Simulcast System
Alignment Manual

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SIMULCAST SYSTEM
ALIGNMENT MANUAL

The E.F. Johnson Company designs and manufactures two-way radio equipment to serve a wide variety of communications needs. Johnson produces equipment for the mobile telephone and land mobile radio services which include business, industrial, government, public safety, and personal users.

LAND MOBILE PRODUCT WARRANTY

The manufacturer's warranty statement for this product is available from your product supplier or from the E.F. Johnson Company, 299 Johnson Avenue, Box 1249, Waseca, MN 56093-0514. Phone (507) 835-6222.

WARNING

This device complies with Part 15 of the FCC rules. Operation is subject to the condition that this device does not cause harmful interference. In addition, changes or modification to this equipment not expressly approved by E. F. Johnson could void the user's authority to operate this equipment (FCC rules, 47CFR Part 15.19).

DO NOT allow the antenna to come close to or touch, the eyes, face, or any exposed body parts while the radio is transmitting.

DO NOT operate the radio near electrical blasting caps or in an explosive atmosphere.

DO NOT operate the radio unless all the radio frequency connectors are secure and any open connectors are properly terminated.

DO NOT allow children to operate transmitter equipped radio equipment.

SAFETY INFORMATION

Proper operation of this radio will result in user exposure below the Occupational Safety and Health Act and Federal Communication Commission limits.

The information in this document is subject to change without notice. E.F. Johnson Company will not be liable for any misunderstanding due to misinformation or errors found in this document.

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1.1 SCOPE OF THE MANUAL

This manual presents an overview of the elements in an E.F. Johnson Simulcast Radio System. The interconnections between the various elements of the system are also illustrated. The procedures used to tune and align the system during installation and maintenance are then discussed.

Before attempting to implement the procedures discussed in this document, it is recommended that the E.F. Johnson manuals listed below be studied.

Manual	Part Number
Simulcast Application Note	009-2100-001
Channel Controller Manual	001-2100-200
High Stability Repeater Manual	001-2008-920
Multi-Net® Voter Service Manual	001-3039-505
Network Management for Simulcast:	
Service Manual	001-0690-201
Operator Manual	002-0690-201
System Manager Manual	004-0690-203

1.2 WHAT IS A SIMULCAST RADIO SYSTEM?

Simulcast as it applies to an E.F. Johnson two-way radio system is the simultaneous transmitting of a message from two or more radio sites on the same radio channel. In addition, the strength of the receive signal at the various sites is monitored and a "Voter" selects the strongest signal. That signal is then routed to all the sites for retransmission.

1.3 SYSTEM ELEMENTS

An E.F. Johnson Simulcast Radio System will typically incorporate a Network Management System. Section 2 of "Network Management for Simulcast: Service Manual" provides a review of the elements of the Network Management System. The discussion in this manual will, therefore, focus on the other Simulcast System components.

Figure 1-1 shows a high level view of the basic components of a Multi-Net System, with the exception that Channel Controllers now take the place of Multi-Net repeaters. The repeaters are now distributed across multiple sites. Relative to the RNT, however, Channel Controllers "appear" to be repeaters. Review of the RNT manual, Part No. 001-3039-009, is recommended in order to understand its operation with respect to the UAS, SMM, RMF, CPP, Consoles, and Telephone resources.

Figure 1-2 presents a more detailed view of the remainder of the Simulcast System. To study its operation, imagine a subscriber radio making a transmission which is received by the Channel 1 Repeaters at both the remotely located Remote Site and the centrally located Remote Site. The outputs from the repeaters, audio on RXA± and data (Received Signal Strength Information (RSSI) and Multi-Net data) on VDIN, are transmitted to the RVMs associated with Channel 1.

For the centrally located Remote Site this is a direct connection, while link equipment is required to connect the remotely located Remote Site to the Central (Control) Site. The RVM uses received signal strength information to select which signal to pass to the Channel 1 Repeater Controller. The Repeater Controller contains the logic processing of a normal Multi-Net repeater, with additional signal processing which has been developed to allow Simulcast operation, however, it has no RF hardware. The Repeater Controller is connected to the RNT in the same manner as a Multi-Net repeater.

The audio and Multi-Net data from the Repeater Controller, which is to be transmitted over the air, is passed to splitters. The outputs from the splitter are available for direct connection to the centrally located Remote Site and for linking to remotely located Remote Sites. The audio/data signal is connected to MA/MB on the repeaters, is processed, and is then transmitted over the air.

Additional Simulcast related equipment is shown in Figure 1-2. The GPS units, 10 MHz splitter drawer, and OCXO drawer are required to maintain synchronization throughout the entire system. Also shown in Figure 1-2 is standard equipment such as combiners, duplexers, and multiplexers.

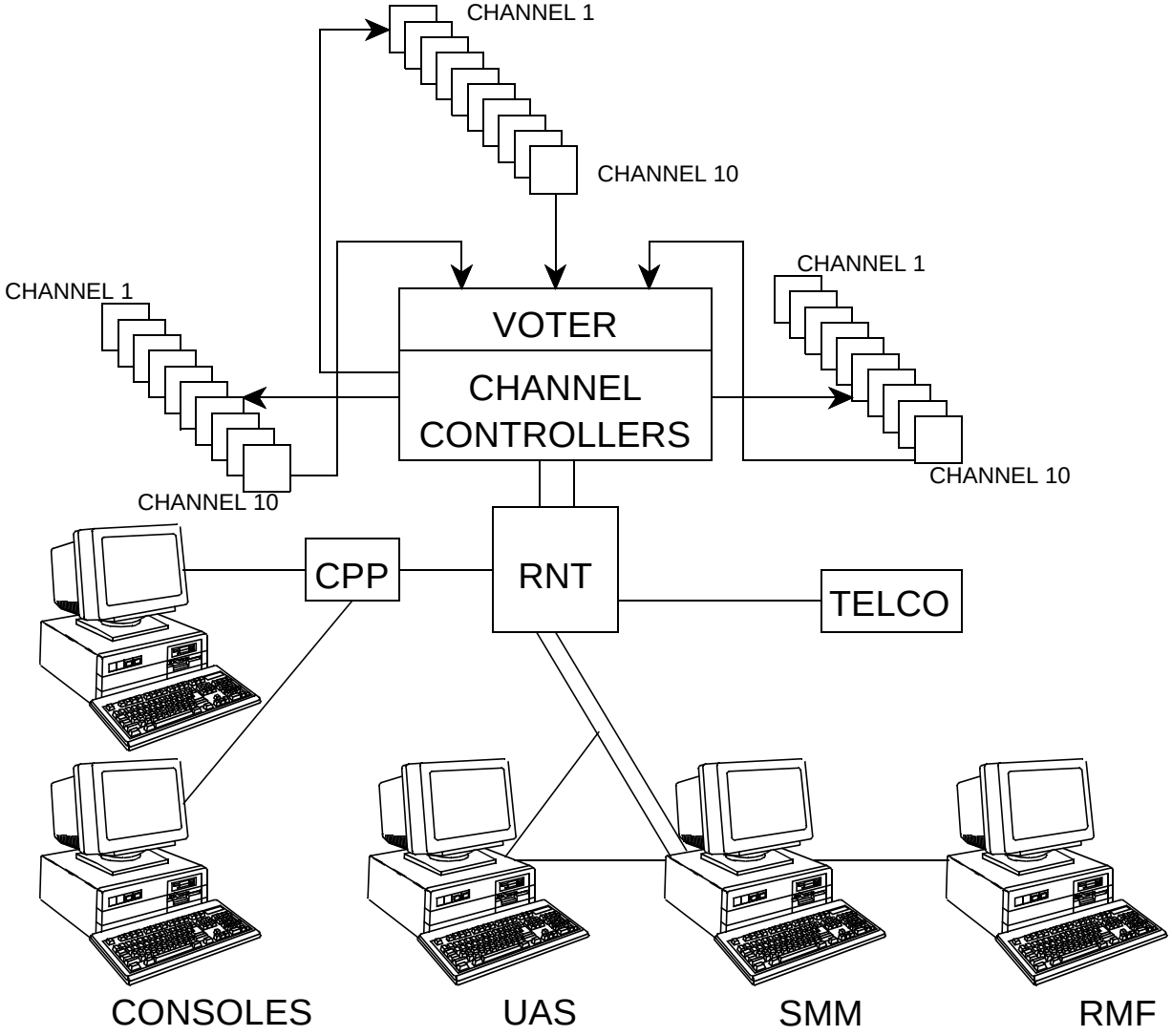


Figure 1-1 MULTI-NET SYSTEM BASIC COMPONENTS

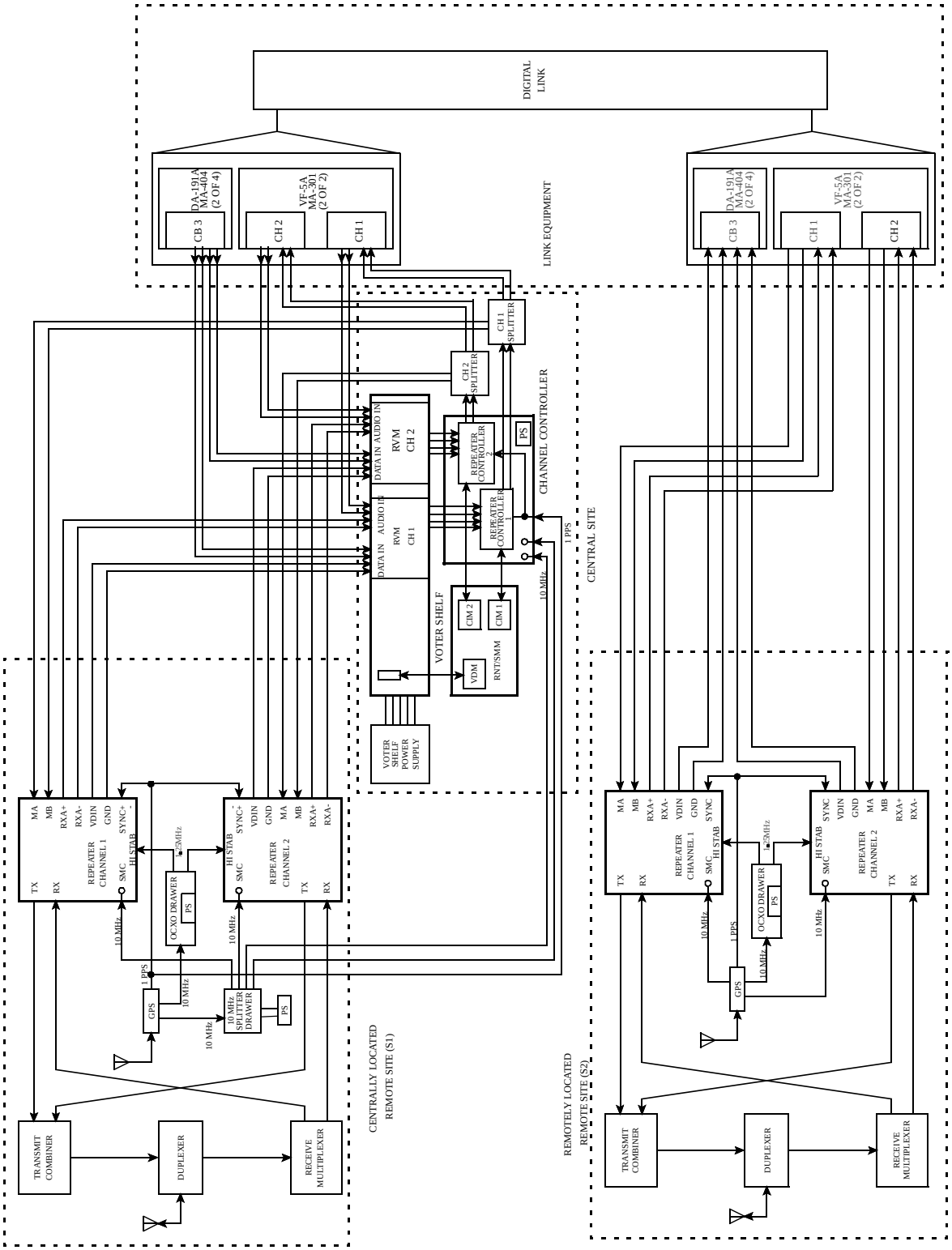


Figure 1-2 SIMULCAST SYSTEM BLOCK DIAGRAM

SECTION 2 TUNING PROCEDURE

2.1 GENERAL

This section presents the procedures used for adjusting signal levels through the Simulcast System. It is intended for use during system installation and for periodic maintenance. It will be helpful to refer to figures 1-1 and 1-2 when implementing the procedures.

NOTE: Whenever a Remote Site repeater is powered off, then on during the course of this tuning procedure, no activity (i.e. a Multi-Net call) should be present while the repeater powering steps are occurring. This and waiting 1-2 minutes after powering the Remote Site repeater on allows the RVM in the Voter to self-align/ stabilize.

2.2 TEST EQUIPMENT REQUIRED

- IFR-1200 or equivalent, 2-each
- Oscilloscope
- Transmission Test Set, 2-each
- Signal/Encoder/Decoder Box (SED)
- Appropriate Cables/Connectors
- Version 8.4 Repeater Programming Software

2.3 SIMULCAST TUNING - TRANSMITTERS

SETTING UP

1. Place the Channel Under Test on the Channel Controller (CC) and all Remote Sites (RS) into "Set-Up State". The Channel Under Test needs to remain in Set Up State for the duration of the tuning procedure. Use either Network Management (click on each individual icon and pull down: Repeater -> Set-Up State) or switch SMC switch S4, section 2 "On" for each component (see Figure 2-7).

   NOTE: Plan ahead, as using Network Management for Set-Up State needs to be reset whenever a component is restarted and using the hardware switch for Set-Up State needs to be physically reset for Normal State at some point.

2. **With Network Management,** set the Channel controller SMC Audio and Data Gain to 1.0000 (click on the System icon and pull down: System -> Calibration -> SMC Configuration and the configuration window pops up).

3. **With Network Management,** set all Remote Site SMC Audio Gains only to 1.0000 (see Step 2).

4. O**n the Channel Controller**, place the SMC on an extender card (may need 10 MHz extender cables).

NOTE: See Appendix A for the procedure to properly remove and re-insert Channel Controller cards ("hot swapping") in an operating system, if necessary.

5. O**n the Remote Site**, place the SMC on an extender card (may need 10 MHz extender cables).

6. **On the Channel Controller**, switch the SMC switch S4, section 5 "On" (this sends a 1 kHz tone to the Remote Sites).

CHANNEL CONTROLLER TRANSMIT LEVEL ADJUST

7. **On the back of the Channel Controller**, connect a transmission test set to TxMOD± and adjust R29 on the SMC for -12.0 dBm at 1 kHz. (Ensure that the test set is receiving in Bridge mode and not Terminate mode.)

8. Connect the test set to the 1:6 splitter outputs to check for unity gain. (If outputs are not -12.0 dBm, adjust the splitter's front panel gain control for -12.0 dBm).

REMOTE SITE REPEATER TRANSMIT AUDIO LEVEL ADJUST

9. **On the back of the Remote Site Repeater**, connect the test set to MA/MB and verify a -12 dBm, ±0.2 dBm at 1 kHz reading. (If outputs are not -12 dBm, check the link equipment and connections for settings and accuracy).

10. **On the Remote Site Repeater**, connect an oscilloscope to SMC WO-10 and adjust R37 for 1.9V P-P (-1.2 dBm at 1 kHz with a test set).

11. **At the Remote Site SMC**, use a receiving IFR to adjust R32 for 1.5 kHz deviation (1.2 kHz for NPSPAC).

REMOTE SITE REPEATER TRANSMIT DATA LEVEL ADJUST

12. **At the Channel Controller**, turn SMC switch S4, section 5 "Off" (1 kHz tone), and turn SMC switch S4, Section 4 "On" (125 Hz Tone).

13. **At the Remote Site**, use a receiving IFR to monitor deviation. With Network Management, adjust the appropriate Remote Site SMC Data Gain (see Step 2 for location of the pop up memu) ***for precisely 1.0 kHz deviation***.

    NOTE: Adjust the Data Gain of the Remote Site Repeater which is being aligned. DO NOT adjust the Channel Controller Data Gain.

14. At the Channel Controller, turn SMC switch S4, section 4 "Off".

15. This concludes the Simulcast portion of the tuning procedure for this channel at this Remote Site. At the Remote Site, remove the SMC from the extender card and replace the SMC in the repeater.

IMPORTANT

Section 2.3, Steps 5-6 and 9-15 must be repeated for all Remote Site repeaters for this channel before continuing with Section 2.4.

NOTE: This tunes the Simulcast transmitter portion of the channel from a single point, the tones from the Channel Controller SMC.

2.4 SIMULCAST THRESHOLD ALIGNMENT AND MANUAL CALIBRATION

1. When completed with the Simulcast tuning portion of a specific channel, threshold alignment and manual calibration is next to be performed with Network Management.

NOTE: A condensed version of the steps necessary is listed here. For more detailed description of the operation or for troubleshooting information, refer to the Network Management For Simulcast Service Manual (Part No. 001-0690-201) Section 7 Alignment and Calibration.

2. **At the Network Manager**, click on the System icon and pull down:
   System -> Calibration -> Threshold Alignment.
   A window titled "Threshold Alignment" should pop up.

3. Click on the channel you just completed tuning at all Remote Sites to highlight both the channel and the "Start Alignment" box.

4. Click on the Start Alignment box. Operation of the Host computer should take about 1-2 minutes to run for a 3 Site channel. If it has successfully finished running, a "C" will be listed next to the channel and an "OK" will be listed next to each Remote Site portion of this channel. The numbers that have been calculated have already been written to each component of this channel. Troubleshooting should be done on the repeater that did not have an "OK" after Threshold Alignment is complete.

5. Click on the "Close" box.

NOTE: A uni-directional system is assumed.

6. **At the Network Manager,** click on the System icon and pull down:
   System -> Calibration -> Manual Calibration.
   A window titled "Manual Calibration" should pop up.

7. Click on the channel that you have just completed the successful Threshold Alignment on to highlight the channel.

8. Click on the "Acquire Data" box. Operation of the Host computer should take under 1 minute to run for a 3 Site channel. If it has successfully finished running, a "W" will be listed next to the channel and an "OK" will be listed next to each Remote Site portion of this channel. Troubleshooting should be done on the repeater that did not have an "OK" after Manual Calibration is complete.

9. The numbers that have been calculated have not been written to each component of this channel. Click on the "Write" box. Do not click on the "Write" box, if Manual Calibration did not successfully get completed.

10. Click on the "Close" box.

2.5 SIMULCAST TUNING - RECEIVERS

SETTING UP THE CALL

1. Place the MAC on the Extender Card in the Remote Site repeater.

2. Turn on the repeater. (Wait 1-2 minutes for the RVM in the Voter to self-align before bringing up a Multi-Net call, especially if alignment ***through*** the voter has not been completed.)

3. Set the IFR to Transmit a Multi-Net call.

a. Connect the SED box to the Ext. Mod SINAD Port of the IFR.

b. Power the SED Box from the repeater IAC.

c. Set Parameters:
Display Entry/Encode Date = Encode Data
Repeater/Mobile = Mobile
Digital/Analog = Analog
Normal/Inverted = Normal
Encode/Decode = Encode
Enter the data as:
System Key
UID HOME GID GOTO STA PRI R

d. Connect the IFR to the Receive port of the repeater.

e. Set the frequency to the Receive frequency.

f. Position the IFR to generate.

g. Check that the Data Level coming from the SED is at 1 kHz Deviation. (If the level is low or high, Adjust Data out POT on the SED Box.)

h. Set the IFR to generate a 1 kHz tone at 1.5 kHz deviation (1.2 kHz deviation NPSPAC).

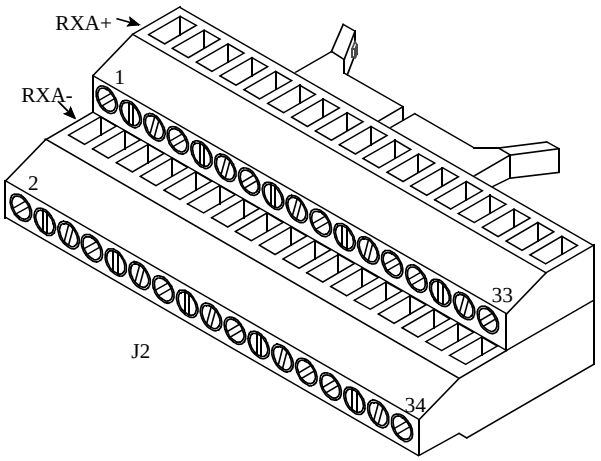


Figure 2-1 J2 CONNECTOR

REMOTE SITE REPEATER RECEIVE AUDIO LEVEL ADJUST

4. Connect transmission test set between the RXA+ and RXA- on the green connector on the rear of the repeater.

5. Ensure a call is set up: (see Figure 2-9)
CR540 on IAC (Mobile-Green LED)
CR500 on IAC (Transmit-Red LED).

6. Set Audio Tone Level by adjusting R239 on the MAC for -12 dBm at 1 kHz tone. (Remember to set the test set for ***Bridge Mode***, not Terminate Mode.)

REMOTE SITE REPEATER PILOT TONE LEVEL ADJUST

NOTE: Section 2.5, Steps 4-6 must be done first. R239 sets the Main Level Output. The Pilot Tone rides with this level.

7. Take the call down by placing the IFR to RCV.

8. Connect transmission test set between the RXA+ and RXA- on the green connector on the rear of the repeater.

9. Set Pilot Tone Level by adjusting R240 on the MAC for -20 dBm at 1200 Hz tone. (Wait 1-2 minutes for the RVM to self-align/stabilize when adjustment is complete, especially if alignment ***through*** the voter has not been completed.)

VOTER (RVM) AUDIO LEVEL ADJUST

10. Bring the call back up at the Remote Site.

11. Connect the Transmission Test Set to RVM audio input (RDM+/RDM-) on the punch block or on the Backplane of the Voter shelf for the appropriate Remote site. (Between Remote Repeater and associated RVM.)

12. Verify a -12 dBm at 1 kHz signal. (If the value is incorrect, verify a -12 dBm signal at RXA+/RXA- at the Remote Site. If the signal is present, check the wiring and link equipment.) This step checks for loss between Remote Site and input to the Voter.

13. Connect the Transmission Test Set to RVM voted audio output (MLM Audio +/-) to the Channel Controller. This is the connection between the Voter and Channel Controller.

NOTE: If the Voter output has not been tuned, proceed with Step 14 ***only****. If the Voter output has been tuned, proceed with Step 15* ***only****.*

14. The level should be at -12 dBm with a 1 kHz tone. If incorrect and no tuning of the Voter output has been completed, the RVM output EEPOT needs to be adjusted (see Figure 2-4).

a. Set S2, sections 1, 3 Off; 2 On.
(Set section 4 Off to increase the output when pressing S1).
(Set section 4 On to decrease the output when pressing S1).

b. Press S1 (bottom push button) in to change the output value to -12 dBm , ±0.5 dB at 1 kHz.

NOTE: Step 15 is included only to verify that the channel's Voter output alignment was done properly.

15. The level should be at -12 dBm with a 1 kHz tone. If incorrect and tuning of the Voter output has been done, bring the call down and wait 1-2 minutes for the Voter input for this Remote Site to self-align to the Pilot Tone. Bring the call back up and recheck the level. Record the level if it is still incorrect (one that is outside of ±0.5 dB of -12 dBm). Do this for the remaining Sites for this channel to determine if there was a problem when the Voter output level was set or if there is a variance in this Site's Voter output on this RVM.

CHANNEL CONTROLLER RECEIVE DATA LEVEL ADJUST

16. Set up a call with no audio at the Remote Site.

17. **At the Channel Controller Site,** with the SMC in the extender card, connect an oscilloscope to P100, pin 29 (Tx MOD) and ground. The data level should be 0.8V P-P. If not, start "2000pgmr -e", then adjust U151 with the following gates ON. (see Figure 2-3).
Hardware > Tools > Manual MAC Adjust
Voter Audio Mute
Rx Mute
Rx Option Gate
Repeat Gate
Tx Option Gate
Normal Mod Mute
Tx Mod Mute

NOTE: Must exit the Test Screen to view adjusted result. When the manual MAC adjust screen is displayed there is no data output. ESC (escape) from this test screen to view the data. The correct levels are obtained by trial and error.

18. **At the Remote Site**, with the Data Only Multi-Net call still up, set up a receiving IFR with the appropriate frequency and the antenna port connected to either the monitor port of a transmit combiner. Using a rubber duck antenna may result in receiving adjacent site's signal.

19. **At the Channel Controller**, adjust R37 on the SMC for a data deviation of 1.0 kHz, ±15 Hz, using the receiving IFR at the Remote Site, if necessary.

CHANNEL CONTROLLER RECEIVE AUDIO LEVEL ADJUST

20. Add audio to the Data Only Multi-Net call, still at 1.5 kHz deviation (1.2 kHz for NPSPAC).

21. This step checks the level of the Channel Controller audio input stage.

a. **Using 2000pgmr -e**, go into:
Hardware -> Tools -> Manual MAC Adjust. Select the following gates:
Voter Audio Mute
Rx Mute
Rx Option Gate
Repeat Gate

LEVEL DETECT
Tx Option Gate
Normal Mod Mute
Tx Mode Mute
(Selecting 'Level Detect' allows J100 and J103-Ground to be monitoring points for the call's audio level at a point after the Voter Audio Input Adjust stage [R233].)
Also select 'U149' (not to be adjusted at this time) and Select 'F2'.

b. With a Test Set, measure J100/J103 for -6.0 dBm at 1 kHz (factory set). The full range of R233 would yield levels at this test point from -14 dBm to +3 dBm. The range of the EEPOT U149 (which is adjusted, if necessary, in Steps 22-23) will ***NOT*** reach the appropriate output level if this test point is below -8.5 dBm. If the level is not -6.0 dBm but above -7.5 dBm, continue with Step 22. If not, continue with the rest of Step 21.

c. Escape the 'Manual MAC Adjust' screen. Bring down the call by placing the IFR into RCV. The SMAC will need to be placed on the extender card. From Step 19, the SMC should be on the extender card. Turn the Channel Controller shelf off. Swap the 2 cards and turn the shelf back on. Bring the Multi-Net call with audio (same deviation) back up. Repeat Step 21a here.

NOTE: See Appendix A for the procedure to properly remove and re-insert Channel Controller cards ("hot swapping") in an operating system, if necessary.

d. Adjust R233 for -6.0 dBm at J100/J103. Escape the 'Manual MAC Adjust' screen. Continue with Step 22. (For Section 2.5, Steps 22-24, the SMAC can remain on the extender card.)

22. Shut the data off in the Channel Controller's SMC as follows:
In the Network Manager under:
System -> Calibration -> SMC Configuration
change the data gain from 1.0000 to 0.0000.

23. **At the Channel Controller**, adjust U149 on the SMAC using the 2000pgmr with the same gates on as in Step 2 for an audio deviation of 1.5 kHz, ±15 Hz (1.2 kHz, ±15 Hz NPSPAC) using the receiving IFR at the Remote Site, if necessary.

24. **At the Network Manager**, under
System -> Calibration -> SMC Configuration, change the Channel Controller's SMC Data Gain from 0.0000 to 1.0000.

IMPORTANT*: Performing Section 2.5, will tune* ***ONE Remote Site's*** *Repeater Receive and* ***the channel's*** *Voter Audio and the Channel Controller Audio and Data levels. Section 2.5, Steps 1-15 need to be performed at the remaining Remote Sites for completion of Simulcast Tuning-Receivers.*

2.6 AUDIO ALIGNMENT CHANNEL CONTROLLER TO/FROM RNT

AUDIO TO RNT

1. Make sure that a Remote Site is still setup with a Multi-Net call, with Audio/Data (Do Not start the 2000pgmr at this time).

2. Place the SMAC into an extender card.

3. Connect the transmission test set to SRXA±.

4. Adjust R239 (Main Audio to RNT) on the SMAC for -12 dBm (see Figure 2-6).

5. On the associated CIM, connect the transmission test set between J11 and ground (see Figure 2-10).

6. Adjust R41 on the CIM for -6 dBm.

AUDIO FROM RNT

7. Set the CIM into Test 1 (S5, section 1 Off; sections 2, 3 and 4 On).

8. Connect transmission test set between J12 and ground.

9. Adjust R44 on the CIM for -12 dBm.

10. Start the 2000pgmr at this time. Make sure that the Link Type is *Digital*. From the Repeater Programming software select:
Test > RNT Interface > Select Link Type > RS232 (see Figure 2-2).

11. From the Repeater Programming software select: Test > RNT Interface > Adjust Links <Enter> then press F2 until the "Voice Audio from RNT" screen appears. This screen selects the appropriate MAC gates to on.

a. Set SMAC S100 all sections OFF, S101 all sections OFF.

b. The CIM is already set to generate an alignment tone.

c. Connect the transmission test set to J100/J103 on the SMAC and adjust R243 (Main Audio from RNT) for -6 dBm (387 mV RMS).

d. Set switches S100/S101 for digital communication.

12. Take the Channel Controller out of the alignment mode and back into normal operation (escape from the alignment screen).

13. Place the CIM back to normal operation (S5, all sections Off).

Repeater Data Path Selection

Select the Data Path between the Repeater and the RNT.

( ) Data over Voice ( ) Separate Data

(√) RS232

Press ENTER to Accept

Press Spacebar to Select

Figure 2-2 LINK TYPE

Manual MAC Adjustment

( ) U137	( ) U140	( ) U143	( ) U146	( ) U149
( ) U138	( ) U141	( ) U144	( ) U147	( ) U150
( ) U139	( ) U142	( ) U145	( ) U148	(√) U151

(√) **V**oter Aud Mute	( ) Tx**A** To FSK	(√) **N**ormal Mod Mute
( ) **L**ocal Aud Mute	( ) **D**ata To A/D	(√) Tx **M**od Mute
(√) **R**x Mute	( ) T**x** Aud Gate	( ) Tx **I**ntcom
(√) Rx **O**pt Gate	( ) Tx **V**oice Gate	( ) Rx S**q** Actv
( ) Rx **V**oice Gate	( ) Data **L**vl Test	( ) **L**og Sq A/D
( ) Rx **A**ud Gate	( ) **C**WID Cntl	( ) Tx Mod **A**/D
( ) R**x** Voice to Bp	( ) Lv**l** Detect	( ) **N**orm Rx
( ) **F**SK To Aud Gate	(√) Tx **O**pt Gate	( ) Digital Mod
(√) Re**p**eat Gate	( ) Local **M**ic Mute	( ) Tx **N**et
( ) **T**xS To FSK	( ) **E**xt Mod Mute	( ) Rx **N**et
		( ) **C**lear Settings
Space - Carrier: OFF	Test Freq: None	RSSI: 0
Channel: 0	Tx Freq: 2489.387	Rx Freq: 2444.387
Tab - Select Next Field	PgUp/Dn: ±10 steps	CurUp/Dn: ±1 step
FN4 - Fan: OFF		

Press F2 to Adjust Pot

Press Spacebar to Select

Figure 2-3 MANUAL MAC GATES

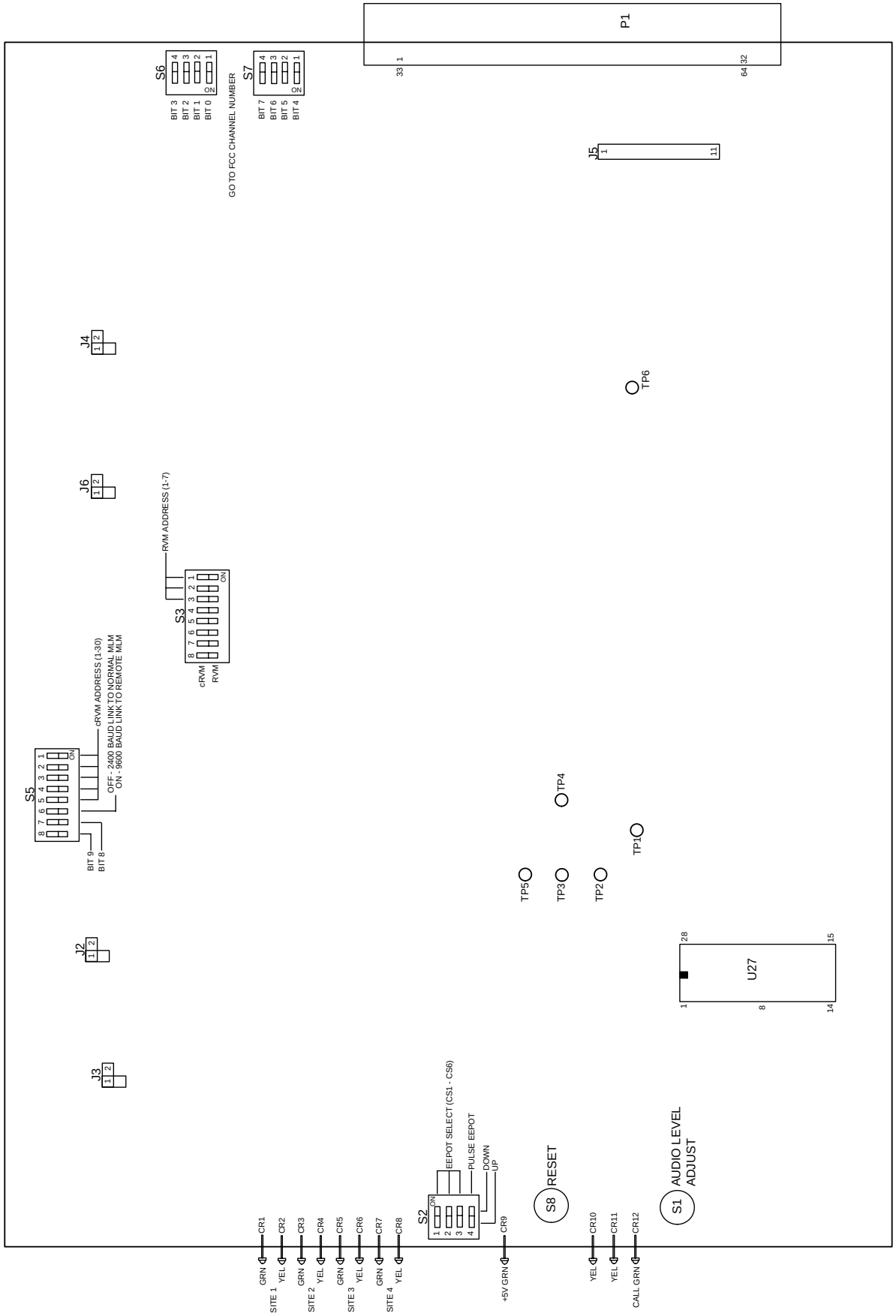


Figure 2-4 RVM ALIGNMENT POINTS

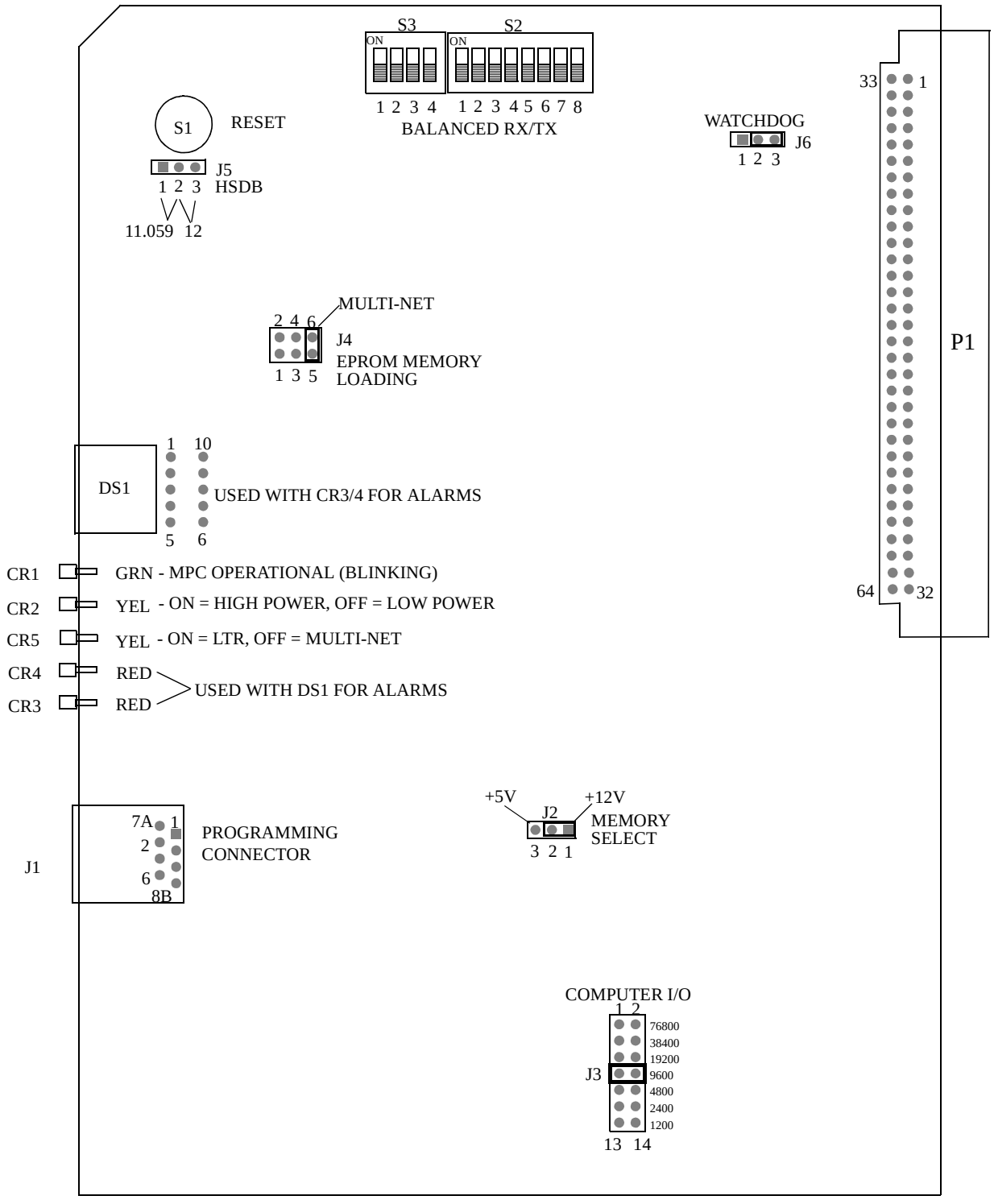


Figure 2-5 MAIN PROCESSOR CARD ALIGNMENT POINTS

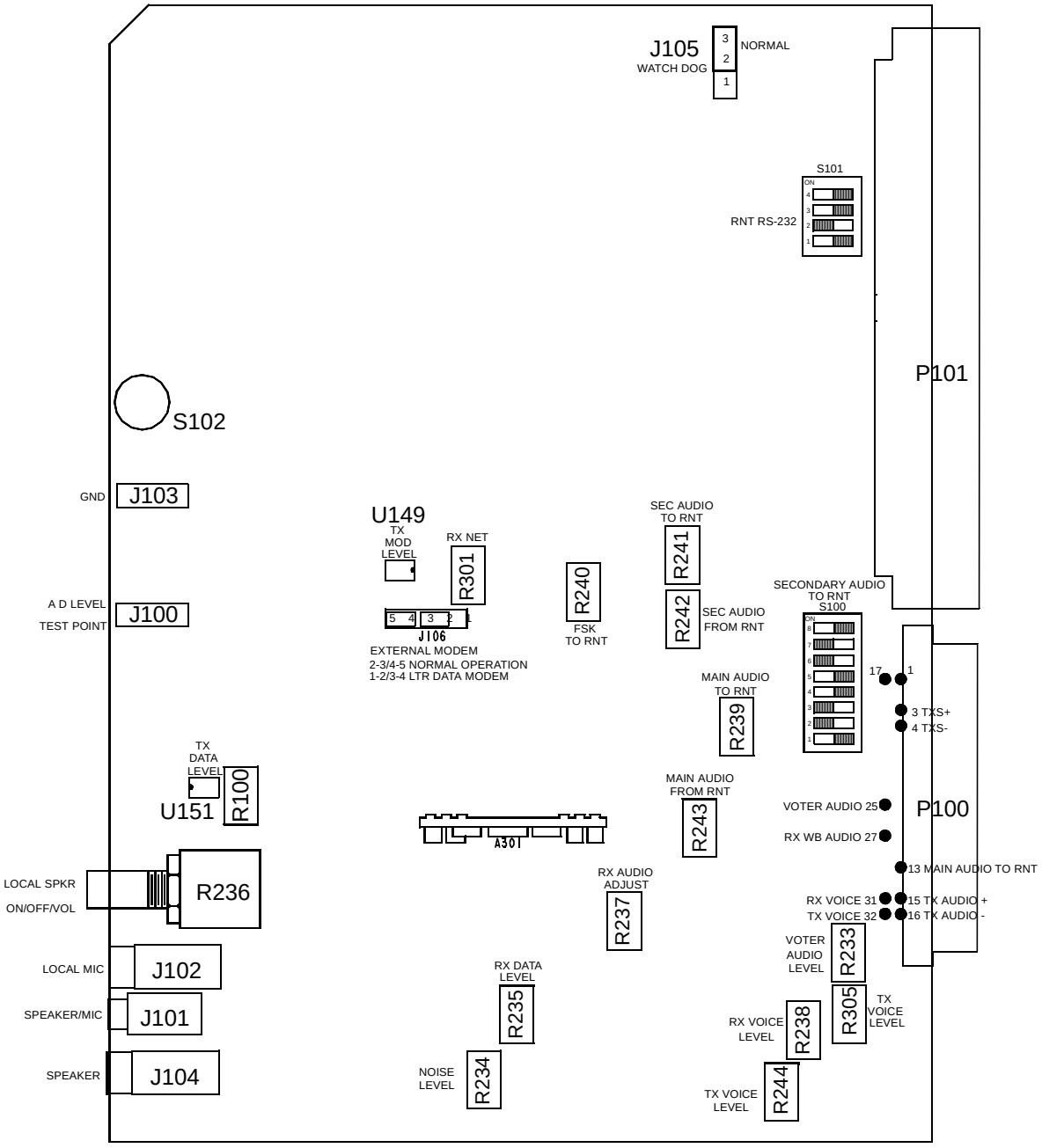


Figure 2-6 SMAC ALIGNMENT POINTS

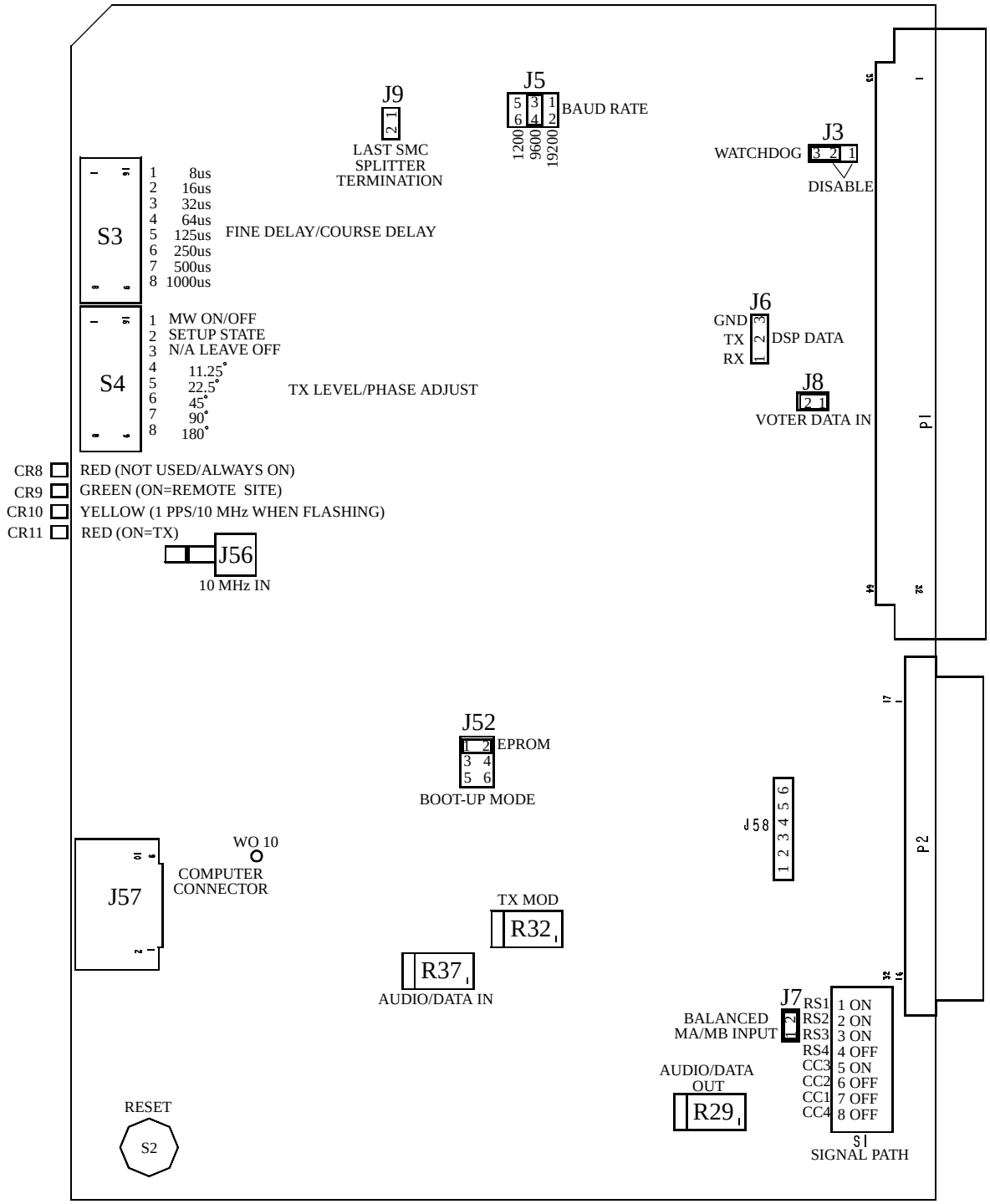


Figure 2-7 REMOTE SITE SMC ALIGNMENT POINTS

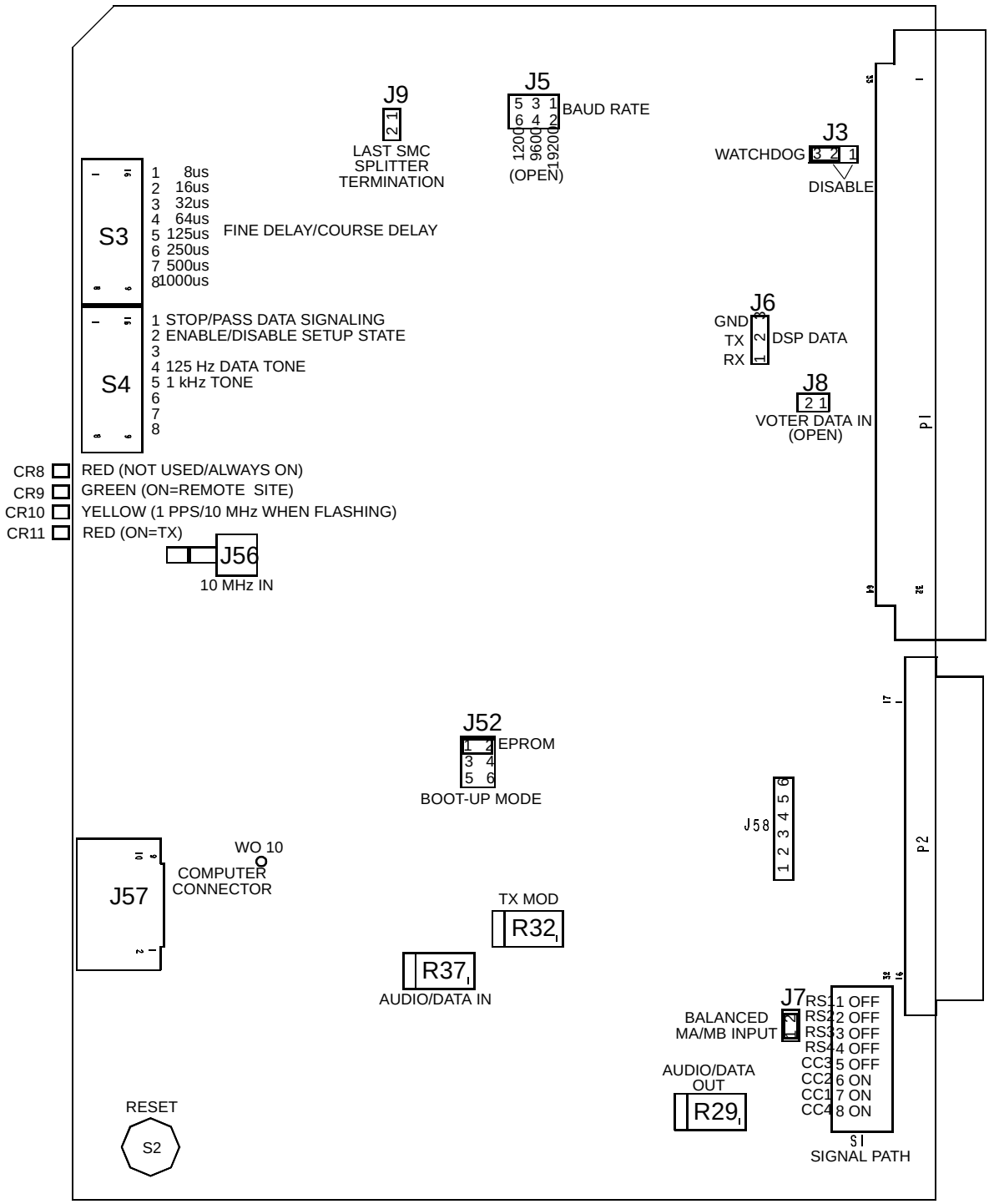


Figure 2-8 CHANNEL CONTROLLER SITE SMC ALIGNMENT POINTS

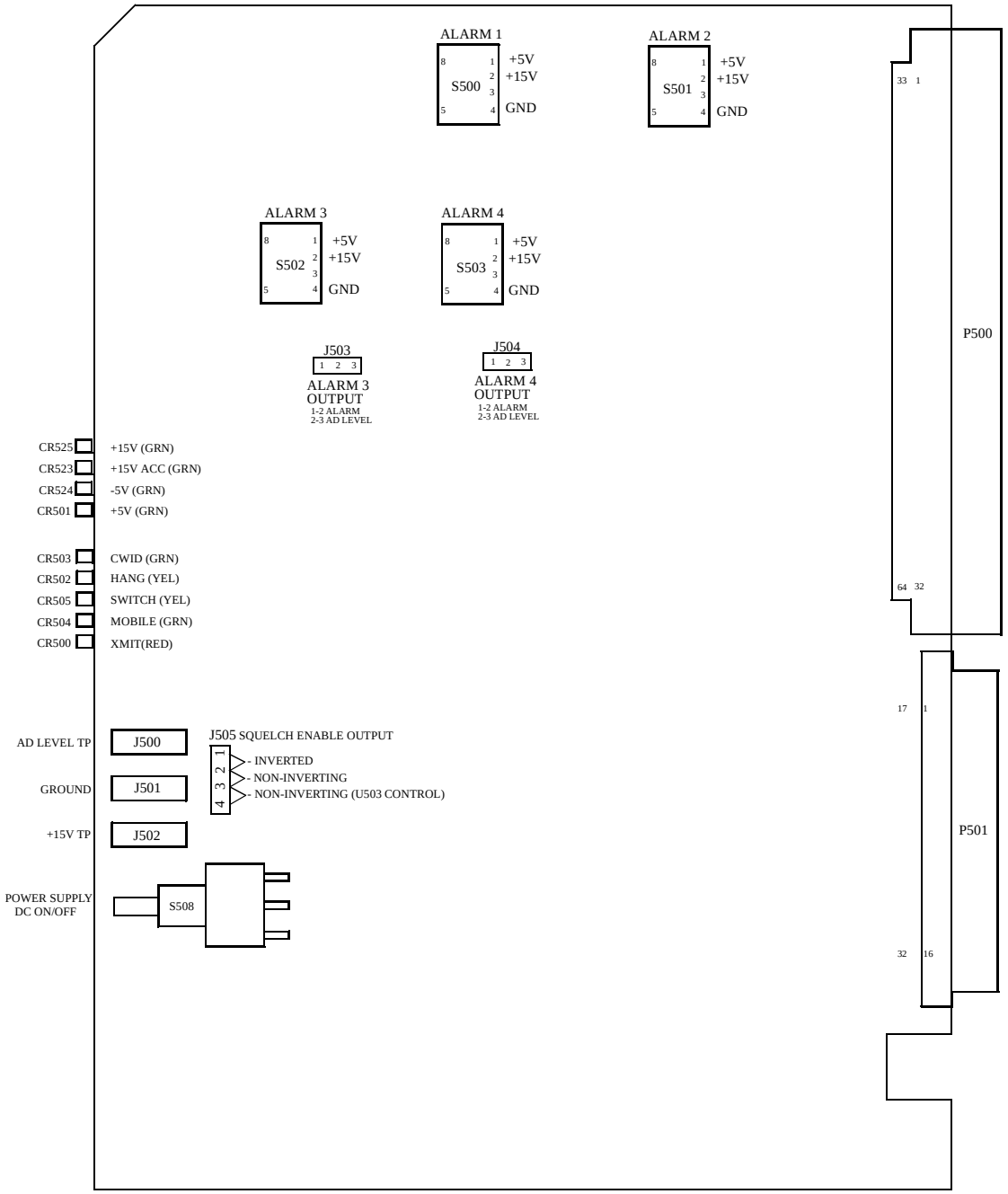


Figure 2-9 INTERFACE ALARM CARD ALIGNMENT POINTS

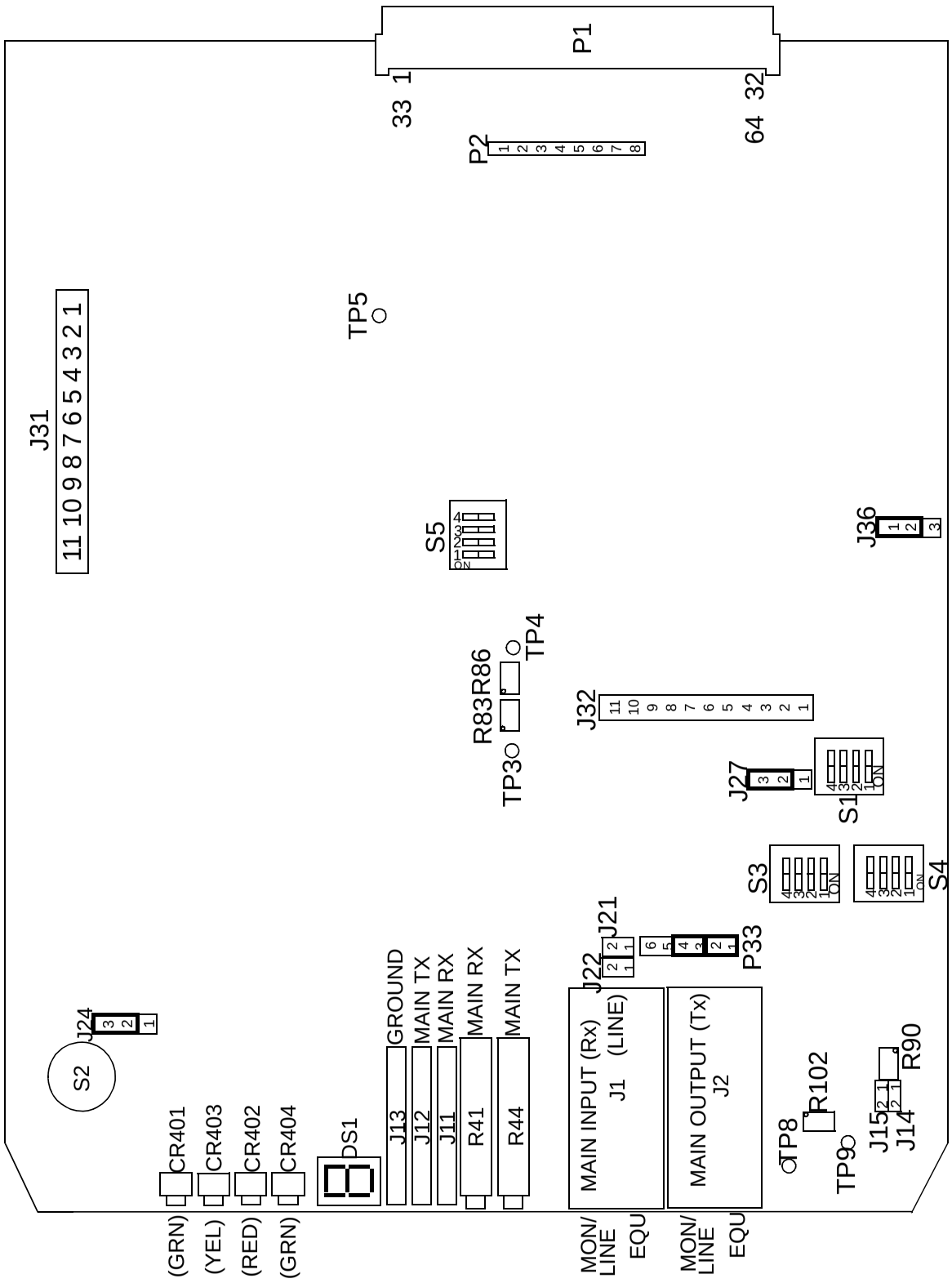


Figure 2-10 CIM ALIGNMENT POINTS

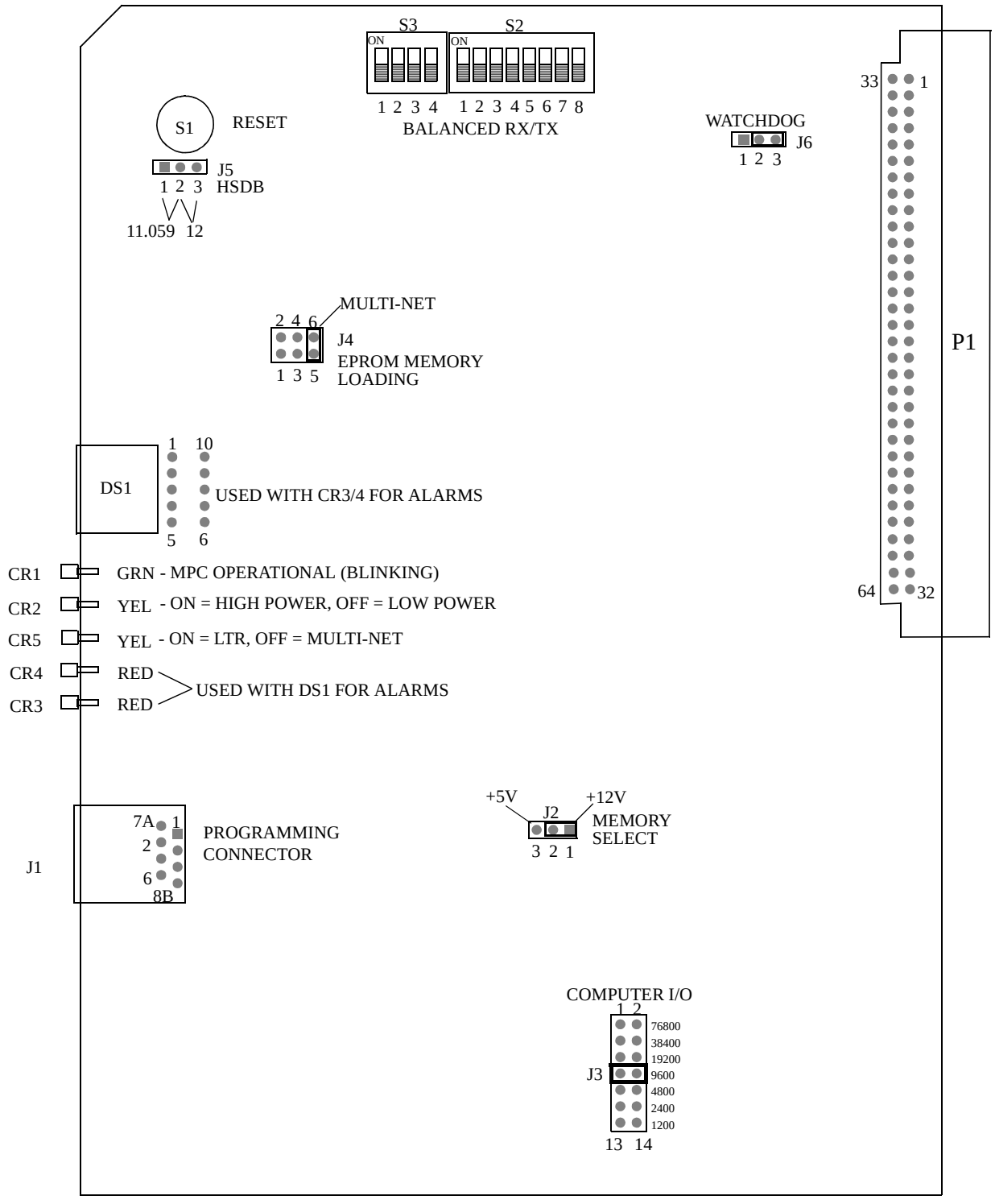


Figure 2-11 MESSAGE BRIDGE CARD ALIGNMENT POINTS

APPENDIX A CARD REMOVAL AND RE-INSERTION PROCEDURE

A.1 GENERAL

This procedure assumes that removal and re-insertion of Channel Controller cards (for testing, etc.) is desired and that there is at least one other channel in this Channel Controller shelf that is operating in a Simulcast system.

A.1.1 REMOVAL

The following steps ***must*** be taken to Remove cards in a required channel with intentions of replacing a card or to place a card in an extender card without turning the power to the shelf off.

1. **At the Host Computer**, place the required channel in Setup State (this should also disable the associated CIM).

2. **At the Channel Controller**, remove the three cards associated with the required channel in this order:

CAUTION

Cards must be removed and re-inserted in proper order or severe damage may occur.

- *MPC*
- *SMAC*
- *SMC*

3. At this time, a card can get switched or an extender can be put into place, so that re-insertion of the cards can take place.

A.1.2 RE-INSERTION

The following steps ***must*** be taken to re-insert cards in a required channel to complete changes or tuning, etc. without turning the power to the shelf off.

1. **At the Channel Controller**, re-insert the three cards associated with the required channel in this order:
   - SMC
   - SMAC
   - MPC

NOTE: If tests to be performed on this channel require more removal and re-insertion of Channel Controller cards, repeat the removal and re-insertion steps in the order listed here.

2. **At the Host computer**, return the required channel to "Normal" state (this should also re-enable the associated CIM).

The channel should now be ready for operation.

NOTE: If an MBC is present in the desired channel during removal and re-insertion of the other cards, it can remain in its slot. Likewise, if placing the MBC on an extender card for troubleshooting is necessary, the channel cards can remain in their slots.

APPENDIX B PAST PROCEDURES

B.1 ALIGNMENT AND AUTO CALIBRATION

B.1.1 GENERAL

This section describes use of the Network Management system for performing the time and phase alignment of an E.F. Johnson Simulcast Radio System. Simulcast systems must be aligned and calibrated to avoid distorted signals in areas that have repeater coverage overlap. During calibration the Channel Controller sends a timing tone that is used to determine the length of time it takes for a signal to reach each repeater. The repeaters' buffer and phase delays are then adjusted so that all repeaters will transmit at the same time and phase. The timing of the entire system is synchronized by Global Positioning System (GPS).

B.1.2 ALIGN THRESHOLD AND TIMING TONE GAIN

Before the Network Management System can calibrate a Simulcast System, the repeaters and Channel Controllers must be adjusted properly. This procedure sets the appropriate parameters to ensure calibration by the Network Manager.

B.1.2.1 EQUIPMENT REQUIRED

- Network Management host computer running OpenView. (If the System -> Calibration -> SMC Configuration menu is not present, exit OpenView, copy the file SERVICE.INI from the first installation disk to the \SITECTR directory, then restart OpenView.)
- Two laptop computers with 2000pgmr software (version 8.38 beta or later) and repeater programming cables.

B.1.2.2 OVERVIEW

The process of setting up a Simulcast System to allow Network Management calibration involves the following steps, which are detailed in Section B.1.3.

1. Put all repeaters in Setup State.
2. Put repeaters in SMC Standby mode.
3. Put Channel Controller in SMC Standby mode.
4. Put repeaters in SMC Link Timing mode. Ensure that the returned value is 0 (zero). Adjust Threshold as required.
5. Put the Channel Controller in SMC Link Timing mode. Ensure that the repeater is returning on-zero values. Adjust Timing Tone Gain as required.
6. Put the repeater in SMC Normal mode.
7. Put the Channel Controller in SMC Normal mode.
8. Put all repeaters on the channel in Normal State.

B.1.3 DETAILED PROCEDURE

The following steps must be repeated for every channel in the system, and for every repeater (at all sites) in the system. One person is needed at the site containing repeaters, one person at the site containing the Channel Controllers, and one person to operate the Host Computer. If equipment is collocated, this may be accomplished with two people.

B.1.3.1 REPEATER SETUP STATE

From the Host Computer put all repeaters in the system in Setup State.

- Click on a repeater icon.
- Select menu item Repeater > Setup State.
- Repeat for each repeater at each site in the system.

B.1.3.2 REPEATER SMC STANDBY MODE

1. **At the Repeater Site** connect a laptop computer to the repeater on the desired channel.
2. Start the 2000pgmr software with the command "2000pgmr -e". This enables menu items required for adjustment.
3. Select menu item Hardware > Tools.

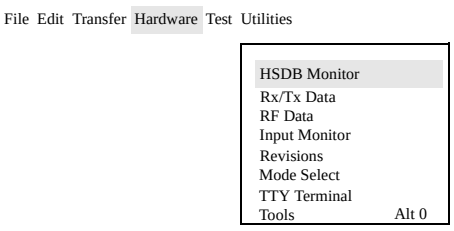


Figure B-3 HARDWARE MENU

4. In the popup box, select Raw Tx/Rx and press Enter.

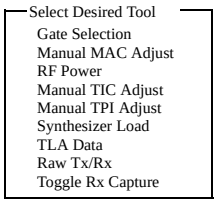


Figure B-4 HARDWARE>TOOLS

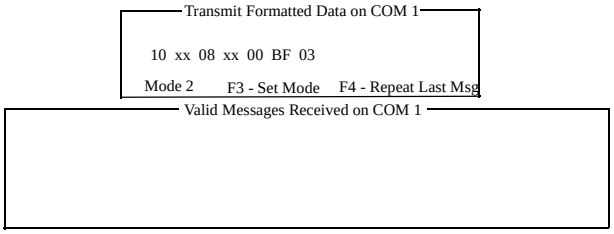


Figure B-5 HARDWARE>TOOLS>RAW TX/RX

5. Press F3 and select Mode 2 messages.

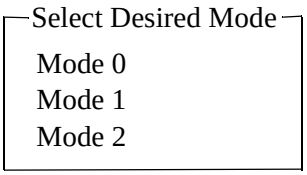


Figure B-6 HARDWARE>TOOLS

6. Put the repeater in SMC Standby Mode, type:
   10 xx 08 xx 00 BF 03
   Where: xx represents the repeater number in hex.

7. Press Enter.

B.1.3.3 CHANNEL CONTROLLER SMC STAND-BY MODE

1. **At the Channel Controller Site** connect a laptop computer to the Channel Controller on the desired channel.

2. Start the 2000pgmr software with the command "2000pgmr -e". This enables menu items required for adjustment.

3. Select menu item Hardware > Tools (see Figure B-3).

4. In the popup box, select Raw Tx/Rx and press Enter (see Figure B-4).

5. Press F3 and select Mode 2 messages (see Figure B-5).

6. Put the Channel Controller in SMC Standby mode, type:
   10 xx 08 xx 00 BF 03
   Where: xx represents the repeater number in hex.

7. Press Enter.

B.1.3.4 REPEATER SMC LINK TIMING MODE

1. **At the Repeater Site** put the repeater in SMC Link Timing Mode, type:
   10 xx 08 xx 00 BF 02
   Where: xx represents the repeater number in hex.

2. Press Enter.

3. The repeater begins sending messages indicating the timing values. The message appears as:
   08 xx 10 xx 00 C3 **00 00** nn
   Where: xx is the repeater number in hex
   nn is a checksum in hex.

4. If the return value (indicated in bold above) is not 00 00, the threshold value must be increased from the Host Computer.

B.1.3.5 THRESHOLD VALUE ADJUSTMENT

To increase the threshold value from the Host Computer, if necessary, follow these steps:

1. Select the System icon.

2. Select menu item System -> Calibration -> SMC Configuration.

3. From the list, select the repeater currently being adjusted.

4. Increase the Threshold value (suggest 0.1 increments).

5. Click the Write button.

6. After the alarm "Repeater Configuration Finished" occurs, check the return values at the Repeater Site (see Section B.1.3.4).

7. Repeat Steps 4 - 6 above until the return value at the repeater is 00 00.

B.1.3.6 CHANNEL CONTROLLER SMC LINK TIMING MODE

1. **At the Channel Controller Site** put the Channel Controller in SMC Link Timing Mode, type:
   10 xx 08 xx 00 BF 02
   Where: xx represents the repeater number in hex.

2. Press Enter.

3. **At the Repeater Site** verify that the returned values are not zero. If the values are zero, the Timing Tone Gain must be increased from the Host Computer.

B.1.3.7 TIMING TONE GAIN ADJUSTMENT

To increase the Timing Tone Gain from the Host Computer, if necessary, follow these steps:

1. Select the System icon.

2. Select menu item System -> Calibration -> SMC Configuration.

3. From the list, select the Channel Controller currently being adjusted.

4. Increase the Time Tone Gain value (suggest 0.1 increments).

5. Click the Write button.

6. After the alarm "Repeater Configuration Finished" occurs, repeat Section B.1.3.6.

7. Repeat Steps 4 - 6 above until the return value at the repeater is not 00 00.

B.1.3.8 REPEATER SMC NORMAL MODE

1. **At the Repeater Site** put the repeater in SMC Normal Mode, type:
   10 xx 08 xx 00 BF 01
   Where: xx represents the repeater number in hex.

2. Press Enter.

B.1.3.9 CHANNEL CONTROLLER SMC NORMAL MODE

1. **At the Channel Controller Site** put the Channel Controller in SMC Normal Mode, type:
   10 xx 08 xx 00 BF 01
   Where: xx represents the repeater number in hex.

2. Press Enter.

NOTE: REPEAT Section B.1.3.1 THROUGH Section B.1.3.9 FOR EACH REPEATER AT EACH SITE IN THE SYSTEM.

B.1.3.10 ALL REPEATERS IN NORMAL STATE

At the Host Computer Put all repeaters in the system in Normal State.

- Click on a repeater icon.
- Select menu item Repeater > Normal State.
- Repeat for each repeater at each site in the system.

B.1.4 CALIBRATE UNI-DIRECTIONAL, NON-REDUNDANT SYSTEMS

The manual calibration process occurs in two steps.

Data Acquisition Procedure

Information is collected that is used to automatically calculate the repeaters' buffer and phase delays (see Section B.1.4.1).

Write Procedure

The calculated values are written to the Simulcast Modulation Cards (SMCs) in the repeaters (see Section B.1.4.3).

B.1.4.1 DATA ACQUISITION PROCEDURE

1. Select a System icon.

2. Select menu item System -> Calibration -> Manual Calibration.

3. Select a channel from the list.

4. Click the Acquire Data button.

- If the channel is the Status Channel, a dialog box is displayed. Click OK to continue the process for the Status Channel. Click Cancel to cancel data acquisition for the Status Channel.

- If a "Channel cannot be calibrated" message appears, the Channel Controller may be described incorrectly. In the Channel Controller's Describe dialog box, the Repeater Type should be Simulcast Controller.

5. Data acquisition requires some time. A flashing icon next to the channel name indicates that data acquisition is in progress. Status messages appear below the Write button

6. When the data acquisition process for the selected channel finishes, the icons next to the channel and associated repeaters change.

- An **OK** icon indicates that data acquisition was successful for a repeater.

- A **W** icon indicates that the channel is writable (two or more repeaters have returned good data).

- Other icons indicate that the data acquisition process was not successful. See Section B.1.4.3 for icon descriptions and remedies.

7. Repeat Steps 3 - 6 above to acquire data for additional channels.

8. When data has been acquired for all channels to be calibrated, continue with the Write Procedure in Section B.1.4.3. Data is only written to repeaters that display an **OK** icon.

CAUTION

If all repeaters on a channel do not have* OK *icons, writing that channel's data may cause poor simulcast performance. The recommended procedure is to close the manual calibration dialog box, fix any unsuccessful repeaters, and recalibrate the associated channels. An exception can be made if a repeater is disabled and remains disabled. When the disabled repeater is put back into service the associated channel should be recalibrated.

B.1.4.2 DATA ACQUISITION ICONS

In the System -> Calibration -> Manual Calibration dialog box, icons appear beside the channel and repeater names to indicate the status of data acquisition. The following tables list the icons, their descriptions, and possible remedies

Table B-1 CHANNEL ICONS DURING CALIBRATION

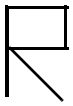
Channel Icons	Description	Remedy
	Other icons appear to the left of this icon as calibration proceeds.	To calibrate, follow the instructions in Section B.1.4.3.
 Flashing	Data acquisition is in progress.	Be patient until data acquisition has finished. Each repeater takes approximately 15 to 20 seconds.
W	The channel is writable. Data acquisition for the channel is completed. Two or more repeaters returned good data that may be written to the SMC.	If data is not to be acquired from other channels, continue with the write procedure in
	Data acquisition for the channel was completed but not successful. No timing values are written for this channel.	Fix any repeater problems and recalibrate the channel.
	The channel is reverted; calibration could not be started.	Fix the problems that have caused the channel to revert. Unrevert the channel. Then, calibrate the channel.

Table B-2 REPEATER ICONS DURING CALIBRATION

Channel Icons	Description	Remedy
	Data acquisition has not occurred for the repeater.	To calibrate, follow the instructions in Section B.1.4.1.
	Data acquisition was successful.	If data is not to be acquired from other channels, continue with the write procedure in Section B.1.4.3 .
F	Data acquisition failed. Possible causes: 1. The repeater is reverted. 2. The Channel Controller's Timing Tone Gain is set too low. 3. The repeater's threshold is set too high.	1. Fix the problems that have caused the repeater to revert. Unrevert the repeater. Recalibrate the channel. 2. Perform the alignment described in Section B.1.2. 3. Perform the alignment described in Section B.1.2.
Z	The repeater's threshold value is set incorrectly.	Perform the alignment described in Section B.1.2.

B.1.4.3 WRITE PROCEDURE

Click the Write button to write the timing values to the repeaters' SMCs. Only repeaters that have **OK** icons are written. If a channel has a check mark icon, none of that channel's repeaters are written. A flashing icon next to the channel name indicates that writing is in progress. An information alarm occurs as each repeater is written.

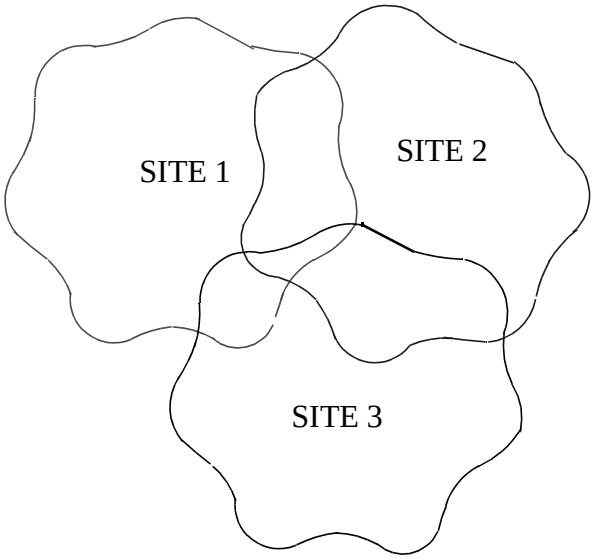
The Write process writes the data for all channels that display the **W** icon every time the Write button is clicked. For example, if data has been acquired for Channel X and the button is clicked, the data is written to all the repeaters that show **OK** and are associated with Channel X. If data is then acquired for Channel Y and the Write button is clicked, the data is written to all the repeaters that show **OK** and are associated with Channels X and Y. To avoid rewriting data, close and reopen the Manual Calibration dialog box after clicking the Write button.

B.1.5 DETERMINE AND SET OVERLAP OFFSET

In a Simulcast System, repeater coverage areas overlap. A radio in the overlap area may receive two or more signals. If the signal strengths are similar, the radio's receive circuits capture two or more signals. The signals often will not arrive at precisely the same time; therefore, the audio from the radio is distorted. The amount of distortion is more noticeable in some locations than in other locations, depending on the distance between the location and each site that is heard.

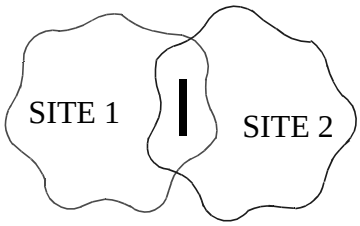
The distortion pattern of the overlap area can be changed with overlap offsets. Initially, repeaters are calibrated so that they all transmit at the same time. An overlap offset causes a repeater to transmit a little earlier or a little later than the initial calibration time. A change in the time of transmission changes the time the signal arrives at the location and therefore change the amount of distortion at each location.

Overlap offset values are set in increments of 1 microsecond. For a rule of thumb: A radio signal travels at 0.186 mile per microsecond, so a setting of 5 microseconds moves the distortion pattern approximately 1 mile. Figure B-4 illustrates the overlap offset concept.

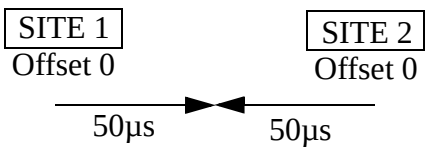


In overlap areas, a distorted audio signal is heard when two or more signals are received if there is a time offset between the signals.

Figure B-4 OVERLAP OFFSET CONCEPT

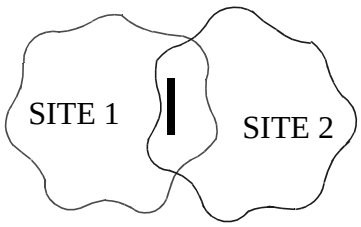


Best reception is where multiple signals are received at precisely the same time.

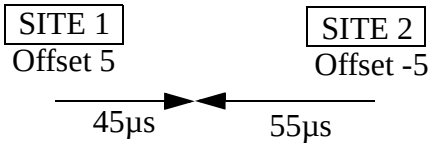


Initial calibration sets all repeaters to transmit at the same time.

Figure B-5 NO OFFSET



Best reception can be moved by setting an overlap offset. The offset offset also affects overlap areas with other repeaters.



The delay at Site 1 is offset by 5 µs more and the delay at Site 2 is offset by 5 µs less than the initial calibration.

Figure B-6 FIVE MICROSECOND OFFSET

B.1.5.1 DETERMINE OVERLAP OFFSET VALUES

NOTE: Calibration must be completed first, refer to Section B.1.4.

Overlap offset values are determined by changing the buffer delay values from the SMC Configuration dialog box. The buffer delay values must then be returned to their original calibrated values and the overlap offset values are entered in an .INI file. With this arrangement, the system can be periodically calibrated for minor propagation changes without affecting the overlap offset values.

Overlap offset values apply to a site; therefore, only one channel needs to be used to determine the values.

1. Select a System icon.
2. Select menu item System -> Calibration -> SMC Configuration.
3. Select a repeater from the list.
4. Click the Read button.
5. From the Buffer Delays section, make a note of the calibrated Buffer Delay values from the User Defined sets. These values need to be re-entered at the end of these instruction.
6. Modify the Buffer Delay value.

- Each increment changes the transmit time 1 microsecond, which is the amount of time it takes the signal to travel approximately 0.186 mile. The signal travels approximately 1 mile in 5 increments time.
- Incrementing in a positive direction increases the delay before transmitting, which moves the distortion pattern closer to the repeater. Incrementing in a negative direction decreases the delay before transmitting, which moves the distortion pattern farther from the repeater.

7. Click the Write button.
8. Repeat Steps 3 - 7 above for other repeaters on the channel that affect the overlap area.
9. Check the reception in the overlap area.
10. If necessary, repeat Steps 3-4 and 6-9 until the overlap area distortion pattern is acceptable. Do not repeat Step 5.
11. Make a note of the new Buffer Delay values for each repeater that was changed.
12. Subtract the values noted in Step 5 from the values noted in Step 11. Results may be negative or positive.
13. Modify the SITECTR.INI file as instructed in Section B.1.5.2

B.1.5.2 MODIFY SITECTR.INI AND RECALIBRATE SYSTEM

1. Select System -> Calibration. Edit offsets.
2. Select (click on) the site to be changed.
3. Enter the proper offset in the Site Settings box.

4. Click on the SAVE button.

5. Repeat Steps 2, 3 and 4 as needed for other sites.

6. Close the Edit Offsets box.

7. Recalibrate every channel in the system.

B.2 MANUAL TIME AND PHASE PROCEDURES

B.2.1 GENERAL

This Section describes manual procedures for timing and phasing an E.F. Johnson Simulcast Radio System. It will produce the same result as the procedures discussed in Section 2. It may also be used after the procedures of Section 2 have been implemented in order to verify the results.

B.2.2 ADDITIONAL TEST EQUIPMENT REQUIRED (TO SECTION 2.2)

- 800 MHz Omnidirectional Antennas, 2 each Maxrad Model BMUF 8063 (mag mount)
- SINAD meter
- Appropriate cables/connectors
- Simulcast Test Set
- Oscilloscope
- 800 MHz Directional Yagi Antennas, 2 each Sinclair Model SRL 406-1
- Tire mount antenna mast
- Version 8.35 beta test Repeater Programming Software
- SED Box (two total)

B.2.3 SYSTEM AUDIO TIMING

NOTE: The following procedures require two or three people to complete. One at the Hub Site (or Network Manager Location), one at the Channel Controller (if not collocated with the Network Manager) and the other in the overlap region. If other channels in the system are functional, they may be used for two-way communication during the alignment process. Otherwise, other methods are needed. This procedure uses <u>two or more RF channels</u> (a different channel at each site to be timed). A single channel may be used, if signals are relatively equal at the test point.

B.2.3.1 SYSTEM SETUP

1. **At the Network Manager**, record the SMC data gain levels for the channel in the Channel Controller used for the test and reset them to 0. This is done by selecting the System Icon, then select the System pull down and then go into SMC Configuration. Write the information.

2. While in the SMC Configuration, set the delay of each Remote Site repeater to be used to 500 µs.

3. Start 2000pgmr (with the -e option) and go to the RAW TX/RX (Mode 2).

4. Enter: 10 xx 08 xx 00 BF 04
   Where: xx is the repeater number.
   This starts the 1 burst-per-second timing signal on the channel.

5. Shut down all the channels that interfere with the test. This can be done manually or using Network Management.

   Example: Timing a three site system.

- On Site-1, Channel-1 is used for the test, turn off Channel-2 and Channel-3.

- On Site-2, Channel-2 is used for the test, turn off Channel-1 and Channel-2.

- On Site-3, Channel-3 is used for the test, turn off Channel-1 and Channel-2

Do not attempt to time two or more at one time or severe interference will be experienced on the oscilloscope screen (align 1 vs. 2, then 2 vs. 3).

6. Drive to the location designated by Applications Engineering for overlap alignment.

7. Drive one tire over the base plate of the antenna mast.

8. Set up two Yagi antennas on the mast. One should be pointed at each of two repeater sites. If the sites are visible, the antennas may be visually pointed toward each site's tower. If they are not visible, use a compass and a map to point them in the proper direction.

9. Fine tune the antenna direction to minimize interference on the oscilloscope screen.

- Connect each antenna to the antenna jack on the two alignment radios (the Simulcast Test Kit).
- Connect the discriminator output jacks of the radios to the two vertical inputs of the oscilloscope Channel-1 and Channel-2.
- One radio should be tuned to Site-1 Channel-1, and the other to Site-2, Channel-2.

B.2.3.2 TIMING

1. Trigger the oscilloscope off Channel-1. Carefully adjust the trigger level for a stable display. A good clear display of two burst signals should appear, one slightly ahead of the other. The difference should be less than a few hundred microseconds. If one signal is persistently weak and noisy, it may be necessary to relocate. Stay as close as possible to the original site so as not to skew the timing. A few hundred feet is acceptable whereas a mile is not. Be sure to maintain a distance from large buildings, sheds, barns, and signs. They will act as reflectors and interfere with the signal.

2. If one of the sites is collocated with the Channel Controller, this site should have no additional delay added. There is a special filter that simulates the group delay of the multiplexer channel cards and it adds approximately 1 ms of delay. This is done by switch settings on the SMC. It is necessary to add approximately 800 µs of delay to the other sites to get close to the delay of the collocated site. Use the Network Management SMC Configuration menu to set the delays in each repeater. By observing the scope screen (see Figure B-3), it is possible to observe the approximate number of microseconds that must be added or subtracted to get the waveforms from each site even. It generally takes a large change followed by two or more small changes. The scope displays two traces, one from Site-1, Channel-1 and one from Site-2, Channel-2. Notice the delay offset. The Network Manager is used to set delays in repeaters to sync the signals.

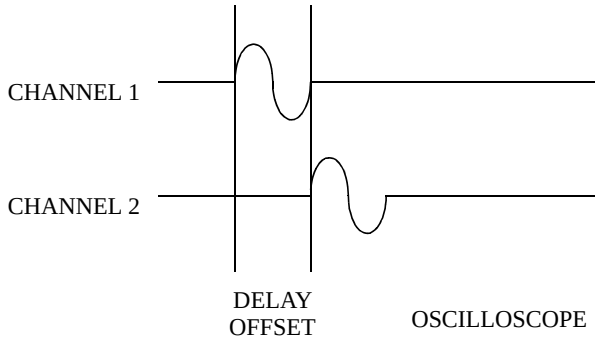
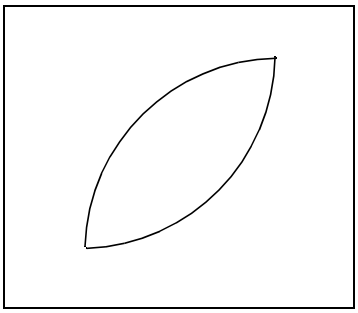
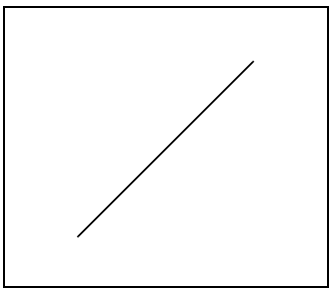


Figure B-3

3. Once the traces are close to being in sync, place the scope in X-Y mode to show minute differences in timing. A straight diagonal line, with no perceivable ellipse shows a well-timed system (see Figure B-4).



NEEDS MORE ALIGNMENT



CORRECTLY ALIGNED

Figure B-4

4. When the first two sites are adjusted, continue to other sites until completed in the same manner. Adjust timing to other repeaters at each site in the same manner.

5. After setting the timing for the designated location, add or subtract the optimization correction factor for each site. This data is supplied from a coverage optimization program. The factors are in the form of plus or minus microseconds and are added or subtracted to the settings of each site's delay setting.

B.2.3.5 NORMAL OPERATION

When the alignment is complete, restore the system back to normal operation.

1. When done timing a channel, enter the following in 2000pgmr (with the -e option) in Raw Rx/Tx::
   10 xx 08 xx 00 BF 01
   Where: xx is the repeater number.

2. At the Network Manager, set the Channel Controllers SMC data gain back to the recorded level (Typically 1).

3. At the Network Manager, or at the physical locations, turn the repeaters that were shutdown back on.

4. At the Network Manager, record the final delay settings at each site.

   EXAMPLE:
   Site-1, Channel-1 = 511 µs
   Site-2, Channel-2 = 330 µs
   Site-3, Channel-3 = 430 µs

5. Now input the Site-1, Channel-1 level into all Site-1 repeaters, Site-2, Channel-2 level into all Site-2 repeaters and Site-3, Channel-3 level into all Site-3 repeaters.

NOTE: Keep in mind that the proper phase "number" (0-255) in the Network Manager corresponds to 0°-360°. The multiplying factor is 1.4. During the Phase procedure, this needs to be input along with the delay setting to set Remote Site Repeater SMC information with the Network Manager instead of Remote Site SMC dip switches.

B.2.4 COARSE PHASE ALIGNMENT

NOTE: One person can perform this alignment once the Network Management places phase control on the DIP switches in the repeaters. However, it is a good idea to have a person at the Network Management console in case a repeater is accidentally not in the proper configuration.

1. Connect an IFR to a repeater as in Section 2.5. Modulate the generator with a 1 kHz tone at 1.5 kHz deviation and 1 kHz data deviation from a SED Box.

2. Using the Network Management SMC Configuration menu, ensure that the Channel Controller data gain is set at its original level (Typically 1) and that it is not shut off (not set to 0).

3. At each repeater, connect a SED box to display Multi-Net data (decode). The cable should be connected to J58, pin 5 (Tx MOD).

4. Using the Network Management SMC Configuration menu, set the Remote Site repeater SMC to accept phase adjustment from the DIP switches.

Make copies of Table B-3 (as needed) to use in determining the best phase setting.

The list of numbers in Table B-3 represents switch settings on SW4, positions 5 through 8 (see Figure B-8). Set the Network Management to allow DIP switch control of the phase. Starting with 0000, proceed through all 16 combinations, noting which ones produce steady, good data on the SED box. If the data fades in and out, mark it bad in the Table.

There will be a range of positions where there is good data (Typically 7 or 8). If the range is an odd number of SMC switch settings, leave the setting in the middle. If the range is even, leave the setting on the lower of the two middle settings.

Read the phase adjustment from the Network Management SMC Configuration menu and copy it into the setting box provided. This will later be adjusted to fine tune the system. Select this box as the setting, returning phase control to Network Management.

B.2.5 FINE DATA PHASE ADJUSTMENT

CRITICAL ADJUSTMENT

This procedure is extremely critical for proper Simulcast operation. Failure to do it properly may result in unacceptable noise levels in overlap areas.

1. Connect the IFR to a repeater as in Section 2.5. Modulate the generator with a 1 kHz tone at 1.5 kHz deviation and 1 kHz data deviation from the SED box.

2. Using the Network Management, disable all but two repeaters on the channel being worked on.

3. Travel to the location used for overlap timing between the two repeaters for the test.

4. Connect one radio of the Simulcast Test Set to an ***Omnidirectional*** antenna.

5. Connect the speaker/microphone output to the SINAD meter. ***DO NOT*** connect the discriminator output to the meter. Only the audio tone, without data is required.

6. Record the current SINAD reading. If a service monitor is used, use the analog meter (if available) or set the digital reading for a slow, averaging response.

7. Using the Network Management SMC Configuration menu, carefully start incrementing the phase of one of the two repeaters. Do this in steps of two, each step on the Network Management console represents 1.4°. If Noise increases and SINAD drops, go in the opposite direction. If there is little difference, return to the original setting and perform this procedure with the other repeater. Do not go further than 20 units from the original setting. Keep track of the positions and record the SINAD readings.

8. Shut down one of the repeaters (if more than one) and bring up another.

9. Repeat Steps 3 - 8 with the third repeater, holding the first one steady this time.

10. Bring up all repeaters. Verify that the SINAD is at an acceptable level (typically 16 dB or better). If not, repeat the above procedure trying Network Management phase steps of one to pin point an acceptable SINAD level in Step 7.

11. Remove the IFR from the repeater and restore all repeaters to normal operation.

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Table B-3 SMC S4 SETTINGS

Section 8 180°	Section 7 90°	Section 6 45°	Section 5 22.5°	Good
0	0	0	0	
0	0	0	1	
0	0	1	0	
0	0	1	1	
0	1	0	0	
0	1	0	1	
0	1	1	0	
0	1	1	1	
1	0	0	0	
1	0	0	1	
1	0	1	0	
1	0	1	1	
1	1	0	0	
1	1	0	1	
1	1	1	0	
1	1	1	1	
0=Off 1=On				

B.2.5.6 S4 TRANSMIT LEVEL/PHASE SWITCHES

This sets the data output at a Remote Site. S4, section 2 is the Installation Mode select. It is only on to allow setup of the Channel Controller. While the levels are being set this switch prevents the MAC from sending alarms that would cause the MPC to shutdown the Channel Controller (can be overridden by Network Management).

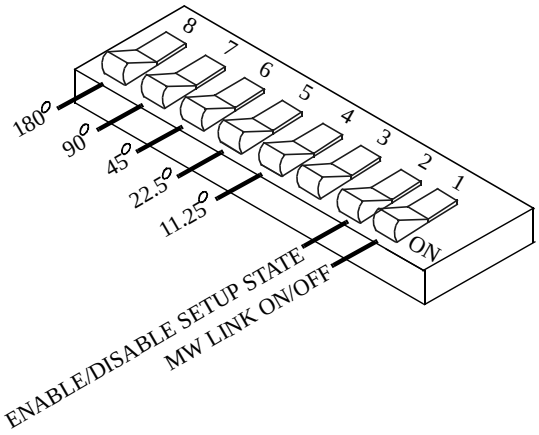

Figure B-7 REMOTE SITE SMC S4 SETTINGS

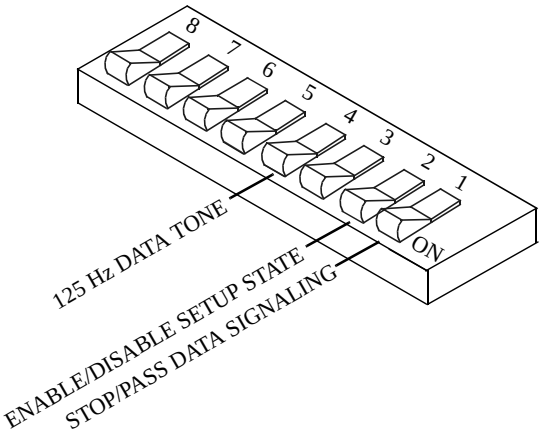

Figure B-8 REPEATER CONTROLLER SMC S4 SETTINGS

B.2.5.9 S3 FINE DELAY/COURSE DELAY

These switches are the manual input for the timing delay setting at the Remote Site repeaters only (can be overridden by Network Management).

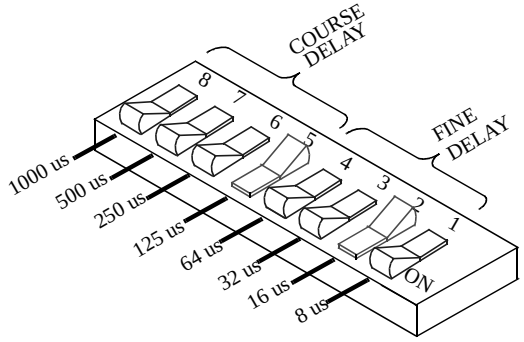

Figure B-10 REMOTE SITE SMC S3 SETTINGS

B.2.5.11 S1 SIGNAL PATH SWITCHES

This 8-section switch routes the audio/data to and from the MAC to and from the microwave link. Input is for a Channel Controller and output is for a Remote Site.

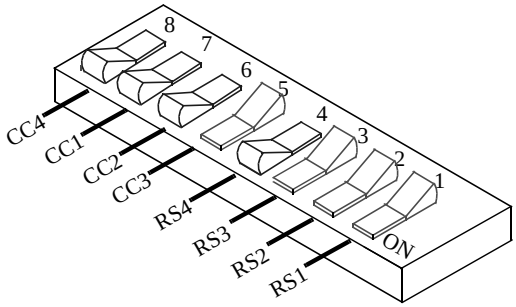

Figure B-12 REMOTE SITE SMC SWITCH S1

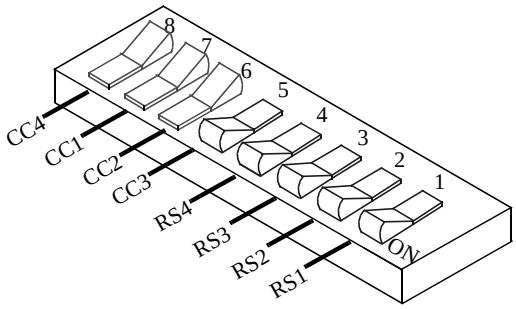

Figure B-13 CHANNEL CONTROLLER SMC S1