Texas Instruments

Series 2000 Reader System

Control Modules RI-CTL-MB2A, RI-CTL-MB6A

Reference Guide

TIRIS Technology by Texas Instruments™

January 2000

SCBU024

Series 2000 Reader System

Control Modules RI-CTL-MB2A, RI-CTL-MB6A

Reference Guide

TIRIS Technology by Texas Instruments™

Literature Number: SCBU024
January 2000

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Read This First

Edition Two – January 2000

This is the second edition of this manual, it describes the following Series 2000 Control Modules:

RI-CTL-MB2A	Control Module with RS232 interface
RI-CTL-MB6A	Control Module with RS422/485 interface

Both modules contain Firmware S2000 -- REV 1.40

About This Guide

This manual describes the TIRIS™ Series 2000 Control Modules RI-CTL-MB2A and RI-CTL-MB6A. It describes the modules themselves, how to install them and how to use them. Regulatory, Safety and Warranty Notices that need to be followed are given in Chapter 4.

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 that must be met or a procedure that must be followed, which if not heeded, could cause permanent damage to the equipment or software.

Note: Indicates conditions that must be met or procedures that must be followed, to ensure proper functioning of any equipment or software.

Information:
Indicates information that makes usage of the equipment or software easier.

If You Need Assistance

Application Centers are located in Europe, North and South America, the Far East and Australia to provide direct support. For more information, please contact your nearest TIRIS Sales and Application Center. The contact addresses can be found on our home page: http://www.tiris.com

Trademarks

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Introduction

This chapter will introduce you to the Control Module and the products with which it works.

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1.1 General

This document provides information about how to install the TIRIS Series 2000 Control Module. It also provides specifications of all the inputs and outputs of the following S2000 Control Modules:

RI-CTL-MB2A and RI-CTL-MB6A.

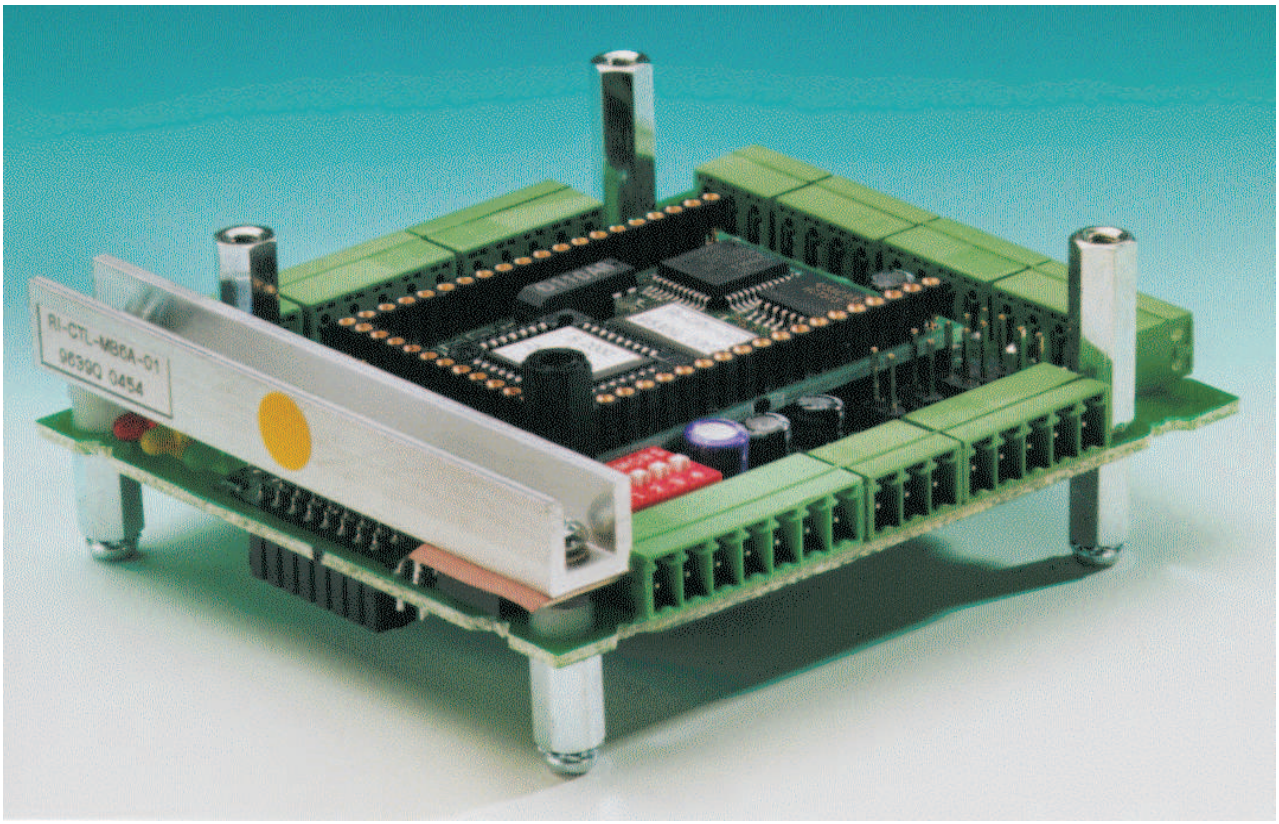

Figure 1-1. Series 2000 Control Module

1.2 Product Description

The Series 2000 Control Module is the interface between a TIRIS Radio Frequency Module and a controlling host. It controls the transmit and receive functions of the RFM according to the commands from the host to send signals to and receive data from a TIRIS transponder. It decodes the received RF signals into the transponder's identification number, checks the validity and handles the protocol conversion to a standard serial interface.

The Control Module is offered with two different serial interfaces:

the RI-CTL-MB2A for point-to-point communication via an RS232C interface,

and the RI-CTL-MB6A for point-to-point via an RS422 interface, or point-to-multipoint communication via an RS422/485 interface.

There are two communications protocols available:

the TIRIS Bus Protocol that can be used for both point-to-point and point-to-multipoint systems,

and the ASCII Protocol for use with point-to-point systems.

For details regarding the communications protocol (ASCII or TBP) please refer to the ASCII Protocol or TBP Reference Guides which are available at the TIRIS internet site: **www.tiris.com**.

The Control Module can be configured via the service/configuration interface or the standard serial interface according to application specific requirements.

The Control Module has eight configurable digital input/outputs that can be defined by the user and two open collector outputs. It also includes a wireless synchronization feature and a port to allow wired synchronization to avoid interference between readers located close to each other.

Three indicator LEDs show the status of the module.

1.3 Associated RFMs

The S2000 Control Module works together with the Radio Frequency Modules listed in Table 1-1.

Table 1-1. Associated RFMs

RFM Type	Number	Reference Guide Number
High Performance RFM	RI-RFM-007B	11-06-21-042 (SCBU022)
High Performance RA-RFM	RI-RFM-008B	11-06-21-047 (SCBU023)
Standard RFM	RI-RFM-104B	11-06-21-035

The RFM Reference Guides listed in Table 1-1 can be found at the TIRIS internet site: **www.tiris.com**.

Installation

This chapter provides information about how to install the Series 2000 Control Module and set all the various switches and Jumpers according to the system within which it is located.

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2.1 General

CAUTION

Handle your Series 2000 Control Module only according to ESD handling requirements!

Since the human body can be charged up to thousands of volts (electrostatic charge) you should not touch any part or connector of the Control Module without taking appropriate precautions.

2.2 Mechanical Installation

Mount the RFM on top of the Control Module using four M3 hexagon spacing bolts so that the connector for supply voltages and interface signal lines from the Control Module (ST4) fits with its counterpart on the RFM. If you are using the High Performance RFM or the High Performance RA-RFM which have longer connection pins, you must use additional 2 mm washers between the modules and the 10 mm screws supplied with the supplement.

2.3 Electrical Installation

The Series 2000 Control Module has 10 plug and screw connectors which provide all connections necessary for supply and control (see Figure 2-1). The connections are given in Section 2.3.1.

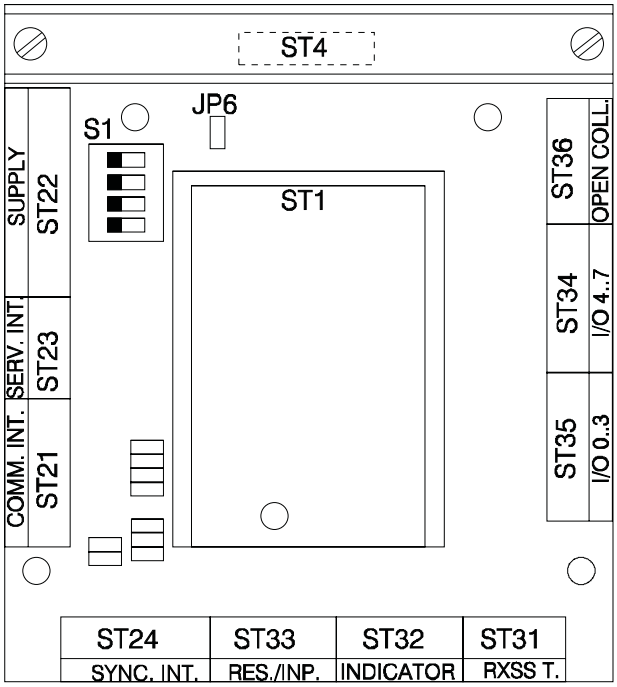

Figure 2-1. Bottom View of the Series 2000 Control Board

Note: ST1 is a plug-in processor board, ST4 is the RFM connector and is accessible from the top.

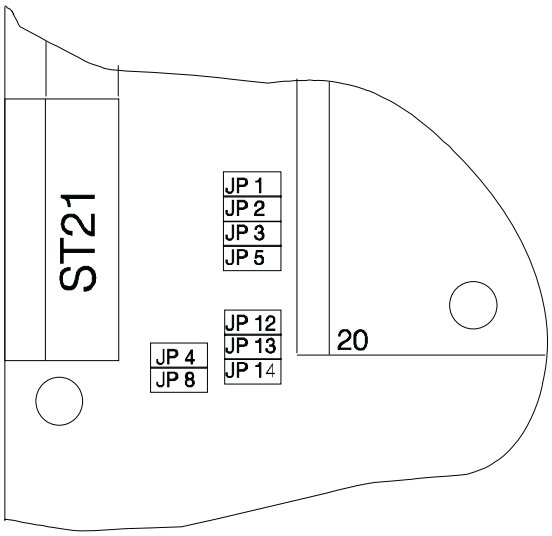

Figure 2-2. Detailed View of Jumpers JP1...JP5, JP8, JP12...JP14

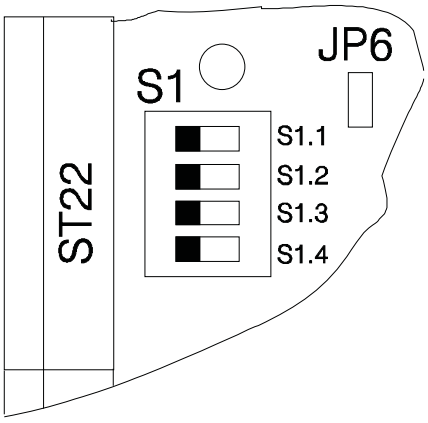

Figure 2-3. Detailed View of DIP-Switch S1

2.3.1 Connectors

Please refer to Section 3.2.1 “Recommended Operating Conditions, Electrical Characteristics” for electrical details and limits for all these connectors.

CAUTION

Always “power-down” before connecting or disconnecting any of the cables.

Table 2-1. ST21 – RS232 Communication Interface (RI-CTL-MB2A)

Signal Name	Pin	Comment
RXD	1	RS232-C serial data Input
DTR	2	RS232-C Data Terminal Ready Input
GND	3	Signal ground
TXD	4	RS232-C serial data Output
DSR	5	RS232-C Data Set Ready Output

Table 2-2. ST21 – RS422 Communication Interface (RI-CTL-MB6A)

Signal Name	Pin	Comment
RX+	1	RS422 non-inverted data Input
RX–	2	RS422 inverted data Input
GND	3	Signal ground
TX+	4	RS422 non-inverted data Output
TX–	5	RS422 inverted data Output

Table 2-3. ST21 – RS485 Communication Interface (RI-CTL-MB6A)

Signal Name	Pin	Comment
TX+/RX+	1	RS485 non-inverted data Output/Input
TX–/RX–	2	RS485 inverted data Output/Input
GND	3	Signal ground

Table 2-4. ST22 – Supply

Signal Name	Pin	Comment
VSP	1	Supply input voltage for the RF Module
GNDP	2	Ground line for the RF Module supply
VDC	3	Non-regulated supply voltage for the control logic circuitry
GND	4	Signal ground line for the control logic supply
VCC2	5	Regulated supply voltage (5 Vdc) for the control logic circuitry
VCC3	6	Memory data retention supply voltage
GND	7	Signal Ground

Table 2-5. ST23 – Configuration/Service Interface

Signal Name	Pin	Comment
SERV.TXD	1	RS232-C serial data Output
SERV.RXD	2	RS232-C serial data Input
GND	3	Signal ground

Table 2-6. ST24 – Synchronization Interface

Signal Name	Pin	Comment
SYNC. RX+	1	RS422/RS485 non-inverted data Input
SYNC. RX–	2	RS422/RS485 inverted data Input
GND	3	Signal ground
SYNC. TX+	4	RS422/RS485 non-inverted data Output
SYNC. TX–	5	RS422/RS485 inverted data Output

Table 2-7. ST31 – RXSS Tuning Inputs

Signal Name	Pin	Comment
RSCA/RXSA1	1	RSCA/RXSA1 Receiver Signal Strength Control A Receiver Signal Strength Adjust refer to RFM Manual
RSCB	2	Receiver Signal Strength Control B (not used)
GND	3	Signal ground

Table 2-8. ST32 – Indicator Outputs

Signal Name	Pin	Comment
VCC2	1	Regulated 5 Vdc supply output
ACTIVE–	2	Open collector Output; RF Module transmitter signal
OK–	3	Open collector Output; O.K. signal
EMI–	4	Open collector Output; EMI signal

Table 2-9. ST33 – Input/Reset

Signal Name	Pin	Comment
IN0	1	General purpose Input 0
IN1	2	General purpose Input 1
RESET–	3	Reset Input/Output
GND	4	Signal ground

Table 2-10. ST34 – Input/Output Port 4..7

Signal Name	Pin	Comment
I/O 4	1	General purpose Input/Output 4
I/O 5	2	General purpose Input/Output 5
I/O 6	3	General purpose Input/Output 6
I/O 7	4	General purpose Input/Output 7
GND	5	Signal ground

Table 2-11. ST35 – Input/Output Port 0..3

Signal Name	Pin	Comment
I/O 0	1	General purpose Input/Output 0
I/O 1	2	General purpose Input/Output 1
I/O 2	3	General purpose Input/Output 2
I/O 3	4	General purpose Input/Output 3
GND	5	Signal ground

Table 2-12. ST36 – Open Collector Outputs

Signal Name	Pin	Comment
VCC2	1	Regulated 5 Vdc supply Output
OC0	2	Open collector Output 0
OC1	3	Open collector Output 1
GND	4	Signal ground

2.4 Software Configuration

The TIRIS Reader Manager (TRM) which is available of our Internet homepage: **www.tiris.com** can be used to configure the Series 2000 Control Module according to the customers application specific requirements concerning:

communication protocol, communication parameters, default read mode, RF Module type, RF Module parameters, synchronization type and default I/O settings.

DIP switch S1 (S1.1) determines the mode of operation of the control module when power is applied to the control module. If DIP switch S1.1 is in the OFF position, standard TIRIS default parameters are used, these are:

RI-CTL-MB2A:

- ASCII protocol
- 9600 baud, eight databits, no parity, one stop bit, Xon/Xoff enabled
- Normal Mode
- RF Module RI-RFM-004 (valid for 104,007,008)
- Wireless synchronization
- I/O 0 to 3 defined as input
- I/O 4 to 7 defined as output and logic high
- Hardware interface RS232

RI-CTL-MB6A:

- ASCII
- 9600 baud, eight databits, no parity, one stop bit, Xon/Xoff enabled
- Normal Mode
- RF Module RI-RFM-004 (valid for 104,007,008)
- Wireless synchronization
- I/O 0 to 3 defined as input
- I/O 4 to 7 defined as output and logic high
- Hardware interface RS422

If DIP Switch S1.1 is in the ON position, customer specific default parameters are used to operate the Control Module. These application specific parameters are stored in the serial EEPROM on the Control Module.

Note: The setting of DIP Switch S1.1 is only checked after power on.

To enable the customer specific parameters to be changed the Control Module can be configured either via the communication port or via the service port. Therefore connect one of these ports to the host and get connection using the standard TIRIS settings by switching DIP Switch S1.1 to the OFF position. Change the default parameters to the customer specific parameter and save them. Then after a reset and DIP Switch S1.1 in the ON position, the control module will work with the customer specific parameters.

For details regarding the communication protocol (ASCII or TBP) please refer to the ASCII Protocol or TIRIS Bus Protocol Reference Guides which are available at the TIRIS site on the internet: **www.tiris.com**.

2.5 Power Supplies

In this section we describe the various Power Supply possibilities for the Series 2000 Control Module, these are:

1. The Series 2000 Control Module and the RF Module are both powered by a regulated Power Supply, described in Section 2.5.1.
2. The Control Module and the RF Module logic circuitry are powered by a non-regulated Power Supply, and the RF Module power circuits are separately supplied by a regulated Power Supply. Described in Section 2.5.2.
3. The Control Module and the RF Module logic circuitry are powered by a regulated (5 V) Power Supply, and the RF Module power circuits are separately supplied by a regulated Power Supply. Described in Section 2.5.3.

When the Series 2000 Control Module control logic circuitry is powered by an external regulated (5 V) Power Supply, Jumper JP6 must be left out.

CAUTION

The supply voltage range that can be used depends on the RFM used, therefore in all cases, refer to Section 3.2.1 "Recommended Operating Conditions. Electrical Characteristics" for minimum, nominal and maximum input supply levels. For the RFM power supply requirements please refer to the relevant RFM Reference Guide.

Please be very careful to ensure that you use the right polarity in all of these methods of Power Supply as there is no reverse polarity protection built into the Control Module.

2.5.1 Common DC Power Supply For Both Control and RF Modules

Figure 2-4 shows how to connect one regulated power supply for both the Control Module and the RFM. Jumper JP6 must be closed.

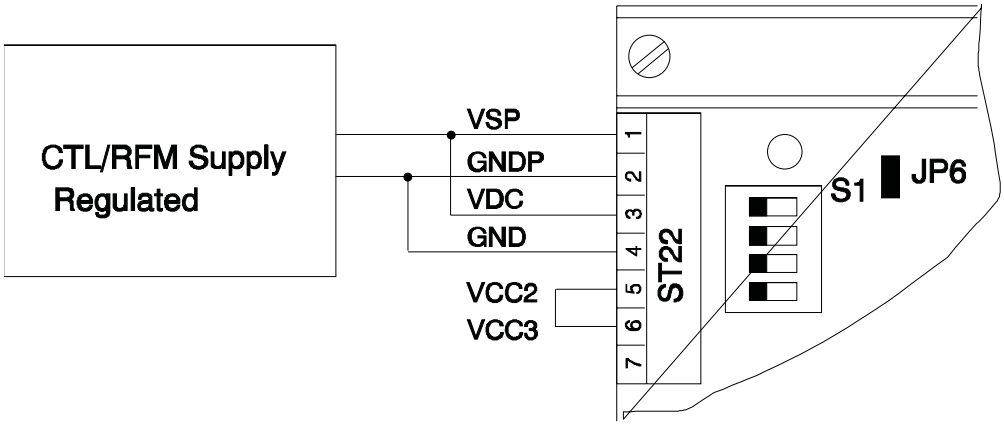

Figure 2-4. Single Power Supply (Control and RF Modules)

2.5.2 Non-Regulated DC Power Supply (Without Memory Battery Backup)

If a non-regulated dc power supply is used to supply the Control Module logic circuits, it should be connected to the reader as shown in Figure 2-5. Jumper 6 (JP6) must be closed.

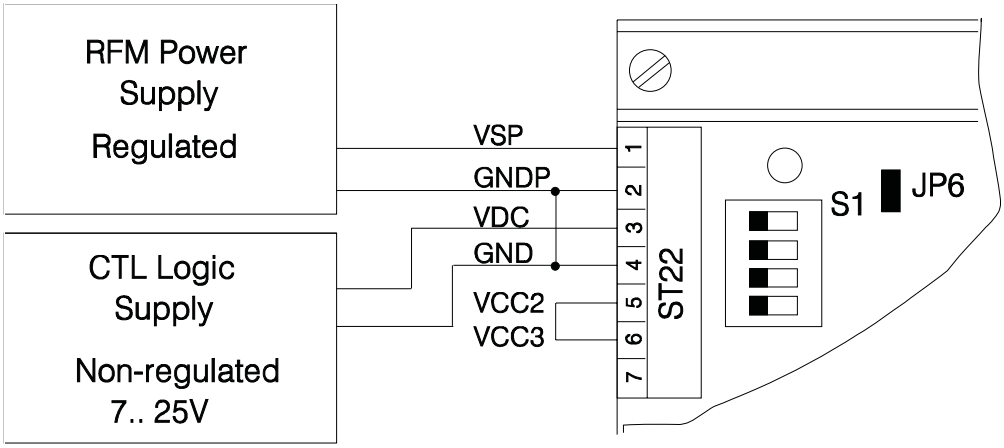

Figure 2-5. Non-Regulated Power Supply

2.5.3 Regulated DC Power Supply (Without Memory Battery Backup)

If you use a regulated (5V) power supply for VCC2, it should be connected to the reader as shown in Figure 2-6. Jumper 6 (JP6) must be removed.

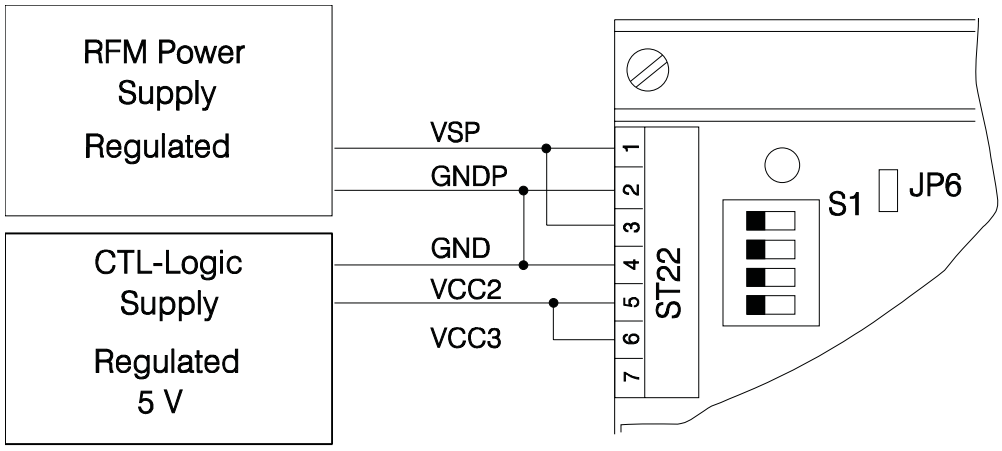

Figure 2-6. 5-V Regulated Control-Logic Power Supply

2.5.4 Battery Backup For Memory

Even though the Series 2000 Control Module remains powered, it is possible that the memory contents can be erased when the Control Module is reset. This occurs because power is temporarily removed from the RAM during reset.

A reset can be initiated in one of three ways:

- internally by the reset/watchdog circuit
- externally by using the reset input (pin 3 of ST33)
- externally by the RS232 DTR signal (RI-CTL-MB2A version only)

In order to prevent memory contents being lost during a reset, we recommend that you take the following precautions:

Connect VCC2 (pin 5 of ST22) and VCC3 (pin 6 of ST22) to each other.

In order to prevent memory contents being lost during power-down, or during a reset, we recommend that you take the following precautions:

Connect a battery (with VCC3 nominally 3 V) between pins 6 (+) and 7 (–) of ST22 as shown in Figure 2-7, instead of a bridge between VCC2 and VCC3. Tolerances for the battery voltage are given in Section 3.2.1.1.

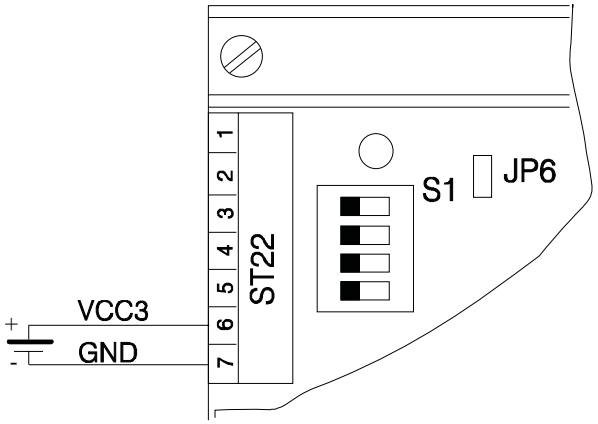

Figure 2-7. Battery Backup for the Memory

2.6 Service/Configuration Interface

The Service/Configuration Interface is used by the Control Module's Firmware to configure the Reader using an RS232-C interface. Recommendations for 9-pin interface connector are given in Figure 2-8.

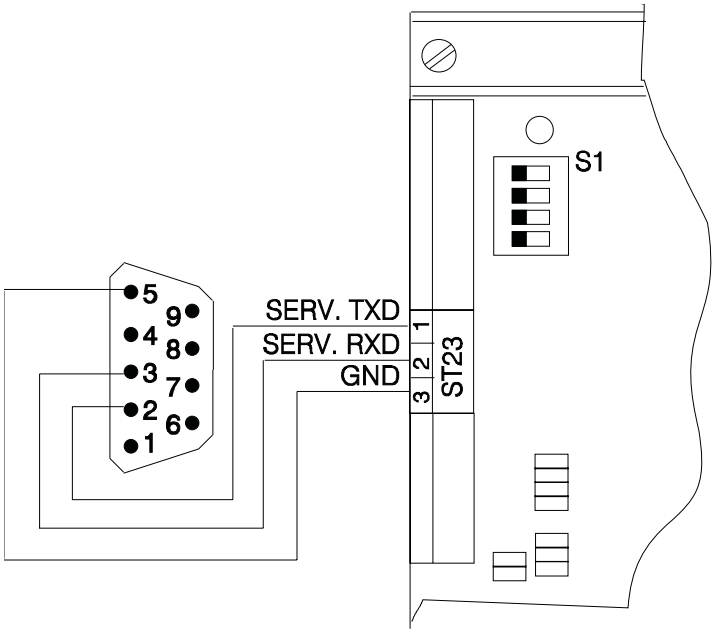

Figure 2-8. 9-Pin Connector to the Service/Configuration Interface

2.7 Serial Communication Interface

A host (usually a PC) is needed to control the Series 2000 Control Module. The computer can either be situated at the reader site, or it can be at a remote location.

If the distance between the reader and the computer is less than 20 m, the RS232-C version of the Control Module (RI-CTL-MB2A) can be used, if it is further away the RS422 or RS485 version (RI-CTL-MB6A) should be used.

2.7.1 Interface Configuration

The Control Module Firmware uses the following configuration:

Start/Stop bit

X_{ON}/X_{OFF} $X_{ON} = 17_{DEC}$

$X_{OFF}=19_{DEC}$

The Data rate, Parity, Data bits and Handshake mode can be configured using the TRM as described in section 2.4.

2.7.2 RS232-C Interface

Recommendations for 9-pin and 25-pin SUB-D interface connectors are given in Figure 2-9 and Figure 2-10, respectively.

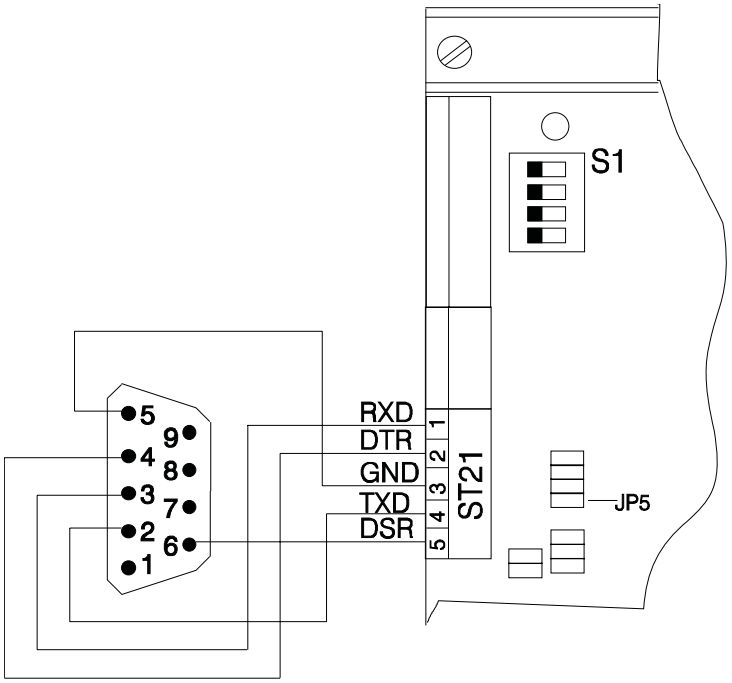

Figure 2-9. RS232-C 9-Pin Interface Connection

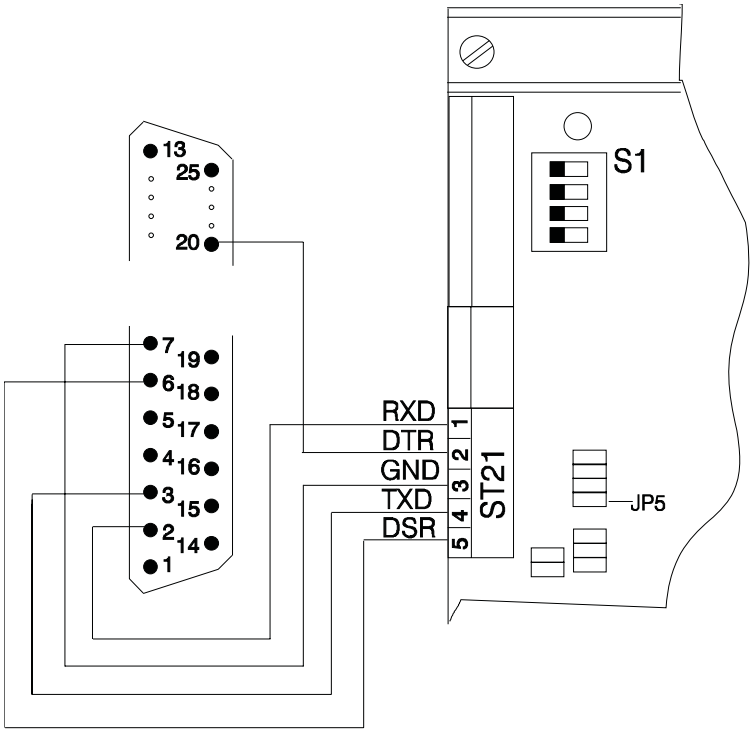

Figure 2-10. RS232-C 25-Pin Interface Connection

2.7.2.1 Activation (RI-CTL-MB2A)

The Data Terminal Ready signal (DTR) is connected to the reset/watchdog circuit of the Control Module. This ensures a PC controlled microcomputer initialization before the default Read Mode is started.

If you want to run the Control Module in a three-wire connection (RXD, TXD and GND), without a remote controlled activation, Jumper 5 (JP5) must be closed, this connects DTR and DSR together.

When power is applied to the control module the Data Set Ready signal (DSR) of the RS232-C interface is activated.

2.7.3 RS422/RS485 Interface

Figure 2-11 shows the circuitry of the RS422/RS485 Interface. Jumper 2 (JP2) must be closed to provide a line-to-line termination. If the PC is at one end of the line it must be terminated at its RX+/RX– inputs and the reader at the end of the line must be terminated. If the PC is connected somewhere into the “middle” of the line, the readers at both ends must both be terminated.

Which of the two interface types is selected (RS422 or RS485) is determined by Jumper JP4 and JP5. This is explained in detail in Sections 2.7.3.1 and 2.7.3.2.

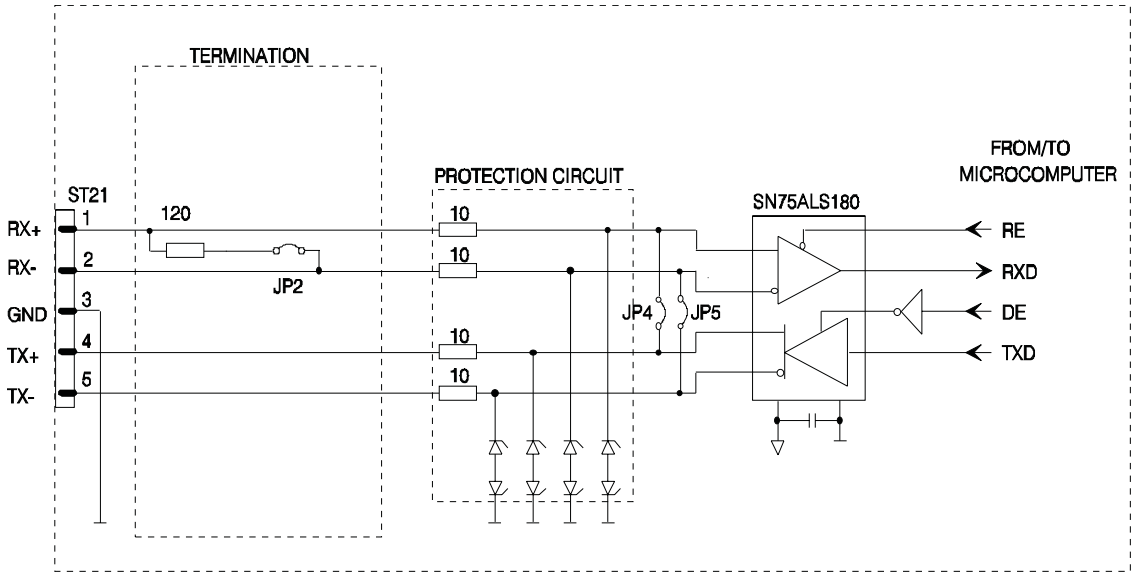

Figure 2-11. RS422/RS485 Interface Circuitry

2.7.3.1 RS422 Interface

Recommendations for a point-to-point RS422 interface connection are given in Figure 2-12. In this case Jumper 2 (JP2) must be closed. Jumpers JP4 and JP5 must be open. For a point-to-multipoint interface, only the reader at the end of the line must be terminated.

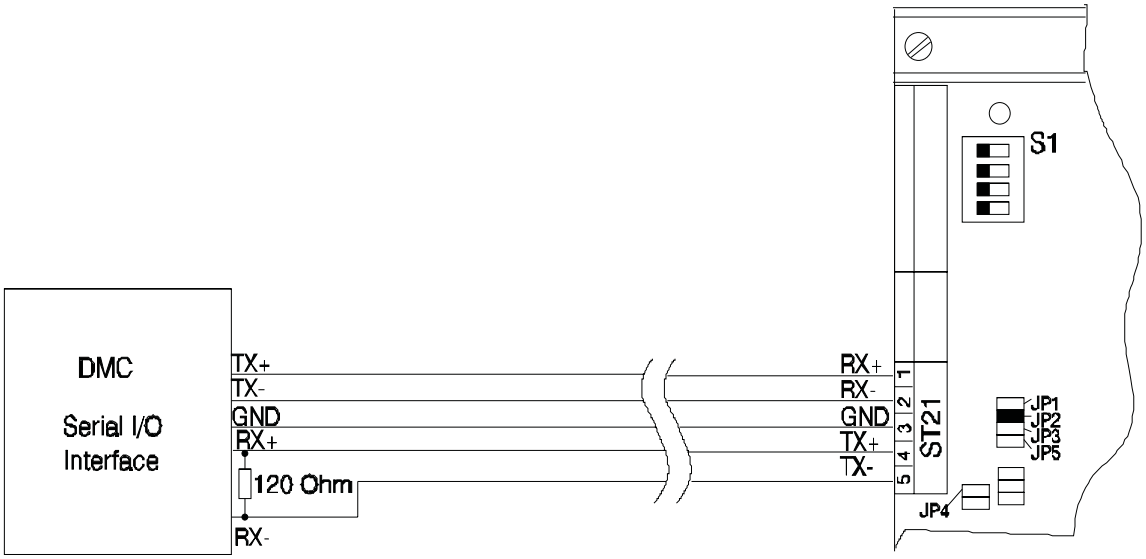

Figure 2-12. RS422 Interface Connection

2.7.3.2 RS485 Interface

When using an RS485 interface, Jumper 4 and 5 (JP4, JP5) must be closed. Recommendations for an RS485 interface connection to a twisted pair bus line is given in Figure 2-13. The last reader in the line must be terminated by connecting Jumper 2 (JP2).

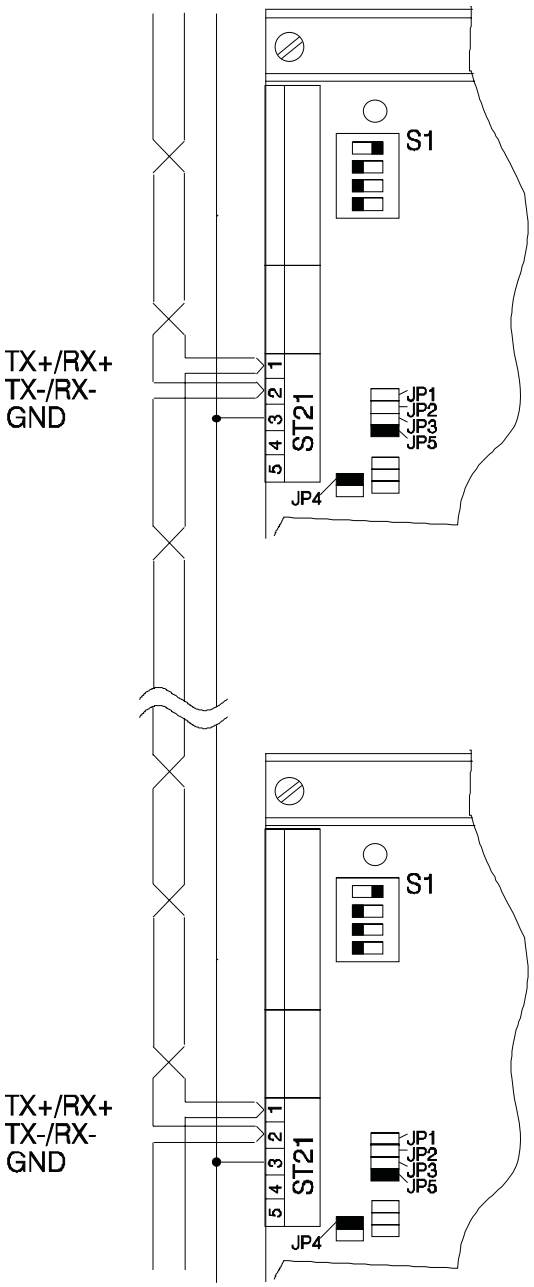

Figure 2-13. RS485 Interface Connection

2.8 Synchronization Interface

2.8.1 Synchronization Interface

Figure 2-14 shows the circuitry of the synchronization interface and Figure 2-15 the connector for the synchronization interface.

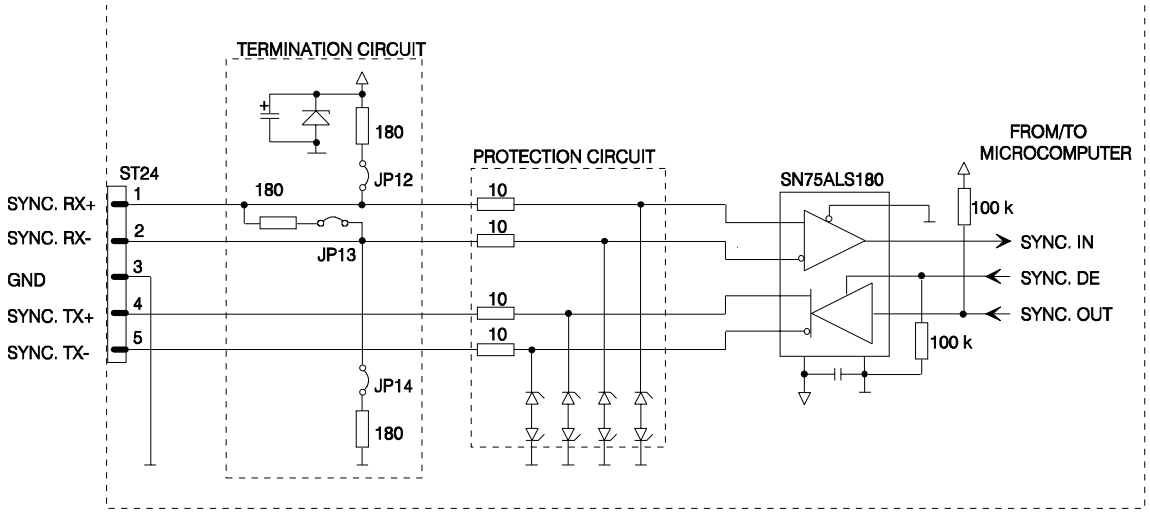

Figure 2-14. Synchronization Interface Circuitry

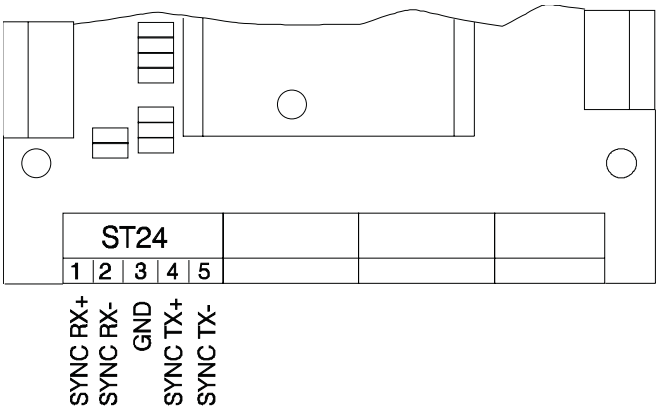

Figure 2-15. Synchronization Interface Connection

To allow the synchronization of up to 32 readers, the Series 2000 Firmware provides five types of synchronization (or No Sync if you are not going to have any synchronization):

- No Sync
- Wireless
- Wired
- Combined Wireless/Wired
- Master/Slave (with or without acknowledgment)
- Triggered

This specification covers the way the Readers have to be connected for the wired, combined wireless/wired, master/slave and triggered synchronization.

When you have completed the hardware synchronization, you must set the DIP switch S1.1 to the **ON** position and then run the TRM (as described in section 2.4) in order to tell the system which synchronization method you have installed. Once you have run the configuration software you must power down and then up again.

2.8.2 Wired and Combined Wireless/Wired Synchronization

Figure 2-16 shows in which way the Control Module must be connected for a wired and a combined wireless/wired synchronization. The Control Module has also to be software configured to the chosen synchronization method. Table 2-13 explains the setting of jumpers 12, 13, and 14 (JP 12, JP13, and JP14).

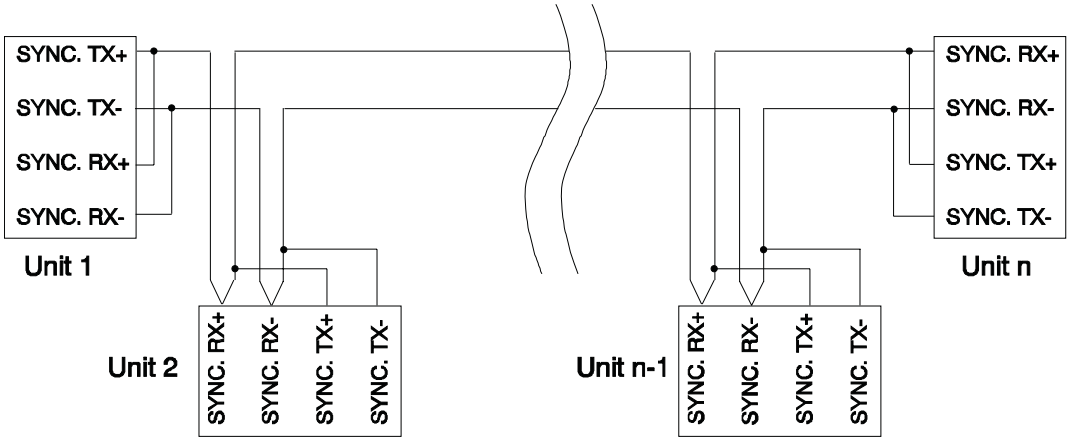

Figure 2-16. Wired and/or Combined Wireless/Wired

Table 2-13. Wired and Combined Wireless/Wired Synchronization

	UNIT 1	UNIT 2....UNIT n–1	UNIT n
Jumper 12 (JP12)	closed	open	closed
Jumper 13 (JP13)	closed (see Note)	open	closed (see Note)
Jumper 14 (JP14)	closed	open	closed

Note: If the distance between Unit 1 and Unit n is less than approximately 400 m, Jumper 13 (JP13) can be left open.

2.8.3 Master/Slave Synchronization Without Acknowledgment; Triggered Synchronization Without Acknowledgment

Figure 2-17 shows the way that the Series 2000 Readers have to be connected for master/slave synchronization or triggered synchronization, both without acknowledgment. The individual SW configuration (Master or Slave) is shown in Table 2-14 and Table 2-15, the tables also explain the setting of Jumpers 12, 13, and 14 (JP12, JP13, and JP14).

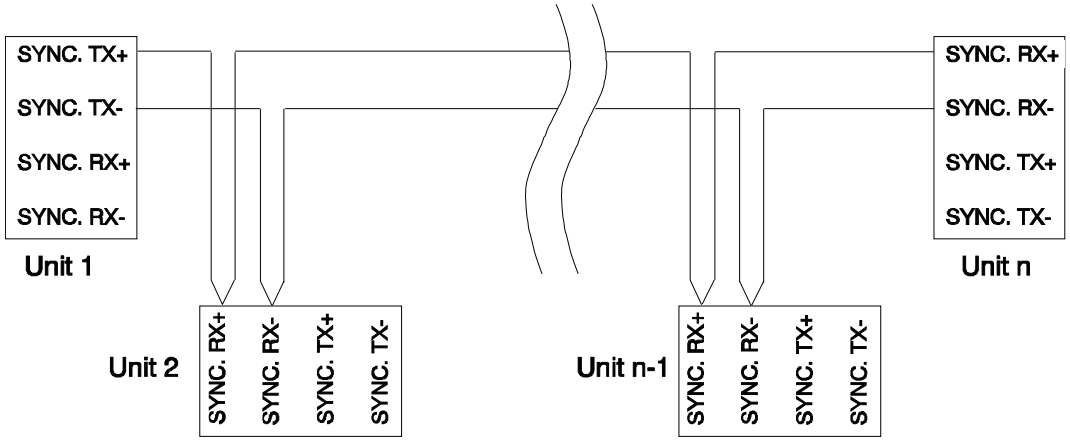

Figure 2-17. Synchronization Interface Connection

Table 2-14. Master/Slave Synchronization Without Acknowledgment

	UNIT 1: S2000 Control Module (Master)	UNIT 2...UNIT n–1: S2000 Control Module (Slaves)	UNIT n: S2000 Control Module (Slave)
Jumper 12 (JP12)	closed	open	closed
Jumper 13 (JP13)	open	open	closed (see Note)
Jumper 14 (JP14)	closed	open	closed

Note: If the distance between Unit 1 and Unit n is less than approximately 400 m, Jumper 13 (JP13) can be left open.

Table 2-15. Triggered Synchronization Without Acknowledgment

	UNIT 1: Trigger Unit	UNIT 2...UNIT n–1: S2000 Control Module (Master)	UNIT n: S2000 Control Module (Master)
Jumper 12 (JP12)	Termination not required	open	closed
Jumper 13 (JP13)	Termination not required	open	closed (see Note)
Jumper 14 (JP14)	Termination not required	open	closed

2.8.4 Master/Slave Synchronization With Acknowledgment

Figure 2-18 shows the way that the Control Module must be connected for master/slave synchronization with acknowledgment. The individual SW configuration (Master or Slave) is shown in Table 2-16 which also explains the setting of Jumpers 12, 13, and 14 (JP12, JP13, and JP14).

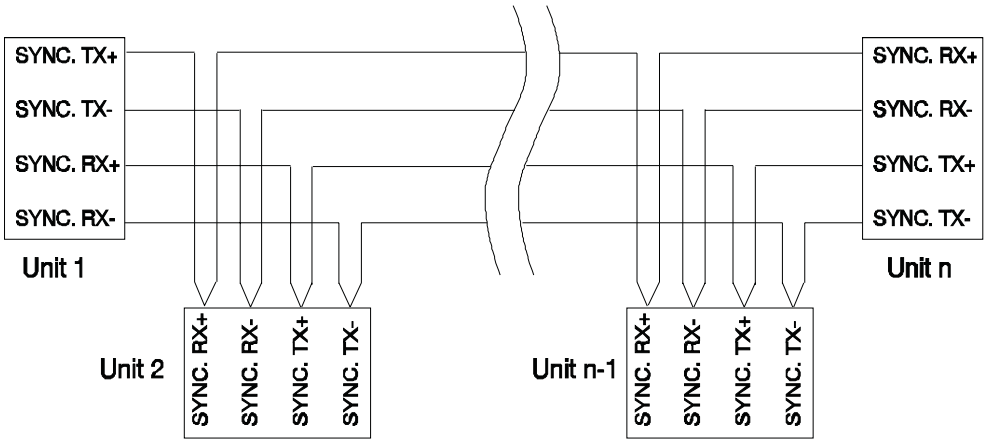

Figure 2-18. Master/Slave Synchronization (With Acknowledgment)

Table 2-16. Master/Slave Synchronization With Acknowledgment

	UNIT 1: S2000 Control Module (Master)	UNIT 2...UNIT n–1: S2000 Control Module (Slaves)	UNIT n: S2000 Control Module (Slave)
Jumper 12 (JP12)	closed	open	closed
Jumper 13 (JP13)	closed (see Note)	open	closed (see Note)
Jumper 14 (JP14)	closed	open	closed

Note: If the distance between Unit 1 and Unit n is less than approximately 400 m, Jumper 13 (JP13) can be left open.

2.9 Input Reset

The Control Module provides two general purpose input lines. Each of these input lines is pulled-up to VCC2 (5 V) by a 100 kΩ resistor.

The Reset- terminal at this connector can be used to reset external circuitry or to reset the Control Module externally. Figure 2-19 shows an example to reset the Control Module with an external push button.

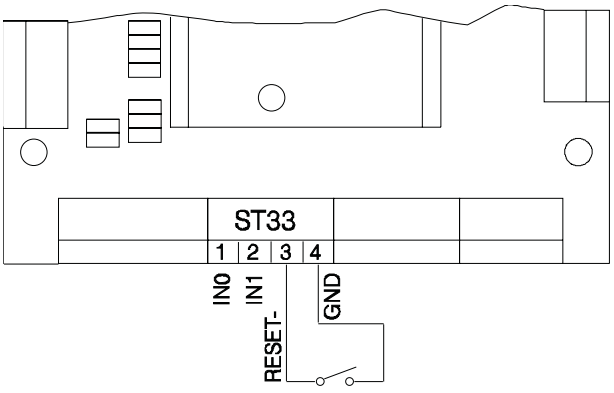

Figure 2-19. Input/Reset Connection

2.10 Indicator Outputs

The signals of the indicator LEDs are available at ST32. They can be used to drive external LEDs which can be mounted on a front panel. A current limiting resistor is required for each LED. An example is shown in Figure 2-20.

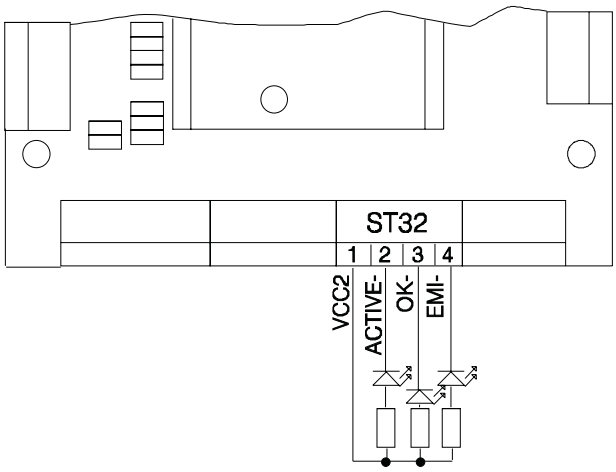

Figure 2-20. Indicator Outputs

2.11 RFM RXSS Tuning Inputs

The signal RXSA is made available at ST31 terminal 1 to allow adjustment of the signal strength threshold level for the S2000 RFM. To adjust the signal strength threshold level please refer to the RFM Manual (RSCA, RSCB are not used).

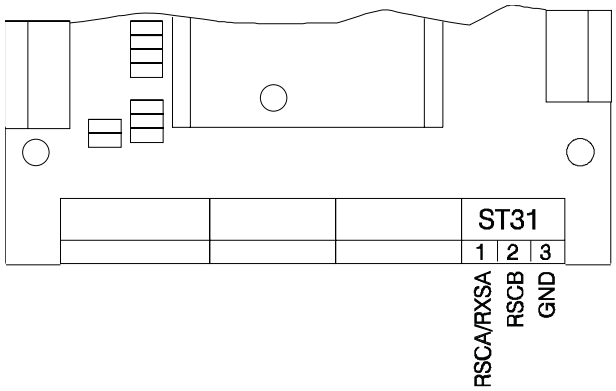

Figure 2-21. RFM Tuning Inputs

2.12 General Purpose I/O

The Control Module provides two I/O ports which can be configured in the following way:

I/O[1]				I/O[1]			
0	**1**	**2**	**3**	**4**	**5**	**6**	**7**
I	I	I	I	I	I	I	I
I	I	I	I	O	O	O	O
O	O	O	O	I	I	I	I
O	O	O	O	O	O	O	O

(1) I = Input; O = Output

The Control Module Firmware configures I/O 0..3 to Input and port I/O 4..7 to Output by default.

The Configuration Software (TRM), can be used to configure the system as required.

Please do not exceed the values given under “Electrical Characteristics” in Chapter 3 of this Guide. The pin-assignment for the I/O lines is shown in Figure 2-22.

These I/O lines are TTL compatible and are connected via a 220 Ω series resistor to the input terminals of the 82C55A CMOS Programmable Peripheral Interface IC (Port C).

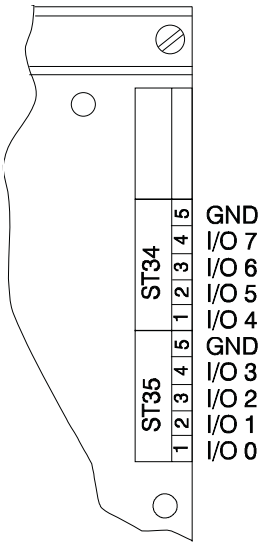

Figure 2-22. General Purpose I/O Port Pin Assignment

2.13 Open Collector Outputs

The Control Module provides two general purpose open collector output lines. They can be used for a Wiegand interface or to drive relays.

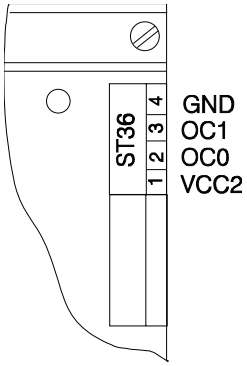

Figure 2-23. Open Collector Outputs

Specifications

This chapter provides the mechanical and electrical specifications for the Series 2000 Control Module.

Topic **Page**

3.1 General Data **34**
3.2 Electrical Data **35**

3.1 General Data

3.1.1 Mechanical Dimensions

Length : 93 mm (3.66 inches)

Width : 82 mm (3.23 inches)

Height : 33 mm (1.14 inches)

Weight : 90 g (3.25 oz)

The dimensions of the holes are given in Figure 3-1. All dimensions are in mm and are given for the Printed Circuit Board (PCB) without the Heat sink.

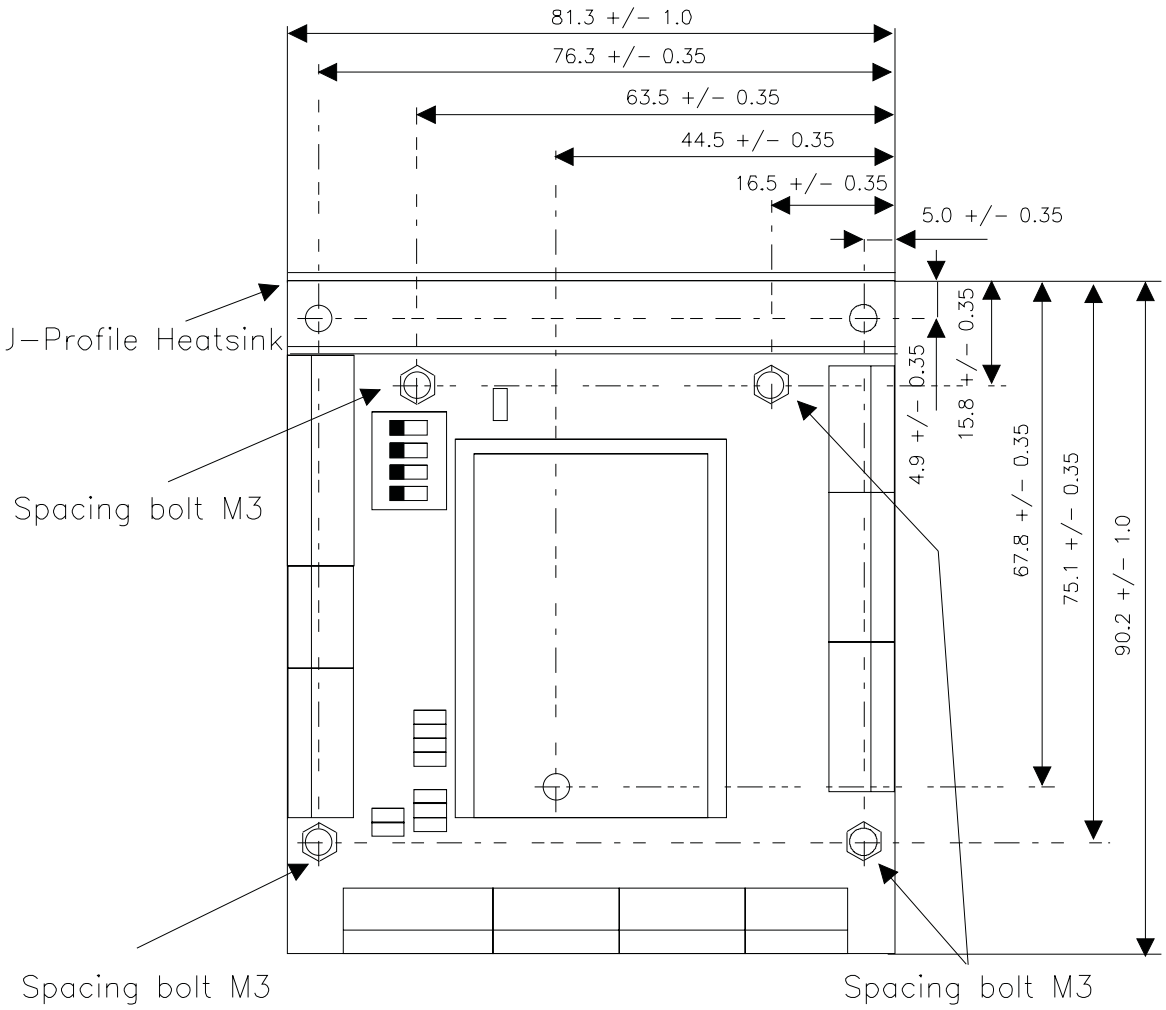

Figure 3-1. Mechanical Dimensions

3.1.2 Temperature

Operating temperature range : 0...70°C

Storage temperature range : –40...85°C

3.2 Electrical Data

3.2.1 Recommended Operating Conditions, Electrical Characteristics

3.2.1.1 ST 22 – Supply

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
V_{DC}			7		25	V
V_{CC2}	Logic supply voltage	Connector ST22 pin 5 is used as logic supply output. V_{DC} = 7...25 V. Jumper JP6 must be closed.	4.75	5.0	5.25	V
V_{CC2}	Logic supply voltage	Connector ST22 pin 5 is used as external logic supply input. Jumper JP6 must be removed.	4.75	5.0	5.25	V
P_{DIS}	Power dissipated by the voltage regulator	No external loads Indicator LEDs are on			4	W
I_{DC}, I_{CC2}	Supply current	No external loads Indicator LEDs are on		120	200	mA
I_{CC2}		Output current if ST22 pin 5 is used as external logic supply output The maximum Power dissipation must not exceeded!			1	A
V_{CC3}	Data retention input voltage		2.7	3.0	V_{CC2}	V
I_{CC3}	Data retention current	RESET– = V_{RESOL} (Reset active; see Note)		2	50	µA

Note: A reset can be initiated in one of three ways:

internally by the reset/watchdog circuit

externally by using the reset input (pin 3 of ST33)

externally by the RS232 DTR signal (RI-CTL-MB2A version only)

3.2.1.2 ST 23 – Configuration/Service Interface

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
V_{SERV_TXD}	Output voltage swing	SERV_TXD loaded 3 kΩ to Ground	±5		±9	V
V_{SERV_RXD}	Input voltage range		–30		30	V
I_{SERV_TXD}	Short circuit current	SERV_TXD connected to Ground infinite duration		±18		mA
R_{SERV_RXD}	Input resistance		3	5	7	kΩ

3.2.1.3 ST 21 – RS232-C Communication Interface

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
V_{TXD}	Output voltage swing	TXD loaded 3 kΩ to Ground	±5		±9	V
V_{RXD}	Input voltage range		–30		30	V
V_{DTR}	DTR Input Voltage		–30		30	V
V_{DSR}	DSR output voltage	DSR loaded 3 kΩ to Ground	3.5	4.1	V_{CC2}	V
V_{RXD_TRES} Low High	RXD input threshold	V_{CC2} = 5 V	 2.4		 0.8	 V V
V_{DTR_TRES} Low High	DTR input threshold	V_{CC2} = 5 V	 1.6 2.25		 3.15 3.85	 V V
I_{TXD}	Short circuit current	TXD connected to Ground infinite duration		±18		mA
R_{RXD}			3	5	7	kΩ
I_{DTR}	DTR current	V_{DTR}=12 V	3.6	3.8	4.1	mA

3.2.1.4 ST 21 – RS422/RS485 Communication Interface

PARAMETER	DESCRIPTION	CONDITIONS		MIN	TYP	MAX	UNIT
V_I, V_{IC}	Voltage at any bus terminal (separately or common mode)			–7		12	V
V_{ID}	Differential input voltage	see Note				±12	V
V_O	Output Voltage	I_O = 0		0		V_{CC2}	V
I_O	Output current	Output disabled; V_O = 12 V				1	mA
I_{OH}	High-level output current	TX+, TX–				–60	mA
		RX+, RX–				–400	µA
I_{OL}	Low-level output current	TX+, TX–				60	mA
		RX+, RX–				8	mA
I_{OS}	Short-circuit output current	Duration should not exceed one second	V_O = 0 V			–150	mA
			V_O = V_{CC2}			250	mA
| V_{OD1} |	Differential Output Voltage	I_O = 0		1.5		V_{CC2}	V
| V_{OD2} |	Differential Output Voltage	R_L = 54 Ω		1.5	2.5	V_{CC2}	V
V_{TH}	Differential-input high-threshold voltage	V_O = 2.7 V, I_O = –0.4 mA		0.3			V
V_{TL}	Differential-input low-threshold voltage	V_O = 0.5 V, I_O = 8 mA				–0.3	V
R_I	Input resistance			12			kΩ

Note: Differential- input/output voltage is measured at the non-inverting terminals RX+/TX+ with respect to the inverting terminals RX–/TX–.

3.2.1.5 ST 24 – Synchronization Interface

PARAMETER	DESCRIPTION	CONDITIONS		MIN	TYP	MAX	UNIT
V_{SYNC_I}, V_{SYNC_IC}	Voltage at any bus terminal (separately or common mode)			–7		12	V
V_{SYNC_ID}	Differential input voltage	see Note 1				±12	V
V_{SYNC_O}	Output Voltage	I_O = 0		0		V_{CC2}	V
I_{SYNC_O}	Output current	Output disabled; V_O = 12 V				1	mA
I_{SYNC_OH}	High-level output current	TX+, TX–				–60	mA
		RX+, RX–				–400	µA
I_{SYNC_OL}	Low-level output current	TX+, TX–				60	mA
		RX+, RX–				8	mA
I_{SYNC_OS}	Short-circuit output current	Duration should not exceed one second	V_O = 0 V			–150	mA
			V_O = V_{CC2}			250	mA
$\lvert V_{SYNC\_OD1} \rvert$	Differential Output Voltage	I_O = 0		1.5		V_{CC2}	V
$\lvert V_{SYNC\_OD2} \rvert$	Differential Output Voltage	R_L = 54 Ω		1.5	2.5	V_{CC2}	V
V_{SYNC_TH}	Differential-input high-threshold voltage	V_O = 2.7 V, I_O = –0.4 mA		0.3			V
V_{SYNC_TL}	Differential-input low-threshold voltage	V_O = 0.5 V, I_O = 8 mA				–0.3	V
R_{SYNC_I}	Input resistance			12			kΩ

Note: Differential- input/output voltage is measured at the non-inverting terminals RX+/TX+ with respect to the inverting terminals RX–/TX–.

3.2.1.6 ST 33 – Input/Reset

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
V_{RESOH}	Reset- High-Level Output Voltage. ST33 pin 3	I_{OH} = 20 µA Reset/watchdog Circuit inactive (see Note 1 and DTR=V_{DTRL} (RS232 Version)	3.8	4.1	V_{CC2}	V
V_{RESOL}	Reset- Low-Level Output Voltage. ST33 pin 3	I_{OL} = 10 mA Reset/watchdog Circuit active (see Note 2 or DTR=V_{DTRH} (RS232 Version)			0.8	V
V_{RESIL}	Reset- Low-Level Input Voltage. ST33 pin 3				0.8	V
V_{RESIL}	Reset- Low-Level Input Voltage. ST33 pin 3				0.8	V
V_{IN0L}, V_{IN1L}	Low-Level Input Voltage for Input 0 and Input 1				0.8	V
V_{IN0H}, V_{IN1H}	High-Level Input Voltage for Input 0 and Input 1		2.2		V_{CC2} – 0.3	V
I_{IL}	Input Leak current	0 <= VIN <=VCC2	–1		1	µA
t_{RESOL}	Reset- Output Low-Level Pulse duration		10	16		ms
t_{RESIL}	Reset- Input Low-Level Pulse duration		10	16		ms

Note: A reset of the Reset/watchdog circuit is initiated if:

the logic supply voltage (V_{CC2}) is below 4.65 V

the watchdog is not periodically retriggered within 50 ms.

3.2.1.7 ST 32 – Indicator Outputs

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage				10	V
V_{OL}	Low-level output voltage	I_{OL} = 100 mA			1	V
I_{OL}	Low-level output current				290	mA
t_{OK_TRG}	Low-level trigger signal pulse width	see Note 1:	40	50		µs
t_{OK_DELAY}	Delay to the low-to-high transition of the trigger signal	see Note 2:	50	70	90	ms

Notes:

1. The OK_LED (ON) and the OK_LED (OFF) functions of S2000 software library can be used to generate a trigger signal
2. The pulse extension circuit is only added for the OK- signal.

3.2.1.8 ST 31 – RFM RXSS Tuning Inputs

For the electrical characteristics of the RXSA input, please refer to the relevant RFM manual.

3.2.1.9 ST 35/34 – General Purpose I/O 0..3/4..7

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
V_{OL}	Low-level output voltage	I_{OL} = 1.6 mA			0.8	V
V_{OH}	High-level output voltage	I_{OH} = –40 µA	4.2			V
		I_{OH} = –1.6 mA	3.4			
V_{IL}	Low-level input voltage				0.8	V
V_{IH}	High-level input voltage		2.2		V_{CC2} + 0.3	V
I_{LI}	Input Leak current	0 <= VIN <=VCC2	–1		1	µA

Note: For more details please refer to the Data Sheet for the 82C55A CMOS Programmable Peripheral Interface IC. All the I/O lines have a 220 Ω series resistor.

3.2.1.10 ST 36 – Open Collector Outputs

PARAMETER	DESCRIPTION	CONDITIONS	MIN	TYP	MAX	UNIT
V_{CC2}	5 V Output	The total consumption of the two VCC outputs (GEN I/O pin 13 and O.C. – I/O pin 1) must not exceed 500 mA	4.75	5	5.25	V
V_{OH}	High-level output voltage				80	V
V_{OL}	Low-level output voltage	I_{OL} = 500 mA			1.3	V
I_{OL}	Low-level output current				500	mA

Terms & Abbreviations

This Appendix provides a list of the abbreviations and terms used in this manual.

ALPHANUMERIC	Denoting that information contains alphabet characters and numeric characters. For example: A1234C9. A string of alphanumeric data can also contain other printable characters such as punctuation marks.
ANTENNA (Aerial)	The antenna is the part of the system that radiates/receives the RF energy, to and from the transponder
ASCII	American Standard Code for Information Interchange. A computer code consisting of 128 alphanumeric and control characters, each encoded with 7 bits, used for the exchange of information between computer devices
ASCII PROTOCOL	This is a simple protocol that you can use to send ASCII character commands to the reader. It is possible to use a standard terminal emulator program to send ASCII commands. The ASCII full-duplex protocol can only be used with RS232 or RS422.
ASK	Amplitude Shift Keying
BAUD	The rate at which a data channel transfers bits of information. The rate is measured in Bits Per Second (BPS). (This is not an accurate measure of the amount of information that can be transferred in a given time, as the number of bits that are needed for each character and start and stop bits, can vary. A more accurate measure is the Data Transfer Rate.)
BCC	Block Check Character. An error checking character added for data integrity.
BINARY (Bin)	A numbering system in which numbers are expressed as combinations of digits 0 and 1, based on powers of 2. In computing these can be represented electrically as 'on' or 'off'.
BIT	An abbreviation for Binary digit. A single element (0 or 1) in a binary number.
BYTE	Eight bits of data.
CONTROL CHARACTERS	The ASCII character set is made up of all the possible combinations that can be made with 7 bits of information. Many of these bit patterns are mapped against recognizable characters which can be displayed on a screen or printer, whilst others are defined as control characters, whose functions are to control devices such as printers.
CONTROL MODULE	In a modular assembled device, it is the unit that co-ordinates the actions of the other modules and may be responsible for the communication with other external devices.
CORRUPTION	When systems have poor error checking protocols, there exists a possibility that data reported by the reader is not the data transmitted by the transponder. This is defined as corrupted data.

CTL	Control Module
CURRENT LOOP (20 mA)	A communications interface (TTY interface) that allows data to be transmitted over relatively long distances and in noisy environments. Point-to-point connection only.
DATA TRANSFER RATE	The number of characters that can be transferred within a given time.
DC	Direct Current
DIP	Dual In-line Plastic
DUPLEX	Full Duplex (FDX) – A channel capable of transmitting data in both directions at the same time. Half Duplex (HDX) – A channel capable of transmitting data in both directions, but not at the same time.
EEPROM	Electrically Erasable Programmable Read Only Memory
EM	Electro-Magnetic
EMI	Electro-Magnetic Interference
ESD	Electro-Static Discharge. The build-up of electrical potential in humans that can cause damage to electronic modules.
FREQUENCY	The number of times a signal executes a complete excursion through its maximum and minimum values and returns to the same value (cycles). The spectrum can be divided into the following frequency bands:

VLF	Very Low Frequency	3 kHz to 30 kHz
LF	Low Frequency	30 kHz to 300 kHz
MF	Medium Frequency	300 kHz to 3 MHz
HF	High Frequency	3 MHz to 30 MHz
VHF	Very High Frequency	30 MHz to 300 MHz
UHF	Ultra High frequency	300 MHz to 3 GHz

g	Gram
HALF DUPLEX (HDX)	A channel capable of transmitting data in both directions, but not at the same time.
HANDS FREE	A situation where no deliberate presentation of the transponder is required to initiate an identification. Although this is an application specific issue, it is generally considered that a reading range greater than one meter is required for effective implementation. (See Proximity)
HOST COMPUTER	The computer that controls other devices. In the case of one or more units on a single network, this computer is the master.
Hz	Hertz
IC	Integrated Circuit
INTERFACE	An electrical or physical standard for the interconnection of devices. Some common interfaces are: CURRENT LOOP (20 mA) RS232 RS422 RS485

INTERFERENCE	Unwanted electrical signals found in the operating environment of RFID equipment that interfere with the transponder or readers normal operation. The effect of interference can be seen in reduced system performance.
INTERROGATOR	See 'Reader'
I/O	Input/output
k	Kilo
LED	Light Emitting Diode
LF	Low frequency
mA	Milliampere
MASTER	In many communications protocols, problems with collisions or corruption of data might occur if all devices connected together communicated at the same time. One way in which this potential problem is overcome, is to define one device as the Master and all other connected devices as slaves. Only the Master can initiate communications and no Slave is allowed to communicated unless instructed to do so.
mm	Millimeter
ms	Millisecond
NOISE	Unwanted ambient electrical signals found in the operating environment of RFID equipment (see also Interference).
PARITY	A technique used to detect data transmission errors by adding an extra bit to each character. This bit is set to 1 or 0 to make the total number of bits ODD or EVEN, depending on the type of parity in use.
PC	Personal Computer
PCB	Printed Circuit Board
PROTOCOL	A set of rules governing the flow of information in a communications system.
PROXIMITY	Generally denotes applications where some deliberate action is required to initiate transponder identification (see also Hands Free).
RAM	Random Access Memory
RA-RFM	Remote Antenna Radio Frequency Module
RANGE	The maximum distance between the antenna and a transponder in a radio frequency system at which the signals can be properly received, either for reading the data encoded in the transponder or for re-programming. This distance may be affected by environmental conditions.
READER (Interrogator)	In an RF system, the device containing the digital electronics which triggers the transponder to respond, and extracts and validates the information from the transponder's modulated RF response. It may also pass the data on to a controlling process such as a host computer.
RF	Radio Frequency
RFM	Radio Frequency Module: contains all the analogue functions of a TIRIS reading unit that are needed to initialize a TIRIS transponder and to detect its return signal.
RF MODULE/STAGE	The part of a reader/interrogator that creates the RF signals.

RS232	A common physical interface standard specified by the EIA for the interconnection of devices. The standard allows for a single device to be connected (point-to-point) at baud rates up to 9600 bps, at distances up to 15 meters. More recent implementations of the standard may allow higher baud rates and greater distances.
RS422	A balanced interface standard similar to RS232, but using differential voltages across twisted pair cables. More noise immune that RS232 and can be used to connect single or multiple devices to a master unit, at distances up to 3000 meters.
RS485	An enhanced version of RS422, which permits multiple devices (commonly 32) to be attached to a two wire bus at distances of over a kilometer.
Rx	Receive (usually referring to an input or output line).
RXSS	Receive Signal Sensitivity Level
SLAVE	Some communications use a Master/Slave protocol. Only the Master unit is allowed to initiate communications and Slave devices are not allowed to respond unless instructed.
SYNCHRONIZATION	A mechanism that allows multiple readers to operate in close proximity by synchronisation of their transmissions.
TAG	Transponder (see RF Tag).
TBP	TIRIS Bus Protocol
TI	Texas Instruments Incorporated
TIRIS	Texas Instruments Registration and Identification System
TIRIS BUS PROTOCOL	This is a binary protocol suitable for communication between a controlling device and one or more readers. For example with a single reader using an RS232 interface or up to 31 readers using RS422/485. The TIRIS Bus protocol (half-duplex) can be used with RS232 or RS422/485.
TRANSPONDER	An electronic TRANSmitter/resPONDER which is attached to the object to be identified and, when appropriate signals are received, transmits information as radio signals to a reader. Sometimes referred to as a Tag.
Tx	Transmit (usually referring to an input or output line).
V	Volt
VSL	Supply Logic

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