

# TECHNICAL MANUAL

TM3600 / O/N 9300-3600-00

## **MODEL TWI222 / TWI224**

Including  
TWI222-T  
TWI222-CM  
TWI-SK70-DCU

## **TW Intercom System Interface Units**

***RTS SYSTEMS***

A Telex Communications Product

## TECHNICAL MANUAL

Model TWI224 /TWI222 Interface Units

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TECHNICAL MANUAL, TM3600

TWI224 / TWI222

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Burbank, CA 91506 USA

### UNPACKING INFORMATION AND INSPECTION

Immediately upon receipt of the equipment, inspect the shipping container and the contents carefully for any discrepancies or damage. Should there be any, notify the freight company and the dealer at once. The shipping Model TWI224 / TWI222 container should contain the following components:

Ordering Number 9000-2195-00 -- TWI224

Ordering Number 9000-2184-00 -- TWI222

<u>QTY</u>	RTS Systems	
	<u>Part Number</u>	<u>Description</u>
1	9010-2195-00	Model TWI224
1	9010-2184-00	Model TWI222
1	9300-3600-00	Technical Manual

# TECHNICAL MANUAL

Model TWI224 / TWI222 Interface Units

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### RTS SYSTEMS' LIMITED WARRANTY

The products of RTS Systems, , a California corporation, are warranted to be free from defects in materials and workmanship for a period of one year from the date of sale.

RTS Systems' sole obligation during the warranty period is to provide, without charge, parts and labor necessary to remedy covered defects appearing in products returned prepaid to RTS Systems, 1100 W. Chestnut Street, Burbank, California, 91506, U.S.A.. This warranty does not cover any defect, malfunction or failure caused beyond the control of RTS Systems, including unreasonable or negligent operation, abuse, accident, failure to follow instructions in this Manual, defective or improper associated equipment, attempts at modification and repair not authorized by RTS Systems, and shipping damage. Products with their serial numbers removed or effaced are not covered by this warranty.

To obtain warranty service, follow the procedures entitled "PROCEDURE FOR RETURNS" and "SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT" listed below.

This warranty is the sole and exclusive express warranty given with respect to RTS Systems' products. It is the responsibility of the user to determine before purchase that this product is suitable for the user's intended purpose.

**ANY AND ALL IMPLIED WARRANTIES, INCLUDING THE IMPLIED WARRANTY OF MERCHANTABILITY ARE LIMITED TO THE DURATION OF THIS EXPRESS LIMITED WARRANTY.**

**NEITHER RTS SYSTEMS NOR THE DEALER WHO SELLS RTS SYSTEMS' PRODUCTS IS LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND.**

### RETURN SHIPPING INSTRUCTIONS

Procedure For Returns:

If repair is necessary, contact the dealer where this unit was purchased.

If repair through the dealer is not possible, phone the RTS Systems Customer Service Department, located at the factory, as directed below. They will issue a Return Authorization Number

**DO NOT RETURN ANY EQUIPMENT TO THE FACTORY WITHOUT FIRST OBTAINING A RETURN AUTHORIZATION NUMBER.**

Be prepared to provide your company's name, address, phone number, a person to contact regarding the repair, the type and quantity of equipment, a description of the defect, and the serial number(s).

Questions regarding returns for repair should be directed to:

Customer Service Department  
RTS Systems,  
1100 W. Chestnut St.  
Burbank, CA 91506, U.S.A.  
Telephone: (818) 840-7311  
Telex: 194855  
Telefax: (818) 843-7953

### SHIPPING TO MANUFACTURER FOR REPAIR OR ADJUSTMENT

All shipments of RTS Systems, equipment should be prepaid via United Parcel Service or the best available shipper. The equipment should be shipped in the original packing carton; if that is not available, use any suitable container that is rigid and of adequate size. If a substitute container is used, the equipment should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material. All shipments should be directed to the attention of the Customer Service Department and must include the Return Authorization Number.

Upon completion of repairs equipment will be returned collect via United Parcel Service or specified shipper.

## SECTION 1: INTRODUCTION AND SPECIFICATIONS

### 1.1 INTRODUCTION

The TWI222 and TWI224 series of interfaces are designed to interface RTS Systems' "TW" system to other intercoms. These interfaces derive operating power from the RTS line, and are transformer isolated to prevent ground loop interference. Three package styles are available --- a compact portable style similar to our belt packs, a rack-mount style, and a console mount package. The rack mount version may be ordered with up to three interfaces in one panel.

### 1.2 APPLICATION GUIDE

This section is intended to help you select the correct interface for your application.

The TWI222 interface is for interfacing an RTS system to a four wire intercom system. This would include some television broadcast cameras, the McCurdy intercom systems, radiotelephones, and cameras which have coaxial or triaxial cable adapters (except for the Hitachi SK-70 with DCU). If your camera has the option of operating in either four wire or two wire mode, use the four wire mode and our TWI222 interface. This will result in easier set up and better performance. The TWI222 may also be used to interface to a Carbon Mic system through a TIP-RING-SLEEVE jack on the Carbon Mic system, however better performance will be achieved using a TWI222-CM connected directly to the Carbon Mic system's line. Two TWI222's can be used to interface 2 RTS "TW" systems over 2 telco dry pairs. This is preferred to using 2 TWI222-T's over telephone lines.

The TWI222 interfaces are for interfacing an RTS system to other two wire intercom systems. The TWI222 is supplied in three different configurations, the TWI222, the TWI222-CM, and the TWI222-T.

The TWI222 is designed to interface RTS "TW" systems to intercom systems with a line impedance of 200 ohms nominal, with a range of 100 to 400 ohms. The impedance may be user selected, allowing the

TWI222 to be used with a line impedance ranging from 25 ohms to 1600 ohms.

The TWI222-CM is designed to interface an RTS "TW" system directly to an RCA/DAVEN type carbon microphone intercom system, with an impedance of 4-16 ohms (30 to 7 stations). To determine the actual impedance of your system, divide 120 by the number of stations on the line. For example, 120 divided by 11 stations yields a line impedance of 10.9 ohms.

The TWI222-T is designed to interface an RTS system to a 2-wire wet telephone line. It includes an electronic hold circuit.

### 1.3 SPECIFICATIONS

Typical Gain:	14 to 20 dB each direction
Balance Null Capability:	20 dB
Input/Output Voltages:	-30 dBm to +10 dBm
Bilateral Current Sources	
Peak Current Drive:	10 mA (200 ohms)

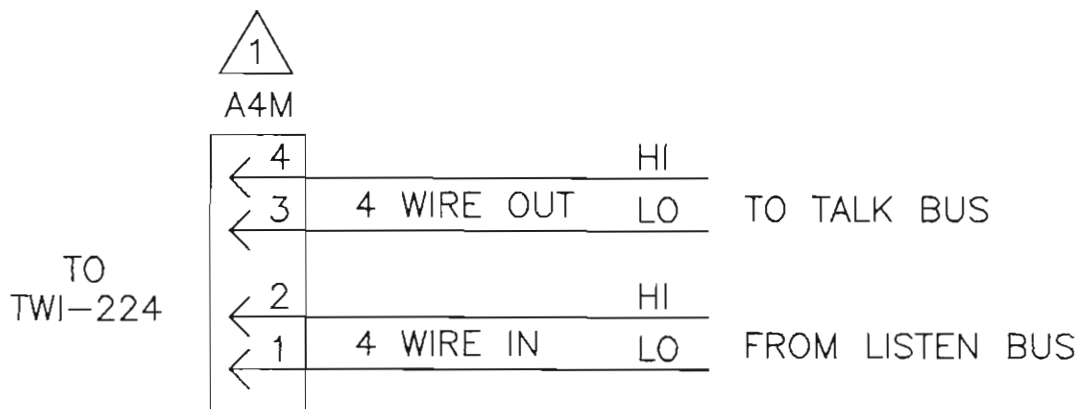
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## Model TWI224 / TWI222 Interface Units

### SECTION 2: INSTALLATION

#### 2.1 RTS TO 4-WIRE CAMERAS AND INTERCOMS

Turn all gain and balance controls to minimum. Connect the RTS line to the RTS LINE jack on the rear of the TWI-224. Connect the Listen bus of the 4-wire system to pins 1 and 2 of the 4-pin frontpanel XLR on the TWI-224. Connect the talk bus of the 4-wire system to pins 3 and 4 of the 4-pin front-panel XLR as shown in figure 2-1. This talk bus must present a 100 ohm to 400 ohm impedance to the output of the TWI-224. If it does not, terminate the TWI-224 4-wire output with a 200 ohm 1/4 watt resistor.



△ 1 FOR TWI224-RM(E) UNITS USE A4F (FEMALE) CONNECTOR

**Figure 2-1**  
Connector And Cable Wiring For The TWI-224

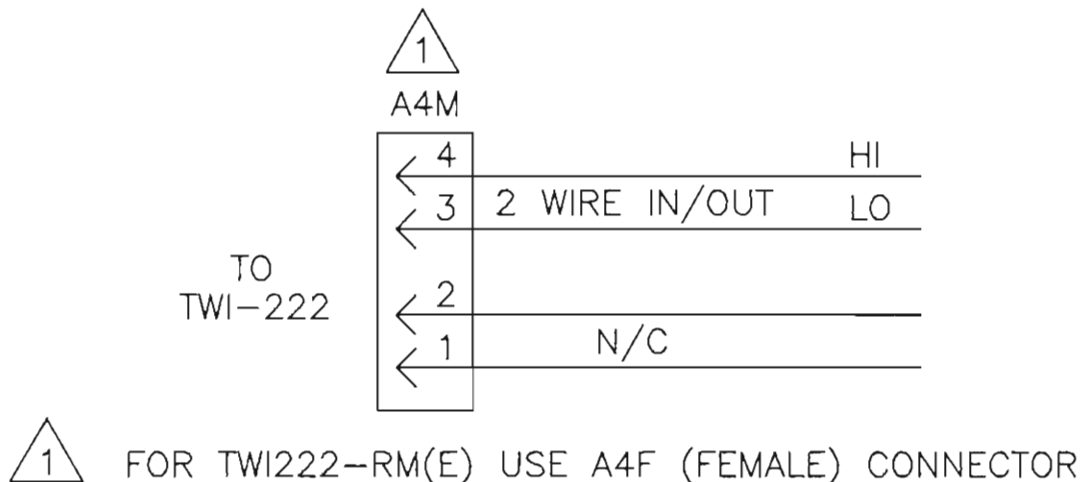
## TECHNICAL MANUAL

### Model TWI224 / TWI222 Interface Units

#### 2.2 RTS TO 2-WIRE SYSTEMS

First confirm that the external intercom system has a nominal impedance of 200 ohms (100 to 400 actual). If it does not, see section 5.5 on how to change the impedance of the TWI-222.

Turn all gain and balance controls to minimum. Connect the RTS line to the RTS LINE jack on the rear of the TWI-222. Connect the external intercom line to pins 3 and 4 of the front-panel XLR-4 connector. See figure 2-2. This input is capacitor coupled and can withstand dc line voltages as high as 25 volts.



**Figure 2-2**  
Connector And Cable Wiring For The TWI-222



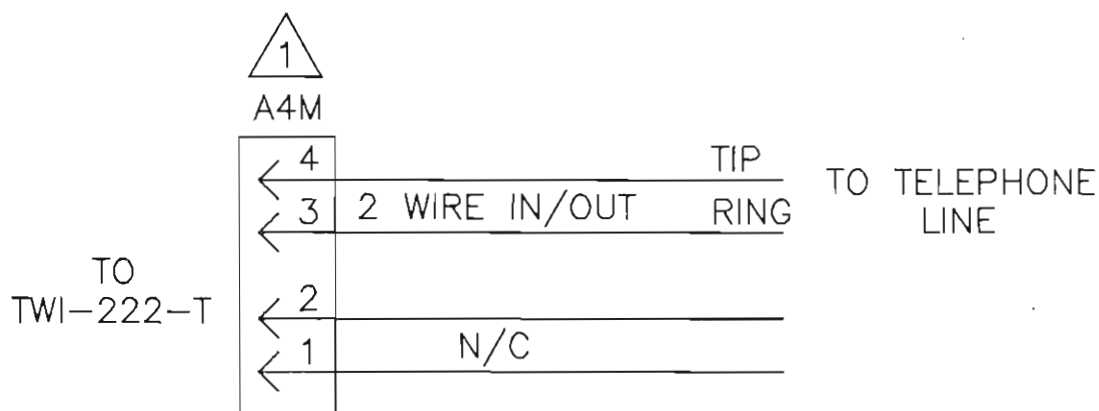
## TECHNICAL MANUAL

### Model TWI224 / TWI222 Interface Units

#### 2.3 RTS TO 2-WIRE TELEPHONE WET/DRY

Turn all gain and balance controls to minimum, switch telco-hold switch off. Connect the RTS line to the RTS LINE jack on the rear of the TWI-222-T. Connect the telephone line to pins 3 and 4 of the front-panel XLR-4 connector. Polarity is not important. See figure 2-3. This input is capacitor coupled and can withstand voltages as high as 50 volts.

On rack mount interfaces (TWI-222-T-RM), the rear panel stereophone jack is connected in parallel with the front-panel XLR-4. Thus the tip and ring of the rear phone jack may be used instead of the front XLR-4 jack. See figure 2-4. Do not use both jacks at the same time.

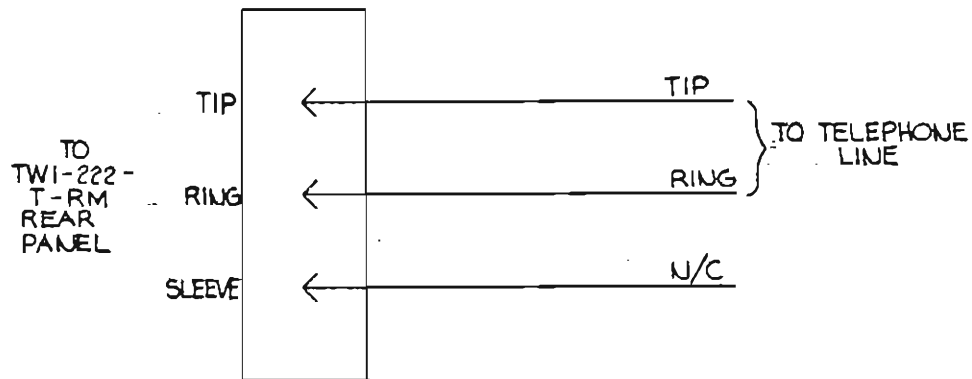


1 FOR TWI222-T-RM(E) USE A4F (FEMALE) CONNECTOR

**Figure 2-3**  
Connector And Cable Wiring For The TWI-222-T

# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units



**Figure 2-4**  
Connector And Cable Wiring For The TWI-222-T-RM

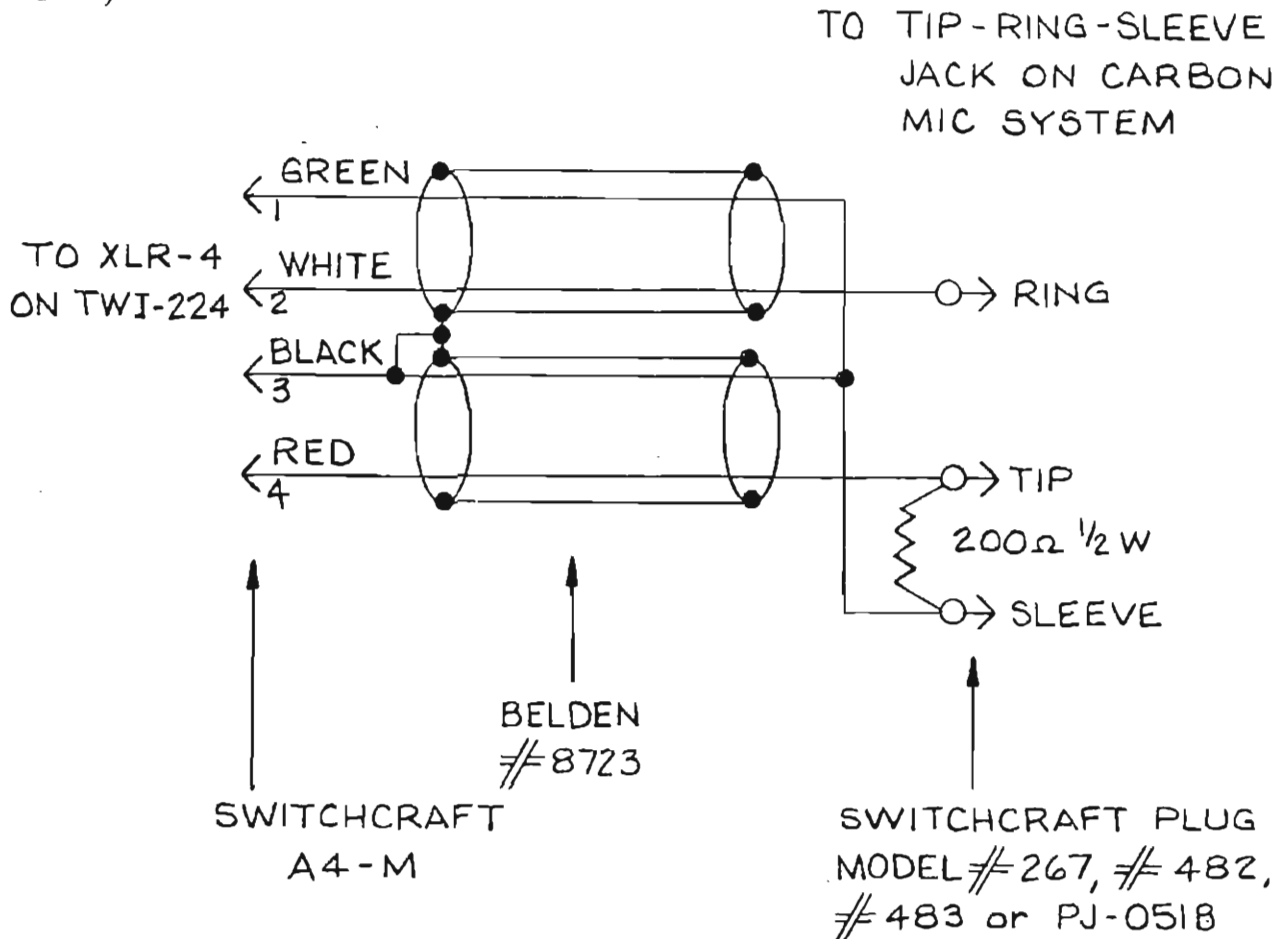
## TECHNICAL MANUAL

### Model TWI224 / TWI222 Interface Units

#### 2.4 RTS TO RCA/DAVEN SYSTEMS

The TWI-224 may be connected to a Carbon Mic system through one of its user station's TIP-RING-SLEEVE jacks. Use the cable shown in figure 2-5. Turn gain and balance controls to minimum.

There are disadvantages to this method. The return signal from the carbon mic system can not be nulled out resulting in excessive sidetone on both systems. This is usually suitable for a small number of stations (less than 7).



**Figure 2.5**  
Adapter Cable #AC 244-1

To connect a TWI-222-CM to a Carbon Mic system, connect the RTS line to the RTS LINE connector on the rear panel of the TWI-222-CM. Connect the line of the Carbon Mic system to pins 3 and 4 of the front-panel XLR-4 connector. See figure 2-2.

# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units

### SECTION 3: OPERATING INSTRUCTIONS

#### 3.1 INTRODUCTION

After making connections as described in section 2 the unit is ready to be adjusted. This section describes how to adjust and operate each of the installations described in section 2. If, after the system is adjusted, any part of the system changes, readjustment may be required.

#### 3.2 RTS TO 4-WIRE SYSTEMS OPERATION

After making the connections described in section 2.1, set all GAIN and BALANCE controls on the TWI224 to minimum. Turn power to the RTS and the 4-wire system on. Establish that both systems are operating properly.

Plug a carbon microphone headset into the CARBON MIC ONLY jack located on the rear panel.

Increase the GAIN FROM RTS to 50%.

Hum into the carbon microphone and adjust BALANCE FROM RTS until the best null is obtained.

With one person on the RTS "TW" line and another on the 4-wire system, adjust the GAIN controls until both people can hear each other clearly.

#### 3.3 RTS TO 2-WIRE SYSTEM OPERATION

After making the connections described in section 2.2 set all GAIN and BALANCE controls on the TWI222 to minimum. Turn on the power to the RTS and the 2-wire system. Confirm that both systems are operating properly.

Plug a carbon microphone headset into the CARBON-MIC-ONLY jack on the rear of the TWI222.

Set the BALANCE FROM RTS control to approximately 50%.

Increase the GAIN FROM RTS control to maximum.

Speak or hum into the carbon microphone headset and adjust the BALANCE FROM RTS control until a null is obtained.

Decrease the GAIN FROM RTS control to minimum.

Use an RTS user station to listen on the RTS system. Turn the microphone off and volume to maximum.

Increase the GAIN TO RTS to maximum.

Adjust the BALANCE TO RTS control for a null in the noise as heard on the RTS system.

Reduce the GAIN TO RTS to minimum.

The interface is now balanced and care should be taken not to disturb the balance controls. An improperly balanced interface may oscillate.

Set both gain controls to approximately 25%.

Have two people establish two-way communication through the interface; adjust the gains so that each person can be heard clearly.

#### 3.4 RTS TO 2-WIRE TELEPHONE OPERATION

After making the connections described in section 2.3, turn the TELCO HOLD switch off and all level and gain controls to minimum. Turn power to the RTS system on and verify that the system works.

Plug a carbon microphone headset into the CARBON MIC ONLY jack on the rear of the TWI222-T. On rack mount versions (TWI222-T-RM) the carbon mic jack is on the front panel.

Set the BALANCE FROM RTS control to approximately 50%.

Increase the GAIN FROM RTS control to maximum.

## TECHNICAL MANUAL

### Model TWI224 / TWI222 Interface Units

Speak or hum into the carbon microphone headset and adjust the BALANCE FROM RTS control until a null is obtained.

Decrease the GAIN FROM RTS control to minimum.

Use an RTS user station to listen on the RTS system. Turn the microphone off and volume to maximum.

Increase the GAIN TO RTS to maximum.

Adjust the BALANCE TO RTS control for a null in the noise as heard on the RTS system.

Reduce the GAIN TO RTS to minimum.

The interface is now balanced and care should be taken not to disturb the balance controls. An improperly balanced interface may oscillate.

Set both gain controls to approximately 25%.

Have two people establish two-way communication through the interface; adjust the gains so that each person can be heard clearly.

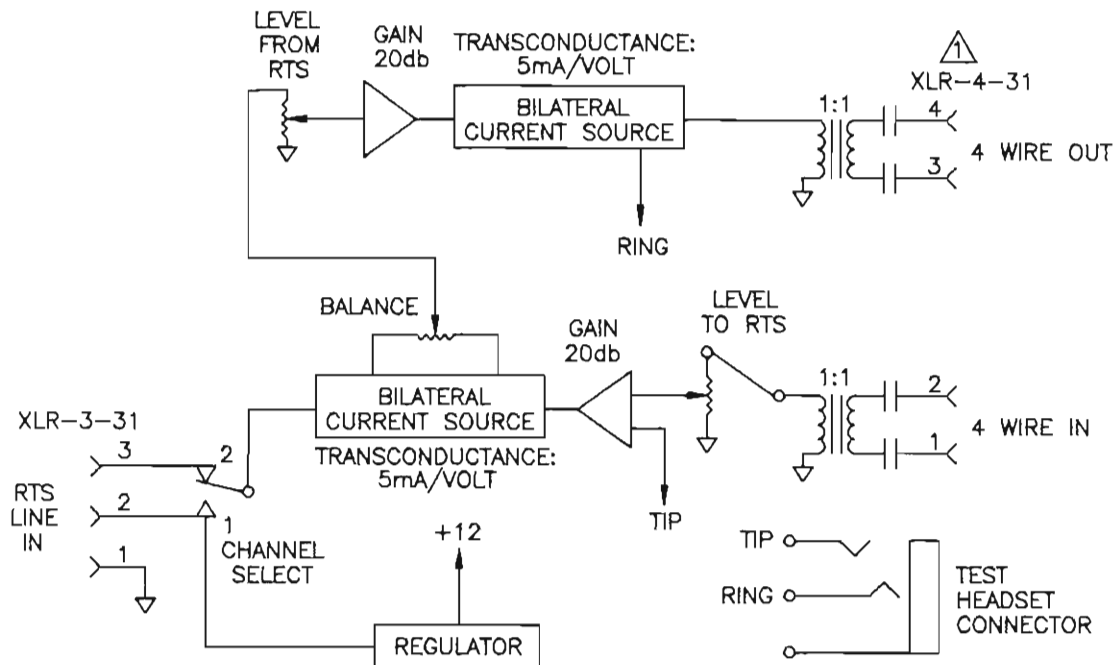
## SECTION 4: THEORY OF OPERATION

### 4.1 INTRODUCTION

Section 4 describes how the TWI224 works. Section 4.2 describes the circuit as used in both the 4-wire and 2-wire models. Section 4.3 describes the Telco Hold circuit which is used in the TWI222-T and TWI222-T-RM.

### 4.2 FUNCTIONAL DESCRIPTION

Figure 4-1 shows the block diagram of the TWI224. The RTS "TW" intercom connects to the XLR-3-31 connector at the lower left.



1 IN RACK MOUNT (-RM) (E) VERSIONS, CONNECTOR IS AN XLR-4-32 (MALE).

**Figure 4-1**  
TWI224 Block Diagram

Model TWI224 / TWI222 Interface Units

## 4.2 FUNCTIONAL DESCRIPTION (continued)

Power to operate the interface is derived from channel 1. Audio from either channel 1 or 2 of the RTS intercom passes through the channel select switch to the output of a bilateral current source. The bilateral current source presents a high input impedance to the RTS line. Signal is picked off of the balance pot and sent to the LEVEL FROM RTS pot. This control sets the level going to the external 4-wire system.

Next an i.c. provides 20 dB of gain. This signal feeds the input of another bilateral current source. The output passes through a 1:1 transformer to the talk bus of the external 4-wire system. The output of this current source must be terminated with 100 to 400 ohms. If the external intercom does not present this impedance to the 4-wire output, an external 200 ohm resistor must be used.

The 4-wire input of the front-panel XLR-4-31 connector passes through a 1:1 transformer to the LEVEL TO RTS pot. The output of the pot feeds an i.c. amplifier with a gain of 20 dB. This feeds the input of a bilateral current source. Output from the current source is inverted when compared to the input. One end of the BALANCE control connects to the input while the other end connects to the output. Thus at some point in the middle of the pot the out-of-phase output will cancel the input such that the return to the 4-wire system is minimized. Too much return to the 4-wire system would mean too much sidetone on the 4-wire system. The balance control does not affect sidetone on the RTS system.

The test headset connector provides a convenient way to balance the system. It is connected to talk and listen to the RTS system, with a carbon-mic headset, just as if it were another station on the 4-wire system.

## 4.3 TWI222 BLOCK DESCRIPTION

Figure 4-2 is the block diagram for the TWI222. It is similar to the TWI224 except there are two balance controls and only one transformer.

Power for the interface is derived from channel 1 with a special regulator circuit.

Audio from RTS passes through the BALANCE FROM RTS pot to the LEVEL FROM RTS pot. The signal is then amplified 20 dB by an i.c. amplifier. This feeds the bilateral current source.

Output from the current source drives the external 2-wire intercom through a 1:1 transformer. This output is inverted.

The BALANCE TO RTS control connects to both the input and the inverted output. Near the center of the pot is a place where the out-of-phase signals will cancel. It is important to set the balance control for a null or feedback will occur.

Input from the external 2-wire intercom enters the TWI222 through the front-panel XLR-4-31. The signal is picked off of the BALANCE TO RTS pot. The LEVEL TO RTS pot sets the level going to the RTS system. 20 dB of gain is provided by an i.c. amplifier. Output from the amplifier feeds another bilateral current source which provides output to the RTS line.

Again the balance control must be set to null the signal coming from the external intercom system or feedback oscillation will result.

The test headset jack is connected to talk and listen to the RTS line with a carbon-mic headset. Persons on the external intercom will not hear, nor will they be able to speak to, the person using the test headset.

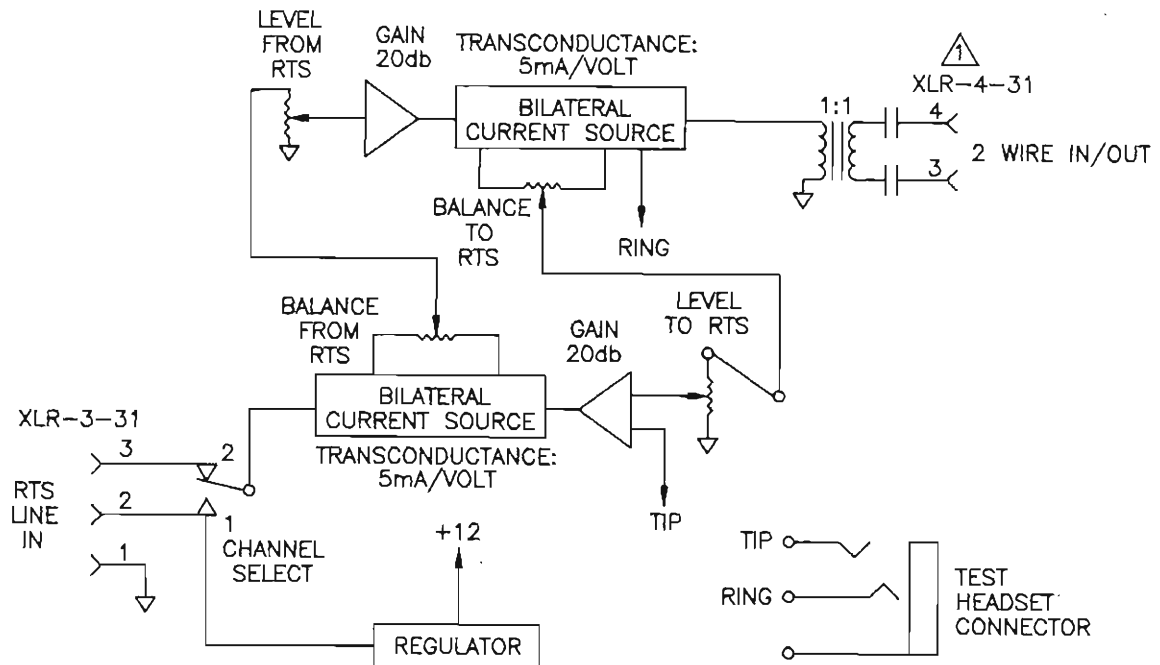
## 4.4 CIRCUIT DESCRIPTION

This section describes the circuit operation of the TWI224. The power supply of the TWI224 derives its power from channel 1 of the RTS line except for local power (LP) units which derive their power from a wall-plug transformer with an output of 14 volts dc.

CR2 provides reverse current protection while R30 acts as a fuse on severe overvoltage conditions or catastrophic unit failure.

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## Model TWI224 / TWI222 Interface Units



△ IN RACK MOUNT (-RM) (E) VERSIONS, CONNECTOR IS AN XLR-4-32 (MALE).

**Figure 4-2**  
TWI222 Block Diagram



#### 4.4 CIRCUIT DESCRIPTION (continued)

VR2 protects the unit from excessive line voltage by shunting anything over 36 volts to ground. High voltage spikes can occur when many user stations are unplugged from the RTS line at once.

The output of U2 is set for 13 volts by R32 and R31. U2 should read 1.2 volts between the adjust (A) and output (O) terminals.

C25 slows down the current response of U2. This keeps the input to U2 a high impedance so that it does not "short out" the audio on the RTS line. C26 provides filtering.

Q1 is a constant current source to VR1 which provides 6 volts to bias the op amps. C28 provides filtering.

Audio from the RTS intercom enters through the rear-panel XLR-3-31 (lower left) and is decoupled by C20 and C29. These capacitors are large because half of the capacitance is lost by their bipolar arrangement. C20 and C29 must also be large because they must pass low frequencies. If they did not, the output level of the bilateral current source would go up and the circuit would become unstable.

The signal continues through C19 to the output of the bilateral current source at the right of R26. C19 is large for the same reason that C20 and C29 are large. It is there to block dc from channel select switch S1. This eliminates clicks when switching channels.

The output of the bilateral current source presents a high impedance to the incoming signal. This is because a bilateral current source converts a varying voltage input to a varying current output. Hence "current source". When the input voltage is not varying, ie. no input, the output current will not vary. In order for the output current to remain constant, the circuit must follow the voltage variations coming in the output so that no current is drawn (0 volts in = 0 volts out). Thus the circuit is actively following the voltage coming in the output so that it is a high impedance and does not load the line.

The signal continues through R23, C18 and R11B through the wiper. R11A (GAIN FROM RTS) sends the signal through C7 to U1. This part of U1 is an amplifying stage with a gain of 10 (20 dB).

U1 is designed to operate with a bipolar power supply. By biasing the inputs to +6 volts, the i.c. can operate on a single-ended +12 volt supply. This biasing is done by R10 and the 6 volt source.

U1b is another bilateral current source whose output feeds the external intercom through T2. For units with the --CM (carbon mic) option, T2 is replaced with a 200:8 transformer. --T (Telco) units have T2 connected for 1:2 step up. C2 is large in order to pass low frequencies.

Audio from the external intercom enters through T2 (upper right) to U1b, the output of a bilateral current source. From the wiper of R25B (BALANCE TO RTS) it passes through C30, jumps to point |8| where it joins R25A (lower right). T1 is not used in the TWI222. R29 and C13 roll off low frequencies to keep the circuit stable.

U1d has a gain of 10 (20 dB). This feeds U1a which is the bilateral current source that feeds the RTS line.

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Model TWI224 / TWI222 Interface Units

## SECTION 5: MAINTENANCE

### 5.1 CHANGING IMPEDANCE, APP NOTE DR-501 (see following application note)

# Application Note

SUBJECT: TWI-222 INTERFACE  
& TWI-224 INTERFACE

APPLICATION: CHANGING IMPEDANCE

GENERAL INFORMATION ☐

SPECIFIC DATA ☐ CUSTOMER:

DATE: 2/5/80

APP NOTE = DR-101

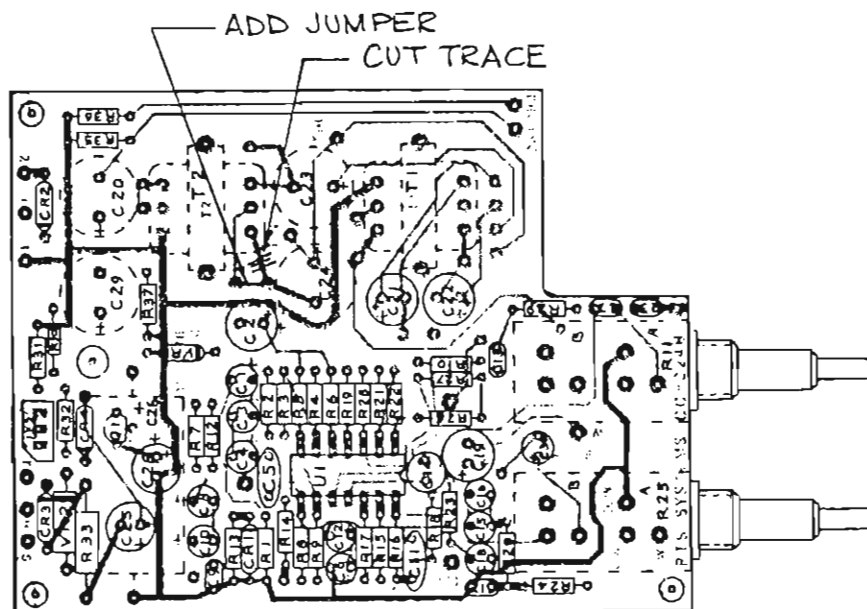
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The impedance of the TWI-224 may be changed to better match your system. Normally, the TWI-224 is built to interface 200 ohms at the input and 200 ohms at the output. The TWI-222 is built to interface to a 200 ohm line. This may be changed to 50 ohms or 800 ohms nominal. In the 50 ohm mode, the interface will handle 25 to 100 ohms. In the 200 ohm mode, the unit will handle 100 to 400 ohms. When the interface is set for 800 ohms, it will handle 400 to 1600 ohms.

Should you find that your system is some impedance other than 200 ohms, change the TWI-222 or TWI-224 to match your system. Find the drawing that applies to the change you want to make. Cut the trace and add the jumper shown.

2 WIRE: 50 OHMS

4 WIRE: 50 OHMS OUTPUT FROM TWI-224



# Application Note

SUBJECT: TWI-224 INTERFACE

APPLICATION: CHANGING IMPEDANCE

GENERAL INFORMATION ☐

SPECIFIC DATA ☐ CUSTOMER:

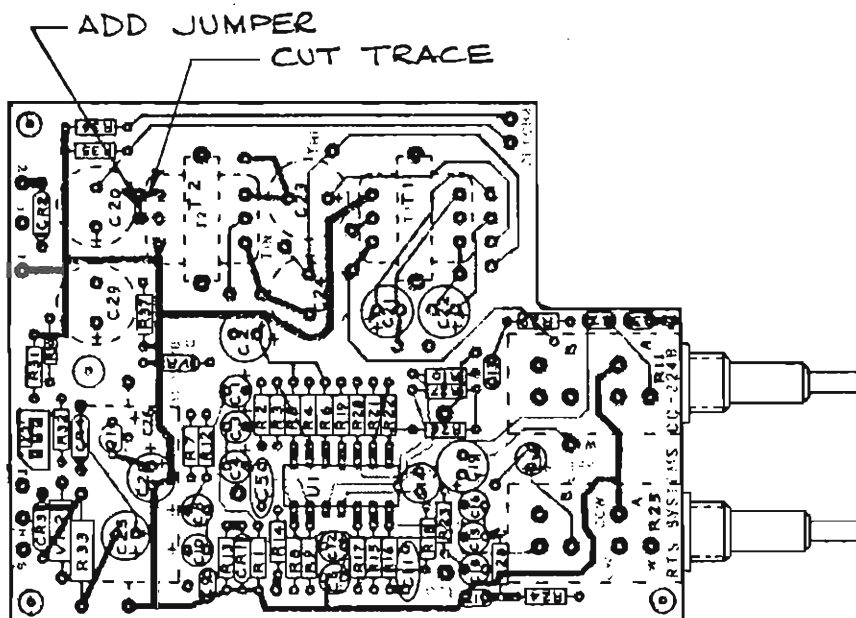
DATE: 2/5/80

APP NOTE =: DR-101

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2 WIRE: 800 OHMS

4 WIRE: 800 OHMS OUTPUT FROM TWI-224



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## SECTION 6: LISTS OR REPLACEABLE PARTS

### 6.1 INTRODUCTION

This section contains parts lists, and instructions for ordering replacement parts. The parts lists are divided into four sections: shipping list, final assembly, back panel and printed circuit board assembly. Immediately following the description of a part is the manufacturer and the manufacturer's part number.

### 6.2 HOW TO OBTAIN PARTS

Parts may be obtained directly from Customer Service, RTS Systems:

RTS Systems  
1100 W. Chestnut Street  
Burbank, CA 91506  
818-566-6700

### 6.3 SHIPPING LIST -- TWI224

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
1	Model TWI224 Interface	9010-2195-00
1	Instruction Manual	9300-3600-00

### 6.3.1 SHIPPING LIST -- TWI222

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
1	Model TWI222 Interface	9010-2184-00
1	Instruction Manual	9300-3600-00

### 6.4 FINAL ASSEMBLY -- TWI224 (9010-2195-00)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
2	Washer, Teflon Seastrom 5612-37-40	1006-0044-00
8	Screw 8-32 x 1/2" 100de Flat HD Phil NKL PL ST	1008-8034-00
1	Pot, Audio TaPer 10K Bourns 81A1A-B24-D15	1406-0008-01
1	Pot, DL 10K/10K "CP" AB 26M907	1407-0023-00
1	Cap, .01uf/1Kv C.D. Use 1510R1032R	1510-R103-2R
1	Transformer, Audio Bourns LM9003	2306-0001-00
5	#73 Shield Bead Fairrite 267300601	2404-0001-00
1	Knob, Single Blk 1/4" Alco K700B	2703-0700-0B
1	Knob, Dual Blk 1/4" Alco, K5700B	2703-5700-0B

# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units

### 6.5 BACK PANEL ASSEMBLY – TWI222 / TWI224 (9020-1788-00)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
1	Washer, 378ID, 6150D, Switchcraft S10451	1006-0031-00
4	Nut, Hex Kep 4-40	1007-0001-00
1	Nut, Hex, 3/8"	1007-0003-00
4	Screw 4-40 x 3/8" 100de FL HD, C/R, BR WH zinc	1008-4012-00
1	Cap, Mono .1uf/50v .1 Spacing, 1" length	1511-R104-2I
1	Conn. Carbon Mic. Switchcraft MN114B	2013-0003-00
1	Conn. 3 Pin male Neutrik NC3MP	2018-0002-00
1	Conn. 3 Pin Female Hirose HA16PR-3S	2018-0036-00
1	Wire, 24 AWG, blue vinyl, stranded, 3"	2511-0001-00
1	Wire, 24 AWG, black vinyl, stranded, 3"	2511-0002-00
1	Wire, 24 AWG, brown vinyl, stranded, 9"	2511-0003-00
1	Wire, 24 AWG, red vinyl, stranded, 9"	2511-0015-00
1	Wire, 24 AWG, green vinyl, stranded, 9"	2511-0018-00
1	Wire, 24 AWG, blue vinyl, stranded, 9"	2511-0043-00
1	Back Panel, STD BP/TWI Per FAB 1511-1 / FD2319	9080-2319-00

### 6.6 FRONT PANEL ASSEMBLY – TWI222 / TWI224 (9020-2193-00)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
1	Lug, Solder #4 Smith 1414-4	1003-0004-00
2	Nut, Hex Kep 4-40	1007-0001-00
4	Nut, Hex 3/8"	1007-0003-00
2	Screw 4-40 x 3/8" 100de. FL HD, C/R, BR WH Zinc	1008-4012-00
1	Switch, Toggle, SPDT Alco MTM-106DPC	1903-0106-PC
1	Conn. 4 Pin Female Cannon AXR 4-31	2018-0001-02
1	Wire, 24 AWG, blue vinyl, stranded, 5"	2511-0005-00
1	Wire, 24 AWG, brown vinyl, stranded, 5"	2511-0006-00
	Wire, 22 AWG, Buss 100 roll, Belden 8021	2512-0022-00
1	Dress Nut Stain Finish JBT W-NU-17A 3/8" O.D.	2709-0003-00
1	Front Panel TWI222 / TWI224 FAB DWG 1375, FD2181	9070-2181-00

### 6.7 PRINTED CIRCUIT ASSEMBLY – TWI222 / TWI224 (9030-2196-02)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
	Teflon Sleeving 20 AWG Alpha TFT 200-20, Roll	1304-0001-00
2	Res. CF 100 ohm 1/4w 5%	1402-1000-5D
7	Res. CF 1K ohm 1/4w 5%	1402-1001-5D
7	Res. CF 100k ohm 1/4w 5%	1402-1002-5D
4	Res. CF 100K ohm 1/4w 5%	1402-1003-5D
1	Res. CF 11K ohm 1/4w 5%	1402-1102-5D
1	Res. CF 1.2K ohm 1/4w 5%	1402-1201-5D

# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units

### 6.7 PRINTED CIRCUIT ASSEMBLY -- TWI222 / TWI224 (9030-2196-02)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
4	Res. CF 20K ohm 1/4w 5%	1402-2002-5D
2	Res. CF 22K ohm 1/4w 5%	1402-2202-5D
1	Res. CF 22 ohm 1/4w 5%	1402-22R0-5D
1	Res. CF 36 ohm 1/2w 5%	1402-36R0-5E
1	Res. CF 3.3 ohm 1/8w 5%	1402-3R30-5B
1	Res. CF 470 ohm 1/4w 5%	1402-4700-5D
1	Res. CF 4.7K ohm 1/4w 5%	1402-4701-5D
1	Cap, .01uf/1kv C.D. Use 1510R1032R	1510-R103-2R
2	Cap, 820pf/1Kv Cer Disc Radial	1510-R821-2R
1	Cap, Mono .1uf/50v .1 spacing, 1 length	1511-R104-2I
1	Cap, Elec 1000uf/16v Axial	1513-A108-4E
9	Cap, Elec 10uf/16v Radial	1513-R106-4E
2	Cap, Elec 10uf/50v Radial	1513-R106-4I
1	Cap, Elec 100uf/10v Radial	1513-R107-4C
4	Cap, Elec 100uf/50v Radial	1513-R107-4I
3	Cap, Elec 2.2uf/50v	1513-R225-4I
3	Cap, Elec 47uf/16v Radial	1513-R476-4E
1	Cap, Mylar .001uf/100v Radial 10%	1514-R102-2L
2	Cap, Mylar .0047/100V Radial	1514-R472-2L
1	Diode, 1N914B Signal	1601-0914-0B
3	Diode, 1N4004 1 Amp, 400V	1601-4004-00
1	Diode, 1N5233A Voltage Regulator	1601-5233-00
1	Diode, 1N5365B Zener Voltage Regulator	1601-5365-0B
1	Transistor, J305 Silicon	1602-0305-00
1	Voltage Regulator, National LM317MP	1603-0317-MP
1	I.C., MC3403P Motorola	1603-3403-0P
1	I.C. Socket, 14 Pin Burndy DIL14P-108	2001-0002-00
1	Transformer, Audio Bourns LM9003	2306-0001-00
	Wire, 22 AWG Buss 100' Roll, Belden 8021	2512-0022-00
1	PCB, CC222/224 FAB Per Dwg 1377/AW2032	9040-1377-00
1	Insulator w/out holes FAB Per Dwg 1840	
1	Natural Rubber .062" Thick x 3' Wide	4501-0027-00
1	Outside Processing Insulator w/out hole	LABR-1840-00
1	Ext. Case, TWI222/224 Per Dwg 1802-6/FD2318	9060-1802-06
6	Extrusion, Belt Pack 6' x 3 1/2" x 1 3/4"	9050-6302-00
1	Outside Processing TWI222/224 Case	LABR-1802-06

## TECHNICAL MANUAL

Model TWI224 / TWI222 Interface Units

### 6.8 FINAL ASSEMBLY -- TWI222 (9010-2184-00)

<u>QTY</u>	<u>DESCRIPTION</u>	<u>RTS PART NUMBER</u>
2	Washer, Teflon Seastrom 5612-37-40	1006-0044-00
8	Screw 8-32 x 1/2" 100de Flat HD Phil NKL PL ST	1008-8034-00
2	Pot, DL 10K/10K "CP" AB 26M907	1407-0023-00
4	#73 Shield Bead Fairrite 267300601	2404-0001-00
2	Knob, Dual Blk 1/4" Alco, K5700B	2703-5700-0B



# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units

### SECTION 7: DIAGRAMS

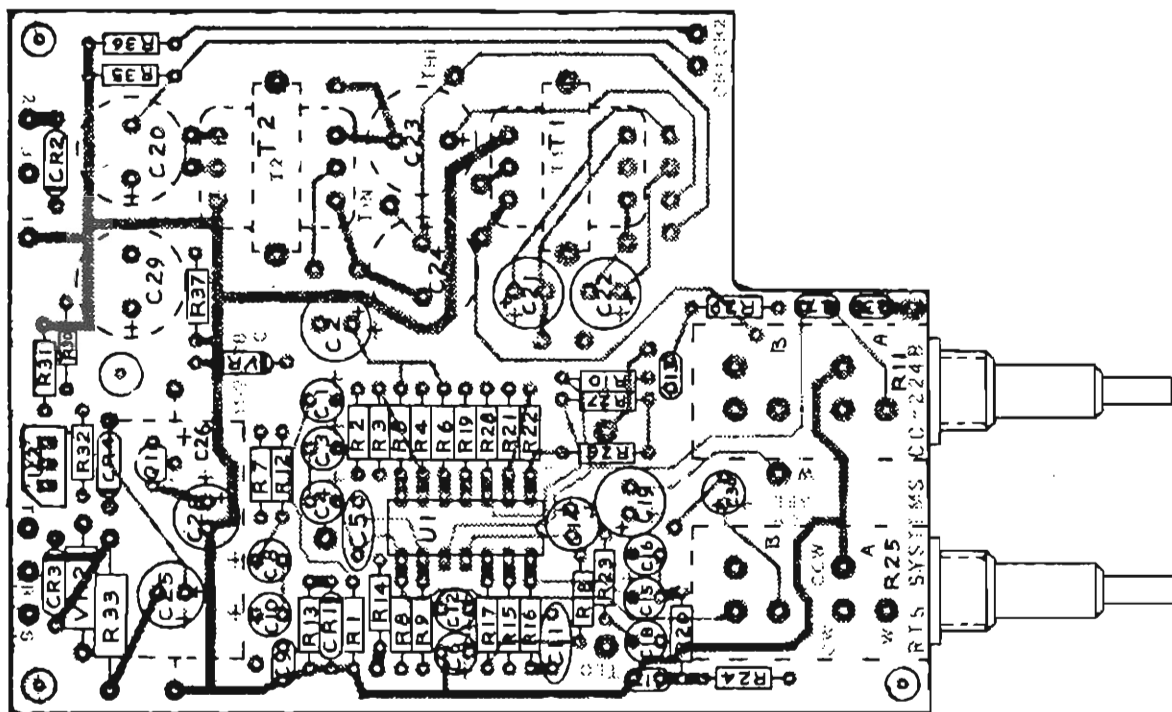
<u>Document</u> <u>Number</u>	<u>Title</u>	<u>Page</u>
SD1255	Schematic Diagram, Intercom Interface TWI224.....	7-2
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## Model TWI224 / TWI222 Interface Units



# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units



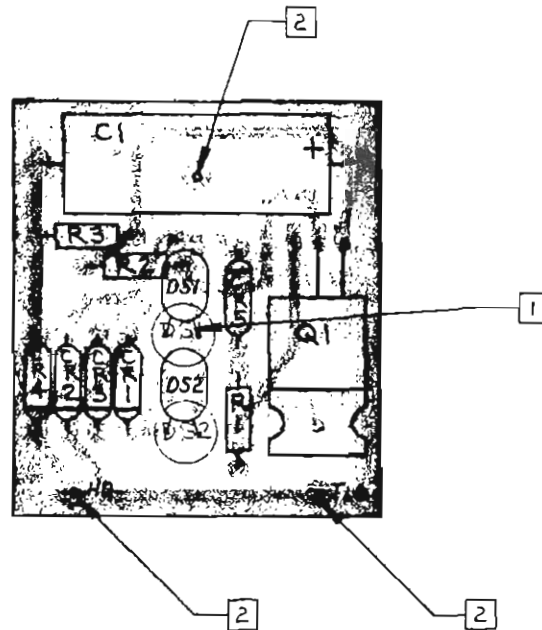
3.  Q1, AS SHOWN, IS J305 (TO-92 CASE)
-  EARLY VERSIONS; Q1, IS E305 (TO-18 PIN CIRCLE)
2. C31 NOT ON BOARD; FOR FUTURE USE.


NOTES: 1. DASHED LINES INDICATE PARTS ON BOTTOM OF BOARD.

Assembly Diagram, P.C.B. TWI224 Interface Layout

## TECHNICAL MANUAL

### Model TWI224 / TWI222 Interface Units



- [2] CAMBION # 460-2970-02-03-00 SWAGE AND SOLDER PINS BEFORE STUFFING THE P.C. BOARD.
- [1] LAMP TYPE 1764 : 28V, .04A, 34MSCP, 5K HR., INCANDESCENT T-1 3/4 WIRE LEAD LAMP. , MOUSER ELECTRONICS PART # 579-1764. MOUNT LAMPS FLAT AGAINST P.C. BOARD. APPLY A DROP OF CLEAR SILICON TO LAMP BASES TO HOLD THEM IN PLACE.

NOTES:

Assembly Diagram, P.C.B., TWI224 Hold Circuit Layout

# Engineering Note

SUBJECT:

TWI-SK70-DCU

INTERFACE CARD

DATE: 07-14-78

CUSTOMER: ALL USERS

ENGINEERING NOTE #: 138

PAGE: 1 of 2

## OPERATION

### SET-UP

- 1) ISO/NORMAL switch to NORMAL.
- 2) BALANCE control to center of range.
- 3) Both GAIN controls to extreme counterclockwise position.
- 4) Plug in a carbon mic or Plantronics type headset into the headset jack.
- 5) Advance GAIN controls to approximately 1/3 of maximum setting.
- 6) Switch on microphone, say ahhhh and adjust BALANCE for null in headphones.
- 7) Move carbon mic headset plug to DCU "AUX" (INCOM) module.
- 8) Set Headphone gain on "AUX" module midway. Set GAIN controls on interface so that you and a person on the RTS line can hear each other well.
- 9) Verify camera position can talk well with RTS line (RTS belt pack gains set for normal two-way conversation on RTS line).

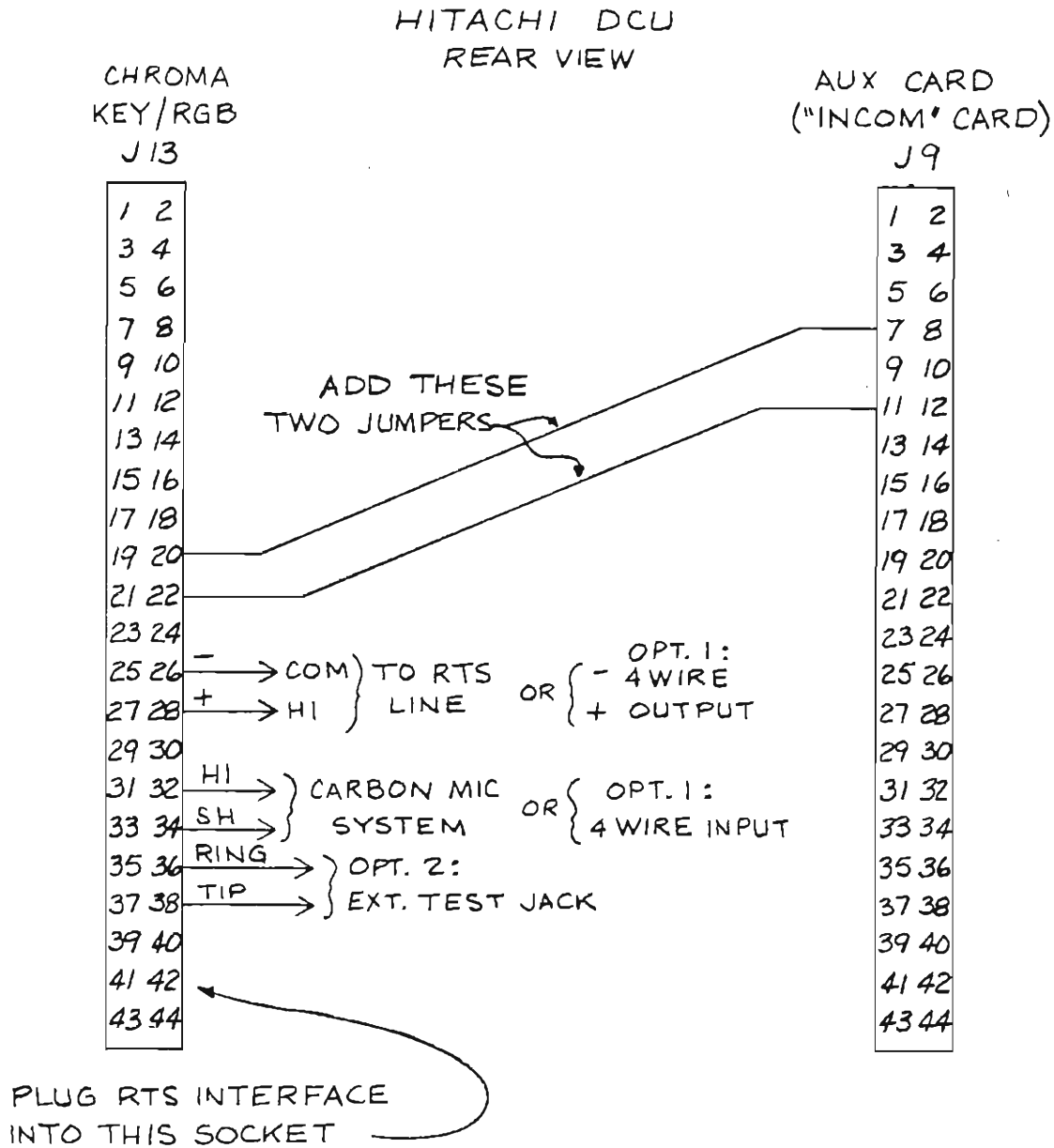
### ADDITIONAL COMMENTS

If there is distortion, check INCOM level settings in Hitachi process pack.

The test jack in the interface module talks to the RTS line but not the camera. Use the jack in the "AUX" module to talk to the camera, and to talk to the camera when the ISO/NORMAL switch is in the ISO position.

# TECHNICAL MANUAL

Model TWI224 / TWI222 Interface Units



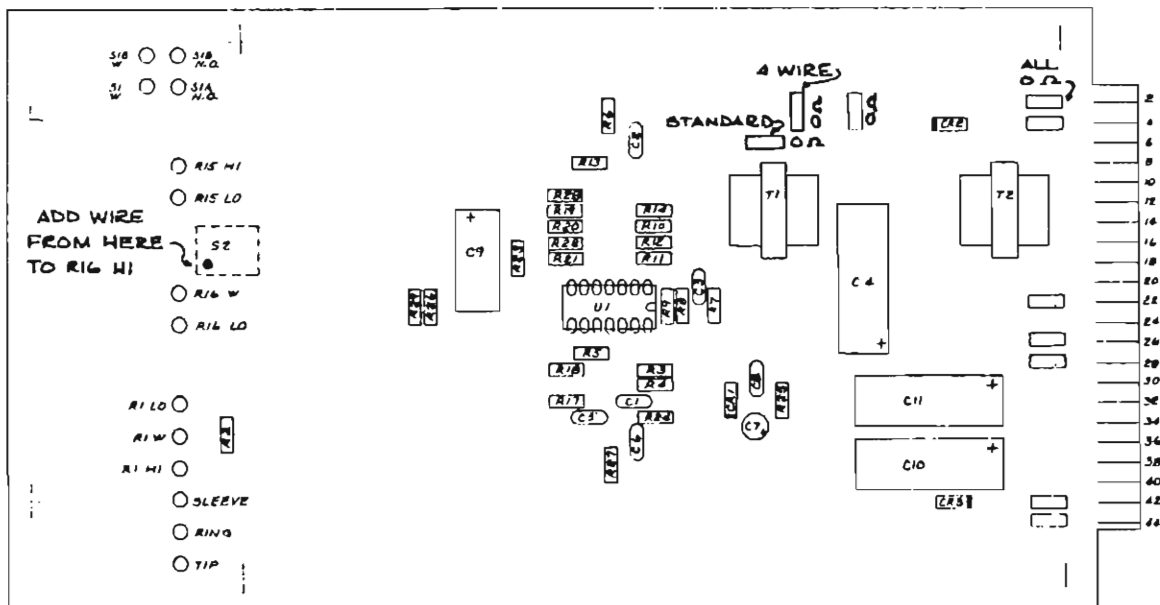
Wiring Diagram, TWI-SK70-DCU Interface

# Engineering Note

SUBJECT: TWI-SK70-DCU  
4 wire interface with the SAP 1024

DATE: 01/29/80  
CUSTOMER:  
ENGINEERING NOTE = DR-500  
PAGE: 1 of 2

For operation in the 4 wire mode, the TWI-SK70-DCU card needs to be converted to 4 wire. To do this, move the zero-ohm jumper shown below. Remove the jumper that goes from the balance pot wiper (R15) to the GAIN FROM RTS pot (R16 HI). Add a wire from the point shown to the HI side of R16.



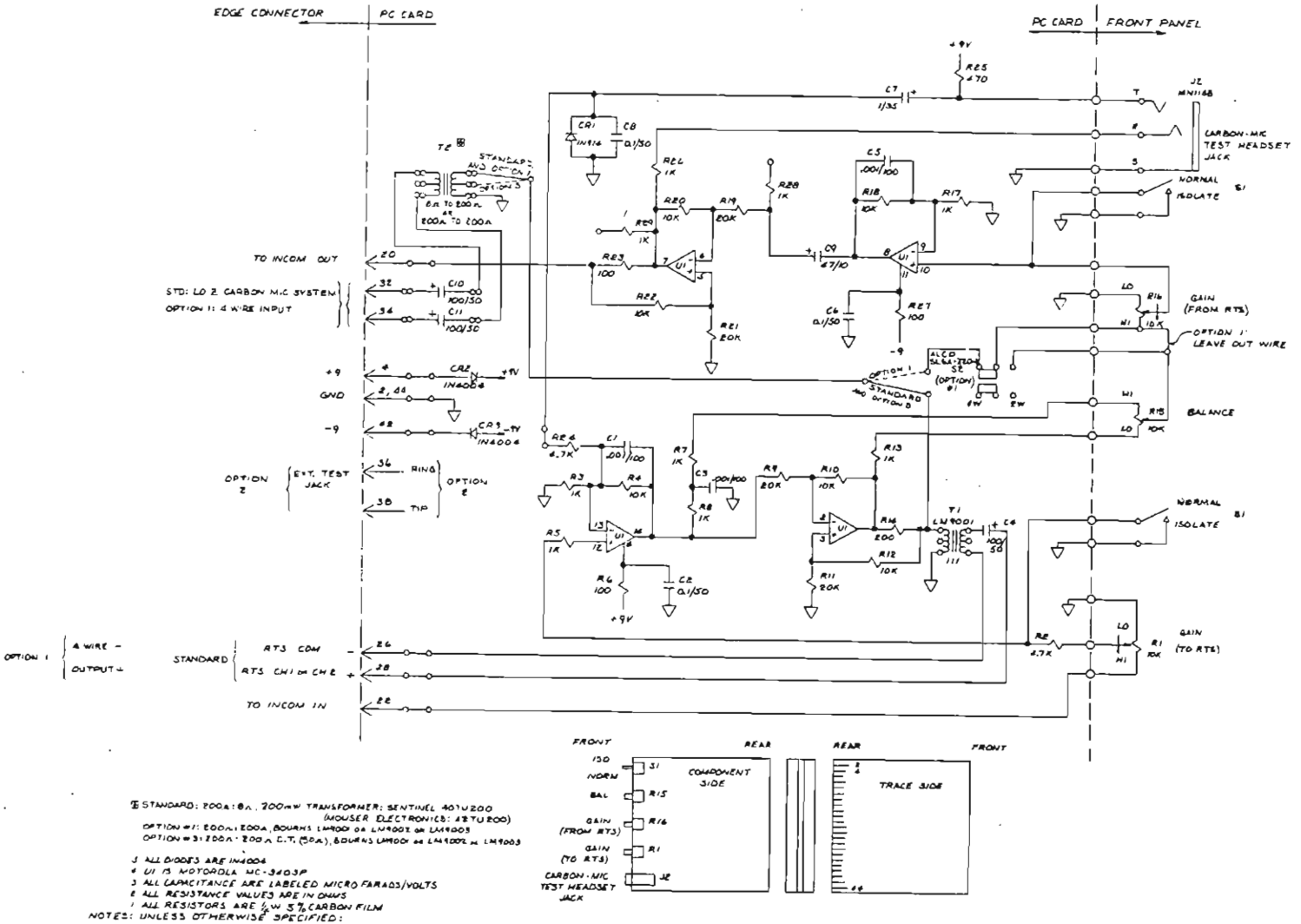
DWG. A31241





# TECHNICAL MANUAL

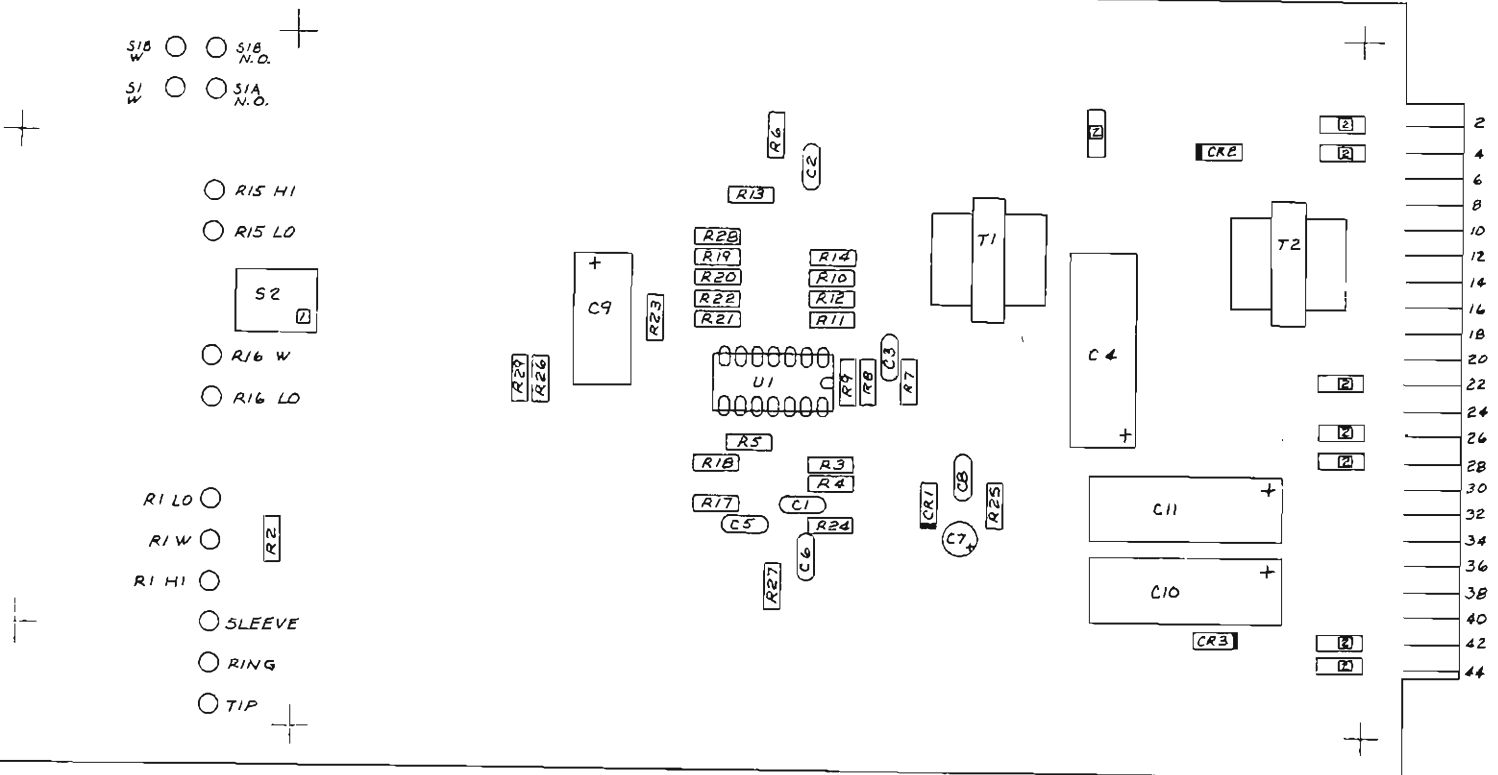
## Model TWI224 / TWI222 Interface Units



Schematic Diagram, TWI-SK70-DCU

# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units



Assembly Diagram, TWI-SK70-DCU Layout Chart

# Application Note

SUBJECT: TWI SK70 DCU SQUELCH CIRCUIT PIGGYBACK BOARD  
INSTALLATION TO INTERFACE CARD

APPLICATION: TWI-SK70-DCU

GENERAL INFORMATION ☐

SPECIFIC DATA ☐

CUSTOMER:

DATE: 4/15/80

APP NOTE #: CN02

PAGE: 1 of 2

The TWI SK70 DCU squelch circuit piggyback board is intended for use on the RTS TWI SK70 DCU INTERFACE CARD (serial numbers 001-058 and 51901-51950). Its purpose is to attenuate noise generated by the DCU when the camera is disconnected from the DCU and to allow the RTS PL/Intercom lines to remain operable and noise free.

Two mounting holes must be drilled into the main board to mount the piggyback board, and five wires connect it to the main board. One zerohm jumper is to be removed from the main interface board. The trimpot on the squelch card controls the sensitivity of the squelch.

The complete installation is outlined below:

1. Place the main board, component side up, card edge fingers pointed to the right.
2. Drill the first 0.156 diameter hole 2.00 inches from the left hand edge and 2.00 inches from the near edge of the board. The second 0.156 diameter hole is placed 4.00 inches from the left and 0.75 inches from the near edge. Accuracy is very important in order to avoid interference with components on the main board or the card guides.
3. Using 4/40 hardware, and extra nuts to act as short stand-offs, bring the screws up from the solder side of the main board, and mount the squelch card (component side up) on the main card. Fasten securely, making sure that no wires are pinched under the card and that the card cage guides will not hit the piggyback squelch card.
4. Remove the zerohm jumper, which, on the main board, is connected between pin 22 of the card edge fingers and R-1 (GAIN TO RTS).

# Application Note

SUBJECT: TWI SK70 DCU SQUELCH CIRCUIT PIGGYBACK BOARD INSTALLATION  
TO INTERFACE CARD

APPLICATION: TWI-SK70-DCU

GENERAL INFORMATION ☐

SPECIFIC DATA ☐ CUSTOMER:

DATE: 4/15/80

APP NOTE #: CN02

PAGE: 2 of 2

5. Wire as follows: (see drawing no. 1869)

<u>wire#</u>	<u>piggyback board</u>	<u>main board</u>
1	from pad marked "IN"	to pin#22 (use pad formerly occupied by zerohm jumper)
2	from pad marked "SW"	to R1 (use pad formerly occupied by zerohm jumper)
3	from pad marked "GND"	to pin#2 or pin#44 (wire to zerohm jumper)
4	from pad marked "+9"	to CR2, cathode
5	from pad marked "-9"	to CR3, anode

6. Adjust the trimpot on the squelch card fully counterclock-wise for maximum sensitivity. If nuisance triggering of the squelch occurs, turn the trimpot clock-wise as needed. No adjustments are needed on the interface card.

# Engineering Note

SUBJECT: TWI-SK70-DCU SQUELCH CARD, CIRCUIT DESCRIPTION

DATE: 4/15/80

CUSTOMER:

ENGINEERING NOTE = CN03

PAGE: 1 of 2

## GENERAL

This squelch circuit solves the following field operation problem of the SK 70 DCU: when the camera/process pack is disconnected and moved, carrier is lost at the DCU and receiver noise is injected on the PL/Intercom line. With the squelch circuit, noise from the camera is greatly attenuated, permitting normal PL/Intercom operation to continue. Circuit operation depends both on the differing amounts of energy in noise and speech, and the distribution of this energy in the frequency spectrum. Generally, speech will not have any significant energy above five kilohertz while the DCU will generate uniform noise from 100 hertz to twenty kilohertz. The squelch circuit utilizes this principle by sensing high frequency high level noise then disconnecting the DCU from the PL/Intercom system. When the camera is reconnected to the DCU, the noise disappears and the PL/Intercom to the camera is enabled with a very short delay. During this time, the rest of the communication network is unaffected.

## DETAILED DESCRIPTION

An input RF bypass capacitor reduces the possibility of RF overload and false triggering of the circuit. The next stage contains an active second order bandpass filter (5 kilohertz to 100 kilohertz) which removes speech energy below 5 kilohertz and spurious RF noise above 100 kilohertz. A schmitt trigger squares up the signal that filters through. The input to the schmitt trigger is biased by the negative supply to ensure that the squelch is off when no signal is present. This negative bias can be adjusted by means of a 10k trimpot and sets the threshold of the schmitt trigger and entire circuit without changing the filter hinge points or compromising the sensitivity of the trigger. Notice that up to this point, all the circuitry is a.c. coupled so that all offset and bias currents and voltages are blocked and are not added to the signal. This allows for a highly sensitive circuit without expensive and cumbersome nulling techniques. Also, the impedances used in the circuit are chosen to minimize the effects of variations in different integrated circuits so that all results are highly repeatable. A rectifier and RC integrator provide a D.C. control voltage to a CMOS analog switch. The integrator filters out occasional high frequency bursts from musical sources. Thus, only

# Engineering Note

SUBJECT: TWI-SK70-DCU SQUELCH CARD, CIRCUIT DESCRIPTION

DATE: 4/15/80

CUSTOMER:

ENGINEERING NOTE = CN03

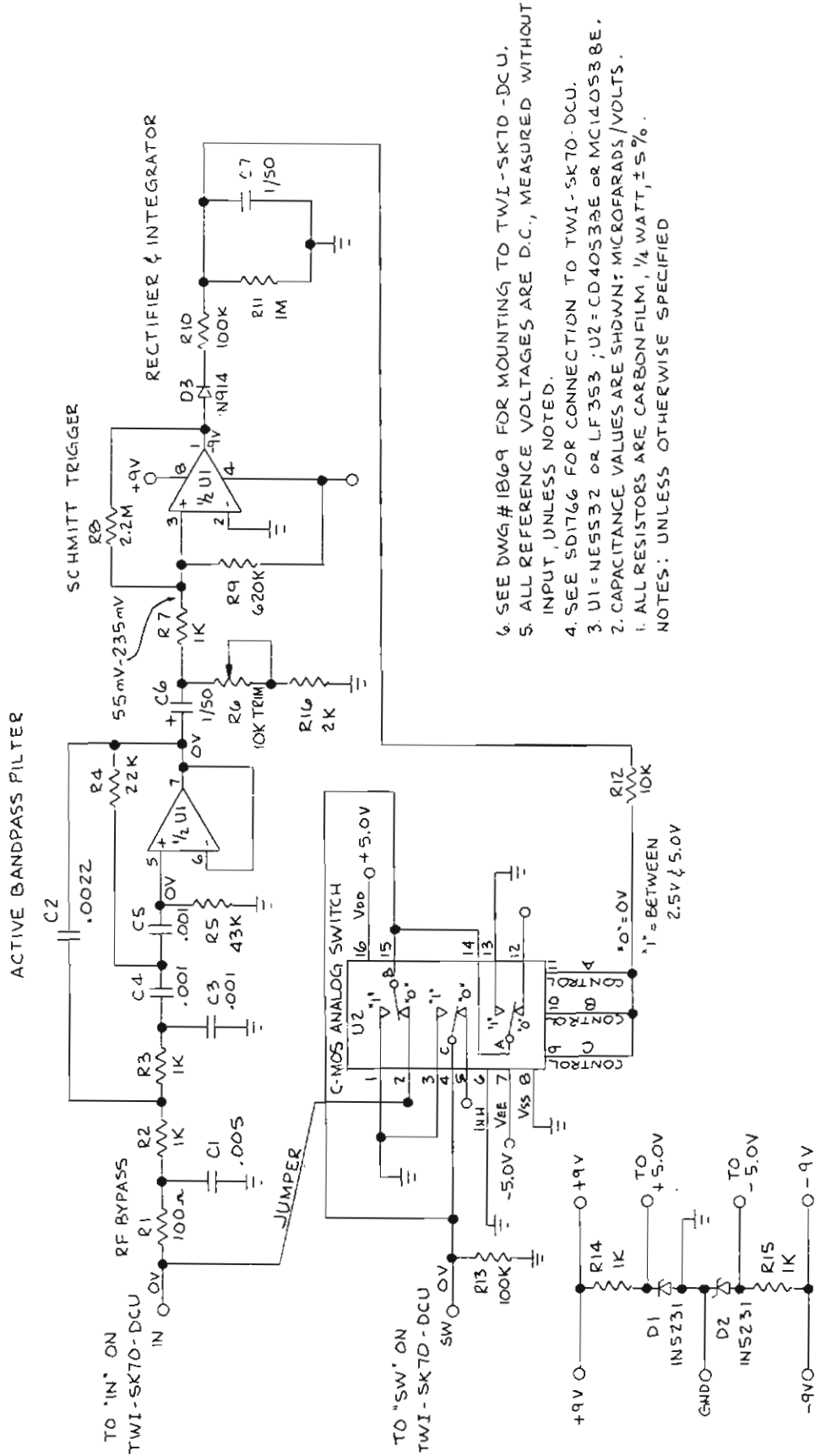
PAGE: 2 of 2

DCU audio noise with a high statistical probability of high frequency components will trigger this circuit. The CMOS switch will normally pass the signal until the control voltage directs the switch to open the signal path and shunt the input of the op-amp going to the PL/Intercom lines to ground. This scheme provides as much attenuation as possible.

It is hoped that this note has given the reader an understanding of both the basics of this circuit as well as some of the major details of the design.

# TECHNICAL MANUAL

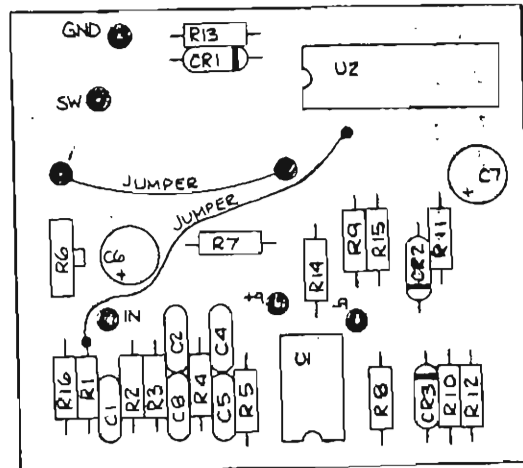
## Model TWI224 / TWI222 Interface Units



Schematic Diagram, Squelch Mod For TWI-SK70-DCU

# TECHNICAL MANUAL

## Model TWI224 / TWI222 Interface Units



Assembly Diagram, P.C.B. Squelch Modification For TWI-SK70-DCU Layout

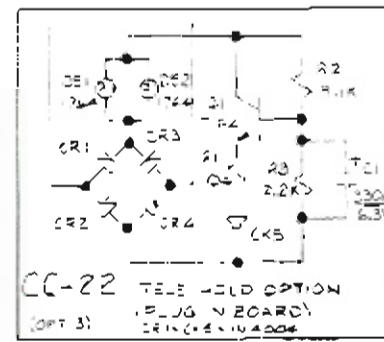
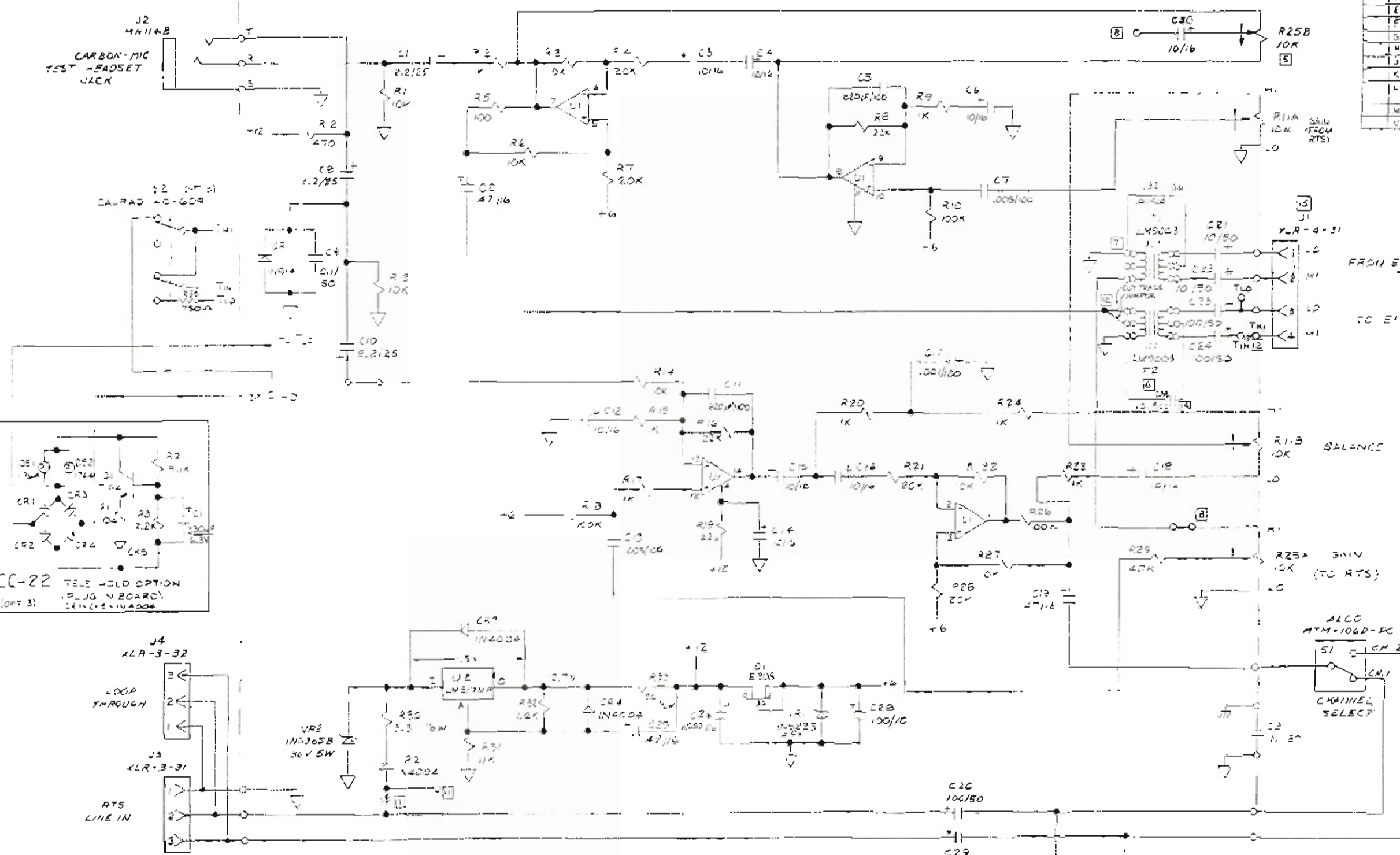




REAR PANEL RE CARD

PC CARD FRONT PANEL

REV	DESCRIPTION	DATE	BY
1	INITIAL	11/30/78	
2	ADDED 52	1/17/79	
3	ADDED 53	1/17/79	
4	2 WIRE/2 WIRE UPDATES	4/17/79	
5	DELETED C4, R12 TO R23	4/30/79	
6	RE/52 CONNECTION	10/14/79	
7	ADDED NOTES 11, 15, 16	10/17/79	
8	NOTE 12 FOR TELCO	10/18/79	
9	PER ECO D02	11/5/79	
10	ADDED C4, C5, C6, C7	1/11/81	
11	REMOVED R17 PER ECO 1649	1-27-87	
12	REMOVED PER ECO 2752	1-27-84	

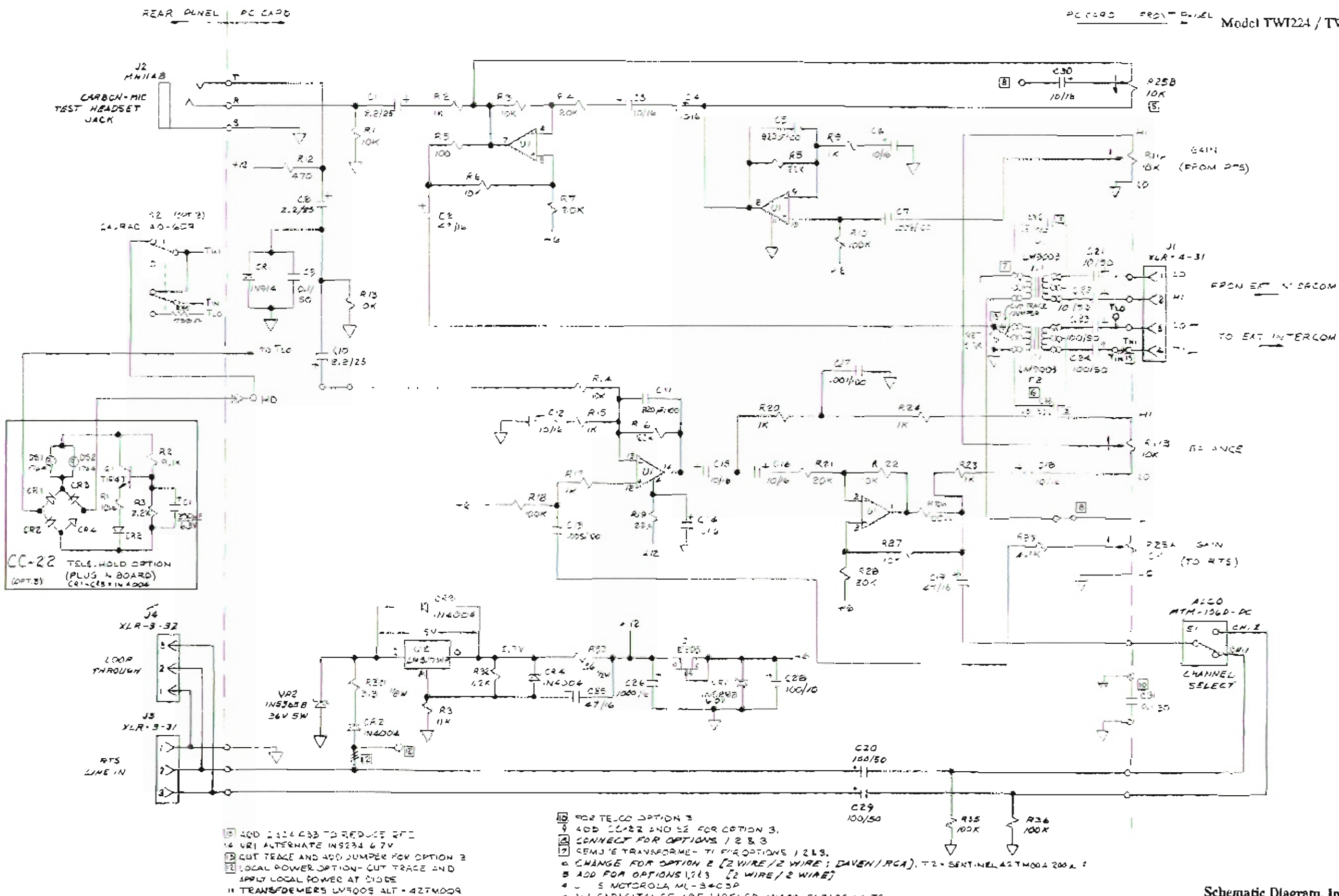


- 1 ON RM UNITS, J1 IS A MALE CONNECTOR AIR-4-75 154000002.
- 2 ADD C1-C4 AND 52 TO REDUCE EFT
- 3 VR1 ALTERNATE USE 34 4.2V
- 4 CUT TR-22 AND ADD JUMPER FOR OPTION 3
- 5 LOCAL POWER OPTION- CUT TRACE AND APPLY LOCAL POWER AT J10
- 6 TRANSFORMERS LM9003 ALT #4214003

- 7 ADD CC-32 AND 52 FOR OPTION 3
  - 8 CONNECT FOR OPTIONS 1, 2 & 3.
  - 9 REMOVE TRANSFORMER T1 FOR OPTIONS 1, 2 & 3.
  - 10 CHANGE FOR OPTION 2 [2 WIRE/2 WIRE: DAVEN/RCA] T1-SENTINEL 4214004 200 1
  - 11 ADD FOR OPTIONS 1 & 2 [2 WIRE/2 WIRE]
  - 12 U1 S MOTOROLA MC-3407
  - 13 ALL CAPACITANCE ARE LABELED MICRO FARADS UNLESS
  - 14 ALL RESISTANCE VALUES ARE IN OHMS
  - 15 ALL RESISTORS ARE 1/4W 5% CARBON FILM
- NOTES: UNLESS OTHERWISE SPECIFIED

LAST USED: C38 CR4 J4, R37, C1 TO U2, VR2, D1  
NOT USED: C37, R35

PROJECT LINE		RTS SYSTEMS MC HOLLYWOOD, CA	
SHEET NO.		SCHEMATIC, INTERCOM INTERFACE CC-22A	
DATE		10/11/78	
BY		D. W. C. 12	
CHECKED		SD, 255	
APPROVED			
REVISIONS			



LAST USED: C33, CR4, J4, R37, S1, T2, U2, VR2, C1  
 NOT USED: C27, R86

Schematic Diagram, Intercom Interface

Model TW1224

RTS Systems Burbank, CA 91506

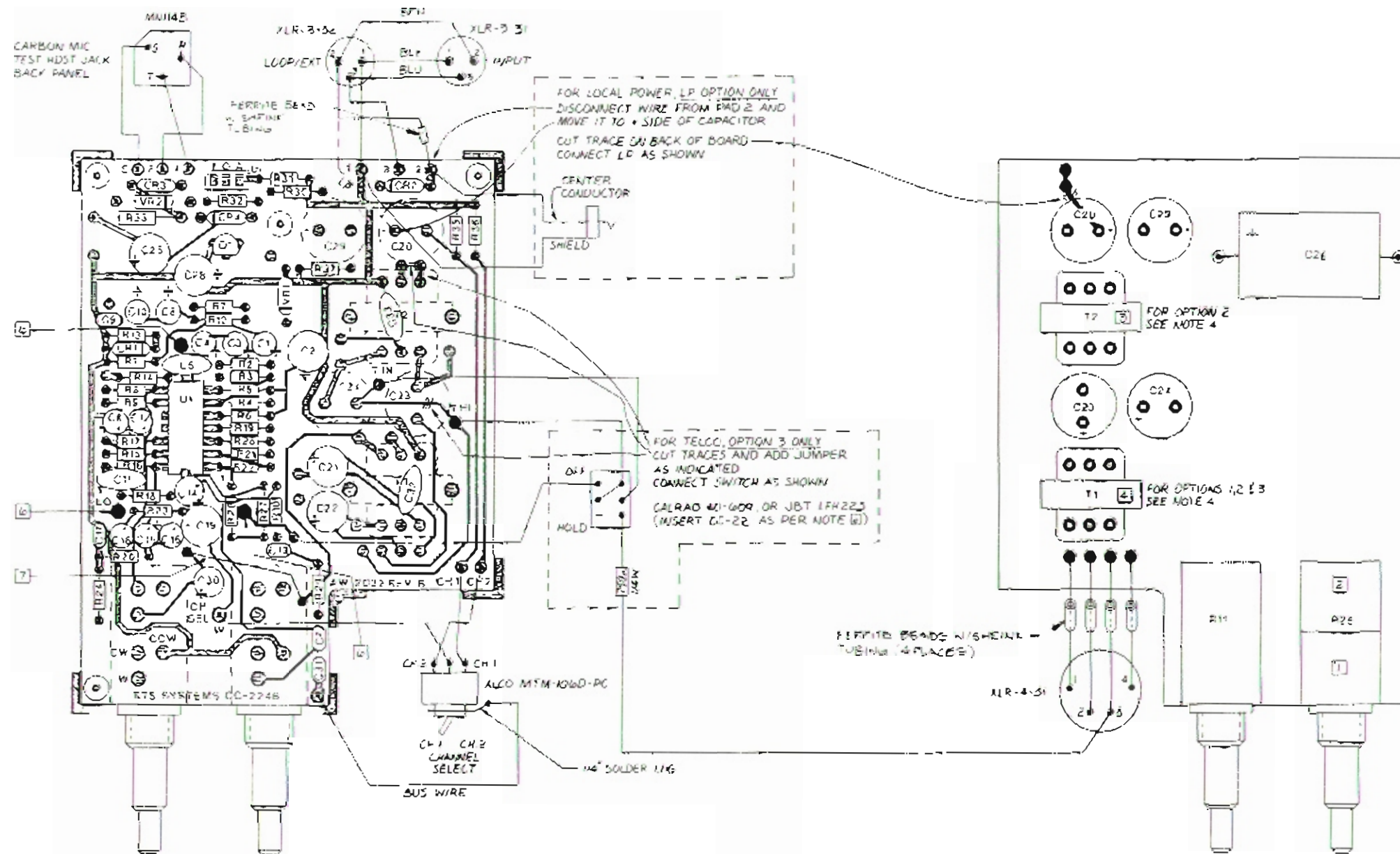
FSCM: 60572 TM3600

Second Edition, July 1989

Page 7-17



REV	DESCRIPTION	DATE	BY
A	CLARIFIED TELCO WIRING	10-21-78	CAF
B	NOTE 8	11-21-78	CAF
C	PER ECO 002	12-6-79	SCW
D	TELCO SW WAS 1BT-213	12-18-79	
E	PER ECO 4051	2-16-80	
F	PER ECO 4046	4-29-80	
G	PER ECO 4046	1-31-81	
H	REMOVED NOTE 1	1-23-81	
J	PER ECO 1361	1-23-81	
K	REV PER ECO 1412	4-30-81	
L	REMOVED TELCO 1699	1-27-81	
M	REDRAWN WITH NO CHANGES	12-14-88	
N	REVISED PER ECO 1610	1-10-89	
P	REVISED PER ECO 1644	1-10-89	



- OPTIONS
- 1 2 WIRE TO 2 WIRE (TWI 222)
  - 2 2 WIRE TO 2 WIRE (FOR DAVEN/RCA) TWI 222-CM)
  - 3 TELCO (TWI 222-7)
  - LP LOCAL POWER

- 7 FOR OPTIONS 1, 2 & 3, INSTALL JUMPER WITH TEFLON SLEEVING
  - 8 FOR TELCO OPTION 3, DRILL .018 DIA. HOLE (3 PLACES) FOR SOCKET PINS. INSTALL PCB CC-22 TELEPHONE HOLD.
  - 9 TRANSISTORS SHOWN ARE 1305 (70-92 CASE).  
EARLY VERSIONS - TRANSISTORS ARE 8305 (70-18 2NW CIRCLE)
  - 10 FOR OPTIONS 1, 2 & 3 LEAVE OUT TRANSFORMER T1 & 01 CAP ACROSS T1
  - 11 FOR OPTION 2, USE SENTINEL 423M004 200K 8
  - 12 INSTALL DUAL POT FOR OPTIONS 1, 2 & 3 DUAL POT IS 10K BUDJ (SECTION A), AND 10K LINEAR (SECTION B).
  - 13 INSTALL SINGLE POT FOR STANDARD CONFIGURATION, 10K, AUDIO TAPER (TWI 224).
- NOTES - UNLESS OTHERWISE SPECIFIED

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES FRACTIONS DECIMALS ANGLES		PRODUCT LINE		RTS SYSTEMS BURBANK, CALIFORNIA	
BY	DATE	APPROVED	DATE	TITLE	
P. NEILSON	12-14-88			WIRING DIAGRAM, TWI-224 INTERFACE, FOR STD, AND OPTIONS 1, 2, 3 & LP	
DESIGNED	DATE	CHECKED	DATE	SCALE	
W. J. NEILSON	12-14-88			D 80572 WD 1806	
DO NOT SCALE DRAWING		SHEET 2/1		TOTAL 1 OF 1	