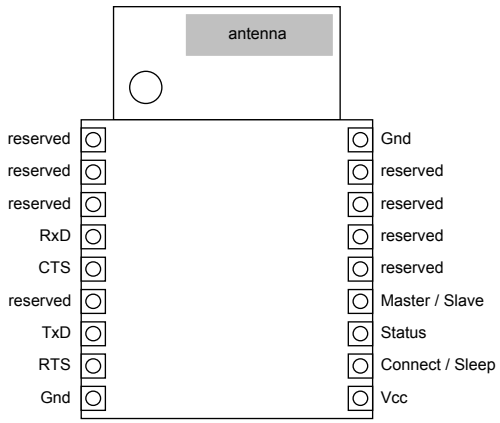
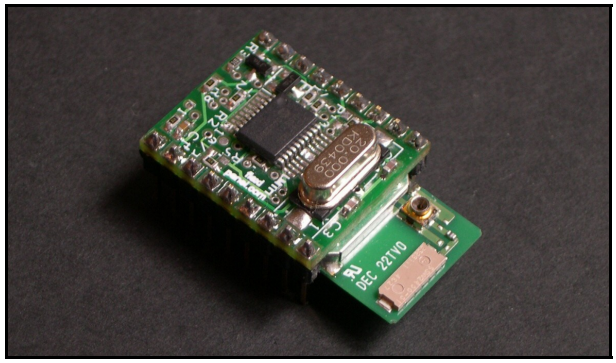
# LinkMatik™

***Fully transparent Bluetooth serial interface – no AT commands required***



- *Easy to use Serial data interface TX / RX (no AT commands!)*
- *Pairs with Bluetooth devices (e.g. PDA's, PC's, Phones) as master or slave.*
- *Maximum data rate approx 50K full duplex.*
- *FCC / CE / IC compliant. Does not need recertification if integral antenna used.*
- *Baud rates 9600 to 115K baud.*
- *Hardware flow control or no flow control.*
- *Bluetooth PIN code and encryption.*
- *Bluetooth error correction layer.*
- *Class I Bluetooth V1.1 radio, 100m range.*
- *3-5V supply.*
- *Integral antenna*.

## *Applications*

- Direct access to PDA's, Laptops, Mobile Phones etc
- Cable replacement
- Enables Bluetooth device control
- Process Control
- Robotics


### *Summary*

LinkMatik is a fully transparent serial to Bluetooth data link. It enables designers to easily add a Bluetooth wireless feature to their product without the need for RF and antenna design expertise.

The module contains all RF circuitry, including integral antenna and controller, and provides a simple-to-use, plug-in module with digital interface to the host application.

Once implemented, the module can interface with many standard Bluetooth devices, *e.g.* Laptop computers, PDAs, Mobile phones *etc.*

Operating in slave mode, it initializes itself and waits for a remote device to connect. In master mode, it looks for specific devices to connect to. Two LinkMatik modules can be paired together. The modules manage themselves and require no external control. Baud rate, device name, class of device, etc, can be reconfigured from a PC via the Bluetooth connection.

Unlike most other Bluetooth modules, no AT Commands are required. It is not necessary to control the module from a host computer. It manages itself.


*Manufactured to ISO9001:2000*

## *Ordering Information*

| ***Part No*** | ***Description*** |
|---|---|
| LINKMATIK | LinkMatik 18pin Dual in Line package |
| LINKMATIK-xxx | LinkMatik 18pin Dual in Line package – custom settings *xxx* |

## *Pin Connections*

| *Pin Name* | *Description* |
|---|---|
| Connect / Sleep | Input: high to connect, low to enter sleep state (notes 2,3). |
| CTS | Clear To Send: Flow control input to *LinkMatik*. When low, *LinkMatik* will output data on the TxD line. |
| Gnd | Power ground reference. Only one Gnd pin needs to be connected. |
| Master / Slave | Input specifying whether to actively connect or wait for another device to connect; also used for erasing partner / authentication information. |
| reserved | leave unconnected |
| RTS | Flow control output from *LinkMatik*. When high, do not send data to *LinkMatik*. |
| RxD | Serial data input to *LinkMatik*. |
| Status | Output indicating connect state. |
| TxD | Serial data output from *LinkMatik*. (note 1) |
| Vcc | 5V power supply peak requirement 250mA |

1. Output uses 4k7 pull-up resistor and a pull-down transistor.
2. Also powers some circuits, drawing 10mA.
3. Must be pulled low to enter sleep state. Leaving this pin floating is not sufficient.

## *Serial Link*

The serial data is standard, active-low format with 8 data bits, no parity bit and 1 stop bit. Hardware flow control is supported. If no flow control is required, RTS must be connected to CTS. For RS232 levels, use a level shifter IC such as a MAX232.

## *Radio Link / Antenna*

The radio is a 2.4GHz Class I Bluetooth device with an integral antenna. To achieve 100m range, the corresponding Bluetooth device must also be Class I.

LinkMatik is supplied with an integral antenna. This will provide adequate range for most applications. There is also the facility to attach an external antenna, via the on-board Hirose U.FL series connector. Please note that the product is certified for use with the antenna supplied. Should an alternative antenna be used then EMC re-certification must be sought.

## *Bluetooth Operation*

When the Connect / Sleep pin goes high, LinkMatik inspects the state of the Master / Slave pin. If it is low, it enters Slave mode. If it is high, it enters Master mode.

In Slave mode, LinkMatik is placed in a detectable state. Unless it has been configured as *Monogamous* and it has already found a partner, it will allow any device to connect to it. A PIN code may be required, depending on configuration. If the remote device disconnects, LinkMatik returns to the discoverable and detectable state. To disconnect locally, set the Connect / Sleep pin low.

In Master mode, LinkMatik searches for a partner to connect to. What it connects to is defined by the device configuration. The partner does not have to be another LinkMatik. When it finds a partner, it connects immediately. If configured as *Monogamous*, it will only thereafter reconnect to that specific Bluetooth device. (It will also reconnect much more quickly.) If the remote device disconnects, LinkMatik starts searching for a partner again. To disconnect locally, set the Connect / Sleep pin low.

If authentication is enabled locally or required by the remote device, LinkMatik will pair with newly encountered remote devices by exchanging PIN codes. LinkMatik will remember up to 7 paired devices. (The eighth device erases the first, etc.) If encryption is enabled or required by the remote device, the link will be encrypted. The PIN code is set in the device configuration. The default is four zeroes.

The Master / Slave pin state should normally remain unchanged. While LinkMatik is looking for a partner, a change of state will erase monogamous partner information and any information about paired devices. The change of state should be at least 10ms long. After erasure LinkMatik will wait for the Master / Slave pin state to change state and then resets.

The module supports Hold and Sniff power saving modes if requested by the remote device, but cannot enter these states itself. Park mode is not supported.

The module is configured with a specific name and device class. The name appears in user interfaces when remote devices search for Bluetooth devices in range. LinkMatik also uses the beginning portion of remote device's name in order to decide whether it should connect to them. The device class specifies the type of device. This is used for icons and by remote devices searching for specific device types. To change these settings refer to the Device Configuration section.

## *PCB Mounting Considerations*

In order to realize the maximum possible range between two modules the antenna position is of importance. During design, consider the RF characteristics of the environment surrounding the module. Experiment with the location and orientation of the antenna and avoid locating it near large conducting materials (e.g. metal, water).

Ideally, mount the module so that antenna overhangs the edge of the motherboard. If this is not possible then ensure that there are no other components or metal within 4cm of the antenna. Finally, ensure the area where the module is mounted has a solid ground plane.

## *Device Configuration Settings*

LinkMatik has settings which may be reconfigured using the LinkMatik Configuration Tool software. This can be freely downloaded from *www.flexipanel.com* and/or *www.rfsolutions.co.uk*. In large volumes, LinkMatik can be supplied with specific configuration settings. The available settings are as follows:

The ***status pin function*** may be:

- Low unless connected
- High during initialization after reset, low if unconnected, high if connected
- Low during initialization after reset, 1Hz if unconnected, high if connected (factory setting)

The ***baud rate*** may be:

| | |
|---|---|
| 9600 baud (factory setting) | 57600 baud |
| 19200 baud | 115200 baud |
| 38400 baud | |

The ***device type*** defines how the module will appear to be to other Bluetooth devices and will therefore affect the icon that appears on other Bluetooth devices. Note that this may affect the device discovery function, for example some mobile phones only look for certain sub classes, *e.g.* headsets. Select one of:

Imaging device†
General peripheral‡
Joystick‡
Gamepad‡
Remote control‡
Sensing device‡
Digitizer‡
Card reader‡
Desktop computer
Server
Laptop computer
Handheld computer
Palm-sized computer
Wearable computer
Computer (other)
Cellphone (factory setting)
Cordless phone
Smartphone
Gateway / modem
ISDN
Phone (other)
Wearable headeset
Hands free audio device
Microphone
Loudspeaker
Headphones
Walkman / iPod
Car audio
Set-top box
Hi-Fi
VCR / DVD
Video camera
Camcorder
Monitor
TV / Monitor with audio
Conferencing device
Toy
LAN 0% utilized
LAN 1% - 17% utilized
LAN 17% - 33% utilized
LAN 33% - 50% utilized
LAN 50% - 67% utilized
LAN 67% - 83% utilized
LAN 83% - 99% utilized
LAN 100% utilized
Miscellaneous device
Uncategorized device

The ***services*** define the capabilities device. Select as many as appropriate from the following list. Note that services marked † or ‡ are only selectable for device types having a corresponding † or ‡ symbol. For an explanation of *limited discoverable* service, refer to *www.bluetooth.org*.

Limited discoverable (factory setting)
Positioning
Networking (factory setting)
Rendering
Capturing
Object transfer (factory setting)
Audio
Telephony (factory setting)
Information
Keyboard†
Pointing device†
Display‡
Camera‡
Scanner‡
Printer‡

The ***device name*** is an ASCII string of up to 31 characters. This is used during device discovery to identify devices. Each LinkMatik module has a unique 12-character hexadecimal Bluetooth ID. To incorporate the Bluetooth ID in the device name, include the '~' in the device name 12 times. LinkMatik will substitute the Bluetooth ID characters for the '~' characters. For example, if a LinkMatik module with Bluetooth ID '123456ABCDEF' uses the factory-setting:

```
LinkMatik ~~:~~:~~:~~:~~:~~
```

The actual device name becomes:

```
LinkMatik 12:34:56:AB:CD:EF
```

Note that most Bluetooth device managers store discovered device names locally. If you re-configure the device name, products which have previously discovered the device may continue to display the old name for a while afterwards.

If operating in master mode, LinkMatik connects to the first device it discovers whose name matches the ***pair match prefix***. If the discovered device name is longer than the pair match prefix, characters beyond the end of the pair match prefix are ignored. For example, the factory setting is:

```
LinkMatik
```

Which specifies that the module will attempt to connect to any device whose name begins with `LinkMatik`. If operating in slave mode, the pair match prefix is ignored; LinkMatik accepts connection from any device, subject to authentication settings.

The ***mating mode*** specifies whether LinkMatik stays paired once first connected. The factory setting is *polygamous* mode, where LinkMatik will allow connection with any device that fulfils the pair match criteria. In *monogamous* mode, once LinkMatik has successfully connected to any device, it will thereafter only connect to that device. To erase monogamous partner information, change the state of the master / slave pin as specified in the *Bluetooth Operation* section.

The ***PIN code*** is an ASCII string of up to 16 characters. This is the code used during bonding if authentication is enabled either on LinkMatik or on the remote device. Note that some devices can only enter the digits 0-9 in PIN codes. The factory setting is four zeroes, which is the *de facto* Bluetooth default value.

The ***Security*** setting defines the level of security with which connections are made. If *authentication* is selected, LinkMatik will only allow connection to a device whose PIN code matches its own. If encryption is enables, the link is encrypted. The factory setting is authentication and encryption.

The ***WFP / Master / Slave*** setting is ignored in the standard LinkMatik product. It is used by some custom versions of LinkMatik for field-programming host controllers.

## *Device Configuration Process*

To configure a LinkMatik module, you will require a PC running Windows ME (with service pack 2), Windows 2000 or Windows XP. It will also need an inbuilt Bluetooth radio or a USB Bluetooth adapter, and you will need to know how to make serial connections from that radio to other Bluetooth devices.

The following steps allow you to configure a LinkMatik module:

1. Connect the module as shown in the schematic diagram below. You will require a 4k7 resistor with a tolerance of 1% and an LED with a 1K current limiting resistor.

2. Apply power. If configured correctly, the LED will flash rapidly (10Hz) after initialization, indicating that LinkMatik is in configuration mode.

3. Download and run the LinkMatik Configuration Tool application on a Windows PC. The application can be downloaded from the Downloads section at *www.FlexiPanel.com*.

4. The factory settings are shown in the screen capture below. Change these settings to the settings you require. If you run the application again later, it will remember the settings you previously selected.

5. Ensure that no applications are connected to the PC's Bluetooth COM port. These might include Windows HyperTerminal, if you have been evaluating LinkMatik, and some ActiveSync programs which try to stay permanently connected.

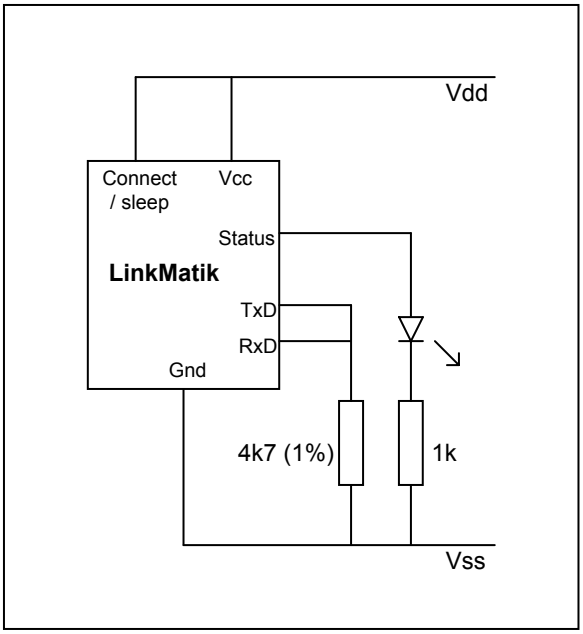
6. Using the Bluetooth device manager on the PC, discover and connect to the LinkMatik module. Authentication is disabled in configuration mode, so LinkMatik will not require a PIN code. However, if your PC requires the use of a PIN code, you must use the code currently programmed into the LinkMatik module.

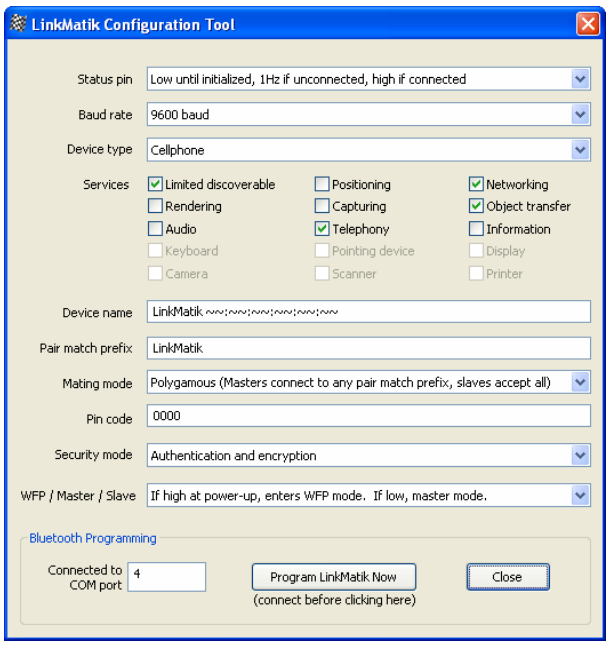
7. Make a note of the COM port that the Bluetooth device manager uses to connect to LinkMatik and enter the COM port value in the box marked 'Connected to COM port'.

8. Press the Program LinkMatik Now button. Successful configuration will take about a second. When complete, the LED will stay lit constantly. If configuration fails for any reason, an error message will be displayed and you should restart from step 1.

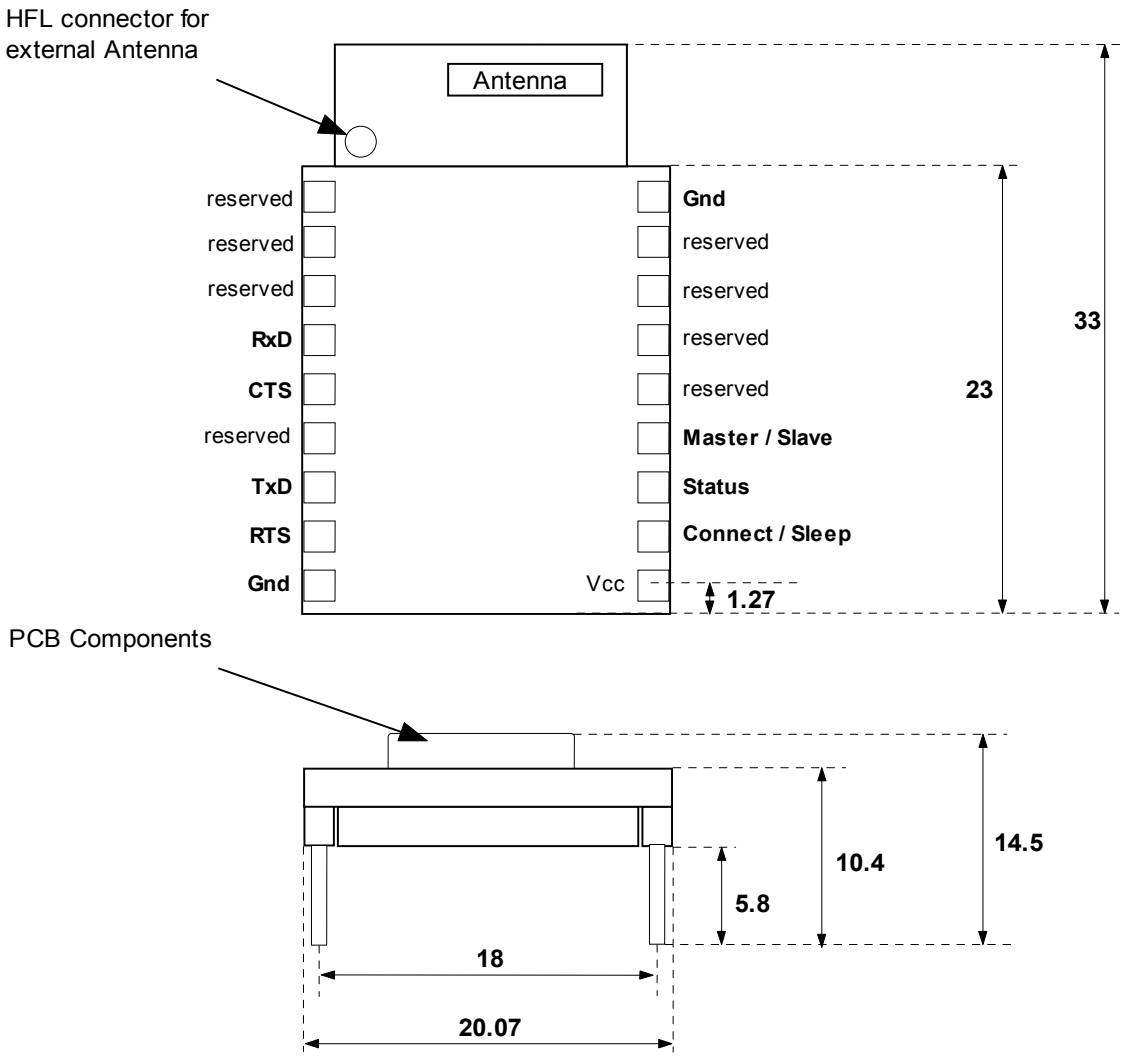
9. Power down, remove the 4k7 resistor and then re-apply power. LinkMatik will now operate in the new configuration. The first time it initializes, it may take a little longer than usual.

Please note that many Bluetooth devices store information about other devices locally, so changes made may not be apparent. In particular, once the name has been changed, the new name may not immediately appear on a device which has previously discovered the device under its old name. The best way to check that reconfiguration has been successful is to scan using a device which has never encountered the LinkMatik before.



## Mechanical Dimensions




Note
1. All dimensions shown are in mm
2. Pin spacing 2.54mm

### *Technical Specifications*

| | |
|---|---|
| Max operating temperature | −20ºC to +75 ºC |
| Max storage temperature | −30ºC to +85 ºC |
| Dimensions L × W × H | 33mm × 20mm × 9mm excluding pins |

### *Electrical*

| | |
|---|---|
| Supply Voltage (regulated) Vcc | 3V to 5.5V (see note 1) |
| Peak power requirement | 270mA |
| Typical current, sleep mode | <10µA est |
| Typical current, unconnected slave mode | 20mA |
| Typical current, unconnected master mode | 120mA |
| Typical current, connected, not communicating | 40mA |
| Typical current, during transmit | 250mA |
| Typical current, during receive | 80mA |
| Max voltage on I/O pins | −0.5V to Vcc+0.5V |

1. LinkMatik will operate down to 3V but Class I performance is only guaranteed if operated above +4.5V.

### *Radio*

| | |
|---|---|
| Max RF output power | Class I = 100mW = +20dBm |
| RF frequency range | 2402MHz to 2480MHz |
| RF channels | 79 |
| Frequency hopping | 1600 Hz |
| Range | 100m nominal |
| Communication latency, serial to serial via two LinkMatik radios | 30ms to 50ms |
| Pairing method | Unit link key |

### *FCC, CE and IC modular approval*

The radio has ‘modular approval’ for USA, Canada and certain European countries, provided the existing integral antenna is used. The CE mark on the module indicates that it does not require further R&TTE certification. The exterior of the product should be marked as follows:

**Contains Transmitter Module FCC ID: CWTUGPZ1**
**Contains Transmitter Module IC: 1788F-UGPZ1**

### *Distributor Contact Details*

LinkMatik is assembled and distributed by agreement by RF Solutions Ltd:

R F Solutions Ltd
Unit 21, Cliffe Industrial Estate,
Lewes, E. Sussex, BN8 6JL, United Kingdom
*email : sales@rfsolutions.co.uk*
*http://www.rfsolutions.co.uk*
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### *Manufacturer Contact Details*

LinkMatik is designed and owned by FlexiPanel Ltd:

*FlexiPanel*

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