

## Firmware Features

- Wireless Data Communications Subsystem
- Embedded Bluetooth Serial Port Profile (SPP)
- Easy to Use AT Command Interface Using UART
- OEM Programmable Configuration
- Remote Command And Control
- Multipoint / Piconet Capable
- 128-Bit Encryption Security
- Custom Firmware Available

## Hardware Features

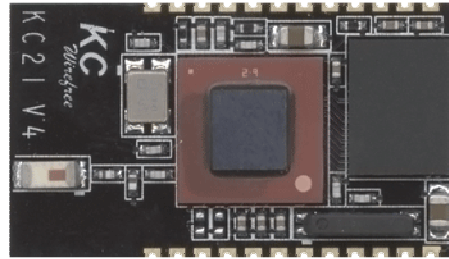
- Bluetooth v1.2
- 2.4 GHz Class 2 Radio
- Range Typically Exceeds 20m
- High Speed 921kbps Data Rate
- 14 Programmable I/O Pins
- Onboard Antenna
- 8Mbit Flash Memory

## Description

One of the most capable and full featured Bluetooth modules available, the KC-21 Bluetooth OEM Module is designed for maximum performance and easy deployment. The KC-21 module includes 14 programmable input/output lines, and offers high speed serial communications up to 921Kbaud.

The KC-21 is a pre-engineered and pre-licensed PCB module that provides fully embedded, ready to use Bluetooth wireless technology. Multi-surface pads provide both bottom pads for high volume reflow soldering and edge pads for low volume hand soldering. The reprogrammable flash memory contains embedded firmware for serial cable replacement deploying the Bluetooth Serial Port Profile (SPP). Other popular Bluetooth profiles are available.

Custom firmware can be pre-loaded into these highly tuned and tested modules so that they are ready to install without additional procedures.



26.9mm x 15.3mm x 2.7mm

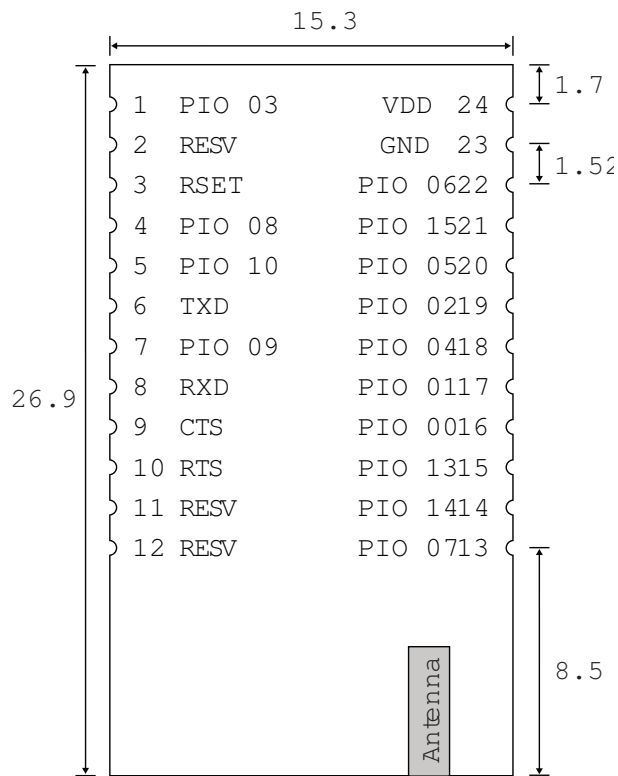
Bluetooth® CE FC RoHS

## Applications

- Data Cable Replacement
- Zero Installation Data Link
- Wireless Data Acquisition Upload/Download
- Remote Sensing
- Machine Data Uploads/Downloads
- Monitoring And Control
- Secure Mobile Financial Transactions
- Mobile Device Communications

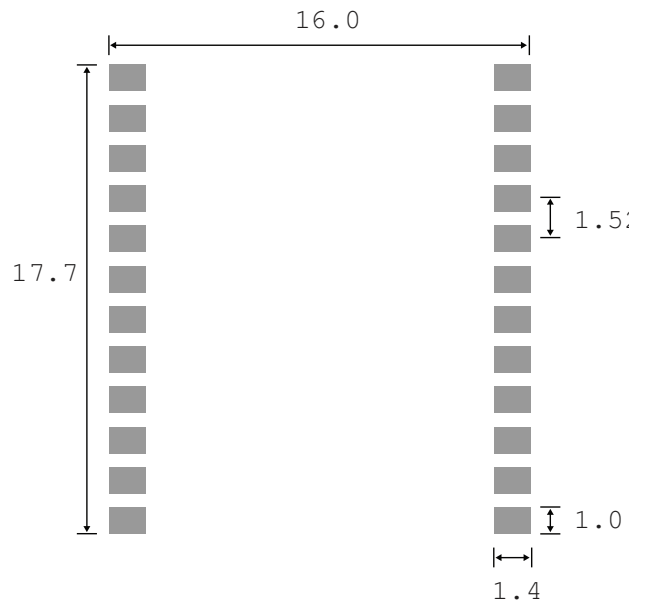
**Physical Dimensions**

KC-21 Top View  
(dimensions in mm)



Max Thickness 2.7

KC-21.4 Landing Pattern  
(dimensions in mm)



**Pin Assignment**

Pin	Function	Type	Description
1	PIO [3]	I/O	Programmable Input/Output
2	RESV	-	Reserved
3	RSET	Input	Hardware Reset - Low for 5 ms
4	PIO [8]	I/O	Programmable Input/Output
5	PIO [10]	I/O	Programmable Input/Output
6	TXD	Output	Transmit data
7	PIO [9]	I/O	Programmable Input/Output
8	RXD	Input	Receive data
9	CTS	Input	Flow Control - Clear to send
10	RTS	Output	Flow Control - Request to send
11	RESV	-	Reserved
12	RESV	-	Reserved
13	PIO [7]	I/O	Programmable Input/Output
14	PIO [14]	I/O	Programmable Input/Output
15	PIO [13]	I/O	Programmable Input/Output
16	PIO [0]	I/O	Programmable Input/Output
17	PIO [1]	I/O	Programmable Input/Output
18	PIO [4]	I/O	Programmable Input/Output
19	PIO [2]	I/O	Programmable Input/Output
20	PIO [5]	I/O	Programmable Input/Output
21	PIO [15]	I/O	Programmable Input/Output
22	PIO [6]	I/O	Programmable Input/Output
23	GND	-	Ground
24	VDD	Input	Voltage Supply

**Electrical Characteristics**

<b>Absolute Maximum Ratings</b>	<b>Min</b>	<b>Max</b>	<b>Unit</b>
Storage temperature range	-40	105	°C
Supply voltage VDD	-0.3	3.6	V
Input voltage for I/O Pin	-	6.0	V

<b>Recommended Operating Conditions</b>	<b>Min</b>	<b>Max</b>	<b>Unit</b>
Temperature Range	-25	85	°C
Supply Voltage VDD (recommend 3.3V)	2.7	3.6	V
Signal Pin Voltage	-	5.5	V

(Conditions VDD= 3.3V and 25 °C)

<b>Programmable I/O Pins Operating Characteristics</b>	<b>Test Conditions</b>	<b>Min</b>	<b>Max</b>	<b>Unit</b>
Input Voltage Low Logic		-	0.8	V
Input Voltage High Logic		2.0	5.5	V
Output Voltage Low Logic	2mA Current	-	0.4	V
Output Voltage High Logic	2mA Current	2.4	-	V
Output Current Low Logic	0.4V	-	2.2	mA
Output Current High Logic	2.4V	-	3.1	mA
Input Leakage Current		-1	1	μA
Low to High Schmitt Trigger Threshold		1.47	1.50	V
High to Low Schmitt Trigger Threshold		0.89	0.95	V
PIO [0-7] Internal Pull-Down Resistor		43	118	KΩ
PIO [8-15] Internal Pull-Up Resistor		53	113	KΩ
Input Capacitance			7.5	pF

**Electrical Characteristics Cont.**

(Conditions VDD= 3.3V and 25 °C)

<b>Current Consumption</b>	<b>Avg</b>	<b>Unit</b>
ACL data 115K Baud UART at max throughput (Master)	35	mA
ACL data 115K Baud UART at max throughput (Slave)	35	mA
Connection, no data traffic (Master)	18	mA
Connection, no data traffic (Slave)	29	mA
Peak current	90	mA

(Conditions VDD= 3.3V and 25 °C)

<b>Selected RF Characteristics</b>	<b>Test Conditions</b>	<b>BT Spec</b>	<b>Typical</b>	<b>Unit</b>
Antenna load			50	Ω
Sensitivity level	BER < .001 with DH5	≤ -70	-85	dBm
Maximum output power	50 Ω load	-6 to 4	1	dBm

## Hardware Design

KC Wirefree modules provide UART and PIO hardware interfaces. This section illustrates a typical implementation. Contact our engineering department for application specific recommendations.

### Application Notes

- RESET pin must be pulled high.
- RXD pin must be pulled high if not connected to a UART/RS-232 device.
- 10 $\mu$ F or larger capacitor filter for VDD input.
- All unused pins should be left not connected.
- Power supply should have less than 10mVrms noise between 0-10MHz.
- Regulator should have a fast response time < 20 $\mu$ s. It is essential that the power rail recover quickly.
- The area around the module should be free of any ground planes, power planes, trace routings, or metal. Minimum clearance is 5mm, but additional clearance allows improved range and throughput.
- Do not clean modules with Alcohol which can interact with no-clean solder flux residue.
- Do not use ultra sonic cleaning, which may cause interconnect damage.

### UART Interface

The UART is compatible with the 16450 industry standard. Four signals are provided with the UART interface: the TXD and RXD pins are used for data, while the CTS and RTS pins are used for flow control. The UART pins operate at TTL voltage level and must be translated to higher RS-232 voltage levels for communicating with PC hosts. A Maxim 3225 series or similar translator is recommend. These terminals can sink 2mA, and are 5V input tolerant with 3V logic level output.

### PIO Interface

All PIOs are capable of sinking and sourcing approximately 2mA of current. These terminals are 5V input tolerant, with 3V logic level output. PIO [0-7] are internally pulled down with 50K $\Omega$  nominal resistors, and PIO [8-15] are internally pulled up with 50K $\Omega$  nominal resistors when configured as inputs.

### Hosts

The KC-21 module can be connected to PC or MCU hosts using the UART interface. Our firmware provides an easy to use AT style command interface using simple text commands and parameters.

**Example Hardware Interface Connections**

Illustration of a KC-21 module to PC connection.

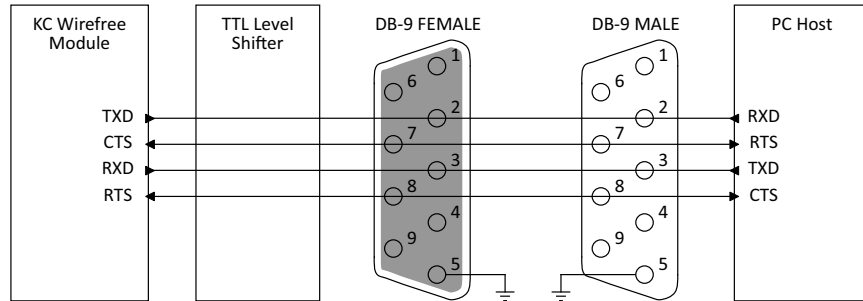
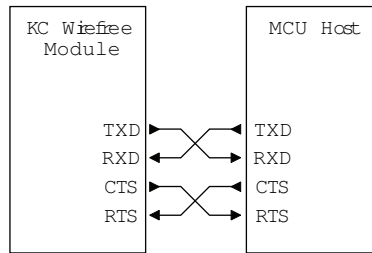
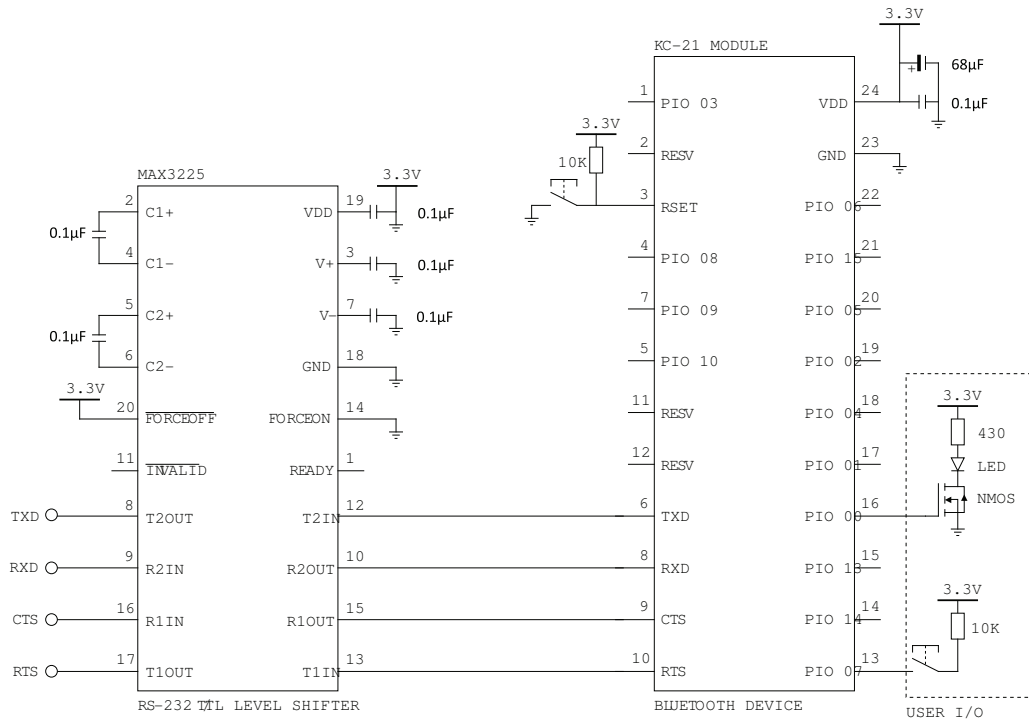


Illustration of a KC-21 module to MCU connection.



KC-21 sample circuit with TTL voltage level shifter ready to connect to a PC RS-232.



## Firmware Interface

Our kcSerial firmware provides an easy to use AT command interface using the UART. The firmware interface allows persistent storage of configuration parameters such as device name, default baud rate, and security PIN. Additionally kcSerial provides operational commands such as connections, security, read/write commands for I/O pins, and our remote command mode offering this same programming interface on the linked remote device as well.

Please refer to our *kcSerial User Guide* for additional information.

### kcSerial v2.2 AT Command List

#### Operation Commands

AT+KC Bond  
 AT+KC Bypass  
 AT+KC DisableBond  
 AT+KC Discovery  
 AT+KC DUNConnect  
 AT+KC DUNDisconnect  
 AT+KC EnableBond  
 AT+KC ExitPark  
 AT+KC ExitSniff  
 AT+KC GPIORead  
 AT+KC GPIOWrite  
 AT+KC Hold  
 AT+KC Park  
 AT+KC RemoteCommand  
 AT+KC RemoteCmdDisconnect  
 AT+KC Reset  
 AT+KC Sniff  
 AT+KC SPPConnect  
 AT+KC SPPDisconnect

#### Configuration Commands

AT+KC ChangeBaud  
 AT+KC ChangeDefaultBaud  
 AT+KC DefaultLocalName  
 AT+KC DeleteSmartCable  
 AT+KC EraseBondTable  
 AT+KC GPIOConfig  
 AT+KC HostEvent  
 AT+KC LocalName  
 AT+KC Security  
 AT+KC SmartCableSetup  
 AT+KC StreamingSerial  
 AT+KC UpdateInquiryScan  
 AT+KC UpdatePageScan  
 AT+KC Version



## Pre Qualifications

### Bluetooth

This firmware and hardware module platform is registered with and licensed by Bluetooth SIG as both a modular component and final product.

Qualification Design ID: B010876

Bluetooth Version 1.2

Qualified Profiles: DUN, GAP, HCI, L2CAP, RFCOMM, SDP, SPP

Further Bluetooth licensing is not required, but usage of Bluetooth registered trademarks must be licensed directly from Bluetooth SIG.

### CE

The KC-21 complies with the following EMC Directives:

EN 300.328 V1.6.1 (2004-11)

### FCC

The KC-21 meets the conducted and radiated emission requirements of the FCC "Code of Federal Regulations" Title 47, Part 15, Subpart C, Section 15.247 for Bluetooth spread spectrum transmitters.

Original Equipment Manufacturers may incorporate the KC-21 into products under this FCC ID transmitter license, which must be visible on the final product.

FCC ID: S22-BTMODULE-CL2

### Industry Canada (IC)

IC ID: 8193A-BTMODULECL2

IC Warning Statement: The device's user manual does not contain the following or equivalent statement as per RSS-GEN section 7.1.5: Operation of this device is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

## Firmware Loading Guide

Firmware can be updated anytime over the UART interface. Firmware files are contained in their own folder, and include the following files:

```
KCLoader.exe
PreV3FlashManager_115200
TC_ExecFlashCode
UartFlashManager
```

### Preparation

Firmware is loaded using the UART interface at 115K baud. Required connections are RXD, TXD, RTS, and CTS. KC Wirefree modules require voltage level shifting from 3.3V to 5V logic for standard RS-232 computer connections. Our serial adapters and development boards already have level shifters onboard.

### Load Firmware

Simply run the KCLoader.exe program. A DOS Command window will open, and request the COM port where the KC Bluetooth device has been connected. Next, the program will require a KC Bluetooth device RESET to begin the firmware load. Either the RESET pin on the device can be grounded for 5ms, or the power supply can be turned OFF, then ON. The new firmware will load in less than 1 minute, and automatically close when finished.

### Troubleshooting

Any checksum errors, hardware connection problems, or other errors will halt the firmware loading procedure in the first few seconds. These errors can cause acknowledgement of hardware reset to fail, or cause the firmware loading procedure to fail after UartFlashManager startup. Errors are typically caused by noisy or poor physical UART connections to the KC Bluetooth device. Ensure the module is clean (do not use Alcohol to clean), and verify that heat, static, high voltage, or bending has not physically damaged the device.

```
*****
KC Wirefree Firmware Loader
Build May 7 2008
*****

Enter Device COM Port: 10
Opening COM Port 10 ..OK
Please reset the board..OK
waiting for response..OK
Request 115200 baud rate..OK
Using 115200 baud.
Loading UartFlashManager..Starting..OK

Updating Firmware
Save Database.

Erasing firmware area.

Loading firmware...
..49384 bytes programmed...
..82384 bytes programmed...
..115384 bytes programmed...
..148384 bytes programmed...
..181384 bytes programmed...
..214384 bytes programmed...
..247384 bytes programmed...
..
```

**Datasheet Version**

February 19, 2009

**Ordering Information**

Product Series	KC-21
Product Version	4.2
Country of Manufacture	USA
<b>Order Part Number</b>	<b>Description</b>
KC-21.4	Bluetooth OEM Module, kcSerial
KC-21.4-FW	Bluetooth OEM Module, Custom kcSerial

**Contact Information**

KC Wirefree 2640 W Medtronic Way Tempe, Arizona 85281	Office
(602) 386-2640	Phone
(602) 386-2642	Fax
www.kcwirefree.com	Website
info@kcwirefree.com	Sales Support
tech@kcwirefree.com	Technical Support