MAXI® Remote Location Kit
MRLK 900

Installation
and
Configuration
Manual

Table of Contents

Introduction

The **M**AXI® **R**emote **L**ocation **K**it 900 utilizes 900 MHz Spread Spectrum radios to position a Field Interface such as a MIM 2-Wire, MIM LINK, LDI, SDI, or ICI at a remote location from the central control computer. The MRLK 900 includes two PolyPhaser surge arrestors to provide in-line protection against surge events at the locations of both radios. These installation instructions assume that the user is already familiar with the installation instructions and physical layout of the MIM 2-Wire, MIM LINK, LDI, SDI, or ICI products. If further information is needed regarding these types of products, please refer to their respective manuals.

Materials Included

The MRLK 900 kit contains the following materials:

Number Find	Description	Quantity
1	FGR2-CE, 902 to 928MHz, Frequency Hopping Spread Spectrum wireless data transceiver in a ruggedized enclosure with TNC female RF connector, DB9 female connector, accepts +6 to +30 VDC.	2
2	Transformer Input: 120VAC 12W Output: 12VDC 500mA EMD 1280UX	2
3A	RS232 Interface Cable DB9 Male to DB9 Female	2
3B	RS232 Interface Cable – Null Modem DB9 Female to DB9 Female	1
Not Pictured	DB9 Male to Male Gender Changer (Used with Null Modem Cable)	2
4 (At Radio)	RFT-1234 N Female to TNC Male Straight Adaptor	2
4	20 Foot Coaxial Cable with male N type connectors (0.24" diameter, 1.7dB loss)	4
5	900-960 MHz 6dB 4 element Yagi directional antenna	2
6	PolyPhaser - Throughput Energy ≤ 220µJ (typical) Frequency Range: 125MHz to 1000MHz Max. Power: VHF 375W, UHF$_{Low}$ 125W 800MHz to 1GHz 50W	2
Not Pictured	FGR2-CE-U Diagnostic and Programming Cable ASC0409DC REV C CCX	1
Not Pictured	User Manual	1

Setup Overview

The following diagram in Figure 1 depicts a typical before and after configuration for the installation of the MRLK 900.
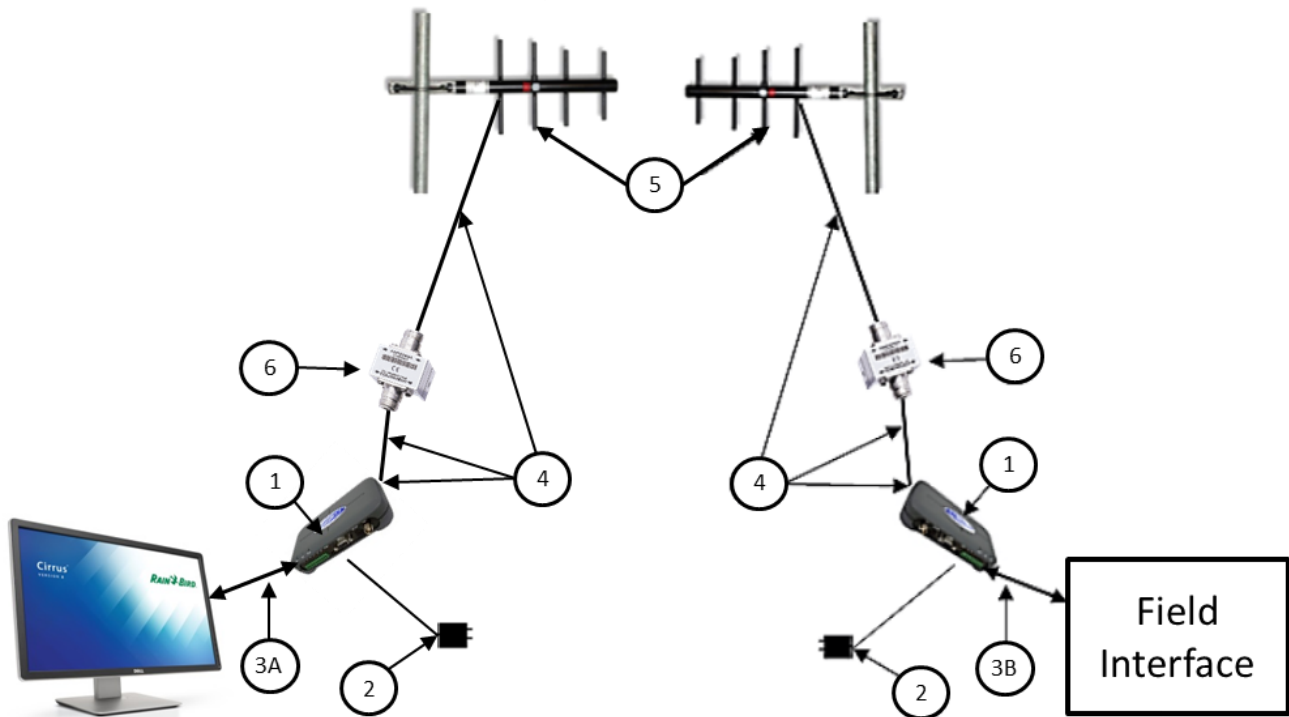
MRLK Installation

Radio Configuration Overview:

Prior to the installation of the MRLK 900, the FreeWave 900 MHz Spread Spectrum radios require configuring. All adjustments are done through the FreeWave Tool Suite. The program can be downloaded from the FreeWave website at:

http://www.freewave.com/tool-suite-programming-configuration-monitoring/

The configuration can also be performed using Microsoft's HyperTerminal program provided with most versions of Microsoft Windows.

The FreeWave radios operate in a Master/Slave configuration for point to point use. Therefore, the radio used at the computer location must be setup as a master using the steps below, and

4

the other will be setup as a slave to be used at the remote interface location. As appropriate, the actions pertaining to the steps below will be highlighted accordingly to differentiate between the directions associated with a master radio configuration and those of a slave radio configuration.

The FreeWave radios are not fully pre-configured from the factory. While many of the required parameters are pre-configured, the corresponding radio's serial number must be added and other settings should be verified to ensure that the radios will communicate properly. After programming the Master radio and prior to establishing a communication link with a slave or repeater, all three of the master's LEDs will be solid red (Note: Always connect an antenna before powering a radio). Even though the "TX" LED may appear dimmer than the other LEDs, it should be displayed at a level which is detectable from being completely off. The MRLK Radios should be configured using the following software and steps:

FreeWaveTool Suite Installation:

1. Insert disc if provided and use the "autorun.exe" program. If software is downloaded from FreeWave Website run the FreeWave Tool Suite Web Install executable.
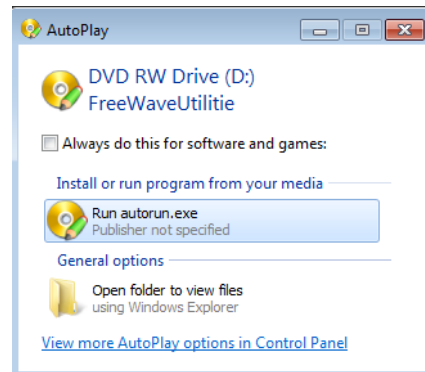
2. Select "Install Software", and then select "Tool Suite vx.x.x" on the next window. If the software on your Disk is older than the below version it can be updated in the Tool Suite.
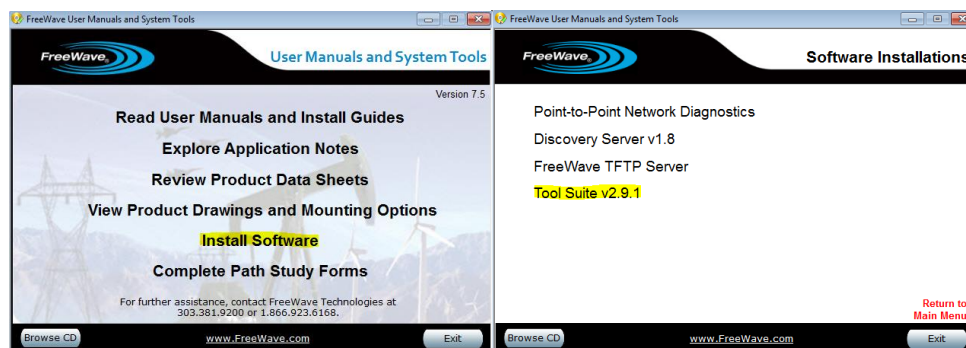
3. Continue through the Setup Wizard, this may prompt you to restart the computer. Restart prior to completing the next steps. Once restarted, complete the following installation.

1) For Configuring Using Tool Suite Configuration:

1. Connect one of the radios to one of the computers COM ports using the supplied "Diagnostics and Programming Cable". Use a Serial to USB adaptor if no Serial port is available. Provide power to the FreeWave radio using the supplied transformer; before powering the radio, an antenna must be connected or immediate damage to the radio may occur.

2. Open the **Free Wave Tool Suite**, select the "**Updates**" icon (2a) from the left navigation bar, and then click "**check updates**" (2b) in the top left to complete any necessary updates to the Tool Suite software.
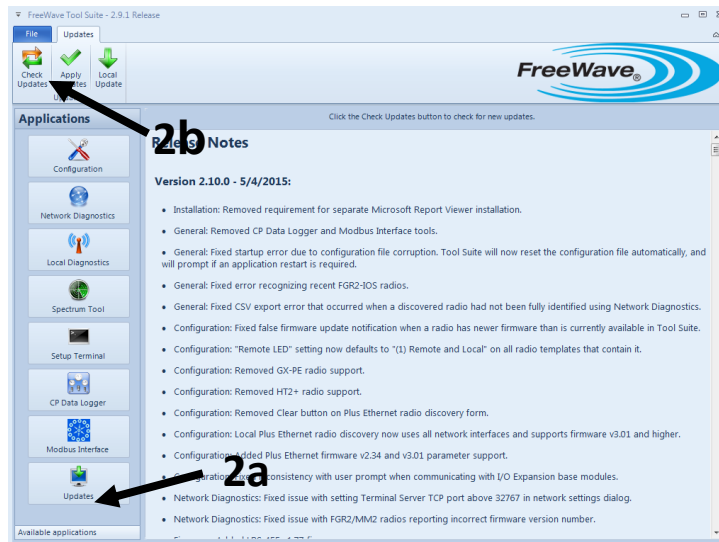
3. After updating the software select the "configuration" button (3a) from the left navigation bar.

4. In the drop down menu under **Com Port** (4a), select the port in which the radio is connected. To determine the correct com port please review the Appendix section of this manual.
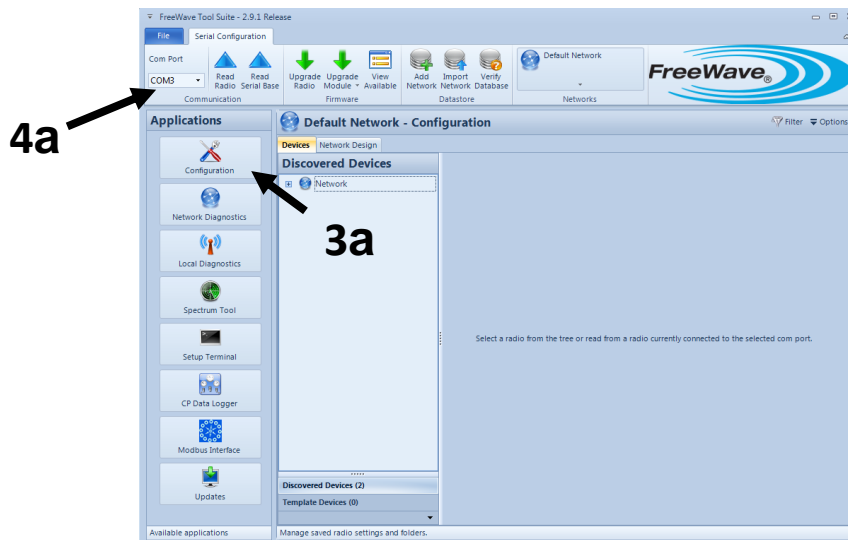
5. Enter "Programming mode" by pressing the black button on the back of the radio (5a). When the setup program is invoked, all three LEDs on the front panel of the FreeWave radio will turn green and will remain green for the entire time the radio is in setup mode.

6. Select "Read Radio" (6a). This will download and communicate with the connected radio.

Verify that the serial number on the setup program screen matches the serial number on the bottom of the FreeWave radio. In addition to providing the radio's unique serial number, the setup program provides a set of choices for editing the operational parameters and viewing the performance data. Also, you should change the name of the radio to signify if it is the master radio or the slave radio, and any other unique identifiers.

7. Select the "Operation Mode" tab, the first line under modem mode should be set to "(0) Point to Point Master" when configuring the master radio and "(1) Point to Point Slave" when configuring the slave radio.
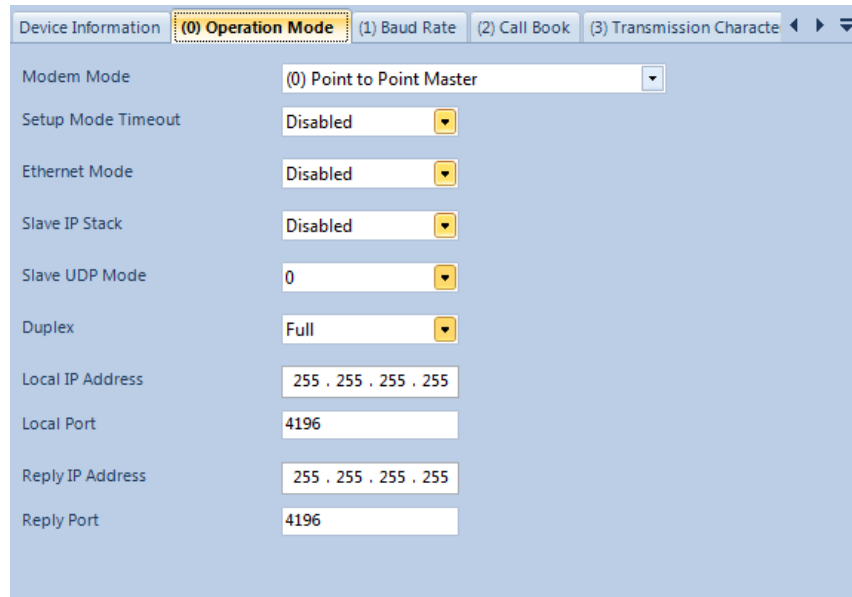
Select the "Baud Rate" tab, then select the appropriate Baud rate for the application. For the MIM and MIM LINK determine the baud rate setting by looking at the baud rate jumper on the inside of the Interface door. Use the table below to determine the selected baud rate for the MIM. For most other applications including the ICI, SDI, and LDI the Baud rate should be set to 9600.

Jumper	Baud Rate
E5 – E4	9,600
E4 – E3	1,200

All other settings should reflect those of the below image:
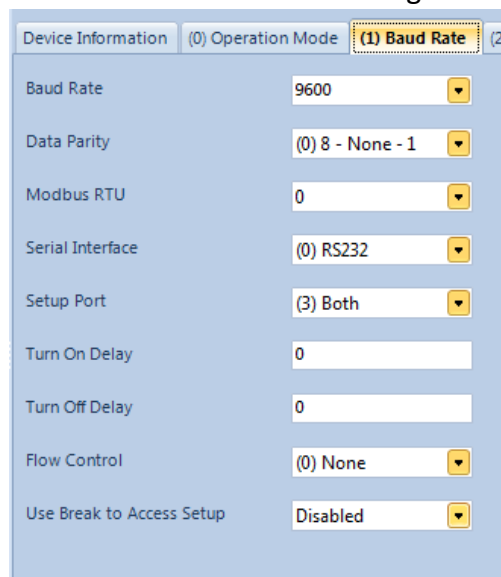
8. Next select the "Call Book" Tab":
    For the master radio, the number for Entry (0) should match the serial number located on the bottom side of the slave radio.

    For the slave radio, the number for Entry (0) should match the serial number located on the bottom side of the master radio.

Entry	Number	Repeater 1	Repeater 2
0	939-7358		
1			
2			

9. IMPORTANT! Select "Program All" (10a) to write the configuration changes to the radio when complete.

10. After configuration of both the Master and Slave radios has been successfully completed, the Carrier Detect (CD) LED on each radio will turn solid green when the radios detect each other's signal.

10a

2) For Configuring Using "Setup Terminal" in FreeWave Tool Suite:

1. Click on Setup Terminal icon on the left navigation bar.

2. Select the Com port the "Diagnostics and Programming Cable" is connected to and click connect. To determine the correct com port please review the Appendix section of this manual. Note: When using a USB-to-serial adapter (not included), the COM port assigned to the adapter must be selected.

3. Select "0" to set Operation Mode.

```
                          MAIN MENU
               D2 AES Version v10.6.8     08-21-2013
                       902 - 928 MHz
               Modem Serial Number 937-0704
                   Model Code DG2C

  (0)   Set Operation Mode
  (1)   Set Baud Rate
  (2)   Edit Call Book
  (3)   Edit Radio Transmission Characteristics
  (4)   Show Radio Statistics
  (5)   Edit MultiPoint Parameters
  (6)   TDMA Menu
  (8)   Chg Password
  (Esc) Exit Setup

  Enter Choice
```
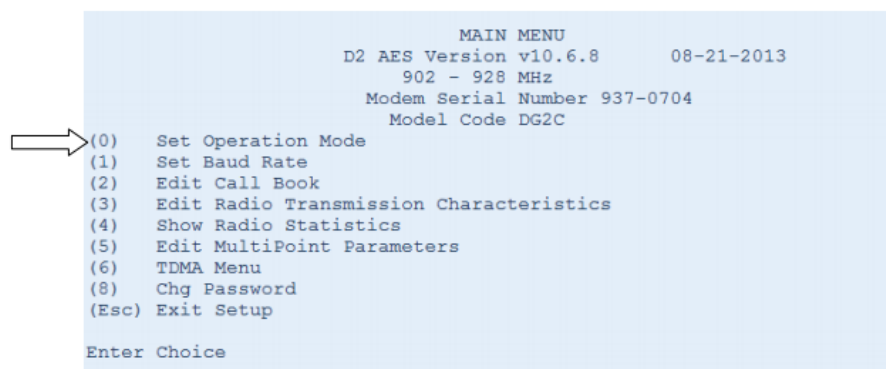
4. Select "0" to configure radio as Master.

```
  Enter Choice
                               SET MODEM MODE
                         Modem Mode is    0

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

  Enter Choice
```

5. Press the "ESC" key to return to the main menu
6. Select "1" to set the Baud Rate

```
                          MAIN MENU
               D2 AES Version v10.6.8     08-21-2013
                     902 - 928 MHz
                 Modem Serial Number 937-0704
                      Model Code DG2C

        (0)   Set Operation Mode
───────>(1)   Set Baud Rate
        (2)   Edit Call Book
        (3)   Edit Radio Transmission Characteristics
        (4)   Show Radio Statistics
        (5)   Edit MultiPoint Parameters
        (6)   TDMA Menu
        (8)   Chg Password
        (Esc) Exit Setup

        Enter Choice
```

7. Select the appropriate baud rate according to the type of interface:

Interface	Baud Rate	Selection Choice
MIM, MIM LINK,TWI, TWI LINK	1200	9
MIM, MIM LINK,TWI, TWI LINK, SDI, LDI, ICI	9600	6

```
Enter Choice
                              SET BAUD RATE
                      Modem Baud is   009600

(0)     230,400
(1)     115,200
(2)     76,800
(3)     57,600
(4)     38,400
(5)     19,200
(6)     9,600
(7)     4,800
(8)     2,400
(9)     1,200
(A)     Data, Parity  0
(B)     MODBus RTU    0
(C)     RS232/485     0
(D)     Setup Port    3
(E)     TurnOffDelay  0       TurnOnDelay   0
(F)     FlowControl   0
(G)     Use break to access setup          0
(Esc)   Exit to Main Menu
Enter Choice
```

8. Press the "ESC" key to return to the main menu

RAIN BIRD.

9. Select "2" to enter the serial number to the Slave radio into the Call Book

```
                                MAIN MENU
                     D2 AES Version v10.6.8       08-21-2013
                            902 - 928 MHz
                       Modem Serial Number 937-0704
                          Model Code DG2C
       (0)   Set Operation Mode
       (1)   Set Baud Rate
    ➤ (2)   Edit Call Book
       (3)   Edit Radio Transmission Characteristics
       (4)   Show Radio Statistics
       (5)   Edit MultiPoint Parameters
       (6)   TDMA Menu
       (8)   Chg Password
    (Esc) Exit Setup
```

10. Type the serial number of the Slave radio. Also enter and Repeater 1 or Repeater 2
    addresses if you are using repeaters in your system.

```
Enter Choice
                                   MODEM CALL BOOK
                                Entry to Call is (ALL)
Entry     Number      Repeater1    Repeater2
(0)       873-8634
(1)       000-0000
(2)       000-0000
(3)       000-0000
(4)       000-0000
(5)       000-0000
(6)       000-0000
(7)       000-0000
(8)       000-0000
(9)       000-0000
(C)       Change Entry to Use (0-9) or A(ALL)
(Esc)     Exit to Main Menu
Enter all zeros (000-0000) as your last number in list
```

11. Now repeat the above steps for the slave radio, enter "1" at step 4 to configure the radio
    as the Slave, enter the Master radio's serial number into the Slave radio's Call book in
   step 10.

3) For Configuring Using HyperTerminal:

Note: Not all Windows PC's have HyperTerminal pre-installed. HyperTerminal can be found online through a quick web search.

1.   Connect one of the radios to the COM1 port of a computer using a standard RS232 cable (not the provided "Null Cable"). Provide power to the FreeWave radio using the supplied transformer.
2.   Start Microsoft's HyperTerminal program in Windows from
         Start ⇒ **Programs** ⇒ **Accessories** ⇒ **Communications**.

3.   Double-click on the **HYPERTRM** icon.

4. Enter a **Name** for the New Connection (temporary name).
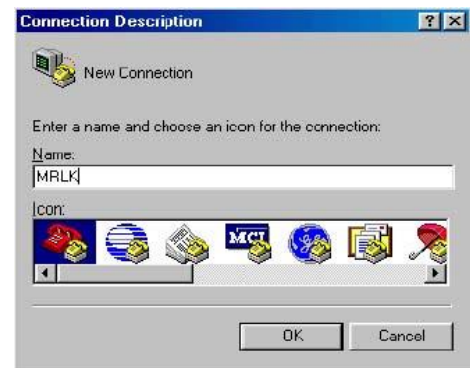
5. Select "Direct to Com1" from **Connect Using** pull-down.

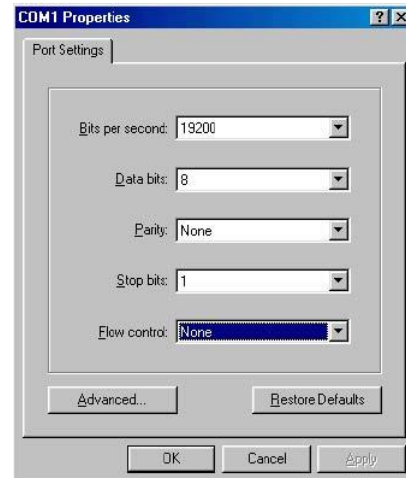6. Select the following settings for the **COM1 Properties** window:

Bits per second: 19200

Data bits: 8

Parity:None

Stop bits: 1

Flow control: None

7. Enter programming mode by pressing the black "Setup" button on the back of the radio(7a): When the radio enters programming mode, all three LEDs on the front panel of the FreeWave radio will turn green and will remain green for the entire time the radio is in programming mode.

7a

8.   Verify that the serial number on the setup program screen matches the serial number on the bottom of the FreeWave radio. In addition to providing the radio's unique serial number, the setup program provides a set of choices for editing the operational parameters and viewing the performance data.   Set operational mode by entering "0".
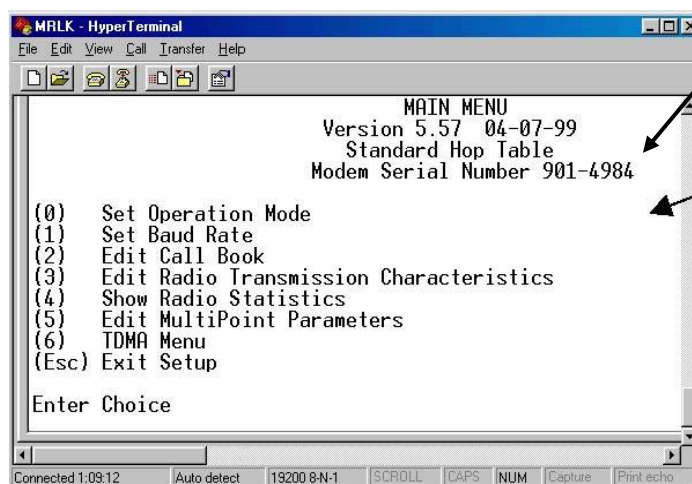
Serial Number

Operational Mode

9. Verify that the radio displaying three solid LEDs after connecting power is configured as the master, and the other radio is configured as the slave. This can be verified by checking the second line of text in the SET MODEM MODE menu as shown below. The second line of text should show the following:

For **Master** radio: Modem Mode is 0
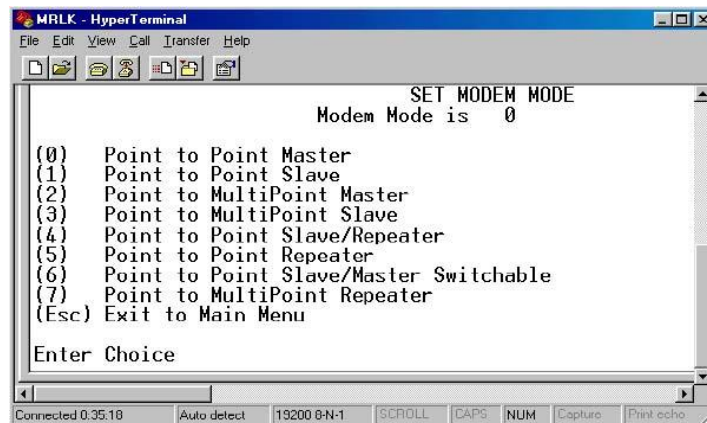
For **Slave** radio: Modem Mode is 1

If the radios have not been pre-configured correctly for the Modem Mode, then configure each radio using the following:

For **Master** radio: Enter "0" to select **Point to Point Master**.

For **Slave** radio: Enter "1" to select **Point to Point Slave**.

If the Modem Mode has been configured properly, then press **ESC** to return to the Main Menu.

10. Verify that each radio has been pre-configured to communicate with the other by checking the entries in the Call Book for each radio. Enter "2" to Edit Call Book from the Main Menu.
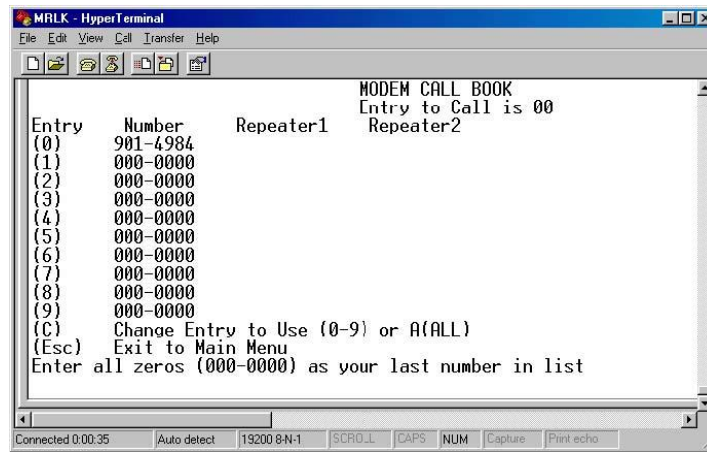
For **Master** radio: The **Number** for Entry (0) should match the serial number located on the bottom of the Slave radio.

For **Slave** radio: The **Number** for Entry (0) should match the serial number located on the bottom of the Master radio.

To change the **Number** of an entry, enter the entry number followed by the seven-digit serial number. Do not enter a "-" after the third digit, the formatting of the number is automatic. For example, to enter the serial number 901-4984 into Entry (0), enter a "0" followed by "9014984" from the MODEM CALL BOOK menu.

Verify that the Call Entry selection of each radio has been pre-configured to communicate with the other radio. This can be verified by checking the second line of text in the MODEM CALL BOOK menu as shown above. The second line of text should show the following:

Entry to Call is 00

If the second line of text does not show the same text as above, then select "C" followed by a "0" to change the selection to the (0) Call Entry.
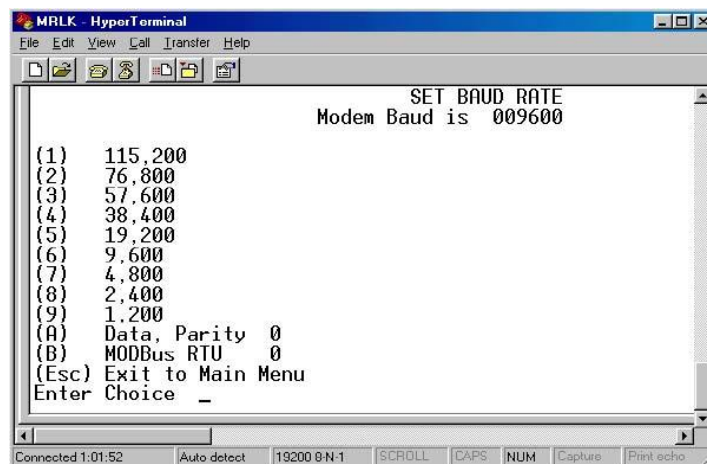
Press **ESC** to return to the Main Menu.

11. For use with a MAXI Interface Module determine the baud rate setting for the MIM by looking at the baud rate select jumper on the inside of the door as shown below. Use the table below to determine the selected baud rate of the MIM. The baud rate setting for an SDI, LDI, or ICI will be 9,600.

Jumper	Baud Rate
E5 – E4	9,600
E4 – E3	1,200
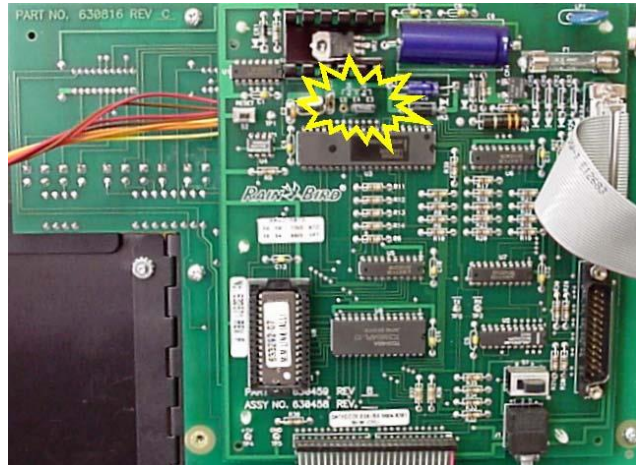
12. Enter "1" to Set Baud Rate from the Main Menu. From the Set Baud Rate Menu, enter a "6" - **9,600** or a "9" -**1,200** to match the baud rate setting determined from the previous step. This baud rate setting will be used to configure each radio.

Press **ESC** to return to the Main Menu. Press **ESC** to Exit Setup.

13. After completing the setup program for one of the radios, perform steps 7-13 for the other radio, making sure that the Operation Mode selection is set to the opposite mode of the other radio.

After configuring both radios, exit from the HyperTerminal program by closing the window or using the Exit selection in the File dropdown menu.

MRLK

Rev 2.1
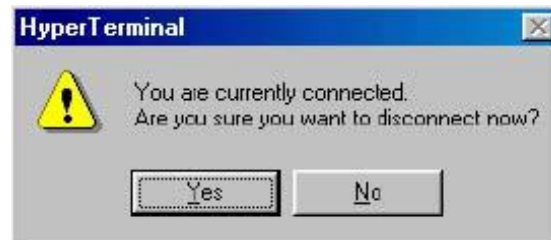
Select Yes to disconnect from the current session of HyperTerminal.

Yagi Antenna Installation:

Prior to the installation of the radios and the antennas, disconnect the power to the interface to prevent communication until the installation is complete. It is highly desirable to obtain a line of sight when mounting the Yagi directional antennas to increase the strength and reliability of the communication signal.

Note: All connections need to be sealed to protect from the elements, this requires a vulcanizing rubberized tape.

PolyPhaser Installation:

A PolyPhaser surge protector must be installed at each radio location to provide in-line protection against lightning. Each of the PolyPhaser surge protectors must be grounded using a dedicated external grounding rod with a resistance of 50 Ohms or less to earth ground (not included).

Note: All connections need to be sealed to protect from the elements, this requires a vulcanizing rubberized tape.

Signal Loss

Signal loss can become a significant problem under several circumstances. For example, increasing the cable length without increasing antenna gain will negatively affect Radio Frequency (RF) range. The same is true is multiple connectors are used to extend the cable, this will negatively affect RF range as well.

Additional Resources:

For any additional resources please check the Rain Brid Golf website at the following link:

http://www.rainbird.com/golf/index.htm

You can also contact your local Rain Bird Distributor, Sales Representative, or the Rain Bird GSP Group for assistance with setup, configuration, or any other questions.

18

January 2018

Appendix:

1) Identifying COM Port

COM Port Assigned to a USB-to-Serial Adapter

When a USB-to-serial adapter is initally connected, Windows will assign a COM port to it. To find out what COM port has been assigned, go to Device Manager (type "device in the start menu search field, then click on Device Manager).

Locate the "Ports" section and expand it. Find the USB-to-Serial adapter.
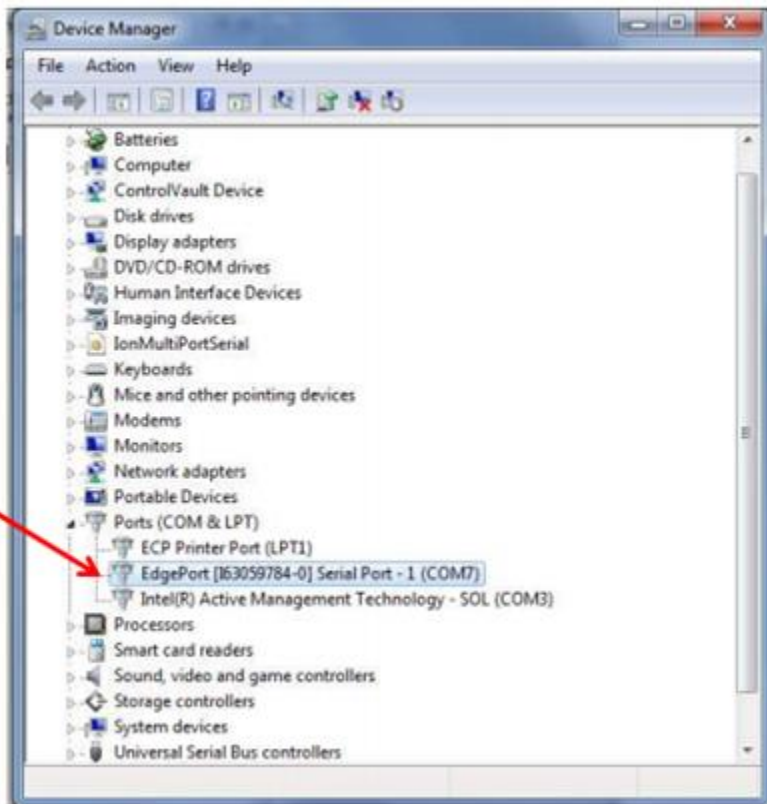
If needed, the COM port number may be changed using the following steps:

1. Right click on the USB-to-Serial adapter device in Device manager and select properties.

2. Choose the "Port Settings" tab

3. Click on "Advanced"

4. Click the "COM Port Number" drop down menu and choose the desired COM port number (e.g. COM1) Click OK to confirm your choice

5. Click OK to close the Device Properties window.

6. Close Device manager

2) Checking Signal Strength

Checking radio signal strength is accomplished through use of the "Setup Terminal" in the FreeWave Tool Suite. To do this simple test follow the below steps:

Note: Radio's should be communicating for a minimum of 20 minutes prior to measuring statistics.

1. Open FreeWave Tool Suite.
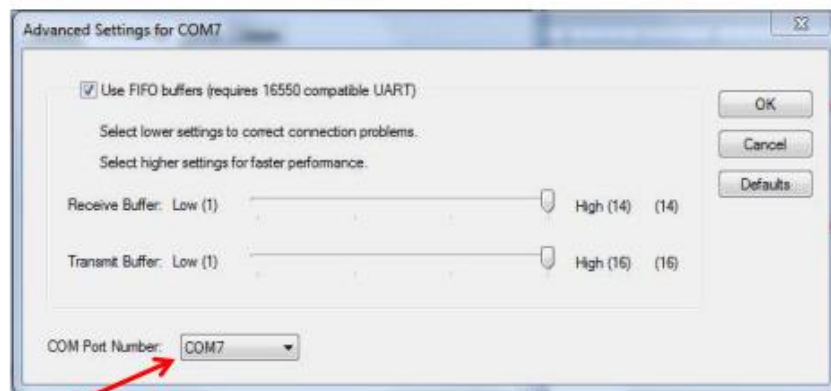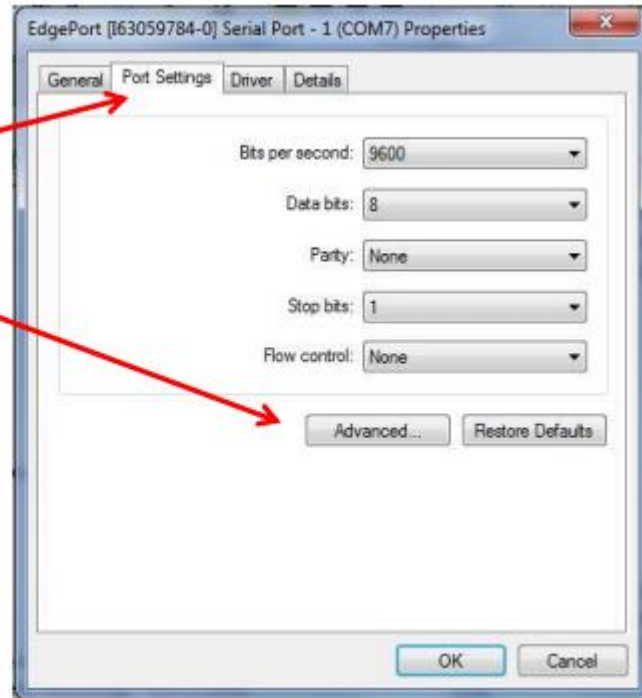
2. Connect to the radio and open the "Setup Terminal" using steps from Section **2) For Configuring Using "Setup Terminal" in FreeWave Tool Suite.**

3. Select (4) to enter the Radio Statistics screen.

```
                            MAIN MENU
                   D2 AES Version v10.6.7      06-24-2013
                        902 - 928 MHz
                    Modem Serial Number 939-7339
                      Model Code DG2C
    (0)    Set Operation Mode
    (1)    Set Baud Rate
    (2)    Edit Call Book
    (3)    Edit Radio Transmission Characteristics
 →  (4)    Show Radio Statistics
    (5)    Edit MultiPoint Parameters
    (6)    TDMA Menu
    (8)    Chg Password
    (Esc) Exit Setup

    Enter Choice
```

4. The radio statistics will be presented. Compare these to the levels provided on the next page.

```
                         MODEM STATISTICS

    Master-Slave Distance(m)  0008555

    Number of Disconnects      0
    Radio Temperature         25
    Antenna Reflected Power    9
            Local  Remote1 Remote2 Remote3
            J dBm    dBm     dBm     dBm
    Noise   18 111        14
    Signal  91   0        90
    Rate %     2
    0000 00 00

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

RAIN BIRD.

Modem Statistics

The below statistics are recommended by Rain Bird. If any major deviation occurs please contact Rain Bird GSP for assistance.

- Number of Disconnects:

  - 0-1

- Antenna Reflected Power:

  - 5   = Good

  - 5-30   = Acceptable

  - 30+   = Problems with Cables/Connectors in Antenna System

- Average Noise Level:

  - <70 J units, and difference between Average Noise and Average Signal levels should be >26 J units

- Average Signal Level:

  - >26 J units difference between Average Noise and Average Signal

- Overall RCV Rate (%):

  - >75   = Robust link

  - <15   = Marginal to Weak

Next press "Enter" key to display Frequency Information. See image on next page for example.

```
Enter Choice
                              MODEM STATISTICS

Master-Slave Distance(m)  0008461

Number of Disconnects       0
Radio Temperature          25
Antenna Reflected Power     8
        Local   Remote1 Remote2 Remote3
        J dBm     dBm     dBm     dBm
Noise   17 112       14
Signal  91   0       90
Rate %     15
0000 00 00


Press <Ret> for Freq Table, <Esc> to return to main menu
                           Stats vs Frequency
```

Freq	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Noise	55	15	15	14	16	16	16	22	16	17	17	18	15	16	16	18
Signal	0	0	0	93	0	0	0	0	0	91	93	0	91	0	94	0
% Rcv	0	0	0	5	0	0	0	0	0	5	5	0	5	0	5	0

Freq	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
Noise	19	18	19	19	13	17	18	19	19	18	18	16	16	18	17	18
Signal	91	91	0	0	0	0	0	91	93	92	92	0	0	0	92	93
% Rcv	5	5	0	0	0	0	0	5	5	5	5	0	0	0	5	5

Freq	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Noise	27	15	16	16	14	16	14	17	15	15	19	18	16	16	15	15
Signal	93	0	0	0	0	0	0	0	0	0	92	0	91	93	0	92
% Rcv	5	0	0	0	0	0	0	0	0	0	5	0	5	5	0	5

Freq	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63
Noise	16	18	0	0	16	11	12	18	17	18	12	14	25	17	15	16
Signal	0	92	0	0	0	92	0	0	0	93	0	92	0	0	92	93
% Rcv	0	5	0	0	0	5	0	0	0	5	0	5	0	0	5	5

Freq	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Noise	14	14	15	17	18	16	16	14	15	14	15	17	16	17	13	18
Signal	92	0	0	93	0	94	0	0	93	0	0	93	0	91	93	0
% Rcv	5	0	0	5	0	5	0	0	5	0	0	5	0	5	5	0

Freq	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95
Noise	15	14	14	17	22	16	17	18	15	12	14	16	16	17	16	12
Signal	91	0	91	0	0	0	0	0	0	0	0	0	91	93	92	0
% Rcv	5	0	5	0	0	0	0	0	0	0	0	0	5	5	5	0

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