TyreSense

Gen II TyreSense System Hardware Installation User Guide

Rimex Supply Ltd.

Hardware Installation User Guide

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The procedures in this guide must be performed by qualified personnel.

Preface

This preface provides general information about the documentation for the TyreSense system.

Purpose

The TyreSense *Hardware Installation User Guide* provides hardware overview information for the TyreSense system including connection and installation procedures.

Audience

The information provided in this guide is intended for the TyreSense system users and installers.

Contact information

Table 1 lists the customer support contact information.

Table 1 – Contact information

Contact	Customer support	
	TyreSense	Rimex Supply Ltd.
Telephone	1-604-290-2465 or 1-250-380-1474	1-604-888-0025 Toll free: Canada, Washington, and Oregon: 1.800.663-9883
Email	dave@tyresense.com	inquiries@rimex.com
Websites	www.tyresense.com	www.rimex.com

Prerequisite knowledge

Knowledge of the tyre industry and vehicle maintenance is required.

Safety requirements

All personnel should exercise sound judgement and follow all safety precautions as established and set out on the customer premises.

The equipment in the TyreSense system, including the TyreSense Client, TyreSense Server Software, Gen II Receiver Unit, Gen II Display Unit, auxiliary modules, cables, antennas, sensors, and accessories should be accessible to authorized personnel only.

All cables with exposed wires must be installed by a qualified electrician. The TyreSense sensors must be installed by qualified tyre and wheel specialists.

Refer to section 9.2 — Antenna and transmission safety precautions before installing the RFDATA, GSM/GPRS, or Bluetooth antennas.

Document overview

Table 2 describes the organization of the *Hardware Installation User Guide* guide.

Table 2 – *Hardware Installation User Guide* documentation

Volume	Chapter	Description
Units	Gen II Receiver Unit	The Gen II Receiver Unit receives pressure and temperature information from the wireless sensors in the vehicle tyres.
	Gen II Display Unit	The Gen II Display Unit is an optional device which mounts in the cabin of the vehicle and displays the data recorded by the Gen II Receiver Unit.
Cables	Power cable	The power cable provides power to the Gen II Receiver Unit and, if installed, the Gen II Display Unit.
	Display patch cable	The display patch cable connects the Gen II Receiver Unit to the Gen II Display Unit.
	Ethernet cable	The Ethernet cable provides a 10/100 Base-T connection allowing a connection from the Gen II Receiver Unit to a computer or server.
	USB cable	The USB cable facilitates data transmission between the Gen II Receiver Unit and a computer.
Antennas	RFDATA	The RFDATA antenna receives pressure and temperature information the wheel sensors and connects to the Gen II Receiver Unit.
	GSM/GPRS	The GSM/GPRS antenna allows the wireless transmission of data by the Gen II Receiver Unit over a cellular network to a computer or local network.
	Bluetooth	The Bluetooth antenna allows short-range wireless communication with Bluetooth enabled devices.

Table 2 – *Hardware Installation User Guide* documentation (continued)

Volume	Chapter	Description
Sensors	Flush mount wheel sensor	The flush mount sensor installs in a threaded hole drilled through the wheel of the vehicle, protruding only a minimum distance into the tyre cavity making it ideally suited for vertical tyre changeovers as it does not need to be removed from the wheel.
	Probe wheel sensor	The probe sensor installs in a threaded hole drilled through the wheel of the vehicle. Either a DE-FUZER valve and DE-FUZER wheel adapter assembly or wheel adapter must be attached to the threaded end of the probe sensor. The DE-FUZER valve or wheel adapter are screwed into the wheel and are required to attach the probe sensor to the wheel.
	Patch mount wheel sensor	The patch mount sensor is a two-piece design which allows the wheel sensor to be removed from the patch mount of a discarded tyre and reinstalled in a replacement tyre. The patch mount can be easily installed in any tubeless OTR tyre, regardless of size or make. The patch mount wheel sensor is a robust design which resists liquid additives, tyre wall flex, and extreme temperatures.
	Valve mount wheel sensor	The valve mount sensor installs on the outside of a wheel in a threaded hole drilled through the wheel of the vehicle. The valve sensor installs easily onto the patented PT valve system. You can use the valve mount sensor as either the backup to an internally mounted sensor or as the primary sensor for monitoring tyre pressure. Using the valve mount sensor as a backup to the internally installed sensor enables you to defer installation or replacement of an internal tyre sensor until the next tyre changeover.
Accessories	PT core tool	The PT core tool is an optional tool that allows the user to replace a core housing on a wheel without deflating the tyre.

Related documentation

Table 3 lists the documentation related to the TyreSense *Hardware Installation User Guide*.

Table 3 – Related documentation

Document	Description	Part number
Client Application User Guide	User guide for the TyreSense Client.	TRS-G-USER-2.0
Gen II Display Unit User Guide	User guide for the TyreSense Gen II Display Unit.	TRS-G-DISPLAY-2.0
Mobile Application User Guide	User guide for the TyreSense Mobile software.	TRS-G-MOBILE-2.0
Server Installation and Setup	User guide for configuring the Gen II Receiver Unit auxiliary modules and installing the TyreSense Server Software.	TRS-G-SERVER
Troubleshooting Guide	The Troubleshooting Guide for the TyreSense system.	TRS-G-TS-1

Document conventions

Table 4 lists the documentation conventions used in this guide.

Table 4 – Document conventions

Convention	Purpose	Example
Boldface type	Boldface type represents buttons or display screens and windows.	Click the **Change** button. **Head Unit Setup** window
Italic type	Italic type is used for document titles and emphasis.	*Display Unit User Guide*
`Courier` type	Courier type indicates file names or information that is viewed on screen or must be manually entered by the user.	`TyreSenseServerTool.exe`
Units of measure	Both metric and imperial measurements are used in the documentation.	0° C (32°F) 20 PSI (138 kPa)
Procedure options	Options available in a procedure are identified by letters. The user must perform one of the options before proceeding to the next step in the procedure.	1. This step offers two options: a. The first option. b. The second option. 2. The next step.
Procedure sub-steps	Required sub-steps within a procedure are identified by roman numerals. The required sub-steps must be completed before proceeding to the next step.	1. This procedure has required sub-steps: i. The first required sub-step. ii. The second required sub-step. iii. The third required sub-step. 2. The next step.
Danger	The danger icon identifies an activity or situation that could cause personal injury or death.	
Caution	The caution icon identifies an activity or situation that could cause equipment damage or data loss.	
Note	The note icon identifies information that may be of particular interest to the user.	

Contents

SYSTEM UNITS

CABLES

ACCESSORIES

APPENDIXES

GLOSSARY

INDEX

Overview

1 Overview

The *Hardware Installation User Guide* guide provides hardware information, connection, and installation procedures for the TyreSense system. The following hardware is included in the TyreSense system:

- Gen II Receiver Unit
- Gen II Display Unit
- cables
- antennas
- wheel sensors
- accessories

1.1 System units

1.1.1 Gen II Receiver Unit

The Gen II Receiver Unit receives pressure and temperature information from the wireless sensors in the vehicle tyres. This information is relayed to the Gen II Display Unit or the TyreSense Client, if installed. The operator can use the Gen II Receiver Unit to set up the system and download data logs.

See chapter 4 for additional information.

1.1.2 Gen II Display Unit

The Gen II Display Unit is an optional device which mounts in the cabin of the vehicle and receives data from the Gen II Receiver Unit. You can:

- view Gen II Receiver Unit status
- view Gen II Display Unit status
- view tyre pressure and temperature
- clear high and low pressure
- set user options
- set wheel ID codes
- set alert levels.

See chapter 3 for additional information.

1.2 Cables

1.2.1 Power cable

The power cable receives power from the vehicle and provides power to the Gen II Receiver Unit and, if installed, the Gen II Display Unit.

See chapter 5 for additional information.

1.2.2 Display cable

The display patch cable connects the Gen II Display Unit to the Gen II Receiver Unit allowing the operator to view the information received by the Gen II Receiver Unit from the wheel sensors. The Gen II Display Unit receives power from the vehicle through the Gen II Receiver Unit.

See chapter 6 for additional information.

1.2.3 Ethernet cable

The Ethernet cable provides a 10/100 Base-T connection and allows the user to make an external connection from the Gen II Receiver Unit to a laptop or desktop computer or a remote server via the local network.

See chapter 7 for additional information.

1.2.4 USB cable

The USB cable provides minimal power to the Gen II Receiver Unit, allowing an operator to set up the system and download data logs. The USB cable facilitates data transmission between the Gen II Receiver Unit and any desktop or laptop computer. The Gen II Display Unit, RFDATA, Bluetooth, and auxiliary module connections are non-functional only with USB power.

See chapter 8 for additional information.

1.3 Antennas

1.3.1 RFDATA antenna

The RFDATA antenna receives wireless data transmissions from the wheel sensors and connects to the Gen II Receiver Unit.

See chapter 10 for additional information.

1.3.2 GSM/GPRS antenna

The GSM/GPRS antenna allows the wireless transmission of data by the Gen II Receiver Unit over a cellular network to a computer or local network.

See chapter 11 for additional information.

1.3.3 Bluetooth antenna

The Bluetooth antenna allows short-range wireless communication with Bluetooth enabled devices.

See chapter 12 for additional information.

1.4 Wheel sensors

1.4.1 Flush mount wheel sensor

The flush mount sensor is ideally suited for vertical tyre changeovers as it does not need to be removed from the wheel once it is installed. The flush mount sensor installs easily in situations where there is low clearance between the wheel and the rim.

See chapter 14 for additional information.

1.4.2 Probe wheel sensor

The probe sensor installs in a threaded hole drilled through the wheel of the vehicle. You must attach either a DE-FUZER valve and DE-FUZER adapter collar assembly or a wheel adapter to the probe sensor in order to attach it to the wheel.

See chapter 15 for additional information.

1.4.3 Patch mount wheel sensor

The patch mount system is a two-piece design which allows the wheel sensor to be installed on a patch mount in any tubeless OTR tyre. The patch mount resists liquid additives, tyre wall flex, and extreme temperatures.

See chapter 16 for additional information.

1.4.4 Valve mount wheel sensor

The valve mount sensor installs on a PT type valve on the exterior of all wheel types. You can use the valve mount sensor either as a backup for an internally installed sensor or leave it permanently in place as the primary sensor for monitoring tyre pressure and temperature

See chapter 17 for additional information.

1.5 Accessories

1.5.1 PT core tool

The optional PT core tool allows a user to remove an existing R-520 (TR-CH-8) core housing and replace it with a PT-R-520 core housing. The PT core tool eliminates the need to deflate a tyre assembly in order to update the standard valve hardware to PT type valve hardware.

See chapter 18 for additional information.

2 DC specifications

This chapter lists the DC specifications for the Gen II Receiver Unit, Gen II Receiver Unit with attached Gen II Display Unit, and the Gen II Receiver Unit with either an Ethernet or GPRS Module installed.

2.1 Gen II Receiver Unit

Table 2-1 lists the minimum and maximum voltages and the current draw specification required in order for the Gen II Receiver Unit to function.

Table 2-1 – Gen II Receiver Unit voltage and current draw

Unit	Minimum	Typical (1)	Maximum
Voltage	7 VDC		28 VDC
Current draw		50 mA @ DC 12 V 30 mA @ DC 24 V	230 mA @ DC 12 V 115 mA @ DC 24 V

Note:
(1) The typical values are the measured averages of the Gen II Receiver Unit.

Caution — Exceeding the maximum voltage can result in damage to the Gen II Receiver Unit.

2.2 Gen II Receiver Unit with Gen II Display Unit

Table 2-2 lists the current draw specifications for the Gen II Receiver Unit with attached Gen II Display Unit. The values are the combined current draw of both the Gen II Receiver Unit and the Gen II Display Unit.

Table 2-2 – Gen II Receiver Unit with Gen II Display Unit

Unit	Typical (1)	Maximum
Gen II Receiver Unit with attached Gen II Display Unit	85 mA @ DC 12 V 48 mA @ DC 24 V	310 mA @ DC 12 V 155 mA @ DC 24 V

Note:
(1) The typical values are the measured averages of the Gen II Receiver Unit and attached Gen II Display Unit.

2.3 Auxiliary modules

This section provides the current draw of:

- Gen II Receiver Unit with installed auxiliary modules
- Gen II Receiver Unit with installed auxiliary modules and attached Gen II Display Unit

2.3.1 Gen II Receiver Unit with auxiliary module

Table 2-3 lists the current draw specifications for the Gen II Receiver Unit with an installed Ethernet or GPRS auxiliary module. The values are the combined current draw of both the Gen II Receiver Unit and the installed auxiliary module.

Table 2-3 – Gen II Receiver Unit with installed auxiliary module

Auxiliary module	Maximum
Ethernet Module	
Gen II Receiver Unit with installed Ethernet Module	358 mA @ 12 VDC 179 mA @ 24 VDC
GPRS Module	
Gen II Receiver Unit with installed GPRS Module	524 mA @ 12 VDC 262 mA @ 24 VDC

2.3.2 Gen II Receiver Unit with auxiliary module and Gen II Display Unit

Table 2-4 lists the current draw specifications for the Gen II Receiver Unit with an installed Ethernet or GPRS auxiliary module and attached Gen II Display Unit. The values are the combined current draw of the Gen II Receiver Unit, the installed auxiliary module, and the Gen II Display Unit.

Table 2-4 – Gen II Receiver Unit with auxiliary module and Gen II Display Unit

Auxiliary module	Maximum
Ethernet Module	
Gen II Receiver Unit with installed Ethernet Module and attached Gen II Display Unit	438 mA @ DC 12 V 219 mA @ DC 24 V
GPRS Module	
Gen II Receiver Unit with installed GPRS Module and attached Gen II Display Unit	604 mA @ DC 12 V 302 mA @ DC 24 V

System Units

3 Gen II Display Unit

The Gen II Display Unit is an optional device. The Gen II Display Unit mounts in the cabin of the vehicle and displays data from the Gen II Receiver Unit. You can perform the following functions on the Gen II Display Unit:

- view the Gen II Receiver Unit and Gen II Display Unit status
- view real-time tyre pressure and temperature data for all tyres with installed sensors
- clear high and low pressure
- set user options
- set wheel ID codes
- set alert levels

See the *Display Unit User Guide* for the procedures to configure and view data though the Gen II Display Unit.

Figure 3-1 shows the Gen II Display Unit.

Figure 3-1 – Gen II Display Unit (TRS-DISPLAY)

3.1 Specifications

Table 3-1 lists the specifications of the Gen II Display Unit.

Table 3-1 – Gen II Display Unit specifications

Specification	Value
Mechanical	Height: 7.6 cm (3 in.) Width: 14 cm (5.5 in.) Length: 4.1 cm (1.6 in.)
Weight	0.35 kg (0.77 lb.)
Voltage	Powered through the patch cable from the Gen II Receiver Unit.

3.2 Gen II Display Unit installation

This section provides the hardware, tools, and procedure for installing the Gen II Display Unit in a vehicle.

3.2.1 Hardware

You need the following hardware:

- Gen II Display Unit:
  Part number: TRS-DISPLAY
- Mounting bracket:
  Part number: TRS-BRACKET-HW
- 2 sheet metal mounting screws
- *Optional*. Rubberized grommets
- *Optional*. Nylon cable ties (for securing loose wiring)

3.2.2 Tools

You need the following tools:

- Screwdriver
- Drill for pre-drilling the mounting holes

Procedure — Install the Gen II Display Unit.

	Caution — The Gen II Display Unit must be securely mounted in the vehicle before connecting the display patch cable from the Gen II Receiver Unit.

1. Select a location to mount the Gen II Display Unit. The Gen II Display Unit must be mounted in a location that is easy to access in order to view the display screen, use the buttons on the faceplate and attach the display patch cable.

When mounted ensure that the Gen II Display Unit does not interfere with the safe operation of the vehicle. Figure 3-2 shows the Gen II Display Unit mounted on the dashboard of a vehicle.

Figure 3-2 – Gen II Display Unit mounted on the dashboard of a vehicle

Figure 3-3 shows the Gen II Display Unit mounted on the ceiling of the vehicle cabin.

Figure 3-3 – Gen II Display Unit mounted on the ceiling of the cabin

2. Mount the Gen II Display Unit:
    i. Determine the location for the Gen II Display Unit.
    ii. Align the mounting bracket and mark the drill holes.
    iii. Pre-drill the mounting holes.
    iv. Align the mounting bracket to the mounting holes.
    v. *Optional*. Add rubberized grommets between the mounting surface and the bracket and between the bracket and the screw head to absorb vibration.
    vi. Screw the mounting brackets into place.
3. Attach the Gen II Display Unit to the mounting bracket:
    i. Align the two screw holes on the bracket uprights with the two screw holes on the left and right sides of the Gen II Display Unit.
    ii. Screw each of the two hand screws through the bracket into the Gen II Display Unit.
4. Adjust the angle of the Gen II Display Unit such that the screen is easily visible.
5. Tighten the two hand screws to hold the Gen II Display Unit in place.

4 Gen II Receiver Unit

The Gen II Receiver Unit receives pressure and temperature data from the wireless sensors in the vehicle tyres. The Gen II Receiver Unit also allows the user to set up the system and download data logs for each of the installed sensors. The Gen II Receiver Unit must be installed in the vehicle and all necessary cables connected in order to receive data from the wheel sensors or transmit data to the Gen II Display Unit or TyreSense Client, as required.

The Gen II Receiver Unit receives power from the power cable which is wired into the electrical panel in the vehicle or, when connected, from the USB cable. The power provided by the USB cable only allows a user to set up the system and download data logs. The Gen II Display Unit, RFDATA, Bluetooth, and auxiliary modules are non-functional with only USB power.

With main power applied, you can connect to the Gen II Receiver Unit using USB, Ethernet, GSM/GPRS, or Bluetooth connections. The USB and Bluetooth connectors are standard on the Gen II Receiver Unit. The Ethernet and GSM/GPRS connections are made through optional auxiliary modules and must be ordered separately from your TyreSense representative. The external USB and Ethernet connections are made using cables. The GSM/GPRS and Bluetooth connections are wireless and require antennas.

4.1 Top plate

The top plate of the Gen II Receiver Unit lists the pin out information for the power cable and connector; see Figure 4-1. See chapter 5 for information on the power cable and additional information on the cable pin outs.

Figure 4-1 – Gen II Receiver Unit top plate

4.2 Endplates

The Gen II Receiver Unit has two endplates: power endplate and antenna endplate. The power endplate has the connectors for the power cable, display patch cable, USB cable, and auxiliary modules, if installed. The connection requirements of the user determine the type of auxiliary module installed in the Gen II Receiver Unit. The types of auxiliary modules are Ethernet or GSM/GPRS; see the *Server Installation and Setup* guide for more information.

Figure 4-2 shows a power endplate.The standard Gen II Receiver Unit has no auxiliary module installed.

Figure 4-2 – Gen II Receiver Unit power endplate

The indicator LEDs are located on the antenna endplate between the connectors for the RFDATA and Bluetooth antennas.

Table 4-1 – Gen II Receiver Unit indicator LEDs

LED	Color	Activity	Description
Power	Green	Solid	The Gen II Receiver Unit is operating normally.
		Flashing	The Gen II Receiver Unit is in boot loader mode.
Connect	Orange	Off	No connection
		On	The Gen II Receiver Unit is connected via a USB, serial, network, or Bluetooth connection.
Data	Orange	Flashing	The Gen II Receiver Unit is transmitting data via an RFDATA, USB, serial, network, or Bluetooth connection.

Table 4-1 – Gen II Receiver Unit indicator LEDs (continued)

LED	Color	Activity	Description
Message	Red	Solid	A sensor alert has occurred for one of the wheel positions. 
		Flashing	An L1 alert has occurred for one of the wheel positions.  On:1.4 s Off: 0.2 s
			An L2 alert has occurred for one of the wheel positions.  On: 1 s Off: 0.2 s On: 0.2 s Off: 0.2 s
			A malfunction error has occurred and the applicable sensor should be replaced as soon as possible.  On: 0.2 s Off: 0.2 s

Note:

(1) The Gen II Receiver Unit enters boot loader mode for one of the following reasons:

Programming:	The Gen II Receiver Unit is being programmed
No firmware:	The Gen II Receiver Unit remains in boot loader mode until the correct firmware is loaded
Unable to exit:	After a reset the Gen II Receiver Unit remains in boot loader mode and does not enter the application firmware mode. If the Gen II Receiver Unit hardware is earlier than version 8-5 then you must reset the unit; if the hardware is later than version 8-6 then the unit will automatically reset after 2 min.

4.3 Modules

Table 4-2 describes the optional modules that are available for the Gen II Receiver Unit. The requested module is pre-installed in the Gen II Receiver Unit depending on the requirements of the user.

Table 4-2 – Gen II Receiver Unit installed modules

Module	Description
Ethernet	The Ethernet Module provides remote access to the Gen II Receiver Unit through a 10/100 Base-T connection.
GPRS	The GPRS Module provides wireless access to the Gen II Receiver Unit through a GPRS equipped GSM cellular network.

The user can configure both the Ethernet and GPRS Modules through the TyreSense Client. When a GPRS Module is installed the user can access the Gen II Receiver Unit using a wireless connection. When an Ethernet Module is installed the user can access the Gen II Receiver Unit using either a USB cable or Bluetooth.

See the Modules volume in the *Server Installation and Setup* guide for detailed information about the Ethernet and GPRS Modules, including the procedures to configure the modules and troubleshooting information.

4.4 Specifications

Table 4-3 lists the specifications of the Gen II Receiver Unit.

Table 4-3 – Gen II Receiver Unit specifications

Specification	Value
Mechanical	Height: 6 cm (2.4 in.) Width: 10.3 cm (4.1 in.) Length: 15.2 cm (6 in.)
Weight	0.37 Kg (0.81 lb.)
Temperature	–40 to 80 °C (-40 176 °F)
Voltage	DC 7 to 28 V

4.5 Gen II Receiver Unit installation

This section provides the hardware, tools, and procedure for mounting the Gen II Receiver Unit in a vehicle.

The Gen II Receiver Unit is attached to the selected mounting surface using the mounting bracket on the Gen II Receiver Unit. Figure 4-3 shows the mounting bracket and mounting holes.

Figure 4-3 – Gen II Receiver Unit mounting brackets and holes

4.5.1 Hardware

You need the following hardware:

- Gen II Receiver Unit (one of):
  Standard: TRS-GEN2-BB-BT
  Ethernet: TRS-GEN2-BB-BT-ETH
  GPRS: TRS-GEN2-BB-BT-CELL
- 4 mounting screws
- *Optional*. Rubberized grommets

4.5.2 Tools

You need the following tools:

- Screwdriver
- Drill for pre-drilling the mounting holes
- Correct sized drill bit for pre-drilling the mounting holes

Procedure — Mount the Gen II Receiver Unit

	Caution — The Gen II Receiver Unit must be securely mounted in the vehicle before connecting the power. Caution — When mounting the Gen II Receiver Unit, ensure that you do not damage the power, display, or antenna connectors.

	Note — Ensure no cables or antennas are attached the Gen II Receiver Unit when it is being mounted.

1. Select a location to mount the Gen II Receiver Unit. The Gen II Receiver Unit must be mounted in a location that is easy to access in order to attach cables and antennas, as required.

   If you mount the Gen II Receiver Unit in the cabin of the vehicle ensure that it is not in the way of the vehicle driver or any passengers. For example, mount the Gen II Receiver Unit on the wall behind the driver's seat; see Figure 4-4.

If the Gen II Receiver Unit is mounted outside of the vehicle cabin or in an open cabin, ensure that it is located such that it is protected from the environment.

Figure 4-4 – Example of Gen II Receiver Unit mounting location

2. Print the drill-hole template in Figure 4-6.

	Note — The drill-hole template is to scale when printed on standard 8.5” x 11” paper.

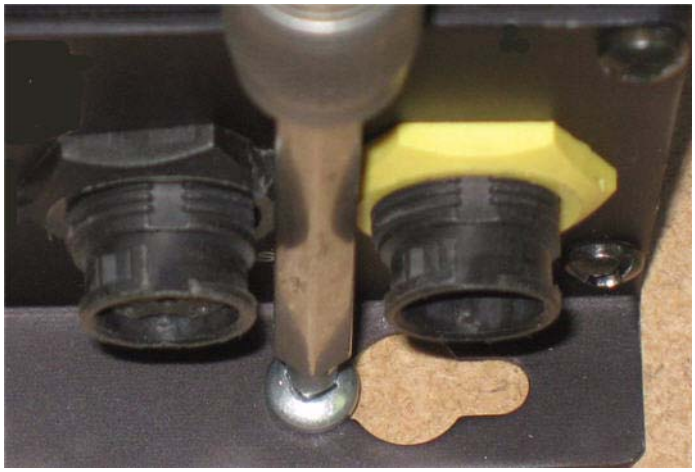
3. Using the template, mark the drill holes for mounting the Gen II Receiver Unit.
4. Pre-drill all of the mounting holes.
5. Partially screw mounting screws 1, 2, and 3 (marked on the drill-hole template) into the pre-drilled holes.
6. Align the center of the mounting holes on the Gen II Receiver Unit mounting bracket with the screw heads, ensuring that the power endplate is to your left.
7. Slip the Gen II Receiver Unit over the screw heads and slide the Gen II Receiver Unit down.
8. Ensure that the Gen II Receiver Unit is straight and that the last pre-drilled screw hole at the bottom right of the Gen II Receiver Unit is easily visible.
9. Tighten the three screws, ensuring that the Gen II Receiver Unit is securely attached to the mounting surface.

10. Securely fasten mounting screw 4 into the pre-drilled hole on the bottom right of the antenna endplate.

	Note — Mounting screw 4 is easily accessed between the power and display cable connectors using a screwdriver; see Figure 4-5.

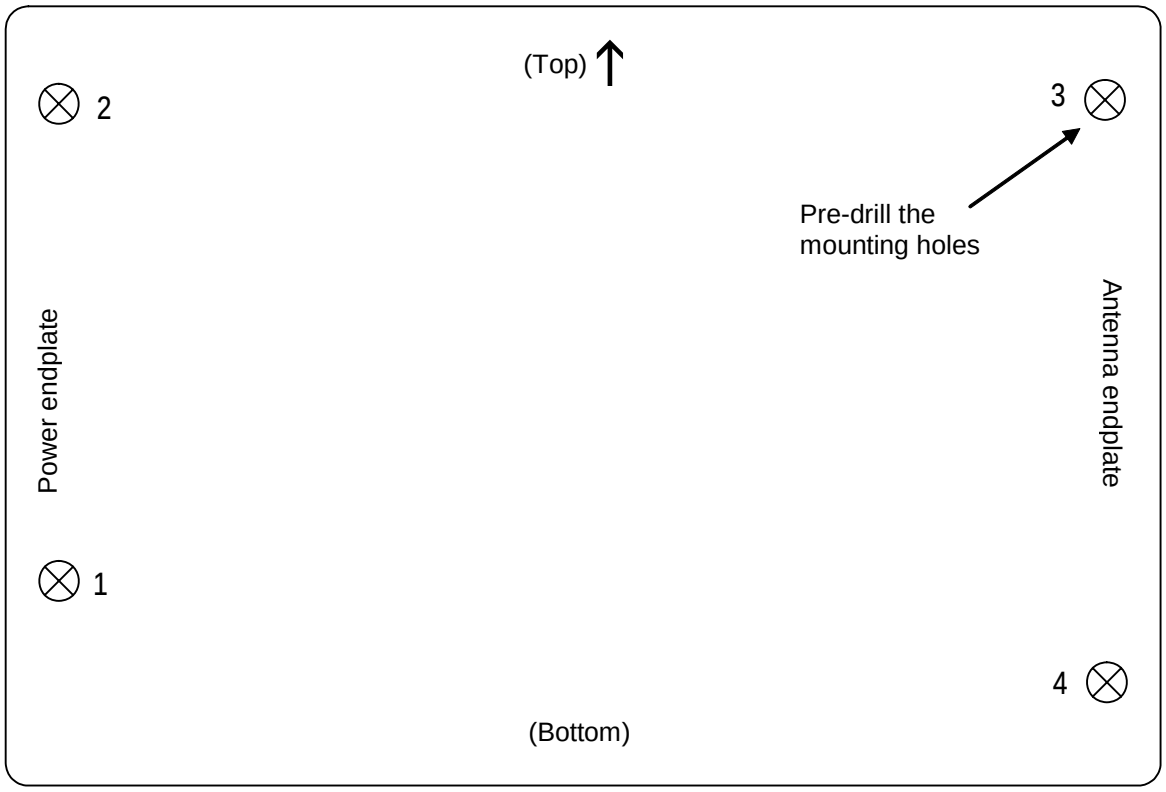
	Caution — When mounting the Gen II Receiver Unit, ensure that you do not damage the power, display, or antenna connectors.

Figure 4-5 – Mounting the Gen II Receiver Unit



11. Ensure all four screws are securely fastened.

Figure 4-6 – Template for pre-drilling mounting holes



Cables

5 Power cable

The power cable provides power to the Gen II Receiver Unit and Gen II Display Unit, if installed. The power cable is connected directly to the electrical panel of the vehicle. Table 5-1 lists the power cable specifications.

Table 5-1 – Power cable specifications

Specification	Description
Connector	• one yellow overmolded 5-pin connector • the non-connector end of the cable is stripped exposing the wires
Length	3 m (10 ft)

The exposed wires of the cable allow the installer to connect the power cable to the electrical panel in the vehicle. Figure 5-1 shows the connector and stripped wires of the power cable.

Figure 5-1 – Power cable connector and exposed wires

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Table 5-1 describes the wires contained in the power cable.

Table 5-1 – Power cable wires

Color	Signal	Description
Green	Ground	The ground or earth wire.
Brown	Ignition	DC 7 to 28 V switched The ignition wire can be connected to either the vehicle ignition or constant wires.
Black	Constant	DC 7 to 28 V The Gen II Receiver Unit has an internal battery for memory backup and, therefore, does not require continuous power to the black wire. In the absence of direct power to the black wire, the internal battery retains all data and settings.

Table 5-1 – Power cable wires (continued)

Color	Signal	Description
Red	Relay	N/O 10 A relay contact This wire is an optional connection.
White	Relay	N/O 10 A relay contact This wire is an optional connection.

5.1 Power cable installation

The power cable is connected to the electrical panel in the vehicle and provides power to the Gen II Receiver Unit. These procedures describe how to connect the exposed wires of the power cable to the electrical panel in the vehicle and how to connect the power cable to the Gen II Receiver Unit.

5.1.1 Hardware

You need the following hardware:

- Gen II Receiver Unit (one of):
  Standard: TRS-GEN2-BB-BT
  Ethernet: TRS-GEN2-BB-BT-ETH
  GPRS: TRS-GEN2-BB-BT-CELL
- Power cable:
  Part number: TRS-POWERCORD

5.1.2 Tools

You need the following tools:

- Wire cutters
- Electrical tape
- Heat shrink tubing

Procedure — Connect the power cable to the vehicle

Use this procedure to connect the wires in the power cable directly to the electrical panel in the vehicle.

Danger — Ensure that this procedure is performed by qualified personnel otherwise personal injury or damage to the truck and or TyreSense equipment may occur.

1. Determine the length of cable required to reach from the mounting location of the Gen II Receiver Unit to the electrical panel.
2. Shorten the cable to the required length:
   a. Bundle and wrap the excess cable.
   b. Cut off the excess cable.
3. Connect the wires from the exposed end of the power cable to the electrical panel in the vehicle.

i. Connect the green ground wire from the power cable to a ground wire in the vehicle's electrical panel or chassis or other grounded surface.

ii. Connect the brown wire from the power cable to the ignition wire in the vehicle's electrical panel.

The ignition wire from the power cable does not need to be directly connected to the ignition wire in the vehicle; it can, alternatively, be connected to the constant wire in the vehicle.

	Note — If the ignition wire is connected to the constant wire, the Gen II Display Unit will always be on, that is, it will not enter standby mode. As well, the user will not be able to identify vehicle ignition cycles from the data log.

iii. Connect the black wire from the power cable to the constant wire in the vehicle's electrical panel.

	Note — The Gen II Receiver Unit has an internal battery for memory backup and, therefore, does not require continuous power to the black wire. In the absence of direct power to the black wire, the internal battery retains all data and settings.

	Caution — Do not connect the black wire (constant) to the fire suppression system or any other safety system.

iv. *Optional*. Connect the red relay contact (N/O) wire to an external device.

v. *Optional*. Connect the white relay contact (N/O) wire to an external device.

4. If the red and white wires are unconnected, ensure that the exposed wires are clipped back to the insulation and covered:

   a. Cover the unconnected wires with electrical tape.

   b. Cover the unconnected wires with heat shrink tubing.

Procedure — Connect the power cable to the Gen II Receiver Unit

1. Ensure that the exposed wires of the power cable are connected to the electrical panel in the vehicle; see Procedure — Connect the power cable to the vehicle.
2. Align the yellow overmolded plug of the power cable with the yellow power socket on the power endplate of the Gen II Receiver Unit.
3. Push the plug into the socket.
4. Slide the locknut forward along the lock groove until it is tight against the Gen II Receiver Unit.
5. Twist the locknut to the right until it locks into place.

	Caution — To prevent damage to the plug and connector do not over-torque the connector.

Figure 5-2 shows the installed power cable.

Figure 5-2 – Installed power cable

6 Display patch cable

The display patch cable allows the user to connect the Gen II Receiver Unit to the Gen II Display Unit. The Gen II Display Unit is powered through the display patch cable. Table 6-1 lists the display patch cable specifications.

Table 6-1 – Display patch specifications

Specification	Description
Connector	Two 6-pin connectors
Length	3.7 m (12 ft)

Figure 6-1 shows the connectors on the display patch cable.

Figure 6-1 – Display patch cable connectors

6.1 Display patch cable installation

The display patch cable is required only if the user is connecting a Gen II Display Unit to the Gen II Receiver Unit.

6.1.1 Hardware

You need the following hardware:

- Gen II Receiver Unit (one of):
  Standard: TRS-GEN2-BB-BT
  Ethernet: TRS-GEN2-BB-BT-ETH
  GPRS: TRS-GEN2-BB-BT-CELL
- Gen II Display Unit:
  Part number: TRS-DISPLAY
- Display patch cable
  Part number: TRS-CABLE-DIS

Procedure — Connect the display patch cable to the Gen II Receiver Unit

1. Align one of the black overmolded plugs on the display patch cable to the black display socket on the Gen II Receiver Unit.
2. Push the plug into the socket.

3. Slide the locknut forward along the lock groove until it is tight against the Gen II Receiver Unit.
4. Twist the locknut to the right until it locks into place.

	Caution — To prevent damage to the plug and connector do not over-torque the locknut.

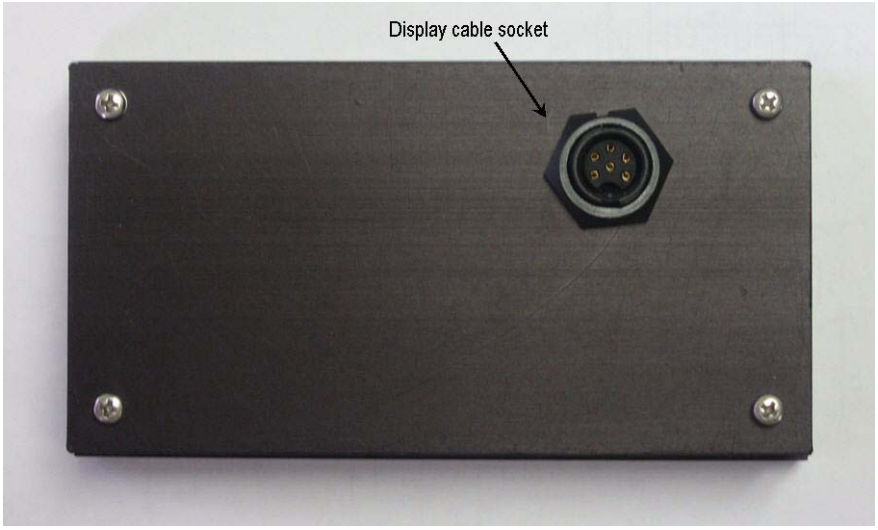
Figure 6-2 shows the display patch cable connected to the Gen II Receiver Unit.

Figure 6-2 – Installed display patch cable

Procedure — Connect the display patch cable to the Gen II Display Unit

1. Align the second black overmolded plug on the display patch cable to the display cable socket on the back of the Gen II Display Unit; see Figure 6-3.

Figure 6-3 – Socket for display cable plug



2. Push the plug into the socket.
3. Slide the locknut forward along the lock groove until it is tight against the Gen II Display Unit.
4. Twist the locknut to the right until it locks into place.

	Caution — To prevent damage to the plug and connector do not over-torque the locknut.

7 Ethernet cable

The Ethernet cable allows the user to connect to the Gen II Receiver Unit through an existing LAN using a network device, such as, a wireless access point or HUB located on the vehicle. Table 7-1 lists the Ethernet cable specifications.

Table 7-1 – Ethernet cable specifications

Specification	Description
Connector	Two RJ45 connectors
Length	Various. The length of the cable depends on the distance between the Gen II Receiver Unit and the network device

7.1 Ethernet cable installation

The Ethernet cable allows the user to connect to the Gen II Receiver Unit through an existing LAN.

7.1.1 Hardware

You need the following hardware:

- Gen II Receiver Unit:
  Ethernet: TRS-GEN2-BB-BT-ETH
- Ethernet cable

Procedure — Connect an Ethernet cable to a Gen II Receiver Unit

1. Ensure that one end of the Ethernet cable is connected to the appropriate network device.
2. Align the second RJ45 connector on the Ethernet cable with the Ethernet socket on the Gen II Receiver Unit.
3. Push the RJ45 connector into the Ethernet socket on the Gen II Receiver Unit.
4. Ensure that the connector fits snugly.

8 USB cable

The USB cable provides minimal power to the Gen II Receiver Unit. The power provided by the USB cable allows a user to configure the system and download data logs. The Gen II Display Unit, RFDATA, Bluetooth, and auxiliary modules are non-functional with only USB power. Table 8-1 lists the USB cable specifications.

Table 8-1 – USB cable specifications

Specification	Description
Connector	One USB type AM connector One USB type BM connector
Length	Various. The length of the cable depends on the distance between the Gen II Receiver Unit and the network device.

The TyreSense system uses a USB cable with AM and BM connectors; see Figure 8-1. The USB cable length can vary depending on the distance between the Gen II Receiver Unit and the desktop or laptop computer.

Figure 8-1 – USB cable connectors

AM connector HG0047 BM connector HG0048

8.1 USB cable installation

The USB cable facilitates data transmission between the Gen II Receiver Unit and any desktop or laptop computer.

8.1.1 Hardware

You need the following hardware:

- Gen II Receiver Unit (one of):
  Standard: TRS-GEN2-BB-BT
  Ethernet: TRS-GEN2-BB-BT-ETH
  GPRS: TRS-GEN2-BB-BT-CELL
- USB cable
  Part number: TRS-USB

Procedure — Connect a USB cable to a Gen II Receiver Unit

1. Ensure that the AM connector on the USB cable is plugged into the desktop or laptop.
2. Align the BM connector on the USB cable with the USB socket on the Gen II Receiver Unit.
3. Push the BM connector into the USB socket on the Gen II Receiver Unit.
4. Ensure that the connector fits snugly.

Antennas

9 Antenna overview

The Gen II Receiver Unit supports RFDATA, GSM/GPRS, and Bluetooth antennas. The type of antenna depends on user requirements. Table 9-1 lists the frequencies used by the TyreSense antennas.

Table 9-1 – Antenna frequencies

Antenna	Frequency
RFDATA	916 MHz
GSM/GPRS	GSM 850/1900 MHz EGSM 900/1800 MHz
Bluetooth	2.4 GHz

9.1 Antenna location

The Gen II Receiver Unit supports both direct connect and base mount antennas.

All antennas must be properly installed in an unobstructed location to accurately receive and transmit data. TyreSense supplies tuned direct connect antennas with each TyreSense system. If a base mount antenna is required, sufficient coaxial cable length is provided to allow the antenna to be placed in a number of different locations.

When choosing a location for any antenna:

- ensure that the whip of the antenna is not near a conductor, such as, metal
- place the antenna in a location where the potential for physical damage is minimized
- mount the antenna such that the possibility of radio transmissions being deflected away from it is reduced
- mount the antenna such that there is line of sight between the sensors and the antenna
- in order to reduce interference, ensure that the antenna is not placed too near any other required antennas on the vehicle

9.2 Antenna and transmission safety precautions

9.2.1 User operation

Do not operate your unit when a person is within 20 cm (8 in) of the antenna. A person or object within 20 cm (8 in) of the antenna could impair the call quality and may cause the unit to operate at a higher power level than necessary.

Note — The unit must be installed in a manner that provides a minimum separation distance of 20 cm (8 in) or more between the antenna and nearby persons.

Note — The unit must not be co-located or operate in conjunction with any other antenna or transmitter to satisfy FCC RF exposure requirements for mobile transmitting devices.

Note — To comply with the FCC RF exposure limits and satisfy the categorical exclusion requirements for mobile transmitters, the requirements described in section 9.2.2 — Antenna installation must be met.

9.2.2 Antenna installation

The antenna installation must provide a minimum separation distance of 20 cm (8 in) from all users and nearby persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

The combined cable loss and antenna gain must not exceed +7.5 dBi (850 band). The combined cable loss and antenna gain must not exceed +2.5 dBi and total system output must not exceed 2.0W EIRP in the PCS (1900) band in order to comply with the EIRP limit of 24.232 (b). OEM installers must be provided with antenna installation instruction and transmitter operating conditions for satisfying RF exposure compliance.

10 RFDATA antenna

The RFDATA antenna receives wireless pressure and temperature transmissions from the wheel sensors installed in the vehicle wheels. The RFDATA antenna does not transmit data.

Table 10-1 lists the specifications for the RFDATA antenna.

Table 10-1 – RFDATA antenna specifications

RFDATA antenna	Specification
Frequency (Fc)	916 MHz
Impedance	50 Ω
Connector	RP-SMA

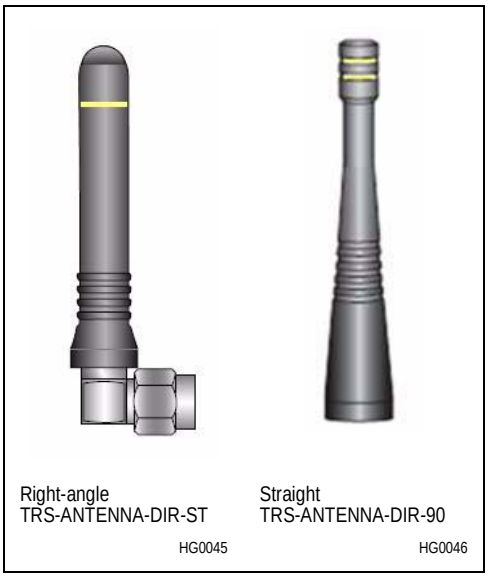
10.1 Direct connect RFDATA antenna

Installing direct connect RFDATA antennas onto the Gen II Receiver Unit reduces antenna installation time and eliminates the need to route antenna cables. Direct connect RFDATA antennas also have the added benefit of eliminating potential damage to both the cable and antenna on a base mount antenna style installed outside the vehicle cabin.

The user can install direct connect RFDATA antennas if the Gen II Receiver Unit is mounted immediately above or below a window in the inside of the vehicle cabin. TyreSense recommends that a direct connect RFDATA antenna be used only with sensors that have an external whip antenna, such as, the TyreSense patch mount and flush mount sensors.

Figure 10-1 shows the two styles of direct connect RFDATA antennas: right-angle and straight.

Figure 10-1 – RFDATA direct connect antennas



10.2 Base mount RFDATA antenna

The base mount RFDATA antenna has magnetic base for attaching directly to a metallic surface. The base mount antenna includes a 4 m (13.1 ft) RG-174 cable. Figure 10-2 shows an example of dual RFDATA base mount antennas.

Figure 10-2 – Dual RFDATA base mount antennas

Note — The dual RFDATA base mount antennas are optional. Any requirement for dual RFDATA base mount antennas would depend on the site where the antennas are being installed.

10.3 RFDATA antenna location

The RFDATA receiving antenna works best if it is in the line of sight of the sensors from which it is receiving data. The location of the antenna is vehicle dependent, in that the wheel base of the vehicle will influence placement of the antenna. For example, on a coal hauler or wheel loader, the best antenna location is on the roof of the cabin, but on a six-wheel haul truck the best antenna locations are the underside of the cabin, the top of the engine compartment, or the rear window.

10.4 RFDATA antenna installation

You can install either a direct connect or magnetic base mount antenna for RF functionality on the Gen II Receiver Unit. Refer to 9.2 — Antenna and transmission safety precautions before installing the RFDATA antenna.

10.4.1 Hardware

You need the following hardware:

- Gen II Receiver Unit (one of):
  Standard: TRS-GEN2-BB-BT
  Ethernet: TRS-GEN2-BB-BT-ETH
  GPRS: TRS-GEN2-BB-BT-CELL

- RFDATA antenna (one of):
  Direct mount (straight): TRS-ANTENNA-DIR-ST
  Direct mount (right-angle): TRS-ANTENNA-DIR-90
  Magnetic base mount: TRS-ANTENNA

Procedure — Install an RFDATA direct connect antenna

1. Locate the RFDATA antenna socket on the Gen II Receiver Unit.
2. Align the antenna connector with the socket on the Gen II Receiver Unit.
3. Screw the nut on the antenna onto the socket on the Gen II Receiver Unit.
4. Adjust the angel of the antenna and tighten the nut so that the antenna does not move.

	Caution — The antenna may not function correctly if the nut is over-tightened.

5. Test the reception of the antenna:
   a. If you have good reception, go to step b.
   b. If you have bad reception, re-adjust the angel of the antenna until you get good reception, then go to step b.

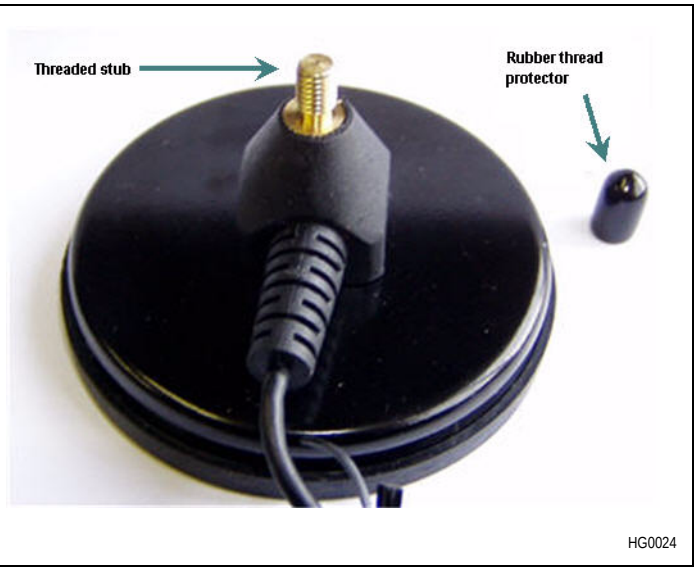
Procedure — Install an RFDATA base mount antenna

1. If present, remove the rubber thread protector from the thread on the antenna base mount unit.
   Figure 10-3 shows the rubber thread protector attached to the antenna base mount.

Figure 10-3 – Rubber thread protector

Figure 10-4 shows the antenna base mount with the rubber thread protector removed.

Figure 10-4 – Base mount with protector removed



2. Inspect the threads to ensure that they are clean and undamaged. If there is any dirt on the thread it will prevent a good connection that could degrade reception.
3. Screw the antenna element onto the threaded stub of the base mount unit; see Figure 10-5.

Figure 10-5 – Assembled base mount antenna

	Note — The reception on the Gen II Receiver Unit can be extremely poor if the correct antenna element is not attached to the base mount unit.

4. Attach the magnetic base mount antenna unit onto any metal surface on the vehicle and in the line of sight of the wheel sensors.
5. Test the reception from the antenna.
   a. If you have good reception, go to step 6.
   b. If you have bad reception, re-adjust the location of the antenna until you get good reception, then go to step 6.
6. Route the coaxial cable for the base mount antenna to the Gen II Receiver Unit, ensuring that the cable does not interfere with the driver or any passengers in the vehicle.

	Caution — Crimping or sharply bending the antenna cable can result in poor reception and or damage to the cable. Loosely coil or use proper length cables instead of tightly bundling the excess cable.

7. Securely tie down the cable, as necessary, between the base mount unit and the Gen II Receiver Unit.
8. Securely attach the RP-SMA connector on the coaxial cable in to the RFDATA antenna socket on the Gen II Receiver Unit.

11 GSM/GPRS antenna

GSM/GPRS antenna allows the Gen II Receiver Unit to wirelessly transmit data over a cellular network to a computer or local network.

11.1 Specifications

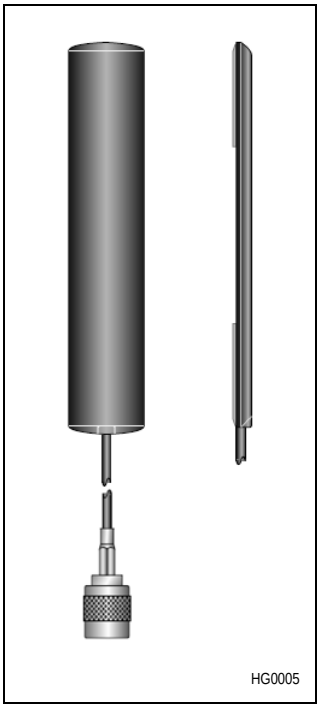
A glass mount GSM/GPRS antenna is available for installation with the TyreSense system. The antenna includes a 3 m (9.8 ft) RG-174 cable. Table 11-1 lists the GSM/GPRS antenna specifications.

Table 11-1 – GSM/GPRS antenna specifications

Antenna	Frequency
Frequency (Fc)	GSM: 850/1900 MHz EGSM: 900/1800 MHz
Impedance	50 Ω
Connector	TNC

Figure 11-1 shows an example of a GSM/GPRS antenna.

Figure 11-1 – GSM/GPRS antenna (TRS-ANTENNA-CELL)



11.2 Location

The GSM/GPRS antenna must be mounted flat on a glass surface. The GSM/GPRS antenna can be mounted on any of the vehicle windows. Line of sight between the antenna and transmitter or receiver is preferred. The antenna should not be mounted in an enclosed area.

11.3 GSM/GPRS antenna installation

The GSM/GPRS antenna facilitates GSM/GPRS functionality on the Gen II Receiver Unit. Refer to 9.2 — Antenna and transmission safety precautions before installing the GSM/GPRS antenna.

11.3.1 Hardware

You need the following hardware:

- Gen II Receiver Unit:
  Part number: TRS-GEN2-BB-BT-CELL
- GSM/GPRS glass mount antenna
  Part number: TRS-ANTENNA-CELL

11.3.2 Tools

You need the following tool:

- Alcohol wipes
- Removable tape

Procedure — Install the GSM/GPRS glass mount antenna

1. Determine an appropriate location for the antenna; preferably on either the driver-side or front window of the vehicle cabin.

   The antenna should be mounted away from other antennas or obstructions.
2. Clean the window of the vehicle with an alcohol wipe to remove any oil, grease, or debris.
3. Temporarily attach the antenna to the window using removable tape.
4. Test the reception from the antenna.
   a. If you have good reception, go to step 5.
   b. If you have bad reception, re-adjust the location of the antenna until you get good reception, then go to step 5.
5. Attach the antenna to the window using the supplied adhesive tape.
6. Route the coaxial cable for the antenna to the Gen II Receiver Unit, ensuring that the cable does not interfere with the driver or any passengers in the vehicle.

Caution — Crimping or sharply bending the antenna cable can result in poor reception and or damage to the cable. Loosely coil or use proper length cables instead of tightly bundling the excess cable.

7. Securely tie down the cable between the mounted antenna and the Gen II Receiver Unit with the supplied cable ties.
8. Securely attach the TNC connector on the coaxial cable to the connector on the Gen II Receiver Unit.

12 Bluetooth antenna

Bluetooth is a wireless short-range communications technology. You can attach either a Bluetooth direct connect or base mount antenna to the Gen II Receiver Unit. You can transmit or receive data to or from any Bluetooth enabled device such as a handheld PC, laptop computer, or mobile phone running Windows based software.

The TyreSense Client 1.0 application supports the following Bluetooth handheld platforms:

- MS Windows Mobile 2003 for Pocket PC
- MS Windows Mobile 5.0 for Pocket PC and Smartphone
- MS Windows 2000 or MS Windows XP or greater

12.1 Specifications

TyreSense provides direct connect antennas mounted on the Gen II Receiver Unit as the standard configuration for Bluetooth connections. The standard antenna is omnidirectional up to a distance of 100 m (328 ft).

Alternate antenna configurations include Bluetooth directional and base mount antennas.

Directional Bluetooth antennas can extend the receiving and transmitting range of a Bluetooth device. Table 12-1 describes the available directional Bluetooth antenna configurations.

Table 12-1 – Bluetooth extended range

Configuration	Range
TyreSense to a handheld device with an optional class 1 Bluetooth.	800 m (0.5 mile)
TyreSense to a handheld device with a standard class 3 Bluetooth.	200 m (0.12 mile)
TyreSense to a computer with a class 1 USB Bluetooth dongle and a remote directional antenna.	1.2 km (0.75 miles)

The base mount antenna includes a RG-174 cable.

If an alternate Bluetooth antenna configuration is required, contact your TyreSense representative.

TyreSense provides two different sizes of standard antenna. The specifications for both antennas are the same and both have a joint which allows them to be mounted at a 90° angle. Table 12-2 lists the specifications for the Bluetooth antennas.

Table 12-2 – Bluetooth antenna specifications

Antenna	Specification
Frequency (Fc)	2.45 GHz
Impedance	50 Ω
Connector	SMA

12.2 Location

The Bluetooth antenna must be located in line of sight of the Bluetooth receiving or transmitting device. It can be mounted either near a window or on the roof of the cabin of any vehicle.

The Bluetooth base mount antenna is only necessary if the Gen II Receiver Unit is located in a position where radio communication is poor when the antenna is directly connected to the Gen II Receiver Unit.

12.3 Bluetooth antenna installation

You can install either a direct connect antenna or base mount antenna for Bluetooth functionality on the Gen II Receiver Unit. Refer to section 9.2 — Antenna and transmission safety precautions before installing the Bluetooth antenna.

12.3.1 Hardware

You need the following hardware:

- Gen II Receiver Unit
  Part number: TRS-GEN2-BB-BT
- Bluetooth antenna (one of):
  Direct connect: TRS-ANTENNA-BT
  Base mount: TRS-ANTENNA-BT-HG

Procedure — Install the Bluetooth direct connect antenna

1. Locate the Bluetooth antenna socket on the antenna endplate of the Gen II Receiver Unit.
2. Align the SMA connector on the direct connect antenna with the Bluetooth socket on the Gen II Receiver Unit.
3. Screw the nut on the antenna onto the socket on the Gen II Receiver Unit.
4. Adjust the angle of the antenna and tighten the nut so that the antenna does not move.

	Caution — The antenna may not function correctly if the nut is over-tightened.

5. Test the reception of the antenna:

   If you have bad reception, re-adjust the angle or position of the antenna until you get good reception.

Procedure — Install the Bluetooth base mount antenna

1. If present, remove the rubber thread protector from the thread on the antenna base mount unit.
2. Inspect the thread to ensure that it is clean and undamaged. If there is any dirt on the thread it will prevent a good connection that could degrade transmission and reception.
3. Screw the antenna element onto the threaded stub on the base mount unit.

	Note — The reception on the Gen II Receiver Units can be extremely poor if the correct antenna element is not attached to the base mount unit.

4. Mount the base mount antenna in a position that will provide line of sight connection to a Bluetooth enabled device.

5. Test the reception from the base mount antenna.
   a. If you have good reception, go to step 6.
   b. If you have bad reception, re-adjust the location of the base mount antenna until you get good reception, then go to step 6.
6. Route the coaxial cable for the base mount antenna to the Gen II Receiver Unit, ensuring that the cable does not interfere with the driver or any passengers in the vehicle.

	Caution — Crimping or sharply bending the antenna cable can result in poor reception and or damage to the cable. Loosely coil or use proper length cables instead of tightly bundling the excess cable.

7. Securely tie down the cable, as necessary, between the base mount unit and the Gen II Receiver Unit.
8. Securely attach the SMA connector on the coaxial cable to the socket on the Gen II Receiver Unit.

	Caution — The antenna may not function correctly if the locknut is over-tightened.

Wheel Sensors

13 Wheel sensors

TyreSense provides a variety of wheel sensor types to accommodate different tyre monitoring requirements. The wheel sensors monitor real-time tyre pressure and temperature for the wheel in which they are installed. The wheel sensors wirelessly transmit the pressure and temperature data to the onboard Gen II Receiver Unit. Once the wheel sensors are installed the tyre must be inflated to more than 55 PSI (379 kPa), in order for the sensor to be activated and enter into the normal state of operation. See section 13.3 — Operational states for detailed information about the operational states of the wheel sensors.

TyreSense has four types of wheel sensors available for installation in the tyres of a vehicle.

Table 13-1 – TyreSense wheel sensor types

Typical	Description	Chapter
Flush mount sensor	The flush mount sensor installs in a threaded hole drilled through the wheel of the vehicle. The flush mount sensor protrudes a minimum distance into the tyre cavity making it ideally suited for vertical tyre changeovers as it does not need to be removed from the wheel.	14
Probe sensor	The probe sensor installs in a threaded hole drilled through the wheel of the vehicle. Either a DE-FUZER valve and DE-FUZER wheel adapter assembly or wheel adapter must be attached to the threaded end of the probe sensor. Either the DE-FUZER valve or wheel adapter screw into the wheel and is required to attach the probe sensor to the wheel.	15
Patch mount sensor	The patch mount sensor is a two-piece design which allows the wheel sensor to be removed from the patch mount of a discarded tyre and reinstalled in a replacement tyre. The patch mount can be easily installed in any tubeless OTR tyre, regardless of size or make. The patch mount wheel sensor is a robust design which resists liquid additives, tyre wall flex, and extreme temperatures.	16
Valve mount sensor	The valve mount sensor installs on the outside of a wheel in a threaded hole drilled through the wheel of the vehicle. The valve sensor installs easily onto the patented PT valve system. You can use the valve mount sensor as either the backup to an internally mounted sensor or as the primary sensor for monitoring tyre pressure. Using the valve mount sensor as a backup to the internally installed sensor enables you to defer installation or replacement of an internal tyre sensor until the next tyre changeover.	17

13.1 Technical specifications

The TyreSense wheel sensors measure tyre pressure and temperature changes in the following ranges:

- Pressure: 15 to 189 PSI (100 to 1300 kPa)
- Temperature: –20 to 107 °C (–4 to 225 °F)

Note — Unless otherwise noted all pressure values are gauge values.

The sensors are designed for heavy vehicle TPMS applications. The specifications for the sensors include the following:

- recommended operating conditions
- maximum pressure and temperature ratings
- performance ratings
- battery
- radio frequency

Caution — Exposure to absolute maximum rating conditions for extended periods may affect the reliability of the sensors. The maximum ratings are absolute ratings; exceeding any of the maximum values can cause irreversible damage to the sensors.

Caution — Pressure washing equipment can put undue pressure on the sensor resulting in unreliable readings or permanently damaging the sensor.

13.1.1 Operating conditions

Table 13-2 – Recommended operating conditions

Parameter	Minimum	Maximum
Input pressure	15 PSI (100 kPa)	189 PSI (1300 kPa)
Temperature range, operational	–40 °C (–40 °F)	85 °C (185 °F)

13.1.2 Maximum ratings

Table 13-3 – Maximum ratings

Parameter	Minimum	Maximum
Input pressure		363 PSI (2500 kPa)
Operational temperature	–40 °C (–40 °F)	85 °C (185 °F)
Storage temperature (1)	–40 °C (–40 °F)	85 °C (185 °F)
Mechanical shock		TBD

Note:

(1) To avoid permanent damage the accumulated storage time of the sensor at 85 °C (185 °F) should not exceed 500 hours.

13.1.3 Performance ratings

The TyreSense sensors have both pressure and temperature measurement performance ratings.

Table 13-4 – Pressure measurement performance ratings

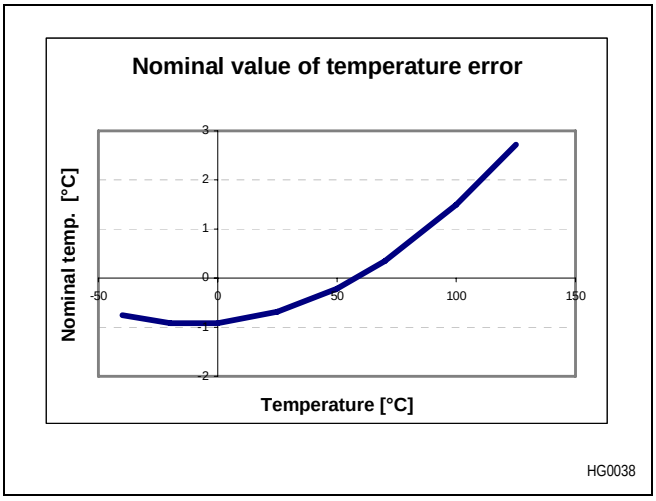
Parameter	Specification		Ambient conditions	
	Typical	Maximum	Temperature	Pressure
Input range		189 PSI (1300 kPa)	–40 to 85 °C (–40 to 185 °F)	15 to 189 PSI (100 to 1300 kPa)
Resolution	0.3 PSI (2 kPa)		–40 to 85 °C (–40 to 185 °F)	0 to 189 PSI (0 to 1300 kPa)

Table 13-5 – Temperature measurement performance ratings

Parameter	Specification			Ambient conditions
	Minimum	Typical	Maximum	Temperature
Input range	40 °C (104 °F)		125 °C (257 °F)	–40 to 125 °C (–40 to 257 °F)
Resolution		1 °C (34 °F)		–40 to 125 °C (–40 to 257 °F)

Figure 13-1 shows the deviation from the nominal value of temperature error.

Figure 13-1 – Deviation from nominal value of temperature error



13.1.4 Battery specifications

Each TyreSense sensor comes equipped with an internal lithium battery. Table 13-6 lists the specifications for the sensor batteries and Table 13-7 lists the battery voltage measurement performance ratings for the TyreSense sensors.

Table 13-6 – Battery technical specification

Parameter	Specification		
	Minimum	Average	Maximum
Nominal capacity @ 0.5 mA to 2 V		1.7 Ah	
Rated voltage		3.6 V	
Sensor nominal draw	0.6 µA	< 20 µA	8680 µA

Table 13-7 – Battery voltage measurement performance ratings

Parameter	Specification			Ambient conditions
	Minimum	Typical	Maximum	Temperature (°C)
Input range	1.8 V		3.6 V	–40 to 85 °C (–40 to 185 °F)
Resolution		0.0368 V		–40 to 85 °C (–40 to 185 °F)
Measurement error	–0.1 V		0.1 V	–40 to 85 °C (–40 to 185 °F)
Low battery flag		< 2.41 V		
Critical battery flag		< 2.28 V		

13.1.5 Radio frequency

Table 13-8 – Radio frequency specifications

Parameter	Specification		
	Minimum	Typical	Maximum
Centre frequency (Fc)		916 MHz	
Output power	–3 dBm		4 dBm

13.2 Sensor disposal

All TyreSense sensors contain a lithium battery. The user should either follow local regulations or guidelines for battery recycling and disposal or return the sensor to Rimex Supply Ltd. for disposal.

13.3 Operational states

The TyreSense wheel sensors have four operational states:

- storage
- initial
- normal
- burst

The wheel sensors check both pressure and temperature in the wheel in all operational states. The temperature is only checked with every second pressure reading. The pressure and temperature information is transmitted at the same time to the Gen II Receiver Unit.

Table 13-9 – Operational states

State	Description
Storage state	Wheel sensors are shipped and received by the user in storage state. The only activity in the wheel sensor in storage state is a check of the surrounding pressure every 240 seconds. If the surrounding pressure is less than or equal to 55 PSI (379 kPa), the wheel sensor remains in storage state. If the pressure is greater than 55 PSI (379 kPa) the wheel sensor enters initial state. The wheel sensor will only transmit information in storage state if it is induced. The user can induce the sensor by passing a magnet across the sensor to force a transmission.
Initial state	In initial state the wheel sensor checks the surrounding pressure every 1 second. If the surrounding pressure is less than or equal to 55 PSI (379 kPa) after 120 seconds, the wheel sensor reverts to storage state. If the surrounding pressure is greater than 55 PSI (379 kPa) for more than 120 seconds the sensor enters normal state.
Normal state	Once the wheel sensors have entered normal state they cannot revert back to either initial or storage state. In normal state the wheel sensors check the surrounding pressure every 3 seconds and the temperature every 6 seconds. The sensors transmit the data to the Gen II Receiver Unit every 4 minutes. If there is a pressure change of more than 1.5 PSI (10 kPa), the wheel sensors immediately transmit the change to the Gen II Receiver Unit. If the surrounding pressure changes by more than 8 PSI (55 kPa) in 4 minutes the wheel sensor enters burst state.
Burst state	In burst state the wheel sensor checks and transmits the surrounding pressure and temperature to the Gen II Receiver Unit every 1 second. The wheel sensors remain in burst state for 20 seconds and then re-enter normal state. If the large pressure changes in the tyre continue after the wheel sensor returns to normal state it re-enters burst state.

13.4 Thread-in sensors

This section describes the thread-in sensor types and installation locations.

13.4.1 Thread-in sensor types

The TyreSense thread-in sensors are the flush mount and probe sensors. See Table 13-1 for a description of the sensors.

13.4.2 Thread-in sensor locations

The thread-in sensors are installed in threaded holes drilled through the wheel of the vehicle. Many of the wheels supplied by Rimex Supply Ltd. are pre-drilled and threaded.

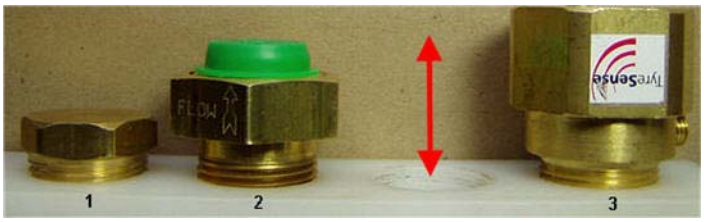
If the vehicle wheel has no pre-drilled holes, contact your TyreSense representative.

The installer must consider the required clearance for the sensor type being installed, before drilling and taping holes in the wheels.

Both thread-in sensor types must be located such that they are not underneath the bead seat band. Adequate clearance must also be considered on the inside of the wheel for braking and drive components.

Figure 13-2 shows an example of the installed wheel adapter, DE-FUZER valve, and flush mount sensor and lists the required installed height clearances on the inside of the wheel.

Figure 13-2 – Height clearances inside of the wheel



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1. Probe sensor installed on 2 cm (¾ in. NPT) wheel adapter requires 1.5 cm (0.6 in.) clearance.
2. Probe sensor installed with a DE-FUZER valve requires 3.2 cm (1.25 in.) clearance.
3. Flush sensor requires 3.8 cm (1.5 in.) clearance.

14 Flush mount sensor

The flush mount sensor protrudes a minimum distance into the tyre cavity and is ideally suited for vertical tyre changeovers as it does not need to be removed from the wheel once it is installed. The distance that the flush mount sensor protrudes into the tyre cavity is dependent on the thickness of the tyre. As well, there is minimum chance of damage to the sensor when the tyre is demounted from the wheel. Install the flush mount sensor in situations where there is low clearance between the wheel and the rim. The flush mount sensor installs in a threaded hole drilled in many of the wheels supplied by Rimex Supply Ltd. If the wheel has no pre-drilled holes, contact your TyreSense representative.

14.1 Flush mount sensor installation

When you install the flush mount sensor, TyreSense recommends using Teflon tape on the threads of the flush mount sensor. The Teflon tape provides a positive air seal for the sensor; whereas, paste or liquids do not provide the same positive air seal. When wrapping Teflon tape on the threads of the flush mount sensor ensure that you have a minimum of four wraps around the threads for a heavy Teflon tape and a minimum of six wraps for a light Teflon tape.

	Caution — If a leak is detected after the tyre is inflated, you must deflate the tyre, remove the sensor, remove the original Teflon tape, ensure the threads are clean, re-apply the Teflon tape, and re-install the sensor. Caution — Do not over-torque the flush mount sensor. If too much pressure is applied to the sensor, it could be damaged resulting in no or incorrect pressure and temperature data. The maximum torque for the flush mount sensor 101.7 N•m (75 lbf•ft).

14.1.1 Hardware

You need the following hardware:

- Flush mount sensor
  Part number: TRS-SENSOR3-4NPT
- Teflon tape:
  Part number: TRS-TEFLON-TP

14.1.2 Tools

You need the following tool:

- Torque wrench

Procedure — Install the flush mount sensor

1. Ensure that there is a pre-drilled hole in the wheel for installing the sensor.
2. Wrap Teflon tape onto the 2 cm (¾ in. NPT) threads of the flush mount sensor.
3. Screw the flush mount sensor into the hole in the wheel, ensuring that the end of the sensor with the ID is on the outside of the wheel and the antenna is on the inside of the wheel.
4. Torque the flush mount sensor to a maximum of 101.7 N•m (75 lbf•ft).

15 Probe sensor

The probe sensor is installed in a threaded hole drilled through the wheel of the vehicle and monitors tyre pressure and temperature for the wheel in which it is installed. The probe sensor installs in a threaded hole drilled in many of the wheels supplied by Rimex Supply Ltd. If the wheel has no pre-drilled holes, contact your TyreSense representative.

Figure 15-1 – Probe sensor (TRS-SENSOR-TH)

You must attach either a DE-FUZER valve and DE-FUZER wheel adapter assembly or wheel adapter to the threaded end of the probe sensor. One of either a DE-FUZER valve and DE-FUZER adapter collar assembly or a wheel adapter is required in order to attach the probe sensor to the wheel.

15.1 DE-FUZER valve

The DE-FUZER valve is a temperature, 392 °C (200 °F), sensitive pressure, 190 PSI (1310 kPa), relief valve designed to release potentially lethal air pressure build-up before catastrophic wheel failure can occur.

You can install the optional DE-FUZER valve in all off-highway tubeless OTR wheels with a 0.6 m (2 ft.) or greater diameter. The DE-FUZER valve is attached to a DE-FUZER adapter collar which is in turn connected to the probe sensor. Figure 15-2 shows the DE-FUZER valve.

Figure 15-2 – DE-FUZER valve (TRS-DE-FUZER-TH)

The DE-FUZER valve threads onto the DE-FUZER adapter collar. The outside threads of the DE-FUZER valve allow the assembled DE-FUZER valve and DE-FUZER adapter collar assembly to be screwed into the wheel of the vehicle.

15.2 DE-FUZER adapter collar

The DE-FUZER adapter collar enables maximum air flow out of the tyre through the DE-FUZER valve in the event of a pressure build up. Figure 15-3 shows the DE-FUZER adapter collar.

Figure 15-3 – DE-FUZER adapter collar (TRS-COLLAR-TH)

15.3 Wheel adapter

The wheel adapter is a cap that, when installed, closes off the open end of the probe sensor. The probe sensor threads into the wheel adapter. Figure 15-4 shows the wheel adapter.

Figure 15-4 – Wheel adapter (TRS-3-4-ADP)

The probe sensor threads through the 2 cm (¾ in. NPT) pre-drilled hole inside the wheel. The threads on the outside of the wheel adapter allow the assembled probe sensor and wheel adapter to be screwed into the wheel of the vehicle.

15.4 Installation

The probe sensor protrudes several inches into the tyre cavity; therefore, install the sensor only after the tyre has been mounted on the rim. As well, remove the sensor from the wheel before the tyre is demounted. You can install the probe sensor on any wheel with a minimum of 10 cm (4 in.) of clearance for inserting the probe sensor into the wheel.

15.5 Clearance

Table 15-1 lists clearance requirements for installing the probe sensor.

Table 15-1 – Probe sensor clearance requirements

Clearance	Clearance around wheel	Installation
Sufficient	16.5 cm (6.5 in.) or greater	Install the probe sensor already attached to either the DE-FUZER valve and DE-FUZER adapter collar or wheel adapter into the hole in the wheel.
Insufficient	Between 10 cm (4 in.) and 16.5 cm (6.5 in.)	Insert the probe sensor into the hole in the wheel, hold it in place and then attach the DE-FUZER valve and DE-FUZER adapter collar or wheel adapter.

15.6 Probe sensor installation

This section provides the procedures for installing the probe sensor attached to either a DE-FUZER valve and DE-FUZER adaptor collar or wheel adapter in situations where there is both sufficient and insufficient clearance around the wheel.

15.6.1 Hardware

You need the following hardware:

- Probe sensor:
  Part number: TRS-SENSOR-TH
- DE-FUZER valve:
  Part number: TRS-DE-FUZER-TH
- DE-FUZER adapter collar:
  Part number: TRS-COLLAR-TH
- Wheel adapter:
  Part number: TRS-3-4-ADP

15.6.2 Tools

You need the following tools:

- Torque wrench
- Teflon tape
- Loctite Threadlocker Blue
  Part number: TRS-LOCTITE

Caution — Use only Loctite Threadlocker Blue. Any other colour of Threadlocker could cause damage to the sensor.

15.6.3 Probe sensor installation with sufficient clearance

The following procedures provide the steps for installing a probe sensor in a wheel area where there is sufficient clearance to install the probe sensor already attached to an assembled DE-FUZER valve and DE-FUZER adapter collar or wheel adapter.

Procedure — Install the probe sensor with DE-FUZER valve and DE-FUZER adapter collar (sufficient clearance)

Use this procedure to install the probe sensor with attached DE-FUZER valve and DE-FUZER adapter collar into a wheel with sufficient clearance around the wheel area.

1. Attach the DE-FUZER valve and DE-FUZER adapter collar:
   i. Apply Loctite Threadlocker Blue to the outside threads of the DE-FUZER adapter collar.
   ii. Thread the DE-FUZER adapter collar into the DE-FUZER valve.
   iii. Torque the DE-FUZER adaptor collar to a maximum of 6.8 N•m (5 lbf•ft).
2. Attach the DE-FUZER valve and DE-FUZER adapter collar assembly to the probe sensor:
   i. Apply Loctite Threadlocker Blue to the threads of the probe sensor.
   ii. Thread the probe sensor into the DE-FUZER adapter collar.
   iii. Torque the probe sensor to a maximum of 6.8 N•m (5 lbf•ft).
3. Install the probe sensor into the wheel:
   i. Wrap Teflon tape onto the outside threads of the DE-FUZER valve.

   Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
   ii. Thread the probe sensor and attached DE-FUZER valve and DE-FUZER adapter collar assembly into the hole in the wheel.
   iii. Screw the DE-FUZER valve into the wheel.
   iv. Torque the DE-FUZER valve to a maximum of 101.7 N•m (75 lbf•ft).
4. After the tyre is fully inflated perform a soap test to ensure that there are no air leaks:

   If an air leak is detected, go to step 5.
5. *Optional*. If an air leak is detected:
   i. Deflate the tyre.
   ii. Loosen and remove the DE-FUZER valve from the wheel.
   iii. Remove the original Teflon tape and ensure that the threads of the DE-FUZER valve are clean.
   iv. Reapply the Teflon tape.

   Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
   v. Screw the DE-FUZER valve back into the wheel.
   vi. Torque the DE-FUZER valve to a maximum of 101.7 N•m (75 lbf•ft).
   vii. Perform the soap test again to check for air leaks.

Procedure — Install the probe sensor and wheel adapter (sufficient clearance)

Use this procedure to install the probe sensor with attached wheel adapter into a wheel with sufficient clearance around the wheel area.

1. Attach the wheel adapter to the probe sensor:
   i. Apply Loctite Threadlocker Blue to the threads of the probe sensor.
   ii. Thread the probe sensor into the wheel adapter.
   iii. Torque the wheel adapter on the probe sensor to a maximum of 6.8 N•m (5 lbf•ft).
2. Install the probe sensor into the wheel:
   i. Wrap Teflon tape onto the outside threads of the wheel adapter.

   Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
   ii. Thread the probe sensor and attached wheel adapter into the hole in the wheel.
   iii. Screw the wheel adapter into the wheel.
   iv. Torque the wheel adapter to a maximum of 101.7 N•m (75 lbf•ft).
3. After the tyre is fully inflated perform a soap test to ensure that there are no air leaks:

   If an air leak is detected, go to step 4.
4. If an air leak is detected:
   i. Deflate the tyre.
   ii. Loosen and remove the wheel adapter from the wheel.
   iii. Remove the original Teflon tape and ensure that the threads of the wheel adapter are clean.
   iv. Reapply the Teflon tape.

   Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
   v. Screw the wheel adapter back into the wheel.
   vi. Torque the wheel adapter to a maximum of 101.7 N•m (75 lbf•ft).
   vii. Perform the soap test again to check for air leaks.

15.6.4 Probe sensor installation with insufficient clearance

Use the following procedures to install the probe sensor in a wheel that has insufficient clearance to install the probe sensor and already attached to DE-FUZER valve and DE-FUZER adapter collar assembly or the wheel adapter.

Procedure — Install the probe sensor with DE-FUZER valve and DE-FUZER adapter collar (insufficient clearance)

Use this procedure to install the probe sensor with DE-FUZER valve and DE-FUZER adapter collar assembly into a wheel with insufficient clearance around the wheel area.

1. Attach the DE-FUZER valve and DE-FUZER adapter collar:
   i. Apply Loctite Threadlocker Blue to the outside threads of the DE-FUZER adapter collar.
   ii. Thread the DE-FUZER adapter collar into the DE-FUZER valve.
   iii. Torque the DE-FUZER adaptor collar to a maximum of 6.8 N•m (5 lbf•ft).

2. Wrap Teflon tape onto the outside threads of the DE-FUZER valve.

   Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
3. Apply Loctite Threadlocker Blue to the threads of the probe sensor.
4. Partially insert the probe sensor into the hole in the wheel. Ensure that the threads of the probe sensor are protruding out of the wheel.
5. Securely hold the sensor in place and thread the DE-FUZER adapter collar onto the sensor. Ensure that the sensor is held in place, such that it does not fall into the tyre.
6. Tighten the DE-FUZER adapter collar onto the probe sensor.
7. Torque the DE-FUZER adapter collar to a maximum of 6.8 N•m (5 lbf•ft).
8. Screw the DE-FUZER valve into the wheel.
9. Torque the DE-FUZER valve to a maximum of 101.7 N•m (75 lbf•ft).
10. After the tyre is fully inflated perform a soap test to ensure that there are no air leaks:

    If an air leak is detected, go to step 11.
11. If an air leak is detected:
    i. Deflate the tyre.
    ii. Loosen and remove the DE-FUZER valve from the wheel, ensuring that the probe sensor does not fall into the tyre.
    iii. Remove the original Teflon tape and ensure that the threads of the DE-FUZER valve are clean.
    iv. Reapply the Teflon tape.

    Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
    v. Re-insert the probe sensor into the wheel and reattach the DE-FUZER valve.
    vi. Screw the DE-FUZER valve into the wheel.
    vii. Torque the DE-FUZER valve to a maximum of 101.7 N•m (75 lbf•ft).
    viii. Perform the soap test again to check for air leaks.

Procedure — Install the probe sensor and wheel adapter (insufficient clearance)

Use this procedure to install the probe sensor and wheel adapter in a wheel with insufficient clearance.

1. Wrap Teflon tape onto the outside of the 2 cm (¾ in. NPT) threads of the wheel adapter.

   Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
2. Apply Loctite Threadlocker Blue to the threads of the probe sensor.
3. Partially insert the probe sensor into the hole in the wheel. Ensure that the threads of the probe sensor are protruding out of the wheel.
4. Securely hold the sensor in place and thread the wheel adapter onto the sensor. Ensure that the sensor is held in place, such that it does not fall into the tyre.
5. Tighten the probe sensor into the wheel adapter.
6. Torque the wheel adapter on the probe sensor to a maximum of 6.8 N•m (5 lbf•ft).

7. Screw the wheel adapter into the wheel.
8. Torque the wheel adapter to the wheel to a maximum of 101.7 N•m (75 lbf•ft).
9. After the tyre is fully inflated perform a soap test to ensure that there are no air leaks:

   If an air leak is detected, go to step 10.
10. If an air leak is detected:
    i. Deflate the tyre.
    ii. Loosen and remove the DE-FUZER valve from the wheel, ensuring that the probe sensor does not fall into the tyre.
    iii. Remove the original Teflon tape and ensure that the threads of the wheel adapter are clean.
    iv. Reapply the Teflon tape.

    Wrap a minimum of four wraps around the threads when using a heavy Teflon tape and a minimum of six wraps when using a light Teflon tape.
    v. Re-insert the probe sensor into the wheel and reattach the wheel adapter.
    vi. Screw the wheel adapter into the wheel.
    vii. Torque the wheel adapter to a maximum of 101.7 N•m (75 lbf•ft).
    viii. Perform the soap test again to check for air leaks.

16 Patch mount sensor

The TyreSense patch mount system is a two-piece design which allows the wheel sensor to be installed on a patch mount in any tubeless OTR tyre, regardless of size or make. The wheel sensor can also be removed from the patch mount of a discarded tyre and reinstalled in a replacement tyre. The patch mount wheel sensor is a robust design which resists liquid additives, tyre wall flex, and extreme temperatures.

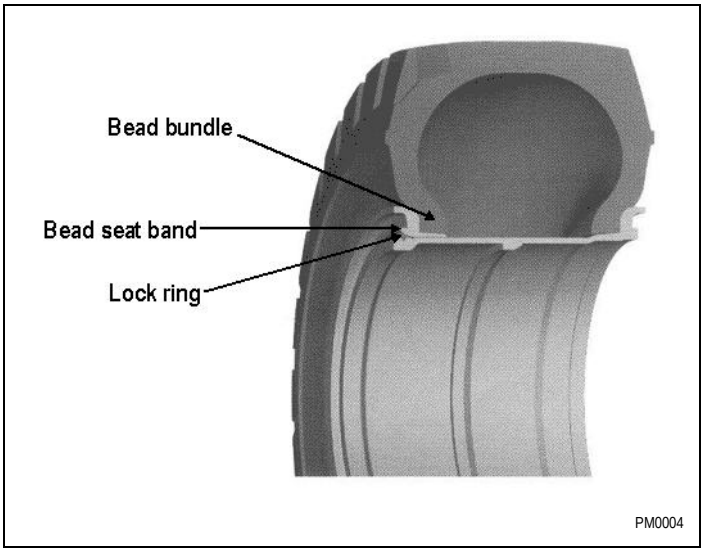
16.1 Patch sensor installation

The patch mount must be installed on the bead bundle of the tyre on the side of the wheel assembly with the lock ring; see Figure 16-1t

	Caution — If the patch mount is installed on the bead bundle on the side of the tyre opposite to the wheel assembly and lock ring damage may occur to the patch mount wheel sensor when the tyre is removed from the wheel assembly.

	Note — The bead bundle area of the tyre experiences the least amount of flex during operation. Installing the patch mount on any other area of the tyre could cause it to fatigue and possibly fail.

Figure 16-1 – Wheel assembly cutaway



	Note — A typical repair patch is rated for 5,000 hours use. This rating does not apply to the TyreSense patch mount as the patch mount is not for the purpose of repairing a damaged tyre.

16.1.1 Temperature

The recommended ambient and tyre temperature range for installing the TyreSense patch mount is between 10 ºC (50 ºF) (10ºC) to 30 ºC (86 ºF).

	Note — A tyre should be in the temperature range of 5 ºC (41 ºF) to 50 ºC (122 ºF) in order to properly vulcanize a patch to the tyre.

16.1.2 Wheel Sensor IDs

Each of the patch mount wheel sensors has a unique ID. Before the wheel sensors are installed in the tyres, the installer must record the four-digit wheel sensor ID and the tyre in which the wheel sensor is installed.

16.1.3 Hardware

You need the following hardware:

- TyreSense patch mount; see Figure 16-2
  Part number: TRS-PATCH
- TyreSense patch mount wheel sensor; see Figure 16-2
  Part number: TRS-SENSOR-PATCH

	Caution — Use only the patch mount supplied by TyreSense. TyreSense does not warranty any other patches. Caution — A substituted patch will result in failure of the patch mount wheel sensor.

Figure 16-2 – TyreSense patch mount and wheel sensors

16.1.4 Tools

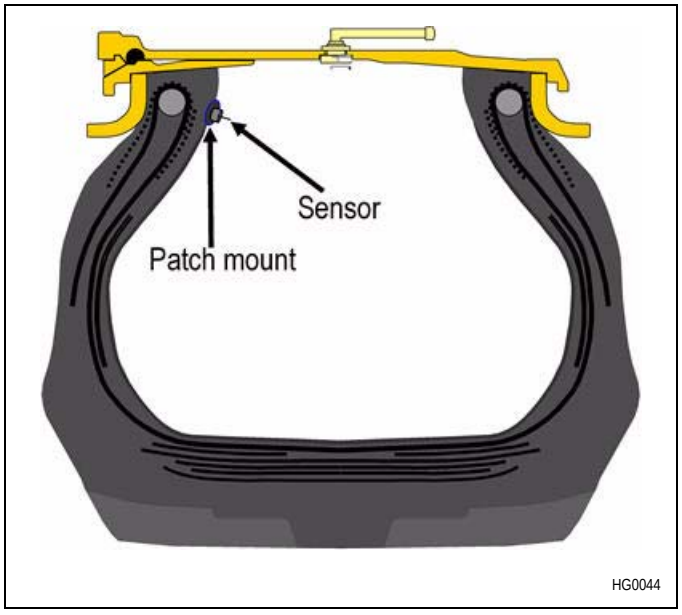
You need the following tools:

- High temperature RTV silicon
  Part number: TRS-SILICON
- Vulcanizing cement (one of):
  Quick dry: TRS-CEMENT-LT
  Heavy Duty: TRS-CEMENT-HD
- Acetone cleaner
- S4 scraper
- Clean cloth
- 5 cm (2 in.) dome grinding stone
  60 grit recommended
- Corrugated stitcher
  3.8 or 5 cm x 0.3 cm (1.5 or 2 in x 1/8 in.)

Procedure — Install the patch mount

1. Clean the area on the bead bundle where the patch mount is to be installed with an acetone solution to remove any mold residue left from the manufacturing process. Figure 16-3 shows the location of the patch on the tyre.

Figure 16-3 – Location of installed patch mount sensor



You can use either an S4 scraper or a clean cloth to clean the area; an S4 liner scraper is recommended. The prepared surface must be clean and dry.

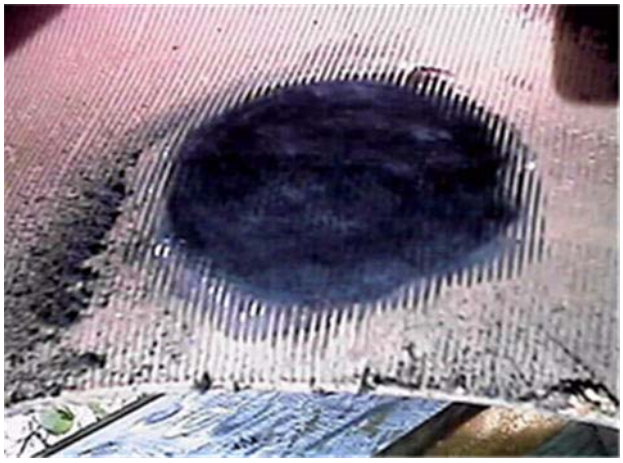
2. Using a grinding stone, roughen the surface of the tyre where the patch is being installed.

	Caution — The installer must ensure that the tyre cords are not exposed while preparing the surface of the tyre. Roughen the surface only enough to remove any ridges or high spots.

	Note — The surface being prepared must remain dull without becoming gummy or shiny. The rubber shavings should come off dry. Note — The surface of the tyre will become gummy if there is excessive heat in the tyre or the speed of the grinding stone is set too high. If the prepared surface becomes gummy allow the tyre to cool and reduce the speed of the grinding stone.

Figure 16-4 shows an example of the roughened surface of a tyre.

Figure 16-4 – Prepared tyre surface



3. Verify that the prepared area is clear of all debris from the grinding. If necessary, clean the area again with the acetone solution.
4. Apply the vulcanizing cement to the tyre and allow it to dry as per the product directions.

	Note — Ensure that the vulcanizing cement is completely dry and not at all tacky to the touch before applying the patch mount.

5. Peel the backing off the patch mount.

	Caution — Do not touch the contact area of the patch mount. Also, ensure that the base of the patch mount does not become contaminated. If it does, it will not properly adhere to the tyre.

6. Center the patch mount over the prepared area and press it down firmly onto the tyre.
7. Stitch the patch mount in place with a corrugated hand stitcher to ensure that it is firmly attached to the cemented tyre. Figure 16-5 shows the patch mount being stitched to the tyre.

Figure 16-5 – Stitching the patch mount

8. Test the patch mount to ensure that it cannot be peeled off.

   If the patch mount easily lifts up, it must be removed and the procedure repeated; go to step 1.

Procedure — Install the patch mount wheel sensor

1. Ensure that the patch mount is already installed. See Procedure — Install the patch mount.
2. Record the four-digit wheel sensor ID number and the tyre in which the patch mount wheel sensor is installed.
3. Coat the threads of the patch mount with high temperature RTV silicon.
4. Screw the patch mount wheel sensor onto the patch mount.

When the patch mount wheel sensor meets the resistance of the raised ridge on the patch mount, turn the patch mount wheel sensor an additional three-quarters of a turn to ensure it fits tightly. Figure 16-6 shows the installed patch mount wheel sensor.

Figure 16-6 – Installed patch mount wheel sensor

17 Valve mount sensor

The external mount valve sensor monitors tyre pressure and temperature for the wheel on which it is installed. The valve mount sensor installs on a PT type valve on the exterior of all wheel types. You can use the valve mount sensor either as a backup for an internally installed sensor or leave it permanently in place as the primary sensor for monitoring tyre pressure and temperature. Using the TyreSense valve mount sensor as a backup to the internally installed sensor enables you to defer installation or replacement of an internal tyre sensor until the next tyre changeover.

	Note — The valve mount sensor does not accurately measure internal tyre air temperature. The temperature measured is the radiated temperature of the wheel.

Figure 17-1 shows the TyreSense valve mount sensor.

Figure 17-1 – Valve mount sensor (TRS-SENSOR-VLVE)

17.1 PT valve system

The patented PT valve system is a universal method of installing a variety of tyre monitoring devices. The PT valve system allows you to easily remove the PT valve block-off collar and install the TyreSense valve mount sensor. The valve mount sensor is interchangeable and compatible with all PT valve styles and installs on any large bore, super large bore, and Z-bore tyre valve. See Appendix B — Part numbers for information on ordering Haltec PT and non-PT valves.

	Note — TyreSense does not recommend installing a TyreSense valve mount sensor on a mega bore valve. TyreSense recommends switching the valve type to a Z-bore valve.

17.2 Valve mount sensor installation

TyreSense recommends installing the valve mount sensor directly onto a PT style valve. If necessary, you can replace the existing valve hardware on a tyre with PT style valves. On super large bore and Z-bore applications you can install

the PT style valve without deflating the tyre by using the TyreSense PT core tool; see Procedure — Remove and replace a core housing.

Once installed, you can rotate the valve mount sensor, as required, in a 360° circle around the stem of the valve. The easy adjustment of the valve mount sensor allows you to position it such that it cannot be damaged in the normal course of the functioning of the tyre. Also, if required, you can easily replace the valve mount sensor.

17.2.1 Hardware

You need the following hardware:

- Valve mount sensor:
  Part number: TRS-SENSOR-VLVE
- 1.6 cm (5/8 in.) retaining nut (brass)
- *Optional*. PT-EX adapter:
  Part number: PT-EX

17.2.2 Tools

You need the following tools:

- Teflon tape:
  Part number: TRS-TEFLON-TP
- Torque wrench
- PT core tool

Procedure — Install valve mount sensor on a PT valve

Use this procedure to install a valve mount sensor directly onto a PT valve.

1. If installed, remove the PTC block-off collar to expose the Urethane O-rings on the PT valve. Figure 17-2 shows a PT valve with a PTC block-off collar installed.

Figure 17-2 – PT valve with PTC block-off collar installed

Figure 17-3 shows the PT valve with the PTC block-off collar removed and the urethane O-rings exposed.

Figure 17-3 – O-rings on the PT valve

2. Slide the valve mount sensor down over the two O-rings on the PT valve; see Figure 17-4.

Figure 17-4 – Valve mount sensor positioned over the O-rings

3. Move the sensor back and forth slightly to center the O-rings.

4. Re-Install the brass 1.6 cm (5/8 in.) retaining nut and gently tighten; see Figure 17-5.

Figure 17-5 – Valve mount sensor and brass retaining nut

5. Perform a soap test to ensure that there are no air leaks.

	Note — Over-tightening the retaining nut will cause the valve mount sensor to be pushed off center on the O-rings resulting in an air leak. An air leak is remedied either by cleaning the O-rings or reducing the torque on the retaining nut.

   a. If an air leak is detected, go to step 6.
   b. If no air leak is detected the procedure is complete.

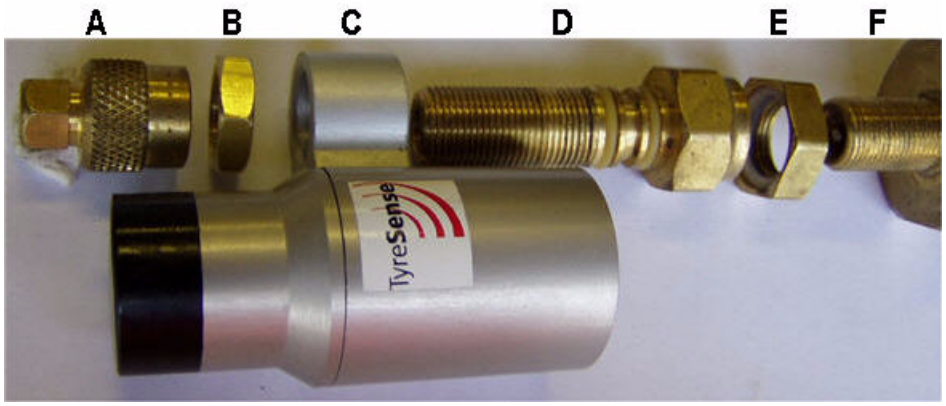
6. If an air leak is detected:
   i. Loosen the retaining nut.
   ii. Move the sensor back and forth to re-center the O-rings.
   iii. Retighten the retaining nut.
   iv. Perform the soap test again to check for air leaks.

Procedure — Install valve sensor on a PT-EX adapter

	Note — If necessary, you can install a valve mount sensor on an existing PT valve by installing a PT-EX adapter. TyreSense does not recommend this type of installation of the valve mount sensor because the adaptor adds a unnecessary connection point that may come loose over time and leak air. As well, it adds extra length to the valve which increases the likelihood of damage.

Figure 17-6 shows an unassembled valve mount sensor and PT-EX adapter hardware.

Figure 17-6 – Valve mount sensor and PT-EX adapter hardware



A: Valve cap
B: Brass retaining nut
C: Valve mount sensor
D: PT-EX adapter
E: Brass retaining nut
F: PT valve

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1. Thread a brass Teflon locking nut onto the existing valve. Ensure that the Teflon seal is facing out, away from the wheel.
2. Remove the valve core from the existing valve and install the PT-EX adapter.
3. Thread the PT-EX adapter onto the existing valve and tighten the adapter.

	Caution — Do not over-tighten the adapter. Over-tightening will cut the nylon washer on the inside of the PT-EX adapter.

4. Thread the Teflon locking nut up against the PT-EX adapter.
5. In order to lock the PT-EX securely onto the existing valve and provide an airtight seal, firmly tighten the Teflon locking nut and the PT-EX adapter using two wrenches.

6. Slip the valve mount sensor onto the PT-EX adapter and move the sensor back and forth slightly to center the O-ring seals.
7. Secure the valve mount sensor with the supplied 1.6 cm (5/8 in.) retaining nut. Figure 17-7 shows the assembled valve mount sensor and PT-EX adapter.

Figure 17-7 – Valve mount sensor installed on PT-EX adapter

8. Perform a soap test to ensure that there are no air leaks.
   a. If an air leak is detected, go to step 9.
   b. If no air leak is detected the procedure is complete.

	Note — Over-tightening the retaining nut will cause the valve mount sensor to be pushed off center on the O-rings resulting in an air leak. An air leak is remedied by reducing the torque on the retaining nut.

9. If an air leak is detected:
   i. Loosen the retaining nut.
   ii. Move the sensor back and forth to re-center the O-rings.
   iii. Retighten the retaining nut.
   iv. Perform the soap test again to check for air leaks.

Accessories

18 PT core tool

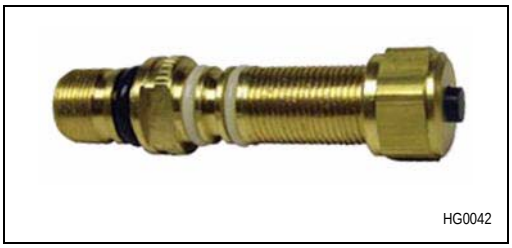
The PT core tool is an optional tool that allows an installer to remove an existing R-520 (TR-CH-8) core housing and replace it with a PT-R-520 core housing. The PT core tool eliminates the need to deflate a tyre assembly in order to update the standard valve hardware to PT type valve hardware.

Figure 18-1 shows the R-520 (TR-CH-8) core housing.

Figure 18-1 – R-520 (TR-CH-8) core housing

Figure 18-2 shows the PT-R-520 core housing.

Figure 18-2 – PT-R-520 core housing



18.1 Assembly

The PT core tool can be disassembled into three sections. The front section is a 1.3 cm (0.5 in.) pipe thread for attaching the PT core tool to an angle connector or valve extension on the vehicle wheel. The middle section is a 2.5 cm (1 in.) gate valve (solder type) with machined brass fittings. The back section is a tap with attached collet for removing and attaching core housings to the wheel.

Figure 18-3 shows the three sections of a disassembled PT core tool.

Figure 18-3 – Disassembled PT core tool

Figure 18-4 shows the assembled PT core tool.

Figure 18-4 – Assembled PT core tool

18.2 Operating the PT core tool

18.2.1 Hardware

You need the following hardware:

- PT-R-520 core housing

18.2.2 Tools

You need the following tool:

- PT core tool
  Part number: TRS-PT-TOOL

Procedure — Remove and replace a core housing

Use this procedure to remove a super large bore core housing from a wheel and replace it with a PT valve using the PT core tool.

	Note — Before using the PT core tool ensure that the collet has no sharp edges that would damage the o-rings on the outside of the PT valve. If the collet has any sharp edges, use a small die grinder to remove the sharp edge.

1. Ensure that the gate valve on the PT core tool is fully open.
2. Thread the PT core tool onto an angle connector or valve extension on the vehicle wheel.
3. Attach the collet to the core housing.
4. Unthread the existing R-520 (TR-CH-8) core housing from the wheel.
5. Retract the core housing into the PT core tool.
6. Close the gate valve.
7. Unthread the end cap from the PT core tool.
8. Remove the collet assembly, with the R-520 (TR-CH-8) core housing attached, from the PT core tool.
9. Remove the R-520 (TR-CH-8) core housing from the collet.
10. Insert the new PT-R-520 core housing into the collet.
11. Thread the collet back into the PT core tool.
12. Open the gate valve.
13. Thread the new PT-R-520 core housing onto the wheel.

	Danger — Ensure the new PT-R-520 core housing is properly threaded onto the wheel before removing the tool.

14. Unthread the PT core tool from the angle connector or valve extension on the vehicle wheel.

Appendixes

Appendix A — Installation Quick Reference

Hardware installation and connection

The following procedure provides quick reference for all of the tasks that the installer must perform in order to correctly install and connect the TyreSense system.

Procedure — Installing and connecting the TyreSense system

1. Mount the Gen II Receiver Unit in the vehicle; see Procedure — Mount the Gen II Receiver Unit.
2. *Optional*. Mount the Gen II Display Unit in the vehicle; see Procedure — Install the Gen II Display Unit.
3. Connect the power cable:
    i. Connect the power cable to the electrical panel in the vehicle; see Procedure — Connect the power cable to the vehicle.
    ii. Connect the power cable to the Gen II Receiver Unit; see Procedure — Connect the power cable to the Gen II Receiver Unit.
4. *Optional*. Install a Gen II Display Unit:
    i. Connect the display patch cable to the Gen II Receiver Unit; see Procedure — Connect the display patch cable to the Gen II Receiver Unit.
    ii. Connect the display patch cable to the Gen II Display Unit; see Procedure — Connect the display patch cable to the Gen II Display Unit.
5. If you are connecting to a network via Ethernet, connect the Ethernet cable to the Gen II Receiver Unit; see Procedure — Connect an Ethernet cable to a Gen II Receiver Unit.
6. If you are connecting from the Gen II Receiver Unit to a PC using the USB port, connect a USB cable; see Procedure — Connect a USB cable to a Gen II Receiver Unit.
7. If you are configuring the TyreSense system to use a wireless connection, install the required antenna.
    a. Install a RFDATA antenna, one of:
        - Connect a direct connect RFDATA antenna; see Procedure — Install an RFDATA direct connect antenna.
        - Connect a base mount RFDATA antenna; see Procedure — Install an RFDATA base mount antenna.
    b. Install a GSM/GPRS glass mount antenna; see Procedure — Install the GSM/GPRS glass mount antenna.
    c. Install a Bluetooth antenna, one of:
        - Connect a direct connect Bluetooth antenna; see Procedure — Install the Bluetooth direct connect antenna.
        - Connect a base mount Bluetooth antenna; see Procedure — Install the Bluetooth base mount antenna.
8. Install the wheel sensors. Four types of wheel sensors are available for installation depending on your requirements.
    a. Install a flush mount wheel sensor; see Procedure — Install the flush mount sensor.
    b. Install a probe wheel sensor:

        In an area with sufficient clearance.

- Install the probe sensor with a DE-FUZER valve and DE-FUZER adapter collar assembly; see Procedure — Install the probe sensor with DE-FUZER valve and DE-FUZER adapter collar (sufficient clearance).
- Install the probe sensor with a wheel adapter; see Procedure — Install the probe sensor and wheel adapter (sufficient clearance).

In an area with insufficient clearance.

- Install the probe sensor with a DE-FUZER valve and DE-FUZER adapter collar assembly; see Procedure — Install the probe sensor with DE-FUZER valve and DE-FUZER adapter collar (insufficient clearance).
- Install the probe sensor with a wheel adapter; see Procedure — Install the probe sensor and wheel adapter (insufficient clearance).

c. Install a patch mount wheel sensor:

- Install the patch mount; see Procedure — Install the patch mount.
- Install the patch mount wheel sensor; see Procedure — Install the patch mount wheel sensor.

d. Install a valve mount wheel sensor:

- Install the valve mount sensor on a PT valve; see Procedure — Install valve mount sensor on a PT valve.
- Install the valve mount sensor on a PT-EX adapter; see Procedure — Install valve sensor on a PT-EX adapter.

9. *Optional*. Install and configure the MotionTrac Module.

i. Mount the MotionTrac Module.

ii. Connect power to the MotionTrac Module.

iii. Program the MotionTrac Module ID.

iv. Set the sensitivity of the MotionTrac Module:

- Set the sensitivity using LEDs.
- Set the sensitivity using the Gen II Display Unit.

10. *Optional*. Remove and replace a core housing using the PT core tool; see Procedure — Remove and replace a core housing.

Appendix B — Part numbers

Table App 3 lists the hardware and software part numbers for the TyreSense system.

Table App 3 – Part numbers

Item	Description	Part number
Gen II Receiver Units		
Standard	Standard Gen II Receiver Unit with no auxiliary module installed.	TRS-GEN2-BB-BT
	Standard Gen II Receiver Unit with weather resistant housing.	TRS-GEN2-BB-BT-AW
Ethernet	Gen II Receiver Unit with pre-installed Ethernet Module.	TRS-GEN2-BB-BT-ETH
	Gen II Receiver Unit with pre-installed Ethernet Module and weather resistant housing.	TRS-GEN2-BB-BT-ETH-AW
GPRS	Gen II Receiver Unit with pre-installed GPRS Module.	TRS-GEN2-BB-BT-CELL
	Gen II Receiver Unit with pre-installed GPRS Module and weather resistant housing.	TRS-GEN2-BB-BT-CELL-AW
Weather resistant housing (upgrade)	Rugged plastic housing upgrade for any Gen II Receiver Unit.	TRS-GEN2-BB-BT-AW
Gen II Display Unit		
Gen II Display Unit	Onboard Gen II Display Unit.	TRS-DISPLAY
Mounting brackets	Gen II Display Unit mounting brackets including thumb screws.	TRS-BRACKET-HW
Cables		
Power cable	Power supply cable from the vehicle to the Gen II Receiver Unit.	TRS-POWERCORD
Display patch cable	12 ft (3.7 m) connection cable from the Gen II Receiver Unit to the Gen II Display Unit.	TRS-CABLE-DIS
Display extension cable	6 ft (1.8 m) extension cable for connecting the Gen II Receiver Unit to the Gen II Display Unit.	TRS-CABLE-DIS-EX6
USB cable	Interface cable from a desktop or laptop computer to the Gen II Receiver Unit.	TRS-USB

Table App 3 – Part numbers (continued)

Item	Description	Part number
RFDATA antennas		
Magnetic base mount antenna	RFDATA magnetic base mount including antenna element.	TRS-ANTENNA
Direct mount RF antenna (straight)	Straight RFDATA antenna which attaches directly to the Gen II Receiver Unit.	TRS-ANTENNA-DIR-ST
Direct mount RF antenna (right-angle)	Right-angle RFDATA antenna which attaches directly to the Gen II Receiver Unit.	TRS-ANTENNA-DIR-90
Dual antenna kit	The dual antenna kit includes: • two magnetic base mount antennas • splitter • extra coaxial cable	TRS-ANTENNA-DUAL
GSM/GPRS antenna		
Glass mount GSM/GPRS antenna	GSM/GPRS antenna which attaches to the vehicle window.	TRS-ANTENNA-CELL
Bluetooth antennas		
Direct connect Bluetooth antenna	Omni-directional antenna which installs directly on the Gen II Receiver Unit. The direct mount antenna provide wireless communication up to 100 m (328 ft) in all directions.	TRS-ANTENNA-BT
Base mount high-gain Bluetooth antenna	Directional antenna provides up to 1.2 km (0.75 mi) of wireless communication in one direction.	TRS-ANTENNA-BT-HG
Flush mount wheel sensor		
Flush mount wheel sensor	2 cm (¾ in. NPT) flush mount thread-in wheel sensor.	TRS-SENSOR3-4NPT
Patch mount wheel sensor		
Patch mount wheel sensor - external	Resin patch mount sensor with external antenna.	TRS-SENSOR-PATCH
Patch mount wheel sensor - internal	Resin patch mount sensor with internal antenna.	TRS-SENSOR-PATCH-IN
Patch mount wheel sensor - serviceable	Serviceable Delrin® patch mount sensor.	TRS-SENSOR-PATCH-DEL
Patch mount	Rubber sensor patch mount.	TRS-PATCH
Silicon	Silicon for applying to the brass threads on the patch mount.	TRS-SILICON

Table App 3 – Part numbers (continued)

Item	Description	Part number
Vulcanizing cement	Quick dry Truflex/Pang SuperSolution: Chemical Vulcanizing Fluid 21/22/23, Supersoln 604/608/610	TRS-CEMENT-LT
	Heavy duty Tech Tire Repair: Heavy Duty Blue Vulcanizing Fluid, No. 775	TRS-CEMENT-HD
Probe wheel sensor		
Probe wheel sensor	Long style probe sensor that installs in a threaded hole drilled through the wheel of the vehicle with either a DE-FUZER valve and DE-FUZER adapter collar assembly or wheel adapter.	TRS-SENSOR-TH
DE-FUZER valve	Threaded DE-FUZER pressure relief valve for the TyreSense probe sensor.	TRS-DE-FUZER-TH
DE-FUZER adapter collar	Adapts a probe wheel sensor to a DE-FUZER valve.	TRS-COLLAR-TH
Wheel adapter	Adapts the probe wheel sensor to a 2 cm (¾ in. NPT) wheel hole.	TRS-3-4-ADP
Valve wheel sensor		
Valve mount wheel sensor	Valve mount wheel sensor including 1.6 cm (5/8 in.) brass retaining nut.	TRS-SENSOR-VALVE
Super large bore PT valve	PT style super large bore core housing.	PT-R-520
Z-Bore PT valve	PT style Z-Bore core housing.	PT-Z-10
PT adapter	Valve extension that adapts any valve to a PT style valve.	PT-EX
Block off collar	Seals a PT valve if no sensor is installed.	PT-C
PT large bore	To order PT valves, add the prefix PT to the Haltec Corporation valve number. Contact your Haltec distributor for additional information and assistance in ordering PT valves.	Example: PT-H42
Accessories		
MotionTrac Module	Optional module that tracks the number of hours that a vehicle is in motion.	TRS-SENSOR-MOTION
PT valve tool	Optional tool that allows an installer to remove and replace core housings.	TRS-PT-TOOL

Table App 3 – Part numbers (continued)

Item	Description	Part number
Standard items		
Standard unit installation kit	Standard installation parts for the Gen II Receiver Unit and Gen II Display Unit. Kit includes: • mounting screws • 3M tape • nylon cable ties	TRS-CAB-HW
Loctite Threadlocker Blue	Loctite Threadlocker Blue for applying to the sensor threads.	TRS-LOCTITE
Teflon tape	Teflon tape for the 2 cm (¾ in. NPT) threads of all thread-in sensor components (flush and probe wheel sensors).	TRS-TEFLON-TP
Auxiliary modules		
Ethernet Module	The Ethernet Module upgrade kit includes: • Ethernet Module • endplate with cutout for the Ethernet Module	TRS-EHT-UG
GPRS Module	The GPRS Module upgrade kit includes: • GPRS Module • endplate with cutout for the GPRS antenna • GSM/GPRS antenna	TRS-CELL-UG
Software		
TyreSense Software 1.0	The software distributed with the Gen I system.	TRS-SW-1.0
TyreSense Software 2.0	The software distribution package for the Gen II system.	TRS-SW-2.0
TyreSense Server	TyreSense Server software for a local, on-site server.	TRS-SW-SER
Bluetooth		
Bluetooth - Field PC	Rugged handheld computer including a class 1 Bluetooth adapter.	TRS-RUGGED-HLD
Bluetooth - CF card	Class 1 Bluetooth compact flash card for a handheld computer. The CF card increases the range of the Bluetooth device.	TRS-CF-BT
Bluetooth - USB adapter	USB Bluetooth adapter for a PC, including a high-gain antenna with a range up to 1.2 km (0.75 mi).	TRS-USB-BT
Documentation		
Client Application User Guide	User guide for the TyreSense Client.	TRS-G-USER-2.0
Gen II Display Unit User Guide	User guide for the TyreSense Gen II Display Unit.	TRS-G-DISPLAY-2.0
Gen II Display Unit User Guide - Spanish	User guide for the TyreSense Gen II Display Unit with Spanish screen caps.	TRS-G-DISPLAY-2.0-SPA

Table App 3 – Part numbers (continued)

Item	Description	Part number
Hardware Installation User Guide	User guide for installing the TyreSense system hardware.	TRS-G-INSTALL-2
Mobile Application User Guide	User guide for the TyreSense Mobile software.	TRS-G-MOBILE-2.0
Server Installation and Setup	User guide for configuring the Gen II Receiver Unit auxiliary modules and installing the TyreSense Server Software.	TRS-G-SERVER
Troubleshooting Guide	The Troubleshooting Guide for the TyreSense system.	TRS-G-TS-1

Glossary

Term	Description
10/100 Base-T	10- to 100-Mb/s LAN An IEEE standard for 10/100 Mb/s twisted-pair Ethernet wiring.
APN	Access Point Name APN is the name of the access point for GPRS. When a GPRS mobile device initiates a call, the access point is selected and the APN is determined.
ASP	Active Server Pages A specification for dynamically created web pages with .ASP extensions that use ActiveX scripting. When a browser requests an ASP, the web server generates an HTML coded page and sends it to the browser.
cold inflation	Cold inflation is the pressure of a tyre at a contained air temperature of 20 °C (68 °F).
COM port	Serial Communication Port
dBm	Decibels below 1 milliwatt dBM is the unit of expression for the measurement of power loss in decibels using 1 milliwatt as the reference point. For example, a signal received at 1 milliwatt yields 0 dBm. A signal at 0.1 milliwatt is a loss of 10 dBm.
DC	Direct Current
DCE	Data Communications Equipment DCE refers to the interface on a data device, such as, a modem or transceiver that establishes and manages a data connection between computers. In a direct connection between interfaces, one port must be DCE and the other DTE.
DHCP	Dynamic Host Configuration Protocol DHCP is an Internet Protocol used to automatically assign dynamic IP addresses, deliver TCP/IP stack configuration parameters, such as, the subnet mask and default router, and provide other configuration information to devices attached to a network.

Term	Description
DNS	Domain Name Server The DNS translates alphanumeric domain names into IP addresses.
DTE	Data Terminal Equipment DCE refers to the interface on a data device, such as, a modem or transceiver that serves as a data source, destination, or both between computers. In a direct connection between interfaces, one port must be DTE and the other DCE.
firewall	A firewall is a system designed to prevent unauthorized access to or from a private network. Firewalls can be implemented in both hardware and software or a combination of both. All messages entering or leaving the private network pass through the firewall. The firewall examines each message and blocks those that do not meet the established security criteria.
GMT	Greenwich Mean Time
GPRS	General Packet Radio Service GPRS is a mobile data service used by GSM and IS-136 mobile device users. GPRS is a standard part of GSM Phase 2+ and is the first implementation of packet switching within GSM. The GPRS connectivity solution is based on Internet Protocols with throughput rates of up to 40 kb/s.
GSM	Global System for Mobile Communications GSM is a cellular network and a global standard for mobile phones. GSM is an open, digital cellular technology used for transmitting mobile voice and data services. GSM is a circuit switched system.
Hz	Hertz is a unit of frequency, equal to one cycle per second. Hertz can also be measured in multiples, including kilohertz (kHz), megahertz (MHz), or gigahertz (GHz).
ICMP	Internet Control Message Protocol ICMP is a protocol that sends and receives control, error, and information messages that manage behavior on the TCP/IP protocol stack. For example, the PING command uses ICMP to test an Internet connection.
IIS	Microsoft Internet Information Services IIS is a set of Internet-based services that provide a Web application infrastructure for servers using Microsoft Windows.
IMSI	International Mobile Subscriber Identity IMSI is a unique number allocated to each subscriber on a GSM network. The IMSI identifies the subscriber on the network. The IMSI is stored on the SIM card. Each SIM card has its own unique IMSI.
IP	Internet Protocol IP is a data-oriented protocol used for communicating data across interconnected packet-switched networks. IP transmits data from source to destination where the source and destination devices are hosts identified by fixed-length addresses.
kPa	Kilopascals The metric unit for measuring pressure.
L1	Level 1 TyreSense alert. The alert occurs when the actual tyre pressure or temperature reaches the configured L1 pressure and temperature limits set for the tyre.

Term	Description
L2	Level 2 TyreSense alert. The alert occurs when the actual tyre pressure or temperature reaches the configured L2 pressure and temperature limits set for the tyre.
LAN	Local Area Network A system linking together electronic equipment, for example, computers, word processors, servers, or printers, to form a network within an office or building.
LED	Light Emitting Diode
N/O	normally open
NAT	Network Address Translation NAT is an Internet standard that enables a LAN to use one group of IP addresses for internal traffic and a second group of addresses for external traffic. A NAT router makes all necessary IP address translations between the LAN and the Internet.
NPT	National Pipe Thread A standard for tapered threads used to join pipes or fittings.
OTR	off the road OTR tyres are 1400/24 or larger size tyres. The TyreSense system is currently intended for 1400/24 or larger size tyres only.
PDA	Personal Digital Assistant A PDA is a mobile handheld computing device.
PIN	Personal Identification Number The PIN code is a numeric value password used to lock a SIM card until you enter the correct code. The PIN code protects your account, even if the SIM card is inserted into another device. If the PIN code is incorrectly entered three times in a row, the SIM card is blocked and you must contact your service provided to unlock the SIM card.
PSI	pounds per square inch The imperial unit for measuring pressure.
PT	pressure tap A PT valve has a second tapped hole in the side of the valve to tap into the air pressure.
removable media	Removable memory, such as an SD card or CompactFlash card, on which data is stored.
RF	radio frequency
RJ45	The RJ45 is a modular connector with eight positions, each of which contains a conductor. Ethernet cables and other networking devices use the RJ45 connector.
router	A device used to forward data packets to a network. A router is always connected to at least two networks. Routers use packet header information and forwarding tables to determine the best path for forwarding the packets in to or out of a network. Routers use protocols, such as ICMP, to communicate with each other and configure the best route between any two hosts.

Term	Description
RP-SMA	Reverse Polarity - SubMiniature version A The RP-SMA connector is proprietary variation of the SMA connector. The RP-SMA connector is widely used by wireless device manufacturers.
RSSI	Received Signal Strength Indication RSSI is a measurement of the power present in a received signal. The higher the RSSI level the stronger the signal.
SIM	Subscriber Identity Module A SIM is a removable smart card that stores encrypted user preferences and information for identifying a mobile device service subscriber. SIM cards are mandatory in a GSM network.
SMA	SubMiniature version A An SMA connector is a coaxial RF connector with a threaded interface. It has a 50 Ω impedance and provides electrical performance from DC to 18 GHz.
TCP	Transmission Control Protocol TCP is one of the main protocols in TCP/IP networks. TCP enables two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and that the packets are delivered in the same order in which they were sent.
TPMS	Tyre Pressure Monitoring System
UDP	User Datagram Protocol UDP is a connectionless protocol that, like TCP, runs on IP networks. UDP is a means of directly sending and receiving datagrams over an IP network. UDP provides very few error recovery services. UDP is used primarily for broadcasting messages over a network.
USB	Universal Serial Bus A serial bus is a high-speed connectivity standard that allows easy connection of peripheral devices to a computer. USB supports plug-and-play installation and hot-plugging. The USB standards support data transfer rates of up to 12 Mb/s, multiple data streams, and up to 127 peripherals.
UTC	Coordinated Universal Time (universal time, coordinated) UTC is a high-precision atomic time standard.
VSWR	Voltage Standing Wave Ratio VSWR is the ratio of the maximum to minimum voltage in a standing pattern on a transmission line.

Index

TyreSense

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Draft 01
TRS-G-INSTALL-2