



Hi-G-Tek Ltd. *Microelectronics and Asset Tracking Technology*

DataReader and DataSeal System

User's Manual

Table of Contents

Page

1. Introduction	15
1.1. About the Product	16
1.2. DataReader System Components	19
1.2.1. DataSeal Mounting Fixture	19
1.2.2. The DataSeal	19
1.2.3. Seal Wire	20
1.2.4. Outdoor DataReader	20
1.2.5. Indoor DataReader	22
2. DataSeal Installation	25
2.1. DataSeal Installation	26
3. DataReader Installation	29
3.1 Outdoor DataReader Installation	30
3.1.1 Connecting the Outdoor Unit	30
3.1.2 Ceiling Installation	31
3.1.3 Wiring the Outdoor Datareader	32
3.1.4 DataReader Configuration switches	33
3.1.5 RS232 Wiring Diagram	33
3.1.5 RS-485 Full Duplex Wiring Diagram ...	34
3.1.6 RS-485 Half Duplex Wiring Diagram...	34
3.2 Indoor DataReader Installation	36
3.2.1 Connecting the Indoor Unit	37
3.2.2 Ceiling Installation	38
3.2.3 Wiring the Indoor DataReader	39
3.2.4 RS-232 Wiring Diagram	39
3.2.5 RS-485 Full Duplex Wiring Diagram ...	40
3.2.6 RS-485 Half Duplex Wiring Diagram...	41
3.3 Chaining DataReaders Together	43
3.4 RS-232/RS-485 Adapter	
3.4.1 Connecting the RS-232/RS-485 Adapter to the First Reader	43
3.4.2. Connecting the RS-232/RS-485 Adapter to the Host	44

<u>Table of Contents</u>	<u>Page</u>
3.5. Power Supply Requirements	44
3.6. Communication Cable Selection	45
3.7. Installation notes	46
4. DataReader Operation Instructions	47
5. The System	49
5.1. System Description	50
5.1.1. General	50
5.2. System Parameters	57
5.2.1. Seal's Parameters	57
5.2.2. Reader's Parameters	63
5.2.3. Calculating Thw	66
5.2.4. Calculating Tw	66
5.2.5. Calculating Thp	67
5.3. Parameters Format	68
5.3.1. Date & Time	68
5.3.2. Seal Serial Number	69
5.3.3. ORG_ID & Department	70
5.3.4. System	70
5.3.5. Mode	70
5.4. Seal Modes of Operations	71
5.4.1. Normal Mode	71
5.4.2. Sleep Mode	72
5.4.3. Alert Burst Mode	72
5.4.4. Events Footprint Mode	72
5.5. Reader Modes of Operation	73
5.5.1. Carrier Sense Collision	73
5.5.2. Unsynchronized Mode	73
5.6. System Commands	74
5.6.1. LSC and Reader Messages	74
5.6.2. Error Codes	76
5.6.3. Detailed Commands	76

<u>Table of Contents</u>	<u>Page</u>
5.6.3.1. Wakeup	76
5.6.3.1.1. Command Transmission	76
5.6.3.2. Execute RF Command	77
5.6.3.2.1. Command Transmission	77
5.6.3.2.2. Verify.....	77
5.6.3.2.3. Tamper	79
5.6.3.2.4. Set	79
5.6.3.2.5. Suspended Set....	80
5.6.3.2.6. Soft Set	80
5.6.3.2.7. Deep Sleep	81
5.6.3.2.8. Hard Wakeup.....	81
5.6.3.2.9. Start Alert Burst Mode.....	81
5.6.3.2.10. Stop Alert Burst Mode.....	82
5.6.3.2.11. Ack Alert Burst Mode	82
5.6.3.2.12. Read Data	83
5.6.3.2.13. Write Data	83
5.6.3.2.14. Reset Data.....	83
5.6.3.2.15. Set/Reset Status	84
5.6.3.2.16. Write Parameters	84
5.6.3.2.17. Read Parameters	84
5.6.3.2.18. Addressed Verify	85
5.6.3.2.19. Read Events	85
5.6.3.3. Get Results	85
5.6.3.4. Get Status	86
5.6.3.5. Get Burst Message	89
5.6.3.6. Reset Reader	91
5.6.3.7. Write Parameters	92

Table of Contents**Page**

5.6.3.8. Read Parameters	93
5.6.3.9. BIT	94
5.6.3.10. Sleep	95
5.6.3.11. Unsynchronized Reader Message	95
5.6.3.12. Get Reader's Baud Rate....	96
5.6.3.13. Set Reader's Baud Rate....	96
5.6.3.14. Set Reader's Address	97
5.6.3.15. Acknowledge OK	98
5.6.3.16. Acknowledge Failed.....	98
5.6.3.17. Save Command	98
5.6.3.18. Execute Saved Command	100
5.6.3.19. Reader Channels Definitions Command.....	101
5.7. System Planning	103
5.7.1. Electromagnetic Environment	103
5.7.2. System Layout	104
5.7.2.1. Radio Frequency Communication Layout.....	104
5.7.2.2. Cellular Layout	105
5.7.2.3. Reader Sessions Retransmissions	106
5.7.2.4. Line Communications RS-485 Layout	106

Table of Contents

Page

5.8. System Segregation	107
5.8.1. Company Segregation by ORG_ID	107
5.8.2. Department Isolation	107
5.8.3. Common Services to Several Companies by a Service Provider	108
5.8.4. How to use subgroups of Seals in a Company	108
5.8.5. ORG_ID, Global and ADI: Impact on Seal's Response	109
5.9. Seal Memory	109
5.9.1. Events Memory	109
5.9.2. User Data	111
5.10. Calculating Reader Session Duration	112
5.10.1. Calculating Tbm	113
5.10.2. Calculating Trw	113
6. RS-485/232 Communication Protocol	115
6.1. RS-485/232 Communication Protocol: General Description	116
6.2. Physical Layer	116
6.2.1. Down Link	116
6.2.2. Up-Link	116
6.3. Protocol Flow	116
6.4. String Format	119
6.4.1. LSC to READERS Messages	119
6.4.1.1. CRC Calculation	119
6.4.1.2. CMND Field Structure	120

<u>Table of Contents</u>	<u>Page</u>
6.4.2. READER to LSC Messages	121
6.4.2.2. R_Status Field Structure.....	123
6.4.2.3. Reader Messages Packed Data Format	126
6.4.2.3.1. Packed Data from the LSC.....	126
6.4.2.3.2. Packed Data from the READER.....	126
6.5. LSC and READER Messages.....	127
6.5.1. LSC Commands and Acknowledge Table	127
6.5.2. Message Table.....	128
6.5.3. Parameter Table	129
6.5.3.1. Reader Master Firmware	130
Vresion MVER	
6.5.3.2. Reader Slave1 Firmware.....	130
Version SVER1.	
6.5.3.3. Reader Slave1 Firmware.....	130
Version SVER2	
Reader Receives Signal 6.5.3.4. Strength RSSI1	131
6.5.3.5. Reader ID RID	131
6.5.3.6. Group Access Identifier ADI	132
Organization identifier OrgID6.5.3.7. ..	132
6.5.3.8. Department DEP	132
6.5.3.9. Reader IH length Thw	133
6.5.3.10. Reader Address RADD	133
6.5.3.11. Mode MODE	133

Table of Contents

Page

6.5.4. Error Codes	134
6.5.5. Detailed Commands	135
6.5.5.1. Wakeup	135
6.5.5.1.1. Command Transmission	135
6.5.5.1.2 Wakeup Response....	135
6.5.5.2. Execute RF Command	135
6.5.5.2.1. Command Transmission	135
6.5.5.2.2. Execute RF Command Ack	136
6.5.5.2.3. Verify	137
6.5.5.2.4. Tamper	138
6.5.5.2.5. Set	138
6.5.5.2.6. Suspended Set	139
6.5.5.2.7. Soft Set	139
6.5.5.2.8. Deep Sleep	140
6.5.5.2.9. Hard Wakeup	140
6.5.5.2.10. Start Alert Burst Mode	140
6.5.5.2.11. Stop Alert Burst Mode	141
6.5.5.2.12. Acknowledge Alert Burst Mode.....	141
6.5.5.2.13. Read Data	141
6.5.5.2.14. Write Data	142
6.5.5.2.15. Reset Data	142
6.5.5.2.16. Set/Reset Status	142
6.5.5.2.17. Write Parameters	143
6.5.5.2.18. Read Parameters	143
6.5.5.2.19. Addressed Verify	143
6.5.5.2.20. Read Events	143

Table of Contents**Page**

6.5.5.3. Get Results	144
6.5.5.3.1. Command Transmission.....	144
6.5.5.3.2. Get Results Command General Response	144
6.5.5.3.3. Get Results Command Response for Verify Command	146
6.5.5.3.4. Get Results Command Response for Tamper Command	147
6.5.5.3.5. Get Results Command Response for Set Command	147
6.5.5.3.6. Get Results Command Response for Suspended Set Command	147
6.5.5.3.7. Get Results Command Response for Soft Set Command	147
6.5.5.3.8. Get Results Command Response for Read Data Command	147
6.5.5.3.9. Get Results Command Response for Write Data Command	148
6.5.5.3.10. Get Results Command Response for Deep Sleep Command	148
6.5.5.3.11. Get Results Command Response for Hard Wakeup Command	148

Table of Contents

Page

6.5.5.3.12. Get Results Command Response for Reset Data Command	149
6.5.5.3.13. Get Results Command Response for Start Alert Burst Mode Command..	149
6.5.5.3.14. Get Results Command Response for Stop Alert Burst Mode Command..	149
6.5.5.3.15. Get Results Command Response for Start Alert Burst Mode Command..	150
6.5.5.3.16. Get Results Command Response for Write Parameters Command..	150
6.5.5.3.17. Get Results Command Response for Read Parameters Command..	150
6.5.5.3.18. Get Results Command Response for Addressed Verify Command	151
6.5.5.3.19. Get Results Command Response for Read Events Command	151
6.5.5.4. Get Status	153
6.5.5.5. Get Burst Message	153
6.5.5.6. Reset Reader	155
6.5.5.7. Write Parameters	156
6.5.5.8. Read Parameters	157
6.5.5.9. BIT	158
6.5.5.10. Sleep	158

Table of Contents

Page

6.5.5.11. Unsynchronized Reader Message.	159
6.5.5.12. Get Reader's Baud Rate	160
6.5.5.13. Set Reader's Baud Rate	160
6.5.5.14. Set Reader's Address.....	161
6.5.5.15. Acknowledge OK	162
6.5.5.16. Acknowledge Failed	162
6.5.5.17. Save Command	162
6.5.5.18. Execute Saved Command	163
6.5.5.19. Read Channel Definitions Command	164
6.5.5.20. Write Channel Definitions Command	165
7. Evaluation Software	167
7.1. Software Installation	168
7.2. Communication Setup- Readers Administration	168
7.2.1 Defining the Readers Connected	168
7.2.2 Setting up the Communication Channel	169
7.3. Readers Setup	170
7.3.1 MCU Setup	170
7.3.2 RF Modem Setup	170
7.4. Built-In Test	171
7.5. Login-Password Setup. Password Change	172

Table of Contents

Page

7.6. Download DataReader	
Software Utility	174
7.6.1 MCU Software Update	174
7.6.2 RF Modem Software	
Update.....	175
7.7. Performing Verify and Set cycles	176
7.7.1 Selecting the Reader.	176
7.7.2 Broadcast Sessions.	176
7.7.2.1 Setting Session's	
Parameters.	177
7.7.2.2 ADI Definition.	179
7.7.2.3 Reader Session	179
7.7.2.4. Single Session	179
7.7.2.5 Multiple Sessions	180
7.7.2.6 Reading the Results	181
7.7.3 Addressed Verify	
Sessions	182
7.7.3.1 Single Session	182
7.7.3.2 Multiple	
Sessions	183
7.7.3.3 Reading the	
Results	185
7.7.4 SET Sessions	186

Table of Contents**Page**

7.8. Performing General Commands Cycles.	187
7.8.1 Selecting a Reader.	187
7.8.2 Selecting a Command	188
7.8.3 Defining Seals	188
7.8.4 Setting the System Session Duration	189
7.8.5 Setting the Command Parameters.	189
7.8.6 Single or Continuous Sessions.	190
7.8.7 Commands.	191
7.8.7.1 Verify Command	191
7.8.7.2 Tamper Command	193
7.8.7.3 Addressed Verify	193
7.8.7.4 Set	194
7.8.7.5 Soft Set	195
7.8.7.6 Suspended Set	196
7.8.7.7 Read Data	197
7.8.7.8 Write Data	198
7.8.7.9 Read Parameter	199
7.8.7.10 Write Parameter	200
7.8.7.11 Reset Data	200
7.8.7.12 Deep Sleep	201
7.8.7.13 Hard Wakeup	201
7.8.7.14 Start Alert Burst	202
7.8.7.15 Start Alert Burst (all)	203
7.8.7.16 Stop Alert Burst	204
7.8.7.17 Stop Alert Burst (all)	204
7.8.7.18 Ack Alert	205
7.8.7.19. Read Events	206

<u>Table of Contents</u>	<u>Page</u>
8. Troubleshooting	207
8.1. DataReader Troubleshooting	208
8.2. Evaluation System Troubleshooting	208
9. Technical Specifications	211
9.1. 24v Outdoor DataReader	212
9.2. 12v Outdoor DataReader	213
9.3. 48v Outdoor DataReader	213
9.4. 24v Indoor DataReader	214
9.5. 12v Indoor DataReader	215
9.6. 48v Indoor DataReader	215
9.7. DataSeal	216
9.8. Magnetic DataSeal	217
10. Index	219

Chapter 1

Introduction

1.1. About the Product

Thank you for choosing Hi-G-Tek quality products.

The Hi-G-Tek range of products provides a highly reliable and secure cargo and asset monitoring system utilising state-of-the-art RFID technologies.

Cost-effective, more reliable and more secure than their mechanical counterparts, the Hi-G-Tek product range will constantly monitor your assets and alert you to any potential problems at all times.

The Hi-G-Tek system was developed in order to fill the requirement for fast, automatic processing of secured cargoes and to provide real time monitoring and improved management of cargoes both in transit and in storage.

The reusable electronic seal automates the processing of secured cargoes enabling the organization to effectively and economically process the increasing numbers of containers' traffic in the ports and between inland destinations.

The DataSeal is a sophisticated device, which includes a transmitter/ receiver unit, real-time clock, processor, memory and sensing circuitry for sealing verification. The Sealing Wire prevents any attempt of opening, bypassing or tampering with the seal without alerting the system and recording of the event. The system combines the technological and operational advantages of both low frequency close-range data management AND high frequency long range sealing verification and automatic data collection.

DataSeal's ability to log data and communicate it through a Handheld DataTerminal is best used In low frequency/short range applications. This way the electronic manifest of the sealed cargo can be written into the DataSeal's memory. The information includes Vehicle ID, container and invoice numbers, cargo description, quantities, destination, etc. Capable of logging up to 55 events, the information can be downloaded into a computerised database for storage and processing.

When used in high frequency/long range applications, the **DataSeal** is capable of communicating its ID and status to a distance of up to 30 meters. The **DataSeal** transmits the information in reply to an interrogation by the **DataReader**. The ability of the **DataSeal** to communicate with the **DataReader** at long range enables the use of the **DataSeal** in applications such as: tracking and sealing verification of containers in transit, protection of containers in storage, remote, automatic data collection from secured cargoes as they pass through check points, etc.

The handheld **DataTerminal** is used for writing information into the **DataSeal's** memory at the departure point and retrieving the information at the destination. Events, logged in the **DataSeal's** memory are also downloaded into the **DataTerminal** for later office use.

The **DataReader** is used in long range applications to interrogate the **DataSeals** over the high frequency channel for their ID and Status. The **DataReader** is also used for writing information into the **DataSeal** and retrieving logged information from the **DataSeal**. Each **DataReader** can communicate with numerous **DataSeals** simultaneously and verify their presence and status. The **DataReaders** can be chained to allow coverage and protection for secured cargoes in large storage yards and ports. The **DataReader** has an optional communication modem which allows the system to transmit the collected information through available communication channels to the Control Center. The **DataReader** is available in both outdoor and indoor models.

A set of **Mounting Fixtures** has been developed for the **DataSeal** system which allow convenient mounting and removal of the **DataSeal** whenever required. The various **Mounting Fixtures** differ in the level of protection they provide to the DataSeal as may be required in various environments.

This User's manual includes all the information required for installing and operating Hi-G-Tek Electronic Seals and DataTerminals.

Software License Agreement

Information in this document is subject to change without notice and does not represent a commitment on the part of the manufacturer. The software described in this document is furnished under license agreement or nondisclosure agreement. It is against the law to copy the software on any medium except as specifically allowed in the license or nondisclosure agreement. The purchaser may make one copy of the software for backup purposes. No part of this manual may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or information storage and retrieval, for any purpose other than for the purchaser's personal use, without written permission.

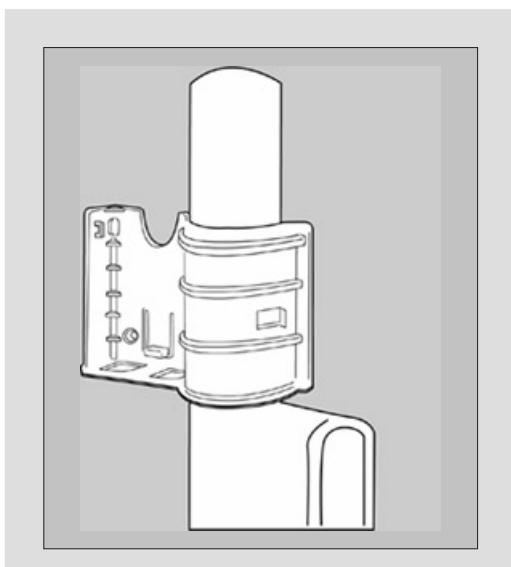
© Copyright 2001 Hi-G-Tek Ltd.
All rights reserved.

DataSeal[™] is a trademark of TydenTek.
Pentium[™] is a trademark of Intel Corporation.

1.2. System Components

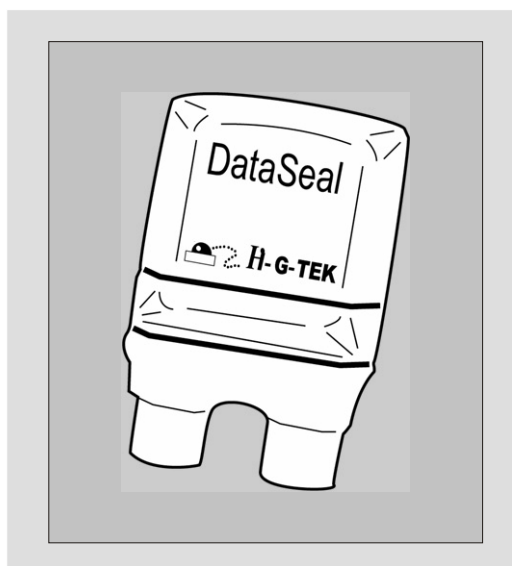
1.2.1. The Mounting Fixture

The DataSeal Mounting Fixture is used to mount the DataSeal on the container's keeper bar or other surface.



1.2.2. The Seal

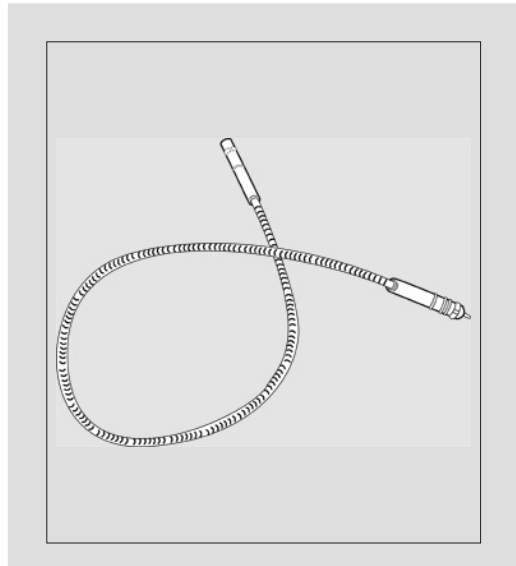
The DataSeal unit contains the DataSeal electronics, a battery, a transceiver, a processor and memory to record and store the events and the relevant information about the cargo.



1.2.3. Seal Wire

The DataSeal Wire serves to seal the cargo.

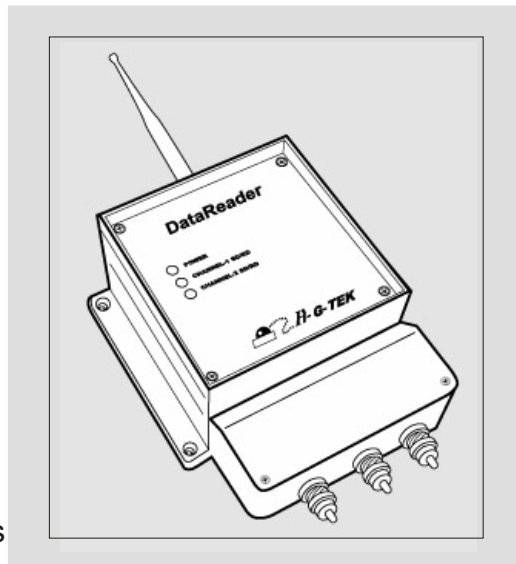
Any tampering with the DataSeal Wire at any point during transport is recorded and reported at once.



1.2.4. Outdoor DataReader

The Hi-G-Tek DataSeal System uses state-of-the-art technology to secure and monitor secured cargoes in storage and during transport.

The DataReader is comprised of two compartments. The upper compartment is the heart of the unit and contains the DataReader's electronics section. The lower compartment contains the terminal glands which connect the unit to the networking cable.



1

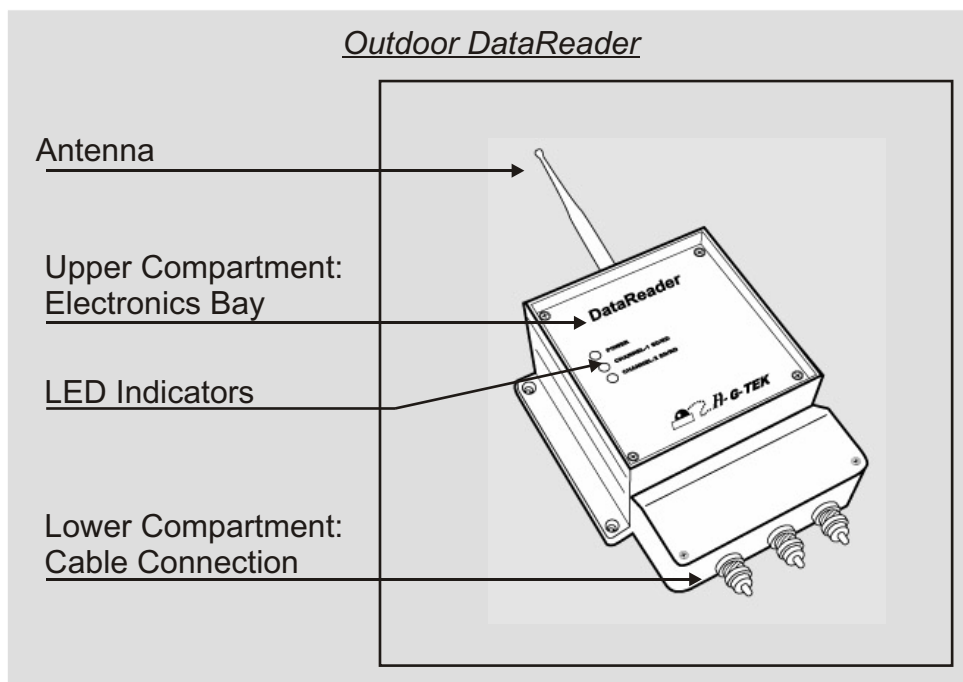
Introduction

The DataReader may be used in both stationary and mobile configurations.

In the stationary configuration, the unit is mounted on a flat stationary surface such as a wall or pole. A typical installation of this configuration is at the point of exit from ports, customs terminals, warehouses, etc. This operation mode allows monitoring of the seal at predetermined sites and checkpoints.

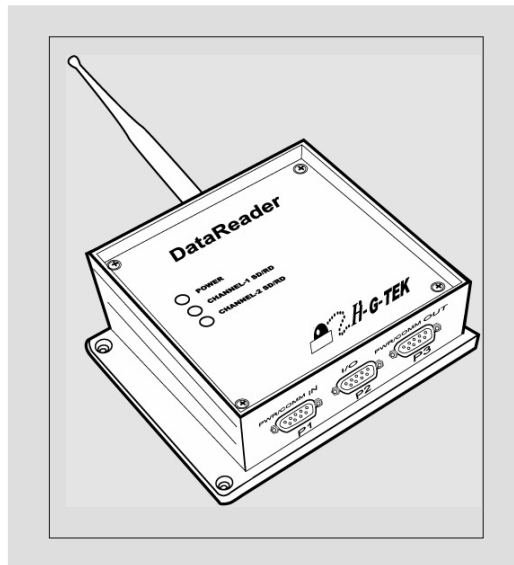
In the mobile configuration, the unit is mounted in the truck cabin. The DataReader monitors the seal during the entire journey, and reports its status via the vehicle's communication system to the control center in real-time.

The DataReader is mastered by a host computer. Once installed, the unit waits for commands coming from the host computer.



1.2.5. Indoor DataReader

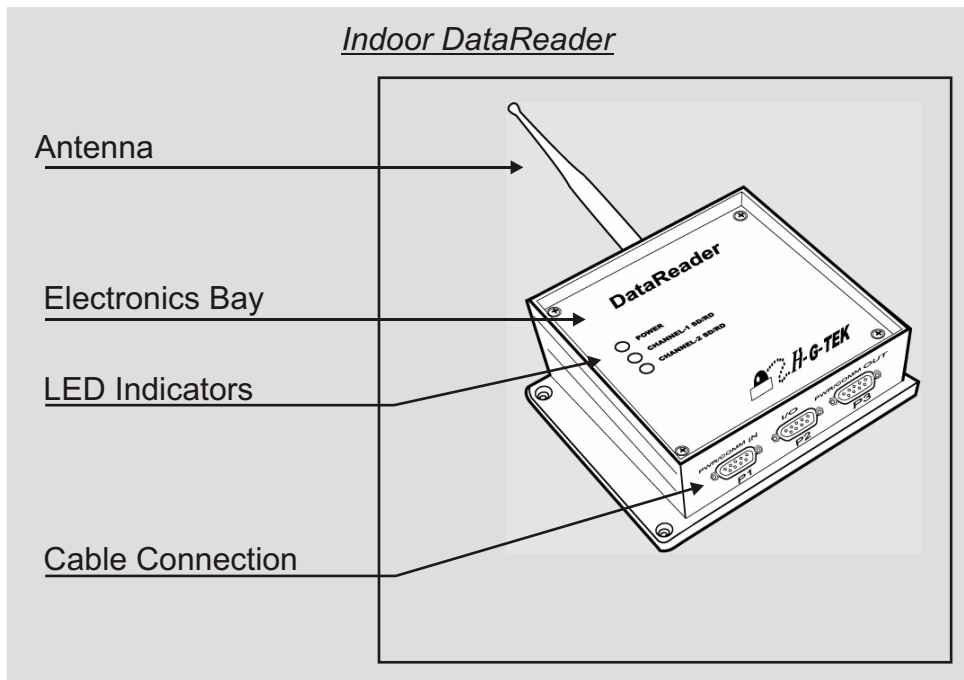
Similar to the outdoor version, the indoor **DataReader** uses state-of-the-art technology to secure and monitor secured cargoes in an indoor environment.



The Indoor DataReader may be used in stationary configuration only.

In the stationary configuration, the unit is mounted on a flat surface such as a wall or pole. A typical installation of this configuration is at the point of exit from ports, customs terminals, warehouses, etc. This operation mode allows monitoring of the seal at predetermined sites and checkpoints.

The DataReader is mastered by a host computer. Once installed, the unit waits for commands coming from the host computer.



Chapter 2

DataSeal Installation

2

DataSeal Installation

2.1 DataSeal Installation

step 1.

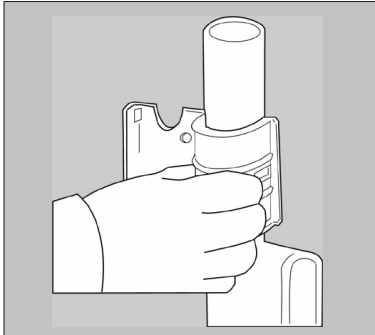


Fig. 1

To install the DataSeal Mounting Fixture, attach the fixture to the keeper bar at the back of the container (fig.1). A click indicates that the fixture is in place.

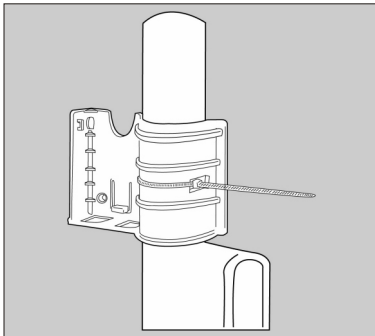


Fig. 2

The two side slots may be used to secure the mounting fixture to the container, using a 3-5mm width by 180-250 mm length plastic strap (fig 2).

step 2.

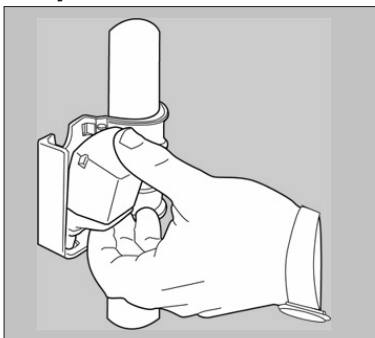


Fig. 3

To install the DataSeal, hold the unit at a 45° angle as illustrated and snap it into place in its cradle on the DataSeal Mounting Fixture. (fig. 3)

2

DataSeal Installation

step 3.

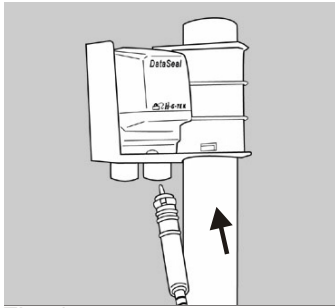


Fig. 4

To connect the DataSeal Wire, simply attach one end of the seal wire connectors to either of the sockets at the base of the DataSeal (fig 4).

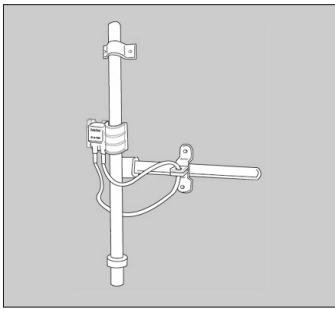


Fig. 5

Loop the wire through the container locking ring and the keeper bar, then insert the end into the other socket (fig. 5).

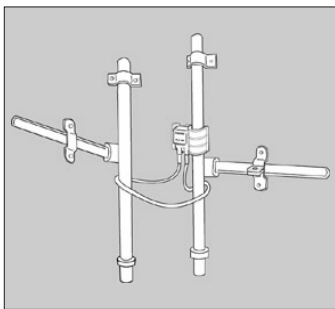


Fig. 6

Alternatively, you may loop the wire through both keeper bars then insert the end into the other socket (fig. 6).

FCC ID: OB6-IGRS40916

This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference that may cause undesired operation.

Chapter 3

DataReader Installation

3

DataReader Installation

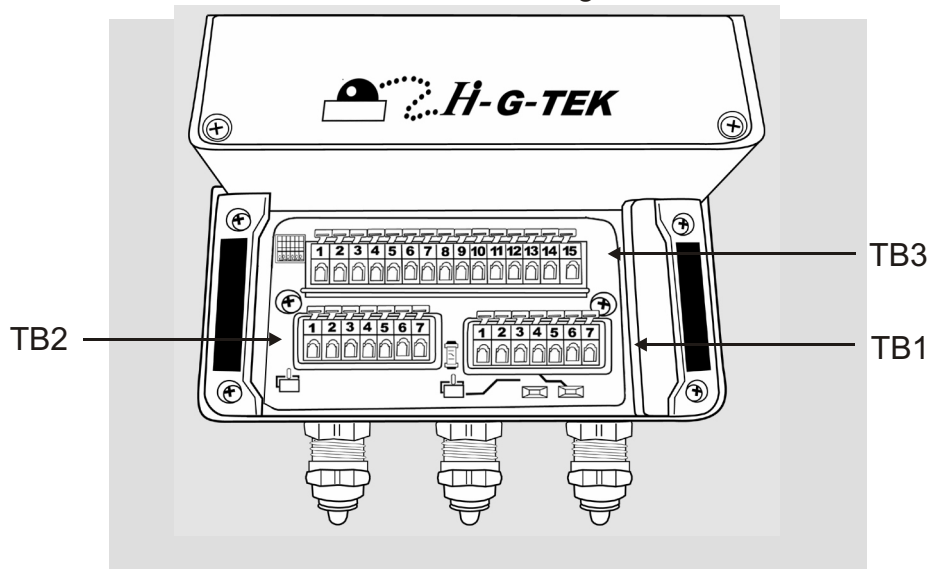
3.1 Outdoor DataReader Installation

- ◆ The DataReader should be mounted on a smooth, flat surface.
- ◆ To mount the unit, insert 4 screws into the slots on the unit and fix to the surface.
A 6mm plastic anchor and 35mm pan head tapping screw is recommended.

3.1.1. Connecting the Outdoor Unit

- * **Note:** *The electronics compartment panel should only be opened by an authorised repair person. Unauthorized use may result in loss of warranty.*

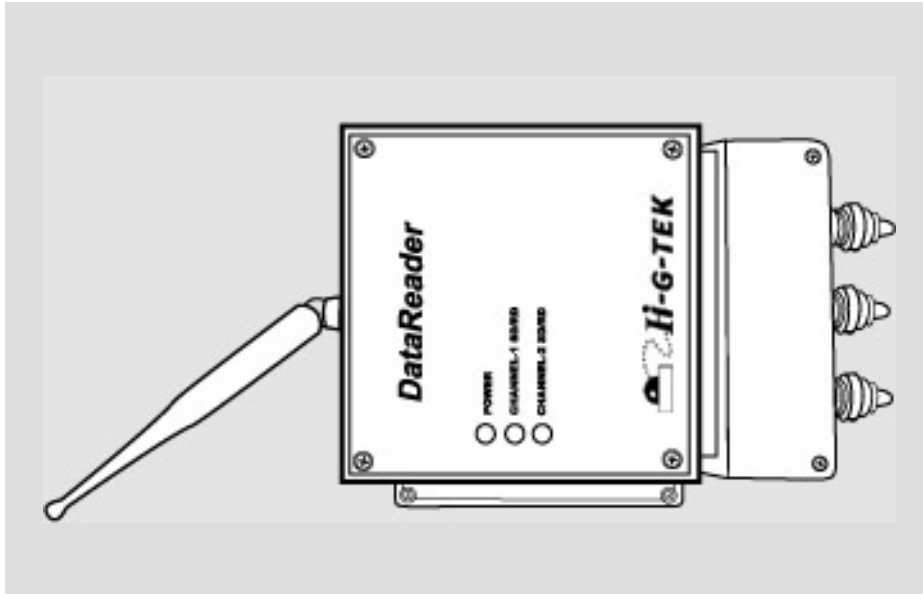
- ◆ Remove the cover on the **bottom portion** of the DataReader unit cover by removing the screws holding it in place.
- ◆ Remove the covers from the glands being used.
- ◆ Expose the wires in the cable and insert them into the terminal blocks. Use a small screwdriver to push the wires in. Ensure wires are inserted in the slots in accordance with the color scheme. See section 3.4. of this manual for wiring information.



3

DataReader Installation

3.1.2 Ceiling Installation



DataReader Ceiling Unit. Antenna is perpendicular to ceiling.

- ◆ The DataReader can be mounted on the ceiling.
In such cases it is requested to mount the antenna perpendicular to the ceiling using a 90° connector.

3

DataReader Installation

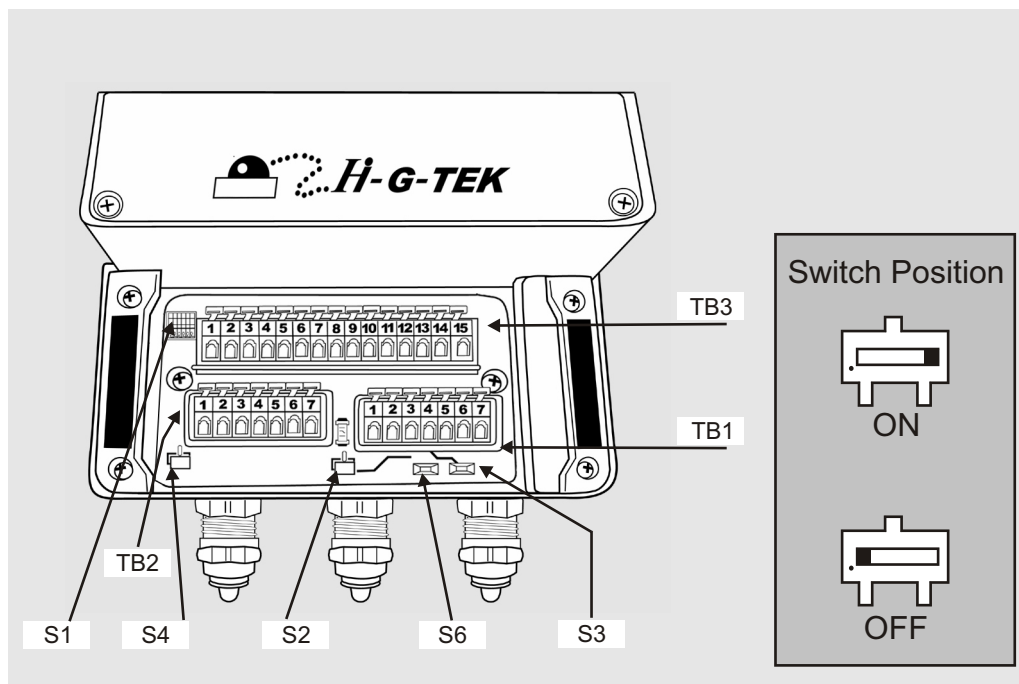
3.1.3 Wiring the Outdoor DataReader

The DataReader may be connected to the network via three types of serial communication:

- RS485 Full Duplex1.
- RS485 Half duplex.2.
- RS232 (different model number)3.

According to the DataReader model in use, the serial connection can be either RS232 or RS485 (see Technical Specifications).

When the reader is connected using RS485, it can be set by the user to full duplex mode or half duplex mode by altering the switch configuration. For further information see sections 3.1.4.-3.1.6.



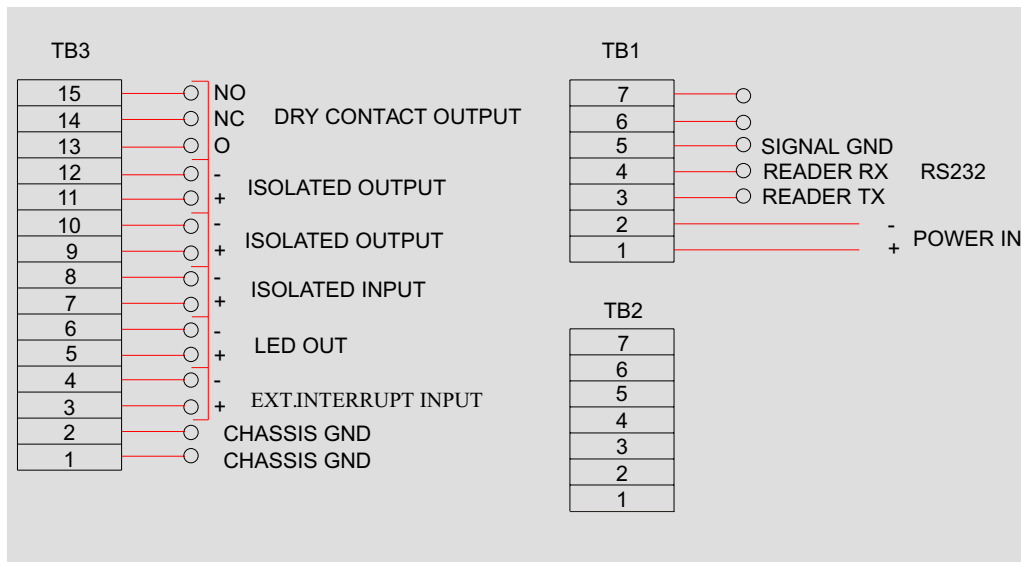
3

DataReader Installation

3.1.4 DataReader Configuration Switches

- S1: Reader configuration setup switch; Future use.
Default position: OFF.
- S2: Termination ON/OFF switch.
While ON, connects an internal 120 Ohm termination resistor to the RS485 chain.
Default position: OFF
- S3, S6: Full/Half duplex switches.
While OFF: Full duplex mode is set
While ON: Half duplex mode is set
Default position: OFF
- S4: Reader shut-down switch.
While OFF: Reader is active
While ON: Reader is not powered
Default position: OFF

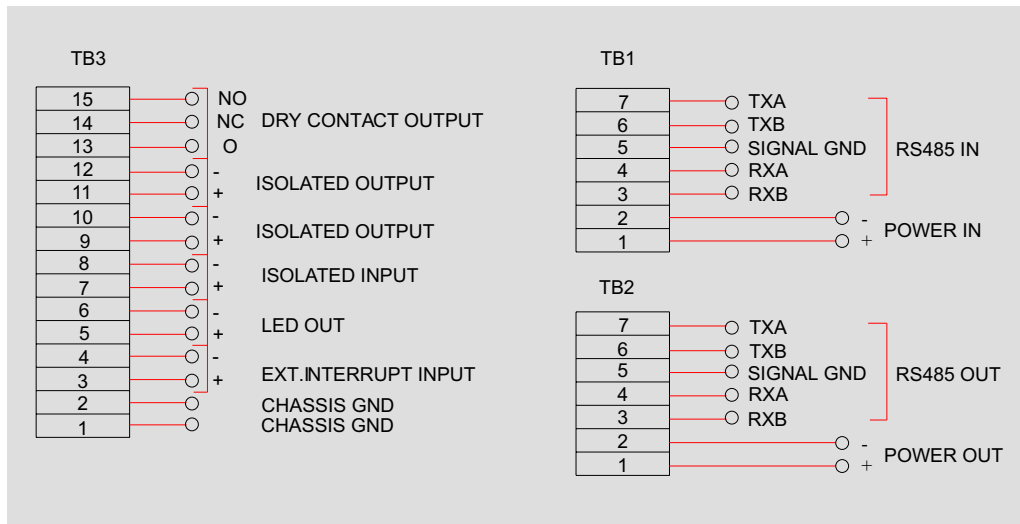
3.1.5. RS-232 Wiring Diagram



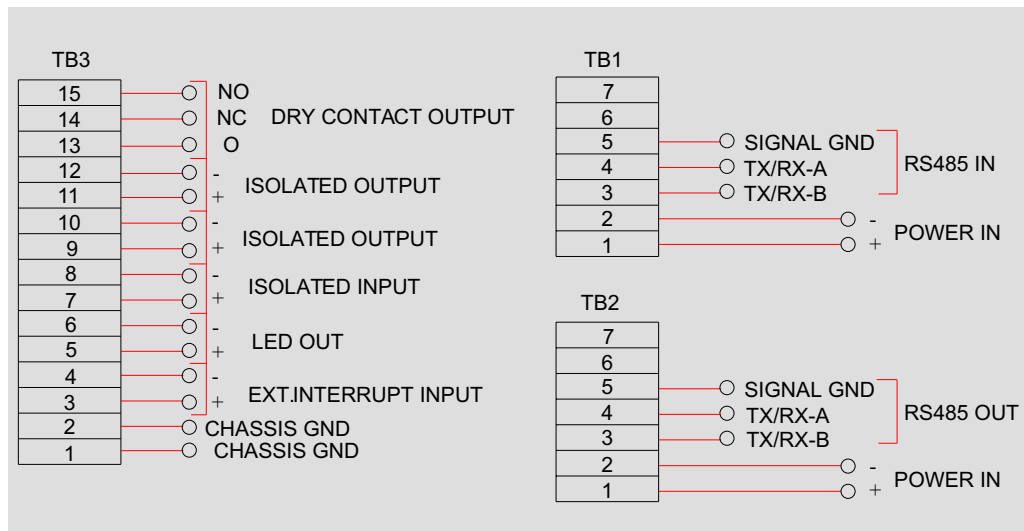
3

DataReader Installation

3.1.6. RS-485 FullDuplex Wiring Diagram



3.1.7. RS-485 Half Duplex Wiring Diagram

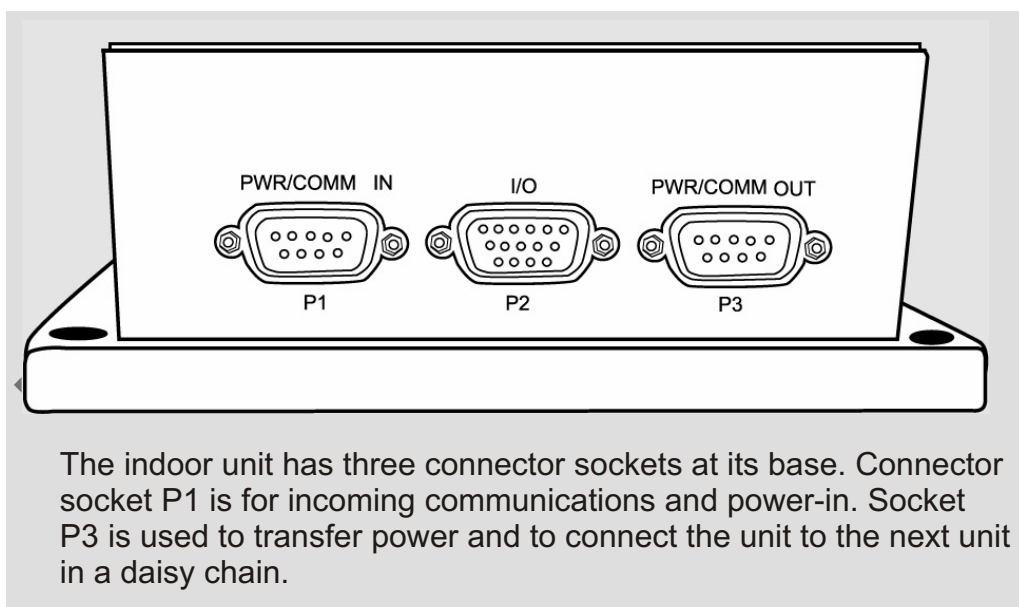


3.2. Indoor DataReader Installation

- ◆ The DataReader should be mounted on a smooth, flat surface.
- ◆ To mount the unit, insert 4 screws into the slots on the unit and fix to the surface.
A 6mm plastic anchor and 35mm pan head tapping screw is recommended.

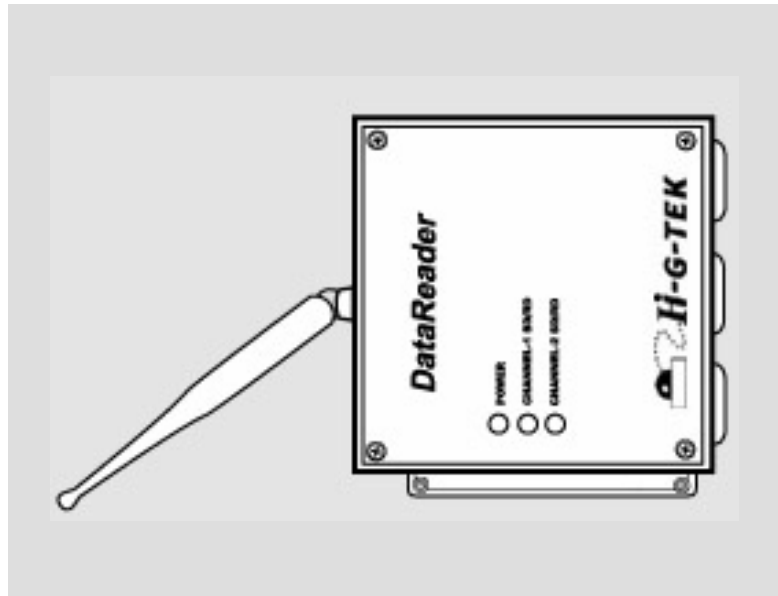
3.2.1. Connecting the Indoor Unit

*** Note: The electronics compartment panel should only be opened by an authorized repair person. Unauthorized use may result in loss of warranty.**



The indoor unit has three connector sockets at its base. Connector socket P1 is for incoming communications and power-in. Socket P3 is used to transfer power and to connect the unit to the next unit in a daisy chain.

3.2.2 Ceiling Installation



DataReader Ceiling Unit. Antenna is perpendicular to ceiling.

- ◆ The DataReader can be mounted on the ceiling.
In such cases it is requested to mount the antenna perpendicular to the ceiling using a 90° connector.

3

DataReader Installation

3.2.3 Wiring the Indoor DataReader

The DataReader may be connected to the network via three types of serial communication:

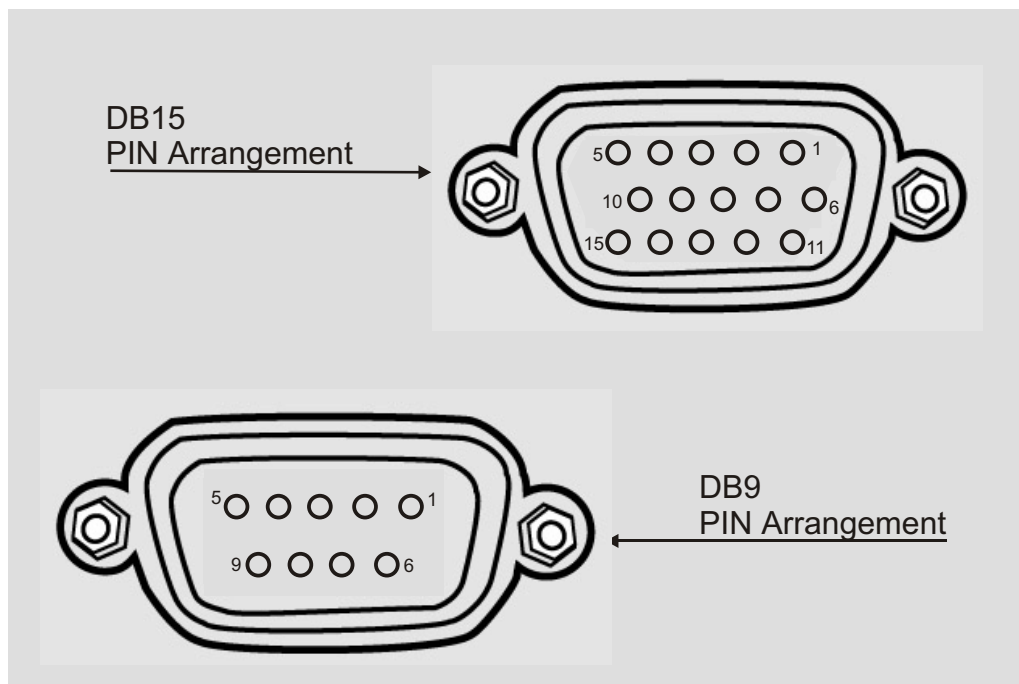
RS485 Full Duplex¹.

RS485 Half duplex².

RS232³.

Each of the above is a different model number.

According to the DataReader model in use, the serial connection can be either RS232 or RS485 (see Technical Specifications). The RS485 connector is always optically isolated.



3.2.4. RS-232 Wiring Diagram

Pin assignment for PWR/COM IN & PWR/COM OUT

Function	Pin Number
Positive Power	1
Positive Power	2
Signal GND	3
Negative Power	4
Negative Power	5
TX	6
RX	7

3.2.5. RS-485 FullDuplex Wiring Diagram

Pin assignment for PWR/COM IN & PWR/COM OUT

Function	Pin Number
Positive Power	1
Positive Power	2
Signal GND	3
Negative Power	4
Negative Power	5
RX-A	6
RX-B	7
TX-A	8
TX-B	9

3.2.6. RS-485 Half Duplex Wiring Diagram

Pin assignment for PWR/COM IN & PWR/COM OUT

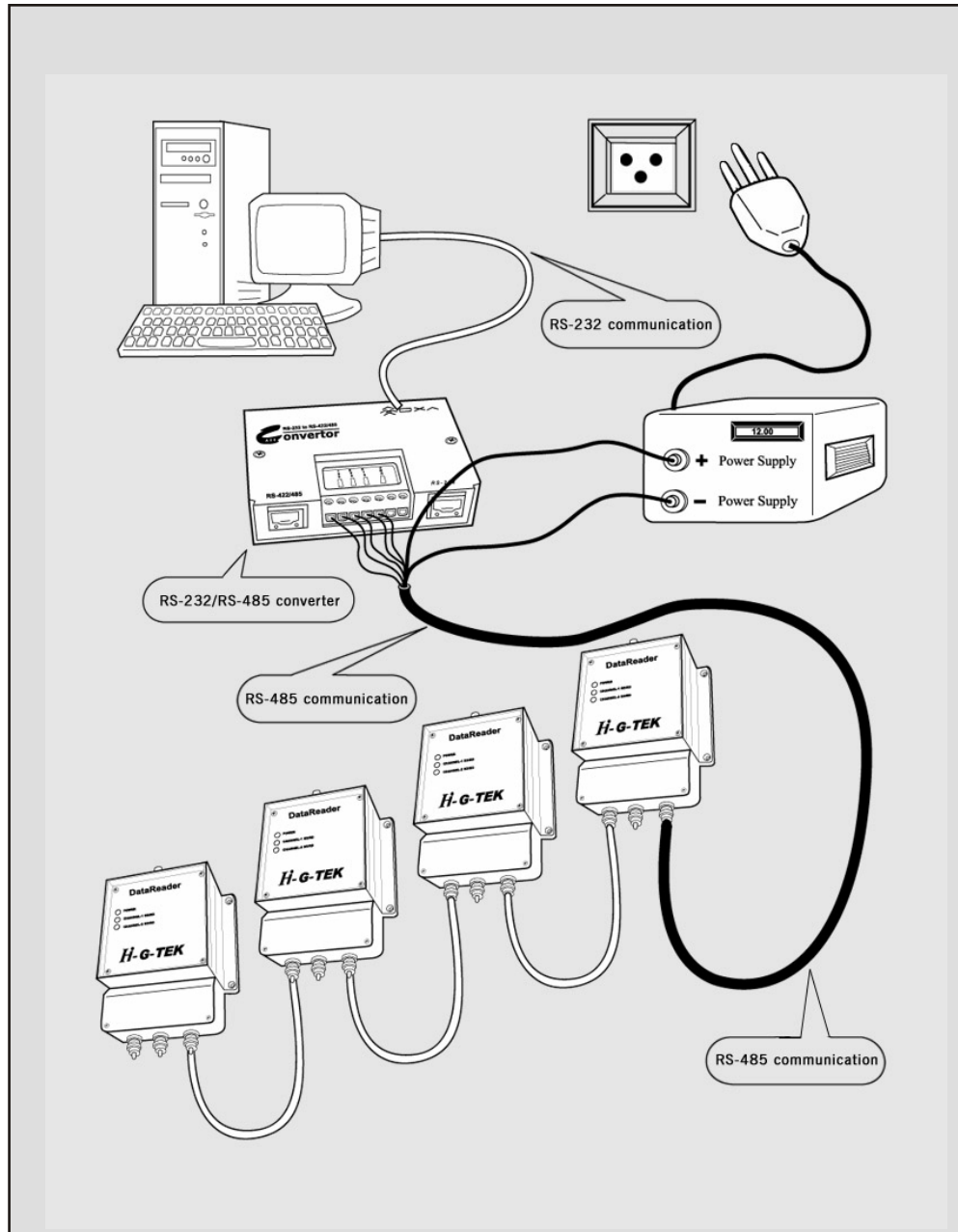
Function	Pin Number
Positive Power	1
Positive Power	2
Signal GND	3
Negative Power	4
Negative Power	5
TX/RX-A	6
TX/RX-B	7

3.3. Chaining DataReaders Together

Up to 32 DataReaders can be connected in a daisy chain using RS485. The last reader in the chain should be terminated by a 120 Ohm resistor between the RXA and the RXB.

For the Outdoor version, the user can decide to create either an internal or external termination switch. The internal termination switch is created by setting to ON the termination switch (S2) of the last reader in the daisy chain.

An external termination is relevant for the Indoor version only. An RS-485 to RS-232 adapter termination should be provided for the adapter receive channel.



3.4. RS-232/RS-485 Adapter

Adapter's requirements:

- Full/Half duplex operation mode
- Isolated communication lines

Recommended adapter: Moxa Technologies, model A51

Adapter configuration: (refer to adapter's User Manual)

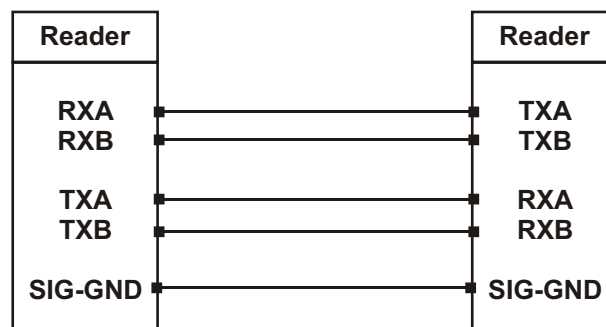
1. Communication mode (either half or full duplex)
2. Txd: always enable
3. Rxd: always enable

Default configuration of the Moxa A51:

- Full Duplex mode
- Txd always enable
- Rxd always enable

3.4.1. Connecting the RS-232/RS-485 Adapter to the First Reader

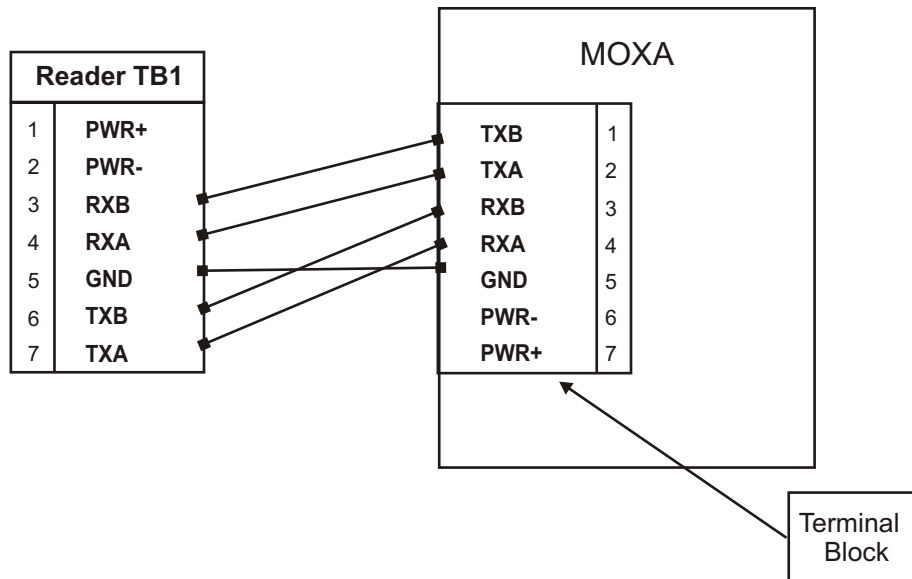
The Rx and Tx lines should be crossed between the adapter and the first reader as follows:



3

DataReader Installation

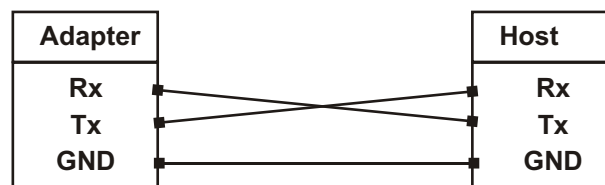
Moxa A51 Wiring:



3.4.2. Connecting the RS-232/RS-485 Adapter to the Host

RS-232 3-wire connection should be performed between the adapter and the host. (Other control signals beside the Rx, Tx and GND are not required).

Rx and Tx should be crossed, as follows:



The Moxa A51 is connected to Host with RJ45/DB25 cable supplied with the adapter. If the Host has a DB9 connector, a DB25/DB9 adapter should be used.

3.5. Power Supply Requirements

The DataReader supply voltage is chosen according to the model, either 12V, 24V or 48V.

Power supply wattage: each Reader consumes maximum 1.7W, so the power should tolerate the number of Readers in the chain multiplied by each Reader's power consumption.

EXAMPLE: 10 Readers connected in a daisy chain require $10 \times 1.7 = 17\text{W}$ power supply.

Note that if the power supply is installed in a high temperature area (usually above 40°C), there is a derate in power supply wattage. (Refer to power supply manual).

For safety reasons, power supply current should be limited to 3A. Current limitation should be done internally in the power supply, or externally with a 3A fuse.

In vehicular installation, a 1A fuse must be used.

In outdoor and indoor system, the power supply should be installed indoor. For outdoor system, approved power supplies are:

For Indoor system, the power supply should be UL1950 approved. A desktop style with IEC320 inlet is recommended.

When power supply cable ends are connected directly to system cable, a proper isolation should be made. Using heat shrink tube is recommended.

3.6. Cable Selection

The cable is used for power supply to Readers in a chain and for RS-485 serial communication.

For most applications, 3 or 4 pairs of 24AWG shielded cable is adequate.

The serial communication requires shielded twisted pair cable, the power supply requires low ohmic resistance of the conductors.

Cable connection:

1 pair for RXA and RXB signals.

1 pair for TXA and TXB signals

SIGNAL GND may be connected to shield or to a pair of wires (shield connection is recommended, though it depends on the noise level of the specific environment).

Supply: Two main issues should be considered, max current carrying capacity and wire resistance.

Max current capacity: For 24AWG cable, the jacket is heated at 1°C at 0.1A current, max temperature is 80°C. So, this cable can carry a max of 2A at 60°C. ($(80-60)*0.1$).

This calculation should be done for the application specific requirements.

Wire resistance: The voltage drop across the cable may cause insufficient voltage to the last readers in chain. Calculation of voltage drop in a certain setup should be done, in order to avoid this.

In most cases, the solution for such problems includes, connecting a pair of wires for the supply (2 for supply and 2 for return), using thicker cable, or using higher temperature rated cable.

Environmental considerations: In an outdoor installation, the cable should withstand all outdoor conditions, that is water proof, temperature, ruggedness etc.

Example:

A setup of 10 DataReaders with 20 meter 24AWG cable between Readers and 24v supply to the first Reader

The ohmic resistance between Readers is 3.4 Ohms (20 meter of supply and 20 meters of return). Calculating the voltage drop across the lines gives 5v only, left to the last Reader in the chain. This is below Reader specification of Reader minimum supply voltage.

If two conductors are used for supply and return, the ohmic resistance would be $3.4/2=1.7$ ohm. The voltage to the last Reader in the chain would then be 17v, well above the minimum voltage required.

If you experience difficulty calculating the voltage drop across the supply line, contact your distributor for assistance.

3.7. Installation notes

3.7.1 The DataReader is distributed to a commercial/industrial use only, and cannot be sold to the general public.

3.7.2 Installation must be performed according to this user manual, and by an authorized personnel only.

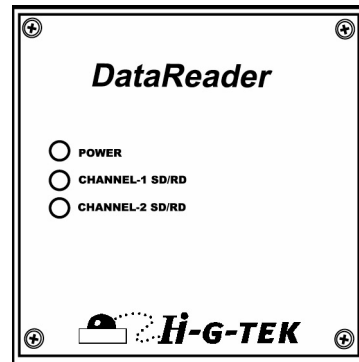
3.7.3 It is the responsibility of the installer to ensure that when using the outdoor antenna kits in the United States (or where FCC rules apply), only those antennas certified with the product are used. The use of any antenna other than those certified with the product is expressly forbidden in accordance with FCC rules CFR47 part 15.204."

Chapter 4

DataReader Operating Instructions

Hi-G-DataReader Operation

Three LED light indicators are located on the left-hand side of the electronics compartment.



- ◆ **Power:** The DataReader is activated by connecting it to a power supply. At power ON and self-test the power indicator alternates between the GREEN and RED indicators for several seconds. If the check result is OK, the indicator remains GREEN. If a problem was detected, the indicator remains RED.
When performing firmware download:
 - MCU download, the indicator alternates between GREEN and RED
 - AVR- the indicator remains off

- ◆ **Channel 2 SD/RD:**

When the indicator is **red**, the unit is in SD (sending data) mode.
When the indicator is **green**, the unit is in RD (receiving data) mode.
When the indicator is **off**, it is in stand-by mode.

- ◆ **Channel 1 SD/RD:**

This channel is optional. The indicators operate in an identical manner to those for channel 2:
When the indicator is **red**, the unit is in SD (sending data) mode.
When the indicator is **green**, the unit is in RD (receiving data) mode.