The *CROSSFIRE* Controller Release Notes
Version: V38R14 – Release date: 2025-11-28

Important Notice

Version **V38R14** replaces **V38R13** & **V38R12**, which was withdrawn shortly after releasing due to stability issues. All features introduced in R12 remain available in this release, with refined command handling, minor interface improvements, and enhanced reliability. Customers who are satisfied with R13 are not required to update to R14, however, if you are having MODBUS connection issues, upgrade to R14 immediately.

Description

This document outlines the release of firmware **V38R14** for the CROSSFIRE Controller (part numbers LCOC-1000-A and LCOC-1000-B). It includes an overview of feature enhancements, technical details, and relevant Modbus command updates. This version consolidates the new functionality introduced in R12 – such as remote compressor control, expanded regional unit selection, high-pressure unloader flexibility, and enhanced runtime and maintenance tracking – while resolving performance inconsistencies observed in the prior release.

https://www.linkedin.com/company/lco-technologies/

https://www.youtube.com/@lcotechnologies8900

LCO Technologies
115 – 1829 54 Street SE
Calgary, AB T2B 1N5
info@lcotechnologies.com

Major Updates and Enhancements
Version V38 R14 (2025-11-28)

Description

LCO Technologies has released firmware **V38R14** for the CROSSFIRE Controller.
This version reintroduces the feature set from R13 & R12 with enhanced stability, refined command handling, and improved documentation clarity.

The release maintains the full functionality introduced in R12 – including remote compressor control, expanded unit selection, flexible pressure control, and advanced runtime tracking – while addressing issues identified in the prior version. These updates continue to strengthen operator visibility, remote management, and compressor lifecycle monitoring, ensuring reliable field performance across all supported hardware.

Enhancements

This version retains all functional upgrades introduced in R12, now refined for improved stability, expanded pressure range support, and enhanced command validation.

- Modbus Process Rate Increase
  - The process rate of incoming Modbus packages was increased by four times to enhance responsiveness SCADA.
- Compressor Remote Start/Stop Feature
  - Allows remote SCADA systems to fully start or stop a compressor or VRU using Modbus, enabling full remote lifecycle management that follows its programmed control curve.
  - Pre-requisite: 24V must be routed to DI1 via a local/remote hand switch.
  - Feature must be enabled using setCompRemTglEn.
  - When 0V is detected on DI1, only local control is permitted.
- Expanded Regional Unit Selection
  Users can now choose from:
  - Canadian (Imperial + Metric mix)
  - U.S. (Imperial)
  - Metric (used internationally)
  - Affects LCO smartphone app, PC GUI software, and Modbus communications.
- High-Pressure Unloader Control Enhancements
  - Extended sensor compatibility to include pressure transmitters from 0–50 PSI up to 0–160 PSI.
  - Operators can now choose between using a pressure switch or a pressure transmitter, offering flexible configuration options for compressor control.
- Expanded System Runtime Monitoring
  - Tracks both current session and total accumulated system runtime for compressors, pumps, and VRUs.
  - Accumulated runtime is retained in non-volatile memory and only resets if memory is reinitialized.
- Persistent Oil-Change Stroke Count
  - Stroke counts are now saved to non-volatile memory, enabling accurate maintenance tracking across multiple sessions.
- Motor Run Light Enhancement

    - Motor run indicator output (DO2) now functions regardless of control mode or device type, providing consistent visual feedback.
- Added Boundary Check to setPIFlowSP Command
    - Ensures flow setpoints respect achievable limits based on plunger configuration and motor RPM.
    - Note: Motor RPM must be configured before using setPIFlowSP to prevent invalid entries.

New Commands

1. Compressor Remote Start/Stop

- setCompRemTglEn <value>
  - 1: Enable SCADA remote start/stop control
  - 0: Disable remote control

- showCompRemTglEn
  - Displays current remote control enablement status
  - Once enabled, SCADA can:
    - Write 1 to coil 13 to start compressor
    - Write 0 to coil 13 to stop compressor

2. Unit Selection

- setUnit <value>
  - 0: Canadian
  - 1: U.S. Customary
  - 2: Metric
- showUnit
  - Displays currently selected unit system
  - Affects LCO app, PC GUI, and Modbus values

3. Discrete Control Mode

- setHpUnldrEn <enable> <DO4_enable> <sensor_type>
  - enable: 1 = enable discrete control mode, 0 = disable discrete control mode
  - DO4_enable: 1 = enable high-pressure unloader solenoid on DO4, 0 = disable
  - sensor_type: 0 = switch, 1 = transmitter
- showHpUnldrEn
  - Displays all three parameters

PSI-Based Configuration

- setHpUnl <stop_PSI> <deadband> <range>
  - stop_PSI: Compressor stop setpoint
  - deadband: Restart offset (PSI)
  - range: Full-scale pressure transmitter
  - Example: setHpUnl 100 08 160 → Stops at 100 PSI, restarts at 92 PSI
- showHpUnl
  - Displays stop point, deadband, and sensor range

kPa-Based Configuration

- sHpKpa <stop_kPa> <deadband> <range>
  - Same as above in kPa
  - Example: sHpKpa 689 055 1100 → Stops at 689 kPa, restarts at 634 kPa
- showHpUnl
  - Displays stop point, deadband, and sensor range

4. System Runtime Monitor

- showSystemRunTime
  - Returns session and accumulated runtime
  - Example Output: 12:25 912:25 → 12 minutes, 25 seconds this session; 912 hours, 25 seconds total

5. Oil Change Stroke Counter

- showOilChangeSC
  - Displays stroke count since last oil change
- clearOilChangeRq
  - Resets the oil change stroke counter

6. Motor Run Light Indicator

- setMotorRunLiteEn <value>
  - 1: Enables DO2 to indicate motor running
  - 0: Disables the feature
- showMotorRunLiteEn
  - Displays feature status

7. Boundary Check: Solenoid Bypass Flow Rate

- setPlFlowSP <plunger> <setpoint>
  - Ensures setpoint does not exceed flow limits
  - Based on plunger size and motor RPM
    - Example: setPlFlowSP 1 63.88 → Valid only if ≤ max flow for current RPM
  - Ensure motor RPM is configured before using setPlFlowSP to avoid invalid setpoints

**For best results, update both firmware and software concurrently to ensure full feature compatibility. See the compatibility and revision history sections below for further guidance.

Compatibility

Version V38 R12 is compatible with firmware releases V38 R01 and later. For customers with controllers V37 or prior, firmware must be updated by LCO Technologies factory direct. Identification can be found in the following ways:

How to identify controller version

1. Look on the controller for a white sticker located on the bottom right-hand corner. The sticker will say “231115**V38R0X**”, where the V38 is the version and the R0X is the revision.
    - Note: Once a firmware upgrade has been completed in the field, this sticker will be out of date
    - To keep the sticker in-date for quick reference of firmware version, write the version on the sticker once an update is completed
2. Connect to the mobile or desktop software
    - To determine the version number, go to the “System Status” tab and read the value listed under “firmware version” (eg. 38R10)
3. Look on the controller for a silver sticker in the top right-hand corner saying “accepts firmware update” as shown below. If you have this sticker, it means you have V38R01 or later and can update firmware as needed by following the below instructions.

Firmware Upgrade Instructions

Download Required Files:

QR Code – LCO Resources Webpage

- Go to the LCO Technologies website and download two files from the "resources" tab onto your computer
  - Scan the QR Code for a direct link
- File 1: "CROSSFIRE latest firmware" file – save to computer
- File 2: "Firmware update tool" (version 1.2)
  - Password: **crossfire2023**

Screenshot of Firmware Update Software on Next Page

Step 1: Connect Serial Port

- Open the firmware update software
- Connect your computer to the controller with an RS232 to USB cable
  - Note: This firmware update **cannot** be done over Bluetooth connection, hardwire connection required
- Ensure your controller is powered on
- Click "refresh com" and select the com port of interest
- Click "open"

Step 2: Select File for Upload

- Click "browse" and select the file that was just downloaded and saved from the LCO website

Step 3: Get into bootloader mode

- Enter the password: **Automatio**
- Click on "Login to Controller"
- Click on "Jump to Bootloader"
  - You are now in bootloader mode and the lights on the controller will be flashing

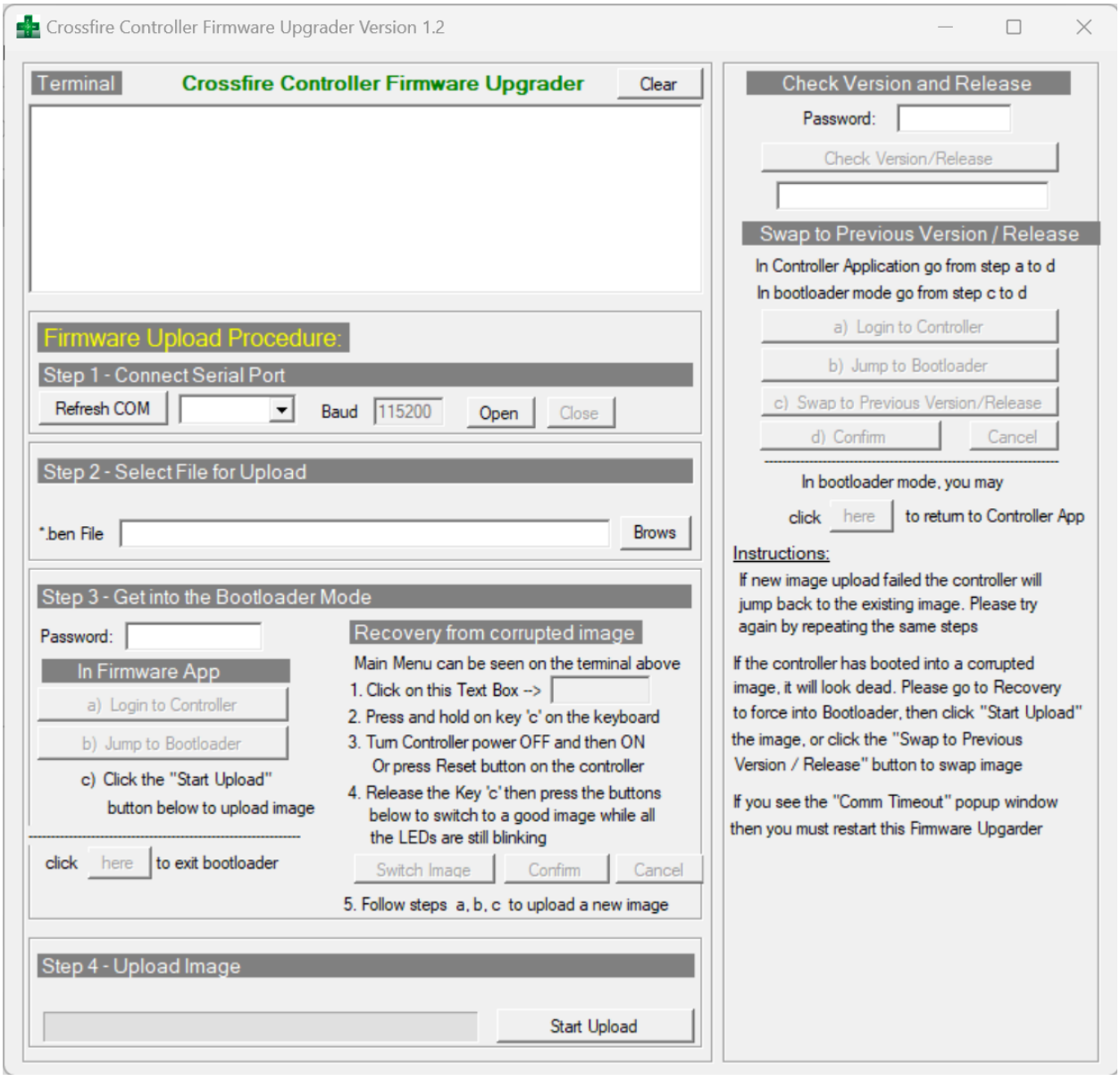
Step 4: Upload Image

- Click on "Start Upload"
- The firmware will now be updating and a visual progress bar will show progress
- Once complete, the progress bar will be green and read 100%

Confirm Upgrade

- Once the upgrade is complete, the new firmware will now be active
- To confirm the upgrade was successful, go to the "check version and release" section
  - Click on "Check Version/Release"
  - If you updated to V38R08 for example, it will say "Version = 38, Release=8

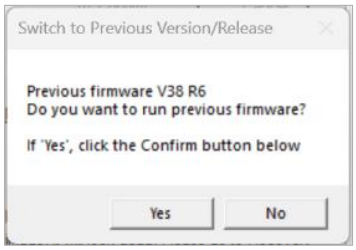
Troubleshooting Guide:

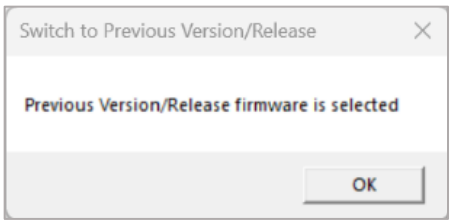


Swap to Previous Version/Release

- The controller stores two versions of the firmware: the one active previously, and the new one just loaded
- If there is a corrupted image or the upload fails, you can revert back to the previous firmware file
- To do this:

- Click “log into controller”
- Click “jump to bootloader
- Click “swap to previous version/release”
- A pop up window will appear to confirm you want to run the previous firmware version.
  - Click “Yes” and then “Confirm” to swap versions
  - A second popup window will appear as confirmation





- To manually confirm the swap was completed successfully, click “check version/release” button in the above section

Firmware Upload Failure

- If in the event uploading a firmware file has failed due to a corrupted file or an interrupted download (ie: serial cable unplugged mid update), the progress bar will turn red and begin blinking to indicate failure
- The controller will automatically recover itself by aborting the upload and jump back to the previous loaded firmware
- Begin the process of uploading the file again:
  - Confirm cable is correctly and securely installed
  - Follow the regular instructions above to load firmware file
- If the controller ever gets stuck in a corrupted firmware file, the controller will appear dead, with no LED lights flashing even when 24V of power is applied to the board
  - In this scenario, follow steps 1-5 listed under “recovery from corrupted image" on the firmware update application
  - Contact your local supplier or LCO Technologies directly for assistance

Software Update Instructions

Update Mobile or Desktop Software

- Go to the LCO Technologies website and download the most recent version of the software
  - Scan the QR Code for a direct link
- Download the appropriate file
  - "CROSSFIRE configuration software (Windows 7/8/10, 64-bit)" for the desktop software
    - Password: **crossfire2017**
  - "CROSSFIRE configuration software (iPhone/iPad)" for Apple App
  - "CROSSFIRE configuration software (Android)" for Android App

QR Code – LCO Resources Webpage

Revision History

Version V38R14 (2025-11-28)

Enhancements

- Modbus Process Rate Increase
  - The process rate of incoming Modbus packages was increased by four times to enhance responsiveness SCADA.

Version V38R13 (2025-08-28)

- Supersedes V38R12, which was withdrawn due to stability issues.
- No new commands introduced.
- Minor documentation refinements, pressure range clarifications, and reliability improvements applied.

Version V38 R11 (2025-05-18)

Enhancements

- Added Compressor Remote Start/Stop via SCADA
- Expanded unit selection: Canadian / U.S. / Metric
- Enhanced High Pressure Unloader control with expanded transmitter range
- Added SystemRunTime monitor (accumulated + session)
- Persistent Oil-Change-Stroke-Count stored in non-volatile memory
- Expanded MotorRunLite output logic
- Added safety limit on setPlFlowSP command input

New Commands

- setCompRemTglEn, showCompRemTglEn
- setUnit, showUnit
- setHpUnl, sHpKpa, showHpUnldr
- showSystemRunTime

- showOilChangeSC, clearOilChangeRq
- setMotorRunLiteEn, showMotorRunLiteEn
- Enhanced: setPIFlowSP

Version V38 R10 (2024-10-01)

Enhancements
• Added new Discrete Mode for compressor control
  o Cycles compressor between full speed and off within a defined pressure deadband
  o Compatible with both pressure transmitters and switches
• Added Experimental Current Dampener feature
  o Toggleable feature to prevent compressor stalling in overcurrent scenarios
  o Limits max current draw to 10 Amps
• Added High Pressure Unloader communication capability

Logging
• Added power line resistance calculation at motor start-up
• Added full-speed-on-time tracking (discOnTimeSec) for HpUnloader
• Introduced 16-bit warning word with new system warning flags saved to non-volatile memory:
  o PhAResHigh, PhBResHigh, PhCResHigh, PwrLResHigh, CompAirLeak, NoLoadVddLow

New Commands
• setFlywheelOn, showFlywheelOn – Control the experimental current dampener
• setCN, showCN – Set and view an 8-character controller name
• showSystemStatus (with arguments) – View system warnings and discOnTimeSec
• setHpUnloaderEn – Enable/disable unloader and DO4 output
• showCalcRes – View calculated resistances (also added to Modbus registers)

Software (V3.6.1) or later
• New compressor control menu with support for Discrete Mode (transmitter/switch)
• Support added for experimental current dampener and high-pressure unloader features
• Extended warning code display under “System Status”
• Support for measurement of motor/power lead resistance
• Ability to set and retrieve a user-defined 8-character ID

Version V38 R08 (2023-11-15)

Communications
- Added IBatt (battery current) to MODBUS holding registers 38 & 39
  - Enter **setPwrEnerCalcEn 1** command in “Terminal” tab (described in FW V38R06 notes) to engage feature and display real time power, energy and battery current

Enhancements
- Resolved an issue where in some scenarios the compressor would not achieve pressure setpoint
  - Modified compressor control curve by adding a minimum speed setpoint in which the unit will run at until setpoint is achieved
  - Improved functionality with continual minimum speed vs multiple start/stop events
- Removed guardband feature which was based upon RPM
- Defined deadband in pressure (PSI)
  - Configurable value now accessible via software/app
  - Deadband language more intuitive to users’ operation expectation of standard operations
  - EG: Static Pressure 36 PSI, Deadband 3 PSI. Unit stops at 36, restarts at 33.
  - Introduced limits on Deadband feature and prompt user at time of data entry

Software (V3.5.0) or later

- Software updated to support the firmware release
  - Deadband configurable in PSI
  - Automated drain valve for tank relocated under compressor curve
  - Improved standard and custom compressor curves
    - Default 0-50 curve modified to 0-49
    - Custom curves for 0-50PSI and 0-100PSI transmitters are now restricted to the ranges 0-49PSI and 0-98 PSI respectively
- Improved language for fault flags and added troubleshooting section called “Fault Record” to break down the last logged fault
  - Fault flag 0xAB and 0xAA added
- Colour blind safe colour scheme

Version V38 R07 (2023-10-07)

Logging

- Added fault flag 0xAB for 4-20mA transmitter signal wire break detection
  - Controller detects 0V/0mA on $AI^{1+,}$ indicating a loss of signal
  - Check wire connections, power, fusing, or transmitter status
  - Fault condition can only be cleared when 4-20mA/1-5V signal is restored

Version V38 R06 (2023-04-15)

Communications

- Improved ModBus/RTU protocol stack for both RS485 and RS232[1] ports

New Commands

- Added the **showPowerDetails** and **setPwrEnerCalcEn 1** commands
  - By engaging both commands, the controller can now monitor power and energy usage of the CROSSFIRE pump or compressor.
  - This allows users to monitor power supply health and show real time working conditions of the CROSSFIRE which can be used for predictive maintenance and troubleshooting.
  - Commands must be engaged in the LCO configuration software (mobile or desktop versions) – “Terminal” tab

  Example Command: **showPowerDetails**

  *Note: This command generates two lines of code. To get power and energy readings, the command **setPwrEnerCalcEn 1** must be engaged prior to sending the **showPowerDetails** command.*

  Line 1: UI: showPowerDetails: Power: 7.11, accKWHr: 0.68
  Line 2: Vbatt: 24.03 Ibatt: 0.40 IA: 0.43 IB: 0.46 IC: 0.46

  Break Down of Code:
  Line 1: Power Consumption (Watts), Energy Usage (KWHr)
  Line 2: Battery Voltage (Volts), Battery Current (Amps), Phase A Current (Amps), Phase B Current (Amps), Phase C Current (Amps)

Hardware[2]

- Addition of RS485 biased resistor for RS485 ModBus communications

Version V38 R05 (2023-03-08)

Logging

- Extended the **showFaultRecord** command
  - Displays extra operational information when the last fault occurred: battery voltage and current, phase currents A, B, C and the automated control settings
  - Commands must be engaged in the LCO configuration software (mobile or desktop versions) – "Terminal" tab

Example Command: **showFaultRecord**
Line 1: faultRecord: 20:4:15 13-11-23: 0x6460**08**
Line 2: Vbatt:17.7 Ibatt:0.3 IA:0.3 IB:0.2 IC:0.3 CtrlBlk:0x1 AuxCtrl:0x0

Breakdown of the above Code:
Line 1: faultRecord: Y:M:D H:M:S: Status Code
Line 2: Battery voltage: battery current in Amps: current to each motor phase (A, B & C) in Amps: which automation feature is activated: which I/O control is activated

Communications and Hardware

- Added ModBus communications to the COM1 RS232[1] port
  - If you have a controller with **hardware version 2.3**, these features and commands are available to you
  - Customers with this controller can select RS232 or RS485 ModBus communications – not both (software selectable)
  - Activate communications mode with the following commands in the LCO configuration software, "Terminal" tab
    - Engage **setMBSPort 0** to use RS485 communications
    - Engage **setMBSPort 1** to use RS232 communications
    - **showMBSPort** to confirm configuration

Version V38 R04 (2023-01-18)

Enhancements

- Improved ModBus control such that the pump or compressor will auto-restart after a controller reboot
  - The pump will resume the last known speed set through ModBus

Version V38 R03 (2022-12-03)

Enhancements

- Improved **MotorRunLite** feature to light up when a compressor stops after reaching the pressure set point
  - An external light must be tied to the controller DO[2+]
  - When the compressor reaches pressure set point, the light will turn on
  - Engage in LCO configuration software, "Automation" tab – motor run light

New Commands

- Added commands **showFpInputReg**, **showFpHoldReg** and **setFpHoldReg** for ModBus troubleshooting
  - **showFpInputReg** is used to see what is inside the input registers

- **showFpHoldReg** is used to see what is inside the holding registers
  - Example: When trying to set the motor speed to 40 RPM over ModBus, you would put 40 into register 40000
  - If the motor does not spin at 40, begin troubleshooting and enter the command showFpHoldReg 0 (where **0** is the final digit of the 4000**0** register)
  - If 40 rpm was correctly written to register 40000, it will generate 40 back
- **setFpHoldReg** is used to troubleshoot whether there is a communications problem with the controller or the SCADA network
  - To use, disconnect from the SCADA system, type in the command **setFpHoldReg**
  - Then, type in **showFpHoldReg** to see if the value was set correctly

Version V38 R02 (2022-10-04)

Logging

- Added fault flag 0xAA for an unbalanced state
  - Motor phases are unbalanced, unit may be in an unbalanced state or may have poor electrical contacts

Enhancements

- Added the Vibration-Stop feature to detect and restart a compressor when it gets stuck in an unbalanced state
  - Unit will stop and fault, throwing a 0xAA fault flag, then automatically re-start

Version V38 R01 (2022-08-22)

Hardware[2]

- Added bootloader for onsite firmware upgrade capability
- Added onboard temperature sensor

New Commands and Features

- Added freeze protection mode
  - This feature is used to automatically increase the pump speed and injection rate as the ambient temperature drops
  - The lower the temperature, the faster the pump runs until maximum RPM is reached
  - The wellhead temperature is provided to Crossfire Controller by SCADA via ModBus
  - Feature must be activated with a command in the LCO software, “Terminal” tab
    - **setFreezeProtectEn 1** to enable
    - **setFreezeProtectEn 0** to disable
    - **showFreezeProtectEn** to show the setting
  - Next, a SCADA programmer must retrieve the ambient process temperature from the temperature transmitter on site and put the value to holding register 40040 and 40041.
    - Additionally, they must set coil 11 on every poll
  - By default, this feature has 0˚C as the threshold temperature at which it is activated, and the rate of injection will increase by 1 RPM per 1˚C drop in in temperature (linear curve)
  - This can be customized with the following commands:
    - Set threshold temperature (default 0˚C)
      - **setFPThold X** (whereas X is any value between -10˚C and +15˚C)
      - **showFPThold** (to show the set value)
    - Set curve and rate of increase of injection (default 1)
      - **setRpmPerDegCDp** X (where X is from 0.3 to 5 RPM / ˚C drop)
      - **showRpmPerDegCDp** (to show the set value)
- Added High Pressure ESD Tank compression controls for compressor

- This feature is used to maintain pressure in the ESD high pressure tank using a pressure switch to DI^{4+} and a normally closed solenoid valve to DO^{4+}
- Engage feature in the LCO software “Terminal” tab with command **setHpUnloaderEn 1**
  - **showHpUnloaderEn** to show the setting

- Added compressor oil change maintenance flag based on accumulated stroke count
  - An indication will arise after 31,104,000 strokes are accumulated indicating oil in the compressor top works should be changed
  - This stroke count is equivalent to a compressor running at full speed, for one month
  - This feature is auto engaged for compressors, no action required to engage
  - This feature is visible in the "system status" tab in the software and is also available over ModBus holding register 40055, bit 10
  - To reset the stroke count, go to the "Terminal" tab in the LCO software and enter **clearOilChangeRq**
- Added feature for automated drain valve control to drain compressor tank condensation
  - Wire a Solenoid valve to DO[1+]
  - Enable feature in the LCO software, system setup tab
  - Select the frequency at which the valve is drained

Protocol

- Wiring change for motor soft stop feature for Advanced controllers only
  - Wire hand switch with 24V on DI[3+]
  - Basic controllers have no change, still wire to AI[3+]

Version V37 (2021-07-21)

Hardware[2]

- Added Ethernet interface to the Advanced controllers

Communications

- Added ModBus communications over Ethernet (ModBus/TCP)
- Additionally, IoT Data Dump via Internet
  - Remote login to monitor a controller via Internet

Version V36 (2020-05-16)

The stable firmware for the chemical injection pump, the air compressor and the VRU

Version V38R99

Please note that V38R99 is a test firmware load only. If you have firmware V38R99, please upgrade immediately.

[1]RS232 ModBus communications requires a controller with hardware version 2.3. There is a firmware and hardware update that must be completed by the factory direct.

[2]Hardware changes are not upgradable in the field. They must be completed by the LCO factory. Any associated features with the hardware update will not be usable unless the corresponding hardware update has been made.

https://www.linkedin.com/company/lco-technologies/

https://www.youtube.com/@lcotechnologies8900

LCO Technologies
115 – 1829 54 Street SE
Calgary, AB T2B 1N5
info@lcotechnologies.com