

Installing a Kantronics KPC-3 Plus WL2K Airmail Station

The purpose of this document is to assist all amateur radio operators out in the field that wish to participate with ARES/RACES. Many amateur radio operators have expressed an interest in helping out their local ARES/RACES Group, but don't know how to setup a WL2K Airmail Station.

To all those who want to help us, here's a step-by-step guide to help you setup a portable or home Airmail Station that will work with the WL2K Network.

This guide will also give you just about all you will need to setup a WL2K RMS Packet Station although the main purpose of this document is to setup an Airmail Station. All the setup information to get your TNC working with your VHF radio is the same, but instead of Airmail you will need to setup RMS Packet Software.

It is my hope that this document will prove to be a valuable guide to the ARES/RACES Operator. If you wish to add or correct content in this document, please email WA3WSJ at wa3wsj@arrl.net

Thanks for reading this document and good luck on installing your WL2K Airmail or RMS Packet Station.

Edward R. Breneiser, WA3WSJ
Berks County ARES/RACRES AEC

CONTENTS

Page 3.....	Materials needed
Page 4.....	Kantronics KPC-3+ Specifications
Page 5.....	Kantronics KPC-3 Power Options
Page 6.....	Getting the KPC-3 TNC to Communicate with the Computer
Page 7.....	Trouble-Shooting KPC-3 to Computer Communications
Page 8.....	Connecting Your KPC-3 Plus to Your VHF Transceiver
Page 9.....	KPC-3 Plus Rear Panel Pinouts & Jumpers
Page 10.....	Yaesu Transceiver Data Port Pinouts
Page 11.....	Icom Transceiver Data Port Pinouts
Page 12-13..	Kenwood Transceiver Data Port Pinouts
Page 14.....	Tranceivers with No External TNC Connector
Page 15.....	KPC-3 Transmit Audio Adjustment – No External Radio Data Port
Page 16.....	KPC-3 Transmit Audio Adjustment – External Radio Data Port
Page 17.....	Airmail Software Setup

Installing a Kantronics KPC-3 Plus TNC with WL2K Airmail Station

Well, you bought a Kantronics KPC-3 Plus TNC and now want to put it on the air with your WL2K Airmail Station. What do you do now? Help is here as the following article will take you through all the steps necessary to get that KPC-3 Plus TNC working with your station.

Here's what you should have to test that TNC:

1. KPC-3 Plus or KPC-3 ver 5.2 or later TNC
2. TNC power cable
3. serial AT modem cable (figure-1)
4. computer with Windows 95 or later for Airmail- Win2000 or later for RMS Packet
5. Recommend installing [Microsoft .Net Framework 2.0](http://www.microsoft.com/windows/win2k/netframework/) on your Win2000 or later O.S.
6. Microsoft .Net 2.0 is required for RMS Packet Installation

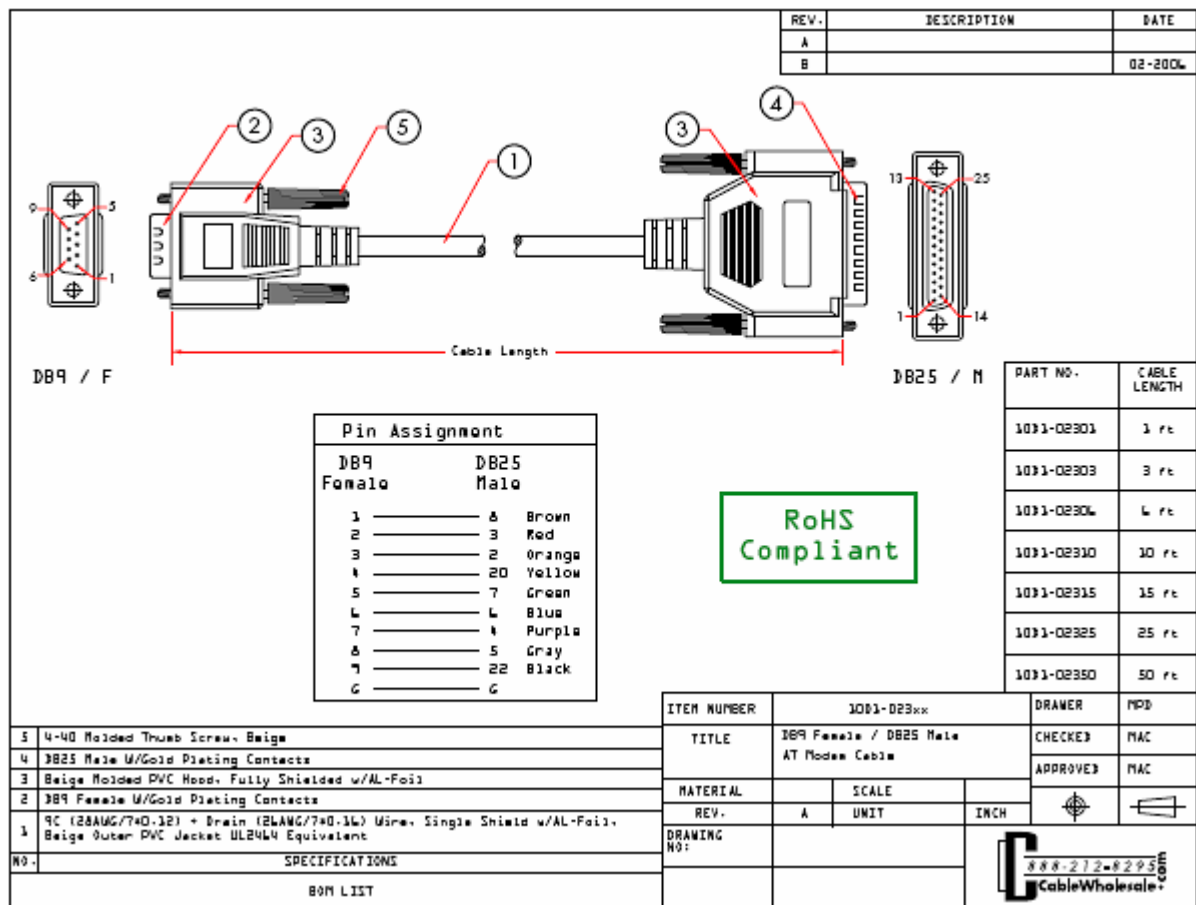


Figure-1

The cable listed here is used on my Yaesu FT-2600M (DB-9) to computer serial port (DB-25). Please visit <http://www.cablewholesale.com/buy/at-modem-cables.htm> to pick the AT-Modem Cable that you need for your system.

Please note that if your computer doesn't have a serial port, that's ok but you will have to purchase a USB-Serial Adapter. We recommend the [DYNEX Model # DX-UBDB9](http://www.dynex.com/) as it works fine when other brands have trouble.

Kantronics KPC-3+ Specifications

Dimensions (H×W×D)	0.8"×5.2"×5.2" (21 mm × 133 mm × 133 mm) without projections
Weight	11 oz (0.32 kg)
Power Requirements	
Voltage	DC 6 V to 25 V
Current	< 30 mA (LEDs on, unit active) < 15 mA (LEDs off, unit inactive)
External Power Connector	2.1 mm coaxial, center pin positive
Internal Power Connector	Circuit board accommodates user-installed 9 V battery connector
External Signal Ports	DB-9 female (radio port) DB-25 female (computer/data terminal)
Watchdog Timer Period	approx. 2.5 minutes
External Carrier Detect	Pulldown to ground
Analog Measurement Inputs (A/D Converter)	Two inputs; 0 V to +5 V, 8-bit accuracy
Data Rate (radio port)	1200 bps (default); 300, 400, 600
PTT Output	Open drain, max +50 V dc, max 200 mA
Audio Output Level	Continuously adjustable from 1 mV p-p to 4 V p-p
Audio Output Impedance	600 Ohm, AC coupled
Modulation	1200 bps FSK full duplex CCITT V.23
Audio Input:	1300 Hz/2100 Hz
Sensitivity	5 mV p-p
Dynamic Range	70 dB
Input Impedance	Unbalanced, 10 kOhm (600 Ohm with jumper J 3 installed)
Max Audio Input Voltage	±12 V dc; 35 V p-p sinusoidal
Operating Modes	Packet, WEFAX, KISS, XKISS, HOST, GPS, MODEM (RX only)
LED Indicators	Power, Xmit, Rcv, Connected, Status, Mail (user option on/off)
Remote Control Access	All controller functions, user-defined password
External Reset	Pulldown to ground
Operating Protocols	AX.25 Levels 1 and 2 (user-selectable)
Compliance	FCC Class B; Europe - CE Conformity

KPC-3 Plus TNC Power

External Power for the KPC-3 or KPC-3 + TNC

1. Use a 2.1mm power plug and at least 18-22 gauge stranded 2-conductor cable to wire it up. The center of the jack is connected to the positive side and the shell to the negative side of the power supply.
2. Turn off the power switch on the TNC then plug in the power cable with 12vdc
3. Press the power switch on the front panel of the TNC to ON
4. The power LED should come on then turn the TNC power to off.

Internal Battery Power for KPC-3 Plus Option

1. Purchase a battery clip from Radio Shack # 270-324. Then solder the clip leads to the PCB in the TNC. The pads are labeled BATT + -.
2. Install battery clip pigtail
3. Then set jumpers J1 to OFF and J2 to ON. This will power the TNC from the battery and cut off battery when external power is supplied to TNC.
4. Battery Backup Mode Power i.e. battery supplies power in event of commercial power failure. Set J1 ON and J2 OFF
5. Connect and install battery in clip

KPC-3 TNC Power through Serial Cable Option

1. Install the AT modem serial cable to your computer serial port. Note- DO NOT connect to the computer parallel port
2. Connect the other end of the serial cable to the TNC DB25 connector.
3. Make sure the TNC does not have the DB-25 pin # 13 wired to power the TNC. TNC ships from factory without pin # 13 power option. Used TNCs make sure that the pin # 13 power option **IS NOT** configured in the TNC:

Jumper J6: center pin to Pin #2

Jumper J7: center pin to pin #1

The above jumper configuration is only used to power the TNC through a serial cable. This option is not normally used to power the TNC.

Getting the KPC-3 TNC to Communicate with the Computer

Setup of Windows HyperTerminal Program

1. Turn power off to the TNC
2. Connect the serial cable to the TNC and to a serial port on your computer
3. Use Windows HyperTerminal Program to communicate with TNC
 - a. Click Start All, Programs, Accessories, Communications
 - b. Click on HyperTerminal
 - c. "Connect To" window will now open- select "Connect using and select Com1 then OK
 - d. "Com 1 Properties" window now appears- select 9600bits/s, 8 data bits, no parity, 1 stop bit and hardware flow control – click OK
4. The main screen should now appear – click "Files", " Properties" , "Settings"
5. Then select "terminal keys" and "CTRL+ H"
6. Use drop-down menu under "Emulation" and select "TTY"
7. "Terminal Setup" and select "Use destructive backspace."
8. "ASCII Setup" delays =0 and "wrap lines" checked
9. Click OK
10. Main HyperTerminal Screen check file then save.
11. This saves the file "KPC-3 Plus 9600.ht" with all the settings – I create a shortcut to my desktop for easy start of this program.

KPC-3 TNC to Computer testing

AUTOBAUD

The first time power is applied to the TNC and it is connected to a valid serial port on a computer it will run AUTOBAUD Routine. Try the following to make it work:

1. AUTOBAUD sends and resends the message " Press (*) TO SET BAUD" at one baud after another. When the TNC baud matches baud of the terminal program, you will read the above message on your screen. If not, the text will be garbled, if it appears at all.
2. When you can read the message hit the SHIFT + 8 key combination or (*). This sets the baud rate.
3. AUTOBAUD then will send a "sign-on" message and ask the CALLSIGN – input your Callsign.
4. You may now input commands – try MYCALL etc.
5. You now have 99% of the work finished as you have the computer and TNC communicating between each.
6. Exit HyperTerminal and turn off TNC for now.

KPC-3 to Computer Communications Trouble-Shooting

If you have trouble with communications between the TNC and the computer, here's a few things to look at:

1. Problem: Go to terminal Screen, but Nothing Happens

- a. Current COM Port has a mouse or other device on it, but no TNC. Try going to the terminal and move your mouse around, if you see characters as you move the mouse, the mouse is on that COM port. If so, change the Com Port Setting in HyperTerminal to another COM port and try again.
- b. KPC-3 already programmed with another baud rate than the baud set in HyperTerminal. Try changing the baud rate in the terminal program or use the self-test Jumper J11 to erase current settings forcing the TNC to try Autobaud routine.

2. Problem: Getting Bad or Intermittent Data

- a. COM port conflicts between devices on common. If your TNC is on COM 1, turn off any device on COM 3. If TNC on COM 2, turn off any device on COM 4. Then check operation using HyperTerminal.

3. Problem: TNC Stops Behaving Normally

- a. Garbled data or non-response may indicate that the TNC is in the wrong mode. The TNC has switched from HOST MODE to KISS MODE. Place TNC back in HOST MODE by performing:

Leave KISS Mode Sequence: CO FF CO

Press and hold ALT Key. Type the numbers 192 from numeric *keypad*, not keyboard - release ALT key.

Press and hold the ALT Key. Type 255 from numeric *keypad*, not keyboard - release ALT key.

Press and hold ALT key. Type 192 from numeric *keypad*,

Hard Reset – Turn off power and Locate Jumper J7 for a KPC-3 or Jumper J11 for a KPC3+, place jumper on both pins. Apply power to TNC Turn power off (if terminal baud at 1200 you'll see message) if not reset ok, but you'll not see message. Return J7 or J11 to one pin Turn TNC power back on and wait for Autobaud message

Connecting Your KPC-3 Plus to Your VHF Transceiver

Now that you have your TNC talking with your computer it's time to connect your VHF radio to the TNC and have them both work together. Please note that this hardware setup will work for an Airmail Station or a RMS Packet Station. The only difference is the software used to connect to the [WL2K network](#).

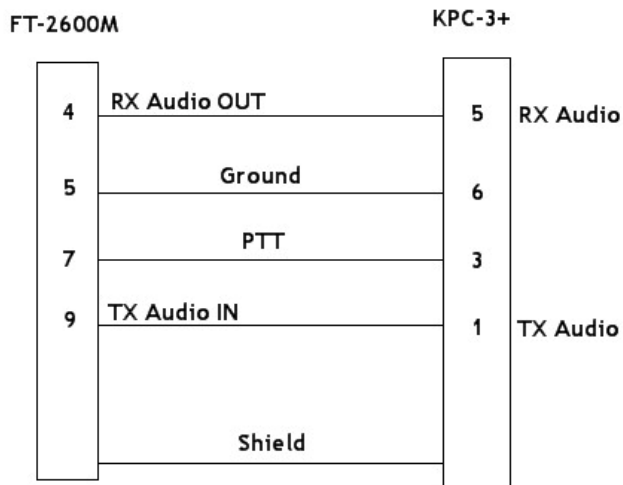
Parts for TNC to Radio Cable

- 1ea. * 9-Pin D-Sub Male Connector Radio Shack # 276-1537
- 1ea. * Shielded Metalized Hood Radio Shack # 276-1513
- 1ea. 3-foot 5-conductor shielded cable
- 1ea. user-supplied mic connector
- 1ea. used-supplied speaker connector

Note* If your transceiver has an external DB-9 TNC connector, use 2ea of this part. If possible, It is highly recommended to use a transceiver that has an external data connector.

Below is a diagram on connecting a Yaesu FT-2600M Radio to a KPC-3 Plus TNC

FT2600M Radio to Kantronics KPC-3+ TNC WL2K Cable



Notes:

1. Cable must be a minimum of four conductor with shield.
2. Use metal or metalized D-Sub Hoods with DB-9 connectors.
3. Wire hood to shield at both ends.

Parts:

- 2ea. Male D-Sub 9-Pin Radio Shack # 276-1537
- 2ea. D-Sub Metalized Hood Radio Shack # 276-1513

KPC-3 Plus Rear Panel Pinouts & Jumpers



Radio Port (DB-9) Pin-out:

Pin no.	Signal name	Function	Related Jumpers
1	TXA	Transmit audio (AFSK out)	J9
2	XCD	External carrier detect (transmit inhibit) input or (via software command w/ 8.2 or higher firmware version) alternate GPS Input port	Software Command
3	PTT	Push-to-talk (to radio PTT/transmitter enable input)	
4	CTRLB/AND	Control line B (or AND input)	J8
5	RXA	Receive audio (AKSK in)	J3, J4
6	GND	Ground	
7	EXT-IN	External input for Power/Reset	J6, J7
8	CTRLA /AN1	Control line A (or AN1 input)	J10
9	GND / RESET	Ground or Reset input (jumper selectable – J5)	J5

To find corresponding pin-outs for many radios, visit www.packetradio.com.

Port-Related Jumpers

J3: Input Impedance Select	<div style="display: flex; justify-content: space-between; width: 40px;"> 1 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 2 </div>	RXA input impedance 10 kΩ. (default) RXA input impedance 600 Ω.
J4: Radio Port Pin 9 Function Select	<div style="display: flex; justify-content: space-between; width: 40px;"> 1 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 2 </div>	Input Equalization on. Input Equalization off. (default)
J5: Radio Port Pin 9 Function Select	<div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div>	Radio Port pin 9 is ground. (default) Radio Port pin 9 is external reset input.
J6: EXT-IN Reset / Input Select	<div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div>	EXT-IN is external reset input. EXT-IN is external power input. EXT-IN not connected. (default)
J7: EXT-IN Port Select	<div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div>	EXT-IN connects via Computer Port pin 13. EXT-IN connects via Radio Port pin 7. (default)
J8: Analog Input AND (channel 0) port select	<div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div>	Radio port pin 4 Computer port pin 18
J9: (NOR/HT) Configures the AFSK output line	<div style="display: flex; justify-content: space-between; width: 40px;"> NOR CTR HT </div> <div style="display: flex; justify-content: space-between; width: 40px;"> NOR CTR HT </div>	Normal, for base station use. (default) AFSK output line also serves as PTT (for HT radios)
J10: Analog Input AN1 (channel 1) port select	<div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div> <div style="display: flex; justify-content: space-between; width: 40px;"> 1 CTR 2 </div>	Radio port pin 8 Computer port pin 11

Data Connectors on YAESU VHF/UHF Tranceivers

Pin	Label	Note	CT-39A Wire Color
1	PKD (DATA IN)	Packet Data Input <i>Impedance: 10 kΩ, Maximum Input Level: 40 mV p-p for 1200 bps 2.0 Vp-p for 9600 bps</i>	Brown
2	GND	Signal Ground	Red
3	PTT	Ground to Transmit	Orange
4	RX9600	9600 bps Packet Data Output <i>Impedance: 10 kΩ, Maximum Output: 500 mV p-p</i>	Yellow
5	RX1200	1200 bps Packet Data Output <i>Impedance: 10 kΩ, Maximum Output: 300 mV p-p</i>	Green
6	PKS (SQL)	Squelch Control <i>Squelch Open: +5 V, Squelch Close: 0 V</i>	Blue

10

FT-7800R OPERATING MANUAL

DATA Jack Pin Out

Pin	Label	Note	CT-39A Wire Color
1	PKD (DATA IN)	Packet Data Input <i>Impedance: 10 kΩ, Maximum Input Level: 40 mV p-p for 1200 bps 2.0 Vp-p for 9600 bps</i>	Brown
2	GND	Signal Ground	Red
3	PTT	Ground to Transmit	Orange
4	RX9600	9600 bps Packet Data Output <i>Impedance: 10 kΩ, Maximum Output: 500 mV p-p</i>	Yellow
5	RX1200	1200 bps Packet Data Output <i>Impedance: 10 kΩ, Maximum Output: 300 mV p-p</i>	Green
6	PKS (SQL)	Squelch Control <i>Squelch Open: +5 V, Squelch Close: 0 V</i>	Blue

10

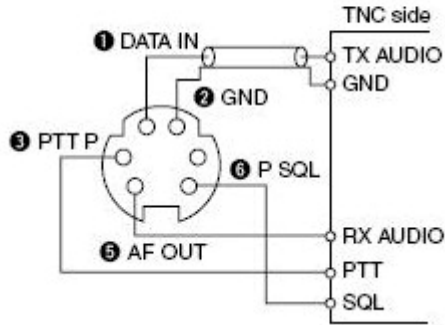
FT-8800R Operating Manual

Data Connectors on Icom VHF/UHF Tranceivers

Icom 208H, 2820H, Tranceivers

◇ 1200 bps packet operation

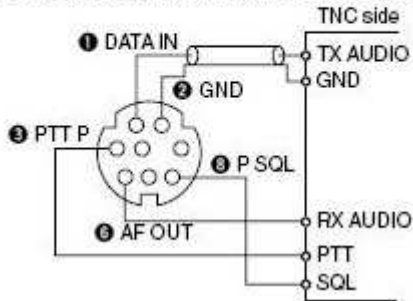
① Connect the transceiver and a TNC as illustrated below.



Icom 800H Transceiver

◇ 1200 bps packet operation

① Connect the transceiver and a TNC as illustrated below.



Data Connectors on Kenwood VHF/UHF Transceivers

Kenwood TM-V7A Transceiver

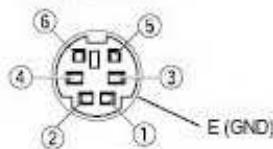
Notes:

- ◆ If the TX delay of your TNC is not long enough, connection errors may occur. If connection errors frequently occur, it is recommended to set the TX delay parameter on the TNC to 300 ms by using your computer.
- ◆ Using a modulator input level that is far different from the optimum 40 mV_{rms} or 2 V_{rms} specifications may result in deterioration of the S/N ratio or signal distortion. This could result in increased errors or a complete failure to connect with other stations.
- ◆ If the modulator input level exceeds approximately 3 V_{rms}, the limiter circuit functions to maintain the same transmit bandwidth as that of 3 V_{rms}.
- ◆ Packet operation, easily affected by transmit and receive conditions, requires a full-scale S-meter reading for reliable communication. When the S-meter reads less than maximum during 9600 bps operation, communication errors are frequent.
- ◆ Inputting 9600 bps GMSK signals at too high a level or inputting significantly distorted signals into the transceiver can cause errors and a wide transmit bandwidth that may interfere with other stations.

DATA Connector Pin Functions

This section describes each pin of the DATA connector equipped on this transceiver.

DATA connector



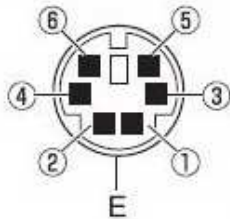
Pin No.	Pin Name	Function
1	PKD	Packet data input. • TX data from TNC to transceiver
2	DE	Ground for PKD
3	PKS	Packet standby • TNC can use this pin to inhibit the transceiver microphone input while transmitting packet signals.
4	PR9	Output of detected 9600 bps data (500 mV _{rms} , 10 kΩ) • Also functions as a common pin for 1200 bps and 9600 bps data output.
5	PR1	Output of detected 1200 bps data (500 mV _{rms} , 10 kΩ)
6	SQC	Squelch control output. • Inhibits TNC data transmitting while transceiver squelch is open. • Prevents interference to voice communications on the same frequency. Also prevents retries. • Output Level Open squelch: +5 V (High) Closed squelch: 0 V (Low)

Note:

- ◆ If your TNC has a common pin for 1200 bps and 9600 bps data input, connect this pin to the DATA connector PR9 pin. Shorting the PR9 and PR1 pins will cause the TNC to malfunction.
- ◆ When DC voltage is input to the PR1 pin, the TNC may not function. If this problem happens, add a 10 μF capacitor between the PR1 pin and the TNC. Be careful about the polarity of the capacitor.

Kenwood TM-V71A Transceiver

Data terminal pins:



No.	Name	I/O	Function
①	PKD	Input	Audio signal for packet transmission
②	DE	—	PKD terminal ground
③	PKS	Input	'L' is transmitted and the microphone is muted
④	PR9	Output	9600 (bps) repeat signal
⑤	PR1	Output	1200 (bps) repeat signal
⑥	SQC	Output	Squelch control signal; Closed: 'H', Open: 'L' (The default settings can be changed in Menu 520)
	E	—	Common ground

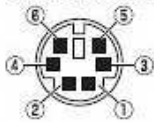
Kenwood TM-D710A Transceiver

PACKET OPERATION

Connect this transceiver to your personal computer via a Terminal Node Controller (TNC). You can send messages or commands to far away stations, obtain a variety of information via your local bulletin boards, or enjoy other Packet applications. Reference material for starting Packet operation should be available at any store that handles Amateur Radio equipment.

Note: When the distance between the radio antenna and your personal computer is too close, interference may occur.

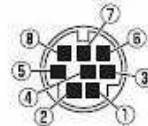
DATA terminal pins



- When using the built-in TNC, the DATA terminal is not used.

No.	Name	I/O	Function
①	PKD	I	Audio signal for packet transmission
②	DE	—	PKD terminal ground
③	PKS	I	'L' is transmitted and the microphone is muted
④	PR9	O	Detected 9600 (bps) data
⑤	PR1	O	Detected 1200 (bps) data
⑥	SQC	O	Squelch control signal; Closed: 'L', Open: 'H' (The default settings can be changed in Menu 520)

PC/ COM terminal pins



- The PC terminal is on the rear of the TX/RX unit and the COM terminal is on the rear of the Operation panel. Connect these terminals to a personal computer.

No.	Name	I/O	Function
①	RTS	O	Request to Send
②	CTS	I	Clear to Send
③	TXD	O	Transmit Data
④	GND	—	Ground
⑤	RXD	I	Receive Data
⑥	NC	—	Non Connect
⑦	NC	—	Non Connect
⑧	NC	—	Non Connect

*If you can not find your radio here, please go to your radio manufacturer website and download the manual. A few good examples on how to wire the cable that connects the radio to the TNC are here under Icom transceivers on page eleven of this document.

Tranceivers with No External TNC Connector

If your radio does not have an external data port or connector, you will have to wire the cable to the radio microphone and speaker connectors. The following will explain this procedure in generic terms as there are many radios in use without an external data port.

KPC-3+ DB-9 Connector

Pin 1 (TX Audio)
Pin 3 (PTT)

Pin 5 (RX Audio)
Pin 6 (Ground)

Transceiver

Radio mic input pin
Mic PTT

Speaker Audio
Speaker Ground

Connecting Tranceiver Cale Assembly

1. Turn off all power to radio and TNC
2. Plug in the TNC DB-9 connector to the TNC
3. Plug the mic and external speaker jacks into your radio

Receive Audio Adjustment

1. Turn on computer with radio off
2. Start terminal program
3. Turn on KPC-3+
4. If not done, set ABAUD and CALLSIGN
5. Turn on radio and open squelch
6. slowly turn up radio volume until TNC **RCV LED** turns on
7. Turn up just above this setting
8. Increase squelch control until **RCV LED** turns off

Tranmit Audio Adjustment

KPC-3 Plus

1. 1200 Baud drive level (TXA) from the KPC-3 Plus to the radio is adjusted using the keyboard and the tranmit level (**XMITLVL**) or the calibrate (**CAL**) commands.
2. Adjust the drive level to provide 3 to 3.5 khz of deviation from the radio. The packet transmissions should have a similar level as voice.

XMITLVL

The XMITLVL command default value is 100 or about 50mv. **This worked for me straight out of the box.** Counts below 256, the voltage is increased in .5mv steps. Above a level of 256 the step is 15mv per step.

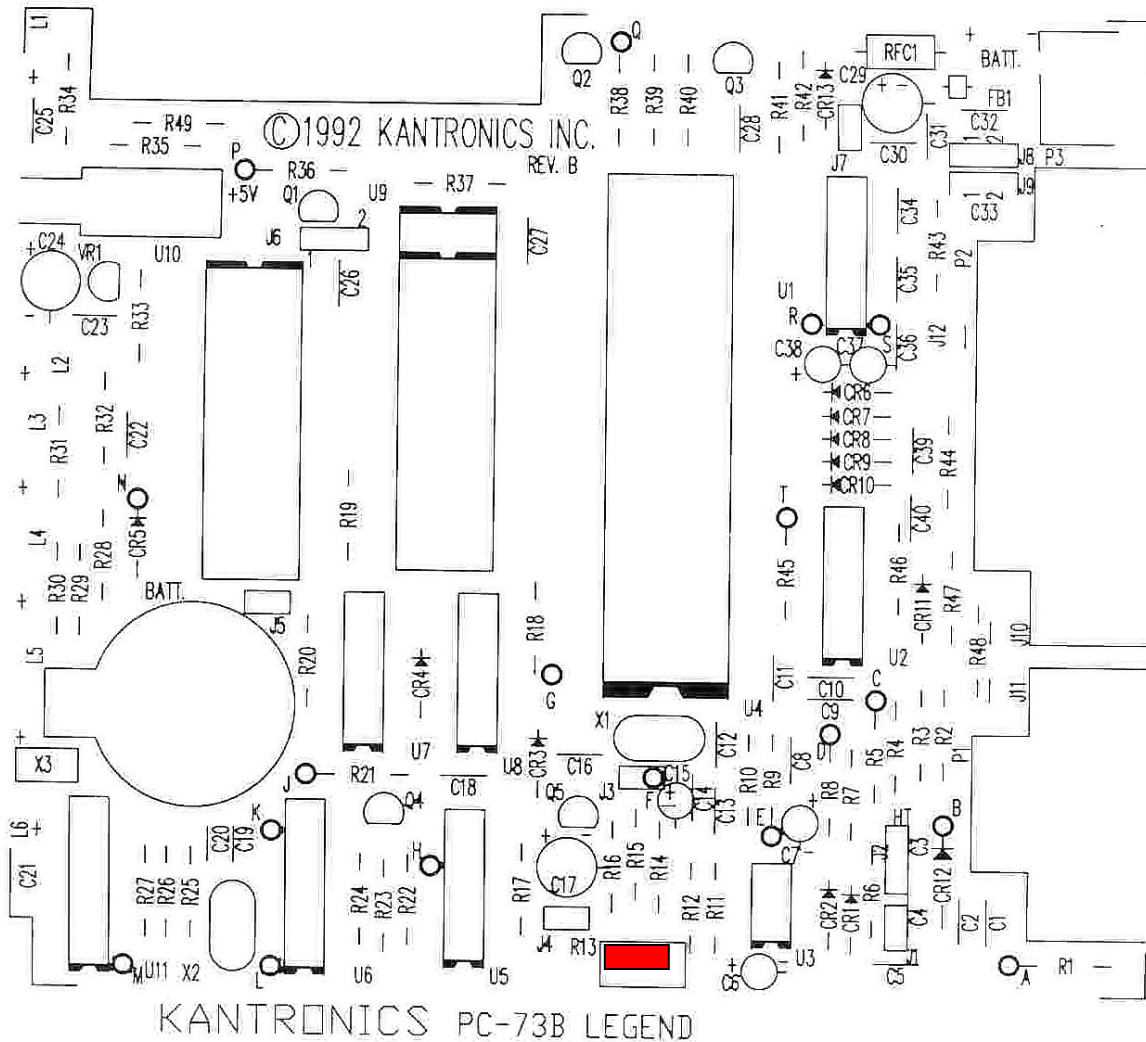
CAL

Hold down the + or - to increase or decrease the deviation level.

KPC-3

Transmit Audio Adjustment

1. Jumper # 3 determines what range of audio output the TNC will have available to transmit. When configured on only one pin: 2mv p/p to 60mv p/p. When configured on both pins: 140mv p/p to 4v p/p. All ranges adjustable with R13 inside TNC.
2. Adjust the drive level to provide 3 to 3.5 khz of deviation from the radio. The packet transmissions should have a similar level as voice.



KPC-3 Parts Layout

Transceivers with External TNC Connector

If your transceiver has an external TNC port, you'll love how easy it is to operate it with WL2K.

Connecting Transceiver Cable Assembly

1. Turn off all power to radio and TNC
2. Plug in the DB-9 or TNC connector to the TNC
3. Plug the DB-9 connector or your radio data connector into your radio data port

Receive Audio Adjustment

4. Usually the default audio level out of the radio data port will work, if not, adjust audio level out of your radio data port .

Transmit Audio Adjustment

KPC-3 Plus

4. Refer to [Airmail: Getting Started](#) – start Airmail Program on computer – Airmail should be setup and working on your computer.
6. 1200 Baud drive level (TXA) from the KPC-3 Plus to the radio is adjusted using the keyboard and the transmit level (**XMITLVL**) or the calibrate (**CAL**) commands.
7. Adjust the drive level to provide 3 to 3.5 khz of deviation from the radio. The packet transmissions should have a similar level as voice.

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CAL

Hold down the + or – to increase or decrease the deviation level.

Airmail Software Setup

Please refer to the [Airmail: Getting Started Document](#) located on the [Berks County ARES/RACES Website](#). This document has been updated in 2009 and includes most of the new WL2K Network updates.