

User Guide

PlantLinc Family Medium-range FHSS Industrial Wireless Serial



PLR6030
900 MHz Band



PLR6130
2.4 GHz Band

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

For coverage from process to perimeter



Think DATA-LINC for the world's broadest line of industrial grade modems ~ world class worldwide

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



Notes:



DATA-LINC GROUP is a Global Encompass Partner with Rockwell Automation and a Schneider Electric Collaborative Alliance 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

The PLR6030/6130 serial radio modem is a high performance wireless radio modem designed for heavy-duty industrial data communications in the 900MHz (6030) or 2.4GHz (6130) license-free bands. It employs advanced spread spectrum frequency hopping and error correction technology to achieve very reliable, noise and interference immune operation. A high data RF rate of 153Kbps and superior sensitivity provide ultra reliable data integrity at data rates from 1200 to 230.4K baud. Full duplex operation at data rates up to 57.6K baud provide the fast response times needed for polling communications. It also meets the demands of the latest security needs offering 256-bit AES encryption standard on both models.

The PLR6030 has a range of up to 5 miles (8 km) (PLR6130 - 2 miles) This can also be extended further with repeaters or higher gain antennas. The modem 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 multi-point operation with a 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. External antennas can be used with up to two hundred feet of coax. This provides a boost in signal strength and decreases induced noise levels. With external antennas, radio modems can be located inside buildings or metallic enclosures.

The modems will operate in virtually any environment where RS232 or 485 data communications are needed. The transceivers RS232 interface is a standard DB9-F connector that is configured for Data Communications Equipment (DCE) operation. The serial port will connect with a straight through RS232 cable to a device configured for Data Terminal Equipment (DTE) operation. The RS485 interface is a 2 position pluggable terminal block, ideal for quick and easy connection to your other equipment.

Data Communication Basics

The PLR6030/6130 can be configured as either a Master, Repeater, or a Remote. Data being received by the Master's port will be sent out to all Remotes in the network and any data being received by the Remotes will be sent out to the Master's port. It is worth noting that Remotes cannot communicate with Remotes, so data being received by one Remote cannot be seen by another. When Repeaters are involved, they can be either passive or active. When passive, the serial ports are not active. When active, the Repeater will also double as a Remote node in your network. Note that in this active mode a Repeater will pass only data from its ports to the network Master, and only data from the network Master will be seen at the Repeater's port.

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 SRM 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 PLR6030 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.

The PLR6130 has a maximum transmitted output power of 500 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 SRM 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).

Note: The PLR6030 and PLR6130 are lower power versions of the SRM6030 and SRM6130 respectively. While they have a lower power output, FCC rules dictate that we document the full power rating that the transmitter was tested for.

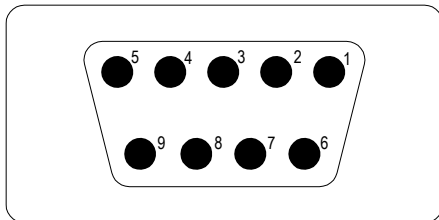
Connections

Serial Connection

For serial communications, there are three serial ports. The “Diagnostics/Configuration” port is for use with LincView OPC and for configuration. This port will not pass any serial data on a PLR6030/6130 network. The other two ports are the “Data” ports. They are used for data communications. The small port on the left (green connector) is for RS-485, and the DB-9 port on the right is for RS-232. Only one of these ports can be used at a time on any given modem, however both ports are tied together, so any data seen on one port is also present on the other one.

Serial Port Pinout

The “Diagnostics” and “Data” ports are DCE ports so connection from either DB-9 port to a PC is done via a standard straight-through cable.



Pin	Diagnostics/Config Port	Data Port
1	N/A	Output - CD
2	Output - Data Out	Output - Data Out
3	Input - Data In	Input - Data In
4	N/A	Input - DTR
5	Signal Ground	Signal Ground
6	Output - DSR (always high)	Output - DSR (wired to CD)
7	N/A	Input - RTS
8	N/A	Output - CTS
9	N/A	N/A

Power Connection

The PLR6030/6130s are DC powered and will accept 10 – 28 Volts DC. The connection is made via a three-position pluggable terminal block. The left most connection is for chassis ground, the center is V- (Ground) and right most connection is V+ (Positive DC Voltage).

Antenna Connection

The PLR6030/6130s antenna connection is a standard thread SMA connector. Connect either the supplied bench test antenna, or external antenna and coax (not included)

LED Indicators

There are 8 LED indicators on the PLR6030/6130.

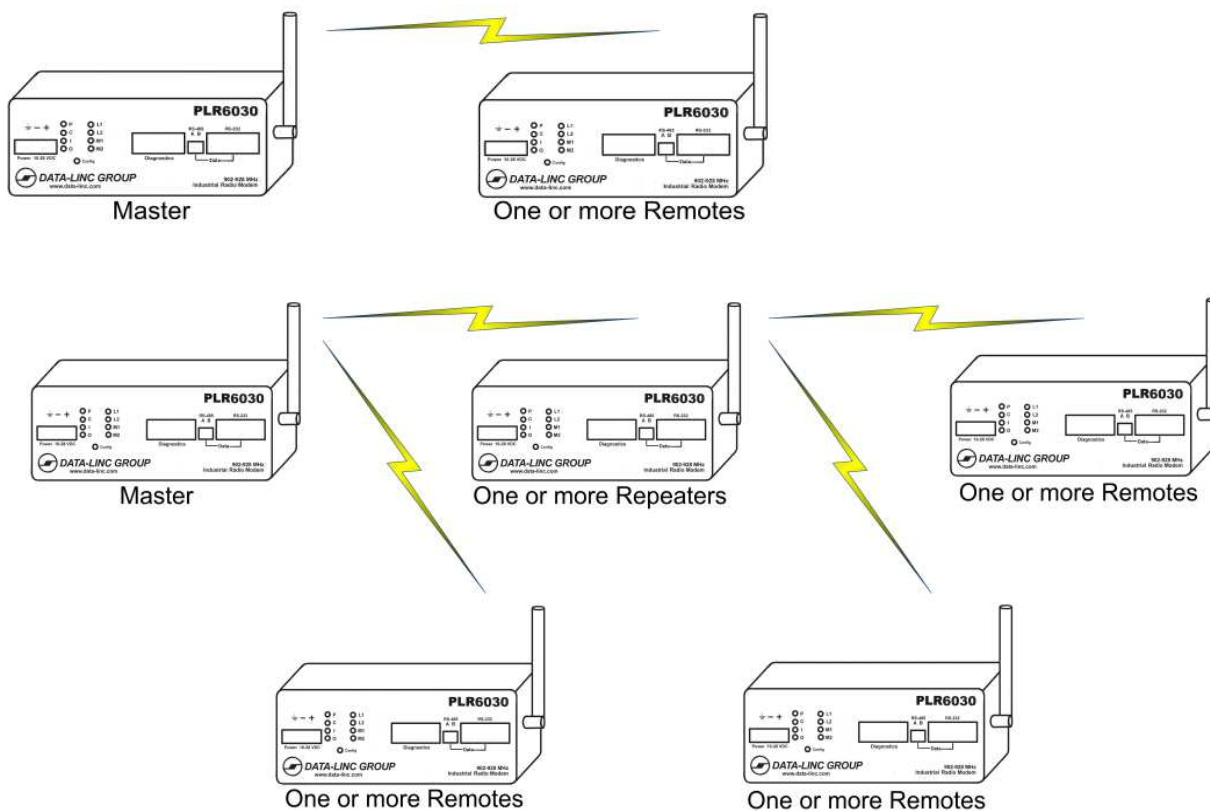
LED	Indication	Note										
"P"	Modem Power	Should be on (red) at all times										
"C"	RF Link	In all configurations this LED should be on (orange) except for Multi-Point Master where it will be off unless a Repeater or Remote is sending data to the Master.										
"I"	Data Port - Data In	Should flash (yellow) when modem is receiving data.										
"O"	Data Port - Data Out	Should flash (green) when modem is transmitting data.										
"L1"	Link Info 1 (6130 only)	<p>Will be solid/blinking/off depending on mode.</p> <table border="1"> <tbody> <tr> <td>Point to Point Master</td> <td>Solid - No connection to Remote Off w/Blinking - Connected to Remote</td> </tr> <tr> <td>Point to Point Remote</td> <td>Slow Blinking - No connection to Master Off w/Blinking - Connected to Master</td> </tr> <tr> <td>Point to MultiPoint Master</td> <td>Intermittent Blinking - Data from a Remote to Master is received.</td> </tr> <tr> <td>Point to MultiPoint Remote</td> <td>Solid - Good connection to Master (or Repeater) Intermittent Blinking - Connection is weak Slow Blinking - No connection to Master or Repeater</td> </tr> <tr> <td>Point to MultiPoint Repeater</td> <td>Same as P-MP Remote</td> </tr> </tbody> </table>	Point to Point Master	Solid - No connection to Remote Off w/Blinking - Connected to Remote	Point to Point Remote	Slow Blinking - No connection to Master Off w/Blinking - Connected to Master	Point to MultiPoint Master	Intermittent Blinking - Data from a Remote to Master is received.	Point to MultiPoint Remote	Solid - Good connection to Master (or Repeater) Intermittent Blinking - Connection is weak Slow Blinking - No connection to Master or Repeater	Point to MultiPoint Repeater	Same as P-MP Remote
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Point to MultiPoint Repeater	Same as P-MP Remote											
"L2"	Link Info 2 (6130 only)	Will be lit when modem is in configuration mode (no data will be passed if modem is in configuration mode).										
"M1"	Mode 1	Not applicable for standard use										
"M2"	Mode 2	Not applicable for standard use										

PLR6030/6130 Configuration

Modem Configuration Types

All PLR6030/6130 radio networks will have one Master radio, at least one Remote and may or may not have repeaters. All Modems can be configured as a Master, Remote or Repeater.

When configuring a network, it is important to note that Remotes are configured to talk to Masters or Repeaters. When using "Network ID" without Repeaters, nothing more than setting all modems in a network to the same Network ID is required. If Repeaters are being used, Network ID must also be accompanied by Subnet ID in order to dictate a Remotes path to the Master, whether it be directly to the Master or by way of a Repeater. When using "Radio Call Book" without Repeaters, all Remotes must have the Call Book number of the Master in their call books. When using Repeaters, Remotes must have the Call Book of the device they are directly connecting to in their call books. Remotes connecting to a Repeater will have that Repeater's Call Book entered and Remotes connecting to the Master will have the Masters Call Book entered. Repeaters can also be directed to connect to other repeaters in the same way.



The above figures show 4 different modem configurations types.

1. Master
2. Repeater (Connecting to Master)
3. Remote (Connecting to Master)
4. Remote (Connection to Repeater)

The configuration for these 4 configuration types will be shown on the following pages.

If your network is going to use Network ID (recommended) and repeaters see the "Adding Repeaters" in **Appendix B**

The PLR6030/6130 can be configured via the provided Config-Linc™ software program (recommended) or with a terminal program thru the “Diagnostic/Configuration” port.

Terminal Configuration

The modem setting can be changed with a terminal program such as Hyperterminal or others. The parameters are divided into 5 categories:

- Operation Mode
- Baud Rate
- Call Book
- Radio Parameters
- MultiPoint Parameters

To access the terminal configuration, connect to PC (Baud rate 19200) and press the “Config” button on the front of the modem.

Config-Linc 2.0 Configuration

Config-Linc™ is a utility program used to configure the PLR6030/6130 radio modem as well as SRM6030/6130's and some version of SRM6000's and SRM6100's. It runs from a PC; however it does not need to be installed on the PC. Instead, all that is needed is to copy the file from the supplied CD or Memory stick to a known location on the PC, click on the file, and the program will start and be ready to use. This User Guide will cover programming using Config-Linc.

Note: Config-Linc 2.0 may not interface with some older version of the SRM6000/6100's. If you are adding PLR6030/6130's to a network where “Config-Linc” will not interface with the older radios, you must use a terminal program to configure the PLR6030/6130's and make sure all of the configuration parameters match.

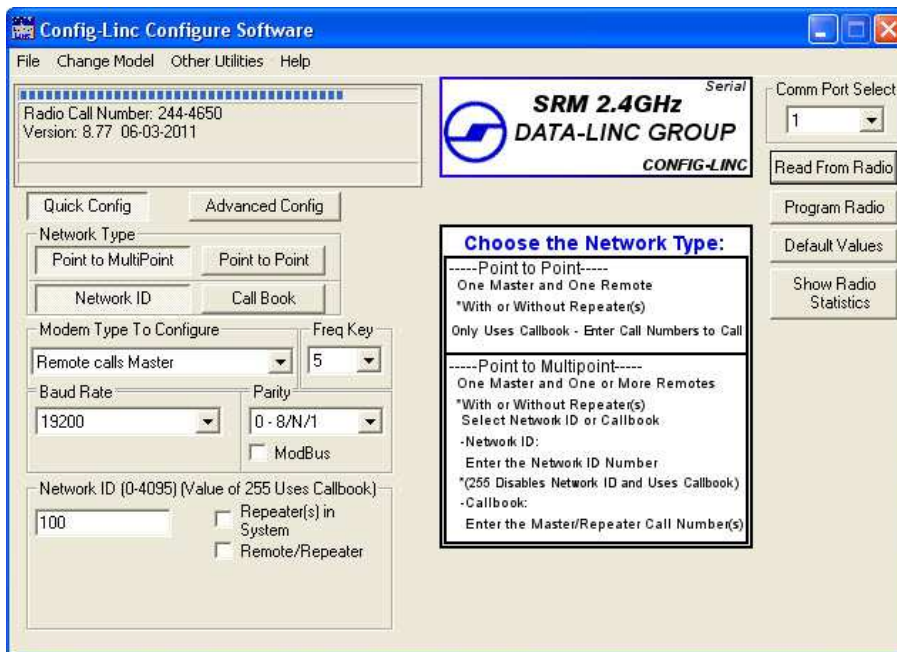
Note: Previous version of Config-Linc allowed for configuration of the PLR6030/6130 via the data port as well as the configuration port. With version 2.02 (or above) this is no longer an option and all configuration must be done through the configuration port.

Accessing the Modem

Once Config-Linc™ is on the PC that will be used for configuring the PLR6030/6130 modem, the blue config cable is connected to the “Diagnostic/Configuration” port and power is applied. Start the program.

Select the connected Comm port (usually Comm 1) from the drop down list labeled “Comm Port Select” and click the “Read From Radio” button from the list of action buttons on the right side of the window to read in the current settings. Follow the prompt to press the “Config” button when the window appears.

Config-Linc will confirm that it was able to read the settings. The modem type, call number and firmware version will now be displayed along with all the current radio settings.



Quick Config Settings

Below are the most commonly needed settings for creating a PLR6030/6130 network.

-Modem Type

You will need to set the modem's operation mode depending on what role it plays in the network. It will either be a Master, Remote, or Repeater in either a Point-to-Point or Multi-point network.

Note: Even if there are only two modems in a network, you can still set the modems up as Multi-point devices. In doing this, if you ever add Remotes to the network you will not have to change the configuration of the existing modems.

-Freq Key

The modems have 15 different "Frequency Keys". These "Keys" are different frequency algorithms that the modems use as hopping patterns. With this feature, you can have multiple networks operating in close proximity to each other while minimizing frequency interference. All modems in a given network need to have the "Freq Key" set to the same number. To do this, open the pull down box and select a number.

-Baud Rate & Parity

The port speed can be selected between 1200 and 115.2k baud. The Baud Rate and the Parity setting should match the configuration of the attached device. Note: The PLR6030/6130 has a maximum baud rate of 230.4K baud. If your application requires 230.4K baud, you must set the baud rate via a terminal program. Contact Data-Linc technical support for more information.

-Network Type

There are two different ways to set the addressing used by a PLR6030/6130 radio network. The two types are "Network ID" and "Callbook". Because Network ID is easier to set up and more flexible when adding and/or replacing modems in a network, it is the preferred method.

-Network ID

When using Network ID, all devices in a given radio network must have the same Network ID number set in the modem. If there are no Repeaters in the system there is nothing more to configure with regards to Network ID. If you are using Repeaters, you must use "SubNet ID" to define the path the remote(s) and repeater(s) use to get to the master.

Note: A Network ID setting of "255" disables the Network ID feature. If the Network ID is set to something other than "255" (between 0 and 4095) then the "Callbook" addressing scheme is disabled

-Callbook

The PLR6030/6130 has a unique "Callbook" number (xxx-xxxx). This number is a seven digit unique number that cannot be duplicated.

In a Point-to-Point network, the callbook number of the Master radio is in the Remote's callbook table, and the Remotes callbook number is in the Masters callbook table. If Repeaters are used, their callbook number would go in the "Repeater Number" location.

When using Callbook addressing in a Multi-Point network, it is important to remember that you are addressing towards the Master radio. In a network without Repeaters, the Remotes have the Master's callbook in their callbook table, and the Master has no entry.

When using Repeaters, any modem (Repeaters and/or Remotes) that are connecting to the Master will have the Master's callbook number in their table. Any modems that are connecting through Repeaters (Repeaters and/or Remotes) will have the callbook number of that Repeater in their tables.

-Repeater(s) & Remote/Repeater(s)

When configuring a network with one or more Repeaters, select the check box for "Repeater(s) in System".

When configuring a Repeater for a Multi-Point network, and that Repeater also needs to act as a Remote (the ports need to be active), select the "Remote/Repeater Mode" check box.

-Diagnostics

The PLR6030/6130 is compatible with a PC running LincView OPC diagnostic software via a standard straight thru serial cable. When setting up an PLR6030/6130 **Point to Multipoint Master** to run diagnostics, the "Diagnostics" value (Advanced Config area) needs to be set to between "1" and "60"

Note: The default value of "1" which will give a diagnostics packet to the software at every frequency hop. In large networks this might affect the overall system performance. Increasing the number of hops before a packet is delivered can help improve the performance in these situations.

See the LincView OPC User Guide on the product CD for using the LincView OPC software.

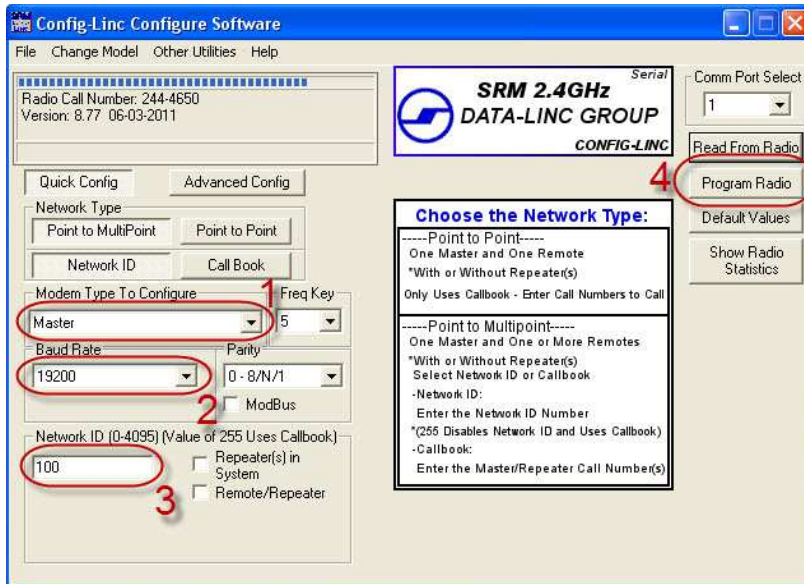
Advanced Config Settings

To gain access to the Advanced Settings, click on the "Advanced Config" button.

Note: The Advanced Settings are for experienced users. These settings have been optimized at the factory, and do not need to be changed for most applications.

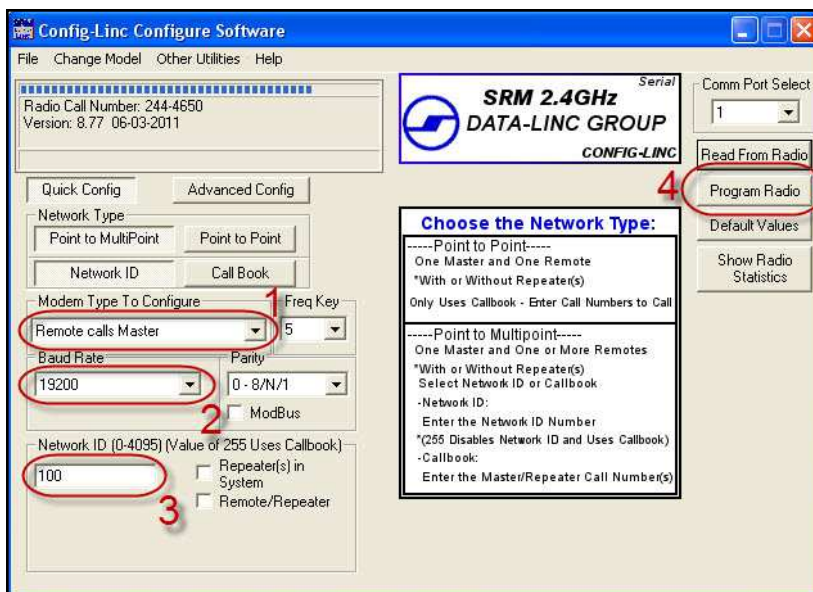
Configure a Master

1. Choose "Master" Modem Type from the drop down.
2. Select Baud Rate to match the attached device or PC from the drop down.
3. If "Network ID" is not already selected, select it and set the "Network ID" to a value in the range of 0 to 4095.
Note: Network ID value 255 must not be used.
4. Click the "Program Radio" button.



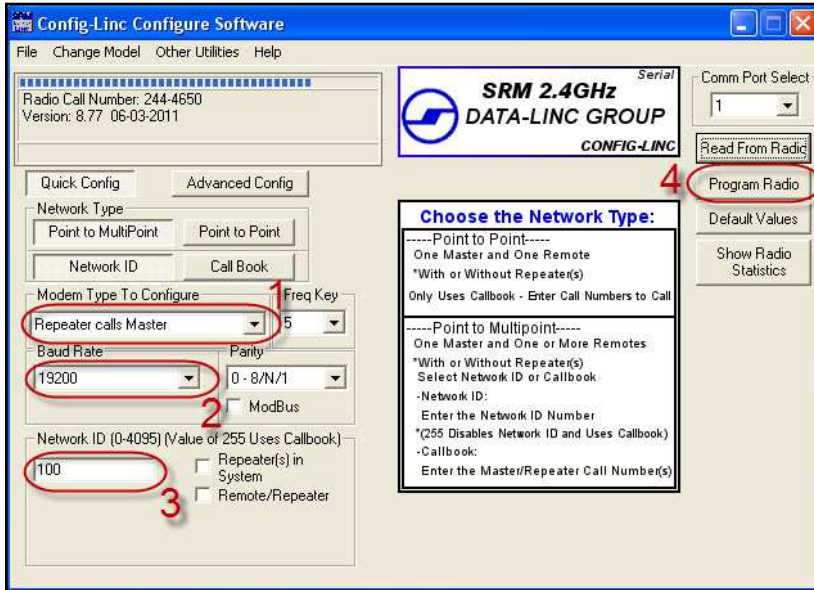
Configure a Remote (Connected to Master)

1. Choose "Remote calls Master" Modem Type from the drop down.
2. Select Baud Rate to match the attached device or PC from the drop down.
3. If "Network ID" is not already selected, select it and set the "Network ID" value to match that of the Master modem.
Note: Network ID value 255 must not be used.
4. Click the "Program Radio" button.



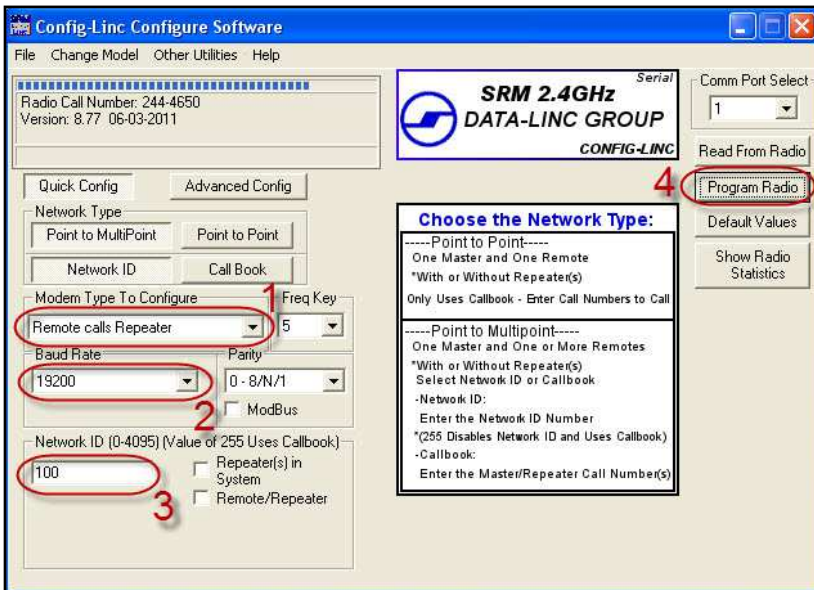
Configure a Repeater (Connected to Master)

1. Choose "Repeater calls Master" Modem Type from the drop down.
2. Select Baud Rate to match the attached device or PC from the drop down.
3. If "Network ID" is not already selected, select it and set the "Network ID" value to match that of the Master modem.
Note: Network ID value 255 must not be used.
4. Click the "Program Radio" button.



Configure a Remote (Connected to Repeater)

1. Choose "Remote calls Repeater" Modem Type from the drop down.
2. Select Baud Rate to match the attached device or PC from the drop down.
3. If "Network ID" is not already selected, select it and set the "Network ID" value to match that of the Master modem.
Note: Network ID value 255 must not be used.
4. Click the "Program Radio" button.

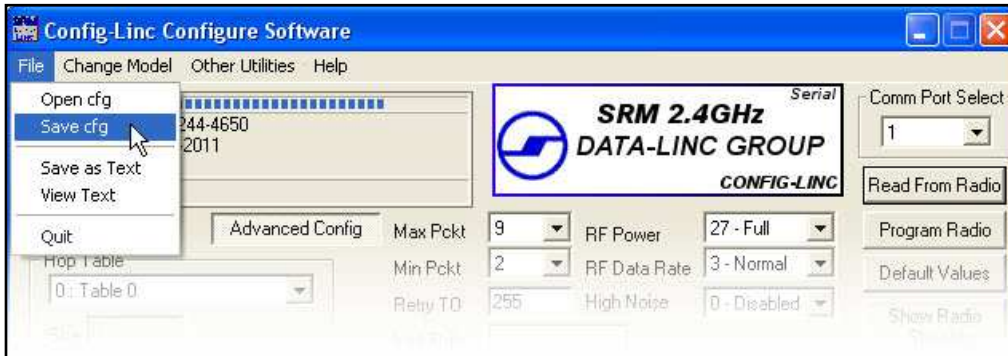


Save / Load Configuration Files

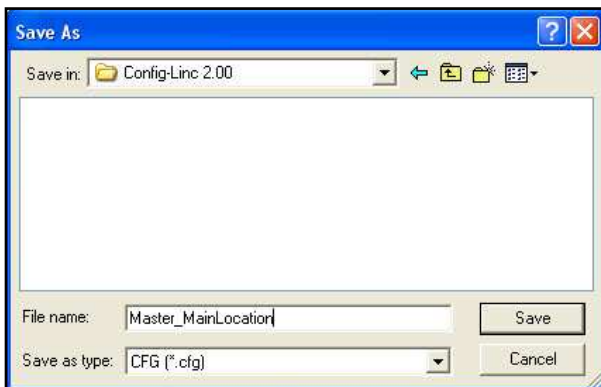
Config-Linc gives the user the option to read the configuration from a radio and save it to a file. This can be useful for configuring multiple remote to connect to the same Master or Repeater. Saved configuration files can also be used for quick deployment of replacement or expansion units.

Save

1. Once the "Read from Radio" button has been pressed, click on the "Advanced Config" button to show all parameters.
2. Select "Save cfg" from the "File" Menu in Config-Linc.



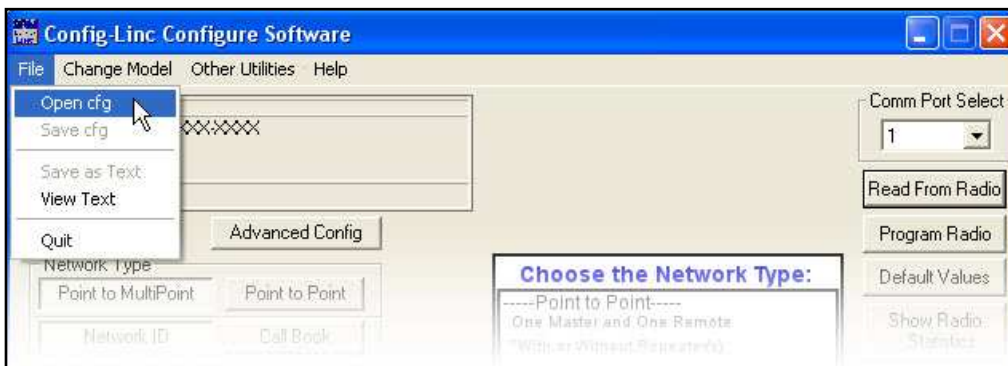
3. Enter a unique file name such as modem type or location of radio.



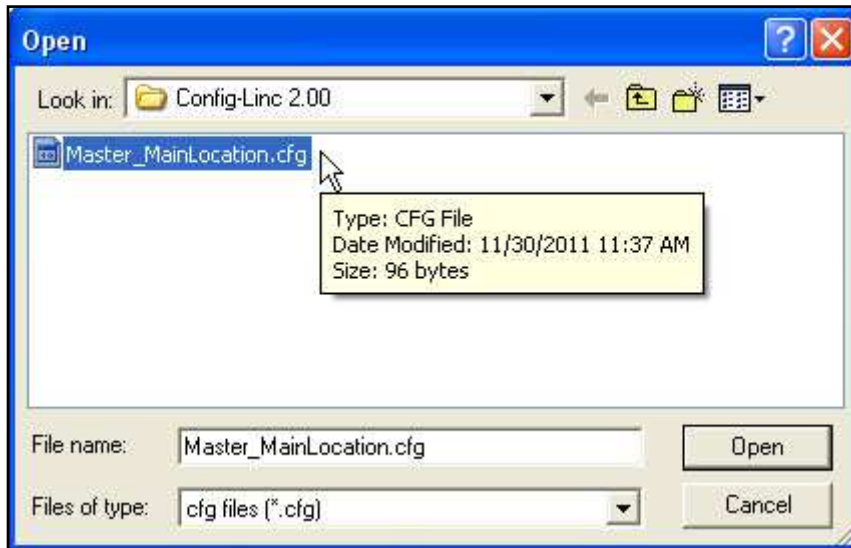
4. Click "Save"

Load

1. Select "Open cfg" from the "File" Menu in Config-Linc.



2. Select the file you wish to load into the attached modem.



3. Click "Open"
4. Follow the prompt to press the "Config" button. The software will notify you when the settings are successfully loaded.

Note: For security reasons if AES Encryption is being used in your system the key is NOT stored into the configuration file and will need to be entered using the Set Encryption tool.

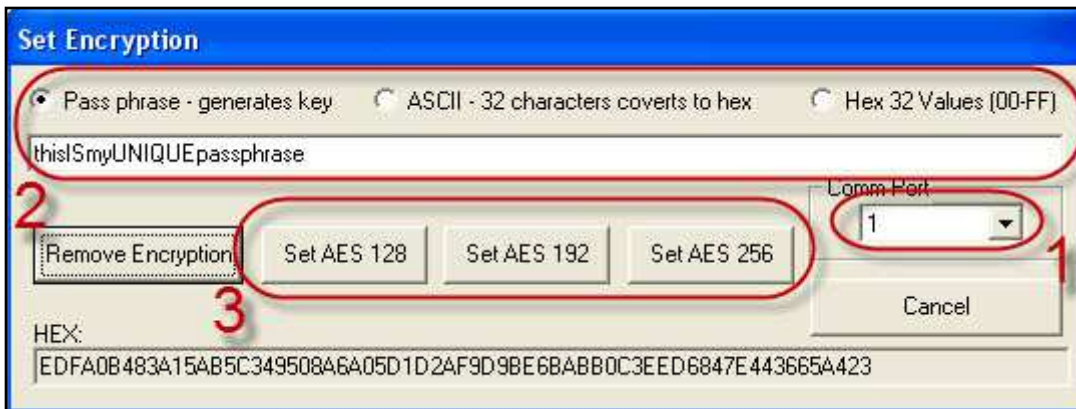
Set/Enable AES Encryption

To enable AES encryption to further enhance the security of your network, complete the following steps on all modems in your network.

Select "Set Encryption" from the "Other Utilities" Menu in Config-Linc.

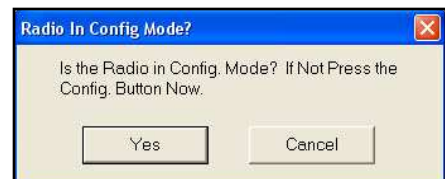


The following window will appear and there are 4 steps to complete the configuration:



1. Choose the Comm Port on the PC used to configure the modem.
2. Choose the method of generating the 32 character hex key that will be used and either enter the pass phrase if that option is selected or enter the full 32 character string.
3. Click the button of the desired level of AES encryption to set.
4. Press the "Config" button on the front of the modem when prompted.

A box will confirm that the modem was configured successfully.



Remove AES Encryption

To remove AES encryption select the "Remove Encryption" button and follow the prompts

Note: ALL modems in the network must have identical encryption settings.

Technical Specifications

	PLR6030	PLR6130
Input Voltage Range	10-28 VDC	
Power Consumption	8 Watts Max (2 Watts Min.)	
Transmitter Output Power	0.5 Watt Max (10 Steps)	250 mW Max (27 Steps)
Transmitter Modulation	2 level GFSK	
Highest Receiver Sensitivity	-105 dBm @ 10 ⁻⁴ raw BER	-102 dBm @ 10 ⁻⁴ raw BER
Operating Frequency	902-928 MHz ISM Band (No FCC site license required)	2400-2483.5 MHz ISM Band (No FCC site license required)
Operating Temperature Range	-40 - 167 F (-40 - 75 C)	
Operating Humidity	0 - 95% (non-condensing)	
RF Data Error Detect / Correction	32 bit CRC, Resend on Error	
RF Data Encryption	Substitution, Dynamic Key, AES up to 256 bit	
RF Data Rate	115.2Kbps - 153.6 Kbps	
RF Range	5 miles (8 km) with line-of-sight,	2 miles (3.2 km) with line-of-sight;
Maximum Data Throughput	115.2 KBaud (in point-to-point mode)	
Serial Connections	Application Data [Either RS-232 DB-9 Female DCE Port or RS-485 Terminal Block] Diagnostics Data [RS-232 DB-9 Female DCE Port]	
Power Connection	3 Position Pluggable Terminal Block	
Antenna Connection	Standard Thread SMA	
Operating Modes	Master, Remote, Repeater, Repeater/Remote	
Enclosure Material	18 Gauge Steel	
Enclosure Dimensions	2.45" x 3.95" x 6.75" w/o Mounting Feet	
Mounting Options	Two L Brackets for Back or Bottom mounting (DIN clip bracket available)	
Weight	1.94 lbs. (0.88 kg.)	

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 and troubleshooting and warranty assistance. Our technical staff are based in Issaquah, 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 via an RMA. Any item returned without an pre-authorized RMA may be returned to sender or disposed of at Data-Linc Group's discretion.

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) request form. Fill the form out and either E-mail or fax it back. Once the request form is received you will receive an RMA form back with instructions on returning the modem(s).

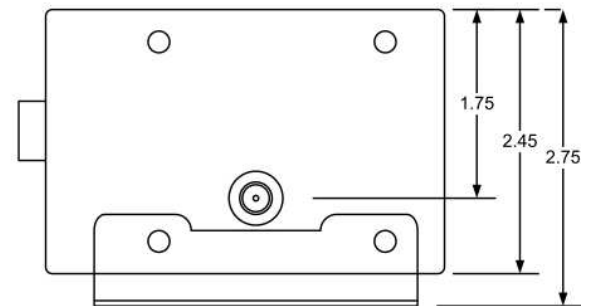
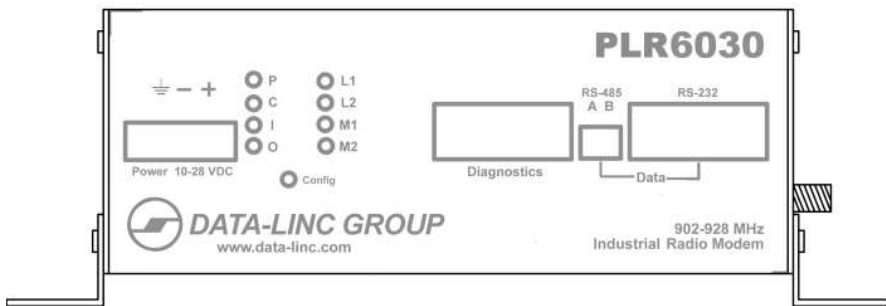
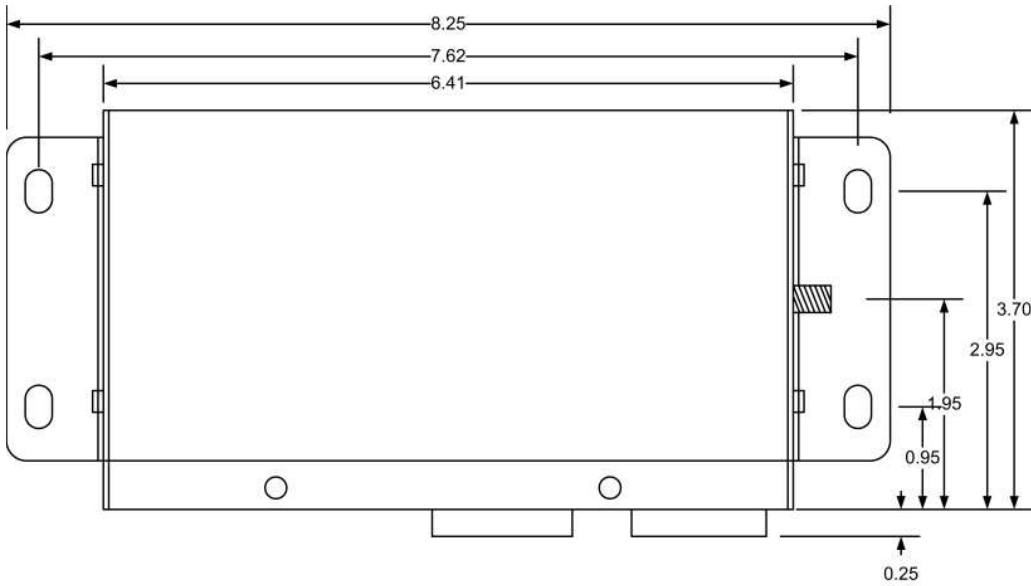
Contact Information

Corporate Office

Data-Linc Group
1125 12th AVE NW
Suite B-1
Issaquah, Washington 98027 USA

Telephone: (425) 882-2206
Fax: (425) 867-0865

E-mail: info@data-linc.com
 Web site: www.data-linc.com



Appendix B: Adding Repeaters.

When adding repeaters to an PLR6030/6130 radio network, there are some configuration parameters that need to be set in order for the network to operate correctly. This appendix addresses the needed configuration requirements.

The basics:

The PLR6030/6130 is a Frequency Hopping Spread Spectrum modem and as the name implies, the modems “hop” from one frequency to another and in the case of the SRM's this is happening around 100 times a second. Because radios can't transmit and receive at the same time, there must be a pattern where when the master is transmitting any remote is receiving and vice versa. In a network without repeaters this pattern is pretty simple, one hop time slot is where the master transmits and the remotes listen and then next slot is where a remote transmits and the master listens. When a repeater is added to the network, this hopping pattern changes to add a slot for the repeater to transmit. Repeaters have two transmit modes, one is transmitting to the master and the other is transmitting to remotes. When transmitting to the master, the master will decide which repeater gets the connection and the other repeaters will buffer their data until it's their turn. However when transmitting to remotes, there is no method to do this and because all repeaters in a network will be transmitting at the same time, it is possible that they will be cancelling each other out. Because of this, there are special configuration settings that must be used in networks with multiple repeaters. These settings allow for multiple repeaters to be transmitting at the same time but using different frequencies.

Note: When adding a repeater to any multipoint network you must set the “Number of Repeaters” to “1” in all radios in the network regardless if they are going through the repeater or not. The “Number of Repeaters” is an “on/off” setting with “0” being off and “1” being on so even if there is more than one repeater a setting of “1” is all that's required.

“Repeater Frequency”

The configuration parameter “Repeater Frequency” is the parameters that allows for multiple repeaters to transmit at the same time using different frequencies. In a network with none or one repeater, the “Frequency Key” (the hopping sequence the radios use) is the same in all radios in the network and the parameter “Repeater Frequency” is set to “0”. When there are two or more repeaters, one of the repeaters can use the same “Frequency Key” as the master but the others must use their own “Frequency Key” so that they will transmit on a different frequency when needed. However simply setting the second (or more) repeater to a different “Frequency Key” won't work because it will never be synchronized with the master or remote(s). Setting the parameter “Repeater Frequency” to “1”, tells said repeater that when it is receiving from and transmitting to its master (a repeater can have another repeater as its master) that it must use the “Frequency Key” of that master but when it is transmitting to or receiving from a remote it uses the “Frequency Key” it is configured to use. It must also be noted that any remote using a repeater that has a “Frequency Key” that is different than the network master must also use the same “Frequency Key” as the repeater. One way to think about it is in a given network, the master first repeater and any remote connected to either the master or first repeater, are the primary network. The second, third (or more) repeaters and any remotes using them are sub-networks using different “Frequency Keys”.

“Subnet ID”

“Subnet ID” is an addressing method that allows for you to dictate the path back to a network master. It uses two configuration parameters “TX” and “RX”. The “TX” setting defines what subnet ID a radio will be transmitting and “RX” defines what subnet ID a radio will be receiving or connecting to. When a network is using “Subnet ID” the master and repeater(s) add to its RF packet information about its subnet ID “TX” setting. A radio using “Subnet ID” will also only accept RF data packets that have a “TX” setting that matches its “RX” setting (with some exceptions). With this, let's look at a network configuration setup with one repeater and two remotes with one of the remotes connecting through the repeater and the other going directly to the master.

Master: The master will always transmit a "0" so its "TX" should be set to "0". The master also will receive any data packet that is a response to a data packet that it transmitted so its "RX" is set to "F" (disabled).

Repeater: The repeater needs to connect to the master so its "RX" setting must be "0" because the master is transmitting a "0". The repeaters "TX" setting is set to "1" so that any remote and/or other repeater(s) needing to connect to it can identify it separately from the master which is transmitting "0".

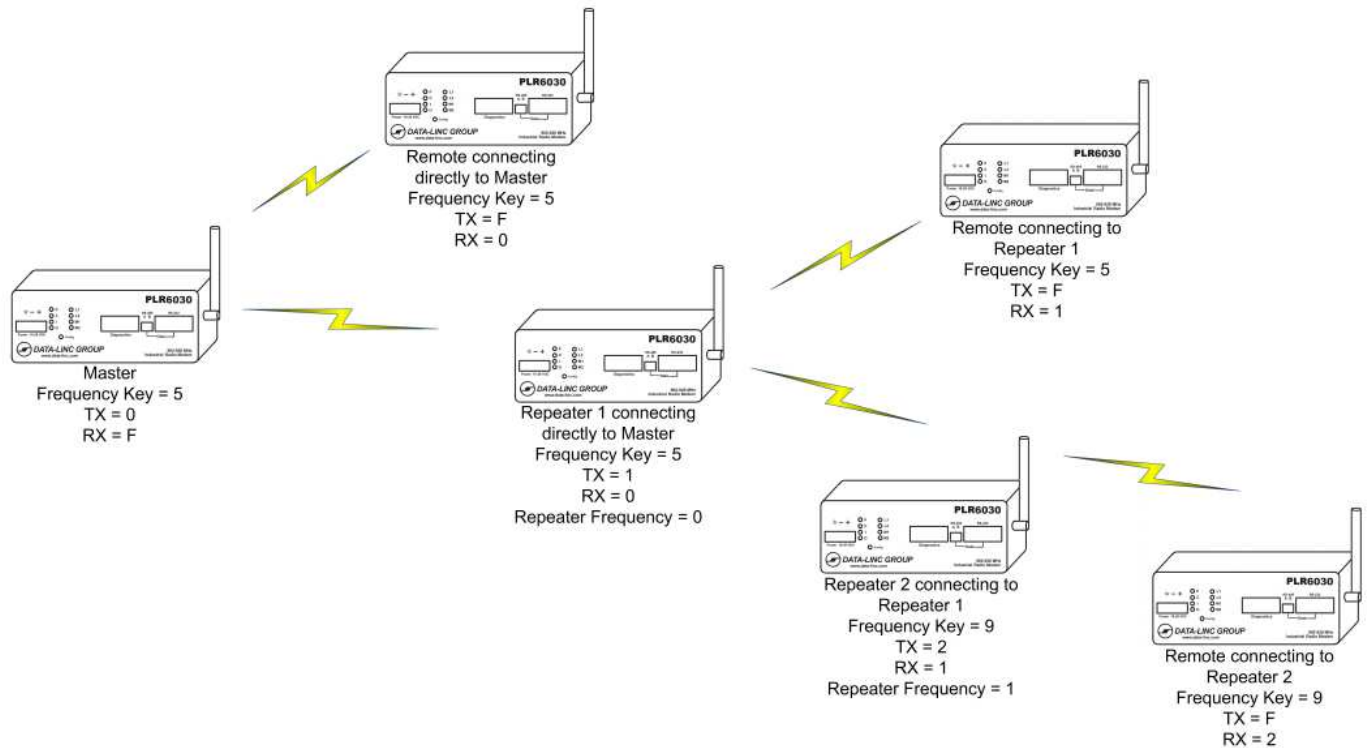
Remotes: The first remote will be connecting back to the master directly so its "RX" is set to "0" because the master is transmitting a "0". All remotes will transmit back to whomever it is receiving from so a remote's "TX" setting is always set to "F" (disabled). The second remote needs to connect to the repeater so its "RX" is set to "1" because the repeater is transmitting a "1".

Now let's add a second repeater with a remote to the network and have it connect to the first repeater.

Second Repeater: This repeater is connecting to the first repeater so its "RX" needs to be set to "1" because the first repeater is transmitting a "1". This repeaters "TX" setting will be "2".

Third remote: This remotes "RX" setting will be "2" so that it will connect to the second repeater which is transmitting a "2".

The following diagram illustrates the above network and includes the "Frequency Key" settings including the "Repeater Frequency" in the repeaters.



Note: All modems in the above network have the same Network ID setting.