MP9320 UHF Long-Range Reader
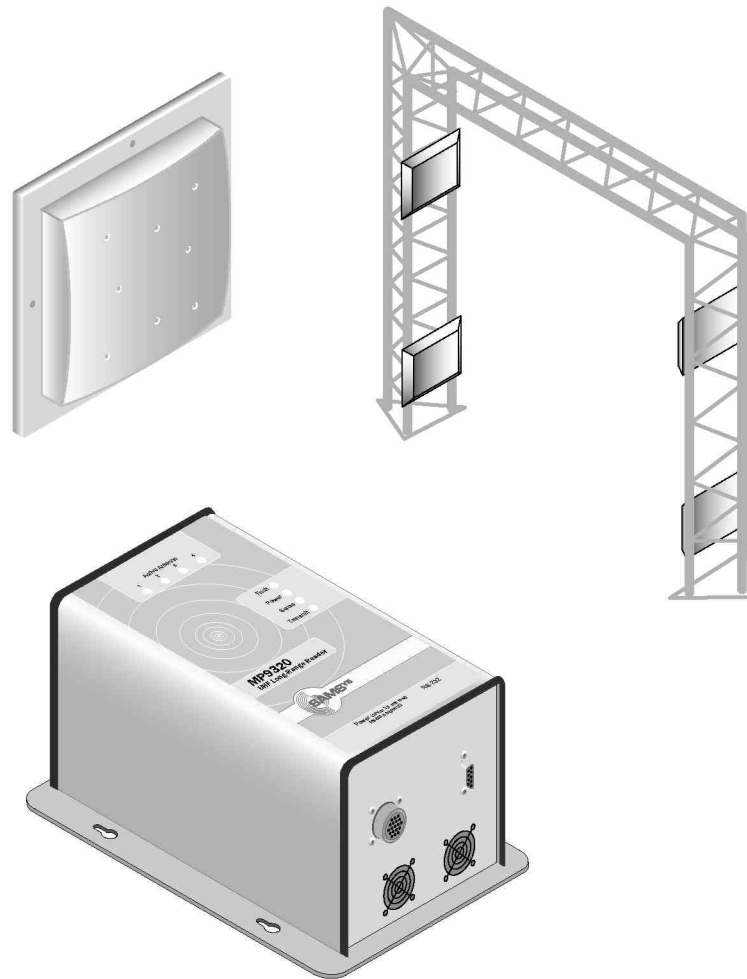
Field Installation and Setup

Technical Installation and Calibration Guide

First Edition (August 2003)

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

Version 1.0, August 2003

Contents

Introduction

This document is intended to assist technical service personnel engaged in the installation of the SAMSys MP9320 UHF Long-Range Reader. The document includes procedures for installing and configuring the reader to meet local standards and regulatory requirements. Topics and procedures presented in this document include the following:

- Antenna Installation
- Reader Mechanical Installation
- Standalone Reader Communication Setup
- Standalone Reader Verification
- Networked Reader Communication Setup
- Networked Reader Verification
- Digital Input/Output Setup
- Field Power Calibration
- Transmit Power Reduction

Assumptions

This document is intended for technical personnel who are trained and experienced with the setup and configuration of SAMSys radio frequency identification systems including readers and antennas. Failure to correctly follow the procedures in this manual may result in faulty reader operation that violated regulatory requirements.

Getting Technical Assistance

If you need assistance or have questions related to the installation or use of this product, call or email SAMSys Technologies' customer service department for support.

E-mail	support@samsys.com
Telephone	1-877-367-4342 (toll free) 8:00am-6:00pm EST, Mon-Fri
Fax	1-919-281-1551

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.

⚠ Caution

For uncontrolled environments (in the general population), the spacing between the antenna(s) and any persons must be at least 9 inches when the reader is operating at full power (4 Watts EIRP).

To eliminate the spacing restriction, reduce the reader power to 3 Watts EIRP.

Readers located in controlled access environments (occupational) have no spacing restrictions
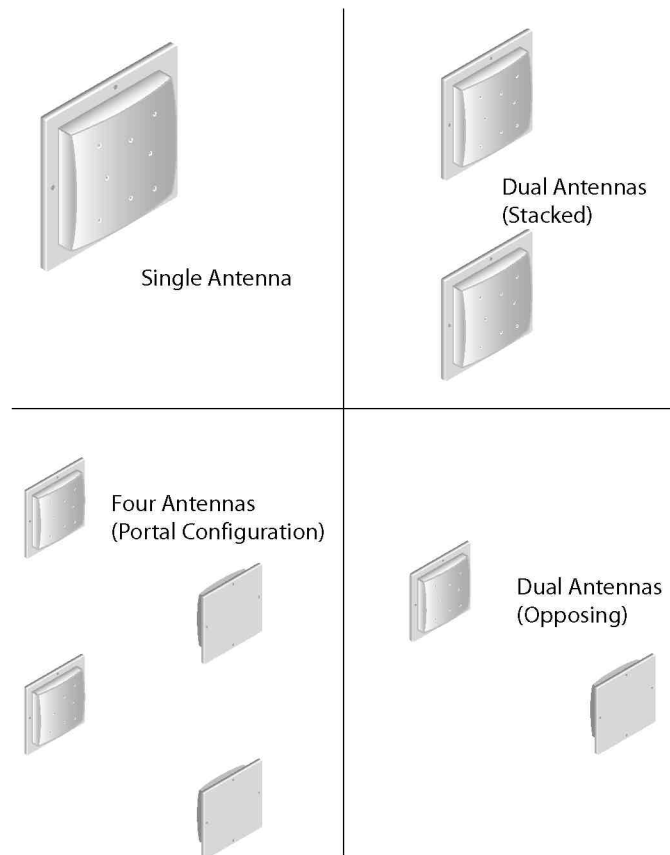

Single Antenna

Dual Antennas (Stacked)

Four Antennas (Portal Configuration)

Dual Antennas (Opposing)

Figure 1–MP9320 Antenna Configurations

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

Antenna Parameter	FCC	ETSI
Frequency	902-928 MHz	865-870 MHz
Polarization	Circular	Circular
Gain, dBic	8, max	5, max
Antenna power handling	1 W, minimum	1 W, minimum
VSWR, maximum	1.3:1	1.3:1

The following antenna cable type is suggested:

Cable Parameter	Value
Type	RG58C/U
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 2, 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.
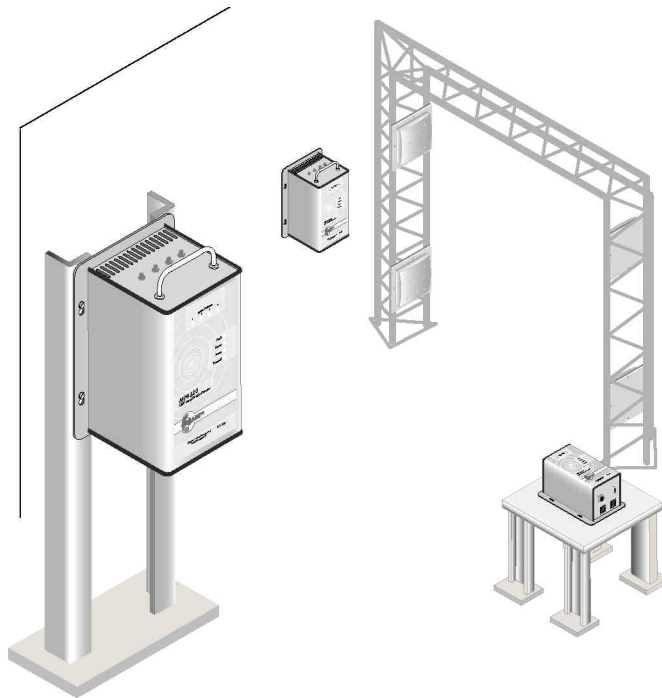

Figure 2–MP9320 Reader Installations

For horizontal or 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 3, keyhole slots are provided for easy installation and removal.
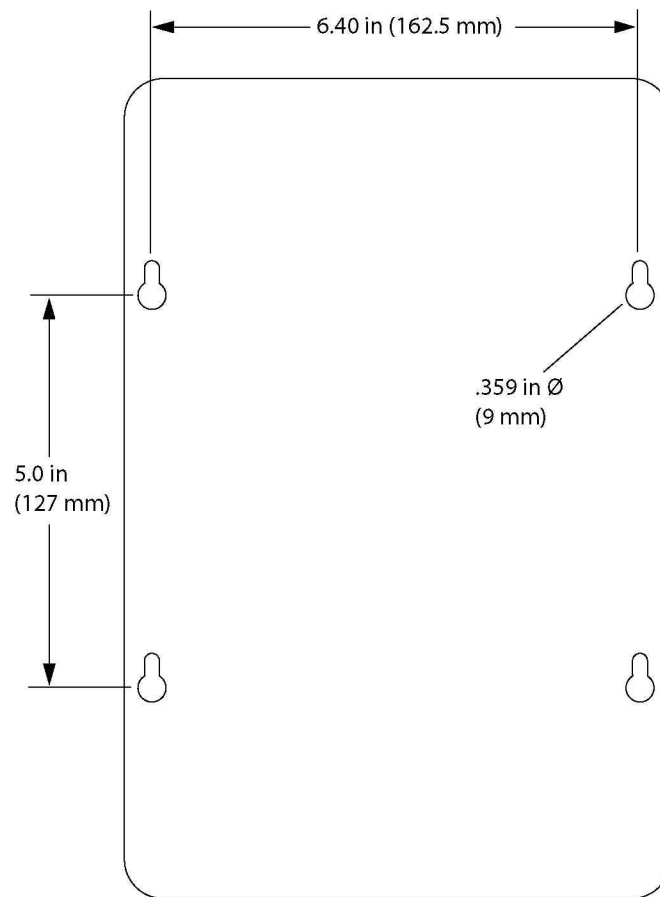
Figure 3–*MP9320 Base Plate with Mounting Keyholes*

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 3, 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 3, 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 3, 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 3, and mark the location of the mounting screws.

2. Refer to the anchor manufacturers 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 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.
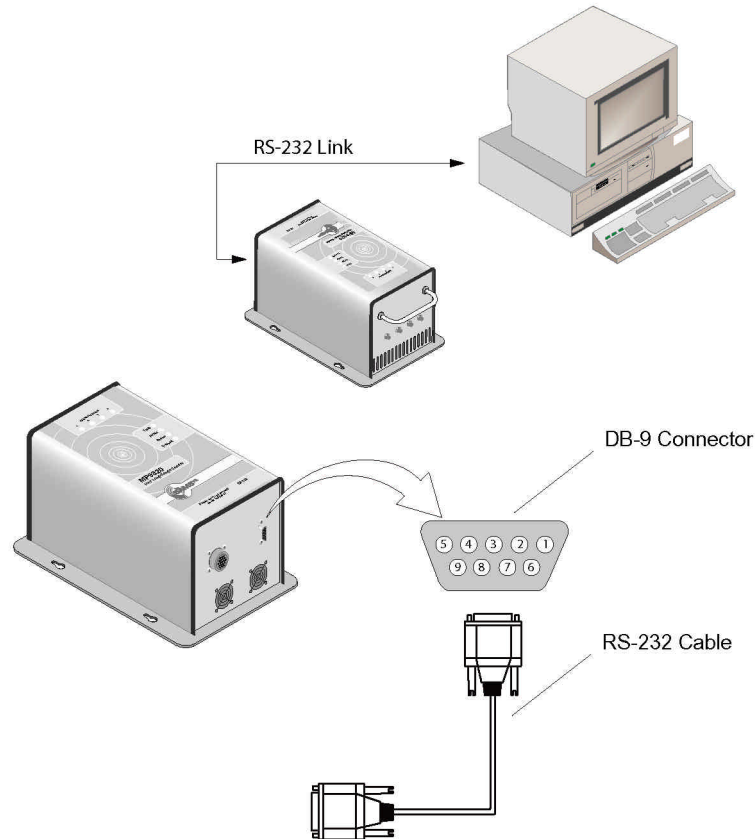

Figure 4–*MP9320 Standalone RS-232 Communication Setup*

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 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.*

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 5). Refer to the *Specifications* chapter for detailed information on the RS-485, Power, and Digital I/O Port.
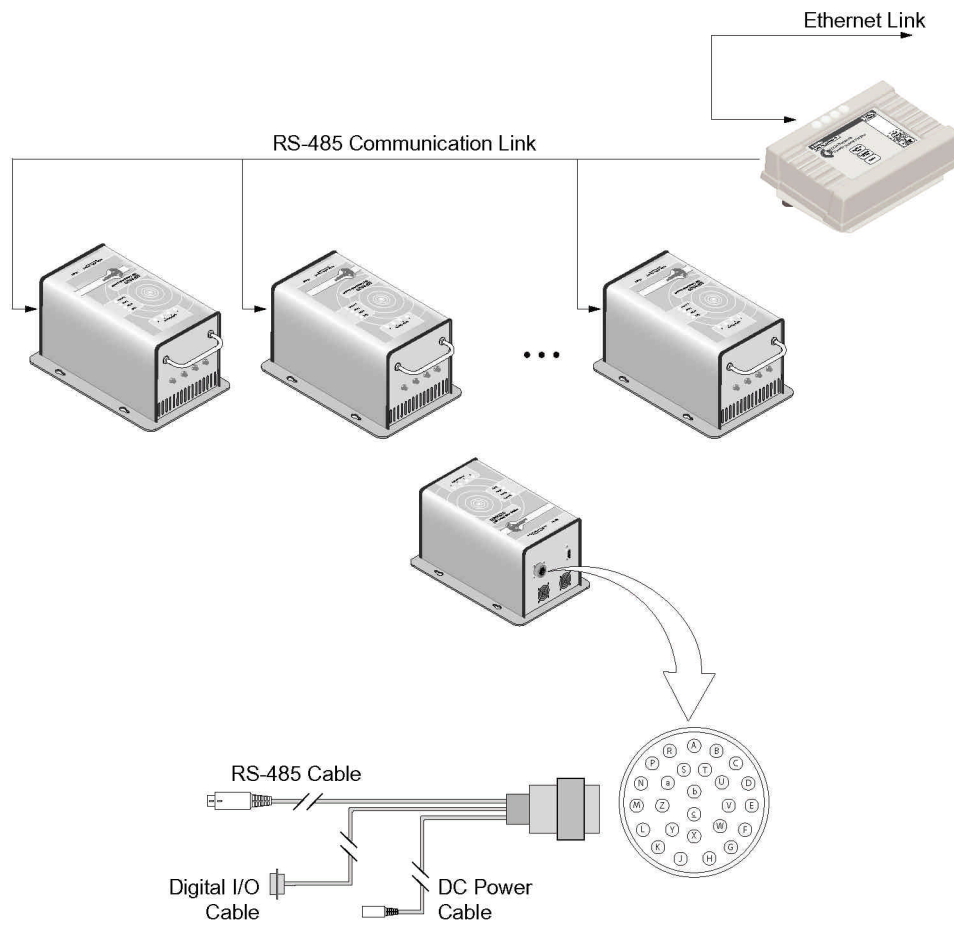

Figure 5–*MP9320 RS-485 Communication Setup*

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 input signals and four output signals. Refer to the *SAMSys Forth Programming Language Reference Guide* for programming information.

Digital I/O Overview

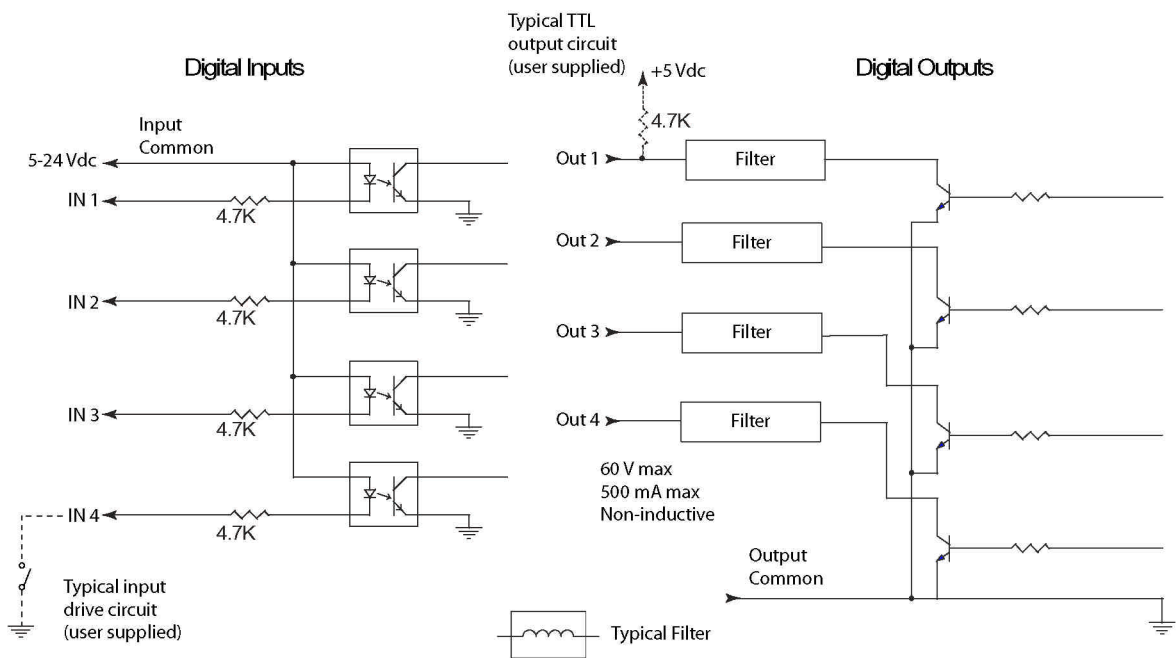As shown in Figure 6, the inputs are optically isolated. The outputs are open collector.

Figure 6–*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 common
Output 1	Z	TTL output - open collector
Output 2	c	TTL output - open collector
Output 3	V	TTL output - open collector
Output 4	E	TTL output - open collector
Digital output common	M	output common

Setting Digital Input for Reader Duty Cycle Control

MP9320 readers with software version 1.33.04 or later can be configured for limited duty cycle (trigger enabled RF output) by setting one of the digital inputs. This functionality can be enabled to meet regulatory requirements or to set the reader to respond to external events.

In order for the reader to recognize the external event, the Protocol Control Word (PCW) must be configured. Perform the following to setup the reader for external trigger:

1. Place the reader into one of the following automatic modes:

    - Field Off between reads: `}Cw,d:GCW,b:03,f:01!`
    - Field On between reads: `}Cw,d:GCW,b:03,f:01!`

2. Set PCW bit 13 (mask 0x2000). Typically, the PCW is set to 0x100 to enable the tag activity buzzer. As a result, a typical setup command is as follows:

    `}Cw,d:PCW,b:2100,f:01!`

3. The reader should now be in limited duty cycle mode.

4. Apply +5-24 Vdc to Digital Input Common pin "N".

5. To trigger a read, apply 0 Vdc to digital input 1. As shown in the previous table and in Figure 7, digital input 1 is pin "a" on the Main I/O connector.
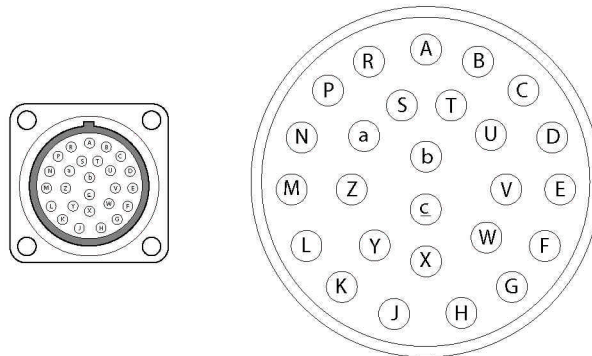

Figure 7–Main I/O Connector

6. At this point, the reader should only radiate RF energy when digital input 1 is pulled low (0 Vdc). Otherwise, the reader's RF field shuts down.

7. For more information on reader configuration and control settings, refer to the *Comprehensive Heuristic Unified Messaging Protocol Reference Guide*.

Field 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.

For readers with software version 1.3.1.pR1 or later, Field Power Calibration automatically sets the MP9320 to the FCC or ETSI legal power limit. For FCC, power is adjusted to 1 Watt maximum at the end of the coax cable or 4 Watt EIRP out of the antenna, whichever is less. For ETSI, power is adjusted to 1/2 Watt ERP out of the antenna (800 mW EIRP).

1. Build up system with cables and antennas in final configuration.

2. Disconnect antennas at the end of the cables. The unit compensates for cable losses.

3. Set the unit to FCC or ETSI by setting the TPC configuration word as follows:

   For FCC: TPC=10000, use the following CHUMP command:
   `}cw,d:TPC,b:10000,F:1!`

   For ETSI: TPC=0, use the following CHUMP command:
   `}cw,d:TPC,b:0,F:1!`

4. Set each RF port configuration word (TPx, where x = 0, 1, 2, 3) for antenna gain (dBi) and antenna polarization (linear or circular).   If a port is not used, set g = F HEX. Antenna polarization and gain settings are as follows:

   Circular Antenna: TPx = 300g0000

   Linear Antenna: TPx = 310g0000

   where g = dB antenna gain in HEX (range = 0x0 - 0xf). Use gain in dBi for linear polarized antennas and gain in dBic for circular polarized antennas.

5. For example, if you have the following configuration:
   - 6 dBic circular antenna on port 1
   - 10 dBi linear antenna on port 2
   - Ports 3 and 4 not used

   Use the following CHUMP commands to set each port:

   `}cw,d:TP0,b:30060000,F:1!`

   `}cw,d:TP1,b:310A0000,F:1!`

   `}cw,d:TP2,b:300F0000,F:1!`

   `}cw,d:TP3,b:300F0000,F:1!`

6. Run the forth command XMITCAL as follows (enter each line in the same way that previous CHUMP commands were entered):

   ```
   }cf!

   xmitcal

   quit
   ```

7. Connect an RF power meter to the antenna cable to verify power output is correct and record the power out.

8. Reconnect the antennas. The unit is calibrated for ETSI or FCC.

   • For FCC, power has been adjusted to 1 Watt max at the end of the cable or 4 Watt EIRP out of the antenna whichever is less.

   • For ETSI, power has been adjusted to 1/2 Watt ERP out of the antenna (800 mW EIRP).

Transmit Power Reduction

To automatically set the Reader to a transmit power level less than FCC or ETSI maximum, follow the previous steps, but increase the "g" value in the TPx by the amount of power reduction.

For example, if the antenna gain is 6 dBi, and it is desired to run at 3 dB below regulatory maximums, use a "g" of 9.