Medio S003 Reader

Integrator's Guide

Revision 1.0

TAGSYS

December 2004

Publishing Information

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Read This First

Welcome to the TAGSYS range of products operating at the 13.56 MHz frequency. This range of products is used to implement high-quality RFID systems for demanding applications.

This document provides information about how to install and use Universal Short Range Medio S003 TAGSYS RFID Tags.

Audience

This document requires familiarity with RFID technology. It is intended for people in charge of installing and using the product.

Conventions

Symbol	Meaning
	**CAUTION**: A note that advises users that a specific action could result in the loss of data or damage the hardware. **WARNING**: A note that advises users that a specific action may result in physical harm.
	A note that provides additional information that helps the user perform a task or obtain the best performance from the product.

Abbreviations and Acronyms

AFI	Application Family Identifier
AON	All Or None
API	Application Programming Interface
ASK	Amplitude Shift Keying
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
DLL	Dynamic-Link Library
DPU	Digital Processing Unit
DSFID	Data Storage Format Identifier
DSP	Digital Signal Processor
EAS	Electronic Article Surveillance
ETX	End of Text
HPI	Host Port Interface
I/O	Input/Output
IFD	Interface Device

LED	Light Emitting Diode
LSB	Least Significant Bit
MSB	Most Significant Bit
OS	Operating System
PC	Personal Computer
PCB	Printed Circuit Board
RAM	Random Access Memory
RF	Radio Frequency
RFID	Radio Frequency IDentification
RFU	Reserved for Future Use
RPU	Radio Processing Unit
RTC	Real Time Clock
RTF	Reader Talks First
SAM	Security Access Module
STX	Start of Text
TTF	Tag Talks First
TTL	Transistor-Transistor Logic
TTY	TeleTYpe
UID	Unique Identifier

Glossary

Anti-Collision Tag capability making it readable while other tags are present in the RF field.

Antenna An aerial that receives and/or transmits radio frequency signals. Aerials are manufactured in a variety of forms, shapes and sizes.

Baud A unit of measure of data transmission speed representing the number of signal changes per second.

BNC Connector Cylindrical metal connector with a copper core that is located at the tip of a coaxial cable, and is used to connect cables together. It attaches by pushing and twisting the outer cylinder on to two locking pins.

Coupler See Reader.

Data Storage Format Identifier Identifies the structure of the data stored in the TAGSYS RFID Tag.

Digital Signal Processor This part of the Radio Processing Unit (RPU) performs real-time TAGSYS RFID Tag decoding and manages the Medio L200 configuration.

Dynamic-Link Library Executable routines that are stored as separate files with DLL extensions and executed only when needed by the program.

Host Port Interface Interface used to access the DSP memory.

IEC Connector Three-pin connector used on sockets that carry mains electricity to the computer. All PCs use a male IEC connector and mains lead with a female IEC connector.

Interrogation Pulse A signal transmitted by the coupler to activate the TAGSYS RFID Tag's transponder.

Monitoring Port Parallel Port granting access to the HPI. It communicates directly with the Radio Processing Unit

Multi-Read See Anti-Collision

Nibble Half a byte (4 bits)

Packaged Reader A reader in its casing.

Phase Shift Difference of phase between the 13.56 MHz field emitted by two antennas. This feature is dedicated to rotating field applications and three-dimensional volume TAGSYS RFID Tag detection.

Protocol A set of rules governing a particular function, such as the flow of data/information in a communication system (communication between a TAGSYS RFID Tag and a reader or a reader and a PC or host computer).

Radio Frequency Identification System (RFID) An automatic identification and data capture system comprising one or more readers and one or more TAGSYS RFID Tags in which data transfer is achieved by means of suitable modulated inductive or radiating electromagnetic carriers.

Radio Processing Unit This unit controls the main features of the Medio L200, such as the RF channels, the multiplexer and the TAGSYS RFID Tag decoding.

Reader Electronic system for the communication between TAGSYS RFID Tags and host computers.

Reader Talks First Chip protocol for exchanges between the reader and the chip, whereby the chip waits for a command from the reader to which it responds.

RS-232 Electronic Industries Association (EIA) standard for serial interfaces between computers and peripherals which defines the function, the electrical characteristics and the timing of signals.

RS-485 Electronic Industries Association (EIA) standard for multipoint, differential data transmission. It allows multiple nodes to communicate bi-directionally over 1 or 2 twisted pairs.

TAGSYS RFID Tag Small, flexible tag from the 13.56 MHz TAGSYS product line. A TAGSYS RFID Tag is made of a chip connected to an etched antenna.

Tag See TAGSYS RFID Tag.

Tag Talks First Chip protocol for exchanges between the reader and the chip, whereby the tag sends information continuously, without waiting for a specific command from the reader.

Transceiver A combined transmitter and receiver.

Transponder A combined receiver/transmitter that automatically transmits a signal when a 'trigger' is received by it. The trigger is often a pulse, called an interrogation pulse.

If you need assistance

Please contact your nearest TAGSYS sales representative or the TAGSYS welcome desk at:

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Contact for Comments

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Please remember to quote the Document Reference Number 11568A0, your job title and your company.

Quality Issues

TAGSYS implements stringent quality controls at all stages of its manufacturing process. However, should you find a defect with this product, please notify your TAGSYS Quality Service representative using the dedicated Product Return Form.

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Table of Contents

1 Certification

1.1 Occupational Health and Safety Notices

TAGSYS Products have been designed to comply with the European Standard EN 50364 “Limitation of human exposure to electromagnetic fields from devices used in Electronic Article Surveillance (EAS), Radio Frequency Identification (RFID) and similar applications” in conjunction with the European Standard EN 50357 describing how to evaluate the exposure level.

It is the responsibility of the CIT (Certified Integrator of TAGSYS) to install the Medio S003 TAGSYS RFID Tag Reader as described in TAGSYS Product Manuals or TAGSYS Documentation and with the appropriate antennas.

Modification of any TAGSYS System is prohibited without the written consent of TAGSYS. Unauthorized modifications may void the conformity of the equipment to safety standards and will void the TAGSYS warranty.

1.2 Regulatory Notices

An RFID system typically composed of an RF emission device such as the Medio S003 is subject to national regulations that may differ by country.

One important item to consider is the maximum permissible magnetic field intensity at a distance of 10 meters from the antenna that must not exceed 42 dBµA/m in Europe and 38 dBµA/m in US.

The Medio S003 TAGSYS RFID Tag Reader meets these limits.

It is the responsibility of the CIT (Certified Integrator of TAGSYS) to install the Medio S003 TAGSYS RFID Tag Reader as described in this Integrator’s Guide or in TAGSYS Documentation.

1.2.1 In Europe (CE and RTTE Directives)

The Medio S003 TAGSYS RFID Tag Reader complies (CE Declaration of Conformity granted) with the European EMC directive.

The Medio S003 complies with the requirements of the Telecommunication Terminal Equipment Act (FTEG) and the RTTE Directive 1995/5/EC.

Any modification of the Medio S003 TAGSYS RFID Tag Reader is prohibited without the written consent of TAGSYS. Unauthorized modifications may void the conformity of the equipment to CE and RTTE Directives and will void the TAGSYS warranty.

If a Medio S003 is further integrated in a different product, it is the responsibility of the manufacturer of this complementary product to obtain the required approvals for this product.

1.2.2 In USA (FCC Directive)

The Medio S003 TAGSYS RFID Tag Reader has been designed to comply with Part 15 of the FCC Rules. Furthermore typical configurations based on a Medio S003 have been successfully tested with Part 15 of the FCC rules.

Medio S003 TAGSYS RFID Tag Reader

WARNING TO USERS IN THE UNITED STATES

FEDERAL COMMUNCIATIONS COMMISSION (FCC) RADIO

INTERFERENCE STATEMENT 47 CFR Section 15.105(b)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different to that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

NO UNAUTHORIZED MODIFICATIONS

47 CFR Section 15.21

CAUTION: This equipment may not be modified, altered, or changed in any way without signed written permission from TAGSYS SA. Unauthorized modification may void the equipment authorization from the FCC and will void the TAGSYS warranty.

ANTENNA REQUIREMENT

47 CFR Section 15.203

CAUTION: This equipment must be professionally installed. The installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded. Non-professional installation or installation of the equipment with an improper antenna may void the equipment authorization from the FCC and will void the TAGSYS warranty.

Operation is subject to the following two conditions: (1) The system devices may not cause harmful interference, and (2) The library system devices must accept any interference received, including interference that may cause undesired operation.

1.2.3 In Canada

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

2 Introduction

2.1 General

This document provides information about how to install and use Universal Short Range Medio S003 TAGSYS RFID Tag Readers.

2.2 Product Description

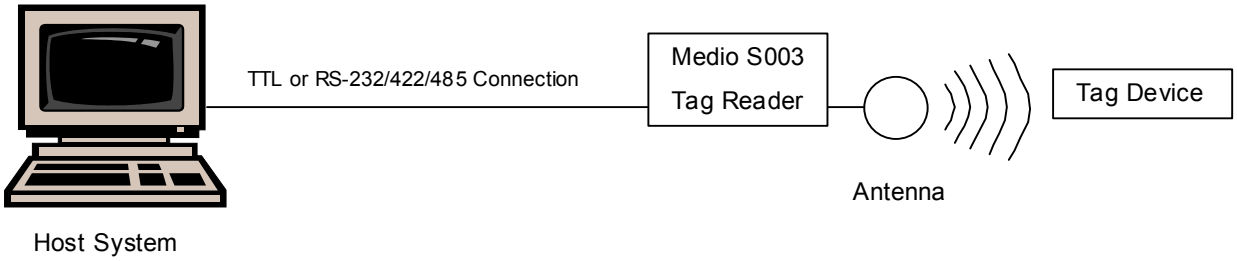
TAGSYS Medio S003 RFID Tag Reader is intended for Original Equipment Manufacturer (OEM) applications. The Medio S003 is Universal Short Range 13.56 MHz RFID reader designed to operate with any TAGSYS RFID Tag using any TAGSYS chip (C210, C220, C240 or C320) as well as I-Code™ chips. Medio S003 reader also complies with ISO 15693 Part-2 and Part-3 specifications.

The Medio S003 reader's technical features make it the ideal device for easy integration into handheld computers or printers. It offers the following features on a small printed circuit board:

- A high-performance radio processing unit operating at 13.56 MHz,
- A digital processing unit that incorporates chip drivers and includes the anti-collision feature (depending on the type of chip).

Medio S003 reader requires minimal computing power from the host workstation (Windows®-based PC or UNIX environment). It communicates easily with this host at a high speed, using the simple TAGSYS enhanced communication protocol (STX-E) that has already been proven on many TAGSYS readers (Medio S001/S002 and Medio L100/L200).

Figure 1: Medio S003 TAGSYS RFID Tag Reader Application Overview



Although Medio S003 reader provides high RF performances with a variety of TAGSYS RFID Tags, its power consumption has been minimized to save host batteries and to increase operating time.

The Medio S003 TAGSYS RFID Tag reader is easy to integrate in a variety of terminals and printers due to its following features:

- small size
- standard communication links
- low power consumption

2.3 Medio S003 Key Features

Table 1: Medio S003 Key Features

Description	Medio S003
Operating Frequency	13.56 MHz
Compatibility	TAGSYS (C210, C220, C240 and C320) C270 (Philips I-Code™) ISO 15693
Stand-alone Mode	TAGSYS (C210, C220, C240 and C320) C270 (Philips I-Code™) ISO 15693
Primary Serial Link	TTL
Secondary Serial Link	RS-232, RS-485 or RS-422
Network Operating	Yes (RS-485)
Configurable I/Os	4 (TTL)
Firmware upgradeable	yes
Boot with last configuration	Yes
Output	1 (TTL)

2.4 Delivery

The Medio S003 TAGSYS RFID Tag Reader kit contains the following items:

Table 2: Package Contents

Quantity	Item
1	Medio S003 TAGSYS RFID Tag Reader
1	HE-10 connector (10-pin)
1	CD-ROM including: • Medio S003 Integrator's Guide • Medio S003 Command Set • User-friendly S002 Explorer software provided for test and debug operations on Windows® 9x, NT®, 2000 and XP platforms • Medio STX Windows® DLLs to facilitate the development your own applications on Windows® 9x, NT®, 2000, XP and Windows® Pocket PC 2002 platforms • Medio STX Windows® DLL Programming Guide • One set of Microsoft® Visual C++® source code and executable samples using the Medio STX Windows® DLLs
1	Welcome Letter / Product Return Form

3 Functional Overview

This section provides an overview of the architectural structure and peripheral devices of the Medio S003 TAGSYS RFID Tag Reader. It also provides a summary of the special functions used to drive the reader board and describes the automatic features managed by the Central Processing Unit (CPU).

3.1 Functional Block Diagram

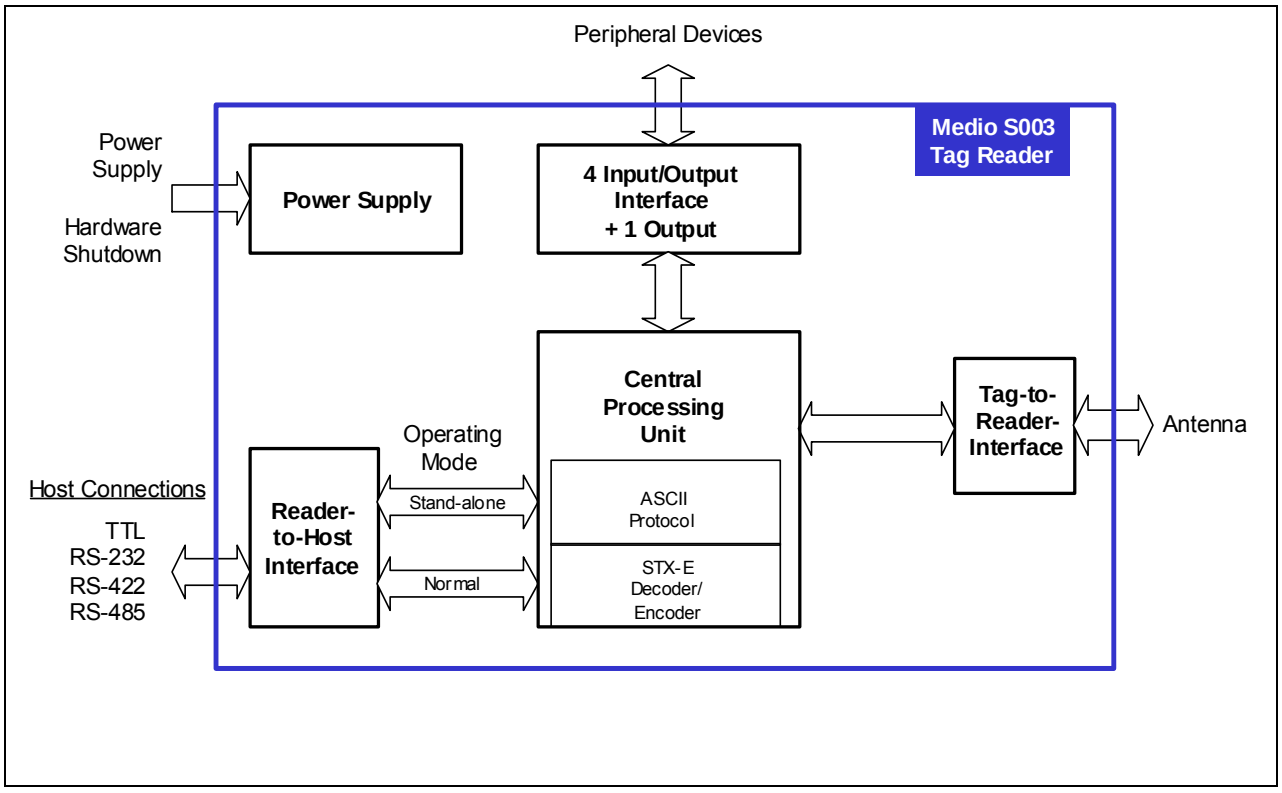
The Medio S003 architectural structure is based on a CPU that drives all reader functions.

It manages communications between the host system (connected to the “Reader-to-Host interface”) and one or more TAGSYS RFID Tags using an antenna (connected to the “Tag-to-Reader interface”).

It also drives five pins, 4 Input/Outputs (I/Os) and 1 output that are CMOS/TTL-compatible.

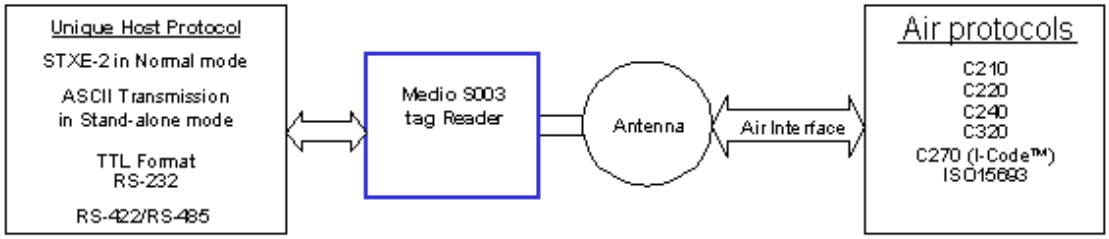
Figure 2 illustrates the general architecture of Medio S003 TAGSYS RFID Tag Reader.

Figure 2: Overall Medio S003 Architecture



3.2 Communication Protocols

Figure 3: Medio S003 Reader Communication Protocols



3.2.1 Tag-to-Reader Interface

To read from TAGSYS RFID Tags, to write to their memory, or to activate their functions, a wide command set is available. For a complete list of embedded commands and their description, please refer to the Medio S003 Command Set document.

Each range of TAGSYS RFID Tags has its own specific set of commands.

Table 3: TAGSYS RFID Tag Dedicated Commands

TAGSYS RFID Tag Family	Available Commands	Comments
C210	Read the ID	
C220	Read Memory Content	Single chip and Anti-Collision
	Write Memory Content	
C240	Read Pages	
	Check Password	
	Write Page	
	Temporary Inhibition	
C320	Read Memory Content	Single chip and Anti-Collision
	Write Memory Content	
C270 (Philips I·Code™)	Read Block	Selective and Unselective Read
	Write Block	
	Anti-Collision Select	
	Halt	
	Reset Quiet	
	Refresh Selection	
ISO 15693	Raw Command	

3.2.2 Reader-to-Host Interface

When the Medio S003 reader is connected to an antenna, it acts more as a protocol converter due to the wide range of tasks it can perform. For more information about these tasks, refer to the Medio S003 Command Set document.

Depending on the task requested by the user through the reader to the host interface, the reader retrieves information from the TAGSYS RFID Tag or provides it with information using its own communication protocol. The reader then converts the result of the operation into STXE-2 protocol and returns the information to the host via the Reader-to-Host interface. For more information, refer to the Medio S003 Command Set document.

The Reader-to-Host interface has two operating modes:

1. Normal Mode

   The Reader-to-Host interface is the slave of the master host system. It waits for a valid command from the host, performs the task and responds. This bi-directional communication is achieved via the STX-Enhanced 2 protocol. (For more information, please refer to the Medio S003 Command Set document.)

2. Stand-alone Mode

   The Reader-to-Host interface is independent from the host system. Stand-alone mode is used by the Medio S003 reader to read tags and send their identification data to the host system. This transmission takes place in ASCII format. While in this mode, the reader cannot receive any commands.

For more information, please refer to Section 7, “Stand-alone Mode”.

3.3 Peripheral Devices

The I/O interface manages five pins (4 I/Os and 1 output) that drive or check external peripherals. The I/Os direction can be set individually as either input or as output. When the reader is powered on, their default direction is set as input.

Inputs are compliant with TTL/CMOS voltage levels.

Outputs consist of a full CMOS driver that can drive up to 20 mA (sunk or sourced).

The I/O pins are mainly used for static applications such as reading sensors or driving LEDs, relays or buzzers. For more information, refer to Section 6.1, “Using the Input / Output Pins (I/Os)”.

3.4 Automatic Features

3.4.1 Baud Rate Recognition

The Baud Rate Recognition feature provides multi-host compatibility. In normal operating mode, the CPU can detect whether the baud rate is 4800, 9600, 19200 or 38400, when a valid STX-E frame is received.

The STXE-2 reader response frame will use the same baud rate as the valid command frame that has been received.

3.4.2 RF Management

To reduce power consumption, TAGSYS RFID Tag dedicated commands automatically manage the RF field. Even if the RF is turned off, these commands activate the RF field. When the task has been performed, the RF field either reverts to its initial state or stays on depending on the command. Please refer to the Medio S003 Command Set document for command-specific RF management information.

4 Installing the Reader

This section explains how best to install the Medio S003 TAGSYS RFID Tag Reader board. The physical description of the reader board is given in Section 9, “Mechanical Characteristics”.

4.1 Pin Connections

The Medio S003 TAGSYS RFID Tag reader board has three connectors with inputs and outputs to the various peripheral devices, as illustrated in Figure 4.

Figure 4: Pin Locations

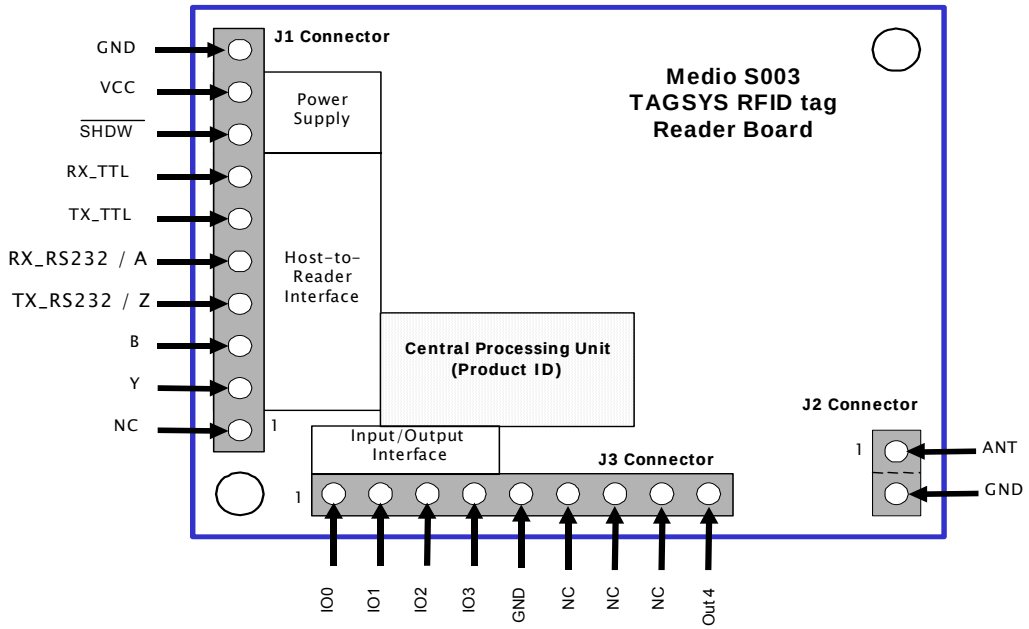


Table 4 lists the pins associated with each peripheral device.

Table 4: Pin Descriptions

Pin	Description	Connector
Power Supply		
VCC	Supply Voltage	J1-9
SHDW	Board Hardware shutdown (active low)	J1-8
Communication Links to the Host System		
RX_TTL	Receive pin for TTL	J1-7
TX_TTL	Transmit pin for TTL	J1-6
RX_RS232/A	Receive pin for RS-232 Non-inverting RS-485/RS-422 Receiver	J1-5 J1-5
TX_RS232/Z	Transmit pin for RS-232 Inverting RS485/RS422 Transceiver Output Inverting Half-Duplex RS-485 Driver	J1-4 J1-4 J1-4
B	Inverting RS485/RS422 Receiver Input	J1-3

Pin	Description	Connector
Y	Non-inverting RS-485/RS-422 Transceiver Output Non-inverting Half-Duplex RS-485 Driver	J1-2 J1-2
Antenna		
ANT	Antenna output pin	J2-1
I/O Interface		
I/O0	Input / Output 0	J3-1
I/O1	Input / Output 1	J3-2
I/O2	Input / Output 2	J3-3
I/O3	Input / Output 3	J3-4
Out 4	Output 4	J3-9
Ground Voltage Reference		
GND	Ground (for power supply)	J1-10
GND	Ground (for I/Os)	J3-5
GND	Ground (for antenna)	J2-2
Reserved Pins		
NC	Do not connect	J1-1
NC		J3-6
NC		J3-7
NC		J3-8

4.2 Power Supply and Hardware Shutdown

The power supply must be connected to a GND pin and to the V_{CC} pin. The optimum GND pin is located on the J1 connector. It must be able to withstand a peak current of 300 mA when the reader is powered on. Please refer to Section 10, “Electrical Characteristics” for more details about reader consumption.

The V_{CC} pin accepts an input voltage between 4 and 6 V.

In order to power the peripheral devices and the CPU, **the shutdown pin (SHDW) must be connected to a high voltage level**. When a low voltage is applied to this pin, the reader switches to Low Consumption mode and the power supply to certain circuits is turned off.

Table 5 lists the electrical limits for the SHDW pin. If the hardware shutdown function is not needed, the SHDW pin can be connected directly to the V_{CC} pin.

Table 5: Shutdown Pin - Electrical Limits

Parameters	Min.	Max.	Unit	Note
SHDW Input Voltage High	2	6	V	Board is powered on
SHDW Input Voltage Low	0.4		V	Board is powered off
SHDW Input Current	7		µA	Max reached when SHDW is low

If the SHDW pin is left unconnected, or if its input voltage is between 0.4 and 2V, the reader may not work correctly. In any event, the SHDW pin voltage must not exceed 6V.

4.3 Antenna

The J2 connector is dedicated to an antenna that is required for reading TAGSYS RFID Tags. This can be a TAGSYS antenna or a custom-made model. The choice of the antenna must take into account the following considerations:

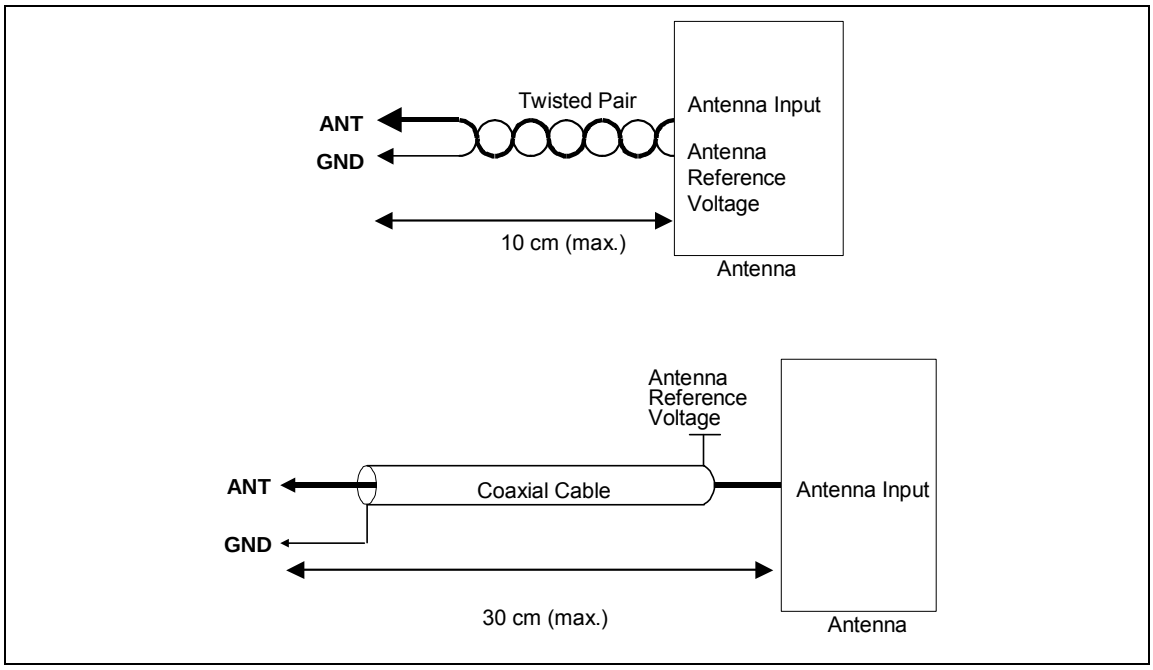
- Physical area (size) of the TAGSYS RFID Tag
- Strength of the reader
- Compliance with electrical characteristics (see Electrical Characteristics chapter)

The antenna has a passive design that features 50 ohm, 0° impedance characteristics at 13.56 MHz frequency.

The reference voltage for the antenna must be connected to the GND pin and the antenna input must be connected to the ANT pin of the J2 connector.

If the antenna is used close to the reader (less than 10 cm), a twisted pair can be used for the connection. Otherwise, a coaxial cable (50 Ω impedance) should be used. This cable must be as short as possible, and must not exceed 30 cm.

Figure 5: Connecting an Antenna



5 Serial Communication Links

Medio S003 TAGSYS RFID Tag Reader is based on a Master-Slave communication system where the host system acts as the master and the reader as the slave.

In Stand-alone mode, the reader is used as a master and the host system becomes the slave.

Table 6: Medio S003 Communication Links

TAGSYS RFID Tag Reader	Primary (Default) Link	Secondary Links
Medio S003	TTL	RS-232, RS-422 or RS-485 (full or half duplex)

The Host-to-Reader interface accepts TTL and an RS-232, RS-422 or RS-485 (Full or Half Duplex) communication links. The communication type is selected using the “Serial Communication Select” command (please refer to the Medio S003 Command Set document). The RS-232 link is the default setting. In any case, the TTL interface is always active and has priority over any Recommended Standard (RS) communication connection.

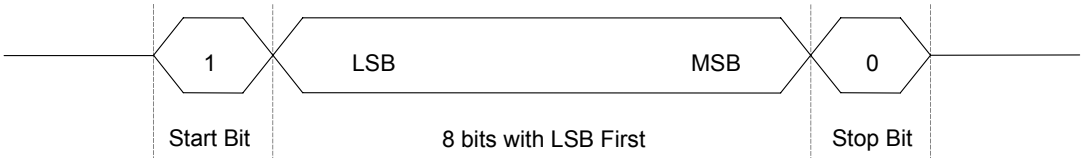
It is recommended that only one link should be connected at a single time to avoid compatibility issues.

To use both TTL and RS-XXX communication links at the same time, the RX_TTL pin must be driven by an open-drain or open-collector system. A full CMOS driver freezes the information coming from the RS-XXX Receiver.

5.1 General Information on Data Acquisition

Communication takes place by sending frames (bytes) on the communication link. The bytes are transmitted LSB first with one start bit and one stop bit as shown in Figure 6.

Figure 6: Structure of a Byte on the Communication Link



Communication parameters are listed in Table 7. These parameters cannot be modified.

Table 7: Parameters for the Transmission of a Byte

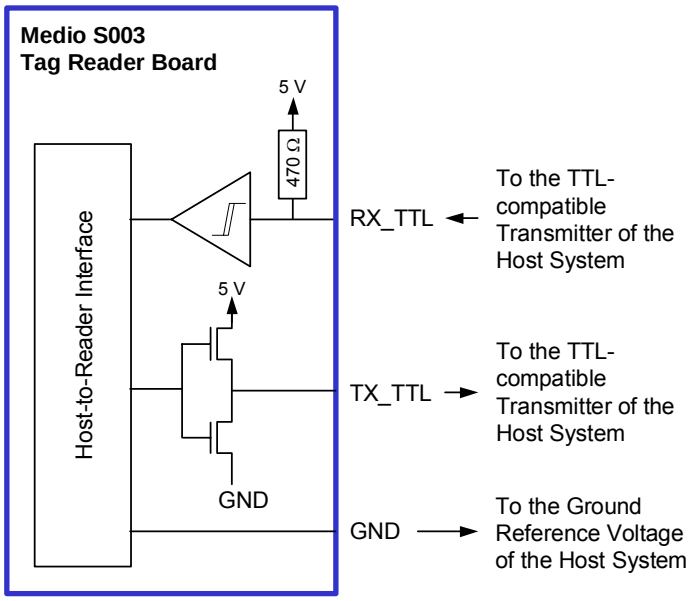
Parameter	Value
Allowed Baud Rates	4800, 9600, 19200 or 38400
Start Bit	On
Number of data bits	8
Parity	None
Stop bit	1

The maximum period between the transmission of bytes is 10 ms, regardless of the applicable baud rate.

5.2 TTL Interface

Figure 7 shows the hardware interface of the TTL communication link:

Figure 7: TTL Hardware Interface



If the TTL interface is not used, do not connect pins RX_TTL and TX_TTL together.

5.2.1 Installing the TTL Interface

To use the TTL Interface, pins TX_TTL and RX_TTL must be connected respectively to the transmit and receive pins of the TTL-compatible communication link of the host system.

The RX_TTL pin is compatible with TTL/CMOS levels. It has an internal pull-up of 470 ohms. This pin can be driven by both an open-drain/open-collector driver or by a full CMOS output driver.

The TX_TTL pin is a full CMOS output driver.

5.2.2 Electrical Signal Requirements

Both RX_TTL and TX_TTL pins have an inactive, high-level voltage. During the transmission of a byte, a bit set to 1 is coded by a low voltage and a bit set to 0 by a high one.

Figure 8: TTL Signal during an Exchange

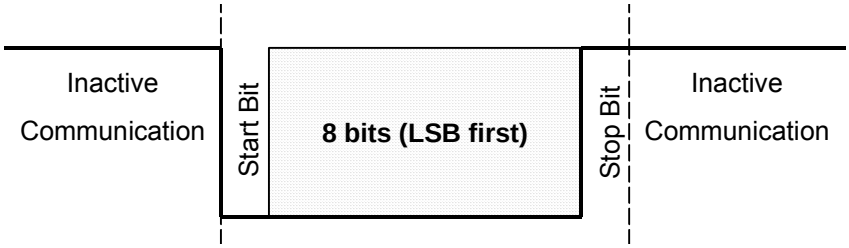


Table 8: TTL Interface Pins - Electrical Characteristics

Parameters	Min.	Typ.	Max.	Unit	Note
RX_TTL Input Voltage Low	0		1	V	
RX_TTL Input Voltage High	4	5		V	
RX_TTL Input Current	1			µA	
TX_TTL Output Voltage Low			0.6	V	
TX_TTL Output Voltage High	4.3			V	
TX_TTL Output Current			20	mA	Sunk or Sourced
TX_TTL Output Capacitance			50	pF	

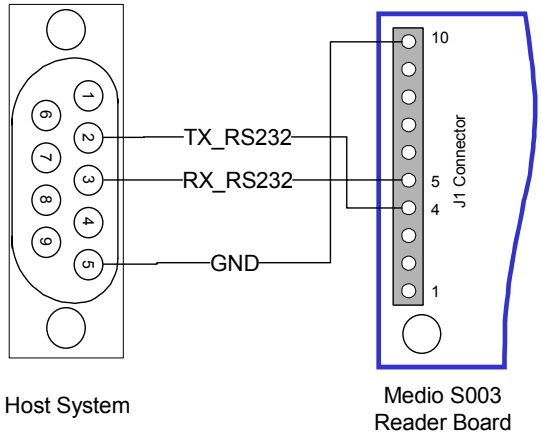
5.3 RS-232 Interface

5.3.1 Installing the RS-232 Interface

To use the RS-232 interface, TX_RS232 and RX_RS232 pins must be connected respectively to the receive and transmit pins of the host system communication link.

Figure 9 shows how to connect the RS-232 interface to a Sub-D 9 female connector. This makes it possible to directly plug the reader into a computer host system.

Figure 9: RS-232 Interface – Rear view of the Sub-D 9-pin (female) Connector



The RS-232 interface is compatible with the RS-232 standard.

5.3.2 Setting the Host System RS-232 Communication Link

The host system RS-232 communication link must be set as shown in Table 9.

Table 9: RS-232 Allowed Settings on the Host System

Parameter	Value
Allowed Baud Rates	4800, 9600, 19200 or 38400
Start bit	On
Number of data bits	8
Parity	None
Stop bit	1
Data flow	None

5.3.3 Electrical Signal Requirements

Table 10 shows the electrical characteristics of the RS-232 interface pins.

Table 10: RS-232 Interface Pins - Electrical Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit
RX-RS232 Input Voltage Range		-25		+25	V
RX-RS232 Input Threshold Low	25°C	0.8	1.5		V
RX-RS232 Input Threshold High	25°C		1.8	2.4	V
RX-RS232 Input Hysteresis			1.8	2.4	V
RX-RS232 Input Resistance		3	5	7	kΩ
TX_RS232 Output Voltage Swing	Loaded with 3 kΩ	±5	±5.4		V
TX_RS232 Resistance		300	1000		kΩ
TX_RS232 Output Short-circuit current			±60		mA
ESD Protection on both pins	IEC 1000-4-2 Air Gap discharge	±15			kV
	IEC 1000-4-2 Contact discharge	±8			kV
	Human body model	±15			kV

5.4 RS-422 / RS-485 Interface

The RS-485 / RS-422 interface and RS-232 interface cannot be used at the same time.

The RS-422 interface is compatible with EIA/TIA-422 standards.

The RS-485 interface is compatible with EIA/TIA-485 standards.

The RS-485 permits a balanced transmission line to be shared in Party Line or Multi-drop mode. As many as 32 receiver (readers or repeaters) pairs can share a Multi-drop network. If more readers are needed in the network, balanced line repeaters can be used (a repeater takes the place of a reader on the network).

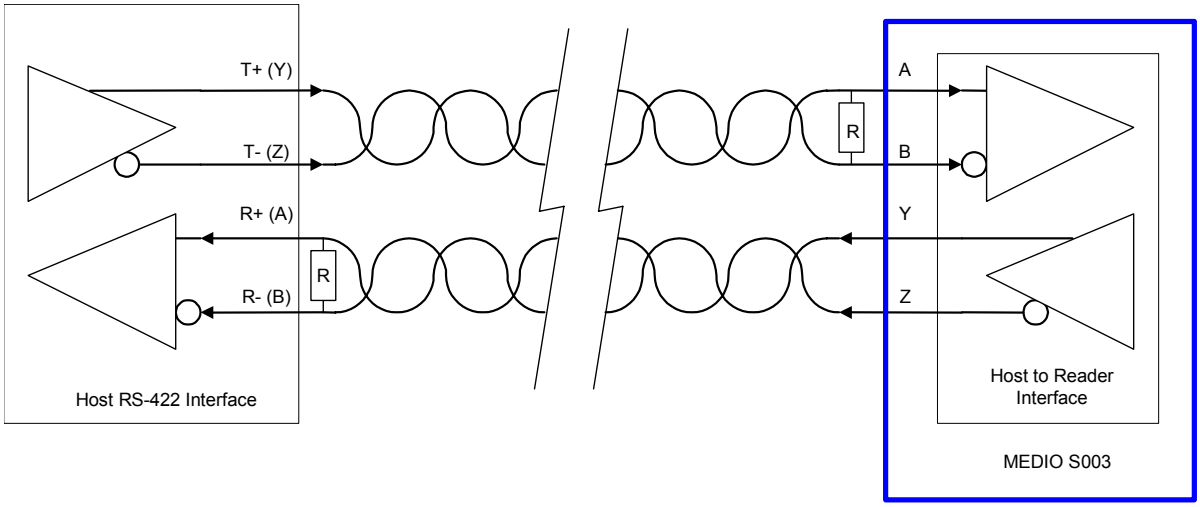
5.4.1 Installing the RS-422 Interface

Figure 10 shows how to connect the RS-422 interface. The balanced line A and B corresponds to the reader receiver and must be connected to the transmitter of the host. The A pin is the non inverted line (+) and B is the inverted line (-). The balanced line Y and Z corresponds to the reader transceiver and must be connected to the receiver of the host. The Y pin is the non-inverted line (+) and the Z pin is the inverted line (-).

A 120-Ohm resistor should be added at the end of a transmission line in compliance with RS-422 specifications.

When set to communicate according to RS-422 specifications, the reader always holds its transceiver active and never switches it into Tri-state mode. The Host-to-Reader Interface should not be unplugged.

Figure 10: Connection of the RS-422 Interface



5.4.2 Installing the RS-485 Full Duplex Interface

The RS-485 Full Duplex Standard requires 2 pairs of balanced lines, one for transmitting and another for receiving data.

The balanced line A and B corresponds to the reader receiver and must be connected to the transmitter of the host (and other reader receivers or repeater). The A pin is the non-inverted line (+) and the B pin is the inverted line (-).

Figure 11: Connection of the RS-485 Full Duplex Interface

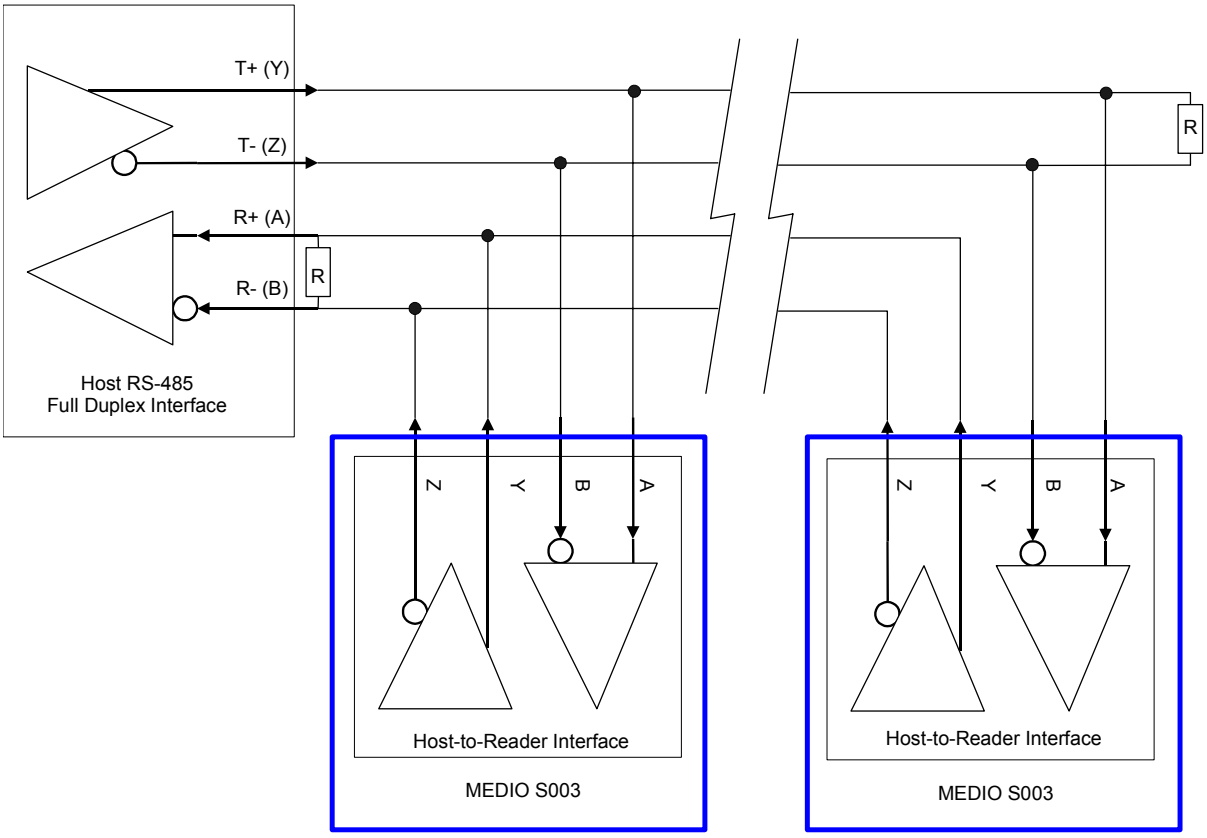


Figure 11 shows how to connect the RS-485 Full Duplex Interface in a Multi-drop network.

The balanced line Y and Z corresponds to the reader transceiver and must be connected to the receiver of the host (and other reader transceivers or repeater). The Y pin is the non-inverted line (+) and the Z pin is the inverted line (-).

A 120-Ohm resistor should be added at the end of the two transmission lines in compliance with RS-485 specifications.

When set to communicate using the RS-485 interface, the reader always holds the transmission lines before the start of any communication and returns to Tri-state mode at the end of communication. The host system should do the same. The reader can be unplugged from the balanced lines.

5.4.3 Installing the RS-485 Half Duplex Interface

RS-485 Half Duplex Standard requires only 1 pair of balanced lines, for both transmitting and receiving data.

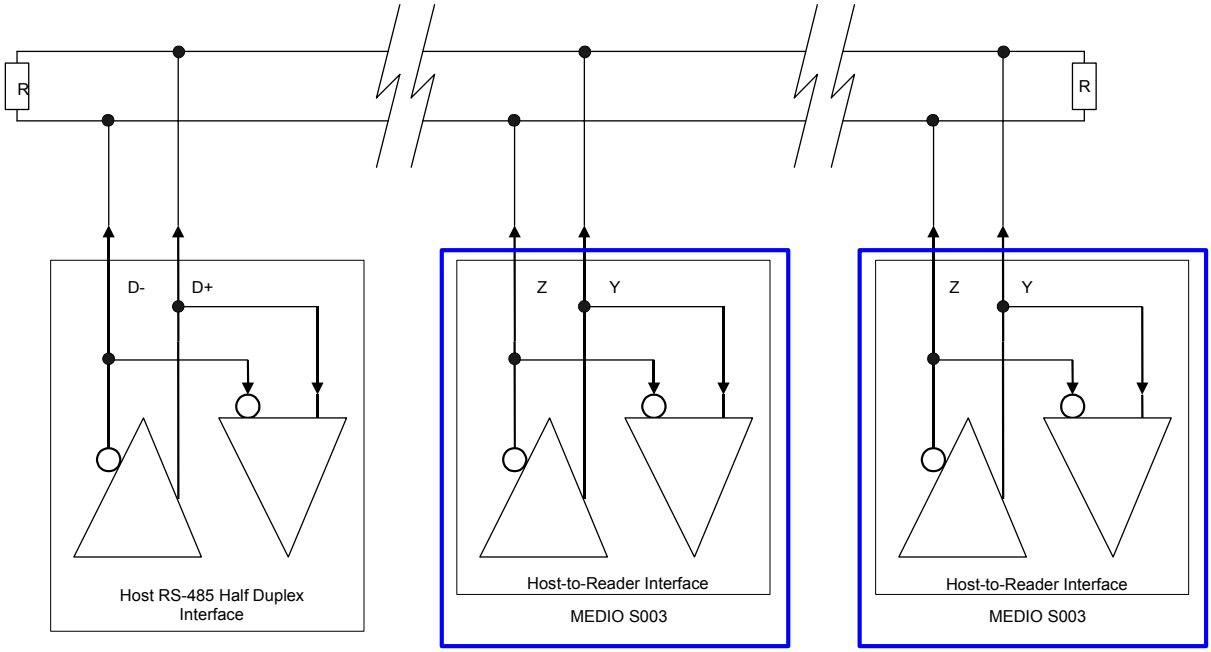
The balanced line Y and Z corresponds to the reader driver and must be connected to the driver of the host (and other reader drivers or repeater). The Y pin is the non-inverted line (+) and the Z pin is the inverted line (-).

The A and B pins are left unconnected.

The RS-485 Half Duplex interface can be configured by setting the reader in RS-485 Full Duplex mode and connecting pins A and B to pins Y and Z pins respectively.

Figure 12 shows how to connect the RS-485 Half Duplex Interface in a multi-drop network.

Figure 12: Connection of the RS-485 Half Duplex Interface



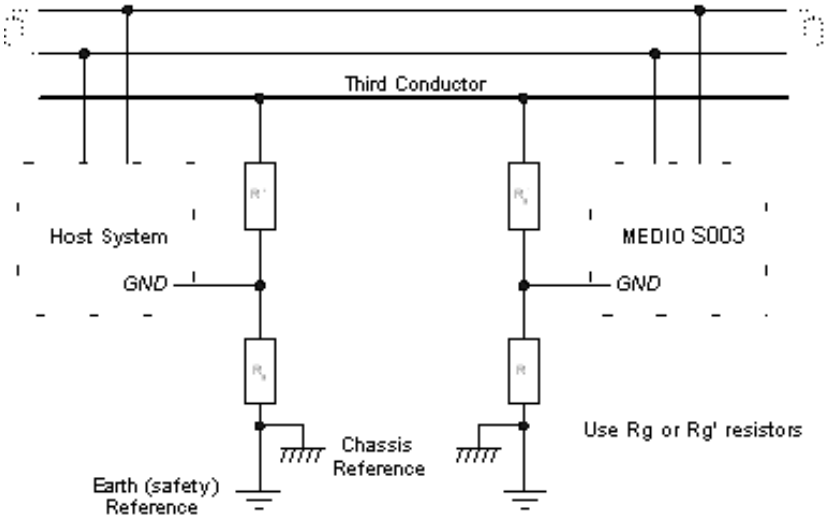
A 120-Ohm resistor should be added at the end of the transmission line in compliance with RS-485 specifications.

When set to communicate using the RS-485 interface, the reader always holds the transmission line before the start of any communication and returns to Tri-state mode at the end of communication. The host system should do the same. The reader can be unplugged from the balanced lines.

5.4.4 Grounding Arrangement

In order for the generator and the receiver to operate correctly, a signal return path must exist between the reader grounds of the equipment at each end of the interconnection. The reader reference may be established by a third conductor connecting the common leads of the devices, or it may be provided by the connection from each equipment item to a ground reference. Where the reader reference is provided by a third conductor, the connection between the reader common and the third conductor must contain a certain amount of resistance (e.g. 100 ohms) to limit circulating currents when other ground connections are provided for safety.

Figure 13: Grounding Arrangement for RS-422 / RS-485



5.4.5 Electrical Signal Requirements

The following table shows the electrical characteristics of the RS-422/RS-485 interface pins.

Absolute Maximum Ratings:

- Input Voltages: A, B to GND: ±25 V
- Output Voltages: Y, Z to GND: ±13.2 V

Table 11: RS-422/ RS-485 Interface Pins - Electrical Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit
Receiver Input Resistance	$-7V < V_{CM} < +12V$		48		kΩ
Receiver Input Current	$V_{CM} = +12V$		0.25		mA
	$V_{CM} = -7V$		-0.15		
Receiver Input Differential Threshold		-200		-50	mV
Receiver Input Hysteresis			30		mV
Transceiver Differential Output Voltage	RS-422		2		V
	RS-485		1.5		
Change In Magnitude of Transceiver Differential Output Voltage for Complementary Output States		-0.2		+0.2	V
Transceiver Output Short-circuit Current			±250		mA
Output Leakage Current			±125		µA

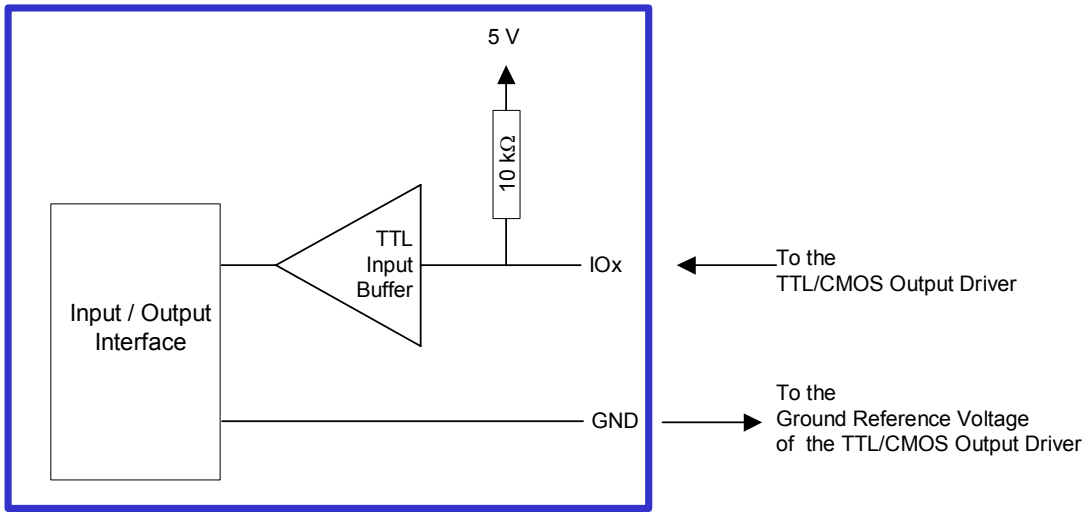
6 Connecting Peripheral Devices

6.1 Using the Input / Output Pins (I/Os)

Each I/O pin can be used as either an input or an output. Its voltage is compatible with the TTL/CMOS level. By default, all pins are set as inputs at each power-on reset.

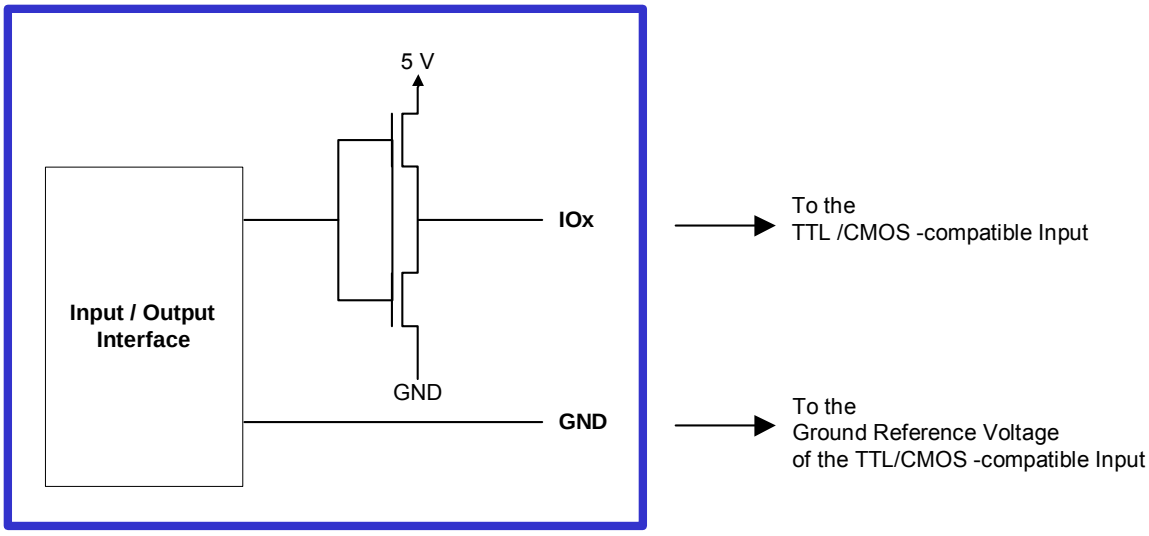
When set as input, each pin features a high impedance state to a TTL input buffer and has an internal pull-up resistance of 10 kΩ. It can be driven by a CMOS output driver or an open-drain/open-collector driver. Unconnected inputs present a high-level voltage.

Figure 14: Hardware Interface with I/Os Set as Input



When set as output, each pin is driven by a full CMOS output driver.

Figure 15: Hardware Interface with I/Os set as Output

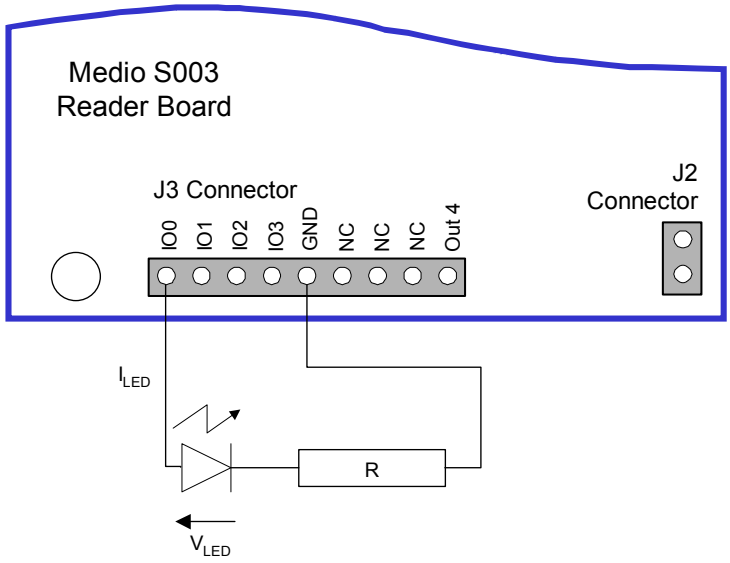


6.2 Connecting an LED or a Buzzer to an Output

An LED or a buzzer can be triggered when a successful read/write operation has been performed. In this case, an output pin must be dedicated to automatically drive the LED or buzzer. This operation is executed by the host system application.

Figure 16 shows how to correctly connect an LED to an output pin.

Figure 16: Connecting an LED to an Output



An external resistor is needed for this connection and the I/O pin must be set as output.

The value of resistor R depends on the value of the current needed by the LED. The formula is:

$$R = \frac{5 - V_{LED}}{I_{LED}} - 30$$

Where:

V_{LED} is the diode voltage dropout,

I_{LED} is the current needed by the LED. It must not exceed 20 mA.

To turn on or off the LED, just change the value on the I/Ox pin.

A monotone buzzer driven by a continuous voltage (5V) with a maximum consumption of 20 mA can be connected directly to an I/O pin.

For more information about programming I/O connections, refer to the Medio S003 Command Set document.

6.3 I/O Electrical Signal Requirements

Table 12 provides the electrical DC characteristics.

Table 12: I/O Interface Pins - Electrical Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit	Note
I/Ox Input Voltage Low		0		0.8	V	
I/Ox Input Voltage High		2			V	
I/O Input Current		1			µA	
I/Ox Output Voltage Low				0.6	V	
I/Ox Output Voltage High		4.3			V	
I/Ox Output Current				20	mA	Sunk or sourced
I/Ox Output Capacitance				50	pF	

6.4 Reserved Pins

The following pins are reserved and must not be connected.

- Medio S003: J1-1, J3-6, J3-7 and J3-8

These pins must NOT be connected or unpredictable results may occur.

7 Stand-alone Mode

Stand-alone Mode is designed to use the reader without using any command set. While in this mode, the reader is limited to tag reading.

The reader sends the tag ID to the Host System using ASCII protocol via the Reader-to-Host interface.

ASCII protocol is used in order to provide hexadecimal data that can be read by a variety of terminal programs (e.g. Microsoft® HyperTerminal).

7.1 Stand-alone Mode Features

Table 13 lists the available features for each TAGSYS RFID Tag reader in Stand-alone mode.

Table 13: Available Features in Stand-alone Mode

Features	Medio S003
Customized tag type reading	C210 C220 C240 C320 C270 (Philips I-Code™) ISO 15693
Serial Communication Type	TTL RS-232 RS-422
Baud Rate	4800, 9600, 19200 or 38400 bps
Repetition Option	Available
Customized ASCII message format	STX/ETX Characters Header String Chip Description String ID String (variable length) End of Message String
Input Trigger	Available
Output for active trigger information	Available
Output for tag reading information	Available

Customized Tag Type Reading

Tags to be scanned can be configured using the “Set Stand-alone Mode” command. For more information, refer to the Medio S003 Command Set document.

Serial Communication Type

When used in Stand-alone mode, Medio S003 reader can communicate via the TTL, RS-232 or RS-422 communication link types. The TTL link has priority over the RS-232 link.

The type of communication link can be set using the “Serial Communication Type” command. For more information, refer to the Medio S003 Command Set document.

Network functions are not available in Stand-alone mode. If the reader starts in Stand-alone mode while its programmed communication type is RS-485, it will start using the TTL communication link.

Customized ASCII Message Format

When a TAGSYS RFID Tag is read, its data is transmitted to the host in the form of an ASCII character frame.

Table 14: Customized ASCII Message Format (TAGSYS RFID Tag is read)

	Start of Text	Header String	Chip Description String	ID		End of Message String	End of Text
Description	<STX> (0x02)	“TAGSYS-“ (Default)	Chip name			<CR/LF> (Default)	<ETX> (0x03)
Size	1 character	0 to 16 characters	0 to 16 characters	C210	2 to 16 characters	0 to 16 characters	1 character
				C220	2 to 10 characters		
				C240	2 to 16 characters		
				C320	2 to 16 characters		
				C270 (Philips I-Code™)	2 to 16 characters		
				ISO15693	2 to 16 characters		
S003	Optional	Optional	Optional	Required		Optional	Optional

Medio S003 reader can decode all chips in Standalone mode. Only the ID field is required in the return ASCII message. All other fields are optional. The ID field length is programmable, the default lengths are given in Table 15.

Table 15: Default ID Field Lengths

Chip Type	Default ID Field Length
C210 chip	16 (Total memory)
C220 chip	10 (Memory area 1)
C240 chip	16 (Block 0 Page 0)
C320 chip	16 (Block 0)
C270 (Philips I-Code™) chip	16 (Block 0 and Block 1)
ISO 15693 chip	16 (UID)

Repetition Option

The reader constantly attempts to read any chips present in the field. When a chip ID is detected, the reader can send the information to the host in one of 2 modes:

1. In “Repeated Read” mode, the reader returns a chip’s ID to the host with each successful read operation.
2. In “Read Once” mode, the reader only returns the ID of a chip if the previous read corresponds to a different chip, or if all reading attempts have failed 3 times (this feature makes it possible to detect a chip’s potential exit out of the field).

Trigger Input

When the trigger capability is enabled, a trigger state is used to start and stop the RF scanning. The trigger consists in one or several signals connected to the defined trigger inputs (pins 1 to 4 of connector J3) of the reader. It is activated when all the signals match a defined criteria (all the inputs match the defined voltage level). For more information, refer to the Medio S003 Command Set document.

Depending on the reply settings of the trigger, the ASCII message can be sent during the trigger activity (Repeated Read mode and Read Once mode are available) or at the end of the trigger. In this last case, a message is always sent to the host system:

- if a tag has been read, the message contains its ID,
- if a tag has not been read, the message contains a No Message string (that can be defined) as shown in Table 16.

Table 16: Customized ASCII Message Format (TAGSYS RFID Tag is not read)

	Start of Text	Header String	No Tag Found String	End of Message String	End of Text
Description	<STX> (0x02)	“TAGSYS-“ (Default)	“????????“ (Default)	<CR/LF> (Default)	<ETX> (0x03)
Size	1 character	0 to 16 characters	0 to 16 characters	0 to 16 characters	1 character
S003	Optional	Optional	Required	Optional	Optional

Show Read status

An LED or buzzer can be connected to one or more outputs to indicate the read activity.

7.2 Enabling Stand-alone Mode

Medio S003 reader can be set in Stand-alone mode in one of three ways:

1. By using the “Serial Communication Select” or “Set Stand-alone Mode” commands followed by a “Reset Reader” command. For more information, refer to the Medio S003 Command Set document.
2. By using the S002 Explorer software provided with the reader
3. As shown below, by connecting the RX_TTL and TX_TLL together and turning on the reader

If the Medio S003 has been supplied with RX_TTL and TX_TTL pins connected together, disconnecting them will put the reader at power up out of the Stand-alone Mode.

If *RX_TTL* and *TX_TTL* pins are connected together, the link to the host transmitter and to the reader receiver (*RX_TTL* or *RX_RS232* or *A and B* pins) must be removed.

Network configuration (RS-485 link) is not allowed in Stand-alone Mode. If the configuration applies to this mode, A,B,Y and Z pins are disconnected and the TTL communication mode applies.

The following three figures show the required connections to the host system for setting the Medio S003 into Stand-alone mode for TTL, RS-232 and RS-422 communication links.

Figure 17: Communication in Stand-alone Mode with the TTL interface

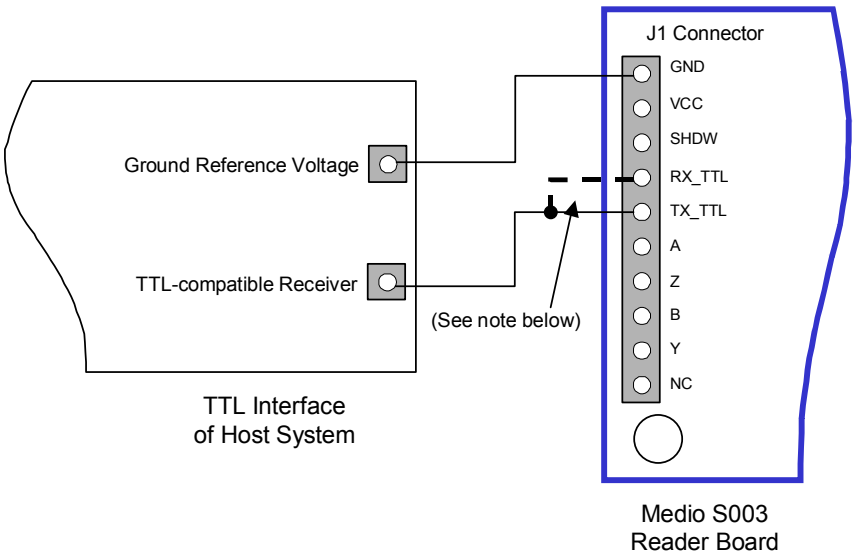


Figure 18: Communication in Stand-alone Mode with the RS-232 interface

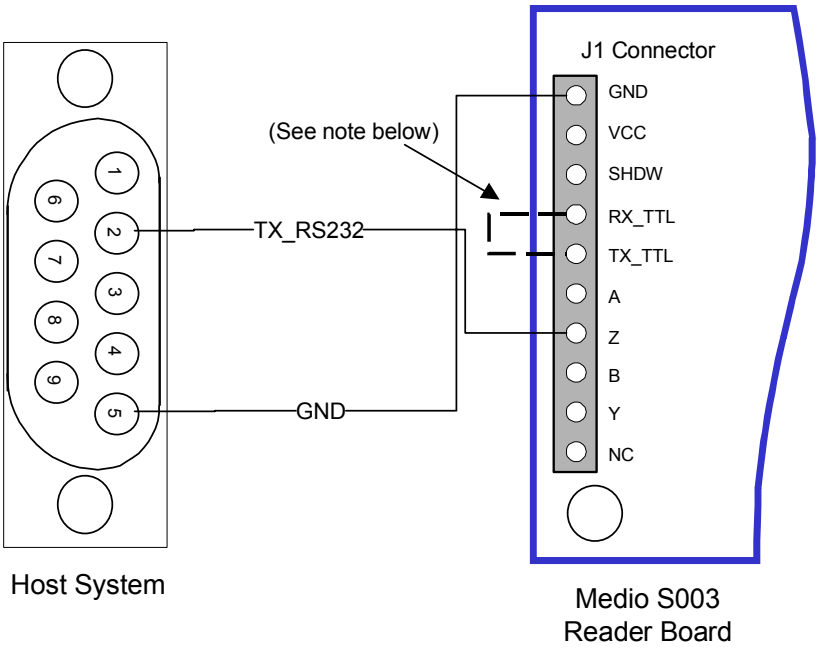
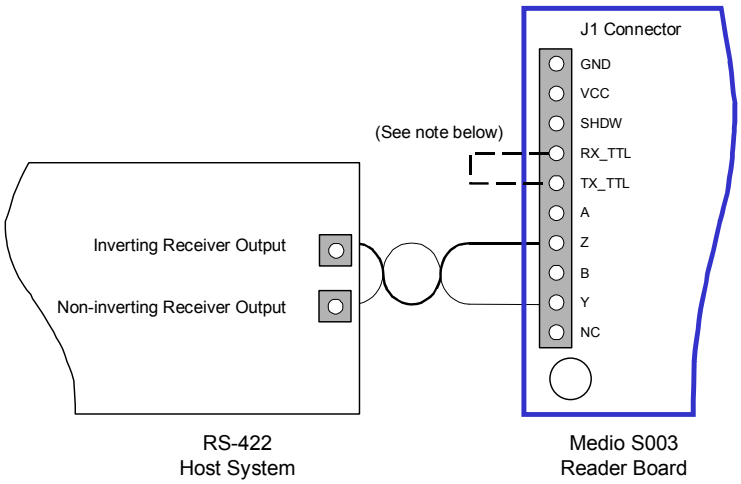


Figure 19: Communication in Stand-alone Mode with the RS-422 interface



RX_TTL and TX_TLL Pin Connection

- This connection is optional for Stand-alone mode and is not required if Medio S003 is set in Stand-alone mode using the “Set Stand-alone Mode” command.
  If an STX-E command is used to enter Standalone mode, the RX_XXX link can be connected allowing the user to exit Standalone mode by sending the 'S' character.

7.3 Stand-alone Mode Settings

Stand-alone Mode can be set in one of two ways while the reader is in Normal Operating mode

1. By using commands “Set Stand-alone Mode” and “Serial Communication Select” (see Medio S003 Command Set Guide).
2. By using the S002 Explorer software provided with the reader

The reader must be entered in stand-alone mode using S002 Explorer to record stand-alone mode parameters into the reader flash memory

7.4 Disabling Stand-alone Mode

The Medio S003 can be reset in Standard mode as described below and depending on how Standalone mode was enabled (two possibilities):

1. If the Medio S003 has been set in Stand-alone mode using the “Set Stand-alone Mode” command or S002 Explorer:
   a. Method A:

      Use the S002 Explorer software provided with the reader.

   b. Method B:

      Send the 'S' character using the communication interface (for example, HyperTerminal).

   c. Method C:

      1. Turn off the reader.
      2. Connect pins RX_TTL and TX_TTL together.
      3. Turn on the reader.

4. Turn off the reader.
5. Remove the connection between pins RX_TTL and TX_TTL.
6. Turn on the reader.

2. If the Medio S003 has been set in Stand-alone mode using the connection between pins RX_TTL and TX_TTL, follow the instructions described below:
    1. Turn off the reader.
    2. Remove the connection between pins RX_TTL and TX_TTL.
    3. Turn on the reader.

8 Technical Specifications

8.1 Medio S003 Technical Specifications

Table 17: Medio S003 Technical Specifications

Reference	Medio S003
Size (L x W x H)	30 x 40 x 20 mm (1.2 x 1.6 x 0.8 inches)
Weight	7g (0.247 ounces)
DC power	4 to 6 V
Chip compatibility	C210 C220 C240 C320 C270 (Philips I-Code™) ISO 15693 Part-2 and Part-3
Communication interface	TTL RS-232 RS-422 RS-485
RF Output Power	250 mW Typical
Simultaneous reading (anti-collision) capability	Eight TAGSYS RFID Tags based on the same chip: either C220, C320, C270 (Philips I-Code™) 16 ISO 15693 Chips
Power consumption under 5V	165 mA Typical 40 µA in standby mode
Operating temperature	0° to +55°C
Storage temperature	-20° to +70°C
Mechanical fixation	Mechanical fixation with two screws (2 mm) Electrical fixation with soldered wires
Connection mechanisms	Pin strip connectors (2.54 mm)
Conformity	CE ETSI 300-330 European Radio compliance (OEM board) FCC Part 15 C according to configuration (antenna & cables)
Communication protocol in Standard mode	TAGSYS-specific STXE-2
ASCII protocol in Stand-alone mode	Programmable (All chips supported)

9 Mechanical Characteristics

9.1 Dimensions and General Mechanical Information

Figure 20: Medio S003 Coupler: Mechanical Dimensions (Side View)

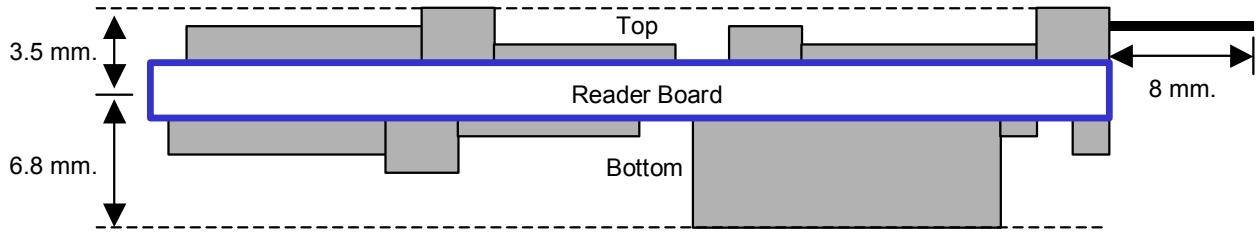
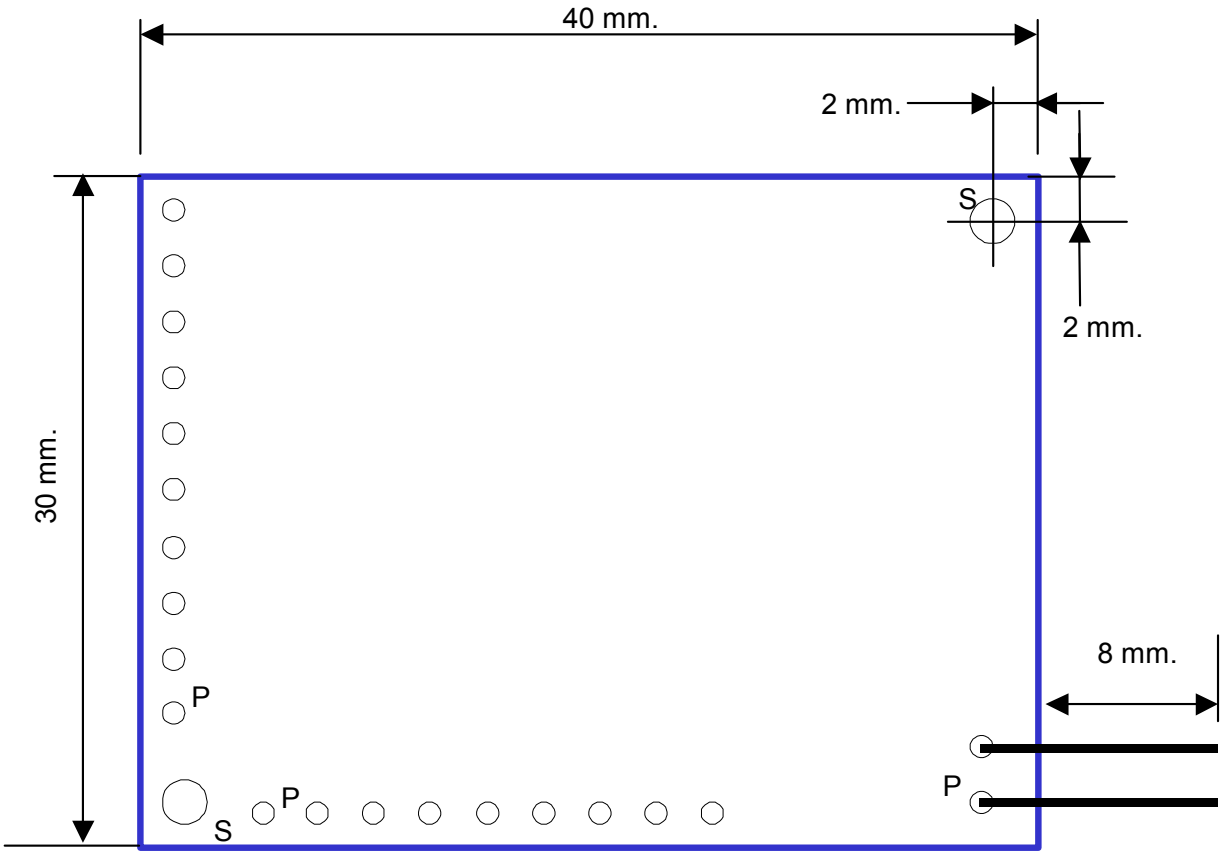


Figure 21: Medio S003 Coupler: Mechanical Dimensions (Top View)



The values given in Figure 20 and Figure 21 have a tolerance of 0.2 mm.

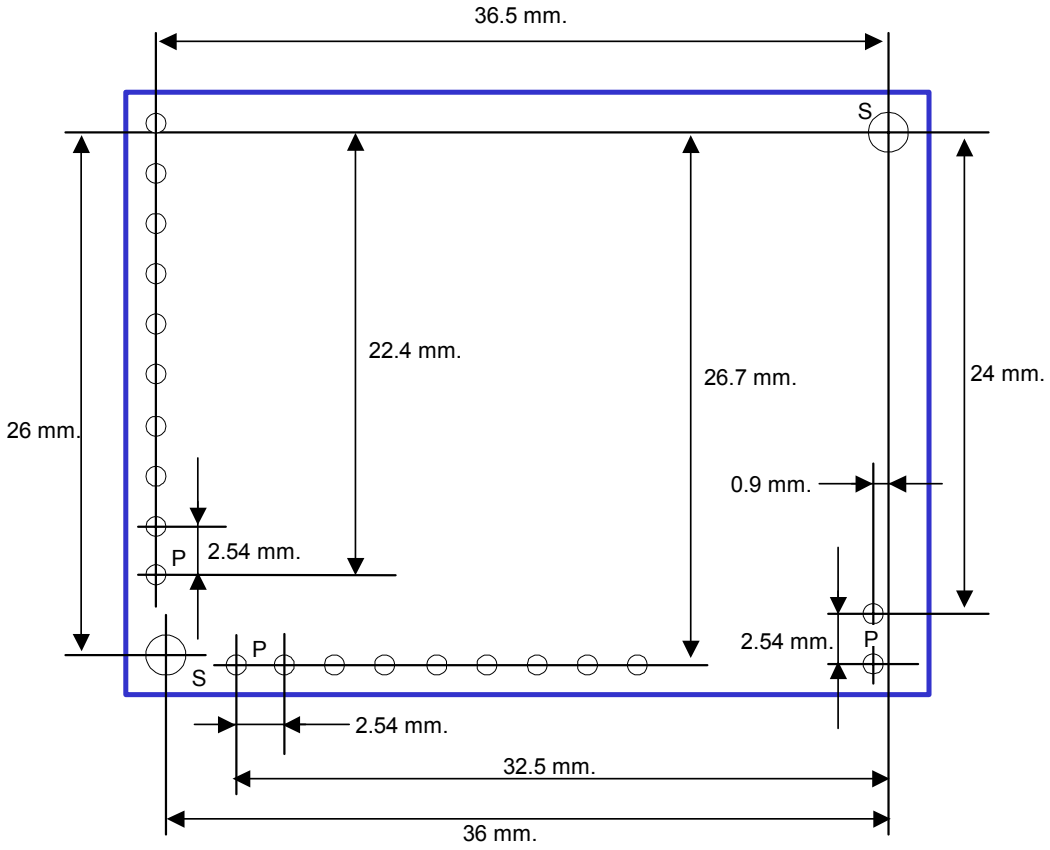
S and P holes are metallic. Their diameters are listed in Table 20.

Table 18: Diameter and Tolerance of the Holes

Type	Diameter (mm)	Tolerance (mm)	Designation
S	2.2	0.1	Fixation hole
P	0.9	0.1	Electrical pin

Figure 22 shows the ratings of the S and P holes, referenced to the top-right fixation hole.

Figure 22: Metallic Holes (Fixation and Pin-Out) Position on the Reader



All pin holes on the connectors have a spacing of 2.54 mm (0.1 inch).

9.2 Markings

The firmware reference programmed in the reader and its version number are indicated on an adhesive strip on the processor unit of the reader.

10 Electrical Characteristics

This chapter provides information about AC and DC and characteristics for all pins. It also gives timing characteristics for the different interfaces.

10.1 Absolute Maximum Ratings

Parameter	Value
Ambient Operating Temperature	0°C to +55°C
Storage Temperature	-20°C to +70°C
Supply Voltage (VCC pin) with respect to GND	6 V
Shutdown Voltage (SHDW pin)	6 V
Total Power Dissipation	0.8 W
Total Power Dissipation on Antenna (ANT pin)	.25 W
DC Current Allowed on VCC Pin	200 mA
Peak Current Allowed on VCC Pin	400 mA
Input Voltage on IOx, Signal Detection and TX_TTL pins	5 V
Output Current Sunk by IOx, Signal Detection and TX_TTL pins	20 mA
Output Current Sourced by IOx, Signal Detection and TX_TTL pins	20 mA
Input Voltage Range on RX_RS232 pin	±25 V
ESD Protection on RX_RS232 and TX_RS232 pins	±15 kV

10.2 Standards Compliance

The Medio S003 coupler is compliant with the following standards:

- CE
- ETSI 300-330 (European Radio Compliance)

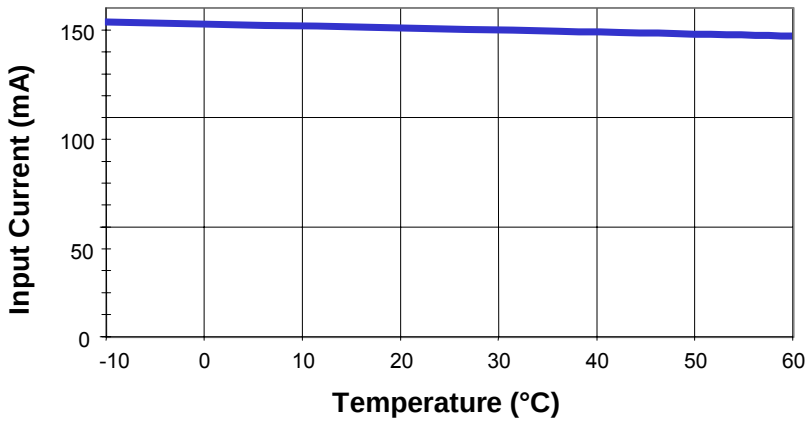
The Medio S003 is also compliant with FCC part 15 regulations.

10.3 Power Supply DC Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit	Comments
VCC Power Input Voltage		4		6	V	
VCC Power On Input Peak Current			300		mA	
VCC Power On Input Peak Current Recovery Time				10	ms	
VCC Input Current (No I/Os connected*)	Input Voltage = 4V		185		mA	All peripherals powered RF On
	Input Voltage = 5V		140		mA	
	Input Voltage = 6V		115		mA	
	Input Voltage = 4V		25		mA	All peripherals powered RF Off
	Input Voltage = 5V		20		mA	
	Input Voltage = 6V		18		mA	
	Input Voltage = 4V			14	mA	Sleep Mode (firmware)
	Input Voltage = 5V			12	mA	
	Input Voltage = 6V			10	mA	
	Input Voltage = 4V		340		µA	Shutdown State (Pin)
	Input Voltage = 5V		420		µA	
	Input Voltage = 6V		500		µA	

(*) : The power requirements of a connected I/O increase the reader total consumption.

Figure 23: Input Current vs. Temperature (V_{cc} Pin at 5 V – RF On - No I/O Connected)



10.4 SHDW Pin Electrical Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit	Comments
SDHW Input Voltage High		2		6	V	Board is supplied
SDHW Input Voltage Low			0.4		V	Board is turned off
SDHW Input Current				7	µA	Max reached when SHDW is low

10.5 Communication Link DC Characteristics and Timing

Parameters	Conditions	Min.	Typ.	Max.	Unit	Comments
RX_TTL Input Voltage Low		0		1	V	
RX_TTL Input Voltage High		4	5		V	
RX_TTL Input Current			1		µA	
TX_TTL Output Voltage Low				0.6	V	
TX_TTL Output Voltage High		4.3			V	
TX_TTL Output Current				20	mA	Sunk or sourced
TX_TTL Output Capacitance				50	pF	
RX_RS232 Input Voltage Range		-25		+25	V	
RX_RS232 Input Threshold Low	25°C	0.8	1.5		V	
RX_RS232 Input Threshold High	25°C		1.8	2.4	V	
RX_RS232 Input Hysteresis			1.8	2.4	V	
RX_RS232 Input Resistance		3	5	7	kΩ	
TX_RS232 Output Voltage Swing	Loaded with 3 kW to GND	±5	±5.4		V	
TX_RS232 Output Resistance		300	1000		kΩ	
TX_RS232 Short-circuit Current				±60	mA	
ESD Protection on both pins	IEC 1000-4-2 Air-Gap Discharge		±15		kV	
	IEC 1000-4-2 Contact Discharge		±8		kV	
	Human body model		±15		kV	
RX - TX error on baud rate	4800 Bps		+0.16		%	
	9600 Bps		-1.36		%	
	19200 Bps		+1.73		%	
	38400 Bps		+1.73		%	
TX Inter-character time			7.5		ms	

10.6 Antenna Electrical and Timing Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit	Comments
ANT output power			250		mW	
ANT output impedance			(50, 0)		(W, °)	At 13.56 MHz
RFOn time to RFOff	End of reception on RX to ANT. RF field turns on		1.3	1.4	ms	
RFOff time to RFOn	End of reception on RX to ANT. RF field turns off		4.2	50	µs	

Figure 24 : Output Power vs. Temperature (V_{cc} Pin at 5 V – RF On - No I/O Connected)

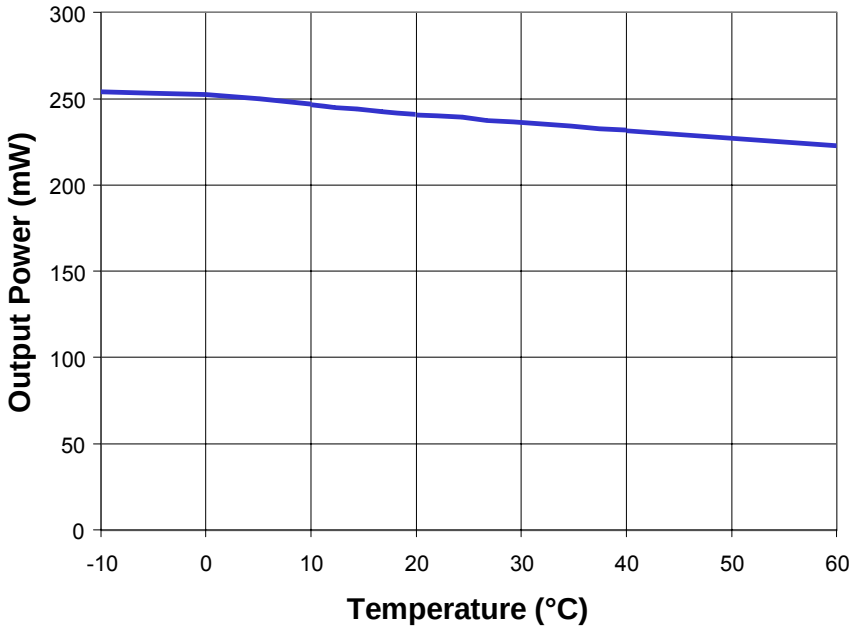
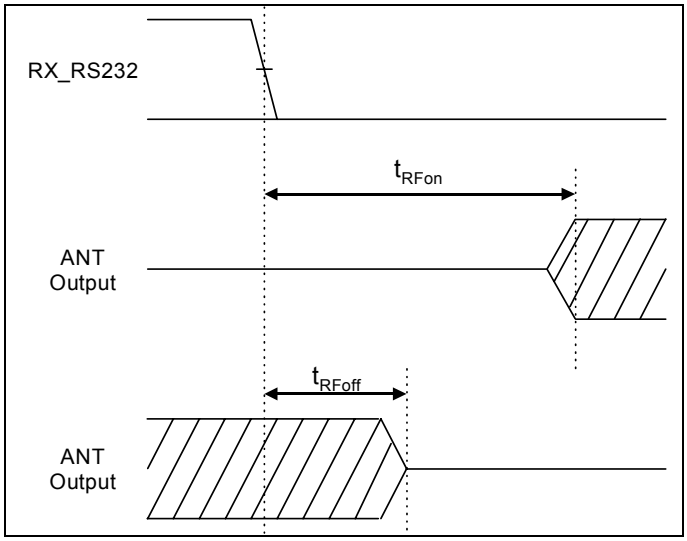


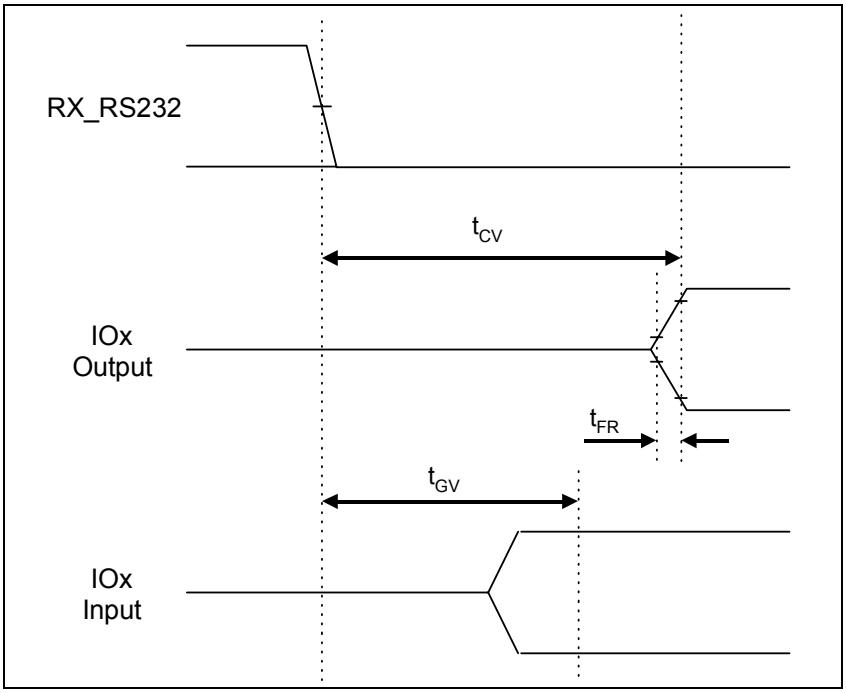
Figure 25: Antenna RF Switch Time



10.7 I/O Electrical and Timing Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit	Comments
I/Ox input voltage low		0		0.8	V	
I/Ox input voltage high		2			V	
I/Ox input current		1			µA	
I/Ox output voltage low				0.6	V	
I/Ox output voltage high		VDD-0.7			V	
I/Ox output current					mA	Sunk or sourced
I/Ox output capacitance			50		pF	
t_{CV} (time to change value)	End of reception on RX to I/Ox level changed		35	40	µs	
t_{GV} (time to get value)	End of reception on RX to I/Ox level read		33	38	µs	
t_{FR} (time to fall or rise)	Fall/rise time		10	25	ns	

Figure 26: I/O DC Characteristics and Timing



11 Warranty Conditions

11.1 Warranty

TAGSYS warrants that this Product shall comply with the functional specifications set forth herein for a period of one year from the date of delivery to the Buyer.

This warranty is valid for the original Buyer of the Product and is not assignable or transferable to any other party.

TAGSYS cannot be responsible in any way for, and disclaims any liability in connection with the operation or performance of:

- any product in which the Product is incorporated;
- any equipment not supplied by TAGSYS which is attached to or used in connection with the Product; or
- the Product with any equipment

This warranty does only cover the Product to the exclusion of any such other equipment.

Optimal operation and performance of the Product are obtained by using TAGSYS' readers, by applying TAGSYS installation guidelines and by having your installation reviewed by a TAGSYS' technical consultant.

TAGSYS warranty does not cover the installation, maintenance or service of the Product and is strictly limited to the replacement of Products considered as defective by TAGSYS and returned according to the return procedure defined below; in such case, TAGSYS will, at TAGSYS' option, either replace every defective Product by one new Product or refund the purchase price paid by Buyer to TAGSYS for the defective Product.

11.2 Warranty Exclusions

- Defects or damages resulting from storage of the Product under conditions which do not comply with TAGSYS specifications or normal usage
- Defects or damages resulting from use of the Product in abnormal conditions (abnormal conditions being defined as any conditions exceeding the ones stated in the product specifications).
- Defects or damages from misuse, accident or neglect.
- Defects from improper testing, operation, maintenance or installation.
- Defects from alteration, modification except modifications or adjustments specifically described in this Product reference guide, adjustment or repair, or any attempt to do any of the foregoing, by anyone other than TAGSYS.
- Any action on Product that prevents TAGSYS from performing an inspection and test of the Product in case of a warranty claim.
- Tampering with or abuse of the Product.
- Any use or incorporation by the Buyer or a third party of TAGSYS' Product into life saving or life support devices or systems, or any related products, TAGSYS expressly excludes any liability for such use.

11.2.1 General Provisions

This warranty sets forth the full extent of TAGSYS responsibility regarding the Product.

In any event, TAGSYS warranty is strictly limited to (at TAGSYS' sole option) the replacement or refund of the Products purchase price to TAGSYS, of Products considered as defective by TAGSYS.

The remedy provided above is in lieu and to the exclusion of all other remedies, obligations or liabilities on the part of TAGSYS for damages, whether in contract, tort or otherwise, and including but not limited to, damages for any defects in the Products or for any injury, damage, or loss resulting from such defects or from any work done in connection therewith or for consequential loss, whether based upon lost goodwill, lost resale profits, impairment of other goods or arising from claims by third parties or otherwise.

TAGSYS disclaims any explicit warranty not provided herein and any implied warranty, guaranty or representation as to performance, quality and absence of hidden defects, and any remedy for breach of contract, which but for this provision, might arise by implication, operation of law, custom of trade or course of dealing, including implied warranties of merchantability and fitness for a particular purpose.

11.2.2 How to Return Defective Products

The Buyer shall notify TAGSYS of the defects within 15 working days after the defects are discovered.

Defective Products must be returned to TAGSYS after assignment by a TAGSYS Quality Department representative of an RMA (Return Material Authorization) number. No Products shall be returned without their proof of purchase and without the acceptance number relating to the return procedure.

All Products shall be returned with a report from the Buyer stating the complete details of the alleged defect.

Call +33 4 91 27 57 36 for return authorization and shipping address.

If returned Products prove to be non-defective, a charge will be applied to cover TAGSYS' analysis cost and shipping costs.

If the warranty does not apply for returned Products (due to age, or application of a warranty exclusion clause), a quote for replacement will be issued, and no replacement will be granted until a valid purchase order is received. If no purchase order is received within 30 days after the date of TAGSYS quote, TAGSYS will return the products and charge the analysis cost and shipping costs.

All replaced Products shall become the property of TAGSYS.

The Product Return Form is included on the following page. This form should accompany any product you need to return to TAGSYS for analysis in the event of a problem.

Product Return Form

Customer Profile:

Company: .....
Address: .....
.....
.....
City & State:.....
Zip Code:.....
Country:.....

Contact Name: .....
Contact e-mail: .....
Contact Phone: .....
Contact Fax:.....

Order identification:

Product Name:.....
Order Number (OEF):.....

Invoice Number:.....
Return Quantity: .....

Reason for return:

.....
.....
.....
.....
.....

To inform TAGSYS of this return, please email it to

RMA@tagsys.net

Address to ship the product with this document attached:

TAGSYS
QUALITY DEPARTMENT
180, chemin de Saint Lambert
13821 La Penne sur Huveaune France

To inform TAGSYS of this return, please also fax it to your Customer Service Representative

+33 4-9127-5701

Return Procedure:

The product returned will go through stringent quality controls.
A final analysis report will be sent to you as soon as possible.
Please contact your Quality Service representative for further details.
+33 4-91-27-5736