

LINK COMMUNICATIONS

RLC-6

4 PORT REPEATER LINK CONTROLLER

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THE RLC-6 IS BUILT AROUND CMOS DEVICES
CMOS HANDLING PRECAUTIONS MUST BE CONSIDERED
WHEN HANDLING THE BOARD, BE IN CONTACT
WITH GROUND. HANDLE THE BOARD BY ITS
EDGES, AND DO NOT TOUCH THE INDIVIDUAL
CHIPS WITHOUT BEING DISCHARGED.

Theory of Operation:

The RLC-6 link controller is controlled by your existing repeater controller. 3 logical output lines are required for total board operation. These 3 lines are used to access the 8 modes that the link controller has programmed into it. When selecting the desired mode of operation, an active low signal is applied to the appropriate control lines.

Incoming audio is immediately changed to DC 2.50V above ground. This gives the RLC-6 the ability to pass, without peak clipping, 2.0V peak to peak input and output. Non squelched audio can be used on the board. Audio squelching is accomplished by the CMOS audio gate 4066. When either a valid COR is received, or the link controller chooses to accept the receivers audio, the 4066 passes the audio. When the link controller chooses to disconnect a receiver from the boards operation, its receivers COR will not un-squelch the Incoming audio. All audio enters its transmitters audio bus multiplexor. The transmitters audio bus can be selected to output 6 channels of audio.

Audio channels:

- LINK PORT 0 (MAIN RECEIVER INPUT)
- LINK PORT 1
- LINK PORT 2
- LINK PORT 3
- MIXED AUDIO (0,1,2,3 AUDIO MIXED)
- CW/VOICE AUDIO (EXTERNAL CONTROLLER)
- RECEIVER MUTED
- RECEIVER MUTED

All transmitter audio is selected from the Personality Proms 1 and 2.

Transmitter PTT:

The transmitter PTT outputs are accomplished from the power MOSFET transistors 2N7000. These devices are built to handle 100 mA or current. The RLC-6 provides an active low for the transmitter PTT circuitry. **DO NOT EXCEED THE 100 mA RATINGS OF THE PTT CIRCUIT OTHERWISE PERMANENT DAMAGE MIGHT OCCUR TO THE 2N7000.**

Receiver COR's:

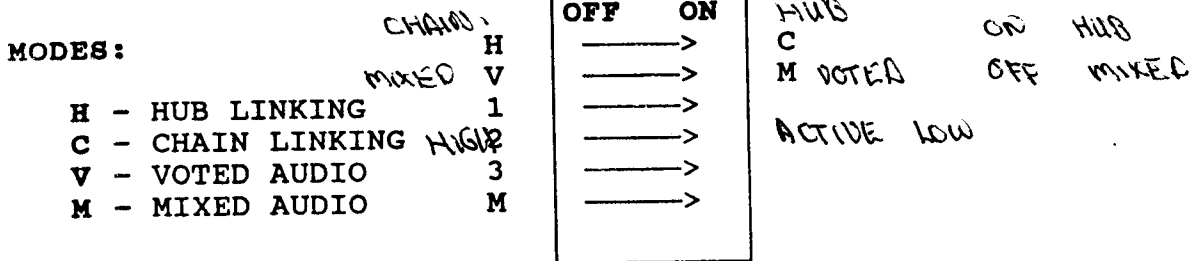
The receiver COR signals are selectable in their "sense". If no receiver is connected to the RLC-6, the appropriate COR switch must be "OFF".

COR Selection

The COR selection of the RLC-6 is accomplished from the COR-MODE SELECT switches. Each receiver is labeled with "M" being the main receivers COR select. When first connecting the receiver to the link controller you must first determine the "sense" or voltage swing of the COR. The voltage must be below 2.0V to be classified as a low going COR. If the COR goes from 0V to 5V when active, you have a high going COR. If the COR goes from 6V to 1V when active, you have a low going COR.

Once you have determined the sense of the Incoming COR, you must select the COR sense on the RLC-6. If you have determined that your COR is HIGH going, then move the COR select switch to the "ON" position. If your COR is LOW going, then move the select switch to the "OFF" position.

OFF IS SWITCH SHORTED



Once you have selected the receivers COR select, no more selection of the COR's is needed. If a receiver is not connected to the controller, then the controller needs the select switch to be in the "OFF" position. A common problem in the initial set-up of the link controller is incorrect selection of the COR sense switch. If your low going voltage does not go below 2V, the link controller will not accept it as a valid COR. A simple way of lowering your COR voltage is by adding external diodes in series with your COR signal. Each diode the COR goes through will lower its voltage by 0.6V. Connect the diode with its cathode (the end with the stripe) towards the link controller.

Mode Select

The two linking modes available on the controller are:

HUB Linking, and CHAIN linking. The mode select switch is switch 1. In the "OFF" position, HUB linking is selected. When the switch is in the "ON" position, CHAIN linking is selected.

LINKING MODES:

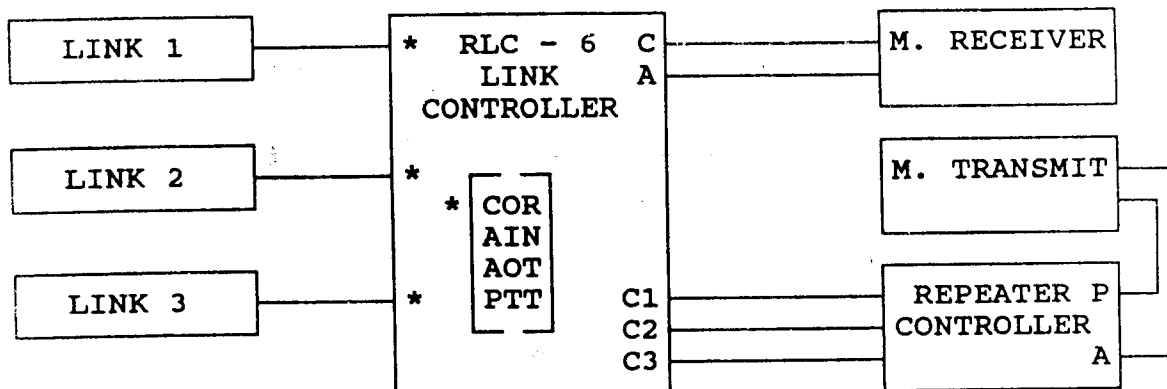
HUB Linking:

When the controller is selected to be in the HUB linking mode, the links can talk to the main repeater port. The PTT of the links is only accomplished from the main receiver COR signal. Link 3, in several modes, is used as a service channel used in monitoring the links. The individual modes of the HUB linking are covered in the MODE section.

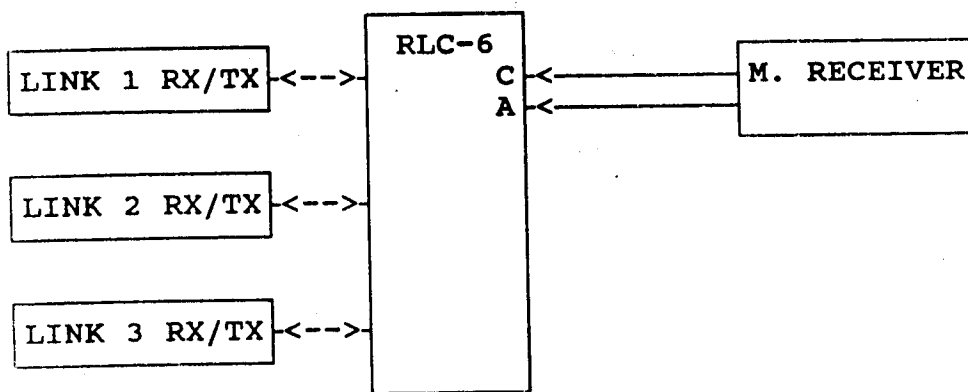
CHAIN Linking:

When the RLC-6 is selected to be in the CHAIN linking mode, the individual links can PTT all other links. This mode is useful when several repeaters want to be linked together. For example, if Link 1 went active, the RLC-6 would PTT Link 2 and route Link 1 audio to Link 2. If while Link 2 is in transmit and Link 2's receiver went active Link 1's transmitter would then go into transmit while its receiver is also active. This style can only be accomplished if full duplex links are attached. The individual modes of the CHAIN linking are covered in the MODE section.

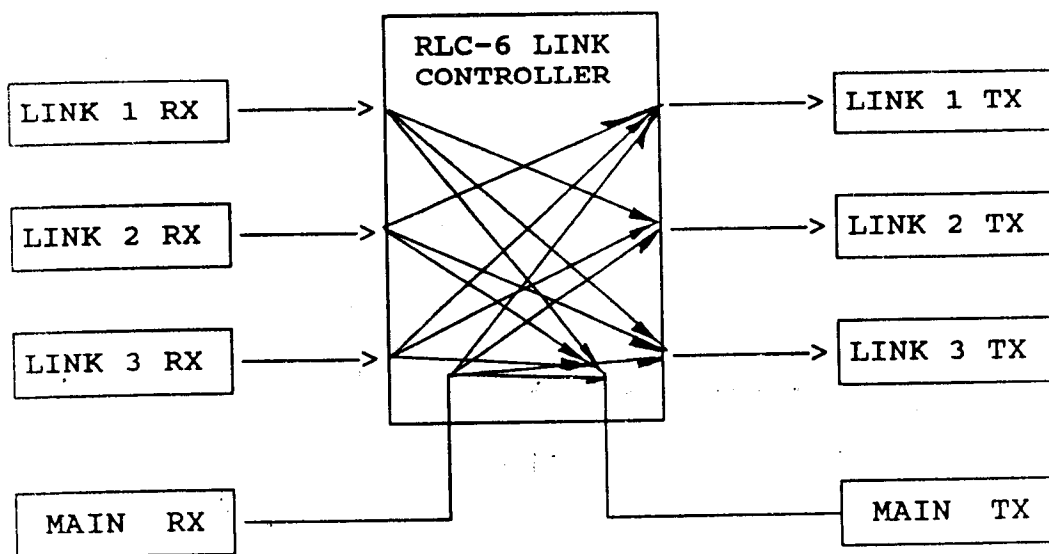
**LINKING DIAGRAMS
SYSTEM BLOCK DIAGRAM**



HUB MODE ISOLATES THE INDIVIDUAL LINKS



CHAIN MODE ALLOWS LINK-LINK COMMUNICATIONS



CONNECTION TO YOUR CONTROLLER

S-COM Users:

The RLC-6 will directly connect to your 5K or 6K controllers. When connecting your controller to the RLC-6 some switch positions need to be adjusted on your S-COM controller.

S-COM COR SENSE ADJUST:

The COR sense that your 5K/6K will need is low going, so set your RX switch to the "OFF" position. The COR sense of the control receiver input is also low going, so select the CT switch to the "OFF" position.

SCOM CONTROL RECEIVER AND PL TONE CONNECTION:

The RLC-6 I/O connector provides then SCOM user the ability to connect an external PL tone decoder. The PL decoder activity signal (active low) is routed directly to the S-COM controller with out any internal connections to the RLC-6. The RLC-6 has 2 PL input lines. PL#1 line, pin 29, is connected to the S-COM main receiver PL input, and PL#2 line, pin 30 is connected to S-COM control receiver PL line on the S-COM 6K. If PL'ed links are required, external PL decoders can be connected to the RLC-6 as the PL'ed links COR input. For the main repeater, the external PL decoder will effect only the S-COM controller, and not the RLC-6. The new S-COM 6K controller will allow the user to also connect a PL tone decoder to the control receiver port. This line is connected to PL#2, pin 30. The control receivers audio input from the RLC-6 is also an external connection. On the RLC-6, audio is mixed from links 1,2,3 and its mixed audio is available on the RLC-6's I/O connector. The mixed audio, if an external control receiver is not connected, can be re-connected to the RLC-6 connector labeled AMXI (audio mix input). This input line is connected directly to the S-COM control receiver input. The control receiver's COR input is also provided on the RLC-6. To keep the main receiver priority access to the S-COM's DTMF decoder, the RLC-6 inverts the main receivers COR and brings that to the external connector. This inverted COR will enable the control receivers COR input, only when the main repeater receiver, link port #0, is inactive, to have access to the DTMF decoder. When the main receiver goes active, the control receiver COR input goes inactive, therefore allowing the main receiver access to the DTMF decoder. If the AMXO is connected to the AMXI pins, then the MCOT(main control receiver cor out) must be connected to the MCIN (main control receiver cor input).

JUMPER 2 CONNECTIONS:

WARNING!!

JP2 is included on the RLC-6 to power the S-COM 6K ONLY. If you are using the S-COM 5K, do not connect this jumper or damage will occur to the RLC-6. This jumper carries +12V and will be connected to the S-COM 5K's ground if connected. Only the S-COM 6K can accommodate this option.

S-COM INPUT LINES:

Link receiver COR's are connected to the S-COM Logical Input lines to allow the user to detect when a receiver (Link 1,2 or 3) is active. These lines are active low when the receiver is active. For detection of receiver active to inactive, set up logical input macros for low - high triggering. (See programming the S-COM for information)

S-COM OUTPUT LINES:

The RLC-6 requires 3 logical output lines for control of the link board. OUT 1,2,3 are used from the S-COM to give the link board its control. These lines are directly connected to the link board when the S-COM is connected. The OUT lines are also brought out to the RLC-6 I/O connector for external system use by the user. When any changes occur to the state's of the logical out lines, the link board will change it's mode to the states of the OUT lines. The lines are active low when in the "ON" state. It is advisable to contain all of the needed commands to control the RLC-6 in macros therefore minimizing the mode change problems that could occur when selecting the different modes. (See programming the S-COM for info.)

S-COM REPEATER TRANSMITTER CONNECTIONS

The RLC-6 connects to your main repeater transmitter through the TXPTT (31) and TXAUD (32) lines. If you experience a zero hang time, no CW audio, and no DTMF muting, then you have connected the RLC-6 incorrectly. The S-COM controller is routed to the TXAUD line for transmitter audio, and TXPTT for transmitter PTT. For zero hang time connection, connect your controller to the AOTM (14), and PTTM (16). This connection bypasses the S-COM controller and patterns your repeater receiver port with linking information included.

ALL CONTROLLER INTERFACING:

Because of the versatility of the RLC-6, connection to any controller can be easy and simple, giving the user total control of the link system. In some applications, the RLC-6 can be connected without the aid of a repeater controller. Without any external control line modifications, the RLC-6 reverts to MODE 0. See the mode definitions section to understand the mode operations.

3 LOGICAL OUTPUT CONTROL LINES:

The RLC-6 requires 3 logical control lines to select the 8 linking Modes of the RLC-6. The lines are active low, and must be either open collector input, or logical level (0-5V). Damage to the controller will occur if the voltages on the control lines exceed 5V. When changing the modes on the RLC-6, care must also be taken to insure that the control lines change in unison. If the lines do not change at the same time, intermediate modes might be selected while the user is selecting their intended mode. The 3 logical control lines are labeled Out 1 pin 17, Out 2 pin 18, and Out 3 pin 19.

For example: The RLC-6 is selected for Mode 0, control lines 0,1,2 are all inactive (5V). The user selects Mode 5, changing control lines 0 and 2 to active (0V). The user changes the status of control line 0, then changes the status of control line 2. When the state of control line 0 goes from inactive to active, the RLC-6 is now in mode 1, therefore transmitting out all 3 links. Now the user changes the state of control line 2, putting the RLC-6 into mode 5. Care must be taken in the mode selections on the link controller.

3 LOGICAL INPUT LINES:

The RLC-6 provides the 3 lines that are connected to Link 1, Link 2, and Link 3 COR signals for metering purposes. These lines can be connected to your controller logical input lines for link activity status. These lines are active low on COR. Applications for these lines include sending special courtesy beeps when a linking port goes from active to inactive. If a special beep is needed for link port 1, send the special beep when logical line 1 (LCOR1 pin 33) goes from a logical 0V to a logical 5V. Link 1 COR is connected to LCOR1 pin 33, Link 2 COR is connected to LCOR2 pin 34, and Link 3 COR is connected to LCOR3 pin 35.

AUDIO IN PRECAUTIONS, ADJUSTMENT:

The maximum audio the RLC-6 can accept without any clipping is 2.2V peak-peak input. The RLC-6 has audio adjusting pots for 5 inputs; Main RX, Link 1, 2, 3 links and the CW/Audio (Mode 7) input. The steps in adjusting the audio level is direct and needs only minimal equipment. It is very important to adjust the audio levels to the same level on the RLC-6 for consistent output deviation. The needed piece of equipment to properly adjust the board is an oscilloscope, true RMS meter, or a service monitor. 5 test points are provided on the RLC-6 to aid in the adjustment of the audio input signals. The test point connector is labeled JP1.

JP1 Pinouts:

1	MAIN RECEIVER	PORT 0
2	LINK RX 1	PORT 1
3	LINK RX 2	PORT 2
4	LINK RX 3	PORT 3
5	CW/VOICE INPUT	
6	SYSTEM GROUND	

Attach your measuring device to pin 1 of JP1. Present the Main Receiver with a known tone, about 1 Khz. and adjust the input level pot (MIN) to 2V peak-peak, or a level that is not into clipping. If no Audio is seen at JP1, then check and see if the Main RX COR is selected. If there is not a valid COR seen by the RLC-6, there will be not audio present at JP1. Once the Main Receiver is adjusted, proceed to adjust the 3 Link receivers in the same manner. It is very important in the adjusting of the audio input levels to keep the levels matched between the 4 receivers. Any differences in the levels will result instabilities in the output deviations when operating the RLC-6. The final input adjustment is the TXIN level. This level is adjusted only after all of the repeater setup is complete. This audio source is usually connected to the main transmitter audio bus. We will cover this adjustment last.

TX AUDIO OUTPUT ADJUSTMENTS:

The audio output adjustments require either a good ear, or a deviation meter. Because all of the input sources are adjusted to the same level, we will use the Main Receiver to adjust all of the output levels. Select MODE 1, control line 3 active (0V), lines 1,2 inactive (5V). This mode will route the Main Receiver to Links 1,2,3 when it goes active. Present your Main Receiver with the DTMF touch tone "1", and connect your deviation meter to your main transmitter. Adjust the MOUT pot for a 3 Khz. deviation level. With the same tone active, adjust links 1,2,3 to the same level. This finishes the audio level adjustments.

TXIN ADJUSTMENT:

Once the RLC-6 is properly adjusted you can now adjust the TXIN level. In order for correct adjustment you need to cause your repeater controller to send a CW/Voice message so the proper level can be set. The TXIN test-point is JP1 pin 5. When the audio message (CW/Voice) is present, adjust the peak voltage monitored to match the levels adjusted earlier in the Audio Input Adjustment section. This level is not a critical in its adjustment because it is only used when selecting Mode 7. This audio can be adjusted to suit your pleasure without affecting the levels of the other links. If there is not enough audio adjustment available on the TXIN pot, replace R60 with a 200K Ω resistor. This will double the gain of the TXIN audio port. Connection to the TXIN audio input is needed if CW or Voice messages are needed to be sent down the linking system, or if applications for USER 1 mode is needed. When USER 1 mode is used, connection to your Main repeater transmitter audio is needed. The TXIN audio contains the telephone audio used to be re-routed to your links. The TXAUD pin is pin 32.

RLC-6 MODE DESCRIPTION:

The logic for mode selection is "negative true" logic. This means that the selection 3 bits, control lines 1,2,3 are read in compliment.

MODE	CONTROL LINES		
	1	2	3
0	H	H	H
1	H	H	L
2	H	L	H
3	H	L	L
4	L	H	H
5	L	H	L
6	L	L	H
7	L	L	L

TERMS:

H - High Voltage, or an open pin
L - Low Voltage, or a grounded pin

The RLC-6 internally pulls up the 3 logical control lines with a 10K resistor. Therefore it is not required for the user to connect any unused lines to +5 V. In order to take a control line low, the user must apply a ground, or a logical "LOW" to the needed pin.

USER 1 Mode:

USER 1 Mode off - H pin 26
USER 1 Mode on - L

When USER 1 Mode is selected it ignores the status of the 3 logical control lines, Hub/Chain linking mode switches, and Voted/Mixed audio.

RLC-6 LINKING MODE DESCRIPTION:

Logical Operations Look-up Chart:

Because of the complexity of a 4 port linking system, a chart has been attached to allow visual look-up of the linking modes used. To use the chart, locate the style of linking needed (Hub or Chain linking). The receiver sources are located on the vertical axis, while the transmitter PTT and audio sources are on the horizontal axis. Just follow the receiver port selected, and the status of the 4 transmitter ports will be seen along with the audio that port will contain. Because the RLC-6 handles full duplex links, more than 1 receiver can be active at a time. This can also be seen on the look-up table.

Link Logical Operation Look-up Chart Chain Linking Mode:

CHAIN°	L1TX	L2TX	L3TX	MTX	AL1	AL2	AL3	AMN	MODE	DESCRIPTION
MODE0 LINKS DISCONNECTED FROM MAIN PORT									Main receiver port disconnected from the linking system ports. The Linking ports are cross connected to each other in full/half duplex mode.	
L1COR	-	X	X	-	-	L1	L1	-		
L2COR	X	-	X	-	L2	-	L2	-		
L3COR	X	X	-	-	L3	L3	MX	-		
MNCOR	-	-	-	X	-	-	-	MN		
MODE1 LINKS CONNECTED TO MAIN PORT									Main receiver port connected to the linking ports Linking system connected to Main ports and cross connected to each other in full or half duplex mode.	
L1COR	-	X	X	X	-	L1	L1	L1		
L2COR	X	-	X	X	L2	-	L2	L2		
L3COR	X	X	-	X	L3	L3	MX	L3		
MNCOR	X	X	X	X	MN	MN	MN	V/M		
MODE2 MAIN PORT MONITORS LINK PORTS									Main receiver port monitors all link ports but will not cause a PTT condition. The link PTT connect system is broken. Link 3 monitors all link ports.	
L1COR	-	-	X	X	-	-	-	L1		
L2COR	-	-	X	X	-	-	-	L2		
L3COR	-	-	-	X	-	-	MX	L3		
MNCOR	-	-	X	X	-	-	-	V/M		
MODE3 MAIN PORT MONITORS LINK PORTS									Main receiver port monitors all link ports but will not cause a PTT condition. Linking ports are cross connected to each other in full/half duplex.	
L1COR	-	X	X	X	-	L1	L1	L1		
L2COR	X	-	X	X	L2	-	L2	L2		
L3COR	X	X	-	X	L3	L3	-	L3		
MNCOR	-	-	-	X	-	-	-	V/M		
AUDIO SOURCE DESCRIPTION:										
MX - ACTIVE RECEIVER MIXED AUDIO										
MN - MAIN RECEIVER PORT AUDIO										
L1 - LINK 1 RECEIVER PORT AUDIO										
L2 - LINK 2 RECEIVER PORT AUDIO										
L3 - LINK 3 RECEIVER PORT AUDIO										
EX - EXTERNAL TX AUDIO IN/SCOM TX AUDIO										
VM - SWITCH SELECTS VOTED OR MIXED AUDIO ON MAIN RX PORT										

Link Logical Operation Look-up Chart Chain Linking Mode:

CHAIN	L1TX	L2TX	L3TX	MTX	AL1	AL2	AL3	AMN	MODE	DESCRIPTION
MODE4 LINKS DISCONNECTED FROM MAIN PORT									Main receiver connected to link system. Link #1 port disconnected from link system. Activity on links 2,3 causes activity on main port.	
L1COR	-	-	-	-	-	-	-	-		
L2COR	-	-	X	X	-	-	L2	L2		
L3COR	-	X	-	X	-	L3	-	L3		
MNCOR	-	-	-	X	-	MN	MN	V/M		
MODE5 LINKS CONNECTED TO MAIN PORT									Main receiver connected to link system. Link #2 port disconnected from link system. Activity on links 1,3 causes activity on main port.	
L1COR	-	-	X	X	-	-	L1	L1		
L2COR	-	-	-	-	-	-	-	-		
L3COR	X	-	-	X	L3	-	-	L3		
MNCOR	X	-	X	X	MN	-	MN	V/M		
MODE6 MAIN PORT MONITORS LINK PORTS									Main receiver connected to link system. Link #3 port disconnected from link system. Activity on links 1,2 causes activity on main port.	
L1COR	-	X	-	X	-	L1	L1	L1		
L2COR	X	-	-	X	L2	-	L2	L2		
L3COR	-	-	-	-	-	-	-	-		
MNCOR	X	X	-	X	MN	MN	-	V/M		
MODE7 MAIN PORT MONITORS LINK PORTS									Main receiver connected to main port only. External audio routed to L 1,2,3 TX, PTT of L 1,2,3 keyed while in MODE 7. Used to ID. link ports only.	
L1COR	X	X	X	-	EX	EX	EX	-		
L2COR	X	X	X	-	EX	EX	EX	-		
L3COR	X	X	X	-	EX	EX	EX	-		
MNCOR	-	-	-	X	EX	EX	EX	MN		
AUDIO SOURCE DESCRIPTION:										
MX - ACTIVE RECEIVER MIXED AUDIO										
MN - MAIN RECEIVER PORT AUDIO										
L1 - LINK 1 RECEIVER PORT AUDIO										
L2 - LINK 2 RECEIVER PORT AUDIO										
L3 - LINK 3 RECEIVER PORT AUDIO										
EX - EXTERNAL TX AUDIO IN/SCOM TX AUDIO										
VM - SWITCH SELECTS VOTED OR MIXED AUDIO ON MAIN RX PORT										

Link Logical Operation Look-up Chart Hub Linking Mode:

HUB	L1TX	L2TX	L3TX	MTX	AL1	AL2	AL3	AMN	MODE	DESCRIPTION
MODE0	LINKS DISCONNECTED FROM MAIN PORT								Main receiver port disconnected from the linking system ports. The Linking ports set to receive only, Link system PTT disable.	
L1COR	-	-	-	-	-	-	-	-		
L2COR	-	-	-	-	-	-	-	-		
L3COR	-	-	-	-	-	-	-	-		
MNCOR	-	-	-	X	-	-	-	MN		
MODE1	LINKS CONNECTED TO MAIN PORT								Main receiver port connected to the linking ports Linking system connected to Main ports and cross connected only to Link port 3.	
L1COR	-	-	X	X	-	-	MX	L1		
L2COR	-	-	X	X	-	-	MX	L2		
L3COR	-	-	-	X	-	-	MX	L3		
MNCOR	X	X	X	X	MN	MN	MX	V/M		
MODE2	MAIN PORT MONITORS LINK PORTS								Main receiver port monitors all link ports but will not cause a PTT condition. The link PTT connect system is broken. Link 3 monitors all link ports.	
L1COR	-	-	X	X	-	-	-	L1		
L2COR	-	-	X	X	-	-	-	L2		
L3COR	-	-	-	X	-	-	MX	L3		
MNCOR	-	-	X	X	-	-	-	V/M		
MODE3	MAIN PORT MONITORS LINK PORTS								Main receiver connected to link system. Link #1 port disconnected from link system. Activity on links 2,3 causes activity on main port.	
L1COR	-	-	-	-	-	-	-	-		
L2COR	-	-	X	X	-	-	MX	L2		
L3COR	-	-	-	X	-	-	MX	L3		
MNCOR	-	X	X	X	-	MN	MX	V/M		
AUDIO SOURCE DESCRIPTION:										
MX - ACTIVE RECEIVER MIXED AUDIO										
MN - MAIN RECEIVER PORT AUDIO										
L1 - LINK 1 RECEIVER PORT AUDIO										
L2 - LINK 2 RECEIVER PORT AUDIO										
L3 - LINK 3 RECEIVER PORT AUDIO										
EX - EXTERNAL TX AUDIO IN/SCOM TX AUDIO										
VM - SWITCH SELECTS VOTED OR MIXED AUDIO ON MAIN RX PORT										

Link Logical Operation Look-up Chart Hub Linking Mode:

HUB	L1TX	L2TX	L3TX	MTX	AL1	AL2	AL3	AMN	MODE	DESCRIPTION
MODE4	LINKS DISCONNECTED FROM MAIN PORT									Main receiver connected to link system. Link #2 port disconnected from link system. Activity on links 1,3 causes activity on main port.
L1COR	-	-	-	X	-	-	MX	L1		
L2COR	-	-	-	-	-	-	-	-		
L3COR	-	-	-	X	-	-	MX	L3		
MNCOR	X	-	X	X	MN	-	MN	V/M		
MODE5	LINKS CONNECTED TO MAIN PORT									Main receiver connected to link system. Link #3 port disconnected from link system. Activity on links 1,2 causes activity on main port.
L1COR	-	-	-	X	-	-	-	L1		
L2COR	-	-	-	X	-	-	-	L2		
L3COR	-	-	-	-	-	-	-	-		
MNCOR	X	X	-	X	MN	MN	-	V/M		
MODE6	MAIN PORT MONITORS LINK PORTS									Main receiver connected to link 3 only. Link #3 port connected to main port only. Activity on links 1,2 causes no activity on link system.
L1COR	-	-	-	-	-	-	-	-		
L2COR	-	-	-	-	-	-	-	-		
L3COR	-	-	-	X	-	-	-	L3		
MNCOR	-	-	X	X	-	-	MN	V/M		
MODE7	MAIN PORT MONITORS LINK PORTS									Main receiver connected to main port only. External audio routed to L 1,2,3 TX, PTT of L 1,2,3 keyed while in MODE 7. Used to ID. link ports only.
L1COR	X	X	X	-	EX	EX	EX	-		
L2COR	X	X	X	-	EX	EX	EX	-		
L3COR	X	X	X	-	EX	EX	EX	-		
MNCOR	-	-	-	X	EX	EX	EX	MN		
AUDIO SOURCE DESCRIPTION:										
MX - ACTIVE RECEIVER MIXED AUDIO										
MN - MAIN RECEIVER PORT AUDIO										
L1 - LINK 1 RECEIVER PORT AUDIO										
L2 - LINK 2 RECEIVER PORT AUDIO										
L3 - LINK 3 RECEIVER PORT AUDIO										
EX - EXTERNAL TX AUDIO IN/SCOM TX AUDIO										
VM - SWITCH SELECTS VOTED OR MIXED AUDIO ON MAIN RX PORT										

Special Link Mode:

User line #1 Mode has been added to aid the repeater users who have an autopatch on the main repeater controller. When User line #1 is pulled low, the RLC-6 will configure itself to allow link system access to the repeater controllers autopatch, or special features available on the repeater controller. This mode requires that the links connected to the RLC-6 are full duplex links. The new mode works like this:

SPCL	L1TX	L2TX	L3TX	MTX	AL1	AL2	AL3	AMN	MODE	DESCRIPTION
USER1	REPEATER TX CONNECTED TO LINKS									Main receiver connected to main port only. External audio routed to L 1,2,3 TX, PTT of L 1,2,3 keyed while in MODE 7. Used to ID. link ports only.
L1COR	X	X	X	X	EX	EX	EX	L1		
L2COR	X	X	X	X	EX	EX	EX	L2		
L3COR	X	X	X	X	EX	EX	EX	L3		
MNCOR	X	X	X	X	EX	EX	EX	MN		
EX - EXTERNAL TX AUDIO IN/SCOM TX AUDIO										

When a special function is needed (ie Autopatch or Special linking features offered on your main repeater controller), pull User line #1 low. The RLC-6 will key up the link transmitters while in this mode, and route the main controllers transmitter audio to the links. When receiver activity on any of the ports (Main, Link 1, Link 2, Link 3) is present, audio from those receivers is routed to the main link port audio out. This allows the special functions audio to be routed to the links, but the links also have access to those special functions. Applications vary on different controllers.

TROUBLESHOOTING THE RLC-6

NO PTT ON MAIN RECEIVER PORT

- Make sure COR voltage on Main Receiver is connected
- Does COR voltage go above 2.5V or below 2.0V
- Is the COR sense switch in the right position
- Is your repeater controller set for low going COR
- Does your main transmitter accept low (gnd) PTT
- Is your transmitter plugged in
- Check Q1 for a low on Main RX COR (Drain)

NO PTT ON THE LINK TRANSMITTERS

- Check the selected MODE to see is transmitter enabled
- Does COR voltage go above 2.5V or below 2.0V
- Is the COR sense switch in the right position
- Does your link transmitter accept low (gnd) PTT
- Is your transmitter plugged in
- Check Q2 or Q3 or Q4 for a low on Link RX COR (Drain)
- Are you in Hub linking when you should be in Chain

PTT BUT NO AUDIO ON THE TRANSMITTERS

- If there is not an active COR, there will be no audio
Refer to the COR adjustment section.
- Is there audio present on JP1 (see Audio Adjustment)
- Are the Audio out adjustments turned up
- Are the Receivers connected to the RLC-6
- Is the audio connected to the Transmitter
- If the audio level is too high, the deviation may
be wider than your receiver can handle.
- Is the Audio out impedance strapped correctly

NO CONTROL OVER THE RLC-6 MODES, OR THE MODES ARE DIFFERENT

- Are the 3 control lines connected
- Do the lines go to ground (Low) when active
- Are the lines connected in the correct order
- Do the control lines, when inactive, go above 5V
- Has the contents of the EPROM's been changed
- Are you selecting the correct modes with your
control lines (See RLC-6 Mode description)

AUDIO OUTPUT DEVIATION CHANGES WHEN CHANGING RECEIVERS

- Was the audio input levels adjusted correctly
(See Audio input adjustment section)
- Are any of the transmitters loading down the board
is the output impedance below 600Ω
- Has any of the receivers audio been increased since
the initial audio input adjustments
- Is any other audio source connected to the same audio
output, transmitter input line

S-COM PROGRAMMING HINTS

In order for correct operation of the RLC-6, a good understanding of the S-COM programming and Macros is required. The general software structure applies to all controllers.

The control of the RLC-6 by the 3 logical control lines. These lines need to be engaged at or about the same time. A macro should be written that contains the 8 mode selections. These 8 macros can then be called from separate macros for the needed operation. Listed will be the 8 command macros that are can be programmed to select the needed mode. A short example will be provided to show how to apply mode 7 for CW identification.

TURN ON A SELECTED MODE

COMMAND: P 71 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 71 2 *
P 71 3 *
SELECTS MODE 0 OF THE CONTROLLER
control lines 1,2,3 inactive

COMMAND: P 71 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 71 2 *
P 70 3 *
SELECTS MODE 1 OF THE CONTROLLER
control lines 1,2 inactive, 3 active

COMMAND: P 71 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 70 2 *
P 71 3 *
SELECTS MODE 2 OF THE CONTROLLER
control lines 1,3 inactive, 2 active

COMMAND: P 71 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 70 2 *
P 70 3 *
SELECTS MODE 3 OF THE CONTROLLER
control lines 2,3 active, 1 inactive

COMMAND: P 70 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 71 2 *
P 71 3 *
SELECTS MODE 4 OF THE CONTROLLER
control lines 2,3 inactive, 1 active

COMMAND: P 70 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 71 2 *
P 70 3 *

SELECTS MODE 5 OF THE CONTROLLER
control lines 1,3 active, 2 inactive

COMMAND: P 70 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 70 2 *
P 71 3 *

SELECTS MODE 6 OF THE CONTROLLER
control lines 1,2 active, 3 inactive

COMMAND: P 70 1 * THIS PROGRAM SHOULD BE IN ITS OWN MACRO
P 70 2 *
P 70 3 *

SELECTS MODE 7 OF THE CONTROLLER
control lines 1,2,3 active

SEND CW PROTOCOL DOWN LINKS

EXAMPLE: USER CALL RLC-6 AND ACCESS MODE 1

The steps needed in the CW sending on the RLC-6 :

- SELECT MODE 7
- SEND CW ROUTINE
- SELECT MODE 1

Macros that would be executed:

```
{ P 70 1 * ;  
P 70 2 * ; SELECTS MODE 7, CW ID MODE  
P 70 3 * } ;  
  
{ P 15 "MESSAGE" * } ; SENDS A CW MESSAGE  
  
{ P 71 1 * ;  
P 71 2 * ; SELECTS MODE 1  
P 70 3 * } ;
```

This program example would call 3 macros from 1 central macro. The central macro would actually call the 3 command macros used; Select Mode 7, Send a CW message, Select Mode 1. This centralized calling allows a minimum of program space used. If you generate a generic "ON" CW message and a generic "OFF" CW message, then you would have a total of 10 macros spaces used; 8 for the mode select, and 2 for the actual messages. Your macros programmed to call these 10 control macros will then become easy to understand and easy to program. This is just one approach to the programming used to control your RLC-6.

Example: S-COM 6K LINK ENABLE

This example will allow the user to bring the links on line and the S-COM 6K will tell the user that some action has occurred.

I will call the Macro 0150 '*' This is the Main Macro

```
0150
    0207          ; call Macro 0207 Mode 7
    0208          ; call Macro 0210 CW Link On Message
    0201          ; call Macro 0201 Mode 1
    0210          ; call Macro 0210 Drop-out Message on
    0212          ; call Macro 0212 Link courtesy beep on
```

Sub-Macros:

```
0207
    -P- 70 1
    -P- 70 2
    -P- 70 3 *
(Selects Mode 7, Turning output lines 1,2,3 on 'Low')
```

```
0208
    -P- 15 21 18 23 20 40 24 23 *
    -P- 98 04 *
(Sends CW Message LINK ON and Delays 4 Seconds)
```

```
0201
    -P- 71 1
    -P- 71 2
    -P- 70 3 *
(Selects Mode 1, Turning output lines 1,2 off and 3 on)
```

```
0210
    -P- 34 21 *
(Adds dropout message 'L' to indicate links enabled)
```

```
0212
    -P- 2621 0215
    -P- 2623 0216
    -P- 2625 0217
(Allows Links to send a Courtesy Beep indicating activity)
```

```
0215    -P- 15 14 *    (Sends CW Message 'E' for Link 1)
0216    -P- 15 18 *    (Sends CW Message 'I' for Link 2)
0217    -P- 15 28 *    (Sends CW Message 'S' for Link 3)
```

This example selects Link Mode 7, and sends out A CW Message indicating activity. Also appends the dropout message to tell the users the the links are active; also sends a single beep when link 1 goes from active to inactive, double beep when link 2 goes from active to inactive, and a triple beep when link 3 goes from active to inactive. 23

Cont...

This example will allow the user to turn off the links and the S-COM 5K will tell the user that some action has occurred.

I will call the Macro 0151 '*' This is the Main Macro

```
0151
    0207          ; call Macro 0207 Mode 7
    0209          ; call Macro 0210 CW Link Off Message
    0200          ; call Macro 0201 Mode 0
    0211          ; call Macro 0210 Drop-out Message off
    0213          ; call Macro 0211 Link courtesy beep off
```

Sub-Macros:

```
0207
    -P- 70 1
    -P- 70 2
    -P- 70 3 *
(Selects Mode 7, Turning output lines 1,2,3 on 'Low')
```

```
0209
    -P- 15 21 18 23 20 40 24 15 15 *
    -P- 98 06 *
(Sends CW Message LINK OFF and Delays 6 Seconds)
```

```
0200
    -P- 71 1
    -P- 71 2
    -P- 71 3 *
(Selects Mode 1, Turning output lines 1,2,3 off)
```

```
0211
    -P- 34 14 *
(Adds dropout message 'E' to indicate links disabled)
```

```
0213
    -P- 2607 *
    -P- 2609 *
    -P- 2611 *
(Clear special courtesy beeps for the links)
```

This example selects Link Mode 7, and sends out A CW Message indicating activity. Also appends the dropout message to tell the users the the links are inactive..

This Example is designed for the S-COM 5K controller. This is just 1 easy way to program your controller to efficiently use the S-COM Macro structure to control you links.

Example:S-COM 6K LINK ENABLE

This example will allow the user to bring the links on line and the S-COM 6K will tell the user that some action has occurred.

I will call the Macro 0150 '*' This is the Main Macro

```
0150
    0207          ; call Macro 0207 Mode 7
    0208          ; call Macro 0210 CW Link On Message
    0201          ; call Macro 0201 Mode 1
    0210          ; call Macro 0210 Drop-out Message on
    0212          ; call Macro 0212 Link courtesy beep on
```

Sub-Macros:

```
0207
    -P- 70 1
    -P- 70 2
    -P- 70 3 *
(Selects Mode 7, Turning output lines 1,2,3 on 'Low')
```

```
0208
    -P- 15 21 18 23 20 40 24 23 *
    -P- 98 04 *
(Sends CW Message LINK ON and Delays 4 Seconds)
```

```
0201
    -P- 71 1
    -P- 71 2
    -P- 70 3 *
(Selects Mode 1, Turning output lines 1,2 off and 3 on)
```

```
0210
    -P- 34 21 *
(Adds dropout message 'L' to indicate links enabled)
```

```
0212
    -P- 2621 0215
    -P- 2623 0216
    -P- 2625 0217
(Allows Links to send a Courtesy Beep indicating activity)
```

```
0215    -P- 15 14 *    (Sends CW Message 'E' for Link 1)
0216    -P- 15 18 *    (Sends CW Message 'I' for Link 2)
0217    -P- 15 28 *    (Sends CW Message 'S' for Link 3)
```

This example selects Link Mode 7, and sends out A CW Message indicating activity. Also appends the dropout message to tell the users the the links are active; also sends a single beep when link 1 goes from active to inactive, double beep when link 2 goes from active to inactive, and a triple beep when link 3 goes from active to inactive.

Cont...

This example will allow the user to turn off the links and the S-COM 6K will tell the user that some action has occurred.

I will call the Macro 0151 '*' This is the Main Macro

```
0151
    0207          ; call Macro 0207 Mode 7
    0209          ; call Macro 0210 CW Link Off Message
    0200          ; call Macro 0201 Mode 0
    0211          ; call Macro 0210 Drop-out Message off
    0213          ; call Macro 0211 Link courtesy beep off
```

Sub-Macros:

```
0207
    -P- 70 1
    -P- 70 2
    -P- 70 3 *
(Selects Mode 7, Turning output lines 1,2,3 on 'Low')
```

```
0209
    -P- 15 21 18 23 20 40 24 15 15 *
    -P- 98 06 *
(Sends CW Message LINK OFF and Delays 6 Seconds)
```

```
0200
    -P- 71 1
    -P- 71 2
    -P- 71 3 *
(Selects Mode 1, Turning output lines 1,2,3 off)
```

```
0211
    -P- 34 14 *
(Adds dropout message 'E' to indicate links disabled)
```

```
0213
    -P- 2621 *
    -P- 2623 *
    -P- 2625 *
(Clear special courtesy beeps for the links)
```

This example selects Link Mode 7, and sends out A CW Message indicating activity. Also appends the dropout message to tell the users the the links are inactive.

This Example is designed for the S-COM 6K controller. This is just 1 easy way to program your controller to efficiently use the S-COM Macro structure to control you links.

Special Mode User 1 Applications:

User Mode 1 special mode is to allow the links to have access to the repeater in cases where repeater functions like autopatch, special linking options, and features available by the main receiver only. The way to access special Mode User 1 (pin 26) is to pull low (0V). The RLC-6 will re-configure itself and will ignore the states of the user control lines (pin 17,18,19), the linking mode selection switch, and the audio selection switch.

Applications:

- A linking port accesses the repeater autopatch:

Tie the 'BUSY' line of the autopatch controller to User Line 1. When this line goes low, the RLC-6 will key up link ports 1,2,3. Audio from TXAUD will be routed to link ports 1,2,3; the main receiver port will contain mixed audio from links 1,2,3 and main port. The main receiver port PTT (Repeater Controller COR signal active low 0V) will go active (0V) only when any of the linking ports receiver COR go active. This configuration allows the telephone audio to go down the links, and allows the links to have access to the autopatch. This mode requires that the links are full duplex.

- A linking port needs access to the Icom IC-901 remote base packs available on some higher cost controllers.

Connect one of the system user lines from the main repeater controller to USER 1 (pin 26). The system must turn this line on (active low 0V) when the Icom remote base linking decks are accesses. When this line goes low, the RLC-6 will PTT link ports 1,2,3. Audio from TXAUD will be routed to link ports 1,2,3; the main receiver port will contain mixed audio from links 1,2,3 and main port. The main receiver port PTT (Repeater Controller COR signal active low 0V) will go active (0V) only when any of the linking ports receiver COR go active. This mode will allow the linking ports connected to the RLC-6 to have access to the repeater controller linking/remote base decks. The links must be full duplex in order for this mode to be used.

Upcoming Product:

LINK_COMM UPCOMING PRODUCTS:

RB-5 5 Port Remote Base Controller \$549.95

The RB-5 remote base controller will offer a fully microprocessor based remote base system. Features include a total of 5 remote base ports, (3) serial radios, (1) BCD radio, and (1) 16 key pad radio. Other features include full digital voice response system that acknowledges frequency, mode and other functions of the remote radio. A serial packet port is available to remotely log activity on the RB-5. 12 latched user lines, and a 4 bit BCD port (RLC-6 interfacing applications) are available for site uses.

Available September 1991

TL-1 Radio Site Telemetry Controller/Monitor

Link Comm will be releasing a radio site telemetry controller/monitoring system on January 1, 1992. This controller is DTMF programmable/Digital Packet I/O. The controller will give the site manager the ability to monitor digital and analog functions at the radio site. The controller also gives you the ability to control 8 switchable outputs, 8 analog inputs, and 8 digital inputs. All analog and digital inputs can be programmed with alarming points that will identify if an alarm condition occurs. These alarm levels can be remotely programmable with serial packet output upon alarming. All alarm and user changes are time stamped and sent down the serial port.

If the site user requires more than 8 Logical outputs, 8 Logical Inputs, and 8 Analog inputs Link Comm will be releasing expansion boards to expand the TL-1 Telemetry controller. A total of 64 output, 64 inputs, and 64 analog lines can be added to fulfill most sites needs.

Pricing and availability of the new products will be available in the year. Any questions on the products can be sent to:

Link Comm
c/o New Product Information
P.O. BOX 1071
Bozeman, MT. 59771

RLC-6 REPEATER LINK CONTROLLER PARTS LIST

Revision: 2

Item	Quantity	Reference	Part
1	4	C1, C2, C3, C4	4.7uF
2	12	C5, C6, C7, C8, C9, C10, C11 C12, C13, C14, C23, C28	1uF
3	9	C15, C16, C17, C18, C24, C25, C26, C27, C29	100pF
4	1	C50	100uF
5	1	D1	1N914
6	1	JP1	6 PIN HEAD/F
7	1	JP2	2 HEAD/JUMPER
8	1	P1	25 PIN RA/F
9	1	P2	25/25 EDGE
10	1	P3	10/10 HEADER
11	5	Q1, Q2, Q3, Q4, Q9	2N7000
12	4	Q5, Q6, Q7, Q8	2N3904
13	4	R1, R2, R3, R4	2.2K
14	22	R8, R9, R10, R11, R12, R13, R14, R15, R18, R19, R20, R24, R25, R26, R45, R48, R49, R50, R51, R52, R53, R54, R55	10K
15	8	R16, R17, R37, R40, R41, R44, R59	47K
16	2	R21, R22	220
17	5	R38, R39, R42, R43, R60	100K
18	2	R46, R47	4.7K
19	1	S1	6 DIP SW.

RLC-6 REPEATER LINK CONTROLLER PARTS LIST

Revision: 2

Item	Quantity	Reference	Part
20	2	U1,U2	2732A-45
21	4	U3,U4,U5,U6	4051
22	1	U9	74HC123A
23	1	U13	LM7805
24	1	U14	LM317
25	2	U15,U17	74HC08
26	1	U16	4066
27	1	U18	74HC86
28	1	U19	74HC02
29	3	U20,U21,U22	LM324
30	2	U1,U2	24 PIN SOCKET
31	5	U3,4,5,6,9	16 PIN SOCKET
32	8	U15,16,17,18,20,21,22	14 PIN SOCKET

RLC-6 LINK CONTROLLER EDGE CARD CONNECTION:

1 LINK 1 AUDIO IN
2 AUDIO OUT
3 COR
4 PTT (ACTIVE LOW)

5 LINK 2 AUDIO IN
6 AUDIO OUT
7 COR
8 PTT (ACTIVE LOW)

9 LINK 3 AUDIO IN
10 AUDIO OUT
11 COR
12 PTT (ACTIVE LOW)

13 MAIN AUDIO IN
14 AUDIO OUT
15 COR
16 PTT (ACTIVE LOW)

17 CONTROL LINE 1 (ACTIVE LOW)
18 CONTROL LINE 2 (ACTIVE LOW)
19 CONTROL LINE 3 (ACTIVE LOW)

20 MIX AUDIO OUT (FOR CONTROL RX MIXING)
21 MIX AUDIO IN (ROUTED TO SCOM CONTROL RX CONNECTOR)
22 MIX COR OUT (FOR CONTROL RX SIGNALING, INV(MAIN COR))
23 MIX COR IN (ROUTED TO SCOM CONTROL RX COR CONNECTOR)

26 USER 1 (ACTIVE LOW) NOT IMPLEMENTED, UP TO USER
27 USER 2 (ACTIVE LOW) NOT IMPLEMENTED, UP TO USER
28 USER 3 (ACTIVE LOW) NOT IMPLEMENTED, UP TO USER

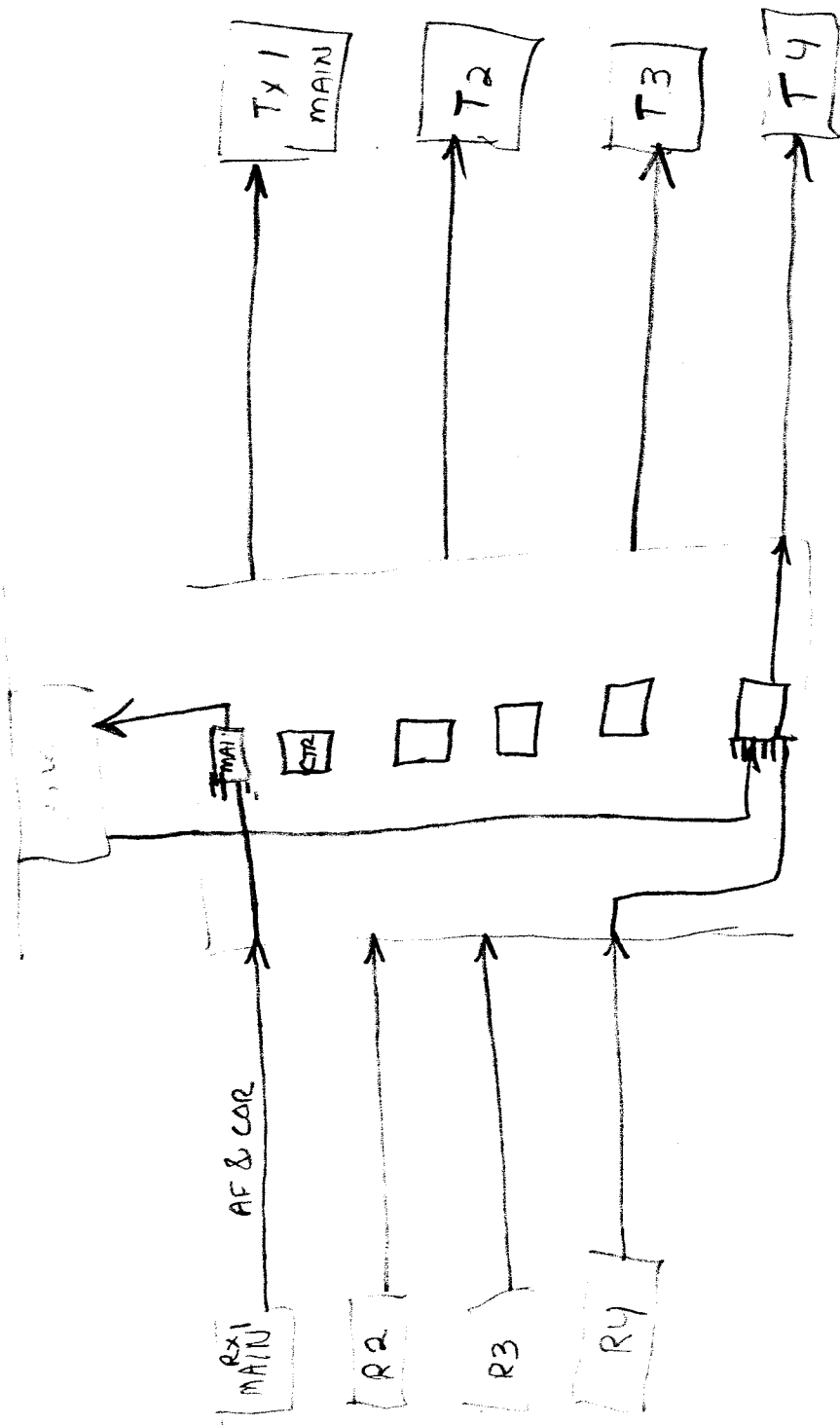
29 PL1 (ROUTED TO SCOM MAIN PL SIGNAL INPUT)
30 PL2 (ROUTED TO SCOM CONTROL RX PL INPUT)

31 MAIN TX PTT INPUT (LINE FROM MAIN TRANSMITTER)
32 MAIN TX AUDIO INPUT (LINE CONTAINING CW/VOICE MESSAGES)

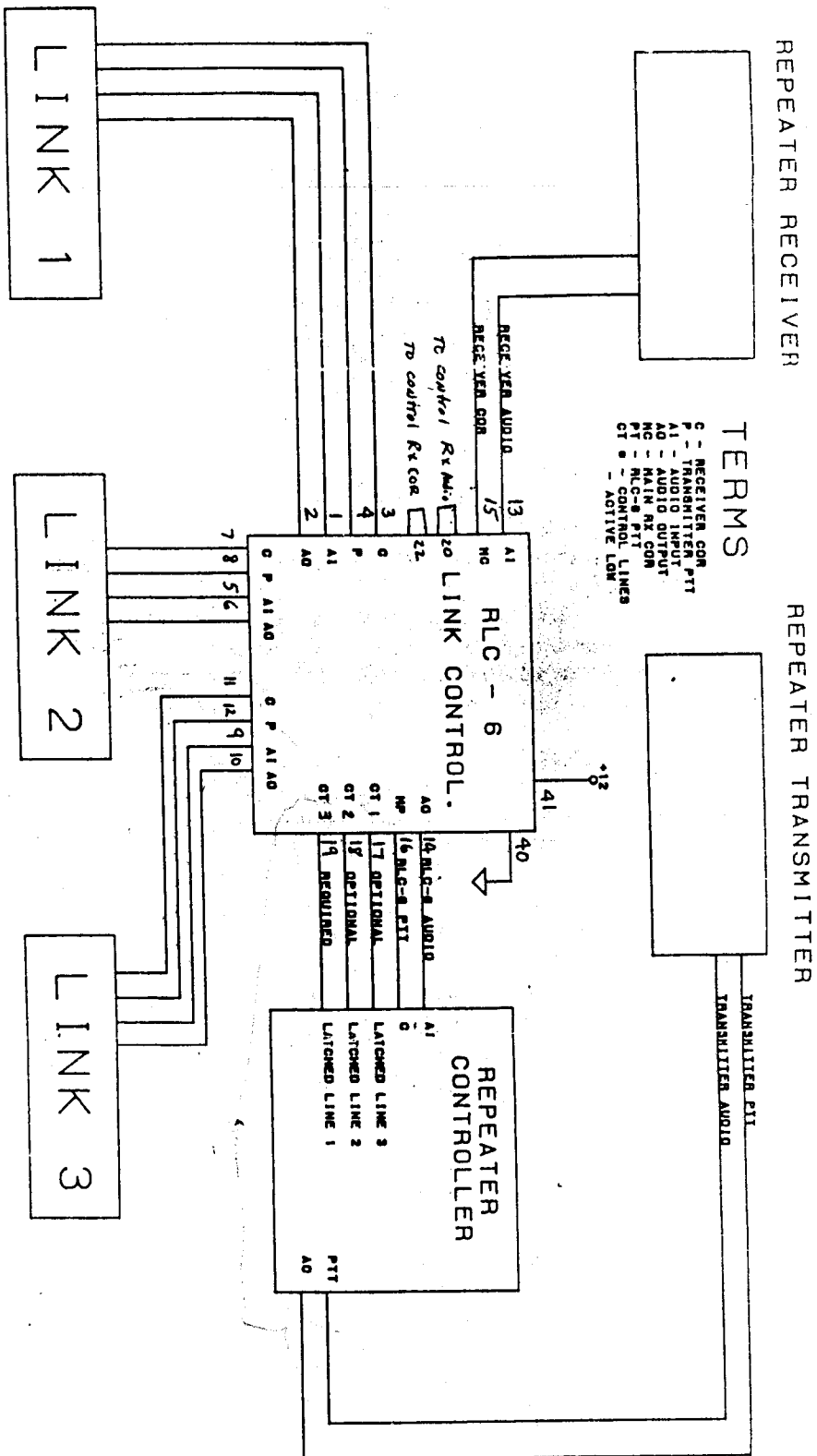
33 SYSTEM COR OUT LINK 1 (FOR LINK 1 COURTSY BEEP)
34 SYSTEM COR OUT LINK 2 (FOR LINK 1 COURTSY BEEP)
35 SYSTEM COR OUT LINK 3 (FOR LINK 1 COURTSY BEEP)

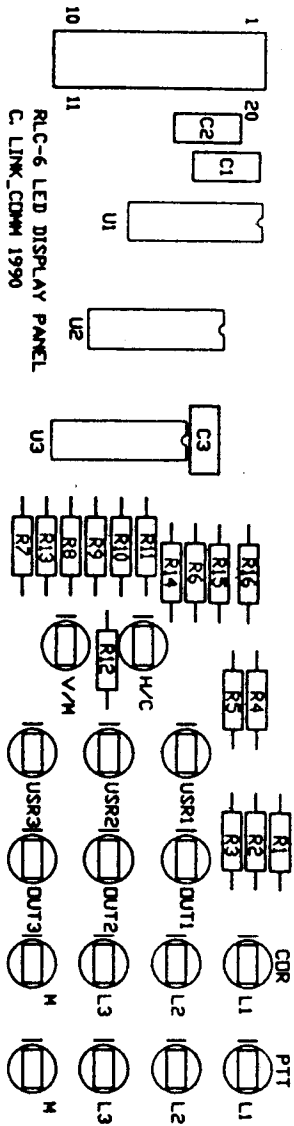
GND (24,25,36,37,38,39,40)
+12 (41,42,43,44,45)
GND (48,49,50)

ALL CONNECTIONS MADE TO A 25/25 EDGE CONNECTOR.
PINS 1-25 ARE ON THE COMPONENT SIDE
PINS 26-50 ARE ON THE SOLDIER SIDE



RLC-6 GENERIC CONTROLLER LAYOUT





RLC-6 LED DISPLAY PANEL
C. LINK_CDMH 1990



S-COM 5K/6K DB-25 FEMALE EDGE CONNECTOR

	<u>PIN NUMBER</u>	<u>SIGNAL NAME</u>
	1	Logical Input #1
	2	Logical Input #2
	3	Logical Input #3
	4	Main Receiver PL Input
	5	Control Receiver COR
	6	Main Receiver COR
	7	Logical Output #1
	8	Logical Output #2
	9	Logical Output #3
	10	Main Transmitter PTT
	11	Main Transmitter Audio
	12	Control RX Audio Input
	13	Main Receiver Audio Input
	14	Ground
	15	Ground
S-COM 6K Only	* 16	Control Receiver PL Input
S-COM 5K Only	* 16	Ground
	17	Ground
S-COM 6K Only	* 18	+12 DC Power Input
S-COM 5K Only	* 18	Ground
	19-25	Ground

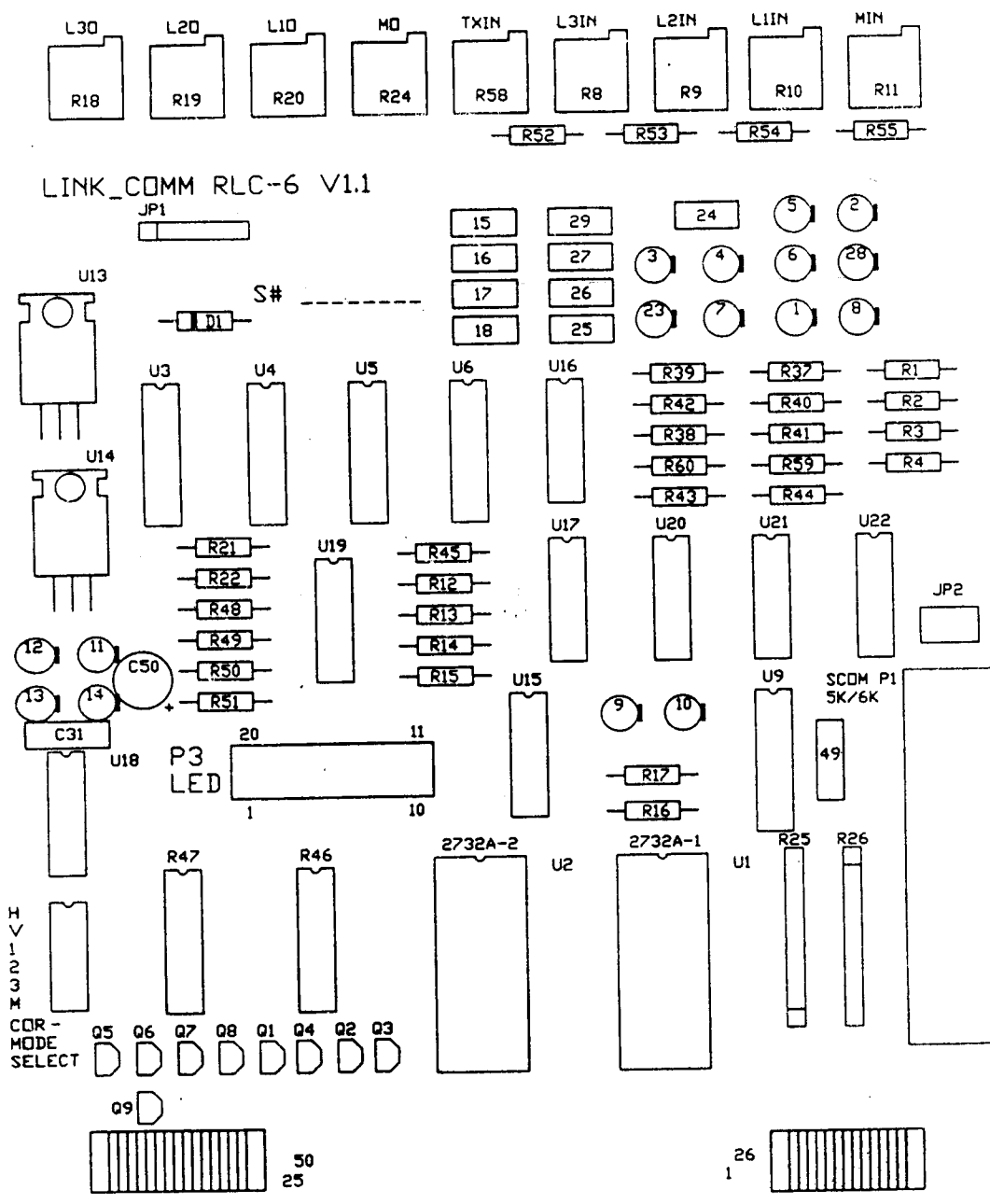
For More Information on S-COM Products:

S-COM 5K Repeater Controller
S-COM 6K Repeater Controller
S-COM 7K Repeater Controller
S-COM ADM-1 Audio Delay Module

Contact:

S-COM Industries
P.O. Box 1718
Loveland, CO 80539-1718 USA

(303) 663-6000



RLC6BD1 Top Overlay

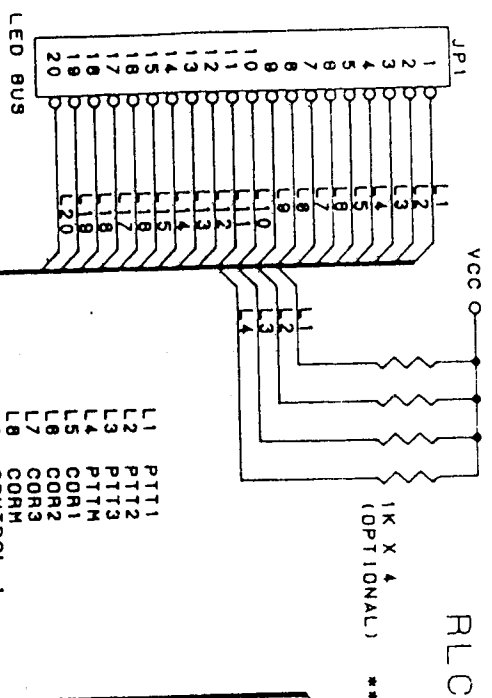
MASTER PHOTO PLOT BY:

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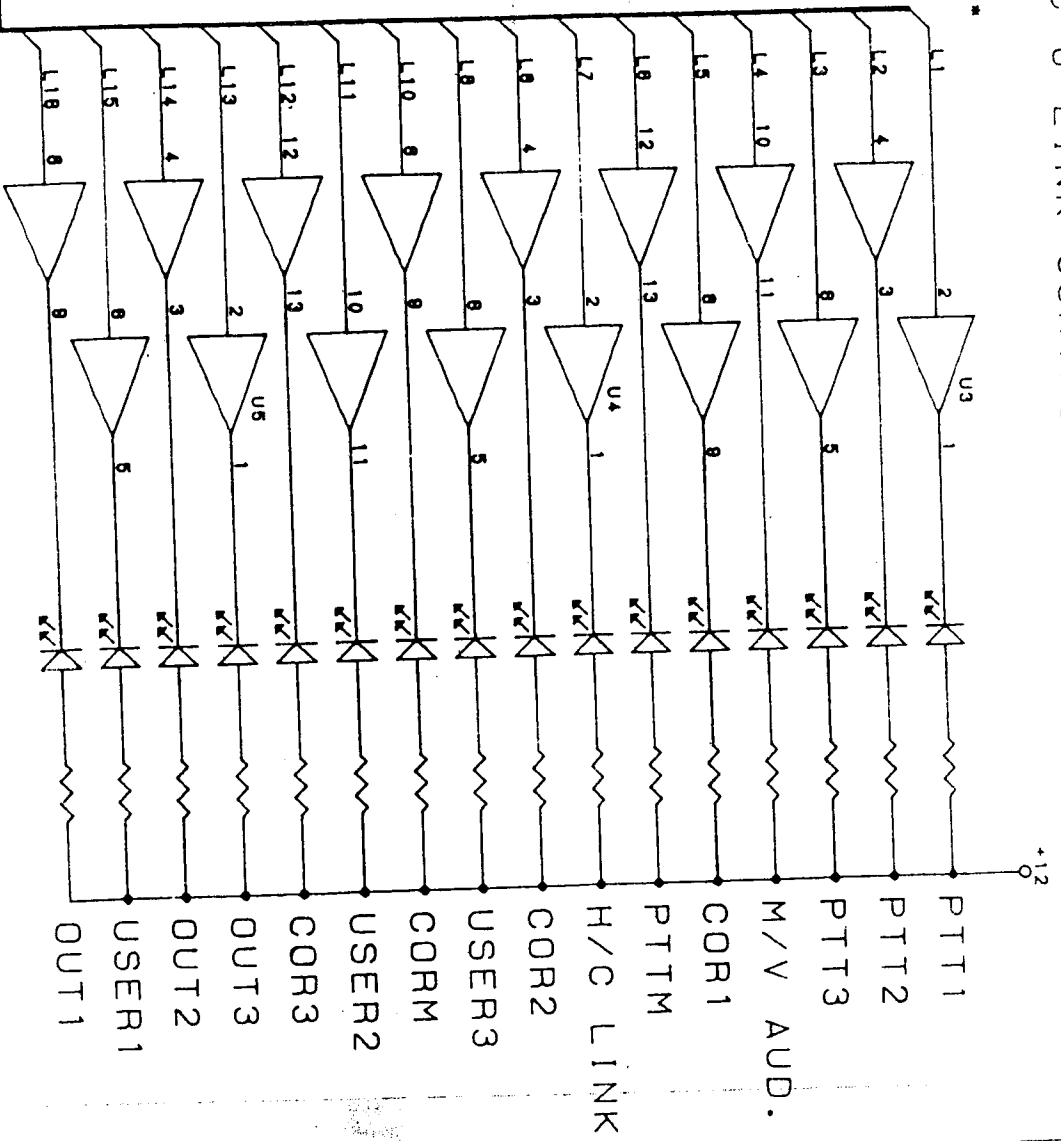
RLC-6 LINK CONTROLLER LED DISPLAY PANEL



- L1 PTT1
- L2 PTT2
- L3 PTT3
- L4 PTM
- L5 COR1
- L6 COR2
- L7 COR3
- L8 CORM
- L9 CONTROL 1
- L10 CONTROL 2
- L11 CONTROL 3
- L12 USER 1
- L13 USER 2
- L14 USER 3
- L15 HUB/CHAIN
- L16 VOTED/MIX
- L17 +12
- L18 +5
- L19 L20 OND

LED DEFINITIONS:
 LED ON - ACTIVE
 CHAIN LED ON
 MIXED LED ON

** IF THE PTT LED'S
 LIGHT THEN ADD
 4 1K PULL UP RES.
 AND THE LED'S WILL
 ONLY LIGHT WHEN
 A VALID PTT IS
 PRESENT.

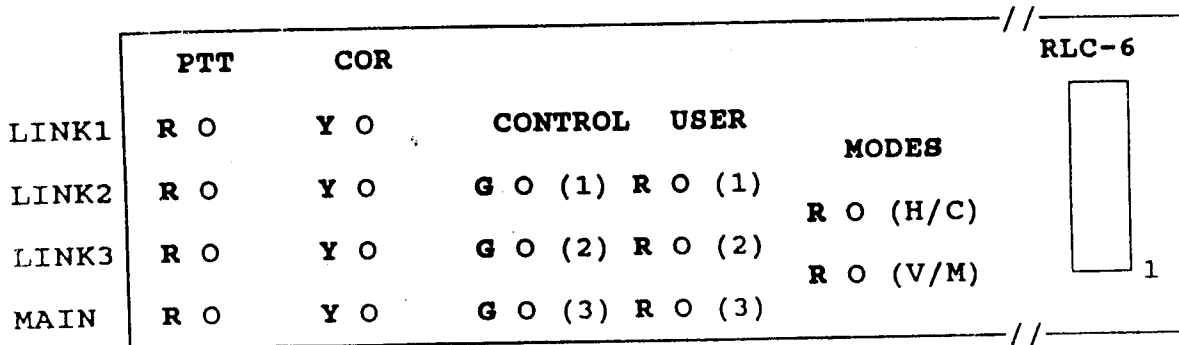


74C906

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Title		RLC-6 REPEATER LINK CONTROLLER	
LINK COMH 511 NO. 18TH BOZEMAN, MT 59715			
Size	Document Number		
A	RLC-6 LED DISPLAY PANEL		
Date:	August 9, 1980	Sheet	1 of 1
REV	1		

RLC-6 LED DISPLAY MODULE



LED Side View

R - RED LED
 Y - YELLOW LED
 G - GREEN LED

LED 'ON' INDICATED ACTIVE ON THE PTT/COR/OUT/USER LINES

LED 'ON' INDICATES CHAIN LINKING MODE ON (H/C)

LED 'ON' INDICATES VOTED AUDIO ON (V/M)

PLEASE OBSERVE THE CORRECT POLARITY OF THE INTERFACE CABLE CONNECTING THE LED BOARD TO THE RLC-6 (P3) CONNECTION.

****** NOTE ******

IF NO TRANSMITTERS ARE CONNECTED TO THE PTT LINES OF THE CONTROLLER THEN THE ADDITION OF A 10K PULLUP RESISTOR IS NEEDED BETWEEN PINS 1,2,3,4 AND +5 (18) ON THE DISPLAY BOARD. WITHOUT THE LOAD OF THE CONNECTED TRANSMITTER, THE PTT LED'S MAY LIGHT. BY ADDING THESE PULL-UP RESISTORS, THE LED WILL BE OUT UNTIL A PTT IS SENT TO THE CONNECTED TRANSMITTER.