OPERATOR'S MANUAL

LRP830-Series Long-Range Passive Reader/Writers

Manual Revision 3, July, '00
Publication #17-1271

Escort Memory Systems Warranty

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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 custom 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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NOTICE

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 and correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the 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.

CAUTION

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

1 GETTING STARTED

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 and material handling applications.

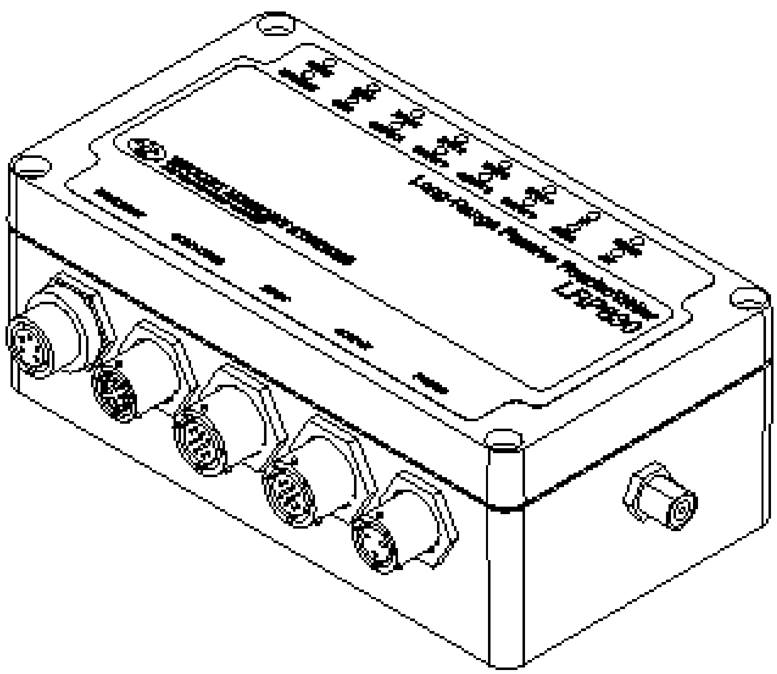
The LRP system uses the internationally recognized ISM frequency of 13.56 MHZ to both power the tag, and to establish a radio link to transfer the information.

The LRP830 is specifically designed to work with LRP-Series passive tags, which provide 48 bytes of reprogrammable memory.

The LRP830 supports the industrial bus protocol DeviceNet. The LRP830 is encased in a NEMA4 enclosure and features two serial ports, 4 opto-isolated inputs, 4 opto-isolated outputs. The LRP830-04 is equipped with an antenna designed for conveyor mounting and the LRP830-08 features a rectangular plate antenna.

The COM1 serial port is used to receive commands from the host and to send the data back. The LRP830 COM1 can be configured either as a DeviceNet, RS232, or RS422 interface.

COM2 is an RS232 serial port used to download new software releases and to setup the configuration parameters.



1.2 Unpacking and Inspection

Unpack the LRP830 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 LRP830 is delivered with the following components:

- LRP830 (-04, -08) Reader/Writer
- LRP830 to Antenna Cable
- LRP830 Operator's Manual

The following components are required for configuring a complete system:

- LRP-Series Passive Read/Write Tags
- User supplied LRP830-to-host cable
- DeviceNet host
- 18 - 30 Vdc, 36 W (1.5 A @ 24 Vdc) power supply
- Mating connectors. Please see Appendix B for more information.

2 MECHANICAL SPECIFICATIONS

2.1 Dimensions

Figure 1 gives the dimensions for the LRP830. Figures 2-3 show the dimensions of the 04 and 08 remote antennas.

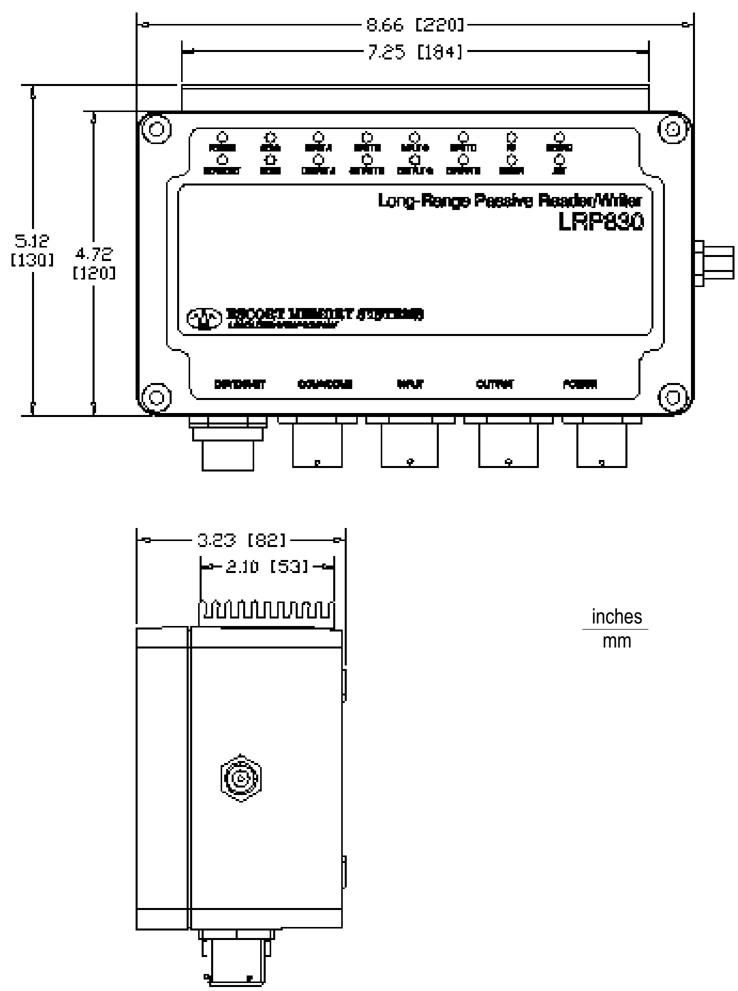


Figure 1 — LRP830 Dimensions

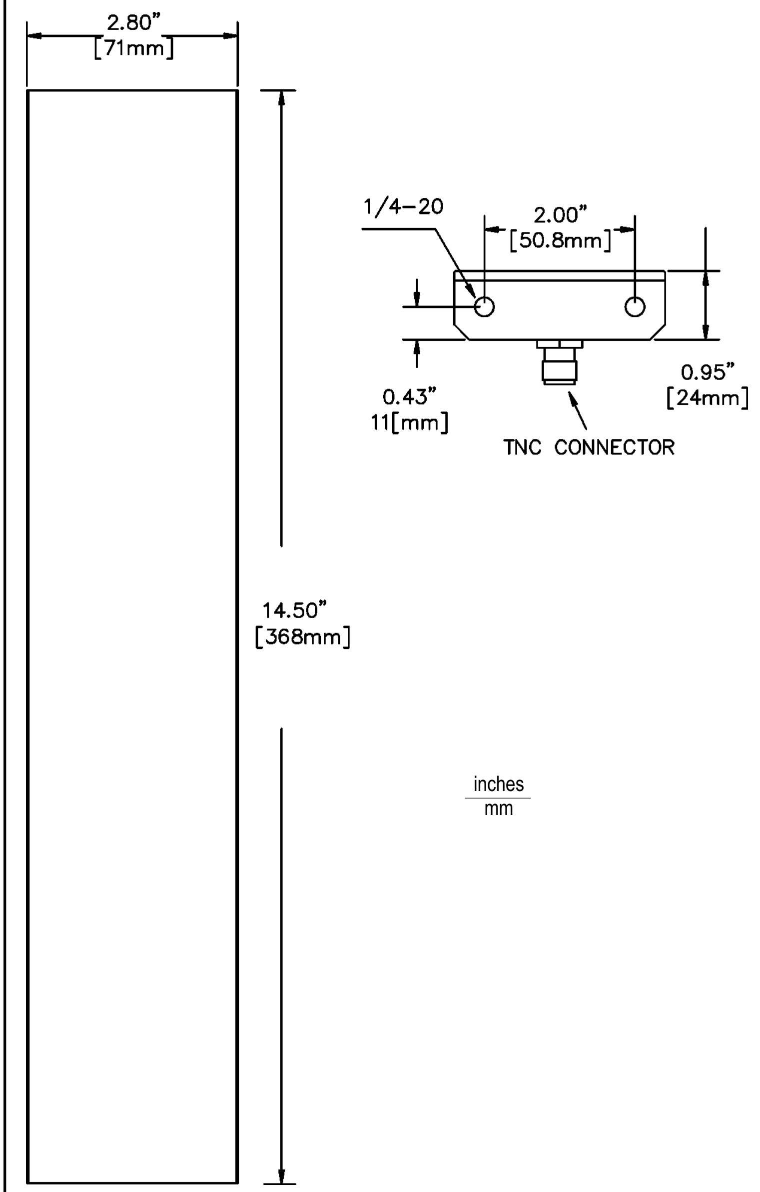


Figure 2 — LRP-04 Conveyor-Mount Antenna

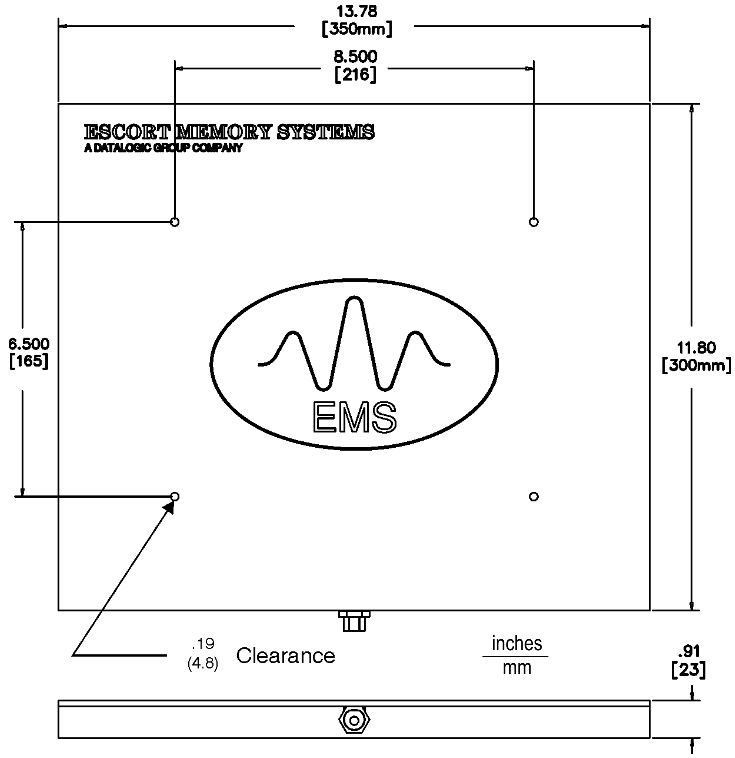


Figure 3 — LRP-08 Antenna Dimensions

2.2 RF Range and Orientation

Figure 4 shows the correct tag orientation as it passes the antenna. Figures 5-7 show the RF fields of the LRP830-04 and LRP830-08 antennas. Tables 1- 3 give the typical and guaranteed ranges of the LRP series tags.

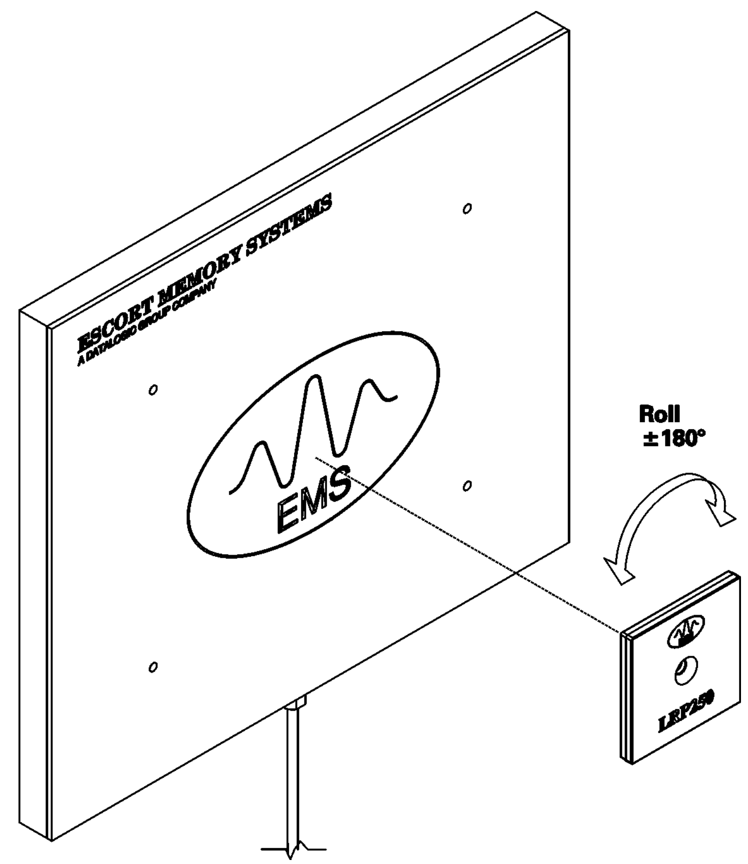


Figure 4 — LRP-08 to Tag Orientation

Table 1 — Antenna to Tag Ranges, LRP-04 Antenna with Metal*

Tag	Typical Range (Z) inches/mm	Guaranteed Range inches/mm
LRP125(HT)	2.50/64	2.00/51
LRP250(HT)	6.75/171	6.00/152
LRP250HT-FLX	6.75/171	6.00/152
LRP-L5555	6.75/171	6.00/152
LRP-L2666	5.75/146	5.00/127
LRP-L4982	8.00/203	7.00/178
LRP-L90140	9.00/229	8.00/203
LRP-P125	2.50/64	2.00/51
LRP-P3858	6.00/152	5.00/127
LRP-P5050	7.00/178	6.00/152

*These ranges are determined with metal near the -04 antenna as it would be in most conveyor mountings. The actual tuning and testing of the -04 antenna is done with the antenna mounted between two metal rollers on metal rails. The metal rollers are mounted 1/4" from the antenna.

NOTE: Proximity to metal, CRT devices, and other sources of electromagnetic radiation may affect the range of the antenna.

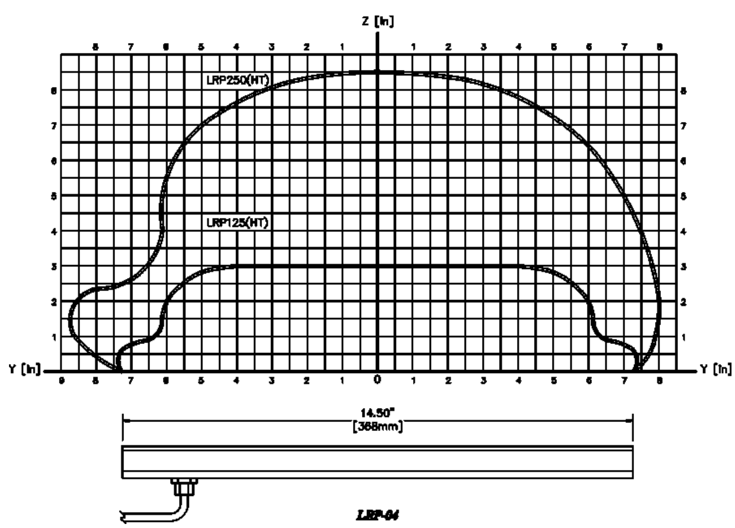


Figure 5 — Side View of RF Field, LRP-04 Antenna, Metal

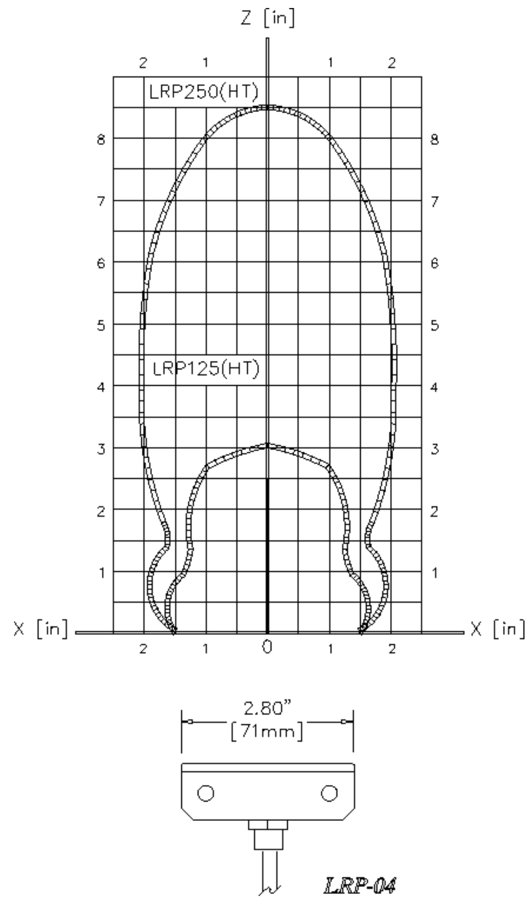


Figure 6 — End View of RF Field, LRP-04 Antenna, Metal

Table 2 — Antenna to Tag Ranges, LRP-40 Antenna, No Metal*		
Tag	Typical Range (Z) inches/mm	Guaranteed Range inches/mm
LRP125(HT)	3.00/76	2.25/57
LRP250(HT)	8.50/216	7.50/191
LRP250HT-FLX	8.50/216	7.50/191
LRP-L5555	8.50/216	7.50/191
LRP-L2666	7.00/178	6.00/152
LRP-L4982	10.00/254	9.00/229
LRP-L90140	12.00/305	11.00/279
LRP-P125	3.00/76	2.25/57
LRP-P33858	7.50/190	6.50/165
LRP-P5050	8.50/216	7.50/191

*These ranges calculated with no metal near the antenna.

NOTE: Proximity to metal, CRT devices, and other sources of electromagnetic radiation may affect the range of the antenna.

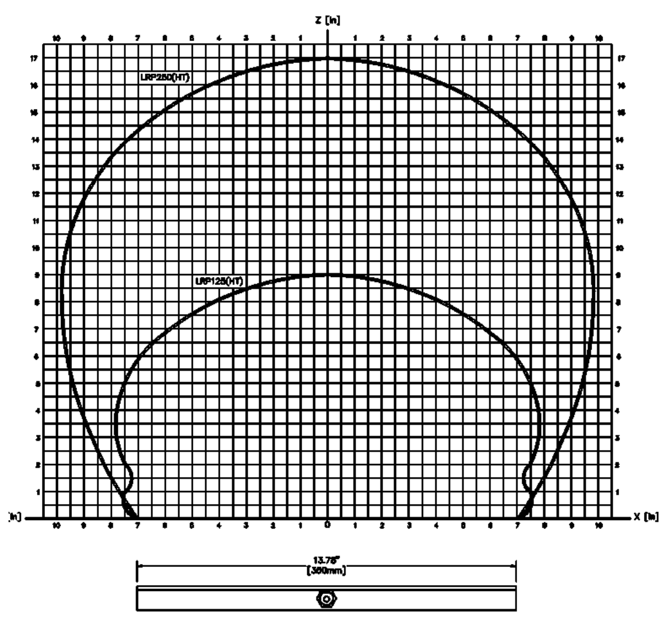


Figure 7 — End View of RF Field, LRP-08 Antenna, No Metal

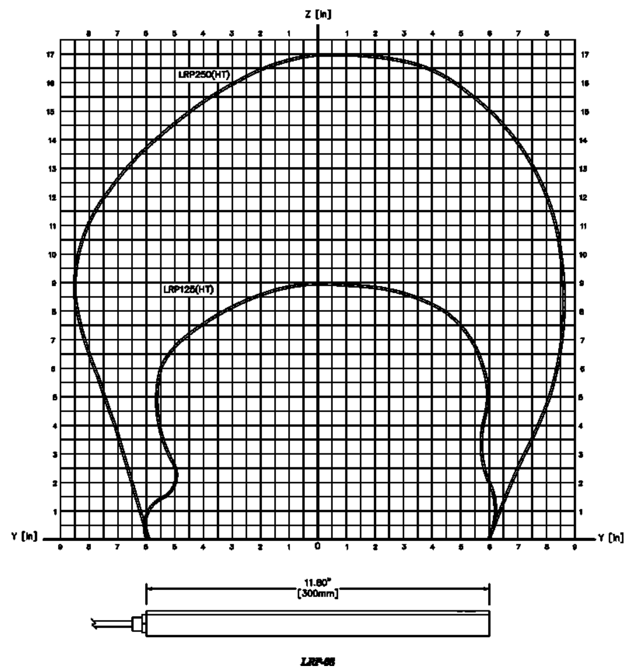


Figure 8 — Side View of RF Field, LRP-08 Antenna, No Metal

Table 3 — Antenna to Tag Ranges, LRP-08 Antenna, No Metal

Tag	Typical Range (Z) inches/mm	Guaranteed Range inches/mm
LRP125(HT)	8.00/203	7.00/178
LRP250(HT)	17.00/432	15.00/381
LRP250HT-FLX	17.00/432	15.00/381
LRP-L5555	17.00/432	15.00/381
LRP-L2666	16.00/406	13.00/330
LRP-L4982	20.00/508	18.00/457
LRP-L90140	25.00/635	22.00/559
LRP-P125	8.00/203	7.00/178
LRP-P3858	16.00/406	14.00/355
LRP-5050	17.00/432	15.00/381

*These ranges calculated with no metal near the antenna.

NOTE: Proximity to metal, CRT devices, and other sources of electromagnetic radiation may affect the range of the antenna.

2.3 Mounting Guidelines

Electromagnetic radiation and metal affect the range of the LRP830. Mount the LRP830 and antenna to minimize the impact of these factors. The RF field of the antenna can also cause errors when antennas are spaced too closely together. Do not position adjacent antennas closer than 2 meters from each other.

The remote antennas for the LRP830 have a cable length 2 meters. Surrounding the antenna with metal will greatly reduce the reading range of the antenna. As rule of thumb, keep any metal structure away from the antenna at least more than the reading range along the axis, and a third of such distance on the side. The mounting holes are accessed through the inside of the LRP830 Reader/Writer. Refer to Figure 9 for locations and dimensions.

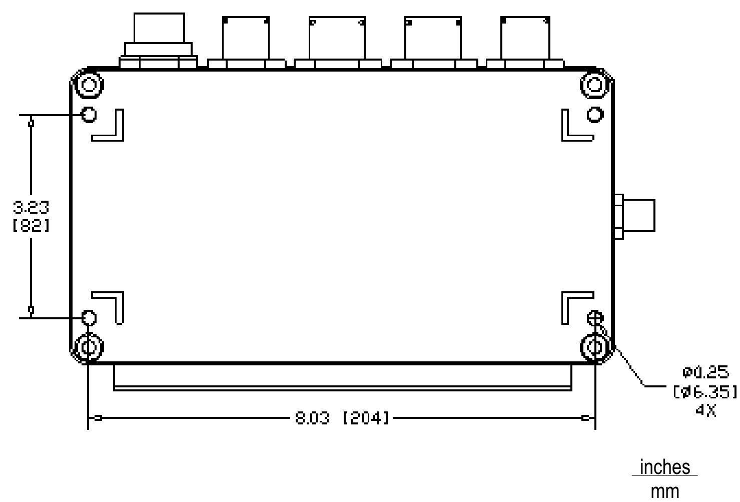


Figure 9 — LRP830 Mounting Holes

Special mounting instructions must be followed to get optimal read/write performance from the LRP830-08 antenna. Mount the antenna with a minimum 5.90" (150mm) spacing from any metal to the back or sides of the antenna, as shown in Figure 10.

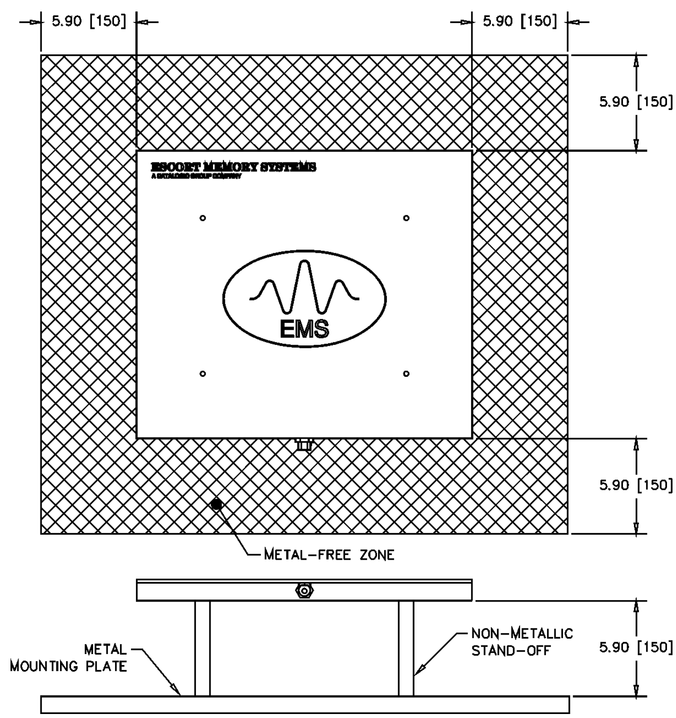


Figure 10 — LRP830-08 Antenna Mounting

Guidelines

- Isolate the LRP830 and antenna from electromagnetic radiation.
- Avoid surrounding LRP830 and remote antenna with metal.
- Maintain at least 2 meters minimum spacing between adjacent LRP830s or antennas.
- Stay within the guaranteed range for the tag to be used.
- Conform with EIA RS232, RS422 and RS485 standards.

3 POWER AND ELECTRICAL INTERFACE

3.1 Connector Panel

Figure 11 shows the LRP connectors, LEDs and connector panel. Unused connectors can be sealed with optional connector caps. Please see Appendix B for ordering information.

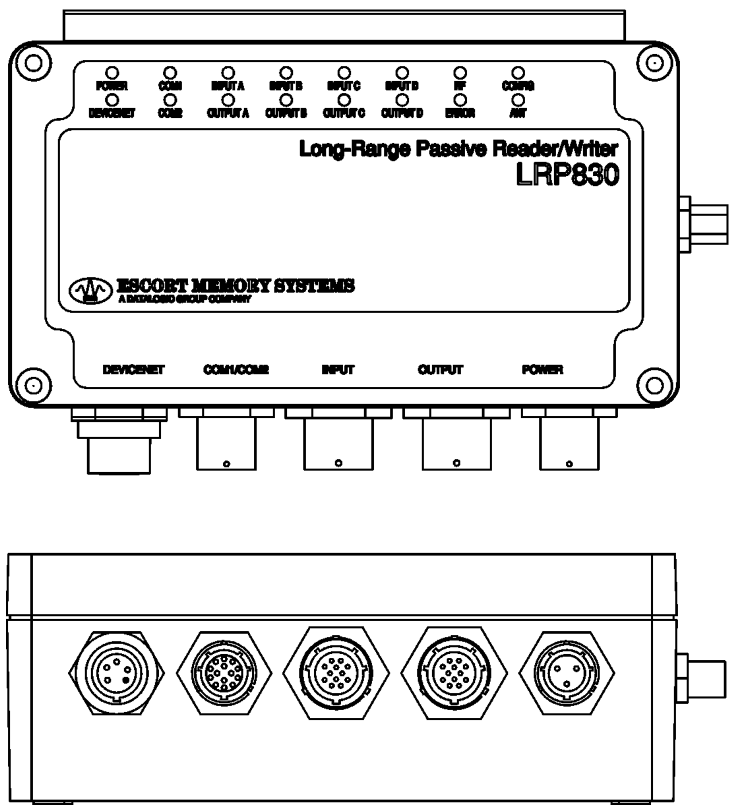


Figure 11 — Connector Panel

3.2 Power Connector

Figure 12 shows the power connector pin designations.

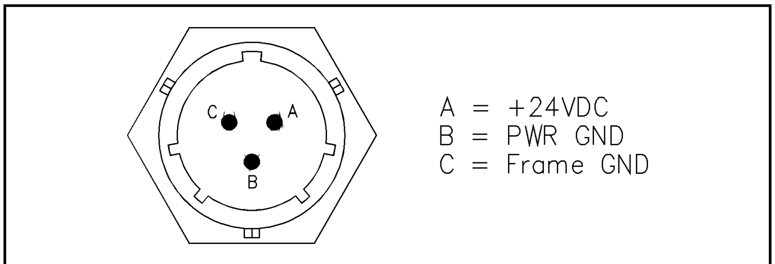


Figure 12 — Power Connector

3.3 COM1/COM2 Connector

Figure 13 shows the connector pin designations for the COM port connections.

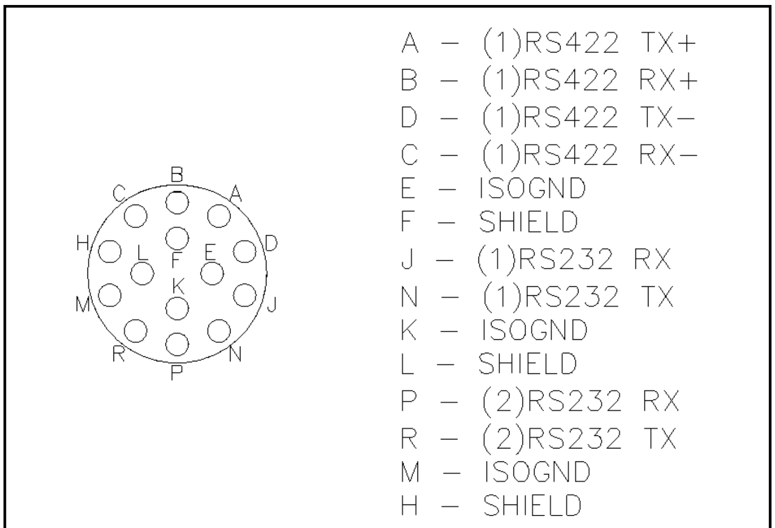


Figure 13 — COM1/COM2 Connector

Serial Communications Cabling

Escort Memory Systems recommends that you use Belden cables 3082A (trunkline) or 3084A (dropline) for RS485/RS422 communications. Use Belden cable 9941 for RS232 communications. More information on Belden cables can be found on their web site at www.belden.com.

3.4 DeviceNet Connector

Figure 14 shows the connections for the DeviceNet connector.

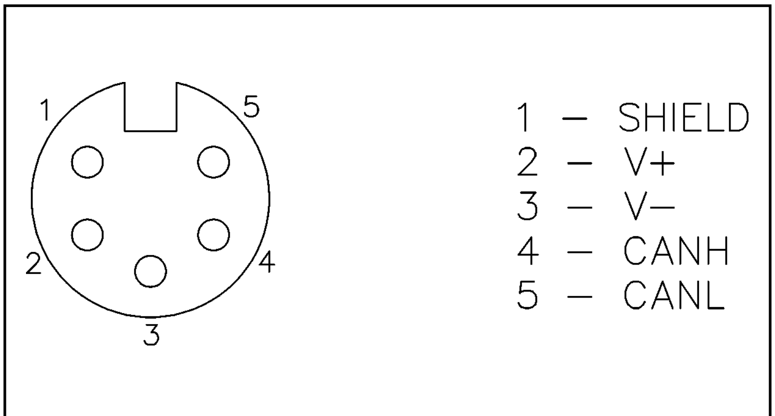
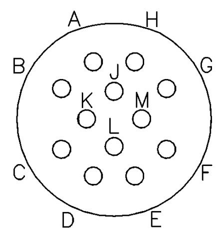


Figure 14 — DeviceNet Connector Pinouts

3.5 Input Connector

Figure 15 shows the Input Connector pin designations.

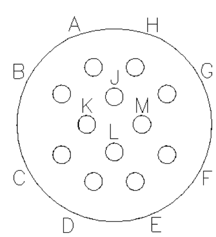


A – OUTPUT B+
B – OUTPUT B–
C – OUTPUT C+
D – OUTPUT C–
E – OUTPUT D+
F – OUTPUT D–
G – OUTPUT A+
H – OUTPUT A–
J – GND
K – GND
L – GND
M – GND

Figure 15 — Input Connector Pinouts

3.6 Output Connector

Figure 16 shows the Output Connector pin designations.



A – OUTPUT B+
B – OUTPUT B–
C – OUTPUT C+
D – OUTPUT C–
E – OUTPUT D+
F – OUTPUT D–
G – OUTPUT A+
H – OUTPUT A–
J – GND
K – GND
L – GND
M – GND

Figure 16 — Output Connector Pinouts

3.7 Digital I/O Wiring

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 LRP830 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 17 through 24 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.

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 in-rush 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).

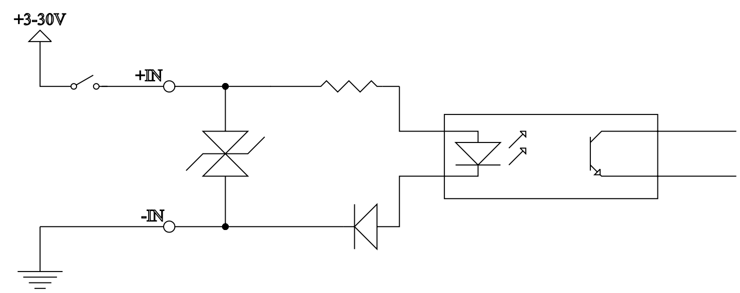


Figure 17 — Input from Sourcing Contact

Figure 17 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.

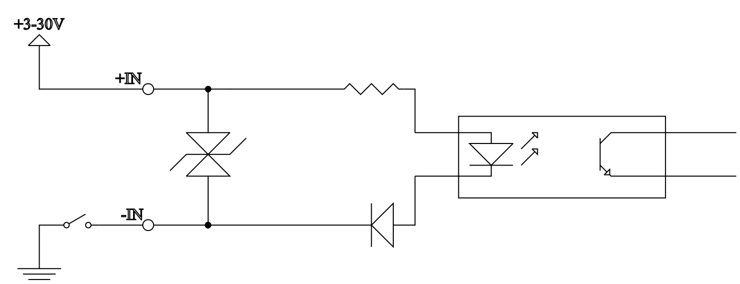


Figure 18 — Input from Sinking Contact

Figure 18 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.

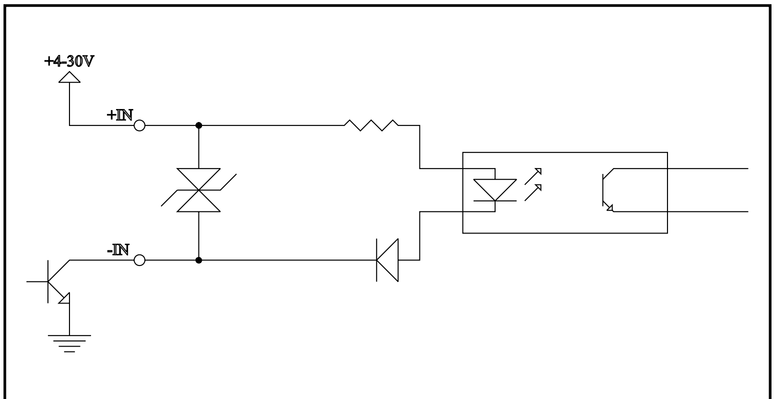


Figure 19 — Input from NPN Sensor

Figure 19 shows an Open Collector NPN output from a photosensor switching to ground. It can be wired as a sinking or low-side contact.

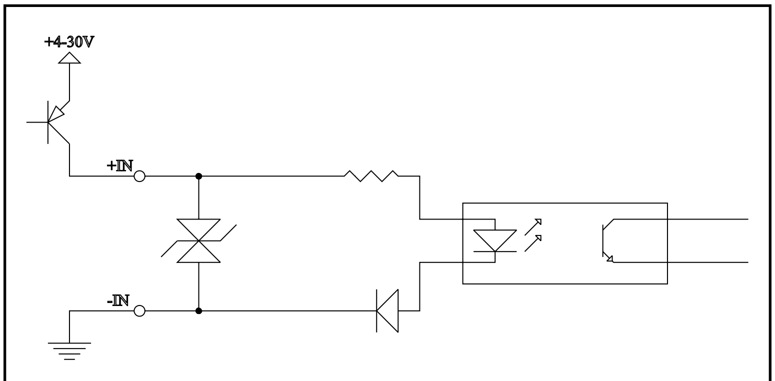


Figure 20 — Input from PNP Sensor

Figure 20 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.

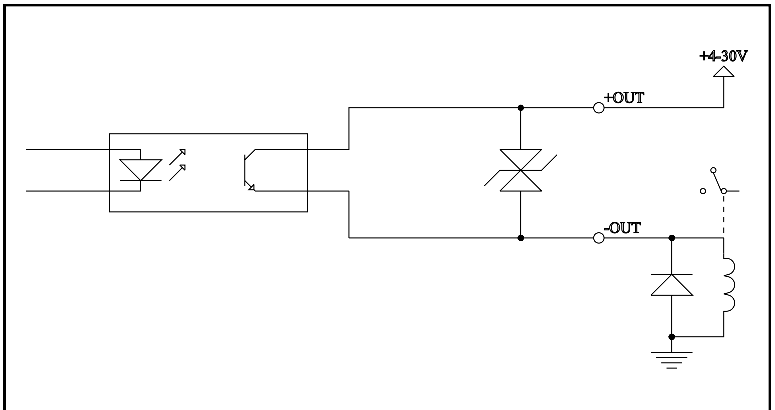


Figure 21 — Sourcing Output "Contact"

Figure 21 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.

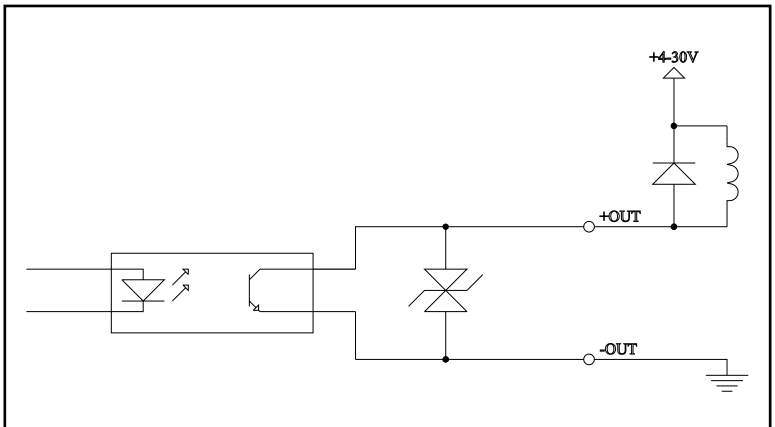


Figure 22 — Sinking Output "Contact"

Figure 22 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.

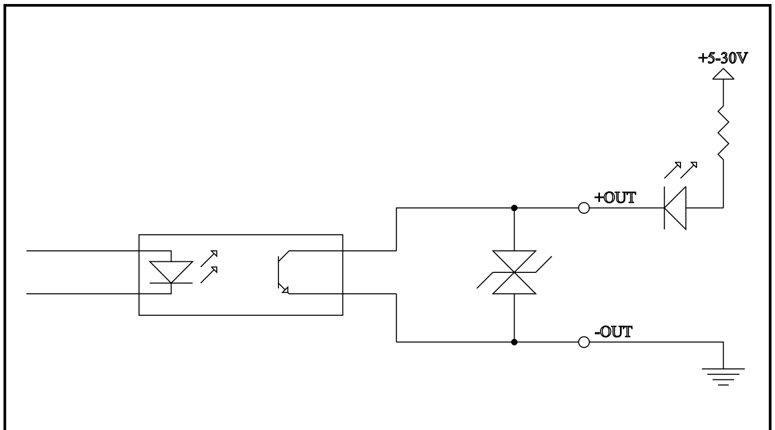


Figure 23 — Sinking Output LED Driver

In Figure 23, 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.

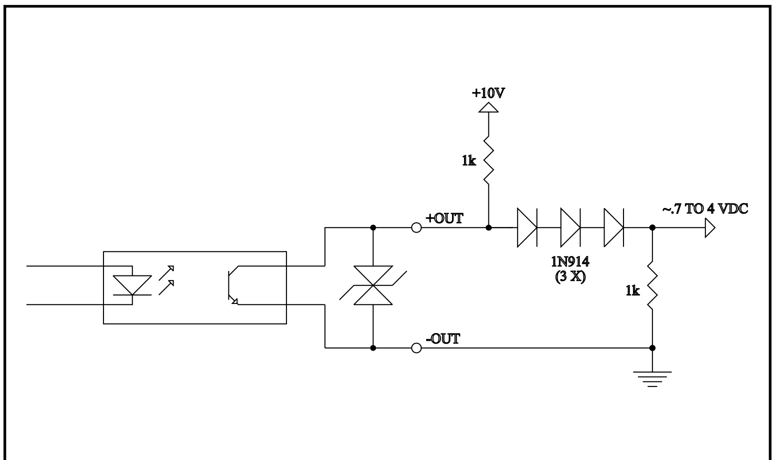


Figure 24 — Output to TTL or CMOS

In Figure 24 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.

3.8 Power Requirement

The LRP830 power supply requirement are:

- 18 to 30Vdc
- 31W maximum power consumption.

The maximum current consumption at 24Vdc is 1.3 A.

Power Options

There are three options for powering the LRP830:

- Powered from the DeviceNet Bus (default)

  This is the default configuration for powering the LRP830. If the power available over your DeviceNet network is not sufficient to power the LRP830, use one of the following methods.

- Powered via the external power connector

  This is how you must power the LRP830 if you are not connecting the LRP830 to a DeviceNet network.

- Powered from an external supply and isolated DeviceNet bus power (isolated mode)

  When the LRP is powered from both sources, the LRP830 will be opto-isolated from the DeviceNet bus.

  The DeviceNet interface board draws 20 mA at 24 Vdc from the DeviceNet bus when the LRP830 is powered with this method. Power to the external power connector should conform to the specifications given above.

If you choose to power the LRP830 with an external supply via the power connector, you must open the LRP830 and changed jumper and cable locations. The following sections describe how to make these changes.

Power from the DeviceNet Bus

By default, the LRP830 is configured to run with power supplied by the network. In this mode, there is no galvanic isolation between the DeviceNet wires and the LRP830, and there is no need for a separate power supply.

If you choose to power the LRP830 form the DeviceNet bus, you do not need to make any internal changes to cables and jumpers. Wire power according to the pinouts given for the DeviceNet connector in Figure 14, page 16.

Power via the external supply connector

The LRP830 contains components sensitive to electro-static discharge. Take proper grounding precautions before opening the LRP830.

To change the LRP830 to run in isolated mode:

1. Open the LPR820 by loosening the four captive screws that secure the cover.
2. Refer to Figure 25 and then move the power cable, labeled assembly 10-3110, from connector J7 to J9.

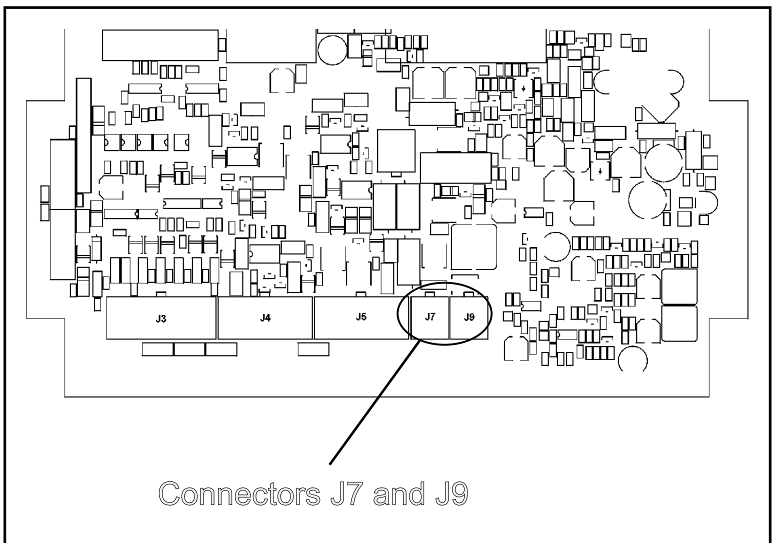


Figure 25 — Power Cable Connectors J7 andJ9

3. The DeviceNet cable, labeled assembly 10-3116, must then exchange places with the power cable, moving from J9 to J7.
4. Referring to Figure 26, locate jumper J1 and move the shunt from pins 4 and 3 to pins 2 and 1.
5. Close the LRP830 and connect a separate +24V power supply to the external power connector shown in Figure 12, page 15.

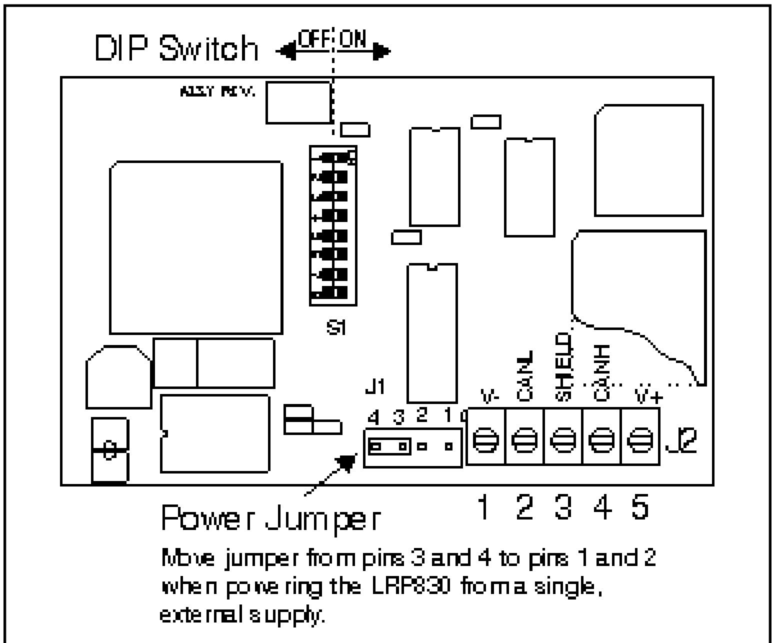


Figure 26 — DeviceNet Board Power Jumper

Power from the DeviceNet bus and from an external power supply

When the LRP is powered from both sources, the LRP830 will be opto-isolated from the DeviceNet bus.

The LRP830 contains components sensitive to electro-static discharge. Take proper grounding precautions before opening the LRP830.

To power the LRP830 from an external supply and the DeviceNet bus:

1. Open the LPR820 by loosening the four captive screws that secure the cover.
2. Refer to Figure 25 and then move the power cable, labeled assembly 10-3110, from connector J7 to J9.
3. The DeviceNet cable, labeled assembly 10-3111, must then exchange places with the power cable, moving from J9 to J7.
4. Make sure that the jumper on J1of the DeviceNet Interface Board connects pins 3 and 4, and then close the LRP830.
5. Connect a separate +24V power supply to the external power connector shown in Figure 12, page 15.
6. Wire the DeviceNet interface and power according to the pinouts given for the DeviceNet connector in Figure 14, page 16.

3.9 LED Indicators

The LRP830 has 16 LEDs indicating status of the LRP830 Reader/Writer, interface communications, and I/O status.

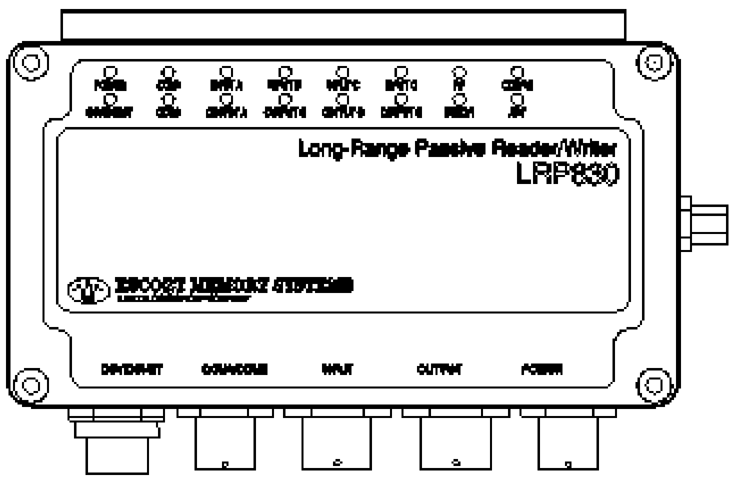


Figure 27 — LRP830 Front with LEDs

Table 4 shows these LEDs and their meaning.

Table 4 — LED Indicators

LED	Color	Indicates
PWR	red	The LRP830 is receiving power
RF	green	RF Data Transfer
ANT	red	Antenna on and tag in field
ERROR	Red	Unsuccessful RF command (.5 sec. flash) Entering Download Mode via DIP switch 5 (4 flashes)
CONFIG	green	Successful RF command - 1 .5 sec. flash
ERROR + CONFIG	green/red	Entering Operating Mode - 4 alternate flashes Configuration Mode initiated (CTRL-D) - Both LEDS flash 4 times Configuration Mode initiated (CTRL-E) - Both LEDS flash 2 times
IN-A	yellow	Input active
IN-B	yellow	Input active
IN-C	yellow	Input active
IN-D	yellow	Input active
COM1	green/red	Incoming data (RX): red Outgoing data (TX): green
COM2	green/red	Incoming data (RX): red Outgoing data (TX): green
DeviceNet	red	Data transfer (RX/TX): red
OUT-A	green	Output active
OUT-B	green	Output active
OUT-C	green	Output active
OUT-D	green	Output active

Additional LED behavior may be observed during certain commands and conditions. This behavior will be indicated as appropriate elsewhere in this manual.

4 Serial and Bus Communications

4.1 Serial Interfaces

The LRP830 has RS232 and RS422 available on the COM1 serial port. COM2 is configured for RS232 communications and is reserved for downloading programs to the LRP830 and for setting up the configuration parameters.

Both RS232 and RS422 interfaces are opto-isolated. The RS422 interface is specially suitable for long cable, noisy environment links.

The specification for the COM1 interface follows:

- Baud rate: 1200, 2400, 4800, 9600, 19200, 38400 bps
- Data: 7, 8
- Parity: Even, Odd, None
- Handshake: None, Xon/Xoff

The specification for the COM2 interface follows:

- Baud rate: 1200, 2400, 4800, 9600, 19200 bps
- Data: 7, 8
- Parity: Even, Odd, None
- Handshake: None, Xon/Xoff

Digital Board DIP Switch

The digital board is mounted inside the top of the LRP830 enclosure. The first 5 switches of the main board sets the COM1 baud rate, electrical interface, and the download options for COM2. Switches 6, 7 and 8 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.

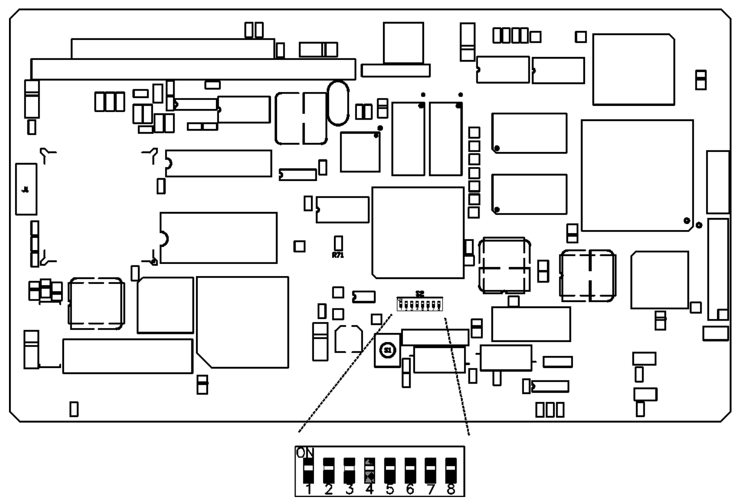


Figure 28 — Digital Board with DIP Switch

NOTE:
When you set switch 5 ON to enable download, the default parameters will first be restored and saved to the non-volatile memory.

The baud rate configuration on the main board only applies to the RS232 and RS422 serial interfaces. When a Bus Interface (DeviceNet) is selected, the baud rate is set by the Interface Board DIP switches.

NOTE:
DIP switch 4 must be in the default **ON** position for the DeviceNet interface to function.

Table 5 Main Board DIP Switch Settings

Baud rate		Interface		Download/ Restore Defaults	
SW 1	SW 2	SW 3	SW 4	SW 5	Settings
					9600
ON					19200
	ON				38400
ON	ON				Set from Configuration Menu
					RS232
		ON			RS422
			ON		DeviceNet
		ON	ON		Reserved
					Disabled
				ON	Enabled Download/ Restore defaults

Switches 6 through 8 are reserved and must be in the OFF position.

4.2 Bus Interfaces

The COM1 serial port, beside the RS232 or RS422 options, can be configured as a DeviceNet interface.

The following bus parameters are set by the DIP switches found on the Interface Board.

DeviceNet interface

- Bus Rate: 125K, 250K, 500Kbps
- DeviceNet Node Address (MAC ID)

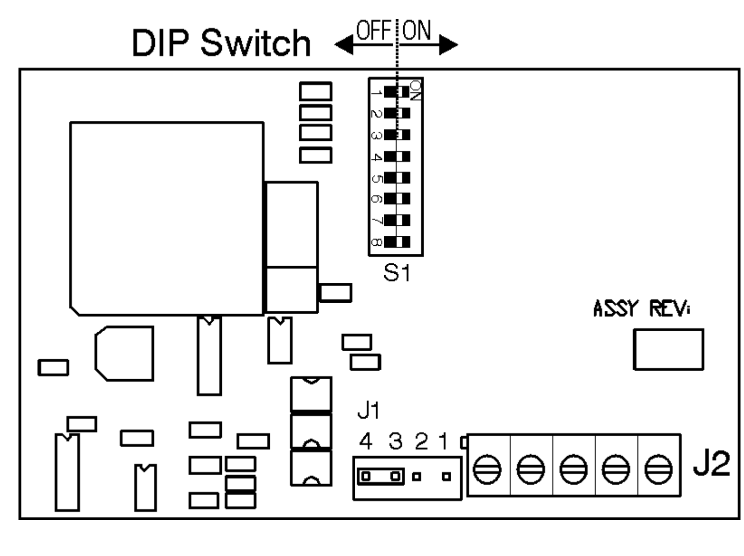


Figure 29 — DeviceNet Interface Board DIP Switch

DeviceNet Interface Board DIP Switch

S1 is an eight position DIP switch. Switches 1 to 6 set the DeviceNet Node address, switches 6 and 7 are reserved and switch 8 sets the bus rate. Table 6 shows these settings.

Table 6 — DeviceNet DIP Switch Settings

DeviceNet Node Switches						Bus Rate		Settings
SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	
					ON			DeviceNet Node 1
				ON				DeviceNet Node 2
				ON	ON			DeviceNet Node 3
			ON					DeviceNet Node 4
			ON		ON			DeviceNet Node 5
			ON	ON				DeviceNet Node 6
			ON	ON	ON			DeviceNet Node 7
		ON						DeviceNet Node 8
		ON			ON			DeviceNet Node 9
		ON		ON				DeviceNet Node 10
		ON		ON	ON			DeviceNet Node 11
		ON	ON					DeviceNet Node 12
		ON	ON		ON			DeviceNet Node 13
		ON	ON	ON				DeviceNet Node 14
		ON	ON	ON	ON			DeviceNet Node 15
	ON							DeviceNet Node 16
	ON				ON			DeviceNet Node 17
	ON			ON				DeviceNet Node 18
	ON			ON	ON			DeviceNet Node 19
	ON		ON					DeviceNet Node 20
	ON		ON		ON			DeviceNet Node 21
	ON		ON	ON				DeviceNet Node 22
	ON		ON	ON	ON			DeviceNet Node 23
	ON	ON						DeviceNet Node 24
	ON	ON			ON			DeviceNet Node 25
	ON	ON		ON				DeviceNet Node 26
	ON	ON		ON	ON			DeviceNet Node 27
	ON	ON	ON					DeviceNet Node 28
	ON	ON	ON		ON			DeviceNet Node 29
	ON	ON	ON	ON				DeviceNet Node 30
	ON	ON	ON	ON	ON			DeviceNet Node 31

Table 5 — DeviceNet DIP Switch Settings (cont.)								
DeviceNet Node Switches						Bus Rate		Settings
SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8	
ON								DeviceNet Node 32
ON					ON			DeviceNet Node 33
ON				ON				DeviceNet Node 34
ON				ON	ON			DeviceNet Node 35
ON			ON					DeviceNet Node 36
ON			ON		ON			DeviceNet Node 37
ON			ON	ON				DeviceNet Node 38
ON			ON	ON	ON			DeviceNet Node 39
ON		ON						DeviceNet Node 40
ON		ON			ON			DeviceNet Node 41
ON		ON		ON				DeviceNet Node 42
ON		ON		ON	ON			DeviceNet Node 43
ON		ON	ON					DeviceNet Node 44
ON		ON	ON		ON			DeviceNet Node 45
ON		ON	ON	ON				DeviceNet Node 46
ON		ON	ON	ON	ON			DeviceNet Node 47
ON	ON							DeviceNet Node 48
ON	ON				ON			DeviceNet Node 49
ON	ON			ON				DeviceNet Node 50
ON	ON			ON	ON			DeviceNet Node 51
ON	ON		ON					DeviceNet Node 52
ON	ON		ON		ON			DeviceNet Node 53
ON	ON		ON	ON				DeviceNet Node 54
ON	ON		ON	ON	ON			DeviceNet Node 55
ON	ON	ON						DeviceNet Node 56
ON	ON	ON			ON			DeviceNet Node 57
ON	ON	ON		ON				DeviceNet Node 58
ON	ON	ON		ON	ON			DeviceNet Node 59
ON	ON	ON	ON					DeviceNet Node 60
ON	ON	ON	ON		ON			DeviceNet Node 61
ON	ON	ON	ON	ON				DeviceNet Node 62
ON	ON	ON	ON	ON	ON			DeviceNet Node 63
								125k
							ON	259k
						ON		500k
						ON	ON	Reserved

5 MENU CONFIGURATION

The LRP830 feature a menu-driven program designed to give convenient access to the serial parameters, restore defaults or change operating modes.

5.1 How to Enter Menu Configuration

Begin by connecting the COM2 port to your PC host (see table below) and running EC that is available on the diskette or from Escort Memory Systems' Web site at www.ems-rfid.com.

LRP830		Standard PC Serial Port	
COM2 Pin Number	Signal Name	DB9 Pin Number	Signal Name
R	TX	2	RX
P	RX	3	TX
M	GND	5	GND

Set the serial parameters to the LRP830 default settings or the last known state of COM2.

The default settings for COM2 are as follows:

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. Place DIP switch five in the ON position and cycle power to the LRP830 or press the reset switch. This will load the default values.
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 then press CTRL-D within the first seven seconds of the initialization. The LRP830 will enter the Configuration Menu. As the LRP830 starts the Configuration program, both the RF and CONFIG LEDs will flash. The Main Board Configuration menu will display with the current software version number together with the DSP firmware version.

```
*****************************************************
LRP830 Standard Program
Software V1.7C, June 2000
DSP Firmware V1.7B, August 2000
*****************************************************
[1]     Set-up Operating Parameters
[2]     Download New Program
[3]     Download DSP Firmware
[4]     Exit to Operating Mode
Enter Selection:
```

5.2 Set-up Operating Parameters

To change the operating parameters of the LRP830, enter 1 at the initial menu. The following menu will be displayed, listing the current settings: The exact appearance of the menu display will depend on 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 LRP830. If you do not save changes to the EEPROM, the new settings will be effective only until the LRP830 is reset.

The following sub-menus are presented here in their entirety. Actually the menus will 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
```

Set COM2 Parameters

Selecting 2 from the above menu will bring to 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 Set Operating Mode menu allows you to choose the command protocol the LRP830 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 LRP830 offers three modes for the transfer of data and commands. ABx Standard (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 LRP830 to start-up in Continuous Read Mode. When you have configured the LRP830 to function in this manner, you do not issue commands to the LRP830. 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 LRP830 will respond to other commands and resume Continuous Read Mode when completed.

This option will not function over a DeviceNet bus.

If you are using your LRP830 in this mode, you must choose if you want the LRP830 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 (0-47)
Enter the tag address where you want the read to begin.

Length (1-48)
Enter the length of the read you wish the LRP830 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 LRP830 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 LRP830 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 LRP830 to known default values. To do so, select 1from this 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 LRP830. After you have saved any changes, you must re-initialize the LRP830 with switch 5 in the OFF position.

Return to Main Menu

When you have completed your configuration, entering 5 will return you to the initial menu. Unsaved changes will be effective until the LRP830 is reset. Saved changes will be loaded automatically the next time the LRP830 is reset.

5.3 Download New Program

Before attempting to download new firmware to the LRP830 main board, read the instructions provided in a readme.txt file on the update diskette.

When you select 2 from the Main Menu, the LRP830 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 LRP830 will display:

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

Send the new program file via your terminal emulation program in ASCII text or Hexadecimal format. Wait 10 seconds after the download is complete before resetting the LRP830.

IMPORTANT:
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 LRP830 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 LRP830 will prompt you to begin the download.

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

Press a key to start Downloading
```

After you have pressed a key, the LRP830 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 LRP830.

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

WARNING:
Do not download **INTERFACE BOARD** firmware to the main board.

IMPORTANT:
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 LRP830 is reset and the saved parameters are restored.

6 RFID INTERFACE

6.1 Introduction

The LRP830 offer three possible command protocols: ABx Standard, ABx Fast and ABx ASCII. The ABx Standard format is word-based and is compatible with most existing RFID systems by Escort Memory Systems. The ABx Fast protocol is a byte-based packet structure that permits command execution with fewer total bytes transferred. The ABx ASCII protocol is also a byte-based format that permits the execution of RFID commands using a seven-bit ASCII character set.

The ABx Fast protocol is the most efficient and therefore recommended by Escort Memory Systems. Table 7 lists the ABx commands available for the LRP830.

The LRP830 command set is made of two subsets: the ‘Non-Anticollision’ commands and the ‘Anticollision’ commands. The Anticollision commands allow you to manage the multiple-tags-in-field capability of the LRP system.

Command Timeout

Most commands have a timeout value that is used to limit the time the LRP830 will attempt to complete the specified operation. This value is given in 1 ms increments with a maximum value of 65,534 ms. A timeout value of 0 will generate a syntax error.

Between 500ms and 1000ms is recommended for a timeout value for single tag commands. Shorter timeouts may result in diminished range. A 30ms timeout value is the shortest allowable timeout and should only be used for short range, single tag command applications. Multiple tag commands will require longer timeout values. For time critical applications the timeout value should be tested to obtain the maximum performance value. A longer timeout value does not mean that the command will take any longer to execute if the tag being addressed is in the field, it only represents the period of time (in milliseconds) the unit will attempt to execute the command. If the tag is present, the response time to execute the command will be the same whether the timeout is 100ms or 10,000ms.

NOTE:
The delay between the characters of the command packet the LRP830 cannot be longer than 200 ms.

Table 7 - ABx Command Set Listing

Non-Anticollision Commands	
04 Hex	Fill Tag
05 Hex	Block Read
06 Hex	Block Write
07 Hex	Read Tag Serial Number
08 Hex	Tag Search
0D Hex	Continuous Block Read*
10 Hex	Set Output
11 Hex	Input Status
Anticollision Commands	
84 Hex	Fill Tag All*
85 Hex	Block Read All*
86 Hex	Block Write All*
87 Hex	Read Tag Serial All*
88 Hex	Tag Search All*
89 Hex	EAS Set/Reset
8A Hex	EAS Start/Stop
8D Hex	Continuous Read All*
8E Hex	Memory Lock
94 Hex	SN Fill
95 Hex	SN Block Read
96 Hex	SN Block Write
97 Hex	SN Block Read All*

*These commands can not be used with DeviceNet.

DeviceNet and Anticollision ABx Limitations

The LRP830 does not support the following “All” commands in multiple tag-in-field mode (i.e. Anticollision Index is not 0) over a DeviceNet interface:

Command Number	Command
84H	Fill Tag All
85H	Block Read All
86H	Block Write All
87H	Read Tag SN All
88H	Tag Search All
8DH	Continuous Read All
97H	SN Block Read All

The entire command set is available for point-to-point serial communications.

6.2 ABx Error Codes

Non-Anticollision Error Codes

The LRP830 will return an error if it encounters a fault during operation. Table 7 lists the possible error codes in Hexadecimal format.

Table 7 — Non-Anticollision Error Codes

Error Code	Description
04H	Fill Operation has failed
05H	Block Read has failed
06H	Block Write has failed
08H	Search Tag Operation failed
21H	Input Command does not match pre-defined format (syntax error)

Additionally there are internal DSP errors, F1H through F5H, for use by Escort Memory Systems technical support.

ABx Standard

ABxS error codes are returned in the LSB of the second register passed to the PLC. The format of the error response is shown below.

MSB	LSB	Remarks
AAH	FFH	Command Error
00H	XXH	Error Code
FFH	FFH	Message Terminator

A Block Write fail error message would appear as: AAFF 0006 FFFFH.

ABx Fast

The format of the error response is shown below.

Field	Bytes Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	02H
Error Flag	FFH
Error Code	XXH
Checksum	XXH
Terminators <ETX>	03H

A Block Write fail error message would appear as: 0202 0002 FF06 F803H.

ABx ASCII

The format of the error response is shown below.

Field	# of ASCII characters	Contents
Header <STX><STX>	2	<STX> 02H
		<STX> 02H
Response Size	4	Packet length in bytes excluding the header, response size, checksum and terminator bytes
Error Flag	2	FFH
Error Code	2	XXH - see Table 7 for details
Checksum	2	XXH - optional checksum
Terminators <ETX>	1	<ETX> 03H

In ABx ASCII format the response size is the number of hex values and not the number of ASCII characters used to represent the hex value.

A Block Write fail error message would appear as an ASCII character string: <STX><STX>0002FF06F8<ETX>.

In hexadecimal the commands appears as:
02H 02H 30H 30H 30H 32H 46H 46H 30H 36H 46H 38H 03H

Anticollision Status Byte

When the anticollision commands encounter a fault condition they indicate the set a bit in a STATUS byte returned in the response. The format of the response is otherwise the same as a successful response.

The STATUS byte is defined as follows:

7	6	5	4	3	2	1	0
Antenna Failure	R/W Error	Collisions	Internal Error	Timeout	Verify Error	Reserved	Reserved

Some of the conditions are the same as found in the non-anticollision commands, other are new and relate only to the anticollision.

If any of the flag bits of the returned Status are set, then that condition occurred during the command execution. Multiple conditions can occur in the same command.

Antenna Failure	There is an error at the antenna
R/W error	Error during the tag memory access
Collision	Collisions detected: more than one tag in the field answered to the LRP830 at the same time, meaning a higher Anticollision Index probably needs to be set
Internal Error	Internal error in low-level firmware (contact Escort Memory Systems technical assistance)
Timeout	Timeout expired
Verify Error	Set when re-read verification fails

Syntax Errors

Syntax errors (error code 21H) will be returned in the same format as described for the non-anticollision commands.

6.3 Anticollision Commands

Family Interrogation

The anticollision commands always have a Family ID and an Anticollision Index as parameters. These parameters manage the read/writes when multiple tags are in the same reading field. The Family ID and Anticollision Index can be used separately or together. If the Family ID is zero, that feature is disabled, if the Anticollision Index is zero, this feature (and multiple tag-in-field) is disabled as well.

If both the features are disabled, the commands operate exactly the same as the Non-Anticollision commands.

Family ID

The Family ID is a 1 byte field in the LRP tag memory at address 0. When the Family ID parameter is set to zero, the command is broadcast to all the tags in the field. On the other hand, if it is not equal to zero, only the tags with the specified Family ID in byte 1will respond to the LRP830.

This feature can help in implementing a multi-level organization of the tags, by permitting the selective reading of tags by Family ID. This gives faster access to the tags than by using Anticollision Index alone. As previously noted, Family ID and the Anticollision Index can be used together for increased efficiency.

When using the Family ID feature, the first byte of tag memory is reserved, and thus only 47 bytes are allowed to be used. When the feature is disabled, 48 bytes are available for user data.

For this reason, in the read and write commands, once the parameter Family ID is not equal to zero, the addresses can go from 1 to 47, and the size from 0 to 47. However, when the Family Code is zero, the addresses can start from 0, and the size can be up to 48.

In order to initialize a tag with a chosen Family ID, byte 0 in the tag must be set to that value by means of a Block Write or a Block Write All command.

Anticollision Index

The Anticollision Index controls the tag reading algorithm to achieve the fastest reading speed for the number of tags expected in the reading field at any given moment. It also can disable the multiple tag-in-field feature when set to 0.

The Anticollision Index should be set in relation to the maximum number of tags possibly present in the reading field at one time. Setting the Anticollision Index higher increases the number of tags that will be expected to be read in the field. Lowering the Index speeds up the tag read operation. Selecting the Anticollision Index is therefore a tradeoff choice between the number of tags in the reading field, and the time required to read/write to them. Regardless of the index setting, ALL tags present will be read. The index simply makes the process more efficient.

None of the Anticollision Index values will absolutely limit the number of tags that can be read by the LRP830. The following table can assist you in setting the Index value, but tests should be done to find the best value. The allowed values are from 0 to 7.

Anticollision Index	Max number of tags
0	1 (*)
1	2-4
2	4-8
3	8-16
4	16-32
5	32-64
6	64-128
7	>128

(*) anticollision disabled

Some commands return or have as a parameter, the Serial Number (SN). The tag serial number is a unique read-only, 64 bit (8 bytes) code in the tag memory. SN commands can be used to selectively write to a specific tag, identified by the SN. A target tag can be identified with a previous SN read command.

Note that the anticollision commands, except SN Block Write, SN Fill and Tag Search All, will return a response packet only after the timeout is expired. If the command has the Anticollision Index set to 0, then a response will be returned after the first successful operation.

The Anticollision Commands return a successful response whenever the operation has successfully been completed on at least 1 tag. They will return an Error Response when no tag, as permitted by the Family ID and Anticollision Index, can be found in the antenna field.

Note also that all the start addresses, byte lengths and packet sizes are expressed in 2 byte words, in order to be compatible with the HMS commands and to allow future developments.

6.4 ABx Standard Protocol

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

ABxS Command 4 (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 an RFID 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 LRP830 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

Field	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 (1EH - FFFEH)
Data Value Byte	The byte to be used as fill
Message Terminator	FFFFH

EXAMPLE

Writes 'A' (41H) to the tag starting at address 0005H for the following next consecutive 10 bytes. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the configuration.

Command from Host

MSB	LSB	Remarks
AAH	04H	Perform Command 4
00H	05H	Start Address = 0005H
00H	0AH	Fill Length= 10 bytes (0064H)
07H	D0H	Timeout value
00H	41H	Data Value Byte = 41H
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	04H	Command echo
FFH	FFH	Message Terminator

ABxS Command 5 (05H): Block Read

DESCRIPTION
Read a block of data from an RFID tag.

DISCUSSION
This command is used to read segments of data from contiguous areas of tag memory. It is capable of handling up to 48 bytes of data transferred to the host with one command. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 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 LRP830 will return error message 21H, invalid format.

The data read from the tag is returned in the LSB of the register, and the MSB is always 00H.

Field	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 (1EH - FFFEH)
Message Terminator	FFFFH

EXAMPLE:
Reads 8 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.

Command from Host

MSB	LSB	Remarks
AAH	05H	Perform command 5
00H	01H	Start Address = 0001H
00H	08H	Read Block Length = 8 bytes (0008H)
07H	D0H	Timeout Value
FFH	FFH	Message Terminator

Response from LRP830

MSB	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

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 48 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 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 LRP830 will return error message 21H, invalid format. The LRP830 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.

Field	**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 (1EH - 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.

Command from Host

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

Response from LRP830

MSB	LSB	Remarks
AAH	06H	Command echo
FFH	FFH	Message Terminator

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

DESCRIPTION
Retrieve the eight-byte tag serial number.

DISCUSSION
Each LRP tag has an unique (2^{64} possible numbers) serial number. This number can not be changed and is not part of the 48 available data bytes. Tag ID will be return in the LSB only, with the MSB as 00H.

Field	Remarks
Command	Command number in hex preceded by AAH
Timeout	2-byte timeout value in 1 ms increments (1EH - 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 SN is 1E6E3DC200000000H in hexadecimal.

Command from Host

MSB	LSB	Remarks
AAH	07H	Perform Command 7
07H	D0H	Timeout
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	07H	Command Echo
00H	1EH	First SN byte
00H	6EH	Second SN byte
00H	3DH	Third SN byte
00H	C2H	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

ABxS Command 8 (08H): Tag Search

DESCRIPTION
Check to see if there is an RFID tag in the LRP830 field.

DISCUSSION
This command will activate LRP830 to "look" for a tag in the RF field. If the LRP830 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 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.

Field	Remarks
Command	Command number in hex preceded by AAH
Timeout	2-byte timeout value in 1 ms increments (1EH - 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

Response from LRP830

MSB	LSB	Remarks
AAH	08H	Command echo
FFH	FFH	Message Terminator

ABxS Command D (0DH): Continuous Block Read

DESCRIPTION
When in Continuous Block Read mode, the LRP830 sends block reads continuously to any tag in range of the antenna. When a tag enters the RF field, it is read and the data passed to the host computer. The LRP830 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 feature prevents redundant data transmissions when the LRP830 is in Continuous Block Read mode.

DISCUSSION
The initiate/cancel Continuous Block Read command contains three parameters: read length, start address, and delay between identical decodes. The read length parameter switches the mode. Any valid, non-zero length (1-48) will set the LRP830 into Continuous Block Read mode. A read length value of 00H will turn Continuous Block Mode off.

The Delay Between Identical Decodes value can have a value of 0 to 60 seconds. When the Delay Between Identical Decodes is set to 0, the LRP830 will continuously read AND transmit tag data to the host. This can flood the buffers and cause communication errors and data loss.

If the LRP830 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:

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

NOTE:
This command can not be used over a DeviceNet interface.

The command is 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 LRP830 will transmit data again from that tag. Value is expressed in 1 second units.
Message Terminator	FFFFH

EXAMPLE

This example places the LRP830 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 1 second increments) is set.

Command from Host

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

Response from LRP830

MSB	LSB	Remarks
AAH	0DH	Command echo
FFH	FFH	Message Terminator

The LRP830 will first return an acknowledgment of the command followed by a response containing read data when a tag enters the antenna field.

Response from LRP830

MSB	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

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.

Command from Host

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

Response from LRP830

MSB	LSB	Remarks
AAH	0DH	Command echo
FFH	FFH	Message Terminator

ABxS Command 10 (10H): Set Output

DESCRIPTION
Set the levels of the output lines and output LEDs "A" through "D."

DISCUSSION
This command uses bit logic to set the levels of the digital output lines. The four least significant bit toggle the output levels; 1 = ON and 0 = OFF. The following chart shows the hex values for all output high combinations. To reset all output, issue the command with 00H in the second word.

MSB	LSB	Remarks	LSB Bit 3 Output D	LSB Bit 2 Output C	LSB Bit 1 Output B	LSB Bit 0 Output A
00H	00H	Reset A, B, C, D	0	0	0	0
00H	01H	Set Output A - Reset B, C, D	0	0	0	1
00H	02H	Set Output B - Reset A, C, D	0	0	1	0
00H	03H	Set Output A, B - Reset C, D	0	0	1	1
00H	04H	Set Output C - Reset A, B, D	0	1	0	0
00H	05H	Set Output A, C - Reset B, D	0	1	0	1
00H	06H	Set Output B, C - Reset A, D	0	1	1	0
00H	07H	Set Output A, B, C - Reset D	0	1	1	1
00H	08H	Set Output D - Reset A, B, C	1	0	0	0
00H	09H	Set Output A, D - Reset B, C	1	0	0	1
00H	0AH	Set Output B, D - Reset A, C	1	0	1	0
00H	0BH	Set Output A, B, D - Reset C	1	0	1	1
00H	0CH	Set Output C, D - Reset A, B	1	1	0	0
00H	0DH	Set Output A, C, D - Reset B	1	1	0	1
00H	0EH	Set Output B, C, D - Reset A	1	1	1	0
00H	0FH	Set Output A, B, C, D	1	1	1	1

Field	Remarks
Command	Command number in hex preceded by AAH
Output Pattern	Hex value for the bit output settings
Message Terminator	FFFFH

EXAMPLE

The following example sets Output B only and resets A, C, and D.

Command from Host

MSB	LSB	Remarks
AAH	10H	Perform Command 10
00H	02H	Set Output B
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	10H	Command echo
FFH	FFH	Message Terminator

ABxS Command 11 (11H): Input Status

DESCRIPTION
Retrieves the input line levels.

DISCUSSION
This command uses bit logic to monitor the levels of the digital input lines. The four least significant bit display the output levels; 1 = ON and 0 = OFF. The following chart shows the hex values for all input conditions that can be returned in word 2 of the response.

MSB	LSB	Remarks	LSB Bit 3 Input D	LSB Bit 2 Input C	LSB Bit 1 Input B	LSB Bit 0 Input A
00H	00H	Inputs A, B, C, D, OFF	0	0	0	0
00H	01H	Input A, ON - B, C, D, OFF	0	0	0	1
00H	02H	Input B, ON - A, C, D, OFF	0	0	1	0
00H	03H	Input A, B, ON - C, D, OFF	0	0	1	1
00H	04H	Input C, ON - A, B, D, OFF	0	1	0	0
00H	05H	Input A, C, ON - B, D, OFF	0	1	0	1
00H	06H	Input B, C, ON - A, D, OFF	0	1	1	0
00H	07H	Input A, B, C, ON - D, OFF	0	1	1	1
00H	08H	Input D, ON - A, B, C, OFF	1	0	0	0
00H	09H	Input A, D, ON - B, C, OFF	1	0	0	1
00H	0AH	Input B, D, ON - A, C, OFF	1	0	1	0
00H	0BH	Input A, B, D, ON - C, OFF	1	0	1	1
00H	0CH	Input C, D, ON - A, B, OFF	1	1	0	0
00H	0DH	Input A, C, D, ON - B, OFF	1	1	0	1
00H	0EH	Input B, C, D, ON - A, OFF	1	1	1	0
00H	0FH	Input A, B, C, D, ON	1	1	1	1

Field	Remarks
Command	Command number in hex preceded by AAH
Message Terminator	FFFFH

EXAMPLE

The following example shows only Input B is ON.

Command from Host

MSB	LSB	Remarks
AAH	11H	Perform Command 11
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	11H	Command echo
00H	02H	Input B ON
FFH	FFH	Message Terminator

ABxS Command 84 (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 present in the antenna field 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 (1-48). The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the Anticollision Index is not zero (multiple tag-in-field enabled), the LRP830 will return a response after the timeout expires. If the Anticollision Index is 0, a response is returned when a successful operation is performed on 1 tag or when the timeout has expired. When the timeout is set to 0, the LRP830 will return a syntax error.

Field	Remarks
Command	Command number in hex preceded by AAH
Family Code	Tag Family ID - 00H = all tags
Anticollision index	Number of tags expected
Start Address	The tag address where the fill will start
Fill Length	The number of tag addresses to be filled (1-48)
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Data Value Byte	The byte to be used as fill
Message Terminator	FFFFH

NOTE:
This command can not be used over a DeviceNet interface.

A response to a successful command will follow this form.

Field	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. The Anticollision Index is set to 2 so 4 to 8 tags will be expected. Four tags are successfully filled within the timeout.

Command from Host

MSB	LSB	Remarks
AAH	84H	Perform Command 84
01H	02H	Tag Family 01/ Index 2
00H	05H	Start Address
00H	28H	Fill Length
07H	D0H	Timeout
00H	41H	Fill byte
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	84H	Command Echo
04H	08H	Ntag/Status
FFH	FFH	Message Terminator

ABxS Command 85 (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 48 bytes of data transferred to the host with one command. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error 21H.

The Block Read All consists of Tag Family ID and an Anticollision Index, a start address and length, followed by a timeout value and the message terminator. If the read length exceeds the last tag address, the LRP830 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. When the Anticollision Index is not zero (multiple tag-in-field enabled), the LRP830 will return a response after the timeout expires. If the Anticollision Index is 0, the command returns after the successful operation on one tag or when the timeout expires. No termination packet is sent after a successful operation when the Anticollision Index set to 0.

Field	Remarks
Command	Command number in hex preceded by AAH
Tag Family	Tag Family ID - 00H = all tags
Anticollision index	Number of tags-in-field expected
Start Address	The tag address where the read will start
Read Length	The number of tag addresses to be read
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Message Terminator	FFFFH

NOTE:
This command can not be used over a DeviceNet interface.

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. The Anticollision Index is set to 2 so 4 to 8 tags will be expected. Three tags respond with read data.

Command from Host

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

Response from LRP830

MSB	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	Data byte 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

ABxS Command 86 (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 48 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The Block Write consists of a Tag Family ID and an Anticollision Index, start address followed by the data stream to be written to the RFID tag. If the write range exceeds the last tag address, the LRP830 will 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 LRP830 returns a response when the timeout expires. If the Anticollision Index is 0 the command returns a response after the successful operation on 1 tag, or when the timeout expires.

Field	Remarks
Command	Command number in hex preceded by AAH
Family ID	Tag Family ID - 0 = all tags
Anticollision Index	Number of tags-in-field expected
Start Address	The tag address where the write will start
Write Length	The number of tag addresses to be written to in bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Write Data	The data to be written (1-48 bytes)
Message Terminator	FFFFH

NOTE:
This command can not be used over a DeviceNet interface.

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). The Anticollision Index is set to 2 so 4 to 8 tags are expected in the field.

Command from Host

MSB	LSB	Remarks
AAH	86H	Perform Command 86
02H	02H	Tag Family 02/ Index 2
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

Response from LRP830

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

ABxS Command 87 (87H): Read Tag SN All

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

DISCUSSION
Each LRP tag has an unique (2^{64} possible numbers) serial number. This number cannot be changed and is not part of the 48 available data bytes. The Tag SN 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error. A special termination packet (starting with AAH FFH) is sent when the timeout expires. If the Anticollision Index is 0, a response is returned after successful operation to 1 tag or after the timeout has expired. No termination packet is sent after a successful operation when the Anticollision Index set to 0.

Field	**Remarks**
Command	Command number in hex preceded by AAH
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags-in-field expected
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Message Terminator	FFFFH

NOTE:
This command can not be used over a DeviceNet interface.

EXAMPLE:
This example will read the 8-byte serial number from Tag Family 2. The Anticollision Index of 2 sets the number of expected tags at 4-8. In this example the SN for the found tag is 1E6E3CD200000000H in hexadecimal. Multiple tags will return a complete response packet for each tag.

Command from Host

MSB	LSB	Remarks
AAH	87H	Perform Command 87
02H	02H	Tag Family 02 / Index 2
07H	D0H	Timeout
FFH	FFH	Message Terminator

Response from LRP830

MSB	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

ABxS Command 88 (88H): Tag Search All

DESCRIPTION
Check to see if there is an RFID tag in the LRP830 field.

DISCUSSION
This command will activate LRP830 to "look" for a tag in the RF field. As soon as the LRP830 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 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.

The number of tags returned can be either 1 (tag found) or 0 (timeout expired without having found a tag).

Field	Remarks
Command	Command number in hex preceded by AAH
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags-in-field expected
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Message Terminator	FFFFH

NOTE:
This command can not be used over a DeviceNet interface.

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 All. The Family ID is set for any tag, and the Anticollision Index is set to expect 4-8 tags. One tag is found and the command is successful.

Command from Host

MSB	LSB	Remarks
AAH	88H	Perform Command 88
01H	01H	Family ID / Index 2
07H	D0H	Timeout
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	88H	Command Echo
01H	00H	Ntags/Status
FFH	FFH	Message Terminator

ABxS Command 89 (89H): EAS Set/Reset All

DESCRIPTION
Sets or resets the EAS feature in tag memory for all tags in range, and of the specified Family, when the command is issued.

DESCRIPTION
The commands contains a 1 byte parameter that enables or disables the EAS feature in tags that receive the command. When the EAS Set/Reset All command is issued, the LRP830 responds with the number of tags affected (Ntag). If the LRP830 returns a 0 for Ntag it means that no tags were set or reset by the command.

When multiple tag-in-field is enabled (Anticollision Index is not 0), the LRP830 will return a response when the timeout period expires. When multiple tag-in-field is disabled, the LRP830 will return a response when it reads a tag or the timeout expires.

Field	Remarks
Command	Command number in hex preceded by AAH
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Set/Reset	1 = Set, 0 = Reset EAS
Message Terminator	FFFFH

EXAMPLE
This example assumes that the tags-in-field are not enabled for the EAS feature. It will enabled the EAS feature for tags with Family ID 09H. The Anticollision Index is 2, so 4-8 tags are expected in the field. When the command is issued, 5 tags with Family ID 09H are found and enabled for EAS.

Command from Host

MSB	LSB	Remarks
AAH	89H	Perform Command 89
09H	02H	Family ID/Anticollision Index 2
07H	D0H	Timeout
00H	01H	Set EAS
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	89H	Command Echo
05H	08H	Ntags/Status
FFH	FFH	Message Terminator

ABxS Command 8A (8AH): EAS Start/Stop

DESCRIPTION
If are using the EAS feature in your application, the EAS Start/Stop command enters and exits the LRP830 from EAS mode.

DISCUSSION
When EAS mode has been started, the LRP830 will return a response when one or more EAS-enabled tags have entered the antenna field. It will send a second response when all EAS-enabled tags have exited the field. The command contains a control byte that toggles EAS: 1 = start, 0 = stop. A Family ID can be set so that only EAS-enabled tags from the specified Family trigger EAS responses. The Anticollision Index is ignored and should be set to 00H for this command.

The EAS mode also controls the CONFIG, ERROR and RF LEDs. The following table:

LED(s)	Behavior	Description
CONFIG, ERROR, RF LEDs	OFF	No EAS-enabled tag in field
RF LED	ON	EAS-enabled tag entered field. LED will remain ON until all EAS tags have left the field.
ERROR LED	BLINKS	Last EAS tag left the field.

IMPORTANT:
EAS mode prevents any other commands from being acknowledged or executed until EAS has been stopped.

Field	Remarks
Command	Command number in hex preceded by AAH
Family ID	Tag Family ID - 00H = all tags
Start/Stop	1 = start, 0 = stop
Message Terminator	FFFFH

EXAMPLE

This example starts EAS mode. Three responses follow. The first is a command acknowledgment. The LRP830 sends the second when the first EAS-enabled tag enters the field, A third response is sent when field is clear of EAS-enabled tags. Family ID is set to 0 so that any EAS-enabled tag will trigger responses.

Command from Host

MSB	LSB	Remarks
AAH	89H	Perform Command 89
00H	00H	Family ID/null byte
00H	01H	Start/Stop
FFH	FFH	Message Terminator

ACT Response from LRP830

MSB	LSB	Remarks
AAH	89H	Command Echo
FFH	00H	Ntag/Status
FFH	FFH	Message Terminator

When an EAS-enabled tag enters the antennas' field, the LRP830 responds with an EAS tag-in-field response.

Tags-in-Field Response from LRP830

MSB	LSB	Remarks
AAH	89H	Command Echo
01H	00H	Ntag/Status
FFH	FFH	Message Terminator

When all EAS-enabled tags have left the field, the LRP830 will send the following response.

EAS Tags Left Field
Response from LRP830

MSB	LSB	Remarks
AAH	89H	Command Echo
00H	00H	Ntag/Status
FFH	FFH	Message Terminator

ABxS Command 8D (8DH): Continuous Read All

DESCRIPTION
Starts and stops Continuous Read All mode for multiple tags.

DISCUSSION
Continuous Read All mode is set by the length byte. To start Continuous Read All mode, send the command with valid, non-zero value for the length of the read (1-48). Stop the mode by sending the command with a read length of 0.

While in this mode, any other command can be issued and it will be handled properly. After processing the new command, the LRP will resume the Continuous Read All mode.

The command has a parameter, tag delay, that can prevent multiple reads of the same tag. A tag is not read a second time until a specified number of tags have been read since it was last read. Allowed value are from 0 to 255 (FFH), where 0 means the tag can be re-read anytime. When Continuous Read All mode is interrupted with other commands, the tag delay count is stopped during execution of the other commands and then resumed.

The LRP830 will respond with an acknowledge packet followed by data packets for each tag read.

CONFIG LED blinks after each packet transmission.

Field	Remarks
Command	Command number in hex preceded by AAH
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	Tag address for the start of the read
Read Length	1-48 = start, 0 = stop
Tag Delay	Number of tags that must be read before the same tag will be read again (0-225)
Message Terminator	FFFFH

NOTE:
This command can not be used over a DeviceNet interface.

EXAMPLE

Reads 4 bytes of data from the tag starting at address 0001H. The Family ID byte is set to zero so all tags will be read. The Anticollision Index is set to 2 so 4 to 8 tags will be expected. The Tag Delay is set to 20 (14H). Three tags respond with read data.

Command from Host

MSB	LSB	Remarks
AAH	8DH	Perform Command 8D
00H	02H	Tag Family 00/ Index 2
00H	01H	Start Address
00H	04H	Read Length
00H	14H	Tag Delay
FFH	FFH	Message Terminator

ACK Response from LRP830

MSB	LSB	Remarks
AAH	8DH	Command Echo
FFH	FFH	Message Terminator

After the LRP830 sends the acknowledgment, it will send the read data from the 3 tags.

Data response from LRP830

MSB	LSB	Remarks
AAH	8DH	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	8DH	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	8DH	Command Echo/Tag 3
00H	34H	Data byte 1/Tag 3
00H	35H	Data byte 2/Tag 3
00H	36H	Data byte 3/Tag 3
00H	37H	Data byte 4/Tag 3
FFH	FFH	Terminator/ Tag 3

ABxS Command 8E (8EH): Memory Lock All

DESCRIPTION
This command “locks” tag addresses in four byte blocks. Once bytes are locked, they can not be unlocked.

DISCUSSION
The memory can be locked only in 4-byte blocks. The command passes a two byte word with bits assigned to 4-byte blocks that can be locked. Remaining bits can lock the EAS feature and the lock configuration itself.

When multiple tag-in-field is enabled (Anticollision Index is not 0), the LRP830 will return a response when the timeout period expires. When multiple tag-in-field is disabled, the LRP830 will return a response when it locks bytes or the timeout expires.

Attempting to write to locked bytes will return a write error timeout in the status byte. If you write to addresses that\ contain both locked and non-locked bytes, the LRP830 will return a write error in the status byte.

The configuration word formatted as shown below.

Byte	Bit	Description
Lock LSB	0	Tag bytes 0-3
	1	Tag bytes 4-7
	2	Tag bytes 8-11
	3	Tag bytes 12-15
	4	Tag bytes 16-19
	5	Tag bytes 20-23
	6	Tag bytes 24-27
	7	Tag bytes 28-31
Lock MSB	8	Tag bytes 32-35
	9	Tag bytes 36-39
	10	Tag bytes 40-43
	11	Tag bytes 44-47
	12	Lock Configuration
	13	Lock EAS feature
	14	Reserved
	15	Reserved

If a bit in the configuration word is set, then the corresponding block in the tag is locked when the command is issued. If a bit in the configuration word is cleared (0), then the corresponding block will not change. Once locked, a block can not be unlocked.

The command is formatted as shown below.

Field	Remarks
Command	Command number in hex preceded by AAH
Family Code	Tag Family ID - 00H = all tags
Anticollision index	Number of tags-in-field expected
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Lock MSB	Bits 8-15 of the configuration word
Lock LSB	Bits 0-7 of the configuration word
Message Terminator	FFFFH

EXAMPLE
This example will lock bytes 0-3 on all tags-in-field with the Family ID of 02H. Two tags are found and locked.

Command from Host

MSB	LSB	Remarks
AAH	8EH	Perform Command 8E
02H	01H	Family ID/anticollision Index
07H	D0H	2 second timeout
00H	01H	Lock Configuration
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	8EH	Command Echo
02H	08H	Ntag/Status
FFH	FFH	Message Terminator

ABxS Command 94 (94H): SN Fill

DESCRIPTION
Fills only the RFID tag specified by serial number 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. Only the tag with the specified serial number will be affected by this command. The LRP830 will return a response after the successful fill operation or when the timeout expires.

The fill function requires a Family ID and an Anticollision Index, one data value byte, a starting address, and a fill length. Then the command lists the serial numbers of the tag to be filled. It fills the specified 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 LRP830 will write fill data from the start address to the end of the tags memory.

The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error. It returns a response when done or when the timeout expires.

Field	Remarks
Command	Command number in hex preceded by AAH
Family Code	Tag Family ID - 00H = all tags
Anticollision index	Number of tags-in-field expected
Start Address	The tag address where the fill will start
Fill Length	The number of tag addresses to be filled
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Tag Serial Number	The 8-byte serial number
Data Value Byte	The byte used to fill
Message Terminator	FFFFH

A response to a successful command will follow this form.

Field	Remarks
Command Echo	Command number in hex preceded by AAH
Number of Tags filled	0 = tag not found, 1 = tag filled
Command Status	One byte Error status
Message Terminator	FFFFH

EXAMPLE
Writes 'A' (41H) to a single tag, starting at tag address 0005H for the following next consecutive 40 bytes. The Family ID is turned off and the Anticollision Index is set to expect 2-4 tags. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the configuration.

Command from Host

MSB	LSB	Remarks
AAH	94H	Perform Command 94
00H	01H	Family ID/ Index 1
00H	05H	Start Address
00H	28H	Fill Length
07H	D0H	Timeout
00H	01H	SN byte 1
00H	ACH	SN byte 2
00H	42H	SN byte 3
00H	D0H	SN byte 4
00H	27H	SN byte 5
00H	1CH	SN byte 6
00H	65H	SN byte 7
00H	33H	SN byte 8
00H	41H	Fill byte
FFH	FFH	Message Terminator

Response from Host

MSB	LSB	Remarks
AAH	94H	Command Echo
01H	00H	Ntag/Status
FFH	FFH	Message Terminator

ABxS Command 95 (95H): SN Block Read

DESCRIPTION
Read a block of data from a specified RFID tag.

DISCUSSION
This command is used to read segments of data from contiguous areas of tag memory. It is capable of handling up to 48 bytes of data transferred to the host with one command if there is no tag Family ID. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The SN Block Read consists of Family ID and an Anticollision Index, a start address and length, followed by a timeout value. The 8-byte serial number of the target tag is specified. If the read length exceeds the last tag address, the LRP830 will return error message in the status byte. It returns a response when done or when the timeout expires.

The data read from the tag is returned in the LSB of the register, and the MSB is always 00H. A special error packet (AAH FFH) is sent if the time-out expires.

Field	**Remarks**
Command	Command number in hex preceded by AAH
Tag Family	Tag Family ID - 00H = all tags
Anticollision index	Number of tags expected
Start Address	The tag address where the read will start
Read Length	The numbers of tag addresses to be read
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Tag Serial Number	8-byte tag serial number
Message Terminator	FFFFH

EXAMPLE:
Reads 4 bytes of data from the tag specified by serial number 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. The Family ID byte is set to zero. The Anticollision Index is set to 2, expecting 4-8 tags in the field.

Command from Host

MSB	LSB	Remarks
AAH	95H	Perform Command 95
00H	02H	Tag Family 00/ Index 2
00H	01H	Start Address
00H	04H	Read Length
07H	D0H	Timeout
00H	ABH	SN byte 1
00H	02H	SN byte 2
00H	F3H	SN byte 3
00H	55H	SN byte 4
00H	C5H	SN byte 5
00H	2DH	SN byte 6
00H	41H	SN byte 7
00H	A0H	SN byte 8
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	95H	Command Echo
00H	30H	Data byte 1
00H	31H	Data byte 2
00H	32H	Data byte 3
00H	33H	Data byte 4
01H	00H	Ntag/Status
FFH	FFH	Message Terminator

ABxS Command 96 (96H): SN Block Write

DESCRIPTION
Write a block of data to a single RFID tag specified by its serial number.

DISCUSSION
This command is used to write segments of data to contiguous areas of tag memory. It is capable of transferring up to 48 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The SN Block Write consists of a Family ID, Anticollision Index, and start address followed by the data stream to be written to the RFID tag. If the write range exceeds the last tag address, the LRP830 will return an error message 21H, invalid format. It returns a response when done or when the timeout expires.

The data to be written to the tag is contained in the LSB of the register, and the MSB is always 00H.

Field	**Remarks**
Command	Command number in hex preceded by AAH
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags-in-field expected
Start Address	The tag address where the write will start
Write Length	The number of tag addresses to be written to
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Tag Serial Number	8-byte tag serial number
Write Data	The data to be written (1-48 bytes)
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 0 and the Anticollision Index is set to 2 for this example.

Command from Host

MSB	LSB	Remarks
AAH	96H	Perform Command 96
02H	02H	Tag Family 02/ Index 2
00H	01H	Start Address
00H	04H	Write Length
07H	D0H	Timeout
00H	A4H	SN byte 1
00H	6CH	SN byte 2
00H	18H	SN byte 3
00H	92H	SN byte 4
00H	2DH	SN byte 5
00H	34H	SN byte 6
00H	DEH	SN byte 7
00H	20H	SN byte 8
00H	40H	Data byte 1
00H	41H	Data byte 2
00H	42H	Data byte 3
00H	43H	Data byte 4
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	96H	Command Echo
01H	00H	Ntags/Status
FFH	FFH	Message Terminator

ABxS Command 97 (97H): SN Block Read All

DESCRIPTION
Read a block of data from all RFID tags-in-field or those with the specified Family ID. Return 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 handling up to 48 bytes of data transferred to the host with one command if there is no tag family ID. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 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, Anticollision Index, 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 Anticollision Index is 0, a response is returned when the operation is successfully completed on 1 tag, or when the timeout expires. A termination packet is not sent for successful completion if the Anticollision Index is 0.

If the read length exceeds the last tag address, the LRP830 will return an invalid format error message (error code 21H).

Field	Remarks
Command	Command number in hex preceded by AAH
Tag Family	Tag Family ID - 00H = all tags
Anticollision index	Number of tags expected
Start Address	The tag address where the read will start
Read Length	The number of tag addresses to be read
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Message Terminator	FFFFH

NOTE:
This command can not be used over a DeviceNet interface.

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. The Anticollision Index is set to 2 so 4-8 tags are expected. Two tags respond with read data.

Command from Host

MSB	LSB	Remarks
AAH	97H	Perform Command 97
00H	02H	Tag Family 00/ Index 2
00H	01H	Start Address
00H	02H	Read Length
07H	D0H	Timeout
FFH	FFH	Message Terminator

Response from LRP830

MSB	LSB	Remarks
AAH	97H	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	97H	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 Echo/end
02H	08H	Ntags/Status
FFH	FFH	Message Terminator

6.5 ABx Fast Protocol

The difference from the standard ABx are:

- The command/response packet contains the packet size
- You can include a checksum in the command
- The headers and terminator are ASCII characters
- Since ABx Fast is a binary protocol, the Xon/Xoff handshake cannot be used.

ABx Command Packet Structure:

The command protocol is based on the following minimal packet structure. The data field and the checksum may not be present depending on the command type and your checksum setting.

Field	Number of Bytes	Content
Header	2	<STX><STX> (02H, 02H)
Command Size	2	Packet length in bytes excluding the header, command size, checksum and terminator bytes.
Command	1	Command Code
(Data)	variable	command data/parameters
(Checksum)	1	Optional Checksum
Terminator	1	<ETX> (03H)

Following a successful operation, the LRP830 will respond with the following. The data field and the checksum may not be present depending on your checksum setting.

Field	Number of Bytes	Content
Header	2	<STX><STX> (02H, 02H)
Response Size	2	Packet length in bytes excluding the header, response size, checksum and terminator bytes.
Command	1	Command Echo
(Data)	variable	response data
(Checksum)	1	Optional Checksum
Terminator	1	<ETX> (03H)

If the LRP830 Reader/Writer encounters a fault it will respond with the following:

Field	Number of Bytes	Content
Header	2	<STX><STX> (02H, 02H)
Response Size	2	Packet length in bytes excluding the header, packet size, checksum and terminator bytes. (02H in this case)
Error Flag	1	FFH
Error Code	1	Hex error code, see Table 7 for details
(Checksum)	1	Optional Checksum
Terminator	1	<ETX> (03H)

- The Header and Terminator are always STX-STX and ETX respectively.
- All other bytes are interpreted as binary data (0 - 255 dec).
- Fields with two bytes are sent most significant byte (MSB) first.

The sequence for each command is given with the response format in the following section.

Command/Response Size

The ABx Fast requires that the length of the packet be included in the command. All parameters and data between the Command/Response Size and the Checksum or Terminator bytes must be accounted for in the command/response size word. This includes all command codes and parameters such as field definitions for Block Read/Writes. The command/response size will be the same with, or without, a checksum.

Checksum

Since the DeviceNet protocol has its own data validation, it is not necessary to use the checksum option when sending ABxF commands over the DeviceNet bus.

The optional checksum must be enabled from the operating mode menu to be available. The checksum is calculated by adding all the byte values in the packet (less the values in the header, checksum if present, and terminator), discarding byte overflow and subtracting the byte sum from FFH. Thus, when the packet length through the checksum are added as byte values, the sum will be FFH.

EXAMPLE
The following is a typical command using a checksum.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	03H
Command Code	01H
Timeout	07H
	D0H
Checksum	24H
Terminators <ETX>	03H

Sum these values to calculate the checksum (Command Size through Timeout)

The summed values begin with the Command Size and end with the timeout value. That sum, less overflow, is subtracted from FFH for the checksum value.

Thus: 00 + 03 + 01 +07 + D0 = DB   FF - DB = 24H

The optional Checksum is included in the following command explanations.

ABxF Command 4 (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 an RFID 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 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 LRP830 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. 0008H for this command
Command	04H
Start Address	2-byte value for the starting tag address
Fill Length	2-byte value for the length of the fill in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Data value byte	1 byte of fill
Checksum	Optional Checksum
Terminator	<ETX>

A response to a successful command will follow this form.

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. 0001H for this command
Command	04H
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE

Writes 'A' (41H) to the tag starting at address 0005H for the following next consecutive 40 bytes. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the configuration.

Command from Host

Field	Bytes Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	08H
Command Code	04H
Start address	00H
	05H
Block Size	00H
	28H
Timeout, 2 seconds	07H
	D0H
Data Value Byte	41H
Terminators <ETX>	03H

Response from LRP830

Field	Bytes Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	01H
Command Echo	04H
Terminators <ETX>	03H

ABxF Command 5 (05H): Block Read

DESCRIPTION
Read a block of data from an RFID tag.

DISCUSSION
This command is used to read segments of data from contiguous areas of tag memory. It is capable of handling up to 48 bytes of data transferred to the host. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The Block Read consists of a start address and length, followed by a timeout value and a message terminator as shown below.

Field	**Content**
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. 0007H for this command
Command	05H
Start Address	2-byte value for the starting tag address
Block Size	2-byte value for the length of the read in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Checksum	Optional Checksum
Terminator	<ETX>

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.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	07H
Command Code	05H
Start address	00H
	01H
Block size	00H
	04H
Timeout, 2 seconds	07H
	D0H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	05H
Command Echo	05H
Data from address 0001H	05H
Data from address 0002H	AAH
Data from address 0003H	E7H
Data from address 0004H	0AH
Terminator <ETX>	03H

ABxF Command 6 (06H): Block Write

DESCRIPTION
Write a block of data to an RFID tag.

DISCUSSION
The Block Write command is used to write segments of data to contiguous areas of tag memory. It is capable of handling up to 48 bytes of data transferred to the host. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The Block Write command consists of a start address followed by the data to be written to the RFID tag. If the write range exceeds the last tag address, the LRP830 will return an invalid format error message (error code 21H).

Field	**Content**
Header	<STX><STX>
Packet Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. 0007H plus the number of data bytes
Command	06H
Start Address	2-byte value for the starting tag address
Block Size	2-byte value for the length of the write in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Data	Data bytes to be written
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE:
Writes 4 bytes of data to the tag starting at address 0000H. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Block Write.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	0BH
Command Code	06H
Start address	00H
	00H
Block Size	00H
	04H
Timeout, 2 seconds	07H
	D0H
Data to write to address 0000H	52H
Data to write to address 0001H	46H
Data to write to address 0002H	49H
Data to write to address 0003H	44H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	01H
Command Echo	06H
Terminators <ETX>	03H

ABxF Command 7 (07H): Read Tag Serial Number

DESCRIPTION
This command retrieves the 8-byte tag serial number.

DISCUSSION
Each LRP tag has an unique (2^{64} possible numbers) serial number. This number can not be changed and is not part of the 48 available data bytes.

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. 0003H for this command
Command	07H
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE:

This example will wait until a tag is in range and then reads the 8-byte identification number. In this example the SN is 1E6E3DC200000000 in hexadecimal.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	03H
Command Code	07H
Timeout	07H
	D0H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	09H
Command Echo	07H
First SN byte	1EH
Second SN byte	6EH
Third SN byte	3DH
Fourth SN byte	C2H
Fifth SN byte	00H
Sixth SN byte	00H
Seventh SN byte	00H
Eighth SN byte	00H
Terminators <ETX>	03H

ABxF Command 8 (08H): Tag Search

DESCRIPTION
Check to see if there is an RFID tag in the LRP830 field.

DISCUSSION
This command will activate the reader/write to "look" for a tag in the RF field. If the LRP830 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error. If no tag is present it will return an error message. See Section 6.2 for information on the error messages.

Field	Content
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, command size, checksum and terminator bytes. 0003H for this command
Command	08H
Timeout	2-byte value for the timeout in 1 ms units (1EH - FFFEH)
Checksum	Optional Checksum
Terminator	<ETX>

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

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	03H
Command Code	08H
Timeout	07H
	D0H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	01H
Command Echo	08H
Terminators <ETX>	03H

ABxF Command D (0DH): Continuous Block Read

DESCRIPTION
Send block reads continuously to any tag in range of the antenna. When a tag enters the RF field, it is read and the data passed to the host computer. The LRP830 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 feature prevents redundant data transmissions when the LRP830 is in Continuous Block Read mode.

DISCUSSION
The initiate/cancel Continuous Block Read command contains three parameters: read length, start address, and delay between identical decodes. The read length parameter switches the mode. Any valid, non-zero length will set the LRP830 into Continuous Block Read mode. A read length value of 00H will turn Continuous Block Mode off.

The Delay Between Identical Decodes value can have a value of 0 to 60 seconds. When the Delay Between Identical Decodes is set to 0, the LRP830 will continuously read AND transmit tag data to the host. This can flood the buffers and cause communication errors and data loss.

If the LRP830 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:

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

NOTE:
This command can not be used over a DeviceNet interface.

The command is formatted as follows.

Field	Content
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, command size, checksum and terminator bytes.
Command	0DH
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 Reads	Delay value given in 1 second units
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE

This example places the LRP830 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 1 second increments) is set.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	06H
Command Code	0DH
Start Address	00H
	01H
Read Length	00H
	08H
Delay Between Identical Decodes	02H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	01H
Command Echo	0DH
Terminator <ETX>	03H

The LRP830 will first return an acknowledgment of the command followed by a response containing read data when a tag enters the antenna field.

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	09H
Command Echo	0DH
Data Byte 1	05H
Data Byte 2	AAH
Data Byte 3	E7H
Data Byte 4	0AH
Data Byte 5	05H
Data Byte 6	AAH
Data Byte 7	E7H
Data byte 8	0AH
Terminator <ETX>	03H

ABxF Command 10 (10H): Set Output

DESCRIPTION
Set the levels of the output lines and output LEDs "A" through "D."

DISCUSSION
This command is used to set the levels of the digital output lines using bit logic. The four least significant bit toggle the output levels; 1 = ON and 0 = OFF. The following chart shows the hex values for all output high combinations. To reset all output, issue the command with 0000H for the Output Pattern byte.

MSB	LSB	Remarks	LSB Bit 3 Output D	LSB Bit 2 Output C	LSB Bit 1 Output B	LSB Bit 0 Output A
00H	00H	Reset A, B, C, D	0	0	0	0
00H	01H	Set Output A - Reset B, C, D	0	0	0	1
00H	02H	Set Output B - Reset A, C, D	0	0	1	0
00H	03H	Set Output A, B - Reset C, D	0	0	1	1
00H	04H	Set Output C - Reset A, B, D	0	1	0	0
00H	05H	Set Output A, C - Reset B, D	0	1	0	1
00H	06H	Set Output B, C - Reset A, D	0	1	1	0
00H	07H	Set Output A, B, C - Reset D	0	1	1	1
00H	08H	Set Output D - Reset A, B, C	1	0	0	0
00H	09H	Set Output A, D - Reset B, C	1	0	0	1
00H	0AH	Set Output B, D - Reset A, C	1	0	1	0
00H	0BH	Set Output A, B, D - Reset C	1	0	1	1
00H	0CH	Set Output C, D - Reset A, B	1	1	0	0
00H	0DH	Set Output A, C, D - Reset B	1	1	0	1
00H	0EH	Set Output B, C, D - Reset A	1	1	1	0
00H	0FH	Set Output A, B, C, D	1	1	1	1

Field	Content
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, command size, checksum and terminator bytes. 0002H for this command
Command	10H
Output Pattern	1 byte representing the desired output settings in bits 0-3
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE
The following example sets Output B only and resets A, C, and D.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	02H
Command Code	10H
Output Value Byte	02H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	01H
Command Echo	10H
Terminator <ETX>	03H

ABxF Command 11 (11H): Input Status

DESCRIPTION
Retrieves the input line levels.

DISCUSSION
This command is used to monitor the levels of the digital input lines using bit logic. The four least significant bit display the input levels; 1 = ON and 0 = OFF. The following chart shows all possible conditions that can be returned in the response.

MSB	LSB	Remarks	LSB Bit 3 Input D	LSB Bit 2 Input C	LSB Bit 1 Input B	LSB Bit 0 Input A
00H	00H	Inputs A, B, C, D, OFF	0	0	0	0
00H	01H	Input A, ON - B, C, D, OFF	0	0	0	1
00H	02H	Input B, ON - A, C, D, OFF	0	0	1	0
00H	03H	Input A, B, ON - C, D, OFF	0	0	1	1
00H	04H	Input C, ON - A, B, D, OFF	0	1	0	0
00H	05H	Input A, C, ON - B, D, OFF	0	1	0	1
00H	06H	Input B, C, ON - A, D, OFF	0	1	1	0
00H	07H	Input A, B, C, ON - D, OFF	0	1	1	1
00H	08H	Input D, ON - A, B, C, OFF	1	0	0	0
00H	09H	Input A, D, ON - B, C, OFF	1	0	0	1
00H	0AH	Input B, D, ON - A, C, OFF	1	0	1	0
00H	0BH	Input A, B, D, ON - C, OFF	1	0	1	1
00H	0CH	Input C, D, ON - A, B, OFF	1	1	0	0
00H	0DH	Input A, C, D, ON - B, OFF	1	1	0	1
00H	0EH	Input B, C, D, ON - A, OFF	1	1	1	0
00H	0FH	Input A, B, C, D, ON	1	1	1	1

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes.
Command	11H
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE

The following example shows only Input B is ON and A, C, and D are OFF.

Command from Host

Field	**Contents**
Header <STX><STX>	02H
	02H
Command Size	00H
	01H
Command Code	11H
Terminators <ETX>	03H

Response from LRP830

Field	**Contents**
Header <STX><STX>	02H
	02H
Response Size	00H
	02H
Command Echo	11H
Input Value Byte	02H
Terminators <ETX>	03H

ABxF Command 84 (84H): Fill 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 present in the antenna field with the specified Family ID will be affected by this command. The LRP830 will return a response after the timeout expires.

The Fill All function requires one data value byte, a starting address, and a fill length. It will 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 (1-48).

The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the Anticollision Index is not zero (multiple tag-in-field enabled), the LRP830 returns a response after the timeout expires. If the Anticollision Index is 0, a response is returned when a successful operation is performed on 1 tag, or when the timeout has expired. When the timeout is set to 0, the LRP830 will return a syntax error.

Field	Content
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, packet size, checksum and terminator bytes. 0008H for this command
Command	84H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	2-byte value for the starting tag address
Fill Length	2-byte value for the length of the fill in number of bytes (1-48)
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Data value byte	1 byte of fill
Checksum	Optional Checksum
Terminator	<ETX>

NOTE:
This command can not be used over a DeviceNet interface.

EXAMPLE

Writes 'A' (41H) to all tags with Family ID 03H, starting at address 0005H for the following next consecutive 40 bytes. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the configuration. Four tags are found and filled successfully.

Command from Host

Field	Bytes Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	0AH
Command Code	84H
Family ID	03H
Anticollision Index	02H
Start address	00H
	05H
Fill Length	00H
	28H
Timeout, 2 seconds	07H
	D0H
Data Value Byte	41H
Terminators <ETX>	03H

Response from LRP830

Field	Bytes Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	84H
Numbers of tags	04H
Status byte	08H
Terminators <ETX>	03H

ABxF Command 85 (85H): Block Read All

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

DISCUSSION
This command is used to read segments of data from contiguous areas of tag memory. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The Block Read All consists of a Family ID, an Anticollision Index, a start address and length, followed by a timeout value and a message terminator as shown below.

If the read length exceeds the last tag address, the LRP830 will return an invalid format error message (error code 21H). A special termination packet is sent when the timeout expires. If the Anticollision Index is set to 0, a response is returned after successful completion of the operation to 1 tag, or when the timeout expires. When the Anticollision Index is 0, no special termination packet is sent after timeout.

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes.
Command	85H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	2-byte value for the starting tag address
Block Size	2-byte value for the length of the read in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Checksum	Optional Checksum
Terminator	<ETX>

NOTE:
This command can not be used over a DeviceNet interface.

EXAMPLE:
Reads 4 bytes of data from tags with Family ID AAH, 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 Tag Family byte is set to zero so all tags will be read. The Anticollision Index is set to 2, expecting 4-8 tags. Two tags respond with data.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	09H
Command Code	85H
Family ID	AAH
Anticollision Index	02H
Start address	00H
	01H
Block size	00H
	02H
Timeout, 2 seconds	07H
	D0H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo/Tag 1	85H
Data from address 0001H	05H
Data from address 0002H	AAH
Terminator <ETX>	03H
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo/Tag 2	85H
Data from address 0001H	05H
Data from address 0002H	AAH
Terminator <ETX>	03H
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Status	FFH
Number of tags	02H
Status Byte	08H
Terminator <ETX>	03H

ABxF Command 86 (86H): Block Write All

DESCRIPTION
Write a block of data to an RFID tag.

DISCUSSION
The Block Write All command is used to write segments of data to contiguous areas of tag memory. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The Block Write All consists of a Family ID, Anticollision Index, 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 LRP830 will return an invalid format error message (error code 21H). The LRP830 will return a response when the timeout expires. If the Anticollision Index is 0, a response is returned when the operation is successfully completed on 1 tag, or when the timeout expires.

Field	**Content**
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. 0009H plus the number of data bytes
Command	86H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	2-byte value for the starting tag address
Block Size	2-byte value for the length of the write in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Data	Data bytes to be written
Checksum	Optional Checksum
Terminator	<ETX>

NOTE:
This command can not be used over a DeviceNet interface.

EXAMPLE:

Writes 4 bytes of data to the tag starting at address 0000H. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the Block Write All. Family ID is set to 00H so all tags-in-field will be written to. The Anticollision Index is 5, expecting 32-64 tags. Five tags are written to.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	0DH
Command Code	86H
Family ID	00H
Anticollision Index	04H
Start address	00H
	00H
Block Size	00H
	04H
Timeout, 2 seconds	07H
	D0H
Data to write to address 0000H	52H
Data to write to address 0001H	46H
Data to write to address 0002H	49H
Data to write to address 0003H	44H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	86H
Ntag	05H
Status	08H
Terminators <ETX>	03H

ABxF Command 87 (87H): Read Tag SN All

DESCRIPTION
This command retrieves the 8-byte tag serial number from all tags-in-field or those with the specified Family ID.

DISCUSSION
Each LRP tag has an unique (2^{64} possible numbers) serial number. This number can not be changed and is not part of the 48 available data bytes.

The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error. A special termination packet (starting with AAH FFH) is sent when the timeout expires. If the Anticollision Index is set to 0, a response is returned when the operation is successfully completed to 1 tag, or when the timeout expires. No special termination packet is sent upon successful completion if Anticollision Index is set to 0.

Field	**Content**
Header	<STX><STX>
Command Size	Packet length in bytes excluding the head er, command size, checksum and terminator bytes. 0005H for this command
Command	87H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Checksum	Optional Checksum
Terminator	<ETX>

NOTE:
This command can not be used over a DeviceNet interface.

EXAMPLE:

This example will read the 8-byte serial number from all tags permitted by the Family ID and Anticollision Index. In this example, one tag responds and the serial number is 1E6E3DC200000000 in hexadecimal.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	05H
Command Code	87H
Family ID	00H
Anticollision Index	01H
Timeout	07H
	D0H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	09H
Command Echo	87H
SN byte 1	1EH
SN byte 2	6EH
SN byte 3	3DH
SN byte 4	C2H
SN byte 5	00H
SN byte 6	00H
SN byte 7	00H
SN byte 8	00H
Checksum	E4H
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Status	FFH
Number of Tags	01H
Status Byte	08H
Terminator <ETX>	03H

ABxF Command 88 (88H): Tag Search All

DESCRIPTION
Check to see if there is any RFID tags in the LRP830 antenna field.

DISCUSSION
This command will activate the LRP830 to "look" for a tag in the RF field. As soon as the LRP830 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 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error. If no tag is present it will return an error message. See Section 6.2 for information on the error messages.

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. 0005H for this command
Command	88H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Timeout	2-byte value for the time in 1 ms units
Checksum	Optional Checksum
Terminator	<ETX>

NOTE:
This command can not be used over a DeviceNet interface.

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 All. A tag is found.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	05H
Command Code	88H
Family ID	00H
Anticollision Index	02H
Timeout	07H
	D0H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	88H
Number of Tags	01H
Status byte	00H
Terminators <ETX>	03H

ABxF Command 89 (89H): EAS Set/Reset All

DESCRIPTION
Sets or resets the EAS feature in tag memory for all tags in range when the command is issued.

DESCRIPTION
The commands contains a 1 byte parameter that enables or disables the EAS feature in tags that receive the command. When the EAS Set/Reset All command is issued, the LRP830 will respond with the number of tags affected. If the LRP830 return a 0 for Ntag it means that no tags were set or reset by the command.

The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error. When multiple tag-in-field is enabled (Anticollision index is not 0), the LRP830 will return a response when the timeout period expires. When multiple tag-in-field is disabled, the LRP830 will return a response when it reads a tag or the timeout expires.

Field	**Content**
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, command size, checksum and terminator bytes.
Command	89H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Set/Reset	1 = enable, 0 = disable EAS
Checksum	Optional Checksum
Message Terminator	<ETX>

EXAMPLE

This example assumes that the tags-in-field are not enabled for the EAS feature. It will enabled the EAS feature for tags with Family ID 09H. The Anticollision Index is 2, so 4-8 tags are expected in the field. When the command is issued, 5 tags with Family ID 09H are found and enabled for EAS.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	05H
Command Code	89H
Family ID	09H
Anticollision Index	02H
Timeout	07H
	D0H
Set/Reset	01H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	89H
Number of Tags	05H
Status byte	08H
Terminator <ETX>	03H

ABxF Command 8A (8AH): EAS Start/Stop

DESCRIPTION
If are using the EAS feature in your application, the EAS Start/Stop command enters and exits the LRP830 from EAS mode.

DISCUSSION
When EAS mode has been started, the LRP830 will return a response when one or more EAS-enabled tags have entered the antenna field. It will send a second response when all EAS-enabled tags have exited the field. The command contains a control byte that toggles EAS: 1 = start, 0 = stop. A Family ID can be set so that only EAS-enabled tags from the specified Family trigger EAS responses. The Anticollision Index is ignored and should be set to 00H for this command.

The EAS mode also controls the CONFIG, ERROR and RF LEDs. The following table explains LED behavior.

LED(s)	Behavior	Description
CONFIG, ERROR, RF LED	OFF	No EAS-enabled tag in field
CONFIG LED	BLINK	EAS-enabled tag entered field.
RF LED	ON	EAS tag has been read. LED will remain ON until all EAS tags have left the field.
ERROR LED	BLINKS	Last EAS tag left the field.

IMPORTANT:
EAS mode prevents any other commands from being acknowledged or executed until EAS has been stopped.

Field	Content
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, command size, checksum and terminator bytes.
Command	8AH
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Anticollision not considered for this command, 00H
Start/Stop	1 = Start and 0 = Stop EAS
Checksum	Optional Checksum
Message Terminator	<ETX>

EXAMPLE

This example starts EAS mode. Three responses follow. The first is a command acknowledgment. The LRP830 sends the second when the first EAS-enabled tag enters the field, A third response is sent when field is clear of EAS-enabled tags. Family ID is set to 0 so that any EAS-enabled tag will trigger responses.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	03H
Command Code	8AH
Family ID	00H
Anticollision Index	00H
Start/Stop	01H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	8AH
Number of Tags	FFH
Status byte	00H
Terminator <ETX>	03H

When an EAS-enabled tag enters the antennas' field, the LRP830 responds with an EAS tag-in-field response.

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	8AH
Number of Tags	01H
Status byte	00H
Terminator <ETX>	03H

When all EAS-enabled tags have left the field, the LRP830 will send the following response.

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	8AH
Number of Tags	00H
Status byte	00H
Terminator <ETX>	03H

ABxF Command 8D (8DH): Continuous Read All

DESCRIPTION
Starts and stops Continuous Read All mode for multiple tags.

DISCUSSION
Continuous Read All mode is set by the length byte. To start Continuous Read All mode send the command with valid, non-zero value for the length of the read (1-48). Stop the mode by sending the command with a read length of 0. While in this mode, any other command can be issued and it will be handled properly. After processing the new command, the LRP will resume the Continuous Read All mode.

The command has a parameter, tag delay, that can prevent multiple reads of the same tag. A tag is not read a second time until a specified number of tags have been read since it was last read. Allowed value are from 0 up to 255 (FFH), where 0 means the tag can be re-read anytime. When Continuous Read All mode is interrupted with other commands, the tag delay count is stopped during execution of the other commands and then resumed.

The LRP830 will respond with an acknowledge packet followed by data packets for each tag read.

CONFIG LED blinks after each packet transmission.

Field	Content
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, command size, checksum and terminator bytes.
Command	8DH
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Anticollision not considered for this command, 00H
Start Address	Tag address for the start of the read
Read Length	1-48 = start, 0 = stop
Tag Delay	Number of tags that must be read before the same tag will be read again (0-255)
Checksum	Optional Checksum
Message Terminator	<ETX>

NOTE:
This command can not be used over a DeviceNet interface.

EXAMPLE

Reads 4 bytes of data from the tag starting at address 0001H. The Family ID byte is set to zero so all tags will be read. The Anticollision Index is set to 1 so 2 to 4 tags will be expected. The Tag Delay is set to 20 (14H). Two tags respond with read data.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	08H
Command Code	8DH
Family ID	00H
Anticollision Index	01H
Start Address	00H
	01H
Read Length	00H
	04H
Tag Delay	14H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	01H
Command Echo	8DH
Terminator <ETX>	03H

After the LRP830 sends the acknowledgment, it will send the read data from the 2 tags.

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	05H
Command Echo/Tag 1	8DH
Data from address 0001H	05H
Data from address 0002H	AAH
Data from address 0003H	21H
Data from address 0004H	44H
Terminator <ETX>	03H
Header <STX><STX>	02H
	02H
Response Size	00H
	05H
Command Echo/Tag 2	85H
Data from address 0001H	05H
Data from address 0002H	AAH
Data from address 0003H	21H
Data from address 0004H	44H
Terminator <ETX>	03H

ABxF Command 8E (8EH): Memory Lock All

DESCRIPTION
This command "locks" tag addresses in four byte blocks. Once bytes are locked, they can not be unlocked.

DISCUSSION
The memory can be locked only in 4-byte blocks. The command passes a two byte word with bits assigned to 4-byte blocks that can be locked. Remaining bits can lock the EAS feature and the lock configuration itself.

When multiple tag-in-field is enabled (Anticollision Index is not 0), the LRP830 will return a response when the timeout period expires. When multiple tag-in-field is disabled, the LRP830 will return a response when it locks bytes or the timeout expires.

Attempting to write to locked bytes will return a write error timeout in the status byte. If you write to addresses that contain both locked and non-locked bytes, the LRP830 will return a write error in the status byte.

The configuration word formatted as shown below.

Byte	Bit	Description
Lock LSB	0	Tag bytes 0-3
	1	Tag bytes 4-7
	2	Tag bytes 8-11
	3	Tag bytes 12-15
	4	Tag bytes 16-19
	5	Tag bytes 20-23
	6	Tag bytes 24-27
	7	Tag bytes 28-31
Lock MSB	8	Tag bytes 32-35
	9	Tag bytes 36-39
	10	Tag bytes 40-43
	11	Tag bytes 44-47
	12	Lock Configuration
	13	Lock EAS feature
	14	Reserved
	15	Reserved

If a bit in the configuration word is set, then the corresponding block in the tag is locked when the command is issued. If a bit in the configuration word is cleared (0), then the corresponding block will not change. Once locked, a block can not be unlocked.

The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The command is formatted as shown below.

Field	**Remarks**
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, command size, checksum and terminator bytes.
Command	8EH
Family Code	Tag Family ID - 00H = all tags
Anticollision index	Number of tags-in-field expected
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH)
Lock MSB	Bits 8-15 of the configuration word
Lock LSB	Bits 0-7 of the configuration word
Checksum	Optional Checksum
Message Terminator	<ETX>

EXAMPLE

This example will lock bytes 0-3 on all tags-in-field with the Family ID of 02H. Two tags are found and locked.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	07H
Command Code	8EH
Family ID	02H
Anticollision Index	01H
Timeout	07H
	D0H
Lock MSB	00H
Lock LSB	01H
Terminator <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	8EH
Number of Tags	02H
Status byte	08H
Terminator <ETX>	03H

ABxF Command 94 (94H): SN Fill

DESCRIPTION
Fill an RFID tag, identified by serial number, 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.

The SN Fill command requires a specific serial number of the tag to be filled. It will 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 LRP830 will write fill data from the start address to the end of the tags memory. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

Field	**Content**
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes.
Command	94H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	2-byte value for the starting tag address
Fill Length	2-byte value for the length of the fill in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Tag Serial Number	8-byte tag serial number
Data value byte	1 byte of fill
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE

Writes 'A' (41H) to the tag specified by serial number starting at address 0005H for the following next consecutive 4 bytes. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the configuration.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	0EH
Command Code	94H
Family ID	00H
Anticollision Index	02H
Timeout	07H
	D0H
SN byte 1	ADH
SN byte 2	23H
SN byte 3	81H
SN byte 4	1DH
SN byte 5	C3H
SN byte 6	66H
SN byte 7	78H
SN byte 8	21H
Fill byte	41H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	94H
Number of Tags	01H
Status byte	00H
Terminators <ETX>	03H

ABxF Command 95 (95H): SN Block Read

DESCRIPTION
Read a block of data from an RFID tag.

DISCUSSION
This command is used to read segments of data from contiguous areas of tag memory. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error. A special error packet is sent if the timeout expires.

If the read range exceeds the last tag address, the LRP830 will return an invalid format error message (error code 21H).

Field	**Content**
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes.
Command	95H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	2-byte value for the starting tag address
Block Size	2-byte value for the length of the read in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Tag Serial Number	8-byte tag serial number
Checksum	Optional Checksum
Terminator	<ETX>

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. If the timeout expires before reading a tag the response packet is: 02H 02H 00 03 FF 00 Status 03H.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	11H
Command Code	95H
Family ID	AAH
Anticollision Index	02H
Start address	00H
	01H
Block size	00H
	02H
Timeout, 2 seconds	07H
	D0H
SN byte 1	ADH
SN byte 2	23H
SN byte 3	81H
SN byte 4	1DH
SN byte 5	C3H
SN byte 6	66H
SN byte 7	78H
SN byte 8	21H
Terminator <ETX>	03H

Response from LRP830, tag found

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	95H
Data from address 0001H	05H
Data from address 0002H	AAH
Terminator <ETX>	03H

Response from LRP830, tag not found

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Status	FFH
Ntag	00H
Status byte	08H
Terminator <ETX>	03H

ABxF Command 96 (96H): SN Block Write

DESCRIPTION
Write a block of data to an RFID tag identified by its serial number.

DISCUSSION
The SN Block Write command is used to write segments of data to contiguous areas of tag memory. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 will return a syntax error.

The SN Block Write consists of a start address followed by the data stream to be written to the RFID tag specified by the serial number given in the command. If the block size exceeds the last tag address, the LRP830 will return an invalid format error message (error code 21H).

Field	**Content**
Header	<STX><STX>
Command Size	Command length in bytes excluding the header, packet size, checksum and terminator bytes.
Command	96H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	2-byte value for the starting tag address
Block Size	2-byte value for the length of the write in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Tag Serial Number	8-byte tag serial number
Data	Data bytes to be written
Checksum	Optional Checksum
Terminator	<ETX>

EXAMPLE:

Writes 4 bytes of data to the tag starting at address 0000H. A timeout of 2 seconds (07D0H = 2000 x 1 msec increments) is set for the completion of the SN Block Write.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	15H
Command Code	96H
Family ID	03H
Anticollision Index	03H
Start address	00H
	00H
Block Size	00H
	04H
Timeout, 2 seconds	07H
	D0H
SN byte 1	ADH
SN byte 2	23H
SN byte 3	81H
SN byte 4	1DH
SN byte 5	C3H
SN byte 6	66H
SN byte 7	78H
SN byte 8	21H
Data to write to address 0000H	52H
Data to write to address 0001H	46H
Data to write to address 0002H	49H
Data to write to address 0003H	44H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	96H
Number of tags	01H
Status byte	00H
Terminators <ETX>	03H

ABxF Command 97 (97H): SN Block Read All

DESCRIPTION

Read a block of data from all RFID tags-in-field or all those with the specified Family ID. Data will be returned with the serial number of the corresponding tag.

DISCUSSION

This command is used to read segments of data from contiguous areas of tag memory. It is capable of handling up to 48 bytes of data transferred to the host with one command if there is no tag family ID. The timeout value is given in 1 msec increments and can have a value of 1EH to FFFEH (65,534 ms). When the timeout is set to 0, the LRP830 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 a Family ID, an Anticollision Index, a start address and length, followed by a timeout value and a message terminator <ETX> as shown below. A special termination packet is sent when the timeout expires. If the Anticollision Index is 0, a response is returned when the operation is successfully completed on 1 tag, or when the timeout expires. A termination packet is not sent for successful completion if the Anticollision Index is 0.

If the read length exceeds the last tag address, the LRP830 will return an invalid format error message (error code 21H).

The command is formatted as follows.

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes.
Command	97H
Family ID	Tag Family ID - 00H = all tags
Anticollision Index	Number of tags expected
Start Address	2-byte value for the starting tag address
Block Size	2-byte value for the length of the read in number of bytes
Timeout	2-byte timeout value in 1 ms increments (1EH - FFFEH).
Checksum	Optional Checksum
Terminator	<ETX>

NOTE:
This command can not be used over a DeviceNet interface.

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 SN Block Read All. The Tag Family byte is set to zero so all tags will be read. Three tags respond with data.

Command from Host

Field	Contents
Header <STX><STX>	02H
	02H
Command Size	00H
	09H
Command Echo	97H
Family ID	03H
Anticollision Index	00H
Start address	00H
	00H
Block Size	00H
	04H
Timeout, 2 seconds	07H
	D0H
Terminators <ETX>	03H

Response from LRP830

Field	Contents
Header/tag 1 <STX><STX>	02H
	02H
Response Size	00H
	0DH
Command Code	97H
SN byte 1/tag 1	ADH
SN byte 2/tag 1	23H
SN byte 3/tag 1	81H
SN byte 4/tag 1	1DH
SN byte 5/tag 1	C3H
SN byte 6/tag 1	66H
SN byte 7/tag 1	78H
SN byte 8/tag 1	21H
Data byte 1/tag 1	52H
Data byte 2/tag 1	46H
Data byte 3/tag 1	49H
Data byte 4/tag 1	44H
Terminators <ETX>	03H

Continued on next page

Header/tag 2 <STX><STX>	02H
	02H
Response Size	00H
	0DH
Command Code	97H
SN byte 1/tag 2	ADH
SN byte 2/tag 2	23H
SN byte 3/tag 2	81H
SN byte 4/tag 2	1DH
SN byte 5/tag 2	C3H
SN byte 6/tag 2	66H
SN byte 7/tag 2	78H
SN byte 8/tag 2	21H
Data byte 1/ tag 2	52H
Data byte 2/tag 2	46H
Data byte 3/tag 2	49H
Data byte 4/tag 2	44H
Terminators <ETX>	03H
Header/tag 3 <STX><STX>	02H
	02H
Response Size	00H
	0BH
Command Code	97H
SN byte 1/tag 3	ADH
SN byte 2/ tag 3	23H
SN byte 3/tag 3	81H
SN byte 4/tag 3	1DH
SN byte 5/tag 3	C3H
SN byte 6/tag 3	66H
SN byte 7/tag 3	78H
SN byte 8/tag 3	21H
Data byte 1/ tag 3	52H
Data byte 2/tag 3	46H
Data byte 3/tag 3	49H
Data byte 4/tag 3	44H
Terminators <ETX>	03H

Header/End Packet <STX><STX>	02H
	02H
Response Size	00H
	03H
Command Echo	FFH
Number of tags	03H
Status byte	08H
Terminators <ETX>	03H

6.6 ABx ASCII Protocol

The ABx ASCII Protocol is based on the ABx Fast protocol. It uses the same headers and terminator (already ASCII characters) and converts the hex value of command and data bytes to printable ASCII (2 digit Hexadecimal notation). In another words, the hex values given in an ABx Fast command are transmitted as separate ASCII characters.

Since it is an ASCII protocol, the Xon/Xoff handshake can be used.

Command Packet Structure:

The command protocol is based on the following minimal packet structure. The data field and the checksum may not be present depending on the command type and your checksum setting.

Field	Number of ASCII Characters	Content
Header	2	<STX><STX> (02H, 02H)
Command Size	4	Packet length in bytes excluding the header, Command size, checksum and terminator bytes.
Command	2	Command Code
(Data)	variable	command data/parameters
Checksum	2	Optional Checksum
Terminator	1	<ETX> (03H)

Following a successful operation, the LRP830 will respond with the following. The data field and the checksum may not be present depending on the command and your checksum setting. If a checksum is enabled in the Configuration Menu, then it is always present for every command.

Field	Number of ASCII Characters	Content
Header	2	<STX><STX> (02H, 02H)
Response Size	4	Packet length in bytes excluding the header, response size, checksum and terminator bytes.
Command	2	Command Echo
(Data)	variable	response data
Checksum	2	Optional Checksum
Terminator	1	<ETX> (03H)

If the LRP830 encounters a fault it will respond with the following:

Field	Number of ASCII Characters	Content
Header	2	<STX><STX> (02H, 02H)
Response Size	4	Packet length in bytes excluding the header, response size, checksum and terminator bytes.
Error Flag	2	FFH
Error Code	2	Hex error code, see Table 11 for details
Checksum	2	Optional checksum
Terminator	1	<ETX> (03H)

Most RF operations will also require additional parameters and data that will be included in the command stream between the command code or echo and the terminator.

The Header and Terminator are always STX and ETX respectively. Any other field value is in ASCII hex notation. Allowed values: '0'-'9', 'A'-'F'. Example: the value ABH (decimal 171) in ASCII protocol is transmitted as a 2-character string «AB», i.e. the 2 bytes: 41H 42H (ASCII values for 'A' and 'B'). The hex value of the hex digits given in ASCII are: '0'-'9' = 30H - 39H, 'A'-'F' = 41H-46H.

The sequence for each command is given with the response format in the preceding section. Referring to the ABx Fast command you can structure the ABx ASCII commands by using ASCII values for each digit of the hex values, excluding the header and terminator that are already ASCII characters.

Command/Response Size

The ABx ASCII requires the length of the packet be included in the command. All parameters and data between the Command Size and the terminator or checksum byte must be accounted for in the packet size word. This includes all command codes and parameters such as field definition for Block Read/Writes. The packet size remains the same with, or without the checksum.

Checksum

The optional checksum must be enabled from the operating mode menu to be available. The checksum is calculated by adding all the byte values (not the ASCII translation values) in the packet (less the values in the header, checksum if present, and terminator), discarding byte overflow and subtracting the byte sum from FFH.

Example ASCII Command

Fill Tag
This command fills the specified number of cells from the specified start address with the specified value. Block size = 0 means filling to the end of the memory. The command will take the same form as the ABx Fast command.

Field	Content
Header	<STX><STX>
Command Size	Packet length in bytes excluding the header, command size, checksum and terminator bytes. Given as four ASCII character value. 0008H for this command
Command	<30H><34H> (04)
Start Address	4 ASCII character value for the starting tag address
Fill Length	4 ASCII character value for the length of the fill in number of bytes
Timeout	4 ASCII character value for timeout in 1 ms units.
Data value byte	2 ASCII character value for 1 byte of fill
Checksum	2 ASCII character value for Optional Checksum
Terminator	<ETX>

The ASCII character string for a fill of 32 bytes, from address 0 with 55H value, timeout 5 sec., follows.

Command from Host

Field	ASCII Hex Value	ASCII String
Header <STX><STX>	02H	STX
	02H	STX
Command Size	30H	0
	30H	0
	30H	0
	38H	8
Command	30H	0
	34H	4
Start Address	30H	0
	30H	0
	30H	0
	30H	0
Fill Length	30H	0
	30H	0
	32H	2
	30H	0
Timeout Value	31H	1
	33H	3
	38H	8
	38H	8
Data Byte Value	35H	5
	35H	5
Checksum	45H	E
	33H	3
Terminators <ETX>	03H	ETX

Response from LRP830

Field	ASCII Hex Value	ASCII String
Header <STX><STX>	02H	STX
	02H	STX
Response Size	30H	0
	30H	0
	31H	1
	30H	0
Command Echo	30H	0
	34H	4
Checksum	46H	F
	41H	A
Terminators <ETX>	03H	ETX

7 LRP830 DEVICENET INTERFACE

7.1 Introduction

The LRP830 is compatible with any DeviceNet scanner host that conforms to DeviceNet standards and can process standard DeviceNet fragmentation protocol as defined by the Open DeviceNet Vendor Association (ODVA) in the ODVA DeviceNet specification (see www.odva.org for details.) You may address DeviceNet protocol and scanner questions to "Dr. DeviceNet" at the ODVA Web site.

An EDS (Electronic Data Sheet) configuration file is provided with the LRP830 software for use with the Allen-Bradley DeviceNet Manager PLC scanner configuration software or any other conforming DeviceNet scanner host. The is EDS text file contains standard vendor specific information for the Escort Memory Systems' LRP830 product. Please refer to the "readme.txt" text files on the release diskette for more information.

Any command packet sent from the host and any response packet sent by the controller back to the host is structured as an 8 byte fixed length packet. The LRP830 supports larger message sizes using the standard DeviceNet message fragmentation technique. When the interface board I/O produce size and/or I/O consume size is greater than 8 bytes, fragmentation is automatically performed by the controller software.

Scan Rates

The user determines the DeviceNet poll frequency via the DeviceNet scanner host configuration program, such as A-B DeviceNet Manager software. For example, the DeviceNet Manager program uses a default poll (scan) rate of 10 milliseconds (version 3.004). LRP830 DeviceNet communications may be lost if the poll rate is set above 500 milliseconds. The interscan delay rate of the DeviceNet scanner host should not be set less than 150 ms for the LRP830(s). If other DeviceNet nodes require a faster poll rate, use the standard background polling option for LRP830 nodes so that the background poll rate does not exceed 150 ms.

COM1 LED Indicator

The COM1 LED indicates DeviceNet traffic activity. The LED does not indicate network status as defined by ODVA.

DeviceNet Interface

To use the DeviceNet interface:

1. Set DIP switch 4 on the main board to "1" (ON) to enable DeviceNet communications.
2. Verified default settings of serial port COM2: 9600, N, 8, 1, no flow control for configuration purposes.

7.2 Interface Board Monitor Mode

The following Section describes steps required to enter the DeviceNet Interface Board Monitor mode. From the Monitor Menu you can download updated LRP830 DeviceNet interface software, see the current configuration, and change the DeviceNet protocol parameters.

Enter Interface Board Monitor

To enter the Interface Board Monitor follow these steps:

1. Connect LRP830 COM2 (see below) to one of your PC serial communication ports.

LRP830		Standard PC Serial Port	
COM2 Pin Number	Signal Name	DB9 Pin Number	Signal Name
R	TX	2	RX
P	RX	3	TX
M	GND	5	GND

2. Install and run EC (at 9600, N, 8, 1), to establish communication with the LRP830. EC is a serial communications program and is available on diskette or can be downloaded from Escort Memory Systems' web site, www.ems-rfid.com.
3. Power the LRP830 via the DeviceNet connector. Refer to Section 3.8 for more information on powering the LRP830.

4. You must press CTRL-E within 7 seconds to enter the Interface Board Monitor mode from a terminal emulator (EC) connected to COM port 2 (9600, N, 8, 1). If the LRP830 does not receive CTRL-E in the seven second period, it will automatically enter "RUN MODE".
5. Upon entering CTRL-E, wait for the following menu to appear.

```
| HMS/LRP Rd/Wrt Controller with DeviceNet & Serial I/O.          |
|   (c) 2000 Escort Memory Systems, a Datalogic Co.               |

Commands:
 I <cr> ———— Display Configuration Info
 E <cr> ———— Edit Configuration Sub-menu
 Z <cr> ———— Download Firmware Hex File (config defaults)
 X <cr> ———— Download Firmware Hex File (retain config)
 RESET  ———— To enter Run Mode (exit monitor)
>x
Note: "X" is the recommended option for new firmware download by the user.  No download option will overwrite the DeviceNet serial number set at the factory (V2.0F and above). Commands are not case sensitive.
*:-D Initiate download now (do not restart prior to RESET msg.)*
```

CTRL-E places the main board in a special mode, that allows the Main Board to pass communications to the interface board during Monitor Mode.

NOTE:
After Monitor Mode has been entered via CTRL-E within 7 seconds, you must reset the device to enter Run Mode. Run Mode is entered automatically if no control key actions are performed.

7.2.1 Downloading Firmware to the Interface Board

To download new software to the interface board, select "X" from the Monitor Menu shown above to retain existing configuration settings or "Z" if you wish to overwrite configuration settings with factory defaults. In most cases you will want to retain existing configuration settings and should use the X command to download new firmware.

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

———————————————————————————
| HMS/LRP Rd/Wrt Controller with DeviceNet & Serial I/O. |
| (c) 2000 Escort Memory Systems, a Datalogic Co. |
———————————————————————————

Commands:
I <cr> ———— Display Configuration Info
E <cr> ———— Edit Configuration Sub-menu
Z <cr> ———— Download Firmware Hex File (config defaults)
X <cr> ———— Download Firmware Hex File (retain config)
RESET ———— To enter Run Mode (exit monitor)
>x
Note: "X" is the recommended option for new firmware download by the user. No download option will overwrite the DeviceNet serial number set at the factory.
:-D Initiate download now (do not restart prior to RESET msg.)

7.2.2 Downloading with the EC Emulation Program

If you are using the terminal emulator "EC" provided by Escort Memory Systems (EMS), do the following from EC to download the new software:

1. Perform ALT-F to enter the file menu.

2. Select "download" from the menu.

3. Select "ASCII" from the pop-up window.

4. Specify the path/name of the hex file provided by Escort Memory Systems.

   When the download is complete, you will be prompted to reset the LRP830 with the following message:

   <:-> RESET NOW...

5. Repower the LRP830.

7.2.3 Display Interface Board Configuration Parameters

The following display reflects the current configuration parameters that are stored in the unit's non-volatile flash ROM. Some of the parameters can be modified via the Configuration Edit option "E" (see next Section).

SW1 positions 7 and 8 can be used to set the DeviceNet baud rate as follows:

00 = 125k (default)
01 = 250k
10 = 500k

Please refer to the ODVA DeviceNet Specification for additional information.

Display Configuration Info

To review the current settings enter "I" from the Monitor Menu and you will see a display similar to the following:

```
|    HMS/LRP Rd/Wrt Controller with DeviceNet & Serial I/O.          |
|    (c) 2000 Escort Memory Systems, a Datalogic Co.                 |

Commands:
I <cr> ————      Display Configuration Info
E <cr> ————      Edit Configuration Sub-menu
Z <cr> ————      Download Firmware Hex File (config defaults)
X <cr> ————      Download Firmware Hex File (retain config)
RESET  ———       To enter Run Mode (exit monitor)
> I (case insensitive)
```

The following display contains the default (factory) recommended configuration:

```
        LRP830 Firmware Version V2.0F DeviceNet Serial # 04 99 00 0A (hex).
<============= LRP830 INTERFACE-BOARD CONFIGURATION DATA =============>
I/O produce size: 34        I/O consume size: 34        Device Type: HDR
DevNet Protocol: POLL       ABx separation: Y
Buf Flush Enable: N         Buf Flush Delay: 200
DNet Rev: 002.000           MAC_ID: 10
Vendor ID:   78             Product Code:   830         Product Type: 12
======================================================================
Edit Configuration Menu (y/n)?> y
```

If your requirements necessitate changing the configuration, enter "Y" at the above prompt. The configuration editor will appear as described in the following section.

7.2.4 Interface Board Configuration Editor

Note: the following menu can be attained via "Y" (above) or selecting "E" from the Monitor Menu (above). These are the recommended parameters, however, it is likely that A and/or B (below) may require modification according to customer requirements.

```
<= LRP830 INTERFACE-BOARD CONFIGURATION MENU =>
Enter Parameter # to Change:
  ===== Std DeviceNet =====
90     A. 830 Tx Msg Size  (0-254)
90     B. 830 Rx Msg Size  (0-254)
 0     C. DevNet Protocol  (Poll=0,Strobe=1)
       D. DeviceNet Serial# 04 99 12 34 (hex)
  ===== LRP830 Specific =====
 2     1. Device Type (GENeric: 0=norm, 1=rev; HDR: 2=n, 3=r)
 Y     2. ABx separation (Y/N)
 N     3. Buf Flush Enable (Y/N)
 200   4. Buf Flush Delay  (0-9999)

SELECTION 1-C? (Ctrl-C Exits)
```

When you wish to exit the interface board configuration menu, enter "CTRL-C." The following prompt will appear which is responded with "n" in this example.

```
Update Flash ROM (y/n)?> n  [:-( Flash ROM *Not* Updated )-:]
{-:) Please Reset LRP830 to enter RUN mode (:-}
    {HALTED}
    <RESET>
```

The LRP830 must now be reset or power cycled to enable the unit to enter "RUN" mode.

7.2.5 Edit Configuration Command.

To change the LRP830 configuration parameters, enter the "E" command from the Monitor Menu. The Interface Board will display the current values for user-configureable variables. In the following configuration menu, range checking and validation is performed on every input provided by the user. The current value of the item is displayed with each prompt for change. ESC exits to a previous level. The backspace key is supported. CTRL-C exits the Configuration Menu and prompts you to store the changes into flash (non-volatile) memory.

```
------------------------------------------------------------------
|       HMS/LRP Rd/Wrt Controller with DeviceNet & Serial I/O.      |
|       (c) 2000 Escort Memory Systems, a Datalogic Co.             |
------------------------------------------------------------------
Commands:
 I <cr> ———— Display Configuration Info
 E <cr> ———— Edit Configuration Sub-menu
 Z <cr> ———— Download Firmware Hex File (config defaults)
 X <cr> ———— Download Firmware Hex File (retain config)
 RESET  ———— To enter Run Mode (exit monitor)
>e
```

Note: the following display reflects the current status of user configureable parameters. The display will refresh automatically after you enter a new value.

Enter the number or letter corresponding to the variable you wish to change followed by the new value. After you have entered and visually verified all of your modifications, enter <CTRL-C> and select "Y" to save your changes to the LRP830's flash memory.

```
LRP830 Firmware Version V2.0F DeviceNet Serial # 04 99 00 0A (hex).
<= LRP830 INTERFACE-BOARD CONFIGURATION MENU =>

Enter Parameter # to Change:
  ===== Std DeviceNet =====
90     A. 830 Tx Msg Size  (0-254)
90     B. 830 Rx Msg Size  (0-254)
 0     C. DevNet Protocol  (Poll=0,Strobe=1)
       D. DeviceNet Serial# 04 99 12 34 (hex)
  ===== LRP830 Specific =====
 2     1. Device Type (GENeric: 0=norm, 1=rev; HDR: 2=n, 3=r)
 Y     2. ABx separation (Y/N)
 N     3. Buf Flush Enable (Y/N)
200    4. Buf Flush Delay  (0-9999)

SELECTION 1-C? (Ctrl-C Exits)
```

Example

The following example shows how the Tx and Rx message sizes are modified from 90 to 48 bytes in length.

```
SELECTION 1-C? (Ctrl-C Exits) a

90    A. 830 Tx Msg Size  (0-254).  ?>48

Enter Parameter # to Change:
  ===== Std DeviceNet =====
48     A. 830 Tx Msg Size  (0-254)
90     B. 830 Rx Msg Size  (0-254)
 0     C. DevNet Protocol  (Poll=0,Strobe=1)
       D. DeviceNet Serial# 04 99 12 34 (hex)
  ===== LRP830 Specific =====
 2     1. Device Type (GENeric: 0=norm, 1=rev; HDR: 2=n, 3=r)
 Y     2. ABx separation (Y/N)
 N     3. Buf Flush Enable (Y/N)
 200   4. Buf Flush Delay  (0-9999)

SELECTION 1-C? (Ctrl-C Exits) b

 90    B. 830 Rx Msg Size  (0-254).  ?>48

Enter Parameter # to Change:
  ===== Std DeviceNet =====
48     A. 830 Tx Msg Size  (0-254)
48     B. 830 Rx Msg Size  (0-254)
 0     C. DevNet Protocol  (Poll=0,Strobe=1)
       D. DeviceNet Serial# 04 99 12 34 (hex)
  ===== LRP830 Specific =====
 2     1. Device Type (GENeric: 0=norm, 1=rev; HDR: 2=n, 3=r)
 Y     2. ABx separation (Y/N)
 N     3. Buf Flush Enable (Y/N)
 200   4. Buf Flush Delay  (0-9999)

SELECTION 1-C? (Ctrl-C Exits) "CTRL-C" entered by user

Update Flash ROM (y/n)?> y     {:->! Flash ROM Updated !<-:}

{-:) Please Reset LRP830 to enter RUN mode (:-}

    {HALTED}

    <RESET>
```

When reset is requested via a monitor mode function, you must reset the LRP830 and let the seven second period elapse without entering anything from the keyboard to enter Run Mode.

7.2.6 Configuration Parameter Validation

```
<= LRP830 INTERFACE-BOARD CONFIGURATION MENU =>

Enter Parameter # to Change:
  ===== Std DeviceNet =====
90    A. 830 Tx Msg Size  (0-254)
90    B. 830 Rx Msg Size  (0-254)
 0    C. DevNet Protocol  (Poll=0,Strobe=1)
      D. DeviceNet Serial# 04 99 12 34 (hex)
  ===== LRP830 Specific =====
 2    1. Device Type (GENeric: 0=norm, 1=rev; HDR: 2=n, 3=r)
 Y    2. ABx separation (Y/N)
 N    3. Buf Flush Enable (Y/N)
 200  4. Buf Flush Delay  (0-9999)

SELECTION 1-C? (Ctrl-C Exits)
```

Begin by selecting the letter or number associated with the parameter to be changed. After entry of the desired option, a prompt will appear with an allowable limits range. Enter the desired value after the modification prompt appears.

For example:

```
Selection (CTRL-C to exit) ...a
```

If an invalid value is entered, the monitor displays an error message and re-prompts for a valid entry.

For example; if an invalid value is entered for LRP830 Transmit Message Size (i.e., I/O produce size), the monitor responds with a limits prompt.

```
34    A. 830 Tx Msg Size  (0-254).  ?>487
34   **Must be 0-253    A. 830 Tx Msg Size  (0-254).  ?>48
```

The leftmost column contains the current parameter setting. Upon entering a valid parameter the monitor will return to the Configuration Menu where the value will be updated in the list of options.

Parameters are separated into two categories: Standard DeviceNet and LRP830 Specific. Following is an explanation of each parameter setting.

7.2.7 Standard DeviceNet Parameters

Produce and Consume Sizes

Before setting the first two parameters (TxMsgSize and RxMsgSize) you should calculate the optimum consume and produce sizes. The default size is 90 for both TxMsg and RxMsg.

The default setting will create a byte offset for the command code byte when using ABx Fast and a word oriented PLC.

ABx Standard has a different header then the ABx Fast protocol and if a HDR (header protocol) has been selected, then you must add 2 handshake bytes into the calculation.

NOTE:
For the sake of clarity, the DeviceNet Header in HDR mode is referred to as the handshake word in the following documentation.

Commands in the ABx Non-separated mode permit more data in the responses because of the packed nature of the return data in this mode. Please refer to Section 7.2.8 for more information on the ABx Non-Separated Mode.

Following are examples of how to calculate sizes for the various command protocols. Refer to Section 7.2.9 for more information on protocols and Section 7.2.8 for information on the non-separated mode.

Produce size — ABx Standard, 8 Byte Read

Generic		HDR		ABX Non-separated	
Description	# of bytes	Description	# of bytes	Description	# of bytes
Protocol Header, AA 05	2	Handshake word	2	Handshake word	2
Terminator, FF FF	2	Protocol Header, AA 05	2	Command Echo	1
Number of read bytes (2x)	16	Terminator FF FF	2	Number of read bytes	8
		Number of read bytes (2x)	16		
Total bytes	20	Total bytes	22	Total bytes	11

Produce size — ABx Fast, 8 Byte Read

Generic		HDR		ABX Non-separated	
Description	# of bytes	Description	# of bytes	Description	# of bytes
Protocol Header, STX STX	2	Handshake word	2	Handshake word	2
Terminator, 03	1	Protocol Header, STX STX	2	Command Echo	1
Response Size	2	Terminator 03	1	Number of read bytes	8
Command Echo	1	Response Size	2	Optional Checksum	1
Number of read bytes	8	Command Echo	1		
Optional Checksum	1	Number of read bytes	8		
		Optional Checksum	1		
Total bytes	15	Total bytes	17	Total bytes	12
Without Checksum	14	Without Checksum	16	Without Checksum	11

Consume size — ABx Standard, 8 Byte Read

Generic		HDR		ABX Non-separated	
Description	# of bytes	Description	# of bytes	Description	# of bytes
Protocol Header, AA 05	2	Protocol Header, AA 05	2	Protocol Header, AA 05	2
Terminator, FF FF	2	Terminator FF FF	2	Terminator FF FF	2
Start Address	2	Start Address	2	Start Address	2
Length	2	Length	2	Length	2
Timeout	2	Timeout	2	Timeout	2
		Handshake word	2	Handshake word	2
Total bytes	10	Total bytes	12	Total bytes	12

Consume size — ABx Fast, 8 Byte Read

Generic		HDR		ABX Non-separated	
Description	# of bytes	Description	# of bytes	Description	# of bytes
Protocol Header, STX STX	2	Handshake word	2	Handshake word	2
Terminator, 03	1	Protocol Header, STX STX	2	Command Echo	2
Command Size	2	Terminator 03	1	Terminator 03	1
Command	1	Command Size	2	Command Size	2
Start Address	2	Command	1	Command	1
Length	2	Start Address		Start Address	2
Timeout	2	Length	8	Length	2
Optional Checksum	1	Timeout	1	Timeout	2
		Optional Checksum		Optional Checksum	1
Total bytes	13	Total bytes	15	Total bytes	15
Without Checksum	12	Without Checksum	14	Without Checksum	14

Write Commands

For write commands you must add the write data to the consume size. Add 2 bytes for each byte of data to write if you are using ABx Standard and 1 byte each if you are using ABx Fast commands.

Also note that there is no length field for Non-contiguous write commands.

LRP830 Transmit Message Size

```
90     A. 830 Tx Msg Size  (0-254)
```

Size of the DeviceNet poll message response from the LRP830 to the DeviceNet Scanner Host. The default is 90.

When "A" is entered from the Configuration Edit menu, the monitor prompts for the LRP830 Transmit Message Size (i.e., DeviceNet I/O produce size, 0-254)

```
Selection (CTRL-C to exit) ...a
90     A. 830 Tx Msg Size  (0-254).  ?>30
```

Important

Determine the field size in commands and responses before programming this value. Field sizes are protocol dependent.

LRP830 Receive Message Size

90 B. 830 Rx Msg Size (0-254)

Size of the DeviceNet poll message command to the LRP830 from the DeviceNet Scanner Host.

When "B" is entered from the Configuration Edit menu, the monitor prompts for the LRP830 Transmit Message Size (i.e., DeviceNet I/O consume size).

Selection (CTRL-C to exit) ...b
48 B. 830 Rx Msg Size (0-254)). ?>30

Important
Determine the field size in commands and responses before programming this value. Field sizes are protocol dependent.

Protocol: Poll or Strobe

0 C. DevNet Protocol (Poll=0,Strobe=1)

When "C" is entered from the Configuration Edit menu, the monitor prompts for DeviceNet Poll or Strobe protocol. Poll is the default selections. Please refer to the current ODVA DeviceNet Specification for more information.

Selection (CTRL-C to exit) ...C
0 C. DevNet Protocol (Poll=0,Strobe=1): ?>>0

DeviceNet Serial Number

D. DeviceNet Serial# 04 99 12 34 (hex)

Each slave node on a DeviceNet bus must have a unique serial number.

7.2.8 LRP830 Specific Parameters

Device Type

2 1. Device Type (GENeric: 0=norm, 1=rev; HDR: 2=n, 3=r)

Device Type specifies whether a handshaking protocol should be used between the DeviceNet Scanner Host and the LRP830.

Generic indicates no handshaking protocol (due to asynchronous communication). Messages and responses are repeated in each poll, until the DeviceNet Scanner Host or LRP830 clears its output buffer.

HDR (header) indicates a handshaking protocol is used for communication between the DeviceNet Scanner Host and the LRP830. This protocol is further described in Section 7.2.9. HDR type requires a one-word (two-byte) header at the beginning of every poll and response message.

ABx separation

Y 3. ABx separation:

If "Y" is specified, each ABx command response from the LRP830 is separated into it's own DeviceNet message. This assures timely response processing.

ABx Non-separation

When "N" is selected, data compression will occur as packed data inside the response.

Selection (CTRL-C to exit) ...2

Y 2. ABx separation. ?>n

The ABx non-separated mode reduces the size of the response fields by removing command/response header bytes (AA and STX STX) and terminator (FFFF and 0x03) bytes as well as the null MSB byte found in the data sections of ABx Standard commands. This reduces DeviceNet traffic and increases data throughput.

Because ABx Non-separation removes the termination bytes that indicate the end of the message, the programmer must remember how many bytes the command asked for. In the ABx Fast response there is always a checksum byte included in the data array (00H if checksum option is disabled).

The ABx Non-separated selection works across all device types (generic & polled) types.

A handshake word (2 bytes) is required in the beginning of the command and response of every single device type (generic and polled). The polled mode uses this word as a handshake field regardless of the ABx separation mode chosen and must be considered when calculating the size of the messages. In essence ABx non-separated always adds 2 bytes (1 word) to the start of both command (produced) and response (consume) fields.

The HMS830 ABx Non-separated command OK responses are protocol independent of protocol in fact they are the same with the exception of the optional checksum byte within ABx Fast.

Polled Commands in ABx Non-separation Mode

In Polled mode, the PLC first Word lower byte raises a single REQ bit to send the message.

For example, this would cause AA050000000607D0FFFF (a read command ABx standard style) to be executed. Generic now has the first Word (word zero) in the command as a header. This means that both types, polled and generic, have the same response format.

ABx Fast protocol commands will also have a handshake word as the header. If no header is desired then do not use the ABx Non-separated mode.

Error Management

ABx Non-separated polled response is the same as the standard response with regards to the first Word. The single exception here is the handshake byte has the most significant bit being set to 1 indicating that the command had an error response. This ERROR bit in the response saves the program from parsing the message to see if the retry is necessary to read a tag. When a response is not an error response this bit is left to 0.

To clear the error bit simply execute a new command. This same bit is used inside the generic mode. All error response codes are the same exact error responses that are given from ABx separated mode. No change in the protocol header or terminator has been made with error responses. Calculations must accommodate the fact that an error could occur, especially if only one byte is being read.

All error responses will have a single word still as part of the header. The response high byte turns into a counter that wraps at 256. The counter counts one count on every new response whether or not it is an error. Power up resets the counter to zero. The counter helps to distinguish between identical reads and reduces the need for having a unique pallet ID located inside the message response. The counter used in generic mode helps reduce identical multiple reads and or writes due to the many repeats of commands that DeviceNet scanner sends.

A good message response now has a packed array of data meaning that both high and low bytes of each PLC Word has valid data bytes as part of the response. The response begins with the header word followed by the command echo byte and then every succeeding byte following will be a byte of data that has been requested from the tag.

Trigger Feature

Generic reversed ABx Non-separated can set up a trigger that allows user to have better control of messages that reach the antenna. The use of the trigger limits command requests from being sent unnecessarily to the antenna before it is time. With the trigger feature, it is not possible to flood the antenna with commands. Typically, a read command is triggered with this feature.

After correct configuration settings have been made, the user must provide a byte that counts up whenever a new command sent to the antenna. Every time a response count comes in, it is copied into the trigger byte to trigger that command thus eliminating the need for a PLC count variable. The counter byte must be incremented by 1 to trigger the next command. The counter can also be set to alternate between 0 and 1, however a rolling counter can track the number of commands. When the counter byte is 0, no command will be triggered.

When the PLC sends the header word with a new number in PLC Word 0 (low byte) will a command be performed. The actual command given in an array must be valid regardless of the protocol (ABx S/ABx F).

Generic repeats a command many times faster than the reader can keep up with responses due to the fact that a read request requires more time than the DeviceNet scan rate. See Section 7.2.9 for more information on Generic protocol.

Command acceptance has a higher order of precedence than the trigger meaning that an invalid command cannot be triggered.

Buf Flush Enable

```
Y       4. Buf Flush Enable (Y/N)
```

This option applies to Generic Device Type protocol only, as defined in Section 7.2.9.

When you have entered 4 from the Configuration Menu, you will be prompted whether you wish to enable Buffer Flush.

If yes, the LRP830's produce buffer (output to DeviceNet Scanner Host) is cleared at the interval defined in "Buffer Flush Delay."

If no, then the produce buffer is not cleared by the LRP830.

```
Selection (CTRL-C to exit) ...4
4. Buf Flush Enable (Y/N): N.  ?>
```

Buf Flush Delay

```
200     5. Buf Flush Delay  (0-9999)
```

Delay value between buffer flushes. The POLL or STROBE output buffer is cleared at the specified interval when the Buffer Flush Enable parameter is set to Y. Valid values are 8 - 9999 milliseconds.

```
Selection (CTRL-C to exit) ...5
5. Buf Flush Delay (8-9999) .2000  ?>4500
```

7.2.9 Device Type Protocols.

There are two protocols that can be used to transport the ABx RF-ID antenna commands: Generic Device Type and Header Device Type. The Generic Device Type does not contain an extra header for handshaking, and is strictly asynchronous. The DeviceNet Scanner Host repeats a command at each poll until a response is received. The LRP830 repeats each poll response until the LRP830 provides a new command response (or buffer flush occurs, when enabled).

The Header Device Type includes a one-word header at the beginning of each DeviceNet message. Therefore, if the Tx or Rx message size was 30, 2 bytes are used for header overhead. This leaves 28 bytes available for user commands and data.

Generic Device Type Protocol

Generic protocol is asynchronous, so the control program running in the DeviceNet Scanner Host (e.g., Allen Bradley SLC500 PLC with DeviceNet scanner module ladder logic) is not aware of exactly when a new message has been received from the LRP830 (e.g., using POLL protocol). Therefore, the DeviceNet Scanner Host must monitor every poll response message to detect changes in the received data and to ignore duplicate responses. For this reason, Generic is recommended as an option only for ease of initial installation and check-out testing.

In summary, for Generic protocol, each ABx command response is sent repeatedly by the LRP830 until:

1. A new command response is received from the antenna controller.

OR

2. A buffer flush occurs (sets buffer to zero) - parameter configureable.

Header Device Type Protocol

When "HDR" device type is selected in the LRP830 configuration, the following features are available. A special message header is required, which precedes each ABx command and response. The HDR device type should always be the choice for operational (i.e., non-test) use.

The DeviceNet Scanner Host must process every message header word coming from the LRP830. It must also correctly setup a handshake header for every message going out to the LRP830. An entire word (2 bytes) is required for the header because some ABx command protocols require antenna data to begin and end on an even word boundary (e.g. ABx Standard).

Both the REQ and the ACK bits can be set when the LRP830 is both acknowledging a command from the DeviceNet scanner host and indicating it has a new ABx command response in the same poll message.

Note:
Appendix E details how to use the handshaking bits where REQ represents the REQuest (new data present) flag and ACK represents the ACKnowledge (REQ acknowledged) flag. The length of the header is one word and should appear at the beginning of each incoming and outgoing message. When you initially configure your message sizes you will have 2 bytes overhead. In essence, for a 30 byte message, you will have 2 bytes of non-data overhead in each DeviceNet message.

A configuration option called ABx separation, instructs the LRP830 to place only one ABx command message response in each DeviceNet message. The default is set to ABx_sep = Y.

Protocol Processing Specifics
An additional ABx command response will only be placed in the same DeviceNet poll response message as another response, if it fits completely in the message. Otherwise it will be placed in a subsequent poll response message.

The HDR protocol streamlines antenna command processing by requiring that the DeviceNet scanner host repeat each ABx poll command (intended for processing at that moment) only until the acknowledgment bit is set by the LRP830. This is typically accomplished by the next poll response message. The LRP830 in HDR mode will only process commands which have the REQ bit set on in the header. In this manner, the LRP830 DeviceNet board only forwards intended commands to the antenna for processing.

Generic protocol repeats the same command over and over again until the scanner clears the poll message buffer or places a new command in the buffer. As a result the antenna receives many unintended commands and not every command can be processed. This is because typical DeviceNet scan rates are much faster than the time it takes for the antenna to process a read or write command. Section 6.2 specifies a timeout value of 2 seconds for the Block Read 0x05 command example. When using a command timeout value of 2 seconds, the antenna could only process 1 out of 20 block read commands with a scan rate of 100ms (with REQ on).

The antenna only processes one command at a time, but it is the nature of the DeviceNet poll protocol to repeat messages at regular intervals. So with the GENERIC protocol, the antenna cannot process every command contained in every poll message, therefore most commands are ignored. If the scanner were to only send each command out once, there is a good possibility of lost commands. This is especially true with A-B PLC's where the interface between the SLC/5 CPU module and 1747-SDN module, for example, is asynchronous. Generic protocol, due to ease of setup, is intended mainly for initial interface setup and test purposes.

A SPECIFICATIONS

Table 8 — LRP830 Specifications

Electrical	
Supply Voltage	18-30 Vdc
Power Consumption	31W (1.3 A @ 24Vdc)
Communication	
RFID Interface	LRP-Series Passive RFID System
Bus Interface	DeviceNet
COM1	RS232/RS422/DeviceNet
COM2	RS232
Inputs	Four industrial-level inputs, 4.5-30 Vdc (25mA max)
Output	Four industrial-level outputs, 30 Vdc (500 mA max)
Mechanical Specifications	
Dimensions (L x W x H)	8.66 x 4.72 x 3.83 inches (220 x 120 x 97 cm)
Weight	3.5 lb. (1.59 kg)
Enclosure	Cast Aluminum Alloy
Environmental	
Operating Temperature	-4 to 120 degrees F (-20 to 49 degrees C)
Storage Temperature	-40 to 185 degrees F (-40 to 85 degrees C)
Humidity	95% non-condensing
Shock Resistance	IEC 68-2-27 test EA 30g; 11 msec; 3 shocks each axis
Vibration Resistance	IEC 68-2-6 test FC 1.5 mm; 10 to 55 Hz; 2 hours each axis
Protection Class	NEMA 4 (IP66)

NOTE: Specifications are subject to change without notice.

B MODELS AND ACCESSORIES

Table 9 — Models and Accessories

Available Models

Part Number	Description
LRP830-10	Long range, passive controller, RS232, RS422 and DeviceNet/RS485 communications, 4 digital inputs and 4 digital outputs, tunnel antenna
LRP830-04	Long range, passive controller, RS232, RS422 and DeviceNet/RS485 communications, 4 digital inputs and 4 digital outputs, conveyor-mount antenna
LRP830-08	Long range, passive controller, RS232, RS422 and DeviceNet/RS485 communications, 4 digital inputs and 4 digital outputs, plate antenna, 12 x 14"

Accessories

Part Number	Description
00-1122	Connector Kit, all five mating connectors for wiring the LRP830
46-1268	Mating Connector, DeviceNet connector, 8 pin metal circular
46-1270	Mating Connector, Power connector, 3 socket metal circular
46-1456	Mating Connector, COM1/COM2 connector, 14 pin metal circular
46-1458	Mating Connector, Input connector, 12 socket metal circular
46-1460	Mating Connector, Output connector, 12 pin metal circular
46-5119	Connector covers, shell size 12, fits DeviceNet and COM1/COM2 connectors
46-5120	Connector covers, shell size 14, fits Input and Output connectors
LRP125	Long range passive read/write tag, 25 mm round, 48 bytes memory
LRP125HT	Long range passive read/write tag, 25 mm round, survives 200° temperatures, 48 bytes memory
LRP250	Passive read/write tag, 50 mm square, 48 bytes memory
LRP250HT	Passive read/write tag, 50 mm square, survives 200° temperatures, 48 bytes memory
LRP250HT-FLX	Passive read/write tag, 50 mm square, survives 200° temperatures, flexible with high temperature adhesive backing, 48 bytes memory
LRP-L5555	Passive read/write tag, 55 mm square, thermal transfer with adhesive backing, 48 bytes memory
LRP-L2666	Passive read/write tag, 26 x 66 mm, thermal transfer with adhesive backing, 48 bytes memory
LRP-L4982	Passive read/write tag, 49 x 82 mm, thermal transfer with adhesive backing, 48 bytes memory
LRP-L90140	Passive read/write tag, 90 x 140 mm, thermal transfer with adhesive backing, 48 bytes memory

Table 9 — Models and Accessories (cont)	
Accessories	
Part Number	Description
LRP-P125	Passive read/write tag, 25 mm round, PCB, 48 bytes memory
LRP-P3858	Passive read/write tag, 38 mm x 58 mm, PCB, 48 bytes memory
LRP-P5050	Passive read/write tag, 50 mm x 50 mm, PCB, 48 bytes memory

C ASCII CHART

Decimal	Hex	Character	Decimal	Hex	Character
000	00	NUL	032	20	(space)
001	01	SOH	033	21	!
002	02	STX	034	22	"
003	03	ETX	035	23	#
004	04	EOT	036	24	$
005	05	ENQ	037	25	%
006	06	ACK	038	26	&
007	07	BEL	039	27	`
008	08	BS	040	28	(
009	09	HT	041	29	)
010	0A	LF	042	2A	*
011	0B	VT	043	2B	++
012	0C	FF	044	2C	'
013	0D	CR	045	2D	-
014	0E	SO	046	2E	.
015	0F	SI	047	2F	/
016	10	DLE	048	30	0
017	11	DC1	049	31	1
018	12	DC2	050	32	2
019	13	DC3	051	33	3
020	14	DC4	052	34	4
021	15	NAK	053	35	5
022	16	SYN	054	36	6
023	17	ETB	055	37	7
024	18	CAN	056	38	8
025	19	EM	057	39	9
026	1A	SUB	058	3A	:
027	1B	ESC	059	3B	;
028	1C	FS	060	3C	<
029	1D	GS	061	3D	=
030	1E	RS	062	3E	>
031	1F	US	063	3F	?

Decimal	Hex	Character	Decimal	Hex	Character
064	40	@	096	60	`
065	41	A	097	61	a
066	42	B	098	62	b
067	43	C	099	63	c
068	44	D	100	64	d
069	45	E	101	65	e
070	46	F	102	66	f
071	47	G	103	67	g
072	48	H	104	68	h
073	49	I	105	69	i
074	4A	J	106	6A	j
075	4B	K	107	6B	k
076	4C	L	108	6C	l
077	4D	M	109	6D	m
078	4E	N	110	6E	n
079	4F	O	111	6F	o
080	50	P	112	70	p
081	51	Q	113	71	q
082	52	R	114	72	r
083	53	S	115	73	s
084	54	T	116	74	t
085	55	U	117	75	u
086	56	V	118	76	v
087	57	W	119	77	w
088	58	X	120	78	x
089	59	Y	121	79	y
090	5A	Z	122	7A	z
091	5B	[	123	7B	{
092	5C	\	124	7C	|
093	5D	]	125	7D	}
094	5E	^^	126	7E	~
095	5F	—	127	7F	DEL

D LRP830 Demonstration

This appendix describes how to setup an LRP830 demonstration using an SS Technologies® DeviceNet scanner card connected to an LRP830 via a DeviceNet CAN bus. The following link describes available SST DeviceNet scanner products (e.g. PCMIA scanner card):

http://www.sstech.on.ca/sales/cards/dn/dnpcm.htm

Note: Cutler/Hammer® DeviceNet scanners use SST similar hard-ware, however, Netsolver® DNS software is typically used with Cutler Hammer scanners. It may be possible to run this SST software demo with the Cutler Hammer hardware.

The recommended demo utility (due to ease of setup) is called the SST DeviceNet scanner demo (DNSW16.exe or DNSW32.exe) and can be downloaded from the following web page:

http://www.sstech.on.ca/tech/produp/cards/dn/content.htm

SST Scanner demo software is included on the SST installation CD.

Before You Begin

Power up the LRP830 and allow it to go into RUN mode. Execute the DNSWnn.exe application program.

For this demo we will use a DeviceNet node address of 8 for the LRP830. Set your LRP830 DeviceNet interface board (top board) S1 DIP switches as follows (where 0=off and 1=on):

0 0 1 0 0 0 0 0
1 2 3 4 5 6 7 8

This demo assumes a DeviceNet bus baud rate of 125K.

Using DNSW32 or DNSW16

The name of the recommended program is DNSW16.exe or DNSW32.exe depending upon whether you have installed the 16-bit or 32-bit version. The typical SST installation placed the program in the following PC path (for example):

"C:\Program Files\SST\DeviceNet\dnscan\Dnsw32.exe"

You may execute the program by entering the path given above in Window's "Run" dialog box.

After installation, you can also find it from Windows 95/98/NT as shown in the following illustration.

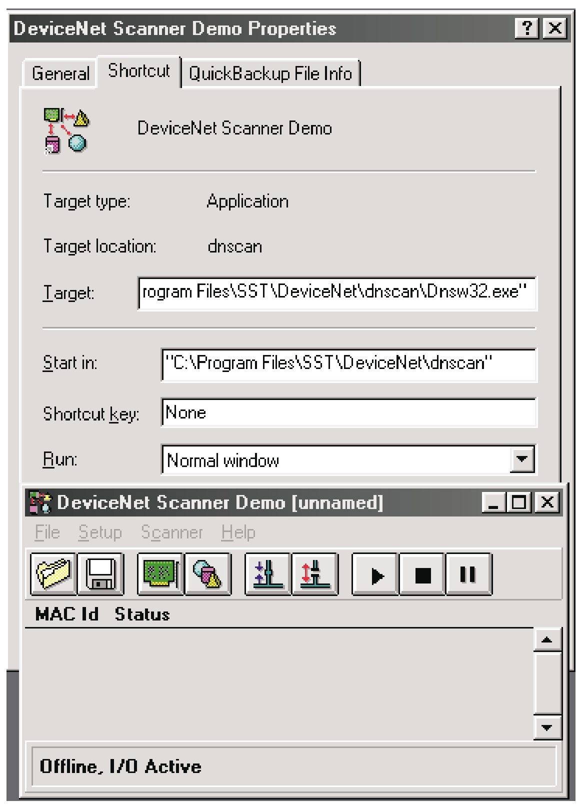


Figure 30 — Initial Window of DNSW32

At the Interface Setup window (not shown) just use the defaults by pressing OK.

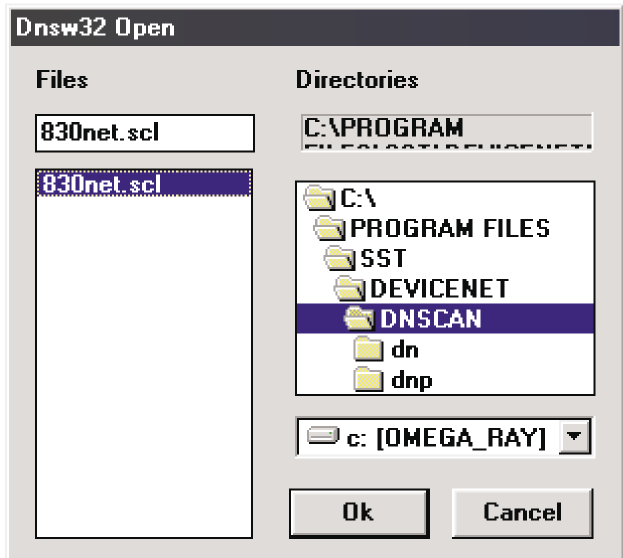


Figure 31 — Opening the LRP830 Configuration File

Next, load the configuration file (830net.SCL), using the FILE>OPEN pull down menu as depicted in Figure 31 and 32. This file can be found on the LRP830 installation disk.

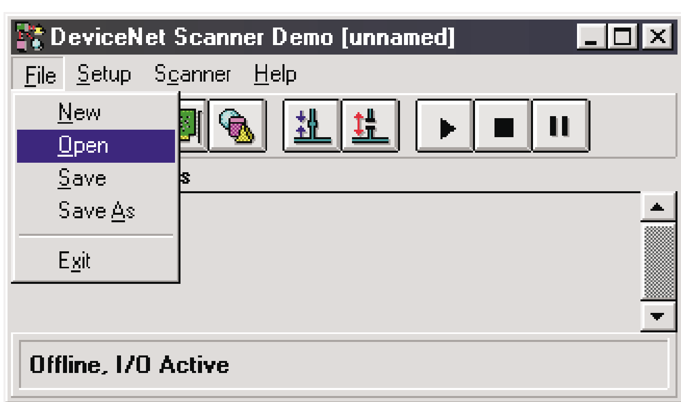


Figure 32 — File Open Menu

Select Scanner from the Setup menu. Setup the node 8 scan list for the scanner interface as shown in Figure 33.

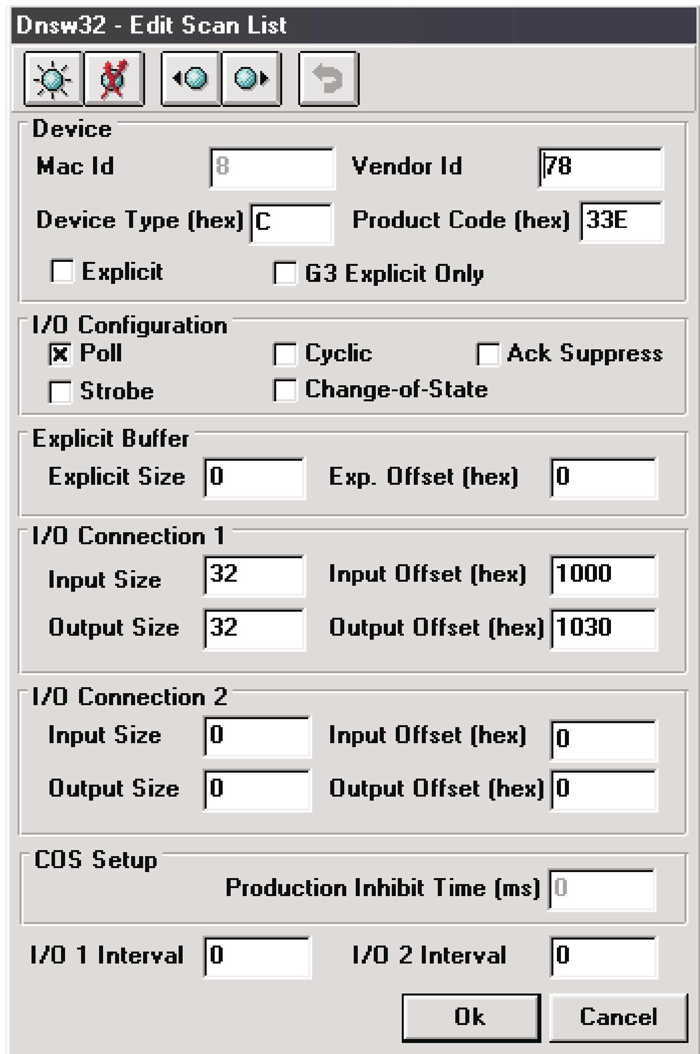


Figure 33 — Node 8 LRP830 Configuration Setup

Note: To insure dynamic update capability in the Device I/O Data window, it is recommended that you configure the SST scanner and LRP830 for 16 byte messages instead of the 32 shown in the examples.

Prepare to go online as depicted in Figure 34.

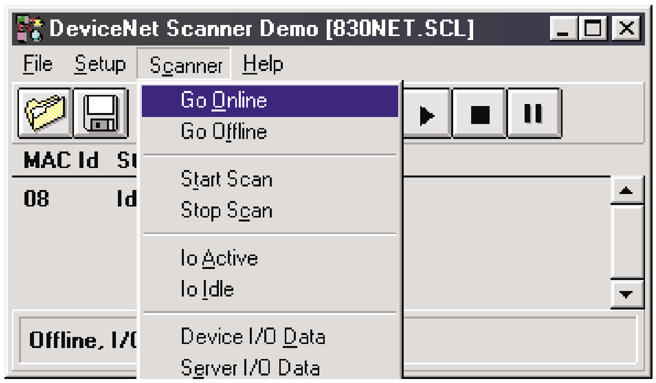


Figure 34 — Going Online

Select the "Advanced" button from the pop-up window which takes you to Figure 35.

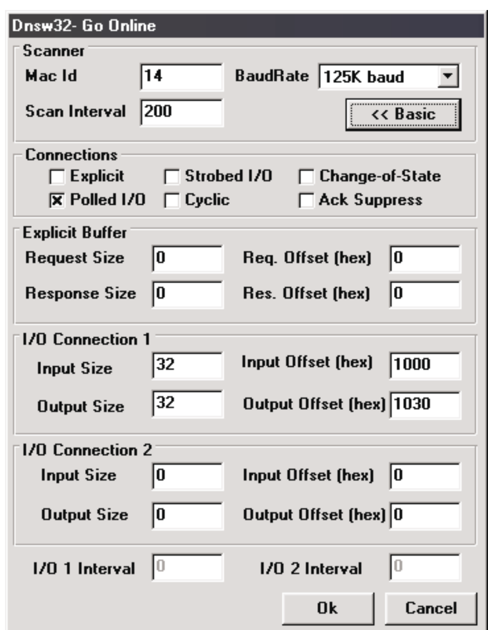


Figure 35 — Advance Setup Dialog Box

Figure 36 shows how to display the Device I/O data window.

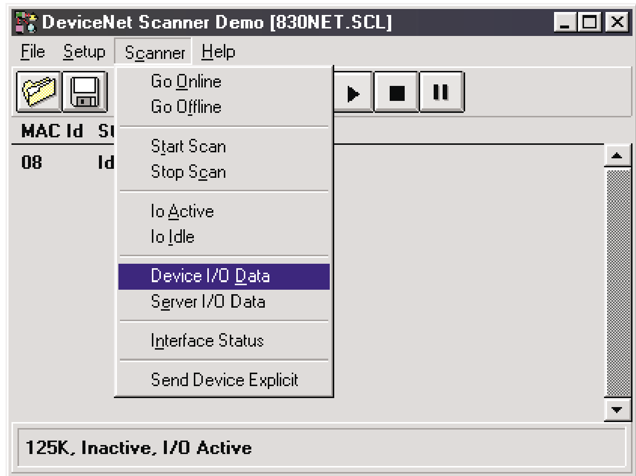


Figure 36 — Entering the Device I/O Data Window

Start scanning now by clicking the PLAY icon, which looks like a black right triangle on the button bar.

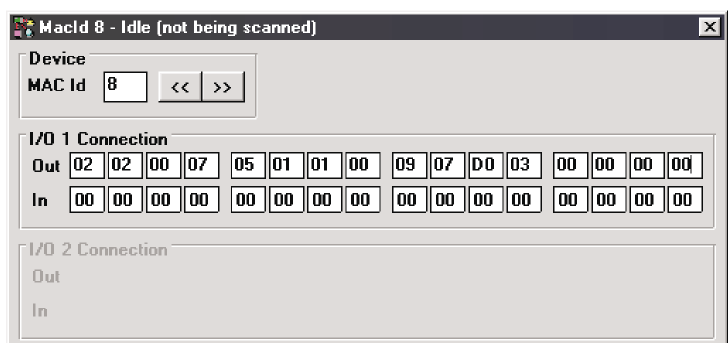


Figure 37 — Device I/O Data Window

Now you are ready to issue commands from the scanner demo program as shown in the Figure 32. Message offsets are shown as 00-15 as the demo only allows 16 characters to be entered. If you need to enter more than 16, DNSWxx.exe is a MS Visual Basic program (source included by SST) which you can modify any way you wish.

Figure 37 shows how to enter an ABx Fast block read command (no checksum) which is output from the scanner to the antenna. The command format is defined in Section 6.4.

Responses from the antenna dynamically appear in the IN row as shown in Figure 37.

You may modify the command parameters from the OUT row window. Try changing the tag read offset and watch the tag read command response data change as the antenna provides the updated tag data.

The Interface Status Window can be displayed as shown in Figure 38 and 39. This dynamic display is valuable in providing CAN bus status information for troubleshooting purposes.

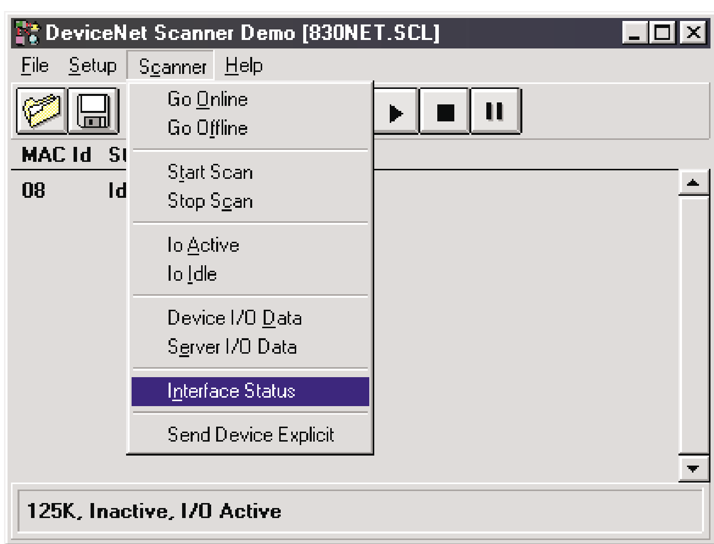


Figure 38 — Entering the Interface Status Window

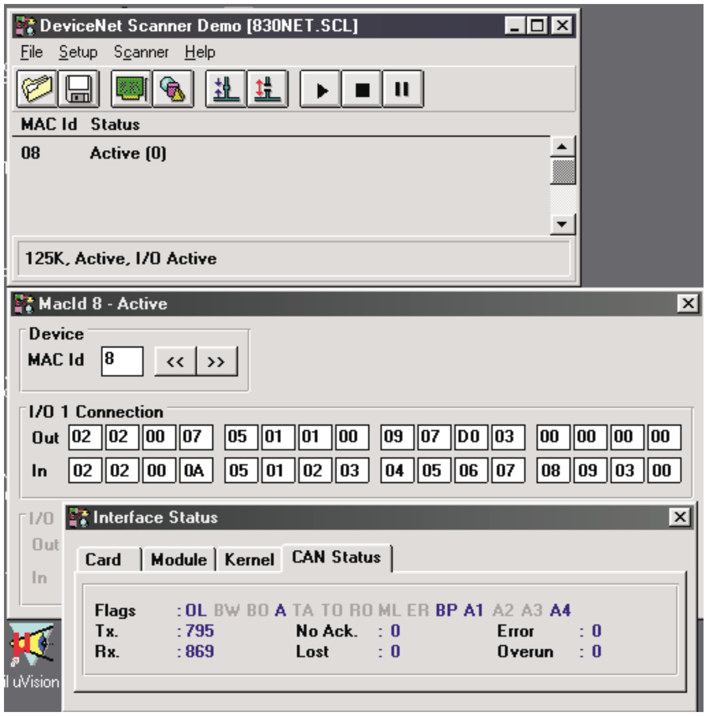


Figure 39 — Interface Status/LRP830 Responses

E DeviceNet Protocol Examples

For the HDR Device Type, when the DeviceNet Scanner Host has data available to send to the LRP830, it must set the "REQ" bit in the DeviceNet message header. If the message length is 30 bytes, then the message is fragmented and structured as follows from the master scanner. The header byte is underlined and italicized. DeviceNet Polled protocol is used.

Examples

The following are actual DeviceNet bus message captures by SS-Technologies DeviceNet Analyzer® software. The first four examples are based on a 30-byte message length and the last on a 28-byte message length.

Generic: GEN (config display notation)

Command to LRP830: Standard ABx Block Write

This example is from the explanation of **ABxS Command 5** found in Section 6.3. It will write 4 bytes of data to the a starting at address 0064H. A timeout of 2 seconds (07D0H = 2000 x 1 ms) is set for the completion of the Block Write.

MCID/MSGID	Lgth	Frg	User Data						
<63>2:05 [5FD]	08	00	**AA**	**06**	**00**	**64**	**00**	**04**	**07**
<63>2:05 [5FD]	08	41	**D0**	**00**	**52**	**00**	**46**	**00**	**49**
<63>2:05 [5FD]	08	42	**00**	**44**	**FF**	**FF**	00	00	00
<63>2:05 [5FD]	08	43	00	00	00	00	00	00	00
<63>2:05 [5FD]	03	84	00	00					

Command Response: Standard ABx Block Write

The LRP830 will respond with a command acknowledgment as shown below, or an error message.

MCID/MSGID	Lgth	Frg	User Data						
<63>1:15 [3FF]	08	00	**AA**	**06**	**FF**	**FF**	00	00	00
<63>1:15 [3FF]	08	41	00	00	00	00	00	00	00
<63>1:15 [3FF]	08	42	00	00	00	00	00	00	00
<63>1:15 [3FF]	08	43	00	00	00	00	00	00	00
<63>1:15 [3FF]	00	84	00	00					

Header Device Type Protocol

When selecting the "Header" device type in the LRP830 configuration, the following features are available. A special message header is required, which precedes each ABx command and response.

The Allen Bradley® SLC500 PLC with DeviceNet scanner module (1747-SDN) must process every message header word coming from the LRP830. It must also correctly setup a handshake header for every message going out to the LRP830. An entire word (2 bytes) is required for the header because some ABx Device Type messages must begin and end on an even word boundary (e.g. ABx Standard).

Header Format

First word of message from PLC (e.g. in file N10:1) is in the following format.

Upper Header Byte								Lower Header Byte							
7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0
NOT USED					ACK	REQ	SEN	Reserved							

Bit 2 is the acknowledge flag, Bit 1 the request flag, and bit 0 is for a sensor and is not used by the LRP830.

The possible hex values for the upper header byte are shown below:

Header Word - Binary	Header Word - Hex	Description
00000001	01 00	Sensor - Not Used
00000010	02 00	REQ - Request
00000100	04 00	ACK - Acknowledge
00000110	06 00	REQ and ACK

Both the REQ and the ACK bits can be set simultaneously when the LRP830 is both acknowledging a command from the DeviceNet Scanner Host and indicating it has a response to a previous command.

Note:
When "unmodified" byte ordering is opted, the PLC (for example) reverses the bytes in each word, so an LRP830 ACK response will appear as 00 06.

The length of the header is one word and should appear at the beginning of each incoming and outgoing message. When you setup your message sizes you will have 2 bytes overhead. In essence, for a 28 byte message, you will have 2 bytes of non-data overhead in each DeviceNet message. The DeviceNet message will be fragmented into four, 8 byte fragments. The first byte of every fragment is reserved for the fragment header byte. The fragment header byte count is not included in the total message size.

A configuration option called ABx separation, instructs the LRP830 to place only one ABx command message response in each DeviceNet message. The default is set to ABx_sep = on.

Examples
When the PLC has data available to send to the LRP830, it sets the "REQ" bit in the DeviceNet message header. If the message length is 30 bytes, then the message is fragmented and structured as follows from the PLC. The header byte is underlined and italicized.

Note:
The fragmentation byte appears in every fragment, but the header word appears only in the first fragment. The SENSOR bit (0) may be consistently on but should be ignored.

Header: HDR (config display notation)

Command to LRP830: Standard ABx Block Read

This is from the explanation of **ABxS Command 5** found in Section 6.3, pages 39 and 40. It reads 8 bytes of data from the tag starting at address 0101H. A timeout of 2 seconds (07D0H = 2000 x 1 ms) is set for the completion of the Block Read. The REQ bit is set in the header word as shown in the first row below.

MCID/MSGID	Lgth	Frg	.Hdr.		User Data				
<63>2:05 [5FD]	08	00	*02*	*00*	**AA**	**05**	**01**	**01**	**00**
<63>2:05 [5FD]	08	41	**08**	**07**	**D0**	**FF**	**FF**	00	00
<63>2:05 [5FD]	08	42	00	00	00	00	00	00	00
<63>2:05 [5FD]	08	43	00	00	00	00	00	00	00
<63>2:05 [5FD]	03	84	00	00					

Command Response: Standard ABx Block Read

The LRP830 will send a response containing the bytes read as requested by the above command. In this example, both the ACK and the REQ bit are set in the header word as shown in the first row below.

MCID/MSGID	Lgth	Frg	.Hdr.		User Data				
<63>1:15 [3FF]	08	00	*06*	*00*	**AA**	**05**	**00**	**52**	**00**
<63>1:15 [3FF]	08	41	**46**	**00**	**49**	**00**	**44**	**00**	**20**
<63>1:15 [3FF]	08	42	**00**	**54**	**00**	**61**	**00**	**67**	**FF**
<63>1:15 [3FF]	08	43	**FF**	00	00	00	00	00	00
<63>1:15 [3FF]	03	84	00	00					

Poll to LRP830

This is the form of a null command from the PLC to the LRP830. No command is issued with this poll and only the ACK bit is set in the header word.

MCID/MSGID	Lgth	Frg	.Hdr.		User Data				
<63>2:05 [5FD]	08	00	*04*	*00*	00	00	00	00	00
<63>2:05 [5FD]	08	41	00	00	00	00	00	00	00
<63>2:05 [5FD]	08	42	00	00	00	00	00	00	00
<63>2:05 [5FD]	08	43	00	00	00	00	00	00	00
<63>2:05 [5FD]	03	84	00	00					

Header Device Type Command Protocol

The following sequence shows the handshaking that will occur between a PLC DeviceNet scanner host and the LRP830. The ladder logic in the PLC must respond with an acknowledgment for each message uploaded from the LRP830.

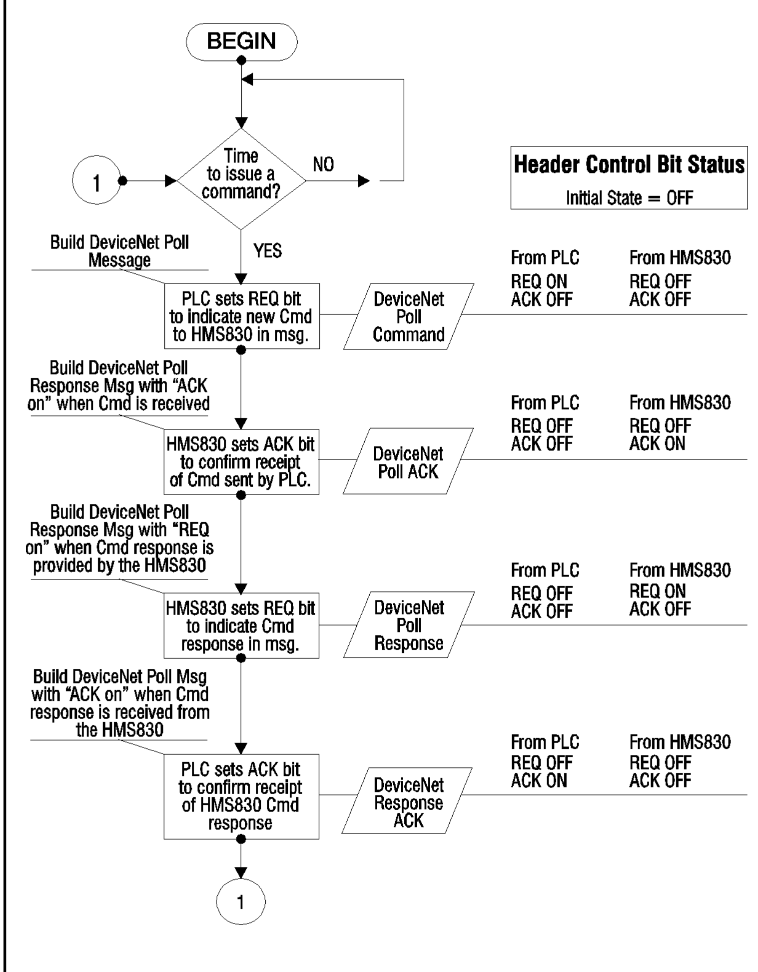


Figure 40 — LRP830 Handshaking Flow

Polls and responses occur at the poll rate of the scanner. The recommended interscan poll delay setting is 200 milliseconds for initial testing. This setting is made in the DeviceNet Scanner Host. Other polls and responses may be occurring in between the process blocks shown in Figure 30. This example shows only polls and responses that affect the ACK and REQ bits in the header word. Multiple handshaking bits may be on in a poll or response message header.

Calculating Message Size

The DeviceNet message will be fragmented into four, 8 byte fragments when traversing the CAN bus. The first byte of every fragment is reserved for the fragment header byte. The fragment header byte count is not included in the total message size.

The LRP830 supports message sizes between 0 and 254 bytes. When specifying the DeviceNet Transmit (Tx) and Receive (Rx) poll message sizes, the number specified represents the total DeviceNet message size. If the Tx or Rx message is greater than 8 bytes, the DeviceNet protocol automatically performs message fragmentation. This means a message is sent as a collection of 8-byte fragments. The first byte of every fragment is reserved as a fragment header but is not considered in the message size calculation.

Message fragmentation is typically transparent to the designer, but to maximize performance and minimize overhead, efficient DeviceNet message sizes should be considered, as follows.

Generic Device Type
When approximately 29 bytes of user data are required:

29 / 7 = 4.14 ~ 5 fragments (always round to next highest whole number).
Thus 35 is the optimal message size in this case (5 x 7 = 35).

Header Device Type
For Header Device Type the fragment calculation is the same but you must include the 2 bytes of the header word before you calculate the number of fragments.

For 29 bytes of I/O message (user) data then:

29 + 2 = 31 (add the two byte header)

31 / 7 = 4.43 ~ 5 fragments.

For the above two examples, the user should consider using 35 byte messages to optimize fragmentation overhead.

35 / 7 = 5 fragments

When between 29 and 35 bytes are specified for I/O Tx size and I/O Rx size (in both the DeviceNet Scanner Host and LRP830 DeviceNet configurations), five fragments are generated each time a message is sent or received over the DeviceNet bus. Each fragment provides space for 7 bytes of user data and uses 1 byte overhead (which is transparent to the user).