BOLTEK CORPORATION

Lightning Detection

ERL-10 EFM Relay Output Module

ADVISORY USE ONLY

DOES NOT INCLUDE SELF-TEST CIRCUITRY

ADDITIONAL MEASURES SHOULD BE IN PLACE TO
SAFEGUARD PERSONNEL OR EQUIPMENT

SEE MANUAL FOR MORE INFORMATION

ERL-10 Programmable
Output Relay Module
Installation/Operators Guide

BOLTEK LIGHTNING DETECTION

ERL-10 Output Relay Module

Disclaimer

ERL-10 lightning data is only approximate and should not be used for safety applications. Strike and storm locations indicated and alarm statuses may be erroneous and should not be used to safeguard personnel, equipment or data.

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Notwithstanding the above Boltek Corp's liability shall not exceed the purchase price of the equipment.

THIS EQUIPMENT IS NOT TO BE USED FOR SAFETY PURPOSES

FCC Compliance Statement
For United States Users

This equipment is tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio or television reception. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio and television reception, which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

WARNING

The connection of a non-shielded equipment interface cable to this equipment will invalidate the FCC Certification of this device and may cause interference levels which exceed the limits established by the FCC for this equipment. It is the responsibility of the user to use a shielded interface cable with this device. If this equipment has more than one interface connector, do not leave cables connected to unused interfaces. Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

For Canadian Users

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la class B respecte toutes les exigences du Règlement sur le materiel brouilleur du Canada.

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Introduction

T he ERL-10 Programmable Output Relay Module puts a live lightning status alarm on your laptop or desktop computer, along with relay connections to activate lighting or audible devices. The ERL-10 is suitable for use with a computer or as a stand-alone relay module for fixed installations.

Your ERL-10 package should contain:

1: ERL-10 Relay	2: USB Cable	3: 12V DC Power Adapter	4: RS485 wire

|		
5: USB flash drive	6: DIN rail mount	7: Rubber feet

Please check that all ERL-10 parts are included.

Quick Start Instructions

1) Install EFM-100 (and LD-250 if purchased). Please refer to user manuals of each detector for installation details.

2) Connect EFM-100 fiber cable to ERL-10 fiber connector or the RS485 wire from the EFA-21 terminal to the ERL-10 terminal

3) Connect (optional) DB9 cable from LD-250 to ERL-10 RS232 connector

4) Connect the USB cable from your computer USB port to the USB connector of your ERL-10.

5) Plug in the AC power adapter into the lead of the ERL-10 and into an AC outlet. The ERL-10 will power up. All of the LEDs will illuminate the indicator lights for 2 seconds then the EFM Data LED will start blinking. If the fault LED stays on, check EFM-100 power and connection or refer to Fault Code chart listed in Appendix A

6) After the ERL-10 is powered up, the USB drivers should automatically install if there is an active internet connection on the computer. If there is no internet connection, the USB driver install program can be found on the Boltek USB Flash Drive in the folder:**\USB_DRIVER**.

7) Run the ERL-10 program executable on the USB Flash Drive to install the Configuration, Monitor, and Data Viewer applications.

8) After installation has completed, run the Config application to set alarm parameters and click "Write config to ERL-10" to save settings to the ERL-10

9) If viewing alarm status on a PC or Laptop, run the Status Monitor software to view active alarms/all clear status.

Unless changed, once the ERL-10 is powered up, it goes into Survey Mode for a default time of 20 minutes. If no lightning activity is detected, then the All Clear status light will illuminate and normal operation of the device will begin.

Chapter

2
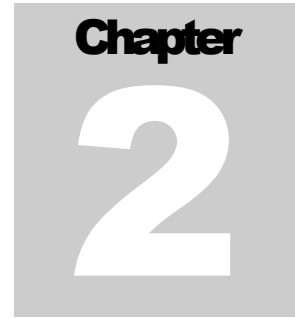
Software

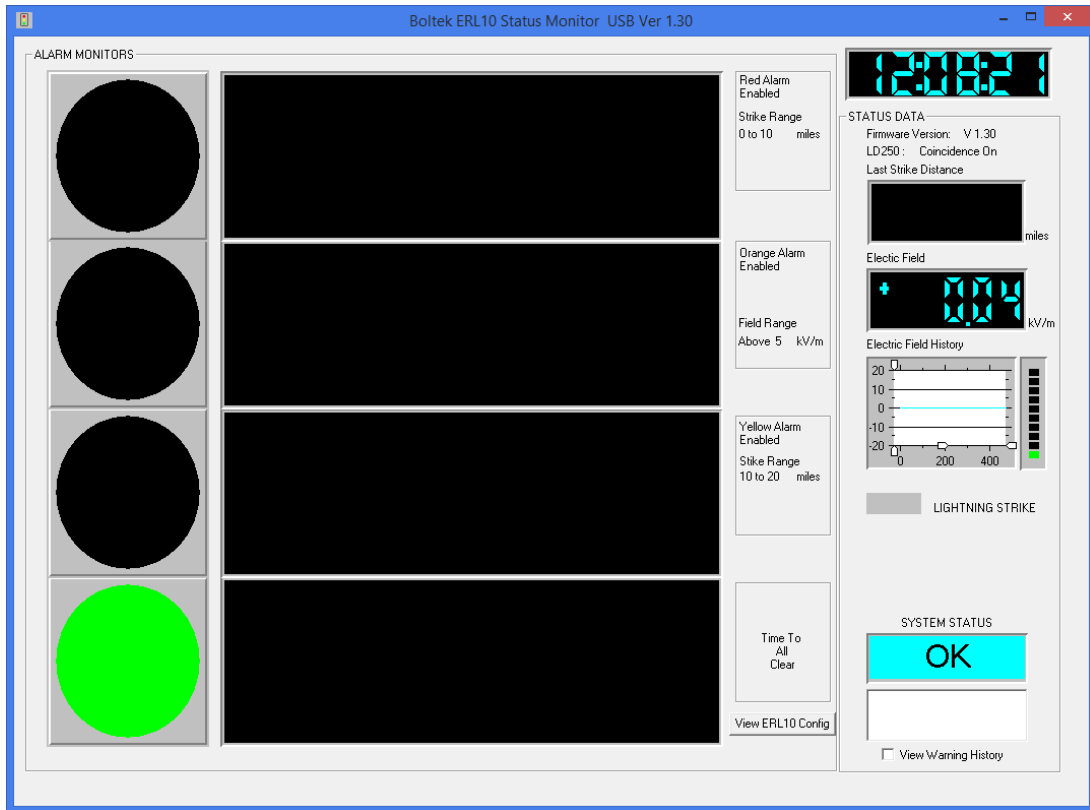## ERL-10 display software installation

Figure 1: ERL-10 Status Monitor Display – All Clear state

Insert the provided Boltek USB Flash Drive into an available USB port. If the setup program does not run automatically, you can start it from the Windows **Run** command window and browse the USB drive for the **ERL10_V130_Install.exe** file (may vary if version number is different) and click open to start installation.

The software installation package installs three programs that work specifically with the ERL-10:

❖ **ERL10 Config** – Configures all of the alarm parameters along with enabling/disabling Coincidence mode, and relay switch states.

❖ **ERL10 Status Monitor** – Displays field reading, last strike distance, alarm status and configuration. A USB and RS485 connection version are both installed for convenience.

❖ **Event Viewer** – Opens archived daily data files created automatically from the Status Monitor software to view and analyze historical alarm and lightning activity.

ERL-10 USB driver installation

1) Plug the square end of the USB cable into the EFA-20, and the other end of the cable into an available USB port on a Laptop or PC.
2) Windows should automatically install the driver if there is an internet connection.

If the "Found New Hardware Wizard" appeared in step 1 or there is no active internet connection:

a) Click Cancel if Found New Hardware Wizard window pops up.
b) Insert EFM-100 Software USB Flash Drive and Open Computer (or My Computer) and go into USB Flash Drive. Open *USB_DRIVER* folder and run *ERL10_USB_Driver_Install.exe*
c) Click Yes (or Continue) if Allow Changes to computer message pops up.
d) When Driver Setup window appears, click Next
e) Browse for a different installation folder or leave default folder then click Install
f) Setup will extract some files then click Next when USB Driver Installer window appears.
g) Read End User Agreement then select "I accept this EULA" and click Next
h) After the two drivers (BOLTEK CDM Driver Package & FTDI CDM Driver Package) have been successfully installed, click Finish

Click Close on Driver setup window, and installation is complete.

ERL-10 Alarm Configuration

After the hardware, drivers and software are setup and installed, the ERL-10 alarm parameters can be configured with the ERL10 Config software. The ERL-10 needs to be connected to the PC/Laptop with the USB cable in order to modify the alarm configuration.

If you see these message windows pop up when starting the Configuration Utility, click the OK button then click the Yes button.
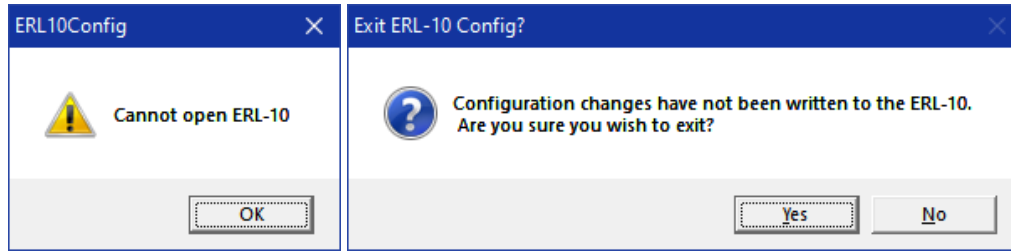
Check the top of the ERL-10 relay module and verify that the power LED is on and the USB cable is properly connected.

To verify connectivity, confirm the correct firmware version (**1**), data scrolling in the USB Live Com Update Window (**2**) and if there are any faults (**3**). See figure below for example.
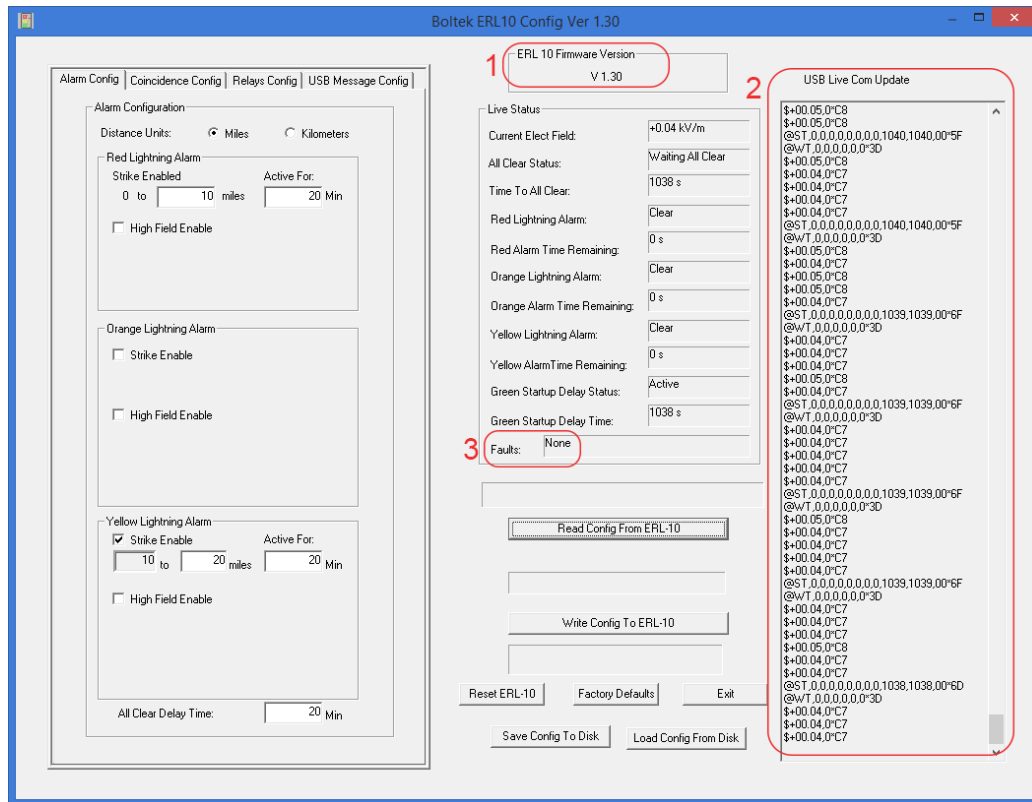

Figure 2: ERL10 Config Utility Window

Alarm Config tab settings

Distance Units
- Select Miles or Kilometers by clicking on the corresponding radio button

Red Lightning Alarm
- The Red strike alarm is always active and cannot be disabled.
- The *Strike Enable* distance box cannot be set to the same or exceed an Orange or Yellow enabled strike alarm distance. The set distance cannot exceed 20 miles/32km using just the EFM-100 sensor or 40 miles/64km with coincidence mode enabled.
- The *Active For* box sets the duration that the Red alarm will remain active when a strike is detected within the set distance range. This value can be set between 1 and 60 minutes.
- The *High Field Enable* box enables/disables a Red High Field alarm.
    - The *Above* box is used to set the desired magnitude of the electrical field to activate the alarm and represents the same positive and negative field levels. This value cannot be the same or less than an active orange or yellow high field alarm.
    - The *Delay On* time is the length of time the set electric field magnitude must remain above before the alarm is activated. If the electric field magnitude drops below the set point before the delay expires, the delay timer will be reset. This value can be set between 1 and 600 seconds.
    - The *Active For* box sets the duration that the Red alarm will remain active when this high field alarm is activated. This value can be set between 1 and 60 minutes.

Orange Lightning Alarm
- The Orange strike alarm can be enabled or disabled.
- The *Strike Enable* distance box cannot be set to the same or lower distance than the Red strike alarm. The set distance cannot exceed 20 miles/32km using just the EFM-100 sensor or 40 miles/64km with coincidence mode enabled.
- The *Active For* box sets the duration that the Orange alarm will remain active when a strike is detected within the set distance range. This value can be set between 1 and 60 minutes.
- The *High Field Enable* box enables/disables an Orange High Field alarm.
    - The *Above* box is used to set the desired magnitude of the electrical field to activate the alarm and represents the same positive and negative field levels. This value cannot be the same or lower than the active Yellow high field alarm level. It also cannot be set to the same level or higher than the Red high field alarm if enabled.
    - The *Delay On* time is the length of time the set electric field magnitude must remain above before the alarm is activated. If the electric field magnitude drops below the set point before the delay expires, the delay timer will be reset. This value can be set between 1 and 600 seconds.
    - The *Active For* box sets the duration that the Red alarm will remain active when this high field alarm is activated. This value can be set between 1 and 60 minutes.

Yellow Lightning Alarm
- The Yellow strike alarm can be enabled or disabled.
- The *Strike Enable* distance box cannot be set to the same or lower distance than the Red (or Orange if enabled) strike alarm. The set distance cannot exceed 40 miles or 64km.
- The *Active For* box sets the duration that the Yellow alarm will remain active when a strike is detected within the set distance range. The set distance cannot exceed 20 miles/32km using just the EFM-100 sensor or 40 miles/64km with coincidence mode enabled.
- The *High Field Enable* box enables/disables a Yellow High Field alarm.
  - The *Above* box is used to set the desired magnitude of the electrical field to activate the alarm and represents the same positive and negative field levels. This value cannot be higher than an active Red or Orange high field alarm level.
  - The *Delay On* time is the length of time the set electric field magnitude must remain above before the alarm is activated. If the electric field magnitude drops below the set point before the delay expires, the delay timer will be reset. This value can be set between 1 and 600 seconds.
  - The *Active For* box sets the duration that the Yellow alarm will remain active when this high field alarm is activated. This value can be set between 1 and 60 minutes.

All Clear Delay Time
- This timer represents the length of time to wait for no alarm activity until the Green All Clear status is enabled. If a strike or high field alarm triggers before this expires, the timer will reset. This value can be set between 1 and 60 minutes.

Coincidence Config Tab

This tab allows the user to enable or disable the coincidence mode feature of the ERL-10 when using both EFM-100 and LD-250 sensors.

Select **LD250 Enable** if the LD-250 lightning detector is connected to the ERL-10's RS232 connector. De-select (default) if no LD-250 is connected to the ERL-10. The Fault LED will illuminate if this option is enabled and the LD-250 lightning detector unit is powered off or not connected.

Relays Config Tab

This tab allows the user to program the normal state of the output relay switches for the Red Alarm Relay, Orange Alarm Relay, Yellow Alarm Relay, and Green All Clear Relay. The default setting is Normally Open for all relays. The switch states can be configured based on how the user hardware connected to the terminal block operates.

USB Message Config Tab

This tab displays what messages are transmitted from the ERL-10, these settings can't be modified

Configuration Buttons

The configuration buttons allow the user to send and read configurations to and from the ERL-10

Read Config From ERL-10
Displays last saved configuration parameters of the ERL-10. A message will appear above this button if any configuration changes have been made.

Write Config To ERL-10
Uploads and saves the parameters that are displayed in the configuration software to the ERL-10.

Reset ERL-10
Clicking this button will clear any active alarms and reset the power on the ERL-10.

Factory Defaults
This button will reconfigure the ERL-10 to its default parameters. If there are any active alarms, they will remain on after clicking this button.

Save Config To Disk

This button saves the current configuration parameters to a data file on the PC or Laptop. This is useful when running multiple sites. Once saved, the file can then be emailed or saved on a flash drive or disk to be loaded on another ERL-10. You can also save multiple files when testing for different parameters.

Load Config From Disk

This is used for loading previously saved configuration files. There are eight pre-configured files that come with the ERL-10 software package for convenience:

- 2AlarmStrikeAndFieldWithCoincidence.cfg
- 2AlarmStrikeAndFieldWithNoCoincidence.cfg
- 2AlarmStrikeWithCoincidence.cfg
- 2AlarmStrikeWithNoCoincidence.cfg
- 3AlarmStrikeAndFieldWithCoincidence.cfg
- 3AlarmStrikeAndFieldWithNoCoincidence.cfg
- 3AlarmStrikeWithCoincidence.cfg
- 3AlarmStrikeWithNoCoincidence.cfg

Exit
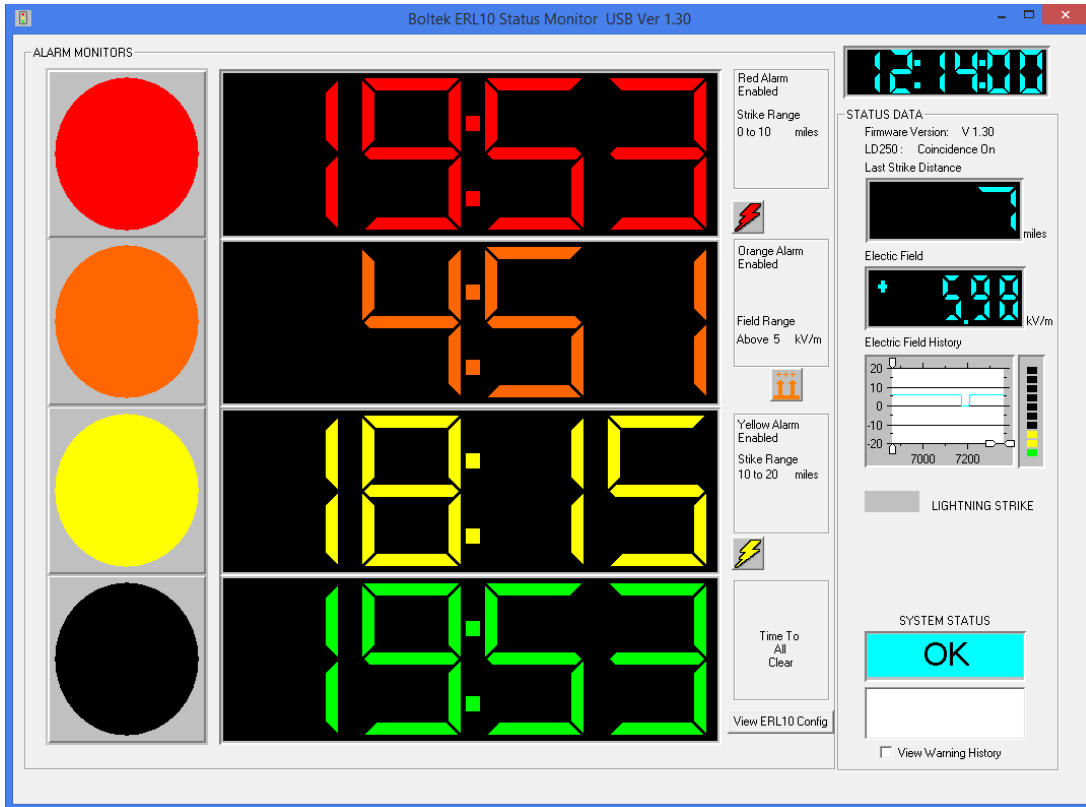
Closes the ERL-10 Config program.

ERL-10 Status Monitor

Figure 3: ERL-10 Status Monitor Display - Active Alarms State

Alarm Monitors
Displays the alarms that are enabled on the ERL-10 as well as any active countdown timers and their respective parameters.

View ERL10 Config
Displays all of the current configuration status of the ERL-10. This display is read only and parameters cannot be changed in this window.

Status Data
Displays ERL-10 firmware version of the ERL-10, coincidence mode on or off along with the last strike distance detected and current electric field levels. There are slider bars on the Electric Field History window that can be used to zoom in and out of the graph. The Lightning Strike box will flash the corresponding alarm color when a strike is detected within each set distance parameters. System Status box will display OK if everything is running properly, or it will display Fault if there is a communications error or other fault with the ERL-10.

View Warning History
Displays a timestamped historical display of the current day's relay activity. Activity is only recorded while the Status Monitor software is running.
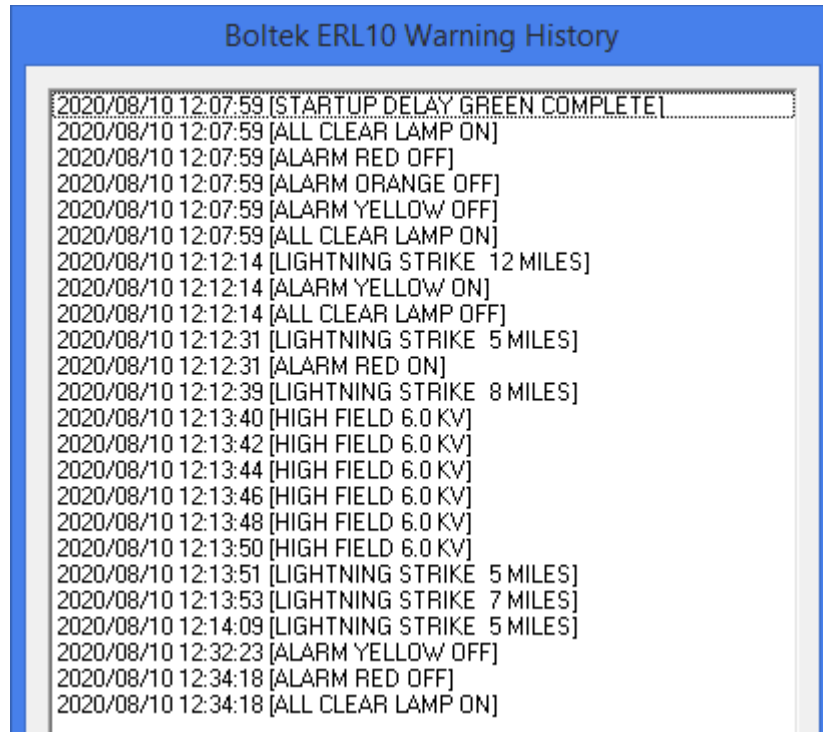

Figure 4: Warning History Log
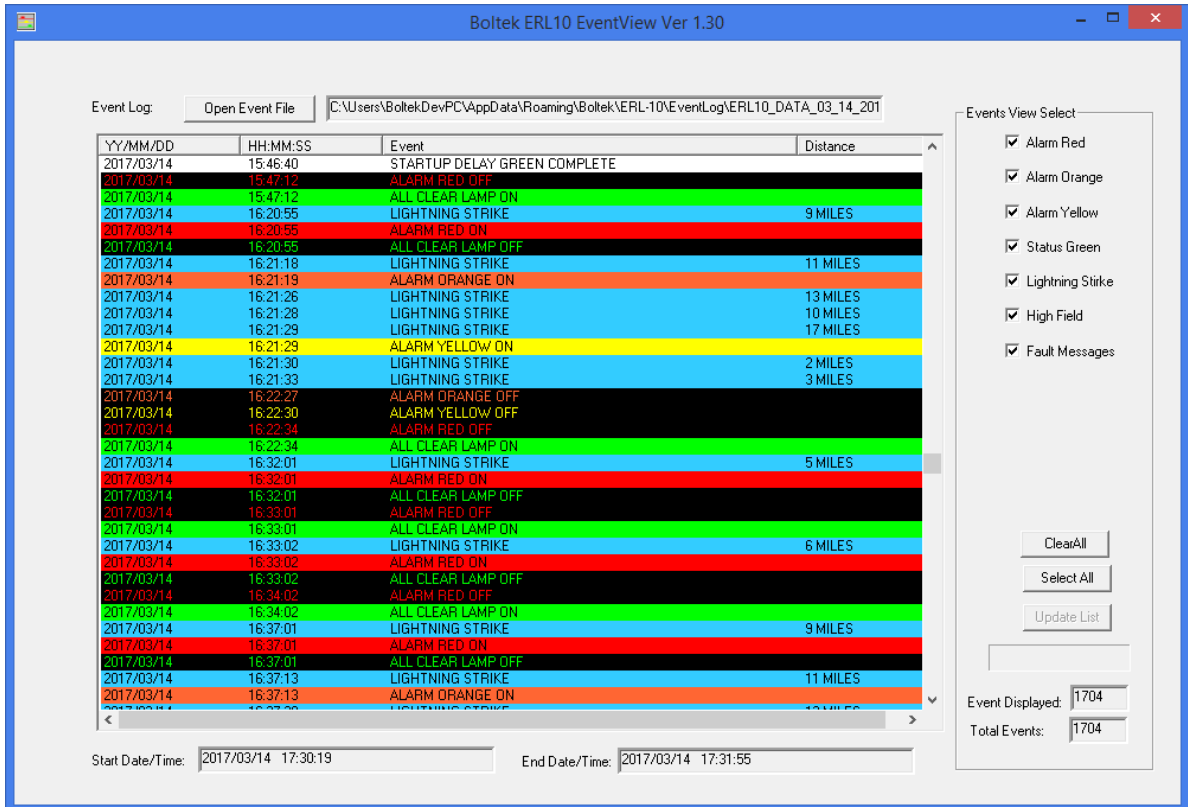
ERL-10 Event Viewer

Figure 5: Historical Event Viewer

The event viewer is used to display historical alarm and lightning strike activity. A daily data file is automatically created and updated by the ERL10 Status Monitor program while it is running. The ERL-10 Output Relay Module does not store data and historical activity cannot be retrieved if the software is not running.

Open Event File

Click this button to open an historical data file. Select the preferred file to view activity for that day. A window with a graph will pop up
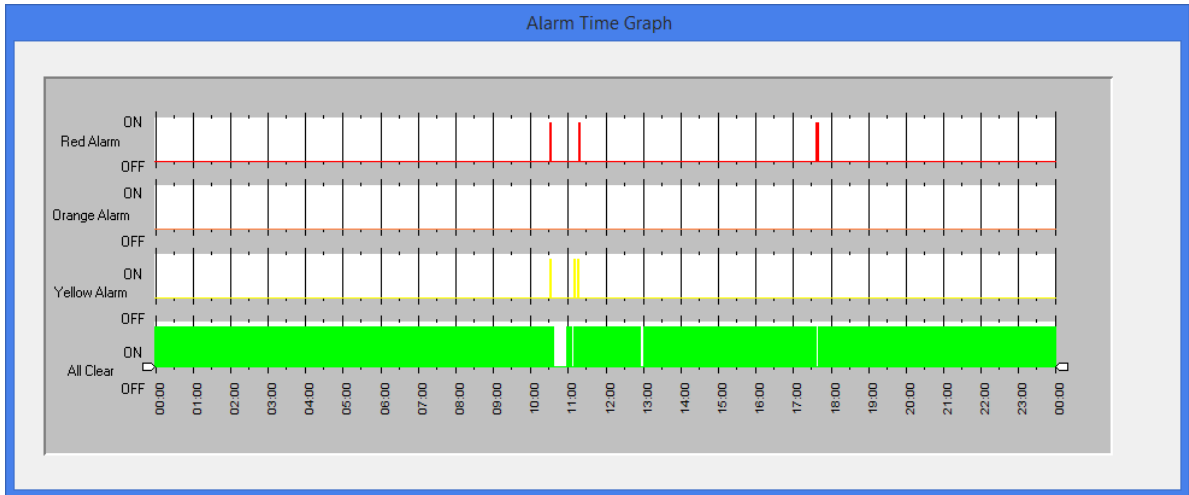

Figure 6: Alarm Time Graph

Zoom handles are located at the bottom of the graph to expand a time frame of interest for an easier view when looking at the relay state changes.
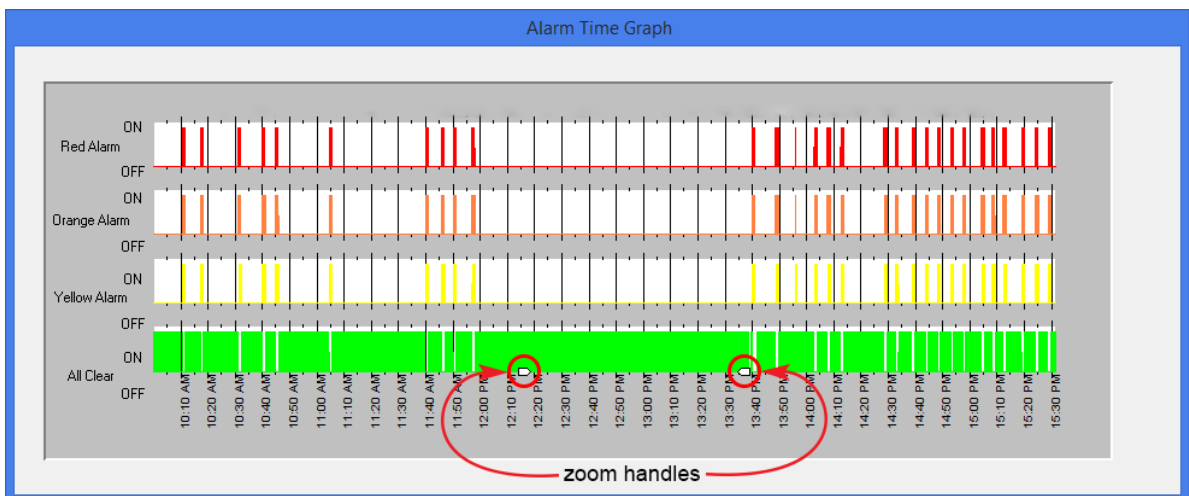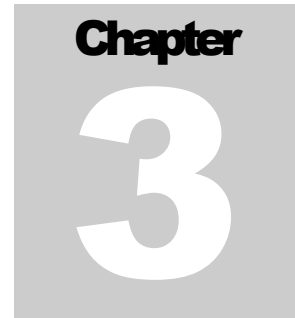

Figure 7: Alarm Time Graph Zoomed In

Chapter

3

Operation

Operation Modes

The ERL-10 can be configured to activate up to three alarm levels, with either a single sensor (EFM-100) or two sensors (EFM-100 & LD-250). It can also be used as a stand-alone device, with external devices connected to the relay contacts, or connected to a PC/Laptop. Alarm status is always shown with the LED's on the top of the ERL-10 and can also been seen with the ERL-10 status monitor software when connected to a PC/Laptop through USB or RS485 connection.

Coincidence Mode
This mode will receive data from both the EFM-100 and LD-250 to virtually eliminate any false strikes that may occur with precipitation noise or objects that could interfere with the normal operation of the EFM-100. Coincidence mode is only applicable within the EFM-100 detection range (0-20 miles/0-32km). Lightning strike detection can be extended further than the EFM-100 range in this mode, in which case would only be detected by the LD-250 and could be subject to false strikes. High electrical field alarms can also be set which are measured by the incoming EFM-100 data.

Single Sensor Mode (Non Coincidence)
This mode will receive data from only the EFM-100 and will activate high field alarms or lightning strike alarms set up to 24 miles (38km) away. Single sensor mode is also liable to display false strikes from heavy precipitation or other objects that could interfere with the normal operation of the detector.

Input Connection Modes

RS485 Input Mode
The factory default input mode of the ERL-10 is setup to receive data from the RS485 input on the terminal block from the EFA-21 power/data module. The diagram below indicates the jumper settings for this input method. If switching from the fiber optic input, access the circuit board by removing the four case screws and cover. The jumpers shown below indicate the correct position.
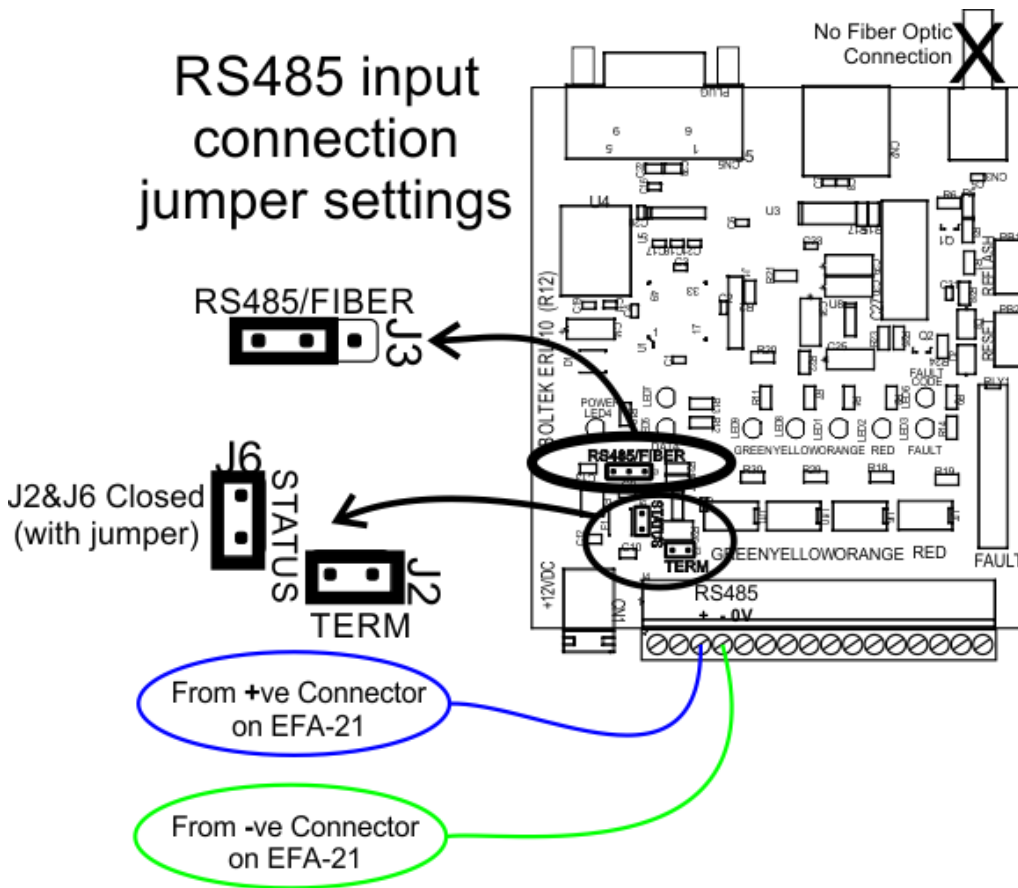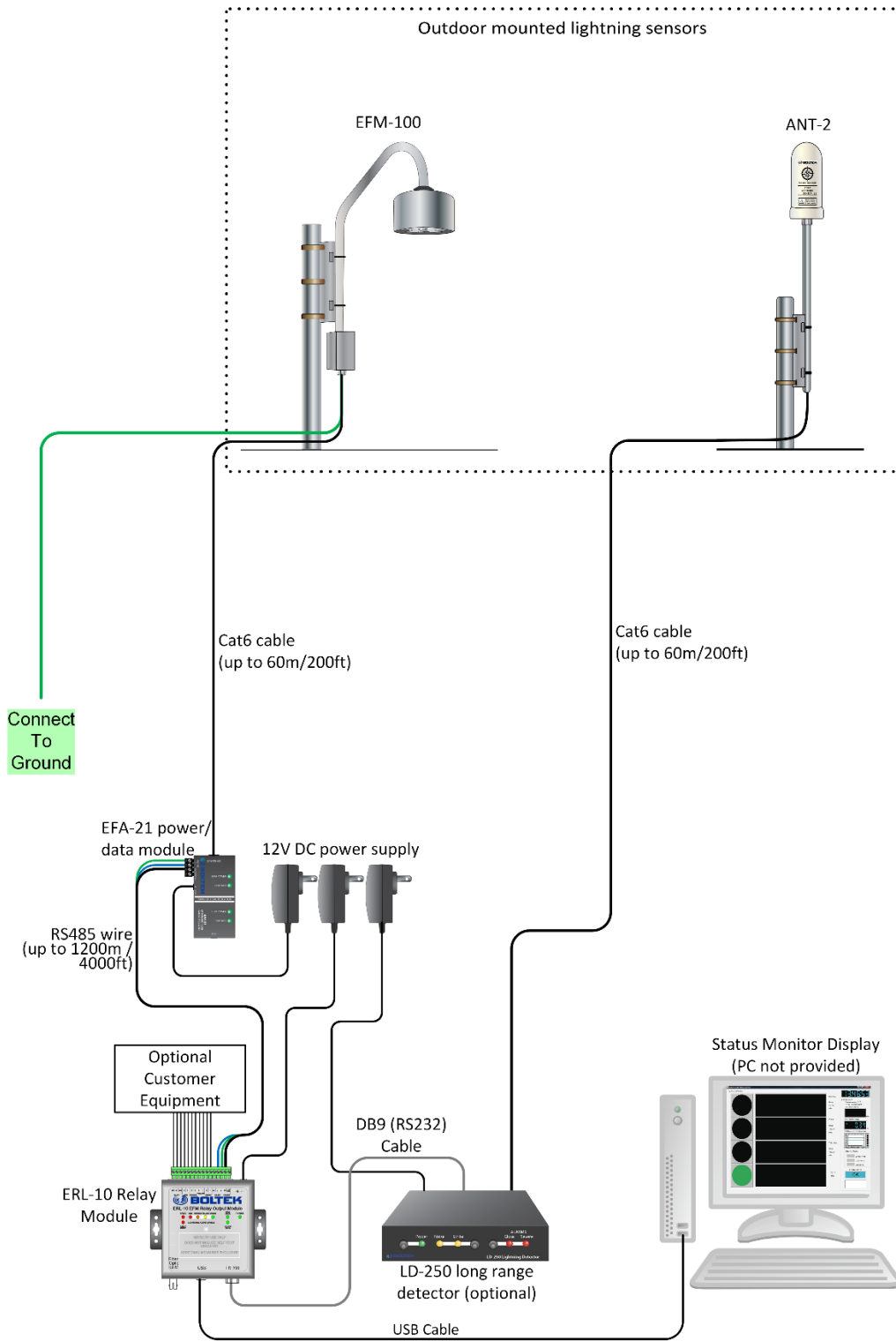

Figure 8: RS485 Input Jumper Settings

Note: the RS485 communication on the ERL-10 is one-way and can only receive data (default) or transmit data depending on the jumper settings.

See connection diagram on next page for the default setup using this input method.

Figure 9: ERL-10 Kit-2 with RS-485 Input.

Fiber Optic Input Mode
The ERL-10 can also accept incoming data from the fiber optic cable connected to the EFM-100. When configured in this mode, output data from the ERL-10 can be accessed from either connecting a USB cable from the ERL-10 to a PC/Laptop. Another method is by connecting a Serial server (data over network/internet) or USB-RS485 adapter to the RS485 output on the terminal block if the PC/Laptop is a long distance away from the ERL-10. Data can also be accessed when both output connections are used at the same time.
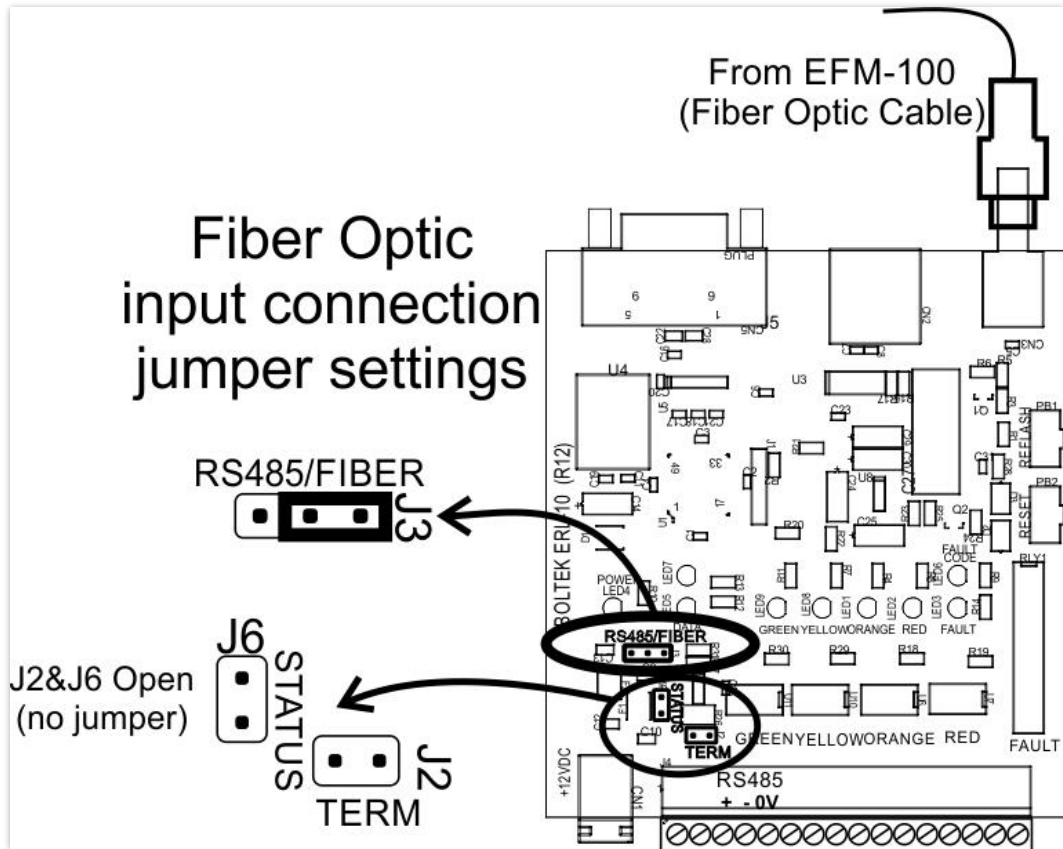
Figure 10: Fiber Optic Input Jumper Settings

See connection diagram on next page for a hardware installation overview of this input method.
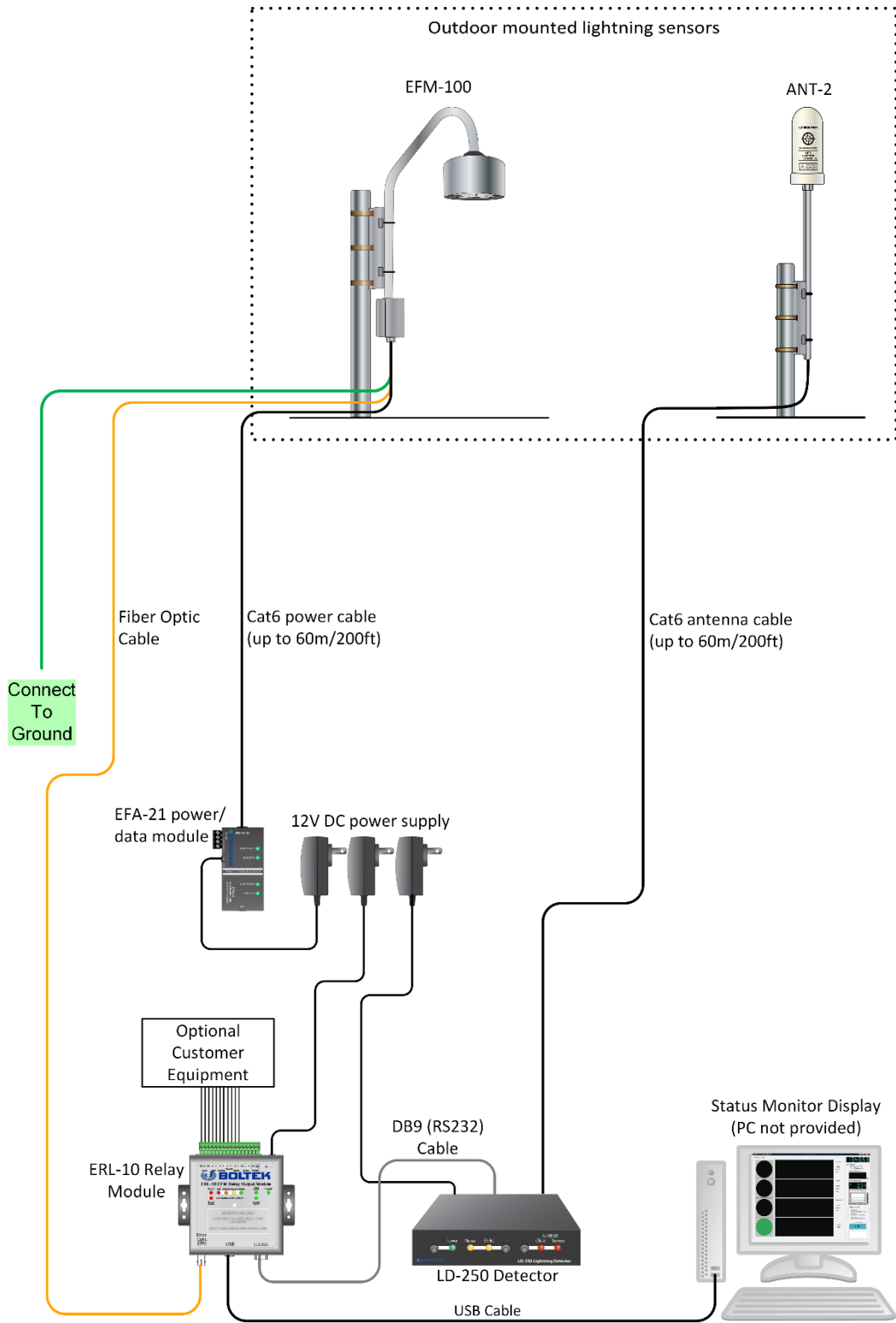
Figure 11: ERL-10 Kit-2 with Fiber Optic Input.

EFM-100
Outdoor mounted
lightning sensor

Cat6 power cable
(up to 60m/200ft)

Connect
To
Ground

12V DC power supply

EFA-21 power/
data module

Optional
Customer
Equipment

Status Monitor Display
(PC not provided)

RS485-USB
Adapter

RS485 wire
(up to 1200m / 4000ft)

ERL-10 Relay
Module

USB Cable

Fiber optic cable
(up to 2000m/6500ft)

Figure 12: ERL-10 Kit-1 with Fiber Optic Input/RS485 Output.

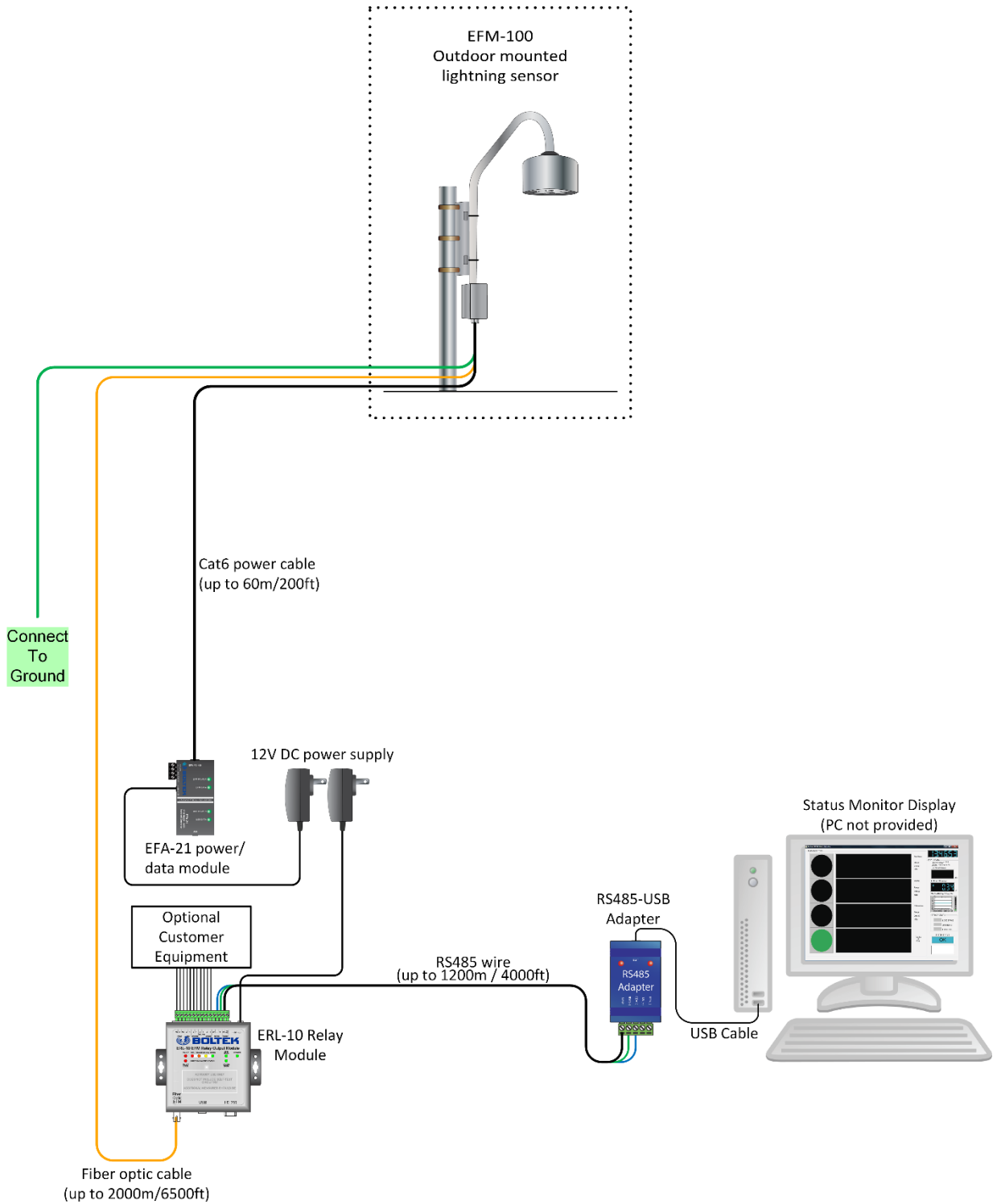## Connectors

Fiber Optic
Connect the fiber optic cable from the EFM-100 to this connector.

USB
Connect the provided USB cable here and attach other end to an available USB port on a Laptop or PC. This connection is needed to display lightning strikes and alarm status on the ERL-10 software.

LD-250
Connect the DB9 cable from the LD-250 RS232 port to the ERL-10 RS232 port. This is needed when coincidence mode is enabled.

Power
Connect supplied 12V DC power supply to this connector

Terminal Block
Use this to connect external devices such as a lighting system or audible devices.
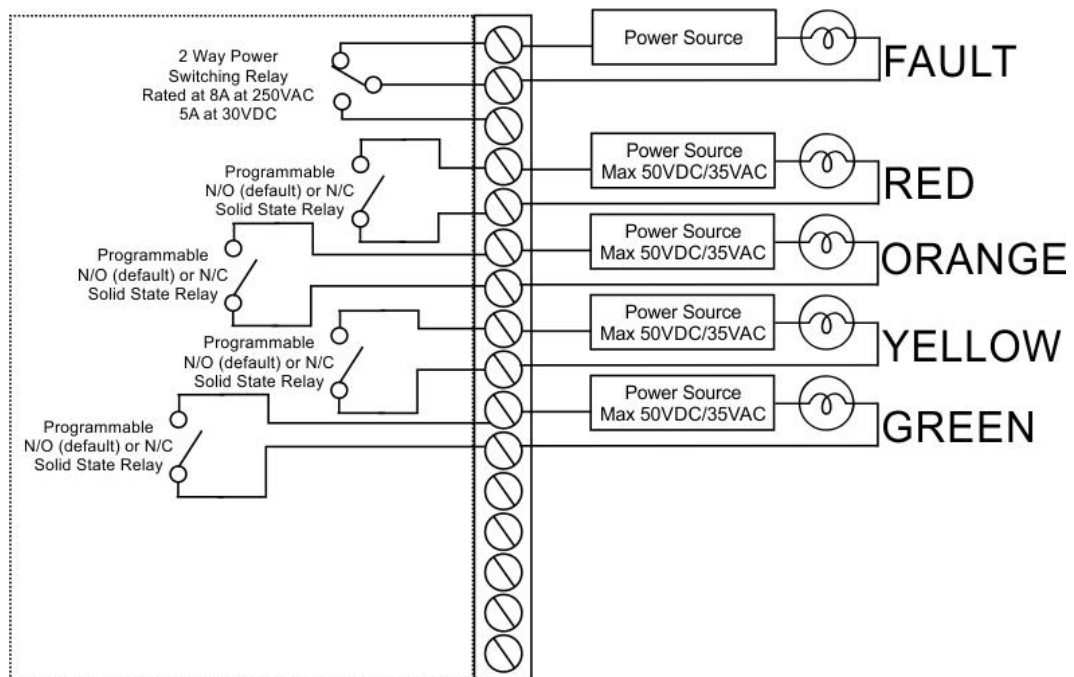See figure below for an example of a wiring diagram.
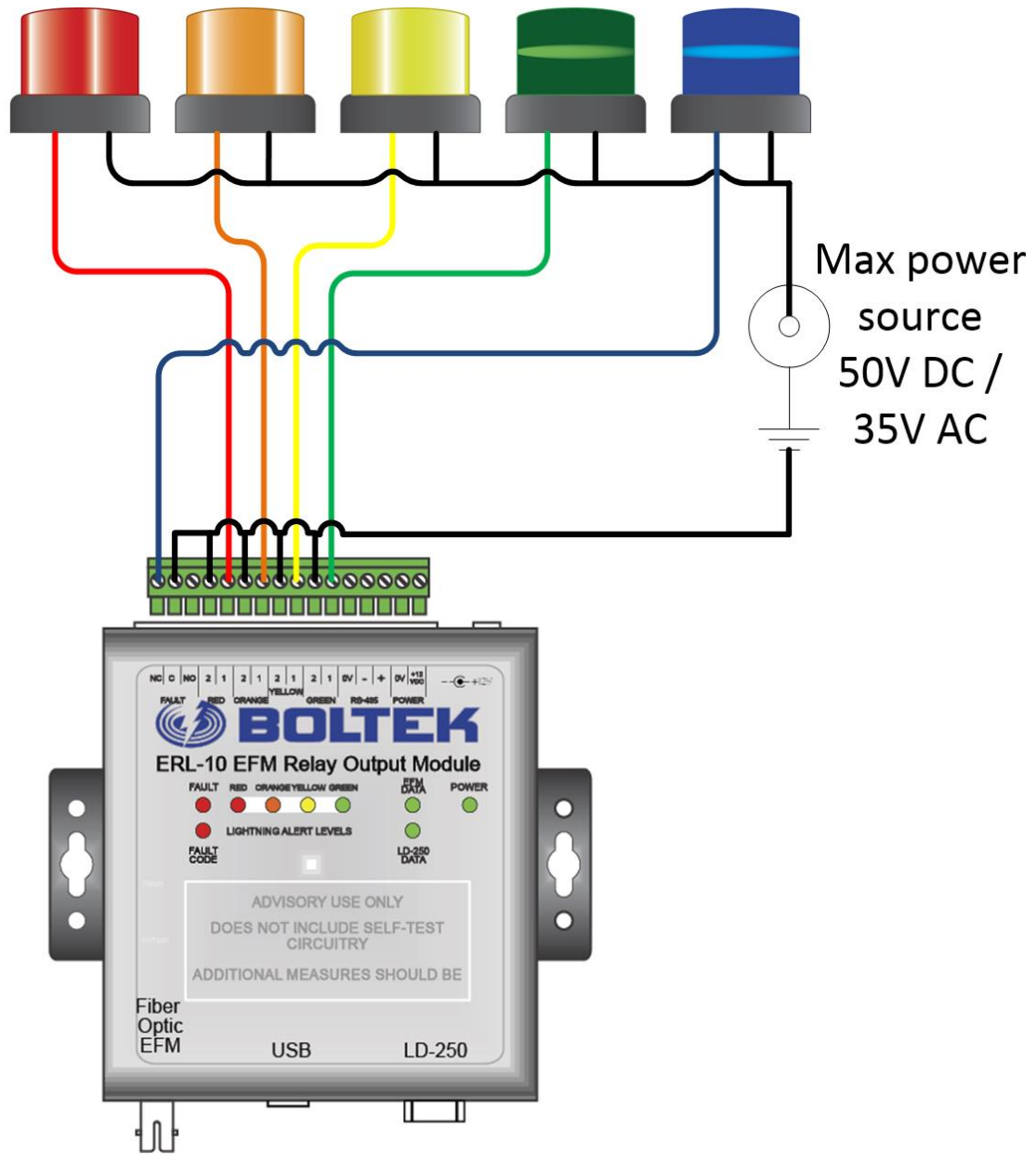

Figure 13: Relay Outputs

Figure 14: Relay connection example.
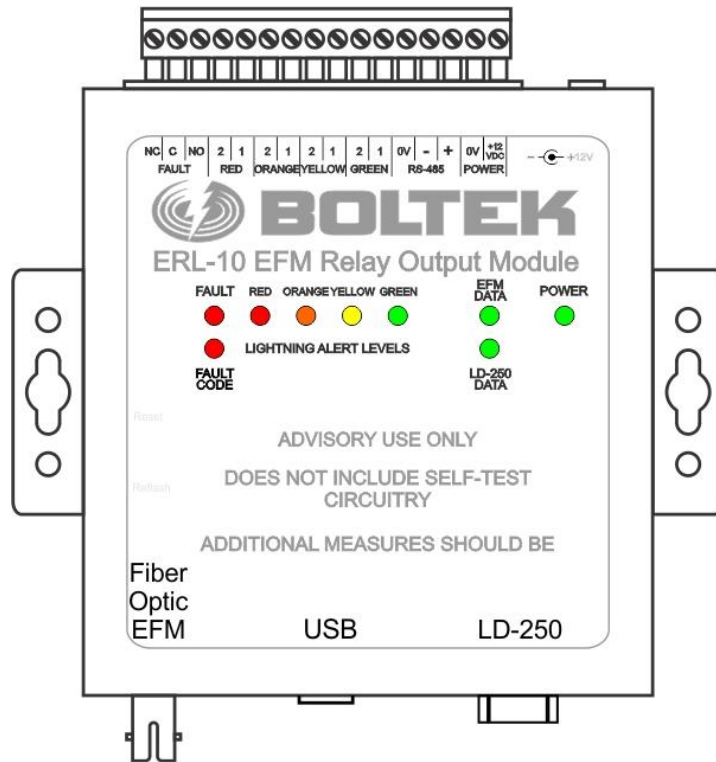
Chapter

4

Overview

Front Panel LEDs

Figure 15: ERL-10 Top View

POWER LED

The power LED illuminates when the 12V power is present on the ERL-10. If the LED does not light when the unit is plugged into a power source check your 12V power supply or outlet.

EFM DATA LED

The EFM DATA LED flashes when data is transmitting from the EFM-100 to the ERL-10 either through the fiber optic cable, or the RS485 connection (if using the EFM-100-RS485 model).

LD-250 DATA LED

The LD-250 DATA LED will flash as data transmits through the RS232 serial port when the optional LD-250 is connected and coincidence mode is enabled in the configuration software.

GREEN LED

The GREEN LED will stay illuminated when there is no lightning or high electrical field activity detected. The GREEN LED will turn off as soon as an active alarm is triggered in any of the ranges.

YELLOW LED

The YELLOW LED will illuminate when a strike or high field alarm is detected based on the settings entered in the configuration software until no further activity is detected within the set active time.

ORANGE LED

The ORANGE LED will illuminate when a strike or high field alarm is detected based on the settings entered in the configuration software until no further activity is detected within the set active time.

RED LED

The RED LED will illuminate when a strike or high field alarm is detected based on settings entered in the configuration software until no further activity is detected within the set active time. The Red lightning alarm is always on for strike activity and cannon be disabled, however the Red high field alarm can be enabled or disabled in the configuration software.

FAULT LED
The FAULT LED will illuminate and stay on when a problem with the ERL-10 is detected.

FAULT CODE LED
The FAULT CODE LED will flash a number of times then pause and repeat if there is a failure. Refer to fault code table below for description.

Fault Description	# of blinks
EFM-100 NO DATA	1
LD-250 NO DATA	2
EFM-100 ROTOR FAULT	3
EFM-100 SELF TEST ERROR	4
EFM-100 SYNTAX ERROR	5
EFM-100 CHECKSUM ERROR	6
EFM-100 UNKNOWN ERROR	7
ERL-10 RESET FAULT	8
ERL-10 CONFIGURATION ERROR	9
LD-250 SYNTAX ERROR	10
LD-250 CHECKSUM ERROR	11
LD-250 UNKNOWN ERROR	12

Table 1: Fault Codes

USB Messages and Commands

USB/RS485 Messages

Electric Field Sentence
Transmitted by the EFM-100 twenty times per second over fiber optic or RS485 (as configured by the jumpers in the ERL-10)

$<p><ee.ee>,<f>*<cs><cr><lf>

       `<p>`   - polarity of electric field + or -
       `<ee.ee>` - electric field level 00.00 to 20.00
       `<f>`   - fault 0: Normal, 1: Rotor Fault
       `<cs>`   - checksum in hex 00 to FF
       `<cr>`   - carriage return
       `<lf>`   - line feed
Example:
$+00.33,0*C9   Represents 0.33kV/m with no faults.

High Field Sentence
Transmitted when an active high field alarm level is detected longer than set delay time.

@HF, $<p><ee.ee>*<cs><cr><lf>

       `<p>`   - polarity of electric field + or -
       `<ee.ee>` - electric field level 00.00 to 20.00
       `<cs>`   - checksum in hex 00 to FF
       `<cr>`   - carriage return
       `<lf>`   - line feed
Example:
@HF,-05.00*C9   Represents a high field alarm was triggered at -5kV/m.

Strike Sentence
Transmitted when a strike is detected within a set distance range.
@LI,<ddd>,<uuu>*<cs><cr><lf>

> <ddd> - strike distance 0-300 miles
> <uuu> - unit of distance (Km, Miles)
> <cs> - checksum in hex
> <cr> - carriage return
> <lf> - line feed

Example:
@LI,06,Miles*B7   Represents a strike that was detected 6 miles away.

Status Sentence

@ST,<r>,<o>,<y>,<g>,<ac>,<tr>,<to>,<ty>,<tg>,<tac>,<fc>*<cs><cr><lf>

<r> - red alarm status (0: not active, 1: active)
<o> - orange alarm status (0: not active, 1: active)
<y> - yellow alarm status (0: not active, 1: active)
<g> - startup green delay status (0: not active, 1: active)
<ac> - all clear green status (0: not active, 1: active)
<tr> - red alarm timer count 0-3600 seconds
<to> - orange alarm timer count 0-3600 seconds
<ty> - yellow alarm timer count 0-3600 seconds
<tg> - startup green delay timer count 0-3600 seconds
<tac> - all clear green timer count 0-3600 seconds
<fc> - fault code (see fault code data output table for description)
<cs> - checksum in hex
<cr> - carriage return
<lf> - line feed

Example:
@ST,1,0,1,0,0,86,0,87,81,87,00*2C
        Represents an active red and yellow alarm status with red alarm to clear in 86 seconds, yellow alarm to clear in 87 seconds, green status startup delay of 81 seconds remaining, 87 seconds remaining until all clear status, and no fault codes present.

Note: If there is more than one fault, the sum of the codes will be transmitted

Fault Description	Output String Code (HEX)
EFM-100 NO DATA	01
LD-250 NO DATA	02
EFM-100 ROTOR FAULT	04
EFM-100 SELF TEST ERROR	08
EFM-100 SYNTAX ERROR	10
EFM-100 CHECKSUM ERROR	20
EFM-100 UNKNOWN ERROR	40
ERL-10 RESET FAULT	80
ERL-10 CONFIGURATION ERROR	100
LD-250 SYNTAX ERROR	200
LD-250 CHECKSUM ERROR	400
LD-250 UNKNOWN ERROR	800

Table 2: Fault Code Data Output.

ERL-10 Connections

The following diagrams display the multiple ways the ERL-10 can be wired together with the detectors and computer displays when the default setup is not preferred or possible. **Note:** Some diagrams are displayed with and without the optional LD-250 long range detector however all connections will work the same with or without the LD-250.
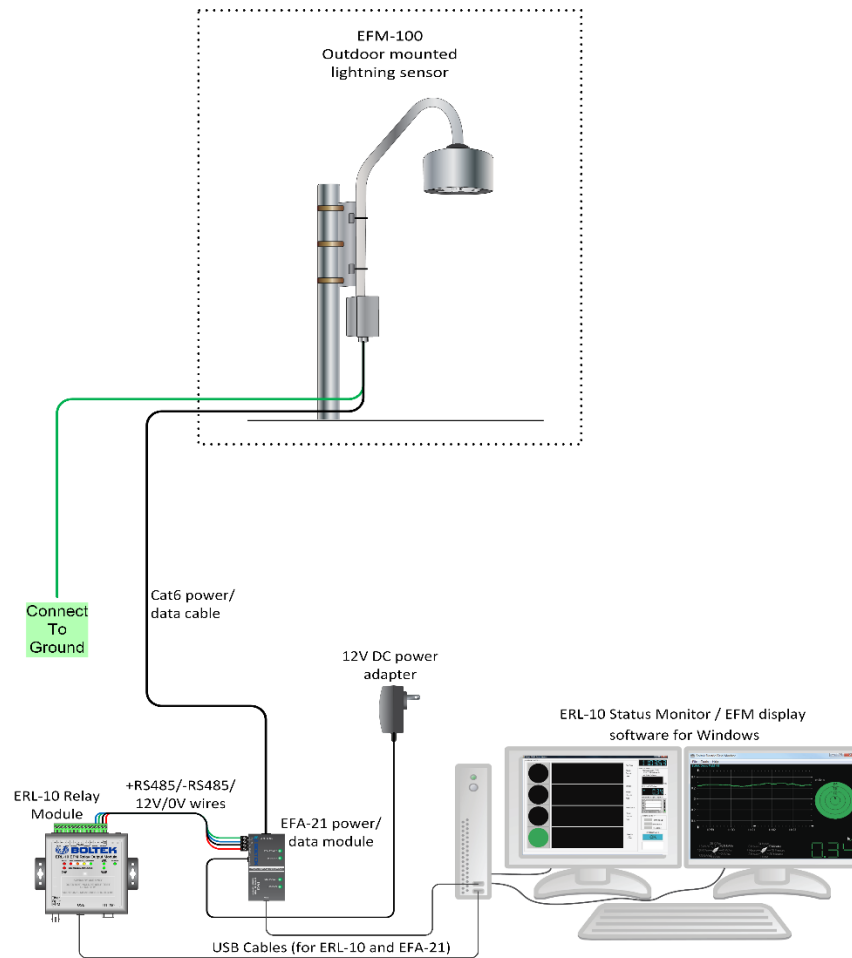

Figure 16: ERL-10 Kit-1 alternate connection.

Remote data access can be achieved with the fiber optic input and serial server connected to the RS485 output on the ERL-10 terminal block. Up to four connections can be made with a single BGW312 serial server, multiple serial servers can be used if more connections are needed.
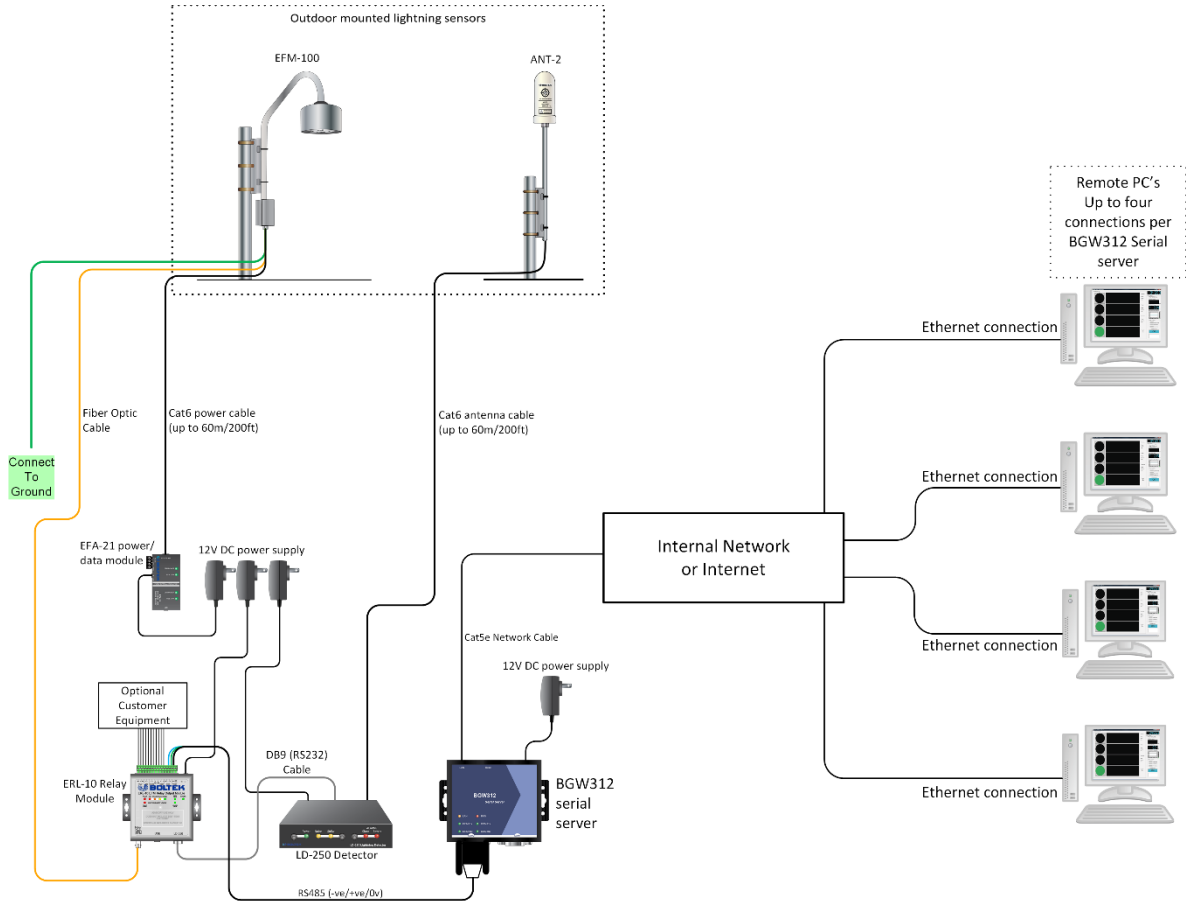

Figure 17: ERL-10 Kit-2 Fiber Optic Input with Serial Server.

The NexStorm long range display software can be run at the same time using a DB9 Y splitter with one end connected to the ERL-10 and the other end connected to a USB-RS232 adapter plugged into an available USB port.
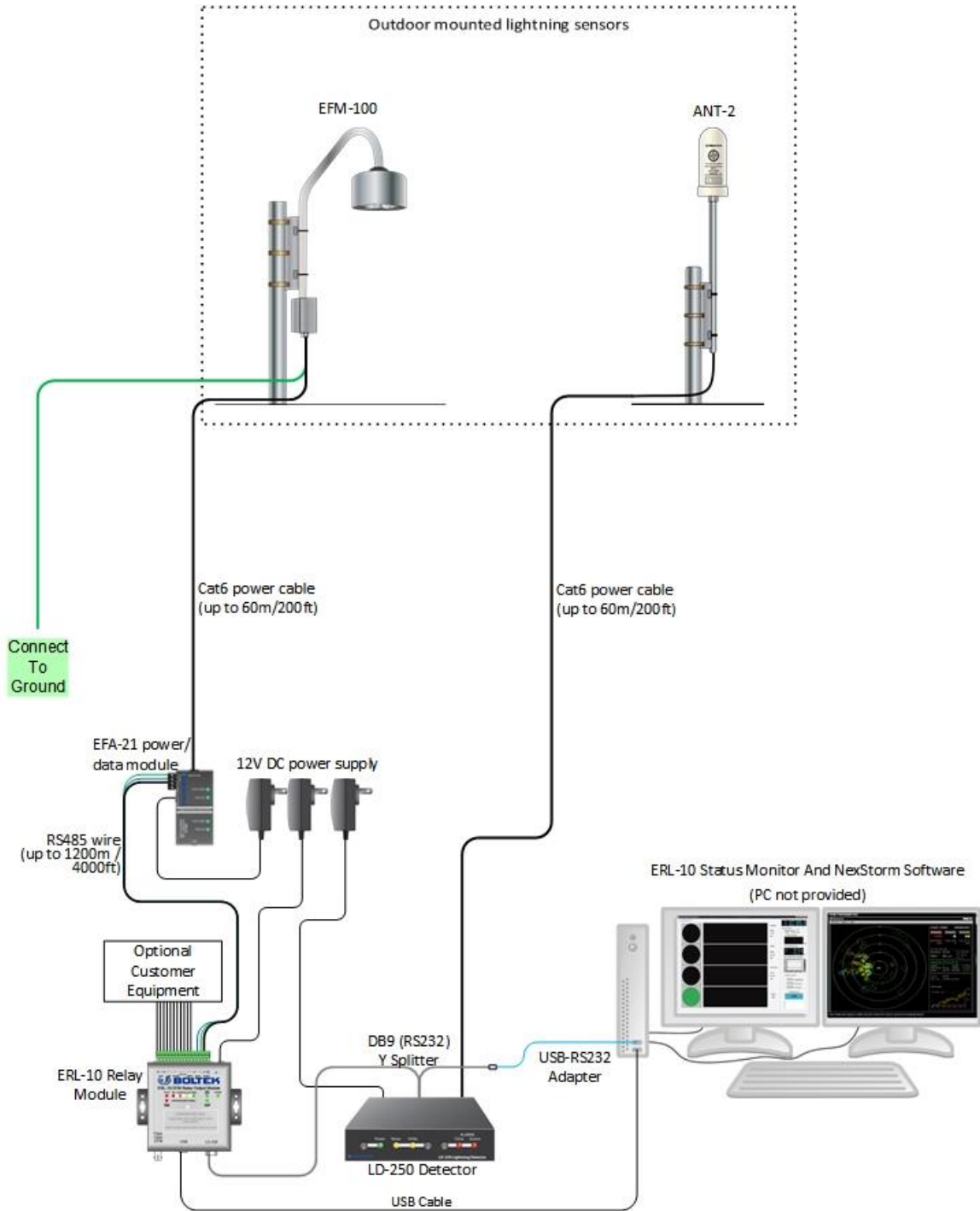

Figure 18: ERL-10 Kit-2 with Status Monitor and NexStorm Display.

Appendix

C

Specifications

ERL-10 Hardware Specifications

Power Supply Voltage: 11.8-18 VDC, 0.8 Amp

AC Adapter: 120 VAC, 60Hz (220VAC 50 HZ in Europe)

USB Port: 1.0/2.0 Compatibility

RS485 Data Format: ASCII, NMEA style data sentences

ERL-10 Dimensions: 5.0" x 6.5" x 1.5" (127 x 165 x 38 mm)

ERL-10 Weight: 0.8 lbs (375 gm)

Shipping Weight: 5.6 lbs (2.6kg)

Shipping Dimensions: 9.0" x 11.5" x 6.5" (229 x 292 x 165 mm)

Software Specifications

Operating Systems: Windows 10,8, 7 (32/64 bit),Vista (32/64 bit), 2000, XP, 98, 95

Alarm Distance Ranges (non Coincidence mode):   0 to 20 mi (0 to 32 km)

Alarm Distance Ranges (Coincidence mode):   0 to 40 mi (0 to 64 km)

High Field Alarm Ranges: 0 to 20 kV/m