Weather Station Calibration Training 2023

Western Weather Group

Overview - Basic Calibration Steps

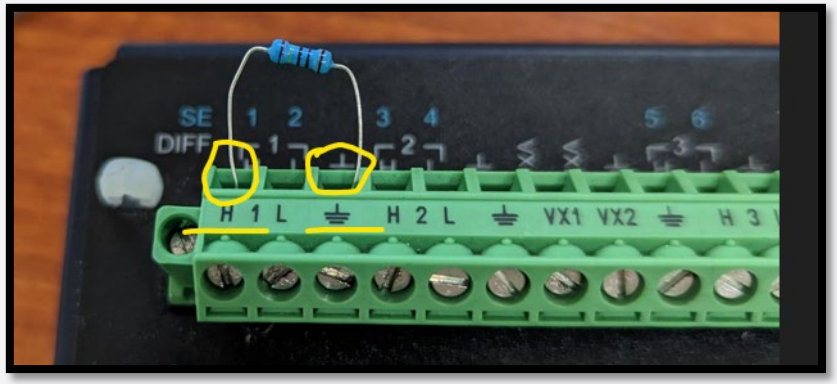
1. **Verify you are at the correct station location**. Some names are very similar.
2. **Check station** for damage, note anything that looks wrong.
3. Connect to the station via USB using Laptop/Device Configuration. **Update OS, Program, add Default program**. Make sure all files have loaded properly.
4. **Perform new wiring additions and changes** (Resistor added and Temp/RH power wire moved)
5. **Set Cal timer, perform station calibration steps** and record all data on calibration sheet or internal form.
6. **Re-install all sensors, replace or adjust any faulty components**, make sure data looks correct, clean anything that looks dirty(solar panel, etc.)
7. **Turn off Cal-timer, call WWG office** to confirm that station is back online and functioning properly. Note any issues or replaced parts. Resolve any internal calibration form

Overview – Updated or New Steps - Programming

1. **New** Datalogger Operating System Version: **6.01** (Previously 5.01, 5.02, or 6.0)
   - **Note:** OS 6.02 has been released, but WWG is still testing it. Use OS 6.01 for 2023.
2. Current Datalogger Program Versions:
   - **SDGE_Ver_2_0.CR1X** – normal station datalogger program
   - SDGE_Ver_2.0_Fuel Sensors.CR1X – stations with Fuel Temp/Moisture Sensors
   - SDGE_Ver_2_0_CCFC.CR1X – stations with CCFC NDVI Cameras
   - SDGE_Ver_2_1_CCFC_FuelMT_newBatt.CR1X – stations with CCFC Cameras & Fuel Sensors
   - SDGE_Ver_2_0_CCFC_26AHBat.CR1X – stations with CCFC Cameras and old SLA Battery
   - SDGE_Ver_2_0_RF.CR1X – stations with radio repeater base and remote sites
3. **New** Datalogger Default Program: **Default.CR1X** (to be reuploaded to all stations through file control)

Overview – Updated or New Steps - Wiring

- **Add a 1-ohm resistor to datalogger wiring** between Wind Direction reference wire and Wind Direction ground wire



- **Move the Temp/RH Probe Power wire** from datalogger 12volts to SW2 (Switched 12v – 2)

Overview – Calling WWG

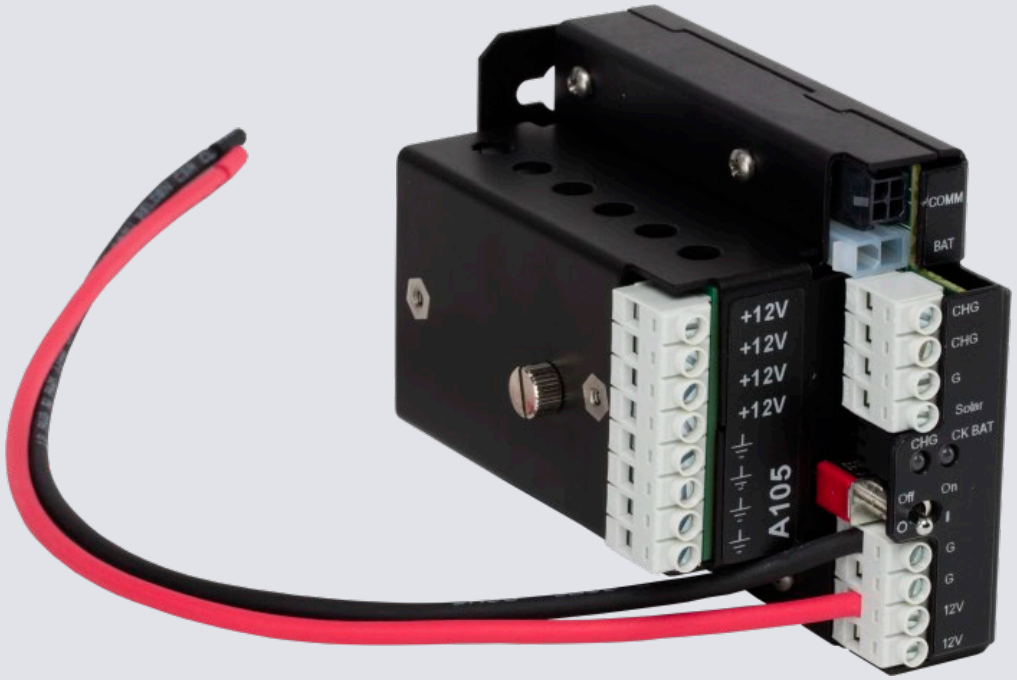
1. **Call WWG Technical Support (530) 342-1700** after the datalogger updates, new wiring changes, and calibration have been completed, but while you are still in the air to review station LEDs or potential troubleshooting.
2. Be ready to **answer the following questions:**
    1. Station ID, Station Name, SCADA ID
    2. Inform if this is a Verizon or AT&T cellular station
    3. Calibration Results (all passed, or any test failed) If failed, was the sensor replaced?
    4. New Wiring Changes Performed (resistor added and Temp/RH power wire moved)
    5. New OS / Program / Default program uploaded?
    6. PakBus and Station Name re-entered into Datalogger Deployment Screen?
    7. Verify Wind Speed/Direction & Temp/RH in real time with WWG

Weather Station Components

- Enclosure(CR1000X Datalogger, CH200 charger, RV50/RV50X Cell Modem, Battery (SLA or Lithium))
- Sensors (EE181 Temperature/RH probe, RM Young Wind Monitor, CS506 Fuel Moisture, and CS205 Fuel Temperature
- Solar Panel

Weather Station Components – CR1000X Datalogger

- The brains of the weather station
- All sensors are wired into it, data is recorded and stored to memory on the datalogger
- Adjustable programs created by WWG to tell the device how to read the sensors, when/how often to record data.
- Requires power from the CH200
- Cell modem is connected to send data over the air at specified intervals.

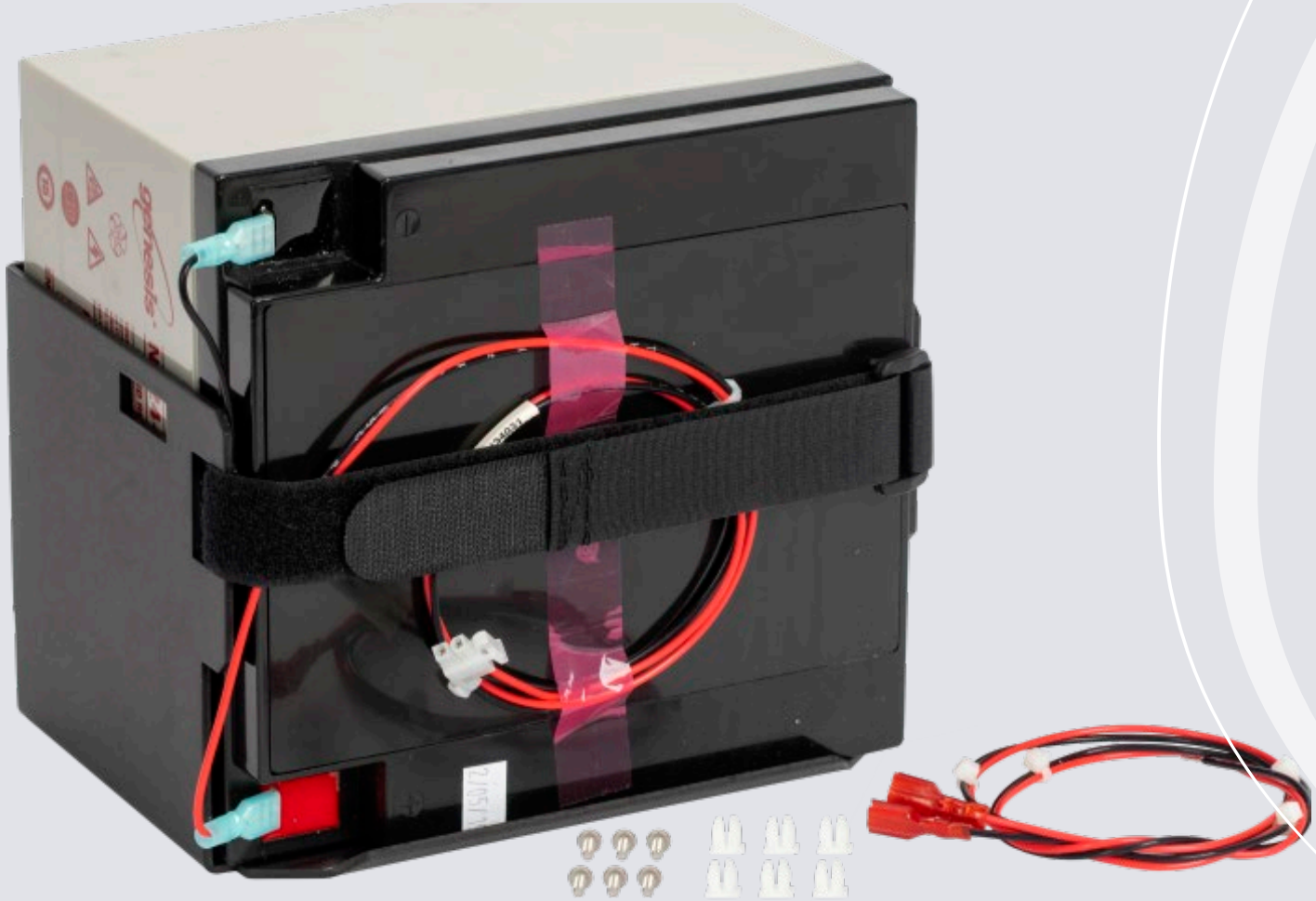


Weather Station Components – CH200 Charging Regulator

- Regulates power from the solar panel and battery to ensure the weather station receives constant power.
- Some data is also sent to the logger to keep track of battery health.
- Needs to be set to the characteristics of the battery connected to it, will need to be changed if switching from SLA to a Lithium battery.

Weather Station Components – RV50/RV50X Cellular Modem

- Requires constant power and connection to the datalogger.
- Sends all stored data from the datalogger to the web via cellular connection to be recorded on the WWG database.
- Sends data at specified intervals (10 minutes, 1 hour, daily)
- SDGE uses both VZW and ATT configured modems. Different modem templates need to be used depending on the network used



Weather Station Components – SLA (Sealed Lead Acid) Battery

- Connects to the CH200 Charger
- Ensures the weather station continues to be powered when solar resources are low/unavailable.
- Will be recharged when solar resources exceed the amount needed to power the station.

Weather Station Components – Lithium Battery

- Like SLA battery it connects directly to the CH200 but requires a different cable.
- Different characteristics than SLA, requires different charging methods.
- Necessary to connect to CH200 to update CH200 OS, battery capacity, adjust the “Battery Family” if newly installing a Lithium battery.
- Are shipped at 50% of total charge, will need to be charged before installing or risk the station losing power overnight.

Weather Station Components – EE181 Temp/RH Probe

- Probe that measures ambient air temperature and relative humidity.
- Wired into the datalogger where electronic signals are sent and then converted to be stored as temperature and humidity values.
- Sensor is inserted into a white radiation shield to minimize the effects of direct sunlight and other atmospheric conditions.
- Moving the red power wire from datalogger 12v to SW2 port this year

Weather Station Components – Wind Monitor

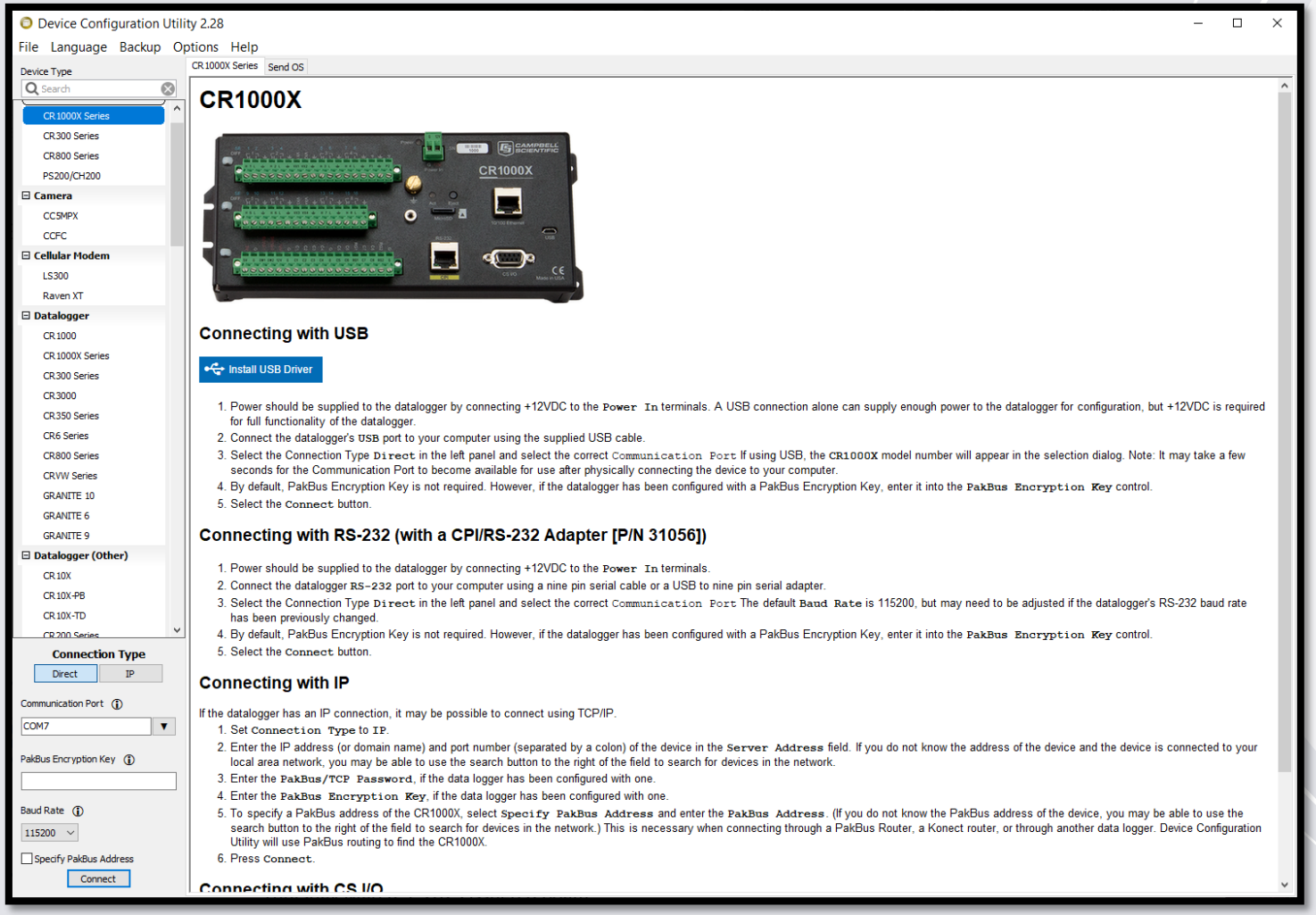
- Sensor that measures instantaneous wind speed and direction.
- Wired into the datalogger where electronic readings are converted into wind speed (usually mph) and azimuthal direction (0-360°).
- Requires a reference of true south, which the wire junction box needs to face.
- Installing a resistor in parallel to the datalogger wind direction and ground wires this year

Weather Station Components – CS506 Fuel Moisture & CS205 Fuel Temp

- Sensors that measure fuel temperature and fuel moisture.
- Wired into the datalogger to send electronic signals converted into values of temperature and percent moisture content by weight.
- Sensors are mounted parallel to the ground on a stake roughly 12 inches above the surface in ambient vegetation.
- Wooden sticks are meant to mimic small-diameter fire fuels. Yearly replacement of sticks is recommended.

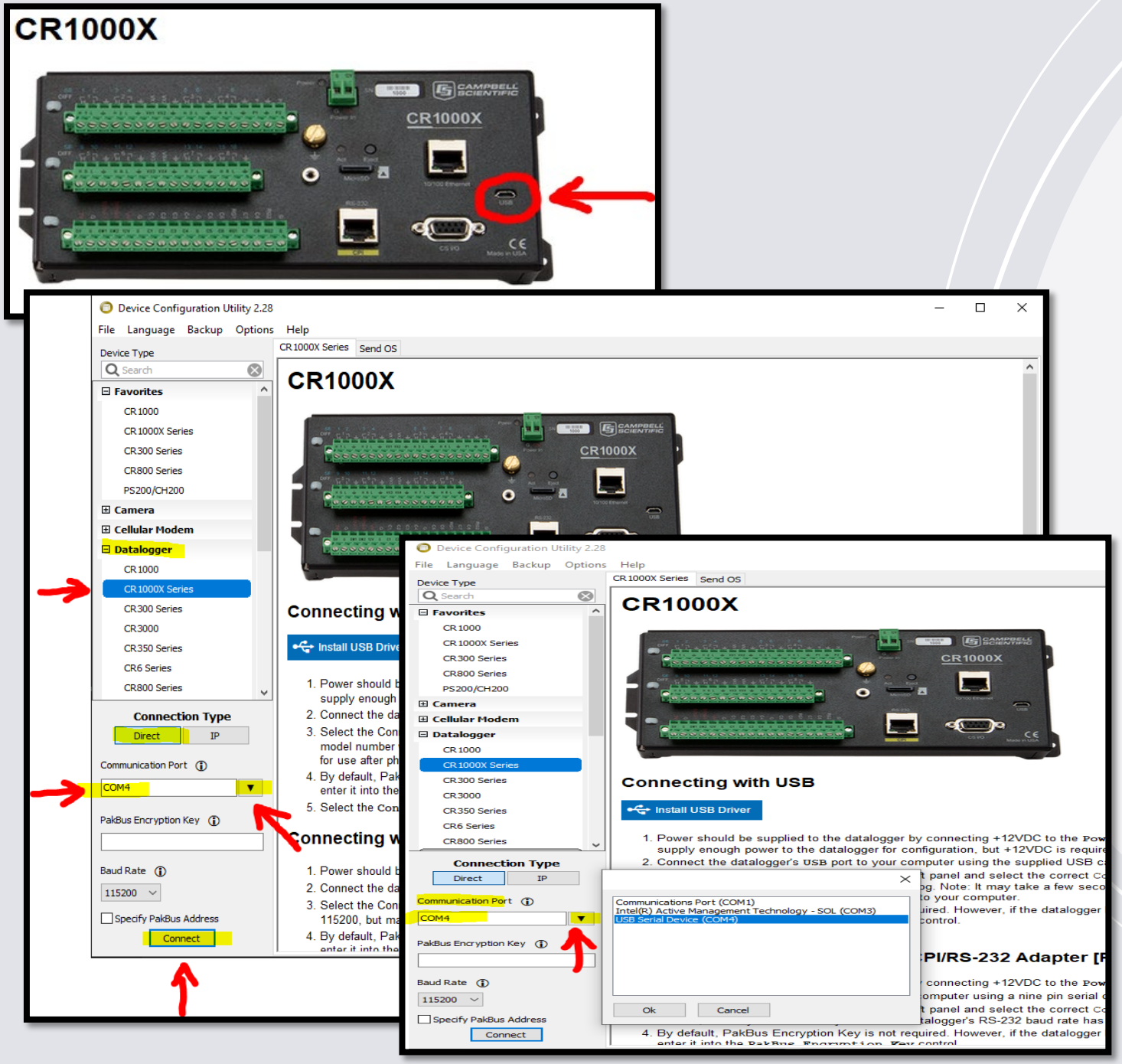
Connecting to a Datalogger to Update Files

- Device Configuration Utility Software
- **Datalogger OS** file through Send OS Tab
- Updating **Station Name & PakBus Address** through Deployment Tab
- **Syncing Datalogger Clock** through Logger Control Tab
- **Datalogger Main Program** file through Logger Control Tab
- **Datalogger Default Program** file through File Control Tab



Device Configuration Utility (DevConfig)

- Interface used to connect to a weather station's datalogger.
- Direct wired USB connection important for sending large files/OS. Micro-USB slot on Datalogger will connect to a USB port on a laptop.
- Current Version used is 2.28

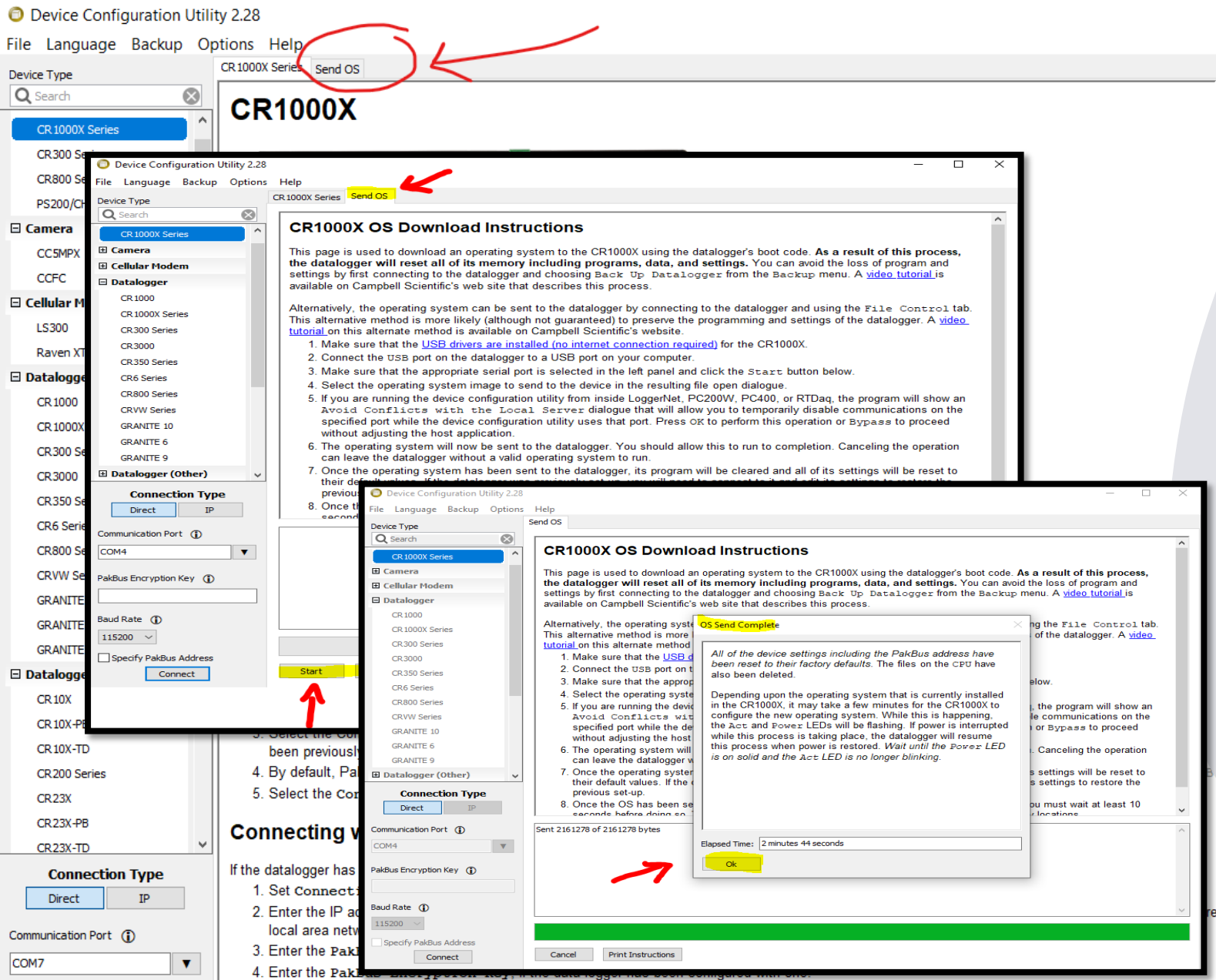


Connecting through DevConfig

- Plug in to the datalogger via the USB port using a Micro-USB Cable
- Confirm the datalogger selection, connection type, communication port, baud rate, etc.
- Test connection through Connect/Disconnect button

Updating Datalogger OS

- The Datalogger's Operating System(OS) should be uploaded using the 'Send OS' tab from the initial DevConfig screen and clicking "Start"
- Send **CR1000X.std.06.01.OBJ**
  - **Ignore any prompt for OS 6.02**
- Wait 2-4 Minutes for completion. Connection through "Connect" button on CR1000X Series tab should be successful when complete
- This OS update will wipe the programs and settings from memory, and these will need to be re-added afterwards.

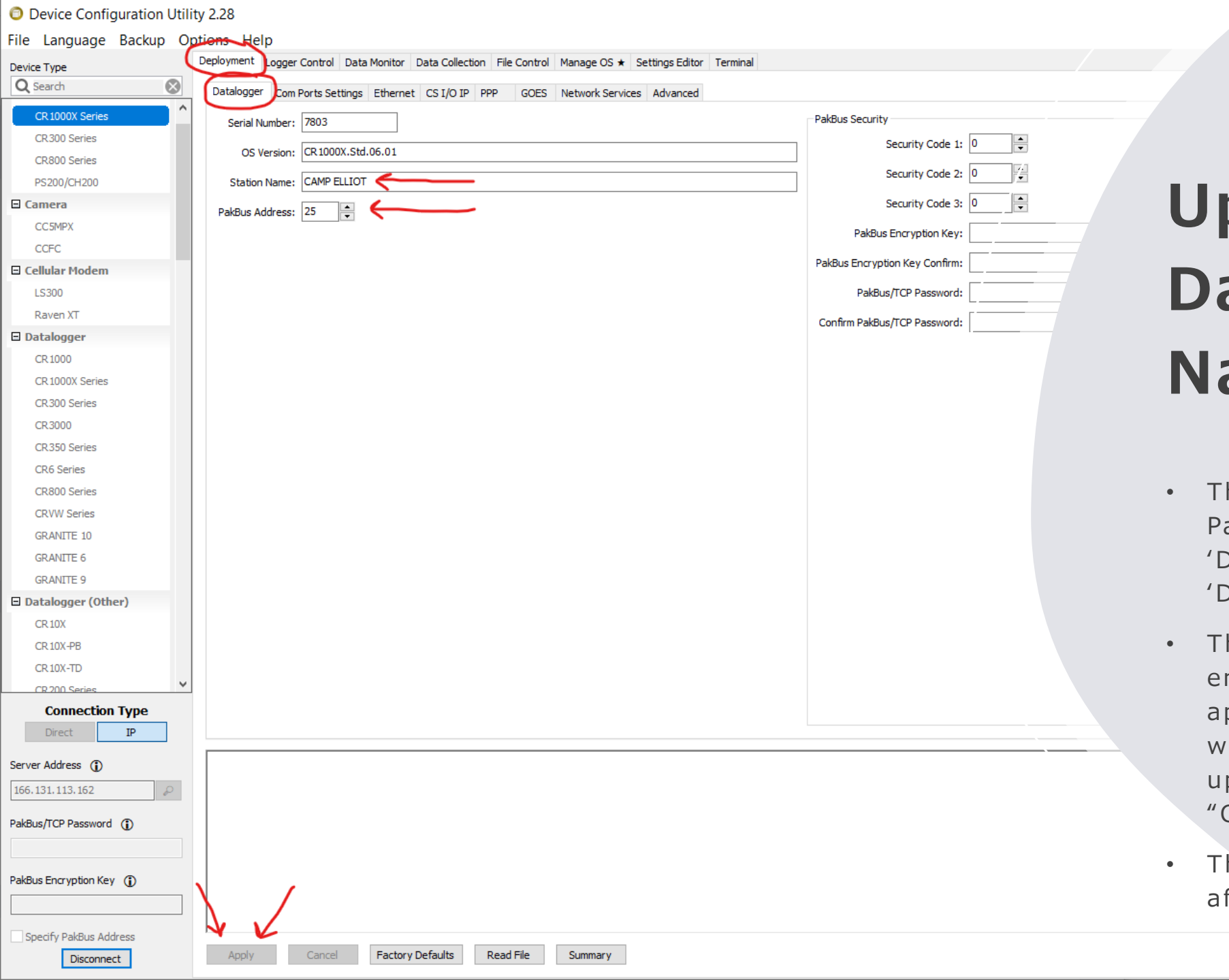


Connecting w

If the datalogger has

1. Set Connecti
2. Enter the IP ad
local area netw
3. Enter the Pak
4. Enter the PakBus Encryption Key
5. To specify a PakBus address of the CR1000X, select Specify PakBus Address and enter the PakBus Address. (If you do not know the PakBus address of the device, you may be
button to the right of the field to search for devices in the network.) This is necessary when connecting through a PakBus Router, a Konect router, or through another data logger. Device Config
use PakBus routing to find the CR1000X.
6. Press Connect.

Connecting with CS I/O



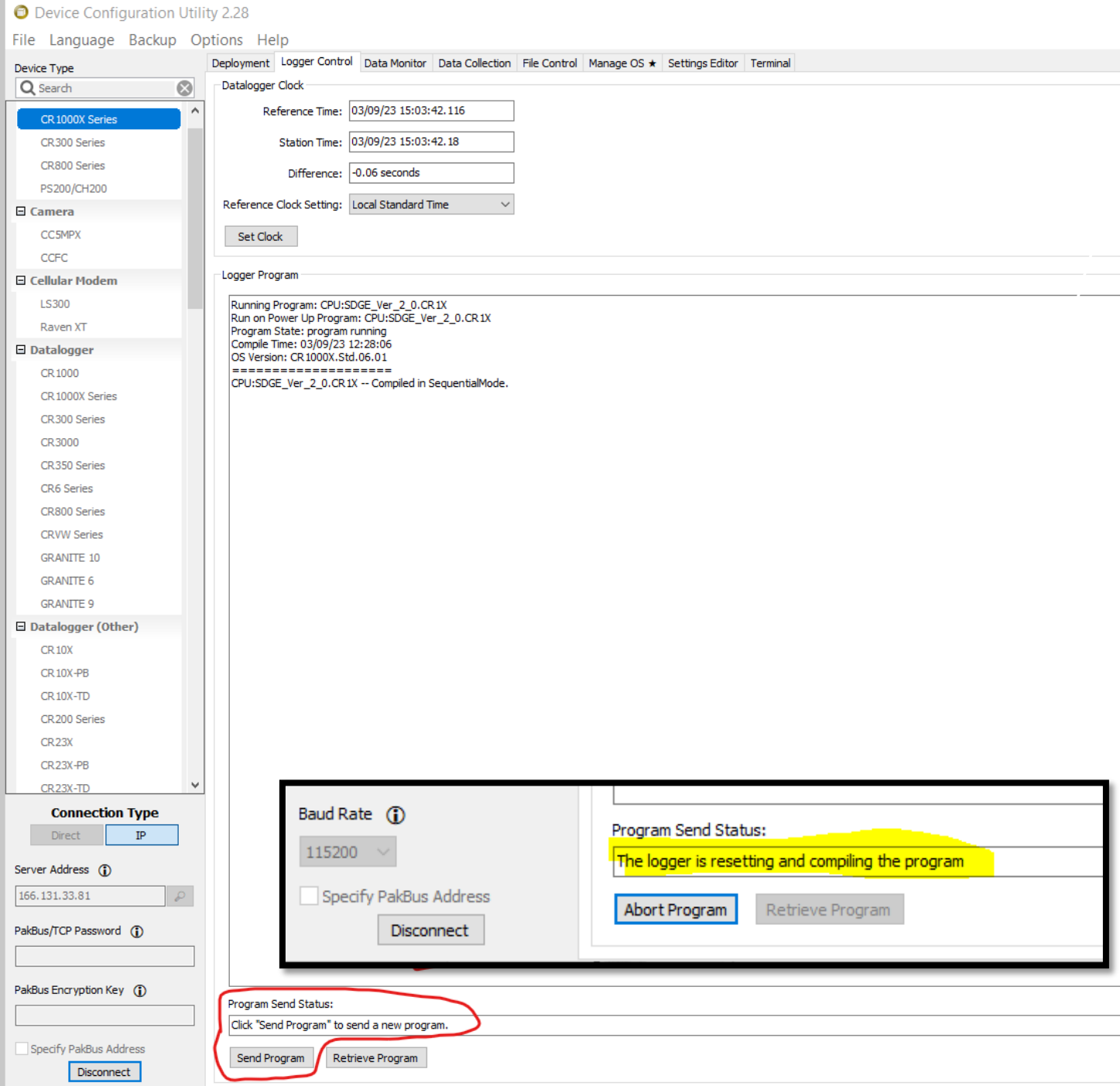
Updating Datalogger Name/PakBus

- The Datalogger Name and PakBus are saved under the ‘Deployment’ tab and ‘Datalogger’ sub-tab.
- These can be changed by entering the info, then clicking apply at the bottom of the window. Click through the pop-ups and re-connect with “Connect” button.
- These will need to be re-added after the OS update.

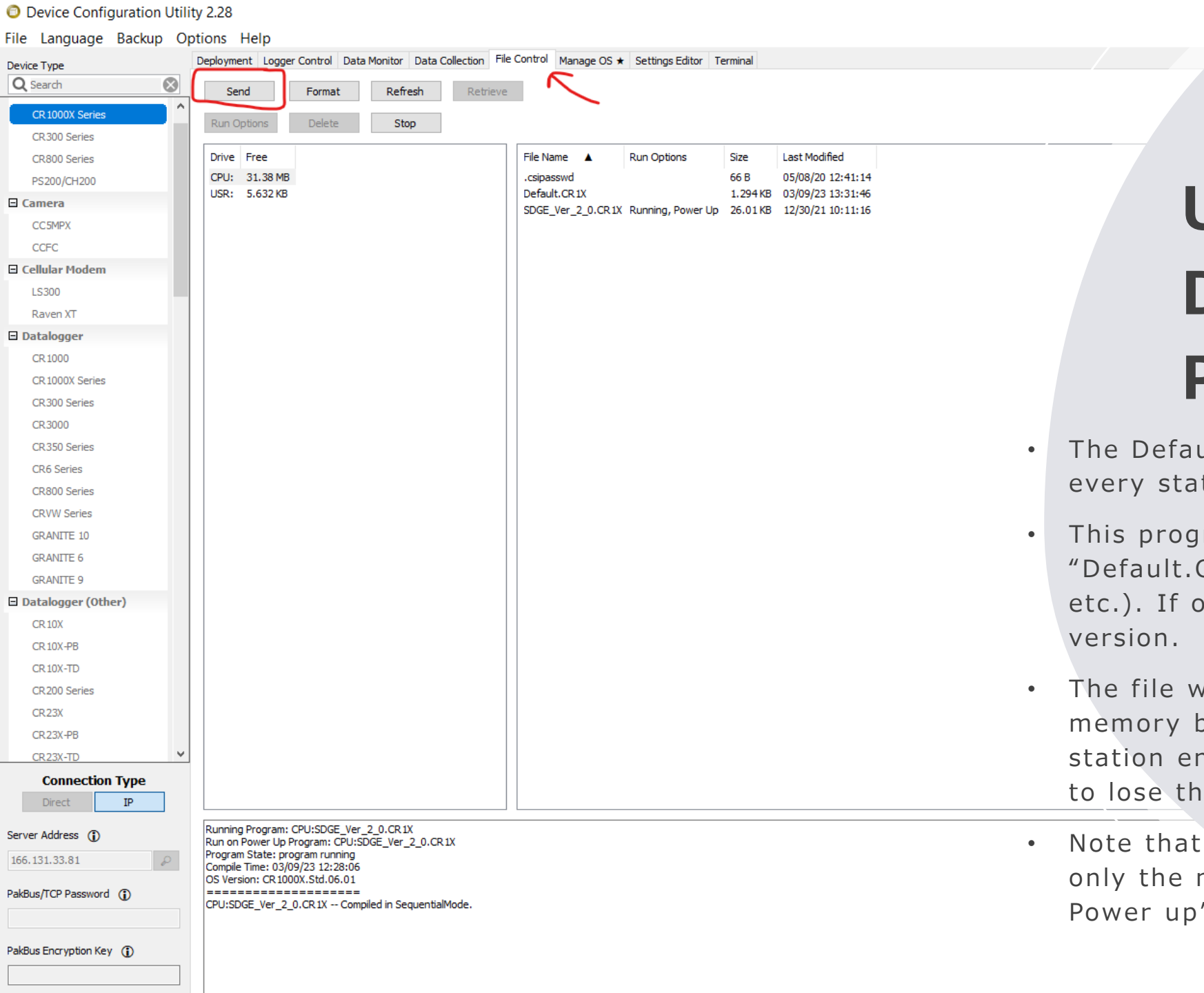
Check / Sync Datalogger Clock

- The Datalogger clock is shown in the ‘Logger Control’ tab on DevConfig.
- The clock should be synced to the current time for the location/time zone that the station is located in.
- “Local Standard Time” should always be selected from the dropdown menu.
- To set the clock to your computer’s reference time, click “Set Clock”. The difference should then change to a number close to 0, but minor fluctuations are OK.

Updating Datalogger Program



- The latest main program file can be sent to the Datalogger via the ‘Logger Control’ tab in Devconfig. This will set the sent program to run immediately and on power up.
- Double check sending correct program. Most use **SDGE_Ver_2_0.CR1X**.
- Click the ‘Send Program’ button and select the correct program file on your laptop. Wait for the upload to finish then click 'Ok’.
- Alternatively, the file can be sent through the ‘File Control’ tab but run options will then need to be adjusted.



Uploading Default Program

- The Default program should be added to every station through the ‘File Control’ tab
- This program must only be named “Default.CR1X” (not “Default(1).CR1X”, etc.). If one already exists, resend the new version.
- The file will remain in the datalogger memory but not be set to run unless the station encounters any errors that cause it to lose the main program.
- Note that under the ‘Run Options’ column, only the main program is set to “Running, Power up”

What was completed using DevConfig?

- **Datalogger OS** file through Send OS Tab
- Updating **Station Name & PakBus Address** through Deployment Tab
- **Syncing Datalogger Clock** through Logger Control Tab
- **Datalogger Main Program** file through Logger Control Tab
- **Datalogger Default Program** file through File Control Tab

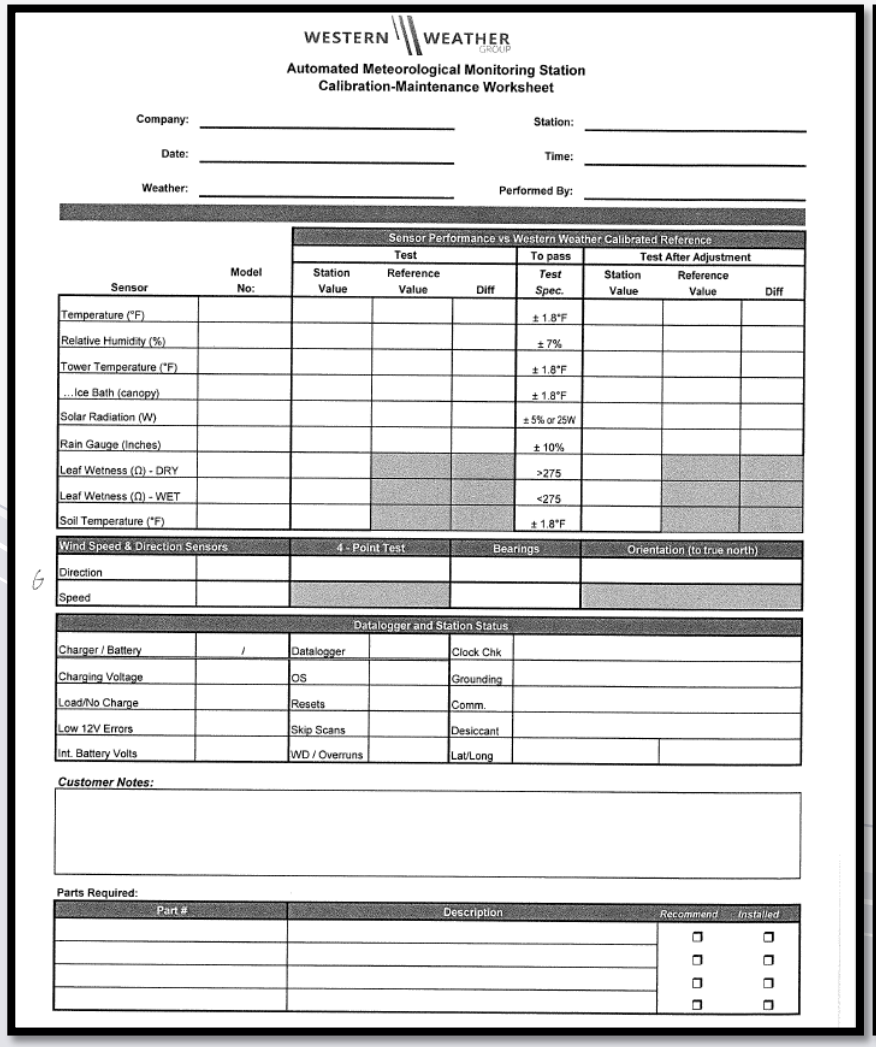
Temp/RH Calibration Case

- 8ah SLA battery and charger (1)
- Datalogger (2)
- Keypad (3)
- EE181 sensor (4)
- Power cable for the aspirated fan tube (5)
- AC Plug for charging the battery (6)

Wind Speed & Direction Case

- A RM Young motor and drive for wind speed testing (1)
- A directional test stand and arm (2)
- Keypad (3)
- A torque test disc (4)
- Aspiration fan tube for use with the temp/RH case (5).
- Additional items may include small Allen wrench for wind monitor adjustment, additional torque disc screws, additional cables, GPS

WWG Calibration Sheets (AG & Utility)



WESTERN WEATHER GROUP

Automated Meteorological Monitoring Station
Calibration-Maintenance Worksheet

Company: _____ Station: _____

Date: _____ Time: _____

Weather: _____ Performed By: _____

Sensor	Model No:	Test: Station Value	Test: Reference Value	Test: Diff	To pass: Test Spec.	Test After Adjustment: Station Value	Test After Adjustment: Reference Value	Test After Adjustment: Diff
Temperature (°F)					± 1.8°F			
Relative Humidity (%)					± 7%			
Tower Temperature (°F)					± 1.8°F			
...Ice Bath (canopy)					± 1.8°F			
Solar Radiation (W)					± 5% or 25W			
Rain Gauge (Inches)					± 10%			
Leaf Wetness (Ω) - DRY					>275			
Leaf Wetness (Ω) - WET					<275			
Soil Temperature (°F)					± 1.8°F			

Sensor Performance vs Western Weather Calibrated Reference

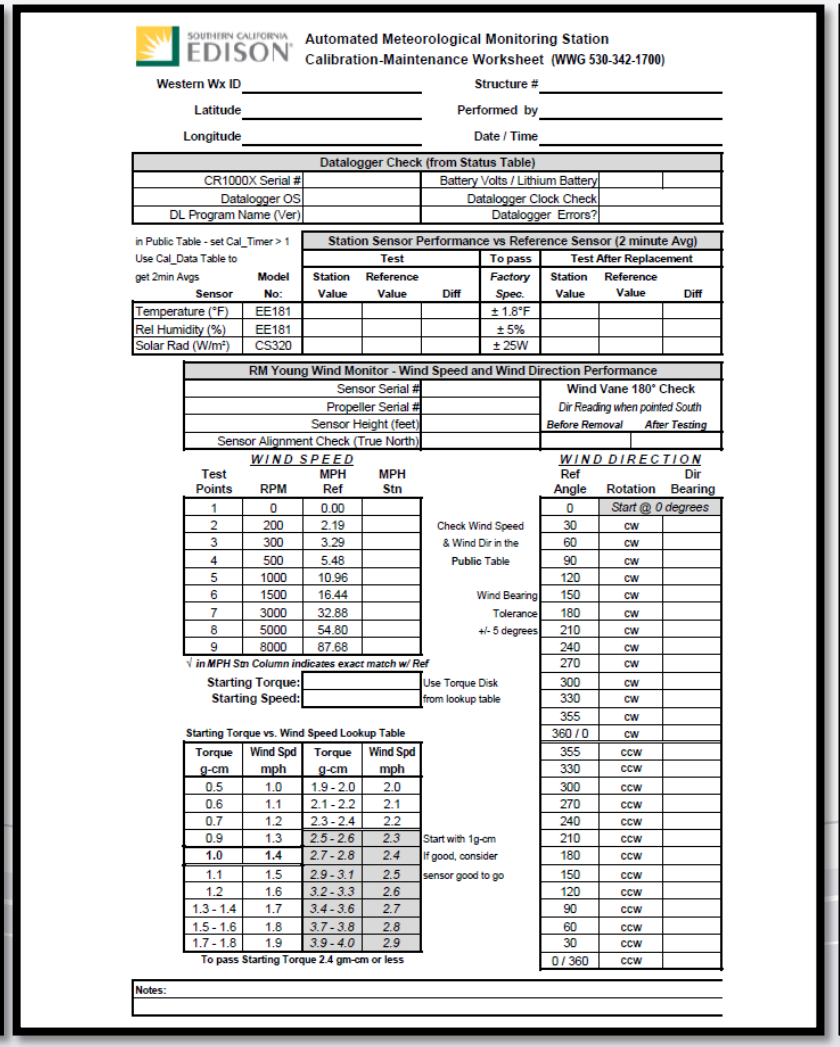
Wind Speed & Direction Sensors		4 - Point Test	Bearings	Orientation (to true north)
Direction				
Speed				

Datalogger and Station Status					
Charger / Battery	/	Datalogger		Clock Chk	
Charging Voltage		OS		Grounding	
Load/No Charge		Resets		Comm.	
Low 12V Errors		Skip Scans		Desiccant	
Int. Battery Volts		WD / Overruns		Lat/Long	

Customer Notes:

Parts Required:

Part #	Description	Recommend	Installed
		☐	☐
		☐	☐
		☐	☐
		☐	☐



SOUTHERN CALIFORNIA EDISON

Automated Meteorological Monitoring Station
Calibration-Maintenance Worksheet (WWG 530-342-1700)

Western Wx ID _____ Structure # _____

Latitude _____ Performed by _____

Longitude _____ Date / Time _____

Datalogger Check (from Status Table)			
CR1000X Serial #		Battery Volts / Lithium Battery	
Datalogger OS		Datalogger Clock Check	
DL Program Name (Ver)		Datalogger Errors?	

in Public Table - set Cal_Timer > 1
Use Cal_Data Table to get 2min Avgs

Station Sensor Performance vs Reference Sensor (2 minute Avg)								
		Test			To pass	Test After Replacement		
Sensor	Model No:	Station Value	Reference Value	Diff	Factory Spec.	Station Value	Reference Value	Diff
Temperature (°F)	EE181				± 1.8°F			
Rel Humidity (%)	EE181				± 5%			
Solar Rad (W/m²)	CS320				± 25W			

RM Young Wind Monitor - Wind Speed and Wind Direction Performance

Sensor Serial # _____ Wind Vane 180° Check
Propeller Serial # _____ *Dir Reading when pointed South*
Sensor Height (feet) _____ *Before Removal* / *After Testing*
Sensor Alignment Check (True North) _____

WIND SPEED

Test Points	RPM	MPH Ref	MPH Stn
1	0	0.00	
2	200	2.19	
3	300	3.29	
4	500	5.48	
5	1000	10.96	
6	1500	16.44	
7	3000	32.88	
8	5000	54.80	
9	8000	87.68	

Check Wind Speed & Wind Dir in the Public Table

√ *in MPH Stn Column indicates exact match w/ Ref*

Starting Torque: _____
Starting Speed: _____ Use Torque Disk from lookup table

Starting Torque vs. Wind Speed Lookup Table

Torque g-cm	Wind Spd mph	Torque g-cm	Wind Spd mph
0.5	1.0	1.9 - 2.0	2.0
0.6	1.1	2.1 - 2.2	2.1
0.7	1.2	2.3 - 2.4	2.2
0.9	1.3	2.5 - 2.6	2.3
1.0	1.4	2.7 - 2.8	2.4
1.1	1.5	2.9 - 3.1	2.5
1.2	1.6	3.2 - 3.3	2.6
1.3 - 1.4	1.7	3.4 - 3.6	2.7
1.5 - 1.6	1.8	3.7 - 3.8	2.8
1.7 - 1.8	1.9	3.9 - 4.0	2.9

Start with 1g-cm
If good, consider sensor good to go

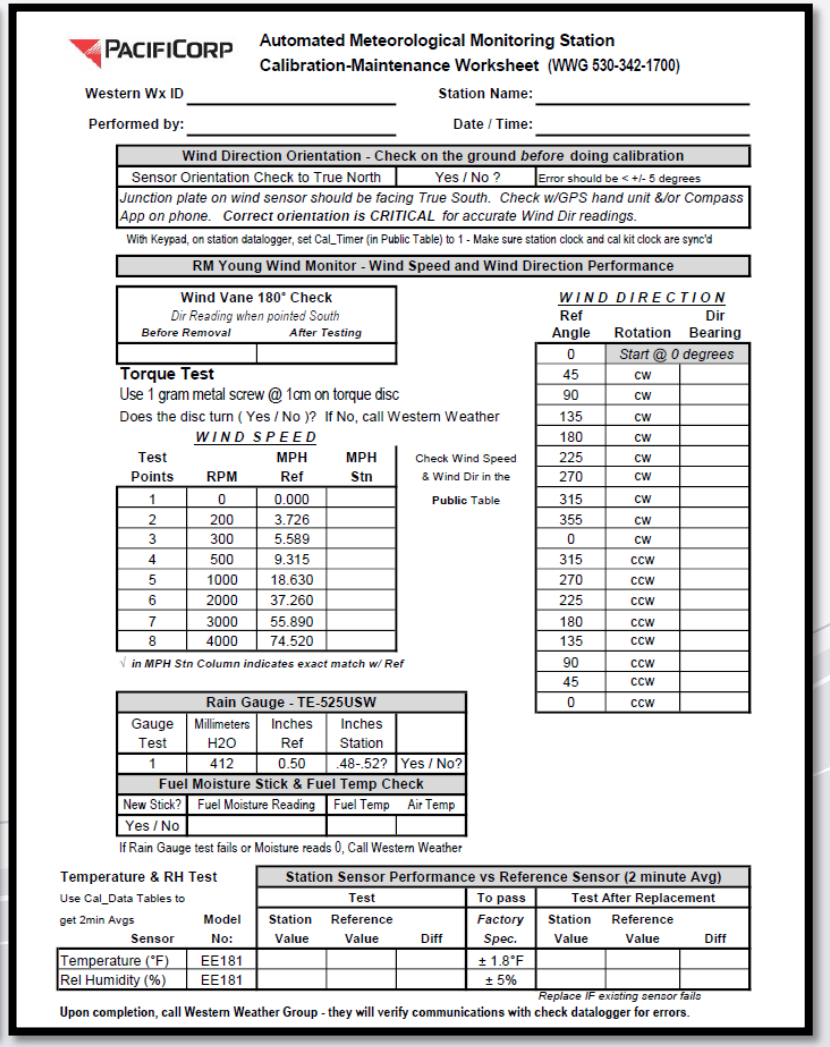
To pass Starting Torque 2.4 gm-cm or less

WIND DIRECTION

Ref Angle	Rotation	Dir Bearing
0	*Start @ 0 degrees*	
30	cw	
60	cw	
90	cw	
120	cw	
150	cw	
180	cw	
210	cw	
240	cw	
270	cw	
300	cw	
330	cw	
355	cw	
360 / 0	cw	
355	ccw	
330	ccw	
300	ccw	
270	ccw	
240	ccw	
210	ccw	
180	ccw	
150	ccw	
120	ccw	
90	ccw	
60	ccw	
30	ccw	
0 / 360	ccw	

Wind Bearing Tolerance +/- 5 degrees

Notes: _____



PACIFICORP

Automated Meteorological Monitoring Station
Calibration-Maintenance Worksheet (WWG 530-342-1700)

Western Wx ID _____ Station Name: _____

Performed by: _____ Date / Time: _____

Wind Direction Orientation - Check on the ground *before* doing calibration		
Sensor Orientation Check to True North	Yes / No ?	Error should be < +/- 5 degrees

*Junction plate on wind sensor should be facing True South. Check w/GPS hand unit &/or Compass App on phone. **Correct orientation is CRITICAL** for accurate Wind Dir readings.*

With Keypad, on station datalogger, set Cal_Timer (in Public Table) to 1 - Make sure station clock and cal kit clock are sync'd

RM Young Wind Monitor - Wind Speed and Wind Direction Performance

Wind Vane 180° Check	
Dir Reading when pointed South	
Before Removal	*After Testing*

Torque Test
Use 1 gram metal screw @ 1cm on torque disc
Does the disc turn (Yes / No)? If No, call Western Weather

WIND SPEED

Test Points	RPM	MPH Ref	MPH Stn
1	0	0.000	
2	200	3.726	
3	300	5.589	
4	500	9.315	
5	1000	18.630	
6	2000	37.260	
7	3000	55.890	
8	4000	74.520	

Check Wind Speed & Wind Dir in the Public Table

√ *in MPH Stn Column indicates exact match w/ Ref*

WIND DIRECTION

Ref Angle	Rotation	Dir Bearing
0	*Start @ 0 degrees*	
45	cw	
90	cw	
135	cw	
180	cw	
225	cw	
270	cw	
315	cw	
355	cw	
0	cw	
315	ccw	
270	ccw	
225	ccw	
180	ccw	
135	ccw	
90	ccw	
45	ccw	
0	ccw	

Rain Gauge - TE-525USW				
Gauge Test	Millimeters H2O	Inches Ref	Inches Station	
1	412	0.50	.48-.52?	Yes / No?

Fuel Moisture Stick & Fuel Temp Check			
New Stick?	Fuel Moisture Reading	Fuel Temp	Air Temp
Yes / No			

If Rain Gauge test fails or Moisture reads 0, Call Western Weather

Temperature & RH Test
Use Cal_Data Tables to get 2min Avgs

Station Sensor Performance vs Reference Sensor (2 minute Avg)								
		Test			To pass	Test After Replacement		
Sensor	Model No:	Station Value	Reference Value	Diff	Factory Spec.	Station Value	Reference Value	Diff
Temperature (°F)	EE181				± 1.8°F			
Rel Humidity (%)	EE181				± 5%			

Replace IF existing sensor fails

Upon completion, call Western Weather Group - they will verify communications with check datalogger for errors.

Calibration Steps Review

1. Initial Arrival at Station Review
2. Update Datalogger OS/Config/Clock/Program/Default
3. Perform new Wiring Changes (Resistor added and Temp/RH wire moved)
4. General Station Checks and Calibration Timer
5. Temp/RH Sensor Calibration Test
6. Wind Torque Test
7. Wind Speed Test
8. Wind Direction Test
9. Replace Fuel Sensors (if applicable)
10. Completion and Final Checks
11. Call WWG to report new calibration & Complete internal calibration form

Initial Arrival at Station Review

Check orientation of wind sensor to true north w/ GPS

This should be done using a GPS unit, walking a straight line either toward the station from the north or south (both if possible). A compass app can also be used on your phone; be sure it’s set to “True North” (Magnetic North is typically the default). Check it from both sides of the station. Interference from power lines and/or other metal sources can cause inconsistent readings.

Important! Proper alignment of the wind vane is critical for valid wind direction data.

Initial Arrival at Station Review

- Verify Solar Panels are aligned for maximum solar resource
- Check the station for any chewed cables or vandalism
- Check for any additional sensors that could change the datalogger program to be uploaded or add calibration steps
- Open the enclosure and note the station and modem LEDs and battery type.
- Perform a quick pull test on datalogger sensor wiring to confirm all wires are tight. Re-secure any if necessary.
- Note the time of day and current weather in case it affects calibration results or WWG inquiries

Update Datalogger OS/Config/Clock/Program/Default

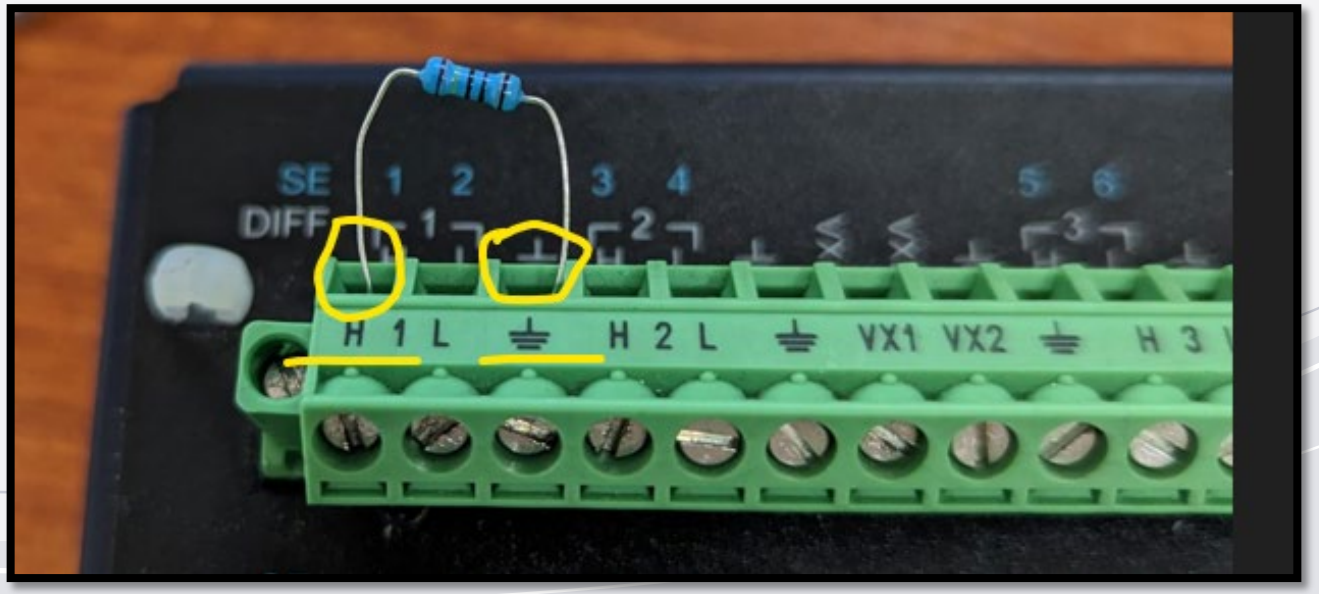
- Device Configuration Utility Software
- **Datalogger OS** file through Send OS Tab
- Updating **Station Name & PakBus Address** through Deployment Tab
- **Syncing Datalogger Clock** through Logger Control Tab
- **Datalogger Main Program** file through Logger Control Tab
- **Datalogger Default Program** file through File Control Tab

- **CR1000X.std.06.01.OBJ**
- **SDGE_Ver_2_0.CR1X** – normal station datalogger program
- SDGE_Ver_2.0_Fuel Sensors.CR1X – stations with Fuel Temp/Moisture Sensors
- SDGE_Ver_2_0_HD WIND.CR1X – stations with HD wind monitor (black)
- SDGE_Ver_2_0_CCFC.CR1X – stations with CCFC NDVI Cameras
- SDGE_Ver_2_1_CCFC_FuelMT_newBatt.CR1X – stations with CCFC Cameras & Fuel Sensors
- SDGE_Ver_2_0_RF.CR1X – stations with radio repeater base and remote sites
- **Default.CR1X**

New Step – Adding Resistor to Datalogger

- **Add a 1-ohm resistor to datalogger wiring** between Wind Direction reference wire and Wind Direction ground wire

- RM Young Wind Monitor Wind Speed & Direction Sensor Wiring
- **Green - SE1 (Direction)**
- White - VX1
- Red - P1 (Speed)
- **Black, Blue, Yellow, Shield - Ground**
- *** Special Note: If the Wind Direction Does Not Work, Try Reversing the Blue & White Wires.



New Step – Move Temp/RH Red Power Wire on Datalogger

- **Move the Temp/RH Probe Power wire** from datalogger 12volts to SW2 (Switched 12v – 2)

- EE181 Temp/RH Sensor Wiring
- Yellow - SE2 (Temp)
- Blue - SE3 (RH)
- **Red - 12V -> SW2**
- Black & Clear - Ground

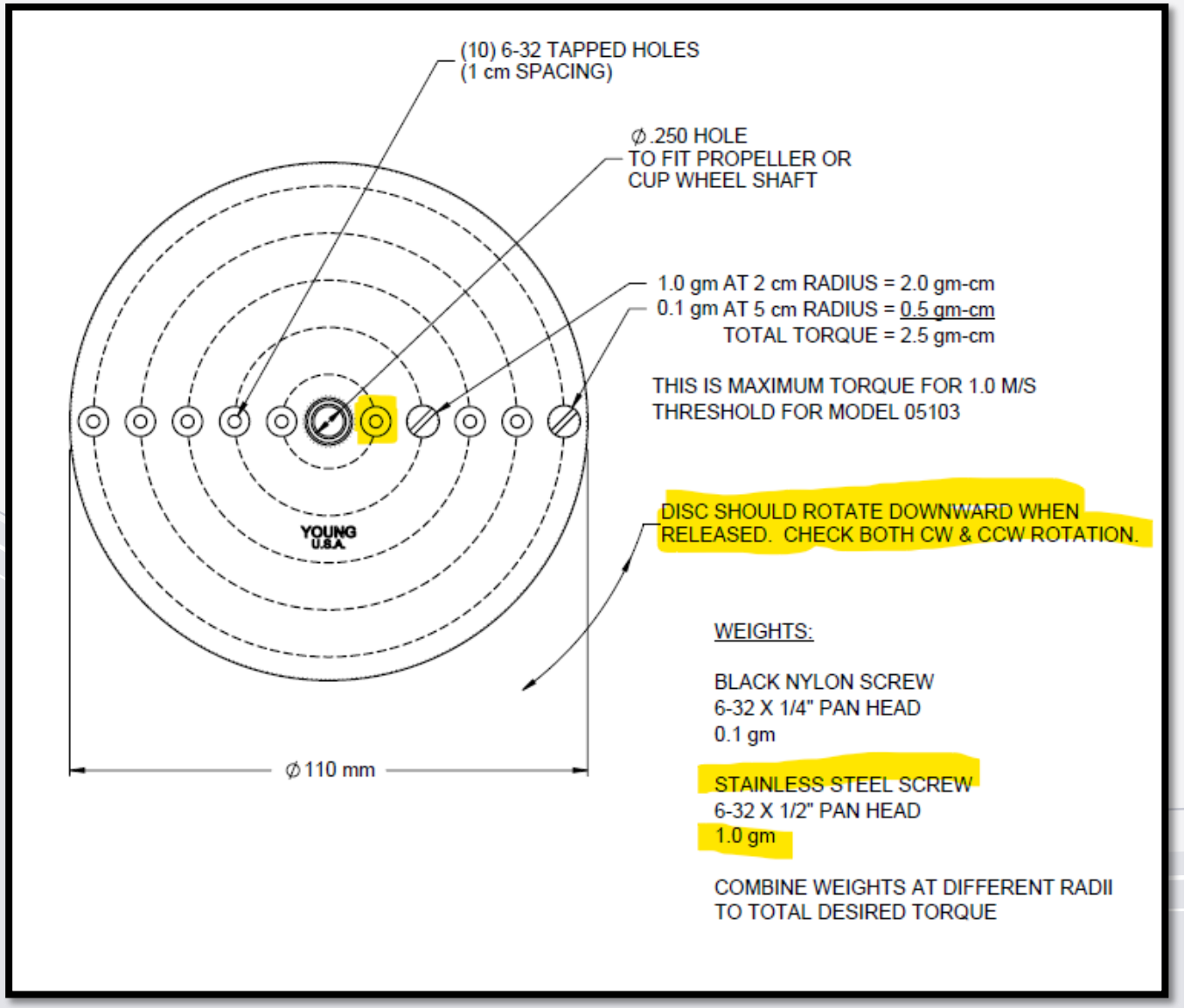
Synchronize Station and Cal Kit Clocks for Temp/RH Test

1. Turn on calibration case's datalogger and synchronize its clock to the station datalogger's clock:
    - Press Esc until you reach the Keypad's splash screen.
    - Press Enter from the Keypad's splash screen to access the main menu.
    - Press Enter from the Keypad's main menu with "Configure, Settings" highlighted.
    - Press Enter from the Keypad's data menu with "Set Time/Date" highlighted.
2. From there you can scroll down to "Minute", press Enter and go into the "Modify Minute" screen. Minutes are the lowest time interval you can set.
3. Use Up/Down keys to change the minute and Enter to set the minute. You will be taken back to the main "Set Time/Date" Screen.
4. Scroll down to "Set". Hit "Set" to confirm the exact time you want (watching the seconds on the station datalogger clock).

Temperature/RH Calibration Test

1. Secure the fan aspirated test shield to the cross-arm.
2. Remove the Temperature and Relative Humidity sensor (EE181) from the white radiation shield and place in fan aspirated shield.
    - Important! The bottom is open and the EE181 can be hit by the rotating fan blade.
3. Place the EE181 from the calibration case in fan aspirated shield (let the two sensors sit in the fan aspirated test shield for 5-20 minutes to stabilize. While waiting, feel free to start the wind tests.
4. Access the “Cal_Data” table. This table takes 2-minute averages from the EE-181.
    1. Press Esc until you reach the Keypad’s splash screen.
    2. Press Enter from the Keypad’s splash screen.
    3. Press Enter from the Keypad’s main menu on “Data”.
    4. Press Enter from the Keypad’s data menu on “Real Time Tables”.
    5. Press Enter from the Keypad’s table menu on “Cal_Data”.
5. Record the readings (Temperature and Relative Humidity) on the Calibration Worksheet.
6. Clean the white radiation shield.
7. Replace station sensor back in white radiation shield (again careful not to damage the sensor).

Wind Torque Test



1. Check starting torque with propeller torque disc, enter value on data sheet
2. Use 1.0 gm screw (silver) at first closest hole
3. Placing disc horizontal, the disc should rotate downward

Wind Speed Test

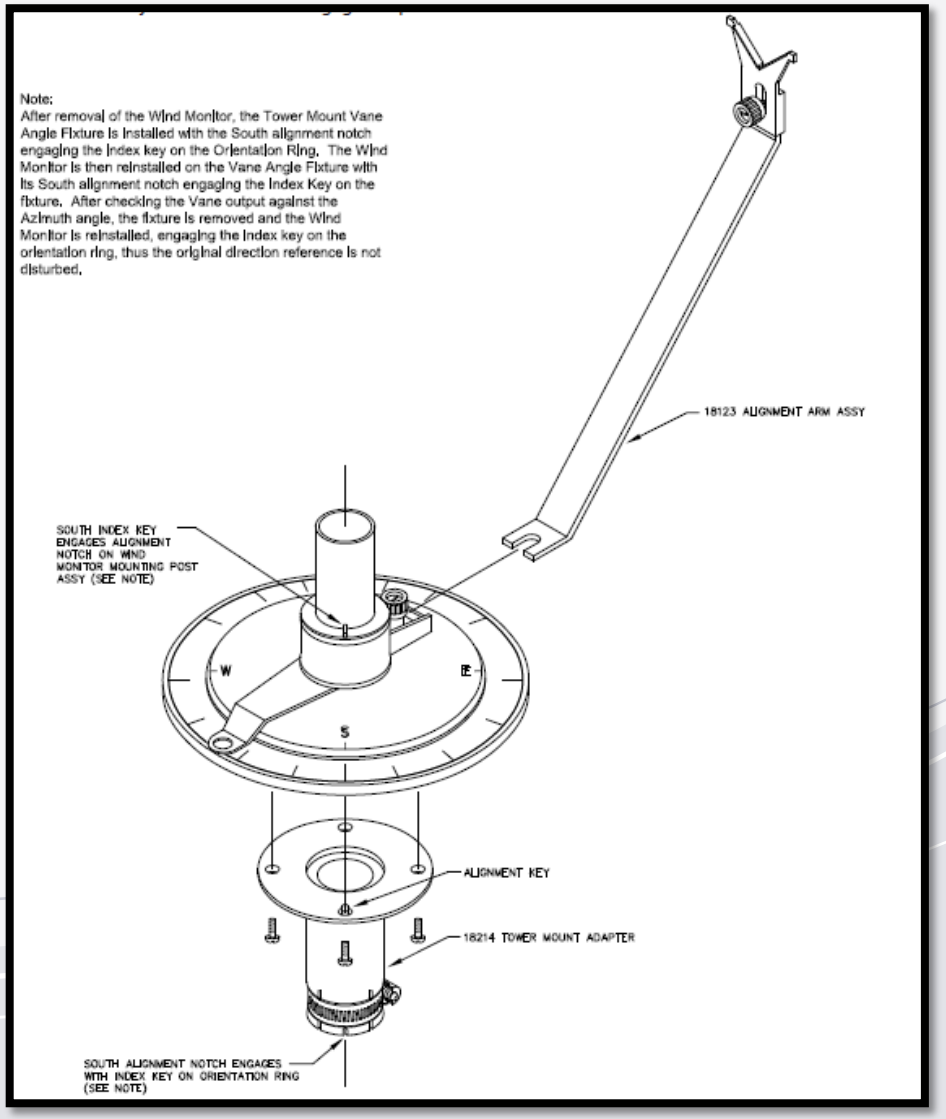
1. Attach anemometer motor drive to wind sensor
    1. Press Esc until you reach the Keypad's splash screen.
    2. Press Enter from the Keypad's splash screen.
    3. Press Enter from the Keypad's main menu on "Data".
    4. Press Enter from the Keypad's data menu on "Real Time Tables".
    5. Press Enter from the Keypad's table menu on "Public".
    6. Press Down Arrow to find "WindSpeed".
2. Double check batteries in Drive are good, mode is set to 'CCW'
3. Check wind speed output at RPM test points and enter on data sheet (view the wind speeds on the station's keypad in the Public table)

Wind Monitor RPM-MPH Check		
RPM	MPH	Ratio
100	1.10	0.49
200	2.19	0.98
300	3.29	1.47
400	4.38	1.96
500	5.48	2.45
600	6.58	2.94
700	7.67	3.43
800	8.77	3.92
900	9.86	4.41
1000	10.96	4.90
1100	12.06	5.39
1200	13.15	5.88
1300	14.25	6.37
1400	15.34	6.86
1500	16.44	7.35
1600	17.54	7.84
1700	18.63	8.33
1800	19.73	8.82
1900	20.82	9.31
2000	21.92	9.80
2500	27.40	12.25
3000	32.88	14.70
3500	38.36	17.15
4000	43.84	19.60
4500	49.32	22.05
5000	54.80	24.50
8000	87.68	39.20

Wind Direction Test

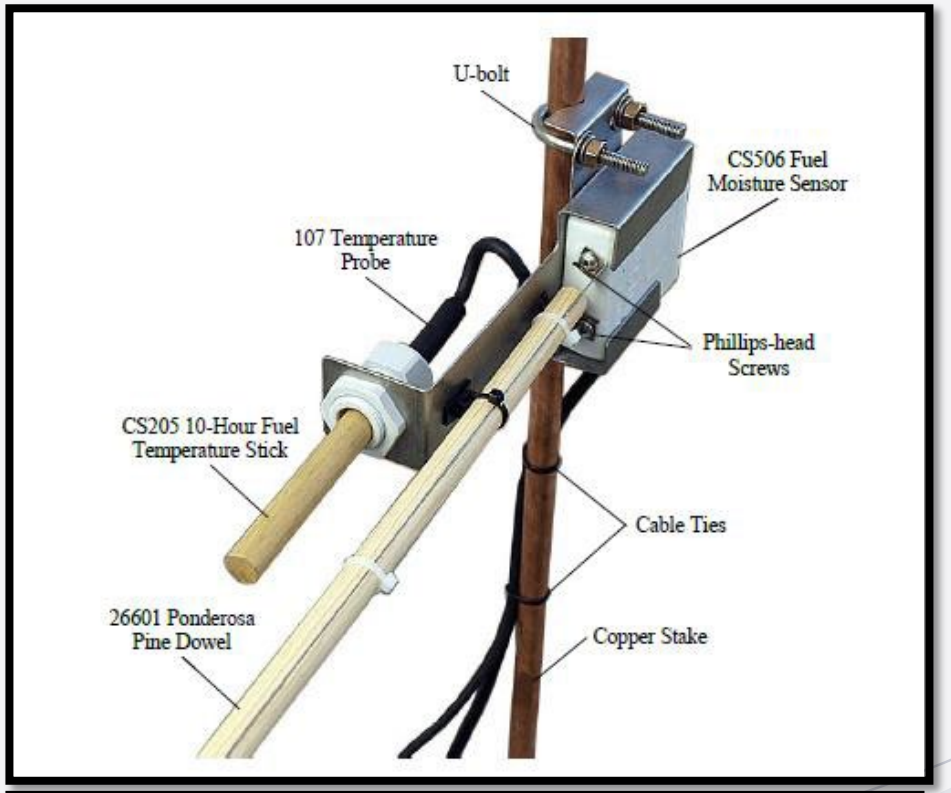
1. a. Before removing the wind sensor, do a “Before Removal” south check by holding the wind vane due south.
    1. i. Press Esc until you reach the Keypad’s splash screen.
    2. ii. Press Enter from the Keypad’s splash screen.
    3. iii. Press Enter from the Keypad’s main menu on “Data”.
    4. iv. Press Enter from the Keypad’s data menu on “Real Time Tables”.
    5. v. Press Enter from the Keypad’s table menu on “Public”.
    6. vi. Press Down Arrow (8) to find “WindDir”.
    7. vii. Record on the data sheet.
2. Remove wind sensor from pole mounting post, note alignment (if no alignment ring or alignment rod, then make special note of the alignment -- before removing the sensor -- by making a mark on the pole where the southerly notch is)
3. Place sensor on vane angle bench stand (southerly notch goes into bench stand’s nipple)
4. Test wind direction at calibration points and note values on data sheet
5. Replace sensor on pole mount and secure, note alignment to true south (i.e. box facing south)
6. Hold wind vane due south; view WindDir reading on keypad (in Public table) record on data sheet under “After Testing”
7. Replace prop, align notches on prop with nose cone and secure propeller nut.

Wind Direction Test



Fuel Stick Replacement

1. Inspect the fuel moisture stick and fuel temperature probe (at the base of the telephone pole) for damage. The fuel moisture stick should be replaced yearly (typically in the spring before the fire season). Replace the fuel sticks.
2. Check and record the sensors' output
    1. Press Esc until you reach the Keypad's splash screen.
    2. Press Enter from the Keypad's splash screen.
    3. Press Enter from the Keypad's main menu on "Data".
    4. Press Enter from the Keypad's data menu on "Real Time Tables".
    5. Press Enter from the Keypad's table menu on "Public".
    6. Press Down Arrow (8) to find "ReadFuelMoistureNow", set to 1 or True
    7. Record on the data sheet the FuelMoisture, Fuel Temp & AirTemp_F.
3. If the FuelMoisture is reading 0, pour some water on it and recheck its reading to make sure it's responding. The fuel temperature may be significantly warmer than the air temperature (especially if sunny).



Maintenance

Replace the 26601 Fuel Moisture Stick each spring; more frequent replacements may be required in some environments. The more wet/dry cycles the dowel experiences, the more frequently it will need to be replaced.

To change the 26601 Fuel Moisture Stick, loosen the Phillips-head screws and remove the old fuel moisture stick. Replace it with the new 26601 Fuel Moisture Stick and tighten the screws.

CAUTION Wear gloves to avoid touching the dowel of the 26601 fuel moisture stick with your bare hands. Your hands can contaminate the dowel with oils and dirt that can affect the measurements.

Misc. Station Checks

1. Set calibration timer to zero with keypad (in Public table).
    1. Press Esc until you reach the Keypad's splash screen.
    2. Press Enter from the Keypad's splash screen.
    3. Press Enter from the Keypad's main menu on "Data".
    4. Press Enter from the Keypad's data menu on "Real Time Tables".
    5. Press Enter from the Keypad's table menu on "Public".
    6. Press Down Arrow (8) until "Cal_Timer" is highlighted.
    7. Press Enter to go into "Edit Field" mode. It will show the current value, for New Value type "0" and press Enter.
2. Verify station's latitude, longitude, and structure #. Record on calibration data sheet
3. Take pictures of the station, ideally one from the North, South, East & West.
4. Ensure that all data points have been recorded before removing calibration equipment and calling WWG.

Misc. Station Checks

- Battery:
  - Check battery voltage using software or voltmeter, swap if necessary, **confirm with WWG if unsure**.
  - Visibly inspect battery terminals and cables for any corrosion
- Enclosure:
  - Check the interior for excessive moisture. Replace desiccant bags, Re-seal hole with putty
  - Check for any loose wires, cellular antenna straight and tight. **Note any external antennas installed to WWG.**
- Solar Panel:
  - Check vertical alignment of solar panel. Confirm solar panel is 45-55 degrees (measured from the bottom)
  - **Note potential shading on solar panel** due to tree canopy or environment to WWG
- Wind Monitor:
  - Re-confirm sensor is accurately aligned (junction box/cable facing true south)
  - Evaluate wind sensor placement, are wind speeds blocked by trees or environment? **Note to WWG.**

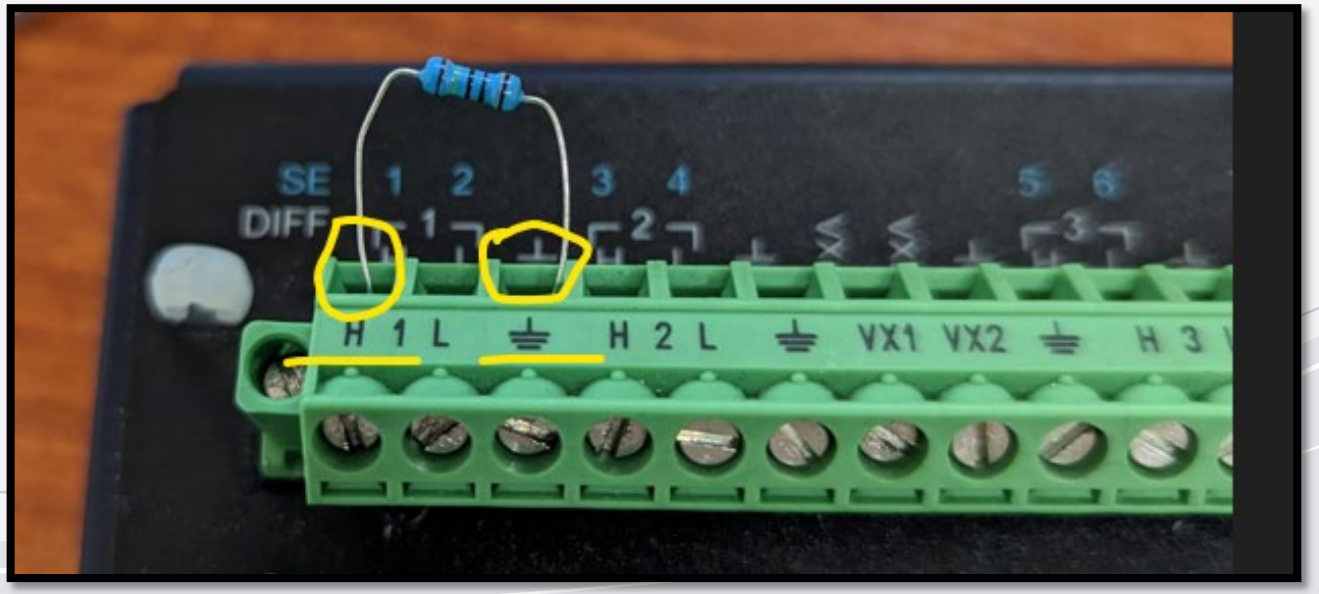
Calling WWG – Completed Calibration

1. **Call WWG Technical Support (530) 342-1700** after the datalogger updates, new wiring changes, and calibration have been completed, but while you are still in the air to review station LEDs or potential troubleshooting.
2. Be ready to **answer the following questions:**
    1. Station ID, Station Name, SCADA ID
    2. Inform if this is a Verizon or AT&T cellular station
    3. Calibration Results (all passed, or any test failed) If failed, was the sensor replaced?
    4. New Wiring Changes Performed (resistor added and Temp/RH power wire moved)
    5. New OS / Program / Default program uploaded?
    6. PakBus and Station Name re-entered into Datalogger Deployment Screen?
    7. Verify Wind Speed/Direction & Temp/RH in real time with WWG

New Step – Adding Resistor to Datalogger

- **Add a 1-ohm resistor to datalogger wiring** between Wind Direction reference wire and Wind Direction ground wire

- RM Young Wind Monitor Wind Speed & Direction Sensor Wiring
- **Green - SE1 (Direction)**
- White - VX1
- Red - P1 (Speed)
- **Black, Blue, Yellow, Shield - Ground**
- *** Special Note: If the Wind Direction Does Not Work, Try Reversing the Blue & White Wires.



New Step – Move Temp/RH Red Power Wire on Datalogger

- **Move the Temp/RH Probe Power wire** from datalogger 12volts to SW2 (Switched 12v – 2)

- EE181 Temp/RH Sensor Wiring
- Yellow - SE2 (Temp)
- Blue - SE3 (RH)
- **Red - 12V -> SW2**
- Black & Clear - Ground

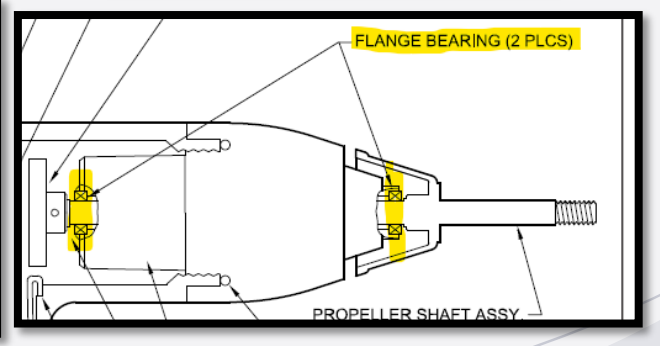
Wind Speed Bearing Replacement

FLANGE BEARING REPLACEMENT:

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

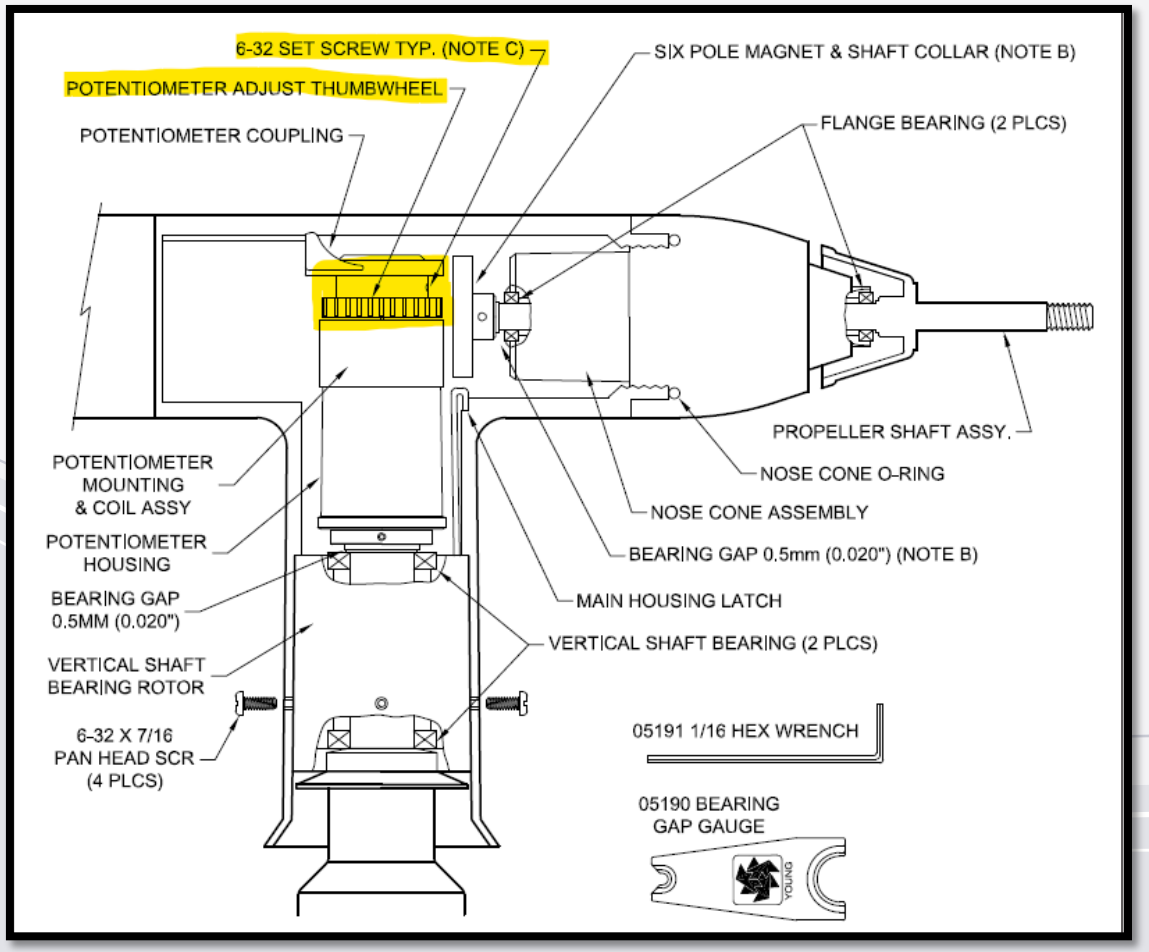
1. REMOVE OLD BEARINGS
   a) Unscrew nose cone. Do not lose O-ring seal.
   b) Loosen set screw on magnet shaft collar and remove magnet.
   c) Slide propeller shaft out of nose cone assembly.
   d) Remove both front and rear bearings from nose cone assembly. Insert edge of a pocket knife under bearing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

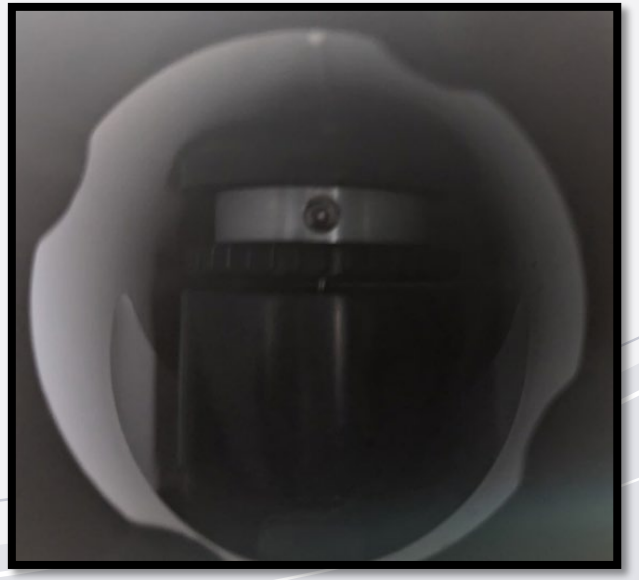
2. INSTALL NEW BEARINGS
   a) Insert new front and rear bearings into nose cone.
   b) Carefully slide propeller shaft through bearings.
   d) Place magnet on propeller shaft allowing 0.5 mm (0.020") clearance from rear bearing.
   e) Tighten set screw* on magnet shaft collar.
   f) Screw nose cone into main housing until O-ring seal is seated. Be certain threads are properly engaged to avoid cross-threading.



Wind Direction Adjustment

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.





Cellular Modem Signal Issues

LED	Color/Pattern	Meaning
Power	Off	Insufficient power input (requires 7-36VDC)
	Solid Green	Sufficient power present
	Green w/Amber Flash	Sufficient power present and modem has a GPS fix
	Solid Red	*Standby mode
	Flashing Green	When the reset button is held, indicates when to release the reset button for a soft reset
	Flashing Red	When the reset button is held, indicates when to release the reset button for a full factory settings reset
	Flashing Amber	When the reset button is held for 20+ seconds, indicates when to release the reset button to enter Recovery mode
Signal	Solid Green	Strong signal (equivalent to 4-5 bars)
	Solid Amber	Fair signal (equivalent to 2-3 bars)
	Flashing Amber	Poor signal (equivalent to 1 bar)
	Flashing Red	Inadequate signal
Network	Solid Green	Connected to 4G LTE network
	Solid Amber	Connected to 2G or 3G network
	Flashing Green	In the process of connecting to a network
	Flashing Red	No network available, attempting to retry connection
	Flashing Red/Amber	Network Operator Switching is enabled, but modem cannot locate the required operator firmware
Activity	Flashing Green	Active data Rx/Tx in progress over WAN (or serial port for default settings)
	Flashing Red	Active data Rx/Tx in progress over serial port (not default setting)
	Flashing Amber	Active data Rx/Tx in progress over both WAN and serial port (not default setting)
All LEDs	Cycling Green	Firmware update or network operator switching in progress
	Cycling Amber	ALEOS software update in progress
	Solid Amber	ALEOS software update complete (power LED not Amber)
	Cycling Red	Modem is in Recovery mode

RF Connectivity	RSRP (dBm)	RSRQ (dB)	SINR (dB)
Excellent	>=-80	>=-10	>=20
Good	-80 to -90	-10 to -15	13 to 20
Medium	-90 to -100	-15 to -20	0 to 13
Weak	<=-100	<-20	<=0

Potential for Issues:

- Cell Modem Model: RV50 vs RV50X
- Cell Modem Network: Verizon or AT&T
- Cell Modem Data Plan Accounting
- SIM Card Re-Seating
- Marginal or Poor Signal
- ALEOS Firmware/Radio Module Firmware
- Cell Modem Template File
- Loose Antennas or External Antenna Alignment

NDVI Camera Issues

SDGE CCFC Camera Stations Status: 3/10/23

Station	Code	PB	IP	DL OS	DL Program	CCFC s/n	CCFC Firmware	Datalogger Settings Confirmed	RV50 Settings Confirmed	RV50 ALEOS	Can connect to camera via RV50	Camera Settings Confirmed	Camera is writing image to DL	Date good image written to DL	DL is getting NDVI value from image	Date last NDVI value written to DL	Notes:
Guejito Ranch	SDGE-GUR		166.161.164.129	5.01	SDGE_Ver_2_0_CCFC	2217	2.7.6	Yes	Yes	4.12	Yes-very good	Yes	Yes	3/10/2023	Yes	3/10/23 - 0.36	Found image showing 1/3 of sky; I zoomed way in, camera was probably
Simon Open Space	SDGE-SOS	3025	166.140.235.50	5.01	SDGE_Ver_2_1_CCFC_FuelMT_newBatt	2218	2.7.6	Yes	Yes	4.13	Yes-very good	Yes	Yes	3/10/2023	Yes	3/10/23 - 0.53	Image looks blurry, camera may be dirty
Highland Valley	SDGE-HVY	55	166.140.250.11	5.01	SDGE_Ver_2_0_CCFC	2223	2.7.6	Yes	Yes	4.12	Yes-very good	Yes	Yes	3/10/2023	Yes	3/10/23 - 0.55	Camera PB = 56
Otay Mesa Border	SDGE-OMB	3361	166.131.33.84	5.01	SDGE_Ver_2_1_CCFC_FuelMT_newBatt	2011	2.7.6	Yes	Yes - slow	4.12	Yes - slow	Yes	Yes	3/10/2023	Yes	3/10/23 - 0.63	It connects to the camera, but you never get to it
Iron Mountain Trail	SDGE-IMT	3007	63.42.9.254	5.01	SDGE_Ver_2_0_CCFC	2186	2.7.6	Yes	Yes	4.12	Yes	Yes	NO	1/18/2023	NO	1/18/2023	Temp/RH not working, battery good. Error Message: Hardware Fault C7 bus C7 OS.
Santa Ysabel North	SDGE-YSA	108	166.167.159.10	5.01	SDGE_Ver_2_1_CCFC_FuelMT_newBatt	?	2.7.6	Yes	Yes - slow	4.14	NO	NO	NO	1/7/2023	NO	1/7/2023	
Warners	SDGE-WAR	86	166.167.66.174	5.01	SDGE_Ver_2_0_CCFC_26AHBat	?	2.7.6	Yes	Yes	4.14	NO	NO	Yes - small	3/10/2023	Yes	3/10/23 - 0.47	cell modem on for 417 days? Same NDVI value for last week
Mission Valley North	SDGE-MVN	3345	166.140.83.38	5.01	SDGE_Ver_2_1_CCFC_FuelMT_newBatt	?	2.7.6	Yes	Yes	4.15	NO	NO	NO	1/7/2023	NO	1/7/2023	NDVI went to -0.95 on 1/8/23
Black Mtn Ranch	SDGE-BMR	3000	63.42.9.250	6.01	SDGE_Ver_2_0_CCFC	?	2.7.6	Yes	Yes	4.15	NO	NO	NO	10/22/2022	NO	10/22/2022	

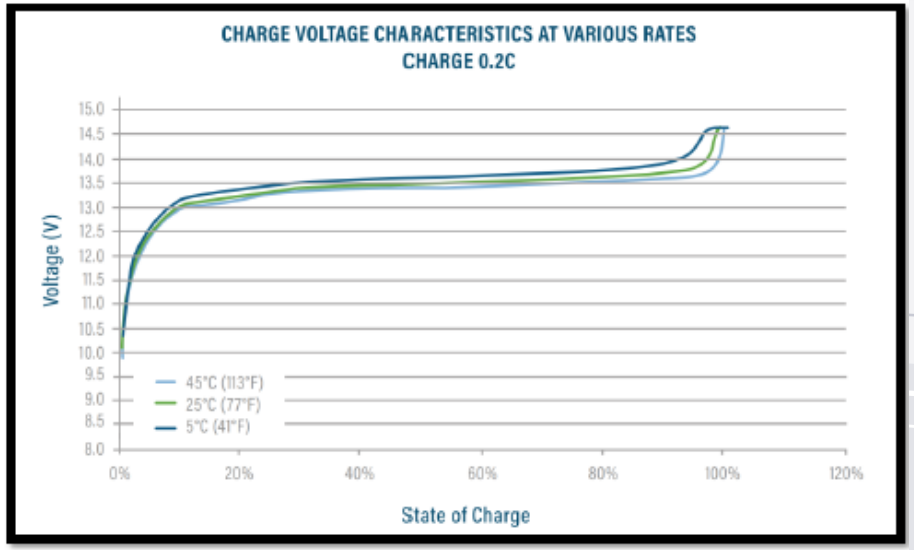
Image pointed at fe

Potential for Issues:

- Datalogger Program
- Datalogger Configuration
- Cell Modem Template
- CCFC Camera Settings
- CCFC Camera Lens Position
- Camera Wiring & Kinked Cables

Lithium Battery Differences

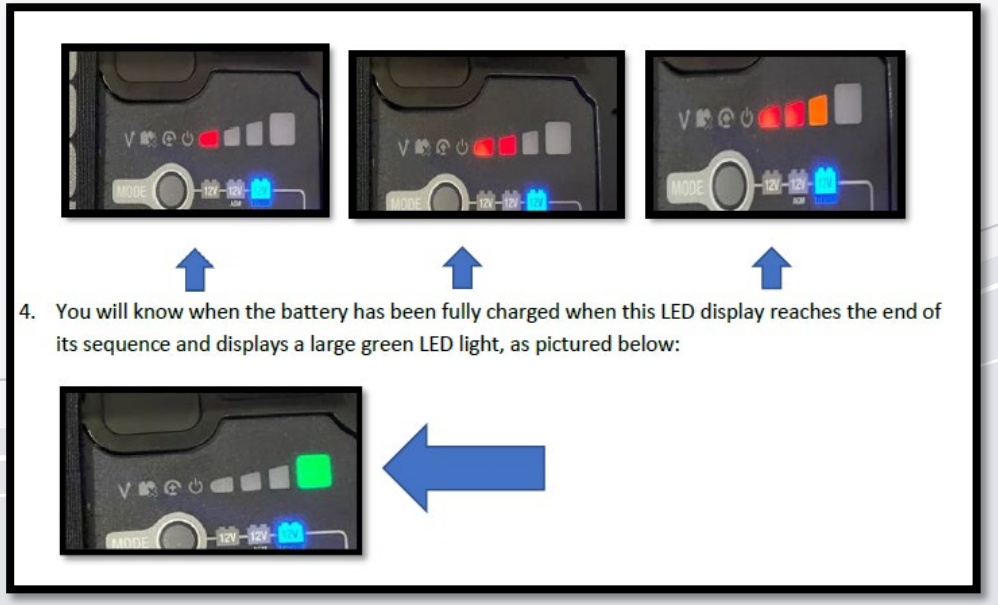
FEATURE	FLOODED LEAD-ACID	AGM	RELiON LiFePO4
Cycle Life	300 - 400 cycles	300 - 400 cycles	3,500
Max Usable Capacity	50%	50%	85%
Discharge Efficiency	50-90%	50-90%	99%
Maintenance	High	Medium	None
Charge Time	6 - 12 Hours	6 - 12 Hours	1 - 5 Hours
Partial Charging Capable	No	No	Yes
Weight Comparison	100%	100%	50%
Charge Efficiency	80%	85%	99%
Cost	$	$$	$$$



List of differences between the two battery types (Lithium Iron Phosphate and Sealed Lead Acid)

- Lithium batteries may be deceptive with their recorded voltage. You need to ensure the lithium battery is charged (optimally overnight or 5+ hours) prior to installation in the field. The charge rate in the field with the solar panel is much slower than charging from the NoCo Genius 10.
- A lithium battery can read good voltage (12-13v) but be almost 90-95% discharged.
- A lithium battery will read around 13v for nearly all its charged capacity (5%-95%).
- RB52 Lithium batteries are shipped 50% charged or less, so they need to be recharged prior to use.
- Installing a new lithium battery out of the box in the afternoon may not allow the solar panel and sunlight to recharge it enough to survive the night. This may result in station hardware or software failure and potential site revisits.
- Lithium batteries require a special CH200 Charging Regulator OS which needs to be uploaded on-site using the special CH200 Update Cable. Without this charger update, the battery may not be charged optimally or efficiently.
- Lithium batteries that have been fully drained can be recharged fully and reused with confidence. There is a minimal hit to the total battery lifespan.
- If the battery is not recovering from a recharge, do not dispose of it, instead follow WWG procedure to start a warranty claim with RELiON. These batteries have a 10-year warranty.
- Because of how LiFePO4 battery chemistry works, the voltage remains constant, and it is difficult to measure discharge or current charge levels, so we rely on a metric called QLOSS. Qloss is the measurement showing the level of battery discharge in Amp Hours. (0 = Fully charged, 52 = 100% drained).
- Sometimes Qloss is reset when the datalogger loses power or the program is re-compiled. You cannot always trust Qloss to be an accurate reading on the lithium battery.

Lithium Battery Charging



RMAs (Sending Bad Parts to WWG)

WWG RMA (Return Material Authorization) Form

First Name		Last Name	
Company		Date	
Return Address		City	
State		Zip	
Email		Telephone	

Returned Part	Serial #	Part Issue Description	From Station ID	Part Removed from Field Date

***Email completed form to Tony@westernwx.com or Place completed form in box with equipment when shipping to WWG Office**

Western Weather Group, 686 Rio Lindo Ave, Chico, CA, 95926, (530) 342-1700

RMAs (Sending Bad Parts to WWG)

RELiON Warranty Claim & Shipment Instructions

Western Weather Group – Madison Chik – Technical Support Level II

- *This guide is to provide you with the proper procedures and information on starting a warranty claim, and the details about shipping a lithium battery.*

Step 1: Double check Lithium battery voltage [Current Voltage & after attempted recharge Voltage].

Step 2: Fill out Warranty Claim Form (See example filled out form below).

Step 3: Email WWG (Johnathan@westernwx.com / Madison@westernwx.com / Tony@westernwx.com) the filled out warranty claim form and wait for follow-up email and details to be supplied by WWG.

Step 4: While warranty claim is in progress, store bad lithium battery (do not dispose) in case RELiON requests return shipment.

Step 5: If necessary, use the RELiON supplied shipping box and shipment details below to ship the bad battery directly to RELiON.

Step 6: If necessary, check in with WWG via phone (530-342-1700) or email to confirm replacement battery progress.

RELiON

CLAIM INFORMATION FORM CIF – 2022March 12, 2023

Do not handwrite or picturize the claim form file (*we do not accept photo's, JPG, PDF, or WPS files*)

REQUIRED DETAIL

Battery model	RB52
(being claimed) **Battery Qty**	How many RB52 batteries are you claiming?
(in battery bank) **Total Battery Qty**	This should be the same # as above
(side sticker) **Battery Serial No.(s)**	Record the battery S/N
Purchase Date	WWG will fill this out
Install Date	Record the date this battery was installed in a weather station
(Vendor name) **Purchased Where**	Campbell Scientific Inc.
Who possess the Battery(s)	Pacific Gas & Electric Company
(Golf, Boat, RV, PV, etc.) **Application**	Weather Station
Battery Issue (Describe symptoms, data, voltages, etc)	WWG will fill this out based on the troubleshooting notes
(daily, weekly, Mo.) **Usage frequency**	Weather station is always powered, battery constantly charged/discharged via DC solar input through regulated 12v

(Name only) **Claim Submitted by** Put contact info in Customer section	Jonathan Arana
Customer Expectation (Replacement, Repair, Credit, or Test)	Replacement
Customer Reference No. (if any)	WWG will fill this out
Additional Remarks/Requests	WWG will fill this out

Customer 1 Type (Consumer, Dealer, Installer, OEM)	End Consumer / Installer
Customer 1 (Business name)	Pacific Gas & Electric Company
Contact	Fill out the PGE name for the return address
phone #	Fill out the phone # for the return address
email	Fill out the email for the return address
Address	Fill out the address for the replacement battery to be delivered


Questions?