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DCD State Assembly Manual

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INTRODUCTION

The TAPR DCD State Machine Upgrade is a kit designed to bring the owners of various manufacturers' TNCs which are not based on phase-lock-loop techniques the same positive, accurate DCD information that properly-designed PLL units possess.

Reliable DCD information is a necessity for proper multiple user access on today's crowded packet channels. See the paper "Can We Continue to Ignore Level One?" by N7CL in the **Proceedings of the 7th ARRL Computer Networking Conference** for details (ARRL, 225 Main Street, Newington CT 06111). Another good reference, also by N7CL, is "DPLL Derived Data Carrier Detect (DCD) for Filter Based and Single-Chip Modems" in the November, 1988 issue of Packet Status Register, available from TAPR.

Construction and check-out of the DCD Upgrade will probably take you only an evening or two.

Warm up your soldering iron, take your time, and enjoy!

Note: Find and read your TNC installation before continuing, to decide on specific installations before building the kit.

PARTS LIST

Sort the parts into egg cartons, muffin tins, or other containers as you inventory them. This will aid you in building.

Check off the part in the () space provided as you locate and verify it against this list.

NOTE: Shaded Parts are contained in the clock option only. These parts should be ignored if building without the clock option. The clock option is used mainly for the Kantronics KPC1, KPC2 and the HF port of the KAM.

Resistors, 1/4 watt, 5%

- () 2 10k ohm (brown-black-orange-gold)
- () 1 100k ohm (brown-black-yellow-gold)
- () 1 220k ohm (red-red-yellow-gold)
- () 1 470k ohm (yellow-violet-yellow-gold)
- () 1 10 Megohm (brown-black-blue-gold)

Capacitors

Capacitors may be marked in various ways. The typical markings are given but may vary. Find all that match the typical markings given and the remaining ones, if any, should become apparent by elimination.

Mylar or Monolithic

- () 4 0.1 uF (104)
- () 2 22 pF (220 or 221 or 22J)
- () 1 0.1 uF (104)

Electrolytic

Electrolytic (or tantalum) capacitors are polarized.

- () 1 1 uF Radial Lead RAD-105

Diode

- () 1 1N4148 Silicon Diode 1N4148

Integrated Circuits

Integrated Circuits come from various manufacturers and may have differing prefixes and/or suffixes. For example, if the part is listed as a 74LS00, it may be marked SN74LS00N or MC74LS00P or DM74LS00N or F74LS00P or some other variation. The key is that the sequence 74LS00 appears in the part number. A four-digit number, such as 8834, indicates the year and week of manufacture and should not be confused with the part number.

NOTE: Do not handle the ICs at this time! Carefully remove the black foam carrier with ICs from the bag and verify the ICs against this list. Then return the foam with the ICs to the bag. Do not touch the ICs!

- () 1 2764 or 2716 EPROM STATE-2.00
- () 1 74HC14 Hex Schmitt Trigger
- () 1 74HC374 or 74HCT374 Octal Latch

- () 1 74HC4060 Oscillator/Divider

Transistors

- () 2 2N3906 PNP Transistor 2N3906

Sockets

- () 1 14-pin DIP Socket DIPS-14
- () 1 20-pin DIP Socket DIPS-20
- () 1 28-pin DIP Socket DIPS-28
- () 1 16-pin DIP Socket DIPS-16

Connectors

- () 1 3-pin male header HM-03
- () 1 Jumper, Push-On JMP-02

Miscellaneous

- () 1 Length 10-wire "Rainbow" Ribbon Cable
- () 1 Printed Circuit Board, DCD Rev 2
- () 1 Assembly Manual, DCD Upgrade
- () 1 4.9152 MHz Crystal XTAL-049

CONSTRUCTION

You are now ready to begin construction of the DCD upgrade. Use a temperature-controlled, fine-tipped soldering iron and good quality 60/40 or 63/37 rosin-core solder for construction. Follow standard construction practices when building the unit.

In addition to the soldering iron and solder, you will need small flush or semi-flush cutting pliers and small-tipped long nosed pliers. A magnifying glass may prove helpful to identify the values of the small components.

Pay careful attention to the directions that follow. Keep the tip of your soldering iron bright and clean, wiping it frequently on a wet rag or sponge. Make solder joints carefully, but swiftly. Prolonged heat on a PC board pad can be as disastrous as too much heat, and ruining this PC board can be expensive! Two to three seconds should be enough time to apply heat to any joint.

NOTE: Shaded Parts are contained in the clock option only. These parts should be ignored if building without the clock option.

IC Sockets

NOTE: If any socket pins are bent, carefully straighten them with a pair of long-nose pliers before assembly. Some types of IC sockets have crimps in the pins to hold them in place when automatic wave-soldering is performed. These sockets may be tricky to install if you are not familiar with them. If your kit contains these sockets, you may want to straighten the pins before attempting to insert them into the PC board.

When installing IC sockets, double check to ensure that the socket is seated properly against the board with the notch, beveled corner or "1" towards the silkscreened reference (U1, U2, etc.). Be sure that all IC socket pins are showing on the solder side of the board. Next, tack-solder two diagonally opposite corners first (such as pins 1 and 8 on a 14-pin socket).

Then solder the remaining pins of that socket before proceeding to the next one. If you find a socket is difficult to install, remove it and double-check for a bent pin.

NOTE: Take care now to avoid solder bridges!

Install the following IC sockets.

- U3 14-pin
- U1 20-pin
- U2 28-pin
- U4 16-pin

Now check your work. All leads should be soldered. There should be no solder bridges (a blob of solder that shorts two adjacent soldered connections) or cold (gray and/or grainy looking) solder connections. You should have no IC sockets remaining.

- OK so far.

Resistors

Resistors lie flat on the PC board and have a lead spacing of 0.5". You may wish to use a lead former to preform the resistor leads for neatest appearance.

Install the following 5% resistors:

- R1 100k ohm (brown-black-yellow-gold)
- R5 220k ohm (red-red-yellow-gold)
- R2 10k ohm (brown-black-orange-gold)
- R3 470k ohm (yellow-violet-yellow-gold)

- R4 10k ohm (brown-black-orange-gold)

- R6 10 Meg (brown-black-blue-gold)

WARNING! Be careful when clipping leads, as they have a tendency to fly towards your eyes! Take appropriate precautions (grasp leads and wear eye protection).

- Solder and clip the leads (10 total) (12 total)

Diode

Diodes are polarized, with the cathode end being banded. Observe polarity when installing the following diode. Leads are at a 0.5" spacing.

- D1 1N4148

- Solder and clip the leads (2 total)

Capacitors

NOTE: All capacitors should be mounted as nearly flush to the board surface as practical without stressing the leads.

- 0.1 uF (104) @U1

- 0.1 uF (104) @U2

- 0.1 uF (104) @U3

- C1 0.1 uF (104)

- 0.1 uF (104) @U4

- C7 22 pF (220 or 22J)

- C8 22 pF (220 or 22J)

The following capacitor is polarized. The positive (+) lead should go in the square pad towards R5. Electrolytic capacitors (tubular metal cans with the leads coming out of one end) have the negative lead marked with a bold black band; tantalum capacitors (teardrop-shaped epoxy-covered blobs) have the positive lead marked with hard-to-read little plus (+) signs.

- C2 1 uF

- Solder and clip the leads (10 total) (16 total)

Now check your work. All leads should be soldered. There should be no solder bridges or cold solder connections. You should have no resistors, diodes or capacitors remaining.

- OK so far.

Remaining Components

NOTE: Transistors are polarized components. Match the body of the transistor with the silkscreened outline and carefully bend the transistor leads to match the hole pattern in the PC board. The bottom of the body of the transistor should be not more than 1/4" above the PC board.

- () Q1 2N3906
- () Q2 2N3906
- () Solder and clip the leads (6 total)

Form the crystal leads straight out from the crystal can for 1/8", then bend upwards and downwards to form an "S". This acts as a strain relief for the leads.

- () Y1 4.9152 MHz Crystal
- () Solder and clip the leads (2 total)

NOTE: When installing jumper strips, be sure that the shorter pins are soldered to the PC board and the longer pins stick up.

NOTE: If your TNC's case is shallow, you may want to skip installing the 3-pin jumper strip in the next step and, when the push-on jumper is called out, solder a wire strap across the appropriate locations on the PC board instead.

WARNING! Don't grip the jumpers with your fingers while soldering. The pins quickly get very hot!

- () JMP Install a 3-pin male header.

CLK Jumper

Using a piece of scrap resistor or capacitor, solder a strap at the CLK jumper.

- () If you are not using the optional on-board clock, strap across the center and outer holes at CLK marked E.
- () If you are using the optional on-board clock, strap across the center and outer holes at CLK marked I.

The silkscreened location marked P1 is sized to allow use of a single row of 0.025" square wire-wrap pins. Normal construction uses a wired harness with no connector.

- () Separate the ribbon cable between the gray and white wires.
- () Peel off the white/black wire pair and discard.
- () Separate the individual wires for a distance of 1/2" at one end of the remaining eight-wire ribbon cable.
- () Strip 1/16" of insulation from the end of the individual wires.
- () Twist the wire strands together at each exposed wire end.
- () Tin the ends with solder. The insulation will melt back a bit; this is normal, but don't overdo it!
- () Trim the ends of the wires with diagonal cutting pliers.

Install and solder in place the wires at P1 as follows:

- () Brown at pin 1 (the end nearest the transistors).
- () Red at pin 2.
- () Orange at pin 3.
- () Yellow at pin 4.
- () Green at pin 5.
- () Blue at pin 6.
- () Violet at pin 7.
- () Gray at pin 8.

Carefully check the board for solder splashes, solder bridges and cold solder joints.

- () OK so far.

Observing static precautions and polarity, install the following ICs in their sockets:

- () U1 74HC374
- () U2 EPROM (STATE 2.00)
- () U3 74HC14
- () U4 74HC4060

You should only a single push-on jumper left.

- () Single push-on jumper remaining.

You are now ready to proceed with installation of the DCD State Machine Upgrade in your TNC.

GENERAL INSTALLATION GUIDE

If your TNC isn't listed in the Specific Unit Installation section of this manual, follow these general guidelines. If you install the DCD Upgrade in a unit not documented here, please send information on the hookup, marked up Xerox schematics, etc., to the TAPR office so we can share this information with others.

Signals required to interface to the DCD Upgrade are:

- (1) A source of +5 volts DC (brown wire).
- (2) Ground or common (red wire).
- (3) A clock signal at 16 or 32 times the data rate (19,200 or 38,400 Hz for 1200 baud) (blue wire) - or use the on-board clock option.
- (4) NRZI data from the TNC demodulator (gray wire).
- (5) DCD from the TNC demodulator (violet wire). This line will be intercepted and a new DCD output signal (yellow or green wire) from the DCD Upgrade will be sent to the TNC.

NOTE: Don't forget to read the OPERATION section at the end of this manual!

7910-based modems

NRZI data is found on the 7910 modem chip at pin 26 (gray wire).

DCD from the 7910 is available at pin 25 (violet wire). This is negative true DCD, so the jumper on the DCD Upgrade PC board must be set to shunt pins 1 and 2 of JMP.

There is no x16 or x32 clock available from the chip, so one will have to be found elsewhere in the TNC (or the optional on-board clock may be used).

+5 volts may be obtained from pin 2 of the 7910 (brown wire).

Ground is found at pin 22 of the 7910 (red wire).

3105-based modems

NRZI data is available at the 3105 modem chip pin 8 (gray wire).

DCD (positive true, requiring the jumper on the DCD Upgrade PC board to shunt pins 2 and 3 of JMP) is found at pin 3 of the 3105 (violet wire).

A 16x clock signal is found at pin 2 of this chip (blue wire).

+5 volts is available at pin 1 (brown wire).

Ground is located at pin 9 (red wire).

SPECIFIC UNIT INSTALLATION

Look in this section for your TNC, or for tips on how to proceed if your TNC is not listed but uses a similar modem design.

AEA PK-87

Receive data is available at the center pin of JP4 (gray wire).

Remove the jumper at JP5.

DCD may be obtained from the end of JP5 which connects to the modem chip (violet wire).

The DCD output from the DCD Upgrade is routed to the center pin of JP5 (green wire).

A 32x clock signal is available at U20 pin 13 (74LS393) (blue wire). **DO NOT USE THE "CLOCK" SIGNAL FOUND AT J4!**

Place the jumper on the DCD Upgrade across JMP pins 1 and 2.

The DCD LED on the front panel of the PK-87 will indicate DCD from the DCD Upgrade circuit.

AEA PK-88

Remove the PK-88 PC board from its cabinet, including the small white connector going to the radio connector. Attach the following wires to the bottom of the PK-88 PC board.

BROWN	+5 volts	7910 Pin 2
RED	Ground	7910 pin 22
GREEN	DCD	Center pin of JP4-CD
BLUE	Clock	U20 pin 13 (74LS393)
VIOLET	CD In	7910 Pin 25
GRAY	NRZI	7910 pin 26

The ORANGE and YELLOW wires are not used.

Pull the jumper off from JP4-CD. You may hang the jumper off one of the end pins of the jumper so it doesn't get lost.

You may wish to use a longer ribbon cable, routing it between the TRANS and CONV LEDs, and placing the DCD PC board upside down on the top of the PK-88 near the EPROM (U15). The State Machine PC board may be held in place with double-sided, foamed tape such as that sold by Radio Shack.

The cabinet is a tight fit -- some builders suggest installing a wire strap across JMP pins 1 and 2 rather than using the push-on jumper.

AEA PK-232

Place the jumper on the DCD Upgrade at JMP pins 1 and 2.

If you have the TAPR Modem Disconnect board for the PK-232, follow the directions given in that kit's instructions, then proceed to PK-232 Operation, below. If not, proceed as follows.

Receive data is obtained from the center pin of JP4 or U15 pin 6 (GRAY).

Remove the jumper at JP6.

DCD is available from the end of JP6 which is not connected to pin 3 of the external modem connector (VIOLET).

NOTE: If your PK232 has been converted to the MBX option by an upgrade PC board, there may be two U8 ICs! If this is the case, use the U8 located on the MBX upgrade PC board.

A 32x clock may be tapped at U8 pin 13 (74LS393) (BLUE).

+5 is available from U8 pin 14 (BROWN).

Ground is available from U17 pin 7 (RED).

The DCD output from the Upgrade is connected to the center pin of JP6 (GREEN).

Add a new LED with a 1K series resistor on the front panel of the PK232 above the existing DCD LED and in line with the word THRESHOLD on the PK232 front panel. Tie the LED anode to +5 volts; the cathode via the 1K resistor to the DCD Upgrade board (orange wire).

The DCD PC board may be secured with a piece of double-sided foamed tape.

PK-232 Operation

Adjust the audio level from the VHF receiver such that the tuning indicator fully spreads on the station with the weakest audio (lowest deviation) on the channel.

Set the THRESHOLD control so that any station's audio will light the factory DCD LED, as well as noise from unsquelched audio. The DCD LED should go out when there is no signal (squelched audio or full quieting from a carrier).

NOTE: The DCD modification may affect Morse reception at certain speeds. It seems to not affect AMTOR operation or BAUDOT. It is recommended that an additional LED be mounted on the PK-232 front panel per the instructions given. Proper tuning of signals in all modes will be easier if this is done. It is important that the new LED as well as the old DCD LED be illuminated during MORSE and BAUDOT operation for proper decoding.

The operation of the DCD circuit on HF may not show any apparent effect when watching front panel LEDs (the hand time is a few tens of milliseconds) but it does work. Observations at VHF with an unsquelched radio will be more obvious.

Kantronics KAM

The KAM has two ports -- VHF and HF. These are covered by separate directions, below. If you wish to use both ports for packet, you should obtain two (2) DCD State Machine upgrade kits, one for each channel (even if you don't operate them at the same time).

NOTE: Due to the small clearance available in the KAM case, trim the JMP pins so they are no taller than a socketed IC, or replace the JMP and CLK jumpers with wire straps.

VHF Port

+5 volts is available at pin 1 of the TCM3105 chip (BROWN).

Ground may be obtained from the TCM3105 chip at pin 9 (RED).

Receive data is available at pin 8 of the TCM3105 modem chip (GRAY).

DCD may be obtained from pin 3 of the TCM3105 chip (VIOLET).

The DCD output from the DCD Upgrade is routed to pin 21 of the 63B03 microcomputer chip (available at the "K8" connector area as well) (YELLOW).

A 16x clock signal is available at pin 2 of the TCM3105 modem chip (BLUE).

Place the jumper on the DCD Upgrade across JMP pins 2 and 3.

The line from the TCM3105 pin 3 to the 63B03 pin 21 passes through a connector-pad area with pads labeled 7 and 8. Cut the trace that joins these two pads.

The DCD LED on the front panel of the KAM will indicate DCD from the DCD Upgrade circuit.

HF Port

For this port, you will need the clock option installed on the State Machine PC board.

NOTE: Clip the CLK jumper pins so they are very short and do not install any jumper or wire strap at the CLK jumper.

Install an insulated piece of wire from the center pin of the CLK jumper to U4 pin 15 (on the bottom of the DCD PC board). This will set things up for best 300 bps operation.

Connect JMP pins 2 and 3.

+5 volts is obtained from from U26 pin 14 (BROWN).

Ground is available at the empty hole nearest the edge of the KAM PC board labeled "C53" just below U26 (RED).

DCD is found at the other empty hole labeled "C53" (VIOLET).

NRZI can be picked up at "K8" pin 13 or 14 (GRAY).

Carefully pry U26 (63B03) from its socket and bend out pin 24, then re-install the IC. Now, solder the DCD out wire (YELLOW) to this free pin.

The State Machine PC board may be secured by use of foamed double-sided tape, such as that sold by Radio Shack, over U26 and U23. This will still allow access to the EPROM at U22, the TCM3105 modem IC at U5 and the serial EEPROM at U25.

Kantronics KPC-2

You will need the clock option for your DCD Upgrade to use it with the KPC-2.

Some KPCs have socketed ICs, some do not. The following steps assume you are willing to cut a trace on your KPC-2 PC board. If you aren't, or if your unit uses socketed ICs, you may simply remove the 7910 modem chip, bend out pin 25, and re-install the chip in its socket making sure that pin 25 of the chip does not make contact with anything else on the PC board, including pin 25 of its socket!

Solder the BROWN wire to 7910 pin 2.

Solder the RED wire to 7910 pin 22.

Solder the VIOLET wire to pin 25 of the 7910 - this may be the "flying lead" if you chose to bend the lead away from the 7910 body to avoid cutting any traces on the KPC-2 PC board.

Solder the GRAY wire to 7910 pin 26.

Solder the GREEN wire to the 63B03 processor pin 21.

If you didn't bend out the 7910 IC pin 25, then turn the KPC-2 PC board upside down and locate the 7910 and 63B03 sockets. Locate the trace between the 7910 pin 25 and the 63B03 pin 21. Cut it with a sharp knife or razor blade, and verify the cut with an ohmmeter.

Shunt JMP pins 2 and 3 on the DCD PC board.

You may need to trim the JMP pins on the DCD PC board for mechanical fit when you re-install the KPC-2 into its case. Be sure to insulate the new PC board to avoid any shorts or other problems.

You can now run open squelch. Be sure SWDET is OFF if your KPC-2 firmware supports this command.

Kantronics KPC-4

This is a dual-port TNC. If you wish to use both ports, you will need two (2) State Machine upgrade kits.

Place the jumper on the DCD Upgrade across JMP pins 2 and 3.

Power (+5 volts) is available on the outboard side of the POWER LED (BROWN).

Ground may be found on the back (connector) side of the 220 ohms resistor nest to the 7805 regulator chip (RED).

Port 1

Receive data is available at U2 pin 8 (GRAY).

32x clock is available at U2 pin 2 (BLUE).

DCD is available at U2 pin 3. Remove U2 from its socket, bend pin 3 out and away from the socket, then re-seat the IC in the socket so that pin 3 does not make contact with the socket. Solder the wire to this free pin (VIOLET).

DCD output is applied to U2 socket pin 3 (or to an open plated-through hole on the KPC-4 PC board down the line from this socket's pin) (YELLOW).

Port 2

Receive data is available at U3 pin 8 (GRAY).

32x clock is available at U3 pin 2 (BLUE).

DCD is available at U3 pin 3. Remove U3 from its socket, bend pin 3 out and away from the socket, then re-seat the IC in the socket so that pin 3 does not make contact with the socket. Solder the wire to this free pin (VIOLET).

DCD output is applied to U3 socket pin 3 (or to U17 pin 21 or to pin 7 of the disconnect header) (YELLOW).

Kantronics KPC-2400

Receive data is available at U3 pin 26 (GRAY).

Carrier detect may be obtained from U3 pin 25 (VIOLET).

+5V is available at U6 pin 14 (BROWN).

A 32x clock signal is available at U6 pin 5 (BLUE).

Ground may be tapped at U6 pin 7 (RED).

DCD from the Upgrade may be connected to the 63B03 microprocessor by removing U19 from its socket, carefully bending out pin 19 and reinserting the the IC at U19 so that pin 19 is no longer making contact in the socket. Then, solder DCD out line (GREEN) to pin 19 of the U19.

Place the DCD jumper at JMP pins 1 and 2.

Pac-Comm Tiny 2 and Micropower 2

All units

Plus 5 volts is available at U11 pin 14 (BROWN).

Ground is available at U11 pin 7 (RED).

An X16 clock may be tapped at U11 pin 3 (BLUE).

NRZI data is available at U11 pin 2 (GRAY).

The next steps depend on whether your PC board is Rev 1.1 or Rev 1.6.

Rev 1.1 PC boards

Cut the trace on the TNC PC board between U12 (74HC86) pin 11 and MODEM DISC pin 2.

DCD from the modem may be obtained from U12 pin 11 (VIOLET).

The DCD output from the DCD Upgrade may be injected at MODEM DISC pin 2 (GREEN).

Proceed to "All units" below.

Rev 1.6 PC boards

DCD from the modem may be obtained from the end of JPD end nearest the "JPD" silkscreen legend (VIOLET).

The DCD output from the DCD Upgrade connects to JPD center pin (GREEN).

Remove the jumper on JPD.

All units

Place the jumper on the DCD Upgrade across JMP pins 1 and 2. You may have to trim the pin length of the connector at JMP to allow the TNC to be replaced in its case.

The existing DCD LED will show the action of the new DCD circuit.

NOTE: The external "RFDCD" input will not work with the mods connected at JPD as described above.

OPERATION

If you operate on VHF FM, you may now operate the radio with the squelch open (set so noise comes from the speaker when there is no signal present). This will reduce the amount of time it takes for your station to respond to another's transmission, allowing the remote station to operate with a shortened TXDelay parameter.

If everyone in the local network has proper DCD operation, all stations will be able to shorten TXDelay. This will result in greater throughput for all users on the channel, as well as fewer retries due to collisions because the "window" when a TNC is "deaf" will be shortened, making it less likely that a TNC will command a transmitter on when another station is starting to transmit.

To operate HF, tune as before except use the new DCD information for proper setting of any THRESHOLD control. THRESHOLD should be set such that DCD is illuminated when ANY other station that is hearable is transmitting - even if your station cannot decode the transmission. It should be off, or flickering from time to time, when noise is present but no signals are detectable.

This will help reduce collisions caused by your station transmitting when another station is active on the frequency. When all stations on an HF channel are using proper DCD action, throughput will generally improve markedly.

NOTE: AX.25 Level 2 Version 2.0 is NOT an optimized protocol for HF operation. With any multiple access protocol, however, proper modem operation, including DCD operation, can only help.

THEORY OF OPERATION

NRZI data and a 16x (or 32x) clock signal are sent to a finite state machine consisting of U1 (74HC374) and U2 (2764 EPROM). The logic for the state machine is stored in the EPROM. If the TNC has no clock available, U4 may provide one.

The EPROM output (D7, pin 19) will go high when the state machine is able to synchronize the incoming data edges with the clock. The high level turns off Q2.

After a small delay (a few tens of milliseconds), R3 will discharge C1 past the threshold point of schmitt trigger U3C, whose output will then go high. D1 will quickly charge C2, and U3F will go low (and U3E, high), providing a DCD output based on a stable phase relationship between the supplied clock and NRZI data.

If the clock loses synchronization, Q2 will be turned on, rapidly charging C1 and switching U3C to a low output. The low output will discharge C2 via R5 which provides a "hang" time before dropping DCD. This time constant allows for brief multipath hits, preventing the TNC from jumping on channel when another station is transmitting.

Amplitude-based DCD information is introduced via U3A, with polarity selected by JMP. When the TNC modem DCD is inactive, Q1 is held on, inhibiting DCD output. When the TNC modem's DCD is active, Q1 is turned off, allowing the state machine to drive Q2 and control the DCD output.

If no DCD signal is available from the associated TNC modem, JMP pins 1 and 2 should be jumpered and pin 7 of the DCD Upgrade left unconnected.

U3D provides an output capable of driving an LED indicator as to the state of the DCD decision.

DRSI PC*PA (8530 SCC) DCD Install

Lyle Johnson, WA7GXD, PSR#39, July 1990, Page 7.

Physical Considerations

The first problem is one of physical placement. If you have a spare slot available, you can simply attach the upgrade with double-sided adhesive tape.

Wiring

The instructions in the State Machine document describe interfacing for various modems. In this case we will wire it for a 8530 SCC. Any attached modem will have to conform to the requirements of this chip anyway, so this is a safe approach.

Channel A (read completely before starting)

For the internal modem on the Type 1 PC*PA, and 8530 Channel A on all units, connect the Upgrade as follows:

- 1) Brown wire (+5) to 8530 pin 9
(or anywhere else on the Vcc bus).
- 2) Red wire (GND) to 8530 pin 31
(or anywhere else on the GND bus)

Break the trace that connects the 8530 pin 19 to the rest of the board. In a Type 1 unit, this is U10 pin 6 (older units) or U6 pin 4 (newer units). In lieu of cutting the trace, you may simply remove the 8530 from its socket and bend pin 19 straight out from the body of the part.

- 3) Green wire (-DCD out) to 8530 pin 19 (or directly to the IC pin if you bent it out instead of cutting).
- 4) Blue wire (CLK) to 8530 pin 12.
- 5) Violet wire (DCDin) to the device that connected to the 8530 pin 19 before you cut it in the step above (in the case of a Type 1 PC*PA, connect this wire to U10 pin 6 [older units] or U6 pin 4 [newer units]), or to pin 19 of the 8530 socket if you bent the lead out instead of cutting the trace.
- 6) Gray wire (NRZI) to 8530 pin 13.

The orange and yellow wires are not used. The green LED on the PC*PA will not reflect the State Machine DCD output. If you wish it to, cut the trace from the green LED D3 to the chip driving it (U8 pin 4 in the case of older Type 1 PC*PAs, and U11 pin 4 in the case of newer Type 1 units) and connect the orange wire from the Upgrade to the LED.

Channel B

For the external port on the Type 1 PC*PA and 8530 Channel B on all units, connect the Upgrade as follows:

- 1) Brown wire (+5) to 8530 pin 9
(or anywhere else on the Vcc bus).
- 2) Red wire (GND) to 8530 pin 31
(or anywhere else on the GND bus)

Break the trace that connects the 8530 pin 21 to the rest of the board. In a Type 1 unit, this is U14 pin 11 (older units) or U9 pin 11 (newer units).

In lieu of cutting the trace, you may simply remove the 8530 from its socket and bend pin 21 straight out from the body of the part.

- 3) Green wire (-DCD out) to 8530 pin 21 (or directly to the IC pin if you bent it out instead of cutting).
- 4) Blue wire (CLK) to 8530 pin 28.
- 5) Violet wire (DCDin) to the device that connected to the 8530 pin 21 before you cut it in the step above (in the case of a Type 1 PC*PA, connect this wire to U4 pin 11 [older units] or U9 pin 11 [newer units]), or to pin 21 of the 8530 socket if you bent the lead out instead of cutting the trace.
- 6) Gray wire (NRZI) to 8530 pin 27.

The orange and yellow wires are not used. The green LED on the PC*PA will not reflect the State Machine DCD output. If you wish it to, cut the trace from the green LED D5 to the chip driving it (U8 pin 4 in the case of older Type 1 PC*PAs, and U11 pin 12 on newer Type 1s) and connect the orange wire from the Upgrade to the LED.

Final Steps

You may want to alter the shift of the 3105 internal modem(s) on your PC*PA. To do so, disconnect the 3105 modem chip pin 5 from whatever is driving it, and connect this pin to ground. Changing from 1000Hz shift to 800Hz shift will more evenly distribute the audio spectrum of your transmission, and narrow it slightly. More importantly, it will speed up the DCD response of receiving units, especially those based on PLL's.

Double-check all wiring, then install the PC*PA in your computer and operate as before. You can now operate open-squelch on VHF using the internal modem of your PC*PA if it is so equipped.

