User Guide - Edge-60R V2

Rev.1
Readers with firmware version:
Controller: 2.0.0 and later
RFID: 1.15.1.1D and later

AcuraGlobal®
The Identification Company

Edge-60R V2

User Guide

Revision 1

August 14, 2014

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Regulation Information

The reader Edge-60R V2 has been tested and found to comply with the limits of a Class II Radio Frequency Identification System, pursuant to Anatel #242 Resolution.

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ACURA Global, headquartered in Brazil, is a pioneer in the market of Radio Frequency Identification (RFID). Since the early 90s ACURA has successfully implemented RFID technology in large scale applications. ACURA's RFID systems have many applications in the commercial, utility and industrial sectors of the economy. Our applications include mining to steel production, agriculture to food processing, logistics to retailing, transports to distribution chain and access control to active management. ACURA RFID Systems is very agile, promoting new technologies and innovation, with a businesslike focus on the viability of R&D projects.

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1. Introduction

This document refers to the Edge-60R V2 reader and PCI Interface (150514).

The **Edge-60R V2** is a multi-protocol, multi-regional Radio Frequency Identification (RFID) System that operates in the 860 – 960 MHz UHF band. This high performance, integrated reader is designed for outdoor applications including tolling, asset tracking, portals, loading dock doors, and parking and Access control. Driven by ThingMagic's powerful Mercury6e UHF RFID reader module, the Edge-60R V2 reader has an excellent performance and support an external antenna connection besides the high gain integrated antenna. It has two communication interface, Ethernet 10/100Mbps and Serial Isolated RS-485 Full Duplex.

The **PCI Interface (150514)** is a Printed Circuit Board (PCB) built to make the connections between the reader and PC easy as possible and provides the option of an Isolated RS-232 serial communication, eliminating the need of converters.

For software development the Edge-60R V2 reader is compatible with the ThingMagic Mercury API v.1.23.0 and later, which is available for several different programming languages, is written in Java, C, and C#. The Mercury API v.1.23.0 and later is available for download from rfid.thingmagic.com/devkit

1.1 Intended audience

This document is intended for professional installers setting up and installing the Edge-60R V2 reader and PCI Interface (150514). Before attempting to install, configure, and operate this product, you should be familiar with the following:

- ✓ Device communication parameters including Ethernet and Serial communications;
- ✓ Basic digital input/output control;
- ✓ RFID reader configuration including antenna placement;

1.2 What's in this guide

The information in this guide is presented as follows:

Chapter 3 - Equipment Overview

This chapter provides an overview of the Edge-60R V2 reader and PCI Interface as well as provides complete technical characteristics of both equipment.

Chapter 4 - Mechanical Installation

This chapter describes how to mechanically install the reader and the PCI Interface.

Chapter 5 - Electrical Installation

This chapter describes how to electrically install the reader and the PCI Interface including how to setup the reader's digital inputs and outputs.

Chapter 6 - Reader Configuration

This chapter describes how to configure the reader through Ethernet using a Web Browser including the reader default settings, PCI Interface settings and feedback interpretation.

Chapter 7 - Software Development

This chapter provides important notes regarding the use of the Mercury API for software development using Ethernet and Serial communication interface.

Chapter 8 – Regulatory Notes

This chapter provides important regulatory information about the reader that should be carefully follow during the installing or operating the reader.

Chapter 9 – Read Polarization

This chapter describes the linear polarization of the reader and examples of tag reading positions.

Chapter 10 – Integrated antenna measurements

This chapter provides some graphics of the integrated antenna parameters measurements.

Chapter 11 - Troubleshooting

This chapter provides the most common problems and their respective solutions.

1.3 Conventions used in this manual

The following conventions are used in this manual:

Italic Bold font indicates values that can be changed by the user.

[**Value**] indicates value or description.

Bold font indicates only important information.

	WARNING: Wranings advise the user that a hazardous condition can be created by a particular action that can cause damage to equipment

	ATTENTION: This warning indicates that device is susceptible to Electro Static Discharge (ESD) and appropriate precautions must be taken to avoid equipment damage.

Note:	Informations and other tips are presented in light blue boxes.

Table of Contents

Table of Figures

2. Revision Table

2.1 Document

Revision	Date	Description
1	08/2014	- First Draft.

2.2 Firmware

Revision	Date	Description
2.0.0	08/2014	- First release.

3.   Equipment Overview

3.1 Reader Hardware

The Edge-60R V2 is a high performance, integrated reader designed for outdoor applications and industrial/harsh environments. As shown in the following figure, the reader contains one integrated antenna and supports one additional Tx/Rx antenna. The reader is equipped with an industrial M23 connector for power, communication and inputs/outputs signals.
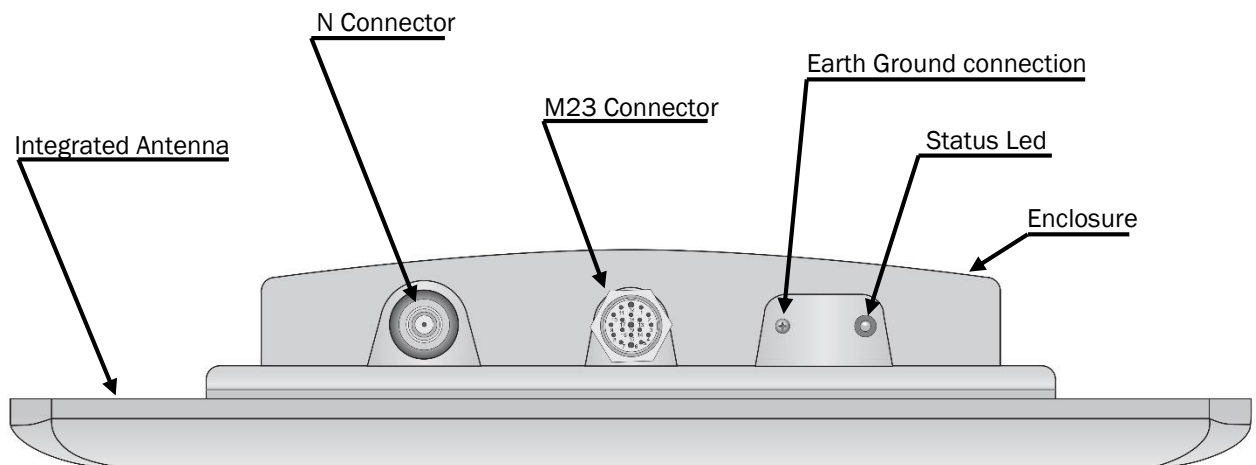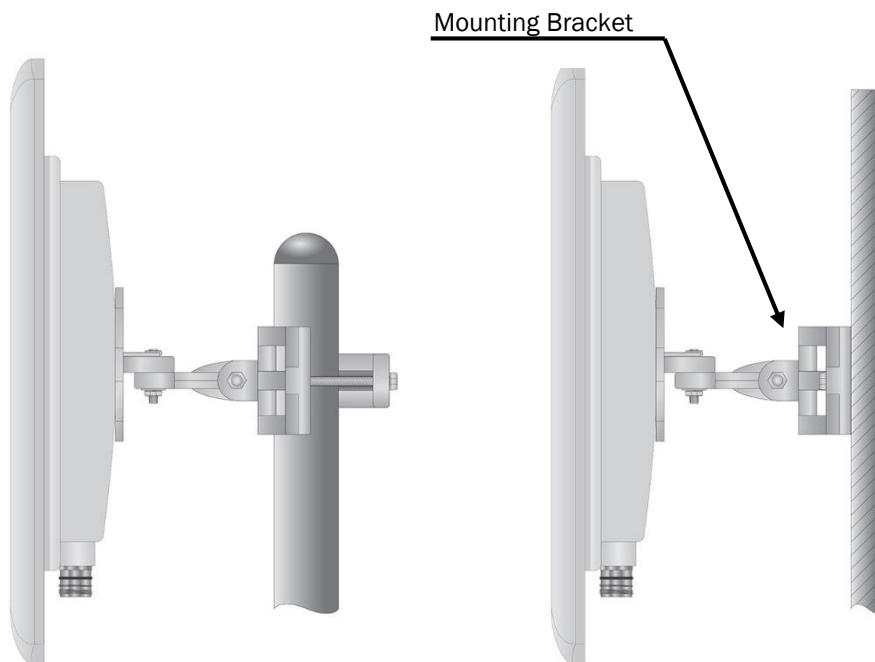

Figure 1 - Reader connectors view

Figure 2 - Reader mounting bracket

3.2 Reader's technical characteristics

Transponder Protocols	
Protocols	ARTEFATO PA SJ5511 v.1.0 SINIAV G0 v.1.0.0 BRASIL-ID P63 EPC Gen2 (ISO 18000-6C) ISO 18000-6B
Custom commands implemented	
Artefato PA SJ5511 protocol	Activate_Secure_Mode Authenticate_OBU
Siniav G0 protocol	Activate_SINIAV_Mode OBU_Auth_ID OBU_Auth_Full_Pass1 OBU_Auth_Full_Pass2 OBU_Auth_Full_Pass (Pass1 + Pass2) OBU_ReadFromMemMap OBU_WriteToMemMap
Brasil-ID P63 protocol	ReadSec WriteSec
EPC Gen2 (ISO 18000-6C) protocol	All mandatory commands (Read, Write, Lock, ReadMemBlock, WriteMemBlock, etc)
RF Interface	
RF Power Output	Separate read and write levels, command adjustable from 5 to 30 dBm (1W) with +/-0.5 dBm accuracy above +15 dBm[1]
Regulatory	Pre-configured for the following regions: ANATEL (BR) 902 - 907 MHz e 915 - 928 MHz FCC (NA) 902 - 928 MHz ETSI (EU, IN) 865.6 - 867.6 MHz
Mode	Frequency Hopping or Fixed Frequency (Configurable frequency hoptable)
RF Modulation	PR-ASK
RF Encoding	FM0, Miller M2, M4 e M8
Backscatter Link Frequency (BLF)	250KHz, 320KHz e 640KHz
Performance	
Max Read Rate	Up to 750 tags/second using high-performance settings
Max Tag Read distance	Over 30 feet (9 m) with 12.5dBi antenna (36dBm EIRP)[2]

[1] Maximum power may have to be reduced to meet regulatory limits, which specify the combined effect of the module, antenna, cable, etc.

[2] Read distance may vary depending of Tag, antenna and environmental conditions.

Control / Data Interface	
Connectors	**Power, Communication and Gpio (shielded cable)**
	Industrial M23 Signal Straight Connector IP66 (connected)
	External antenna
	N type connector 50Ω IP66 (connected)
Data Communication	**Serial:**
	RS-485 Full-Duplex
	Complies with ANSI/TIA/EIA-485-A-98 and ISO 8482:1987(E)
	5KV RMS fully isolated
	High common-mode transient immunity: >25 kV/µs
	±15 KV ESD protection on RS-485 input/output pins
	Surge protection (Overvoltage and Overcurrent) with a coordinate scheme using GDT - TBU - TVS
	Ethernet:
	Data rate: 10/100Mbps
	1.5 KVAC isolated
	Surge protection (Overvoltage and Overcurrent) with a coordinate scheme suing GDT - TBU - TVS
GPIO	**2x Opto-Isolated Digital Input:**
	1KV RMS fully isolated
	Dry contact and Wet contact (any polarization) scheme supported
	Minimum pulse width: 100ms
	3.0 ~ 24.0VDC - High level
	0 ~ 2.0VDC - Low level
	2x Opto-Isolated Digital Output:
	1KV RMS fully isolated
	Open collector output type
	Max. Current sink: 400mA
	Max. Voltage sourcing: 40V
Shielded Cable	2 twisted pairs 24AWG (UTP) + 8 twisted pairs 22AWG
	Shield: bare copper braid 90% with tape viscose
	Cover: PU polyurethane compound 1.2mm thick
	Outside diameter: 12mm +/- 0,5mm
API support	C#/.Net, Java, C
	(Include samples, source codes and Demo Software)
Power	
DC Power required	DC Voltage: 24.0 VDC +/- 10%
	Max Ripple: 25mVpp
DC power consumption @ RF level	Max 15W @30dBm
	With maximum duty cycle

Mechanical / Environmental	
Water Tightness	IP66 (with M23 correctly attached)
Integrated antenna	12.5dBi gain Linear Horizontal or Vertical polarization (See more details on antenna table)
Dimensions	450x450x79mm [LxWxH]
Weight	6Kg ±0.5Kg
Operational temperature	-10°C a + 65°C
Storage temperature	-10°C a + 70°C
Humidity	95%
Mounting	Both wall and pole mount (Pole size Ø 1" to 1.75" - 1.75" to 3")
Adjustable positions (angles)	40° +/-3°Azimuth axis (Horizontal) e 30° +/-3° Elevation axis (Vertical)
Mechanical shock	IEC 60721-3-4 4M5
INTEGRATED ANTENNA	
Electrical	
Frequency range	902 - 928 MHz
Gain	12.5 dBi (min)
VSWR	1.7:1 (max)
3dB Beamwidth	42°
Polarization	Linear (Vertical or Horizontal)
Sidelobes levels	-19dB (max)
Front/Back ratio	-24dB
Input Impedance	50 Ohms
Input Power	6W (max)
Lightning protection	DC Ground
Mechanical / Environmental	
Radome	Plastic
Base plate	Aluminum with chemical conversion coating
Operational temperature	-10°C a + 65°C
Storage temperature	-10°C a + 70°C
Water Tightness	IP64
Environmental Tests	
Test	Standard and notes
Low temperature	IEC 68-2-1 (72h -55°C)
High temperature	IEC 68-2-2 (72h +71°C)
Temperature cycling	IEC 68-2-14 (1h -45°C +71°C)
Vibration	IEC 60721-3-4 (30min/axis 4M3)
Mechanical shock	IEC 60721-3-4 (4M3)
Humidity	ETSI EN300-2-4 T4.1E (144h 95%)
Water tightness	IEC 529 (IP64)
Solar radiation	ASTM G53 (1000h)
Wind speed	Operation 160Km/h Survival 220Km/h
Wind load (survival)	Front thrust 58,3Kg Side thrust 3,9Kg

3.3 PCI Interface's Hardware

The PCI Interface (150514) is a Printed Circuit Board (PCB) built to make the connections between the Reader and PC easy as possible. As shown in the following figure, the PCI Interface board contains a variety of connectors in order to make the installation easy. The board also provides two options of Isolated Serial Communication, RS-232 and RS-485 FD, between the Reader and PC.
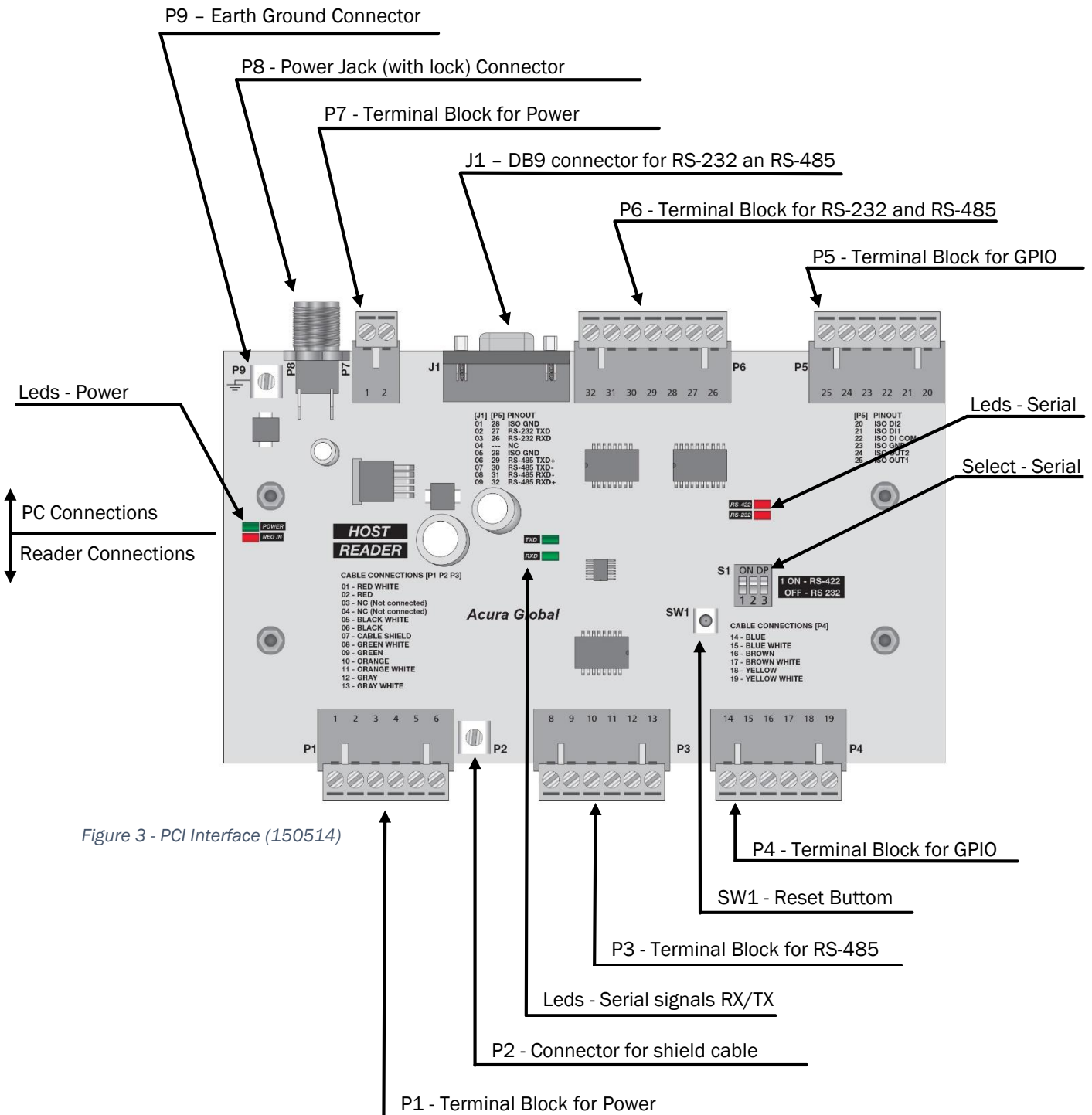

Figure 3 - PCI Interface (150514)

3.4 PCI Interface's technical characteristics

Control / Data Interface	
Connectors	**Power:** Connector power Jack 2,5mm (connector P8) Terminal Block Plug, solid/stranded wire 12-24 AWG (P7) Screw terminal M3 (connector P9) **Communication:** DB9 connector female (J1) Terminal Block Plug, wire 12-24 AWG (P1, P3 and P6) Screw terminal M3 (connector P2) **GPIO:** Terminal Block Plug, wire 12-24 AWG (P4 and P5)
Serial data communication	**Communication between Reader and Interface Board** RS-485 Full-Duplex **Communication between Interface Board and Host** RS-232 or RS-485 Full-Duplex selection through DipSwitch **1x RS-485 Full-Duplex (Reader <-> Interface Board) (P3)** **1x RS-485 Full-Duplex (Interface Board <-> Host) (P6)** Complies with ANSI/TIA/EIA-485-A-98 and ISO 8482:1987(E) 5KV RMS fully isolated High common-mode transient immunity: >25 kV/µs ±15 kV ESD protection on RS-485 input/output pins Open - Short-circuit, fail-safe receiver inputs Data rate: 9600 to 921.600 bps **1x RS-232 (Interface Board <-> Host) (P6 e J1-DB9)** Meets EIA/TIA-232E specifications 2.5KV RMS fully isolated High common-mode transient immunity: >25 kV/µs ESD protection on in and out pins: ±8 kV: contact discharge ESD protection on in and out pins: ±15 kV: air gap discharge Data rate: 9.600 a 921.600 bps
Visual feedback	Power led (On/Off) Signal led indication (TX/RX) Interface led indication (RS232 or RS485)
Power	
DC Power required	DC Voltage: 24.0 VDC +/- 10% Max Ripple: 25mVpp
DC power consumption @ Baudrate	Max 2.5W @ > 500Kbps
Mechanical / Environmental	
Water Tightness	Indoor use only
Dimensions	175x120x20mm [LxWxH]
Weight	200g +/- 20g
Operational temperature	-10°C a + 65°C
Storage temperature	-10°C a + 70°C
Humidity	80%
Mounting	Compatible with top hat DIN Rail TS35 (35x7,5mm)

4. Mechanical Installation

4.1 Reader mechanical installation

The Edge-60R V2 can be mounted on walls and poles (1" to 1,75" or 1,75" to 3"). The following figure shows the step by step of the reader mounting bracket.
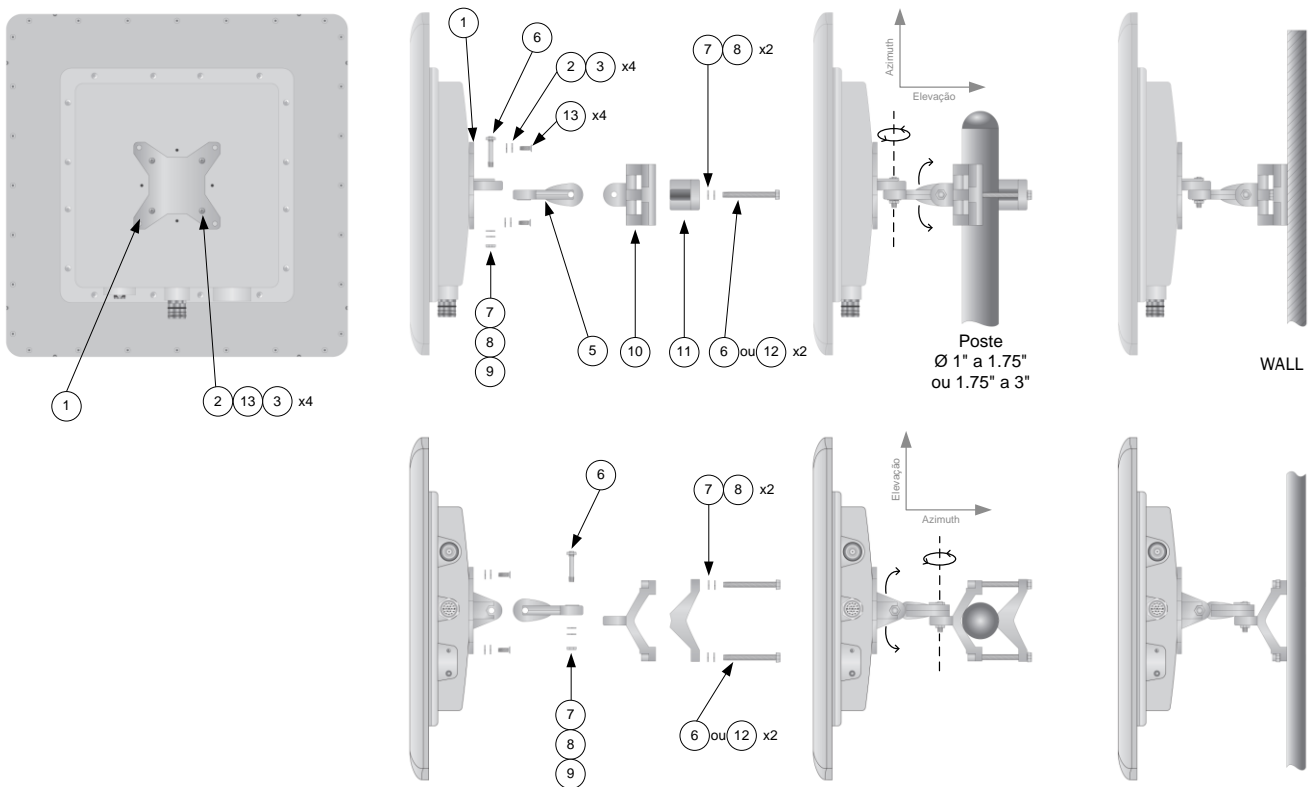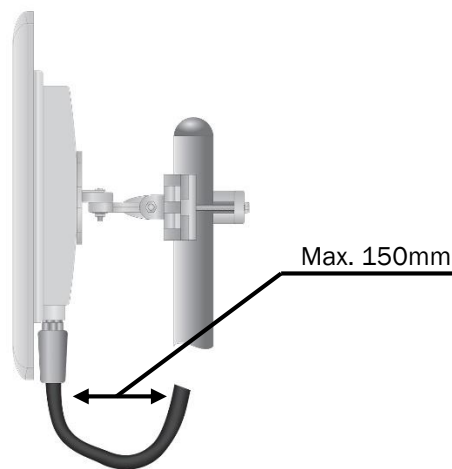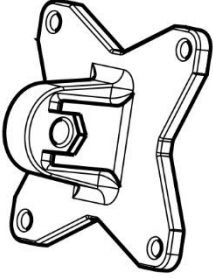
Figure 4 - Reader mounting bracket
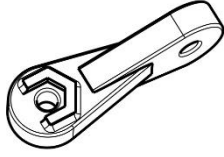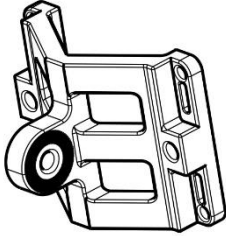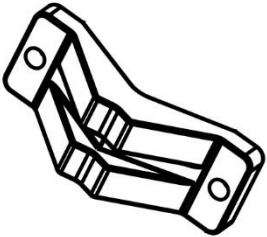
Figure 5 - Maximum cable bend

Items showed in figure 4 above:

Item: 1-Enclosure base bracket **Qt: 1**	**Item: 2**-Flat Washer M5 **Qt: 4** **Item: 3**-Spring Washer M5 **Qt: 4**	**Item: 4**-Nut M5 **Qt: 4**	**Item: 5**-Arm bracket **Qt: 1**
Item: 6-Bolt M8x40 **Qt: 4** **Item: 7**-Flat Washer M8 **Qt: 4**	**Item: 8**-Spring Washer M8 **Qt: 4** **Item: 9**-Nut M8 **Qt: 2**	**Item: 10**-Wall/Pole bracket **Qt: 1**	
Item: 11-Clamping bracket **Qt: 1**	**Item: 12**-Bolt M8x70 **Qt: 2**	**Item: 13** Bolt M5x16 **Qt: 4**	

4.2 PCI Interface board mechanical installation

The board should be fixed on a Top Hat Rail EN50022 (35 x 7,5mm) as shown the following figure.

Figure 6 - PCI Interface fixed on a top hat rail

To remove the board pull the pawl
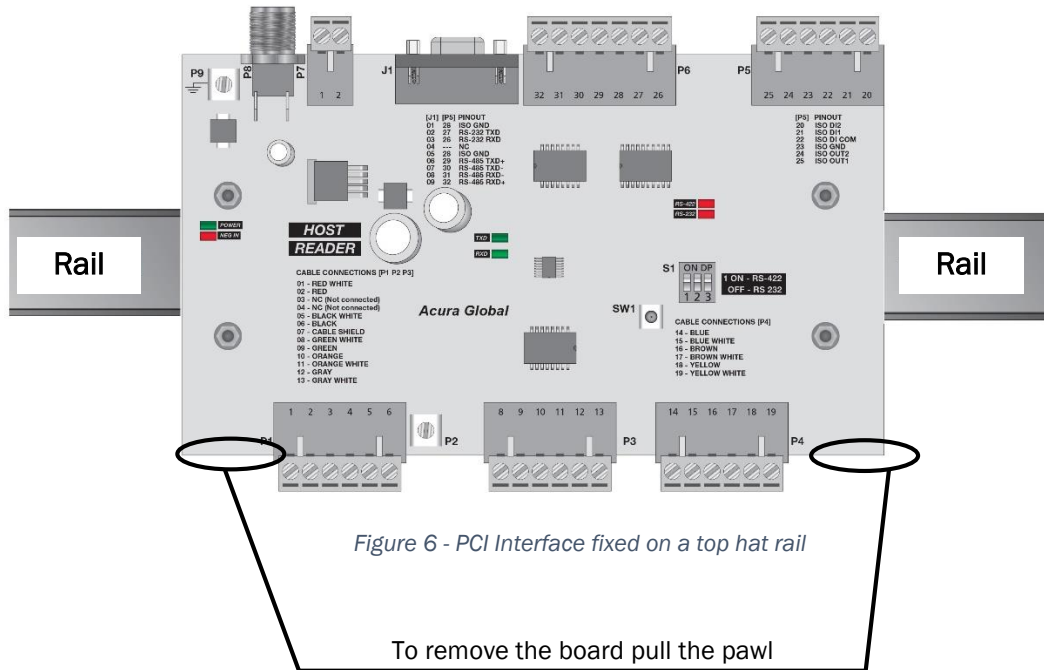
ATTENTION: The electronic components of the board are susceptible to Electrostatic Discharge (ESD) and can be damage in case of direct hand contact. Please handle the board by its edges. Avoid direct hand contact with the electronic components.

5. Electrical Installation

5.1 Connections diagram

The following figure shows the connections between Reader <–> PCI Interface board <–> PC.
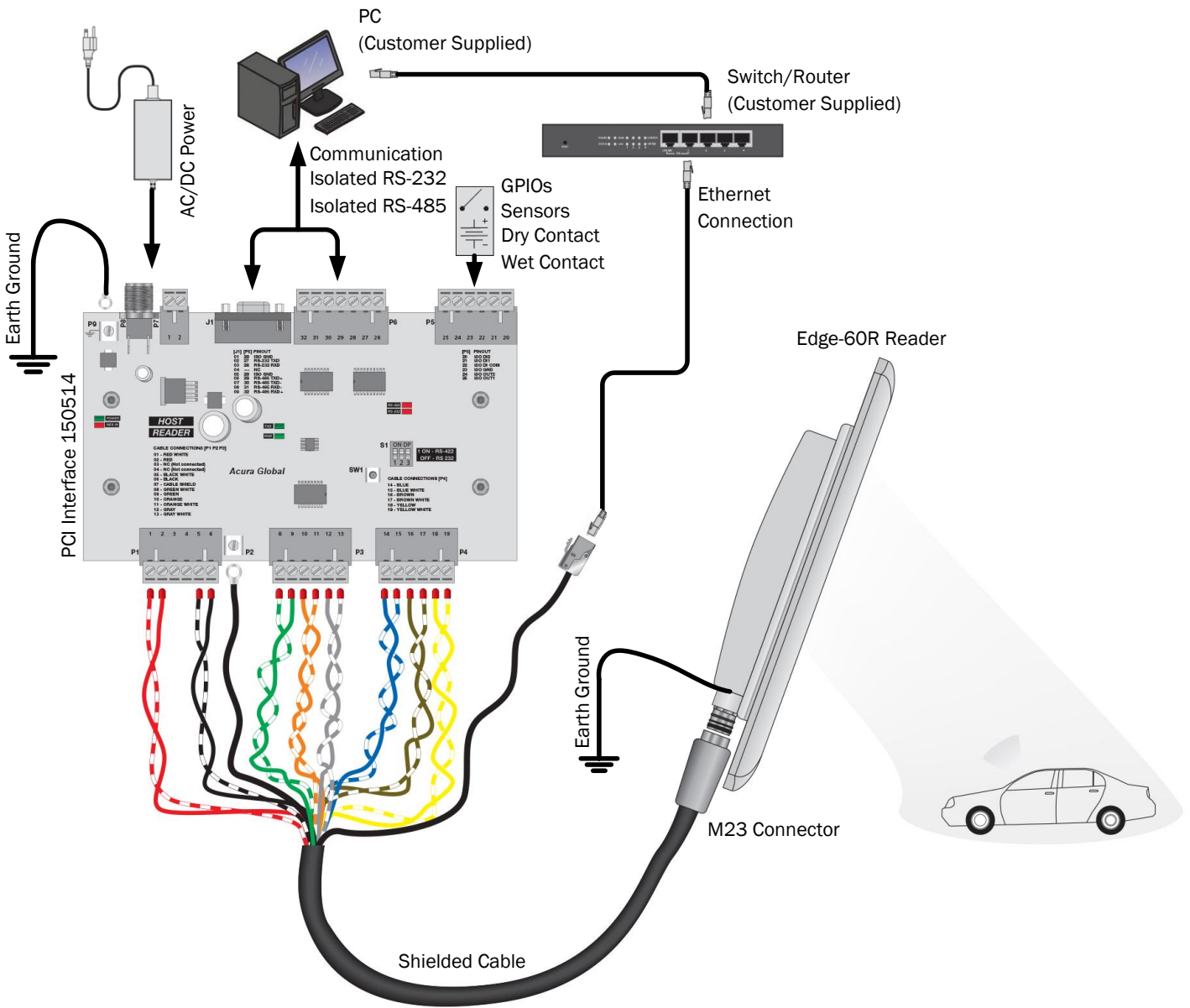
Figure 7 - Connections diagram

The connection of the external antenna is shown in the following figure.

RF coaxial cable RG-213
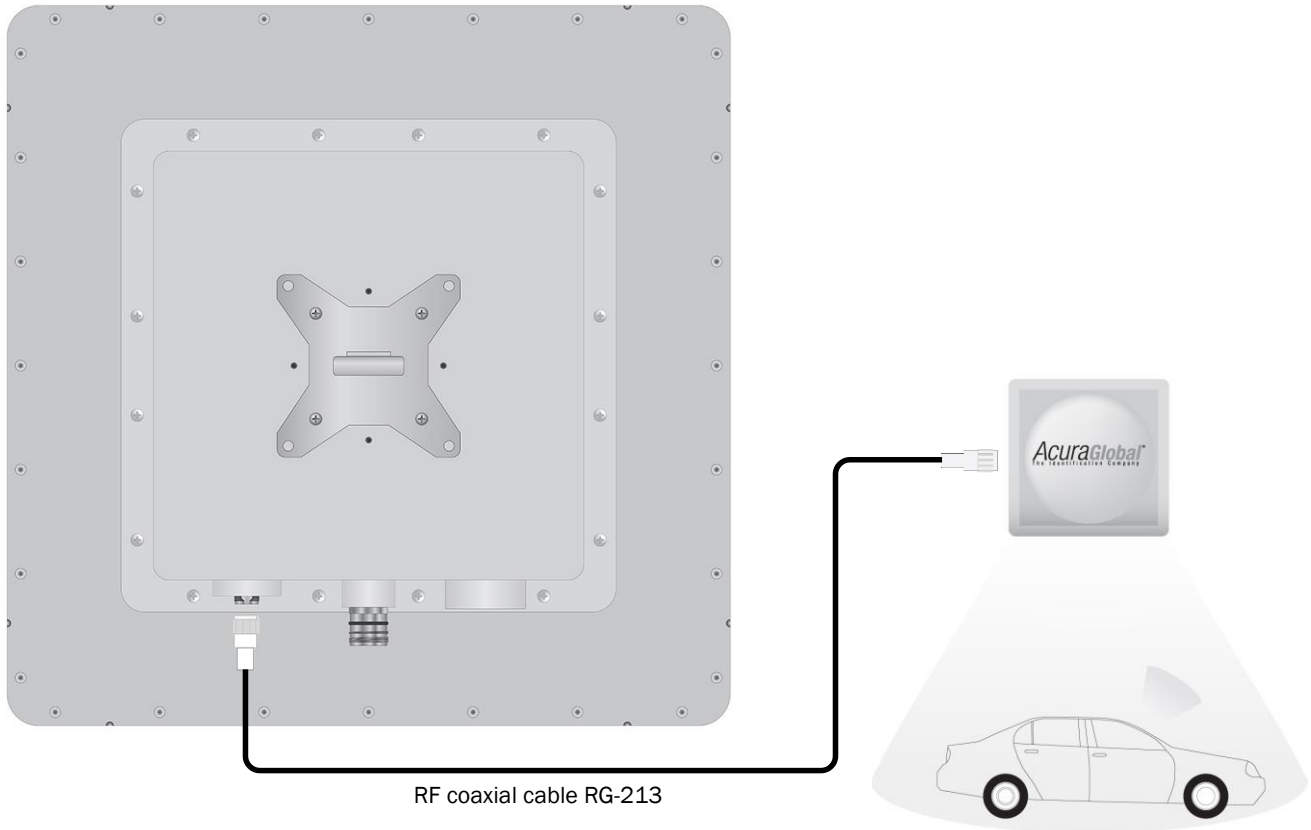
Figure 8 - External antenna connection

	ATTENTION:	Edge-60R V2 antenna ports may be susceptible to damage from static discharge or other high voltage. Use proper Electrostatic Discharge (ESD) precautions to avoid static discharge when handling or making connections to the Edge-60R V2 reader antenna or communication ports. Equipment failure can result if the antenna or communication ports are subjected to ESD.

	WARNING:	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.

5.2 Reader Industrial M23 Connector

The following figure and table shows in detail the reader connector where power, communication, inputs and outputs are provided to the reader.
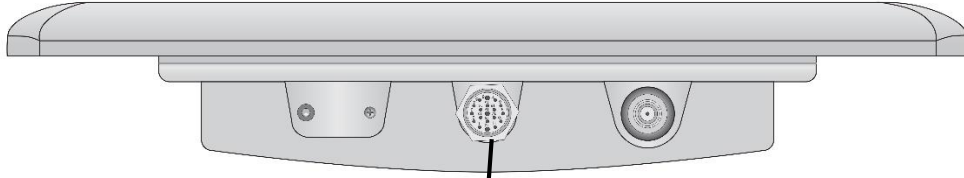
Figure 9 – Pins of M23 connector
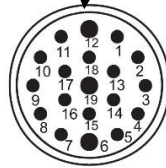
Pare	M23 connector Pin	Shielded cable colors	Function	Description
1	1	Orange White (RXD+ Interface)	ISO_TXD+ RS485	
	2	Orange (RXD- Interface)	ISO_TXD- RS485	
2	3	Green (TXD- Interface)	ISO_RXD- RS485	Isolated RS-485
	4	Green White (TXD+ Interface)	ISO_RXD+ RS485	
3	5	Grey	ISO GND RS485	
4	6	Black	GND	Reader Power
3	7	Grey White	Reset	Reader Reset
5	8	Orange (OR/WH UTP)	RJ pino6 RX-	
	9	White (OR/WH UTP)	RJ pino3 RX+	Ethernet
6	10	Green (GR/LGR UTP)	RJ pino2 TX-	
	11	Light Green (GR/LGR UTP)	RJ pino1 TX+	
4	12	Black White	GND	Reader Power
7	13	Blue	ISO_OUT1	
	14	Blue White	ISO_OUT2	
8	15	Yellow	ISO_DI1	GPIO (Inputs and Outputs)
	16	Yellow White	ISO_DI2	
9	17	Brown White	ISO_DI_COM	
	18	Brown	ISO_GND GPIO	
10	19	Red	VCC	Reader Power
	19	Red White	VCC	Reader Power

NOTA: To fit the M23 cable connector on the M23 reader connector, align the arrow of the cable connector with the mark of the reader connector !!!
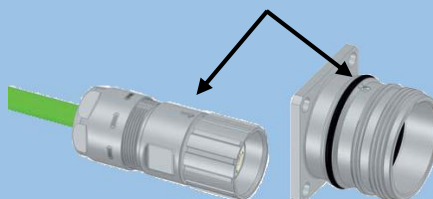
5.3 PCI Interface Electrical Wiring

The following figure shows the connections between Reader <–> PCI Interface board.

Figure 10 - PCI Interface Electrical Wiring

The following table shows the details of the connections between Reader <–> PCI Interface board.

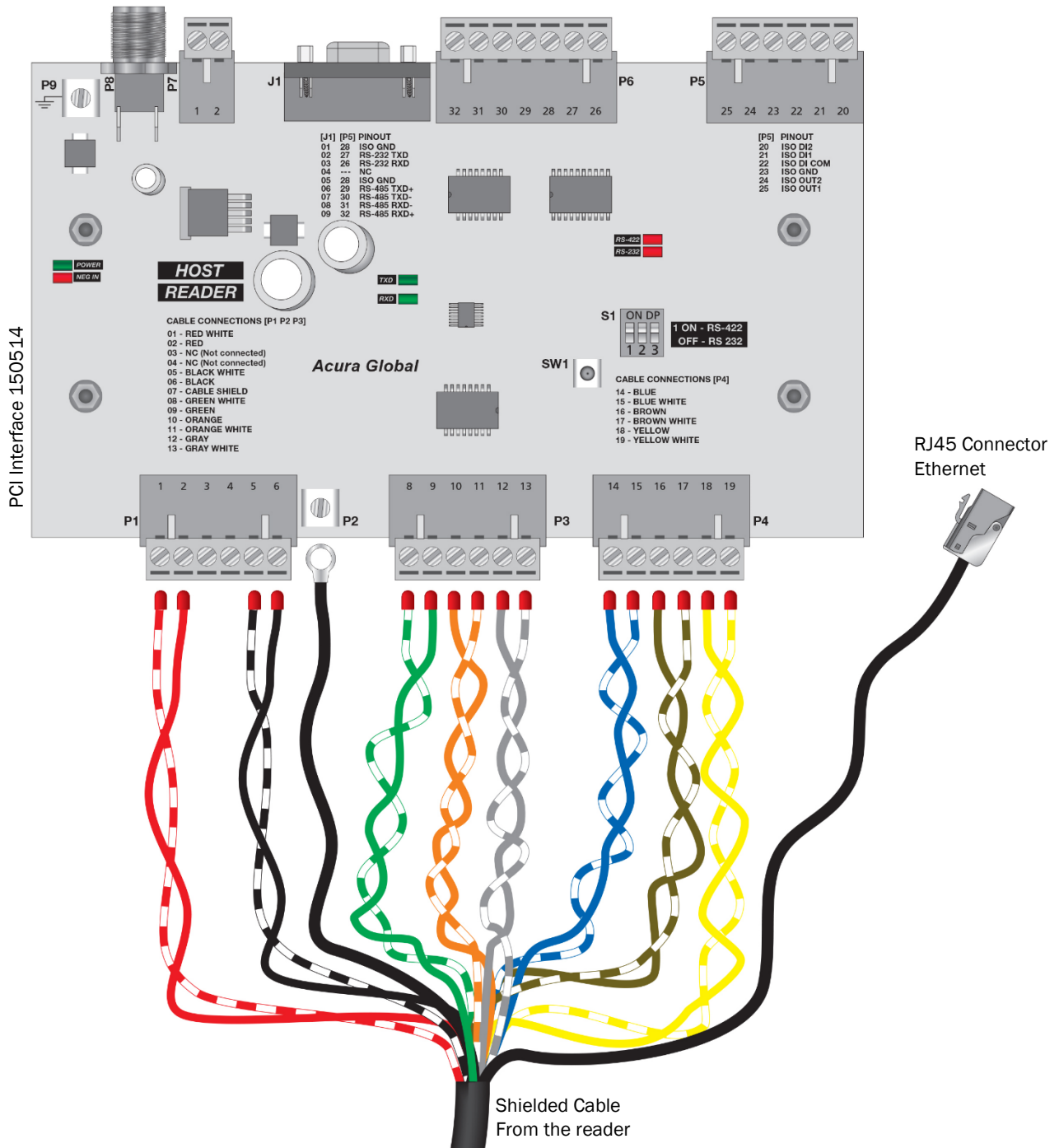| PCI Connector	PCI Connector Pin	Shielded Cable Color	Function	Description
P1	1	Red While	+24VCC	Reader Power
	2	Red	+24VCC	
	3	NC (No Connection)	--	
	4	NC (No Connection)	--	
	5	Black White	GND	
	6	Black	GND	
P2	---	Cable Shield	Shield GND	Cable Shield
P3	8	Green White	ISO_TXD+	Isolated RS-485
	9	Green	ISO_TXD-	
	10	Orange	ISO_RXD-	
	11	Orange White	ISO_RXD+	
	12	Grey	ISO GND RS485	
	13	Grey White	Reset	Reader Reset
P4	14	Blue	ISO_OUT1	GPIO (Inputs and Outputs)
	15	Blue White	ISO_OUT2	
	16	Brown	ISO_GND GPIO	
	17	Brown White	ISO_DI_COM	
	18	Yellow	ISO_DI1	
	19	Yellow White	ISO_DI2	
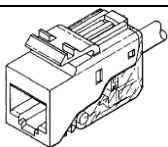
The following table shows the details of the connections between PCI Interface board <-> PC.

PCI Connector	PCI Connector Pin	Function	Description
P5	20	ISO_DI2	GPIOs
	21	ISO_DI1	
	22	ISO_DI_COM	
	23	ISO_GND GPIO	
	24	ISO_OUT2	
	25	ISO_OUT1	
J1 / P6	1 / 28	ISO_GND SERIAL	Isolated communications
	2 / 27	ISO_RS-232 TXD	
	3 / 26	ISO_RS-232 RXD	RS-232 and RS-485
	4 / ----	NC	
	5 / 28	ISO_GND SERIAL	
	6 /29	ISO_RS-485 TXD+	
	7 / 30	ISO_RS-485 TXD-	
	8 / 31	ISO_RS-485 RXD-	
	9 / 32	ISO_RS-485 RXD+	
P7	1	GND	Power
	2	+24VCC	
P8	Center pin	+24VCC	Power
	Screw	GND	
P9	--	Earth Ground	Earth connection

NOTE: The "TXD" nomenclature means that the signal is a transmission signal (reader outpu) and "RXD" means a receive signal (reader input).
The "ISO" nomenclature means that the signal is electraly isolated from the main circuit.

For Ethernet connections please use the following standard.

RJ45 Network Cable	T568A Standard	RJ45 pins
1	White/Green	
2	Green	
3	White/Orange	
4	Blue	
5	White/Blue	
6	Orange	
7	White/Brown	
8	Brown	

RJ45 Reader cable	Reader cable color	RJ45 Reader
1	White/Green	
2	Green	
3	White/Orange	
6	Orange	

NOTE: The Ethernet communication of the reader uses only two pairs.

5.4 GPIO – Digital Input

The Edge-60R V2 reader provides two digital inputs with the following characteristics:

- Two opto-isolated digital inputs, 1KV RMS isolation;
- Compatible with Dry Contact and Wet Contact with any polarization;
- Minimum pulse width: 100ms;
- High level (3,0 to 24,0VCC);
- Low level (0 to 2,0VCC);
- Maximum voltage in wet contact: 24VCC;

The digital inputs can be used through connector P5 of PCI Interface board the table below shows more details:

Function	Description	API reference
ISO_DI2	Isolated Digital Input #2	GPIO4
ISO_DI1	Isolated Digital Input #1	GPIO3
ISO_DI_COM	Common reference for Wet Contact Sensors type	
ISO_GND GPIO	Common reference for Dry Contact Sensors type	

The following figure provide examples of digital input connections.
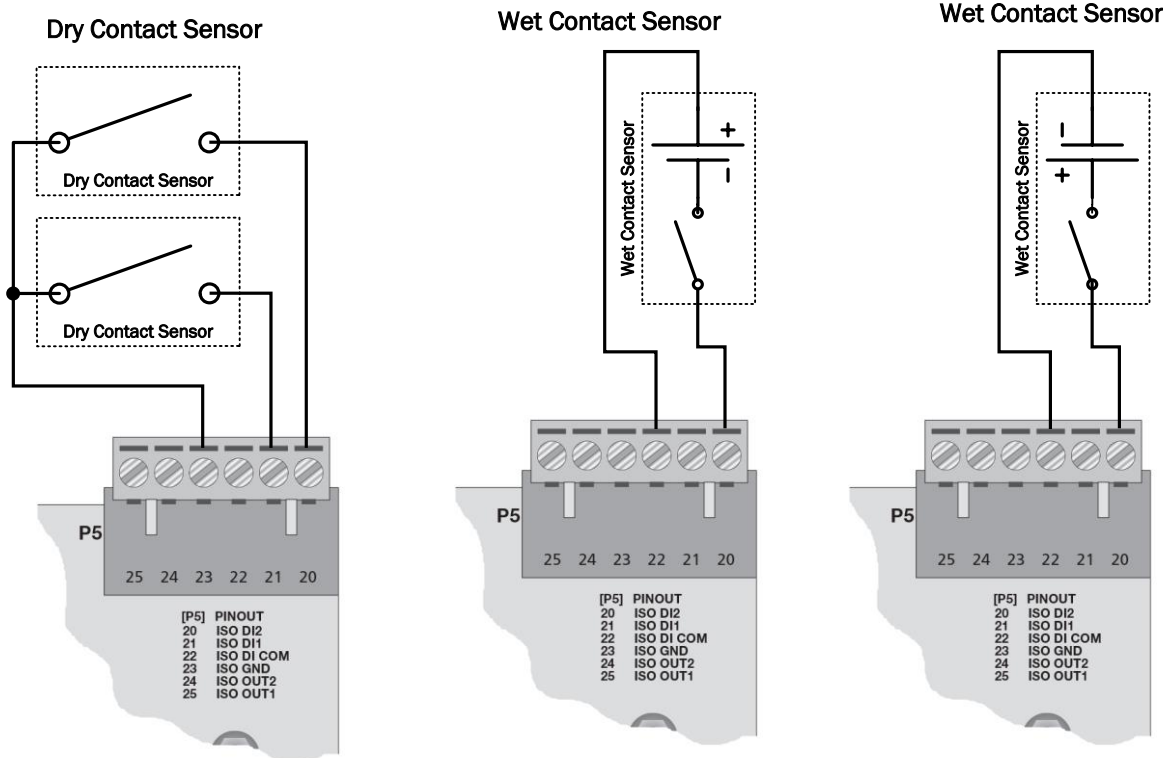
Figure 11 – Digital Inputs connections

> **NOTE:** Use "ISO_GND" for Dry Contact Sensor.
>
> Use "ISO_DI_COM" for Wet Contact Sensor in any polarization.

5.5 GPIO – Digital Output

The Edge-60R V2 reader provides two digital outputs with the following characteristics:

- Two opto-isolated digital inputs, 1KV RMS isolation;
- Open Collector (npn) output type
- Minimum pulse width: 100ms;
- Maximum current: 400mA;
- Maximum voltage: 40V;

The digital outputs can be used through connector P5 of PCI Interface board the table below shows more details:

Function	Description	API reference
ISO_OUT2	Isolated Digital Output #2	GPIO2
ISO_OUT1	Isolated Digital Output #1	GPIO1
ISO_GND GPIO	Common reference for load	

The following figure provide examples of digital output connections.

Relay Drive

Buzzer Drive

DC Lamp Drive

LAMP   CA

Relé

External Power

Buzzer

External Power

DC Lamp

External Power

P5

25 24 23 22 21 20

[P5] PINOUT
20   ISO DI2
21   ISO DI1
22   ISO DI COM
23   ISO GND
24   ISO OUT2
25   ISO OUT1

P5

25 24 23 22 21 20

[P5] PINOUT
20   ISO DI2
21   ISO DI1
22   ISO DI COM
23   ISO GND
24   ISO OUT2
25   ISO OUT1

P5

25 24 23 22 21 20

[P5] PINOUT
20   ISO DI2
21   ISO DI1
22   ISO DI COM
23   ISO GND
24   ISO OUT2
25   ISO OUT1

Figure 12 - Digital Output connections
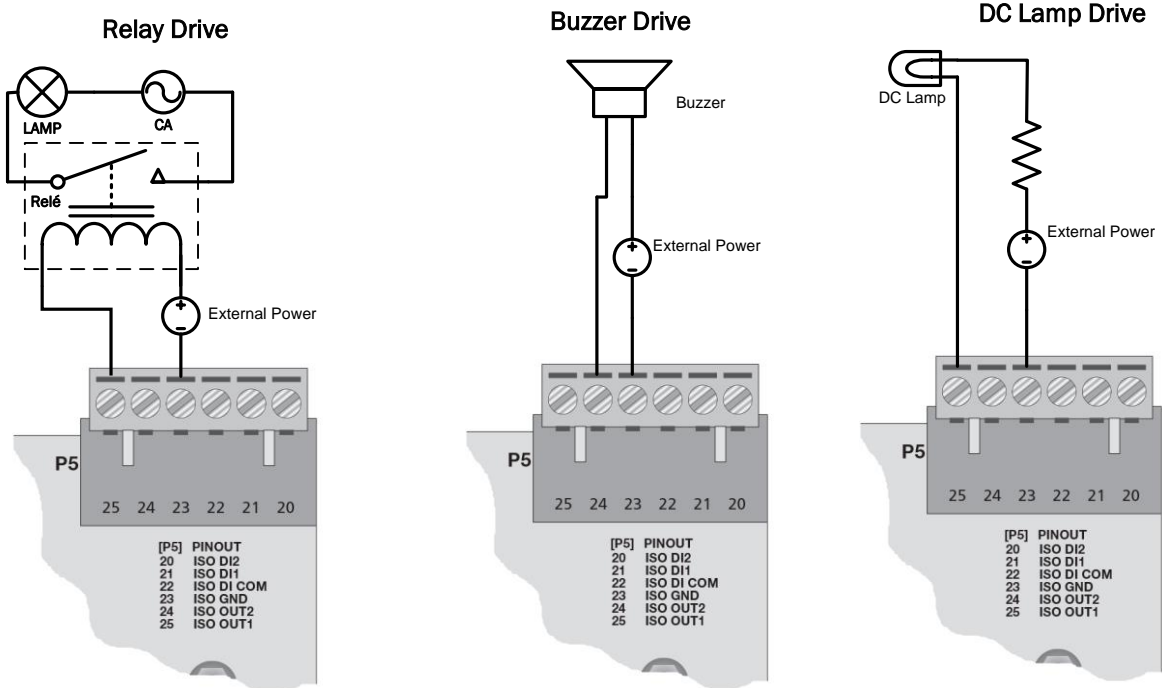
NOTE: Always use "ISO_GND" as common reference for digital outputs.

WARNING: The limits described for digital inputs and outputs should be respected, otherwise permanent damage can occur.

WARNING: The digital inputs and outputs of internal M6e RFID module are already set up at Edge-60R V2 reader initialization. Do not change the gpio directions through Mercury API.

6. Reader Configuration

6.1 Configure Reader using Web Browser

Accessing the reader across a LAN or WAN you can enter the reader's IP into your web browser and configure some basics settings as follows:

- Change the login password of the settings page;
- Change the network settings of the reader;
- Change the communication interface of the reader;
- Visualize information and status of the reader;

The following steps shows how to configure the reader using web browser.

1. Enter the reader's IP into your web browser. The login page will load as show the following figure:
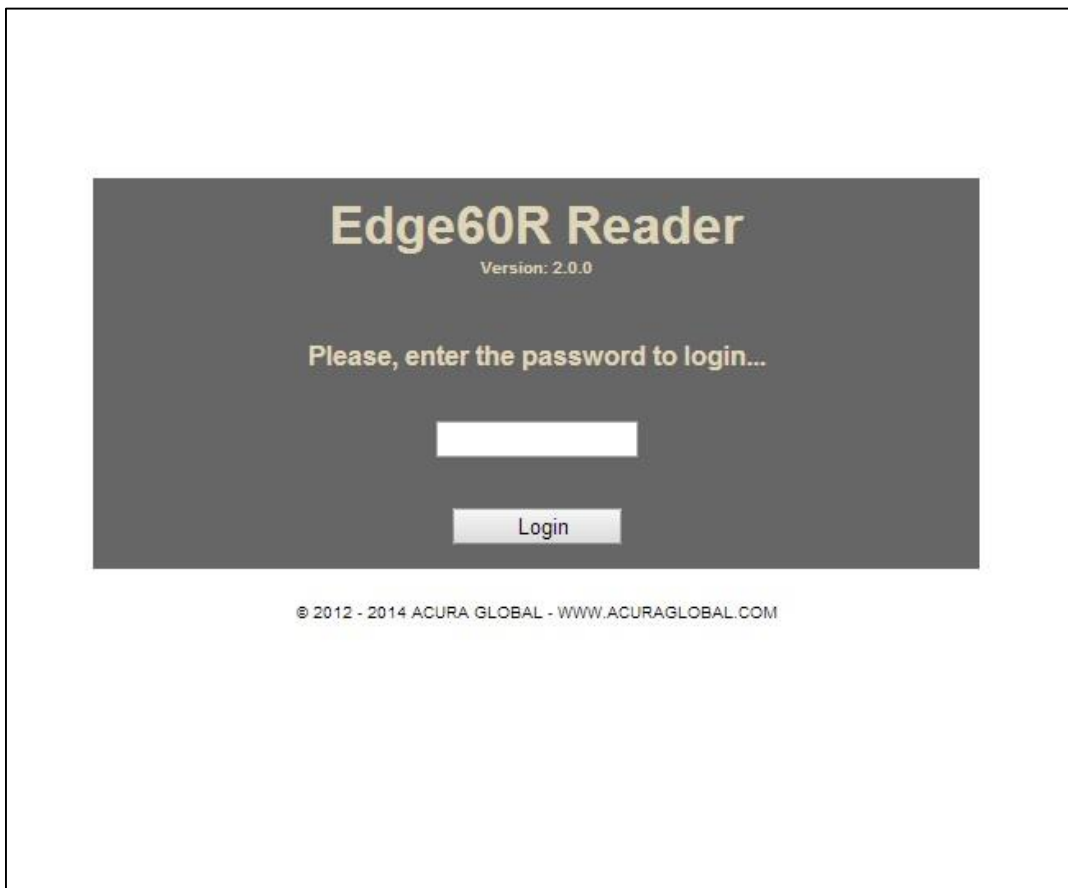

Figure 13 - Login page

2. Login password is user choice, the reader is factory configured with no password, just leave empty and click Login to go to the settings page as show the figure bellow.

Reader Configuration

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General Informations	
RFID Firmware	01.15.01.1D
RFID Bootloader	10.11.16.00
RFID Hardware	18.00.00.01
Controller Firmware	2.0.0
MAC Address	00:24:77:51:8A:BF
	0.36.119.81.138.191
Status Integrated Antenna at power up/restart[4]	**Connected**
Status External Antenna at power up/restart[4]	**Not detected**
TCP communication port	**8081 - Connected** 192.168.0.64:59352
TCP status port	**9090 - Not connected**
Regulatory Region[4]	BR 902~907.5MHz and 915~928MHz

Security		
Login password	[ ]	?

Network		
IP address	192.168.1.110	?
Subnet mask	255.255.255.0	?
Gateway address	10.0.0.1	?

Communication		
Communication interface	◉ Ethernet ○ Serial	?

Save **Reload** **Restart** **Logout**

Note 1: The new saved settings will be used after the reader be reseted by clicking in "Restart".
Note 2: The settings saved on this page are non volatile.
Note 3: The session timeout is 3 minutes, after that time you need to login again. The "Reload" and "Save" buttons reset the session time.
Note 4: The values are measured only at reader power up/restart event. The "Reload" button does not refresh the values.

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Figure 14 - Settings page

NOTE: Only one user can be logged in in the settings page, which has a session timeout of 3 minutes.

3. After change the desired parameters, click Save and then Restart the reader.

6.2 Configurations

Following are the descriptions of the information and configurations of the reader.

General Informations

RFID Firmware

Internal RFID M6e module's firmware version.

RFID Bootloader

Internal RFID M6e module's bootloader firmware version.

RFID Hardware

Internal RFID M6e module's hardware version.

Controller Firmware

Edge-60R V2 reader internal controller firmware version.

MAC Address

Physical Ethernet address.

Status Integrated Antenna at power up/restart

Indicates if the reader can detect an antenna connected on RF port #1.

Status External Antenna at power up/restart

Indicates if the reader can detect an antenna connected on RF port #2.

TCP communication port

Shows the connection status of the TCP/IP port #8081, used for reader communication, when a connection is established the remote host ip and port are shown too.

TCP status port

Shows the connection status of the TCP/IP port #9090, used for reader status, when a connection is established the remote host ip and port are shown too.

Regulatory Region

Indicates the region and frequencies configured at reader initialization.

Security

Login password

Alphanumeric characters up to six digits that can be stored in the reader to form the password that will provide access to the settings page.

Network

IP address

Fixed IP address of the reader, this version of the reader does not support DHCP.

Subnet mask

Mask used to determine what subnet the reader IP address belongs to, devices on the same subnet can communicate locally without routing.

Gateway address

Gateway IP address for the local network, it is usually the address of the router.

Communication

Communication interface

What kind of communication the reader will use, Serial or Ethernet.

NOTE: Even if the chosen interface is Serial, the settings page can still be accessed.

NOTE: Always save reader setup information, like IP and password for future access of setings page.

6.3 Factory Configuration (Default Settings)

Following are the default settings of the reader. You can return the reader to default settings by performing a hard reset as show the next session.

Login password
[No password, empty]

IP address
[10.0.0.101]

Subnet mask
[255.255.255.0]

Gateway address
[10.0.0.1]

Communication interface
[Serial]

6.4 Reader Hard Reset

To return the reader back to factory settings, it is necessary to perform a hard reset, which is a physical reset, different from the Restart button on the settings page.

The hard reset can be done by pressing the SW1 button on the PCI Interface board.

The following steps show how to perform a reader hard reset.

1. On switch S1 set the positions 1 and 2 ON

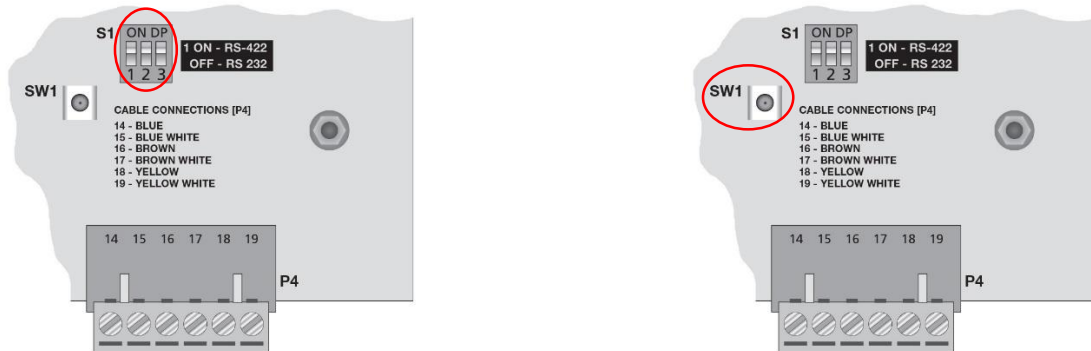**2. Press SW1 button for 15s and then release.**

Figure 15 - Reader Hard Reset

> ⚠️ **WARNING:** Doing a hard reset will stop any activity that the reader is performing.

6.5 Choose of Serial communication on PCI Interface board

When the reader is configured to use Serial communication, there is two types of serial communications standards available on PCI Interface board to communicate with PC, RS-232 and RS-485 full duplex, both isolated. Follow the instruction bellow to choose which serial communication standard will be used.

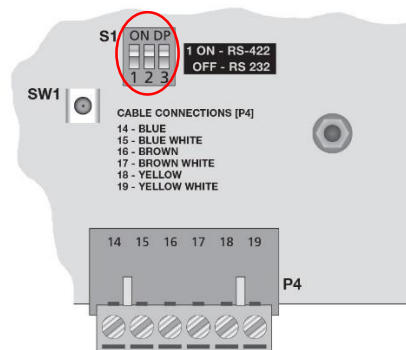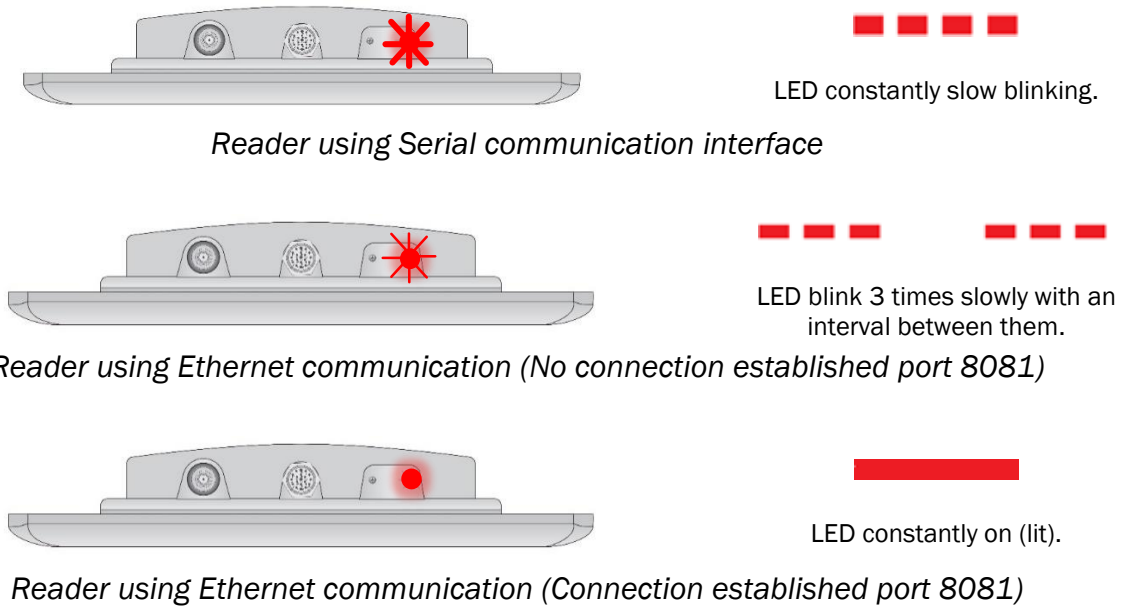**S1 switch: Position 1 ON – RS-485 / OFF – RS-232**

Figure 16 - Choose of serial communication

> **NOTE:** The serial communication between the reader and PCI Interface board will always be Isolated RS-485 full duplex.

6.6 Reader Visual Feedback

The Edge-60R V2 reader has an indicator LED and its interpretation is as follows.

Figure 17 - Reader indicator LED

LED constantly slow blinking.

Reader using Serial communication interface

LED blink 3 times slowly with an interval between them.

Reader using Ethernet communication (No connection established port 8081)

LED constantly on (lit).

Reader using Ethernet communication (Connection established port 8081)

6.7 PCI Interface Visual Feedback

The PCI Interface board has three group of LED indicators and its interpretation is as follows.
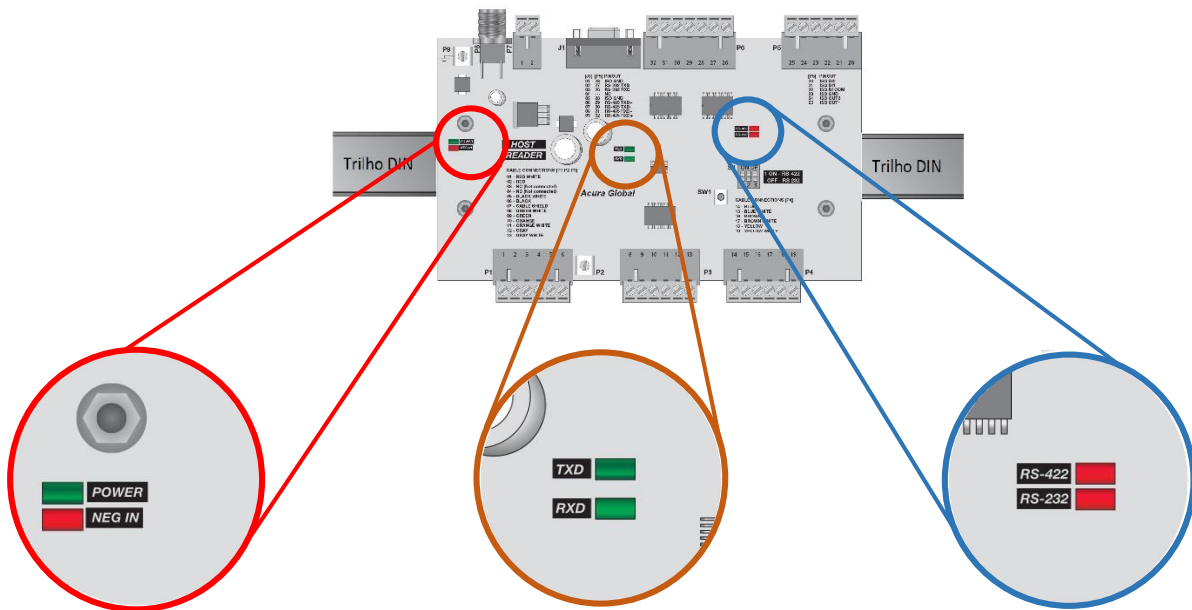
POWER on: Board powered up and OK.
NEG IN on: Inverted power input.

TXD blinking: Serial TX data traffic.
RXD blinking: Serial RX data traffic.
Both on: Communication is not Serial.

RS-422 on: Serial RS-485 FD
RS-232 on: Serial RS-232

Figure 18 - PCI Interface board indicator LEDs

7. Software Development

7.1 Using the Mercury API

For software development the Mercury API version 1.23.0 or last must be used. The Mercury API is an extensive software development kit (SDK) with example applications and sample code in Java, C, and C#.

The Mercury API can be downloaded using the following link.

http://www.thingmagic.com/manuals-firmware

On the next sessions is explain how to use the API to perform connections to the reader using Ethernet and Serial communication.

> ⚠️ **WARNING:** The version of Mercury API must be 1.23.0 or last, older versions does not support direct connection with the reader via Ethernet communication.

7.2 Software connection using Serial communication

To use Serial communication, just follow the instructions of the document "Mercury API Programmers Guide" and use the defaults URIs. You can find the API manual on the same link shown on session 7.1. Following are examples in three languages:

C#/.Net:
```
Reader r = Reader.Create("eapi:///COM1");// Windows serial port COM1.
Reader r = Reader.Create("eapi:///dev/ttyS1");//Linux serial port device.
r.Connect();//conecta com o leitor.
```

Java:
```
Reader r = null;
r = Reader.Create("eapi:///COM1");// Windows serial port COM1.
r = Reader.Create("eapi:///dev/ttyS1");// Linux serial port device.
r.Connect();//conecta com o leitor.
```

C:
```
TMR_Reader r, *rp;
TMR_Status ret;
rp = &r;
ret = TMR_create(rp, "eapi:///COM1"); // Windows serial port COM1.
ret = TMR_create(rp, "eapi:///dev/ttyS1"); // Linux serial port device.
ret = TMR_connect(rp); //conecta com o leitor.
```

> **NOTA:** The above examples are only for reader connection using Serial communication. For more detailed information, please refer to document "Mercury API Programmers Guide" which can be can be downloaded using the following link.
>
> http://www.thingmagic.com/manuals-firmware

7.3 Software connection using Ethernet communication

To use Ethernet communication, the application should set up the URI dispatch table (a mapping from string to factory function) before calling Reader.Create(). Please refer to document "Mercury API Programmers Guide" sessions "Advanced Customization" and "Custom Serial Transport Naming". This manual can be can be downloaded at
http://www.thingmagic.com/manuals-firmware

After set up the URI, the user application must call Reader.Create() using **URI_scheme://Reader_IP:Port** as parameter. Following are examples in three languages:

C#/.Net:
Reader.SetSerialTransport("tcp", SerialTransportTCP.CreateSerialReader); // set up the URI "tcp"
Reader r = Reader.Create("tcp://10.0.0.101:8081"); //use URI "IP do leitor:Port 8081"
r.Connect();//connect to the reader

Java:
Reader r = null;
Reader.setSerialTransport("tcp", new SerialTransportTCP.Factory());//set up the URI "tcp"
r = Reader.Create("tcp://10.0.0.101:8081"); // use URI "IP do leitor:Port 8081"
r.Connect();//connect to the reader.

C:
TMR_Reader r, *rp;
TMR_Status ret;
rp = &r;
ret = TMR_setSerialTransport("tcp", &TMR_SR_SerialTransportTcpNativeInit);// set up the URI "tcp"
ret = TMR_create(rp, "tcp://10.0.0.101:8081"); // use URI "IP do leitor:Port 8081"
ret = TMR_connect(rp); // connect to the reader.

NOTA: The TCP/IP port for reader Ethernet communication is 8081.

8. Regulatory Notes

8.1 Frequencies and Regional Operations

At Edge-60R V2 reader initialization the operational frequencies (hoptable) are configured according to the region set up by the controller firmware, however these settings can be changed using the Mercury API and may cause irregular operation of the reader depending of the regional regulatory rules.

8.2 Reader RF Power

For any combination of antenna and cable the maximum RF power is determined from antenna gain (Max Linear Gain value from antenna list) and antenna cable loss Insertion Loss value from cable list) using the formula:

$$P_{max} = 36\ dbm^3 - Antenna\ Gain^4 + Cable\ Loss^5$$

For example, for the reader integrated antenna the following calculation can be performed:

Max linear antenna gain = 12.5 dBiL

Minimum cable insertion loss (internal) = 1.5 dB

Max Power = 36 – 12.5 + 1.5 = **25 dBm**

The maximum RF power that may be set using the reader integrated antenna is 25 dBm.

> ⚠️ **WARINING:** To reduce potential radio interference to other users, the RF power should be chosen that the equivalent isotropically radiated power (EIRP) is not more than that required for successful communication.

---

[3] Max effective power (EIRP).
[4] Antenna gain in dBi.
[5] Cable loss in dB.

9. Read Polarization

The reader's integrated antenna has linear polarization, which means that the tag's antenna must be in the same orientation (polarization) of the reader's integrated antenna to perform reads, the following figures shows examples:
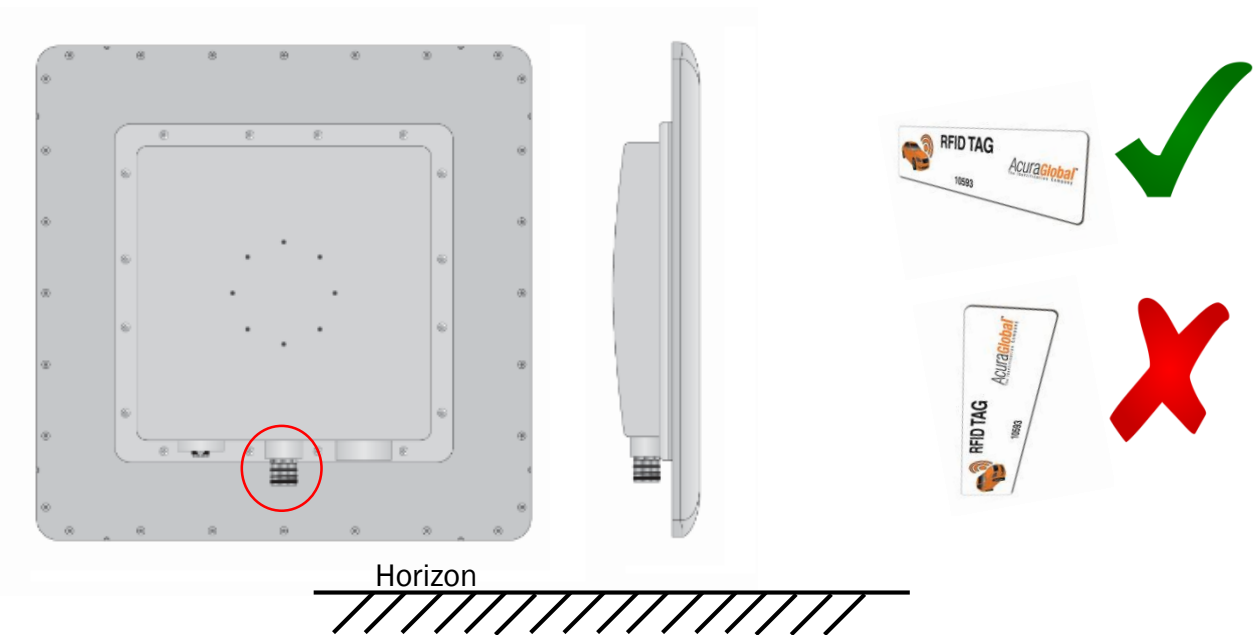
9.1 Horizontal Polarization

Figure 19 - Horizontal Polarization
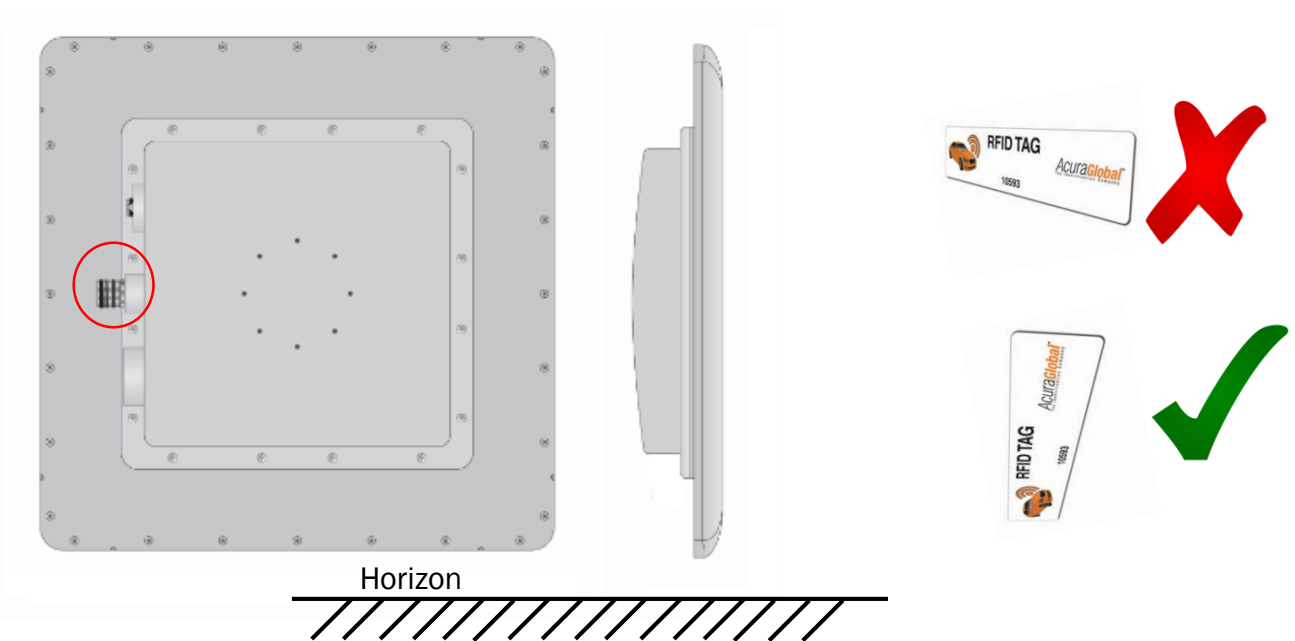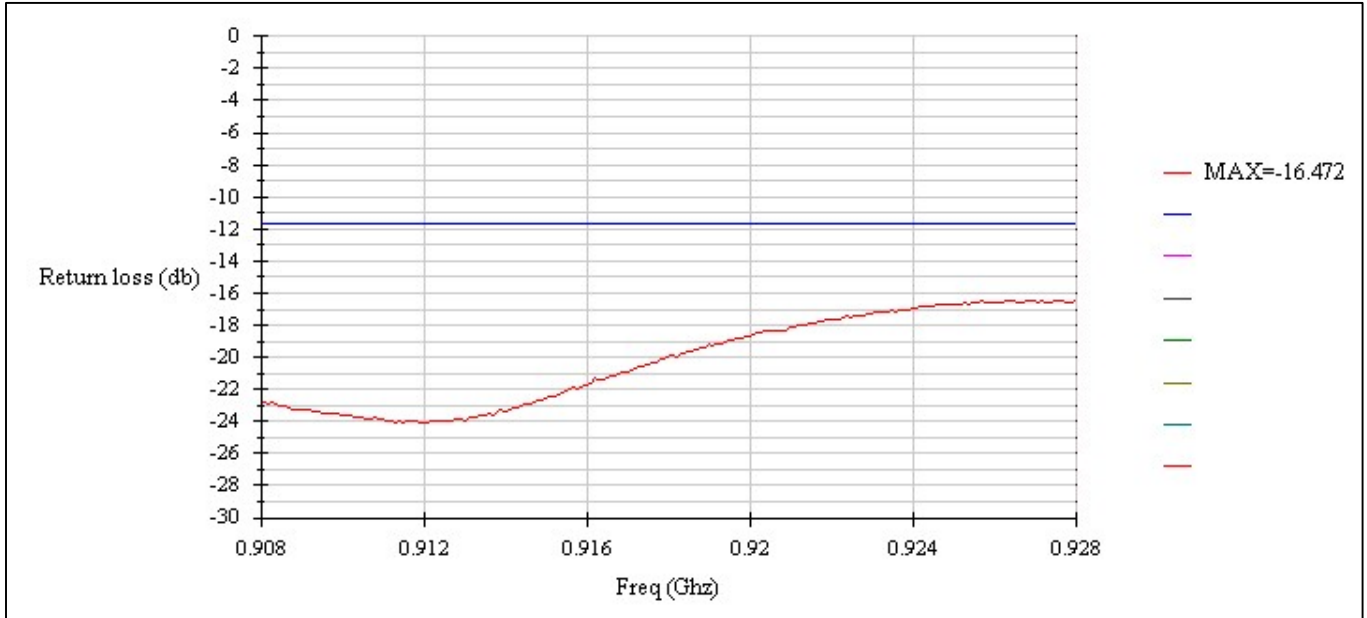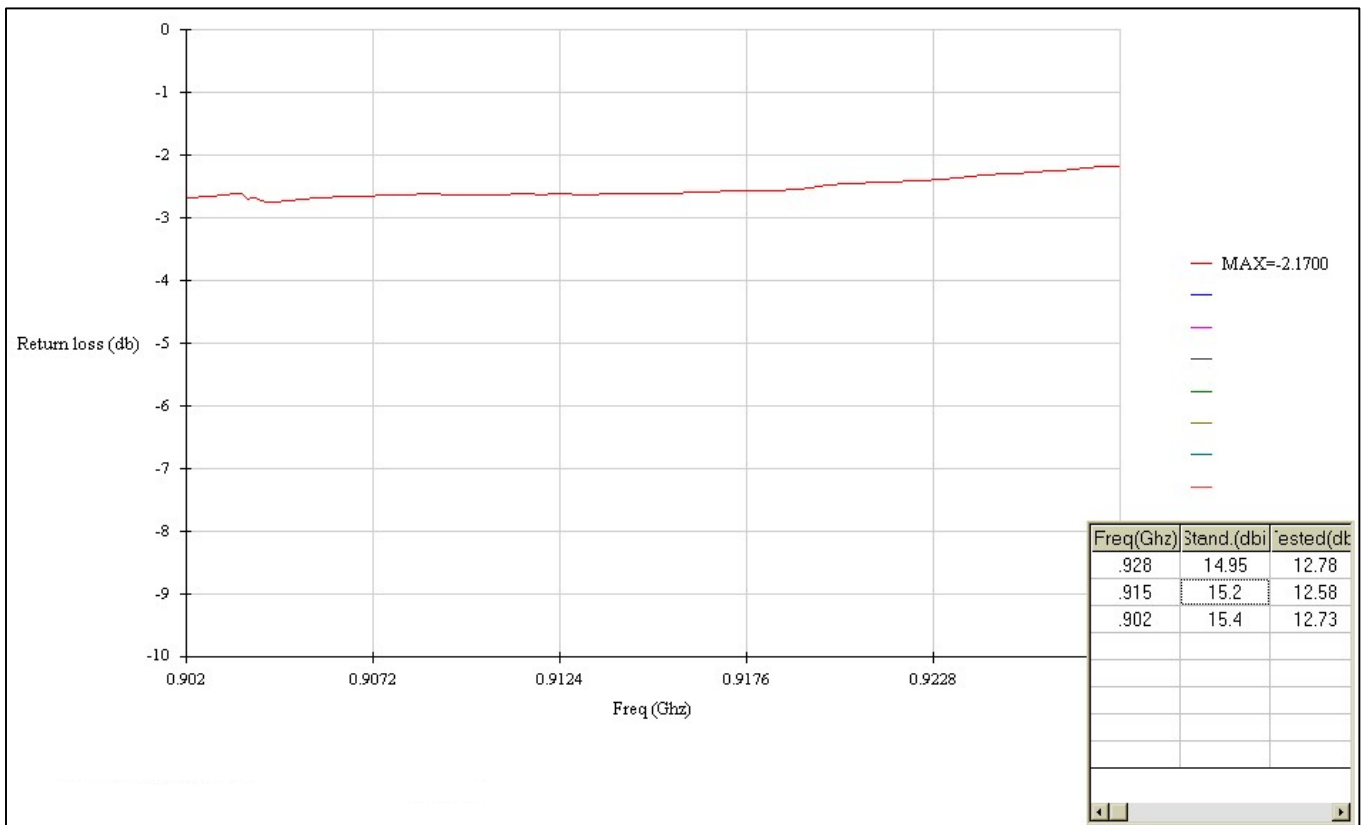
9.2 Vertical Polarization

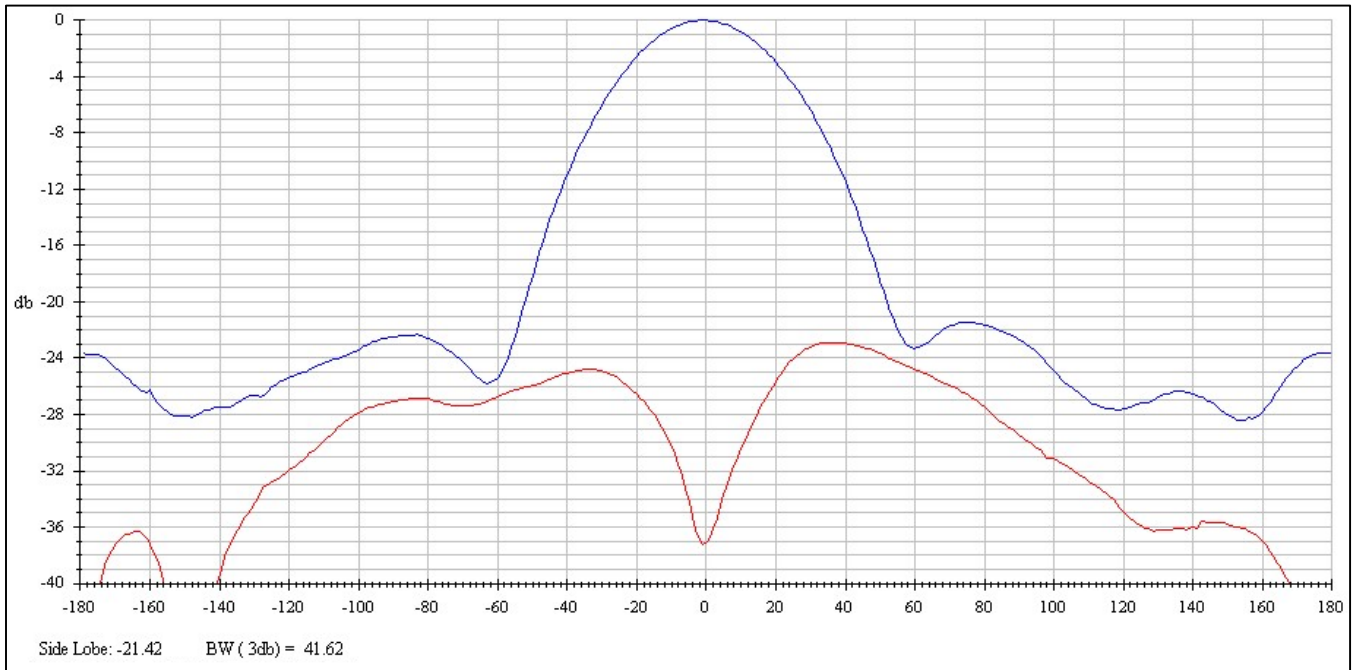*Figure 20 - Vertical Polarization*

10. Integrated Antenna measurements

10.1 VSWR

10.2 Sweep Gain

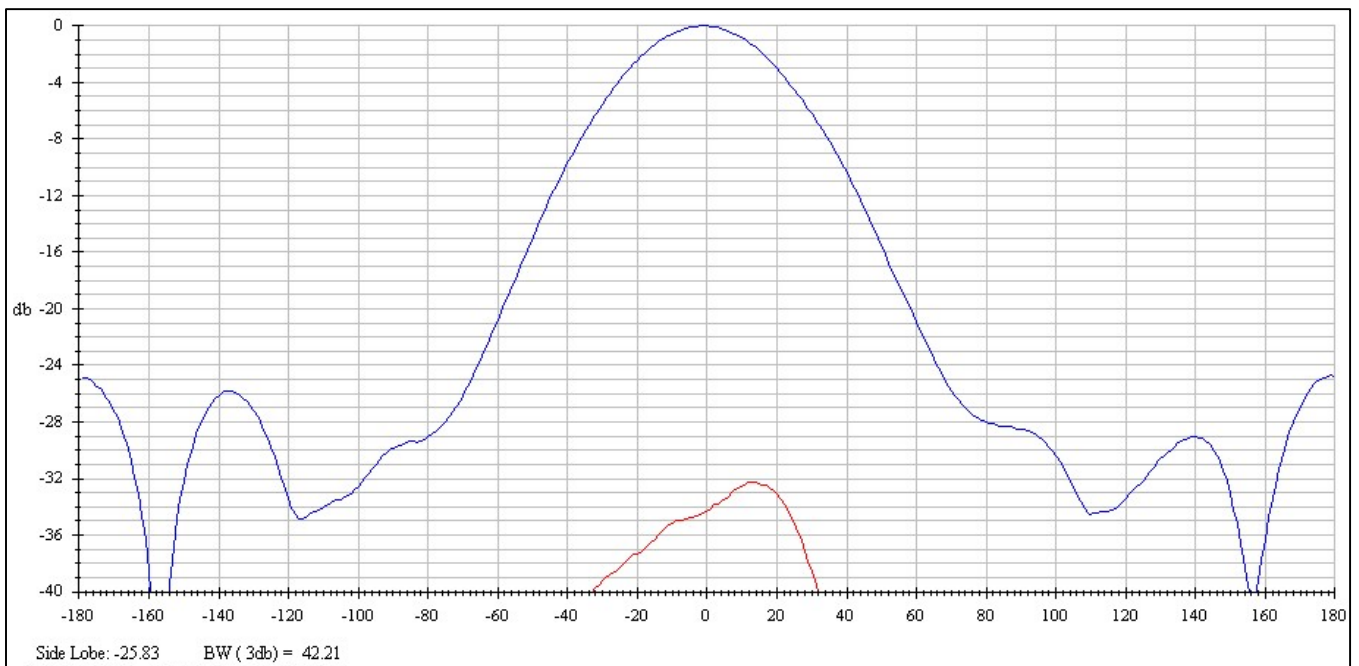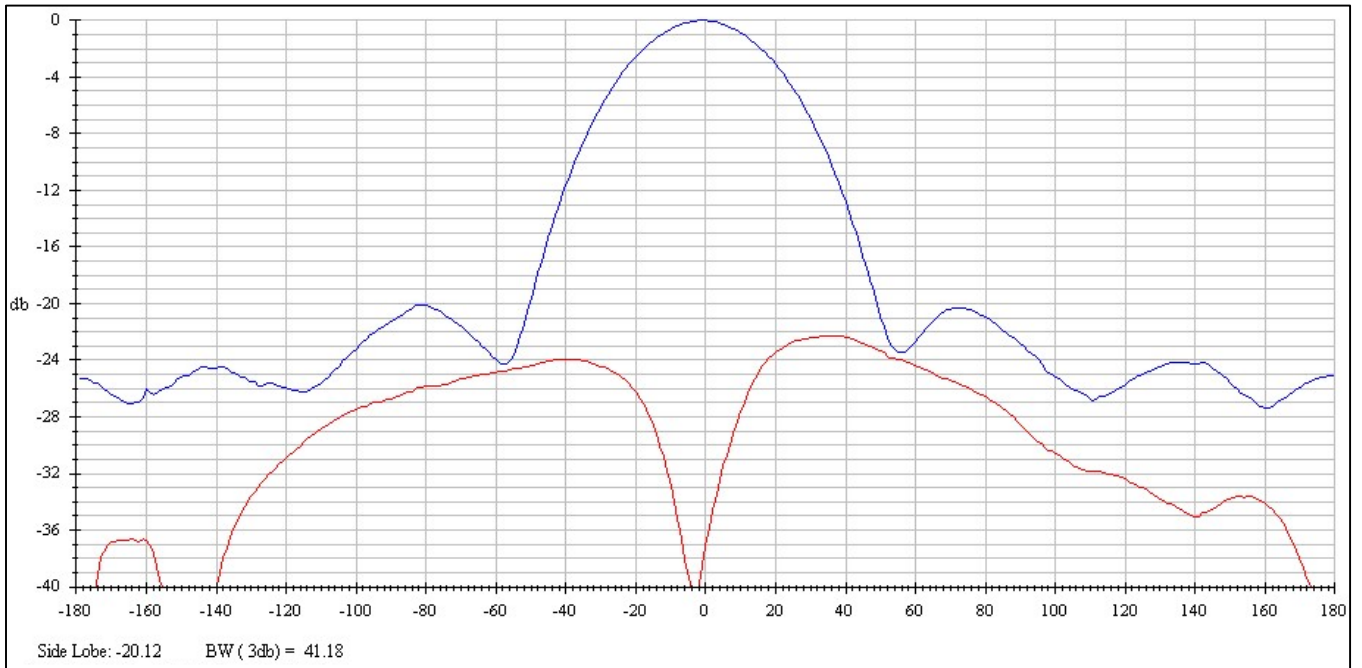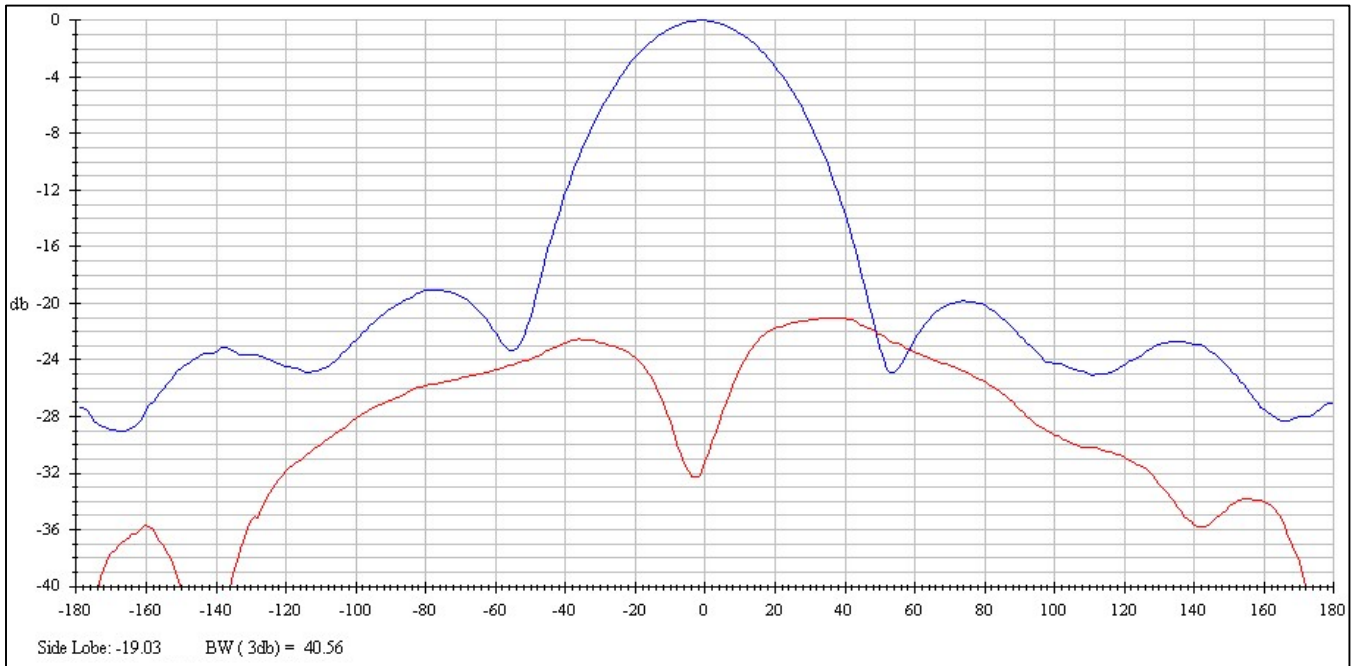| Freq(Ghz)	Stand.(dbi)	Tested(db)
.928	14.95	12.78
.915	15.2	12.58
.902	15.4	12.73

10.4 Radiation pattern (Azimuth 902MHz)

10.5 Radiation pattern (Elevation 902MHz)

10.6 Radiation pattern (Azimuth 915MHz)

Side Lobe: -20.12   BW (3db) = 41.18

10.7 Radiation pattern (Elevation 915MHz)

Side Lobe: -27.96   BW (3db) = 43.63
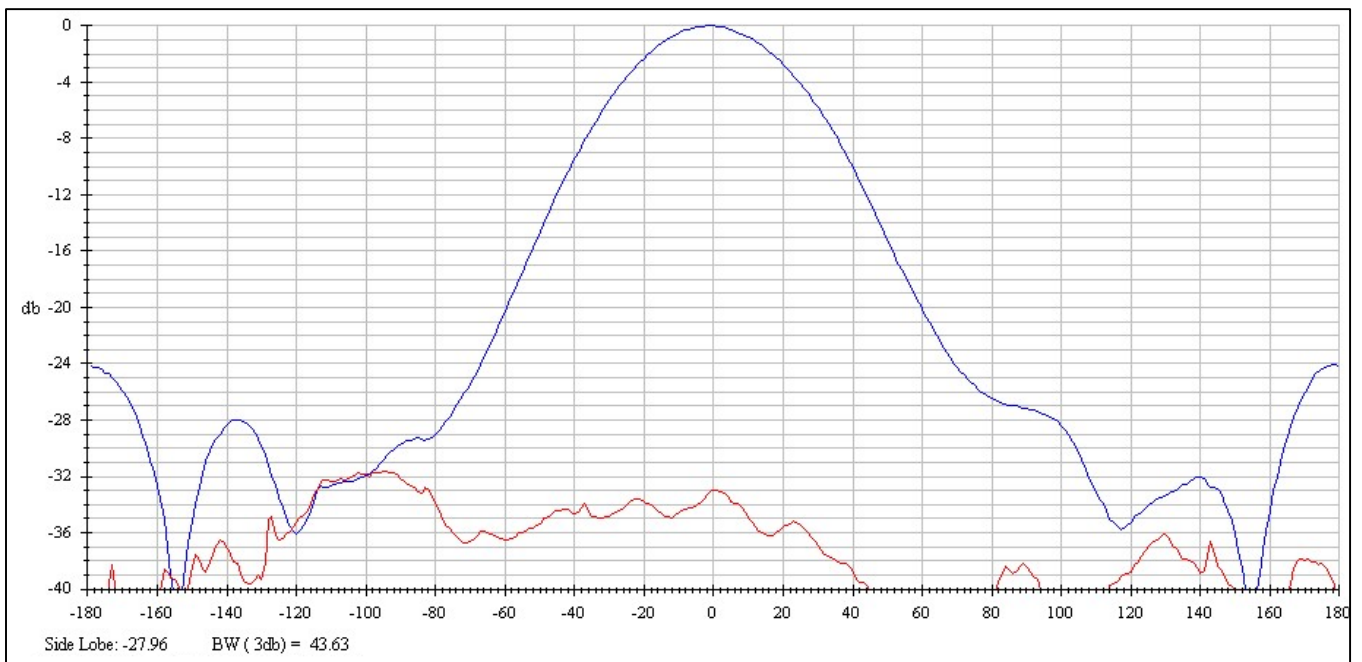
10.8 Radiation pattern (Azimuth 928MHz)

Side Lobe: -19.03   BW (3db) = 40.56

10.9 Radiation pattern (Elevation 928MHz)

Side Lobe: -30.5   BW (3db) = 43.72
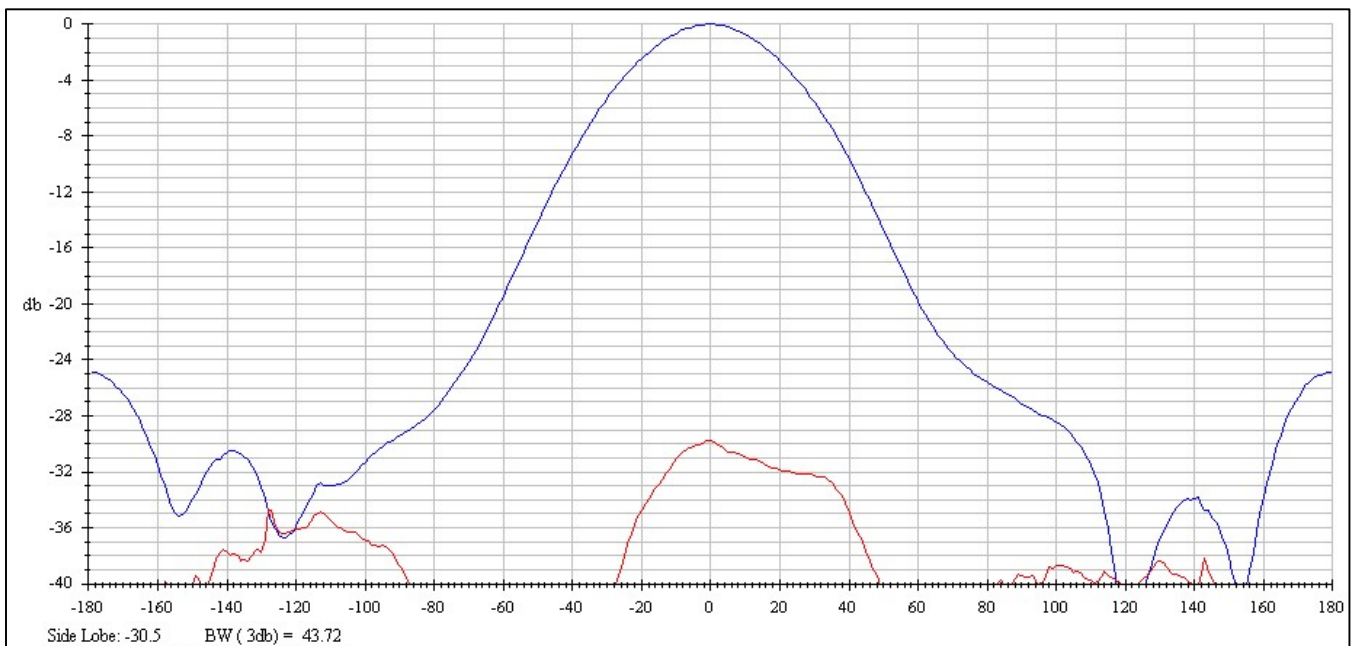
11. Troubleshooting

11.1 Common problems solutions

- Unknown reader IP address

In this case, there are two options:

1º You can find the reader on the local network (LAN) by using the "Device Explorer" software. This software send UDP broadcast to locate the reader on the local network segment and shows the IP and Mac address. The following figure shows an example.
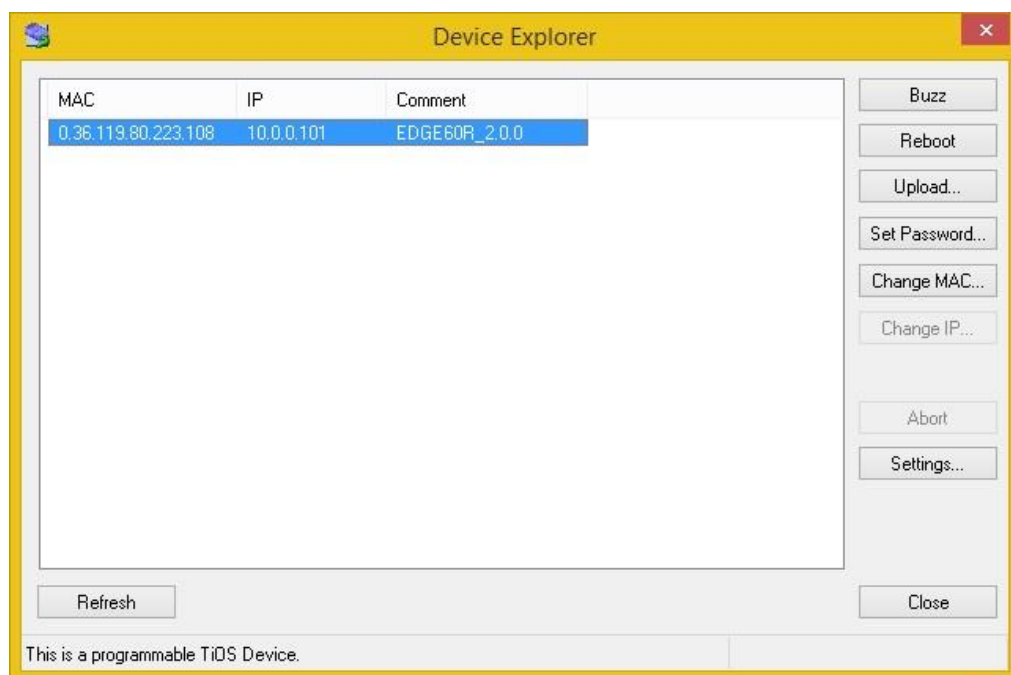

Figure 21 - Device Explorer screem

Device Explorer can downloaded using the following link:

http://www.acura.com.br/Downloads/tdevexplore-3-07-75.exe

2º You can perform a reader hard rest to restore the default settings, please refer to session 6.3.

- Unknown login password to access the settings page

You can perform a reader hard rest to restore the default settings, please refer to session 6.3.

- I cannot connect to the reader through Ethernet communication

    a) Check if the reader is connected to power and connected to the network cable;

    b) Check if the network cable used is working properly;

    c) Check if the PC is in the same network segment;

    d) Check if the reader is configured to Ethernet communication, you can see on the reader's settings page;

    e) In last case, you can perform a reader hard rest to restore the default settings;

- I cannot connect to the reader through Serial communication

    a) Check if the reader is connected to power;

    b)   Verifique as conexões do cabo blindado do leitor na PCI Interface, seguindo as instruções em "5.3 Ligações elétricas PCI Interface";

    c) Check if the electrical connections between the reader and PCI Interface board are correct as shown on session "5.3 PCI Interface Electrical Wiring";

    d) Check if the reader is configured to Serial communication, you can see on the reader's settings page;

ACURA Global, headquartered in Brazil, is a pioneer in the market of Radio Frequency Identification (RFID). Since the early 90s ACURA has successfully implemented RFID technology in large scale applications. ACURA's RFID systems have many applications in the commercial, utility and industrial sectors of the economy. Our applications include mining to steel production, agriculture to food processing, logistics to retailing, transports to distribution chain and access control to active management. ACURA RFID Systems is very agile, promoting new technologies and innovation, with a businesslike focus on the viability of R&D projects.

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