



CREATING
VALUE

LINCS II

JOYGLOBAL

LDG2-S-T-LI-EN-0001

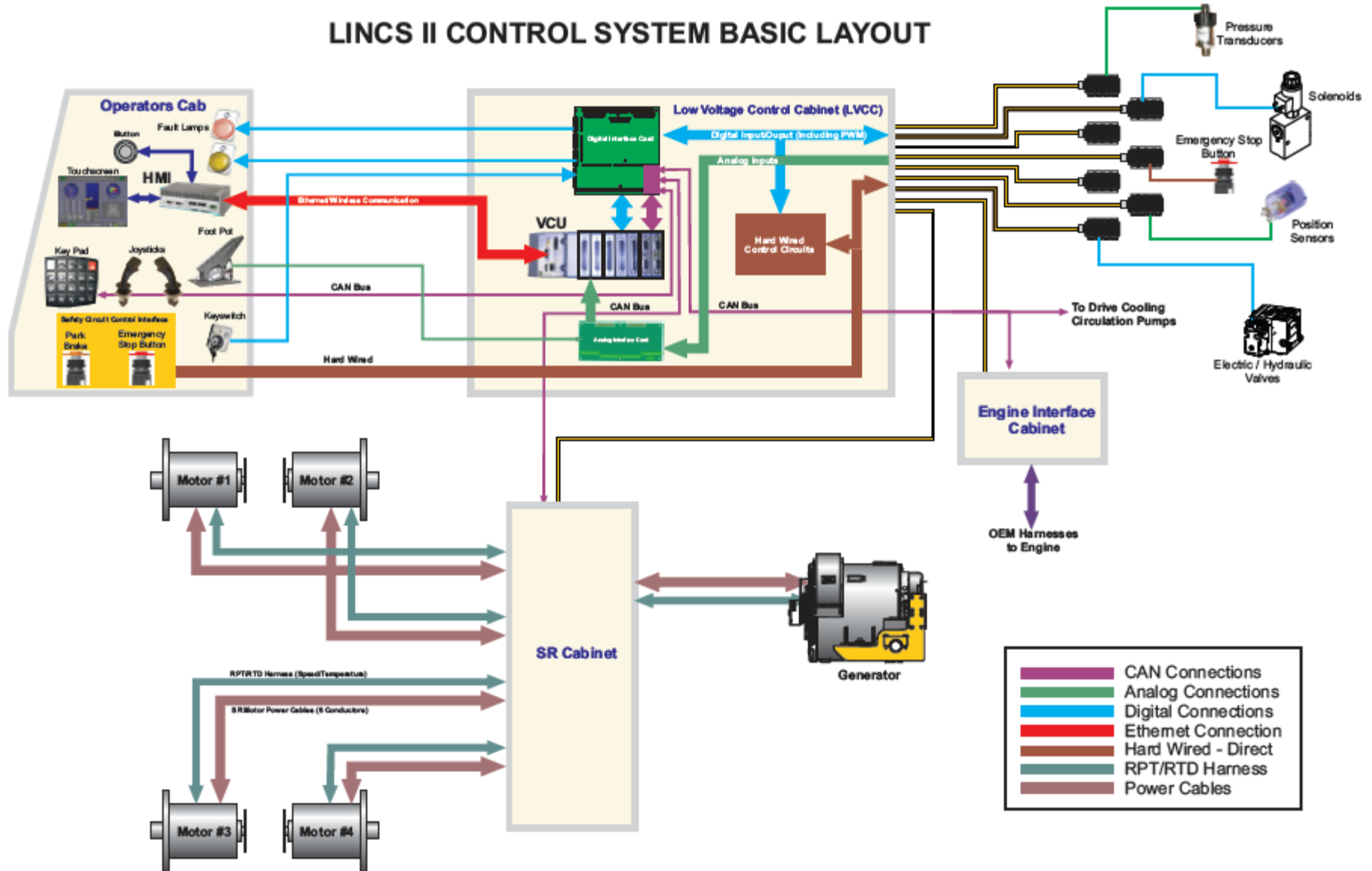
LINCS II

- Theory of Operation
- Component Descriptions
- Screen Navigation
- Circuit Descriptions
- Troubleshooting
- Support Software

THEORY OF OPERATION “INTRODUCTION”

LINCS II Layout

LINCS II CONTROL SYSTEM BASIC LAYOUT



HIGHLIGHTS

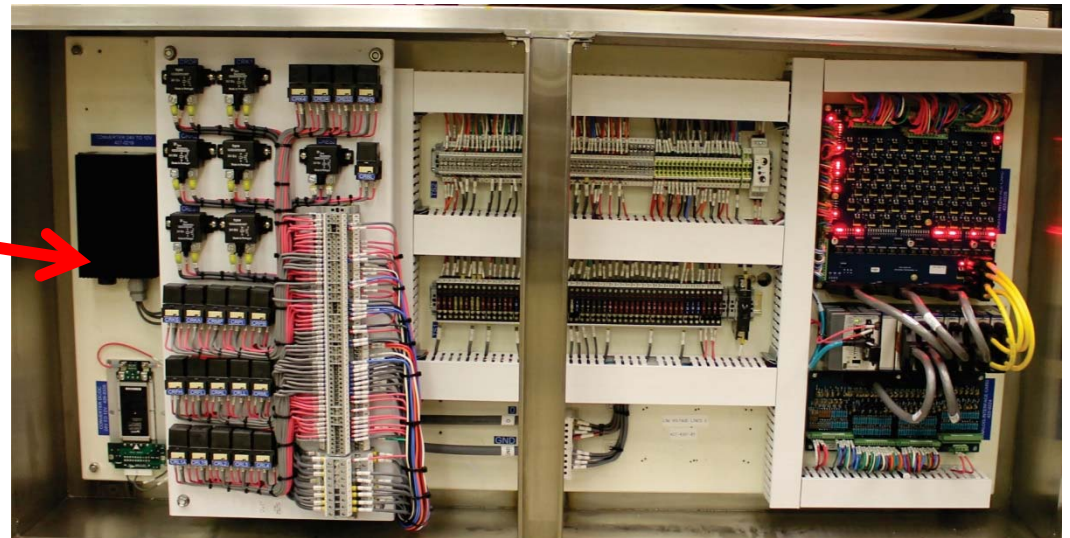
- ❑ The same software will be used on all GEN 2 loaders. Electrical wiring is the same to accommodate.
- ❑ Drive system will be functionally the same on all loaders. Expandable based on requirements.
- ❑ Due to extensive testing there is very little customization and configurability.
- ❑ Control logic is hidden. Software is programmed to tell you when the logic is preventing the operators command from being preformed.
- ❑ Rolling channel log. Always recording all channels. 6 days stored on machine.
- ❑ Normal and Troubleshooting notices.
- ❑ Automated Calibration of Position Sensors

COMPONENT DESCRIPTIONS

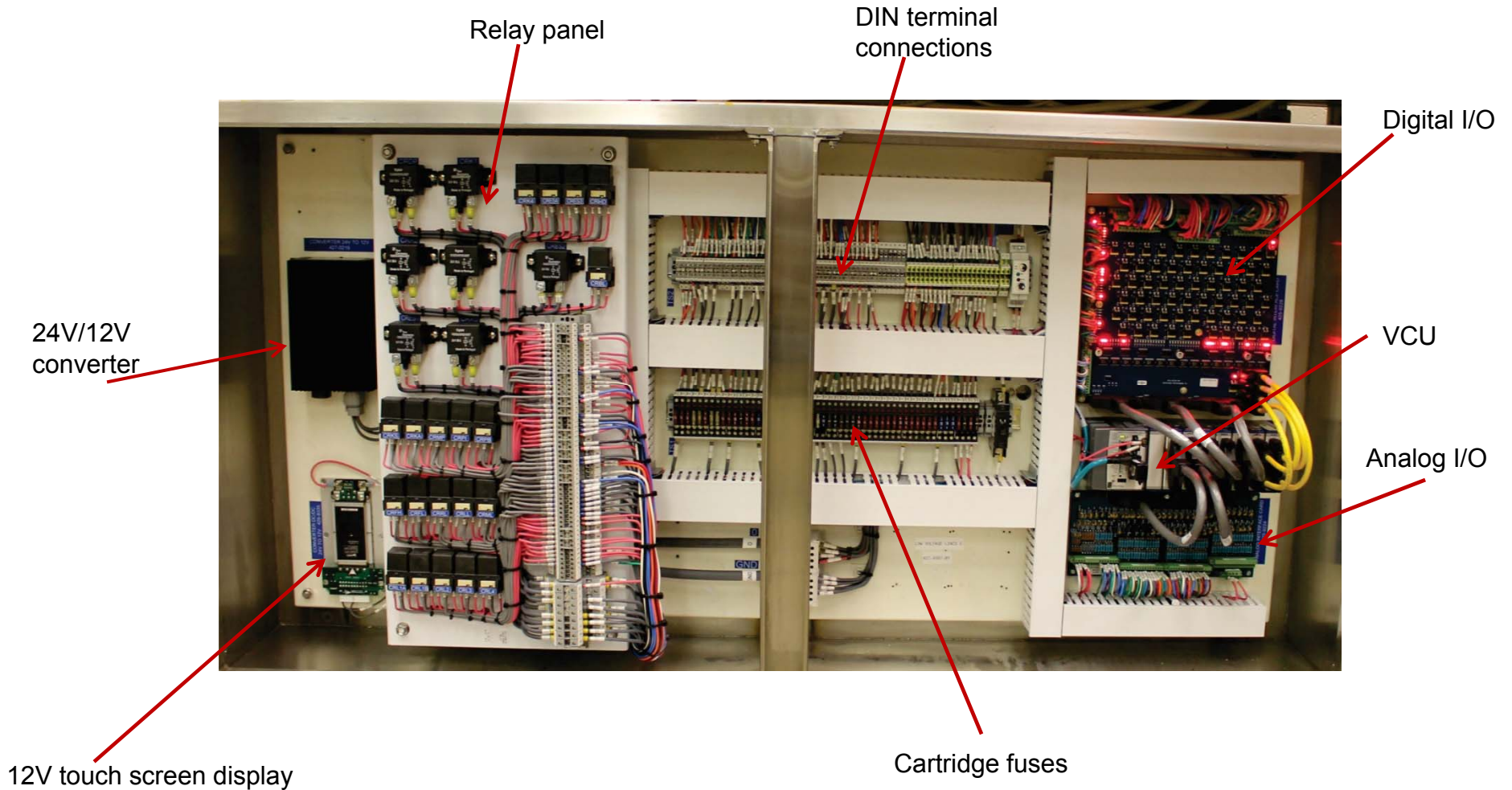
COMPONENT DESCRIPTIONS

- Low Voltage Control Cabinet**
 - VCU (Vehicle Control Unit)
 - Digital Interface Card
 - Analog Interface Card
 - Fuses & Relays
 - 12v Power Supplies (Dealer options & touch screen)
- Cab**
 - HMI (Human/Machine Interface)
 - Touch Screen Display
 - Keypad
 - Joysticks
 - User access key reader
 - USB Port (Download)
- Enclosures**
- Breakout Boxes**
- I/O Devices and Cables**
- Other Cabling**

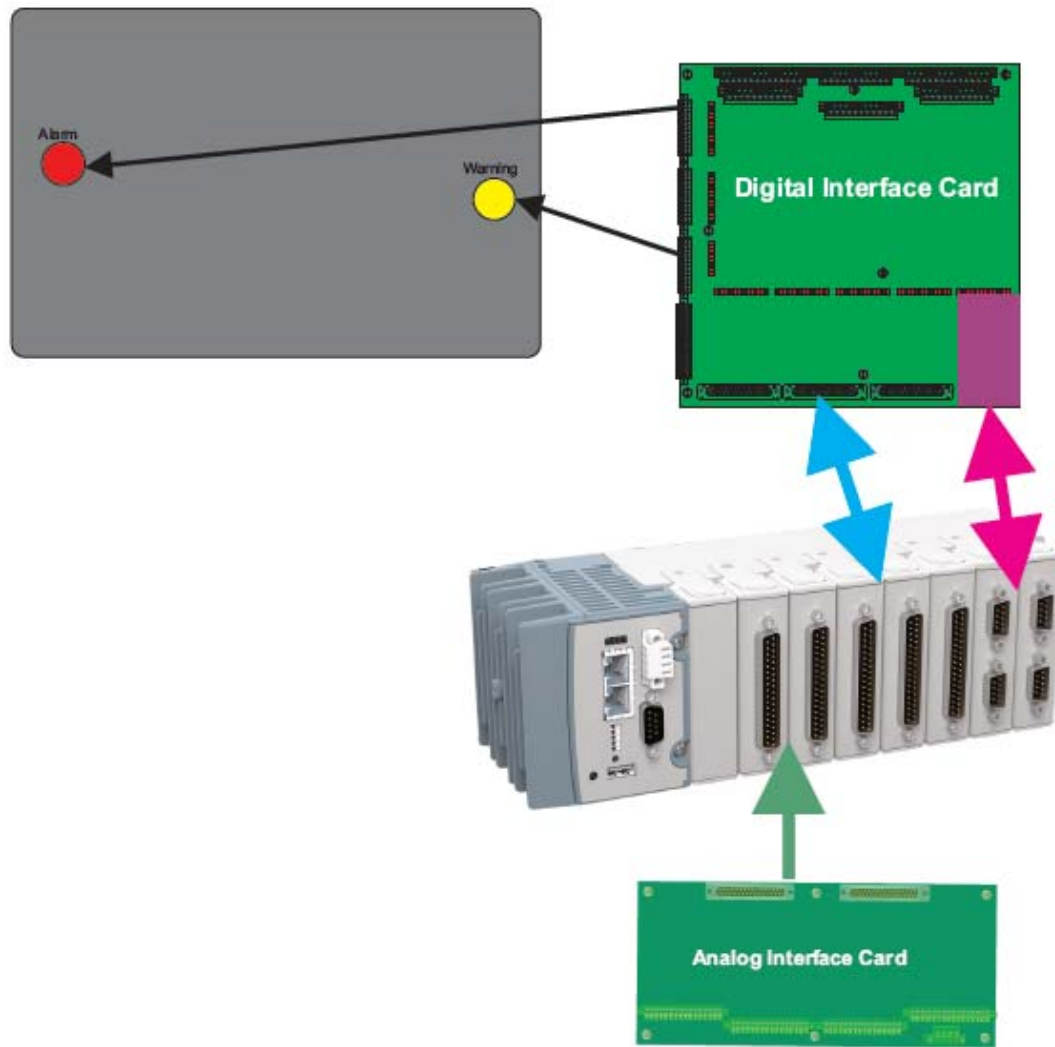
LOW VOLTAGE CONTROL CABINET



LOW VOLTAGE CONTROL CABINET



VCU (VEHICLE CONTROL UNIT)



VCU Functionality

The Brains of the Loader

- *Control*
- *Protection - Alarm/Warnings*
- *Safety features*

Loader can operate at full production without touch screen and/or HMI

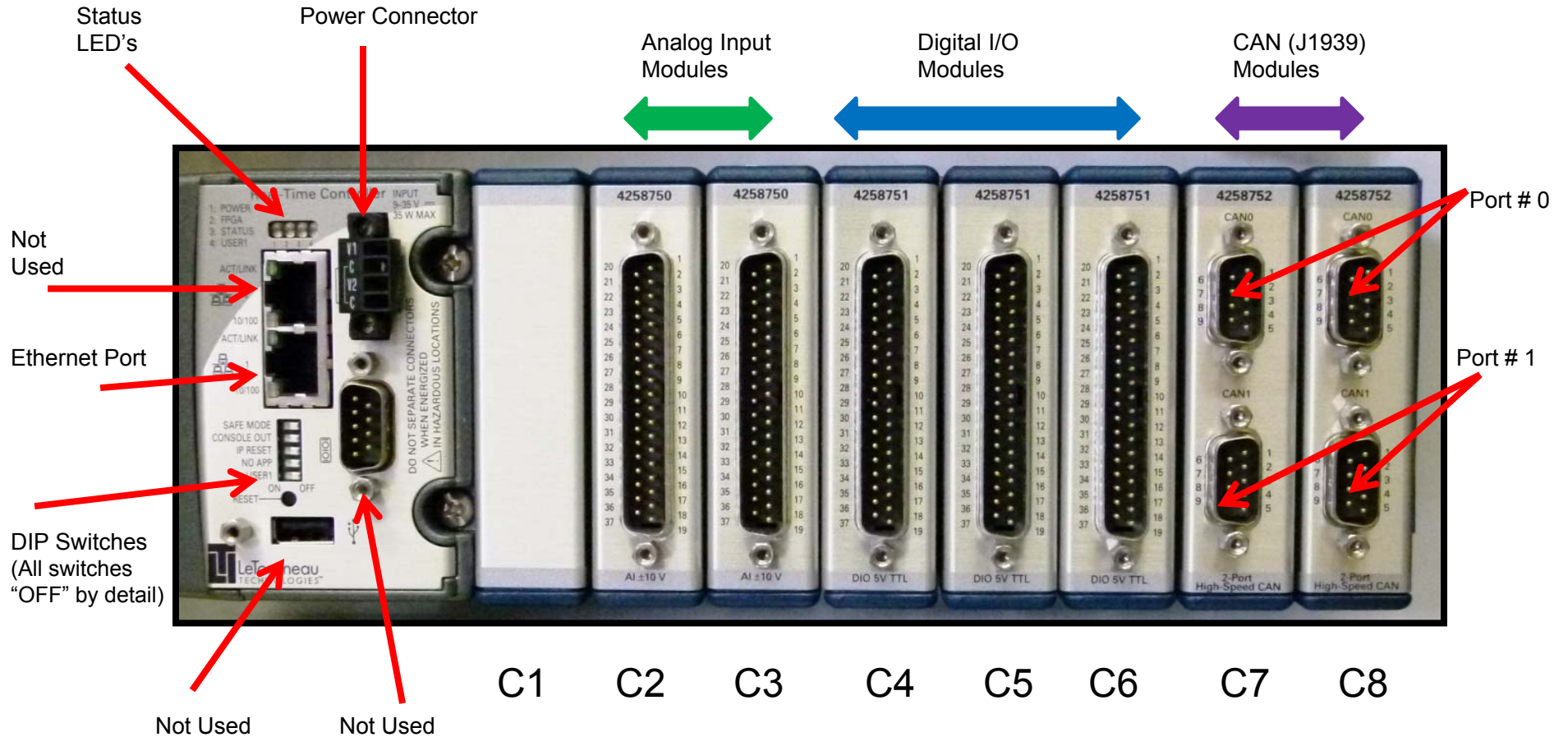
EXCEPT:

If an alarm or warning happens you will only see the light and not know what it is.

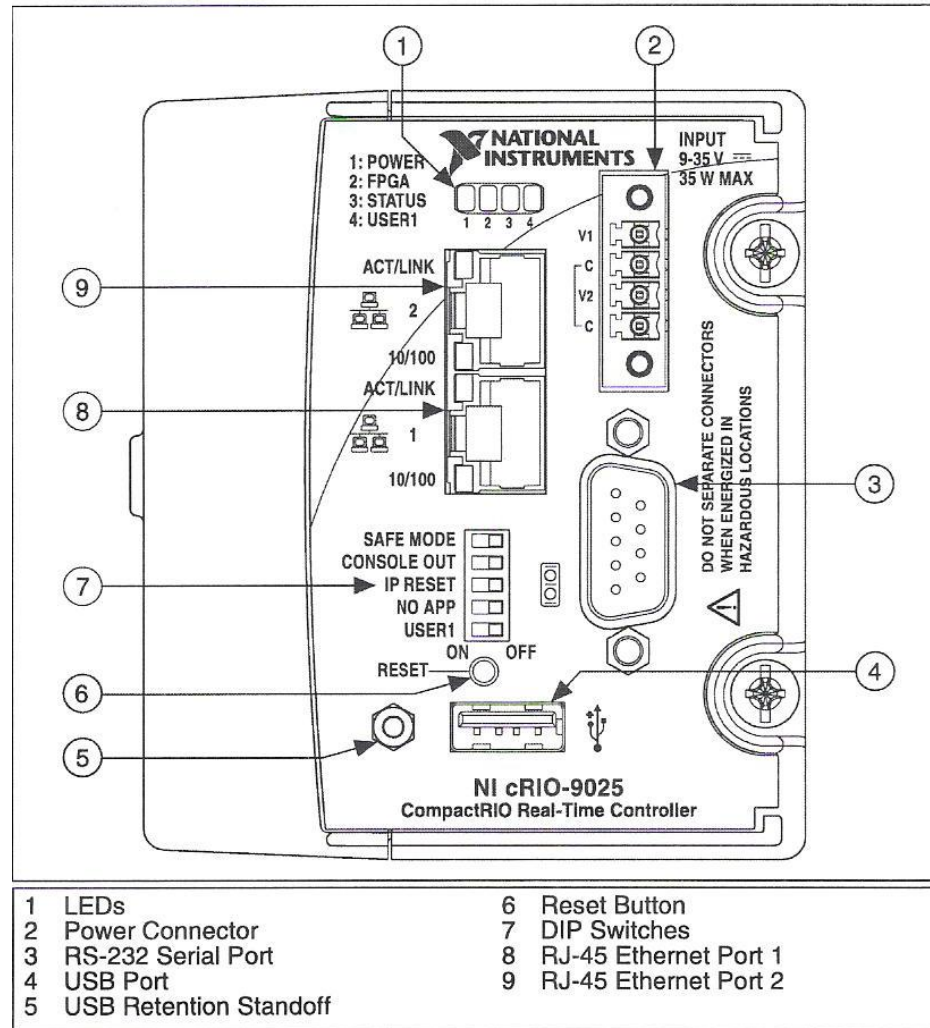
When Park Brake Sw LED is on the VCU is fully booted and engine can be cranked. If no inhibits exist. System is Logging.

Missing modules will be reported except if module 4 is missing. This will prevent LINCS from booting.

VEHICLE CONTROL UNIT (VCU)



VCU



LED INDICATIONS

Understanding LED Indications

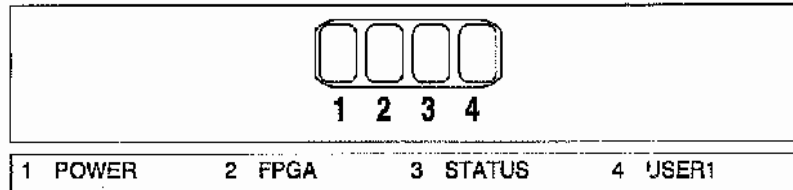


Figure 7. CompactRIO Controller LEDs

POWER LED

The POWER LED is lit while the controller is powered on. This LED indicates that the power supply connected to the controller is adequate, and that the controller is supplying power to the CompactRIO system.

This LED is a bi-color LED. When the controller is powered from V1, the POWER LED is lit green. When the controller is powered from V2, the POWER LED is lit yellow.

FPGA LED

You can use the FPGA LED to help debug your application or easily retrieve application status. Use the LabVIEW FPGA Module to define the FPGA LED to meet the needs of your application. Refer to the *LabVIEW Help* for information about programming this LED.

STATUS LED

The STATUS LED is off during normal operation. The controller indicates specific error conditions by flashing the STATUS LED a certain number of times every few seconds, as shown in Table 2.

LED INDICATIONS

Table 2. Status LED Indications

Number of Flashes	Indication
1	The controller is unconfigured. Use MAX to configure the controller. Refer to the <i>Measurement & Automation Explorer Help</i> for information about configuring the controller.
2	The controller has detected an error in its software. This usually occurs when an attempt to upgrade the software is interrupted. Reinstall software on the controller. Refer to the <i>Measurement & Automation Explorer Help</i> for information about installing software on the controller.
3	The controller is in safe mode because the Safe Mode DIP switch is in the ON position. Refer to the <i>Configuring DIP Switches</i> section for information about the Safe Mode DIP switch.
4	The controller software has crashed twice without rebooting or cycling power between crashes. This usually occurs when the controller runs out of memory. Review your RT VI and check the controller memory usage. Modify the VI as necessary to solve the memory usage issue.
Continuous flashing or solid	The controller has detected an unrecoverable error. Please contact National Instruments.

USER1 LED

The USER1 LED is a bi-color green/yellow LED. You can define the USER1 LED to meet the needs of your application. To define the LED, use the RT LEDs VI in LabVIEW. For more information about the RT LEDs VI, refer to the *LabVIEW Help*.

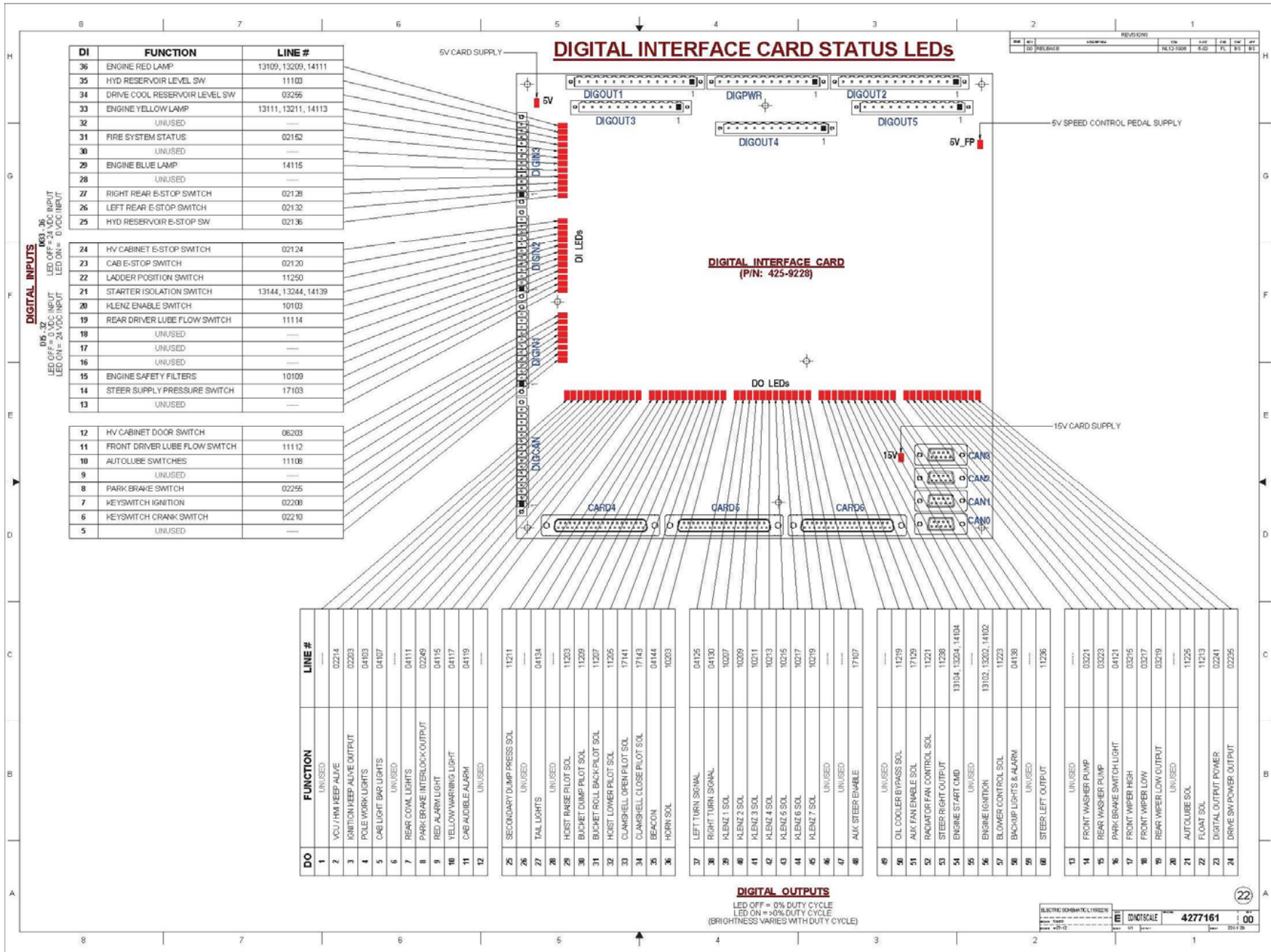
I/O

Digital I/O

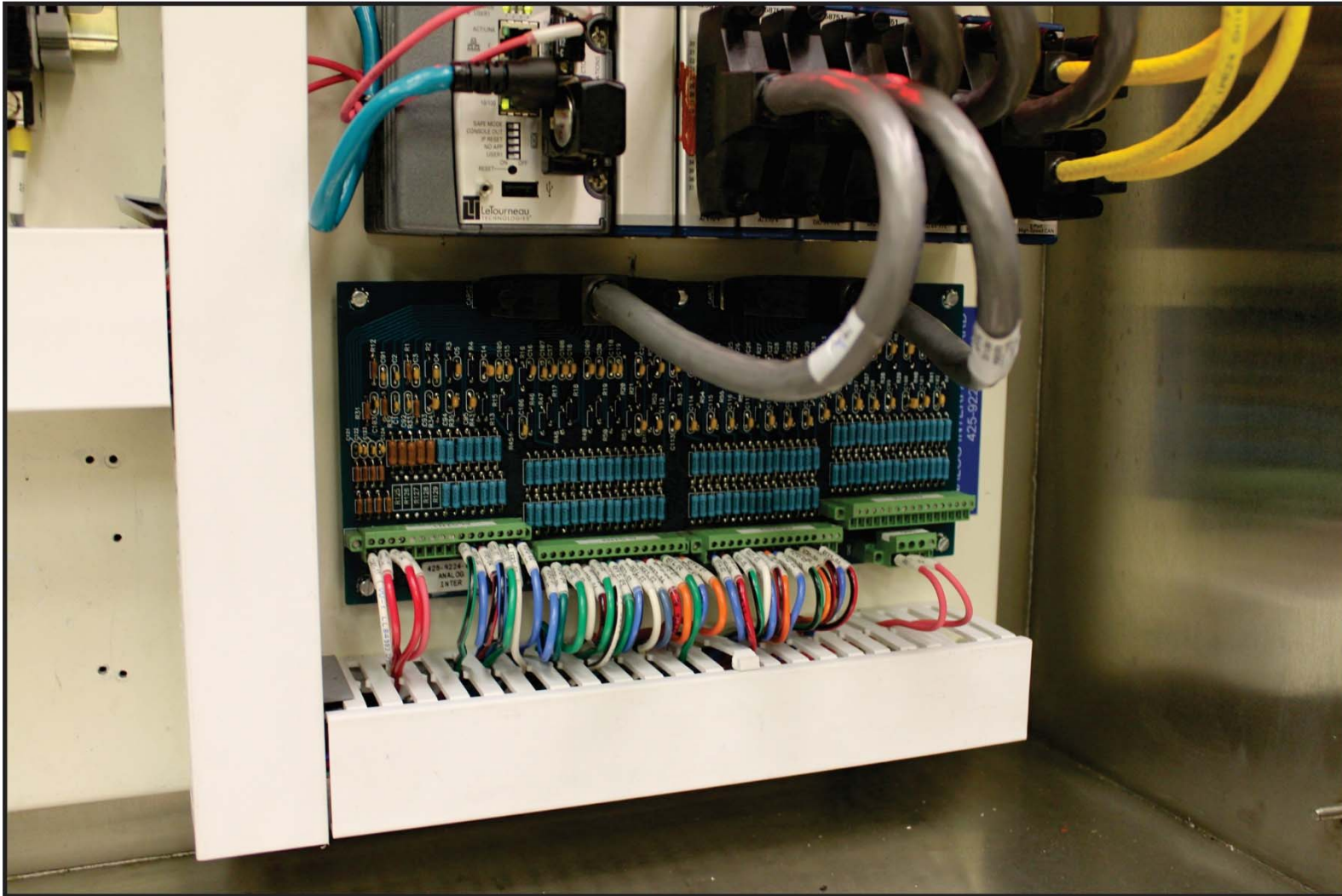
VCU

Analog I/O

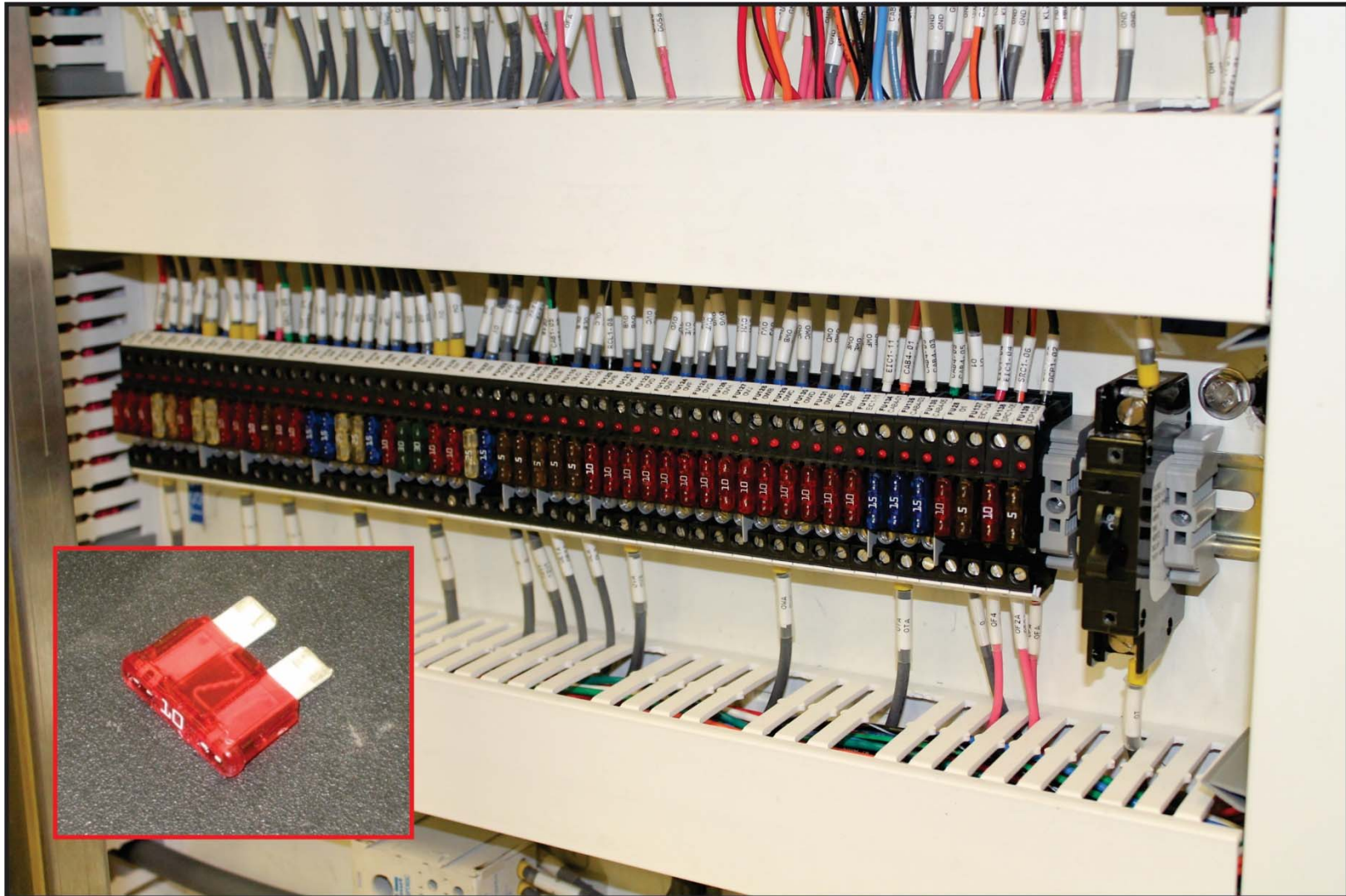




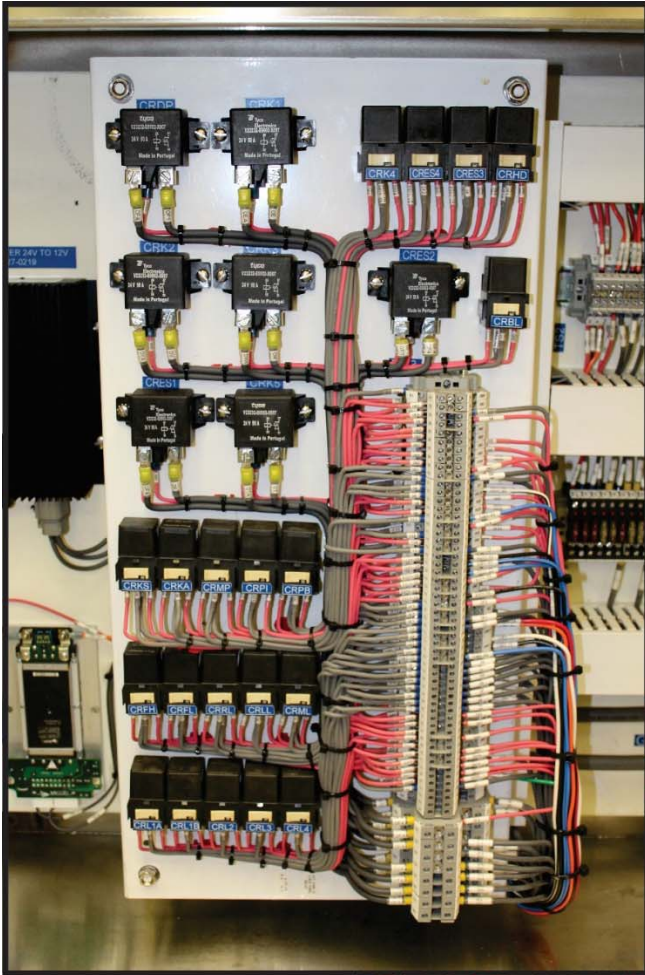
ANALOG INTERFACE CARD



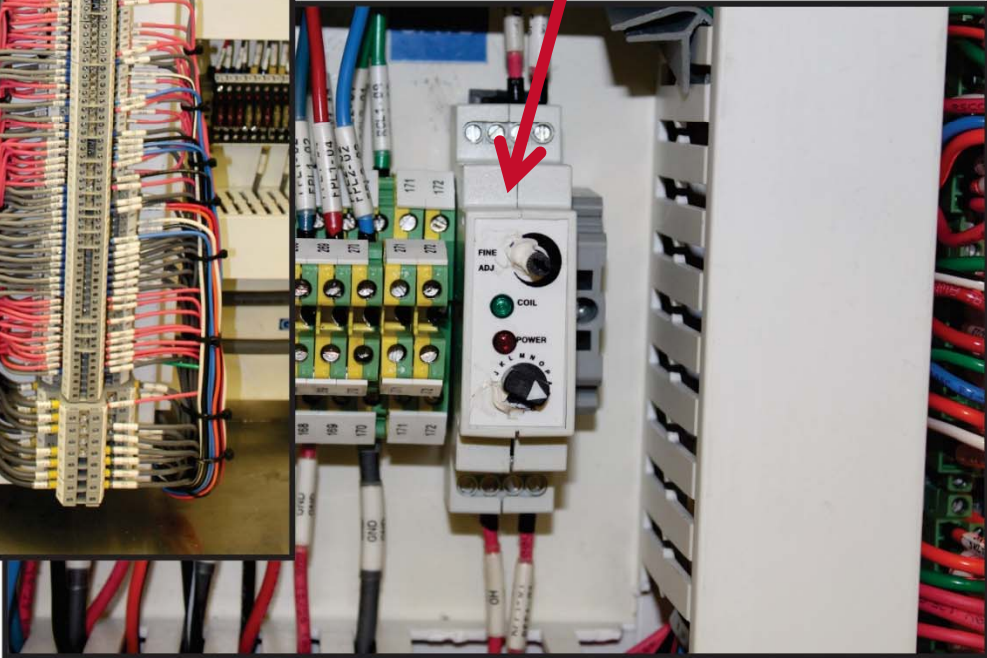
24VDC FUSES



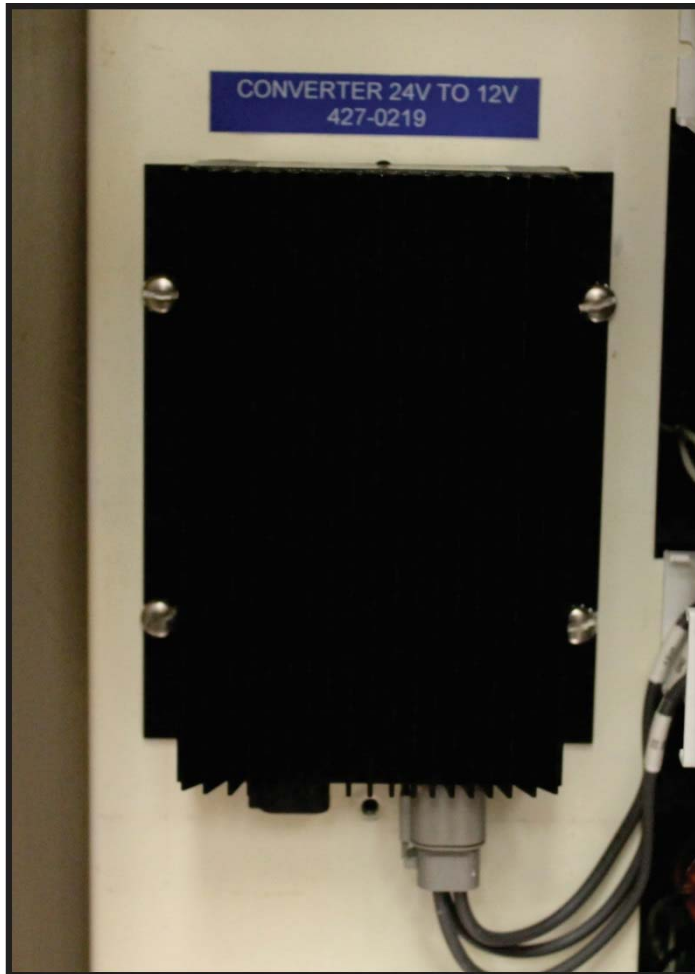
CONTROL RELAYS



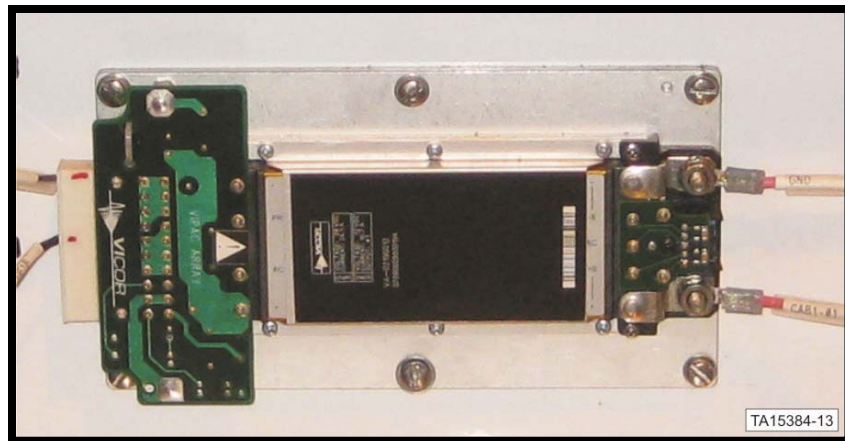
0.5 sec. Time Delay Relay CR TD



12V POWER SUPPLIES

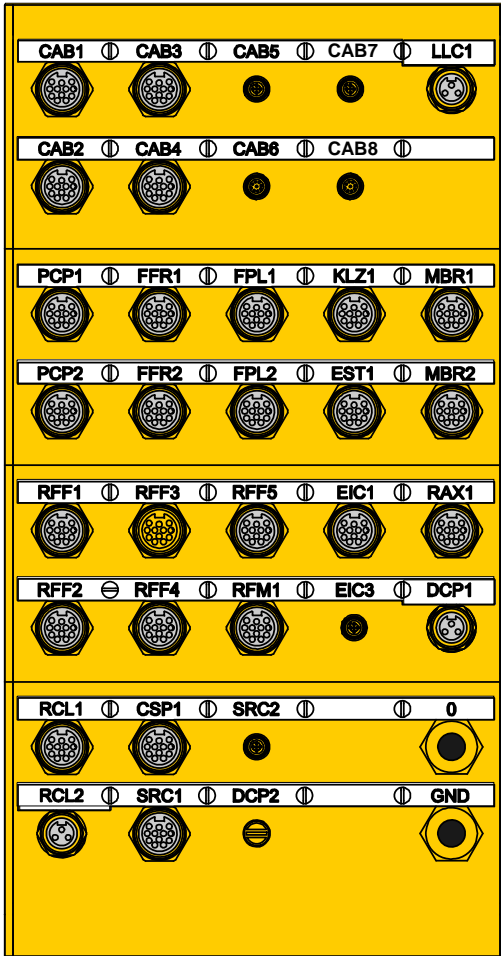


12v Supply for Radio and Power Outlet



12v Supply for Display

LOW VOLTAGE CABINETCONNECTORS



CONNECTOR ABBREVIATIONS

- CAB - CAB
- LLC - LADDER LIGHT CONTROL
- PCP - PILOT CONTROL PANEL
- FFR - FRONT FRAME
- FPL - FRONT POLE LIGHT
- MBR - MIRROR BAR
- KLZ - KLENZ
- EST - EMERGENCY STOP
- RFF - REAR FRAME FORWARD
- RFM - REAR FRAME MIDDLE
- EIC- ENGINE INTERFACE CABNET
- RAX - REAR AXLE
- DCP - DRIVE COOLING PUMP
- RCL - REAR COWL
- CSP - CONTROL SWITCH PANEL
- SRC - SR CABNET



CAB



CAB



CAB CONNECTIONS



DISPLAY CONSOLE



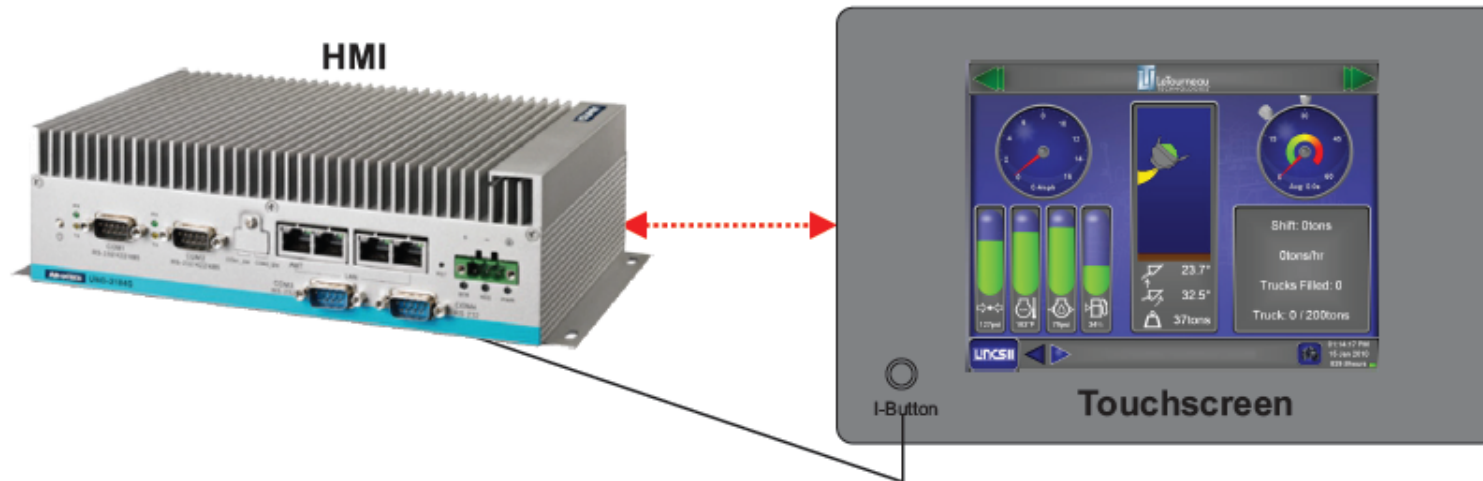
KEY PAD



JOY STICKS



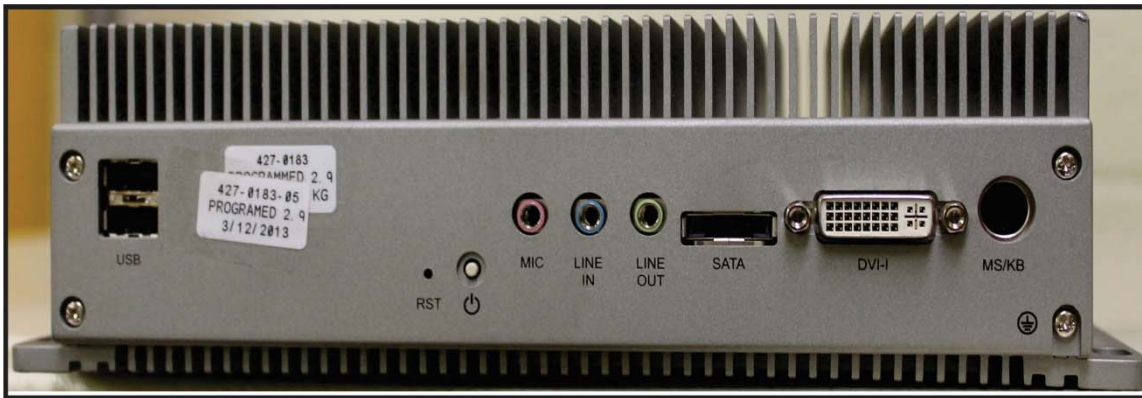
HMI (Human Machine Interface)



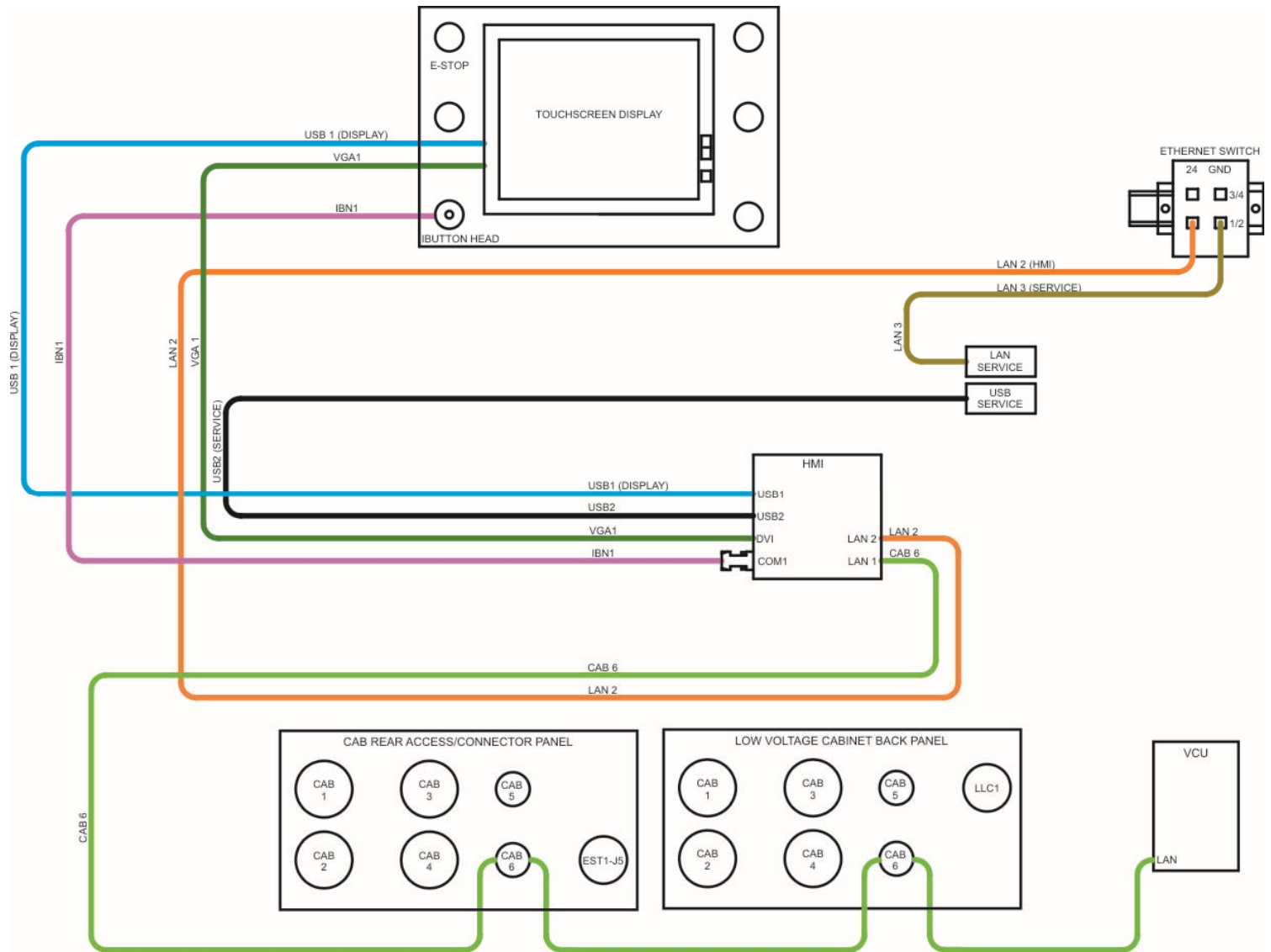
- Gauge cluster
- Channel charting
- Event viewing - I-Button determines access level
- Channel forcing
- Calibrations (sequence of automated channel forces and data collection)
- Software upload
- Download logs
- Configure VCU (Service Rep access only)
- Create user access keys – only down one level
- **Additional channel and event log storage capacity**

HMI Functionality

HUMAN MACHINE INTERFACE (HMI)

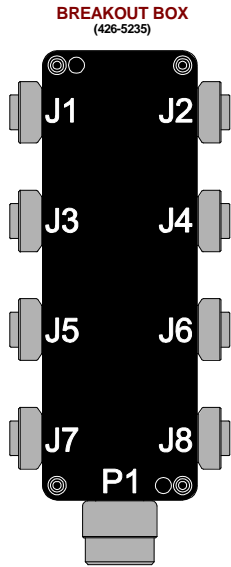


CAB LINCS WIRING DIAGRAM



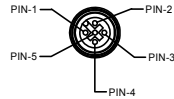
TA15384-18

BREAKOUT BOXES



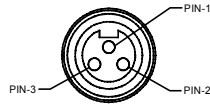
CONNECTOR COLOR CODES

5 PIN FEMALE CAN RECEPTACLE



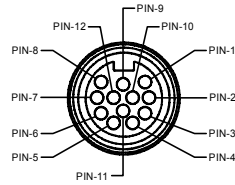
PIN LEGEND	
PIN	COLOR
1	DRAIN
2	RED 24V
3	BLK GND
4	WHIT (CAN H)
5	BLU (CAN L)

3 PIN FEMALE RECEPTACLE

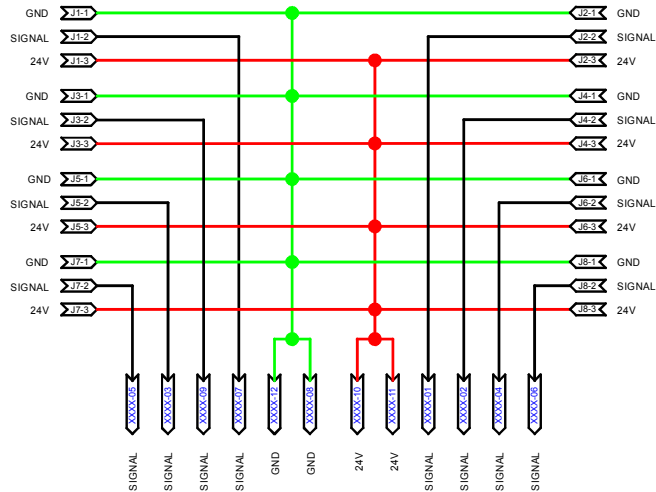


PIN LEGEND	
PIN	COLOR
1	GREEN
2	BLACK
3	WHITE

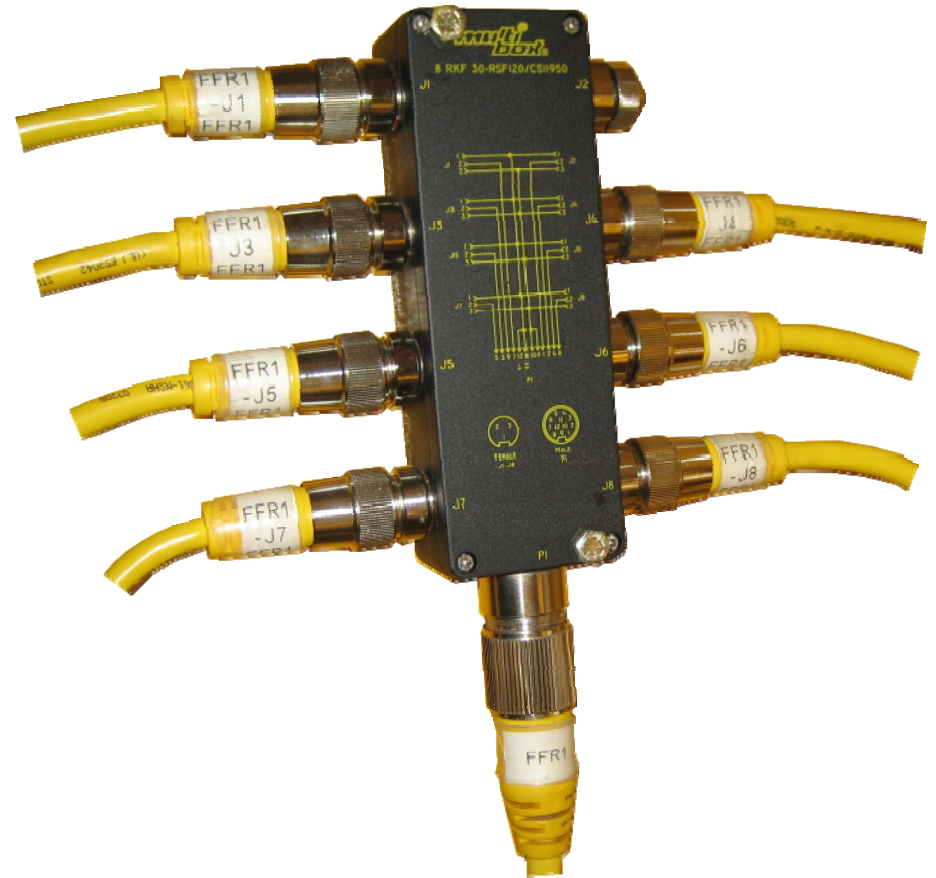
12 PIN FEMALE RECEPTACLE



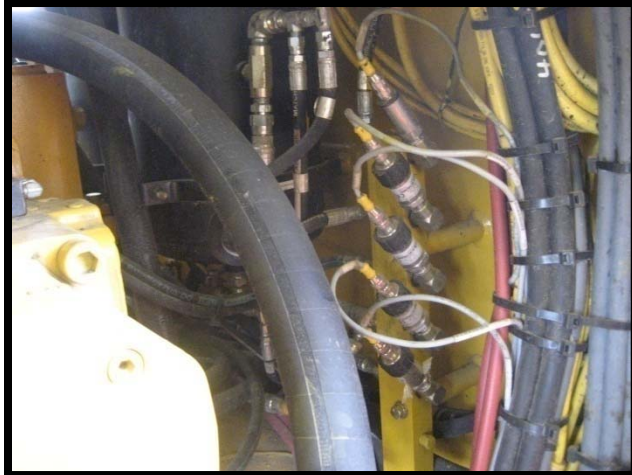
PIN LEGEND	
PIN	COLOR
1	ORANGE
2	BLUE
3	WHITE/BLACK
4	RED/BLACK
5	GREEN/BLACK
6	ORANGE/BLACK
7	BLUE/BLACK
8	BLACK/WHITE
9	GREEN
10	RED
11	WHITE
12	BLACK



XXXX: HARNESS NAME / WIRE CODE



I/O DEVICE CABLING



Pressure Sensors



426-5234

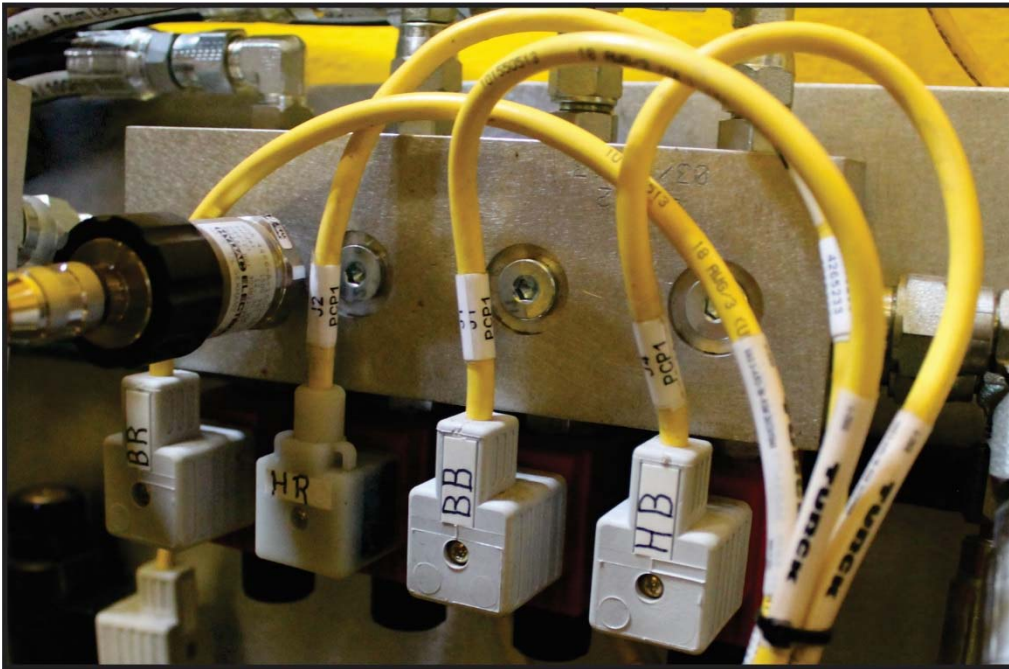


Position Sensors



426-7338

I/O DEVICE CABLING



Solenoids



426-5233



426-5232

CABLE EXTENSIONS



3 Pin Extension (From breakout box to device cable)



12 Pin Extension (To breakout boxes)

R4266241 = 10 meter

R4266240 = 5 meter

R4265213 = 3 meter

R4265231 = 2 meter

R4264198 = 1.6 meter

R4264197 = 1.4 meter

R4264196 = 1.2 meter

R4265230 = 1 meter

R4266243 = 10 meter

R4266242 = 8 meter

R4265229 = 6 meter

R4265228 = 5 meter

R4265227 = 4 meter

R4265226 = 3 meter

R4265225 = 2.8 meter

R4265221 = 2 meter

R4265207 = 1.5 meter

R4265220 = 1 meter

CAN CABLING



CAN Cables

R4266251 = 10 meter
R4264188 = 1.5 meter
R4266246 = .5 meter
R4266245 = .3 meter
R4266247 = .8 meter

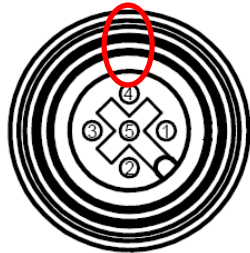


CAN Tee

R4266253

CAN CABLING

FEMALE END VIEW

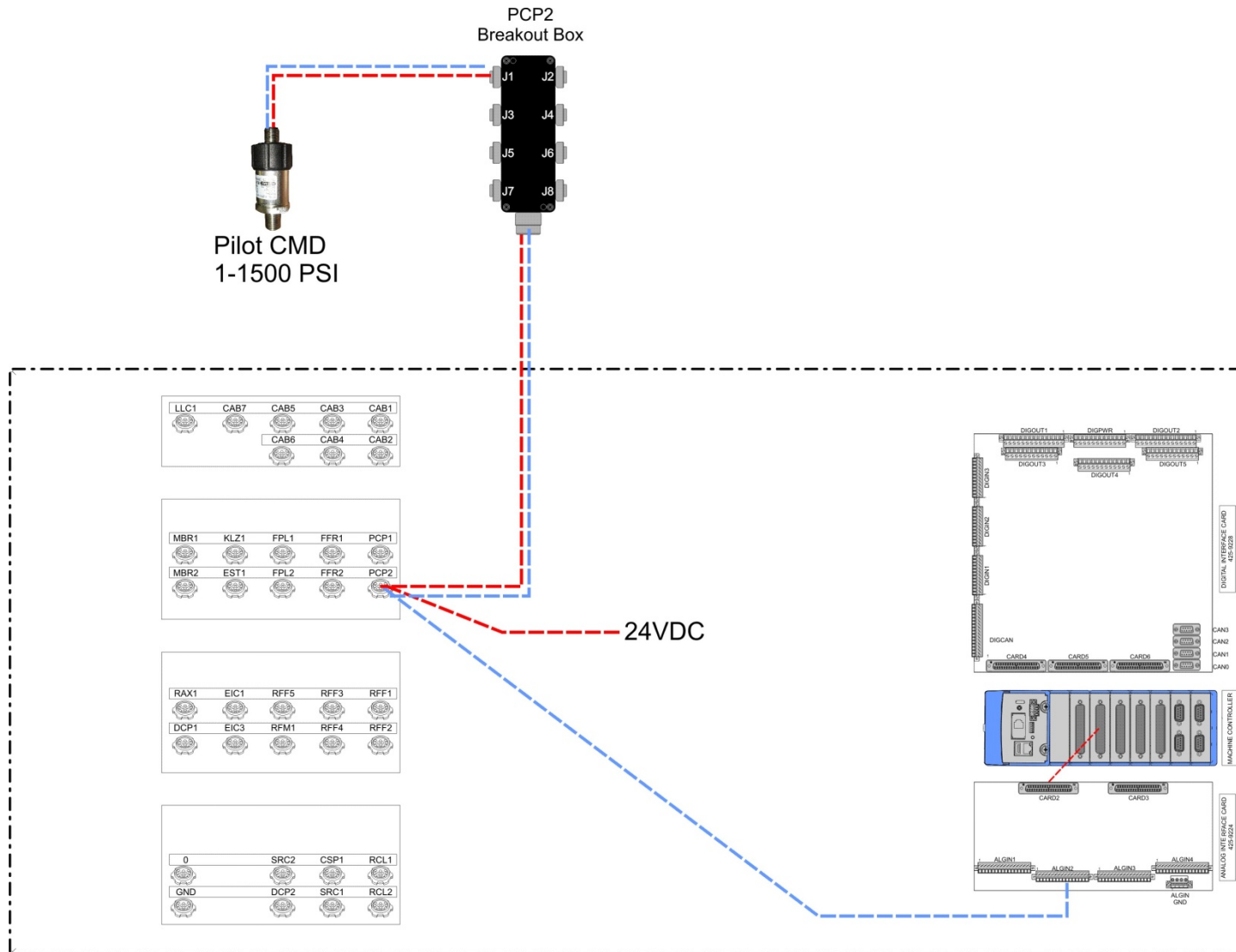


PIN LEGEND	
PIN	COLOR
1	SHIELD
2	RED (+)
3	BLK (-)
4	WHT (CAN_H)
5	BLU (CAN_L)



120 Ohm
Terminating Resistor
426-6254

LOW VOLTAGE CABINET



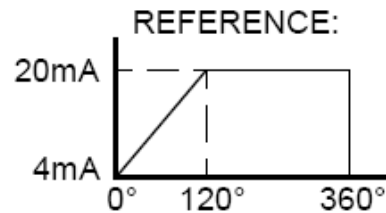
LOW VOLTAGE CABINET

PRESSURE TRANSDUCERS



Measuring	4-20 mA Low Value	@4 mA Low Value	@4 mA High Value	@20 mA Low Value	@20 mA High Value	Part Number
Pressure	0 - 15 PSIG	-0.3	0.3	14.7	15.3	R4265196
	0 - 50 PSIG	-1	1	49	51	R4255488
	0 - 200 PSIG	-4	4	196	204	R4255489
	0 - 1500 PSIG	-30	30	1470	1530	R4255490
	0 - 5000 PSIG	-100	100	4900	5100	R4255491
Δp	0 - 20 IN H2O	-0.4	0.4	19.6	20.4	R4255418
Temperture	-10°C - 100°C	-22.4	-17.6	97.6	102.4	R4256107
Temperture Ambient	-50°C - 85°C					R4268390

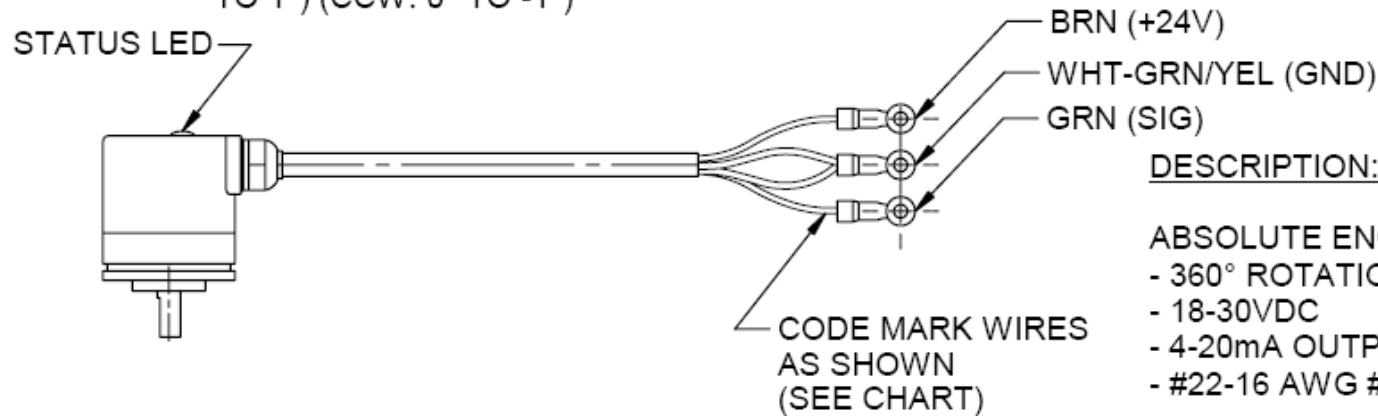
POSITION SENSORS



OUTPUT Vs. CLOCKWISE SHAFT ROTATION (CLOCKWISE AS VIEWED FROM THE SHAFT END OF THE ENCODER).

STATUS LED:

RED: SENSOR BREAK DETECTION, OUTPUT LOAD MONITORING
GREEN: REFERENCE POINT (CW: 0° TO 1°) (CCW: 0° TO -1°)

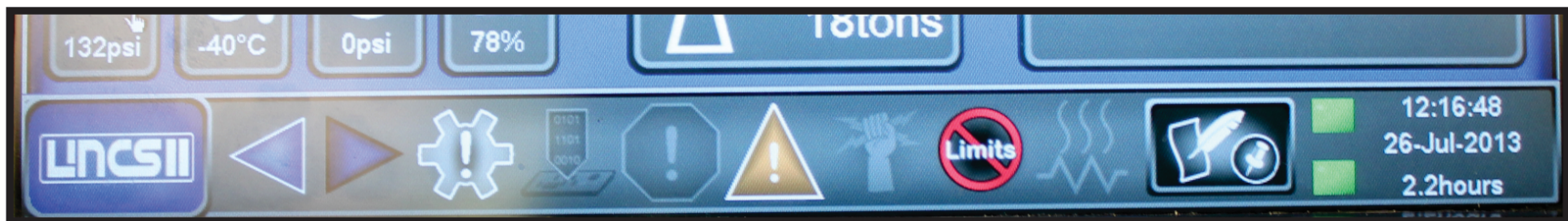


DESCRIPTION:

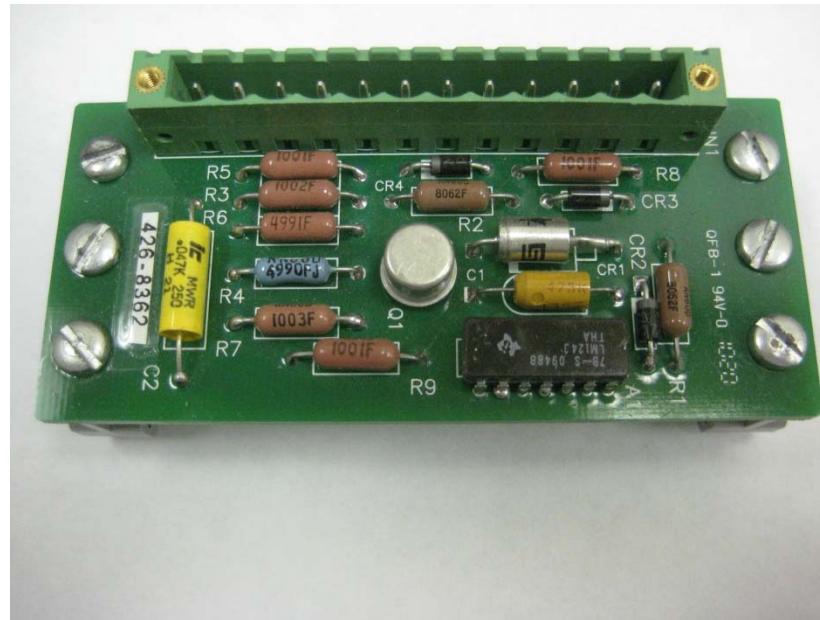
ABSOLUTE ENCODER WITH
- 360° ROTATION WITH NO STOPS
- 18-30VDC
- 4-20mA OUTPUT
- #22-16 AWG #6 HOLE WIRE TERMINALS

POSITION SENSOR CABLE FAIL

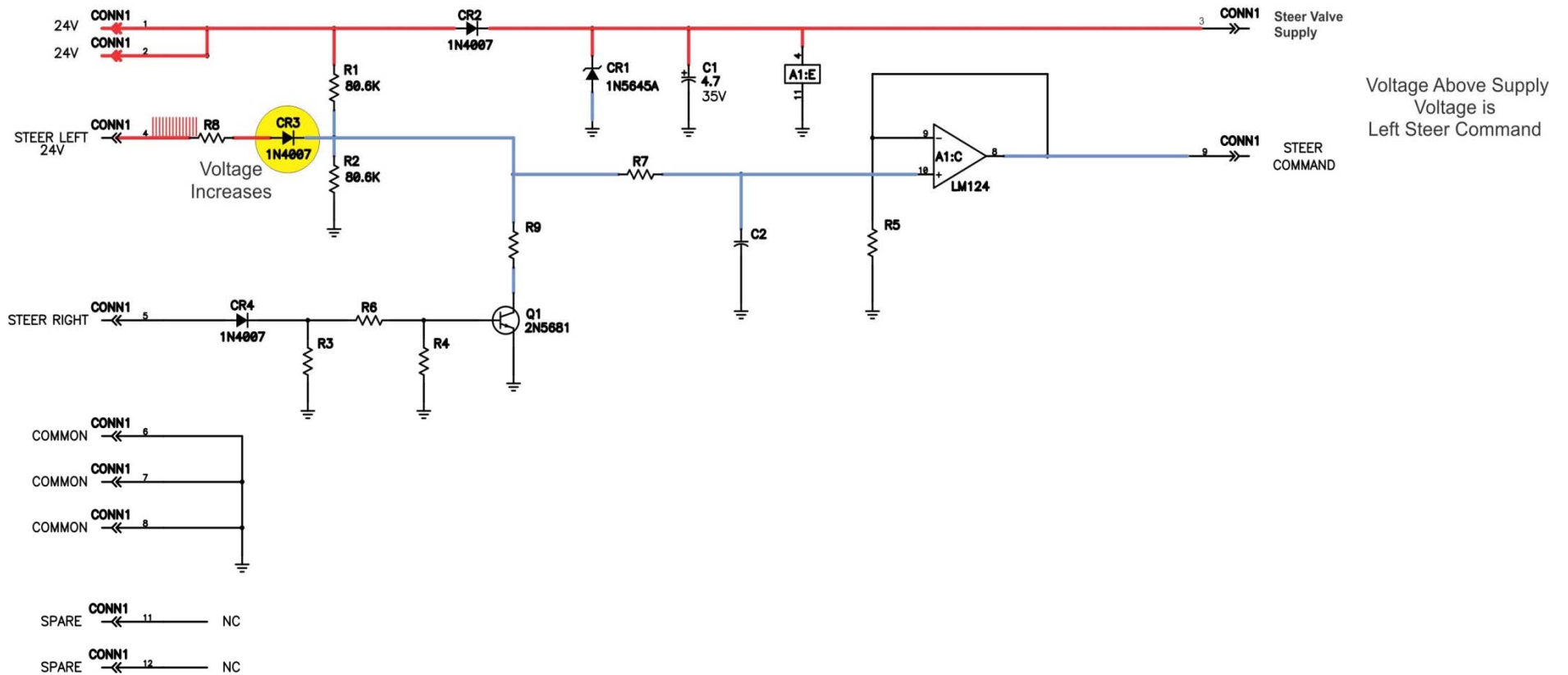
- ❑ Automatically bypasses limits with manual restore
- ❑ Automatic motion functions will be disabled
- ❑ Bypass limits does not disable inhibits like Park Brake
- ❑ Slip control does not work if steering sensor is bypassed
- ❑ Load Weight will not work = (Hoist Base)



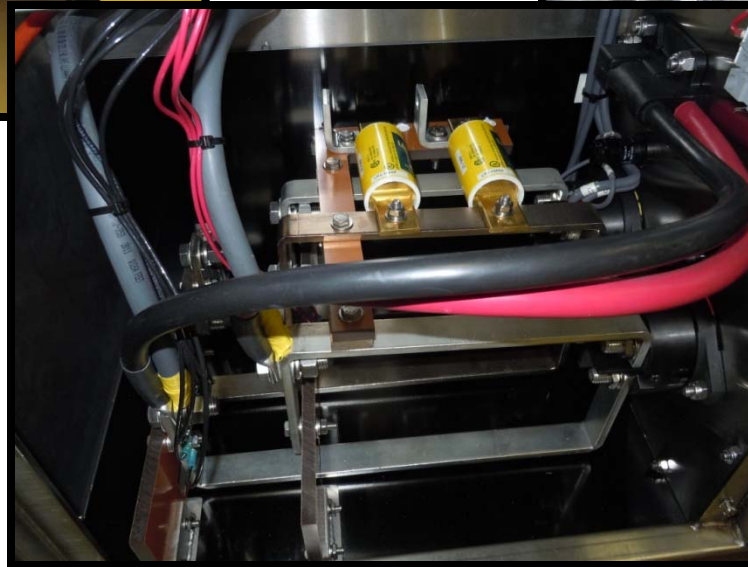
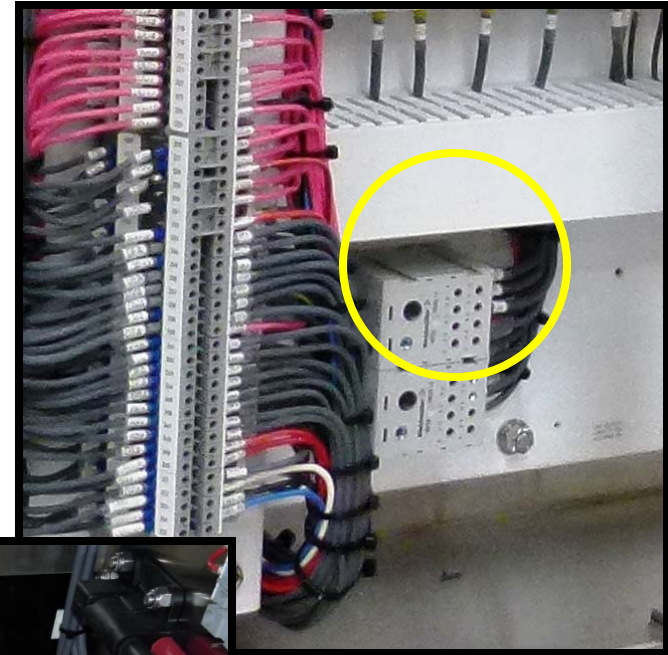
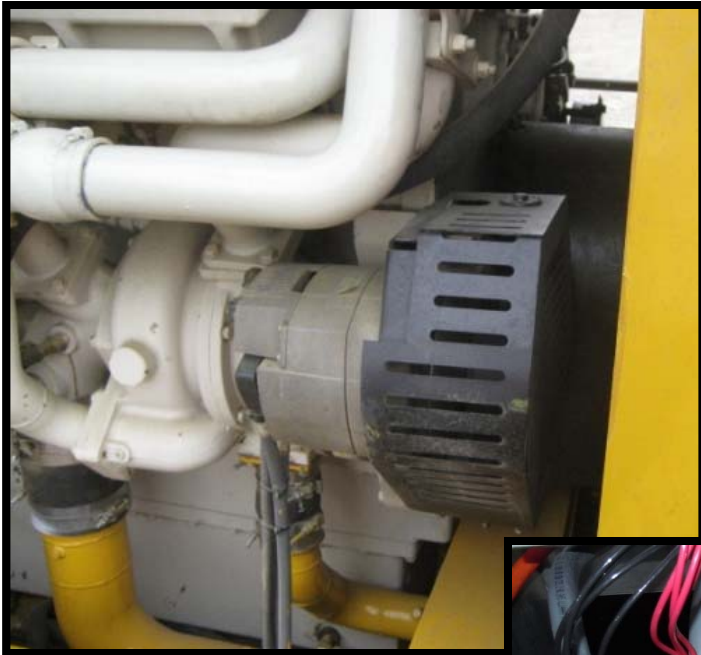
STEERING INTERFACE CARD



Steering Interface Card Left



24VDC DISTRIBUTION

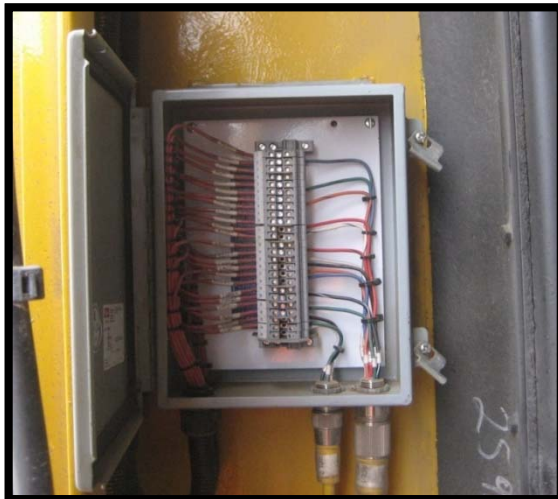
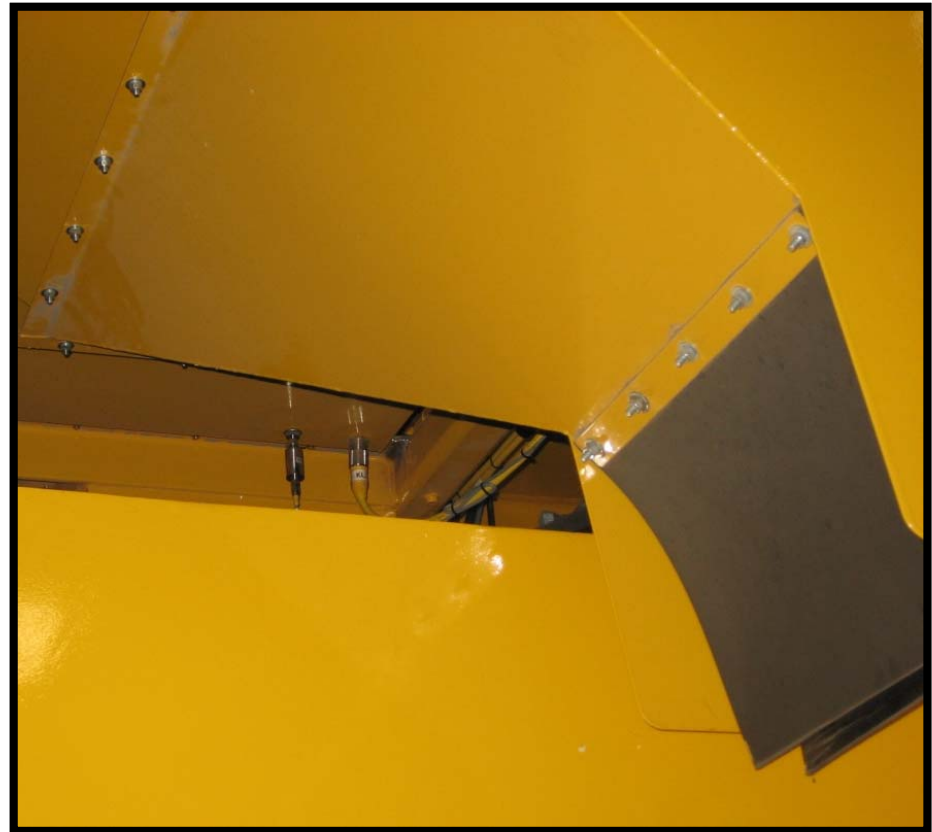


ENCLOSURES



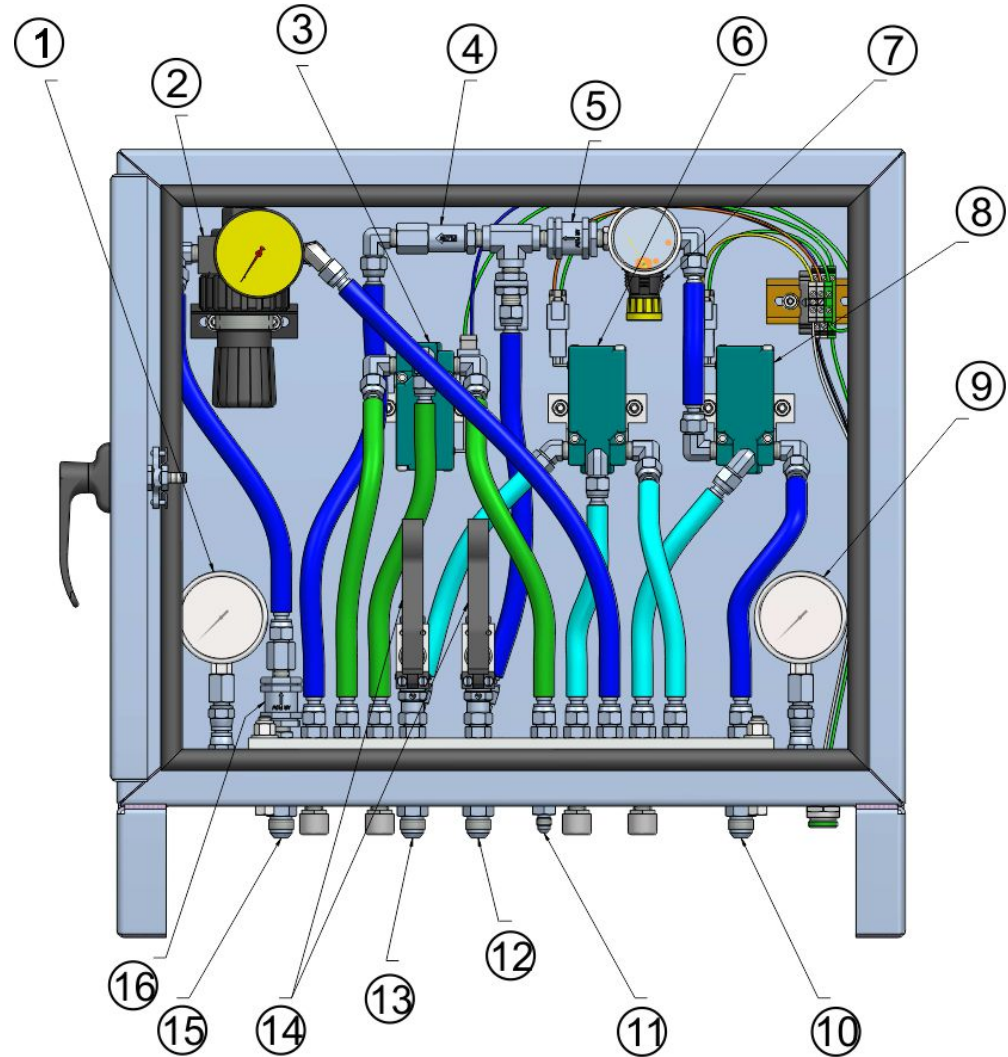
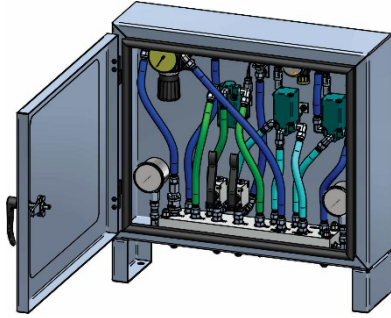
Engine

Klenz Box



Rear Lights

AIR VALVES ENCLOSURE



- 1) Distribution Reservoir Pressure
- 2) Klenz Supply Regulator
- 3) SOL TD
- 4) 12 PSI Relief Valve
- 5) Check Valve
- 6) SOL KA
- 7) Hyd Supply Regulator
- 8) SOL HA
- 9) Klenz Reservoir Pressure
- 10) To/From Klenz Reservoir
- 11) To SOL TD
- 12) To Hyd Reservoir
- 13) To Klenz Manifold
- 14) Manual Shut Off
- 15) From Distribution Reservoir
- 16) Check Valve

OPTIONAL EQUIPMENT POWER SOURCE



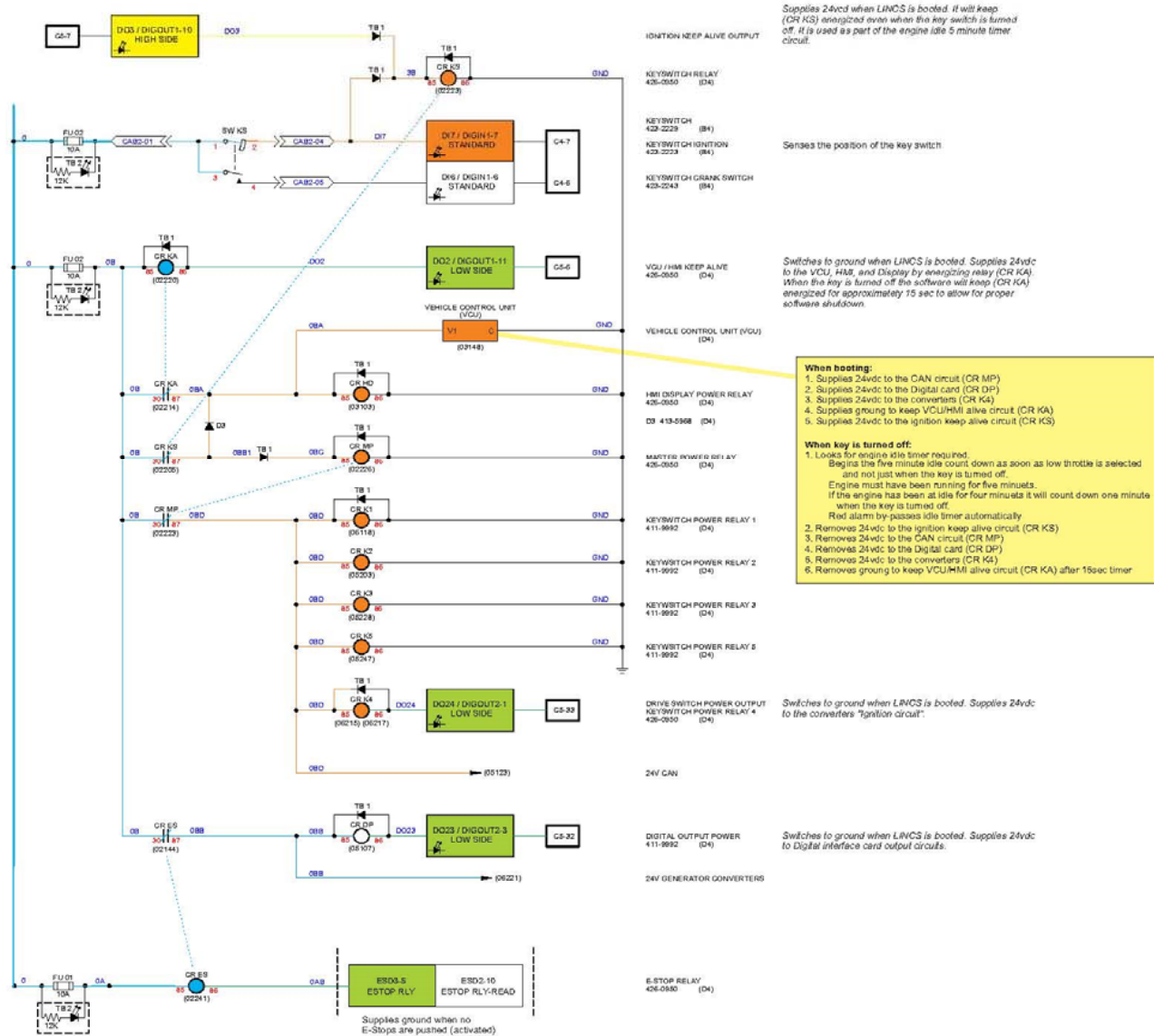
CIRCUIT DESCRIPTIONS

CIRCUIT DESCRIPTIONS

- KEY “ON” POWER UP
- DATA RECORDING
- IDLE TIMER
- USER ACCESS

LINCS "Key On" start circuit

KEYSWITCH



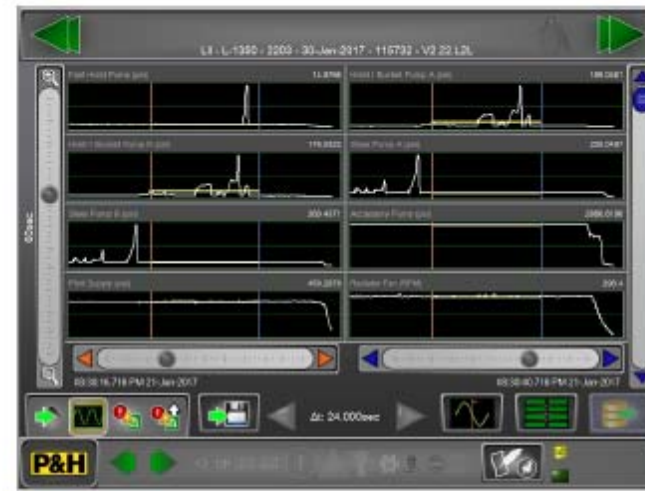
Types of Recorded Data

Event Data



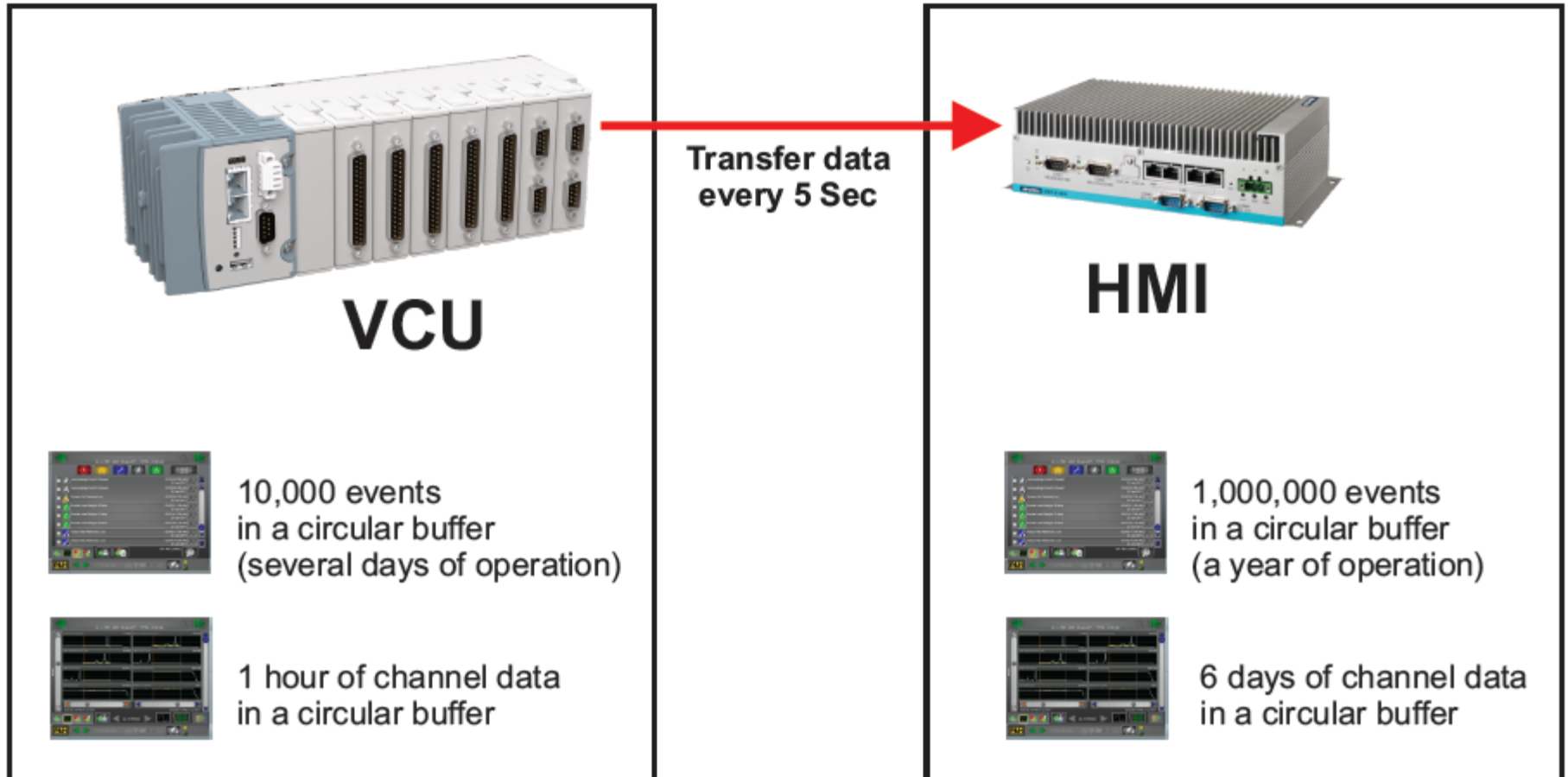
Red - Alarms
Yellow - Warnings
Blue - Alerts
Load Weight
Events - Log in, Ack Button Press, etc

Channel Data

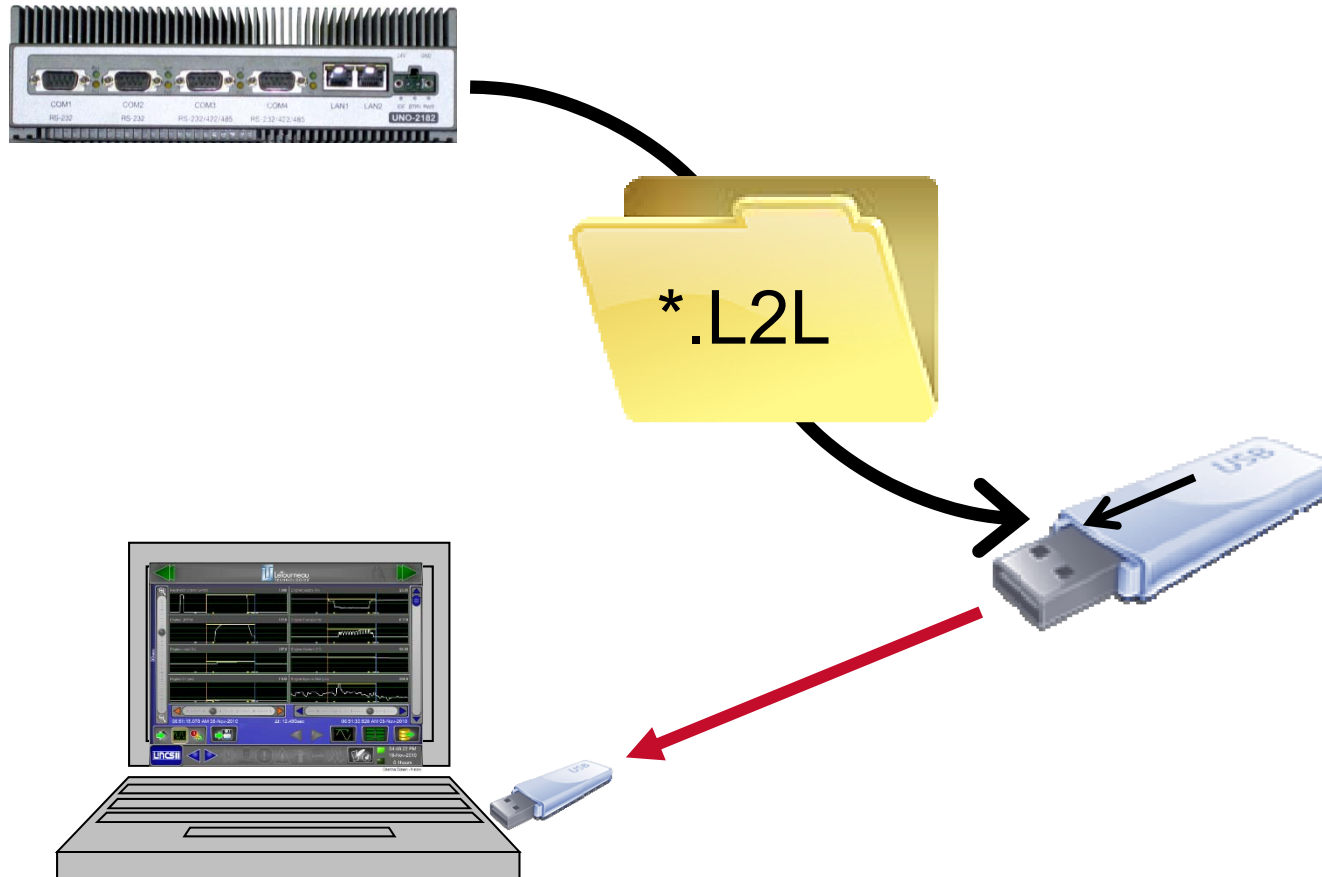


All 450+ channels being recorded
Sampled at 20ms (5 times per Second)

Recorded Data Storage



Downloading / Viewing LOG FILES



GEN 2

IDLE TIMER



- ❑ Begins the five minute idle count down as soon as low throttle is selected and not just when the key is turned off. Engine must have been running for five minutes.
- ❑ If the engine has been at idle for four minutes it will count down one minute when the key is turned off.
- ❑ Red alarm by-passes idle timer automatically

USER ACCESS KEYS

- ❑ LINCS I key will not work with new system
 - ❑ *(it will tell you wrong Key)*
 - ❑ *New LINCS I software is compatible with LINCS II key.*
- ❑ Keys can be programmed on or off loader
- ❑ USB reader (laptop) and serial on loader
- ❑ User cannot create a key of their security level
- ❑ Factory Rep keys are made by Engineering in Longview only.
- ❑ Data on key
 - ❑ *Name*
 - ❑ *Password*
 - ❑ *Security level*
 - ❑ *Language*
 - ❑ *12/24hr clock*
 - ❑ *Unit preference*
- ❑ System changes preferences at log on



USER ACCESS LEVELS

Operator

- Display Troubleshooting Notices
- Adjust Alternate Machine Speed and Motor Torque
- Turn Off or On Aux Steer Test, Brake Test, and Inhibit P.B Released mode.

Maintenance

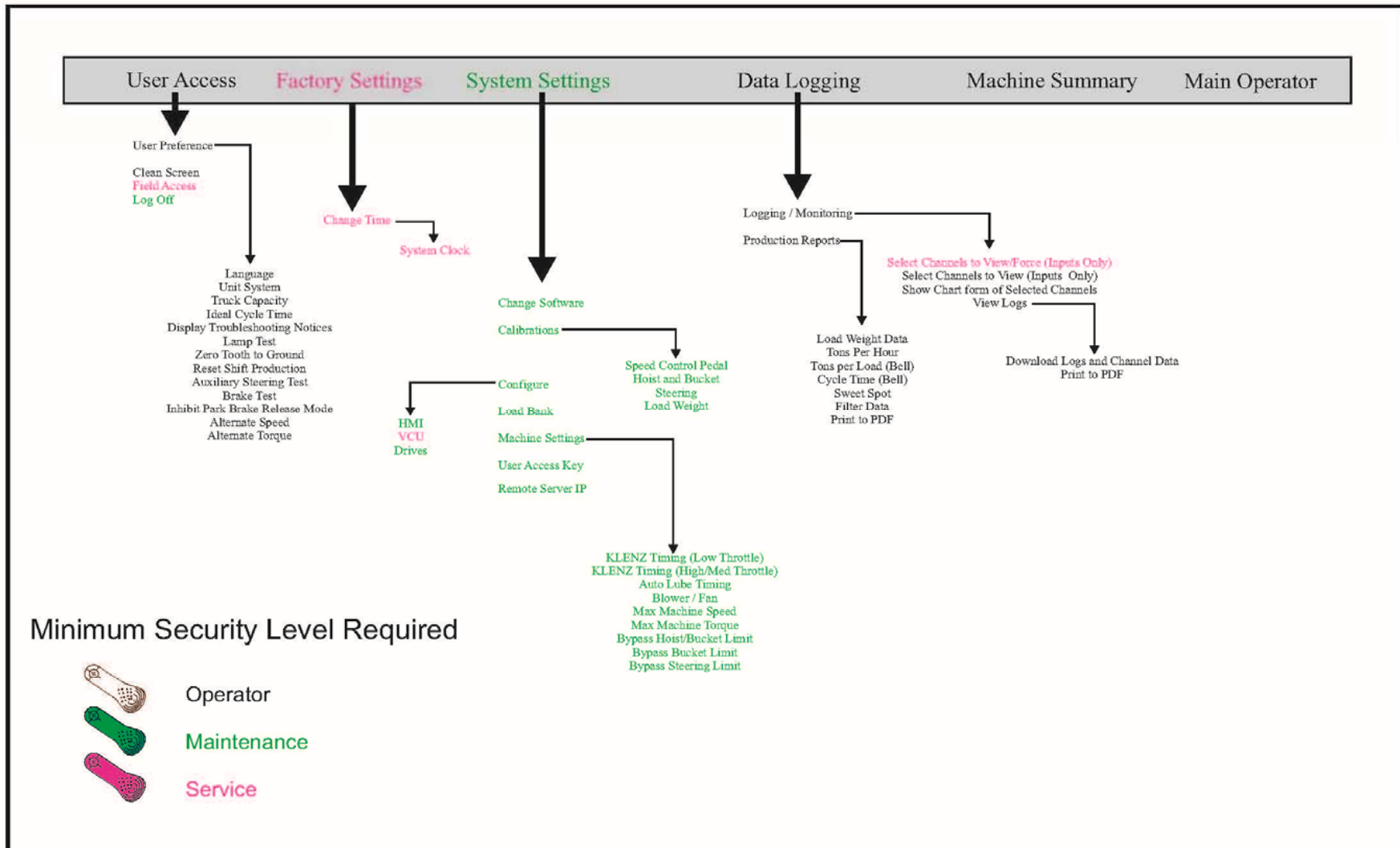
- Machine settings screen
- Software upload, download & restore
- Calibrations
- Load bank
- Create user access keys “Operator”
- Reset red alarm
- Configure Drives
 - Disable drive, swap RPT, Disable phase, Disable panel

Service

- Force channels
- Configure VCU to match machine
- Create user access keys “Maintenance”
- Change system clock

SCREEN NAVIGATION

LINCSII Menu Structure



TROUBLESHOOTING

TROUBLESHOOTING

- ❑ TROUBLESHOOTING NOTICES
- ❑ RED ALARMS
- ❑ YELLOW WARNINGS
- ❑ BLUE EVENTS
- ❑ LOAD WEIGHT

TROUBLESHOOTING NOTICES

- ❑ Can be turned on at any level of access.
- ❑ Will display logic applied limit or inhibit information
 - ❑ For example Raise Hoist Limited by End of Travel



RED ALARMS

Red Alarms indicate something has failed that could result in catastrophic damage or personal injury.

□ Step 1:

- The cab audible beeper is sounded and the red light on the dash is illuminated.
- Idle speed is changed to low idle and the drive system if energized will remain energized. This means top speed is limited to half machine rated speed.
- If the touch screen is present it will display the alarm text on screen.
- Pressing the acknowledge switch silences the beeper and removes the text from the screen.
- A counter on the upper bar of the screen will display the amount of time the operator has until the machine is shut down. This amount of time will vary based on the alarm. This time can be zero for some alarms. When the counter reaches zero the shut down sequence will begin. At any time during step 1 if the park brake switch is pressed in, it will skip to step 2.



□ Step 2:

- Zero speed is commanded to the drive system.

□ Step 3:

- When the vehicle has reached .5mph the engine is turned off bypassing the idle timer and the park brakes are set.
- The operator can release the computer's park brake control by pushing the park brake switch in.
- The engine will not restart until the system is rebooted unless someone with high enough security access resets the alarm.

RED ALARMS

Delay to shut down time

- ❑ Auxiliary Steering System Activated = 30 Sec
- ❑ **Auxiliary Steering System Fault = 0 Sec**
- ❑ Battery Charging Alternator Voltage Critically Low = 30 Sec
- ❑ **Emergency Stop Switch Pressed (Any) = 0 Sec**
- ❑ Engine Red Lamp Active = 10 Sec
- ❑ Engine Safety Filter(s) Restricted = 1 Min
- ❑ Fire System Engaged = 10 Sec
- ❑ Detected Five Consecutive Auto Lube Warnings = 15 Min
- ❑ HPD Gearbox Oil Pressure Critically Low = 10 Sec
- ❑ Hydraulic Oil Reservoir Level Low = 30 Sec
- ❑ Hydraulic Reservoir Air Pressure Low = 15 Min
- ❑ Klenz Filter Restriction High At Low Throttle = 5 Min
- ❑ Vehicle Control Unit Critical Over Temperature = 30 Sec



YELLOW WARNINGS

Yellow Warnings indicate something that effects how the machine performs has failed or is out of tolerance.

Some Yellow Warnings:

- ❑ Idle speed is limited to low until boot down
 - ❑ (example) Klens restriction.

- ❑ Auto Lube cycle long is a progressive warning that after 5 consecutive occurrences becomes a Red Alarm.

- ❑ Drive faults are yellow, but do not explain cause of fault. You must look at Blue PM alerts in log for details.

BLUE PM ALERTS

Blue PM Alerts indicate something is out of tolerance and should be repaired or replaced at the next scheduled PM.

These PM Alerts do not pop up on the screen so they must be checked using the view logs screen.

Since many of the PM Alerts are there to assist troubleshooting. You should always look for any PM Alerts related to the circuit you are working on.

LOAD WEIGH

- ❑ GEN 2 machines incorporate the standard load weigh mechanisms along with a 'load and carry' load weigh function. The load and carry load weigh function is always active and is easy and fun to use.
- ❑ The standard load weigh mechanism works by calculating the load weight when the Lift Arm angle reaches zero degrees. (Horizontal) However, this calculation is only performed if a load weight does not currently exist. How can a load weight already exist you might ask? Well, if a 'load and carry' load weigh was previously calculated, the load weigh software will not re-calculate at 0 degrees. Instead, the software will simply use the current load weigh stored.
- ❑ To get a 'load and carry' load weigh, the lift arms and bucket must be in a certain range. The Lift Arm angle must be greater than -20 degrees and the bucket must be rolled back greater than 30 degrees (Bucket Position). In addition, you must cease any hydraulic functions associated with the right joystick. When this is detected, a 'load and carry' weight will register. While in position, if you want to trigger a re-weigh, all you must do is move the right joystick and stop again. If hydraulic commands are active, the software assumes you are still loading.

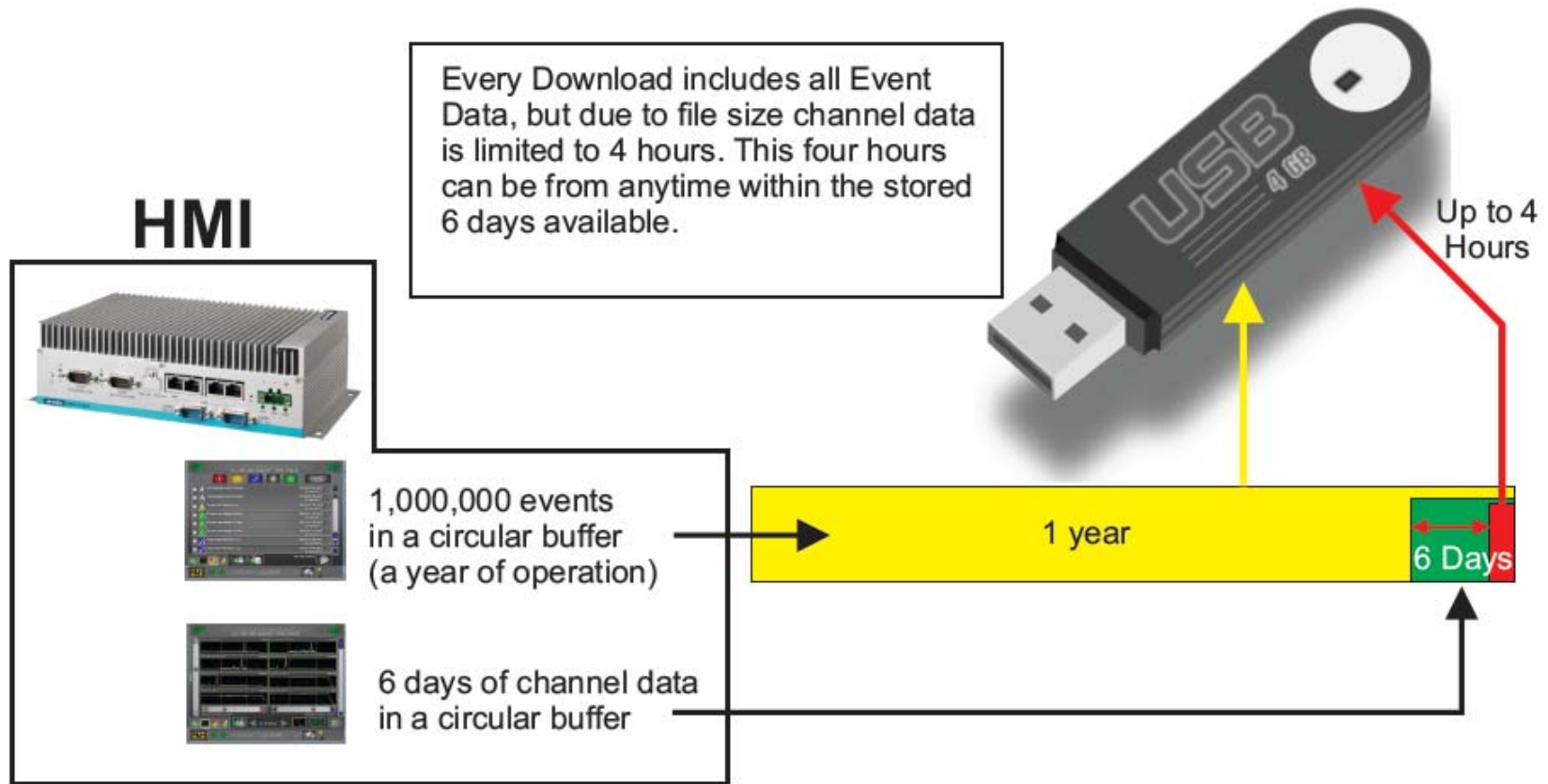
SUPPORT SOFTWARE AND TOOLS

SUPPORT SOFTWARE AND TOOLS

- ❑ DOWNLOAD LOG
- ❑ UPLOAD NEW Software
- ❑ USE OF OFF LINE TOOL – Same software as what is on machine
- ❑ FTP SITE – for Software and downloads

Downloading Data

Downloading Data



DOWNLOADING LOG FILES

- ❑ Put USB drive in USB port
- ❑ Navigate to download screen under logging and monitoring.
- ❑ Transfer files to USB drive – (Drive E)
- ❑ Channel log files can be very large
 - ❑ Date range selected in channel viewer only applies to channels. A maximum of 4 hours can be downloaded
- ❑ Creates a (.I2I) file



OFF LINE TOOL FUNCTIONALITY

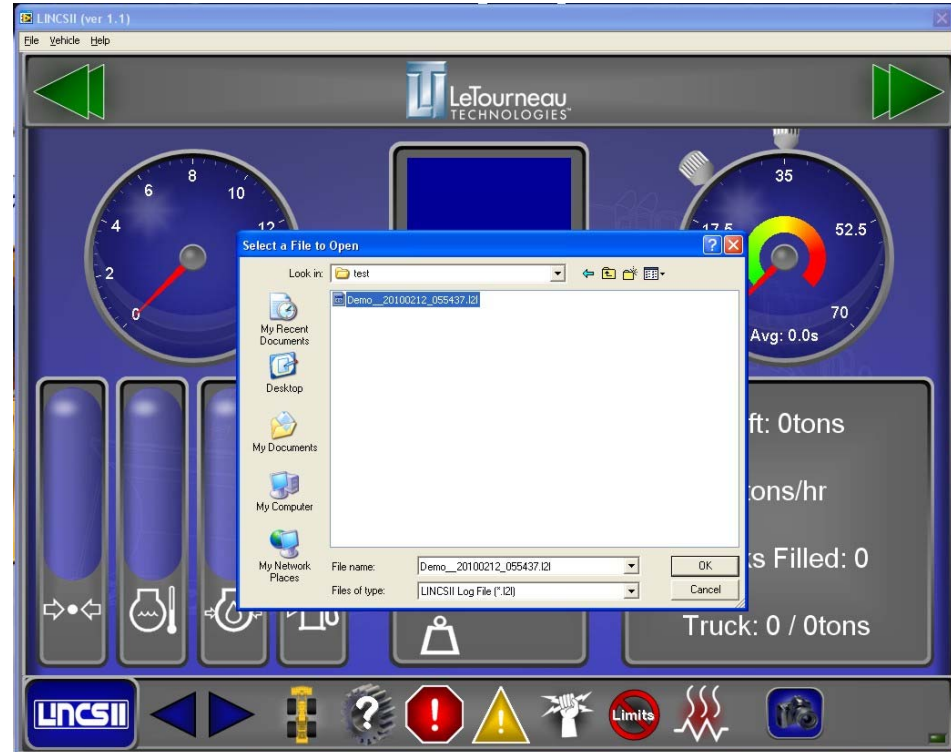
- ❑ HMI software will run on a laptop computer (1280x1024min resolution)
- ❑ Has menu bar
- ❑ Channel charting
- ❑ Event viewing
- ❑ Cannot view calibration and setting screens
- ❑ Create user access keys

- ❑ Download logs to USB
 - ❑ Allows downloading a selected section of the log small enough to email



UPLOADING LOG FILES TO OFF LINE TOOL

- ❑ Put USB stick in lap top
- ❑ Open LINCSh application
- ❑ File then Open on menu bar
- ❑ Navigate to USB drive
- ❑ Select file
- ❑ View data just as on loader
- ❑ Download must be compatible with version of OFF LINE TOOL.



LOADING NEW SOFTWARE ON LOADER

- ❑ Use another computer to put .I2u file on a USB drive
- ❑ Software will be available on our website at some point
- ❑ Put USB drive in USB port
- ❑ Use security key to log on
- ❑ Navigate to load new software screen
- ❑ Select correct file and load software



- ❑ If drive software has changed it can take over an hour at reboot to program all of the drives
- ❑ Perform software spot check