DATA-LINC GROUP

USER GUIDE

INDUSTRIAL DATA COMMUNICATIONS

CIX6400
CIX6500

Communication Interface I/O Extender

Rockwell Automation
Encompass™
Product Partner
Global

Siemens
PRODUCT PARTNER

Accompany Program
GE Fanuc

NATIONAL INSTRUMENTS™

Schneider Electric
Building a New Electric World

OMRON

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

Notes:

Table of Contents

Warnings / FCC

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 CIX 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 CIX6400 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 CIX6500 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 CIX 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).

Introduction

Data-Linc Group (DLG) has prepared this user guide for use by customers as a guide to the proper installation, operation, and maintenance of a Communication Interface Extender (CIX) system.

This includes the following DLG products:

CIX6400/M – Master Ethernet and Serial interface for Wireless I/O Remotes (CIX6400/R) (1 Watt, 900 MHz FHSS)

CIX6400/R – Wireless I/O Remote with 8 discrete inputs, 8 discrete outputs, 4 analog inputs, and 4 analog outputs (1 Watt, 900 MHz FHSS)

CIX6500/M – Master Ethernet and Serial interface for Wireless I/O Remotes (CIX6500/R) (500mW, 2.4 GHz FHSS)

CIX6500/R – Wireless I/O Remote with 8 discrete inputs, 8 discrete outputs, 4 analog inputs, and 4 analog outputs (500mW, 2.4 GHz FHSS)

CIX/EXR – Wired I/O Remote with 8 discrete inputs, 8 discrete outputs, 4 analog inputs, and 4 analog outputs. This unit connects to either the CIX6400/R or CIX6500/R via RS-232 or RS-485. (No Radio)

The CIX is a cost effective and easy-to-implement Ethernet and serial to wireless I/O extension. The CIX system is designed to provide wireless communication where wire lengths are too long, too costly or not possible and integrate the conversion from analog and discrete to register values that can be accessed using Ethernet/IP and DF1 Serial or ModBus/TCP and ModBus RTU to reduce the need for additional equipment at each remote location.

Each system must have one master and at least one remote, but can have up to 16 Remotes. Each CIX Remote unit provides 8 discrete inputs, 8 discrete outputs, 4 analog inputs and 4 analog outputs. Discrete inputs are self-sensing dry contact. Discrete outputs are open collector common emitter (sinking) to drive a relay, and the 12 bit resolution analogs can be configured for 0-20 mA, 4-20 mA or 0-10 VDC. The CIX/M unit comes standard with a diagnostics port capable of utilizing LincView™ OPC RF network diagnostics and management software tool.

If the system needs to expand or change, these units are capable of being easily reconfigured in the field and have access to the radio setup parameters. The master units are configured using Windows© software or web browser through an Ethernet connection. The remote units are configured using Windows© software through a straight through Serial connection.

The wireless communication is accomplished using radio transceivers. A unity gain whip antenna is supplied with each radio unit for test purposes.

Note: These transceivers are "line of sight" transceivers, so line of sight is required for communications. In some instances, depending on distance and obstruction, line of sight may not be necessary, but high latency or poor communications could result. If line of sight does not exist or the units are to be mounted into grounded metal enclosures, an external
antenna may be needed. If external antennas were not purchased with this equipment, contact Data-Linc Group for information.

Requirements

CIX/M Requirements

Power
10-28 VDC

Ethernet
1 RJ45 - Straight through 10BaseT connection
1 RJ45 - Crossover 10BaseT connection

Diagnostics Port
DB9 female RS232 port for running radio diagnostics

EX-Linc Port
Shared DB9 female RS232 and 2-pin terminal RS485 port for full duplex DF1 Serial or Slave ModBus RTU connection.

RF Antenna Connection
SMA antenna or coax connection.

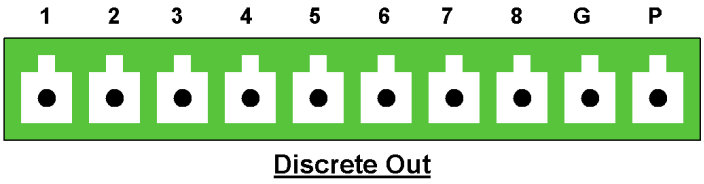
CIX/R Requirements

Power
12-28 VDC

Discrete Operation

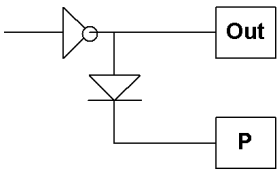
Outputs
The discrete outputs are bipolar current-sink Darlington output drivers. The outputs are designed to operate the coil of a relay (typically a 12V or 24V relay coil). The outputs of the units cannot directly drive a relay. An external power supply must be used to provide DC power to any relays. The outputs are rated to 200mA each, but at 200mA not all the channels can be used simultaneously, only 4 channels should be used simultaneously if 200mA are needed to drive each of the relay coils. All 8 channels can be used simultaneously with 100mA or less current sink per channel.

If driving inductive loads, place a voltage suppression diode across the relay coil.

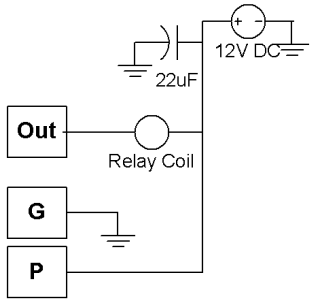


Discrete Out

Internal connection



Typical Connection



Inputs

Detect a contact closure or short to ground. The inputs do not detect voltage.

Analog Operation

Outputs

4-20mA or 0-10V DC output transmitters.

For producing a 0-10VDC analog signal a dipswitch and a 500 ohm resister is provided for each analog output. For 0-10VDC the connected unit expects the unit to have high input impedance to avoid loading the outputs.

Note: To use the 0-10VDC, the channel must be configured for to 0-20mA operation.

Inputs

Accepts a 4-20mA current or 0-10 VDC voltage.

Note: All connections share a common ground connection labeled "G".

EX-Linc Port

Shared DB9 female RS232 and 2-pin terminal RS485 port for configuration of the I/O and expansion of I/O with a CIX/EXR unit

Diagnostics Port

DB9 female RS232 port for configuration of the radio

RF Connections

SMA antenna or coax connection for use of external omni or yagi antennas

Features

CIX/M Features

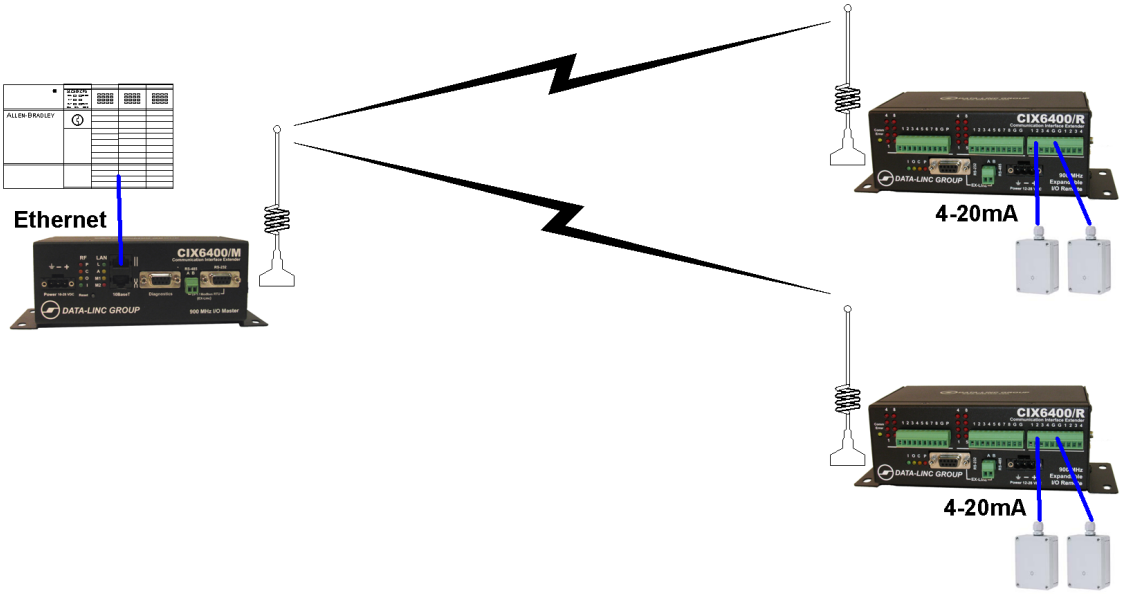
•Wireless extension of discrete and analog values converted to register values (count values)
•Configurable for either Ethernet/IP and DF1 full duplex or Modbus/TCP and Modbus RTU for data access
•Radio diagnostics port for RF network statistics

CIX/R Features

•Wireless extension of discrete inputs to a register or coil.
•Failure condition of outputs settable to "off", "on" or "hold last value".
•Wireless extension of analog inputs to register values (count values)
•Failure condition of outputs settable to "hold last value" or a count value
•LEDs for power, data transmit, data receive, RF Carrier Detect, Comm Error, discrete input and output channel status.
•Operating temperature -40 °F to 150 °F (-40 °C to 65 °C).
•RS232 and RS485 Expansion port and I/O configuration port
•RS232 radio configuration port

Applications

The CIX are designed for point-to-point or point-to-multipoint wireless extension of wired sensors or input and output controls. The system consists of one master unit and at least one remote unit, but can have up to 16 remotes. The master unit stores the recorded values from the remote unit(s) in registers, the remotes are continuously polled for updated values and to set the output to the register value set in the master. The CIX/R units have 4 analog inputs and outputs these channels are addressed in the master for the specific remote.



Installation

Unpacking the Box

- •CIX6400/CIX6500 Master or Remote
- •Cat5 Ethernet Cable (Master)
- •Test Antenna
- •120 VAC Wall Transformer (US Power Connector)
- •Blue Config Cable (Remote)
- •Quick Start and Software/User Guide CD

The equipment was carefully packaged to prevent shipping damage. It should be free from any defect, electrical or mechanical, and in good operating condition. If your package contents are damaged or missing, please contact your place of purchase immediately.

Hardware Overview

CIX/M unit

Front Panel

- •3 pin terminal power connector (F-Ground, Negative, Positive)(10-28VDC)
- •RF indication LEDs
  - P – Unit Power, always on with power present
  - C – RF Carrier, flashes with received responses from the remotes
  - O – RF Data Out, flashes on polls
  - I – RF Data In, flashes on polled responses
- •LAN indication LEDs
  - L – LAN link, should be on solid with link Link
  - A – LAN activity,
  - M1 – No Response for remote error
  - M2 – Status
- •10BaseT port (Straight Through or Crossed Connection)
- •Diagnostics port (RS-232 DB9 for RF diagnaostics)
- •DF1/Modbus RTU (EX-Linc) (Shared RS-485 and RS-232 port for Serial Communications)
- •Reset Button (Button to reset the unit to default on power-up)

Side Panel

- •Antenna Connector with standard thread SMA connector

CIX/R unit

Front Panel

- •Comms Error LED (normally OFF)
- •8 Discrete open collector outputs (sinking) with pluggable connector with LED indicators (1-8)
- •8 Discrete inputs, self-sensing with pluggable connector with LED indicators (1-8)
- •4 Analog passive inputs with shared pluggable connector
- •4 Analog powered outputs with shared pluggable connector
- •Indicator LEDs
  - I – Data out of the radio(into the I/O), normally flashing from polled messages from the Master
  - O – Data in the radio(out of the I/O), normally flashing with polled response
  - C – RF Carrier, should always be on for the remotes
  - P – Power, should be on if power is present
- •EX-Linc port, Shared RS-485 and RS-232 port for configuring the CIX I/O module.
- •3 pin terminal power connector (F-Ground, Negative, Positive) (12-28VDC)

Side Panel (Right

- •Antenna SMA connector with standard thread SMA connector

Side Panel (left)

- •Pin hole to Access Pushbutton.
- •RS232 Radio Configuration/Diagnostics Port

Getting Started

Setup

The system is setup with one CIX/M unit connected to up to 16 CIX/R units. Each CIX/R unit is uniquely addressed and polled by the CIX/M unit; the polled values are stores in the CIX/M registers for access using Ethernet or Serial protocols. The Protocols supported are Ethernet/IP and DF1 full duplex serial or Modbus/TCP and Modbus RTU using the RJ45 Ethernet connector or DB9 Serial port.

CIX/M Configuration

The CIX/M unit is configured using the CIX-Linc Utility. The CIX-Linc Utility runs on a Windows© PC and uses UDP Ethernet packets to configure the units.

•Launch the CIX-Linc Utility

•Connect the CIX/M to the network port of the computer running the configuration software.

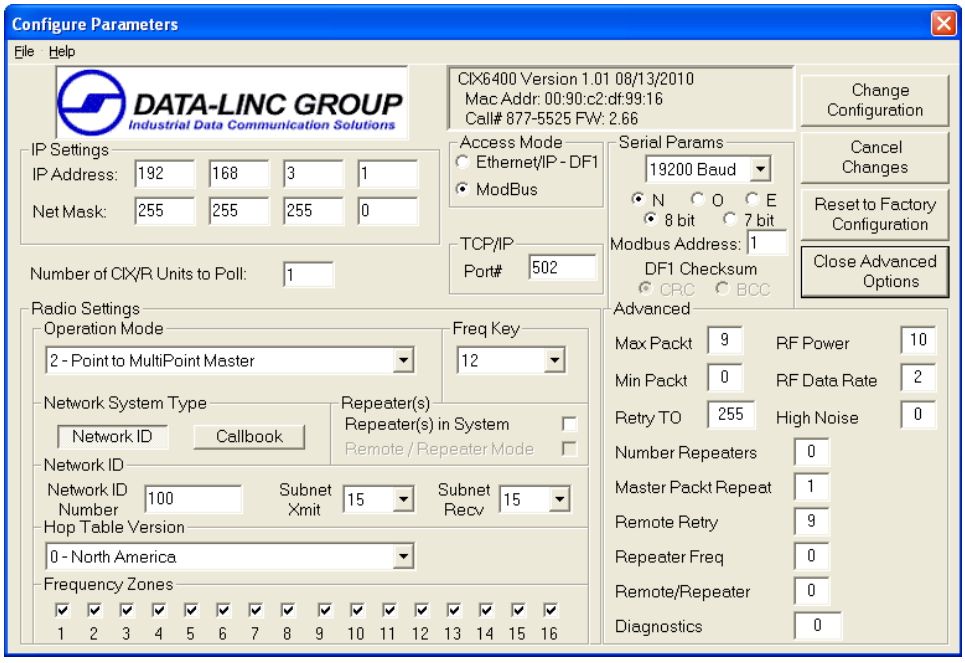
•Click the "Ethernet Locate" button to find the CIX/M unit(s).

Note: If multiple devices are found use the MAC address or call number to identify the unit.

•When the search for units is complete or your unit has been found click the "Configure" (or "Radio Statistics" to view the current radio statistics).

•If more than one unit was located, select the unit to configure and enter the password for the unit.
The default password is: default

•Click the "OK" button to continue to the configure parameter page.



On this page are the parameters that are settable or changeable for the network settings and radio settings.

Below is a description of each changeable option:

•IP Settings:
IP Address: The IP address the unit is to use on the network.
Net Mask: The Subnet Mask to use for the network.

•Number of CIX/R Units to Poll: Sets the number of CIX/R unit(s) the CIX/M will poll to acquire data from.
Available Options: (Default is 1) A setting of "1" thru "16" is the number of CIX/R units in the system.

•Radio Settings
Operation Mode:The radio supports a few different operation modes, for the CIX/M units this option should always be set to either (0 – Point to Point Master) or (2 – Point to Multipoint Master). To set the operation mode, open the pull down box and select the operation mode for the unit to configure.

Note: Even if there are only two modems in a network, the modems can be setup in a Multipoint configuration, so if more remotes need to be added in the future the configuration of the existing remote modem(s) will not change and the Master modem will just add to the number of remotes.

Freq Key: The radio have 15 different "Frequency Keys". These "Keys" use different frequency hopping patterns, so multiple networks operating in close proximity, will minimize the frequency interference between networks. All the modems in a given network need to have the same "Freq Key" number. To set the frequency key, open the pull down box and select the number (0-14) to use for the unit to configure.

Network System Type: There are two different ways to set the multipoint radio network configuration. The two types of addressing are "Network ID" and "Callbook". Network ID is the preferred method for a multipoint network because it is more flexible when adding and/or replacing modems in the network. Select the type of network by pressing the button labeled "Network ID" or "Callbook".

Selecting "Network ID":

Network ID: Network ID is an arbitrary number assigned to the network for addressing. All the units in the network must have the same Network ID to communicate. If there are Repeaters in the system, the communication paths can be directed using Subnet ID.

Subnet ID: is the sub ID for the transmission to give an address to retransmission packets. Subnet ID is 2 parts, a Transmit(Xmit) ID and a Receive(Recv) ID. The Xmit ID is only used in the Master and Repeater units, and the Recv ID is used at the Repeater and Remote unit(s). If using Subnet ID, the Master is usually set to Subnet ID Xmit = 0 and Recv = 0. Any units that are directed to connect directly with the Master will have a Subnet ID Recv of 0. If the unit is a Repeater then the Xmit will be the rebroadcast of the packet and the subsequent Remotes or Repeaters would Recv the selected Xmit ID from that Repeater. A setting of Xmit = 15 and Recv = 15 disables using Subnet IDs.

Reapeater(s) in System: If Repeaters are used in the system check the "Repeater(s) in System" checkbox.

Selecting "Callbook": Callbook uses the radio unique seven-digit number (that cannot be duplicated) for directing the communications.

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

In a Multi-Point network, the callbook number of the Master or Repeater radio is in the Remote's (or Repeater's) callbook table (depending on which unit it is directly connected with), and it is important to remember that you are addressing towards the Master radio. The Master radio callbook table has no entries in Multipoint, it broadcasts to all the units and then is filtered by the Remote or Repeater's callbook entries.

In a network without Repeaters, the Remotes have the Master's callbook in their callbook table.

In a network with Repeaters, any modem (Repeaters or Remotes) that are connecting to the Master will have the Master's callbook number in the callbook table and any modems that are connecting through Repeaters (Repeaters or Remotes) will have the callbook number of that Repeater in the callbook table.

•Access Mode: Selects the access mode for acquiring the data from the CIX/M.
Available Options: (Default is Modbus)
•Select Ethernet/IP – DF1 for read and write access using Allen Bradley© PLC message instructions. Refer to "Using Ethernet/IP – DF1" Section for more setup detailed information.
•Select Modbus for Modbus read and write access from a Modbus master. Refer to "Using Modbus" section for more detailed setup information.

•TCP/IP: Port # Sets the port to use for a Modbus/TCP connection.
Available Options: (Default is 502)
A setting of "1" thru "65536" will set the port number that the Modbus/TCP master device will connect with to access the data tables.

•Serial Params
Baud Rate: Sets the EX-Linc port baud rate. (RS-232 and RS-485)
Available Options: (Default is 19200)
1200 Baud, 2400 Baud, 4800 Baud, 9600 Baud, 19200 Baud, 38400 Baud, 115200 Baud and 57600 Baud.

Parity and Bits: Sets the parity and the bits for the EX-Linc port.
Available Options: (Default is N, 8 bit) N = No Parity, O = Odd Parity, E = Even Parity
8 bit = 8 bit word , 7 bit = 7 bit word

Modbus Address: Sets the slave modbus node address for the port, this is also used for the TCP ID.
Available Options: (Default is 1) A setting of "1" thru "247" for the Modbus Address.

DF1 Checksum: Sets the type of checksum used for the DF1 Full Duplex serial communications.
Available Options: (Default is CRC) CRC type checksum, BCC type checksum

Advanced
To show the Advanced Settings, click on the "Edit Advanced Options" button on the right hand side of the screen.

To hide the Advanced Settings, click on the "Close Advanced Options" button. A "keep changes" prompt will keep the changes if yes is clicked or revert the settings to before the Advanced settings were in the edit mode.

Note: The Advanced Settings are for experienced users, and in most cases these settings have been optimized at the factory, and do not need to be changed. See Appendix B for detailed information on these settings.

CIX/R I/O Configuration

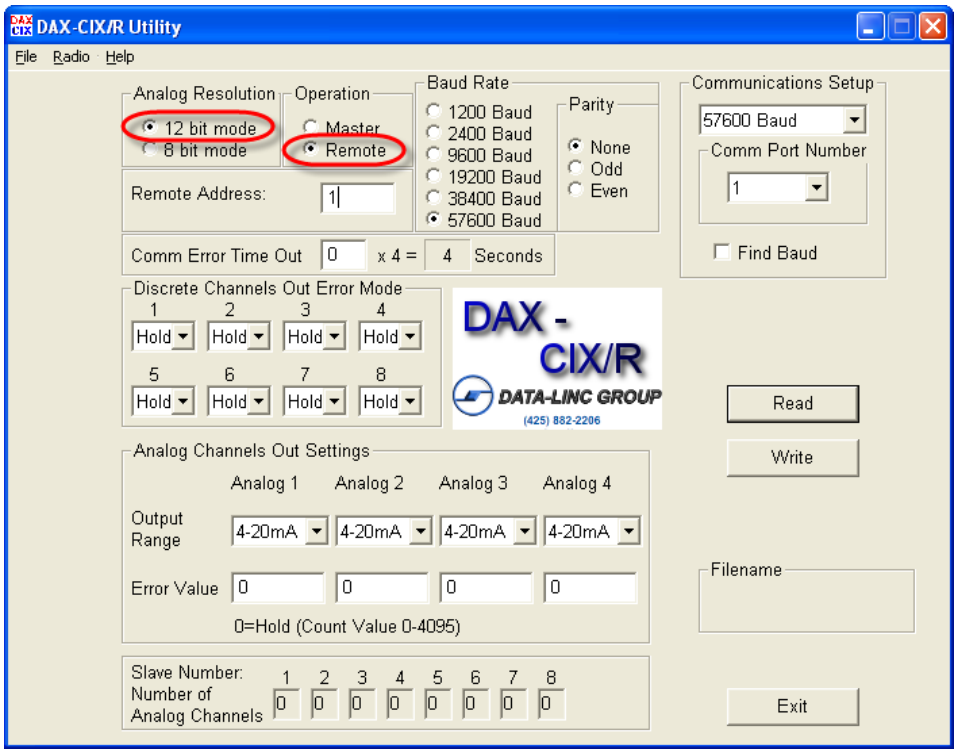
The CIX/R unit is configured using the DAX-CIX/R Utility.

•Connect a straight through serial cable to the EX-Linc port (The RS-485 port may also be used)

•Press the Configuration button
The Comm Error LED should begin to flash (1)

•On the software select the port and the baud rate (or find baud if unknown)

•Select "Read" to see the current settings



•Select "Write" to set the changes.

Note: The changes will not take affect until the power has been removed and re-applied

CIX/R will only work with the following options set:
Analog resolution: 12 bit mode
Operation: Remote – Responds to master CIX polls to update I/O points

Description of all Settings

Analog resolution:
12 bit mode (normal operation)
8 bit mode (DDAA packet format, not recommended for CIX system)

Operation (Mode):
Master – The Master unit will poll the remote DAX units
Remote – The Remote unit will respond to polls addressed to the unit.

Baud Rate: 1200 Baud, 2400 Baud, 9600 Baud, 19200 Baud, 38400 Baud, 56700 Baud (default)

Parity: None (default), Odd, Even

Note: Baud Rate and Parity MUST match the Radio Baud Rate and Parity

Number of Remotes: This is set in Master units to know how many Remote units to poll.

Remote Address: The address of the unit (1-16 (1-8 for a DAX system) and must be sequentially assigned starting at 1)

Comm Error Time Out: Time out in increments of 4 seconds times the multiplier

Discrete Channels Out Error Mode: Discrete outputs value if a Comm Error time out occurs.
Hold (default) – Hold last known good value
On – Turn on output
Off – Turn off output

Analog Channels Out Settings: The options for the operation of the Analog outputs
Output Range:

0-20mA (default) – Full 0mA to 20mA readings
4-20mA – 4mA to 20mA, 0 to 4mA values is output as 4mA

Error Value:

0 (default) – Hold last known good value
1-4095 – The value to output on Comm Error time out

CIX/R Radio Configuration

•Connect the serial cable to the Radio Diagnostics and Configuration Port (14)

•Start the ConfigLinc-S.exe software (or select the Radio option from the menu and it should start the local copy of the software)

•Select the type of radio to configure (CIX6400 = SRM6000 (900MHz), CIX6500 = SRM6100 (2.4GHz))

•Select the "Read from Radio" button to view the current configuration of the radio.
This will put you in the manual configuration mode. The options here should match the configuration for the CIX/M for a CIX/R unit (except for operation mode, it should be (3) Multipoint remote or (7) multipoint repeater). For DAX systems the configuration should still match(except for mode), but both units will be configured using the ConfigLinc-S.exe utility.

•Select the "Program Radio" button to make the changes in the radio.

With the Master Radio unit powered up the Remote units will have the "C" LED on solid, meaning a RF link exists. The "I" LED and "O" LED should be blinking rapidly from the polls from the Master unit. If not all the units are powered up then there will be pauses waiting for the response for those units.

Reading the I/O

Using Ethernet/IP – DF1

Using the Ethernet/IP – DF1 mode will put the CIX/M unit into a SLC PLC style file access mode. The unit will connect using Ethernet/IP through the LAN port and DF1 full Duplex through the EX-Linc port.

Using the serial DF1, the baud rate, parity, and checksum type must match between the PLC and the CIX/M. The CIX/M will read and write to the wireless CIX/R units to update the changes made to the register values by the PLC instruction/ messages.

Addressing the CIX/M – Ethernet/IP – DF1

Remote 1: File register N10
Remote 2: File register N11
…
Remote 16: File register N25

The words in each file register are as follows:

NXX:0 discrete inputs (LSB = 1, MSB = 8, 8 bits)
NXX:1 analog input 1
NXX:2 analog input 2
NXX:3 analog input 3
NXX:4 analog input 4
NXX:5 discrete outputs (LSB = 1, MSB = 8, 8 bits)
NXX:6 analog output 1
NXX:7 analog output 2
NXX:8 analog output 3
NXX:9 analog output 4

Using Modbus/TCP – Modbus RTU

Using the Modbus mode will put the CIX/M unit into a Modbus style access mode. The unit will connect Modbus/TCP through the LAN port and Modbus RTU through the EX-Linc port.

Using Modbus/TCP the ID number is the same as the Modbus address for the serial params.

Using the Modbus RTU, the baud rate, parity, and address must match between the connected Modbus master for a connection to be established. The CIX/M will read and write to the wireless CIX/R units to update the changes made to the Modbus addresses by the connected Modbus master device.

Addressing the CIX/M – Modbus

	Discrete Outputs	Discrete Inputs	Analog Inputs	Analog Outputs
Remote 1	00001 – 00008	10001 – 10008	30001 – 30004	40001 – 40004
Remote 2	00009 – 00016	10009 – 10016	30005 – 30008	40005 – 40008
...	...	...	...	...
Remote 16	00121 – 00128	10121 – 10128	30061 – 30064	40061 – 40064

General Remote formula where X is the CIX/R address number

Remote X

discrete output (1) = (X-1)*8+1
discrete input (1) = (X-1)*8+10001
analog input (1) = (X-1)*4+30001
analog output (1) = (X-1)*4+40001

discrete output (8) = (X)*8
discrete input (8) = (X)*8+10000
analog input (4) = (X)*4+30000
analog output (4) = (X)*4+40000

Using the Modbus mode will put the CIX/M unit into a Modbus style access mode. The unit will connect Modbus/TCP through the LAN port and Modbus RTU through the EX-Linc port.

Using Modbus/TCP the ID number is the same as the Modbus address for the serial params.

Using the Modbus RTU, the baud rate, parity, and address must match between the connected Modbus master for a connection to be established. The CIX/M will read and write to the wireless CIX/R units to update the changes made to the Modbus addresses by the connected Modbus master device.

Supported Modbus Commands:

Read Coils (Discrete Outputs) (Modbus 0x01)
Read Discrete Inputs (Modbus 0x02)
Read Holding Registers (Analog Outputs) (Modbus 0x03)
Read Input Registers (Analog Inputs) (Modbus 0x04)
Write Single Coil (Discrete Output) (Modbus 0x05)
Write Single Register (Analog Output) (Modbus 0x06)
Write Multiple Coils (Discrete Outputs) (Modbus 0x0F)
Write Multiple Registers (Analog Outputs) (Modbus 0x10)
Mask Write Register (Analog Output) (modbus 0x16)
Read/Write Multiple Registers (Analog Outputs) (Modbus 0x17)

Technical Specifications

CIX6400	CIX6500
Operating ranges **System gain**. 138 dB **Distance**. 25+ miles (40 km) LOS with omni antennas **Transmitter** **RF Output Power.** 1 W (30 dBm maximum, (10 programmable steps) **Modulation.** Frequency Hopping Spread Spectrum, GFSK **Hop Patterns.** 15 (user selectable) **Occupied Bandwidth.** 230KHz **Error Correction.** 32 bit CRC **RF Encryption.** Substitution Dynamic Key **Receiver** **Sensitivity.** -108 dBm @ 10^{-6} raw BER **Selectivity.** 40 dB @ fc ±230 KHz and 60dB @ fc ±460 KHz	**Operating ranges** **System gain**. 134 dB **Distance**. 10 miles (16 km) LOS with omni antennas **Transmitter** **RF Output Power.** 500 mW maximum, (10 programmable steps) **Modulation.** FHSS, GFSK **Hop Patterns.** 15 (user selectable) **Occupied Bandwidth.** 230KHz **Error Correction.** 32 bit CRC **RF Encryption.** Substitution Dynamic Key **Receiver** **Sensitivity.** -107 dBm @ 10^{-4} raw BER **Selectivity.** 40 dB @ fc ±230 KHz and 60dB @ fc ±460 KHz

CIX6x00/M Master

Connections
- **Antenna.** Standard thread female SMA for optional external omni directional or yagi antennas
- **Ethernet.** 2 RJ45s, 10Base-T (1 straight, 1 crossed)
- **Serial.** DB9 or RS485 2-wire
- **Power.** Detachable 3-position screw terminal block

Indicators
- **LAN.** LAN connection (L), LAN activity (A)
- **RF.** Power (P), RF Link (L), RF output (O), RF input (I)
- **Mode.** M1, M2

Power
- **Voltage.** 10-28VDC nominal
- **Current.** 160mA idle, 660mA peak on transmit

CIX6x00/R Remote

Channel Functions
- **Analog.** 0-20ma, 4-20mA or 0-10 VDC, 24VDC max. loop voltage, 12 bit resolution. Self-powered outputs.
- **Discrete Input.** Dry contact closure
- **Discrete Output.** Open collector (sink to ground), 100mA per channel, 12-24VDC

Connections
- **Antenna.** Standard thread female SMA for optional external omni directional or yagi antennas
- **I/O Discrete and Analog** Detachable screw-type terminal blocks, Wire size 12-26 AWG
- **Power.** Detachable three position screw terminal block
- **Configuration port.** Standard DB9 RS232 port
- **EX-Linc.** DB9 RS232 or RS485 2-wire

Indicators
- **General.** Power (P), Carrier Detect (C), RF output (O), RF input (I), Comm Error
- **Discrete.** Activity LED for each discrete I/O

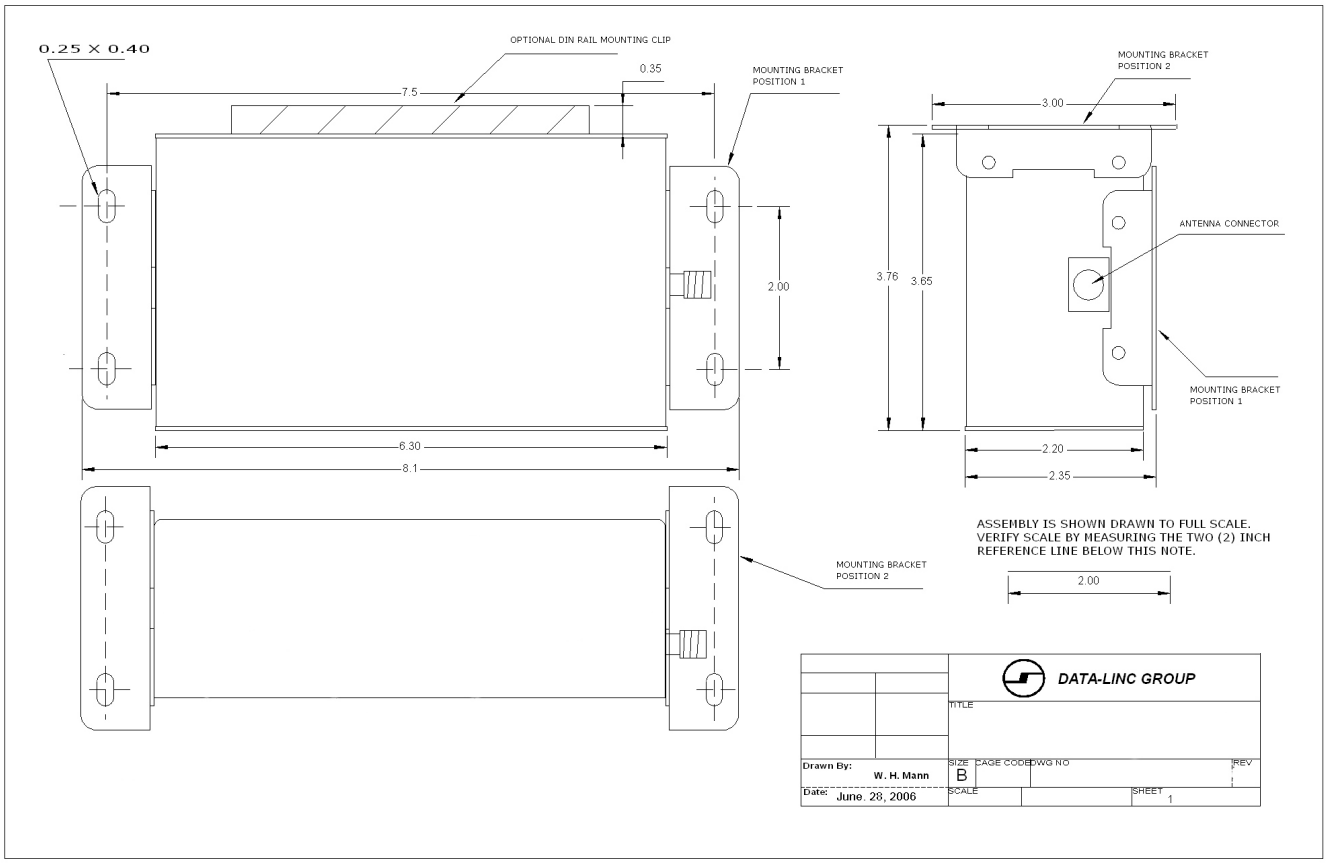
Power
- **Voltage**. 12-28VDC nominal
- **Current**. 160mA idle, 660mA peak on transmit

Operating Environment
- **Temperature**. -40 to 167°F (-40 to 75°C)
- **Humidity**. 0 to 95% non-condensing humidity

Enclosure
- **Standard.** 18-gauge steel with mounting flanges 3.0 in x 2.75 x 8.1 in (7.6 x 7 x 20.6 cm)
- **Optional.** DIN rail mounting
- **Shipping Weight.** 1.8 lb (0.82 kg)

Appendix A: Dimensions, Drawings and Accessories

Enclosure Dimensions



Optional Antennas

A-OB	900MHz Omnidirectional Antenna, 12"L,	5.14dBi (3dBd) Gain, Mounting Brkt.
A-O7B	900MHz Omnidirectional Antenna, 22"L,	7.14dBi (5dBd) Gain, Mounting Brkt.
A-Y8B	900MHz Yagi Directional Antenna, 17.5"L,	8dBi Gain, 4 Element, Mounting Brkt.
A-Y11B	900MHz Yagi Directional Antenna, 29.3"L,	11dBi Gain, 7 Element, Mounting Brkt.
A-2.4-O5B	2.4GHz Omnidirectional Antenna	5dBi Gain, Mounting Brkt.
A-2.4-O6B	2.4GHz Omnidirectional Antenna (fiberglass)	6dBi Gain, Mounting Brkt.
A-2.4-Y10B	2.4GHz Yagi Directional Antenna, 4.4"L, (enclosed)	10dBi Gain, 18" Coax w/ Fem"N", Mounting Brkt.
A-2.4-Y14B	2.4GHz Yagi Directional Antenna, 14"L, (enclosed)	14dBi Gain, 18" Coax w/ Fem"N", Mounting Brkt.

Appendix B – Radio Settings

The Radio settings menu with most of the details of the settings discussed.

Menu (0): Set Operation Mode

(0) Point-to-Point Master

Sets the radio as a Master in Point-to-Point mode. The unit must use call book and can connect to a remote unit designated in the call book. The Master determines the setting used for most of the radio transmission characteristics, regardless of the settings in the remotes and/or repeaters. The settings in the remote not determined by the Master are: RF Xmit Power, Slave Security, Retry Time Out,
and the Hop Table settings

(1) Point-to-Point Slave

Sets the radio as a remote in Point-to-Point mode. The unit must use call book and can connect with any point-to-point master designated in the call book, but only able one connection with a master at a time.

(2) Point–to-MultiPoint Master

Sets the radio as a Master in MultiPoint mode. The unit communicates simultaneously with numerous remotes and repeaters.

(3) Point-to-MultiPoint Slave

Sets the radio as a remote in MultiPoint mode. The unit communicates with a MultiPoint Master. The remote may communicate with its Master through one or more Repeaters.

(4) Point-to-Point Slave/Repeater

Sets the radio as a remote or repeater depending on the instructions from the Master. The unit cannot act as both a remote and a repeater at the same time. True Slave/Repeater functionality is only available in a MultiPoint mode.

> **Note:** Configured as a point-to-point repeater, the radio has no security features, it will allow any point-to-point master to use it as a repeater.

(5) Point-to-Point Repeater

Sets the radio as a repeater in Point-to-Point mode. The unit will allow any point-to-point master to use it as a repeater (the repeater must still be set up in the master's call book). The use of up to two repeaters in a communications link, significantly extending the operation range or reliability. All settings for the call book, baud rates, and radio transmission characteristics are disabled.

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

Sets the radio into mode 6. The unit is controlled entirely through software commands. A number of key parameters may be changed either directly with a terminal emulation or through the use of script files. When the in mode 6 is not calling a remote, it will function as a remote and accept any appropriate calls from other radios.

When using mode 6, the following items must be followed:

- Mode 6 only works with the RS232 interface. (The DTR line is not available in RS485/422, Ethernet, I/O models.)
- The radio remains in remote mode waiting for a connection until called by another radio in mode 6 in its call book or instructed to call another radio through an AT command. All script file or AT commands issued to the radio in mode 6 must be in ALL CAPS.
- The radio will not call until the DTR line goes high, if the DTR line is high when the command is given, it will call out immediately.
- The master will disconnect when DTR goes low.

AT Commands	Function
ATXFx	Changes Frequency Key
ATXTx	Changes Max Packet Size
ATXDx	Changes Min Packet Size
ATXXx	Changes Transmit Rate
ATXRx	Changes RF Data Rate
ATXPx	Changes RF Transmit Power
ATDTx	Position to call from the call book
ATDxxxxxxx	Call a specified call number
ATXC	Calls a repeater path
ATXS	Goes into setup mode

(7) Point-to- MultiPoint Repeater

Sets the radio as a Repeater in MultiPoint mode. The unit will receive and re-transmit packets to significantly extend the operating range and network reliability where needed.

The unit can be used as a remote and a repeater if the Slave/Repeater mode is set. When Slave/Repeater is set, packets are sent across the network as well as the local RS232 port. Reducing the need for a separate repeater and a remote.

> **Note:** To operate a radio as a MultiPoint Repeater and remote, Slave/Repeater must be set to 1 in the MultiPoint Parameters menu.

Note: Options in Blue are SRM/CIX/DAX models only

(A) Mirrorbit Master

Sets the radio as a master radio compatible with the SEL Mirrorbit Protocol.

(For more information call the factory).

(B) Mirrorbit Slave

Sets the radio as a remote radio compatible with the SEL Mirrorbit Protocol.

(For more information call the factory).

(F) Ethernet Options – Sets the Ethernet options for Ethernet modems.

(0) Ethernet Mode

- 0 for non-Ethernet Mode
- 1 for Ethernet Mode

(1) Half/Full Duple

- 0 for Full Duplex
- 1 for Half Duplex

(2) Slave IP Stack

- 0 to disable
- 1 to enable

(3) Slave UDP Mode

- 0 to disable
- 1 to use IP UDP mode
- 2 to use IP UDP BroadCast

(4) IP Address

- Sets the local IP Address to use for diagnostics or UDP Mode.

(5) Port Address

- Sets the UDP port number for diagnostics to use.

(6) IP Address 2 (use this mode only in UDP Slave Mode)

- Sets the IP Address to connect to if no incoming UDP packet has been received.

(7) Port Address 2 (use this mode only in UDP Slave Mode)

- Sets the port number to connect to with IP Address 2

(8) MAC Filter

- 0 to disable
- 1 to use

Menu (1): Set Baud Rate

Note: For the Ethernet models this should not be changed unless the Ethernet I/O baud rate is also changed.

(0) -> (9) for the SRM/CIX/DAX radio – (230,400 to 1,200 baud)
(0) -> (5) for the PLR radio – (38,400 to 1,200 baud)

This is the baud rate between the radio and the equipment to which it will be connected. It is important to note that this is independent of the baud rate for the other radio modem(s) in the communication loop.

(A) Data, Parity for the SRM/CIX/DAX radio / (6) Data, Parity for the PLR radio

Selection	Data Bits	Parity	Stop Bits
0	8	None	1
1	7	Even	1
2	7	Odd	1
3	8	None	2
4	8	Even	1
5	8	Odd	1

(B) MODBus RTU for the SRM/CIX/DAX radio
(7) MODBus RTU for the PLR radio
0 to disable MODBus RTU mode (Default)

1 - 9 to use MODBus RTU mode, the larger the number the longer the delay for collection of full packets.

Note: When using the ModBus RTU mode the Master Packet Repeat must be set to "3" regardless of whether the modems are being used in point-to-point or multi-point mode. If a setting that is higher than "3" is required, it can be done, but the throughput speed will be decreased. (A higher Master Packet Repeat setting may need to be used when the radios are in a high noise environment or at long ranges).

Note: Options in Blue are SRM/CIX/DAX models only

(C) RS232/485
These settings are not used. Default is 0.

(D) Setup Port
This setting determines which port, Main or Diagnostics, is used to enter the setup Main Menu.

- 1 to only use the main data port for setup.
- 2 to only use the secondary diagnostics port for setup.
- 3 to use both the main and secondary diagnostics port for setup.

Note: DO NOT change this setting unless the correct port is available. Without the diagnostics port the unit will no longer be configurable in the field, if set to 2.

(E) TurnOn/OffDelay
These settings are not used. Default is 0.

(F) FlowControl
This setting specifies the hardware flow control for the main data port, for connected equipment and for the setup menu. Most applications do not require handshaking.

XON/XOFF data will be passed through the data port, but will not be utilized in any way.

- 0 to disable flow control (none). (Default)
- 1 to use RTS/CTS flow control.
- 2 to use DTR flow control.
- 3 to use DOT half duplex flow control.

(G) Use break to access setup
This setting specifies the break character access mode to put the radio into setup mode over the data port.

To send a break character the end device must hold the Tx data line in the space voltage level for longer than 1 character time. If a character is defined as having 1 start bit, 8 data bits, and 1 stop bit, the character time is 10 bits, thus the Tx data line must be held in the space voltage level for a period of time longer than 10 bits

- 0 to disable break command. (Default)
- 1 to use the break command and access the setup menu at the default 19200 baud rate.
- 2 to use the break command and access the setup menu at the configured port baud rate.

Menu (2): Edit Call Book

The call book is required to be used in point-to-point networks.

The call book is an option in point-to-multipoint networks, but the Network ID feature is strongly recommended in most applications.

The call book is an innovative feature that offers both security and flexibility in use. The call book accomplishes this by allowing the user to determine with which radio it will communicate based on the call book numbers for both the master and remote. The radio modem's call book number is unique. It is identified on the radio setup menu and a label on the outside of the unit.

Using call book for a point-to-point system.

- The master call number must be listed in the remote call book or slave security is disabled in the remote.
- The remote call number must be listed in the master call book.
- The master entry to call must be set to the remote to call or call all.

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 establishing a RF link through a repeater, the master must first establish a RF link with the repeater, and then establish a RF link with it prior to making contact with the remote.

Using call book for a point-to-multipoint system.

- The master call number or repeater call number must be listed in the remote or repeater call book.
- The master call book is not used in a point-to-multipoint system.
- At times it may be desirable to force a remote to go through a specific multiPoint repeater. In this scenario, the remote call book should contain only the call number for the repeater to call on line 0 of the call book.

Entering or modifying call book numbers in the call book.

- Select the entry number (0 – 9) you wish to change.
- When prompted "Enter New Number", enter the 7 digit call number of the unit to call (the dash is automatically inserted).
    - Enter the Repeater1 in a Point-to-Point Network. If no repeater is to be used or this is a Point to Multipoint Network, press "ESC" to return to the modified call book menu screen.
    - Enter the Repeater2 in a Point-to-Point Network. If no Repeater2 is to be used, press "ESC" to return to the modified call book menu screen.

Menu (3): Edit Radio Transmission Characteristics

Sets the options for the radio data transmission, most of these parameters should match throughout the system.

These parameters are for the experienced user who has a good understanding of the principles of radio transmission characteristic options.

(0) FreqKey

Sets the hopping patterns of the radio to 1 of 15 different hop patterns.
Sets each network and repeaters to use different frequency key to minimize the interference with other Data-Linc Group radio networks operating in the area.

- 0 thru 9 and A thru E
- F - More Setting
    Sets the hop table parameters. Some applications may require changes in the hop table parameters.

Note: most applications do not require any modification to the frequency tables.

(0) Hop Table Version

Sets the portion of the band in which the radio will operate.

900 MHz Radio Hop Table Selections

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

Note: Do not use FreqKey 14 (E) with the Australia (915-928 MHz), Taiwan (916-920 MHz), or New Zealand (921-928) hop table versions.

2.4 GHz Radio Hop Table Selections

Selection	Name	Reference
0	Table 0	Full 2.400 - 2.4835 GHz
1	Table 1	Full 2.400(46) To 2.483(54) GHz - Offset
2	Table 2	2.400(46) To 2.427(49) GHz - Lower 1/3 of the Band
3	Table 3	2.428(49) - 2.455(51) GHz - Middle 1/3 of the Band
4	Table 4	2.456(51) - 2.455(54) GHz - Upper 1/3 of the Band
5	Table 5	902-928 MHz, center frequencies of 911-919 notched out
6	South Africa	902-915 MHz

(1) Hop Table Size

•Sets the number of hop channels to use within the specified band:
•Set between (50 to 112) for the 900 MHz. Default is 112.
•Set between (50 to 80) for the 2.4 GHz radio. Default is 80.

(2) Hop Freq Offset

The feature is not used in the 900 MHz radio.

In the 2.4 GHz radio, sets the frequency offset for the hop channel.

•0 to disable. Default is disabled.
•1 to select an offset of 115.2 KHz
•2 to select an offset of 230.4 KHz

(3) Frequency Zone

Sets the frequency bands for the radio transmission.

Divides the frequency band into 16 smaller bands of 5, 7, or 8 channels depending on the zone. The zones are represented by 16 "0" or "1" entries.

•0 to disable the zone
•1 to use the zone

900 MHz Radio Frequency Zone

Zone Number	Beginning Freq. MHz	Ending Freq. MHz	# of Channels
1	902.2464	903.8592	8
2	904.0896	905.4720	7
3	905.7024	907.0848	7
4	907.3152	908.6976	7
5	908.9280	910.3104	7
6	910.5408	911.9232	7
7	912.1536	913.5360	7
8	913.7664	915.1488	7
9	915.3792	916.7616	7
10	916.9920	918.6048	8
11	918.8352	920.2176	7
12	920.4480	921.8304	7
13	922.0608	923.4432	7
14	923.6736	925.0560	7
15	925.2864	926.6688	7
16	926.8992	927.8208	5

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 7 frequency zones is required for legal communications.

Note: The Hop Table Version must be set to 0 (Entire Band) when using Frequency Zones. If another Hop Table Version were to be selected, the limitations of that selection would be applied to the hopping pattern as well.

2.4 GHz Radio Hop Table Versions

Zone Number	Beginning Freq. MHz	Ending Freq. MHz	# of Channels
1	2400.3072	2405.4912	5
2	2405.8368	2410.6752	5
3	2411.0208	2415.8592	5
4	2416.2048	2421.0432	5
5	2421.3888	2426.2272	5
6	2426.5728	2431.4112	5
7	2431.7568	2436.5952	5
8	2436.9408	2441.7792	5
9	2442.1248	2446.9632	5
10	2447.3088	2452.1472	5
11	2452.4928	2457.3312	5
12	2457.6768	2462.5152	5
13	2462.8608	2467.6992	5
14	2468.0448	2472.8832	5
15	2473.2288	2478.0672	5
16	2478.4128	2483.2512	5

Warning: To adhere to the EU specifications, it is necessary to use the proper frequency zone combination based on the frequency offset. While using a frequency offset of zero, the first zone (0) needs to be removed. Using frequency offsets of one or two, the last zone (15) needs to be removed.

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.

(4) Goverment Rules (2.4 GHz Models Only)

Sets the radio to comply with different government standards.
Set the mode to comply with the correct regulations for the area in which the radio will be operated.

- 0 to comply with FCC rules.
- 1 to comply with EU 328 rules.
- 2 to comply with EU 440 rules.

(1) Max Packet Size &
(2) Min Packet Size

Sets the size of the packets (in bytes) used by the radio for the RF communications. The packet size is determined by a combination of the size settings and the RF Data Rate.

This may be of particular value when using the radio with different communications protocols; you may find that throughput is optimized when packet sizes are restricted by the radio.

Note: Using Diagnostics mode uses the extra space in the packets for diagnostics data, using small max and min packet sizes may reduce or stop the diagnostics data available.

Maximum Packet Size Settings where RF Data Rate=2

Min Setting \ Max 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

Maximum Packet Size Settings where RF Data Rate=3

Min Setting \ Max 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

(3) Xmit Rate

Sets the operation mode for the transmitter.

- 0 for normal operation.
- 1 for continuous transmit.

Continuous transmit mode is useful to qualitatively gauge signal strength viewed in the menu Show Radio Statistics option or it may be gauged by the Clear to Send LED. A solid red CTS LED indicates a strong signal; a blinking CTS LED indicates a weaker signal.

Due to the fact that the radio transmits continuously when Xmit Rate is set to 0, this mode should be used only as a diagnostic tool and not for normal operation.

(4) RF Data Rate

•2 when the radios are closer together and data throughput is to be optimized.
•3 when the radios are farther away and a solid RF data link is preferred over data throughput.

Note: The RF Data Rate setting must be identical for all units in the system. Any radio modem with a different RF Data Rate than the master will not establish a communication link.Sets the RF Data Rate for the over-the-air communications rate.

(5) RF Xmit Power

Sets the radio output transmit power. The table below shows the typical power breakdown.

Value	SRM/CIX/DAX 900MHz (1W Power)		SRM/CIX/DAX 2.4GHz (500mW Max)		PLR 900 MHz (200mW Max)	
	mW	dBm	mW	dBm	mW	dBm
0	5	+6	0.5	-3	5	+6
1	75	+18.7	20	+13	10	+10
2	115	+23.5	60	+18	25	+14
3	325	+25	125	+21	60	+17.7
4	450	+26.5	200	+23	95	+19.7
5	550	+27.4	300	+24.8	125	+21
6	675	+28	350	+25.4	140	+21.5
7	750	+28.7	400	+26	155	+21.9
8	825	+29	430	+26.3	165	+22.1
9	925	+29.6	450	+26.5	185	+22.6
10	1000	+30	500	+27	200	+23

Note: The output power in the table may slightly very from transceiver to transceiver, but the output power will never exceed the RF Xmit Power settings of 10 dBm specifications from the table below.

(6) Slave Security

Sets the security mode of a remote in a call book based system to only accept connections from radios in the remote units call book.

•0 to enable security.
•1 to disable security.

This may need to be disabled if the radio is operating in a point-to-point system where calls from more than 10 different radios may be needed.

Note: With Slave security disabled the radio will accept calls from any unit calling this remote and additional system security measures should be taken to prevent unauthorized access.

(7) RTS to CTS

Sets the RTS line on the master radio to control the CTS line on the remote.

•0 to disable RTS pass-through.
•1 to use RTS to CTS pass-through.

This pass-through control can be enabled in point-to-point mode as well as point-to-multi-point. In the latter, the master RTS line will control all remotes' CTS lines.

When this mode is enabled the CTS line ceases to function as flow control. Therefore it is not recommended to enable this feature when operating at high RS232 speeds.

Note: The RTS to CTS feature does not function in point-to-point systems that contain a repeater. If this feature is needed in with a repeater, the system should be changed to a point-to-multiPoint system.

Note: If the DTRConnect feature is set to 2, the RTS to CTS feature will not work.

Note: If the DTRConnect feature is set to 1 and RTS to CTS function in enabled on the radio, the RTS to CTS mode takes precedence over the functionality of the CTS line on the remote relating to the DTRConnect feature.

(8) Retry Time Out

Sets the retry time out of the radio before it will drop a connection and attempt to reconnect.

- 8 – 255 in multipoint mode.
- 151 – 255 in point-to-point mode.

The number of packets that fail in a row before dropping the connection and re-establishing a connection from a calling master or repeater. Default is 255.

A lower setting will allow a remote to drop the connection after fewer failed packets and re-establish a connection with other units in the remotes call book or in the same Network ID.

Note: Options in Blue are SRM/CIX/DAX models only

(9) Lowpower Mode

Lowpower Mode is used only in MultiPoint remote using serial protocol. The power savings occur only when a remote is in receive mode. When the remote is transmitting data no power savings occur so it is of little value when a remote has a constant, high throughput.

- 0 to disable low power mode. Default is 0.
- 1-31 to enable low power mode. See table for description.

Note: MCUSpeed must be set to '0' and RF Data Rate must be set to '3' for Lowpower Mode to operate properly and additional power savings may result when the Number Repeaters is set to 1.

Note: To communicate to the RS232 port of the radio transceiver that is in Lowpower Mode, the RTS line must be held high to wake it up. Because the Lowpower mode puts the radio to sleep, latency will be introduced before it becomes fully linked to the master. This latency can range from 20 ms to 2.5 seconds

Master	Repeater
0	Low Power Mode Disabled
1	The radio LED's are dimmed and the radio remains awake. The radio's data port is shut down if the RTS line is held low.
2	The radio LED's are dimmed and the radio sleeps every other slot. The radio's data port is shut down if the RTS line is held low.
3	The radio LED's are dimmed and the radio sleeps 2 of 3 slots. The radio's data port is shut down if the RTS line is held low.
4 thru 31	The radio LED's are dimmed and the radio sleeps (n-1) of (n) slots. The radio's data port is shut down if the RTS line is held low.

(A) High Noise
Sets the radio High Noise feature.

This feature is useful in determining if out of band interference is affecting a radio link.

- 0 to disable high noise.
- 1 to use the high noise feature

When enabled it reduces the gain in the front-end circuitry, which decreases the affects from out-of-band noise. The results will be seen as a lower signal value and a much lower noise value (as found in Radio Statistics or Diagnostics).

Note: When enabling the High Noise feature reduces a noise problem, chances are that the noise may be reduced further with the use of a band pass filter.

Note: If the noise is not reduced by a greater amount than the signal, the interference is most likely an in-band issue.

(B) MCU speed
Sets the MCU speed of the radio processor.

- 0 for normal speed and lower power consumption.
- 1 for high speed, which is required for a 230,400 port baud rate or Ethernet mode.

Note: Only needs to be enabled for Ethernet and UDP operation, a baud rate set to 115.2Kbaud or 230.4Kbaud, or if LincView Diagnostics software is being used.

(C) Remote LED
This settings is not used.

- Default is 0.

Menu (4): Show Radio Statistics
Number of Disconnects
The value records the number of times the radio has lost the RF link and re-establishes a link. The value indicates the total number of disconnects that have occurred from the time the transceiver is powered on until the radio is put into Setup mode. Under ideal operating conditions, the number of disconnects should be 0. One or more disconnects may indicate a weak link, the presence of severe interference problems or loss of power to any of the radios in the link.

Radio Temperature
The Radio Temperature value is the current operating temperature of the transceiver in degrees Celsius. For proper operation, a radio must be in the temperature range of -40° to +75° C.

Antenna Reflected Power
This is a measurement of the transmitted power that is reflected back into the transceiver from mismatched antennas or cables, or loose connections between the transceiver and antenna. A reading of 0-5 is good and 5-30 is acceptable, but a 30+ number would indicate that the connections from the radio to the antenna should be inspected for a loose connection and the cable quality checked.

Transmit Current (mA)
This measures the current draw of the transmitter in milliamps. Refer to the radio model specs for typical values.

Average Noise Level
The average noise level indicates the level of background noise and interference at this radio and at each of the radios used as repeaters in the link.

The average noise levels will typically fall in the range of 15 to 35 "J", and the noise levels should be below 70 "J". Higher noise levels 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:

- The addition of a bandpass filter for out-of-band noise
- Relocation of the antenna or antenna polarization.
- Proper antenna and equipment grounding

Average Signal Level
The average signal level indicates the level of received signal strength at this radio and each repeater in the link. For each of these, the signal source is the radio that transmits to it.

Low Average Signal Levels can often improved with:

- Using higher gain antennas or directional instead of omni
- The relocation of the antenna to improve the line of site
- The use of repeaters

The signal and noise number is an average of the received levels measured at each frequency in the radio'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 in the Show Radio Statistics menu.

For a reliable link, the margin or delta between the signal and noise should be at least 26 "J" units.

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 100 Kbaud of bandwidth with an RF data rate of 3 (Radio Transmission Parameters Menu) and approximately 150 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.

Menu (5): Edit Multipoint Parameters
When installing a Point-to-MultiPoint system, for the system it requires that several parameters be set consistently on all the radios. This includes RF data rate, Min and Max Packet Size, and FreqKey (Unless it is a repeater using repeater frequency).

(0) Number Repeaters
Sets the number of repeaters in the system, this setting is critical for transmission timing for the system.

- 0 when not using repeaters or diagnostics at the master.
- 1 if repeaters are in the system or if running diagnostics at the master.

Note: This should be the same for all the radios in the system.

Note: This should be enabled when running diagnostics from the master.

(1) Master Packet Repeat

Sets the number of times the packet is re-broadcast to the system by the master or repeaters in the system. The remotes do not acknowledge the packets in a multipoint system, so the higher the value the high the probability of receiving a successful packet at the remote, but the higher the latency for the repeated data packets.

- 0 or 1 if the software protocol being used controls the retries.
  This could improve throughput if the system has strong RF links and high data rates.
  For lower data rates this is not an optimal setting.
- 2 or 3 for most well designed networks.
- 4 thru 9 for a robust system where high data throughput is not an issue.

Note: This setting is only used in the master and repeaters in a multipoint system.

(2) Max Remote Retry

Sets the number of times the remote will attempt to retransmit a packet to the master. If the packet is not received successfully within the number of set retries the remote waits a specified a time from the Retry Odds setting.

Set to a higher value for a better probability of a successful packet to the master with one transmission time, but this could cause a higher latency for the other remotes in the system.

Note: The remote will stop the retries when an acknowledgement is received from the Master.

(3) Retry Odds

Sets the fallback time algorithm to wait to retry for the remote, to resolve contention to the master.

- A lower setting to assign a lower priority to the remote re-transmitting the data buffer.
  his could be used with a remote with a strong RF link to have a lower priority to a remote with a weaker RF link.
- A higher setting to assign a higher priority to the remote re-transmitting the data buffer.
  This could be used with a remote with a weak RF link to have a higher priority than a remote with a strong RF link.

Note: If Retry Odds is set to 0, the remote's data buffer will be purged if all the max remote retry were unsuccessful.

(4) DTR Connect

Sets the operation of the radio based of the DTR line.

- 0 to ignore the DTR line, data is transmitted when it is received.
- 1 to form a point-to-point link with the Master when the DTR line is high.
- 2 to transmit data in bursts when the DTR line is high.
  Use this mode when a system is comprised of many low data rate devices and it is desirable to increase overall system capacity.

Note: If the DTRConnect feature is set to 1 and RTS to CTS function in enabled on the radio, the RTS to CTS mode takes precedence over the functionality of the CTS line on the remote relating to the DTRConnect feature.

Note: If the DTRConnect feature is set to 2, then the RTS to CTS feature will not work.

(5) Repeater Frequency

Sets the hopping pattern to use for the re-transmitted data from a repeater.

- 0 to use the master or repeater hopping pattern.
- 1 to use the set FreqKey for the repeater.

Note: When the repeater frequency is set to 0 the FreqKey setting must match the master or the repeater that this radio is connected to.

(6) NetWork ID

Sets the Network ID of the network or sets the use of the call book.

The use of network ID allows units to connect to different master radios without using call book entries, to direct the RF link path subnet ID is used.

The masters and repeaters may be replaced without changing the remotes that link to the unit.

- 0 thru 254 NetWork ID values (below 255 may be needed for backward compatibility with older units).
- 255 to disable Network ID and use the call book entries in multipoint mode.
- 256 – 4095 NetWork ID values (extended range).

Note: A remote will link with the first master or repeater with a matching Network ID.

Note: Options in Blue are SRM/CIX/DAX models only

(8) MultiMaster Synch

Sets in point-to-point and multipoint systems to reduce interference between the masters where concentrations of master radios exist.

- 0 to disable synch mode.
- 1 to enable synch mode.

(9) 1 PPS Enable/Delay

This mode allows the master to propagate a 1PPS signal to all the remotes in a multipoint network. The properly generated pulse applied on the DTR line of the master will provide a 1 PPS pulse on the CD line of any remote in the system. The output on the Slave will occur within 20 microseconds of the input to the Master.

- 0 in the master to enable 1 PPS pulse mode.
  The master must have a 1 PPS pulse on the DTR line.
- 0 – 254 Set to adjust the timing out the CD line of the remote unit.
  When properly calibrated the CD line of a Slave radio will output a pulse that goes high for about 2mS in synch with the 1 PPS pulse on the Master radio.
- 255 to disable 1 PPS pulse mode.

Note: If 1 PPS is set to 1, the Master must have a 1 PPS pulse on its DTR pin, otherwise the RF network will not function.

(A) Slave/Repeater for the SRM/CIX/DAX model
(8) Slave/Repeater for the PLR model

Set this mode to allow a repeater to act as a remote and a repeater. In this mode data will be re-transmitted over the RF as well as sent out the local data port.

- 0 to disable the data port on a repeater.
- 1 to enable the data port on a repeater.

Note: This option is only used if the radio is in mode (7) MultiPoint Repeater.

Note: Options in Blue are SRM/CIX/DAX models only

(B) Diagnostics – (Not Available on the DD1000 or DDAA1000)

This option is to view diagnostics data at the master radio in parallel with application data.

- 0 to disable diagnostics.
- 1 thru 128 Set to enable serial diagnostics.
- 129 for UDP diagnostics.

Note: The diagnostic program must be connected to the master radio using the secondary optional diagnostics port.

Note: A Windows© computer with a serial port or UDP connection (Ethernet models only) running the diagnostics software is needed.

(C) SubNet ID for the SRM/CIX/DAX model
(9) SubNet ID for the PLR model

This option is to to direct the RF path of a system. These are the sub-channels that repeaters use to differentiate the RF links. The Subnet ID option is particularly helpful to force two repeaters in the same system to operate in series rather than in parallel, or if desired, to force the remote to communicate to a specific repeater for load balancing purposes.

The Subnet ID option consists of the receive (Rcv) channel and the transmit (Xmit) channel.

- The receive (Rcv) Subnet ID identifies which channel a repeater or remote will listen to.
- The transmite (Xmit) Subnet ID identifies which channel a repeater will transmits, and in turn which devices will listen to it.

- Rcv Options (0 – 9, A - F) / (0 – 15)
  The channel to listen to.
- Xmit Options (0 – 9, A - F) / (0 – 15)
  The channel to use for transmitting.

The default is disable, which is a setting for both Rcv and Xmit of F.

The master using this mode should have a setting for both Rcv and Xmit of 0.

Note: The Subnet ID only works in a multipoint system using Network ID addressing.

Note: The transmit (Xmit) Subnet ID parameter is only used for multipoint repeaters.

Note: A Master will always transmit and receive on 0 and should be set to Rcv 0 and Xmit 0, which is roaming mode.

Sample picture of using network ID:

Network ID: 100
SubNet ID TX: 0 RX: 0 (Roaming)

Network ID: 100
SubNet ID TX: 1 RX: 0

Network ID: 100
SubNet ID TX: F RX: 1

Note "TX:" is ignored on Remote only

Note: Options in Blue are SRM/CIX/DAX models only

(D) Radio ID

Sets an arbitrary, user selectable, 4-digit number, which identifies the transceiver in diagnostics mode.

•Set to the arbitrary number to use as reference in diagnostics mode.

Note: Once this option is changed it cannot be changed back to "not set"; this does not affect the operation of the unit in any way.

(E) Local Access

These settings are typically not used. Contact Data-Linc Group for further information.

Note: This feature is only available with firmware versions 2.54 and 3.54 or higher.

(G) Radio Name

Sets a unique radio name up to 20 characters in length.

Menu (8): Chg Password

Sets a password, which will prevent unauthorized users from making or viewing the configuration of the radio

Note: If the password feature is enabled and you cannot remember the password, the radio modem will have to be returned to Data-Linc Group to have the password disabled. Use with caution.

Setting a Password

Note: All ASCII characters are valid except the "ESC" character (Backspace, Enter, etc..) and the password is case sensitive.

•Choose option 8 from the Main Menu.

•The prompt "New PW? (<esc> to exit)" will appear.

•Press "ESC" to cancel and return to the main menu or enter 4 characters to set the password.

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".

•Press enter to set the password or "ESC" to cancel and to the main menu.

Changing or Disabling a Password

Note: it is possible to change or remove the password.

•Choose option 8 from the Main Menu.

•The prompt "Enter Security Code" will appear.

•Enter the current password.

•Refer to Setting a password at this point to change the password. See below to remove a known password.

•Disabling Password, enter the following password:
- •Hold the "Alt" key down and using the number key pad (not the numbers across the top of the key board) type "0255"
- •Release the "Alt" key
- •Repeat steps 1 and 2 three more times (this will enter 0255 a total of four times).

•At the prompt "<Enter> to accept, <esc> to quit." Hit the "Enter" key to disable the password or hit the escape key to keep the password.

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, 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 ofice and request a Return Material Authorization (RMA) number. The RMA number identiies the part and the owner and must be included with the part when shipped to the factory.

Contact Information

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