



Installation Instructions Weather Station

Anemometer, Pyranometer, & Temperature/Humidity

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Product Application Limitation

Obvius 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 Obvius nullify this statement.

Easy Installation

- Simple U-bolt attachments makes for quick and easy installation
- Wireless version, drastically decreases installation cost and time, resulting from lack of extensive wire runs
- Comes with pre-wired weather resistant enclosure, making attachment of sensors both simple and straightforward

Applications

- Solar Applications- Inverters, Solar Current Monitors...etc
- Processes dependent on external weather conditions
- Monitoring performance of building systems when used in conjunction with Acquisuite (e.g., chillers, boilers, fans)

Operation

The Weather Station is a wireless weather sensing device designed to monitor varying meteorological conditions. Designed specifically for solar applications, the Weather Station provides efficiency verifications for photovoltaic cells, by allowing users to chart and note varying meteorological conditions and the particular effect each has on solar DC power generation. For instance, the introduction of rain to solar arrays can minimize production as a result of both associated cloud cover and water accumulation on the cells themselves. For a more direct comparative measure, the pyranometer works in a similar fashion as the solar arrays themselves, generating a number representative of solar radiation per square meter.

The standard Weather Station A89WSW includes the following:

- Weather resistant Nema 6P/12 enclosure w/panel
- One I/O Module (Built-In)
- One Mast and Tri-pod
- Four U-bolt mast attachments
- One metal support arm
- Temperature and Humidity Sensor (Analog x 2)
- Wind Speed and Direction (Analog x 2)
- Pyranometer (Analog)

Optional Weather Station attachments:

- Temperature Sensor (Analog)
- Cell Temperature Probe (Analog)
- One Modhopper- Allows for wireless capability (Built-In)

The Weather Station is a rather flexible and scalable product in terms of the possible mix of sensor configurations; thus, making it a customizable product allowing for adaptation to almost any environmental application. Most applications dependent on external weather conditions can use the weather station for both measurement and verification of processes.

Location

As there are many variables which could affect the accuracy of the Weather Station's readings, there are certain things to take into consideration when installing. Use the following as a guide for factory recommended assembly:

- Ensure that the device is located in as open and unobstructed area as possible (i.e. roofs). Each of the sensors requires certain directional and spatial alignments when installing.
- As the Pyranometer records solar radiance, the main concern during installation is an unobstructed view of the sky; this means to avoid bushes, trees, or other objects which might cast a shadow over the sensor effectively limiting the validity of the readings.
- The Temperature and Humidity sensors must be installed inverted, with the protruding tube pointing down. Also to avoid direct contact with the thermal variances caused by the sun, place the sensor in a Northerly direction.
- Other thermal variances can be caused by exhaust from other mechanical equipment, thus the device should be spaced accordingly.
- As for the Wind Direction and Speed sensors, the main concern is an area that allows for free flowing air circulation. Often this is attained by locating the device on the highest possible location, and if not available, ensuring that the distance from such obstructions is maximized. As a general rule, air flow around a structure is distributed to twice the height of the structure upwind, six times the height downwind, and up to twice the height of the structure above ground.

Installation

Mast and Tri-pod assembly (See diagram below)

- 1) Remove tri-pod and antenna from packaging
- 2) Expand tri-pod legs and insert antenna mast through hole at the top and secure using nuts and bolts attached to tri-pod





(Use ½" Wrench to secure inner nut while tightening)

- 3) Place NEMA enclosures flush against the antenna mast, with the bottom resting on the top supports of the tri-pods legs. Secure the top using one of the four U-bolts provided, tighten to ensure stability
- 4) Remove the Temperature/Temperature and humidity device and using screws and bolts provided, attach the device in an inverted position to the longest of the adjacent sides of the support arm.
- 5) (SEE ARM DIAGRAM BELOW FOR REFERENCE) Approximately 5" from the top of the enclosure is the optimum placement for the bottom of the support arm. Use the other two U-bolts provided to secure the arm directly to the mast via the longer of the adjacent sides (the same side the temperature sensor is attached to, only mounted internally within the enclosure)
- 6) Next attach the Pyranometer to the top of the support arm, assuring alignment with the three mounting holes on the arm and the sensor itself. Attach using bolts and nuts provided
- 7) The final step for installation is simply placing the wind direction and speed sensor over the top of the mast, using attached fastening screws to secure.

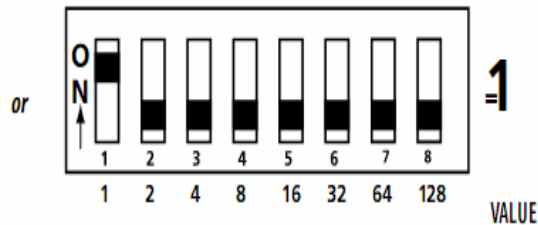
Configuration

- 1) It is important that each Modbus device on a single network must have a unique address before the device is connected to the Modbus RS485 network.
- 2) In the case of the Weather Station, the Modhopper comes preconfigured with a Modbus address of 101. The I/O modules come preconfigured with a Modbus address of 51 and 52 if a second module is needed. As these are somewhat unique addresses there should be little if any instances where a change in addressing is needed. If however Modbus addresses 101 or 51-52 are already in use, follow step 3 below for alteration. If more than one weather station is included in a purchase, the second weather station Modbus addresses will be the following: Modhopper 102, I/O 53, and if needed I/O 52 and so on with additional units.
- 3) The Modbus address given is important to remember as this is the way to initially identify the device via the master. Therefore use the following guide for altering the addresses via a dip switch:

The Dip Switches are activated by moving them into the ON position as noted on the devices. The sum of the value of the dipswitches is the address. In the below examples Modbus address 1 is set by simply turning switch 1 to the ON position, whereas Modbus address 40 is set by placing switch 4 and 6 to the ON position.

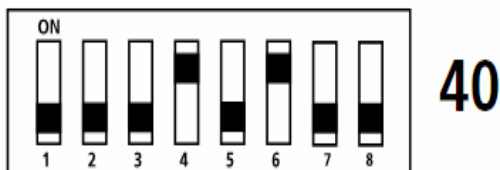
The values of each dip switch are as follows;

1=1
 2=2
 3=4
 4=8
 5=16
 6=32
 7=64
 8=128



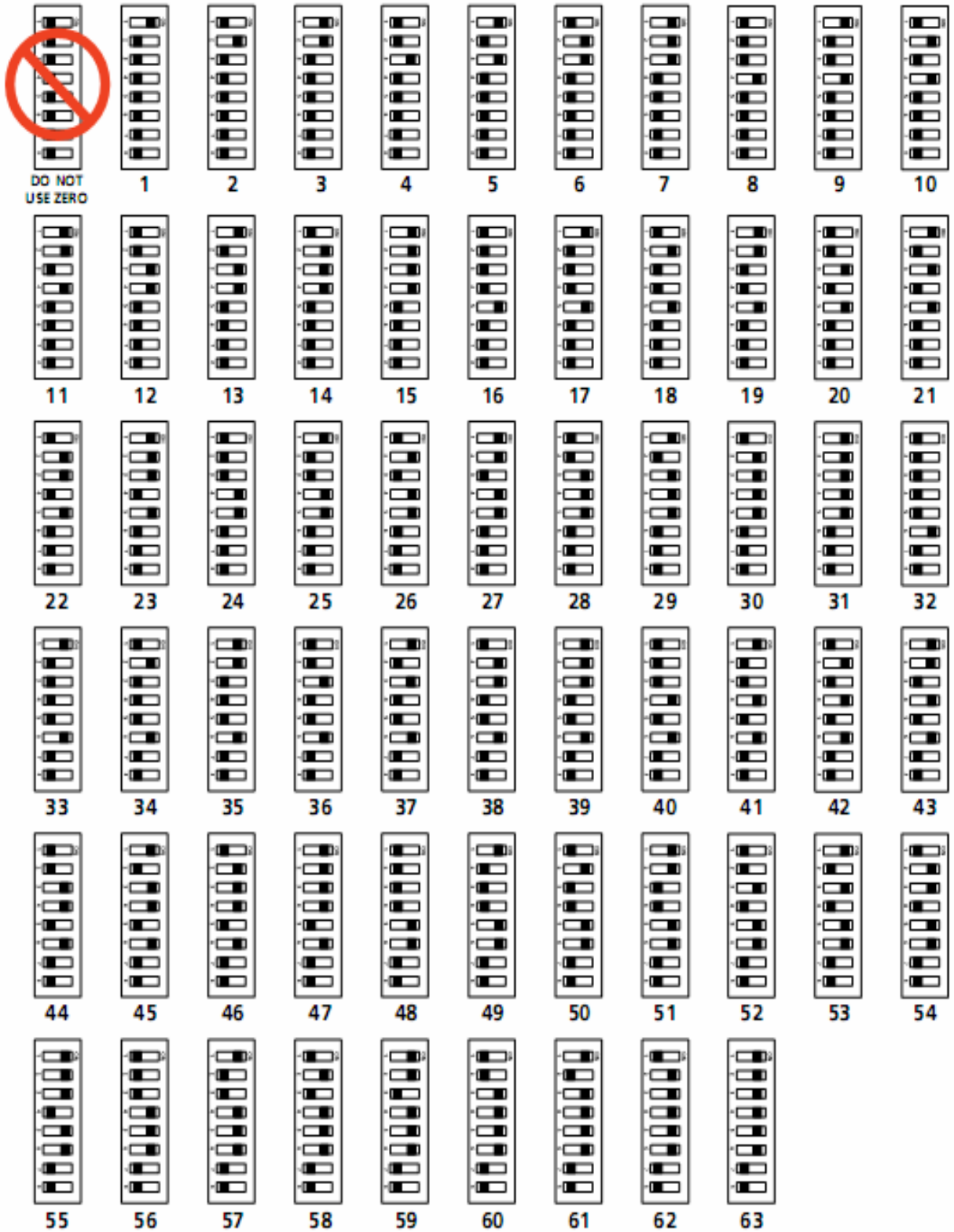
To determine an address you simply add the values of any switch that is on.

For example:



Switch number 4 has an ON Value of 8 and switch number 6 has an ON Value of 32. (8+32 = 40)

ADDRESS SELECTION EXAMPLES



- 4) The following are the default factory settings for the Modhoppers:
- Modbus Address Dip Switch 1,3,6, and 7 ON
 - Modbus Address Dip Switch 2,4,5, and 8 OFF
 - Modbus Channel 1,2, and 3 OFF -Channel 0 (If integrating with an existing Modhopper subsystem ensure that both devices are on the same channel to ensure communication).
 - All other dipswitches should be left in the off position

The A8332-8F2D module only has 7 dipswitches which allow up to 128 possible Modbus addresses.

Wiring Instructions

The devices within (Modhopper, I/O and Power Supplies) come pre wired and configured. The installer will need to attach the sensors and power supply, and modify the Modbus addressing as described in the Installations section above.

Note: the series of water tight gaskets on the bottom of the enclosure, these are the slots for the leads for connecting the individual sensors and power supply respectively. The A8332-8F2D I/O modules can each handle up to 8 flexible outputs (Analog, Resistive, Status or Pulse). The number of modules needed is dependent on the particular sensors being used. The following is the factory recommended connections for each sensor (if not incorporating all of the sensors, are using a different sensor than one provided with the Weather Station, or your weather station only consists of one IO module, consult factory for wiring instructions).

I/O-51

IN1- Wind Speed

IN2- Wind Direction

IN3- Temperature (Orange)

IN4- Humidity (Blue)

IN5- Pyranometer

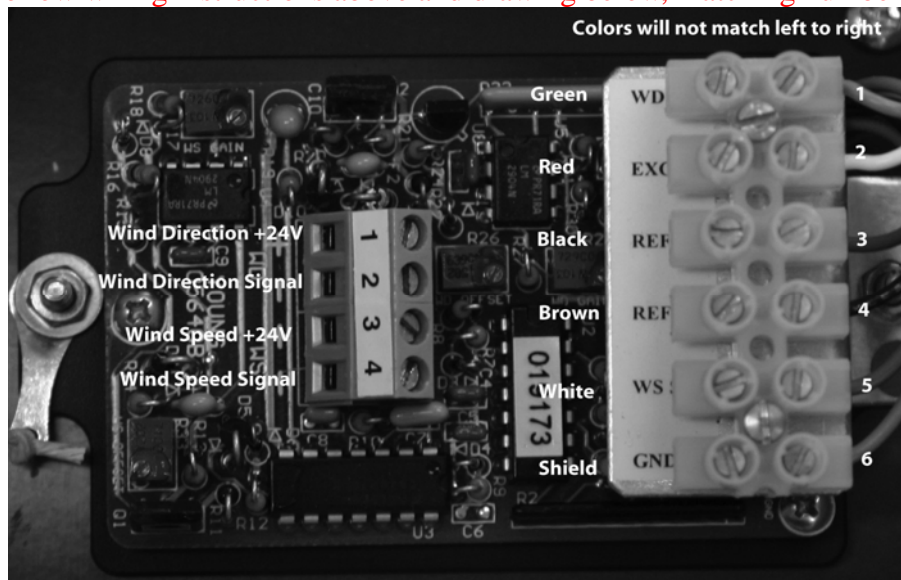
Follow the wiring diagram and instructions below to ensure proper communication:

Wind Speed & Direction-

The Wind Speed & Direction Sensor is also polarity sensitive. Using the wiring instructions provided, run the wire through the weather proof gasket of the large Nema enclosure and locate the anemometer converter labeled Novalynx (see below picture). Run the wire through the gaskets of the converter and connect the wires to the terminal labeled 1-6 as seen below, if further instructions are needed see the manufacturers manual included with the device. Tighten the gasket to ensure weather proofing and move on to the next sensor.

- 1) (WD SIG) – Green
- 2) (EXC) – Red
- 3) (WD REF) – Black
- 4) (WS REF) – Brown
- 5) (WS SIG) – White
- 6) (GND) - Shield

Always follow wiring instructions above and drawing below, matching numbers to colors



Temperature/ Temperature & Humidity-

Both the Temperature and Humidity analog sensors in both devices (whether just the temperature, or encompassed in one) are not polarity sensitive. What this means is that either of the lead wires can be attached to the +24V power supply or the Analog input interchangeably. So for the temperature and humidity sensor which has two blue (humidity) and two orange (temperature) wires coming from the device, either one of the blue wires and either one of the orange wires can be attached to any of the inputs (typically IN3 or IN4 respectively), and the remaining blue and orange wires to any available +24V terminal. The temperature & humidity sensor is powered off two dependent current loops. Therefore, both wires for the temperature and both wires for the humidity must be connected to the IO module to get an accurate signal.



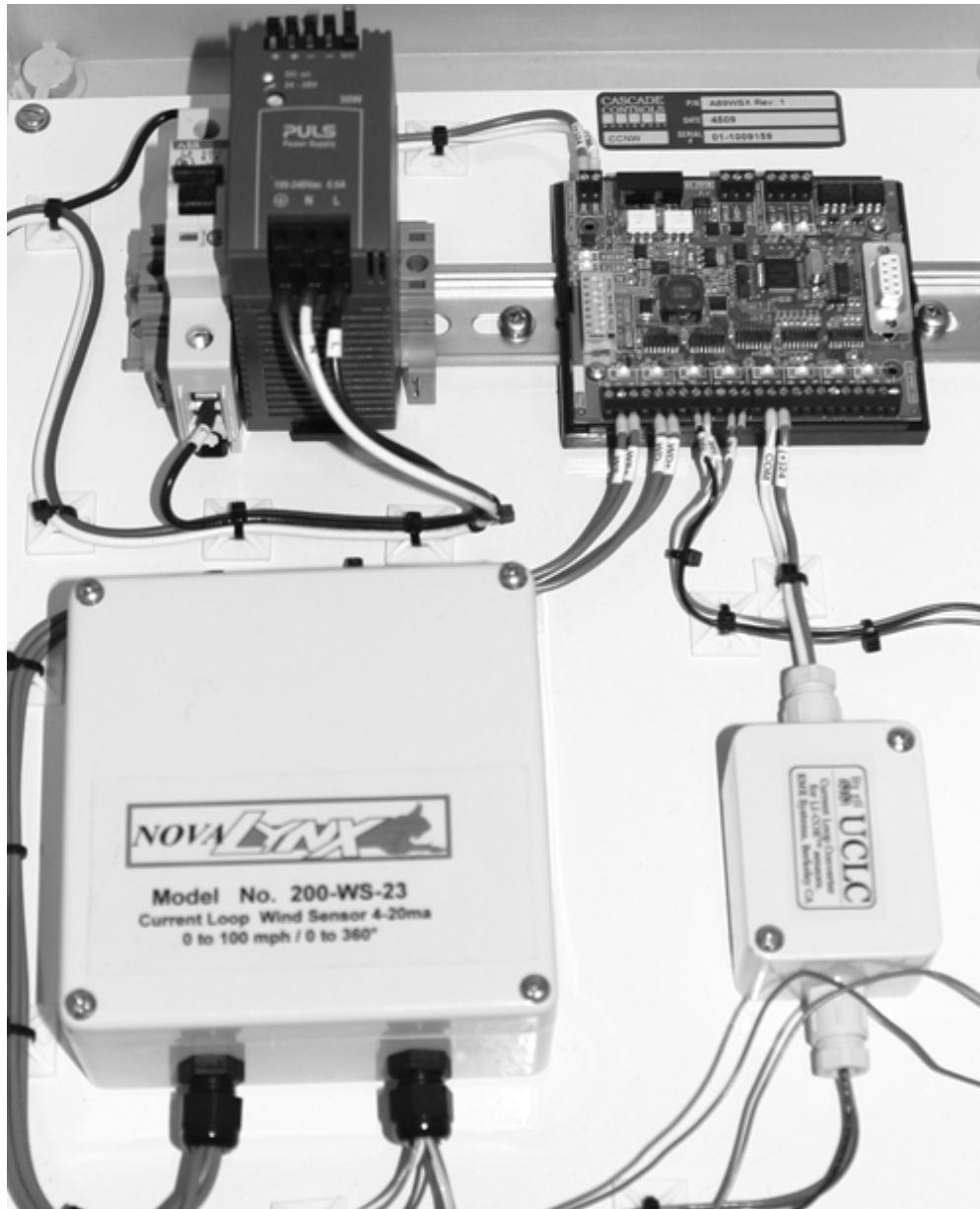
Weather
Proof
Screw
Cap



Weather
Proof
Gasket

Pyranometer- Solar Irradiance-

The Pyranometer is polarity sensitive. Improper connection of this device may destroy the sensor. The Pyranometer uses an Amplifier to convert the standard millivolt signal to a 4-20 mA. Locate the device labeled UCLC inside of the large Nema enclosure. Unscrew the amplifier lid and make note of the two sets of paired colored screw terminals (Black & White and Red & Black). Locate the leads coming from the Pyranometer (center conductor and shield) and insert them through the gasket on the left of the device correlating with the black & white screw terminals. Attach the center conductor lead (clear coat) to the white screw terminal and the shield (bare) lead to the black screw terminal.



Internal Wiring

No power cable is provided for providing power to the weather station. To power the device, the user needs to either supply the device with a 110-120VAC, in which case we would install the power supply as shown above; otherwise the user would need to provide 24VDC to a terminal strip where the power can be branched off to power the respective devices. (Notify you sales person which method you prefer)

The Weather Station communicates internally with an RS485 Modbus RTU loop, that daisy chains the two I/O modules together with the Modhopper. If additional RS485 modbus devices are required, continue the 485 loop by connecting the additional devices at the RS485 terminals of the Modhopper. Take care to prevent disconnecting the 485 wires when attaching you additional cabling.

Alignment

The Wind Speed & Direction and Pyranometer both require slight aligning to ensure proper readings.

Wind Speed & Direction Alignment-

Align the front of the wind vain (the propellers) facing direct north. Rotate the base of the sensor, keeping the vain aligned northerly, until the values are reading close to north which is approximately 360 degrees/0 degrees (A 5 degree variance will suffice for most applications... i.e. 355-360 degrees or 0-5 degrees). As a reference point, for alignment purposes there is a sticker on the sensor labeled North, ensure this is faced in a northerly direction.

Pyranometer Alignment-

Once removed from packaging, note the built in leveling system attached to the device. This allows you to ensure the device is level to ensure proper sun exposure. After mounted to the arm support, use the adjustment screws to level the device. A Pyranometer is level when the bubble is in the center, or as close as possible, of the leveling gauge.

Configuration and Scaling

When using the Acquisuite as a master Modbus device, the following configurations can be entered by accessing the Acquisuite directly then proceeding to select the device, in this case the I/O module in question. Click on the 'configure' button at the bottom of the page, once the page refreshes select the option 'Config Point', this will allow you to enter the following values for each device.

Wind Direction

Min Range 0

Max Range 360

Make and Model as Custom

Preconfigured Units as Custom

Engineering units Degrees

(for your use only, not to be entered on the Acquisuite)

Azimuth: 360° mechanical, 355° electrical (5° open)

360°/0°=North 90°=East 180°=South 270°=West

Wind Speed

Min Range 0

Max Range 100

Make and Model as Custom

Preconfigured Units as Custom

Engineering units MPH

(for your use only, not to be entered on the Acquisuite)

Gusts up to 220 MPH

Temperature

Min Range -40

Max Range 122

Preconfigured Units as Custom

Engineering units Degrees F

Humidity

Min Range 0

Max Range 100

Make and Model as HW Humidity

Preconfigured Units as Custom

Engineering Units %RH

Pyranometer

Min Range 0

Max Range 1562.5

Make and Model as Custom

Preconfigured Units as Custom

Engineering Units Watts

(for your use only, not to be entered on the Acquisuite)

Operating Temperature -40°F to 131°F

BAPI Cell Temperature

Min Range -52

Max Range 152

Make and Model as Custom

Preconfigured Units as Custom

Engineering Units Degrees F

Powering the station

As previously discussed there is no power cord included for providing external power to the devices. Therefore the user has two options for powering the device. The first option is to install a power transformer as seen in the pictures above, in which case all the user will be required to do is provide 110-120VAC using a power cable rated for outdoor conditions to the transformer directly. The second option is to utilize a terminal strip, in which case the user would need to provide 24VDC to the strip, supplying the necessary voltage to the respective devices.

Modbus Register Listing – A8332-8F2D

Data points:

Offset	point	type	desc	modes-->	Pulse	Status	Ohms,	mA,	volts
0	40001	UINT32	input 1	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
1	40002	UINT32	input 1	value LSW					
2	40003	UINT32	input 2	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
3	40004	UINT32	input 2	value LSW					
4	40005	UINT32	input 3	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
5	40006	UINT32	input 3	value LSW					
6	40007	UINT32	input 4	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
7	40008	UINT32	input 4	value LSW					
8	40009	UINT32	input 5	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
9	40010	UINT32	input 5	value LSW					
10	40011	UINT32	input 6	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
11	40012	UINT32	input 6	value LSW					
12	40013	UINT32	input 7	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
13	40014	UINT32	input 7	value LSW					
14	40015	UINT32	input 8	value MSW	(count/NV,	count/NV,	inst,	inst,	inst)
15	40016	UINT32	input 8	value LSW					

modes-->					Pulse	Status	Ohms,	mA,	volts
16	40017	UINT32	input 1	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
17	40018	UINT32	input 1	ave LSW					
18	40019	UINT32	input 2	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
19	40020	UINT32	input 2	ave LSW					
20	40021	UINT32	input 3	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
21	40022	UINT32	input 3	ave LSW					
22	40023	UINT32	input 4	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
23	40024	UINT32	input 4	ave LSW					
24	40025	UINT32	input 5	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
25	40026	UINT32	input 5	ave LSW					
26	40027	UINT32	input 6	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
27	40028	UINT32	input 6	ave LSW					
28	40029	UINT32	input 7	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
29	40030	UINT32	input 7	ave LSW					
30	40031	UINT32	input 8	ave MSW	(rate-inst,	on-time/NV,	ave,	ave,	ave)
31	40032	UINT32	input 8	ave LSW					

modes-->					Pulse	Status	Ohms,	mA,	volts
32	40033	UINT32	input 1	min MSW	(rate-min,	dutycycle,	min,	min,	min)
33	40034	UINT32	input 1	min LSW					
34	40035	UINT32	input 2	min MSW	(rate-min,	dutycycle,	min,	min,	min)
35	40036	UINT32	input 2	min LSW					
36	40037	UINT32	input 3	min MSW	(rate-min,	dutycycle,	min,	min,	min)
37	40038	UINT32	input 3	min LSW					
38	40039	UINT32	input 4	min MSW	(rate-min,	dutycycle,	min,	min,	min)
39	40040	UINT32	input 4	min LSW					
40	40041	UINT32	input 5	min MSW	(rate-min,	dutycycle,	min,	min,	min)
41	40042	UINT32	input 5	min LSW					
42	40043	UINT32	input 6	min MSW	(rate-min,	dutycycle,	min,	min,	min)
43	40044	UINT32	input 6	min LSW					
44	40045	UINT32	input 7	min MSW	(rate-min,	dutycycle,	min,	min,	min)

45	40046	UINT32	input 7	min LSW					
46	40047	UINT32	input 8	min MSW	(rate-min,	dutycycle,	min,	min,	min)
47	40048	UINT32	input 8	min LSW					

modes-->

					Pulse	Status	Ohms,	mA,	volts
48	40049	UINT32	input 1	max MSW	(rate-max,	status	max,	max,	max)
49	40050	UINT32	input 1	max LSW					
50	40051	UINT32	input 2	max MSW	(rate-max,	status	max,	max,	max)
51	40052	UINT32	input 2	max LSW					
52	40053	UINT32	input 3	max MSW	(rate-max,	status	max,	max,	max)
53	40054	UINT32	input 3	max LSW					
54	40055	UINT32	input 4	max MSW	(rate-max,	status	max,	max,	max)
55	40056	UINT32	input 4	max LSW					
56	40057	UINT32	input 5	max MSW	(rate-max,	status	max,	max,	max)
57	40058	UINT32	input 5	max LSW					
58	40059	UINT32	input 6	max MSW	(rate-max,	status	max,	max,	max)
59	40060	UINT32	input 6	max LSW					
60	40061	UINT32	input 7	max MSW	(rate-max,	status	max,	max,	max)
61	40062	UINT32	input 7	max LSW					
62	40063	UINT32	input 8	max MSW	(rate-max,	status	max,	max,	max)
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)

72	40073	UINT16	input	status	bitmap. (pulse/status modes only)
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73	40074	UINT16	input	broken wire alarm	bitmap. (resistance, current modes only)
				Restive 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
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--- system settings and information ---

999	41000	UINT16	contact closure threshold (NV/r/w) in ohms, default 1000 = 1kohm. (minimum value 100 ohms, maximum value 5000 ohms)
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1000	41001	UINT16	contact open wire threshold (NV/r/w) in ohms, default/unused = 0xFFFF, limit 100 to 10,000 ohms.
------	-------	--------	--

1001	41002	UINT16	number of pulses for inst rate (NV/r/w) default 5. limit 2 to 20.
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1002	41003	UINT16	serial number bytes 1,2
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1003	41004	UINT16	serial number bytes 3,4
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1004	41005	UINT16	serial number bytes 5,6
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1005	41006	UINT16	firmware version (major)
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1006	41007	UINT16	firmware version (minor)
1007	41008	UINT32	Reserved
1008	41009	UINT32	Reserved
1009	41010	INT16	Reserved
1010	41011	INT16	Reserved
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.
1021	41022	UINT8	reserved
1022	41023	UINT8	reserved
1023	41024	UINT8	reserved
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.
1029	41030	UINT16	relay output 1 mode. (R/W, NV) 0>manual, 1=follow pulse input #1. Note: input must be in pulse or status mode.
1030	41031	UINT16	relay output 2 mode. (R/W, NV) 0>manual, 1=follow pulse input #2. Note: input must be in pulse or status mode.

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

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

Register Functions

Pulse Count: The pulse count is stored as an unsigned 32bit integer. This allows for 2³² pulses (4.2billion) to be counted before rollover. On Modbus systems that do not allow you to read 32bit values, you can calculate the pulse count as follows:

$$\text{count} = (\text{MSW} * 65536) + \text{LSW}$$

or

$$\text{count} = (\text{MSW} \ll 16) | \text{LSW} \text{ [bit shift high order word by 16 bits and xor against low order word]}$$

Pulse count registers accumulate a total number of pulses received on each pulse input. The pulse count totals always increment and can not be cleared or set to an arbitrary

value to prevent tampering. All pulse count totals are stored in non-volatile memory to preserve counts during power failure. The unsigned 32 bit counter values can accumulate up to 4.29 billion (2^{32}) pulses before rollover.

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 pulse count to increment in the middle of the two Modbus queries, and will cause intermittent data readings that are incorrect.

For example, a pulse input has a count 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 between the two readings, the pulse input counts 2 more pulses, 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