



TRC-1

Tone Remote Controller with DTMF Dialing

Manual Revision: 2012-07-27

Covers TRC Firmware Revisions:
1.22 & Higher

Covers Keyboard Firmware Revisions:
3.2 & Higher

Covers Encoder/Decoder Firmware Revisions:
1.7 & Higher

Covers PCB Revisions:
G & Higher

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SPECIFICATIONS

Voltage/Current:

Operating Voltage:	18 VDC
Operating Current (standby):	170 mA
Operating Current (RX):	310 mA
Operating Current (TX):	170 mA

RX Inputs:

Input Impedance (RX):	600 Ohms
Compression Threshold:	Adjustable to -20 dbm
Compression Range:	Not more than 3 db change for 30 db increase above threshold
Speaker Audio Output:	2.0 Watt
Distortion:	Less than 3% at full audio
Hum & Noise:	50 db below normal operating level
Frequency Response:	Less than 3 db from 300 Hz-3 KHz
Notch Filter Depth:	45 db relative to 1 KHz below compression

TX Outputs:

TX Output:	Adjustable to +15 dbm on 2175 Hz
Output Impedance (TX):	600 Ohms
Mic Compression Threshold:	Adjustable typically 50 mv
Compression Range:	Not more than 3 db change for 30 db increase above threshold
Hum & Noise:	50 db below normal operating level
Notch Filter Depth:	45 db relative to 1 KHz below compression

Mechanical:

Dimensions:	2.875" H x 6.5" W x 8.75" L
Operating Temp (excluding LCD):	-30° to +60° C

Default Control Tone Frequencies & Timing:

Function Tone	Frequency	Level & Duration	Function Tone	Default	Level & Duration
High-Level Guard	2175 Hz	10 dBm for 120 msec	F8	1250 Hz	0 dBm for 40 msec
Low-Level Guard	2175 Hz	-20 dBm continuous	F9	1150 Hz	0 dBm for 40 msec
Monitor	2050 Hz	0 dBm for 40 msec	F10	1050 Hz	0 dBm for 40 msec
F1	1950 Hz	0 dBm for 40 msec	F11	950 Hz	0 dBm for 40 msec
F2	1850 Hz	0 dBm for 40 msec	F12	850 Hz	0 dBm for 40 msec
F3	1750 Hz	0 dBm for 40 msec	F13	750 Hz	0 dBm for 40 msec
F4	1650 Hz	0 dBm for 40 msec	F14	650 Hz	0 dBm for 40 msec
F5	1550 Hz	0 dBm for 40 msec	F15	550 Hz	0 dBm for 40 msec
F6	1450 Hz	0 dBm for 40 msec	F16	2350 Hz	0 dBm for 40 msec
F7	1350 Hz	0 dBm for 40 msec	F17	2450 Hz	0 dBm for 40 msec

Encode Formats:

DTMF (0-9, *, #)

GENERAL INFORMATION

Midian's TRC-1 is a basic tone remote controller with DTMF dialing. The TRC uses EIA and Industry standards for monitor, guard, and F1-F16 function tones. Midian also adds F17 for additional function control when used with Midian's TTC-1. The TRC comes standard with an internal microphone and speaker. A gooseneck microphone (TRC Option A) or handset and cradle (TRC Option C) are also available. The standard configuration is for a 2-wire and single line system. A 4-wire option (TRC Option F) or a Line 2 option (TRC Option E) is available for these types of systems. An LCD option (TRC Option I) is available for displaying frequency/function selection, time and dialing sequences.

Midian's TRC can be used with Midian's TTC-1, tone remote adaptor, or another manufacturer's tone remote adaptor that uses EIA and industry standard F1-F16 function tones.

Be certain to follow standard anti-static procedures when handling any of Midian's products.

Getting Started:

The TRC has a number of adjustment potentiometers and configuration jumpers. These have been adjusted and configured at the factory for a typical installation. However, audio levels should be verified and adjusted (if necessary) at the time of installation. Also, the configuration jumpers should be inspected prior to installation to verify that they are in the right configuration. Jumper descriptions appear in the jumper settings section with a quick reference table. **NOTE:** The Zener Diode D-605 is installed to reduce the input voltage to regulators U601 and U602. D-605 is operating within specifications however when the TRC is open for adjustment, care should be used to avoid touching the diode as it can be hot to the touch.

Line Interface

The line interface connector PL1 is a 10-pin RJ-45 style connector in the center of the back panel. A standard 4-pin RJ-11 cable will plug into the RJ-45 and connect to the center 4-pins that are needed for 2-wire or 4-wire interfaces. The remaining 6 pins are for use with a telemetry radio or microwave E&M options and for future interoperability options.

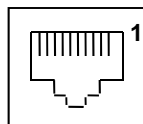


Diagram 3.1

2-Wire & Line 1 Operation: For a single line, 2-wire installation, simply connect pins 5 and 6 (red and green) to the dedicated line. This is the standard configuration for the TRC. See table 3.1.

Table 3.1

Pin	Color	2-Wire
PL1-4	Black	Not Used
PL1-5	Red	Line 1
PL1-6	Green	Line 1
PL1-7	Yellow	Not Used

2-Wire with Line 1 & 2 Operation: For a 2-line, 2-wire installation connect pins 5 and 6 (red and green) for line 1 and pins 4 and 7 (black and yellow) for line 2. For this feature TRC Option E must be installed in the TRC. Remove JP202 and JP203 for proper operation. See table 3.2. Please note that the 4-Wire Option (TRC Option F) is not available in Line 2 operation.

Table 3.2

Pin	Color	2-Wire
PL1-4	Black	Line 2
PL1-5	Red	Line 1
PL1-6	Green	Line 1
PL1-7	Yellow	Line 2

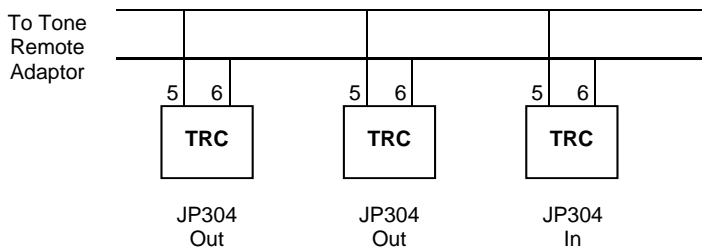
4-Wire & Line 1 Operation: For a single line 4-wire installation, connect pins 4 and 7 (black and yellow) for receive audio and pins 5 and 6 (red and green) for transmit audio. For this feature TRC Option F must be installed in the TRC. JP204 should be moved to the 3-4 position. See table 3.3. Please note that the Line 2/Supervisor Option (TRC Option E) is not available in 4-wire operation.

Table 3.3

Pin	Color	4-Wire
PL1-4	Black	RX
PL1-5	Red	TX
PL1-6	Green	TX
PL1-7	Yellow	RX

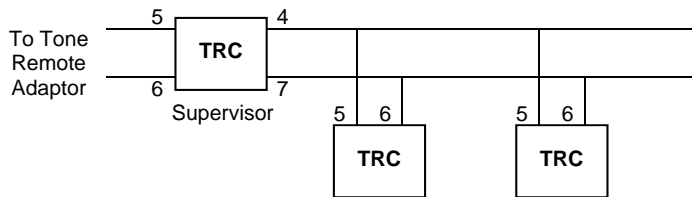
Parallel Remote Operation: When multiple remotes are connected to a single dedicate phone line JP304 must be installed in the unit furthest from the phone line connection. All remaining units must have JP304 removed.

Diagram 3.2 – Parallel Remote Wiring



Supervisor Operation: When using the supervisor option (TRC Option E), the supervisor TRC is connected to the line via pins 2 and 3. The remaining TRC's pins 5 and 6 are connected in parallel to the supervisor's TRC pins 4 and 7. To enable these remotes, the supervisor relay must be engaged by pressing the * and # keys simultaneously.

Diagram 3.3 – Supervisor Wiring



Telemetry Radio: Rather than connecting the TRC to a dedicated line to communicate with the tone remote adaptor, telemetry radios can be used for communication. If connecting to a telemetry radio connect PL1 as follows to the radio:

PL1-3: PTT Output: Connect to the PTT of the radio. Jumpers JP210 1-2 and JP208 1-2 should be installed.

PL1-6: TX Audio Output: Connect to the mic-hi input of the radio. Install JP205 2-3.

PL1-7: RX Audio Input: Connect to a point in the radio providing flat receive audio. Install JP11 1-2 & remove JP204.

PL1-9: Battery: 15 volts through a 100 Ohm current limiting resistor (R216).

PL1-10: Ground: Connect to the ground of the radio.

Microwave: Connect the 4-wire audio to the TX and RX sides of the microwave. If the M lead is desired install JP208 1-2 and JP10 1-2. Connect the microwave's M lead to PL1 Pin 3 for an open collector to ground. If using an external relay to control the microwave's M lead you may use Q205 to provide 12 volts and install JP207 1-2 and JP208 2-3.

PL1-8: External Speaker or PA System

HARDWARE ALIGNMENT

The following procedures assume a good quality dedicated line is being used and the tone remote adaptor is already installed. The alignments are preset at the factory and should not need to be adjusted during installation. However, if an adjustment is needed, please follow the procedures below.

RX Input Line Level Adjustment:

1. With the dedicated line connected to the TRC, connect a line level meter to the red and green (or yellow & black with the 4-wire option) in bridging mode. If testing on a bench with no tone remote adaptor available use termination mode on the line level meter.
2. With the line level meter generating Low-Level Guard Tone at -20 dBm, monitor TP304 with an oscilloscope.
3. Adjust RP306, so that 200 mV p-p is seen at TP304 or 165 mV p-p is seen at TP301. If paralleling multiple remotes, this alignment should be done with all remotes attached.

TX Output Line Level Adjustment:

1. With the dedicated line connected to the TRC, connect a line level meter to the red and green in bridging mode. If testing on a bench with no tone remote adaptor available use termination mode on the line level meter.
2. Set RP201 to 90%.
3. Push and hold the SEND key on the TRC to generate the Low-Level Guard Tone.
4. Adjust RP202 so that the line level meter shows the Low-Level Guard Tone at -20 dBm. If paralleling multiple remotes, this alignment should be done with all remotes attached.

RX Notch Filter Alignment:

1. Generate the 2175 Hz Low-Level Guard Tone to the TRC.
2. Turn RP303 fully clockwise.
3. Monitor TP303 with a Sinadder. The sensitivity of the Sinadder should be adjusted to hear the tone.
4. Adjust RP302 until the tone is at it's most diminished point.
5. Adjust RP303 until the tone fully diminishes.
6. Repeat steps 4 and 5 until no tone remains.

TX Notch Filter Alignment:

1. Unplug the internal microphone from the TRC, install JP101 1-2 and turn RP102 fully clockwise.
2. Push and hold the SEND key on the TRC to generate the 2175 Hz Low-Level Guard Tone.
3. Monitor TP103 with a Sinadder. The sensitivity of the Sinadder should be adjusted to hear the tone.
4. Adjust RP103 until the tone is at it's most diminished point.
5. Adjust RP102 until the tone fully diminishes.
6. Repeat steps 4 and 5 until no tone remains.
7. After aligning the TX notch filter, remove JP101 and plug back in the internal or gooseneck microphone.

Handset Ear Level (TRC Option C Only):

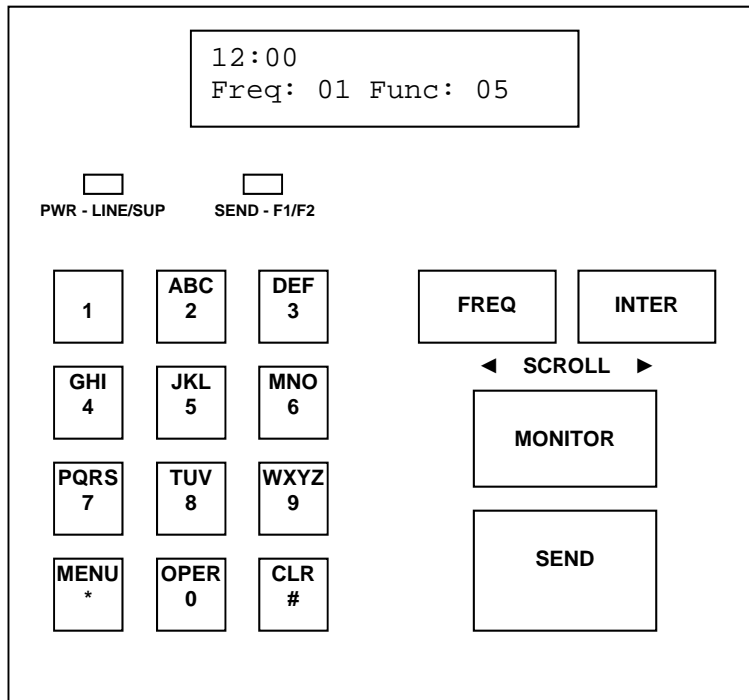
1. With a field radio talking on channel to the TRC, adjust RP304 to a comfortable level.

JUMPER SETTINGS

The following table shows the default jumper settings and their function:

Jumper Number	Default Position	Description
JP101	Out	Install during TX Notch Filter Alignment only
JP201	Out	Sidetone for dialing (4-wire option only)
JP202	In	Removed when TRC Option E is installed (Line 2/Supervisor)
JP203	In	Removed when TRC Option E is installed (Line 2/Supervisor)
JP204	1-2 In – 3-4 Out	2-wire (1-2 In 3-4 Out) or 4-wire option (1-2 Out 3-4 In)
JP205	1-2 In – 2-3 Out	Balanced (1-2 In 2-3 Out)/Unbalanced (1-2 Out 2-3 In) Audio Selection for use with a telemetry radio instead of a dedicated line.
JP206	Out	Power with current limit.
JP207	Out	Activates Q205 to provide 14 V to external M lead relay.
JP208	Out	If JP208 1-2 is installed with JP210 1-2, provides an open-collector to ground on PL1-3 to PTT a telemetry radio or ground a relay for an M lead.
JP209	In	Always installed unless directed otherwise by Midian.
JP210	1-2 Out – 2-3 Out	Install JP210 1-2 with JP208 1-2 to PTT a telemetry radio.
JP301	1-2 In – 2-3 Out	Future Use
JP302	Out	Handset Audio Feedback. Install only with the TRC Option C if dial tones and voice in the ear piece are desired.
JP303	Out	TX Audio Loading. If less TX audio is needed, install this jumper.
JP304	In	2-Wire RX Audio Termination. If more RX audio is needed, remove this jumper. This should only be needed if paralleling remotes.
JP305	Out	4-wire option only. RX Audio Loading. If less RX audio is needed, install this jumper.
JP306	Out	4-wire option only. RX Audio Termination. If more RX audio is needed, remove this jumper. This should only be needed if paralleling remotes.
JP307	1-2 Out – 2-3 In	With 2-3 installed the volume control switch is the main source of controlling the handset ear piece audio level. With 1-2 installed and 2-3 removed, the volume control switch does not affect the handset ear piece audio level and RP304 is the only source of control.
JP308	Out	Low impedance audio for external speaker or PA System.
JP309	In	Leave In: In for hard mute and out for soft mute
JP401	Out	Factory Use Only
JP409	Out	Factory Use Only

CONTROLS & INDICATORS



Power/Volume Switch: On the right side of the TRC, there is a switch which acts as the power and volume switch. The switch is in the power off position when turned fully clockwise past the click. Turning the switch counter-clockwise past the click turns the power on to the volume control. At this point the volume is in the low position. Turning the switch further counter-clockwise increases the volume.

LCD: The 2-line LCD (TRC Option I) displays the time on the first line and the frequency selection and function selection on the second. When a dialing sequence is performed the second line is cleared and the dialing sequence is displayed.

LED 1 (PWR - LINE/SUP): This LED is a bi-color LED. The LED will glow red when the power is on to the TRC. It glows orange when Line 2/Supervisor mode is active.

LED 2 (SEND - F1/F2): This LED is a tri-color LED. The LED will glow red during transmit of Freq 1 and orange during transmit of Freq 2. It glows green when Guard Tone is detected from a parallel tone remote.

FREQ: The FREQ button acts as the frequency select and the function select key. Pressing this key followed by 0-17 will select the associated frequency or function. When using the TRC with Midian's TTC series tone remote adaptor both frequency and function tones are available. When using the TRC with another manufacturer's tone remote adaptor the frequency tones are selectable.

INTER: Pressing the INTER key will allow intercom communications between several connected tone remotes without transmitting over the radio. When the INTER key is pressed and held, the audio is routed on the line without the Guard Tone activating the transmitter. Other tone remotes on the same line will hear the audio automatically. No cross mute is available in intercom mode since there is no Guard Tone present.

MONITOR: Pressing the MONITOR key will allow the user to monitor the channel before pressing the SEND key to make a call. If a conversation is heard then another co-channel user presently "owns" the channel and should not be interrupted.

SEND: Pressing SEND will transmit the high-level guard tone for 120 msec, followed by the frequency tone for 40 msec, followed by the low-level guard tone that keys the radio with the voice and dialing riding over the low-level continuous tone.

0-9 Keys: Used in conjunction with the **FREQ** key these number keys can be used to select the frequency/function tone. The number keys can also be used to dial DTMF.

***/MENU:** Not used on the TRC-1.

#/CLR: When CLR is pressed, any keyboard entries in the buffer will be cleared.

Frequency versus Function: The F1-F17 tones are referred to, industry wide, as Function Tones, but are used as frequency selector tones to control the base station radio channel selection. Midian, with its TTC-1 tone remote adaptor can use the Function Tones for either frequency selection or for controlling a function for remote monitoring and control. These functions can be used for turning on/off a scrambler in the TTC-1, controlling voice prompts from the TTC-1, or providing outputs from the TTC-1 to the TTC Option A (wild card module) for remotely controlling equipment. If using the TRC with the LCD Option (TRC Option I) the TRC will display the Frequency and the Function. For example, Frequency 1 can be selected while controlling Function 5 and the display will show "Freq: 01 Func: 05". A frequency and function should not share the same Function Tone. For example, if only channel 1 and 2 at the base station need to be controlled (F1-F2), this leaves F3-F17 for use as function control. If 16 channels need to be controlled at the base station (F1-F16), this leaves F17 for use as function control.

Frequency Selection: To change the channel of the radio (F1 up to F16), press the **FREQ** button followed by a single digit number for F1-F9 or a double digit number for F01-F16. When the Function Tone is selected, the TRC sends the High-Level Guard Tone followed by the selected Function Tone to the tone remote adaptor to change the channel of the radio. If using with other Midian TRC's (revision G and higher), the paralleled remotes will also show the channel change on the display.

Function Selection: To control a function press the **FREQ** button followed by a single digit number for F1-F9 or a double digit number for F10-F16. When the Function Tone is selected, the TRC sends the High-Level Guard Tone followed by the selected Function Tone to the TTC-1 to command the function control. **Note:** The selection of a function does not cancel any frequency selection. If the TRC is on Frequency 1 and Function 5 is selected, the tone remote adaptor will remain on Frequency 1.

Transmitting: After selecting the desired Function Tone for frequency selection, pressing and holding the **SEND** key will generate the High-Level Guard Tone followed by the continuous Low-Level Guard Tone. The user speaks into the microphone of the TRC and the voice goes out over the Low-Level Guard Tone.

DTMF Dialing: After selecting the desired Function Tone for frequency selection, type the desired DTMF sequence on the number keys (0-9) followed by the **SEND** key. The TRC will generate the High-Level Guard Tone followed by the continuous Low-Level Guard Tone. The DTMF tones will go out over the Low-Level Guard Tone. The user can then follow the tones with voice if desired.

Monitor: Prior to transmitting or dialing, the user should Monitor the channel to see if there is activity on the channel. If there is activity, the user should wait until the channel is clear. Pressing the **MONITOR** button sends the High-Level Guard Tone followed by the Monitor Function Tone to the tone remote adaptor giving it a command to open the squelch of the radio. Depending on the tone remote adaptor this can be momentary or latched. If momentary, the tone remote adaptor will close the squelch of the radio after a set amount of time. If latched, the squelch will remain open until the tone remote adaptor receives a second Monitor command from the TRC.

Receiving: When a field radio keys up, the tone remote adaptor passes the voice down the line to the TRC. The voice will then be passed through to the internal speaker of the TRC.

Line 2/Supervisor Capability (* + #): If the TRC is ordered with TRC Option E, then the TRC is equipped with the Line 2/Supervisor Capability. Line 2 is used for toggling between 2 different base station radios and Supervisor is used to shut down any paralleled remotes. Pressing the * and # keys simultaneously activates the Supervisor or the Line 2 mode depending on the options installed in the unit. Pressing the keys again deactivates the Supervisor or the Line 2 mode. When activated LED 1 changes from red to orange.

Memory Dialing: The TRC supports up to 9 memory dials (1-9). Press and release the * key, followed by the desired 1-9 number key for 1 second.

Last Number Redial: The TRC can recall the last sequence dialed by pressing and releasing the * key followed by the **SEND** key.

Memory Dial: To set up the memory dial locations first enter configuration mode by entering “* *FREQ 0” on the keypad. To exit programming mode enter “* 0 0”.

Each memory dial location can support up to 16 DTMF digits (0-9, *, #). To enter 0-9 press the associated number key. To enter a *, press the * key three times. To enter a #, press *#. For example to have “#1234” as a memory dial you would enter “*#*1234” into the register. Enter the desired DTMF sequence followed by * and the memory dial location number which would be 60-69 as below. If a mistake is made during entry, pressing the # key clears the register.

- ddddddddddddddd*61 – Memory Dial Slot #1
- ddddddddddddddd*62 – Memory Dial Slot #2
- ddddddddddddddd*63 – Memory Dial Slot #3
- ddddddddddddddd*64 – Memory Dial Slot #4
- ddddddddddddddd*65 – Memory Dial Slot #5
- ddddddddddddddd*66 – Memory Dial Slot #6
- ddddddddddddddd*67 – Memory Dial Slot #7
- ddddddddddddddd*68 – Memory Dial Slot #8
- ddddddddddddddd*69 – Memory Dial Slot #9
- ddddddddddddddd*60 – Memory Dial Slot #0

Once memory dial programming is completed, exit configuration mode by entering “*00” on the keypad.

Function Tone Frequency Programming: The Function Tone Frequencies are programmable. However, most applications do not require this to be done. Therefore, to avoid confusion for the majority of users, for those requiring this please contact Midian for assistance.

Programmable Parameters: The following features are programmable in the TRC. To enter programming mode enter “* *FREQ 0”. To exit programming mode enter “* 0 0”.

Dialing Tones Hang Time Delay: This field is programmed with T*42, where T equals the time in seconds (i.e. 2 equals 2 seconds). This field is defaulted to 2 seconds. This keeps the Low-Level Guard Tone keying the transmitter after tones are dialed, so that the decoded pager does not drop out due to carrier loss.

External Handset Option: If ordered with the TRC Option C this field will be preprogrammed. This field is programmed with A*43, where A equals either 0 for disabled or 1 for enabled.

F10-F17: If you wish to use F10-F17 function tones you should enable this feature. This field is programmed with A*54, where A equals either 0 for disabled or 1 for enabled.

Line-2/Supervisor Option: If ordered with the TRC Option E this field will be preprogrammed. This field is programmed with A*44, where A equals either 0 for disabled or 1 for enabled.

4-Wire Option: If ordered with the TRC Option F this field will be preprogrammed. This field is programmed with A*57, where A equals either 0 for disabled or 1 for enabled.

Key-Up Delay: This field is programmed with TT*45, where TT equals the time in hundreds of milliseconds (i.e. 05 equals 500 milliseconds or 12 equals 1200 milliseconds). This field is defaulted to 04 for 400 milliseconds.

Crossmute: This field is programmed with A*49, where A equals either 0 for disabled or 1 for enabled. This field is defaulted to 0. Enabling the Crossmute feature keeps feedback from occurring with multiple tone remote controllers in the same room or from having to listen to other tone remotes’ conversations in the same building.

Off-Hook Polarity: If ordered with the TRC Option C this field will be preprogrammed. This field is programmed with A*50, where A equals either 0 for Active Low or 1 for Active High.

External PTT Polarity: If ordered with the TRC Option C this field will be preprogrammed. This field is programmed with A*51, where A equals either 0 for Active Low or 1 for Active High.

Side Tone Jumper: This field is programmed with A*52, where A equals either 0 for Not Installed or 1 for Installed. This feature is only available when the TRC Option C (Handset) is ordered and JP302 is installed. The TRC will allow side tone audio to be passed back to the earpiece on the externally attached handset.

Automatic External Monitor Option: This field is programmed with A*53, where A equals either 0 for disabled or 1 for enabled. This field is defaulted to 1. This feature is only available when the TRC Option C (Handset) is ordered. When enabled the TRC will automatically transmit the Monitor function sequence to the tone remote adaptor when the operator picks up the handset.

Reset Factory Defaults: To reset the unit back to factory defaults enter *80. This will erase all custom programming you have entered.

TRC OPTION H: MULTI-FORMAT DIALING

The TRC Option H gives the TRC the ability to dial in DTMF, 2-Tone, 5-Tone or Pulse Tone. There are three parameters that will need to be programmed into the TRC; Dialing Format, Dialing Time 1 and Dialing Time 2. Enter programming mode by entering “* FREQ 0” on the keypad.

Dialing Format: To program the desired dialing format enter the two digit format number from the table below followed by *46 (i.e. 04*46 for Motorola General). Note: QC2 stands for Motorola Quick Call 2.

#	Format	#	Format	#	Format	#	Format
01	AvCall	10	Motorola F – QC2	20	Motorola R – QC2	34	DDZVEI – 5-Tone
01	QuickCall 1	11	Motorola G – QC2	21	Motorola S – QC2	35	CCIR1 – 5-Tone
02	GE Type 99	12	Motorola H – QC2	22	Motorola T – QC2	36	EEA – 5-Tone
03	Reach Slow	13	Motorola J – QC2	23	Motorola U – QC2	37	NATEL – 5-Tone
04	Motorola General QC2	14	Motorola K – QC2	24	Motorola V – QC2	38	MODAT – 5-Tone
05	Motorola A – QC2	15	Motorola L – QC2	25	Motorola W – QC2	50	2805 Hz Pulse Tone
06	Motorola B – QC2	16	Motorola M – QC2	30	EIA – 5-Tone	51	1500 Hz Pulse Tone
07	Motorola C – QC2	17	Motorola N – QC2	31	Eurosignal – 5-Tone	59	Plectron
08	Motorola D – QC2	18	Motorola P – QC2	32	ZVEI – 5-Tone	60	DTMF
09	Motorola E – QC2	19	Motorola Q – QC2	33	DZVEI – 5-Tone		

Dialing Time 1: This field is programmed with TTTT*47, where TTTT equals the time in milliseconds (i.e. 0060 equals 60 msec or 1000 equals 1 second). For DTMF this sets the tone on time. For 2-Tone this sets the A tone time. For 5-Tone this sets the time of the first tone. For Pulse Tone this sets the time of the tone break.

Dialing Time 2: This field is programmed with TTTT*48, where TTTT equals the time in milliseconds (i.e. 0060 equals 60 msec or 1000 equals 1 second). For DTMF this sets the tone off time. For 2-Tone this sets the B tone time. For 5-Tone this sets the time of each subsequent tone. For Pulse Tone this sets the time of the tone make.

To exit programming mode enter “* 0 0” on the keypad.

Entering a user ID number, often called a CAP code, is straightforward for most of the encoding formats. For example, when encoding DTMF or 5-tone, the digits 0-9 are simply typed in directly. For Motorola Quick Call 2, GE Type 99 and Reach you simply enter the 3 digit cap code. Some formats do not allow for this straightforward approach. These are Plectron, Quick Call 1, and Avcall. This section explains how to enter a code in these formats.

Plectron Encoding: To encode Plectron, four digits must be used. The first two digits represent the 1st tone, and the 2nd two digits represent the 2nd tone. Simply locate the code associated with each tone from the table. For example, the tone sequence 454.6 + 2688 would be entered as 1253.

Plectron Tones																	
01	282.2	08	382.2	15	517.7	22	701	29	950	36	1287	43	1743	50	2361	57	3197
02	294.7	09	399.2	16	540.7	23	732	30	992	37	1344	44	1820	51	2465	58	3339
03	307.8	10	416.9	17	564.6	24	765	31	1036	38	1403	45	1901	52	2574	59	3487
04	321.4	11	435.3	18	589.7	25	799	32	1082	39	1465	46	1985	53	2688		
05	335.6	12	454.6	19	615.8	26	834	33	1130	40	1530	47	2073	54	2808		
06	350.5	13	474.8	20	643	27	871	34	1180	41	1598	48	2165	55	2932		
07	366.0	14	495.8	21	672	28	910	35	1232	42	1669	49	2260	56	3062		

Avcall & Motorola Quick Call 1: Avcall & Quick Call 1 are dual-tone formats, which means a pair of tones are sent simultaneously. Two tone-pairs are sent, meaning that 4 tones in total must be selected. Like Plectron 2 digits are entered for each tone. Locate the desired tone in the table to find its corresponding code. A total of 8 digits must be entered. For example, the tone sequence 645.7 & 312.6 + 881.0 & 1479.1 would be entered as 07001015.

Avcall & Motorola Quick Call 1 Tones															
00	312.6	07	645.7	14	1333.5	21	668.3	28	412.1	35	851.1	42	473.2	49	346.7
01	346.7	08	716.1	15	1479.1	22	741.3	29	457.1	36	944.1	43	524.8	50	977.2
02	384.6	09	794.3	16	398.1	23	822.2	30	507.0	37	371.5	44	582.1	51	1084.0
03	426.6	10	881.0	17	441.6	24	912.0	31	562.3	38	1047.1	45	645.7		
04	473.2	11	977.2	18	489.8	25	358.9	32	623.7	39	1161.4	46	716.7		
05	524.8	12	1083.9	19	543.3	26	1011.6	33	691.8	40	384.6	47	794.3		
06	582.1	13	1202.3	20	602.6	27	1122.1	34	767.4	41	426.6	48	881.0		

Signaling Format Compatibility

In tone remote systems, the industry standard 2175 guard tone is filtered out by the tone remote adapter at the base station so that it is not heard over the air. This filter can affect signaling tones close to 2175 Hz. Tones within +/-70 Hz could be attenuated to a level such that they cannot be decoded by receiving equipment. There are several ways to deal with this issue:

1. Choose a format that will not be affected.
2. Do not use the affected tone(s).
3. Change the guard tone.

The last solution involves re-tuning the notch filters on the TRC. This can be done at the factory upon request (recommended). It also requires that the guard tone and notch filters on the tone remote adapter be changed as well. While Midian's products allow for this, not all do. Please note that this issue often applies to decoding as well. Many tone remote adapters notch 2175 out of the receive audio as well. This possibility should be investigated if decode problems are experienced. The following sections address the formats and tones that are likely to be affected.

ZVEI: All ZVEI formats use 2200 Hz for either the '0' or the '9' tone. This is only 25 Hz away from the standard guard tone frequency of 2175. The best solution to this problem is to simply not use the '0' tone when encoding DZVEI and not use the '9' tone when encoding ZVEI or DDZVEI formats. Alternatively, the guard tone could be changed to another frequency. If this is done, it should be at least 150 Hz away from the nearest frequency used by the format. 2970 Hz is a common choice.

CCIR and EEA: CCIR and EEA both use the tone 2110 Hz as the 'repeat' tone. This tone indicates that the current digit is the same number as the last digit. The best solution to this problem is to simply not use codes that have repeating digits. That is to say, do not use a code where a digit appears next to itself in the code such as '12334' which has two 3's in a row. Another solution is to change the guard tone. If this is done, it should be at least 150 Hz away from the nearest frequency used by the format. 2970 Hz is a common choice.

Other Affected Formats: REACH two-tone, tone group A, uses 2274, 2196, and 2121 Hz to represent the digits 6, 7, and 8. Do not use tone group A if using this format. PLECTRON tones 2260 and 2164 should not be used.

Formats Not Affected: The following formats do not use tones between 2105 and 2245 and therefore should be unaffected by the guard tone filter: AVCALL, DTMF, EIA, EUROSIGNAL, GE, MODAT, NATEL, QUICK CALL I, and QUICK CALL II.

Analog Circuit

RX Audio Input Path: RX audio from a tone remote adaptor at the remote site travels down the phone line to the RJ-11 line interface connector PL-1. Line 1 uses the standard red/green Telco ring tip on positions 5 and 6 of the RJ-11 cable or pins 5 and 6 of the RJ-45 10-pin connector. This signal is fed into a transient absorber across the line, then through an auto-resettable polyswitch fuse to another set of transorbs that can shunt a signal to ground if the ground lead is tied to Earth. There are then 2 capacitors across the line, which also go to Earth to remove RF. The audio signal is then fed into transformer T201 through jumpers JP202 and JP203 or Line 2 relay K201. From the bottom winding of T201 audio is fed to jumper JP204 contacts 1 and 2 or contacts 2 and 3 if using T202 in a 4-wire duplex configuration. From JP204 audio is fed into the RX Input Gain Pot RP-306 where the output level of the RX line amp U302 is typically set to 200 mV p-p with -20 dbm from a Line Test Set tone generator.

There is a disable transistor Q303 that can mute the incoming audio under microprocessor control. Coming out of the RX line amp the audio is passed to the compression circuit U102B. The audio output of the compressor is also about 165 mV p-p and will change no more than 3 db over a 30-35 db input change. The audio then goes into the RX Bandpass amplifier U301D and the output of this Bandpass is fed into the Guard Tone detector which turns on the busy light and depending on how the unit is programmed can activate the crossmute function when another unit in the same room is transmitting to prevent howling and feedback. The output of the Bandpass is also fed over to the RX notch filter U301C through a nulling pot. When the Bandpass filter has been tuned to the appropriate frequency for the desired Guard Tone (usually 2175 Hz) its output is fed through the nulling pot and R303 and R346 where it mixes with audio from R324 coming from the compressor. These two signals cancel at the summing input of Notch filter U301C thus removing the continuous Guard Tone audio leaving only the resulting voice and dialing audio to be transmitted through the volume control SR601B to the speaker amplifier. Keypad beeps are also input on this same pot to be heard out the speaker. When the handset is taken off-hook, the magnetic reed switch located inside of the handset opens it's contact which signals the microprocessor to activate transistor Q302. Activating transistor Q302 mutes the speaker amplifier. Audio from U301C is fed into ear level RP304 which drives the earpiece driver Q303B to drive the handset earpiece. There is also an ear mute transistor Q304 that allows the microprocessor to mute the earphone. There is also a jumper JP302 that feeds handset mic audio back into the earpiece for sidetone. This jumper should not be used in 4-line duplex mode. There is another jumper JP201 that feeds DTMF and paging and dialing tones into the RX audio path so that they can be heard during the dialing time.

TX Audio Output Path: Mic bias is developed with R100, R134 and R101. This provides mic bias to either the internal mic, or gooseneck mic. These are all electret type mics. When using the internal mic or gooseneck mic, Q306 switches audio into the mic amp U101A where the gain is set by RP101. Q101 on the input of the mic amp kills mic audio during the High-Level function tones and dialing times. Coming out of the mic amp the audio level is approximately 200 mv peak to peak where it is fed into the compressor U102A. The audio out of it is also about 200 mv peak to peak and will change no more than 3 db over a 30-35 db input change. It is then fed into notch filter U103C and U103D. This notch filter is usually set to the standard Guard Tone of 2175 Hz and is designed to remove 2175 Hz components from the voice so that they do not mix with the 2175 tone generator and cause phase cancellation and thus momentary breaks in the Low-Level Guard Tone. The notch filter feeds into the audio mixer along with the signaling and dialing tones from the digital to analog converter. The tones and voice out of the audio mixer are presented to the TX line level pot RP202 and then to the line amplifier U201A. U201A then feeds the top winding of T201. When the line level pot RP202 is set all the way to maximum it is sufficient to drive a single phone line with up to 8 additional tone remotes to about +10 db on the high level guard tone.

The regulator has an input from a wall charger of around 16-20 volts which is passed through a auto-resettable polyswitch F601 into transient absorber TZ601, then through the volume control on/off switch SR601A to an RF bypass cap C602, across several filter caps into the input of the 13.4 volt regulator. D601 is a reverse polarity diode that will blow the auto-resettable polyswitch if the power is reversed. Powering off for one to two seconds will reset the polyswitch. The output of the 13.4 volt regulator is fed to all of the analog circuitry on the analog schematic page. U303A has a voltage divider R373 and R374 that creates the analog pseudo ground reference to all of the op amps on the analog schematic page.

Digital Circuit

There are three microprocessors on the digital schematic page. U402 controls the keypad interface and also talks to the LCD if installed. In addition it generates the keyboard beeps to the speaker amp, it controls the speaker mute when the handset is taken off-hook. Additionally, it controls the Line 2/Supervisor to the line relay on the analog page.

Microprocessor U401 generates the Guard Tone, function tones and signaling tones on its B0-B7 port. These tones are fed into U405 the DAC output over to the analog page. U401 also controls PTT disable, PTT mic enable and ear mute. Both of these microprocessors get their voltage from 5-volt regulator U601.

Microprocessor U403 controls the printer option U404 and decodes the high and low level guard tone, as well as the function tones.

Microprocessor U407 is the real time clock chip with battery back-up if installed.

TECHNICAL NOTES

No technical notes are available at this time.

MIDIAN CONTACT INFORMATION

MIDIAN ELECTRONICS, INC.
2302 East 22nd Street
Tucson, Arizona 85713 USA

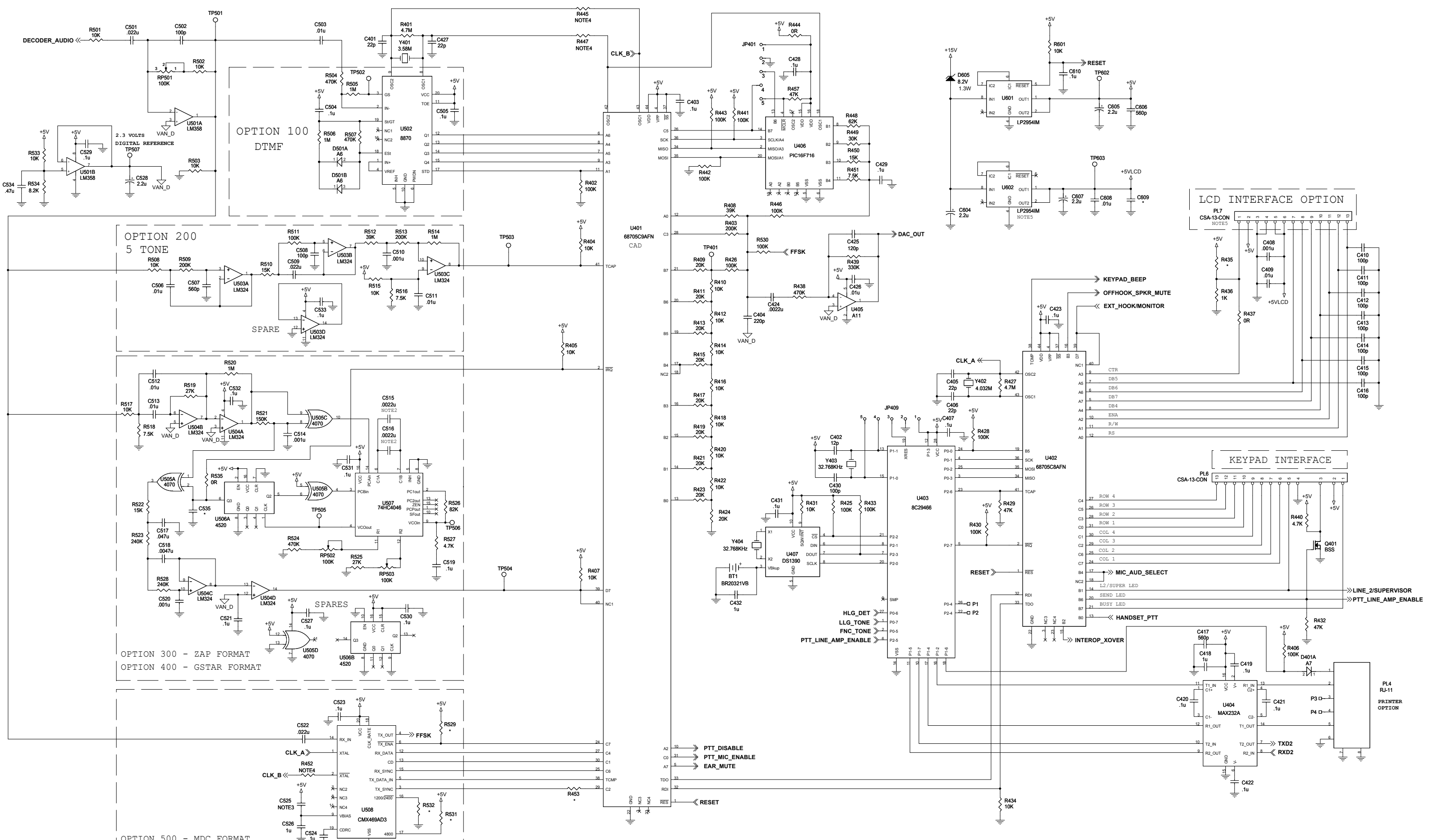
Toll-Free: 1-800-MIDIANS

Main: 520-884-7981

E-mail: sales@midians.com

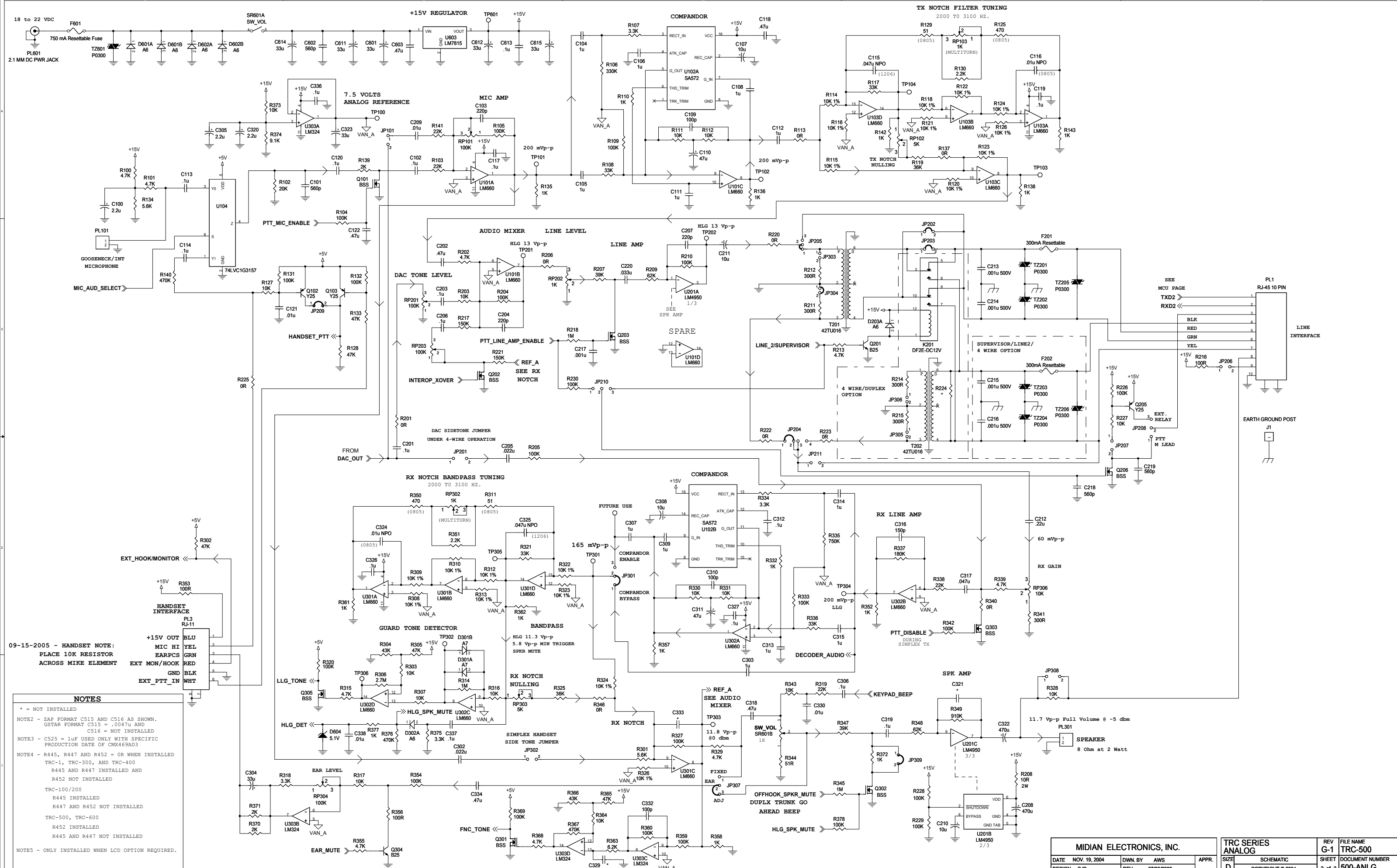
Web: www.midians.com

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FOR NOTE INFORMATION, PLEASE SEE ANALOG PAGE.

MIDIAN ELECTRONICS, INC.		TRC SERIES		REV G-1	FILE NAME
DATE NOV. 16, 2004	DWN BY AWS	APPR.	MCU	SIZE	TRC-500
DESIGN CJS	REV. 07/06/2008		D	SHEET	DOCUMENT NUMBER
				1 of 2	500-MCU

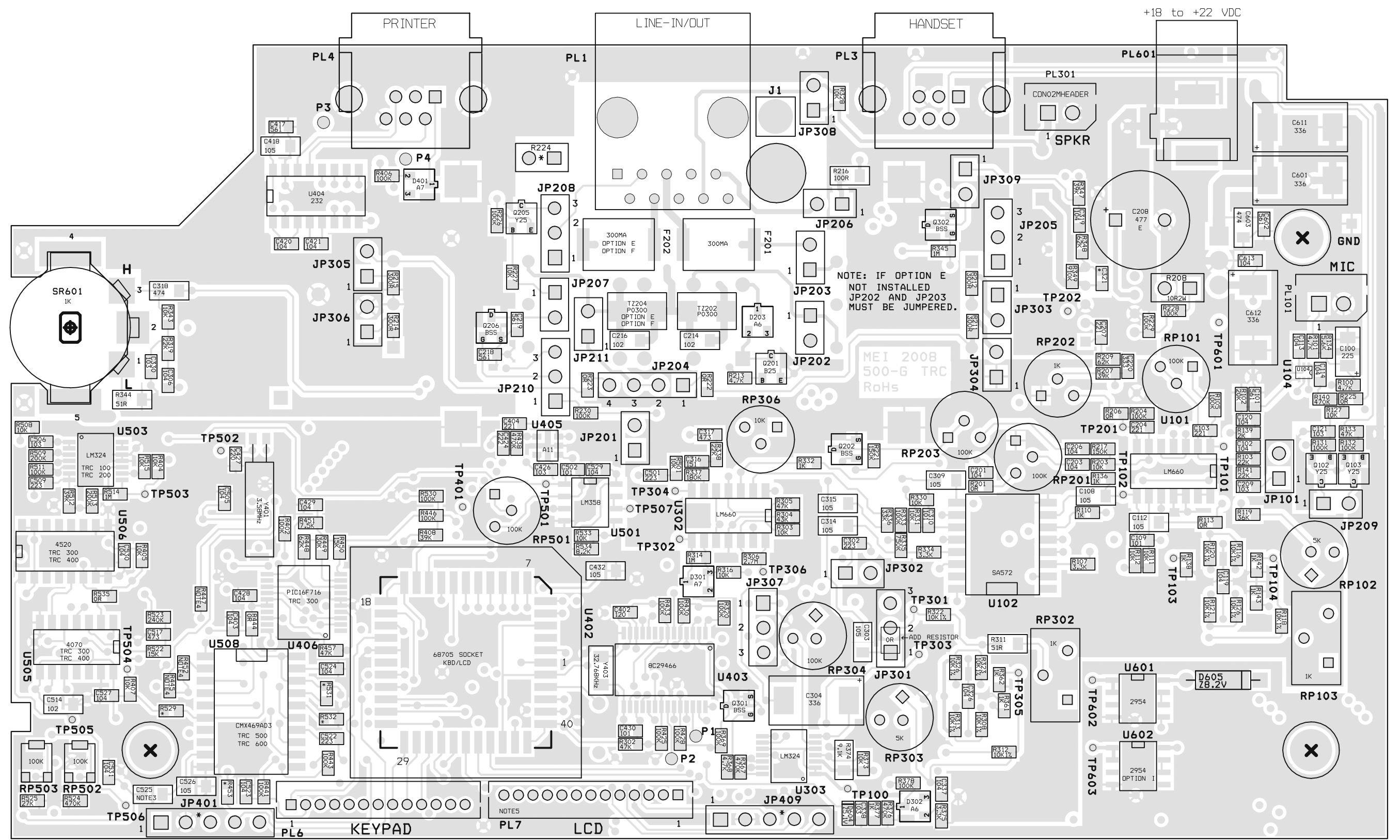


09-15-2005 - HANDSET NOTE:
 PLACE 10K RESISTOR
 ACROSS MIKE ELEMENT

BLU +15V OUT
 YEL MIC HI
 GRN EARPCS
 RED EXT MON/HOOK
 BLK GND
 WHT EXT_PTT_IN

- NOTES**
- * = NOT INSTALLED
 - NOTE2 - ZAP FORMAT C515 AND C516 AS SHOWN. GSTAR FORMAT C515 = .0047u AND C516 = NOT INSTALLED
 - NOTE3 - C525 = 1uF USED ONLY WITH SPECIFIC PRODUCTION DATE OF CMX469AD3
 - NOTE4 - R445, R447 AND R452 = OR WHEN INSTALLED TRC-1, TRC-300, AND TRC-400
 R445 AND R447 INSTALLED AND R452 NOT INSTALLED
 TRC-100/200
 R445 INSTALLED
 R447 AND R452 NOT INSTALLED
 TRC-500, TRC-600
 R452 INSTALLED
 R445 AND R447 NOT INSTALLED
 - NOTE5 - ONLY INSTALLED WHEN LCD OPTION REQUIRED.

MIDIAN ELECTRONICS, INC.		TRC SERIES ANALOG		REV G-1	FILE NAME TRC-500
		DATE NOV. 19, 2004	DOWN BY AWS	APPR.	SHEET DOCUMENT NUMBER
DESIGN CJS	REV. 07/06/2008	D SCHEMATIC		2 of 2 500-ANLG	



TRC 300
INSTALL U406 = PIC16F716

WHEN INSTALLED R445, R447
AND R452 = 0 OHMS

TRC 100/200/1000 (NOTE4)
R445 INSTALLED
R447 AND R452 NOT INSTALLED

TRC 1/300/400 (NOTE4)
R445 AND R447 INSTALLED
R452 NOT INSTALLED

TRC 500/600 (NOTE4)
R452 INSTALLED
R445 AND R447 NOT INSTALLED

NOTE: IF OPTION E
NOT INSTALLED
JP202 AND JP203
MUST BE JUMPERED.

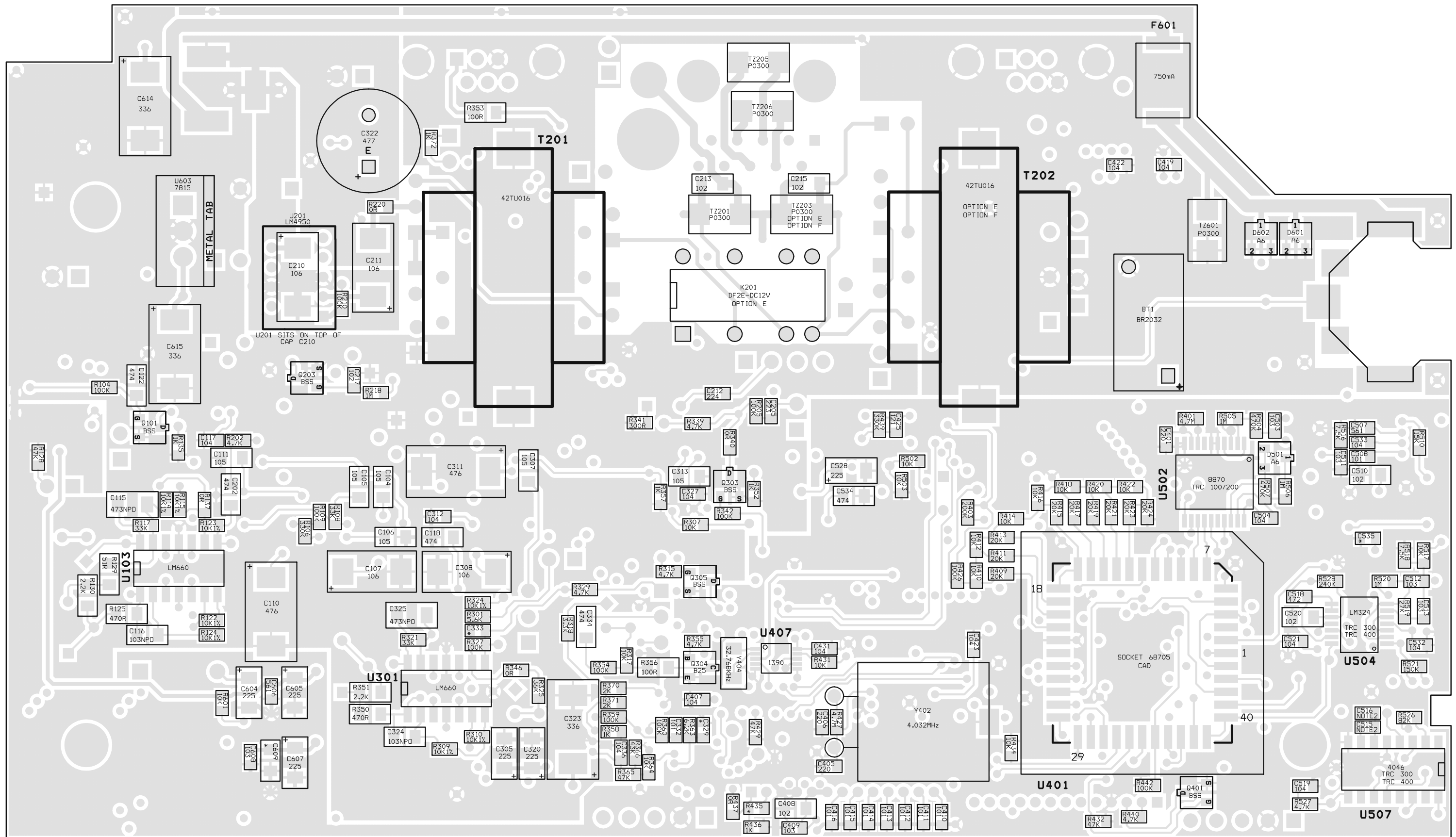
* = NOT INSTALLED

TRC 500/600 (NOTE3)
TESTING ADDS C525 = 1UF(105)
ONLY IF EXCESSIVE CHATTER
EXISTS ON U508

MIDIAN ELECTRONICS, INC.		
DATE: 12/21/2004	DWN. BY: AWS	APPR.
DESIGN: CJS	REV. 07/06/2008	

TRC-SERIES	REV G-1	PROJECT NAME PRJ_500_TRC
COMPONENT	SHEET 1 of 2	DOCUMENT NUMBER 500-G
COPYRIGHT 2008		

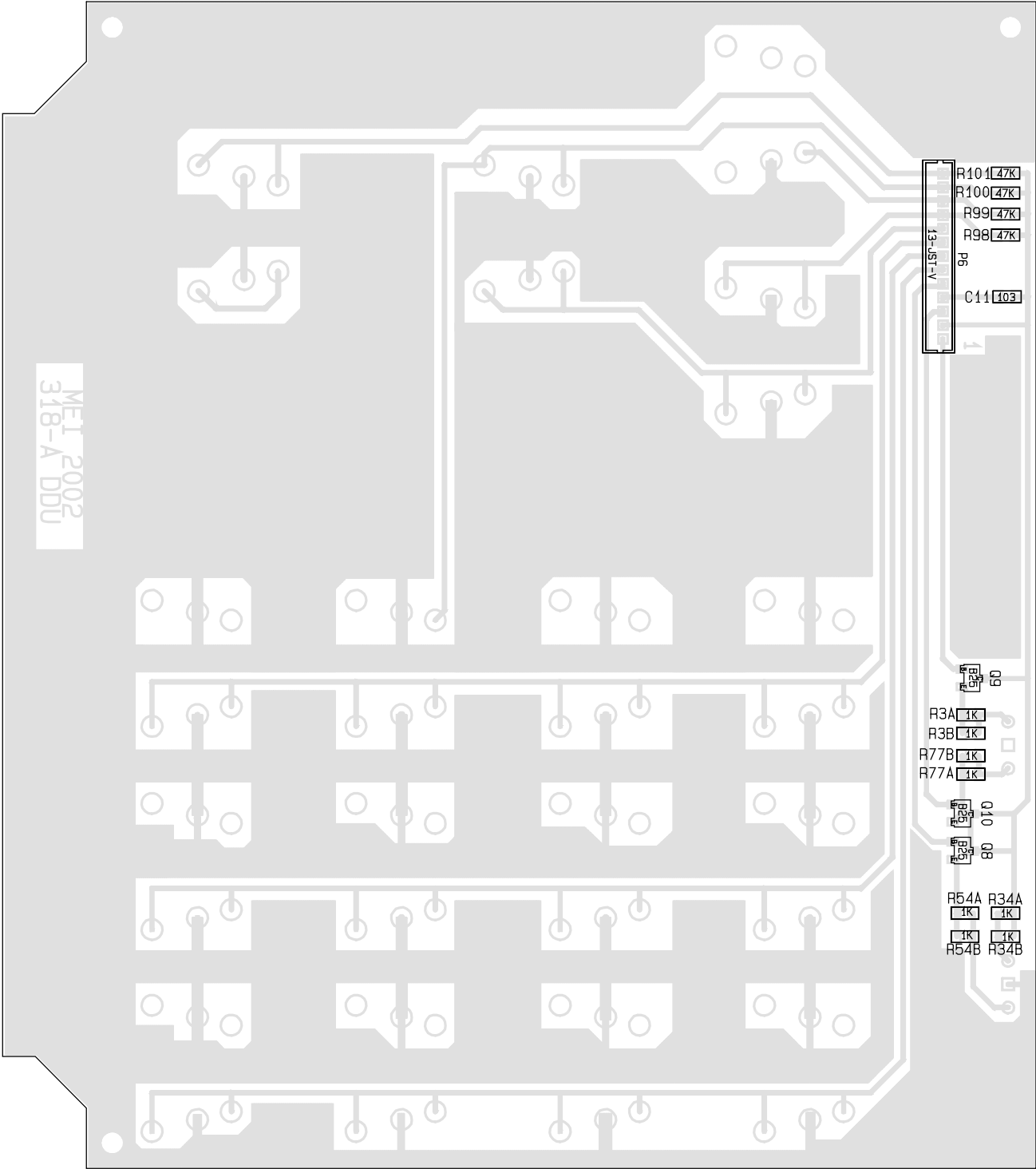
TRC1 (NOTE 5)
HAS NO LCD DISPLAY UNLESS
OPTION I IS ORDERED



MIDIAN ELECTRONICS, INC.		
DATE: 12/21/2004	DWN. BY: AWS	APPR.
DESIGN: CJS	REV. 07/06/2008	

TRC-SERIES	REV	PROJECT NAME
SOLDER	G-1	PRJ_500_TRC
COPYRIGHT 2008	SHEET	DOCUMENT NUMBER
	2 of 2	500-G

* = NOT INSTALLED
 TRC 300 (NOTE2)
 INSTALL C515 & C516
 WITH .0022UF (222)
 TRC 400 (NOTE2)
 INSTALL C515 = .0047UF (472)
 C516 = NOT INSTALLED

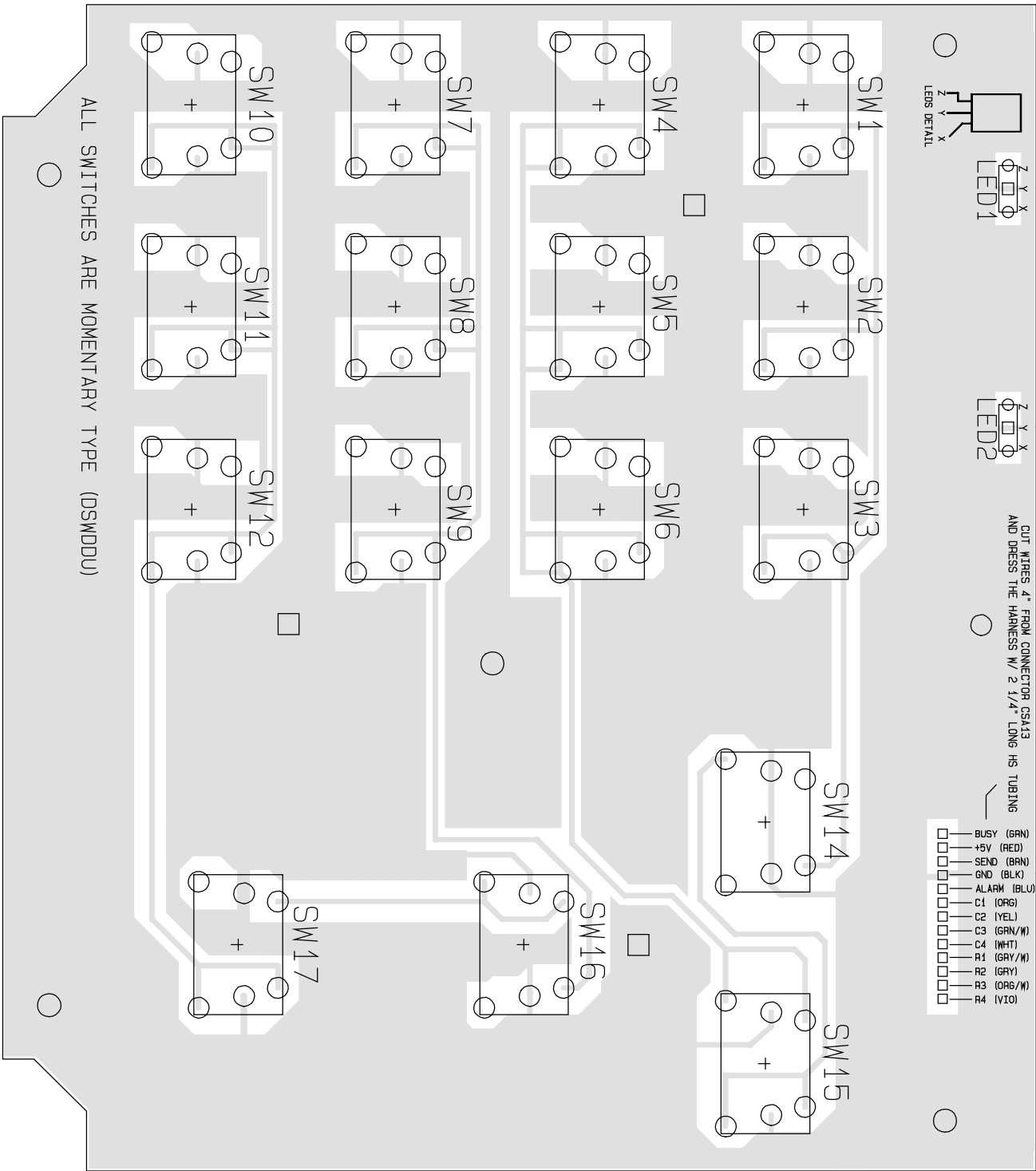


MET 2002
318-A DDU

- R101 [47K]
- R100 [47K]
- R99 [47K]
- R98 [47K]
- or
- C11 [103]
- 60
- R3A [1K]
- R3B [1K]
- R77B [1K]
- R77A [1K]
- 60
- 60
- R54A [1K]
- R54B [1K]
- R34A [1K]
- R34B [1K]

MIDIAN ELECTRONICS		MIDIAN		
DATE	MAY 2K	DWN.BY	AB	APPR.
DESIGN	CJS	REV.	FEB 16/02 AB	

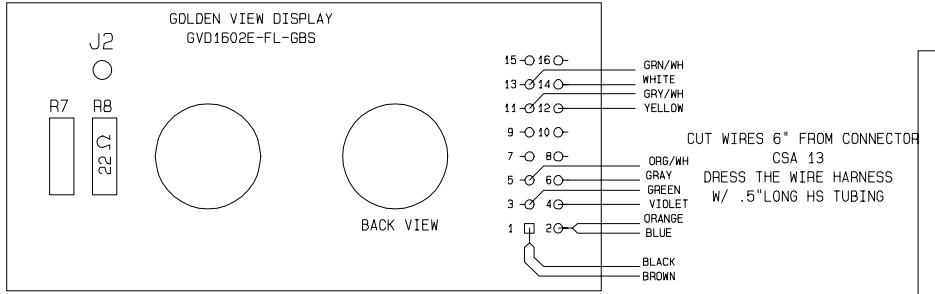
DDU SERIES		REV.	FILE NO.
PICTORIAL		B	318RB.PCB
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			318.CHP



ALL SWITCHES ARE MOMENTARY TYPE (DSWDDU)

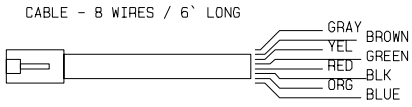
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DATE	MAY 2K	DWN.BY	AB	APPR.
DESIGN	CJS	REV.	FEB 16/02 AB	

DDU SERIES		REV.	FILE NO.
PICTORIAL		B	318RB.PCB
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			318.CHP

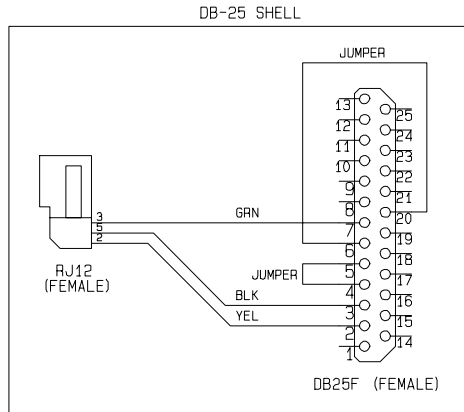
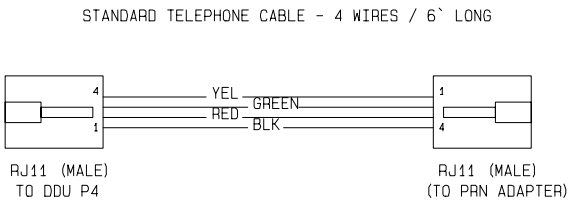


REMOVE EXISTING RES R8. REPLACE WITH 22 Ohm
INSTALL JUMPER J2 WHEN THERE IS PROVISION FOR IT.

CUT WIRES 6" FROM CONNECTOR
CSA 13
DRESS THE WIRE HARNESS
W/ .5" LONG HS TUBING



MIDIAN ELECTRONICS				DDU/PDE1 PAGING & DIALING ENCODER		REV. B	FILE NO. 318B.SCH
DATE MAY 00	DWN.BY AIB	APPR.	SCHEMATIC		SHEET	DWG.NO. 318.CHD	
DESIGN CJS	REV. APR 9/03 AB		COPYRIGHT © 2003				



NOTE: BLUE, RED AND WHITE WIRES ARE NOT USED

MIDIAN ELECTRONICS				DDU/PDE1 PAGING & DIALING ENCODER		REV. B	FILE NO. 318B.SCH
DATE 6/02	DWN.BY AIB	APPR.	SCHEMATIC		SHEET	DWG.NO. 318.CHD	
DESIGN BB	REV. APR 9/03 AB		COPYRIGHT © 2003				