Hi-G-TEK

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

DataReader and DataSeal System

User's Manual

Ver. A2 **UM4710**

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Chapter 1

Introduction

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.

1 Introduction

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.

1 Introduction

Software License Agreement

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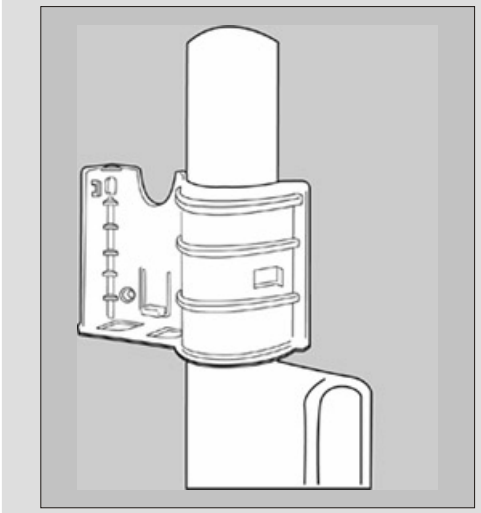
1.2. System Components

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.



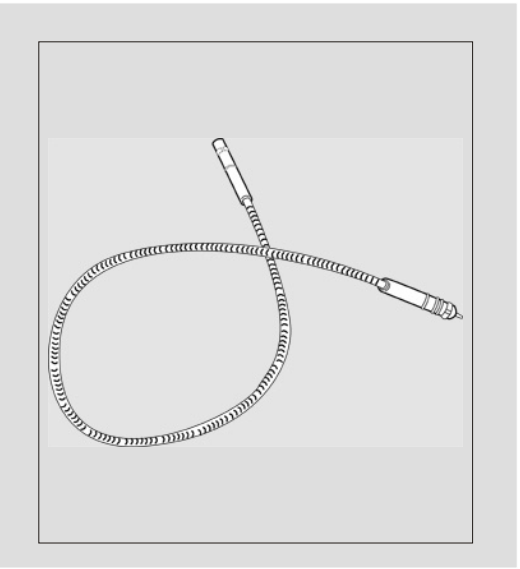
1.2.2. The Seal

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.

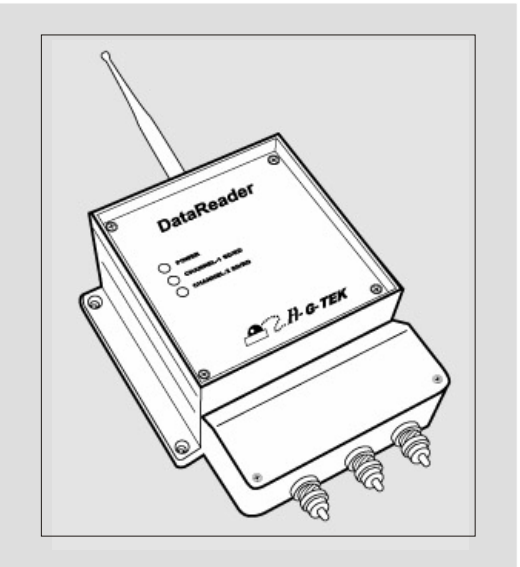
Any tampering with the DataSeal Wire at any point during transport is recorded and reported at once.



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

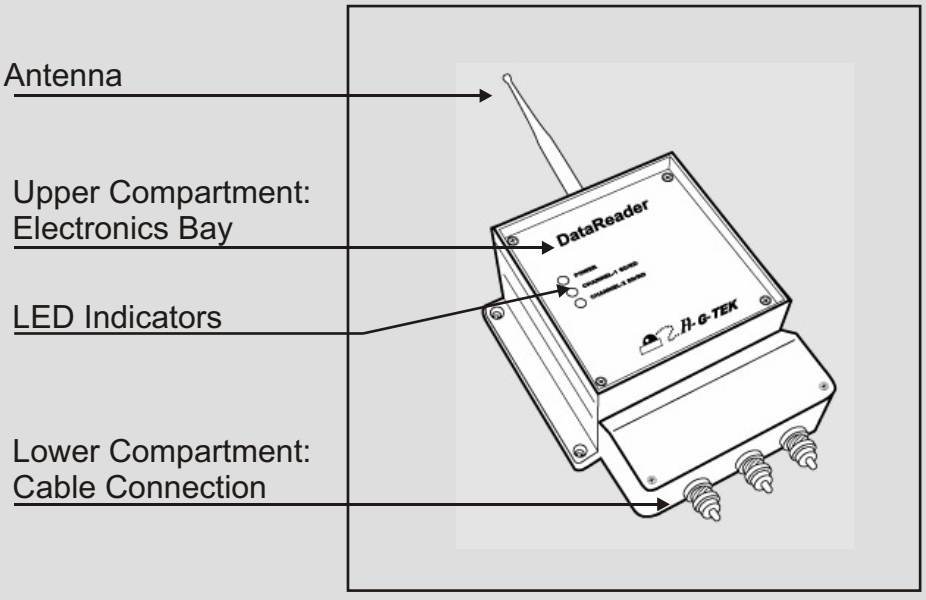
The DataReader may be used in both stationary and mobile configurations.

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.

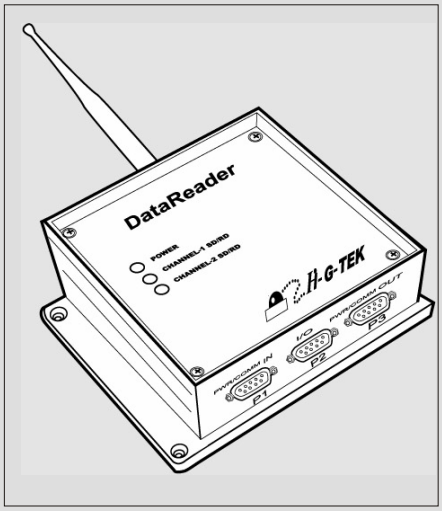
The DataReader is mastered by a host computer. Once installed, the unit waits for commands coming from the host computer.

Outdoor DataReader



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.



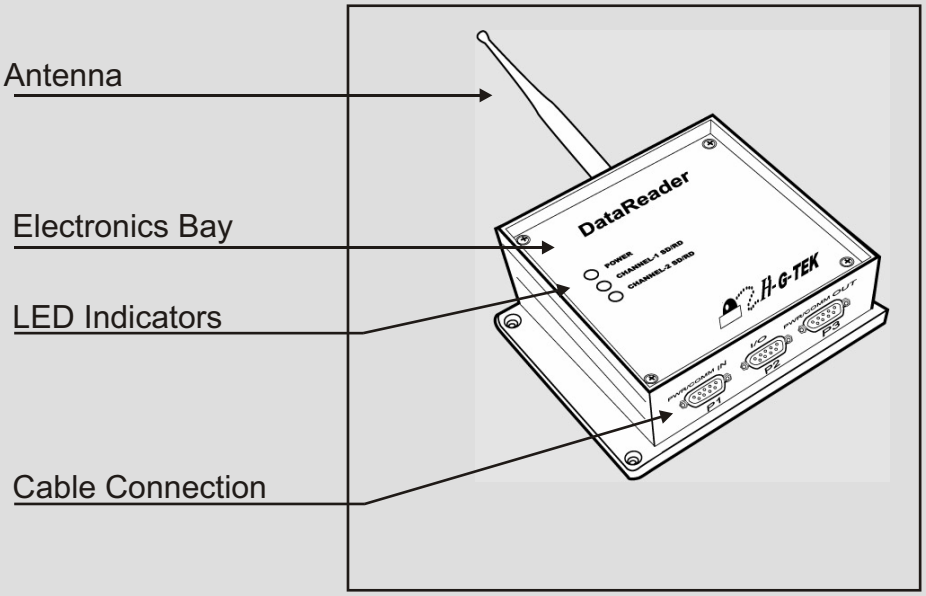
The Indoor DataReader may be used in stationary configuration only.

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.

1 Introduction

Indoor DataReader



1 Introduction

Chapter 2

DataSeal Installation

2 DataSeal Installation

2.1 DataSeal Installation

step 1.

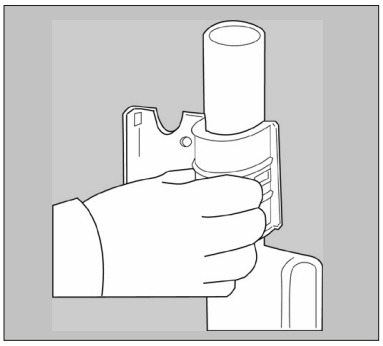


Fig. 1

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.

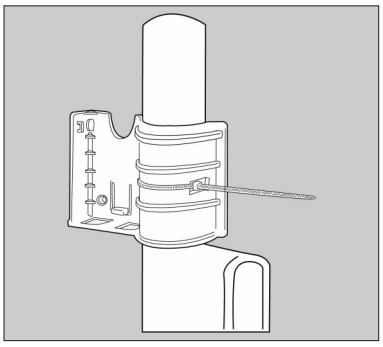


Fig. 2

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.

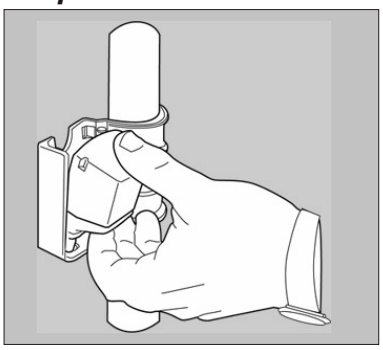


Fig. 3

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.

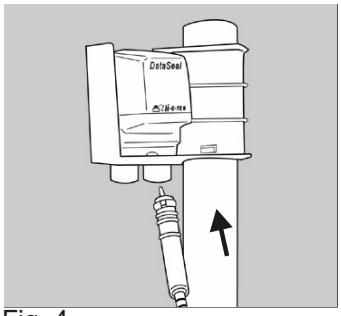


Fig. 4

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

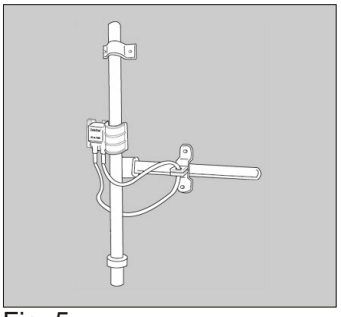


Fig. 5

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

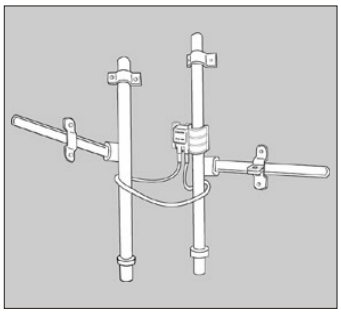


Fig. 6

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

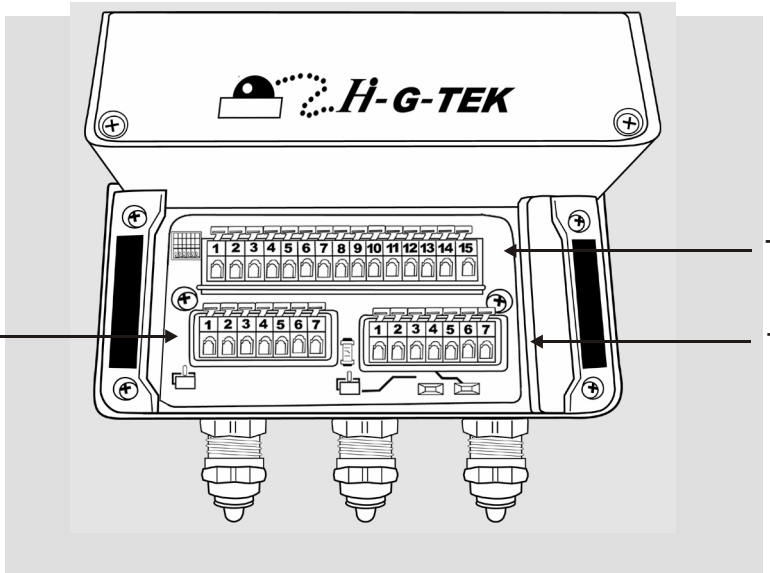
3.1 Outdoor DataReader Installation

- 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.

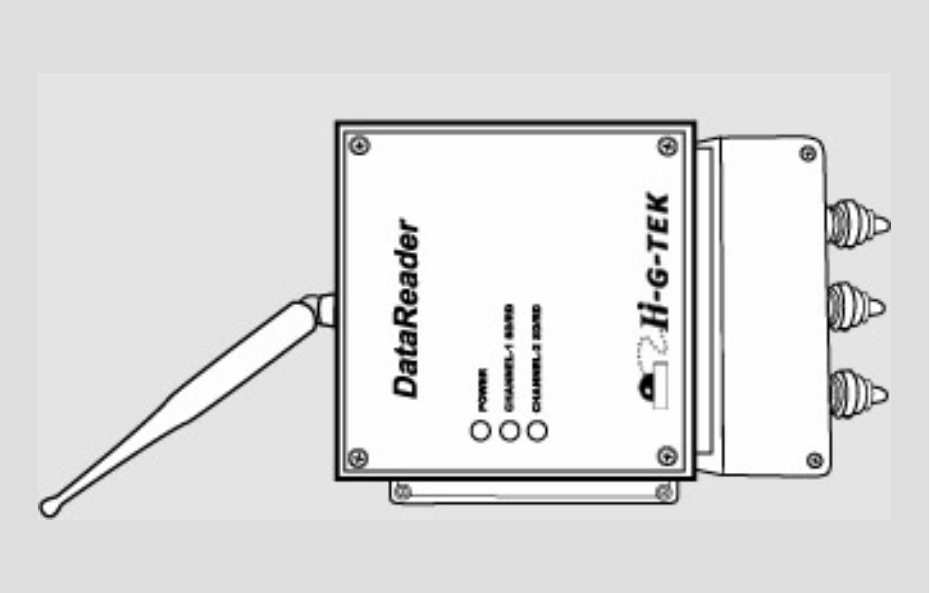
3.1.1. Connecting the Outdoor Unit

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

- 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.



3.1.2 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 90º connector.

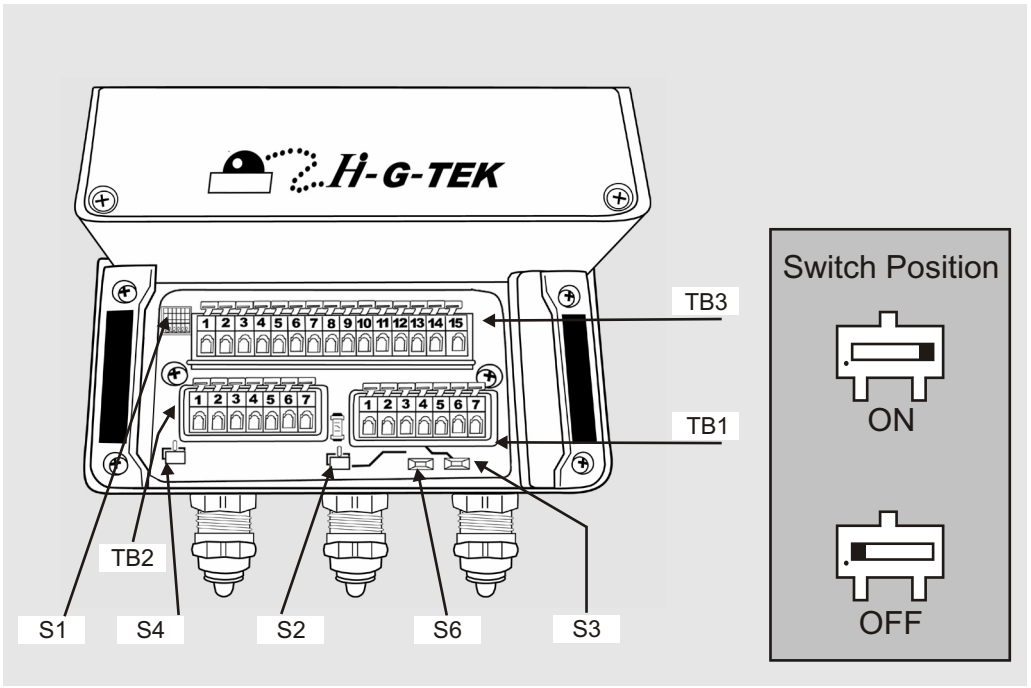
3.1.3 Wiring the Outdoor DataReader

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.



3.1.4 DataReader Configuration Switches

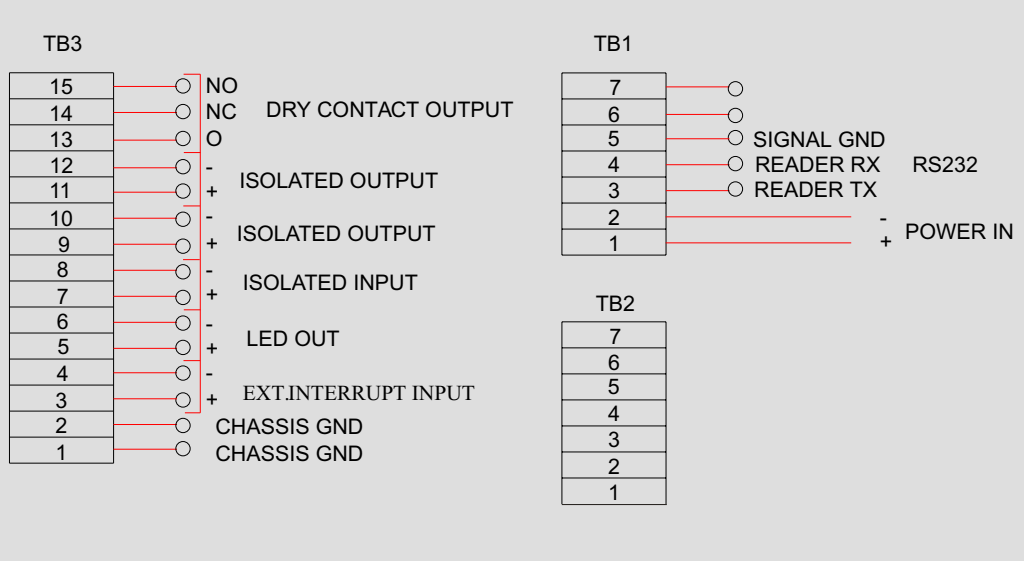
S1: Reader configuration setup switch; Future use.
Default position: OFF.

S2: Termination ON/OFF switch.
While ON, connects an internal 120 Ohm termination resistor to the RS485 chain.
Default position: OFF

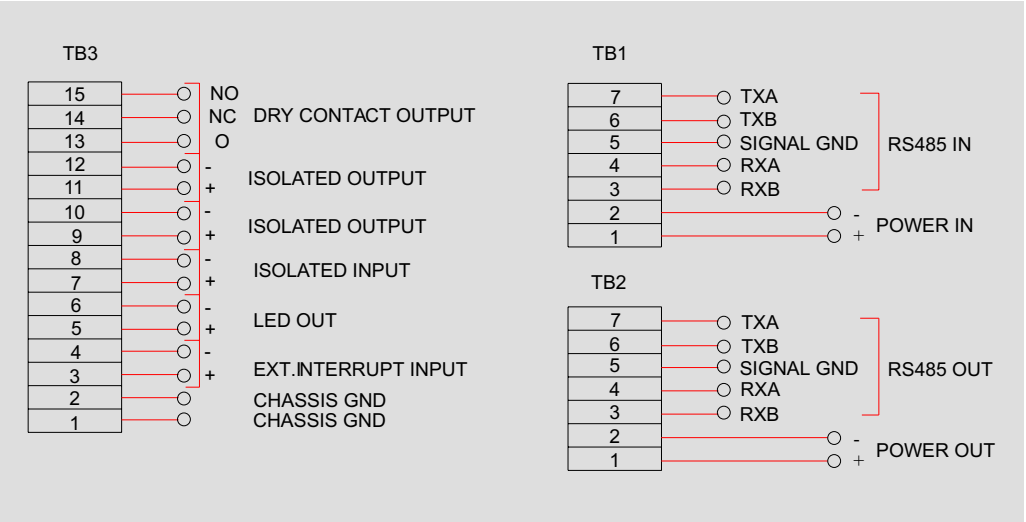
S3, S6: Full/Half duplex switches.
While OFF: Full duplex mode is set
While ON: Half duplex mode is set
Default position: OFF

S4: Reader shut-down switch.
While OFF: Reader is active
While ON: Reader is not powered
Default position: OFF

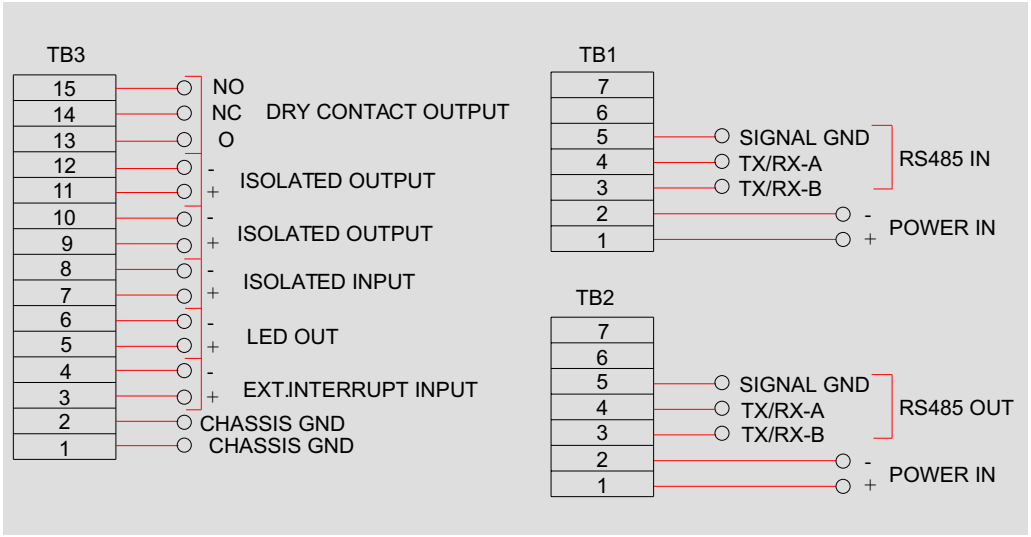
3.1.5. RS-232 Wiring Diagram



3.1.6. RS-485 FullDuplex Wiring Diagram



3.1.7. RS-485 Half Duplex Wiring Diagram

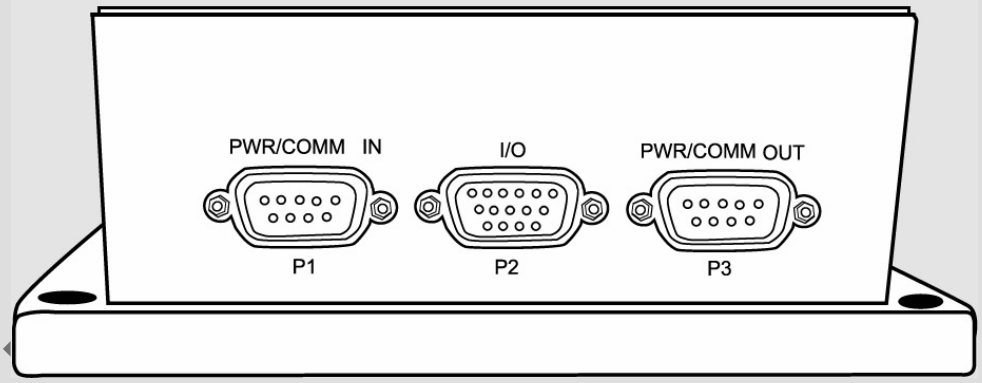


3.2. Indoor DataReader Installation

- 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.

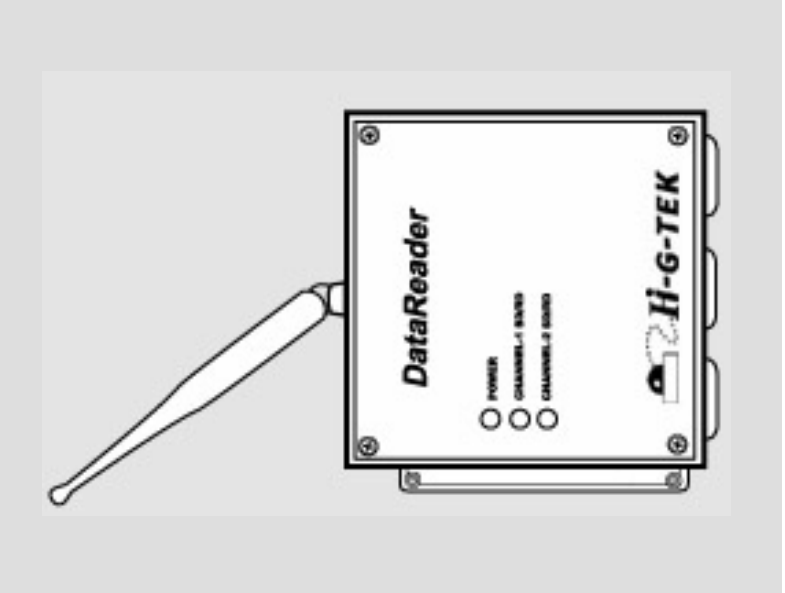
3.2.1. Connecting the Indoor Unit

*** 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.

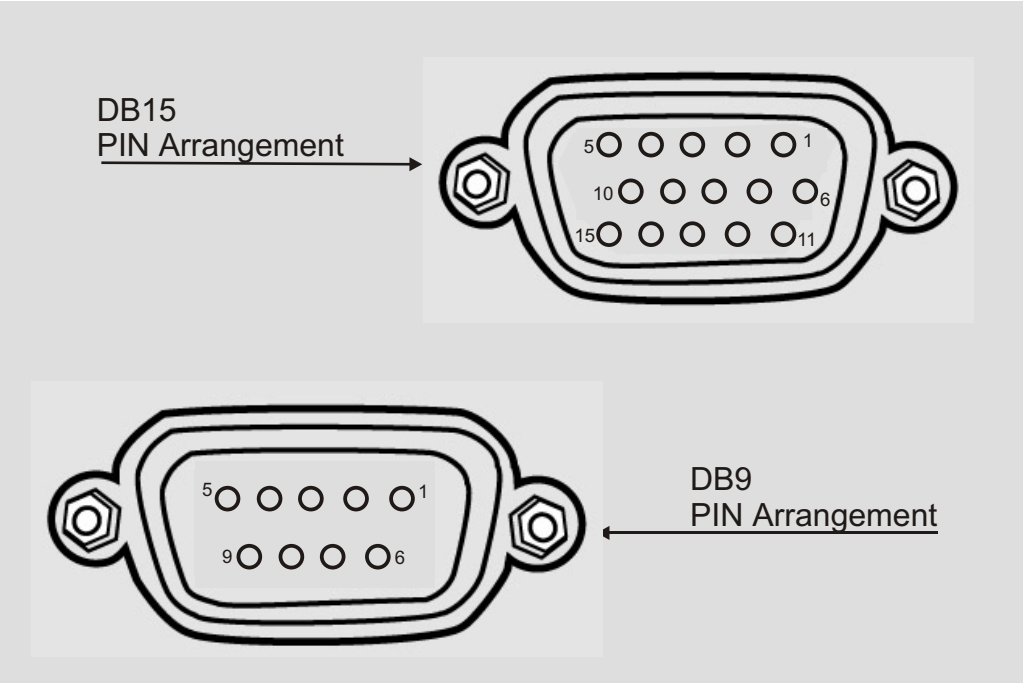
- The DataReader can be mounted on the ceiling.
  In such cases it is requested to mount the antenna perpendicular to the ceiling using a 90º connector.

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 duplex.2.
RS232.3.
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 (seeTechnical 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

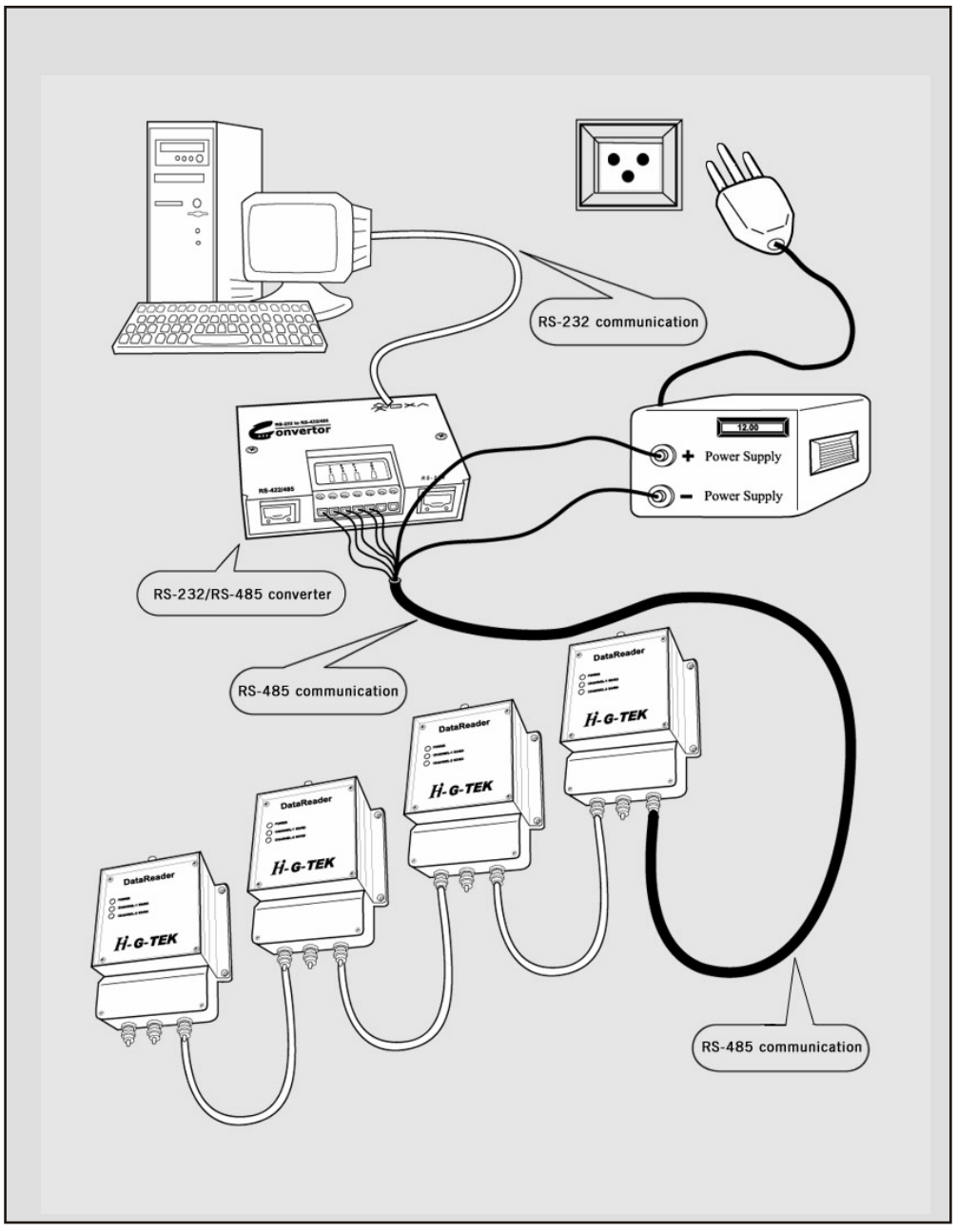
3.3. Chaining DataReaders Together

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 DataReader Installation



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)

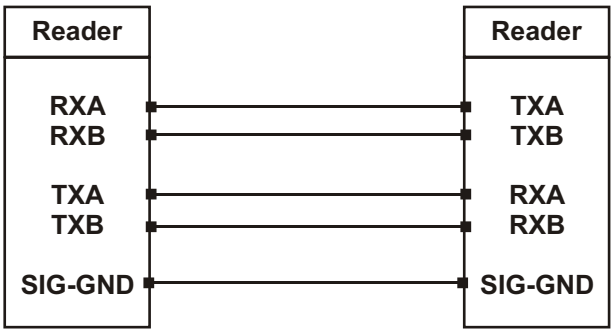
1. Communication mode (either half or full duplex)
2. Txd: always enable
3. Rxd: always enable

Default configuration of the Moxa A51:

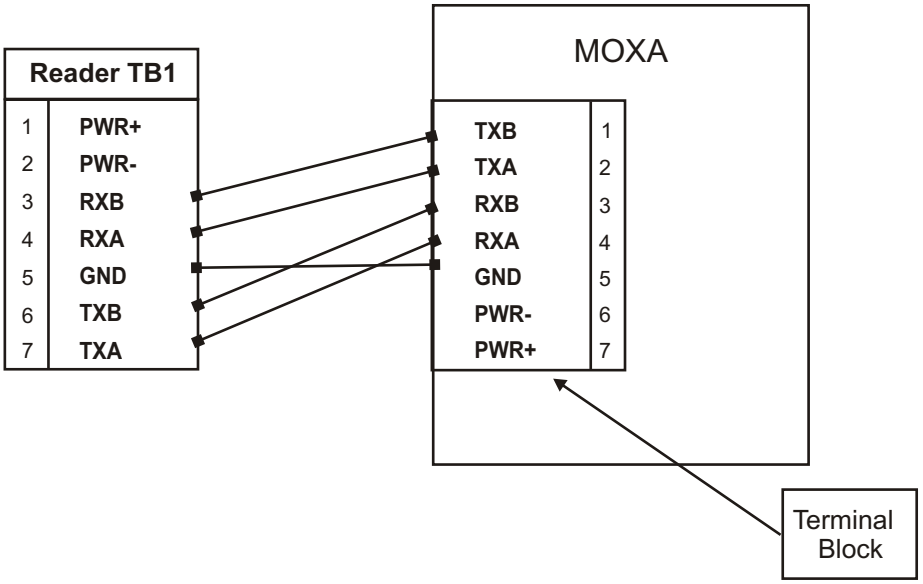
- Full Duplex mode
- Txd always enable
- Rxd always enable

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:



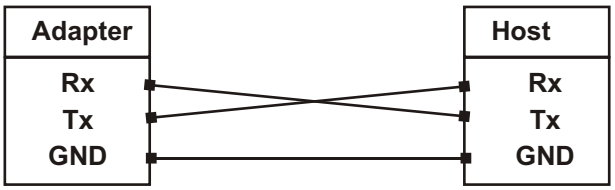
Moxa A51 Wiring:



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

RS-323 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 10X1.7=17W power supply.

Note that if the power supply is installed in a high temperature area (usually above 40^0C), 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.

3 DataReader Installation

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."

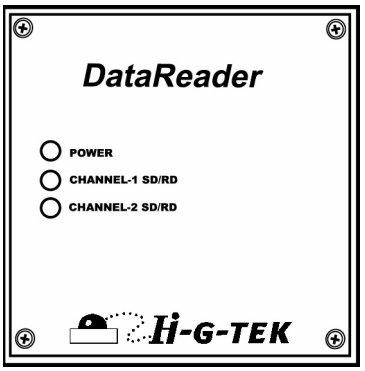
Chapter 4

DataReader Operating Instructions

4 DataReader Operation 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.