Ruggedized Reader
User's Manual

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Contents

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Section 1. Introduction

This *Ruggedized Reader User's Manual*, designed for end-users of a Matrics Radio Frequency Identification (RFID) System, describes the Matrics Ruggedized Reader (PN: RDR-RUG-100) and how to use it.

Document Conventions

The following conventions are used in this *User's Manual*:

CONVENTION	DESCRIPTION
1. Numbered list	Provides step-by-step procedures for performing an action
• Bulleted list	Provides grouped information, not procedural steps

Acronyms and Abbreviations

The following acronyms and abbreviations are used in this *User's Manual*:

ACRONYM	DEFINITION
IC	Integrated Circuit
MVM	Matrics Visibility Manager
OOK	On Off Keyed
RFID	Radio Frequency Identification
TBD	To Be Determined

References

For additional information, refer to the following documentation:

- *Reader Station User's Manual* (DCN: MNI03H002)
- *Clamp Truck Application User's Manual* (DCN: MNI03H003)
- *Reader Station Application User's Manual* (DCN: MNI03H004)

Disclaimer

While Matrics has committed its best efforts to providing accurate information and timely updates to this *User's Manual*, we assume no responsibility for any inaccuracies that may be contained herein, and we reserve the right to make changes to this *User's Manual* without notice.

Section 2. System Description

Matrics develops and markets RFID solutions that are effective and affordable by offering a combination of low cost, long read range, and a very high read rate unmatched by other RFID systems. A Matrics RFID System gives you real-time, end-to-end visibility of products and assets in your factory, distribution center, retail outlet, or other facility. A typical Matrics RFID system consists of three main components:

- Silicon-based **RFID tags** that can be attached to vehicles, trailers, containers, pallets, paper rolls, boxes, etc., to create a "people-free" wireless environment for tracking assets,
- **Reader network components** (reader stations, readers, antennas, cables, connectors, power supplies, etc.) that power and communicate with the tags, and
- The **Matrics Visibility Manager (MVM)** software that runs on your choice of host computer and collects tag data automatically.

Product Description

The **Ruggedized Reader** (PN: RDR-RUG-100) is an industrial strength UHF RFID Reader designed for the International Paper warehouse tracking system. The outer enclosure of the Ruggedized Reader is made of EMI/RFI watertight die-cast aluminum material, coated with a beige-colored, textured polyester powder paint. The enclosure meets standards (NEMA 4X, IP66, DIN 40050) for degree of protection, and is CSA certified (Type 4) for use with industrial control equipment.

The Ruggedized Reader offers superior and robust read range capabilities, anti-collision features, and very high data read rates unmatched by other systems. It provides all of the RF and control functions required to power and communicate with Matrics passive RFID tags. It sends digital data to the tag (through one antenna at any given time) on a pulse width modulated On Off Keyed (OOK) transmitter signal, demodulates the identification signal received from the tag, and then sends the data to your host computer.

The Matrics Reader network is structured to allow for flexibility in system configurations and in the arrangement of read points to optimize coverage at a low overall cost. Providing 12 physical antenna connections, the Ruggedized Reader allows up to 20 varying antenna combinations (depending on your application) attached directly to a single Reader.

The Ruggedized Reader is designed for use in two different applications:

- Clamp Truck – mounted on Taylor and/or Hyster clamp trucks, and
- Reader Station – mounted overhead in a portal configuration.

In the Clamp Truck application, the Ruggedized Reader is powered by a 48VDC power supply from Matrics mounted on the clamp truck, with on-board power filtering and regulation to accommodate gas and electric lift devices and associated noise/voltage variation. Refer to the *Clamp Truck Application User's Manual* (DCN: MNI03H003) for more information about this application.

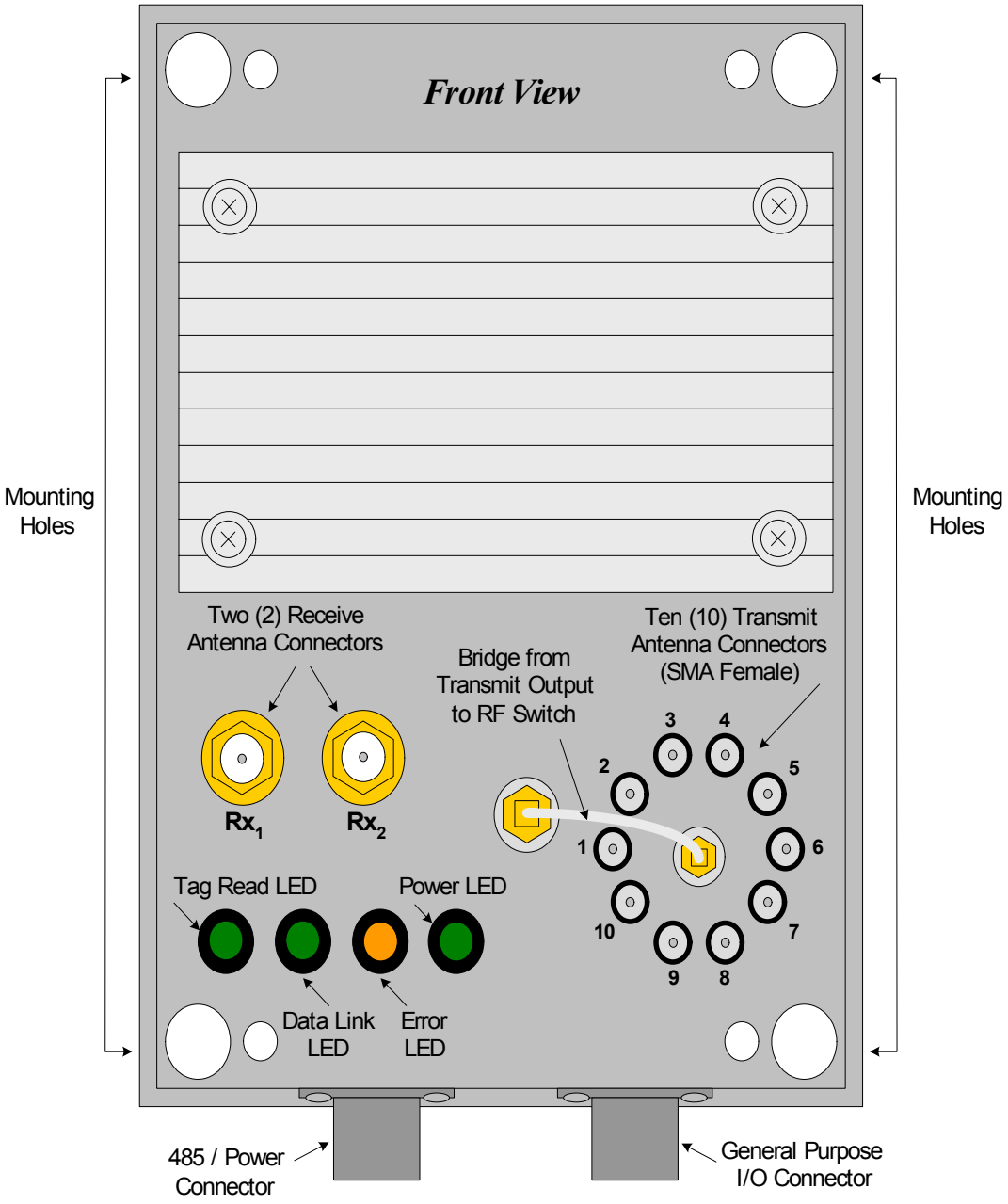
In the Reader Station application, the Ruggedized Reader is powered through the Reader Station from Matrics (PN: RDR-STA-100). Refer to the *Reader Station User's Manual* (DCN: MNI03H002) for more information about the Reader Station. Refer to the *Reader Station Application User's Manual* (DCN: MNI03H004) for more information about this application.

Section 3. Specifications and Diagrams

Ruggedized Reader Specification

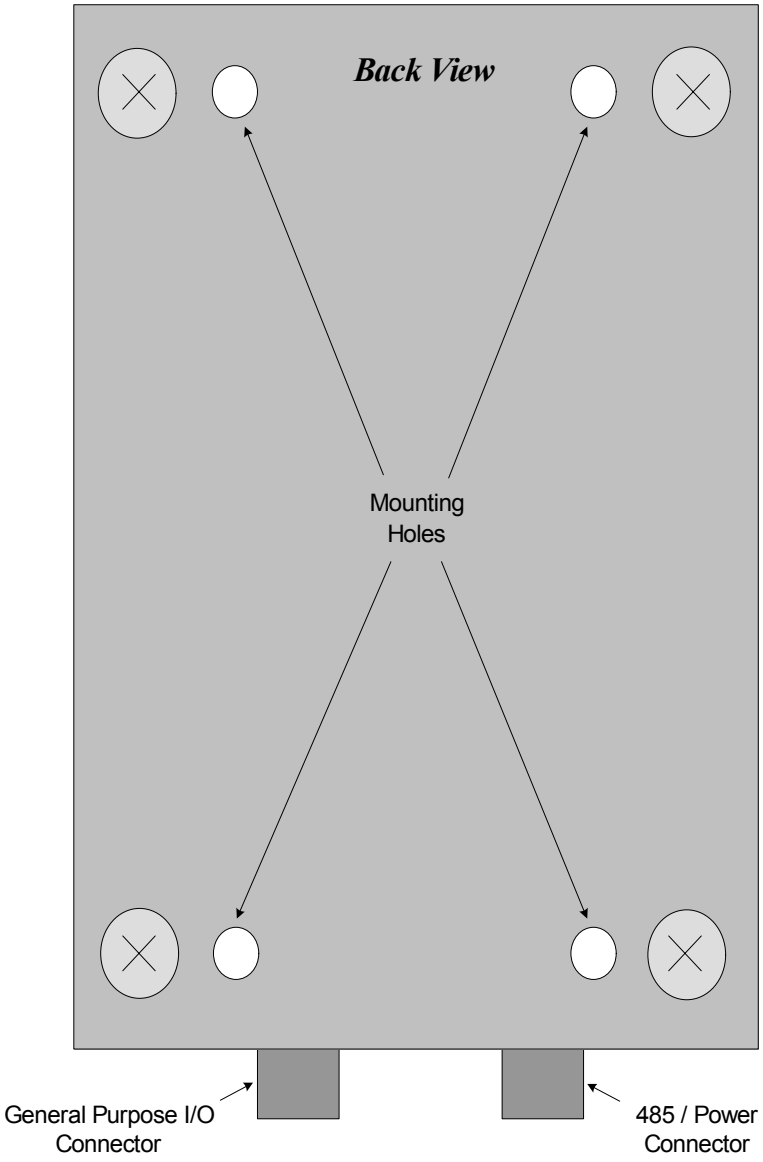
CHARACTERISTIC	DESCRIPTION
Name/Part Number	Ruggedized Reader (PN: RDR-RUG-100)
Operating Frequency	UHF band, FCC Part 90 (909.75-921.75 MHz), 911.75 center frequency; FCC Part 15 Class A Digital Device
Channels (RF Ports)	12 (10 Transmit and 2 Receive)
Power Supply	48VDC
Power Consumption	48V up to 5 amps (max.)
Simultaneous Reading Capability	500 tags per second or more
Memory Search	< 0.5 sec. (for specific tag ID)
Dimensions	11” long x 6.5” wide x 3” deep (including connectors and bridge)
Temperature	Operational: -10° to +50° C Storage: -20° to +85° C
Safety	EMI/RF Emissions
Seal	Water tight, hermetically sealed (with a UL approved compound) against windblown dust and rain
Vibration	Withstands sinusoidal vibration to the following specifications: o IEC 68-2-6/MIL-STD-810E, Method 514.4 o 10-55 Hz/0.15mm (~.03-.91g) o 55-500 Hz/2.0g (~.32-.004mm)
Shock	Withstands shock to the following specifications: o IEC 68-2-27/MIL-STD-810E, Method 516.4 o 50g, 11ms, half sine wave
Host Communications	RS422/485
Input/Output	12 dual coax antenna SMA connectors, 1 RS485/Power connector, 1 general purpose I/O connector (2 input and 1 output pair)
RS422/485 Pin Assignments (host communications)	Pin A: Rx+ Data Pin B: Rx- Data Pin C: Tx- Data Pin D: Tx+ Data Pin E: 48V- Pin F: 48V+
I/O Connector Pin Assignments	Pin A: Input 1+ (opto-isolated) Pin B: Input 1- (opto-isolated) Pin C: Input 0+ (passive switch) Pin D: Input 0- (passive switch) Pin E: Output 1 emitter Pin F: Output 1 collector

Ruggedized Reader Diagram – Front View



11" long (includes connectors) x 6.5" wide
x 3" deep (includes bridge)

Ruggedized Reader Diagram – Back View



LEDs

ITEM	DESCRIPTION
Power LED	Green LED is lit when the Reader is powered on and receiving power.
Data Link LED	Green LED flashes as it communicates, and indicates a good link.
Error LED	Amber LED is lit to indicate a bad link, or a communications error.
Tag Read LED	Green LED flashes to indicate tag reads.

Section 4. Installation

The instructions provided in this section describe a generic installation of the Ruggedized Reader. For installation instructions specific to a Clamp Truck application, refer to the *Clamp Truck Application User's Manual* (DCN: MNI03H003) for more information. For installation instructions specific to a Reader Station application, refer to the *Reader Station Application User's Manual* (DCN: MNI03H004) for more information.

Getting Started

Follow the steps listed below (and detailed in the following sections) to install your Ruggedized Reader:

1. Mount the Reader in a location chosen for optimal surveillance.
2. Connect antenna(s) to the Ruggedized Reader.
3. Connect the Ruggedized Reader to your host computer.
4. Power on the Ruggedized Reader.

Mount the Ruggedized Reader

Before mounting the Ruggedized Reader, you must select a location for it. For best results, consider the following when determining the optimal placement for your antennas and Ruggedized Reader:

- Make sure that you follow the FCC guidelines for antenna placement. Antennas should be at least 45 centimeters from trained personnel and 100 centimeters from all other persons.
- Mount the Ruggedized Reader as close as possible to your antennas in order to minimize cable lengths.

> **CAUTION:** If the Ruggedized Reader is not installed properly, it could be damaged and your system performance diminished.

To mount the Ruggedized Reader:

1. Position the Ruggedized Reader (PN: RDR-RUG-100) at the desired mounting position on the wall, shelf, portal structure, or clamp truck, etc..

2. Using the pre-drilled holes at the corners of the Reader, slide through four (4) 10-32 screws for mounting the Ruggedized Reader.

3. Securely affix the Ruggedized Reader to the selected location using the four (4) 10-32 screws with lock washers and bolts.

Connect Antenna(s) to the Ruggedized Reader

Attach your antenna(s) to the Ruggedized Reader in order (1, 2, 3, 5, 6, 7, 8, Rx_1, and then Rx_2), and remove them in reverse order.

1. Attach the straight SMA end of the antenna connector cables to the SMA connector on the back of the antennas.

> **NOTE:** Make sure that the straight SMA end of the cables connect to the antennas, and the right angle SMA end of the cables connect to the Ruggedized Reader.

2. Attach the right angle SMA end of the antenna connector cables to the corresponding connectors on the Reader.

3. Use an SMA wrench to carefully tighten the cable connection.

> **CAUTION:** Do not over-tighten the cable connection, because you may damage the connectors.

4. Secure your cables using wire ties (do not bend the cables.)

> **WARNING:** Do not disconnect antenna cables when actively reading tags (if the LED is lit on the Reader, don't disconnect the antenna cables.) You could severely damage your Reader. Make sure that you unplug the power supply (or power off the clamp truck) to power off the system first before disconnecting cables.

Connect the Reader to a Host Computer

The steps you must follow to interface the Ruggedized Reader with your system depend upon the software package you choose to use. Contact Matrics for more information.

Power On (and Off) the Reader

In the Clamp Truck application, the Ruggedized Reader is powered by a 48VDC power supply from Matrics mounted on the clamp truck, with on-board power filtering and regulation to accommodate gas and electric lift devices and associated noise/voltage variation. Refer to the *Clamp Truck Application User's Manual* (DCN: MNI03H003) for more information about this application.

In the Reader Station application, the Ruggedized Reader is powered through the Reader Station from Matrics (PN: RDR-STA-100). Refer to the *Reader Station User's Manual* (DCN: MNI03H002) for more information about the Reader Station. Refer to the *Reader Station Application User's Manual* (DCN: MNI03H004) for more information about this application.

Section 5. Cautions, Notes, and Approvals

- Federal Communications Commission (FCC), Part 15, Digital Device

Note: This equipment has been tested and found to comply with the limits for a Class A 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 *User's Manual*, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his or her own expense.

No Modifications: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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

> **WARNING:** This device must be installed in a location that is not accessible to the general public. Install the device so that the antenna is at least one (1) meter from unsuspecting personnel. Failure to install this device as described will result in a failure to comply with FCC rules for RF exposure and is discouraged.

Disclaimer: Operation of any radio transmitting equipment, including this product, may interfere with the functionality of inadequately protected medical devices. Consult a physician or the manufacturer of the medical device if you have any questions. Other electronic equipment may also be subject to interference.

Radio Station Licensing: In the United States, operation of this device by entities other than the federal government agencies requires a radio station license issued by the FCC under Part 90 of its Rules. Operation by federal agencies is subject to licensing by the National Telecommunications and Information Administration. Operation in other countries is subject to national regulation.

Radio Frequency Emissions Exposure: This device must be installed in licensed stations in such a manner that the maximum permissible exposure (MPE) limits set forth in § 1.1310 of the FCC Rules are met for both occupational/controlled exposure and for general population/uncontrolled exposure. The maximum duty cycle for this device shall not exceed 37% if operated in a manner consistent with this manual. The combination of output power and antenna gain shall not exceed an effective radiated power of 30 watts. All qualified end-users of this device must control their exposure conditions and/or duration to comply with the occupational/controlled MPE limit and requirements. Users must be provided with training information, antenna installation instructions, and transmitter operating conditions, including antenna co-location requirements of §1.1307(b)(3) for satisfying RF exposure compliance. The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 45 cm from trained authorized operators and 100 cm from all other persons. Never touch an antenna that is transmitting or come closer to an active antenna than the distances specified in this paragraph. A qualified technician should perform all repairs.

Section 6. Warranties and Returns

Limited Warranty

Matrics warrants its products to International Paper to be free of defects in workmanship and material for a period of one (1) year from date of receipt. Matrics' sole and complete responsibility under this warranty is expressly limited to repair or replacement of the defective product.

Replacement products may be new or reconditioned. All products that are replaced shall become the property of Matrics The warranty for replacement products is the same as the equivalent newly purchased product.

Any tampering or modification to the product, or subjecting of product to abnormal electrical, mechanical, or environmental abuse will void this product warranty.

Return Material Authorization (RMA)

You must obtain a return material authorization (RMA) number from Matrics Customer Service (refer to the "Contact Us" section in this *User's Manual*) before you return any parts for repair or replacement. This RMA number must be clearly marked on the outside of the returned package, and referenced in any correspondence contained within the package.

> **NOTE:** If you return parts to Matrics without a RMA number, they may be returned to you at your own expense.

Before you call Matrics to receive a RMA number, make sure that you have the following information available for the Customer Service technician:

- ☑ A description of the returning item.
- ☑ Serial numbers (if applicable.)
- ☑ A description of the fault or failure. (Example: The antenna cable appears to have been pulled out of the antenna, and the system is not functioning.)
- ☑ Fault or Error message (if applicable.)

Section 7. Troubleshooting

In the event that you encounter a problem with your system, refer to the following table for possible solutions:

PROBLEM	POSSIBLE CAUSE	SOLUTION
TBD		
TBD		
TBD		

Section 8. Contact Us

For sales, service, and technical assistance, contact Matrics at:

Tel: 410.872.0300
Monday-Friday 8:30 a.m. – 5:00 p.m. EST
Fax: 410.872.0700

http://www.matrics.com/

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