

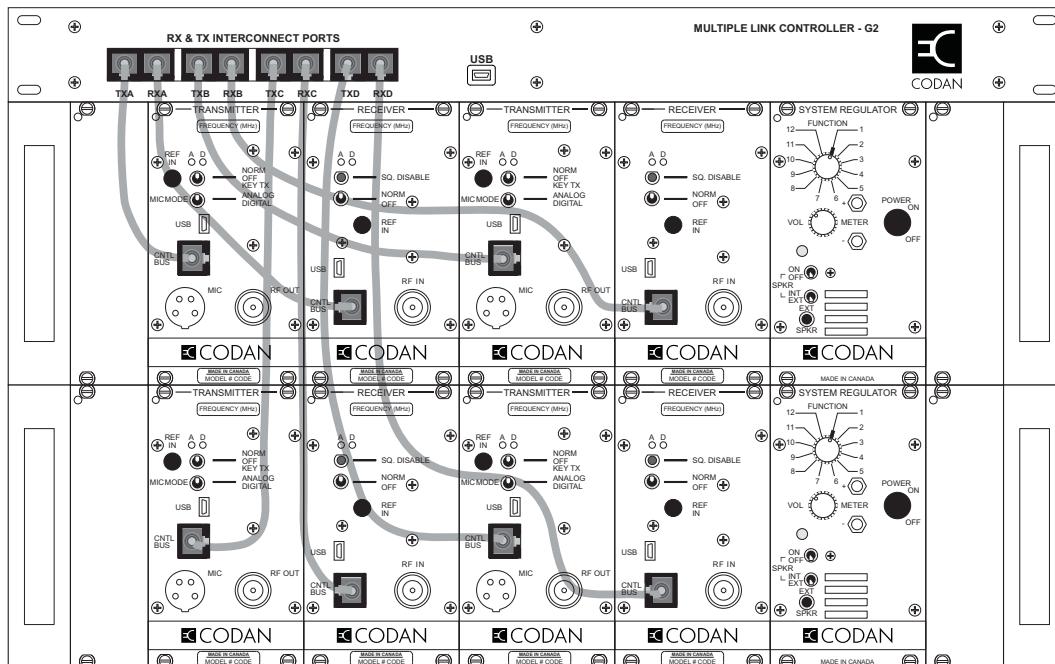


TN652 CI-RC-4M-G2 Multiple Link Controller

The CI-RC-4M-G2 Multiple Link Controller provides control capability for up to four receiver / transmitter pairs in an MT-4E repeater radio system. The CI-RC-4M-G2 controller provides the following features:

- interconnection (LVDS Serial Data routing, COR-PTT routing, Audio routing) of up to four receiver and four transmitter modules in any configuration (repeater, repeater with links, crossband systems, etc.).
- four-way analog audio bridge allowing analog to digital and digital to analog conversions with up to four pairs of radios (with adjustable audio levels).
- multiple CTCSS tones and NAC codes may be selected to operate each connection between receivers and transmitters (up to seven CTCSS/NAC for each link).
- DTMF control of receiver to transmitter links.
- setting of receiver priorities.
- transmitter channel switching based on received CTCSS or NAC.
- auxiliary E&M connection.
- acknowledge tones for each transmitter on DTMF disable / enable.
- custom jumperable Repeat Disable line for controlling analog bridging (links) and E&M connections.
- current draw of 8 mA to 72 mA dependant on system configuration (17 mA to 27 mA without audio bridging).
- 2 independent general purpose outputs that can be controlled by NAC, CTCSS or DTMF (open collector 750 mA / 30 Vdc max).

The MT-4E receiver and transmitter modules all plug into the CI-RC-4M-G2 repeater controller via cables that plug into the RJ45 jacks on the front panel of all the modules. The CI-RC-4M-G2 comes with eight different cable lengths to plug into the eight receiver and transmitter modules. If the system only uses some of the cables, the other cables can be kept for future system expansion or as spare cables. The CI-RC-4M-G2 is 19" rack mountable in 1 RU of rack space.





TN652 CI-RC-4M-G2 Multiple Link Controller

Installation:

In addition to the RJ45 interconnect cables on the front panel, the +9.5 Vdc power and ground must be connected on the back panel. Figure 1 shows a diagram of the back panel of the CI-RC-4M-G2.

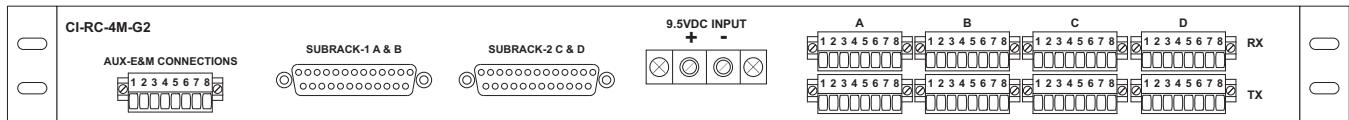


Figure 1: CI-RC-4M-G2 Back Panel

A female DB25 connector on the back of the subrack (J12) can be used for connection to the CI-RC-4M-G2 using a standard straight-through male-to-male DB25 cable. The A-PNL-AUX96-3 auxiliary connector can also be used to connect to the CI-RC-4M-G2, as shown in Figure 2. The information in brackets is the function that uses that particular connection. For example, if you are using CTCSS tones, the Rx Disc O/P must be connected. The diagram only shows connections for Receiver and Transmitter A.

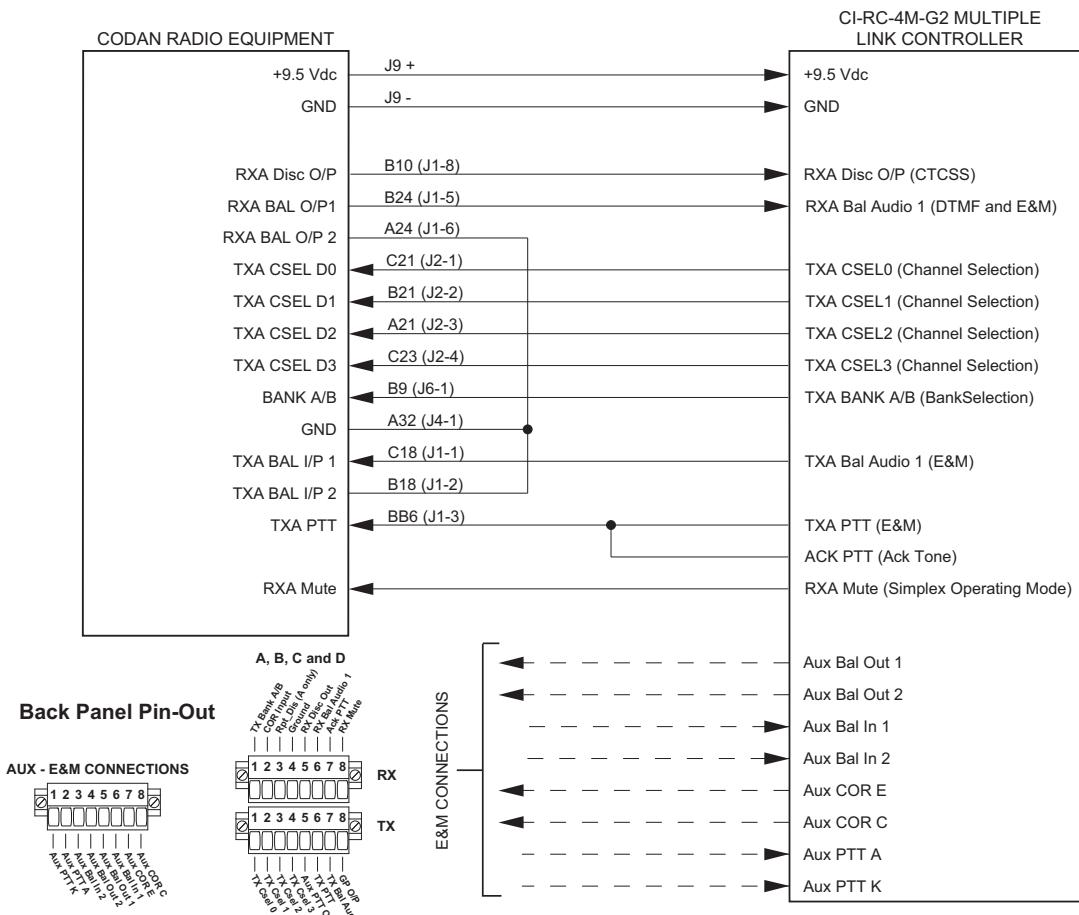


Figure 2: CI-RC-4M-G2 Connection Diagram



TN652 CI-RC-4M-G2 Multiple Link Controller

Multiple Link Controller Programming:

The CI-RC-4M-G2 multiple link controller is software programmable using the MLCS (Multiple Link Controller Software). The MLCS allows flexible programming options for the radio system. A type A to 5 pin mini-type B USB cable is used to connect the USB port of the computer to the USB port on the front panel of the controller. The System Settings and Receiver / Transmitter Links windows are shown in Figure 3.

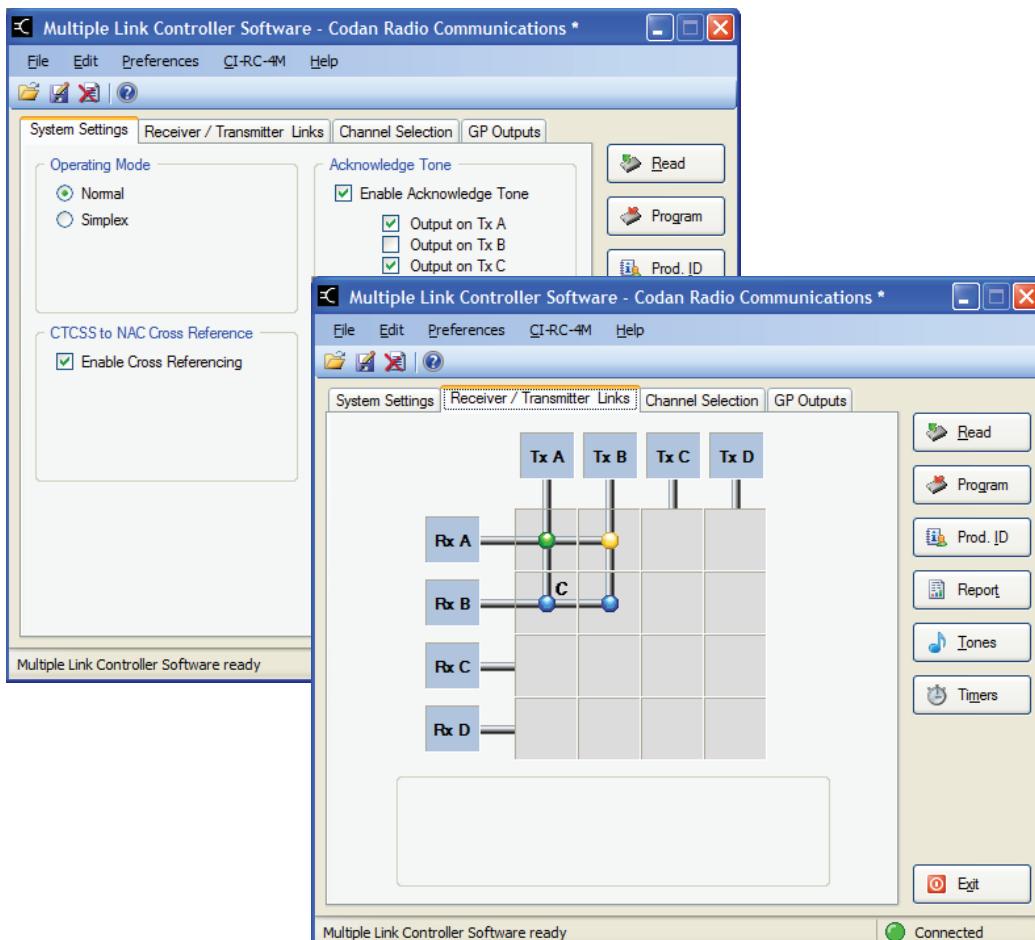


Figure 3: System Settings and Receiver / Transmitter Links

The Receiver / Transmitter Links window allows for a wide variety of complex repeater configurations using a link configuration grid. The grid uses color coding to indicate different connection settings.

TN652 CI-RC-4M-G2 Multiple Link Controller

Each link on the grid can be programmed separately for a different configuration. Three different link configurations are shown in Figure 4: COR Controlled Link, DTMF Controlled Link and a Conditional Link (with both CTCSS and NAC conditions, as well as Channel Selection capability).

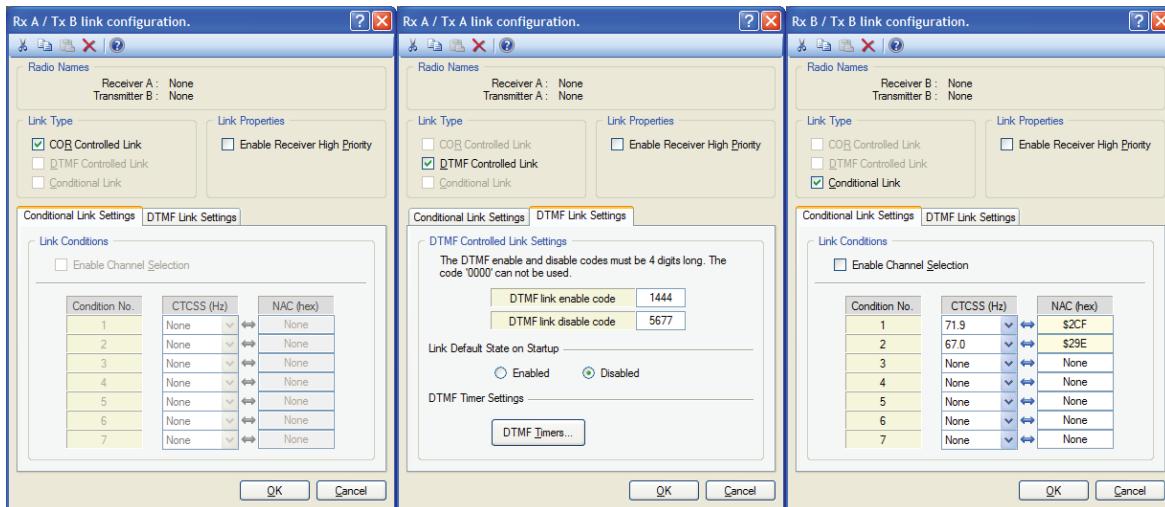


Figure 4: Link Configurations

Figure 5 shows the CTCSS selection window (CTCSS tones need to be selected globally for the CI-RC-4M-G2), Channel Selection window and General Purpose Output window.

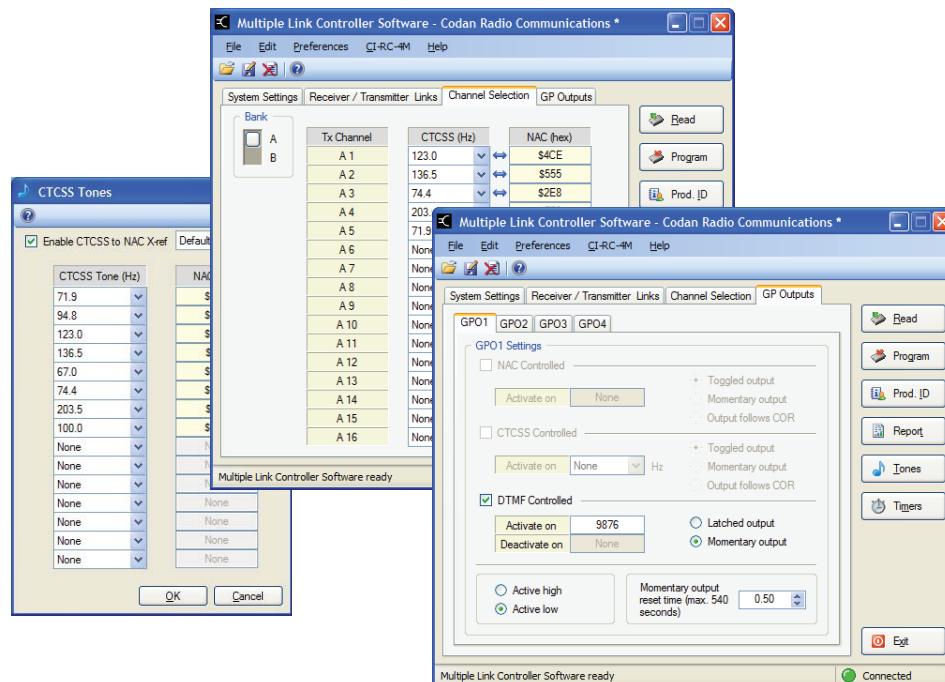


Figure 5: CTCSS Tones, Channel Select and General Purpose Outputs



TN652 CI-RC-4M-G2 Multiple Link Controller

Analog Audio Bridging Circuit:

The CI-RC-4M-G2 controller is equipped with a 4 way analog audio bridge. This audio bridge allows the user to interconnect RF modules using an analog audio interface similar to the AC-3E and BC-4E products. It allows the user to interconnect up to four RF modules modules as well as an auxiliary audio input and output.

On the multi-link controller there is an audio adjustment pot for each audio path available. The block diagram on the next page (see Figure 6) shows the audio routing and audio pot adjustments.

To enable a specific audio path, the appropriate audio jumper must be removed. For the specific audio jumper required for enabling the appropriate audio path, refer to the jumper table below:

JU53	RXA to TXA Audio Disable	JU63	RXC to TXA Audio Disable
JU59	RXA to TXB Audio Disable	JU70	RXC to TXB Audio Disable
JU54	RXA to TXC Audio Disable	JU64	RXC to TXC Audio Disable
JU58	RXA to TXD Audio Disable	JU68	RXC to TXD Audio Disable
JU52	RXB to TXA Audio Disable	JU65	RXD to TXA Audio Disable
JU57	RXB to TXB Audio Disable	JU71	RXD to TXB Audio Disable
JU51	RXB to TXC Audio Disable	JU66	RXD to TXC Audio Disable
JU56	RXB to TXD Audio Disable	JU69	RXD to TXD Audio Disable
JU55	RXA to Aux Audio O/P Disable		
JU50	RXB to Aux Audio O/P Disable		
JU62	RXC to Aux Audio O/P Disable		
JU67	RXD to Aux Audio O/P Disable		

To enable COR-PTT routing of the signal, the following jumpers must be installed:

JU23A	COR A to PTT A Enable	JU25A	COR A to PTT C Enable
JU23B	COR B to PTT A Enable	JU25B	COR B to PTT C Enable
JU23C	COR C to PTT A Enable	JU25C	COR C to PTT C Enable
JU23D	COR D to PTT A Enable	JU25D	COR D to PTT C Enable
JU24A	COR A to PTT B Enable	JU26A	COR A to PTT D Enable
JU24B	COR B to PTT B Enable	JU26B	COR B to PTT D Enable
JU24C	COR C to PTT B Enable	JU26C	COR C to PTT D Enable
JU24D	COR D to PTT B Enable	JU26D	COR D to PTT D Enable



MT-4 Radio Systems

TN652 CI-RC-4M-G2 Multiple Link Controller

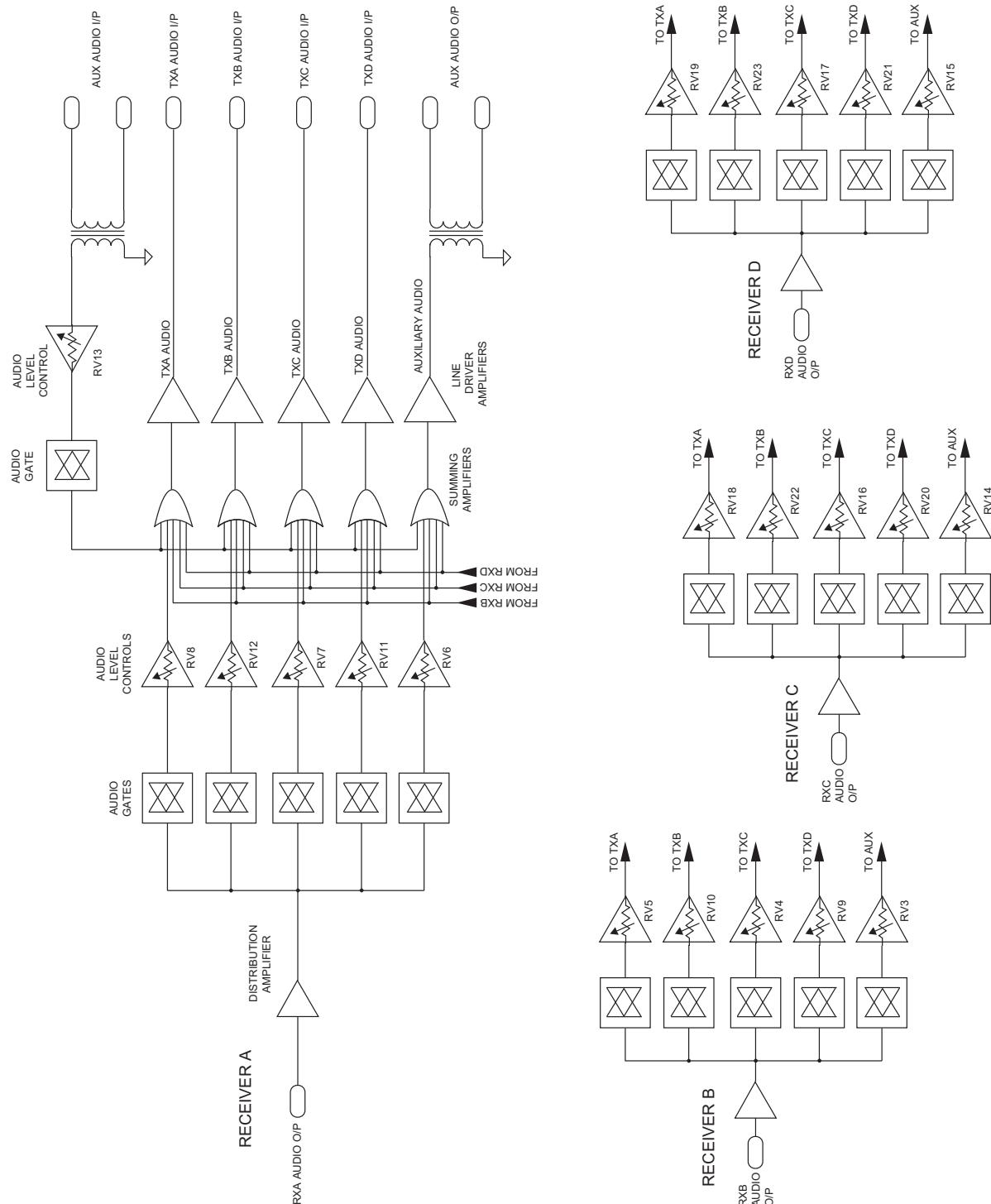


Figure 6: Audio Routing and Audio Pot adjustments



TN652 CI-RC-4M-G2 Multiple Link Controller

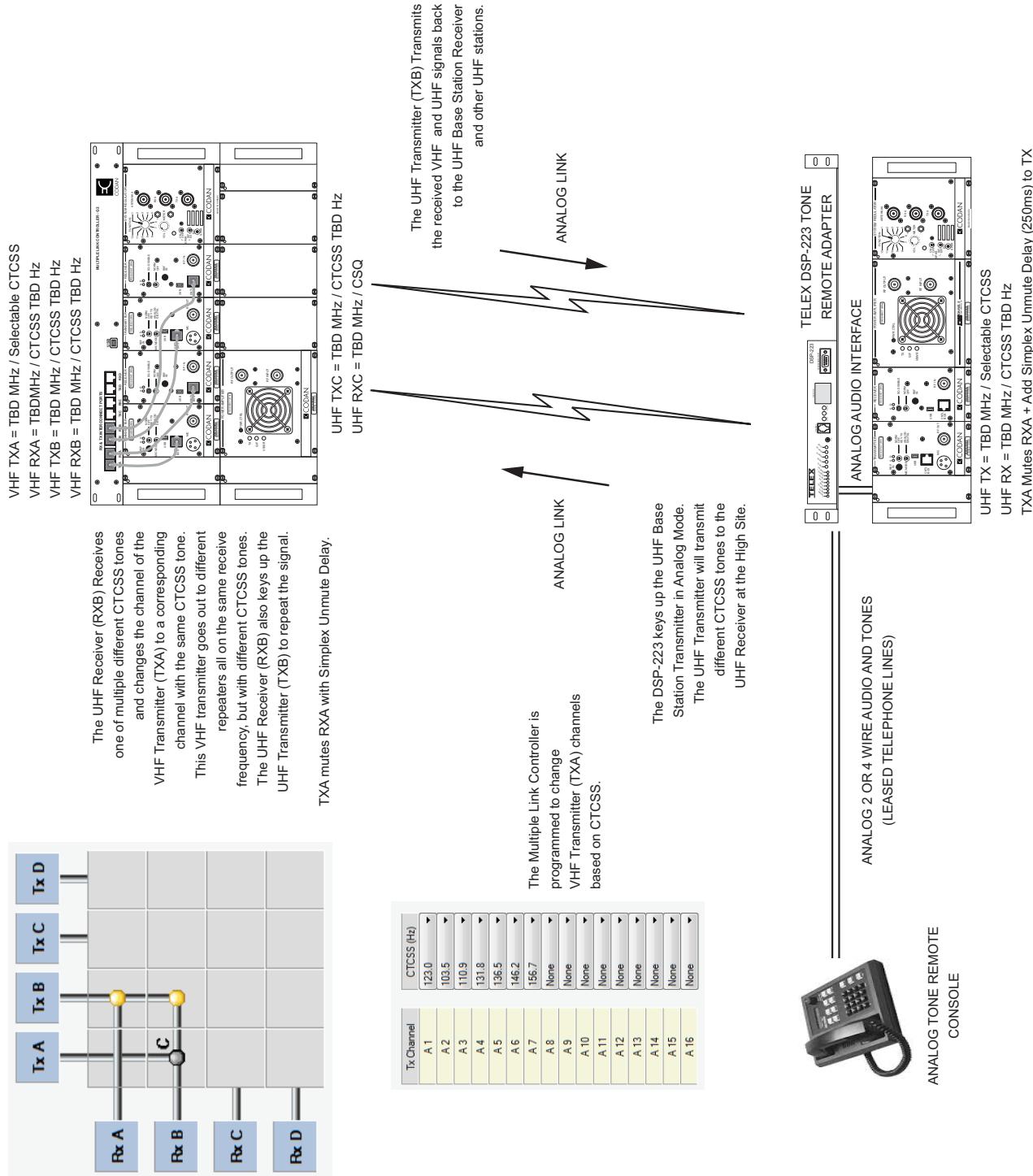
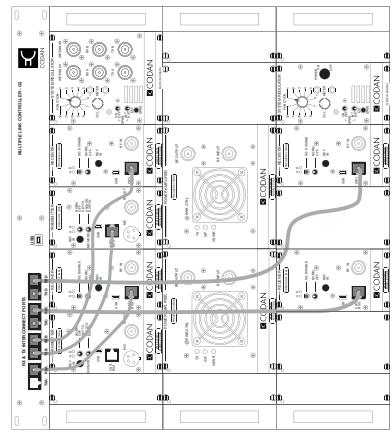


Figure 7: Example Multiple Link Controller System with analog links



TN652 CI-RC-4M-G2 Multiple Link Controller

VHF TXA Ch. 1 = 168.650 MHz / CTCSS 110.9 Hz = Flight Following
 VHF TXA Ch. 2 = 168.625 MHz / CTCSS 110.9 Hz = Air Guard
 VHF TXA Ch. 3 = 168.750 MHz / CTCSS TBD = Air Detect



The UHF Receiver (RXB) needs to be connected via LVDS serial data for the NAC detect and also through the audio routing circuitry in order to allow the P25 Digital to Analog conversion. The UHF Receiver (RXB) de-encodes the P25 Digital signal and outputs audio that is routed to the audio input of the VHF Transmitter (TXB).

Three VHF Receivers receive on Flight Following (RXA), Air Guard (RXC), or Air Detect (RXD) and transmit the Received signal on the UHF Transmitter (TXB).

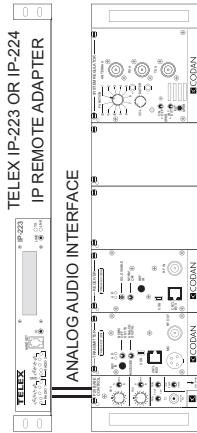
System Settings		Receiver / Transmitter Links		[Channel Selection] [GP Outputs]	
Bank					
		CTCSS (Hz)	NAC (nec)	\$455	
		111.9		\$4CE	
	A	123.0		\$526	
	B	131.8			
		None		None	
		A.4			
		A.5			
		A.6			
		A.7			
		A.8			
		A.9			
		A.10			
		A.11			
		A.12			
		A.13			
		A.14			
		A.15			
		A.16			

The Multiple Link Controller can be programmed to change channels based on CTCSS (for an analog link) or NAC (for a digital link).



TELEX IP BASED CONSOLE

TELEX PROPRIETARY DIGITAL IP INTERFACE



The UHF Transmitter (TXB) Transmits the received VHF signals back to the UHF Base Station Receiver. The Air Guard Receiver (RXC) has High Priority.

ANALOG LINK

P25 DIGITAL LINK

The UHF Receiver (RXB) Receives one of three separate NACs and changes the channel of the VHF Transmitter (TXA) to Air Guard, Flight Following or Air Detect.

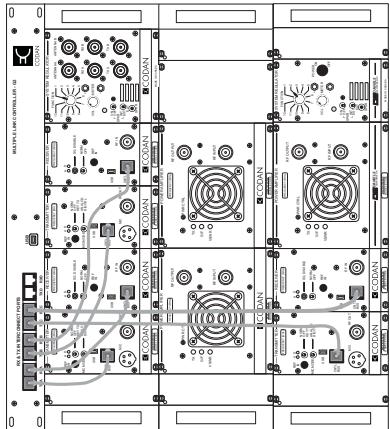
The IP-223 keys up the UHF Base Station Transmitter in Digital Mode. The UHF Transmitter can transmit three different NACs to the UHF Receiver at the High Site.

Figure 8: Example Multiple Link Controller System with P25 Digital uplink



TN652 CI-RC-4M-G2 Multiple Link Controller

VHF TXA = 163.150 MHz / Selectable CTCSS
 VHF RXA = 163.150 MHz / CSQ
 VHF TXB = 169.775 MHz / CTCSS 103.5 Hz
 VHF RXB = 169.775 MHz / CTCSS 103.5 Hz



The VHF Receiver (RXA) keys up the UHF Transmitter (TXC) and when it receives CTCSS tone 7 (151.4 Hz) it will also key up VHF Transmitter (TXB) on CTCSS tone 8 (103.5 Hz) to act as a local repeater.
 The VHF Receiver (RXB) keys up the UHF Transmitter (TXC).
 TXA mutes RXA and RXB both with Simplex Unmute Delay. TXB mutes RXB with Simplex Unmute Delay.

The UHF Receiver (RXC) Receives one of seven separate CTCSS tones and changes the channel of the VHF Transmitter (TXA) to a corresponding channel with the same CTCSS tone. CTCSS tone 8 (103.5 Hz) will key up VHF Transmitter (TXB) on the same CTCSS tone. The UHF Receiver (RXC) also keys up the UHF Transmitter (TXC) to repeat the signal.

CTCSS Tone (Hz)	
F1 = 1950 Hz	> Kirtport
F2 = 1850 Hz	> Gams
F3 = 1750 Hz	> Big Butte
F4 = 1650 Hz	> Taylor
F5 = 1550 Hz	> Sedgewick
F6 = 1450 Hz	> Kelly
F7 = 1350 Hz	> Malad
F8 = 1250 Hz	> Direct

The DSP-223 keys up the UHF Base Station Transmitter in Analog Mode. The UHF Transmitter will transmit eight different CTCSS tones to the UHF Receiver at the High Site.

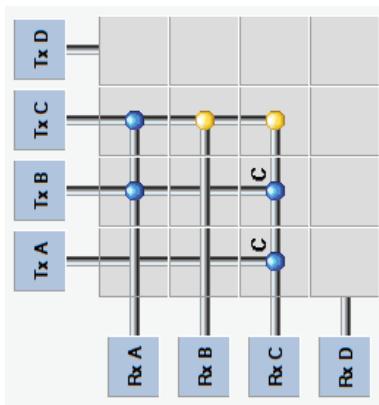
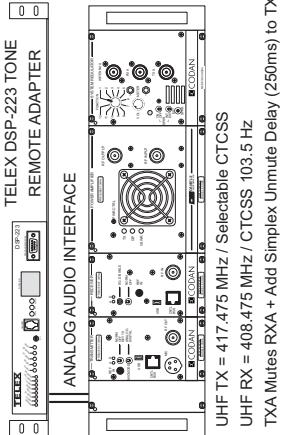
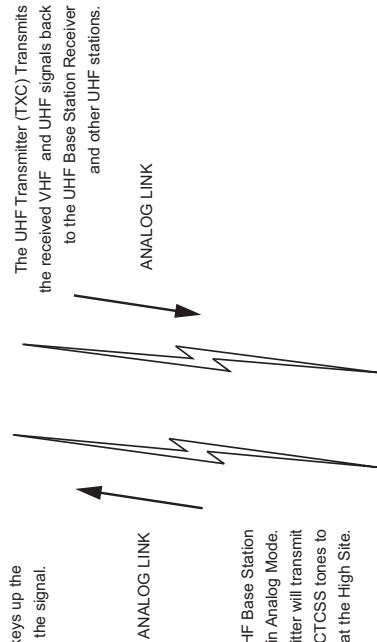


Figure 9: Example Multiple Link Controller System with co-located repeater



TN652 CI-RC-4M-G2 Multiple Link Controller

Multiple Link Controller Conditional Linking and Channel Change Programming:

The Multiple Link Controller can be configured to operate as a Conditional Link. If the Conditional Link is selected the path from Rx to Tx will only be active if the received signal contains one of the programmed CTCSS tones or NACs. Up to 7 CTCSS tones or NACs may be programmed into a Conditional Link.

The Multiple Link Controller can also be programmed to allow for Channel Selection of the transmitter, based on the received CTCSS tone or NAC. To activate the Channel Selection for a link, the link needs to be programmed as follows:

- Open the Rx / Tx Link configuration window for the link required.
- Select the Conditional Link check box.
- Select the Enable Channel Selection check box.
- CTCSS tones / NACs are not required to be programmed into the Rx / Tx Link configuration window. Programming CTCSS tones / NACs in the Rx / TX Link configuration window limits Channel Selection to ONLY these 1 to 7 codes. Leaving these selections as "none" will pass ALL CTCSS tones / NACs to the Channel Selection tab.
- A grey dot with the C (for Channel Selection enabled) will show on the grid (the dot will be blue if CTCSS tones / NACs were programmed into the Conditional Link).
- The CTCSS tones / NACs used to change the channels should be programmed in the Channel Selection tab.

Note that the Multiple Link Controller will ONLY allow up to 15 Channels changed based on CTCSS tones, as it can only allow up to 15 CTCSS tones programmed globally for the entire controller. An unlimited number of NACs can be used for Channel Selection as the NACs are not required to be programmed globally

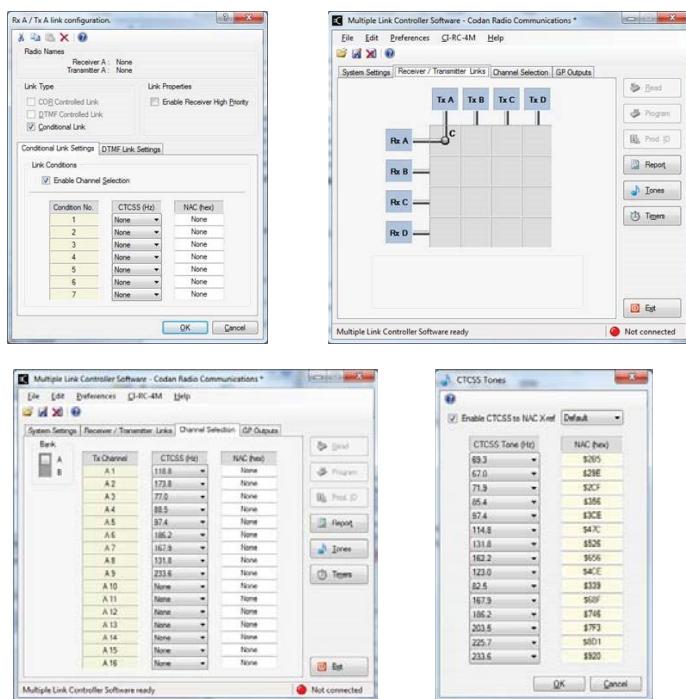


Figure 10: Example Programming for Channel Selection with CTCSS tones / NACs