

Firefly User Guide

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Date	Rev.	Author	Comments
06/07/06	A	GR	Preliminary Release
06/22/06	B	GR	Firefly now available with FEMALE DB-9
07/27/06	C	GR	Removed BluePlug section.
06/21/07	D	GR	Add firmware code 4.22 for 7 data bit mode

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1. Bluetooth Introduction

Bluetooth wireless technology is a short-range radio technology. Bluetooth wireless technology makes it possible to transmit signals over short distances between computers and other devices and thereby simplify communication and synchronization between devices.

The protocol operates in the license-free ISM band at 2.45 GHz. In order to avoid interfering with other protocols which use the 2.45 GHz band, the Bluetooth protocol divides the band into 79 channels and changes channels up to 1600 times per second. Implementations with version 1.2 reach speeds of 723.1 kbit/s.

2. Preparation

Before you use this product, you should be aware of certain industry specifications and standards for Bluetooth and RS232 Interface Specifications.

This manual contains a summary of RS232 common connection practices and cable pin descriptions. See **Guide to RS-232** on page 5-8.

The Firefly is **NOT** a Plug-and-Play device. When used in pairs, these devices consist of a radio link that connects two different RS232 devices. Therefore, you should understand basic radio transmission principals and more importantly, the methods and practices used to connect RS232 devices. Since each Firefly has a Bluetooth radio and an RS232 interface, you must configure the Bluetooth radio so that it properly links to another Bluetooth device, and you must configure the RS232 interface to match the device attached to it.

Several examples are provided to aid in setup and configuration.

*If you are connecting a pair of Firefly radios, use the **Quick Start Guide** found on page 6-14.*

3. Firefly

The Firefly is a Class1 Bluetooth radio modem with 2.4GHz RF ceramic chip antenna. The modules are Bluetooth version [1.2 compliant](#). Two Firefly devices can be configured to make a wireless RS232 cable replacement or extender.



This section provides the setup and operation of the Firefly modules and describes the [command mode](#) protocol used to control and configure Firefly Serial Modules. The protocol is similar to the industry standard Hayes AT protocol used in telephone modems due to the fact that both types of devices are connection oriented. Appropriate commands have been provided to make the module perform the two core actions of a Bluetooth device, which is make/break connections and Inquiry. Additional commands are also provided to perform ancillary functions. The serial devices can be configured, commanded, and controlled through simple ASCII strings through the Firefly's hardware serial UART or over a remote Bluetooth RF connection.

NOTE: If you are new to Bluetooth devices or RS232 communications, see the [Guide to RS-232](#) on page 5-8, and the [Quick Start Guide](#) on page 6-14. If you are having problems with the setup and configuration, read these sections for more details. Please read these sections before calling for technical support.

The Firefly has an RS-232 DB-9 Male or Female connector. Firefly is a Class1 Bluetooth device with high power transceiver (100meters/330 feet). Actual range may vary due to environment or type of client device used to connect to Firefly.

3.1 Firefly Features

- High speed RS-232, with available baud rates: 9600, 19200, 38400, 57600, 115200, 232400bps. Baud Rates other than 9600 or 115200 are selected in command mode.
- Switch selectable baud rates of 9600 and 115200bps.
- [Parity Even, Odd, or None, 7/8 Data Bits, 1 Stop Bit.](#)
- Hardware flow control via RTS, CTS. NO Modem control signals.
- Settings can be easily changed via local serial port connection.
- High Power (Class 1, 20dB TX, 330', 100m) Bluetooth™ radio
- Serial Port Profile used for direct connect to BT clients.
- Green (connection) and Yellow (TX/RX) LEDs.
- Low power operation requires only 3.3VDC at 40ma when connected, only 1ma on standby.
- Powered by external 5VDC wall adapter. Input range is 4-9VDC. Can be powered through the DB9 connector.
- Smallest possible form factor.
- DB-9 Male connector standard, DB-9 Female optional.

3.2 Overview

The following drawings show the top and bottom views of the Firefly. Note that the standard DB-9 Male connector is shown. An optional DB-9 Female is available.

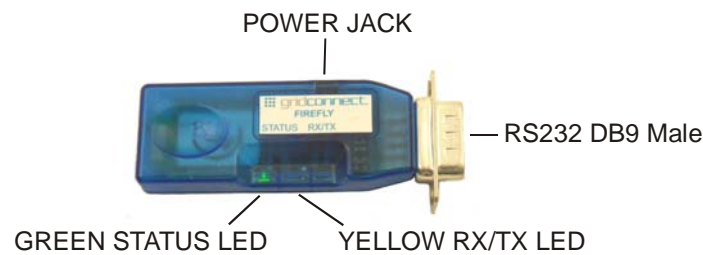


Figure 1 - Firefly Top View

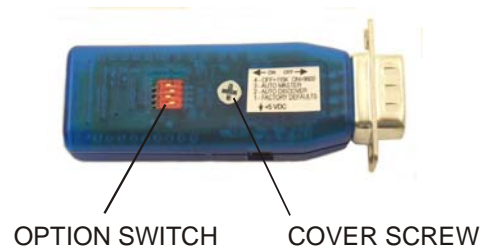


Figure 2 - Firefly Bottom View

3.2.1 RS232 Physical Port Description

The pin names and descriptions are shown in the following table. Please note that many signal pins have no connection.

Pin	Description	Source
1 -DCD	Carrier Detect (NOT Connected)	
2 - RD	Receive Data	Attached Device (In)
3 - TD	Transmit Data	Host Device (Out)
4 - DTR	Data Terminal Ready (NOT Connected)	
5 - GND	Ground	
6 - DSR	Data Set Ready (NOT Connected)	
7 - RTS	Request to Send	Host Device (Out)
8 - CTS	Clear to Send	Attached Device (In)
9 -PWR	4-7 VDC	External Power Supply

Table 1 - RS232 DB9 Male Pin Descriptions

Note: 4-7VDC will appear on Pin 9 when using an external power supply. Power can be supplied through the RS232 cable on Pin 9.

The standard configuration for RS232 connections with straight DB9 to DB9 connectors is shown below. It is very important to note the direction of the data flow, as indicated by the arrows. The names of the signals are often confusing so follow the direction of the data flow.

Note: Some of the signals have no connection in the Firefly. Only RD, TD, RTS and CTS are used.

IMPORTANT: If your device uses signals NOT available on the Firefly, you will have to make an adapter cable or modify your hardware to allow it to operate with the Firefly. For additional information, see Unused RS232 Signals on page 5-9.

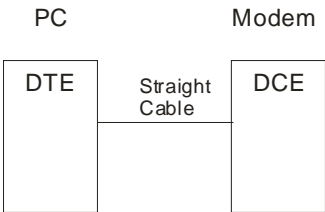
DTE Device (Computer)			Signal Direction		DCE Device (Modem)		
Pin #	DB9	Signal Names			Pin #	DB9	Signal Names
#1	No Connection				#1	No Connection	
#2	Receive Data	RD	←		#2	Receive Data	RD
#3	Transmit Data	TD		→	#3	Transmit Data	TD
#4	No Connection				#4	No Connection	
#5	Signal Ground	GND			#5	Signal Ground	GND
#6	No Connection				#6	No Connection	
#7	Request to Send	RTS		→	#7	Request to Send	RTS
#8	Clear to Send	CTS	←		#8	Clear to Send	CTS
#9	4-7VDC				#9	4-7VDC	

Figure 3 - RS232 Straight Cable

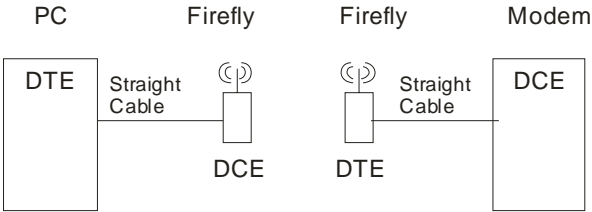
3.2.2 Typical Application

A typical connection between a Computer (DTE) and a Modem (DCE) is shown below. The cable between them is a **straight** cable. A straight cable means that pin 2 on one side goes to pin 2 on the other side. The pins are connected straight through from one side to the other. Generally, a straight cable uses all 9 wires and connects all RS232 signals as shown in Table 1 - RS232 DB9 Male Pin Descriptions.

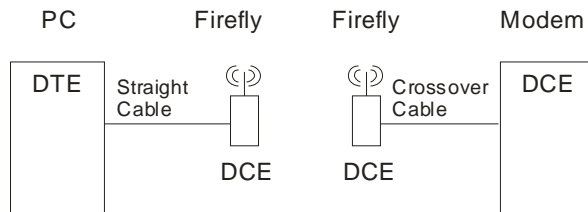
Note: the term Modem is for reference only. The Firefly does not support Modems.



A Firefly wireless radio set will allow you to remove the straight cable and replace it with a wireless Firefly connection. The connection looks something like the drawing below. Please note that the Firefly does NOT use all the signals from the PC or the Modem. The Firefly uses only RX, TX, RTS and CTS.



An important point to consider in the drawing is that the Firefly connected to the Modem (DCE) has been configured as a DTE device. This is done so that the signals from the Modem to the Firefly will match. You can also match the signals by using a Modem crossover or Null Modem cable as shown below.



In the above diagram both Firefly devices are configured as DCE devices. The Crossover (Null Modem) cable will match up the signals between the Modem and the Firefly.

Rule of Thumb: If your device plugs into the computer serial port with a straight cable and works normally, the device is wired as DCE.

Check your cable wiring to determine if you are using a straight or crossover cable. A straight cable requires one of the Firefly devices, the one connected to your device, to be configured as DTE. The other option is to use a crossover cable and configure both Firefly devices as DCE.

The Firefly's DB9 (Male) Serial Connector usually comes configured as a DTE device according to the factory settings as shown in Table 1 - RS232 DB9 Male Pin Descriptions. Jumpers are available inside the case to change the pin configuration of the Firefly (see section 3.5 for more information on how to access and modify the jumpers).

3.2.3 Power Requirements

The Firefly's Power Jack accepts 4VDC – 9VDC. The center pin of the power jack is for the input power (typically +5V), while the outer cylinder should be connected to ground. The requirements can be met with the supplied 5VDC, 300ma wall plug adapters.

Note: When using an external power supply, Pin 9 on the DB9 connector is connected to the external power supply. You can remove the power to the pin by removing a small resistor. Remove R3 for units with DB9 Male or remove R30 for units with DB9 Female.

The Firefly can be powered through the DB9 connector on Pin 9.

When actively transmitting or receiving data, the Firefly has a power draw of 30-50ma, depending on the data rate. When idle, the power draw can be as low as 2ma.

3.2.4 Status LEDs

The Firefly comes equipped with two status LEDs. The Green LED provides Bluetooth Device status, while the Yellow LED provides status of the transmit/receive lines.

The Bluetooth Device status is indicated by the Green LED as shown in Table 2 - Status LEDs.

Table 2 - Status LEDs

Firefly Device Status	Green LED Blink Rate
Configuring	Fast, 10 times per second
Boot up, Remote Configurable	2 times per second
Discoverable/Idle	1 time per second
Connected	On Solid

The Yellow LED shows the physical state of the TX and RX data pins, pulse stretched for improved visibility. The Yellow LED blinks when data is **transmitted** or **received** on pins 2 and 3 of the serial port. The Yellow LED works using a physical hardware connection, and does not depend on software from the Firefly to make it operational.

3.3 Firefly Configuration Switches

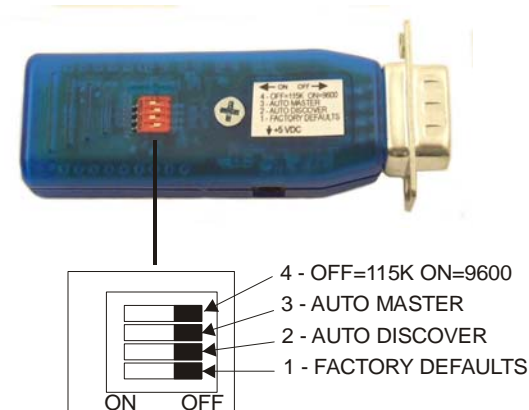


Figure 4 - Configuration Switches

For RS232 cable extender mode of operation, set one unit to Slave and the other unit to Auto Master. The default settings are 115200bps, Parity=None, Data bits = 8 bits (fixed), Stop bits 1 (fixed). If your device uses a different baud rate, you will have to configure the Firefly for the new baud rate.

1- FACTORY DEFAULTS- Set this switch **ON**, power up the unit, and toggle the switch from ON to OFF 2 times to return the unit to factory settings.

2-AUTO DISCOVER MODE – In Slave mode, this will set a special class of device which is used by a remote Firefly Master to auto connect. IF Switch 3 also ON, the device performs a search, store, and connect to a remote slave which has switch 2 ON.

3- AUTO MASTER MODE- Firefly will act as master and auto-connect to a stored remote address. You first set the Firefly address of the device to connect to using the SR command or have Firefly auto discover and connect by setting this switch AND Switch 2 ON.

4- DEFAULT BAUD RATE – OFF = 115K (factory setting), ON = 9600. You can set a different baud rate by software configuration.

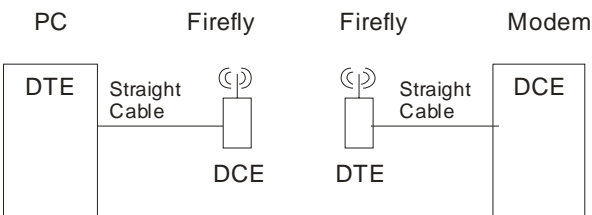
*This is the Baud Rate of YOUR device. Other baud rates are available using the command mode.

3.4 Cable Replacement Example

This section shows how to set up two units as a wireless cable replacement or cable extender. This example assumes that one end of the cable is attached to a PC and the other to a compatible RS232 device, such as a Modem, remote sensor, etc. Remember that the Firefly does not fully support modems. The term Modem is just used for reference.

Since there is no way to determine what kind of compatible device you are using, you will have to verify the cable and the pin connections are correct. In some cases, you will need a crossover cable or may have to fabricate a custom cable in order to get the proper connections between your device and the Firefly radios. See the **Guide to RS232** at the end of the manual.

For this example, the PC side of the cable and radio connection will be referenced as the MASTER (PC). The device connected to the PC will be referenced as the SLAVE (Modem). The PC is a DTE device, so the Firefly radio attached to it must be a DCE device. The Modem is a DCE device, so the Firefly radio attached to it must be a DTE device. Use the following drawing as a reference.



The cables used in these examples are straight cables, meaning that pin 2 goes straight through to pin 2 on the other end. The following drawing shows a 9-pin straight cable that can be used with the Firefly.

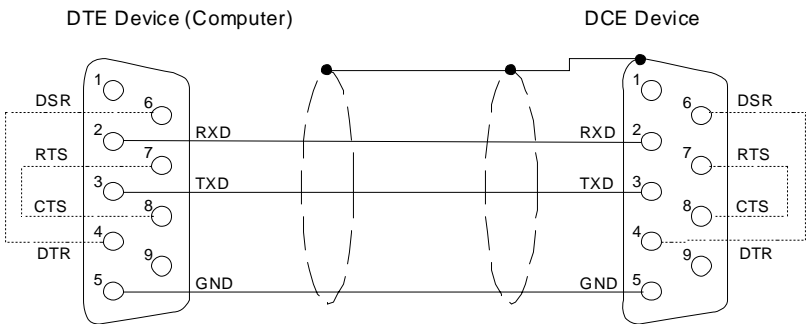
NOTE: The cable shows several pins with NO Connections. If your device requires these signals, you will have to make a custom cable or modify your device to ignore the signals.

Straight Cable DB9 to DB9

DTE Device (Computer)			Signal Direction	DCE Device (Modem)		
Pin #	DB9	Signal Names		Pin #	DB9	Signal Names
#1	No Connection			#1	No Connection	
#2	Receive Data	RD	←	#2	Receive Data	RD
#3	Transmit Data	TD	→	#3	Transmit Data	TD
#4	No Connection			#4	No Connection	
#5	Signal Ground	GND	—	#5	Signal Ground	GND
#6	No Connection			#6	No Connection	
#7	Request to Send	RTS	→	#7	Request to Send	RTS
#8	Clear to Send	CTS	←	#8	Clear to Send	CTS
#9	4-7VDC			#9	4-7VDC	

Note: Pin 9 is used to power the device over the RS-232 cable. If you are using an external power adapter, there will be 4-7VDC on Pin 9.

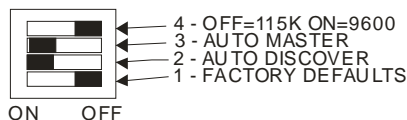
Here is a drawing of a cable that can be used for a wide variety of applications.



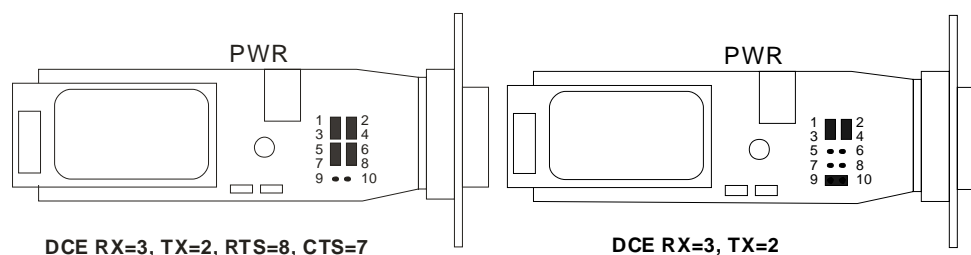
3.4.1 Configuration Procedures

1. Assign one of the Firefly radios as the MASTER and set the switches as shown below. The settings are for 115K. Put Switch 4 in the ON position for 9600. This is the baud rate of the com port on your PC. The baud rate must be the same on BOTH Firefly devices.
2. The Master device will be setup as a DCE device and should be connected to the PC side of the connection.

MASTER (below)



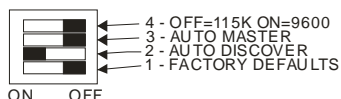
Set the internal jumpers as shown below. If your device does not use flow control signals RTS and CTS, set the jumpers as shown on the right. If you are not sure, use the drawing on the right.



Connect the MASTER unit to the PC with a straight cable. See *Figure 3 - RS232 Straight Cable*.

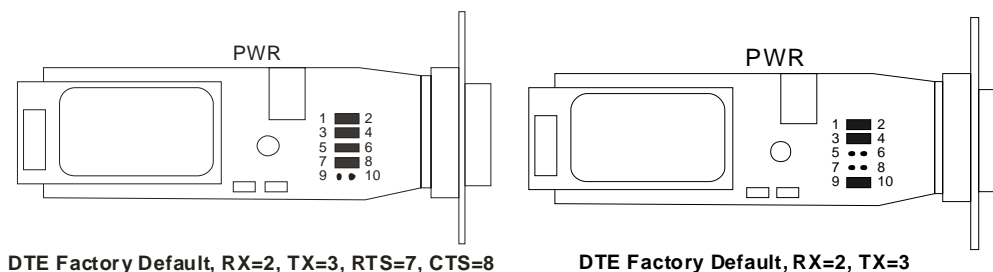
3. Assign one of the Firefly radios as the SLAVE and set the switches as shown below. The settings are for 115K. Put Switch 4 in the ON position for 9600.

SLAVE (below)



Set the internal jumpers as shown below. Slave devices connected to a PC are generally configured as DCE so the Firefly connected to your slave device should look like a PC or a DTE device. The drawings below show DTE jumper settings.

If you are not using flow control signals RTS and CTS, set the jumpers as shown in the drawing on the right. If you are not sure, use the drawing on the right.



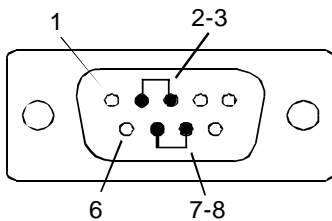
Connect the SLAVE unit to the slave device with a straight cable. See *Figure 3 - RS232 Straight Cable*.

4. Power up both devices.
5. The MASTER finds and stores the SLAVE address and auto connects. The **GREEN** LED on both units will flash and within a short time should be on **solid**. The solid LED indicates the units are properly linked.
6. Verify data flow by observing the **YELLOW** LED. Flashing indicates data flow, both transmit and receive. The above configuration is for 115K Baud. Both units should flash the Yellow LED as data is sent from one side to the other.

3.4.2 Link Test

Note: You can verify communications by connecting one Firefly to your PC and connecting a Loop-back adapter to the other Firefly as shown in the drawing below. The Firefly not connected to the PC can be configured as DCE or DTE. The loop-back adapter will take any received characters and send them back. The loop-back adapter connects transmit and receive lines together and the RTS/CTS lines together. You can make an adapter by using a DB9 Female connector and adding a wire between pins 2 and 3. If you are using RTS and CTS signals, also add a wire from pin 7 to 8.

DB9 FEMALE REAR

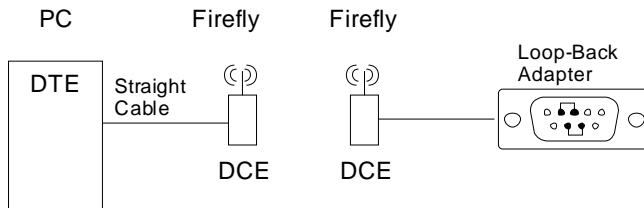


LOOP BACK ADAPTER

In the drawing below, the slave device has a loop-back

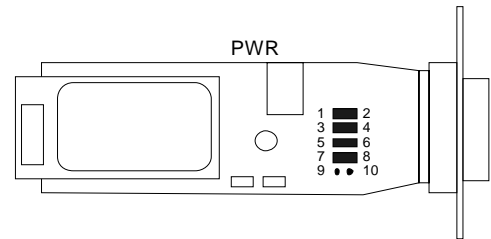
Use a program like Hyperterminal to connect to the serial port of one of the Firefly radios, then you will see a character displayed on the screen each time you send a character. See *Hyperterminal Setup* on page 6-18 for instructions.

First make sure the units are linked by observing the steady GREEN LED on both units. When you type a character on the PC side, the yellow LED on the Firefly attached to it will blink. If the other Firefly is configured properly, the yellow LED on it should also blink, indicating data is being received and transmitted. Typing a character in Hyperterminal will send the character out the PC serial port to the attached Firefly, through the radio link to the other Firefly, loop around from the receive line to the transmit line and come back to the PC.



3.5 Option Jumpers

The unit is generally delivered as a DTE device, with jumpers set for DTE. You can change this configuration by removing the circuit board from the plastic case. Remove the screw from the back of the case and set the configuration jumpers are shown in the table below.

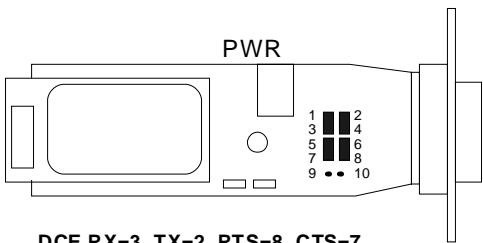


DTE Factory Default, RX=2, TX=3, RTS=7, CTS=8

Note: The table is for a Firefly with a DB9 MALE connector. See section Firefly with Female DB9 for information about units with FEMALE DB9 connectors.

NAME	DB-9 male DTE	DTE Jumpers	DB-9 male DCE	DCE Jumpers
DCD	No Connection			
RX	2	1-2	3	1-3
TX	3	3-4	2	2-4
DTR	No Connection			
GND	5			
DSR	No Connection			
RTS	7	7-8	8	6-8
CTS	8	5-6	7	5-7
PWR	Pin 9 4-7 VDC			

Here is an example of a unit configured as DCE.



Many RS232 cable systems use only Transmit, Receive, and Ground, which is commonly called a 3-wire connection. The other control signals are not used or are tied together on the DB9 connector. To use a 3-wire connection, the Firefly must see an active RTS and CTS connection. To internally tie RTS to CTS, connect the Firefly option pins 9 and 10.

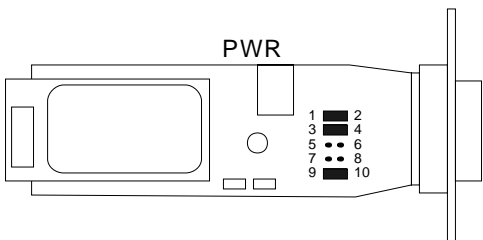


Figure 5 - DTE Configuration, Male DB9, 3-Wire

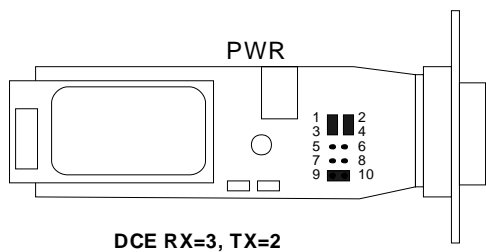


Figure 6 - DCE Configuration, Male DB9, 3-Wire

3.5.1 Firefly with Female DB9

Note: The jumper settings for a Firefly with a FEMALE DB9 connector are different than a unit with a MALE DB9.

The following drawings show the jumper settings for units with FEMALE connectors.

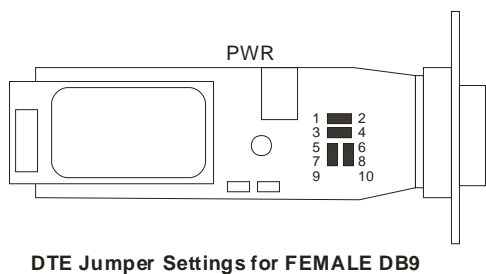


Figure 7 - DTE Configuration, Female DB9

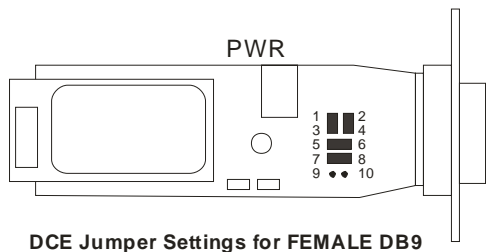


Figure 8 - DCE Configuration, Female DB9

3.6 Firmware Configuration

Parameters, such as the Bluetooth Name, Class of Device and Serial Port settings can be viewed and configured. This can be done locally through the serial port UART or from a remote Bluetooth RF link. To access configuration, the Firefly must be in command mode by issuing (\$\$\$). While in command mode Firefly will accept ASCII bytes as commands.

3.6.1 From Local Serial Port

Connect a cable from a PC or from an ASCII terminal to the Firefly. Communication settings of your program should match the stored settings. Once you change these parameters, they will be stored permanently.

Note: If the Firefly is jumpered as a DCE device, then use a straight thru cable. If jumpered as a DTE device, then use a cross-over or NULL Modem cable between the Firefly and your PC.

Default baudrate is 115200 (switch 4=OFF), no parity, 8 bits, 1 stop.

Local configuration works at any time the device does NOT have a Bluetooth connection, and also works under certain conditions when the device is connected. If the device is in configuration mode and a connection occurs, the device will exit configuration mode, and data will pass back and forth from the remote device.

- Run your favorite terminal emulator, HyperTerminal or other program.
- Cycle power to the Firefly.
- [Type \\$\\$\\$ on your screen \(3 dollar signs\).](#)
- You should see the characters **CMD** returned to you.

This will verify that your cable and settings are correct. Valid commands will return an AOK. Errors in format will return ERR, and unrecognized commands will return a ?. Type “h”<cr> to see a list of commands, and “d”<cr> to see a summary of current settings.

To exit command mode, type “---“<cr>. (three minus or dash signs).

3.6.2 Remote via Bluetooth

In some case it is very useful to be able to perform configuration remotely over a Bluetooth connection. The **Firefly** has this capability. To utilize it, connect to the device over Bluetooth and using a remote terminal emulator, perform the same steps as you would for local configuration. When finished configuring be sure to either reset the device or send the “---” command, which will exit configuration mode and allow data to pass normally.

NOTE: The Firefly firmware implements a configuration timer window, which defaults to 60 seconds after power up. The device will ignore configuration attempts after this timer expires, and data will flow back and forth in normal mode. The timer can be set to any value from 0 (disable remote configuration) to 0xFF hex, which allows continuous (no timeout) configuration.

WARNING: Configuration (local or remote) is NEVER enabled when the device is in auto-mode.

VALUE (decimal)	DESCRIPTION
0	No remote config, No local config when connected
1-252	Time in seconds from powerup to allow config
253	Continuous config LOCAL only
254	Continuous config, REMOTE only
255	Continuous config, both LOCAL and REMOTE

The unit must be in configuration mode to remotely configure it via Bluetooth.

- Set the Auto Master and Auto Switches to OFF.
- Set the Baud Rate Switch to 115K

or 9600 and make sure HyperTerminal is also set to the same baud rate.

- Set the Factory Defaults switch to ON and cycle the power.
- Toggle the Factory Default switch from ON to OFF 2 times.
- The Green LED should be blinking at 2 times per second.

Make a connection via Bluetooth. Type \$\$\$ on your screen (3 dollar signs). You should see CMD returned to you. This will verify that your cable and settings are correct. Valid commands will return an AOK. Errors in format will return ERR, and unrecognized commands will return a ?. Type “h”<cr> to see a list of commands, and “d”<cr> to see a summary of current settings.

To exit command mode, type “---”<cr>. (three minus signs).

3.6.3 Modes of Operation

There are several modes of operation.

Slave mode – This is the default mode, whereby other Bluetooth devices can discover and connect to the device. Outbound connections can also be made in this mode.

Master Mode - This mode is useful when the device only wants to initiate connections (not received them). In this mode the device will NOT be discoverable or connectable.

Trigger Master Mode - In this mode, the device will automatically connect to the pre configured remote slave address when a character (or characters) is received on the local UART. Connection will continue until a configurable idle timer (1 to 255 seconds) determines that no more data is being received, or a configurable BREAK character is seen.

Auto-connect Master Mode- This mode can be set by command or by Switch 3 on the Firefly. If auto-connect mode is set, the device will initiate a connection to the pre-stored remote address immediately upon power up. In this mode, data is passed without being interpreted by the Firefly (high speed), hence the connection cannot be broken via command.

Auto Discovery/Pairing Mode -This mode can be set by command or by Switch 2. In this mode, if Master Mode (or Auto-Connect) is set, the device will perform a device Inquiry Scan and search for a partner Device with a special matching class. Once found, it stores the address of the device into the remote address field then auto-connects to the remote device. If this mode is set on a slave device, the device will enter slave mode with the special matching class and wait to be found by the master. This mode is usually set once on both ends of a pair of devices for instant “cable replacement” and then removed.

Command Mode (vs Normal Data mode)- Upon powerup, the device will be in data mode. To enter command mode, the characters “\$\$\$” must be sent. The device will respond with “CMD”. To exit command mode, send “---<cr>”. The device will respond with “END”. If configuring remotely over Bluetooth, data will now pass back and forth over the serial port and the connection.

NOTE 1: You can enter command mode locally over the serial port at any time when not connected. Once a connection is made, you can only enter command mode if the config timer has not expired. To enable continuous configuration, set the config timer to 255. Also, if the device is in Auto Master mode3, you will NOT be able to enter command mode.

NOTE 2: You can only enter command mode remotely over Bluetooth if you have made a connection and sent the \$\$\$ within the “config timer” window after powerup. The default config timer expires 60 seconds after power up. Once the timer has expired, any data sent to the device will pass unmodified and unrecognized by the command interpreter. The timer can be modified by command.

3.7 Factory Default Power up Settings

- Bluetooth Service Profile = Serial Port Profile (SPP)
- Mode = 0 Slave
- Baud Rate = 115200bps, Parity=None, Data bits = 8 bits(fixed), Stop bits 1 (fixed).
- Power Mode = Auto low power discoverable mode.
- Name of Device (local name) = Firefly-XXXX last 2 bytes of BT address
- Service Name = SPP
- Service Class=0000 (undefined service type)
- Major & Minor Class Of Device (COD) = 0x1F00 (unknown device type)
- Authentication Disabled
- Encryption disabled
- Discovery Enabled (0x0200 = window, fixed interval of 0x800= 1.28 Seconds)
- Connection Enabled (0x0200 = window, fixed interval of 0x800= 1.28 Seconds)
- Bonding Disabled (0)
- Config Timer=60 seconds
- SNIFF mode disabled
- Default PIN = “1234”

Note: Switch 1, Set ON at power up time and then toggled 3 times will change all settings above back to their factory values (except the Device name). Device will reboot immediately upon detection of this mode.

3.8 Example of a Master Discovery/Connection Sequence

From power up and no connection:

- 1) Perform an Inquiry to obtain *BT_Address* (unless it is already known).

Sent : \$\$\$ <cr> // Places Radio in Command Mode
Reply: CMD<cr>

Sent : I,30<cr> // Looks for Bluetooth devices
Reply:<cr>00A096112233,00000104,RN-112233<cr>DONE<cr>

- 2) Store the remote address just found.

Sent : SR,00A096112233 <cr>
Reply:<cr>AOK

- 3) Connect.

Sent : C <cr> // Places Radio in Connect
Reply: AOK<cr>

Device will attempt connection to remote slave.

Reply: CONNECT<cr> // this will be displayed once connection is made.

- 4) Send /Receive data.

4. Firefly Command Reference

The commands are all single or 2 character commands, generally comma delimited. Commands and hex input data can be upper or lower case. Text data, such as Bluetooth name, and pin code, are case sensitive. Commands fall into 4 general categories:

SET COMMANDS - store information permanently and take effect after power cycle or software reset.

GET COMMANDS -retrieve the permanently stored information for display to the user.

CHANGE COMMANDS –temporarily change the value of serial baudrate, parity, etc.

ACTION COMMANDS – perform action such as inquiry, connect, etc.

SET COMMANDS

SA,<1,0>	Authentication. 1 to enable, 0 to disable. This will force authentication when any remote device attempts to connect. Regardless of this setting, if a remote device forces authentication, this device will respond with the stored pin code. Once a remote device has exchanged pin codes with this device, a link key will be stored for future use. Up to 8 keys are automatically and permanently (in flash) stored in the device, in a first in, first out fashion.
SB,<timer>	Send BREAK. This is an immediate command, which can send a BREAK signal on the TX . The timer is used to send a variable length BREAK signal. Timer value Break length (in milliseconds) 1= 37ms, 2=18.5ms, 3=12ms, 4=9ms, 5= 7ms, 6=6ms. Example : “SB,2” sends a 18.5 millisecond break signal.
SC,<hex word>	Service Class (16 bits, 11 used, this is used with Device Class below to create the 24-bit class of device number. Example : “SC,0002”
SD,<hex word>	Device Class (major and minor in a 16-bit word, used with service class above) Example : “SD,8040”
SE,<1,0>	Encryption 1 to enable, 0 to disable
SF,1	Set Factory Defaults.
SI, <hex word>	Inquiry Scan Window. Sets amount of time device spends enabling inquiry scan (discoverability). Minimum value is 0x0012, corresponding to about 1% duty cycle. Inquiry interval is fixed at 0x1000, so time spent in inquiry is 0x12/0x1000 by default. Maximum value is 0x1000, set to 0x0000 to disable inquiry scan and make device non-discoverable.
SJ, <hex word>	Page Scan Window. Sets amount of time device spends enabling page scan (connectability). Minimum value is 0x0012, corresponding to about 1% duty cycle. Page Scan interval is fixed at 0x1000, so time spent in page scan mode is 0x12/0x1000 by default. Maximum value is 0x1000, set to 0x0000 to disable page scan and make device non-connectable.

SL,<E,O,N>	Parity. Can be Even, Odd or None. Only the first character is needed. Example : “ <i>SL,E</i> ” sets the parity to Even
S7,1	Enables 7 bit data mode
SM,<3,2,1,0>	Mode (0 = slave, 1 = master, 2=trigger, 3 = auto) Example: “ <i>SM,1</i> ” sets the mode to Master
SN,<name>	Friendly Name of the device, 16 characters maximum. Example: “ <i>SN,MyDevice</i> ”
SP,<text>	Security Pin Code, 16 character maximum. Example: “ <i>SP,secretcode</i> ”
SO,<text>	Extended Status String, 8 character maximum. Setting this string to from 1 to 8 characters will enable status messages to be sent to the local serial port. Two status messages are sent, when a Bluetooth connection is established, the string “<text> CONNECT” will be sent. Upon a Disconnect, the string <text> DISCONNECT will be sent. This parameter is useful, for example, when connected to a printer. The printer can examine an escape sequence and if the <text> is set to ESC%, the printer can parse the ESC%CONNECT and ESC%DISCONNECT messages without interfering with normal print jobs. In Trigger or Master modes, the first character of this string is used as the BREAK connection character. Example : “ <i>SE,ESC%</i> ”
SP,<text>	Security Pin Code, 16 character maximum Example : “ <i>SP,secretcode</i> ”
SR,<adr>	Remote Address. 12 hex digits, (6 bytes) no spaces or chars between. Example : “ <i>SR,00A053112233</i> ” NOTE: 2 special characters can be used here: “ SR,Z ” will erase any stored address. “ SR,I ” will write the last address seen by using the Inquiry command. This can be helpful when you just have 1 other device in range and want to quickly store and connect to it.
SS,<text>	Service Name (1 to 16 characters). Example : “ <i>SS,SerialPort</i> ”
ST,<num>	Config Timer, # of seconds (range= 0 to 255 decimal,, default = 60 decimal) to allow remote configuration over Bluetooth after power up in Slave Mode. In all Master modes, the remote config timer is set to 0 (no remote configuration). In Trigger Master Mode, this Timer is used as an Idle timer to Break the connection after the timer expires with no characters being received. Example : “ <i>ST,0</i> ” disables remote configuration Example : “ <i>ST,255</i> ” enables remote configuration forever
SU,<rate>	Baudrate, { 1200, 2400, 4800, 9600, 19.2, 38.4, 57.6, 115K, 230K, 460K, 921K }, only the first 2 characters are needed. Example : “ <i>SU,96</i> ” sets the baudrate to 9600 baud.

- SW,<num>** Enable low power SNIFF mode. Set this to either 1= SNIFF enabled, or 0 = Sniff Disabled. Default is 0=disabled. SNIFF mode allows extreme low power operation. Device goes into a deep sleep, and wakes up approx every 250ms to send/receive chars. NOTE: setting this mode can cause latency issues, and dropped bytes/loss of performance in cases where large amounts of data are being transferred. This mode is only recommended for low speed, small byte transfers.
- SX,<1,0>** Bonding enabled, creates a single stored connection pair with a remote device.
- SZ,<num>** Raw Baudrate (decimal) allows entering of non-standard baud rates. Based on the formula: num = Baudrate * 0.004096.
- \$\$,<char>** Configuration detect character. This allows a change from the default \$\$\$ to some other character. Factory defaults returns the device to \$\$\$.

GET COMMANDS

- D** Display basic settings. Address, Name, UART Settings, Security, Pin code, Bonding, Remote Address. This command is an easy way to check the configuration.
- E** Display extended settings. Service Name, Service Class, Device Class, Config Timer, Link Timer, Status, Link Keys, DeBug Mode.
- O** Display other settings. Config character, IO port values, debug mode.
- G<X>** Display stored settings . These commands correspond to the SET commands above. (See below for exceptions)
Example: "GS" will return 1 or 0 depending on the value of security.
Example: "GP" will return the pin code.
- GB** Returns the Bluetooth Address of the device. Example: 00A0961D97D6.
- GK** Returns the current connection status: 1=connected, 0 = not connected.
- G&** Return a hex byte containing the value of the PIO Pins
- V** Return the software release version.
Ver 2.12 10/04/2004
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CHANGE COMMANDS

- U,<rate>,<E,O,N>** Temporary UART Change, will change the serial parameters immediately, but not store them. Command will return "AOK" at current settings, then switch to new.
Example: "U,9600,E" Sets baudrate to 9600, parity even.

ACTION COMMANDS

\$\$\$	Enter command mode. Characters are PASSED until this exact sequence is seen. If any bytes are seen before these chars, or after these chars, in a 1 second window, command mode will not be entered and these bytes will be passed on to other side.
---	Exit command mode. "END" will be displayed. If connected over BT, data will now pass in both directions.
C{,<address>}	connect. The device will attempt to connect to the remote stored BT address, or an optional address can be entered directly.
I,<time>,<cod>	performs an inquiry scan. Default time is 10 seconds, maximum is 48. <cod> is optional class of device, 0 or no entry looks for all device classes. A maximum of 9 devices will be returned. As devices are found, they are displayed in the format below: <bt address>, <bt name>, <cod> 00A053000123,MySerialPort,72010C
IN<time>,<cod>	performs an inquiry scan, does not return the Bluetooth NAME (returns much faster, since name requires a remote lookup for each device found).
IR<time>	Performs an inquiry scan, with a COD of 0x001F00 , which is the default COD for Roving Networks Serial adapters and modules.
IS<time>	Performs an inquiry scan, with a COD of 0x0055AA , which is the special COD used by Roving Networks Serial adapters and modules to enable "instant cable replacement".
H	Will print out a list of Help commands and their basic syntax.
K,	Kill (disconnect) from the current connection.
P,<char>	Pass thru, sends any chars along up to a CR or LF while in command mode.
Q -	Causes device to be non-discoverable and non-connectable (temporarily). Does not survive a power cycle or reset. Used with the Z command below
R,1	Forces a complete reboot of the device (similar to a power cycle)
& -	Returns the value of the switches on Firefly, or value of PIO3,4,6,7 on other modules.
Z -	Enters low power deep sleep mode (100ua) can only be exited by toggling the RESET pin on the module or power cycling the device. To get the lowest power mode, first issue a Q, then a Z.
F,1	Enter Fast data mode, end configuration

4.1.1 Command Summary

SET COMMANDS are stored in flash and only take effect AFTER reboot

Example: SU,96 sets UART Baudrate to 9600
 SN,myname sets Bluetooth name to “myname”
 SA,1 enables secure authentication and encryption
 SP,secret sets security pincode to “secret”
 SF,1 restores all values to factory defaults

CMD	VALUE	TYPE	DEFAULT	DESCRIPTION
SA	0,1	dec	0 (disabled)	Enable Authentication and Encryption
SB	timer		NA	Send Break
SC		Hex	0x0000= unknown	Service Class
SD		Hex	0x1F00= undefined	Device Class
SE		Text	Null	Ext conn/discon Status
SF	1	dec		Reset to Factory Defaults
SI	Hex word	Hex	0x0200	Inquiry Scan Window
SJ	Hex word	Hex	0x0200	Page Scan Window
SL	E,O,N	char	N (8 Data bits, 1 Stop Bit)	Parity, Even, Odd, or None
SM	0,1,2,3	dec	0=Slave	Mode (0=slave, 1=master, 2=trig, 3=auto)
SN	string	1-16 char	Firefly-xxxx	Bluetooth Name
SO	Text		Conn/Disconn status	Null = no status string
SP	string	1-16 char	1234	Security Pin Code
SR	string	12 chars	NOT SET	Remote Address (123456789ABCDEF)
SS		Text	SPP	Service Name
ST	word	seconds	60	Config Timer(0=no config, 255=always on)
SU	string	2 char	115K	Baudrate:1200,2400,4800,9600,384k,576k,115k,230k,460k)
SW	Num		SNIFF mode	0=disabled
SX	0,1	dec	0 (disabled)	Bonding (locks to a single remote address)
SZ		Num		Raw Baudrate

CMD	DESCRIPTION
D	Basic Settings
E	Extended Settings
O	Other Settings
G<X>	A single setting matching the commands above
H	Help
GB	Bluetooth Address of this device (00A0961D97D6)
GK	Connection Status
G&	I/O Ports
V	Firmware Revision (Ver 4.00 06/02/06)

CMD	VAL1	VAL2	DESCRIPTION
C			Connect to Remote Address(in Master Mode only)
F,1			Enter Fast data mode, end configuration
H			Help, Show list of commands
I	<time>	<COD>	Iquiry Scan, time= xx seconds ,optional COD filter
IN	<time	<cod>	Device Scan Inquiry, returns NAMES.
IR	<time	<cod>	Device Scan Inquiry , Fixed cod=0x001F00 to find Roving devices
IS	<time		Device Scan Inquiry, Fixed cod=0x0055AA to find instant cable pairs
K			Kill (disconnect) from current connection
Q			Turn off Discovery and Connectability
R	1		Reboot device immediate (R,1)
U	<rate>	<E,O,N>	Temporary UART Change, immediate, not stored (U,9600,E)
&			Return the value of the DIP switches
Z			Enter low power Sleep mode

4.1.2 Testing the COM Port

By pairing a Bluetooth USB device on your computer to a Firefly remote device, you have established a Bluetooth wireless connection to the remote device. To test the remote device, you can use HyperTerminal to send and receive ASCII characters.

A quick way to test a remote Firefly device is to use a loop-back plug. This is just a DB9 Female plug with two jumpers: Pin 2 tied to Pin 3 and Pin 7 tied to Pin 8. This ties the receive line back to the transmit line so that any character received by the remote device is instantly sent back. This jumper plug also ties the RTS and CTS lines together.

Start HyperTerminal and configure the Serial Properties to use the COM port assigned when you created the link. In the previous section, COM3 was configured to connect to the Firefly-97E9. Make sure you set the Baud Rate to match the Firefly settings. When HyperTerminal indicates it is connected, you can type characters and see the characters being returned by the remote unit. See ***Hyperterminal Setup*** on page 6-18 for instructions.

Note: make sure Local Echo is turned OFF, otherwise you will get two characters.

5. Guide to RS-232

Confused about how to connect your device to a Firefly? Don't feel bad because RS-232 signal names are very confusing. You would think that the data coming out of a device would be called Transmit Data and data going into a device is Receive Data. It depends on which side of the link you are on, the Data Terminal Equipment (DTE) side or the Data Communication Equipment (DCE) side. Even the equipment naming convention is confusing.

To help you understand how a signal gets from your computer to the device on the other side of a communication link (cable, radio, modem, etc.), this section presents some very basic cable diagrams and shows how the signals move from one point to the other.

First, here is drawing of a typical PC connected to a Modem using a straight cable. A Modem is used as reference because that is where all the naming conventions started. The cable diagram shows the wiring standard for a 9-pin RS-232 cable. The gender of the cable doesn't matter at this point.

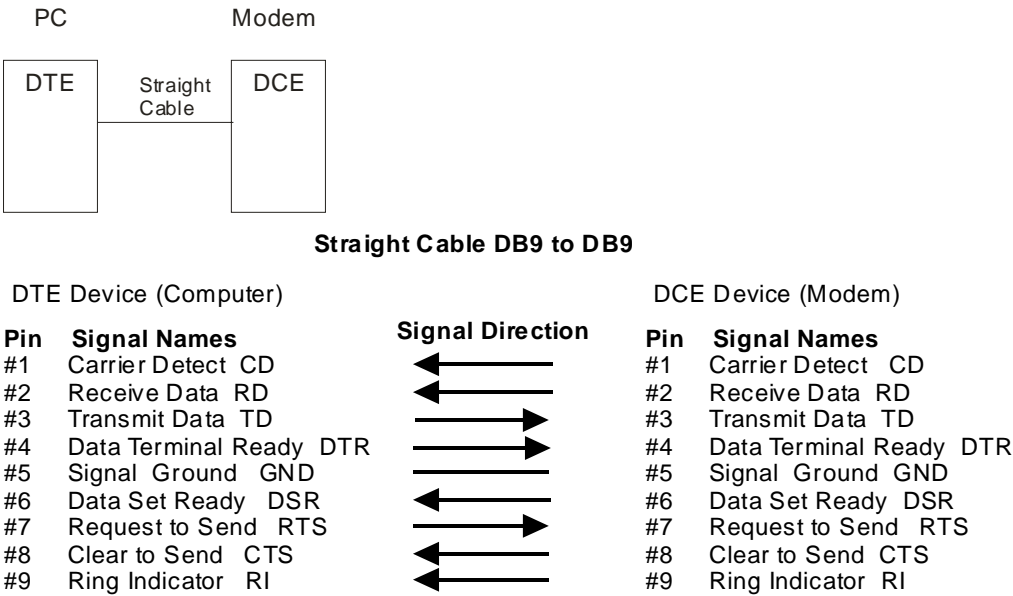


Figure 9 - Straight Cable

All signal names are derived from the early naming convention used to connect a PC to a Modem. The signals from the PC are shown on the left side and the signals to the Modem are shown on the right. The signal names on both sides of the connection have the same name. For instance, Pin 3 on the computer side is Transmit Data and it is connected to Pin 3 Transmit Data on the Modem. The reference is the PC, so that when you see Transmit Data it means data is going from the PC to the Modem. In the same way, Receive Data means data is coming from the Modem to the PC. The arrows in the drawing indicate the direction of the data flow.

The Modem in the previous drawing can be replaced by any device that uses RS232 signals. We use the term Modem as a reference only. You must match the signals from the PC to the RS232 device.

Most of the Modem control signals, like Ring Indicator, are no longer used.

When illustrating a cable connection, the Computer PC side is generally named DTE and the Modem side is named DCE. For reference, DTE means Data Terminal Equipment and DCE means Data Communication Equipment. The names don't really help a lot but we are stuck with them. Any connection between two RS232 devices must follow the convention of connecting a DTE device to a DCE configured device. For example, if you connect an embedded controller to a robot, one side must be a DTE device and the other a DCE.

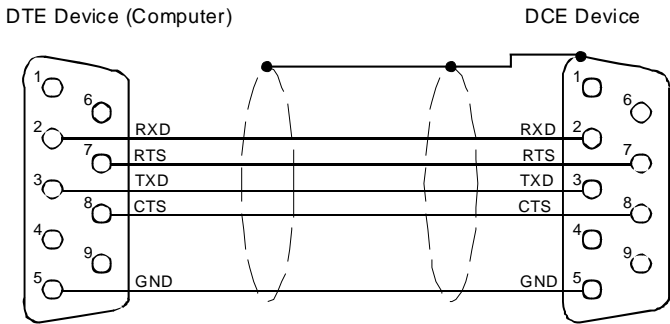
5.1.1 Unused RS232 Signals

You can't really connect one RS232 device to another RS232 device. Why not? The naming convention again causes problems. RS232 generally means the signal levels used by the devices. An RS232 transmitter can send data to an RS232 Receiver. However, there are many signal names for the RS232 standard and many RS232 devices use only the ones they need. One device might use Transmit, Receive and Ground and you can call it an RS232 interface. Another device uses Transmit, Receive, RTS and CTS for flow control. It is also an RS232 interface. But they cannot be connected together because one device lacks the circuits to handle the RTS and CTS signals. There are ways to compensate for the lack of interface circuits.

Here is an example of two devices, both with an RS232 interface but one of them does not use all of the interface signals. The device on the left is a DTE or master device and requires all the RS232 signals but the device it is connected to, possibly your device, does not have all the necessary signals. As you can see, your device (in the example) does not have Carrier Detect or Data Set Ready or Ring Indicator, and doesn't use Data Terminal Ready.

DTE Device (Computer)			DCE Device (Your Device)		
Pin	Signal Names	Signal Direction	Pin	Signal Names	
#1	Carrier Detect CD	←	#1		
#2	Receive Data RD	←	#2	Receive Data RD	
#3	Transmit Data TD	→	#3	Transmit Data TD	
#4	Data Terminal Ready DTR	→	#4		
#5	Signal Ground GND	→	#5	Signal Ground GND	
#6	Data Set Ready DSR	←	#6		
#7	Request to Send RTS	→	#7	Request to Send RTS	
#8	Clear to Send CTS	←	#8	Clear to Send CTS	
#9	Ring Indicator RI	←	#9		

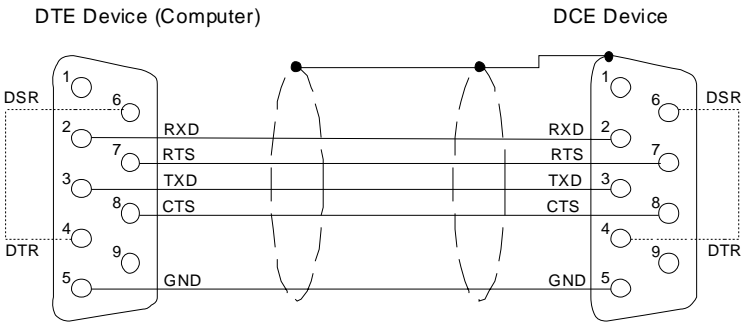
How can you make these two devices work together? You can wire the cable between the devices in such a way as to make the master think the signals are coming from the slave device. First, take a look at the cable that connects the slave device to the master. Note there is no connection for Carrier Detect on pin 1, no connection for Data Terminal Ready on pin 4, etc. This cable uses four signals, RXD, RTS, TXD and CTS.



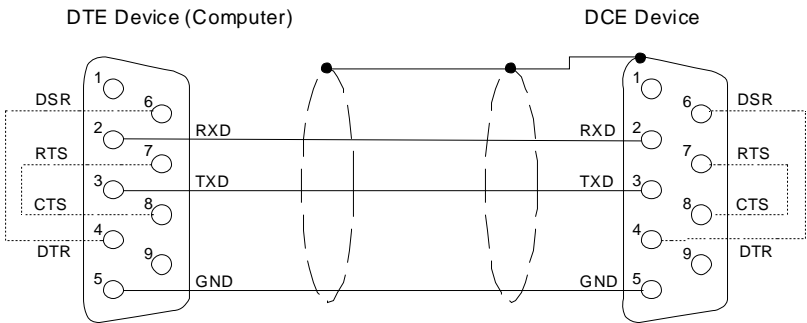
RS232C STRAIGHT CABLE

You need to add some additional wires to the cable so that the master side thinks it is receiving the right signals. Here is an example of how to modify the cables to make the connection work. Since the connected

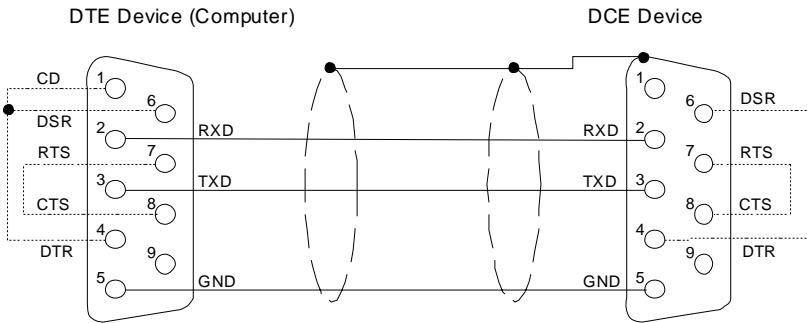
device, the DCE device, does not have a DSR signal on pin 4, you can add jumper wires on the DB9 connectors to provide the proper signal levels. In this case, connect pin 4 and pin 6 to provide a DSR signal. Add the jumper wires to each side of the cable connection, just in case both sides need an unused signal.



Some devices do not have hardware flow control signals RTS and CTS available. In that case you can add more jumper wires to connect those signals. Here is an example of a cable with jumpers for RTS and CTS. The example is called a 3-wire cable adapter.



Some computer devices may require the Carrier Detect CD signal from the slave. Again, you will have to modify a cable to provide this signal. Here is an example of how to modify a cable to add the CD signal.



5.1.2 Firefly Signals

The Firefly does not use all the 9-pin cable signals. This simplifies the connection to a Firefly. The table below shows the provided signals.

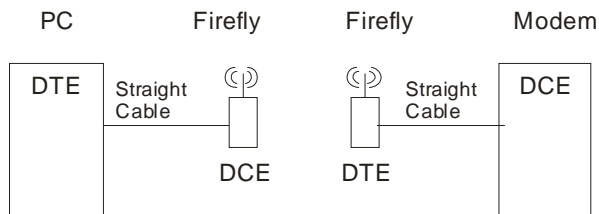
Straight Cable DB9 to DB9

DTE Device (Computer)			DCE Device (Modem)		
Pin	Signal Names	Signal Direction	Pin	Signal Names	
#1			#1		
#2	Receive Data RD	←	#2	Receive Data RD	
#3	Transmit Data TD	→	#3	Transmit Data TD	
#4			#4		
#5	Signal Ground GND	—	#5	Signal Ground GND	
#6			#6		
#7	Request to Send RTS	→	#7	Request to Send RTS	
#8	Clear to Send CTS	←	#8	Clear to Send CTS	
#9			#9		

5.1.3 Firefly Radio

A wireless radio link should allow you to unplug the cable from the PC to the modem and replace it with a pair of radios.

Here is what the connection will look like.



The link on the left side has the Firefly shown as a DCE device and the link on the right shows the Firefly as a DTE device. Why? When a single cable was used, the PC is a DTE device connected to the Modem which is a DCE device. Therefore, you have to connect the PC to a DCE device.

The Firefly radios can be configured to be either version so that they can be configured to connect a wide range of devices.

The units come from the factory configured as DTE. Therefore, the radio on the left link must be changed to a DCE device. This is done with internal jumpers discussed in a previous section.

Here is what the connection looks like.

NOTE: Do not confuse the electrical drawings of the jumpers with the physical jumper settings.

PC Connected to a DCE Firefly

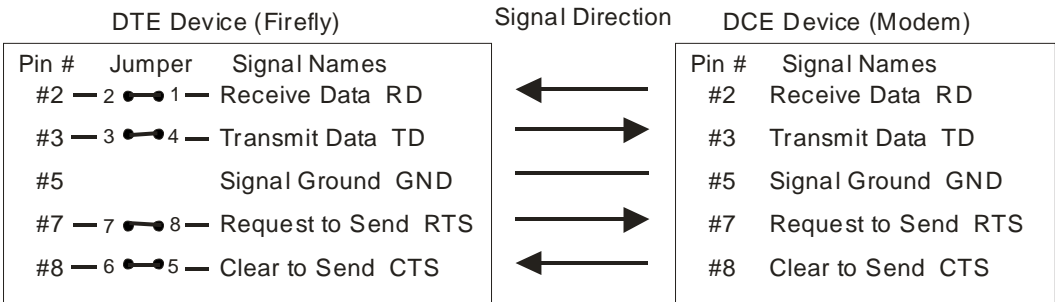
DTE Device (Computer)			DCE Device (Firefly)		
Signal Names	Pin #	Signal Direction	Pin #	Jumper	Signal Names
Receive Data RD	#2	←	#2 — 2	1 —	Receive Data RD
Transmit Data TD	#3	→	#3 — 3	4 —	Transmit Data TD
Signal Ground GND	#5	—	#5		Signal Ground GND
Request to Send RTS	#7	→	#7 — 7	8 —	Request to Send RTS
Clear to Send CTS	#8	←	#8 — 6	5 —	Clear to Send CTS
				Jumper	

Take a look at the Transmit Data coming from the Computer side. It is connected to cable pin 3 and the flow shows it going out from the Computer. It connects to pin 3 on the other end of the cable attached to the Firefly. The internal jumper routes the signal from pin 3 to the Receive Data line (Jumper 1-3). In this configuration, the link works properly.

Now you have to consider what the radio link does to the data. Basically, it extends the cable connection so that Transmit Data coming in on cable pin 3 should go across the radio link and come out the other side on pin 3. Let’s take a look at the connection to see how it works.

In the following drawing, the Firefly is configured as a DTE device because the Modem on the other end of the cable is a DCE device. Since the Computer is sending out Transmit Data on pin 3, you expect to see Transmit Data on pin 3 on the other side of the link. In the drawing below, Transmit Data comes across on pin 3, goes straight through the jumpers (Jumper 3-4) to the Transmit Data line and out to the Transmit Data pin 3 on the Modem. The signal flow is correct and the link should work properly.

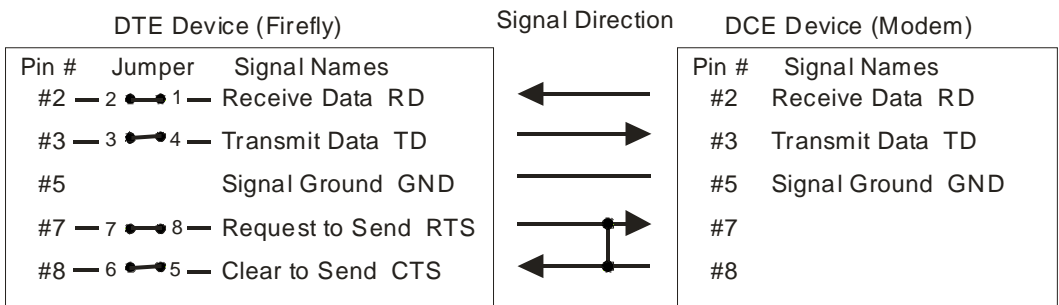
BluePort DTE connected to a DCE Device



5.1.4 RTS and CTS

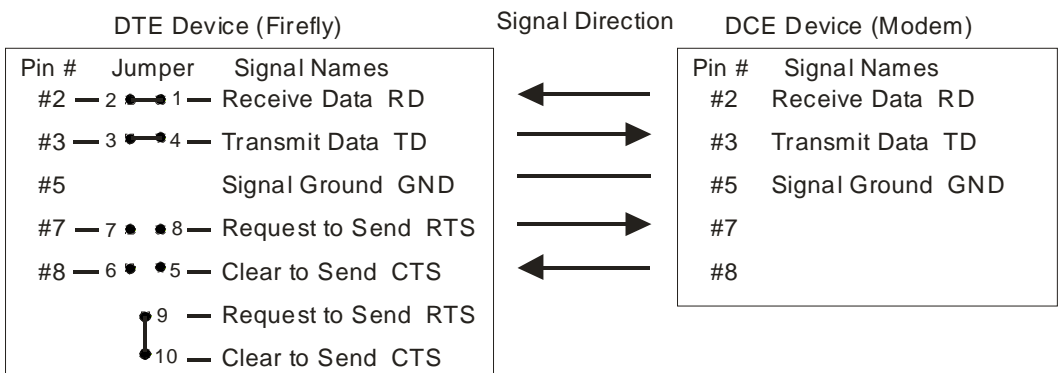
There are a lot of devices that can handle simple RS-232 communications but do not use any control signals like Clear To Send (CTS) and Request To Send (RTS). The Firefly needs to see the control signals for proper operation. The simple solution is to jumper the RTS and CTS pins on the cable.

Firefly DTE connected to a DCE Device(NO RTS/CTS)



Another solution is to jumper the RTS/CTS signals inside the Firefly. This is done by connecting a jumper between pins 9 and 10. Pins 9 and 10 were designed for this purpose.

Firefly DTE connected to a DCE Device(NO RTS/CTS)



6. Quick Start Guide

If you purchased a pair of Firefly radios for the purpose of replacing a cable, follow the instructions below.

6.1 Two Firefly serial devices as a Cable Replacement

A typical connection between a Computer (DTE) and a Modem (DCE) is shown in *Figure 10*. A Modem is used in this illustration because it represents many devices that can be connected to a computer using a serial cable. You can connect badge readers, CNC machines, label printers, ATMs or most any device that uses an RS232 serial interface. We say *most* devices because there are some devices that use all the RS232 signals or others may modify the RS232 signal in a way that cannot be recognized by the Firefly. However, if your device can be connected to your computer through an RS232 cable, there is a good chance it can be connected to a Firefly.

Note that in *Figure 10* the PC is marked as a DTE device, which means Data Terminal Equipment. The Modem is marked as DCE or Data Communications Equipment. The RS232 serial standard defines the flow of signals and the names of the signal pins based on whether the device is DTE or DCE. Remember that the PC is generally a DTE device and the Modem is a DCE device.

Note that in *Figure 10* the cable between the PC and the Modem (or your device) is a straight cable, which means that the RS232 standard for connecting serial devices is used. For example, Transmit Data leaves the PC on pin 3 of the 9-pin connector and enters pin 3 of 9-pin connector on the Modem (or your device). See *Figure 9 - Straight Cable* for more details.

There are other ways to connect a PC to an RS232 device even if it is not a DCE configured device. We will discuss more about that later.

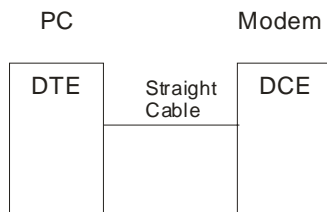


Figure 10 - PC to Modem

A pair (2) of Firefly wireless radios will allow you to remove the straight cable and replace it with a wireless connection. The connection looks something like Figure 11.

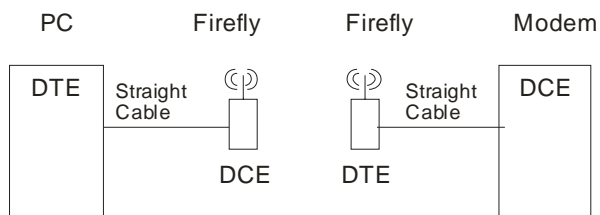


Figure 11 - Firefly radio link

It is important to note that the radio attached to the PC is marked DCE and the radio attached to the Modem is marked DTE. When you started with just a cable, the PC (a DTE device) was connected to a Modem (a DCE device). Now that two new devices have been connected, the naming conventions have to remain the same. The PC as a DTE device must be connected to a DCE configured radio.

Across the radio link we have a similar situation. The Modem as a DCE device must be connected to a DTE configured radio.

6.1.1 Configuration Options

Configuration options for the Firefly are provided by jumper pins on the circuit board. Remember that the jumper pins allow you to configure the radio module as a DTE or DCE device for the RS232 signals.

6.1.2 Opening a Firefly

To open a Firefly, remove the screw on the back of the case. The circuit board is attached to the DB9 connector.

6.1.3 Selecting DTE or DCE

Once you remove the circuit board, locate the option jumpers using the drawings below. The following drawing shows the jumpers set for a **DTE** device.

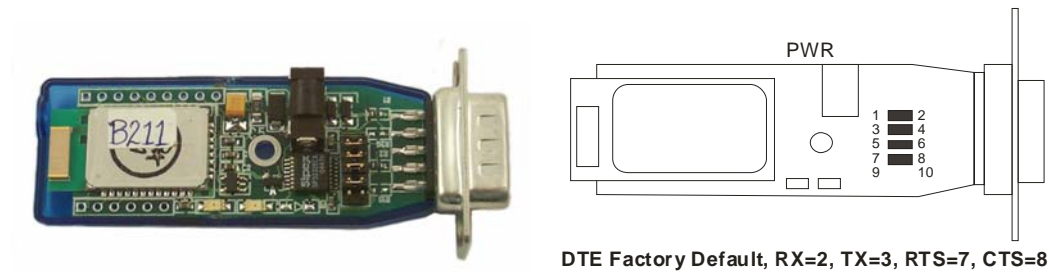


Figure 12 - Option Jumpers for DTE

The following drawing shows the jumper options set for a DCE device.

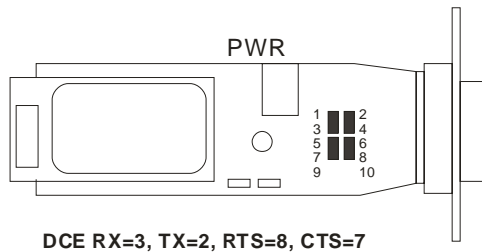


Figure 13 - Option Jumpers for DCE

6.1.4 Clear to Send Option

Your device must be capable of supplying the CTS Clear to Send signal because the Firefly radio uses this signal to control the flow of data. If your device does not have an active CTS signal, or you are not sure, you can jumper the internal option pins 9 and 10 as shown below. The jumper will tie CTS to RTS internally. If you use a jumper between 9 and 10, you will not need the other jumpers for RTS and CTS.

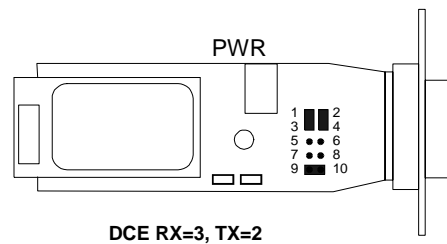


Figure 14 - CTS to RTS Jumper

6.1.5 Master and Slave

When two units are used for a cable replacement, one unit is setup as the **Master** and the other is setup as the **Slave**. It does not make any difference if the Master is connected to the PC or to the Modem. Typically, the Master is associated with the PC, so we will continue that designation. The selection is done using the Auto Master switch. Setting the switch **ON** will make the unit a **Master**. Setting the switch **OFF** will make it a **Slave**.

Pick one of your units and set the Auto Master, Switch 3 to the ON position. Set Switch 3 on the other unit to OFF. The following drawing shows Switch 3 set to ON and the unit set to Auto Master.

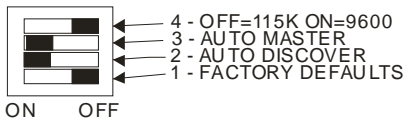


Figure 15 - Switch 3 to Master

6.1.6 Select the Baud Rate

There are two SWITCH selectable Baud rate settings, 115K or 9600. You can change the baud rate to 1200, 2400, 4800, 9600, 38.4K, 57.6K, 115K, 230K or 460K by entering the command mode and selecting a different baud rate. See *Firmware Configuration* on page 3-13 for details.

The following drawing shows Switch 4 set to 115K Baud.

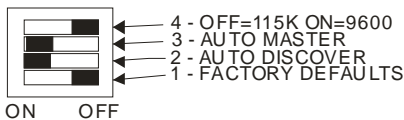


Figure 16 - Switch 4 to 115K

6.1.7 Select Auto Master

When the Master has Switch 2 and Switch 3 ON, it searches for a Slave, stores the Slave identification, and connects to the Slave if the Slave has Auto Discover Switch 2 is ON.

Set the Master with Switch 2 and Switch 3 ON.

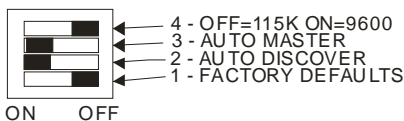


Figure 17 - Switch 3 to Auto Master

6.1.8 Select Auto Discover

Auto Discover allows a Master device to read the identification number and automatically connect.

Set the Slave with Switch 2 ON and Switch 3 OFF. This unit is now a Slave with Auto Discover.

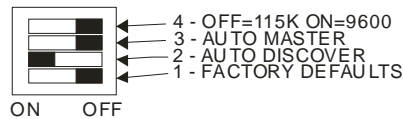


Figure 18 - Slave with Auto Discover

6.1.9 Factory Defaults

Set this switch **ON**, power up the unit, and toggle the switch from ON to OFF 3 times to return the unit to factory settings.

6.1.10 Connecting Power

Connect the 5VDC, 300ma wall plug adapter to the Firefly power jack. The Green LED will start to blink.

See *Power Requirements* on page 3-5.

6.1.11 Quick Test

When you power up both devices, the MASTER finds and stores the SLAVE address and auto connects. The green LED on both units will flash and within a short time should be on solid. The solid LED indicates the units are properly linked.

Verify data flow by observing the Yellow LED. Flashing indicates data flow, both transmit and receive.

You can verify communications by connecting one Firefly to your PC and connecting a Loop-back connector to the other Firefly as shown in the drawing below. The loop-back adapter will take any received characters and send them back. The loop-back adapter connects the transmit and receive lines together and the RTS/CTS lines together. If you use a program like Hyperterminal to connect to the serial port of one of the Firefly radios, then you will see a character displayed on the screen each time you send a character. See *Hyperterminal Setup* on page 6-18 for instructions.

First make sure the units are linked by observing the steady green LED on both units. When you type a character on the PC side, the yellow LED on the Firefly attached to it will blink. If the other Firefly is configured properly, the yellow LED on it should also blink, indicating data is being received and transmitted. Typing a character in Hyperterminal will send the character out the PC serial port to the attached Firefly, through the radio link to the other Firefly, loop around from the receive line to the transmit line and come back to the PC.

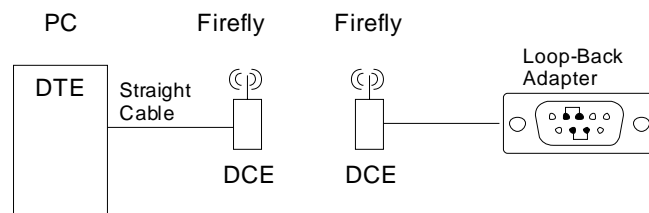


Figure 19 - Loop Back Test

6.1.12 Hyperterminal Setup

1. Start Hyperterminal and enter a name for the connection. When the **Connect To** dialog box appears, select a COM port (example COM2) from the **Connect Using** list box and click OK.
2. Ignore the COMx Properties for now and click OK. The status bar at the bottom of the screen may indicate Auto Detect. Click the **Disconnect** icon.
3. Click on the **Properties** icon, select the **Connect To** tab and click the **Configure** button below the selected COM port. Set to 9600, 8, None (parity), 1 None (Flow Control). Verify the settings and click OK.
4. Select the **Settings** tab. Change the Emulation from Auto detect to VT100. The status should show VT100 and 9600 8-N-1.
5. Click the **Call** icon to complete the setup.