HighPerTec
High Performance Technology

BlueSerial

Bluetooth Serial RS232 Port Adapters

User Manual

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1   Introduction

The BlueSerial Bluetooth serial port adapter makes it easy to turn any device with an RS232 compatible serial port into a Bluetooth device. BlueSerial enables wireless communication with other Bluetooth devices like personal computers, PDAs, cell phones and many more. This User Manual describes the installation and usage of your BlueSerial Bluetooth serial port adapter. Please take some time to read this manual. If you don't want to read the whole manual, read at least the sections marked important.

If you are not familiar with the operation of Bluetooth devices we encourage you to read the chapter *Bluetooth Basics* before you start using the BlueSerial adapter.

BlueSerial Adapter Versions:

BlueSerial with Enclosure:
The complete electronics is built into a small plastic enclosure. The LED shows power and status of the BlueSerial adapter. The MMCX antenna connector with the small antenna and a power suplly connector is located on the rear side. Optional, the BlueSerial adapter could get the power (5 to 10 Volt) through Pin 9 of the RS232 connector if available. The BlueSerial adapter is available with built in NiMH battery as well. The size of the complete unit is only 2 x 1.5 x 0.8 inch.

BlueSerial without Enclosure:
Complete electronics as above, but no enclosure around. The PCB has mounting holes on each side and size is only 1.8 x 1.2 inch

BlueSerial OEM without Enclosure:
Complete electronics as above, but PCB size is reduced down to 1.2 x 0.8 inch by removing the sides with the mounting holes.

Additional Versions:
We can offer the BlueSerial Modules in any enclosure (plastic / metal) with different high gain antennas, power options, customer specific layout and more to make the Bluetooth integration as easy as possible.

Getting Started

1.1 Box content

Items included when you receive your BlueSerial adapter:

- BlueSerial Bluetooth adapter for serial ports.

- Wall box power supply (230 or 110 Volt depending on country)

- Stub antenna

- CD containing the configuration software

- This user manual

<u>Important</u>

Please use the BlueSerial adapter only with the power supply delivered with the device. If you have to use another power supply, please make sure its voltage rating falls within the range indicated in the technical specification. Using a power supply voltage outside of the specified range will void any warranty.

1.2 Standard Configuration

When you receive the BlueSerial adapter the device is configured as follows

- Operating mode: Bluetooth slave, visible, connectable.

- No authentication, no encryption.

- Serial port 115kBit / second, 8 data bits, 1 stop bit, automatic detection of port type, accepts port settings from a remote device over Bluetooth RFCOMM protocol.

A detailed description of the configuration parameters can be found in the *Configuration* section below.

1.3 Status Indicators

Two LEDs provide monitoring of the BlueSerial adapter operation mode.

- The green LED flashes once followed by a long interval (~ 3 seconds)
The BlueSerial adapter is operational, but no device has been detected on the serial port.

- The green LED flashes once followed by a short interval (~ 1 second)
The BlueSerial adapter is operational and a device has been detected on the serial port.

- The green LED flashes twice, followed by a short interval (~ 1 second)
A Bluetooth connection to a remote device is active.

- The red and the green LED both flash simultaneously
The BlueSerial adapter is in configuration mode.
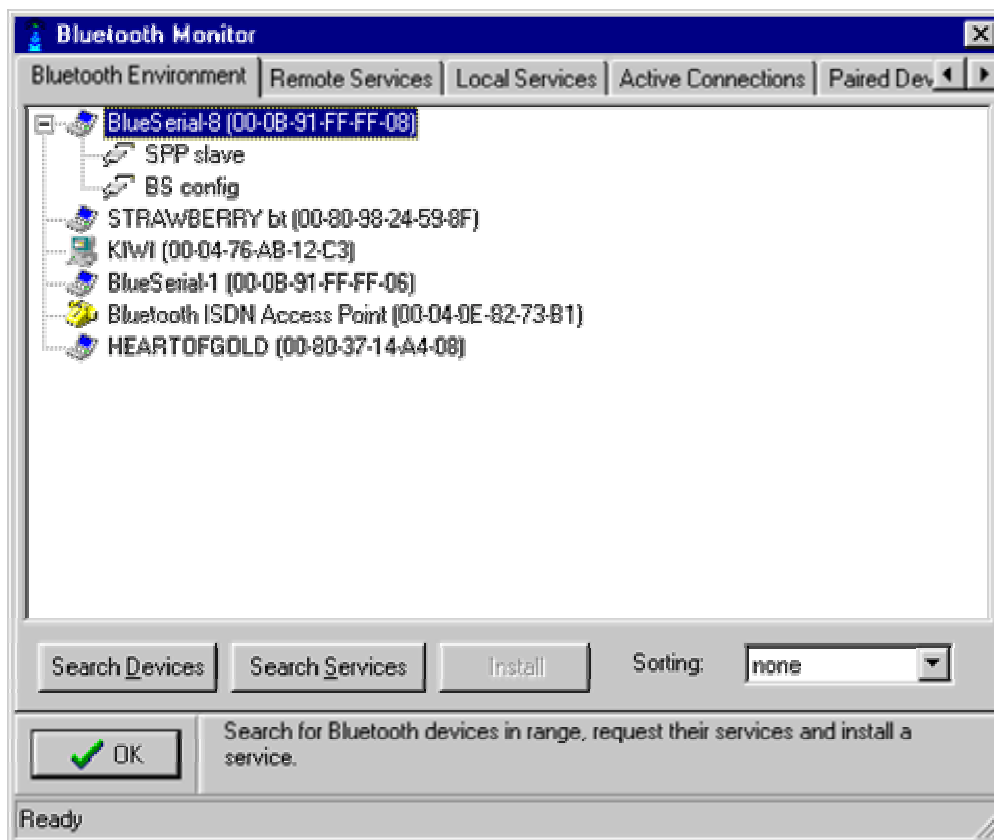
2   Configuration

The configuration software that comes with the BlueSerial adapter allows you to change operating modes. The program runs on any standard PC with a Windows operating system (Windows 95 or higher). The program can be started directly from the CD, or you can copy it to a folder on your hard drive. The configuration can be carried out directly over a serial port or over a Bluetooth connection.

2.1   Starting the Configuration over a Serial Port

Connect the BlueSerial adapter to a serial port on your PC and connect the power supply before you start the program BlueSerialConfig.exe. When the program starts it searches for a BlueSerial adapter connected to a serial port (either COM 1 or COM 2). If the BlueSerial adapter cannot be found you can manually select the appropriate port.

2.2   Starting the Configuration over a Bluetooth Connection

To start the configuration over a Bluetooth link you need a Bluetooth adapter for your PC which supports the Serial Port Profile (SPP). Power up the BlueSerial adapter first and then start the device search from your Bluetooth PC application software. The BlueSerial adapter offers two services as shown in the example below, "SPP Slave" and "BS config".


Install a virtual serial port on the "BS config" service from your Bluetooth application. Please consult the documentation of your Bluetooth PC application how this is done. Then you can start the configuration software on this port. You can do this either from the command line with

```
d:\>BlueSerialConfig \\.\COM3
```

assuming "d:" is your CD-ROM drive and you have installed the "BS config" service on COM3, or you may create a shortcut to the program on your hard drive and add the parameter \\.\COM3 under Properties->Shortcut->Target.


## 2.3   Using the Configuration Software

After starting the software, the *Bluetooth Environment* tab sheet will be displayed. In the status line the currently active operation and the serial port used to communicate with the BlueSerial adapter will be displayed (COM1 in the example below). The software will automatically search for Bluetooth devices within range. You can also query the services these devices offer. This is only required if you want to use the BlueSerial adapter as a Bluetooth Master (see section *Bluetooth  Master Operation* ).
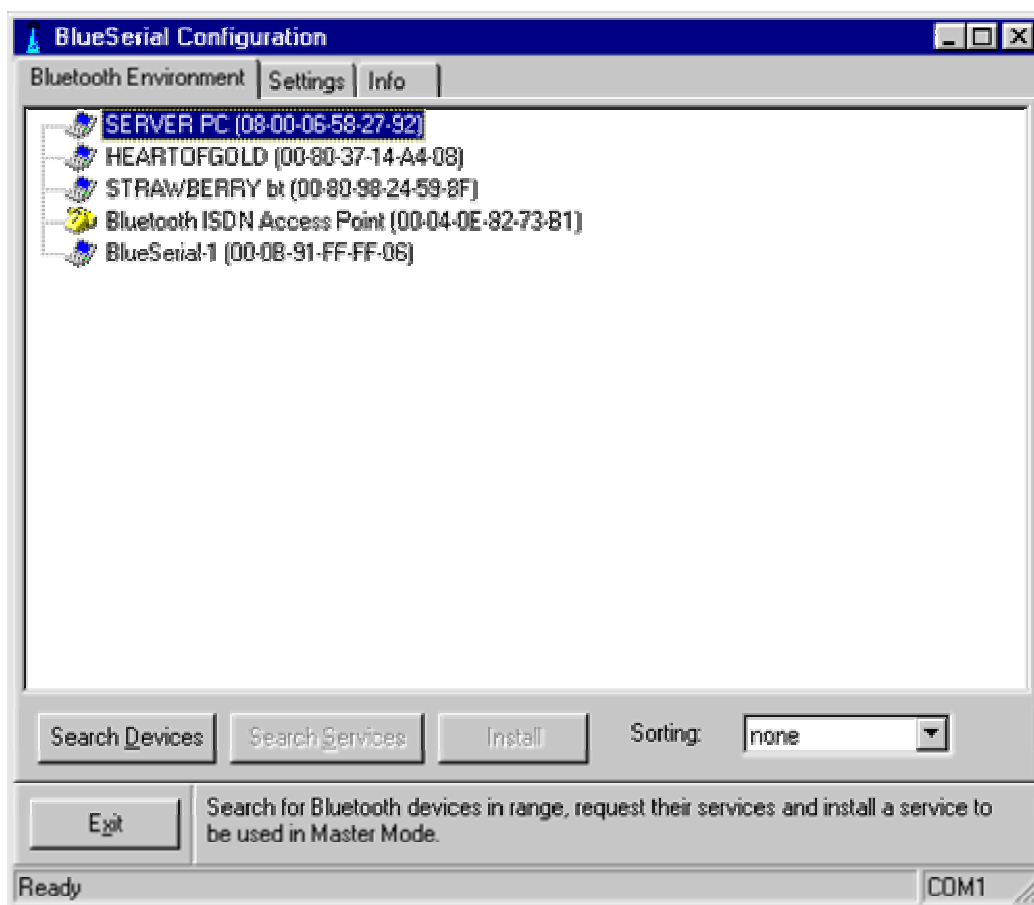


If you want to check or modify the configuration settings of your BlueSerial adapter click the *Setting*s tab sheet. Please note that any changes to the configuration only become effective when you clicked the *Apply* button before leaving the configuration program.
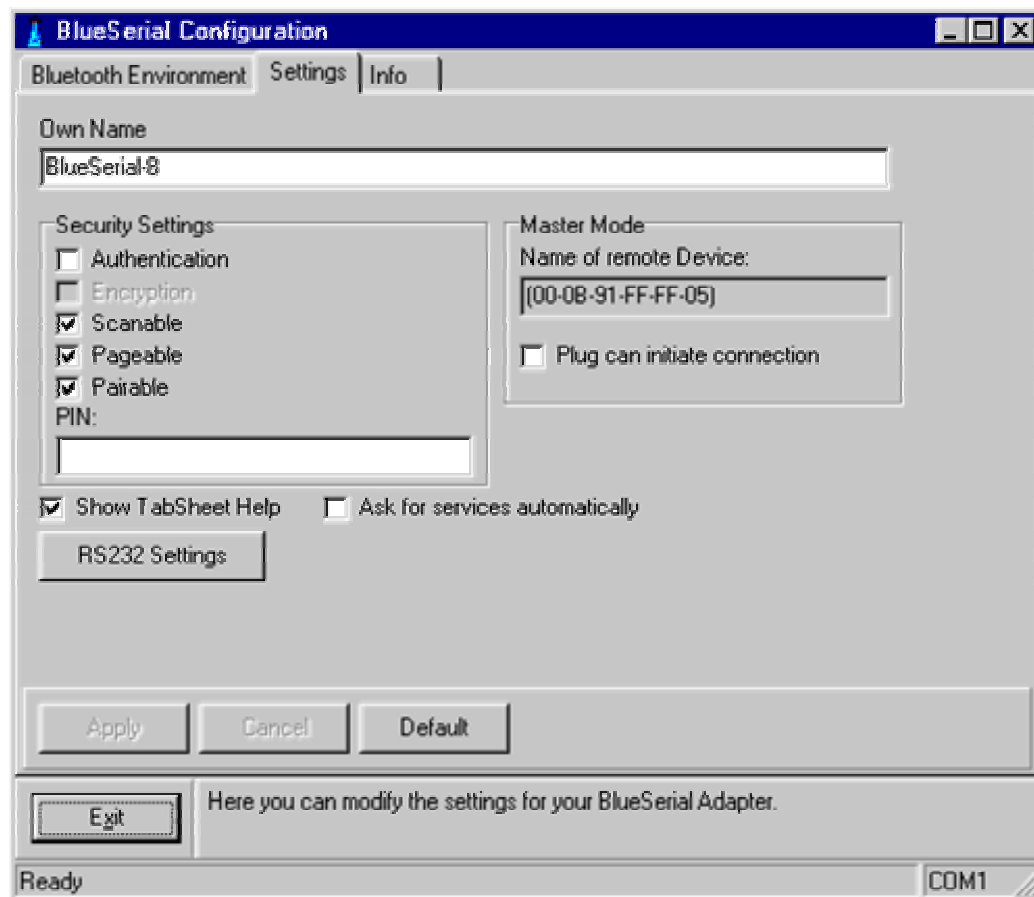
**Own Name**
The name of your BlueSerial adapter that is displayed on a remote device querying your BlueSerial adapter.

**Security Settings**

**Authentication**
When this options is enabled the BlueSerial adapter will only accept connections from a remote device it has been paired with.

**Encryption**
All data transfers will be encrypted. This will only work if Authentication is enabled.

**Scanable**
The BlueSerial Adapter is visible to other Bluetooth devices.

**Pageable**
The BlueSerial adapter can be connected by other Bluetooth devices. If this option is deactivated the BlueSerial adapter only works as a Bluetooth Master.

**Pairable**
If this option is deactivated the BlueSerial adapter cannot be paired with other devices. However, it is still possible to connect to the BlueSerial adapter from devices it has been already paired with.

**PIN**
This code must be entered on a remote device that wants to pair with the BlueSerial adapter. The default is an empty pin.

**Master Mode**

**Name of remote Device**
The name of the device the BlueSerial adapter tries to connect to as a master. It is only displayed if the installed device is in range. If not, only its Bluetooth address will be displayed.

**Plug can initiate connection**
The BlueSerial adapter only tries to connect to a remote device as a master when this option is activated. When you have installed a remote device but do not want the BlueSerial adapter to connect to it, then deactivate this option.

**Show TabSheet Help**
If this option is checked a short description of the current tab sheet functions will be displayed.

**Ask for Services automatically**
If this option is checked, the BlueSerial adapter will automatically query all remote devices for the services they offer. If unchecked you have to ask for the services manually.

**RS232 Settings**

To configure the serial port settings click the RS232Settings button.
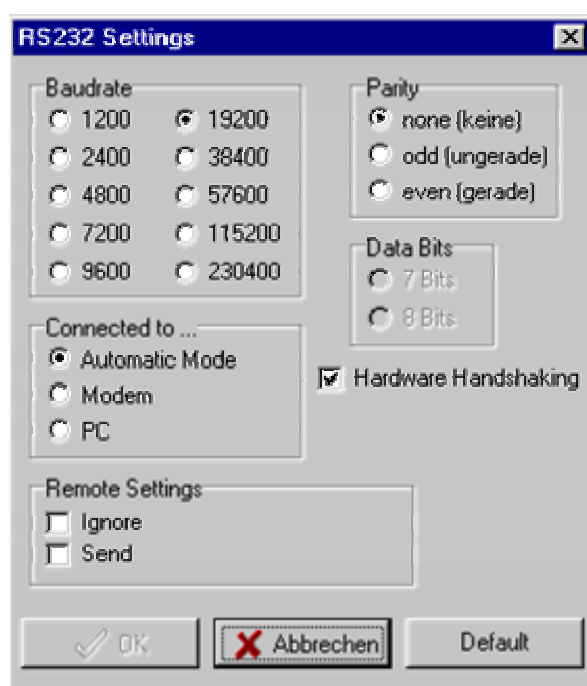
### Baud rate and Parity

These set the default port parameters used.

### Connected to...

**Automatic Mode**
The BlueSerial adapter automatically detects the type of device (DTE or DCE) it is connected to.

**Modem**
The BlueSerial adapter will configure its serial port to operate when connected to a modem (DCE device) only. If this option has been selected you must connect the BlueSerial adapter to the PC **before** applying power if you need to use the configuration program again.

**PC**
The BlueSerial adapter will configure its serial port to operate when connected to a PC (DTE device) only.

### Remote Settings

The Serial Port Profile allows port settings to be sent over the Bluetooth link. These options define how the BlueSerial adapter will handle those requests.

**Ignore**
If this option is activated the BlueSerial adapter will ignore any port settings received from a remote device and always use its own settings.
If this option is deactivated it will change its port setting when it receives such a request from a remote device.

**Send**
The BlueSerial adapter will indicate its port settings to a remote device upon connection set-up.

## 3   Bluetooth Slave Operation

As a Bluetooth slave the BlueSerial adapter will not try to connect to a remote device. Normally only the serial port settings and the security settings (if you want something more secure than the defaults) have to be configured.

**<u>Important</u>**

The BlueSerial adapter offers two services:

- SPP Slave

- BS config

For normal operation only the service *SPP Slave* can be used. The service *BS config* is only used for configuration. It is not possible to use this service to transfer data.

## 4   Bluetooth Master Operation

If you like to use your BlueSerial adapter Plug as a Bluetooth Master device that can connect to other devices you have to configure it first. Please be aware that the BlueSerial adapter can connect to only one remote device as a master.

To configure the Bluetooth Master mode, go to the tab sheet *Bluetooth Environmen*t. If the device you want to connect to is not displayed click on *Search Device*s. In this example, you want to configure your BlueSerial adapter to connect to the remote device "BlueSerial-1" when there are data to send. To do this, highlight that device and click on *Search Service*s. The available services on this device will be queried and displayed.
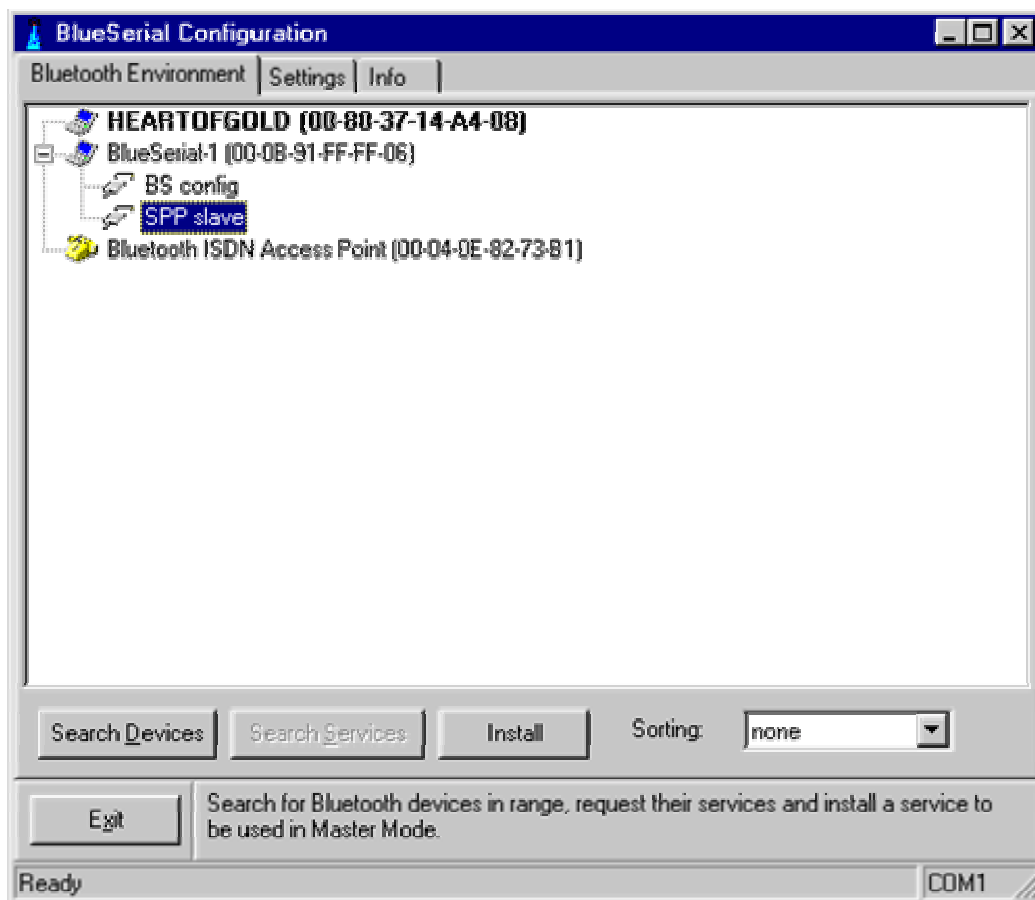


Highlight the service you want to use on the remote device and click on *Install.*

You can now initiate a test connection to the device. This is used to pair with the remote device. If any of the two devices requires authentication you will be asked for a PIN. If the remote device has fixed PIN you must enter this PIN now. If the remote device allows you to enter a PIN manually, you must enter the same PIN here and on the remote device.

After establishing a connection, the configuration program will change to the *Settings* tab sheet and the parameters for this service can be set. To store the new settings permanently click on *Appl*y.

If at any time the BlueSerial adapter receives data on the serial port it will try to connect to the service just installed and transfer the data received. The connection, once established, will remain open until the BlueSerial adapter detects a serial port close (technically speaking: a DTR drop) or the connected device is turned off.

# 5   Bluetooth Basics

Bluetooth is a manufacturer independent standard for the wireless connection of various electronic devices. It supports data transfer for applications like wireless printing or Internet access as well as voice for applications like headsets or phones.

Bluetooth supports connections between just two or between multiple devices. In the latter case one device, the master, can connect to multiple other devices, the slaves, at the same time. Such a configuration is called a "PICO-Net".

## 5.1   Radio Transmission

Bluetooth utilizes the license free 2.4 GHz ISM radio band. Because this frequency range is also used by other devices like wireless LAN, most wireless phones, or wireless video transmission devices, Bluetooth implements sophisticated techniques for error free operation:

- A frequency hopping scheme with 1600 frequency changes per second.

- Utilization of state of the art coding techniques with forward error correction.

- Low transmission power with automatic power control.

The low transmission power (about 1/1000 of a mobile phone) limits the range of Bluetooth devices. For the lowest power class (class 3) a range of about 10 meters outside buildings can be expected. Inside buildings the range is usually smaller.
For the highest power class (class 1) a range of up to 100 meters outside and about 30 meters inside buildings is achievable in practice.

## 5.2   Device Properties

All Bluetooth Devices have a unique identification, the Bluetooth Device Address. This is a twelve digit hexadecimal number usually displayed in a notation like 01-23-45-67-89-AB.
Because this device address isn't very handy, Bluetooth devices also have a name and a device code, which identifies their main function, e.g. printer, modem, mobile phone or computer.

These properties can be discovered from other Bluetooth devices and are used to identify a particular Bluetooth device. However, the device code and the device name are only used for informational purposes. To connect to another Bluetooth device, the only thing that is needed is its device address.

Further, all Bluetooth devices have an internal data base which describes all services offered by a particular device. Other devices can query this data base. The protocol used to query the data base is specified as SDP (Service Discovery Protocol) within the Bluetooth standard.

## 5.3   Protocols and Profiles

The Bluetooth standard defines various protocols and profiles which specify how Bluetooth devices can communicate. In general the protocols define how information is to be exchanged and the profiles define the type of data to be exchanged. For normal users the protocols used are of less interest. Much more important is some knowledge about the profiles, because they are visible at the user interface level. The following table gives an

overview of the Bluetooth profiles. Because new profiles are added to the Bluetooth standard from time to time there may be profiles not listed here. Further, some rarely used profiles have been omitted.

| Profile | Applications |
|---|---|
| Generic Access (GAP) | Describe device discovery and general security aspects. This profile is not related to a special service but is used by all services. |
| Service Discovery Application (SDAP) | Describes the access to the service database. Like the GAP profile it is used by other services. |
| Serial Port(SPP) | Basic profile which describes the emulation of a serial port over Bluetooth . Is used by a number of other profiles for data communication. |
| Headset Hands Free (*) | Used for wireless headsets |
| Dial Up Networking (DUN) | Used for modems, either analogue or ISDN, as well as mobile phones. Uses the SPP for data communication. |
| Fax | Used to send and receive Faxes. Often found in combination with DUN. Uses the SPP for data communication. |
| LAN Access (LAN) | Used for network access over a PPP connection. Uses the SPP for data communication. |
| Generic Object Exchange (GOEP) | Base profile for OBEX based services. Uses the SPP for data communication. |
| Object Push | OBEX service used to exchange address book information and business cards, e.g. between a mobile phone and a PC. |
| File Transfer | OBEX service used to exchange general files. |
| Synchronization | OBEX service to synchronies address book information, notes, calendar information and messages between, for example, between a PDA and a PC. Often realized by special software supplied by the PDA manufacturer which directly uses the SPP and that will also function over a cable connection. |
| Hardcopy Cable Replacement (HCRP) (*) | Parallel port emulation over Bluetooth. Mainly intended for printers and scanners. |
| Personal Area Network (PAN) (*) | Direct (TCP/IP based) network connection over Bluetooth. More flexible than the LAN profile. |
| Common ISDN Access (*) | Used for ISDN applications over Bluetooth. More flexible than the DUN and FAX profiles. |
| Human Interface Device (HID) (*) | Used to connect mice, keyboards, joysticks and similar devices. |

The profiles marked with an (*) are not part of the original Bluetooth 1.1 specification and partly not finally standardized.

### 5.4    Establishing a Bluetooth Connection

Even though Bluetooth has a lot of different applications, the basic steps to establish a Bluetooth connection the first time are more or less the same:

- Searching for the device to connect to. This so called inquiry discovers the Bluetooth address, the device code (class) and the name of the device you want connect to.

- Asking for available services and selection of the service to use.

- Pairing of the devices. This step is optional and not required if no security options are enabled. During this step the entry of a PIN code (or passkey) on one or both devices is required. Using this PIN code a so called Link Key is generated. This link key is stored in both devices and used to authenticate the devices on subsequent connections.

The information collected during these three steps are now stored within the devices and used whenever a connection is to be created between them. In most cases, the initial establishment of a Bluetooth connection will be initiated by the device that will create the connection later. This device will be the master of the Bluetooth connection.

Devices which communicate over Bluetooth will always have one of two roles: master or slave.
A master
        - creates a connection (paging).
        - controls which slave is allowed to send data.
        - can create additional connections while others are active.

A slave
        - waits for the connection request from a master.
        - can not create or accept additional connection while a connection is active.

Depending on the application the device roles can be
        a) fixed,
        b) fixed for the duration of a single connection,
        c) dynamically change while a connection is active.

An example for case a) is the connection between a computer and a printer. The computer always creates a connection when some document is to be printed.

An example for case b) is the connection between a mobile phone and a headset. If there is an incoming call, the phone will connect to the headset. as the master. If the user wants to make a call, he will press some button on the headset, which will connect to the phone and allow the user to voice dial a number.

An example for case c) is a network access point for multiple users. The first device connects to the access point as a master. However, if it keeps its master role, no further connections to the access point (now a slave) are possible. To allow other devices to connect to the access point, the devices will change the roles. Now the access point is a master and can accept additional connections.

## 5.5   Security Aspects

The Bluetooth standard defines various security options. There are options to prevent unauthorized usage of a device and options to prevent monitoring a connection.

The options to prevent unauthorized usage may not be all implemented in a given device. Possible options are:

- Bluetooth devices may be made invisible. This makes it impossible for other devices to get their Bluetooth address. Only devices which already know the Bluetooth address of an invisible device can connect to this device.

- Paring can be disallowed.

- The user must authorize every connection.

- A connection is only accepted from paired devices (authentication).

To prevent monitoring a connection it is also possible to enable encryption for a connection. This is only possible if authentication is enabled, too.

# 6   Technical Specifications

| Radio Transmission | |
|---|---|
| Frequency Range | 2.402 - 2.480 GHz |
| Transmit Power | + 4dBm maximum (Bluetooth Class 2) |
| Input Sensitivity | better than -80 dBm |
| Modulation | GFSK Modulation with frequency hopping. |
| **Connectors** | |
| RS232 | SUB-D 9 Pin, female<br>automatic DTE/DCE detection<br>1200 Baud to 230 kBaud<br>Baud rate, Parity, Data Bits fixed or over Bluetooth protocol. |
| Antenna | MMCX 50 Ohm |
| Power Supply | 1.3 mm power connector, Plus on inner pin<br>4..10 Volt, 100 mA (max) |
| **Bluetooth** | |
| Version | 1.1 |
| Protocols | L2CAP, SDP, RFCOMM |
| Bluetooth Profiles | Generic Access, Service Discovery, Serial Port, LAN Access, Dial Up Networking, FAX |
| Device Role | Slave and/or Master |
| Role Switch | supported |
| **General** | |
| Dimensions | 32x57x14mm |

## 6.1   Serial Connector Pin Out
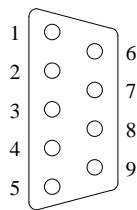
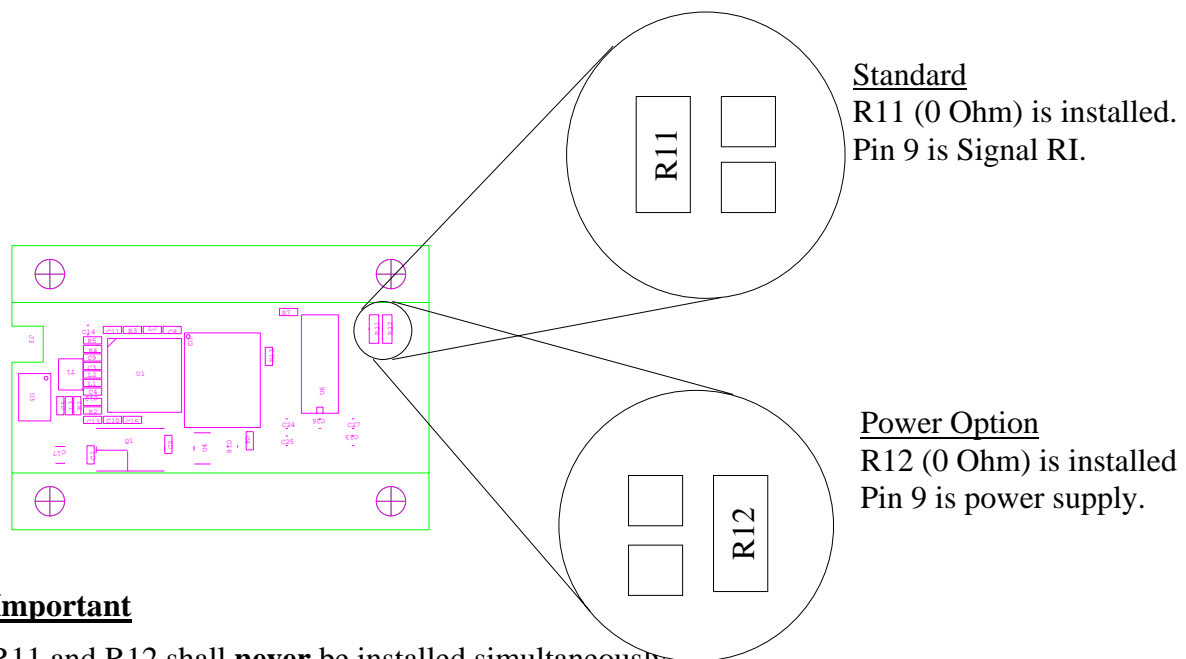| Pin no. | Signal name | Direction when connected to a DTE (PC) | Direction when connected to a DCE (Modem) |
|---|---|---|---|
| 1 | CD | output | input |
| 2 | RX | output | input |
| 3 | TX | input | output |
| 4 | DTR | input | output |
| 5 | Ground | - | - |
| 6 | DSR | output | input |
| 7 | RTS | input | output |
| 8 | CTS | output | input |
| 9 | RI | output | input |

## 6.2    Mechanical Dimensions Internal Mounting Version
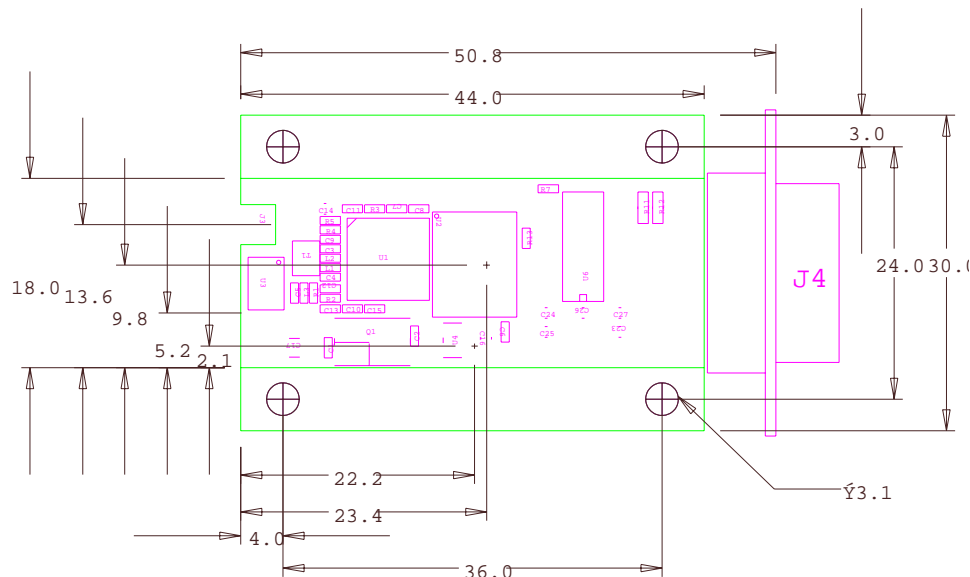


(all dimensions in mm)

## 6.3    Power Supply through Serial Port Pin 9

For internal mounting or non standard applications it is possible to supply power to the BlueSerial adapter through pin 9 of the SUB-D connector. This pin is normally used for "Ring Indicator" (RI). If it is used for power supply the RI signal is not available.



Standard
R11 (0 Ohm) is installed.
Pin 9 is Signal RI.

Power Option
R12 (0 Ohm) is installed
Pin 9 is power supply.

## Important

R11 and R12 shall **never** be installed simultaneously.