

# **Special Instruction**

## **Installation Procedure for PL444 Cellular Radio Systems**

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# Introduction

This Special Instruction will provide instructions for installing and configuring the PL444 cellular radio Systems.

PL444 cellular radio is a remote monitoring solution that enables efficient and effective equipment management. Product Link transmits the information via a cellular network.

## PL444 Cellular Radio

PL444 cellular radio sends data to the user interface over the cellular network. This radio uses internal antennas to transmit/receive data via cellular or Bluetooth and use GPS location services.

## Important Safety Information

Work safely. Most accidents that involve product operation, maintenance, and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs.

A person must be alert to potential hazards. This person must also have the necessary training, skills, and tools to perform these functions properly.

Safety precautions and warnings are provided in this instruction and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. If a tool, procedure, work method, or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance, or repair procedures that you intend to use. The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Cat dealers have the most current information available.



## WARNING

Personal injury or death can result when voiding this certification.

Structural damage, an overturn, modification, alteration, or improper repair can impair the Rollover Protective Structure's (ROPS) protection capability thereby voiding this certification.

**Do not drill holes in the ROPS. Do not weld on the ROPS unless welding is specified in the procedure. Place welds only at the locations that are specified in the procedure.**

To avoid possible weakening of this ROPS, consult a Caterpillar dealer before altering this ROPS in any way. The protection offered by this ROPS will be impaired if it has been subjected to structural damage.

Consult a Caterpillar dealer to determine this structure's limitations without voiding its certification.

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## WARNING

Improper operation of an access platform could result in injury or death. Operators must carry out their duties properly and follow all instructions and guidelines given for the machine and access platform.

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## Machine Specific Warnings

### **WARNING**

**Do not operate or work on this machine unless you have read and understand the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Caterpillar dealer for replacement manuals. Proper care is your responsibility.**

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### **WARNING**

**Sudden movement or accidental starting of the machine can cause personal injury or death to persons on or near the machine.**

**To prevent personal injury or death, perform the following:**

**Park the machine on a smooth level surface.**

**Lower the blade and or attachments to the ground.**

**Stop the engine and engage the parking brake.**

**Block the wheels and install the steering frame lock.**

**Turn the battery disconnect switch to the OFF position and remove the key.**

**Place a Special Instruction, SEHS7332, "Do Not Operate" tag at the battery disconnect switch location to inform personnel that the machine is being worked on.**

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## Engine Specific Warnings

### **WARNING**

Do not operate or work on this engine unless you have read and understand the instructions and warnings in the Operation and Maintenance Manual. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Caterpillar dealer for replacement manuals. Proper care is your responsibility.

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### **WARNING**

Accidental engine starting can cause injury or death to personnel working on the equipment.

To avoid accidental engine starting, disconnect the battery cable from the negative (-) battery terminal. Completely tape all metal surfaces of the disconnected battery cable end in order to prevent contact with other metal surfaces which could activate the engine electrical system.

Turn the battery disconnect switch to the OFF position and lockout the battery disconnect switch with a safety lock.

Place a Special Instruction, SEHS7332, "Do Not Operate" tag at the start switch and battery disconnect location to inform personnel that the machine is being worked on.

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## Generator Specific Warnings



**Do not connect generator to a utility electrical distribution system unless it is isolated from the system. Electrical feedback into the distribution system can occur and could cause personal injury or death.**

**Open and secure main distribution system switch, or if the connection is permanent, install a double throw transfer switch to prevent electrical feedback. Some generators are specifically approved by a utility to run in parallel with the distribution system and isolation may not be required. Always check with your utility as to the applicable circumstances.**

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**Only persons with training in electrical installations must carry connections to the generator.**

**The generator must be wired correctly. A fire or electrocution could result from wiring that is incorrect.**

**The generator is capable of generating high voltages. Ensure that the generator is not on while the connections are being made. Follow these steps in order to prevent accidental starting:**

- 1. Isolate the machine from all external loads and sources.**
- 2. Shut off the Engine.**
- 3. Disconnect the battery supply lines and tape the leads.**

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## Required Parts for PL444 Cellular Radio

Table 1

| Quantity | Part Number | Description                  | Remarks   |
|----------|-------------|------------------------------|---|
| 1        | 604-9580    | PL444 (NA)<br>Cellular Radio | Radio for North America & South America             |
| 1        | 604-9581    | PL444 (EU)<br>Cellular Radio | Radio for Europe, Africa, Middle East, Asia Pacific |
| 1        | 610-1015    | Control Harness As           | Aftermarket   |
| 3        | 3T0849      | M6x1 Hex Socket Bolt         |   |
| 3        | 9X-8267     | M6 Washer                    |   |

|   |          |              |  |
|---|----------|--------------|--|
| 3 | 6V8225   | M6x1 Hex Nut |  |
| 1 | 433-9730 | Film         | Blast zone film required for any system that transmits RF energy |
| 1 | 433-9728 | Film         | Blast zone film required for any system that transmits RF energy |
| 1 | 433-9722 | Film         | Film required on any system that broadcasts information          |
| 1 | 304-5284 | Fuse holder  |  |
| 1 | 139-5345 | Fuse         |  |

## Optional Installation Components

Table 2

| Part Number | Description                        |
|-------------|------------------------------------|
| 497-8355    | VHB 5962 Adhesive Tape – Bulk Roll |
| 515-3506    | Grommet – M20 Black                |
| 350-4303    | Grommet – Blanking                 |
| 7K-1181     | Cable Strap                        |
|             | Sealant                            |

## Radio Disable Switch

Table 3

| Quantity | Part Number | Description       |
|----------|-------------|-------------------|
| 1        | 353-4515    | Toggle Switch Gp  |
| 1        | 6T-6969     | Switch Guard      |
| 1        | 433-9723    | Film              |
| 2        | 3E-3390     | Connector Pins    |
| 1        | 102-8803    | Receptable Kit    |
| 2        | 174-0502    | Connector Plug As |
| 4        | 9X-3402     | Connector Sockets |

## Optional Remote Disable Parts

Table 4

| Quantity | Part Number | Description                   |
|----------|-------------|-------------------------------|
| 1        | 464-7816    | Communication Installation Gp |
| 1        | 419-3911    | Indicator Lamp Gp             |
| 1        | 115-1615    | Relay As (12VDC)              |
| 1        | 3E-5239     | Relay As (24VDC)              |
| 1        | 9X-1055     | Receptacle Terminal           |
| 1        | 155-2269    | Connector Plug As             |
| 1        | 155-2261    | Plug Lock Wedge               |
| 1        | 9X-3402     | Connector Socket              |

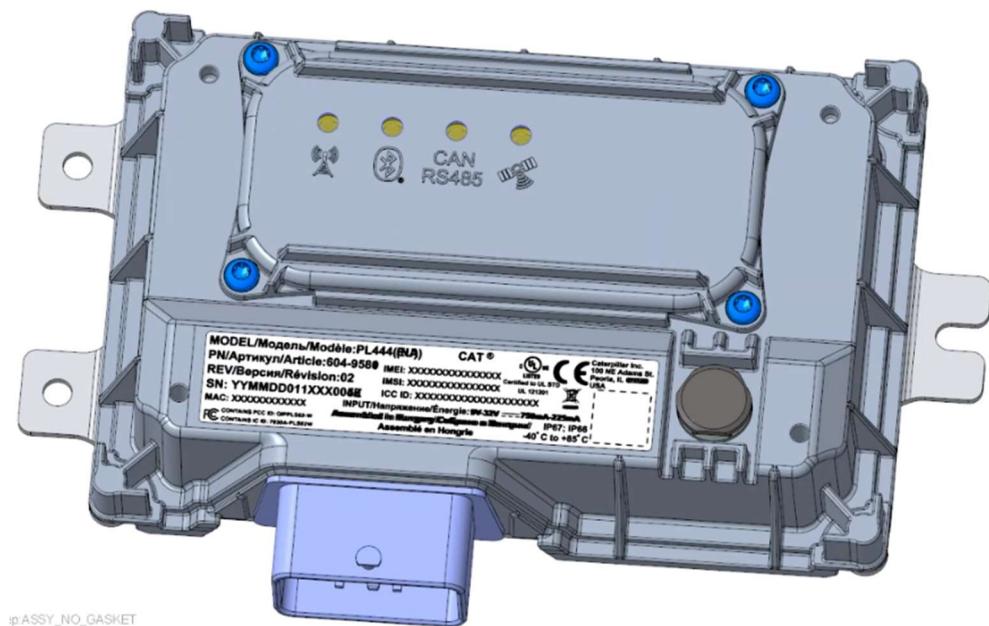


Illustration 1  
PL444 Cellular Radio

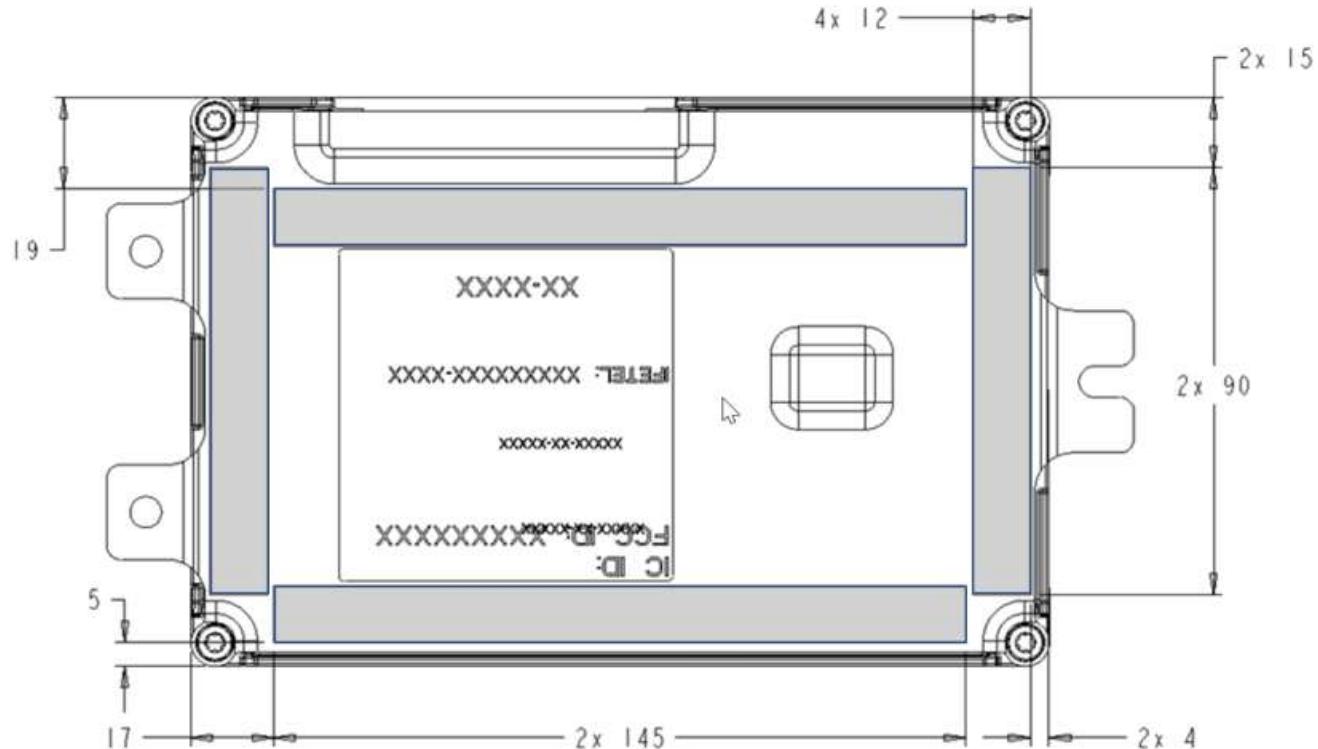


Illustration 2  
VHB 5962 Adhesive Tape Placement

## VHB Tape Application

- Note tape strip size and location in Illustration 2.
- To obtain optimum adhesion, the bonding surfaces must be flat, clean and dry. Typical surface cleaning solvents are 50:50 IPA/ water mixture (rubbing alcohol) or use a degreasing solvent, Citrus Base Cleaner, mineral spirits, naphtha or similar solvents are suggested to cut the oil. This should always be followed with an IPA/water cleaning to help ensure that any residue or film is completely removed.
- Bond strength is dependent upon the amount of adhesive-to- surface contact developed. Firm application pressure develops better adhesive contact and helps improve bond strength. Generally, this means that the tape should experience at least 15 psi (100 kPa) in roll down or platen pressure.
- After application, the bond strength will increase as the adhesive flows onto the surface. At room temperature, approximately 50% of the ultimate strength will be achieved after 20 minutes, 90% after 24 hours and 100% after 72 hours.

# System Diagram

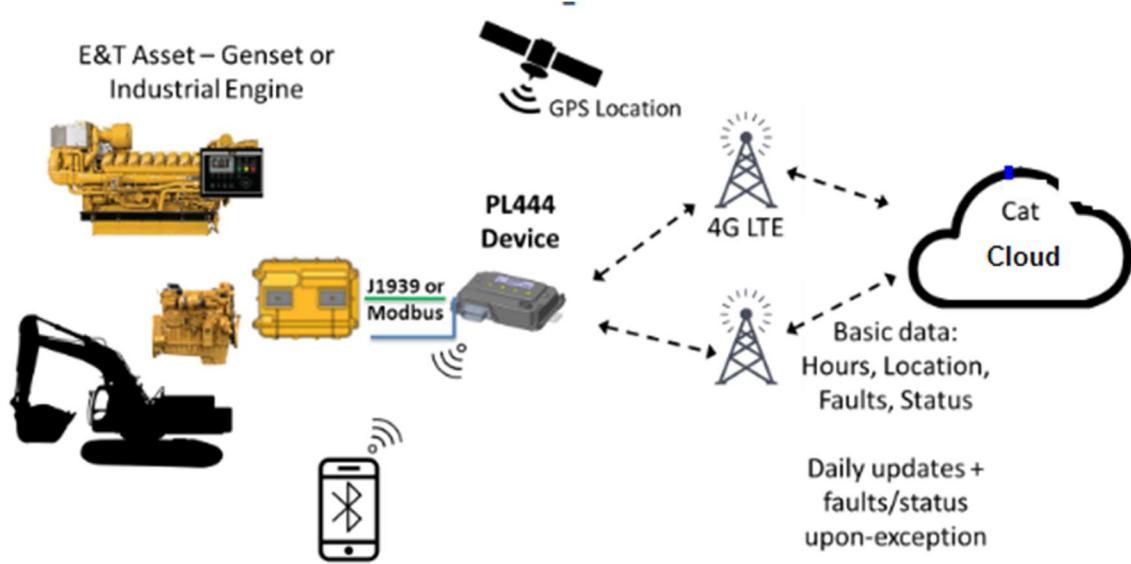


Illustration 3  
PL444 System Diagram

## Mounting the Radio

### PL444 Mounting Requirements

Read all instructions prior to installing the hardware. Be sure to consider the length and routing of harnesses when installing the hardware to minimize extra hardware needed.

**Note:** Ensure that power is disconnected from the battery during the beginning steps of the installation.

The following are requirements when deciding where to mount the radio:

- The radio should be exposed to a large portion of the sky. In most cases, the canopy/container roof usually provides an optimal view of the sky with minimal blockages
- For outdoor installations, radio should be mounted in horizontal orientation or in a vertical orientation to the horizon, closest to the top-most horizontal surface as possible, and with the connector facing in the downward position.
- The module has LEDs to aid in troubleshooting and should be considered when finding a suitable mounting location.
- In order to utilize the GPS Signal, the cellular radio may be mounted under a non-metallic cover, but not a metallic one
- Do not mount the radio in an area that will expose the radio to extreme conditions of heat. Exposure to high heat may make the radio inoperable. Refer to Table 5
- The maximum torque for the radio mounting bolts is 12 N·m (8.85 lb ft).
- Locate the radio so that the radio connectors are not exposed to high-pressure spray or underwater immersion. Exposure to high-pressure spray or underwater immersion may compromise the connector seals and lead to connection failure

- Keep no less than 500 mm (19.68 inch) between the radio and other antennas that transmit a radio signal. The lists of radio antennas to maintain a distance from include the citizen band radio, data radio, and commercial communication radios
- Route the cable such that the cable is not subject to abrasion or pinching.
- Do not route the harness near any source of extreme heat (exhaust)
- Do not mount the harness so that the limitations of temperature are exceeded
- Do not mount on a cantilever
- Do not mount on a flexible surface
- Must be mounted on a flat surface
- Place the radio in an area that is easily accessible and can be serviced in a reasonable amount of time
- Place the radio in an area, and with an orientation, that the radio is not used as a "boot step" or a "fulcrum point". The radio is made of a high strength plastic and, although durable, is still breakable.
- Locate the radio with sufficient clearance for the radio harness to be installed to prevent sharp bends in the radio harness.

## PL444 Environmental Information

Table 5

| PL444 Environmental Information Table |   |
|---------------------------------------|---|
| Parameter                             | Specification                                 |
| Operating Temperature Range           | -40°C to +85°C<br>(-40°F to +185°F)           |
| Vibration                             | 9.8 Grms random (24-2000 Hz), up to 0.5 g2/Hz |
| Sealing                               | IP66 & IP67                                   |
| Operating Voltage                     | 9 to 32 VDC                                   |
| Humidity                              | SAE J1455                                     |

## Installing the PL444

1. Mount the radio in a location with the least amount of exposure to extreme environmental conditions as possible.

**Note:** Avoid mounting the radio next to high heat sources such as exhaust stacks

**Note:** Keep a distance between the radio and other antennas that transmit a radio signal. Caterpillar recommends a distance of at least 1 m (3.28 ft). Keep no less than 500 mm (19.69 inch) between the radio and other antennas that transmit a radio signal. The list of radio antennas

to maintain a distance from include the citizen band radio, data radio, and commercial communication radios.

**Note:** Avoid mounting the radio in a transmitted beam of any radar equipment.

2. Install the required bolts, washers, and locknuts to secure the radio. Tighten the mounting bolts for the radio to  $12 \pm 3 \text{ N}\cdot\text{m}$  ( $8.85 \pm 2.21 \text{ lb ft}$ ).
3. Plug in the harness. The harness should extend straight out of the radio. Harness must be connected to protect the radio from paint operations and to maintain sealing. Follow product servicing procedures.
4. Route the cable in such a way that the cable is not subject to abrasion or pinching. Do not route the radio harness near any source of extreme heat (exhaust). Do not mount the radio or the radio harness so that the limitations of temperature  $-40^\circ \text{ C}$  ( $-40^\circ \text{ F}$ ) and  $85^\circ \text{ C}$  ( $185^\circ \text{ F}$ ) are exceeded.

**Note:** Place Product Link radios on independent fuses and ensure that the fuse is a 5A fuse. Having an independent fuse for the Product Link will also prevent other key components from being disabled if Product Link fails.

## Connector & Definition

Table 6

| 44-Pin Connector & Definition |                  |
|-------------------------------|------------------|
| Pin Number                    | Definition       |
| A1                            | CAN HIGH         |
| B1                            | CAN LOW          |
| L1                            | KEYSWITCH        |
| M1                            | (+) BATTERY      |
| M2                            | (-) BATTERY      |
| K2                            | WIRELESS DISABLE |
| H3                            | OUTPUT DRIVER 1  |
| J3                            | OUTPUT DRIVER 2  |
| A3                            | RS485 RTN        |
| A4                            | RS485 A+         |
| B4                            | RS485 B-         |

|   | A         | B        | C        | D        | E        | F        | G        | H        | J        | K                | L        | M        |
|---|-----------|----------|----------|----------|----------|----------|----------|----------|----------|------------------|----------|----------|
| 1 | CAN_H     | CAN_L    | Not used         | KSW      | Batt+    |
| 2 | Not used  | Not used | Not used | Not used | Not used | Not used | Not used | Not used | Not used | Wireless Disable | Not used | Batt-    |
| 3 | RS485 RTN | Not used | LSD1     | LSD2     | Not used         | Not used | Not used |
| 4 | RS485_A   | RS485_B  | Not used         | Not used | Not used |

Illustration 4

## Warning Film Installation

Install the warning film in Illustration 4 in a location such as the dash or control panel. Ensure that the warning film is clearly visible to the operator during the normal operation of the equipment.



Illustration 5  
Warning Film



The blast site is defined as the area that handles explosive material during loading. Included is the perimeter that is formed by the loaded blast holes.

If required, the following are suggested methods to disable the Caterpillar Product Link communication device:

- Turn the Product Link radio disable switch to OFF.
- Disconnect the Caterpillar Product Link communication device from the main power source. This action is performed by disconnecting the wiring harness at the Product Link radio.

**Note:** If no radio disable switch is installed and the equipment will be operating near a blast zone, a Product Link radio disable switch may be installed on the equipment. The switch will allow the Caterpillar Product Link communication device to be shut off by the operator from the equipment control panel. Refer to "Radio Disable Switch (Optional)" for more details and installation instructions.

## Harness Installation

Table 7

| Quantity | Part Number | Description        |
|----------|-------------|--------------------|
| 1        | 610-1015    | Control Harness As |

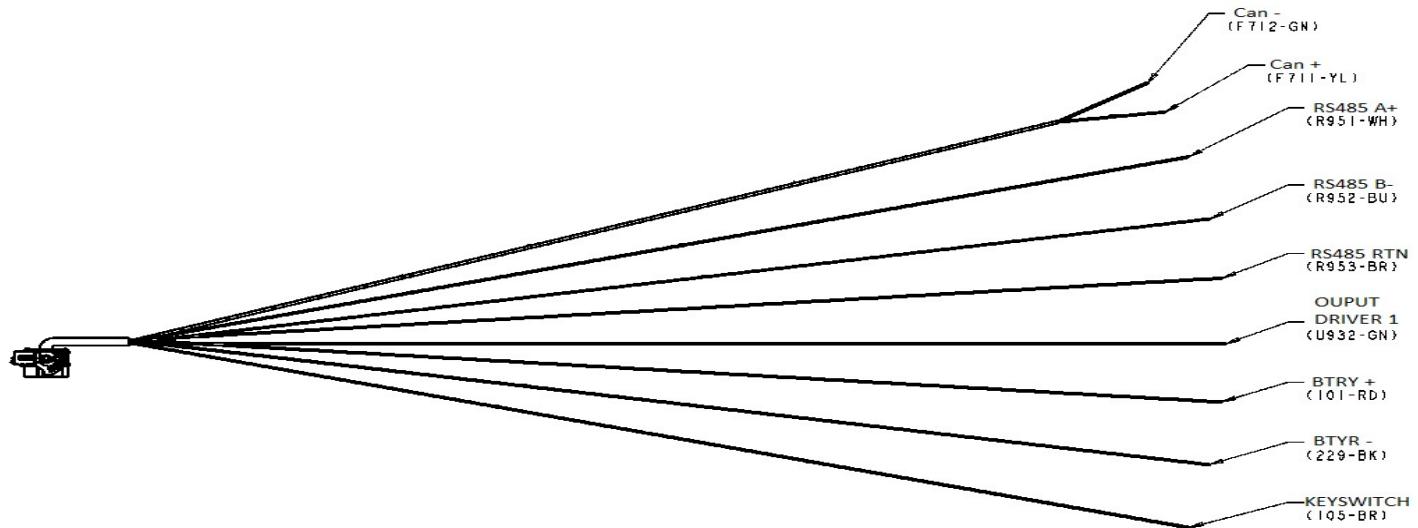


Illustration 6  
610-1015 Control Harness As.

Table 8

| Wire Information | Description      | Required/Optional |
|------------------|------------------|-------------------|
| (+) Battery      | 101-RD (Red)     | Required          |
| (-) Battery      | 229-BK (Black)   | Required          |
| Keyswitch        | 105-BR (Brown)   | Required          |
| CAN High         | F711-YL (Yellow) | Required          |
| CAN Low          | F712-GN (Green)  | Required          |
| RS485 A+         | R951-WH (White)  | Optional          |
| RS485 B-         | R952-BU (Blue)   | Optional          |
| RS485 Rtn        | R953-BR (Brown)  | Optional          |
| Output Driver 1  | U932-GN (Green)  | Optional          |
| Output Driver 2  | -                | Optional          |
| Wireless Disable | -                | Optional          |

### Wire to the Equipment

**Note:** Ensure that the equipment power is OFF, and the battery disconnect is ENGAGED when installing harness.

The standard harness for the installation is part number **610-1015** Control Harness As. Connect the wires to the equipment by following Table 8.

Battery (+) should be connected to a 5A fused battery power supply.

Recommended wire splicing practices should be followed for any of the harness splices.

**Note:** Use proper application and installation guide, and schematic of equipment to determine the best place to splice wires for installation.

Provide a drip loop in the harness to prevent water from being directed to the radio. If the harness is too long, gather in loops and secure with zip ties.

### **Connect the Harness to the PL444 Cellular Radio**

**Note:** Ensure that the equipment power is OFF, and the battery disconnect is engaged when installing the harness.

Connect the 44-Pin connector to the radio.

### **Turn the Equipment Power ON**

Once the PL444 cellular radio has been connected, and the wires from the harness for battery positive, battery negative, and key switch power have been connected to the equipment, turn on the power to the equipment.

### **Configuring the Product ID Remotely**

The PL444 device will register with its own serial number. The Product Link device serial number can be searched in the "Dealer Services Portal". Once the Product Link device serial number is found, the Product ID, or Machine Serial Number can be set remotely from the "Dealer Services Portal".

To set the Product ID remotely, select the pencil icon in the "S/N" row. In the popup box, select the "New Serial Number" option. This selection will allow you to put in the serial number of your choice.

### **Upgrading Firmware Procedure (Over the Air)**

The firmware can only be updated remotely through cellular communication. To have your software updated, submit a DSN ticket stating that you would like to have the software on your PL444 updated, along with acknowledgment of customer consent, and the DSN Tier 2 analysts will have the software on your radio updated.

## Check the LED Lights on the Radio

The PL444 cellular radio is equipped with LED lights that function when the equipment key switch is turned to ON. The LED lights on the radio from left to right are yellow, white, blue, orange.

Table 9

| LED Light Status    |   |                             |                             |
|---------------------|---|-----------------------------|-----------------------------|
| LED Color (Purpose) | LED Off   | LED Flashing                | LED On Solid                |
| Yellow (Cellular)   | Device off, fault, modem off, low power mode          | Searching for signal        | Data connection established |
| White (Bluetooth®)  | Device off, fault, Bluetooth disabled, low power mode | Data traffic occurring      | Connection established      |
| Blue (Datalink)     | Device off, fault, or no connection                   | Activity on J1939 or Modbus | -                           |
| Orange (GNSS)       | Device off, fault, low power mode                     | Searching / No Lock         | GNSS Fix                    |

## Subscribe the Equipment in the “Dealer Services Portal”

The PL444 cellular radio is configured automatically for the services selected in the Dealer Services portal. Your Caterpillar dealer administrator will be notified when your device is on-line and ready to have services enabled. Once the dealer selects the desired services, the configuration will be sent over the air and the device will be configured to provide the proper data at the proper frequency for the service in the Dealer Services Portal.

Consult with your dealers Product Link specialist for more details in assisting you for the right data service to meet your needs. Service starts with basic equipment management features providing hour, location monitoring, health, and utilization.

## Regulatory compliance statements

PL444 cellular radio is a remote monitoring solution that enables efficient and effective equipment management. Product Link transmits the information via a cellular network.

### Classification for PL444 cellular radio

*NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.*

### ***Radiofrequency radiation exposure Information:***

*This equipment complies with FCC and IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 [\*] cm between the radiator and your body.*

*This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.*

*Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de 20 [\*] cm de distance entre la source de rayonnement et votre corps.*

*Ce transmetteur ne doit pas être placé au même endroit ou utilisé simultanément avec un autre transmetteur ou antenne.*

[\*] Insert min distance where justified by measurement / calculation. Distances lower than 20cm are prohibited. Distances more than 20cm shall be justified by normal / intended use of the device

## **Manual Requirements according 15.19 / RSS-GEN**

### ***NOTICE:***

*This device complies with Part 15 of the FCC Rules [and with Industry Canada licence-exempt RSS standard(s)].*

*Operation is subject to the following two conditions:*

- (1) this device may not cause harmful interference, and*
- (2) this device must accept any interference received, including interference that may cause undesired operation.*

**AVIS:**

*Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:*

- (1) l'appareil ne doit pas produire de brouillage, et*
- (2) l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.*

**Manual Requirements according 15.21**

**NOTICE:**

*Changes or modifications made to this equipment not expressly approved by (Caterpillar Inc.) may void the FCC authorization to operate this equipment.*



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*Approval owner of PL444*

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