TEXAS INSTRUMENTS

HF Reader System Series 6000

S6550 Long Range Reader (Housed)
RI-STU-655A

Reference Guide

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This is the first edition of this manual. It describes the following equipment:

S6550 Long Range Reader (Housed) RI-STU-655A

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About This Manual

This reference guide for the S6550 Long Range Reader (Housed) is designed for use by TI partners who are engineers experienced with Radio Frequency Identification Devices (RFID).

Regulatory, safety and warranty notices that must be followed are given in Chapter 5.

Conventions

WARNING:

A WARNING IS USED WHERE CARE MUST BE TAKEN, OR A CERTAIN PROCEDURE MUST BE FOLLOWED IN ORDER TO PREVENT INJURY OR HARM TO YOUR HEALTH.

CAUTION:

This indicates information on conditions which must be met, or a procedure which must be followed, which if not heeded could cause permanent damage to the equipment or software.

Note:

Indicates conditions which must be met, or procedures which must be followed, to ensure proper functioning of the equipment or software.

Information:

Indicates information which makes usage of the equipment or software easier

If You Need Assistance

For more information, please contact the sales office or distributor nearest you. This contact information can be found on our web site at:

http://www.ti-rfid.com

Document Overview

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CHAPTER 1

Introduction

This chapter introduces you to the S6550 Long Range Reader (Housed).

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1.1 General

This document provides information about the S6550 Long Range Reader (Housed). It describes the reader and how to install it.

1.2 System Description

The HF Reader System Series 6000 works at a frequency of 13.56 MHz. It comprises a reader, antenna and transponder (for example: smart label) and is used for wireless identification.

The system works according the "reader talks first" principle which means that the transponder keeps quiet until the reader sends a request to it. The reader can rapidly and simultaneously identify numerous transponders in the antenna's field. It can write data to and read data from the transponders; either in addressed mode by using the factory programmed read only number, or in general mode to all of the transponders in its field. The read/write capability of the transponder allows users to update the data stored in the transponders memory anywhere along its movements.

1.3 Product Description

The S6550 Long Range Reader (Housed) handles all RF and digital functions required in order to communicate with Tag-it HF, Tag-it HF-I (ISO 15693 compliant) and all other ISO 15693 compliant transponders from various suppliers.

The Reader Module is encased in a powder coated sheet steel box (IP54 protection level). This means that the housed reader can be mounted either inside or outside. The reader has two digital inputs, two digital outputs, a relay output and an asynchronous interface which can be configured as RS232 or RS485.

The configurability of the interfaces also allows the reader to be operated on an RS485 data bus. The address can be assigned either through software or hardware (3 DIP switches).

1.4 Communications Protocols

The Host protocol is suitable for communication between a controlling device (for example a PC) and one or more readers.

For details regarding the Host protocol, please refer to the relevant SW manual (document number: 11-06-21-064) available at the document center on the TI-RFID homepage: **http://www.ti-rfid.com**

1.5 Delivery

When delivered the RI-STU-655A includes the following items:

Quantity	Item	Where Used
1	Reader	
2	EMC ring core 41mm (Diameter) x 15 mm	1 for the RS232 line 1 for the Power supply line
2	EMC ring core 28mm (Diameter) x 20 mm	for the Antenna lines
2	2 x Duo wire end ferrule (2 x 1,5 mm², blue)	for the Power Supply lines
2	2 x Duo wire end ferrule (2 x 2,5 mm², black)	for the Power Supply lines
6	Jumpers	
1	Key	to open and close the housing

Figure 1: S6550 Long Range Reader (Housed) (RI-STU-655A)

CHAPTER 2

Reader Hardware

This chapter describes the hardware of the S6550 Long Range Reader (Housed). It describes the reader's functionality and its interfaces.

Topic **Page**

2.1 General

This chapter provides a description of the S6550 Long Range Reader (Housed) hardware. It also provides the electrical specifications of the inputs and outputs.

2.2 Mechanical Information

The reader housing contains the reader electronics boards (an upper and a lower board) and a mains power supply unit. The reader and its connection cable glands is shown in Figure 2, the cable connections are described in section 2.3 and Table 1. Figure 3 shows the location of the connectors and jumpers on the power supply and the printed circuit boards.

Figure 2: Top View of Reader Showing Cable Glands

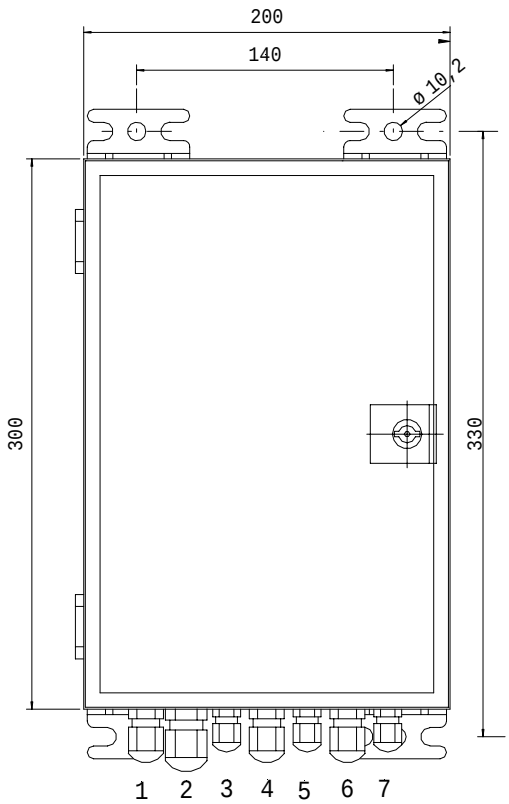
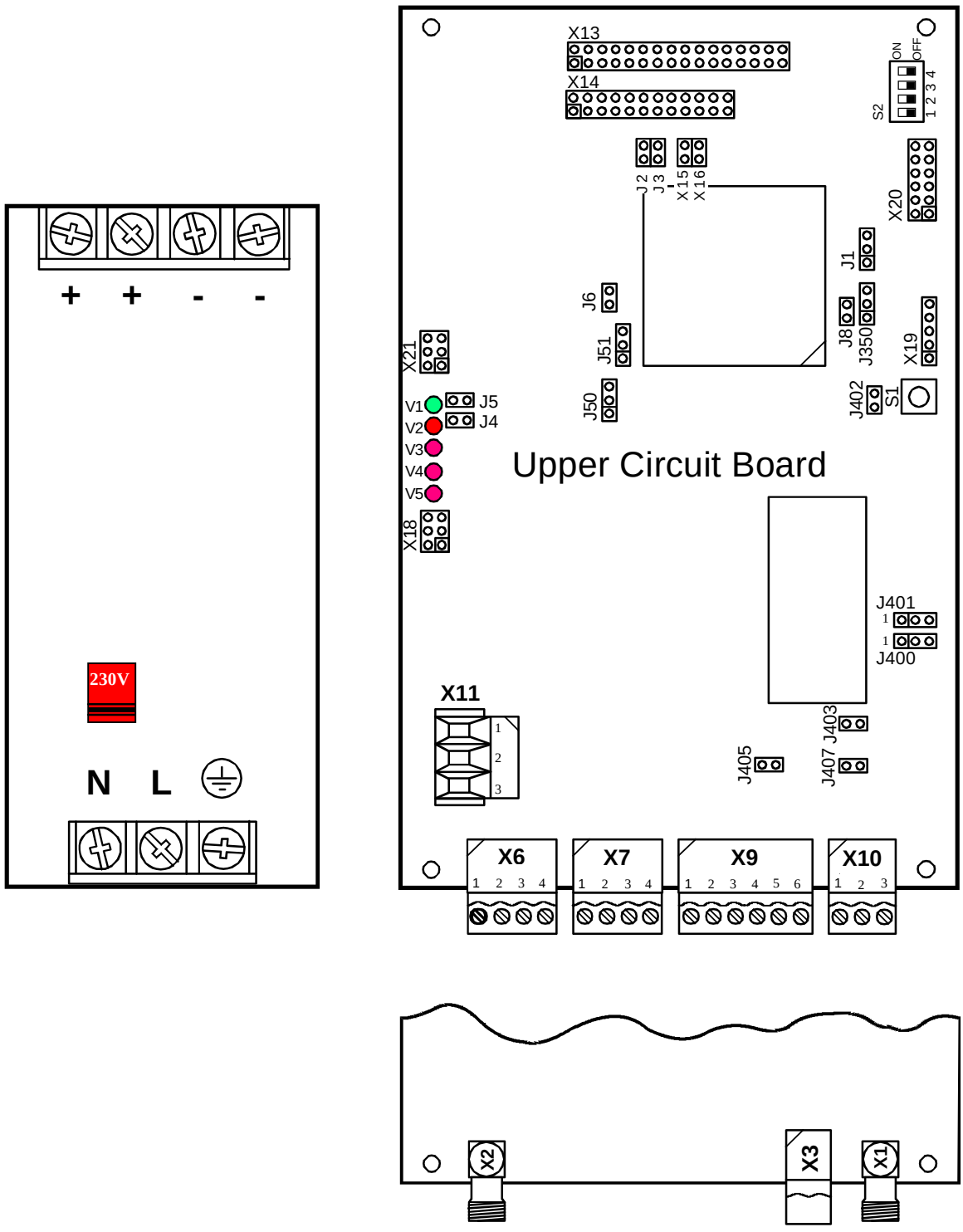


Table 1: List of Cable Entries

Cable Gland Number	Size	Cable Diameter (mm)	Function
1	M 16	4.5 - 10	Power Supply
2	M 20	7 - 13	Relay
3	M 12	3.5 - 7	Outputs
4	M 16	4.5 - 10	Tx/RX Antenna Connection Cable
5	M 12	3.5 - 7	Inputs
6	M 16	4.5 - 10	RX Only Antenna Connection Cable
7	M 12	3.5 - 7	Interface (RS232/RS485)

Figure 3: Top View of Power Unit, Upper and (part of) Lower pcb



2.3 Connectors

Three connectors are located on the lower pcb and 5 connectors are on the upper pcb. The connectors are all shown on Figure 3. Table 2 provides an overview of all the connectors and lists the section that describes them.

Table 2: List of Connectors

Identifying Letter	Function	Section
X1	Rx Only Antenna Connection	2.3.1
X2	Tx/Rx Antenna Connection	2.3.1
	Voltage Supply	2.3.2
X6	Isolated Optocoupler Outputs	2.3.4
X7	Isolated Optocoupler Inputs	2.3.3
X9	RS485 Interface	2.3.6
X10	RS232 Interface	2.3.7
X11	Relay Outputs	2.3.5

2.3.1 Antenna Connectors

There are two antenna connectors on the reader. They are listed in Table 3.

Table 3: Antenna Connectors

Pin	Signal	Description
X1	ANT	Receive Only Antenna
X2	ANT	Transmit/Receive Antenna

Table 4: Antenna - Specifications

Parameter	Minimum	Maximum
Antenna Q-factor	10	30
Antenna Impedance	$50\ \Omega \pm (3\ \Omega \angle 3^{o})$	
Tightening Torque	-	0.45 Nm

2.3.2 Supply Connector

The mains supply voltage is connected to connectors L and N on the power supply unit. The reader is supplied switched to 230 Vac 50 Hz supply, there is a slide-switch on the power supply unit allowing you to change this to 110 Vac 60 Hz supply if required.

Table 5: Supply Connector

Pin	Name	Description
L N	Line Neutral	Mains supply
	GND	Protection Ground

Table 6: Supply Connector - 230 V Specifications

Parameter	Minimum	Maximum
Mains Power Supply	195.5 Vac	264.5 Vac
Mains Power Supply Frequency	47 Hz	53 Hz

Table 7: Supply Connector - 110 V Specifications

Parameter	Minimum	Maximum
Mains Power Supply	93.5 Vac	126.5 Vac
Mains Power Supply Frequency	57 Hz	63 Hz

2.3.3 Isolated Optocoupler Inputs (X7)

The optocoupler inputs on Terminal X7 are galvanically isolated from the reader electronics and must therefore be powered by a separate external DC supply. For supply voltages above 10 V, the input current must be limited to a maximum of 20 mA by an additional external dropping resistor (see section 3.4.3).

Table 8: Optocoupler Inputs Connector

Pin	Name	Description
1	IN1+	+ Input 1
2	IN1-	- Input 1
3	IN2+	+ Input 2
4	IN2-	- Input 2

Table 9: Optocoupler Inputs Connector - Specifications

Parameter	Minimum	Maximum
External Supply Voltage	5 VDC	24 VDC
External Supply Current	-	20 mA

2.3.4 Isolated Optocoupler Outputs (X6)

The transistor connections, collector and emitter, of the two optocoupler outputs are galvanically isolated from the reader electronics and brought out on connector X6 without any additional circuitry. The outputs must therefore be externally supplied.

The outputs are designed to switch resistive loads only.

Table 10: Optocoupler Outputs Connector

Pin	Name	Description
1	O1-C	Collector - Output 1
2	O1-E	Emitter - Output 1
3	O2-C	Collector - Output 2
4	O2-E	Emitter - Output 2

Table 11: Optocoupler Outputs Connector - Specifications

Parameter	Minimum	Maximum
External Supply Voltage	-	24 VDC
External Supply Current	-	30 mA

2.3.5 Relay Outputs (X11)

Two relay change-over contacts are provided on connector X11. They are designed to switch resistive loads only, if you are using an inductive load, the relay contacts must be protected by means of an external protection circuit.

Table 12: Relay Outputs Connector

Pin	Name	Description
1	COM	Working contact
2	NC	Normally closed contact
3	NO	Normally open contact

Table 13: Relay Outputs Connector - Specifications

Parameter	Minimum	Maximum
External Supply Voltage	-	24 VDC
External Supply Current	-	2 A

2.3.6 RS485 Interface (X9)

Depending on the configuration, the reader will communicate either via the RS232 or RS485 interface (see Section 3.5).

The RS485 interface is connected to X9.

The transmission parameters can be software configured.

Table 14: RS485 Interface Connector

Pin	Name	Description	Direction
1	Rx+/Tx+	RS485 Non-inverted data	Input/Output
2	Rx-/Tx-	RS485 Inverted data	Input/Output
3	GND	Signal ground	-
4	-	n.c.	
5	-	n.c.	
6	-	n.c.	

All interface parameters are according to RS485 specifications and are not given in detail in this manual.

2.3.7 RS232 Interface (X10)

Depending on the configuration, the reader will communicate either via the RS232 or RS485 interface (see Section 3.5).

The RS232 interface is connected to X10.

The transmission parameters can be software configured.

Table 15: RS232 Interface Connector

Pin	Name	Description	Direction
1	GND	Signal ground	-
2	RxD	Receive data	Input
3	TxD	Transmit data	Output

All interface parameters are according to RS232 specifications and are not given in detail in this manual.

2.4 LEDs

There are five (one green and four red) LEDs on the reader. Their location is shown in Figure 3 and their function is described in Table 16.

Table 16: Description of LEDs

Name	Description
LED V1 (green)	"RUN-LED" - If all checks are OK this LED comes on (flashes) when V5 goes out. It indicates that the reader's internal software is running properly. - Flashing rate approximately 1 Hz. - After a firmware change this LED flashes alternately with V2 until a second reset is performed.
LED V2 (red)	Diagnostic 1: RF communication / EEPROM status - Short flashing indicates error-free communication with a transponder on the RF interface. - After a firmware change this LED flashes alternately with V1 until a second reset is performed. - Flashes alternating with V1 in case a data error while reading the parameters occurred following a Reset.
LED V3 (red)	Diagnostic 2: Host communication - Short flashing indicates a protocol is being sent to the host on the RS232/RS485 interface.
LED V4 (red)	Diagnostic 3: Reserved
LED V5 (red)	Diagnostic 4: Reader initialization / RF error - Comes on during Reader initialization after power-up or after a reset, and goes out if everything is OK. - Comes on to indicate an error in the RF section of the Reader. The error type can be read out via software on the RS232/ RS485 interface. - After a firmware change this LED comes on for about 3 seconds before V1 and V2 flash alternately.

2.5 Switches

There are two switches on the reader. Their location is shown in Figure 3 and their function is described in Table 17.

Table 17: Description of Switches

Name	Description
S1	Reset button
S2	1 - Setting data bus addresses (0 ... 7) 2 - Setting data bus addresses (0 ... 7) 3 - Setting data bus addresses (0 ... 7) 4 - not used

Note:

In order to set the bus address using S2, the reader must be set to software address “0" (default factory setting).

CHAPTER 3

Installation

This chapter provides you with the information that you need in order to install the reader.

Topic Page

3.1 Introduction

Note:

Always ensure that the reader is switched off when making or breaking connections to it.

3.2 General

The S6550 Housed Reader has been designed with easy installation in mind. The following information provides you with any details that you will need to know.

3.2.1 Default Configuration

The S6550 Reader is delivered with the default configuration as follows:

- Communication Interface: 38400 Baud, 8 data bits, 1 stop bit, even parity
- Antenna Connection: Only TX/RX Antenna active
- Anticollision procedure: active
- Supported Transponder Types: Tag-it HF, Tag-it HF-I (and other ISO 15693 compliant transponders)

Note:

If you are only using one transponder Type in the application, the reaction time of the reader for transponder read/write operations can be optimized as long as only one transponder driver (not both of them) is activated.

However, if your system requires that you use the reader with a different configuration, you can use the S6 Reader Utility program which is available at our internet site http://www.ti-rfid.com (S/W Tools & Download) to re-configure the reader to your system's requirements.

3.3 Mechanical Mounting

Mounting is accomplished using the mounting brackets fitted at the two ends of the reader housing (see Figure 2). If required you can loosen the securing bolts on the mounting brackets and move the brackets round to the sides of the housing if the location requires this.

Mount the reader so that there is at least 4 cm between the wall and the reader; and at least 10 cm free space around the reader to ensure free air circulation for an optimal heat distribution.

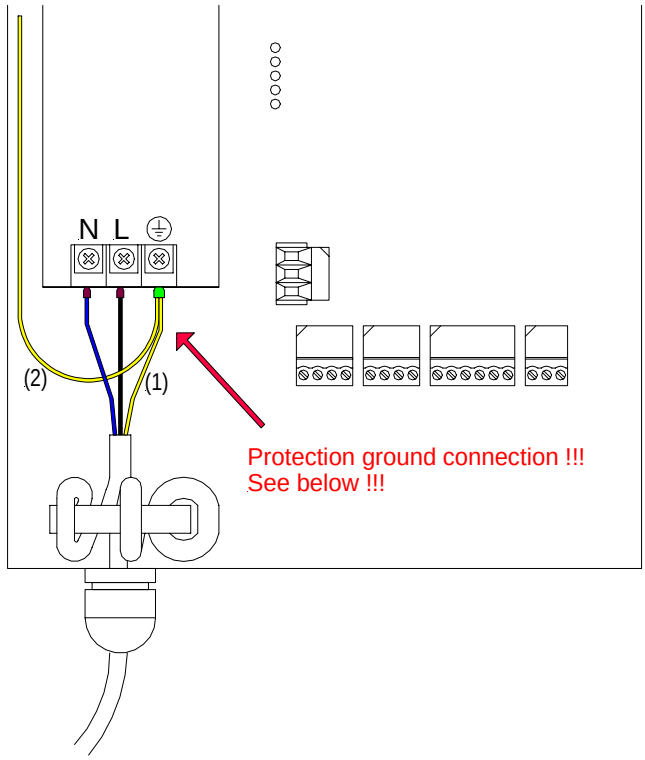
3.4 Connectors

The connectors are all on the printed circuit boards inside the housing. You must feed the connecting cables thru the relevant cable gland (see Table 1), make the connection to the correct connector and then tighten the nut on the cable gland to "lock" the cable into place.

3.4.1 Mains Power Supply

The mains power supply voltage is connected to connectors N (neutral) and L (line) on the power supply unit.

Figure 4: Mains Power Connected



Notes:

1. In order to form the **protection ground connection** the corresponding green/yellow lead on the feed line (1) must be crimped together with the pre-assembled green/yellow line (2) in one of the supplied duo wire end ferrules. The connection is then made at the corresponding protection ground terminal of the power supply.
2. In order to conform to national requirements for radio devices, the mains power line must incorporate one of the ∅ 41 mm x 15 mm ring cores mentioned in section 1.5. The cable must be wound around the core at least six times (see Figure 4). The distance between the ring core and the reader connection must not be more than 10 cm.

3.4.2 Antenna Connectors (X1 & X2)

The transmit/receive antenna must be connected to the reader via the antenna SMA socket (X2). The maximum tightening torque for the SMA socket is 0.45 Nm.

If you are using a receive only antenna (together with the read write antenna) it must be connected to the reader via the antenna SMA socket (X1). The maximum tightening torque for the SMA socket is 0.45 Nm.

Notes:

1. In order to conform to national requirements for radio devices, each antenna line must incorporate one of the ∅ 28 mm x 20 mm ring cores mentioned in section 1.5. The cable must be wound around the core at least four times (as shown in Figure 5). The distance between the ring core and the reader connection must not be more than 10 cm.
2. When connecting an antenna, ensure that it does not exceed the permissible limits as prescribed by the national regulations for radio frequency devices.

Figure 5: Antenna Line on a Ring Core

3.4.3 Isolated Optocouplers Input Connector

The input LED's on the optocouplers have an internal input series resistor of 500 Ω. For supply voltages above 10V the input current must be limited to a maximum of 20 mA by an additional external dropping resistor (see Figure 6 and Table 18).

CAUTION:

Reversing the polarity or overloading the inputs will destroy the reader.

Notes:

1. If the connecting cable is longer than 3 m you must use a shielded cable.
2. You must NOT use the reader's supply voltage to drive these inputs as the added noise may reduce the effective reading range.

Figure 6: Optocoupler Input - Internal and External Wiring

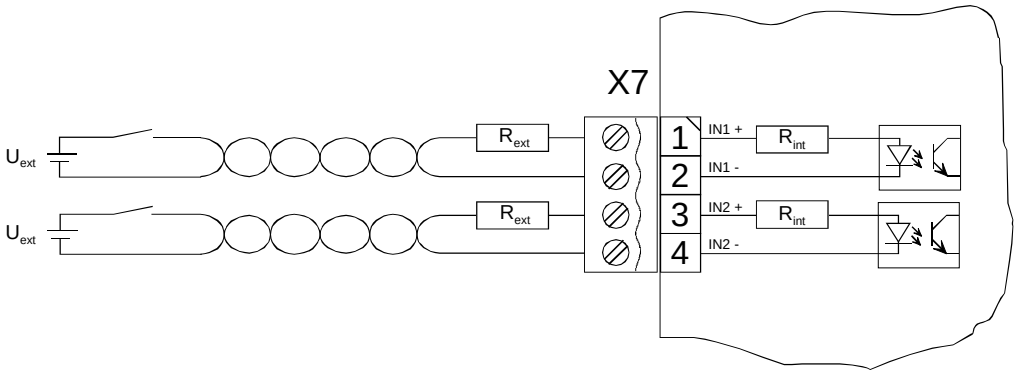


Table 18: Required External Dropping Resistor

External voltage V_{ext}	Required External Dropping Resistor R_{ext}
5 V ... 10 V	---
11 V ... 15 V	270 Ω
16 V ... 20 V	560 Ω
21 V ... 24 V	820 Ω

3.4.4 Isolated Optocoupler Outputs Connector

The transistor connections, collector and emitter, of the two optocoupler outputs are galvanically isolated from the reader electronics and brought out on connector X6 without any additional circuitry. The outputs must therefore be powered by external supplies.

The outputs are designed to switch resistive loads only.

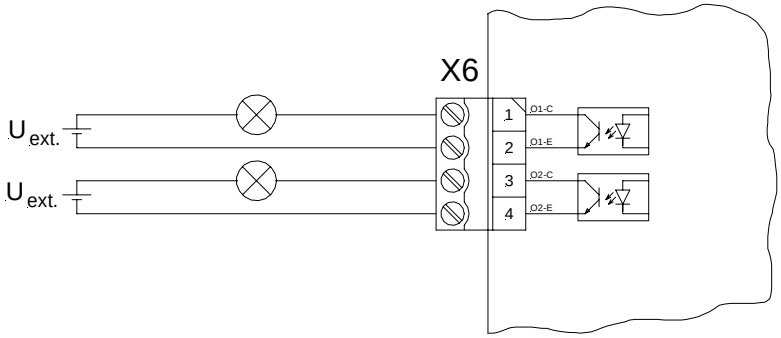
Note:

If the connecting cable is longer than 3 m you must use shielded cable.

CAUTION:

Reversing the power supply wires may destroy the device.

Figure 7: Optocoupler Outputs

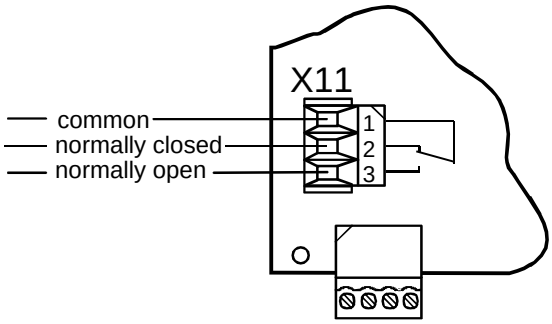


3.4.5 Relay Connector

CAUTIONS:

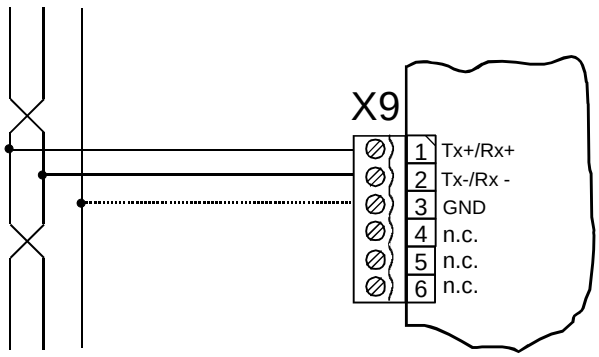
The two relay change-over contacts are designed to switch resistive loads only. If you are using an inductive load, the relay contacts must be protected by means of an external protection circuit.

Figure 8: Relay Connector



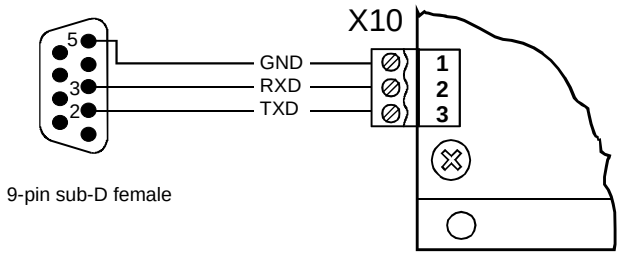
3.4.6 RS485 Connection

Figure 9: RS485 Interface



3.4.7 RS232 Connection

Figure 10: RS232 Interface



Note:

In order to conform to national requirements for radio devices, the interface connector line must incorporate one of the ∅ 41 mm x 15 mm ring cores mentioned in section 1.5. The cable must be wound around the core at least eight times as shown in Figure 11.
The distance between the ring core and the reader connection must not be more than 10 cm.

Figure 11: RS232 Interface Line on a Ring Core

3.5 Interface Configuration Jumper Settings

There are five jumpers used on the reader. They are Jumpers J400 - J401 which are used to configure the asynchronous interface for RS232 or RS485 described in Table 19, and Jumpers J403, J405 and J407 are used to insert the termination resistors which may be required for the RS485 interface, described in Table 20 and shown in Figure 14.

Table 19: Jumper Setting - J400 and J401

Jumper	RS232	RS485
400	1 - 2 connected (default)	2 - 3 connected
401	1 - 2 connected (default)	2 - 3 connected

Figure 12: Jumper Settings for RS232

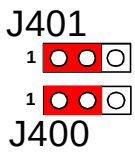


Figure 13: Jumper Settings for RS485

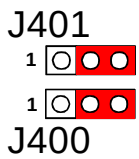
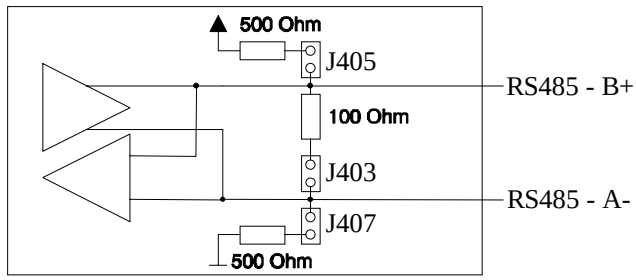


Table 20: Jumper Setting - J403, J405 and J407

Jumper	In	Out
403	Termination resistor between RS485 - A and RS485 - B	No termination resistor between RS485 - A and RS485 - B
405	Pull-Up on RS485 - B	No Pull-Up on RS485 - B
407	Pull-Down on RS485 - A	No Pull-Down on RS485 - A

Figure 14: Jumper Settings for RS485 Line Termination



3.6 Setting Bus Addresses

If you are going to use the reader connected to a bus you will have to give each reader an individual address. You can do that either by setting switch S2 on the reader or by software from the controlling computer.

3.6.1 Using S2 to Set the Address

You can use switch S2 to set the reader address between “0" and “7".

To set the bus address using S2, the Reader must be set to software address “0" (factory setting).

Address	S2-1	S2-2	S2-3
0	OFF	OFF	OFF
1	OFF	OFF	**ON**
2	OFF	**ON**	OFF
3	OFF	**ON**	**ON**
4	**ON**	OFF	OFF
5	**ON**	OFF	**ON**
6	**ON**	**ON**	OFF
7	**ON**	**ON**	**ON**

Note:

When you are using the readers in a multi-drop configuration you must power the readers up one-by-one, giving each reader its unique address before progressing to the next reader.

3.6.2 Setting the Reader’s Bus Address through Software

Addresses “0” to 253” can be set by the host computer software, using the S6 Reader Utility program.

CHAPTER 4

Technical Data

This chapter provides the technical specifications of the S6550 Housed Reader. It also provides information about packing and storage.

Topic **Page**

4.1 Specification Summary

Table 21: Mechanical Data

Housing	Powder Coated Sheet Steel Lock-up Lid
Dimensions	200 x 300 x 160 mm
Weight	5.5 kg
Protective Level	IP 54
Color	RAL 7032

Table 22: Ambient Conditions

Operating Temperature	-20°C to +55°C
Storage Temperature	-25°C to +70°C
Vibration	According to EN60068-2-6, 10 Hz to 200 Hz: 0.075 mm / 1 g
Shock	According to EN60068-2-27, acceleration 30 g

Table 23: Electrical Data

Supply Voltage	230/110 Vac (47 - 63 Hz) ± 15%
Power Consumption	maximum 60 W
Operating Frequency	13.56 MHz ± 7 kHz
Transmitter Power	0.5 to 10 W* (set by software in steps of 0.25W)
Transmitter Modulation	(10% to 30%) ± 6% and 100% (adjustable by software)
Antenna Connection **- Tx/Rx Antenna** **- Rx Only Antenna**	 1 x SMA socket (50 Ω) 1 x SMA socket (50 Ω)
Optocoupler Outputs	24 Vdc / 30 mA (galvanically isolated)
Relay (1 x change-over) Outputs	24 Vdc / 2 A
Optocoupler Inputs	maximum 24 Vdc/ 20 mA
Interfaces	RS232 or RS485 (internally selectable)
Memory	EEPROM 1 kByte (for parameters; up to 10,000 write cycles) RAM 256 kByte (for data) Flash 512 kByte (for firmware; update via communication interface)

CHAPTER 5

Regulatory, Safety and Warranty Notices

This chapter provides important information about regulatory constraints and safety precautions.

Topic **Page**

5.1 Regulatory Notes

An RFID system comprises an RF transmission device, and is therefore subject to national and international regulations.

Prior to operating the S6550 Long Range Reader (Housed) together with antenna(s), the required FCC, PTT or relevant government agency approval must be obtained. Sale, lease or operation in some countries may be subject to prior approval by the government or other organization.

5.1.1 FCC Notices (U.S.A.)

A typical system configuration containing the S6550 Long Range Reader (Housed) has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. It is the responsibility of the system integrators to get their complete system tested and to obtain approvals from the appropriate local authorities before operating or selling this system.

5.1.2 CE Conformity (Europe)

A CE Declaration of Conformity is available for the S6550 Long Range Reader (Housed) at TI*RFID Sales Offices.

Any device or system incorporating the S6550 Long Range Reader (Housed) in any configuration other than the originally tested configuration needs to be verified against the European EMC directive. A separate Declaration of Conformity must be issued by the System Integrator or user of such a system prior to marketing and operating it in the European Community.

5.1.3 R&TTE Conformity (Europe)

A R&TTE Declaration of Conformity is available for the S6500 Long Range Reader Module (which represents the RF transmission part of the S6550 Long Range Reader (Housed)) at TI*RFID Sales Offices.

The equipment complies with the essential requirements of the Telecommunication Terminal Equipment Act (FTEG) and the R&TTE Directive 1999/5/EC when used for its intended purpose.

Any device or system incorporating the S6500 Long Range Reader Module in any other than the originally tested configuration needs to be verified against the requirements of the Telecommunication Terminal Equipment Act (FTEG) and the R&TTE Directive 1999/5/EC. A separate Declaration of Conformity must be issued by the System Integrator or user of such a system prior to marketing and operating it in European Community.

It is the responsibility of the system integrators to get their complete system tested and to obtain approvals from the appropriate local authorities before operating or selling the system.

5.2 Safety Precautions

5.2.1 Human Safety

WARNING:

CUSTOMERS USING THE S6550 HOUSED READER ARE RESPONSIBLE FOR OPERATING THEIR SYSTEM UNDER IMPLEMENTED POWER LEVELS AND ANTENNA CONFIGURATIONS AGAINST RELEVANT STANDARDS FOR HUMAN SAFETY IN ELECTRONIC FIELDS.

5.3 Warranty and Liability

The “General Conditions of Sale and Delivery” of Texas Instruments Incorporated or a TI subsidiary apply. Warranty and liability claims for defect products, injuries to persons and property damages are void if they are the result of one or more of the following causes:

- improper use of the Reader
- unauthorized assembly, operation and maintenance of the Reader
- operation of the Reader with defective and/or non-functioning safety and protective equipment
- failure to observe the instructions during transport, storage, assembly, operation, maintenance and setting up of the Reader
- unauthorized changes to the Reader
- insufficient monitoring of the Reader's operation or environmental conditions
- improperly conducted repairs
- catastrophes caused by foreign bodies and acts of God.

APPENDIX A

Terms & Abbreviations

The terms and abbreviations used in this manual can be found in the TIRIS Terms and Abbreviations Manual - document number 11-03-21-002. This manual can be found in the document center on our home page:

http://www.ti-rfid.com