

Cellular DR Overview

Elliott Mills & Yash Patel



Powering Business Worldwide

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Speaker Introductions



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Why Demand Response (DR)?

Reduce power supply costs

- Turn customer loads off during monthly billing peaks (co-ops and munis)
- Avoid building/buying generation capacity (IOUs and G&Ts)

Reduce Transmission and Distribution costs

- Controlling peak demands may also reduce a utility's transmission costs
- Delaying construction costs for a few years can pay for the project

Frequency and Voltage support

- Line Under Frequency (LUF) & Line Under Voltage (LUV)
- Dispatch control

Risk Management

- It can be less expensive to turn off the load than to serve it
- Increased PV and EV penetration will create more DR opportunity

DR Customer Load Examples:

Residential

AC (air conditioning)
Water Heating
Space Heating
ETS (electric thermal storage)
Dual Fuel

Agricultural

Irrigation
Grain Drying

Commercial and Industrial

Customer Owned Generation
Curtailed/Interruptible Loads
Crypto mining farms

And more....

DR Building Blocks



Controller (DRMS)

Yukon DR



Communications

Many choices;
some one-way
some two-way

Cellular Cat-M1



Switches

LCRs options for:

Comms

of Relays

Voltage

Form Factors

DR Communications Options

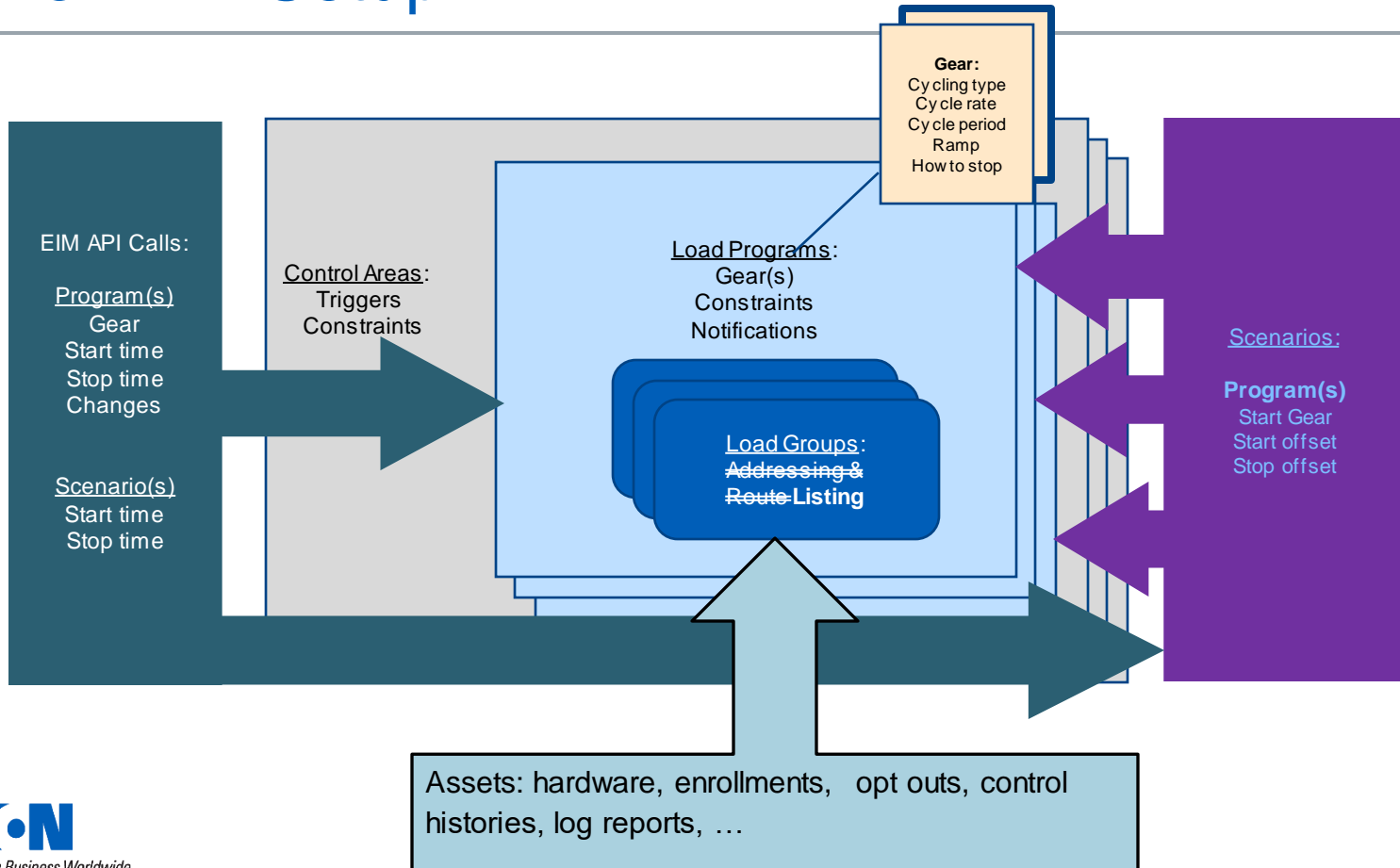
One-Way

Ripple (really old)
PLC (old but still used)
FM Side Band (Dead)
VHF (EOL soon, still big)
900 MHz paging (EOL soon, still big)

Two-Way

1. ZigBee (limited 2-Way)
2. RFN (902-928 MHz)
3. Itron (SSN) mesh
4. **Cellular Cat-M1**
 - **Optional Wi-Fi**






Yukon DR Setup



What's Different about Cellular (Load Groups)?

- Load Groups = List of Switches
 - No ExpressCom Addressing
 - Route indicated in the Load Group type
- Load Group Parameters:
 - Specify Relay Number
- Old Priority moved to Criticality at the Load Program level
 - If you ask a relay to do two different things, which is more important? Which do you really want it to do?

Eaton DR Switch Menu

Comms	Old Big Box (up to 3 relays)	Small Box (one 5 amp relay)	New Big Box (up to 3 or 4 relays)	Retrofit Board (up to 3 relays)	Disconnect Meter
PLC	LCR3000 LCR3100 LCR3102				
VHF	LCR4500	LCR4700	LCR4600	LCR4601	
900 MHZ Paging	LCR5000	LCR5200	LCR5600	LCR5001 LCR5601	
RFN		LCR6200RFN	LCR6600RFN LCR6700RFN	LCR6701RFN	
Itron SSN		LCR6200S LCR6201S	LCR6600S	LCR6601S	
ZigBee		LCR6200Z	Big Box LCR6200Z	LCR6201Z	
Cellular Cat-M1 w/ Opt Wi-Fi		LCR6200C LCR7200C LCR7201C board only	LCR6600C LCR7600C/w	LCR7601C/W	

EOL
2024

One-way

Two-way

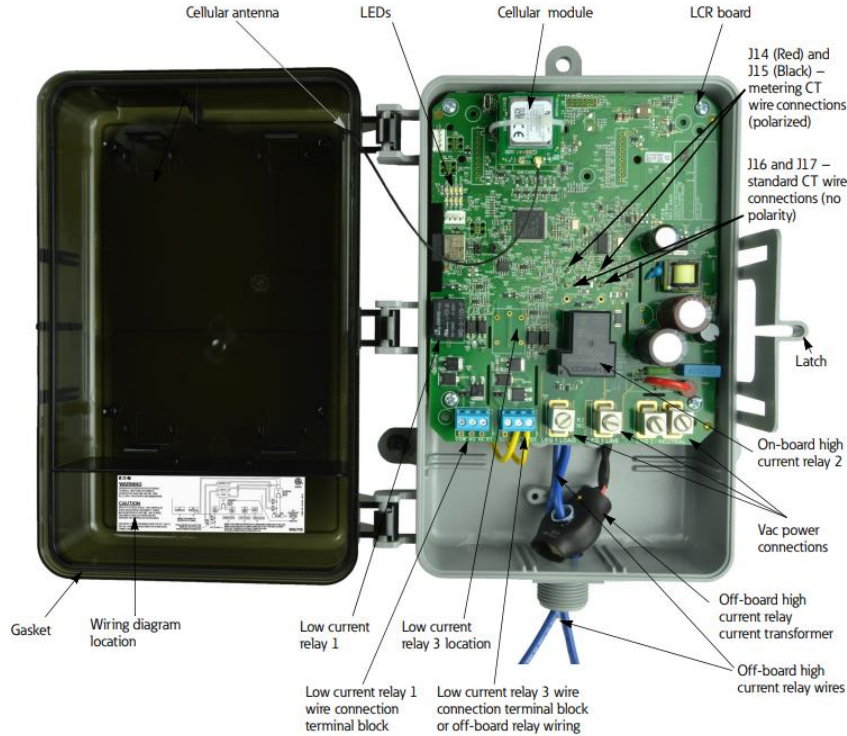


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LCR7600 / LCR7601

Figure 1. LCR 7600 switch with cellular radio (1 low current relay, 1 on-board high current relay, 1 off-board high current relay)



Cellular Coms...

Yukon

Yukon responsible for initiating actions.

- *Control
- *Read Data
- *Ping

Control
Read
Data

Utility Firewall

Ping (Is the cellular connection there?)

BrightLayer Eaton

Control

Data
Storage

BrightLayer
Utility
Layer
EAS

Cat-M1
Cellular

Control >>>>

<<Data

<<Ping>>

LCR
7600

LCRs responsible for maintaining cellular connection and reporting data hourly plus on control event

Control >>>>

<<Data

<<Ping>>

LCR
7200



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Two Way Data

Standard (RFN) Data

- Broadcast performance
- Hourly runtimes of controlled loads
- Hourly shed times
- ExpressCom addressing

Additional Cellular Data

- Event Participation
- Optional Metering(kWh)
- Voltage
- Frequency
- Powering down

Checking Cellular programs

How can we check if it is working?

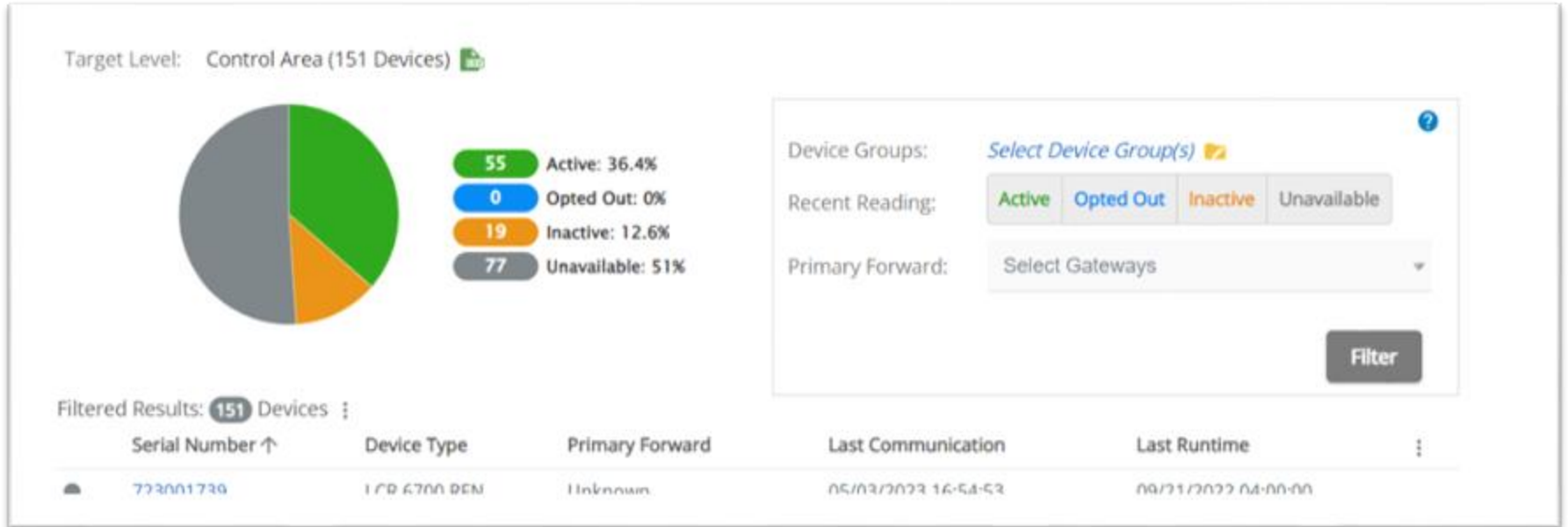
- Groups of switches
 - Asset Availability / Cellular Coms Data Collection Widget
 - Event Participation Summary
 - Control Audit Report (time sensitive)
- Individual switches
 - Ping
 - Runtime & Shed time
 - Enrollment

What do we do if it is not working?

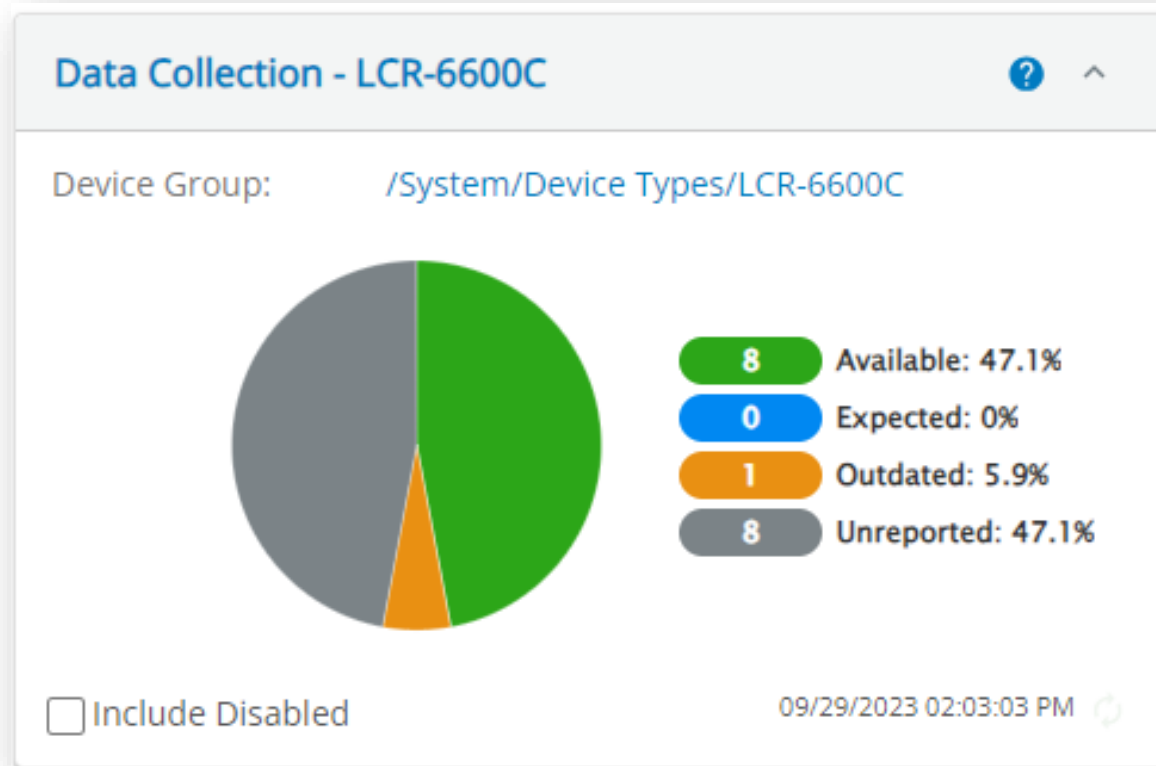
- It depends on what isn't working

Troubleshooting Tools - Software

Asset Availability (Before the Event)



Cellular Data Collection Widget



Event Participation Summary (During the Event)

★ Event Participation Summary

Date Range: 03/28/2023 to 04/28/2023 Update

Events Found: 31 Download

External Event Id	Program	Group	Start Time	Device Status
211	Rogers Device Heat Pump Strip Heat	Roger Device Heat Pump Strip Heat	04/25/2023 11:54:23 CDT	
210	Yash Device AC	Yash Device AC	04/25/2023 11:53:57 CDT	
209	Yash Device WH	Yash Device WH	04/25/2023 11:53:34 CDT	
208	Yash Device AC	Yash Device AC	04/21/2023 14:15:20 CDT	
207	Rogers Device Heat Pump Strip Heat	Roger Device Heat Pump Strip Heat	04/21/2023 14:13:56 CDT	
206	Yash Device WH	Yash Device WH	04/21/2023 14:10:12 CDT	
205	Yash Device WH	Yash Device WH	04/21/2023 13:53:54 CDT	
204	Yash Device AC	Yash Device AC	04/21/2023 13:40:26 CDT	
203	Yash Device WH	Yash Device WH	04/21/2023 13:40:02 CDT	
202	Rogers Device Heat Pump Strip Heat	Roger Device Heat Pump Strip Heat	04/21/2023 13:36:39 CDT	
201	Yash Device WH	Yash Device WH	04/21/2023 12:59:16 CDT	
200	Yash Device AC	Yash Device AC	04/21/2023 12:59:07 CDT	
199	Rogers Device Heat Pump Strip Heat	Roger Device Heat Pump Strip Heat	04/21/2023 12:58:59 CDT	
198	Yash Device WH	Yash Device WH	04/21/2023 11:37:16 CDT	

Recent Event Participation ×

Confirmed Success
The devices in this category have reported DR message for the event.

Confirmed Success After Retry
The devices in this category have reported DR message for the event after retry.

Failed
The devices in this category have failed to receive the DR message for the event.

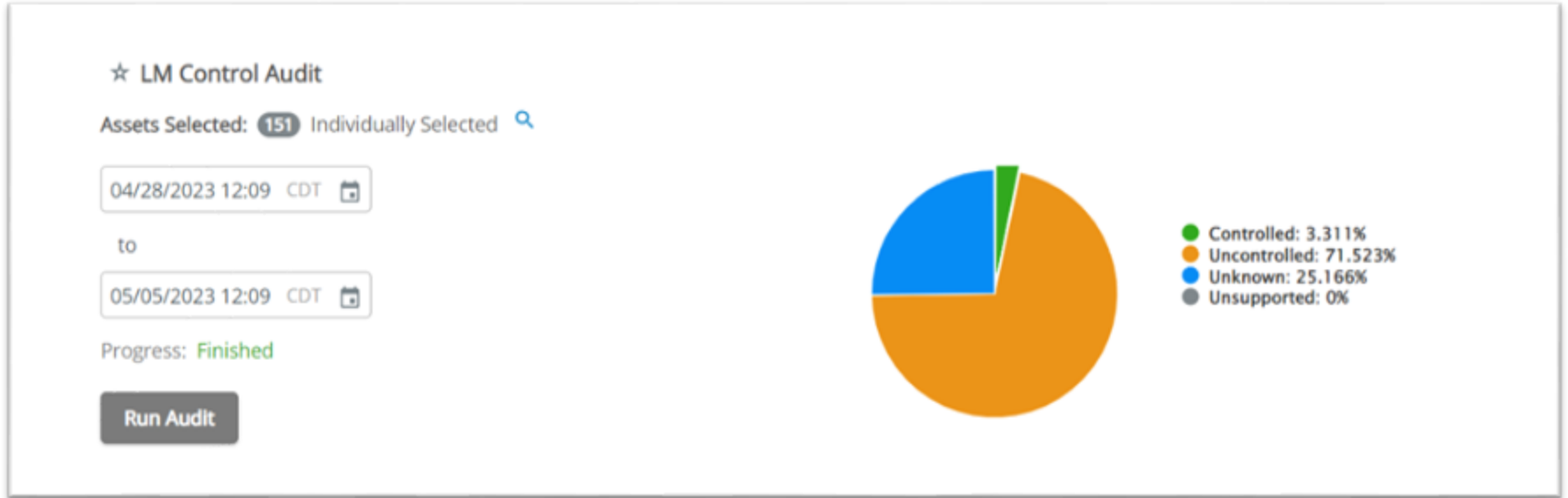
Unreported
The devices in this category have not reported DR message for the event.

4/21/2023 14:10:12

External Event Id	Program	Group	Start Time	Stop Time	Device Name	Account Number	Event Phase	Participation State	Serial Number	OptOut Status	Fail Reason	Retry Time
189	Yash Device AC	Yash Device AC	4/20/2023 7:52	4/20/2023 8:59	7.8331E+13	Yash's Test Devices	Unknown	Unreported	7.8331E+13	NONE	Unable to send device command., id=5534b7eb-9e7b-4700-b637-d3caa8df7832	
189	Yash Device AC	Yash Device AC	4/20/2023 7:52	4/20/2023 8:59	7.1789E+14	Yash's Test Devices	Completed	Confirmed	7.1789E+14	NONE		



Control Audit Report (After the Event)



Accessing Individual LCRs

- Search for an LCR Serial Number, using the Assets Dashboard
- Can also search by Account Number, Street Address, Name (if used in setting up Accounts)

Account Search

- Account Number
- Phone Number
- Last Name
- Serial Number
- Map Number
- Address
- Alt Tracking Number
- Company

Asset Search

Serial No:

Meter No:

Account No:

Home Phone:

Last Name:

Work Order #:

Alt Tracking #:

LCR Point Guide

Home / Accounts / 619 / Hardware / LCR-6200C 717890132210032

★ LCR-6200C 717890132210032 Actions ▾

619
Elliott Mills
619 Cragmoor St
Savanna, IL 61074

ACCOUNT

CONTACTS

METERING

CONTROL HISTORY

ENROLLMENT

OPT OUT

APPLIANCES

HARDWARE

ACCOUNT LOG

Device Info

Switch Type: LCR-6200C
Serial Number: 717890132210032
Device Name: 717890132210032
GUID: aac026bd-d3a4-4b55-b747-460e8046078d
Firmware Version: V0.2.3
IMEI: 864351052890086
ICCID: 8914800007634848200
Label: 717890132210032
Alt Tracking Number:
Voltage:
Field Install Date: 08/02/2023
Field Receive Date:
Field Remove Date:
Notes: aac026bd-d3a4-460e8046078d
Status: Installed
Asset Availability: Inactive

Service And Storage

Service Company: (none)
Warehouse: (none)
Install Notes:

Notes

Note Text (255 characters max) + Create

No notes to display.
All Notes

Edit

Device Readings

Analog

10/03/2023 11:58:00	RSSI	-51 dBm
10/03/2023 11:00:00	Relay 1 Run Time Data Log	0 Minutes
10/03/2023 11:00:00	Relay 1 Shed Time Data Log	0 Minutes

Status

08/02/2023 10:22:11	Relay 1 Shed Status	Inactive
---------------------	---------------------	----------

Show All Refresh

History

DEVICE STATUS | HARDWARE

Event	Username	Time of Event
Installed	elliott	08/02/2023 10:54:28



LCR Point Guide Cont.

Home / Accounts / 619 / Hardware / LCR-6200C717890132210032 / Points

★ Points: LCR-6200C717890132210032

619
Elliott Mills
619 Cragmoor St
Savanna, IL 61074

ACCOUNT

CONTACTS

METERING

CONTROL HISTORY

ENROLLMENT

OPT OUT

APPLIANCES

HARDWARE

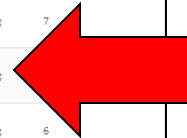
ACCOUNT LOG

Device Points

+ Create

Filter By: Select Point Type(s) **Filter** **Download**

Point Name ↑	Attribute	Value/State	Date/Time	Point Type	Point Offset	
Blink Count	Total Blinks and Outages	15 Counts	08/02/2023 10:22:11	Analog	1	
Comms Loss Count	Comms Loss Count	200 Counts	10/03/2023 11:54:06	Analog	2	
Firmware Update Status	Firmware Update Status	<input type="checkbox"/> Nothing Pending	08/02/2023 10:22:11	Status	1	
Frequency	Frequency	60.042 Hz	10/03/2023 11:58:00	Analog	4	
Relay 1 Activation Status	Relay 1 Activation Status	<input checked="" type="checkbox"/> False	10/03/2023 11:58:00	Status	2	
Relay 1 Cold Load Pickup Time	Relay 1 Cold Load Pickup Time	0.0 Seconds	08/02/2023 10:22:11	Analog	41	
Relay 1 Load State	Relay 1 Load State	<input checked="" type="checkbox"/> Off	10/03/2023 11:58:00	Status	3	
Relay 1 Run Time Data Log	Relay 1 Run Time Data Log	0 Minutes	10/03/2023 11:00:00	Analog	5	
Relay 1 Run Time Data Log 15 Minutes	Relay 1 Run Time Data Log 15 Minutes	0 Minutes	10/03/2023 10:00:00	Analog	7	
Relay 1 Run Time Data Log 30 Minutes	Relay 1 Run Time Data Log 30 Minutes	0 Minutes	10/03/2023 10:00:00	Analog	8	
Relay 1 Run Time Data Log 5 Minutes	Relay 1 Run Time Data Log 5 Minutes	0 Minutes	10/03/2023 10:00:00	Analog	6	
Relay 1 Shed Status	Relay 1 Shed Status	<input checked="" type="checkbox"/> Inactive	08/02/2023 10:22:11	Status	4	
Relay 1 Shed Time Data Log	Relay 1 Shed Time Data Log	0 Minutes	10/03/2023 11:00:00	Analog	9	



Any Timestamp can be clicked to get all archived values for that Point

LCR Point Guide - Trending

Home / Accounts / 619 / Hardware / LCR-6200C 717890132210032 / Points

★ Points: LCR-6200C 717890132210032

619
Elliott Mills
619 Cragmoor St
Savanna, IL 61074

ACCOUNT
CONTACTS
METERING
CONTROL HISTORY
ENROLLMENT
OPT OUT
APPLIANCES
HARDWARE
ACCOUNT LOG

Device Points

Filter By: Select Point

Point Name ↑

Blink Count

Comms Loss Count

Firmware Update Status

Frequency

Relay 1 Activation Status

Relay 1 Cold Load Pickup Time

Relay 1 Load State

Relay 1 Run Time Data Log

Recent Archived Frequency Readings

1 Month [Export] [Refresh]

1 Month Trend for Frequency

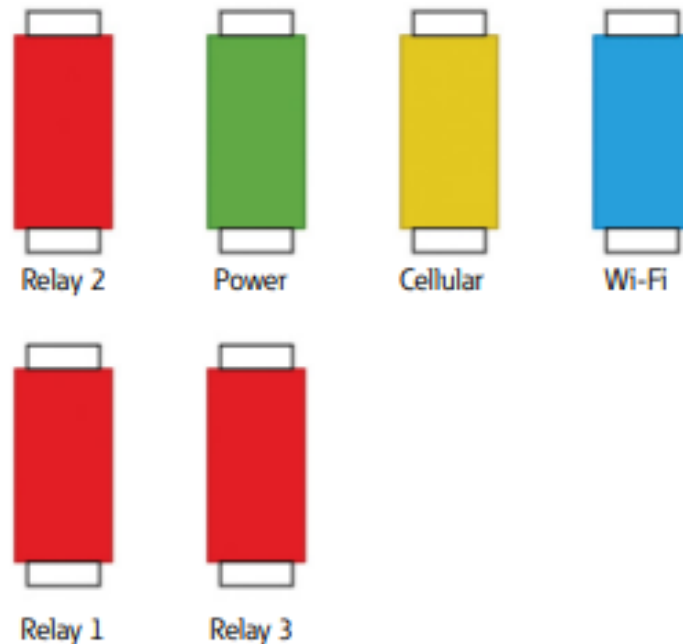
Date	Frequency (Hz)
Sep 4	60
Sep 5	60
Sep 6	60
Sep 7	60
Sep 8	60
Sep 9	60
Sep 10	60
Sep 11	60
Sep 12	60
Sep 13	60
Sep 14	60
Sep 15	60
Sep 16	60
Sep 17	60
Sep 18	60
Sep 19	60
Sep 20	60
Sep 21	60
Sep 22	60
Sep 23	60
Sep 24	60
Sep 25	60
Sep 26	60
Sep 27	60
Sep 28	60
Sep 29	60
Sep 30	60
Oct 1	60
Oct 2	60

Troubleshooting Tools - Hardware

LCR 7600 LED's

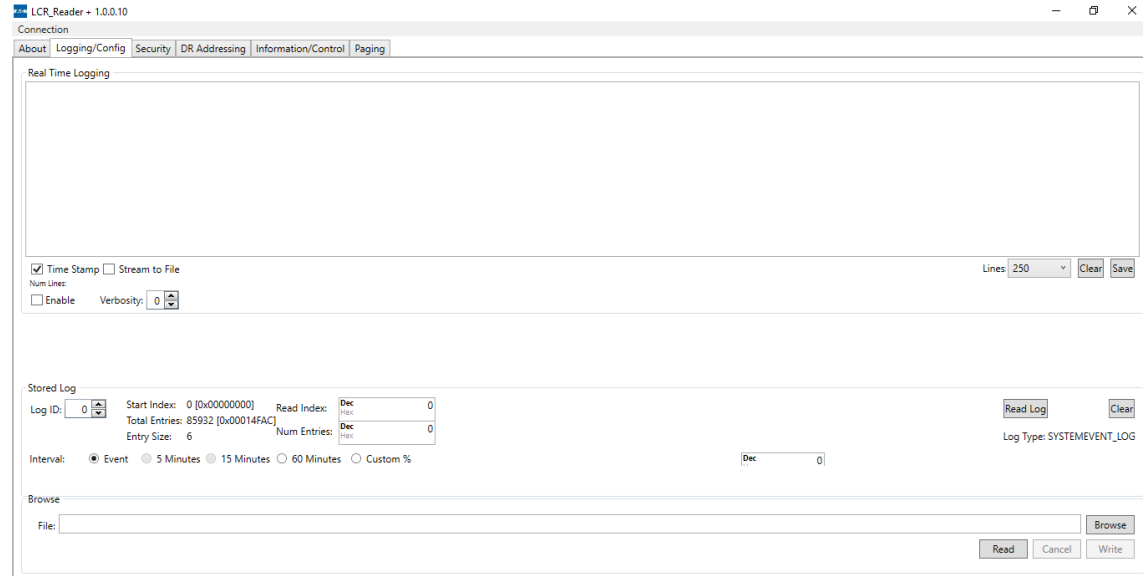
- **Green:** Power light
- **Red** light on, load off
- **Yellow:** Cellular Status
 - Slow blink (1 sec)
 - connecting to cellular
 - Fast blink (1/2 sec)
 - connecting to BrightLayer
 - Solid On -- Connected
- **Blue:** Wi-Fi status

Figure 8. LCR LED layout as viewed through front cover (enclosure door closed)



LCR_Reader?

- Switch troubleshooting
- Different Logs
 - Log 0: Event Log
 - Log 1 and Log 2



Network Runner?



Questions?



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