Kantronics D4-10 Upgrade and Alignment

Introduction

This document is a guide that can be used for the upgrade and alignment of the Kantronics D4-10 transceiver.

Parts List

4-each, 1/4"-square 10-Kohm multi-turn potentiometer, p/n T63YB103KT20
1-each, 1/4"-square 1-Kohm multi-turn potentiometer, p/n T63YB102KT20
1-each, 1/4"-square 500-Kohm multi-turn potentiometer, p/n T63YB504KT20
1-each, 43-Kohm 1/8-watt resistor
1-each, chassis solder lug
1-each, 470pf ceramic capacitor, 50 VDC
2-each, crystal heater, Vertex Standard, p/n G9090019, phone: (714)-827-7600

Test Equipment List

Digital Multi-Meter (DMM)
Oscilloscope
RF Dummy Load, 15-watts minimum rating
RF Watt Meter
SINAD Meter
Service Monitor

Component Replacement and Installation

1. Remove single-turn potentiometers RXA1, TXA1, RXA2, TXA2.
2. Remove single-turn potentiometers R11, and R17
3. Clear holes for missing resistor R72.
4. Install 10-Kohm multi-turn potentiometers RXA1, TXA1, RXA2, TXA2.
5. Install 500-Kohm multi-turn potentiometer R11.
6. Install 1-Kohm multi-turn potentiometer R17.
7. Install 43-Kohm 1/8-watt resistor R72.
8. Install 470pf capacitor between U5 pins 11 and 12 if not already present.
9. Install chassis solder lug at right mounting screw for front shield panel.
10. Install heater assemblies on RXA and TXA crystals, either channel 1 or 2 but not both as there is not enough clearance. Positive leads to go to interior side of fuse F1. Ground leads are installed on chassis solder lug.

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VCO Alignment Procedure

1. Adjust RX and TX PLL potentiometers RXA1 and TXA1 for channel-1.
   1.1. Connect the dummy load to the D4-10's BNC antenna jack.
   1.2. Connect an oscilloscope probe tip to rear pin of JP2 and the probe ground to the chassis. Set Volts/Div to 0.5 volts DC.
   1.3. Adjust RXA1 potentiometer for 2.5 volts DC on the oscilloscope.
   1.4. Key the transmitter via the Analog port PTT pin 3 and ground. If the transmit LED does not illuminate, then the oscillator is not operating which can be corrected by adjusting the slug in inductor TL1.
   1.5. Adjust TXA1 potentiometer for 2.5 volts DC on the oscilloscope.
   1.6. Switch between RX and TX to verify no noticeable voltage change.
2. Repeat the same steps for channel-2 if populated with channel crystals.

Transmitter Alignment Procedure

1. Key the radio using the PTT pin ***on the analog I/O port***, causing the radio to transmit. Adjust the transmit VCO trimmer coil TL1 (TL2 for channel-2) to bring the transmitter exactly on frequency.
2. Key the radio using the PTT pin ***on the TTL I/O port.*** The frequency should now be 10-kHz lower (bit value=0) than in step 1. If not then adjust R11 to cause a 10-kHz shift. To check the high side shift, apply 5.0 volts DC (available from the output of VR1) to pin 1 on the TTL I/O port. The frequency should shift 10-kHz above (bit value=1) the center frequency set in step 1 .
   - *It is important that there is at least 10-kHz of shift both down and up from the transmitter center frequency. If the shift is too narrow, then performance falls off drastically. Another acceptable parameter is to have between 19.200-kHz and 20.000-kHz of total bandwidth (e.g. 433.4200-MHz to 433.4392-MHz).*

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Receiver Alignment Procedure

1. Establish the following test equipment and radio configurations in preparation for receiver alignment.
    1.1. Set the service monitor signal generator to the receive frequency, configured to apply a 1-kHz modulated FM signal with 5-kHz deviation and 2 to 3 microvolts of RF output. Connect the generator to the D4-10's antenna jack.
    1.2. Connect the oscilloscope probe to the RXData circuit (pin 5) on the TTL I/O port. Configure the oscilloscope to handle a 1-kHz waveform (time/division: 0.5-milliseconds), DC coupled at 5.0 volts/division, with the vertical trigger source tied to the probe channel.
    1.3. Connect the SINAD meter across a 8-ohm speaker that is connected to the 3.5mm audio output jack. Connect the second oscilloscope probe to the audio output as was done with the SINAD meter. Adjust the audio output to a comfortable level. This provides good visible and audible clarity.
2. Set the D4-10's bandwidth selector to the narrow position.
3. With signal applied to the D4-10, adjust the receiver VCO trimmer coil RL1 (RL2 for channel-2) for the best quieting level on the SINAD meter. The objective is to get the receiver close to the desired receive frequency.
4. Disable signal generation into the D4-10 and observe the TTL RXData circuit on the oscilloscope. Two horizontal lines should be visible, representing logic zero and one with noise in between them. One line may have a greater intensity than the other, or one line may even be missing, both conditions indicating an imbalance between logic zero and one. Adjust the data slicer threshold potentiometer R17 to produce an equal amount of intensity on both lines which will put the data slicer in the center of the noise passband. Figure-1 (see page 4) illustrates a properly adjusted data slicer threshold.
5. Apply signal generation to the radio, reducing the deviation to approximately 3-kHz and making certain that the signal is fairly strong (e.g. 100 microvolts). Set the D4-10 bandwidth selector to wide. A square waveform should now appear on the oscilloscope. Adjust the VCO receiver trimmer coil RL1 (RL2 if aligning channel-2) for an equal duty cycle, in effect the lower and upper edges of the waveform should be the same width. The receiver channel is now on frequency. Figure-2 (see page 4) illustrates the data slicer output with a properly aligned VCO receiver trimmer coil.

Upgrade and Alignment Completed

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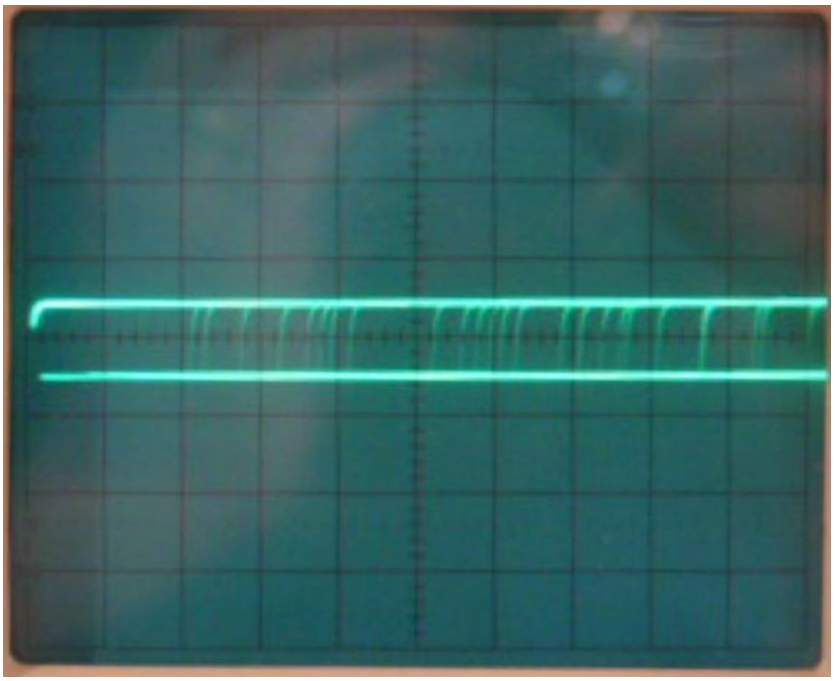

Figure-1 Properly adjusted data slicer threshold waveform.

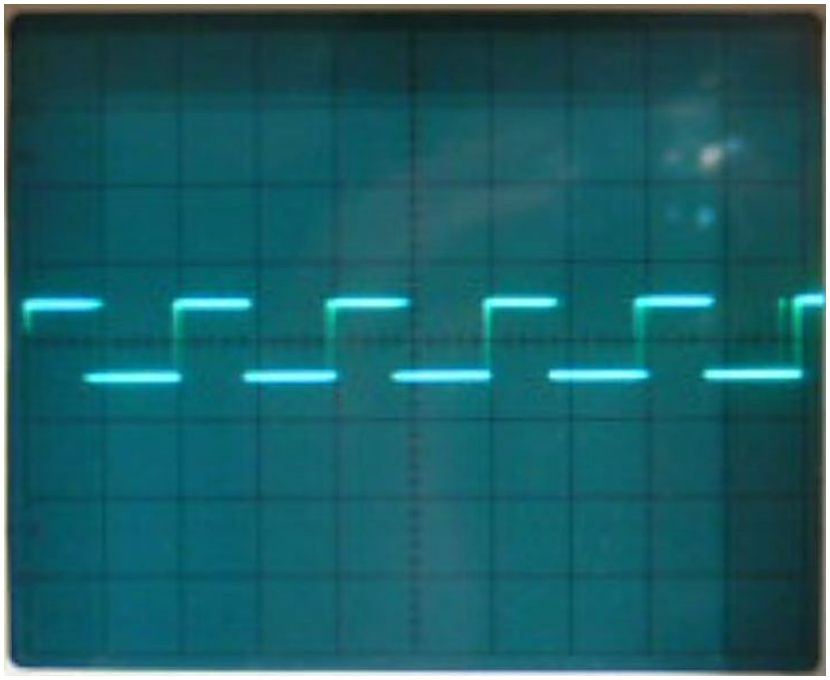

Figure-2: Data slicer output with properly aligned VCO receiver trimmer coil.

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