ZETRON

Model 66 Transmitter Controller
Operation and Maintenance Manual

Part No. 025-9078W

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

1. INTRODUCTION AND SPECIFICATIONS

INTRODUCTION

The Zetron Model 66 Transmitter Controller provides control of a remote transmitter when interfaced to the Zetron Model 2200 Paging Terminal (equipped with the remote control option) by means of a communications (control) link. The main functions of the Transmitter Controller are to command the paging transmitter into either the analog or digital mode; and when in the digital mode, to demodulate the FSK signals provided by the paging terminal.

Control of these radio functions is by continuous tone protocols generated by the paging terminal and sent over the communications link. This protocol is compatible with Motorola PURC controllers. The link can be any suitable communications link, such as a radio link, a telco line, or even a simplex audio grade pair.

An optional built-in 202-type FSK modem converts digital paging tones to RS-232 data levels for interface to a digital-capable transmitter. A transmit audio mute feature ensures that all audio signals are muted when the transmitter is placed in the digital mode.

A selectable timer prevents the transmitter from being keyed for longer than a preset duration. Timeouts of 1.1, 2.3, 4.5, and 9.1 minutes are available (or no timeout at all).

Standard guard tone is 2175 Hz with 2600 Hz or 2675 Hz optional. Optional guard tone frequencies permit the use of a controller with HSC format.

A carrier-operated relay (COR) feature provides a tone back to the paging terminal (over an optional duplex pair) whenever there is a channel busy condition. This allows the paging terminal to avoid interfering with pages from other transmitters on the same channel. The frequency of this tone is 387 Hz.

The Transmitter Controller mounts onto a standard 19-inch equipment rack at the transmitter site. The front panel contains the necessary indicators and controls to insure optimum performance of the unit. A built-in speaker and volume control allow maintenance personnel to monitor unit operation during service procedures. While the Transmitter Controller operates from any 12 to 14 VDC power source, and optional 9 VAC wall transformer can be used where 115 VAC 50/60 Hz power is available.

The Transmitter Address Decoder option for the Model 66 adds the ability to direct pages to particular transmitters. The option decodes one particular address out of 30 possible. This allows paging terminals, such as the Zetron 2000 Series, to direct pages to one, a combination, or all addresses (transmitters) to provide selective coverage in multiple transmitter systems.

The option's address is DIP switch configurable as to which address it decodes. When the paging terminal sends the sequence of tones that correspond to a transmitter's address, the Model 66 is disabled and will not key up during that transmission. The paging terminal, therefore, sends the sequences to disable the sites NOT wanted. Or, in other words, the terminal does NOT send the sequences for the sites desired. This is why the sequence of tones are referred to as "disable tones" in this documentation.

Utilizing bucket-brigade analog delay line and quartz-crystal referenced clock circuitry, the optional Simulcast Delay Module provides low cost, precise, adjustable analog delays for simulcast configurations.

SPECIFICATIONS

Input from Control Link

Signal Level Range:	–30 to +10 dBm
Impedance:	600 ohms

Output Signals to Transmitter

Audio Output Level:	Adjustable to 0 dBm (maximum)
Digital Data Signal:	RS-232/TTL compatible (±9-volt swing, +5-volt swing, unloaded, nominal)
Digital Mode Signal:	RS-232 compatible (±9-volt swing, unloaded, nominal)
Analog Push-to-Talk Output:	Form C relay contacts
Digital Push-to-Talk Output:	Form C relay contacts

Output Signals to Link

Audio Output Level:	Adjustable to 0 dBm (maximum)

COR/CAS Input

Compatible with relay closure or TTL level (RS-232 input)

Simulcast Delay Module Specifications

Architecture:	
Delay circuitry:	Variable clock speed bucket brigade device (BBD)
Clock circuitry:	Quartz-crystal referenced phase-locked loop
Analog filters:	Two-pole constant-delay active filters
Minimum Delay:	1330 microseconds
Maximum Delay:	3885 microseconds
Resolution:	5 microseconds
Accuracy:	5 microseconds
Adjustments:	
Delay:	2 rotary 16-position DIP switches and a jumper
Input Level:	Single turn pot on board
Ouput Level:	Single turn pot on board
Test points:	Input, output signals; clock to BBD; ground

Power Requirements

12 - 14 VDC or 12 VRMS

115 VAC 50/60 Hz with 12 VAC wall transformer

Dimensions

1.75-inch height in a 19-inch equipment rack

Environmental

Operating Temperature: 0 to 50 degrees Celsius

Relative Humidity: up to 95% (non-condensing)

Options

120 VAC Wall Transformer

2. HARDWARE INSTALLATION

This section describes how to configure and install the Model 66 Transmitter Controller. Following the installation instructions are procedures for making any necessary adjustments and testing operation of the unit.

Caution!

Do not attempt to power-up the Transmitter Controller until you have read and understand this entire section.

INSTALLATION OVERVIEW

Installation of the Transmitter Controller is divided into the following main functions. As closely as is practical, install the equipment in the listed order.

- Configure the internal jumpers
- Locate and mount the Transmitter Controller
- Connect the control link
- Connect the control lines to the radio transmitter
- Connect AC or DC power
- Make preoperational adjustments
- Verify operation of the Transmitter Controller

Before beginning installation of the Transmitter Controller, it may be of benefit to see how the unit fits into the paging system. Figure 2-1 shows how the Transmitter Controller interfaces a Zetron Model 2200 Paging Terminal to the paging transmitter to provide the necessary transmitter control. In this example, the communications link between the paging terminal and the Transmitter Controller consists of a transmitter/receiver combination. The link could just as easily be a voice grade cable or telco line, in which case the paging terminal would effectively be connected to the Transmitter Controller.

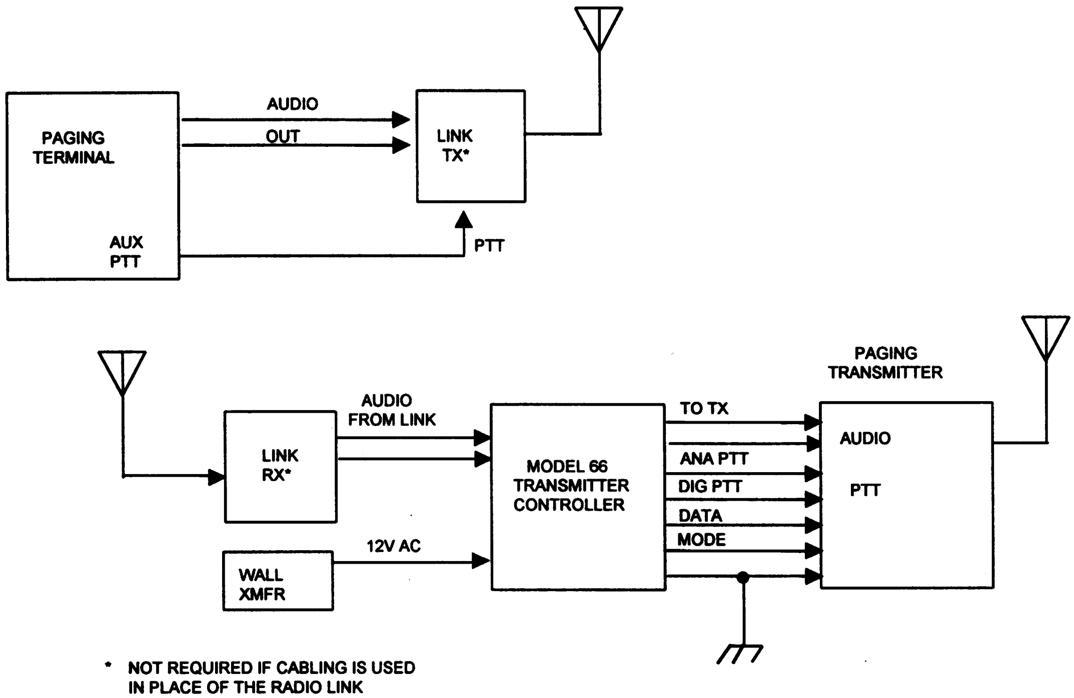


Figure 2-1. Typical Interfaces

In order to operate with the Transmitter Controller over the communications link, the paging terminal is equipped with an optional Radio Station Card (Part No. 950-9781).

The illustration shows that the paging terminal provides audio signals to the input of the Transmitter Controller, either over a radio link, cable pair, or a telco line. The timing and content of the audio signals are interpreted by the Transmitter Controller to provide voice signals (labeled TO TX), push-to-talk signals, as well as data and mode signals to the paging transmitter. (The illustration does not show use of the COR signal back to the paging terminal from the paging transmitter site.)

INSTALLING THE TRANSMITTER CONTROLLER

Remove the Transmitter Controller Cover

Note

Before removing the cover of the Transmitter Controller, read "Configure the Internal Jumpers" on page 2-3 to determine if you need to alter any of the jumper settings from those provided at the factory. If you do not need to make any jumper changes, proceed to the subsection titled "Connect the Control Link" on page 2-9.

To gain access to the printed circuit board, and the jumpers, within the Transmitter Controller, place the unit on a smooth horizontal surface and remove the cover. Remove the two Phillips screws from the back panel and the nut from each side panel, and then slide the cover rearward and off (see Figure 2-2).

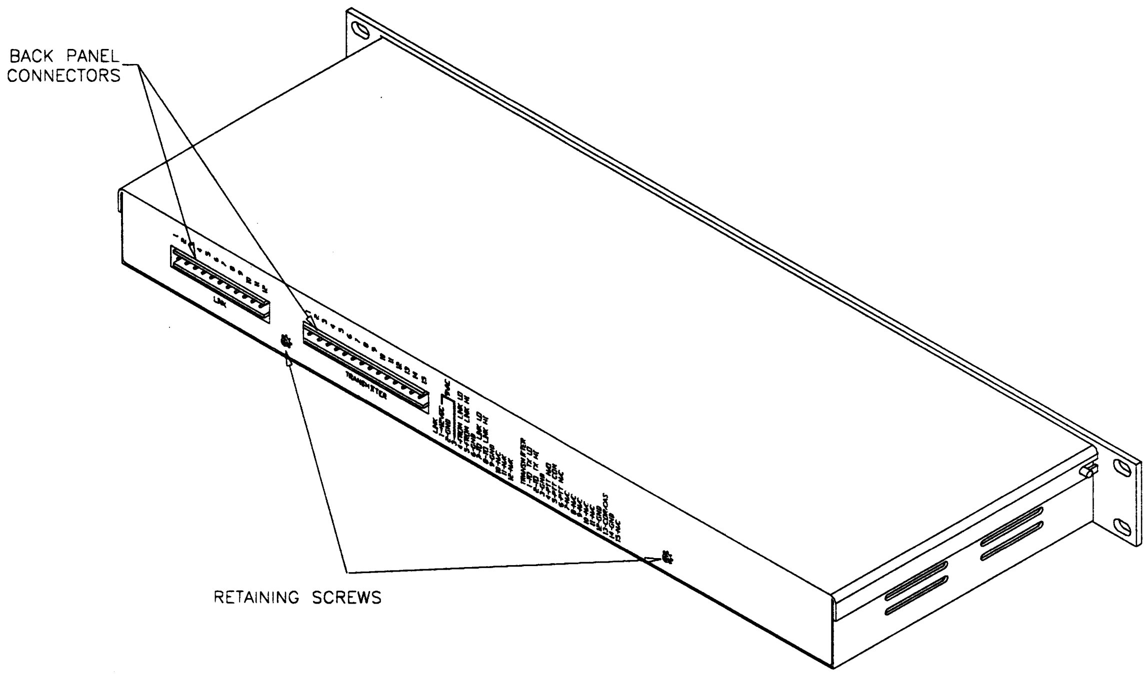


Figure 2-2. Model 66 Back Panel

Configure the Internal Jumpers

Several jumpers and switches are provided on the printed circuit board within the Transmitter Controller to select timeout delays, signal polarities, etc.

Table 2-1, Table 2-2, and Table 2-3 list each jumper with its designation on the printed circuit board and its default (factory set) position. A diagram showing the jumper locations follows each table. Table 2-1 and Figure 2-3 refer to Revision F through H, and Table 2-2 and Figure 2-4 refer to Revision J through N. For the jumper designations and locations for Revision P and later revisions, refer to Table 2-3 and Figure 2-5 on page 2-6.

A more detailed description of each jumper position follows the tables and figures to assist you in determining the appropriate position for the jumper for a particular transmitter installation.

Table 2-1. Revision F through H Jumpers

Jumper	Default Position	Description
JP1	A	COR Input Pull-Up Resistor
JP2	A	Digital Mode Signal Polarity
JP3	A	Digital Data Signal Polarity
JP4	A	COR Input Signal Polarity
JP5	A	Analog PTT for All Pages
JP6	-	Factory Set - Do Not Change
JP7	A	COR Tone Disable
JP8, JP9	-	Factory Set - Do Not Change
JP10	A	De-emphasis/Flat Audio Input
JP11-15	-	Transmitter Keying Timeout
JP16	A	Optional Delay Board
JP17	OUT	Data Detect Override *
JP18	IN	Balanced Audio Input
JP19	IN	2175 Hz/2600 Hz Guard Tone

* Installed in special applications when the Model 66 should change to digital mode immediately after the gap.

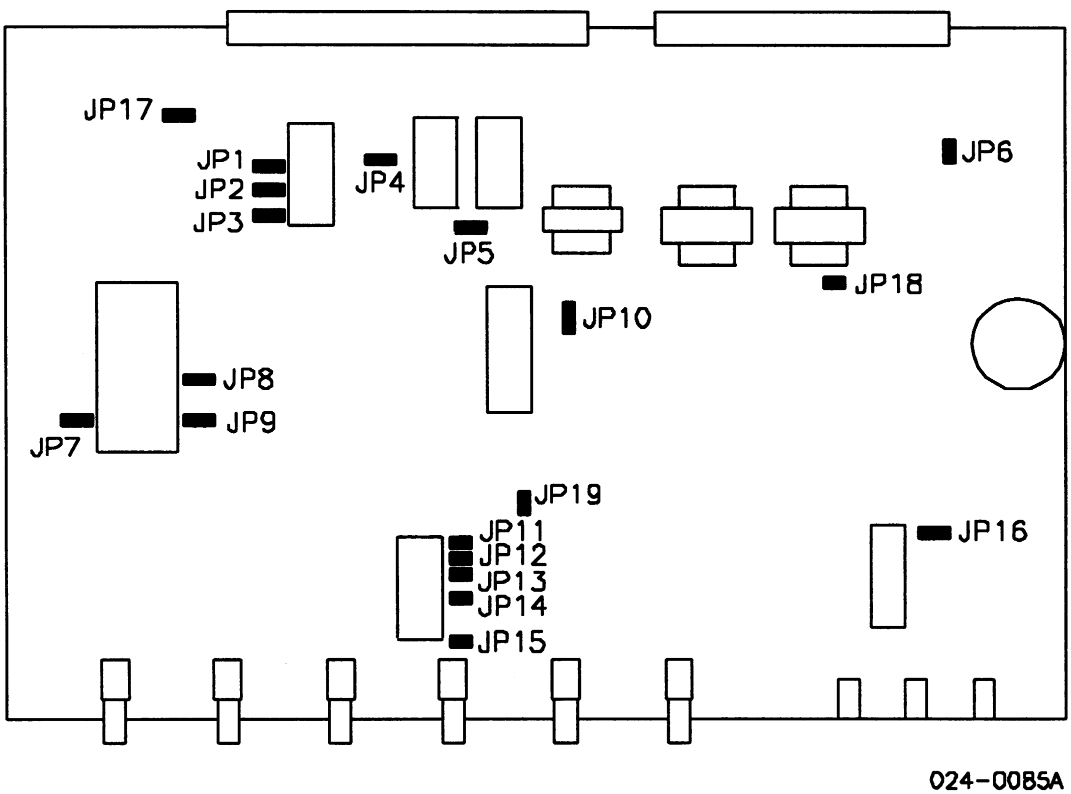


Figure 2-3. Model 66 PCB Jumper Locations, Revisions F through H

Table 2-2. Revision J through N Jumpers

Jumper	Default Position	Description
JP1	A	COR Input Pull-Up Resistor
JP2	A	Digital Mode Signal Polarity
JP3	A	Digital Data Signal Polarity
JP4	A	COR Input Signal Polarity
JP5	A	Analog PTT for All Pages
JP6	-	Factory Set - Do Not Change
JP7	A	COR Tone Disable
JP8, JP9	-	Factory Set - Do Not Change
JP10	A	De-emphasis/Flat Audio Input
JP11-15	-	Transmitter Keying Timeout
JP16	A	Optional Delay Board
JP17	OUT	Data Detect Override *
JP18	IN	Balanced Audio Input
JP20	A	Digital Data Output Level Select (RS-232/TTL)
JP21	A	Digital Data Bistate

* Installed in special applications when the Model 66 should change to digital mode immediately after the gap.

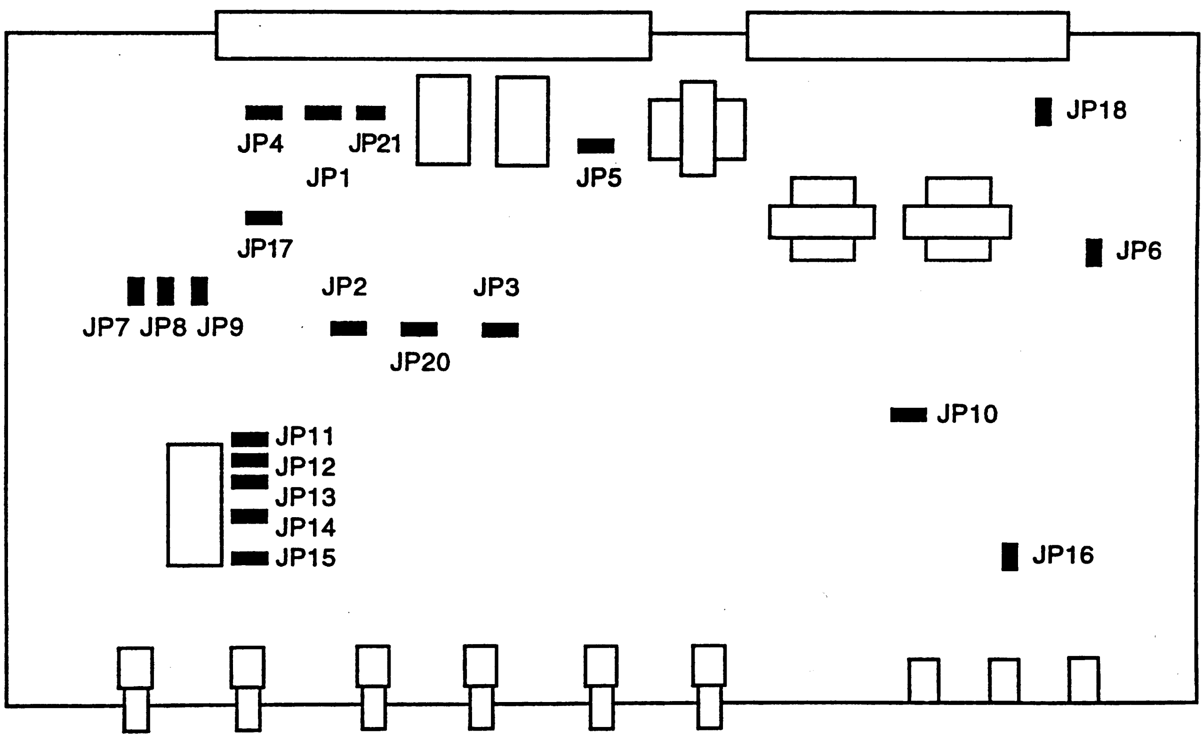
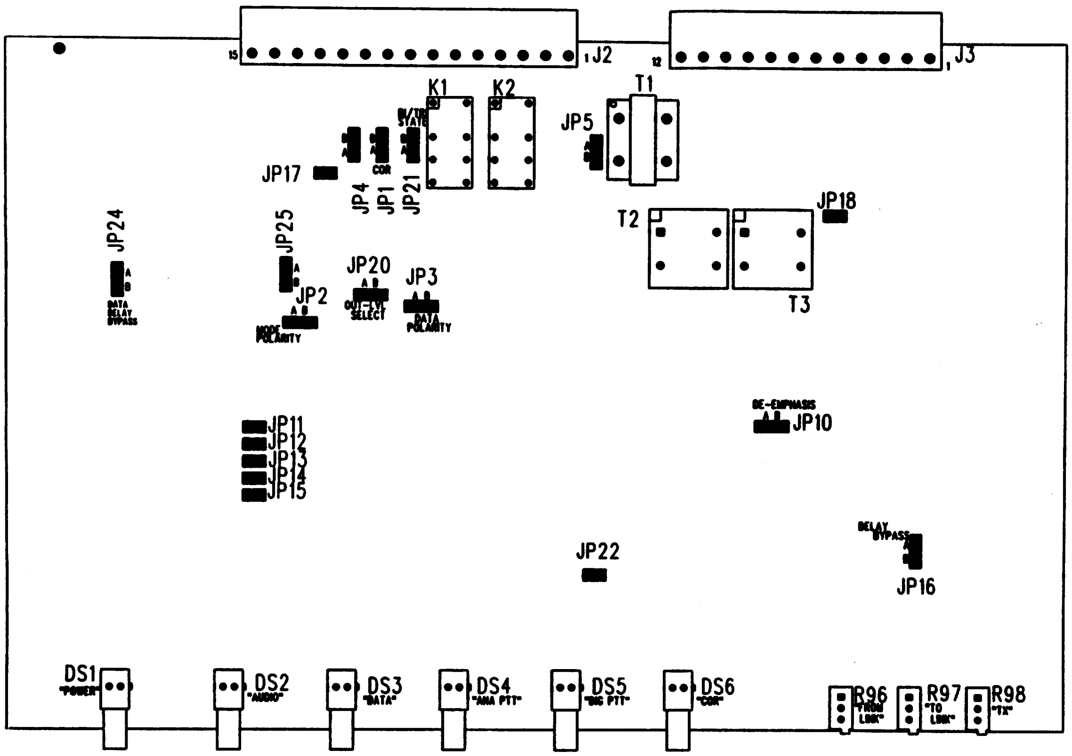


Figure 2-4. Model 66 PCB Jumper Locations, Revision J through N 024-0103C

Table 2-3. Revision P and Later Jumpers

Jumper	Default Position	Description
JP1	A	COR Input Pull-Up Resistor
JP2	A	Digital Mode Signal Polarity
JP3	A	Digital Data Signal Polarity
JP4	A	COR Input Signal Polarity
JP5	A	Analog PTT for All Pages
JP8, JP9	-	Factory Set - Do Not Change
JP10	A	De-emphasis/Flat Audio Input
JP11-15	-	Transmitter Keying Timeout
JP16	A	Optional Delay Board
JP17	OUT	Data Detect Override *
JP18	IN	Balanced Audio Input
JP20	A	Digital Data Output Level Select (RS-232/TTL)
JP21	A	Digital Data Bistate
JP22	IN	Selects Digital Mode Default (New with Rev P)
JP23, JP25	-	Factory Set – Do Not Change
JP24		Data Delay

* Installed in special applications when the Model 66 should change to digital mode immediately after the gap.



024-0283B

Figure 2-5. Model 66 PCB Jumper Locations, Revision P and Later

Jumper Descriptions

COR Input Pull-Up Resistor Jumper - This jumper (JP1) connects/disconnects a 3.3 kohm pull-up (to +5 volts) resistor to the active COR input from the transmitter to the Transmitter Controller. The A position of the jumper connects the pull-up resistor; the B position disconnects the resistor. This feature is useful where dry contacts are used within the transmitter to provide the COR signal.

Digital Mode Signal Polarity - This jumper (JP2) determines the polarity of the digital mode signal, which is, provided to the transmitter to select/deselect the digital transmission mode. When the jumper is in the A position, the digital mode is signified by a high signal level at the digital mode output to the transmitter. Conversely, when the jumper is in the B position, the digital mode is signified by a low signal level at the digital mode output.

Digital Data Signal Polarity - This jumper (JP3) determines the polarity of digital data signals provided to the transmitter. When the jumper is in the A position, the digital data output to the transmitter is considered to be in the normal polarity. When the jumper is in the B position, the digital data is provided in the inverse polarity. This feature is provided to accommodate transmitters that require the inverted polarity for digital data.

COR Input Signal Polarity - This jumper (JP4) matches the busy/not busy polarity of the COR signal from the transmitter to the input of the Transmitter Controller. When the jumper is in the A position, a high COR input from the transmitter means that the transmitter is not busy. When the jumper is in the B position, a high COR input means the transmitter is busy.

Analog PTT for All Pages - This jumper (JP5) operates analog PTT output to the transmitter for both analog and digital pages when in the A position. When the jumper is in the B position, the analog PTT output operates for analog portions of the page, and the digital PTT output operates for digital portions of the page.

COR Tone Disable – (Revision F-N only) This jumper (JP7) disables the COR 387-Hz tone sent back to the paging terminal, even though there may be a "busy" COR input from the receiver. The B position disables the COR tone to the paging terminal.

De-emphasis/Flat Audio Input - This jumper (JP10) provides de-emphasis or flat for audio input to the transmitter. For a transmitter without pre-emphasis, place the jumper in the A (flat) position; for a transmitter with pre-emphasis, place the jumper in the B (de-emphasis) position.

Transmitter Keying Timeout - These jumper positions (JP11 through JP15) use a single jumper to select the reset timeout value for transmitter keying. That is, the Transmitter Controller can be made to reset after it has been continuously keyed for a certain period of time. This feature ensures that the transmitter cannot be keyed indefinitely, and when the transmitter is reset, a new paging sequence is required to restart the transmitter. To select specific timeout values, place the jumper in the appropriate position as listed below:

JP11 position = 4.5 minute timeout (approximate)

JP12 position = 2.3 minute timeout (approximate)

JP13 position = 1.1 minute timeout (approximate)

JP14 position = 0.6 minute timeout (approximate)

JP15 position = no timeout

Optional Delay Board - This jumper (JP16) allows the installation of the optional delay board. If the delay board is added, place the jumper in the B position, otherwise the jumper should be kept in the A position.

Balanced Audio Input - This jumper (JP18) selects the 600-ohm balanced audio input when installed. With the jumper removed, the alternative 5-kohm input can be used.

Guard Tone Select (Revisions F through H only) - This jumper (JP19) determines the guard tone to which the Model 66 will respond; with the jumper installed, 2175 Hz is used and with the jumper removed, 2600 Hz is used.

Output Level Select (Revision J and later only) - This jumper (JP20) determines the output level of the digital data. In the A position, the output level is RS-232 compatible (±9-volt swing). In the B position, the output level is TTL (+5-volt swing).

Data Output Routing (Revision J and later only) - This jumper (JP21) determines the path of the digital data. With the jumper in the A position, the digital data is routed via the secondary contacts of the digital data relay to the transmitter connector J2. In the B position, the digital data is routed directly to the transmitter connector J2.

JP21 Digital Model Default (Revision P and later only) - Removing JP22 causes the control logic to default to digital mode. This is for unusual applications only and it is recommended that the user always leave JP22 installed until they have contacted Zetron Service regarding the application.

JP24 Digital Delay Bypass (Revision P and later only) - Used in conjunction with JP16 in Simulcast Systems where Revision P and later units are mixed with Prerevision P units. Place in position B to match the data delay with older units, use position A if all units are Revision P or later, or in nonsimulcast systems.

Install the Transmitter Controller Cover

To install the Transmitter Controller cover, slide the cover on from the back and install the two Phillips screws in the back panel and the nuts on each side panel.

Locate and Mount the Transmitter Controller

The Transmitter Controller can be mounted onto any standard 19-inch equipment rack. It requires 1.75 inches of vertical space and access to the rear panel for making connections. Since the front panel contains adjustment controls and indicators, it should be mounted at a height that is easily accessible.

To mount the Transmitter Controller onto the equipment rack, proceed as follows:

1. Check the chosen mounting location to be sure that the front panel is at a convenient height and that the connectors on the back panel are accessible for making connections.

2. Locate the hardware package from the shipping carton. Fasten the tabs of the Transmitter Controller front panel to the equipment rack using the flathead screws provided.

MAKING CONNECTIONS

Connect the Control Link

The control link between the paging terminal and the Transmitter Controller can be a single voice-grade pair. If the COR (carrier-operated relay) feature is to be used, then a second pair must be used to return the tone back to the paging terminal. Make control link connections as follows:

1. On the back panel, locate the connector labeled LINK. Pull to remove the mating connector from the LINK connector.

2. Loosen the connector screws at terminals 4, 5 and 6, and insert the wires of the control link pair that provide the audio and control tones from the paging terminal. Terminal 4 is the low side of the pair, terminal 5 is the high side, and terminal 6 is ground. If the audio lines from the link are unbalanced, be sure to connect terminal 4 to ground. Tighten the screws.

3. If the COR feature is to be used, loosen the connector screws at terminals 7 and 8 and insert the control link pair that connects the carrier-on signal back to the paging terminal. Tighten the screws.

4. Replace the mating connector (with the wires installed) back on the LINK connector.

Connect the Control Lines to the Radio Transmitter

The Transmitter Controller provides the following functions to the radio:

- 600-ohm transmit audio
- Analog push-to-talk
- Digital push-to-talk
- Digital RTS
- Digital data
- COR (input)

Make the transmitter connections as follows:

1. On the back panel, locate the connector labeled TRANSMITTER. Pull to remove the mating connector from the TRANSMITTER connector.
2. Loosen the connector screws at terminals 1 and 2. Insert the wires for the audio input (terminal 1 is the low side of the pair) to the transmitter and tighten the screws.
3. Loosen the connector screws at terminals 4 through 9 for the analog and digital push-to-talk functions. Each push-to-talk output from the Transmitter Controller is a form C relay closure as shown in Figure 2-6. Make the necessary push-to-talk connections to the mating connections and tighten the screws.
4. Loosen the screws at terminals 10, 11, and 12. Connect the digital data and digital RTS wires to terminals 10 and 11 respectively, and connect the common side to terminal 12.
5. If the COR function is being used, loosen terminals 13 and 14. Connect the COR output from the receiver across these terminals and tighten the screws.
6. Recheck each of the terminal screws to make sure that they are snug, and then install the mating connector onto the TRANSMITTER connector on the back panel of the Transmitter Controller.

Figure 2-6. Form C Relays

Connect the Power Source

The Transmitter Controller can be powered by any 9 VAC or 12 to 14-volt DC power source. For 115 VAC sources, the plug-in low-voltage wall transformer accessory can be used. For DC power, the DC battery supply can be used if 12 to 14 volts are available.

If an AC source is used, connect the 9 VAC supply across terminals 1 and 3 of the mating connector for the LINK connector. If a DC source is used, connect the DC supply across terminals 1(+) and 2(-) of the mating connector.

Once all connections to this connector are complete, recheck each of the terminal screws to make sure that they are snug, then replace the mating connector onto the LINK connector on the back panel of the Transmitter Controller.

Connect to System Ground

Connect the Transmitter Controller to system ground by running a wire from any unused ground terminal (such as terminals 3, 12, or 14 of the 15-pin TRANSMITTER connector on the back panel).

PINOUT DESCRIPTION OF BACK PANEL TERMINATIONS

Link

The Link connector pinout is shown in Table 2-4.

Table 2-4. Link Pinout

Pin	Name	Description
1	+12 VDC or 9 VAC	Power input to Model 66. Connect positive 12 volts or 9 volts AC to this terminal.
2	GND	Power ground input to Model 66. Connect to common power ONLY if using DC power.
3	9 VAC	9 volts AC power input. Connect 9 volts AC to this terminal if using AC power.
4	FROM LINK LO	Low side of balanced audio input. Connect to audio from phone line or link receiver. Connect to ground for unbalanced audio input.
5	FROM LINK HI	High side of balanced audio input. Connect to audio from phone line or link receiver.
6	GND	Ground. Useful for connecting to pin 4 if unbalanced audio is desired.
7	TO LINK LO	Low side of balanced COR-tone output transformer. Connect to phone line or link transmitter. Ground if unbalanced audio desired.
8	TO LINK HI	High side of balanced COR-tone output transformer. Connect to phone line or link transmitter.
9	GND	Ground. Useful for connecting to pin 7 if unbalanced "TO LINK" audio is desired.

Transmitter

The Transmitter connector pinout is shown in Table 2-5.

Table 2-5. Transmitter Pinout

Pin	Name	Description
1	TO TX LO	Low side of balanced audio output. Connect to transmitter audio input. Ground if unbalanced audio desired.
2	TO TX HI	High side of balanced audio output. Connect to transmitter audio input.
3	GND	Ground. Useful for connecting to pin 1 if unbalanced transmit audio is desired.
4	ANA PTT N/O	Analog PTT normally open. Connect to PTT of transmitter. Closes when analog page is placed. Also closes when digital page is placed if JP5 is in A position.
5	ANA PTT COM	Analog PTT common. Connect to ground if desired. Normally floating.
6	ANA PTT N/C	Analog PTT normally closed.
7	DIG PTT N/O	Digital PTT normally open. Closes when digital page is placed if JP5 is in B position.
8	DIG PTT COM	Digital PTT common. Connect to ground if desired. Normally floating.
9	DIG PTT N/C	Digital PTT normal closed.
10	DIG DATA	Digital data output. RS-232/TTL level output (jumper-selectable), polarity jumper-selectable. Connect to transmitter data input. Output is not predictable during analog mode.
11	DIG MODE	Digital mode output. RS-232 level output, polarity jumper-selectable. Connect to transmitter mode input. Output is asserted when digital page is placed.
12	GND	Ground
13	COR/CAS	Busy input. Threshold is about 0.6 volts, polarity jumper-selectable. Pull-up resistor is jumper-selectable.

MAKE PREOPERATIONAL ADJUSTMENTS

Before placing the Transmitter Controller into general service, certain signal levels should be checked, and adjusted if necessary, to assure optimum performance of the unit. Perform the following steps:

1. Adjust the input signal level from the control link/paging terminal
2. Adjust the output signal level to the transmitter
3. Adjust the signal level of the COR tone back to the paging terminal (if used)

Note

The adjustments are made with multi-turn potentiometers. It may be necessary to rotate the potentiometer more that one full turn to obtain the proper adjustment.

Systematic Alignment

Using a standard flat-head adjustment tool, check/adjust the input level of the control signals received over the control link from the paging terminal as follows:

1. Adjust the LINK TRANSMITTER for a HLGT deviation of 4.0 kHz. The length of the HLGT should be increased to be able to get an accurate reading.

2. At the LINK RECEIVER two tests should be performed:

   a. Verify flat LINK - send paging tones of 500 Hz, 1000 Hz, 1500 Hz, and 2000 Hz from the paging terminal. The levels of these tones should be within 3 dB of each other.

   b. Signal to noise ratio - key up the LINK TX (with the paging terminal disconnected from it). Measure the noise (Vrms) at the output of the LINK RX. With the paging terminal sending a 1000-Hz paging tone, remeasure the output of the LINK RX (Vrms).

   The signal to noise ratio is:

$$\frac{1000 - \text{Hz tone reading (Vrms)}}{\text{Noise reading (Vrms)}}$$

   This ratio should be in the region of 100 to 1.

3. Attach a voltmeter at connector J4 pin 1 on the Model 66. With a 1000-Hz paging tone being sent from the paging terminal, adjust the front panel FROM LINK control to read 1.0 Vrms on the voltmeter. Readings at connector J4 pin 1 should be 1.25 Vrms ±12% for the other paging tones of 500 Hz, 1500 Hz and 2000 Hz. This will be an optimum setting for the Model 66.

4. Adjust the front panel TO TX control of the Model 66 so there is a deviation of ±3.5 kHz during the paging tones at the transmitter. Don't use the FROM LINK to adjust the output level. Test a digital pager--invert the polarity if necessary.

Note

A frequency deviation of 3.5 kHz is standard for most paging equipment. If your equipment differs in its modulation specifications, adjust the TO TX accordingly.

COR Tone Level Adjustment

> **Note**
>
> The required level of the COR tone will vary depending on the type of link used for communication back to the paging terminal.

Check/adjust the output level of the COR tone back to the paging terminal as follows:

1. Connect an appropriate AC voltmeter at a convenient point in the link that carries the COR tone to the paging terminal; such as the punch-down block, LINK connector (terminals 7 and 8) on the Transmitter Controller, etc.

2. Create a channel busy condition (such as turning the receiver squelch control all the way down) and adjust the TO LINK control to obtain the correct level on the link to the paging terminal, as recommended by the manufacturer of the link equipment.

> **Note**
>
> There is no control for digital data level. The output swing is fixed.

MODEL 66 COR\BUSY TONE CONTROL - This will help you set up a Model 66 to a Model 68 with busy tone back to the 2000 Series Paging Terminal. On the Model 66, JP1 will be in the B position if your transmitter supplies a dry contact. If your transmitter supplies a 5 VDC source, then JP1 should be in the A position. COR input signal polarity is selected by JP4. When the jumper is in the A position, a high COR input from paging transmitter means that the transmitter is not busy. When the jumper is in the B position, a high input means that the transmitter is busy. It is necessary to have the digital option installed in the Model 66 for busy tone back to the paging terminal. The Model 66 can only generate a tone of 387 Hz for COR\busy.

WIRING MODEL 66 TO MODEL 68 FOR BUSY TONE - From the Model 68 to the Model 66, there are four wires needed. The first pair of wires from the Model 68 to the Model 66 is audio out high and low; these lines go to the back of the Model 66 on connector pins 4 and 5. The second pair of wires is the audio in/busy and audio in/COR. These lines go from the Model 68 to the Model 66 on connector pins 7 and 8: these lines carry the tones for the busy signal.

JUMPERS ON MODEL 68 CONTROLLER CARDS - With jumpers JP12=B, JP13=B, JP4=B, and JP2=A, check pin 3 on U3 and adjust the 387 Hz for 0.77 to 1 VAC by adjusting the pot R2. With a scope, monitor pin 8 of U1. This should go low when the signal from the Model 66 goes away. Adjust R3 so that the signal is as close to going low as possible. When this is done, remove the signal back from the Model 66, and the COR light should come on the station card. If this fails, readjust the Model 68 R3.

CONNECTING TO A 2000 SERIES PAGING TERMINAL

The following application-specific adjustments are required when the Model 66 transmitter controller is combined with a Zetron 2100 or 2200 paging terminal.

Paging Terminal Database Adjustments

The "Station Xmit Audio" field during voice time should be reset for 3.5 kHz to 4.2 kHz RF deviation. The "Xmit Tone" field during paging tones should be reset for 3.5 kHz to 4.0 kHz deviation.

Verify the settings by test paging a POCSAG digital pager. Be sure that the link modem tones are at the appropriate levels. The RF transmitter tone deviation should be adjusted to +3.5 kHz and the digital deviation to ±4.5 kHz.

Model 66 Adjustments

Take the following readings at connector J4, pin #1 on the Model 66 to ensure the appropriate levels:

1. Send a 1000 Hz tone from the paging terminal. Then adjust the Model 66 FROM LINK pot (R96) to 1.0 Vrms.
2. Send similar tones from the paging terminal at 500, 1500, and 2000 Hz. Verify the levels for each frequency at J4, pin #1 to be 1.0 Vrms ±12 % (.88 - 1.12 Vrms).
3. The input level to the Model 66 from the link receiver should be 0 dB.

These are optimum settings for the transmitter controller.

TESTING THE INSTALLATION

Normal operation of the Transmitter Controller and transmitter can be verified by observing certain front panel indications. Tones and audio signals can be monitored by means of the speaker.

To verify normal operation, the following items can be checked as appropriate to your particular installation:

1. Make sure the transmitter keys in the digital mode for POCSAG and GOLAY pagers, and in the analog mode for analog pagers. If the transmitter does not key into the digital mode, change the position of the Digital Mode Signal Polarity jumper (JP2).

2. If digital pagers do not respond, change the position of the Digital Data Signal Polarity jumper (JP3).

3. The LEVEL lamp should light during the digital portion of a page and flash during the audio portion. This lamp should be off when the transmitter is not keyed.

4. The DIG PTT lamp will not light at any time with the factory jumper configuration. (Refer to the Analog PTT for All Pages jumper (JP5) described in "Jumper Descriptions" on page 2-6.)

This completes the installation and adjustment of the Transmitter Controller.

TRANSMITTER ADDRESS DECODER OPTION

The Transmitter Address Decoder option for the Model 66 can be field installed into any Model 66. The option plugs into the main PCB of the Model 66 and mounts to the chassis near the speaker.

For older Model 66 units, install the Address Decoder option as described in the installation instructions provided with the product.

To install the option in newer units:

1. Power down and remove the lid of the Model 66.
2. Slide the option into the connector located on the left edge of the Model 66 main PCB.
3. Fasten option board with enclosed 4-40 screws at each corner.
4. Set the DIP switch to proper address (see Table 2-6 and Table 2-7).
5. Reassemble and install Model 66.

Setting the DIP Switches

The transmitter address is set by a combination of DIP switch settings. Revision C boards have three switches while previous revisions have only two.

- SW1 sets the frequency of one of the tone decoders.
- SW2 identifies the transmitter group for the PAL.
- SW3 (only on Revision C and later boards) sets the group 2 enable tone frequency. This frequency, when decoded, latches an F2 output on pin #15 of the transmitter connector J2 on the rear of the Model 66. This switches a dual-frequency transmitter to use the secondary frequency. A special version of PAL is required for this operation.

Table 2-6 and Table 2-7 show how to set each switch for the legal addresses. The DIP switch settings for SW3 are the same as for SW1 for the frequencies shown in Table 2-6. Table 2-7 gives the SW3 settings for 1850 Hz and 2050 Hz.

There are 10 tones (set by SW1) and 3 different groups (set by SW2) used in standard operation. Each address is a combination of a particular tone and group. Thirty unique transmitter addresses are available (10 x 3). For the dual-frequency application using SW3, only 10 different addresses are available

The groups are divided as follows:

- Transmitter addresses 1-10 correspond to group 1
- Transmitter addresses 11-20 correspond to group 2
- Transmitter addresses 21-30 correspond to group 3

For example, transmitter address 23 is the tone number 3 in group 3. To select this address, set SW1 to A B A A B B B B, and SW2 to B B A A. See Table 2-6 and Table 2-7.

Note that the DIP switches MAY be changed while powered up, and the change will be recognized at next key-up.

Table 2-6. DIP Switch 1 and 2 Settings

Transmitter	Switch 1 *								Switch 2 *				Center Freq.
	1	2	3	4	5	6	7	8	1	2	3	4	
1	A	B	A	A	A	B	B	A	B	A	A	B	1755.4
2	A	B	A	A	B	A	B	A	B	A	A	B	1660.5
3	A	B	A	A	B	B	B	B	B	A	A	B	1555.4
4	A	B	A	B	A	B	A	B	B	A	A	B	1445.6
5	A	B	A	B	B	A	B	B	B	A	A	B	1350.3
6	A	B	B	A	A	A	B	A	B	A	A	B	1253.9
7	A	B	B	A	B	A	B	B	B	A	A	B	1148.4
8	A	B	B	B	A	B	A	B	A	A	A	B	1050.3
9	B	A	A	A	A	A	A	B	A	A	A	B	952.6
10	B	A	B	A	A	B	A	A	A	A	A	B	749.3
11	A	B	A	A	A	B	B	A	B	A	B	A	1755.4
12	A	B	A	A	B	A	B	A	B	A	B	A	1660.5
13	A	B	A	A	B	B	B	B	B	A	B	A	1555.4
14	A	B	A	B	A	B	A	B	B	A	B	A	1445.6
15	A	B	A	B	B	A	B	B	B	A	B	A	1350.3
16	A	B	B	A	A	A	B	A	B	A	B	A	1253.9
17	A	B	B	A	B	A	B	B	B	A	B	A	1148.4
18	A	B	B	B	A	B	A	B	A	A	B	A	1050.3
19	B	A	A	A	A	A	A	B	A	A	B	A	952.6
20	B	A	B	A	A	B	A	A	A	A	B	A	749.3
21	A	B	A	A	A	B	B	A	B	B	A	A	1755.4
22	A	B	A	A	B	A	B	A	B	B	A	A	1660.5
23	A	B	A	A	B	B	B	B	B	B	A	A	1555.4
24	A	B	A	B	A	B	A	B	B	B	A	A	1445.6
25	A	B	A	B	B	A	B	B	B	B	A	A	1350.3
26	A	B	B	A	A	A	B	A	B	B	A	A	1253.9
27	A	B	B	A	B	A	B	B	B	B	A	A	1148.4
28	A	B	B	B	A	B	A	B	A	B	A	A	1050.3
29	B	A	A	A	A	A	A	B	A	B	A	A	952.6
30	B	A	B	A	A	B	A	A	A	B	A	A	749.3

* A=Down or On
B=Up or Off
Switches numbered from left to right when viewed from rear

Table 2-7. DIP Switch 3 Settings

Switch 3 *								Freq.
1	2	3	4	5	6	7	8	
A	B	A	A	A	A	B	A	1850
A	A	B	B	B	B	A	A	2050

* A=Down or On
B=Up or Off
Switches numbered from left to right when viewed from rear

Figure 2-7 and Figure 2-8 illustrate the DIP switch settings for Address 1 and Address 10 on the Model 66 board (Part No. 702-9156).

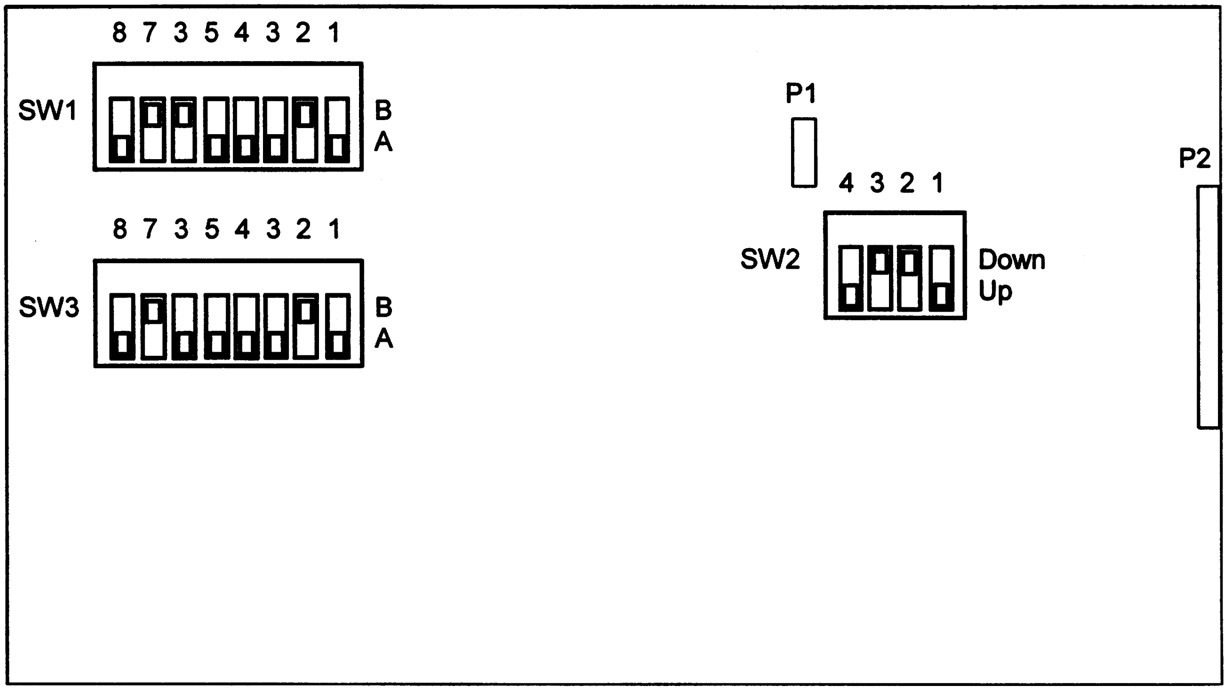


Figure 2-7. DIP Switch Settings for Address 1

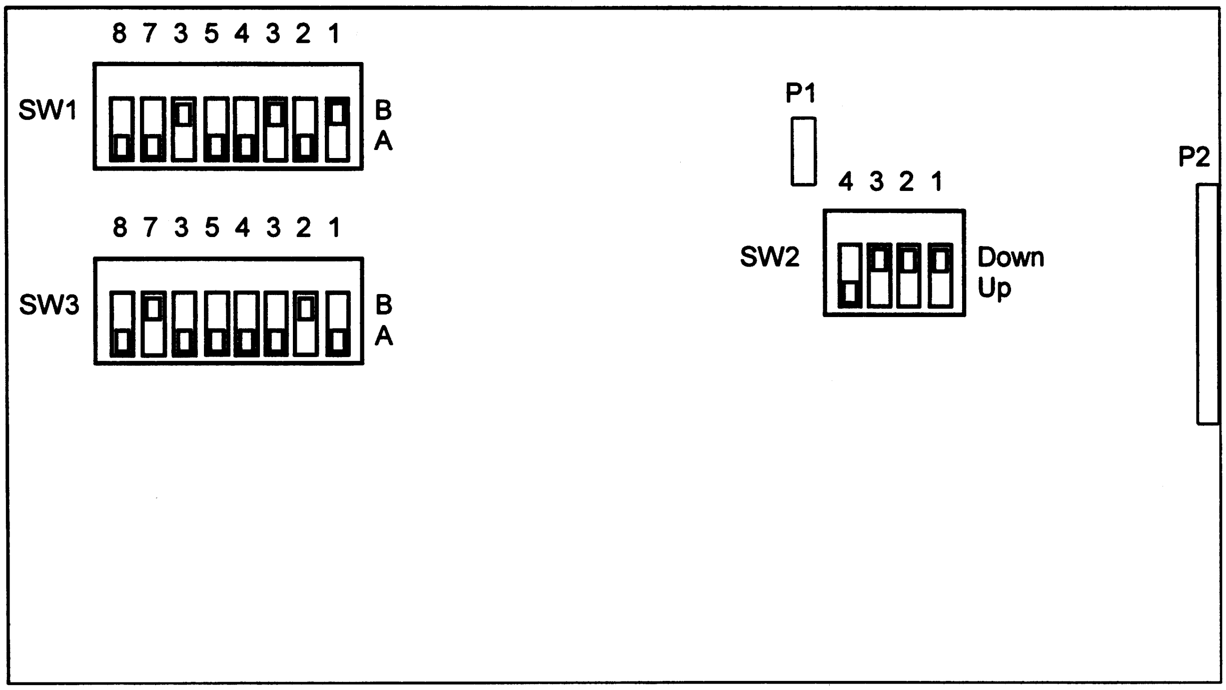


Figure 2-8. DIP Switch Settings for Address 10

SIMULCAST SYSTEM ENGINEERING

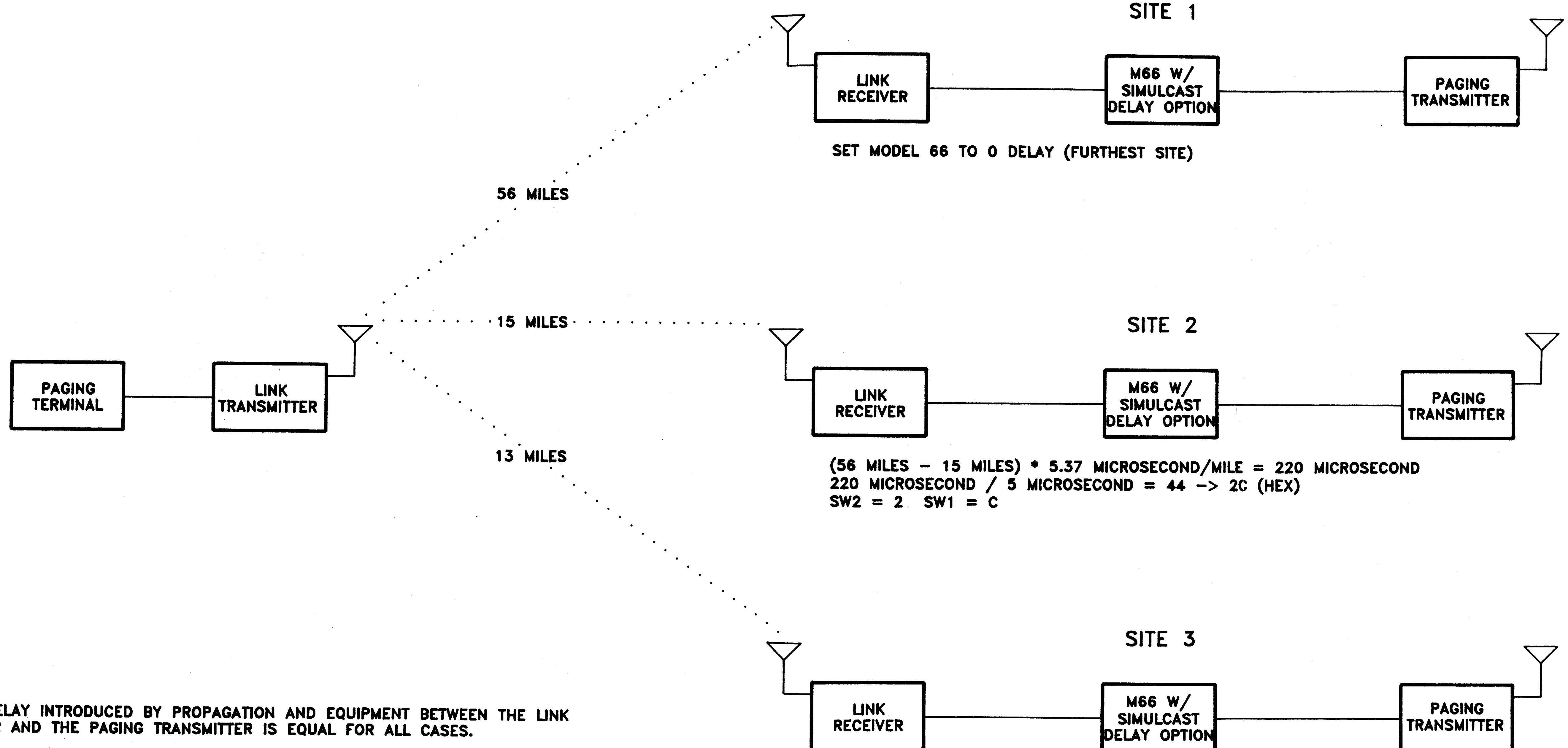
Successful simulcasting requires the instantaneous output of all transmitters to have similar frequency components. The traditional approach to assure the output from all transmitters is similar is to pay close attention to the following key points:

- Frequency response of link equipment
- Phase response of link equipment
- Time delay of signals introduced by link equipment and propagation
- Modulation characteristics of paging transmitter
- Carrier frequency of paging transmitter

The delay module addresses the third key point. The other points are extremely important, though. Each of these can alter the signal being transmitted by one transmitter so the combined signal with another transmitter causes distortion that degrades paging reliability and intelligibility.

Delays are introduced by equipment (link and paging) and propagation through the link medium and paging medium. Figure 2-9 shows a typical Model 66 simulcast system. The time delay from the paging terminal to the paging transmitter antenna should be equal between transmitters that overlap in the coverage area. Most systems will have delays that are not equal in all legs, so compensation is necessary.

MODEL 66 SIMULCAST SYSTEM EXAMPLE



(56 MILES – 13 MILES) * 5.37 MICROSECOND/MILE = 230 MICROSECOND
230 MICROSECOND / 5 MICROSECOND = 46 -> 2E (HEX)
SW2 = 2 SW1 = E

NOTES:

THE TIME DELAY INTRODUCED BY PROPAGATION AND EQUIPMENT BETWEEN THE LINK TRANSMITTER AND THE PAGING TRANSMITTER IS EQUAL FOR ALL CASES.

WHERE T(N MILES) IS PROPAGATION DELAY OF RADIO WAVES THROUGH N MILES
T(LRX) IS THE DELAY THROUGH LINK RECEIVER
T(M66) IS THE DELAY THROUGH MODEL 66 SET TO 0 DELAY
T(TC) IS THE DELAY THROUGH TRANSMITTER CONTROLLER
T(PTX) IS THE DELAY THROUGH PAGING TRANSMITTER

SITE 1: DELAY = T(56 MILES) + T(LRX) + T(M66) + T(TC) + T(PTX)
SITE 2: DELAY = T(15 MILES) + T(LRX) + T(M66) + 220 MICROSECONDS T(TC) + T(PTX)
SITE 3: DELAY = T(13 MILES) + T(LRX) + T(M66) + 230 MICROSECONDS T(TC) + T(PTX)

Figure 2-9. Typical Model 66 Simulcast System

024-0025A 11-27-90

The delay introduced by equipment may not be constant for all audio frequencies. The delay at frequencies near roll-off frequencies of audio filters will generally change versus frequency, while delays well into the passband of filters will be fairly constant versus frequency. For example, a 2-pole low-pass filter with cutoff around 3500 Hz will have a fairly constant delay of about 70 microseconds through the audio spectrum until the frequency nears 3500 Hz where the delay will start to decrease. It should be noted that de-emphasis circuits are low-pass filters that will introduce considerable delay at low frequencies. Link equipment should avoid pre-emphasis and de-emphasis circuits because they may introduce delays that may not be the same from unit to unit due to component variations.

Generally, it is not necessary to know what the characteristic delay response through link or paging equipment is, if the same equipment is used in all legs of the network. It is the relative delays that are important. If all of the equipment is the same, the difference in delay through the equipment is typically small for all frequencies. The delay through a link repeater, for example, might be approximately 200 microseconds for a given model at 1000 Hz. It is possible there are part to part variances that may cause slight differences in delays through identical equipment, but it is suggested to ignore this source for simplicity. Delays for equipment made by different manufacturers should not be considered the same, however. Even if the relative delay difference at some frequency is known, the delay vs. frequency may be so different that a fixed delay will not compensate.

The other source of delay is propagation through air by the radio waves from the link transmitter. This delay is constant for all audio frequencies modulated by the link transmitter and is dependent only on the length of path and speed of light. Both are easily defined constants.

In a well engineered simulcast system, the only delay that needs to be compensated for is the link medium delay. By making each of the paging transmitter sites a carbon copy of each other, the only delay difference that needs compensation is the delay of the signal by propagation through the link medium. It is suggested that transmitters co-located with the link transmitter be controlled through a link receiver so the delays are same as other sites except for the propagation delay.

Determining Necessary Compensation Delay

Calculating the delay for RF linked systems is simple, but telephone and microwave systems are more complicated. Typically, in telephone or microwave systems the delay must be measured because the path length and equipment delays are unknown.

One method for measuring the delay through telephone or microwave is making a loop from the control point to the site and back again. This requires 4-wire duplex circuits for the medium. A signal can be injected at the control point and the delay can be directly measured with a dual trace scope with adjustable delay.

The delay due to propagation delay of radio waves is about 5.37 microseconds per mile. Use this constant in calculating the delay necessary to compensate for propagation path differences.

Note

Due to the changes made between Revisions D and E of the Simulcast Delay PCB (Part No. 702-9157), an additional delay of 30 microseconds was introduced into the audio path through the clock rejection filters. This does not present any problem if all the simulcast units in a system are of the same revision. However, if Revision E or later simulcast boards are added to a system employing Revision D or earlier units, the difference in delay should be considered for best performance.

In mixed systems, subtract 6 miles from the propagation path for all Revision E and later units.

Simulcast Considerations for Revision P and Later Units

The modem circuit of the Model 66 was changed with Revision P. The new modem responds to audio input about 275 microseconds sooner than the old modem (Revision N and earlier). These differences must be understood when adding new units onto a system containing earlier revisions of Model 66s. This difference would cause a timing shift between the signals in digital mode if the data were not realigned.

U5 of Revision P and later boards delays the output data so that the total delay is the same as Prerevision P units. This delay is enabled by placing JP24 in the B position. Since the delay through the audio path of all revisions of Model 66s is the same, there is no alternative to using the delay in cases where both analog and digital pages are to be simulcasted. With JP24 in the B position there are no significant timing differences between any revisions. This is the recommended method for simulcasting. However, using the delay is not mandatory in digital only operation.

If there are no analog pages to be sent, the timing shift in analog mode that results between mixed revision units (when JP24 is placed in the A position) is irrelevant, as the audio output is not used. One advantage of this situation is that shift register sampling noise is eliminated. Secondly, the shorter delay of later Model 66s can make simulcast design more flexible. The disadvantage is that the delay difference must be considered when figuring the delay to add in each leg. As a general rule, if figuring the delay to be added to legs having older revision Model 66s, subtract 137 microseconds from the relative delay; if figuring the delay of legs having newer Model 66s, add 137 microseconds to the relative delay. As always, it may be necessary to add a constant delay to all legs to obtain the desired range of delay.

In summary, the following steps are suggested to determine the necessary delay:

1. Design each leg of the network to have identical numbers and types of equipment so the only variable delay is the propagation path of the link.

2. Set the farthest transmitter delay to minimum (0, 0 on SW1 and SW2).

3. Determine relative path difference for each transmitter that overlaps with the far site and multiply the miles by 5.37 microseconds to get the relative delay.

   relative delay (t) = relative path difference × 5.37 microseconds

4. Determine the switch settings for the relative delay (t).

Determining Switch Settings for Desired Delay

1. Determine relative delay necessary (t) (see the previous subsection)

2. Calculate divide-by-value (n) base 10: $n = t/5$

3. Convert divide value (n) to switch position:

a. If $n < 128$, you must add a constant delay to all paths in the system so that $n \geq 128$.

b. If $128 < n < 255$, then $n = n$. Use position C on JP1.
   If $256 < n < 511$, then $n = n–256$. Use position A on JP1.
   If $512 < n < 767$, then $n = n–512$. Use position B on JP1.

c. Use to convert n in decimal (0-255) to hexadecimal. Use SW2 for the first hex digit, and use SW1 for the second hex digit.

d. Set SW1 and SW2.

Note

SW2 is the most significant switch despite being located on the right.

Installing the Option Board

1. Plug option board into J4 of main board.

2. Place JP16 on main board into position B. If the unit is Revision P or later and is being added to a system using Prerevision P units, move JP24 to position B.

3. Set SW1, SW2, JP1 for desired delay.

4. Set R19 to maximum (fully clockwise).

5. Measure AC voltage at pin 1, J2, of option board during a test page.

6. Adjust R15 so that voltage at pin 6, J2, is same as step 5's measurement.

Table 2-8. Decimal-to-Hex Conversion

Dec	Hex *	Dec	Hex *	Dec	Hex *	Dec	Hex *	Dec	Hex *	Dec	Hex *
0	00	50	32	100	64	150	96	200	C8	250	FA
1	01	51	33	101	65	151	97	201	C9	251	FB
2	02	52	34	102	66	152	98	202	CA	252	FC
3	03	53	35	103	67	153	99	203	CB	253	FD
4	04	54	36	104	68	154	9A	204	CC	254	FE
5	05	55	37	105	69	155	9B	205	CD	255	FF
6	06	56	38	106	6A	156	9C	206	CE		
7	07	57	39	107	6B	157	9D	207	CF		
8	08	58	3A	108	6C	158	9E	208	D0		
9	09	59	3B	109	6D	159	9F	209	D1		
10	0A	60	3C	110	6E	160	A0	210	D2		
11	0B	61	3D	111	6F	161	A1	211	D3		
12	0C	62	3E	112	70	162	A2	212	D4		
13	0D	63	3F	113	71	163	A3	213	D5		
14	0E	64	40	114	72	164	A4	214	D6		
15	0F	65	41	115	73	165	A5	215	D7		
16	10	66	42	116	74	166	A6	216	D8		
17	11	67	43	117	75	167	A7	217	D9		
18	12	68	44	118	76	168	A8	218	DA		
19	13	69	45	119	77	169	A9	219	DB		
20	14	70	46	120	78	170	AA	220	DC		
21	15	71	47	121	79	171	AB	221	DD		
22	16	72	48	122	7A	172	AC	222	DE		
23	17	73	49	123	7B	173	AD	223	DF		
24	18	74	4A	124	7C	174	AE	224	E0		
25	19	75	4B	125	7D	175	AF	225	E1		
26	1A	76	4C	126	7E	176	B0	226	E2		
27	1B	77	4D	127	7F	177	B1	227	E3		
28	1C	78	4E	128	80	178	B2	228	E4		
29	1D	79	4F	129	81	179	B3	229	E5		
30	1E	80	50	130	82	180	B4	230	E6		
31	1F	81	51	131	83	181	B5	231	E7		
32	20	82	52	132	84	182	B6	232	E8		
33	21	83	53	133	85	183	B7	233	E9		
34	22	84	54	134	86	184	B8	234	EA		
35	23	85	55	135	87	185	B9	235	EB		
36	24	86	56	136	88	186	BA	236	EC		
37	25	87	57	137	89	187	BB	237	ED		
38	26	88	58	138	8A	188	BC	238	EE		
39	27	89	59	139	8B	189	BD	239	EF		
40	28	90	5A	140	8C	190	BE	240	F0		
41	29	91	5B	141	8D	191	BF	241	F1		
42	2A	92	5C	142	8E	192	C0	242	F2		
43	2B	93	5D	143	8F	193	C1	243	F3		
44	2C	94	5E	144	90	194	C2	244	F4		
45	2D	95	5F	145	91	195	C3	245	F5		
46	2E	96	60	146	92	196	C4	246	F6		
47	2F	97	61	147	93	197	C5	247	F7		
48	30	98	62	148	94	198	C6	248	F8		
49	31	99	63	149	95	199	C7	249	F9		

* Set SW2 for the first hex digit, and set SW1 for the second hex digit.

TEST POINTS

The test points for Model 66 are shown in Table 2-9.

Table 2-9. Test Points

Test Point	Use
TP1	CLOCK
TP2	GROUND
TP3	AUDIO INPUT
TP4	–5V
TP5	AUDIO OUTPUT

Reworks

Model 66s, Revisions D through H, have a 180-degree phase shift and -30 microseconds of delay difference from Model 66s, Revisions A, B, and C. These new revisions became available in January of 1991. If you are using a combination of these revisions for a simulcast system, the following reworks *must* be performed on the Revision D through H units (see Figure 2-10).

1. The polarity of the input to the Model 66 must be reversed.

2. A 1.0 µF capacitor must be placed in series with the FROM LINK LO input of the Model 66.

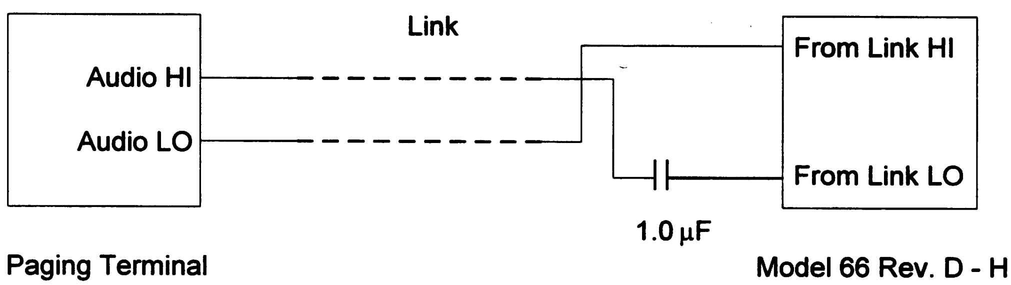


Figure 2-10. Reworks for Revisions D through H

Model 66s, Revision J and later, have a 180-degree phase shift from Model 66s, Revisions A, B, and C. Revision J and later became available in June of 1993. If you are using a combination of Revisions J and later and A, B, or C for a simulcast system, only the inversion of the AUDIO HI and LO is required. The capacitor is not required.

For a combination of Revision J and later units with Revision D through H, only the 1.0 µF capacitor needs to be used on the Revision D through H units.

TROUBLESHOOTING THE INSTALLATION

Failure of the Model 66 to key up or not switch modes (analog to digital or digital to analog) is usually due to one of three problems. These problems are:

1. Link signal too noisy. This causes mode switching problems. The low level 2175 detector that is used to keep the unit in the analog mode can be falsed by hiss. If the signal-to-noise ratio is around 30 dB, then the unit may not switch out and thus stay in the analog mode. Since the protocol for keying up into digital essentially keys in analog first, then to digital, this problem will also appear as a digital key-up problem when modem is not being sensed, but instead, hiss is actually falsing the 2175 decoder. Solutions are reducing hiss with a preamp, increasing transmitter power, or reducing the FROM LINK control sometimes helps.

2. Excessive roll-off of frequency response. This causes "talkdown" where paging tones or loud voices will cause the unit to unkey. It is easily verified by having the paging terminal send several test tones at 500, 1000, and 2000 Hz and checking the level at the Model 66 input. If the voltages are not all within 10-20% of each other and are dropping at the higher frequencies, then compensation is necessary. Usually a 0.01-microfarad capacitor in series with the input of the Model 66 will compensate for the roll-off.

3. Level too low or distorted. This will cause keying problems. The Model 66 needs a minimum amplitude of keying tones to enable the key-up procedure. This amplitude corresponds with the level lamp coming on. It must be ON during all of the keying tones. If the link is being driven into distortion or the adjustment of the FROM LINK control is too low, the unit may not key reliably.

In general, if you are experiencing problems the suggested diagnostic procedure is:

Determine if the link equipment is introducing distortion. The deviation of the low level 2175 during analog should be around 700 Hz. The deviation of the control tones should be around 3 kHz. If deviation is too high, distortion of voice or paging tones may result. If deviation is too low, the low level 2175 may be "in the mud."

Verify the frequency roll-off to be minimal. It is not important how much the deviation changes versus frequency but rather how the voltage presented to the Model 66 changes. Run test tones through the system and plot the amplitude vs. frequency relationship at the input of the Model 66.

Adjustment of the FROM LINK should not be critical unless the link system is less than optimum. In general, the higher the FROM LINK adjustment, the more susceptible the Model 66 is to noise. The lower the adjustment the more likely the unit won't key up. It is better to be low, because the threshold when the unit won't key up is abrupt and unlikely to change much.

If the unit is Revision P or later and analog operation is not required, another solution to this noise problem is to force the unit to default to digital mode; this is accomplished by setting JP22 to position B.

3. THEORY OF OPERATION

The main functions of the Transmitter Controller are:

- To key the paging transmitter in the appropriate mode (analog or digital) in response to a sequence of paging control tones from the paging terminal
- To demodulate FSK digital signals for application to the digital data input of the paging transmitter

Before a description of Transmitter Controller operation can be meaningful, the sequence of the paging tones must be known so that the function of the individual circuits can be related to the paging operation.

There are two basic type of paging sequences that are provided by the paging terminal to the transmitter:

1. Analog Paging Sequence (Tone/Voice)
2. Digital Paging Sequence

ANALOG PAGING SEQUENCE (TONE/VOICE)

The sequence of paging tones for the analog (tone and voice) paging sequence is shown in Figure 3-1. The key-up sequence for the analog page begins with a period (Tkey) of +6dB high-level guard tone which is used by the Station Controller in preparation to key the transmitter. The standard guard tone frequency is 2175 Hz, with 2600 Hz and 2675 Hz frequencies optional. Following the high-level guard tone, a 1950 Hz function tone indicates the end of the key-up sequence and allows the Transmitter Controller to subsequently key the transmitter by means of the analog push-to-talk function. With the transmitter keyed, the analog pager tone and voice signal is transmitted to the appropriate pagers while the superimposed 2175 Hz (or optionally 2600 Hz or 2675 Hz) low-level guard tone is filtered out.

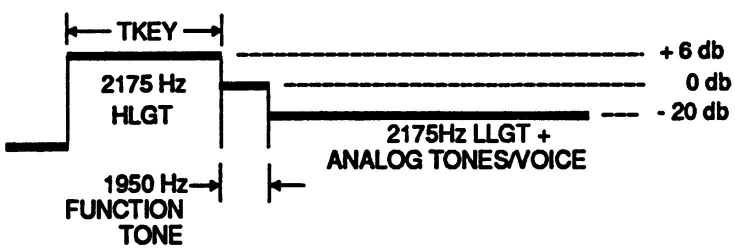


Figure 3-1. Analog Paging Sequence

DIGITAL AND ANALOG PAGING SEQUENCES

Figure 3-2 shows a key-up sequence followed by a digital page, an analog page, and another digital page. The key-up sequence, consisting of the 2175 Hz (standard) high level guard tone and the 1950 Hz function tone is the same as that described for the analog paging sequence. A 140-millisecond gap (no signals present) separates the function tone and the FSK modem signals from the paging terminal that become the data signals sent to the transmitter for the digital page. During the digital signals, the digital push-to-talk function of the transmitter is active.

Figure 3-2 shows that a 50-millisecond pause separates the end of the digital page and the analog page which is now in queue. The analog page begins with a 130-millisecond burst of high level guard tone. At the end of this 2175 Hz burst, the digital push-to-talk function ends and the analog push-to-talk function begins. During the analog transmission, the voice signals are transmitted while the superimposed 2175 Hz low-level guard tone is filtered out.

The example in Figure 3-2 shows a second digital page which has been placed in the queue. The page begins after a 140-millisecond pause as described for the first digital page.

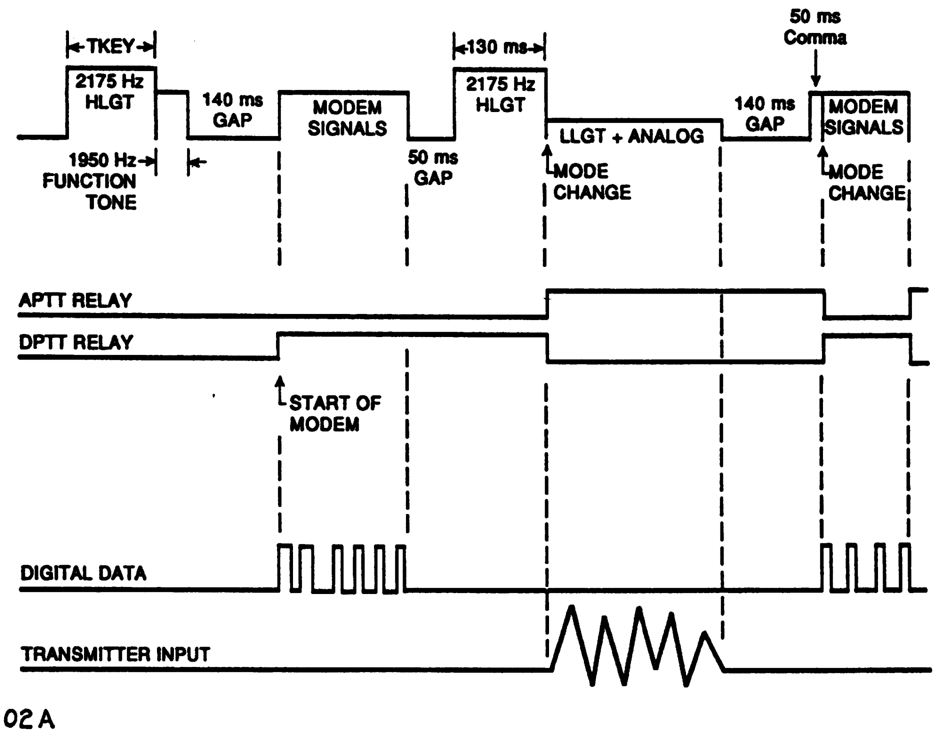


Figure 3-2. Digital and Analog Paging Sequence

BLOCK DIAGRAM DESCRIPTIONS

The following pages describe the operation of the Transmitter Controller on a block diagram level.

Block Diagram for Revisions F through H

Figure 3-3 shows the Model 66 block diagram for Revisions F through H. It should be referred to for this discussion of Transmitter Controller operation.

Analog Paging Sequence Operation

All paging tones and analog signals sent by the paging terminal are received over the communications link and fed through the input transformer (T3) and amplifier. The initial burst of high-level guard tone (2175 Hz) is received at the envelope detector, CR11/CR13, and also at the envelope detector, CR15/CR16 (via the bandpass filter, U22 and the selectable attenuator, U6). Each of the envelope detectors provides a true input to the comparator circuit, U13, when the 2175 Hz signal is present. The output of U13 provides an input to the state machine, U7, to initiate the key-up sequence.

The comparator, U13, insures that the burst of high level guard tone is the major component of the signals appearing on the communications link. That is, the filtered 2175 Hz (HLGT) signal detected by CR15/CR16 must be close to the level of the wideband signals detected by CR11/CR13. If the 2175 Hz signal was present on the link, but at a low level compared to other signals on the link (because it was resulting from crosstalk or some other phenomenon), the threshold values of the comparator would not be met and the low-level 2175 Hz would effectively go undetected and would not initiate a key-up sequence.

The detected high-level guard tone readies the state machine to receive an input from the comparator formed by U13. This comparator provides an output in response to an input from the envelope detector, CR12/CR14, which is present when the 1950 Hz function tone is present. When the 1950 Hz function tone ends, the key-up sequence is complete and the state machine operates the analog push-to-talk relay and generates an analog mode output signal to the transmitter. The state machine also removes the mute signal from U16 in the analog signal path to the transmitter, and also switches the selectable attenuator (U6) to increase the amplitude of signals applied to the 2175 Hz bandpass filter. The 2175 Hz notch filter (U23) in the signal path to the transmitter input insures that none of the subsequent 2175 Hz guard tone reaches the transmitter input.

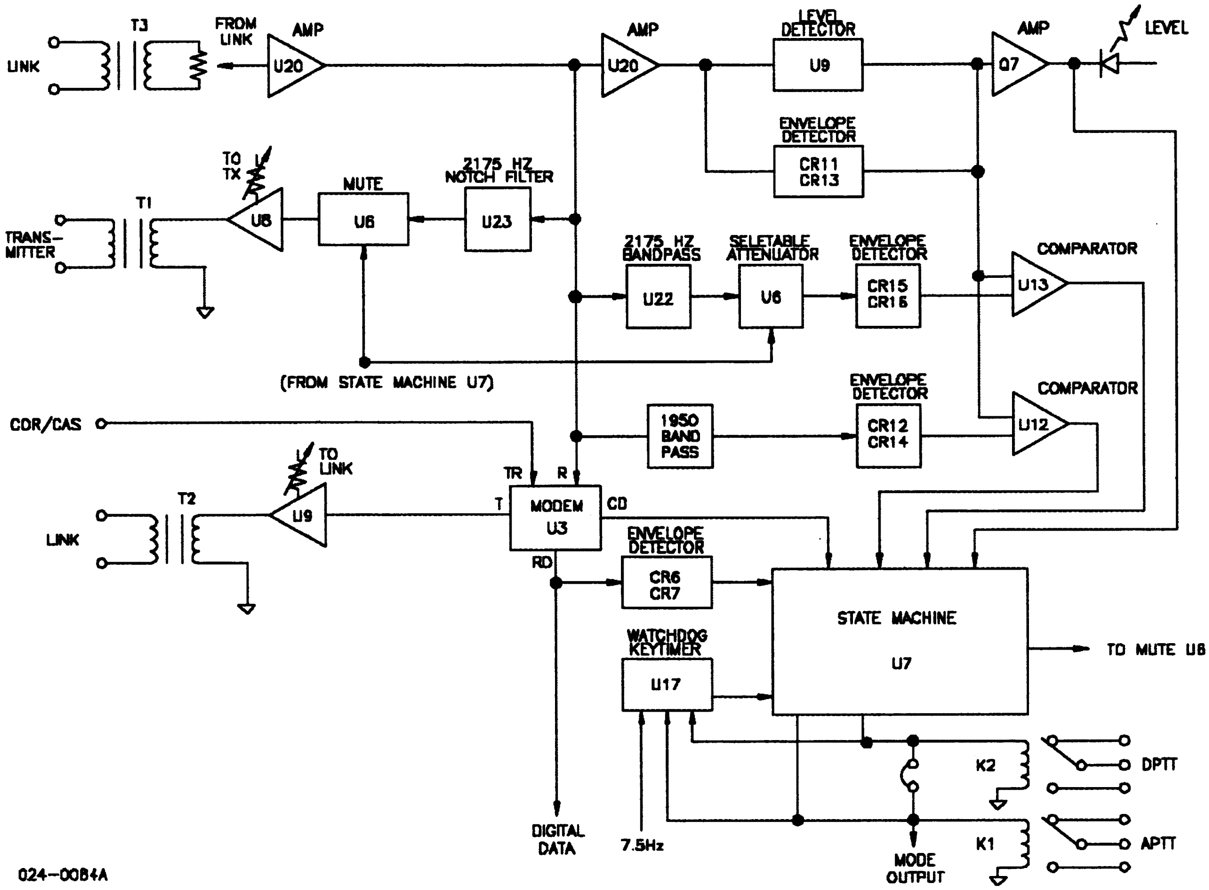


Figure 3-3. Model 66 Block Diagram, Revisions F through H

If the current page is an analog page, the analog push-to-talk mode is maintained by the presence of the low level 2175 Hz guard tone shown in Figure 3-1. The low level guard tone is detected, compared, and passed to the state machine in the same manner as the high level guard at the beginning of the paging sequence. During this portion of the analog page, voice signals are fed through the 2175 Hz notch filter, the mute circuit (now unmuted), the output amplifier (U8), and coupling transformer, T1, to the audio input of the transmitter. When the low level guard tone ends, the state machine assumes that the page is completed and after a 200-millisecond pause, resets all circuits in preparation for the next paging sequence. Refer to Figure 3-2 and the accompanying description to see how consecutive pages are handled.

If at the end of the key-up sequence (i.e., at the end of the 1950 Hz function tone), the paging terminal sends a digital page, it is first preceded by a 140-millisecond pause. Following this 140-millisecond pause, the mute signal is maintained by the state machine to block all signals (by means of the mute circuit, U6) to the audio input to the transmitter. At the end of the 140-millisecond pause, the FSK digital page signals are applied to the receive (R) input of the modem, U3. The modem generates a carrier detect (CD) signal level which is fed to the state machine. The demodulated digital data received by the modem is also fed to the state machine by means of the envelope detector, CR6/CR7, as well as to the digital input of the transmitter. As a result of these inputs, the state machine operates the digital push-to-talk relay and generates an digital mode output to the transmitter. By using both the carrier detect and digital data signals as an indication that digital data is present, the state machine insures that the digital push-to-talk relay is not operated in response to a "false" carrier detect signal, such as could happen if a signal close to 2200 Hz appeared on the communications link.

Figure 3-1 showed that an analog page can immediately follow a digital page, which is then followed by another digital page. When this occurs, the 130-millisecond burst of 2175 Hz high level guard tone that follows the digital page (and the 50-millisecond gap after the page) provides an input to the state machine from the output of the comparator, U12. At the end of the high-level guard tone, the state machine changes the mode of the transmitter from digital to analog and removes the mute function from the selectable attenuator and from the audio signal path to the transmitter, as previously described.

If a digital page follows the analog page, the paging terminal inserts a 140-millisecond gap before sending the FSK digital signals to the modem, U3. This 140-millisecond gap tells the state machine to make the mode change from analog to digital.

If the COR (carrier-operated relay) function is used, the COR signal from the receiver is applied to the transmit data (TD) input of the modem (U3). The modulator circuit in the modem generates a tone at the transmit (T) output in response to the applied input level. This tone is fed via the output amplifier (U9) and the output transformer (T2) back to the paging terminal over the communication link. This tone is used by the paging terminal to determine if the transmit channel is busy such that no paging sequence should be initiated.

Block Diagram for Revision J and Later

Figure 3-4 shows the Model 66 block diagram for Revision J and later. It should be referred to for this discussion of transmitter Controller operation.

Analog Paging Sequence Operation

All paging tones and analog signals sent by the paging terminal are received over the communications link and fed through the input transformer (T3) and amplifier. The initial burst of high-level guard tone (2175 Hz) is received at the envelope detector, U21, and also at the envelope detector, CR11/CR12 (via the bandpass filter, U12 and the selectable attenuator, U13). Each of the envelope detectors provides a true input to the comparator circuit, U11, when the 2175 Hz signal is present. The output of U11 provides an input to the state machine, U4, to initiate the key-up sequence.

The comparator, U11, insures that the burst of high level guard tone is the major component of the signals appearing on the communications link. That is, the filtered 2175 Hz (HLGT) signal detected by CR11/CR12 must be close to the level of the wideband signals detected by CR16/CR17. If the 2175 Hz signal was present on the link, but at a low level compared to other signals on the link (because it was resulting from crosstalk or some other phenomenon), the threshold values of the comparator would not be met and the low-level 2175 Hz would effectively go undetected and would not initiate a key-up sequence.

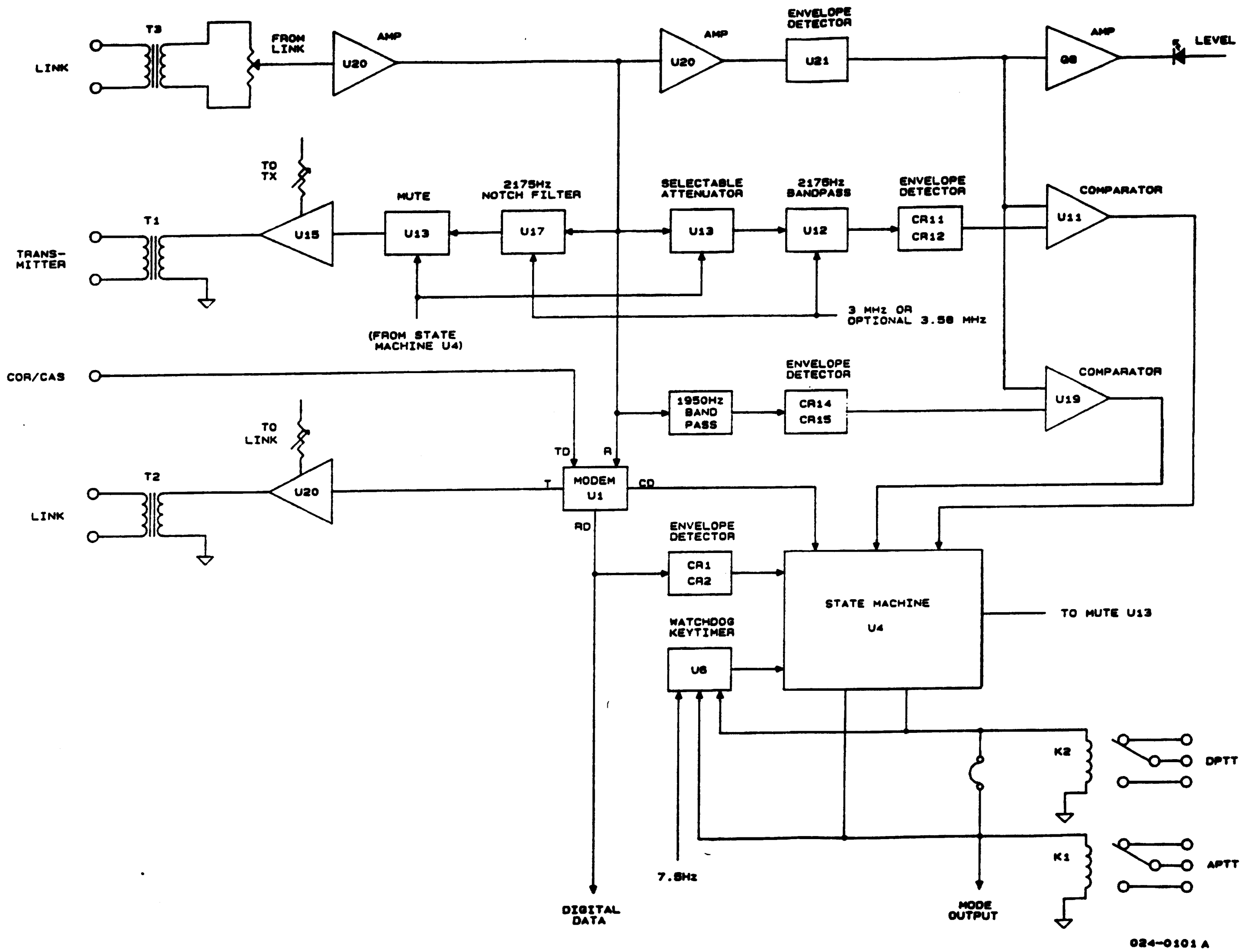


Figure 3-4. Model 66 Block Diagram, Revision J and Later

The detected high-level guard tone readies the state machine to receive an input from the comparator formed by U11. This comparator provides an output in response to an input from the envelope detector, CR14/CR15, which is present when the 1950 Hz function tone is present. When the 1950 Hz function tone ends, the key-up sequence is complete and the state machine operates the analog push-to-talk relay and generates an analog mode output signal to the transmitter. The state machine also removes the mute signal from U16 in the analog signal path to the transmitter, and also switches the selectable attenuator (U13) to increase the amplitude of signals applied to the 2175 Hz bandpass filter. The 2175 Hz notch filter (U17) in the signal path to the transmitter input insures that none of the subsequent 2175 Hz guard tone reaches the transmitter input.

If the current page is an analog page, the analog push-to-talk mode is maintained by the presence of the low level 2175 Hz guard tone shown in Figure 3-1. The low level guard tone is detected, compared, and passed to the state machine in the same manner as the high level guard at the beginning of the paging sequence. During this portion of the analog page, voice signals are fed through the 2175 Hz notch filter, the mute circuit (now unmuted), the output amplifier (U15), and coupling transformer, T1, to the audio input of the transmitter. When the low level guard tone ends, the state machine assumes that the page is completed and after a 200-millisecond pause, resets all circuits in preparation for the next paging sequence. Refer to Figure 3-2 and the accompanying description to see how consecutive pages are handled.

If at the end of the key-up sequence (i.e., at the end of the 1950 Hz function tone), the paging terminal sends a digital page, it is first preceded by a 140-millisecond pause. Following this 140-millisecond pause, the mute signal is maintained by the state machine to block all signals (by means of the mute circuit, U6) to the audio input to the transmitter. At the end of the 140-millisecond pause, the FSK digital page signals are applied to the receive (R) input of the modem, U1. The modem generates a carrier detect (CD) signal level which is fed to the state machine. The demodulated digital data received by the modem is also fed to the state machine by means of the envelope detector, CR1/CR2, as well as to the digital input of the transmitter. As a result of these inputs, the state machine operates the digital push-to-talk relay and generates an digital mode output to the transmitter. By using both the carrier detect and digital data signals as an indication that digital data is present, the state machine insures that the digital push-to-talk relay is not operated in response to a "false" carrier detect signal, such as could happen if a signal close to 2200 Hz appeared on the communications link.

Figure 3-1 showed that an analog page can immediately follow a digital page, which is then followed by another digital page. When this occurs, the 130-millisecond burst of 2175 Hz high level guard tone that follows the digital page (and the 50-millisecond gap after the page) provides an input to the state machine from the output of the comparator, U19. At the end of the high-level guard tone, the state machine changes the mode of the transmitter from digital to analog and removes the mute function from the selectable attenuator and from the audio signal path to the transmitter, as previously described.

If a digital page follows the analog page, the paging terminal inserts a 140-millisecond gap before sending the FSK digital signals to the modem, U1. This 140-millisecond gap tells the state machine to make the mode change from analog to digital.

If the COR (carrier-operated relay) function is used, the COR signal from the receiver is applied to the transmit data (TD) input of the modem (U1). The modulator circuit in the modem generates a tone at the transmit (T) output in response to the applied input level. This tone is fed via the output amplifier (U20) and the output transformer (T2) back to the paging terminal over the communication link. This tone is used by the paging terminal to determine if the transmit channel is busy such that no paging sequence should be initiated.

Power Supply

The positive 5-volt supply consists of a standard full-wave rectifier (CR1 - CR4) that is followed by a series pass voltage regulator (VR1). Refer to the schematic diagram in Section 4 for the power supply circuits. The negative 5-volt supply, required for operation of the modem and for the RS-232 compatible signals to the transmitter, is produced by a 123kHz component of the clock signal that is applied to a flyback coil (T4). The induced negative voltage developed across the coil is rectified by CR17 and regulated by series pass regulator, VR2, to produce -5VDC.

TRANSMITTER ADDRESS DECODER

There are 12 different tone frequencies used between 750 and 2050 Hz. Ten of the tones correspond to the 10 individual transmitter disable tones, the other two control which group the transmitter disable tones following it belong.

The sequence begins with transmission of all group 1 transmitters' disable tones, optionally followed by the group 1 disable, group 2 enable tone (KT2) along with all group 2 transmitters' disable tones, optionally followed by the group 2 disable, group 3 enable tone (KT3) along with all group 3 transmitters' disable tones, then finally followed by the 1950 Hz function tone commanding all transmitters left to key.

The KT2 or KT3 tones are not sent if there are no transmitters in group 2 or 3 to be disabled. Therefore, a simple key up sequence is HLGT followed by one disable tone followed by the 1950 function tone. This will disable one transmitter in group 1 and leave all others up.

The Transmitter Address Decoder option has three tone decoders. Two of which are set to decode the KT2, KT3 tones while the other is DIP switch configurable to decode any one of the 10 disable tones. Each decoder consist of a divider chain dividing the 491.52 kHz reference clock to derive the clock frequency for a commutating filter consisting of the 4051 analog switch and associated 0.1-microfarad capacitors. One of the dividers is DIP switch programmable, the other two are fixed. The commutating filter is a high Q bandpass filter whose output is rectified, filtered and compared to a reference voltage. The comparator's output is connected to the PAL chip U13.

A DIP switch is also connected to three inputs of the PAL. The setting of the DIP switch tells the PAL to which group the transmitter belongs. The fourth position of the DIP switch connects a capacitor to the programmable tone decoder to reduce it's harmonic response when set to the 3 lowest frequency disable tones which comes close to the highest frequency disable and the function tones. The capacitor forms a low pass filter which will eliminate the chance that a 1450 or 1550 Hz disable tone will false the 750 Hz filter.

The PAL (programmable array logic) chip U13 is configured as a state machine which makes decisions periodically based on it's current outputs and inputs. It is clocked by a signal on pin 1 which is 60 Hz so every 17 milliseconds it may change its outputs, but only will do so at a clock transition. One might think of it as a very simple micro controller. It looks at the DIP switch and output from the three tone decoders to decide whether or not to reset the main PCB of the Model 66 which will cause the transmitter NOT to key.

Because of the state machine, the Transmitter Address Decoder is able to make decisions based on the past, therefore has the capability of debouncing and conditioning the less than perfect real world of analog signals. This results in superior falsing and dropout protection than can be had with simple filters.

SIMULCAST DELAY OPTION

Power Supply

The Model 66's power supply provides power at +5.0 volts to the Phase Locked Loop (PLL) and all the digital circuits except U5.

The delay line, U5 and all the analog circuits operate from +15 volts derived from the +5 volt supply by U11, L2, CR6, and C36. Filtering for the +15 volt power is provided by L1 and C17. CR1 and U7B establish a +6.8-volt operating point for the delay line and the analog circuits. DS1 indicates the presence of +15 volt power, and its current plus the current in CR1 provide a minimum load on the regulator of about 50 mA to assure proper operation at all times.

Digital Timing

The 4-MHz clock from Y1 is divided by 10 by U8A. The 400 kHz is further divided by a number set with SW1 and SW2 using the divide by n counter U4. JP1 allows the value of n to be selected in the range of 256 to 511 (position A) or in the range of 512 to 767 (position B), or values of less than 256 (position C). U9 and U10 form a phased locked loop which multiplies the resultant frequency after division by 128. The output of the PLL is voltage shifted by Q1 which drives the clock of U5A which further divides the clock by 2 and forms the bi-phased clock required by the bucket brigade delay line.

Analog Circuitry

The input signal is level set by R19 amplified by U12B. The signal is low pass filtered by U12A to remove frequency components above half the clocking frequency. The cutoff frequency of the input filter is about 10 kHz.

The low-passed signal is fed into the bucket brigade device U1. This IC is an analog version of a shift register. It can be thought of as a 256-step shift register where a sample input appears at the output 256 clock cycles later. The BBD will delay the audio signal equal to 256 divided by the clock frequency. The clock frequency is set by SW1 and SW2 in a manner to provide constant 5-microsecond steps in delay.

The output of the delay line is low pass filtered by U2A and U2B to remove the high frequency clock components resulting from the clocked nature of the BBD delay line. The output level is set by R15. U7A provides gain for driving the signal into a 600-ohm load.

The delay introduced by the filters is about 80 microseconds and is about 30 microseconds longer than revision D and earlier printed circuit boards.

4. REPAIR

IN CASE OF DIFFICULTY

See "Troubleshooting the Installation" in Section 2.

In case of installation difficulty, call Zetron Service Department at (425) 820-6363. Engineers are available for assistance. Please have the serial number of the unit and the Zetron Order number. If the call is made from the installation site by the installer or radio technician, the problem can probably be solved over the phone.

If a problem develops after the unit has been in service for some time, call the Zetron Model 66 Service Department at (425) 820-6363. If requested, units shipped back to Zetron can be serviced and returned the same day if received before 11:00 am Pacific time.

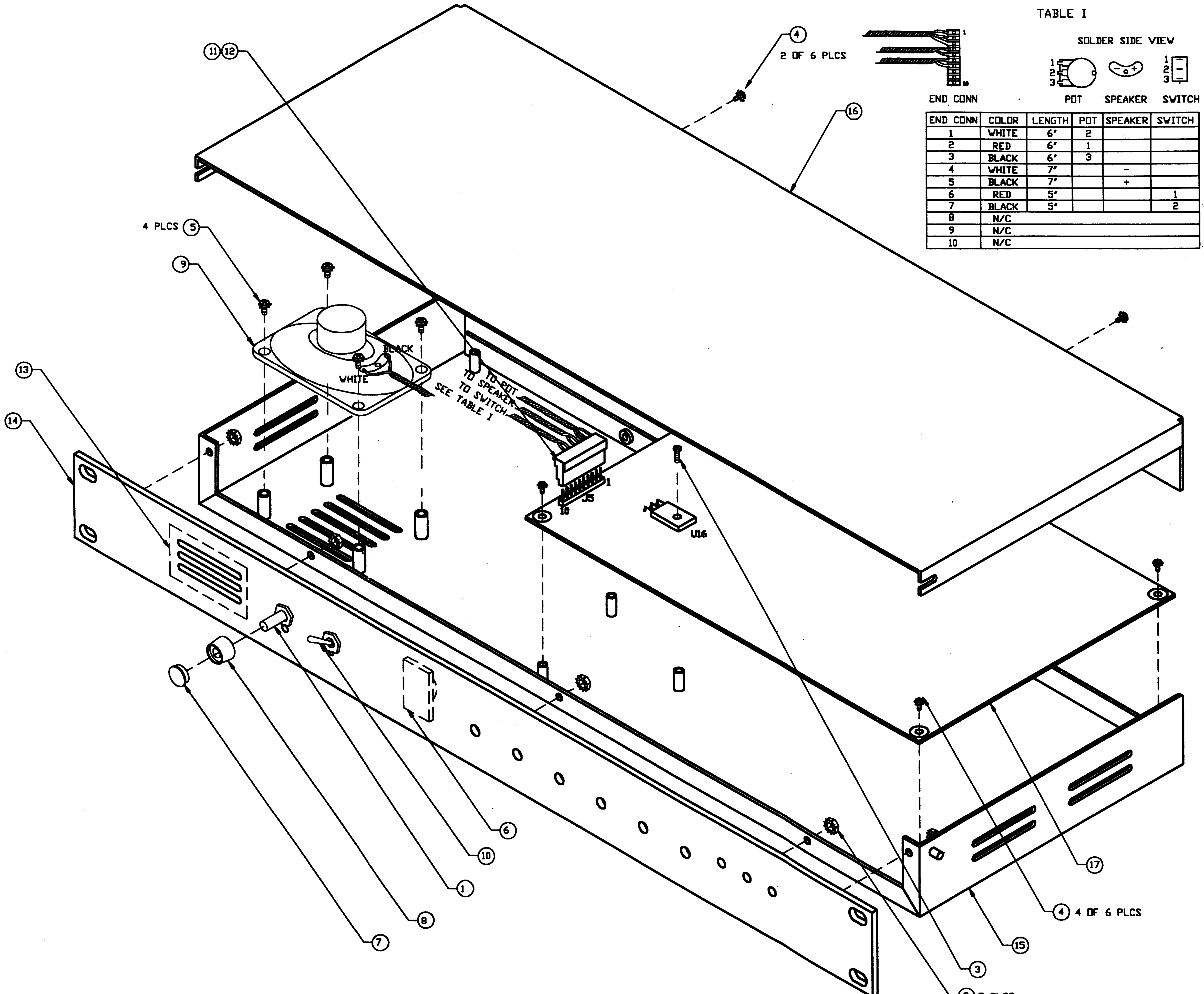
REVISION	DESCRIPTION	DRAWN	CHECKED	APPROVED	DATE
A	RELEASE	ME			
B	ECN 3447	BW	GH		2-26-96
C	ECN 4804	BW	[signature]	[signature]	3-27-96

NOTES: REF: 901-9094

TABLE I

SOLDER SIDE VIEW

END CONN	COLOR	LENGTH	POT	SPEAKER	SWITCH
1	WHITE	6"	2		
2	RED	6"	1		
3	BLACK	6"	3		
4	WHITE	7"		−	
5	BLACK	7"		+	
6	RED	5"			1
7	BLACK	5"			2
8	N/C				
9	N/C				
10	N/C				



ITEM	QTY	PART NUMBER	DESCRIPTION
17	1	702-9931	PCB MAIN BOARD
16	1	415-9310-1	TOP COVER, FIN
15	1	415-9309	BOTTOM COVER
14	1	415-9308-1	FRONT PANEL, FIN
13	1	415-9193	M20 SPEAKER GRILLE
12	1	401-0246	10-POS HOOD
11	1	401-0245	10-POS
10	1	371-0016	SPDT TOGGLE
9	1	305-0016	M20 SPEAKER
8	1	265-0114	1/4" KNOB W/INDICATOR
7	1	265-0013	KNOB COVER
6	1	265-0008	WIRE RETAINER, SMALL
5	4	221-0207	632X3/8 PAN PHIL, SEM
4	6	221-0108	440X1/4 PAN PHIL, SEM
3	1	220-0102	440X3/8 PAN PHIL
2	5	210-0001	440 KEP NUT
1	1	107-0022	10K PANEL MOUNT POT

DRN	ME	8-31-93
CHK		
APV		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:

DECIMAL	±.XX	±.01
	±.XXX	±.005
ANGULAR	∠	± 1°

ZETRON. ZETRON INCORPORATED PO BOX 97004 REDMOND, WASHINGTON 98073-9704

TITLE: MODEL 66 TRANSMITTER CONTROLLER ASSEMBLY

SIZE: D | DRAWING NUMBER: 024-0202 | REV. C

SCALE: NONE | DO NOT SCALE DRAWING | SHEET 1 OF 1

MODEL 66 TRANSMITTER CONTROL BOARD (702-9931B)

Parts List

LEGEND:
+ = OPTION
# = NOT INSTALLED
^ = INSTALLED ON HIGHER ASSY
- = SUBSTITUTE PART
* = JUMPER POSITION DEFAULT

Item	Qty	Reference	Part	DESCRIPTION	PART REFERENCE
1	1	R61	101-0010	RESISTOR,1.0 OHM,1/4W,5%,CARBON FILM	1.0
2	1	R95	101-0025	RESISTOR,10 OHM,1/4W,5%,CARBON FILM	10
3	6	R43,R58,R73,R74,R75,R86	101-0049	RESISTOR,100 OHM,1/4W,5%,CARBON FILM	100
4	1	R83	101-0057	RESISTOR,220 OHM,1/4W,5%,CARBON FILM	220
5	2	R90,R88	101-0061	RESISTOR,330 OHM,1/4W,5%,CARBON FILM	330
6	4	R59,R84,R87,R89	101-0065	RESISTOR,470 OHM,1/4W,5%,CARBON FILM	470
7	1	R79	101-0067	RESISTOR,560 OHM,1/4W,5%,CARBON FILM	560
8	1	R22	101-0068	RESISTOR,620 OHM,1/4W,5%,CARBON FILM	620
9	9	R23,R28,R29,R49,R50,R56, R57,R60,R85	101-0073	RESISTOR,1.0K OHM,1/4W,5%,CARBON FILM	1.0K
10	2	R38,R44	101-0075	RESISTOR,1.5K OHM,1/4W,5%,CARBON FILM	1.5K
11	2	R21,R20	101-0081	RESISTOR,2.2K OHM,1/4W,5%,CARBON FILM	2.2K
12	7	R4,R6,R18,R35,R67,R82, R91	101-0085	RESISTOR,3.3K OHM,1/4W,5%,CARBON FILM	3.3K
13	2	R64,R63	101-0087	RESISTOR,3.9K OHM,1/4W,5%,CARBON FILM	3.9K
14	30	R5,R7,R8,R9,R11,R14,R15, R16,R17,R19,R24,R25,R27, R31,R32,R34,R41,R47,R48, R51,R52,R53,R54,R68,R72, R78,R80,R93,R94,R99	101-0097	RESISTOR,10K OHM,1/4W,5%,CARBON FILM	10K
15	2	R30,R70	101-0105	RESISTOR,22K OHM,1/4W,5%,CARBON FILM	22K
16	6	R36,R40,R42,R71,R77,R92	101-0113	RESISTOR,47K OHM,1/4W,5%,CARBON FILM	47K
17	5	R37,R39,R45,R46,R55	101-0114	RESISTOR,51K OHM,1/4W,5%,CARBON FILM	51K
18	8	R2,R3,R10,R13,R26,R65, R66,R81	101-0121	RESISTOR,100K OHM,1/4W,5%,CARBON FILM	100K
19	3	R33,R69,R76	101-0137	RESISTOR,470K OHM,1/4W,5%,CARBON FILM	470K
20	2	R62,R1	101-0160	RESISTOR,10M OHM,1/4W,5%,CARBON FILM	10M
21	1	R12 **NOTE 3**	103-3050	RESISTOR,5 OHM,5W,5%,WIREWOUND,FLAMEPROOF	5.0 5W
22	2	R96,R97	108-1502	POT,5K OHM,10 TURN,R/A	5K 10T
23	1	R98	108-1503	POT,50K OHM,10 TURN,R/A	50K 10T
24	3	C18,C61,C71	150-0024	CAP,24pF,1KV,10%,CERAMIC DISC	24pF
25	2	C9,C8	150-0096	CAP,1000pF,1KV,10%,CERAMIC DISC,Y5P	.001 1KV
26	3	C22,C54,C55	150-0110	CAP,.01uF,50V,80%-20%,CERAMIC DISC	.01
27	1	C19	151-0020	CAP,.001uF,100V,10%,CERAMIC X7R	.001
28	2	C12,C13	151-0022	CAP,22pF,100V,10%,CERAMIC NPO	22pF
29	1	C81	151-0028	CAP,270pF,100V,5%,CERAMIC NPO	270pF
30	4	C45,C77,C80,C82	151-0090	CAP,.0033uF,100V,10%,CERAMIC X7R	.0033
31	1	C46	151-0100	CAP,.033uF,50V,10%,CERAMIC X7R	.033
32	2	C58,C73	151-0120	CAP,.01uF,50V,10%,CERAMIC X7R	.01
33	43	C1,C2,C3,C4,C11,C14,C16, C20,C23,C28,C29,C30,C31, C32,C33,C34,C35,C36,C37, C38,C39,C40,C43,C44,C47, C49,C50,C51,C53,C59,C60, C62,C63,C66,C72,C74,C75, C76,C78,C79,C83,C84,C86	151-0180	CAP,.1uF,50V,20%,CERAMIC Z5U	.1

MODEL 66 TRANSMITTER CONTROL BOARD (702-9931B)

Parts List (Continued)

Item	Qty	Reference	Part	DESCRIPTION	PART REFERENCE
34	2	C27,C25	151-0181	CAP,.1uF,50V,10%,CERAMIC X7R	.1
35	6	C5,C41,C52,C64,C65,C67	151-0199	CAP,.47uF,50V,5%,POLYESTER	.47
36	2	C6,C7	152-0127	CAP,.027uF,50V,5 %,POLYESTER	.027 50V
37	2	C17,C21	152-0130	CAP,.033uF,50V,5%,POLYESTER	.033 50V
38	2	C48,C24	154-0022	CAP,22uF,16V,10%,TANTALUM	22 TANT
39	3	C15,C26,C42	154-0025	CAP,1uF,35V,10%,TANTALUM	1 TANT
40	3	C56,C57,C85	154-0100	CAP,10uF,16V,10%,TANTALUM	10 TANT
41	2	C69,C70	155-0080	CAP,100uF,25V,20%,AXIAL,AI-E	100
42	1	C68	155-0082	CAP,470uF,16V,20%,AXIAL, AI-E	470 16V
43	1	C10	155-0140	CAP,3300uF,25V,+50%/-10%,AXIAL,AI-E	3300 25V
44	12	E1,E2,E3,E4,E5,E6,E7,E8, E9,E10,E11,E12	305-0001	BEAD,3B FERRITE,W/LEADS	
45	2	T2,T3	305-0022	XFMR,BABT,600:600, *SAFETY/NETWORK CRITICAL*	
46	1	L1	305-0023	INDUCTOR,470uH,1.2A ,15%	470UH 1.2A
47	1	T1	305-0600	XFMR,600:600 DRY TELCO,1500 VAC HIPOT	
48	1	DS1	311-0011	LED,RED,DIFFUSED,5mm CYLINDRICAL	
49	5	DS2,DS3,DS4,DS5,DS6	311-0012	LED,GREEN,DIFFUSED,5mm CYLINDRICAL	
50	1	U9	314-7490	COUNTER,LS,BCD,DIVIDE BY 5,DIP-14	74LS90
51	1	U14	314-7492	COUNTER,LS,BCD,DIVIDE BY 6,DIP-14	74LS92
52	1	U12	316-0010	FILTER,UNIVERSAL,SWITCHED CAPACITOR,DUAL,DIP-20	C10
53	4	U15,U18,U20,U21	316-0353	OP-AMP,BIFET,DUAL,DIP-8	353
54	2	U11,U19	316-0358	OP-AMP,BIPOLAR,DUAL,DIP-8	358
55	1	U16	316-2002	AMP,AUDIO,8W,VERT MOUNT,TO-220-5	LM383
56	1	U17	316-5432	FILTER,SIGNALLING,2600Hz,DIP-18	5432
57	1	VR1	316-7805	REGULATOR,+5V,1.5A,TO-220	7805
58	1	VR2	316-7809	REGULATOR,+9V,10%,LOW POWER,TO-92	78L09
59	1	VR3	316-7906	REGULATOR,-5V,500mW,TO-92	79LO5
60	1	U6	317-5406	DRIVER,RS-232,+-12V POWER,DUAL,DIP-16	MC145406
61	1	U1	321-0008	MODEM,BELL 202,DIP-16	MX614
62	1	U4 **NOTE 4**	322-1618	PAL,16R8,25NS,100mA ICC-MAX	16R8 PAL
63	1	U3 **NOTE 4**	322-2210	PAL,22V10,DIP-24	22V10 PAL
64	1	U10	323-4040	COUNTER,12-BIT,BINARY,DIP-16	4040
65	1	U13	323-4053	ANALOG SWITCH,TRIPLE SPDT,DIP-16	4053
66	1	U5	323-4557	SHIFT REGISTER,1 TO 64 BIT VARIABLE LENGTH,DIP-16	14557
67	3	U2,U8,U22	325-4393	COUNTER,HCT,BINARY,RIPPLE,4-BIT,DUAL,DIP-16	74HCT393
68	1	U7	325-7404	INVERTER,HCT,HEX,DIP-14	74HCT04
69	2	Q3,Q4	340-0014	XSTR,NPN,DARLINGTON,0.5A 30V,BETA >10,000,TO-92	MPSA14
70	5	Q1,Q2,Q5,Q6,Q7	340-3904	XSTR,NPN,40V/200MA,TO92	2N3904
71	1	Q8	340-3906	XSTR,PNP,40V/200MA,TO92	2N3906
72	5	CR5,CR6,CR7,CR8,CR9	342-0001	DIODE,SILICON,1A,100V,D0-41	1N4002
73	13	CR1,CR2,CR3,CR4,CR10, CR11,CR12,CR14,CR15,CR16, CR17,CR18,CR19	342-3009	DIODE,SILICON,100V,250MW	1N4148
74	1	CR13	342-4935	DIODE,SILICON,FAST,1A,200V	1N4935
75	1	Y3 **NOTE 1**	376-0030	XTAL,3.000MHZ XTAL,CL=32pF,HC-49	3.000MHZ
76	1	Y1 **NOTE 1**	376-0358	XTAL,3.579545MHZ,CL=18pF,HC-49	3.58MHZ
77	1	Y2 **NOTE 1**	376-0490	XTAL,4.9152MHZ,CL=SERIES,HC-49	4.9152MHZ
78	2	K2,K1	380-0030	RELAY,DPDT MINI-DIP,12 V COIL	
79	1	J2	401-0059	CONN,15-POS MALE HEADER,PC-RA 0.200"	
80	2	JB1,JA1	401-0066	6 POS RA	
81	1	J3	401-0086	12-POS R/A HEADER,0.200"	
82	1	J4	401-6005	6-POS FEMALE	

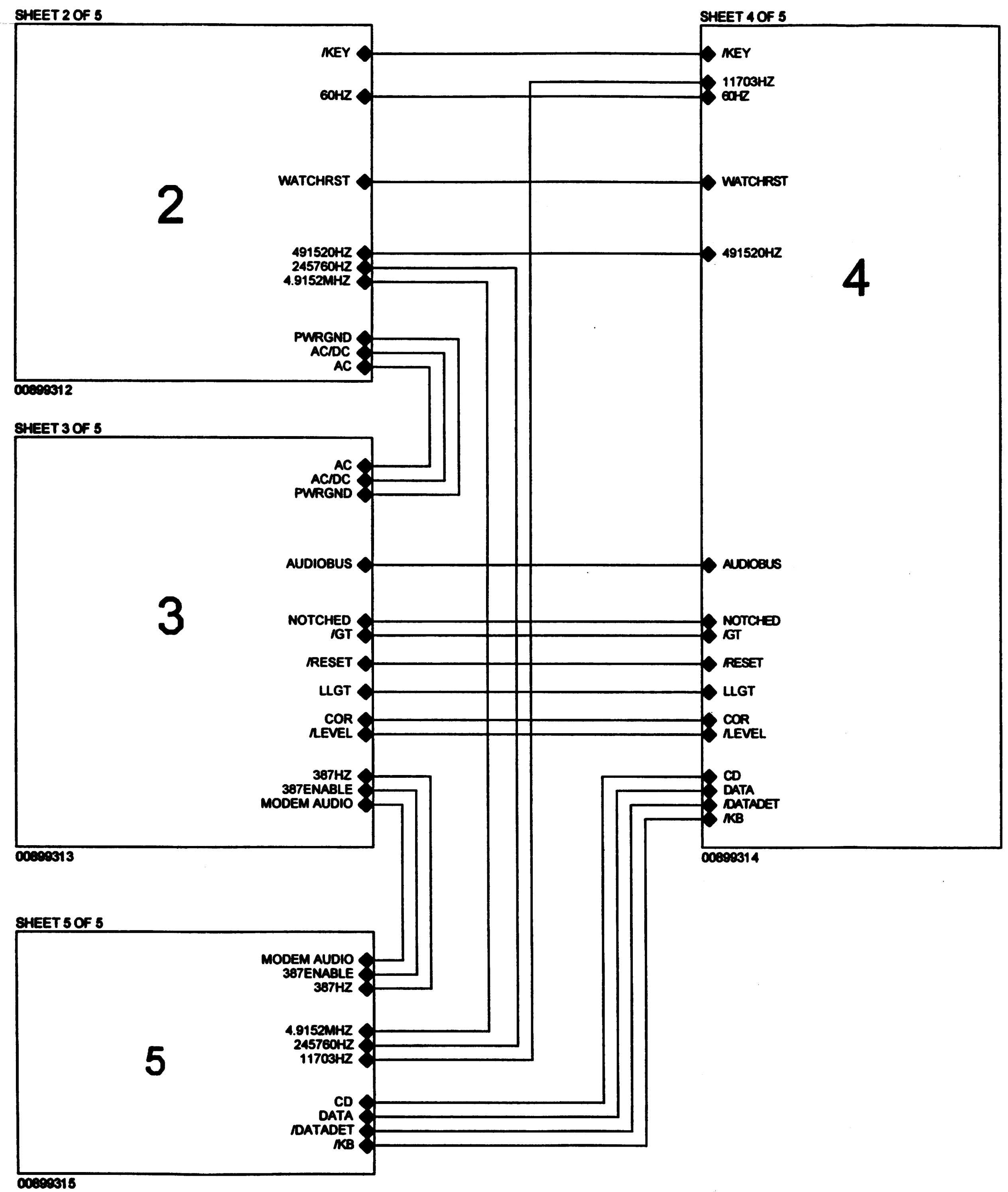
MODEL 66 TRANSMITTER CONTROL BOARD (702-9931B)

Parts List (Continued)

Item	Qty	Reference	Part	DESCRIPTION	PART REFERENCE
83	3	TP1,TP2,TP3	403-0001	01 OF 401-0052	
84	9	JP11,JP12,JP13,JP14,JP15, JP17,JP18,JP22,JP23#	403-0002	02 OF 401-0052	
85	11	JP1,JP2,JP3,JP4,JP5,JP10, JP16,JP20,JP21,JP24,JP25	403-0003	03 OF 401-0052	
86	1	J5	404-1010	10 OF 401-1364	
87	1	F1	416-1577	FUSE,1 AMP,SLO-BLO,SPIRAL WOUND	1A
88	2	XVR1	210-0001	NUT,KEP,4-40,S-Zn	
89	2	XVR1	220-0102	SCREW,4-40 x 3/8, PAN PHL,S-Zn	
90	1	XVR1	236-0010	INSULATOR,TO-220,GREASELESS,0.35 C/W	
91	1	XVR1	381-0022	HEATSINK,DUAL TO-220,BLACK EXTRUSION	
92	13	XJP1-4,10,16 (POS A) XJP20,21,24 (POS A) XJP5 (POS B) XJP15,XJP18,XJP22 (IN)	402-3040	JUMPER,MINI,0.1 x 0.2 x 0.37"	
93	6	XU11,15,18-21	407-0008	SKT,DIP-8	
94	6	XU2,7,8,9,14,22	407-0014	SKT,DIP-14	
95	5	XU1,5,6,10,13	407-0016	SKT,DIP-16	
96	1	XU17	407-0018	SKT,DIP-18	
97	2	XU4,12	407-0020	SKT,DIP-20	
98	1	XU3	407-0023	SKT,DIP-24,SKINNY	
99	1	JP25 (POS A)	408-0001	WIRE, JUMPER (24 GA WIRE .35)	
100	1	PCB	410-9931B	M66 TRANSMITTER CONTROLLER	
101	1	XF1	416-3040	FUSE CLIP	
102	6	XDS1-6	417-0010	LED MOUNT RA	
103	1	XU8 NOTE 4 SOFTWARE	601-0989V1.00		M66
104	1	UX2 NOTE 4	601-0695V1.00		TIMING GEN.

NOTES: Notes are for production use only.

REV	DESCRIPTION	DRN	CHK	APD	DATE
A	RELEASE	MM	JC	GH	01-20-98
B	ECN 5024	MM	JC		3-17-98



NOTES: UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTOR VALUES ARE IN OHMS. 1/4 WATT. 5%.
2. ALL CAPACITOR VALUES ARE IN MICROFARADS.
3. ALL POTENTIOMETERS ARE 10 TURN.

UNUSED PARTS:

LEGEND:

ANALOG GROUND — DIGITAL GROUND — CHASSIS GROUND

+	OPTION, INSTALL PER CUSTOMER ORDER
#	NOT INSTALLED
^	INSTALL ON HIGHER ASSEMBLY
-	SUBSTITUTE PART
•	JUMPER POSITION DEFAULT
___ X ___	CUT TRACE (REWORK)
----------	JUMPER WIRE (REWORK)
X	CUTTABLE JUMPER
----X----	CUTTABLE TRACE

ZETRON INCORPORATED
P.O. BOX 97004
REDMOND, WASHINGTON 98073-9704

Title: M66 TRANSMITTER CONTROLLER

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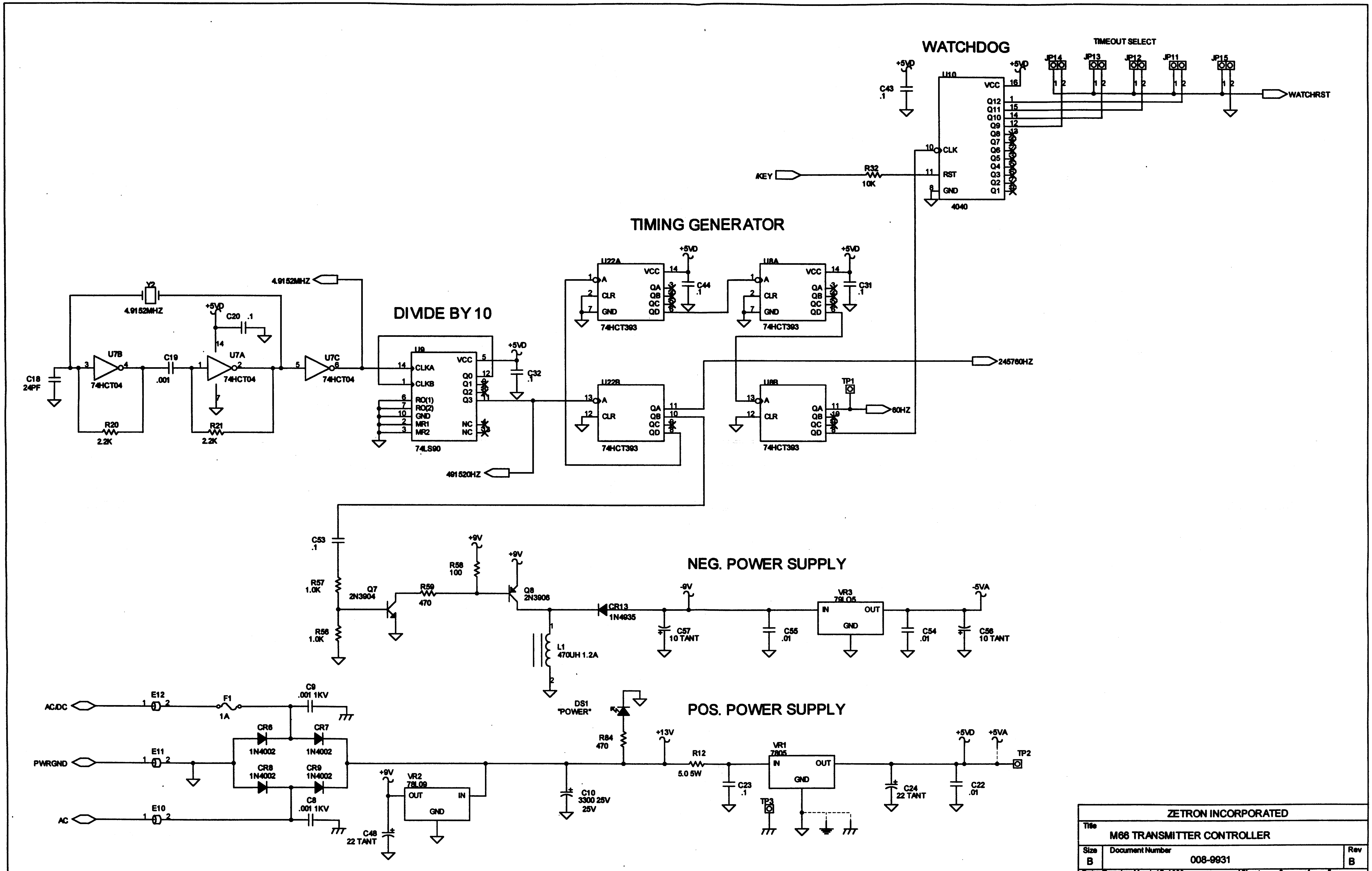
WATCHDOG
TIMEOUT SELECT
JP14 JP13 JP12 JP11 JP15
WATCHRST
U10
4040
/KEY
R32 10K
TIMING GENERATOR
U22A 74HCT393
U8A 74HCT393
U22B 74HCT393
U8B 74HCT393
245760HZ
60HZ
TP1
DIVIDE BY 10
U9
74LS90
4.9152MHZ
491520HZ
Y2 4.9152MHZ
U7B 74HCT04
U7A 74HCT04
U7C 74HCT04
C18 24PF
C19 .001
C20 .1
R20 2.2K
R21 2.2K
NEG. POWER SUPPLY
C53 .1
R57 1.0K
R56 1.0K
Q7 2N3904
R59 470
R58 100
Q8 2N3906
CR13 1N4935
L1 470UH 1.2A
C57 10 TANT
C55 .01
VR3 79L05
C54 .01
C56 10 TANT
-9V
-5VA
POS. POWER SUPPLY
AC/DC
PWRGND
AC
E12 E11 E10
F1 1A
C9 .001 1KV
C8 .001 1KV
CR6 1N4002
CR7 1N4002
CR8 1N4002
CR9 1N4002
VR2 78L09
C48 22 TANT
C10 3300 25V 25V
DS1 "POWER"
R84 470
+13V
R12 5.0 5W
C23 .1
VR1 7805
TP3
C24 22 TANT
C22 .01
+5VD
+5VA
TP2
ZETRON INCORPORATED
Title
M66 TRANSMITTER CONTROLLER
Size B
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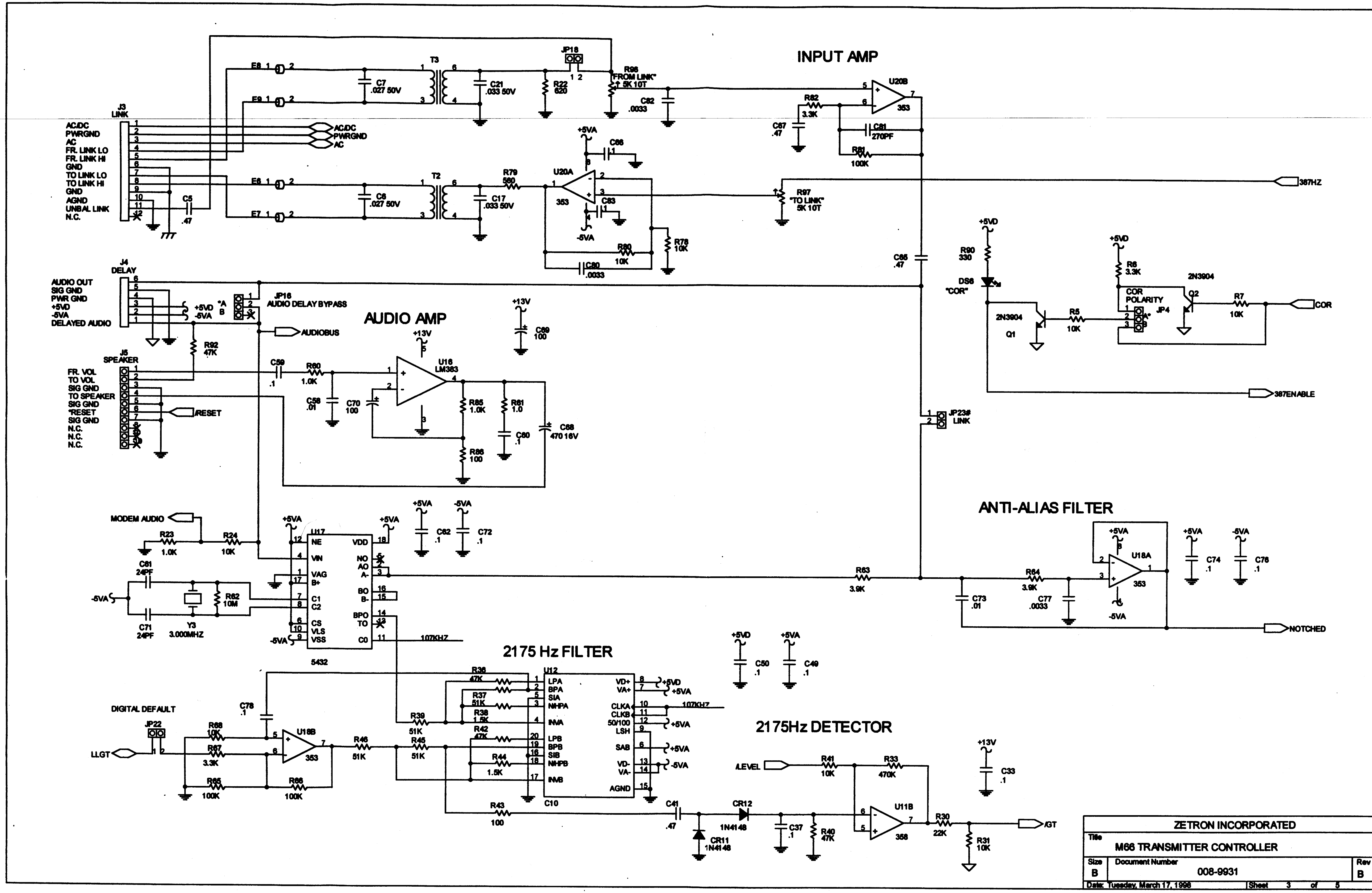
INPUT AMP
AUDIO AMP
ANTI-ALIAS FILTER
2175 Hz FILTER
2175Hz DETECTOR
J3 LINK
AC/DC
PWRGND
AC
FR. LINK LO
FR. LINK HI
GND
TO LINK LO
TO LINK HI
GND
AGND
UNBAL LINK
N.C.
J4 DELAY
AUDIO OUT
SIG GND
PWR GND
+5VD
-5VA
DELAYED AUDIO
JP16 AUDIO DELAY BYPASS
AUDIOBUS
J5 SPEAKER
FR. VOL
TO VOL
SIG GND
TO SPEAKER
SIG GND
*RESET
SIG GND
N.C.
N.C.
N.C.
/RESET
MODEM AUDIO
DIGITAL DEFAULT
LLGT
/LEVEL
/GT
387HZ
COR
387ENABLE
NOTCHED
JP23# LINK
COR POLARITY
"COR"
R96 "FROM LINK" 5K 10T
R97 "TO LINK" 5K 10T
U17 5432
Y3 3.000MHZ
107KHZ
ZETRON INCORPORATED
Title
M66 TRANSMITTER CONTROLLER
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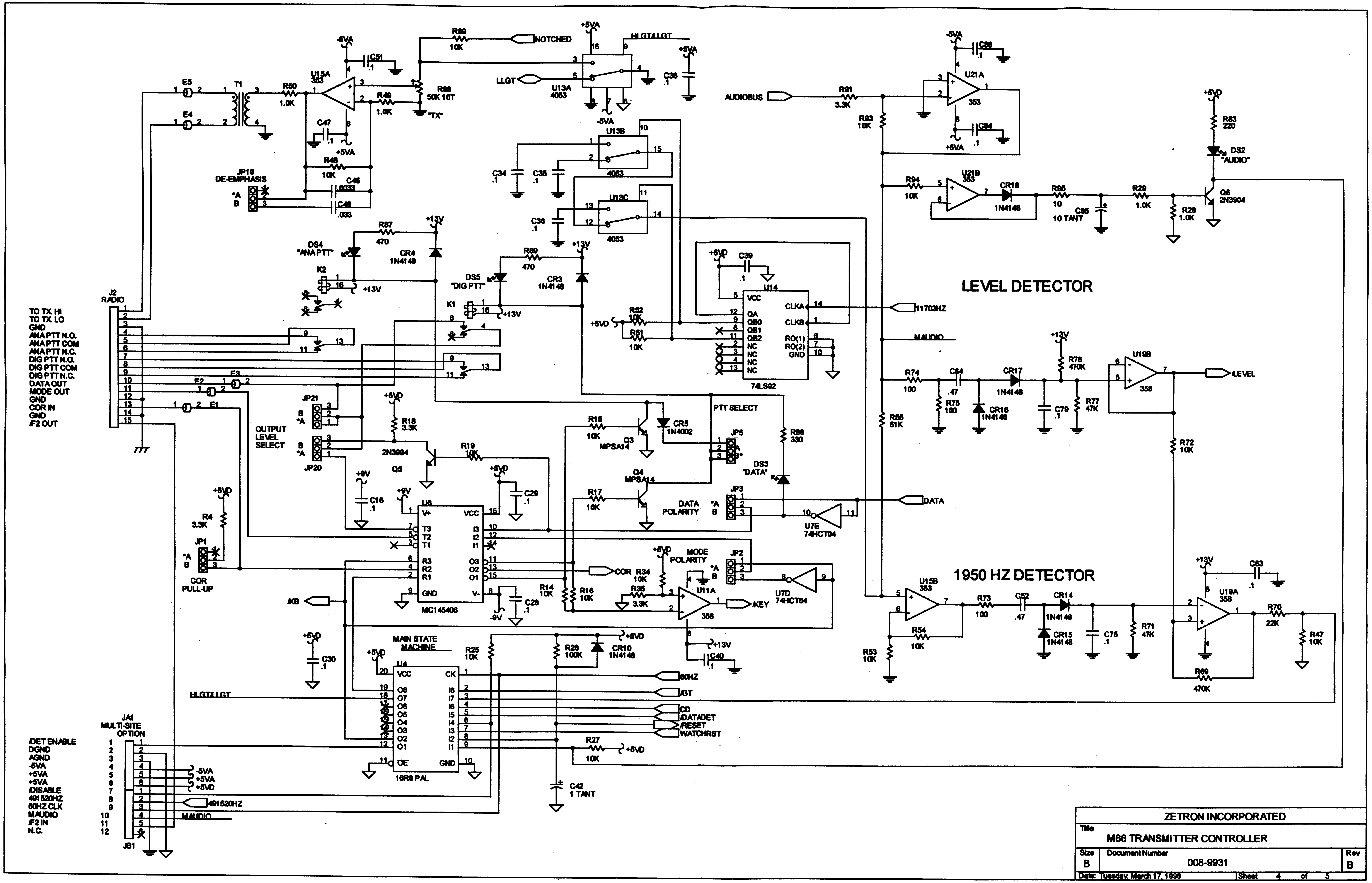
LEVEL DETECTOR
1950 HZ DETECTOR
J2
RADIO
TO TX HI
TO TX LO
GND
ANA PTT N.O.
ANA PTT COM
ANA PTT N.C.
DIG PTT N.O.
DIG PTT COM
DIG PTT N.C.
DATA OUT
MODE OUT
GND
COR IN
GND
/F2 OUT
JA1
MULTI-SITE
OPTION
/DET ENABLE
DGND
AGND
-5VA
+5VA
+5VA
/DISABLE
491520HZ
60HZ CLK
MAUDIO
/F2 IN
N.C.
JB1
JP10
DE-EMPHASIS
OUTPUT
LEVEL
SELECT
COR
PULL-UP
PTT SELECT
DATA
POLARITY
MODE
POLARITY
MAIN STATE
MACHINE
NOTCHED
HLGT/LLGT
LLGT
AUDIOBUS
11703HZ
MAUDIO
/LEVEL
DATA
COR
/KEY
/KB
60HZ
/GT
CD
/DATADET
/RESET
WATCHRST
491520HZ
ZETRON INCORPORATED
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M66 TRANSMITTER CONTROLLER
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Date: Tuesday, March 17, 1998
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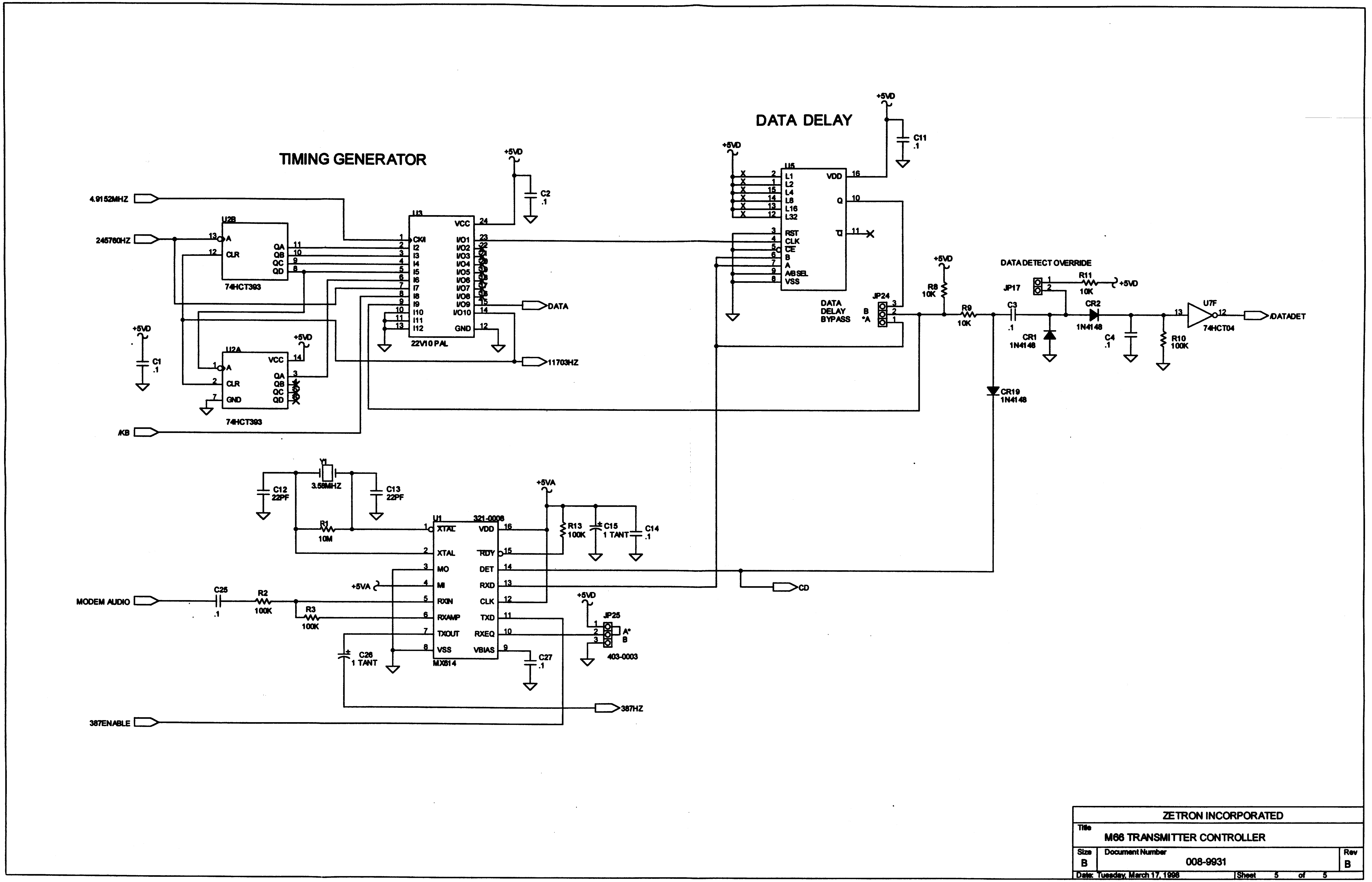

TIMING GENERATOR
DATA DELAY
4.9152MHZ
245760HZ
U2B
74HCT393
U2A
74HCT393
U3
22V10 PAL
+5VD
C2
.1
C1
.1
DATA
11703HZ
AKB
U5
DATA DELAY BYPASS
JP24
C11
.1
DATA DETECT OVERRIDE
JP17
R11
10K
R8
10K
R9
10K
C3
.1
CR1
1N4148
CR2
1N4148
C4
.1
R10
100K
CR19
1N4148
U7F
74HCT04
/DATADET
Y1
3.58MHZ
C12
22PF
C13
22PF
R1
10M
U1
321-0008
MX614
+5VA
R13
100K
C15
1 TANT
C14
.1
CD
MODEM AUDIO
C25
.1
R2
100K
R3
100K
C26
1 TANT
C27
.1
JP25
403-0003
387HZ
387ENABLE
ZETRON INCORPORATED
Title
M66 TRANSMITTER CONTROLLER
Size
B
Document Number
008-9931
Rev
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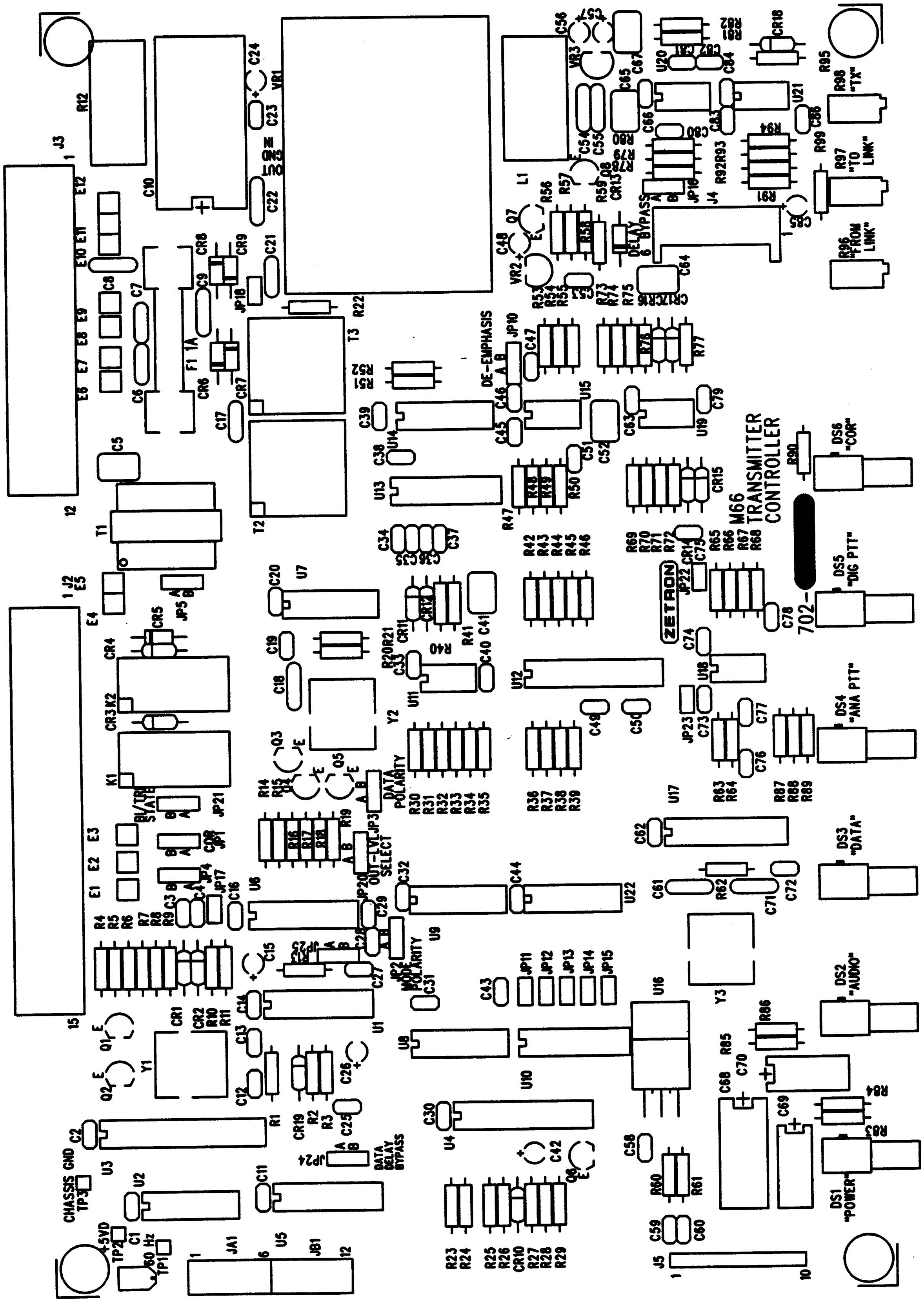
Sheet 5 of 5

MODEL 66 TRANSMITTER CONTROL BOARD (702-9931B)

Silkscreen

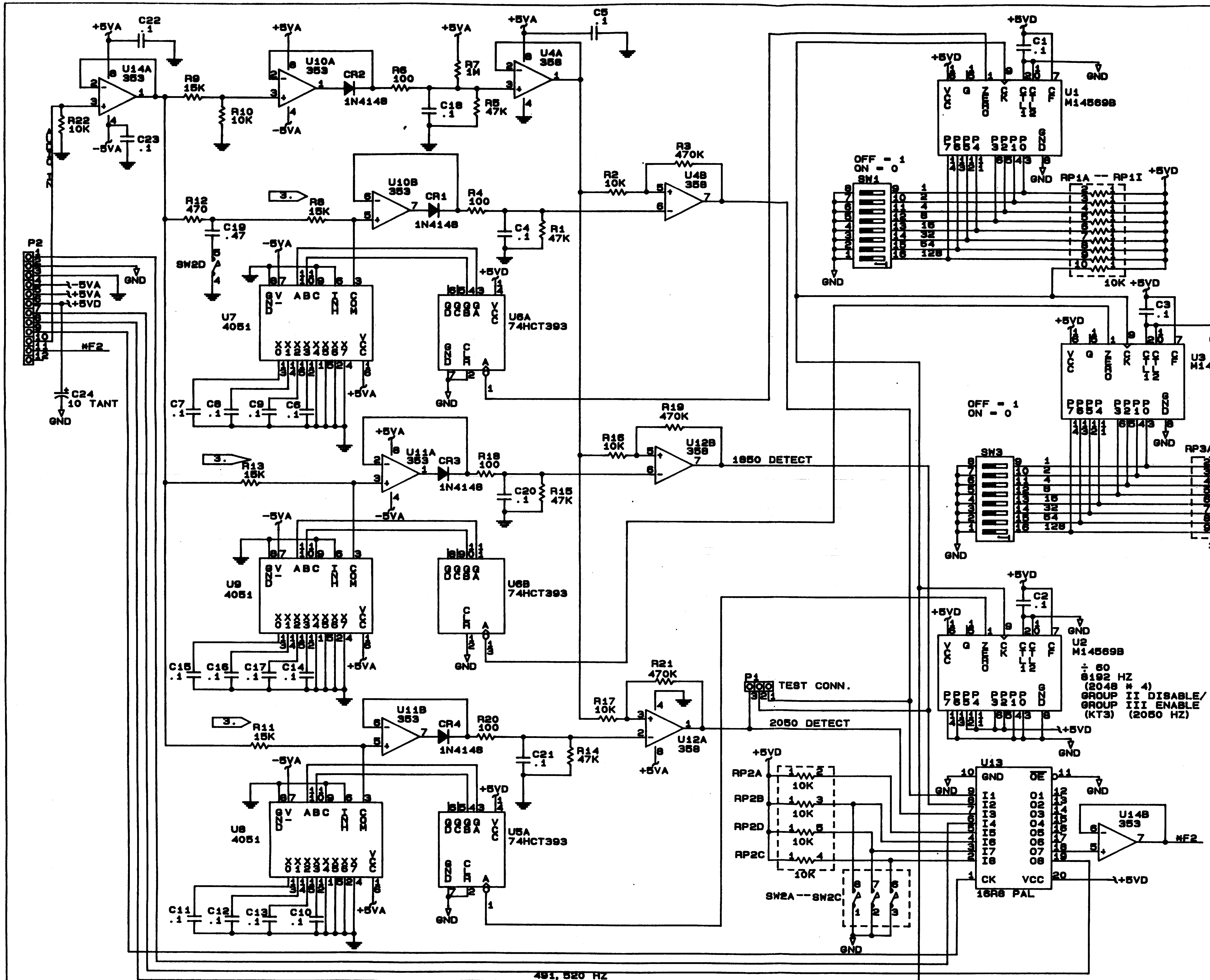


MODEL 66 MULTI-SITE OPTION (702-9156C)

Parts List

Item	Quantity	Reference	Part	Description	Mfg.Part No.
1	4	R4,R6,R18,R20	101-0049	100 OHM 1/4W 5% CARBON FILM	
2	1	R12	101-0065	470 OHM 1/4W 5% CARBON FILM	
3	5	R2,R10,R16,R17,R22	101-0097	10K 1/4W 5% CARBON FILM	
4	4	R8,R9,R11,R13	101-0101	15K 1/4W 5% CARBON FILM	
5	4	R1,R5,R14,R15	101-0113	47K 1/4W 5% CARBON FILM	
6	3	R3,R19,R21	101-0137	470K 1/4W 5% CARBON FILM	
7	1	R7	101-0145	1M 1/4W 5% CARBON FILM	
8	2	RP1,RP3	119-0006	10K x 9 R-SIP	4610X-101-103
9	1	RP2	119-0008	10K x 7 R-SIP	EXB-F8E103G or J
10	22	C1,C2,C3,C4,C5,C6,C7,C8, C9,C10,C11,C12,C13,C14, C15,C16,C17,C18,C20,C21, C22,C23	151-0180	.1 UF 50V +-10% CERAMIC, UNSTABLE	AVXSR205E104MAA
11	1	C19	151-0199	.47 UF 50V +-5% POLYESTER	ECQVIH474JZ
12	1	C24	154-0100	10 UF 16V TANTALUM	ECS-FICE106K
13	3	U10,U11,U14	316-0353	DUAL OP-AMP, DUAL BIFET	LF353
14	2	U4,U12	316-0358	OP-AMP, DUAL	LM358N
15	1	U13	322-1618	PAL 16R8	PAL16R8A2CN
16	3	U7,U8,U9	323-4051	1-TO-8 ANALOG MUX/DEMUX	MC14051B
17	3	U1,U2,U3	323-4569	DIVIDE BYN CTR	MC14569B
18	2	U5,U6	325-4393	DUAL 4 BIT COUNTER	74HCT393P
19	4	CR1,CR2,CR3,CR4	342-3009	SILICON .50 SP	1N4148
20	1	SW2	371-0007	SW QUAD DIP	CTS-194-4S
21	2	SW1,SW3	371-0010	DIP SW, 8 POS	CTS-206-008
22	1	P1	403-0003	3 OF 401-0052	
23	1	P2	405-0012	12 OF 401-0030	
24	5	XU4 10-12 14	407-0008	SKT 8 PIN DIP	
25	2	XU5 6	407-0014	SKT 14 PIN DIP	
26	6	XU1-3 7-9	407-0016	SKT 16 PIN DIP	
27	1	XU13	407-0020	SKT 20 PIN DIP	
28	1	PCB	410-9156C	M66 MULTI-SITE OPTION BOARD	

REV	DESCRIPTION	DN	AP	DATE
A	RELEASE	DGW		03/20/89
B	ECN	DGW		03/20/89
C	ECN 1591	KM	GZ	3/9/92



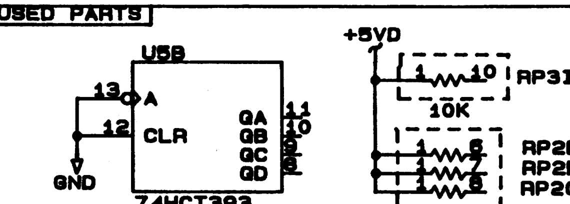
	TARGET FREQ.	4X FREQ.	ACTUAL FREQ.	÷ BY
1	1750	7021.7	1755.4	70
2	1650	6642.2	1660.5	74
3	1550	6221.8	1555.4	79
4	1450	5782.6	1445.6	85
5	1350	5401.6	1350.3	91
6	1250	5015.5	1253.9	98
7	1150	4593.5	1148.4	107
8	1050	4201.0	1050.3	117
9	950	3810.2	952.6	129
10	750	2997.1	749.3	164

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. THIS RESISTOR SETS THE FILTER BANDWIDTH WITH THE CAPACITORS CONNECTED TO RESPECTIVE 4051.

$$BW = \frac{1}{4\pi RC}$$

UNUSED PARTS



LEGEND

*	NOT INSTALLED
____X____	CUT TRACE
- - - - - -	JUMPER WIRE

ZETRON INC.

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

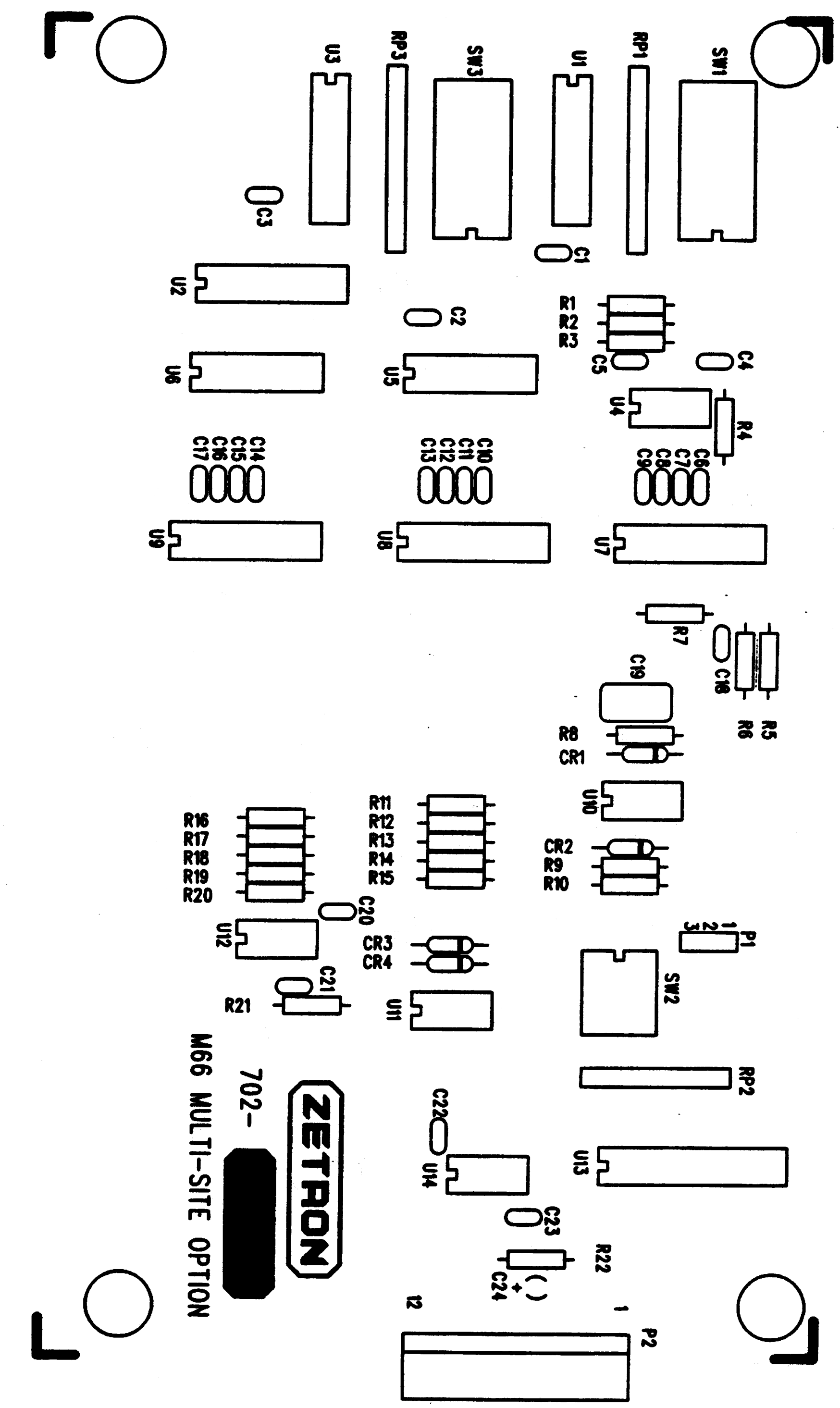
Title: MODEL 66 MULTI-SITE OPTION

Size	Document Number	REV
B	008-9156	C

Date: October 1, 1991 Sheet 1 of 1

MODEL 66 MULTI-SITE OPTION (702-9156C)

Silkscreen



MODEL 66 SIMULCAST DELAY BOARD (702-9157F)

Parts List

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

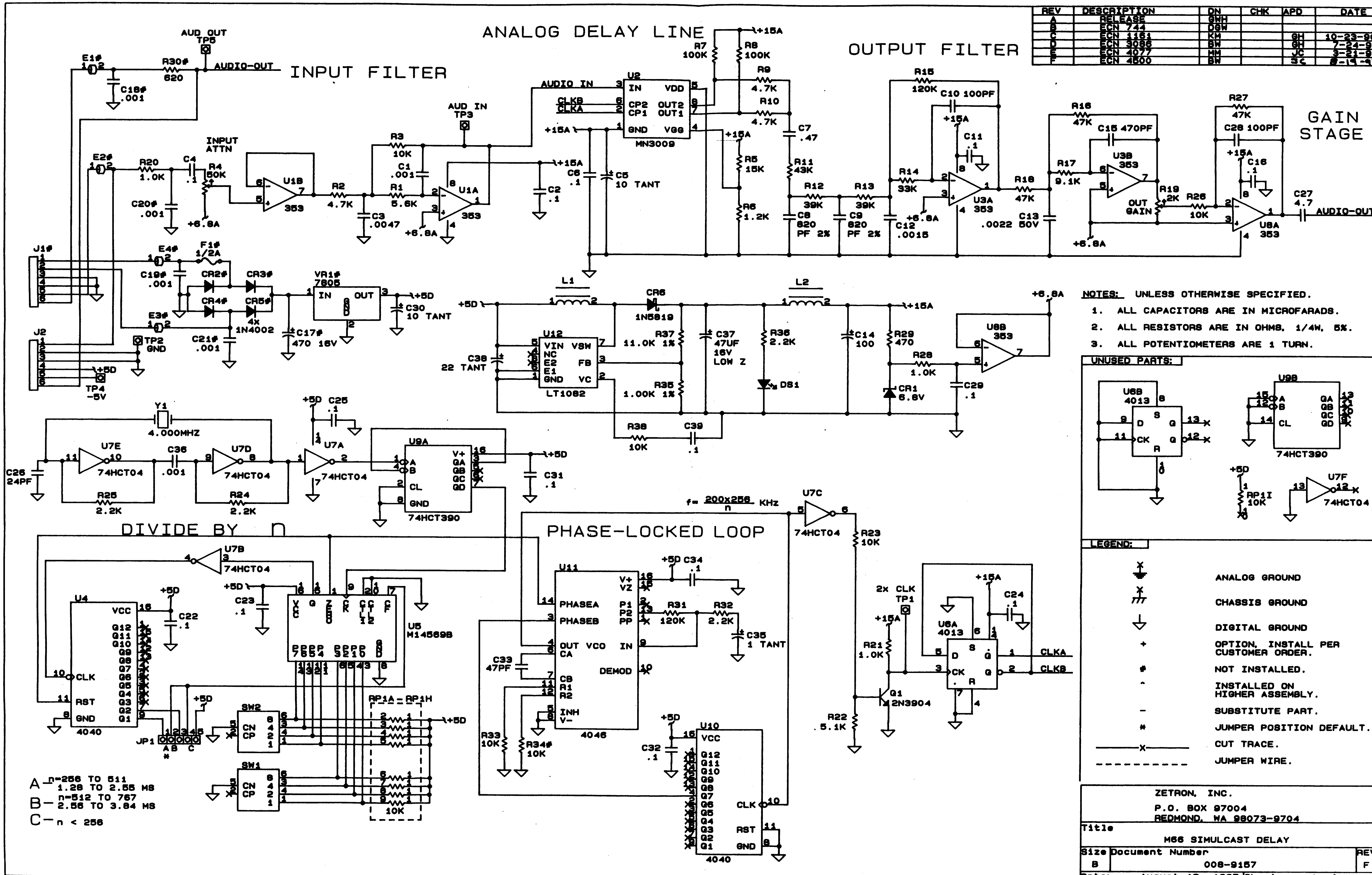
Item	Quantity	Reference	Part	Description	Part Reference
1	1	R29	101-0065	RESISTOR,470 OHM,1/4W,5%,CARBON FILM	470
2	0	R30#	101-0068	RESISTOR,620 OHM,1/4W,5%,CARBON FILM	620
3	3	R20,R21,R28	101-0073	RESISTOR,1.0K OHM,1/4W,5%,CARBON FILM	1.0K
4	1	R6	101-0074	RESISTOR,1.2K OHM,1/4W,5%,CARBON FILM	1.2K
5	4	R24,R25,R32,R36	101-0081	RESISTOR,2.2K OHM,1/4W,5%,CARBON FILM	2.2K
6	3	R2,R9,R10	101-0089	RESISTOR,4.7K OHM,1/4W,5%,CARBON FILM	4.7K
7	1	R22	101-0090	RESISTOR,5.1K OHM,1/4W,5%,CARBON FILM	5.1K
8	1	R1	101-0091	RESISTOR,5.6K OHM,1/4W,5%,CARBON FILM	5.6K
9	1	R17	101-0096	RESISTOR,9.1K OHM,1/4W,5%,CARBON FILM	9.1K
10	5	R3,R23,R26,R33,R34#,R38	101-0097	RESISTOR,10K OHM,1/4W,5%,CARBON FILM	10K
11	1	R5	101-0101	RESISTOR,15K OHM,1/4W,5%,CARBON FILM	15K
12	1	R14	101-0109	RESISTOR,33K OHM,1/4W,5%,CARBON FILM	33K
13	2	R12,R13	101-0111	RESISTOR,39K OHM,1/4W,5%,CARBON FILM	39K
14	1	R11	101-0112	RESISTOR,43K OHM,1/4W,5%,CARBON FILM	43K
15	3	R16,R18,R27	101-0113	RESISTOR,47K OHM,1/4W,5%,CARBON FILM	47K
16	2	R7,R8	101-0121	RESISTOR,100K OHM,1/4W,5%,CARBON FILM	100K
17	2	R31,R15	101-0123	RESISTOR,120K OHM,1/4W,5%,CARBON FILM	120K
18	1	R35	104-1001	RESISTOR,1.00K OHM,1/4W,1%,100PPM/C,METAL FILM	1.00K 1%
19	1	R19	107-0202	POT,2K OHM,1 TURN	2K
20	1	R4	107-0502	POT,50KOHM,1 TURN	50K
21	1	R37	115-1102	RESISTOR,11.0K OHM,1/4W,1%,METAL FILM	11.0K 1%
22	1	RP1	119-0006	R-NETWORK,10K OHM x 9,BUSSED,SIP-10	10K
23	1	C26	150-0024	CAP,24pF,1KV,10%,CERAMIC DISC	24pF
24	1	C33	151-0005	CAP,47pF,100V,10%,CERAMIC NPO	47pF
25	2	C28,C10	151-0010	CAP,100pF,100V,10%,CERAMIC NPO	100pF
26	2	C8,C9	151-0018	CAP,820pF,100V,2%,CERAMIC NPO	820 pF 2%
27	1	C18#,C19#,C20#,C21#,C36	151-0020	CAP,.001uF,100V,10%,CERAMIC X7R	.001
28	1	C15	151-0047	CAP,470pF,100V,10%,CERAMIC NPO	470pF
29	13	C2,C4,C6,C11,C16,C22,C23, C24,C25,C29,C31,C32,C34	151-0180	CAP,.1uF,50V,20%,CERAMIC Z5U	.1
30	1	C39	151-0181	CAP,.1uF,50V,10%,CERAMIC X7R	.1
31	1	C7	151-0199	CAP,.47uF,50V,5%,POLYESTER	.47
32	1	C27	152-0040	CAP,4.7uF,50V,20%,NON-POLAR ELECTROLYTIC,AXIAL	4.7
33	1	C3	152-0088	CAP,.0047uF,50V,5%,POLYESTER	.0047
34	1	C1	152-0089	CAP,.001uF,50V,5%,POLYESTER	.001
35	1	C13	152-0092	CAP,.0022uF,50V,5%,POLYESTER	.0022 50V
36	1	C12	152-0152	CAP,.0015uF,50V,5%,POLYESTER	.0015
37	1	C38	154-0022	CAP,22uF,16V,10%,TANTALUM	22 TANT
38	1	C35	154-0025	CAP,1uF,35V,10%,TANTALUM	1 TANT
39	2	C5,C30	154-0100	CAP,10uF,16V,10%,TANTALUM	10 TANT
40	1	C37	155-0061	CAP,47uF,16V,20%,RADIAL,LOW ESR,OS-CON	47uF 16V LOW Z
41	1	C14	155-0080	CAP,100uF,25V,20%,AXIAL,A1-E	100
42	0	C17#	155-0082	CAP,470uF,16V,20%,AXIAL, A1-E	470 16V
43	0	E1#,E2#,E3#,E4#	305-0001	BEAD,3B FERRITE,W/LEADS	

MODEL 66 SIMULCAST DELAY BOARD (702-9157F)

Parts List (Continued)

Item	Quantity	Reference	Part	Description	Part Reference
44	2	L1,L2	305-0041	INDUCTOR,100uH,1.1A,15%	100uH 1.1A
45	1	DS1	311-0010	LED,RED,DIFFUSED,T1-3/4	
46	3	U1,U3,U8	316-0353	OP-AMP,BIFET,DUAL,DIP-8	353
47	1	U12 **NOTE 3**	316-1082	REGULATOR,SWITCHING,HIGH VOLTAGE,DIP-8	LT1082
48	1	U2	316-3009	BUCKET BRIGADE DEVICE,256 STAGE,LOW NOISE,DIP-8	MN3009
49	0	VR1#	316-7805	REGULATOR,+5V,1.5A,TO-220	7805
50	1	U6	323-4013	FLIP FLOP,D,DUAL,DIP-14	4013
51	2	U10,U4	323-4040	COUNTER,12-BIT,BINARY,DIP-16	4040
52	1	U11	323-4046	PHASE-LOCKED LOOP,DIP-16	4046
53	1	U5	323-4569	COUNTER,DIVIDE-BY-N,4-BIT,PROGRAMMABLE,DIP-16	M14569B
54	1	U9	325-4390	COUNTER,HCT,DECADE,4-BIT,DUAL,DIP-16	74HCT390
55	1	U7	325-7404	INVERTER,HCT,HEX,DIP-14	74HCT04
56	1	Q1	340-3904	XSTR,NPN,40V/200MA,TO92	2N3904
57	0	CR2#,CR3#,CR4#,CR5#	342-0001	DIODE,SILICON,1A,100V,DO-41	1N4002
58	1	CR6	342-5819	DIODE,SCHOTTKY,1A,40V	1N5819
59	1	CR1	343-3031	DIODE,ZENER,6.8V,1W,5%	6.8V
60	2	SW2,SW1	371-0023	SWITCH,ROTARY,16 POS,TOP ADJUSTED	
61	1	Y1 **NOTE 4**	376-0004	XTAL,4.000MHZ,CL=18,20pF,HC-49	4.000MHZ
62	0	J1#	401-0129	6 POS RA HEADER	
63	1	J2 **NOTE 2**	401-6006	6-POS MALE	
64	5	TP1,TP2,TP3,TP4,TP5	403-0001	01 OF 401-0052	
65	1	JP1	404-0005	05 OF 401-0061	
66	0	F1#	416-1200	FUSE,AGC,1/2 AMP,FAST BLOW	1/2A
67	1	XJP1 (POS A)	402-3040	MINI JUMPER	
68	4	XU1,2,3,8	407-0008	SKT, 08 PIN DIP	
69	2	XU6,7	407-0014	SKT, 14 PIN DIP	
70	5	XU4,5,9,10,11	407-0016	SKT, 16 PIN DIP	
71	1	PCB	410-9157D	PCB MODEL 66 SIMULCAST DELAY BOARD	

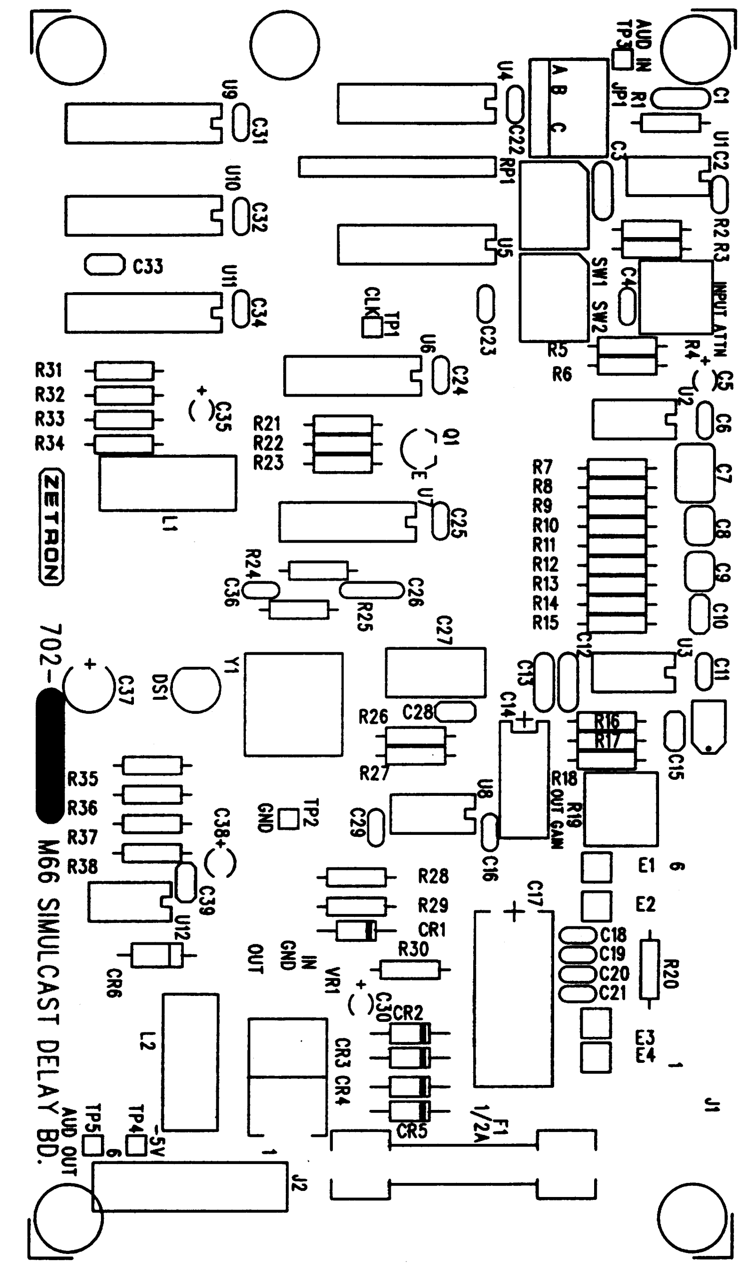
NOTES: Notes are for production use only.



REV | DESCRIPTION | DN | CHK | APD | DATE
A RELEASE GWH
B ECN 744 DGW
C ECN 1161 KM GH 10-23-90
D ECN 3086 BW GH 7-24-95
E ECN 4077 MM JC 3-21-97
F ECN 4600 BW
ANALOG DELAY LINE
INPUT FILTER
OUTPUT FILTER
GAIN STAGE
AUD OUT TP5
AUDIO-OUT
AUDIO IN
AUD IN TP3
INPUT ATTN
MN3009
DIVIDE BY n
PHASE-LOCKED LOOP
f= 200x256/n KHz
4.000MHZ
2x CLK TP1
CLKA
CLKB
A — n=256 TO 511 1.28 TO 2.55 MS
B — n=512 TO 767 2.56 TO 3.84 MS
C — n < 256
NOTES: UNLESS OTHERWISE SPECIFIED.
1. ALL CAPACITORS ARE IN MICROFARADS.
2. ALL RESISTORS ARE IN OHMS, 1/4W, 5%.
3. ALL POTENTIOMETERS ARE 1 TURN.
UNUSED PARTS:
LEGEND:
ANALOG GROUND
CHASSIS GROUND
DIGITAL GROUND
OPTION, INSTALL PER CUSTOMER ORDER.
NOT INSTALLED.
INSTALLED ON HIGHER ASSEMBLY.
SUBSTITUTE PART.
JUMPER POSITION DEFAULT.
CUT TRACE.
JUMPER WIRE.
ZETRON, INC.
P.O. BOX 97004
REDMOND, WA 98073-9704
Title M66 SIMULCAST DELAY
Size B Document Number 008-9157 REV F
Date: August 13, 1997 Sheet 1 of 1

MODEL 66 SIMULCAST DELAY BOARD (702-9157F)

Silkscreen



CHANGE INFORMATION

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

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