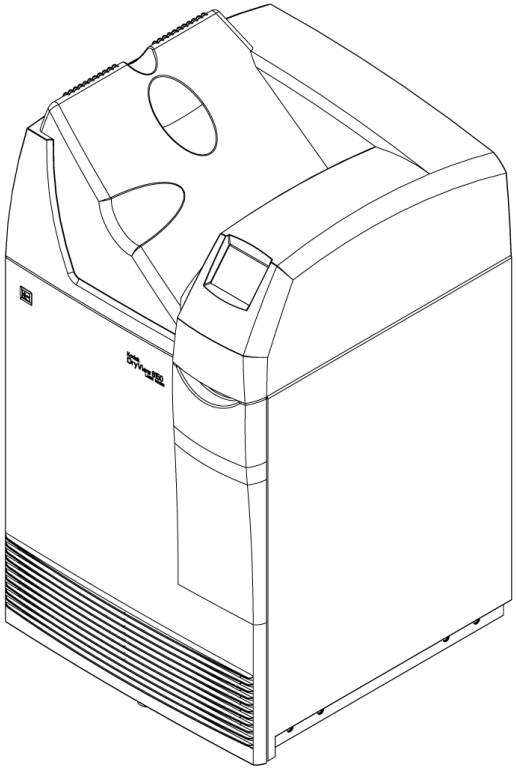
SAFETY MANUAL

See Pages 1-3 through 1-4 and 1-9 through 1-10
for compliance statements and modification warnings.

Kodak DryView
8150 Laser Imager



Safety Manual

Eastman Kodak Company
343 State Street
Rochester, NY 14650

7F3779

Catalog number 1415014
Rev. A

Table of Contents

1 Safety and Related Information

Safety, Warnings, and Cautions

Please read and understand all instructions before using the *Kodak DryView* 8150 Laser Imager.

RISK OF ELECTRIC SHOCK:
This equipment is operated with hazardous voltage which can shock, burn or cause death.

- Remove wall plug before servicing equipment. Never pull on cord to remove from outlet. Grasp plug and pull to disconnect. Only an **Authorized Service Provider of Kodak products** may perform service maintenance on this equipment.
- Do not operate equipment with a damaged power cord.
- Do not use an extension cord to power this equipment.
- Do not operate equipment with any of the safety interlocks overridden.
- Position the power cord so it will not be tripped over or pulled.
- Connect this equipment to a grounded wall outlet.
- Do not operate equipment with the covers open.

***WARNING*:**
This equipment contains moving parts that may be accessible to the user. Loose clothing, jewelry or long hair may cause personal injury or damage to the equipment.

***WARNING*:**
This equipment is not contained in a sealed cabinet. Do not use this equipment in locations where it can come in contact with liquids, including body fluids.

CAUTION:
This equipment is intended to connect to other medical devices. Only an Authorized Service Provider of Kodak products or Customer's Qualified Service Personnel may install this equipment.

CAUTION:
Only an Authorized Service Provider of Kodak products may perform service maintenance on this equipment.

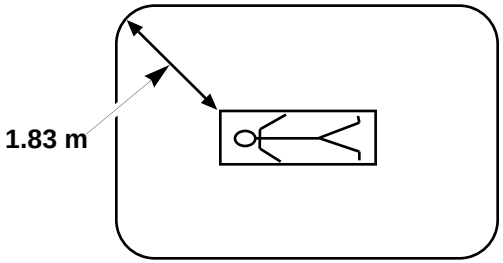
CAUTION:
Do not use a cell phone within 2 meters (6.56 feet) of this equipment even if you are separated by a wall from this equipment.

CAUTION:
Do not use a microwave oven within 4 meters (13.12 feet) of this equipment. Electromagnetic radiation from a microwave oven is only an issue if after the oven door is closed and latched, the seal does not maintain an electromagnetic tight fit between the oven door and oven main housing. Determining if the seal has an electromagnetic tight fit requires special detection equipment.

CAUTION:
Do not use in the presence of flammable anesthetics, oxygen, or nitrous oxide. This equipment does not have a gas-sealed electronics enclosure and could ignite any flammable or explosive gases present in its environment.

CAUTION:

This equipment should not be located within the patient environment. Therefore, do NOT locate this equipment closer than 1.83 meters (6 feet) from a patient bed or chair.



CAUTION:

This equipment should not be used in close contact with MRI devices, due to possible very high magnetic fields near an MRI unit. The magnetic field in the area where this equipment is installed must be less than 50 Gauss.

CAUTION:

Do not substitute or modify any part of this equipment without prior written approval of Eastman Kodak Company.

CAUTION:

(USA Only)
Federal law prohibits dispensing without a prescription.

CAUTION:

FCC (USA Only)
This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the

instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

CAUTION:
Do not use isopropyl alcohol to clean the exterior surfaces of this equipment because alcohol can dissolve the exterior paint on the equipment.

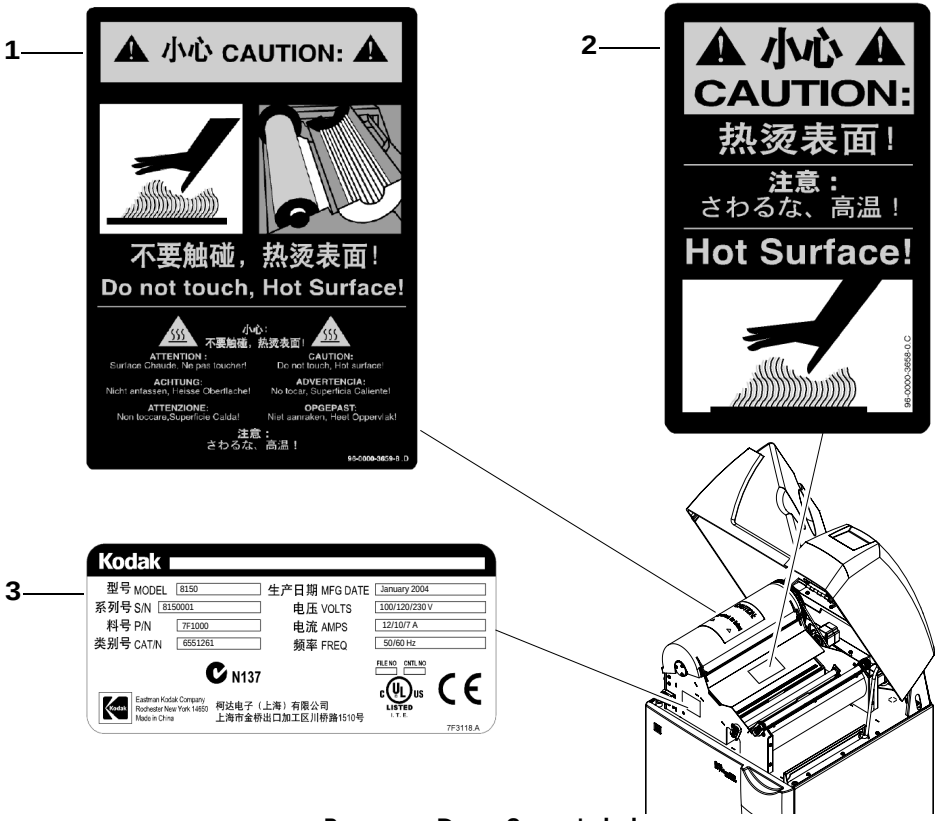
CAUTION:
Filters are considered to be non-hazardous waste according to the US Environmental Protection Agency Resource Conservation Recovery Act (RCRA). You may dispose of filters in a landfill or incinerator with energy recovery in a municipal, commercial or industrial facility. Contact your state or local government to determine if additional disposal requirements apply.

CAUTION:
This equipment contains lead and mercury. The lead is located in the solder on the circuit boards. Mercury is located in the back light of the local panel. Disposal of components containing these materials may be regulated due to environmental considerations. For disposal or recycling information at the end of usable service, please contact your local authorities or visit the Electronics Industry Alliance Web site at: http://www.eiae.org.

LASER WARNING:
The equipment uses a 50-milliwatt invisible laser. Laser radiation may be present behind this back panel. The back panel may only be removed by an Authorized Service Provider of Kodak products or Customer's Qualified Service Personnel. EXPOSURE TO LASER ENERGY MAY RESULT IN EYE DAMAGE.

Safety Labels

Safety labels are attached to this equipment in compliance with international standards.

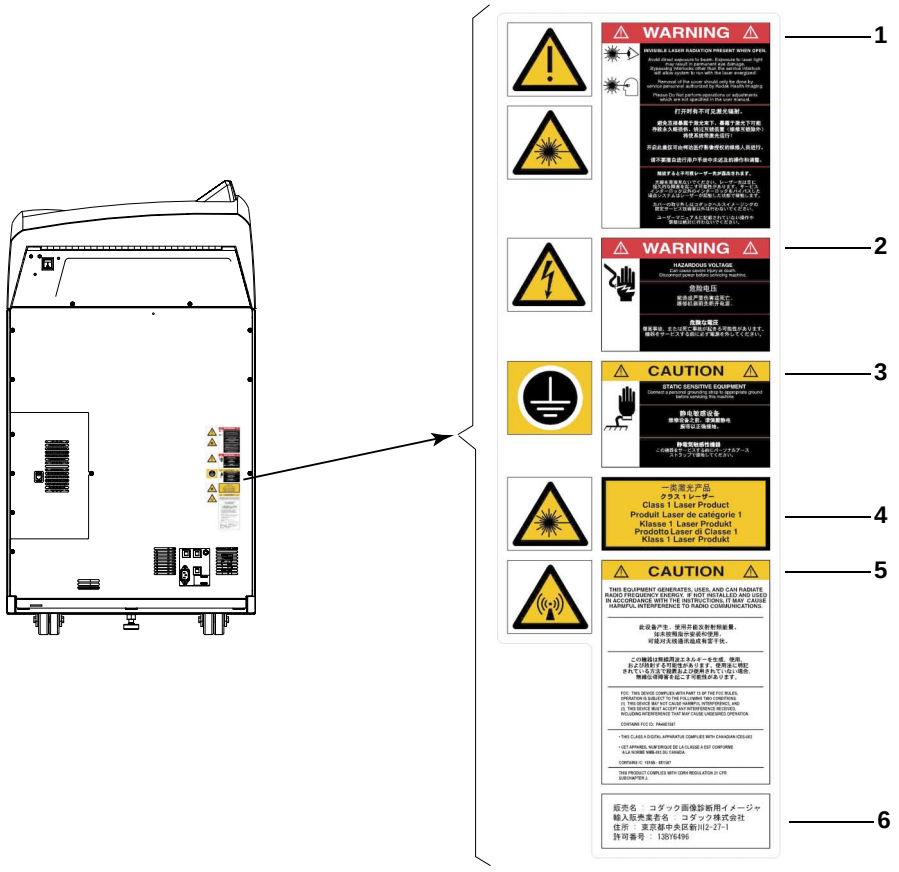


Processor Drum Cover Labels

1 Processor Drum Cover label - Warns operators to avoid hot surfaces when the processor drum cover is open.

2 Caution Hot Surface label - Warns operators to use care near the processor drum to avoid possible burns.

3 Serial Plate label - Shows the serial number and model number of this equipment along with several other important data items.



Rear Panel - Warning and Caution Labels

1 Invisible Laser Radiation Present When Open label - Warns operators that invisible laser radiation is present under the panel where the label is attached. Only an Authorized Service Provider of Kodak products or Customer's Qualified Service Personnel should attempt access.

2 Hazardous Voltage label - Warns operators that high voltage is present under panels where the label is attached. Only the an Authorized Service Provider of Kodak products or Customer's Qualified Service Personnel should attempt access.

3 Static Sensitive Equipment label - Identifies static-sensitive components. Connect a personal grounding strap to appropriate ground before servicing this equipment. Only an Authorized Service Provider of Kodak products may perform service maintenance on this equipment.

4 Class 1 Laser Product - Indicates that this equipment complies with IEC requirements for a Class 1 Laser Product.

5 Radio Frequency Energy - Indicates that this equipment can radiate radio frequency energy. If not installed and used in accordance with the instructions, this equipment may cause harmful interference to radio communications.

6 Japanese Import License - Not safety-related.

Safety and Health Compliance

This equipment has been tested for and complies with the following Safety and Emissions Standards. Certificates of Compliance and Declarations of Conformity have been issued as shown below.

Safety

United States

21 CFR 1040.10 Class I: FDA CDRH Code of Federal Regulations Title 21 Food and Drugs, Volume 8 - Food and Drugs, Part 1040 - Performance Standards for Light Emitting Products, Section 10 - Laser Products.

FDA 95-415 Premarket Notification 510(K): Regulatory Requirements For Medical Devices.

UL 60950-1: Safety of Information Technology Equipment. (3rd Edition)

UL 60601-1-1: Medical electrical equipment - Part 1: General requirements for safety - Section 1: Collateral standard: Safety requirements for medical electrical systems, Clause 19.

IEC 60825-1: Safety of laser products - Part 1: Equipment classification, requirements and user's guide.

Canada

C22.2 NO 60950-1 CAN/CSA, Safety of Information Technology Equipment, Including Electrical Business Equipment (Gen Instr 1) (UL 1950-95).

IEC 60825-1: Safety of Laser products - Part 1: Equipment classification, requirements and user's guide.

Europe

EN60950-1: Safety of Information Technology Equipment, Including Electrical Business Equipment (2000).

EN60601-1-1: Medical electrical equipment - Part 1: General requirements for safety - Section 1: Collateral standard: Safety requirements for medical electrical systems, Clause 19.

EN60825-1: Safety of laser products - Part 1: Equipment classification, requirements and user's guide.

Rest of World

IEC 60950-1: Safety of information technology equipment.

IEC 60601-1-1: Medical electrical equipment - Part 1: General requirements for safety - Section 1: Collateral standard: Safety requirements for medical electrical systems, Clause 19.

IEC 60825-1: Safety of laser products - Part 1: Equipment classification, requirements and user's guide.

EMC

United States

FCC Rules and Regulations, Title 47, Part 15, Subpart B, Class A: Radio Frequency Devices: Unintentional Radiators.

This equipment has been tested and been found to comply with the limits for a Class A digital device pursuant to part 15 of the FCC rules. Those limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Rules and Regulations, Title 47, Part 15, Subpart C, Radio Frequency Devices: Intentional Radiators. “FCC ID: PA481507E2537"

Canada

CAN/CSA-C108.6-M91, Class A: Limits and Methods of Measurement of Electromagnetic Disturbance Characteristics of Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment. (CISPR 11,Class A (EN55011)).

RSS-210, Issue 5:2001, Section 6.2.2(e): Low Power License-exempt Radio Communication Devices (All Frequency Bands), a Spectrum Management and Telecommunications Policy, Radio Standard Specification.

Intentional Radiation “IC: 1016B-8150”

This Class A digital apparatus complies with Canadian ICES-003.

CET APPAREIL NUM ENRIQUE DE CLASSE A EST CONFORME A LA NORME NMB–003 DU CANADA.

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Europe

European Telecommunication Standard (ETS) EN300 330: Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Short Range Devices (SRD); Technical Characteristics and Test Methods for Radio Equipment in the Frequency Range 9 kHz to 25 MHz and Inductive loop Systems in the Frequency Range 9 kHz to 30 MHz.

European Telecommunication Standard (ETS) EN300 489-3: Electromagnetic Compatibility and Radio Spectrum Matters (ERM) - Electromagnetic compatibility (EMC) standard for radio equipment and services - Part 3: specific conditions for short-range devices (SRD) operating on frequencies between 9 kHz and 40 GHz.

Rest of World

IEC 60601-1-2: Medical electrical equipment - Part 1-2: General requirements for safety - Collateral standard: Electrical compatibility - Requirements and tests.

Japan

VCCI V.3/2001.04: Agreement of Voluntary Control Council for Interference by Information Technology Equipment Technical Requirements.

Europe and the Rest of the World

Guidance and Manufacturer's Declaration for Electromagnetic Emissions		
The *Kodak DryView* 8150 Laser Imager is intended for use in the electromagnetic environment specified below. The customer or user of the *Kodak DryView* 8150 Laser Imager should assure that it is used in such an environment.		
Emissions Test	**Compliance**	**Electromagnetic Environment - Guidance**
RF emissions: • EN55011 • CISPR 11	Group 1	The *Kodak DryView* 8150 Laser Imager uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.
RF emissions: • EN55011 • CISPR 11	Class A	The *Kodak DryView* 8150 Laser Imager is suitable for use in all establishments other than domestic and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Harmonics emissions: • EN61000-3-2 • IEC 61000-3-2	Class A	The *Kodak DryView* 8150 Laser Imager is suitable for use everywhere, including those establishments directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.
Voltage fluctuations and flicker emissions: • EN61000-3-3 • IEC 61000-3-3	Complies	The *Kodak DryView* 8150 Laser Imager is suitable for use everywhere, including those establishments directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.

Guidance and Manufacturer's Declaration for Electromagnetic Immunity			
The *Kodak DryView* 8150 Laser Imager is intended for use in the electromagnetic environment specified below. The customer or user of the *Kodak DryView* 8150 Laser Imager should assure that it is used in such an environment.			
Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment - Guidance**
Electrostatic discharge (ESD): • EN61000-4-2 • IEC 61000-4-2	± 6 kV contact ±8 kV air	± 6 kV contact ± 8 kV air	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%.
Electrical fast transient/burst: • EN61000-4-4 • IEC 61000-4-4	± 2 kV for power supply lines ± 1 kV for input/output lines	± 2 kV for power supply lines ± 1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge: • EN61000-4-5 • IEC 61000-4-5	± 1 kV differential mode ± 2 kV common mode	± 1 kV differential mode ± 2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply lines: • EN61000-4-11 • IEC 61000-4-11	<5% U_τ* (>95% dip in U_τ*) for 0.5 cycle 40% U_τ* (60% dip in U_τ*) for 5 cycles 70% U_τ* (30% dip in U_τ*) for 25 cycles <5% U_τ* (>95% dip in U_τ*) for 5 sec.	<5% U_τ* (>95% dip in U_τ*) for 0.5 cycle 40% U_τ* (60% dip in U_τ*) for 5 cycles 70% U_τ* (30% dip in U_τ*) for 25 cycles <5% U_τ* (>95% dip in U_τ*) for 5 sec.	Mains power quality should be that of a typical commercial or hospital environment. If the user of the *Kodak DryView* 8150 Laser Imager requires continued operation during power mains interruptions, it is recommended that the *Kodak DryView* 8150 Laser Imager be powered from an uninterruptible power supply or a battery.
NOTE: * U_τ is the a.c. mains voltage prior to application of the test level.			
Power frequency (50/60 Hz) magnetic field: • EN61000-4-8 • IEC 61000-4-8	3 A/m	3 A/m	Mains power quality should be that of a typical commercial or hospital environment.

Guidance and Manufacturer's Declaration for Electromagnetic Immunity			
The *Kodak DryView* 8150 Laser Imager is intended for use in the electromagnetic environment specified below. The customer or user of the *Kodak DryView* 8150 Laser Imager should assure that it is used in such an environment.			
Immunity Test	**IEC 60601 Test Level**	**Compliance Level**	**Electromagnetic Environment - Guidance**
			Portable and mobile RF communications equipment should be used no closer to any part of the *Kodak DryView* 8150 Laser Imager, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. **Recommended Separation Distance:**
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 Vrms	$d = 1.17\sqrt{P}$
Radiated RF IEC 61000-4-3	3 v/m 80 MHz to 2.5 GHz	3 v/m	$d = 1.17\sqrt{P}$ 80 MHz to 800 MHz $d = 2.33\sqrt{P}$ 800 MHz to 2.5 GHz *d* is the recommended separation distance in meters (m). *P* is the maximum output rating of the transmitter in watts (W) according to the transmitter manufacturer. Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey [a], should be less than the compliance level in each frequency range [b]. Interference may occur in the vicinity of equipment marked with the following symbol: 
NOTE: • At 80 MHz and 800 MHz, the higher frequency range applies. • These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people. [a] See Note 1 on next page. [b] See Note 2 on next page.			

Guidance and Manufacturer's Declaration for Electromagnetic Immunity	
Note 1	Field strengths from fixed transmitters, such as base station for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the *Kodak DryView* 8150 Laser Imager is used exceeds the applicable RF compliance level on the previous page, the *Kodak DryView* 8150 Laser Imager should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting or relocating the *Kodak DryView* 8150 Laser Imager.
Note 2	Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 v/m.

Recommended separation distance between portable and mobile RF communications equipment and the *Kodak DryView* Model 8150 Laser Imager

The *Kodak DryView* 8150 Laser Imager is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the *Kodak DryView* 8150 Laser Imager can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communication equipment (transmitters) and the *Kodak DryView* 8150 Laser Imager as recommended below, according to the maximum output of the communications equipment.

Rated maximum output power of transmitter (*P*) in Watts (W)	**Separation distance (*d*) according to frequency of transmitter in meters (m)**		
	150 kHz to 80 MHz $d = 1.17\sqrt{P}$	80 MHz to 800 MHz $d = 1.17\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.33\sqrt{P}$
0.01			
0.1			
1			
10			
100			

For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.

NOTE 1: At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.

NOTE 2: These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.

EU Directives

93/42/EEC Title: Council Directive Concerning Medical Devices.

99/05/EEC Title: Council Directive Concerning Radio and Telecommunications Terminal Equipment.

73/23/EEC Title: Council Directive on the Harmonization of the Laws of Member States Relating to Electrical Equipment Designed for Use within Certain Voltage Limits.

89/336/EEC Title: Council Directive on the Approximation of the Laws of the Member States Relating to Electromagnetic Compatibility.

CE Marking

Documents concerning the conformance of this product to Council Directive 93/42/EEC of 14 June 1993 concerning Medical Devices can be obtained from the Eastman Kodak Company, Health Imaging Systems European Representative at:

Kodak GmbH
Product Safety
70323 Stuttgart
Germany
Phone: ++49 711 406 2993
Fax: ++49 711 406 3513

Note

The information contained herein is based on the experience and knowledge relating to the subject matter gained by Eastman Kodak Company prior to publication. No patent license is granted by this information. Eastman Kodak Company reserves the right to change this information without notice and makes no warranty, express or implied, with respect to this information. Kodak shall not be liable for any loss or damage, including consequential or special damages, resulting from the use of this information, even if loss or damage is caused by Kodak's negligence or other fault.

Eastman Kodak Company
343 State Street
Rochester, NY 14650

TI READER MODULE

TEXAS INSTRUMENTS

HF Reader System Series 6000

S6350 Midrange Reader Module
RI-STU-TRDC-02

Reference Guide

11-06-21-700 September 2002

TI-RFid
A TEXAS INSTRUMENTS TECHNOLOGY

Third Edition - September 2002

This is the third edition of this manual. It describes the following product:

S6350 Midrange Reader Module **RI-STU-TRDC-02**

Firmware Version 1.44

Major Changes: - Addition of Baud Rate Configuration Command
- Note to ISO Read Multiple Blocks Command

Read This First

About This Manual

This reference guide for the S6350 Midrange Reader Module is designed for use by TI customers who are engineers experienced with RFID Systems and Radio Frequency Identification Devices (RFID).

Regulatory, safety and warranty notices that must be followed are provided in Chapter 4.

Conventions

The following pictograms and designations are used in these operating instructions:

CAUTION:

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

Note:

Indicates conditions, which must be met, or procedures which must be followed, to ensure proper functioning.

If You Need Assistance

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

http://www.ti-rfid.com

Terms and Abbreviations

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

http://www.ti-rfid.com

Numerical Representations

Unless otherwise noted, numbers are represented as decimal.

Hexadecimal numbers are represented with the suffix $_{hex}$, e.g. $A5F1_{hex}$

Binary numbers are represented with the suffix $_2$, e.g. 1011_2

Byte representations: the least significant bit (lsb) is bit 0 and the most significant bit (msb) is bit 7.

Document Overview

Chapter 1

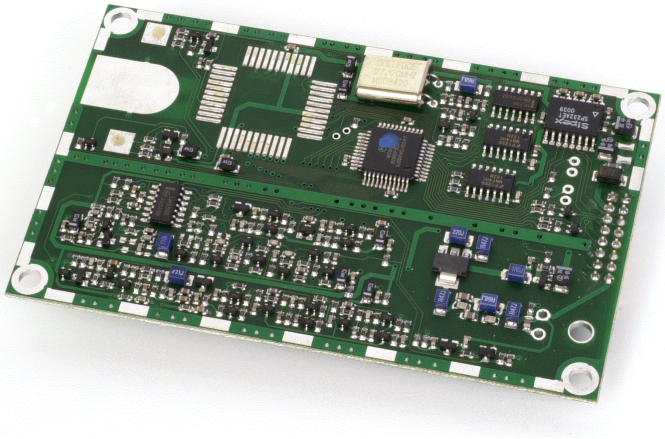
Introduction

Topic **Page**

1.1 Description

This document describes the features and operational characteristics of the S6350 Midrange Reader Module as shown in **Figure 1**. The S6350 Reader operates at a frequency of 13.56MHz and handles all RF and digital functionsin in order to communicate with Tag-it HF, Tag-it HF-I (ISO15693 compliant) and all other ISO15693 compliant transponders from various suppliers. This reference guide provides the details that are necessary to properly interface and use the reader as a part of an integrated system.

Figure 1: S6350 High Frequency Reader



1.2 Programming Interface

The S6350 Reader is designed to operate as a part of a host-based reader system, which essentially relegates the reader to be a slave to the host. Host-to-Reader serial communications are accomplished within data packets whereby communications from the host to the reader are known as requests, and replies from the reader to the host are known as responses. This communication occurs at RS-232 levels using 1 start bit, 8 data bits, 1 stop bit, no parity and the baud rate is configurable to 9600, 19200, 38400 and 57600baud. By definition, the host is always the primary station and initiates all communication sequences. These sequences consist of request/response pairs where the host waits for a response prior to continuing.

Chapter 2

Hardware Description

Topic **Page**

2.1 General Specification

This chapter describes the electrical and mechanical specifications of the S6350 Midrange Reader Module (RI-STU-TRDC-02). Operating at a frequency of 13.56 MHz, this low profile, low power device is designed to be easily integrated into many systems as an embedded device. All reader I/O is accomplished through the use of a 16-pin header connector (labeled as CN1), to include all communication, which is asynchronous RS232 as controlled by a host system.

2.1.1 Functional Requirements

The following parameters define the functional requirements and operational environment of the S6350 reader.

Parameter	Specifications
Operating temperature	-20°C to +70° C
Storage temperature	-40°C to +85°C
Mechanical shock	According to MIL STD-801E, Method 516.3 (5 Gs at 10 ms, half sinusoidal waves, 6 axes)
Vibration	According to MIL-STD-810E, Method 514.4 (15 Hz to 500 Hz, 1 g peak, 30 minutes sweep, logarithmic
Operating frequencies	13.56 MHz
Supported Transponder types	Tag-it HF Tag-it HF-I and all other ISO15693 compliant transponders

2.1.2 Power Supply

Input Voltage	5 ± 0.5 VDC
Average quiescent current	90mA
Average current during read (Dependent on read rate)	200mA (for Tag-it HF tags)
Maximum current during read	250mA

2.1.3 Output Power

Output Power	120mW into 50 Ohms (Typical)

2.1.4 RF Physical Layer

Reader to Transponder: 10% - 30% (nominally set at 20%) or 100% modulation (set by software) - **ASK**.

Data Coding Mode: **1 / 4 or 1 / 256**.

Transponder to Reader: **FSK** / Fast Data Rate.

2.1.5 Required Antenna Parameters

Impedance	50Ω ± 5Ω at 13.56 MHz
Loaded Q	10 < Q < 30

Note:

As no standard antenna is provided by Texas Instruments for the S6350 reader, the noted required antenna parameters must be closely followed by the integrator for the reader to operate properly.

2.1.6 Input / output pins (CN1 pins 3 and 4)

Pins 3 and 4 on CN1 may be configured by software commands to read a logic level input or to switch an external load to ground (no pull-up is provided). **See Figure 2.**

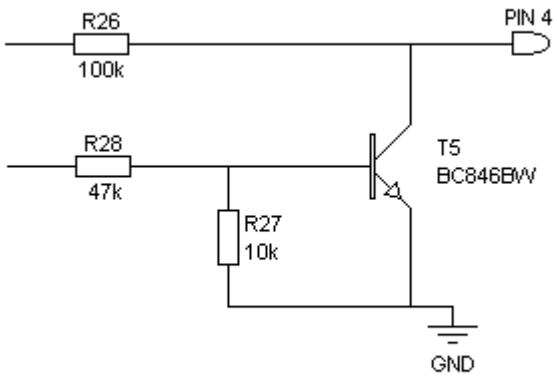


Figure 2: Example Circuit Diagram of an IO pin

When used as a switch to ground the following ratings should not be exceeded:

Maximum voltage **20V**
Maximum current **50mA**

CAUTION:

Exceeding this Voltage and Current limit could cause permanent damage to the reader.

Note:

That if an output has been set by a software command the state will always read back as a logic 0.

2.1.7 Baseband receiver

Minimum data pulse width	5µs
Maximum data pulse width	500µs
Typical settling time	50µs from the first transition

Note:

The receiver extracts the mean level of the incoming data stream as a reference. This takes approximately 50µs; therefore the data output of the receiver is not valid until after this time.

2.1.8 Connector Details

All reader input and output is provided through a 16-pin header connector that is mounted on the backside of the RI-STU-TRDC-02 reader. The details and orientation of each connector pin are provided in the following tables.

2.1.9 16-pin Header Connector CN1

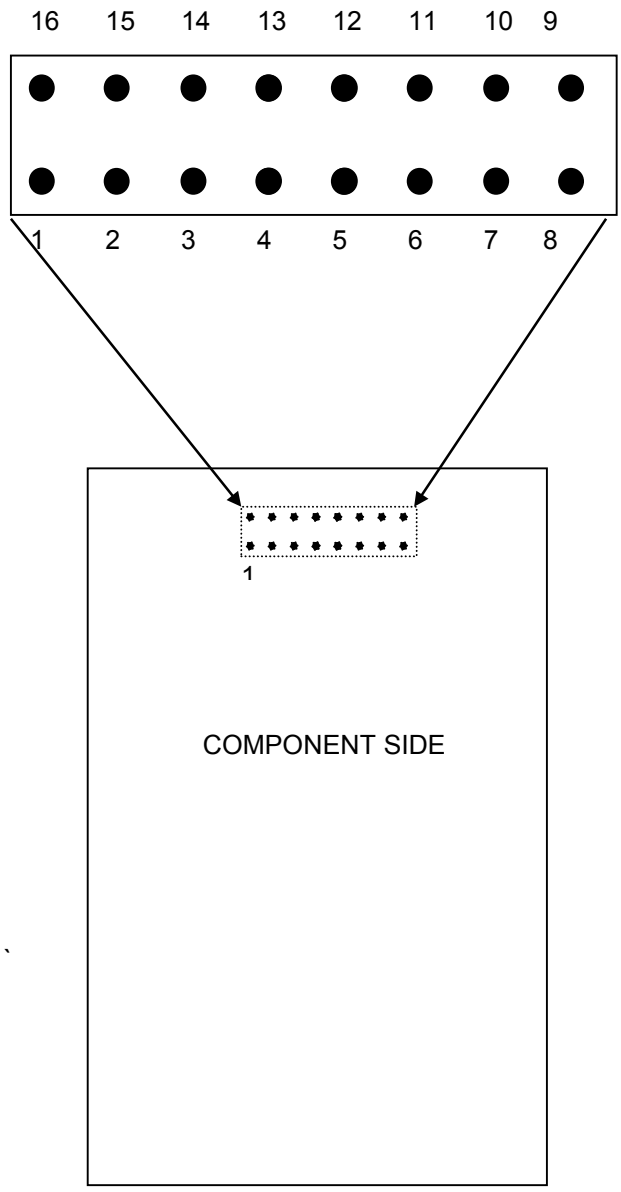
Pin	Function
1	0 Volts
2	+5 Volts
3	Open collector output / data input 2
4	Open collector output / data input 1
5	RS232 TxD (output from reader)
6	RS232 RxD (input to reader)
7	No connection (antenna guard)
8	Antenna screen
9	Antenna signal
10	No connection (antenna guard)
11	RS232 ground
12	No connection (reserved for future expansion)
13	No connection (reserved for future expansion)
14	No connection (reserved for future expansion)
15	No connection (reserved for future expansion)
16	No connection (reserved for future expansion)

CAUTION:

Only pins 8 and 9 of connector CN1 should be used for the antenna connection.

2.1.10 RI-STU-TRDC-02 (CN1) Pin Assignments

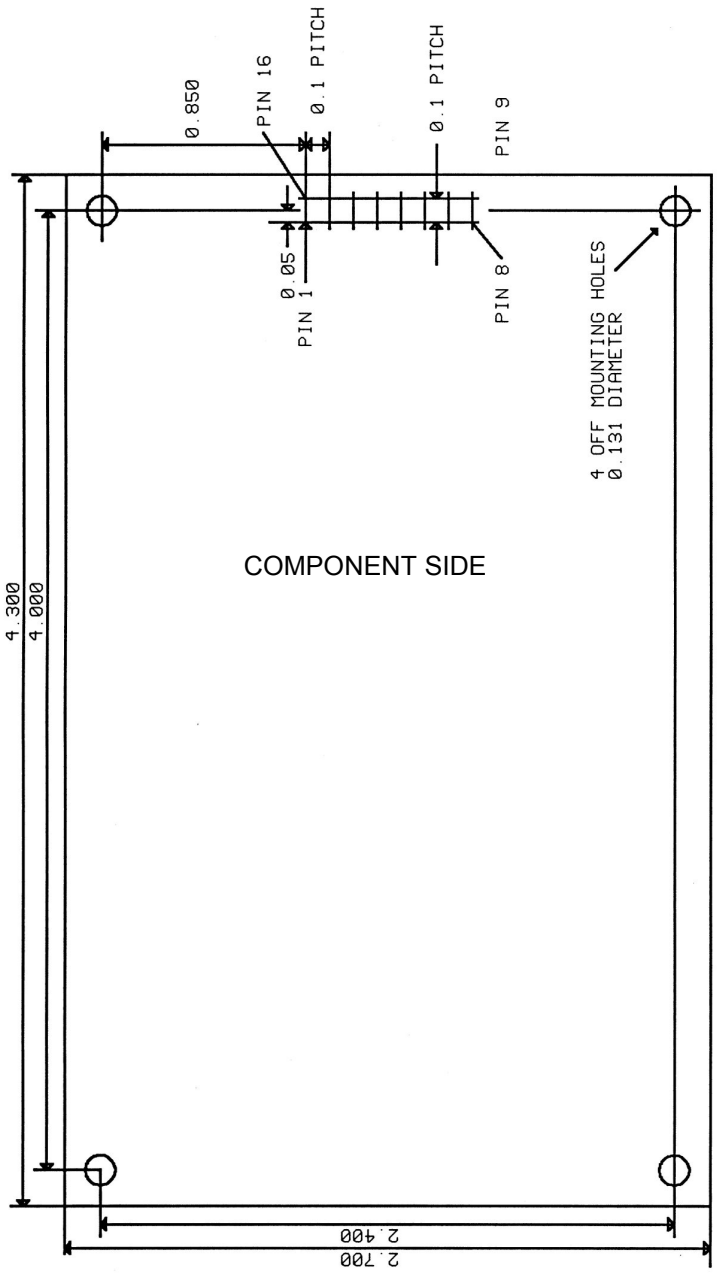
Figure 4: 16-pin Header Connector (CN1) viewed from component side.



2.2 Mechanical Specifications

2.2.1 RI-STU-TRDC-02 with 16-pin Straight Header Connector

Figure 6: Note: All dimensions are in inches



Chapter 3

Reader Protocol

Topic **Page**

3.1 Serial Protocol Definition

The S6350 Midrange Reader Module accepts and sends data at RS232 levels using 1 start bit, 8 data bits, 1 stop bit, no parity and the baud rate is configurable to 9600, 19200, 38400 and 57600baud. The data packet from the host to the reader is known as the request and the reply from the reader to the host as the response. The host is always the primary station and initiates all communication sequences. These consist of request/response pairs where the host waits for a response before continuing. The S6350 Midrange Reader Module does not use the node address.

3.1.1 Request Packet Format (Host to Reader)

Field Name	SOF
Field Size	1 byte
Field Value	01_{hex}
Purpose	Start of Frame

Field Name	Length
Field Size	2 byte LSB first
Field Value	Packet dependent
Purpose	Describes the length of the whole packet including SOF

Field Name	Node Address
Field Size	2 byte LSB first
Field Value	0000_{hex}
Purpose	Must be 0000_{hex} for upward compatibility

Field Name	Command flags
Field Size	1 byte
Field Value	Varies by command
Purpose	Specifies the action to be taken by the reader

Field Name	Command
Field Size	1 byte
Field Value	Varies by command
Purpose	Specifies the action to be taken by the reader

Field Name	Data
Field Size	0 to xx bytes
Field Value	Command dependent
Purpose	Contains the parameters and data for the command

Field Name	BCC
Field Size	2 bytes
Field Value	16 bit LRC of the preceding packet including the SOF
Purpose	Allows the reader to validate the correct reception of the request packet

3.1.2 Response Packet Format (Reader to Host)

Field Name	SOF
Field Size	1 byte
Field Value	01_{hex}
Purpose	Start of Frame

Field Name	Length
Field Size	2 byte LSB first
Field Value	Packet dependent
Purpose	Describes the length of the whole packet including SOF

Field Name	Node Address
Field Size	2 byte LSB first
Field Value	0000_{hex}
Purpose	always 0000_{hex}

Field Name	Command flags
Field Size	1 byte
Field Value	Varies by command
Purpose	Specifies the action just taken by the reader

Field Name	Command
Field Size	1 byte
Field Value	Varies by command
Purpose	Specifies the action just taken by the reader

Field Name	Data
Field Size	0 to 23 bytes
Field Value	Command dependent
Purpose	Contains the parameters and data for the command just processed

Field Name	BCC
Field Size	2 bytes
Field Value	16 bit LRC of the preceding packet including the SOF
Purpose	Allows the host to validate the correct reception of the response packet

3.1.3 Command Flags Request

The command flags in the request packet control the actions of the reader. The meanings of the bits are defined below.

Bits 0-3	Reserved for future use and should be set to ‘0’ for upward compatibility.
Bit 4	Is the address flag and if set, the command is only performed on transponders whose address matches the data section of the packet.
Bits 5-7	Reserved for future use and should be set to ‘0’ for upward compatibility.

3.1.4 Command Flags Response

The command flags in the response packet report the actions of the reader. The meanings of the bits are defined below.

Bits 0-3 Reserved for future use.

Bit 4 Error flag. If this flag is set the command was unsuccessful and the data section of the response packet contains the error code. (See section Appendix B for a list of error codes.)

Bits 5-7 Reserved for future use.

3.1.5 BCC

A Block Check Character (BCC) is used for error detection and is attached to the end of the packet. The 16 bit BCC is calculated on all the bytes of the packet including the SOF. The BCC consists of two parts: the LSbyte is a Longitudinal Redundancy Check (LRC) and the MSbyte is the ones compliment of the LRC. The LRC is calculated by performing a cumulative Exclusive-OR operation on all the bytes of the packet.

3.1.6 Example Request Packet

01_{hex}	SOF
$0A_{hex}$	LSbyte of length
00_{hex}	MSbyte of length
00_{hex}	LSbyte of node address
00_{hex}	MSbyte of node address
00_{hex}	Command flags (Not addressed)
02_{hex}	Command (Tag-it™ Read block)
01_{hex}	Data (Block number 1)
08_{hex}	LSbyte of Checksum
$F7_{hex}$	MSbyte of Checksum

3.2 Command Definitions

3.2.1 Tag-it HF Command Definitions

Command Function (Tag-it HF)	Command Code
Read Single Non-addressed & Addressed Block	**02_{hex}**
Write Single Non-addressed & Addressed Block	**03_{hex}**
Lock Single Non-addressed & Addressed Block	**04_{hex}**
Read Transponder Details	**05_{hex}**
Special Read Block Command	**$0F_{hex}$**

Read Block Command (02_{hex})

Reads a single block of data from a Tag-it HF transponder. If the address flag is set, the address forms the first part of the data section (LSbyte first), followed by a single byte containing the block number to be read. If the address flag is clear the data section only contains the block number.

Example
Read block 3 of a Tag-it HF transponder whose address is $0134A4D5_{hex}$
Request packet
01 0E 00 00 00 10 02 D5 A4 34 01 03 5A $A5_{hex}$

The response packet is similar to the request packet, with the data section containing the data received from the transponder (LSbyte first) followed by a single byte indicating the lock status and then another single byte containing the block address. The two LSB's of the lock status byte reflect the two lock bits in the transponder.

Example
Response packet
01 0F 00 00 00 00 02 33 22 11 00 00 03 0F $F0_{hex}$
00112233_{hex} read from unlocked block 3 of a Tag-it™ transponder.

Write Block Command (03_{hex})

Writes a single block of data to a Tag-it HF transponder. If the address flag is set, the address forms the first part of the data section, followed by a single byte containing the block number to be written. The data to be written follows the block number. If the address flag is clear the data section only contains the block byte and the data to be written.

Example
Write Block 4 of a Tag-it HF transponder whose address is $000134A4_{hex}$ with data 01234567_{hex}
Request packet
01 12 00 00 00 10 03 A4 34 01 00 04 67 45 23 01 95 $6A_{hex}$

The response packet is similar to the request packet; with the data section containing 00_{hex} for a successful write operation.

Example
Response packet
01 0A 00 00 00 00 03 00 08 $F7_{hex}$
Successful write.

Lock Block Command (04_{hex})

Locks a single block of data in a Tag-it HF transponder. If the address flag is set, the address forms the first part of the data section, followed by a single byte containing the number of the block to lock.

Example
Lock Block 4 of a Tag-it HF transponder whose address is $000134A4_{hex}$
Request packet
01 0E 00 00 00 10 04 A4 34 01 00 04 8E 71_{hex}

The response packet is similar to the request packet, with the data section containing 00_{hex} for a successful lock operation.

Example
Response packet
01 0A 00 00 00 00 04 00 0F $F0_{hex}$
Successful lock.

Read Transponder Details Command (05_{hex})

Reads the details of a Tag-it HF transponder. If the address flag is set, the address forms the data section.

Example
Read the details of a Tag-it HF transponder non-address
Request packet
01 09 00 00 00 00 05 0D $F2_{hex}$

The response packet is similar to the request packet, with the data section containing the transponder address (4 bytes), manufacturers code (1 byte), transponder version number (2 bytes), the number of blocks (1 byte) and the number of bytes per block (1byte).

Example
Response packet
01 12 00 00 00 00 05 A4 34 01 00 01 05 00 08 04 8F 70_{hex}

Transponder ID	$000134A4_{hex}$
Manufacturers Number	01_{hex}
Version Number	0005_{hex}
Number of blocks	08_{hex}
Number of bytes per block	04_{hex}

Special Read Block Command ($0F_{hex}$)

Reads blocks of data from a Tag-it HF transponder. The address flag should not be used. The data section contains a single byte detailing the blocks to be read. Each bit of this byte represents a block of data (bit 0 = block 0 etc) if a bit is set then that block is read. If the data byte is zero then only the SID is returned. The SID is always retrieved first and then used to read the selected blocks in addressed mode.

Example
Read blocks 0, 3 & 4 of a Tag-it HF transponder (data byte = 00011001_{bin} = 19_{hex})
Request packet
01 0A 00 00 00 00 0F 19 1D $E2_{hex}$

The data section of the response packet contains:

The SID address (LSbyte first),
Block 0 data (if selected) followed by a single byte indicating the lock status and then another single byte containing the block address,
Block 1 data (if selected) followed by a single byte indicating the lock status and then another single byte containing the block address,
Block 7 data (if selected) followed by a single byte indicating the lock status and then another single byte containing the block address,
(The two LSB's of the lock status bytes reflect the blocks two lock bits in the transponder.)

Example
Response packet
01 1F 00 00 00 00 0F 23 4F 10 00 EF CD AB 89 00 00 33 22 11 00 00 03
67 45 23 01 00 04 6A 95_{hex}

$00104F23_{hex}$ SID
$89ABCDEF_{hex}$ read from unlocked block 0 of a Tag-it HF transponder.
00112233_{hex} read from unlocked block 3 of a Tag-it HF transponder.
01234567_{hex} read from unlocked block 4 of a Tag-it HF transponder.

3.2.2 Miscellaneous Commands

Command Function	Command Code
Initiate FLASH Loader Command	**$D0_{hex}$**
Send Data to FLASH Command	**$D8_{hex}$**
Reader Version Command	**$F0_{hex}$**
Read Inputs Command	**$F1_{hex}$**
Write Reader Outputs Command	**$F2_{hex}$**
RF Carrier on/off Command	**$F4_{hex}$**
Baud Rate Configuration Command	**FF_{hex}**

Initiate FLASH Loader Command ($D0_{hex}$)

This command is used to initialize and transfer control to the FLASH loader software.

Example
Request packet
01 09 00 00 00 00 D0 D8 27_{hex}

The response packet is similar to the request packet with the data section containing '00' if successful.

Example
Response packet
01 0A 00 00 00 00 D0 00 DB 24_{hex}

FLASH loader initialised and control transferred.

Send Data to FLASH Command ($D8_{hex}$)

This command is used to load data into the FLASH memory.

Example
Request packet
01 8D 00 00 00 00 D8 <132 bytes of data> <2 byte checksum>$_{hex}$
The Data section must always contain 132 bytes

The response packet data section contains '00' if successful.

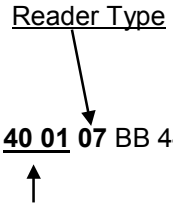
Example
Response packet
01 0A 00 00 00 00 D8 00 D3 $2C_{hex}$
The section of FLASH memory was programmed correctly.

Reader Version Command ($F0_{hex}$)

Requests the version number of the reader. The flags are ignored for this command.

Example
Get the version number of the reader.
Request packet
01 09 00 00 00 00 F0 F8 07_{hex}

The response packet is similar to the request packet with the data section containing the 2 byte version number LSB first followed by a single byte representing the reader type.



Example
Response packet
01 0C 00 00 00 00 F0 **40 01 07** BB 44_{hex}

The version number is 1.4

The reader type response can be defined as follows:

Type 07 = Indicates that the reader has been successfully loaded with the noted application firmware version number (in this example, version 1.4).

Type 00 = Indicates that the reader has not been loaded with application firmware, but does have the boot-loader firmware in place with which to download the appropriate application firmware. (Please refer to **Appendix A: Downloading Data to FLASH Memory**)

Reader inputs Command ($F1_{hex}$)

Reads the state of the reader inputs. The flags are ignored for this command.

Example
Get the status of the reader inputs.
Request packet
01 09 00 00 00 00 F1 F9 06_{hex}

The response packet is similar to the request packet with the data section containing a byte representing the state of the inputs. Bit 0 of this byte represents input 1 and bit 1 represents input 2 all other bits are reserved.

Example
Response packet
01 0A 00 00 00 00 F1 01 FB 04_{hex}
Input 1 is at Logic 1
Input 2 is at Logic 0

Write reader outputs Command ($F2_{hex}$)

Writes the state of the reader outputs. The flags are ignored for this command. The data section contains 1 byte with bits defined as follows:

Bit 0	1 = Output 1 switched on (output is pulled to ground)
Bit 1	1 = Output 2 switched on (output is pulled to ground)
Bit 2	Reserved
Bit 3	Reserved
Bit 4	1 = Bit 0 enabled (output 1 is controlled)
Bit 5	1 = Bit 1 enabled (output 2 is controlled)
Bit 6	Reserved
Bit 7	Reserved

Example
Switch output 2 on without affecting output 1.
Request packet
01 0A 00 00 00 00 F2 22 DB 24_{hex}
The response packet is similar to the request packet with the data section containing '00_{hex}' for a successful write operation.

Example
Response packet
01 0A 00 00 00 00 F2 00 F9 06_{hex}
Write successful.

RF Carrier on/off Command ($F4_{hex}$)

Switches the RF carrier on or off. The data section contains one byte FF_{hex} to turn the carrier on or 00_{hex} to turn the carrier off.

Example
Switch the carrier on.
Request packet
01 0A 00 00 00 00 F4 FF 00 FF_{hex}

The response packet is similar to the request packet with the data section containing '00_{hex}' for a successful operation.

Example
Response packet
01 0A 00 00 00 00 F4 00 FF 00_{hex}
Command successful.

Baud Rate Configuration Command (FF $_{hex}$)

This command is used to change the baud rate of the reader.

Data Byte (1byte) = Baud rate code

09 = 57600 baud (default)
08 = 38400 baud
07 = 19200 baud
06 = 9600 baud

Example

Set Baud rate to 57600baud.
Request packet
01 0A 00 00 00 00 FF 09 FD 02_{hex}

Set Baud rate to 38400baud.
Request packet
01 0A 00 00 00 00 FF 08 FC 03_{hex}

Set Baud rate to 19200baud.
Request packet
01 0A 00 00 00 00 FF 07 F3 $0C_{hex}$

Set Baud rate to 9600baud.
Request packet
01 0A 00 00 00 00 FF 06 F2 $0D_{hex}$

The response packet is similar to the request packet with the data section containing '00_{hex}' for a successful operation.

Example
Response packet
01 0A 00 00 00 00 FF 00 F4 $0B_{hex}$
Command successful.

Note:

Changing this parameter only becomes effective after a power-on reset of the reader.

3.2.3 ISO/IEC 15693 Part 3 Transmission Protocol

In addition to supporting the Tag-it HF transponder protocol outlined within the preceding section, the S6350 Midrange Reader Module complies with the standard RF interface and transmission protocol of ISO/IEC 15693-2, -3. Please note that each of the ISO protocol command and response packets outlined within the following sections are contained within the standard reader protocol as outlined within Section 3.1.
The ISO 15693-3 commands that are specifically applicable to the S6350 Reader are defined within the following table.

3.2.3.1 ISO/IEC 15693-3 Command Codes

Command Function	Command Code
Inventory (Mandatory Command)	**01_{hex}**
Stay Quiet (Mandatory Command)	**02_{hex}**
Read Single Block	**20_{hex}**
Write Single Block*	**21_{hex}**
Lock Block*	**22_{hex}**
Read Multiple Blocks	**23_{hex}**
Write AFI*	**27_{hex}**
Lock AFI*	**28_{hex}**
Write DSFID*	**29_{hex}**
Lock DSFID*	**$2A_{hex}$**
Get Multiple Block Security Status	**$2C_{hex}$**

Note:

* **Bit 7** of the ISO 15693 protocol **Option_Flag** must be set to **1** for all **Write** and **Lock** commands to respond properly.

3.2.3.2 Request/Response Packet Format for ISO/IEC 15693-3

The data packet from the host to the reader is known as the request and the reply from the reader to the host as the response. The host is always the primary station and initiates all communication sequences. These consist of request/response pairs where the host waits for a response before continuing. All ISO/IEC 15693-3 command request packets are contained within the standard reader command request packet format. In all cases, reader command 60_{hex} is used to pass through ISO 15693 Part 3 commands to the reader.

Note:

The Reader's RF Physical Layer is defined as:

Reader to Transponder: 10% - 30% (nominally set at 20%) or 100% modulation (set by software) - **ASK**. Data Coding Mode: **1 / 4 or 1 / 256**

Transponder to Reader: FSK / Fast Data Rate.

The Configuration Byte (ISO Command Data Byte 0)

As detailed in ISO/IEC 15693-2, the Configuration Byte (ISO Command Data Byte 0) is an 8-bit byte that is used to configure the Data Coding Mode and Modulation Depth of the reader.

Modulation Depth

Bit 4 of the Configuration Byte is used to set Modulation Depth. When set high the reader is configured for 100% Modulation Depth, when set low the reader will operate at 10% to 30% (with a 20% nominal setting) Modulation Depth.

Data Coding Mode

Bit 0 of the Configuration Byte is used to set the Data Coding Mode. When set high the reader is configured for Data Coding Mode 1 / 4; when set low the reader is configured for Data Coding Mode 1 / 256.

Request Packet Format for ISO/IEC 15693-3

The request packet consists of the header, packet length, node address, command flags, reader command (60_{hex}), ISO/IEC 15693-3 command/data bytes **0** to some number **"n"** (where byte 0 is the configuration byte) and the checksum.

ISO 15693 Command Data Request Structure

The structure of the ISO 15693 Command Data Request is contained within the Data section of the ISO Command Data, bytes 1 - n. Specific to the S6350 Midrange Reader Module, the ISO 15693 SOF, CRC16 and EOF fields must not be included in the message data packet. Please refer to ISO/IEC 15693-3 for details about the ISO packet format. Specific to the S6350 reader, the ISO 15693 SOF, CRC16 and EOF fields must not be included.

Note:

The protocol of S6350 Midrange Reader Modue does not use the ISO 15693 SOF, CRC16 and EOF fields within its message packet.

Note:

Please refer to ISO/IEC 15693-3 for details about the ISO message packet.

Request Packet Format

<table>
<tr><td colspan="10">Standard reader Request Packet Format (See Section 3.1)</td></tr>
<tr><td rowspan="2">Header</td><td colspan="2" rowspan="2">Packet Length</td><td colspan="2" rowspan="2">Node Address</td><td rowspan="2">Command Flag</td><td rowspan="2">Command</td><td colspan="2">ISO Command Data</td><td colspan="2" rowspan="2">Checksum</td></tr>
<tr><td>Config. Byte</td><td>Data</td></tr>
<tr><td>‘01_{hex}’</td><td>LSB</td><td>MSB</td><td>LSB</td><td>MSB</td><td>Flags</td><td>‘60_{hex}’</td><td>XX_{hex}</td><td>Data</td><td>Byte 1</td><td>Byte 2</td></tr>
<tr><td rowspan="2">1 byte</td><td colspan="2" rowspan="2">2 bytes</td><td colspan="2" rowspan="2">2 bytes</td><td rowspan="2">1 byte</td><td rowspan="2">1 byte</td><td>Byte 0</td><td>bytes 1 - n</td><td colspan="2" rowspan="2">2 bytes</td></tr>
<tr><td>1 byte</td><td>n bytes</td></tr>
</table>

Request Packet Description

Field	Length	Description
Header	1 byte	Defines the start of the packet (01_{hex}).
Packet Length	2 bytes	Defines the length of the packet, including checksum.
Node Address	2 bytes	Defines the Node address of the reader.
Command Flags	1 byte	Defines how a command will be executed.
Command	1 byte	Defines the command for the reader to execute (60_{hex} for ISO 15693-3 commands)
Data	0 - n bytes	Defines the data required by the reader for a command.
Checksum	2 bytes	Byte 1 is an XOR checksum of all elements from the header to the last byte

Response Packet Format for ISO/IEC 15693-3

Similar to the request packet, the response packet consists of the header, packet length, node address, command flags, reader command (60_{hex}), ISO/IEC 15693-3 command/data bytes **0** to some number **"m"** and the checksum.

The ISO Response Data packet can come in one of two possible generic formats: (a) One for the ISO Inventory Response, and (b) all other ISO responses. These will be highlighted in the following sections.

Note:

With the exception of the ISO Inventory Response packet, the format for each standard response packet is the same.

The Error Byte (ISO Response Data Byte 0)

There are three possible reader errors that can be generated in response to an ISO 15693 command. This error code will be returned within the Error Byte (Byte 0) of the ISO Response Data. The error codes are as follows:

01_{hex} Transponder not found
02_{hex} Command not supported
04_{hex} Invalid flags

Response Packet Format

Standard reader Response Packet Format (See Section 3.1)								
Header	Packet Length		Node Address		Response Flags	Command	ISO Response Data	Checksum	
							Data bytes 0 - 'm'		
'01_{hex}'	**LSB**	**MSB**	**LSB**	**MSB**	**Flags**	**'60_{hex}'**		**Byte 1**	**Byte 2**
1 byte	2 bytes		2 bytes		1 byte	1 byte	'm' bytes	2 bytes	

Response Packet Description

Field	Length	Description
Header	1 byte	Defines the start of the packet (01_{hex}).
Packet Length	2 bytes	Defines the length of the packet, including checksum.
Node Address	2 bytes	Defines the Node address of the reader.
Response Flags	1 byte	Defines the response of the reader to the request. Bit 4 defines the error status; a set value indicates that an error has occurred. (Other values reserved for future use)
Command	1 byte	Defines the command that the reader executed (60_{hex} for ISO 15693-3 commands)
Data	0-m bytes	Defines the data returned by the reader in response to a command.
Checksum	2 bytes	Byte 1 is an XOR checksum of all elements from the header to the last byte of the data field. Byte 2 is calculated as (FF_{hex}) XOR (byte 1)

3.2.3.3 Mandatory Commands

The data packet from the host to the reader is known as the request and the reply from the reader to the host as the response. The host is always the primary station and initiates all communication sequences. These consist of request/response pairs where the host waits for a response before continuing. All ISO/IEC 15693-3 command request packets are contained within the standard reader command request packet format. In all cases, reader command 60_{hex} is used to pass through ISO 15693 Part 3 commands to the reader.

Inventory: Command Code (01_{hex})

ISO Inventory Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check -sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Inventory Request Format

SOF	Flags	Inventory Command	Opt. AFI	Mask Length	Mask Value	**CRC16**	**EOF**
Not Used	1 byte	**'$O1_{hex}$'**	1 byte	1 byte	0 - 7 bytes	**Not Used**	**Not Used**

ISO Inventory Response Packet

The inventory response packet format, while complying with ISO 15693, is unique to the reader and is described within the following illustrations. All other ISO 15693 packet responses contain ISO 15693 data as detailed within ISO/IEC 15693-3.

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 0 - m**	2 bytes

ISO Inventory Response Format

SOF	Valid Data Flags	Collision Flags	80-bit response to Inventory Command	Etc…	**CRC16**	**EOF**
Not Used	2 bytes **LSB/MSB**	2 bytes **LSB/MSB**	Data returned from 1st valid time slot	Etc…	**Not Used**	**Not Used**

Valid Data & Collision Flags

Valid Data Flags: This 16-bit field corresponds to whether valid data was received in the 16 possible Time Slots. **Bits 0** to **7** of the **LSB** respectively correspond to **Time Slots 1** to **8**, while **bits 0** to **7** of the **MSB** correspond to **Time Slots 9** to **16** respectively. A set bit corresponds to valid data being received in that particular Time slot.

Collision Flags: This 16-bit field corresponding to whether a collision occurred in the 16 possible Time Slots. **Bits 0** to **7** of the **LSB** respectively correspond to **Time Slots 1** to **8**, while **bits 0** to **7** of the **MSB** correspond to **Time Slots 9** to **16** respectively. A set bit corresponds to a collision being detected in that particular Time Slot.

Note:

It is possible to issue the Inventory Command for just 1 Time Slot instead of 16. In this case, the preceding packet structure is still valid; the required Valid Data flag and Collision flag reside in bit 0 of the LSB of their respective fields. It follows that issuing the Inventory Command for a single Time Slot will result in a maximum of one 80-bit response being returned

If both a Valid Data flag and its corresponding Collision flag are both clear then this indicates that no transponder was detected for that particular Time Slot.

Starting from Time Slot 1 and progressing to Time Slot 16, for each Time Slot where a transponder was successfully read (without collision), its 80-bit data is appended to the Data section of the message packet.

ISO Stay Quiet Request Command Packet: Command Code (02_{hex})

Upon receipt of the Stay Quiet command, the Tag-it HF-I (ISO15693) tag will enter the quiet state and will not initiate a response.

Note: There is no response to the Stay Quiet command.

The Stay Quiet command is always executed in the Addressed mode:

Select_flag set to 0
Addressed_flag set to 1

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check -sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Stay Quiet Request Format

SOF	Flags	Stay Quiet Command	UID	**CRC16**	**EOF**
Not Used	1 byte	**'$O2_{hex}$'**	8 bytes	**Not Used**	**Not Used**

3.2.3.4 Optional Commands

Read Single Block: Command Code (20_{hex})

ISO Read Single Block Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check -sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	Flags	Read Single Block	UID	Block number	**CRC16**	**EOF**
Not Used	1 byte	**'20_{hex}'**	8 bytes	1 byte	**Not Used**	**Not Used**

ISO Read Single Block Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 0 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	CRC16	EOF
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	Block Security status	Data	CRC16	EOF
Not Used	1 byte	1 byte	Block length	**Not Used**	**Not Used**

ISO Write Single Block: Command Code (21_{hex})

ISO Write Single Block Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	*Flags	Write Single Block	UID	Block number	**CRC16**	**EOF**
Not Used	1 byte	**'21_{hex}'**	8 bytes	1 byte	**Not Used**	**Not Used**

ISO Write Single Block Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	**CRC16**	**EOF**
Not Used	1 byte	**Not Used**	**Not Used**

Note:

* **Bit 7** of the ISO 15693 protocol **Option_Flag** must be set to **1** for all **Write** and **Lock** commands to respond properly.

ISO Lock Block: Command Code (22_{hex})

ISO Lock Block Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	*Flags	Lock Block	UID	Block number	**CRC16**	**EOF**
Not Used	1 byte	**'22_{hex}'**	8 bytes	1 byte	**Not Used**	**Not Used**

ISO Lock Block Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	**CRC16**	**EOF**
Not Used	1 byte	**Not Used**	**Not Used**

Note:

* **Bit 7** of the ISO 15693 protocol **Option_Flag** must be set to **1** for all **Write** and **Lock** commands to respond properly.

ISO Read Multiple Blocks: Command Code (23_{hex})

ISO Read Multiple Blocks Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	Flags	Read Multiple Blocks	UID	1st Block #	# of blocks	**CRC16**	**EOF**
Not Used	1 byte	**'23_{hex}'**	8 bytes	1 byte	1 byte	**Not Used**	**Not Used**

ISO Read Multiple Blocks Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	Block Security Status	Data	**CRC16**	**EOF**
Not Used	1 byte	1 byte	Block length	**Not Used**	**Not Used**
		Repeat as needed			

Note:

The maximum number of data blocks which can be requested with one ISO Read Multiple Blocks Command is 61.

ISO Write AFI: Command Code (27_{hex})

ISO Write AFI Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Chec k-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	*Flags	Write AFI	UID	AFI	**CRC16**	**EOF**
Not Used	1 byte	**'27_{hex}'**	8 bytes	1 byte	**Not Used**	**Not Used**

ISO Write AFI Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	**CRC16**	**EOF**
Not Used	1 byte	**Not Used**	**Not Used**

Note:

* **Bit 7** of the ISO 15693 protocol **Option_Flag** must be set to **1** for all **Write** and **Lock** commands to respond properly.

ISO Lock AFI: Command Code (28_{hex})

ISO Lock AFI Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	*Flags	Lock AFI	UID	AFI	**CRC16**	**EOF**
Not Used	1 byte	**'28_{hex}'**	8 bytes	1 byte	**Not Used**	**Not Used**

ISO Lock AFI Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	**CRC16**	**EOF**
Not Used	1 byte	**Not Used**	**Not Used**

Note:

* **Bit 7** of the ISO 15693 protocol **Option_Flag** must be set to **1** for all **Write** and **Lock** commands to respond properly.

ISO Write DSFID: Command Code (29_{hex})

ISO Write DSFID Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	*Flags	Write DSFID	UID	DSFID	**CRC16**	**EOF**
Not Used	1 byte	**'29_{hex}'**	8 bytes	1 byte	**Not Used**	**Not Used**

ISO Write DSFID Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	**CRC16**	**EOF**
Not Used	1 byte	**Not Used**	**Not Used**

Note:

* **Bit 7** of the ISO 15693 protocol **Option_Flag** must be set to **1** for all **Write** and **Lock** commands to respond properly.

ISO Lock DSFID: Command Code ($2A_{hex}$)

ISO Lock DSFID Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	*Flags	Lock DSFID	UID	**CRC16**	**EOF**
Not Used	1 byte	**'$2A_{hex}$'**	8 bytes	**Not Used**	**Not Used**

ISO Lock DSFID Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	**CRC16**	**EOF**
Not Used	1 byte	**Not Used**	**Not Used**

Note:

* **Bit 7** of the ISO 15693 protocol **Option_Flag** must be set to **1** for all **Write** and **Lock** commands to respond properly.

ISO Get Multiple Block Security Status: Command Code ($2C_{hex}$)

ISO Get Multiple Block Security Status Request Command Packet

Header	Packet Length	Node Address	Cmd Flag	Cmd	ISO Command Data		Check-sum
					Config. Byte	**Data**	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	Byte 0	**bytes 1 - n**	2 bytes

ISO Request Format

SOF	Flags	Get Multiple Block Security Status	UID	1st Block #	# of Blocks	**CRC16**	**EOF**
Not Used	1 byte	**'$2C_{hex}$'**	8 bytes		8 bytes	**Not Used**	**Not Used**

ISO Get Multiple Block Security Status Response Packet

Header	Packet Length	Node Address	Response Flags	Command	ISO Response Data	Check sum
					Data	
'01_{hex}'	2 bytes	2 bytes	1 byte	**'60_{hex}'**	**bytes 1 - m**	2 bytes

Response when Error_flag is set

SOF	Flags	Error Code	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**

OR

Response when Error_flag is not set

SOF	Flags	Block Security Status	**CRC16**	**EOF**
Not Used	1 byte	1 byte	**Not Used**	**Not Used**
		Repeat as needed		

Chapter 4

Regulatory and Warranty Notices

Topic **Page**

4.1 Regulatory Notes

An RFID system comprises an RF transmission device, and is therefore subject to national and international regulations.
Prior to operating the S6350 Midrange Reader Module together with antenna and power supply, the required FCC, PTT or relevant government agency approval must be obtained. Sales, lease or operation in some countries may be subject to prior approval by the government or other organization.

4.2 FCC Notices (U.S.A.)

A typical system configuration containing the S6350 Midrange Reader Module has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules.

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

4.3 R&TTE Conformity (Europe)

A typical system configuration containing the S6350 Midrange Reader Module has been tested and found to comply with the requirements of the Telecommunication Terminal Equipment Act (FTEG) and the R&TTE Directive 1999/5/EC. Any device or system incorporating the S6350 Midrange Reader Module in any other than the originally tested configuration needs to be verified against the requirements of the Telecommunication Terminal Equipment Act (FTEG) and the R&TTE Directive 1999/5/EC. A separate Declaration of Conformity must be issued by the System Integrator or user of such a system prior to marketing and operating it in European Community.

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

4.4 Warranty and Liability

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

- Improper use of the reader module.
- Unauthorized assembly, operation and maintenance of the reader module.
- Operation of the reader modules with defective and/or non-functioning safety and protective equipment.
- Failure to observe the instructions during transport, storage, assembly, operation, maintenance and setting up of the reader modules.
- Unauthorized changes to the reader modules.
- Insufficient monitoring of the reader modules' operation or environmental conditions.
- Improperly conducted repairs.
- Catastrophes caused by foreign bodies and acts of God.

Appendix A

Downloading Data to FLASH Memory

The S 6350 Reader FLASH memory contains two areas: the application area for the Reader application firmware and a boot-loader area for the boot-loader firmware. The boot-loader memory is factory locked.

After a reset the boot-loader firmware runs the following sequence:

- Control registers are initialized
- IO ports are initialized
- Application memory is scanned and verified
- If the application memory checksums are valid then control is transferred to the application memory
- If the checksums fail then the boot-loader takes control of the communications.

The boot-loader will only accept the following commands:

- Initiate FLASH Loader Command ($D0_{hex}$)
- Send Data to FLASH Command ($D8_{hex}$)
- Read reader Version Command ($F0_{hex}$)

The boot loader only operates at 57600 baud with 8 data bits, 1 start bit, 1 stop bit and no parity.

The application firmware will always accept the **Initiate FLASH Loader Command ($D0_{hex}$)**. When this command is received by the application firmware, control is transferred to the boot-loader. If the boot-loader does not receive a **Send Data to FLASH Command ($D8_{hex}$)** within 5 seconds of the **Initiate FLASH Loader Command ($D0_{hex}$)** then a system reset is generated.

The application firmware is provided in a single file and contains all the necessary checksums. The file will always contain 29700 bytes of data.

The file must be sent to the reader in one session if any errors occur the whole file must be resent. The file is sent in 225 segments, 132 bytes at a time (225 x 132 = 29700). Each segment is sent using the **Send Data to FLASH Command ($D8_{hex}$).** The 132 bytes of data are contained in the data section of the packet.

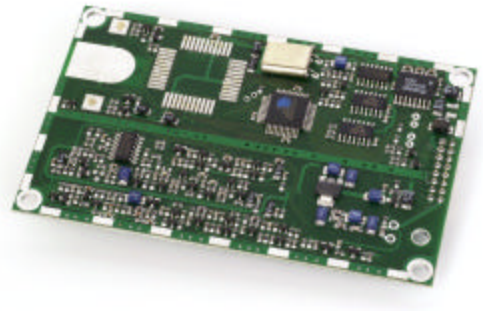
Appendix B

Error Codes

Code number	Meaning
01_{hex}	Transponder not found
02_{hex}	Command not supported
03_{hex}	Packet BCC invalid
04_{hex}	Packet flags invalid for command
05_{hex}	General write failure
06_{hex}	Write failure due to locked block
07_{hex}	Transponder does not support function
$0F_{hex}$	Undefined error

Data Sheet

HF Reader System Series 6000
S6350 Midrange Reader Module



Specifications:

Part Number	***RI-STU-TRDC-02***
Operating Frequency	13.56 MHz ± 7 kHz
Supported Transponders	Tag-it HF, Tag-it HF-I & ISO 15693 compliant transponders
Supply Voltage	5 VDC ± .5VDC
Power Consumption	1250 mW Maximum
Transmitter Power	120 mW into 50 (Typical)
Transmitter Modulation	AM 10% - 30% (set at 20% nominal) or 100% - Software Selectable
Data Coding Mode	1 / 4 or 1 / 256
Input/Output	16-pin Header Connector
Antenna Connection	2 pins of 16-pin Header Connector
Antenna Impedance	50 ± 5 @ 13.56MHz
Antenna Q, Loaded	10 < Q < 30
Communication Interface	RS232 (via 16-pin Header Connector)
Communication Parameters	57.6 K-baud, 8 data bits, 1 start bit, 1 stop bit & no parity
Communication Protocol	Tag-it & ISO Host protocol
Memory	Flash for downloadable firmware updates
Synchronization	Protocol synchronization via I/O
Operating Temperature	-20°C to +70°C
Storage Temperature	-40°C to +85°C
Vibration	15 Hz to 500 Hz, 1g peak, 30 minutes sweep, logarithmic (MIL-STD-810E, Method 514.4)
Dimensions	4.3” x 2.7” x 0.4” 109.22mm x 68.58mm x 10.2mm (metric)
Weight	1.09 oz (31 grams)

For more information, contact the sales office or distributor nearest you. This contact information can be found on our web site at: **http://www.ti-rfid.com**