



# **Medio S001/S002 Reader**

Integrator's Guide

Revision 1.4

TAGSYS

September 2003

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Printed in France.

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Document Reference: 10969A1

# 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 S001/S002 Smart Label Readers.

## Audience

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

## Conventions

Symbol	Meaning
	<p><b>CAUTION:</b> A note that advises users that a specific action could result in the loss of data or damage the hardware.</p> <p><b>WARNING:</b> A note that advises users that a specific action may result in physical harm.</p>
	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 smart label.

**Digital Signal Processor** This part of the Radio Processing Unit (RPU) performs real-time smart label 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 smart label'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 smart label detection.

**Protocol** A set of rules governing a particular function, such as the flow of data/information in a communication system (communication between a smart label 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 smart labels 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 smart label decoding.

**Reader** Electronic system for the communication between smart labels 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.

**Smart Label** Small, flexible tag from the 13.56 MHz TAGSYS product line. A smart label is made of a chip connected to an etched antenna.

**Tag** See Smart Label.

**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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## 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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# 1 Certification

## 1.1 Occupational Health and Safety Notices

TAGSYS Products have been designed not to exceed the limits given in 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 TAGSYS Partner to install the Medio S001/S002 Smart Label 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.

An RF fields survey has been carried out on all the System components, in accordance with AS/NZS 2771.1: Radio Frequency Radiation, Part 1. According to this standard the maximum allowable RF exposure levels (non-occupational) at 3 kHz to 300 GHz are 200  $\mu\text{W}/\text{cm}^2$ .

## 1.2 Regulatory Notices

An RFID system typically composed of an RF emission device such as the Medio S001/S002 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  $\text{dB}\mu\text{A}/\text{m}$  in Europe and 38  $\text{dB}\mu\text{A}/\text{m}$  in US.

The Medio S001/S002 Smart Label Reader meets these limits.



It is the responsibility of the TAGSYS Partner to install the Medio S001/S002 Smart label Reader as described in this Integrator's Guide or in TAGSYS Documentation.

### 1.2.1 In Europe (CE and RTTE Directives)

The Medio S001/S002 Smart Label Reader complies (CE Declaration of Conformity granted) with the European EMC directive.

The Medio S001/S002 complies with the requirements of the Telecommunication Terminal Equipment Act (FTEG) and the RTTE Directive 1995/5/EC.

Any modification of the Medio S001/S002 Smart Label 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 S001/S002 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 S001/S002 Smart Label Reader has been designed to comply with Part 15 of the FCC Rules. Furthermore typical configurations based on a Medio S002 have been successfully tested with Part 15 of the FCC rules.

## Medio S001/S002 Smart Label Reader

### *WARNING TO USERS IN THE UNITED STATES*

FEDERAL COMMUNICATIONS 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 S001/S002 Smart Label Readers.

### 2.2 Product Description

TAGSYS Medio S001/S002 Smart Label Readers are intended for Original Equipment Manufacturer (OEM) applications. The Medio S001 and Medio S002 are Universal Short Range 13.56 MHz RFID readers designed to operate with any smart label using any TAGSYS chip (C210, C220 or C240) as well as I-Code™ and Tag-It™ chips. Medio S002 readers also comply with ISO 15693 Part-2 and Part-3 specifications.



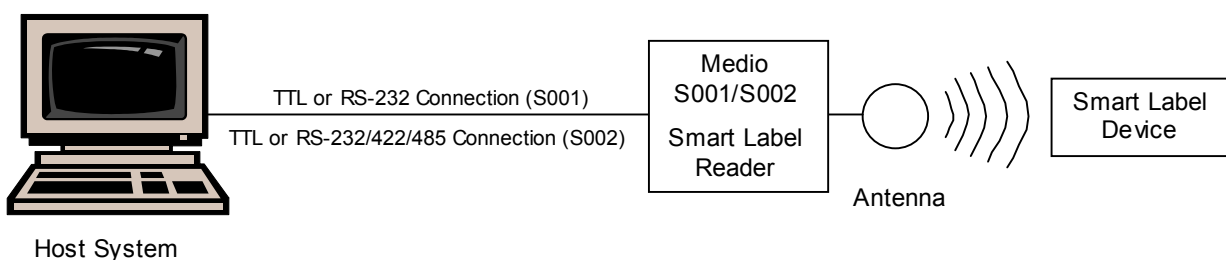
The Medio S001 has been upgraded allowing it to be compatible with the Medio S002 in Standalone mode. This new version is known as the Medio S001 Rev. 2 and its characteristics are clearly indicated throughout the document.

The Medio S001/S002 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 S001 or Medio S002 readers require 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 S011/S012/S013 and Medio L100/L200).

**Figure 1: Medio S001/S002 Smart Label Reader Application Overview**



Although Medio S001/S002 readers provide high RF performances with a variety of smart labels, their power consumption has been minimized to save host batteries and to increase operating time.

The Medio S001 and Medio S002 Smart label readers are easy to integrate in a variety of terminals and printers due to their following features:

- small size
- standard communication links
- low power consumption

## 2.3 Medio S001/S002 Key Features

**Table 1: Medio S001/S002 Key Features**

Description	Medio S001	Medio S001 Rev. 2	Medio S002
Operating Frequency	13.56 MHz		
Compatibility	TAGSYS (C210, C220 and C240) I-Code™ Tag-It™		TAGSYS (C210, C220 and C240) I-Code™ Tag-It™ ISO 15693
Stand-alone Mode	TAGSYS C210 only	TAGSYS (C210, C220 and C240) I-Code™ Tag-It™	TAGSYS (C210, C220 and C240) I-Code™ Tag-It™ ISO 15693
Primary Serial Link	TTL		
Secondary Serial Link	RS-232		RS-232, RS-485 or RS-422
Network Operating	No		Yes
Configurable I/Os	4 (TTL)		
Firmware upgradeable	No	Yes	
Boot with last configuration	No	Yes	

## 2.4 Delivery

The Medio S001/S002 Smart Label Reader kit contains the following items:

**Table 2: Package Contents**

Quantity	Item
1	Medio S001 or Medio S002 Smart Label Reader
1	HE-10 connector (10-pin)
1	CD-ROM including: <ul style="list-style-type: none"> <li>• Medio S001/S002 Integrator's Guide</li> <li>• Medio S001/S002 Command Set</li> <li>• User-friendly S002 Explorer software provided for test and debug operations on Windows® 9x, NT®, 2000 and XP platforms</li> <li>• Medio STX Windows® DLLs to facilitate the development your own applications on Windows® 9x, NT®, 2000, XP and Windows® Pocket PC 2002 platforms</li> <li>• Medio STX Windows® DLL Programming Guide</li> <li>• One set of Microsoft® Visual C++® source code and executable samples using the Medio STX Windows® DLLs</li> </ul>
1	Welcome Letter / Product Return Form

# 3 Functional Overview

This section provides an overview of the architectural structure and peripheral devices of the Medio S001 and Medio S002 Smart Label Readers. 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

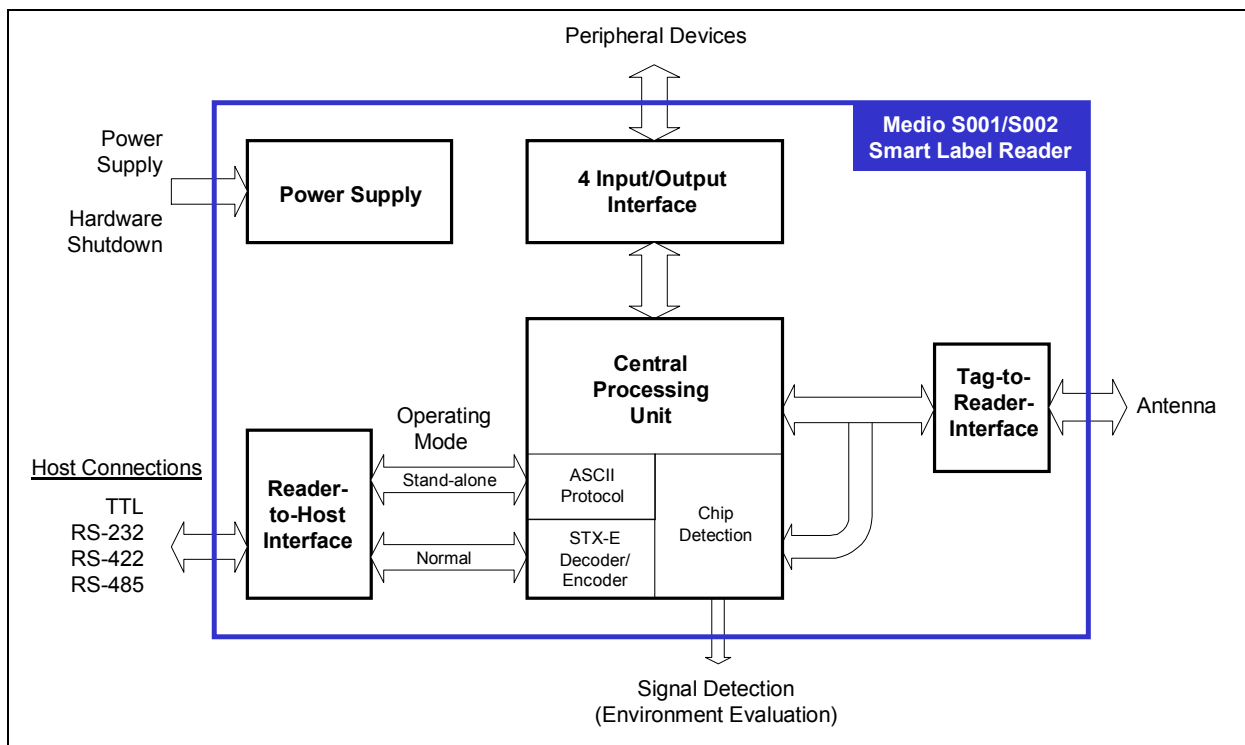
The Medio S001/S002 architectural structure is based on a CPU that drives all reader functions.

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

It also drives four standard Input/Outputs (I/Os) that are CMOS/TTL-compatible, and the Signal Detection module that is used to detect signals (for instance, a smart label signal or environmental radio noise).

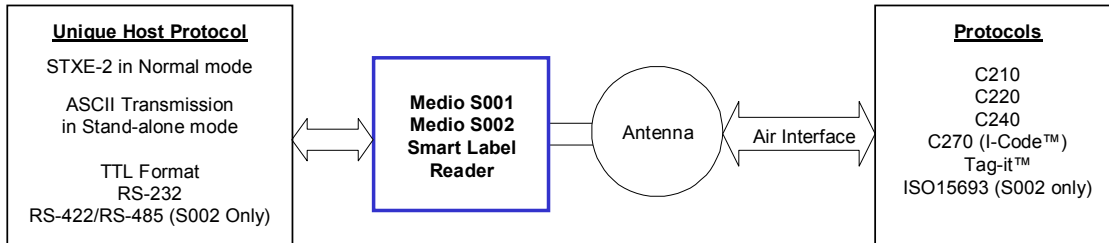
Figure 2 illustrates the general architecture of Medio S001/S002 Smart Label Reader.

**Figure 2: Overall Medio S001/S002 Architecture**



## 3.2 Communication Protocols

Figure 3: Medio S001/S002 Reader Communication Protocols



### 3.2.1 Tag-to-Reader Interface

To read from smart labels, 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 S001/S002 Command Set document.

Each range of smart labels has its own specific set of commands.

Table 3: Smart Label Dedicated Commands

Smart Label Family	Available Commands	Comments
C210	Read the ID	
C240	Read Pages	
	Check Password	
	Write Page	
	Temporary Inhibition	
C220	Read Memory Content	Single chip and Anti-Collision
	Write Memory Content	
C270 I-Code™ -based smart labels	Read Blocks	Selective and Unselective Read
	Write Block	
	Halt	
	Reset Quiet	
	Refresh Selection	
Tag-It™-based smart labels	Read Blocks	
	Write Block	
	Get Version	
	SID Poll	
ISO 15693	Raw Command	Medio S002 Only

### 3.2.2 Reader-to-Host Interface

When the Medio S001/S002 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 S001/S002 Command Set document.

Depending on the task requested by the user through the host interface, the reader retrieves information from the smart label 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 S001/S002 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 S001/S002 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 S001/S002 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 6, "Stand-alone Mode"](#).

---



When using Medio S001 readers, Stand-alone Mode is only available with C210 chips. Medio S002 and Medio S001 Rev. 2 readers support all their respective chip types.

---

## 3.3 Signal Detection Module

The Signal Detection module is a special feature that is managed by the CPU. This module is used to evaluate the environment in which the reader is located. When activated, this module indicates any signal detected by the Tag-to-Reader interface. This signal can be:

- A signal created by a TTF (Tag Talks First) chip such as a C210, C220 or a C240 smart label,
- Any noisy signal that disrupts the Tag-to-Reader interface.

The Signal Detection module has two main applications:

#### 1. Evaluating the Reading System Environment (Tag-to-Host Interface)

This function can detect any signal. It can, in particular, be used to detect environmental noise that might disrupt reader reception.

Installation is optimum when the Signal Detection pin stays low with the RF field turned on (no noisy signal). Nonetheless, because the reader has a basic signal filtering process, when a noisy signal is received, smart labels may be able to read it. Performance, however, may be affected.

#### 2. Detecting TTF Smart Labels

TTF smart labels (C210, C220 or C240 chips) generate a continuous signal on the Tag-to-Reader interface. This function can be used to detect those specific types of smart labels.

---



When TTF smart labels are being detected, communication such as reading the smart label contents is not established. This function cannot be used to detect smart labels when the reader is installed in a noisy environment creating a signal on the Tag-to-Reader interface.

---





The Signal Detection module is interrupted when the reader:

- Receives data on the host communication link
- Performs a task initiated by any valid command
- Sends a response
- Is in Stand-alone mode

## 3.4 Peripheral Devices

The I/O interface manages four pins that drive or check external peripherals. Their 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 5.1, “Using the Input / Output Pins \(I/Os\)”](#).

## 3.5 Automatic Features

### 3.5.1 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.

### 3.5.2 RF Management

To reduce power consumption, smart label 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 S001/S002 Command Set document for command-specific RF management information.

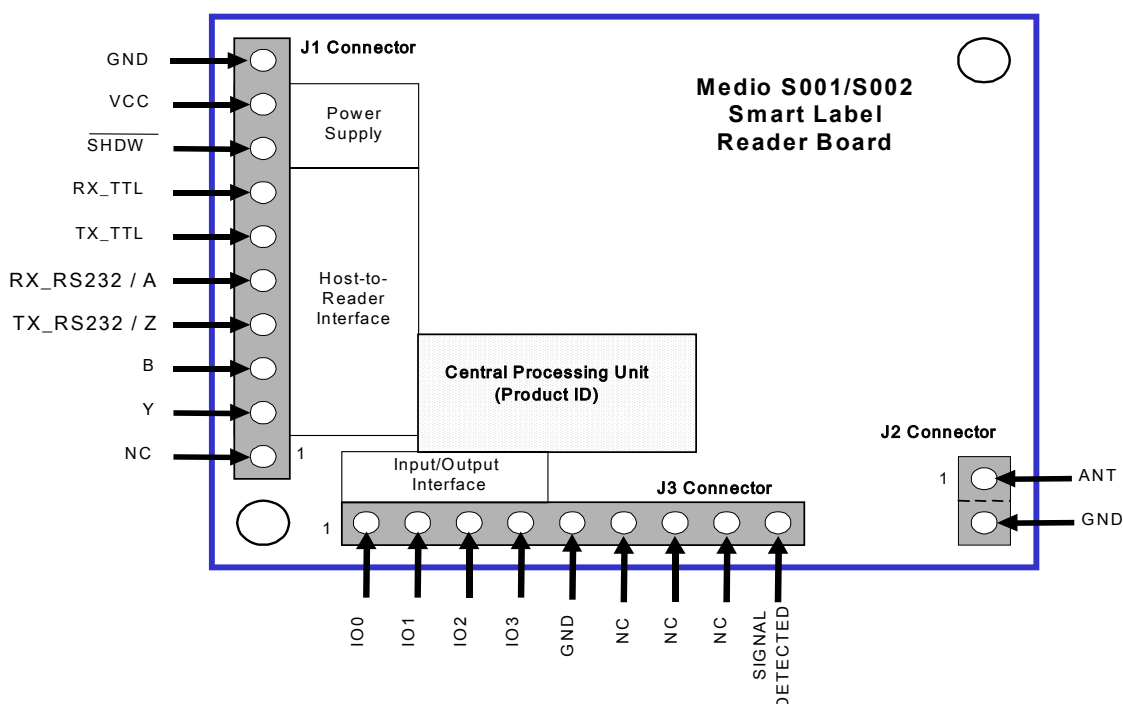
# 4 Installing the Reader

This section explains how best to install the Medio S001/S002 Smart Label Reader board. The physical description of the reader board is given in [Section 8, "Mechanical Characteristics"](#).

## 4.1 Pin Connections

The Medio S001/S002 Smart Label 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 (Medio S002 Only)
TX_RS232/Z	Transmit pin for RS-232 Inverting RS485/RS422 Transceiver Output Inverting Half-Duplex RS-485 Driver	J1-4 J1-4 (Medio S002 Only) J1-4 (Medio S002 Only)

Pin	Description	Connector
B	Inverting RS485/RS422 Receiver Input	J1-3 (Medio S002 Only)
Y	Non-inverting RS-485/RS-422 Transceiver Output Non-inverting Half-Duplex RS-485 Driver	J1-2 (Medio S002 Only) J1-2 (Medio S002 Only)
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
Signal detection	Output signal for the signal detection function	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		J1-2 (Medio S001 Only)
NC		J1-3 (Medio S001 Only)
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 7, "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		$\mu$ A	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 smart labels. This can be a TAGSYS antenna or a custom-made model. The choice of the antenna must take into account the following considerations:

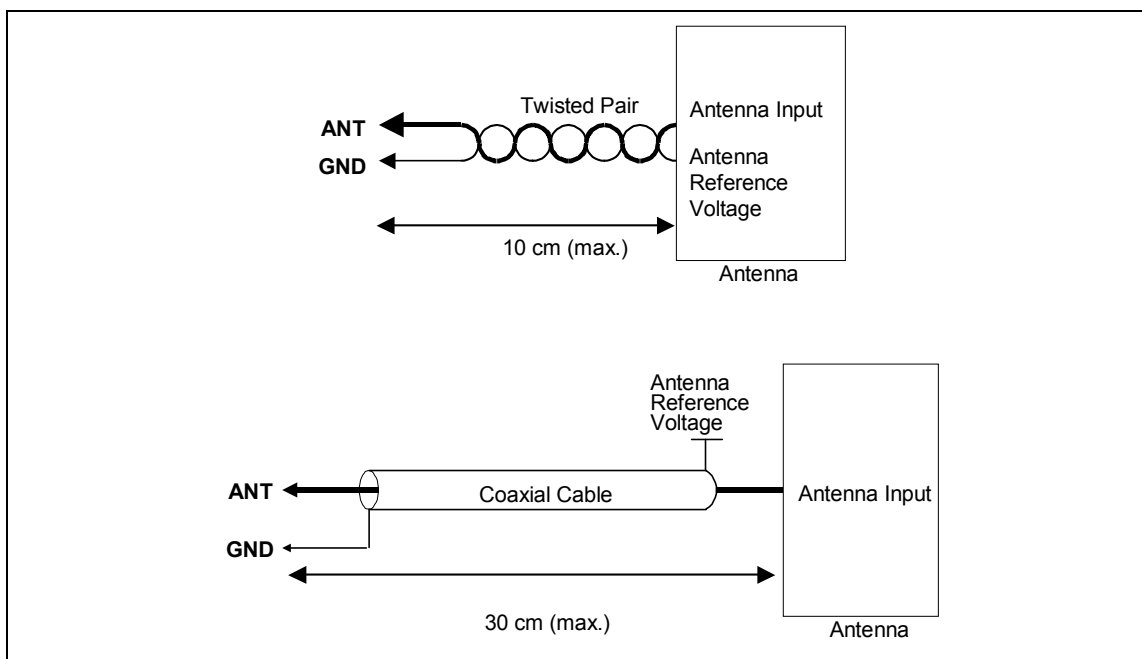
- Physical area (size) of the smart label
- Strength of the reader
- Compliance with electrical characteristics (see Electrical Characteristics chapter)

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  $\Omega$  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 S001/S002 Smart Label Readers are 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 S001/S002 Communication Links**

Smart Label Reader	Primary (Default) Link	Secondary Links
Medio S001/S001 Rev. 2	TTL	RS-232
Medio S002	TTL	RS-232, RS-422 or RS-485 (Full- or Half-duplex)



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 Medio S001 and S001 Rev. 2

The Host-to-Reader interface accepts both TTL and RS-232 communication links. The TTL interface has priority over the RS-232 link.

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

## 5.2 Medio S002

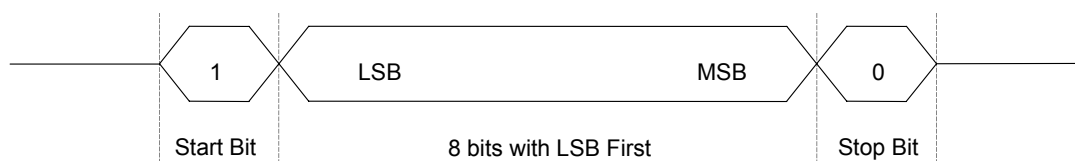
The Host-to-Reader interface accepts TTL and an RS-232, RS-422 or RS-485 (Full or Half Duplex) communication links. The communication type is selected using the “Serial Communication Select” command (please refer to the Medio S001/S002 Command Set document). The RS-232 link is the default setting. In 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.

## 5.3 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**

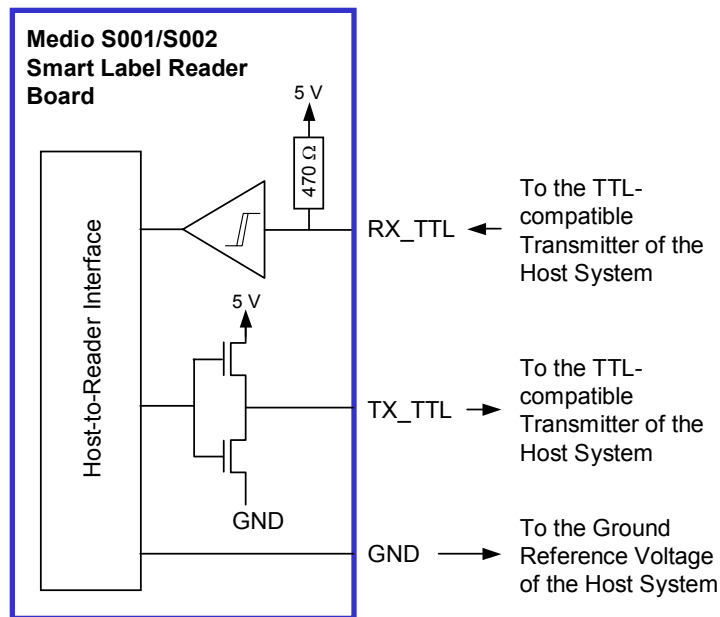
Parameter	Value
Allowed Baud Rates	4800, 9600, 19200 or 38400
Start Bit	On
Number of data bits	8
Parity	None
Stop bit	1

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

## 5.4 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.

### 5.4.1 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.

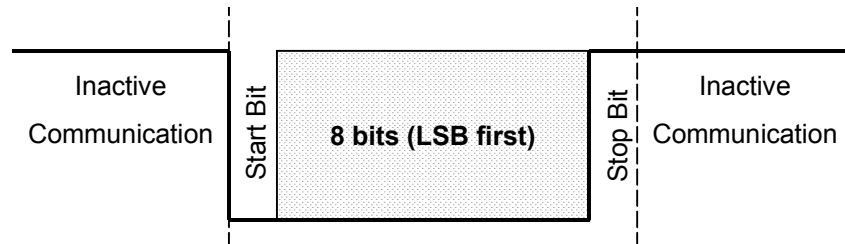
The RX\_TTL pin is compatible with TTL/CMOS levels. It has an internal pull-up of 470 ohms. This pin can be driven by both an open-drain/open-collector driver or by a full CMOS output driver.

The TX\_TTL pin is a full CMOS output driver.

## 5.4.2 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	

## 5.5 RS-232 Interface

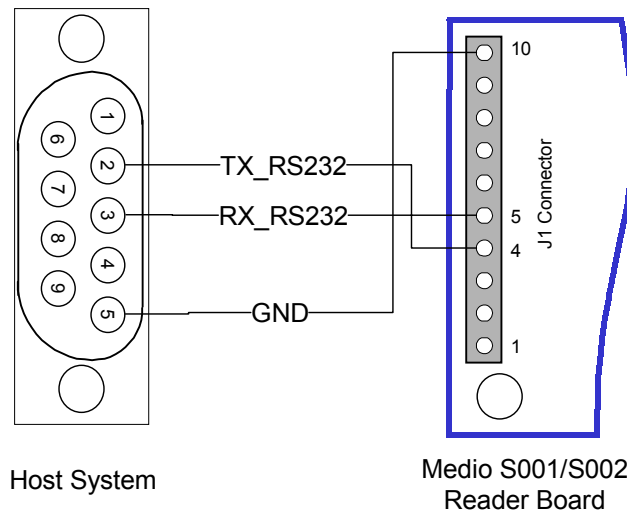
The RS-232 interface is compatible with both the Medio S001 and S002 Smart Label readers.

### 5.5.1 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**



If the RS-232 interface of a Medio S001 is not used, do not connect the RX\_RS232 and TX\_RS232 pins together on the reader board.



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

### 5.5.2 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



### 5.5.3 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

## 5.6 RS-422 / RS-485 Interface (Medio S002 Only)

The RS-422 and RS-485 interfaces are only compatible with the Medio S002 Smart Label reader.



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).

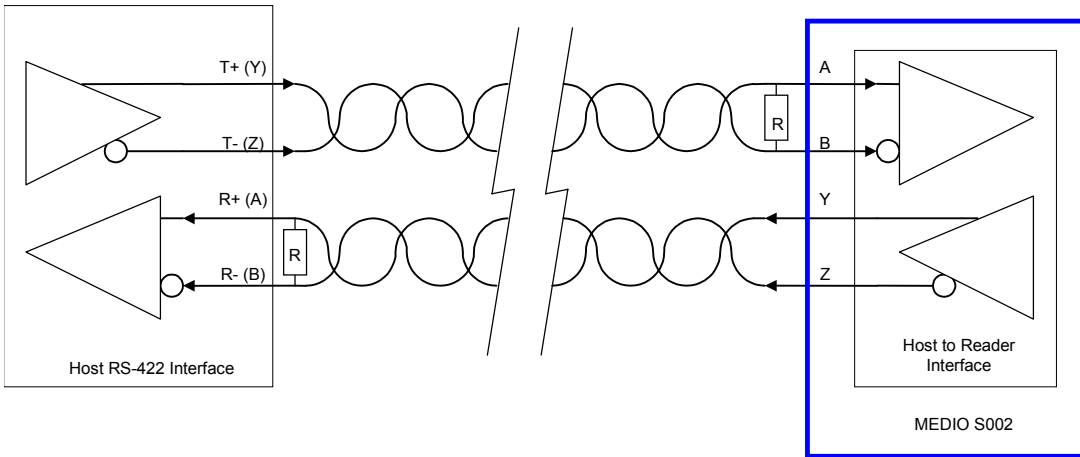
### 5.6.1 Installing the RS-422 Interface

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**



### 5.6.2 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**

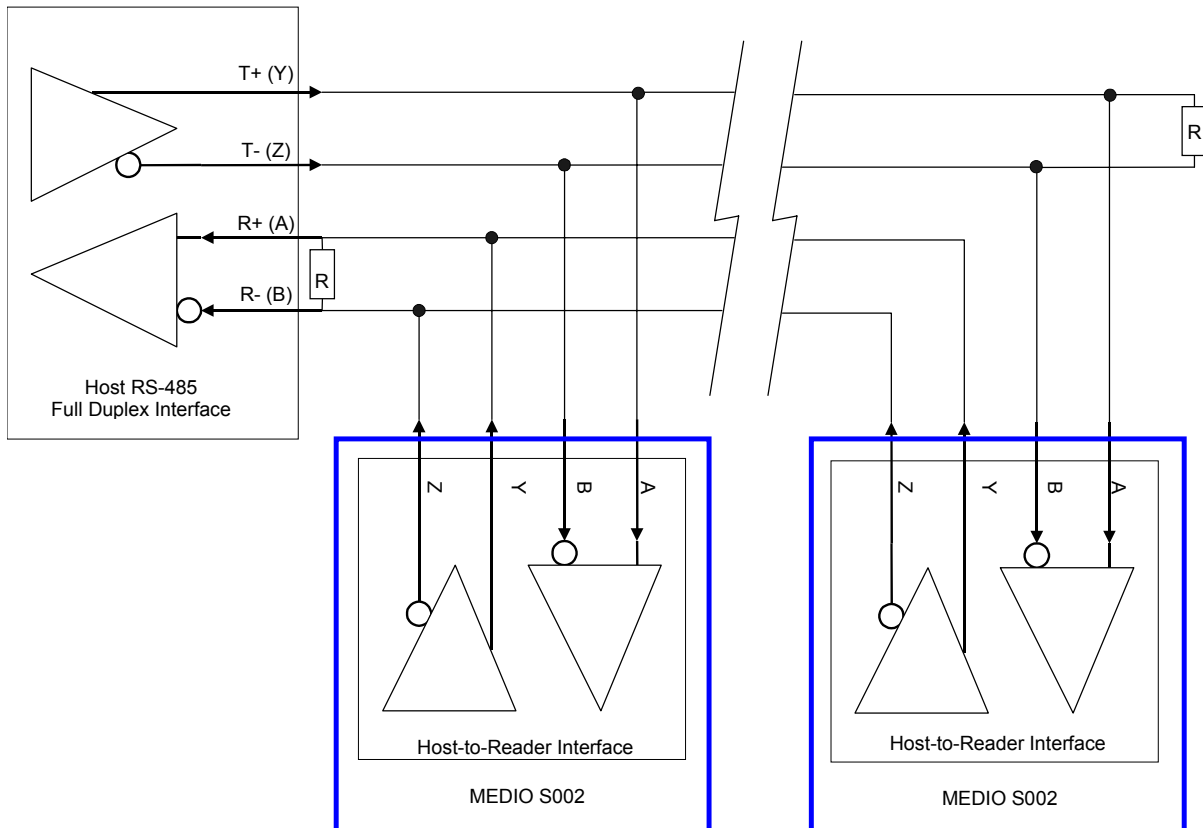


Figure 11 shows how to connect the RS-485 Full Duplex Interface in a Multi-drop network.

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.

### 5.6.3 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 (-).

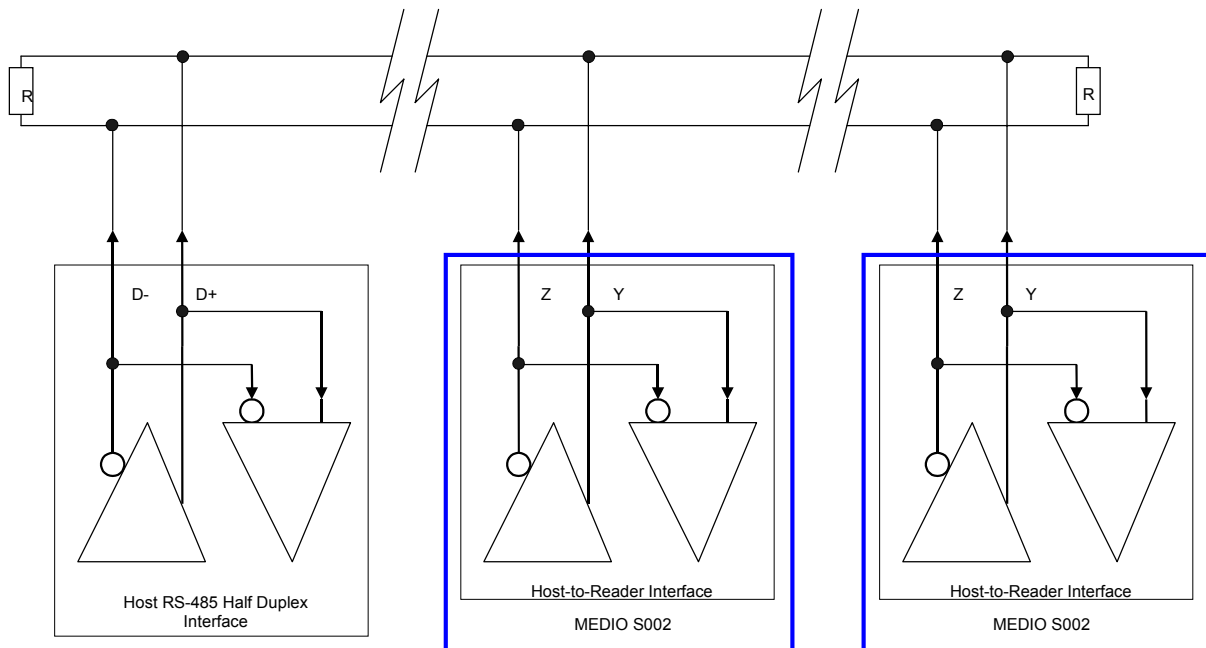
The A and B pins are left unconnected.



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.

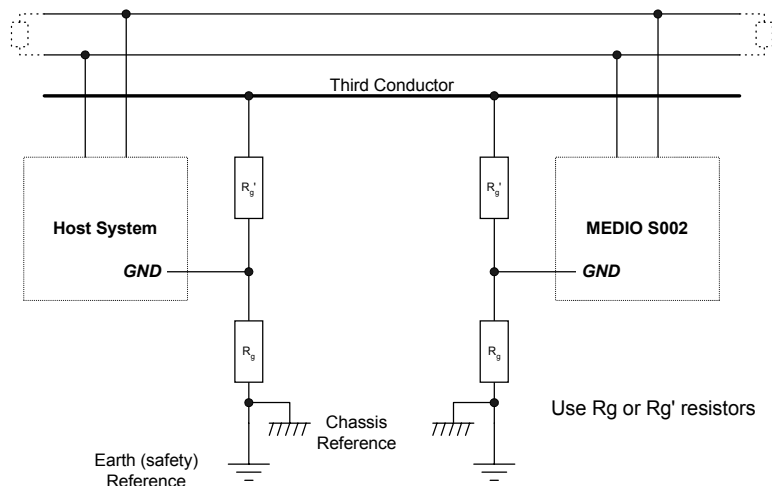
When set to communicate using the RS-485 interface, the reader always holds the transmission line before the start of any communication and returns to Tri-state mode at the end of communication. The host system should do the same. The reader can be unplugged from the balanced lines.

### 5.6.4 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**



### 5.6.5 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:  $\pm 25$  V
- Output Voltages: Y, Z to GND:  $\pm 13.2$  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		k $\Omega$
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			$\pm 250$		mA
Output Leakage Current			$\pm 125$		$\mu A$

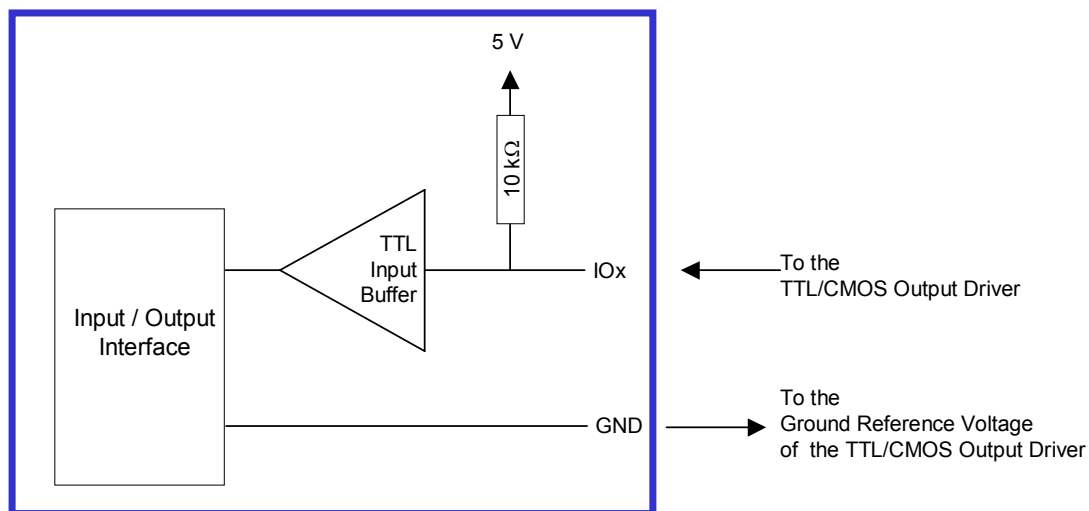
# 6 Connecting Peripheral Devices

## 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.

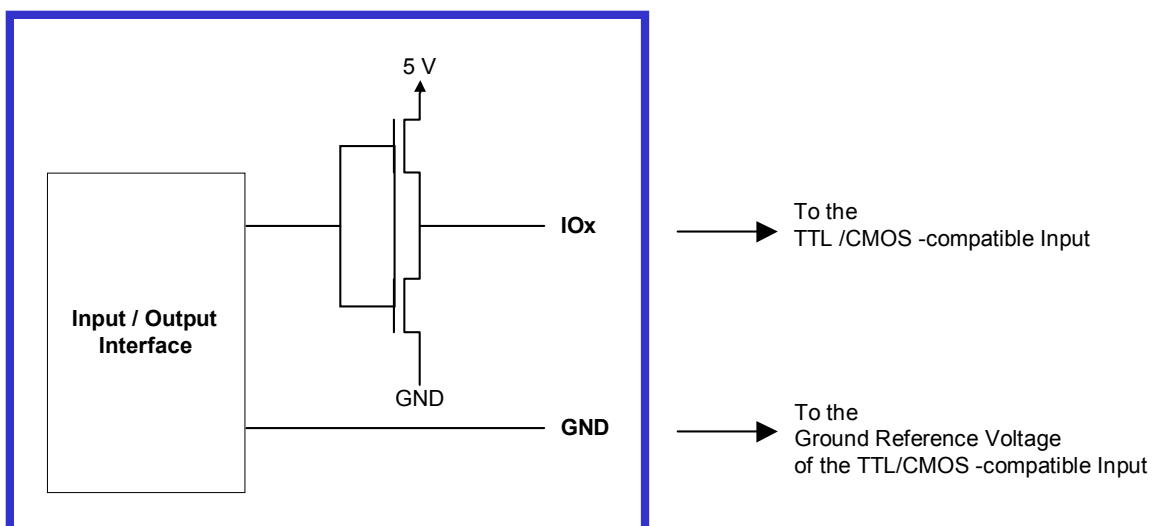
When set as input, each pin features a high impedance state to a TTL input buffer and has an internal pull-up resistance of 10 k $\Omega$ . It can be driven by a CMOS output driver or an open-drain/open-collector driver. Unconnected inputs present a high-level voltage.

**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**



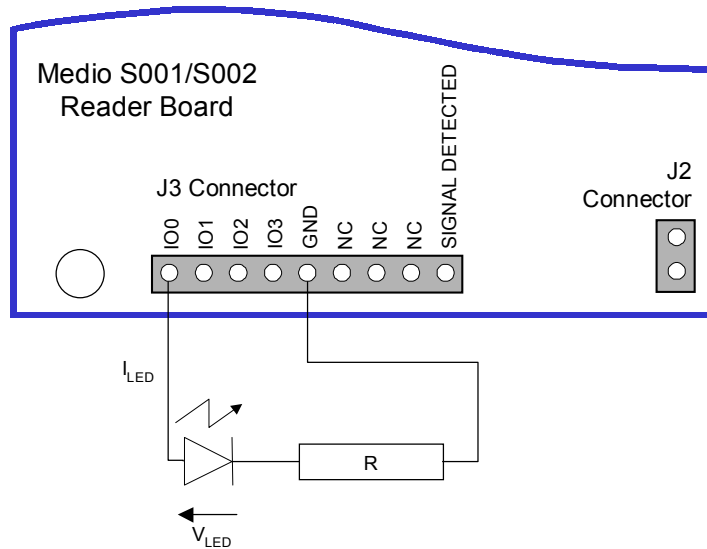
The Signal Detection pin has the same hardware and electrical characteristics as an output pin. It is used the same way, but it cannot be set as a standard I/O pin because it has a dedicated function.

## 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 S001/S002 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 S001/S001 Rev. 2: J1-1, J1-2, J1-3, J3-6, J3-7 and J3-8
- Medio S002: 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).



The performance of the Medio S001 Rev. 2 in Standalone mode is identical to the Medio S002.

## 7.1 Stand-alone Mode Features

Table 13 lists the available features for each Smart Label reader in Stand-alone mode.

**Table 13: Available Features in Stand-alone Mode**

Features	Medio S001	Medio S001 Rev. 2	Medio S002
Customized tag type reading	C210	C210 C220 C240 C270 (I-Code™) Tag-It™	C210 C220 C240 ISO 15693 C270 (I-Code™) Tag-It™
Serial Communication Type	TTL RS-232		TTL RS-232 RS-422
Baud Rate	4800, 9600, 19200 or 38400 bps		
Repetition Option	Available		
Customized ASCII message format	9 or 12 digits ID	STX/ETX Characters Header String Chip Description String ID String (variable length) End of Message String	
Input Trigger	No	Available	
Output for active trigger information	No	Available	
Output for tag reading information	No	Available	

### Customized Tag Type Reading

The Medio S001 readers can only read C210 smart labels while in Stand-alone Mode.

When using Medio S001Rev. 2 and Medio S002 readers, tags to be scanned can be configured using the “Set Stand-alone Mode” command. For more information, refer to the Medio S001/S002 Command Set document.



## Serial Communication Type

Medio S001 readers can only communicate via TTL or RS-232 links. The TTL link has priority over the RS-232 link.

When used in Stand-alone mode, Medio S002 readers can communicate via the TTL, RS-232 or RS-422 communication link types. The type of communication link can be set using the “Serial Communication Type” command. For more information, refer to the Medio S001/S002 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 smart label is read, its data is transmitted to the host in the form of an ASCII character frame.

**Table 14: Customized ASCII Message Format (Smart Label 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	9 or 12 characters (Medio S001) 2 to 16 characters (Medio S002/S001 Rev.2)	0 to 16 characters	1 character
				C220	2 to 10 characters		
				C240	2 to 16 characters		
				C270	2 to 16 characters		
				Tag It™	2 to 8 characters		
				ISO15693	2 to 16 characters		
S001	None	None	None	Required		Required	None
S001 Rev. 2	Optional	Optional	Optional	Required		Optional	Optional
S002	Optional	Optional	Optional	Required		Optional	Optional

In Standalone mode, the Medio S001 reader only processes C210 chips. Only the ID field is returned with 9 or 12 ASCII characters.

Medio S001 Rev. 2 and Medio S002 readers 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)
C240 chip	16 (Block 0 Page 0)
C220 chip	10 (Memory area 1)
C270 chip	16 (Block 0 and Block 1)
Tag-it™ chip	8 (Address)
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 during a lapse of 300 ms for a Medio S001 or have failed 3 times for a Medio S002 and S001 Rev. 2 (this feature makes it possible to detect a chip’s potential exit out of the field).

## Trigger Input (Medio S002 and S001 Rev. 2)

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 S001/S002 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 (Smart Label 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
S001	Not available				
S001 Rev. 2	Optional	Optional	Required	Optional	Optional
S002	Optional	Optional	Required	Optional	Optional

## Read LED Settings (Medio S002 and S001 Rev. 2)

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

## 7.2 Enabling Stand-alone Mode

### 7.2.1 Medio S001

To set Medio S001 readers in Stand-alone mode:

1. Turn off the reader.
2. Connect pins RX\_TTL and TX\_TTL together.
3. Turn on the reader.

When the reader is turned back on, it automatically detects that the two pins are connected together and Stand-alone mode is enabled. To remain in Stand-alone mode, these two pins must always be connected.

### 7.2.2 Medio S002 and S001 Rev. 2

Medio S002 and S001 Rev. 2 readers 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 S001/S002 Command Set document.
2. By using the S002 Explorer software provided with the reader
3. As shown above for the Medio S001.

If the Medio S002 or S001 Rev. 2 has been supplied with RX\_TTL and TX\_TTL pins connected together, disconnecting them will put the reader out of the Stand-alone Mode.

### 7.2.3 All Readers

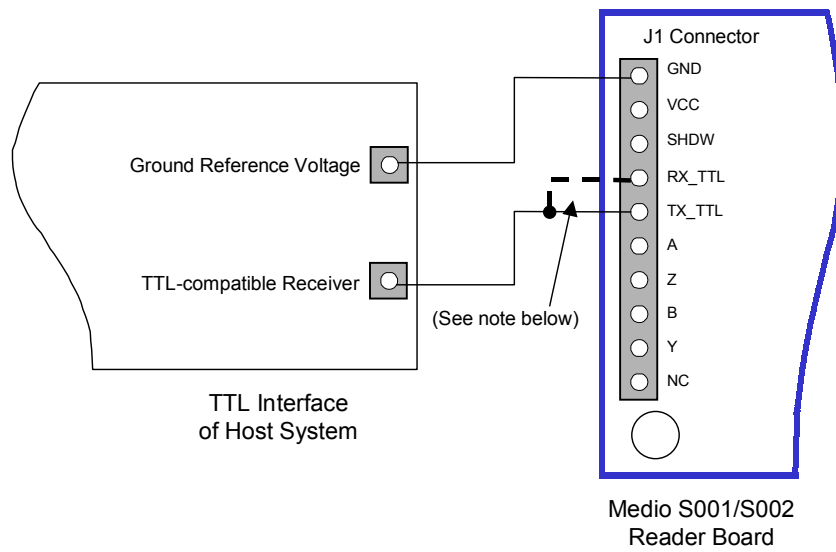


If *RX\_TTL* and *TX\_TTL* pins are connected together, the link to the host transmitter and to the reader receiver (*RX\_TTL* or *RX\_RS232* or *A and B* pins) must be removed.

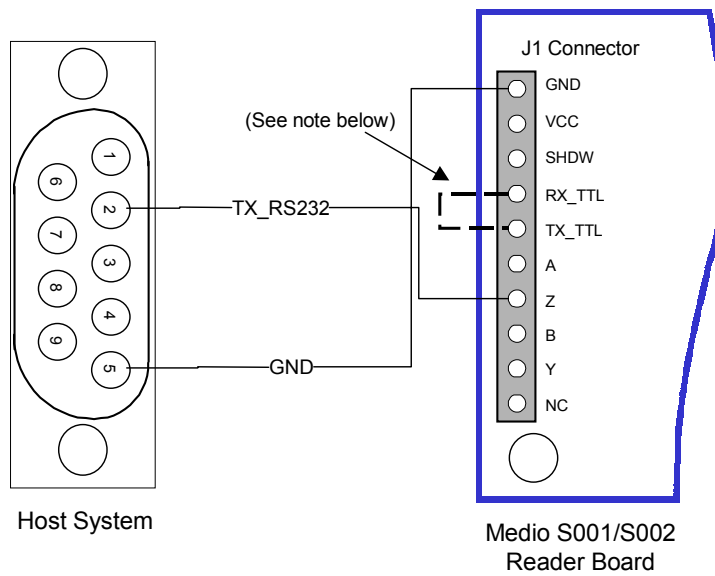
Network configuration (RS-485 link) is not allowed in Stand-alone Mode. If the configuration applies to this mode, A,B,Y and Z pins are disconnected and the TTL communication mode applies.

The following three figures show the required connections to the host system for setting the Medio S001 (or Medio S002 if *TX\_TTL* and *RX\_TTL* are connected together) into Stand-alone mode for TTL, RS-232 and RS-422 communication links.

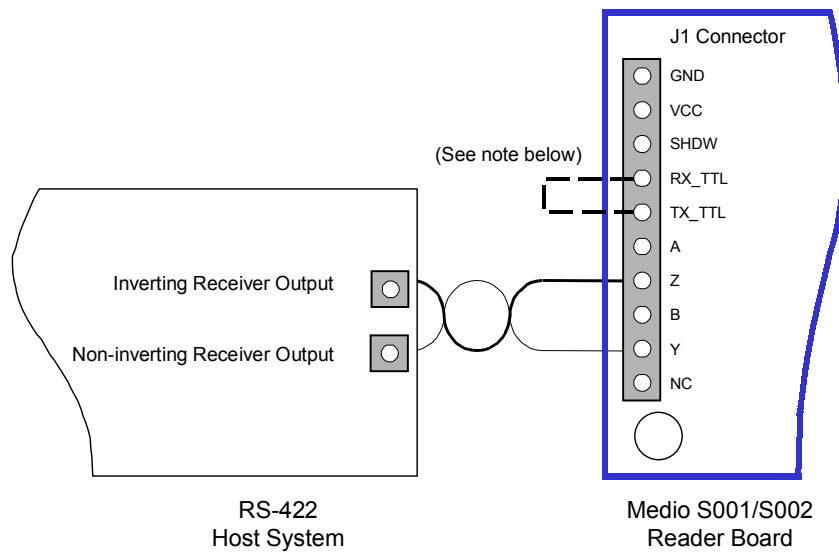
**Figure 17: Communication in Stand-alone Mode with the TTL interface**



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



**Figure 19: Communication in Stand-alone Mode with the RS-422 interface (Medio S002)**



**RX\_TTL and TX\_TLL Pin Connection**



- Medio S001: Connection required for Stand-alone mode.
- Medio S002 and Medio S001 Rev. 2: Connection optional for Stand-alone mode. Connection not required if Medio S002 or Medio S001 Rev. 2 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 capabilities are set in different ways depending on whether a Medio S001 or a Medio S002 is used.

### 7.3.1 Medio S001

The I/O pins on connector J3 are used to configure communication links towards the host system. The following tables provide all possible configurations. “Connected” means that the I/O pin must be directly connected to the reader’s ground (pin present on connector J3).

**Table 17: Selecting the Communication Rate**

Baud Rate	I/O1	I/O2
38400	Free	Free
19200	Connected	Free
9600	Free	Connected
4800	Connected	Connected

**Table 18: Selecting the Read Mode**

Read Mode	I/O 3
Read Once	Free
Repeated Read	Connected

The S001 reader constantly attempts to read any C210 chip present in the field.

The “Repeated Read” mode returns a C210 chip’s ID to the host with each successful read operation.

The “Read Once” mode only returns the ID of a chip if the previous read corresponds to a different chip, or if all reading attempts have failed during a lapse of 300ms (this makes it possible to detect a chip’s potential exit out of the field).

When selecting the format, note that the ID String of the message can only have 9 or 12 digits.

**Table 19: Selecting the Format**

Format	I/O 0
12 digits	Free
9 digits	Connected

By default (with no I/O connected), the reader is configured for transmission at a rate of 12 digits in 38400 Baud, in Read-Only mode.

### 7.3.2 Medio S002 and S001 Rev. 2

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 S001/S002 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

### 7.4.1 Medio S001

To reset the Medio S001 in Standard mode:

1. Turn off the reader.
2. Remove the connection between pins RX\_TTL and TX\_TTL.
3. Turn on the reader.

When the reader is turned back on, it automatically detects that the two pins are no longer connected together and Stand-alone mode is disabled.

### 7.4.2 Medio S002 and S001 Rev. 2

The Medio S002 and S001 Rev. 2 can be reset in Standard mode in one of fore ways depending on how Standalone mode was enabled (two possibilities):

1. If the Medio S002 or S001 Rev. 2 has been set in Stand-alone mode using the “Set Stand-alone Mode” command:
  - a. Method A:  
Use the S002 Explorer software provided with the reader.



This function is only available with Firmware version 2.4 or more recent.

When exiting Standalone mode using this command, note that the response time varies in function of the current Medio S002/S001 Rev. 2 activity (tag reading in progress, for example).

---

b. Method B:

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

---



This function is only available with Firmware version 2.4 or more recent.

When exiting Standalone mode using this command, note that the response time varies in function of the current Medio S002/S001 Rev. 2 activity (tag reading in progress, for example).

---

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 S002 or S001 Rev. 2 has been set in Stand-alone mode using the connection between pins RX\_TTL and TX\_TTL, follow the instructions described above for the Medio S001.

# 8 Technical Specifications

## 8.1 Medio S001/S002 Technical Specifications

**Table 20: Medio S001/S002 Technical Specifications**

Reference	Medio S001	Medio S002
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 C270 or Philips I-Code™ TI Tag-It™	C210 C220 C240 C270 or Philips I-Code™ TI Tag-It™ ISO 15693 Part-2 and Part-3
Communication interface	TTL RS-232	TTL RS-232 RS-422 RS-485
RF Output Power	200 mW Typical	250 mW Typical
Simultaneous reading (anti-collision) capability	Eight smart labels based on the same chip (either C220, C270, I-Code™ or Tag It™) 16 ISO 15693 Chips (Medio S002)	
Power consumption under 5V	150 mA Typical 400 µA in standby mode	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 Japanese ARIB T60 Radio Standard compliance ETSI 300-330 European Radio compliance	CE ETSI 300-330 European Radio compliance FCC
Communication protocol in Standard mode	TAGSYS-specific STXE	TAGSYS-specific STXE-2
ASCII protocol in Stand-alone mode	Fixed (C120 chip only)	Programmable (All chips supported)



# 9 Mechanical Characteristics

## 9.1 Dimensions and General Mechanical Information

Figure 20: Medio S00x Coupler: Mechanical Dimensions (Side View)

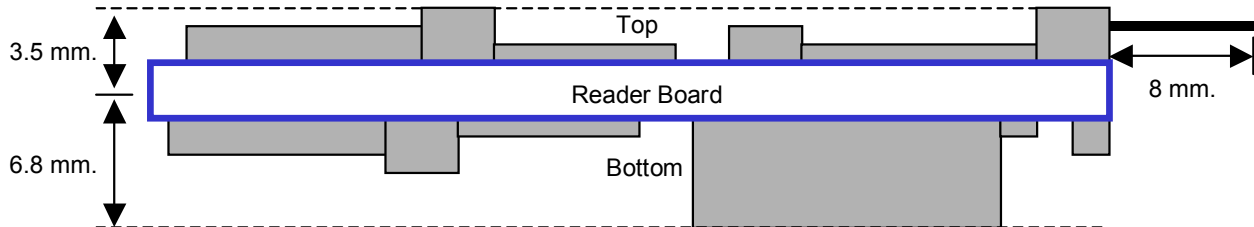
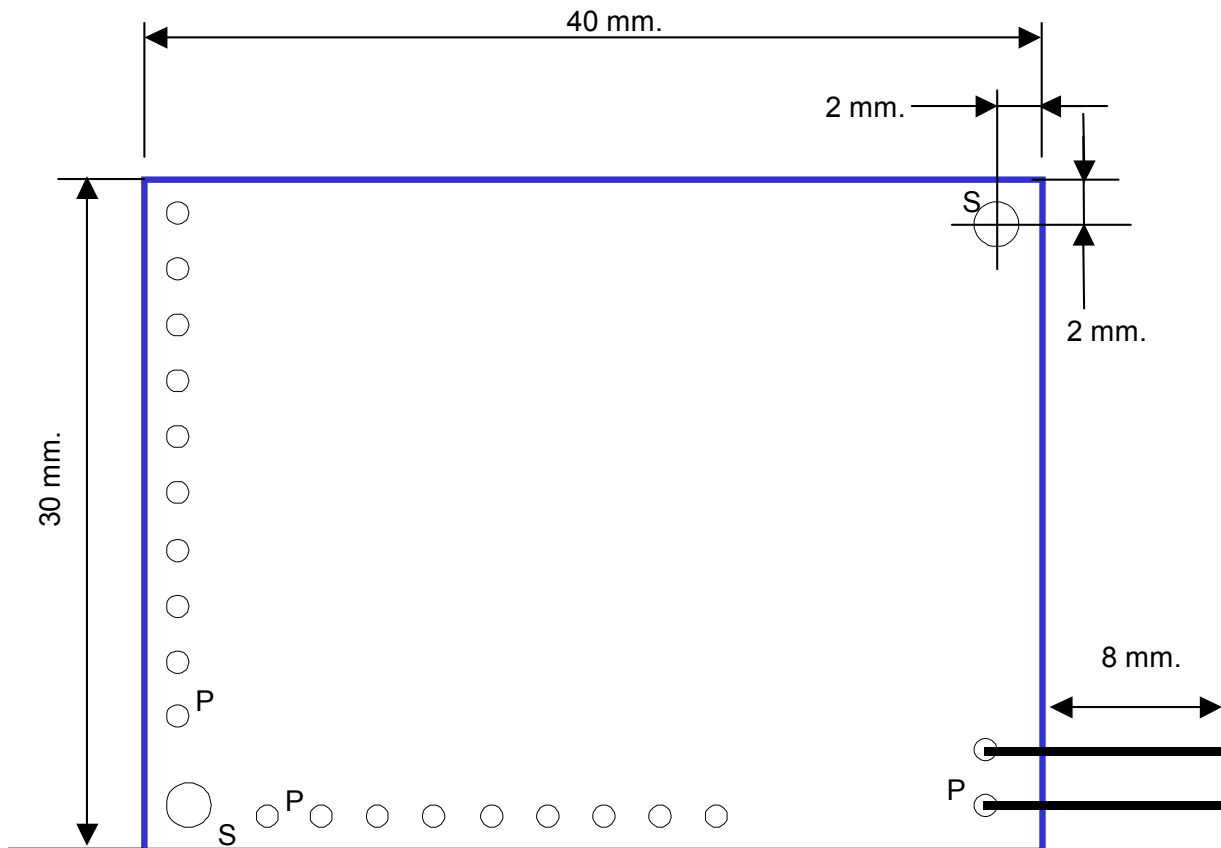


Figure 21: Medio S00x Coupler: Mechanical Dimensions (Top View)



The values given in [Figure 20](#) and [Figure 21](#) have a tolerance of 0.2 mm.

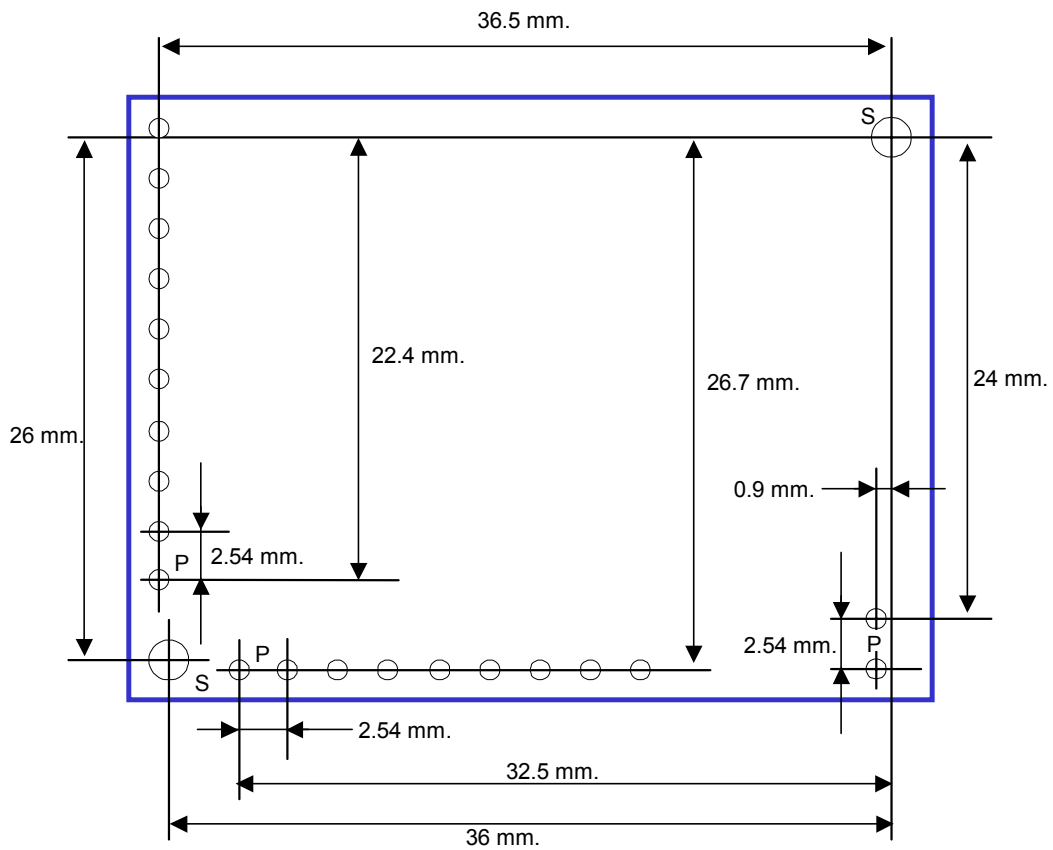
S and P holes are metallic. Their diameters are listed in [Table 20](#).

Table 21: 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 application 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)	0.2 W (Medio S001) 0.25 W (Medio S002/S001Rev. 2)
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 S001 coupler is compliant with the following standards:

- CE
- ARIB T60 (Japanese Radio Standard Compliance)
- ETSI 300-330 (European Radio Compliance)

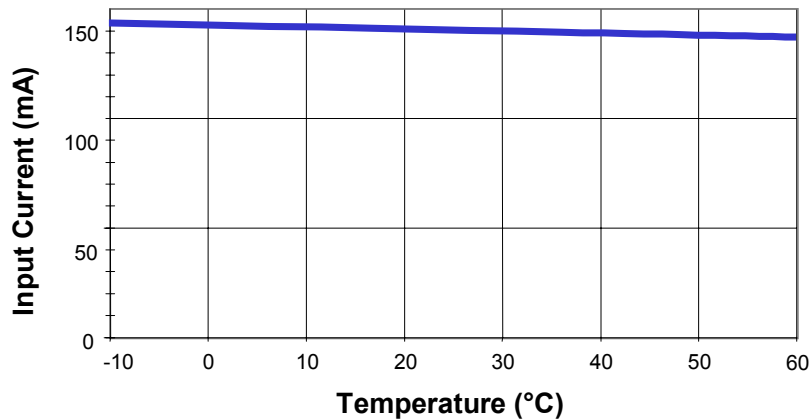
The Medio S002 is also compliant with FCC part 15 regulations.

### 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<sub>cc</sub> 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

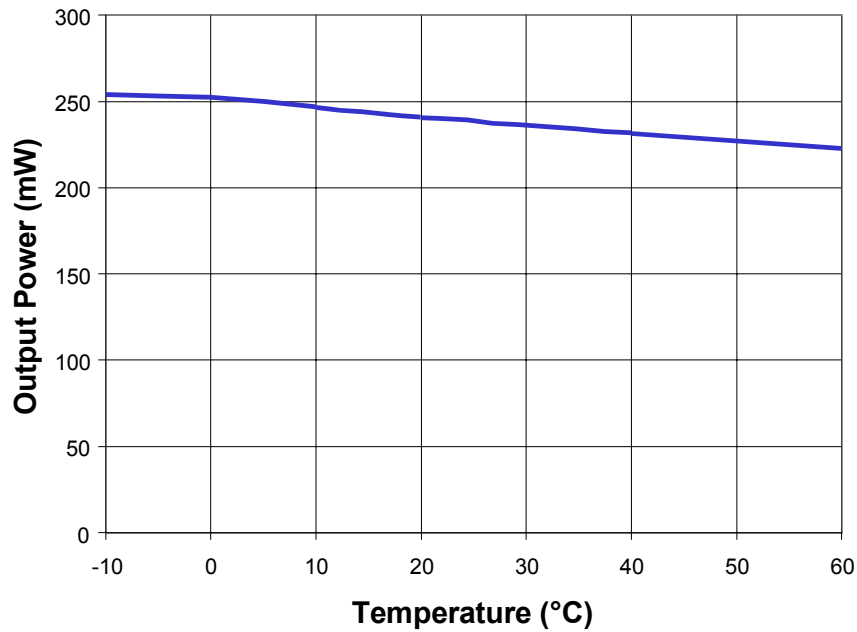
## 10.5 Communication Link DC Characteristics and Timing

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	

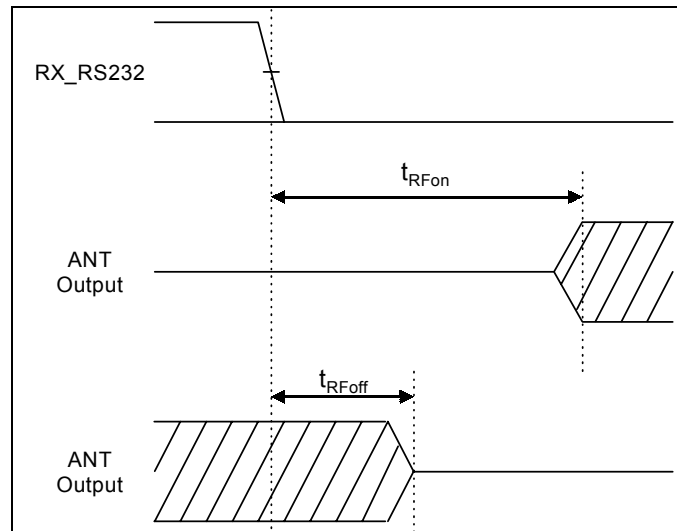
## 10.6 Antenna Electrical and Timing Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit	Comments
ANT output power			200 250		mW	Medio S001 Medio S002/S001 Rev2
ANT output impedance			(50, 0)		(W, °)	At 13.56 MHz
RFO n time to RFO ff	End of reception on RX to ANT. RF field turns on		1.3	1.4	ms	
RFO ff time to RFO n	End of reception on RX to ANT. RF field turns off		4.2	50	μs	

**Figure 24 : Output Power vs. Temperature**  
(V<sub>CC</sub> Pin at 5 V – RF On - No I/O Connected)



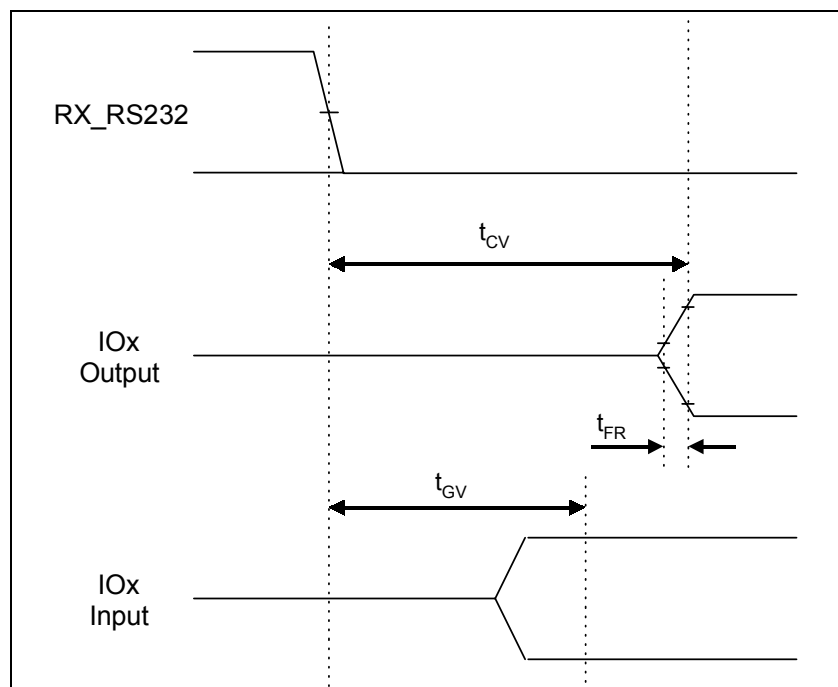
**Figure 25: Antenna RF Switch Time**



## 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			$\mu$ A	
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	$\mu$ s	
$t_{GV}$ (time to get value)	End of reception on RX to I/Ox level read		33	38	$\mu$ s	
$t_{FR}$ (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.