Model 80 Serial Number _____
Software Version _____

Z E T R O N
Model 80 TrunkBridge
Instruction Manual

#025-9181E

* *

Please check for change information at the end of this manual.

* *

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WARRANTY STATEMENT

Zetron's warranty is published in the current Zetron *United States Price Book*.

FEDERAL COMMUNICATIONS COMMISSION (FCC) REGULATIONS

To comply with FCC regulations, the following requirements must be met:

1. This device complies with Part 15 of the FCC rules for a Class A digital device. Operation is subject to the following two conditions:

   a. This device may not cause harmful interference.

   b. This device must accept any interference received, including interference that may cause undesired operation.

2. Repair work on this device must be done by Zetron, Inc. or a Zetron authorized repair station.

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TRADEMARKS

1. INTRODUCTION

PRODUCT DESCRIPTION

The Zetron Model 80 TrunkBridge connects two distant trunked, conventional, or mixed trunked and conventional radio systems together using a pair of low cost mobile radios. TrunkBridge can provide an interface between two E.F. Johnson (EFJ) 8600 series mobiles or a combination of EFJ 8600 series and EFJ Challenger series remote mount radios. The TrunkBridge also allows two trunked or conventional radios on separate radio systems to communicate with one another.

TrunkBridge extends the range of any radio system through back-to-back control stations connected to one another using the TrunkBridge controller. Mobile radio traffic from one radio system is received by a control station located between two widely separated radio systems. This control station is in turn connected to the TrunkBridge controller. TrunkBridge recognizes a valid signal from the receiving control station and simultaneously relays the received traffic to one control station, through the second distant radio system, and out to listening mobile units. TrunkBridge works with any EFJ 8600 or Challenger series remote mount mobile radio or control station and makes radio system range extension as simple as plugging in the TrunkBridge controller.

FEATURES

* Compatible with E.F. Johnson 8600 series or Challenger series remote mount radios
* Links two or more LTR trunked radio systems together
* Links trunked and conventional radio systems together
* Can be used for single or multiple user radio systems
* Low current consumption
* Low cost
* Simple Installation

SPECIFICATIONS

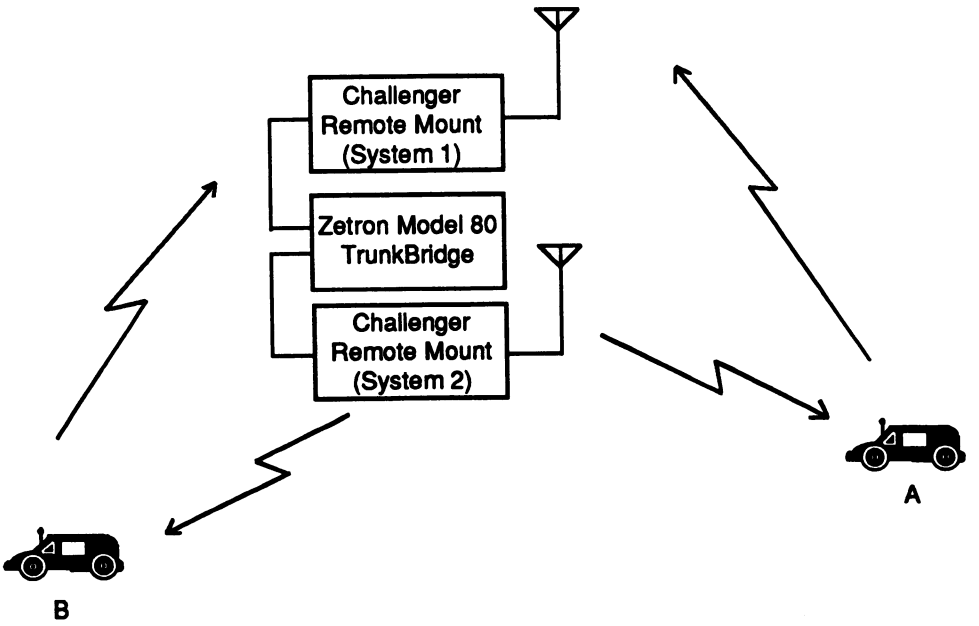
Radio Type	E.F. Johnson 8600 Series LTR mobiles and control stations and E.F. Johnson Challenger remote trunk mount mobiles
Power	12 VDC @ 100 mA, provided by the connected radios
Indicators	Power, System 1 PTT, System 2 PTT, System 1 TX Data, System 2 TX Data, System 1 RX Data, System 2 RX Data
Adjustments	TX Level 1, TX Level 2
Connectors	System 1 Radio, System 2 Radio

2. OPERATION

MODES OF OPERATION

The following pages describe the four different modes of operation for the Model 80 TrunkBridge.

Scanning Repeater



When the TrunkBridge is used as a scanning repeater, two Challenger remote mount radios in the same frequency band are used to form a repeater that repeats on multiple conventional channels. The system 1 Challenger remote mount radio is programmed only for receive, and the system 2 Challenger remote mount radio is programmed only for transmit. Vertically spaced antennas or a duplexer are required for duplex communications. When the system 1 Challenger remote mount receives carrier, the system 2 Challenger remote mount is placed on the same channel position and its transmitter keyed. For example, let's assume that the Challenger remote mount radios are programmed as follows:

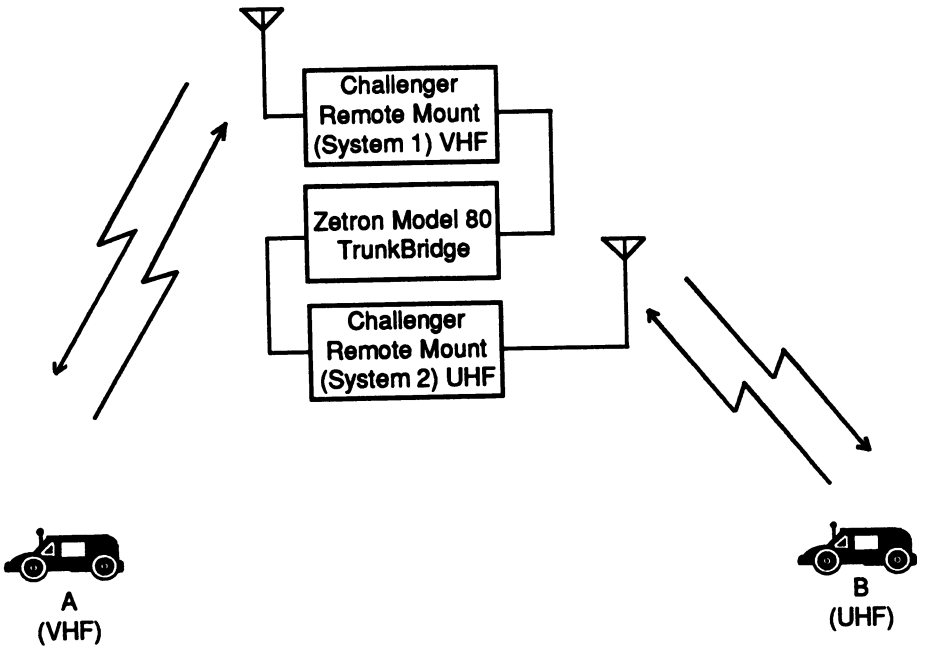
System 1 Challenger remote mount	System 2 Challenger remote mount
Ch 1 RX: 450.000 MHz	Ch 1 TX: 455.000 MHz
Ch 2 RX: 451.000 MHz	Ch 2 TX: 456.000 MHz
Ch 3 RX: 452.000 MHz	Ch 3 TX: 457.000 MHz

Both radios are initially placed into scan by the TrunkBridge. When the system 1 Challenger remote mount receives valid carrier on any of the three scanned channels, TrunkBridge stops the system 2 Challenger remote mount from scanning and selects the same channel that the system 1 scan stopped on. PTT is activated on the system 2 Challenger remote mount, and audio is passed from the system 1 radio to the system 2 radio.

We now have a scanning repeater. To add additional repeat paths, the system 1 Challenger remote mount radio may be programmed for transmit as well as receive, and the system 2 Challenger remote mount radio for receive as well as transmit channels. The transmit/receive pair for each channel of the scanning repeater is based on the channel assignments in each of the Challenger remote mount radios. Notice that the system 1 radio's channel 1 RX matches the system 2 radio's channel 1 TX. This capability is particularly useful considering that the Challenger remote mount radios' transmit/receive spacing can be up to 20 MHz.

The TrunkBridge keeps the transmitter keyed for as long as the receive Challenger remote mount is detecting carrier (or CTCSS/DCS decode if enabled). The radios will resume scanning after 2 seconds if there is no activity.

Cross-band Repeater



Cross-band repeat is simply the ability to receive on one band and repeat the received audio on another band. This may be either a unidirectional or bidirectional path. For example, in the diagram above, we have a VHF Challenger remote mount radio connected to the system 1 input of the TrunkBridge, and a UHF Challenger remote mount radio on the system 2 input to the TrunkBridge. The transmit/receive pair of the cross-band repeater are programmed into the same channel assignments of each of the Challenger radios. For example, we may program the two Challengers remote nount radios as follows:

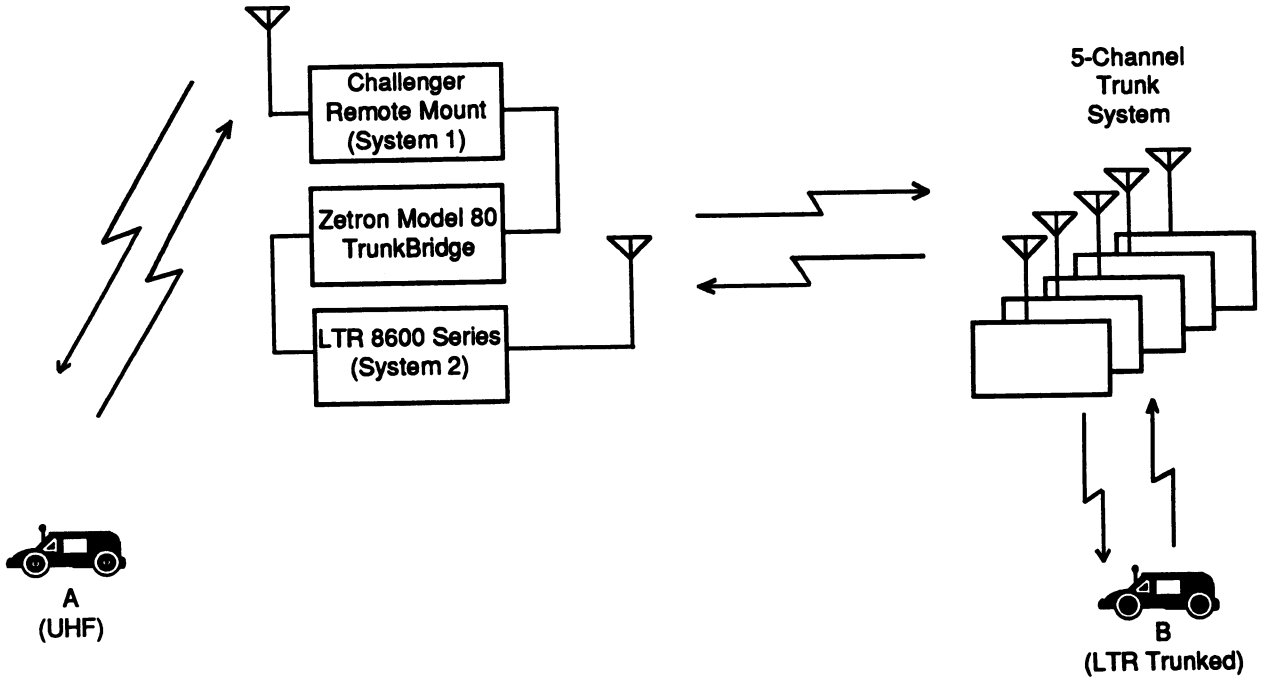
System 1 Challenger (VHF) remote mount
Ch 1 TX: 150.125 MHz RX: 150.125 MHz
Ch 2 TX: 156.925 MHz RX: 156.125 MHz
Ch 3 TX: 158.925 MHz RX: 158.125 MHz

System 2 Challenger (UHF) remote mount
Ch 1 TX: 455.000 MHz RX: 450.000 MHz
Ch 2 TX: 460.000 MHz RX: 460.000 MHz
Ch 3 TX: 469.000 MHz RX: 464.000 MHz

When a VHF user transmits, the system 1 Challenger remote mount radio stops scanning. The TrunkBridge stops the system 2 Challenger remote mount radio from scanning and changes the channel to match the system 1 Challenger remote mount. The system 2 Challenger remote mount radio's transmitter is keyed, and the audio is passed from the VHF Challenger remote mount radio to the UHF Challenger remote mount radio. When the user unkeys and the UHF user keys up, the reverse happens. The TrunkBridge detects carrier on the system 2 radio (UHF), keys the system 1 radio (VHF), and passes audio.

The TrunkBridge keeps the transmitter keyed for as long as the receive Challenger remote mount radio is detecting carrier (or CTCSS/DCS decode if enabled). The radios will resume scanning after 2 seconds if there is no activity.

Mixed Trunked-Conventional System



The capability of allowing a conventional radio system and a trunked radio system to communicate with each other is a powerful feature of the Model 80 TrunkBridge. In this configuration, a VHF or UHF Challenger remote mount radio is connected to the system 1 input of the TrunkBridge, and an 8600 series LTR radio is connected to the system 2 input of the TrunkBridge. As with the other two TrunkBridge configurations, both radios are placed in scan when the system is initially placed in service.

When the Challenger remote mount receives a carrier (or CTCSS/DCS decode if enabled), the LTR radio is taken out of scan. The TrunkBridge changes the system and group of the LTR radio to follow the channel programming in the Challenger remote mount. For example, the Challenger remote mount stops scanning on channel 17. This correlates to system 1, group 7 on the LTR radio. The TrunkBridge selects the proper system and group, actuates PTT

on the LTR radio, and passes audio from the Challenger remote mount radio to the trunking radio. If the LTR radio was unable to obtain a channel on the trunked system, the Model 80 TrunkBridge will unkey the LTR radio and wait for the carrier to drop on the Challenger remote mount radio. The Model 80 will then key the Challenger remote mount radio and send beeps back to the user indicating that his call was not processed. The response beeps may be disabled by placing JP5 and JP6 in position "B."

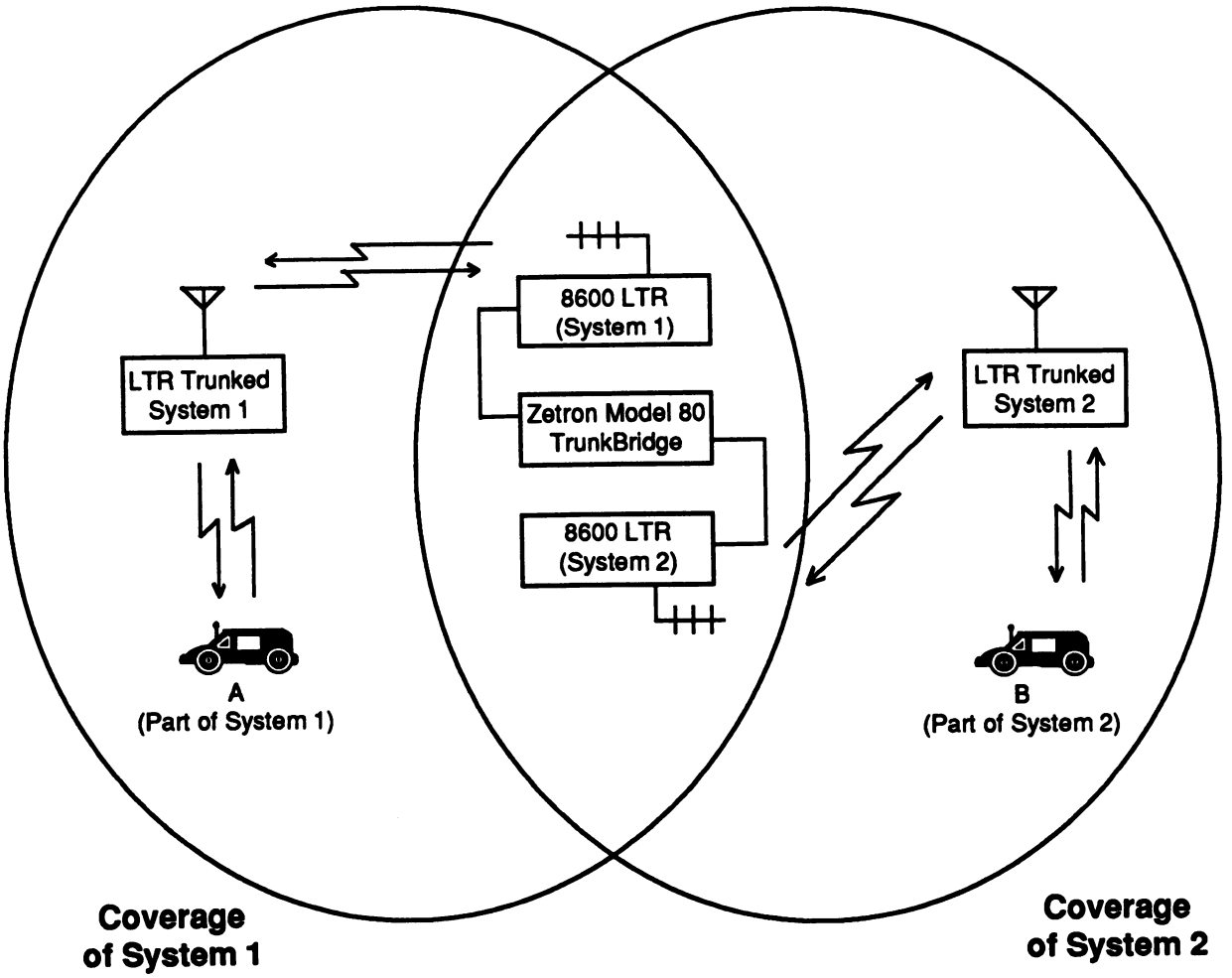
In the LTR to Challenger remote mount direction, the same process occurs. When the LTR radio stops scanning, TrunkBridge takes the Challenger remote mount out of scan, changes the channel, and activates PTT. Audio is then passed from the LTR radio to the Challenger remote mount. The diagram above illustrates the basic system configuration.

When the conversation has concluded (no activity for 2 seconds), both radios resume scanning.

Note that system 10, groups 1 through 9 on the LTR radio "maps" to channels 1 through 9 on the Challenger remote mount.

Challenger Remote Mount Conventional Channels	8600 Series System/Group
F1	System 10, Group 1
F2	System 10, Group 2
⋮	⋮
F9	System 10, Group 9

TrunkBridge



This mode of operation is the reason the Model 80 is called the "TrunkBridge." When the TrunkBridge is connected as shown above, selected users from two LTR trunked systems are allowed to communicate with each other. In full TrunkBridge operation, the TrunkBridge is connected to two 8600 series LTR radios. Each radio belongs to a different system. The same system and group slots are programmed on both radios.

Mobile A selects the correct system and group to communicate with mobile B and presses PTT. The TrunkBridge detects that the system 1 LTR radio has stopped scanning in response to mobile A's activity on LTR system 1 and halts the scanning on the system 2 LTR radio. It then sets the system and group on the system 2 LTR radio to match the system 1 LTR radio and activates the second radio's PTT. The audio from the system 1 LTR radio is passed to the system 2 LTR radio, and the conversation may begin. As long as the system 1 LTR radio is receiving, the transmitter on the system 2 LTR radio remains keyed. When mobile B responds, the TrunkBridge activates PTT on the system 1 LTR radio and passes audio from the system 2 LTR radio.

When the conversation is over (no activity for 2 seconds), both radios resume scanning.

BASIC OPERATION

The TrunkBridge interfaces to two scanning radios and watches both for an "out of scan" indication (indicating that a user is attempting to process a call). The TrunkBridge stops the second radio from scanning, sets it to the SAME system and group or conventional channel as the receiving radio, activates PTT, and allows the audio to pass from the radio receiving the call to the second radio. When a Challenger remote mount radio is used, the system number is the 10's place of the channel and the group number is the 1's place in the channel (i.e., system 3 group 5 is channel 35 on the Challenger remote mount). Challenger remote mount channels 1 through 9 match up with system 10, groups 1 through 9 on the LTR radio (see the table in the description of the Mixed Trunked-Conventional System mode of operation).

Because of the way in which the TrunkBridge "searches" for the correct channel on the transmitting radio, the installer must ensure that both radios have the same system and group locations programmed. There must be a one-to-one correspondence of the channels or systems/groups in both radios. If not, the operation of the TrunkBridge will significantly slow down because, during the search, the TrunkBridge cannot pay attention to the receiving radio.

When users access the Model 80 TrunkBridge and don't get access to the second system they are trying to call, the Model 80 will wait for the user to unkey, then it keys up on the calling user's system and sends back warning beeps indicating that the call was not processed. The calling user can then try the call again. The response beeps may be disabled by placing JP5 and JP6 in position "B."

3. INSTALLATION

WARNING

This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, it may cause interference to radio communications. Installation of the Model 80 TrunkBridge should only be attempted by qualified radio service personnel.

SYSTEM CONFIGURATION REQUIREMENTS

1. On an LTR radio programmed with conventional channels, the conventional channels are not scanned the same way the LTR systems and groups are. Only the scan revert channel will be scanned from each system programmed in the LTR radio. For example, if a particular system is programmed with groups 1, 2, and 3, and channel 2 was the last selected group, only group 2 will be scanned. This means that on a conventional-only radio, you may only scan 16 conventional channels at one time.

2. The radios used (either EFJ Challenger remote mount radios or 8600 series) MUST be modified to function properly. See the subsection below for details on the modification.

3. When using a Challenger remote mount and an 8600 series radio, use ascending channel numbers in the Challenger remote mount instead of "scattering" them. The reason for this is that the 8600 series radio MUST have contiguous groups programmed (i.e., you can't program system 5 group 3 until groups 1 and 2 are also programmed). By sequentially numbering the channels in the Challenger remote mount, the problem is taken care of.

4. If both radios are 800 or 900 MHz radios, directional antennas should be used to access each system. Keep the antennas separated by a minimum of 20 feet to prevent interference between radios.

5. If a Challenger remote mount and an LTR radio are used for cross-band repeating on a single channel only, make sure to use channel "11" on the Challenger remote mount to match system 1, group 1 on the LTR radio.

RADIO MODIFICATIONS

The EFJ 8600 series radios and the Challenger remote mount radios don't provide any carrier or decode indication on the 8 pin modular connector. Therefore, the radios need to be modified so that the TrunkBridge knows when one of the radios has stopped scanning and is receiving a valid signal. The modifications are straightforward but must be made in order to allow proper operation of the TrunkBridge. These modifications switch the hanger output pin with the new Zetron "decode" output.

Challenger Remote Mount Radio

1. Turn the Challenger remote mount radio over and remove the two Phillips head screws that hold the case on.

2. Turn the radio back over and slide the case off toward the front of the radio.

3. Remove the five Phillips head screws that hold the top PC board down.

4. Flip over the Audio/Logic PC board. Desolder the green wire that comes into the radio from the 8 pin modular microphone connector and resolder it to the collector of Q400. This is easily accomplished by soldering it to the feed through in sector A4 on the circuit board (this is on the component side of the Audio/Logic PC board).

5. Install a wire jumper from chassis ground to the point where the green wire was originally soldered. This jumper places the radio "on-hook."

6. Place the Audio/Logic PC board back on the chassis and secure it with the five Phillips head screws.

7. Slide the case back onto the chassis and reinstall the two Phillips head screws on the bottom of the case.

8. The Challenger remote mount must be programmed with the "CG priority scan" enabled; otherwise, the radio will come out of scan whether tone is present or not.

8605/8610/8615/8620 Radios

1. Remove the case by removing the five Phillips head screws on the bottom of the radio.

2. Remove both covers.

3. Remove JU3 and R317 from the Main PC board.

4. Install JU1 and JU2 on the Main PC board.

5. Install a jumper from JU3 (the pin closest to the front of the radio) on the Main PC board to pin 12, U6 on the Audio/Logic PC board.

6. Place the two covers back on the radio and tighten down the screws.

8600 Radios

1. Remove the case by removing the five Phillips head screws on the bottom of the radio.

2. Remove both covers.

3. Remove JU3 and ~~R314~~ R314 from the Main PC board.

4. Install JU1 and JU2 on the Main PC board.

5. Install a jumper from JU3 (the pin closest to the front of the radio) on the Main PC board to pin 13, U6 on the Audio/Logic PC board.

6. Place the two covers back on the radio and tighten down the screws.

INSTALLATION PROCEDURE

All connections to the transmitters, receivers, and power are made through the 8 pin connectors on the back of the Model 80 TrunkBridge. Power is derived from the system 2 radio. Simply connect the two 8 conductor cables between the system connectors on the back of the TrunkBridge and the two radios being used. The TrunkBridge communicates with both radios. As it does, the RXD and TXD LEDs on the front panel should flicker indicating that communications between the TrunkBridge and the radios are taking place. If the TXD LED flickers, but the RXD LED does not flicker, there is a problem with the associated radio or cable.

1. Generate a 1-KHz tone at ±3 KHz deviation (±1.5 KHz for 900 MHz) on the receive frequency of the radio connected to the system 1 jack. Adjust R3 (RX1) for 1 Vpp on pin 1 of U1. If 1 Vpp cannot be obtained, move JP1 (RX1 GAIN) and readjust R3.

2. While generating the tone on the receive frequency, monitor the transmitted level coming from the radio plugged into the system 2 jack. Adjust R1 (TX2) on the back of the Model 80 for unity gain through the system. If unity gain cannot be achieved, move JP2 (TX2 GAIN) and readjust R1.

3. Generate a 1-KHz tone at ±3 KHz deviation (±1.5 KHz for 900 MHz) on the receive frequency of the radio connected to the system 2 jack. Adjust R4 (RX2) for 1 Vpp on pin 1 of U2. If 1 Vpp cannot be obtained, move JP3 (RX2 GAIN) and readjust R4.

4. While generating the tone on the receive frequency, monitor the transmitted level coming from the radio plugged into the system 1 jack. Adjust R2 (TX1) on the back of the Model 80 for unity gain through the system. If unity gain cannot be achieved, move JP4 (TX1 GAIN) and readjust R2.

4. REPAIR

IN CASE OF DIFFICULTY...

In case of installation difficulty, call Zetron Model 80 Applications Department at (206) 820-6363. Please have the serial number of the unit and/or the Zetron Order number. If the call is made from the installation site by the installer or radio technician, the problem can usually be solved over the phone.

If a problem develops after a unit has been in service for some time, call the Zetron Model 80 Service Department at (206) 820-6363. If the call is made from the installation site by a radio technician, the problem can usually be solved over the phone.

The following Model 80 parts lists, schematic, and silkscreen are included to aid with repair or installation of the unit.

MODEL 80 TRUNKBRIDGE ASSEMBLY TOP LEVEL PARTS LIST
Ref: 901-9244

ITEM	QTY	PART NUMBER	DESCRIPTION
1.	1	025-9181	M80 MANUAL
2.	4	220-0108	440x1/4 PAN PHILLIPS
3.	4	220-0199	632x1/4 PAN PHILLIPS BLK OXIDE
4.	4	234-0010	STAR WASHERS
5.	1	415-9523	TOP COVER
6.	1	415-9601-1	BOTTOM CASE, FIN
7.	4	431-0006	RUBBER FEET
8.	1	702-9394	M80 PCB ASSY
9.	2	709-0016	8 COND. 4' CABLE

MODEL 80 TRUNKBRIDGE PARTS LIST (702-9394C)

LEGEND:
+ = OPTION
# = NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY

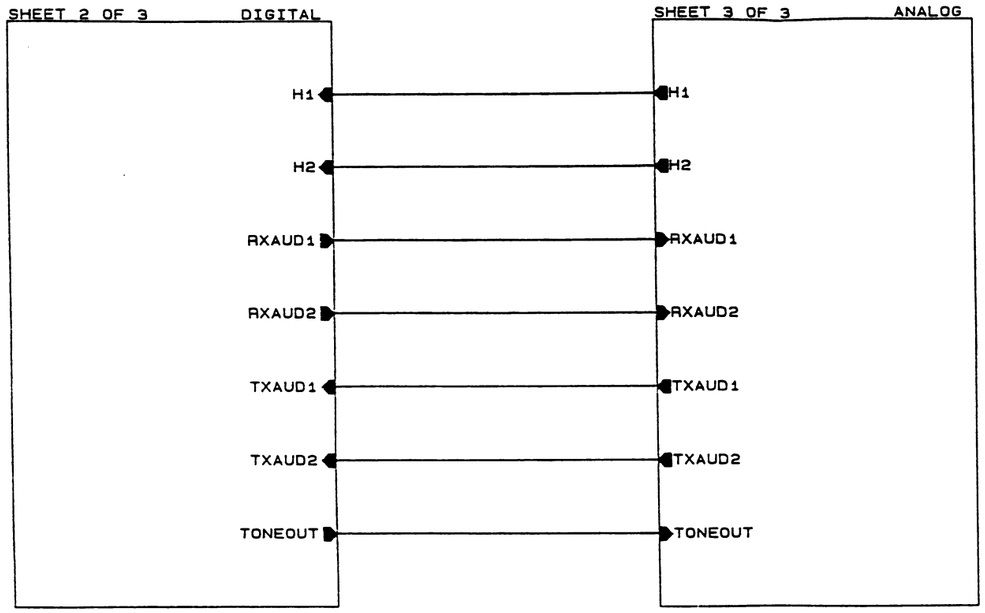
ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	MANUFACTURE P/N
1	1	R11	101-0036	33 OHM 1/4W 5% CARBON FILM	
2	2	R36,R19	101-0047	47 OHM 1/4W 5% CARBON FILM	
3	10	R21,R32,R42,R45,R46,R47, R48,R49,R50,R51	101-0061	330 OHM 1/4W 5% CARBON FILM	
4	8	R5,R6,R7,R8,R9,R10,R20, R33	101-0065	470 OHM 1/4W 5% CARBON FILM	
5	2	R12,R28	101-0073	1K 1/4W 5% CARBON FILM	
6	2	R14,R30	101-0089	4.7K 1/4W 5% CARBON FILM	
7	5	R23,R37,R41,R43,R44	101-0097	10K 1/4W 5% CARBON FILM	
8	2	R15,R31	101-0104	20K 1/4W 5% CARBON FILM	
9	2	R25,R39	101-0105	22K 1/4W 5% CARBON FILM	
10	4	R22,R27,R34,R40,	101-0113	47K 1/4W 5% CARBON FILM	
11	3	R16,R24,R35	101-0117	68K 1/4W 5% CARBON FILM	
12	2	R18,R17	101-0123	120K 1/4W 5% CARBON FILM	
13	2	R13,R29	101-0131	270K 1/4W 5% CARBON FILM	
14	2	R26,R38	101-0137	470K 1/4W 5% CARBON FILM	
15	2	R1,R2	107-0003	2K POT 1 TURN R/A	3386X-1-202
16	2	R4,R3	107-0502	50K POT 1 TURN	3386P-1-503
17	13	C3,C4,C5,C6,C7,C8,C9,C12, C13,C14,C15,C16,C17	150-0096	1000 PF 1KV +-20% CERAMIC DISC	GE-102G
18	2	C32,C30	151-0022	22PF 50V +-10%	CN15C220K
19	1	C23	151-0090	.0033 UF 50V +-10% CERAMIC, TEMPERATURE STABLE	CW15C332K
20	6	C18,C20,C21,C26,C29,C31	151-0180	.1 UF 50V +-10% CERAMIC, UNSTABLE	AVXSR205E104MAA
21	5	C10,C11,C24,C25,C27	152-0012	.1 UF 50V +-5% POLYESTER	ECQ-V1H104JZ
22	2	C1,C2	152-0040	4.7 UF 50V NON-POLAR ELECTROLYTIC	EHN-4.7M50BA
23	1	C28	152-0085	.01 UF 50V +- 5% POLYESTER	ECQ-V1H103JZ
24	2	C19,C33	154-0100	10 UF 16V TANTALUM	ECS-FICE106K
25	1	C22	155-0083	470 UF 10 VOLT RADIAL ALUMINUM ELECTROLYTIC	ECEA-1AU471
26	13	E1,E2,E3,E4,E5,E6,E7,E8, E9,E10,E11,E12,E13	305-0001	FERRITE BEADS W/ LEADS	11413-3B
27	6	DS1,DS2,DS3,DS4,DS5,DS6	311-0011	LED RED FLUSH	LT741R-81
28	1	DS7	311-0012	LED GREEN FLUSH	TLSG-5201
29	2	U1,U2	316-0324	OP-AMP, QUAD	LM324
30	1	VR1	316-7805	REGULATOR, +5V 1.5A	LM340T-5
31	1	U3 NOTE 7	321-0451	ASIC 002	
32	2	U4,U7	324-7414	HEX SCHMIDT	74HC14
33	1	U6	324-7427	TRIPLE 3 INPUT NOR	74HC27
34	1	U5	325-7432	QUAD OR GATE	74HCT32
35	2	Q2,Q1	340-3904	NPN 40V/200MA	2N3904
36	2	Q4,Q3	340-7000	HEX FET	2N7000

MODEL 80 TRUNKBRIDGE PARTS LIST (702-9394C) Continued

ITEM	QTY	COMPONENT REFERENCE	PART NO.	DESCRIPTION	MANUFACTURE P/N
37	10	CR1,CR2,CR3,CR6,CR7,CR8, CR9,CR12,CR13,CR14	342-3009	SILICON .50 SP	1N4148
38	1	CR15	343-3100	1W 8.2V +-5% .50 SP	1N4738A
39	4	CR4,CR5,CR10,CR11	343-3110	1W 20V +-5%	1N4747A
40	1	Y1 NOTE 6	376-1106	11.06 MHz HC-18 CASE	MP49 11.0592 18PF
41	2	J1,J2	401-0350	6/8 MODULAR FEMALE CONN. LOW PROFILE	020-000-024
42	6	JP1,JP2,JP3,JP4,JP5,JP6	403-0003	3 OF 401-0052	
43	6	XJP1,XJP2,XJP3,XJP4 (POS B) XJP5,XJP6 (POS A)	402-3040	MINI JUMPER	
44	6	XU1,XU2,XU4,XU5,XU6,XU7	407-0014	SKT, 14 PIN DIP	
45	1	XU3	407-0068	SKT, 68 PLCC	
46	1	PCB	410-9394B	BARE PCB, M80 TRUNKBRIDGE	
47	7	XDS1,XDS2,XDS3,XDS4,XDS5, XDS6,XDS7	417-0010	LED MOUNT RA	
48	1	XU3 NOTE 7	601-0301	V1.4 M80 TRUNKBRIDGE SOFTWARE	

NOTES: Notes are for production use only.

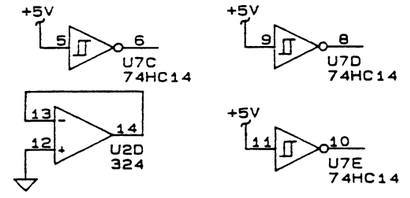
REV	DESCRIPTION	DRN	APVD	DATE
A	RELEASE	DGW		
B	HCN 1683	DGW		
C	ECN 2906	ML	DH	3/19/93



NOTES: UNLESS OTHERWISE SPECIFIED.

1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. ALL POTENTIOMETERS ARE 1 TURN.

UNUSED PARTS:



LEGEND:

+	OPTION, INSTALL PER CUSTOMER ORDER.
-	INSTALLED ON HIGHER ASSEMBLY.
#	NOT INSTALLED.
———X———	CUT TRACE.
- - - - - - - - - -	JUMPER WIRE.

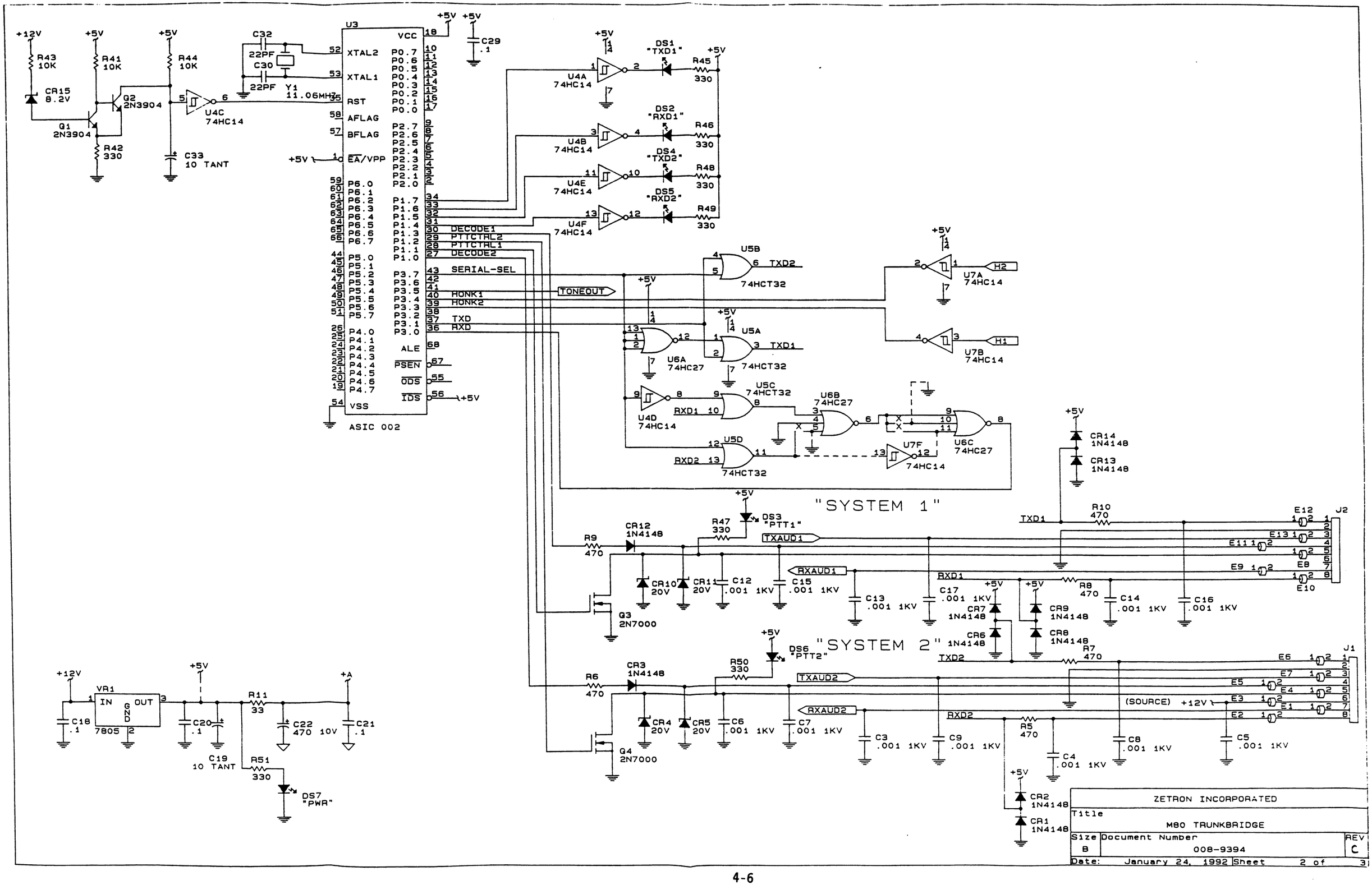
ZETRON, INC.

12335 134TH COURT N.E.
REDMOND, WASHINGTON, 98052-2433

Title: MODEL 80 TRUNKBRIDGE

Size	Document Number	REV
B	008-9394	C

Date: January 24, 1992 Sheet 1 of 3



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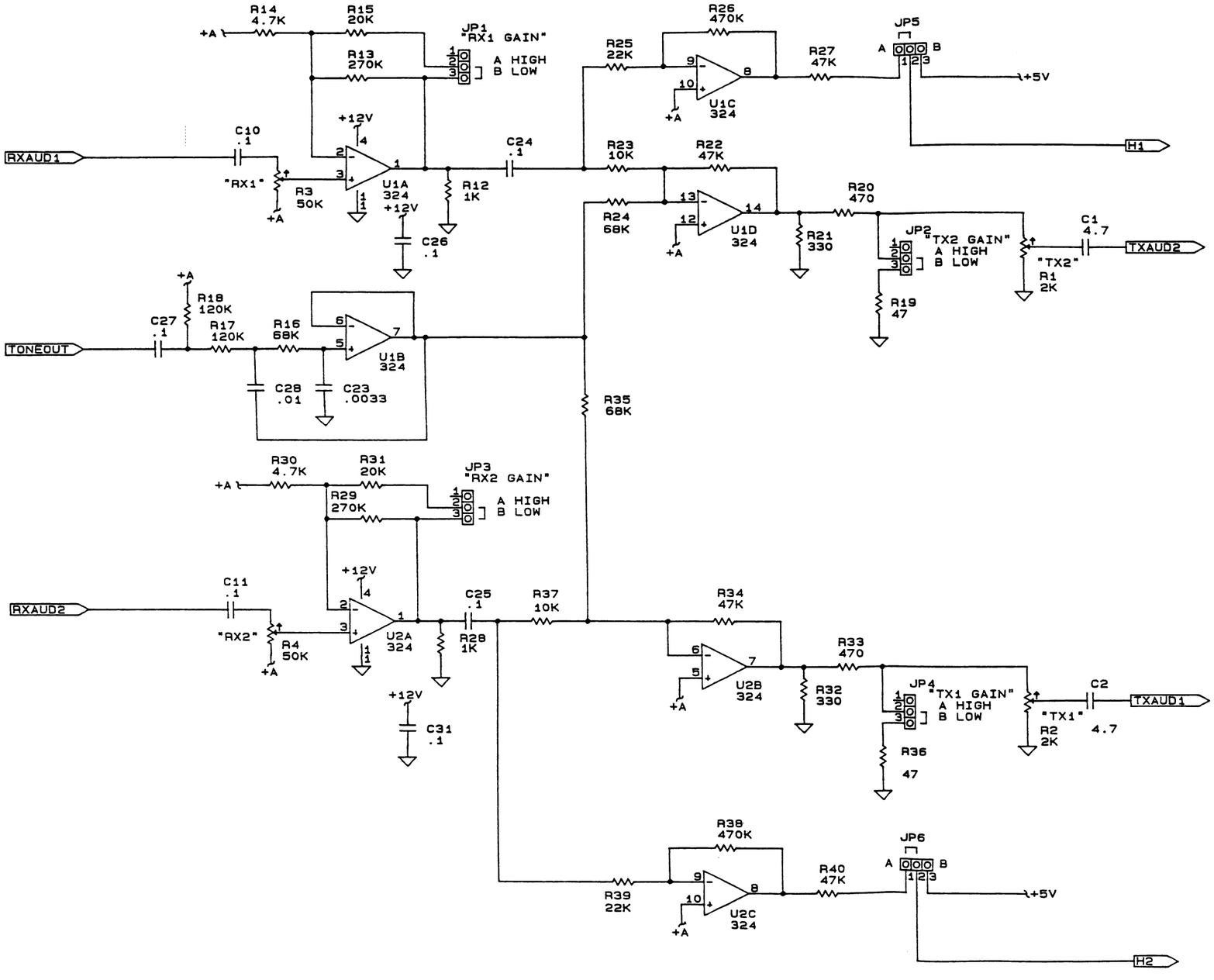

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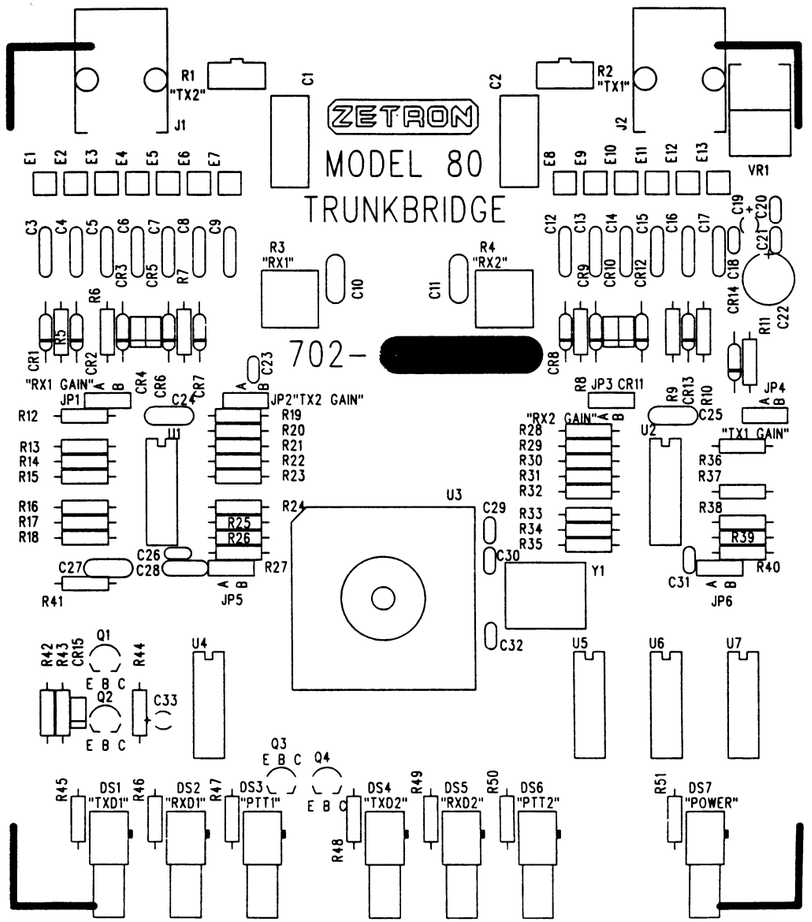
MODEL 80 TRUNKBRIDGE SILKSCREEN (702-9394C)



CHANGE INFORMATION

At Zetron, we continually strive to improve our products by updating hardware components and software as soon as they are developed and tested.

Due to printing and shipping requirements, this manual may include information about the latest changes on the following pages.