



LINCS II 24 Volt DC System Theory of Operation

Section 06-04-02

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LINCS II Overview

The P&H wheel loaders use the LINCS II supervisory control and data acquisition (SCADA) system. The Integrated Network Control System (LINCS) is a complete machine control and monitoring system. It manages all machine systems, including hydraulics, electrics, pneumatic, drive system and engine. LINCS II features a centrally located process automation controller (PAC) that controls machine input/output (I/O) directly or via CAN based network control.

The LINCS II Human Machine Interface (HMI) has a graphical user interface (GUI) providing the operator with key information about the machines productivity and operational performance. While the GUI is primarily graphical in nature, it has full multilingual support for all displayed textual information. The default language on the HMI is English but with a menu driven command, LINCS II HMI can display the required language for the specific customer location.

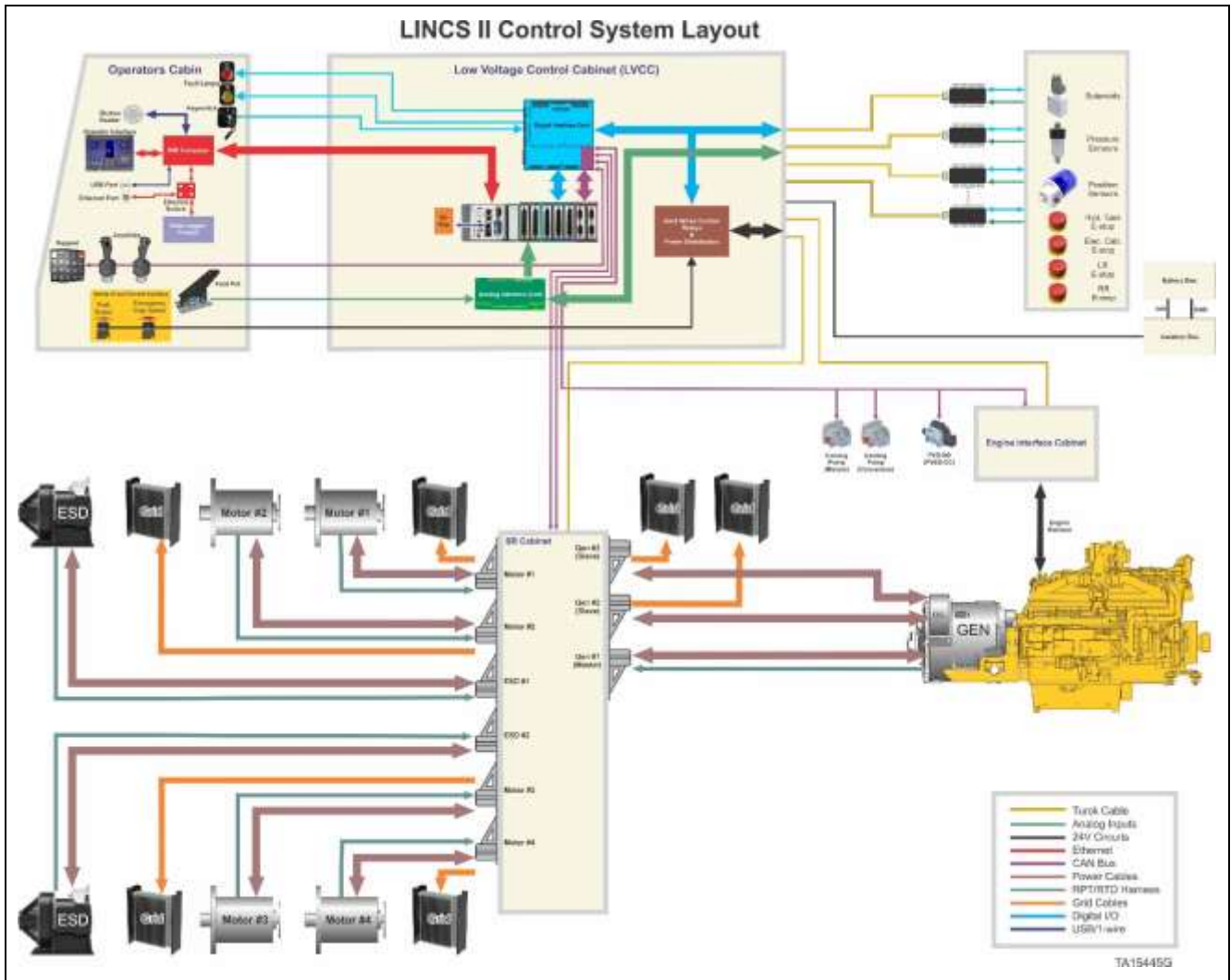
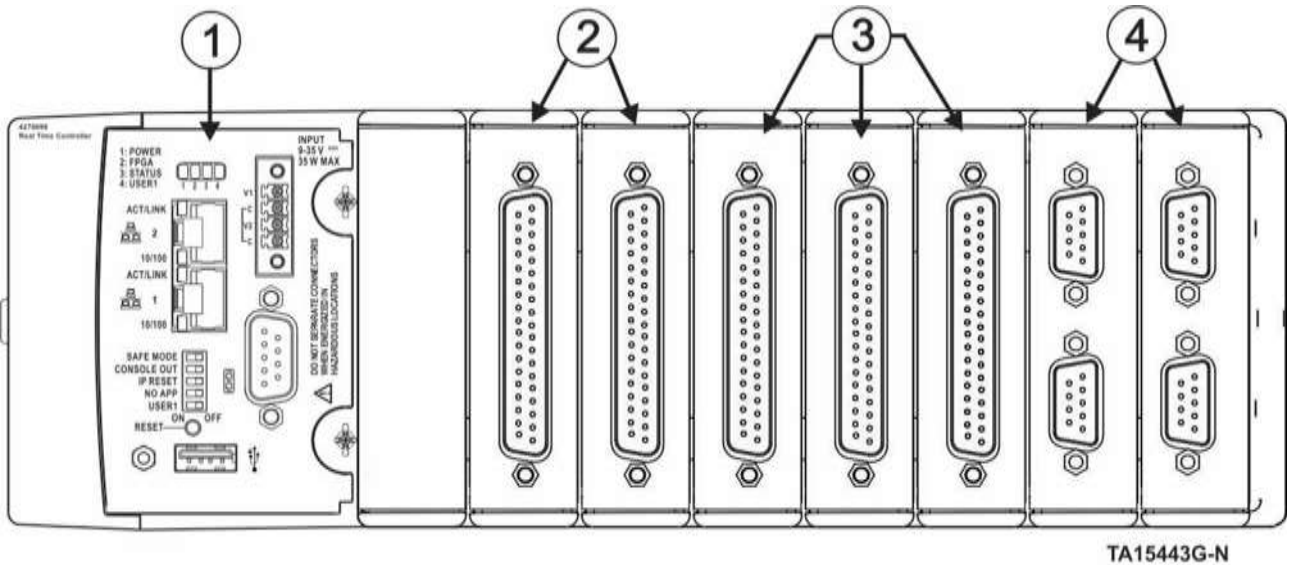


Figure 1. Sample LINCS II system

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Vehicle Control Unit (VCU)

The Vehicle Control Unit (VCU) is the primary controller of the entire machine. The VCU is of a modular design with plug in components to support the required functionality. The system hardware configuration supports digital voltage I/O including pulse width modulation (PWM), analog voltage input and CAN protocol. The VCU contains non-volatile solid-state memory which requires no battery to store its operating system, runtime application, persistent machine settings and history log data.



1) Controller, 2) Analog modules, 3) Digital modules, 4) CAN modules
(mounted inside LVCC)

Figure 2. Vehicle control unit

HMI Computer and Display

The Human Machine Interface (HMI) computer is mounted underneath the operator’s seat. The touch screen display is mounted on the dash in front of the operator. The HMI’s purpose is to allow the operator to access key production data during machine operation and to provide the maintainer with a set of functions and feedback to effectively fault find the machine. Additionally, the HMI is responsible for long term storage of historical log data. The HMI computer communicates directly with the VCU via an Ethernet network connection.

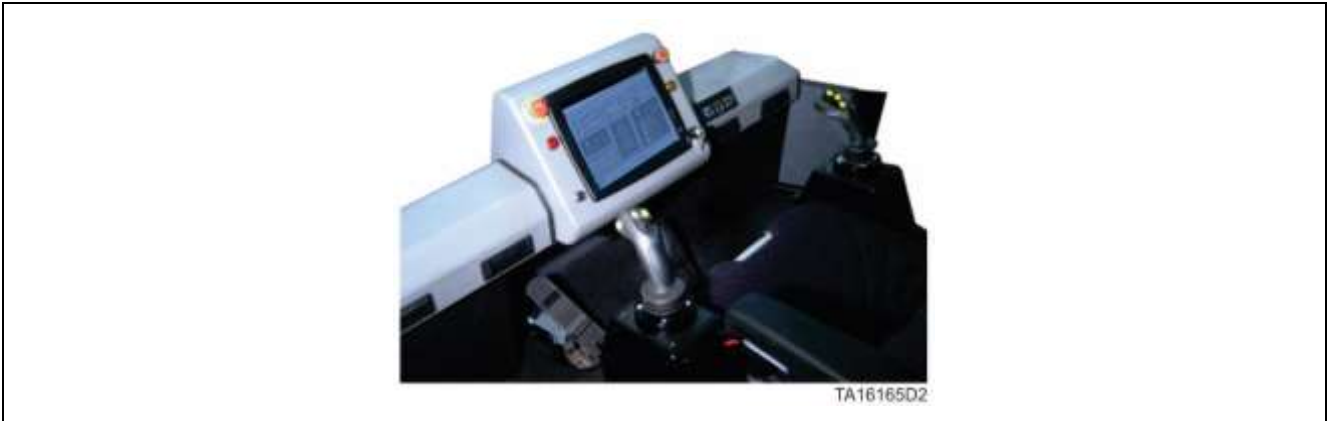
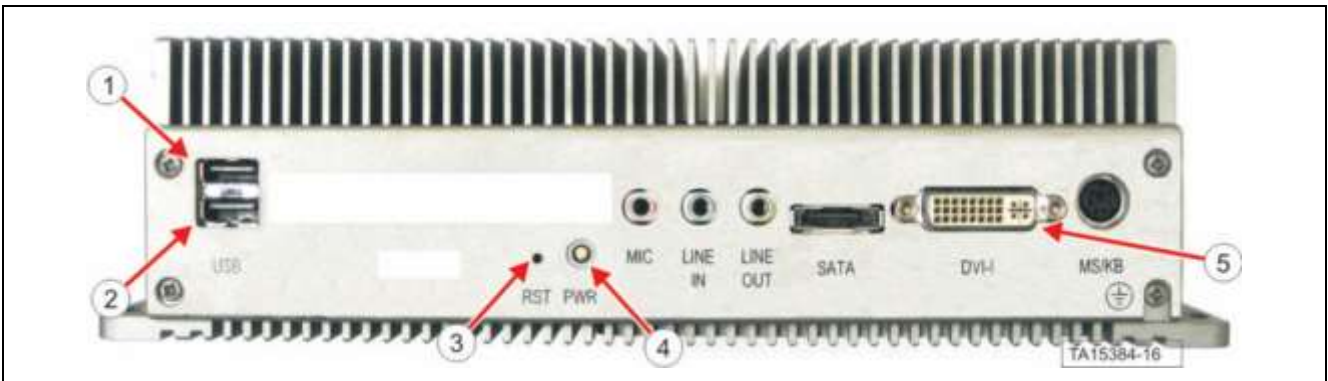


Figure 3. HMI display



1) USB1 Port, 2) USB2 Port, 3) Reset Button, 4) Power Button, 5) DVI-I Connector



6) COM1 Connector, 7) LAN1 Connector, 8) LAN2 Connector, 9) LED's, 10) Power Connector

Figure 4. HMI (Human Machine Interface) computer

LINCS II Topology

The VCU on a LINCS II machine connects to I/O hardware via a range of methodologies depending upon the I/O hardware type. The VCU communicates over J1939 controller area networks (CAN) bus with the Joysticks, keypad, engine, SR drives and drive cooling pumps. Digital devices such as switches and solenoids, lights and speed sensors connect to the VCU through the digital interface card which functions as a signal conditioning device. Analog voltage and 4-20ma components connect to the VCU via the analog interface card. Finally the VCU communicates with the HMI computer via a dedicated Ethernet connection.

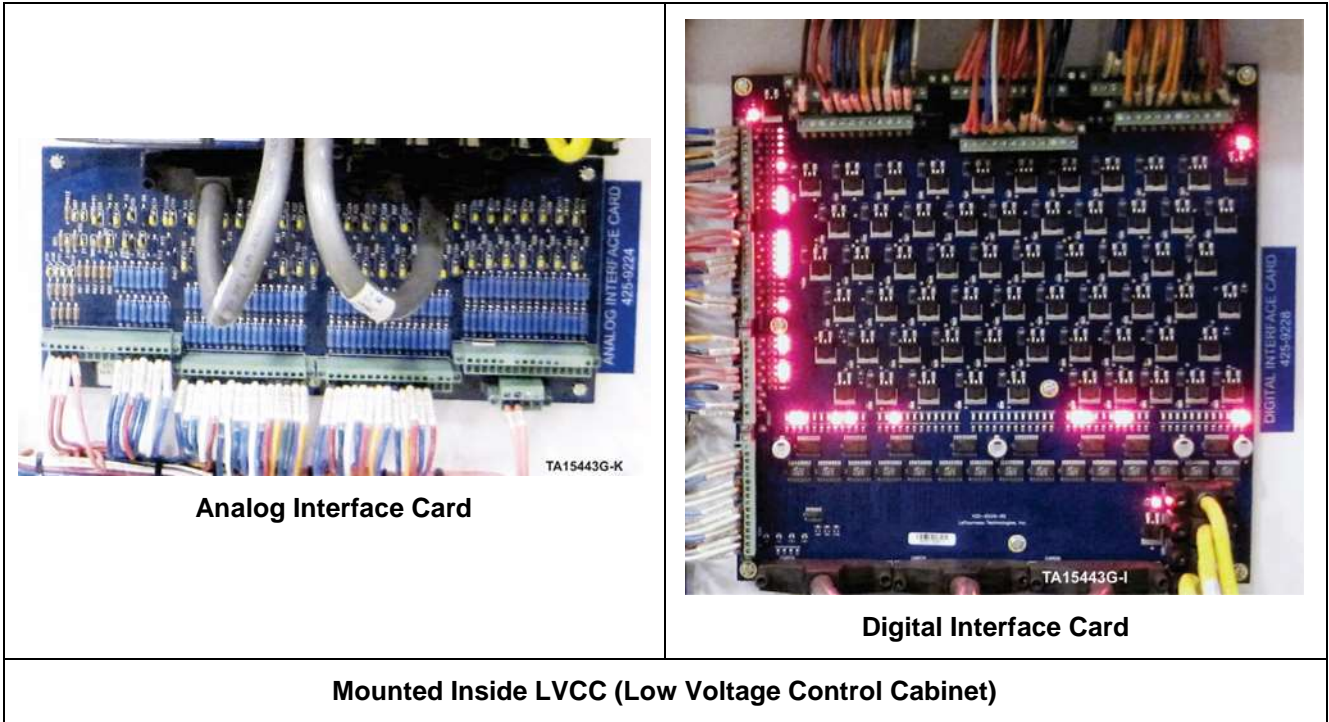


Figure 5. Digital and analog interface cards

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Components

Operator's Cab Components

The user interface with LINCS II is via the touch screen display, joysticks and the keypad. The keypad is used for machine controls that have high frequency of usage. The monitor provides the operator production data information on the main screen. The maintainer has the option of viewing diagnostic and charting screens and additional fault messages.

LINCS II Operation

The LINCS II vehicle control system “boots up” when the key switch is turned to the ON position. There are two parts of the boot up process – the VCU and the HMI computer. The VCU boots quickly and the machine is operational once it has booted. This can be noted in the cab as the park brake light will light when the VCU has completed booting. At this time the engine can be started. The HMI computer takes a few more seconds before its display is operational.

User Access Key

The LINCS II control system implements a multi-tiered system of security. The levels of security provide access to appropriately trained or qualified personnel to various diagnostic, troubleshooting or adjustment functions within the software.

The security levels are:

- Operator
- Maintenance
- Service
- Factory Rep
- Engineering

Access to each of the security levels is by way of a User Access key. The user contacts their User Access key to the reader head on the display console. The HMI display responds with a password screen where the user inputs their numerical password. If the password correlates to the User Access key, the user is permitted access to the security level programmed into the User Access key.



Figure 6. Application of assembly grease to pump O-ring and pump

File Transfer

The loader has functionality for both downloading event and channel log data as a single file and uploading machine update files. This functionality is by way of a USB port located under the left hand side of the dash assembly in the operator's cabin.