

West Kootenay Amateur Radio Club

West Kootenay Amateur Radio Technical Information

RC210 Interface to Daniels MT-3 Repeater

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WKARC RC210 - Daniels

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1. INTRODUCTION

This document describes how to interface the Daniels Electronics (now Codan Communications) MT-3 repeater system to the ARCOM RC210 repeater controller.

2. WIRING INFORMATION

The following table shows where to connect the required RC210 DB-9 interface lines to the Daniels Sub-Rack for Receiver/Transmitter A. The table below shows connection points to either direct to the backplane connector pins, or to the A-PNL-AUX96-3 Auxiliary Connector pins.

Daniels P1 or J1 Pin	Daniels RX/TX A Pin	A-PNL-AUX96 Pin	Daniels Functional Name	RC210 Function	RC210 DB9 Pin
				CTCSS Encode Control Out	1
B8	B12 + Z12	J1-7	RX A COR	CTCSS Decode Logic In	2
B6	No Timeout: B14 + Z14 Timeout: B10 + Z10	J1-3	PTT <i>No Timeout: JU8 jumper to A With Timeout: JU8 jumper to B</i>	TX PTT Radio Control Out	3
C18	Z18	J1-1	Tx A Balanced IP #1	Tx Audio Output	4
A22	B20	J4-12	RX A SQL De-Emp	Rx Audio Input from radio	5
J1: D32, C32, B32, A32, Z32 P1: A32, B32, C32	B32, Z32	J4-1,2,3,4	Ground	Ground	6, 8, 9, Shield
B31	Z24	J4-10	RX A PRIOR COR	RX COS Login In	7
P2: B2, Z2 P1: A2, B2	B2, Z2			+13.8 Volts	Power

Table 1 – MT-3 A Wiring to RC210 DB9 connector

2.1 ICS Controllers MT3 Repeater Interface Adapter

ICS Controllers makes an easy method to interface the RC210 to the Daniels backplane. Their **MT3 Repeater Interface Adapter** hardware mounts to the Sub-Rack backplane, and provides two DB9 connectors for interfacing to the RC210 controller:

See this link: <https://ics-ctrl.com/daniels-codan/>

From the ICS web site:

The “[MT3 Repeater Interface Adapter](#)” is an adapter for the Daniels MT3 chassis back-plane to allow using external repeater controllers such as our PI-REPEATER-2X dual port controller system, or other pinout compatible external controllers.

The board mates directly with the system interface as shown and is held in place with the connector and 2 screws/spacers to prevent creating a lever arm that could break the connectors. The high-density connector is brought out to 2 DSUB-9 connectors that follow a pinout common to most controllers, so all you will need is basic 9/10 conductor DSUB-9 cables to connect up to your desired controller.

A pair of 14 pin headers is designed in to allow selection of a number of audio configurations for both transmit and receive audio on each port. Additionally, a 6-pin screw terminal is provided for each dsub-9 interface, with some useful signals. Please refer to the schematic on our documents page (<https://ics-ctrl.com/docs/>) for details on the audio interface, and other signal connections.



Pinout of the DSUB-9

1 - No connect	6 - GND
2 - CTCSS	7 - COS/COR
3 - PTT	8 - GND
4 - Tx Audio	9 - GND
5 - Rx Audio	

2.2 COS/CTCSS Notes

For the RC210 COS input, use the Daniels **RX A PRIORITY CORE** signal (P1/J1-B31). This signal is active regardless of the state of the CTCSS decoder.

For the RC210 CTCSS input, use the Daniels **RX A COR** signal (P1/J1-B8). This signal is active when receiving a signal and the CTCSS decoder detects the correct CTCSS tone. NOTE: changing the AC-3 front panel toggle switch to disable CTCSS decode makes this signal true all the time, when receiving a RF signal.

2.3 CTCSS Signal Path (Daniels HW)

The following table shows the electrical signal path taken through the Daniels hardware for the selected CTCSS decode logic line. This assumes you have the AC-3 module installed with the CTCSS decode installed in the “A” position. The arrows show the electrical connection path. Documented here as this was not easy to figure out!

MT-3 Module:	AC3	RX A	RX A	P1 / J1	Aux Connector
	B22→	B28 →	B12 → Z12	B22 →	J1-7
	RX MUTE	RX MUTE	RX A CORE	RX A MUTE	RX A CORE

Table 2 – MT-3 CTCSS Signal Path

2.4 Do Not Use Daniels RX A MUTE signal

Do not use the Daniels signal **RX A MUTE**. It was initially considered for use as the RC210’s CTCSS logic input, but due to electrical loading in the RC210 input pin 3, will cause the Daniels receiver to be 100% muted all the time.

2.5 Signal Electrical Path Checks

The table below shows what the electrical signal path is for each of the used signals. This needed to be checked to ensure that neither the RC210 nor the MT-3 system would experience too high or low voltage levels.

Signal Name:	RC210	MT-3	Status
TX PTT	Open-drain driver, good to 33v	Pull-up to 9.5v	OK
RX COS	+5v pull-up (470 ohms) 10k → ground or diode	+6.5v or +9.5v pull-up Open collector pull down to ground	OK
CTCSS	+5v pull-up (470 ohms) 10k → ground or diode	+6.5v or 9.5v pull-up MOSFET switch to ground	OK
TX Audio	TL064 Op-Amp powered by +12V, but o/p DC blocked with Cap and 470-ohm resistor	Audio T1 and/or resistive pot to ground	OK
RX Audio	10K port, DC blocked with cap	Disc: Cap → 1KR De-Emphasis: 100 uf Cap (DC Block) Flat: System Module? BAI: Transformer R → C Disc O/P LPF: possible 9.5v → 1KR	OK

Table 3 – MT-3 CTCSS Signal Path

3. MODULE PCB JUMPERS

3.1 AC-3x Audio Control Module

The AC-3X Audio Control Module is only used to provide CTCSS decoding (and optionally CTCSS encoding). When using only a single ‘A’ Tx/Rx module pair, only the CTCSS TS-64 option ‘A’ PCB is installed.

The following PCB jumpers were set on the AC-3 module used on the VE7BDY (147.040+) system. This AC-3 module was a “stripped-down” module with most components not factory installed on the PCB.

Function:	Jumper:	Position:	Sub-Function:
CTCSS TS-64 Decode/Encode Module ‘A’	JU-1	OUT	
	JU-2	OUT	
	JU-3	IN	
Repeater Control Circuit	JU54	OUT	
	JU55	OUT	
	JU56	OUT	
	JU57	OUT	
	JU58	OUT	
	JU59	OUT	
	JU52 JU53 JU60 JU68 JU69 JU70 JU77	All OUT	
	JU61 JU71 JU72 JU73 JU74 JU75 JU76	All OUT	
Audio Path Enable	JU3 JU4 JU5 JU6 JU19 JU20 JU21 JU78 JU79	All OUT (Neither A or B)	

CTCSS A	JU44	B	
	JU22	IN	Power to CTCSS A module
	JU23 JU24	OUT (Both)	CTCSS A low pass filter
	JU25	IN	FP SW1 controls CTCSS modules
	JU28	IN	FP SW1 controls CTCSS A mod.
	JU29	OUT	Repeat Disable 1 controls CTCSS A encode
	JU30	OUT	Allows SW1 or SW2 to control both CTCSS modules
	JU32	IN	Allows switches or repeat disable to control CTCSS module A
	JU33	OUT	Disables CTCSS A encode
	JU34	OUT	Enables encode out on decode in for CTCSS A
	JU47	A	'A' mutes RXA until valid CTCSS A decode tone
	JU101	IN	Allows CTCSS A encoder output to be selected as TXA or TXB subtone i/p
	JU115	OUT	Enables CTCSS A encoder output
	JU1	OUT	RXA Bal o/p 1 to i/p buffer amplifier
CTCSS B (Not used)			
Hang Timer	JU62	OUT Neither A or B	Hang Timer A/B -> TX B PTT
	JU63	OUT Neither A or B	Hang Timer A/B -> TX A PTT

3.2 VT-3 VHF Transmitter Module

3.2.1 VT-3 Transmitter Main PCB Jumpers

The following PCB jumpers were set on the VHF transmitter A module main PCB used on the VE7BDY (147.040+) system. The PTT Tx Timeout timer is set to **7.5 minutes**.

Function:	Jumper:	Position:	Sub-Function:
	J2	X	Optional Relay Configuration
	J3	None	Optional Relay Configuration
	J4	Y	Optional Relay Configuration
	J6	Out	Tx standby mode select – Mode 1
	J7	Y	Audio Processor Standby Select
	J9	Out	Rx audio ac/dc input coupling
	J12	Out	Amplifier power sense o/p config
	J13	X	Amplifier power sense o/p config
	J14	X	Amplifier power sense o/p config
	J15	X	Amplifier power sense o/p config
	J16	X	Microphone configuration
	J17	In	Microphone output line
	J18	Y	Synth/Crystal module standby mode select
	J19	Y	600-ohm audio transformer ‘y’ position disables
	J20	Y	600-ohm audio transformer ‘y’ position disables
	J21	Out	+8 Vdc audio processor supply bypass
	J22	Y	600-ohm audio transformer ‘y’ position disables
	J23	Y	600-ohm audio transformer ‘y’ position disables
	J24	In	Subtone #2 output enable
	J25	X	Audio output enable
PTT TX Timeout Set to 7.5 minutes	J26	OUT	
	J27	IN	
	J28	OUT	
	J29	IN	
	J31	IN	
	J32	OUT	
	J33	IN	PTT TO Input Enable
	J34	IN	PTT TO Power Enable
	J35	IN	PTT TO Output Enable

3.2.2 VT-3 Audio Processor PCB Jumpers (Version 1.6)

The table below shows the factory default configuration only.

Jumper:	Position:	Function:
JU1	Out	Power source
JU2	Out	MT-2 deviation enable
JU3	In	Microphone preamplifier power enable
JU4	In	Balanced audio preamplifier power enable
JU5	Out	Balanced audio ground enable
JU6	In	Processed audio path enable
JU7	Out	Unprocessed auxiliary audio path enable
JU8	Out	Audio output DC coupled
JU9	In	Balanced input preemphasis response enable
JU10	Out	Balanced input flat audio response enable
JU11	Out	Balanced input to auxiliary audio circuit enable
JU12	Out	Tone/Digital input to auxiliary audio circuit enable
JU13	Out	Direct modulation input to aux. audio circuit enable
JU14	Out	Auxiliary input preemphasis response enable
JU15	Out	Auxiliary flat audio response enable
JU16	Out	Subtone input 2 audio path select
JU17	In	MT-2 temperature compensation bypass
JU18	Out	Continuous data selection
JU19	Y	Power source for audio switches
JU20 to JU22		Not used
JU23	Out	Direct modulation input to subtone 2 enable
JU24	In	Lowpass filter response select
JU25	In	Lowpass filter response select
JU26	In	Lowpass filter response select
JU27	Out	Direct modulation input audio path select
JU28	Out	Amplified direct modulation bypass
JU29	Out	Amplified direct modulation input DC couple enable
JU30	Out	Amplified direct modulation audio path select
JU31	Out	Subtone 2, AC coupled, to direct mod o/p enable
JU32	Out	Audio o/p AC coupled (MT-3 crystal Tx)
JU33	Out	Audio o/p AC coupled (MT-3 synthesized Tx)
JU34	Out	Audio o/p from direct modulation circuits select
JU35	Out	Direct modulation output source select
JU36	X	Subtone input 1 audio path select
JU37	Out	Summed subtone audio to direct mod o/p enable
JU38	Out	Subtone 2, DC coupled, to direct mod o/p select
JU39	Out	Direct modulation low input impedance enable

3.2.3 VT-3 Audio Processor PCB Jumpers (Version 1.8)

The table below shows the factory default configuration only.

Jumper:	Position:	Function:
JU1	Out	Power source select for direct modulation circuits
JU2	Out	MT-2 deviation enable
JU3	Y	Microphone preamplifier flat response
JU4	Out	Subtone input 2 audio path select
JU5	Out	Auxiliary input enable (DC or AC coupled)
JU6	In	Processed audio path enable (limited & filtered)
JU7	Out	Unprocessed auxiliary audio path enable
JU8	Out	Audio output DC coupled
JU9	In	Balanced input preemphasis response enable
JU10	Out	Balanced input flat audio response enable
JU11	Y	Balanced input to auxiliary audio circuit enable
JU12	Out	Tone/Digital input to auxiliary audio circuit enable
JU13	Out	Direct modulation input to aux. audio circuit enable
JU14	Out	Auxiliary input preemphasis response enable
JU15	Out	Auxiliary input flat audio response enable
JU16	In	Subtone input 1 audio path select
JU17	Out	MT-2 temperature compensation bypass
JU18	Out	Continuous data selection
JU19	Out	Power source for audio switches
JU20	Out	Power source for Q2
JU21	Out	Power source for bilateral switch U9
JU22	X	Audio output to lowpass filter
JU23	Out	Direct modulation input to subtone 2 enable
JU24	In	Lowpass filter response select
JU25	In	Lowpass filter response select
JU26	In	Lowpass filter response select
JU27	Out	Direct modulation input audio path select
JU28	Out	Amplified direct modulation bypass
JU29	Out	Amplified direct modulation input DC couple enable
JU30	Out	Amplified direct modulation audio path select
JU31	Out	Audio o/p AC coupled (MT-3 synthesized Tx)
JU32	Out	Audio o/p AC coupled (MT-3 crystal Tx)
JU33	Out	Audio o/p AC coupled
JU34	Out	Audio o/p from direct modulation circuits select
JU35	Out	Direct modulation output source select
JU36	Y	Power source select for AGC preamplifier
JU37	Out	Direct modulation output enable
JU38	Out	Subtone 2, DC coupled, to direct mod o/p select
JU39	Out	Direct modulation low input impedance enable
JU40	In	Power for Microphone preamplifier enable
JU41		Not used
JU42	Out	Processed audio path to direct modulation input
JU43	In	Bilateral switch U9 bypass enable

3.2.4 VT-3 Audio Processor PCB Jumpers (Version 2.3)

The following PCB jumpers were set on the VHF transmitter A module used on the VE7BDY (147.040+) system. *The table below shows the factory default configuration. It has not yet been confirmed on the VHF A transmitter module – Dec 12, 2022.*

Jumper:	Position:	Function:
JU1	Y	Microphone Pre-Emphasis/Flat audio
JU2	Y	Balanced Audio Pre-Emphasis/Flat Audio
JU3	??	Custom Temperature compensation network
JU4	Out	Sub Tone input 2 audio path select
JU5	Out	Auxiliary input routing
JU6	In	Splatter Filter Output
JU7	Out	Auxiliary output routing
JU8	Out	Direct coupled final OP Amp O/P
JU9	Out	Auxiliary Output – Pre-Emphasis/Flat
JU10	Out	4V AC Ground
JU11	Out	Balanced Input Compression Bypass
JU12	Out	Tone/Digital Input AC/DC Coupling
JU13	Out	Direct Modulation Routing
JU14	Out	Two Port Polarity Select
JU15	X and Y	4V Regulator Adjust (Bypassed)
JU16	In	Subaudible Enable
JU17	Out	Balanced Input Adjust Range Extend
JU18	Out	Audio Gate disable
JU19	Y	Voltage Select (+9.5V/8V) Audio Gates
JU20	Out	Direct Modulation Audio Routing
JU21	X	Audio Gate Switch
JU22	Y	Splatter Filter Enable/Bypass
JU23	Out	Narrow Band Gain Reduction
JU24	??	Custom Temperature Compensation Network
JU25	Out	Wide/Narrow Band switched select
JU26	Out	Auxiliary output routing
JU27	Out	Direct Modulation Input Offset Output
JU28	Out	Direct Modulation Input Routing
JU29	Out	Coupling Capacitor selection
JU30	N/A	Not used
JU31	Out	Splatter Filter Output Routing
JU32	Out	Coupling Capacitor Selection
JU33	Out	Direct Input Coupling – Auxiliary Amplifier
JU34	Out	Audio Routing
JU35	Out	Audio Routing
JU36	X	AGC Preamp Power Select
JU37	Out	Direct Couple (TCXO)
JU38	In	Low Pass Enable
JU39	X	Low Frequency Amplifier Bias Select
JU40	N/A	Not used
JU41	Out	Narrow Band Gain Reduction
JU42	Out	Direct modulation input bias select

JU43	Out	Direct Modulation Direct/Cap Couple
JU44	Out	Coupling Capacitor Selection
JU45	In	Coupling Capacitor select (default)

The following diagram is taken from the Daniels manual for the audio processor v2.3.

Jumper	Default Type	Position	Description	NB VHF Pre-emphasis CTCSS / Synthesized	NB VHF Flat CTCSS / Synthesized	NB UHF Pre-emphasis CTCSS / Synthesized	NB UHF Flat CTCSS / Synthesized
1	XY	Y	Microphone Pre-Emphasis/Flat Audio	Y	X	Y	X
2	XY	Y	Balanced Audio Pre-Emphasis/Flat Audio	Y	X	Y	X
3	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
4	XY	Not Installed	Subtone input 2 audio path select				
5	XY	Not Installed	Auxiliary Input routing				
6	Single	Installed	Splatter Filter Output	Installed	Installed	Installed	Installed
7	Single	Not Installed	Auxiliary output routing				
8	Single	Not Installed	Direct Coupled final OP Amp O/P				
9	XY	Not Installed	Auxiliary Output - Pre-Emphasis/Flat	Not installed	Not installed	Not installed	Not installed
10	Single	Not Installed	4V AC Ground	Not installed	Not installed	Not installed	Not installed
11	Single	Not Installed	Balanced Input Compression Bypass				
12	XY	Not Installed	Tone/Digital Input AC/DC Coupling				
13	Single	Not Installed	Direct Modulation Audio Routing				
14	XY	Not Installed	Two Port Polarity Select	Not installed	Not installed	Not installed	Not installed
15	XY	XY	4V Regulator adjust (Bypassed)	X and Y both	X and Y both	X and Y both	X and Y both
16	Single	Installed	Subaudible Enable	Installed	Installed	Installed	Installed
17	Single	Not Installed	Balanced Input Adjust Range extend				
18	Single	Not Installed	Audio Gate disable				
19	XY	Y	Voltage Select (+9.5V/10V) Audio gates	Y	Y	Y	Y
20	XY	Not Installed	Direct Modulation Audio Routing				
21	XY	X	Audio Gate Switch	X	X	X	X
22	XY	Y	Splatter Filter Enable/Bypass	Y	Y	Y	Y
23	Single	Not Installed	Narrow Band gain reduction	Installed	Installed	Installed	Installed
24	XY	Factory	Custom Temperature Compensation Network	Refer to pg.43	Refer to pg.43	Refer to pg.43	Refer to pg.43
25	XY	Not Installed	Wide/Narrow Band switched select	Not installed	Not installed	X	X
26	Single	Not Installed	Auxiliary output routing	Not installed	Not installed	Not installed	Not installed
27	XY	Not Installed	Direct Modulation Input Offset Output				
28	Single	Not Installed	Direct Modulation Input Routing	Not installed	Not installed	Not installed	Not installed
29	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Installed	Installed
30	N/A	N/A	This skipped designator has been deleted				
31	Single	Not Installed	Splatter Filter output routing	Not installed	Not installed	Not installed	Not installed
32	Single	Not Installed	Coupling Capacitor selection	Installed	Installed	Installed	Installed
33	Single	Not Installed	Direct Input Coupling - Auxiliary amplifier	Not installed	Not installed	Not installed	Not installed
34	XY	Not Installed	Audio Routing				
35	XY	Not Installed	Audio Routing	See Note	See Note	See Note	See Note
36	XY	X	AGC Preamp Power select	X	X	X	X
37	Single	Not Installed	Direct Couple (TCXO)	Not installed	Not installed	Not installed	Not installed
38	Single	Installed	Low pass enable	Installed	Installed	Installed	Installed
39	XY	X	Low Frequency amplifier bias select	X	X	X	X
40	N/A	N/A	This skipped designator has been deleted				
41	Single	Not Installed	Narrow Band gain reduction	Not installed	Not installed	Not installed	Not installed
42	XY	Not Installed	Direct Modulation input bias select				
43	Single	Not Installed	Direct Modulation Direct/Cap couple				
44	Single	Not Installed	Coupling Capacitor selection			Installed	Installed
45	Single	Installed	Coupling Capacitor selection (Default)	Installed	Installed	Installed	Installed

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3.3 VR-3 VHF Receiver Module

The following PCB jumpers were set on the VHF receiver module used on the VE7BDY (147.040+) system. (Dec 12, 2022)

Jumper:	Position:	Function:
JU1	Out	Mixer bypass
JU2	In ??	Installed if L3 is not a transformer
JU3	In ??	IF output disconnect (for testing purposes)
JU4	In	Demod input disconnect (for testing purposes)
JU5	Out	AC/DC couple amplified discriminator output
JU6	Out	Subtone filter enable
JU7	Out	Subtone filter power enable
JU8	In	Voice band filter +9.5V power enable
JU9	In	Voice band filter +4.75V power enable
JU10	Out	Unfiltered audio voice band filter input select
JU11	In	Unfiltered flat audio select
JU12	Out	Voice band filtered flat audio select
JU13	Out	De-Emphasized audio voice band filter input select
JU14	Out	De-Emphasized audio select
JU15	In	Voice band filtered De-Emphasized audio input select
JU16	Out	Flat audio high level drive select
JU17	Out	De-Emphasized audio high level drive select
JU18	Out	High Level drive power enable
JU19	Out	Auxiliary Speaker output
JU20	In	Balanced audio, low level de-emphasized audio select
JU21	In	Balanced audio bypass
JU22	Out	Balanced audio, high level drive select
JU23	Out	Balanced audio, low level flat audio select
JU24	In	Unbalanced audio output enable
JU25	Out	Direct Discriminator output enable
JU26	Out	+6.0 Vdc COR pull-up
JU27	Out	+9.5 Vdc COR pull-up
JU28	Out	Opto-isolated COR enable
JU29	Out	Relay COR enable
JU30	In	Noise based squelch select
JU31	Out	Signal strength squelch select
JU32	Out	Squelch override Zener diode bypass
JU33	Out	Mute Zener diode bypass
JU34	In	OS-3 synthesizer mute control enable
JU35	In	High level drive gain select (Narrow Band)
	Out	High level drive gain select (Wide Band)
JU36	In	Fuse Bypass
JU37	In	Amplified discriminator output enable
JU38	Out	LPF discriminator output to discriminator output routing
JU39	Out	+6.0 / +9.5 Vdc Priority COR pull-up select
JU40	In	Squelch override precedence enable

JU41	Out ??	45 Mhz IF Narrow band matching
JU42	Out	Installed for 45 Mhz only
JU43	Out	Squelched discriminator audio ENA
JU44	Out	Squelched discriminator audio ENB

3.4 AMP-2 VHF Power Amplifier

There are no user configuration jumpers

3.5 SM-3 System Monitor

No review of user configuration jumpers has been done.

The +9.5V DC low voltage shutdown occurs at below DC power input voltage going below +8.0 volts and restores when the DC power voltage increases past +11.0 volts. This was not tested. To change this PCB resistors would need to be changed.

WKARC RC210 - Daniels