

KING-GAGE®

Tank Liquid Level ▪ Inventory Monitoring

LP3 System

User Operation/Installation Manual



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Warranty - All King Engineering products are guaranteed to be free from defects in material and workmanship for one year from the date of purchase. Any product or part found to be defective under normal use within one year of purchase will be repaired or replaced at no charge if returned to the company at Ann Arbor, Michigan within ten days of discovery of the defect. No other warranties, whether expressed, implied, or statutory, including the warranties of fitness for a particular purpose or merchantability, are given by this agreement.

The exclusive remedy for nonconformity of these goods shall be repair and/or replacement of the nonconforming goods or parts.

Seller will not be liable for consequential damages resulting from breach of this agreement. The term "consequential damages" shall include but shall not be limited to damage to all machines, equipment and goods other than the goods sold hereby, interruption of production, loss of profits, delays of any kind, administrative expense and overhead.

Revisions:

- (A) April, 2006 – Original Release
- (B) July, 2006 – Serial port, Ethernet and flash card text, photographs of inside.

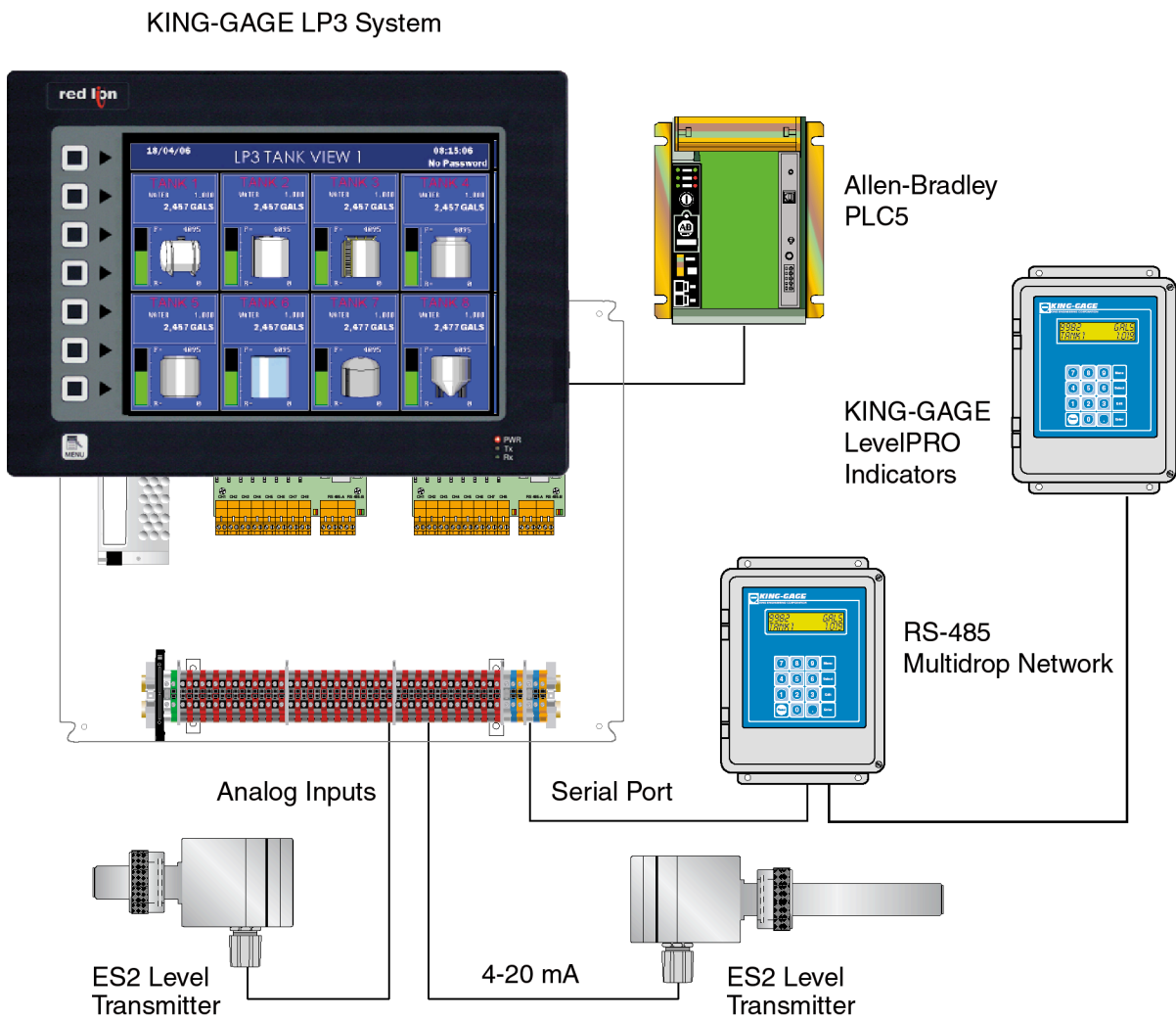
KING-GAGE LP3 **Tank Level Monitoring System**

LP3 system provides a complete tank gauging solution with an HMI touchscreen display and networking/process integration. A built in web server permits remote display of tank levels on any PC over an Ethernet LAN using standard web browser software.

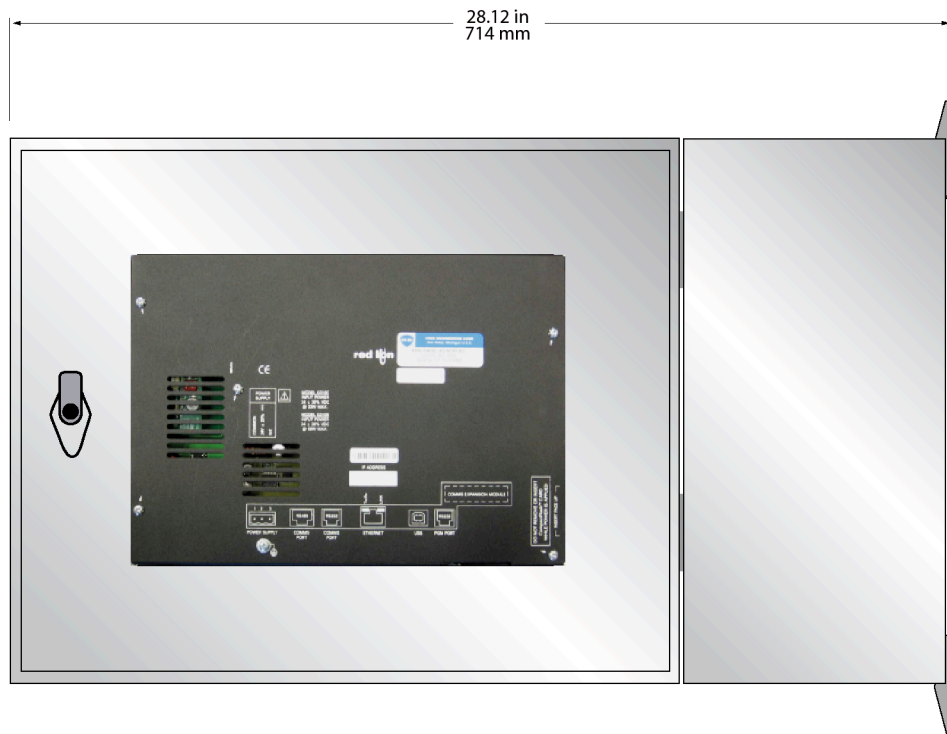
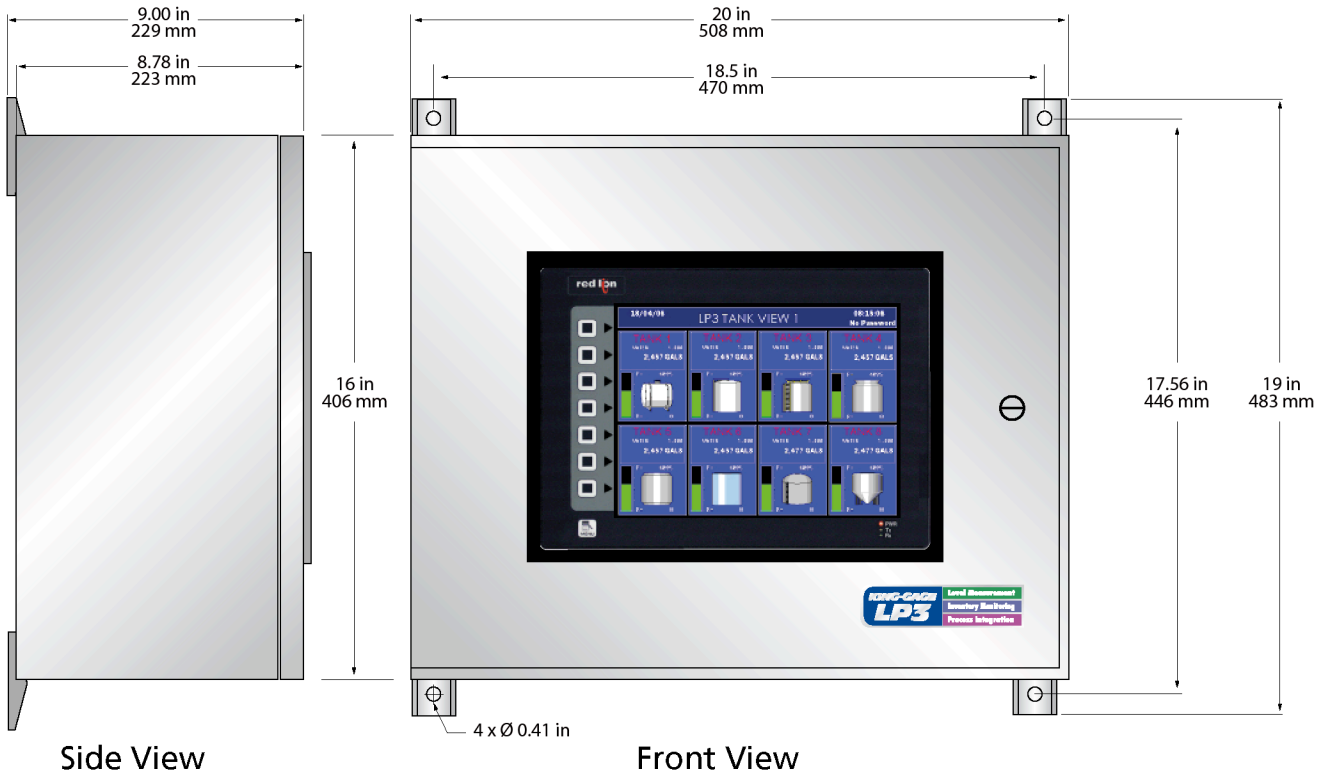
Complete hardware package includes:

1. Analog input modules(s) for signal processing and data acquisition using typical two wire transmitters. These input modules compensate for the specific tank geometry (via a capacity table) to scale the transmitter signal and calculate a volumetric (gallons, liters, etc.) or mass (pounds, kilograms, etc.) measurement of tank contents.
2. Power supply for internal components and external excitation (+24 Vdc) of transmitters through the signal loops.
3. HMI touchscreen display with web server and network connections (Ethernet, serial ports)

A simplified system overview is depicted below.



DIMENSIONS

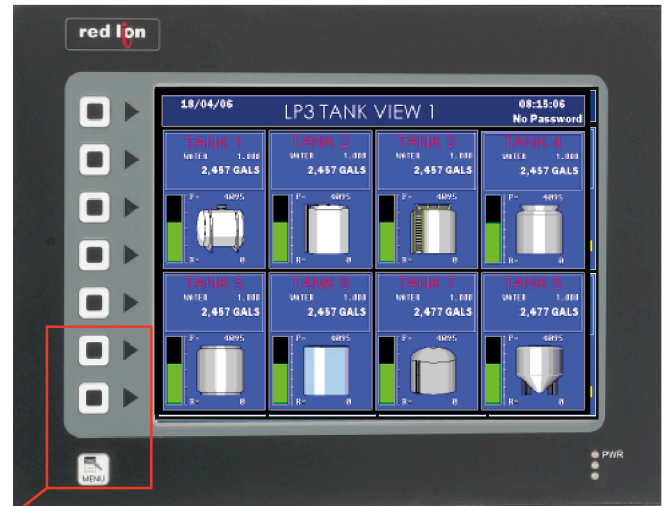


Side View with Door Open

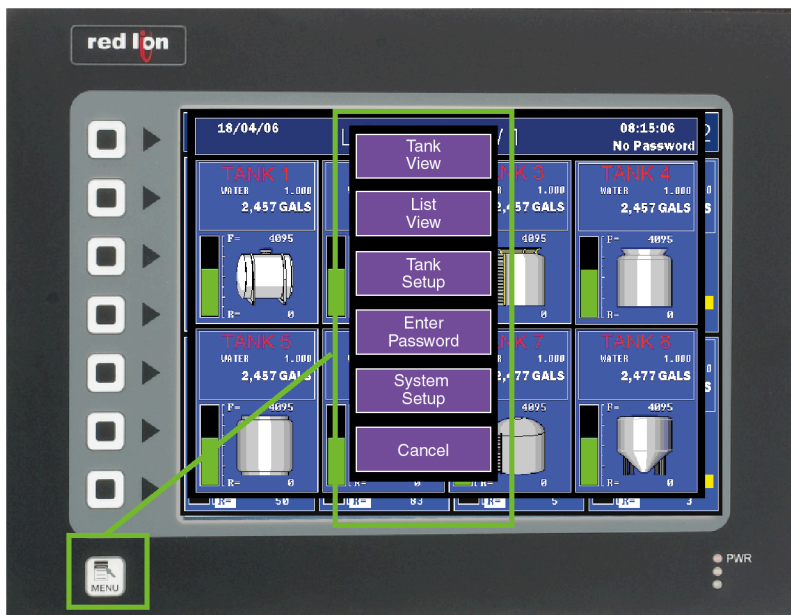
TANK VIEW

The system will start up and display the LP3 Tank View screen. Up to eight (8) tanks will be displayed showing Tank Name, designated contents, specific gravity, inventory display value (in selected engineering unit), tank icon, bar graph of current level with full and empty reserve values.

You may change screens or view tank details using a combination of physical navigation keys and the touch screen panel.



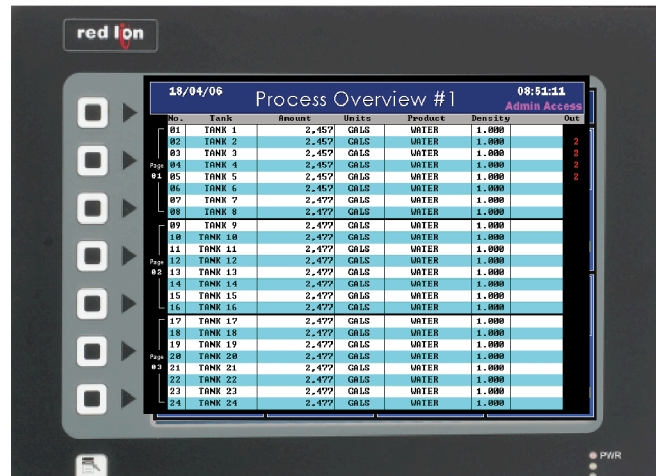
	Next Page — pressing this navigation key scrolls forward to the next page within the display mode currently selected (i.e., Tank View, List View or Tank Setup).
	Previous Page — pressing this navigation key scrolls backward to the next page within the display mode currently selected (i.e., Tank View, List View or Tank Setup).
	MENU — pressing this key on the front panel will bring up the menu of navigation commands. These selections allow the user to go directly to different displays or setup screens.



LIST VIEW

An alternate display of tank levels is presented by the List View or "Process Overview" screen. This tabular format displays tank name, current amount (inventory value), units of measurement, product designation, density (specific gravity) and set point status (if applicable).

The list of tanks entries is noted as to the display page on the Tank View screen. Pressing the touch screen within the grouping will take the user directly to that Tank View page. (Note that you cannot select an individual tank directly from the List View screen.)



TANK SETUP

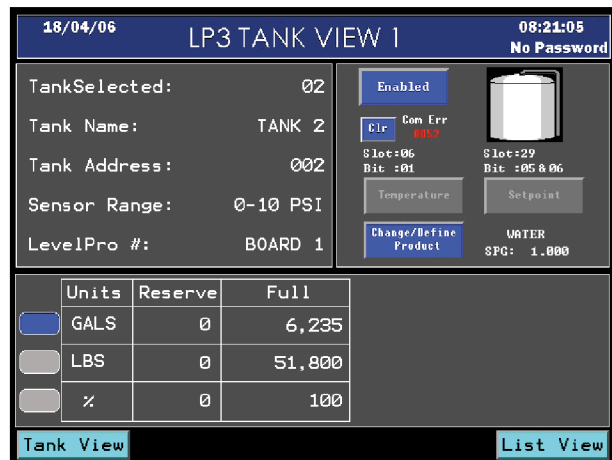
Using either the MENU button or pressing the touch screen while in TANK VIEW mode, the user can view the Tank Setup (or "Tank Scrn #") display. This screen provides details on the current settings for the tank, including tank name, sensor range (psi), full and empty reserve capacity of the tank. This information can be viewed from within any access level (i.e., no password, Operator access, or Admin access password).

No Password – Users can simply view data or select a different tank product from the menu list; no editing of data is allowed

Operator Access – Users may change engineering units (e.g., lbs, gallons, %), select a different tank product selection (from menu listing) and edit product description or specific gravity values.

Admin Access – Users may change engineering units (e.g., lbs, gallons, %) or change product selection (from menu listing). Additionally, admin users can directly enter new full and empty reserve values, define new product entries into the menu listing or edit any specific gravity value associated with the product entries. Set point function (if applicable) can be made active or disabled via the Tank Setup screen as well for admin users.

Users may scroll through the multiple tank setup screens by using the Next Page or Previous Page physical navigation keys (see page 5).



ENABLED Button - This is an Admin Access level function that is used to show (ENABLED) or hide (DISABLED) the tank display on the main Tank View screen(s). Pressing this button will toggle between showing and hiding that specific tank input channel on the main screens (Tank View or List View). When the button appears highlighted in blue and labeled "Enabled", the tank display status is active on the main screen. If the button is not highlighted (grayed out) it will be labeled "Disabled" and the tank is not displayed.

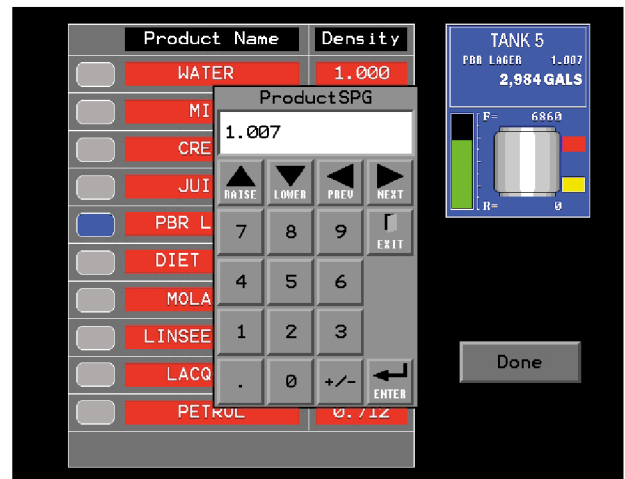
TANK SETUP - Continued

CHANGE/DEFINE PRODUCT Button - You can change the current tank product by pressing this button. This will access the Product Menu that indicates available product designations by name and density (showing specific gravity value). The current selection is highlighted by a blue indicator button.

To change the current selection, simply touch the left hand indicator button. A small "updating" window will open while the system accepts the selection.



Operator or Admin Access – if you are password entered into this access level, you can edit the product name or add a new product designation to the list (and enter a specific gravity value). Simply touch the existing text or touch an unused position to launch the on screen keypad.

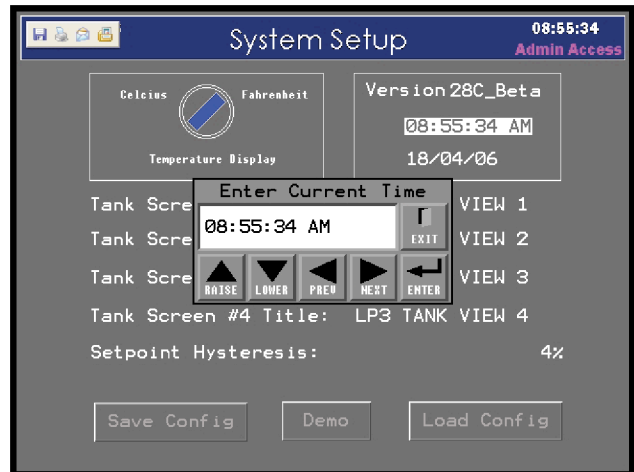


SYSTEM SETUP

The main System Setup screen is accessed via the MENU button. This is where the date and time settings for the system can be found. (If the system is configured for temperature inputs, there will also be that additional display setting.) Some functions on this screen are restricted based on access level (i.e., operator access or admin access password).



Time/Date – Press the time or date display on the touch screen to launch the edit keypad window, then press ENTER for hour to either raise (increment up) or lower (increment down). Press NEXT to edit minutes (or again to edit seconds). When complete, press ENTER to close the window. Similar sequence is used to edit the date by month, day, year.



Temperature – Press the round switch icon labeled Temperature Display on the touch screen to toggle between Celsius/Fahrenheit displays.

Tank Screen Titles – (Operator or Admin access password required) Press the Tank Screen title text to launch the edit keypad window. Simply enter the text (numbers and symbols are accessed by pressing the SYMBOL key on the keypad). To edit additional screen page titles, press NEXT. When finished, press ENTER.



Set point Hysteresis – (Applies only to system with set point function; Operator or Admin access password required.) Press the Hysteresis text or value displayed to launch the edit keypad window.

COMPACT FLASH CARD (Configuration File)

The LP3 system can be configured via a direct USB interface or by reading the configuration file from a Compact Flash (CF) memory card. Reading from the CF card or saving the current file is initiated from the System Setup screen. These selection buttons are not highlighted unless user has entered the Upload/Download access password code.

Save (Current) Configuration - Press the Save Config on the touch screen to save the current settings. This will launch the "Save Status" window on the screen.

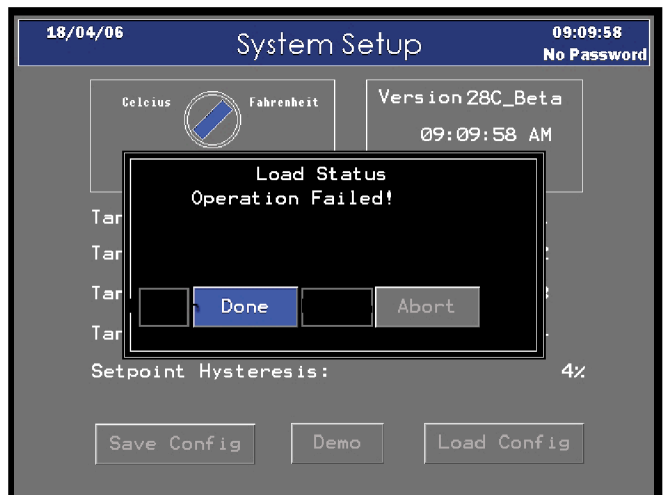
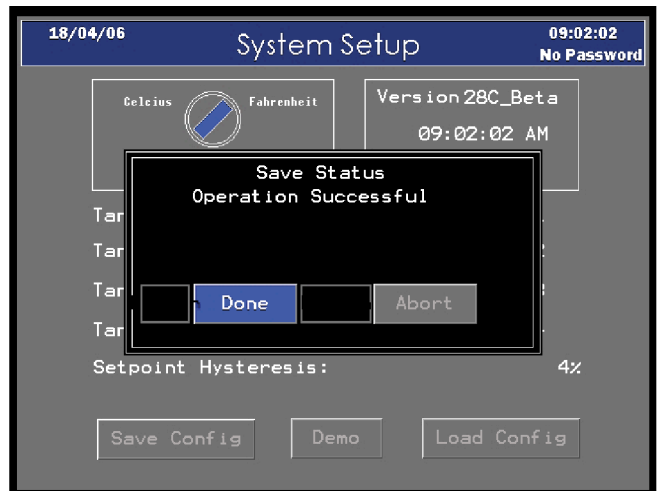
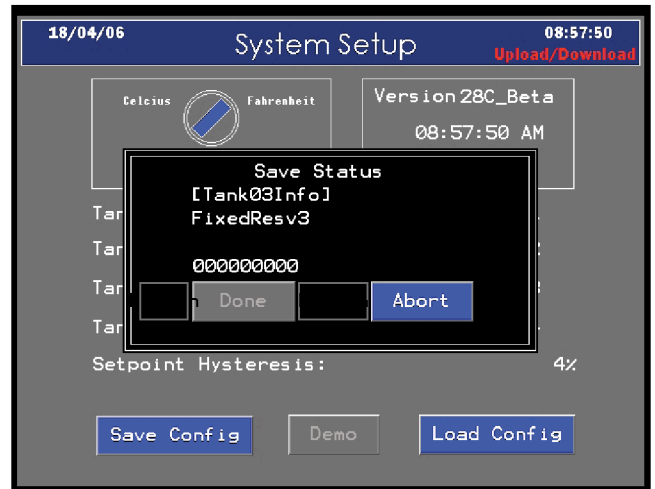
The file settings will be saved for each tank sequentially. Pressing the "Abort" will interrupt the save function. (Note that any data written to the CF card prior to pressing abort will overwrite that portion of existing entries in the Configuration File stored on the memory card.) Press "Done" when the "Operation Successful" message appears.

Load Configuration (from CF card) - Press the Load Config on the touch screen to copy the configuration file on the CF card into the system memory. This will launch the "Load Status" window on the screen.

The file settings will be saved for each tank sequentially. Pressing the "Abort" will interrupt the file copying function. (Note that any data copied into system memory prior to pressing abort will overwrite that portion of existing entries stored in system memory.) Press "Done" when the "Operation Successful" message appears.

NOTE - If no memory card is inserted into the Compact Flash slot, launching either the Save or Load function will display "Operation Failed!" in the status window.

WARNING!
TURN OFF POWER before installing or removing the CF card from the slot.



ENTER PASSWORD

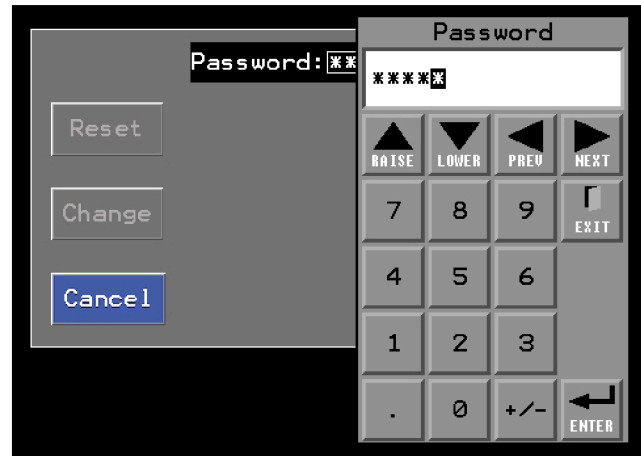
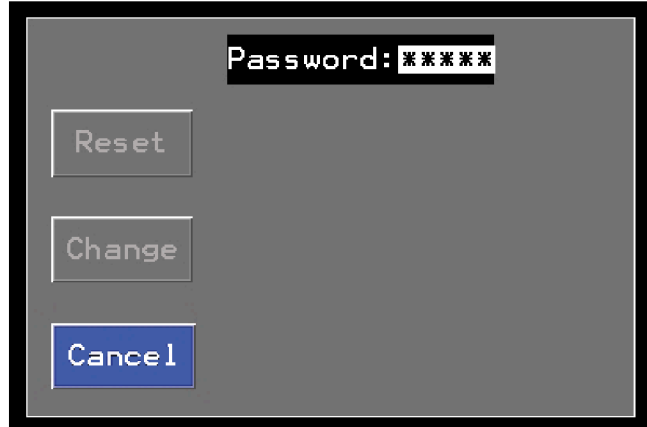
There are three (3) levels of password access incorporated into the LP3 system. These are designed to protect system integrity from unauthorized editing of data or changing the installed configuration file.

Operator Access – Enables selection of engineering units (lbs, gal, %) and direct entry or editing of text and/or specific gravity on product selection menu. This password code can be changed via the password menu. (Valid numeric passwords can range from 1-10 digits in length.)

Upload/Download – Required for loading configuration files or saving to Compact Flash (CF) card. Factory preset numeric password cannot be changed via the password menu.

Admin Access – Full administrative access to all configuration settings (allows direct entry or editing of text and/or numeric values). Factory preset numeric password cannot be changed via the password menu.

The Password entry is accessed via the MENU button and launches a new window that displays "Password: **** ". To gain password level access, press the "*****" text to launch the numeric keypad.



FACTORY DEFAULT CODES

(User can change the Operator Access code via the Password keypad)

Upload/Download	1234
Operator Access	**** (user defined)

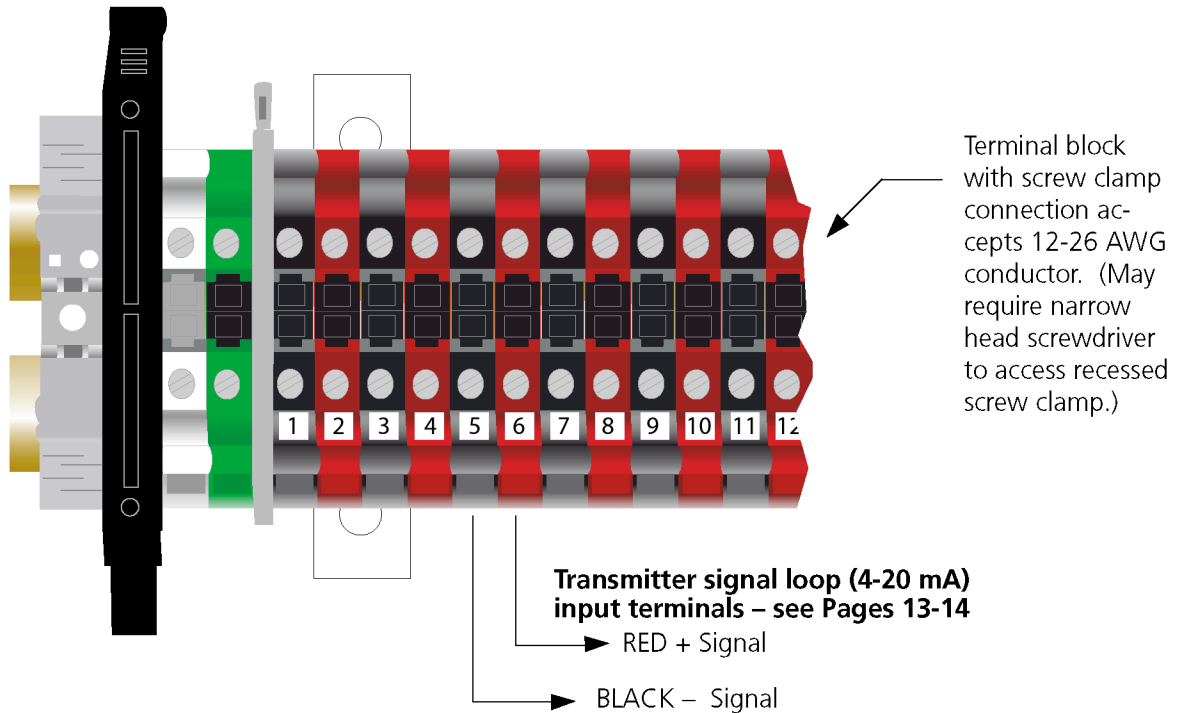
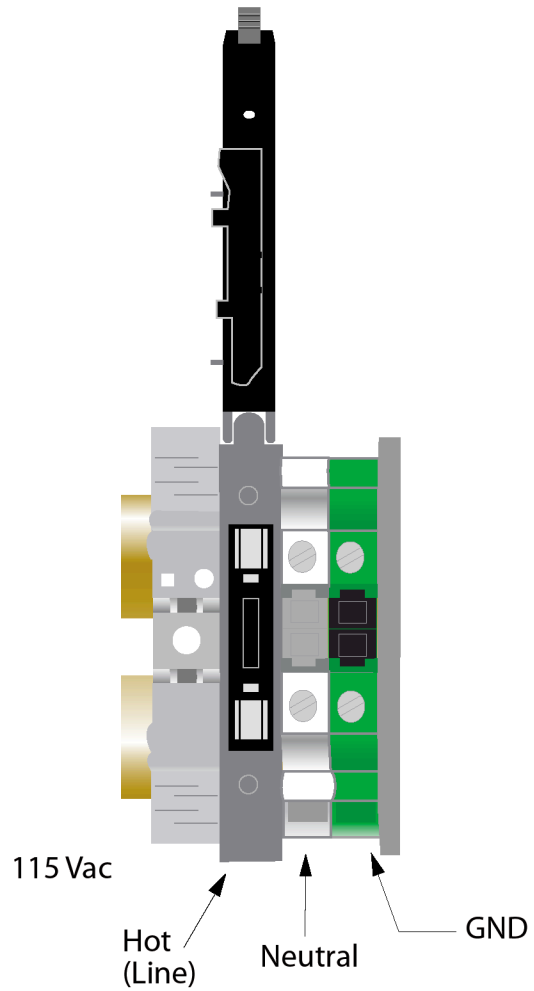
INSTALLATION REQUIREMENTS

Enclosure should be mounted in an upright position and secured to a wall or other structural member. Cable entry ports are 3/4" NPT and intended for conduit or water-tight cable connectors. Keep unused entry ports sealed to maintain enclosure integrity.

1. Allow adequate clearance below enclosure for access to lower entry ports.
2. Requires 115 Vac, 60 Hz. single phase power via 3-conductor, source grounded cable.

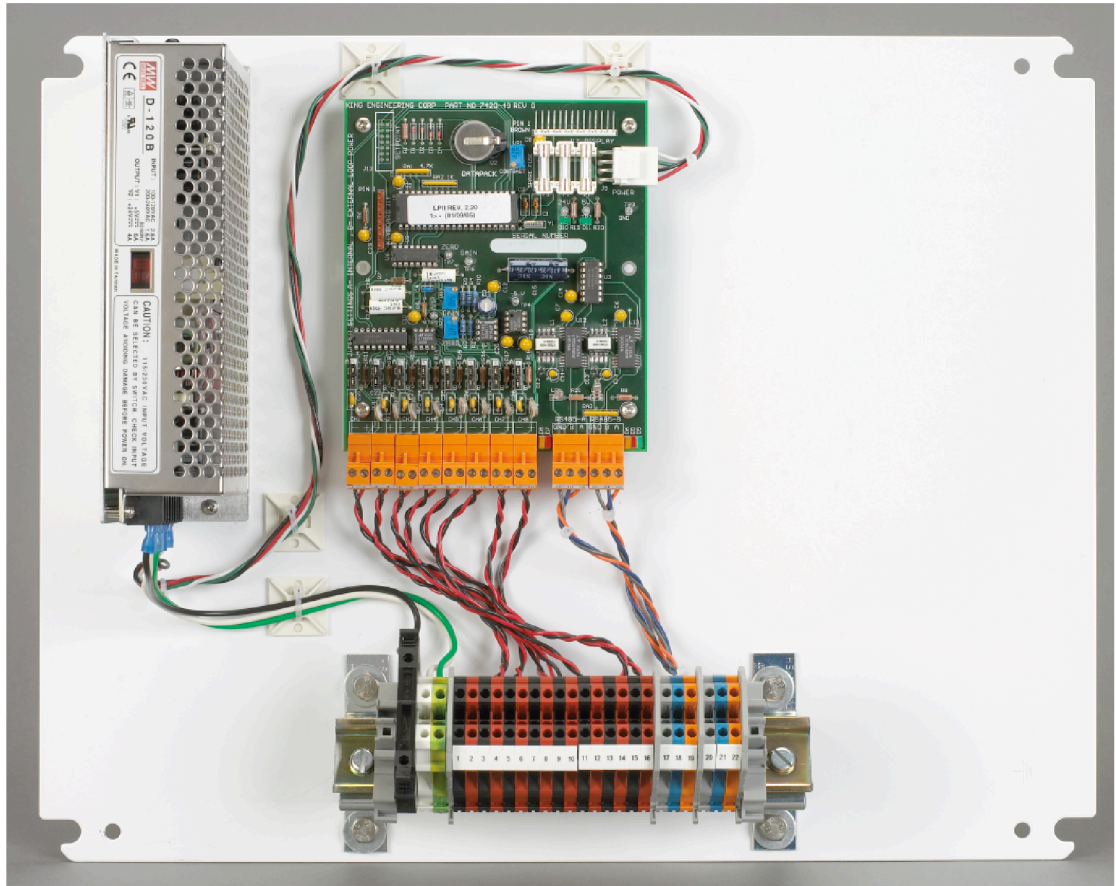
AC power input fused at 6.3 Amps.
 Replacement fuse: GDC-6.3A (250V) or equivalent
 5mm x 20mm, time delay.

NOTE — Complete input single (transmitter loop) connections prior to introducing AC power, when practical.



LP3 back plane assembly–8 tank configuration

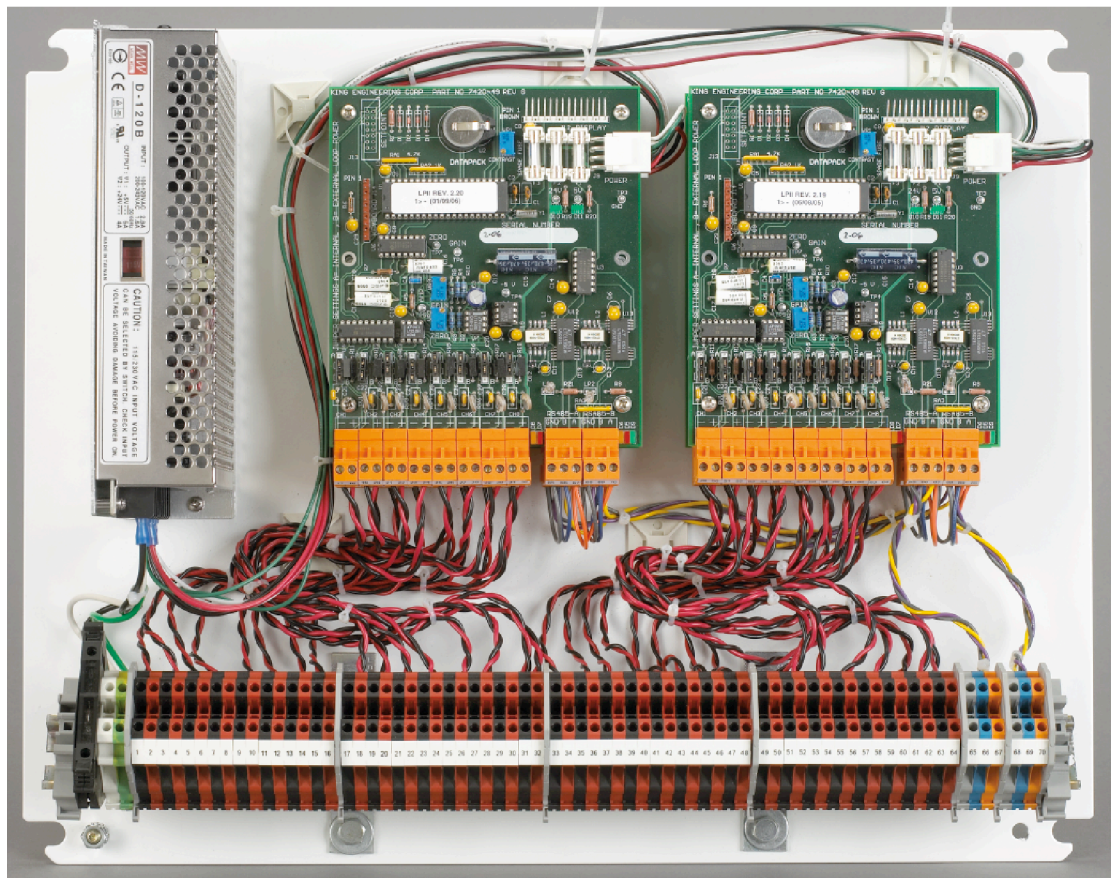
Power supply, analog input module and user wiring terminal rail (see Page 14 for numbered terminal assignments key)



LP3 back plane assembly–32 tank configuration

Power supply, analog input modules and user wiring terminal rail (see Page 14 for numbered terminal assignments key)

NOTE: 16 tank configuration (not shown) is similar to 8 tank version depicted.

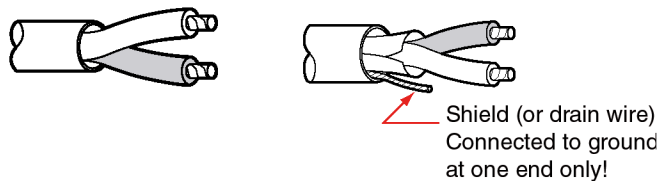


Transmitter Signal Loop

Typical transmitter provides a 4-20 mA output over a dc-powered two wire current loop circuit. This normally requires at least a 24 Vdc power source to provide excitation voltage to the transmitter. The power requirements should be calculated to accommodate the total resistive load residing on the circuit (e.g., cabling impedance, input impedance of receivers, etc.). Refer to the specific load capacity specifications for the sensor or transmitter being used.

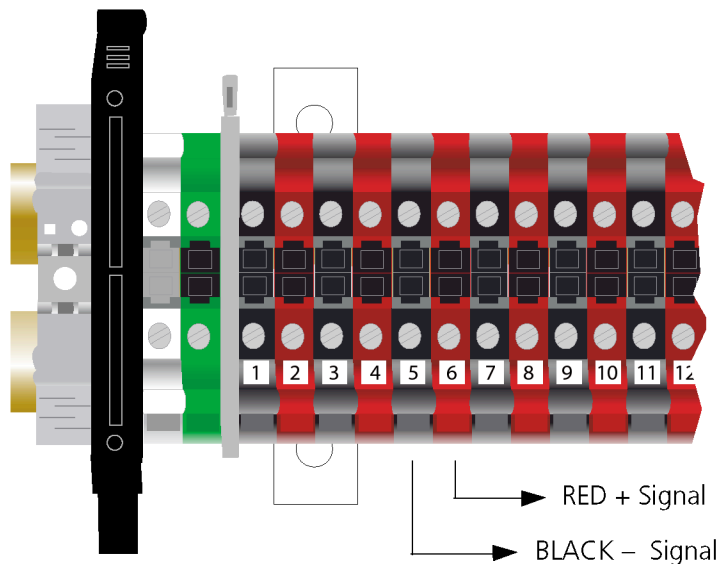
Signal Cabling

The 4-20 mA signal loop needs to be run using twisted pair (two conductor) cable. "Noise" or EMI (electromagnetic interference) does not generally create a problem since it is common to both wires in the pair and essentially cancels itself out. In most applications, non-shielded twisted pair instrumentation cable (20-22 AWG) will be suitable for the signal loop between the LevelPRO and sensor/transmitter.



Recommended Signal Cable: 20 or 22 AWG twisted pair.

NOTE: Shielded twisted pair cable may be used for extremely noisy environments where strong EMI/RFI fields exist. It is critical that shielded cabling be properly earth grounded on one end only. This will guard against the shield from becoming a conductor if improper electrical wiring exists elsewhere in the system or facility. The shield should be grounded to the GND terminal of the earth grounded Vac power connection. (Power supplied to the LevelPRO processor must be 3-line source with earth ground.)



8 Tank System

HOT (Line)
 NEU
 GND
 1 Signal - Channel 1
 2 Signal +
 3 Signal - Channel 2
 4 Signal +
 5 Signal - Channel 3
 6 Signal +
 7 Signal - Channel 4
 8 Signal +
 9 Signal - Channel 5
 10 Signal +
 11 Signal - Channel 6
 12 Signal +
 13 Signal - Channel 7
 14 Signal +
 15 Signal - Channel 8
 16 Signal +
 17 GND COM 1
 18 B
 19 A
 20 GND COM 2
 21 B
 22 A

16 Tank System

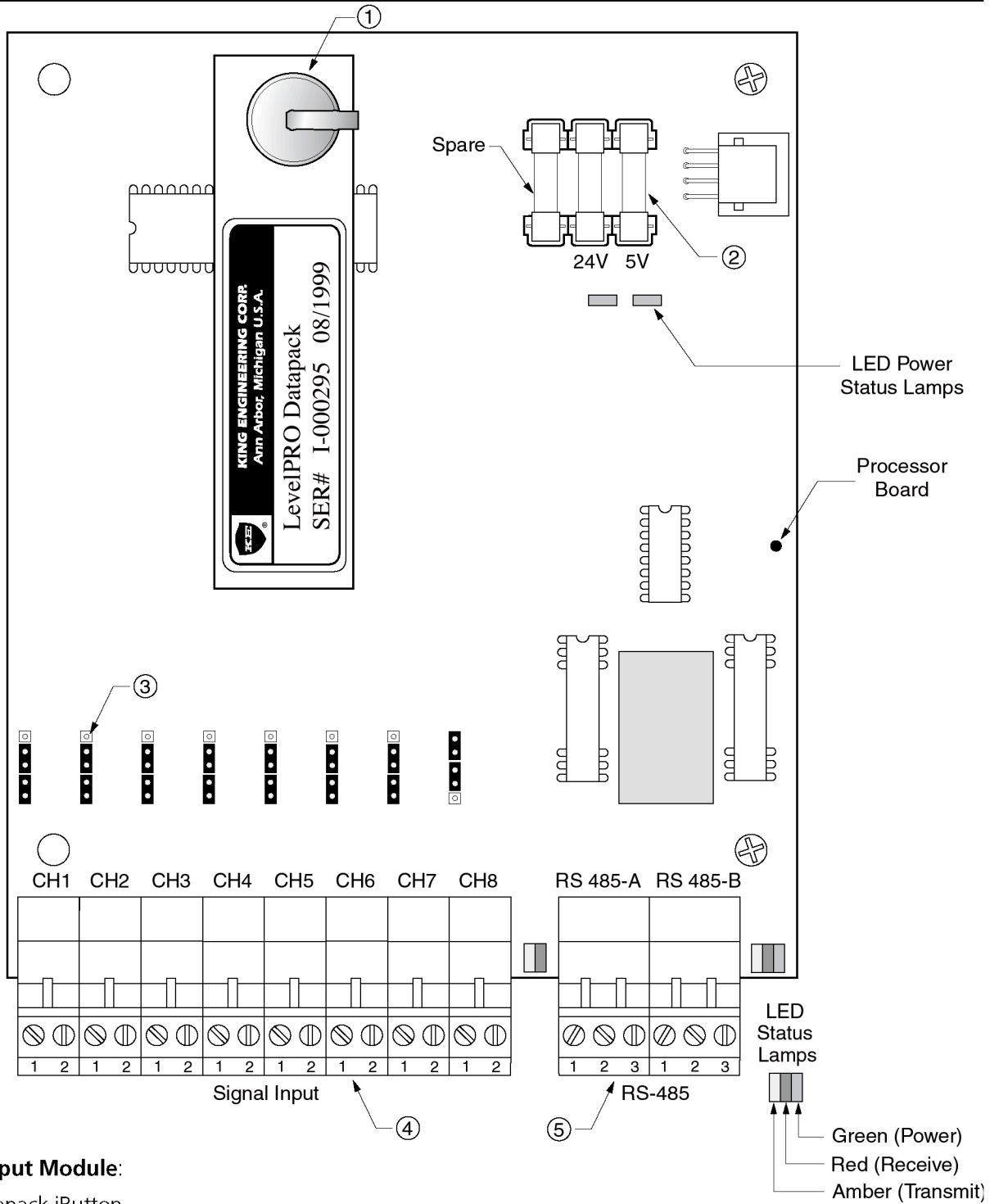
HOT (Line)
 NEU
 GND
 1 Signal - Channel 1
 2 Signal +
 3 Signal - Channel 2
 4 Signal +
 5 Signal - Channel 3
 6 Signal +
 7 Signal - Channel 4
 8 Signal +
 9 Signal - Channel 5
 10 Signal +
 11 Signal - Channel 6
 12 Signal +
 13 Signal - Channel 7
 14 Signal +
 15 Signal - Channel 8
 16 Signal +
 17 Signal - Channel 1
 18 Signal +
 19 Signal - Channel 2
 20 Signal +
 21 Signal - Channel 3
 22 Signal +
 23 Signal - Channel 4
 24 Signal +
 25 Signal - Channel 5
 26 Signal +
 27 Signal - Channel 6
 28 Signal +
 29 Signal - Channel 7
 30 Signal +
 31 Signal - Channel 8
 32 Signal +
 33 GND COM 1
 34 B
 35 A
 36 GND COM 2
 37 B
 38 A

24 Tank System

HOT (Line)
 NEU
 GND
 1 Signal - Channel 1
 2 Signal +
 3 Signal - Channel 2
 4 Signal +
 5 Signal - Channel 3
 6 Signal +
 7 Signal - Channel 4
 8 Signal +
 9 Signal - Channel 5
 10 Signal +
 11 Signal - Channel 6
 12 Signal +
 13 Signal - Channel 7
 14 Signal +
 15 Signal - Channel 8
 16 Signal +
 17 Signal - Channel 9
 18 Signal +
 19 Signal - Channel 10
 20 Signal +
 21 Signal - Channel 11
 22 Signal +
 23 Signal - Channel 12
 24 Signal +
 25 Signal - Channel 13
 26 Signal +
 27 Signal - Channel 14
 28 Signal +
 29 Signal - Channel 15
 30 Signal +
 31 Signal - Channel 16
 32 Signal +
 33 Signal - Channel 17
 34 Signal +
 35 Signal - Channel 18
 36 Signal +
 37 Signal - Channel 19
 38 Signal +
 39 Signal - Channel 20
 40 Signal +
 41 Signal - Channel 21
 42 Signal +
 43 Signal - Channel 22
 44 Signal +
 45 Signal - Channel 23
 46 Signal +
 47 Signal - Channel 24
 48 Signal +
 49 GND COM 1
 50 B
 51 A
 52 GND COM 2
 53 B
 54 A

32 Tank System

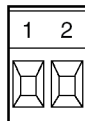
HOT (Line)
 NEU
 GND
 1 Signal - Channel 1
 2 Signal +
 3 Signal - Channel 2
 4 Signal +
 5 Signal - Channel 3
 6 Signal +
 7 Signal - Channel 4
 8 Signal +
 9 Signal - Channel 5
 10 Signal +
 11 Signal - Channel 6
 12 Signal +
 13 Signal - Channel 7
 14 Signal +
 15 Signal - Channel 8
 16 Signal +
 17 Signal - Channel 9
 18 Signal +
 19 Signal - Channel 10
 20 Signal +
 21 Signal - Channel 11
 22 Signal +
 23 Signal - Channel 12
 24 Signal +
 25 Signal - Channel 13
 26 Signal +
 27 Signal - Channel 14
 28 Signal +
 29 Signal - Channel 15
 30 Signal +
 31 Signal - Channel 16
 32 Signal +
 33 Signal - Channel 17
 34 Signal +
 35 Signal - Channel 18
 36 Signal +
 37 Signal - Channel 19
 38 Signal +
 39 Signal - Channel 20
 40 Signal +
 41 Signal - Channel 21
 42 Signal +
 43 Signal - Channel 22
 44 Signal +
 45 Signal - Channel 23
 46 Signal +
 47 Signal - Channel 24
 48 Signal +
 49 Signal - Channel 25
 50 Signal +
 51 Signal - Channel 26
 52 Signal +
 53 Signal - Channel 27
 54 Signal +
 55 Signal - Channel 28
 56 Signal +
 57 Signal - Channel 29
 58 Signal +
 59 Signal - Channel 30
 60 Signal +
 61 Signal - Channel 31
 62 Signal +
 63 Signal - Channel 32
 64 Signal +
 65 GND COM 1
 66 B
 67 A
 68 GND COM 2
 69 B
 70 A



LP3 Input Module:

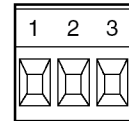
1. Datapack iButton
2. 1/2 Amp Fuse - 120/250 Volt Fast-Blo Order No. 7469-24-0 (5-pack)
3. Shunt /Jumper ; used in pairs to activate or bypass 24Vdc excitation.
4. Terminal, Signal Input
5. Serial EIA RS485 communication ports(2).

Input Signal Connector



- 1 – Signal –
- 2 – Signal + (4-20 mA)

RS – 485 Connector



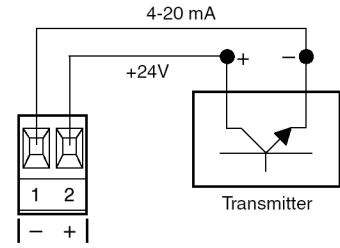
- 1 – GND
 - 2 – B
 - 3 – A
- } Data

24 Vdc Output (Transmitter Excitation)

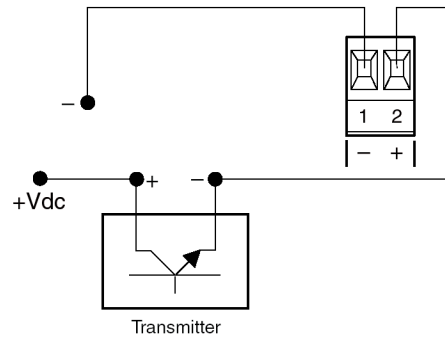
The LP3 System incorporates an internal 24 Vdc supply that can be used to power the signal loops. A pair of shunt/jumpers for each input channel are used to enable or disable this voltage supply across the signal input terminals. The unit is shipped from the factory with the jumpers installed in the ENABLED (B) position to provide 24 Vdc across signal input terminals #1 and #2. If you are using an external power supply, move the jumpers to the DISABLED (A) position. Refer to the illustration showing the location of the shunt/jumpers.

NOTE: When configured for external power (DISABLED), all of the affected (-) terminals are connected together in the LP3 input module. The transmitters must be connected to the (+) side of the loop and the (-) side must return directly to the power supply. Be certain to check that the external power supply is "floating" such that the (-) terminal is not directly tied to an earth ground.

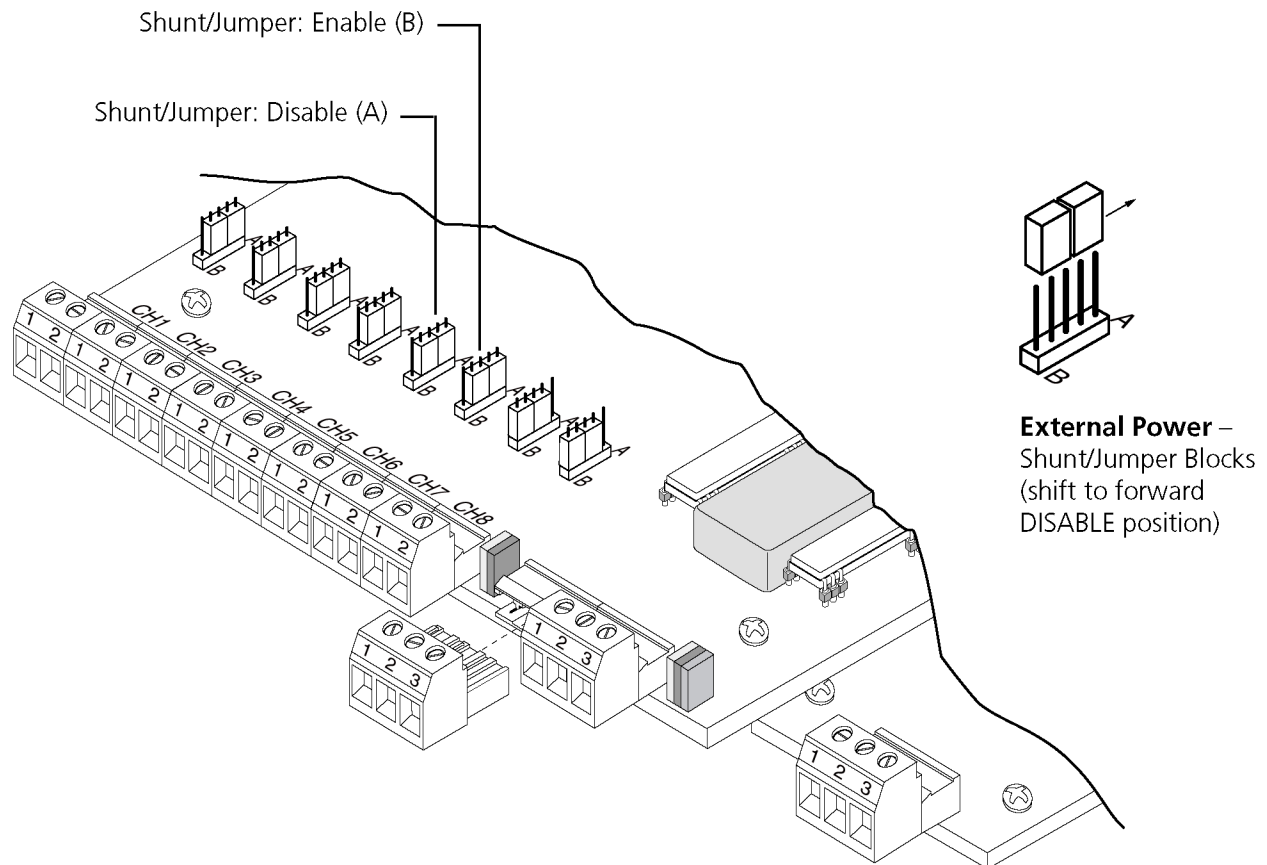
IMPORTANT! Use caution when connecting signals to analog input cards in computers or PLCs. Many of these are "single ended" in that they tie the signal grounds of many different devices together. This can result in unpredictable current paths and unstable signals.



Detail - Onboard 24 Vdc Output



Detail - External Power Supply



LP3 SERIAL PORTS

Ethernet – network connection is provided via RJ45 jack wired as a NIC (network interface card). When wired to another NIC, such as directly to a desktop PC, you must use a crossover cable.

RS232 – network connection is provided via RJ12 jack. Two ports are supplied as COMMS and PGM (programming Port).

RS485 – network connection is provided via RJ45 jack that can be configured as either RS422 (4-wire) or RS485 (2-wire).

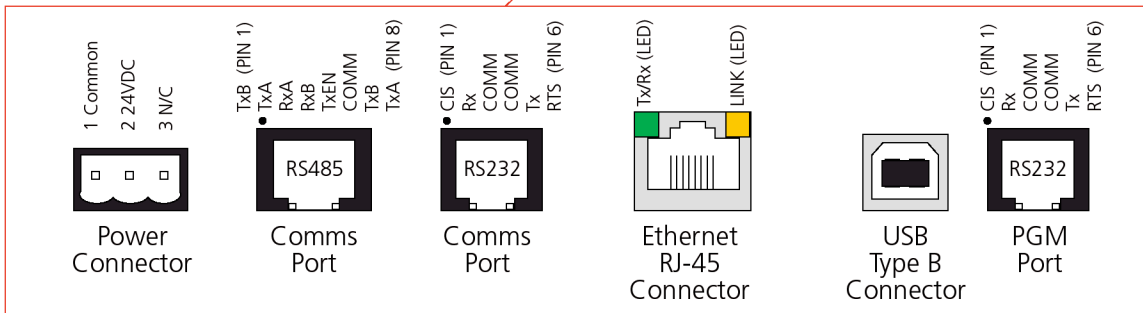
ETHERNET STATUS LEDs

Ethernet communications can be established at either 10 BASE-T or 100 BASE-TX. (Gigabit Ethernet is not supported.) Connection status is indicated by a yellow LED and Bi-color (green/amber) LED – refer to status codes below:

YELLOW – solid Link established.
 YELLOW – flashing Data transfer

GREEN – solid 10 BASE-T (10 Mbps)
 AMBER – solid 100 BASE-TX (100 Mbps – Fast Ethernet)

WARNING!
 DO NOT use standard DH485 cable to connect this port to Allen Bradley equipment.



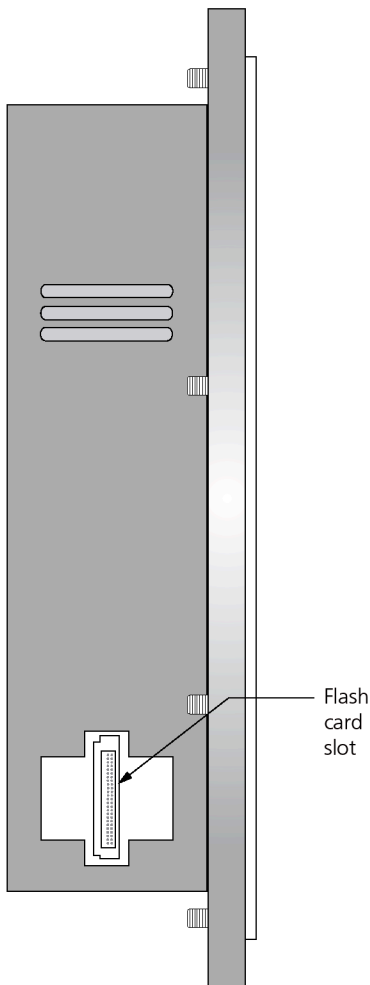
CompactFlash (CF) Card

WARNING!

TURN OFF POWER before installing or removing the CF card from the slot.

This unit is equipped with a Type II slot for CompactFlash (CF) memory cards. (Slot is compatible with Type I or Type II cards.) KING-GAGE® LP3 system backup and configuration files are stored on CF card. Note that the non-volatile system memory normally retains system configuration even with power turned off. When changes are entered via the user menus, you may save the updated configuration to the CF card (this overwrites the existing backup file).

Upload/Download Access – To load the backup configuration file or to save current configuration to CF card, you must enter a password to enable this function. (See Page 10.)



Side View of Display Panel



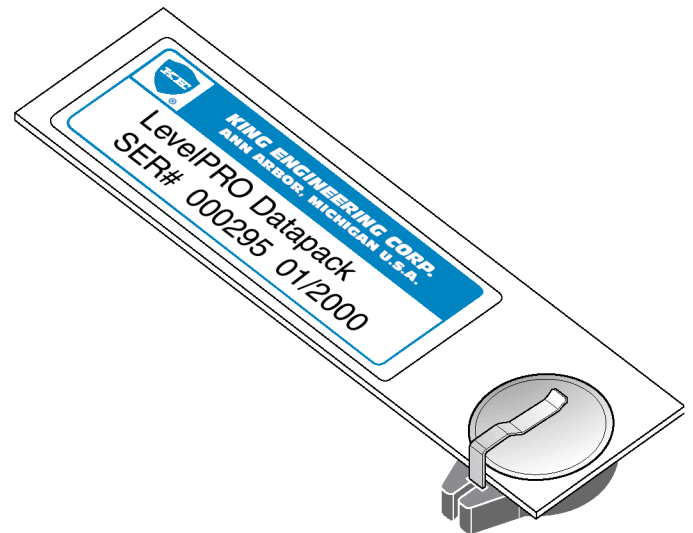
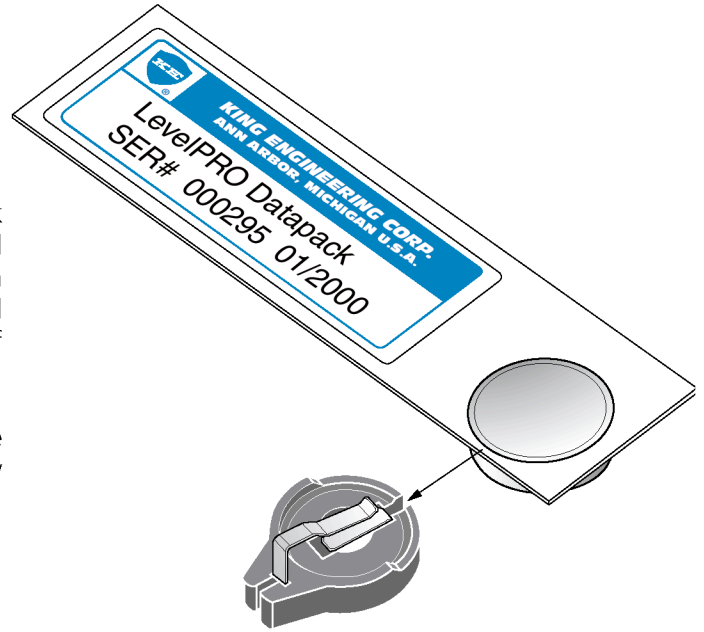
Back of Display Panel

Application Programming (Datapack)

Non-addressable application parameters (i.e., network polling address, tank capacity profile) require updated datapack programmed at the factory. Use caution when accessing the datapack — internal circuitry and electrical connections should not be exposed to moisture. Turn off power to unit prior to handling internal components.

Turn off power or open the enclosure and disconnect the plug-in terminal connector. Datapack (iButton) is readily accessible at the upper portion of the circuit card.

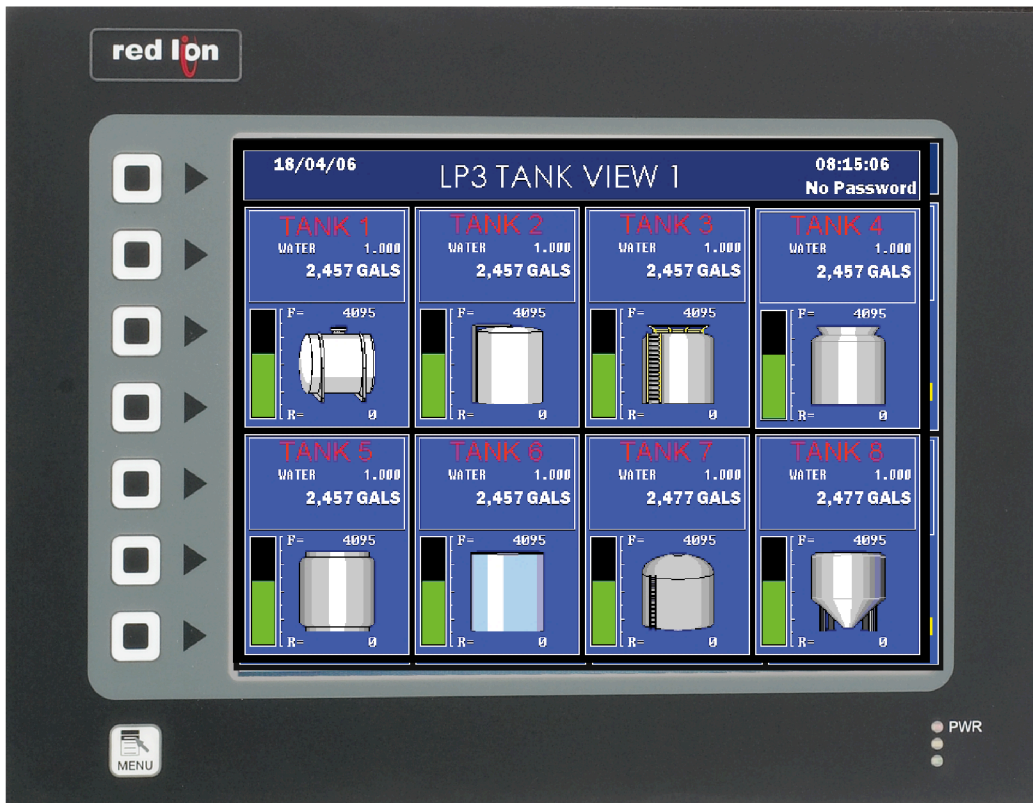
- A. To remove datapack, lift up and slide Datapack outward (see illustration) to free it from the clip socket.
- B. To install datapack, slide datapack under clip. Make certain Datapack iButton is fully seated in socket.



FRONT PANEL LEDs

In addition to the PWR (power) red LED on the front panel, there are also yellow (CompactFlash status) and green LED indicators. (If no CompactFlash card is present, the yellow LED will not be lit.)

RED – solid	Power on, normal operation
RED – flashing	No valid configuration is loaded
YELLOW – off	CompactFlash (CF card) slot is empty
YELLOW – solid	CompactFlash (CF card) installed
YELLOW – flashing	System is checking CompactFlash (CF card)
YELLOW – flickering	Saving data to CompactFlash (CF card)
GREEN – solid	Valid configuration loaded, normal operation



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