User's Guide

MP9320
UHF Long-Range Reader

SAMSYS
THE POWER TO CHOOSE

Declaration of Conformity

Manufacturer: Samsys Technologies, Inc.
44 East Beaver Creek Rd., Unit 11
Richmond Hill, Ontario, Canada
L4B 1G8

EU Contact: Midvaag
Rownham Hill
Leigh Woods
Bristol BS8 3PU
United Kingdom

Standard(s) to which Conformity is Declared:

EN300 220-3, EN301 489-3, IEC60950-1, EN50364, EN55022 (Class A), EN61000-(3-2, 3-3), EN61000-(4-2, 4-3, 4-5, 4-6, 4-8, 4-11)

Product Model No.: Model MP9320

Description: 869.525 MHz Radio Frequency Identification Reader/Interrogator module with AC/DC power supply

The product(s) herewith comply with the requirements of the R&TTE Directive 99/5/EC.

14 July, 2003
Date

Signature

Mr. James Wiley
President and Chief Operating Officer

SAMSys

MP9320 UHF Long-Range Reader
Owner's Manual

Third Edition (January 2004)

Disclaimer and Limitation of Liability

The content of this manual is for information use only and is subject to change without notice. SAMSys assumes no responsibility or liability for any errors or inaccuracies that may appear in this publication. No part of this manual may be reproduced in any form or by any means, electronic, mechanical, recording, or otherwise, without the prior written permission of SAMSys.

SAMSys products are not designed, intended, authorized or warranted to be suitable for life support applications or any other life critical applications which could involve potential risk of death, personal injury, property damage, or environmental damage.

About SAMSys

SAMSys is the world leader in the design and supply of radio frequency identification (RFID) hardware solutions for high volume pallet and reusable container tracking applications in global logistics management, materials handling, and supply chain industries. SAMSys is a public company listed on the Canadian Venture Exchange under the symbol SMY.

SAMSys Technologies, Inc.
44 East Beaver Creek Rd., Unit 11
Richmond Hill, Ontario L4B 1G8 Canada
Phone: (905) 707-0404
Toll Free: (877) 463-6546
Fax: (905) 707-9944
E-mail: samsys@samsys.com
Web: www.samsys.com

Part Number: HI46932-01-OM-V3.2

Federal Communications Commission (FCC) Notice (Preliminary)

This device was tested and found to comply with the limits set forth in Part 15 of the FCC Rules. Operation is subject to the following conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received including interference that may cause undesired operation. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This device generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, the product may cause harmful interference to radio communications. Operation of this product in a residential area is likely to cause harmful interference, in which case, the user is required to correct the interference at their own expense.

The authority to operate this product is conditioned by the requirements that no modifications be made to the equipment unless the changes or modifications are expressly approved by SAMSys Technologies.

Trademarks

SAMSys is a trademark of SAMSys Technologies, Inc.

HyperTerminal® is a registered trademark of Hilgraeve, Inc.

Other company, product or service names appearing in this manual may be trademarks or service marks of their respective owners.

Contents

Chapter 1 – Introduction 1
Unpacking the Reader 2
About the MP9320 3
Physical Description 5

Chapter 2 – Getting Started 7
Installing the SSTool Application 8
Configuring for Single or Multiple Readers 8
Configuring the Serial Port 8
Connecting the Reader to a Terminal 9
Connecting the Reader to the ICCM 9
Setting the RF Mode 9
Activating Tag Protocols 11
Selecting the Number of Antennas 12
Reading tags 12

Chapter 3 – Installation 13
Antenna Installation 14
Reader Mechanical Installation 17
Standalone Reader/PC Communication Setup 21
Standalone Reader/PC Verification 22
Standalone Reader/ICCM Communication Setup 23
Standalone Reader/ICCM Verification 24
Networked Reader Communication Setup 25
Networked Reader Verification 26
Digital (TTL) Input/Output Setup 27
Main I/O Connector Modification 28
Transmit Power Calibration 28

Chapter 4 – Operation 29
Reader Power Up 30
Reading Tags 32
Operation with the ICCM 33

Chapter 5 – Troubleshooting 35
General Troubleshooting 36
Contact Us 38

Chapter 6 – Specifications 31
Reader Specifications 42
Environmental Specifications 42
Battery Specifications 42
Power Supply Specifications 43
RS-232 Connector Specifications 43
Main I/O Connector Specifications 44
Antenna Specifications 45
Regulatory Standards 46

Appendix A – Reader Configuration 49
Operating Modes 50
Default Configuration 51
Changing Reader Configuration 52
Updating Reader Firmware 54

Figures

MP9320 Reader and Accessories 2
SAMSys Reader Network 4
MP9320 LED Status Indicators 5
MP9320 Active Antenna LED Indicators 6
MP9320 End-Panel Connectors 6
MP9320 Antenna Configurations 14
MP9320 Reader Installations 17
MP9320 Base Plate with Mounting Keyholes 18
MP9320/PC Standalone RS-232 Communication Setup . 21
MP9320/ICCM Standalone RS-232 Comm Setup 23
MP9320 RS-485 Communication Setup 25
Digital Input and Output Port Configuration 27
LED Startup Sequence 30
Power LED On – Reader Operational 30
Active Antenna LED Indicators - Ant 2 Transmitting . . 31
LED Indicators - Tag Successfully Read 32
RS-232 Connector 43
Main I/O Connector 44
Optional Communication Cable Pinout 45
Firmware Upload System Configuration 54

Chapter 1

Introduction

This chapter provides a general description of the MP9320. Topics discussed in this chapter include the following:

- Unpacking the Reader
- About the MP9320
- Physical Description

Unpacking the Reader

After opening the shipping container perform the following:

1. Unpack the contents of the shipping container.

2. Inspect the shipping container for damage. If damaged, notify the carrier and SAMSys Technologies. Keep the shipping materials for inspection by the carrier.

3. Verify your reader package includes the following items:

   - MP9320 UHF Long-Range Reader
   - Power cord
   - 15 Vdc power supply with cable
   - Sample RFID tags
   - RS-232 communication cable
   - System documentation CD
   - Antennas (optional)

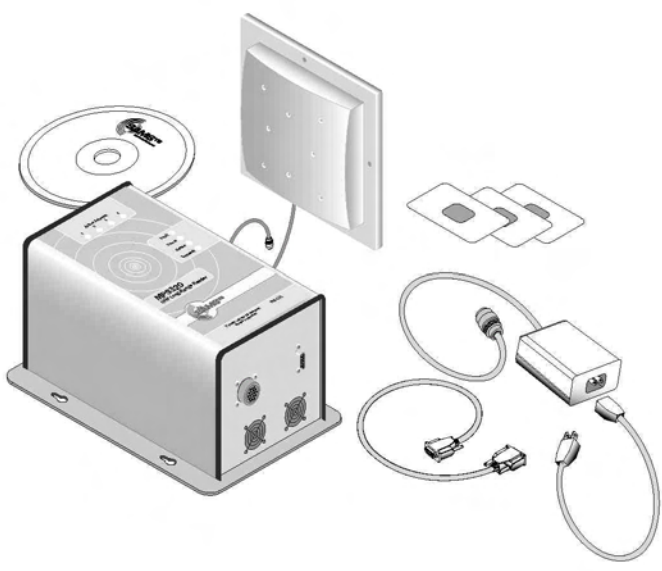

Figure 1–*MP9320 Reader and Accessories*

About the MP9320

The MP9320 is one of the most advanced UHF long-range readers in the industry. This multi-protocol device currently supports many of today's most popular UHF tags.

The MP9320 recognizes multiple protocols simultaneously during operation. With full-duplex capability, the device can read or write to any tag, depending on the tag capabilities.

The MP9320 incorporates a scalable architecture that enables the reader to be implemented as a stand-alone UHF solution or included in a networked reader environment using the SAMSys Interrogator Control and Concentrator Module (ICCM).

With its extended read range and high data rates, the MP9320 is especially suited for asset management and logistics applications requiring the simultaneous reading of a large number of tags at greater distances. Typical RFID applications supported by the MP9320 include the following:

- Warehouse Logistics
- Inventory Management
- Asset Management
- Pallet Tracking
- Parking Lot Access
- Aggregated Container Tracking
- Loading Dock Portals

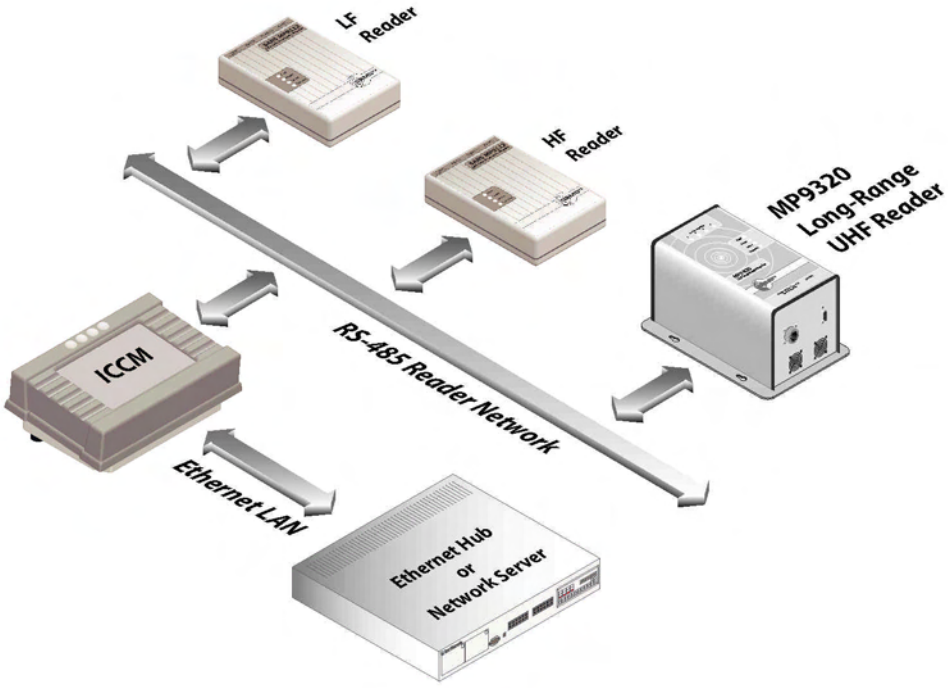

Figure 2–*SAMSys Reader Network*

In addition to the scalable, multi-protocol architecture, the MP9320 includes the following features:

- LED indicators
- (4) antenna ports
- Multiple interface connection options (RS-232, RS-485)
- Digital input and output lines
- Integrated real-time clock with battery backup (optional)
- On-board temperature sensor (optional)

Physical Description

NOTE: *The reader enclosure is designed for office, indoor warehouse, and light manufacturing areas. If a sealed reader is required for wet or hazardous environments, contact your SAMSys representative.*

The digital board contains four LED indicators to provide the operational status of the reader. The LEDs are visible on the front panel of the reader.

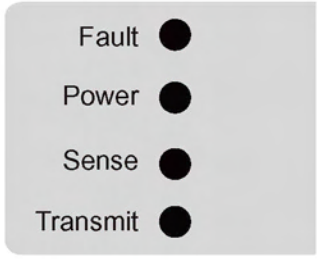

Figure 3–*MP9320 LED Status Indicators*

Indicator	Color	Description
Fault	Red	Error condition exists
Power	Green	Power is applied to the reader and processor initialization complete
Sense	Green	Reader has tag data to report.This LED also flashes when the reader software is being loaded.
Transmit	Green	Transmitter is operating and RF power is applied to one of the antennas

In addition to the operational status LEDs, four Active Antenna LEDs provide indication that RF power is being applied to one of the four antennas.

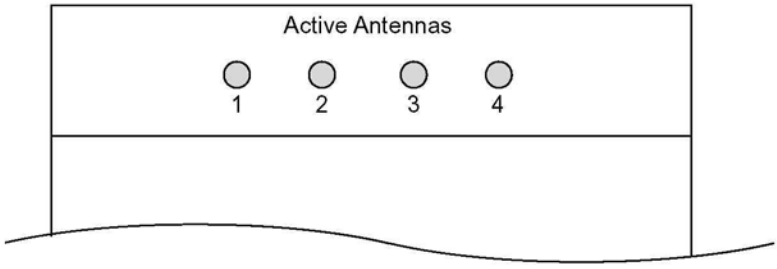

***Figure 4**–MP9320 Active Antenna LED Indicators*

Four SMA type antenna ports are provided on the end panel. The reader also has two power and communication interface connectors on the opposite end panel.

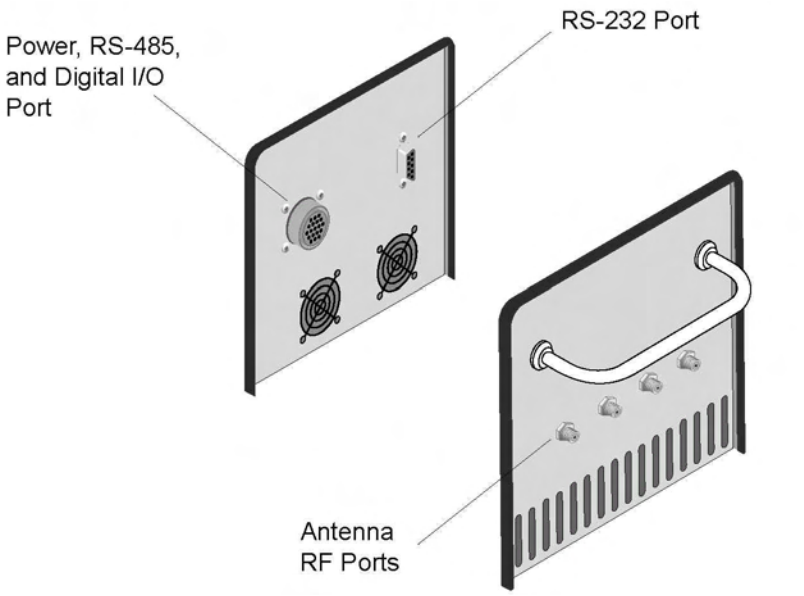

***Figure 5**–MP9320 End-Panel Connectors*

Chapter 2

Getting Started

This chapter provides information to quickly get your MP9320 up and reading tags. Topics discussed in this chapter include the following:

- Installing the SSTool application
- Configuring for single or multiple readers
- Configuring the serial port
- Connecting the reader to a terminal
- Connecting the reader to the ICCM
- Selecting the RF mode
- Activating tag protocols
- Selecting the number of antennas
- Reading Tags

Installing the SSTool Application

The SSTool is a Microsoft Windows based serial data interface application for SAMSys readers. The application allows you to easily view tag data, configure the reader, and perform other tag data functions. This application is provided on the CD shipped with your reader and can be installed on a personal computer.

To install the SSTool, refer to Chapter 1 - *Installation* in the SSTool User's Guide.

Configuring for Single or Multiple Readers

The MP9320 can be operated as a single reader solution or networked with other readers. If you are placing the reader in a networked configuration, refer to Chapter 2 - *Installation* for additional information. For network addressing, refer to the SAMSys *Interrogator Control and Concentrator Module User's Guide* for detailed information on assigning network addresses.

Configuring the Serial Port

The RS-232 port on the MP9320 is factory configured as follows:

- 9600 Baud
- 8 Data Bits
- 1 Stop Bit
- No Parity

Refer to the Reader Configuration chapter in the *Comprehensive Heuristic Unified Messaging Protocol Reference Guide* for serial port programming information.

Connecting the Reader to a Terminal

The MP9320 can be connected to a personal computer, laptop, or other serial device equipped with a terminal emulation program. Perform the following to connect the reader to a serial device.

1. Connect an RS-232 cable from the serial port on the reader to the serial port on the terminal (see Chapter 2 - *Installation*).
2. Use the SSTool to set the terminal serial port parameters to the reader default values (9600, 8, 1, none).

Connecting the Reader to the ICCM

The MP9320 can be connected to the Interrogator Control and Concentrator Module. Perform the following to connect the reader to a serial device.

1. Connect an RS-232 or RS-485 cable from the appropriate port on the reader to the serial or RS-485 port on the ICCM (see Chapter 2 - *Installation*).
2. Power up both the reader and the ICCM.
3. Follow the instructions in the *Interrogator Control and Concentrator Module User's Guide* for information on using the ICCM to view tag data from the reader.

Setting the RF Mode

The MP9320 is factory configured for continuous RF scanning or "auto-read" mode. This mode is equivalent to the **Auto Read** button on the SS Tool screen. If desired, you can reconfigure the reader for Polled RF mode (reader activates the transmit carrier and waits for host to send a read command).

With SSTool, click the **Polled Read** button.

To halt the Auto Read or Polled Read mode, press the **RF Off** button on the SSTool screen.

Activating Tag Protocols

The MP9320 is factory configured with only those protocols selected by the user. In the event that additional protocols were purchased but not activated, the Protocol Select Word (PSW) must be reconfigured. Use the SSTool to activate the protocol.

EPC 1 Protocol Selection

With the SSTool, click the **EPC1** button (version 2.0 only).

ISO 18000-6A Protocol Selection

With the SSTool, click the **ISO -6A** button.

ISO 18000-6B Protocol Selection

With the SSTool, click the **ISO -6B** button.

ISO 18000-6A and -6B Protocol Selection

With the SSTool, click the **ISO -6A & -6B** button.

SuperTag Protocol Selection (EM 4022, EM 4222, BiStar tags(optional))

With the SSTool, click the **Supertag** button.

IntelliTag Protocol Selection

With the SSTool, click the **IntelliTag** button.

Selecting the Number of Antennas

The MP9320 is factory configured to operate with one antenna connected to Port 1. However, the reader can operate with up to four (4) antennas. If additional antennas are to be installed, use the SSTool to select the number of antennas or enter the antenna selection from the command line.

With the SSTool, click the **`2 Antenna`**, **`3 Antenna`**, or **`4 Antenna`** button.

Refer to the Reader Configuration chapter in the *Comprehensive Heuristic Unified Messaging Protocol Reference Guide* for detailed programming information.

Warning

The SAMSys MP9320 UHF Reader is equipped with four (4) RF ports. To prevent reader damage, RF ports must be properly terminated with a 50 ohm load or a functional UHF RFID antenna before power up. UHF Readers are factory configured to operate on RF port 1. As a result, port 1 must be properly terminated before initially powering on the reader. Before activating any additional RF ports, they must also be properly terminated. Never power up the reader unless the loads or antennas are connected. Always power down the reader before removing an antenna or load from an RF port.

Reading tags

To beging reading tags, place a tag in front of the antenna and press the **`Auto Read`** button on the SSTool screen.

The SSTool will display the tag data.

To halt reading tag data, press the **`RF Off`** button on the SSTool screen.

Chapter 3

Installation

This chapter provides information for installing the MP9320. Topics discussed in this chapter include the following:

- Antenna Installation
- Reader Mechanical Installation
- Standalone Reader/PC Communication Setup
- Standalone Reader/PC Verification
- Standalone Reader/ICCM Communication Setup
- Standalone Reader/ICCM Verification
- Networked Reader Communication Setup
- Digital (TTL) Input/Output Setup
- Transmit Power Calibration

Antenna Installation

The MP9320 supports from one to four external antennas in a variety of configurations. One- and two-antenna configurations are typical for most conveyor and container tracking. Four-antenna configurations are used for portals and loading dock doorways.

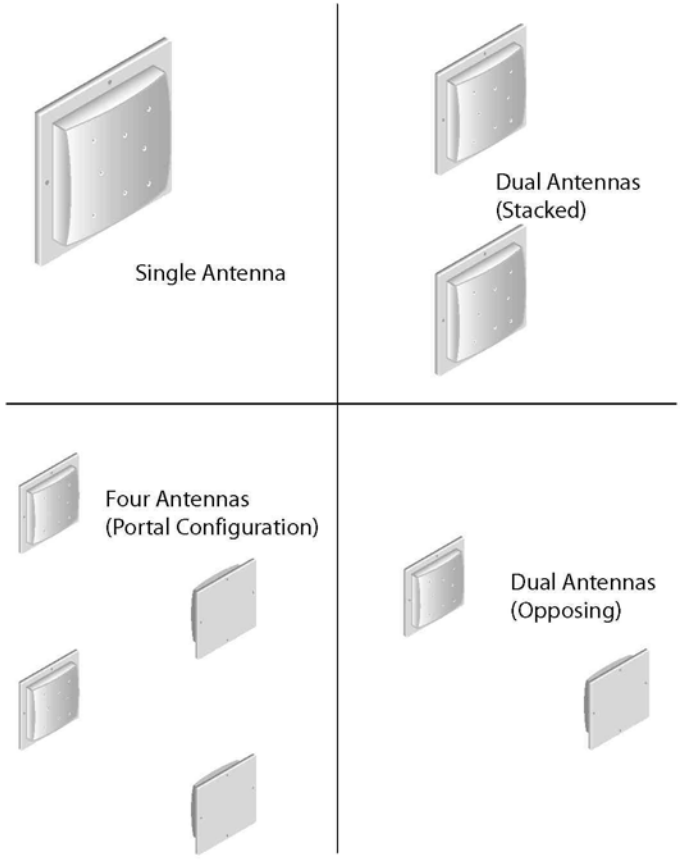

***Figure 6**–MP9320 Antenna Configurations*

Warning

The SAMSys MP9320 UHF Reader is equipped with four (4) RF ports. To prevent reader damage, RF ports must be properly terminated with a 50 ohm load or a functional UHF RFID antenna before power up. UHF Readers are factory configured to operate on RF port 1. As a result, port 1 must be properly terminated before initially powering on the reader. Before activating any additional RF ports, they must also be properly terminated. Never power up the reader unless the loads or antennas are connected. Always power down the reader before removing an antenna or load from an RF port.

Activation of these RF ports is controlled by the internal MCW and MSW registers as described in the MP9320 User's Guide, the MP9320 Field Installation Guide, and the Comprehensive Heuristic Unified Messaging Protocol (CHUMP) Reference Guide.

The MP9320 is factory calibrated for operation with the following type of antenna and cable:

Antenna Parameter	**FCC**	**ETSI**
Frequency	902-928 MHz	865-870 MHz
Polarization	Circular	Circular
Gain, dBic	9, max	6, max
VSWR, maximum	1.5:1	1.5:1

Cable Parameter	**Value**
Type	RG58C/U
Length	2 Meters
Connector	SMA type plug, reader side

It is highly recommended that the antenna mounting be adjustable in order to obtain the best performance from the system. However, the antennas must be installed on a solid surface or frame to prevent damage or later misalignment. Perform the following to install the antennas.

NOTE: *Use the existing mounting holes on the antenna flange. Drilling new holes in the flange is not recommended.*

1. Determine the location of each antenna. Ensure the antenna(s) will not be vulnerable to damage by moving inventory or equipment.
2. Use the antenna as a template and mark the mounting holes.
3. Drill and tap (if necessary) mounting holes for #10 or 1/4 inch mounting screws. For drywall mounting, use drywall anchors or toggle screws.
4. Mount each antenna and install the mounting screws. Do not overtighten the screws. Damage to the antenna case may result.
5. Route each antenna cable back to the reader location. For dual-opposing or portal configurations, route the opposing cables so they can not be damaged by equipment or personnel.
6. Secure each antenna cable with wire ties or other restraint.

Reader Mechanical Installation

The MP9320 is designed for easy installation. The following instructions provide the information to install your UHF reader.

As shown in Figure 7, the reader is designed for horizontal or vertical installation. Mounting keyholes are provided on each side of the base plate for easy, non-permanent, installation and removal.

Caution

To ensure proper cooling of the reader, verify that the fan intakes and vents are free of obstructions.

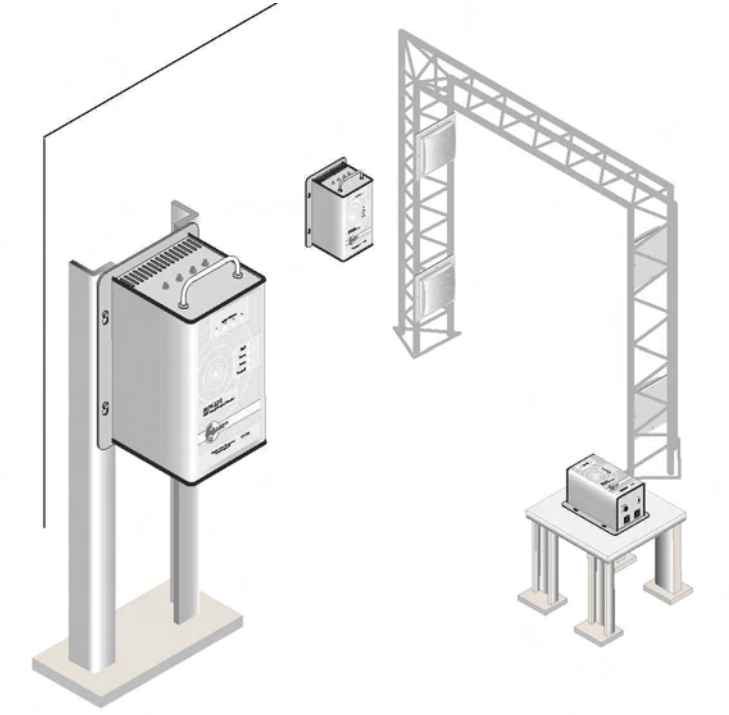

Figure 7–*MP9320 Reader Installations*

For horizontal or table table mounting, ensure the reader and all cabling is secured to the surface or frame.

SAMSys recommends that the MP9320 be mounted on a horizontal surface. However, if vertical surface installation is required, refer to the following sections for the appropriate mounting. As shown in Figure 8, keyhole slots are provided for easy installation and removal.

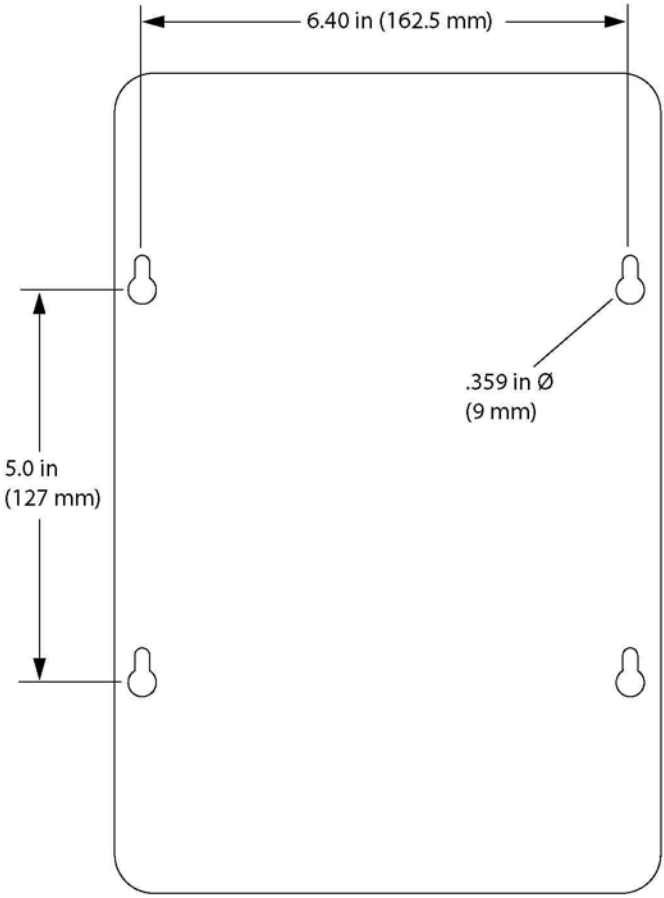

Figure 8–*MP9320 Base Plate with Mounting Keyholes*

Hollow Concrete Block Wall Mounting

To temporarily mount the MP9320 to a hollow concrete block wall, SAMSys recommends metal sleeve type concrete anchors that accept a #10 screw and flat washer. To install the MP9320 on a hollow concrete block wall, perform the following.

1. Refer to Figure 8, and mark the location of the mounting screws. Do not install the anchors into the mortar joint.
2. Drill the appropriate size hole for a metal sleeve type anchor.
3. Install the anchors.
4. Install the washers and insert the screws.
5. Tighten the screws to within .375" of the anchor.
6. Install the reader and finish tightening the screws.

Solid Concrete Wall Mounting

To temporarily mount the MP9320 to a solid concrete wall, SAMSys recommends one-piece expansion type concrete anchors that accept a #10 screw and flat washer. To install the MP9320 on a solid concrete wall, perform the following.

1. Refer to Figure 8, and mark the location of the mounting screws.
2. Drill the appropriate size hole for a expansion type anchor.
3. Install the anchors
4. Install the washers and insert the screws.
5. Tighten the screws to within .375" of the anchor.
6. Install the reader and finish tightening the screws.

Wood or Metal Wall Mounting

To temporarily mount the MP9320 to a wood or sheet metal wall, SAMSys recommends either #10 x 1 inch wood screws or #10 x 3/4 inch sheet metal screws and flat washers. To install the MP9320 on a wood or metal wall, perform the following.

1. Refer to Figure 8, and mark the location of the mounting screws.
2. Drill the appropriate size hole for screws.
3. Install the washers and insert the screws.
4. Tighten the screws to within .375" of the surface.
5. Install the reader and finish tightening the screws.

Drywall Mounting

To temporarily mount the MP9320 to drywall, SAMSys recommends either #10 toggle bolts or #10 drywall anchors.

NOTE: *There are many types of screw-in, hammer-in, and predrill drywall anchors. Each one is designed for specific applications and pull-out ratings. Ensure that the anchor you select has a pull-out rating of at least 12 lbs.*

To install the MP9320 on drywall, perform the following.

1. Refer to Figure 8, and mark the location of the mounting screws.
2. Refer to the anchor manufactureres instructions for installing the anchors.
3. Install the washers and insert the screws.
4. Tighten the screws to within .375" of the surface.
5. Install the reader and finish tightening the screws.

Standalone Reader/PC Communication Setup

The reader is equipped with a 9-pin RS-232 communication port for communication directly with a PC or other serial device. Refer to the *Specifications* chapter for information on the port.

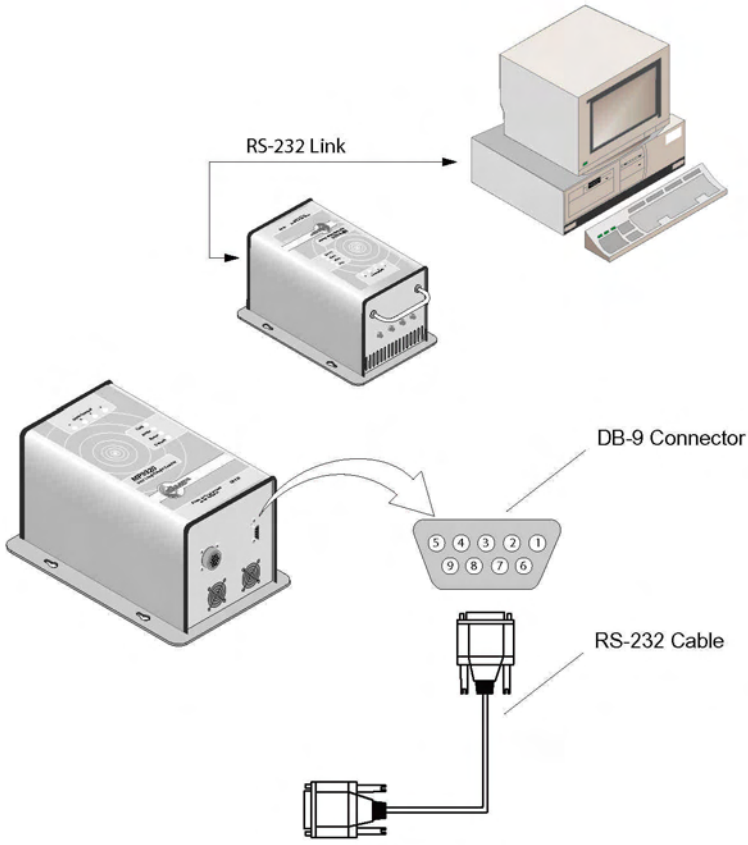

Figure 9–*MP9320 Standalone RS-232 Communication Setup*

NOTE: *A serial port adapter may be required if the device has a different connector type. For example, some PCs may have 25-pin serial connectors.*

Standalone Reader/PC Verification

Every effort has been made to ensure the MP9320 is configured to match your application. However, it is recommended that the reader configuration be verified before placing the reader into service. If the system is to be used as a local, standalone reader connected to a terminal or PC, perform the following:

1. Verify all antennas, cabling and power supplies are secure.
2. Verify the operator terminal or PC is connected to the reader and operational.
3. Launch a terminal emulation program such as HyperTerminal®.
4. Set the terminal serial port parameters to the reader default values (9600, 8, 1, none).
5. Power up the reader.
6. Introduce a test tag into the RF field.
7. Verify the tag was read correctly.
8. If the tag did not read correctly, use the Configuration Read (Cr) command to verify the reader operating mode matches the application requirements (refer to Appendix A). If necessary, use the Configuration Write (Cw) command to reconfigure the reader operating modes.

NOTE: *Refer to the Comprehensive Heuristic Unified Messaging Protocol (CHUMP) Reference Guide for detailed information on the Cr and Cw commands, reader configuration words, and other CHUMP commands.*

Standalone Reader/ICCM Communication Setup

The MP9320 can be operated as a standalone reader with the Interrogator Control and Concentrator Module (ICCM) using the RS-232 communication links. For RS-485 communication setup, efer to *Networked Reader Communication Setup* section.

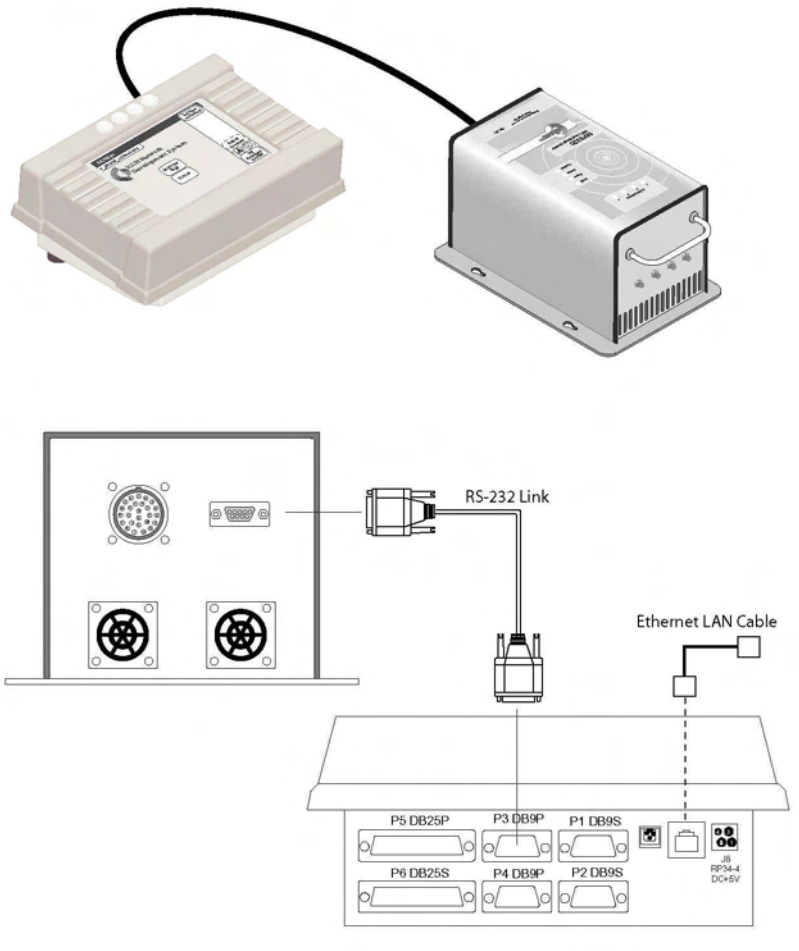

Figure 10–*MP9320 Standalone RS-232 Communication Setup*

Standalone Reader/ICCM Verification

After connecting the reader to the ICCM with the serial communication, perform the following:

1. Verify all antennas, RS-232 cabling, Ethernet LAN cabling, and power supplies are secure.
2. Power up the reader and ICCM and verify both are operational.
3. Press the status button on the ICCM display to obtain the ICCM IP address.
4. Launch your web browser and access the Web-Based Administration tool. Refer to Chapter 5 in the *Interrogator Control and Concentrator Module User's Guide* for information on using the Web Administration tool.
5. Press **`Auto-Find Readers`** on the Main Menu of the administration tool. Follow the instructions in the ICCM User's Guide to locate the reader.
6. Introduce a test tag into the RF field.
7. Click the **`Tag Inventory`** button on the Main Menu to verify the tag was read correctly.

Networked Reader Communication Setup

The MP9320 can be networked with other readers and to the SAMSys Interrogator Control and Concentrator Module (ICCM) using an RS-485 interface (see Figure 11). Refer to the *Specifications* chapter for detailed information on the RS-485, Power, and Digital I/O Port.

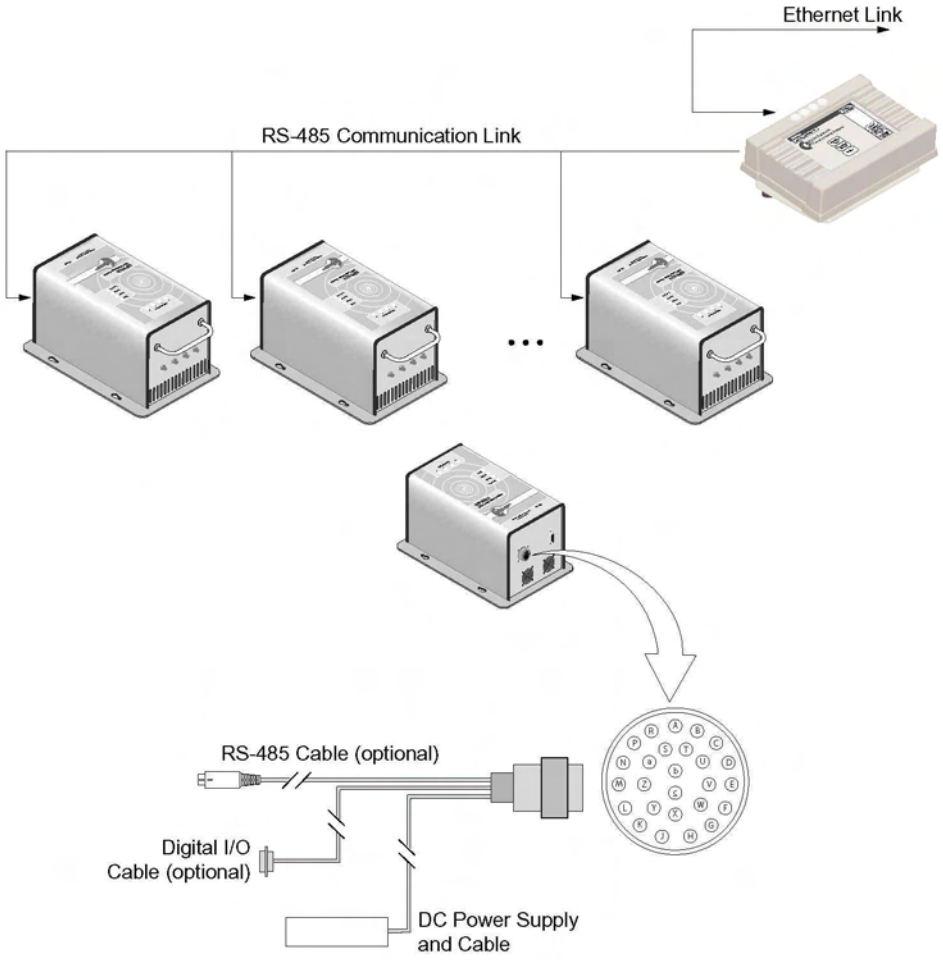

Figure 11–*MP9320 RS-485 Communication Setup*

Networked Reader Verification

Similar to standalone reader verification, networked readers should also be verified before entering service.

If the system is an RS-485 networked configuration using the ICCM, perform the following:

1. Verify all antennas, cabling and power supplies are secure.
2. Verify the ICCM is connected to the RS-485 network and operational.
3. Power up the readers.
4. Follow the instructions in the *Interrogator Control and Concentrator Module User's Guide* to **Auto-Find** all readers on the network.
5. Introduce a test tag into the RF field.
6. Verify the tag was read correctly.
7. If the tag did not read correctly, use the ICCM **Configure Readers** function to verify the reader operating mode matches the application requirements.

Digital (TTL) Input/Output Setup

The MP9320 is equipped with a digital I/O port that provides four logic-level (TTL) input signals and four output signals. Refer to the *SAMSys Forth Programming Language Reference Guide* for programming information. The digital inputs are optically isolated. The outputs are open collector.

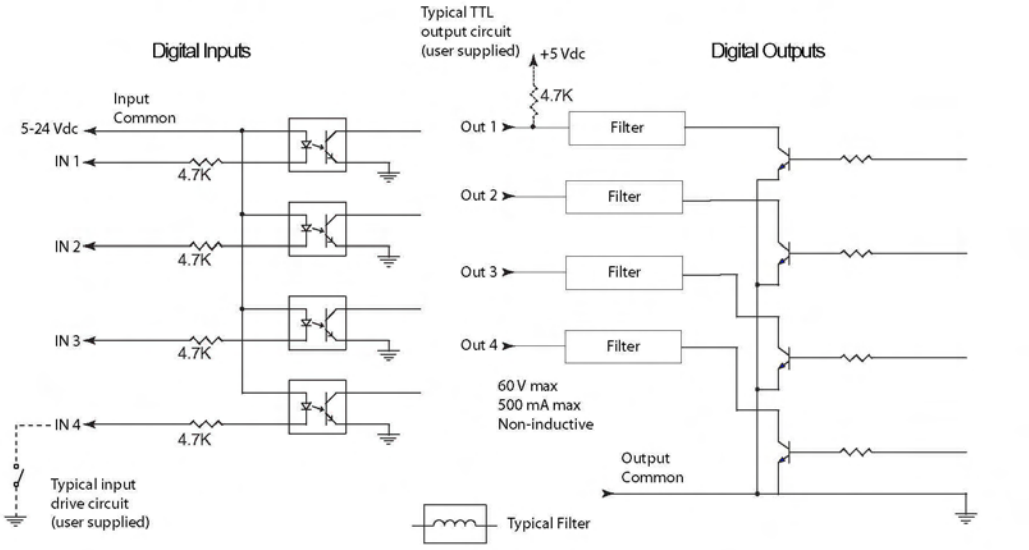

Figure 12–*Digital Input and Output Port Configuration*

Signal Name	Pin No.	Description
Input 1	a	TTL input - optically isolated
Input 2	b	TTL input - optically isolated
Input 3	U	TTL input - optically isolated
Input 4	D	TTL input - optically isolated
Digital input common	N	input commmon
Output 1	Z	TTL output - open collector
Output 2	c	TTL output - open collector
Output 3	V	TTL utput - open collector
Output 4	E	TTL output - open collector
Digital output common	M	output common

Main I/O Connector Modification

In the event that the 26-pin bayonet connector on the cable is to be modified, perform the following:

1. Remove the two screws on the strain relief bars.
2. Install the connector on the reader bulkhead connector (to hold the connector during disassembly).
3. Using pliers or similar tool, carefully loosen the knurled outer ring by turning the ring counterclockwise.
4. Slide the ring up the cable to the ferrite.
5. Slide the white plastic ring up the cable.
6. Carefully cut the heat shrink tubing on the power cable and remove.
7. Slide the rubber insulator up the cable providing access to the connector pins.
8. If adding wires, thread the wires through the knurled ring, white plastic ring, and appropriate hole in the rubber insulator.

Transmit Power Calibration

The MP9320 can be operated with a variety of commercially available antennas and coaxial cables. As a result, the output RF power of the reader must be configured to optimize the read range for a given antenna configuration, while not violating FCC or CE regulations.

Calibration of the reader transmit RF power must only be performed by SAMSys authorized installation personnel or certified resellers.

Chapter 4

Operation

This chapter provides general information to operate the MP9320. Topics discussed in this chapter include the following:

- Reader Power Up
- Reading Tags
- Operation with the ICCM

Reader Power Up

When the power supply is connected, the reader starts an internal initialization sequence. This sequence momentarily lights the LEDs as follows:

1. **Transmit** on
2. **Sense** on
3. **Power** on
4. **Fault** on
5. All four on
6. Beeper on

If the **Fault** LED illuminates during the intialization sequence, the reader has detected a software load fault. Restart the reader to clear the fault.

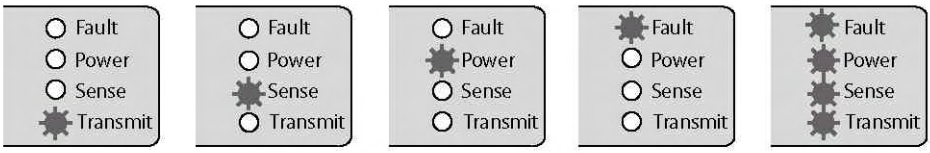

Figure 13– *LED Startup Sequence*

The reader is operational when the **Power** LED remains on.

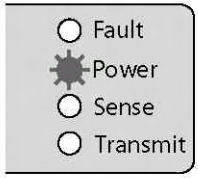

Figure 14– *Power LED On – Reader Operational*

After the startup sequence, the RF multiplexer in the MP9320, alternately provides RF power to each of the four antennas. The **Active Antenna** LEDs indicate which antenna is transmitting.

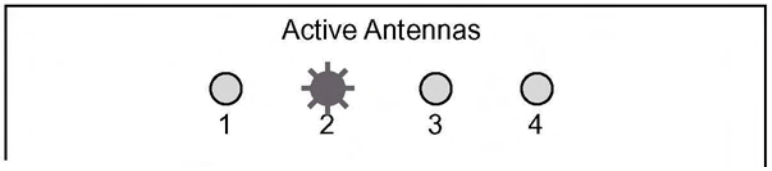

Figure 15– *Active Antenna LED Indicators - Antenna 2 Transmitting*

NOTE: *The number of antennas and the antenna transmit sequence is user configurable depending on the application. Refer to Appendix A for more information on reader configuration.*

Reading Tags

When the reader completes the intialization sequence, the reader activates the RF field and, depending on the configuration, begins transmitting read detect (Rd) commands at the specified frequency. When a tag is placed within range, the reader activates the tag and reads the data. The **Sense** LED flashes and the beeper sounds when the tag is successfully read.

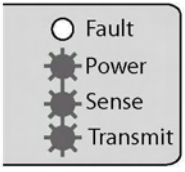

Figure 16– *LED Indicators - Tag Successfully Read*

The following example shows a typical Rd return message with ASCII tag data that was returned by the reader:

```
{Rd,d:164D7026DB,f:3C00,t:IS186A;62
```

NOTE: *The tag read beeper can be enabled or disabled depending on the application. Refer to Appendix A for more information on reader configuration.*

Operation with the ICCM

The Interrogator Control and Concentrator Module (ICCM) provides greater flexibility for accessing, configuring, and manage SAMSys readers. With the ICCM, you can access your RFID data with your own client/server applications, perform administrative functions from an easy-to-use Web interface, and remotely perform debug activities on your readers.

The ICCM also has a 1/4 VGA touch screen LCD. The LCD can be used to provide an operator interface for applications running directly on the ICCM. This allows for local access to RFID data and applications in environments where a remote application server is not available or required.

The ICCM includes an integrated 10baseT Ethernet LAN interface. You can use the Ethernet connection to establish communication between your reader and a LAN-attached application server.

Contact your SAMSys representative for more information on the ICCM product or visit the SAMSys web site at *www.samsys.com*.

Chapter 5

Troubleshooting

This chapter provides general information to troubleshoot the MP9320. Topics discussed in this chapter include the following:

- General Troubleshooting
- Contact Us

General Troubleshooting

SAMSys readers are designed, manufactured, and tested to provide many years of trouble-free service. However, in the event of a reader malfunction or failure, refer to the following troubleshooting instructions to help identify and correct the problem.

Warning - Electric Shock Hazard

The following procedures may involve AC voltage. Use extreme caution when measuring voltage or installing cables and power supplies. Serious injury or death may occur if proper precautions are not observed.

Caution - ESD

The following procedures involve electrostatic discharge sensitive components. ESD protection is required. Damage to the reader can occur if proper ESD equipment such as grounded wrist straps and ESD protected work surfaces are not used.

Symptom	Probable Cause	Corrective Action
No LEDs or buzzer during power up.	Power supply malfunction.	Ensure power supply is inserted into wall outlet. Verify correct operating voltage at outlet.
		Replace Power Supply.
	Reader software is corrupt.	Replace reader.
Reader appears to lock up.	Readers are vulnerable to high ESD pulses. As a result, the reader can lock up.	Disconnect the power from the reader and reconnect. The reader should reset. If the reader does not function normally after reset, replace the reader.
Any LED fails and buzzer alarms during power up.	Suspect LED bad.	Reader may operate normally with one or more bad LEDs, but the reader should be replaced as soon as possible.
	Reader board failure.	If reader does not read or write, replace the reader.
No buzzer on power up.	Buzzer malfunction.	Reader may operate normally without buzzer, but the reader should be replaced as soon as possible.
	Reader board failure.	If reader does not read or write, replace the reader.
	Reader software is corrupt.	Replace reader.
No buzzer when reading a tag.	Buzzer malfunction.	Reader may operate normally without buzzer, but the reader should be replaced as soon as possible.
	Reader board failure.	If the reader does not read or write, replace the reader.
	Reader software is corrupt.	Replace reader.

Symptom	Probable Cause	Corrective Action
No RS-232 Communication.	External RS-232 cable malfunction	Check cable connectors for bent or broken pins. Replace external RS-485 cable if necessary.
	Reader board failure.	Replace reader.
No RS-485 Communication.	External RS-485 cable malfunction	Check cable connectors for bent or broken pins. Replace external RS-485 cable if necessary.
	Reader board failure.	Replace reader.
No Digital I/O signals present.	Reader board failure.	Replace reader.
Tag ID/data is different from expected value.	Reader software version.	Program reader with latest software version release.
	Electromagnetic interference.	Shield or reposition reader
Tag read failure.	Read range exceeded.	Reposition reader or tag.
	Tag speed exceeded.	Slow tag when within range of reader.
	Faulty tag.	Verify reader operation with a known good tag.

Contact Us

For any questions regarding products and services, including returns, repairs, technical support, training, and all other available services, contact your distributor or SAMSys Customer Service at the following:

E-mail	support@samsys.com

Telephone	1-877-367-4342 (toll free) 8:00am-6:00pm EST, Mon-Fri
Fax	1-919-281-1551

Chapter 6

Specifications

This chapter describes the specifications for the MP9320. Information provided includes the following:

- Reader Specifications
- Environmental Specifications
- Battery Specifications
- Power Supply Specifications
- RS-232 Connector Specifications
- Main I/O Connector Specifications
- Optional Communication Cable Specifications
- Antenna Specifications
- Regulatory Standards

Reader Specifications

Frequency	865-870 MHz (25 KHz steps) 902-928 MHz (100 KHz steps) 869.525 MHz single frequency
RF Power	16 mW - 3 W
Connections	RS-232, RS-485, or Digital I/O (TTL)
Input Voltage	15 Vdc +/-5%
Input Current	3A maximum

Environmental Specifications

Operating Temperature	-4° F to 158° F (-20° C to 70° C)
Storage Temperature	-40° F to 185° F (-40° C to 85° C)
Maximum Shock	1 foot (0.3 meter) drop to any corner
Relative Humidity	5% to 95% non-condensing
Case Material	Aluminum
Case Dimensions	5.25 x 7.0 x 11.5 in (133 x 178 x 286 mm)
Weight	4 lbs (1.8 kg)

Battery Specifications

Battery Parameter	Value
Battery type	Lithium/Manganese Dioxide
Designation	ANSI/NEDA 5012LC / IEC-CR1220
Voltage	3.0 volts
Average capacity	40 mAh to 2.0 volts

Caution - Risk of Explosion

Only replace battery with a battery of the same type and designation. There is a risk of explosion if the battery is replaced with incorrect type. Dispose of old battery according to manufacturers instructions and local regulations.

Power Supply Specifications

Input Voltage	100 – 240 VAC
Input Consumption	0.3 A, 31 – 45 VA
Input Frequency	50 – 60 Hz
Output Voltage	15 VDC
Output Current	3 A

RS-232 Connector Specifications

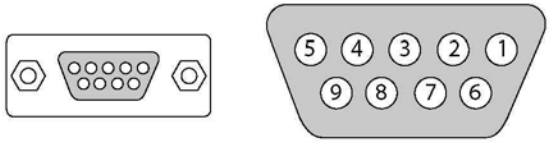

Figure 17–*RS-232 Connector*

Baud rate	9600
Parity	None
Data bits	8
Stop bits	1
Pin 1	CNVSS (Normally low. High puts reader in programming mode.)
Pin 2	TXD
Pin 3	RXD
Pin 4	DTR (shorted to pin 6)
Pin 5	GND
Pin 6	DSR (shorted to pin 4)
Pin 7	CTS
Pin 8	RST
Pin 9	+5 Vdc

Main I/O Connector Specifications

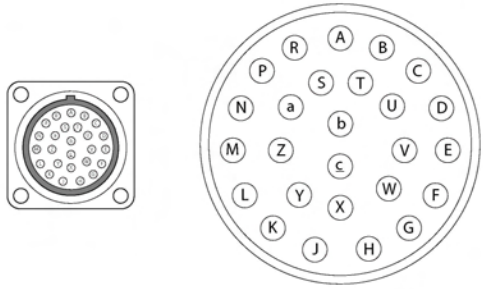

Figure 18–*Main I/O Connector*

Pin A	Spare
Pin B	Spare
Pin C	Spare
Pin D	Digital input 4
Pin E	Digital output 4
Pin F	Spare
Pin G	Ground
Pin H	Ground
Pin J	Vin (+15 Vdc)
Pin K	Vin (+15 Vdc)
Pin L	Spare
Pin M	Digital output (common)
Pin N	Digital input (common)
Pin P	Spare
Pin R	Spare
Pin S	Spare
Pin T	Spare
Pin U	Digital input 3
Pin V	Digital output 3
Pin W	RS-485 Phase A
Pin X	RS-485 Phase B
Pin Y	RS-485 Phase C (common)
Pin Z	Digital output 1
Pin a	Digital input 1
Pin b	Digital input 2
Pin c	Digital output 2

Optional Communication Cable Specifications

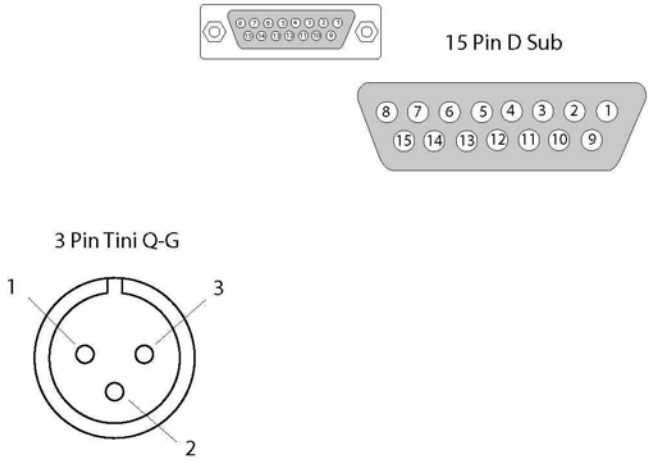

Figure 19–*Optional Communication Cable Pinouts*

15 Pin D Sub (Digital Input/Output)	
1	Input common
2	In 1
3	In 2
4	In 3
5	In 4
6	Out 1
7	Out 2
8	Out 3
9	Out 4
10	Output common
11-15	not used
3 Pin Tini Q-G (RS-485)	
1	A
2	B
3	Ground

Suitable Antenna Specifications

Antenna Parameter	FCC	ETSI
Frequency	902-928 MHz	865-870 MHz
Polarization	Circular	Circular
Gain, dBic	8, max	6, max
VSWR, maximum	1.3:1	1.3:1

Caution

This device has been designed to operate with no more than 1 Watt into the antenna and an antenna gain of no more than 9 dBic. Antenna having a higher gain is strictly prohibited per regulations of Industry Canada, unless power into the antenna is decreased to compensate for the increased antenna gain.The required antenna impedence is 50 ohms.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit an RF field in excess of Health Canada limits for the general population; consult Sagfety Code 6, obtainable from Health Canada'a website at www.hc-sc.gc.ca/rpb

Regulatory Standards

Emissions

Radiated Emissions (enclosure)	EN 55022 Class B FCC Part 15
Conducted Emissions (AC port)	EN 55022 FCC Part 15
Harmonic Distortion (AC port)	EN 61000-3-2: 1999
Voltage Fluctuation (AC port)	EN 61000-3-3
RF Spectrum	EN 300 220-1 EN 300 220-2 FCC Part 15 Canada RSS-210

Immunity

Electrostatic Discharge Immunity (all ports)	EN 61000-4-2
Radiated Immunity (enclosure)	EN 61000-4-3
Magnetic Immunity (enclosure)	EN 61000-4-8
Electrical Fast Transient Immunity (all ports)	EN 61000-4-4
Lightning Surge Immunity (all ports)	EN 61000-4-5
Conducted Immunity (all ports)	EN 61000-4-6
Voltage Dips and Short Interruptions (AC port)	EN 61000-4-11
EMC	EN 301 489-1 EN 301 489-3

Safety

Electrical Safety	EN 60950
RFID Human Safety	EN 50364

Appendix A

Reader Configuration

This appendix describes how to change or update the MP9320 configuration. For detailed information on configuration variables, refer to the *Comprehensive Heuristic Unified Messaging Protocol Reference Guide*. Information provided includes the following:

- Operating Modes
- Default Configuration
- Changing Reader Configuration
- Updating Reader Firmware

Operating Modes

SAMSys reader software is configurable for different operating modes and protocols. Use the Configuration Read (Cr) command to verify configuration parameters. Typical reader parameters include the following:

- RF communication mode (polled or continuous)
- Serial communication mode (polled or continuous)
- Multiplexer Configuration (# antennas, inventory rounds, and antenna hopping)
- Serial multidrop addressing
- Protocol configuration
- Protocol selection

For specific syntax information on the configuration variables, refer to the *Comprehensive Heuristic Unified Messaging Protocol Reference Guide*.

Default Configuration

The factory default configuration is as follows:

- General Configuration
  - RF Continuous
  - Serial Continuous
- Serial Configuration
  - 9600 Baud
  - 8 Data Bits
  - 1 Stop Bit
  - No Parity
- Multiplexer Configuration
  - 1 antenna
  - Antenna hopping enabled
  - 1 inventory round per antenna

Changing Reader Configuration

To setup a SAMSys reader, the Configuration Write (Cw) command is used to write a three-letter configuration variable name and a 32-bit word to the reader. This word contains the individual setup parameters required by the reader.

For specific syntax information on the Configuration Write command refer to Chapter 2 in the *Comprehensive Heuristic Unified Messaging Protocol Reference Guide*.

Commonly used configuration variables include the following:

- GCW – General Configuration Word
- SCW – Serial Configuration Word (CHUMP 1.31 and above)
- MCW – Multiplexer Configuration Word
- SMA – Serial Multidrop Address
- PCW – Protocol Configuration Word
- PSW – Protocol Select Word
- Pxx – Specific Protocol Configurations

The following example shows the Cw command used to write the MCW to the reader.

```
}Cw,d:MCW,b:00040200! <CRLF>

   where:

      00040200 = 4 antennas, 2 inventory
      round operations per antenna.
```

If the Cw command was successful, the reader responds with the following:

```
{A7; <FCS><CRLF>
```

Warning

Users that operate UHF readers in Polled Mode with RF always On ("Mode 4" with the lowest bits of the GCW register set to 4 Hex) should disable transmit power drift compensation. To disable transmit power drift compensation, enter the following one-time CHUMP command:

}cw,d:tpc,b:20000,f:1! (for ETSI users)

}cw,d:tpc,b:30000,f:1! (for FCC users)

If you have any questions about the use of any of the MP9320 registers or RF ports, consult your reader manuals or call SAMSys customer support at 1-919-281-1541 (Durham, North Carolina, USA).

Warning

The SAMSys MP9320 UHF Reader uses internal registers to provide a high degree of flexibility in setting operational parameters. The use of these registers is described in the MP9320 User's Guide, the MP9320 Field Installation Guide, and the Comprehensive Heuristic Unified Messaging Protocol (CHUMP) Reference Guide. However, improper setting of these registers can result in reader inoperability or permanent damage.

In particular, the TPC, TP0, TP1, TP2 and TP3 registers control the transmit power of the reader. The user should not modify these registers unless specifically directed by SAMSys personnel. Trained, professional installers should only modify them as part of the transmit calibration procedure described in the Field Installation Guide.

Updating Reader Firmware

Periodically, SAMSys releases updated reader firmware that incorporates new protocols, enhanced features, and updated FlashROM images. SAMSys readers can be automatically updated with new firmware using the Interrogator Control and Concentrator Module (ICCM).

To upgrade the reader firmware using the ICCM, verify that the ICCM is connected to the reader via the RS-232 or RS-485 communication port and that a PC or other host computer is connected to the ICCM via the RS-232 port. See Figure 20.

NOTE: *If you do not have an ICCM, contact SAMSys for additional firmware upload instructions.*

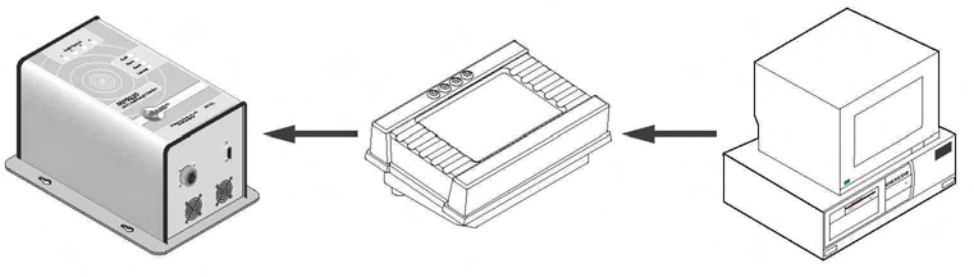

Figure 20–*Firmware Upload System Configuration*

Receiving Updated Firmware from SAMSys

Updated MP9320 reader firmware is available on CD or via download from the SAMSys website at www.samsys.com. The upgrade files include the reader application code which has a **`.mot`** extension and a FlashROM image file which has a **`.mcs`** extension.

The following files are example upgrade files for an MP9320 reader. Your files may have different names, but the extensions will be the same.

```
UHFrdr_1.30d.mot

UHFrdr_r2.mcs
```

Copy the files to a PC or other host computer connected to the ICCM.

Transferring the Files to the ICCM

Once the upgrade files are loaded to your PC, use the **Transfer Files** function on the ICCM to transfer the files to the ICCM. For detailed information on the Transfer Files function, refer to the *Interrogator Control and Concentrator Module User's Guide*.

Uploading the File to the Reader

After transferring the files to the ICCM, use the **Upload Reader Firmware** function to upload the reader application file to the reader. Use the **Upload Reader FlashROM** function to upload the Forth word definitions file to the reader. For detailed information on the Upload Reader functions, refer to the *Interrogator Control and Concentrator Module User's Guide*.

SAMSys Technologies, Inc.

Part Number: HI46932-01-OM-V3.2
Printed in U.S.A.