OPERATOR'S MANUAL

# LRP2000 Series Passive Reader/Writer

Manual Revision 17, 05-02
Publication # 17-1257

# Escort Memory Systems Warranty

Escort Memory Systems warrants that all products of its own manufacture conform to Escort Memory Systems specifications and are free from defects in material and workmanship when used under normal operating conditions and within the service conditions for which they were furnished. The obligation of Escort Memory Systems hereunder shall expire one (1) year after delivery, unless otherwise specified, and is limited to repairing, or at its option, replacing without charge, any such product which in Escort Memory System's sole opinion proves to be defective within the scope of this Warranty. In the event Escort Memory Systems is not able to repair or replace defective products or components within a reasonable time after receipt thereof, Buyers shall be credited for their value at the original purchase price. Escort Memory Systems must be notified in writing of the defect or nonconformity within the warranty period and the affected product returned to Escort Memory Systems factory or to an authorized service center within thirty (30) days after discovery of such defect or nonconformity. Shipment shall not be made without prior authorization by Escort Memory Systems.

This is Escort Memory Systems' sole warranty with respect to the products delivered hereunder. No statement, representation, agreement or understanding oral or written, made by an agent, distributor, representative, or employee of Escort Memory Systems which is not contained in this warranty, will be binding upon Escort Memory Systems, unless made in writing and executed by an authorized Escort Memory Systems employee. Escort Memory Systems makes no other warranty of any kind whatsoever, expressed or implied, and all implied warranties of merchantability and fitness for a particular use which exceed the aforestated obligation are hereby disclaimed by Escort Memory Systems and excluded from this agreement. Under no circumstances shall Escort Memory Systems be liable to Buyer, in contract or in tort, for any special, indirect, incidental, or consequential damages, expenses, losses or delay however caused. Equipment or parts which have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by warranty. Escort Memory Systems shall make the final determination as to the existence and cause of any alleged defect. No liability is assumed for expendable items such as lamps and fuses. No warranty is made with respect to equipment or products produced to Buyer's specifications except as specifically stated in writing by Escort Memory Systems in the contract for such custom equipment. This warranty is the only warranty made by Escort Memory Systems with respect to the goods delivered hereunder, and may be modified or amended only by a written instrument signed by a duly authorized officer of Escort Memory Systems and accepted by the Buyer. Extended warranties of up to four years are available for purchase for most EMS products. Contact EMS or your distributor for more information.

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# 6. EMS RFID Communications

## 1.1 Introduction

Escort Memory Systems' passive read/write system is a complete family of field-proven read/write Radio-Frequency Identification products. The system consists of RFID tags, reader/writers, antennas, controllers, bus interfaces, and ancillary equipment. Tags can be attached to a product or its carrier and act as an electronic identifier, job sheet, portable database, or manifest.  Tags are read and updated via an Escort Memory Systems Reader/Writer, through any nonconductive material, while moving or standing still.  Escort Memory Systems' LRP-Series long range passive RFID system is the latest in our line of high performance, industrial RFID equipment. The passive design of the LRP read/write system uses the RF field from the antenna to power the tag, eliminating the need for tag batteries. The LRP passive read/write system is designed to provide cost effective RFID data collection and control solutions to automation, item-level tracking, and material handling applications.  The LRP system uses the internationally recognized ISM frequency of 13.56 MHZ to both power the tag, and to establish a radio link to transfer the information.The LRP2000 is specifically designed to work with LRP-Series passive tags, which provide 48 bytes of reprogrammable memory, and LRP-SISO-15693 compliant tags which provide up to 8K bytes ofreprogrammable memory.

## 1.2 Unpacking and Inspection

Unpack the LRP2000 and documentation and retain the original shipping carton and packing material in case any items need to be returned. Inspect each item carefully for evidence of damage. If any item appears to be damaged, notify your distributor immediately. The LRP2000 is delivered with the following components:

- LRP2000 Controller
- LRP2000 Antenna
- LRP2000 Power Supply- includes AC cord and DC cable assembly CBL-1474
- LRP2000 Operator's Manual
- CBL-1475 controller-to-antenna cable assembly

The following user-supplied components are required for configuring a complete system:

- LRP-S Series ISO15693-compliant Passive Read/Write Tags
- Power and Data cabling (refer to section 3.4)

- A Host Computer With RS232 Serial Interface for Configuration
- A Host Computer with RS232, RS422, or Ethernet Interface for Operation (The Ethernet interface is available as an option on the LRP2000)
- AC Power 120VAC, 60 Hz, 5.0 Amp max 230VAC, 50 Hz, 2.6 Amp max

## 1.3 FCC Compliance

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

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

## 1.4 Changes and Modifications

Any changes or modifications to the LRP2000 not expressly approved by Escort Memory Systems, could void the user's authority to operate the equipment.

# Installation and Guidelines

## 2.1 Dimensions

**Figure 2-1. gives the dimensions for the LRP2000 controller.**

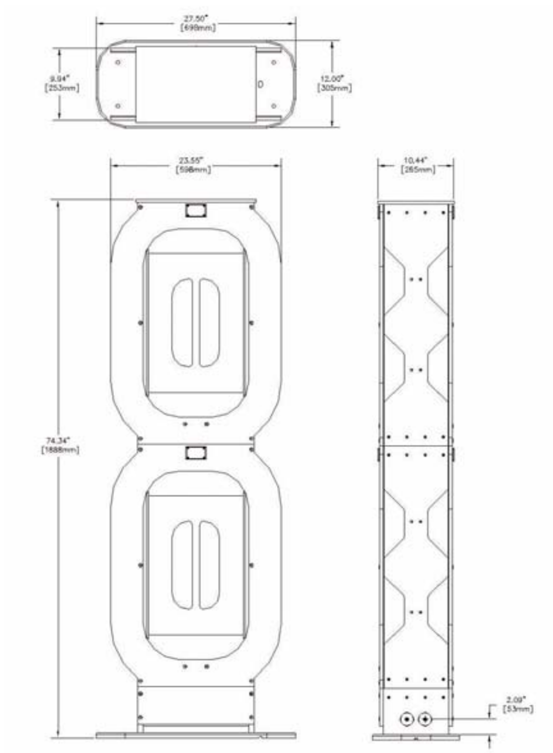
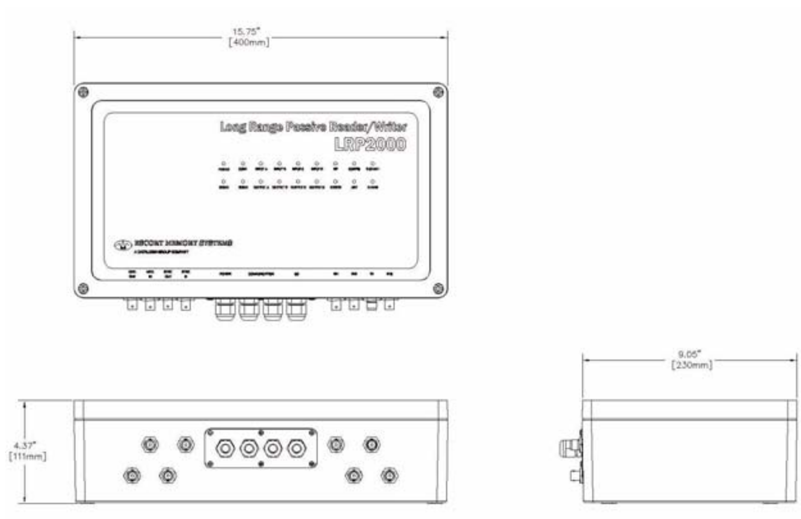


**Figure 2-2. gives the dimensions for the LRP2000 antenna.**




# 2.2 Instalation

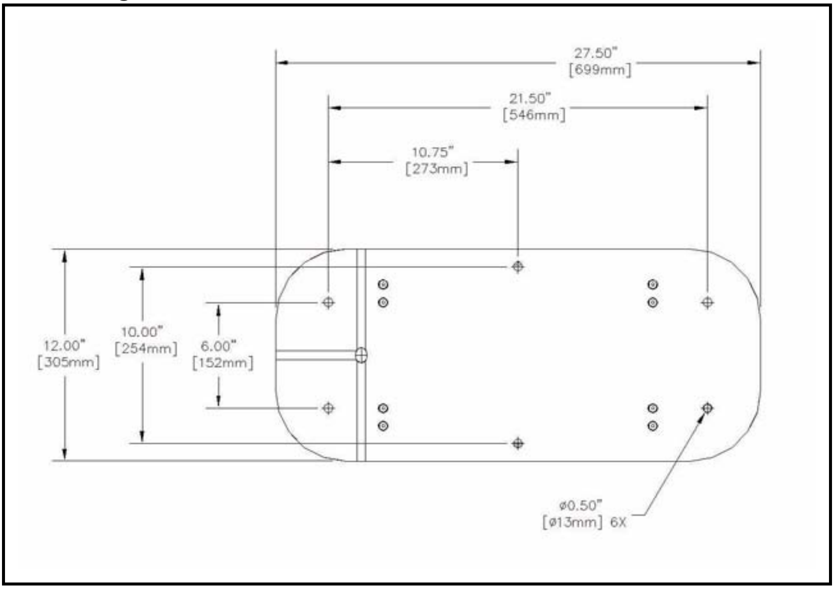
### Antenna Environment

Electromagnetic radiation and the presence of metal within the reading field of the antenna affect the range of the LRP2000. Mount the antenna to minimize the impact of these factors.

### Installing the Antenna

Once a suitable location is selected for the LRP2000 antenna, the structure should be securely bolted to the floor using the holes provided in the base. The dimensions for the antenna bolt pattern are shown in Figure 2.3.

**Figure 2-3. Antenna Bolt Pattern**



## 3.1 Connectors and Wiring

**Figure 3-1. RF Connectors and Strain Reliefs**

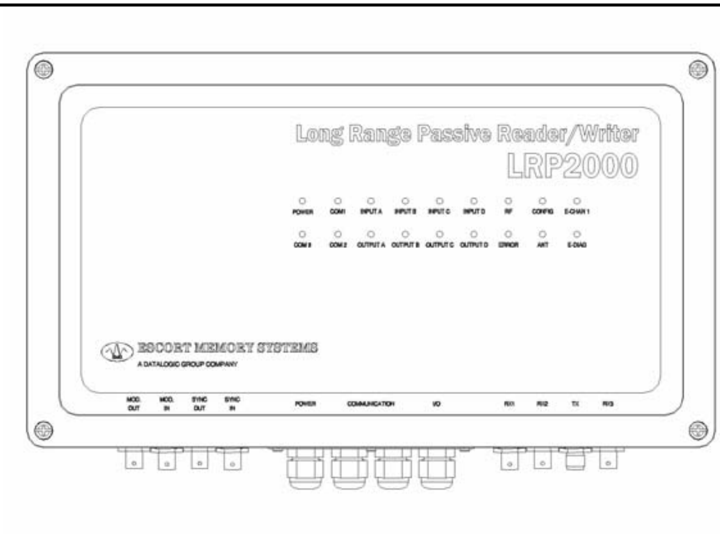



Figure 3.1 shows the front connector panel with the four strain reliefs and the RF connectors. The controller ships with sealing caplugs in the strain reliefs, which should be left in any unused location for an environmental seal.

The four strain reliefs will seal around cables ranging in diameter from 0.12 [3.0 mm] minimum to 0.32 [8.0mm] maximum. The wrench flats are [17mm].

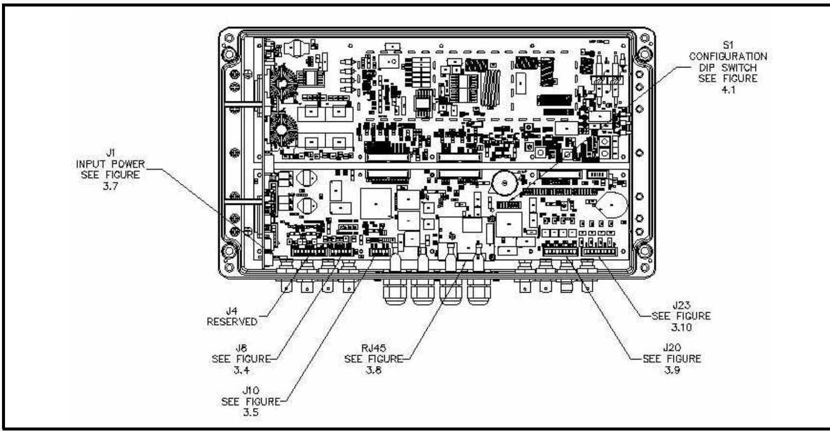



**Figure 3-2. Internal Connectors**

Figure 3.2 shows an internal view of the controller. It details the locations of all internal terminal blocks needed for wiring the system.

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**CAUTION:** The controller contains ESD sensitive components. Always observe ESD-sensitive handling procedures when working inside the controller.

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## Terminal Blocks

The controller is equipped with removable terminal blocks to aid wiring. The data terminals are all equipped with screw terminals which accept AWG 28 minimum to AWG 16 maximum diameter solid or stranded wire. The screws heads accept a 3/32 inch [2.0mm] or [2.5mm] screwdriver blade.

# 3.2 Antenna Cabling

**Figure 3-3. Antenna Connectors**

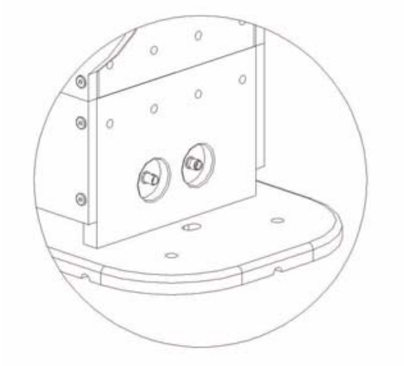

Figure 3.3 shows the two antenna connectors at the base of the LRP2000 antenna. Connect one end of the antenna cable assembly, CBL-1475, to the antenna connectors at the base of the antenna. Mate the connectors at the opposite end of the cable assembly to the corresponding RF connector on the controller as shown in Figure 3.1. The cable assembly has two different types of RF connectors, one threaded TNC and one bayonet-syle BNC. The controller has one TNC and seven BNC connectors. The BNC connector of the antenna cable assembly must only be connected to the controller connector shown in Figure 3.1.

**CAUTION:** The antenna cables must be properly connected to both the controller and the antenna at any time that power is applied to the controller. Failure to properly connect the controller to the antenna can cause damage to the unit. Connecting the controller to any antenna other than the LRP2000 Antenna can not only damage the controller, but can void the operator's authority to operate the LRP2000.

# 3.3 Data Terminal Blocks

**Figure 3-4. J8 COM1 RS232 / COM2 RS232**

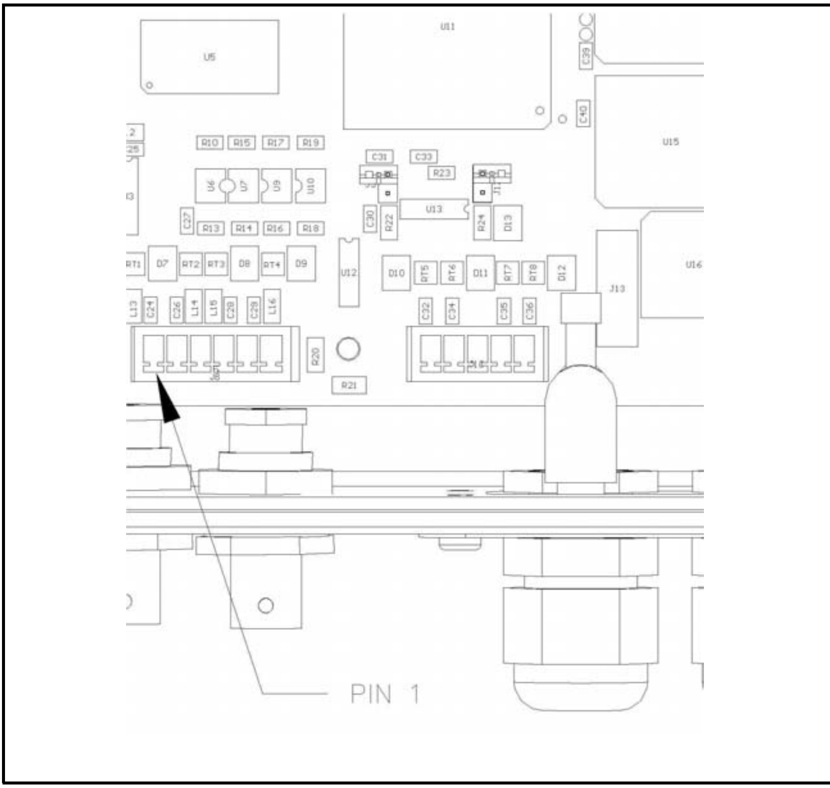


Figure 3.4 shows the LRP2000 RS232 terminal block, J8, and a detail view illustrating the arrangement of the terminals.

J

| | Interface | J8 Signal Name | DB9 Pin Number | DB25 Pin Number |
|---|---|---|---|---|
| 1 | COM1 | RS232 RX | 3 | 2 |
| 2 | COM1 | RS232 TX | 2 | 3 |
| 3 | COM1 | RS232GND | 5 | 7 |
| 4 | COM2 | RS232 RX | 3 | 2 |
| 5 | COM2 | RS232 TX | 2 | 3 |
| 6 | COM2 | RS232 GND | 5 | 7 |

**NOTE:** The signal names given in Table 3.1 refer to the signals from the LRP2000, not from the host. The DB9 and DB25 pin numbers are provided for reference. These give the pin numbers from standard RS232 connectors to which the LRP2000 terminals should be connected.

**Figure 3-5. J10 COM1 RS422**

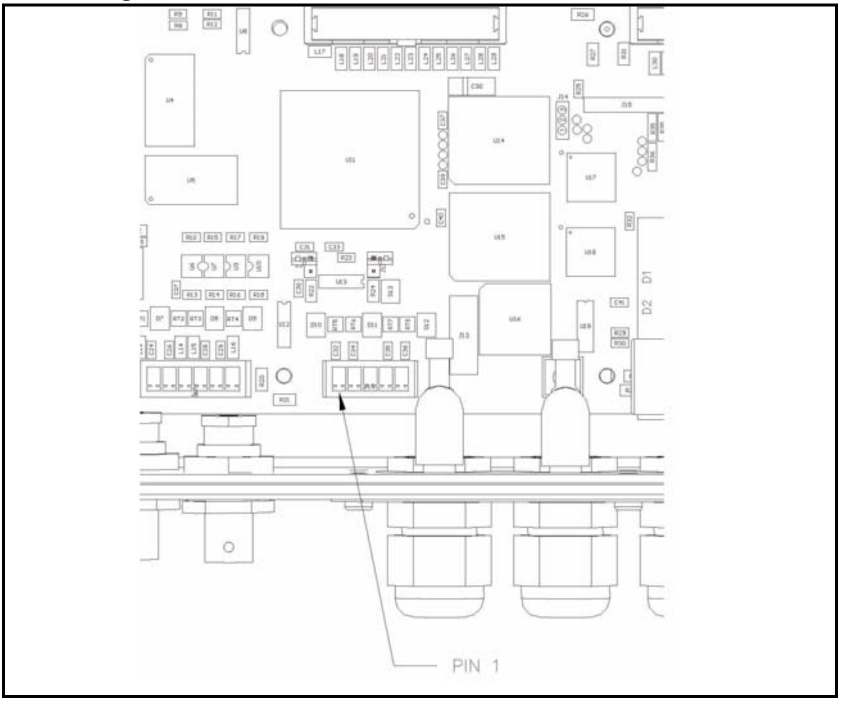


Figure 3.5 shows the LRP2000 COM1 RS422 terminal block, J10, and a detail view illustrating the arrangement of the terminals

**Table 3-1: J 10 Pinout**

| J10 terminal number | Signal name | Polarity | Description |
|---|---|---|---|
| 1 | TX Z | - Negative | Transmits data to host |
| 2 | TX Y | + Positive | Transmits data to host |
| 3 | GND | Neutral | Auxiliary Ground |

**Table 3-1: J 10 Pinout**

| J10 terminal number | Signal name | Polarity | Description |
|---|---|---|---|
| 4 | RX B | - Negative | Receives data from host |
| 5 | RX A | + Positive | Receives data from host |

The signal names given in Table 3.2 refer to the signals from the LRP2000, not to the signals from the host.

## 3.4 Power Supply Wiring

**CAUTION:** The antenna cables must be properly connected to both the controller and the antenna at any time that power is applied to the controller. Failure to properly connect the controller to the antenna can cause damage to the unit. Connecting the controller to any antenna other than the LRP2000 Antenna can not only damage the controller, but can void the operator's authority to operate the LRP2000.

Back out the terminal screws on the terminal block of the power supply and connect the spade lugs of Cable CBL-1474 to the terminals according to Table 3.3. Strip 1/4 inch from the opposite ends of the cable assembly and connect to the input power terminals according to Table 3.3.

**CAUTION:** Only after all internal connections are completed should the LRP2000 Power Supply be connected to the AC mains.

**Figure 3-6. Input Power Supply Lugs**

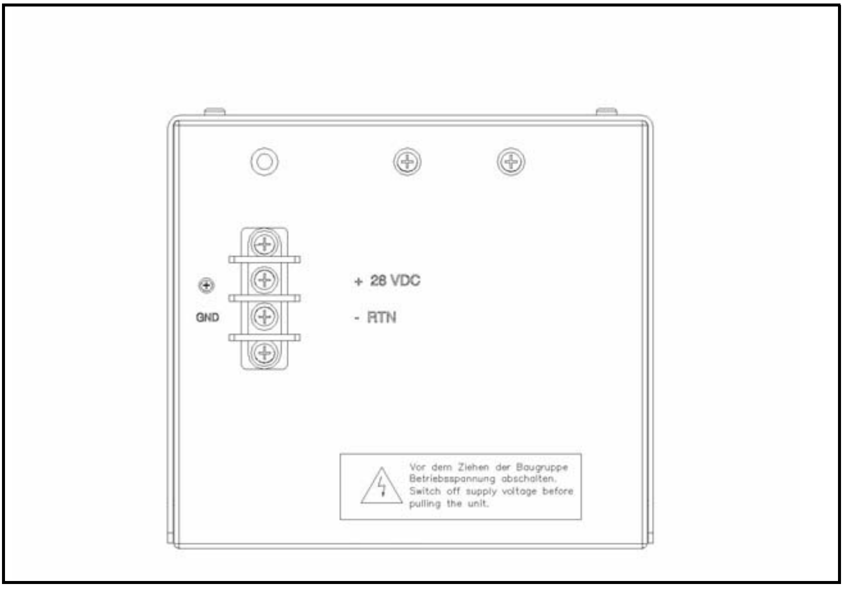


Figure 3.6 Shows the LRP2000 Power Supply and spade lugs.

**Figure 3-7. Input Power Terminals**

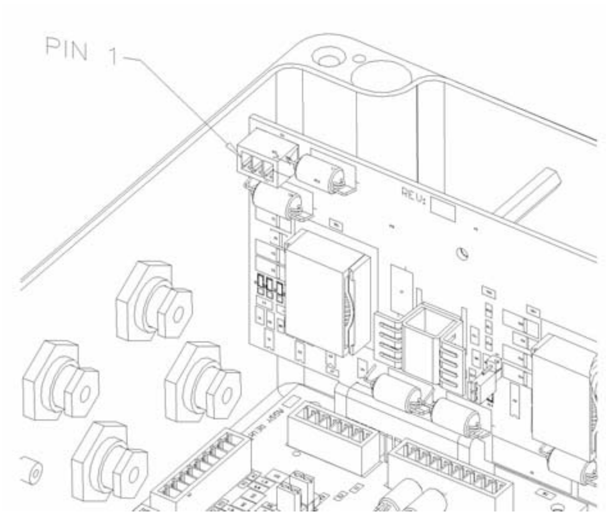


Figure 3.7 shows the LRP2000 Input Power Terminals

**Table 3-2: Imput Power Pinout**

| Power Supply Lug | Wire color | LRP2000 Terminal Number |
|---|---|---|
| +26 | RED | 3 |
| - RTN | BLACK | 2 |
| GND | Tin | 1 |

## 3.5 RS232 Wiring

The recommended cable medium for RS232 communication is Belden part number 9941. Specifications for Belden cables can be found at WWW.BELDEN.COM.

## 3.6 RS422 Wiring and Termination

In installations where long cable runs must be used, or in noisy environments, RS422 is them communications standard of choice for point-to-point serial communications. The recommended cable medium is Belden p/n 3084A (dropline), or Belden p/n 3082A (trunkline.) With a maximum baud rate of 38.4 kBaud it is generally unnecessary to terminate the RS422 terminals to match the impedance of the cable. The input impedance of the RS422 terminals is ??? Ohms. This provides an functional impedance match at all baud rates up 38.4 kBaud, the maximum rate supported by the LRP2000.

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**NOTE:** The RS422 receiver within the LRP2000 controller has failsafeprotection circuitry which eliminates the need for any pullup or pulldown resistors on the RS422 lines.

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# 3.7 Ethernet Wiring

**Figure 3-8. : The RJ45 Connector on the Optional Ethernet Module**

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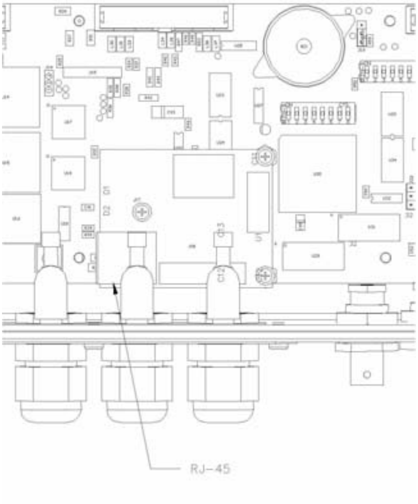


Because of the narrow size of the strain reliefs on the LRP2000, the standard RJ-45 connector cannot be inserted through the strain relief. It is recommended to loosen the nut on the strain relief, feed through the cable, and crimp the connector in place. After the connector is crimped onto the cable, the cable can be connected to the Ethernet module and the excess cable withdrawn from the unit before tightening the strain relief. Escort Memory Systems recommends stranded cable for Ethernet wiring in areas where the unit will be subjected to vibration.

# 3.8 Digital I/O Circuitry

Both the Digital Inputs and Digital Outputs are optically isolated circuits with no common path between any channel terminal and another channel, or between any channel and the LRP2000 power. Because they are independent and floating, the external wiring controls their use. The inputs can be configured for sensors with a PNP or NPN output. The outputs can be configured in a Sourcing or Sinking configuration. The examples in Figures 3.11 through 3.18 show different connections for common input and output devices.

## Inputs

The +IN terminal must be at a higher positive potential than the -IN terminal for current to be sensed correctly. The voltage range is 4.5 to 30V between the +IN and the -IN inputs and the maximum current is 25 mA.

**Figure 3-9. J23 Input Connector**

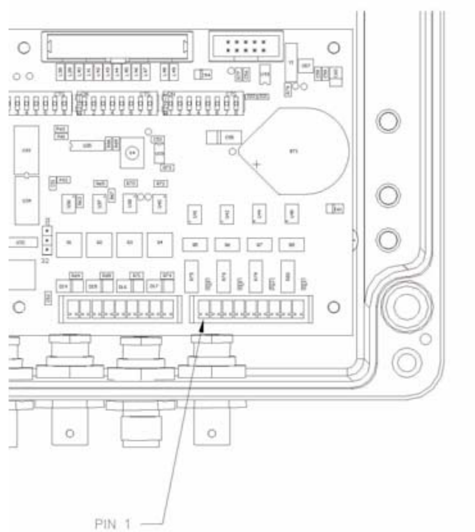


**Table 3-3: Input Connector Pinout**

| Terminal number | Signal Name | Polarity |
|---|---|---|
| 1 | + IN A | Positive |
| 2 | - IN A | Negative |
| 3 | + IN B | Positive |

**Table 3-3: Input Connector Pinout**

| Terminal number | Signal Name | Polarity |
|---|---|---|
| 4 | -IN B | Negative |
| 5 | + IN C | Positive |
| 6 | - IN C | Negative |
| 7 | + IN D | Positive |
| 8 | - IN D | Negative |
| 9 | GND | Neutral |

## Outputs

The output is limited to 30Vdc when off and 500 mA. These are maximum ratings. A device that operates at 200 mA may destroy the output due to inrush current if that current exceeds 500 mA(e.g. an incandescent light). The inductive "kick" (back EMF from a collapsing magnetic field) when a relay is released can impose a voltage higher than 30V and destroy the output transistor (use a backwards diode to clamp the back EMF).

**Figure 3-10. J20 Output Connector**

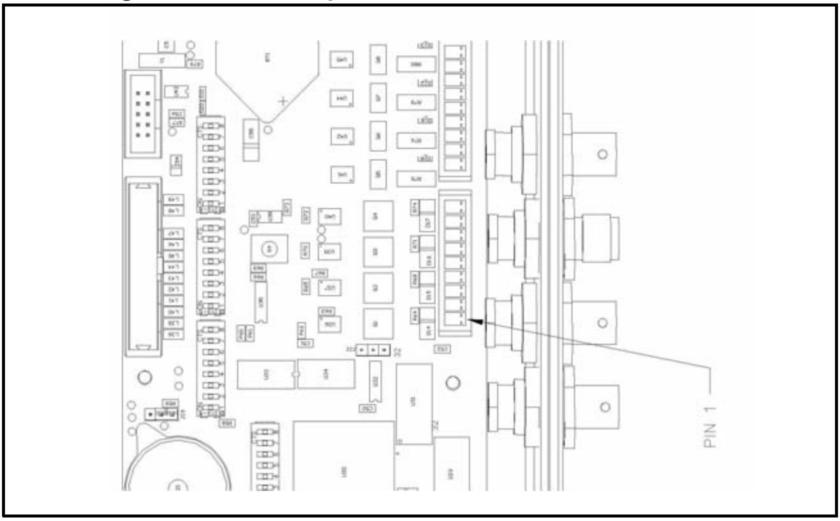


**Table 3-4: Output Connector Pinout**

| Terminal number | Signal name | Polarity |
|---|---|---|
| 1 | + OUT A | Positive |
| 2 | - OUT A | Negative |

**Table 3-4: Output Connector Pinout**

| Terminal number | Signal name | Polarity |
|---|---|---|
| 3 | + OUT B | Positive |
| 4 | - OUT B | Negative |
| 5 | + OUT C | Positive |
| 6 | - OUT C | Negative |
| 7 | + OUT D | Positive |
| 8 | - OUT D | Negative |
| 9 | GND | Neutral |

**Figure 3-11. Input From Sourcing Contact**

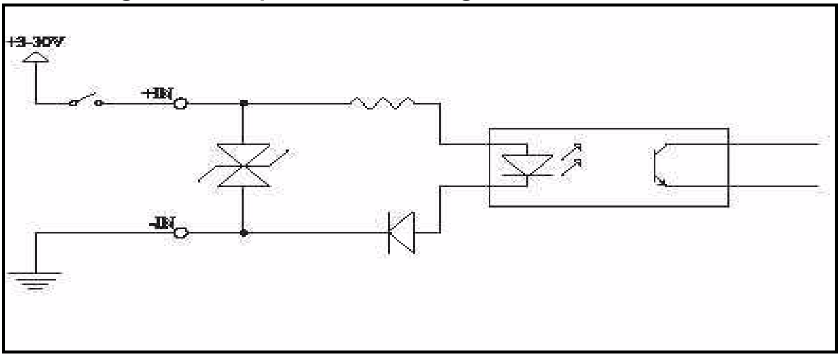


Figure 3.11 shows the switch on the high side with the low side grounded. As this is a "Dry" contact (the current is limited to 15 mA) a high quality sealed switch should be used.

**Figure 3-12. Input From Sinking Contact**

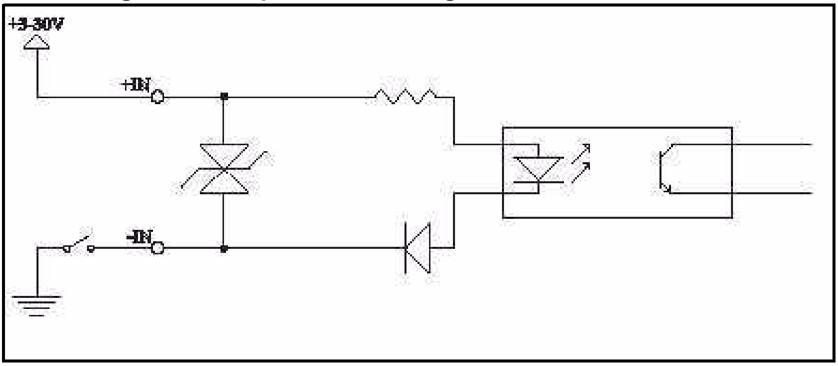

Figure 3.12 (previous page) shows a switch connected on the low side with the high side connected to the positive supply. This also requires a high quality sealed contact.

**Figure 3-13. Input From NPN Sensor**

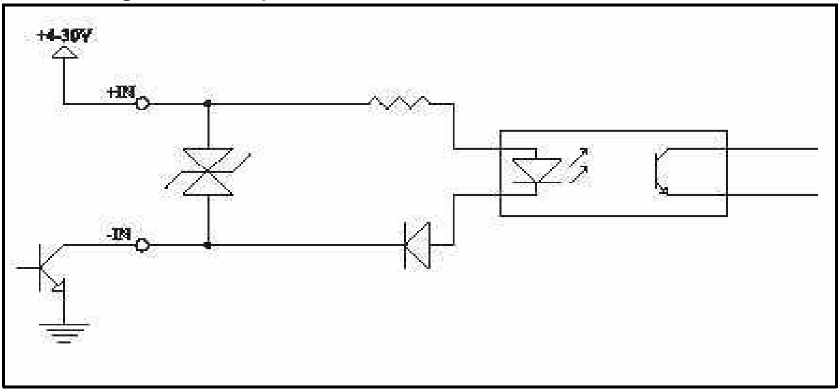


Figure 3.13 shows an Open Collector NPN output from a photosensor switching to ground. It can be wired as a sinking or low-side contact

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**Figure 3-14. Input From NPN Sensor**

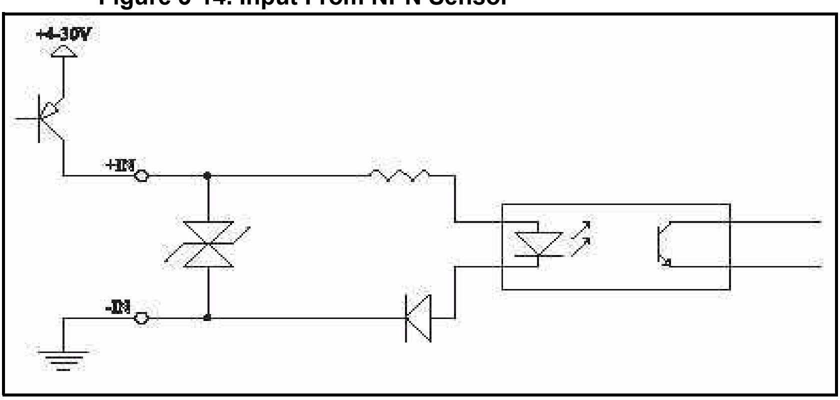



Figure 3.14 shows an Open Collector PNP output from a photosensor switches to the positive supply. It can be wired as a sourcing or high-side contact.

**Figure 3-15. Sourcing Output 'Contact'**

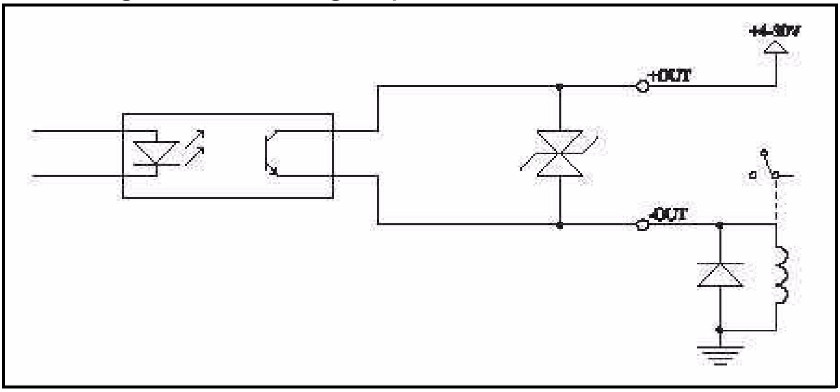



Figure 3.15 shows a relay connected as a current sourcing "Contact." The relay is grounded and the +OUT terminal goes to the positive supply. The diode across the relay coil is essential to protect the output circuit and reduce noise along the wiring. It should be connected at the relay to minimize the length of wiring that could radiate noise. A 1N4001 or similar diode may be used.

**Figure 3-16. Sinking Output 'Contact'**

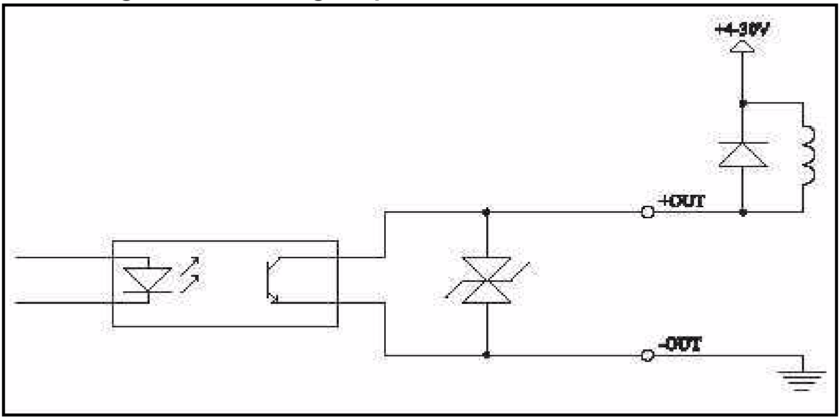
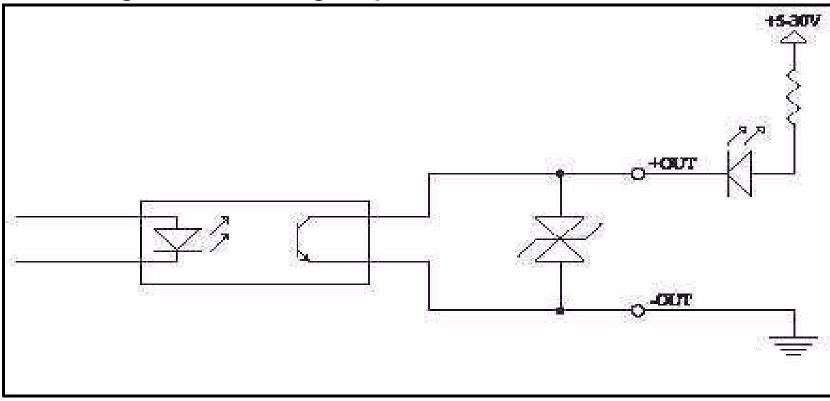


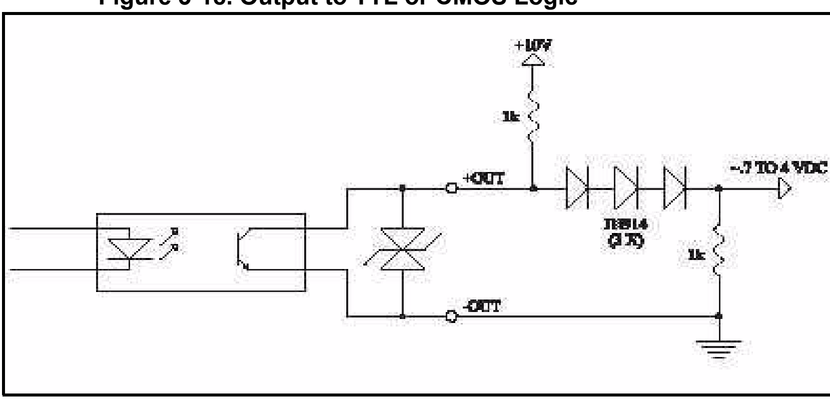

Figure 3.16 shows a "Contact" sinking current from a relay, the -OUT terminal is grounded and the relay goes to the positive supply. This configuration must also have a diode across the relay coil to protect the circuit and reduce noise.

**Figure 3-17. Sinking Output LED Driver**




In Figure 3.17, the LED and current limiting resistor are in series between the positive supply and the +OUT terminal. The -OUT terminal is grounded. The resistor in series with the LED sets the forward current. 1.2K will provide 20 mA LED current when run from 24 Vdc.

**Figure 3-18. Output to TTL or CMOS Logic**




In Figure 3.18 the output acts as an Open Collector. This will provide a TTL or CMOS compatible signal when a 1K to 10K pull-up to +5 Vdc (the logic supply) is used.

# 4.1 Configuring the Serial Interface

### COM1

In normal use for reading and writing RFID tags, communications with the LRP2000 will be accomplished via the main communications interface, COM1. This communications interface can be accessed by both point-to-point and addressed serial communications protocols. For point-to-point serial communication, the LRP2000 supports RS232 and RS422 as the standard protocols. For multiplexed communications, Ethernet is available as an option. Both RS232 and RS422 interfaces are optically isolated. The RS422 interface is especially suited for long cable lengths, and for noisy environments.

**NOTE:** NOTE: The delay between the characters sent to the controller cannot be longer than 200 ms.

The options for each configuration parameter for the COM1 interface follow:

**Table 4-1:**

| Baud rate | 1200, 2400, 4800, 9600, 19200, 38400 bps |
|---|---|
| Number of Data Bits | 7, 8 |
| Number of Stop Bits | 1 |
| Parity | Even, Odd, None |
| Handshake | None, Xon/Xoff |

The default configuration parameters for COM1 are:

**Table 4-2:**

| Baud rate | 9600 bps |
|---|---|
| Number of Data Bits | 8 |
| Number of Stop Bits | 1 |
| Parity | None |
| Handshake | None |

## COM2

For the purpose of configuring the controller's operating parameters, communication will be accomplished via the auxiliary communications interface, COM2. This auxiliary interface only communicates via RS232 and is reserved for configuring and updating the operating parameters and for updating the firmware in the controller. For example, with the correct hardware dip switch settings, the COM2 interface can be used to configure the parameters of the COM1 interface. The electronics of this interface are also optically isolated from the other circuits of the controller.

The communication options for the COM2 interface follow:

**Table 4-3:**

| **Baud rate** | **1200, 2400, 4800, 9600, 19200 bps** |
|---|---|
| Number of Data Bits | 7, 8 |
| Parity | Even, Odd, None |
| Handshake | None, Xon/Xoff |

The default configuration parameters for COM2 are:

**Table 4-4:**

| **Baud rate** | **9600 bps** |
|---|---|
| Number of Data Bits | 8 |
| Number of Stop Bits | 1 |
| Parity | None |
| Handshake | None |

## Digital Board DIP Switch

The digital board is mounted inside the LRP2000 enclosure closest to the wall with the cable entries. The first 5 switches of the main board set the COM1 baud rate, electrical interface, and the download options for COM2. SW6, SW7 and SW8 are not used and should remain OFF. When switch 1 and 2 are both set ON, the baud rate is set via the Configuration Menu. The table below illustrates possible combinations of switch settings for typical applications.

**Figure 4-1. Configuration Dip Switch, S1**

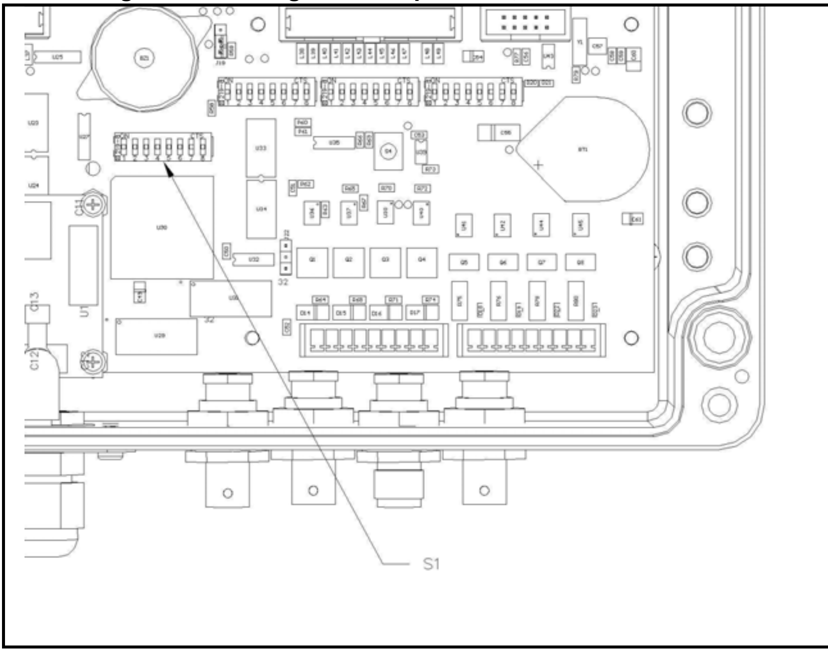



Figure showing the location of the digital board dip switches, and hard reset switch. Also includes a detail view of the dip switch array which indicates the arrangement of the switches from left to right and which indicates the "ON" and "OFF" directions.

**Table 4-5: Dip Switch Settings**

| Baud Rate | | | | | |
|---|---|---|---|---|---|
| SW1 | SW2 | SW3 | SW4 | SW5 | Settings |
| OFF | OFF | * | * | OFF | 9600 BAUD |
| ON | OFF | * | * | OFF | 19200 |
| OFF | ON | * | * | OFF | 38400 |
| ON | ON | * | * | OFF | 38400 |
| * | * | OFF | OFF | OFF | RS232 |
| * | * | ON | OFF | OFF | RS422 |
| IGNORED | IGNORED | IGNORED | ON | OFF | Ethernet |
| IGNORED | IGNORED | ON | ON | OFF | Reserved |
| OFF | OFF | OFF | OFF | OFF | Disabled |
| IGNORED | IGNORED | IGNORED | IGNORED | ON | Download / Restore Defaults |

**NOTE:** By setting SW5 ON to enable download, the default parameters will first be restored and saved to the non-volatile memory, erasing the previously stored communication and operating parameters. These parameters will take effect after a hard reset or a power-on reset. A hard reset is invoked by depressing the hard reset switch, holding for one second, and releasing. The hard reset switch is shown in Figure 4.1.

The baud rate, as determined by SW1 and SW2, only applies to the COM1 serial interface. When the optional ethernet interface is selected by setting switch 4 to the "on" position, the baud rate is set automatically for Ethernet communication, and switches 1 and 2 are ignored.

The communication parameters for COM2 can only be changed by menu configuration. Because COM2 is an auxiliary interface, the default parameters for COM2 are sufficient for the infrequent use of this interface, and should not be changed. For example, if a user changes to a faster baud rate on COM2, a problem can occur when trying to re-establish communication at a later date. Because there is no obvious indication that the baud rate has been changed, the next operator would likely try to reconnect at the default, 9600 baud, and would be unable to connect. The quickest way to re-establish communication is to set SW5 ON and reset, then set SW5 OFF and reset again. This will overwrite all the communication parameters on COM2 and allow the operator to connect, but it will also overwrite all the information for COM1, as well as the RFID parameters. The best practice is always to use the defaults for COM2.

## 4.2 Optional Ethernet Interface

As an alternative to the RS232 and RS422 interfaces, COM1 of theLRP2000 can be configured to communicate on Ethernet networks. Thisoption can be fulfilled by Escort Memory Systems' Ethernet module. To configure the LRP2000 COM1 to communicate via Ethernet, set Switch 4 ON. This correctly sets all communication parameters between the Ethernet module and the controller. Section 4.3 details the configuration of the Ethernet module for network

## 4.3 Configuring the Ethernet Module for Network Communication

Once wired correctly, the Ethernet Module must be configured to communicate on a network of computers and peripherals. This can be accomplished by connecting the controller's RJ45 jack directly to the NIC on a PC through a crossover cable. Alternatively, the Ethernet module can be connected directly to a router of a LAN. This can cause serious problems if another device on the network has the same IP address.

### The default IP address.

The default IP address of all LRP2000 controllers is set to 192.168.253.222 at the factory. In order to avoid IP address conflicts, the unit must be assigned a unique IP address before it is installed for operation. For configuration, the Ethernet module provides an interactive web page to update addresses.

---

**NOTE:** If connecting directly from the NIC on a PC, under some operating systems with dynamic IP allocation, it is necessary to fix the IP address of the PC to ensure that the IP address will not change during configuration.

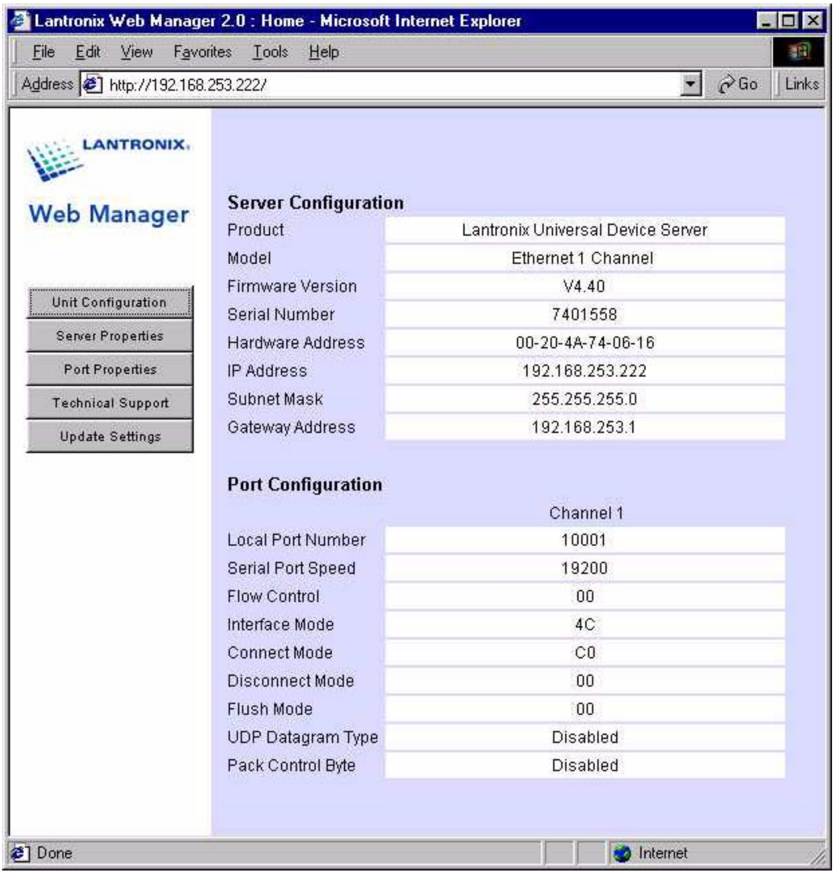
---

Once connected, apply power to the LRP2000 and direct the PC's web browser to http://192.168.253.222. The page shown in Figure 4.2 will be displayed as it is decompressed by the Ethernet module.

**Figure 4-2.**

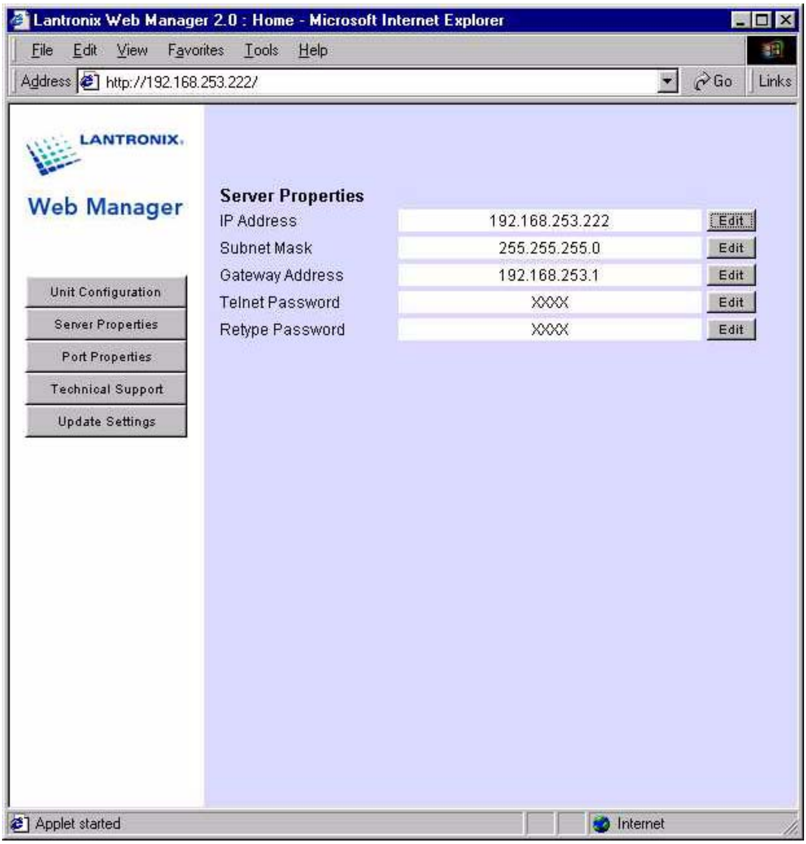
Click "Connect" to see the current configuration of the module as shown in Figure 4.3.

**Figure 4-3.**



To change the IP address, click "Server Properties" from the menu on the left side. This will load the Server Properties page as shown in Figure 4.4.

**Figure 4-4.**




Click the "Edit" button next to the IP address field to produce a separate window. Type or paste in the desired IP address and hit "Enter." Follow the same procedure to change the Subnet Mask and the Gateway Address. This will only save the information for the display. After all of the desired parameters are entered correctly, click "Update Settings" from the menu on the left. This will download the configuration parameters to the Ethernet Module.

After these steps are completed, reset the LRP2000, and the Ethernet module will be ready for network communication directed to its new IP address.

## 4.4 LED Indicators

The LRP2000 has 18 LED indicators conveniently located on the front panel to indicate the operating status of the controller. The locations of the LED indicators is shown in Figure 4.5.

**Figure 4-5. LED Indicators**

TONY I NEED THIS GRAPHIC

**Table 4-6: LED Indicators**

| LED | Color | Meaning |
|---|---|---|
| POWER | RED | The LRP2000 is receiving power |
| COM1 | GREEN / RED | RED: Incoming data on COM1 RS232 RX<br>GREEN: Outgoing data on COM1 RS232 TX And COM1 RS422 Y and Z |
| INPUT A | YELLOW | The Input is active |
| INPUT B | YELLOW | The Input is active |
| INPUT C | YELLOW | The Input is active |
| INPUT D | YELLOW | The Input is active |
| RF | GREEN | RF data transfer |
| CONFIG | GREEN | Flashes green for 0.5 seconds to indicate thesuccessful execution of an ABx command. |
| E-CHAN 1 | | lights solid to indicate that Ethernet connection is idle, blinks to indicate that Ethernet Module is connected and active |
| COM3 | | Not Used |
| COM2 | GREEN / RED | RED: Incoming data on COM2 RS232 RX<br>GREEN: Outgoing data on COM2 RS232 TX |
| OUTPUT A | GREEN | Output A active |
| OUTPUT B | GREEN | Output B active |
| OUTPUT C | GREEN | Output C active |
| OUTPUT D | GREEN | Output D active |

**Table 4-6: LED Indicators**

| LED | Color | Meaning |
|---|---|---|
| ERROR | RED | Flashes red for 0.5 seconds to indicate the unsuccessful execution of an ABx command. |
| ANT | RED | Antenna is transmitting |
| E-DIAG | | Blinks in combination with E-CHAN 1 LED to provide diagnostic information. See explanation below. |

## Flashing LED Signals

Flashing LED indicators, or combinations of flashing LED indicators, are used to indicate certain controller states, or transitions from one state to another.

### ERROR LED - 4 Flashes

The ERROR LED alone will flash four times to indicate that the controller is entering the download routine. This indicates that Switch 5 is in the ON position during a power-on or hard reset. With a terminal correctly configured and connected to COM2, the download menu will be displayed.

### ERROR and CONFIG LEDs - 4 Simultaneous Flashes

The ERROR and CONFIG LEDs will flash simultaneously four times to indicate that (CTRL-D) has been received within the first seven seconds of power-on or hard reset. With a terminal correctly configured and connected to COM2, the configuration menu will be displayed.

### ERROR and CONFIG LEDs - 4 Alternating Flashes

The ERROR and CONFIG LEDs will alternately flash four times to indicate that the controller is entering operating mode and is ready to receive commands on COM1.

## E-DIAG and E-CHAN 1 Ethernet Module diagnostic codes

The E-DIAG LED will light solidly to indicate the following errors. These errors can be identified by the number of times that the E-CHAN 1 LED blinks.

| | **Error** |
|---|---|
| 1 | EPROM Checksum Error |
| 2 | RAM Eror |
| 3 | Network Controller Error |
| 4 | EEPROM Checksum Error |
| 5 | Duplicate IP Address on network |
| 6 | Software does not match hardware |

The E-DIAG LED and the E-CHAN 1 LEDs will blink at the same time to indicate the following errors:

| **Number of blinks** | **Error** |
|---|---|
| 4 | Faulty Network Connection |
| 5 | No DHCP Response Received |

## 5.1 How to Enter Menu Configuration

Begin by connecting the COM2 port to your PC host and running EC that is available on the diskette or from Escort Memory Systems Web site at www.ems-rfid.com. Set the serial parameters to the LRP2000 default settings or the last known state of COM2. The default settings for COM2 are as follows:

**Table 5-1:**

| **Baud** | **9600** |
|---|---|
| Parity | None |
| Data bits | 8 |
| Stop bits | 1 |
| Flow control | None |

If you can not establish communications with COM2, do the following to restore the default values.

1. 1. Place DIP switch five in the ON position and cycle power to the LRP2000 or press the reset switch. This will load the default values.
2. 2. Place DIP switch 5 in the OFF position and cycle power once more.

Please refer to Chapter 4, Serial and Bus Communications, for more information on the serial interface. To enter the Main Board configuration menu, cycle power or press the reset switch, and thenpress CTRL-D within the first seven seconds of the initialization. The LRP2000 will enter the Configuration Menu. As the LRP2000 starts the Configuration program, both the RF and CONFIG LEDs will flash. The Main Board Configuration menu will display with the current main board software version number together with the DSP firmware version.

```
*****************************************
   LRP2000 (ISO Only) Standard Program
   Main Program  V0.5D, Sept 2002
```

```
   DSP  Program  V0.5c, November 2002
*******************************************


[1] Set-up Operating Parameters
[2] Download Main Program
[3] Download DSP  Program
[4] Exit to Operating Mode

Enter Selection:
```

## 5.2 Set-up Operating Parameters

To change the operating parameters of the LRP2000, enter 1 at the initial menu. The following menu will be displayed, listing the current settings. The exact appearance of the menu display will dependon the settings you have made, and will be updated when you save your changes.

```
Serial Port COM1: RS232, 9600, N, 8, 1, No handshake
(DIP switches)
Serial Port COM2: RS232, 9600, N, 8, 1, No handshake
Operating Mode: ABx Standard
RF Communication: Fast Mode
[1] Set COM1 Parameters
[2] Set COM2 Parameters
[3] Set Operating Mode
[4] Set RF Communications
[5] Restore Factory Defaults
[6] Return to Main Menu
```

Enter Selection: Enter the number of the sub-menu you wish to enter. When you have made your selection you will be prompted to save your changes to the non-volatile EEPROM. For the new settings to take effect, you must save your changes to the EEPROM and reset the LRP2000. If you do not save changes to the EEPROM, the new settings will be effective only until the LRP2000 is reset. The following sub-menus are presented here in their entirety. When operating, the menus will be presented one option at time, advancing as you enter selections. Some options shown are dependent on earlier selections.

### Set COM1 Parameters

Selecting 1 from the above menu will present the following display for the COM1 parameters. These settings are valid only if you are not using the DeviceNet Interfaces (e.g. DIP switch 4 is in the OFF position). Enter the appropriate number at each prompt. The default values are indicated by an asterisk (*).

```
*** Set COM1 Parameters ***
Baud Rate? [0] 1200 [1] 2400 [2] 4800 [3] 9600* [4]
19200 [5] 38400
Data size? [0] 7 bit [1] 8 bit*
Parity? [0] None* [1] Even [2] Odd
Handshake? [0] None* [1] Xon/Xoff
Save Changes to EEPROM? [0] No [1] Yes
```

Selecting 2 from the "[1] Set-up Operating Parameters" menu will bring up the following display for the COM2 parameters. Enter the appropriate number at each prompt. The default values are indicated by an asterisk.

```
*** Set COM2 Parameters ***

Baud Rate? [0] 1200 [1] 2400 [2] 4800 [3] 9600* [4]
19200

Data size? [0] 7 bit [1] 8 bit*
Parity? [0] None* [1] Even [2] Odd
Handshake? [0] None* [1] Xon/Xoff
Save Changes to EEPROM? [0] No [1] Yes
Set Operating Mode
```

The "[3] Set Operating Mode" menu allows you to choose the ABx command protocol the LRP2000 will use, or configure it to automatically enter Continuous Read Mode upon start-up.

```
*** Set Operating Mode ***
Command Protocol? [0] ABx Standard* [1] ABx Fast [2]
ABx ASCII
Checksum? [0] Disabled* [1] Enabled
Power up in Continuous Read Mode? [0] NO [1] Single
```

```
Tag [2] Multiple Tag
Start Address (0 to 47)
Length (1 to 48)
Delay Between Duplicate Decodes (0 to 60)
Raw Read Response? [0] NO [1] CR terminate [2] CR/LF
terminate
Save Changes to EEPROM? [0] No [1] Yes
Command Protocol?
```

The LRP2000 offers three modes for the transfer of data and commands. ABxStandard (ABxS) uses only the LSB for tag data while ABx Fast (ABxF) will use both the MSB and the LSB for the passing of data. ABx ASCII (ABxA)mode permits RFID operations using seven bit data packets in the form of printable ASCII characters.

### Checksum

ABx Fast and ABx ASCII also permits you to include a checksum in the command. To use a checksum value with the ABx commands, you must enable the checksum option. It is recommended that you enable the checksum option.

### Power up in Continuous Read Mode

You also have the option of setting the LRP2000 to start-up in Continuous Read Mode. When you have configured the LRP2000 to function in this manner,you do not issue commands to the LRP2000. It will, upon start-up, enter directly into a Continuous Read Mode. Since this bypasses the normal command parameters, you must specify the Continuous Read Mode parameters. The LRP2000 will respond to other commands and resume Continuous Read Mode when completed. If you are using your LRP2000 in this mode, you must choose if you want the LRP2000 to read a single tag or read multiple tags within the field. To exit Continuous Read Mode you must either re-enter the configuration menu and select NO from the Power up in Continuous Read Mode option, or issue a Continuous Read command from the host with a read length of 0 as described in Chapter 6, RFID Interface.

### Start Address (0 to 111)

Enter the tag address where you want the read to begin.

### Length (1 to 112) 112

Enter the length of the read you wish the LRP2000 to perform. Make certain that the length value does not exceed the number of possible addresses following the starting tag address. Entering a read length of 0 will disable Continuous Read Mode.

### Delay Between Identical Decodes (0-60)

The Delay Between Identical Decodes parameters can have a value of 0 to 60 seconds. When the Delay Between Identical Decodes is set to 0, the LRP2000 will continuously read AND transmit tag data to the host. This can flood the buffers and cause communication errors and data loss.

### Raw Read Response

If you have selected ABx Fast or ABx ASCII, you have the option of stripping the command protocol from the data and adding a terminator to separate the data packets. You can choose a CR (0DH) or CR/LF (0DH, 0AH) to terminate the data.

### Set RF Communication

The LRP2000 should be configured with the default (0) Fast Mode.

```
*** Set RF Communication ***
RF Communication? [0] Fast Mode* [1] Standard Mode 0
Save Changes to EEPROM? [0] No [1] Yes
Restore Factory Defaults
```

It is often helpful during troubleshooting to restore the LRP2000 to known default values. To do so, select 5 from the "[1] Set-up Operating Parameters" menu .

```
*** Restore Factory Defaults ***
Restore Factory Default? [0] No [1] Yes
```

The restored defaults will be saved to the EEPROM. The communication defaults can also be restored by placing the main board DIP switch number 5 in the ON position and then restarting the LRP2000. After you have saved any changes, you must re-initialize the LRP2000 with switch 5 in the OFF position.

### Return to Main Menu

When you have completed your configuration, entering 6 will return you to the initial menu. Unsaved changes will be effective until the LRP2000 is reset.  Saved changes will be loaded automatically the next time the LRP2000 is reset, or upon selection of "[4] Exit to Operating Mode" from the main menu.

## 5.3 Download New Program

Before attempting to download new firmware to the LRP2000 main board,read the instructions provided in a readme.txt file on the update diskette. When you select 2 from the Main Menu, the LRP2000 will display information on the current program and prompt you to begin the download.

```
*** Download New Program***
Program Size :21824 Bytes
Program Checksum :5AE0H (OK)
Free Program Memory :39600 Bytes
Flash Write Counter :2 times
Press a key to start Downloading
```

After you have pressed a key, the LRP2000 will display:

```
Send the Intel Hex file. Downloading now.
```

Send the new program file via your terminal emulation program in Text (Hyperterminal: Transfer->Send Text file) or ASCII (EC: PgDn->ASCII).

**NOTE:** It is not necessary to download firmware into the unit unless instructed to do so by Escort Memory Systems technical support personnel.

## 5.4 Downloading DSP Firmware

Before attempting to download new firmware to the LRP2000 main board, read the instructions provided in a readme.txt file on the update diskette. When upgrading software in the controller the number and meaning of the configuration parameters may not match between the old and new software. The old settings may not be interpreted properly with the new software. Before downloading another version of software, display and record the current configuration settings. Then download the new software version. Set switch 5 (on the main board) on and apply power to initialize the configuration parameters to their default states. When the LEDs stop flashing, turn Switch 5 to Off and press the reset switch. Enter the Configuration Menu and re-enter any non-default configuration parameters. When you select 3 from the Main Menu, the LRP2000 will prompt you to begin the download.

```
*** Download DSP Firmware***

Press a key to start Downloading
```

After you have pressed a key, the LRP2000 will display:

```
Send the Intel Hex file. Downloading now.
```

Send the new firmware via your terminal emulation program in ASCII text or Hexadecimal format. The firmware will be automatically transferred to the DSP Flash Memory. Wait 10 seconds after the download is complete before resetting the LRP2000.

```
Record: 750
Download OK
File Transfer to DSP
Blocco 24/24
DSP Flash Programming...
New Firmware Transferred to DSP
```

**CAUTION:** Do not download a DSP file into the microcontroller.

**CAUTION:** It is not necessary to download firmware into the unit unless instructed to do so by Escort Memory Systems technical support personnel.

## 5.5 Exit to Operating Mode

This option is available if you wish to use temporary, unsaved, configuration parameters. The unsaved options you have selected will be used until the LRP2000 is reset and the saved parameters are restored.

## 6.1 Introduction

### Conventions

In this manual, numbers expressed in Hexadecimal are appended with "H." For example, the number of fingers on a typical person will be expressed either as "10" in decimal or as "AH" in hexadecimal. The addresses of the bytes of read/write memory within an RFID tag are numbered from 0 to N, where N is one less than the number of read/write bytes in the tag. The number of read/write bytes is equal to the Block Size multiplied by the Number of Blocks. These parameters can be found for a particular tag using the ABx Command 16H, Get Label Information.

### Command protocols

The LRP2000 offers three possible command protocols: ABx Standard, ABx Fast and ABx ASCII. The ABx Standard format is word-based and shares a common syntax with most existing RFID systems produced by Escort Memory Systems.The ABx Fast and ABx ASCII protocols are byte-based packet structures that permit command execution with fewer total bytes transferred. Escort Memory Systems offers more support for ABx Fast protocol in terms of examples and demonstration software. Because of this, and the fact that ABx Fast speeds communication while increasing error immunity, operators are encouraged to implement ABx Fast protocol.

The commands in all three protocols consist of the same basic structure. They comprise a header, a number of parameters, and a command terminator. The headers and terminators are unique to each protocol, but are the same for every command within one protocol. For example, in ABx Standard, every command begins with the one-byte header "AAH," and ends with the two-byte terminator "FFFFH". In ABx Fast and in ABx ASCII, every command begins with the 0202H, and ends with 03H. Like the commands, the responses from the controller comprise a header, a number of response codes and data, and a response terminator. The headers and terminators are the same for the responses as they are for the commands. The ABx command set is made of three subsets: the single-tag commands, multi-tag commands, and user I/O commands. The single-tag commands perform read/write operations on exactly one tag in the range of the antenna at a time. The presence of more than one tag within the range of the antenna may cause RFID communication errors. To avoid these errors, the multi-tag commands allow for simultaneous communication to and from multiple tags within the reading range of the antenna. The user I/O commands do not communicate with RFID tags. They simply interrogate the status of the inputs wired to the unit, and to the status of the outputs. Table4.1 and 4.2 list the ABx commands recognized by the LRP2000.

## Table 4.1 and 4.2- ABx Command Set Listings

Single tag Commands

| **04H** | **Fill Tag** |
|---|---|
| 05H | Block Read |
| 06H | Block Write |
| 07H | Read Tag Serial Number |
| 08H | Tag Search |
| 0DH | Continuous Block Read |
| 14H | Get Block Status |
| 15H | Get Label Information |
| 16H | Write Family Code |
| 17H | Lock Family Code |

Multi tag commands

| **82H** | **SN Block Read All** |
|---|---|
| 83H | Start/Stop Continuous SN Block Read All |
| 84H | Fill Tag All |
| 85H | Block Read All |
| 86H | Block Write All |
| 87H | Read Tag SN All |
| 88H | Tag Search All |
| 8DH | Start/Stop Continuous Read All |
| 8EH | Memory Lock All |
| 8BH | Write Family Code All |
| 8CH | Lock Family Code All |
| 94H | SN Fill |
| 95H | SN Block Read |
| 96H | SN Block Write |
| User I/O Commands: | 10H |
| Set Output | 11H |

| 82H | SN Block Read All |
|---|---|
| Input Status | |

**NOTE:** The delay between the characters of a command sent to the controller cannot be longer than 200 ms.

# 6.2 Command Parameters

## Command Timeout

All single-tag and multi-tag commands have a timeout value that is used to specify the time the controller will attempt to complete the specified operation. The absolute minimum timeout value which can be issued to the controller is 1 millisecond. The absolute maximum time for which the controller will attempt to complete a command is just over one minute. The timeout parameter is passed to the controller in units of milliseconds with a maximum value of 65,534 (FFFEH) milliseconds. A timeout value of 0 will generate a syntax error. Thirty milliseconds is the shortest recommended timeout and should only be used for single tag command applications. Multiple tag commands will require longer timeout values. For applications where the time that the tags spend in the field must be short, tests should be performed to ensure that a sufficiently large timeout value is chosen in order to read all of the tags. A longer timeout value does not necessarily mean that a command will take any longer to execute. If the tags being addressed are in the field, it only represents the period of time (in milliseconds) the unit will attempt to execute the command. If the tags are present, the response time to execute the command will be the same whether the timeout is 100ms or 10,000ms.

## Delay Between Duplicate Decodes

The one parameter which is unique to the single-tag command 0DH is Delay Between Duplicate Decodes. After Continuous Read is started, any tag that comes within range of the antenna will be read and the requested data from the tag will be sent to the host. This delay parameter represents the number of seconds that a tag must remain out of range before it is read a second time. This delay is implemented to enable the operator to limit the volume of information sent by the controller. With this delay parameter set to 00H, the controller will repeatedly send the requested information until the tag is out of range. The maximum allowable value is 60(3CH) seconds.

# Multi-tag Command Parameters

## Tag Repeat Count

This parameter is used on the multi-tag Continuous Read commands, 83H and 8DH. After Continuous Read is initiated, any tag that comes within range of the antenna will be read and the requested data from the tag will be sent to the host. The Tag Repeat Count parameter represents the number of other tags which must be read before the data from the first tag will be sent for a second time. This count is implemented to enable the operator to limit the volume of information sent by the controller. In this way, it is functionally similar to the Delay parameter used in the single-tag Continuous Read command. The difference between the two is that the single-tag parameter indicates an amount of time for which a tag must remain out of range of the antenna in order for its data to be sent a second time. The Tag Repeat Count is strictly the number of tags whose data will be sent before the data from a certain tag is sent again. With this Count parameter set to 00H, the controller will repeatedly send the requested information until the tags are out of range.

## Selectively Reading and Writing Tags By Family

The multi-tag commands always have a Family Code as a parameter. This parameter manages the reads and writes when multiple tags are in the reading field. This parameter can be used to differentiate between tags without communicating directly with all of the tags in the field at one time. In this condition it is still possible to communicate with individual tags through the use of commands 94H, 95H, and 96H. These commands operate on one specific tag by including the tag's unique serial number as a parameter. The Family Code is a one-byte field in the tag which resides outside the read/write memory address space. When the Family Code parameter is set to 0, the command is broadcast to all the tags in the field. On the other hand, if the Family Code parameter is set to a non-zero byte value, only tags with implementing a multi-level organization of the tags, by permitting thethe specified Family code will respond. This feature can help in selective reading of tags by Family Code. This gives faster access to the tags than by using Family Code zero. The Family Code byte can be read, written, and locked independently of the rest of the read/write address space in the tag.

## Anticollision Index

The multi-tag commands in the ABx protocols include a parameter which is not used with ISO15693-compliant tags. The Byte allocated for this obsolete parameter has been left in the multi-tag command packets.  It is referred to as the "Anticollision Index" in documentation for EMS products with firmware support for LRP-L series tags. This series of tags does not comply with the ISO-15693 standard. The Anticollision Index is ignored by the controller and may be set to any value, but to maintain consistency in the case that this byte is used in the future, it is recommended to set this Byte to 00H.

### Start Continuous Read

This parameter, included only on command 83H, is a one-Byte parameter which starts the Continuous Read if set to 01H, and stops the Continuous Read if set to 00H. Both of the other Continuous Read commands-- 0DH and 8DH rely on the Number of Bytes to be read to start and stop the command. If the Number of Bytes is set to any valid nonzero value, the Continuous read starts. If it is set to zero, the Continuous Read stops. The use of this additional parameter on command 83H allows for the Number of Bytes to be set to zero upon initiation of the command, thereby interrogating the tags only for their serial numbers.

## 6.3 Standard Abx Protocol

### 6.3 ABx Standard Protocol

The ABx standard is a binary protocol, word (2-byte) oriented, so thesyntax table reports the Most Significant Byte (MSB) and the LeastSignificant Byte (LSB). In the serial transmission, the MSB istransmitted first.

| Field | Number of Bytes | Content |
|---|---|---|
| Header | 1 | AAH |
| Command | 1 | Command Code |
| Start Address | 2 | one word gives the first Byte of tag memory to be accessed |
| Number of Bytes | 2 | One word gives the number of contiguous bytes to be accessed. Not used on 07H, 08H, 14H, 15H, 16H |

| Field | Number of Bytes | Content |
|---|---|---|
| Block Addresses | 2 | The first Byte gives the address of the first block. The second Byte gives the number of blocks to be interrogated. Only used with command 14H. |
| Timeout | 2 | 0001H to FFFEH milliseconds |
| Data | varies | Data which will be written to a tag. Each byte is included in the LSB of a two-Byte word. |
| Terminator | 1 | FFFFH |

| Field | Number of Bytes | Content |
|---|---|---|
| Header | 1 | AAH. Always the MSB of the first word of an ABX Standard command |
| Command | 1 | Command Code - LSB of the first word |
| Family code | 1 | LSB 00H to address all tags in field |
| Reserved | 1 | Reserved for future use, set to 00H |
| Start Address | 2 | One word gives the first Byte of tag memory to be accessed |
| Number of Bytes | 2 | One word gives the number of contiguous bytes to be accessed - Not used with commands 87H, 88H, 8EH, 8BH, 8CH |
| Block Addresses | 4 | The first word gives the address of the first block. The second word gives the number of blocks to be interrogated - Only used with command 8EH |
| Timeout | 2 | 0001H to FFFEH milliseconds |
| Data | varies | Data which will be written to a tag. Each byte is included in the LSB of a two-Byte word. |
| Terminator | 2 | FFFFH |

*****************************************************************************

## ABxS Command 04H: Fill Tag

DESCRIPTION

Fill an RFID tag with a one byte value over multiple contiguous addresses.

DISCUSSION

This command is commonly used to clear contiguous segments of a tag's memory. It writes a one byte value repetitively across a specified range of tag addresses. The fill function requires one data value byte, a starting address, and a fill length. It will then proceed to fill the tag with the data value byte, starting at the specified start address for the specified number of consecutive bytes. When Fill Length is set to 0, the controller will write fill data from the start address to the end of the tag's memory. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Start | Address The tag address where the fill will start |
| Fill Length | The number of tag addresses to be filled in bytes |
| Timeout | Timeout value given in 1 ms units (10H - FFFEH) |
| Data Value Byte | The byte to be used as fill |
| Message Terminator | FFFFH |

## Example

The goal is to write ASCII 'A' (41H) to the ten bytes of tag memory starting at byte address 5. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the command.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 04H | Perform Command 4 |
| 00H | 05H | Start Address = 0005H |
| 00H | 0AH | Fill Length= 10 bytes(000AH) |
| 07H | D0H | Timeout value |
| 00H | 41H | Data Value Byte = 41H |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| AAH | 04H | Command echo |
| FFH | FFH | Message Terminator |

****************************************************************************

## ABxS Command 5 (05H): Block Read

DESCRIPTION

Read data from contiguous bytes of the RFID tag's read/write memory.

DISCUSSION

This command is used to read bytes from contiguous areas of tag memory. The minimum length of the data read from the tag is 1 byte. The maximum is the entire read/write address space of the tag. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error. The Block Read command consists of a start address and length, followed by the message terminator, FFFFH, as shown below. If the read range exceeds the last tag address, the controller will return error message 21H, invalid format. The data read from the tag is returned in the less significant byte of the word, and the more significant byte is always 00H.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Start Address | The tag address where the read will start |
| Read Length | The number of tag addresses to be read |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH |

## Example

The goal is to read the 8 bytes of data from the tag starting at address 1. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Block Read.

| MSB | LSB | Remarks |
|---|---|---|
| AAH | 05H | Perform Command 5 |
| 00H | 01H | Start byte Address = 0001H |
| 00H | 08H | = 8 bytes(0008H) |
| 07H | D0H | Timeout Value |
| FFH | FFH | Message Terminator |

| | LSB | Remarks |
|---|---|---|
| AAH | 05H | Command echo |
| 00H | 52H | Read Data 1 =52H |
| 00H | 46H | Read Data 2 =46H |
| 00H | 49H | Read Data 3 =49H |
| 00H | 44H | Read Data 4 =44H |
| 00H | 20H | Read Data 5 =20H |
| 00H | 54H | Read Data 6 =54H |
| 00H | 61H | Read Data 7 =61H |
| 00H | 67H | Read Data 8 =67H |
| FFH | FFH | Message Terminator |

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## ABxS Command 6 (06H): Block Write

DESCRIPTION

Write a block of data to an RFID tag.

DISCUSSION

This command is used to write segments of data to contiguous areas of tag memory. It is capable of transferring up to 112 bytes of data transferred from the Host with one command. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error.  The Block Write command consists of a start address followed by the data stream to be written to the RFID tag. If the write range exceeds the last tag address, the controller will return error message 21H, invalid format. The controller will also return an error if the write length is 0.  The data to be written to the tag is contained in the LSB of the register, and the MSB is always 00H.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Start Address | The tag address where the write will start |
| Write Length | The number of tag addresses to be written to in bytes |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Write Data | The data to be written |
| Message Terminator | FFFFH |

## Example

Writes 4 bytes of data to the tag starting at address 0020H. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Block Write.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 06H | Perform Command 6 |
| 00H | 20H | Start Address = 0020H |
| 00H | 04H | Write Length = 4 bytes |
| 07H | D0H | Timeout Value |
| 00H | 52H | Write Data 1 =52H |
| 00H | 46H | Write Data 2 =46H |
| 00H | 49H | Write Data 3 =49H |
| 00H | 44H | Write Data 4 =44H |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 06H | Command echo |
| FFH | FFH | Message Terminator |

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## ABxS Command 7 (07H): Read Tag Serial Number

DESCRIPTION

This command retrieves the eight-byte tag serial number.

DISCUSSION

Each controller tag has a unique serial number. This number cannot be changed and is not part of the available data bytes. The tag serial number will be returned in the LSB only, with the MSB as 00H.

| | Remarks |
|---|---|
| Command | Command number in hex preceded by AAH |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH |

### Example

This example will wait until a tag is in range and then reads the 8-byte serial number. In this example the ID is 1E6E3DC200000000H in hexadecimal.

| Command from host | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 07H | Perform Command 7 |
| 07H | D0H | Timeout |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 07H | Command Echo |
| 00H | 001EH | First SN byte |
| 00H | 6EH | Second SN byte |
| 00H | 3DH | Third SN byte |
| 00H | C2H | Fourth SN byte |
| 00H | 00H | Fifth N byte |
| 00H | 00H | Sixth SN byte |
| 00H | 00H | Seventh SN byte |
| 00H | 00H | Eighth SN byte |
| FFH | FFH | Message Terminator |

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## ABxS Command 08H: Tag Search

DESCRIPTION

Check to see if there is an RFID tag in the field.

DISCUSSION

This command will activate the controller to search for the presence of a tag within range of the antenna. If the controller finds a tag it will return a command echo to the host. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (30 to 65,534 ms). When the timeout is set to 0, the controller will return a syntax error. If no tag is present, it will return an error message. See Section 6.2 for more information on error codes.

| | Remarks |
|---|---|
| Command | Command number in hex preceded by AAH |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH |

### Example

Checks for an RFID tag in the RF field. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Tag Search.

| Command from host | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 08H | Perform Command 8 |
| 07H | D0H | Timeout Value |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 08H | Command echo |
| FFH | FFH | Message Terminator |

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## ABxS Command 0DH: Stop/Start Continuous Block Read

DESCRIPTION

When in Continuous Block Read mode, the controller sends block read commands continuously to any tag in range of the antenna. When a tag comes within range, it is read and the data passed to the host computer. The controller continues to read the tag but will not send the same data to the host until the tag has been outside the RF field for a specified time period. This Delay Between Identical Decodes parameter prevents redundant data transmissions when the controller is in Continuous Block Read mode.

DISCUSSION

The Start/Stop Continuous Block Read command contains three parameters: read length, start address, and delay between identica decodes. The read length parameter switches the mode. Any valid, non-zero length (1-48) will set the controller into Continuous Block Read mode. A read length value of 00H will turn Continuous Block Mode off. The Delay Between Identical Decodes parameters can have a value of 0 to 60 seconds. When the Delay Between Identical Decodes is set to 0, the controller will continuously read AND transmit tag data to the host. This can flood the buffers and cause communication errors and data loss.  If the controller receives other commands from the host, it will execute them and then resume Continuous Block Read mode. To exit Continuous Block Read mode, issue the command with a read length of 0.

In Continuous Block Read mode, the LEDs will display as follows:

| | Behavior | Description |
|---|---|---|
| ANT | ON | Assumes the Antenna is powered and functioning |
| CONFIG | BLINK | Tag entered the RF field |
| RF | ON | A tag has been read and is still in the field |
| RF | OFF | A read tag has been out of range for the specified time |

## The command and Response from the controller are formatted as follows

| | |
|---|---|
| **Field** | **Remarks** |
| Command | Command number in hex preceded by AAH |
| Start Address | 2 byte value for the start address in the tag |
| Read Length | 2 byte value for the block read length |
| Delay Between Identical Decodes | Time the tag must be out of the antenna range before the controller will transmit data again from that tag. Value is expressed in 1 second units. |
| Message Terminator | FFFFH |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 0DH | Command echo |
| FFH | FFH | Message Terminator |

### Example

This example places the controller in Continuous Block Read mode and reads 8 bytes of data from the tag starting at address 0001H. A delay between identical reads of 2 seconds (0002H =2 x 1second increments) is set.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 0DH | Perform Command D |
| 00H | 01H | Start address |
| 00H | 08H | Read 8 bytes |
| 00H | 02H | 2 second delay |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 0DH | Command echo |
| 00H | 52H | Read data byte 1 |
| 00H | 46H | Read data byte 2 |
| 00H | 49H | Read data byte 3 |
| 00H | 44H | Read data byte 4 |
| 00H | 41H | Read data byte 5 |
| 00H | 20H | Read data byte 6 |
| 00H | 54H | Read data byte 7 |
| 00H | 61H | Read data byte 8 |
| FFH | FFH | Message Terminator |

The controller will first return an acknowledgment of the command followed by a response containing read data when a tag enters the antenna field.

To exit Continuous Block Read mode, Send the command with the read length variable set to 0 as shown below. The value of the other variables are not considered.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 0DH | Perform Command D |
| 00H | 01H | Start address |
| 00H | 00H | Read 0 bytes/end mode |
| 00H | 02H | 2 second delay |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 0DH | Command echo |
| FFH | FFH | Message Terminator |

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## ABxS Command 14H: Get Block Status

DESCRIPTION

Returns the lock status of the specified blocks of data.

DISCUSSION

This command can be used to determine whether blocks of tag memory are locked; marked "read-only." The number of specified contiguous blocks are addressed from the specified first block. The response from the controller gives the status of each block through a one-word value. The value is 0000H if the block is unlocked, 0001H if locked. The size and organization of the blocks in a particular tag can be found through the use of command 15H, Get Label Information.

| | **Content** |
|---|---|
| Header | AAH |
| Command | 14H |
| First Block | Two-Byte value for the first block whose lock status will be interrogated |
| Number of blocks | Two-Byte value for the number of blocks whose lock status will be interrogated. |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH |

### Response from controller:

| **Field** | **Content** |
|---|---|
| Header | AAH |
| Command Echo | 14H |
| Block Status | One word represents the status of each block 0000H indicates that the block is not locked 0001H indicates that the block is locked |
| Terminator | FFFFH |

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## ABxS Command 15H: Get Label Information

DESCRIPTION:

This command retrieves manufacturer's data and the Family Code from the tag.

| | Content |
|---|---|
| Header | AAH |
| Command | 15H |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Terminator | FFFFH |

## Response from controller

| Field | Content |
|---|---|
| Header | AAH |
| Command Echo | 15H |
| Info Flags | One-word value |
| Format Info | One-word value |
| Family Code | One word with the tag's family code in the LSB |
| Block Size | Number of Bytes in each tag block given in the LSB |
| Number of blocks | Number of blocks of rewriteable memory given in the LSB |
| IC Ref | One-word value |
| Terminator | FFFFH |

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## ABxS Command 16H: Write Family Code

DESCRIPTION

Change the family code of an RFID tag.

| | Content |
|---|---|
| Header | AAH |
| Command | 16H |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| New Family code | One word with 00H in the MSB and the new Family Code in the LSB |
| Terminator | FFFFH |

## Response from controller:

| Field | Content |
|---|---|
| Header | AAH |
| Command Echo | 16H |
| Terminator | FFFFH |

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## ABxS Command 17H: Lock Family Code

Description:

Locks the Family Code Byte to its current value so that it cannot be written. Once locked, the Family Code cannot be unlocked.

| | **Content** |
|---|---|
| Header | AAH |
| Command | 17H |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Terminator | FFFFH |

## Response from controller:

| **Field** | **Content** |
|---|---|
| Header | Command Echo |
| 17H | Terminator |
| FFFFH | |

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## ABxS Command 82H: SN Block Read All

DESCRIPTION

Command 82H reads the serial numbers and the specified bytes of data from all RFID tags in the field or those with the specified Family ID. Returns the serial number of the tags read, along with tag data.

DISCUSSION

This command is used to read segments of data from contiguous areas of tag memory. It is capable of transferring the entire read/write

address of data transferred to the host with one command. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error. The response to this command will contain the serial number of the responding tags preceding the data from those tags. The termination packet is transmitted when the timeout expires. Each packet will be sent to the host as soon as it is available. The returned serial numbers can be used to read/write to tags-in-field via the SN Block Read/Write command. The SN Block Read All consists of Family ID, Reserved Byte, a start address and length, followed by a timeout value and the message terminator, FFFFH. A special termination packet is sent when the timeout expires. If the read length exceeds the last tag address, the controller will return a syntax error, code 21H.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Tag Family | Tag Family ID - 00H = all tags |
| Reserved | 00H |
| Start Address | The tag address where the read will start |
| Read Length | The numbers of tag addresses to be read |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH |

**Example:**

Reads 2 bytes of data from the tag starting at address 0001H. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the SN Block Read All. The Family ID byte is set to zero so all tags will be read. Two tags respond with read data.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 82H | Perform Command 82 |
| 00H | 00H | Tag Family 00/ Reserved |
| 00H | 01H | Start Address |
| 00H | 02H | Read Length |
| 07H | D0H | Timeout |
| FFH | FFH | Message Terminato |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 82H | Command Echo/Tag 1 |
| 00H | 10H | SN byte 1/Tag 1 |
| 00H | 43H | SN byte 2/Tag 1 |
| 00H | 6CH | SN byte 3/Tag 1 |
| 00H | 73H | SN byte 4/Tag 1 |
| 00H | 92H | SN byte 5/Tag 1 |
| 00H | C0H | SN byte 6/Tag 1 |
| 00H | D6H | SN byte 7/Tag 1 |
| 00H | 54H | SN byte 8/Tag 1 |
| 00H | 30H | Data byte 1/Tag 1 |
| 00H | 31H | Data byte 2/Tag 1 |
| FFH | FFH | Terminator/ Tag 1 |
| AAH | 82H | Command Echo/Tag 2 |
| 00H | 08H | SN byte 1/Tag 2 |
| 00H | 0AH | SN byte 2/Tag 2 |
| 00H | 81H | SN byte 3/Tag 2 |
| 00H | 18H | SN byte 4/Tag 2 |
| 00H | 23H | SN byte 5/Tag 2 |
| 00H | CCH | SN byte 6/Tag 2 |
| 00H | D0H | SN byte 7/Tag 2 |
| 00H | EFH | SN byte 8/Tag 2 |
| 00H | 40H | Data byte 1/Tag 2 |
| 00H | 41H | Data byte 2/Tag 2 |
| FFH | FFH | Terminator/ Tag 2 |
| AAH | FFH | Command end |
| 02H | 08H | Ntags/Status |
| FFH | FFH | Message Terminator |

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## ABxS Command 83H: Start/Stop Continuous SN Read All

DESCRIPTION

Starts and stops continuous read all mode for multiple tags. It reads the Serial Number and tag data. If the read length is zero (0), then only the tag's serial number is read. While in this mode, any other command can be issued and it will be handled properly. After processing the new command, the controller will resume the continuous read. Continuous SN Read all is started or stopped by the start/stop Byte in the command. A one indicates it is TRUE to start and a zero (0) indicated it is FALSE to start, or to stop continuous read. The command has a parameter, Repeat Count, that can prevent multiple reads of the same tag. A tag is not read a second time until this specified number of tags have been read since it was last read. Allowed values are from 0 to 255, where 0 means the tag can be re-read anytime. When Start/Stop Continuous SN Read All is interrupted with other command, the repeat count is stopped during execution of the other commands and then resumed. The Reader/Writer will respond with an acknowledge packet followed by data packets for each tag read.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Family ID | Tag Family ID - 00H = all tags |
| Reserved | 00H |
| Start Address | Tag address for the start of the read |
| Read Length | One word for the number of bytes to be read. |
| Repeat Count | Number of tag that must be read before the same tag will be read again(0-255) |
| Start/Stop | 0001H to start, 0000H to stop |
| Message Terminator | FFFFH |

**Example:**

Starts continuous read of three bytes starting at address two, Repeat count of four, with a family code of zero.

| | | |
|---|---|---|
| MSB | LSB | Remarks |
| AAH | 83H | Perform Command 83 |
| 00H | 00H | Tag Family 00/ Reserved Byte |
| 00H | 02H | Start Address |
| 00H | 03H | Read Length of the data bytes |
| 00H | 04H | Repeat count |
| 00H | 01H | Stop/Start continuous read. This is to Start |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | LSB | Remarks |
| AAH | 83H | Command Echo |
| FFH | FFH | Message Terminator |

After the controller sends the acknowledgement, it will send the data read from the tags in the field.

## Data response from controller

| MSB | LSB | Remarks |
|---|---|---|
| AAH | 83H | Command Echo |
| 00H | 1EH | Serial Number byte /Tag 1 |
| 00H | 94H | Serial Number byte /Tag 1 |
| 00H | 0BH | Serial Number byte /Tag 1 |
| 00H | 01H | Serial Number byte /Tag 1 |
| 00H | 00H | Serial Number byte /Tag 1 |
| 00H | 00H | Serial Number byte /Tag 1 |
| 00H | 00H | Serial Number byte /Tag 1 |
| 00H | 01H | Serial Number byte /Tag 1 |
| 00H | 6CH | Tag data byte /Tag 1 |
| 00H | 6CH | Tag data byte /Tag 1 |
| 00H | 20H | Tag data byte /Tag 1 |
| FFH | FFH | Message Terminator |

| MSB | LSB | Remarks |
|---|---|---|
| AAH | 83H | Command echo |
| 00H | 4BH | Serial Number byte /Tag 2 |
| 00H | C5H | Serial Number byte /Tag 2 |
| 00H | 0BH | Serial Number byte /Tag 2 |
| 00H | 01H | Serial Number byte /Tag 2 |
| 00H | 00H | Serial Number byte /Tag 2 |
| 00H | 00H | Serial Number byte /Tag 2 |
| 00H | 00H | Serial Number byte /Tag 2 |
| 00H | 01H | Serial Number byte /Tag 2 |
| 00H | 6CH | Tag data byte /Tag 2 |
| 00H | 6CH | Tag data byte /Tag 2 |
| 00H | 20H | Tag data byte /Tag 2 |
| FFH | FFH | Message Terminator |
| AAH | 83H | Command echo |
| 00H | FCH | Serial Number byte /Tag 3 |
| 00H | C5H | Serial Number byte /Tag 3 |
| 00H | 73H | Serial Number byte /Tag 3 |
| 00H | 00H | Serial Number byte /Tag 3 |
| 00H | 00H | Serial Number byte /Tag 3 |
| 00H | 00H | Serial Number byte /Tag 3 |
| 00H | 00H | Serial Number byte /Tag 3 |
| 00H | 01H | Serial Number byte /Tag 3 |
| 00H | 32H | Tag data byte /Tag 3 |
| 00H | 33H | Tag data byte /Tag 3 |
| 00H | 34H | Tag data byte /Tag 3 |
| FFH | FFH | Message Terminator |

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## ABxS Command 84H: Fill Tag All

DESCRIPTION

Fill all RFID tags-in-field or all tags in the same family with a one-Byte value over multiple contiguous addresses.

DISCUSSION

This command is commonly used to clear an RFID tag's memory. It writes a one-Byte value repetitively across a specified range of tag addresses. All tags within range of the antenna with the specified Family ID will be affected by this command. The fill function requires one data value byte, a starting address, and a fill length. It will then proceed to fill the tag with the data value byte, starting at the specified start address for the specified number of consecutive bytes. The Fill Length must be set to a non-zero value. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). The controller will return a response after the timeout expires. A response is returned when a successful operation is performed or when the timeout has expired. When the timeout is set to 0, the controller will return a syntax error.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Family Code | Tag Family ID - 00H = all tags |
| Reserved Byte | 00H |
| Start Address | The tag address where the fill will start |
| Fill Length | The number of tag addresses to be filled (1-48) |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Data Value Byte | The byte to be used as fill |
| Message Terminator | FFFFH |

A response to a successful command will follow this form.

| | Remarks |
|---|---|
| Command Echo | Command number in hex preceded by AAH |
| Number of Tags filled | Number of tags found in the field and filled |
| Command Status | One byte Error status |
| Message Terminator | FFFFH |

## Example

Writes 'A' (41H) to all tags of family 01H, starting at tag address 0005H for the following next consecutive 40 bytes with four to eight tags expected in the field.. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Fill All Tag. Four tags are successfully filled within the timeout.

| Command from host | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 84H | Perform Command 84 |
| 01H | 00H | Tag Family 01 / Reserved |
| 00H | 05H | Start Address |
| 00H | 28H | Fill Length |
| 07H | D0H | Timeout |
| 00H | 41H | Fill byte |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 84H | Command Echo |
| 04H | 08H | Ntag/Status |
| FFH | FFH | Message Terminator |

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## ABxS Command 85H: Block Read All

DESCRIPTION

Read a block of data from all RFID tags-in-field or those with the specified Family ID.

DISCUSSION

This command is used to read segments of data from contiguous areas of tag memory. It is capable of handling up to 1 kByte of data transferred to the host with one command. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error message 21H.  The Block Read All consists of Tag Family ID and Reserved Byte, a start address and number of Bytes, followed by a timeout value and the message terminator, FFFFH. If the read length exceeds the last tag address, the controller will return a syntax error message 21H.  The data read from the tag is returned in the LSB of the register, and the MSB is always 00H.  A special termination packet (AAH FFH) is sent after the timeout expires.  The controller will return a response after the timeout expires. The command returns a response after the successful operation or when the timeout expires.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Tag Family | Tag Family ID - 00H = all tags |
| Reserved Byte | 00H |
| Start Address | The tag address where the read will start |
| Read Length | The number of tag addresses to be read |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH |

## Example:

Reads 4 bytes of data from the tag starting at address 0001H. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Block Read All. The Family ID byte is set to zero so all tags will be read. Three tags respond with read data.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 85H | Perform Command 85 |
| 00H | 02H | Tag Family 00/ Index 2 |
| 00H | 01H | Start Address |
| 00H | 04H | Read Length |
| 07H | D0H | Timeout |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 85H | Command Echo/ Tag 1 |
| 00H | 30H | Data byte 1/Tag 1 |
| 00H | 31H | Data byte 2/Tag 1 |
| 00H | 32H Data byte 3/ Tag 1 | 00H |
| 33H | Data byte 4/Tag 1 | FFH |
| FFH | Terminator/ Tag 1 | AAH |
| 85H | Command Echo/ Tag 2 | 00H |
| 40H | Data byte 1/Tag 2 | 00H |
| 41H | Data byte 2/Tag 2 | 00H |
| 42H | Data byte 3/Tag 2 | 00H |
| 43H | Data byte 4/Tag 2 | FFH |
| FFH | Terminator/ Tag 2 | AAH |
| 85H | Command Echo/ Tag 3 | 00H |
| 34H | Data byte 1/Tag 3 | 00H |
| 35H | Databyte 2/Tag 3 | 00H |
| 36H | Data byte 3/Tag 3 | 00H |
| 37H | Data byte 4/Tag 3 | FFH |
| FFH | Terminator/ Tag 3 | AAH |
| FFH | Termination Packet | 03H |
| 08H | Ntag/Status | FFH |
| FFH | Terminator Message | |

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## ABxS Command 86H: Block Write All

DESCRIPTION

Write a block of data to all RFID tags or all tags with the same Family ID.

DISCUSSION

This command is used to write segments of data to contiguous areas of tag memory. It is capable of transferring up to 1 kByte of data from the Host with one command. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error. The BlockWrite consists of a Tag Family ID and an Reserved Byte, start address followed by the data stream to be written to the RFID tag. If the write range exceeds the last tag address, the controller wil return error message 21H, invalid format. The data to be written to the tag is contained in the LSB of the register, and the MSB is always 00H. The controller returns a response when the timeout expires. The controller returns a response when the timeout expires.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Family ID | Tag Family ID - 00H = all tags |
| Reserved | 00H |
| Start Address | The tag address where the write will start |
| Write Length | The number of tag addresses to be written to in bytes |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Write Data | The data to be written |
| Message | Terminator FFFFH |

## Example:

Writes 4 bytes of data, starting at address 0001H. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Block Write. The Family ID byte is set to 2, so all tags with Family ID of 2 will be written to (four tags in this example).

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 86H | Perform Command 86 |
| 02H | 00H | Tag Family/Reserved |
| 00H | 01H | Start Address |
| 00H | 04H | Write Length |
| 07H | D0H | Timeout |
| 00H | 40H | Data byte 1 |
| 00H | 41H | Data byte 2 |
| 00H | 42H | Data byte 3 |
| 00H | 43H | Data byte 4 |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 86H | Command Echo |
| 04H | 08H | Ntags/Status |
| FFH | FFH | Message Terminator |
| **MSB** | **LSB** | **Remarks** |
| AAH | 86H | Command Echo |
| 04H | 08H | Ntags/Status |
| FFH | FFH | Message Terminator |
| **MSB** | **LSB** | **Remarks** |
| AAH | 86H | Command Echo |
| 04H | 08H | Ntags/Status |

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## ABxS Command 87H: Read Tag SN All

DESCRIPTION

This command retrieves the 8-byte tag serial number from all tags o r those with the specified Family ID number.

DISCUSSION

Each ISO-15693 compliant tag has an unique (over 280 trillion possibilities) serial number. This number cannot be changed and is not part of the available data bytes. The tag serial number is returned in the LSB only, with the MSB as 00H. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error. A special termination packet (starting with AAH FFH) is sent when the timeout expires. A response is returned after successful operation or after the timeout has expired.

| | **Remarks** |
|---|---|
| Command | Command number in hex preceded by AAH |
| Family ID | Tag Family ID - 00H = all tags |
| Reserved | 00H |
| Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH |

### Example

This example will read the 8-byte serial number from Tag Family 2. In this example the ID for the found tag is 1E6E3CD200000000H in hexadecimal.  Multiple tags will return a complete response packet for each tag.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 87H | Perform Command 87 |
| 01H | 00H | Family ID/Reserved |
| 07H | D0H | Timeout |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 87H | Command Echo |
| 00H | 1EH | First SN byte |
| 00H | 6EH | Second SN byte |
| 00H | 3CH | Third SN byte |
| 00H | D2H | Fourth SN byte |
| 00H | 00H | Fifth SN byte |
| 00H | 00H | Sixth SN byte |
| 00H | 00H | Seventh SN byte |
| 00H | 00H | Eighth SN byte |
| FFH | FFH | Message Terminator |
| AAH | FFH | Termination packet |
| 01H | 08H | Ntags/Status |
| FFH | FFH | Message Terminator |

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## ABxS Command 88H: Tag Search All

DESCRIPTION

Check to see if there is an RFID tag within range of the antenna.

DISCUSSION

This command will activate controller to "look" for a tag in range. As soon as the controller finds a tag it will return a command echo to the host. The timeout value is given in 1 msec increments and can have a value of 001EH to FFFEH (65,534 ms). When the timeout is set to 0, the controller will return a syntax error. The number of tags returned can be either 1 (tag found) or 0 (timeout expired without having found a tag).

| | Remarks | Command |
|---|---|---|
| Command number in hex preceded by AAH | Family ID | Tag Family ID - 00H = all tags |
| Reserved 00H | Timeout | Timeout value given in 1 ms units (001EH - FFFEH) |
| Message Terminator | FFFFH | |

## Example

Checks for an RFID tag in the RF field. A timeout of 1 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Tag Search. The Family ID is set for any tag. One tag is found and the command is successful.

| | | |
|---|---|---|
| **MSB** | **LSB** | **Remarks** |
| AAH | 88H | Perform Command 88 |
| 00H | 00H | Family ID/ Reserved |
| 07H | D0H | 2 second Timeout |
| FFH | FFH | Message Terminator |

| | | |
|---|---|---|
| | **LSB** | **Remarks** |
| AAH | 88H | Command Echo |
| 01H | 00H | Ntags/Status |
| FFH | FFH | Message Terminator |