

# USER GUIDE

INDUSTRIAL DATA COMMUNICATIONS

## *PlantLinc™ 580D /DA*

### **PLR580D /DA**

Discrete (/D) & Discrete and Analog (/DA)  
900 MHz Frequency Hopping Spread Spectrum  
Wireless I/O Extender



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

## FCC 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 and
- 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.

**Caution:** This device has a maximum transmitted output power of 200 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: 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 Data-Linc Group PLR series modem is placed inside an enclosure a label **must** be placed on the outside of that enclosure which includes the modem's FCC ID.

The following antennas are approved for use with Data-Linc Group's 900MHz series modems.

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

### 900MHz Directional Antenna

Gain	Manufacturer	Manufacture Model Number	Data-Linc Model Number
8.2 dBi	Larsen	YA6-900W	A-YB
12.2 dBi	Larsen	YA0006	A-Y10B

### 900MHz Omni-Directional Antenna

Gain	Manufacturer	Manufacture Model Number	Data-Linc Model Number
5.2 dBi	Maxrad	MAX-9053	A-OB
7.2 dBi	Maxrad	BMEFC8985HD	A-O5B
0 dBi	Ying Hao	YH920801/AD-725-A-1	A-06/ADJ
0 dBi	Centurion	EXC-902-BN	A-06BH-3S / 10S (**)

(\*\*) This part number refers to an antenna kit(s). The 0dB refers to the antenna portion of the kit.

**Note:** The antenna used for this device 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).

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## Introduction

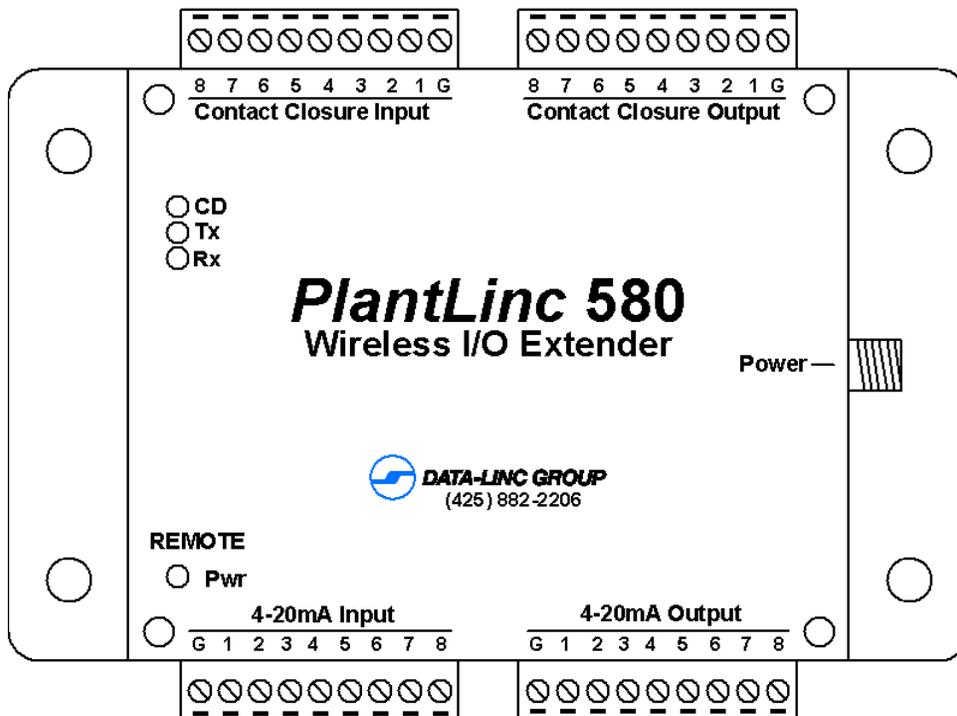
The PLR580D / PLR580DA are discrete/analog signal multiplexers. They are designed to provide wireless communication where wire lengths are too long, too costly or not possible. In general, these units behave as if they replace a set of wires between the two or more locations. These units are normally factory configured and eliminate the necessity of having to preset the system configurations. The units are ready for installation into the system upon receipt. If the system changes, these units do have the capability to be field reconfigured and to have access to the radio setup parameters using jumper settings and a serial cable to a PC.

Two version of the product exist. The PLR580DA has both analog and discrete inputs and outputs. The PLR580D has only the discrete inputs and outputs. Discrete (digital) connections and operations are the same for both of the models. Only the PLR580DA has 4-20 mA inputs and outputs. Both the PLR580D and PLR580DA have distinct master and remote units. Each system must have one and only one master and can have up to 8 Remotes.

Both the PLR580D and PLR580DA take an input at one end and reproduce it at the other end. The Master unit has a possible total of 8 discrete inputs, 8 discrete relay drive outputs. The Master has eight 4-20 mA inputs and eight 4-20 mA outputs. When designing a system that use these units, keep in mind that if using more than one remote (8 possible) that the Master unit can never have more that 8 digital-in, 8 digital-out, 8 analog-in, and 8 analog-out.

Communication is accomplished using radio transmissions. A six inch unity gain whip antenna is supplied with each unit for test purposes. Note that line of sight is required for communications. In some instances, under 1/2 mile (.80 km), line of sight may not be necessary. 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.

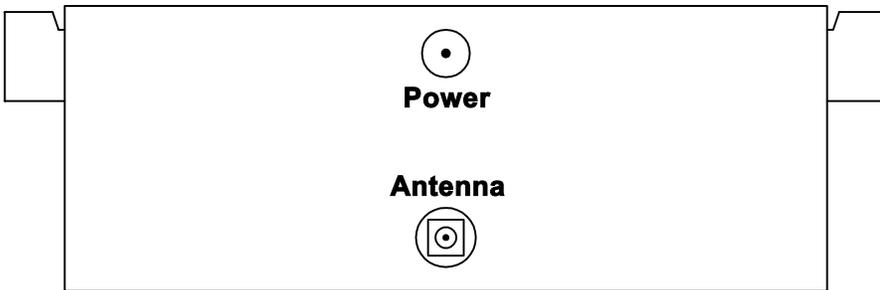
Figure 1: PLR580D and PLR580DA



**Table 1: LED Description**

<b>CD</b>	Carrier Detect LED. When the units have established an RF Link this LED will be on solid.
<b>Tx</b>	Transmit LED. Will flash when the unit is sending data to the receiving unit.
<b>Rx</b>	Receive LED. Flashes when receiving data being sent by transmitting unit.
<b>Pwr</b>	Power LED. Flashes on solid when unit has power applied.
<b>Status</b> (Master Only)	The status LED will be off when communication is working properly. LED flashes or stays on steadily when a communication problem exists.

**Figure 2: Normal User Connection**



<b>Antenna Connectoin Type</b>	
Thread Type	Standard Thread
Gender	Female
Connector	SMA
<b>Power Connector</b>	
Dimensions of Post	2 mm
Dimensions of Hole	6.5 mm
Polarity	Center Pin Positive
Voltage	12VDC Nominal , 9-24VDC
Current	160mA Idle, 50mA Peak on Transmit
<b>Teminal Block</b>	
Wire Size	12-26 AWG

## Discrete Operation

### Requirements

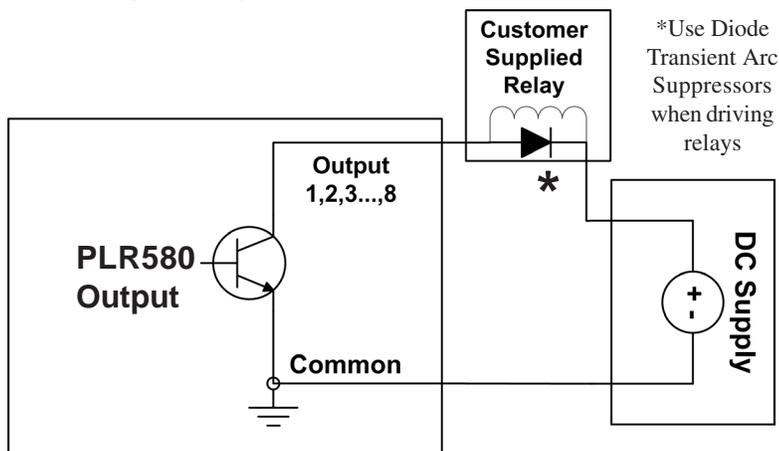
1. The outputs of the units cannot directly drive a relay. The digital outputs are open collector current sinking to the common ground. An external power supply must be used to provide DC power to any relays.
2. The maximum voltage on the relay driver outputs is 24 VDC.
3. Ensure that the pull up voltage is sufficient for your relay. i.e. a 12 VDC relay needs 12 VDC, a 24 VDC relay needs 24 VDC.
4. Each digital output can sink up to 100 mA for the purpose of controlling the relay coil.
5. If driving inductive loads, place a voltage suppression diode across the relay coil.
6. There is one common ground for all input and output connections.

### Connections

The discrete connection to the device is made via the terminals labeled “Contact Closure Input” and “Contact Closure Output.” The digital input expects a dry contact, such as a switch or even just a jumper wire.

The output is open collector. The following diagram illustrates the output drive circuit connection for a discrete unit.

**Figure 3: Simplified Open Collector**

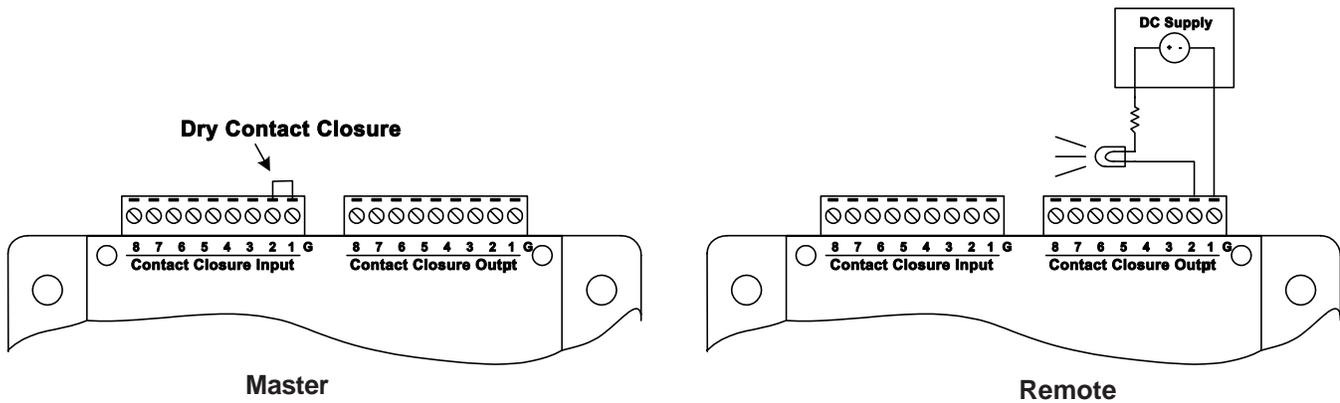


## Point-to-Point Discrete Operation

The following illustrates an example of a point-to-point discrete system. The “Contact Closure Input” may be as simple as a bare wire or be connected to an output of an I/O module. This is an example of turning a lamp at the Master unit by closing a contact at the Remote unit using a discrete output.

Point-to-point discrete operations are bi-directional. An input on the Remote will activate same numbered output on the Master. A contact closure on an input of the Master will close the output on the Remote on the same contact.

Figure 4: Point-to-Point Discrete Operation Example



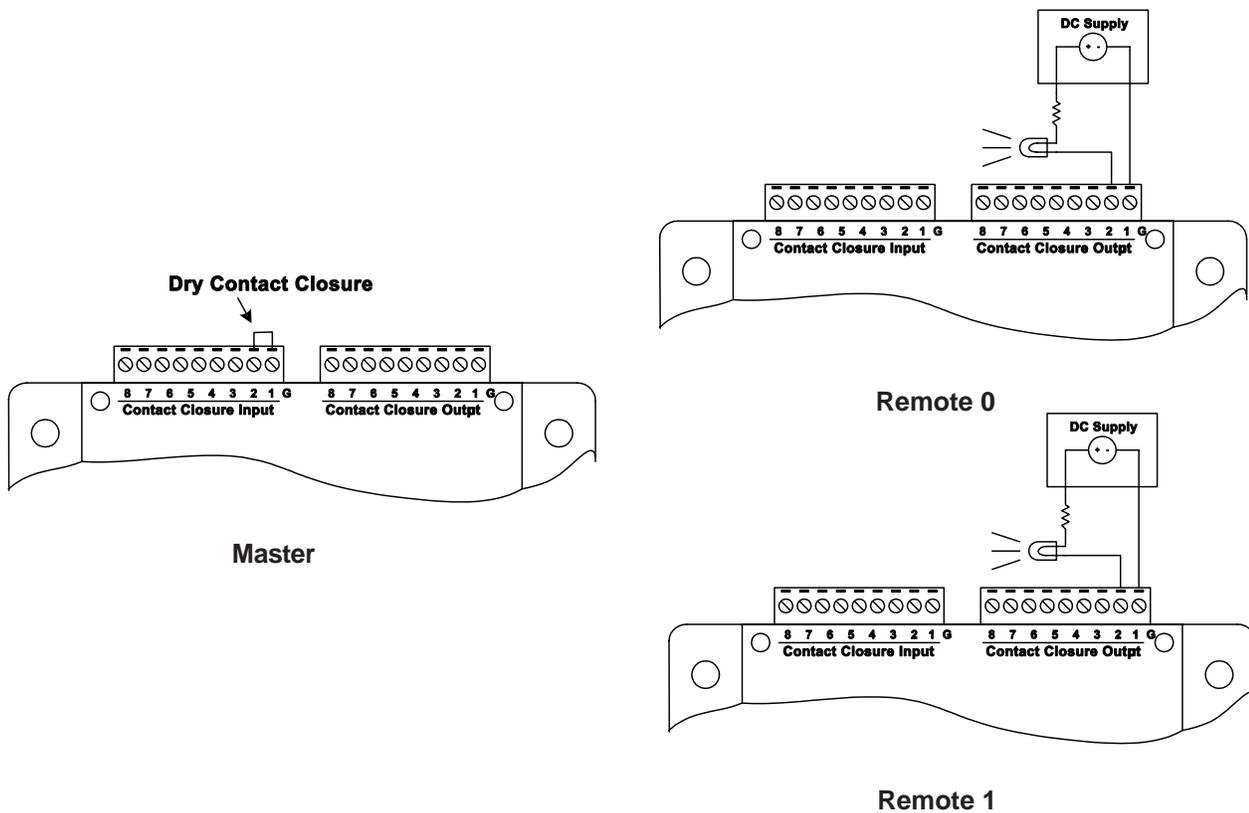
## Point-to-Multipoint Discrete Operation

A multipoint system will involve two or more remote locations, which may be transmitting contact input information, providing discrete outputs or both. The following is an example of a multipoint configuration.

In this example, the Master is transmitting a contact closure input to both Remotes. Note that input #1 on the Master will trigger the same numbered output on all Remote units at the same time.

Since there are more remote inputs than master outputs, the contact closures at the Remote inputs are 'OR'd at the Masters outputs. The closure of any Remote input will cause the Master output to be On (sinking current). If any Remote input is closed the Master output will be On for that position. For the Master output to be Off, all Remote inputs must be open (Off).

Figure 5: Point-to-Multipoint Discrete Operation Example



## Analog Operation Specifications

1. This unit does not provide loop power to devices.
2. The outputs can operate on loops with a maximum total resistance of 300 ohms.
3. The resolution of this unit is 8 bits with accuracy of 2%.
4. All inputs use a common ground connection labeled "G".
5. The input signal must be a 4-20 mA signal.

## Point-to-Point Analog System

These units are bi-directional, they send and receive analog information both directions. The following is a common example of analog use for the PLR580DA units. Again, the Master's input corresponds to the same numbered output on the Remote and vice versa. The 8 Master inputs match the 8 Remote outputs and the 8 Remote inputs match the 8 Master outputs.

Figure 6: Point-to-Point Analog Example

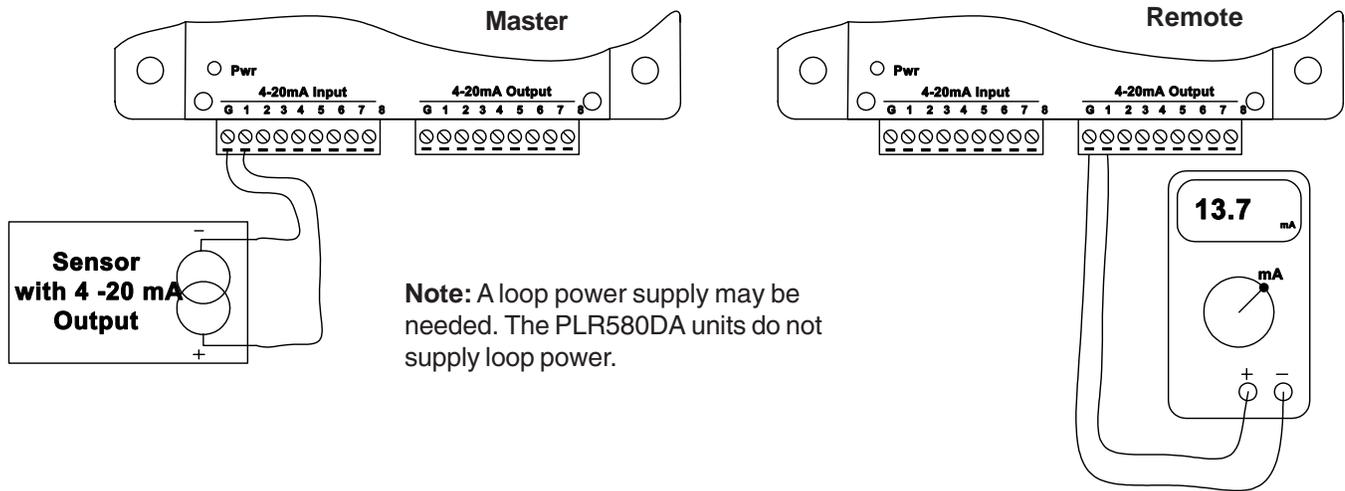
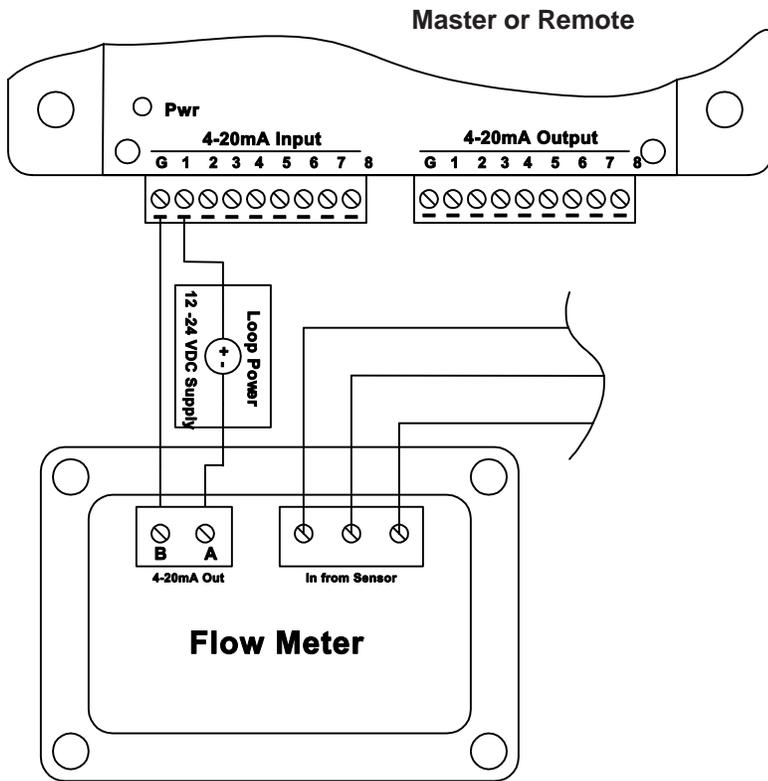


Figure 7: Connection of a flow meter to the PLR580DA unit



## Point-to-Multipoint Analog System

Unlike the discrete versions, the system must be configured for where specific inputs and outputs are directed. Each unit is normally factory configured and designed to interface with the specific system. Alterations to this configuration are possible using an accessory cable and jumpers and software provided by Data-Linc Group. Reconfiguring the units requires the removal of the cover and uses a custom serial data cable connected to a computer. The reconfiguration of the Master and Remotes should normally be left to qualified personnel or performed under Data-Linc Group supervision.

### Factory Configuration Process

At the factory, each remote unit is given an address, which is zero (0) to seven (7). Each unit is then programmed for a specific number of analog inputs and outputs, which should be predetermined prior to sale. Also consider if the system is to be expended in the future. Note that any system will have one Master and a maximum of 8 Remotes.

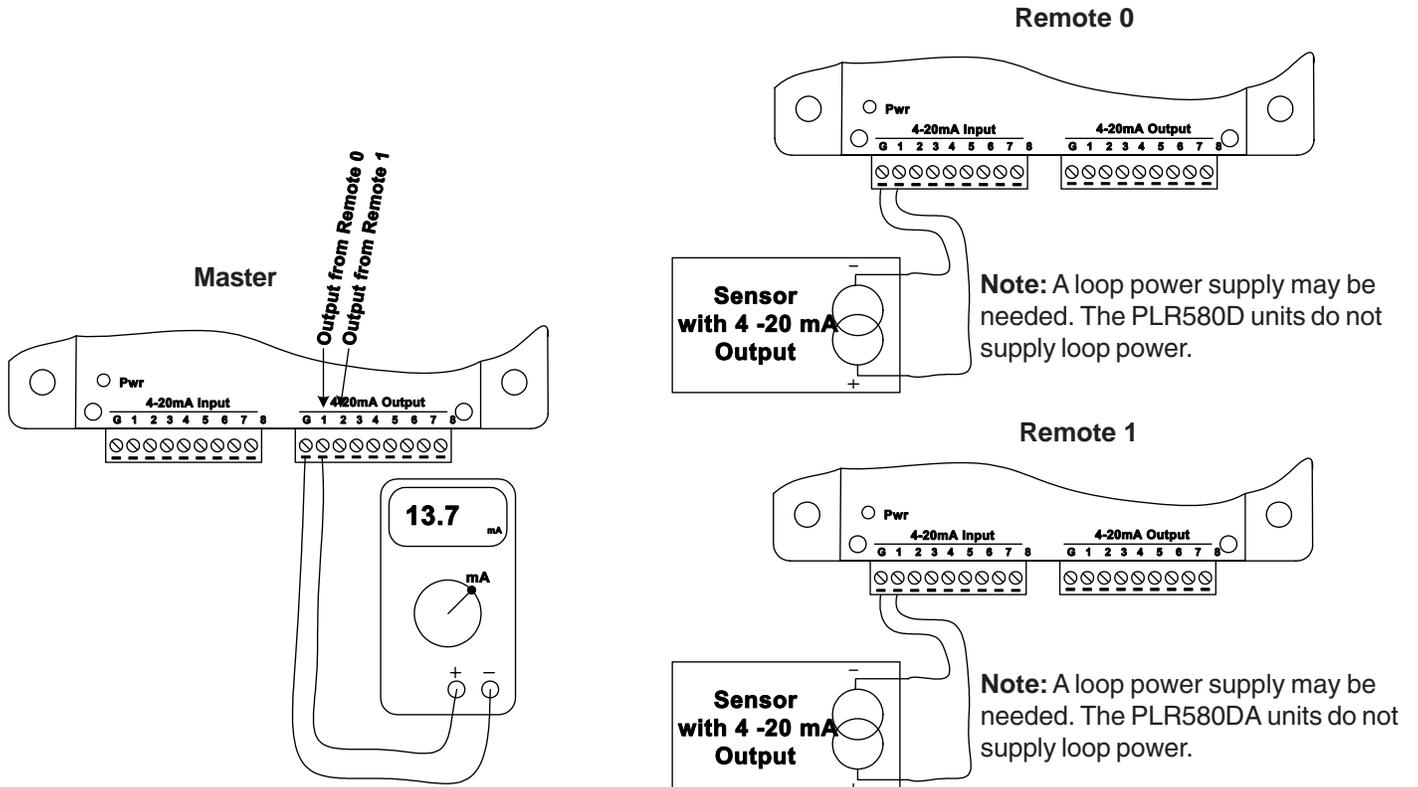
### Limitations of the Configuration Process

Each master unit has eight analog inputs and eight analog outputs. These inputs and outputs can be spent in a variety of ways when configuring a multipoint system. Note that with analog operation, each remote unit's input corresponds with a specific master output. Two remote units cannot share the same inputs and outputs as with the discrete section. The following is a sample diagram of a point to multipoint configuration.

## Point-to-Multipoint Analog Operation

A system is to be built where one analog input exist at one remote and one at another. The maximum possibility of master outputs is eight, so this is a valid configuration. Remote 0 being the first remote in the Master's poll list will be assigned Master output one. Remote 1 being next in the poll list will be Master output two.

Figure 8: Point-to-Multipoint Analog Example



\*\*\* Systems with only one analog input on each remote

## Changing System or Radio Configurations

To access the system or radio setups the user must remove all connectors from the PLR580D or PLR580DA, then remove the cover and change the jumpers at location P1 and P2, and add a serial data cable (SRM6200E-SLC), supplied by Data-Linc Group, to connector P3. These jumper settings must be returned to the RUN/RF settings after reconfiguring the system or the radio or the units will not operate. See layout drawing.

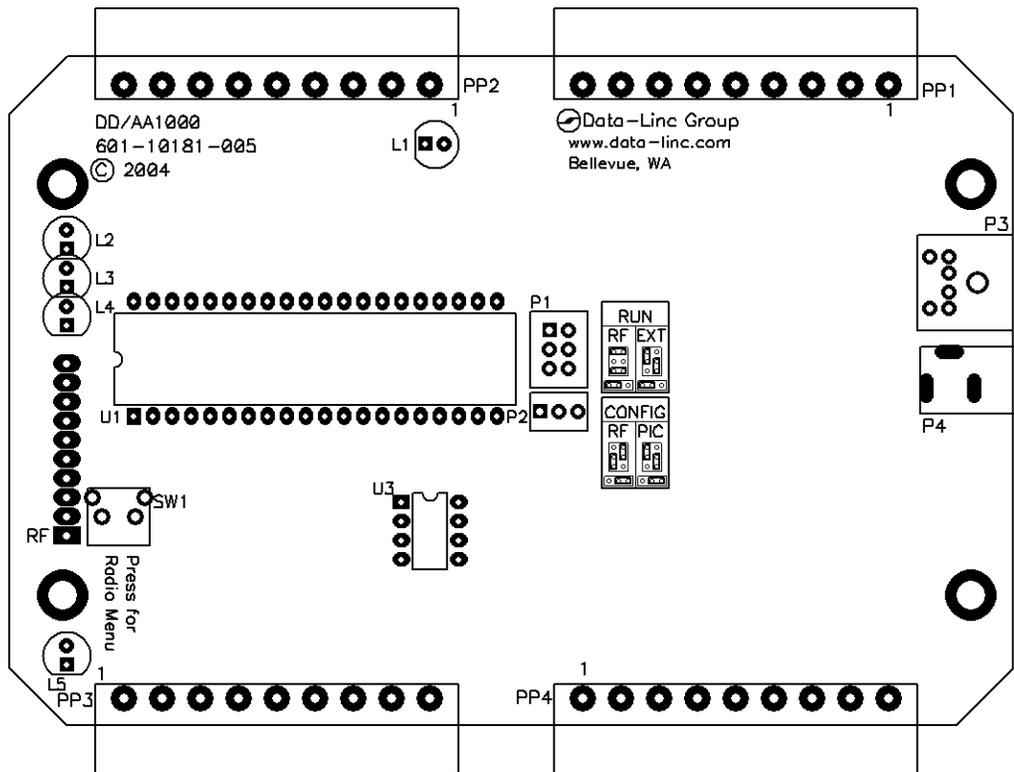
There are 4 configurations of the jumpers.

1. RUN / RF                      Normal PLR580 operating mode
2. CONFIG / RF                Serial port P3 to PC (computer) to access the radio parameters
3. CONFIG / PIC                To reprogram the system configuration setup memory
4. RUN / EXT                    Factory use only - do not use

If changing the system configuration go to Appendix B.

If changing the radio parameters go to Appendix C.

Figure 9: Layout Drawing



## Technical Specifications

### Channels

PLR580D has 8 discrete inputs and 8 discrete outputs.

PLR580DA has 8 discrete inputs, 8 discrete outputs, 8 analog inputs and 8 analog outputs.

### Channel Specifications

Analog: 2% accuracy or better with a maximum output load of 300 ohms.

Discrete: Open collector outputs which can handle up to 24V and can sink up to 100 mA for controlling relay coil.

### Temperature

32° to 140°F (0° to 60°C)

### Power

10.5 - 18 VDC. Maximum current draw is 660 mA.

### RF Specifications

Spread spectrum frequency hopping

Modulation: GFSK

Frequency Range: 902-928 MHz

Channel Spacing: 230.4 kHz

Error Detection: 32 bit CRC

Operating Mode: Class A

Method of Tuning: Digital Synthesizer

RF Power: 200 mW

Receiver Sensitivity: -108 dBm

## Troubleshooting

**I have the units setup on a bench for testing, but the Master's status LED keeps flashing or is solid and I do not have a carrier.**

When shipped, the units are setup for a maximum transmit power of 200 mW. If there are only a couple feet of separation between them, the supplied whip antenna may need to be removed. Note that this will not damage the unit.

**The units are installed in the field, but I have a flashing or solid LED on the status and no carrier.**

The Master's status LED only comes on when a response from a remote is not obtained after 3 tries, then the Master moves on to the next Remote. A solid light indicates that the Master can not connect to any remotes. A blinking light indicates that the Master has lost communication with at least one remote. Most likely problem is a radio line-of-sight problem exists. If external antennas are being used, verify that they are grounded and that line of sight exists. Also verify that the input power is OK. A UPS is recommended in areas where clean power may not exist. If units are bench tested, and there is no communication, then you may have a mis-configured system. If the system has been working and then fails, check for cable and antenna connections, and DC power levels.

**The power LED on one or both of my units is out and I have no communication.**

Try cycling power on either of the units, the resettable fuse may have tripped. If communications do not come up again, verify that there is power to the device. The supplied wall transformer output is nominally around 18 VDC when the radio is not transmitting, and drops to 12 VDC when the transmitter is on. If the supply is okay and cycling power does not fix the problem, contact Data-Linc Group.

**My analog output reads 4 mA all the time.**

Verify that the connection of the transducer at the transmitter is okay. Put a milliamp meter in the loop, and verify that the connected transducer is supplying more than 4 mA into the unit. Verify that the correct current polarity is used. Note that Data-Linc Group unit does not supply loop power.

**My analog output is 0 or below 4 mA.**

Contact Data-Linc Group. The analog output has failed. This is a hardware problem.

**The discrete output will not activate my relay.**

The discrete output of the PLR580D or PLR580DA does not supply power for a relay coil. Refer to the open collector diagram for connections.

**My relay switches on and off constantly.**

Verify that the Master's status LED does not light. The status LED refers to loss of RF communication data stream. Make sure the relay coil does not require more than 100 mA. The discrete outputs can only sink 100 mA.

**The relay never switches.**

Verify that the switch on the input side is wired properly to the PLR580D or PLR580DA. Check the discrete output with a multimeter. Set the meter for continuity and place the "+" lead on the "G" or common terminal and "-" on the correct discrete output.

## 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 is based in Bellevue, Washington USA and may be reached at (425) 882-2206 or e-mail [support@data-linc.com](mailto:support@data-linc.com)

## Product Warranty

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

## Return Material Authorization

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

## Contact Information

### Corporate Office

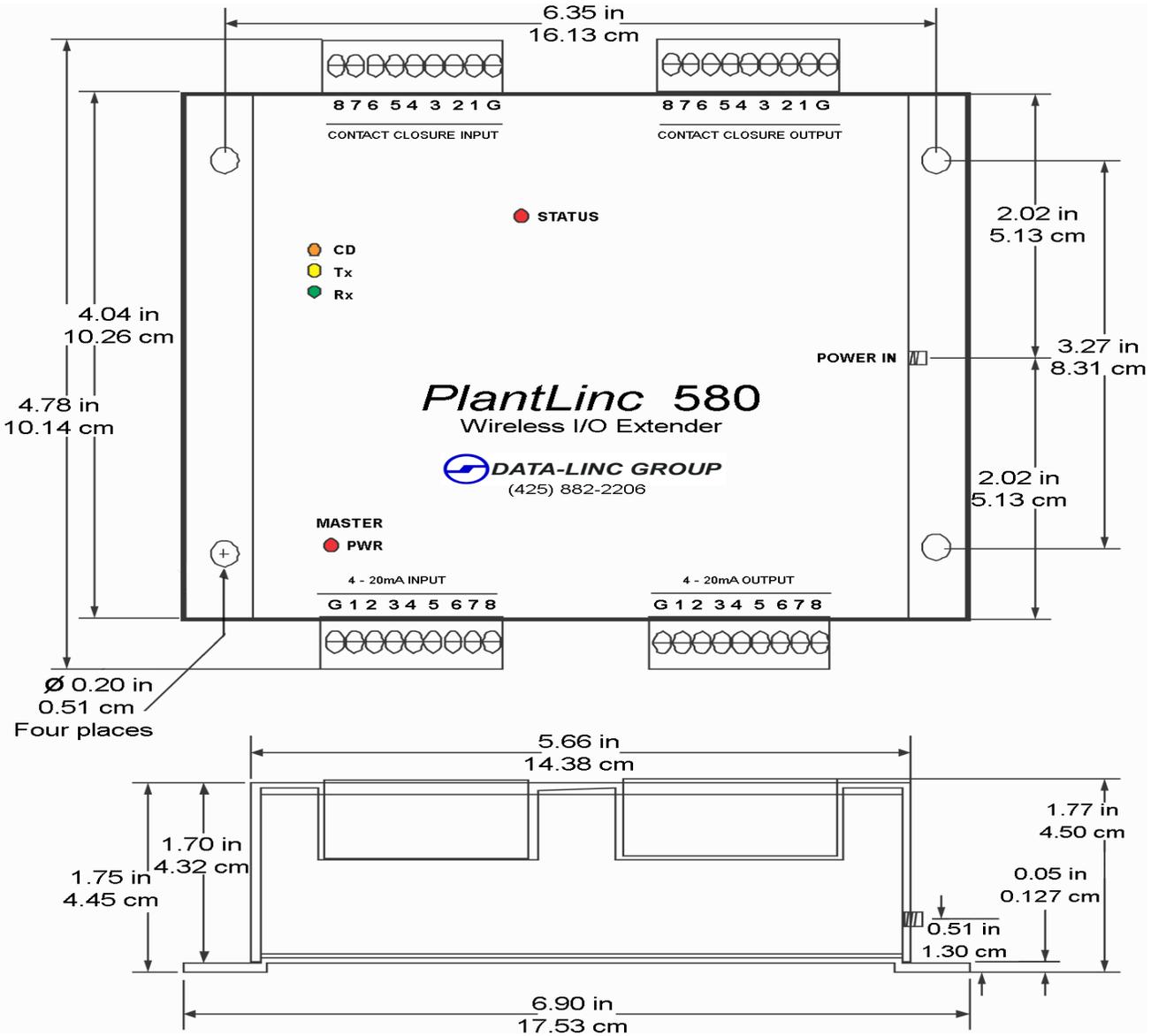
### Data-Linc Group

3535 Factoria Blvd. SE  
Suite 100  
Bellevue, Washington 98006 USA

Telephone: (425) 882-2206  
Fax: (425) 867-0865  
E-mail: [info@data-linc.com](mailto:info@data-linc.com)  
Web site: [www.data-linc.com](http://www.data-linc.com)

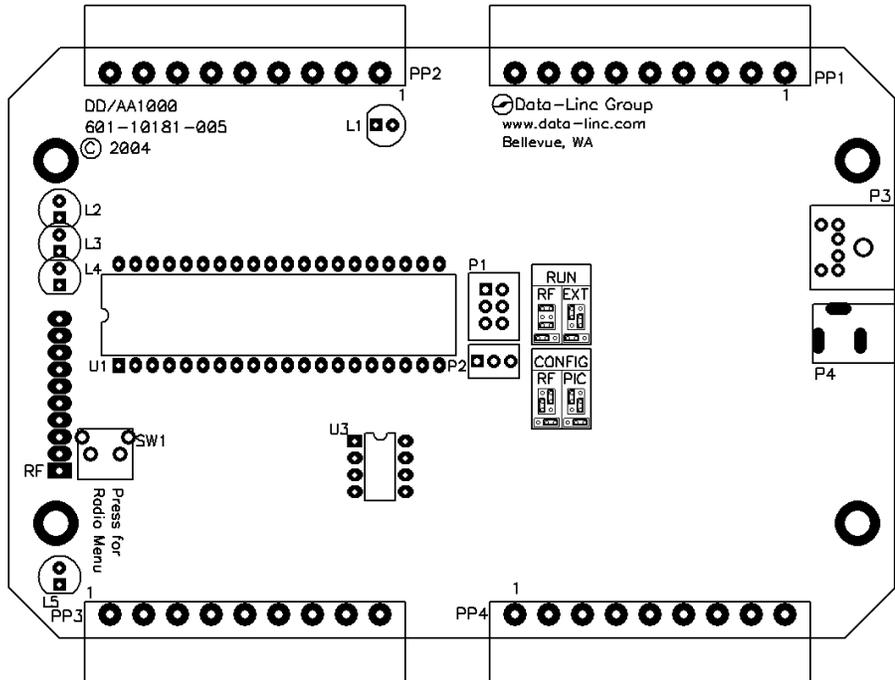
# Appendix A

## Enclosure Dimensions



## Appendix B

Figure 10: PCB Layout



### PLR580D and PLR580DA Configuration

The system configuration parameters are stored in an EEPROM memory. This memory can only be changed by the onboard microprocessor using serial commands via port P3. The easiest method is to use the Data-Linc Group program provided with the master unit, to be run on a PC. If the program is missing contact Data-Linc Group Technical Support.

A PLR580D / PLR580DA system is normally factory pre-configured. Changes to the system are possible, but it is recommended that the user perform this function under direction of Data-Linc Group Technical Support personnel. If the utility program is missing, it is possible to change the setting using a PC with a terminal program, but Data-Linc Group help must be used as the system setting can be confusing. An internal knowledge of the microprocessor operation is vital to understand how to set the system memory. Setting any of the system configuration parameters wrong will make a broken system.

To access the system configurations the user must remove all connectors from the PLR580D / PLR580DA, the remove the cover, and change a set of jumpers at location P1 and P2 and add a serial data cable (SRM6200E-SLC) available from Data-Linc Group to connector P3. See Figure 10, PCB layout drawing. Use the CONFIG-PIC layout as shown on the PCB drawing.

To change the system configuration, set the P1 and P2 jumpers as shown on the layout drawing. Use the CONFIG-RF layout as shown on the PCB drawing. The dark lines represent the three small jumpers. Then insert the Data-Linc Group serial cable into connector P3 located next to the power connector. Attach the serial cable to a PC.

Remember that there are two different part numbers for Masters and Remotes. They contain different firmware. A Master cannot be made into a Remote, and a Remote cannot be made into a Master.

**If you have the Data-Linc Group PC program PLR580EEprom.exe** it is designed to run in Windows. Load the program PLR580EEprom.exe into your PC. Start the program. When the system layout window appears fill in the following information:

1. Select Model PLR580D or PLR580DA with mouse click.
2. The PCs Comm (serial port) number 1 or 2 with a mouse click.
3. The serial Baud rate that the PLR580D / PLR580DA uses to talk to the radio module. This is not the connection speed to the computer. This must match the Baud rate set in the radio module. The factory default for the radio module is 9600.
4. Select System Configuration as either a Point-to-Point (one remote) or a Multipoint system (more than one remote) with mouse click.
5. Select this unit is a Master or a Remote. This must agree with the code in the microprocessor. You can not change a units Master/Remote type in the field.
6. The number of remotes if a Multipoint System.
7. If programming a Multipoint Remote select Remote ID or address you are changing. Remotes have addresses of zero(0) to seven(7).

**If the unit is a PLR580D** click on the “Make an EEprom” button and follow the prompting instructions on the screen. If any previous setting are in conflict or you have not made a needed selection, the parameter will highlight to red. To proceed, correctly fill in the parameter and click the “Make an EEprom” again.

The program will write several characters into the boxes at the bottom, and lower left of the display. These are the serial commands containing the system parameters that are sent and received by the PLR580D / PLR580DA units.

Repeat this procedure once for each Master, and once for each Remote in the system. Make sure you change the address for each Remote.

Each time the program finished making an EEprom, and if a printer is connected to the computer, you can click on the PRINT button on the lower right corner to make a record of the system configuration. It will be handy later when you call Data-Linc Group to try to figure out why your system won't work.

When done, click on the EXIT button at the lower right corner of the window.

**If the unit is a PLR580DA**, fill in the Master 4-20mA chart. The 'X's in the chart are the system configuration. The Remotes ID is the left side of the chart, the IN columns are the 4-20ma input numbers on the Masters connectors. Assign analog input(s) to each Remote by clicking the cursor on the row (address) and column (input #) for the Remote and the input to use. This will toggle the 'X' on or off. Assign the analogs for Remote zero (0) first, then Remote one (1), Remote two (2) thru seven (7). If there are less than seven remotes toggle the remaining 'X's off. The default for the system is all 8 analog inputs assigned to Remote zero( 0).

The program will not allow the user to assign analog inputs in a wrong order. If a wrong assignment is made then program removes the 'X' selection. The maximum number of rows used is set by the number of remotes selected in step 6 above. Do not leave any columns blank if a later column has an 'X'. The data transfer from Master to Remote will stop when a blank filed is reached. Blank columns at the right side of the table are okay. Not all analog inputs need to be assigned, just no orphaned –empty columns.

The number of analog values received from a remote is the same as the number of analog inputs sent to a remote. If a PLR580 remote unit has no analog input/outputs assigned it must have an address(1 to 7) higher than any remote using the analog input. i.e. All remotes using 4-20mA input/outputs must be assigned addresses lower than any digital only remotes.

After filling in the chart click on the "Make an EEPROM" button and follow the prompting instructions on the screen. If any previous setting are in conflict or have not been made the parameter will highlight to Red. To correct fill in the parameter and click the "Make an EEPROM" again.

The program will write several characters into the boxes at the bottom, and lower left of the display. These are the serial commands containing the system parameters that are sent and received by the PLR580D / PLR580DA units.

Repeat this procedure once for each Master, and once for each Remote in the system. Make sure you change the address for each Remote.

Each time the program finished making an EEPROM, and if a printer is connected to the computer, you can click on the PRINT button on the lower right corner to make a record of the system configuration. It will be handy later when you call Data-Linc Group to try to figure out why your system won't work.

When done, click on the EXIT button at the lower right corner of the window.

**If you lost the program PLR580EEPROM.exe** either contact Data-Linc Group service for a new copy or you can use a terminal program such as "Hyper-terminal" with port settings of 9600 baud, 8 data bits, no parity and one stop bit. This process requires a very good understanding of how the units work internally or help from Data-Linc Group Technical Support.

1. Apply DC power to the unit. A line of characters will appear on the terminal screen. It must say:

```
*DDAA EEPROM MENU**
```

```
*SET CAPLCK
```

```
B# 1=12 2=24 3=48 4=96 5=19
```

If not the connection is wrong, or more likely the terminal program's baud setting is not 9600. Close the terminal connection, reset the baud to 9600 and reopen the terminal connection. Now remove and reapply the units DC power. If these instruction are confusing to you, do not proceed. Find someone who has computer knowledge of serial ports and terminal programs, and call Data-Linc Group service support.

2. Make sure the CapsLock light is set ON at your keyboard.

3. Now select the baud rate that matches the setting of the radio module. The most common setting are 5 for 19.2K baud, or 4 for 9600 baud. If your not sure use 5 and later check the radio baud setting to match.

4. Display shows 'M or S'. Select 'M' if these settings are for a Master unit. Select 'S' if this is to be a Remote/Slave unit. If CapsLock not on the unit will jump back to step 1.

5. Display shows '#Slvs1-8'. It is asking for the number of remotes/slave units in the system. A point to point would be one (1). You can have as many as eight (8). Press 1 to 8.

6. The unit will now ask for the number of ADs (analog inputs) on each Remote. '#ADsSlv0'. The question is repeated for each Remote unit. '#ADsSlv1'.etc. Any units that have no (zero) active analog channels must be put after any remotes that do have analog channels. Enter the number of analogs channels for each Remote.
7. The display now asks for the number of analog inputs at the Master unit. '0-8 MstrAD' The number of master analog inputs must equal the total number of analog inputs entered for each remote in step 6 above.
8. The display now asks for the number of analog outputs on each Remote '#DAsSlv0'. The question is repeated for each Remote unit. '#DAsSlv1' etc. These values must be the same as the numbers entered in step 6 above.
9. The display now asks for number of analog outputs at the Master unit. '0-8 MstrDA' This number is the same as entered in step 7 above.
10. The display now prints out a status of your entries. Write these down and keep for use when you call Data-Linc Group technical support. Note the first line may say Master or Slave/Remote. Review the settings. The EEprom has been changed. The print out has been read from the changed EEprom. The data shown is from a master unit. The Remote display is similar.

```
Mstr EEP:  
B# AD DA Slvs  
5 3 3 3  
ADs/Slave 1 2 0 0 0 0 0 0  
DAs/Slave 1 2 0 0 0 0 0 0  
Check
```

11. Remove DC power, remove the serial cable, replace the jumpers on P1 and P2 back to the RUN/NORMAL position. Repeat the procedure for all of the units that you are reconfiguring.
12. After all units are changed, bench test the system. The most likely problem is the baud rate setting does not match the setting in the radio modules.

## Appendix C

### Radio Configuration

The radio module in the PLR580D / PLR580DA can be set to suit your particular application. All adjustments are done through the built-in setup program, with a user interface that eliminates the need for setup diskettes or custom software.

The radio modules used in the PLR580D / PLR580DA are factory pre-configured. The likely times the user would need to change a parameter would be to replace a defective radio module, add the repeater function to a radio, or change the system configuration. The user is encouraged to contact Data-Linc Group before making any changes, as a wrong setting may cause the radios to stop communicating. The main parameters that might need to be changed are:

- call book (phone) number
- network ID
- system operating mode
- repeater mode
- frequency key
- baud rate (if changing the radio)

To access the radio setups the user must remove all connectors from the PLR580D / PLR580DA, then remove the cover, and change a set of jumpers at location P1 and P2 and add a serial data cable supplied by Data-Linc Group to connector P3. See Figure 10, PCB layout drawing (Appendix B).

To access the radio configuration menu, set the P1 and P2 jumpers as shown on the PCB layout drawing (Appendix B). Use the CONFIG-RF selection as shown on the PCB drawing. The dark lines represent the three small jumpers. Then insert the Data-Linc Group serial cable into connector P3 located next to the power connector. Attach the serial cable to a PC. Start a terminal program such as "Hyperterminal" with port settings of 19.2 K baud, 8 data bits, no parity and one stop bit. Apply DC power to the unit. Press the Configure button label SW1 located at the end opposite the power connector. While any terminal program that can be set to 19200 baud will work, examples for this manual were generated using the Microsoft Windows 2000 application "HyperTerminal."

Note that the computer setup communications to configure radio modules will always be at a baud rate of 19.2 K. The baud rate of the PLR580 communications may be different. The radio module baud rate setting is for talking to the PLR580 circuit board, not the computer terminal program.

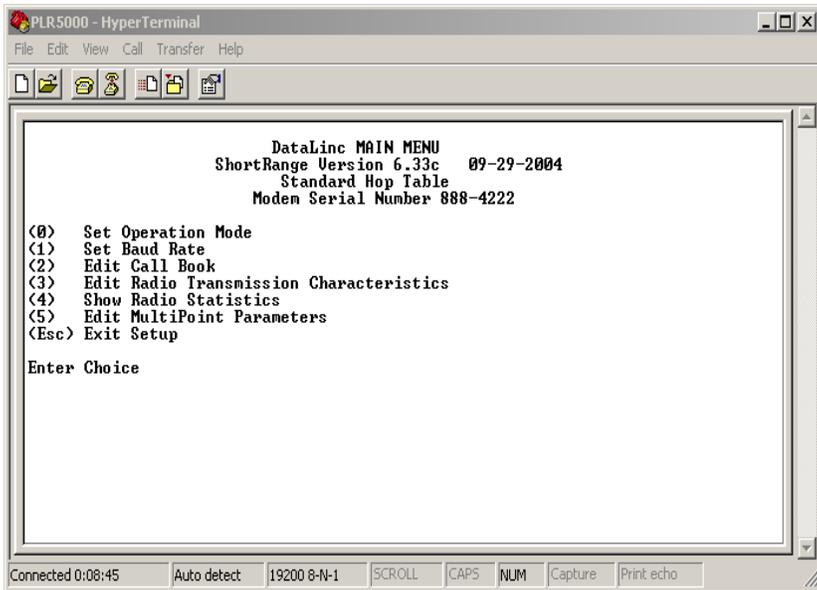
**Note:** When using HyperTerminal, set Handshaking to none.

**Table 2: Terminal Settings**

Parameter	Setting
Baud Rate	19200
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

When the setup program the main menu will appear on the screen. The main menu also displays the radios unique ID number and firmware version. The user selects the parameter group by pressing a single key. The next level menu is then displayed. Select the parameters you want to change with a single keystroke. Now you can enter the parameter or data value. To return to the previous menu press the 'ESC' escape key. When done making changes, press the 'ESC' key at least 3 times.

Figure 11: Main Menu

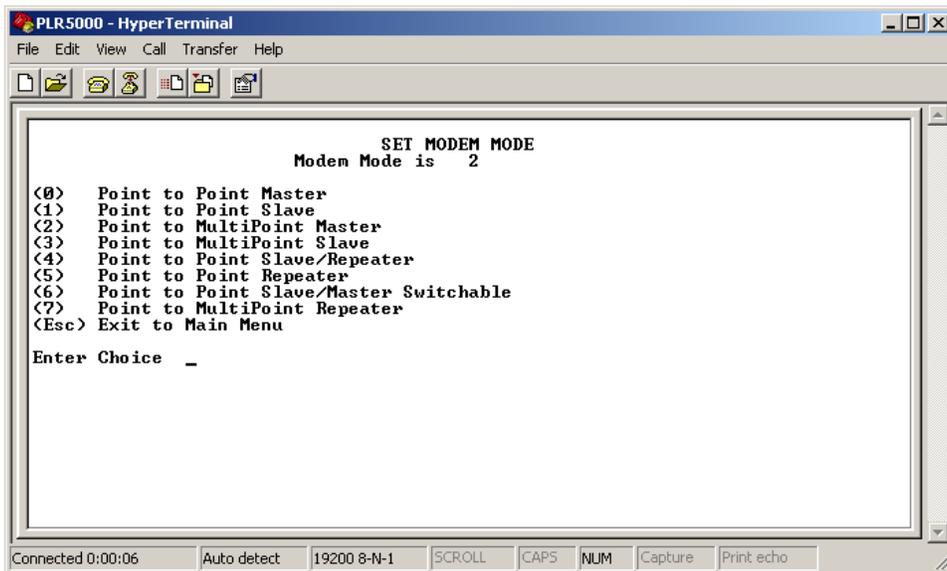


## Main Menu Option (0): Set Operation Mode

When item (0) is selected, the Operation Mode Menu appears as shown in figure 12. The Operation Mode option is used to designate the method in which the particular PLR580 will be used. The PLR580 operates in a master to remote configuration; therefore, any radio modems that are intended to operate together must be set up as such. In a point-to-point setup, either the master or remote may be used on either end of the communications link. One consideration when setting up the radio modems is that a number of parameters are controlled by the settings in the master; therefore, you may wish to deploy the master on the communications end where you will have easier access to the radio modem.

**Figure 12: Mode Menu**

Shown below are example settings. Please refer to supplied configuration sheets for your modem's configuration.



### (0) Point-to-Point Master

The PLR580 operates in a master/remote configuration. When designated as a master in point-to-point mode, the radio modem will call any or all remotes it is instructed to call in the call book. The master determines the settings used for all Radio Transmission Characteristics, regardless of the settings in the remotes and/or repeaters.

### (1) Point-to-Point Remote

When set up as a point-to-point remote, a PLR580 will communicate with any master in its call book, either directly or through one or two repeaters. When functioning as a remote, the Entry to Call feature in the radio modem's call book (Figure 13) is not operational. The remote will communicate with any master on the list that calls.

### (2) Point-to-Multipoint Master

The PLR580 may be set to run in multipoint mode, which allows one master to simultaneously be in communication with numerous remotes. A point-to-multipoint master will communicate only with other radio modems designated as point-to-multipoint remotes or point-to-multipoint repeaters.

### (3) Point-to-Multipoint Remote

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

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

**(4) Point-to-Point Remote/Repeater**

Do not use this mode with the PLR580

**(5) Point-to-Point Repeater**

Do not use this mode with the PLR580

If a repeater is need in the system do not use a PLR580D or PLR580DA. If and extended range of non-line-of-sight situation exists, use the Data-Linc Group PLR5000 radio modem as a repeater. When designated as a repeater, a radio modem behaves as a pass-through link. All settings for the call book, baud rates, and radio transmission characteristics are disabled. A repeater will connect with any master that calls it (the repeater must still be set up in the master's call book).

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

Do not use this mode with the PLR580

**(7) Point-to-Multipoint Repeater**

Can be used as a repeater / remote in a multipoint network. Please contact Data-Linc Group for detailed information on this setting.

## Main Menu Option (1): Set Baud Rate

The PLR580 use 8 Data Bits/ no Parity, 1 Stop bit only. Do not change. These settings are not used when setting radio operating values. The default setting is 0 (8,N,1).

**Note:** The RF parameter baud rate must match the internal set baud rate in the EEprom. A mismatched baud rate will cause communication to always stop.

### ModBus RTU

Do not use this mode with the PLR580.

## Main Menu Option (2): Edit Call Book

If the PLR580 system is only two (2) units, one Master and one Remote, then either Point-to-Point or Multipoint modes can be used. If the system has more than one Remote, then Point-to-Multipoint mode must be used. Use of the Call Book for multipoint systems is explained later in this chapter.

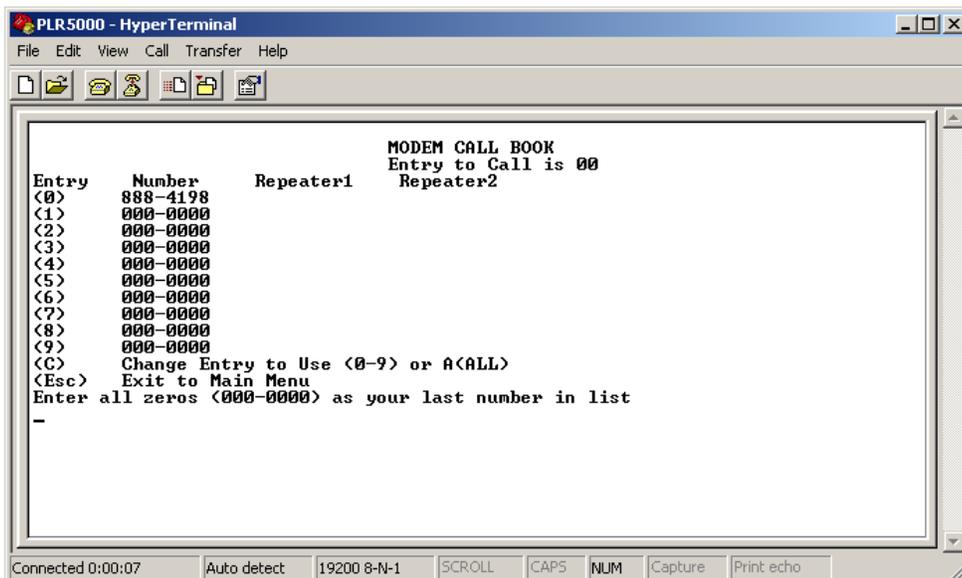
The Call Book is an innovative feature in the PLR580 that offers both security and flexibility in use. The Call Book accomplishes this by allowing the user to determine with which other PLR580s a given radio modem will communicate, based on the Call Book numbers for both the master and remote. The radio modem's Call Book number is encoded in the microprocessor and identified on a label on the modem. The instructions provided in this section are for point-to-point mode only. Use of the Call Book for multipoint systems is explained later in this chapter. For two PLR580 radio modems to communicate in point-to-point mode, three events must occur:

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

As shown in figure 13, the Call Book allows users to set up a list of up to 10 PLR580s to communicate with. Designate up to 2 repeaters to be used in communicating with a given radio modem, and tell the master which remote to call. To direct the master to call a remote, the Remote must be in the Call Book Menu. A specific remote may be called by entering (C) at the prompt, followed by the menu number corresponding to that remote. To call any available remote in the list, the user should enter C and then A (for All).

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

Figure 13: Call Book Menu



**Entering or Modifying Numbers in the Call Book**

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

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

**Edit Call Book in Multipoint Systems**

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

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

Shown below are example settings. Please refer to supplied configuration sheets for your modem’s configuration.

Multipoint Master Call Book (Unit Call Book number 555-0001)

**No call book number entries are necessary in the Point to Multi-point master’s Call Book**

Entry	Number	Repeater 1	Repeater 2
(0)	000-0000		
(1)	000-0000		

Multipoint Repeater Call Book (Unit Call Book number 555-0002)

Entry	Number	Repeater 1	Repeater 2
(0)	555-0001		
(1)	000-0000		

Multipoint Remote Call Book (Unit Call Book number 555-0003)

Entry	Number	Repeater 1	Repeater 2
(0)	555-0001		
(1)	555-0002		
(2)	000-0000		

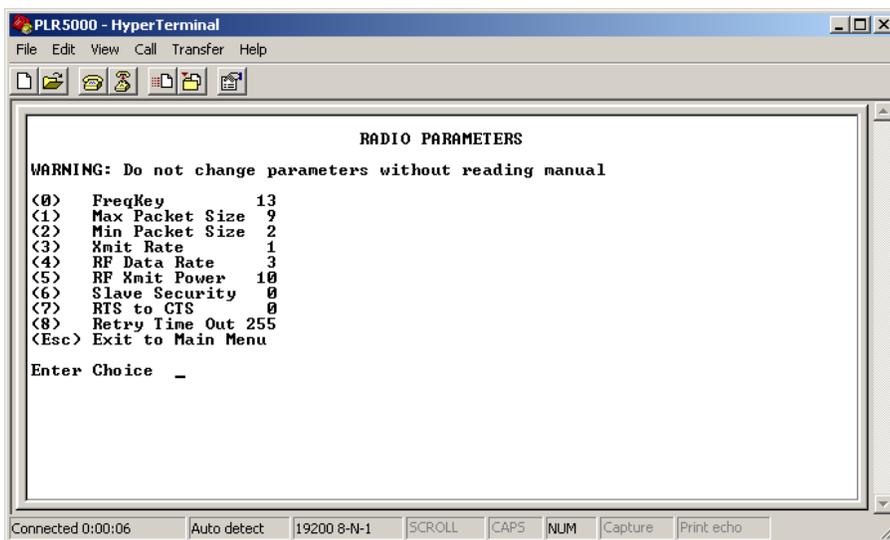
## Main Menu Option (3): Edit Radio Transmission Characteristics

When option (3) is selected in the main menu the screen in figure 14 appears, which allows the user to modify the radio transmission characteristics of the radio modems. As stated in the warning, these parameters are for the experienced user who has a good understanding of the principles of radio data transmission. They should be changed only after consulting this user guide.

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

**Figure 14: Radio Parameters Menu**

Shown below are example settings. Please refer to supplied configuration sheets for your modem's configuration.



### (0) FreqKey

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

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

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

For PLR580 use the user should not change this parameter.

### (3) Xmit Rate

There are two settings for the Transmit Rate parameter. For normal operation PLR580s should be set at Transmit Rate 1. Transmit Rate 0 is useful to qualitatively gauge signal strength. When set to Transmit Rate 0 the radio modems will transmit data back and forth continuously, and the strength of the signal may be gauged by viewing the Show Radio Statistics option.

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

**(4) RF Data Rate**

For PLR580 use the user should not change this parameter.

**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.

**(5) RF Xmit Power**

The PLR580 offers users the ability to modify the Transmission Power of the radio modem. There are 10 power settings available (1-10) which are roughly linear. Therefore a setting of 10 is full power (or 200 mW) and 1 is 10% power (or 20 mW). The following guidelines should be followed when setting the RF Transmission Power:

**Table 6: Power Transmit Settings**

Setting	Power Level	Used When
1-3	Low	Pair of pairs of radio modems operating within the same or adjoining rooms.
4-6	Medium	More than one pair of radio modems operating withi the same facility.
7-10	Full	Normal operation extending beyond a facility.

**(6) Remote Security**

For PLR580 use the user should not change this parameter.

**(7) RTS to CTS**

For PLR580 use the user should not change this parameter. Leave it disabled (0).

**(8) Retry Time Out**

For PLR580 use the user should not change this parameter.

## Main Menu Option (4): Show Radio Statistics

Option (4) in the main menu allows the user to view data transmission statistics, which have been gathered by the Transceiver during the most recent session. Statistics are gathered during each data link and are reset when the next link begins. Ideally, noise levels should be below 30, and the difference between the average signal level and average noise level should be 15 or more. High noise levels tend to indicate other sources of RF interference, while low signal levels indicate a weak link. The “Local” stats are the statistics that are being gathered by the modem you are connected to while “Remote1, Remote2, and Remote3” are the stats of the repeater(s) that the modem you are attached to is using to get back to the master modem. The following sections provide information useful to the process of troubleshooting and improving radio links.

```

MODEM STATISTICS

Master-Slave Distance(m) 0052711

Number of Disconnects 0
Radio Temperature 27
Antenna Reflected Power 5
Transmit Current (mA) 0024
  Local Remote1 Remote2 Remote3
  J dBm dBm dBm dBm
Noise 55 4
Signal 0 4
Rate % 0
C0A0EF

Press <Ret> for Freq Table, <Esc> to return to main menu_

```

### Average Noise Level

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

### Average Signal Level

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

For a reliable link, the average signal level should be at least 30 higher than the average noise level reading. The table below provides an approximate conversion of average signal level values into the more common dBm (decibel milliwatts). Low Average Signal Levels can often be corrected with higher gain antennas, antenna placement, and use of repeaters. Contact Data-Linc Group for more information.

### **Overall Rcv Rate (%)**

The Overall Rcv Rate measures the percentage of data packets that were successfully transmitted from the Master to the Remote on the first attempt without requiring retransmission. A number of 75 or higher indicates a robust link that will provide very good performance even at high data transmission rates. A number of 25 or lower indicates a weak or marginal link that will provide lower data throughput.

### **Number of Disconnects**

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

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

### **Radio Temperature**

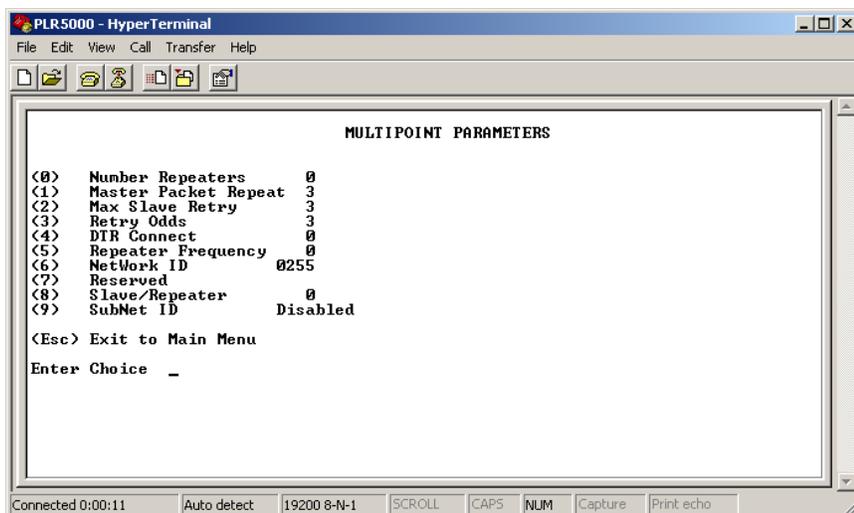
The radio temperature value is the current operating temperature of the radio in degrees C (Celsius.) For proper operation, PLR580 radio modems must be in the range of 0° to 60° C.

### **Multipoint Operation**

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

## Main Menu Option (5): Edit Multipoint Parameters

Figure 15: Multipoint Parameters



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

In a multipoint network, it is critical to know how many radio modems are being used as repeaters. Any radio modem that is used as a repeater essentially becomes a master to the remotes and other repeaters to which it is communicating. Therefore, the user must first identify how many repeaters are connected to the master by assigning a value in parameter **(0) Number Repeaters**. This parameter must also be set for each repeater in the system (i.e., in the event that a repeater is connected to one or more other repeaters). This parameter does need to be set for multipoint remotes.

In point-to-point operation, the PLR580 radio modems acknowledge every data packet transmitted. In a multipoint network, the remotes do not acknowledge transmissions from a master to the remotes. This is to prevent system overload. If the remotes acknowledged all data transmissions from the master in a large multipoint system, then all system capacity would be spent having the master listen for acknowledgments from the remotes. Because the transmission is not acknowledged by the remotes, 100% confidence does not exist that every remote has received every message from the master. To address this issue, the user may modify option **(1) Master Packet Repeat**, assigning a value between 0 (the packet is transmitted once) to 9 (the packet is repeated 9 times). For networks with solid RF links, this parameter would be set at the lower end of the scale (0-1). If the network has some weak or marginal links, it would be set toward the higher values. If a remote receives a packet from a master more than once, it will discard the repeated packets received.

While packets transmitted from the master to the remotes in a multipoint network are not acknowledged, packets transmitted from remotes to the master are. However, it is possible that more than one remote will attempt to transmit to the master at the same time, and it is therefore important that a protocol exists to resolve contention for the master between remotes.

This is addressed through parameters **(2) Max Remote Retry** and **(3) Retry Odds**. The Max Remote Retry setting defines how many times (0 to 9) the remote will attempt to retransmit a packet to the master before beginning to use a back-off algorithm. Once the remote has unsuccessfully attempted to transmit the packet the number of times specified in Max Remote Retry, it will attempt to transmit to the master on a random basis.

The Retry Odds parameter determines the probability that the remote will attempt to retransmit the packet to the master; a low setting will assign low odds to the remote attempting to transmit and conversely a high setting will assign high odds. An example of how this parameter might be used would be when considering two different remotes in a multipoint network, one close in with a strong RF link and the other far from the master with a weak link. It may be desirable to assign a higher Retry Odd to the remote with the weaker link to give it a better chance of competing with the closer remote for the master's attention.

**(4) DTR Connect.**

For PLR580 use the user should not change this parameter.

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

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

**(8) Remote/Repeater** The remote/repeater mode allows a PLR580 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.

in a multipoint system to simultaneously act as a remote and a repeater. When in this mode, a radio will repeat transmit any packets sent from a master as well as send them out the RS232 port. This allows a PLR580 set as a slave/repeater to act as a remote at the same time. 0 disables this mode, 1 enables it.

**(9) SubNet ID**

The PLR580 modems offer a SubNet ID system for use in multipoint networks using Network ID. This feature allows the users to dictate what path a given repeater or remote will use to achieve a link to the network master. For example, if a remote modem in a given network has line of sight to the network master and one or more repeaters, but only one repeater is close to that remote, SubNet ID can be used to link that master with the proper repeater only.

**Note:** This feature can only be used in networks using Network ID with one or more repeaters.

There are two components to SubNet ID. The first is the Xmit (transmit) SubNet ID, and the second is Rcv (receive) SubNet ID. The Xmit SubNet ID is used only by repeaters and is the ID that a repeater sends out when sending data to other repeaters or remotes. The Rcv SubNet ID is the ID that repeaters or remotes look for to receive data.

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

**Modem configurations are as follows:**

<b>Master</b>	No setting used
<b>Repeaters</b>	Any repeater that should be linked directly to the master should have the Rcv SubNet ID set to 0. Any repeater using another repeater as its link, needs the Rcv SubNet ID set to the Xmit SubNet ID of that repeater. The Xmit SubNet ID can be set to anything from 1 to E.
<b>Remotes</b>	Any remote that should be linked directly to the master should have the Rcv SubNet ID set to 0. Any remote using a repeater as its link should have the Rcv SubNet ID set to the Xmit SubNet ID of that repeater

## PLR580 Placement Locations

Placement of your PLR580 is likely to have a significant impact on its performance. In general, the rule of thumb with the PLR580 is that the higher the placement of the antenna, the better the communication. In practice you should also place the radio itself away from computers, telephones, answering machines, and other similar equipment. To improve the data link, Data-Linc Group offers directional and omni directional antennas with cable lengths ranging from 10 to 200 feet.

When using an external antenna, placement of that antenna is critical to a solid data link. Other antennas in close proximity are a potential source of interference. It is also possible that slight adjustments in antenna placement (as little as 2 feet) will solve noise problems. In extreme cases, such as when the radio modem is located close to pager or cellular telephone transmission towers, Data-Linc Group offers a band pass filter to reduce the out of band noise.