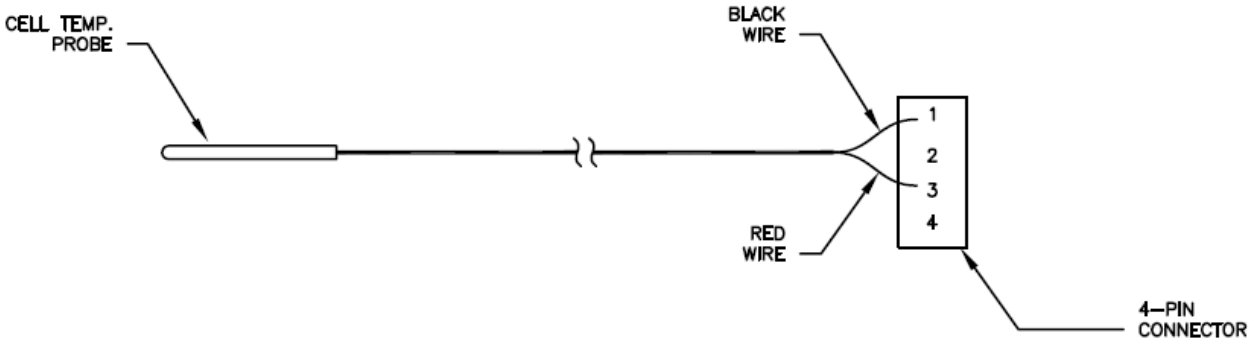
The cell temperature probe is a 10k ohm type 2 thermistor sensor in a bullet probe configuration.

- TC1 has a 50' cable.

The cell temperature probe should be mounted to the back of a solar panel to measure the panel temperature. Care should be taken to not damage the solar panel when installing the sensor.

The bullet probe can be glued to the panel, or attached by securing the probe with a hardware attachment on the panel or panel holding system.

The probe may also be secured using durable foil tape typically used to seal HVAC systems in outdoor applications. Foil tape can also be used to secure a probe while glue such as epoxy is curing.



WIRING DIAGRAM

WS-TEMPHUM-1: Air Temperature and Humidity Probe

WS-TEMP-1: Air Temperature Probe

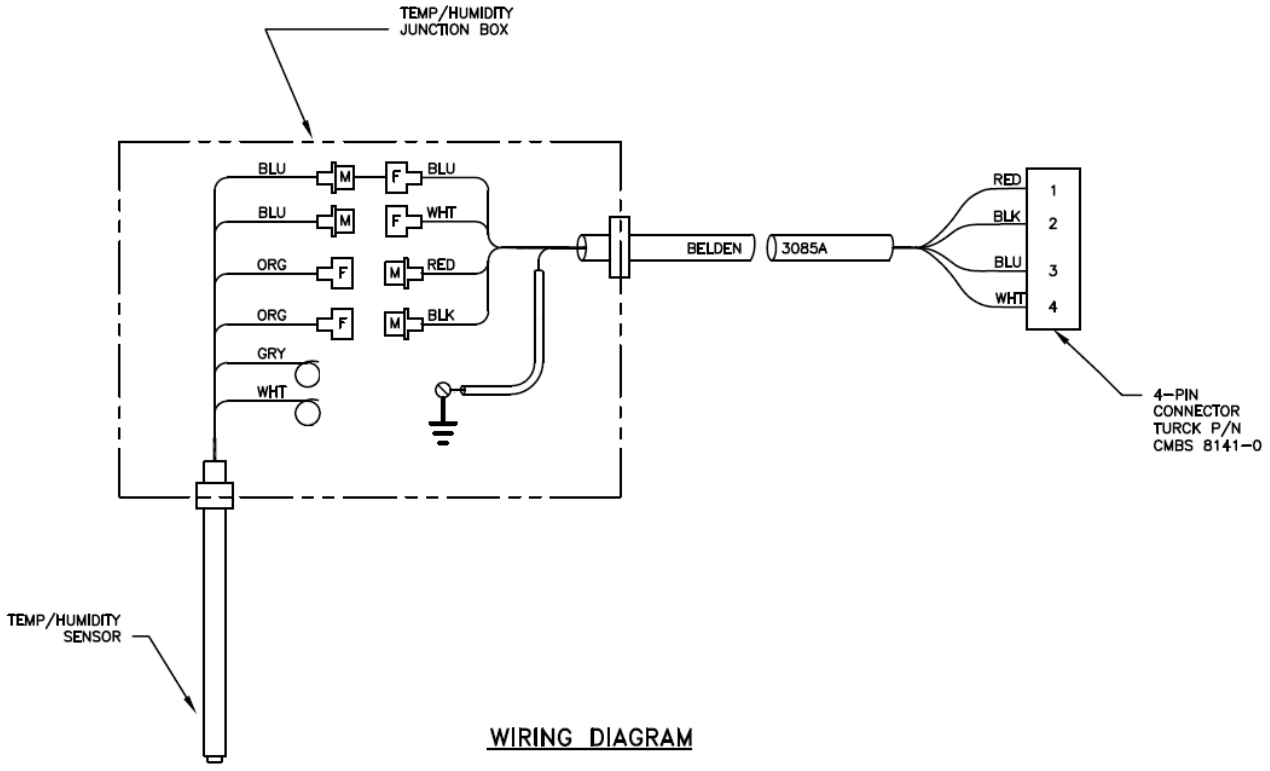
Note: The WS-TEMPHUM-1 and WS-TEMP-1 kits have a similar appearance and the hardware mounting is the same. The only difference is that the WS-TEMPHUM-1 kit includes a humidity sensor in the air probe, and the WS-TEMP-1 air probe does not. For purposes of installation, the hardware assembly is the same.

Kit contains: Air sensor with cable, 2 screws and nuts.

Install the air sensor on the inside of the weather station mounting arm with the probe facing down. The probe should be oriented so that the sensor is in the vented sun shade area of the arm.

Use the two screws provided to attach the sensor to the arm. Secure the screws using the nut on the back of the arm. Tighten the screws until the air sensor box is flush against the back of the mounting arm.

Bring the yellow cable down the mast and around to the control box. Plug the cable into the connector labeled “temp/humidity”



WIRING DIAGRAM

Software setup and configuration

The AMtec Solar A89WS weather station uses an A8332-8F2D I/O Module to convert the sensor data to a Modbus output. The A8332-8F2D must be configured to read each of the sensors. Each input on the A8332-8F2D represents a specific sensor input, and two inputs remain unused.

Note: the default configuration of the weather station I/O Module is Modbus address 51, 9600, N81

Modbus Configuration

Default Input mode configuration:

Input channel 1:	Air Temperature	(4-20mA)
Input channel 2:	Air Humidity	(4-20mA)
Input channel 3:	Pyranometer	(4-20mA)
Input channel 4:	Cell Temperature	(resistance)
Input channel 5:	Wind Speed	(4-20mA)
Input channel 6:	Wind Direction	(4-20mA)
Input channel 7:	(not used)	
Input channel 8:	(not used)	

Note: Some weather station configurations may not use all the sensors listed above. The input channels associated with these sensors should be disabled if the sensor is not present. Use the OCC software or the AcquiSuite configuration menu to disable channels with no sensor attached.

Note: The YWX0483 (rev A) control box shipped between Aug and Sep 2010 have a different wiring connection list. The inputs are configured as 1= wind speed, 2=direction, 3=temp, 4=humidity, 5=pyranometer, 6=cell temp. For more information on the rev-a model of this control box, please contact technical support at AMtec Solar.

Modbus Address and Dipswitch Configuration

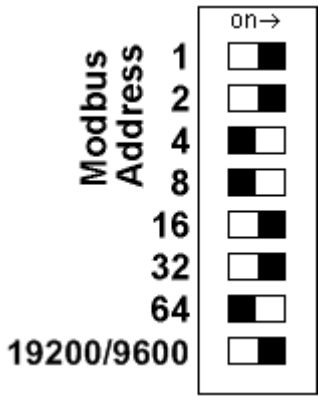
Modbus Address: The default Modbus address of the weather station A8332-8F2D I/O Module is set to 051. The address may be modified by changing the Modbus address dipswitches on the A8332-8F2D I/O Module. This address must be unique among all Modbus devices in the system. The A8332-8F2D supports address 001 through 127.

Select an address, and set the dipswitches to match.

The sum of the value of the switches is the address. In the example to the right, address 51 is set by placing switch 1, 2, 16 and 32 to the on position.

Note: 1 + 2 + 16 + 32 = **51**

Baud Rate: This option sets the serial port speed for the RS-485 port. Set this option to "off" for 19200. Set the switch to "on" for 9600 baud. The default is 9600 (on)

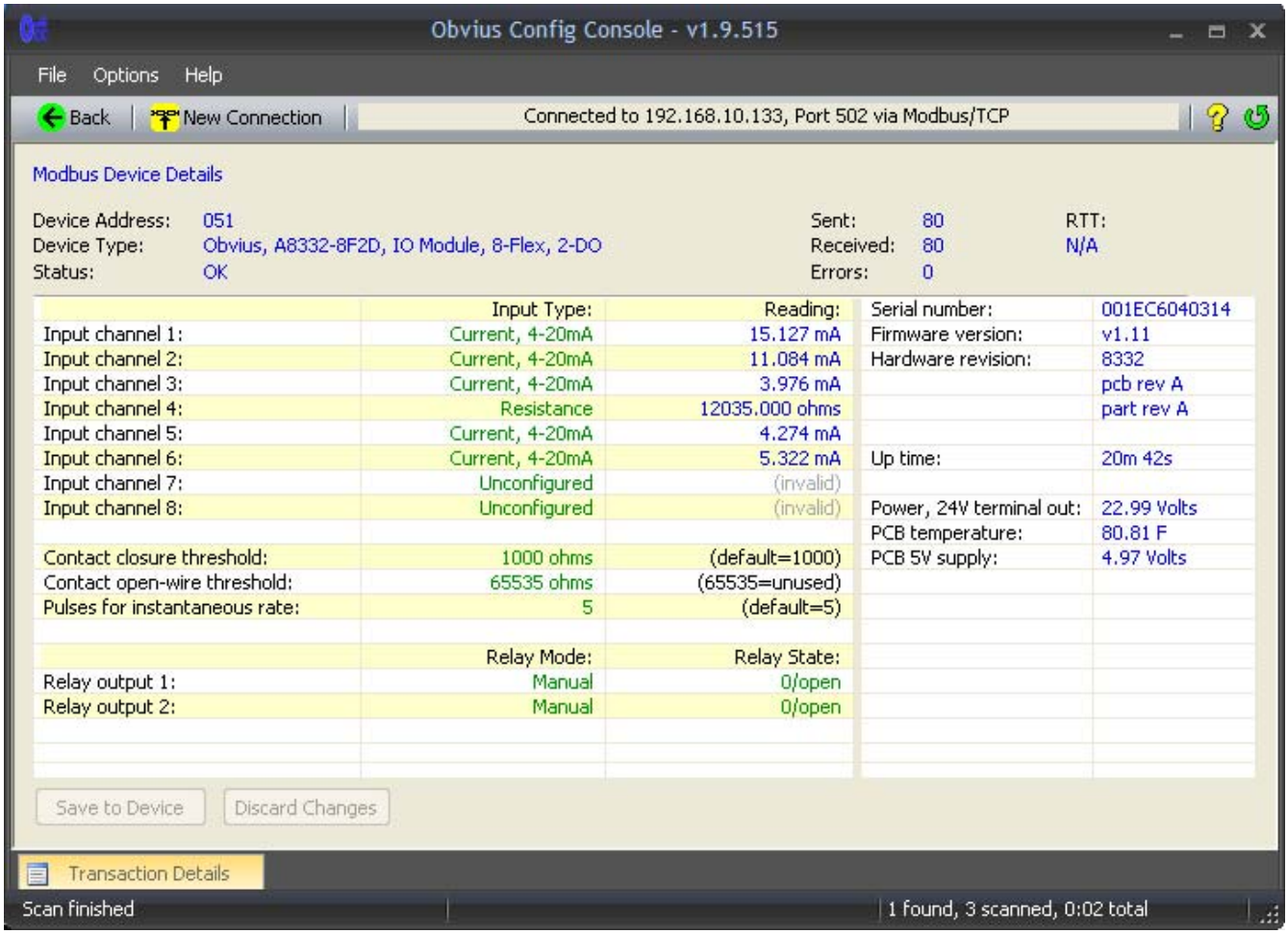


Setup and testing with Obvius Config Console (OCC) (optional)

After the weather station has been installed and powered, the installer should take the time to verify that all the sensors are working properly. One way to do this is to use an AcquiSuite data acquisition server to configure and display the data points from the weather station. If an AcquiSuite is not available, a free software tool can be downloaded from Obvius.com that can help with both configuration and confirm the operation of the device.

Using a USB to Serial adapter, connect a laptop computer to the Flex IO module inside the control box. Either an RS-485 or RS232 adapter may be used. Obvius sells two adapters (A89-USB485 or A89-USB232) that may be used. Verify that the I/O Module inside the weather station control box is powered and has a blinking green LED.

Next, run the OCC software. On the connection screen, select your serial port, and specify 9600, N, 8, 1 serial options, and click Connect. Click the Scan button on the top of the page to scan the serial port for devices. Device #051 (A8332-8F2D) should appear in the list. Double click on the line item for this Flex I/O Module. You should see something like this screen:

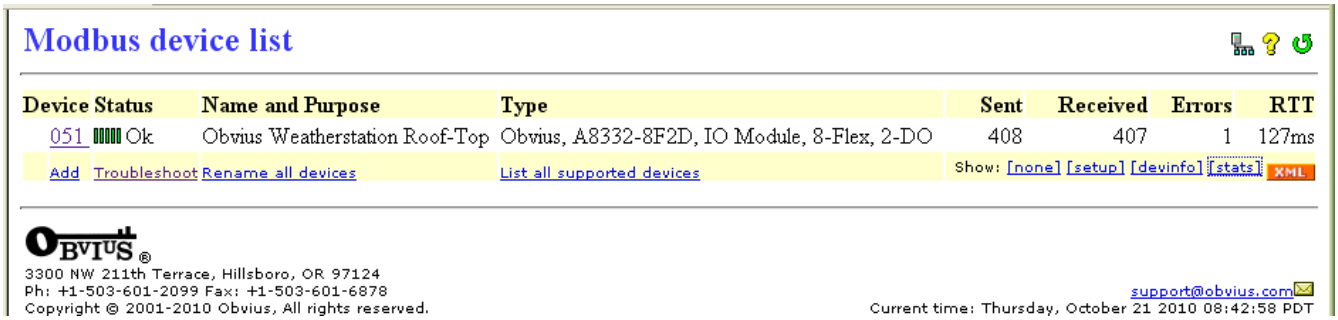


Verify the following options and readings:

Input channel 1	Current 4-20mA
Input channel 2	Current 4-20mA
Input channel 3	Current 4-20mA
Input channel 4	Resistance
Input channel 5	Current 4-20mA
Input channel 6	Current 4-20mA
Input channel 7	Unconfigured
Input channel 8	Unconfigured

Setup with Obvius AcquiSuite

Configure the AcquiSuite Modbus options to allow 9600 baud communications. The default settings in the AcquiSuite should allow the weather station I/O to communicate directly. Select the Modbus Device List option from the AcquiSuite configuration menu. The following screen should be displayed. Notice the weather station shows up in the list at address 51. The actual device type is that of the I/O module, an Obvius A8332-8F2D.

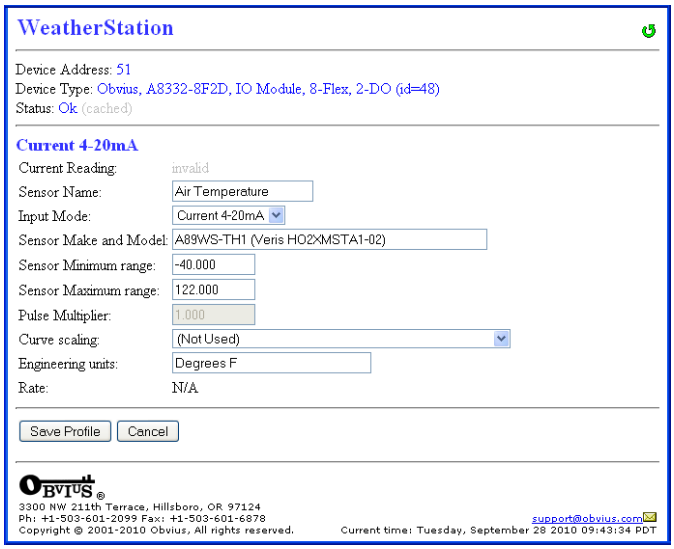


Select the weather station device 51 from the device list. Next, click the configure button at the bottom of the page. Each data point will now have a "Configure Point" button open to the right of each data point. To configure each input sensor, click each configure point button, and set the options as described in the following sections.

Channel 1: WS-TEMP-1: Air Temperature Probe

Configure the following options

- Sensor Name: "Air Temperature"
- Input Mode: "Current 4-20mA"
- Sensor Make and Model: "WS-TEMP-1 (Veris TOAM10-02)"
- Sensor Minimum Range: "-40"
- Sensor Maximum Range: "122"
- Engineering Units: "Degrees F"



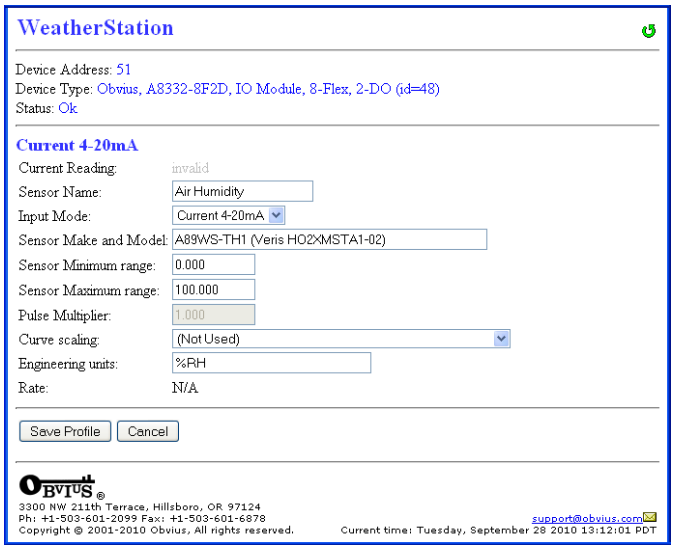
Note: the option for "Sensor make and model" is for reference information only. This field is intended to store information about the physical sensor to assist in record-keeping for identification of the attached sensor.

Channel 2: WS-TEMPHUM-1: Air Humidity Probe

Configure the following options

- Sensor Name: “Air Humidity”
- Input Mode: “Current 4-20mA”
- Sensor Make and Model: “WS-TEMPHUM-1 Veris HO2XMSTA1-02”
- Sensor Minimum Range: “0”
- Sensor Maximum Range: “100”
- Engineering Units: “%RH”

Note: the option for “Sensor make and model” is for reference information only. This field is intended to store information about the physical sensor to assist in record keeping for identification of the attached sensor.

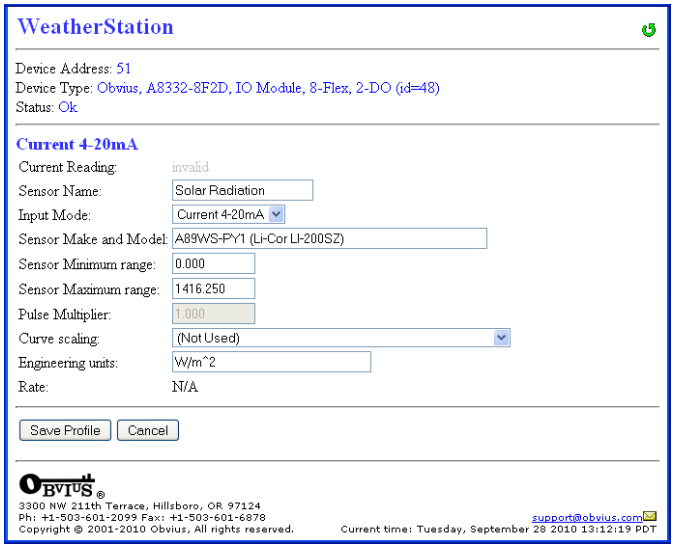


Channel 3: WS-PYRO-1: Pyranometer

Configure the following options

- Sensor Name: “Solar Radiation”
- Input Mode: “Current 4-20mA”
- Sensor Make and Model: “WS-PYRO-1 (Li-Cor LI-200SZ)”
- Sensor Minimum Range: “0”
- Sensor Maximum Range: “xxxx” *
- Engineering Units: “W/m^2”

Note: the option for “Sensor make and model” is for reference information only. This field is intended to store information about the physical sensor to assist in record keeping for identification of the attached sensor.



*** Pyranometer max range calculation:**

The Sensor Maximum Range setting for the pyranometer is based on the multiplier supplied on the calibration certificate for the sensor. Locate the multiplier on the calibration certificate. If the calibration certificate is not available, use a web browser to access the LI-COR website at http://envsupport.licor.com choose the Calibration Data option at the bottom of the page and enter the serial number on the Pyranometer. The multiplier is different for each pyranometer.

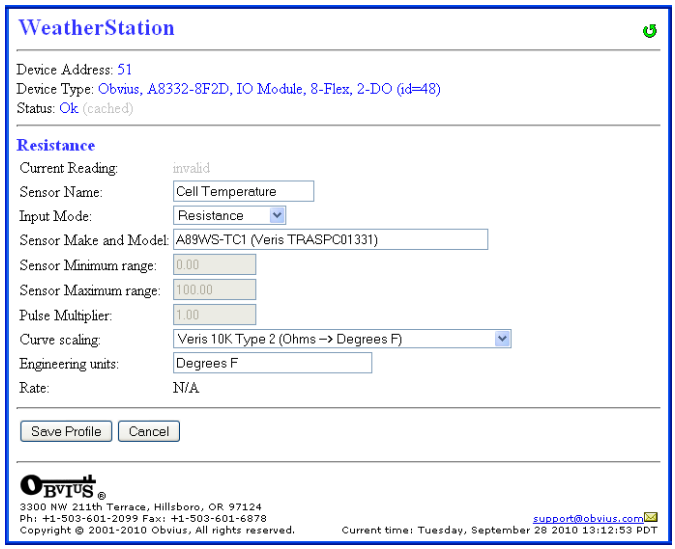
Using the multiplier from the calibration certificate, multiply the absolute (positive) value by 125. The result is the Sensor Maximum Range. e.g. Maximum Range = 125 * LicorMultiplier.

Example: LI-COR multiplier of **-11.33**
Maximum Range = 125 * 11.33
Maximum Range = **1416.25** w/m^2

Channel 4: WS-CELLTEMP-1, TC2: Cell Temperature

Configure the following options

- Sensor Name: “Cell Temperature”
- Input Mode: “Resistance”
- Sensor Make and Model: “WS-CELLTEMP-1 (Veris TRASPC-01331)”
- Curve Scale: “Veris 10K Type 2”
- Engineering Units: “Degrees F”



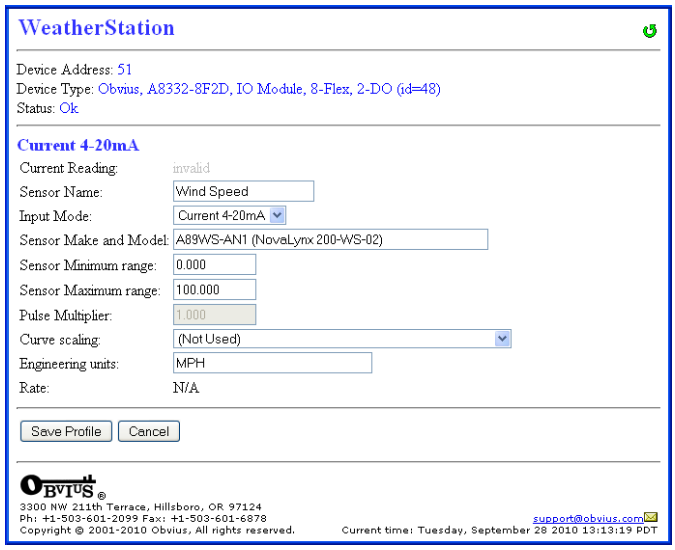
Note: the option for “Sensor make and model” is for reference information only. This field is intended to store information about the physical sensor to assist in record keeping for identification of the attached sensor.

The Curve Scale option has a provision for converting 10K Type 2 to either Degreees F or C. You may select either conversion depending on your project needs. Be sure to set the Engineering Units field to match the unit of measure for your conversion.

Channel 5: WS-ANEMO-1: Anemometer / wind speed

Configure the following options

- Sensor Name: “Wind Speed”
- Input Mode: “Current 4-20mA”
- Sensor Make and Model: “WS-ANEMO-1 (NovaLynx 200-WS-02)”
- Sensor Minimum Range: “0”
- Sensor Maximum Range: “100”
- Engineering Units: “MPH”



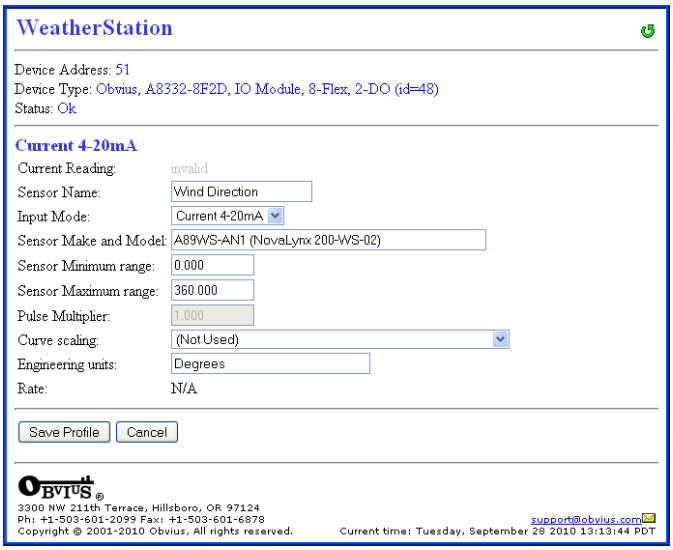
Note: the option for “Sensor make and model” is for reference information only. This field is intended to store information about the physical sensor to assist in record keeping for identification of the attached sensor.

Channel 6: WS-ANEMO-1: Anemometer / wind direction

Configure the following options

- Sensor Name: “Wind Direction”
- Input Mode: “Current 4-20mA”
- Sensor Make and Model: “WS-ANEMO-1 (NovaLynx 200-WS-02)”
- Sensor Minimum Range: “0”
- Sensor Maximum Range: “360”
- Engineering Units: “Degrees”

Note: the option for “Sensor make and model” is for reference information only. This field is intended to store information about the physical sensor to assist in record keeping for identification of the attached sensor.



Channel 7, Channel 8

Channels 7 and 8 are not used in the weather station. Set these channels to be unconfigured:

- Input Mode: “Unconfigured”

Setup with 3rd party Modbus master

Flex I/O Module Modbus information, specific to the Weather Station

(For complete details such as reserved or pulse input registers or values not listed here, refer to the latest Obvius documentation regarding the A8332-8F2D Modbus Flex IO Module Installation and Operation Manual).

Weather Station Modbus Register Listing

Data points

offset	point	type	description and modes

Values (instantaneous Ohms or mA)

0	40001	UINT32	input 1 value MSW
1	40002	UINT32	input 1 value LSW
2	40003	UINT32	input 2 value MSW
3	40004	UINT32	input 2 value LSW
4	40005	UINT32	input 3 value MSW
5	40006	UINT32	input 3 value LSW
6	40007	UINT32	input 4 value MSW
7	40008	UINT32	input 4 value LSW
8	40009	UINT32	input 5 value MSW
9	40010	UINT32	input 5 value LSW
10	40011	UINT32	input 6 value MSW
11	40012	UINT32	input 6 value LSW
12	40013	UINT32	input 7 value MSW
13	40014	UINT32	input 7 value LSW
14	40015	UINT32	input 8 value MSW
15	40016	UINT32	input 8 value LSW

Average (Ohms or mA)

16	40017	UINT32	input 1 ave MSW
17	40018	UINT32	input 1 ave LSW
18	40019	UINT32	input 2 ave MSW
19	40020	UINT32	input 2 ave LSW
20	40021	UINT32	input 3 ave MSW

21	40022	UINT32	input 3 ave LSW
22	40023	UINT32	input 4 ave MSW
23	40024	UINT32	input 4 ave LSW
24	40025	UINT32	input 5 ave MSW
25	40026	UINT32	input 5 ave LSW
26	40027	UINT32	input 6 ave MSW
27	40028	UINT32	input 6 ave LSW
28	40029	UINT32	input 7 ave MSW
29	40030	UINT32	input 7 ave LSW
30	40031	UINT32	input 8 ave MSW
31	40032	UINT32	input 8 ave LSW

Minimum (Ohms or mA)

32	40033	UINT32	input 1 min MSW
33	40034	UINT32	input 1 min LSW
34	40035	UINT32	input 2 min MSW
35	40036	UINT32	input 2 min LSW
36	40037	UINT32	input 3 min MSW
37	40038	UINT32	input 3 min LSW
38	40039	UINT32	input 4 min MSW
39	40040	UINT32	input 4 min LSW
40	40041	UINT32	input 5 min MSW
41	40042	UINT32	input 5 min LSW
42	40043	UINT32	input 6 min MSW
43	40044	UINT32	input 6 min LSW
44	40045	UINT32	input 7 min MSW
45	40046	UINT32	input 7 min LSW
46	40047	UINT32	input 8 min MSW
47	40048	UINT32	input 8 min LSW

Maximum (Ohms or mA)

48	40049	UINT32	input 1 max MSW
49	40050	UINT32	input 1 max LSW
50	40051	UINT32	input 2 max MSW
51	40052	UINT32	input 2 max LSW
52	40053	UINT32	input 3 max MSW
53	40054	UINT32	input 3 max LSW
54	40055	UINT32	input 4 max MSW
55	40056	UINT32	input 4 max LSW
56	40057	UINT32	input 5 max MSW
57	40058	UINT32	input 5 max LSW
58	40059	UINT32	input 6 max MSW
59	40060	UINT32	input 6 max LSW
60	40061	UINT32	input 7 max MSW
61	40062	UINT32	input 7 max LSW
62	40063	UINT32	input 8 max MSW
63	40064	UINT32	input 8 max LSW

Mode setting options (see above for value details)

64	40065	UINT16	input 1 mode (NV/r/w)
65	40066	UINT16	input 2 mode (NV/r/w)
66	40067	UINT16	input 3 mode (NV/r/w)
67	40068	UINT16	input 4 mode (NV/r/w)
68	40069	UINT16	input 5 mode (NV/r/w)
69	40070	UINT16	input 6 mode (NV/r/w)
70	40071	UINT16	input 7 mode (NV/r/w)
71	40072	UINT16	input 8 mode (NV/r/w)
73	40074	UINT16	Input broken wire alarm bitmap. (resistance, current modes only) Resistive mode: bit set when resistance is off-scale-high. 4-20mA mode: bit is set when current is below 4mA.
74	40075	UINT16	Relay output 1 (r/w) 0=open, 1=closed, defaults to open on power-up. r/w allowed when register 41030 = 0.
75	40076	UINT16	relay output 2 (r/w) 0=open, 1=closed

1002	41003	UINT16	serial number bytes 1,2
1003	41004	UINT16	serial number bytes 3,4
1004	41005	UINT16	serial number bytes 5,6
1005	41006	UINT16	firmware version (major)
1006	41007	UINT16	firmware version (minor)
1011	41012	UINT32	Uptime MSW number of seconds since IO module booted.
1012	41013	UINT32	uptime LSW
1013	41014	UINT16	hardware version (major) for example: 8332
1014	41015	UINT16	hardware version (minor) MSB = pcb rev, LSB = part rev. value 1=Rev_A, 2=Rev_B, etc.
1015	41016	UINT32	hardware Date of Manufacture (MSW)
1016	41017	UINT32	Hardware Date of Manufacture (LSW) time, UTC, unix epoch, seconds past 1970.
1017	41018	UINT16	RS485 Stats: Good RX (all packets received)
1018	41019	UINT16	RS485 Stats: Total TX
1019	41020	UINT16	RS485 Stats: TX failed
1020	41021	UINT16	Clear min/max/ave (r/w) read returns 0, write any value to clear min/max/ave for all channels.
1024	41025	UINT8	Reason for reboot. 0x01=POR, 0x02=EXTR 0x04=WDTR 0x08=BODR,0x8000=WDTOF
1025	41026	UINT16	Power supply voltage monitor. scale: x100, volts
1026	41027	INT16	pcb temperature monitor. scale: x100, degrees F.
1027	41028	UINT16	5V internal power supply voltage monitor. scale: x100, volts
1028	41029	UINT16	RS485 baud rate. 2=9600, 3=19200.

Modbus function 0x11 Slave ID responses will report the following:

"Obvius, A8332-8F2D, IO Module, 8-Flex, 2-DO", id=48

Register Functions

All 32 bit data point values are encoded in 2 Modbus registers (16bits each). Modbus master systems should always query the A8332-8F2D using a single query to read an entire block of registers. Never use two queries to read one register and then combine the two results into a single 32 bit value. Doing so will allow the input value to increment in the middle of the two Modbus queries, and will cause intermittent data readings that are incorrect.

For example, an input has a decimal value of 65534. This is represented as a 32 bit hex number 0x0000FFFE. The first 4 digits are the MSW register; the second 4 digits are the LSW register. The Modbus Master reads the first (MSW) register and gets 0x0000. In the moment between the two readings, the input raises 2 more digits (in decimal), making the total 65536 or 0x00010000 in hex. Next the Master reads the second (LSW) register and gets 0x0000. When the two registers

are combined, the result is 0x00000000. The proper way to handle this situation is to simply read both registers in a single Modbus query.

Data Conversion

Knowing the register values and types, and expected ranges of resultant values, calculate to derive the sensor readings from the Modbus register values listed above.

Example

Registers 40001 and 40002 typically describe an Air Temperature reading from a 4-20mA sensor on Input 1. The expected minimum sensor value (in degrees F) is -40º F and the maximum is 122º F.

The minimum value is two unsigned 32-bit integers, MSW=0, LSW=0, and the maximum is MSW=65535, LSW=65535.
To calculate a single value x from those by combining each register $R_{[address]}$, shift the higher word register value in order to add it the lower register value, as follows.

$$x = (R_{40001}) * 10000) + (R_{40002})$$

Calculate the slope m for y as follows.

$$m = (x_2 - x_1) / (y_2 - y_1) = (6553565535-0) / (122--40) \approx 39960765.457$$

So the approximate temperature T value is as follows.

$$T = ((((\text{register 40001}) * 10000) + (\text{register 40002})) / 39960765) - 40$$

If register 40001 was 32767, and register 40002 was 32767, then the resulting value would be interpreted as approximately 41.9º F, which is about half of the Air Temperature range listed above.

Use similar formulae to derive the values for the other sensors based on the register values for those types. Resistive measurements may require curve scales.

Recommended Maintenance of third party devices

Some of the sensors included in the weather station require either replacement or re-calibration after deployment.

WS-PYRO-1: LI-COR recommends that the LI-200SZ Pyranometers be calibrated every two years to maintain the sensor accuracy. This requires the device to be sent to LI-COR (402) 467-3576 for recalibration.

WS-TEMPHUM-1: Veris recommends that the humidity element on the HO2XMSTA1-O2 Temperature/Humidity sensors be tested every year and replaced accordingly. This element is field-replaceable, and can be obtained by contacting Veris Industries (503) 598-4564 directly.

WS-ANEMO-1, AN2: NovaLynx recommends that you apply several drops of light weight (3-in-1) machine oil or lightly spray WD40 onto the anemometer bearing located just below the cups. Always look at the wind vane alignment to North. If the alignment is critical, do the check with a compass. Make corrections to the alignment as needed. Always check the alignment after a severe storm with high velocity winds.