



Supplement for  
*HE-XRC9*

# 900MHz Modem COM Module

## PREFACE

This manual explains how to use the HE-XRC9 XLe 900MHz Modem COM Module.

Copyright (C) 2006 Horner APG, LLC., 59 South State Avenue, Indianapolis, Indiana 46201. All rights reserved. No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form by any means, electronic, mechanical, magnetic, optical, chemical, manual or otherwise, without the prior agreement and written permission of Horner APG, Inc.

All software described in this document or media is also copyrighted material subject to the terms and conditions of the Horner Software License Agreement.

Information in this document is subject to change without notice and does not represent a commitment on the part of Horner APG.

Cscape, SmartStack, SmartStix and CsCAN are trademarks of Horner APG.  
Ethernet is a trademark of Xerox Corporation.

Micro SD and CompactFlash are registered trademarks of SanDisk Corporation.

MS-DOS, Microsoft, Windows 95, Windows 98, Windows 2000, Windows NT, and Windows XP are trademarks of Microsoft Corp.

### ***For user manual updates, contact Technical Support:***

#### **North America:**

(317) 916-4274

[www.heapg.com](http://www.heapg.com)

email: [techspt@heapg.com](mailto:techspt@heapg.com)

#### **Europe:**

(+) 353-21-4321-266

[www.horner-apg.com](http://www.horner-apg.com)

email: [techsupport@hornerirl.ie](mailto:techsupport@hornerirl.ie)

## LIMITED WARRANTY AND LIMITATION OF LIABILITY

Horner APG, LLC. ("HE-APG") warrants to the original purchaser that the HE-XRC9 XLe 900MHz Modem COM Module manufactured by HE-APG is free from defects in material and workmanship under normal use and service. The obligation of HE-APG under this warranty shall be limited to the repair or exchange of any part or parts which may prove defective under normal use and service within two (2) years from the date of manufacture or eighteen (18) months from the date of installation by the original purchaser whichever occurs first, such defect to be disclosed to the satisfaction of HE-APG after examination by HE-APG of the allegedly defective part or parts. THIS WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR USE AND OF ALL OTHER OBLIGATIONS OR LIABILITIES AND HE-APG NEITHER ASSUMES, NOR AUTHORIZES ANY OTHER PERSON TO ASSUME FOR HE-APG, ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OF THIS HE-XRC9 XLe 900MHz Modem COM Module. THIS WARRANTY SHALL NOT APPLY TO THIS HE-XRC9 XLe 900MHz Modem COM Module OR ANY PART THEREOF WHICH HAS BEEN SUBJECT TO ACCIDENT, NEGLIGENCE, ALTERATION, ABUSE, OR MISUSE. HE-APG MAKES NO WARRANTY WHATSOEVER IN RESPECT TO ACCESSORIES OR PARTS NOT SUPPLIED BY HE-APG. THE TERM "ORIGINAL PURCHASER", AS USED IN THIS WARRANTY, SHALL BE DEEMED TO MEAN THAT PERSON FOR WHOM THE HE-XRC9 XLe 900MHz Modem COM Module IS ORIGINALLY INSTALLED. THIS WARRANTY SHALL APPLY ONLY WITHIN THE BOUNDARIES OF THE CONTINENTAL UNITED STATES.

In no event, whether as a result of breach of contract, warranty, tort (including negligence) or otherwise, shall HE-APG or its suppliers be liable of any special, consequential, incidental or penal damages including, but not limited to, loss of profit or revenues, loss of use of the products or any associated equipment, damage to associated equipment, cost of capital, cost of substitute products, facilities, services or replacement power, down time costs, or claims of original purchaser's customers for such damages.

**To obtain warranty service, return the product to your distributor with a description of the problem, proof of purchase, post paid, insured and in a suitable package.**

## ABOUT PROGRAMMING EXAMPLES

Any example programs and program segments in this manual or provided on accompanying diskettes are included solely for illustrative purposes. Due to the many variables and requirements associated with any particular installation, Horner APG cannot assume responsibility or liability for actual use based on the examples and diagrams. It is the sole responsibility of the system designer utilizing the HE-XRC9 XLe 900MHz Modem COM Module to appropriately design the end system, to appropriately integrate the HE-XRC9 XLe 900MHz Modem COM Module and to make safety provisions for the end equipment as is usual and customary in industrial applications as defined in any codes or standards which apply.

**Note: The programming examples shown in this manual are for illustrative purposes only. Proper machine operation is the sole responsibility of the system integrator.**

## Table of Contents

<b>LIMITED WARRANTY AND LIMITATION OF LIABILITY .....</b>	<b>3</b>
<b>CHAPTER 1: SAFETY / COMPLIANCE .....</b>	<b>5</b>
1.1 Safety Warnings and Guidelines .....	5
<b>CHAPTER 2: INTRODUCTION .....</b>	<b>7</b>
2.1 Overview.....	7
2.2 Technical Support Contacts .....	7
<b>CHAPTER 3: INSTALLATION PROCEDURE .....</b>	<b>8</b>
3.1 Installation Procedure.....	8
<b>CHAPTER 4: OPERATION.....</b>	<b>9</b>
4.1 Configuration .....	9
4.2 Ladder communications .....	9

## CHAPTER 1: SAFETY / COMPLIANCE

### 1.1 Safety Warnings and Guidelines

When found on the product, the following symbols specify:



**Warning:** Consult user documentation.



**Warning:** Electrical Shock Hazard.

**WARNING:** This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 30 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

**NOTE:** The separation distance indicated in the above is 30 cm, but any distance greater than or equal to 23 cm can be used (per MPE evaluation).

**WARNING:** To avoid the risk of electric shock or burns, always connect the safety (or earth) ground before making any other connections.

**WARNING:** To reduce the risk of fire, electrical shock, or physical injury it is strongly recommended to fuse the voltage measurement inputs. Be sure to locate fuses as close to the source as possible.

**WARNING:** Replace fuse with the same type and rating to provide protection against risk of fire and shock hazards.

**WARNING:** In the event of repeated failure, do not replace the fuse again as a repeated failure indicates a defective condition that will not clear by replacing the fuse.

**WARNING:** Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate, or service this equipment. Read and understand this manual and other applicable manuals in their entirety before proceeding. Failure to observe this precaution could result in severe bodily injury or loss of life.

- All applicable codes and standards need to be followed in the installation of this product.
- For I/O wiring (discrete), use the following wire type or equivalent: Belden 9918, 18 AWG or larger.

Adhere to the following safety precautions whenever any type of connection is made to the module.

- Connect the green safety (earth) ground first before making any other connections.
- When connecting to electric circuits or pulse-initiating equipment, open their related breakers. Do not make connections to live power lines.
- Make connections to the module first; then connect to the circuit to be monitored.
- Route power wires in a safe manner in accordance with good practice and local codes.
- Wear proper personal protective equipment including safety glasses and insulated gloves when making connections to power circuits.
- Ensure hands, shoes, and floor are dry before making any connection to a power line.

- Make sure the unit is turned OFF before making connection to terminals. Make sure all circuits are de-energized before making connections.
- Before each use, inspect all cables for breaks or cracks in the insulation. Replace immediately if defective.

## 1.2 FCC Compliance

The HE-XRC9 contains a MaxStream OEM RF module, FCC ID: OUR-9XTEND The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (i) this device may not cause harmful interference and (ii) this device must accept any interference, including interference that may cause undesired operation.

**IMPORTANT:** The XTend OEM RF Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by MaxStream could void the user's authority to operate the equipment.

### Effective Isotropic Radiated Power (EIRP)

**IMPORTANT:** Power output is conducted at the antenna terminal and can be adjusted from 1 milliwatt to 1 Watt at the OEM level. This is an RF module approved for Limited Modular use operating as a mobile transmitting device with respect to section 2.1091 and is limited to OEM installation for Mobile and Fixed applications only. During final installation, end-users are prohibited from access to any programming parameters. Professional installation adjustment is required for setting module power and antenna gain to meet EIRP compliance for high gain antenna(s). Final antenna installation and operating configurations of this transmitter including antenna gain and cable loss must not exceed the EIRP of the configuration used for calculating MPE. Grantee (MaxStream) must coordinate with OEM integrators to ensure the end-users and installers of products operating with the module are provided with operating instructions to satisfy RF exposure requirements. The FCC grant is valid only when the device is sold to OEM integrators. Integrators are instructed to ensure the end-user has no manual instructions to remove, adjust or install the device.

FCC regulations stipulate a 36 dBm EIRP power requirement. Users implementing antenna gain greater than 6.0 dB must compensate for the added gain with cable loss. When operating at 1 W power output, the sum (in dB) of cable loss and antenna gain shall not exceed 6.0 dB.

**FCC-approved Antennas** WARNING: This device has been tested with Reverse Polarity SMA connectors with the antennas listed in the tables of this section. When integrated into OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

**Fixed Base Station and Mobile Applications** MaxStream RF Modules are pre-FCC approved for use in fixed base station and mobile applications. When the antenna is mounted at least 20cm (8") from nearby persons, the application is considered a mobile application.

**Portable Applications and SAR Testing** When the antenna is mounted closer than 20cm to nearby persons, then the application is considered "portable" and requires an additional test be performed on the final product. This test is called Specific Absorption Rate (SAR) testing and measures the emissions from the module and how they affect the person.

## CHAPTER 2: INTRODUCTION

### 2.1 Overview

To supplement the built-in MJ1 and MJ2 serial ports on the XLe, the 900MHz modem optional COM module (HE-XRC9) can be installed internal to the XLe to provide 900MHz spread spectrum communications. This optional COM module provides a cost savings over an external modem and reduces the amount of consumed space.

The HE-XRC9 has the following features:

Topology	- Spread spectrum (HSFF)
Frequency	- ISM 908-928 MHz
Encryption	- 256bit AES
Power	- 1mW to 1 watt (adjustable to match antenna to maximum EIRP)
Indoor range	- up to 3000 feet
Outdoor range	- up to 40 miles (line-of-sight)
Transfer rate	- 9.6k or 115.2k (range reduced at higher baud rate)

The HE-XRC9 allows spread spectrum communications through ladder communication function blocks when the MJ1/Com Option port is opened in *Radio 900MHz* mode via the OPEN function block. The SEND function block may then be used to initialize the operating parameters utilizing Hayes AT style commands (such as source and destination IDs). Once the HE-XRC9 is initialized and an AT style command to exit command mode is issued; thereafter, either the SEND/RECV or MODBUS function blocks may be then used to transfer data.

The HE-XRC9 utilizes the same internal communications channel (UART) as the MJ1 serial port; thus, enabling the HE-XRC9 deactivates the MJ1 serial port. However, support is provided to select which device is currently active through ladder control.

The HE-XRC9 is provided connection to the internal handshake lines of RTS and CTS. As such, the OPEN function block handshake parameter of hardware is functional if the HE-XRC9 is programmed appropriately. Additionally, software handshaking (XON/XOFF) is also available if both the OPEN function block and the HE-XRC9 is programmed appropriately.

Included with the HE-XRC9 is an articulated 1/2-wave dipole RPSMA antenna (2.1 db gain).

The HE-XRC9 internally uses the MaxStream 9XTend 900MHz OEM core. For additional technical information, certifications or extended AT command set information, see [www.maxstream.net](http://www.maxstream.net)

### 2.2 Technical Support Contacts

For manual updates and assistance, contact Technical Support at the following locations:

**North America:**

(317) 916-4274

[www.heapg.com](http://www.heapg.com)

email: [techspt@heapg.com](mailto:techspt@heapg.com)

**Europe:**

(+) 353-21-4321-266

[www.horner-apg.com](http://www.horner-apg.com)

email: [techsupport@hornerirl.ie](mailto:techsupport@hornerirl.ie)

## CHAPTER 3: INSTALLATION PROCEDURE

### 3.1 Installation Procedure

1. Disconnect all power from the XLe unit including I/O power.
2. Remove the four screws on the back of the XLe unit and remove the back cover. The back cover can be discarded or saved, but it will be replaced with the extended back cover that ships with the communication add-on. Screws are re-used (Figure 1).

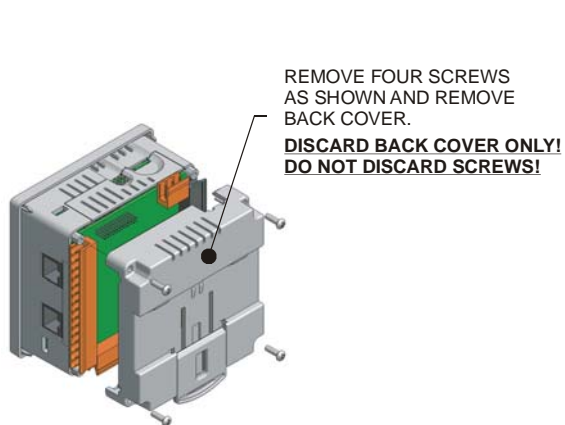


Figure 1 - Removing Back Cover of the XLE  
the XLE

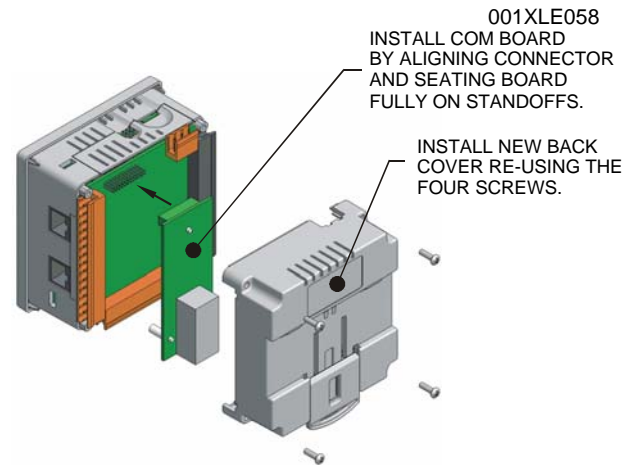


Figure 2 - Installing the COM Board in

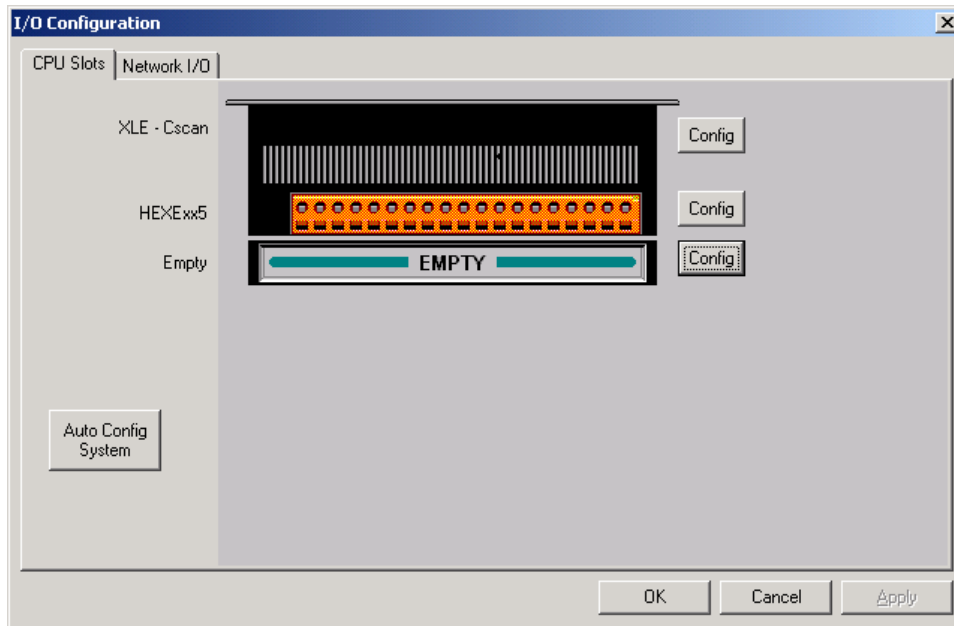
3. Plug the communication board onto the 24-pin connector. Make sure all the pins are properly aligned (Figure 2).
4. Place the extended back cover onto the unit. It can be helpful to tip it at an angle so the connector on the COM board passes through the opening on the back cover.
5. Place the screw back into the hole and turn the screw slowly counter clockwise until it clicks into the threads. This prevents the screw from being cross-threaded. Now, turn the screw clock-wise until the cover is firmly secured. Repeat this process for all four (4) screws.
6. Install the included antenna.



## CHAPTER 4: OPERATION

### 4.1 Configuration

Once the HE-XRC9 is installed, the corresponding CSCAPE application must be made aware of the optional COM module. This is accomplished through the CSCAPE: Controller -> I/O Configuration menu as shown below:



If the target XLe (with the HE-XRC9 installed) is available and connected to CSCAPE, the Auto Config System will fill the EMPTY slot with *HEXRC9* information. If the target XLe is NOT available, the user may manually configure by clicking the Config button adjacent to the EMPTY slot and selecting *HEXRC9 – radio modem option card* (this assumes that XLe has previously been selected as the Controller). Thereafter, on exiting the I/O Configuration dialog by clicking the OK button, the application is configured for the HE-XRC9.

Failure to set *HEXRC9* in the I/O Configuration when attempting to download an application that uses an OPEN function block set to *Radio 900* generates a download error. Even if the HE-XRC9 is not used by the application, the *HEXRC9* must still be set in the I/O Configuration to prevent an I/O Configuration error on the XLe.

### 4.2 Ladder communications

To access the HE-XRC9 optional COM module from ladder, the application must first execute an OPEN function block for MJ1/Option port with Mode set to **Radio 900**. This function block accomplishes three tasks:

- Serial port is disconnected from the CSCAPE command interpreter and made available to ladder communications function blocks.
- Serial port is internally connected to the HE-XRC9.
- Serial port transfer rate and frame protocol set to match HE-XRC9

The OPEN function block Baud rate and frame parameters (Parity, Data bits, etc...) must be set to match that of the HE-XRC9. The factory default setting of these parameters are **9600, 8, N, and 1**. It is possible to program the HE-XRC9 for a different baud rate and frame protocol and save those values to non-volatile memory; however, it is left to the user to record those values and set the OPEN function block appropriately.

Once the MJ1/Option port is opened in Radio 900 mode, it is ready to start transmitting data; however, it may be desired to change modes of operation, source and destination addresses, or add encryption. This requires entering command mode through the sending of a “+++” sequence to the HE-XRC9 followed by the appropriate “AT” commands by using SEND function blocks. The “AT” commands and corresponding transmit modes are covered in detail in the MaxStream 9Xtend OEM RF Module – Product Manual, available at:

[http://www.maxstream.net/products/xtend/product-manual\\_XTend\\_OEM\\_RF-Module.pdf](http://www.maxstream.net/products/xtend/product-manual_XTend_OEM_RF-Module.pdf) .

When transferring data, handshaking is generally not required for messages less than 2K bytes. The HE-XRC9 breaks larger messages into smaller packets for transfer between HE-XRC9 modems. Note that Modbus RTU communications may be unreliable if the HE-XRC9 packet size or transfer method is not configured for complete RTU message transfer without breaking into individual transfer packets. Refer to MaxStream Xtend9X OEM RF Module – Product Manual for setting packet size and transfer methods.

Once the HE-XRC9 is properly *Opened*, SEND/RECV or MODBUS function blocks may be used to transfer data.

User access to SLEEP and CONFIG pins on the MaxStream Xtend9 are not supported on the HE-XRC9. Likewise CMD mode is not supported since CSCAPE applications cannot directly access the RTS handshake line.

---

## NOTES