Lion Power SMS Alerts System

1 Introduction

The Lion Power Alerts system is a web-based infrastructure for supplying alerts and information to owners and maintainers of the Power Hive. These alerts are collected at the site of the occurrence, distributed to listening client back-ends, and processed according to rules set by the client.

For mission-critical alerts that require immediate awareness and action, a SMS-based automated messaging system has been developed to inform personnel of hive events quickly and effectively.

2 Overview

At each hive, the control system is generating alerts from events that occur and pushing them up to the Lion Power server. These alerts are routed to listening Clients that have been authorized to connect with the server.

Within the Client package, users are created and assigned roles to hives of interest. As defined in this document, these roles govern which alerts are forwarded, as well as message structuring around acknowledgement permissions and awareness.

When an alert is received via SMS, the message contains a unique 6-digit numeric code used to identify the alert. If the user has acknowledgement privileges, the message will inform them to reply with that code. This reply will acknowledge the alert has been received and send a notification message containing the name of the ack user and alert code to all personnel subscribed to that hive/level combination.

3 Registration

Users are registered in the Client, supplying contact information for SMS delivery and roles as they pertain to deployed hives. This data allows the linking of alert levels with an affected user and sending appropriate messages to alert properly. For instance, a Technician needs to be able to receive and respond to alerts, while a Manager only needs to be made aware of the issue and who has responded.

3.1 Alert Levels

Based on the severity of the event that generated the alert, it will be classified in a manner that determines delivery and acknowledgement requirements. Below is a table of alert levels that are applied, the intent of the level, and whether the corresponding alert would be delivered over SMS.

Level	Intent	SMS activity
Critical	Must be addressed immediately (system down, etc)	Repeated send every 10 minutes for 1 hour until acknowledged
Error	Should be addressed as soon as possible to prevent system downtime	One-shot message sent
Warning	Should be addressed to maintain ideal operating performance.	If three of the same warning occur within 1 hour of each other, an SMS alert is sent

Table 1 Alert Levels

3.2 Roles

When registering with the Alerts system, roles are used to determine the levels and acknowledgement capability of the user with respect to the hives in the fleet. For instance, a technician will receive SMS alerts for Critical, Error and (escalated) Warnings on hives they are responsible for, while managers will receive a version of the alert for the same levels (without the repeated 'Critical' messages) but will not be provided a means to acknowledge. Roles that can be assigned are listed below.

Role	Description	Levels	Can Ack?
Technician	Service personnel tasked with maintaining Hives	Critical, Error, Warning	Yes
Manager	Managing member responsible for Technician activities	Critical, Error	No
Site Facilities Maintenance	Site facilities person responsible for local processes.	Critical	Yes

Table 2 Alert Roles

3.3 Required Information

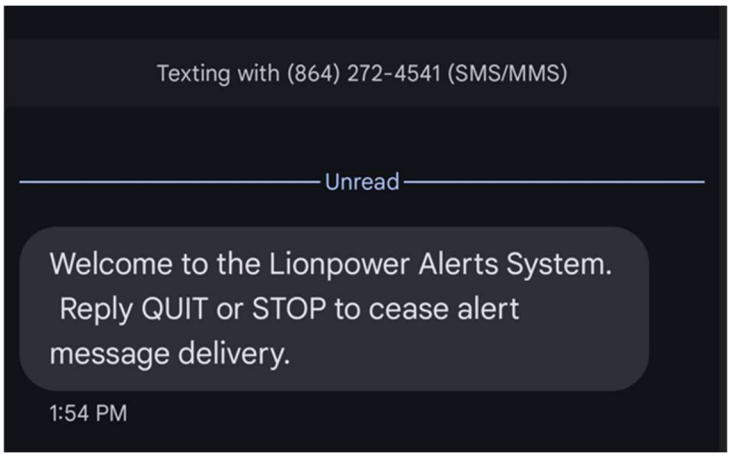
User registration requires the following to enable alert notifications and acknowledgement capabilities over SMS:

1. Name (Last, First)
2. Country Code (+1 for USA)
3. Phone number including regional code (10-digit number including area code for USA)
4. Role/Hive combination
    a. Examples: Technican for PFG Little Rock, Manager at Michelin US1(A)
    b. Users can be assigned different roles for different hives

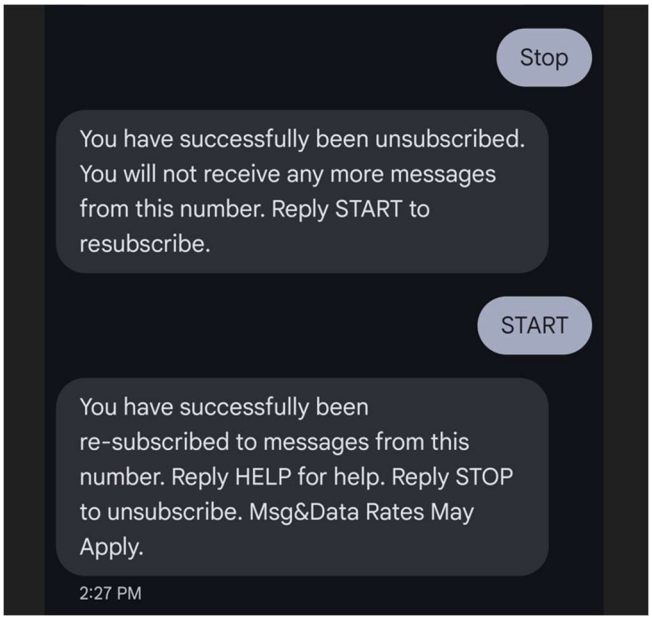
4 SMS Messaging

4.1 Welcome Message and opt-out

After the user is first added to the Client, a Welcome Message is sent to confirm registration. The user will receive the message as shown below:

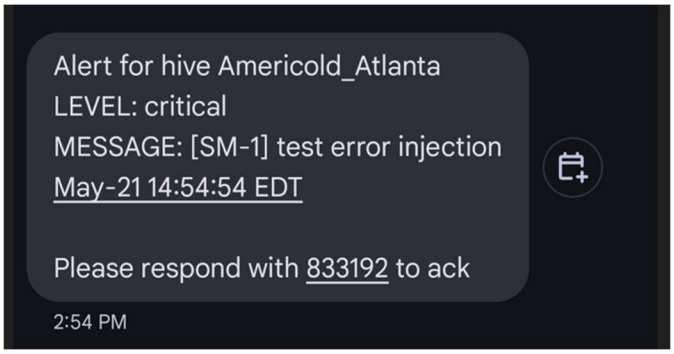


As noted, replying with QUIT or STOP will disable the user from receiving alerts. While not recommended, this is an FCC requirement for automated SMS services and cannot be blocked. If any of these are entered, a response will be generated notifying of opt-out and replying START will resume SMS messages:

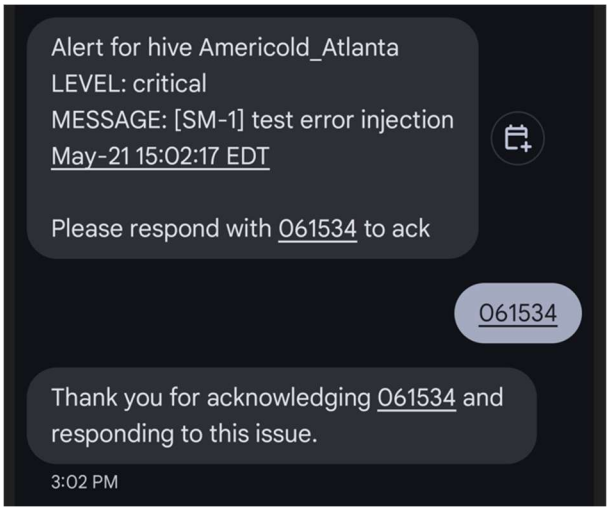


4.2 SMS messages with Acknowledgement

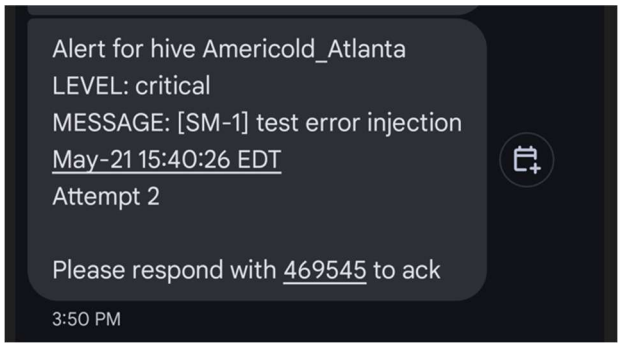
For technicians and other roles intending to address the issue causing the alert trigger, a message will be sent with a request to acknowledge if that person will be responding. Note that only 1 person can acknowledge an alert over SMS.



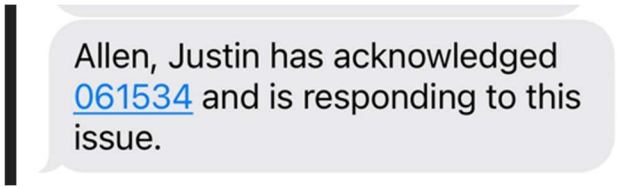
The message contains the Hive name, level of the alert, a message providing the Lion Power error code and a description of the event, as well as a timestamp when the event occurred in Hive local time. Additionally, roles that can acknowledge will receive the request “Please respond with <code> to ack”. Sending this code back via SMS will acknowledge and send a confirmation response.



With a 'Critical' level, if the alert has not been acknowledged, the alert will be repeated every 10 minutes (up to an hour):

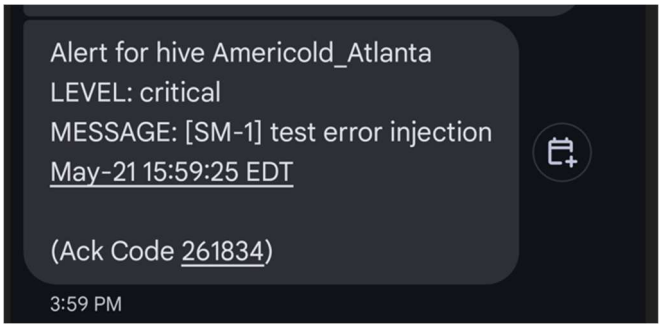


Once acknowledged, the Client will send a message containing the name and ack code to everyone listening to the hive/level combination:



4.3 SMS Messages without acknowledgement

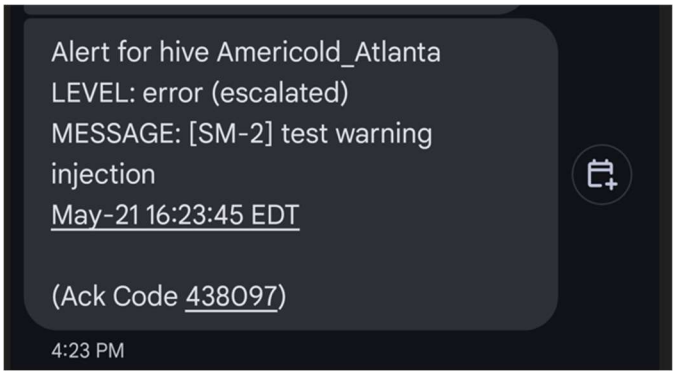
Users assigned to roles that cannot acknowledge alerts receive similar messages, with the adjustment that the system will not respond to acknowledgement, and only one alert message is sent for a 'Critical' level alert. The code is included in the message so acknowledgement messages can be matched to the alert.



Acknowledgement responses are delivered in the same manner as above, so the user can track the responder to the alert.

4.4 SMS messages with Alert Level Escalation

When a Warning message recurs 3 times within an hour, the alert is escalated to 'Error' status in order to generate an alert message. This can be identified by the '(escalated)' notation beside the 'error' level:



Note that this example is for a user without acknowledgment capability, but the message would be the same with the request to acknowledge for a user with that capability.

5 Table of Alerts

While the list of alerts and levels are continuously being updated, this is a snapshot of expected critical, error, and warning level alerts currently provided.

5.1 Critical Alerts

Code	Description	Level	Troubleshooting
RS14	The robot process control programs are not running.	critical	Robot startup / comms issues. Generally requires a PC and/or roboswap service restart. These can occur after power outages, collisions, or returning from TEACH mode
RS15	The robot did not start its program.	critical	
RS16	The robot is not online.	critical	
RS17	Could not reset active robot error.	critical	
RS18	Could not turn on robot motors.	critical	
RS19	Robot cycle did not start.	critical	
RS38	The system commanded a battery collision.	critical	~~Accidental placement of a battery into an unavailable space~~Battery queueing subsystem told robot to put a battery on top of another battery. Requires TEACH intervention.
RS40	The pin was still detected after an unmate sequence.	critical	Gripper isn't properly separating from the battery after being placed. Requires TEACH intervention.
RS41	The robot might be dragging the battery.	critical	
RS65	Unable to communicate with robot	critical	PC can't communicate with robot. This could be a network issue. First check would be restarting the Robot controller and/or roboswap service restart.
RS74	FIRE DETECTION: Heat detection wire has tripped!	critical	(if equipped) Fire issues in rack detected.
RS75	FIRE DETECTION: Battery temperature exceeds alarm level	critical	

Code	Description	Level	Troubleshooting
RS84	The robot has reported an error	critical	Robot has encountered an issue. Robot controller and/or roboswap service restart.
RS86	The operator has reported an issue.	critical	Operator has pressed the 'Report Issue' button on the HMI.
RS91	The robot was switched to Teach Mode	critical	Robot has been switched to TEACH (just in case this action was performed unintentionally by an unauthorized user)

5.2 Errors

Code	Description	Level	Troubleshooting
RS13	The robot programs did not stop.	error	Robot did not respond correctly to PC request to stop control programs. Robot controller reset and/or roboswap service restart may be needed.
RS20	Gripper did not open when commanded.	error	Gripper either stuck on pin or loss of air supply. Requires Technician to ensure air supply is functioning properly or remediate the cause for inability for gripper to separate from pin.
RS23	Invalid retract pose was calculated.	error	(Unlikely) Requires TEACH to pull robot back to Restart position and perform roboswap service restart.
RS24	Could not get rack locations for swap.	error	System can't identify location to place battery. Confirm rack doors are closed.
RS25	Could not set Gocator Laser Safety bit.	error	Possible networking issue between PC and IO-Link Master
RS39	The commanded place sleeve is not calibrated.	error	Need to perform sleeve calibration on reported sleeve

Code	Description	Level	Troubleshooting
RS42	There are no available battery locations.	error	System has no sleeves to place battery. Likely because rack doors are open.
RS54	The system could not test air pressure because the gripper is not empty	error	System is started up with battery connected to robot. Requires TEACH to remove battery into rack or truck.
RS55	Could not send command to the gripper	error	Comms issue between PC and IO-Link master
RS64	No place sleeves were available after battery was removed from truck.	error	System can't identify location to place battery. Confirm rack doors are closed.
RS73	Returned same battery to vehicle	error	System unable to identify battery type removed from truck in order to select new battery. Generally caused by either battery board installed upside down or alignment issue with sleeve brush bracket, exceeding the time allowed for comms check between battery and place sleeve.
RS83	Rack door has been open 30 minutes. Battery availability is compromised.	error	Close rack doors.
RS85	Battery reload has taken more than 3 1/2 minutes. System may need attention.	error	Excessive time for swap. Could be due to curtain break/operator issue, bad scanning, etc.

5.3 Warnings (escalation if repeated)

Code	Description	Level	Troubleshooting
RS10	The robot is not at its home position.	warning	Reset Robot (Use Teach pendant if necessary to unload and move to “restart” position). Contact Lion Power if robot appears to move home but warning does not clear
RS21	Pin was not detected during mate sequence.	warning	Check pin detection switch operates properly. If using old-style gripper, adjust sensor depth to trigger with pin insertion.
RS22	Gripper did not close when commanded.	warning	Confirm pin plate surface is clear of anything that keeps gripper from fully seating; Confirm no burrs on pin plate locating pins. Repeated issues may require limit switch calibration
RS26	Could not send Gocator command.	warning	Check network cabling from cabinet to Gocator; restart Roboswap service. Contact Lion Power if this doesn’t resolve.
RS27	Gocator message transfer failed.	warning	
RS28	Gocator job load failed.	warning	
RS29	Gocator failed to return data in the allowed time.	warning	
RS30	Calculated Gocator plane is not within limits.	warning	
RS31	Nothing is in the gripper. Calibration will not continue.	warning	Calibration error – insert calibration plate
RS32	Something other than the cal plate is in the gripper.	warning	Calibration plate features not detected when performing calibration – insert calibration plate
RS33	Could not clear Gocator alignment.	warning	Reattempt calibration. Restart Roboswap service if not resolved after reattempt.
RS34	Could not set Gocator alignment.	warning	
RS35	Could not save updated calibration constants	warning	
RS36	Could not find pin plate	warning	Pin plate either obstructed or not in camera/Gocator field of view. If error persists for more than 10 consecutive

Code	Description	Level	Troubleshooting
			swap attempts, restart Roboswap service.
RS37	The Gocator could not get in plane after the permissible number of attempts	warning	Vehicle parking angle is too extreme for Gocator to match. Re-park vehicle straight in the hallway. Attempt wiping down the pin plate.
RS43	The task was interrupted by the user.	warning	Sequence interrupted, generally by: light-curtain break, stepping away from pressure pad, e-stop pressed or floor scanner trip. Return to pressure pad, confirm clear cell/hallway, and press flashing green button to continue.
RS44	The task was interrupted by the user.	warning	
RS45	The hallway is not empty.	warning	Foreign object in hallway instead of vehicle when initiating swap OR something is in the hallway at the beginning of the calibration sequence
RS46	The sequence was reset to protect the robot.	warning	~~Contact Lion Power~~Do not enter the hallway during a battery swap. This error is reported when the hall curtain is broken between the start of the swap and the first battery mate attempt.
RS47	Could not find cradle DM code	warning	Ensure the cradle DM is attached to the vehicle and not damaged. If this occurs on 10 swap attempts in a row, restart Roboswap service.
RS48	The cradle type could not be determined.	warning	System could not read cradle DM code to identify cradle/battery type. If this occurs on 10 swap attempts in a row, restart Roboswap service.
RS49	There is not enough clearance to extract the battery.	warning	~~Contact Lion Power~~Ensure the lid covering the battery comparment is raised, if vehicle is so equipped. Contact Lion Power if error cannot be resolved.
RS50	No collision values found in configuration file for this setpoint.	warning	Contact Lion Power
RS52	The difference between the prescan O angle and the calibrated O angle is too large	warning	Battery incorrectly placed into the rack. Attempt straightening battery manually and restarting sequence.

Code	Description	Level	Troubleshooting
RS53	The difference between the prescan location and calibrated position is too large	warning	
RS56	TeachGripperOpen sequence failure	warning	Check network connection between robot and HMI cabinet. Power cycle Robot controller if necessary. Restart Roboswap service
RS57	TeachGripperOpenWithPin sequence failure	warning	
RS58	TeachGripperOpenWithoutPin sequence failure	warning	
RS59	TeachPinAbsent sequence failure	warning	
RS6	The robot did not receive the last message.	warning	Communication break between PC and robot controller; typically occurs after teach recovery. Cycle Teach/Repeat switch on Teach pendant.
RS60	TeachPinPresent sequence failure	warning	Contact Lion Power
RS61	The gripper teach sequence timed out	warning	Contact Lion Power
RS62	The battery extraction position could not be verified	warning	Reattempt the swap. If condition persists, contact Lion Power.
RS63	The robot gripped an unexpected battery size	warning	Confirm the magnet pickup is installed on the pin plate if XL battery or absent if standard battery. If present, check field terminations on robot arm for plate sensor.
RS66	Robot returned NACK response	warning	Contact Lion Power
RS67	The robot cannot reach the battery. Try parking closer.	warning	Vehicle is parked beyond the operating range of robot
RS68	The sleeve is already quarantined	warning	
RS69	Could not determine pin plate thickness. Clean pin plate, then try again.	warning	The system could not determine whether a thick pin plate or thin plate is installed on the battery. Clean the pin plate and try again.
RS7	The laser did not turn on.	warning	Check network connection between HMI panel and

Code	Description	Level	Troubleshooting
RS70	The compressor drain command was not ackowledged.	warning	If system is equipped with automatic compressor drain: Check that the shutoff valve in the drain line is open. Check that the drain tank is not full. Check that the drain valve solenoid wire is connected to the bulkhead on the bottom of the LV box.
RS71	Sleeve quarantined due to repeated prescan failure	warning	Check pin plate on battery for damage/debris. Clean and reattempt.
RS72	Replacement battery was not fully charged	warning	Confirm all rack doors are closed; space swap attempts further apart if possible. Contact Lion Power if these do not resolve the issue.
RS76	Battery temperature exceeds warning level	warning	A battery internal temperature is higher than expected. Contact Lion Power.
RS77	Cradle DM code may require replacement	warning	Confirm cradle DM code is not damaged. Replace if needed.
RS78	Measured thick pin plate on XL battery	warning	Improper pin plate installed or possible bad scan. Replace if thick pin plate is mounted to XL battery. Clean plate and battery surface and reattempt.
RS79	Measured thin pin plate, but forcing to thick	warning	Clean the pin plate.
RS8	The object is too far out of plane.	warning	Battery orientation too far out of range. If in the vehicle, re-park to straighten. If in the rack, manually adjust to straighten battery.
RS80	Measured thick pin plate, but forcing to thin	warning	Clean the pin plate.
RS81	Battery was quarantined due to capture assignment	warning	Perform whatever work or inspection was needed on that battery, then release the quarantine. Contact Lion Power if needed.
RS82	Rack door has been open 10 minutes. Battery availability is compromised.	warning	Close rack doors to allow charging and pick/place operations within that rack.
RS88	The battery unloaded from a vehicle did not match the expected voltage.	warning	Inspect battery DM code for damage; ensure SN on battery DM label matches SN on side of battery. Quarantine sleeve if issue persists and contact Lion Power

Code	Description	Level	Troubleshooting
RS89	A battery unexpectedly disappeared from the network.	warning	Ignore if battery was removed via manual cart. This also is caused by intermittent communications loss between battery and sleeve. Confirm battery NFC board is installed correctly (connector down) and if issue persists, quarantine sleeve and contact Lion Power
RS9	The laser did not turn off.	warning	Possible network issue between PC and IO-Link master. Possible wiring issue between IO-Link master and Time-of-Flight sensor.
RS90	There were consecutive vehicle location failures.	warning	Clean Lux camera lenses; Gocator may require lens cleaning or calibration. Restart Roboswap service. Contact Lion Power if issue persists.