

# Hardware Installation Guide

Ranger 7-RNGR-04X

Ver 5.4

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	<p data-bbox="430 61 494 121"></p> <p data-bbox="563 77 773 121"><b>WARNING</b></p> <p data-bbox="430 159 957 293"><b>FAILURE TO INSTALL THE EQUIPMENT AS RECOMMENDED COULD CAUSE OR CONTRIBUTE TO AN ACCIDENT AND RESULT IN DAMAGE TO PROPERTY OR PERSONS.</b></p>
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## SAFETY & AFTER-MARKET EQUIPMENT

The use of after-market equipment in motor vehicles can compromise a vehicle's safety-related design characteristics, including but not limited to:

- Airbags, including but not limited to potential obstruction of air-bag deployment;
- Passenger compartment, including but not limited to potential for ergonomic problems, physical obstacles, etc.; and
- Trunk/gas tank protection, including but not limited to the potential for trunk-mounted equipment to exacerbate tank vulnerability in a rear collision.



## QUALIFIED INSTALLER

This product is to be installed by qualified installation personnel only. The installer must be trained in industry best practices for this type of installation. The training would include but not be limited to:

### 1. The appropriate methods for installing cables such that:

- The operation of the vehicle is not interfered with.
- The installation process does not damage or interfere with other vehicle components and/or systems.
- Wiring is kept clear of sharp objects, sources of heat and any other hazard that could damage the cable or wire.
- Wiring is secured such that it does not cause damage to other equipment, itself, or interfere with the operation of other systems and devices.
- Wiring through bulkheads is performed such that wiring does not chafe, and a seal is maintained between compartments.
- Appropriate and industry standard fasteners, splices, connectors and ties are used for the vehicle environment.
- Appropriate slack is in place to prevent straining of the wire, cable or connectors.
- Any other issue that could affect the integrity of the wiring or the safe operation of the vehicle is addressed appropriately.

# QUALIFIED INSTALLER

## **2. The appropriate methods for mounting equipment in vehicles such that:**

- The safe operation of the vehicle is not interfered with.
- The equipment is attached to the vehicle as securely as possible to minimize the risk of the equipment breaking free in an accident situation.
- The installed device does not interfere with the deployment of air bags.
- The installed device does not obscure displays or interfere with the ability of the driver to operate other vehicle systems and components.
- The installation process does not damage other vehicle systems or components.
- Compartments remain sealed against the elements.

## **3. The correct use and operation of the required tools.**

Further:

- The installer must have the ability to read, understand and follow the instructions in the installation manual.
- The installer must be equipped with the correct tools for performing each installation operation.

The Customer must ensure that the installation of all equipment provided for this project is safe, used for its intended purpose, and is in continual accordance with all applicable codes, rules, regulations and guidelines provided by motor vehicle and equipment manufacturers, as well as any state, local or jurisdictional bodies.

# INTRODUCTION

Mentor Ranger® v4.0 is a Windows CE fixed-mount computer for two-way wireless communication, electronic dispatching, in-vehicle navigation, and more.

This Ranger Installation guide includes directions for successfully installing and interfacing a Ranger into a vehicle. Specific wiring and installation procedures may change from customer to customer and should be discussed prior to installation. If any questions remain after reading this guide, please contact Mentor Engineering, (403) 777-3760 ext. 3, for more information.



MENTOR  
*Ranger*  
4.0



# BEFORE YOU BEGIN

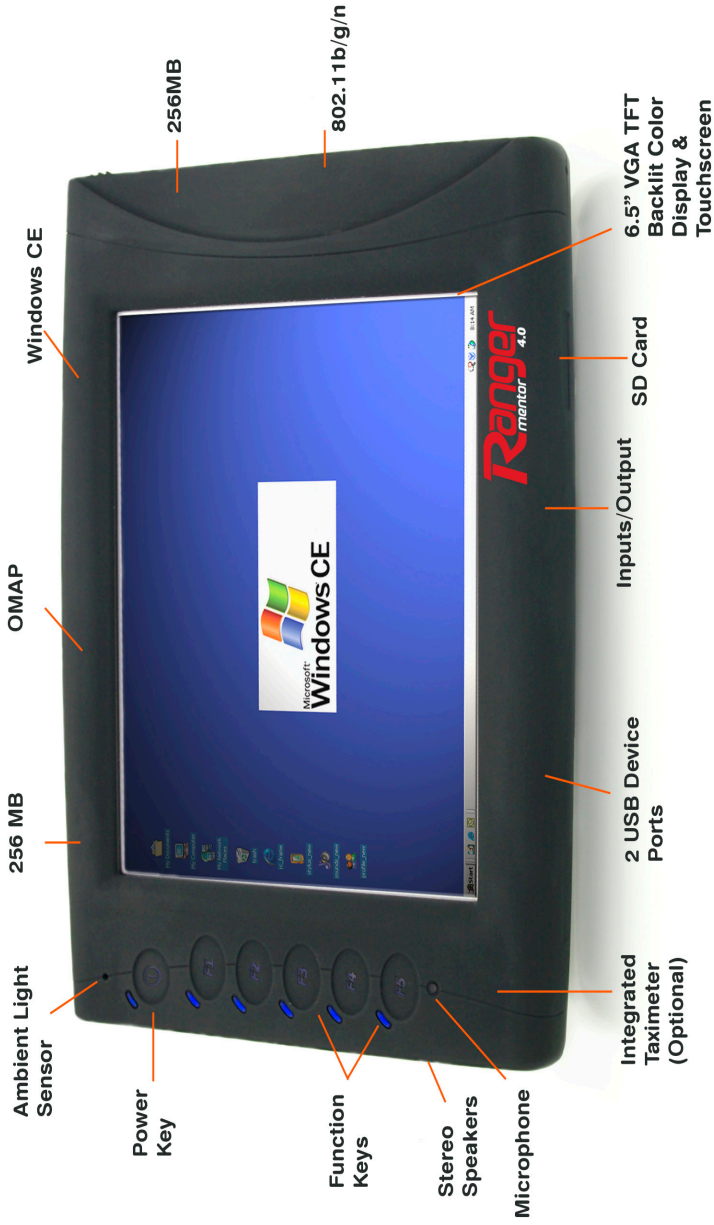
## CAUTIONS

- a) Carefully read the Installation Guide before installing this product. If anything is unclear please contact Mentor Engineering for support.
- b) Ensure that the **NEGATIVE** battery connection is disconnected before beginning work.  
**NOTE:** Some components may lose short-term memory (i.e. engine or transmission adaptive parameters, and radio presets) after a protracted time without battery power.
- c) Ranger should be serviced by qualified, trained personnel only. Attempting to remove the cover or disassemble the device could expose you to dangerous high voltage points.
- d) Only use a damp cloth for cleaning. Never use any type of liquid/aerosol cleaner or any type of organic solvent to clean this product.
- e) Do not attempt to install or operate a damaged device. If the unit has been exposed to excessive amounts of water; shows evidence of physical damage; or is not operating properly; unplug it from the power source and contact qualified service personnel.
- f) Use of thread-locking compounds such as Loctite may cause serious damage to plastic enclosures. Many thread-locking compounds are not compatible with thermoplastics and can lead to stress cracking. This will require the unit to be returned to replace the ABS enclosures.

**ENSURE THAT YOU HAVE ALL OF THE ITEMS LISTED IN THE PARTS LIST**



# RANGER OVERVIEW



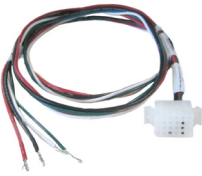
# PARTS LIST

Please verify that you have everything that you need to complete the Ranger installation. NOTE: Not all parts are provided by Mentor.

## SUPPLIED



- Ranger
- Ranger Interface Cable  
4-CAS-CGRDMMMLX18-31



- Ranger Power Pigtail

- Ranger Mount



- In-line Cable Fuse(s)

# PARTS LIST

## SUPPLIED (OPTIONAL)

- Emergency switch



## NOT SUPPLIED

- Zip Ties
- Glued Heat Shrink
- Tools as Required
- Grommets
- Loom
- Fasteners

# MOUNTING LOCATIONS

## PLACEMENT

- 1) Ensure that the driver's view of the road will not be impacted.
- 2) Ensure that the equipment will not be in the path of any active airbags.
- 3) Ensure that the driver will still have access to all controls on the dash.
- 4) Ensure that the driver has a clear view of the terminal from the seated driving position.
- 5) Ensure that the terminal is within easy reach of the driver from the seated driving position.
- 6) Ensure that the mounting location is a solid surface. Locations that allow even small amounts of initial movement will loosen over time.
- 7) Before drilling any holes or using screws, check for vehicle wiring under the carpet or behind the instrument panel which could be pinched, cut or otherwise damaged.
- 8) If mounting through the floor, put body sealer over the underbody projections. Stamped acorn nuts, filled with sealer, are available at most body shops for this purpose. This will keep moisture out of the carpet and insulation and will forestall rust in this area.
- 9) If mounting under the instrument panel, be sure that there is no interference with proper operation of the foot controls.
- 10) Inquire if the vehicle will be cleaned with a high pressure water wand. If so, ensure that all equipment is installed somewhere that will be protected from this type of cleaning.

# RANGER MOUNTING EXAMPLES

## EXAMPLES OF SUITABLE MOUNTING LOCATIONS

FIGURE 1

Ranger Installed in an Orion II Bus



FIGURE 2

Ranger Installed in a Ford E-Series Cutaway



FIGURE 3

Ranger Installed in a Chevrolet 3500 Series Cutaway



# INSTALLING THE RANGER COVER PLATE

## SUPPLIES REQUIRED TO INSTALL COVER

In order to install the Ranger Cover, the following items will be used. Most items are included in your shipment of Ranger equipment:

- Ranger Cover Plate
- 6mm hex head screw (Quantity 2)
- 2mm hex head screw (Quantity 2)
- Hex bit, for 2mm hex head screws
- 5/16" wrench (torque wrench preferred) \*\*

\*\*Not included

Ranger Back View



Ranger Back Cover Plate



## STEP 1

Connect the Ranger power cable to the power input as shown. Use 2mm screws and fasten cover. This requires a 2mm Hex bit.



# INSTALLING THE RANGER COVER PLATE

## STEP 2A

Align the back cover plate with the Ranger as shown.



## STEP 2B

If there are external cables connected to the Ranger, ensure to thread the cables through the holes in the cover.

The cables must be threaded in such a way that they are not pinched by the cover when fastened to the Ranger.



## STEP 3

Secure the cover to the Ranger with the screws provided. This will require 6mm and 2mm hex head screws (2 of each).



# INSTALLING THE RANGER COVER PLATE

## Torque Settings

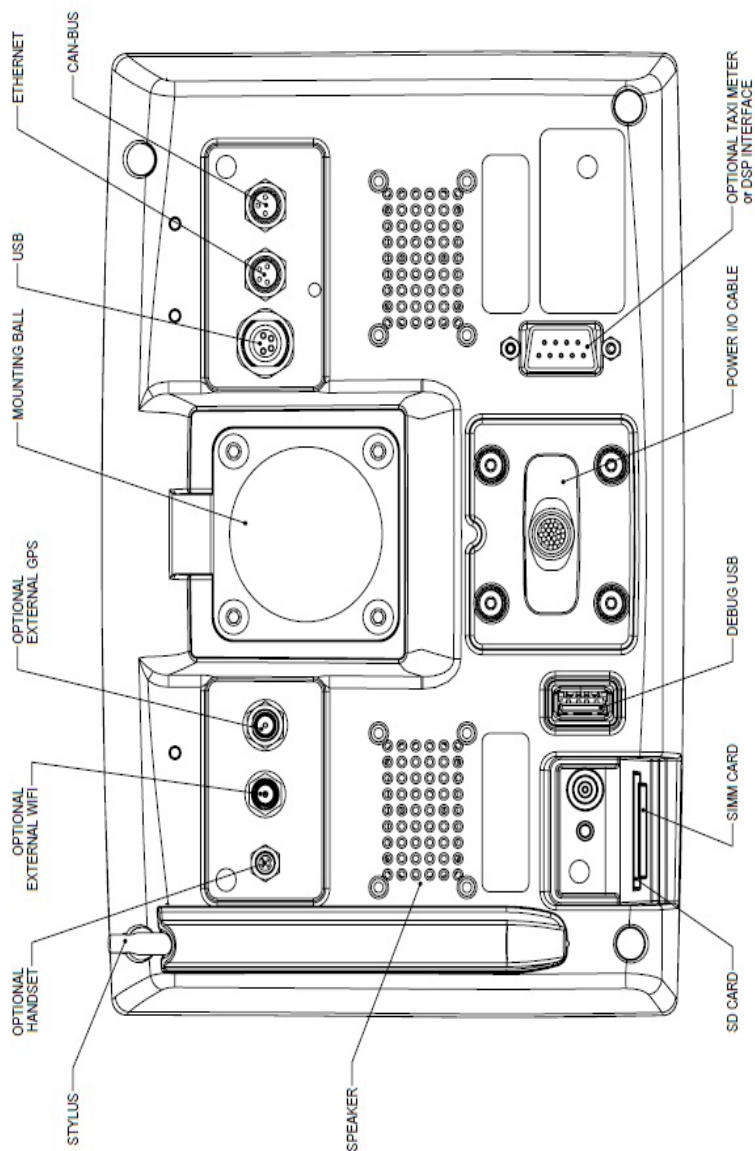
There are a number of items that may need to be installed to a specific torque level. This includes the Main Cable Cover, Mounting Ball, RF Cable Cover and antennas. The following Table lists the recommended torque settings for installing these items. Over and under torquing can lead to product damage and/or failure.

We recommend using a calibrated torque screwdriver for tightening all screws. A Huber Suhner SMA torque wrench (74Z-0-0-21) is recommended for tightening the Antenna cable.

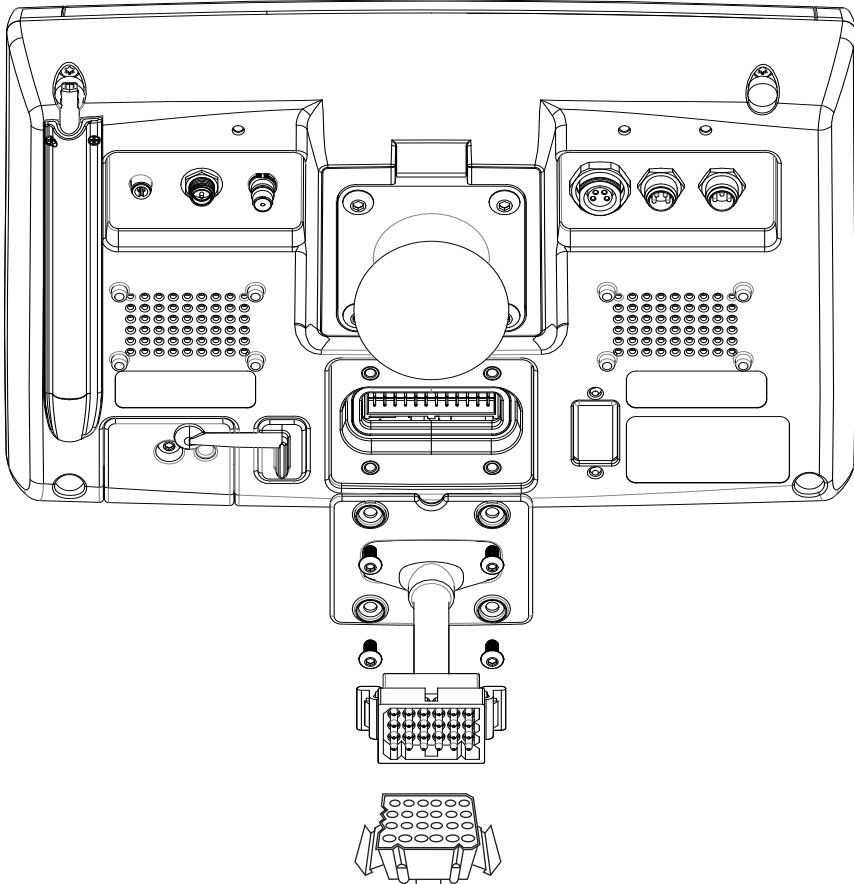
Description	Mentor Part Number	Recommended Torque	
		Oz.In	N.cm
Main Cable Cover	3-ENC-RNGRP226-XX	80-90	55-65
Mounting Ball	6-MNT-RAMCMN3X-XX	80-90	55-65
RF Cable Cover	3-ENCRNGRP301-XX	80-90	55-65
R-SMA Antenna Cable	6-ANT-XXXXXXXX-XX	140	100



# WIRING - RANGER BACK VIEW



# WIRING - RANGER BACK VIEW



4-CAS-PIGTVEHCXX-XX →

## REQUIRED

- Green (Ignition Sense, 12/24V, 2A fuse) 6
- White (Odometer - typically not used) 7
- Red (Vin, 12/24V, 3A fuse) 8
- Black (Ground) 16

# CONNECTION POINTS

## 1) SPLICING

T-Taps are not a suitable form of splicing into existing cabling. All splices must be soldered and glued. Heat shrink must be used for protection.

## 2) POWER

Power connections should be made directly to the battery and fused as close to the battery as possible. Avoid using a cigarette lighter or “Power Point” receptacles as power sources. Mentor does not recommend wiring power directly to a vehicle kill switch because the Ranger will not power down correctly. Appropriate fuses are provided with the installation equipment.

## 3) GROUND

The ground point should be that point where the (-) terminal from the battery is connected to the body. This connection to the battery is typically a 6 or 8 AWG black wire connected to the wheelhouse or radiator support.

Do not fuse the ground lead. If the ground-side fuse were to open, the entire supply current would be conducted by an alternate current return path, which may cause the feed line to overheat possibly resulting in damage.

## 4) SWITCHED IGNITION POWER

It is important to utilize an unused ignition point. Connecting to an ignition point that is currently being used to switch other devices can cause improper operation of those devices.

There are two methods for interfacing to the vehicle ignition. If neither of these options are possible, then contact your Mentor project manager and alternate ignition options can be discussed and approved.

# CONNECTION POINTS

It is highly preferable to find an ignition source that goes high only when the engine is actually on. If this source cannot be found, an ignition source that goes high only when the ignition is in the ON position is the next recommended source.

## a) Auxiliary Electrical Panel (Preferred)

Many bus manufacturers will include an auxiliary electrical panel for interfacing peripheral devices. Below is an example of a common location in buses with a Ford chassis. One of these terminals will typically be a switched ignition point. A ring terminal should be used when connecting to this type of ignition interface point. Ask the local maintenance personnel if you need assistance to find this panel.



FIGURE 6

Example of an Auxiliary  
Electrical Panel on a  
Ford Van

## b) Fuse Panel

An unused ignition activated position in the fuse panel is another option. This installation requires an Add-A-Circuit fuse holder as pictured below. It is not acceptable to use a “fuse sleeve”



FIGURE 7

Add-A-Circuit Installation

## 5) VSS (VEHICLE SPEED SENSOR FOR ODOMETER PULSES)

Many vehicles have a VSS point which provides a pulse train from the transmission. Vehicles that do not have a VSS point with adequate signal characteristics will require the installation of a transducer. It is the responsibility of the installer and customer to locate a VSS point or determine the appropriate location for a transducer. Your Mentor Systems Engineer may be able to assist in locating suitable VSS point. He/She can also provide information on the type of signal that is required for accurate odometer tracking.

# CONNECTION POINTS

## 6) EMERGENCY SWITCH (OPTIONAL)

The emergency switch is usually installed somewhere that would allow for covert operation. This location needs to be chosen by the customer prior to the start of installation. Mentor will provide a switch if one is required. It is sometimes possible to use an existing switch already on the vehicle. Ranger 4.0 requires a normally closed momentary push button switch with one side connected to the blue wire (or the wire corresponding to Pin 14 ) on the Ranger Power Pigtail input/output cable (Part Number 4-CAS-PIGT-VEHC24-45\_R05).

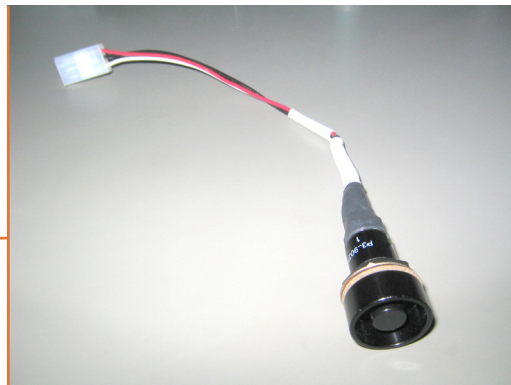


FIGURE 8

Emergency Switch

The emergency switch is typically installed on the lower left side of the driver seat.

Always ensure that the connector on the emergency switch pigtail is strain relieved off the floor to prevent shorts if water enters the connector.

## 1) ROUTING

- a) Use caution when routing wires between the passenger and engine compartments to avoid chafing or pinching the wires. Use grommets over any exposed sharp edges and strain reliefs to keep wires in place. Seal all holes to prevent moisture intrusion.
- b) Route and secure all under-hood wiring away from mechanical hazards such as exhaust manifolds and moving parts.
- c) Maintain as great a distance as possible between mobile radio power leads and the vehicle's electronic modules and wiring. Avoid running power leads in parallel with vehicle wiring over long distances.
- d) If cabling is routed under the instrument panel, be sure that there is no interference with proper operation of the foot controls.

## 2) STRAIN RELIEF

Ensure that there is no strain exerted on cable connectors where they enter the unit. Avoid placing the unit in a position where the cable connectors entering the back of the unit are under pressure or strain of any kind. Ensure the power cable is fully inserted before replacing the cable cover. In the event of undue stress or strain on installed cables and connectors, permanent damage may occur impairing the connections. This may result in intermittent or complete loss of communication and or power. Always include strain relief every 2-3 feet on long cable runs.

As the Ranger can be tilted and rotated freely by the driver/user, cabling should be installed such that moving/adjusting the position of the unit does not exert any significant stress on the cables.

# CABLING

## 3) LABELING

It is important to always label cabling at connection points. This simplifies maintenance in the future. Using cables with consistent coloring will also make maintenance easier.

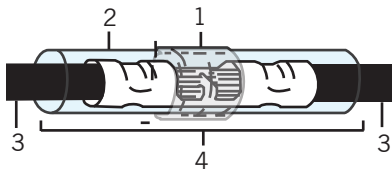
## 4) CONNECTION TYPES

### Acceptable Connection Types

- a) Ring Terminals



- b) Butt Splices with Self Contained Solder and Shrink Tubing




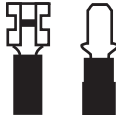



1. Solder Sleeve
2. Crimp Splice (shown crimped)
3. Wire
4. Shrink Tubing

- c) Soldered Connections with Shrink Tubing



## Unacceptable Connection Types

- a) T-Taps 
- b) Spade Terminals 
- c) Marrettes 
- d) Blade Connectors 
- e) Standard Butt Splices 

## 5) WIRE TYPES

The following are the minimum specifications for hook-up wire that should be used during the installation process:

- a) Ranger Power and Ground  
300V, 105°C PVC, 18AWG stranded
- b) Ignition  
300V, 105°C PVC, 22AWG stranded
- c) Odometer Interface  
300V, 105°C PVC, 22AWG stranded
- d) Ranger Inputs (i.e. Emergency Input, etc.)  
300V, 105°C PVC, 22AWG stranded

## 6) ELECTRICAL MEASUREMENTS

Always ensure that there is adequate voltage at the point where Ranger is being powered. Compare this voltage to the voltage at the battery. The two voltages should be almost the same or a different power point should be chosen closer to the battery.

# ANTENNAS

## 1) INTERNAL ANTENNAS

Ranger 4.0 contains cellular, WIFI, Bluetooth and GPS antennas.

Cellular, WIFI and Bluetooth antennas are capable of transmitting. Ranger should be installed and operated with a minimum distance of 20 cm (8") between the radiator and the operator.

The orientation and mounting location of Ranger4.0 can have an effect on antenna performance.

To optimize GPS performance, mount the Ranger vertically with a clear view of the sky.

## 2) EXTERNAL ANTENNAS

If desired, external WIFI and/or GPS antennas can be used with Ranger 4.0

Specific antenna selection depends on the individual system setup. Contact Mentor Engineering for assistance in selecting an appropriate antenna.

Use short lengths of low loss cabling whenever possible. WIFI performance is especially susceptible to cable losses.

Some important features to consider are:

- Compact construction,
- Durability
- Weatherproofing
- Temperature stability
- Mode of Installation

# ANTENNAS

Groundplane style antennas are ideally mounted on the centre of a metal vehicle roof.

Glass mount antennas should be mounted away from metal objects.

When using an adhesive antenna, it is extremely important to make sure that the surface of the mounting location has been thoroughly cleaned. Use Isopropyl alcohol to clean the surface just before securing the adhesive pad.

## 3) CABLE ROUTING

The antenna cabling has a minimum inside bend radius of 2". Bending the cable tighter will cause degradation in antenna performance.

Avoid routing the antenna cable in parallel with the vehicle wiring over long distances.

Do not coil excess antenna cable slack.

FIGURE 7  
Antenna Routing



# ANTENNAS

## CONNECTORS

- R- SMA - The reverse SMA connector is used for WIFI and requires a 1N-M torque wrench to properly secure
- QMA - The QMA connector is used for GPS and is a snap on version of the SMA connector

## GENERAL DESCRIPTION

Mentor Ranger® v4 is a water resistant<sup>1,2</sup> WinCE device that is equipped with color Touchscreen display, Compact Flash, smart card/magnetic card readers and USB host/device port. Application software can be custom-designed making it adaptable to a wide variety of applications. It has an optional internal wireless modem for HSPDA or EVDO networks. Internal GPS allows Ranger to be used for vehicle navigation, AVL (Automatic Vehicle Location) and/or Computer Aided Dispatch systems for fleet applications.

## STANDARD FEATURES

- 256MB of Flash
- 256MB of DDR SDRAM
- 2 USB Device Ports<sup>8</sup>
- Bluetooth 2.1
- WIFI 802.11b/g/n
- CANBUS J1939
- J1708
- Built in Odometer Signal Conditioner
- 4 Digital Input / Open Drain Output with software selectable pull up or pull down
- 6 Button Capacitive Touch Keypad
- 3W Stereo Speakers
- 6.5" TFT Color Display with Touchscreen
- External SD Card Socket
- Covert Microphone
- 2 RS-232 Com Ports
- Tactile Wear Resistant Coating
- Internal 50 Channel GPS

# RANGER SPECS 7-RNGR-04X

## COMPLIANCE AND TESTING

- FCC Class B Part 15
- IEC 60950 3rd Edition (2000)
- ISO 7637-1 Load Dump Transient
- MIL STD 810F: General Vibration
- MIL STD 810F: Shock
- IP54: Environmental, Dust and Water exposure <sup>7</sup>

## OPTIONAL FEATURES

- Taximeter
- ISO 7811 Magnetic card reader/ISO 7816 Smart Card Reader (combined module)
- Internal SD Card Socket (4GB max)
- Internal Wireless Data Modems (HSDPA or EVDO or DSP Radio)<sup>3</sup>
- Handset and/or Handsfree Voice Calls

## KEY SPECIFICATIONS

- Supply Voltage
  - Typical 12 V
  - Min 6 V
  - Max 32 V
- Current Consumption

Input Voltage (V)	Current Draw (mA)		
	Standby	Idle <sup>4</sup>	Typical <sup>5</sup>
9	68	360	965
13.8	50	250	645
24	39	160	405

Maximum<sup>6</sup> 3.0 A

# RANGER SPECS 7-RNGR-02X

- Operating Temperature  
Min -30° C    Max 65° C
- Storage Temperature  
Min -30° C    Max 70° C
- Size  
8.25" x 2.0" x 5.75"  
210mm x 57mm x 146 mm
- Weight  
2.0 lbs / 0.9 kg
- 5% - 95% relative humidity non-condensing

## Foot Notes

- 1) Ranger is designed to be splash resistant. It's not designed to be immersed in water.
- 2) Ranger may not be water resistant when some of the options are specified.
- 3) DSP Radio and Wireless Modem options cannot be specified at the same time.
- 4) When diisplay is off, the unit is in idle without modem options
- 5) Unit Idle with full backlight with GPS, Wifi and Bluetooth. No modem options
- 6) This is an absolute maximum which includes an installed modem and all peripheral devices. Actual current draw will depend on system design.
- 7) Unit is IP54 rated for water without Mag swipe, or Taximeter Options or DSP modem.

8) USB 2.0 High Speed; One port is for maintenance only.

**NOTE:** Mentor Engineering Inc. reserves the right to change circuitry and specifications without notice at any time. Please ensure you have the most recent revision of this document.

**NOTE:** Operation at Temperatures outside the ranges is not recommended.

**NOTE:** Only use Mentor Engineering approved cables for installation purposes. Refer to cable section of the Hardware Installation Manual for additional information.



# APPENDIX A - CONFORMITY

## 1) FCC CLASS B PART 15

This device complies with Part 15 of FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference
2. This device must accept any interference received, including interference that may cause undesired operation.

## INDUSTRY CANADA STATEMENT

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions:

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

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communica-

# APPENDIX A - CONFORMITY

tion satisfaisante.

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

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

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

# APPENDIX A - CONFORMITY

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

## **2) IEC 60950 3RD EDITION (2000) SAFETY OF INFORMATION TECHNOLOGY EQUIPMENT**

### **3) ISO 7637-1 LOAD DUMP TRANSIENT**

Designed for ISO 7637-1 Load Dump Transient

### **4) MIL STD 810F: GENERAL VIBRATION**

Tested to MIL-STD-810F Vibration Test Method 514.5 Procedure I: General Vibration, Category 20 Ground Vehicles.

#### **4.1) Highway Vehicle Endurance Testing**

Each axis was exposed to 1 hour of vibration according to Figure 514.5C-1 U.S. Highway Truck Vibration Exposure Levels. This is an accelerated fatigue test meant to test the unit's life cycle. The unit was functionally tested before and after the test.

### **5) MIL STD 810F: SHOCK TEST**

Tested to MIL-STD-810F Shock Test Method 516.5 Procedure I: Functional Shock. Functional Shock was performed on the vertical, transverse, and longitudinal axes with a pulse of 40gs. The tests were performed to ensure the unit stays intact during vehicle operation.

### **6) IEC 60529 - IP54**

Tested to IEC 60529 IP54 for protection against ingress of water with harmful effects splashing. Unit must not be equipped with magnetic card reader or taximeter.

# APPENDIX B - RF RADIATION SPECS

## **RF EXPOSURE**

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

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

# APPENDIX C - APPROVALS

## 1) CDMA/EVDO - VOICE/DATA NETWORK CERTIFICATIONS

FCC ID: RZ3RAN45728

IC ID:2234A-RAN45728

Approvals: FCC, IC

## 2) GSM/HSDPA

FCC ID RZ3RAN48790

IC ID 2234A-RAN48790

Approvals: FCC, IC, PTCRB

## 3) WIFI/BLUETOOTH ONLY - NO CELLULAR MODEM

Contains Transmitter Module FCC ID: N7NMC8790

FCC ID RZ3RAN49110

IC ID 2234A-RAN49110