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

DataReader and DataSeal

User's Manual

Ver. A61

UM4710

1 INTRODUCTION 10

1.1 WHAT PRODUCTS ARE COVERED BY THIS MANUAL 10
1.2 ABOUT THE PRODUCT 10
1.3 SYSTEM COMPONENTS 14
1.3.1 The Mounting Fixture 14
1.3.2 The DataSeal 14
1.3.3 Sealing Wire 15
1.3.4 Outdoor DataReader 15
1.3.5 Indoor DataReader 17

2 QUICK-START 20

2.1 BEFORE YOU BEGIN 20
2.2 SETTING UP THE DATAREADERS 21
2.3 INSTALLING THE EVALUATION SOFTWARE 21
2.4 CONFIGURING THE SYSTEM 22
2.5 PREPARING THE DATASEAL/DATA TAG 24
2.6 EXECUTING A VERIFY COMMAND 27
2.7 A BRIEF TUTORIAL THROUGH THE STATES OF THE DATASEAL 29

3 DATASEAL INSTALLATION 34

4 DATATAG INSTALLATION 38

4.1 PLACING THE DATA TAG ON A VEHICLE 38
4.1.1 Horizontal Orientation: 39

4.1.2 Vertical Orientation 39

5 DATAREADER INSTALLATION 42

5.1 OUTDOOR DATAREADER INSTALLATION 42
5.1.1 Ceiling Installation 42
5.1.2 Connecting the Outdoor Unit 43
5.1.3 Wiring the Outdoor DataReader 44
5.1.4 RS-232 Wiring Diagram 45
5.1.5 RS-485 Full Duplex Wiring Diagram 46
5.1.6 RS-485 Half Duplex Wiring Diagram 46
5.1.7 DataReader Configuration Switches 46
5.2 INDOOR DATAREADER INSTALLATION 47
5.2.1 Connecting the Indoor Unit 47
5.2.2 Wiring the Indoor DataReader 48
5.2.3 RS-232 Wiring Diagram 49
5.2.4 RS-485 Full Duplex Wiring Diagram 50
5.2.5 RS-485 Half Duplex Wiring Diagram 51
5.3 CHAINING DATAREADERS TOGETHER 51
5.4 RS-232/RS-485 ADAPTER 54
5.4.1 Connecting the RS-232/RS-485 Adapter to the First DataReader 54
5.4.2 Connecting the RS-232/RS-485 Adapter to the Controlling Computer 56
5.5 POWER SUPPLY REQUIREMENTS 56
5.5.1 General 56
5.5.2 Indoor Installation 57
5.5.3 Outdoor Installation 57
5.6 CABLE SELECTION 58
5.7 INSTALLATION NOTES 59
5.8 DATA READER OPERATION INSTRUCTIONS 60

5.8.1 Power Indicators: 60
5.8.2 Channel 1 SD/RD Indicator: 60
5.8.3 Channel 2 SD/RD Indicator: 61

6 SYSTEM OVERVIEW 64

6.1 SYSTEM DESCRIPTION 64
6.2 DATASEAL AND DATAREADER MODES OF OPERATION 66
6.2.1 DataSeal Modes of Operation 66
6.2.2 DataReader Modes of Operation 68
6.3 MOST COMMON COMMANDS AND SEAL STATUS 69
6.3.1 Most Commonly Used Commands 69
6.3.2 DataSeal's Status 70
6.4 SYSTEM PLANNING 71
6.4.1 Electromagnetic Environment 72
6.4.2 System Layout 72
6.4.2.1 Radio Frequency Communication Layout 73
6.4.2.2 Line Communication RS-485 Layout 74
6.5 SYSTEMS SEGREGATION 75
6.5.1 Companies Segregation by OrgID 76
6.5.2 Department Isolation 76
6.5.3 Services to Several Companies by a Service Provider 77
6.5.4 Subgroups of DataSeals 77
6.5.5 OrgID, Department, Global and ADI Impact on DataSeal's Response 78
6.6 DATASEAL'S MEMORY 79
6.6.1 Events Memory 79
6.6.2 User Data 80
6.6.2.1 The User Data portion used by the DataTerminal 81
6.7 SYSTEM COMMANDS 82

7 EVALUATION SOFTWARE 88

7.1 SOFTWARE INSTALLATION 88
7.2 COMMUNICATION SETUP – THE READERS ADMINISTRATION WINDOW 89
7.2.1 Defining the Connected DataReaders 89
7.2.2 Setting Up the Communication Port 90
7.3 READER SETUP 90
7.4 THE VERIFY AND SET WINDOW 91
7.4.1 Executing Broadcast Verify Command 94
7.4.2 Executing Addressed Verify Command 96
7.4.3 Executing Set Command 98
7.4.4 Cyclical Interrogations Options 99
7.5 EXECUTING ANY COMMAND USING THE ALL COMMANDS WINDOW 100
7.5.1 Executing an RF Command 101
7.6 SPECIFIC COMMAND STRUCTURES 102
7.6.1 Verify 103
7.6.2 Tampered (Tamper) 105
7.6.3 Addressed Verify 105
7.6.4 Set 106
7.6.5 Soft Set 107
7.6.6 Suspended Set 107
7.6.7 Read Data 108
7.6.8 Write Data 110
7.6.9 Read Parameters 112
7.6.10 Write Parameters 113
7.6.11 Reset Data 115
7.6.12 Deep Sleep 116
7.6.13 Hard Wakeup 117
7.6.14 Start Alert Burst Mode 118

7.6.15 Start Alert Burst Mode (all)..... 119
7.6.16 Stop Alert Burst Mode..... 120
7.6.17 Stop Alert Burst Mode (all)..... 120
7.6.18 Acknowledge Alert Burst..... 121
7.6.19 Read Events..... 122
7.7 ADVANCED FEATURES..... 124
7.7.1 Built-In Test..... 124
7.7.2 Authorization Levels and Passwords..... 125
7.7.2.1 Logging-in Using the Desired Authorization Level..... 126
7.7.2.2 Changing Passwords..... 126
7.7.3 Updating the DataReader's Internal Software..... 127
7.7.3.1 The MCU Download Utility..... 128
7.7.3.2 RF Modem Download Utility..... 129

8 SYSTEM PARAMETERS AND COMMANDS 132

8.1 THE HIGH FREQUENCY RF PROTOCOL..... 132
8.1.1 The Basics..... 132
8.1.2 Addressing Types..... 134
8.1.3 The Slotted Aloha Concept..... 135
8.2 DATASEAL PARAMETERS..... 136
8.2.1 The DataSeal Status Flags..... 167
8.3 EVENTS..... 179
8.3.1 General Structure of an Event Record..... 180
8.4 HIGH-FREQUENCY RF COMMANDS SUMMARY..... 186
8.4.1 Broadcast Commands..... 187
8.4.2 Addressed Commands..... 195
8.4.3 Multi Addressed Commands..... 204
8.4.3.1 Multi Addressed Commands With Parameters..... 204
8.4.3.2 Multi Addressed Commands Without Parameters..... 205
8.5 BURST MESSAGES..... 210

8.6 DATA READER PARAMETERS 215
8.7 COMMAND CHAIN 230

9 TROUBLESHOOTING AND PROBLEM SOLVING 234

9.1 GENERAL DATAREADER PROBLEMS 234
9.2 RS-232/485 COMMUNICATION PROBLEMS 234
9.3 GENERAL RF COMMUNICATION PROBLEMS 234
9.4 SPECIFIC RF COMMANDS TROUBLESHOOTING: 235

10 TECHNICAL SPECIFICATIONS 238

10.1 24V OUTDOOR DATAREADER 238
10.2 12V OUTDOOR DATAREADER 239
10.3 48V OUTDOOR DATAREADER 241
10.4 24V INDOOR DATAREADER 242
10.5 12V INDOOR DATAREADER 243
10.6 48V INDOOR DATAREADER 243
10.7 DATASEAL 244
10.8 MAGNETIC DATASEAL 245
10.9 FCC APPROVED PRODUCTS: 246

11 INDEX 250

This User's Manual includes all the information required for installing and operating Hi-G-Tek Electronic DataSeals and DataReaders.

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Chapter 1

Introduction

1 Introduction

1.1 What Products are Covered by this Manual

This manual covers the DataReader (both Indoor and Outdoor versions), DataSeal, DataTag and the MagneticDataSeal products.

The DataTerminal, DataPort, MicroDataReader, TrackingDataReader and SmartDataReader are Hi-G-Tek products that are referred to in some places in the manual, but are not covered by it.

1.2 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 utilizing 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 basis of the system is a family of reusable electronic seals named ***DataSeal***. This family of products includes the DataSeal, DataTag and the MagneticDataSeal.

Note: This manual uses the term DataSeal to refer to any member of this family of products, unless otherwise specified.

The most significant purposes of the DataSeal are:

- Track any attempts of opening, bypassing or tampering.
- Record events when tamper occurs.
- Write and read user data.

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 includes a transmitter / receiver unit, real-time clock, processor, memory and sensing circuitry for sealing verification. The Sealing Wire[1] 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 AND high frequency (UHF) long range for sealing verification and other communications with the DataSeal.

The low frequency (short range) communication protocol is used by the DataTerminal, the DataPort and the MicroDataReader. This channel of communication is useful for writing the electronic manifest of the sealed cargo into the DataSeal's memory. For example: this information can

[1] In the case of DataTag, there's a "Sensor Plate" instead of the Sealing Wire, and in the case of the MagneticDataSeal, there's a "Magnet Element".

include the vehicle ID, container and invoice numbers, cargo description, etc. It is also useful for reading the DataSeal's event records, and to reset the DataSeal for a new use (an operation called "Set").

Note: The low frequency protocol, the DataTerminal, DataPort and MicroDataReader devices are not covered by this manual.

The high frequency protocol is used by devices of the DataReader family of products. This family includes the DataReader itself, which connects to a controlling computer (normally a PC) through an RS-232/485 interface; the TrackingDataReader which contains a GPS and GSM modules and is usually installed on a truck; and the SmartDataReader which contains an embedded PC and connects to an Ethernet network. This manual covers only the DataReader device itself. The high frequency protocol is useful for monitoring the presence and status of one or more DataSeals constantly or periodically. It is capable of communicating with multiple DataSeals simultaneously and even with DataSeals in high speed motion, for example: on a train.

The DataSeal and DataReader devices are capable of communicating in distances of up to 30 meters, and in some cases even more.

The use of the high frequency/long range protocol enables 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 DataReader is able to detect which DataSeals are present in its area, and their statuses (open/close, tampered, etc). It can also receive messages from DataSeals in real-time, for example when the DataSeal is tampered. These types of messages that the DataSeal transmits are called "Burst Messages".

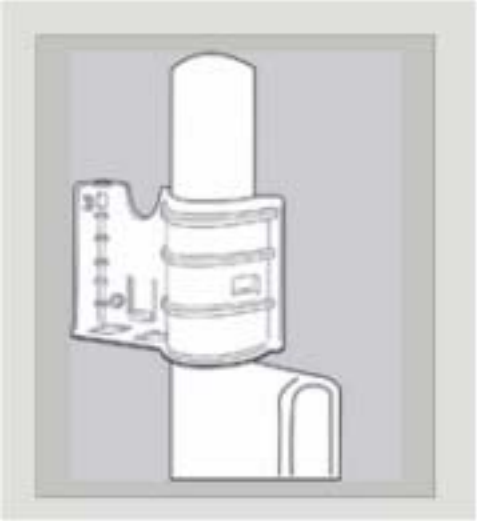
Multiple DataReaders can be connected to a single controlling computer using the RS-485 interface. This allows to maximize the coverage area of the DataReaders while keeping them synchronized. The DataReader is available in both indoor and outdoor models.

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

1.3 System Components

1.3.1 The Mounting Fixture

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



1.3.2 The DataSeal

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.

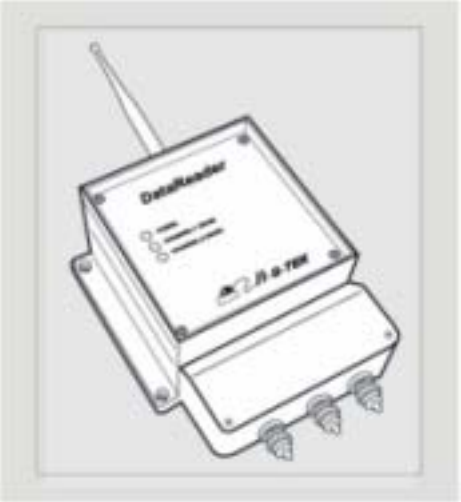
1.3.3 Sealing Wire

The Sealing Wire serves to seal the cargo. Any tampering with the Sealing Wire at any point during transport is recorded and can be reported at once.

1.3.4 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.

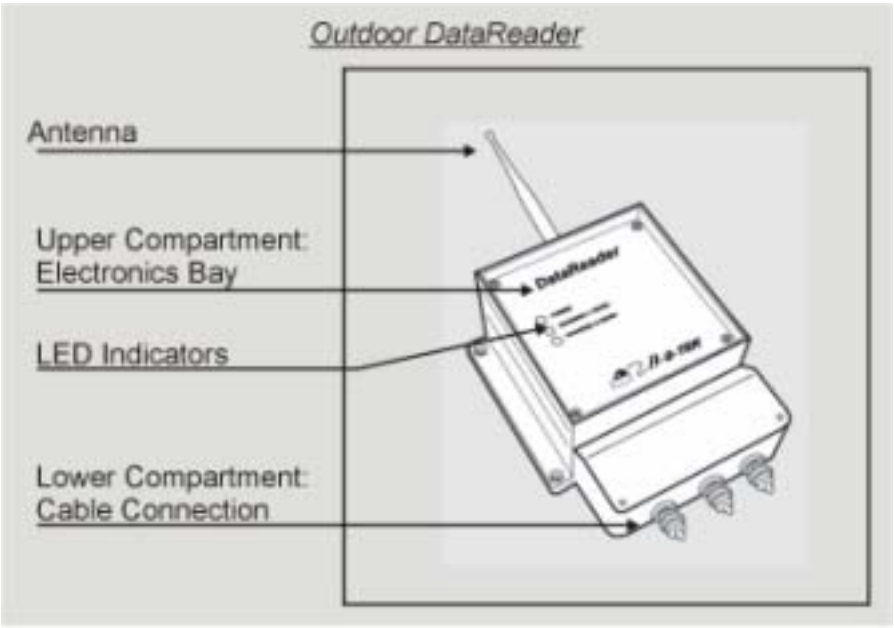
The DataReader is comprised of two compartments. The upper compartment is the heart of the unit and contains the DataReader's electronics section. The lower compartment contains the terminal glands which connect



the unit to the RS-232/485 networking cable.

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

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 DataSeal 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. This configuration requires an additional 3rd party controlling device to control the DataReader, or to use the TrackingDataReader which is not covered by this manual.

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

1.3.5 Indoor DataReader

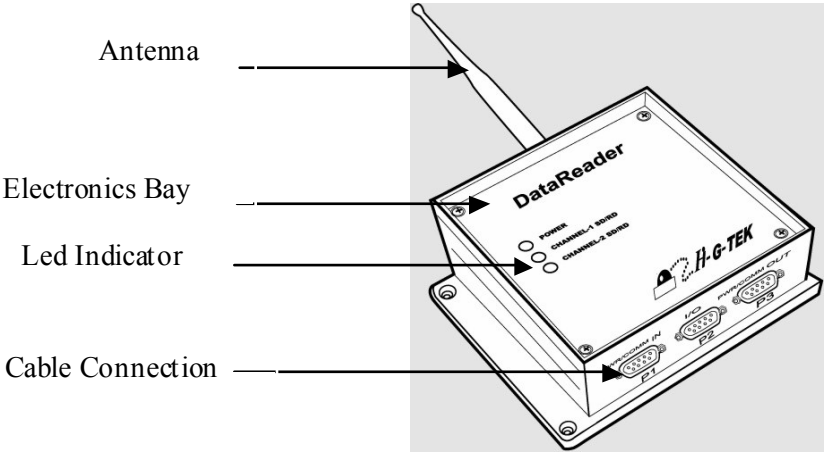
Similar to the outdoor version, the Indoor DataReader uses state-of-the-art technology to secure and monitor secured cargoes in an indoor environment.

The Indoor DataReader may be used in stationary configuration only.

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 closed warehouses, offices, etc.

Unlike the Outdoor DataReader, the Indoor version does not have the lower compartment. Instead it has 3 connectors.

Indoor DataReader



Chapter 2

Quick Start

2 Quick-Start

The aim of this chapter is to lead you step-by-step in the quickest way to the stage where you can verify that the Demo System is working properly, and that you have a simple system that you can play with, in order to evaluate the potential of the products. This guide assumes that the parameters of the DataReader and DataSeal are the factory defaults, and it refers only to the Demo System. For installation instructions for a DataReader that is not a Demo System, see chapter 5.

2.1 Before you begin

Before you begin, make sure that you have the following items available:

1. The Hi-G-Tek DataReader device.
2. DataReader Antenna.
3. At least one Hi-G-Tek DataSeal device.
4. The Seal ID of the DataSeal (printed on the sticker on the bottom side of the DataSeal).
5. Sealing Wire(s) (according to the number of DataSeals. If you are using DataTags you need Sensor Plate(s) instead of the Sealing Wires)
6. PC running one of the following operating systems:
   - Windows 98 or above.
   - Windows NT 4.0 or above.

This computer must have at least one available serial communication port, a CD-ROM drive, and at least 20MB of free hard disk space. The computer must use an Intel Pentium™ or compatible processor.

7. CD-ROM with Evaluation Software.

2.2 Setting up the DataReaders

First, connect the antenna to the DataReader. The antenna connects to the TNC connector at the top side of the DataReader.

Then, connect the DB9 female connector to a serial communication port in the PC. Take note of which port you are using (for example COM2). It is good practice to connect and disconnect cables only when the computer is off.

Plug the power chord of the DataReader into a power outlet. You should see the POWER LED blinking red and green. After about 30 seconds it should remain green. If it remains red, or isn't lit at all, there is a problem with the DataReader. Refer to the chapter 0 for troubleshooting.

2.3 Installing the Evaluation Software

If the computer is not turned on, turn it on now, and wait until the operating system is loaded completely.

Insert the CD-ROM labeled "Hi-G-Tek" into the CD-ROM drive.

From the Start menu, choose "Run". Assuming your CD-ROM drive is drive E, type "E:\DataSeal Evaluation Software\Setup.EXE" in the "Run" dialog box. If your CD-ROM drive letter is not E, replace the first E with your CD-ROM drive letter. Click OK to start installing the DataSeal Evaluation Software.

Follow the instructions on the screen until it says that the software is successfully installed.

If you're using Windows 98, restart your computer (even if you're not requested to by the installation software).

The Evaluation Software is now installed. A new shortcut icon " DataSeal Evaluation" is added to your Start->Programs menu.

2.4 Configuring the System

Run the Evaluation Software by clicking on that icon. The **Readers Administration** Window shown in Figure 2-1 will be displayed.

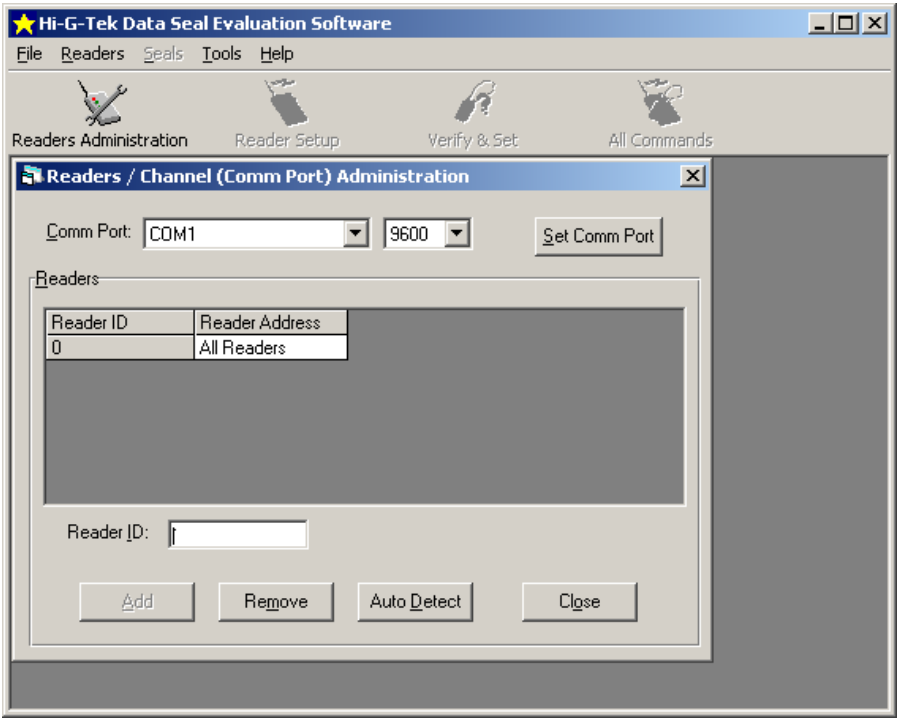


Figure 2-1 - The Readers Administration Window.

If you connected the Reader to a serial port other than COM1, choose the appropriate COM port from the **Comm Port** drop down list, and then click on the **Set Comm Port** button. Click **OK** to close the message window that says "Comm port was set successfully".

Click on the **Auto Detect** button on the bottom of the window, to automatically find the Reader ID of the DataReader. The message shown in Figure 2-2 will be displayed.

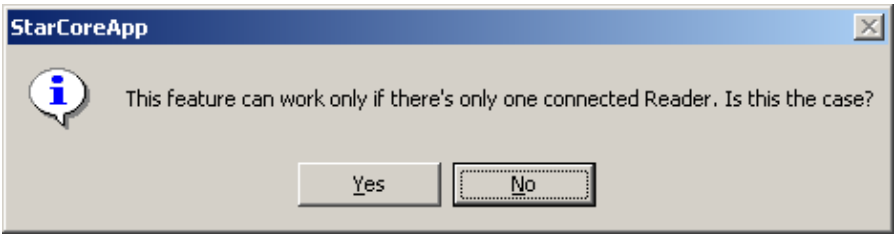


Figure 2-2 - Auto Detect Warning Message.

Because you're using the Demo System that includes only one DataReader, click **Yes**.

If everything is connected appropriately, a message window will appear saying "Reader was added successfully". Click **OK** to close this message.

If instead of this message, a "Timeout" message appears, check your connections and verify that the communication port setting corresponds to the one you're using. Remember to click on **Set Comm Port** each time you change the communication port setting.

If a different message appears, refer to chapter 9 for troubleshooting.

The DataReader's ID is now added to the list with a Reader Address of 1. Click on the **Close** button to close the **Readers Administration window**.

2.5 Preparing the DataSeal/DataTag

DataSeals provided by Hi-G-Tek leave the factory in a special power saving mode called "Deep Sleep Mode". Before you can communicate normally with a DataSeal, you must send it a special command called "Hard Wakeup" that returns the DataSeal into its normal mode of operation. You will then have to close the Sealing Wire (as will be

explained below), and send another command called "Set" that prepares the DataSeal for normal operation.

This section describes how to prepare a single DataSeal. If you have more than one DataSeal, repeat all the instructions in this section for each DataSeal you have.

In order to send the Hard Wakeup command to the DataSeal or DataSeals do the following:

Click on the

button on the tool bar to open the window shown in Figure 2-3.

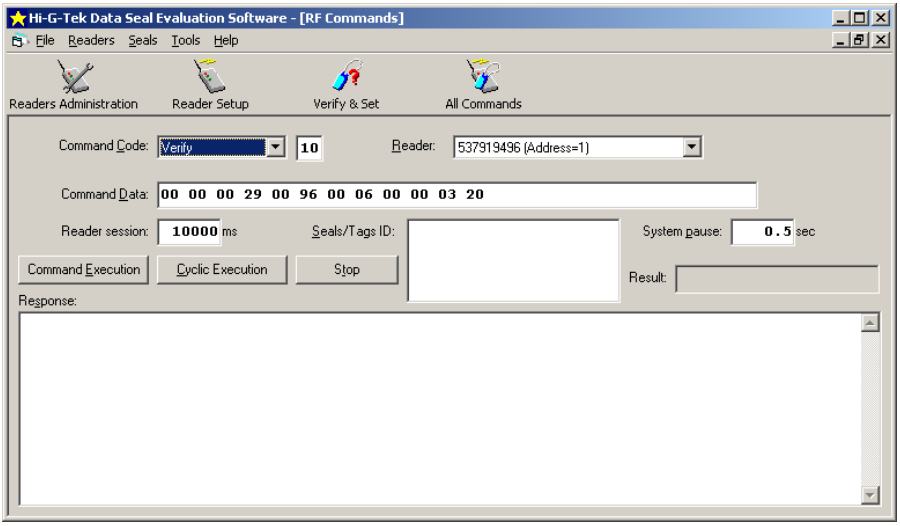


Figure 2-3 - All Commands Window.

From the **Command Code** drop down list, select **Hard Wakeup**.

Copy the Seal ID of the DataSeal you want to wake up into the **Seals/Tags ID** text box. The Seal ID is printed on the sticker on the bottom of the DataSeal.

Click the **Command Execution** button. The mouse cursor will change to an hourglass icon for about 11.5 seconds and then return to a normal pointer cursor.

If the DataSeal received the message, The **Result** box will show the message "Command OK" in green letters. If not, verify that you typed the Seal ID correctly in the **Seals/Tags ID** box, and that the DataSeal is nearby, and try again. If you still don't get the green "Command OK" message, or you see a different red message in the **Result** box, refer to chapter 9 for troubleshooting.

If you're using a DataSeal (as opposed to a DataTag), you now have to close the Sealing Wire by inserting its 2 ends to the 2 sockets in the DataSeal. Push the ends inside the sockets as far as you can. (You should hear a 'Click' when the wire end is fully inserted). If you're using a DataTag, you should place the Sensor Plate in its appropriate place at the bottom of the DataTag.

From the **Command Code** drop down list, select **Set** and then click the **Command Execution** button. After about 4 seconds, a green "Command OK" message should appear in the **Result** box.

Congratulations! Now your DataSeal is prepared for normal operation!

2.6 Executing a Verify command

As a matter of fact, if everything worked fine up to this point, you can be sure that your Demo System is working. Nevertheless, you probably want to know how to perform some basic operations.

The most commonly used command is the Verify command. The main purpose of this command is to detect which DataSeals are currently around, and their status (opened/closed, tampered/not tampered).

In order to execute a Verify command, open the **Verify & Set** window, by clicking on the

button on the tool bar. The window shown in Figure 2-4 will be displayed.

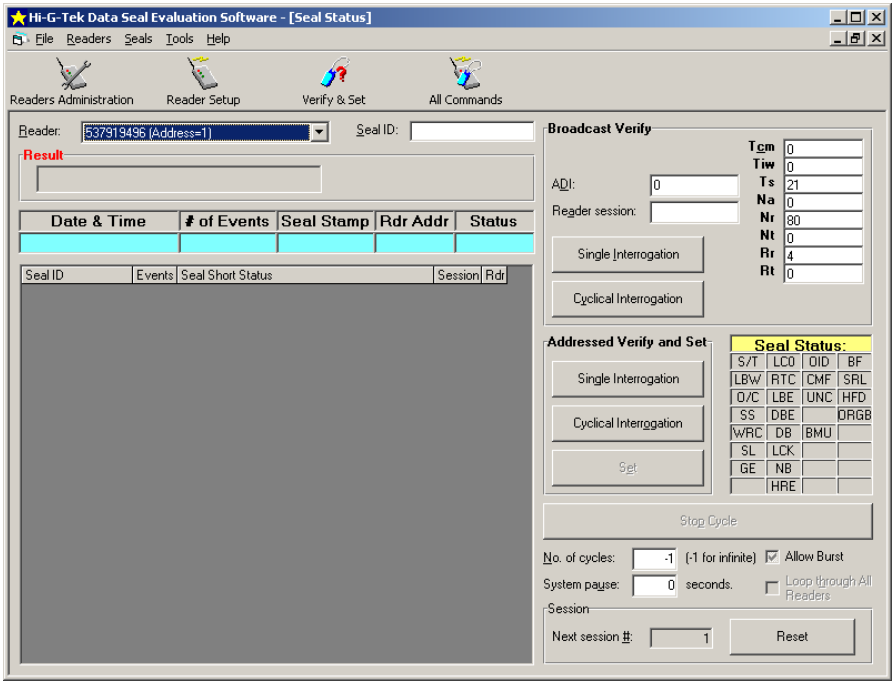


Figure 2-4 - The Verify & Set Window.

Note that there are 2 buttons labeled "Single Interrogation": the upper one resides in a rectangle labeled "Broadcast Verify", and the lower one in a rectangle labeled "Address Verify and Set". In this guide, we'll only use the upper one (Broadcast Verify). Click this button now. After about 5 seconds, one or more lines will be added to the list, according to the number of DataSeals that were detected.

Figure 2-5 shows an example of a list with 5 detected DataSeals.

Seal ID	Events	Seal Short Status							Session	Rdr
IAHA01052742	42	S\T	LBW	O\C	SS	WRC	Sleep	GE	1	1
IAHA52101074	1	S\T	LBW	O\C	SS	WRC	Sleep	GE	1	1
IDBA01052691	1	S\T	LBW	O\C	SS	WRC	Sleep	GE	1	1
IAHA01052754	0	S\T	LBW	O\C	SS	WRC	Sleep	GE	1	1
IAHA01052762	10	S\T	LBW	O\C	SS	WRC	Sleep	GE	1	1

Figure 2-5 - 5 DataSeals Detected.

Clicking the **Single Interrogation** button again will add another one or more lines to the list. To clear the list, click on the **Reset** button at the bottom of the window.

A complete explanation about the results you see is out of the scope of this Quick-Start chapter. Nevertheless, there are 2 flags in the DataSeal's Short Status that are worth a brief explanation here.

2.7 A Brief Tutorial Through the States of the DataSeal

The DataSeal has many flags that determine its state, as well as Parameters, Event Records and User Data. Even though most of these features are out of the scope of this chapter, 2 of the flags represent the most fundamental concepts of the DataSeal. These flags are the **Tampered** flag (shown in Figure 2-5 as "S/T"), and the **Opened** flag (shown in Figure 2-5 as "O/C"). Note that in the Evaluation Software, flags that are set appear in red, while unset flags appear in black.

If you have followed this guide step by step up to this point, you should have both flags off (black). If you cleared the list, click **Single Interrogation** (the upper one) again to see the flags.

The **Opened** flag is set (on) whenever the Sealing Wire is open, and unset (off) whenever it is closed. That explains why the O/C flag appears black.

Now, open the Sealing Wire by pulling one of its ends out of the socket. Click the **Single Interrogation** button again to see that the O/C flag has turned red (on).

You may have noticed that also the S/T flag has become red. This indicates that the DataSeal was *Tampered*. If you now close the Sealing Wire, this flag will remain on, even though the **Opened** flag will turn off again. Try it now: close the wire, and click the **Single interrogation** once more. You should see the O/C flag black again, but the S/T remains red.

No matter how many times you would open and close the wire now, the **Tampered** flag remains set, to indicate that it was **opened** at least once. You can try it if you want.

You may be wondering by now, whether this tutorial led you to a state where the DataSeal is irreversibly tampered, meaning that the DataSeal is no longer usable! Well, you can relax because the Hi-G-Tek DataSeal is a reusable seal, meaning that you *can* clear that **Tampered** flag. The **Tampered** flag can be cleared only when the Sealing Wire is closed, and it is done by sending a **Set** command to the DataSeal. That's right, that's the same command you sent after the Hard Wakeup in the "Preparing the Seal/Tag" section.

You can send this command from the **Verify & Set** windows too. After performing a **Single Interrogation**, click on the line in the list that shows the Seal ID of the DataSeal you want to *Set*. Notice that the Seal ID now appears in the **Seal ID** box at the top part of the window. You may also type the Seal ID there manually if you prefer. Make sure that the Sealing Wire is closed, and then click on the **Set** button (inside the **Addressed Verify and Set** frame).

After about 5 seconds, you should see a green "Set OK" message in the **Result** box (in the upper left side of the window). If you see a "Set Failed" message instead, it means that the Sealing Wire is not properly closed. If you see a different message, refer to chapter 0 for troubleshooting.

Perform another **Verify** interrogation (click the **Single Interrogation** button). You should see now that both the **Tampered** (S/T) and **Opened** (O/C) flags are clear (black), just as they were in the beginning.

Chapter 3

DataSeal Installation

3 DataSeal Installation

step 1.

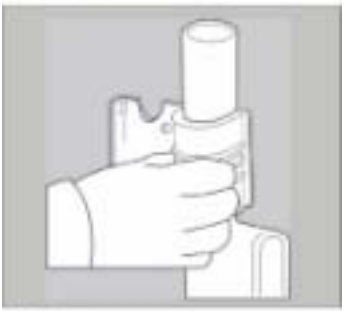


Fig. 1

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.

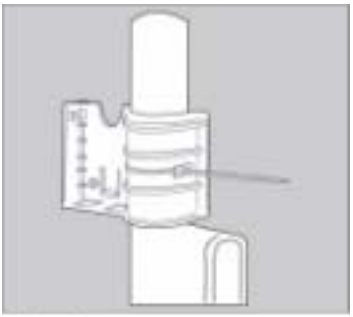


Fig. 2

The two side holes 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.

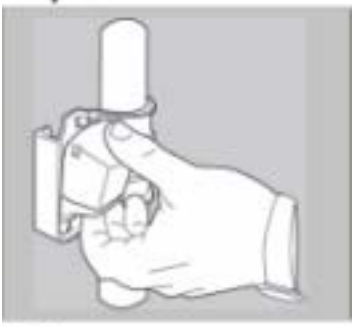


Fig. 3

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)

step 3.

Fig. 4

To connect the Sealing Wire, simply attach one end of the Sealing 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).

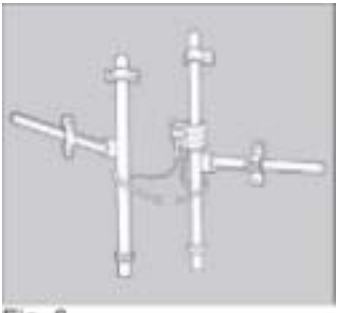


Fig. 6

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

FCC ID: OB6-IGRS40916

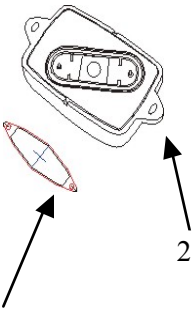
This device complies with Part 15 of FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference that may cause undesired operation.

Chapter 4

DataTag Installation

4 DataTag Installation

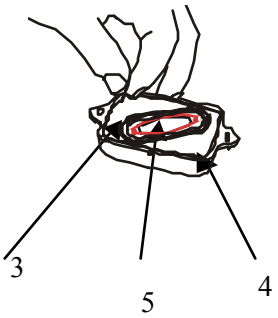
The DataTag is delivered with a set of double-sided tapes that are used for placing the DataTag on the tagged object.



The Sensor Plate (item #1) is supplied separately from the DataTag. To place the Sensor Plate peel the paper from the double-sided tape (item #2) and place the Sensor Plate in its place.

Press the Sensor Plate to the DataTag such that the double-sided tape will hold the Sensor Plate in place. Make sure the contacts at the bottom part of the plate are aligned with the pins in the DataTag.

Peel the paper from the three pieces of double-sided tape: The two larger pieces (items #3 & #4) are used for holding the DataTag to the tagged object, while the smaller piece in the middle (item #5) is used for pulling the Sensor Plate off the DataTag when the DataTag is removed from the tagged object, in order to detect the Tamper event.



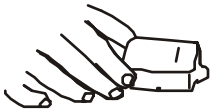
4.1 Placing the DataTag on a Vehicle

Note: The Installation instructions refer to the case when the DataReader is installed *Vertically*.

There are two preferred orientations for placing the DataTag on a vehicle: Horizontal and Vertical. These 2 options are described in the following sections:

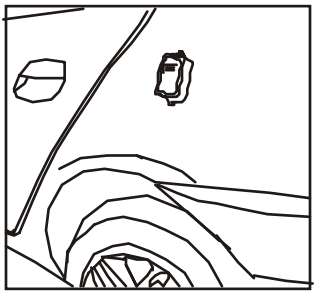
4.1.1 Horizontal Orientation:

Place the tag on a flat surface that is completely horizontal and press firmly to create good contact between the DataTag and the tagged object.



4.1.2 Vertical Orientation

Place the DataTag on a flat surface that is completely vertical, and press firmly to create good contact between the DataTag and the vehicle. It is recommended that the height of the DataTag above the ground will be above 3', and the optimal height is 5' above ground.



FCC ID: OB6-IGRS40T916

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.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which
- the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this equipment not expressly approved by Hi-G-Tek Ltd. could void the user's authority to operate the equipment.

Chapter 5

DataReader Installation and Operating Instructions

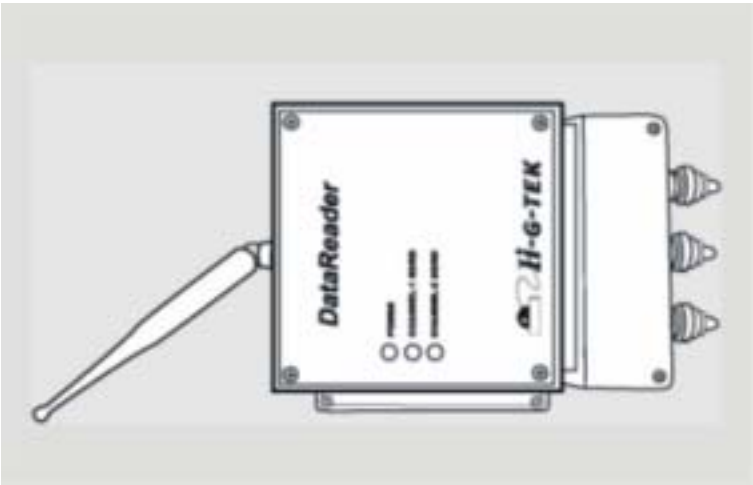
5 DataReader Installation

5.1 Outdoor DataReader Installation

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

5.1.1 Ceiling Installation

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. The figure below shows the DataReader installed on a ceiling, with the



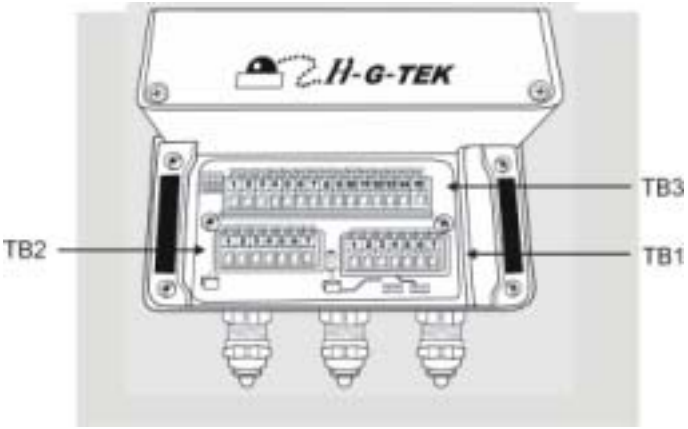
antenna perpendicular to the ceiling.

5.1.2 Connecting the Outdoor Unit

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

- Remove the cover of the **bottom portion** of the DataReader unit 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 through the glands into the terminal blocks. Use a small screwdriver to push the lever of the connector in order to let the wires in. Ensure that the wires are inserted in the slots in accordance with the color scheme. Wiring information for specific configurations are given further on in the chapter.



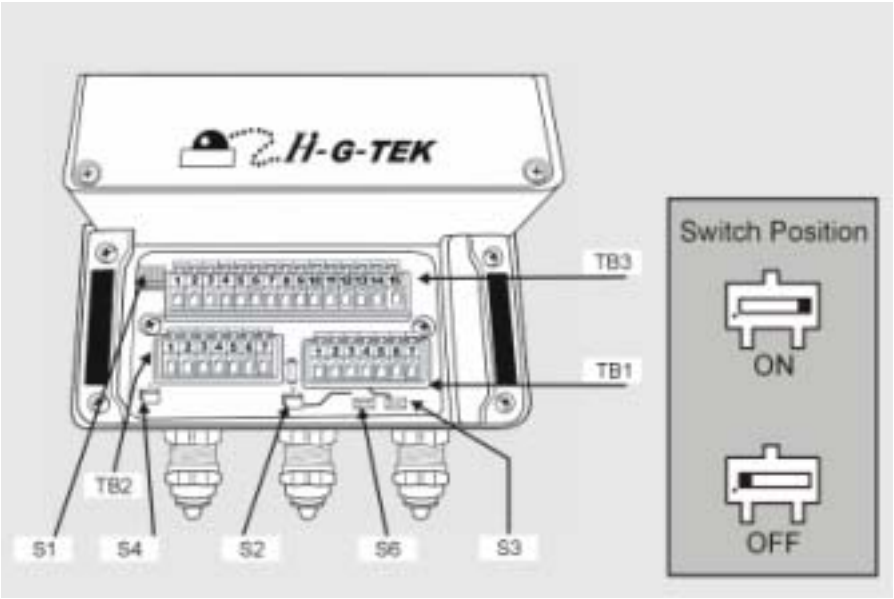
5.1.3 Wiring the Outdoor DataReader

The DataReader can be communicated with via one of three types of serial communication modes:

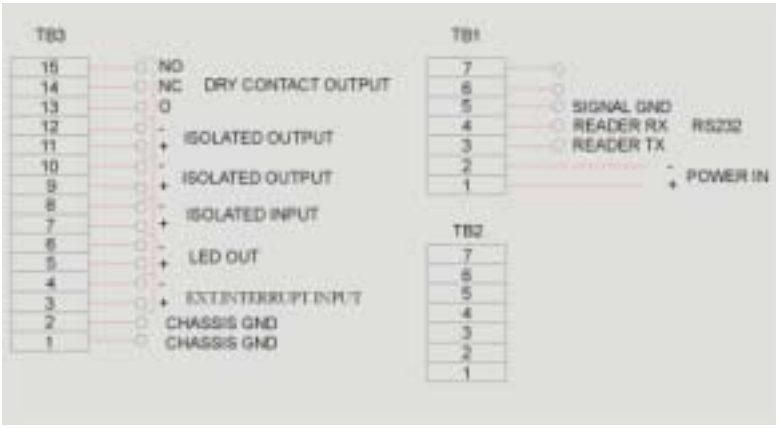
1. RS-485 Full Duplex
2. RS-485 Half duplex.
3. RS-232 (different model number)

According to the DataReader model in use, the serial connection can be either RS-232 or RS-485 (see chapter 10 for technical specifications).

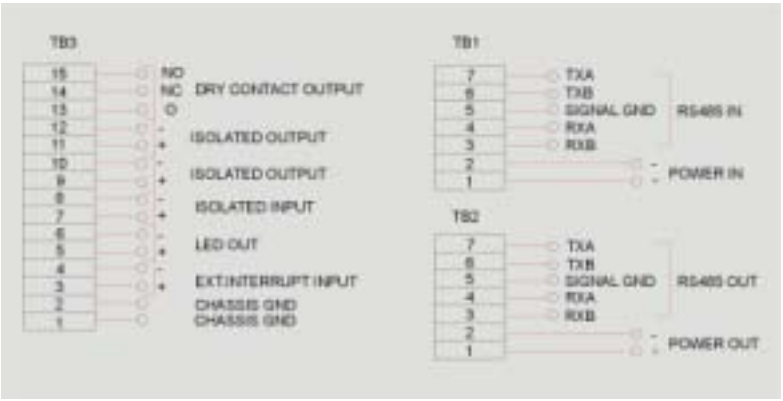
When the DataReader is connected using RS485, it can be set by the user to full duplex mode or half duplex mode by altering a configuration switch. For further information see sections 5.1.45.1.5 - 5.1.7.



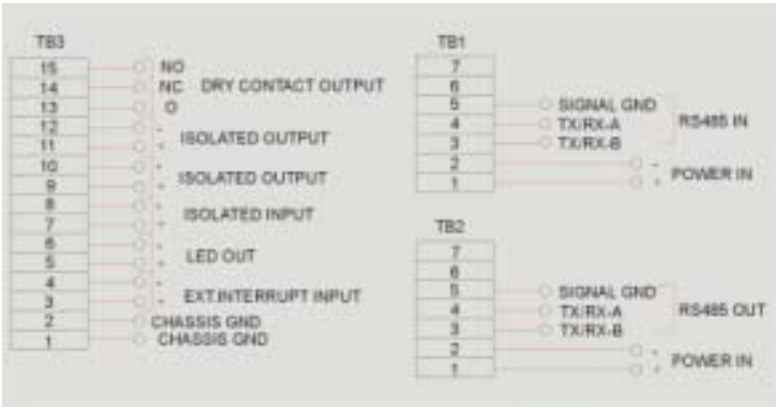
5.1.4 RS-232 Wiring Diagram



5.1.5 RS-485 Full Duplex Wiring Diagram



5.1.6 RS-485 Half Duplex Wiring Diagram



5.1.7 DataReader Configuration Switches

S1: Reserved for future use. Must be OFF.

S2: Termination ON/OFF switch.

In RS-232 mode this switch does not exist. In RS-485 mode, set this switch to ON if this is the last DataReader in the RS-485 chain. When this switch is ON, it connects an internal 120 Ohm termination resistor to the RS485 chain.

S3, S6: Full/Half duplex switches.

In RS-232 mode this switch does not exist. In RS-485 Full Duplex mode this switch must be ON. In RS-485 Half Duplex mode this switch must be OFF.

S4: DataReader shut-down switch.

While OFF: DataReader is active. While ON: DataReader is not powered. Default position: OFF

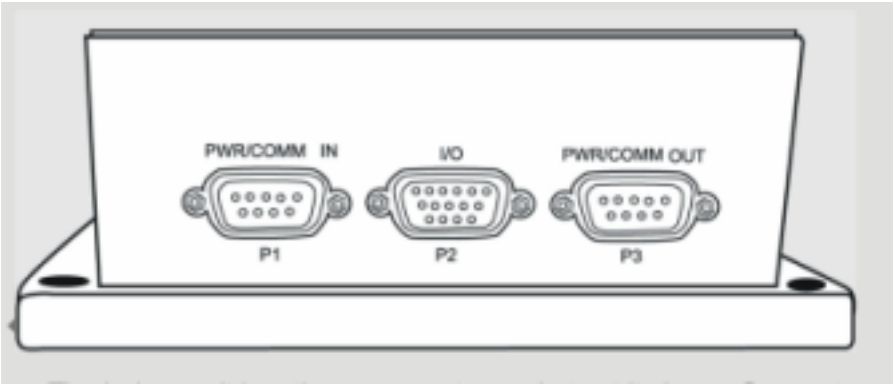
5.2 Indoor DataReader Installation

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

5.2.1 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.



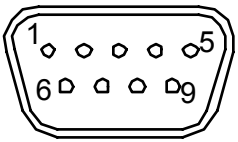
5.2.2 Wiring the Indoor DataReader

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

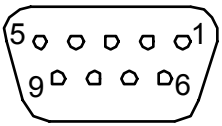
1. RS-485 Full Duplex
2. RS-485 Half duplex.
3. RS-232.

Note: RS-485 and RS-232 are different models.

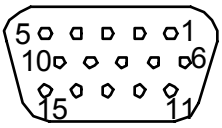
According to the DataReader model in use, the serial connection can be either RS232 or RS485 (see Technical Specifications). The RS485 connector is always optically isolated.



DB9 MALE
PIN ARRAGEMENT



DB9 FEMALE
PIN ARRAGEMENT



DB15 FEMALE
PIN ARRAGEMENT

5.2.3 RS-232 Wiring Diagram

4. Pin assignment for PWR/COM IN (P1) & PWR/COM OUT (P3)

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

5.2.4 RS-485 Full Duplex Wiring Diagram

Pin assignment for PWR/COM IN (P1) & PWR/COM OUT (P3)

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

5.2.5 RS-485 Half Duplex Wiring Diagram

Pin assignment for PWR/COM IN (P1) & PWR/COM OUT (P3)

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

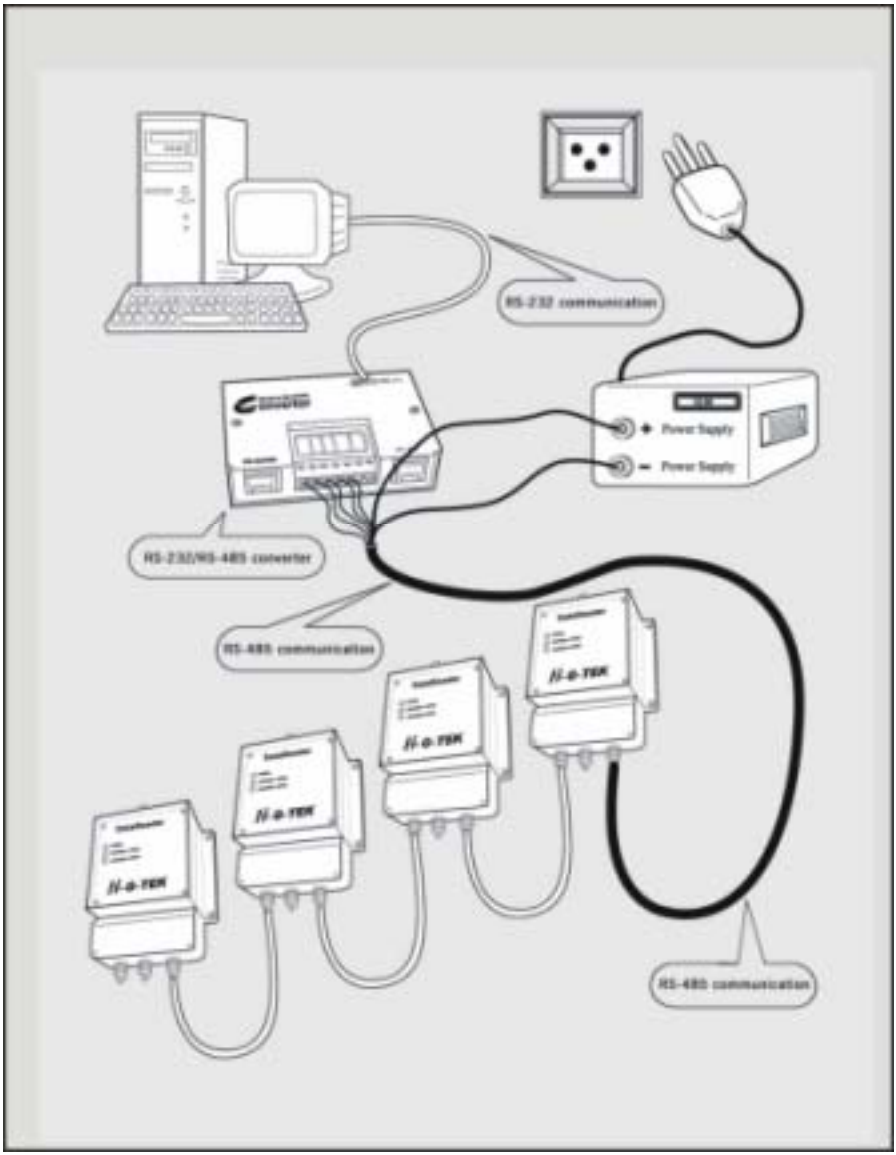
5.3 Chaining DataReaders Together

Up to 32 DataReaders can be connected in a daisy chain using RS-485. The last DataReader 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 DataReader 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.

The diagram in the next page shows the connections of a system with 4 DataReaders using an RS-485 chain.


RS-232 communication
Power Supply
Power Supply
RS-232/RS-485 converter
RS-485 communication
RS-485 communication

5.4 RS-232/RS-485 Adapter

To connect one or more DataReaders that use RS-485 to a controlling computer you need an RS-232 to RS-485 adapter.

Adapter's requirements:

- Full/Half duplex operation mode.
- Isolated communication lines.

Recommended adapter: Moxa Technologies, model A53.

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

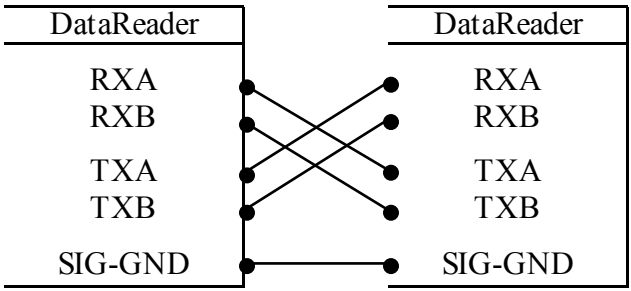
1. Communication mode, either half or full duplex – according to the DataReader configuration.
2. Txd: always enabled.
3. Rxd: always enabled.

Default configuration of the Moxa A53:

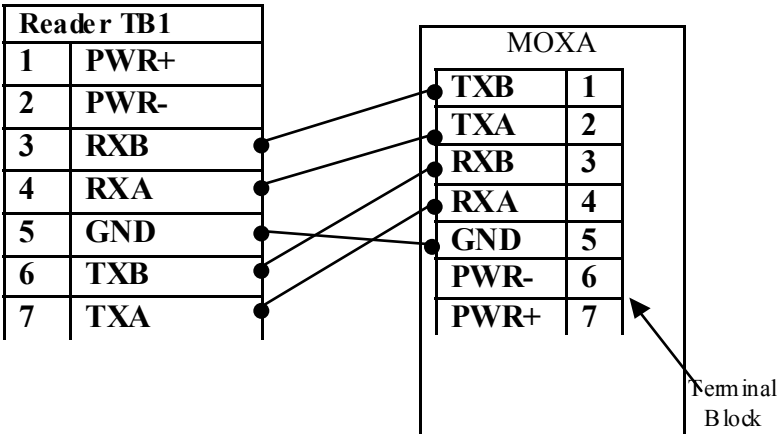
- Full Duplex mode
- Txd always enabled.
- Rxd always enabled.

5.4.1 Connecting the RS-232/RS-485 Adapter to the First DataReader

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



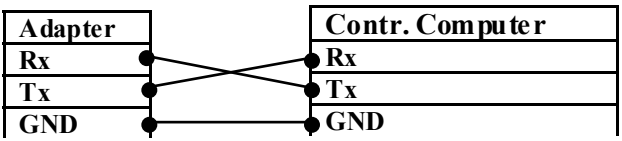
Moxa A53 Wiring:



5.4.2 Connecting the RS-232/RS-485 Adapter to the Controlling Computer

RS-232 3-wire connection should be performed between the Adapter and the controlling computer. (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 the controlling computer with RJ45/DB25 cable supplied with the adapter. If the controlling computer has a DB9 connector, a DB25/DB9 adapter should be used.

5.5 Power Supply Requirements

5.5.1 General

The DataReader supply voltage is chosen according to the model, either 12v, 24v or 48v (see the specifications of the different models in chapter 10.

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

Example: 10 DataReaders connected in a daisy chain require 10x1.7=17W of 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 your 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.

Both in the Outdoor and Indoor systems, the power supply should be installed indoor.

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

5.5.2 Indoor Installation

When the DataReader is installed indoor, the power supply used should be UL1950 approved. A desktop style with IEC320 inlet is recommended.

5.5.3 Outdoor Installation

For safety reasons, the DataReader shall be used with the following power supply only:

HI-G-TEK P/N	Manufacturer	Manufacturer P/N	Supply Voltage [V]	Supply Wattage [W]
HGT5291A	EDAC	EA1050D-240	24	24

5.6 Cable Selection

The cable is used for power supply to DataReaders 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).

For the power 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 DataReaders in the chain. Calculation of voltage drop for the certain setup should be done, in order to avoid this.

In most cases, the solution for such problems can be 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, including water proof, temperature, ruggedness etc.

Example:

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

The ohmic resistance between DataReaders 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 DataReader in the chain. This is below DataReader specification of DataReader 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 DataReader 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.

5.7 Installation Notes

The DataReader is distributed to a commercial/industrial use only, and should only be sold to the professional customers.

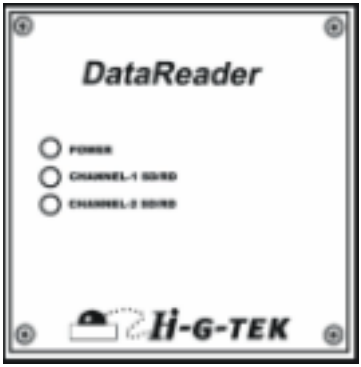
When installed outdoors, the unit shall be installed in accordance with the NEC or CEC.

Installation must be performed according to this user manual, and by a professional personnel only.

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.

5.8 DataReader Operation Instructions



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

5.8.1 Power Indicators:

The DataReader is activated by connecting it to a power supply. At power ON and self-test the power indicator's color alternates between green and red for several seconds. If the check result is OK, the indicator remains green. If a problem was detected, the indicator remains red.

This LED also has a special meaning when performing firmware download:

- On MCU firmware download, the indicator alternates between green and red.
- On RF Modem firmware download - the indicator remains off.

5.8.2 Channel 1 SD/RD Indicator:

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

5.8.3 Channel 2 SD/RD Indicator:

This indicator is not in use.

Chapter 6

System Overview

6 System Overview

6.1 System description

The Hi-G-Tek system consists of the following components:

1. **DataSeal**

The DataSeal is a sophisticated device, which includes 2 transmitter/receiver units (one for high frequency/long range and another one for low frequency/short range communications), real-time clock, processor, memory and sensing circuitry for sealing verification. The Sealing Wire prevents any attempt of opening, bypassing, or tampering with the DataSeal without alerting the system and recording the event. Data may also be written into and read from the DataSeal to store and retrieve general information. The DataSeal can communicate both in low frequency with short range devices, such as the DataTerminal and MicroDataReader, and in high frequency for long ranges with the DataReader, together allowing a broad range of applications.

2. **DataTag**

The DataTag is a variant of the DataSeal device. Instead of the Sealing Wire it has a removal sensing mechanism. This makes it more suitable for cases where you want to tag goods, but you don't have to seal them. Other than that, it is identical to the DataSeal device.

3. **MagneticDataSeal**

The MagneticDataSeal is a variant of the DataSeal device. Instead of the Sealing Wire it has a Magnet element. This makes it more suitable for cases

where you want to sense if the door is open but you can't seal it. Other than that, it is identical to the DataSeal device.

4. **DataReader**

The DataReader uses in high frequency (long range) RF communication to communicate with the DataSeals mainly for reading their IDs and their Statuses. The DataReader can also be used for reading and writing information to and from the DataSeal and retrieving logged events from the DataSeal. Each DataReader can communicate with numerous DataSeals simultaneously and verify their presence and status. The DataReaders can also be chained together to allow a longer and wider range of coverage. DataReaders must be connected to a controlling computer that control them.

5. **DataTerminal** (previously known as Hand Held Terminal or HHT)

This is a mobile handheld device which includes a keypad, a small LCD screen, a low frequency receiver/transmitter, and an RS-232 interface.

The main things that you can do with the DataTerminal are: Reading a DataSeal's ID and Status; Reset the DataSeal for a new use ("Set" command); reading and writing data to and from the DataSeal – for example: manifest number, truck number, driver name etc.; reading the events that were logged in the DataSeal; Transferring this information to and from a PC.

6. **DataPort** (Previously known as Low Frequency Terminal, or LFT)

The DataPort is a simple low frequency modem. It includes a low frequency transmitter/receiver and an RS-232 interface that connects to a PC. In other words, it enables a PC to communicate almost directly with a DataSeal. In general, the DataPort enables the PC to perform the same

operations as the DataTerminal, given that an appropriate software exists in the PC.

7. **MicroDataReader**

The MicroDataReader is a key ring size mobile device that includes a low frequency transmitter/receiver, 1 or 2 buttons and a LED indicator. Using the MicroDataReader you can perform the following functions:

1. Verify – The LED will turn green if the DataSeal's Status is OK, or to red if it's Tampered.
2. Set (Optional) – prepares the DataSeal for a new use. The type of the Set command (normal, Soft Set or Suspended Set) is model specific. Hi-G-Tek can provide MicroDataReaders with different commands if required.

6.2 DataSeal and DataReader Modes of Operation

6.2.1 DataSeal Modes of Operation

Generally speaking, a DataSeal can be used in any of the following ways:

1. **Operation Mode (Normal Mode)**

This is the normal and most basic mode of operation. In this mode, the DataSeal is on standby most of the time. Once every predetermined period, called **Tw**, the DataSeal samples the HF (high frequency) channel searching for a transmission from a DataReader. If it detects such transmission, it listens and answers as needed. The default value of Tw is 3 seconds, which is the most appropriate for most applications. In the Operation Mode, the DataSeal also listens constantly to the low frequency channel and responds as needed. During the Operation Mode the DataSeal

logs events (like opened, closed, tampered, etc.) and stores them internally in the Events Memory.

2. **Deep Sleep Mode**

This mode should be used when the DataSeal is not in use in order to conserve energy. DataSeals always leave the factory in this mode. It is possible to enter a DataSeal to this mode also by using high frequency or low frequency command. To exit this mode, interrogate the DataSeal using low frequency (for example, using a DataTerminal), or send a **Hard Wakeup** command in high frequency using a DataReader.

Note: While in Deep Sleep mode, no Events are recorded. Events aren't recorded also after waking up the DataSeal, until a **Set** command is performed. In other words, after waking up a DataSeal, you must also perform a **Set** command in order for the DataSeal to start record events.

3. **Alert Burst Mode**

This mode is similar to the Operation Mode. In addition, whenever the DataSeal is opened, it transmits an **Alert Burst** message in the high frequency channel. The DataReader and the application should both be configured to receive and handle the alert message. A DataSeal can be configured also to transmit Burst messages on other events.

4. **Footprint Events Mode**

This mode is a way of *using* the DataSeal, rather than a configuration of the DataSeal. When the DataSeal receives a special variant of the **Verify** command in low frequency or in high frequency, it records a certain Event called "**Read**", that includes the DataReader's ID or the low frequency device's ID. To use this special command in the DataReader, the DataReader has to be configured accordingly. This mode is useful to determine the DataSeal's track if there are several DataReaders, or check

points with DataTerminals along the way. In this scenario, you can know the DataSeal's track by reading its Events, without having to have these DataReaders connected to any central system.

6.2.2 DataReader Modes of Operation

There are several aspects that determine the DataReader's mode of operation. These aspects are determined by the Mode parameter, which is a bit oriented parameter.

5. **Carrier Sense Collision Prevention**

Just like you can't understand what two people are saying when the speak simultaneously, that way a DataSeal can't understand two DataReaders that transmit simultaneously. When two (or more) close DataReaders aren't controlled by the same controlling computer (or by controlling computers that are synchronized among them), there's a chance that they will try to transmit simultaneously. In order to prevent that, the DataReaders can be configured to sense for a carrier (transmission of another DataReader or DataSeal) before they start transmitting. When a DataReader is configured for Carrier Sense, each time before it transmits something it listens to the frequency, and only if it's clear (no one else is transmitting), it start transmitting its own message.

6. **Burst Receiving Mode**

When DataSeals are operating in Alert Burst mode, the DataReader's receiver must be ON at all times in order to receive the Burst messages. The controlling computer has to query the DataReader periodically to receive the Burst messages that the DataReader received.

6.3 Most Common Commands and Seal Status

6.3.1 Most Commonly Used Commands

There are a number of key commands that are used in most applications, as they enable the basic operation of the system. These commands are:

7. **Verify**

The **Verify** command is used to detect DataSeals which are located within the DataReaders Receiving Zone and also verify their state. The DataSeals which respond may be in one of two states. The DataSeals may be in either the normal state, meaning the have not been tampered with, or in the tampered state, meaning they have been tampered with. Additional information can also be queried from the DataSeal. This is the most useful and commonly used command in the system.

8. **Tampered**

The **Tampered** command is used to communicate with tampered DataSeals. The command operates the same as the **Verify** command only DataSeals which are in the Tampered state respond. The aim of the command is to provide high priority to tampered DataSeals in a crowded DataSeals environment.

9. **Set**

The **Set** command is used to set a DataSeal for a new use. The Sealing Wire must be connected and closed in order for a DataSeal to be set. The **Set** command deletes all Events stored in the Events Memory and is the first new Event recorded in the DataSeal. The DataReader can send the **Set** command to up to 8 DataSeals simultaneously.

10. **Suspended Set**

Similar to the **Set** command, **Suspended Set** is used to set a DataSeal for new use. Unlike the **Set** command, when performing a **Suspended Set** command, the Sealing Wire Must be opened (or completely disconnected from the DataSeal). The DataSeal will become armed (Set) once the Sealing Wire has been connected to the DataSeal and closed.

11. **Approve Open**

The **Approve Open** command allows a Sealing Wire to be opened after the DataSeal has been set in a way that the application can determine that the DataSeal was opened with an approval. When the Sealing Wire will be opened after receiving this command, the application will be able to determine that the opening is approved by examining the Approved Open flag in the DataSeal's Status.

6.3.2 DataSeal's Status

The DataSeal's Status consists of 4 bytes. A DataReader may be used to request the DataSeal's Status. The DataSeal's Status is used to indicate the DataSeal's current state and is a bitwise value. Each bit in the Status represents a specific status flag. The DataSeal's Status is divided into the **Short Status** and **Long Status** parameters as explained below:

The DataSeal's **Short Status** parameter consists of 1 byte (8 bits) which is a subset of the **Long Status** parameter. The **Short Status** contains the most important flags. These flags are:

1. **Tampered** – The **Tampered** flag gets set if the Sealing Wire was opened or tampered with. It remains set even if the Sealing Wire is closed again. It can only be unset by performing on of the **Set** commands.
2. **Low Battery Warning** – Battery is low, replace the DataSeal.
3. **Opened** – Indicates that the Sealing Wire is open.

4. **Suspended Set** – A **Suspended Set** command was performed, and the Sealing Wire wasn't closed yet.
5. **Sealing Wire Changed** – Indicates that the Sealing Wire's electronic characteristics have changed since the DataSeal was Set.
6. **Deep Sleep** – Indicates that the DataSeal is in Deep Sleep mode.
7. **General Error** – Indicates an error with the DataSeal that is not represented in the DataSeal's **Short Status**.
8. **Approved Open** – If the DataSeal **Opened** flag is on, the **Approved Open** flag means that the opening is approved. If the DataSeal's **Opened** flag is off, it means that the next open will be approved, if performed during a certain period.

The DataSeal's **Long Status** contains the **Short Status** flags as well as 3 additional bytes that together represents the complete DataSeal's status. For a detailed description of the **Long Status**, see chapter 8.

6.4 System Planning

When planning an application, attention should be paid to both system operation and topology. Application requirements and electromagnetic environment characteristics should also be taken into account.

2 basic types of applications are possible: Fixed DataReader applications and Mobile DataReader applications. A complex application that combines DataReaders in both configurations is also possible.

The Fixed DataReader applications are applications where the DataReaders are mounted at a fixed site. The Mobile applications are situations where the DataReaders are mounted on vehicles for monitoring DataSeals in transit. Mobile applications are normally implemented using the TrackingDataReader, but may also be implemented using a DataReader

connected to any mobile controller (E.g. laptop, palmtop, etc), that has a serial communications port.

6.4.1 Electromagnetic Environment

Radio Frequency Communication is the basic technology used by the system. While this is a very robust method for communicating with remote devices, several issues should be considered when planning a site.

- Metal walls should not be used to shield the remote devices.
- Communication distance between remote devices may vary due to atmospheric conditions and other electromagnetic interferences.
- Communication distance may also vary according to one or more of the following:
  - Line of sight between devices – existence and clearance.
  - Proximity to metal objects.
  - Indoor or Outdoor environment.
  - Antenna orientation between the devices.

It is recommended to map the site with actual devices for proper coverage. When planning the site layout, safe margins should be taken into account to ensure proper operation at all times. Possible environmental changes should also be considered.

6.4.2 System Layout

Two aspects should be considered when dealing with system layout:

1. Radio Frequency Communication Layout.
2. Line Communication RS-485 or RS-232 Layout.

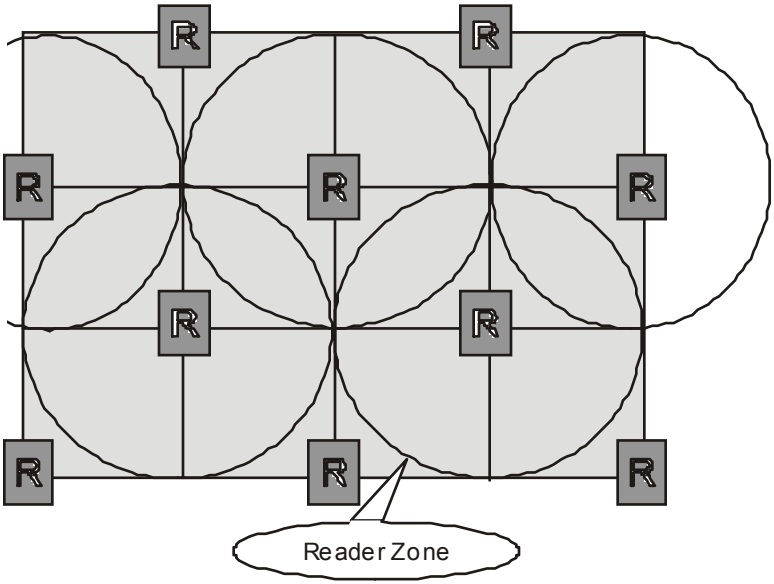
6.4.2.1 Radio Frequency Communication Layout.

When only one DataReader is in use, the previously mentioned environmental considerations are all that need be taken into account.

When more than one DataReader is in use, it should be understood that in the same area **only one** DataReader can communicate with the DataSeals at the same time. Interference will be caused by more than one DataReader Trying to communicate with the DataSeals in the same period of time. **The DataReaders should be synchronized using the application software or using the Carrier Sense mode**. Several DataReaders may operate simultaneously provided that it has previously been confirmed that they will not interfere with each other.

6.4.2.1.1 Cellular Layout

Cellular topology should be used to ensure efficient coverage of a large area. The following diagram illustrates the concept:



DataReaders must be properly placed to ensure there are no dead zones within the defined area. Overlaps should be as shown in the above drawing.

DataReader's Receiving Zone is the term used to describe the area of reliable communication covered by a DataReader. The DataReader's Receiving Zone is also called a Cell. As the drawing illustrates, it is extremely important that the application software controls and synchronizes the DataReader's operation in order to avoid RF collisions. In other words, the application software has to make sure that no two DataReaders with overlapping Receiving Zones transmit at the same time.

6.4.2.2 Line Communication RS-485 Layout

The connection of many DataReaders to a controlling computer is done via the RS-485 protocol. Up to 32 DataReaders may be connected to one serial

communications port, depending on the type of RS-485 to RS-232 converter used.

Two topologies can be used:

- A long daisy chain connection, where all the DataReaders are connected in one long line.
- A star-type connection, where the DataReaders are split into groups and each group is connected directly to the converter.

It is recommended that the second alternative be used wherever possible. A star-type connection provides better tolerance to connection failures. This alternative is also preferable from the power supply point of view, as only one power supply for the DataReaders is necessary. The power supply should be located near the converter. When the line is divided into segments, the voltage drop along the segments is smaller.

6.5 Systems Segregation

When Hi-G-Tek has designed the system, several security and operational considerations have been taken into account:

- Similar equipment belonging to one company should not be able to mess with another company's system either intentionally or unintentionally.
- Limit unauthorized access between different departments of the same company. Equipment belonging to one department of a company should not be able to interfere with equipment of another department, either intentionally or unintentionally.
- Service Providers should be able to communicate with their customer's equipment in order to supply common services to several companies. This should be done in an authorized an limited manner.

- DataSeals may have to be divided into groups that are not related to companies or departments.

6.5.1 Companies Segregation by OrgID

OrgID is a unique value assigned to each company by Hi-G-Tek or by one of its authorized dealers. Every device supplied to that company is pre-programmed with the same OrgID at production, and the customer can't change it ever again. In every communication between two devices, the caller (e.g. DataReader) sends its own OrgID value. When the consignee (e.g. DataSeal) receives the message, it first compares the OrgID it received with its own OrgID, and only if they match the consignee performs the command and sends its response. If a DataSeal receives a message a different OrgID than its own, it turns on the **Illegal OrgID** flag in the **Long Status**, and ignores the message.

There's one exception in which a DataSeal can respond to a message with a different OrgID in order to allow collaboration with service providers. This is described in more details in section 6.5.3.

6.5.2 Department Isolation

Department is a unique value assigned by a company to a group of devices belonging to the same department. It is possible to isolate equipment between departments by using the Department parameter in the various devices.

The default value of Department is zero in all devices. When set to that default setting, all the devices can communicate with one another without any limitations.

If a DataReader's Department value is not zero, it can communicate only with DataSeals that has the same Department value.

If a DataReader's Department value is not zero, it can communicate with all of the DataSeals in the same organization, even if their Department value is non-zero. Such a DataReader is considered "Supervisor". The **Department** parameter both in DataReaders and in DataSeals can be changed by the user at any time.

6.5.3 Services to Several Companies by a Service Provider

The DataSeal has a boolean parameter named **Global**, which is designed to allow a Service Provider to service several customers. If a DataSeal's Global parameter is on, then that DataSeal will respond to any **Verify** command from any DataReader, regardless of OrgID. The **Verify** response will be a limited one, containing only a certain few of the DataSeal parameters. See the description of the **Global** parameter in chapter 8 for a list of the parameters that can be included in the **Verify** response in this case.

Note: The **Global** parameter is programmed during production, and **it must be defined and requested in advance**.

6.5.4 Subgroups of DataSeals

When a DataReader sends a **Verify** command In order to detect the DataSeals in its area, it can receive only a limited number of responses at a time. If there are many DataSeals in the DataReader's Receiving Zone there could be too many DataSeals trying to respond at the same time, and that would cause that none of them will be properly received by the DataReaders. In order to avoid that, the DataSeals can be divided into small groups and each group be assigned a unique value called ADI. When the DataReader will execute a **Verify** command, it would be able to specify a specific group, and only DataSeals that belong to that group will respond. If the DataReader would iterate through the groups, it can receive all the DataSeal in a relatively short time.

For that purpose, the DataSeal and DataReader devices have an **ADI** parameter. The ADI parameter works very similar to the **Department** parameter, with 2 differences: **ADI** is 4 bytes while **Department** is 1 only byte, and the controlling computer can explicitly specify a different ADI for each RF command it requests the DataReader to transmit.

The **ADI** parameter can be used also to create groups by usage in other scenarios.

6.5.5 OrgID, Department, Global and ADI Impact on DataSeal's Response

The following statements summarizes when and what a DataSeal responds:

1. If the DataReader's **Department** parameter is zero, the **Department** is always considered to match.
2. If the DataReader sends a zero **ADI**, the **ADI** is always considered to match.
3. **OrgID** doesn't match and **Global** is on: DataSeal will respond with limited **Verify** command only.
4. **OrgID** doesn't match and **Global** is off: DataSeal will not respond.

Table 6-1 : OrgID and Global

OrgID	Global	Effect:
Unmatched	ON	DataSeal will respond with limited Verify command only
Unmatched	OFF	DataSeal will not respond

5. **OrgID** matches, **Department** matches, and **ADI** matches: DataSeal will respond without limitations.
6. **OrgID** matches, and **ADI** doesn't match: DataSeal will not respond.

Table 6-2 : OrgID, Department, and ADI

OrgID	Department	ADI	Effect:
Match	Match	Match	DataSeal will Respond without any limitations.
Match	Match/ Unmatched	Unmatched	DataSeal will not respond
Match	Unmatched	Matched/ Unmatched	DataSeal will not respond
Unmatched	Match/ Unmatched	Match/ Unmatched	DataSeal will not respond

6.6 DataSeal's Memory

The DataSeal's Memory is divided into 2 sections: Events Memory and User Data.

6.6.1 Events Memory

This memory stores the Events detected by the DataSeal during normal operation. This memory can contain up to 55 Event records.

The memory has a FIFO type structure with 2 segments: The first segment can store 45 Events and is a simple FIFO buffer. The second segment can store 10 Events and is a cyclic buffer with the last Events detected.

When this cyclic buffer is overrun, the **Scroll** flag in the Long Status is set.

The **Set** Event is always the first Event record in the Events Memory.

First segment: 45 Events	**Set** Event
Second segment: 10 Events	

Some Events are caused by an external intervention (like Opened and Closed), while others are caused by internal procedures.

The most common Events are the **Set**, **Tampered**, **Opened** and **Closed** Events. See chapter 8 for a complete list and descriptions of each Event type.

6.6.2 User Data

User Data is the memory segment where free data can be written and read. For example, the electronic manifest can be stored in this memory.

The User Data can be read and written using the **Read Data** and **Write Data** RF commands accordingly. The User Data can also be read by the **Verify** and the **Read Multi Access Data** RF commands. The size of the User Data memory segment is 2KB.

Even though all the User Data is simply a flat memory segment, the lowest 53 bytes are of special meaning for the DataTerminal. If you're using or considering to use a DataTerminal in your system someday in the future, you should use these 53 bytes in a way that is compatible with the DataTerminal. The DataTerminal uses the first 53 bytes as follows:

6.6.2.1 The User Data portion used by the DataTerminal

The DataTerminal is capable of viewing and editing 48 bytes (addressed 5 – 52) of the User Data as a structure of ASCII fields. This structure has to be defined first by the user, using a special PC software provided with the DataTerminal, and then uploaded to the DataTerminal. The structure definition includes the labels and sizes of the fields and is assigned an identifier (called UDT), and a version number. When the user writes User Data using the DataTerminal, the DataTerminal always stores this identifier and version number in address 0, and the date and time when the data was written, in addresses 1-4.

Table 6-3: Memory map of the lower portion of the User Data.

Address	Byte Content	
0	UDT	Version
1	Time & Date	
2		
3		
4		
5	Data	
.		
.		
.		
52		

6.7 System Commands

The following list describes the commands that can be sent to one or more DataSeals by the DataReader. For more information about each command see chapter 8 and the DataSealLib COM DLL help file.

1. **Verify** – Uses to detect DataSeals located inside a DataReader's Receiving Zone.
2. **Tampered** – Uses to detect DataSeals located inside a DataReader's receiving zone that are in the Tampered state.

3. **Set** – Uses to prepare DataSeals for a new use. Sealing Wire must be attached and closed prior to the **Set** command. This command can be sent up to 8 DataSeals simultaneously.
4. **Suspended Set** – Similar to the **Set** command except that the Sealing Wire must be open prior to performing the command and the DataSeal gets set once the Sealing Wire is closed. This command can be sent to up to 8 DataSeals simultaneously.
5. **Soft Set** – Similar to the **Set** command, the **Soft Set** command is used to prepare DataSeals for a new use. Unlike the **Set** command, the **Soft Set** command does not delete the previously recorded Events in the Events Memory. This command can be sent to up to 8 DataSeals simultaneously.
6. **Deep Sleep** – Puts the DataSeal into Deep Sleep mode. This command can be sent to up to 8 DataSeals simultaneously.
7. **Hard Wakeup** – Brings DataSeals which are in Deep Sleep mode back to normal operating mode. This command can be sent to up to 8 DataSeals simultaneously.
8. **Start Alert Burst Mode** – Puts DataSeals into Alert Burst mode. This command can be sent to up to 8 DataSeals simultaneously, or to all the receiving DataSeals.
9. **Stop Alert Burst Mode** – Brings DataSeals which are in Alert Burst mode back to normal operating mode. This command can be sent to up to 8 DataSeals simultaneously, or to all the receiving DataSeals.
10. **Acknowledge Alert Burst** – Acknowledges the reception of Alert Burst messages from DataSeals. The **Acknowledge Alert Burst** command tells the DataSeal that its message has been received. After receiving an **Acknowledge Alert Burst** command, the DataSeal stops transmitting its Burst message until a new Tampered event is detected. This command can be sent to up to 8 DataSeals simultaneously.
11. **Read Data** – Retrieves data from a DataSeals' User Data area.

12. **Write Data** – Writes data into a DataSeal's User Data area.
13. **Reset Data** – Erases all the data in a DataSeals' User Data area.
14. **Set/Reset Status** – Sets or resets specific flags of the DataSeal's **Long Status**.
15. **Write Parameters** – Writes new values to one or more DataSeal parameters.
16. **Read Parameters** – Reads the values of one or more DataSeal parameters.
17. **Addressed Verify** – The **Addressed Verify** command is the same as the Verify command except that it is applicable to only one DataSeal. This command is most commonly used to verify that a specific DataSeal is located within a DataReader's Receiving Zone.
18. **Multi Addressed Verify** – The **Multi Addressed Verify** command is the same as the **Addressed Verify** command, but is applicable to up to 7 DataSeals simultaneously.
19. **Read Events** – Reads part of or all Events stored in the DataSeal's Events Memory.
20. **Approve Open** – Permits to open a DataSeal after it has been **Set**. If opened, both the DataSeal's **Approved Open** and the **Tampered** flags will be set. This command is intended for recognizing permitted DataSeal openings.
21. **Start Forced Burst** – Forces the DataSeal to send a special Burst message called **Forced Burst**. It is most useful when this command is executed in Low Frequency, and by that causing the DataSeal to send information to the DataReader. When used in high frequency, it may be executed in one DataReader, while a different DataReader (in another place for example), should receive the **Forced Burst** message.
22. **Temporarily Disable HF** – Disables the HF channel in a DataSeal for a specified period. This is useful to conserve battery when the area may

be dense with HF communications that don't apply to that DataSeal, or to prevent the DataSeal from responding to a **Verify** command for a certain period, in order to allow other DataSeals to be received.

Chapter 7

Evaluation Software

7 Evaluation Software

Hi-G-Tek provides the **DataSeal Evaluation Software** for its customers in order for them to get an impression of how the system works. Using the Evaluation Software you can play with many of the system's features and examine its behavior.

If you're reading this manual chapter by chapter, you should now have an idea of how the system works but lacking the details. Before going into the details in the next chapters, getting to know the Evaluation Software is just the right thing to do in order to have a tool that allows you to play with the "bits and bytes" of the various commands.

7.1 Software Installation

If you have an older version of the Evaluation Software you should first remove it (from the "Add/Remove Programs" icon in the Control Panel)

Insert the CD-ROM labeled "Hi-G-Tek" into the CD-ROM drive.

From the Start menu, choose "Run". Assuming your CD-ROM drive is drive E, type "E:\DataSeal Evaluation Software\Setup.EXE" in the "Run" dialog box. If your CD-ROM drive letter is not E, replace the first E with your CD-ROM drive letter. Click **OK** to start installing the DataSeal Evaluation Software.

Follow the instructions on the screen until it says that the software is successfully installed.

If you're using Windows 98, restart your computer (even if you're not requested to by the installation software).

The Evaluation Software is now installed. A new shortcut icon "DataSeal Evaluation" is added to your Start->Programs menu.

7.2 Communication Setup – The Readers Administration Window

The Evaluation Software must know which DataReaders are connected to the computer as well as the serial communication port they're connected to and the baud rate of that port.

The Evaluation Software supports up to 32 DataReadres connected using RS-485 to a single communication port or a single DataReader connected using RS-232. Configuring the DataReaders, communication port and baud rate is done through the **Readers Administration** window.

Figure 7-0

The **Readers Administration** window can be accessed by clicking on the **Readers** menu button on the top of the screen, and then on **Readers Administration**. Alternatively, click on the **Readers Administration** icon (Figure 7-0) or press Ctrl+R.

7.2.1 Defining the Connected DataReaders

To add a DataReader, insert the Reader ID in the **Reader ID** text box and click on the **Add** button (Figure 7-0). The Reader ID is located on the back of the DataReader, in barcode and in numeric format. To remove a DataReader, use the mouse to

Figure 7-0

mark it and click on the **Remove** button.

The Evaluation Software assigns a Reader Address to each configured DataReader automatically.

7.2.2 Setting Up the Communication Port

In the **Readers Administration** window, click on the **Comm. Port** drop down list to define the communication port that the DataReaders are connected to. Click on the **Baud Rate** drop down list to the right of the **Comm. Port** drop down list to define the baud rate of that port. Once you have made your selection, click on the **Set Comm Port** button. Figure 7-0 shows the **Readers Administration** window.

Figure 7-0

7.3 Reader Setup

The **Reader Setup** window allows you to view and to modify the parameters of the DataReaders. A complete description of each parameter is given in chapter 8.

To open the **Reader Setup** window, click on the **Reader Setup** icon in the toolbar or select the **Readers** menu and then the **Reader Setup** item as shown in Figure 7-0.

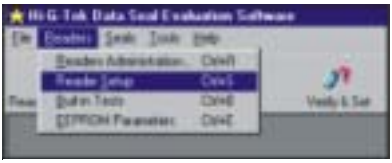


Figure 7-0

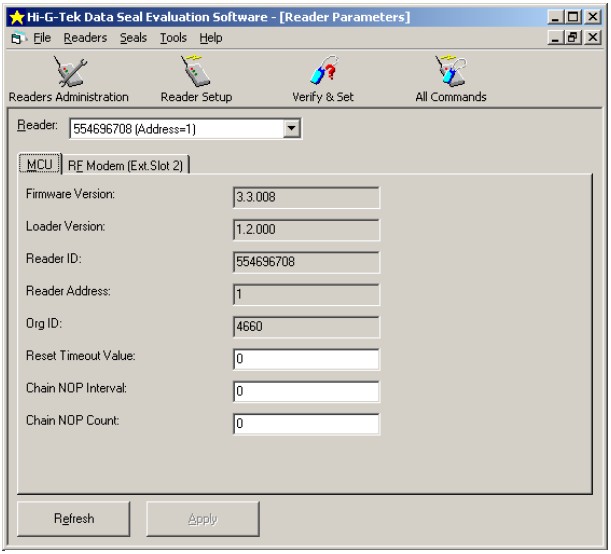


Figure 7-0

The parameters of the DataReader are divided into 2 groups: MCU and RF Modem. Each group has its own tab in the **Reader Setup** window. Some parameters are read-only. These parameters appear over a grey background (like the Firmware Version parameter in Figure 7-0)

If you want to change the value of one or more parameters, enter the new value(s) in their corresponding text boxes, and then click **Apply** to write the new values to the DataReader. To read the current values from the DataReader click on the **Refresh** button.

7.4 The Verify and Set Window

The **Verify and Set** window contains the most useful commands in a way that is easy to use.

You can access the **Verify and Set** window by clicking the **Seals** menu button on the top of the screen, and then on **Verify and Set** as shown in Figure 7 0-. Alternatively, you can click on the **Verify & Set** icon as shown in Figure 7-0

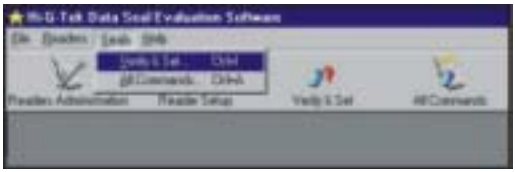


Figure 7-0

or press Ctrl+I.

Figure 7-0 shows the various parts of the window. Following are the descriptions of these parts:

Figure 7-0

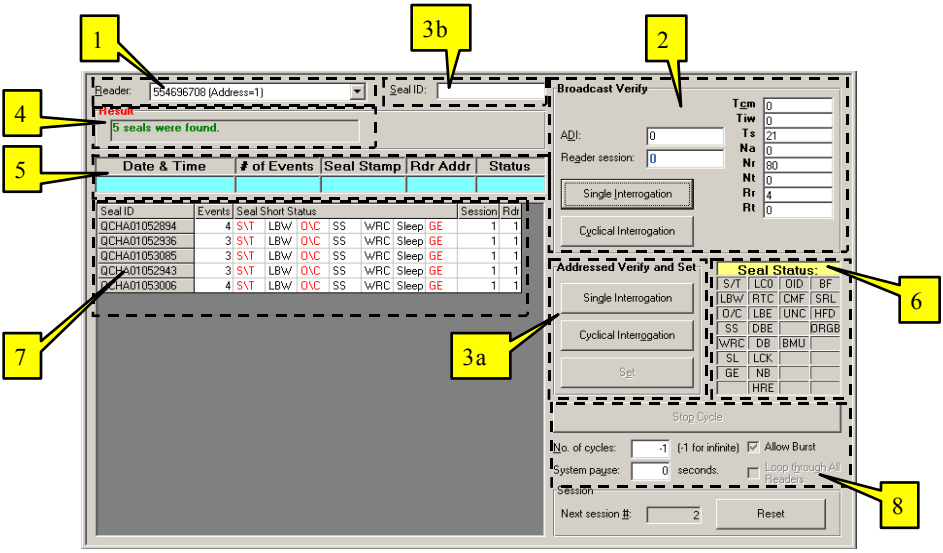


Figure 7-0

1. Reader ID selection box: In this box, you can choose which DataReader will invoke the commands.

2. Broadcast (normal) Verify frame: Through this frame you can invoke the **Verify** command as well as to control some of its parameters.

3a. Addressed Verify and Set frame: Through this frame you can invoke the **Addressed Verify** command and the **Set** command.

3b. Seal ID box: In this box you have to specify the Seal ID with which you want to communicate using the **Addressed Verify** and the **Set** commands. A Seal ID can also be entered to this box by clicking on the desired Seal ID in the Broadcast Verify responses list (Item #8)

4. Result indication box: After invoking any of the commands, this box indicates whether the command succeeded or failed. Success indications appear in green, while failure indications appear in red. In

some cases of failure more detailed information about the cause of the failure can be seen by hovering with the mouse cursor over this box.

5. Addressed Verify response indicators: When a DataSeal responds to an **Addressed Verify** command, these indicators display the information that was received by it. Its **Long Status** is displayed in the Seal Status indicators (Item #6)
6. Seal Status indicators: When a DataSeal responds to an **Addressed Verify** command, these indicators reflect the DataSeal's **Long Status** as reported by the DataSeal. Flags that are set appear in red, while unset flags remain black. When a DataSeal responds to a **Set** command, only the **Short Status** is returned and is indicated by the leftmost column. The rest 3 columns are dimmed. A complete list of the DataSeal's **Long Status** flags and their meanings appear in chapter 8.
7. Broadcast Verify responses list: After a Broadcast Verify interrogation, the responses of the DataSeals are added to this list.
8. Cyclical interrogations control frame: This frame contains some controls that you can use to affect the way that a cyclical interrogation (Broadcast or Addressed) is executed.

7.4.1 Executing Broadcast Verify Command

The **Broadcast Verify** command (sometimes referred to simply as **Verify**) is a command that collects information from all the DataSeals that receive the command (given that their OrgID, Department and ADI match). This command is the most powerful command, and has many parameters that enable to fine tune its behavior. A complete description of all the parameters is given in chapter 8. Normally, the default values of the parameters are adequate, but you may change them to best suit your needs.

If you want to execute the **Broadcast Verify** command only once, click on the **Single Interrogation** button (shown in Figure 7-0). You can also execute the **Broadcast Verify** command continuously (or cyclically) by

clicking the **Cyclical Interrogation** button. You can control some aspects of the cyclical interrogation from the cyclical interrogations control frame (item #8 in Figure 7-0) as described in section 7.4.4.

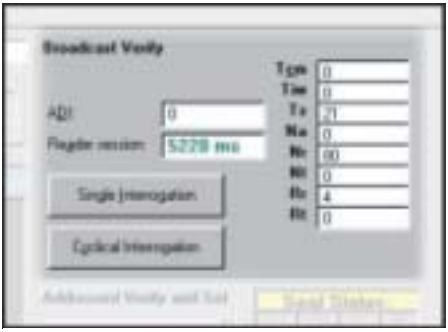


Figure 7-0

The results (responses) of the **Broadcast Verify** command are displayed in the Broadcast Verify responses list (item #7 in Figure 7-0). The results are always appended to this list. To clear the list click on the **Reset** button on the lower right side of the window.

Each response in the Broadcast Verify responses list contains the following information:

- Seal ID
- Events: The number of Event records that exist in the DataSeal.
- Seal Short Status: This column is divided into 7 sub columns, each represents a single flag in the DataSeal's **Short Status**. If the flag is set (on), the flag appears red, and if unset (off) the flag appears black. The flags are:
  - S/T – Set/Tampered: if on, indicates that the DataSeal was tampered.
  - LBW – Low Battery Warning.
  - O/C – Open/Close: if on, indicates that the Sealing Wire is open.
  - SS – Suspended Set: if on, indicates that the DataSeal is in Suspended Set state.

- WRC – Wire Resistance Changed: indicates that an attempt to short circuit the Sealing Wire was detected.
- Sleep – If on, indicates that the DataSeal is in Deep-Sleep mode.
- GE – General Error: if this flag is on, it indicates a problem that can be determined by other flags in the DataSeal's **Long Status**, that are not included in the **Short Status**.
- Session: This column displays the sequential number of the session (interrogation). This number is increased with each new **Verify** command. This parameter is added by the Evaluation Software, and is not part of the DataSeal's response.
- Rdr (Reader): The Reader Address of the DataReader that executed the command. This parameter is added by the Evaluation Software, and is not part of the DataSeal's response.

You can sort the list using any of the following columns by clicking on the title of that column: Seal ID, Events, Session and Reader.

The content of the Broadcast Verify responses list can be saved to a tabbed-delimited text file (Seals.txt), by choosing **Save to Seals.txt** from the **File** menu. After saving the file, you'll be given the possibility to view the file (if a correct version of Microsoft Excel is installed, the file will be viewed using Excel, otherwise it will be viewed using Notepad).

7.4.2 Executing Addressed Verify Command

The **Addressed Verify** command is similar to the **Broadcast Verify** command except that it addresses only one specified DataSeal, instead of all the DataSeals that receive the command.

In order to execute an **Addressed Verify** command, you must first specify the Seal ID of the DataSeal you want to interrogate. You do it by typing the

Seal ID into the Seal ID box (Item #3b in Figure 7-0). Another option is to select the Seal ID from the Broadcast Verify responses list (Item #7 in Figure 7-0), if it previously responses to **Broadcast Verify**.

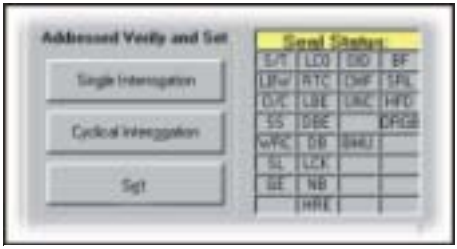


Figure 7-0

As in the **Broadcast Verify** frame, here you also have the **Single Interrogation** and the **Cyclical Interrogation** options: clicking the **Single Interrogation** button will execute the **Addressed Verify** command only once, while clicking the **Cyclical Interrogation** button will execute the **Addressed Verify** command cyclically according to the options that are selected in the Cyclical Interrogations control frame (Item #8 in Figure 7-0) as described in section 7.4.4.

The result (response) of the **Addressed Verify** is displayed in the **Addressed Verify** response indicators (Item #5 in Figure 7-0) and in the Seal Status indicators (Item #6 in Figure 7-0).

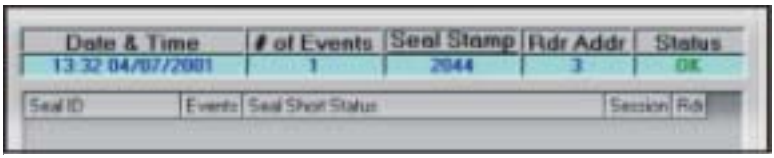


Figure 7-0

The **Addressed Verify** response indicators contains the following fields:

- Data & Time – The current date and time in UTC (GMT) as returned by the DataSeal.

- # of Events – The number of Event records that are written in the DataSeal.
- Seal Stamp – The value of the **Seal Stamp** parameter of the DataSeal. This parameter is a random number that is generated on each open and close.
- Rdr Addr (Reader Address) – The Reader Address of the DataReader that executed the command. This field is added by the Evaluation Software and is not part of the DataSeal's response.
- Status – OK or Tampered.

In addition to these indicators, the Seal Status indicators also indicates the DataSeal's **Long Status**. Flags that are set appear in red, while unset flags appear black. For a complete list of the flags in the DataSeal's **Long Status**, and their meanings see chapter 08.

If the DataSeal didn't respond to the **Addressed Verify** command, the Result indication box (Item #4 in Figure 7-0) displays a red message "Seal does not respond".

7.4.3 Executing Set Command

The **Set** command is used to prepare a DataSeal for a new use. The **Set** command is addressed to a specific DataSeal (in fact, it can be addressed to up to 8 DataSeals simultaneously, but the Evaluation Software does not support it through this window). In order to execute a **Set** command you must first specify the DataSeal you want to send the command to in the Seal ID box (Item #3b in Figure 7-0). You can do it also by selecting it from the Broadcast Verify responses list (Item #8 in Figure 7-0) if it appears there.

The Sealing Wire must be close in order for the **Set** command to succeed. The result of the command is indicated using the Addressed Verify

command indicators and the Seal Long Status indicators (Items #5 and #6 in Figure 7-0).

7.4.4 Cyclical Interrogations Options

The Cyclical Interrogations control frame (Figure 70-) contains some options that allow you a variety of ways to execute cyclical interrogations.

In the **No. of cycles** box you can enter the number of cycles that will be executed. If you enter "-1", the Evaluation Software will execute interrogations until you click on the **Stop Cycle** button. Even if **No. of cycles** is not "-1", you can click on the **Stop Cycle** button to stop the interrogations.

Figure 7-0

In the **System Pause** field you can specify the pause between one interrogation to the next in seconds.

The **Loop through all Readers** check box is available if more than 1 DataReader is defined. If this check box is checked, the Evaluation Software will execute the first interrogation using the first DataReader in the list, the second interrogation using the second DataReader and so on. After the last DataReader was used, the first one is used again, and so on. For example, it there are 3 DataReaders, and **No. of cycles** is 8, the order that the DataReaders will interrogate will be: 1,2,3,1,2,3,1,2.

The **Session #** box indicates the sequential number of the interrogation. The Evaluation Software increases this value with each new interrogation. To reset this number, and to clear the Broadcast Verify responses list, click the **Reset** button.

7.5 Executing Any Command using the All Commands Window

The **All Commands** window lets you execute any RF command and play with the "bits and bytes" of the RF protocol. Normally, when a software programmer writes an application, he doesn't have to play with the bits and bytes, because the DataSealLib software library (COM DLL) provides higher level interfaces, but acquaintance with the bits and bytes can be very helpful sometimes. Also, this is the only place in the Evaluation Software that you can execute all the RF commands.

To access the **All Commands** window, choose the **All Commands** item from the **Seals** menu as shown in Figure 7-0. Alternatively, click on the **All Commands** icon or press Ctrl+A.

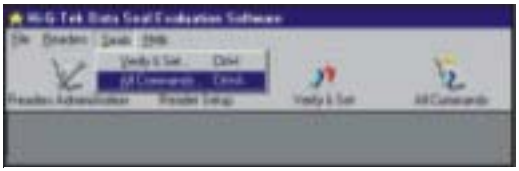


Figure 7-0

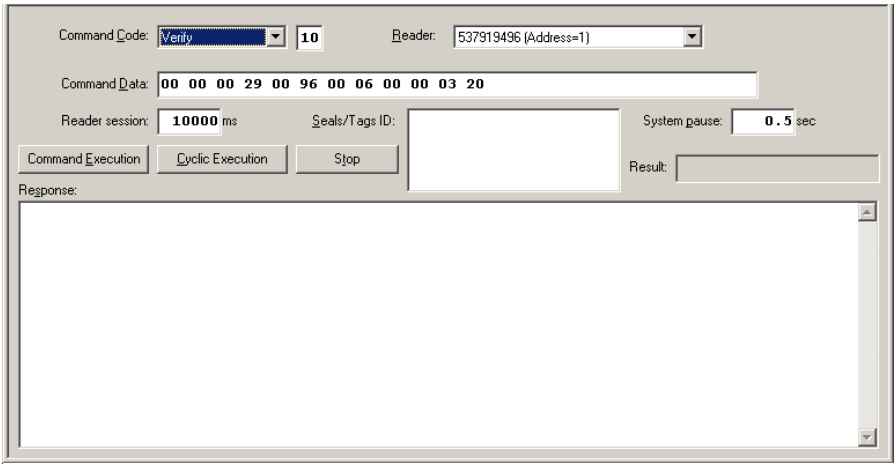


Figure 7-0

7.5.1 Executing an RF Command

To execute an RF command do the following:

1. Select the command from the **Command Code** drop down list. The code of the command will be displayed to the right of the drop down list, and the **Command Data** field will be filled by the default parameters for that command in hexadecimal format. For commands that does not have any parameters this field will be empty.
2. You may change the arguments in the **Command Data** line as desired. A detailed explanation of each command's structure is the following sections.
3. Select the DataReader that you want to use from the **Reader** drop down list.

4. If the command is an addressed command or multi-addressed command (also called BMM List), you have to enter the Seal ID of the DataSeal or DataSeals that you want to address in the **Seals/Tags ID** box. To enter more than one Seal ID, enter each Seal ID on its own line.
5. Click the **Command Execution** button.

The results will be displayed in an hexadecimal format in the **Response** box, and for some commands the result will be displayed also as a table or as text.

You can also execute a command cyclically by clicking the **Cyclic Execution** button instead of the **Command Execution** button. To stop the cyclical execution click the **Stop** button. Using the **System Pause** field you can specify the pause in seconds between two interrogations in a cycle.

The **Reader Session** field displays the duration in milliseconds of one interrogation of the selected command. For some commands you can also change this value. However, note that specifying lower value than the default will usually cause an error.

When the command completes, the **Result** box indicates whether the command succeeded or failed.

7.6 Specific Command Structures

Below is a description of the each one of the RF commands. For each command its structure (Command Data) is given and also the structure of the response. Complete descriptions of the command arguments are given in chapter 8.

7.6.1 Verify

The **Verify** command is used to seek all the DataSeals located in the DataReader's Receiving Zone, that their OrgID, Department and ADI values match those of the DataReader.

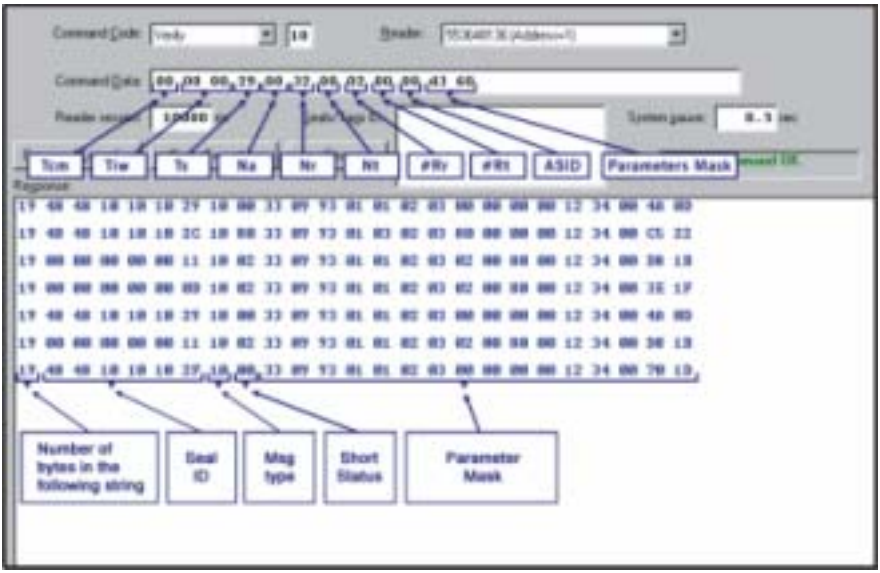


Figure 7-0

The following table explains the most important arguments shown in Figure 70-:

Argument	Value in example	Description
Ts	29h (41)	Size of response window in milliseconds
Nr	32h (50)	Number of response windows

Argument	Value in example	Description
#Rr	2	Number of windows that each DataSeal will chose to respond in.
Mask	D360h	A bit mask that determines which parameters the DataSeal will send in the response. In the example, the mask contains the following fields: **Short Status**, **Date & Time**, **Number of Events**, **Firmware Version**, **Long Status**, **OrgID & Department** and **Seal Stamp**.

In the example, the result contains 7 responses (some of them are from the same DataSeal). Each response is composed of the following fields:

Field	Value in example	Description
Number of bytes	19h (25)	The total number of bytes in the response.
Seal ID	48 48 10 10 10 2F (IADA01052719)	The Seal ID of the DataSeal that sent this response.
Msg type	10h (16)	The code of the **Verify** command.
Short Status	0	
Date & Time	33 09 93 01(hex) (13/08/2001 9:33)	The DataSeal's internal clock value (UTC)
Number of Events	1	

Field	Value in example	Description
Firmware Version	02 03 (hex) (2.03)	
Long Status	00 00 00 00	
OrgID & Department	12 34 00 (hex)	OrgID = 4660, Department = 0
Seal Stamp	70 1D (hex) (28701)	

7.6.2 Tampered (Tamper)

The **Tampered** command is used to find all the DataSeals in the DataReader's Receiving Zone which indicate a **Tampered** status. The command parameters and response structure are identical to the **Verify** command.

7.6.3 Addressed Verify

The **Addressed Verify** command is identical to the **Verify** command, except that it is addressed to a specific DataSeal.

This command is an Addressed command, and therefore the Seal ID of the addressed DataSeal has to be entered in the **Seals/Tags ID** field before executing the command.

The arguments of the command are identical to the arguments of the **Verify** command. Note however that there is no use in specifying **Rr** that is different than **Nr** in **Addressed Verify**, because there are no collisions. **Nr** and **Rr** can be greater than 1 in order to increase the probability of reception in case of RF interferences.

7.6.4 Set

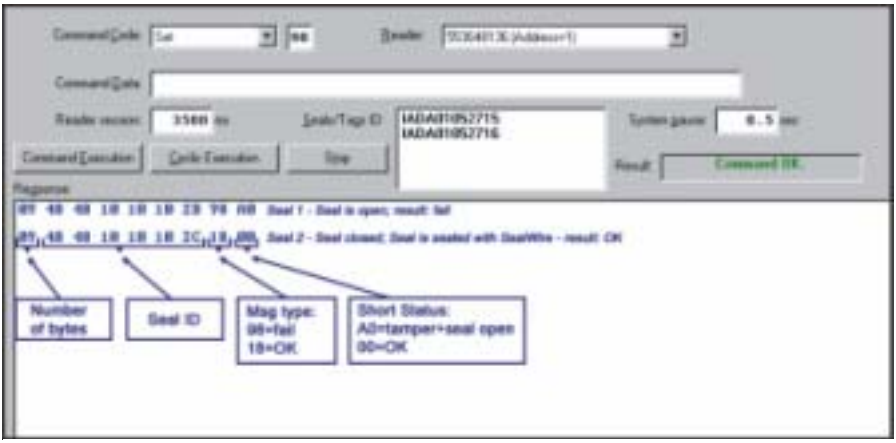


Figure 7-0

The **Set** command is used to prepare a DataSeal for a new use. If the Sealing Wire is open while the DataSeal receives the command, the command is not executed. If the Sealing Wire is closed, then all the Event records are deleted, the **Tampered** flag is cleared, and a new (first) Event record is written to indicate the **Set** operation.

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

The Seal Status in the response indicates whether the command succeeded or failed: If the Status is OK (closed, not tampered) the command succeeded, and if it is tampered the command failed. An example of this can be seen in the **Response** box in Figure 70-: the first row indicates an open Sealing Wire and Tampered state, (the **Set** operation failed), while the second row indicates a closed Sealing Wire and OK state (the **Set** operation succeeded).

Note: old DataSeals return only the **Short Status** as a response to the **Set** command (as shown in Figure 70-), while newer ones (version 2.20 and above) return **Long Status** and **Seal Stamp**.

7.6.5 Soft Set

Similar to the **Set** command, the **Soft Set** command is used to prepare a DataSeals for a new use, but unlike the **Set** command, the existing Event records are not deleted. For the description of the response see the **Set** command in the previous section.

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

7.6.6 Suspended Set

This command is also similar to the **Set** command, but unlike the **Set** command, the Sealing Wire can be open, and the operation completes only afterwards, when the Sealing Wire is closed. Between the command execution and the closing of the Sealing Wire, the **Suspended Set** (SS) flag in the **Short Status** is set. Only when the Sealing Wire is closed, the Event records are deleted, the **Tampered** flag is cleared and a new **Suspended Set** Event record is written.

If the Sealing Wire was open at the time of the command execution, the DataSeal's will indicate the following flags in the Status: **Tampered**, **Opened**, and **Suspended Set**. If the Sealing Wire was closed at the time of the command execution, the DataSeal will indicate an OK status.

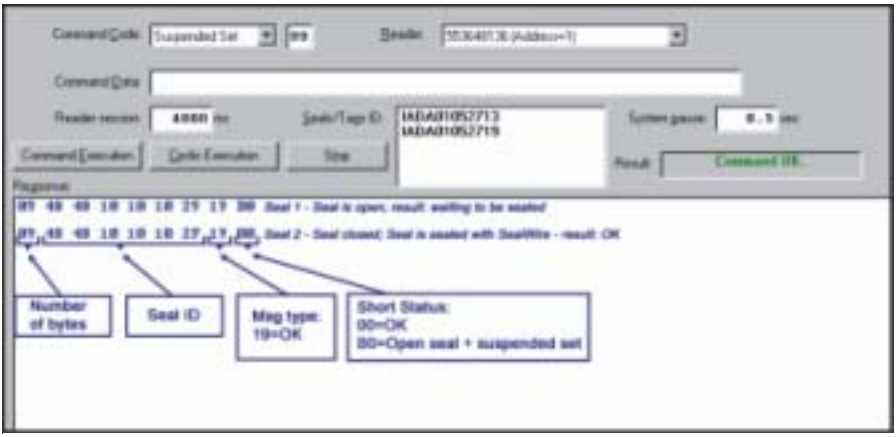


Figure 7-0

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

7.6.7 Read Data

The **Read Data** command reads data from the User Data memory of the DataSeal.

The Evaluation Software displays the result of this command both in hexadecimal and ASCII formats.

The largest block size that can be read in one session is 67 bytes.

If the arguments of the command are invalid, or the DataSeal can't perform the command due to any other reason, it responds with message type E3 (hex).

This command is an Addressed command, and therefore the Seal ID of the addressed DataSeal has to be entered in the **Seals/Tags ID** field before executing the command.

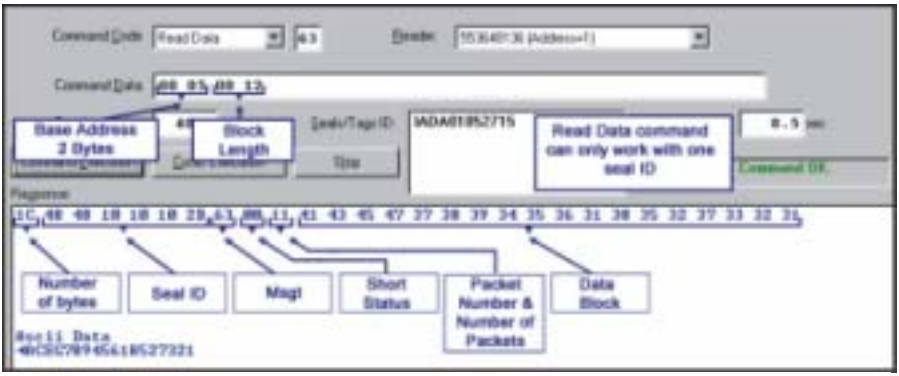


Figure 7-0

The Command Data is composed of the following arguments:

Argument	Value in example	Description
Address (2 bytes)	5	The address of the block of data in the DataSeal's memory that you want to read.
Block Length (2 bytes)	12h (18)	The length in bytes of the block of data that you want to Read.

The response is composed of the following fields:

Field	Value in example	Description

Field	Value in example	Description
Number of bytes	1Ch (28)	The total number of bytes in the response.
Seal ID	48 48 10 10 10 2B (hex) (IADA01052715)	The Seal ID of the DataSeal that sent this response.
Msg type	63h	The code of the Read Data command.
Short Status	0	
Packet/# of Packets	11h (1 of 1)	The first nibble is the packet number, the 2nd is the total number of packets.
User Data	…	The requested data.

7.6.8 Write Data

The **Write Data** command writes a block of data into the User Data memory in the DataSeal.

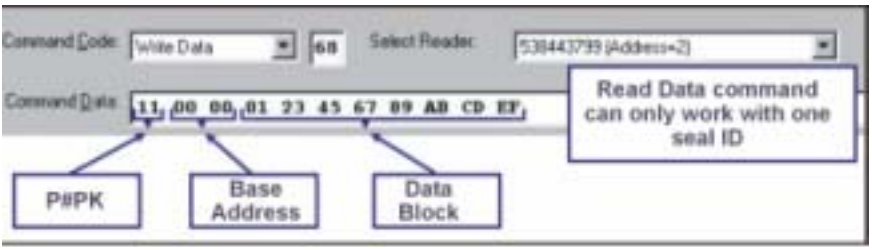


Figure 7-0

The largest block size that can be written in one session is 67 bytes.

If the parameters of the command are invalid, or the DataSeal can't perform the command due to any other reason, it responds with message type E8 (hex).

This command is an Addressed command, and therefore the Seal ID of the addressed DataSeal has to be entered in the **Seals/Tags ID** field before executing the command.

The Command Data is composed of the following arguments:

Argument	Value in example	Description
P/#PK	11h	Packet number out of total number of packets. At this stage this argument is not in use and must be 11h.
Base Address	0	The address in the DataSeal's User Data memory to where you want to write the data.
Data	(All the rest)	The data to write to the DataSeal's User Data memory. This field can have any length up to 67.

The response data is shown in Figure 70-.

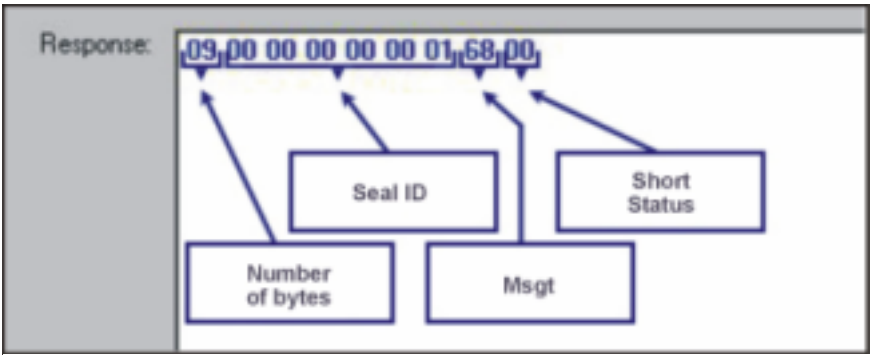


Figure 7-0

7.6.9 Read Parameters

The **Read Parameters** command uses to read the values of selected Parameters of a DataSeal.

This command is an Addressed command, and therefore the Seal ID of the addressed DataSeal has to be entered in the **Seals/Tags ID** field before executing the command.

The Command Data is composed of the following arguments:

Argument	Description
P/#PK	Packet number out of total number of packets. At this stage this argument is not in use and must be 11h.
Parameter codes	This argument can contain a list of the codes of the Parameters that you want to read. Each Parameter code is 1 byte. A complete list of the DataSeal Parameters and their codes can be found in chapter 8.

The response is composed of the following fields:

Field	Description
Number of bytes	The total number of bytes in the response.
Seal ID	The Seal ID of the DataSeal that sent this response.
Msg type	The code of the Read Parameters command (64h)
Short Status	
Packet/# of Packets	The first nibble is the packet number, the 2nd is the total number of packets.
Parameter codes and values	This field is a list of pairs of codes and values. Each pair corresponds to one Parameter that was requested in the Command Data and is composed from 1 byte of the code of the Parameter and then the value of the Parameter. The size of the value of the Parameter depends on the Parameter itself and can be found in the list of the DataSeal Parameters in chapter 8.

7.6.10 Write Parameters

The **Write Parameters** command writes new values for specified Parameters of the a DataSeal.

You can write new values for multiple Parameters in one **Write Parameters** command. Note that some Parameters in the DataSeal are read only and cannot be written. In this case, and in any other case of failure, the DataSeal will respond with the Message Type E9 (hex).

This command is an Addressed command, and therefore the Seal ID of the addressed DataSeal has to be entered in the **Seals/Tags ID** field before executing the command.

The example in Figure 7-0 updates the **ADI** parameter of the DataSeal to 11h.

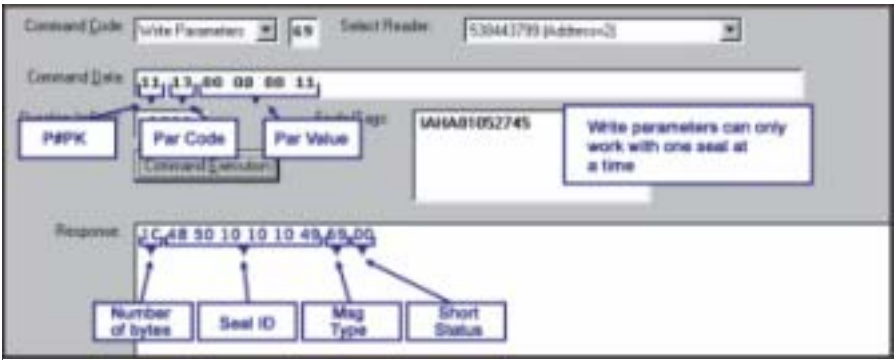


Figure 7-0

The Command Data is composed of the following arguments:

Argument	Value in example	Description
P/#PK	11h	Packet number out of total number of packets. At this stage this argument is not in use and must be 11h.

Argument	Value in example	Description
Parameters' codes and values	13h (The code of the ADI parameter), 00 00 00 11h (new value)	This argument can contain a list of pairs of Parameters codes and their new values that you want to write. Each Parameter code is 1 byte, followed by the value that you want to write to that Parameter. The size of the value depends on the Parameter itself and can be found in the list of the DataSeal Parameters in chapter 8.

The response is composed of the following fields:

Field	Description
Number of bytes	The total number of bytes in the response.
Seal ID	The Seal ID of the DataSeal that sent this response.
Msg type	The code of the **Read Parameters** command (64h)
Short Status	

7.6.11 Reset Data

The Reset Data command erases all the User Data area and initialize it to 0s.

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

The command has no arguments, and the response is shown in Figure 70-.

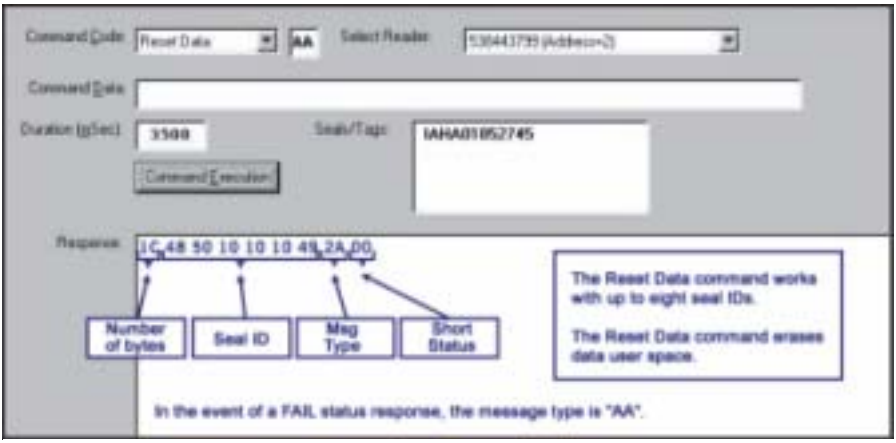


Figure 7-0

7.6.12 Deep Sleep

The **Deep Sleep** command puts DataSeals in Deep Sleep mode.

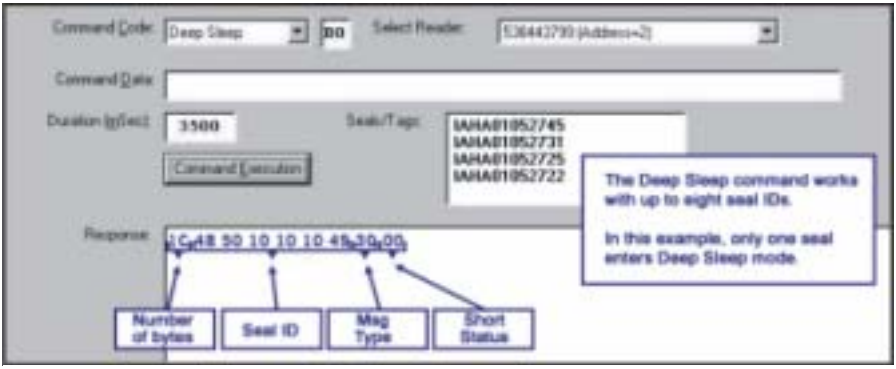


Figure 7-0

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

7.6.13 Hard Wakeup

This command returns DataSeals from Deep Sleep mode into normal operation mode.

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

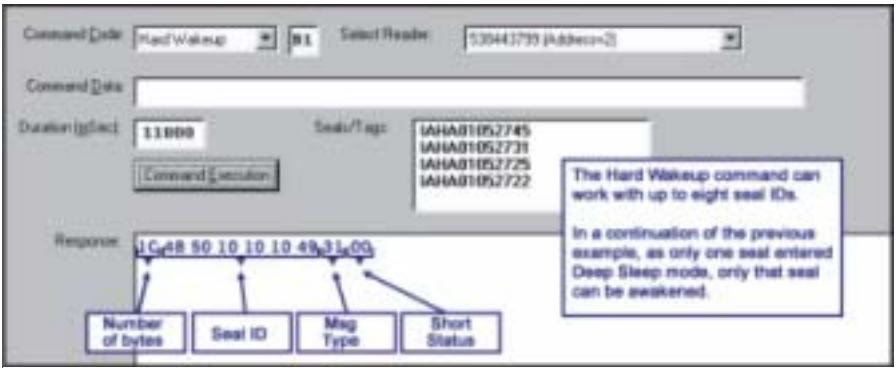


Figure 7-0

7.6.14 Start Alert Burst Mode

The **Start Alert Burst Mode** command puts the DataSeal into Alert Burst mode. In this mode, whenever the DataSeal is opened, it transmits a message that the DataReaders can receive to report the event.

The number of transmissions, the pause between then, and the data that will be sent with it can be configured using some DataSeal Parameters. See chapter 8 for a detailed descriptions of the DataSeal Parameters.

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

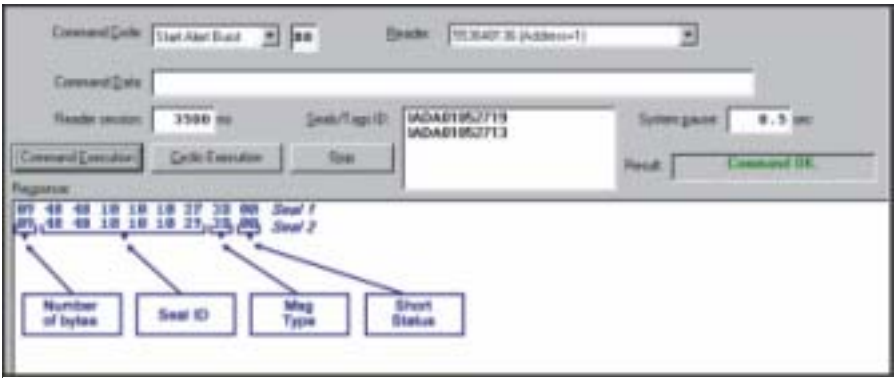


Figure 7-1

7.6.15 Start Alert Burst Mode (all)

This command is similar to the **Start Alert Burst Mode** command, except that it is a broadcast command instead of a multi-addressed command. In

Figure 7-1

other words, all the DataSeals that receive this command enter into Alert Burst mode.

This command does not have any arguments, and the receiving DataSeals don't send any response to this command.

7.6.16 Stop Alert Burst Mode

The **Stop Alert Burst Mode** command stops the DataSeal from working in Alert Burst mode.

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

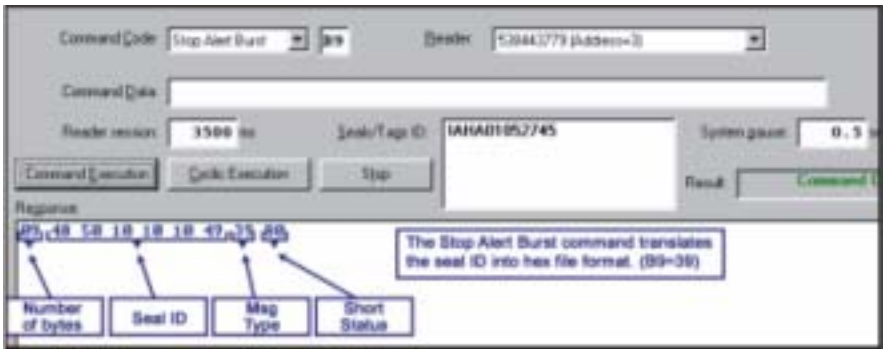


Figure 7-1

7.6.17 Stop Alert Burst Mode (all)

This command is similar to the **Start Alert Burst Mode** command, except that it is a broadcast command instead of a multi-addressed command. In other words, all the DataSeals that receive this command stop being in Alert Burst mode.

Figure 7-1

7.6.18 Acknowledge Alert Burst

The **Acknowledge Alert Burst** command confirms to the DataSeal that its Burst message has been received. After The DataSeal receives the **Acknowledge Alert Burst** command, the DataSeal stops transmitting the Burst message until a new **Tampered** Event occurs.

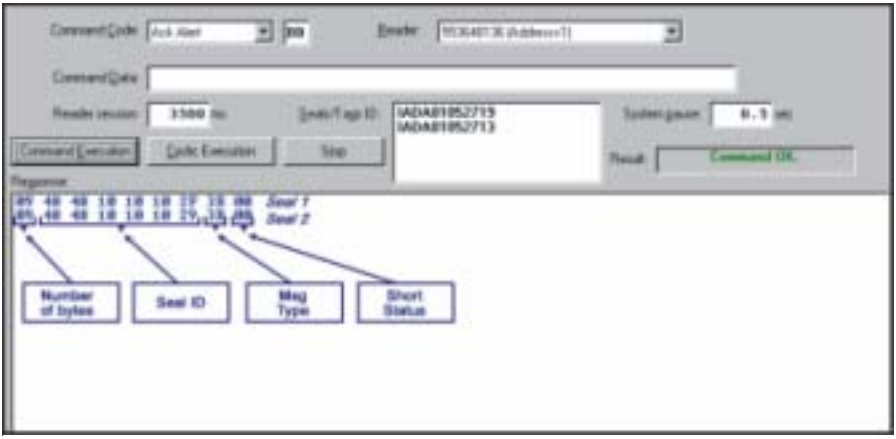


Figure 7-1

This command is multi-addressed, and can be sent to up to 8 DataSeals in a single command. You must enter between 1 and 8 Seal IDs in the **Seals/Tags ID** box, one in each line, before executing the command.

7.6.19 Read Events

The **Read Events** command reads part or all of the Event records stored in the DataSeal's Events Memory.

This command is an Addressed command, and therefore the Seal ID of the addressed DataSeal has to be entered in the **Seals/Tags ID** field before executing the command.

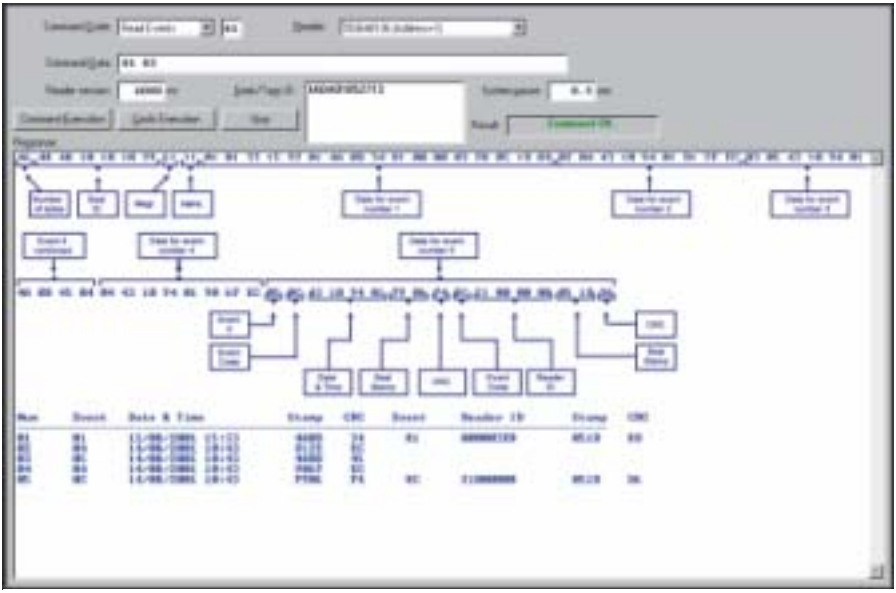


Figure 7-1

The Command Data is composed of the following arguments:

Argument	Value in example	Description
First Event number	1	The sequential number of the first Event record to read.
Number of Events to read	5	The number of Event records to read.

The response is composed of the following fields:

Field	Description
Number of bytes	The total number of bytes in the response.
Seal ID	The Seal ID of the DataSeal that sent this response.
Msg type	The code of the **Read Parameters** command (64h)
Short Status	
Packet/# of Packets	The first nibble is the packet number, the 2nd is the total number of packets.
Event records	This field contains all the requested Event records. Figure 7-1 illustrates the format of the Event records. A complete description of the Event records is found in chapter 8.

The Evaluation software displays the Event records also as a table below the hexadecimal string.

Note that there are 2 kinds of Event records: Short Events (8 bytes) and Long Events (16 bytes). In Figure 7-1, Event records 1 and 5 are Long Events, and the rest are Short Events.

7.7 Advanced Features

7.7.1 Built-In Test

The DataReader can perform a self-test and report its status. In order to perform the test, open the **Tests** window by clicking on the **Readers** menu and then on the **Built-In Tests** menu item as

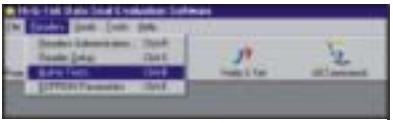


Figure 7-1

shown in Figure 7-1.

Figure 7-1 shows the **Tests** window. In order to perform the built-in test, first select the DataReader you want to test from the **Reader** drop down list (Item #1). Then click on the **Execute Built-In Test** button. If you only want to get the results of the last performed test, click on the **Get Current Reader Status** button.

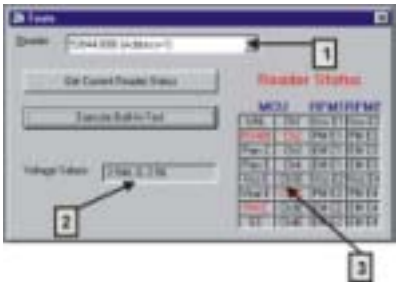


Figure 7-1

The **Voltage Values** box (Item #2) displays the actual values measured by the DataReader: The first value (2.544 in the example) represents the voltage value of the MCU, the second (0 in the example) represents the voltage value of RF Modem #1 (not installed) and the third value (2.56 in the example) represents the voltage value of RF Modem #2.

Item #3 displays the status flags of the DataReader. A flag that is *on* appears red, while flags that are *off* appear black.

7.7.2 Authorization Levels and Passwords

Some features in the Evaluation Software are meant to be used only by advanced users or by Hi-G-Tek's distributors. To prevent unauthorized users from accessing the advanced features, the software requires a password. The software recognizes 3 levels of authorized users: User (the default), Administrator and Distributor. This manual does not cover the features that are available only to Distributors.

Note: The levels of authorization, passwords and log-ins of the Evaluation Software are completely separate from the user permissions, passwords and log-ins which are used by the operating system.

7.7.2.1 Logging-in Using the Desired Authorization Level

After the software is installed, it does not request a password and is automatically activated using the User authorization level (the lowest). In order to log in with a different level of authorization, do the following:

- Open the **Options** dialog (shown in Figure 7-1) by choosing **Options** from the **Tools** menu, as shown in Figure 71-.
- Clear the check box labeled **Always login using this user type and password** (item #1 in Figure 7-1)
- Click **OK** to close the **Options** dialog window.
- Restart the Evaluation Software (exit the software, the run it again).
- You should now see the **Login** dialog window as shown in Figure 7 1-. Choose the desired authorization level from the **Login as** drop down list, type the appropriate password in the **Password** box and click **OK**.

Figure 7-1

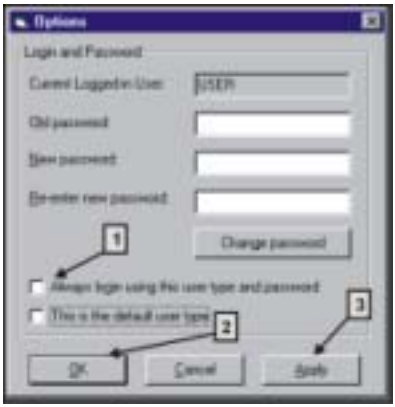


Figure 7-1

The Default password for User is empty (no password), and for Administrator is "Admin".

Figure 7-1

7.7.2.2 Changing Passwords

In order to change a password for a particular user type (authorization level), you must be logged in to the

Evaluation Software using this user type. For example, in order to change the Administrator's password you must be logged in as Administrator.

To change the password of the currently logged in user type do the following:

- Open the **Options** dialog (shown in Figure 7-1) by choosing **Options** from the **Tools** menu, as shown in Figure 71-.
- Make sure that the user type that appears in the **Current Logged-in User** box is the user type to which you wish to change the password. If it is not, close the **options** dialog by clicking **Cancel**, then restart the Evaluation Software and log in using the user type to which you want to change the password.
- Type in the old password in the appropriate box.
- Type the new password in the appropriate box.
- Type the new password again in the box labeled **Re-enter new password**.
- Click on the **Change Password** button.
- If everything went fine (the old password was correct and the 2 new copies of the new password are equal), an acknowledgment message box will appear, saying that you must click on **Ok** or **Apply** in order to apply the change.
- Click **OK** to apply the change and to close the dialog window.

7.7.3 Updating the DataReader's Internal Software

The DataReader's internal software is composed of 2 modules. These modules can be updated (downloaded to the DataReader) with newer versions supplied by Hi-G-Tek when they're available. The Evaluation

Software includes 2 download utilities to update these 2 modules: The **MCU Download** Utility and the **RF Modem Download** utility.

7.7.3.1 The MCU Download Utility

To update the DataReader's MCU software do the following:

- Open the **MCU Download** window (shown in Figure 71-) by choosing the **Tools** menu, then the **Update Reader's Software -> MCU** item as shown in Figure 71-.
- Select the appropriate Reader ID from the drop down list.
- Type the full path and file name of the updated software's file, or click **Browse...** to select it using a common file selection dialog box.
- Click **Start** to start the download process.

Figure 7-1

Figure 7-1

If the download process starts successfully, a progress bar will indicate the progress of the download process. If after 10 seconds the process won't start, the message shown in Figure 7 1- will be displayed, letting you the option to keep trying or to cancel.

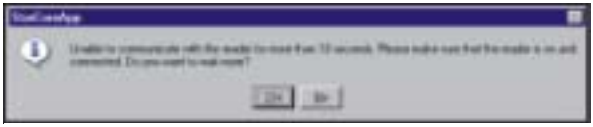


Figure 7-1

After the process has been completed successfully, an appropriate message will appear, and the DataReader will re-initialize itself using the new software. The re-initialization takes about 30 seconds in which the power LED of the DataReader alternates between red and green, and at the end it should remain green. If it remains red or unlit, see chapter 0 for troubleshooting.

7.7.3.2 RF Modem Download Utility

To update the DataReader's RF Modem software do the following:

- Open the **Device Download Utility** window (shown in Figure 71-) by choosing the **Tools** menu, then the **Update Reader's Software ->RF Modem** item as shown in Figure 7-1.

Figure 7-1

- Select the appropriate Reader ID from the drop down list. If the appropriate Reader ID does not appear in the drop down list, return to the **Readers Administration** window and add the DataReader as described in section 7.2.
- Type the full path and file name of the updated

Figure 7-1

software's file, or click **Browse…** to select it using a common file selection dialog box.

- Make sure that the value in the **Device** drop down list shows "2".
- Click **Start** to start the download process.

A progress bar will indicate the progress of the download process. During the process the DataReader's Power LED indicator will be off. After the process has been completed successfully an appropriate message will appear, and the DataReader's Power LED indicator will turn green.

Chapter 8

System Parameters and Commands

8 System Parameters and Commands

This chapter describes the details of the communications with the DataSeal and the DataReader. Even though Hi-G-Tek publishes the RS-232/485 protocol of the DataReader, and part of the RF protocol, this manual does not cover these details. Instead, it describes the commands and the parameters in a more conceptual way, with syntax and examples in Visual Basic as they can be used through the DataSealLib COM library. Note there's also an online help that is supplied with the library. This online help is more technical than the explanations in this chapter: while this chapter explains the concepts, the online help describes the COM interface in more details.

8.1 The High Frequency RF Protocol

8.1.1 The Basics

In order to conserve power, the DataSeal is "asleep" most of the time. It only opens its High-Frequency receiver for a short time every predetermined period – usually 3 seconds. This fact has some implications on the RF protocol as explained below.

The interval in which the DataSeal opens its receiver is determined by a configurable parameter called **Tw** (which its default value corresponds to about 3 seconds). Because the DataSeal listens to the RF only in this intervals, if a DataReader wants to communicate with that DataSeal, it must transmit a special signal called Reader Interrogation Header, that is at least in the duration of **Tw**, in order for the DataSeal to receive it. When the DataSeal receives this signal (in the short period that its receiver is open), it knows that a command should follow, and it waits for that command. After

receiving and performing the command and responding if necessary, it returns to the state of sleeping and opening the receiver every **Tw**.

- The duration of the Reader Interrogation Header should be 135msec more than **Tw**. The DataReader has a configurable parameter called **Thw** that determines this period. Note that the DataSeal's **Tw** parameter should be configured with the same value for all the DataSeals, and the corresponding **Thw** parameter value should be configured appropriately in all the DataReaders in a given system.

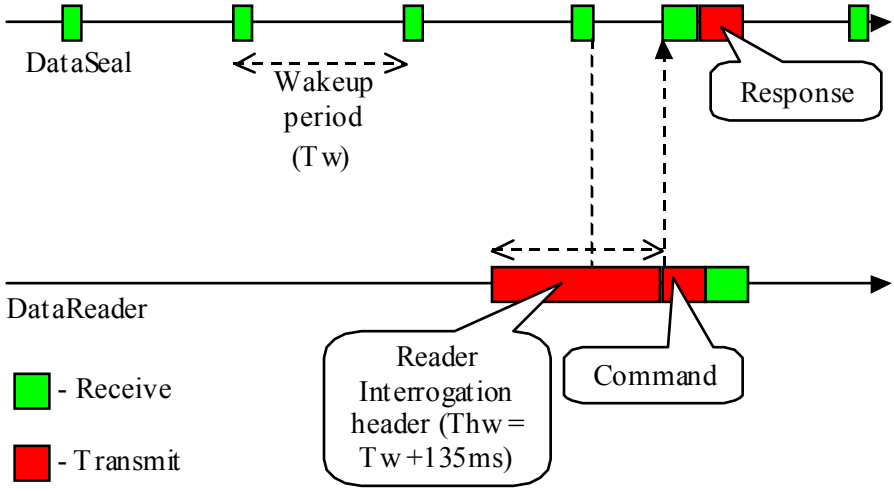


Figure 8-0

Figure 8-0 demonstrates the concept of the wakeup period and the Reader Interrogation Header. The upper line represents the time line of the DataSeal, and the bottom line represents the time line of the DataReader. It is clear to see from that figure why **Thw** (the length of the Reader Interrogation Header) should be just a bit more than the Wakeup Period (**Tw**).

The Reader Interrogation Header is composed of many short segments that contain indications of when the command starts. This way, when a DataSeal receives the Reader Interrogation Header, it doesn't have to keep its receiver open until the command, rather, it goes to sleep exactly until the command.

Choosing the best **Tw** and **Thw** should take in account the following facts:

- Small **Tw** and **Thw** will improve response times for RF command. Big **Tw** and **Thw** will cause lengthily interrogations.
- Small **Tw** and **Thw** will shorten the battery lifetime of the DataSeals. Big **Tw** and **Thw** will lengthen it.

8.1.2 Addressing Types

In general, there are 3 types of commands that are distinguished by the way they indicate which DataSeal or DataSeals will respond:

1. **Addressed** (AMM): These commands specify exactly one Seal ID. Only the DataSeal with that Seal ID responds.
2. **Multi Addressed** (BMM List): These commands specify a list of Seal IDs. The DataSeals in the list respond in the same order as they appear in the list. This way there are no RF collisions between the responses of the different DataSeals. Multi Addressed commands without arguments can contain up to 8 Seal IDs in the list. Currently, the only Multi Addressed command with arguments is the **Multi Addressed Verify**, which can contain up to 7 Seal IDs.
3. **Broadcast** (BMM): These commands are aimed for all the DataSeals that receive the DataReader's transmission. There are actually 2 types of broadcast commands: commands without response and commands with response. The commands that do not wait for a response from the DataSeals are the simplest, in the way that after the DataReader has

transmitted the command, the commands is completed, and whatever DataSeals that received the command, performed it. The second type – commands with response – use the Slotted Aloha concept in order to overcome potential RF collisions between the responding DataSeals. The only commands of this type are the (broadcast) **Verify** and the **Tampered** commands. The Slotted Aloha concept is described in the following paragraph.

8.1.3 The Slotted Aloha Concept

Because the set of the receiving DataSeals is not known in advance, there's no deterministic way to synchronize their responses. In other words, RF collisions are unavoidable. However, by using retransmits, the probability of receiving all the responses can be very high. Here's the way it works:

The command includes 2 arguments that are relevant to this matter: **Nr** and **Rr**. **Nr** determines the total number of windows (time slots) in which the DataSeal can respond, and **Rr** determines how many times the DataSeal will transmit its response (or: how many time slots the DataSeal will actually use to send its response). It is clear that **Nr** should be much greater than **Rr** in order to allow many DataSeals to be received. Each DataSeal randomly chooses **Rr** time slots in which it will respond. The following table demonstrates the situation when **Nr** (number of windows) is 23, **Rr** (number of retransmits) is 4, and there are 3 DataSeals in the DataReader's Receiving Zone:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1				x				x						x		x		
2	x			x			x											
3						x				x						x		

In this table, each row represents one DataSeal, and each column represents a window. An 'X' in a cell represents that the DataSeal sent its response in the specified window. Note that there are exactly 4 'X's in each row, corresponding to **Rr**. You can see that even though there were some collisions (in windows 4 and 16), all the 3 DataSeals have at least 1 transmission that does not collide with any other transmission.

In order to achieve high probability to receive all the DataSeals, an estimation of the maximal number of DataSeals that would respond should be taken in account before selecting the appropriate values for **Nr** and **Rr**. Fortunately, DataSealLib provides a function that calculates the appropriate values for **Nr** and **Rr** according to the maximal number of expected DataSeals. This function is the **RFParameters.DefaultsFor** method.

In fact, the newer DataSeals (versions 3.0 and above), use an improvement of the Slotted Aloha concept: Whenever the DataReader receives a specific DataSeal it sends an acknowledge to that DataSeal, causing it to stop retransmitting its response. This lowers the probability for further collisions and can shorten the total time of the interrogation by using lower **Nr** value, or allow more DataSeals to be received in the same time. The **RFParameters.DefaultsFor** method takes this improvement into account too.

8.2 DataSeal Parameters

The DataSeal can be configured very flexibly to fit almost any application requirements. For that purpose it has a set of predefined Parameters that can be read and/or written. The DataSeal also has some Parameters that are read-only, either because they are configured in the factory (like the Seal ID), or because they are status Parameters.

All the Parameters can be read using the **Read Parameters** RF command, and all the Parameters that are not read only can be written to the DataSeal using the **Write Parameters** RF command. Some Parameters can also be

read using the **Verify** and **Tampered** commands (including Addressed and **Multi Addressed Verify**).

In DataSealLib, all the DataSeal Parameters has corresponding properties of the **Seal** object. See the online help for information about how to use these properties. There's also an enumeration that contains constants for the parameter codes (**HGTSealParameterCodeEnum**). This enumeration is used by the **Seal.ReadParameter**, **Seal.ReadParameters**, **Seal.WriteParameter** and **Seal.WriteParameters** methods. Another enumeration contains the flags of the Verify Mask that allows to read parameters using the **Verify** and **Tampered** commands. This is the **HGTVerifyMaskEnum** enumeration, and it is used by the **Reader.Verify**, **Seal.Verify**, and **Seals.Verify** methods.

Below are the descriptions of all the DataSeal Parameters:

ADI

Seal Object Property	**ADI**
Access	Read & Write.
Description	An identifier of a group that the DataSeal belongs to.
Constant in HGTSealParameterCodeEnum	**HGTADI** (13h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Long**

Remarks

See chapter 6 for more information about this parameter.

Alert and Close Burst Period (Tb)

Seal Object Property	**AlertBurstPeriod** (**CloseBurstPeriod** is a synonym).
Access	Read & Write.
Description	This Parameter determines the base interval for sending retries of **Alert Burst** messages and **Close Burst** messages.
Constant in HGTSealParameterCodeEnum	**HGTAlertBurstPeriod** (34h). **HGTTb** and **HGTCloseBurstPeriod** are synonyms to **HGTAlertBurstPeriod**.
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Long**. Max Value: 65535. Unit is 1/1.024ms (976ms).
Default Value	4096 (4 seconds).

Remarks

The actual interval is calculated as follows:

Tb + *r** **Tw**/8

Where *r* is random value between 1 and 7.

Alert Burst Data Descriptor

Seal Object Property	**AlertBurstDataDescriptor**
Access	Read & Write.
Description	Determines what data will be included in an Alert Burst message.

Constant in HGTSealParameterCodeEnum	**HGTAlertBurstDataDescriptor** (72h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**BurstDataDescriptor** type.
Default Value	All 0's.

Remarks

This type has 3 members:

Mask (as **HGTVerifyMaskEnum**) – determines which parameters the DataSeal will include in the **Alert Burst** message. It works in the same way as the Mask argument of the **Verify** command.

StartAddress (Integer) – determines the starting address of a block of User Data to be included in the Alert Burst message. This value is relevant only if the **HGTUserDataVerifyMask** flag is specified in the **Mask** member.

Length (Byte) – determines the length in bytes of the block of User Data to be included in the Alert Burst message. This value is relevant only if the **HGTUserDataVerifyMask** flag is specified in the **Mask** member.

Note: if all the members are 0, the DataSeal uses the old **Alert Burst** message format (code 77h) instead of the new one (7Ah).

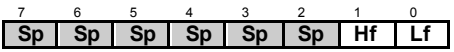
Application Flags

Seal Object Property	**ApplicationFlags** (Hidden property)
Access	Read & Write.
Description	Bit oriented value that controls specific aspects of the DataSeal's behavior.
Constant in HGTSealParameterCodeEnum	**HGTApplicationFlags** (14h)

Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**

Remarks

The format of this parameter is as follows:



Where:

Sp - not used (spare) - must be 0.

Lf - if **Lf=1**, then before issuing a **Deep Sleep** command in LF, the Sealing Wire must be open; If Lf = 0, **Deep Sleep** command in LF will always succeed.

Hf - if **Hf=1**, then before issuing a **Deep Sleep** command in HF, the Sealing Wire must be open; If Hf = 0, **Deep Sleep** command in HF will always succeed.

Battery Voltage Value

Seal Object Property	**BatteryVoltageValue**
Access	Read-Only.
Description	Indicates the a value that is proportional to the current voltage value of the DataSeal's battery.
Constant in HGTSealParameterCodeEnum	**HGTBatteryVoltageValue** (70h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit is of internal A/D converter.

Remarks

See also the **Low Battery Error Threshold** and **Low Battery Warning Threshold** Parameters.

BIT (Built-in Test) Period

Seal Object Property	**BITPeriod** (Hidden property).
Access	Read-Only.
Description	This Parameter determines interval that the DataSeal will perform a built-in test.
Constant in HGTSealParameterCodeEnum	**HGTBITPeriod** (35h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit: 2 * **Tw**.
Value	150 (about 15 minutes).

Close Burst Data Descriptor

Seal Object Property	**CloseBurstDataDescriptor**
Access	Read & Write.
Description	Determines what data will be included in a **Close Burst** message.
Constant in HGTSealParameterCodeEnum	**HGTCloseBurstDataDescriptor** (73h).
Verify Mask in HGTVerifyMaskEnum	(not supported).

Data Type	**BurstDataDescriptor** type.
Default Value	All 0's.

Remarks

This type has 3 members:

Mask (as **HGTVerifyMaskEnum**) – determines which parameters the DataSeal will include in the **Close Burst** message. It works in the same way as the **Mask** argument of the **Verify** command.

StartAddress (Integer) – determines the starting address of a block of User Data to be included in the **Close Burst** message. This value is relevant only if the **HGTUserDataVerifyMask** flag is specified in the **Mask** member.

Length (Byte) – determines the length in bytes of the block of User Data to be included in the **Close Burst** message. This value is relevant only if the **HGTUserDataVerifyMask** flag is specified in the **Mask** member.

Date & Time (UTC)

Seal Object Property	**DateTime**
Access	Read-Only
Description	Returns the current date & time of the real-time clock of the DataSeal. The date & time are in Universal Time Coordinates (GMT).
Constant in HGTSealParameterCodeEnum	**HGTDateTime** (1)
Verify Mask in HGTVerifyMaskEnum	**HGTDateTimeVerifyMask** (4000h)
Data Type	**Date**

Deep Sleep Burst Period

Seal Object Property	**DeepSleepBurstPeriod**
Access	Read & Write.
Description	This Parameter determines the base interval for sending retries of **Deep Sleep Burst** messages.
Constant in HGTSealParameterCodeEnum	**HGTDeepSleepBurstPeriod** (77h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit is 250ms.
Default Value	32

Remarks

The actual interval is calculated in the same manner as the actual interval of the Alert Burst messages.

Department

Seal Object Property	**Department**
Access	Read & Write.
Description	The identifier of the department within the organization.
Constant in HGTSealParameterCodeEnum	**HGTDepartment** (16h)
Verify Mask in HGTVerifyMaskEnum	(not supported).

Data Type	**Byte**

Remarks
See chapter 6 for more information about this parameter.

Distance Index

Seal Object Property	**DistanceIndex**
Access	Read-Only
Description	Returns a value that is proportional to the distance between the DataReader and the DataSeal.
Constant in HGTSealParameterCodeEnum	(not available)
Verify Mask in HGTVerifyMaskEnum	**HGTDistanceIndexVerifyMask** (400h)
Data Type	**Byte**

Remarks
This parameter can be read only using the **Verify** and **Tampered** commands. In order to read this parameter, the **Tcm** value **(RFParameters.Tcm)** that is used by the **Verify** or **Tampered** command must not be 0.

Event Counter Value

Seal Object Property	**EventCounterValue** (Hidden property)
Access	Read-Only.

Description	Indicates the total number of Event records that were written since the last reset.
Constant in HGTSealParameterCodeEnum	**HGTEventCounterValue** (75h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**

Remarks

Note: Do not confuse this parameter with the **Number of Events** parameter that indicates the current number of Events.

Firmware Version

Seal Object Property	**FirmwareVersion**
Access	Read-Only
Description	Returns the version of the firmware of the DataSeal.
Constant in HGTSealParameterCodeEnum	**HGTFirmwareVersion** (6)
Verify Mask in HGTVerifyMaskEnum	**HGTFirmwareVersionVerifyMask** (200h)
Data Type	**String**.

Remarks

The format of the string is *n.nn* where the left part is the version number and the right part is the edition number.

Flags

Seal Object Property	**Flags** (Hidden property)
Access	Read & Write.
Description	Bit oriented value that controls specific aspects of the DataSeal's behavior.
Constant in HGTSealParameterCodeEnum	**HGTFlags** (14h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**

Remarks

The format of this parameter is as follows:

7	6	5	4	3	2	1	0
Sp	Sp	Sp	Sp	Sp	A	E	M

Where:

Sp - not used (spare) - must be 0.

A – if A = 1, after the DataSeal has sent a Burst message it waits for an immediate acknowledge from a DataReader. See the description of the ABM flag in the DataReader's Mode parameter in section 8.6 for more information about this flag.

E – if E = 1 then the internal coding of the Date & Time in the DataSeal Event records is the new format, which has an accuracy of 1 second (instead of 1 minute).

M – if M = 1 then the internal coding of the Date & Time when returned as a response to **Verify** or **Tampered**, or in a Burst message (when the Mask parameter contains the appropriate flag), is the new format, which has an accuracy of 1 second (instead of 1 minute).

Global

Seal Object Property	(not supported).
Access	Read-Only.
Description	Determines whether the DataSeal will respond to **Verify** commands that are sent from a DataReader with a different OrgID.
Constant in HGTSealParameterCodeEnum	**HGTAcceptGlobalCommands** (15h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**

Remarks

If the value of this parameter is 1, the DataSeal will respond to **Verify** commands even if the OrgID of the DataReader is not the same as of the DataSeal. Nevertheless, only the following parameters can be retrieved by a DataReader with a different OrgID: **Short Status**, **Date & Time**, **Number of Events**, **Firmware Version** and **Seal Stamp**.

See chapter 6 for more information about this parameter.

Include User Data in Verify Response

Seal Object Property	**UserData**
Access	Read-Only

Description	Returns a byte array corresponding to a portion of the DataSeal's memory that was requested in a **Verify** or **Tampered** command or in a Burst message
Constant in HGTSealParameterCodeEnum	(not supported)
Verify Mask in HGTVerifyMaskEnum	**HGTUserDataVerifyMask** (4)
Data Type	Array of Bytes

Remarks

In fact, this in not a Parameter of the DataSeal, and cannot be read or written using the **Read Parameters** and **Write Parameters** commands. Instead, it is a flag in the **Verify** and **Tampered** commands that indicates that a block of the User Data is requested, and that the command includes the address and size of this block after the **Mask** argument.

When the DataSeal responds to the **Verify** or **Tampered** command it returns the data that corresponds to the specified address and size.

Even though this property is Read-Only, you can write to the User Data area using the **Write Data** command.

Internal Firmware Version

Seal Object Property	**InternalFirmwareVersion** (Hidden property).
Access	Read-Only.
Description	Internal version number (build number) of the DataSeal's firmware.

Constant in HGTSealParameterCodeEnum	**HGTInternalFirmwareVersion** (40h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**.

Remarks

See also the **Firmware Version** parameter.

Last Date & Time Update

Seal Object Property	**LastDateTimeUpdate**
Access	Read-Only.
Description	The date & time of the last time that the **Date & Time** parameter was written.
Constant in HGTSealParameterCodeEnum	**HGTLastDateTimeUpdate** (38h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Date**

Remarks

See also the **Minimal Interval between Time Updates** parameter.

Last Set Reader ID

Seal Object Property	**LastSetReader**
Access	Read-Only

Description	Indicates the Reader ID of the device that sent the last **Set** command (or any of its variants) to the DataSeal.
Constant in HGTSealParameterCodeEnum	**HGTLastSetReader** (9)
Verify Mask in HGTVerifyMaskEnum	**HGTLastSetReaderVerifyMask** (2)
Data Type	**Long** (Reader ID), or **Reader** object. See the online help for more information about the type of this property.

Life Counter

Seal Object Property	**LifeCounter**
Access	Read-Only
Description	This value is initialized at the factory to a value of 2048 and it is decremented in each **Set** command.
Constant in HGTSealParameterCodeEnum	**HGTLifeCounter** (4)
Verify Mask in HGTVerifyMaskEnum	**HGTLifeCounterVerifyMask** (800h)
Data Type	**Long**. Max value: 65535.

Long Status

Seal Object Property	**LongStatus**

Access	Read-Only
Description	Returns a bit field of the flags that represent the status of the DataSeal.
Constant in HGTSealParameterCodeEnum	**HGTLongStatus** (7)
Verify Mask in HGTVerifyMaskEnum	**HGTLongStatusVerifyMask** (100h)
Data Type	**HGTSealLongStatusBitEnum** (Long)

Remarks

This parameter contains all the status flags of the DataSeal (including these that are part of the **Short Status** parameter).

Use the constants in the **HGTSealLongStatusBitEnum** enumeration to determine the state of the specific flags. Each flag has also a corresponding boolean property in the **Seal** object.

Even though this parameter is read-only, some of the flags can be set using the **Set Status** command (**Seal.SetStatus**).

Section 8.2.1 contains descriptions of the various flags.

Low Battery Error Threshold

Seal Object Property	**LowBatteryErrorThreshold** (Hidden property)
Access	Read-Only.
Description	The highest value of the battery voltage that will cause the **Low Battery Error** status flag to be set.
Constant in HGTSealParameterCodeEnum	**HGTLowBatteryErrorThreshold** (61h).

Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit is of internal A/D converter.
Value	112

Remarks

This parameter is factory configured and cannot be changed.

See also the **Low Battery Warning Threshold**, and the **Battery Voltage Value** parameters.

Low Battery Warning Threshold

Seal Object Property	**LowBatteryWarningThreshold** (Hidden property)
Access	Read-Only.
Description	The highest value of the battery voltage that will cause the **Low Battery Warning** status flag to be set.
Constant in HGTSealParameterCodeEnum	**HGTLowBatteryWarningThreshold** (61h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit is of internal A/D converter.
Value	104

Remarks

This parameter is factory configured and cannot be changed.

See also the **Low Battery Error Threshold**, and the **Battery Voltage Value** parameters.

Maximal Alert and Close Burst Retries

Seal Object Property	**MaxAlertBurstRetries**
Access	Read & Write.
Description	Determines the number of times that the DataSeal will transmit an **Alert Burst** message or a **Close Burst** message if it doesn't receive an acknowledge.
Constant in HGTSealParameterCodeEnum	**HGTMaxAlertBurstRetries** (76h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**
Default Value	10

Remarks

See also the **Alert Burst Period** parameter.

Maximal Deep Sleep Burst Retries

Seal Object Property	**MaxDeepSleepBurstRetries**
Access	Read & Write.
Description	Determines the number of times that the DataSeal will transmit a **Deep Sleep** Burst message if it doesn't receive an acknowledge.
Constant in HGTSealParameterCodeEnum	**HGTMaxDeepSleepBurstRetries** (78h)

Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**
Default Value	5

Remarks

See also the **Deep Sleep Burst Period** Parameter.

Maximal Difference in Time Update

Seal Object Property	**MaxTimeDiffUpdate**
Access	Read-Only.
Description	Updating the **Date & Time** Parameter is allowed only if the difference from the current value is less than the value of this Parameter.
Constant in HGTSealParameterCodeEnum	**HGTMaxTimeDiffUpdate** (37h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit: minutes.
Value	8 minutes.

Remarks

This Parameter is factory configured and cannot be changed.

See also the **Minimal Interval between Time Updates** Parameter.

Maximal Message Size

Seal Object Property	**MaxMessageSize** (Hidden property)
Access	Read-Only.
Description	The maximal size in bytes of an RF message that the DataSeal can send.
Constant in HGTSealParameterCodeEnum	**HGTMaxMessageSize** (52h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**
Value	80

Remarks

This Parameter is factory configured and cannot be changed.

Maximal Number Of Events

Seal Object Property	**MaxNumberOfEvents**
Access	Read-Only.
Description	The maximal number of Event records that the DataSeal can store.
Constant in HGTSealParameterCodeEnum	**HGTMaxNumberOfEvents** (50h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**
Value	55

Remarks

This Parameter is factory configured and cannot be changed.

See also the **Number of Events**, and the **Number of Scroll Events** Parameters. See also the next section for further information about the Events Memory and the DataSeal Events.

Minimal Interval between Time Updates

Seal Object Property	**MinIntervalBetweenTimeUpdates**
Access	Read-Only.
Description	Updating the **Date & Time** Parameter is only allowed if a the interval specified by this Parameter has passed since the last update.
Constant in HGTSealParameterCodeEnum	**HGTMinIntervalBetweenTimeUpdates** (36h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit: weeks.
Value	13 weeks (3 months).

Remarks

This Parameter is factory configured and cannot be changed.

See also the **Maximal Difference in Time Update** parameter.

Number of Events

Seal Object Property	**EventsCount**
Access	Read-Only

Description	Returns the number of Event records that are currently written in the Events Memory of the DataSeal.
Constant in HGTSealParameterCodeEnum	**HGTEventsCount** (3)
Verify Mask in HGTVerifyMaskEnum	**HGTEventsCountVerifyMask** (1000h)
Data Type	Byte

Remarks

The value of this Parameter may vary according to the version of the DataSeal's firmware, and according to the value of the **Maximal Number of Events** parameter.

Number of Scroll Events

Seal Object Property	**NumberOfScrollEvents**
Access	Read-Only.
Description	The size of the Scrollable Portion of the Events Memory, specified by the number of Event records that can be stored in it.
Constant in HGTSealParameterCodeEnum	**HGTNumberOfScrollEvents** (51h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**
Value	10

Remarks

This Parameter is factory configured and cannot be changed.

See also the **Maximal Number of Events**, and the **Number of Events** Parameters. See also the next section for further information about the Events Memory and the DataSeal Events.

OrgID & Department

Seal Object Property	**OrgID**
Access	Read-Only
Description	The identifier of the organization and of the department within the organization.
Constant in HGTSealParameterCodeEnum	**HGTOrgID** (12h)
Verify Mask in HGTVerifyMaskEnum	**HGTOrgIDVerifyMask** (40h)
Data Type	Long

Remarks

The first (most significant) bytes of this parameter are the OrgID value, and the 3rd byte is the Department.

See chapter 6 for further details about the **OrgID** & **Department** Parameters.

RSSI

Seal Object Property	**RSSI**
Access	Read-Only

Description	Returns the reception level of the last RF command.
Constant in HGTSealParameterCodeEnum	**HGTRSSI** (8)
Verify Mask in HGTVerifyMaskEnum	**HGTRSSIVerifyMask** (80h)
Data Type	**Byte**

Seal ID

Seal Object Property	**SealID** (binary format), **FormatB** (string format)
Access	Read-Only*.
Description	This is the identifier of the DataSeal. Each DataSeal has a unique Seal ID that is given to it in the factory.
Constant in HGTSealParameterCodeEnum	**HGTSealID1** (10h) – first 2 bytes. **HGTSealID2** (11h) – last 4 bytes.
Verify Mask in HGTVerifyMaskEnum	(not supported).

Data Type	**SealID: SEAL_ID** type (contains an array of 6 bytes) **FormatB**: **String** in the format *AAAAnnnnnnnn* where *A* is any letter from A to Z, and *n* is any digit from 0 to 9. When read using **HGTSealID1** and **HGTSealID2**: Both values are of type **Long**: **HGTSealID1** returns the first 2 bytes (0-65535) and **HGTSealID2** returns the last 4 bytes (0-FFFFFFFFh)

Remarks

*Even though the Parameter in the DataSeal is Read-Only, the **SealID** and **FormatB** properties of the **Seal** object in DataSealLib are read/write. See the online help for further details about these properties.

Seal Stamp

Seal Object Property	**SealStamp**
Access	Read-Only
Description	This is a unique (random) value that DataSeal generates each time it is being opened or closed, or when it receives one of the **Set** commands.
Constant in HGTSealParameterCodeEnum	**HGTSealStamp** (17h)
Verify Mask in HGTVerifyMaskEnum	**HGTSealStampVerifyMask** (20h)
Data Type	**Long**. Max value: 65535.

Remarks

This value is also recorded in each Event record.

If you read only the Status of the DataSeal periodically, you may see the same Status even though the DataSeal has been opened, closed or Set between the 2 interrogations. By reading also the **Seal Stamp**, you can determine if something like this happens.

Short Status

Seal Object Property	**ShortStatus**
Access	Read-Only
Description	Returns a bit field of the most important flags that represent the status of the DataSeal.
Constant in HGTSealParameterCodeEnum	**HGTShortStatus** (0)
Verify Mask in HGTVerifyMaskEnum	**HGTShortStatusVerifyMask** (8000h)
Data Type	**HGTSealShortStatusBitEnum** (byte)

Remarks

This parameter is part of the **Long Status** Parameter which contains all the status flags of the DataSeal.

Use the constants in the **HGTSealShortStatusBitEnum** enumeration to determine the state of the specific flags. Each flag has also a corresponding boolean property in the **Seal** object.

Section 8.2.1- The DataSeal Status Flags contains descriptions of the various flags.

Size of User Data

Seal Object Property	**UserDataSize**
Access	Read-Only.
Description	The size of the User Data memory area in the DataSeal.
Constant in HGTSealParameterCodeEnum	**HGTUserDataSize** (42h).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**.
Value	About 2K

Remarks

The exact value of this Parameter depends on the version of the DataSeal's firmware, and on the **Maximal Number of Events** Parameter.

Sleep Duration Unit

Seal Object Property	**SleepDurationUnit**

Access	Read & Write.
Description	This Parameter defines the units for the **Sleep Duration** argument in the **Verify** and **Tampered** commands.
Constant in HGTSealParameterCodeEnum	**HGTSleepDurationUnit** (33h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit is seconds.
Default Value	5

Remarks

See the description of the **Verify** command for more information about this parameter.

Time Filter for Read (Footprint) Events

Seal Object Property	**TimeFilterForReadEvent**
Access	Read & Write.
Description	If the interval between 2 **Read** (Footprint) Events is less than the value of this Parameter then the 2nd Event record won't be written.
Constant in HGTSealParameterCodeEnum	**HGTTimeFilterForReadEvent** (6Ah).
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Byte**. Unit is **Tw**.

Default Value 0

Remarks

If the value of this Parameter is 0, then **Read** (Footprint) Event record are always written.

The purpose of this Parameter is to prevent too many Event records to be written if a DataReader performs a **Verify** command with Footprint cyclically.

See the DataReader's **SYS** Parameter, and the **Read** Event for further details.

Tp (Wakeup Time Interval in Deep Sleep Mode)

Seal Object Property	**Tp** (hidden property)
Access	Read & Write.
Description	The interval in which the DataSeal wakes up in Deep Sleep Mode, in order to check for a HF **Hard Wakeup** RF command.
Constant in HGTSealParameterCodeEnum	**HGTTp** (32h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Long**. Max value: 65535. Unit is 1/1.024ms (0.976ms).
Default Value	10000 (9.766 seconds)

Remarks

In Deep Sleep mode, the DataSeal wakes up in the interval specified by this Parameter, to check for a **Hard Wakeup** command in HF.

Ts (Time Slot Duration)

Seal Object Property	**Ts** (hidden property)
Access	Read-Only.
Description	Indicates the duration of each time slot in Multi Addressed commands without arguments.
Constant in HGTSealParameterCodeEnum	**HGTTs** (30h)
Verify Mask in HGTVerifyMaskEnum	(not supported).
Data Type	**Long**. Max value: 65535. Unit is 1.024ms.
Value	41

Remarks

This Parameter is factory configured and cannot be changed.

Tw (Wakeup Time Interval)

Seal Object Property	**Tw** (hidden property)
Access	Read & Write.
Description	The interval in which the DataSeal wakes up in Normal Mode, in order to check for HF RF commands.
Constant in HGTSealParameterCodeEnum	**HGTTw** (31h)
Verify Mask in HGTVerifyMaskEnum	(not supported).

Data Type	**Long**. Max value: 65535. Unit is 1/1.024ms (0.976ms).
Default Value	3000 (2.93 seconds)

Remarks

See section 8.1 - The High Frequency RF Protocol for more information about this Parameter.

User Parameter 1 and **User Parameter 2**

Seal Object Property	**UserParameter1** **UserParameter2**
Access	Read & Write
Description	Each of these Parameters are strings of 8 bytes that the user can use to store anything he wants.
Constant in HGTSealParameterCodeEnum	**HGTUserParameter1** (68h) **HGTUserParameter2** (69h)
Verify Mask in HGTVerifyMaskEnum	**HGTUserParameter1VerifyMask** (10h) **HGTUserParameter2VerifyMask** (8)
Data Type	**String**. Max length: 8 bytes.

Remarks

These Parameters can be used by the user for any purpose.

8.2.1 The DataSeal Status Flags

The **Long Status** Parameter of the DataReader is a 32-bit value which each bit represents a specific flag of Status. The **Short Status** Parameter is the 8 most significant bits of the **Long Status**.

Below are the descriptions of each of the Status flags: (All the flags are included in the **Long Status**, and the first 8 are also included in the **Short Status**)

Tampered

Seal Object Property	**Tampered**
Mnemonic	**S/T**
Description	This flag gets set when the Sealing Wire is opened or its electrical resistance changes. It is cleared only by one of the **Set** commands.
Constant in HGTSealShortStatusBitEnum	**HGTTamperedShort** (80h)
Constant in HGTSealLongStatusBitEnum	**HGTStatusTampered** (80000000h)

Low Battery Warning

Seal Object Property	**LowBatteryWarning**
Mnemonic	**LBW**

Description	This flag gets set when the DataSeal's battery voltage gets below the value of the **Low Battery Warning Threshold** Parameter.
Constant in HGTSealShortStatusBitEnum	**HGTLowBatteryWarningShort** (40h)
Constant in HGTSealLongStatusBitEnum	**HGTStatusLowBatteryWarning** (40000000h)

Remarks

If this flag is on, the DataSeal is still functioning. However, you should replace the DataSeal as soon as possible before it stops functioning.

Opened

Seal Object Property	**Opened**
Mnemonic	**O/C**
Description	This flag is on when the Sealing Wire is open, and off when it is closed.
Constant in HGTSealShortStatusBitEnum	**HGTOpenShort** (20h)
Constant in HGTSealLongStatusBitEnum	**HGTStatusOpen** (20000000h)

Remarks

When this flag is on, the **Tampered** flag is also set (if it wasn't yet).

Suspended Set

Seal Object Property	**SuspendedSet**

Mnemonic	**SS**
Description	This flag gets set when a **Suspended Set** command is received, and stays on until the Sealing Wire is closed.
Constant in HGTSealShortStatusBitEnum	**HGTSuspendedSetShort** (10h)
Constant in HGTSealLongStatusBitEnum	**HGTStatusSuspendedSet** (10000000h)

Sealing Wire Changed

Seal Object Property	**SealWireChanged**
Mnemonic	**WRC**
Description	This flag gets set when the electrical resistance of the Sealing Wire changes relative to what it was during the last **Set** operation.
Constant in HGTSealShortStatusBitEnum	**HGTSuspendedSetShort** (8h)
Constant in HGTSealLongStatusBitEnum	**HGTStatusSuspendedSet** (8000000h)

Remarks

This may indicate that a thief tries to short the Sealing Wire.

Deep Sleep

Seal Object Property	**DeepSleep**
Mnemonic	**SL**

Description	Indicates whether the DataSeal is in Deep Sleep mode.
Constant in HGTSealShortStatusBitEnum	**HGTDeepSleepShort** (4h)
Constant in HGTSealLongStatusBitEnum	**HGTStatusDeepSleep** (4000000h)

General Error

Seal Object Property	**GeneralError**
Mnemonic	**GE**
Description	Indicates an error that is indicated by flags of the **Long Status** that are not part of the **Short Status**.
Constant in HGTSealShortStatusBitEnum	**HGTGeneralErrorShort** (2)
Constant in HGTSealLongStatusBitEnum	**HGTStatusGeneralError** (2000000h)

Remarks

This flag's value (0 or 1) is the logical OR of the following flags: **Life Counter 0**, **Real Time Clock Error**, **Low Battery Error**, **Database Error**, **Database Corrupted**, **Hardware Error** and **Illegal OrgID**.

Approved Open

Seal Object Property	**ApprovedOpen**
Mnemonic	**AO**

Description	If the **Opened** flag is on, this flag indicates whether the open is approved. If the **Opened** flag is off, this flag indicates whether opening the DataSeal is allowed.
Constant in HGTSealShortStatusBitEnum	**HGTApprovedOpenShort** (1)
Constant in HGTSealLongStatusBitEnum	**HGTStatusApprovedOpen** (1000000h)

Remarks

This flag gets set using the **Approve Open** command, and unset according to the arguments of that command.

Opening the Sealing Wire while this flag is on does not prevent the **Tampered** flag from turning on, rather it is possible to detect that this is an allowed "tampered" situation by examining the **Approved Open** flag.

Life Counter 0

Seal Object Property	**LifeCounterZero**
Mnemonic	**LC0**
Description	When the **Life Counter** Parameter reaches 0, this flag is set. In this case the DataSeal ceases to write Event records.
Constant in HGTSealLongStatusBitEnum	**HGTStatusLifeCounterZero** (800000h)

Remarks

The **Life Counter** Parameter is decremented on each open and close events, and when a **Set** command is issued.

Real Time Clock (RTC) Error

Seal Object Property	**RTC Error**
Mnemonic	**RTC**
Description	Indicates an error in the Real Time Clock of the DataSeal.
Constant in HGTSealLongStatusBitEnum	**HGTStatusRTCError** (400000h)

Remarks

You can clear this flag using the **Set/Reset Status** command.

Low Battery Error

Seal Object Property	**LowBatteryError**
Mnemonic	**LBE**
Description	This flag gets set when the DataSeal's battery voltage gets below the value of the **Low Battery Error Threshold** Parameter.
Constant in HGTSealLongStatusBitEnum	**HGTStatusRTCError** (200000h)

Remarks

When this flag is on, the DataSeal is about to stop functioning, and you should replace the DataSeal immediately.

Database Error (Corrupted and Restored)

Seal Object Property	**DBCorruptedAndRestored**

Mnemonic	**DBE**
Description	This flag indicates that an error in the DataSeal's internal database was detected, but successfully restored.
Constant in HGTSealLongStatusBitEnum	**HGTStatusDBCorruptedAndRestored** (100000h)

Remarks
You can clear this flag using the **Set/Reset Status** command.

Database Corrupted

Seal Object Property	**DBCorrupted**
Mnemonic	**DBC**
Description	This flag indicates that an error in the DataSeal's internal database was detected, and could not be fixed.
Constant in HGTSealLongStatusBitEnum	**HGTStatusDBCorrupted** (80000h)

Remarks
When this flag is on, you should replace the DataSeal.

New Battery

Seal Object Property	**NewBattery**
Mnemonic	**NB**
Description	Indicates that a battery was replaced.

Constant in HGTSealLongStatusBitEnum	**HGTStatusNewBattery** (20000h)

Remarks

This flag is used only with DataSeals with replaceable batteries.

You can clear this flag using the **Set/Reset Status** command.

Hardware Error

Seal Object Property	**HardwareError**
Mnemonic	**HRE**
Description	Indicates that an hardware error was detected.
Constant in HGTSealLongStatusBitEnum	**HGTStatusHardwareError** (10000h)

Remarks

When this flag is on, you should replace the DataSeal.

Illegal OrgID

Seal Object Property	**IllegalOrgID**
Mnemonic	**OID**
Description	Indicates that communication with the DataSeal was attempted from a device with a different OrgID or Department.
Constant in HGTSealLongStatusBitEnum	**HGTStatusIllegalOrgID** (8000h)

Remarks

This flag may indicate that someone tried to "hack" the DataSeal using unauthorized equipment.

You can clear this flag using the **Set/Reset Status** command.

Command Failed

Seal Object Property	**CommandFailed**
Mnemonic	**CMF**
Description	Indicates that the DataSeal could not execute a command it received.
Constant in HGTSealLongStatusBitEnum	**HGTStatusCommandFailed** (4000h)

Remarks

You can clear this flag using the **Set/Reset Status** command.

Unrecognized Command

Seal Object Property	**UnrecognizedCommand**
Mnemonic	**UNC**
Description	Indicates that the DataSeal received a command that it does not recognize.
Constant in HGTSealLongStatusBitEnum	**HGTStatusUnrecognizedCommand** (2000h)

Remarks

One reason for this flag to be set can be in case you're using a DataReader and a COM DLL with a versions that are newer that the version of the DataSeal, and you're trying to execute a new command that the DataSeal does not recognize.

You can clear this flag using the **Set/Reset Status** command.

Close Burst Mode

Seal Object Property	**CloseBurstMode**
Mnemonic	**BMC**
Description	Determines whether the DataSeal will send a Burst message when the Sealing Wire becomes closed.
Constant in HGTSealLongStatusBitEnum	**HGTStatusCloseBurstMode** (1000h)

Remarks

The Burst message that is sent in this case is the **Close Burst** message.

You can set or clear this flag using the **Set/Reset Status** command.

Note: This flag is in effect only if the **Alert Burst Mode** flag is also set.

(Alert) Burst Mode

Seal Object Property	**AlertBurstMode**
Mnemonic	**BMU**
Description	Determines whether the DataSeal will send Burst messages.

Constant in HGTSealLongStatusBitEnum	**HGTStatusAlertBurstMode** (800h)

Remarks

If this flag is on, the DataSeal will send an **Alert Burst** message when the Sealing Wire becomes opened. The Burst message that is sent in this case is the **Alert Burst** message or the **Extended Alert Burst** message.

This flag also determines whether other types of Burst message is allowed. If this flag is off, the DataSeal won't send any kind of Burst message.

This flag can be set using the **Start Alert Burst Mode** and **Start Alert Burst Mode for All Seals**, and cleared using the **Stop Alert Burst Mode** and **Stop Alert Burst Mode for All Seals** commands.

Buffer Full

Seal Object Property	**BufferFull**
Mnemonic	**BF**
Description	This flag is set if a **Read Data**, **Read Events** or **Read Parameters** command requests too much data that exceeds the size of the DataSeal's output buffer.
Constant in HGTSealLongStatusBitEnum	**HGTStatusAlertBurstMode** (80h)

Remarks

The largest block you can read is **Maximal Message Size** – 13 (=67 bytes).

You can clear this flag using the **Set/Reset Status** command.

Scroll

Seal Object Property	**Scroll**

Mnemonic	**SRL**
Description	Indicates whether the Events Memory began to overwrite older Event records in the Scrollable Portion of the Events Memory, because the Events Memory is full.
Constant in HGTSealLongStatusBitEnum	**HGTStatusScroll** (40h)

Remarks

See the next section for more information about the Events Memory and the DataSeal Events.

High Frequency (HF) Disabled

Seal Object Property	**HFDisabled**
Mnemonic	**HFD**
Description	Determines whether the DataSeal will listen to the HF channel.
Constant in HGTSealLongStatusBitEnum	**HGTStatusHFDisabled** (20h)

Remarks

When this flag is on the DataSeal will not open the HF receiver to listen for messages.

You can set or clear this flag using the **Set/Reset Status** command. The **Temporarily Disable HF** command, and the **Verify** and **Tampered** commands with **Sleep Duration** argument that is not 0, also turn on this flag for a specified period.

Note: This mode does not affect the Low Frequency channel.

Send OrgID in Burst

Seal Object Property	**OrgIDBurst**
Mnemonic	**OIB**
Description	Determines whether the OrgID of the DataSeal will be sent when it transmits a Burst message.
Constant in HGTSealLongStatusBitEnum	**HGTStatusOrgIDBurst** (10h)

Remarks

You can set or clear this flag using the **Set/Reset Status** command.

Accelerated Verify Mode

Seal Object Property	(Not supported).
Mnemonic	**AVM**
Description	Indicates that the DataSeal is in an Accelerated Verify mode.
Constant in HGTSealLongStatusBitEnum	**HGTStatusAcceleratedVerifyMode** (8)

Remarks

See the **Accelerate Verify** command for further information about this flag.

8.3 Events

See chapter 6 for a general description of the Events Memory.

8.3.1 General Structure of an Event Record

There are 2 main types of Event records: Short Event Record and Long Event Record. In DataSealLib, both types are represented by the **SealEvent** class, but the Short Event Record does not use all the members. The following **SealEvent** class members are used both in Short Events and in Long Event records:

- **Number** – The sequential number of the Event record.
- **Code** – The code (type) of the Event record. The **HGTEventCodeEnum** enumeration contains the constants for these codes.
- **DateTime** – The date & time (in UTC) when the event occurred.
- **SealStamp** – The value of the **Seal Stamp** parameter when the event occurred.
- **CRC** – The Cyclic Redundancy Check code that ensures the validity of the first part of the record.

The following **SealEvent** class members are used only in the Long Event records:

- **CodeEx** – The code of the extension of the Event record. This is always the same as **Code** + 80h.
- **Reader ID** – The ID of the device that caused the Event (for example, in a Set operation). Note that this is not necessarily an ID of a DataReader – it could also be the ID of a DataTerminal, DataPort or any other kind of device that could cause the Event.

  Note: If DataSealLib recognizes the Reader ID as a DataReader that it knows it returns the **Reader** object instead of the Reader ID itself.

- **SealStamp2** – 2 Additional bytes that contain data specific to the type of Event. Most Event types does not use this field at all.

- **CRC2** - The Cyclic Redundancy Check code that ensures the validity of the second part of the record.

Below are the descriptions of the different Event types:

Set

Constant in HGTEventCodeEnum	**HGTSetEvent** (1)
Type of Event record	Long
When Written	On a successful completion of a **Set** command.

Remarks
This is always the first Event record in the Events Memory.

Sealing Wire Changed

Constant in HGTEventCodeEnum	**HGTWireTamperedEvent** (2)
Type of Event record	Short
When Written	If the electrical resistance of the Sealing Wire has changed relative to what it was when the last **Set** command was executed.

Low Battery Warning

Constant in HGTEventCodeEnum	**HGTLowBatteryWarningEvent** (3)
Type of Event record	Short

When Written	When the DataSeal's battery voltage gets below the value of the **Low Battery Warning Threshold** Parameter.

Remarks

There's no "Low Battery Error" Event because when the **Low Battery Error** flag is set the DataSeal ceases to write Events.

Sealing Wire Opened

Constant in HGTEventCodeEnum	**HGTWireOpenedEvent** (4)
Type of Event record	Short
When Written	When the Sealing Wire is opened or cut.

Sealing Wire Closed

Constant in HGTEventCodeEnum	**HGTWireClosedEvent** (5)
Type of Event record	Short
When Written	When the Sealing Wire is closed.

Soft Set

Constant in HGTEventCodeEnum	**HGTSoftSetEvent** (7)
Type of Event record	Long

When Written	On successful completion of a **Soft Set** command.

Remarks

The **Soft Set** command is similar to the **Set** command, but does not clear the Events Memory. Instead, it writes the **Soft Set** Event record.

Real Time Clock (RTC) Stopped

Constant in HGTEventCodeEnum	**HGTRTCStoppedEvent** (8)
Type of Event record	Short
When Written	When the Built-in Test detects an error in the Real Time Clock.

Database Corrupted and Restored

Constant in HGTEventCodeEnum	**HGTDBCorruptedEvent** (9)
Type of Event record	Short
When Written	When the Built-in Test detects an error in the DataSeal's internal Database, but succeeds to restore it.

Remarks

If the DataSeal is not able to restore the database, it doesn't write Event records, and you should replace the DataSeal.

Read (Footprint)

Constant in HGTEventCodeEnum	**HGTReadEvent** (10)
Type of Event record	Long
When Written	On successful completion of one of the **Verify** or **Tampered** commands, if bit 7 of the DataReader's **SYS** Parameter of the DataReader is 1. Also written on completion of the Low-Frequency **Read** command.

Date & Time Updated

Constant in HGTEventCodeEnum	**HGTTimeUpdateEvent** (0Bh)
Type of Event record	Long
When Written	On successful completion of a **Write Parameters** command that updates the **Date & Time** Parameter.
Value of SealStamp2	The high (MSB) byte contains the number of minutes (signed) that was added to the previous value of the **Date & Time** Parameter. The low (LSB) byte is not used (0).

Suspended Set

Constant in HGTEventCodeEnum	**HGTSuspendedSetEvent** (0Ch)

Type of Event record	Long
When Written	On successful completion of a **Suspended Set** command.

Remarks
If the Sealing Wire was opened when the **Suspended Set** command was executed, the **Suspended Set** Event will first be appended to the existing Events, and after closing the Sealing Wire, all the previous Event records will be deleted, and the **Suspended Set** Event will become the first.

Start Burst Mode

Constant in HGTEventCodeEnum	**HGTStartBurstModeEvent** (0Dh)
Type of Event record	Long
When Written	On successful completion of a **Start Alert Burst Mode** or **Start Alert Burst Mode for All Seals** command.

Stop Burst Mode

Constant in HGTEventCodeEnum	**HGTStopBurstModeEvent** (0Eh)
Type of Event record	Long
When Written	On successful completion of a **Stop Alert Burst Mode** or **Stop Alert Burst Mode for All Seals** command.

Start Deep Sleep Mode

Constant in HGTEventCodeEnum	**HGTStartDeepSleepModeEvent** (0Fh)
Type of Event record	Long
When Written	On successful completion of a **Deep Sleep** command.

Remarks
After this Event the DataSeal enters Deep Sleep mode and stops writing new Event records. After a **Hard Wakeup** command the DataSeal wakes up, but it continues to write Event records only after a new **Set** command is executed.

Approved Open

Constant in HGTEventCodeEnum	**HGTApprovedOpenEvent** (0Fh)
Type of Event record	Long
When Written	On successful completion of an **Approve Open** command.

8.4 High-Frequency RF Commands Summary

There are 3 groups of HF RF commands: Addressed, Multi Addressed (with or without arguments) and Broadcast (see section 8.1.2 - Addressing Types for descriptions about these 3 groups). DataSealLib exposes each RF command as a method of a class: Addressed commands are provided as methods of the **Seal** class; Multi Addressed commands are provided as methods of the **Seals** class, and Broadcast commands are provided as methods of the **Reader** class.

All of the methods in DataSealLib that execute RF commands take the following 2 optional arguments (usually these are the last arguments):

- **RFCommandObject** – This argument is used for controlling specific issues regarding the way that DataSealLib returns the results of the RF command. When the command completes, its **Result** property contains the results. For further information about this argument and the **RFCommandObject** class see the online documentation.
- **ADI** – This is the **ADI** (group ID) that will be sent with the command. See chapter 6 for further information about **ADI**.

The following sections contain a summary of the (HF) RF commands and their arguments. The **RFCommandObject** and **ADI** arguments are omitted from each command, because they are common to all and described above. Arguments that are relevant only to DataSealLib and does not affect the RF communications, are omitted too. See the online documentation for help about these arguments. Note that there are default values to almost all arguments of all the commands. See the online documentation for further information about these default values.

8.4.1 Broadcast Commands

NOP (No Operation)

Method	**Reader.NOP** (Hidden method)
Description	When a DataSeal receives this commands it does nothing for the specified period. This is sometimes useful when performing a Command Chain.

Arguments:

Name	Type	Description
Period	**Long**	The period until the DataSeal will wait for the next command.

Result Type **Boolean**

Result Description Always returns True (DataSeals don't respond to this command).

Remarks

See section 8.7 for further information about Command Chains.

Verify, Tampered

Method **Reader.Verify**

Description Detects which DataSeals are in the DataReader's Receiving Zone, or which tampered DataSeals are in the DataReader's Receiving Zone. It can also read selected Parameters and/or User Data from the receiving DataSeals.

Arguments:

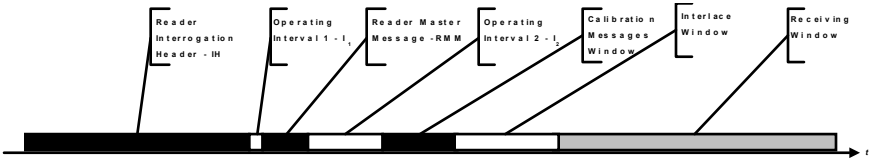
Name	Type	Description
Mask	**HGTVerifyMaskEnum** enumeration	The set of parameters to request. Use the 'Or' operator to combine more than one constant from the HGTVerifyMaskEnum enumeration.
TamperedOnly	**Boolean**	Whether to ask only the tampered DataSeal to respond. Internally, DataSealLib uses this argument to determines the type of the command that will be sent (the **Verify** command or the **Tampered** command).
RFParameters	**RFParameters** class	Contains properties that controls low-level features of the command. See the Remarks below for further information.
StartAddress	**Integer**	The starting address of the User Data to request. This argument is relevant only if the HGTUserDataVerifyMask flag is included in the **Mask** argument.
Length	**Byte**	The length in bytes of the User Data to request. This argument is relevant only if the HGTUserDataVerifyMask flag is included in the **Mask** argument.

Result Type **Seals** class

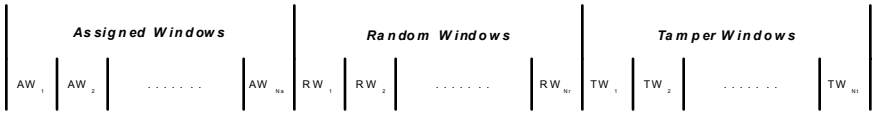
Result Description The **Seals** class contains the **Seal** objects that represents the responded DataSeals. The requested parameters are reflected through the **Seal** objects' properties.

Remarks

The following scheme demonstrates the various parts of the **Verify** command through time:



The following scheme demonstrates the various parts of the Receiving Window through time:



The **RFParameters** class has the following properties:

Name	Type	Description
Tcm	**Byte**	Duration of the Calibration Message Window. Units are 1.024ms. If 0 – there's no Calibration Message Window. The Calibration Message Window is used along with the HGTDistanceIndexVerifyMask flag of the **Mask** argument, to determine the relative distance of the DataSeal from the DataReader. (Default is 0).
Tiw	**Integer**	The duration of the Reader Interlace Window. Units are 1.024ms. (Default is 0).

Ts	**Byte**	Duration of the Time Slice (window) that the DataReader receives a single DataSeal response. This duration must be in correlation with the number of bytes that were requested in the **Mask** and **Length** arguments, and with the value of the **RFParameters.Confirmation Flag** property. This property is usually calculated automatically, or you can use the **SetBestTs** method to calculate it. Units are 1.024 ms
Na	**Byte**	Number of Assigned Windows. This argument is currently not supported by the DataSeals.
Nr	**Byte**	Number of Random Windows. You can calculate the best value for this property using the **DefaultsFor** method.
Nt	**Byte**	Number of Tamper Windows. These windows are meant only for DataSeals that their Tampered flag is on.
Rr	**Byte**	The 7 rightmost bits are the number of random retries in the Random Windows, which is the number of Windows in which each DataSeal chooses randomly to send his responses. The leftmost bit determines whether the DataReader will send a confirmation to a DataSeal when it receives its response. This bit is also exposed through the **ConfirmationFlag** property. You can calculate the best value

		for this property using the **DefaultsFor** method.
Rt	**Byte**	Number of random retries in the Tamper Windows.
SleepDuration	**Byte**	If this parameter is not 0, and the **ConfirmationFlag** is True, the DataSeal will execute a **Temporarily Disable HF** command with the duration specified by this argument, upon receiving the confirmation. The units of this arguments is determined by the DataSeal's **Sleep Duration Unit** parameter. This is useful to avoid collisions and to save battery when you need to receive large amount of DataSeals that are in the same zone.

Start Alert Burst Mode for All Seals, Stop Alert Burst Mode for All Seals

Method	**Reader.SetAsyncAlertBurstMode**
Description	Causes all the DataSeals that receive this command to start or to stop being in Alert Burst Mode by setting or clearing their **Alert Burst Mode** status flag.

Arguments:

Name	Type	Description
BurstMode	**Boolean**	Determines whether to start or to stop Burst Mode. Internally, DataSealLib uses this argument to determines the type of the command that will be sent (the Start Alert Burst Mode for All Seals command or the Stop Alert Burst Mode for All Seals command).

Result Type **Boolean**

Result Description Always returns True (DataSeals don't respond to this command).

Accelerate Verify

Method **Reader.AccelerateVerify**

Description Allows large amount of DataSeals to respond to a **Verify** command in a short period of time, and in high velocity (on a train, for example).

It does so by changing **Tw** temporarily to a smaller value (shorter period).

Arguments:

Name	Type	Description
NewTw	**Integer**	The new (temporary) value of **Tw**.

Phase	**Long**	The interval in seconds of the time between the DataSeal receives the command and until it starts the Active Period (the period in which **Tw** is replaced with **NewTw**).
ActiveInterval	**Long**	The duration of the Active Interval in seconds. The resolution is the maximum of the following two values: the original value of the **Tw** parameter and the value of the **NewTw** argument.
CheckReader	**Boolean**	See Remarks.
UseInVerify	**Boolean**	See Remarks.
UseInTamper	**Boolean**	See Remarks.
RestoreTwOnConfirmation	**Boolean**	Determines whether the DataSeal should exit the Active Period (restore **Tw**) when it receives a confirmation to a **Verify** response.

Result Type **Boolean**

Result Description Always returns True (DataSeals don't respond to this command).

Remarks

If the DataSeal received a **Verify** command during the Active Period and **UseInVerify** is True, upon receiving a confirmation flag to its response it does the following:

If **RestoreTwOnConfirmation** is True, it restores the original **Tw**, and leaves the Active Period. If it is False, the DataSeal ignores further **Verify** commands until the end of the Active Period. If **CheckReader** is True, the DataSeal ignores only **Verify** commands transmitted by the same DataReader.

The same thing applies for a **Tampered** command and the **UseInTamper** flag.

When the DataSeal receives this command it sets the **Accelerated Verify Mode** flag in the **Long Status**, and clears it when it leaves the Active Period.

8.4.2 Addressed Commands

Addressed Verify

Method	**Seal.Verify**
Description	Verifies that a specific DataSeal is in the DataReader's Receiving Zone. It can also read selected parameters and/or User Data from that DataSeal.

Arguments:

Name	Type	Description
Mask	**HGTVerifyMaskEnum** enumeration	The set of parameters to request. Use the 'Or' operator to combine more than one constant from the HGTVerifyMaskEnum enumeration.

RFParameters	**RFParameters** class	Contains properties that controls low-level features of the command. See the Remarks of the **Verify** command for further information. The following properties are not applicable to the **Addressed Verify**: **Na**, **Nt** and **Rt**.
StartAddress	**Integer**	The starting address of the User Data to request. This argument is relevant only if the HGTUserDataVerifyMask flag is included in the **Mask** argument.
Length	**Byte**	The length in bytes of the User Data to request. This argument is relevant only if the HGTUserDataVerifyMask flag is included in the **Mask** argument.

Result Type **Seal** class

Result Description The original **Seal** objects that represents the specified DataSeal. The requested parameters are reflected through the object properties.

Approve Open

Method **Seal.ApproveOpen**

Description Turns on the **Approved Open** flag in the DataSeal's Status to indicate that it allows to be opened.

Arguments:

Name	Type	Description

ClearOnClose	**Boolean**	Whether the DataSeal should clear the **Approved Open** flag when the Sealing Wire is closed again.

Result Type **Byte**

Result Description The **Short Status** of the DataSeal.

Remarks
When the DataSeal receives this command it writes an **Approved Open** Event record.

Temporarily Disable High Frequency

Method **Seal.TempDisableHF**

Description Turns on the **HF Disabled** flag in the DataSeal's Status for a specified period.

Arguments:

Name	Type	Description
Period	**Long** (Max value: 65535).	The duration in seconds in which the HF will be disabled.
InterruptOnTamper	**Boolean**	Whether the DataSeal would reactivate its HF receiver when a **Tampered** Event occurrs.

Result Type **Byte**

Result Description The **Short Status** of the DataSeal.

Read Events

Method **Seal.ReadEvents**

Description Returns all or part of the Event records that are currently in the DataSeal's Events Memory.

Arguments:

Name	Type	Description
StartEventNumber	**Byte**	The first Event number to read.
NumberOfEvents	**Byte**	The maximum number of Event records to read.

Result Type **Events** class

Result Description The returned **Events** object is a collection of **SealEvent** objects that represent the Event records.

Read Data

Method **Seal.ReadData**

Description Reads a block of data from the User Data memory of the specified DataSeal.

Arguments:

Name	Type	Description
BaseAddress	**Integer**	The first address in the DataSeal's User Data memory from which to start reading.
BlockLength	**Integer**	The length in bytes of the block of memory to read from the DataSeal.

Result Type Array of **Byte**s.

Result Description The block of data that was read from the DataSeal.

Remarks

The maximal possible **BlockLength** is 67 bytes.

Read Parameters

Method	**Seal.ReadParameters** (for reading multiple parameters) **Seal.ReadParameter** (for reading single parameter)
Description	Reads the value of one or more Parameters of the specified DataSeal.

Seal.ReadParameters Arguments:

Name	Type	Description
CodesAndValues	**SealCodesAndValues** class	The collection of the parameters to read. See the online documentation for further information regarding how to fill this collection.

Seal.ReadParameter Arguments:

Name	Type	Description
Code	**HGTSealParameterCodeEnum** enumeration	The code of the parameter that you want to read.

Result Type for Seal.ReadParameters	**SealCodesAndValues** class
Result Description for Seal.ReadParameters	The collection is filled with the values of the parameters.
Result Type for Seal.ReadParameter	**Variant** (according to the type of the parameter)

Result Description for Seal.ReadParameter The value of the parameter that was read.

Read Multi Access Data

Method **Seal.ReadMultiAccessData**

Description Reads one or more blocks of data (possibly inadjacent) from the User Data memory of the specified DataSeal.

Arguments:

Name	Type	Description
AddressesAndSizes	**Variant**	An array that contains pairs of Address and Size of the blocks of User Data to read.

Result Type Array of bytes or an array of array of bytes – see the online documentation for further information.

Result Description The result is the requested data.

Write Data

Method **Seal.WriteData**

Description Writes a block of data to the User Data memory of the specified DataSeal.

Arguments:

Name	Type	Description
BaseAddress	**Integer**	The first address in the DataSeal's User Data memory to where you want to write the data.
Data	Array of bytes	The data that you want to write to

	the DataSeal.

Result Type Byte

Result Description The **Short Status** of the DataSeal.

Write Parameters

Method **Seal.WriteParameters** (for writing multiple parameters)
Seal.WriteParameter (for writing single parameter)

Description Writes new value(s) to one or more Parameters of the DataSeal.

Arguments for Seal.WriteParameters:

Name	Type	Description
CodesAndValues	**SealCodesAndValues** class	A collection that contains pairs of Parameter codes and the values that you want to write to them.

Arguments for Seal.WriteParameter:

Name	Type	Description
Code	**HGTSealParameterCodeEnum** enumeration	The code of the parameter that you want to update.
Value	**Variant** (according to the specific parameter)	The new value that you want to write to that parameter.

Result Type **Byte**

Result Description The **Short Status** of the DataSeal.

Start Forced Burst

Method **Seal.StartForcedBurst**

Description Instructs the DataSeal to transmit a special Burst message according to the specified arguments.

Arguments:

Name	Type	Description
Mask	**HGTVerifyMaskEnum** enumeration	The set of parameters that you want the DataSeal to transmit in the **Forced Burst** messages. Use the 'Or' operator to combine more than one constant from the **HGTVerifyMaskEnum** enumeration.
Phase	**Long**	The interval in milliseconds since the DataSeal received the command and until it should start sending the **Forced Burst** messages.
Period	**Long**	The mean interval, in miliseconds, between retries (retransmits) of the **Forced Burst** messages.
RandomDiff	**Long**	The range, in miliseconds, of the random variance from the mean interval between retries of the **Forced Burst** messages.
Retries	**Byte**	The maximum number of retries that the DataSeal will send. Specify 0 for unlimited number of retries. Specify 255 to stop the DataSeal from sending further **Forced Burst** messages.
UserCode	**Byte**	A general purpose value that will be sent in the Forced Burst

		messages, that you may use to indicate the reason for the **Forced Burst** message.
StartAddress	**Integer**	The start address of the User Data that will be transmitted in the **Forced Burst** messages. The **HGTUserDataVerifyMask** value must be included in the **Mask** argument in order to send data.
Length	**Byte**	The length in bytes of the User Data that will be transmitted in the **Forced Burst** messages. The **HGTUserDataVerifyMask** value must be included in the **Mask** argument in order to send data.

Result Type Byte

Result Description The **Short Status** of the DataSeal.

Remarks

The DataSeal must be in Burst Mode in order to send the **Forced Burst** messages.

Set/Reset Status

Method **Seal.SetStatus**

Description Sets or clears specified flags in the DataSeal's **Long Status**.

Arguments:

Name	Type	Description
Mask	**HGTSealLongStatusBitEnum** enumeration	The mask of the flags that you want to set.
Value	**HGTSealLongStatusBitEnum** enumeration	The values of the flags that you want to set.

Result Type Byte

Result Description The **Short Status** of the DataSeal.

Remarks

Not all flags in the **Long Status** can be changed. See section 8.2.1- The DataSeal Status Flags for information about which flags can be changed using this command.

8.4.3 Multi Addressed Commands

8.4.3.1 Multi Addressed Commands With Parameters

Multi Addressed Verify

Method **Seals.Verify**

Description Verifies that the specific DataSeals are in the DataReader's Receiving Zone. It can also read selected parameters and/or User Data from those DataSeals.

Arguments:

Name	Type	Description
Mask	**HGTVerifyMaskEnum** enumeration	The set of parameters to request. Use the 'Or' operator to combine more than one constant from the HGTVerifyMaskEnum enumeration.
RFParameters	**RFParameters** class	Contains properties that controls low-level features of the command. See the Remarks of the **Verify** command for further information. The following properties are not applicable to

		the **Multi Addressed Verify**: **Na**, **Nt** and **Rt**.
StartAddress	**Integer**	The starting address of the User Data to request. This argument is relevant only if the HGTUserDataVerifyMask flag is included in the **Mask** argument.
Length	**Byte**	The length in bytes of the User Data to request. This argument is relevant only if the HGTUserDataVerifyMask flag is included in the **Mask** argument.

Result Type **Seals** class

Result Description The returned **Seals** object contains only the **Seal** objects of the DataSeals that responded.

The requested parameters are reflected through the **Seal** objects' properties.

Remarks

The maximal number of DataSeals that can be addressed using this command is 7. To address more than 7 DataSeals you can send this command multiple times, or use a Command Chain.

8.4.3.2 Multi Addressed Commands Without Parameters

All the Multi Addressed commands without parameters can apply up to 8 DataSeals. The result type is always a **Seals** object that contains only the DataSeals that have responded. For all the commands their **ShortStatus** property is updated according to their response, and for the **Set**, **Suspended Set** and **Soft Set** commands also the **LongStatus** and **SealStamp** properties are updated.

Note: All the 3 types of set are performed through DataSealLib using the **Seals.SealSet** method. You specify the type of **Set** through the **SetOptions** argument. See the online documentation for further information.

Set

Method **Seals.SealSet**

Description Prepares the DataSeal for a new use.

Remarks

When a DataSeal receives this command it performs the following actions:

1. Clearing the following Status flags: **Tampered**, **Low Battery Warning**, **Opened**, **Suspended Set** and **Sealing Wire Changed**.
2. Deleting all the Event records from the Events Memory.
3. Write a new **Set** Event record.
4. The **Last Set Reader** parameter is updated.

The **Set** command fails in the following situations:

- The DataSeal is in Deep Sleep mode.
- **Life Counter** is 0.
- The DataSeal's internal database is corrupted.
- The Low Battery Error flag is on.
- The Sealing Wire is open.

Suspended Set

Method **Seals.SealSet**

Description Prepares the DataSeal for a new use.

Remarks

When a DataSeal receives this command it performs the following actions:

If upon receiving the command the Sealing Wire is opened:

1. Turning on the **Suspended Set** flag in the Status is on
2. A **Suspended Set** Event is written.
3. After the Sealing Wire gets closed: the following Status flags are cleared: **Tampered**, **Low Battery Warning**, **Opened**, **Suspended Set**, **Sealing Wire Changed**, **Approved Open** and **Database Error**.
4. All the Event records are deleted from the Events Memory, except the **Suspended Set** Event, that becomes the first Event record.
5. The **Last Set Reader ID** parameter is updated.

If upon receiving the command the Sealing Wire is closed:

1. The following Status flags are cleared: **Tampered**, **Low Battery Warning**, **Opened**, **Suspended Set**, **Sealing Wire Changed**, **Approved Open** and **Database Error**.
2. All the Event records are deleted from the Events Memory.
3. A new **Suspended Set** Event is written.
4. The **Last Set Reader ID** parameter is updated.

The **Suspended Set** command fails in the following situations:

- The DataSeal is in Deep Sleep mode.
- **Life Counter** is 0.
- The DataSeal's internal database is corrupted.
- The **Low Battery Error** flag is on.

Soft Set

Method	**Seals.SealSet**
Description	Prepares the DataSeal for a new use without deleting existing Event records.

Remarks

When a DataSeal receives this command it performs the following actions:

1. Clearing the following Status flags: **Tampered**, **Low Battery Warning**, **Opened**, **Suspended Set** and **Sealing Wire Changed**.
2. Write a new **Soft Set** Event record.
3. The **Last Set Reader ID** parameter is updated.

The **Soft Set** command fails in the following situations:

- The DataSeal is in Deep Sleep mode.
- **Life Counter** is 0.
- The DataSeal's internal database is corrupted.
- The **Low Battery Error** flag is on.
- The Sealing Wire is open.

Reset Data

Method	**Seals.ResetDataBlock**
Description	Initializes all the User Data memory to 0's.

Deep Sleep

Method	**Seals.DeepSleep**
Description	Puts the specified DataSeals in Deep Sleep mode.

Remarks

When a DataSeal receives this command it performs the following actions:

1. The **Deep Sleep** flag in the DataSeal's Status is turned on.
2. A **Deep Sleep** Event is written.
3. If the **Alert Burst Mode** flag is on, an **Alert Burst** message sending

process begins.

If the **HF** flag in the **Application Flags** parameter is 1 and the Sealing Wire is closed, the command fails.

In Deep Sleep mode, built-in tests and Sealing Wire resistance checking are not performed. The DataSeal wakes up in **Tp** intervals to check for a **Hard Wakeup** command.

Hard Wakeup

Method **Seals.DeepSleep**

Description Wakes up DataSeals that are in Deep Sleep mode.

Remarks

When a DataSeal receives this command it performs the following actions:

1. The **Deep Sleep** flag is cleared.
2. The wakeup interval of the DataSeal returns to be **Tw** (instead of **Tp**). However, built-in tests and Sealing Wire resistance checking are not performed until the successful completion of the next **Set**, **Suspended Set**, or **Soft Set** command.

Start Alert Burst Mode, Stop Alert Bust Mode

Method **Seals.SetAsyncAlertBurstMode**

Description Starts or stops the specified DataSeals from being in Burst Mode.

Remarks

The method has a boolean argument called **BustMode** that determines whether to perform **Start Alert Burst Mode** command or a **Stop Alert Burst Mode** command.

When a DataSeal receives this command it sets (Start) or clears (Stop) the

Alert Burst Mode flag in the **Long Status**.

Acknowledge Alert Burst, Acknowledge Close Burst, Acknowledge Forced Burst

Method	**Seals.AckBurst**
Description	Tells the DataSeals that send the specified type of Burst message that their message has been received, and that they can stop sending more retries of it.

Remarks

The method has an argument called **AckBurstType** that determines the specific type of command to perform.

When a DataSeal receives this command it stops sending more retries of the same Burst message of the specified type, until a new Event of this kind occurs.

8.5 Burst Messages

Burst messages are messages that a DataSeal transmits to the listening DataReaders. Unlike the RF commands, the Burst messages are sent from the DataSeal not as a response to a command, but asynchronous to the DataReader's transmissions, as a result of some kind of event.

Be aware that Burst messages may interfere with normal RF commands transmissions because they are not synchronized with them. Proper system design should be made in order to prevent or overcome these cases.

There are 4 events that can cause Burst messages: Sealing Wire is opened, Sealing Wire is closed, The DataSeal is being put in Deep Sleep (either through HF or LF), and an event that is initiated by a special RF command

called **Start Forced Burst** (either LF or HF). Further details about each type of Burst message are given below.

Burst messages should be enabled in the DataSeal, by sending the **Start Alert Burst Mode** or **Start Alert Burst Mode for All Seals** command. In addition, in order for a DataReader to receive Burst message, a special flag called **Allow Burst** in the DataReader has to be on. When a DataReader receives a Burst message, if it's **Allow Burst** flag (**Reader.AllowBurst** property) is on and it is not currently executing another RF command, it stores the message inside its memory. The application software should check for Burst messages periodically in order to receive them, using the **Reader.GetBurstMessages** method. In addition, **Close Burst** messages have to be enabled in the DataSeal by setting the **Close Burst Mode** flag in the DataSeal's **Long Status**.

Burst messages can be sent more than once (for each causing event) in order to maximize the probability that a DataReader will receive the message. The exact number of retries is determined by the **Maximal Alert and Close Burst Retries** and **Maximal Deep Sleep Burst Retries** DataSeal parameters, and the intervals between them is determined by the **Alert and Close Burst Period** and the **Deep Sleep Burst Period**. For **Forced Burst** messages the number of retries an the interval is determined by the command arguments.

When a DataReader receives a Burst message, it can send an acknowledge back to the DataSeal, so the DataSeal can stop sending more retries of the same message. This helps to reduce the DataSeal's battery usage and make the RF environment less "noisy". There are 2 options to acknowledge Burst messages: automatic and manual.

The automatic acknowledge is sent by the receiving DataReader immediately when it receives the message. In order to use the automatic acknowledge, the **Automatic Acknowledge Burst** flag (**Reader.AutoAckBurst** property) in the DataReader should be on and also

the 2nd bit in the DataSeal's **Flags** parameter should be on. If the **Automatic Acknowledge Random Delay** flag (**Reader.AckBurstRandomDelay** property) in the DataReader is on too, the DataReader will randomly choose 1 of 4 windows in which it will send its acknowledge.

The advantages of the automatic Burst acknowledge are:

- The acknowledge is very short (about 50ms).
- The application doesn't have to take care of it.

The disadvantages of the automatic Burst acknowledge are:

- The acknowledge does not ensure that the application received the message.
- If the **Automatic Acknowledge Random Delay** flag is off, if more than one DataReader receives the message, and both will try to send an acknowledge, the RF transmissions of these acknowledges will collide.
- If **Automatic Acknowledge Random Delay** flag is on, for 2 DataReaders there's a chance of 25% for collision, for 3 DataReaders 35%, and for 4 DataReaders or more the probability rises to about 50% or more.

The manual acknowledge is a normal RF command initiated by the application. Note that DataSealLib sends this command by default when the application gets the Burst messages from a DataReader (using the **Reader.GetBurstMessages** method), but you have the opportunity to cancel it, and/or send it when most appropriate to you. See the online documentation for more information.

The advantages of the manual Burst acknowledge are:

- The application may send the acknowledge after it has written the message to a database. This ensures that no data will be lost even in case of application crash or DataReader's reset.
- The application can send only one acknowledge to every burst message even if many DataReaders received it or more than one retry was received.
- The application can choose the most appropriate timing for sending the acknowledge.

The disadvantages of the manual Burst acknowledge are:

- Because it is a normal RF command it takes the 3 seconds of the Reader Interrogation Header (**Thw).**
- It is not automatic. Nevertheless, DataSealLib sends it automatically by default.

Note that more than one DataReader may receive the same Burst message, and that each DataReader may receive more than one retry of the same burst message. It is the application's responsibility to correlate equal Burst messages.

There are 2 formats of Burst messages: one is older, an always included only the **Short Status** of the DataSeal. The new format can include any parameter and/or User Data. See the description of the **Alert Burst Data Descriptor**, **Close Burst Data Descriptor** and the arguments of the **Start Forced Burst** RF command for information about how to define which parameters and User Data will be included in each type of message. In addition, the new format includes a sequential number for each event that caused a Burst message. This way you can easily correlate messages that are received by different DataReader, or 2 retries of the same message. The **Forced Burst** messages also contain a special **User Code** argument that the user can use to define the purpose of the Burst message. In DataSealLib, you receive the Burst messages through the **Reader.BurstEx** event, and

you can know which parameters a Burst message includes by examining the **Seal.ResponseMask** property. See the online documentation for further details.

Below there's a summary of all the Burst messages:

Alert Burst

Constant in HGTBurstTypeEnum	**HGTAlertBurst** (77h) – old format. **HGTAlertBurstEx** (7Ah) – new format.
Constant of acknowledge type in HGTAckBurstTypeEnum	**HGTAckAlertBurst** (BBh)
Occurs when	Sealing Wire is opened or its resistance changes.

Remarks
Any of the **Set** commands also stops the Burst message from being retransmitted.

Deep Sleep Burst

Constant in HGTBurstTypeEnum	**HGTDeepSleepBurst** (77h) – old format (this is a synonym of the **HGTAlertBurst** constant). **HGTAlertBurstEx** (7Ah) – new format.
Constant of acknowledge type in HGTAckBurstTypeEnum	**HGTAckDeepSleepBurst** (BBh) (this is a synonym of the **HGTAckAlertBurst** constant).
Occurs when	The DataSeal completes a **Deep Sleep** RF command (either in LF or in HF).

Remarks

The RF message and the acknowledge are the same for **Alert Burst** and for **Deep Sleep Burst**. However, you can distinguish them using the flags in the **Short Status**.

Close Burst

Constant in HGTBurstTypeEnum	**HGTCloseBurst** (79h)
Constant of acknowledge type in HGTAckBurstTypeEnum	**HGTAckCloseBurst** (BDh)
Occurs when	Sealing Wire is closed.

Forced Burst

Constant in HGTBurstTypeEnum	**HGTForcedBurst** (78h)
Constant of acknowledge type in HGTAckBurstTypeEnum	**HGTForcedBurst** (BCh)
Occurs when	The DataSeal completes a **Start Forced Burst** RF command (either in LF or in HF), and the specified **Period** has passed.

8.6 DataReader Parameters

Like the DataSeal, the DataReader also has a set of configurable parameters that affect its operation. In DataSealLib most of these parameters are exposed as properties of the **Reader** class, and some are even used

internally by the library. You can use the **ReadParameter** and **WriteParameter** methods of the **Reader** class to read and write the parameters. As in the DataSeal, some parameters are Read-Only, and others are Read/Write. Below is a summary of the DataReader Parameters:

MCU Firmware Version

Property Name	(not supported).
Access	Read-Only.
Data Type	**String**.
Constant in HGTReaderParameterCodeEnum	**HGTReaderFirmwareVersion** (1)
Description	Returns the firmware version of the MCU (main) unit of the DataReader.

Reader ID

Property Name	**ReaderID** (Default property).
Access	Read-Only.
Data Type	**String.** The string contains a number between 0 and 2^{32}-1.
Constant in HGTReaderParameterCodeEnum	**HGTReaderID** (2)
Description	Returns the unique identification number of the DataReader.

Remarks

Hi-G-Tek assigns the Reader ID uniquely to each manufactured DataReader, DataPort, DataTerminal and MicroDataReader.

Reader Address

Property Name	**Address** (Hidden property).
Access	Read-Only.
Data Type	**Long**. Max value: 65535.
Constant in HGTReaderParameterCodeEnum	**HGTReaderAddress** (3)
Description	Returns the RS-485 address of the DataReader.

Remarks

Inside the DataReader this parameter is writable, but DataSealLib assigns and manages the **Address** parameter of all the connected DataReaders internally. Each DataReader that is connected to the same RS-485 chain must have a unique **Address**.

Warning: Even though changing this parameter using **WriteParamete**r is possible, the behavior of DataSealLib will be unpredictable.

OrgID

Property Name	(not supported).
Access	Read & Write.
Data Type	**Integer**
Constant in HGTReaderParameterCodeEnum	**HGTReaderOrgID** (4)
Description	The organization identifier of the DataReader.

Remarks

This parameter does not include the Department ID. See chapter 6 for more

information about the OrgID parameter.

Analog Values

Property Name	(not supported).
Access	Read-Only.
Data Type	Array of **Double**
Constant in HGTReaderParameterCodeEnum	**HGTReaderAnalogValues** (5)
Description	Returns the internal voltage values of the MCU unit, and each of the RF modem units. (currently only RF Modem #2 is available).

Remarks

The first element in the returned array is the MCU voltage, the 2nd is the RF Modem #1 (Extension Slot #1) voltage (this value is always 0). And the 3rd is the RF Modem #2 (Extension Slot #2) voltage.

Built-in Test Period

Property Name	(not supported).
Access	Read-Only.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	**HGTReaderBITPeriod** (6)
Value	60

Description	Returns the interval in minutes between automatic executions of the Built-in Test.

Minimal Threshold for MCU Voltage Checking

Property Name	(not supported).
Access	Read-Only.
Data Type	**Double**
Constant in HGTReaderParameterCodeEnum	**HGTReaderVccMin** (7)
Value	2.368

Maximal Threshold for MCU Voltage Checking

Property Name	(not supported).
Access	Read-Only.
Data Type	**Double**
Constant in HGTReaderParameterCodeEnum	**HGTReaderVccMax** (8)
Value	2.624

Minimal Threshold for RF Modem Voltage Checking

Property Name	(not supported).
Access	Read-Only.
Data Type	**Double**

Constant in HGTReaderParameterCodeEnum	**HGTReaderVRFMin** (9)
Value	2.368

Maximal Threshold for RF Modem Voltage Checking

Property Name	(not supported).
Access	Read-Only.
Data Type	**Double**
Constant in HGTReaderParameterCodeEnum	**HGTReaderVRFMax** (0Ah)
Value	2.624

Loader Firmware Version

Property Name	(not supported).
Access	Read-Only.
Data Type	**String**
Constant in HGTReaderParameterCodeEnum	**HGTReaderLoaderVersion** (0Bh)
Description	Returns the version number of the Loader software module of the DataReader.

Internal Version of MCU Firmware

Property Name	(not supported).

Access	Read-Only.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	(not supported) (0Ch).
Description	Returns the Build number of the MCU firmware.

Internal Version of Loader Firmware

Property Name	(not supported).
Access	Read-Only.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	(not supported) (0Dh).
Description	Returns the Build number of the Loader firmware.

Inputs

Property Name	**Inputs**
Access	Read-Only.
Data Type	**HGTReaderInputsEnum** enumeration.
Constant in HGTReaderParameterCodeEnum	(not supported) (0Eh).

Description	Returns the state of the 2 input ports (Isolated Input and External Interrupt Input) and the 6 configuration flags.

Remarks

You can also use the **Reader.IsolatedInput** and **Reader.ExternalInterruptInput** properties to read the values of the input ports.

Outputs

Property Name	**Outputs**
Access	Read & Write.
Data Type	**HGTReaderOutputsEnum** enumeration.
Constant in HGTReaderParameterCodeEnum	(not supported) (0Eh).
Description	Returns the last state or set the state of the 4 output ports (External LED output, Isolated Output #1, Isolated Output #2 and the Dry Contact Output).

Remarks

You can also use the **Reader.ExternalLEDOutput**, **Reader.IsolatedOutput1**, **Reader.IsolatedOutput2** and **Reader.DryContact** properties to write to the output ports.

Reader Reset Timeout

Property Name	(not supported).
Access	Read & Write.
Data Type	**Integer**
Constant in HGTReaderParameterCodeEnum	(not supported) (10h).
Description	Determines the maximal interval in seconds that the DataReader will wait for a command from the controlling computer before it will reset itself.

Remarks

If this parameter is not 0, then the DataReader will reset itself if it does not receive a command from the controlling computer in the duration specified by this parameter's value. This is like a "watchdog" for the RS-232/485 communication.

You should set this value to the biggest gap you expect between 2 commands that are addressed to that DataReader. If you set this parameter to 0, and there is a problem with the RS-232/485 communications you will have to reset the DataReader manually.

Chain NOP Interval

Property Name	**ChainNopInterval**
Access	Read & Write.
Data Type	**Long**. Max value: 65535.
Constant in HGTReaderParameterCodeEnum	(not supported) (11h).

Description	See the online documentation for further information about this parameter.

Remarks
This parameter is used with Command Chains. Command Chains are described in the next sections of this chapter.

Chain NOP Count

Property Name	**ChainNopCount**
Access	Read & Write.
Data Type	**Long**. Max value: 65535.
Constant in HGTReaderParameterCodeEnum	(not supported) (12h).
Description	See the online documentation for further information about this parameter.

Remarks
This parameter is used with Command Chains. Command Chains are described in the next sections of this chapter.

RF Modem Firmware Version

Property Name	(not supported).
Access	Read-Only.
Data Type	**String**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemFirmwareVersion** (40h).

Description	Returns the version of the firmware of the HF RF Modem of the DataReader.

ADI

Property Name	**ADI**
Access	Read & Write.
Data Type	**Long**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemADI** (41h)
Description	The default ADI value that will sent with each RF command that the DataReader transmits.

Remarks

When executing an RF command, if you specify and ADI that is not 0, the ADI you specified is used. If you specify 0 (or does not provide the optional argument), the value of this parameter is used.

See chapter 6 for further information about the ADI concept.

Department

Property Name	(not supported).
Access	Read & Write.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemDepartment** (42h)

Description	The Department ID of the DataReader.

Remarks

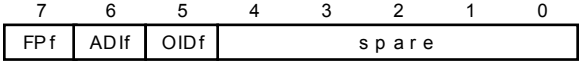
See chapter 6 for further information about the department and organization IDs concept.

SYS

Property Name	(not supported).
Access	Read & Write.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemSYS** (43h)
Description	This value is part of the End of Header of all RF commands.

Remarks

This value is a bit oriented value that is sent in all the HF RF commands. The format of this value is as follows:



where:

FPf Footprint Flag: if FPf=1, after successful completion of one of the **Verify** or **Tampered** commands, a **Footprint (Read)** Event will be written in the DataSeal.

ADIf ADI Flag: In an execution of a Command Chain, if ADIf=1 and the ADI in the DataSeal does not match the ADI in the command (and it isn't 0), the DataSeal stops listening to the Command Chain.

OIDf OrgID Flag: In an execution of a Command Chain, if OIDf=1 and the value of the OrgID and Department in the DataSeal does not

match the OrgID and Department in the command (and they're not 0), the DataSeal stops listening to the Command Chain.

Mode

Property Name	**Mode**
Access	Read & Write.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemMode** (44h)
Description	A bit oriented value that controls that controls the operation of the DataReader.

Remarks

DataSealLib also provides several Boolean or enumerated properties that reflect specific flags of this parameter:

CarrierSense – Determines whether the DataReader will make sure that the RF is clear before starting transmitting a command. Use this flag when there are DataReaders that are not connected to the same controlling computer to avoid RF collisions. In synchronized systems this flag should be off to ensure that the timings are deterministic.

AllowBurst – Determines whether the DataReader will listen for Burst messages while it is not executing another RF command. If this flag is on, you have to check for the Burst messages that the DataReader received using the **Reader.GetBurstMessages** method.

PowerCalibrationMode – Because temperature changes affect transmission power, it is required to perform a temperature test and power calibration process every once in a while. This property determines the terms in which the DataReader will perform those operations. See the online documentation for further information about the different options.

AutoAckBurst – Determines whether to send an acknowledge message automatically to every Burst message the DataReader receives. See section 8.5 above for further information about this flag.

AckBurstRandomDelay – Determines whether the DataReader will choose 1 of 4 windows for the automatic acknowledgment message. See section 8.5 above for further information about this flag.

Thw

Property Name	**Thw**
Access	Read & Write.
Data Type	**Long**. Max value: 65535.
Units	3.072msec.
Default Value	997 (3 seconds).
Constant in HGTReaderParameterCodeEnum	**HGTHFModemThw** (45h)
Description	The duration of the Reader Interrogation Header.

Remarks

See section 8.1.1 for further information about this parameter.

Thp

Property Name	**Thp**
Access	Read & Write.
Data Type	**Long**. Max value: 65535.
Units	3.072msec.

Default Value	3256 (10 seconds).
Constant in HGTReaderParameterCodeEnum	**HGTHFModemThp** (46h)
Description	The duration of the Reader Interrogation Header for a **Hard Wakeup** command.

Remarks
This parameter is the same as the **Thw** parameter, but for **Hard Wakeup** command.

RSSI

Property Name	(not supported).
Access	Read-Only.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemRSSI** (47h)
Description	The reception level of the last message that was received from a DataSeal.

Remarks
This value may give an approximate estimation about the distance of the DataSeal from the DataReader.

RF Transmission Power

Property Name	(not supported).
Access	Read & Write.

Data Type	**Byte**
Default Value	**65**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemTransmittionPower** (48h)
Description	The nominal value of the RF transmission power.

Remarks
Using this parameter you can control the DataReader's Receiving Zone.

Internal Version of RF Modem Firmware

Property Name	(not supported).
Access	Read-Only.
Data Type	**Byte**
Constant in HGTReaderParameterCodeEnum	**HGTHFModemFirmwareVersion** (48h)
Description	The Build number of the firmware version of the RF Modem.

8.7 Command Chain

As mentioned before, setting **Thw** and **Tw** to smaller numbers reduces the response times, but shortens the batteries' lifetime. Even though the default 3 seconds is mostly a reasonable response time, when you have to send many RF commands, it can accumulate to a lengthily time. The Command Chain feature allows to execute many RF commands in a row with a single Reader Interrogation Header (one **Thw**). The battery consumption of all the DataSeals that are in Normal Mode (not in Deep Sleep or HF Disabled), even those that are not addressed by any command in the Chain is exactly

the same as it would if these commands were executes normally one after the other, but now that consumption is at a shorter period. However, in times that there are no transmissions, the battery consumption is normal (unlike the result of using a small **Thw** and **Tw**).

Commands can also be added to the Command Chain on the go, when you want to perform a command as a result of the response or responses that you received in a previous command. For example, suppose that you want to perform a **Set** command to all the DataSeals that their **User Parameter 1** contains the string "READY". You can do it by initiating a Command Chain with only a broadcast **Verify** command that asks for the **User Parameter 1** parameter, and after receiving the results and examining the content of the **User Parameter 1** parameter, you add the **Set** command with the list of Seal ID's of those DataSeals that their **User Parameter 1** parameter contain the string "READY".

Note that all the DataSeals that receive the Reader Interrogation Header of a Command Chain keep listening to all the commands, which consumes battery as if these commands were executed one after the other. For DataSeals that there are no command for them it means a waste of battery. There are few things that you can do to avoid it:

1. Make sure that the DataSeals that should not receive the commands in the Chain are either in Deep Sleep, but usually more appropriate, their **HF Disabled** flag is on (for example by using the **Sleep Duration** argument of the **Verify** command).
2. If there are DataSeals with different OrgIDs or Departments, and you want to turn only to one of them, you should turn on the **OIDf** flag in the DataReader's **SYS** parameter.
3. If there are DataSeals with different **ADI**s, and want to turn only to a specific group, you should turn on the **ADIf** flag in the DataReader's **SYS** parameter.

For more information about Command Chains see the description of the **CommandChain** class in the online documentation.

Chapter 9

Troubleshooting and Problem Solving

9 Trouble Shooting and Problem Solving

9.1 General DataReader Problems

1. Power LED is red: The DataReader is malfunctioning. Replace the DataReader.
2. Power LED is off: Check the power connection.

9.2 RS-232/485 Communication Problems

3. DataReader does not respond to the controlling computer:
   - Verify that the Power LED blinks during power on. The LED should then remain steadily green.
   - Verify that the cables are connected according to the diagrams in chapter 5.
   - Verify that the Reader ID you specified is the same number as the S/N printed on the sticker on the back side of the DataReader (below the barcode).
   - Verify that a terminator exists at end of the RS-485 chain, as described in chapter 5.
   - Make sure that the specified COM port is the COM port that in fact the DataReader is connected to.

9.3 General RF Communication Problems

4. DataReader does not receive a specific DataSeal:
   - Verify that the DataSeal is within the DataReader's Receiving Zone. Check that the **RF Transmission Power** parameter is not too

low. Putting the DataSeal too close to the DataReader's antenna (few centimeters) may causes signal distortions.

- Verify that the antenna is connected properly.
- Verify that the SD/RD LED of Channel 2 is red for a about 3 seconds (with default **Thw**) upon receiving the command from the controlling computer, and then turns green for a short time.
- The DataSeal may be in Deep Sleep mode. Try to execute a **Hard Wakeup** command.
- Make sure that the **ADI** and **Department** parameters in the DataReader are either 0 or the same values that should be in the DataSeal.
- If you can communicate with the DataSeal using a Low Frequency device (DataTerminal or DataPort), make sure that the **ADI**, **OrgID** and **Department** parameters match those of the DataReader. Also make sure that **Tw** is appropriate for the **Thw** in the DataReader. See chapter 8 for information about **Thw** and **Tw**. Make sure that the **HF Disabled** flag is off too.
- The **Verify** parameters are invalid. See chapter 8 for information about the parameters of the Verify command.

9.4 Specific RF commands troubleshooting:

5. DataSeal does not respond to a **Tampered** command:
   - The DataSeal is not tampered. Check the DataSeal's **Tampered** flag.
6. DataSeal does not respond to a **HardWakeup** command:
   - The DataSeal may already be waked up (in Normal mode). Check the DataSeal's **Deep Sleep** flag.
7. **Set/Reset Status** command fails:

- On or more of the specified flags may be read-only.

8. **Write Parameters** command fails:
   - One or more of the specified parameters may be read-only.
   - The data type or the parameter size of one or more parameters are invalid.

Chapter 10

Technical Specifications

10 Technical Specifications

10.1 RS485 24V Outdoor DataReader

24V Outdoor DataReader	IG-RS-46D-916	IG-RS-46D-433	IG-RS-46D-318	IG-RS-46D-315
Physical Characteristics				
Dimensions	195x165x95mm, not including antenna			
Weight	1000gr			
Power requirements – External	Nominal - 24VDC Minimum – 10VDC Maximum – 35VDC			
Power Consumption	1.7W @Tx, 1.1W@Rx			
Performance Characteristics				
Interface	RS485 optically isolated			
Operating frequency [MHz]	916.5	433.92	318	315
Read Range	30m @ open space			
Environmental Conditions				
Operating Temperature	-40°C — 70°C			
Storage Temperature	-40°C — 70°C			
Humidity	90% Non condensing			
Mechanical Vibration	As per MIL-810D & SAE J1455			
Mechanical Shock	As per MIL-810D & SAE J1455			
Standards				
Designed according to	FCC part 15C UL1950	EN300220 EN301489 EN60950	UL1950	UL1950

10.2 RS232, 24V Outdoor DataReader

24V Outdoor DataReader	IG-RS-43D-916	IG-RS-43D-433	IG-RS-43D-318	IG-RS-43D-315
Physical Characteristics				
Dimensions	195x165x95mm, not including antenna			
Weight	1000gr			
Power requirements – External	Nominal - 24VDC Minimum – 10VDC Maximum – 35VDC			
Power Consumption	1.7W @Tx, 1.1W@Rx			
Performance Characteristics				
Interface	RS232			
Operating frequency [MHz]	916.5	433.92	318	315
Read Range	30m @ open space			
Environmental Conditions				
Operating Temperature	-40°C — 70°C			
Storage Temperature	-40°C — 70°C			
Humidity	90% Non condensing			
Mechanical Vibration	As per MIL-810D & SAE J1455			
Mechanical Shock	As per MIL-810D & SAE J1455			
Standards				
Designed according to	FCC part 15C UL1950	EN300220 EN301489 EN60950	UL1950	UL1950

10.3 Specific- 24V Outdoor DataReader

24V Outdoor DataReader	IG-RS-46D9-916	IG-RS-43D9-916
Physical Characteristics		
Dimensions	195x165x95mm, not induding antenna	
Weight	1000gr	
Power requirements – External	Nominal - 24VDC Minimum – 10VDC Maximum – 35VDC	
Power Consumption	1.7W @Tx, 1.1W@Rx	
Performance Characteristics		
Interface	RS485optically isolated	RS232
Operating frequency [MHz]	916.5	
Read Range	Antenna dependant	
Environmental Conditions		
Operating Temperature	-40°C — 70°C	
Storage Temperature	-40°C — 70°C	
Humidity	90% Non condensing	
Mechanical Vibration	As per MIL-810D & SAE J1455	
Mechanical Shock	As per MIL-810D & SAE J1455	
Standards		
Designed according to	FCC part 90, FCC part 15B UL1950	

10.4 12V Outdoor DataReader

12V Outdoor DataReader	IG-RS-26D-916	IG-RS-26D-433	IG-RS-26D-318	IG-RS-26D-315
Physical Characteristics				
Power requirements – External	Nominal - 12VDC Minimum – 10VDC Maximum – 35VDC			
Power Consumption	1.7W @Tx, 1.1W@Rx			

**** All other specifications are as in section 10.1.***

10.5 48V Outdoor DataReader

48V Outdoor DataReader	IG-RS-86D-916	IG-RS-86D-433	IG-RS-86D-318	IG-RS-86D-315
Physical Characteristics				
Power requirements – External	Nominal - 48VDC Minimum – 20VDC Maximum – 70VDC			
Power Consumption	1.7W @Tx, 1.1W@Rx			

All other specifications are as in section 10.1.

10.6 24V Indoor DataReader

24V Indoor DataReader	IG-RS-46-916	IG-RS-46-433	IG-RS-46-318	IG-RS-46-315
Physical Characteristics				
Dimensions	195x165x95mm, not including antenna			
Weight	1000gr			
Power requirements – External	Nominal - 24VDC Minimum – 10VDC Maximum – 35VDC			
Power Consumption	1.7W @Tx, 1.1W@Rx			
Performance Characteristics				
Interface	RS485 optically isolated			
Operating frequency [MHz]	916.5	433.92	318	315
Read Range	30m @ open space			
Environmental Conditions				
Operating Temperature	0°C — 70°C			
Storage Temperature	-20°C — 70°C			
Standards				
Designed according to	FCC part 15.249 UL1950	EN300220 EN301489 EN60950	UL1950	UL1950

10.7 12V Indoor DataReader

12V Indoor DataReader	IG-RS-26-916	IG-RS-26-433	IG-RS-26-318	IG-RS-26-315
Physical Characteristics				
Power requirements – External	Nominal - 12VDC Minimum – 10VDC Maximum – 35VDC			
Power Consumption	1.7W @Tx, 1.1W@Rx			

**** All other specifications are as in section 10.6.***

10.8 48V Indoor DataReader

48V Indoor DataReader	IG-RS-86-916	IG-RS-86-433	IG-RS-86-318	IG-RS-86-315
Physical Characteristics				
Power requirements – External	Nominal - 48VDC Minimum – 20VDC Maximum – 70VDC			
Power Consumption	1.7W @Tx, 1.1W@Rx			

**** All other specifications are as in section 10.6.***

10.9 DataSeal

DataSeal	IG-RS-40-916	IG-RS-40-433	IG-RS-40-318	IG-RS-40-315
Physical Characteristics				
Dimensions	49x37x35mm			
Weight	100gr			
Housing	Plastic reinforced with fiberglass			
Power	Internal 3.6V battery			
User Memory	2048 bytes			
Events Memory	55			
Performance Characteristics				
Interface	Mounting cradle p/n IG-DH-40			
Operating frequency [MHz]	916.5	433.92	318	315
Read Range	30m @ open space			
Operating frequency	125KHz			
Read Range	50cm			
Environmental Conditions				
Operating Temperature	-40°C — 70°C			
Storage Temperature	-40°C — 70°C			
Humidity	90% non condensing			
Mechanical Vibration	As per MIL-810D & SAE J1455			
Mechanical Shock	As per MIL-810D & SAE J1455			
Standards				
Designed according to	FCC part 15.249	EN300220 EN301489		
Antenna Characteristics				
Beam Divergence	Omni-directional on non-metal wall. Hemisphere on metal wall.			
Polarization	Vertical			

10.10 Magnetic DataSeal

Magnetic DataSeal	IG-RS-40M-916	IG-RS-40M-433	IG-RS-40M-318	IG-RS-40M-315
Physical Characteristics				
Dimensions	49x37x35mm			
Weight	100gr			
Housing	Plastic reinforced with fiberglass			
Power	Internal 3.6V battery			
User Memory	2048 bytes			
Events Memory	55			
Performance Characteristics				
Operating frequency [MHz]	916.5	433.92	318	315
Read Range	30m @ open space			
Operating frequency	125KHz			
Read Range	50cm			
Environmental Conditions				
Operating Temperature	-40°C — 70°C			
Storage Temperature	-40°C — 70°C			
Humidity	90% non condensing			
Mechanical Vibration	As per MIL-810D & SAE J1455			
Mechanical Shock	As per MIL-810D & SAE J1455			
Standards				
Designed according to	FCC part 15.249	EN300220 EN301489		
Antenna Characteristics				
Beam divergence	Omni-directional on non-metal wall. Hemisphere on metal wall.			
Polarization	Vertical			

10.11 FCC approved products:

Product	P/N	FCC ID
DataReader	IG-RS-46D-916	OB6-IGR46D916
DataSeal	IG-RS-40-916	OB6-IGRS40916
DataTag	IG-DT-40-916	OB6-IGDT40916
DataReader	IG-RS-46D9-916	OB6-IGRS46D9916
DataReader	IG-RS-43D9-916	OB6-IGRS46D9916

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications to this equipment not expressly approved by Hi-G-Tek Ltd. could void the user's authority to operate the equipment.

Warning:For unlicensed transmitters approved according to FCC part 15 subpart C, 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."

Index

11 INDEX

1

12v Indoor DataReader 242
12v Outdoor DataReader 241

2

24v Indoor DataReader 241
24v Outdoor DataReader 240

4

48v Indoor DataReader 243
48v Outdoor DataReader 241

A

Accelerate Verify (RF Command) 181
Accelerated Verify Mode (Status flag) 181, 197
Acknowledge Alert Burst (RF Command) 85, 123, 212
Acknowledge Close Burst (RF Command) 212
Acknowledge Forced Burst (RF Command) 212
Address (DataReader Parameter) 219
Addressed Commands 136, 197
Addressed Verify (RF Command) 32, 86, 95, 96, 98, 99, 100, 107, 139, 197
ADI 79, 80, 96, 189, 227, 228, 233
  DataReader Parameter 226, 237
  DataSeal Parameter 139
Alert and Close Burst Period (DataSeal Parameter) 140, 213
Alert Burst
  Burst Message 155, 179, 210, 216
  Mode 69, 70, 85, 120, 122, 194, 205, 211
Alert Burst Data Descriptor (DataSeal Parameter) 140, 215
Alert Burst Mode (Status flag) 178, 194, 210, 211
Alert Burst Period (DataSeal Parameter) 155
Analog Values (DataReader Parameter) 220

Application Flags (DataSeal Parameter) 141, 210
Approve Open (RF Command) 72, 86, 173, 188, 198
Approved Open
  Event 188, 199
  Status flag 72, 73, 86, 172, 173, 198, 208

B

Battery Voltage Value (DataSeal Parameter) 142, 154
Baud Rate 92
BIT Period (DataSeal Parameter) 143
BMM *See* Broadcast Commands
BMM List *See* Multi Addressed Commands
Broadcast Commands 136
Broadcast Verify (RF Command) *See* Verify (RF Command)
Buffer Full (Status flag) 179
Built-In Test 126
Built-in Test Period (DataReader Parameter) 220
Burst Messages 14, 148, 212
Burst Mode *See* Alert Burst Mode
Burst Mode (Status flag) *See* Alert Burst Mode (Status flag)
Burst Receiving Mode (DataReader) 70

C

Cables 60
Calibration Message Window 192
Carrier Sense 70, 75
Cellular Layout 75
Chain
  of Commands *See* Command Chain
  RS-485 53, 76
Chain NOP Count (DataReader Parameter) 226
Chain NOP Interval (DataReader Parameter) 225
Close Burst (Burst Message) 155, 178, 213, 217
Close Burst Data Descriptor (DataSeal Parameter) 143, 215
Close Burst Mode (Status flag) 178, 213
Closed (Event) 82
Command Chain 189, 190, 207, 225, 226, 228, 232, 233
Command Failed (Status flag) 177
CommandChain (DataSealLib Class) 233

D

Database Corrupted
  Status flag 172
Database Corrupted (Status flag) 175
Database Corrupted and Restored
  Event 185
  Status flag 174
Database Error
  Status flag 172, 174, 208
DataPort 12, 13, 14, 67, 182, 218, 237
DataReader 14
  Installation 44
DataSeal 12, 243
  Installation 36
DataSeal Evaluation Software *See* Evaluation Software
DataSealLib (COM DLL) 84, 102, 134, 182, 188, 189, 195, 207, 214, 215, 217, 219, 229
DataTag 12, 13, 22, 26, 28, 40, 41, 66
  Installation 40
  Placing on a Vehicle 40
DataTerminal 12, 13, 14, 66, 67, 68, 69, 70, 83, 182, 218, 237
Date & Time (DataSeal Parameter) 144, 149, 151, 156, 158, 186
Date & Time (Parameter) 186
Date & Time Updated (Event) 186
Deep Sleep
  Burst 145
  Burst Message 155
  Event 210
  Mode 26, 69, 73, 119, 166, 172, 188, 208, 209, 210, 211, 232, 233
  RF Command 85, 118, 142, 188, 210, 216
  Status flag 73, 171, 210, 211, 237
Deep Sleep Burst (Burst Message) 216
Deep Sleep Burst Period (DataSeal Parameter) 145, 156, 213
Deep Sleep Mode (Event) 188
Demo System 22
Department 78, 80, 96, 160, 176, 233
  DataReader Parameter 227, 237
  DataSeal Parameter 79, 80, 145
Distance Index (DataSeal Parameter) 146

E

Evaluation Software 23, 90
  Installation 90
Event Counter Value (DataSeal Parameter) 146
Events 31, 69
Events (DataSealLib Class) 200
Events Memory 69, 71, 81, 82, 85, 86, 124, 158, 159, 160, 180, 181, 183, 185, 199, 208, 243, 244
Extended Alert Burst (Burst Message) 179

F

Firmware Version (DataSeal Parameter) 147, 149
Flags (DataSeal Parameter) 148, 213
Footprint 69, 165, 166, 186, 228
Footprint (Event) *See* Read (Event)
Footprint Events Mode 69
Forced Burst 86, 204
Forced Burst (Burst Message) 204, 205, 213, 215, 217
Forced Burst (Burst Message) 204

G

General Error (Status flag) 73, 172
Global (DataSeal Parameter) 79, 80, 149
GPS 14
GSM 14

H

Hard Wakeup (RF Command) 26, 27, 28, 32, 69, 85, 119, 166, 188, 210, 211, 230, 231, 237
Hardware Error (Status flag) 172, 176
HF *See* High Frequency
HF Disabled (Status flag) *See* High Frequency Disabled
HGTSealParameterCodeEnum (DataSealLib Enumeration) 139, 201, 203
HGTVerifyMaskEnum (DataSealLib Enumeration) 139, 141, 144, 191, 197, 204, 206
High Frequency 13, 14, 134, 168
High Frequency Disabled (Status flag) 180, 199, 233, 237

I

Illegal OrgID (Status flag) 78, 172, 176
Indoor DataReader 19, 49, 59
Inputs (DataReader Parameter) 223
Internal Firmware Version (DataSeal Parameter) 150
Internal Version of Loader Firmware (DataReader Parameter) 223
Internal Version of MCU Firmware (DataReader Parameter) 222
Internal Version of RF Modem Firmware (DataReader Parameter) 232

L

Last Date & Time Update (DataSeal Parameter) 151
Last Set Reader ID (DataSeal Parameter) 151, 208, 209
LF*See* Low Frequency
Life Counter (DataSeal Parameter) 152, 173, 208, 209
Life Counter 0 (Status flag) 172, 173
Loader Firmware Version (DataReader Parameter) 222
Long Event 182
Long Events 126
Long Status (DataSeal Parameter) 72, 73, 78, 82, 86, 96, 98, 100, 109, 152, 164, 169, 172, 197, 205, 206, 211, 213
Low Battery Error (Status flag) 143, 153, 154, 172, 174, 184, 208, 209
Low Battery Error Threshold (DataSeal Parameter) 143, 153, 154, 174
Low Battery Warning
Event 183
Status flag 169, 208, 209
Low Battery Warning (Status flag) 72, 154
Low Battery Warning Threshold (DataSeal Parameter) 143, 154, 170, 184
Low Frequency 13

M

MagneticDataSeal 12, 13, 66, 244
Maximal Alert and Close Burst Retries (DataSeal Parameter) 155, 213
Maximal Deep Sleep Burst Retries (DataSeal Parameter) 155
Maximal Deep Sleep Burst Retries (DataSeal Parameters) 213
Maximal Difference in Time Update (DataSeal Parameter) 156, 158
Maximal Message Size (DataSeal Parameter) 157, 179
Maximal Number of Events (DataSeal Parameter) 159, 160, 164
Maximal Number Of Events (DataSeal Parameter) 157
Maximal Threshold for MCU Voltage Checking (DataReader Parameter) 221

Maximal Threshold for RF Modem Voltage Checking (DataReader Parameter) 222
MaxTimeDiffUpdate (DataSealLib Property) 156
MCU 62, 93, 127, 130, 218, 220, 223
MCU Firmware Version (DataReader Parameter) 218
MicroDataReader 12, 13, 14, 66, 68, 218
Minimal Interval between Time Updates (DataSeal Parameter) 156, 158
Minimal Threshold for MCU Voltage Checking (DataReader Parameter) 221
Minimal Threshold for RF Modem Voltage Checking (DataReader Parameter) 221
Mode
  DataReader Parameter 148
Mode (DataReader Parameter) 228
Mounting Fixture 15, 16, 36
Moxa Technologies 56
Multi Addressed Commands 136
Multi Addressed Verify (RF Command) 86, 136, 139, 206

N

New Battery
  Status flag 175
NOP (RF Command) 189
Normal Mode *See* Operation Mode
Number of Events (DataSeal Parameter) 149, 158, 160
Number of Events (DataSeal Paramter) 158
Number of Scroll Events (DataSeal Parameter) 159

O

Opened
  Event 82
  Status flag 31, 72, 109, 170, 173, 208, 209
Operation Mode 68
OrgID 78, 79, 80, 96, 149, 160, 176, 181, 228, 233
  DataReader Parameter 219, 237
OrgID & Department (DataSeal Parameter) 160
Outdoor DataReader 17, 44, 46, 59
Outputs (DataReader Parameter) 224

P

Parameters
  DataSeal 31, 138

Power LED 62, 236
Power Supply 58

R

Random Windows 192
Read (Event) 166, 186, 228
Read Data (RF Command) 82, 85, 110, 179, 200
Read Events (RF Command) 86, 124, 179, 199
Read Multi Access Data (RF Command) 82, 202
Read Parameters (RF Command) 86, 114, 138, 150, 179, 201
Reader (DataSealLib Class) 188, 217
Reader Address (DataReader Parameter) 218
Reader ID (DataReader Parameter) 218
Reader Interlace Window 192
Reader Interrogation Header 134, 135, 136, 215, 230, 232, 233
Reader Reset Timeout (DataReader Parameter) 224
Reader.AccelerateVerify (DataSealLib Method) 195
Reader.AckBurstRandomDelay (DataSealLib Property) 213, 229
Reader.Address (DataSealLib Property) 218
Reader.ADI (DataSealLib Property) 226
Reader.AllowBurst (DataSealLib Property) 213, 229
Reader.AutoAckBurst (DataSealLib Method) 213
Reader.AutoAckBurst (DataSealLib Property) 229
Reader.BurstEx (DataSealLib Event) 215
Reader.CarrierSense (DataSealLib Property) 229
Reader.ChainNopCount (DataSealLib Property) 226
Reader.ChainNopInterval (DataSealLib Property) 225
Reader.DryContact (DataSealLib Property) 224
Reader.ExternalInterruptInput (DataSealLib Property) 223
Reader.ExternalLEDOutput (DataSealLib Property) 224
Reader.GetBurstMessages (DataSealLib Method) 213, 214, 229
Reader.Inputs (DataSealLib Property) 223
Reader.IsolatedInput (DataSealLib Property) 223
Reader.IsolatedOutput1 (DataSealLib Property) 224
Reader.IsolatedOutput2 (DataSealLib Property) 224
Reader.Mode (DataSealLib Property) 228
Reader.NOP (DataSealLib Method) 189
Reader.Outputs (DataSealLib Property) 224
Reader.PowerCalibrationMode (DataSealLib Property) 229
Reader.ReaderID (DataSealLib Property) 218
Reader.ReadParameter (DataSealLib Method) 217

Reader.SetAsyncAlertBurstMode (DataSealLib Method) 194
Reader.Thp (DataSealLib Property) 230
Reader.Thw (DataSealLib Property) 230
Reader.Verify (DataSealLib Method) 139, 190
Reader.WriteParameter (DataSealLib Method) 217
Real Time Clock Error (Status flag) 172, 174
Real Time Clock Stopped (Event) 185
Receiving Zone 71, 76, 79, 86, 137, 190, 197, 206, 232, 236
Reset Data (RF Command) 86, 117, 210
RF Modem 62, 93, 127, 130, 131, 220, 226, 232
RF Modem Firmware Version (DataReader Parameter) 226
RF Transmission Power (DataReader Parameter) 231, 236
RFCommandObject (DataSealLib Class) 189
RFParameters (DataSealLib Class) 138, 146, 191, 192, 197, 206
RFParameters.DefaultsFor (DataSealLib Method) 138
RFParameters.Tcm (DataSealLib Property) 146
RS-232 14, 18, 46, 47, 49, 50, 51, 53, 56, 58, 67, 74, 77, 91, 134, 225, 236
  Wiring Diagram 47, 51
RS-232/RS-485 Adapter 56
RS-485 15, 46, 48, 49, 50, 52, 53, 54, 56, 58, 60, 74, 76, 91, 219, 236
  Full Duplex 46, 48, 50, 52
  Half Duplex 46, 48, 50, 53
RSSI
  DataSeal Parameter 160
RSSI (DataReader Parameter) 231
RTC Error (Status flag) 174
RTC Stopped (Event) *See* Real Time Clock Stopped (Event)

S

Scroll (Status flag) 82, 158, 179
Scrollable Portion 159, 180
SD/RD LED 62, 63, 237
Seal (DataSealLib Class) 153, 188, 191, 198, 207
Seal ID (DataSeal Parameter) 161
Seal Stamp (DataSeal Parameter) 100, 109, 149, 162, 163, 182
Seal.ADI (DataSealLib Property) 139
Seal.AlertBurstDataDescriptor (DataSealLib Property) 140
Seal.AlertBurstMode (DataSealLib Property) 178
Seal.AlertBurstPeriod (DataSealLib Method) 140
Seal.ApplicationFlags (DataSealLib Property) 141
Seal.ApprovedOpen (DataSealLib Property) 172

Seal.ApproveOpen (DataSealLib Method) 198
Seal.BatteryVoltageValue (DataSealLib Property) 142
Seal.BITPeriod (DataSealLib Property) 143
Seal.BufferFull (DataSealLib Property) 179
Seal.CloseBurstDataDescriptor (DataSealLib Property) 143
Seal.CloseBurstMode (DataSealLib Property) 178
Seal.CloseBurstPeriod (DataSealLib Method) 140
Seal.CommandFailed (DataSealLib Property) 177
Seal.DateTime (DataSealLib Property) 144
Seal.DBCorrupted (DataSealLib Property) 175
Seal.DBCorruptedAndRestored (DataSealLib Property) 174
Seal.DeepSleep (DataSealLib Property) 171
Seal.DeepSleepBurstPeriod (DataSealLib Property) 145
Seal.Department (DataSealLib Property) 145
Seal.DistanceIndex (DataSealLib Property) 146
Seal.EventCounterValue (DataSealLib Property) 146
Seal.EventsCount (DataSealLib Property) 158
Seal.FirmwareVersion (DataSealLib Property) 147
Seal.Flags (DataSeal Parameter) 148
Seal.FormatB (DataSealLib Property) 161
Seal.GeneralError (DataSealLib Property) 172
Seal.HardwareError (DataSealLib Property) 176
Seal.HFDisabled (DataSealLib Property) 180
Seal.IllegalOrgID (DataSealLib Property) 176
Seal.InternalFirmwareVersion (DataSealLib Property) 150
Seal.LastDateTimeUpdate (DataSealLib Property) 151
Seal.LastSetReader (DataSealLib Property) 151
Seal.LifeCounter (DataSealLib Property) 152
Seal.LifeCounterZero (DataSealLib Property) 173
Seal.LongStatus (DataSealLib Property) 152, 207
Seal.LowBatteryError (DataSealLib Property) 174
Seal.LowBatteryErrorThreshold (DataSealLib Property) 153
Seal.LowBatteryWarning (DataSealLib Property) 169
Seal.LowBatteryWarningThreshold (DataSealLib Property) 154
Seal.MaxAlertBurstRetries (DataSealLib Property) 155
Seal.MaxDeepSleepBurstRetries (DataSealLib Property) 155
Seal.MaxMessageSize (DataSealLib Property) 157
Seal.MaxNumberOfEvents (DataSealLib Property) 157
Seal.MinIntervalBetweenTimeUpdates (DataSeal Property) 158
Seal.NewBattery (DataSealLib Property) 175
Seal.NumberOfScrollEvents (DataSealLib Property) 159
Seal.Opened (DataSealLib Property) 170

Seal.OrgID (DataSealLib Property) 160
Seal.OrgIDBurst (DataSealLib Property) 181
Seal.ReadData (DataSealLib Method) 200
Seal.ReadEvent (DataSealLib Method) 199
Seal.ReadMultiAccessData (DataSealLib Method) 202
Seal.ReadParameter (DataSealLib Method) 139, 201
Seal.ReadParameters (DataSealLib Method) 139, 201
Seal.ResponseMask (DataSealLib Property) 215
Seal.RSSI (DataSealLib Property) 160
Seal.RTCError (DataSealLib Property) 174
Seal.SealID (DataSealLib Property) 161
Seal.SealStamp (DataSealLib Property) 162
Seal.SealWireChanged (DataSealLib Property) 171
Seal.SetStatus (DataSealLib Method) 153, 205
Seal.ShortStatus (DataSealLib Property) 163, 207
Seal.SleepDurationUnit (DataSealLib Property) 164
Seal.StartForcedBurst (DataSealLib Method) 203
Seal.SuspendedSet (DataSealLib Property) 170
Seal.Tampered (DataSealLib Property) 169
Seal.TempDisableHF (DataSealLib Method) 199
Seal.TimeFilterForReadEvent (DataSealLib Property) 165
Seal.Tp (DataSealLib Property) 166
Seal.Ts (DataSealLIb Property) 167
Seal.Tw (DataSealLib Property) 167
Seal.UnrecognizedCommand (DataSealLib Property) 177
Seal.UserData (DataSealLib Property) 149
Seal.UserDataSize (DataSealLib Property) 164
Seal.UserParameter1 (DataSealLib Property) 168
Seal.UserParameter2 (DataSealLib Property) 168
Seal.Verify (DataSealLib Method) 139, 197
Seal.WriteData (DataSealLib Method) 202
Seal.WriteParameter (DataSealLib Method) 139, 203
Seal.WriteParameters (DataSealLib Method) 139, 203
SealCodesAndValues (DataSealLib Class) 201, 203
SealEvent (DataSealLib Class) 182, 200
Sealing Wire 13, 17
Sealing Wire Changed
  Event 183
  Status flag 171
Sealing WireChanged (Status flag) 73, 208, 209
Sealing Wire Closed (Event) 184
Sealing Wire Opened (Event) 184

Seals (DataSealLib Class) 188, 191, 207
Seals.AckBurst (DataSealLib Method) 212
Seals.DeepSleep (DataSealLib Method) 210, 211
Seals.ResetDataBlock (DataSealLib Method) 210
Seals.SealSet (DataSealLib Method) 207, 208, 209
Seals.SetAsyncAlertBurstMode (DataSealLib Method) 211
Seals.Verify (DataSealLib Method) 139, 206
SealStamp (DataSealLib Property) 207
Send OrgID in Burst (Status flag) 181
Sensor Plate 13, 22, 28, 40
Set
  Event 82, 183
  RF Command 14, 32, 69, 71, 85, 95, 100, 108, 152, 162, 169, 171, 173, 183, 185, 188, 207, 208, 211, 216, 233
  Suspended (RF Command) *See* Suspended Set (RF Command)
Set Status (RF Command) 153
Set/Reset Status (RF Command) 86, 174, 175, 176, 177, 178, 179, 180, 181, 205, 237
Short Event 182
Short Events 126, 182
Short Status (DataSeal Parameter) 31, 72, 73, 96, 97, 98, 109, 149, 153, 163, 169, 172, 199, 203, 205, 215, 216
Size of User Data (DataSeal Parameter) 164
Sleep Duration Unit (DataSeal Parameter) 164, 192
Slotted Aloha 137
SmartDataReader 12, 14
Soft Set
  Event 209
  RF Command 209
Soft Set (Event) 184, 185
Soft Set (RF Command) 68, 85, 109, 185, 207, 209, 211
Start Alert Burst Mode (RF Command) 85, 120, 121, 122, 179, 187, 194, 195, 211, 213
Start Alert Burst Mode for All Seals (RF Command) 121, 179, 187, 194, 195, 213
Start Burst Mode
  Event 187
Start Forced Burst (RF Command) 86, 203, 212, 215, 217
Status
  DataSeal 72
Stop Alert Burst Mode (RF Command) 85, 122, 179, 187
Stop Alert Burst Mode for All Seals (RF Command) 122, 179, 187, 194, 195
Stop Alert Bust Mode (RF Command) 211
Stop Burst Mode
  Event 187

Suspended Set
Event 109, 186, 187, 208
RF Command 71, 85, 109, 171, 187, 207, 208, 211
Status flag 73, 109, 170, 208, 209
SYS (DataRead Parameter) 186, 228, 233
SYS (DataReader Parameter) 166

T

Tamper Windows 192
Tampered
Event 82, 85, 123, 199
RF Command 71, 84, 107, 139, 146, 148, 150, 165, 180, 186, 190, 197, 228, 237
Status flag 31, 72, 86, 107, 108, 109, 169, 170, 173, 208, 209, 237
Tb*See* Alert and Close Burst Period (DataSeal Parameter)
Temporarily Disable HF (RF Command) 86, 180, 192
Temporarily Disable High Frequency (RF Command) 199
Terminal Blocks 45
Thp (DataReader Parameter) 230
Thw (DataReader Parameter) 135, 136, 215, 230, 231, 232, 237
Time Filter for Read (Footprint) Events (DataSeal Parameter) 165
Time Slot Duration (DataSeal Parameter) 167
Tp (DataSeal Parameter) 166, 210, 211
Tracking DataReader 12, 14, 18, 73
Ts (DataSeal Parameter) 167
Tw (DataSeal Parameter) 68, 134, 135, 136, 165, 167, 195, 197, 211, 232, 237

U

Unrecognized Command (Status flag) 177
User Data 31, 81, 82, 83, 85, 86, 110, 112, 117, 141, 144, 150, 164, 190, 191, 197, 200, 202, 204, 206, 210, 215
User Parameter 1 (DataSeal Parameter) 168, 233
User Parameter 2 (DataSeal Parameter) 168

V

Verify
Addressed (RF Command) *See* Addressed Verify (RF Command)
Verify (RF Command) 29, 30, 32, 33, 68, 69, 71, 79, 80, 82, 84, 86, 87, 95, 96, 97, 98, 99, 105, 107, 137, 139, 144, 146, 148, 149, 150, 165, 166, 180, 186, 190, 191, 192, 195, 197, 206, 228, 233, 236, 237

W

Wakeup Time Interval (DataSeal Parameter) 167
Wakeup Time Interval in Deep Sleep Mode (DataSeal Parameter) 166
Write Data (RF Command) 82, 86, 112, 150, 202
Write Parameters (RF Command) 86, 115, 138, 150, 186, 203, 238

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