DATA-LINC GROUP

User Guide

SRM6210E

SRM Family

Frequency Hopping Spread Spectrum Industrial grade Ethernet radio modem— 900 MHz

SRM6210E
902-928 MHz Ethernet Radio Modem

For coverage from process to perimeter

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DATA-LINC modems interface seamlessly with the major manufacturers' PLCs

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DATA-LINC GROUP is a Global Encompass Partner with Rockwell Automation and a Schneider Electric Collaborative Allliance Partnership Program Gold Level member.

Its modems interface seamlessly with the other major PLC manufacturers as well.

It is essential that all instructions contained in the User Guide are followed precisely to ensure proper operation of equipment.

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Introduction

NOTE: SRM6210E units ordered after February 1, 2013, no longer have Class 1 Div 2 certification. These units do not carry the MetLabs sticker and the top of the enclosure does not contain Class 1 Div 2 certification text.

The SRM6210E is a high performance, Ethernet wireless radio modem designed for heavy-duty industrial data communications in the 902-928 MHz license-free band. It employs advanced spread spectrum frequency hopping and error detection technology to achieve very reliable, noise and interference immune operation. A high RF data rate of 188 Kbps and superior sensitivity provide ultra reliable data integrity. The SRM6210E has a rated range of up to 25 miles (40 km) and an installed range of up to 35 miles (56 km) in optimal conditions with line-of-sight and an omni directional antenna. This can be extended further with repeaters or higher gain antenna.

The SRM6210E can be operated in a number of different modes to satisfy a broad range of communications requirements. It can be configured for point-to-point or multipoint operation with an unlimited number of remote sites on a single master depending on data throughput requirements. Repeaters can be used in the system to extend range and eliminate dead RF zones that are blocked by obstructions.

An external antenna can be used with up to two hundred feet of coax. This provides a boost in signal strength and decreases induced noise levels. With an external antenna, the SRM6210E can be located inside buildings or metallic enclosures.

The SRM6210E will operate in virtually any environment where Ethernet communications are required.

This user's guide covers the operating modes and configurations that are available to users of the SRM6210E. It also provides the user with bench testing instructions, technical information and specifications.

This user's guide covers the following models:

•**SRM6210E**
•**SRM6210E/DIAG**

In most applications, the SRM6210E comes pre-configured for the application in which it is going to be used. In most cases no other configuration is required. If you are unsure if the SRM6210E needs further configuration, please contact Data-Linc Group.

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Quick Start

The SRM6210E comes pre-configured for your application (unless otherwise requested). In most cases, configuration settings are not required.

Although each SRM6210E is tested before shipment, it is recommended that a bench test be done before the SRM6210E is field installed.

In all applications, there is a master SRM6210E and one or more remotes. Some applications may also have one or more repeaters. This "Quick Start" will assume that there is a repeater in the system. If there is not, ignore the parts that talk about repeaters, as the remote SRM6210E should operate the same with or without repeaters.

Locate the SRM6210E labeled "Master" and connect its power supply to an appropriate 120VAC power source, then connect it to the SRM6210E. The "P" LED should come on and stay on

> **Note:** On all SRM6210E, the RF Link LED will come on for the first few seconds after power up.

Next, locate the SRM6210E(s) labeled "Repeater" and connect to power. The LED's "P" and "RF Link" should come on and stay on. Now locate the SRM6210Es) labeled "Remote" and connect to power. The LED's "P" and "RF Link" should come on and stay on. The SRM6210Es are now ready to carry Ethernet data.

Connect the "Master" and "Remote" (or "Repeater/Remote" if your network has one) to the Ethernet equipment that has been pre-tested for operation.

> **Note:** The SRM6210E will not support "Peer to Peer" communications. The equipment that is attached to the SRM6210E must be capable of operating in a "Master (host) to Remote" network.

It is recommended that a "Ping" test be done at this point. This can be done in either direction, but remember that only a "Master to Remote" or "Remote to Master" connection can be established through the SRM6210Es. Also note that because of the MAC filtering done by the SRM6210Es, if you take a piece of Ethernet equipment on one side of the SRM6210E network and move it to the other side of said network, you must power down both the "Master" and the effected "Remote" in order to re-establish connectivity through the SRM6210Es. If powering down the SRM6210E is not practical to the applications, the SRM6210Es will rebuild the MAC filter table in approximately six minutes and communications should return. Once a successful "Ping" test has been done, the SRM6210Es are ready for communication. If the "Ping" test was not successful, please refer to the trouble shooting section of this manual or contact Data-Linc Group tech support for assistance.

Safety & Operational Notices
Installation recommendations:
The SRM6210E enclosure should allow for clearance for the Ethernet, DC power, and antenna cable connections to the SRM6210E and clearance for conduit fittings.

> **Note:** The SRM6210E radio modem is normally expected to be mounted in an enclosure with the LED indicators, DC power connector, and the Ethernet connection facing outward.

•**SRM6210E Horizontally mounted** - The minimum dimensions for the enclosure with the SRM6210E is ten (10) inches in width by six (6) inches in height and six (6) inches in depth.

•**SRM6210E Vertically mounted** - The minimum dimensions for the enclosure with the SRM6210E is six (6) inches in width by ten (10) inches in height and six (6) inches in depth.

The enclosing unit should be installed per either the National Electrical Code (ANSI/NFPA 70) or the Canadian Electrical Code, as applicable. Use only the Data-Linc Group supplied retained screw terminal connector for DC input power. The SRM6210E includes a separate frame grounding screw.

All connected cables, antennas, and power cables should be routed through conduit in accordance with the National Electrical Code(ANSI/NFPA 70) or Canadian Electrical Code, as applicable.

Installation, maintenance and operation of the SRM6210E will be in accordance with the SRM6210E's installation manual, and the appropriate electrical code.

Modifying or tampering with the SRM6210E with non-factory parts may adversely affect the safe use of the SRM6210E.

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FCC Part 15 Notification

This device complies with part 15 of the FCC rules. Operation is subject to the following conditions:

1) This device may not cause harmful interference
2) This device must accept any interference received, including interference that may cause undesired operation.

The device must be operated as supplied by Data-Linc Group. Any changes or modifications made to the device without the express written approval of Data-Linc Group may void the user's authority to operate the device.

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

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

   Note: Whenever any SRM6210E is placed inside an enclosure a label must be placed on the outside of that enclosure which includes the modem's FCC ID.

   Note: Per FCC Rules, the maximum power allowed at the antenna is 4 Watts E.I.R.P.

RF Exposure

 The SRM6210E has a maximum transmitted output power of 955 mW. It is required that the transmit antenna be kept at least 23 cm away from nearby persons to satisfy FCC RF exposure requirements.

   Note: The antenna used for the SRM6210E must be professionally installed on a fixed-mounted permanent outdoor structure for satisfying RF exposure requirements, including antenna co-location requirements of 1.1307(b)(3).

Hardware Settings

In most cases, the SRM6210E comes pre-configured from the factory. However, it may sometimes be necessary to change the configuration. Most parameters are changed in the Setup Menu of the SRM6210E although there are a few parameters that are set using switches. If you are not sure if you need to change the configuration of the SRM6210E, you probably don't. Please contact Data-Linc Group for further information if you are unsure about your configuration.

Switches

Access to the switches is via removal of the left side (LAN side) end plate.

> **Note:** Leave switch positions 4, 5 and 6 at the factory setting of "off" unless otherwise directed by Data-Linc Group. Changing these switches requires a radio parameters change.

Mac Filtering Function

All devices capable of generating Ethernet traffic have a MAC (Medium Access Control) address. This address is used in the communications of Ethernet data.

The SRM6210E is factory set to perform MAC level filtering. This means that it learns all the MAC addresses from the LAN segment it is connected to, and only forwards data packets across the radio links which are destined for addresses located across the radio link.

The MAC address table can store up to 10,000 addresses. Each entry to the table has a lifetime of six minutes after which the address is deleted. This dynamic table building allows for the possibility of stations being removed from the LAN. The net result of this filtering functionality is the reduction of unnecessary network traffic across the radio link.

Any device that does not communicate on the network within a six minute time out period will be dropped from the radio's MAC table list. If frequent changes in the LAN cabling are done, cycle the DC power or press the reset button on the front of the modem.

> **Note:** Many Ethernet networks have data packets that are not covered by the MAC filter function (broadcast packets for example). These packets can occupy a tremendous amount of the network's bandwidth and over-whelm the SRM6210E section of the network. If the SRM6210E's are going to be installed where they are linked to an open network (office network, etc…), a properly configured router or switch should be installed to protect the SRM6210Es from excessive data traffic. If you are unsure about your network, please consult with your network administrator.

Setup Menu

The SRM6210E allows you to set several parameters to suit your particular application. All adjustments are done through the SRM6210E setup menu --a serial interface that eliminates the need for setup diskettes or custom software.

To access the configuration menu, connect the SRM6210E's configuration port to any terminal program with port settings of 19.2k baud, 8 data bits, no parity and one stop bit. With the SRM6210E connected to the PC running the terminal program, press the "Reset/Config" button. While any terminal program will work, examples for this manual were generated using the Microsoft Windows "HyperTerminal."

> **Note:** When using HyperTerminal, set handshaking to none and use a standard straight through cable. If you are using something other than HyperTerminal, it may be necessary to use a cable that has pins 4 and 6 connected together on the modem side of the cable. Contact Data-Linc Group for further information.
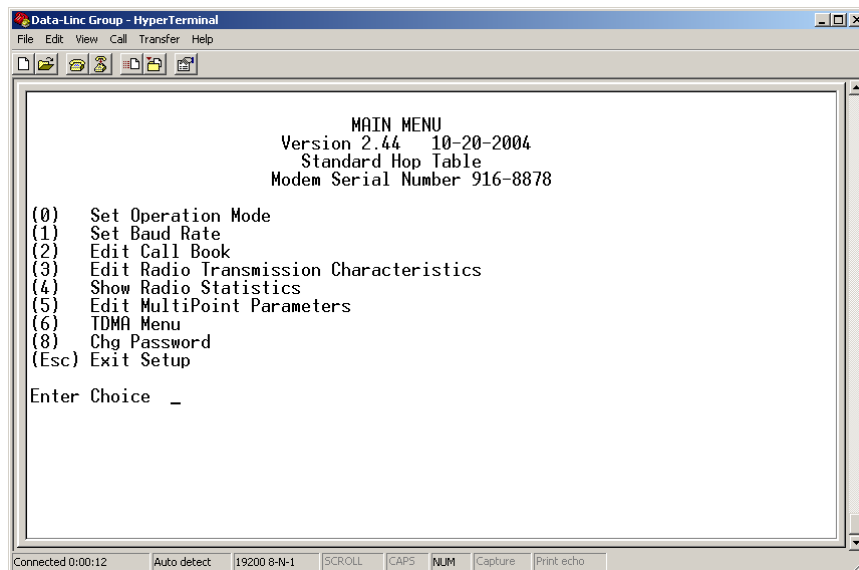
Table 1: Terminal Settings

Parameter	Setting
Baud Rate	19.2k
Data Bits	8
Parity	None
Stop Bits	1
Parity Check	None
Carrier Detect	None

When the setup menu is invoked the RF "IN" LED on the SRM6210E front panel will flash once when the "Reset/Config" button is pressed and the "Link" LED will remain on for the entire time the SRM6210E is in setup mode.

The main menu provides the SRM6210E's unique call book number and the set of choices for editing the operational parameters and viewing the performance data.
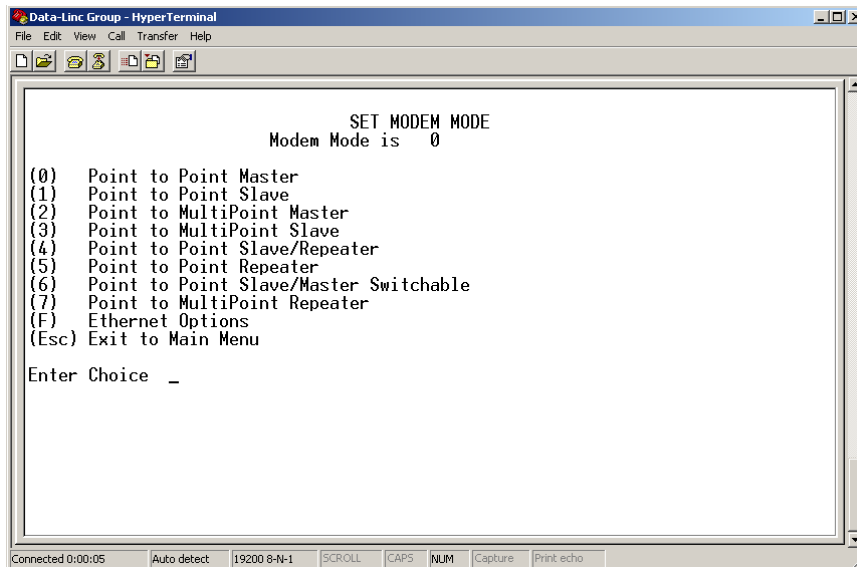
Figure 1: Main Menu

Main Menu Option (0): Set Operation Mode

When item (0) is selected, the Operation Mode Menu appears as shown in figure 2. The Operation Mode option is used to designate the method in which the particular SRM6210E will be used. The SRM6210E operates in a master to remote configuration; therefore, any SRM6210Es that are intended to operate together must be set up as such. In a point-to-point setup, either the master or remote may be used on either end of the communications link. One consideration when setting up the SRM6210Es is that a number of parameters are controlled by the settings in the master; therefore, you may wish to deploy the master on the communications end where you will have easier access to the SRM6210E.

Figure 2: Mode Menu

```
SET MODEM MODE
Modem Mode is   0

(0)   Point to Point Master
(1)   Point to Point Slave
(2)   Point to MultiPoint Master
(3)   Point to MultiPoint Slave
(4)   Point to Point Slave/Repeater
(5)   Point to Point Repeater
(6)   Point to Point Slave/Master Switchable
(7)   Point to MultiPoint Repeater
(F)   Ethernet Options
(Esc) Exit to Main Menu

Enter Choice  _
```

Shown above are example settings. Please refer to supplied configuration sheets for your SRM6210E's configuration.

(0) Point-to-point Master

The SRM6210E operates in a master/remote configuration. When designated as a master in point-to-point mode, the SRM6210E will call any or all remotes defined in it's call book. The master determines the settings used for all Radio Transmission Characteristics (except power), regardless of the settings in the remotes and/or repeaters.

(1) Point-to-Point Remote

When set up as a point-to-point remote, the SRM6210E will communicate with any master in its call book, either directly or through one or two repeaters. When functioning as a remote, the Entry to Call feature in the SRM6210E's call book is not operational. The remote will communicate with any master defined in it's call book that attempts to make a connection.

(2) Point-to-Multi-Point Master

The SRM6210E may be set to run in multipoint mode, which allows one master to simultaneously be in communication with numerous remotes. A point-to-multi-point master will communicate only with other SRM6210Es designated as point-to-multi-point remotes or point-to-multi-point repeaters.

(3) Point-to-Multi-Point Remote

Setting (3) allows the SRM6210E to operate as a remote in a multipoint network.

Please refer to the section entitled multipoint operation, for more information on running a multipoint network.

(4) Point-to-Point Remote/Repeater

Option 4 allows you to designate the SRM6210E to act as either a remote or a repeater, depending upon the instructions received from the master for the specific communications session. When a SRM6210E is placed in an ideal location, this setting offers the flexibility of using that SRM6210E as an end point in the communication links (remote) and to extend the link to a further point (repeater).

Note: Configured as a repeater, a SRM6210E has no security features as explained below. When a SRM6210E is designated as a Point-to-Point Remote/Repeater, it will allow any master to use it as a repeater.

(5) Point-to-Point Repeater

SRM6210E networks allow the use of up to two repeaters in a communications link, significantly extending the operating range. When designated as a repeater, a SRM6210E behaves as a pass-through link. All settings for the call book, baud rates, and radio transmission characteristics are disabled. A repeater will connect with any master that calls it (the repeater must still be set up in the master's call book).

The use of one repeater in a communications link will reduce the top data throughput available when compared to a direct master to remote link (generally on the order of 50%). The throughput does not decrease further if two repeaters are used.

(6) Point-to-Point Remote/Master Switchable

Mode 6 is not applicable to the SRM6210E.

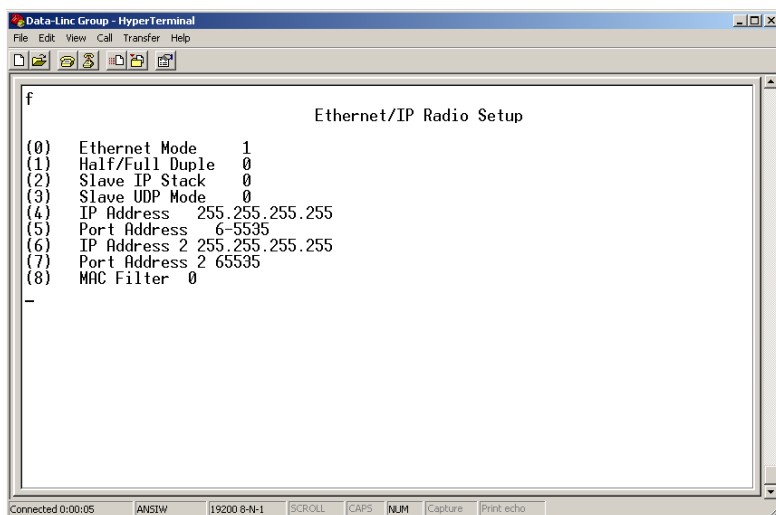## (7) Point-to-Multi-Point Repeater

Setting (7) allows the SRM6210E to operate as a repeater in a multipoint network.

Please refer to the section entitled, multipoint operation, for more information on running a multipoint network.

(F) Ethernet options

This selection is factory set and should not be changed.

Figure 3: Ethernet/IP Radio Setup Menu

Main Menu Option (1): Set Baud Rate
The baud rate setting affects the interface between the RF and Ethernet sections of the modem. All of the settings are factory set and should not be changed.

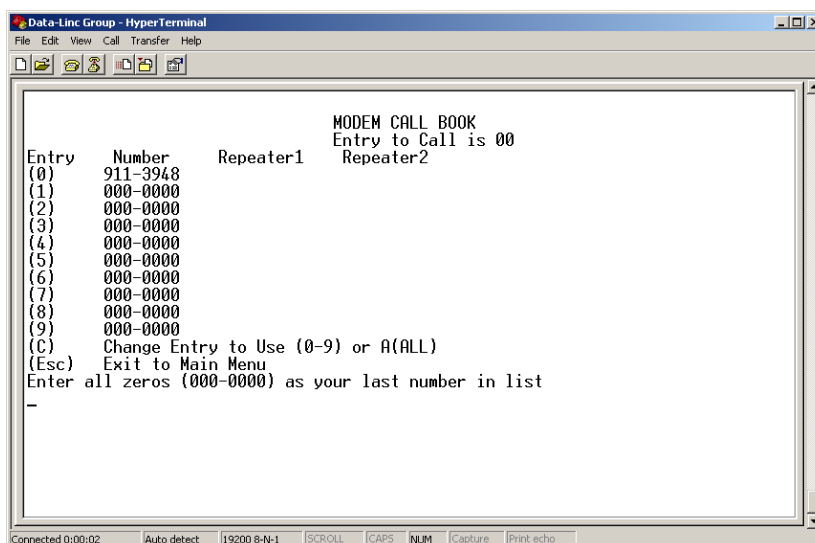## Main Menu Option (2): Edit Call Book
The Call Book is an innovative feature in the SRM6210E that offers both security and flexibility in use. The Call Book accomplishes this by allowing the user to determine with which other SRM6210Es a given radio modem will communicate, based on the call book numbers for both the master and remote. The SRM6210E's call book number is encoded in the microprocessor and identified on a label on the end of the SRM6210E. The instructions provided in this section are for point-to-point mode only. Use of the Call Book for multipoint systems is explained later in this chapter. For two SRM6210E radio modems to communicate in point-to-point mode, three events must occur:

1. The call book number for the master must be listed in the remote's Call Book.
2. The call book number for the remote must be listed in the master's Call Book.
3. The master must be programmed to call the remote.

The Call Book allows users to set up a list of up to 10 SRM6210E remotes. Addionally, it allows the user to define up to 2 repeaters for each communication path. To direct the master to call a remote, the remote must be in the master's "Call Book". To specify which remote is be connected, enter (C) at the prompt, followed by the menu number corresponding to that remote. To call any available remote in the list, the user should enter (C) and then (A) for All.

> **Note:** To call a remote through one or two repeaters, you must call that remote directly (as opposed to using the Call All option). When Call All is selected, the master is not able to connect with any remotes through repeaters. This is because the master calls every remote in the list when instructed to call all and will connect with the first remote to respond. When calling through a repeater, the master must first call that repeater and establish a communications link with it prior to making contact with the remote.

Figure 4: Call Book Menu

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Entering or Modifying Numbers in the Call Book

Entering or modifying call book numbers in the Call Book is a straightforward process. When in the Call Book menu select the entry number (0 – 9) you wish to edit. You will be prompted for the new number (formatting is automatic, you do not need to enter the dash). Once the number is entered (unless it is 000-0000) you will be asked for the call number of the first repeater to be used. If no repeater is to be used, enter the escape key; your entry will be complete and you will be back in the Call Book menu screen. If you enter a repeater number you will then be prompted for the call number of the second repeater to use. If a second repeater is being used, enter the call number at this time; if not then enter the escape key. Once again, the SRM6210E will retain your entries, as shown in the updated Call Book menu screen.

> **Note:** It is important that the Call Book slots (0 – 9) are filled sequentially beginning with 0, the first slot in the book. Call book numbers do not need to be entered in numerical order; however, there must not be any 000-0000 numbers in the middle of the list of good call book numbers. The reason for this is that when a master is instructed to Call All available remotes, it will call all remotes listed until it reaches the first call number of 000-0000. If a valid call book number is entered after the all zero number, it will not be recognized as a valid number to be called by the master.

Edit Call Book in Multi-Point Systems

In a multipoint system the remotes and repeaters are not listed in the master's Call Book. When establishing such a system, it is necessary only to have the master's call book number in each remote's and repeater's Call Book, and to have each repeater's call book number in the Call Book of each remote which may potentially communicate through it.

The following example shows the Call Books of a multipoint system comprised of a master, repeater and remote in which the remote can communicate either through the repeater or directly to the master:

Table 2: Multi-Point Master Call Book (Unit Call book number 912-0001)

Entry	Number	Repeater 1	Repeater 2
(0)	000-0000	<blank>	<blank>
(1)	000-0000	<blank>	<blank>

No call book number entries are necessary in the master's Call Book

The Master's Call Book may be programmed to call any entry

Table 3: Multi-Point Repeater Call Book (Unit Call book number 912-0002)

Entry	Number	Repeater 1	Repeater 2
(0)	912-0001	<blank>	<blank>
(1)	000-0000	<blank>	<blank>

Table 4: Multi-Point Remote Call Book (Unit Call book number 912-0003)

Entry	Number	Repeater 1	Repeater 2
(0)	912-0001	<blank>	<blank>
(1)	912-0002	<blank>	<blank>
(2)	000-0000	<blank>	<blank>

Main Menu Option (3): Edit Radio Transmission Characteristics

When option (3) is selected in the main menu, the screen in figure 4 appears, which allows the user to modify the radio transmission characteristics of the SRM6210E.

It is important to note that the radio parameters between any SRM6210Es will be determined by the settings for the master (except when in multipoint mode, see (4) RF Data Rate and (5) RF Power below). While the settings may be modified for the remote(s) and/or repeaters, they will be overridden by the master's parameters.

Figure 5: Radio Parameters Menu

Shown above are example settings. Please refer to supplied configuration sheets for your modem's configuration.
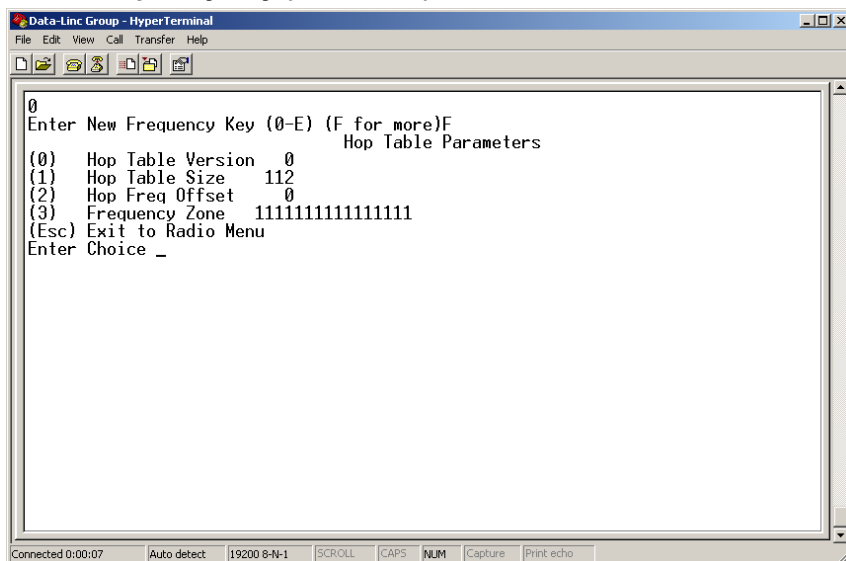
(0) FreqKey

 Selection (0) in the Radio Parameters menu allows the user to modify the hopping patterns of the SRM6210Es to minimize the interference with other SRM6210Es in operation in the area. For instance, if there were 10 pairs of SRM6210Es in operation within a factory or refinery, changing the Frequency Key would ensure that they would not jump onto the same frequencies at the same time for the same length of time.

There are 15 choices available for the Frequency Key (0-9 and A-E). It is recommended that a list be maintained of the settings for each master to ensure that each is set to a different hopping pattern.

> **Note:** Most applications do not require any modification to the frequency tables. Please consult with Data-Linc Group before making changes.

Some applications require changes in the frequency tables. Option F allows you to modify these parameters.

Figure 6: Frequency Key (F for More) Menu

(0) Hop Table Version
Entry 0 allows the user to choose the portion of the band in which the transceiver will operate.

Table 5: Hop Table Versions

Selection	Name	Band
0	Standard	Full 902-928 MHz
1	Austrialia	910-928 MHz
2	International	902-928 MHz, 16 fewer frequencies than full Standard set
3	Taiwan	916-920 MHz
4	New Zeland	921-928 MHz
5	Notch	902-928 MHz, center frequencies of 911-919 notched out
6	Brazil	902-915 MHz

(1) Hop Table Size
Within the specified band, the number of frequencies may be set ranging from 50 to 112.

(2) Hop Freq Offset
The Hop Freq Offset option is not functional in the SRM6210E.

(3) Frequency Zone
Frequency Zone: The idea of frequency zoning is to divide the available band (902-928 MHz) into smaller bands, in this case 16 smaller bands each consisting of 7 frequency channels. These 16 Zones are stored in a Word, which is made up of 16 bits numbered 0-15. These bits when displayed LSB to MSB directly represent the zones that the SRM6210E will operate on from lowest frequency to highest. A value of "1" in the bit sequence will instruct the radio to operate within the represented band. Likewise, a "0" value will instruct the SRM6210E to bypass the represented band. This feature should only be used with the standard hop table.

Frequency Zones are activated through the setup menu. To enable zoning from the main setup menu:

1. Select Menu 3 *"Edit Radio Transmission Characteristics"*
2. Select Option 0 *"FreqKey"*
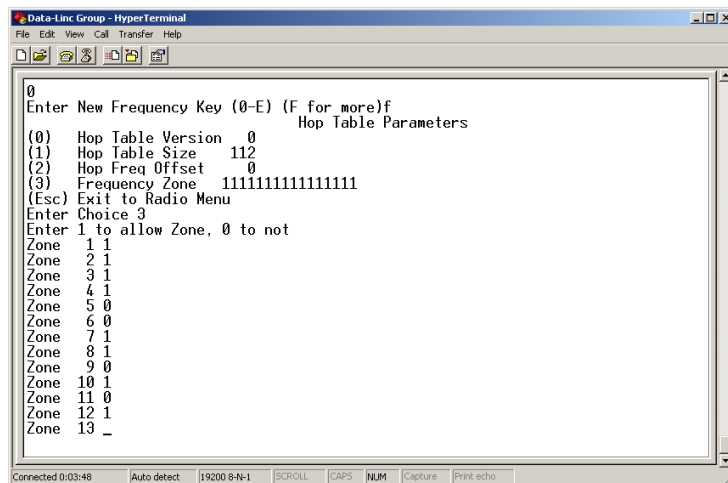3. Select F *"For More"*
4. Select Option 3 *"Frequency Zone"*

Enter 1 to enable desired frequency zone and a 0 to disable desired frequency zone. Frequency Zone entries begin with 0 (LSB) and continue through 15 (MSB)

Table 6: Frequency Zones

Binary Zone Number (LSB First)	Beginning Frequency MHz	Ending Frequency MHz	Number of Channels
0	902.2464	903.6288	7
1	903.8592	905.2416	7
2	905.4720	906.8544	7
3	907.0848	908.4672	7
4	908.6976	910.0800	7
5	910.3104	911.6928	7
6	911.9232	913.3056	7
7	912.5360	914.9184	7
8	915.1488	916.5312	7
9	916.7616	918.1440	7
10	918.3744	919.7568	7
11	919.9872	921.3696	7
12	921.6000	922.9824	7
13	923.2128	924.5652	7
14	924.8256	926.2080	7
15	926.4384	927.8208	7

Warning: In order to stay within FCC regulations it is required that a minimum of 50 separate frequency channels be used within a hop pattern. This means that a minimum of 8 frequency zones along with the standard hop table is required for legal communications.

Figure 7: Frequency Zone - Entry Example

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(1) Max Packet Size and (2) Min Packet Size Selections

(1) and (2) allow the user to designate the size of the packets (in bytes) used by the SRM6210E in its communication link. This may be of particular value when using the SRM6210E with different communications software packages; you may find that throughput is optimized when packet sizes are restricted by the SRM6210E.

Packet size is determined by a combination of the settings entered by the user and the RF Data Rate. In addition, the Max Packet Size is a function of the setting selected for the Min Packet Size. Tables 7, 8 and 9 provide the packet sizes for each different combination of settings.

Table 7: Minimum Packet Size Settings (bytes)

Setting	Min Packet Size RF Data Rate = 2	Min Packet Size RF Data Rate = 3
0	16	8
1	21	12
2	26	16
3	32	20
4	37	34
5	42	38
6	48	32
7	53	36
8	58	40
9	64	44

Table 8: Maximum Packet Size Settings where RF Data Rate=3

Maximum Setting

Minimum Setting		0	1	2	3	4	5	6	7	8	9
	0	8	24	40	56	72	88	104	120	136	152
	1	12	28	44	60	76	92	108	124	140	156
	2	16	32	48	64	80	96	112	128	144	160
	3	20	36	52	68	84	100	116	132	148	164
	4	24	40	56	72	88	104	120	136	152	168
	5	28	44	60	76	92	108	124	140	156	172
	6	32	48	64	80	96	112	128	144	160	176
	7	36	52	68	84	100	116	132	148	164	180
	8	40	56	72	88	104	140	136	152	168	184
	9	44	60	76	92	108	124	140	156	172	188

Table 9: Maximum Packet Size Settings where RF Data Rate=2

Maximum Setting

	0	1	2	3	4	5	6	7	8	9
0	15	36	58	79	100	121	142	164	185	206
1	20	42	63	84	105	127	148	169	190	212
2	26	47	68	90	111	132	153	175	196	217
3	31	52	74	95	116	137	159	180	201	222
4	36	58	79	100	121	143	164	185	206	228
5	42	63	84	105	127	148	169	190	212	233
6	47	68	90	111	132	153	175	196	217	238
7	52	74	95	116	137	159	180	201	222	244
8	58	79	100	121	143	164	185	206	228	249
9	63	84	95	127	148	169	190	212	233	254

Minimum Setting

(3) Xmit Rate

There are two settings for the Transmit Rate parameter. For normal operation, the SRM6210E should be set at Transmit Rate 1. Transmit Rate 0 is useful to qualitatively gauge signal strength. When set to Transmit Rate 0 the SRM6210Es will transmit data back and forth continuously, and the strength of the signal may be gauged by viewing the show radio statistics option.

Due to the fact that the SRM6210Es transmit continuously when Transmit Rate is set to 0 (whether or not they have data to send) they use radio frequency spectrum unnecessarily. Therefore, Transmit Rate 0 should be used only as a diagnostic tool and not for normal operation.

(4) RF Data Rata

The SRM6210E has two settings for the RF Data Rate (the speed that the SRM6210Es talk to each other). Setting 2 should be used when the SRM6210Es are close together and data throughput is to be optimized. Setting 3 should be used when the SRM6210Es are farther away and a solid data link is preferred over data throughput.

> **Note:** The RF Data Rate setting must be identical for all units in the system. Any SRM6210E with a different RF Data Rate than the master will not establish a communication link.

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(5) RF Xmit Power

The SRM6210E offers users the ability to modify the RF Transmission Power. There are 10 power settings available (1-10) which are roughly linear. Therefore a setting of (10) is full power or 1 Watt and 1 is 10% power or 100 mW. The following guidelines should be followed when setting the RF Transmission Power:

Table 10: Power Transmit Settings

Setting	Power Level	When Used
1-3	Low	One SRM6210E system operating within the same or adjoining rooms
4-6	Medium	More than one SRM6210E system operating within the same facility
7-10	Full	Normal operation extending beyond a facility

(6) Remote Security

With option 6 the user may disable the SRM6210E's security so it will accept a call from any other SRM6210E. The default setting is 0 where security is enforced (the caller's call book number must be in the remote's Call Book). With a setting of 1 security is disabled.

(7) RTS to CTS

This setting is not applicable to the SRM6210E and should not be changed from the factory setting of 0.

(8) Retry Time Out

The Retry Time Out parameter allows the user to determine when a remote will drop a connection to a master or repeater in multipoint mode. The default setting is 255, meaning that if one packet in 255 from the master is sent successfully to the remote it will maintain a link. The lowest setting is 8, at which a remote will drop a connection much faster.

The Retry Time Out parameter is useful when a multipoint system is used with a moving master or remotes. As the link gets weaker, a lower setting will allow a remote to drop it's link and search for a stronger connection.

While intended primarily for multipoint systems, the Retry Time Out parameter may also be modified in point-to-point systems. In point-to-point mode the Retry Time Out should not be set to a value of less than 151.

(9) Lowpower Mode

The Lowpower Mode is not applicable to the SRM6210E. This setting should not be changed.

(A) High Noise

Use this option if the SRM6210E will be operated in an environment with a high degree of RF noise and interference. With a setting of 1, the rejection of interference is improved, at the cost of reduced range and/or throughput.

(B) MCU speed

This setting is factory set to 1 (high speed) and should not be changed.

Main Menu Option (4): Show Radio Statistics

Option (4) in the main menu allows the user to view data transmission statistics, which have been gathered by the SRM6210E during the most recent session. Statistics are gathered during each data link and are reset when the next link begins. Ideally, noise levels should be below 30 and the difference between the average signal level and average noise level should be 30 or more. High noise levels tend to indicate other sources of RF interference, while low signal levels indicate a weak link. The "Local" stats are the statistics that are being gathered by the SRM6210E you are connected to while "Remote1", "Remote2", and "Remote3" are the statistics of the repeater(s) that the SRM6210E you are attached to is using to get back to the master SRM6210E. The following sections provide information useful to the process of trouble-shooting and improving RF links.

Average Noise Level

The average noise level indicates the level of background noise and interference at this SRM6210E and at each of the modems used as repeaters in the link. The number is an average of the noise levels measured at each frequency in the SRM6210E's frequency hop table. The individual measurement values at each frequency hop channel are shown in the frequency table. The frequency table is accessed by pressing the ENTER key on the computer when the radio statistics menu is displayed. Average noise levels will typically fall in the range of 15 to 30. Average noise levels significantly higher than this are an indication of a high level of interference that may degrade the performance of the link. High noise levels can often be improved with bandpass filters, antenna placement or antenna polarization. Please contact Data-Linc Group for more information.

Average Signal Level

The average signal level indicates the level of received signal at the SRM6210E and at each of the SRM6210Es used as repeaters in the system. For each of these, the signal source is the SRM6210E that transmits to it. The number is an average of the received signal levels measured at each frequency in the SRM6210E's frequency hop table. The individual measurement values at each frequency hop channel are shown in the frequency table. The frequency table is accessed by pressing the ENTER key on the computer when the radio statistics menu is displayed.

For a reliable link, the average signal level should be at least 30 higher than the average noise level reading. When using "J" units. Low Average Signal Levels can often be corrected with higher gain antennas, antenna placement, and use of repeaters. Contact Data-Linc Group for more information.

Overall Rcv Rate (%)

The Overall Rcv Rate measures the percentage of data packets that were successfully transmitted from the master to the remote on the first attempt without requiring retransmission. A number of 75 or higher indicates a robust link that will provide very good performance even at high data transmission rates. A number of 25 or lower indicates a weak or marginal link that will provide lower data throughput. An Overall Rcv Rate of 100% will provide approximately 90 Kbaud of bandwidth with an RF data rate of 3 (Radio Transmission Parameters Menu) and approximately 110 Kbaud of bandwidth with an RF Data Rate of 2. These numbers are reduced approximately 50% if there are one or more repeaters in the network.

Number of Disconnects

If, during the course of performing a link test, the link between the master and the remote is broken and the SRM6210Es lose RF carrier, the occurrence is recorded in the Number of Disconnects value. The value indicates the total number of disconnects that have occurred from the time the link test started until the SRM6210E was put into config mode. Under normal operating conditions, the number of disconnects should be 0. One or more disconnects may indicate a very weak link, the presence of severe interference problems or loss of DC power to any of the SRM6210E in the system.

   Note: A remote and/or repeater will record a disconnect if the system master is placed into configuration mode or has power interrupted while the remote and/or repeater is linked to the master

Radio Temperature

The radio temperature value is the current operating temperature of the SRM6210E in degrees C. For proper operation the SRM6210E should be in the range of -40^0 to 75^0 C.

Multi-Point Operation

In a multipoint system, a SRM6210E designated as a master is able to simultaneously be in communication with numerous remotes. In its simplest form, a multipoint network functions with the master broadcasting its messages to all remotes and the remotes responding to the master as appropriate.

Traditionally, a multipoint network is used in applications where data is collected from many instruments and reported back to one central site. As such, the architecture of such a system is completely different from point-to-point applications. The theoretical maximum number of remotes that can be configured into a multipoint network is a function of the data throughput needed from each of the remotes. For example, if the network will be polling remotes once a day to retrieve sparse data, several hundred remotes could be configured to a single master. If, on the other hand, each remote will be transmitting data at greater levels, then fewer remotes can be connected to the master before reaching system capacity.
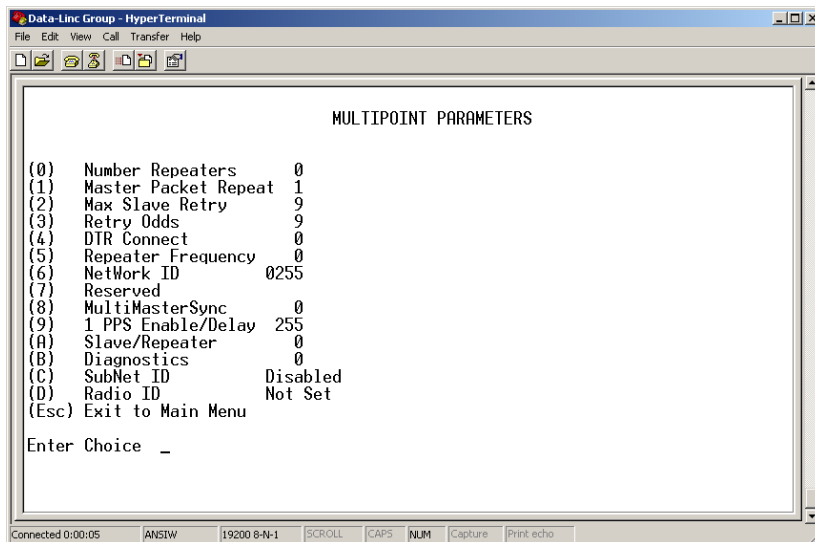
The theoretical limit of a multipoint system is influenced by the following parameters:

- Size of the blocks of data. The longer the data blocks the greater the system capacity.
- Throughput.
- The amount of contention between remotes.
- Use of repeaters.

Note: A single repeater in a multipoint network will decrease overall system capacity by 50%; more than one repeater does not further decrease network capacity.

Main Menu Option (5): Edit Multi-Point Parameters

Figure 8: Multi-Point Parameters

Shown above are example settings. Please refer to supplied configuration sheets for your SRM6210E's configuration.

In the multipoint configuration not every data packet sent from the master to all the remotes is acknowledged. If each remote acknowledged every packet from the master this would use the entire system's capacity. Because of this, it is critical to know some extra information about the system. The Multi-Point Parameters give the user the ability to fine tune the network, for optimal speed and reliability

(0) Number Repeaters
This parameter must be set in the master SRM6210E to represent how many levels of repeaters are in the system (for example, in the event that a repeater is connected to one or more other repeaters).

(1) Master Packet Repeat
A value between 0 (the packet is only transmitted once) to 9 (the packet is re-transmitted 9 additional times) is set in the master SRM6210E to allow each packet to be quickly re-transmitted by the master to give each remote in the system better chance of receiving a good packet.

For networks with solid RF links, this parameter would be set at the lower end of the scale (0-1). If the network has some weak or marginal links it would be set at a higher values. If a remote receives a packet from a master more than once it will discard the repeated packets received. While packets transmitted from the master to the remotes in a multipoint network are not acknowledged, packets transmitted from remotes to the master are.

(2) Max Slave Retry
The Max Slave Retry setting defines how many additional times (0 to 9) the remote will attempt to re-transmit a packet to the master before beginning a back-off algorithm. Once the remote has unsuccessfully attempted to transmit the packet the number of times specified in Max Slave Retry it will continue to attempt to transmit to the master on a random basis.

(3) Retry Odds
The Retry Odds parameter determines the probability that the remote will attempt to re-transmit the packet to the master. A low setting will assign low odds to the remote attempting to transmit and conversely a high setting will assign high odds.

An example of how this parameter might be used would be when considering two different remotes in a multipoint network, one close in with a strong RF link and the other further away with a weak link. It might be desirable to assign a higher Retry Odd to the remote SRM6210E with the weaker link to give it a better chance of competing with the closer remote SRM6210E for the master's attention.

(4) DTR Connect.
This setting is not applicable in the SRM6210Es and should not be changed from a factory default of 0.

(5) Repeater Frequency.
The repeater's hopping pattern must also be set in a multipoint network; Setting this parameter is in contrast with point-to-point mode where the repeater automatically uses the master's hopping pattern. The repeater may be programmed to either use the master's hopping pattern selection (0) or its own selection (1).

(6) NetWork ID
This allows multipoint networks to be established without the use of the Call Book. If the NetWork ID is set to any value lower than the default (255) the remotes in the multipoint network will communicate with the first multipoint master or repeater heard with the same NetWork ID. When the NetWork ID is used, multipoint masters and repeaters may be replaced without reprogramming all of the remotes in the network. In addition, this allows a remote to establish communications with different masters (though not at the same time) without having the call book numbers in the Call Book. This is very useful in mobile multipoint applications.

(8) MultiMasterSync
This is reserved for multipoint applications with concentrations of master units is necessary to reduce interference between the masters.

(9) 1PPS Enable/Delay
This setting is not applicable to the SRM6210E and should not be changed from the factory default of 255.

(A) Remote/Repeater
The Remote/Repeater mode allows a SRM6210E in a multipoint system to simultaneously act as a remote and a repeater. When in this mode a SRM6210E will repeat any packets sent from a master as well as send them out the Ethernet port. 0 disables this mode and 1 enables it.

(B) Diagnostics
The SRM6210E has the ability to run a diagnostic program (LincView OPC) while in normal operations. Contact Data-Linc Group for additional information.

(C) SubNet ID
The default setting is "Disabled." Please see the SubNet ID section of this manual.

(D) Radio ID
Used for setting a name to be displayed within LincView OPC . (See LincView OPC user's guide for more info)

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SubNet ID

The SRM6210E offers a SubNet ID configuration method to be used in conjuction with Network ID. This feature allows the user to dictate what path a given repeater or remote will use to achieve a link to the network master.

For example, if a remote SRM6210E in a given network has line of sight to the network master and one or more repeaters, but only one repeater is close to that remote, SubNet ID can be used to link that remote with the proper repeater only.
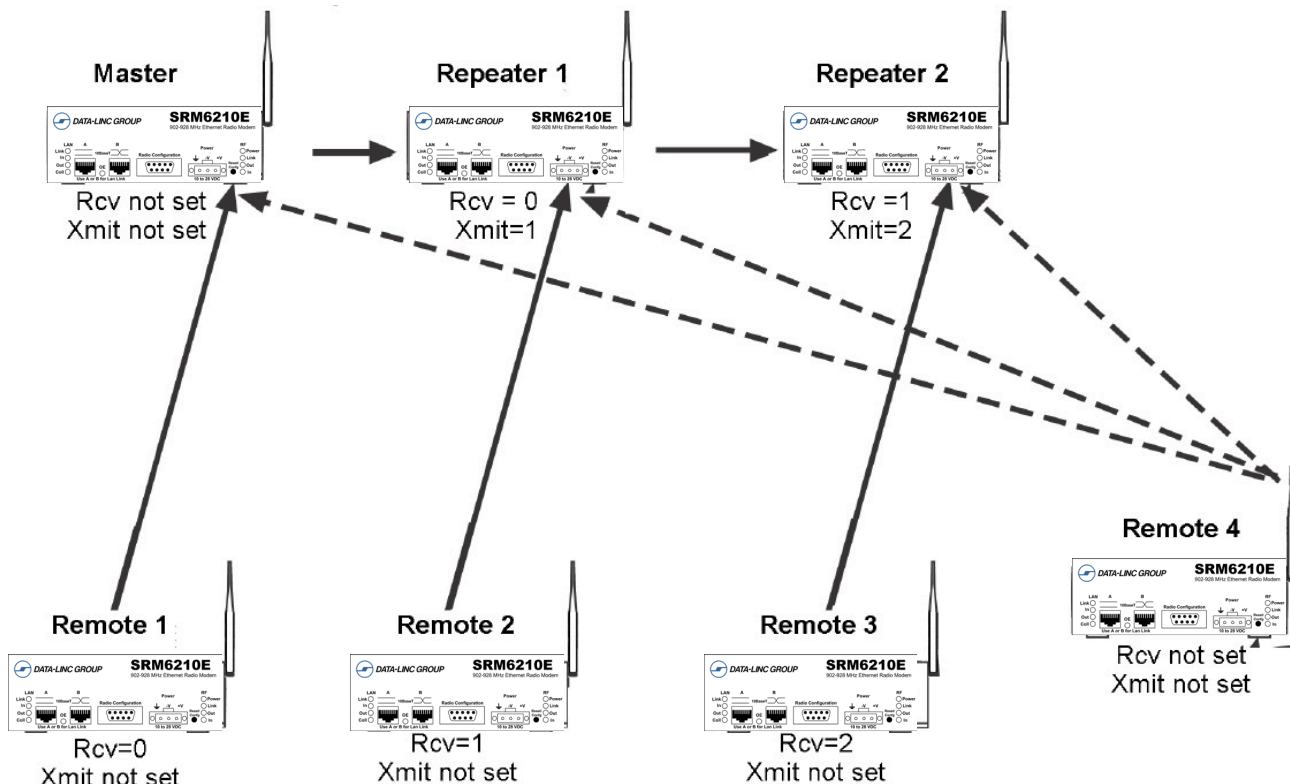
There are two components to SubNet ID. The first is the Xmit (transmit) SubNet ID, and the second is Rcv (receive) SubNet ID. The Xmit SubNet ID is used only by repeaters and is the ID that a repeater sends out when sending data to other repeaters or remotes. The Rcv SubNet ID is the ID that repeaters or remotes look for to receive data.

Note: The master is not affected by these settings. Only repeaters and remotes use these settings. Remotes only use Rcv SubNet ID.

Modem configurations are as follows (see diagram 1 below):

Master No setting used

Repeaters Any repeater that should be linked directly to the master should have the Rcv SubNet ID set to 0. Any repeater using another repeater as its link, needs the Rcv SubNet ID set to the Xmit SubNet ID of that repeater. The Xmit SubNet ID can be set to anything from 1 to E.

Remotes Any remote that should be linked directly to the master should have the Rcv SubNet ID set to 0. Any remote using a repeater as its link should have the Rcv SubNet ID set to the Xmit SubNet ID of that repeater.

Diagram 1: SubNet ID System Example

Main Menu Option (8): Password

Caution: If the password feature is enabled and you cannot remember the password, the SRM6210E will have to be returned to Data-Linc Group to have the password reset. **Use with caution.**

Option (8) in the Main Menu allows the user to set a password which will prevent unauthorized users to change the configuration of the SRM6210E.

Setting a Password

To enable the Password feature choose (8) from the Main Menu. You will be prompted with "New PW? (<esc> to exit)

To back out of the process and not enable the password, hit escape. To set a password type in **exactly 4 characters.** At any point in the process you can cancel by hitting the escape key. Once the 4 characters have been entered you will be prompted with "<enter> to accept, <esc> to quit".

At this point, if you wish to accept the password entered and enable the feature, press the enter key. The password that you have chosen is displayed on the line above (please note that the password is case sensitive). To quit the process and not enable the password press escape.

Changing a Password

Once the password feature has been enabled it is possible to change to a new password. To enter a new password select (8) from the Main Menu. You will be prompted with "Enter Security Code". Enter the current password. Once the password has been entered correctly (it is case sensitive) you will be prompted to enter the new password. At any point this process may be cancelled by pressing escape.

Disabling Password

The process to disable the password is similar to the process to change the password. However, when prompted to enter the new password, the following procedure needs to be followed:

1. Hold the "Alt" key down and using the number key pad (not the numbers across the top of the key board) type "0255"
2. Release the "Alt" key
3. Repeat steps 1 and 2 three more times (this will enter 0255 a total of four times).
4. You will be prompted with "<Enter> to accept, <esc> to quit
5. Hit the "Enter" key to disable the password or hit the escape key to keep the password

Using External Antennas

The use of external antennas will greatly improve the range and link reliabily of the SRM6210E

The SRM6210E is equipped with a standard SMA male antenna connector. Data-Linc Group offers directional and omni directional antennas and coaxial cable lengths ranging from 3 to 200 feet.

When using an external antenna, placement is critical to solid RF communications. It is imperative to obtain good line-of-sight between the antennas. Gennerally, high antenna placement yieds the best result.

Other antennas in close proximity are a potential source of interference. It is also possible that slight adjustments in antenna placement (as little as 2 feet) will solve noise problems. For extreme cases, such as when the SRM6210E's external antenna is located close to pager or cellular telephone transmission towers, Data-Linc Group offers a band pass filter to reduce out of band noise.
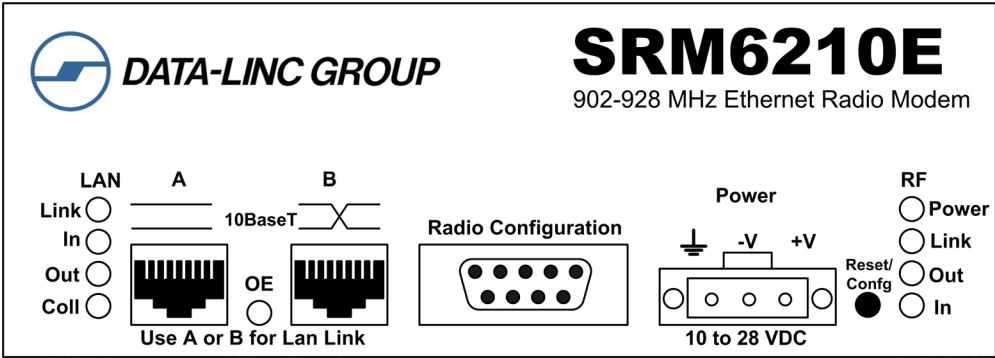
If external directional antennas are used, FCC regulations concerning effective radiated power limitations must be followed.

Caution: Any antenna placed outdoors must be properly grounded. It is required by FCC regulations that qualified personnel experienced in antenna installation and familiar with local codes and regulations complete the antenna installation. It is also required by FCC regulations that only approved antennas be used. Use extreme caution when installing antennae and follow all instructions included with the antennas.

Note: The use of an external antenna subjects the SRM6210E to greater exposure to direct lightning strikes. It is strongly recommended that a lightning arrestor be used on all outdoor antenna installations.

Front Panel
Figure 9: SRM6210E Front Panel

LEDs
The LEDs on the front panel provide important status information of the SRM6210E.
Table 11 below describe each LED's function.

Table 11: Led Function

LAN LEDs	Function
Link	Indicates LAN link to SRM6210E
In	Indicates incomming Ethernet data
Out	Indicates outgoing Ethernet data
Coll	Indicates and Ethernet collision
OE	Overrun Error; Indicates more data coming into the SRM6210E then the SRM6210E can buffer and/or transmit

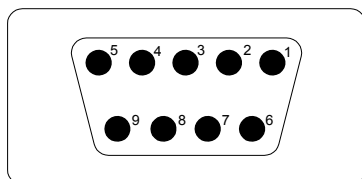| RF LEDs	Function
Power	Indicates power to the SRM6210E
Link	Indicates a RF link to another SRM6210E
Out	Indicates RF data being sent to another SRM6210E
In	Indicates RF data being received from another SRM6210E

10BaseT Ethernet Ports
The SRM6210E has 2 standard RJ-45 10 Base-T connectors. Port A is configured straight, while Port B is configured as crossover.

Important: Only connect a single Ethernet device to the SRM6210E at a time.

Radio Configuration Port

Diagram 2

DB-9 Female

Table 12: Configuration Port Pin Assignment

Pin	Assignment
1	< Not Used >
2	Transmit Data (Out)
3	Receive Data (In)
4	Data Terminal Ready (In)
5	Ground
6	Data Set Ready (Out)
7	< Not Used >
8	< Not Used >
9	< Not Used >

Power Connector

The power connector on the SRM6210E is a 3 position pluggable terminal block with retaining screws.

Table 13: Power Connector Pin Assignment

Pin	Assignment
Left	Frame Ground
Center	VDC -
Right	VDC + (10 to 28 VDC)

Reset/Config Button

The Reset/Config button on the SRM6210E is used for two functions:

•**To** reset the Ethernet microprocessor
•**To** initiate the "Setup Menu" when ths SRM6210E is properly connected to a PC with a data cable (see section "Setup Menu" for more)

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Sample Communication Links

The SRM6210E's versatility allows data communication links to be established using a variety of different configurations. This makes it possible to extend the range of the SRM6210E and get around obstacles.

Diagram 3 shows the most common and straightforward link, a master communicating to a remote (Point to Point).

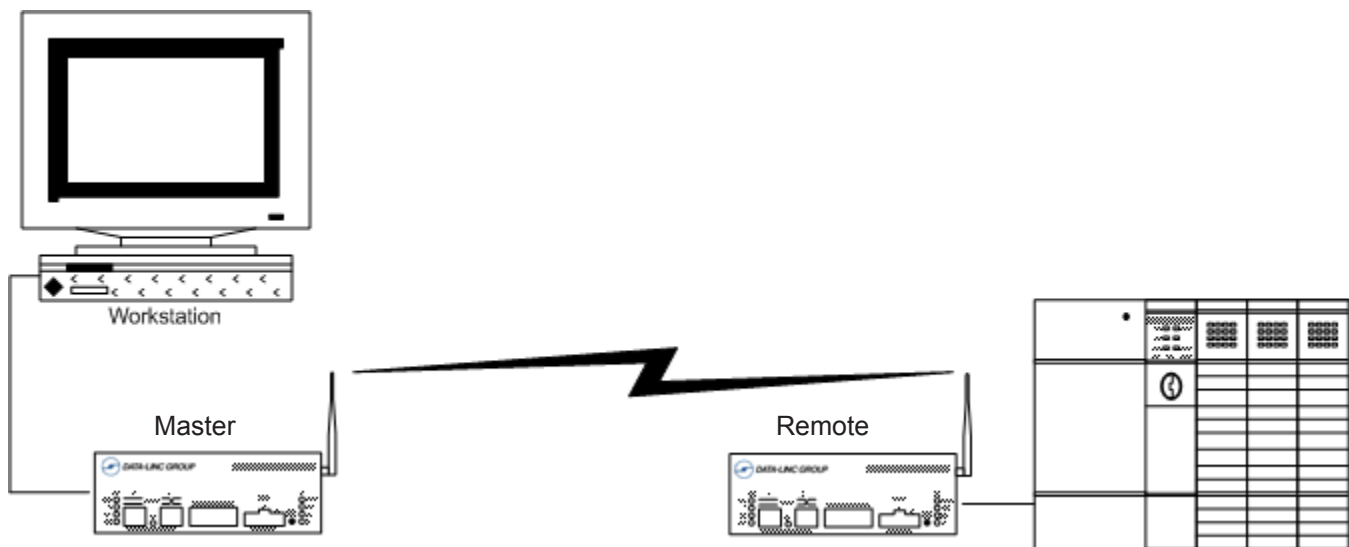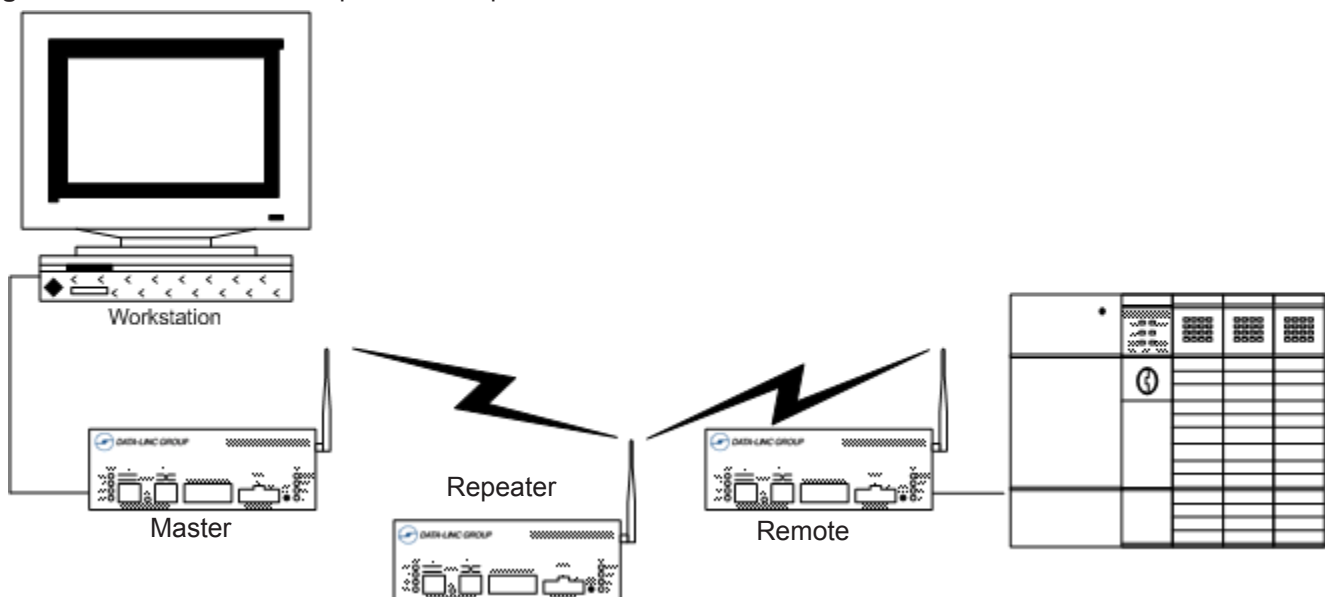**Diagram 3:** Point to Point Example

Diagram 4 depicts how a link might be set up using a repeater. The repeater may be sitting on a hilltop or other elevated structure to link the master to the remote (Point to Point with a Repeater).
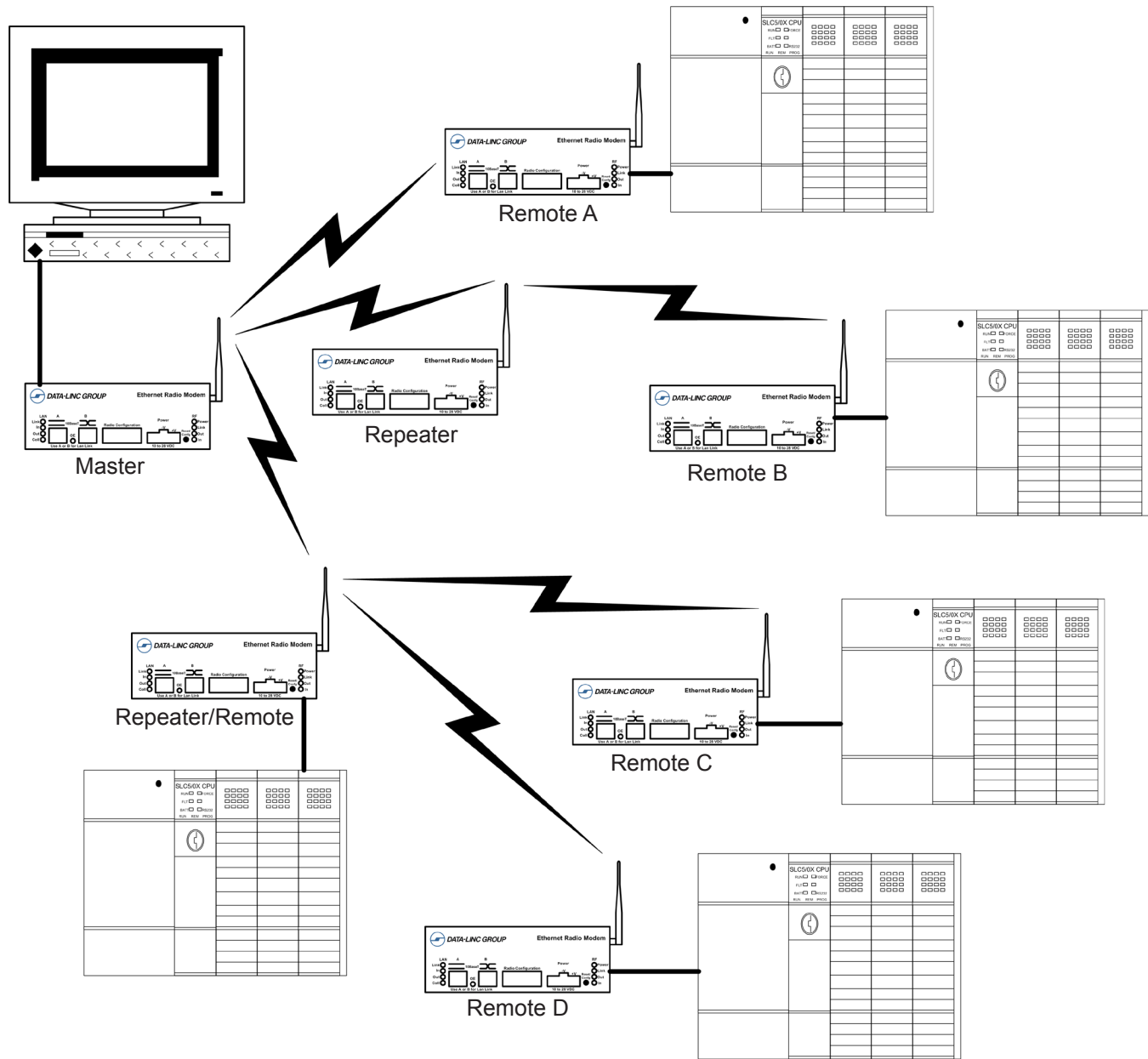
Diagram 4: Point to Point w/Repeater Example

Note: When a repeater is used the throughput is cut in half. Adding a second (or more) repeater does not further reduce the throughput, however it does increase the latency.

Diagram 5 depicts a multi-point system. In this example any data sent from the master PC is broadcast to all five remote PLCs. Remote A is connected to the Master directly. Remote B is connected via Repeater back to the Master. Remotes C and D are both connected via Repeater which is setup in Repeater/Remote mode.

Diagram 5: Point to Multi-Point Example

Technical Specifications

Power Requirements	10 to 28 VDC
Operating Power	8 Watts Max, 2 Watts Min
Operating Frequency	902-928 MHz; ISM Band (no FCC site license required)
Operating Temperature Range	-40 to 167 °F (-40 to 75 °C)
RF Data Rate	188 kbps
RF Range	Rated: 25 miles (40 km) with line-of-sight; 35 miles (56 km) with line-of-sight under optimal conditions
RF Output Power	Up to 1.0 Watt
Maximum Data Throughput	110 kbps (point to point mode)
Antenna Connector	Standard Thread Female SMA
Operating Modes	Point to Point Point to Multi-Point Repeater Repeater/Remote combined
Enclosure Material	18 Gauge Steel
Enclosure Dimensions	2.45" x 3.38" x 6.30" (6.22cm x 8.59cm x 16.0cm)
Mounting Options	2 "L" Brackets for either side, rear, top, bottom, front (panel mounting) Din Rail Bracket Available (**Optional**)
Weight	1.94 lb. (0.88kg)

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Troubleshooting

"I have two SRM6210Es, one configured as a master and the other as a remote. When they are plugged in, the LEDs indicate they are receiving power, and yet they will not connect. Why not?"

There are several reasons why this may occur:

1. The SRM6210Es are not in each other's Call Books.

2. The number of the remote is in the master's Call Book, but the master's menu is not set to call that number.

3. The master is set to Call All and a setting of 000-0000 precedes the phone number of the SRM6210E with which you are trying to communicate.

"I am able to link to a remote unit within line of sight when the SRM6210E I have is outside. However, as soon as I walk inside with it I lose the link, even if I place the radio modem by the window which faces the remote unit."

Many modern buildings use energy efficient glass that wreaks havoc on RF signals. This glass contains a metal film that is very effective in blocking all radio waves. If your situation is as described above the preferable solution is to install an antenna outdoors.

"I have several SRM6210Es set up to communicate with each other in a point-to-multi-point mode, yet they are not establishing contact."

In a multipoint system there are two critical parameters which must be set correctly to establish a communications link:

1. The remote's Call Book must contain the call book number or Network ID of the master and/or repeaters to which it will be communicating.

2. All radios must be set to run at the same RF data rate. Remote SRM6210Es must match the Masters RF data rate.

"In bench testing several SRM6210Es in a multipoint system, it appears that they are not communicating through the multipoint repeater. When all units are powered the remotes' Carrier Detect lights are on, indicating a connection, yet when I unplug the repeater those remotes set up to communicate through that repeater remain connected."

In a multipoint system a remote will attempt to communicate with any master or repeater (which looks like a master in a multipoint system) that is in its Call Book. Therefore, it may be that the remotes are communicating with the repeater when it is powered, and when it is unplugged they are establishing a link with the master. To test whether or not this is what is occurring go into the Call Book of the remotes which are set up to communicate through the repeater and remove the master's call book number. When all units are powered the remotes' Carrier Detect lights should be on, when the repeater is unplugged the remotes should lose contact and Carrier Detect should turn off.

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Technical Support

Data-Linc Group maintains a fully trained staff of service personnel who are capable of providing complete product assistance. They can provide you with technical, application, troubleshooting, spare parts and warranty assistance. Our technical staff are based in Bellevue, Washington USA and may be reached at (425) 882-2206 or e-mail support@data-linc.com

Product Warranty

Data-Linc Group warrants equipment of its own manufacture to be free from defects in material and workmanship for one year from date of shipment to original user. Data-Linc Group will replace or repair, at our option, any part found to be defective. Buyer must return any part claimed defective to Data-Linc Group, transportation prepaid.

Return Material Authorization

If a part needs to be sent to the factory for repair, contact Data-Linc Group's corporate office and request a Return Material Authorization (RMA) number. The RMA number identifies the part and the owner and must be included with the part when shipped to the factory.
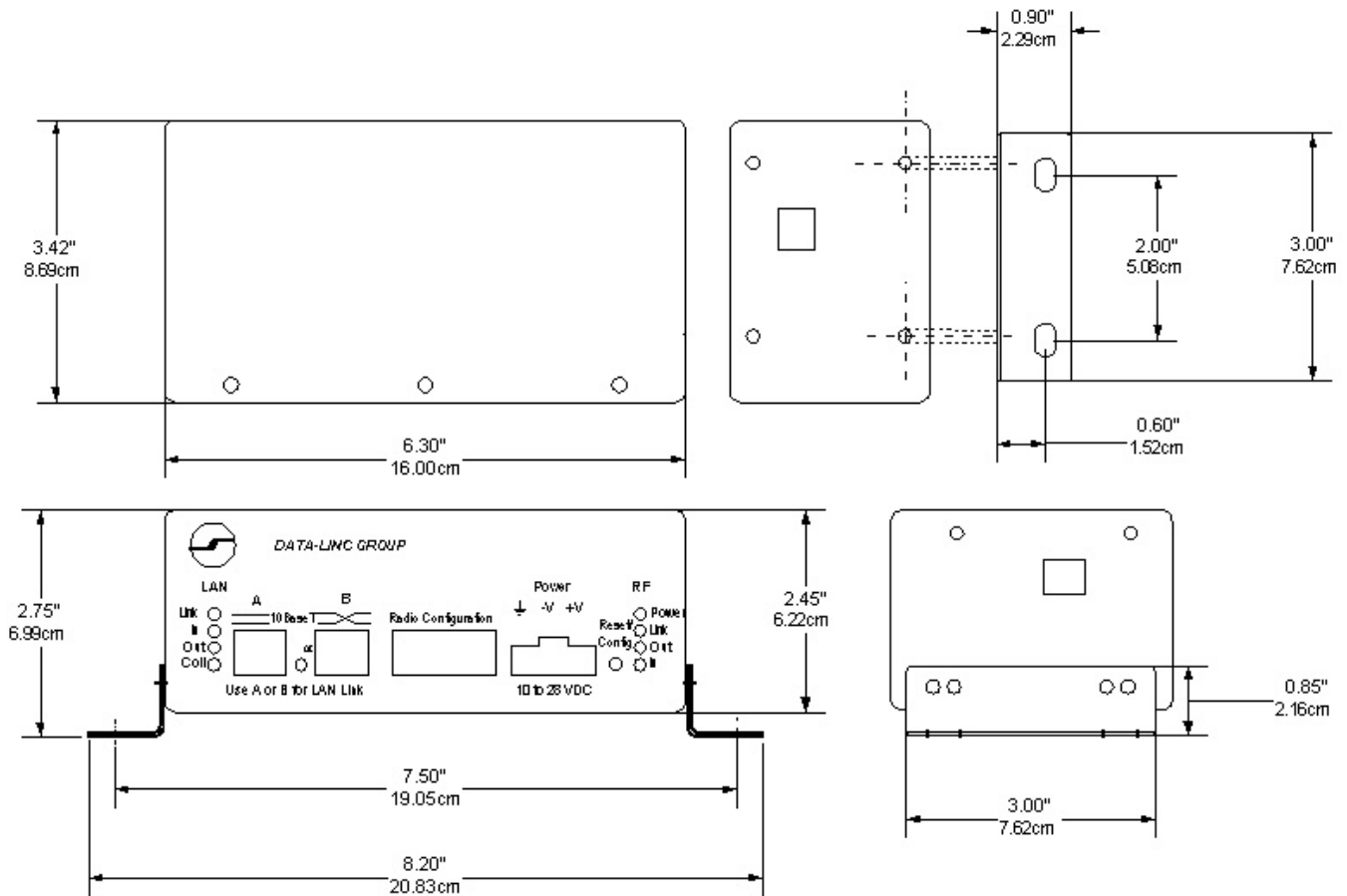
Contact Information

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DATA-LINC GROUP

Web site: www.data-linc.com

Appendix A : **Enclosure Dimensions**

Note: Enclosure Size, Mounting Holes and Locations may change without notice.
Contact Data-Linc Group (425) 882-2206 for the latest Enclosure Dimensions.

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