TAGSYS RFID™
e-connecting goods

Textile L100 Reader

User's Guide

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Read This First

Welcome to the TAGSYS RFID System. This User's Guide is designed to help you get up and running quickly using this high-quality Radio Frequency Identification (RFID) system. It describes all you need to know about how to install and use the TAGSYS system and its associated applications.

This document describes how to:

- Install the Textile L100 Reader,
- Select the best-adapted configuration for your application,
- Develop custom application software,
- Troubleshoot any eventual problems.

This guide is designed for all TAGSYS partners and for TAGSYS Expert Network customers implementing a low-cost and high-performance RFID solution.

This document does not require any previous knowledge of Radio Frequency Identification (RFID) technology.

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.

If you need assistance

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

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Fax: +33 (0) 4 91 27 57 01
E-Mail: info@tagsysrfid.com

Website: http://www.tagsysrfid.com

Contact for Comments

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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 customer service representative using the dedicated Product Return Form.

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Table of Contents

1 For Your Safety

1.1 General Use

The Textile L100 Reader is designed to be rugged and reliable and to provide years of trouble-free service. Please observe the following general tips:

- Take care not to scratch the device. Keep the device clean. When working with the device, use only TAGSYS-approved accessories.
- This device is not waterproof and should not be exposed to rain or moisture. Under extreme conditions, water may enter the circuitry.
- Take care not to drop the device or subject it to any strong impact.
- Protect the device from extreme temperatures. For example, do not leave the device in front of a window on a hot day, and keep it away from heaters and other heat sources.
- Do not store or use the device in any location that is extremely dusty, damp, or wet.
- Use a soft, damp cloth to clean the device. If the surface of the device becomes soiled, clean it with a soft cloth moistened with a diluted window-cleaning solution.

1.2 Care and Maintenance

This device is a product of superior design and should be handled with care. The suggestions below will further increase the lifetime of this device.

- Keep the device and all parts and accessories out of the reach of small children.
- Keep the device dry. Precipitation, humidity and liquids contain minerals that will corrode electronic circuits.
- Do not use or store the device in dusty, dirty areas. Its moving parts can be damaged.
- Do not store in hot areas. High temperatures can shorten the life of electronic devices, damage batteries and warp or melt certain plastics.
- Do not store in cold areas. When the device warms up (to its normal temperature), moisture can form inside the device, which may damage electronic circuit boards.
- Do not attempt to open the device. Non-professional handling of the device may damage it.
- Handle the device with care. Shocks may break internal circuit boards.
- Do not clean the device with harsh chemicals, cleaning solvents or strong detergents. Gently wipe the device with a soft cloth slightly dampened in a mild soap-and-water solution.
- Do not paint the device. Paint may clog the device’s moving parts and prevent proper operation. Paint with metallic contents may limit device performance.

1.3 Important Safety Information

1.3.1 Operating Environment

Follow all special regulations that are applicable in any area and always switch off the device whenever its use is prohibited, or when it may cause interference or danger.

When connecting the device or any accessory to another device, read its user's guide for detailed safety instructions. Do not connect incompatible products.

As with all RF equipment, users are advised that the equipment should only be used in its normal operating position.

1.3.2 Electronic Devices

Most modern electronic equipment is shielded from radio-frequency (RF) signals. However, other electronic equipment may not be shielded against the RF signals from your device.

Medical Devices

Operation of radio transmitting equipment, including RFID devices, may interfere with the functionality of inadequately protected medical devices. Consult a physician or the manufacturer of the medical device to determine if they are adequately shielded from external RF energy or if you have any questions.

2 Certification

2.1 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 Textile L100 Reader as described in 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 TAGSYS 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 µW/cm2.

2.2 Regulatory Notices

An RFID system typically composed of an RF emission device such as the Textile L100 Reader 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 Textile L100 Reader meets these limits.

It is the responsibility of the TAGSYS Partner to install the Textile L100 Reader as described in this User’s Guide or in TAGSYS Documentation.

2.2.1 In Europe (CE and RTTE Directives)

The Textile L100 Reader complies (CE Declaration of Conformity granted) with the European EMC directive.

The Textile L100 Reader complies with the requirements of the Telecommunication Terminal Equipment Act (FTEG) and the RTTE Directive 1995/5/EC.

It is the responsibility of the TAGSYS Reseller to install the Textile L100 Reader as described in this Reference guide or TAGSYS Documentation.

Any modification of the Textile L100 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.

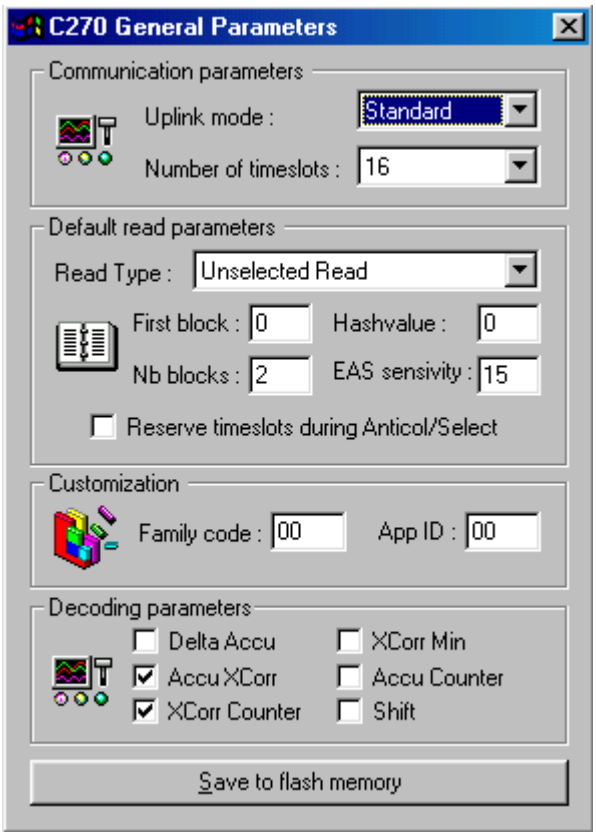
If a Textile L100 Reader is further integrated in a different product, it is the responsibility of the manufacturer of this complementary product to obtain the required approvals for this product.

2.2.2 FCC ID Cross Reference Table

It is the responsibility of the TAGSYS Partner to install the Textile L100 Reader as described in the table below, taking care of only installing the right antenna configuration with the right power settings.

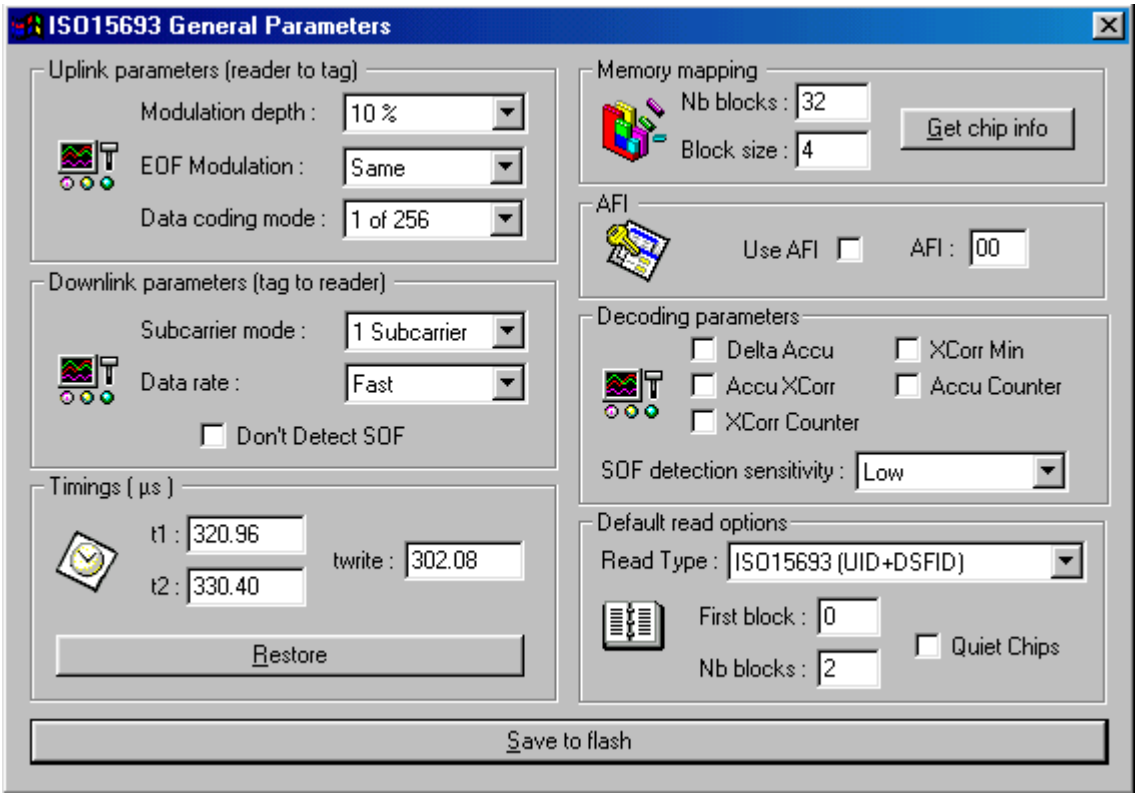
Antenna Configuration	Outside Dimension	Channel Setting	Multplexing	Max. Output Power	FCC ID
Conveyor Antenna 120X470	120X470 120X470	Dual channel	Yes	2W	QHKCONVYRANT
Conveyor Antenna 200X200 & 140X140	200X200 & 140X140	Dual channel	Yes	1.5W	QHKCONVYRANT
Conveyor Antenna 200X900	200X900	Single Channel	No	2W	QHKCONVYRANT
Conveyor Antenna 300X900	300X900	Single Channel	No	2W	QHKCONVYRANT
Textile rental stack Antenna	400X500	Single Channel	No	2W	QHKTRSTACKANTENNA
Aero LB Antenna	250X250	Single Channel	No	2W	QHKTRL100AEROLBLC
Aero LC Antenna	400X500	Single Channel	No	2W 	QHKTRL100AEROLBLC

To comply with band edge regulation, when used in vertical upright position the Aero LC antenna can read tags in the following RFID uplink protocols configurations



In C270 General Parameters window set the uplink parameters as follow:

C270 protocol: modulation ASK and set to “standard mode” (1 out of 256 pulse)



In ISO 15693 General Parameters window set the uplink parameters as follow:

ISO 15693 protocol: modulation depth set to 10% (ASK) with EOF set to “Same” (full ASK modulation) and Data coding mode set to “1 of 256” pulses

2.2.3 In USA (FCC Directive)

The Textile L100 Reader has been designed to comply with Part 15 of the FCC Rules. Furthermore typical configurations based on the use of Single Antenna like Aero LB & Aero LC at 2 Watts, have been successfully tested with Part 15 of the FCC rules (FCC ID Numbers are listed on all system-mounted TAGSYS Antennas).

Textile L100 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 system devices must accept any interference received, including interference that may cause undesired operation.

2.2.4 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.

3 Overview

The TAGSYS Textile L100 Reader (TR-L100) smart label packaged reader is intended for Original Equipment Manufacturer (OEM) applications.

The TR-L100 reader incorporates hardware, software and other components that manage the Radio Frequency (RF) interface as well as the external connections for power, data exchange and various communication protocols.

The TAGSYS TR-L100 reader is specifically designed for use in Industrial Laundry and Textile Rental environments and therefore is easily integrated into conveyor system applications.

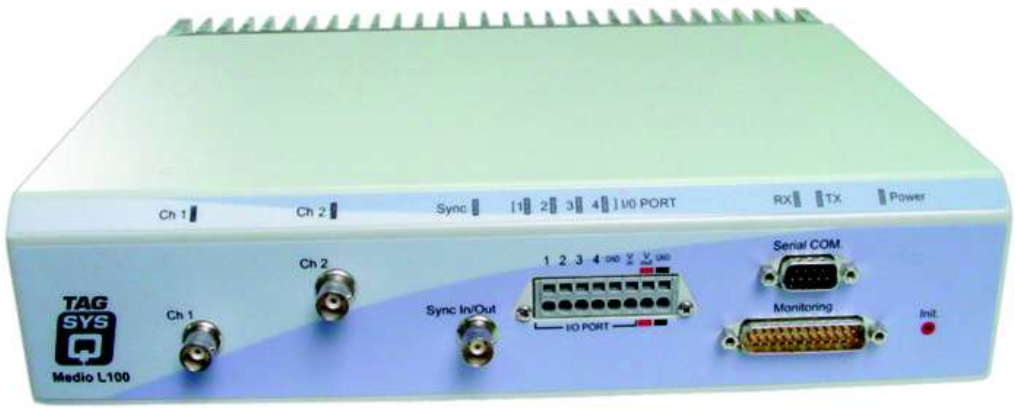
Customized software, such as STXE Protocol application or the Teletype (TTY) menu application, can be easily downloaded.

3.1 Key Features

- 13.56-MHz RF multi-channel packaged reader
- Multiple tag compatibility (TAGSYS and ISO 15693 smart labels)
- Standard software applications
- High RF output power, with software configuration
- Software-configurable multiplex operating mode
- Two dedicated processing units, namely a microcontroller for the customer application and a Digital Signal Processor (DSP) unit for real-time signal processing
- Serial communication with an embedded end-user application
- Multi-purpose configurable industrial I/O ports
- Parallel port monitoring

3.2 General Description

Figure 1: TR-L100 Packaged Reader



3.2.1 RF Channels

The TR-L100 Reader can drive up to two antennas with each channel able to drive up to four watts. LEDs indicate which RF field (channel) is transmitting (green).

CAUTION: The antenna **MUST** be connected to the reader before the unit is turned on.

3.2.2 Synchronization Input/Output

When configured for input, this BNC connector makes it possible to use an external 27.12-MHz clock to generate the RF field, instead of the internal clock generator.

When configured as output, this connector can drive other TR-L100 readers and provide the 27.12-MHz clock.

The Sync LED indicates the clock mode:

- Red: The internal clock generator is enabled and an external clock signal cannot be input.
- Green: The internal clock generator is disabled. A 27.12-MHz clock signal must be connected to the Sync In/Out connector.

By default, the internal clock mode is applied and the Sync In/Out connector is configured as an output. If the external clock mode is required, contact your TAGSYS sales representative for specific configuration information.

3.2.3 I/O Port Connector

The TR-L100 reader provides four Input/Output (I/O) ports. Each I/O can be independently configured as an input or output by the application software.

When configured as outputs, I/Os are open drain (250 mA). A pull-up supply must be connected to the I/O port reference input (V_{IN}). The pull-up supply voltage range is between 5V and 28V.

When configured as inputs, the I/O input signal range is between 0V and 28V.

I/O port LEDs indicate whether the I/O is configured for input (green) or output (red).

Please refer to Section 8, "I/O Ports" for more information.

Industrial I/O ports can only be accessed via the Data Processing Unit (DPU).

3.2.4 Init Button

The Init button aborts the embedded application stored in the Data Processing Unit memory. The TR-L100 Reader is then ready to be downloaded with a new application.

The TR-L100 Reader must be switched off and then back on before an embedded application takes effect.

3.2.5 Serial Connector

The serial connector is used to communicate with an external environment. User commands and data exchanges are transmitted through this port that can be set to RS-232, RS-485 or RS-422 mode by the software. Different baud rates can be defined for each mode.

The Default Mode is defined by the application software that is downloaded in the TR-L100 Reader.

Tx (Transmit Data) and Rx (Receive Data) LEDs indicate the activity of the serial port.

The RS-232 cable is a null modem cable.
For more information about Application Software, refer to Section 7, "Operating Modes".

3.2.6 Monitoring Port (Parallel Port)

The monitoring port communicates directly with firmware stored in the Flash memory. When the parallel cable is plugged in, the GemCore® OS and STX application software is automatically deselected. The parallel port can be used as a monitoring tool or as a means to upgrade the TR-L100 Reader firmware via the L200 Explorer.

The parallel cable uses pin-to-pin DB25 connectors. A shielded cable must be used to prevent disruptions when antennas have a high output power.

Please refer to TR-L100 Reader Architecture chapter for further information about the RPU and DPU. Please refer to the Lx00 Firmware Reference Guide for further information about TR-L100 Reader Firmware.

3.2.7 Antennas

The TR-L100 Reader is primarily designed for use with Aero-LA,-LB and -LC antennas as well as the TAGSYS Conveyor Antenna with its five different configurations. It is also operational with other TAGSYS antennas, provided that the power applied to the antenna does not exceed antenna specifications. For more information, refer to Section 5, "Antennas".

TR-L100 Reader performance has been characterized for a 3-meter long antenna cable. Optimized operation is not guaranteed for a cable with a length other than three meters.

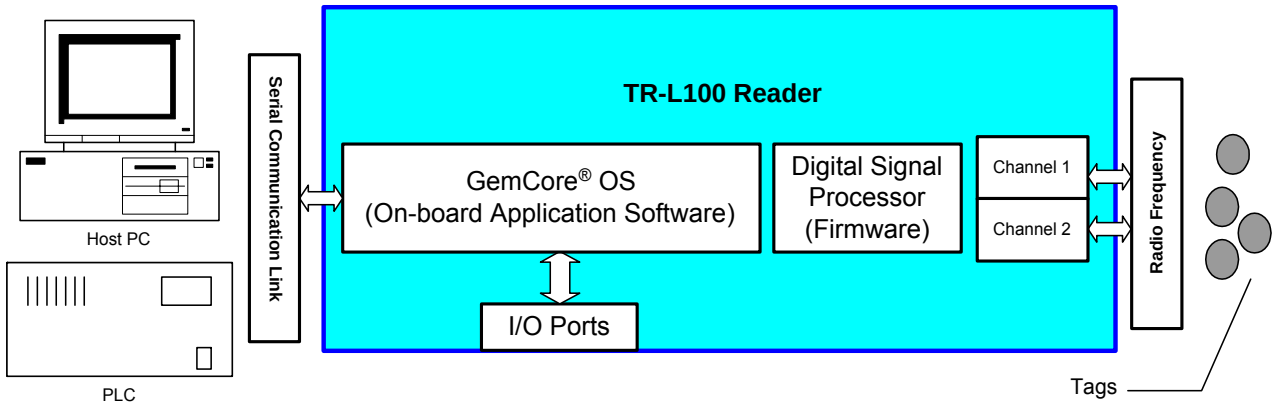
4 Architecture

The TR-L100 Reader is specifically designed for the Industrial Laundry and Textile Rental sectors. The TAGSYS Firmware is optimized for these applications and in particular for Multi-Read operations. Compatible with C210, C220, C240 and C270 tags, it is easily upgradeable for processing the future ISO 18000 tags.

As the TR-L100 reader unit is developed for Industrial Laundry and Textile Rental applications, it is delivered with the standard TAGSYS STX on-board application software that integrates an industry-specific Standalone mode.

Included with the TR-L100 package is the L200 Explorer, a Windows®-based development tool that enables you to carry out on-site test and debug operations as well as to customize the Standalone mode for your system.

Figure 2: TR-L100 Architecture



4.1 Software Overview

The GemCore® operating system controls the STX on-board application software that manages the four configurable industrial I/O ports and drives the firmware that controls the RF channels that decode the tags.

The TR-L100 Reader firmware is easily upgradeable for ensured compatibility with future ISO 18000 tags. For more information about the TR-L100 Reader Firmware, refer to the Lx00 Reader Firmware Reference Guide.

4.2 On-Board Application Software

The on-board software application is based on the GemCore® operating system. Different applications can be downloaded into the TR-L100 Reader, but only one can be stored at a single time.

The TR-L100 Reader is delivered with the STXE standard protocol application and includes an industry-specific Standalone module.

The STXE Protocol is the TAGSYS standard protocol. It is compatible with all TAGSYS products. We recommend using the STXE protocol in order to address all TAGSYS reader functions.

Custom software can also be developed using the STX Command set. This Windows®-based application is easy to implement using the STX-E DLLs. This requires a Master/Slave configuration and does not allow Standalone mode. For more information, refer to the MedioSTX DLL Programming Guide.

The GemCore® Development Kit is available for developing custom programs for Standalone applications.

For more information, refer to Section 7, "Operating Modes".

5 Antennas

TAGSYS TR-L100 readers are optimized for use with TAGSYS antennas.

The antennas are factory-calibrated to an impedance of 50 Ohms that offers optimal performances when the antenna is mounted on a desktop surface.

Due to their specific design, these antennas can be safely used in proximity to other TAGSYS RFID products. They will also work, if properly installed, in metallic-type environments. In this case, performance may be reduced.

It may be necessary to retune the antenna once installed if the environment is highly metallic or if the antenna is installed underneath a table or desk (and depending on the material of which the desk/table is manufactured).

Table 1: Antenna Characteristics

Parameter	LA	LB	LC	Conveyor Antenna		
				S140	S200	R1247
Antenna Coil Dimensions	300 x 300 mm.	250 x 250 mm.	400 x 500 mm.	140 x 140 mm.	200 x 200 mm.	120 x 470 mm.
Packaged Antenna Dimensions	310 x 440 x 25 mm.	275 x 315 x 25 mm.	450 x 625 x 30 mm.	Not Applicable		
Weight	600 g.	430 g.	1.9 kg.	Not Applicable		
Operating Temperature	0 °C to +55 °C					
Storage Temperature	-25 °C to +60 °C					
Maximum Output Power [1]	7 W	4 W	7 W	8 W		
Operating Frequency	13.56 MHz					
Impedance	50±5 Ω and 0 ± 5°					

[1] FCC-compliant antennas are available (maximum output power of 1 W).

Table 2: Minimum Single-Antenna Station Performance[1]

Parameter	LA	LB	LC	Conveyor Antenna		
				S140	S200	R1247
Reading				15 cm	18 cm	15 cm
Writing				Not Applicable		

[1] Multiplexed with TR-L100 reader using Ario TL tags.

Performance given for single tag operation and measured on any point above the RF loop. In the middle of the loop, the performance may be greater.

6 Installation

6.1 Mechanical Aspects

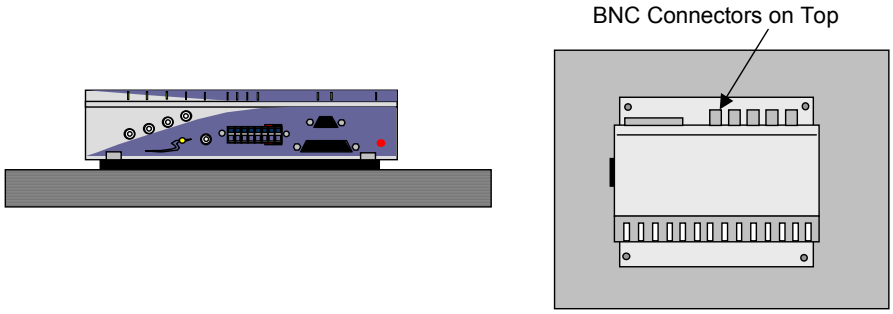
The TR-L100 Reader is delivered with four rubber pads screwed on the bottom of the package for installation on a table or desk.

A mounting plate available with the TR-L100 Reader can be used to mount the unit in various positions. When mounted vertically, the BNC connectors must be facing upwards and perpendicular to the floor.

When installing the TR-L100 Reader on the mounting plate, remove the rubber pads from the TR-L100 Reader and fasten the unit directly to the mounting plate.

CAUTION: The screws must be always attached to the bottom of the TR-L100 Reader even if the rubber pads and mounting plate are not used.

Figure 3: Authorized Installation Positions



CAUTION: For continuous protection against risk of fire, use only T 2.5A – 250V rated fuses.

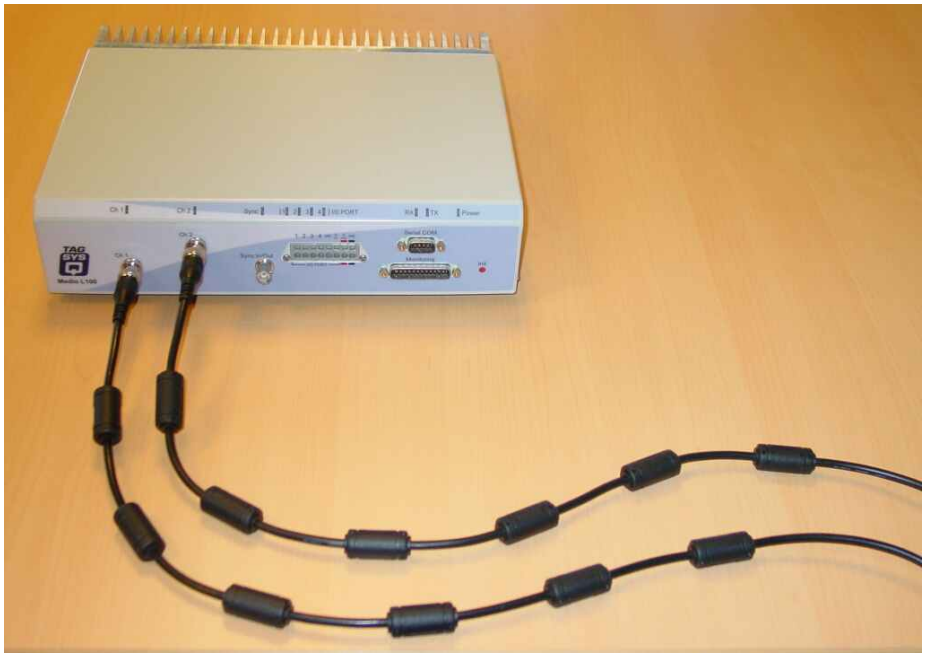
6.2 Cabling Requirements

All TR-L100 Reader cables must be correctly shielded. The shielding effectiveness of the material used should be of good performance (60 dB minimum), especially in the frequency range of 10 to 60 MHz. The addition of ferrite clamps near the reader unit will increase common mode rejection. TAGSYS antenna products are delivered with good performance shielded coaxial cables with 6 ferrite beads already mounted to increase shielding effectiveness at low frequencies.

CAUTION: Only use recommended cable with correct shielding when using the Conveyor Antenna Signal Box.

Conveyor Antennas must be connected to the TR-L100 Reader unit using only the supplied RG-58 cable with 6 ferrite beads fastened at the reader unit end.

Figure 4: Ferrite Beads with TR-L100 Reader



7 Operating Modes

Specifically designed for use in Industrial Laundry and Textile Rental applications, the main operating mode of the TR-L100 Reader is Standalone mode. In this mode, the reader unit automatically sends the data from tags that are read to the host PC or programmable logic controller (PLC) via the RS serial communication link. This is the standard STX software application delivered with the TR-L100 Reader unit.

Custom software can also be developed using the STX Command set. This Windows®-based application is easy to implement using the STX-E DLLs. This requires a Master/Slave configuration and does not allow Standalone mode. For more information, refer to the MedioSTX DLL Programming Guide.

The GemCore® Development Kit is also available for developing a custom program that enables Standalone mode.

7.1 STX On-Board Application with Standalone Mode

The Standalone mode parameters are set using the L200 Explorer. For more information, refer to the L200 Explorer User's Guide.

7.1.1 Reader Parameters

250 mW (Low) or 4 W (Full) power consumption modes are available. The recommended power consumption mode is 1 W.

7.1.2 Channel Settings

Select the number of active antenna channels. If None is selected, all channels are switched off and no tag commands can be executed. Selecting Channel 1 or Channel 2 causes the corresponding channel to be switched on immediately.

CAUTION: Antennas **MUST** be connected to the reader unit before the Channel settings are enabled.

Select Multiplex to switch off all channels. In this case, the reader uses the multiplexer patterns during default read operations. In Multiplex mode, only the default Standalone read command can be executed.

7.1.3 Multiplexing Configuration

The TR-L100 Reader is designed with two transmit channels but with only one receive channel. This means that each antenna can transmit an RF field used to read tags, but tag contents can only be read by one antenna at a single time.

Tag reading performance can be enhanced by using the TR-L100 Reader to perform read operations on both antennas one after the other.

In addition, a phase shift can be applied between Antenna 1 and Antenna 2 for 3-D rotating field applications.

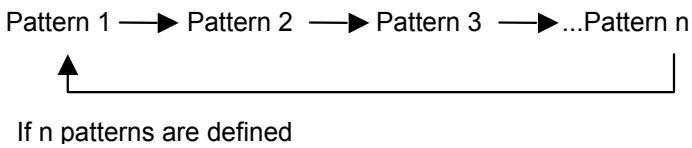
These parameters are selected in Multiplexing mode that allows the user to completely define a system based on its multiplexing configuration.

In particular, the following parameters are defined by the multiplexing mode:

- the transmitting antennas,
- the phase shift between the antennas,
- which antenna is read, and for how long.

Multiplexing information is organized into patterns. A sequence contains between one and eight patterns that are applied one after the other in a loop. The TR-L100 Reader can only store a single sequence.

Figure 5: Sequence of Patterns in a Loop



Multiplexing mode enables the user to implement several combinations on the basis of this physical configuration.

Phase shifts can be used to detect tags in a 3-D rotating field application. Phase shifts of 0° and 180° are available.

In this case, both antennas must be enabled (transmitting) simultaneously in order for the two phases to create a 3-dimensional RF field. For more information, refer to Appendix A: "Pattern Examples".

7.1.4 Communication Parameters

Standard communication speed parameters are available. 4800, 9600, 19200 or 38400 bauds can be selected.

Other parameters are set to their standard values: no parity, 1 stop bit and 8-bit characters.

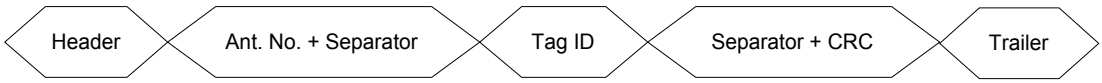
7.2 Message Format

The format of the ASCII message used in Standalone mode can also be defined. The Header and Trailer strings are optional, as is the Antenna (RF channel) and its separator string. If Tag ID is selected, the number of characters to be displayed must be entered (in bytes).

A Checksum is also available to verify the validity of the data.

Messages are sent in frames with the elements shown in Figure 6. The elements sent in the message can be individually selected.

Figure 6: Message Format



The Header can contain from 1 to 16 characters or be absent. Note that the both the Header and the Trailer are either absent or present simultaneously.

The Antenna Number is either 1 or 2. This Separator can contain between 1 and 16 characters.

The Tag ID field contains the tag ID for C210, C220 and C270 tags. This field can contain 1 to 16 characters and the repetition of characters is configurable.

The second Separator can contain between 1 and 16 characters. The CRC field is the XOR of the sum of all the characters (in hexadecimal format) included in the message. This value is represented by two ASCII characters.

The Trailer can contain from 1 to 16 characters or be absent.

7.3 Sorting Mode

The Standalone module of the STX on-board software application features a Sorting mode. In normal conditions, each tag frame is sent to the host PC or PLC as soon as it is decoded by the TR-L100 reader.

In Sorting mode, the tags are sorted by the TR-L100 reader before the tag frames are sent to the host PC or PLC. The tags are sorted by a combination of three parameters selected by the user.

- Buffer depth: between 1 and 50 frames
- Timeout per tag: between 500 milliseconds and 5 minutes
- Reader sorts tags by antenna or regroups all tags into a single group

7.4 Reading Mode

Tags can be read by one of two Reading modes. In Continuous Reading mode, the TR-L100 reader continually reads tags.

A Trigger Reading mode is also available. In this mode, tags can be read either at the high or low state of the trigger. Tag data is sent to the host PC or PLC by the TR-L100 as soon as it is decoded or at the end of the trigger. The sending of a No Read signal can also be selected.

In Trigger Reading mode, the RF field is switched on only when the trigger is activated.

7.5 Watchdog

A Watchdog function is available. Using the L200 Explorer, select Activate Watchdog and enter the Repetition Delay and Message parameters.

8 I/O Ports

The TR-L100 Reader features four I/O ports. When using the standard STX software application delivered with the TR-L100 Reader unit, the four I/Os are specifically configured for Industrial Laundry and Textile Rental applications.

However, if you choose to develop your own software, the four I/O ports can be configured independently as a general-purpose input or output. Depending on the application software downloaded in the GemCore® OS, the I/O port may command a relay, trigger specific commands (Windowing…) or read input signals.

8.1 Standard STX Standalone Module

When using the standard STX software application delivered with the TR-L100 Reader unit, the Standalone module uses the I/O configuration given in Table 3.

Table 3: I/O Configuration in Standalone Module

I/O Port	Description
1	Trigger (Input)
2	Copy of Trigger (Output)
3	Active when tag is correctly read (Output)
4	Active when no tag is read after a trigger (Output)

For more information about application software, refer to Section 4.2, "On-Board Application Software".

8.2 General Purpose I/Os

Each I/O can be configured independently as an input or output.

When an I/O is configured as input, it can be used to connect sensors or industrial logic commands to execute a specific task. For instance, the TR-L100 Reader can execute a tag Read command according to the logical level of the input command.

When the I/O is configured as output, it can command a relay or any other transducer.

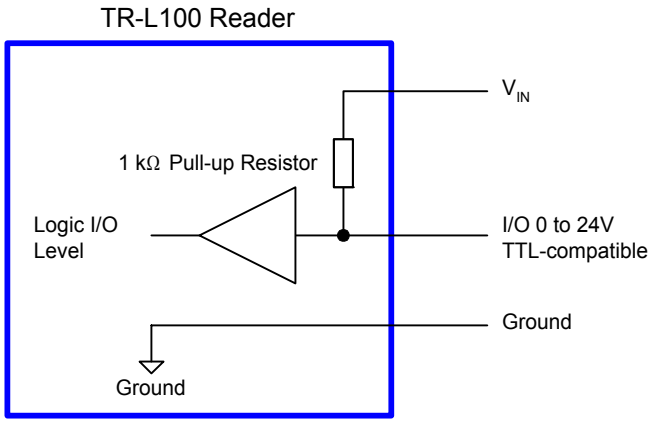
- Input: Industrial logic (0V to 28V) TTL-compatible.
- Output: Open drain, 250 mA (maximum).

8.2.1 Internal Connections

This paragraph describes I/O electronic schematics when the configuration is set to input or output. It also gives the characteristics of the V_{OUT} supply that is available on the I/O port.

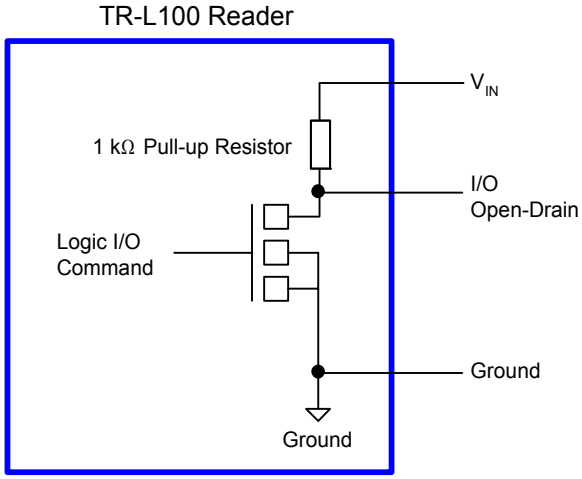
8.2.1.1 Input Configuration

Figure 7: I/O Configured as Input



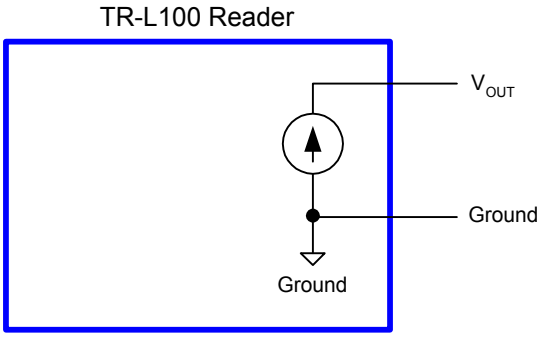
8.2.1.2 Output Configuration

Figure 8: I/O Configured as Output



8.2.1.3 VOUT Characteristics

Figure 9: VOUT Characteristics



V_{OUT}:

- Output DC 28V.
- Output current: 100 mA max.

8.2.2 Input Configurations

When an I/O port is configured as an input, the external logic signal must be connected directly to the input (0V-24V) of the requested I/O port. If the output of the external logic signal is an open-collector output, the V_{IN} signal must be connected to a supply (V_{OUT} or external supply) or to the ground to pull up/down the I/O port. In this case, all the grounds must be connected together (external logic, external supply and TR-L100 Reader ground supply). The following examples show how to connect a signal (from a sensor, a push-button, etc…) to the TR-L100 Reader.

Figure 10: Connecting a "Totem-Pole" Sensor

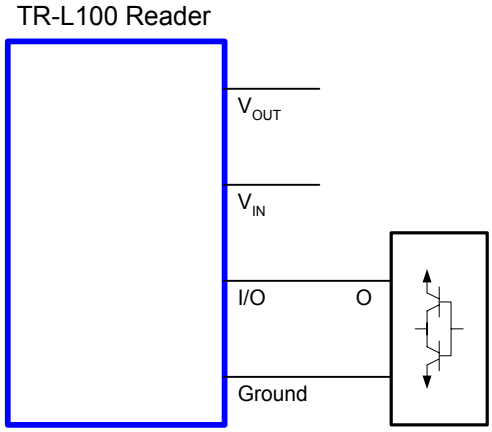


Figure 11: Connecting an "Open-Collector" Sensor (N Type)

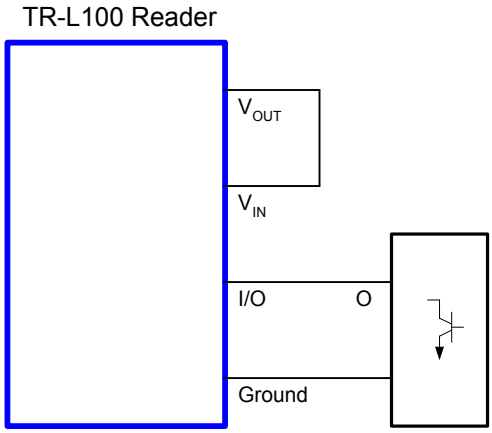
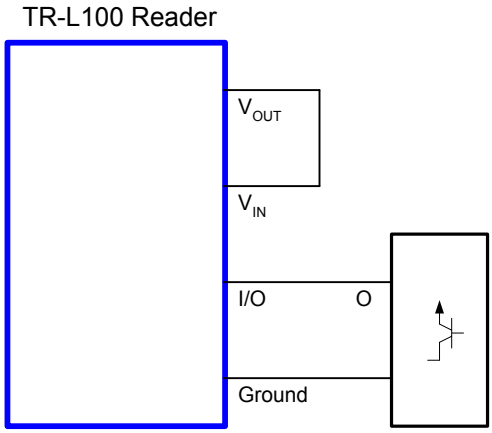


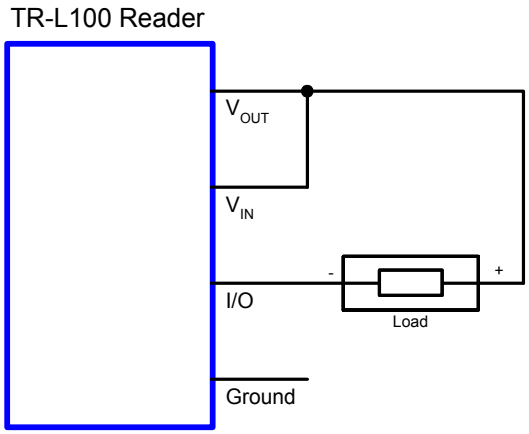
Figure 12: Connecting an "Open-Collector" Sensor (P Type)



8.2.3 Output Configurations

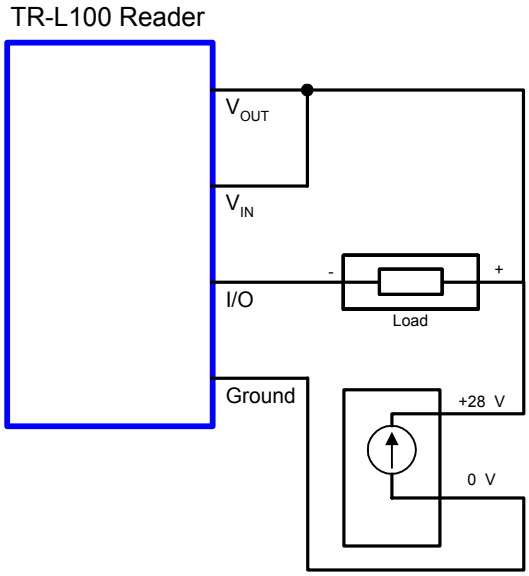
When an I/O port is configured as an output, the V_{IN} signal must be connected to a supply to pull up the I/O port when it is not activated. Setting the I/O port pulls down its output to the GND. V_{OUT} supply may be used to supply V_{IN} signal and the external load. The following examples show how to connect a load (a relay, a light, etc.) to the TR-L100 Reader using the internal supply (V_{OUT}) or an external supply.

Figure 13: Connecting a load using the internal supply (V_{OUT})



Using an external supply

Figure 14: Connecting a load using an external supply



When the I/O port is set, the relay is activated. When the I/O port is reset, the relay is not activated.

8.3 Application Diagrams

When using the standard STX software application delivered with the TR-L100 Reader unit, the Standalone module uses the I/O configuration given in Table 3.

Figure 15: Aero LA Green Lamp and Buzzer Connection

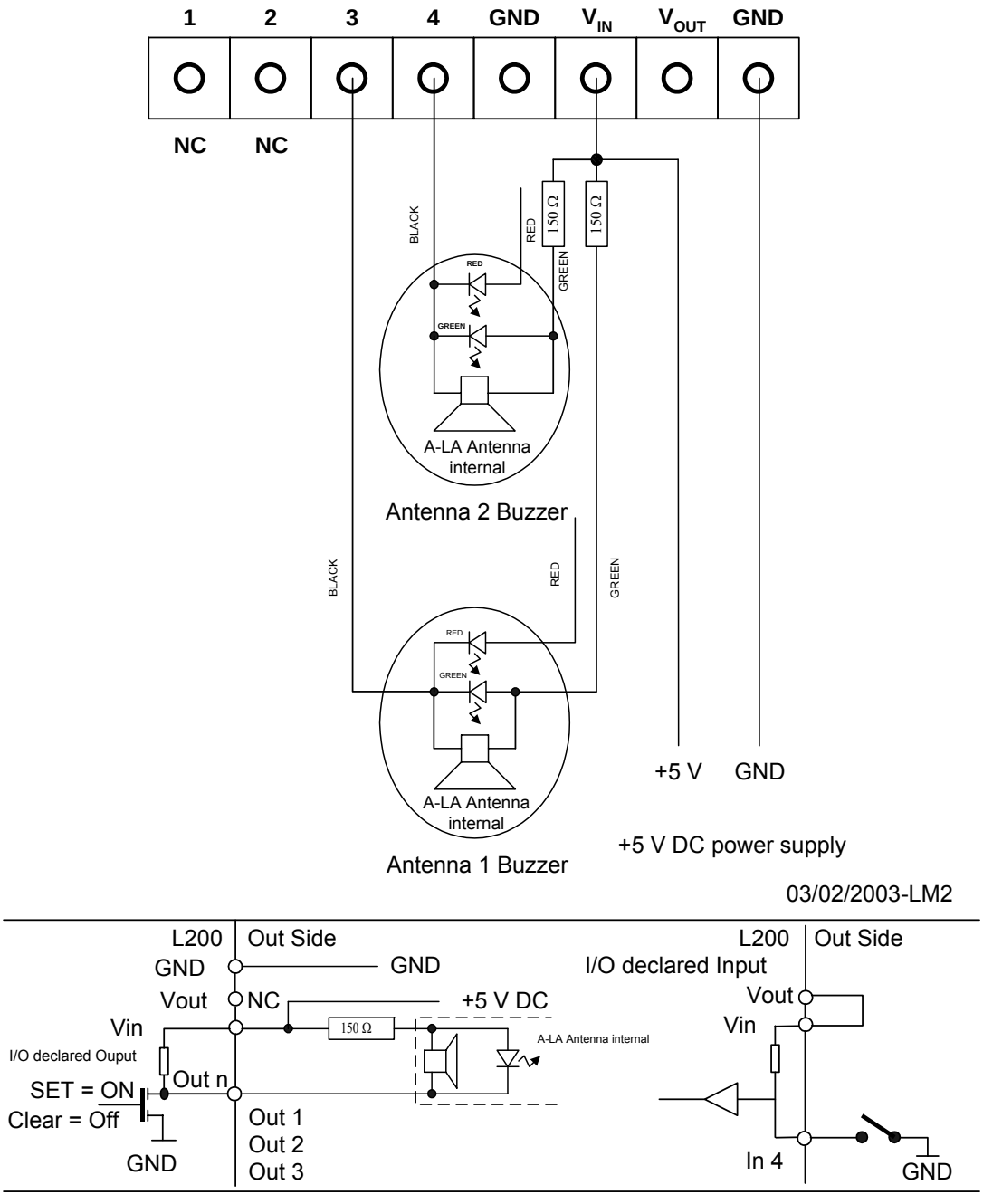
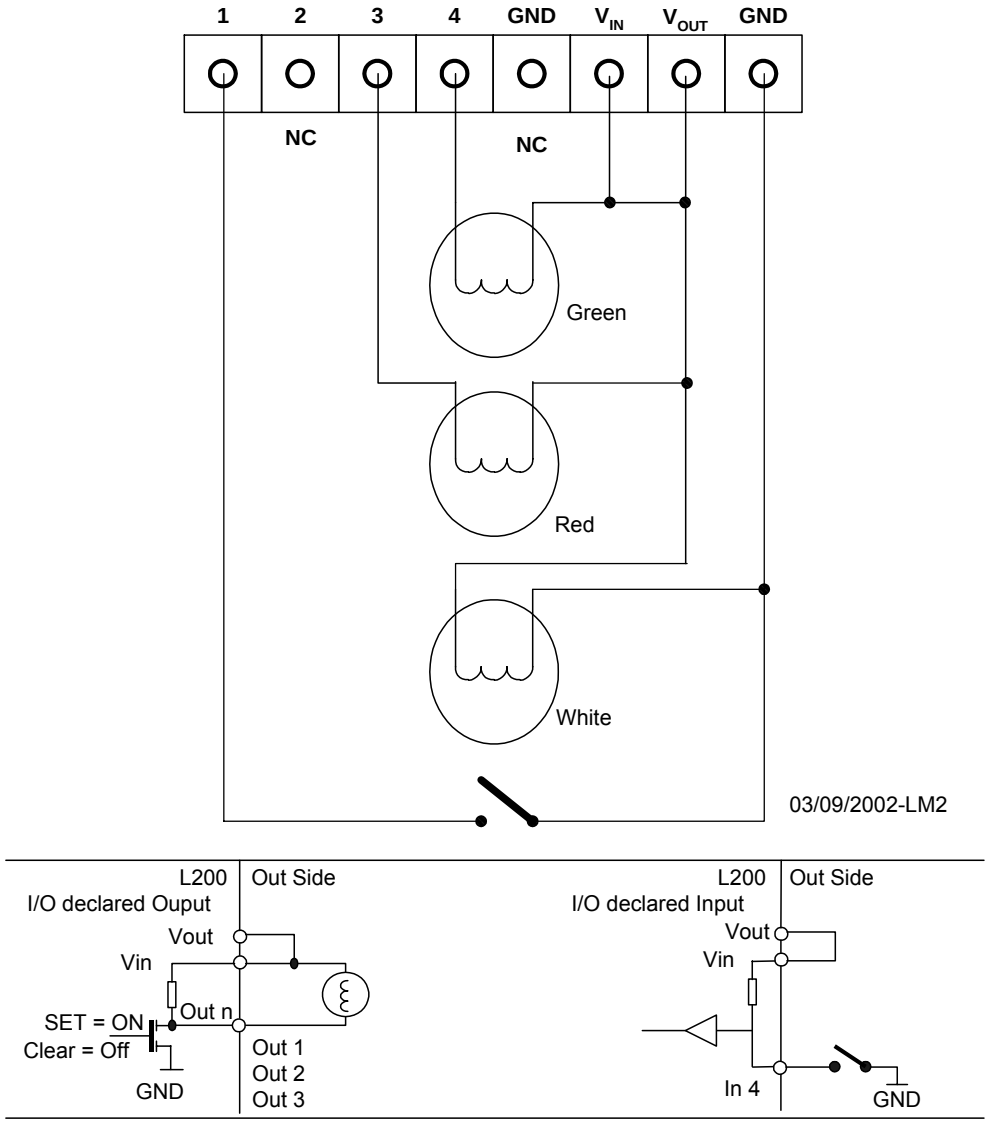


Figure 16: Universal 3-Lamp Setup



9 Calibration

The TR-L100 Reader features an innovative technology based on Digital Signal Processing (DSP) to optimize long-distance reading and writing performances.

In particular, the TR-L100 Reader is very efficient even in industrial and noisy environments.

Environmental conditions can vary significantly according to the application-specific factors such as antenna size, output power, machines close to the TR-L100 Reader antenna, etc. Such parameters can create noise around the RFID system.

9.1 Calibrating the Trigger Threshold Value

In order to optimize the performance of your RFID system, it is possible to calibrate the TR-L100 Reader. The calibration consists of selecting the best trigger threshold used to capture and decode a smart label signal. The trigger threshold value corresponds to the sensitivity of the TR-L100 Reader making it possible to differentiate a smart label signal from a noise signal.

If the trigger threshold value is too low, the TR-L100 Reader may start decoding a signal that actually is a noise signal. In this case, the decoding efficiency of the TR-L100 Reader may decrease.

If the trigger threshold value is too high, the TR-L100 Reader will not decode a low-magnitude smart label signal (because it treats it as an ambient noise signal). In this case, reading distance performance may decrease.

Ultimately, a compromise must be selected to find the best trigger threshold value.

The L200 Explorer application defines the optimized trigger threshold value. Please refer to the L200 Explorer User's Guide for further information.

Default trigger threshold values stored in the TR-L100 Reader upon delivery depend on the smart label type. These trigger values are optimized for Aero-LA, -LB, -LC and Conveyor Antennas at middle-range power.

The calibration process is only available for C210, C220 and C240 tag types.

CAUTION: C210 and C240 decoding algorithms have been modified to improve TR-L100 Reader performances. It is possible that trigger values optimized for TR-L100 Reader Firmware releases previous to version 3.0 must be changed when using version 3.0 or more recent.

10 How to Improve Performance

In certain cases when the TR-L100 Reader is installed in a highly metallic environment, its reading performance can be significantly reduced.

In this event, it is strongly recommended changing the location of the TR-L100 Reader.

10.1 Verification of TR-L100 Reader Performance

The L200 Explorer software tool is used to verify the reading performance of the TR-L100 Reader.

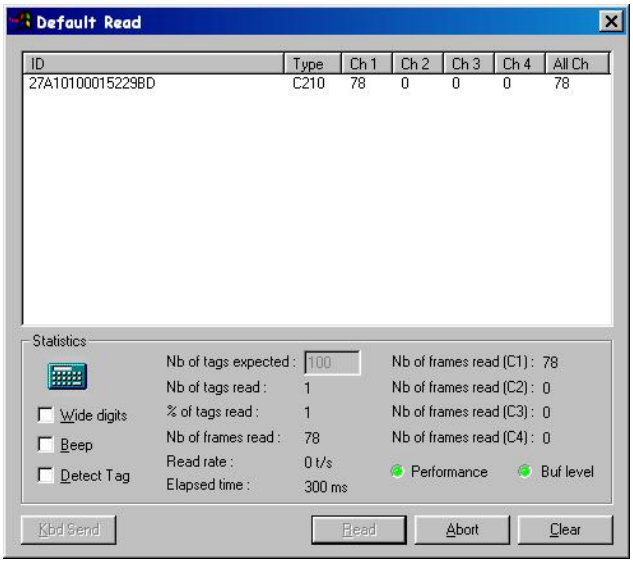
Procedure:

1. Install the L200 Explorer software tool on your PC. (Compatible with Windows® 9x, NT®, 2000 and XP operating systems.)
2. Connect the antenna to the TR-L100 Reader.
3. Connect the TR-L100 Reader to the parallel port of your PC and connect the power supply.
4. Run the L200 Explorer software tool.
5. In the Settings menu, select General Reader Settings and set the following parameters as listed below.
    a. Set the Output Power selection to 1 W (recommended).
    b. Select Open Channel Management Window and verify that the correct antenna channel is enabled.
    c. Select the Read Continuously button in the Default Read Parameters.
    d. Place a (Ario 10) smart label on the TR-L100 Reader antenna.
    e. Click Detect Tag Type.
    f. The 'C210 is now the default tag type' message is displayed.

Figure 17: General Reader Settings

6. In the Commands menu, select C210, open the Default Read dialog box and click Read.

Figure 18: Default Read Window



7. Using a ruler, measure the distance in which the antenna is able to read a C210 smart label. If this distance is less than 100 mm., you should verify the tuning of the antenna.

10.2 Antenna Tuning Procedure

The TR-L100 Reader antenna must be re-tuned only by an approved TAGSYS integrator or by a TAGSYS technical consultant. Any attempt by a non-qualified third-party to re-tune the antenna will void the product's warranty.

For detailed tuning procedures, refer to the TAGSYS Antenna Tuning Kit User's Guide.

When re-tuning the antenna, make sure that the TR-L100 Reader is not connected to the PC.

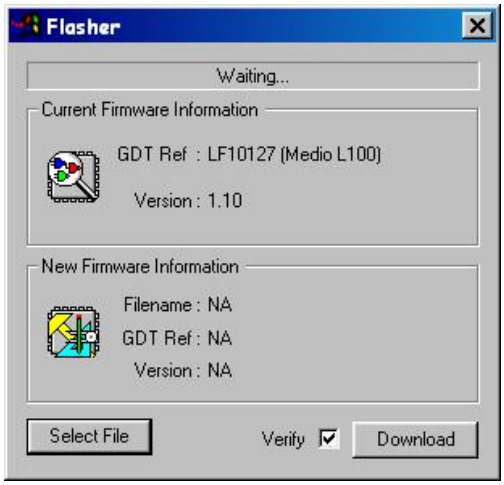
10.3 Upgrading the Firmware

The TR-L100 Reader has the capability to have firmware upgrades. This feature allows you to protect your investment by upgrading your TR-L100 Reader when an enhanced chip-decoding algorithm or new chip drivers become available.

Upgrading the Firmware of the TR-L100 Reader is a straightforward operation.

1. Install the L200 Explorer software tool on your PC. (Compatible with Windows® 9x, NT®, 2000 and XP operating systems.)
2. Connect the TR-L100 Reader to the serial port of your PC and to the power supply.
3. Run the L200 Explorer software tool.
4. In the File menu, select Upgrade Firmware.
    a. In the Flasher window, click Select File.
    b. Select the BIN file supplied with the firmware upgrade.
    c. Click Download.

Figure 19: Upgrade Firmware Window



5. The Download procedure may take several minutes. A progress bar is displayed at the bottom right-hand side of the L200 Explorer window.
6. If the new firmware has been successfully downloaded, a message is displayed. If the final dialog box at the end of the procedure contains an error message, reload the original firmware supplied with the TR-L100 Reader and contact your approved TAGSYS representative.
7. Click OK to reset the TR-L100 Reader.

Always use Firmware upgrades supplied by TAGSYS. If you have any doubt on the origin of the firmware you intend to download; contact your TAGSYS approved reseller. Any attempt to download a Firmware supplied by a third party may lead to permanent damages to the TR-L100 Reader.

Never interrupt the Firmware upgrade procedure while the firmware is being downloaded. This may lead to permanent damages to the TR-L100 Reader.

11 Debugging

11.1 Debugging Tools

The TR-L100 Reader features debugging tools to optimize your RFID system installation and communication with the tags.

Debugging tools can only be accessed with the L200 Explorer Software and consist of:

- A real-time oscilloscope to display the antenna signals received by the TR-L100 Reader,
- A real-time frequency analyzer to display the frequency information of the antenna signal,
- Certain statistic information about the quality of your RFID System environment.

Please refer to “Medio L200 Explorer User’s Guide” for further information about debugging tools.

12 Technical Specifications

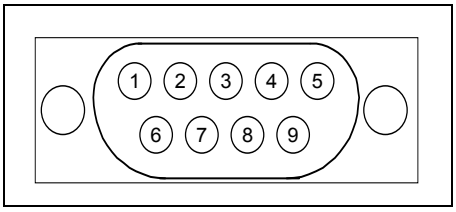
12.1 Technical Specifications

Table 4: Technical Specifications

Parameter	Value
Size (L x W x H)	310 x 260 x 80 mm. (12.2 x 10.2 x 3.1 in.)
Weight	4.5 kg. (10 lbs.)
Power Supply	85 to 265 V AC / 50/60 Hz
Chip compatibility	TAGSYS C220 (Firmware upgrade required for other chips)
Communication Speed	Serial: Up to 38.4 Kbps Parallel: Up to 200 Kbps
Communication Interface	Serial: RS-232, RS-485 and RS-422 Parallel: Bi-directional and Enhanced
RF Output Power	Up to 4 W with multiplex capability and balanced 0° / 90° / 180° operation
Power Consumption	Up to 40 W
Operating temperature	0 °C / +55 °C (+32 °F / +131 °F)
Storage temperature	-20 °C / +70 °C (-4 °F / 158 °F)
Mechanical Interface	Rubber pads (Desktop) or metal mounting plate (with screws for vertical installation)
Conformity	CE, UL EN 300-330, ETS 300-683 European Radio FCC Part 15 (for typical configurations)
Reading/Writing Distance	Up to 120 cm (47¼ inches) in a gated antenna configuration
Antenna Compatibility	50-Ohm antenna
Application Software	512 KB of Flash memory
Inputs/Outputs	4 I/O ports independently configurable

12.2 Serial Port Pin Assignment

Figure 20: RS-232 Serial Link Connector Diagram



Connector	Description	Connector	Description
1	NC	6	TRx+ RS485/ Rx+ RS422
2	Rx RS232 / TRx- RS485 / Rx- RS422	7	NC
3	Tx RS232 / TRx- RS485 / Tx- RS422	8	NC
4	NC	9	TRx+ RS485/ Tx+ RS422
5	NC		

13 Electrical Characteristics

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

13.1 Absolute Maximum Ratings

Parameter	Value
Ambient Operating Temperature	0 °C to 55 °C (32 °F to 131 °F)
Storage Temperature	–20 °C to 70 °C (–4 °F to 158 °F)
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
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

13.2 Standards Compliance

The TR-L100 Reader is compliant with the following standards:

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

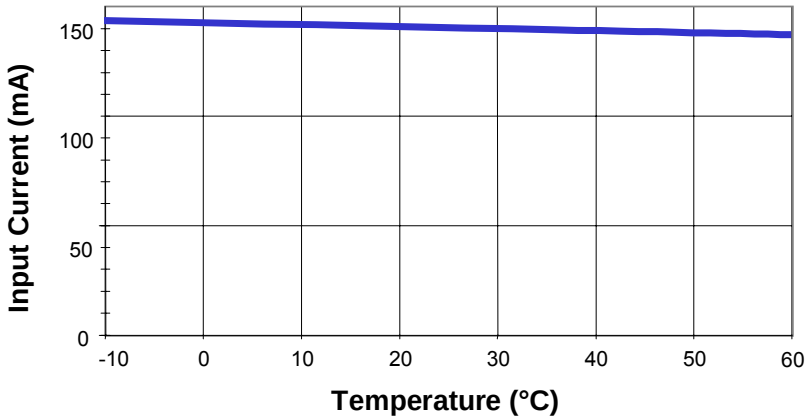
The TR-L100 Reader is also compliant with FCC Section 15 regulations.

13.3 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 21: Input Current vs. Temperature (V_{cc} Pin at 5 V – RF On - No I/O Connected)



13.4 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	µA	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	

13.5 Antenna Electrical and Timing Characteristics

Parameters	Conditions	Min.	Typ.	Max.	Unit	Comments
ANT output power			4		W	
ANT output impedance			(50, 0)		(Ω, °)	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 22: Output Power vs. Temperature (V_{cc} Pin at 5 V – RF On - No I/O Connected)

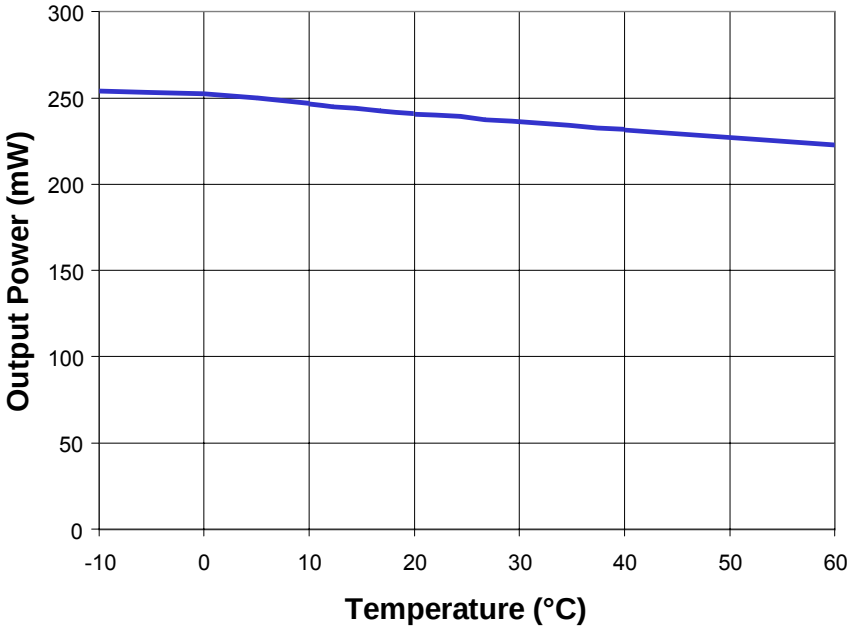
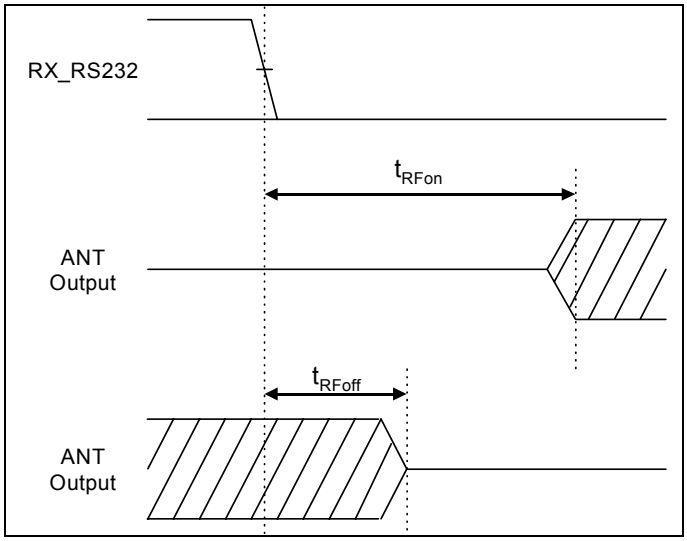


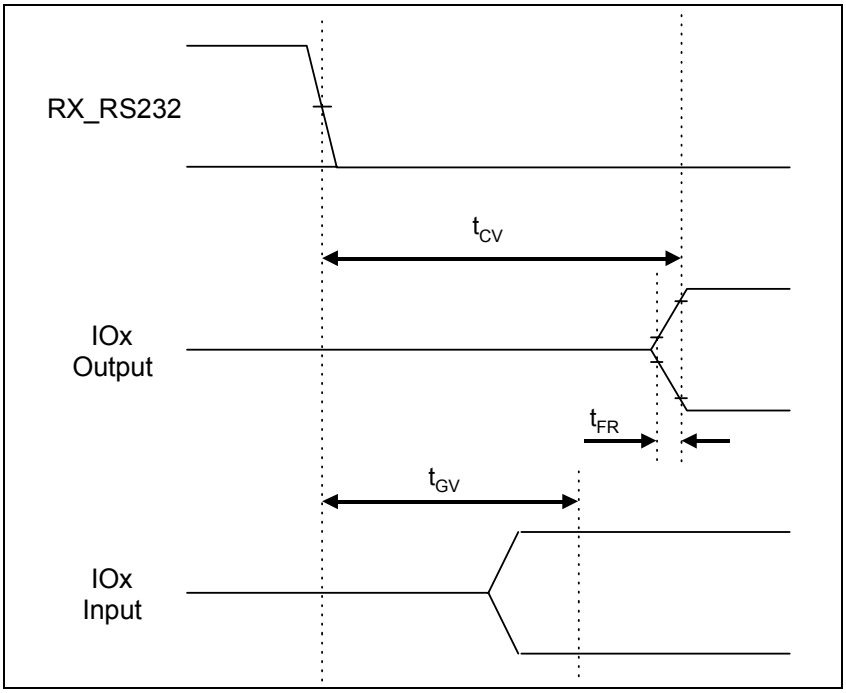
Figure 23: Antenna RF Switch Time



13.6 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					V	
I/Ox output voltage high					V	
I/Ox output current					mA	Sunk or sourced
I/Ox output capacitance					pF	
tCV (time to change value)	End of reception on RX to I/Ox level changed		35	40	µs	
tGV (time to get value)	End of reception on RX to I/Ox level read		33	38	µs	
tFR (time to fall or rise)	Fall/rise time		10	25	ns	

Figure 24: I/O DC Characteristics and Timing



14 Warranty Conditions

14.1 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.

14.2 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.

14.2.1 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.

14.2.2 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@tagsysrfid.com

Address to ship the product with this document attached:

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

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.
+33 491-275-736

Appendix A: Pattern Examples

Enabling one Antenna after Another

This is the most common example of a tag-reading pattern and requires the use of two patterns. The first one enables only Antenna 1, while the second enables only Antenna 2.

In Pattern 1, Antenna 1 is enabled and then the detected tags are read. Afterwards in Pattern 2, Antenna 1 is disabled, Antenna 2 is enabled and then the detected tags are read.

Channel	1	2	Phase Shift
Pattern 1	Enabled	Disabled	Disabled
Pattern 2	Disabled	Enabled	Disabled

The advantage of this configuration is that the two antennas are not enabled at the same time, reducing interference.

Enabling both Antennas Simultaneously

This configuration is implemented with only one pattern that enables Antennas 1 and 2 at the same time. This configuration is best used for detecting smart labels in 3-dimensional rotating field applications.

In this case, a phase shift should be applied to one of the antennas in order to create a 3-D RF field.

Both Antennas 1 and 2 are enabled and the tags detected by Antenna 1 are read and then the tags detected by Antenna 2 are read. (Only one channel can be read at a single time.)

Channel	1	2	Phase Shift
Pattern 1	Enabled	Enabled	Enabled

Enabling each Antenna Separately and then both at once

Depending on the application requirements, in this configuration each antenna can be enabled separately and then both at once.

In order to implement this configuration, three patterns are necessary. The first one enables only Antenna 1, the second enables only Antenna 2 and the third enables both Antennas 1 and 2.

Channel	1	2	Phase Shift
Pattern 1	Enabled	Disabled	Disabled
Pattern 2	Disabled	Enabled	Disabled
Pattern 3	Enabled	Enabled	Enabled

In this example, the scanning parameters must be carefully selected. As both the Scan Number and Scan Duration parameters are the same for all three patterns, if the Scan Number is set to 1, Antenna 2 in Pattern 3 will not be read.

If the Scan Duration is set to 100 ms. and the Scan Number is set to 2, the tags detected by Antenna 1 will be read twice (for 100 ms. each time) in Pattern 1, then the tags detected by Antenna 2 will be read twice (for 100 ms. each time) in Pattern 2. In Pattern 3, the tags detected by Antenna 1 will be read once for 100 ms. and then the tags detected by Antenna 2 will be read once for 100 ms.

In the event that the Scan Number parameter is set to 3, the tags detected by Antennas 1 and 2 are read three times in Patterns 1 and 2, respectively. In Pattern 3, the tags detected by Antenna 1 are read once, then the tags detected by Antenna 2 are read once, and then the tags detected by Antenna 1 are read a second time.

Each pattern will be executed for the same amount of time regardless of the number of antennas selected in the pattern.
This duration is equal to the Scan Number x Scan Duration.