IS1001™ READER
STANDALONE OPERATION
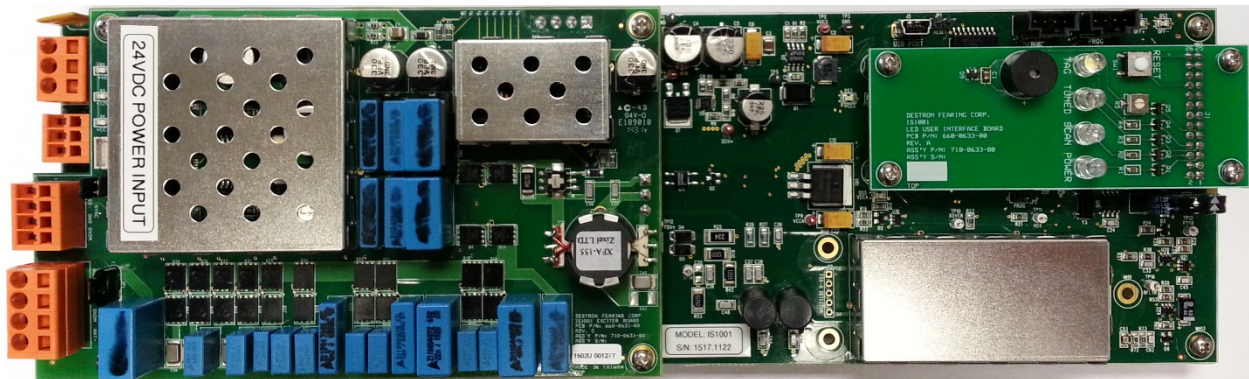
FOR MODELS IS1001 & IS1001-12V

Copyright

© Copyright 2020 Biomark, Inc. All rights reserved. This manual contains valuable proprietary information. It should not be published, copied, or communicated to any person without prior authorization from Biomark, Inc.

Trademarks

IS1001, IS1001-12V, Fastag, BioTherm, BioTerm and BioStat are trademarks of Biomark, Inc.

Lantronix DeviceInstaller is a trademark of Lantronix, Inc.

Microsoft and Windows are registered trademarks of Microsoft Corporation.

All other trademarks, trade names, or images mentioned herein belong to their respective owners.

Document History

Release Date	Doc Revision	Firmware Version	Comments
May, 2014	1	1.4.0 (2.4.0)	Original release of this manual.
October, 2014	2	1.4.5 (2.4.5)	Updated release of this manual.
December, 2014	3	1.4.5 (2.4.5)	Updated Data Logger Board Operation section.
July, 2015	4	1.5.2 (2.5.2)	Updated Synchronization section.
April, 2016	5	1.6.0 (2.6.0)	Updated list of commands and reports to include changes from firmware v1.6.0 release.
September, 2016	6	1.6.1 (2.6.1)	Added Over-Temperature Protection mechanism description and updated list of commands and reports to include Reader Idling Time setting.
January, 2017	7	1.6.1 (2.6.1)	Updated Data Logger Board Operation section. Removed Using BioTerm and BioStat section. Updated links and screenshots.
March, 2017	8	1.6.2 (2.6.2)	Updated list of commands to include changes from firmware v1.6.2 release.
July, 2017	9	1.6.3 (2.6.3)	Updated list of commands to include changes from firmware v1.6.3 release.
June, 2019	10	1.7.0 (2.7.0)	Updated functionalities and list of commands to include changes from firmware v1.7.0 release. Removed USB Data Logger Board Operation section. Added BLE Data Logger Board description.
April, 2020	11	1.7.1 (2.7.1)	Updated Reader Idling Time functionality description and Full Status Report structure

READ THROUGH THIS ENTIRE MANUAL BEFORE INSTALLING AND OPERATING IS1001 OR IS1001-12V READER. FOLLOW ALL STEPS EXACTLY. USING IS1001 OR IS1001-12V READER IN A MANNER FOR WHICH IT WAS NOT DESIGNED MAY IMPAIR THE SAFETY FEATURES BUILT IN BY THE MANUFACTURER.

Safety Symbols

⚠️	Indicates care should be taken to avoid physical harm. Only qualified service personnel should access the internal components of IS1001 or IS1001-12V reader.

Table of Contents

Table of Content

Description

The IS1001™ reader is a high performance, ISO-compliant stationary RFID transceiver designed for detecting, storing, and transmitting FDX-B and HDX PIT tag IDs in permanent installations. It is specifically designed for applications that require low power consumption, large detection area, and high adaptability to environmental changes.

Each IS1001 reader's antenna exciter circuitry is designed to operate large antenna (as large as 4 feet by 20 feet or similar) with low coil inductance to provide a detection area that is tolerant of environmental changes. In addition, IS1001 reader can carry out independent automatic dynamic antenna tuning while providing ample power to its antenna for optimal tag activation and detection. The IS1001 reader saves tag data and system information in its internal memory. It can also save the information on a removable memory device or communicate the data in real time via various paths to a host computer or data logger.

Models

There are two available models of IS1001 reader:

- **IS1001:** This is the base model. It requires a 24 V DC power input. This model uses IS1001 Application Firmware v1.x.x.

- **IS1001-12V:** Same as IS1001 except that it requires a 12 V DC power input and it does not offer adjustable antenna power output. This model is identified by a yellow model number sticker on the Mother board. This model uses IS1001 Application Firmware v2.x.x.

Features

The IS1001 reader incorporates the following features:

- Dynamic antenna auto-tuning

- Support for a wide range of antenna inductances

- Adjustable antenna output power (not available on IS1001-12V reader)

- Detection of ISO-compliant FDX-B and HDX PIT tags

- Detection of Fastag™ FDX-B Half-Telegram PIT tags

- FDX-B tag detection signal level measurement and BioTherm™ tag temperature detection

- Automatic system performance diagnostics using a Virtual Test Tag

- Flexible and configurable to support a wide array of system applications

- Configurable non-volatile setup parameters

- Non-volatile internal memory for storing up to 78,583 tag IDs and 1,023 status reports.

- Storing real-time information such as tag IDs, alarms, messages, and reports on an external USB flash drive (requires optional USB Data Logger Board)

- USB port, RS-232 and Bluetooth port for local access (requires optional BLE Data Logger Board)

- Ethernet and fiber optic ports for remote access (requires optional Remote Communication Board)

- DC power input (24 volts for model IS1001, 12 volts for model IS1001-12V)

- Remote and field upgradeable firmware

Description

Specifications

Item	Description
Input Voltage	18-28 V DC (12-15 V DC for model IS1001-12V)
Input Fuse	3 A, Resettable
Reverse Polarity Protection	Yes
Undervoltage Protection	Yes
Overvoltage Protection	Yes
In-rush Current Limiting	Yes
Antenna Exciter Voltage	- Model IS1001: 12-20 V DC, Electronically Adjustable, 5-Steps - Model IS1001-12V: Fixed to 10 V DC
Antenna Exciter Configuration	Full Bridge
Antenna Current Limit	11.0 Ap-p, Firmware Enforced
Antenna Tuning	10 Capacitors, Electronically Switched
Operating Frequency	134.2 KHz
Synchronization Capability	- Antenna Exciter Oscillator Synchronization, Network Configuration, Hardwired Twisted-Pair Interface - Real-time Clock Synchronization
Tag Technologies Decoding	- ISO FDX-B　　　- ISO HDX - Fastag™ FDX-B Half-Telegram (non-ISO)　　- FDX-B BioTherm
Self-Diagnostics	Virtual Tag Test, Electronically Adjustable Level
Internal Data Storage	78,583 Tag IDs, 1,023 Status Reports
External Data Storage (with optional Accessory Board)	- Up to 64 GB of real-time information on USB flash drive - 1,024,000 Tag IDs, 55,296 Status Reports on extended memory
Communication Ports	- USB (Mini-B), ASCII Protocol - Ethernet (RJ45), ASCII Protocol (with optional Accessory Board) - Fiber Optics (ST), ASCII Protocol (with optional Accessory Board) - RS232 (DB9), ASCII Protocol (with optional Accessory Board) - Bluetooth, ASCII Protocol (with optional Accessory Board)
External Status LEDs (with optional Accessory Board)	- Power (Green)　　　- Tuned (Red) - Scan (Yellow)　　　- Tag (White)
Beeper (with optional Accessory Board)	Piezo Indicator, 4 KHz, 70 dB
Operating Temperature Range	-4˚F to 158˚F (-20˚C to 70˚C)
Operating Humidity Range	10% to 90%, Non-Condensing
Weight	1.0 lbs. (0.45 kg) (w/o enclosure)
Dimensions	12.25"L x 3.75"W x 2.00"H (31 cm x 9.5 cm x 5 cm) (w/o enclosure)
Agency Approvals	No

Major Internal Hardware Components

Note: *Shown as supplied by Biomark.*

Exciter Board   Mother Board   LED User Interface Board (optional)
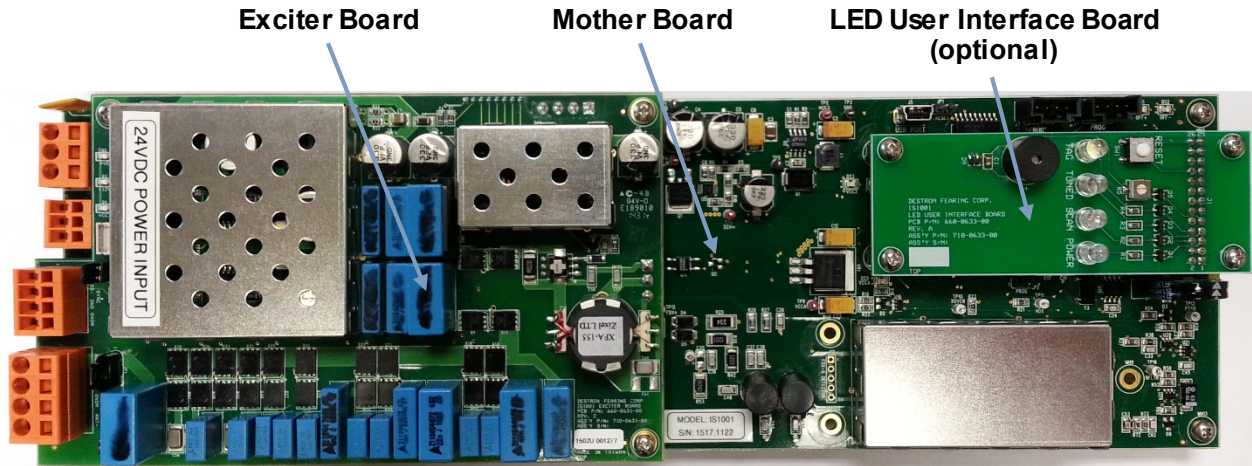
Note: *Shown with sample enclosure.*
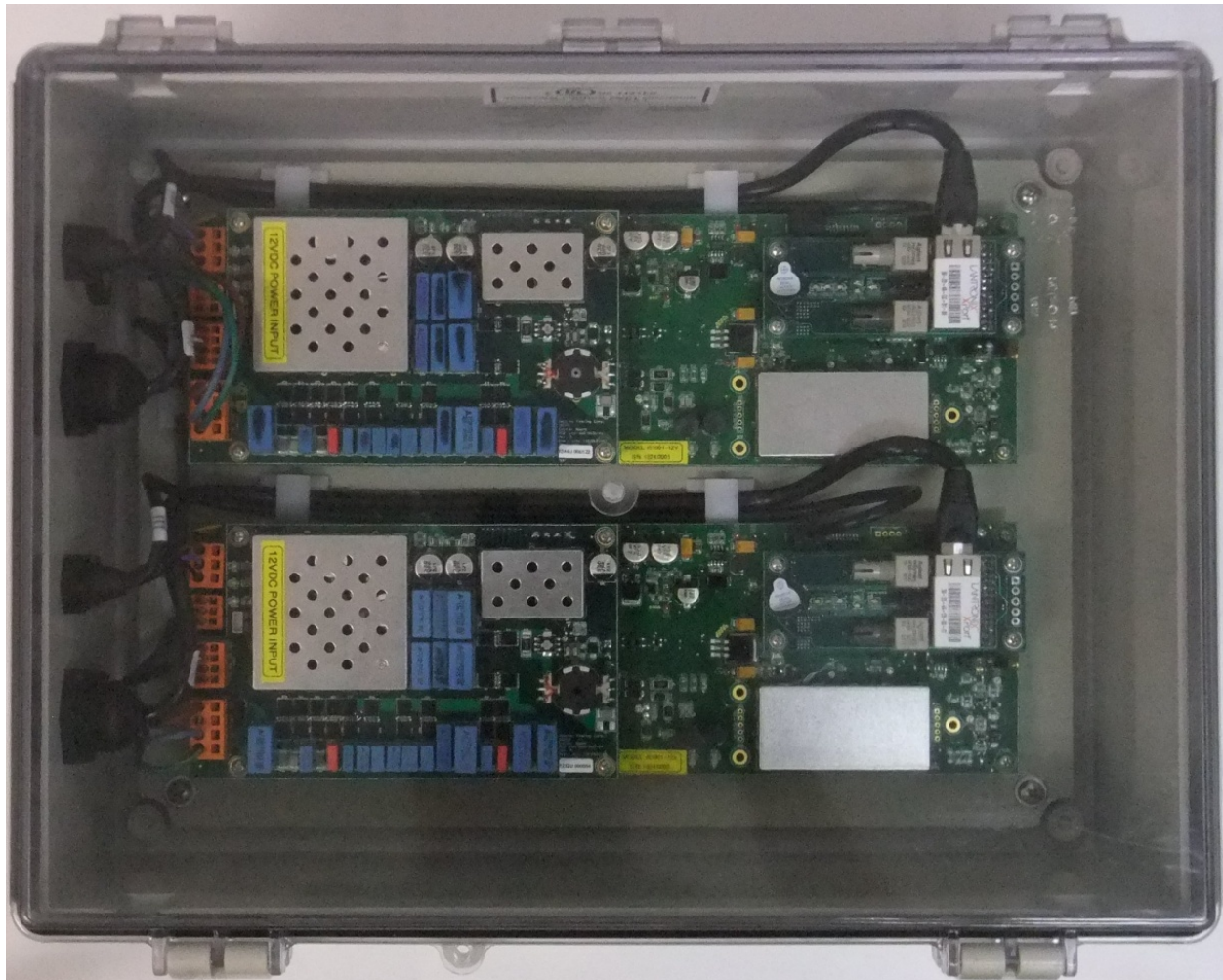
Description

Note: *Optional LED User Interface Board, Remote Communication Board, USB Data Logger Board and BLE Data Logger Board are all mutually exclusive. Only one can be installed at a time.*

Mother Board and LED User Interface Board

The Mother Board incorporates the following: input power connection and monitoring, CPU, internal memory, optional accessory boards interface, USB local communication interface, CAN Bus interface, Date/Time synchronization interface and FDX-B tag and HDX tag signal decoding filters. This board also contains two yellow antenna tuning status LEDs (OFF+ and OFF-) that indicate if the antenna is out of tune and if the tuning capacitance needs to be increased (OFF+) or reduced (OFF-).

The LED User Interface Board incorporates IS1001 status LEDs, an IS1001 beeper with a potentiometer to adjust its volume, and an IS1001 reset button.

The four IS1001 status LEDs indicate the following:

- Green "POWER" LED indicates that power has been applied to the IS1001 reader

- Yellow "SCAN" LED indicates that the IS1001 reader is in Scan mode

- Red "TUNED" LED indicates that the antenna is properly tuned to the set target phase

  Flashing LED indicates that the IS1001 reader is performing Antenna Full Tune process

- White "TAG" LED indicates that a tag ID was successfully decoded
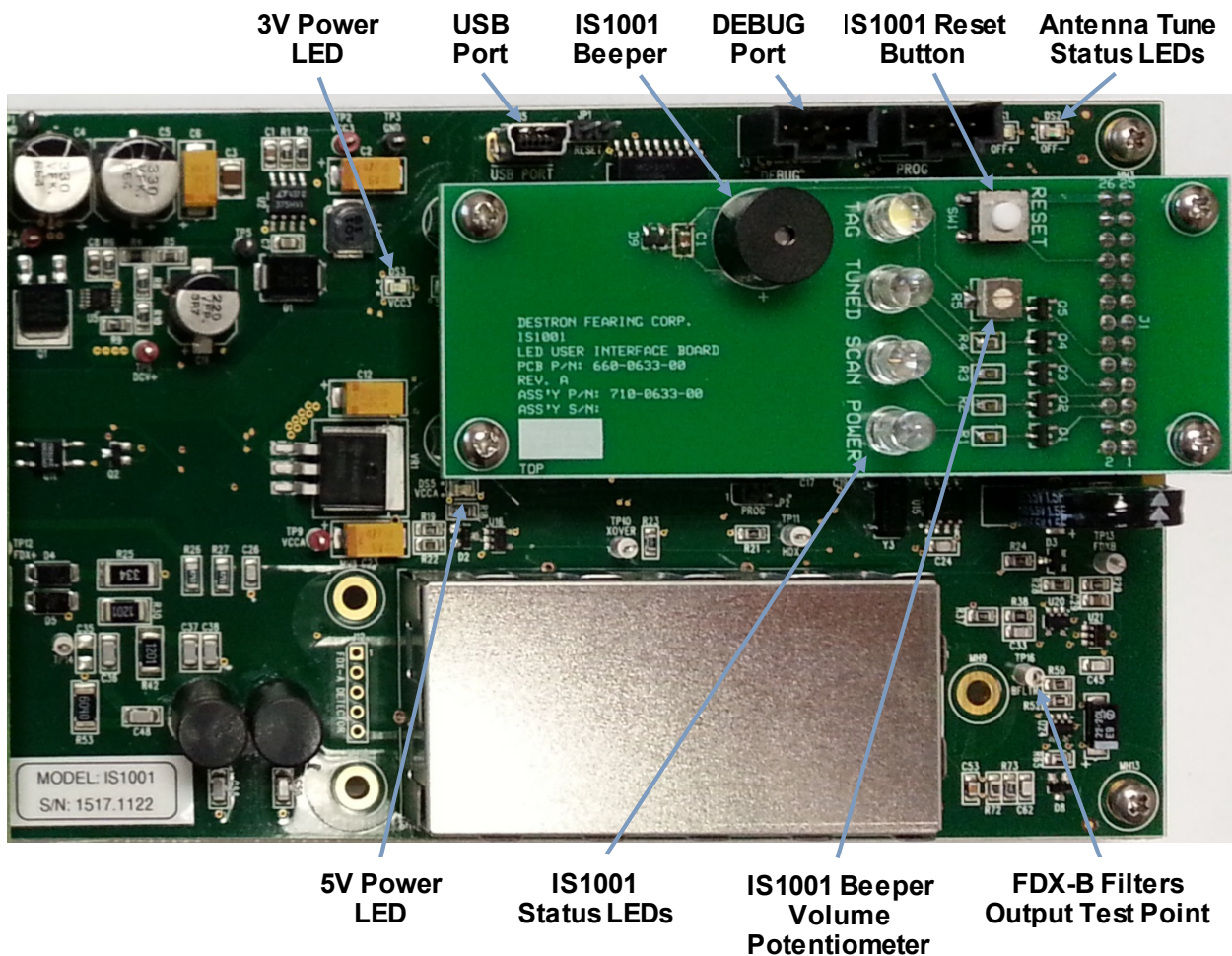
Exciter Board

The Exciter Board incorporates the following: the antenna exciter with adjustable power output, dynamic tuning capacitors, antenna exciter oscillator synchronization interface, Virtual Test Tag, and FDX-B tag and HDX tag signal detectors.
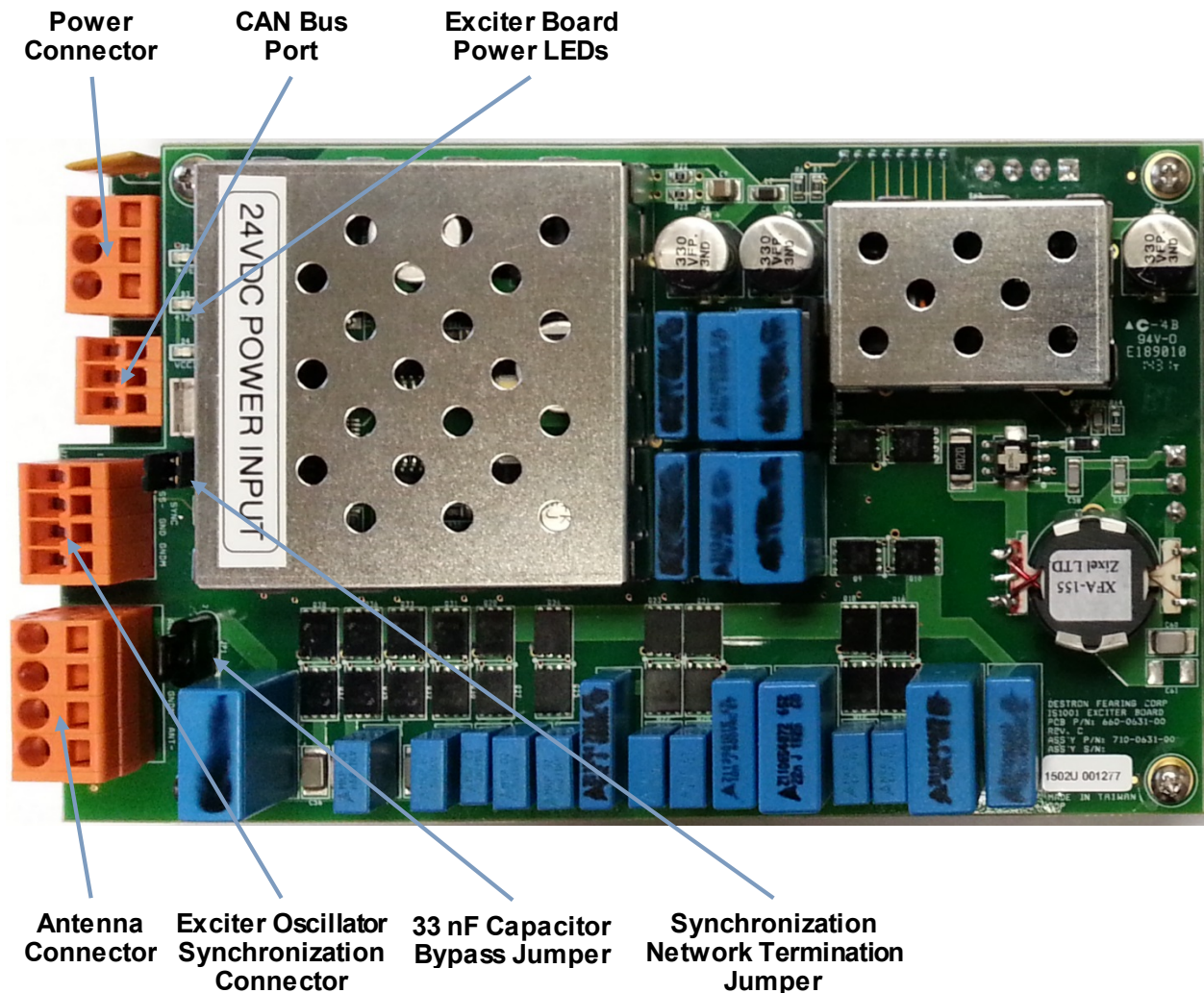
Remote Communication Board

The Remote Communication Board incorporates the Ethernet and fiber optic communication interface and enables remote access to the connected IS1001 reader for data collection and reader configuration.

The board contains two jumpers to enable each individual communication port. It is recommended to use only one communication port at a time, to avoid communication conflicts. To disable one of the ports, to save on power consumption, remove the corresponding jumper. This board also contains IS1001 status LEDs and an IS1001 beeper.

Description

IS1001 Beeper   Fiber Optic Transmit Port   Fiber Optic Port Status LEDs   Ethernet Port Enable Jumper   Ethernet Module

IS1001 Status LEDs   Fiber Optic Receive Port   Fiber Optic Port Enable Jumper   Ethernet Module MAC Address
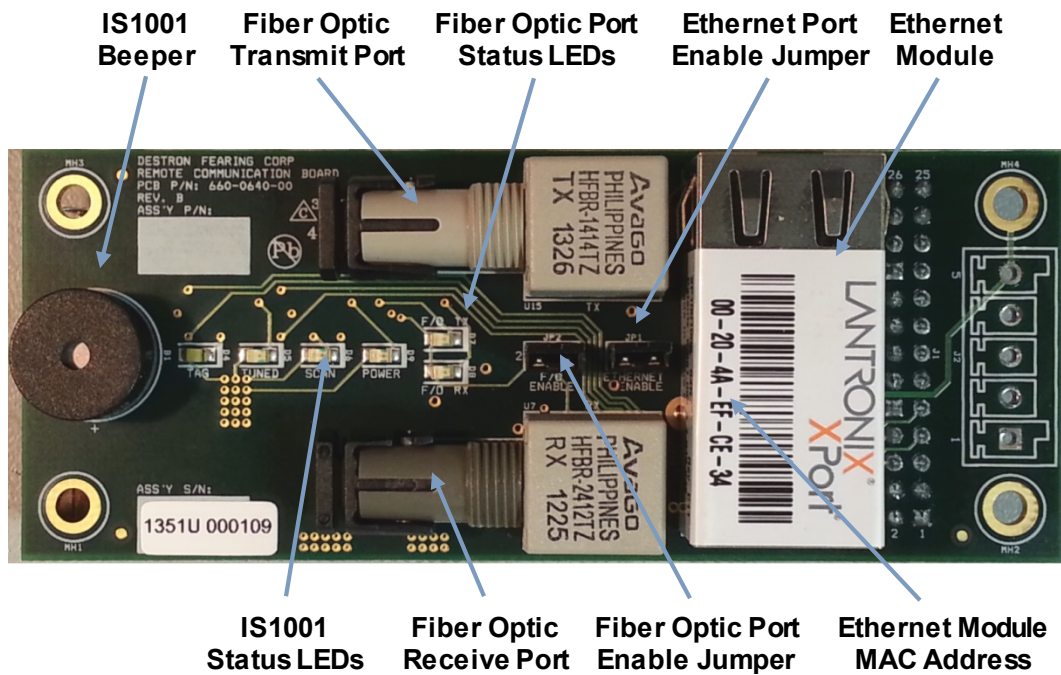
USB Data Logger Board

The USB Data Logger Board stores real-time information such as tag IDs, alarms, messages, and reports on an external USB flash drive. The maximum supported flash drive size is 64 GB. The amount of data that can be stored varies depending on the type of data received.

It incorporates the RS-232 communication interface for local access to the stored data and to the connected IS1001 reader. This port also allows connection to a second IS1001 reader for collecting and combining data from both readers into a single file on the USB flash drive.

The board contains IS1001 status LEDs, an IS1001 beeper, and an IS1001 reset button. For information on using this board, see IS1001 USB Data Logger User Manual.

Flash Drive Status LEDs   Flash Drive Eject Button   Flash Drive Port   RS-232 Port   IS1001 Reset Button   IS1001 Beeper   IS1001 Status LEDs
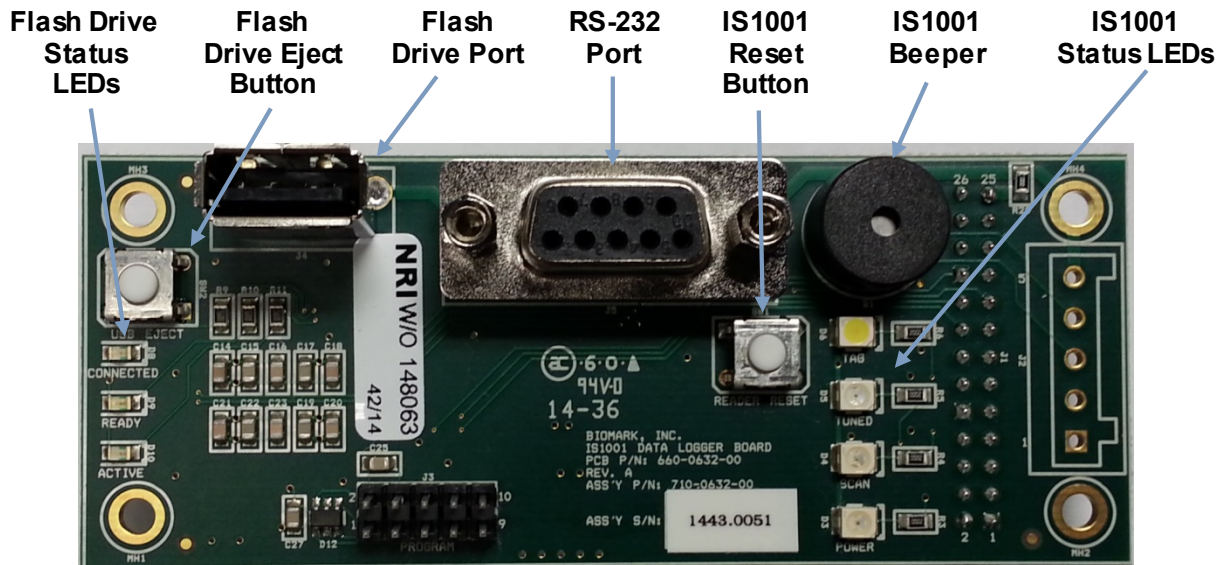
BLE Data Logger Board

The BLE (Bluetooth Low Energy) Data Logger Board stores tag IDs and diagnostics data it receives from the attached IS1001 reader to its internal flash memory. It has the capacity to store 1,024,000 tag IDs and 55,296 short status reports.

It incorporates the RS-232 wired and Bluetooth wireless communication interface for local access to the stored data and to the connected IS1001 reader.

The board also contains IS1001 status LEDs and an IS1001 beeper.

For information on using this board, see IS1001 BLE Data Logger User Manual.

Installing and Configuring IS1001 Reader
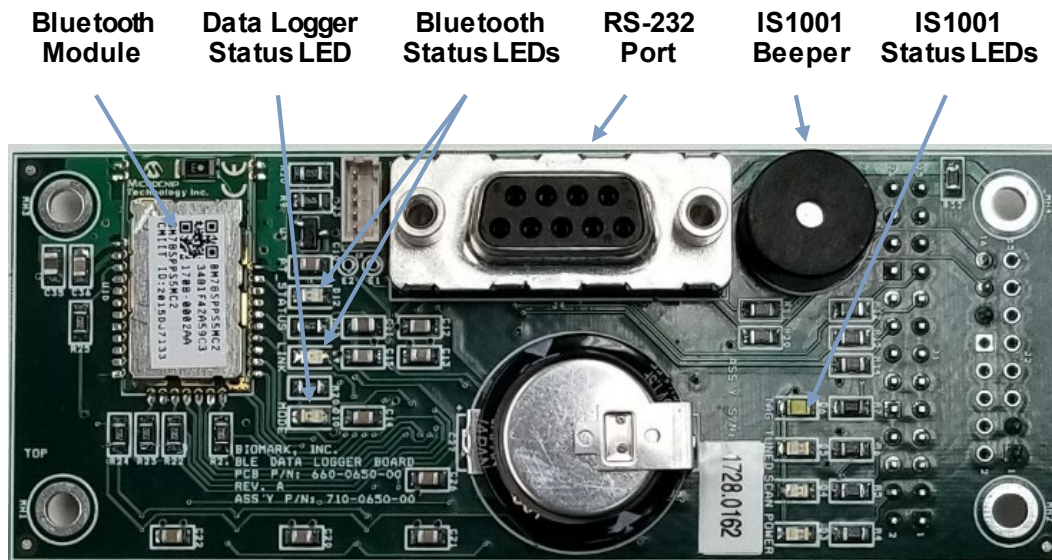
Pre-Installation Steps

Before going on location, install the following software on the computer you will use to communicate with the IS1001 reader:

- Install the **Silicon Labs CP210x USB to UART Bridge Virtual COM Port (VCP) Windows** drivers.

  The CP210x USB to UART Bridge Virtual COM Port (VCP) drivers are required to facilitate host communication. The drivers are available for download at: http://www.silabs.com/products/mcu/pages/usbtouartbridgevcpdrivers.aspx

- Install the BioTerm and BioStat programs.

  BioTerm is used to connect a computer to the IS1001 reader and perform communication and configuration tasks. BioStat is used to monitor the status of the IS1001 reader by gathering diagnostic data and presenting it in a chart format. The programs are available for download at: https://www.biomark.com/software-drivers

Installing IS1001 Reader

1. Remove the IS1001 reader and all items from the shipping cartons.

2. Locate an area to mount the IS1001 reader.

   If you are installing multiple IS1001 readers, they can be co-located in a common area (such as a cabinet located along the shore) or each IS1001 reader can be housed in a separate location near its respective antenna.

   An IS1001 reader can be mounted to a rigid surface using the six threaded standoffs located on the bottom of the IS1001 assembly. A common installation technique is to mount an IS1001 to a board or plate and then mount the board/plate within your enclosure.

3. (Optional) Install the LED User Interface Board, the Remote Communication Board, or the Data Logger Board by attaching it to the Mother Board and securing it with the four supplied screws and lockwashers.

4. Make the power connection to the IS1001 reader.

   (Model IS1001 = 24 V DC, Model IS1001-12V = 12 V DC)

   Note: IS1001 reader will not turn on if supply voltage level is outside of acceptable range (see the IS1001 Reader Specifications section on page 2). During operation, IS1001 will turn itself OFF if supply voltage level goes outside of acceptable range by 2 V (by 1 V for IS1001-12V) and will turn itself back on once the level returns to normal.

   Tip: Use a narrow screwdriver to open the pin slot before inserting the wire.

   - Connect the power cable's positive wire to pin 1 (+) of the 3-pin "POWER" connector J6 on the Mother Board.

   - Connect the power cable's negative wire to pin 2 (-) of the 3-pin "POWER" connector J6 on the Mother Board.

   - Connect the power cable's shield drain wire and chassis (Earth) ground wire to pin 3 (GNDM) of the 3-pin "POWER" connector J6 on the Mother Board.

   Note: For the best performance the IS1001 reader should be locally grounded.

Pin 1   Pin 2   Pin 3
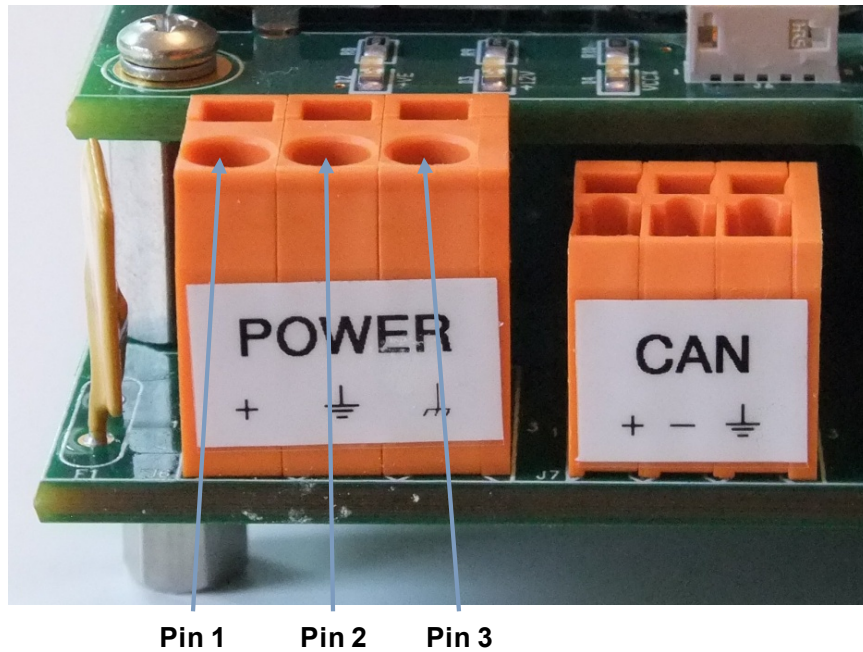
5. Make the antenna connection to the IS1001 reader.

- Connect the antenna leads to pins 1 (+) and 4 (-) of the 4-pin "ANTENNA" connector J8 on the Exciter Board.

    Note: If there is a tuning capacitance connected in series at the antenna, the recommendation is to connect the lead attached to it to Pin 4 and the lead attached to the coil of the antenna to Pin 1; otherwise either lead can be connected to either of those two pins. Both configurations should be tested to determine the one that yields the best performance.

- Connect the antenna cable shield drain wire to Pin 3 (GNDM) or to Pin 2 (GND) of the 4-pin "ANTENNA" connector J8 on the Exciter Board, or leave it unconnected. You can determine which configuration results in the best performance.

Pin 1   Pin 2   Pin 3   Pin 4
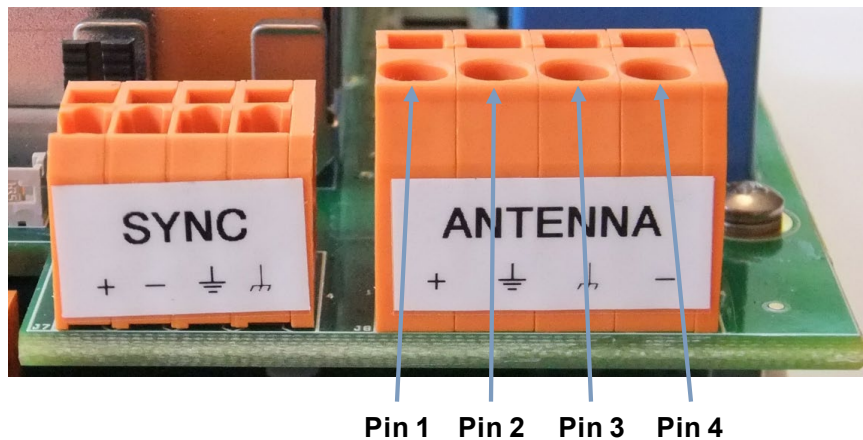
- Adjust tuning capacitance range, if needed.

  The IS1001 reader has a 33 nF capacitor, C57, on the Exciter Board that is connected in series with the IS1001 reader's bank of tuning capacitors. This capacitor should be used when antenna inductance is between 130 uH and 180 uH, no additional capacitance is connected in series at the antenna, and the IS1001 reader is installed next to or close to the antenna (the antenna cable is less than 6 feet long).

  In most other cases, this capacitor needs to be shorted out by installing jumper JP1 on the Exciter Board and additional capacitance needs to be added (connected in series) at the antenna to bring it within tuning range of the IS1001 reader and to reduce the voltage across the antenna cable.

6. Make the communication line connection(s) to the IS1001 reader.

   - USB connection: A mini-USB port is available on all models and used to connect to a local computer. See page 21 for details.

   - (Optional) Connect the Ethernet and/or Fiber Optic cables to their respective ports on the Remote Communication Board. The Remote Communication Board is an optional accessory. See pages 22 and 24 for details.

   - (Optional) Connect the DB-9 serial communication cable to the RS-232 port on the Data Logger Board. The Data Logger Board is an optional accessory. For more information see the USB Data Logger or BLE Data Logger Manual.

Synchronizing Multiple IS1001 Readers

If you are employing two or more IS1001 readers at your site and either of the following conditions is true, you must synchronize the antenna exciter oscillators of the IS1001 readers in order to avoid interference between their antennas.

- HDX tag detection is enabled.

- The antennas are located in close proximity to one another (typically within 50' of each other but the actual distance depends on the antennas' properties, orientation, etc.)

If the IS1001 readers antenna exciter oscillators are not synchronized:

- When HDX tag detection is enabled, noise spikes from antennas switching ON and OFF at different times by different IS1001 readers can interrupt FDX-B detection on other readers. In addition, if an IS1001 reader's exciter is activated, it can interfere with another reader whose exciter is OFF while receiving an HDX tag response.

- When antennas are located in close proximity, their fields can interact and cause elevated noise levels and constant tuning adjustments, which in turn leads to decreased FDX-B detection distance and efficiency.

Additionally, real-time clocks (date/time settings) of the IS1001 readers can be synchronized to ensure consistent timing of events among readers (for instance, to determine direction of travel of tags through multiple antennas). See page 13 for details.

Antenna Exciter Oscillator Synchronization Process

IS1001 antenna exciter oscillator synchronization should be configured using a 4-conductor, two twisted pairs, 18-22 AWG wire, shielded cable.

Note: If using single twisted pair, 18-22 AWG wire, shielded cable, the cable shield drain wire should be used as a signal reference conductor GND.

1. Use the conductors of one pair to connect the SS+ and SS- signals.

The IS1001 reader utilizes a network synchronization topology.

- Connect SS+ (pin 1 of Exciter Board connector J7) of the master IS1001 reader to SS+ of all the slave IS1001 readers.

- Connect SS- (pin 2 of Exciter Board connector J7) of the master IS1001 reader to SS- of all the slave IS1001 readers.

2. Use both conductors of the second pair as the signal reference connection GND (pin 3 of Exciter Board connector J7).

3. Use the cable shield drain wire to connect to the chassis ground pins GNDM (pin 4 of Exciter Board connector J7).

4. 120 Ohm termination resistor needs to be connected between Pin 1 (SS+) and Pin 2 (SS-) of connector J7 on the Exciter Board of the two IS1001 readers that are closest to each end of the synchronization cable. This is accomplished by installing jumper JP2 on the Exciter Board of each of the two IS1001 readers.

   Jumper JP2 on the Exciter Board of all other IS1001 readers on the synchronization network should not be installed.

   If there are only two IS1001 readers on the synchronization network, then both must have jumper JP2 installed.

   Note: By default, jumper JP2 is installed on all IS1001 readers.

Jumper JP2   Pin 1   Pin 2   Pin 3   Pin 4
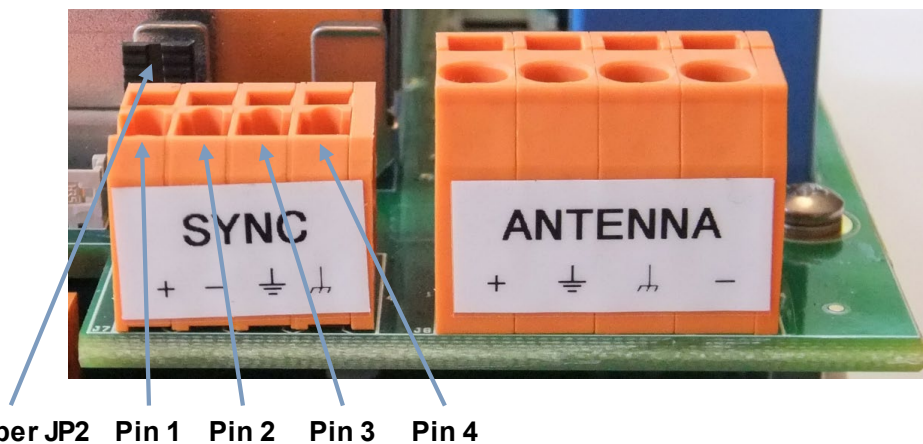
5. Power on the IS1001 readers.

6. Use BioTerm to establish a connection with the IS1001 readers.

   For information on establishing a connection, see page 19.

7. By default, an IS1001 reader is configured to operate in IS1001 Standalone network mode (as standalone reader). But if prior to this installation it was connected to a Master Controller as part of an MTS system, the network mode setting has been changed to MTS Node. In such case, you need to switch the IS1001 reader from MTS Node to IS1001 Standalone network operation mode by using the **RNMS** command (see page 30).

   You should see the echo of all characters in the Data Traffic window as you type. Press Enter and verify the reader's network mode has been changed to "Standalone" from the confirmation message.

8. Set Reader ID of each IS1001 to a different value by using the **RISxx** command (see page 30).

9. IS1001 Synchronization Mode default setting is Secondary Master.

   IS1001 reader that is set as Secondary Master will assume the Master role and will enable its own antenna exciter oscillator if it did not detect the presence of synchronization signal on the synchronization network, otherwise it will operate as a Slave and will use antenna exciter oscillator signals received through the synchronization network.

   When multiple Secondary Masters are present on the network, the delay, which is tied to reader ID, is used to determine which one becomes the Master when synchronization input signal is not present, i.e. IS1001 reader with lowest reader ID number will be the first to enable its antenna exciter oscillator. The delays is calculated by multiplying reader ID by 50 milliseconds, if HDX detection is enabled the delay is increased by 25 milliseconds (50 - 12750 milliseconds when HDX is disabled or 75 - 12775 milliseconds when HDX is enabled).

   To maintain the presence of a sole source of synchronization signal on the network, the presently active Secondary Master will occasionally disable its exciter oscillator (for up to 60 microseconds) and check for the presence of synchronization input signal:

   - Periodic verification is performed every hour.

   - Conditional (off-schedule) verification is performed if noise level exceeds High Noise alarm threshold. If the synchronization input signal is not detected, but high noise level persists, the verification will be repeated in 5 minutes.

   - Conditional (off-schedule) verification is performed if antenna tuning capacitors are being adjusted more than twice per second. If the synchronization input signal is not detected, but sporadic tuning activity continues, the verification will be repeated in 5 minutes.

   If the synchronization input signal is detected the Secondary Master will revert to being a Slave.

   Secondary Master option provides assurance that the site will remain operational in case the Master reader becomes inactive or fails.

10. If you wish to have a certain IS1001 reader to always act as a Master and the rest as Slaves, so that you can activate or deactivate the entire site by activating or deactivating the Master IS1001 reader, then configure that IS1001 reader as the Master by using the **RSM1** command and configure the remaining IS1001 readers as Slaves by using the **RSM3** command (see page 30).

The following figure shows two IS1001 readers wired for antenna exciter oscillators synchronization.
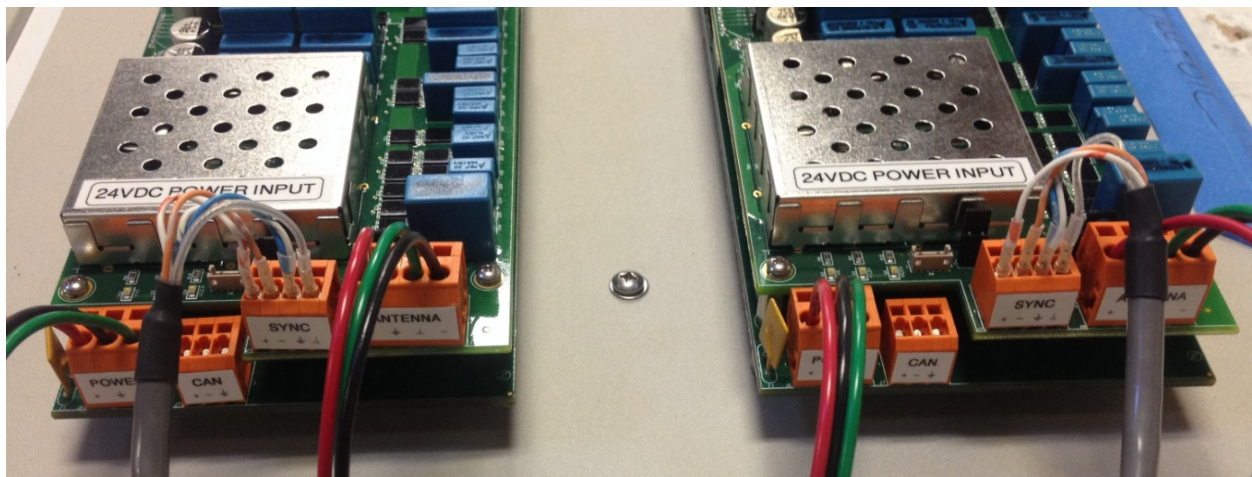
Real-Time Clock Synchronization Process

IS1001 real-time clock synchronization should be configured using a special 2-conductor RTC synchronization cable (please contact the Technical Services Department of Biomark at (208) 275-0011 or email customerservice@biomark.com for details).

1. Connect the synchronization cable between "DEBUG" ports (Mother Board connector J3) of IS1001 readers. Connect the cable end marked "Source" to IS1001 reader you wish to be the source for real-time clock synchronization.

    Note: Under normal conditions "DEBUG" port operates as Local communication port, so if you connect the synchronization cable between IS1001 readers and power them all on, there will be communication traffic between the ports. This communication will be confusing to readers as they only expect to receive commands through the ports. This will lead to infinite loop of "unrecognized command" error messages sent back and forth between IS1001 readers and will cause their CPU to overload. To avoid the later, when such condition is detected on "DEBUG" port, IS1001 reader will automatically enable real-time clock synchronization and set itself as the source. This means, there may be multiple IS1001 readers that will set themselves as the source of real-time clock synchronization. This is not a critical issue but can be confusing. To ensure proper real-time clock synchronization configuration follow these steps.

2. Power on the IS1001 reader you wish to set as the source for real-time clock synchronization.

3. Use BioTerm to establish a connection with the IS1001 reader.

    For information on establishing a connection, see page 19.

4. If necessary, set the proper IS1001 reader's date and time settings by using the **RDS** and the **RTS** commands (see page 30).

5. Enable the real-time clock synchronization and set the IS1001 reader as the source by using the **RST1** command (see page 30).

    Note: You only need to enable real-time clock synchronization on one IS1001 reader. No settings need to be changed on the remaining IS1001 readers for the synchronization to function properly.

6. Reset the source IS1001 reader and power on the remaining IS1001 readers.

Real-time clock synchronization occurs 10 seconds after the synchronization is enabled or 1 minute after the source IS1001 reader is reset and then every 12 hours after.

Note: An off-schedule real-time clock synchronization event will occur whenever date or time setting of the source IS1001 reader is changed.

Tuning Antenna

Note: If you are employing two or more IS1001 readers, antenna of each individual IS1001 must be tuned while all other adjacent IS1001 systems are disabled (in Standby mode or powered OFF).

In order for antenna dynamic auto-tuning to function properly you must perform an antenna full tune after the initial system installation. During this process the IS1001 reader determines the target tuning phase, the tuning phase deviation threshold and the initial tuning capacitance setting based on the properties of your system and its environment.

The antenna full tune process is activated by establishing a connection with the IS1001 reader and entering the Antenna Full Tune (**AFT**) command (see page 30).

1. Power on the IS1001 reader.

2. Use BioTerm to establish a connection with the IS1001 reader.

   For information on establishing a connection, see page 19.

3. By default, an IS1001 reader is configured to operate in IS1001 Standalone network mode (as standalone reader). But if prior to this installation it was connected to a Master Controller as part of an MTS system, the network mode setting has been changed to MTS Node. In such case, you need to switch the IS1001 from MTS Node to IS1001 Standalone network operation mode by using the **RNMS** command (see page 30).

   You should see the echo of all characters in the Data Traffic window as you type. Press Enter and verify the reader's network mode has been changed to "Standalone" from the confirmation message.

4. Tune the antenna by entering the Antenna Full Tune (**AFT**) command.

   The Antenna Full Tune process will take approximately 40 seconds to complete. During this process the IS1001 reader will go through every possible electronically switched capacitor setting combination. There are total of 1024 setting combinations (0 to 1023) providing a tuning capacitance range from 15nF to 124.25nF with +/-5% tolerance. The capacitance change step (resolution) is 220pF (+/-5%).

   - Setting "0" means all capacitors are switched OFF and the tuning capacitance value is at a minimum – 15.0nF (+/-5%).

   - Setting "1023" means all capacitors are switched ON and the tuning capacitance value is at a maximum – 124.25nF (+/-5%).

Note: These values may vary due to components' tolerances and should be used for reference purposes only. These values do not account for capacitance of components from other circuitries or antenna cable and parasitic capacitance that have an effect on antenna tuning.

The IS1001 reader will report the results of the entire tuning process and, if successful, will switch into Scan mode. The reader will select the capacitors setting that produced the highest antenna current as the **initial tuning capacitance** setting and will be used as the origination setting every time the reader is powered up or reset. At the same time, the antenna signal phase measurement is taken and saved as the **Dynamic Tuning Target Phase** value. This value will be used by the Dynamic Tuning feature (if enabled) to track any changes to the environment (such as water depth, ambient temperature, foreign objects presence, components deterioration, etc.) that may result in antenna de-tuning, and to adjust the capacitors setting accordingly to keep the antenna tuned. **Dynamic Tuning Phase Deviation Threshold** value will be determined and set based on the maximum phase value change. These maximum phase value changes are the result of the smallest step tuning capacitance change around the highest antenna current point.

Note: It is recommended to adjust tuning capacitance at the antenna, so that the highest antenna current is achieved with IS1001 reader tuning capacitance settings that are NOT close to 256, 512, 768, when the two largest value capacitors are switched in, and all smaller value capacitors are switched out, resulting in rapid tuning capacitance reduction (due to +/- 5% tolerance of the utilized capacitors).

If the antenna is out of tuning range:

- The IS1001 reader will switch itself to Standby mode and display a message suggesting if the antenna tuning capacitance needs to be increased or decreased. No changes will be made to the existing antenna tuning parameters.

- The tuning capacitance needs to be increased or decreased at the antenna to bring it within the tuning range of the IS1001 reader.

Antenna Dynamic Tuning

When the antenna de-tunes it means its signal phase has deviated from the target value. During system operation, Dynamic Tuning tracks this phase deviation to determine when and what adjustments to make to the tuning capacitors setting to return the phase value to the target value and to re-tune the antenna. The adjustments are done gradually so there is no interruption of tag detection. If there is an interruption in tag detection, it is due to the antenna being too far out of tune while Dynamic Tuning is making the necessary adjustments.

Since Dynamic Tuning has a finite range, not all changes in antenna tuning can be recovered using electronically switched capacitors. With this in mind, it is recommended that you adjust the capacitors at the antenna so that the initial tuning capacitance setting is as close to the mid-range as possible.

There are customizable alarms available that can notify you in advance if your system is approaching the limit of the Dynamic Tuning range. Alarms will also notify you if the antenna is out of tuning range, and they will suggest the direction of changes to make to antenna capacitors.

The responsiveness (sensitivity) of the Dynamic Tuning can be adjusted by changing the **Dynamic Tuning Phase Deviation Threshold** value. Dynamic Tuning will not attempt any tuning capacitance adjustments until the phase deviation value exceeds the threshold setting in either direction. This value is determined and set automatically during Antenna Full Tune process, but can be adjusted afterwards, if necessary. For instance, for low Q systems, where wider tuning changes would not cause big detection losses, or for systems with rapid and frequently changing conditions, the threshold setting can be set higher (10 or more) to reduce the unnecessary Dynamic Tuning activity. But beware of setting the deviation value so low that the reader is not able to maintain the tune point or so high that the IS1001 reader is not making any adjustments.

Adjusting Antenna Output Power

Note: This section does not apply to IS1001-12V readers because their exciter voltage is fixed at 10 V DC.

Antenna output power (current) can be adjusted by changing exciter voltage (VE Level) on standard 24 V DC IS1001 readers. There are five steps of exciter voltage adjustments: from 12 V DC to 20 V DC in 2 V increments. Therefore, setting "1" adjusts the exciter voltage to 12 V DC (the minimum antenna power) and setting "5" adjusts the exciter voltage to 20 V DC (the maximum antenna power).

It is recommended that you set antenna output power (current) to the lowest setting that provides the necessary detection range.

Antenna Over-Current Protection and Dynamic Output Power

The IS1001 reader has a built-in antenna current limiting mechanism that will generate an alarm message when an antenna current in excess of 10 A peak-to-peak is detected and will automatically reduce the exciter voltage when an antenna current in excess of 11 A peak-to-peak is detected in order to bring the later to an acceptable level. If an antenna current exceeds 11 A peak-to-peak, even at the minimal exciter voltage setting, the IS1001 reader will switch to Standby mode until it is reset or toggled back to Scan mode.

If after the over-current protection had been activated and exciter voltage level had been reduced to keep antenna current below 11 A peak-to-peak, the IS1001 reader detects antenna current drop of more than 5%, the reader will return exciter voltage level to the original, defined by user, setting in order to maintain highest acceptable antenna current.

Over-Temperature Protection

The IS1001 reader has a built-in over-temperature protection mechanism that will generate an alarm message when the temperature inside its enclosure above +65°C is detected.

If the temperature reaches +75°C, the IS1001 reader will automatically switch into Standby mode to reduce the amount of heat it is generating and will switch back into Scan mode once the temperature drops below +70°C.

Detecting and Capturing Tag IDs

When the IS1001 reader is powered on or reset, it will automatically start in Scan mode and will immediately begin scanning for tags. Depending on the configuration, detected tag IDs may be stored in up to 5 locations:

- Internal IS1001 reader memory
- Locally-attached computer
- Remote computer
- USB Data Logger external flash drive
- BLE Data Logger memory

Storing Tag IDs in IS1001 Reader Memory

New tag IDs will be stored in IS1001 reader's internal memory if the **Save Tags to Memory** (**MTG**) setting is enabled. The IS1001 memory can store up to 78,583 tag IDs (with signal level and temperature measurements, when enabled).

In addition:

- Duplicate tag IDs (the same tag ID detected multiple times by the same IS1001 reader) may or may not be recorded depending on how **Set Detection Unique Mode** is configured. See the **DUM** command in the *IS1001 Reader Commands* section beginning on page 30.
- Virtual Test Tag IDs will be stored in memory if the **Save Virtual Tags to Memory** setting is enabled. See the **MVT** command in the *IS1001 Reader Commands* section beginning on page 30.

Storing Tag IDs on Locally-Attached Computer

New tag IDs will be sent to the local USB port if the **Set Tags Communication to Local Port** (**CTL**) setting is enabled. Duplicate tags may or may not be sent depending on how **Set Detection Unique Mode** is configured.

The BioTerm or BioStat communication program monitoring this port will receive the tag data. See page 21 for information on using the USB port.

Storing Tag IDs on Remote Computer or on Optional Data Logger Board

These two options are mutually exclusive; tag IDs may be stored on a remote computer OR stored on an optional Data Logger Board. Using both storage options is not available. By default, new tag IDs are sent to the chosen storage device. Duplicate tag IDs (the same tag ID detected multiple times by the same IS1001 reader) well be sent to the chosen storage device based on the **Set Detection Unique** Mode setting. See the **DUM** command in the *IS1001 Reader Commands* section beginning on page 30.

- Optional Remote Communication Board can be used to send tag data over a hardwire Ethernet network or over a serial Fiber Optic line for live data capture.

  The BioTerm or BioStat communication programs monitoring these ports will receive the data. See pages 22 and 24 for information on using these ports.

- Optional USB Data Logger Board can be used to store tag data on an external USB flash drive. See USB Data Logger User Manual for details on collecting data.

- Optional BLE Data Logger Board can be used to store tag data on its extended flash memory. See BLE Data Logger User Manual for details on collecting data.

Tag Detection Counter

The tag detection counter shows the number of tag IDs that have been detected since the IS1001 reader was powered on or since the counter was reset.

- The tag counter behavior is configured using the **Set Detection Counter** setting. See the **DCS** command in the *IS1001 Reader Commands* section beginning on page 30.

- To view the number of tag detections, generate a full status report (see page 41).

Tag Memory Counter

The tag memory counter shows the number of tag IDs stored in IS1001 reader internal memory. To view this counter, generate a full status report (see page 41).

Downloading Tag IDs from IS1001 Reader Memory

To download tag IDs and short status reports that are stored in IS1001 reader's internal memory, use the **MED** command. The data will be sent only to the port that initiated the **MED** command.

Establishing Connection with IS1001 Reader

There are five ways to make a connection with the IS1001 reader:

- **USB port:** Connects the IS1001 reader to a local device such as a laptop. Use this port to monitor, maintain, and update the IS1001 reader while at the local site. Tag IDs detected by the IS1001 reader are sent to this port only if the **Set Tags Communication to Local Port** command has been issued (**CTL1**). Sending other types of data to the local port can also be controlled using the **CAL** and **CML** commands. This port operates using the ASCII protocol. See page 21 for information on using the USB port.

- **Fiber Optic Transmit and Receive ports:** (requires the optional Remote Communication Board.) Connects the IS1001 reader to a high-speed fiber optic serial network for long distance communication. Use this port to monitor, maintain, and update the IS1001 reader from a remote site. Tag IDs detected by the IS1001 reader are automatically sent to this port. Other data such as alarms and messages are also automatically sent to this port. This port operates using the ASCII protocol, so make sure to verify the setting of the IS1001 reader Remote Communication Port protocol and use the **CPR** command to set it to ASCII, if necessary. See page 22 for information on using the fiber optic ports.

- **Ethernet port:** (requires the optional Remote Communication Board.) Connects the IS1001 reader to a local area network (LAN). Use this port to monitor, maintain, and update the IS1001 reader from a remote site. Tag IDs detected by the IS1001 reader are automatically sent to this port. Other types of data such as alarms and messages are also automatically sent to this port. This port operates using the ASCII protocol, so make sure to verify the setting of the IS1001 reader Remote Communication Port protocol and use the **CPR** command to set it to ASCII, if necessary. See page 24 for information on using the Ethernet port.

- **RS-232 port:** (requires the optional USB Data Logger Board or BLE Data Logger Board) Use this port to monitor, maintain and update the IS1001 reader from a local computer by opening Direct Communication Channel To the reader. Tag IDs, detected by the IS1001 reader, can be configured to be sent to this port. This port operates using the ASCII protocol, so make sure to verify the setting of the IS1001 reader Remote Communication Port protocol and use the **CPR** command to set it to ASCII, if necessary. See IS1001 USB Data Logger User Manual or IS1001 BLE Data Logger User Manual for information on using the RS-232 port.

- **Bluetooth port:** (requires the optional BLE Data Logger Board) Use this port to monitor, maintain and update the IS1001 reader from a local computer by opening Direct Communication Channel To the reader. Tag IDs, detected by the IS1001 reader, can be configured to be sent to this port. This port operates using the ASCII protocol, so make sure to verify the setting of the IS1001 reader Remote Communication Port protocol and use the **CPR** command to set it to ASCII, if necessary. See IS1001 BLE Data Logger User Manual for information on using the Bluetooth port.

Although multiple connections may be established, only a single connection is recommended. This will prevent conflicting configuration commands from being sent simultaneously from different sources.

Note: USB port communication is achieved through IS1001 reader Local Communication Port. All other communication connections are passed through IS1001 reader Remote Communication Port. By default, the tag IDs, alarms, messages, and automatic reports are sent by the IS1001 reader to both of its communication ports. The type of data sent to the Local Port can be customized by using CAL, CML, and CTL commands.

ASCII Protocol

ASCII protocol is used for communication between IS1001 reader and a PC. ASCII (American Standard Code for Information Interchange) is a character-encoding scheme based on the ordering of the English alphabet. A string of 7 binary digits represents each character. This is the simplest communications protocol. It transmits only ASCII characters, uses ASCII control codes, and implies little or no error checking. This protocol is supported by the BioTerm and BioStat programs developed by Biomark and by most standard communications programs such as Terminal, HyperTerminal, Tera Term Pro, ProComm, PuTTY, etc.

Biomark recommends using BioTerm and BioStat programs to securely monitor, maintain, and update an IS1001 reader. For more details refer to BioTerm and BioStat User Manual, available at: https://www.biomark.com/pub/media/BioTerm_and_BioStat_User_Manual_Rev2.pdf.

The BioTerm and BioStat programs are available for download at: https://www.biomark.com/software-drivers.

Message Types and Formats

To help sort the data, all messages have an identifier to delineate type:

- MSG: Used to define an informational message

- ALM: Used to define an alarm or error message

- TAG: Used to define a tag ID message

- SRP: Used to define an abbreviated status report message

- NRP: Used to define an abbreviated noise report message

- INF: Used to define the beginning or end of multi-line informational messages (such as reports, memory downloads, etc.)

MSG, ALM, TAG, SRP and NRP type messages have the following format:

<Identifier>: <Reader ID> <Date> <Time> <Message Body>

Messages Examples

ALM: 01 06/05/2019 11:06:35.750 Noise High

MSG: 01 06/05/2019 11:06:35.750 Noise In Spec.

TAG: 01 06/05/2019 11:06:35.750 3D9.2098AB0380

TAG: 01 06/05/2019 11:06:35.750 3D9.2098AB0380 30.0 C

TAG: 01 06/05/2019 11:06:35.750 3D9.2098AB0380 30.0 C 202 mV

SRP: 01 06/05/2019 11:06:35.750 16,4,212,0,0,126,140,131,19,219,263,0,0,0,0,0

NRP: 01 06/05/2019 11:06:35.750 0,19,18,60

INF type messages contain multiple lines and have two lines with identifier delineating the beginning and the end of the message:

INF: Start Of Noise Report
  Present Noise: 85 mV (9%)
  Maximum Noise: 177 mV (19%)
  Average Noise: 162 mV (18%)
 Time Averaged Over: 0:01:00
INF: End Of Noise Report

Note: An asterisk (*) at the beginning of a message indicates that the message is being sent as part of a memory download.

USB Port Operation

The IS1001 reader can be operated and configured locally using the USB communication port.

Note: BioTerm or BioStat and the proper driver must be installed on your computer. If your computer is missing these programs, see the Pre-Installation Steps section on page 8.

1. Connect the IS1001 reader to a local computer using a USB type A-to-mini USB type B cable (not supplied).

2. Start the BioTerm or BioStat communication program.

3. In the **Serial Port** box, make sure that **COMx Silicon Labs CP210x USB to UART Bridge** is selected (where x is the port number assigned to the local computer's USB port).

4. In the **Baud Rate** box, make sure you match the IS1001 reader's Local Port speed setting (the factory default baud rate setting is **115200 baud**).

5. Make a serial port connection to the IS1001 reader by clicking on the **Open** button.
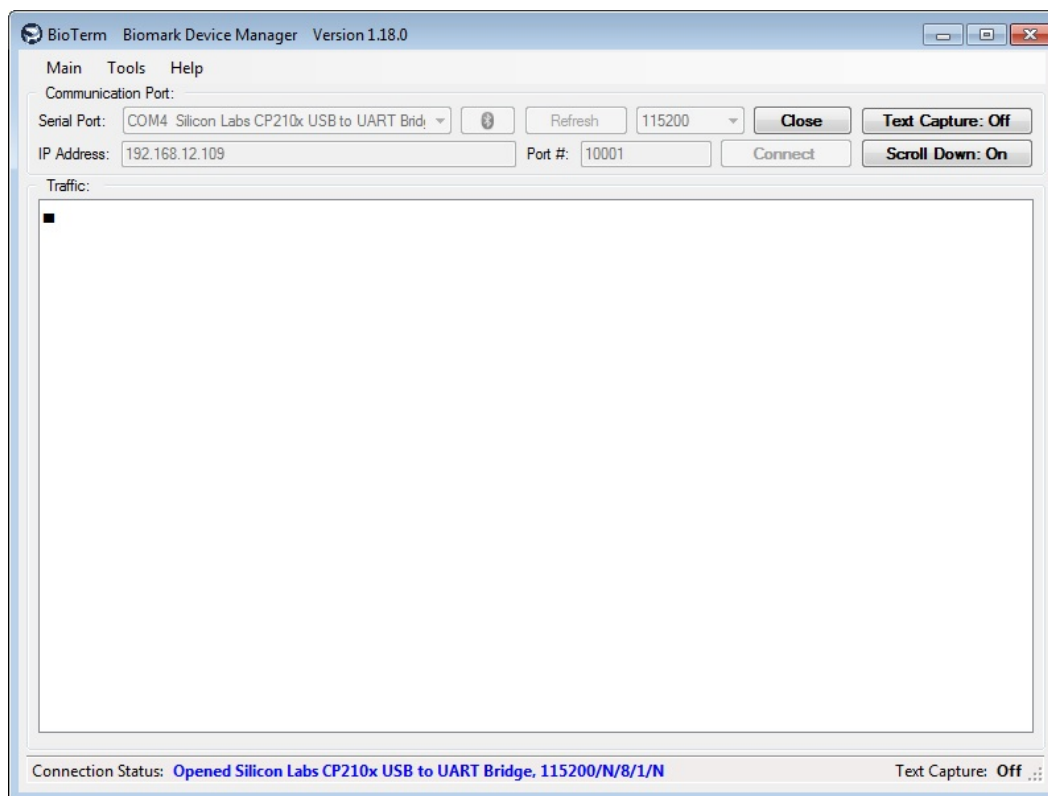
6. To verify the connection between the computer and the IS1001 reader, within BioTerm or BioStat **Traffic** window type **?** and then press **Enter**. A list of available commands should be displayed. All the commands are described in detail on page 30.

7. Type appropriate commands to perform the desired actions.

8. As shown in the example above, BioTerm may be used to capture Tag IDs, alarm messages, reports, etc. from the attached IS1001 into a text file. To configure the BioTerm utility program to act as a data logger, select **Tools > Enable Capture** or by clicking on the **Text Capture ON/OFF** button. By default, captured data is written to a text file (BioTerm.txt) on the Windows Desktop.

Fiber Optic Port Operation

Note: The optional Remote Communication Board is required to make a serial fiber optic connection. This connection will require an additional piece of hardware- a fiber optic-to-serial converter (not supplied).

The IS1001 reader can be operated and configured remotely using a serial fiber optic connection. To establish a connection:

1. Connect the IS1001 reader to a network using fiber optic cables (not supplied).

2. Start the BioTerm or BioStat communication program.

3. Determine the communication port number assigned to the fiber optic-to-serial communication converter.

4. In the BioTerm or BioStat **Serial Port** box, select the serial port number you identified in the previous step.

5. In the **Baud Rate** box, make sure you match the IS1001 reader's Remote Port speed setting that is fixed to 115200.

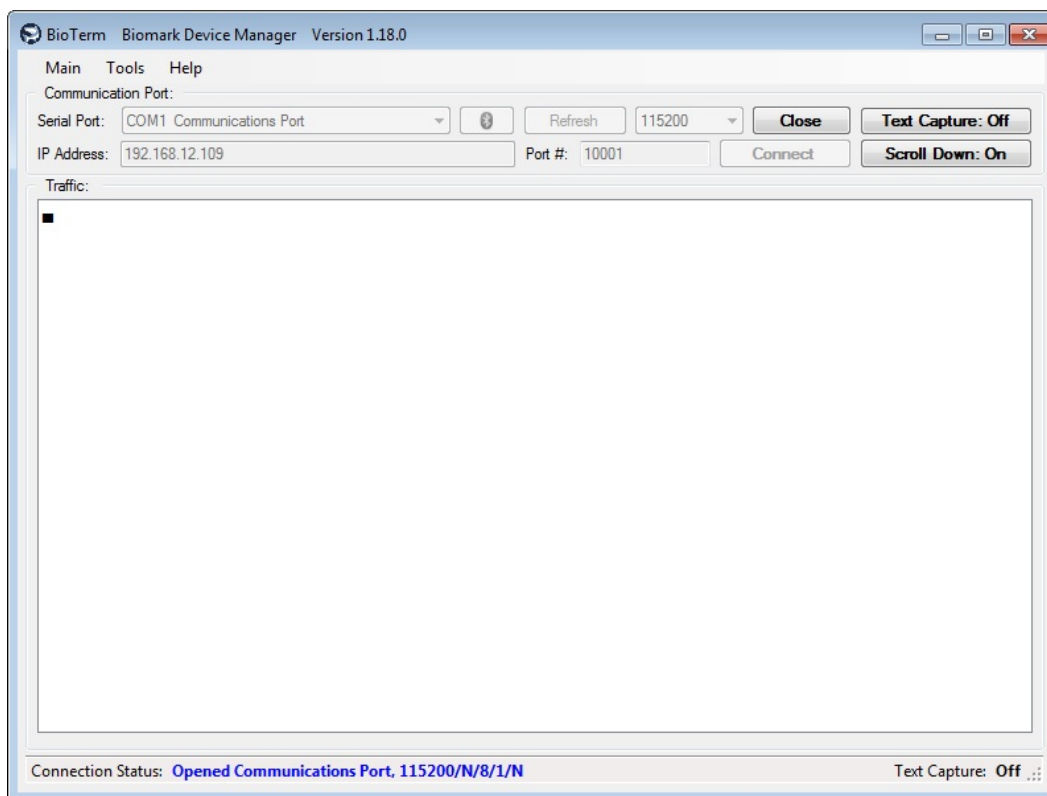6. Make a serial port connection to the IS1001 reader by clicking on the **Open** button.

7. To verify the connection between the computer and the IS1001 reader, within BioTerm or BioStat **Traffic** window type **?** and then press **Enter**. A list of available commands should be displayed. All the commands are described in detail on page 30.

8. Type appropriate commands to perform the desired actions.

9. As shown in the example above, BioTerm may be used to capture Tag IDs, alarm messages, reports, etc. from the attached IS1001 into a text file. To configure the BioTerm utility program to act as a data logger, select **Tools > Enable Capture** or by clicking on the **Text Capture**

ON/OFF button. By default, captured data is written to a text file (BioTerm.txt) on the Windows Desktop.

Ethernet Port Operation

Note: The optional Remote Communication Board is required to make an Ethernet connection.

The IS1001 reader can be monitored and configured remotely across a local area network.

1. Connect the IS1001 reader to a local area network with an available Dynamic Host Configuration Protocol (DHCP) server using a CAT5 or greater Ethernet cable (not supplied).

2. With the PC attached to the same local area network, start the BioTerm or BioStat communication program.

3. Determine the IS1001 reader's IP address by selecting **Tools > Lantronix Device Utilities** and clicking on the **Search** button within the BioTerm or BioStat utility.

   The IS1001 reader is set to automatically obtain an IP address from the network's DHCP server when it is powered on. The easiest way to discover the assigned IP address is to use the BioTerm or BioStat communication program. This utility will scan the network for Lantronix products (the IS1001 reader uses a Lantronix XPort Ethernet module) and will display the IP addresses of the devices it finds. If there are multiple IS1001 readers on the network use the MAC address of the IS1001 readers' Ethernet module to help identify each one.
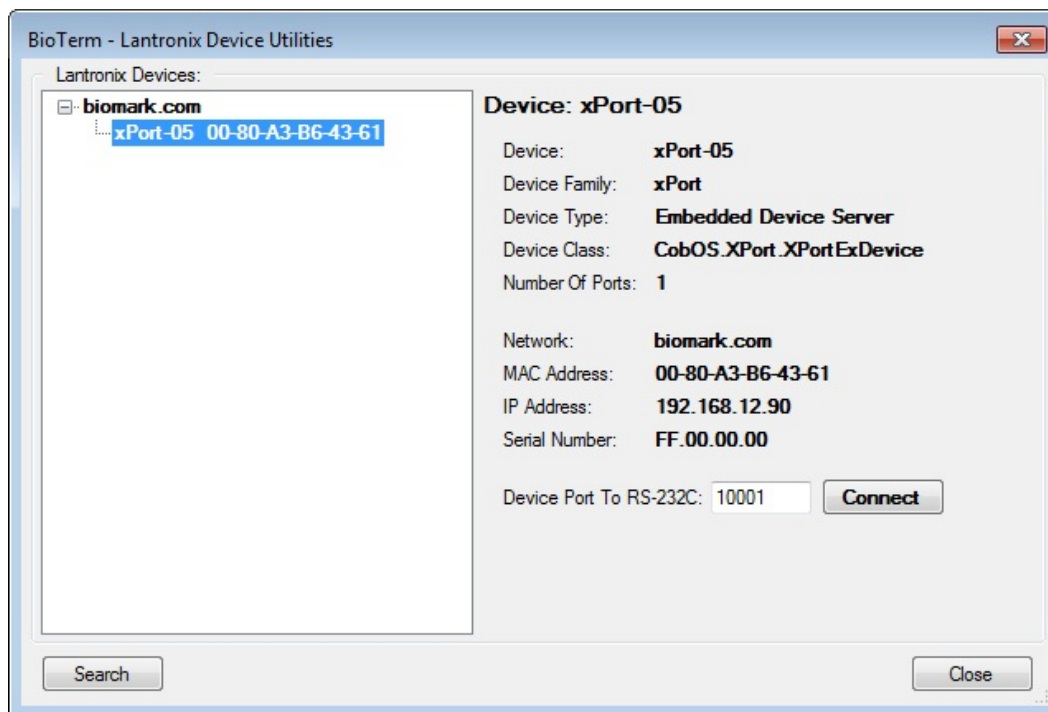
4. Select the desired IS1001 reader and then click on the **Connect** button to make a connection to the IS1001 reader.

   If you receive an error when attempting the connection, make sure the BioTerm or BioStat communication parameters are configured as follows:

   - *IP address* = the IS1001 reader's IP address

   - *Port* = 10001

   - *Connection type* = TCP/IP

   If connection problems persist or if the IS1001 reader is not shown in the list of found devices, use the Lantronix DeviceInstaller utility to reconfigure the IS1001 reader's XPort Ethernet

module (described in the *Configuring the IS1001 Reader's Ethernet Settings* section on page 25).
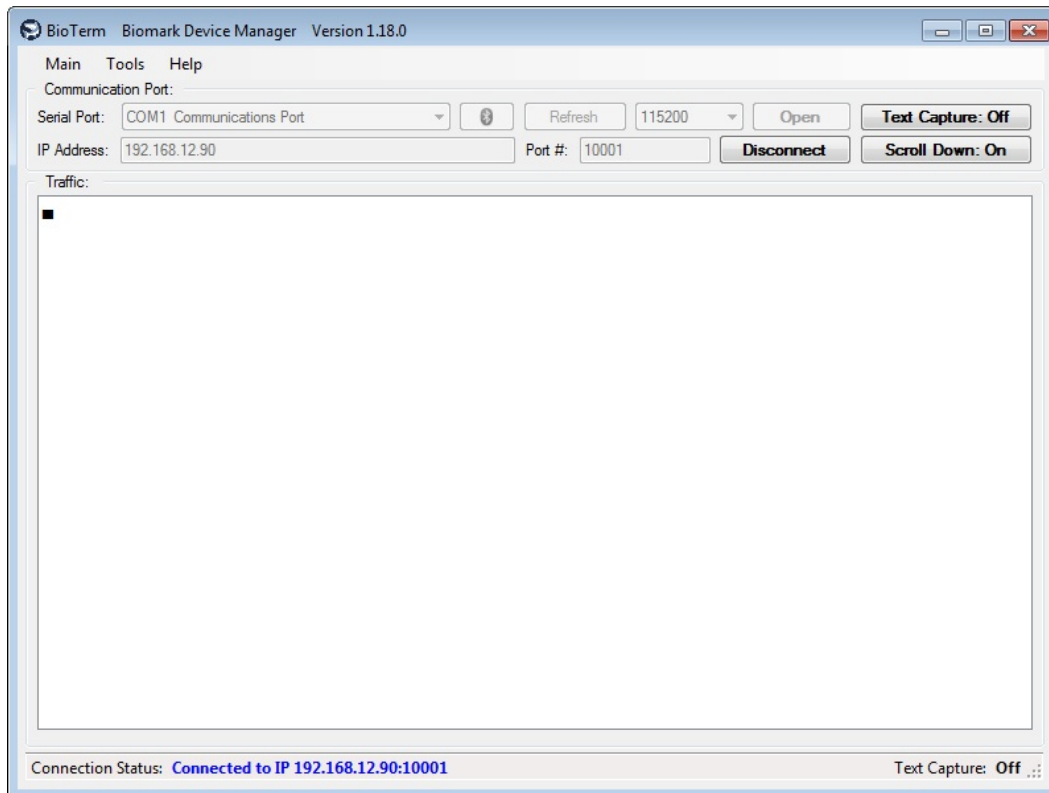
5. To verify the connection between the computer and the IS1001 reader, within BioTerm or BioStat **Traffic** window type **?** and then press **Enter**. A list of available commands should be displayed. All the commands are described in detail on page 30.

6. Type appropriate commands to perform the desired actions.

7. BioTerm may be used to capture Tag IDs, alarm messages, reports, etc. from the attached IS1001 into a text file. To configure the BioTerm utility program to act as a data logger, select **Tools > Enable Capture** or by clicking on the **Text Capture ON/OFF button**. By default, captured data is written to a text file (BioTerm.txt) on the Windows Desktop.

Configuring Ethernet Settings

Note: *The optional Remote Communication Board is required to make an Ethernet connection.*

This section describes how to properly configure the IS1001 Ethernet module (Lantronix XPort module). By default, the module is configured to request a IP address from a DHCP server when connected to the network. Changes may be necessary, however, if a firmware upgrade becomes available for the Lantronix XPort module or if your local network requires changes to the configuration.

To perform these maintenance tasks, Lantronix provides a free, Windows-based utility, Lantronix DeviceInstaller. DeviceInstaller provides the ability to search for and configure Lantronix XPort devices attached to the network.
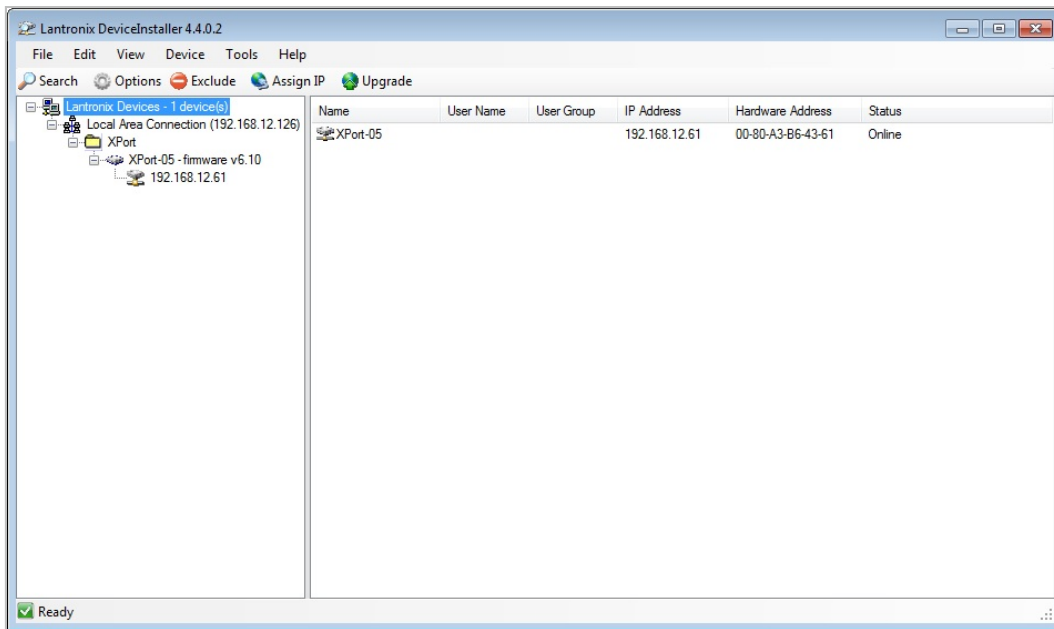
DeviceInstaller is available for download at:
http://www.lantronix.com/device-networking/utilities-tools/device-installer.html

DeviceInstaller provides the ability to:

- Update Lantronix XPort firmware

- Setup the XPort module to request a DHCP IP address or set a static IP address

- Configure important network settings such as TCP timeout and MTU- important for slower speed, limited bandwidth network connections

- Enable web-based and telnet communication with the XPort module

- Ping or query XPort device(s) attached to the network

- Password protect access to both the IS1001 and the XPort module configuration

Note: For additional information, see the Lantronix XPort User Guide, available at:
http://www.lantronix.com/pdf/XPort_UG.pdf.

Assigning Static IP Address to IS1001 Reader

When a default configured IS1001 reader is connected to a network with DHCP service, it will be assigned an IP address based on the network's addressing scheme. Depending on your network configuration, this IP address may change each time the IS1001 is power-cycled. To assign the IS1001 reader a static IP address:

1. Contact the network administrator for a static IP address assignment including information on the network's subnet mask and default gateway.

2. Connect the IS1001 reader to the network.

3. Within the Lantronix DeviceInstaller, click on **Search** to locate the IS1001 reader and identify its current IP address.

   Note: If there are multiple IS1001 readers at the site, use the MAC address of the IS1001 readers' Ethernet module to uniquely identify each IS1001 reader.

4. In the left-hand pane, select the IS1001 reader's XPort module by clicking on its identified IP address.

5. Click on the **Assign IP** button and follow the on-screen instructions for assigning a specific IP address and associated subnet mask and default gateway.

Note: More information about Lantronix DeviceInstaller and XPort configuration may be found in the Lantronix XPort User Guide available at: http://www.lantronix.com/pdf/XPort_UG.pdf
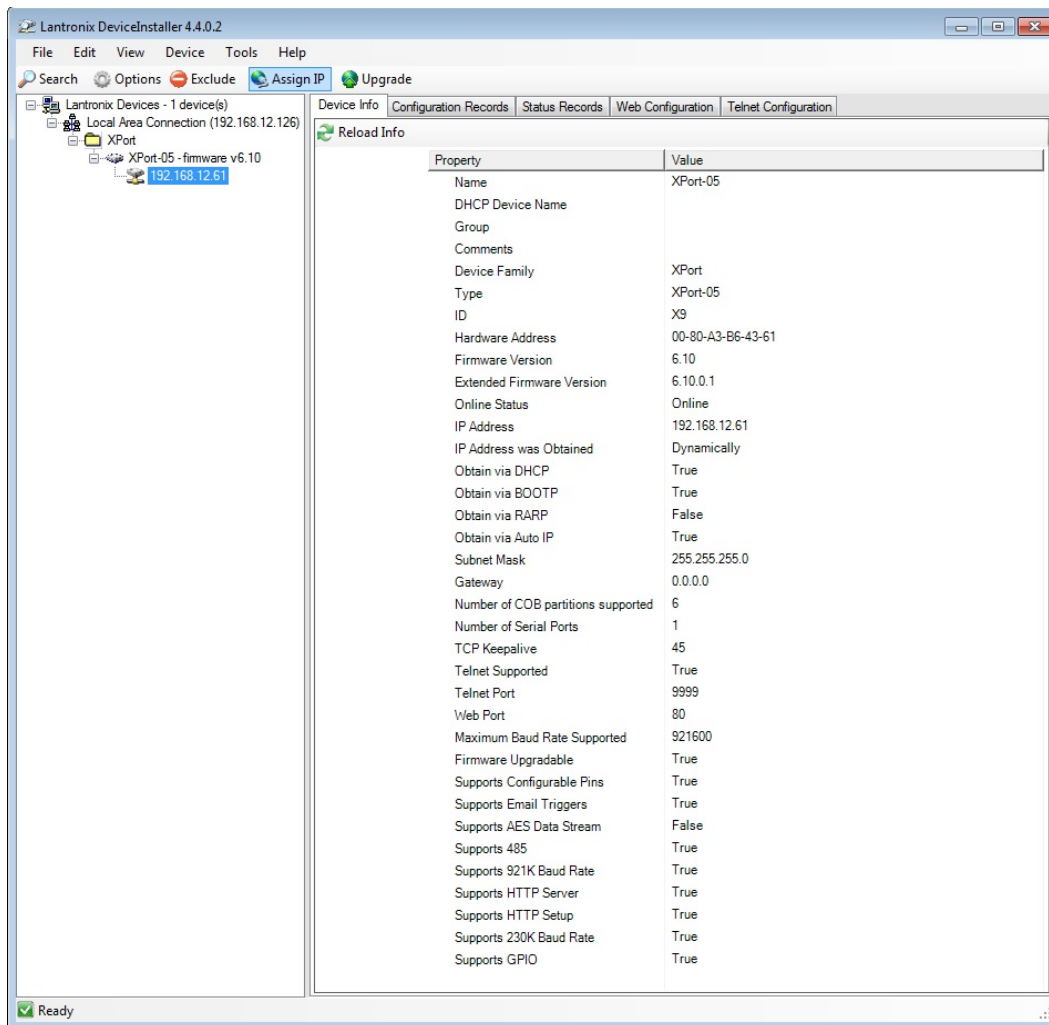
Configuring Ethernet Module Settings

Important! Only experienced and qualified network administrators should attempt to modify any of the IS1001 reader's Ethernet configuration settings.

1. In the left-hand pane, select the IS1001 reader's XPort module by clicking on its IP address.

2. In the right-hand pane, select the **Web Configuration** tab.

   The IS1001 reader's IP address/URL access address is displayed in the **Address:** field.

3. To the right of the IP address/URL access address, click on the green arrow.

4. A **Windows Security** dialog box will appear. For default configuration IS1001s, access credentials are not set. Click on the **OK** button in the security dialog box to proceed.

   Note: For more information on securing access to both the Lantronix XPort module configuration and password protecting access to the IS1001 terminal interface, refer to the ***Configuration Using Web Manager - Server Configuration*** *and* ***Channel 1 Configuration*** *sections of the Lantronix XPort User Guide, available at:* http://www.lantronix.com/pdf/XPort_UG.pdf
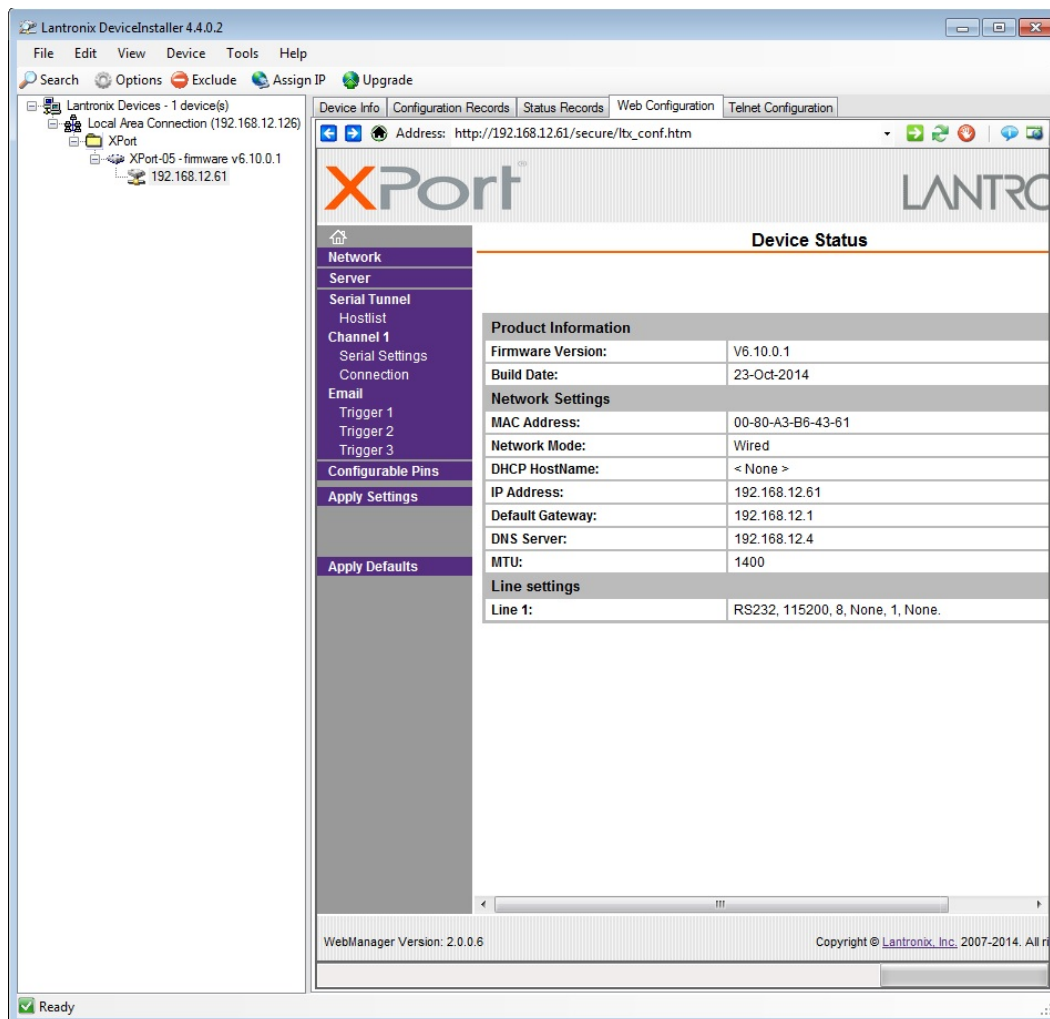
5. Use the browser interface to modify the desired settings.

6. Once the settings are modified, click on the **OK** button at the bottom of the settings section to save changes. Once all changes have been made, press **Apply Settings** in the left column

to commit all changes made during the configuration session. This will restart the XPort module.

7. Following a reboot, the XPort module will return. Verify that the new settings have been applied.

Important! Make sure the XPort module's Serial Settings match the IS1001 reader's Remote Port settings. The IS1001 reader's Remote Port speed is fixed to 115200.

Commands

The IS1001 reader commands are made up of three or more characters followed by a carriage return, as illustrated in the following example:

<div align="center">ACL1.0↵</div>

Generally, the first three letters designate the command group and the remaining letters/digits designate the command parameters; commands are **not** case sensitive. The backspace key can be used to correct mistakes. Command responses confirming the requested action or setting parameter change are sent to all available ports (unless the **CML0** command has been set, in which case responses will not be sent to the local USB port).

The following table is a list of the available commands:

Cmd	Format	Description
?		Print List of Commands Used to display the list of available commands. *Note: The response is sent only to the port from which the list of commands was requested.*
Alarms		
ACL	{0.0-9.0}	Set Antenna Current Low Alarm Threshold in Amperes Used to set the low antenna current alarm threshold. Valid values are 0.0 (disabled), 0.1 – 9.0 Amperes peak-to-peak. Default is 1.0A. An Antenna Current Low alarm will be issued if the current in the IS1001 reader's antenna drops below the specified value. A low antenna current may be caused by an out-of-tune antenna, a damaged antenna, or a bad antenna connection.
ANH	{0-100}	Set Noise High Alarm Threshold Percent Used to set the excessive noise level alarm threshold. Valid values are 0 (disabled), 1 – 100%. Default is 20%. A Noise High alarm will be issued if the noise level exceeds the specified level. A high noise level may indicate a tuning or connection problem.
ATH	{512-1023}	Set Tuning Capacitance High Alarm Threshold Used to set the tuning capacitance high alarm threshold. If an IS1001 reader's tuning capacitance value becomes equal to or greater than this limit, an alarm will be sent. Valid values are 512 – 1023. Default is 970.
ATL	{0-511}	Set Tuning Capacitance Low Alarm Threshold Used to set the tuning capacitance low alarm threshold. If an IS1001 reader's tuning capacitance value becomes equal to or less than this limit, an alarm will be sent. Valid values are 0 – 511. Default is 50.
AUD	{0-3600}	Set Alarms Unique Delay in Seconds

		Used to set the alarm auto rebroadcast period. Valid values are 0 (disabled), 1 – 3600 seconds. Default is 3600 seconds.
		This specifies how long to wait before rebroadcasting a persistent alarm. For example, if Alarm Unique Delay = 60 and the capacitance low alarm is triggered, the IS1001 reader will wait 60 seconds before resending the alarm. If the alarm condition clears and then reappears, the new alarm will be sent without delay.
		Note: The Virtual Tag Test Failed alarm and the Antenna Over Current alarm are the exceptions and will not be rebroadcast. These alarms are triggered only when the condition takes effect.
Antenna/Tuning		
ADT	{1|0}	Set Dynamic Tuning {1} ON, {0} OFF
		Used to set antenna dynamic tuning to either ON or OFF. Default is ON.
		Dynamic Tuning automatically adjusts the tuning capacitance settings to achieve the set target phase value.
AFT		Perform Antenna Full Tune
		Used to initiate the full auto-tune process for the antenna attached to the IS1001 reader. It is used to determine the optimum tuning parameters. During this process the IS1001 reader goes through every possible electronically-switched capacitor setting combination to find the tuning target phase, the tuning phase deviation threshold, and the initial tuning capacitance setting based on the properties of your system and its environment.
		Note: The initial tuning capacitance setting will be used as the origination setting every time the reader is powered up or reset.
		The full auto-tune process will typically take about 40 seconds to complete.
		Results of the entire process are sent to all available ports for review and analysis. This information is useful for determining the proper tuning capacitance adjustments at the antenna, if needed.
		The **Esc** key can be used to cancel the process.
		Note: The full auto-tune process should be performed during initial system installation; after IS1001 reader's parameters are reset to default values and anytime the antenna has been repaired, replaced, or moved to a new location, as this may change the optimal settings for the antenna.
ATC	{0-1023}	Set Antenna Tuning Capacitors
		Used to set the specific antenna tuning capacitance setting. Valid values are 0 – 1023.
		Note: This value is also controlled by the dynamic tuning mechanism. You should turn OFF dynamic tuning while manually adjusting the tuning capacitors or the settings will be overridden by the auto-tuning mechanism. Changing capacitors manually should

		only be considered if a high-precision tune is required. In this case you can set up any value of the tuning capacitors and check the read performance. When the desired read performance is achieved, note the corresponding measured phase and set this value as the target phase for the IS1001 reader.
ATP	{300-500}	Set Dynamic Tuning Target Phase Used to set or adjust the dynamic tuning target phase. Valid values are 300 – 500. Default is 390. This value is determined and set automatically during the Antenna Full Tune process. *Note: Changing target phase manually should only be considered if a high-precision tune is required. In this case you can adjust target phase value to see if better read performance can be achieved.*
ATS	{2-63}	Set Dynamic Tuning Target Phase Deviation Threshold Used to set or adjust the tuning phase deviation threshold. Valid deviation values are 2 – 63. Default is 10. This specifies how far the actual antenna signal phase can deviate from the target phase before the IS1001 reader begins the dynamic auto-tune process. During this process the IS1001 reader adjusts capacitance in an effort to return to the target phase and retune its antenna. This value is determined and set automatically during the Antenna Full Tune process. *Note: In low Q systems, setting the Phase Deviation rather high (10 or more), may cause problems. Beware of setting the deviation value so high that the IS1001 reader is not making any adjustments at all or so low that the reader is not able to maintain the tune point.*
AVE	{1-5}	Set Exciter Voltage Level (Not available with model IS1001-12V) Sets the exciter voltage level to adjust the antenna output power (current). Valid values are 1 – 5. Default is 1.
Communication		
CAL	{1|0}	Set Alarms Communication to Local Port {1} ON, {0} OFF Specifies if alarms issued are sent to the local USB communication port. Valid options are either ON or OFF. Default is ON.
CML	{1|0}	Set Messages Communication to Local Port {1} ON, {0} OFF Specifies if messages issued are sent to the local USB communication port. Valid options are either ON or OFF. Default is ON.
CPR	{A|M}	Set Remote Communication Port Protocol {A} ASCII, {M} MODEM Sets the communication protocol of the remote communication port. Valid options are ASCII or MODEM. Default is ASCII.

		ASCII protocol is used in conjunction with either BioTerm or BioStat program to monitor, maintain, and update the IS1001 reader.
CRR	{F|S}	Set Remote Comm. Port Transfer Rate {F} Full, {S} Slow
		Sets the data transfer rate of the remote communication port. Valid options are Full or Slow. Default is Full.
		Slow transfer rate option should be used whenever external communication hardware has limited data transfer capabilities.
CSL	{bps}	Set Local Communication Port Speed
		Sets the speed of the local USB communication port. Valid options are 9600, 19200, 38400, 57600, or 115200. Default is 115200 bits/s.
CTL	{1|0}	Set Tags Communication to Local Port {1} ON, {0} OFF
		Specifies if detected tag IDs are sent to the local USB communication port. Valid options are either ON or OFF. Default is ON.
		Note: This parameter does not apply to previously detected tag IDs that are stored in memory.
		Also Note: The Detection Unique Mode (DUM) setting will be used to determine if duplicate tag IDs are sent to the USB port.
Detection		
DCS	{1|0|R}	Set Detection Counter {1} ON, {0} OFF, {R} Reset
		Specifies whether a running count of the detected tags is maintained. Valid values are ON, OFF, or ON+Reset. Default is ON.
		The detection counter counts detected tag IDs and depends on the **Detection Unique Mode** settings. It does not count Virtual Test Tag detections. It resets to 0 whenever the IS1001 reader resets, powers up, or you activate the **Reset** option.
DET	{1|0}	Set Detection Efficiency Test {1} ON, {0} OFF
		Enables the detection efficiency test. This is used to qualify the performance of the entire system. When enabled, a detection efficiency report will be generated every 4 seconds. Valid values are ON or OFF. Default is OFF.
		Efficiency is calculated as a percentage of the number of detections vs. the maximum possible over the allowed time interval. This test will work with physical tags and with a Virtual Test Tag.
DFH	{1|0}	Set FDXB Fastag Detection {1} ON, {0} OFF
		Specifies if FDX-B Fastag tag detection is enabled. Valid values are ON or OFF. Default is OFF.
DFT	{45-500}	Set FDXB Detection Scan Time in milliseconds (5ms increments).
		Sets the FDX cycle time when HDX is enabled. Valid values are 45 – 500 milliseconds. Default is 120 milliseconds.

DHT	{1|0}	Set HDX Tag Detection {1} ON, {0} OFF
		Specifies if HDX (half-duplex) tag detection is enabled. Valid values are ON or OFF. Default is OFF.
DTD	{0-1440}	Set Automatic Virtual Test Tag Single Shot Delay in Minutes
		Used to set the automatic Virtual Test Tag single shot activation delay. The delay can be set from 0 (disabled) to 1440 minutes (24 hours). When the delay expires the Virtual Test Tag will be activated for up to 120 milliseconds, unless the IS1001 reader has detected the presence of a real PIT tag at its antenna, in which case the Virtual Tag Test will be aborted and skipped. This test is done in order to verify that the system is operating properly, especially during extended periods when no PIT tags are present.
		*Note: Virtual Test Tag will be activated for the amount of time equal to the **FDXB Detection Scan Time** setting, but no longer than 120 milliseconds.*
DTS	{1|0}	Set FDXB Tag Signal Level Detection {1} ON, {0} OFF
		Enables FDXB tag detection signal level measurement. When enabled, every time a FDXB tag ID is successfully detected, signal level is measured and reported. The measured signal level value is appended to the end of the detected tag ID message; it is also stored with the tag ID in memory.
		Valid values are ON or OFF. Default is OFF.
DTT	{1|0}	Set BioTherm Tag Temperature Detection {1} ON, {0} OFF
		Implemented BioTherm tag temperature detection. The measured temperature value is appended to the end of the detected tag ID message; it is also stored with the tag ID in memory. The displayed temperature range is +25.0°C to +50.0°C. Temperature below range is displayed as "LL.L C", temperature above range is displayed as "HH.H C".
		Valid values are ON or OFF. Default is OFF.
		Note: Specified BioTherm tag temperature measurement accuracy is ±0.5°C, BUT only from +33.0°C to +43.0°C. Accuracy is not specified and not guaranteed outside the +33.0°C to +43.0°C range.
DUD	{1-43200}	Set Detection Unique Delay in Seconds
		Specifies the delay value for the **Detection Unique Mode Delay** option. Valid values are 1 – 43200 seconds. Default is 60 seconds.
		*Note: In order for **Detection Unique Delay** to take effect, **Detection Unique Mode** must be set to **Delay**.*
DUM	{5|1|0|D}	Set Detection Unique Mode {5} Last 5, {1} Last 1, {0} OFF, {D} Delay
		Specifies how the tag ID is handled if it is detected multiple times by the same IS1001 reader. Valid values are:
		• **Last 5:** The following occurs only if the tag ID is different from the last five dissimilar tag IDs previously detected by the IS1001

		reader: The tag ID is sent to the communication ports, is stored in memory, is counted by the detection counter, and is accompanied by a beeper sound (if these features are enabled). • **Last 1:** The following occurs only if the tag ID is different from the tag ID previously detected by the IS1001 reader: The tag ID is sent to the communication ports, is stored in memory, is counted by the detection counter, and is accompanied by a beeper sound (if these features are enabled). This is the default value. • **OFF:** Disables detection unique mode. All tag IDs are sent to the communication ports, stored in memory, counted by the detection counter, and accompanied by a beeper sound (if these features are enabled). • **Delay:** The following occurs only if the tag ID is different from the last five dissimilar tag IDs or if the specified number of seconds have passed since this tag ID was first detected: The tag ID is sent to the communication ports, is stored in memory, is counted by the detection counter, and is accompanied by a beeper sound (if these features are enabled). Use the **DUD** (**Detection Unique Delay**) command to specify the delay value. *Note: Detection Unique Mode rules do not apply to Virtual Test Tag ID.*
DVL	{0-255}	Set Virtual Test Tag Level Used to specify the Virtual Test Tag signal level. The higher this value is set, the stronger the Virtual Test Tag signal that will be generated. This allows you to check the IS1001 reader performance for sensitivity. Valid values are 0 – 255. Default is 128.
DVT	{1|0|S}	Set Virtual Test Tag {1} ON, {0} OFF, {S} Single-Shot Uses a virtual tag to perform a test that verifies the system's integrity and sensitivity. It generates an ISO FDX-B tag signal at selectable signal levels (**Virtual Test Tag Level**) and can be activated in the following manner: • Automatically, if **Automatic Virtual Test Tag Single Shot Delay** is set to a non-zero value. The test is performed at user-selectable intervals. • Manually, if this parameter is set to **Single Shot**. The test is initiated on the IS1001 reader for up to 120 milliseconds. *Note: Virtual Test Tag will be activated for the amount of time equal to the FDXB Detection Scan Time setting, but no longer than 120 milliseconds.* • Manually, if this parameter is set to **ON**. The test is initiated on the IS1001 reader continuously and works in conjunction with the detection efficiency test. The detection efficiency test is automatically activated when this parameter is set to ON and deactivated when this parameter is set to **OFF**.
Measurements		

MCG	{0-200}	Set Antenna Current Measurement Gain
		Sets antenna current measurement gain value. Valid values are 0 – 200. Default is 120.
		The antenna current measurement is calibrated and tested at the factory.
MCO	{0-200}	Set Antenna Current Measurement Offset
		Sets antenna current measurement offset value. Valid values are 0 – 200. Default is 110.
Memory		
MED		Download Entire Memory
		Initiates the download of all data contained in the IS1001 reader's memory.
		The **Esc** key can be used to cancel the process.
		Note: The data will be sent only to the port from which the memory download was requested.
MEE		Erase Entire Memory
		Permanently erases all data contained in the IS1001 reader's memory.
		The recommendation is to download the contents of memory to another computer or storage device before erasing memory.
MSD		Download Status Reports Memory
		Initiates the download of status reports data contained in the IS1001 reader's memory.
		The Esc key can be used to cancel the process.
		Note: The data will be sent only to the port from which the memory download was requested.
MSR	{1|0}	Save Status Reports to Memory {1} ON, {0} OFF
		Specifies if the short version of automatically generated status reports will be stored in memory. Valid values are ON or OFF. Default is ON.
MTD		Download Tags Memory
		Initiates the download of tags data contained in the IS1001 reader's memory.
		The Esc key can be used to cancel the process.
		Note: The data will be sent only to the port from which the memory download was requested.
MTG	{1|0}	Save Tags to Memory {1} ON, {0} OFF
		Specifies if tag IDs will be stored in memory as they are detected. Valid values are ON or OFF. Default is ON.

MVT	{1|0}	Save Virtual Tags to Memory {1} ON, {0} OFF
		Specifies if Virtual Test Tag IDs will be stored in memory as they are detected. Valid values are ON or OFF. Default is ON.
Reader		
RBS	{1|0}	Set Reader Beeper {1} ON, {0} OFF
		Specifies if the IS1001 reader's internal speaker will issue an audible beep when a tag is detected. Valid values are ON or OFF. Default is OFF.
		Note: The IS1001 reader's internal beeper is contained on the optional accessory boards.
RDF	{H|D}	Set Reader Tag ID Display Format {H} Hexadecimal, {D} Decimal
		Specifies the format for displaying detected tag IDs. Valid values are Hexadecimal or Decimal. Default is Hexadecimal.
RDP		Reset to Factory Default Parameters
		Replaces all IS1001 reader present settings with the factory default values.
		Note: Current Measurement Gain and Current Measurement Offset present values will be preserved and will not be changed to default.
RDS	{MM/DD/YYYY}	Set Reader Date
		Sets the IS1001 reader's real-time clock present date. The date is specified as mm/dd/yyyy.
RID	{1,0}	Set Reader Initiation Delay {1} ON, {0} OFF
		Specifies if the IS1001 reader will delay the startup diagnostics and the schedule of all enabled automatic diagnostics. These diagnostics include Virtual Tag Test, Status Report and Noise Report. All other functionalities, including tag detection, are not delayed. Valid values are ON or OFF. Default is OFF.
		The delay time is calculated by multiplying the IS1001's **Reader ID** by 1 second.
RIS	{01-FF}	Set Reader ID in HEX
		Sets the distinctive ID for this IS1001 reader. The ID is a hexadecimal value in the range 01 – FF. Default is 01.
RIT	{0-10000}	Set Reader Idling Time in Milliseconds
		Sets for how long to switch the IS1001 reader into Standby mode (to conserve power) after each FDX-B or HDX cycle. The FDX-B cycle is defined by the FDXB Detection Scan Time parameter; the HDX cycle is controlled by the HDX Tag Detection setting. Valid values are 0 (disabled), 1 – 10000 milliseconds. Default is 0 (disabled).
		*Note: Reader Idling Time cannot be used in conjunction the **Reader Exciter Synchronization** set to **Secondary Master**. When Reader*

		*Idling Time is enabled with the **Standalone Exciter Synchronization Mode** setting, FDX-B and HDX cycles times will vary depending on tag(s) presence in the antenna field. For FDX-B, variance can range from 45 milliseconds to the present setting of the **FDXB Detection Scan Time** parameter, and from 4 to 20 milliseconds for HDX.*
RNM	{S|M}	Set Reader Network Mode {S} IS1001 Standalone, {M} MTS Node Switches the IS1001 reader to either Standalone network operation mode or MTS Node mode (in MTS Node mode the IS1001 reader is controlled by a Master Controller). Default is IS1001 Standalone mode.
ROM	{1|0|R}	Set Reader Operation Mode {1} Scan, {0} Standby, {R} Reset Sets the IS1001 reader into either Scan mode, Standby mode, or performs a reset.
RPS	{SS,DD}	Set Reader Periodic Standby: {Start Hours (00-23), Duration (00-23)} Sets at what hour of the day and for how many hours to automatically switch the IS1001 reader into Standby mode in order to save power during periods of inactivity. Default is 00,00 (disabled).
RSM	{1|2|3|0}	Set Reader Exciter Synchronization Mode {1} Master, {2} Secondary Master, {3} Slave, {0} Standalone Sets the IS1001 reader exciter synchronization mode. Valid values are Master, Secondary Master, Slave and Standalone. Default is Secondary Master. If set to Master, the IS1001 reader will use its own antenna exciter oscillator as the source of the synchronization signal and will transmit this signal over the synchronization network. If the unit is put in Standby mode, its synchronization output signal is disabled. While in Standby mode, if HDX tag detection is enabled, FDX-B and HDX cycles times will be fixed to either the present setting of the **FDXB Detection Scan Time** parameter for FDX-B, and 20 milliseconds for HDX. If set to Secondary Master and the reader does not detect the presence of synchronization signal on the synchronization network, the IS1001 reader will assume the Master role and will enable its own antenna exciter oscillator. Otherwise it will operate as a Slave and use antenna exciter oscillator signals received through the synchronization network. If set to Slave, the IS1001 reader will disable its own antenna exciter oscillator and use the synchronization signal received over the synchronization network. If set to Standalone, the IS1001 reader will use its own antenna exciter. In Standalone mode, if HDX tag detection is enabled, FDX-B and HDX cycles times will vary depending on tag(s) presence in the antenna field. For FDX-B, variance can range from 45 milliseconds to the present setting of the **FDXB Detection Scan**

		Time parameter, and from 4 to 20 milliseconds for HDX. Even though the synchronization signal is still transmitted over the synchronization network, this mode must not be used when multiple IS1001 readers are being synchronized.
RST	{1,0}	Set Reader As Source For Date/Time Synchronization {1} ON, {0} OFF Enables real-time clock synchronization and sets the IS1001 reader as the source. Valid values are ON or OFF. Default is OFF.
RSV	{VV,VV}	Set Reader Automatic Standby Activation and Deactivation Voltages (16-24,17-25) Specifies at what input voltage the IS1001 reader will automatically switch into Standby mode to extend battery life and at what input voltage it will switch back into Scan mode. Valid values are 16 to 24 V for activation of the feature (switching to Standby) and 17 to 25 V for deactivation (switching back to Scan). Default values are 16 V and 18 V respectively.
RTS	{HH:MM:SS}	Set Reader Time (24-hour) Sets the IS1001 reader's real-time clock present time. The time is specified as hh:mm:ss (hours:minutes:seconds) in 24-hour format.
Reports		
RDD		Report Diagnostic Data Reports the IS1001 reader's vital diagnostics information. *Note: The data will be sent only to the port from which the report was requested.*
RDT		Report Reader Date and Time Reports the IS1001 reader's real-time clock present date and time. *Note: The data will be sent only to the port from which the report was requested.*
RFS		Report Full Status Immediately generates and sends a Full Status Report. This report contains vital configuration settings and diagnostic data. *Note: The data will be sent only to the port from which the report was requested.*
RFV		Report Firmware Version Immediately generates and sends a Firmware Version Report. *Note: The data will be sent only to the port from which the report was requested.*
RND	{0-1440}	Set Automatic Noise Report Delay in Minutes Specifies how often to automatically send the Noise Report. Valid values are 0 (disabled), 1 – 1440 minutes. Default is 0 (disabled).

Commands

RNS		Report Noise Status
		Immediately generates and sends a Noise Report. The report provides noise statistics such as present, average, and peak noise measurement values. The report contains the information since the last time a Noise Report was generated or since the last system reset.
		Note: The data will be sent only to the port from which the report was requested.
RSD	{0-1440}	Set Automatic Status Report Delay in Minutes
		Specifies how often to automatically send the Full Status Report. Valid values are 0 (disabled), 1 – 1440 minutes. Default is 60 minutes.

Reports Structures

Full Status Report Structure

A full status report contains important configuration settings and diagnostic data for the IS1001 reader. The report can be generated using the **RFS** command.

Status Message	Message Information
Reader	
ID	Reader ID setting in HEX (01-FF)
Model	Reader Model (IS1001/IS1001-12V)
S/N	Reader Serial Number (YYWW.XXXX)
Date	Reader date setting
Time	Reader time setting
Application Firmware Version	Application firmware version
Operation Mode	Reader operation mode setting (Scan/Standby)
Network Mode	Reader network mode setting (IS1001 Standalone/MTS Node)
Exciter Sync. Mode	Reader exciter synchronization mode setting (Master/Sec. Master/Slave/Standalone)
Date/Time Sync.	Reader real-time clock synchronization setting (Enabled/Disabled)
Beeper	Reader beeper setting (Enabled/Disabled)
Tag Display Format	Tag ID display format setting (Hex/Dec)
Initiation Delay	Reader automatic diagnostics delay setting (Enabled/Disabled)
Auto Standby Voltages	Reader automatic Standby activation and deactivation voltages settings in Volts (16-24,17-25)
Periodic Standby Start Time	Reader periodic Standby activation time settings in hours (00-23)
Periodic Standby Duration	Reader periodic Standby duration settings in hours (00-23)
Idling Time	Reader idling time setting in milliseconds (0 – 10000)
Alarms	
Antenna Current Low Alarm	Antenna current low alarm threshold setting in Amperes peak-to-peak (0.0 – 9.0)
Noise High Alarm	Noise high alarm threshold setting in percent (0 – 100)
Tuning Capacit. High Alarm	Tuning capacitance high alarm threshold setting (512 – 1023)
Tuning Capacit. Low Alarm	Tuning capacitance low alarm threshold setting (0 – 511)
Alarms Unique Delay	Alarms unique delay setting in seconds (Disabled/1 – 3600)
Antenna/Tuning	
Exciter Voltage Level	Exciter voltage level setting (1 – 5)
Dynamic Tuning	Dynamic tuning setting (Enabled/Disabled)
Tuning Target Phase	Dynamic tuning target phase setting (0 – 1023)
Tuning Target Phase Deviation Threshold	Dynamic tuning target phase deviation threshold setting (2 – 63)

Reports Structures

Communication	
Local Port Speed	Reader local USB port speed setting
Tags to Local Port	Tags communication to local USB port setting (Enabled/Disabled)
Alarms to Local Port	Alarms communication to local USB port setting (Enabled/Disabled)
Messages to Local Port	Messages communication to local USB port setting (Enabled/Disabled)
Remote Port Protocol	Reader remote port communication protocol setting (ASCII/MODEM)
Remote Port Transfer Rate	Reader remote port data transfer rate setting (Full/Slow)
Detection	
HDX Tag Detection	HDX tag detection setting (Enabled/Disabled)
Fastag Detection	FDX-B Fastag tag detection setting (Enabled/Disabled)
FDXB Tag Signal Level Detection	FDX-B tag detection signal level measurement setting (Enabled/Disabled)
BioTherm Tag Temperature Detection	BioTherm tag temperature detection setting (Enabled/Disabled)
Detection Counter Enabled	Detection counter setting (Yes/No)
Unique Mode	Detection unique mode setting (Last 5/Last 1/Delay/Disabled)
Unique Delay	Detection unique delay setting in seconds (1 – 43200)
FDXB Detection Scan Time	FDX-B detection scan time in milliseconds (45 – 500)
VTT Level	Virtual Test Tag level setting (0 – 255)
Auto VTT Delay	Automatic Virtual Tag Test delay setting in minutes (Disabled/1 – 1440)
Measurements	
Antenna Current Gain	Antenna current measurement gain setting (0 – 200)
Antenna Current Offset	Antenna current measurement offset setting (0 – 200)
Memory	
Tags Memory Size	Maximum number of tag IDs that can be stored in memory
Status Reports Memory Size	Maximum number of short status reports that can be stored in memory
Store Tags to Memory	Store detected tags to memory setting (Enabled/Disabled)
Store VTT to Memory	Store Virtual Test Tags to memory setting (Enabled/Disabled)
Store Stat. Reports to Memory	Store status reports to memory setting (Enabled/Disabled)
Reports	
Auto Noise Report Delay	Automatic noise report delay setting in minutes (Disabled/1 – 1440)
Auto Status Report Delay	Automatic status report delay setting in minutes (Disabled/1 – 1440)
Diagnostics	
Detection Counter	Detection counter value
Tags in Memory	Number of tag IDs presently stored in memory and percentage of memory used
Status Reports in Memory	Number of short status reports presently stored in memory and percentage of memory used

Input Voltage	Measured input voltage in Volts DC
Exciter Voltage	Measured exciter voltage in Volts DC
Antenna Tuning	Antenna tuning status (Tuned/Tuning/Out Of Tune)
Antenna Current	Measured antenna current in Amperes peak-to-peak
Tuning Capacitors	Antenna tuning capacitance setting (0 – 1023)
Tuning Phase	Measured tuning phase
Tuning Relative Phase	Measured tuning relative phase
FDXB Signal Level	Measured FDX-B signal strength in milliVolts peak-to-peak and in percent
Temperature	Measured reader temperature in degrees Celsius
Sync. Input Present	Exciter synchronization input signal presence (Yes/ No/ N/A)
Sec. Master Active	Exciter synchronization Secondary Master status (Yes/ No/ N/A)
Active Alarms	Contains the list of all active alarms

Example

```
INF: Start Of Full Status Report
   Reader:
      ID:                              01
      Model:                           IS1001
      S/N:                             1915.0902
      Date:                            06/05/2019
      Time:                            09:52:56
      Application Firmware Version:    1.7.0
      Operation Mode:                  Scan
      Network Mode:           IS1001 Standalone
      Exciter Sync. Mode:          Sec. Master
      Date/Time Sync.:             Disabled
      Beeper:                      Disabled
      Tag Display Format:              HEX
      Initiation Delay:            Disabled
      Auto Standby Voltages:       16 V, 18 V
      Periodic Standby Start Time:     0:00
      Periodic Standby Duration:   Disabled
      Idling Time:                 Disabled
   Alarms:
      Antenna Current Low Alarm:       1.0 A
      Noise High Alarm:                20%
      Tuning Capacit. High Alarm:      970
      Tuning Capacit. Low Alarm:       50
      Alarms Unique Delay:         3600 sec
   Antenna/Tuning:
      Exciter Voltage Level:           1
      Dynamic Tuning:              Enabled
      Tuning Target Phase:             382
      Tuning Target Phase Deviation Threshold     3
   Communication:
      Local Port Speed:                115200
      Tags To Local Port:          Enabled
      Alarms To Local Port:        Enabled
```

```
            Messages To Local Port:           Enabled
            Remote Port Protocol:             ASCII
            Remote Port Transfer Rate:        Full
        Detection:
            HDX Tag Detection:                Disabled
            Fastag Detection:                 Disabled
            FDXB Tag Signal Level Detection:  Disabled
            BioTherm Tag Temperature Detection:Disabled
            Detection Counter Enabled:        Yes
            Unique Mode:                      Disabled
            Unique Delay:                     60 sec
            FDXB Detection Scan Time:         120 ms
            VTT Level:                        128
            Auto VTT Delay:                   60 min
        Measurements:
            Antenna Current Gain:             120
            Antenna Current Offset:           110
        Memory:
            Tags Memory Size:                 78583
            Status Reports Memory Size:       1023
            Store Tags To Memory:             Enabled
            Store VTT To Memory:              Enabled
            Store Stat. Reports To Memory:    Enabled
        Reports:
            Auto Noise Report Delay:          Disabled
            Auto Status Report Delay:         60 min
        Diagnostics:
            Detection Counter:                0
            Tags In Memory:                   2 (0%)
            Status Reports In Memory:         5 (0%)
            Input Voltage:                    19.5 V
            Exciter Voltage:                  11.9 V
            Antenna Tuning:                   Tuned
            Antenna Current:                  2.1 A
            Tuning Capacitors:                175
            Tuning Phase:                     381
            Tuning Relative Phase:            1
            FDXB Signal Level:                74 mV (8%)
            Temperature:                      27.3 C
            Sync. Input Present:              No
            Sec. Master Active:               Yes
        Active Alarms:
            No Active Alarms
    INF: End Of Full Status Report
```

Short Status Report Structure

A short status report contains information regarding dynamic diagnostic parameters of the IS1001 reader and is provided each time an automatic status report is generated. This report is stored in the IS1001 reader's internal memory (if **Save Status Reports to Memory** (**MSR**) setting is enabled) in a comma separated value data string. The IS1001 reader can store up to 1,023 status reports in its internal memory; stored reports can be dowloaded using the **MED** command.

Value Order	Value Range	Parameter	Parameter Range	Description
1	0 … 16	Reader Operation Mode	0 … 16	0 = N/A 1 = Standby 2 = Full tuning in progress 3 = Reserved (not implemented in this version) 4 = Reserved for MTS Mode 5 = Reserved for MTS Mode 6 = Reserved for MTS Mode 7 = Reserved for MTS Mode 8 … 15 = Reserved (not implemented in this version) 16 = Scan, IS1001 Standalone
2	0 … 1	Reader Network Mode	0 … 1	0 = IS1001 Standalone 1 = MTS Node
3	0 … 3	Reader Exciter Synchronization Mode	0 … 3	0 = Standalone 1 = Master 2 = Secondary Master 3 = Slave
4	0 … 2	Synchronization Input Status	0 … 2	0 = Absent 1 = Present 2 = N/A
5	1 … 5	Exciter Voltage Level	1 … 5	Exciter voltage level, 1 = lowest, 5 = highest (Always reports 1 for model IS1001-12V)
6	-500 … 500	Tuning Relative Phase	-500 … 500	Measured tuning relative phase
7	0 … 1023	Tuning Capacitors	0 … 1023	Antenna tuning capacitance setting
8	0 … 100	Tag Memory Usage	0% … 100%	Tag memory usage in percent
9	0 … 100	Status Reports Memory Usage	0% … 100%	Status report memory usage in percent
10	0 … 320	Input Voltage	0V … 32.0V	Input voltage in 100 mV units
11	0 … 320	Exciter Voltage	0V … 32.0V	Exciter voltage in 100 mV units
12	0 … 110	Antenna Current	0A … 11.0A	Antenna current in 100 mA units
13	0 … 100	FDX-B Signal Level	0% … 100%	FDX-B signal level in percent
14	300 … 500	Tuning Phase	300 … 500	Measure tuning phase
15	-400 … 1249	Reader Temperature	-40.0C … 124.9C	Reader temperature in 0.1 °C units
16 … 20	0 … 24	5 Last Alarms	0 … 24	Codes, associated with specific alarms. See Alarm Messages and Codes section for details. 0 = No Alarm

Example

SRP: 01 06/12/2019 14:33:43.800 16,0,1,2,5,1,815,99,91,244,200,93,26,384,248,8,14,0,0,0

Noise Report Structure

Parameter	Value
Present Noise	The value is presented in milliVolts peak-to-peak and in percent
Maximum Noise	The value is presented in milliVolts peak-to-peak and in percent
Average Noise	The value is presented in milliVolts peak-to-peak and in percent
Time Averaged Over	The amount of time used when computing the average. The time is shown in a H:MM:SS format. For example: 0:01:00 = 60 seconds.
NRP	Identifies an abbreviated noise report message containing the reader ID, the date and time that the report was generated, the noise values in percent, and the time averaged over in seconds.

Note: The report contains information from the time when the previous noise report was generated or from the time when reader was powered up or reset.

Example

```
INF: Start Of Noise Report
    Present Noise:               85 mV  (9%)
    Maximum Noise:             177 mV  (19%)
    Average Noise:             162 mV  (18%)
    Time Averaged Over:           0:01:00
INF: End Of Noise Report
```

Diagnostic Data Report Structure

A Diagnostic Data report contains important diagnostic information for the IS1001 reader. The report can be generated using the **RDD** command.

Status Message	Message Information
Reader	
Operation Mode	Reader operation mode setting (Scan/Standby)
Detection Counter	Detection counter value
Tags in Memory	Number of tag IDs presently stored in memory and percentage of memory used
Status Reports in Memory	Number of short status reports presently stored in memory and percentage of memory used
Input Voltage	Measured input voltage in Volts DC
Exciter Voltage	Measured exciter voltage in Volts DC
Antenna Tuning	Antenna tuning status (Tuned/Tuning/Out Of Tune)
Antenna Current	Measured antenna current in Amperes peak-to-peak
Tuning Capacitors	Antenna tuning capacitance setting (0 – 1023)
Tuning Phase	Measure tuning phase
Tuning Relative Phase	Measured tuning relative phase
FDXB Signal Level	Measured FDX-B signal strength in milliVolts peak-to-peak and in percent
Temperature	Measured reader temperature in degrees Celsius

Sync. Input Present	Exciter synchronization input signal presence (Yes/ No/ N/A)
Sec. Master Active	Exciter synchronization Secondary Master status (Yes/ No/ N/A)
Active Alarms	Contains the list of all active alarms

Example

```
INF: Start Of Diagnostic Data Report
  Reader:
    Operation Mode:              Scan
    Detection Counter:           0
    Tags In Memory:              2 (0%)
    Status Reports In Memory:    5 (0%)
    Input Voltage:               19.5 V
    Exciter Voltage:             11.9 V
    Antenna Tuning:              Tuned
    Antenna Current:             2.1 A
    Tuning Capacitors:           175
    Tuning Phase:                381
    Tuning Relative Phase:       1
    FDXB Signal Level:           91 mV (10%)
    Temperature:                 27.3 C
    Sync. Input Present:         No
    Sec. Master Active:          Yes
  Active Alarms:
    No Active Alarms
INF: End Of Diagnostic Data Report
```

Alarm Messages and Codes

When an abnormal condition is detected by the IS1001, the reader generates an alarm message sent to the communication ports. The alarms are sent to all available ports (unless the **CML0** command has been issued, in which case the alarms will not be sent to the local USB port.) The following table is a list of the available alarms and their corresponding codes.

Code	Alarm Message	Solution and/or Action
1	*Reader Date/Time Lost*	IS1001 reader date/time setting has been lost. Set the reader's real-time clock to the present date and time.
2	*Reserved for MTS Mode*	
3	*Reader Memory Error*	IS1001 reader internal data memory read/write error detected. Memory content is not guaranteed to be correct. The IS1001 requires repair.
4	*Antenna Out Of Tune, Decrease Capacitance*	The IS1001 reader is unable to reach the desired antenna tuning using the internal capacitors bank. Manual antenna capacitance reduction is required.
5	*Antenna Out Of Tune, Increase Capacitance*	IS1001 reader is unable to reach the desired antenna tuning using the internal capacitors bank. Manual antenna capacitance increase is required.
6	*VTT Test Failed*	IS1001 reader failed to detect VTT. Verify antenna tuning and system noise level. VTT level adjustment may be needed.
7	*Antenna Current Low*	IS1001 reader has detected that the antenna current is below the user-defined specification. Verify antenna tuning and the reader's DC power supply. Exciter voltage level adjustment may be needed. Alarm threshold adjustment may be needed.
8	*Noise High*	IS1001 reader has detected that the noise level is above the user-defined specification. Verfy antenna tuning. Verify surrounding environment for the cause of the noise. Alarm threshold adjustment may be needed.
9	*Tuning Capacitance Low*	IS1001 reader has detected that the internal capacitors setting is below the user-defined alarm threshold. Verify the antenna environment is not the cause of the problem (significant changes in water level, metal objects in the antenna field, etc.). Manual antenna capacitance adjustment may be needed. Tuning capacitance low threshold adjustment may be needed.
10	*Tuning Capacitance High*	IS1001 reader has detected that the internal capacitors setting is above the user-defined alarm threshold. Verify the antenna environment is not the cause of the problem (significant changes in water level, metal objects in the antenna field, etc.). Manual antenna capacitance adjustment may be needed. Tuning capacitance high threshold adjustment may be needed.
11	*Input Voltage Low*	IS1001 reader has detected that the input voltage is below the factory specifications. Alarm threshold depends on exciter voltage level setting: 23 V for VE=5; 21 V for VE=4; 19 V for VE=3 and 18 V for VE=1 and 2. For IS1001-12V the threshold is 11.5 V. Verify the reader's DC power supply.

Alarm Messages and Codes

12	*Exciter Voltage Low*	The IS1001 reader has detected that the antenna exciter voltage is below the factory specifications. Alarm threshold depends on exciter voltage level setting: 19 V for VE=5; 17 V for VE=4; 15 V for VE=3; 13 V for VE=2 and 11 V for VE=1. For IS1001-12V the threshold is 9.5 V. Verify the reader's DC power supply.
13	*Tags Memory Low*	Internal memory allocated for storing tag IDs is 95% full. The IS1001 reader will soon start to overwrite the oldest data records in memory with new ones. Download memory content as soon as possible to avoid data loss.
14	*Tags Memory Full*	Internal memory allocated for storing tag IDs is 100% full. When this alarm is raised, from this point forward, the IS1001 reader will overwrite the oldest data records in memory with new detections (First In First Out). Download memory content immediately to minimize data loss.
15	*Temperature Low*	IS1001 reader has detected that the temperature inside its enclosure is below -15°C and is approaching the manufacturer's specified operation limit of -20°C.
16	*Temperature High*	IS1001 reader has detected that the temperature inside its enclosure is above +65°C and is approaching the manufacturer's specified operation limit of +70°C.
17	*Sync. Input Not Present*	IS1001 reader is set to operate as a Slave and has not detected the input synchronization signal. Verify that the Master IS1001 reader is working properly. Verify that the synchronization wiring is intact.
18	*Antenna Current Exceeded 10.0 A*	IS1001 reader has detected that the antenna current exceeded 10 A peak-to-peak which is approaching the manufacturer 's specified limit of 11 A peak-to-peak. Verify that the antenna environment is not the cause of the problem (significant changes in water level, antenna wiring is shorted due to antenna damage, etc.). Verify that the antenna cable is intact. Exciter voltage level adjustment may be needed.
19	*Antenna Current Exceeded 11.0 A*	IS1001 reader has detected that the antenna current exceeded 11 A peak-to-peak even while the exciter voltage setting is at the lowest level. In the interest of preserving the IS1001, the reader is placed into Standby mode. Verify that the antenna environment is not the cause of the problem (significant changes in water level, antenna wiring is shorted due to antenna damage, etc.). Verify that the antenna cable is intact.
20	*Reports Memory Low*	Internal memory allocated for storing short status reports is 95% full. When this alarm is raised, from this point forward, the IS1001 reader will overwrite the oldest data records in memory with new short status reports (First In First Out). Download status reports memory content as soon as possible to avoid data loss.
21	*Reports Memory Full*	Internal memory allocated for storing short status reports is 100% full. When this alarm is raised, from this point forward, the IS1001 reader will overwrite the oldest data records in memory with new short status reports (First In First Out). Download status reports memory content immediately to minimize data loss.
22	*Reader Temperature Exceeded 75 C*	IS1001 reader has detected that the temperature inside its enclosure is above +75°C which exceeds the manufacturer's specified operation limit of +70°C. IS1001 reader is switched to Standby mode to reduce heat dissipation and to prevent damage.

Alarm Messages and Codes

23	*Reader Forced To Standby*	IS1001 reader has detected fault condition (Reader Temperature Exceeded +75°C, Antenna Current Exceeded 11.0 A, or Input Voltage too low) and switched to Standby mode to avoid damage
24	*Antenna Not Connected*	IS1001 reader has not detected an antenna. Verify antenna connection and system integrity.

Self-Tests and Diagnostics

A number of self-tests and diagnostics are available to verify the integrity of the IS1001 reader hardware.

- Input voltage level monitoring: If the input voltage level drops below the factory specifications, an alarm message will be generated.

- Exciter voltage level monitoring: If the exciter voltage level drops below the factory specifications, an alarm message will be generated.

- Antenna current monitoring

  Excessive current: To protect its internal components from an excessive antenna current level, the IS1001 reader has a built-in antenna current limiting mechanism that will generate an alarm message if an antenna current in excess of 10 A peak-to-peak is detected. If an antenna current in excess of 11 A peak-to-peak is detected, the IS1001 reader will automatically reduce its exciter voltage in order to bring the current to the acceptable level. If the antenna current exceeds 11 A peak-to-peak even when the minimal exciter voltage setting is applied, the IS1001 reader will switch itself into Standby mode until it is either reset or toggled back to Scan mode.

  Minimum current: If the antenna current drops below the user-selectable threshold, an alarm message will be generated.

- Noise level monitoring: If the noise level increases above the user-selectable threshold, an alarm message will be generated.

- Antenna tuning monitoring: If the IS1001 reader tuning capacitance setting approaches the limit and crosses the user-selectable threshold, an alarm message will be generated.

- Reader temperature monitoring: If the reader temperature falls outside of the factory specifications, an alarm message will be generated. If the temperature exceeds +75°C, the IS1001 reader will switch itself into Standby mode until the temperature drops below +70°C.

- Reports: Periodic status and noise reports provide diagnostic data.

- Virtual Tag Test: Detection sensitivity and front-to-back system operation verification are performed periodically using Virtual Test Tag.

Troubleshooting

This section provides solutions to the most common IS1001 reader errors.

> ⚠️ *Warning! Only qualified service personnel should access the internal components of the IS1001 reader. Before performing any repairs, the IS1001 reader must be disconnected from the power source.*

IS1001 Reader Does Not Power Up

1. Check the power supply connection and integrity.

2. Check the IS1001 reader's power connection and integrity.

3. Flashing LEDs:

- All LEDs flash once a second – This code indicates the IS1001 is in bootloader mode, the result of a firmware update command from the BioTerm program. If programming fails to complete, or if the IS1001 is powercycled during bootloader mode, upon restart, the device will check and run the present firmware. The IS1001 will exit from this mode by a timeout, if the update process has not started within 10 seconds.
- All LEDs flash twice per second – This code indicates the IS1001 is in bootloader mode following a powercycle and is unable to run the present firmware due to incomplete programming. Powercycling during this mode will force the IS1001 to recheck the installed firmware's integrity and boot normally, if the firmware passes all checks. In the event the firmware verification fails, the all LEDs will flash twice a second once again. To resolve this issue, use BioTerm to reprogram the IS1001.
- All LEDs flash three times per second - This code indicates the IS1001 is in bootloader mode following a powercycle and is unable to run the present firmware due to Cyclic Redundancy Check (CRC) failure (the IS1001 is fully programmed, but the firmware is corrupt). Powercycling during this mode will force the IS1001 to recheck the installed firmware's CRC and boot normally, if the firmware passes all checks. In the event the firmware CRC verification fails, the all LEDs will flash three times a second once again. To resolve this issue, use BioTerm to reprogram the IS1001.

4. If problem is not resolved, the IS1001 reader must be sent to the manufacturer for repair.

No Antenna Connection Detected

1. Check the antenna's connection and integrity.

2. Check the IS1001's antenna connection and integrity.

3. Check the IS1001 reader's antenna tuning.

4. If the problem is not resolved, the IS1001 reader must be sent to the manufacturer for repair.

All Other Problems

For all other problems that cannot be resolved by checking the proper wire or cable connections, the IS1001 reader(s) must be sent to the manufacturer for repair.

Maintenance

⚠️ *Warning! Only qualified service personnel should access the internal components of the IS1001 reader The IS1001 reader must be disconnected from the power source before performing such tasks.*

The IS1001 reader requires very little maintenance. To keep it operating at peak efficiency, periodically do the following:

- Check all wire and cable connections

- Remove any dust and dirt

- Perform a full re-tune of the IS1001 reader's antenna (see page 14).

- Periodically download data from internal memory by using the **MED** command

- If an optional USB or BLE Data Logger Board is used for IS1001 data collection, periodically download the data from the logger's memory to prevent data loss. Also, on the USB version of the data logger, replace the USB flash drive before all drive space is consumed (see the IS1001 USB or BLE Data Logger User Manual for detailed information).

⚠️ *Warning! Do not remove the USB flash drive while data is being written to it. To safely remove the USB flash drive, use the **Eject External Storage** button.*

Advanced Diagnostics

⚠️ *Warning! Only qualified service personnel should access the internal components of the IS1001 reader or perform the advanced diagnostics described in this section.*

The advanced diagnostics described in this section can be performed with the help of an oscilloscope.

Monitoring Antenna Current

Attach a current probe (Tektronix P6021 or equivalent) to either one of the antenna leads.

This test:

- Verifies the IS1001 reader's antenna is tuned properly.

- Verifies the IS1001's internal current measurement is well calibrated.

Monitoring FDX-B Tag Signal Decoding Filters Output

Connect a voltage probe to the white "BFLTR" test point TP16 on the Mother Board. If HDX detection is enabled, attach another voltage probe to the white "HDX_EN" test point TP7 on the Mother Board and trigger the view of the oscilloscope by the falling slope of this signal. The probe's ground leads can be attached to the shield SH1 on the Mother Board.

This test:

- Checks for the presence of excessive noise and may help determine its source.

- Verifies the integrity of a FDX-B tag signal.

Monitoring HDX Tag Signal Decoding Filters Output

Connect a voltage probe to the white "HFLTR" test point TP15 on the Mother Board (located inside the shield SH1). Attach another voltage probe to the white "HDX_EN" test point TP7 on the Mother Board and trigger the view of the oscilloscope by the rising slope of this signal. The probe's ground leads can be attached to the shield SH1 on the Mother Board. For this test to produce results, HDX detection must be enabled.

This test:

- Checks for the presence of excessive noise and help determine its source.
- Verifies the integrity of an HDX tag signal.

Signals Examples

IS1001 Reader FDX-B Signal • No noise • No tag • 0.5ms per div	 .5 ms 50mV pkpk (1) 46.9mV SINGLE
IS1001 Reader FDX-B Signal • No noise • No tag • 1.0 ms per div	 1 ms 50mV pkpk (1) 43.8mV SINGLE
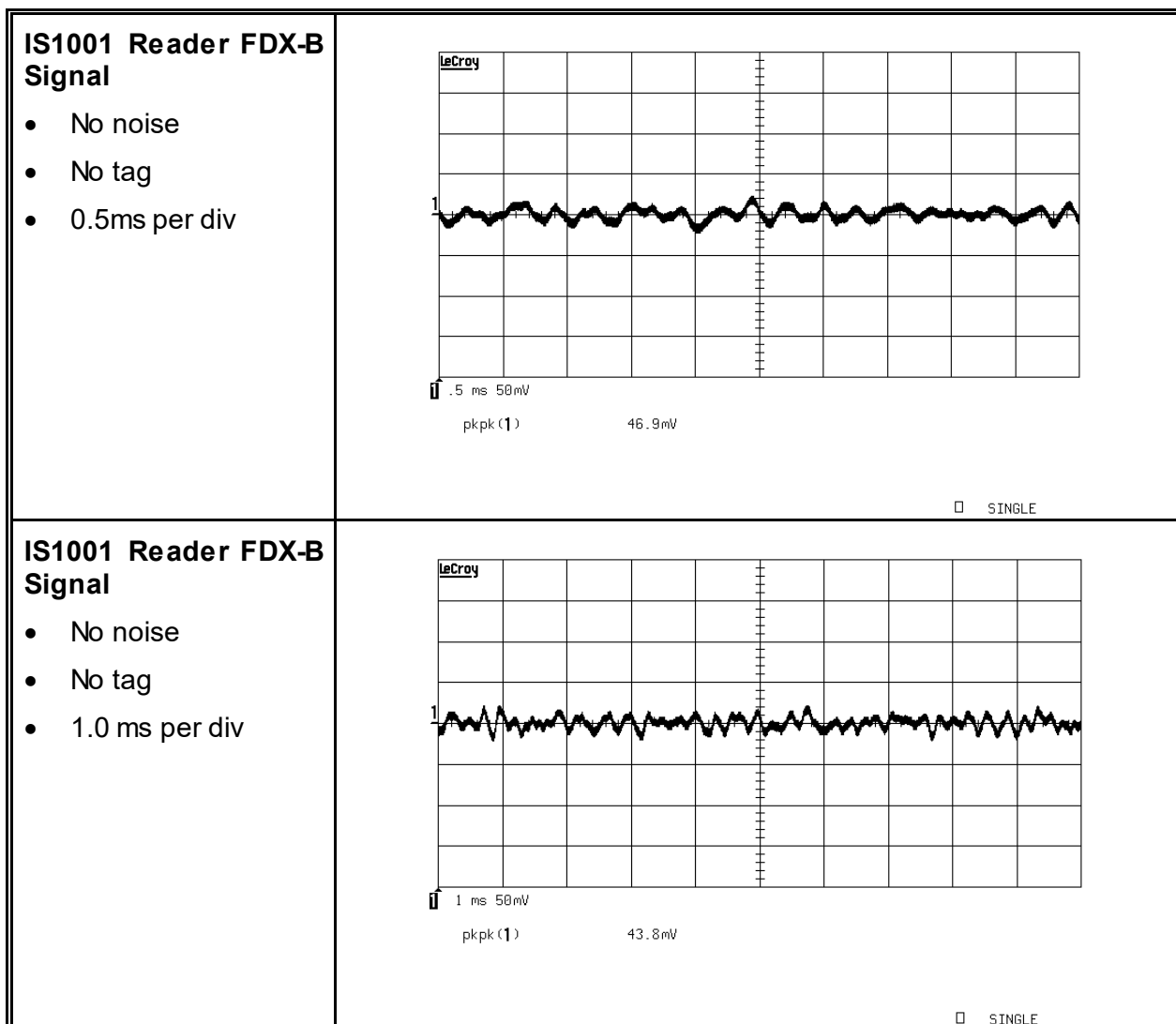
IS1001 Reader FDX-B Signal

- Noise

- 0.5ms per div

LeCroy

1

.5 ms 50mV

pkpk(1)   175.0mV
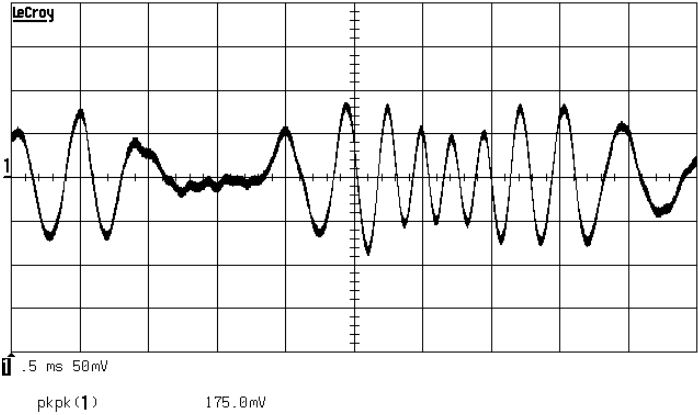
☐ STOPPED

IS1001 Reader FDX-B Signal

- Noise

- 1.0ms per div

LeCroy

1

1 ms 50mV

pkpk(1)   187.5mV
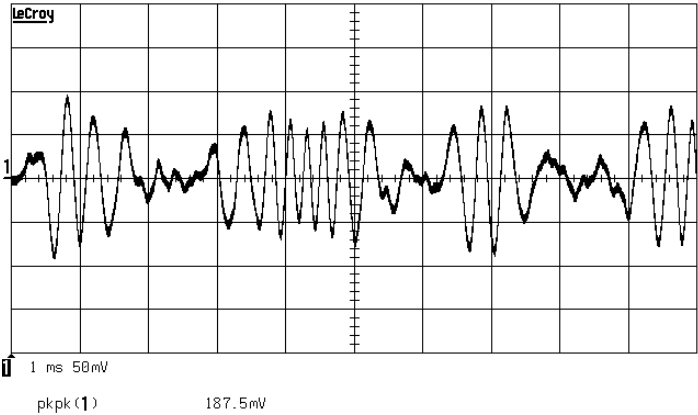
☐ STOPPED

IS1001 Reader FDX-B Signal

- Noise

- 2.0ms per div

LeCroy

1

2 ms 50mV

pkpk(1)   187.5mV
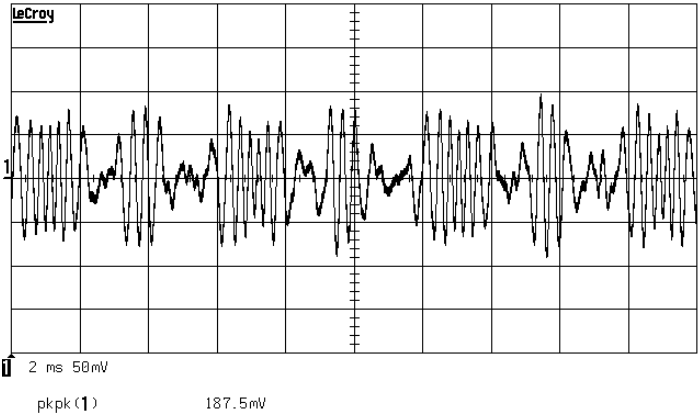
☐ STOPPED

IS1001 Reader FDX-B Signal • Tag • 0.5ms per div	LeCroy .5 ms 50mV pkpk(1)　　96.9mV ☐ SINGLE
IS1001 Reader FDX-B Signal • Tag • 1.0ms per div	Reading Floppy Disk Drive LeCroy 1 ms 50mV pkpk(1)　　103.1mV ☐ STOPPED
IS1001 Reader HDX Signal • No noise • No tag • 2.0ms per div	2 ms 100mV pkpk(1)　↕　797mV ☐ STOPPED
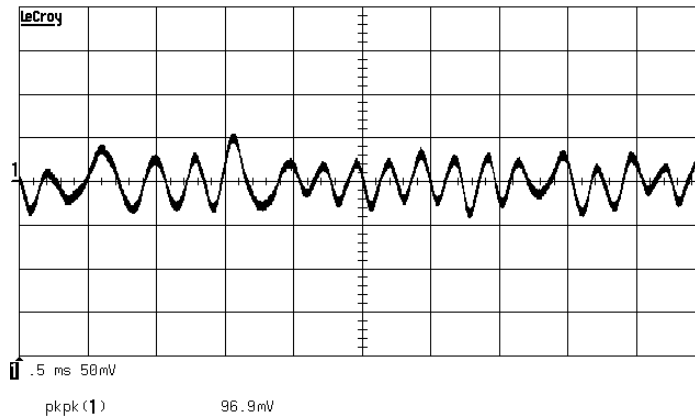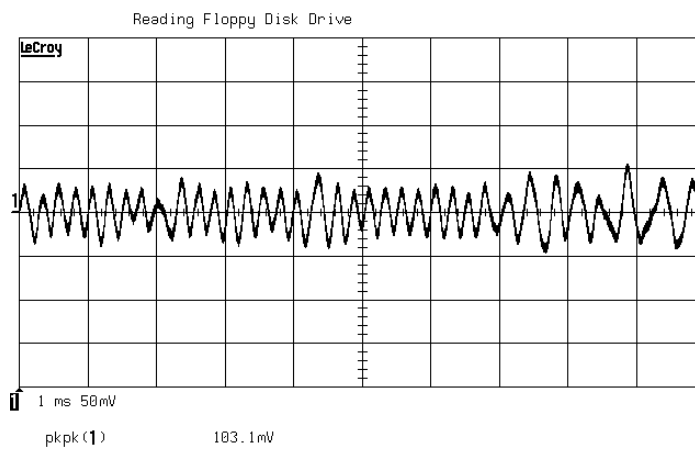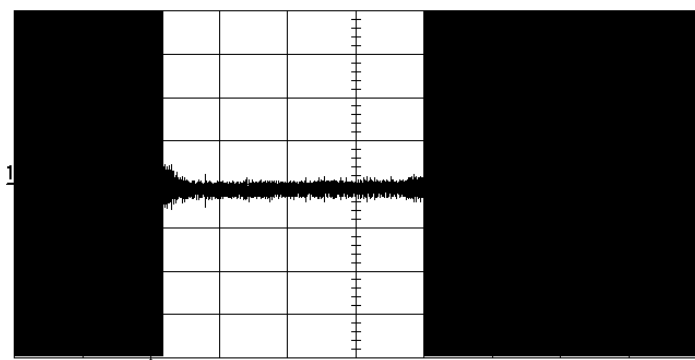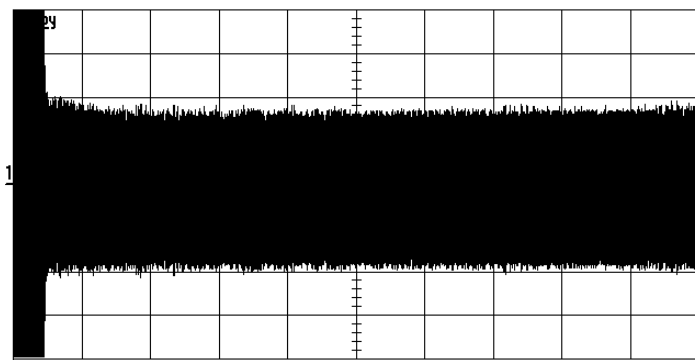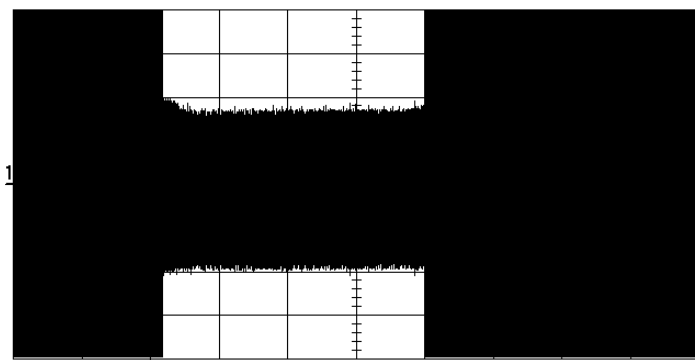
IS1001 Reader HDX Signal • No noise • No tag • 5.0ms per div	 1 5 ms 100mV pkpk(1) ↕ 797mV □ STOPPED
IS1001 Reader HDX Signal • 134KHz noise • 2.0ms per div	 1 2 ms 100mV pkpk(1) ↕ 797mV □ STOPPED
IS1001 Reader HDX Signal • 134KHz noise • 5.0ms per div	 1 5 ms 100mV pkpk(1) ↕ 797mV □ STOPPED

IS1001 Reader HDX Signal • Tag • 2.0ms per div	 1 2 ms 100mV pkpk(1) ⇕ 797mV ☐ STOPPED
IS1001 Reader HDX Signal • Tag • 5.0ms per div	 1 5 ms 100mV pkpk(1) ⇕ 797mV ☐ STOPPED
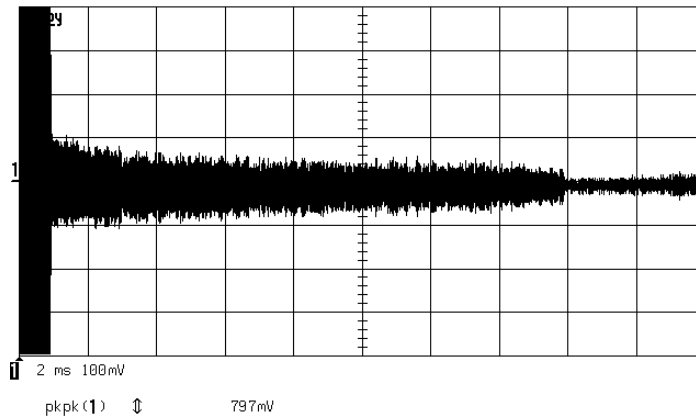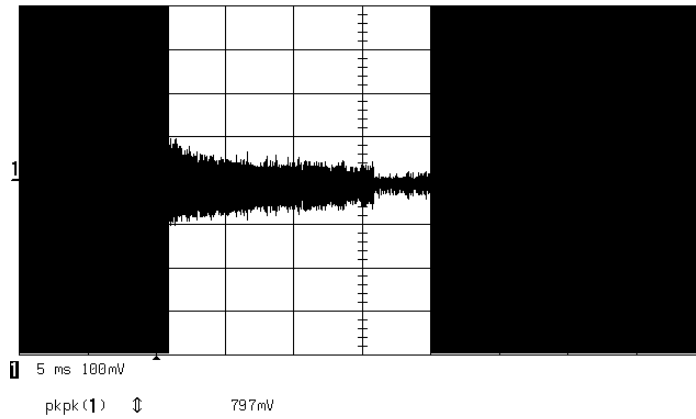
Updating Firmware

Important! *As a precaution, you should download all tag IDs and short status reports contained in memory before initiating the update process. Use the* ***MED*** *command to initiate the memory download. All settings may be reset to manufacturer default values during the update process; take a note of the present settings prior to updating the IS1001 reader.*

New or updated firmware may periodically become available for IS1001 reader. To update the firmware:

1. Download the latest IS1001 firmware release from the Biomark website at: https://www.biomark.com/is1001-reader-board#product.info.specifications

2. Start the BioTerm communication program.

   Note: BioStat program does not support device firmware update.

3. Make a connection to the IS1001 reader using any available communication port.

4. Select **Tools > Update Device Firmware** within the BioTerm utility.
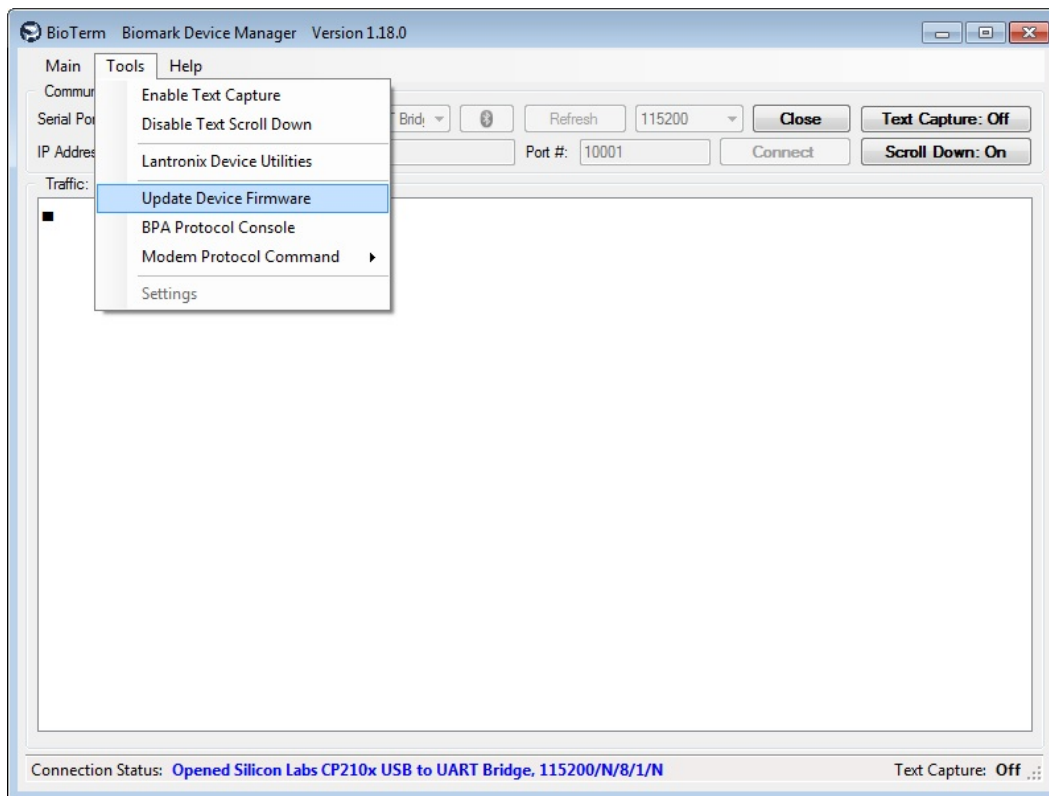
5. Locate the new firmware file downloaded in step 1 above, click on the **Open** button.

   Make sure to apply the appropriate firmware file based on IS1001 model type:

   - **IS1001:** This model uses IS1001 Application Firmware v1.x.x.

   - **IS1001-12V:** This model uses IS1001 Application Firmware v2.x.x.

6. Click on the **Start Programming** button.
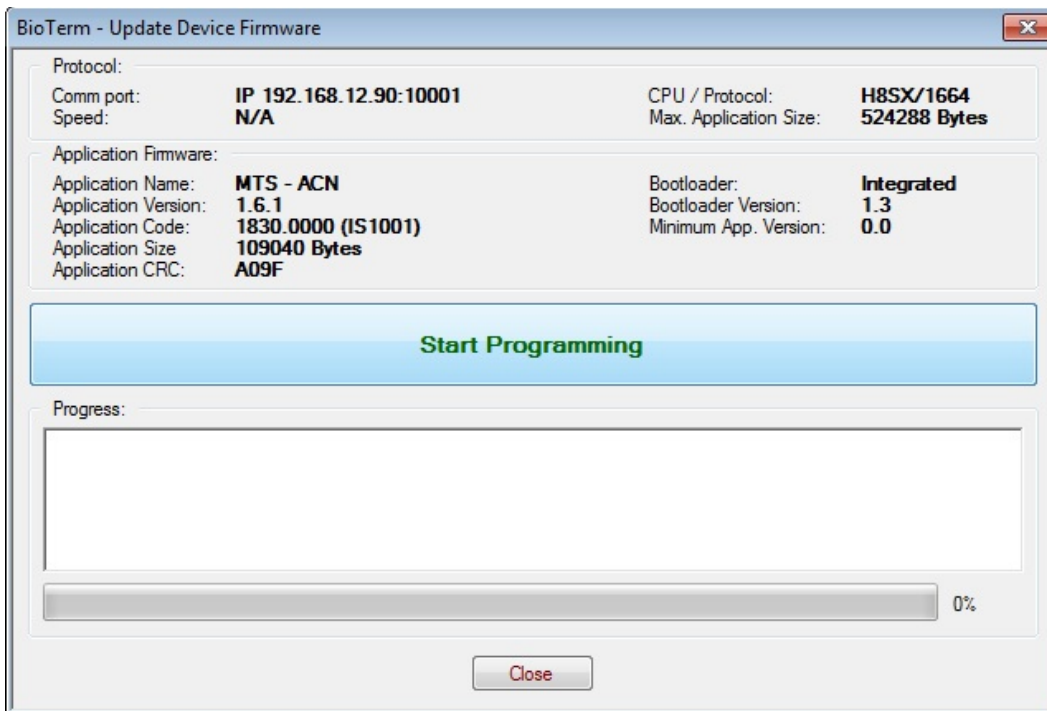
7. In the confirmation dialog, click on the **OK** button. The firmware update process should take less than a minute to complete.
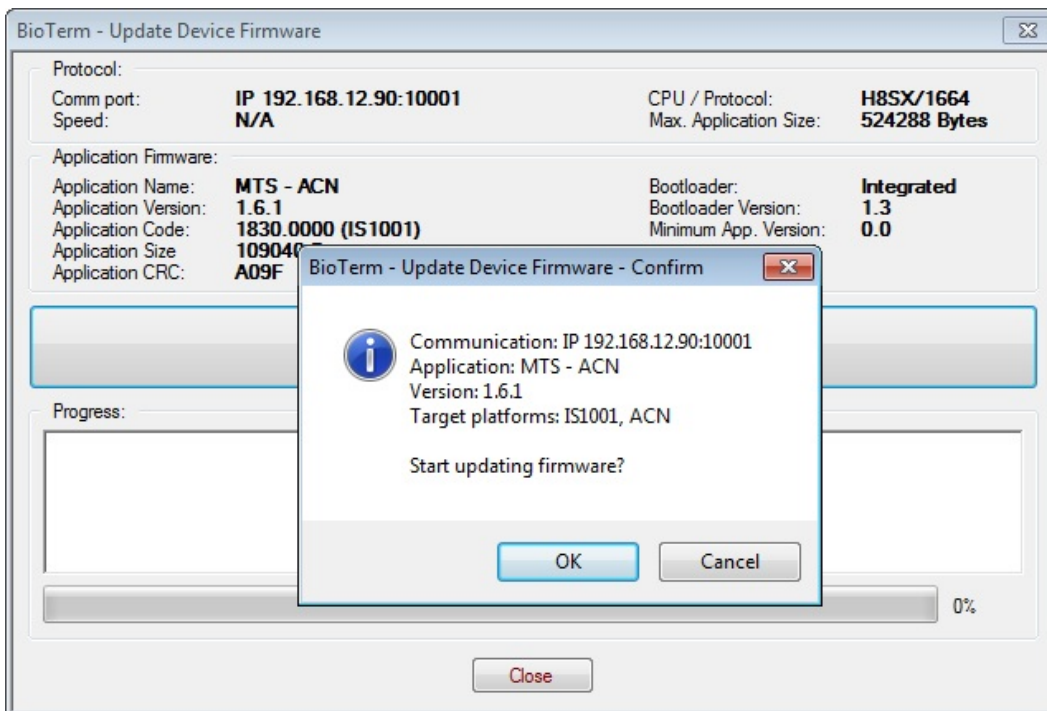
8. Wait for the update process to finish.
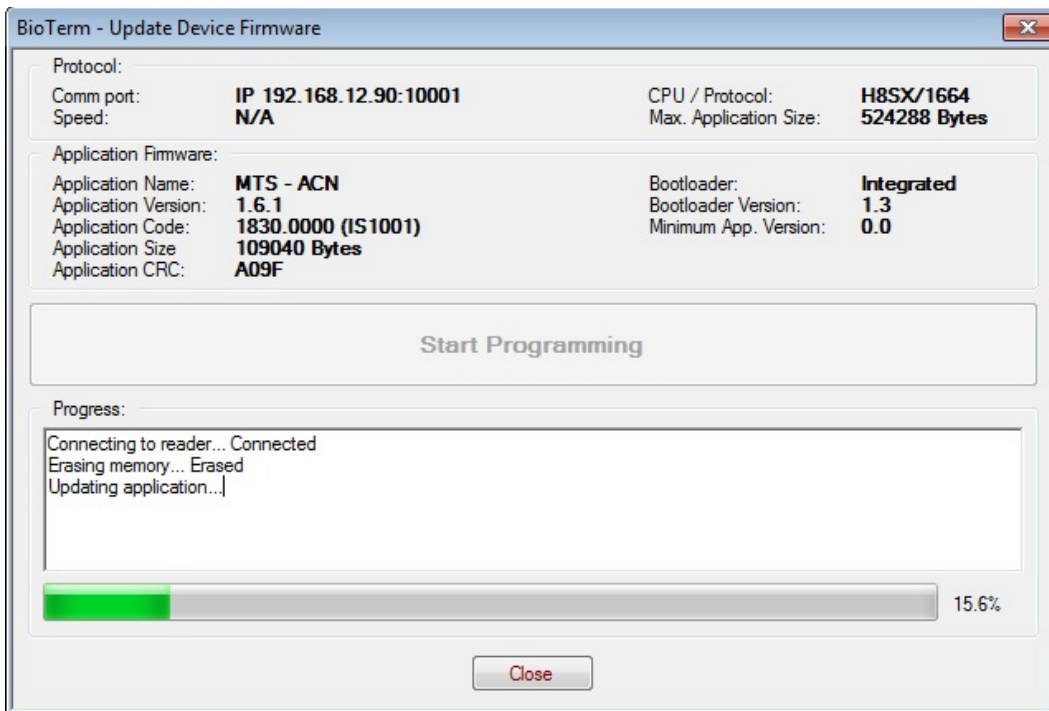
9. In the **Application Update – Success** dialog, click on the **OK** button.

Index

705 S. 8th Street

Boise, Idaho 83702, USA

1-208-275-0011

www.biomark.com

customerservice@biomark.com

PIT TAGS READERS IMPLANTERS SOFTWARE TISSUE SAMPLING CUSTOM SYSTEMS