



AeroX Light

Runway Light Intensity Monitor (RLIM)



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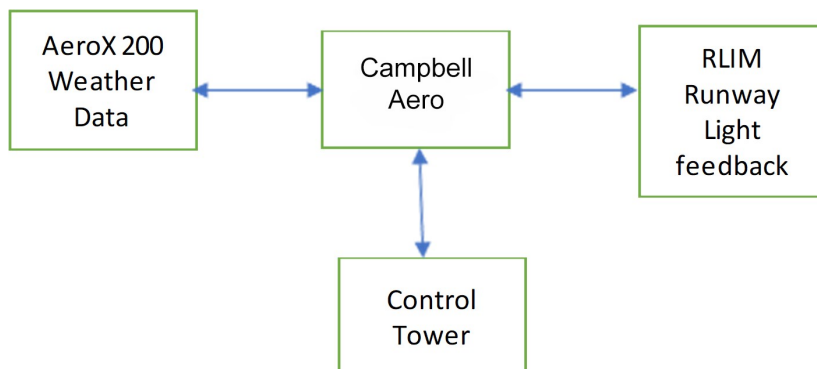
1. Introduction

The AeroX Light is a runway light intensity monitor (RLIM) designed specifically for Campbell Scientific automated weather observing systems (AWOS) and runway visual range systems (RVR). Runway light intensity measurements are critical to RVR, which is either highly recommended or required for categorized runways. RVR provides users, such as pilots and air traffic controllers, with information on runway visibility conditions during periods of low visibility weather due to fog, rain, snow, or sandstorms.

This single-box solution monitors runway light intensity by measuring the current in the lighting loop using clamp-on current transducers. Each current transducer outputs from 4 to 20 mA of current proportional to the amount of current in the lighting loop.

Typically, each airport runway has both an edge and a center lighting loop. The lights can be LED or incandescent. The LED lights typically use from 0 to 6.6 A and the incandescent lights use 0 to 20 A.

The AeroX Light monitors the current and sends the calibrated current data to Campbell Aero for RVR calculations. The Campbell Aero polls the AeroX Light when the data is required.



The AeroX Light consists of an enclosure that houses a CR1000X data logger, AC power protection devices, and a power supply (see [Figure 1-1](#) [p. 2]). Campbell Scientific offers power options to handle voltages up to 260 VAC and provide battery backup.

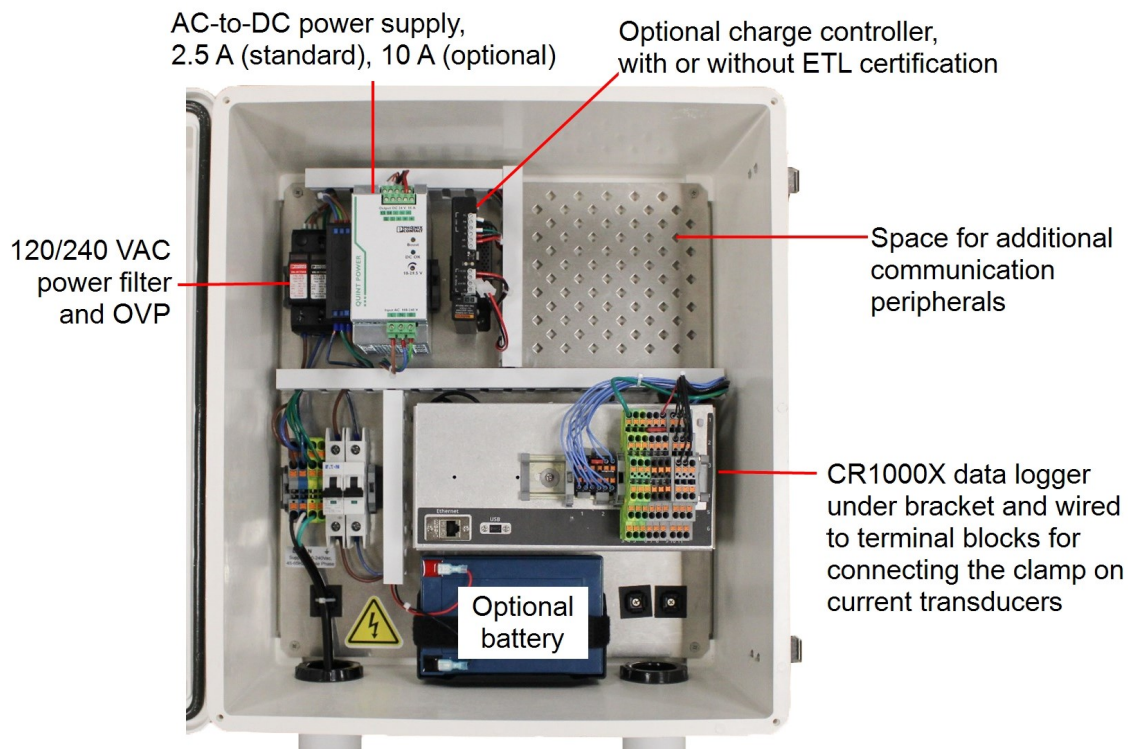


Figure 1-1. Enclosure containing the AeroX Light components

2. Precautions

- READ AND UNDERSTAND the [Safety](#) (p. 19) section at the back of this manual.
- Although the AeroX Light is rugged, it should be handled as a precision scientific instrument.

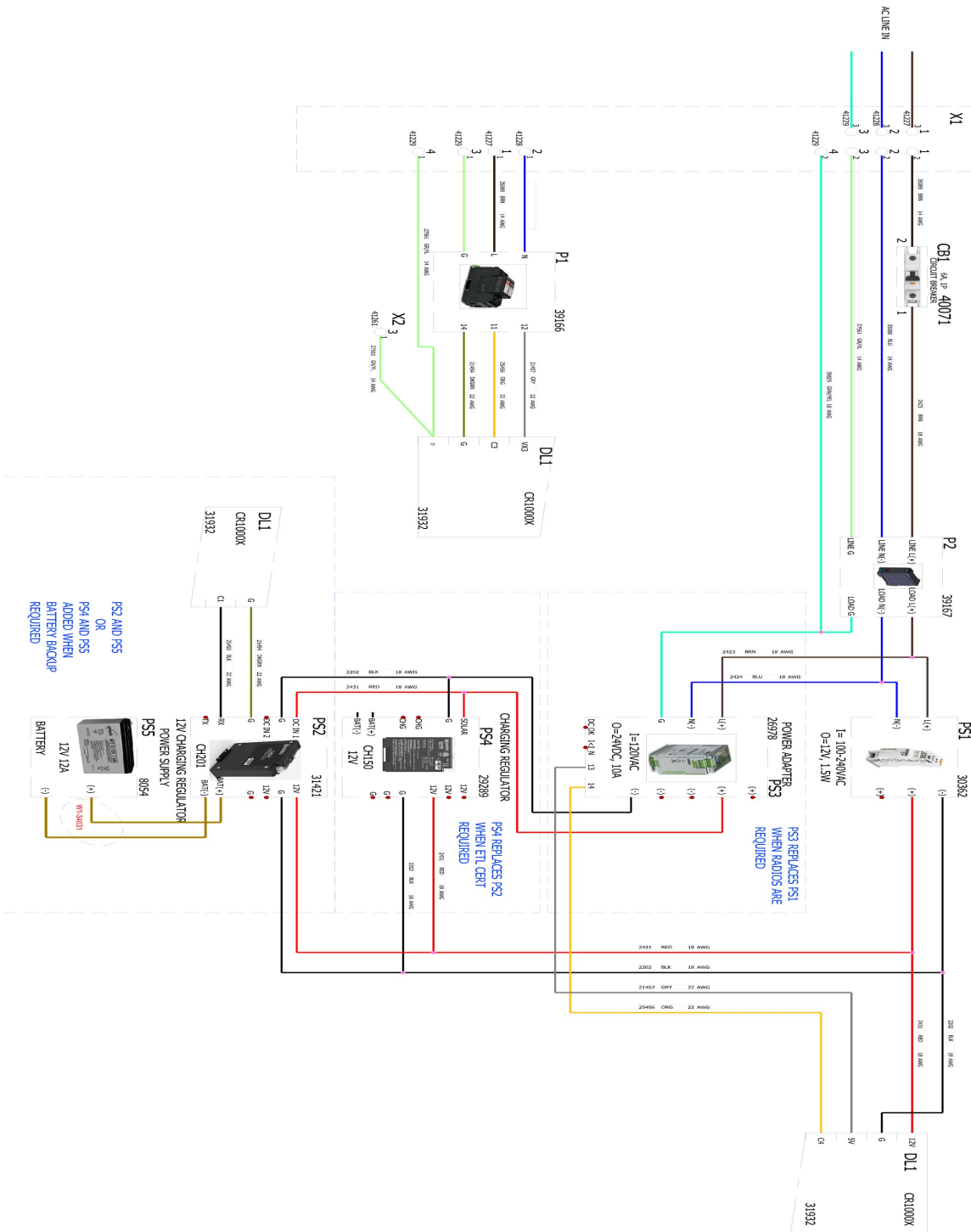
3. Initial inspection

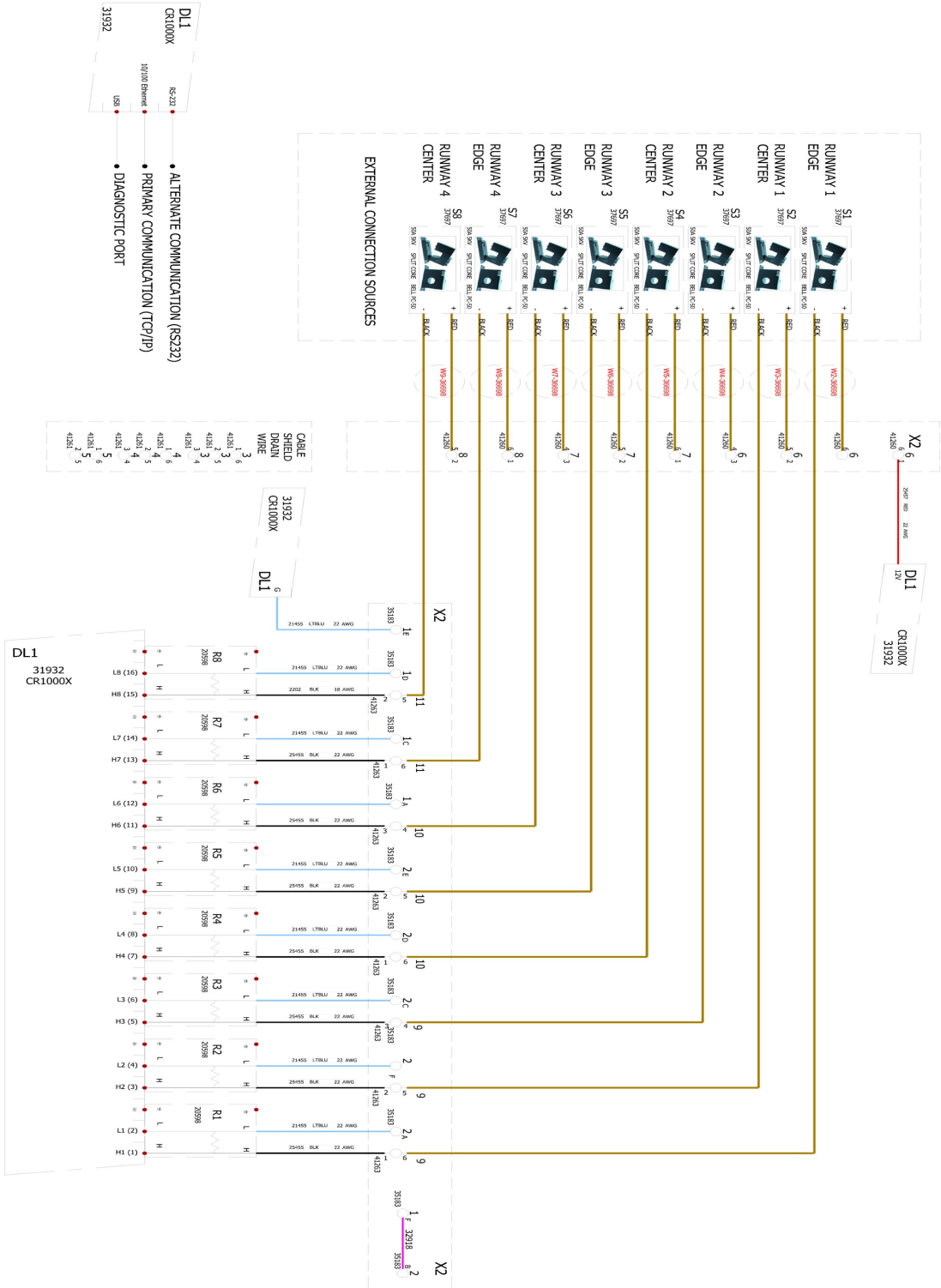
- Upon receipt of the AeroX Light inspect the packaging and contents for damage. File damage claims with the shipping company.
- Check the ships with list to ensure all components are received.

4. Specifications

Number of lighting loops monitored:	4 runways edge and center lighting loops for a total of 8 lighting loops
Type of lights monitored:	LED (up to 6.6 A), incandescent (up to 20 A)
AC input range:	85 to 264 VAC
Short-term input voltage:	300 VAC
Maximum AC input current:	2 A
AC frequency range:	45 to 65 Hz
Inrush surge current:	< 15 A (typical)
Backup battery:	Maintains power to AeroX Light for a minimum of 4 hours
Operating temperature:	-40 to 85 °C
Clamp on current transducer calibration:	Software controlled
Communications:	TCP/IP communications with Campbell Aero
MTBF:	> 500 000 h in accordance with IEC 61709 (SN 29500)
Transient protection:	Pluggable, no-fuse, fail-safe surge suppression device
Terminals:	Spring clamp terminal connections
Enclosure:	Lockable poly-fiber
Enclosure dimensions:	46 x 51 x 30 cm (18 x 20 x 12 in)
Weight:	14 kg (30 lb)
Compliance:	All components meet UL, CE, and CSA power safety requirements

4. Schematics





5. Configuration

The CR1000X program requires the system to be configured to the airport configuration. The AWOS/RVR systems deployed may have different requirements such as the quantity of runways, the types of lights, and the reporting requirements. Some Aero systems will need to indicate whether AeroX Light has a backup power system and when the backup power should be used.

5.1 Power configuration

No Battery Backup Version: no adjustments.

Battery backup version: adjust the open circuit voltage of the power supply to **18Vdc**.

5.2 Hardware configuration

One AeroX Light can manage four runways that have two lighting loops per runway. When the airport has more than four runways, additional AeroX Light are required. Campbell Scientific configures each AeroX Light according to the number of runways included at the airport. Terminal blocks are wired to data logger differential channels. The user connects the current transducers to the terminal blocks using a three wire cable ([Table 5-1](#) [p. 7], [Figure 5-1](#) [p. 8], and [Figure 5-2](#) [p. 8]).

CAUTION:

Failure to connect the hardware according to [Table 5-1](#) (p. 7) will result in calibration failures and inaccurate data.

Table 5-1: Data logger and current transducer connections

Runway	Light location	Transducer	Data logger differential channel	X2 terminal #	X2 terminal port	Wire color	Transducer terminal
1	Edge	S1	H1	9	6	Black	(-)
				6	6	Red	(+)
				3	6	Shield	none
1	Center	S2	H2	9	5	Black	(-)
				6	5	Red	(+)
				3	5	Shield	none
2	Edge	S3	H3	9	4	Black	(-)
				6	4	Red	(+)
				3	4	Shield	none
2	Center	S4	H4	10	6	Black	(-)
				7	6	Red	(+)
				4	6	Shield	none
3	Edge	S5	H5	10	5	Black	(-)
				7	5	Red	(+)
				4	5	Shield	none
3	Center	S6	H6	10	4	Black	(-)
				7	4	Red	(+)
				4	4	Shield	none
4	Edge	S7	H7	11	6	Black	(-)
				8	6	Red	(+)
				5	6	Shield	none
4	Center	S8	H8	11	5	Black	(-)
				8	5	Red	(+)
				5	5	Shield	none

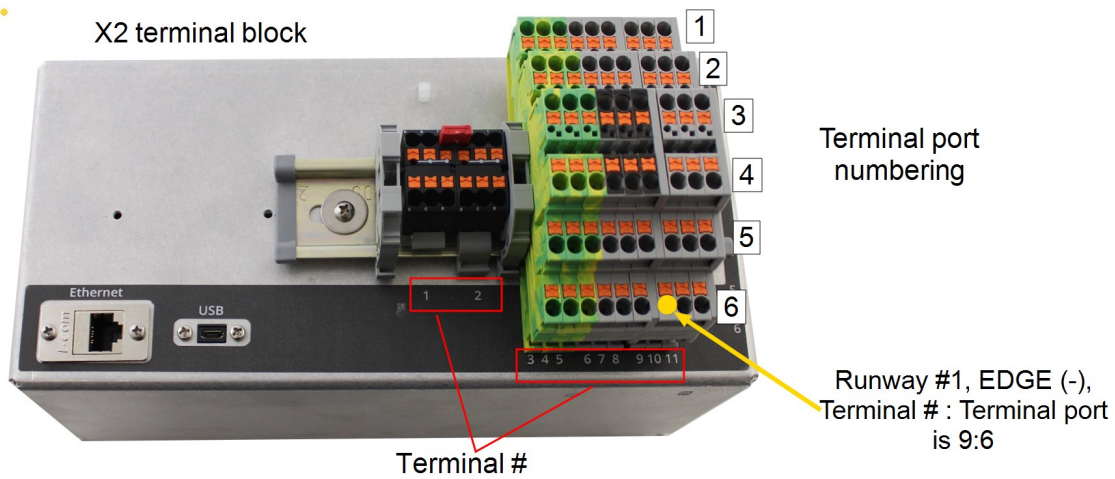


Figure 5-1. Terminal block and port numbering

The current transducers are configurable using a jumper to set the current range (see [Figure 5-2](#) [p. 8] and [Figure 5-3](#) [p. 9]). The current transducers are set to the 0 to 10 A scale for the 6.6 A LEDs and to the 0 to 20 A scale for the incandescent lights. This enables the highest resolution of data.



Figure 5-2. Current transducer

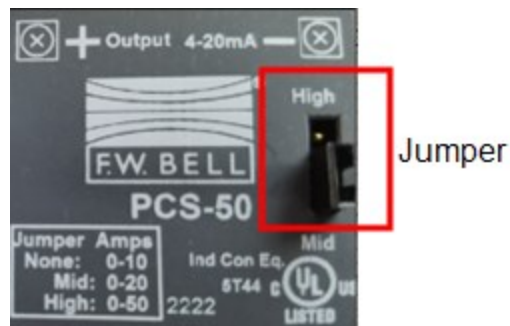


Figure 5-3. Jumper set to the 0 to 20 A scale for the incandescent lights

5.3 Data logger configuration

To enhance the security of the data logger, some services were disabled at the factory. If the data logger has been replaced, follow the steps in [Disable unused services](#) (p. 10) to secure the data logger.

The software has constants and variables that are set to identify the hardware configuration that matches the runway and sensor configuration. The **Public Table** contains variables that may need to be changed to match the airport configuration (see [Table 5-2](#) [p. 10]). The variables are written to the **RLIMCalValues** constant table in the data logger. Information about changing the variables are provided in [Edit configuration settings](#) (p. 12).

NOTE:

Configuration and calibration data is written to an SD card for later use.

Table 5-2: Public table variables and values descriptions		
Variable	Values	Note
Program_Name	CSIRLIMmsg	Do not change
Station_ID	1 (default)	Use the default value of 1 unless multiple RLIM systems at the airport.
Configuration_Version	V0.0	Changes made to the configuration require incrementing sCfgVersion
Firmware_Version	V0.0	Factory released version of the CSIRLIMmsg program
Number_RLIMS	1	Number of RLIMS in use at this airport
Number_Runways	1 to 4	RLIM support 1 to 4 runways. Indicate the number of runways at the airport. Assumption is that each runway will have an edge and a center lighting loop.
Current_Scale	6.6 or 20	6.6 A is typical of LED light loop; 20 A is typical of incandescent light loops.
Battery Backup	0 or 1	Battery option installed: 0 = No 1 = Yes

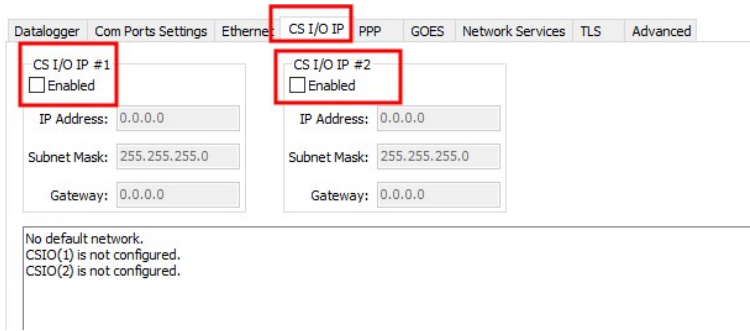
NOTE:

The default time allowed for configuration and calibration is one minute. If more time is needed, change the **EntryDelay_Seconds** parameter. Double click in the window and change 60 to the desire timeout period. Time displayed in this setting is in seconds.

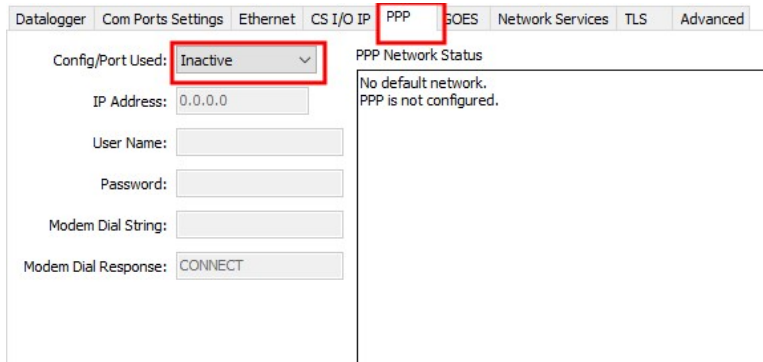
5.3.1 Disable unused services

Secure the data logger by disabling unused services:

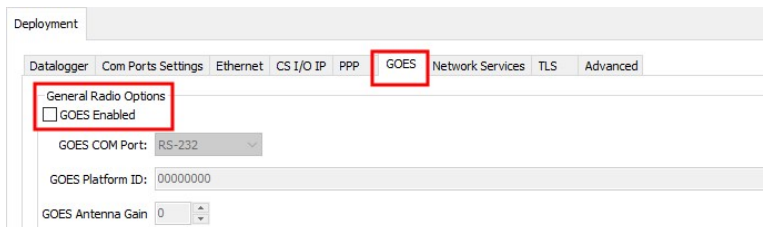
1. Supply power to the data logger by connecting +12 VDC to the **Power In** terminals.
2. Connect the data logger USB port to your computer using the supplied USB cable.
3. Access the *Device Configuration Utility* software.
4. Type CR1000X in the device type window and select the **CR1000X Series**.
5. Select the **Connection Type**, **Communication Port**, and **Baud Rate**, then click **Connect**.
6. Click the **CS I/O IP** tab and uncheck the **Enabled** boxes.



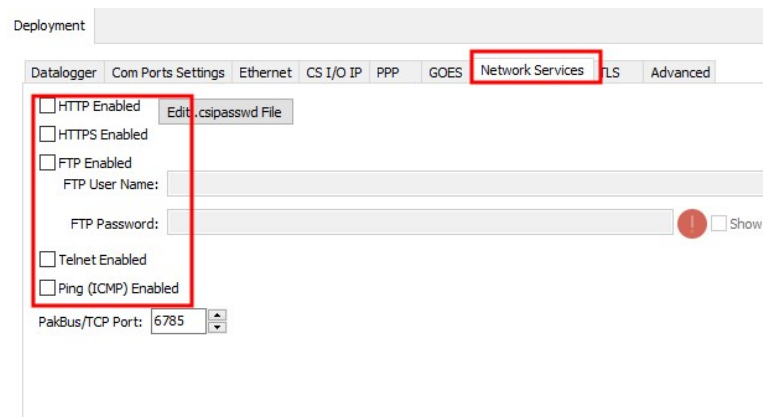
- Click the **PPP** tab and ensure that the **Config/Port Used** setting is **Inactive**.



- Click the **GOES** tab and ensure that the **GOES Enabled** box is not checked.



- Click the **Network Services** tab and ensure that none of the boxes are checked.



- Click **Apply** to save the changes.

5.3.2 Edit configuration settings

The following procedure uses *Loggernet, PC400*, or the *Device Configuration Utility* software. The configuration settings are changed by editing the **Public Table**.

1. Change the **Update_Configuration** variable from **false (0)** to **true (1 or -1)**.
2. Edit the configuration variables to the values indicated in [Table 5-2](#) (p. 10). Press Enter after typing each new value.
3. When all the new values have been entered, change the **Update_Complete** variable from **false (0)** to **true (1 or -1)**. This saves the changes and restarts the data logger.
 - a. Valid data must be entered in both the **Number_Runways** and **Current_Scale** to exit the calibration routine using the **Update_Complete** field.
 - b. Calibration routine can be exited without saving changes by either waiting for the routine to time out or by changing the **CANCEL_Configuration** from **false (0)** to **true (1,-1)**.

Instructions are provided in the **Config_Instruction** field and status messages are provided in the **Config_Message** variable.

NOTE:

The data logger may need to be reconnected after the data is saved and the data logger restarts.

The new values are automatically updated in the **RLIMCaValues** constant table and can be restored to the data logger using the [Backup and restore](#) (p. 14) process.

5.4 Current transducer calibration

Calibration of the current transducers and lighting level ensures consistent current measurement data for the expected current ranges. The calibration routine requires coordination with the light controller. When prompted, use the light controller to turn off the light loop, then, when prompted, turn the light loop to highest light level. Each lighting loop is calibrated separately and may take several minutes to complete.

The calibration routine needs to be done for each runway defined in the configuration. Calibration on individual light loops can be performed in any order. The runways are assigned a number starting at number one and have an edge and center light identifier. Each runway calibration uses the lowest light level and the brightest light level. The low light level must be entered first, followed by the highest light level. Instructions and feedback are provided in the **Calibration_Instructions** and **Calibration_Message** variables.

NOTE:

Wait for the instructions to prompt for all entries. By default, if no changes have been made by 60 seconds, the program will time out and exit the calibration process. Increase the **EntryDelay_Seconds** value if more time is needed to input information. Changing the **EntryDelay_Seconds** variable to 120 will increase the time out delay to 2 minutes.

Occasionally the calibration routine will time out for no apparent reason. If this happens, restart the calibration of the failed lighting loop.

The calibration procedure is done by editing the **Public Table**.

1. Instruct the light controller to turn on the runway lighting loop to be calibrated to the lowest light setting
2. Set **Start_Calibration** to **true (1 or -1)**.
3. Type the **Runway Number** and press Enter.
4. Type **e** for the runway edge or **c** for center light loop to be calibrated and press Enter.
5. Type the measured Off light level meter reading value in amps in the **Low_Current_Measurement** variable and press Enter.

NOTE:

Meter reading must be greater than 0.00. Therefore, enter 0.001 if the meter reading is 0.00.

The **FieldcalMode** variable will change to 3 after the first input value is processed, and the **Calibration_Message** will request the lighting loop high value.

6. Instruct the light controller to turn on the runway lighting loop to be calibrated to the Highest light setting.
7. Type the measured high light level meter reading value in amps into the **High_Current_Measurement** variable and press Enter. The **FieldcalMode** variable will change to 6 when calibration has completed. The program will restart and place the values into the constants table. The *Device Configuration* utility may need to be reconnected.
8. Turn OFF the runway lights.
9. Repeat the previous steps for each runway lighting loop.

The calibration data is contained in the constants table **RLIMCalValues**.

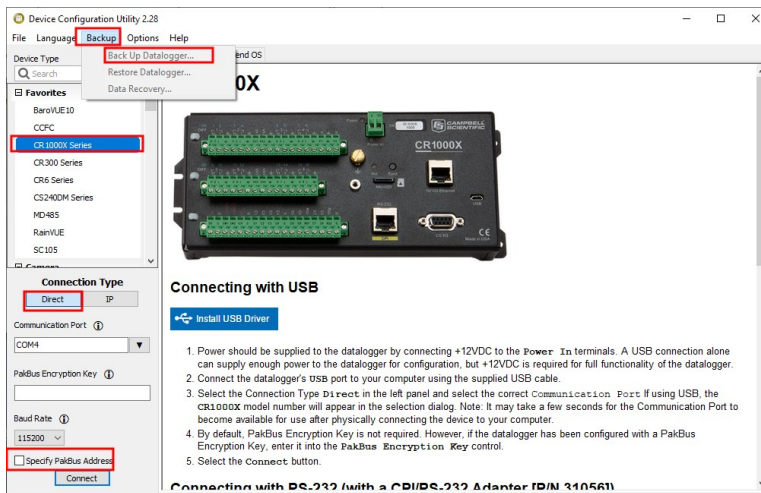
5.5 Backup and restore

This process backs up the program, configuration, and calibration data. It is only applicable when all the connections configurations remain unchanged. The backup and restore process requires a computer running the *Device Configuration utility* software to be connected to the data logger USB port.

Backup procedure:

Create a backup after the AeroX Light RLIM has been fully configured and all current transducers have been successfully calibrated.

1. Connect the data logger USB port to your computer using the supplied USB cable.
2. Access the *Device Configuration Utility* software.
3. Type CR1000X in the device type window and select the **CR1000X Series**.
4. For **Connection Type**, click **Direct**. Do not check **Specify PakBus Address**.
5. Select **Backup -> Back Up Datalogger** to launch the backup function in the *Device Configuration utility*.



6. Create the **Output File Name** and browse the local computer to select the directory to place the backup file. Campbell Scientific recommends changing the default name to the program name with the backup date (for example, CsiRLIMmsg_V1.0_1-1-22). The file name of the program running on the data logger can be found in the **Status Table**. For example, if the **Status Table** displays **ProgName | CPU:CsiRLIMmsg_V1.0.CR1X**, the CR1000X data logger is running a data logger program named CsiRLIMmsg..
7. Click **Next**
8. Select the program file (.CR1X) and the calibration file (.cal)

9. Click **Next**
10. Click **Finish**
11. The created zip file (CsiRLIMmsg_V1.0_1-1-22.zip) should be copied to a secure location for retrieval if a restore is desired.

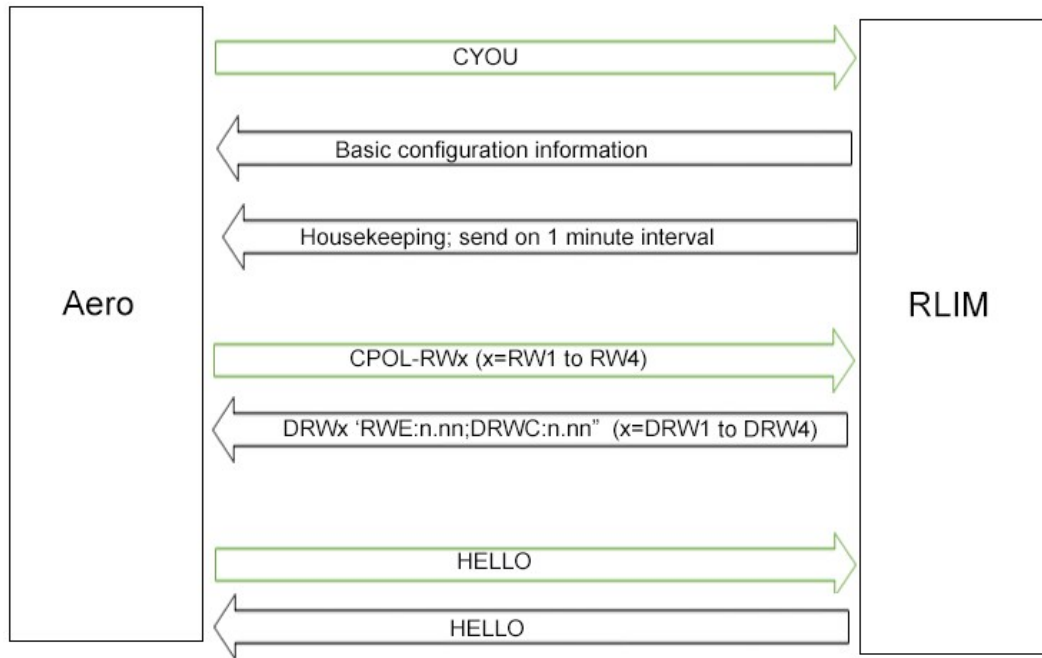
Restore procedure

NOTE:

If a program is running, stop the program before the restore process is initiated. Keeping the data when stopping the program does not effect the restoration of the configuration and calibration data.

1. Connect the data logger USB port to your computer using the supplied USB cable.
2. Access the *Device Configuration Utility* software.
3. Type CR1000X in the device type window and select the **CR1000X Series**.
4. For **Connection Type**, click **Direct**. Do not check **Specify PakBus Address**.
5. Select **Backup -> Restore Datalogger**.
6. Browse to the directory containing the backup file. Select the file to restore and click **Open**.
7. Click **Next**.
8. Select the program file (.CR1X) and the calibration file (.cal).
9. Click **Next**.
10. Click **Finish**.
11. Select the **Settings Editor** tab and enter the **IP address** assigned to the RLIM station.
12. Click **Apply**.
13. Select the **Logger Control** tab and click **Set Clock**.

5.6 RLIM to Aero communication flow



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Safety

DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND **TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.** FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at www.campbellsci.com. You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

General

- Protect from over-voltage.
- Protect electrical equipment from water.
- Protect from electrostatic discharge (ESD).
- Protect from lightning.
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical

- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines**.
- Maintain a distance of at least one-and-one-half times structure height, 6 meters (20 feet), or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.
- Only use power sources approved for use in the country of installation to power Campbell Scientific devices.

Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

Internal Battery

- Be aware of fire, explosion, and severe-burn hazards.
- Misuse or improper installation of the internal lithium battery can cause severe injury.
- Do not recharge, disassemble, heat above 100 °C (212 °F), solder directly to the cell, incinerate, or expose contents to water. Dispose of spent batteries properly.

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