

3351

VXIbus
FREQUENCY STANDARD

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PUBLICATION DATE: MAY 1994

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FOR YOUR SAFETY

Before undertaking any troubleshooting, maintenance or exploratory procedure, read carefully the **WARNING** and **CAUTION** notices.

This equipment contains voltage hazardous to human life and safety, and is capable of inflicting personal injury.

If this instrument is to be powered from the AC line (mains) through an autotransformer, ensure the common connector is connected to the neutral (earthed pole) of the power supply.

Before operating the unit, ensure the conductor (green wire) is connected to the ground (earth) conductor of the power outlet. Do not use a two-conductor extension cord or a three-prong/two-prong adaptor. This will defeat the protective feature of the third conductor in the power cord.

Maintenance and calibration procedures sometimes call for operation of the unit with power applied and protective covers removed. Read the procedures and heed warnings to avoid "live" circuit points.

Before operating this instrument:

1. Ensure the instrument is configured to operate on the voltage at the power source. See Installation Section.
2. Ensure the proper fuse is in place for the power source to operate.
3. Ensure all other devices connected to or in proximity to this instrument are properly grounded or connected to the protective third-wire earth ground.

If the instrument:

- fails to operate satisfactorily
- shows visible damage
- has been stored under unfavorable conditions
- has sustained stress

Do not operate until performance is checked by qualified personnel.

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1.1 INTRODUCTION

The Racal Instruments Model 3351 Frequency Standards are VXibus compatible modules offering three precision frequency outputs derived from an internal frequency standard. The 3351E contains an oven-controlled ultra-high stability oscillator, and the 3351R contains a Rubidium Frequency Standard.

The 3351 provides output status information to the Slot 0 System Resource Manager of a VXibus compatible mainframe. No control of the 3351 by the VXibus is provided. The 3351 conforms to VXibus System Specification Revision 1.4.

1.2 FEATURES AND CAPABILITIES

- The 3351R and 3351E provide 1 MHz, 5 MHz and 10 MHz sinusoidal outputs with an amplitude of approximately $1.0V_{RMS}$ across a 50Ω load.
- The standard configuration is 10 MHz on Channel 1, 5 MHz on Channel 2 and 1 MHz on Channel 3. Other combinations can be provided by special order.
- The outputs are short circuit proof and are available at front panel mounted BNC connectors.
- A green LED indicator adjacent to each output BNC glows when an output signal is present, and extinguishes if an output fails.
- A green LOCK MONITOR LED on the 3351R front panel indicates when the Rubidium Standard oscillator is under atomic resonance control.
- An interrupt signal is provided to the VXibus if an output failure occurs, or the Rubidium Standard is not in its "Lock" condition.

1.3 OPTIONS

1.3.1 Option 01 (1 PPS Output)

Channel 3 output can be replaced with Option 01, a 1 PPS TTL compatible output. A positive going pulse of approximately 200mS in duration, synchronized with the internal frequency standard, is provided. The indicator LED flashes for each occurrence of the output pulse. In the absence of an output pulse, the LED stops flashing, but no error indication is provided to the VXIbus.

1.4 SPECIFICATIONS

Output Characteristics

| | |
|------------------------------|--|
| Number of Outputs | Three |
| Sinewave Frequencies | 1 MHz, 5 MHz and 10 MHz. The standard configuration is 10 MHz on Channel 1, 5 MHz on Channel 2 and 1 MHz on Channel 3. |
| Level | 0.9V to 1.25V _{RMS} across 50Ω |
| Impedance | 50Ω nominal |
| Protection | Each output will withstand a continuous short circuit and application of reverse power up to 500 mW |
| Connectors | Front panel mounted BNC Connectors |
| 1 PPS Output | TTL output (74LS) V _{Hmin} 2.7V, -400 μA V _{Lmax} 0.4V, 4 mA Pulsewidth 200 mS |
| Frequency Accuracy/Stability | All outputs are derived from an internal frequency standard; an oven-controlled ultra-high stability oscillator (Model 3351E) or a Rubidium Frequency Standard (Model 3351R). (See Specifications under 3351E Frequency Characteristics and 3351R Frequency Characteristics) |

3351E Frequency Characteristics

| | |
|----------------------|--|
| Adjustment Range | Coarse and fine screwdriver operated trimmers accessible through side of module |
| Coarse | $\pm 1 \times 10^{-6}$ minimum |
| Fine | 1×10^{-7} minimum range |
| Setability | 1×10^{-9} |
| Stability | $\leq 5 \times 10^{-10}$ /day at shipment averaged over 10 days |
| | $\leq 1 \times 10^{-8}$ /month after 3 months |
| | $\leq 2 \times 10^{-7}$ in the first year |
| Retrace | $\leq 2 \times 10^{-8}$ within 30 minutes |
| | $\leq 1 \times 10^{-8}$ within 5 hours |
| Short term stability | 5×10^{-10} _{RMS} 30 min. after turn-on (1 second measurement time) 5×10^{-11} _{RMS} within 5 hours |
| Temperature | $\pm 7 \times 10^{-9}$ with respect to the frequency at 25°C |
| Harmonics | At least 30dB below the output level (50 Ω load) |

3351R Frequency Characteristics

| | |
|------------|---|
| Warmup | ≤ 4 minutes to reach 1×10^{-9} at 25°C ambient |
| Stability | $\leq 4 \times 10^{-11}$ /day after 1 hour stabilization at $25 \pm 3^\circ\text{C}$ |
| | $\leq 5 \times 10^{-11}$ /month after 1 month of continuous operation |
| Accuracy | 1×10^{-9} /year |
| Retrace | 2×10^{-11} after 1 hour power on at 25°C and up to 48 hours power off |
| Trim Range | $\pm 1 \times 10^{-9}$ minimum Screwdriver operated trimmer accessible through side cover of module. |

| | |
|--------------------|--|
| Setting Resolution | 1 x 10 ⁻¹¹ |
| Harmonics | At least 28dB below the output level (50 Ω load) |

General

| | |
|--------|---------------------------------------|
| Size | VXIbus C-size, 2 slots, message-based |
| Weight | 6 pounds, maximum |

Temperature Performance

| | |
|-----------------------------|----------------|
| 3351E Operating Temperature | 0°C to + 50°C |
| 3351R Operating Temperature | -0°C to +55°C |
| Storage Temperature | -40°C to +70°C |

Power Requirements

| | |
|-------|---|
| 3351E | +5V:3.0A -24V:0.1A +5VSTDBY:0.75A |
|-------|---|

| | |
|-------|------------------------------------|
| 3351R | +24V:2.0A +5V:2.3A -24V:0.1A |
|-------|------------------------------------|

| | |
|----------------------|--------------------------------------|
| Cooling Requirements | 4.0 Liters at 0.5mm H ₂ O |
|----------------------|--------------------------------------|

Options

| | |
|-----------|--|
| Option 01 | 1 PPS Output TTL compatible (Replaces one standard output) |
|-----------|--|

VXibus Compatibility

| | |
|----------------------------|--|
| VXibus | 1.4, Message-based module Dual Slot, C-sized |
| Manufacturer's I.D. Number | 4091 (Racal Instruments Inc.) The Model Number is 3351. |

1.5 SAFETY

Refer to: **"FOR YOUR SAFETY"** page preceding the Table of Contents. Follow all **NOTES, CAUTIONS AND WARNINGS** to ensure personal safety and prevent damage to the instrument.

1.6 PRODUCT SUPPORT

Racal Instruments supports the Model 3351 with Product Engineering, Service and Parts Departments. A complete listing of service centers and field representatives is provided on the last two pages of this manual.

2.1 INTRODUCTION

This section describes the unpacking and inspection, reshipment, installation and environmental requirements of the Model 3351.

2.2 UNPACKING AND INSPECTION

1. Prior to unpacking, check the shipping carton exterior for any signs of damage. Note all irregularities on the shipping bill.
2. Remove the instrument and preserve the packaging.
3. Inspect the instrument for defects or damage. Immediately notify the carrier if damage is apparent.
4. Before use, have qualified personnel perform a safety check.

2.3 RESHIPMENT INSTRUCTIONS

1. Use the original packaging when returning the 3351 to Racal Instruments for calibration or servicing. The original shipping carton and packaging will provide support for safe reshipment.
2. Wrap the module in plastic sheeting and use plastic spray foam to surround and protect the instrument if original packaging is not available.
3. Reship in the original or a new carton.

2.4 LOGICAL ADDRESS SETTING

The Logical Address is settable via an 8-position DIP switch on the Interface daughter card. Carry out the following procedure when changing the Logical Address.

1. Remove the 16 flathead screws that secure the right side cover (as viewed from the front). Remove the cover from the module and expose the Interface daughter card at the rear of the module.

2. To set the Logical Address, set switch S1 on the Interface daughter card to the binary equivalent of the logical address selected. Logical addresses between 1 and 255 (FF_{HEX}) are permitted. The OFF switch positions on S1 correspond to binary 1. The 3351 is shipped from the factory with the logical address set to 03.
3. Replace and secure the cover using the 16 flathead screws.

2.5 VXIBUS INTERRUPT HANDLER SETTING

One programmable interrupt line is provided on the 3351 module. This line is assigned by using the assign interrupter line word serial protocol command (See page 183 in Rev. 1.4 of the VXibus Specifications). The interrupt level is set to 1 at the factory.

2.6 STANDBY POWER

When the warmup period required to obtain a specified frequency accuracy cannot be provided, or the best long term stability is required, a standby power source must be applied during periods when VXibus system power is shut down.

2.6.1 3351E Standby Power

Standby power for the 3351 is provided by a +5V STDBY power supply connected to the VXibus system connector, P1. The oven-controlled oscillator and frequency multiplier PCB require a peak current (during warmup) of 750 mA, and approximately 350 mA after warmup at an ambient temperature of +35°C. A relay internal to the 3351 automatically switches oscillator power to the +5V STDBY line when normal +5 VDC VXibus power is shutdown.

2.6.2 3351R Standby Power

Standby power for the Rubidium Frequency Standard is +24V DC nominal (23 VDC-30 VDC). A 2-pin (twin ax) front panel connector is provided to connect an external power source to the rubidium oscillator when normal +24 VDC VXibus power is shutdown. A peak current of 2.0 A is required during warmup, and approximately 420 mA after warmup at an ambient temperature of +25°C. Isolation diodes in the 3351 automatically switch the Rubidium Frequency Standard to standby power when normal +24 VDC VXibus power is shut down, and protects the rubidium standard from an accidental reverse application of 24V standby power.

CAUTION

Observe proper voltage polarity and amplitude when applying 24 DC standby voltage. The positive terminal is on the right-hand when viewing the module from the front. The left-hand terminal is ground.

2.7 OUTPUT GROUNDING

The 3351 is shipped from Racal Instruments with the ground side of each output connected to the ground plane via soldered jumpers, W7, W8 and W9 on the printed circuit board. W7 connects Channel 1 to ground, W8 connects Channel 2 to ground, and W9 connects Channel 3 to ground. The outputs can be isolated from the ground plane and each other by removing W7, W8 and W9. Removal of these jumpers allows independent or common grounding of the outputs at the load.

WARNING

Removal of W7, W8 or W9 can create a potential shock hazard. If a difference of potential exists between the VXIbus ground and the ground or low side of the load, this potential will be present on the metal shell of the BNC output connector.

2.8 INSTALLATION

Prior to installation, inspect the module. Pay particular attention to connectors P1 and P2 on the rear of the module to ensure there are no bent, damaged or missing pins on any connectors. Repair damage before proceeding.

To install the Model 3351 in a C-size VXIbus mainframe, use the following procedure:

1. Verify that the 3351 has rear connector P1 oriented to mate with the corresponding connector on the mainframe backplane.
2. Align the 3351 with the guides for the slot selected, and slide the 3351 into the mainframe using a firm even pressure. Push the module home to connect the 3351 to the mainframe.

NOTE

Poor mechanical alignment of rear connectors P1 and P2 may require the 3351 to be reseated in the VXIbus mainframe. Do NOT use undue force to seat the module.

3. Secure the 3351 to the mainframe with the captive screws from the front panel.
4. To remove the 3351 from the VXIbus mainframe, power down the mainframe and release the captive screws. Use the plastic levers on the top and bottom edges to eject the 3351. Pull the module along the guides provided, and out of the mainframe.

3.1 INTRODUCTION

This section defines the front panel features and the power-up procedure.

3.2 FRONT PANEL FEATURES

| <u>Reference</u> | <u>Item</u> | <u>Description</u> |
|------------------|--|---|
| 1 | FAIL LED | Glows RED during power-up self-test, and is extinguished upon successful completion. |
| 2 | Output LED | Separate output indicator for each channel. Glows GREEN when a signal is present at the corresponding Channel output connector. |
| 3 | Output BNC Connector | Each BNC connector provides a sinusoidal output at a frequency of 1, 5 or 10MHz, synchronized to an internal Frequency Standard. (Optional 1 PPS available on channel 3.) |
| 4 | +24 VDC Standby Voltage Input Connect (3351R only) | Two-pin connector for external 24 VDC standby voltage to Rubidium Frequency Standard. Left-hand pin is ground. Right-hand pin accepts +24 VDC. |
| 5 | Rubidium Standard Lock Monitor LED (3351 only) | Glows GREEN when the oscillator in the Rubidium Frequency Standard is under atomic resonance control. Normally occurs approximately four minutes after power-up. LED does not function when normal VXI power is OFF and external 24 VDC standby voltage is powering the Rubidium Standard. |

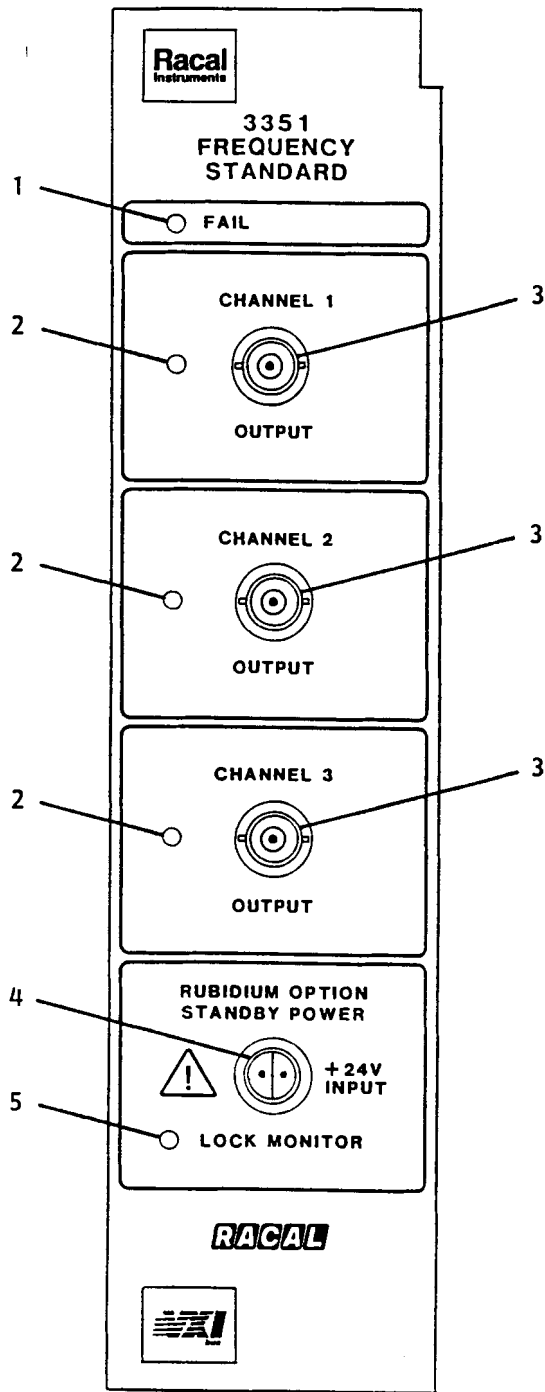


Figure 3-1, Front Panel Features

POWER-ON INITIALIZATION, SELF-TEST AND FREQUENCY LOCK

During power-on, the interface waits up to four seconds for the BLOCK/ERROR* signal to go high. If the BLOCK/ERROR* signal does not go high within four seconds, the interface continues with an orderly power-up but generates an interrupt. If the BLOCK/ERROR* signal goes high during power-on, a normal power-up occurs and no interrupt is generated.

An interrupt is generated when the BLOCK/ERROR* signal changes from high to low. This occurs when lock is lost or when no output signal is detected. The interrupt STATUS/ID word generated is "01xx" (in hex), where xx is the logical address of the instrument.

An interrupt also is generated when the BLOCK/ERROR* signal changes from low to high. This occurs when lock is regained or when the output signal is again detected. The interrupt STATUS/ID word generated is "02xx" (in hex), where xx is the logical address of the 3351.

NOTE

These interrupts are user defined EVENTS 1 and 2. See Appendix E.4 in Revision 1.3 of the VXibus specification. These EVENTS can be enabled and disabled using the word serial command "Control Event". See Control Event in Appendix E.1 in Revision 1.4 of the VXibus Specification for further information.

3.4 SOFTWARE COMMANDS

The 3351 is a VXibus message-based module which uses Word Serial Protocol to communicate status and error information to the Resource Manager.

3.4.1 CAL(*string*);

Syntax: CAL(*string*);

Definition: This command saves any printable *ASCII string* into non-volatile memory. Although it is intended for storing calibration information, it can store any string. For example, it can store the date calibration was last done, and who performed the calibration. The command line is limited to 99 characters. This effectively limits the *string* to 91 characters.

Example 1:

CAL("02/27/91"); stores the date 02/27/91 into non-volatile memory.

NOTE

This string can be enclosed in either single or double quotes. This allows the other mark to be used in the string.

Example 2:

CAL("Station one's standard");

Example 3:

CAL('Station "ONE" standard');

3.4.2 CAL?();

Syntax: CAL?();

Definition: This command recalls the string stored in non-volatile memory. An EOI is returned with the last character of the string.

NOTE

If CAL(""); is sent (i.e., no space between""), a null string is stored. When a null string is recalled, the 3351 software will actually return a space with the EOI.

3.4.3 STATE?();

Syntax: STATE?();

Definition: This command returns the current state of the BLOCK/ERROR* signal. A "1" is returned if the 3351 is in lock and no error is detected. A "0" is returned if the 3351 is not in lock or an error is detected. An EOI is returned with the result.

POWER-UP

1. Power-up the mainframe. Ensure the **FAIL LED** on the front panel lights and then extinguishes after a few seconds to show the module has passed its power-up self-test.
2. Verify the green **LED** output indicators are **ON** to indicate the presence of an output signal. If Option 01 is installed (1 PPS Output), the Channel 3 output **LED** will light momentarily each time an output pulse is present.
3. If the module is a 3351R, ensure the green Lock Monitor **LED** lights after approximately four minutes of operation. If the module is a 3351E, the Lock Monitor **LED** will remain off. The 3351 is now ready for use.

4.1 INTRODUCTION

This section contains the theory of operation for the Model 3351 based on block diagrams shown in Figures 4-1 and 4-2, and the schematics found in Section 6 of this manual.

When an integrated circuit package contains more than one circuit, suffix letters are used to distinguish them (e.g. UIA). If it is necessary to identify a specific pin of an IC, the reference designator with a suffix letter is followed by a hyphen and then the pin number (e.g. UIA-7).

4.2 FUNCTIONAL BLOCKS

The 3351 contains two major functional blocks.

- Frequency Generation/Distribution
- Error Detection

4.2.1 Frequency Generation/Distribution

The frequency generation/distribution block (Figure 4-1) contains either a Rubidium Frequency Standard (3351R) or Ovenized Oscillator (3351E), signal conditioning, frequency dividers, filters, three output amplifiers, error detection circuits, power supply filters and -15VDC regulator. The frequency standard outputs are 10 MHz sinusoids which are passed through a signal conditioning section for conversion to TTL logic levels required by the 2 and 10 frequency dividers. The resulting 10, 5 and 1 MHz TTL level signals are applied to low-pass filters to remove all frequency components except the fundamental, and provide low distortion sinusoidal inputs for the output amplifiers. Any one of the three frequencies available at J6-J14 can be connected to an output amplifier via a soldered coaxial cable. The three output amplifiers are identical, each consisting of a cascade connected wideband amplifier with a transformer coupled output. The overall gain of each amplifier is approximately 7 when loaded with 50 Ω . The outputs at J18-J20 are routed to front panel BNC connectors with coaxial cables.

4.2.2 Error Detection

The error detection block (Figure 4-2) monitors the output signal amplitude at the primary of each output transformer, and provides a TTL logic output to the controller board if an output amplitude drops below a specified level. (See Figure 4-2). The 3351R error detection circuit also includes an RLOCK signal from the

rubidium standard to indicate when the oscillator is operating under atomic resonance control. An output error signal is generated whenever the rubidium standard is not in a "LOCK" condition.

The 1 PPS output option replaces the output on CHANNEL 3, and is discussed in Section 4.8.

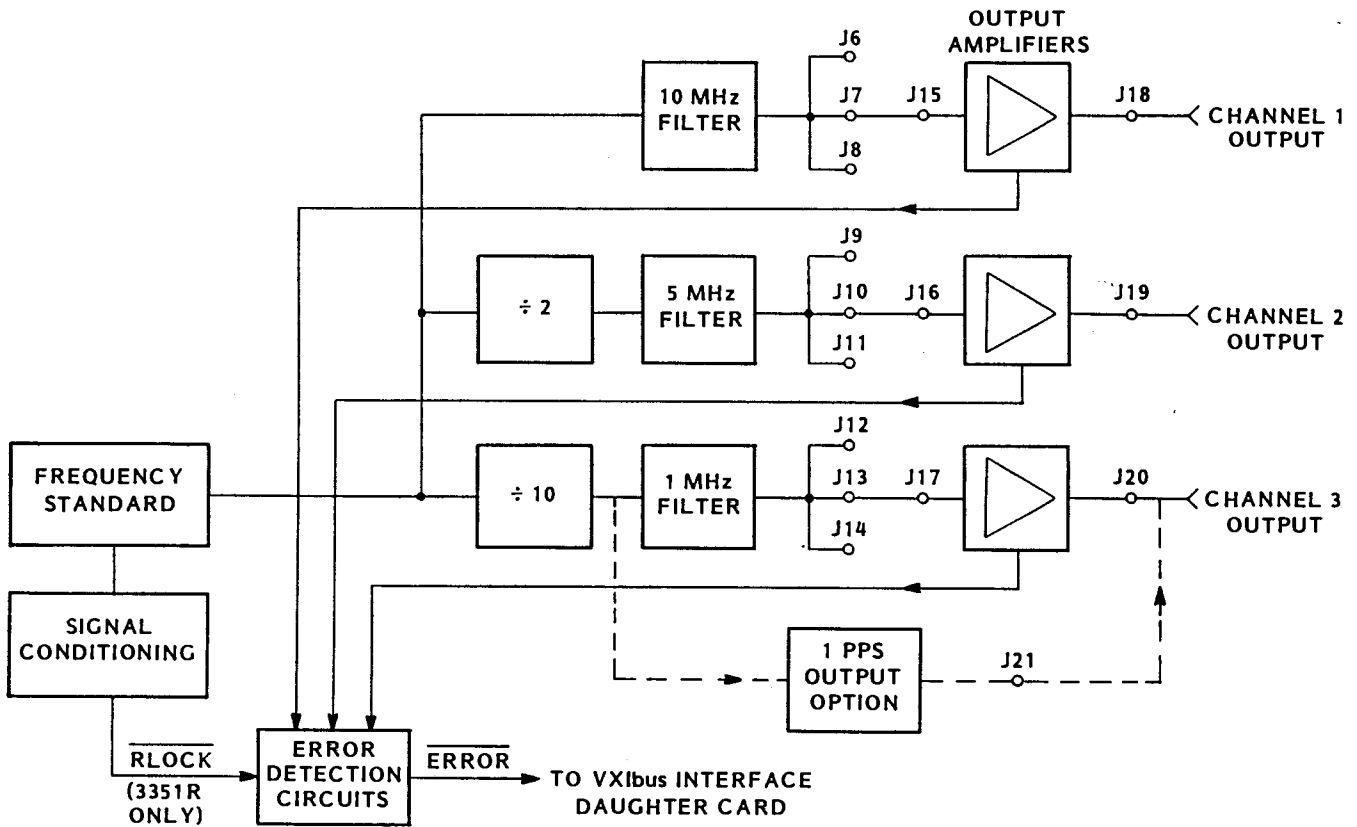


Figure 4-1, Frequency Generation/Distribution Block Diagram

4.3

POWER SUPPLIES

DC power is supplied to the 3351 by the VXIbus backplane. +5V and -24V are used by both versions of the 3351; +24VDC is required by the rubidium standard in the 3351R, and +5V STDBY by the oven-controlled oscillator in the 3351E (Table 4.1).

Table 4.1, Power Supplies

| POWER SUPPLIES | |
|----------------|---|
| +24VDC | Filtered by L8,L9,C22-C25 |
| -24VDC | Filtered by L11,C3,C4,C12; regulated by U2 to provide -15VDC |
| +5VDC | Filtered by L10,L12,C1,C2,C13,C14 before being used by the circuits |

4.3.1

3351E Frequency Standard

The frequency standard used in the 3351E is an oven-controlled ultra-high stability oscillator with a 5 MHz sinusoidal output. A frequency doubler circuit (see Schematic 431822) converts the oscillator output to 10 MHz. The 5 MHz oscillator/oven assembly and attached frequency multiplier circuit are powered by +5VDC from power relay K1. Filtered +5VDC is applied across the coil and to the normally open contact of K1; +5V STDBY is applied to the normally closed contact of K1. When +5V is present on the VXIbus backplane, K1 is energized and the filtered voltage is applied to the oscillator/multiplier assembly through J5/P5-1. When +5V is not present on the VXIbus backplane, K1 de-energizes and connects the +5V STDBY line from the VXIbus backplane to J5/P5-1. The 10 MHz output of the frequency multiplier circuit is applied to the input of a buffer stage (Q2) through J5/P5-4.

4.3.2

3351R Frequency Standard

The 3351R contains a Rubidium Frequency Standard with a 10 MHz sinusoidal output. The internal heater and voltage regulator for the rubidium oscillator are powered by +24VDC. +24VDC from the VXIbus backplane is filtered by L8, L9 and C22 - C25. The filtered +24VDC is applied to the rubidium standard through isolation diode CR2. +24VDC standby power is applied to the rubidium standard via a 2-pin front panel connector through isolation diode CR1. CR2 prevents the application of standby voltage to the backplane power supply. CR1 prevents the

application of backplane voltage to the +24V standby power supply and protects the rubidium standard from accidental reversal of the +24V standby voltage. The 10 MHz output of the rubidium standard is applied to the input of a buffer stage (Q2) through J22.

4.3.3 3351R Rubidium Standard Lock Monitor

The LOCK MONITOR LED (DS4), visible through a hole in the front panel, is controlled by the LOCK MONITOR output of the rubidium standard. The LOCK MONITOR output goes low approximately four minutes after +24DC power is applied to the rubidium standard, and is applied to the non-inverting input of comparator UIA through CR13. CR13 protects the input of UIA from damage when the rubidium standard is operating on standby power, and +5VDC to the comparator is off. The inverting inputs of UIA and UIB are biased to approximately +2.5V by R1 and R2. The output of UIA, RLOCK, goes to a TTL logic low level when the LOCK MONITOR output is low. RLOCK is applied to the inverting input of UIB and one input of U3A. A logic low input to UIB drives the output of UIB high, turning Q1 on and illuminating DS4. U1, DS4 and associated circuitry are still operational when the rubidium standard is not installed (i.e., Model 3351E). In this case, R9 pulls the input of U1A high, turning DS4 off and setting RLOCK high. Jumper W6 is installed in the 3351E to provide a logic high output at U3A-3, independent of the state of RLOCK.

4.4 SIGNAL CONDITIONING

4.4.1 Sinusoidal Signal

The output waveform of either frequency standard is a 10 MHz sine wave. This sinusoidal signal is capacitively coupled through C27 to an emitter-follower stage consisting of Q2, R50, R51, R55, and R56. The emitter-follower stage buffers the frequency standard output from the following stage that converts the sine wave signal to TTL logic levels.

The sinusoidal signal at the emitter of Q2 is coupled through C31 and R57 to a waveform shaping stage consisting of Q3, CR3, R58 and R59. Negative-going half cycles of the sine wave input are clipped by CR3 and turn Q3 off. Q3 is turned on during the positive excursion of the sine wave input. The waveform (at the collector of Q3) switches between approximately 0 and +5V and is applied to the input of a TTL buffer U4A. The output of U4A is coupled to other sections of U4 that further buffer the 10 MHz TTL signal prior to divide-by-2, divide-by-10 and 10 MHz filter circuits.

4.5 FREQUENCY DIVIDERS

5 MHz and 1 MHz TTL square waves are generated by dividing the 10 MHz signal by 2 and 10, respectively.

The buffered 10 MHz TTL signal is applied to the clock input of U5-B from the output of U4C. U5-B is configured to divide the 10 MHz signal to a 5 MHz square wave. The 5 MHz square wave at U5B-9 is applied to the buffered low-pass filter where it is converted to a low distortion 5 MHz sine wave.

The buffered 10 MHz TTL signal is also applied to a divide-by-10 circuit, U6, from the output of U4B. U6 is configured to provide a 1 MHz square wave at U6-12. This signal is applied to a low pass filter and converted to a low distortion 1 MHz sine wave.

4.6 1 MHz, 5 MHz, AND 10 MHz FILTERS

Low distortion sine wave signals of 1 MHz, 5 MHz and 10 MHz are derived from the TTL level signals by passing the square waves through elliptic low-pass filters. The filter outputs are then coupled to emitter-follower stages to provide low impedance distribution points for each frequency. Each filter is 3 dB down just above the fundamental frequency (1 MHz, 5 MHz or 10 MHz), and is more than 80 dB down at the 3rd harmonic.

4.7 OUTPUT DRIVER AMPLIFIERS

One of the filter outputs is routed to J15 and coupled to the base of Q14 through C93. The bases of Q14 and Q13 are biased by R151, R153 and R155 from the -15V supply. The base of Q13 is at approximately -10VDC and the base of Q14 at approximately -12.5V. The amplitude of the sine wave input to Q14 is 600-650 mV_{p-p}. This signal is amplified by Q14 and applied through R154 to the emitter of cascade transistor Q13. The signal is further amplified by Q13 and applied across the primary of output transformer T1 and R152. The signal at the secondary is coupled to the CHANNEL 1 output connector through C95 at an amplitude of approximately 1.0V RMS.

CHANNEL 2 and CHANNEL 3 output amplifiers are identical to CHANNEL 1.

4.8 OUTPUT ERROR DETECTION

The signal at the primary of T1 is coupled through C138 to a voltage doubling detector consisting of R158, CR4, CR5, C97 and R194. A positive DC voltage appears across C97 and R194 when an output signal is present at the primary of T1. The detected voltage is compared with a reference voltage VR of

approximately 1.6V derived from the +5V supply and voltage divider R16 and R17. The comparison is made by comparator U7C. When there is adequate signal at the primary of T1, the comparator output is held low, and current is supplied to front panel LED indicator, DS1, through limiting resistor R5.

CHANNEL 2 and CHANNEL 3 output detectors are identical to CHANNEL 1.

4.8.1 Outputs

The outputs of U7C, U7B and U7A are routed to one input of U7D via the wired-OR gate consisting of CR10-12. If the signal level at the primary of T1, T2 or T3 drops below a specified amplitude, the voltage at the input of U7D is pulled below the reference voltage on U7D-11, and the output of U7D is held low providing an output error signal OPERROR to one input of NAND Gate U3B. The other input to U3B is RLOCK from U3A-3.

4.8.2 RLOCK

The RLOCK signal from the rubidium standard (3351R) or a fixed logic 1 from the 3351E is combined with the OPERROR signal at U3B. If either signal goes low, the output of U3B goes high turning Q19 on and providing an error signal, ERROR, to the controller board. This error signal generates an interrupt signal at the VXibus backplane.

4.9 1 PPS OUTPUT (OPTION 01)

The 1 PPS output replaces the normal output on Channel 3, and consists of three cascaded dual decade counters, U8, U9 and U10. The clock pulse input of one half of U8 is a 1 MHz square wave from the output of divide-by-ten counter U6, and is connected via jumper W5. The 1 MHz input is divided by 10^6 through U8, U9 and U10 and the final output appears at U10⁻⁹ as a 200 mS TTL level pulse that repeats at a 1 Hz rate. The 1 PPS output is routed to the CHANNEL 3 output connector and to U3D-13. The output of U3D is connected to CHANNEL 3 output LED (DS3) through jumper W2. Jumper W4 is also installed to disable one input of the diode OR-gate controlling comparator U7-D. Thus, a failure of the 1 PPS output will not cause an output error signal OPERROR at U7D-13. Jumpers W1 and W3 are removed from the circuit to disconnect the CHANNEL 3 output detector (U7A) from DS3 and CR10.

5.1 INTRODUCTION

This section contains information and procedures to verify performance of the 3351, and to adjust the internal frequency standard.

5.2 TEST EQUIPMENT REQUIRED

Test equipment required is listed in Table 5.1. Suggested models are recommended, but other instruments having the required specifications may be substituted.

Table 5.1, Test Equipment Required

| Equipment Type/Suggested Model | Required Parameters |
|---|---|
| RF Millivoltmeter/Racal Instruments 9303 | To measure $1.00V_{RMS}$ nominal at 1 MHz, 5 MHz and 10 MHz. Input Impedance 50Ω . |
| Spectrum Analyzer/Hewlett-Packard 8568 | Resolution sinewave outputs bandwidth 1 kHz to 100 kHz. To measure relative power levels in the range from +15 dBm to -60 dBm over a frequency range from DC to 100 MHz for sinewave outputs. |
| Frequency Standard/Racal Instruments 9480/FRK | Rubidium Oscillator 10 MHz output, $1V_{RMS}$ nominal, ± 5 parts in 10^{11} accuracy to calibrate Rubidium Oscillator. |
| Frequency Standard/Racal Instruments 9480/FRS | Rubidium Vapor Frequency Standard, 10 MHz output, $1V_{RMS}$ nominal, ± 1 part in 10^{10} accuracy to calibrate ovenized standard. |
| Frequency Counter/Racal Instruments 2251 | To measure 1 MHz, 5 MHz and 10 MHz at a level of $1V_{RMS}$ with 1 part in 10^{10} resolution. |
| Digitizing Oscilloscope/Hewlett-Packard 54502 | To measure amplitude and pulsewidth of 5V 1 PPS signal. |
| BNC Adapters and Connectors (as required) | ----- |
| 50Ω Load | BNC, with feedthrough for monitor |
| 50Ω Coaxial Cables | BNC-to-BNC, various lengths |

5.3 PERFORMANCE VERIFICATION TESTS

5.3.1 Output Level and Frequency

1. Connect the RF Millivoltmeter and Frequency Counter to monitor the CHANNEL 1 output and provide a 50Ω load.
2. Verify the output level on the millivoltmeter is between 0.9V and 1.25V, and the frequency is 1 MHz, 5 MHz or 10 MHz within 1 part in 10⁹, as determined by the internal wiring of the 3351.
3. Repeat the above procedures for CHANNEL 2 and CHANNEL 3 outputs.

5.3.2 Harmonic Distortion

1. Connect the Spectrum Analyzer to one of the outputs.
2. Set the Spectrum Analyzer to the conditions given in Table 5.2 relating to the output frequency of the channel being tested.
3. Ensure all harmonic signals are at least 30 dB below the 3351E output level (28 dB below the 3351R output level). The frequency span can be increased to observe higher harmonics.
4. Repeat the above procedures for other outputs.

Table 5.2, Spectrum Analyzer Settings (Harmonic Test)

| Spectrum Analyzer Setting | 3351 Output Frequency | | |
|---------------------------|-----------------------|--------|---------|
| | 1 MHz | 5 MHz | 10 MHz |
| Video BW | 3 kHz | 3 kHz | 3 kHz |
| Resolution BW | 10 kHz | 30 kHz | 100 kHz |
| Frequency Span | 10 MHz | 50 MHz | 100 MHz |
| Center Frequency | 1 MHz | 5 MHz | 10 MHz |
| Reference Level | 13 dBm | 13 dBm | 13 dBm |
| Input Attenuator | 30 dB | 30 dB | 30 dB |

5.4

SPURIOUS OUTPUTS

1. Connect the Spectrum Analyzer to one of the outputs.
2. Set the Spectrum Analyzer to the conditions given in Table 5.3 relating to the output frequency of the channel being tested.
3. Ensure all spurious signals displayed are at least -65 dB below the output level.

Table 5.3, Spectrum Analyzer Settings (Spurious Test)

| Spectrum Analyzer Setting | 3351 Output Frequency | | |
|---------------------------|-----------------------|--------|--------|
| | 1 MHz | 5 MHz | 10 MHz |
| Video BW | 1 kHz | 3 kHz | 3 kHz |
| Resolution BW | 1 kHz | 30 kHz | 30 kHz |
| Frequency Span | 1 MHz | 5 MHz | 10 MHz |
| Center Frequency | 1 MHz | 5 MHz | 10 MHz |
| Reference Level | 13 dBm | 13 dBm | 13 dBm |
| Input Attenuator | 30 dB | 30 dB | 30 dB |

5.5

Calibration

5.5.1

Internal Frequency Standard Adjustment

1. Prior to calibration, the 3351 must be in continuous operation for 24 hours at an ambient temperature of $25 \pm 2^{\circ}\text{C}$.
2. Prior to calibration of the 3351E, remove the large slotted head screws covering the access holes to the COARSE and FINE frequency adjustment trimmers on the oscillator. It will only be necessary to remove the screw covering the FINE adjustment, in most cases. These screws are accessible through a hole in the side of the module.
3. Connect the master frequency standard (9480/FRK for 3351R calibration and 9480/FRS for 3351E) to the EXT STD INPUT of the 2251 Frequency Counter.

4. Connect the 3351 10 MHz output to INPUT A of the 2251.

5. Program the 2251 Frequency Counter as follows:

1. Frequency, Channel A
2. AC coupled 50 Ω input impedance
3. Auto-Trigger
4. External Reference Input
5. 10 S Gate Time
6. Enable math function for deviation read-out

Command string: IP A0 AAU ALI B1 SGT 10 SMX 10E6 SMZ 10E6 ME

5.5.2 1 PPS Output

1. Set up the Digitizing Oscilloscope to couple DC, 1M Ω input impedance.
2. Connect the 1 PPS output to the digitizing oscilloscope input, and verify that the low voltage is < 0.8 V and the high voltage is > 3.8 V. Verify that the width is 3.6 mS \pm 1 mS.
3. Connect the 2251 Channel A input to the output under test and the master frequency to the 2251 EXT STD INPUT.
4. Set up the counter as follows:
 - a. Frequency Channel A
 - b. DC coupled, 1M Ω input impedance
 - c. Attenuation x 1
 - d. Trigger level manual at 2 V, positive slope
 - e. External reference input
 - f. 1 mS gate time

Command String: 1P A0 AAD ADC AHI AMN APS AFD SLA 2.0
FA B1 SGT 1e-3 T0

5. Verify that the frequency is 1 Hz within 1 part in 10⁴.
6. Repeat Steps 1 through 5 for any other 1 PPS outputs.

5.5.3 3351R Calibration

1. Adjust the FINE FREQUENCY ADJUST trimmer (accessible through a hole in the side cover) until the 2251 reads $.100 \times 10^{-9}$. This is equivalent to a resolution of ± 1 part in 10^{10} of the difference between the master frequency standard and the 3351R output.

5.5.4 3351E Calibration

1. Adjust the COARSE and FINE FREQUENCY ADJUST trimmers (accessible through a hole in the side of the 3351E) until the 2251 reads 5×10^{-9} . This is equivalent to a resolution of ± 5 parts in 10^9 of the difference between the master frequency standard and the 3351E output.
2. Replace the screws covering the COARSE and FINE adjustment trimmers on the oscillator.

NOTE

If 10 MHz output is not installed, modify the command string for the appropriate frequency. For example, if a 5 MHz signal is used, the math function commands would read: SM 5E6 SMZ 5E6.

3351E

| | | |
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| 404947-001 | Final Assy., 3351E | 6-4 |
| 401991 | PCB Assy., Freq. Distribution | 6-10 |
| 431991 | Schematic, Freq. Distribution | 6-11 |
| 404979-001 | Cable Assy., Freq. Distribution | 6-24 |
| 404979-002 | Cable Assy., Freq. Distribution | 6-24 |
| 404979-003 | Cable Assy., Freq. Distribution | 6-24 |
| 404980-001 | Cable Assy., Freq. Out | 6-25 |
| 404980-002 | Cable Assy., Freq. Out | 6-25 |
| 404980-003 | Cable Assy., Freq. Out | 6-25 |
| 404386 | Oscillator Assy | 6-26 |
| 401822 | PCB Assy., Doubler | 6-27 |
| 431822 | Schematic, Doubler | 6-28 |

3351E/01

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3351E/10M

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3351R

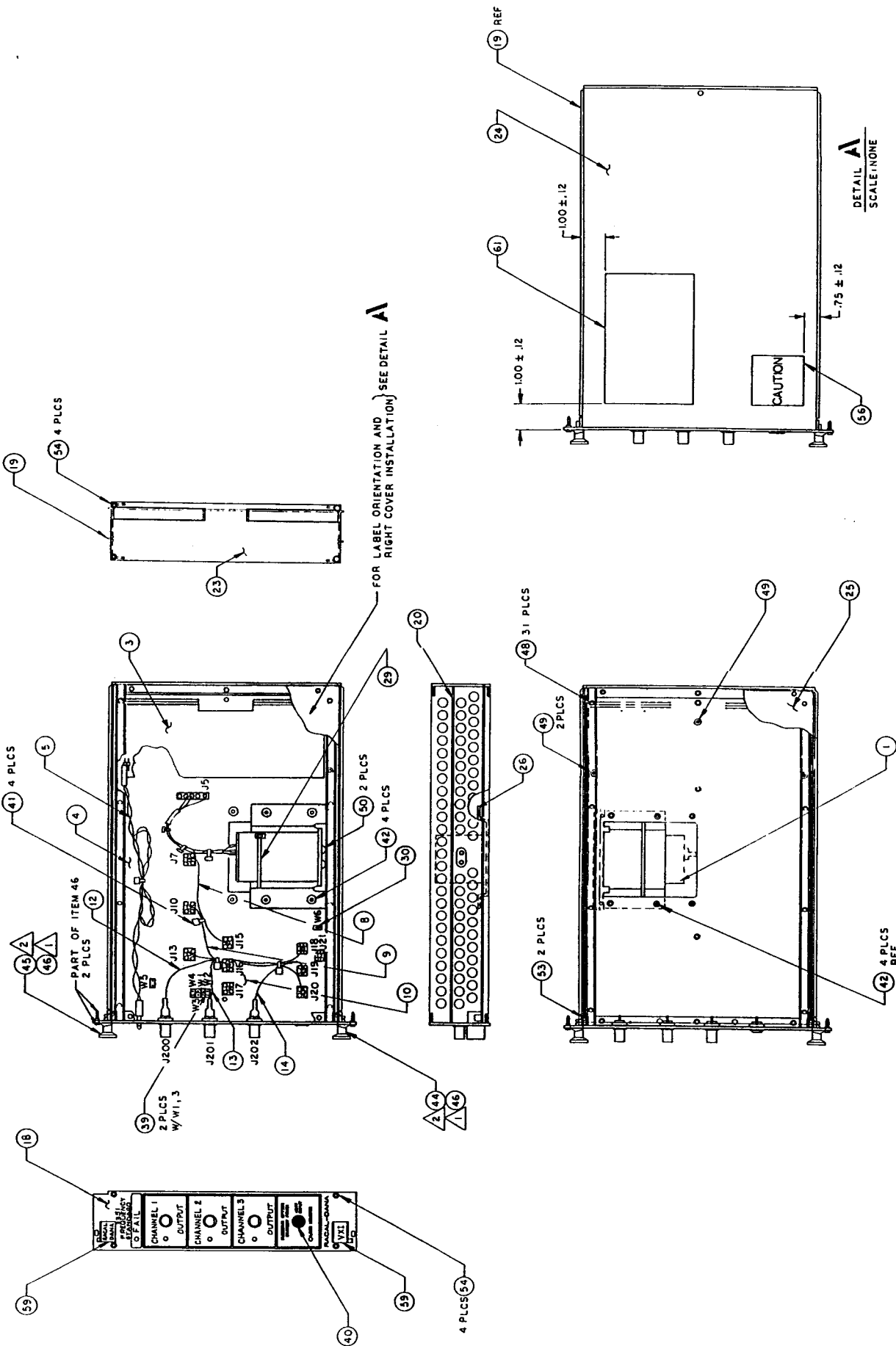
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3351R/01

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3351R/10M

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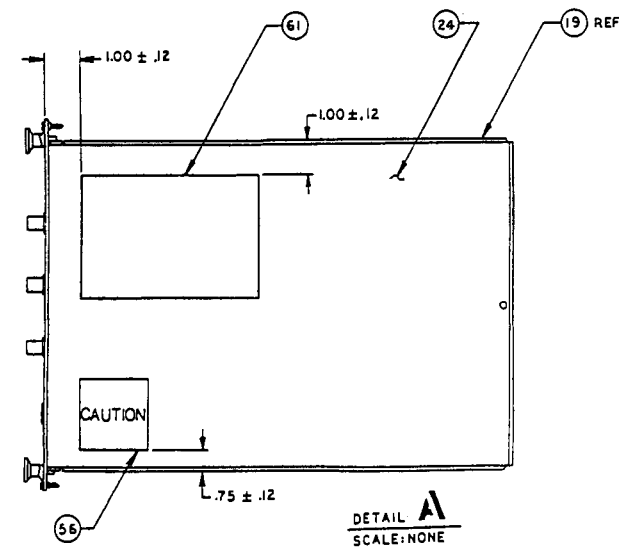
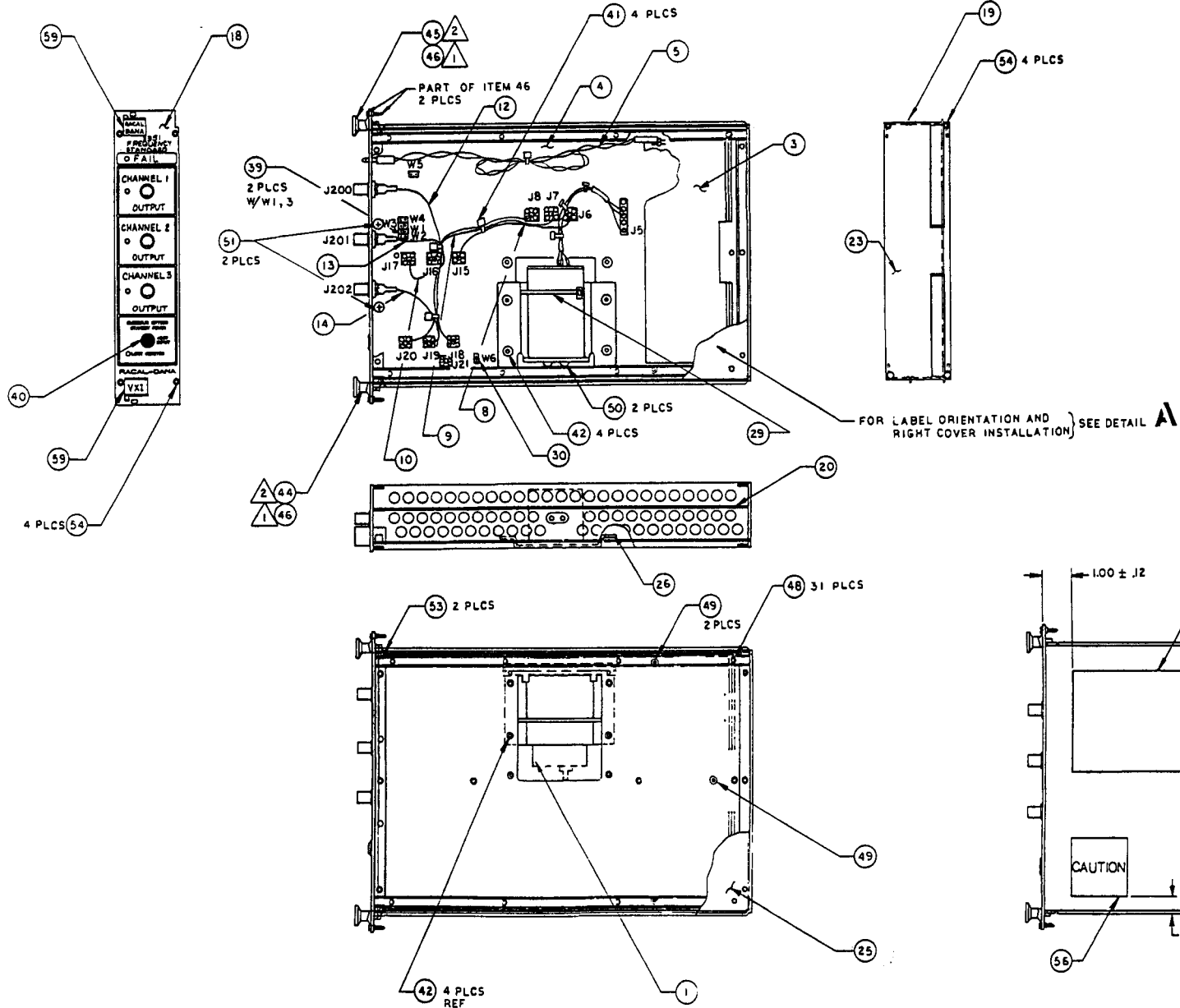
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1. ITEM 46 CONSISTS OF MOUNTING HARDWARE FOR HANDLES AND ASSOCIATED PARTS. DISCARD UNUSED HARDWARE SUPPLIED WITH ITEM 46.



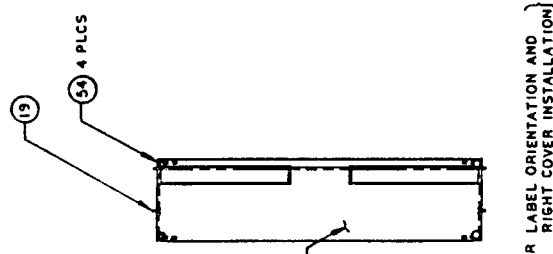
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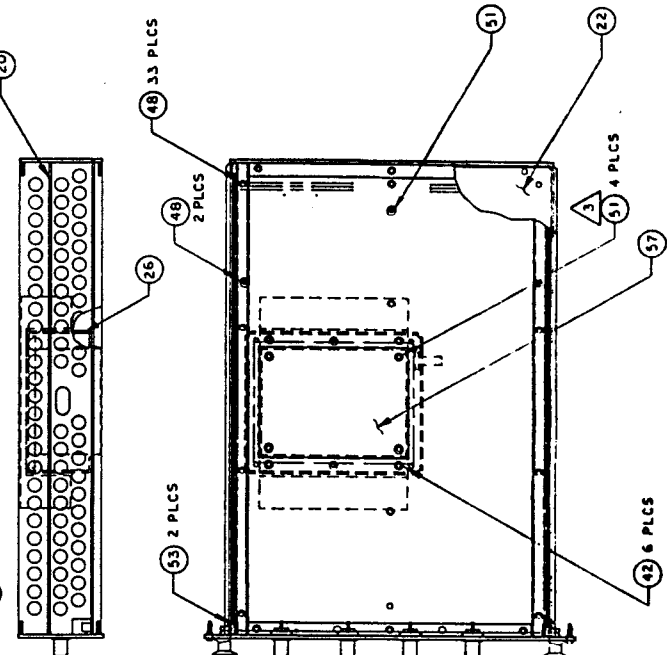
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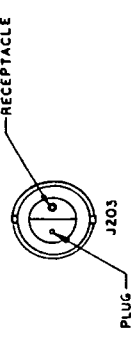
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| 10 | 404979-003 | J13-J17 |
| 12 | 404980-001 | J18-J200 |
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| 14 | 404980-003 | J20-J202 |



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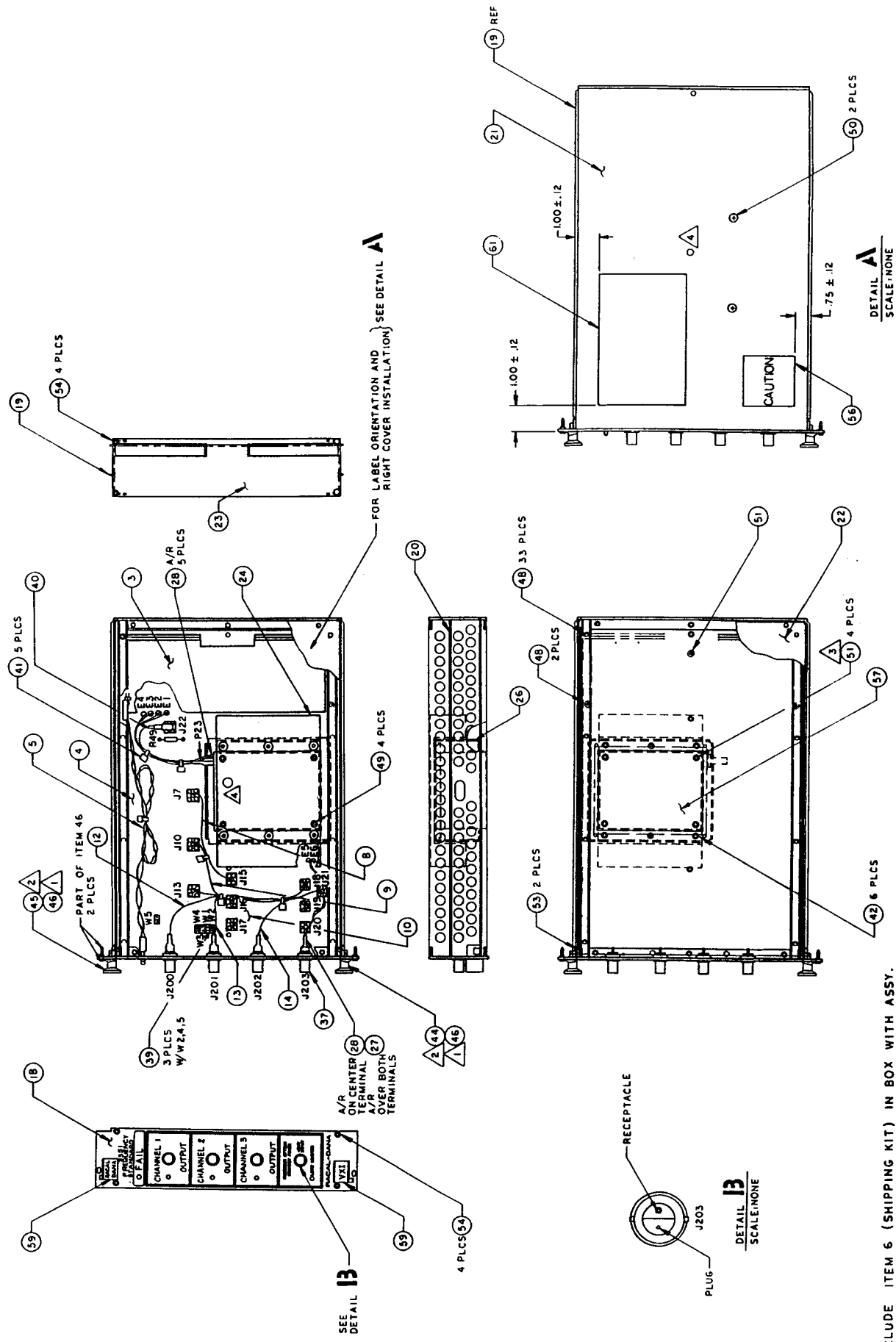
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| MODULE ASSY, 3351R | | | |
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- 4 HOLES ON RIGHT COVER AND HEATSINK MUST ALIGN WITH ADJUSTMENT SCREW IN OSCILLATOR.
- 3 ITEM 51, REPLACE PANHEAD WITH FLATHEAD SCREWS, 4 PLCS.
- 2 ITEM 44 CONSISTS OF 1 BOTTOM HANDLE, MOUNTING BLOCK AND ASSOCIATED PARTS. ITEM 45 IS THE SAME (AS ITEM 44), BUT THE HANDLE IS FOR THE TOP.
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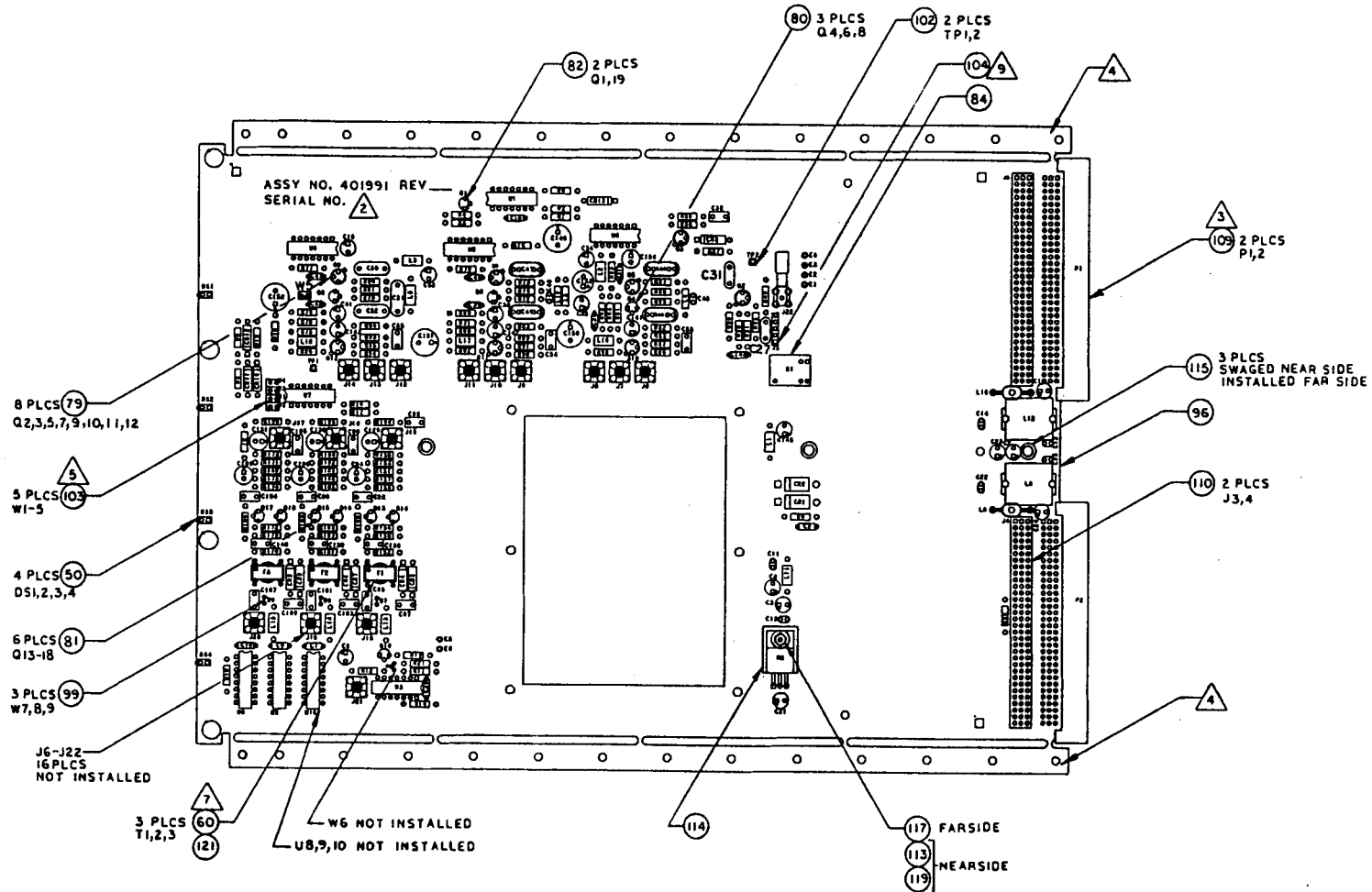
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- ▲ HOLES ON RIGHT COVER AND HEATSINK MUST ALIGN WITH ADJUSTMENT SCREW IN OSCILLATOR.
- ▲ ITEM 51, REPLACE PANHEAD WITH FLATHEAD SCREWS, 4 PLCS.
- ▲ ITEM 44 CONSISTS OF 1 BOTTOM HANDLE, MOUNTING BLOCK AND ASSOCIATED PARTS. ITEM 45 IS THE SAME (AS ITEM 44), BUT THE HANDLE IS FOR THE TOP.
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| SIZE | CODE IDENT NO | DOCUMENT NO | REV |
| D | 21793 | 404946002 | A |
| SCALE | | | SHEET 1 OF 4 |

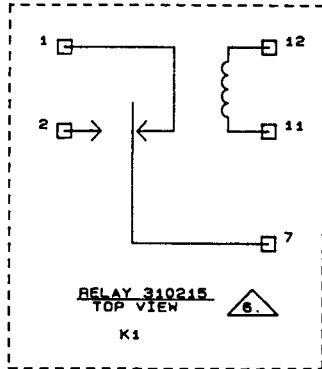


10. ON FAR SIDE, SOLDER ITEM 99 (JUMPER WIRE) FROM NEGATIVE LEAD OF C41 TO NEGATIVE LEAD OF C143; FROM NEGATIVE LEAD OF C38 TO NEGATIVE LEAD OF C142; AND FROM NEGATIVE LEAD OF C141 TO GROUND END OF R82.

- 9 CUT OFF PIN 2 ON J5.
- 8 THE FOLLOWING COMPONENTS ARE NOT INSTALLED: C36, 37, 39, 40, 42, 43 & R49.
- 7 SECURE ITEM 60 (T1, 2 & 3) TO ITEM 96 (PC BOARD) USING ITEM 121 (ADHESIVE BACKED TAPE) AS REQUIRED.
- 6 ALL SOLDER TAILS ON FAR SIDE OF PCB TO BE TRIMMED TO A MAXIMUM HEIGHT OF .045.
- 5 INSTALL WITH SHORT PINS INTO PCB.
- 4 REMOVE SIDE PANELS AND FILE PCB EDGE SMOOTH AFTER ASSY IS COMPLETE.
- 3 P1 & P2 MUST BE INSTALLED FLUSH AT RIGHT ANGLE TO PCB.
- 2 INK STAMP SERIAL NUMBER, ASSY NUMBER AND CURRENT REV. ON NEAR SIDE IN INDICATED AREA.
- 1. REFERENCE SCHEMATIC 431991 .

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| | | | |
|--------------------------------------|---------------|-------------|------|
| RACAL-DANA Instruments Inc. | | | |
| 4 GOODYEAR, IRVINE, CALIFORNIA 92714 | | | |
| DOCUMENT TITLE | | | |
| PCB ASSY, FREQ. DISTR 3351R/E | | | |
| SIZE | CODE IDENT NO | DOCUMENT NO | REV |
| D | 21793 | 401991 | A |
| SCALE | SHEET | | OF 4 |



6. RELAY K1 IS RACAL DANA P/N 310215. RELAY SHOWN IN DE-ENERGIZED POSITION.

5. R49 IS INSTALLED ON 3351R ONLY.

4. W6 IS INSTALLED ON 3351E ONLY.

3. W2, W4 AND W5 ARE INSTALLED WITH OPTION 01. W1 AND W3 ARE INSTALLED WITHOUT OPTION 01.

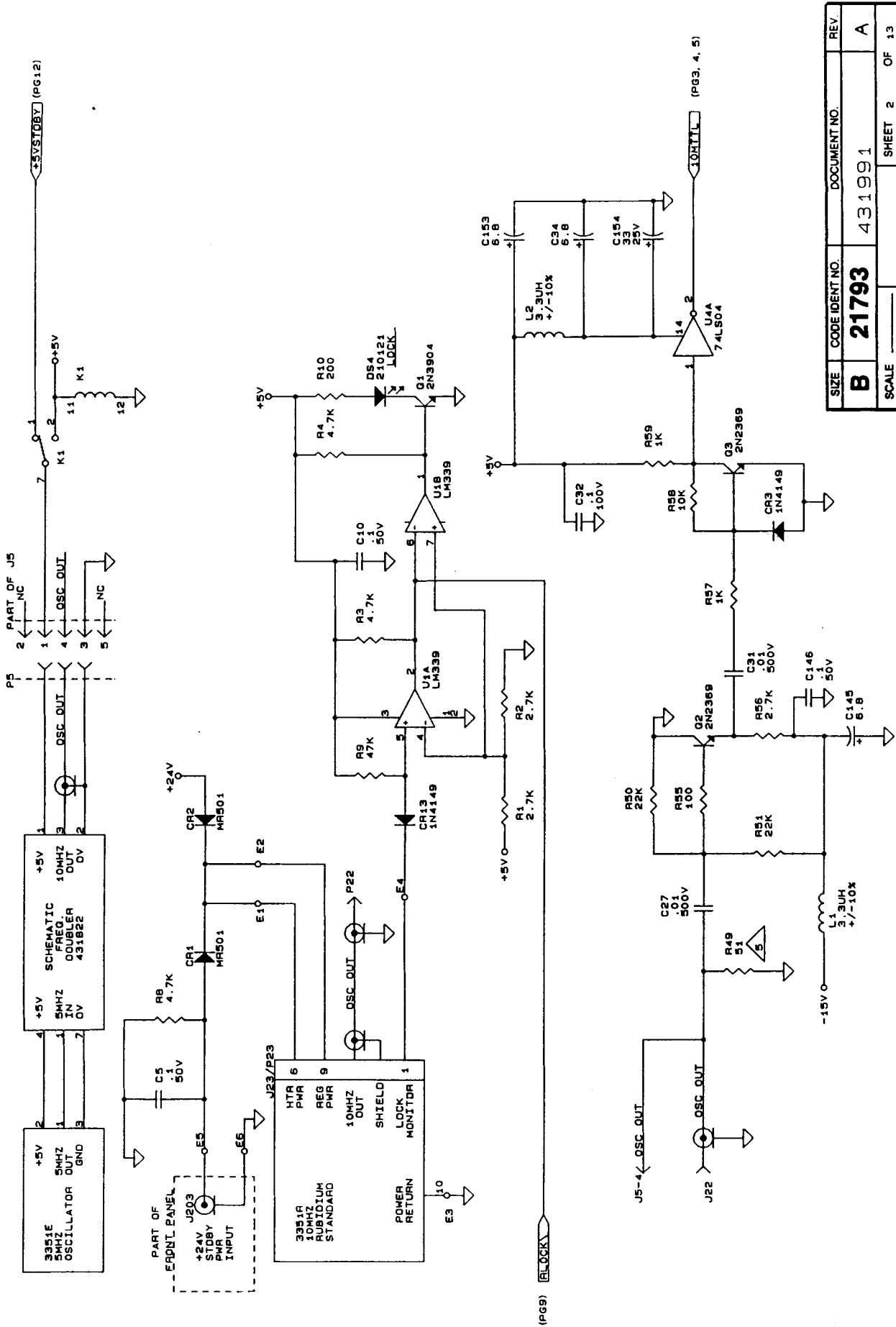
2. RESISTORS ARE IN OHMS $1/4W$ $\pm 5\%$ UNLESS OTHERWISE SPECIFIED.

1. CAPACITOR VALUES ARE IN MICROFARADS, $35V$, $\pm 20\%$ UNLESS OTHERWISE SPECIFIED.

NOTES: UNLESS OTHERWISE SPECIFIED

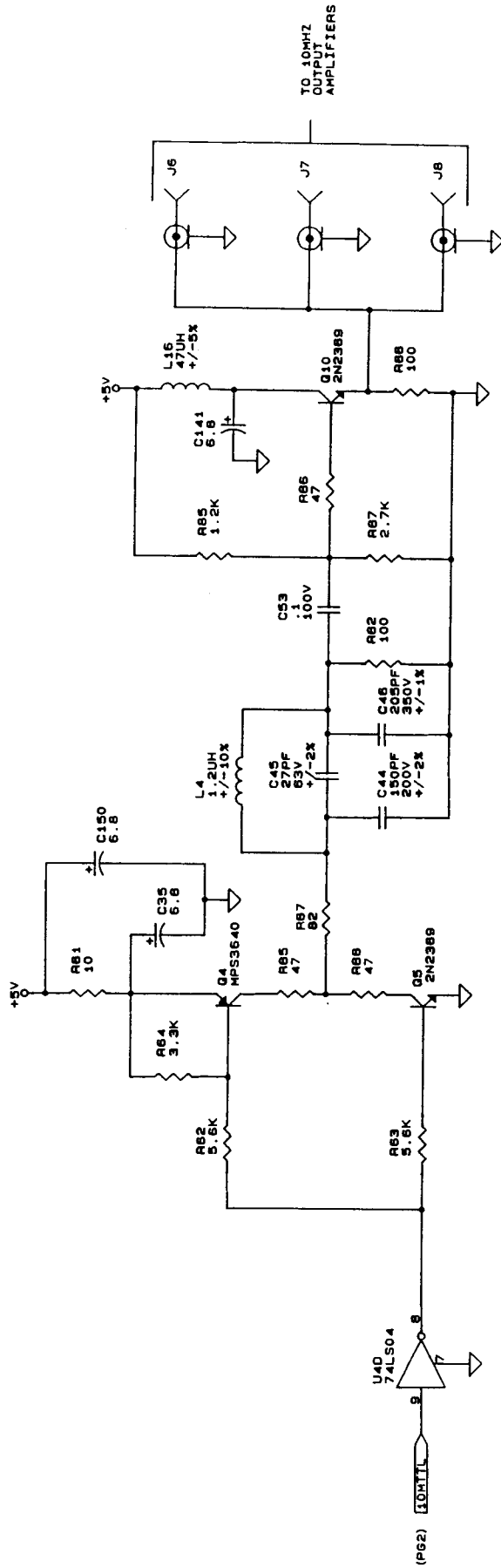
| |
|----------------------|
| W9 |
| U7 |
| TP2 |
| T3 |
| R196 |
| Q19 |
| P2 |
| L19 |
| K1 |
| J22 |
| E6 |
| DS4 |
| CR13 |
| C154 |
| HIGHEST REF. DES. |

| | | | |
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| RACAL-DANA Instruments Inc. 4 GOODYEAR, IRVINE, CALIFORNIA 92714 | | | |
| DOCUMENT TITLE | | | |
| SCHEM, FREQ. DISTR. | | | |
| SIZE | CODE IDENT NO | DOCUMENT NO. | REV. |
| B | 21793 | 431991 | A |
| SCALE | | SHEET 1 | OF 13 |



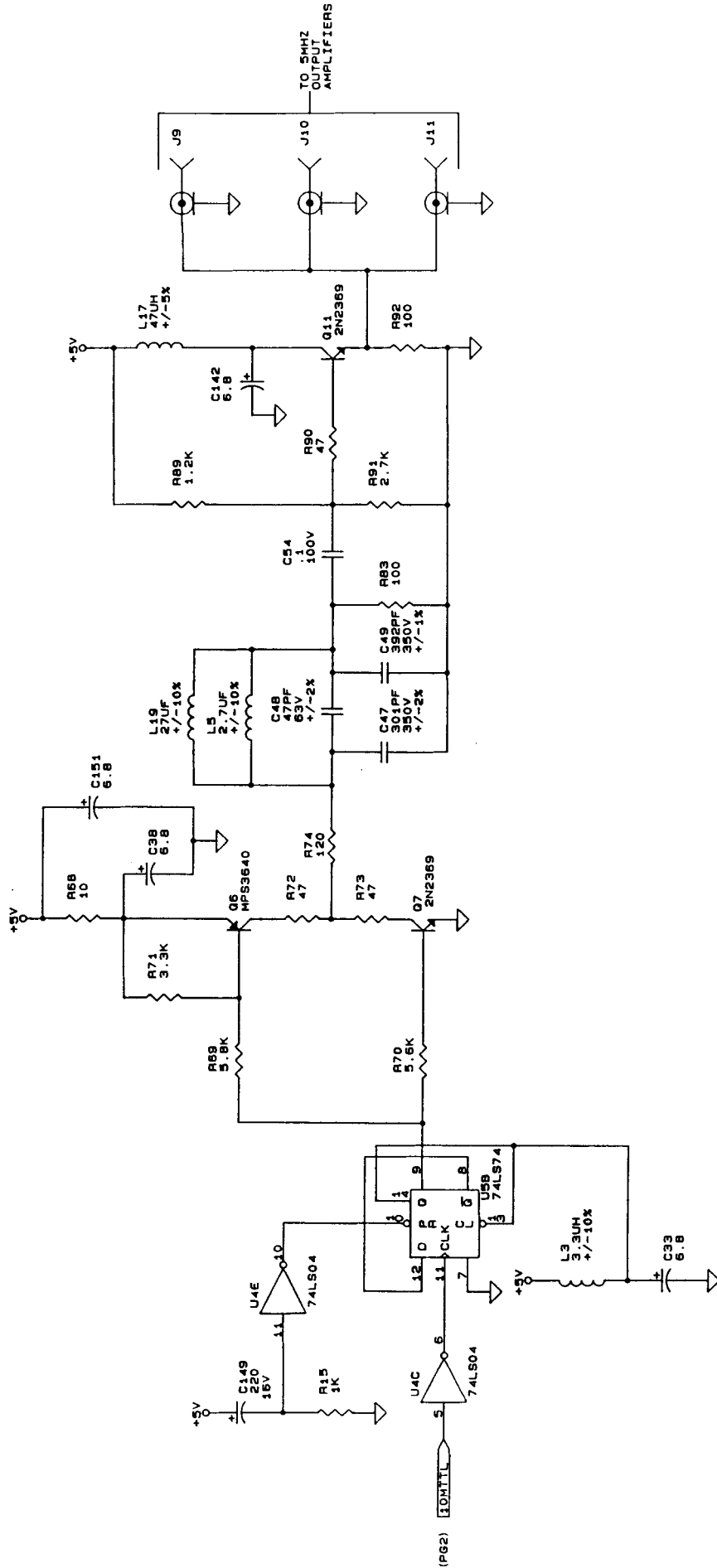
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| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
| B | 21793 | 431991 | A |
| SCALE | | SHEET 2 | OF 13 |

10MHZ FILTER



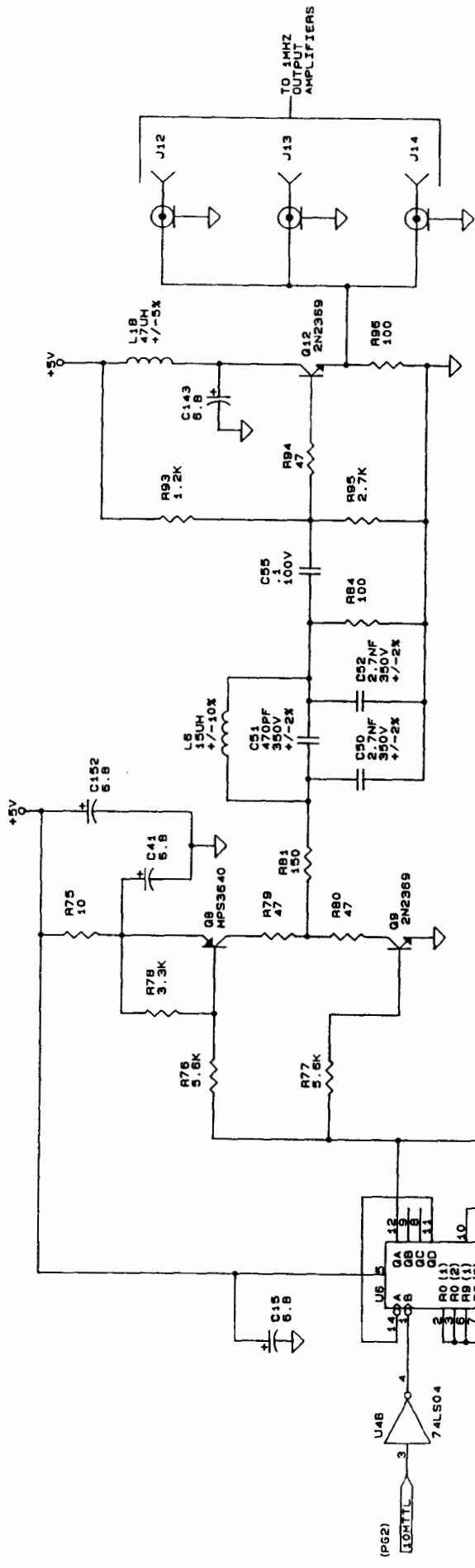
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| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
| B | 21793 | 431991 | A |
| SCALE | | SHEET 3 | OF 13 |

5MHZ FILTER

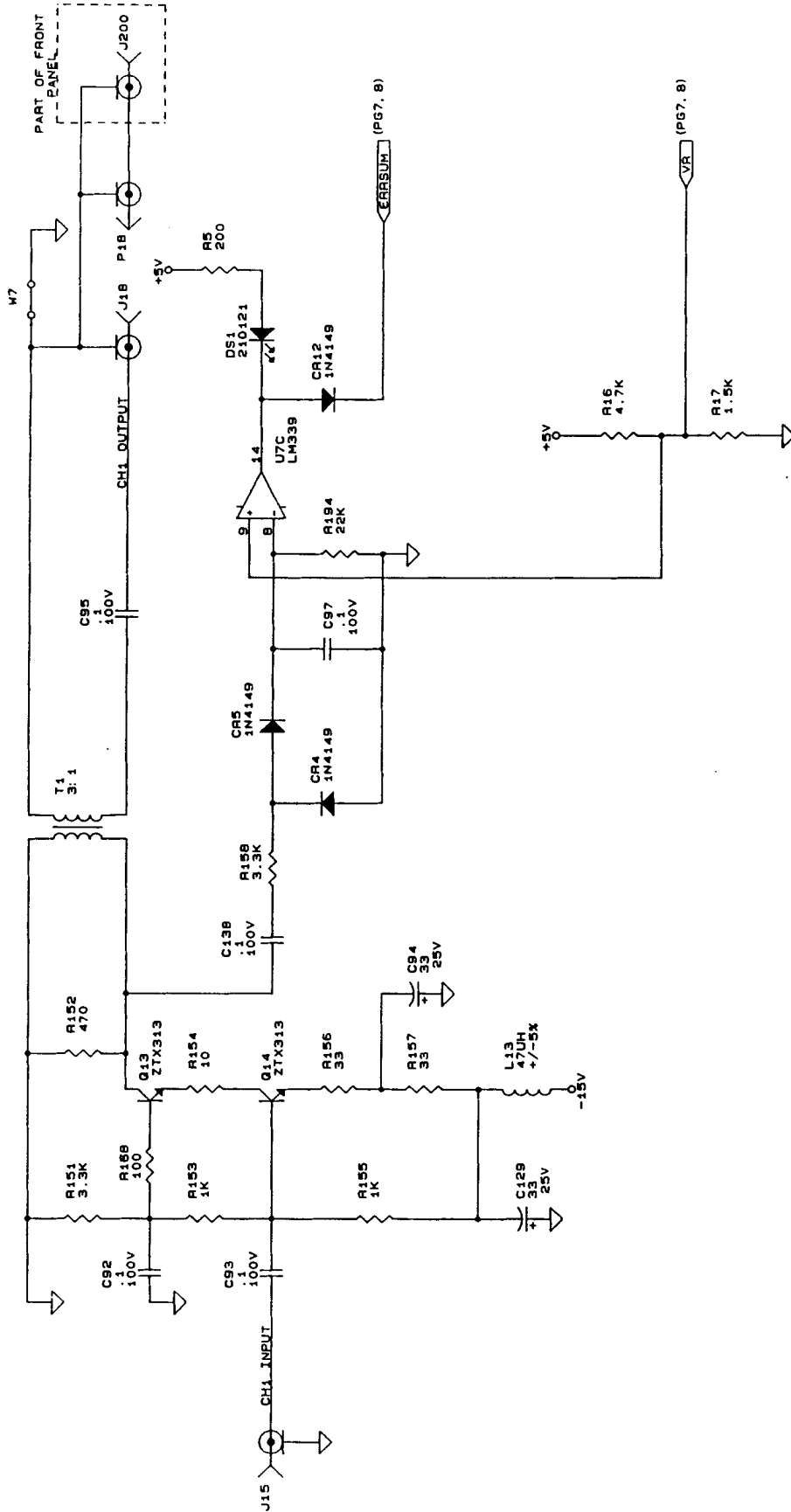


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| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
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| SCALE | | SHEET 4 | OF 13 |

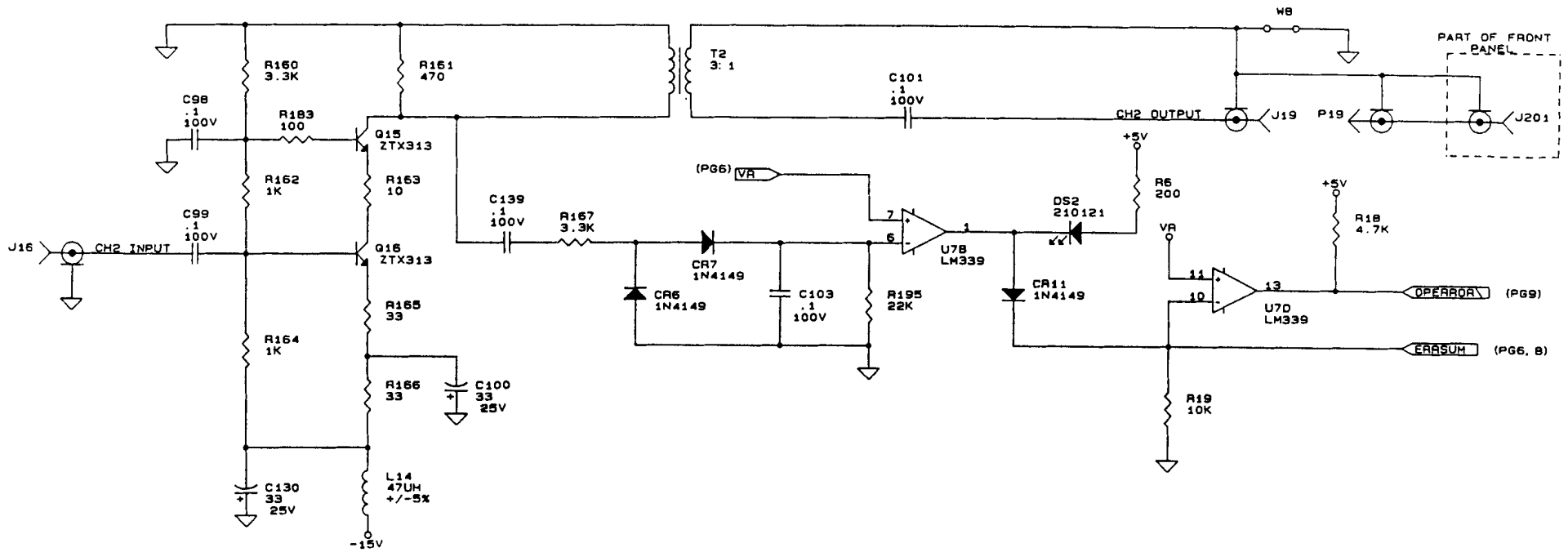
1MHZ FILTER



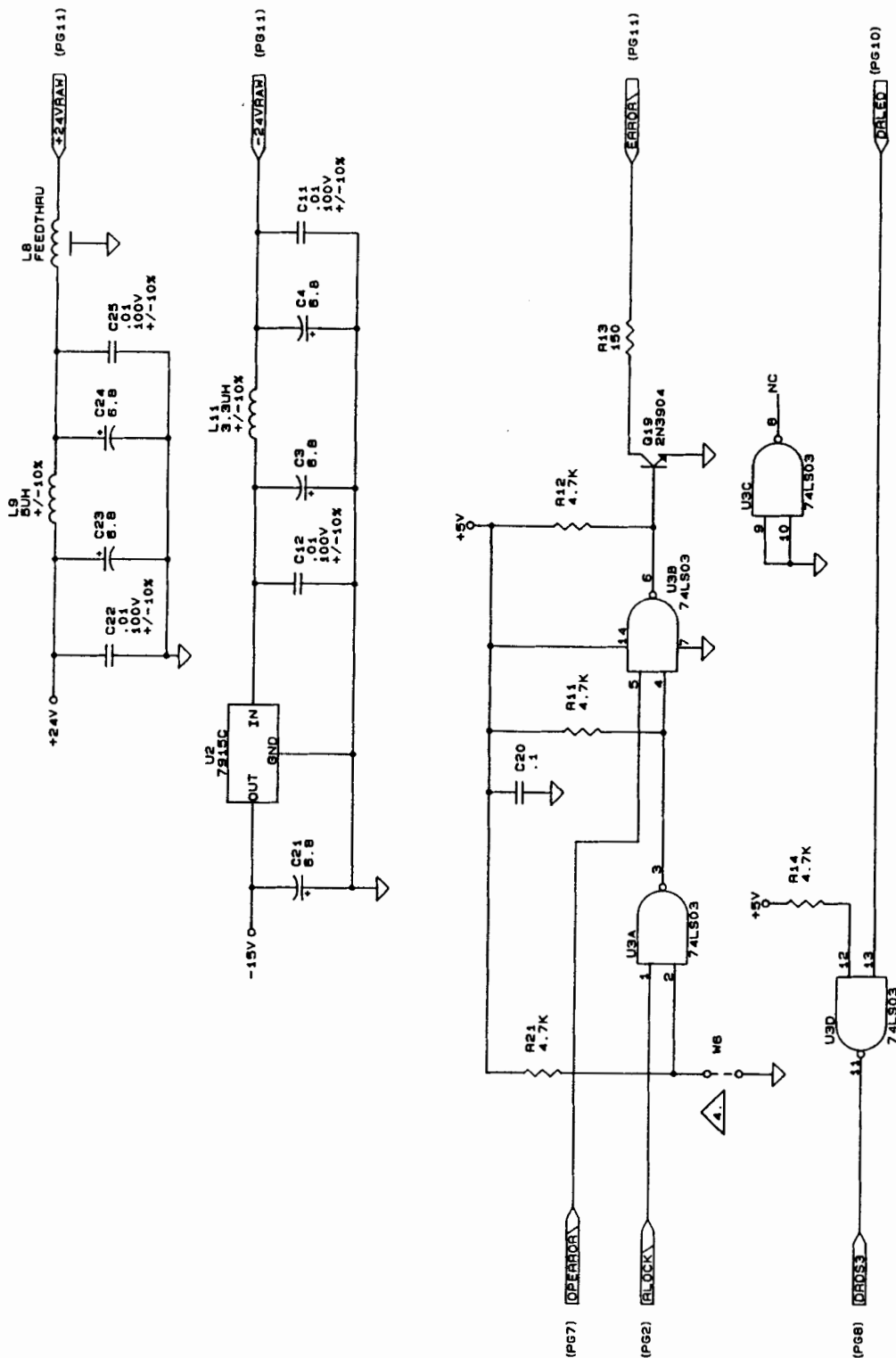
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| B | 21793 | 431991 | A |
| SCALE | | SHEET 5 | OF 13 |



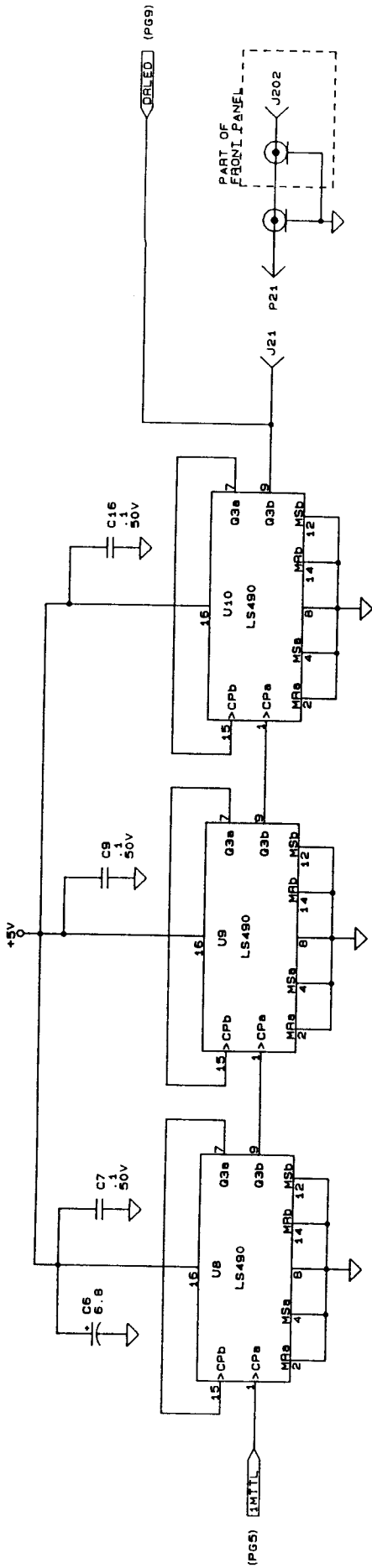
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| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
| B | 21793 | 431991 | A |
| SCALE | | SHEET 6 | OF 13 |



| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
|-------|----------------|--------------|-------|
| B | 21793 | 431991 | A |
| SCALE | | SHEET 7 | OF 13 |

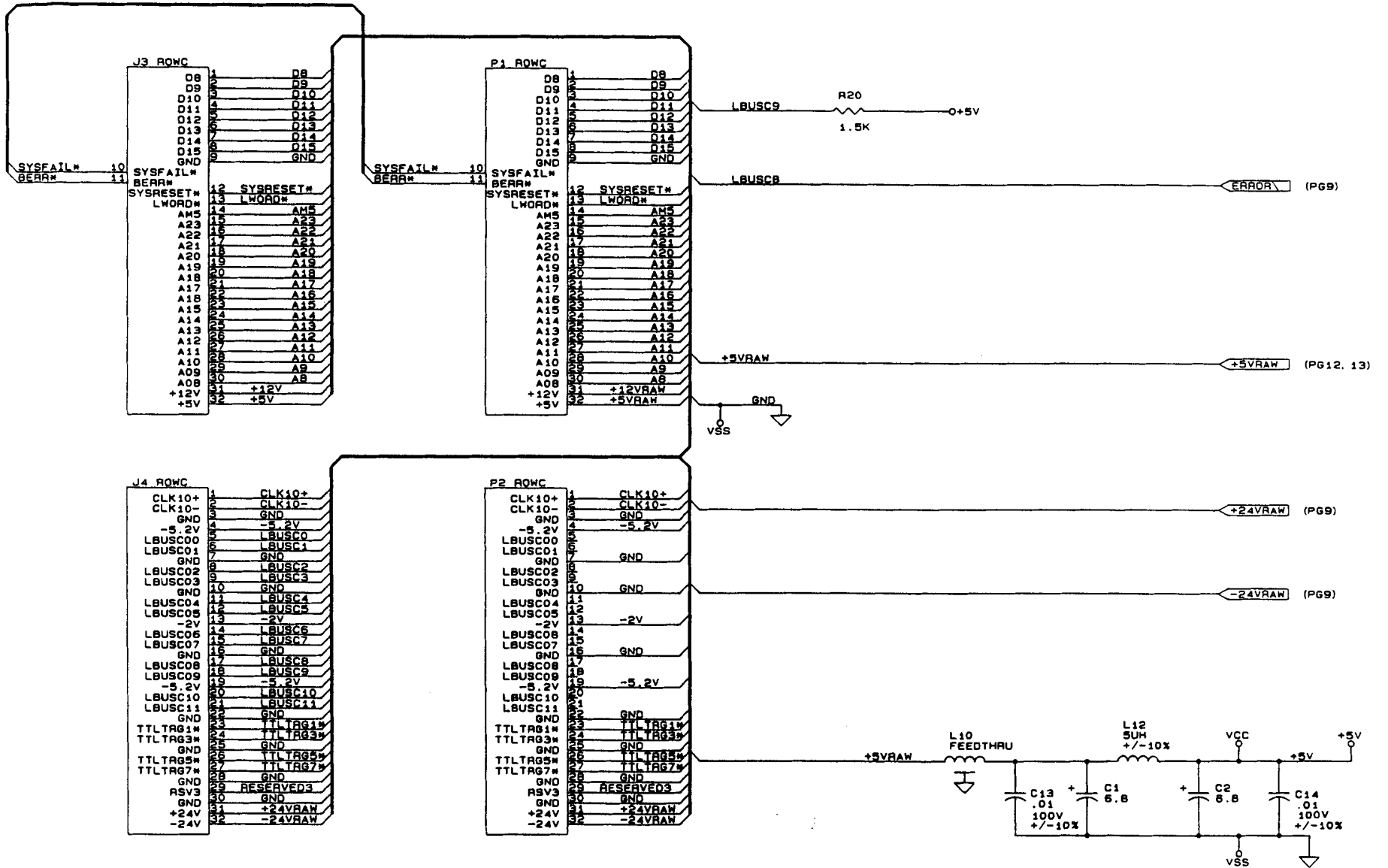


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| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
| B | 21793 | 431991 | A |
| SCALE | | SHEET 9 | OF 13 |

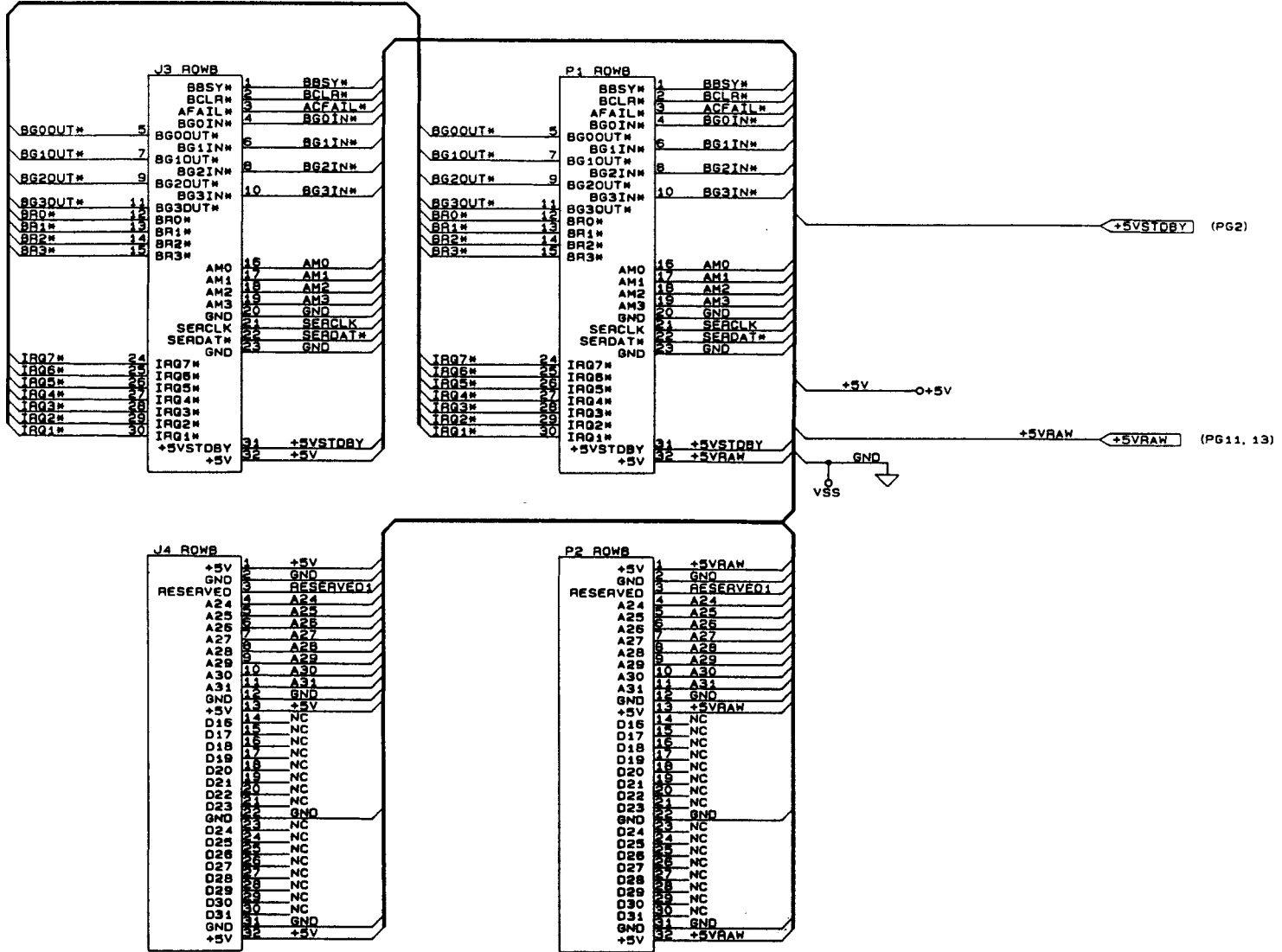


OPTION 01 ONLY
1PPS OUTPUT

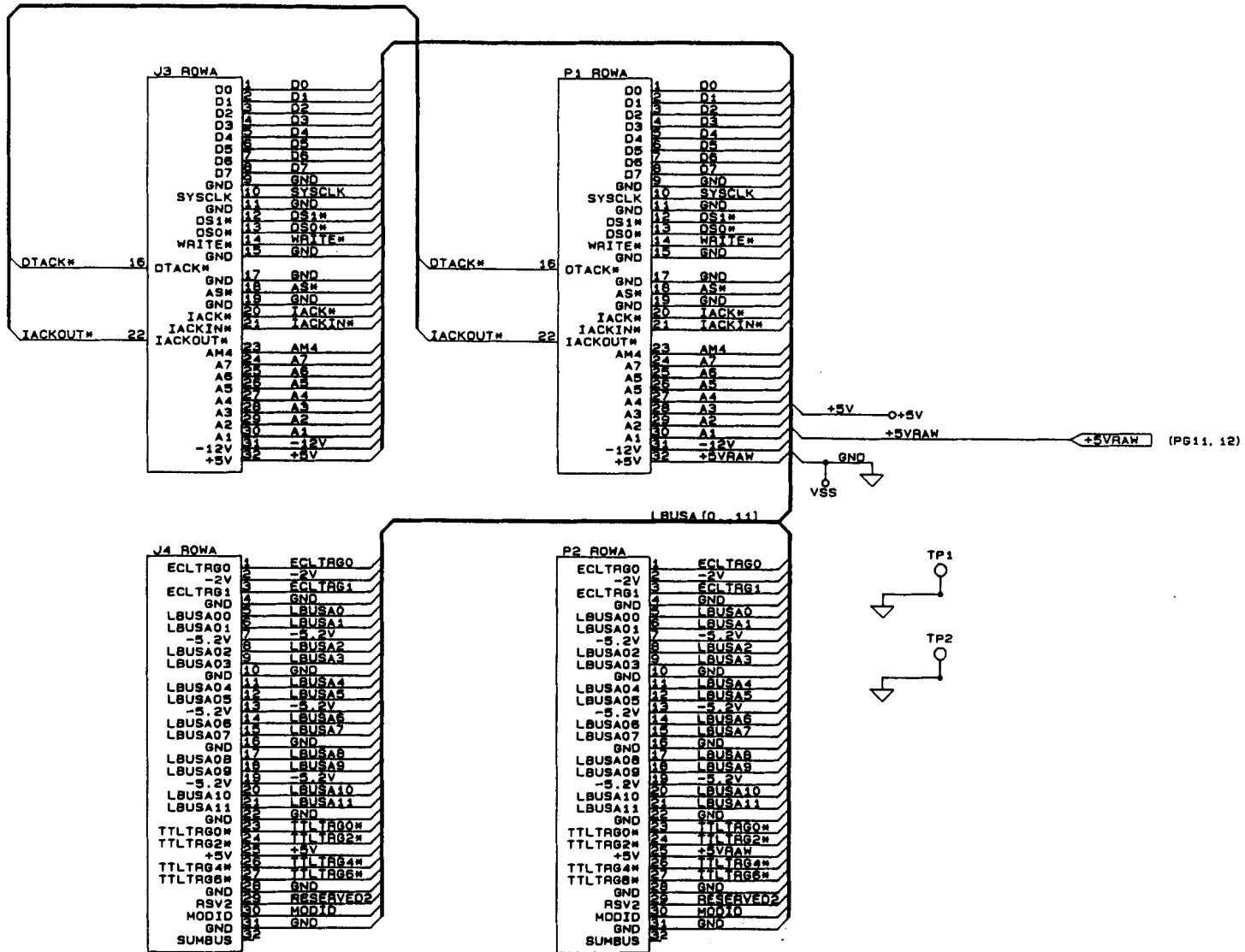
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|-------|----------------|--------------|-------|
| B | 21793 | 431991 | A |
| SCALE | | SHEET 10 | OF 13 |



| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
|-------|----------------|--------------|-------|
| B | 21793 | 431991 | A |
| SCALE | | SHEET 11 | OF 13 |



| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
|-------|----------------|--------------|------|
| B | 21793 | 431991 | A |
| SCALE | SHEET 12 OF 13 | | |



| | | | |
|-------|----------------|--------------|-------|
| SIZE | CODE IDENT NO. | DOCUMENT NO. | REV. |
| B | 21793 | 431991 | A |
| SCALE | | SHEET 13 | OF 13 |

3 PACKAGE AND IDENTIFY WITH RACAL-DANA PART NUMBER AND CURRENT REV. LTR.

△ INSERT CABLE UNTIL THE BRAID CONTACTS THE FLAT SURFACE, AND THE DIELECTRIC EXTENDS THROUGH THE HOLE IN THE FLAT SURFACE.

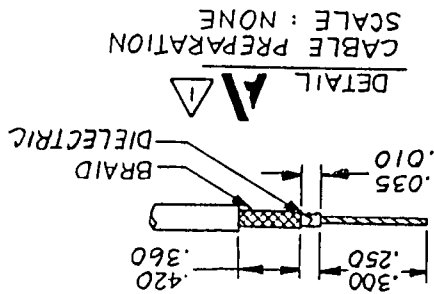
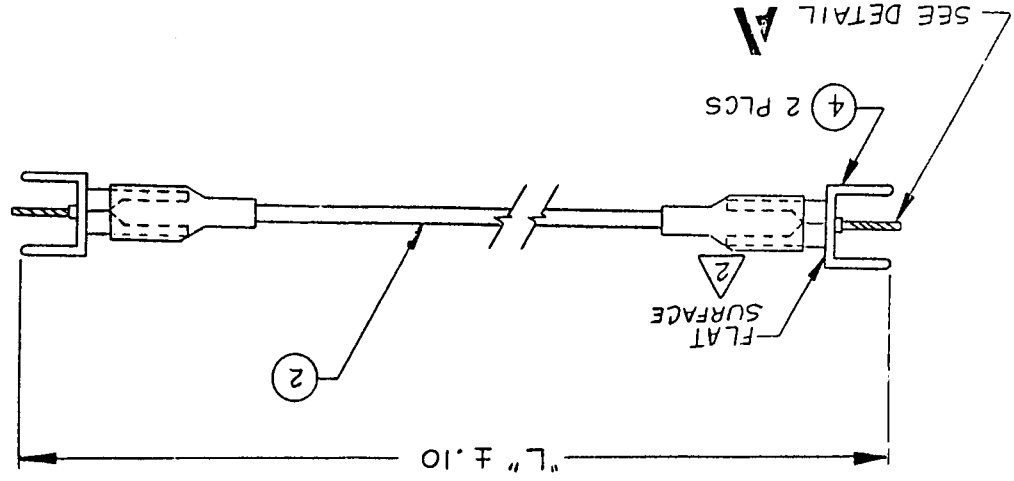
△ STRIP COAXIAL CABLE AS SHOWN IN DETAIL 'A'.

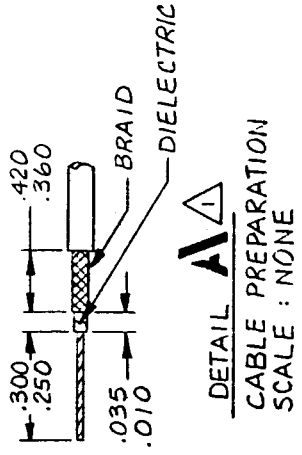
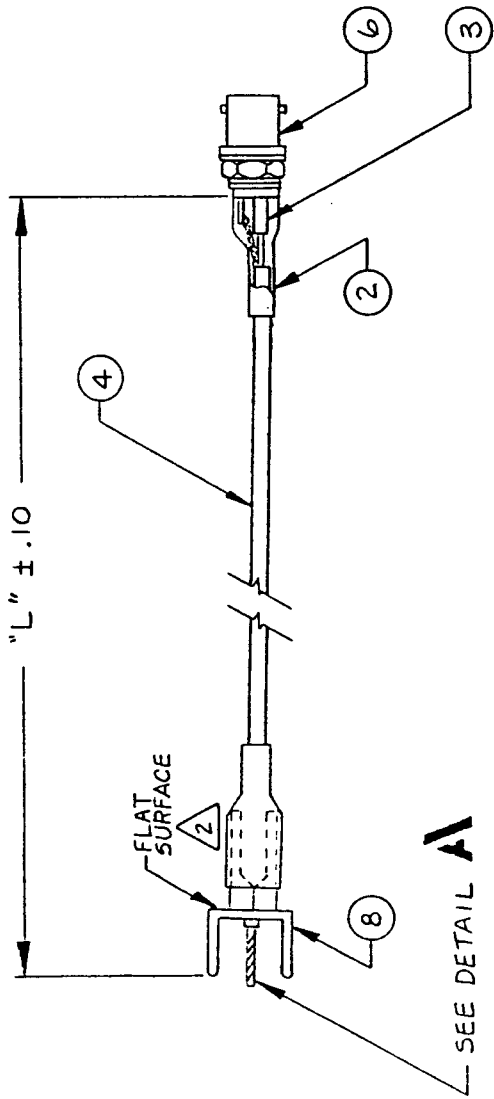
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| | | | |
|----------------|---------------|--|-----|
| DOCUMENT TITLE | | RACAL-DANA Instruments Inc 4 GOODYEAR, IRVINE, CALIFORNIA 92714 | |
| SIZE | CODE IDENT NO | DOCUMENT NO | REV |
| B | 21793 | 404979-001 | A |
| SCALE NONE | | SHEET 1 OF 2 | |

| | |
|----------------|------------------|
| RACAL-DANA P/N | LENGTH IN INCHES |
| 404979-001 | 6.0 |
| 404979-002 | 5.5 |
| 404979-003 | 4.75 |





DETAIL **A**
 CABLE PREPARATION
 SCALE : NONE

| RACAL-DANA P/N | LENGTH 'L' IN INCHES |
|----------------|----------------------|
| 404980-001 | 8.0 |
| 404980-002 | 7.0 |
| 404980-003 | 6.0 |

3. PACKAGE AND IDENTIFY WITH RACAL-DANA PART NUMBER AND CURRENT REV. LTR.

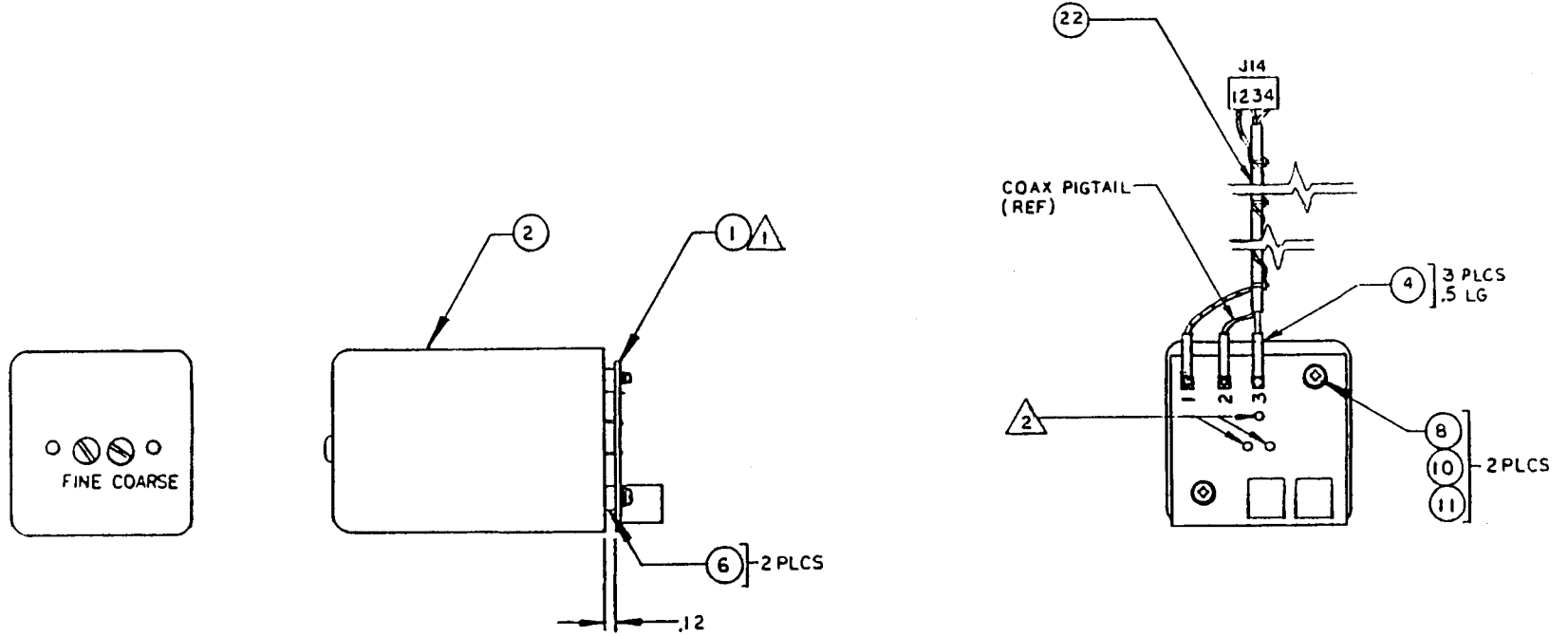
2. INSERT CABLE UNTIL THE BRAID CONTACTS THE FLAT SURFACE, AND THE DIELECTRIC EXTENDS THROUGH THE HOLE IN THE FLAT SURFACE.

1. STRIP COAXIAL CABLE AS SHOWN IN DETAIL 'A'.

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| | |
|--|-------------------|
| RACAL-DANA Instruments Inc. 4 GOODYEAR, IRVINE, CALIFORNIA 92714 | |
| DOCUMENT TITLE | |
| CABLE ASSY, FREQ. OUT | |
| SIZE | DOCUMENT NO. |
| B | 404980-001 |
| SCALE | SHEET |
| NONE | 1 OF 2 |



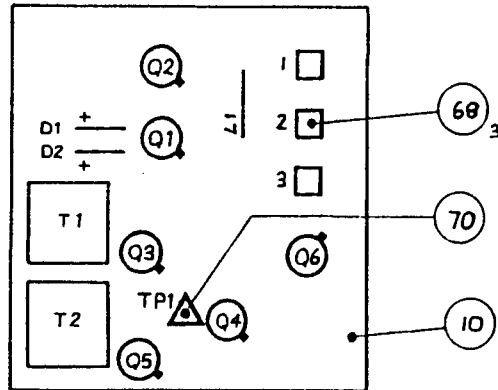
2 SOLDER AT ASSY.

1 REMOVE AND DISCARD CABLE SUPPLIED WITH ITEM 1 AND REPLACE WITH CABLE ITEM 22.

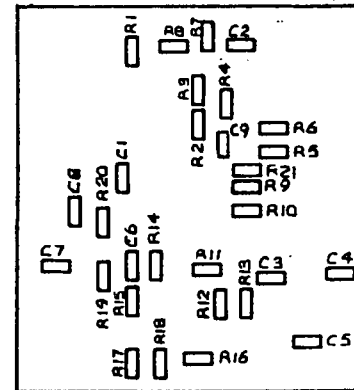
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| | | | |
|--------------------------------------|--------------|---------------|----------|
| RACAL-DANA Instruments Inc. | | | |
| 4 GOODYEAR, IRVINE, CALIFORNIA 92714 | | | |
| DOCUMENT FILE | | | |
| OSCILLATOR ASSY | | | |
| REV | DATE | BY | CHK |
| C | 21793 | 404386 | D |
| SCALE | SHEET 1 | | OF 2 |



VIEWED FROM COMPONENT SIDE



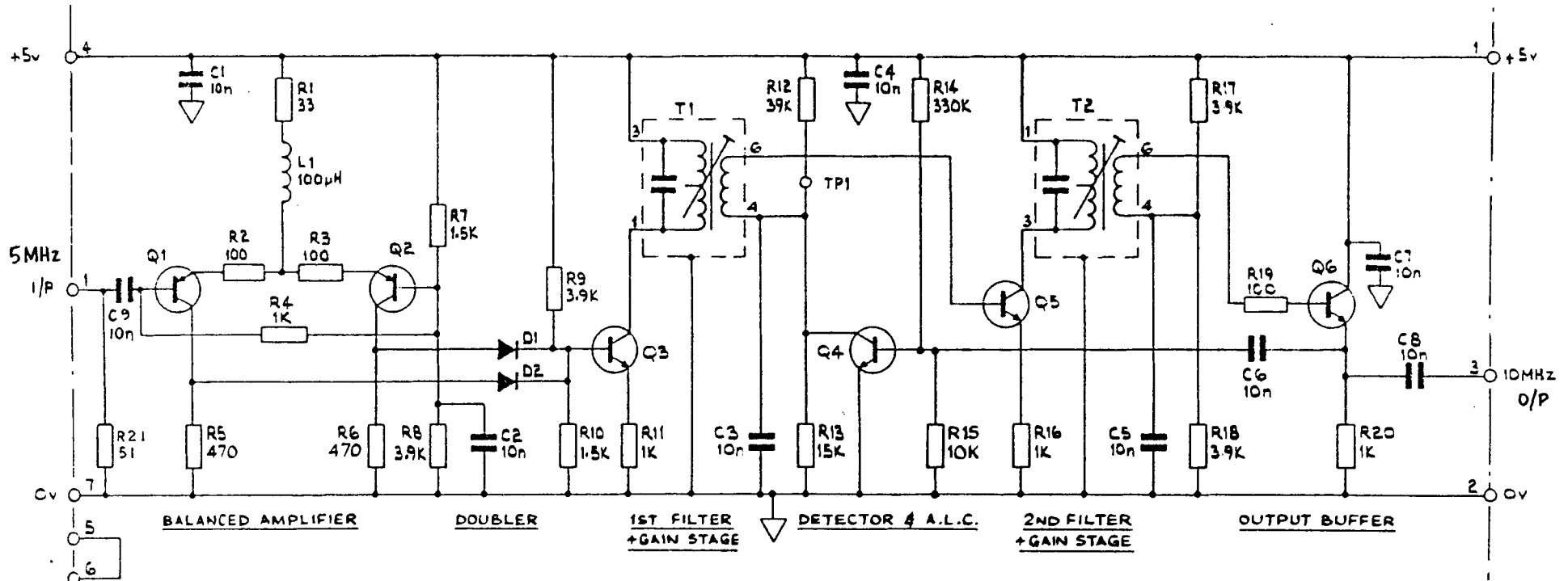
VIEWED FROM TRACK SIDE
(CIRCUIT SIDE)

NOTES

- 1, FIT PIN PART No 24-3519 ITEM No. 68 IN HOLE POSITIONS MARKED TO PROTRUDE ON COMPONENT SIDE. 3OFF
- 2, FIT PIN PART No 24-3537 ITEM No 70 IN HOLE POSITIONS MARKED TO PROTRUDE ON COMPONENT SIDE. 10FF

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| | | | |
|--|---------------|------------|-----|
| RACAL-DANA Instruments Inc. IRVINE, CALIFORNIA | | | |
| PCB ASSY, DOUBLER | | | |
| SIZE | CODE IDENT NO | DWG NO. | REV |
| C | 21793 | 401822 | A |
| SCALE | | SHEET OF 4 | |



| COMPONENT REF. | |
|----------------|-------|
| R1-21 | T1 |
| C1-9 | T1, 2 |
| D1, 2 | L1 |
| Q1-6 | |

| REFERENCE | PART No | TYP. TYPE No |
|-----------|---------|--------------|
| D1, 2 | 22-1029 | 1N4149 |
| Q3-6 | 22-6007 | 2N3904 |
| Q1, 2 | 22-6008 | 2N3906 |

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RACAL-DANA Instruments Inc.
 IRVINE, CALIFORNIA

SCHEMATIC, DOUBLER

| | | | |
|-------|----------------|------------|-----|
| SIZE | CODE IDENT NO. | DWG NO. | REV |
| C | 21793 | 431822 | A |
| SCALE | | SHEET OF 1 | |

| | | |
|------------|---|------|
| 404947-001 | Final Assy., 3351E | 7-4 |
| 404947-002 | Final Assy., 3351E Opt. 01 | 7-5 |
| 404947-003 | Final Assy., 3351E/10M | 7-6 |
| 404946-001 | Final Assy., 3351R | 7-7 |
| 404946-002 | Final Assy., 3351R Opt. 01 | 7-8 |
| 404946-003 | Final Assy., 3351R/10M | 7-9 |
| 401991 | PCB Assy., Freq. Distribution | 7-10 |
| 404979-001 | Cable Assy., Freq. Distribution | 7-14 |
| 404979-002 | Cable Assy., Freq. Distribution | 7-14 |
| 404979-003 | Cable Assy., Freq. Distribution | 7-14 |
| 404980-001 | Cable Assy., Freq. Out | 7-14 |
| 404980-002 | Cable Assy., Freq. Out | 7-14 |
| 404980-003 | Cable Assy., Freq. Out | 7-14 |
| 404386 | Oscillator Assy | 7-15 |
| 401822 | PCB Assy., Doubler | 7-16 |

List of Suppliers

| FSC | SUPPLIER | FSC | SUPPLIER |
|-------|--|-------|---|
| 00779 | AMP, INC. HARRISBURG, PA | 52072 | CIRCUIT ASSY. CORP. COSTA MESA, CA |
| 01295 | TEXAS INSTRUMENTS INC. DALLAS, TEXAS | 55761 | BALL CORPORATION (EFRATON DIVISION) IRVINE, CA |
| 02660 | AMPHENOL CORP. BROADVIEW, ILLINOIS | 56289 | SPAGUE ELECTRIC CO. N. ADAMS, MA |
| 04222 | AEROVOX CORP. (HI-Q DIVISION) MYRTLE BEACH, SC | 62559 | SCHROFF INC. WARWICK, RI |
| 04713 | MOTOROLA, INC. (SEMICONDUCTOR PRODUCTS DIV) PHOENIX, ARIZONA | 62643 | UNITED CHEMICON ROSEMONT, IL |
| 05397 | UNION CARBIDE CORP. (MATERIALS SYSTEMS DIV.) CLEVELAND, OHIO | 65940 | ROHM CORPORATION IRVINE, CA |
| 06090 | RACHEM CORP. MENLO PARK, CA | 71468 | ITT CANNON ELECTRIC SANTA ANA, CA |
| 06540 | AMATOM ELECTRONIC HARDWARE NEW ROCHELLE, NY | 72982 | ERIE TECHNOLOGICAL PRODUCTS, INC. ERIE, PA |
| 14433 | ITT SEMI CONDUCTORS WEST PALM BEACH, FL | 77342 | AMERICAN MACHINE & FOUNDRY CO. (POTTER/BRUMFIELD CO.) PRINCE, IN |
| 16956 | DENNISON MFG. CO. FRAMINGTON, MA | 78189 | ILLINOIS TOOL WORKS, INC. (SHAKEPROOF DIV.) ELGIN, ILLINOIS |
| 18324 | SIGNETICS, INC. SUNNYVALE, CA | 81349 | MILITARY SPECIFICATION |
| 18565 | CHOMETRICS, INC. WOBURN, MA | 83125 | NYTRONICS INC. DARLINGTON, SC |
| 19738 | AVDEL-CHOBERT TELESBORO, NJ | 86928 | SEASTROM MFG CO. GLENDALE, CA |
| 21793 | RACAL-DANA INSTRUMENTS INC. IRVINE, CA | 91637 | DALE ELECTRONICS INC. COLUMBUS, NEBRASKA |
| 22119 | FERRANTI ELECTRIC PLAINVIEW, NY | 91802 | INDUSTRIAL DEVICES INC. EDGEWATER, NJ |
| 27014 | NATIONAL SEMI-CONDUCTOR CORP. SANTA CLARA, CA | 92194 | ALPHA WIRE ELIZABETH, NEW JERSEY |
| 28520 | HEYCO KENILWORTH, NJ | 95275 | VITRAMON, INC. BRIDGEPORT, CONNECTICUT |
| 29005 | STORM PRODUCTS CO. LOS ANGELES, CA | 99800 | AMERICAN PRECISION INDUSTRIES INC. (DELEVAN DIVISION) EAST AURORA, NY |
| 34359 | THREE (3) M CO. (COMMERCIAL TAPE DIV.) ST. PAUL MINNESOTA | K8918 | RACAL-DANA INSTRUMENTS LTD SLOUGH, BERKSHIRE, ENGLAND |

404947-001 FINAL ASSY., 3351E

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|-------------------------------------|-------|--------------------|
| W1 | 601195 | PLUG, JUMPER, 0.1 CTR, LOW PROFILE | 00779 | 530153-2 |
| W3 | 601195 | PLUG, JUMPER, 0.1 CTR, LOW PROFILE | 00779 | 530153-2 |
| W6 | 500022 | WIRE, BARE COPPER/TIN, 22 GA | 21793 | 500022 |
| {1}1 | 404386 | OSCILLATOR ASSY, 5 MHZ | 21793 | 404386 |
| {3}1 | 921238 | MODULE ASSY., 3351 INTERFACE | 21793 | 921238 |
| {4}1 | 401991 | PCB ASSY., FREQUENCY DISTRIBUTION | 21793 | 401991 |
| {5}1 | 404782 | CABLE ASSY., LED FAIL | 21793 | 404782 |
| {6}1 | 404994 | SHIPPING KIT, 3351E | 21793 | 404994 |
| {8}1 | 404979-001 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-001 |
| {9}1 | 404979-002 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-002 |
| {10}1 | 404979-003 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-003 |
| {12}1 | 404980-001 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-001 |
| {13}1 | 404980-002 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-002 |
| {14}1 | 404980-003 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-003 |
| {18}1 | 455805 | PANEL FRONT, 3351R | 21793 | 455805 |
| {19}1 | 455818 | PANEL TOP, 3351 | 21793 | 455818 |
| {20}1 | 455819 | PANEL BOTTOM, 3351 | 21793 | 455819 |
| {23}1 | 455822 | PANEL REAR 2X.1 PCB | 21793 | 455822 |
| {24}1 | 455779 | PANEL, SIDE | 21793 | 455779 |
| {25}1 | 455779-001 | PANEL, STD SIDE, 3SCR, LEFT | 21793 | 455779-001 |
| {26}1 | 455831 | BRACKET, OSCILLATOR MOUNTING | 21793 | 455831 |
| {29}A/R | 500005 | TIE CORD, NYLON, BLACK | 92194 | LC-136 |
| {40}1 | 610390 | PLUG, HOLE | 28520 | P-375 |
| {41}4 | 610777 | CABLE TIE | 16956 | 08-432 |
| {42}4 | 610949 | RIVET, .205D X .276L | 19738 | 1601-5307 |
| {44}1 | 611264 | HANDLE, EXTRACTOR, BOTTOM | 62559 | 20817-327 |
| {45}1 | 611265 | HANDLE, EXTRACTOR, TOP | 62559 | 20817-328 |
| {46}1 | 611266 | MOUNTING HARDWARE, HANDLE | 62559 | 21100-745 |
| {48}31 | 615539 | SCREW, PFH, 4-40X.125 | - | - |
| {49}3 | 615541 | SCREW, PFH, 4-40X.250 | - | - |
| {50}2 | 616314 | SCREW, PPH, M3X5 | 21793 | 616314 |
| {53}2 | 616405 | SCREW, PFH, M2.5-.45 X 12 | - | - |
| {54}8 | 616480 | SCREW, PFH, 4-40 X .375 | - | - |
| {56}1 | 921059 | LABEL, CAUTION, STATIC | 21793 | 921059 |
| {59}1 | 921148 | LABEL SET, VXI-VME | 21793 | 921148 |
| {61}1 | 921212-015 | LABEL, IDENTIFICATION, 3351 | 21793 | 921212-015 |

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|-------------------------------------|-------|--------------------|
| U8-U10 | 230383 | IC, DUAL 4-BIT DECADE COUNTER | 01295 | SN74LS490N |
| W6 | 500022 | WIRE, BARE COPPER/TIN, 22 GA | 21793 | 500022 |
| {1}1 | 404386 | OSCILLATOR ASSY, 5 MHZ | 21793 | 404386 |
| {3}1 | 921238 | MODULE ASSY., 3351 INTERFACE | 21793 | 921238 |
| {4}1 | 401991 | PCB ASSY., FREQUENCY DISTRIBUTION | 21793 | 401991 |
| {5}1 | 404782 | CABLE ASSY., LED FAIL | 21793 | 404782 |
| {6}1 | 404994 | SHIPPING KIT, 3351E | 21793 | 404994 |
| {8}1 | 404979-001 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-001 |
| {9}1 | 404979-002 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-002 |
| {10}1 | 404979-003 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-003 |
| {12}1 | 404980-001 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-001 |
| {13}1 | 404980-002 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-002 |
| {14}1 | 404980-003 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-003 |
| {18}1 | 455805 | PANEL FRONT, 3351R | 21793 | 455805 |
| {19}1 | 455818 | PANEL TOP, 3351 | 21793 | 455818 |
| {20}1 | 455819 | PANEL BOTTOM, 3351 | 21793 | 455819 |
| {23}1 | 455822 | PANEL REAR 2X.1 PCB | 21793 | 455822 |
| {24}1 | 455779 | PANEL, SIDE | 21793 | 455779 |
| {25}1 | 455779-001 | PANEL, STD SIDE, 3SCR, LEFT | 21793 | 455779-001 |
| {26}1 | 455831 | BRACKET, OSCILLATOR MOUNTING | 21793 | 455831 |
| {29}A/R | 500005 | TIE CORD, NYLON, BLACK | 92194 | LC-136 |
| {39}3 | 601195 | PLUG, JUMPER, 0.1 CTR, LOW PROFILE | 00779 | 530153-2 |
| {40}1 | 610390 | PLUG, HOLE | 28520 | P-375 |
| {41}4 | 610777 | CABLE TIE | 16956 | 08-432 |
| {42}4 | 610949 | RIVET, .205D X .276L | 19738 | 1601-5307 |
| {44}1 | 611264 | HANDLE, EXTRACTOR, BOTTOM | 62559 | 20817-327 |
| {45}1 | 611265 | HANDLE, EXTRACTOR, TOP | 62559 | 20817-328 |
| {46}1 | 611266 | MOUNTING HARDWARE, HANDLE | 62559 | 21100-745 |
| {48}31 | 615539 | SCREW, PFH, 4-40X.125 | - | - |
| {49}3 | 615541 | SCREW, PFH, 4-40X.250 | - | - |
| {50}2 | 616314 | SCREW, PPH, M3X5 | 21793 | 616314 |
| {53}2 | 616405 | SCREW, PFH, M2.5-.45 X 12 | - | - |
| {54}8 | 616480 | SCREW, PFH, 4-40 X .375 | - | - |
| {56}1 | 921059 | LABEL, CAUTION, STATIC | 21793 | 921059 |
| {59}1 | 921148 | LABEL SET, VXI-VME | 21793 | 921148 |
| {61}1 | 921212-015 | LABEL, IDENTIFICATION, 3351 | 21793 | 921212-015 |

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|-------------------------------------|-------|--------------------|
| W6 | 500022 | WIRE, BARE COPPER/TIN, 22 GA | 21793 | 500022 |
| {1}1 | 404386 | OSCILLATOR ASSY, 5 MHZ | 21793 | 404386 |
| {3}1 | 921238 | MODULE ASSY., 3351 INTERFACE | 21793 | 921238 |
| {4}1 | 401991 | PCB ASSY., FREQUENCY DISTRIBUTION | 21793 | 401991 |
| {5}1 | 404782 | CABLE ASSY., LED FAIL | 21793 | 404782 |
| {6}1 | 404994 | SHIPPING KIT, 3351E | 21793 | 404994 |
| {8}1 | 404979-001 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-001 |
| {10}1 | 404979-004 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-004 |
| {12}1 | 404980-001 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-001 |
| {13}1 | 404980-002 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-002 |
| {14}1 | 404980-003 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-003 |
| {18}1 | 455805 | PANEL FRONT, 3351R | 21793 | 455805 |
| {19}1 | 455818 | PANEL TOP, 3351 | 21793 | 455818 |
| {20}1 | 455819 | PANEL BOTTOM, 3351 | 21793 | 455819 |
| {23}1 | 455822 | PANEL REAR 2X.1 PCB | 21793 | 455822 |
| {24}1 | 455779 | PANEL SIDE | 21793 | 455779 |
| {25}1 | 455779-001 | PANEL STD SIDE, 3SCR, LEFT | 21793 | 455779-001 |
| {26}1 | 455831 | BRACKET, OSCILLATOR MOUNTING | 21793 | 455831 |
| {29}A/R | 500005 | TIE CORD, NYLON, BLACK | 92194 | LC-136 |
| {39}2 | 601195 | PLUG, JUMPER, 0.1 CTR, LOW PROFILE | 00779 | 530153-2 |
| {40}1 | 610390 | PLUG, HOLE | 28520 | P-375 |
| {41}4 | 610777 | CABLE TIE | 16956 | 08-432 |
| {42}4 | 610949 | RIVET, .2050 X .276L | 19738 | 1601-5307 |
| {44}1 | 611264 | HANDLE, EXTRACTOR, BOTTOM | 62559 | 20817-327 |
| {45}1 | 611265 | HANDLE, EXTRACTOR, TOP | 62559 | 20817-328 |
| {46}1 | 611266 | MOUNTING HARDWARE, HANDLE | 62559 | 21100-745 |
| {48}31 | 615539 | SCREW, PFH, 4-40X.125 | - | - |
| {49}3 | 615541 | SCREW, PFH, 4-40X.250 | - | - |
| {50}2 | 616314 | SCREW, PPH, M3X5 | 21793 | 616314 |
| {51}2 | 616251 | SCREW, PPH, SEMS ASSY, 4-40X.250 | 78189 | - |
| {53}2 | 616405 | SCREW, PFH, M2.5-.45 X 12 | - | - |
| {54}8 | 616480 | SCREW, PFH, 4-40 X .375 | - | - |
| {56}1 | 921059 | LABEL, CAUTION, STATIC | 21793 | 921059 |
| {59}1 | 921148 | LABEL SET, VXI-VME | 21793 | 921148 |
| {61}1 | 921212-015 | LABEL, IDENTIFICATION, 3351 | 21793 | 921212-015 |

404946-001 MODULE ASSY., 3351R

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|---|--------|--------------------|
| J22 | 601264 | PC TERMINATOR, RT. ANGLE | 106090 | DG07-10 |
| J203 | 600951 | CONNECTOR, BNC, RECEPTACLE | 102660 | 31-223 |
| R49 | 000510 | RES, CARB COMP, 51 OHM, 5 PERCENT, 1/4W | 181349 | RC07GF510J |
| {3}1 | 921238 | MODULE ASSY., 3351 INTERFACE | 21793 | 921238 |
| {4}1 | 401991 | PCB ASSY., FREQUENCY DISTRIBUTION | 21793 | 401991 |
| {5}1 | 404782 | CABLE ASSY., LED FAIL | 21793 | 404782 |
| {8}1 | 404979-001 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-001 |
| {9}1 | 404979-002 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-002 |
| {10}1 | 404979-003 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-003 |
| {12}1 | 404980-001 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-001 |
| {13}1 | 404980-002 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-002 |
| {14}1 | 404980-003 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-003 |
| {18}1 | 455805 | PANEL FRONT, 3351R | 21793 | 455805 |
| {19}1 | 455818 | PANEL TOP, 3351 | 21793 | 455818 |
| {20}1 | 455819 | PANEL BOTTOM, 3351 | 21793 | 455819 |
| {21}1 | 455820 | PANEL RIGHT, 3351R | 21793 | 455820 |
| {22}1 | 455821 | PANEL LEFT, 3351R | 21793 | 455821 |
| {23}1 | 455822 | PANEL REAR 2X.1 PCB | 21793 | 455822 |
| {24}1 | 455823 | HEATSINK, 3351R | 21793 | 455823 |
| {26}1 | 455827 | BRACKET, OSC. MOUNTING | 21793 | 455827 |
| {27}A/R | 500002 | TUBING, SHRINK, .187 ID | 29005 | RNF-100-1-3/16 |
| {28}A/R | 500064 | TUBING, SHRINK, .093 ID, BLK | 29005 | RNF-100-1-3/32 |
| {29}A/R | 500132 | WIRE, TEFLON TWISTED PAIR, 24 GA, BLK/WHT | - | - |
| {30}A/R | 500254 | CABLE, COAXIAL, 50 OHM | 92194 | 9178B |
| {32}A/R | 524000 | WIRE, TEFLON STRANDED, 24 GA, WHT | - | - |
| {33}A/R | 524555 | WIRE, TEFLON STRANDED, 24 GA, GRN | - | - |
| {34}A/R | 524999 | WIRE, TEFLON STRANDED, 24 GA, BLU | - | - |
| {39}2 | 601195 | PLUG, JUMPER, 0.1 CTR, LOW PROFILE | 100779 | 530153-2. |
| {41}5 | 610777 | CABLE TIE | 16956 | 08-432 |
| {42}6 | 610949 | RIVET, .205D X .276L | 19738 | 1601-5307 |
| {44}1 | 611264 | HANDLE, EXTRACTOR, BOTTOM | 162559 | 20817-327 |
| {45}1 | 611265 | HANDLE, EXTRACTOR, TOP | 162559 | 20817-328 |
| {46}1 | 611266 | MOUNTING HARDWARE, HANDLE | 162559 | 21100-745 |
| {48}35 | 615539 | SCREW, PFH, 4-40X.125 | - | - |
| {49}4 | 615542 | SCREW, PFH, 4-40 X .312 | - | - |
| {50}2 | 615543 | SCREW, PFH, 4-40X.375 | - | - |
| {51}5 | 615541 | SCREW, PFH, 4-40X.250 | - | - |
| {53}2 | 616405 | SCREW, PFH, M2.5-.45 X 12 | - | - |
| {54}8 | 616480 | SCREW, PFH, 4-40 X .375 | - | - |
| {56}1 | 921059 | LABEL, CAUTION, STATIC | 21793 | 921059 |
| {57}1 | 921090 | RUBIDIUM OSCILLATOR | 155761 | FRS-C-1A8A4C |
| {59}1 | 921148 | LABEL SET, VXI-VME | 21793 | 921148 |
| {61}1 | 921212-016 | LABEL, VXI GENERATOR | 21793 | 921212-016 |
| {63}1 | 920710 | LABEL, IDENTIFICATION | 21793 | 920710 |

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|--|-------|--------------------|
| J22 | 601264 | PC TERMINATOR, RT. ANGLE | 06090 | DG07-10 |
| J203 | 600951 | CONNECTOR, BNC, RECEPTACLE | 02660 | 31-223 |
| R49 | 000510 | RES, CARB COMP, 51 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF510J |
| U8-U10 | 230383 | IC, DUAL 4-BIT DECADE COUNTER | 01295 | SN74LS490N |
| {3}1 | 921238 | MODULE ASSY., 3351 INTERFACE | 21793 | 921238 |
| {4}1 | 401991 | PCB ASSY., FREQUENCY DISTRIBUTION | 21793 | 401991 |
| {5}1 | 404782 | CABLE ASSY., LED FAIL | 21793 | 404782 |
| {6}1 | 404993 | SHIPPING KIT, 3351R | 21793 | 404993 |
| {8}1 | 404979-001 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-001 |
| {9}1 | 404979-002 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-002 |
| {10}1 | 404979-003 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-003 |
| {12}1 | 404980-001 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-001 |
| {13}1 | 404980-002 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-002 |
| {14}1 | 404980-003 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-003 |
| {18}1 | 455805 | PANEL FRONT, 3351R | 21793 | 455805 |
| {19}1 | 455818 | PANEL TOP, 3351 | 21793 | 455818 |
| {20}1 | 455819 | PANEL BOTTOM, 3351 | 21793 | 455819 |
| {21}1 | 455820 | PANEL RIGHT, 3351R | 21793 | 455820 |
| {22}1 | 455821 | PANEL LEFT, 3351R | 21793 | 455821 |
| {23}1 | 455822 | PANEL REAR 2X.1 PCB | 21793 | 455822 |
| {24}1 | 455823 | HEATSINK, 3351R | 21793 | 455823 |
| {26}1 | 455827 | BRACKET, OSC. MOUNTING | 21793 | 455827 |
| {27}A/R | 500002 | TUBING, SHRINK, .187 ID | 29005 | RNF-100-1-3/16 |
| {28}A/R | 500064 | TUBING, SHRINK, .093 ID, BLK | 29005 | RNF-100-1-3/32 |
| {29}A/R | 500132 | WIRE, TEFLON TWISTED PAIR, 24 GA, BLK/WHT. | - | - |
| {30}A/R | 500254 | CABLE, COAXIAL, 50 OHM | 92194 | 91788 |
| {32}A/R | 524000 | WIRE, TEFLON STRANDED, 24 GA, WHT | - | - |
| {33}A/R | 524555 | WIRE, TEFLON STRANDED, 24 GA, GRN | - | - |
| {34}A/R | 524999 | WIRE, TEFLON STRANDED, 24 GA, BLU | - | - |
| {39}3 | 601195 | PLUG, JUMPER, 0.1 CTR, LOW PROFILE | 00779 | 530153-2 |
| {41}5 | 610777 | CABLE TIE | 16956 | 08-432 |
| {42}6 | 610949 | RIVET, .205D X .276L | 19738 | 1601-5307 |
| {44}1 | 611264 | HANDLE, EXTRACTOR, BOTTOM | 62559 | 20817-327 |
| {45}1 | 611265 | HANDLE, EXTRACTOR, TOP | 62559 | 20817-328 |
| {46}1 | 611266 | MOUNTING HARDWARE, HANDLE | 62559 | 21100-745 |
| {48}35 | 615539 | SCREW, PFH, 4-40X.125 | - | - |
| {49}4 | 615542 | SCREW, PFH, 4-40 X .312 | - | - |
| {50}2 | 615543 | SCREW, PFH, 4-40X.375 | - | - |
| {51}5 | 615541 | SCREW, PFH, 4-40X.250 | - | - |
| {53}2 | 616405 | SCREW, PFH, M2.5-.45 X 12 | - | - |
| {54}8 | 616480 | SCREW, PFH, 4-40 X .375 | - | - |
| {56}1 | 921059 | LABEL, CAUTION, STATIC | 21793 | 921059 |
| {57}1 | 921090 | RUBIDIUM OSCILLATOR | 55761 | FRS-C-1A8A4C |
| {59}1 | 921148 | LABEL SET, VXI-VME | 21793 | 921148 |
| {61}1 | 921212-014 | LABEL, VXI, 3351R | 21793 | 921212-014 |

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|---|-------|--------------------|
| J22 | 601264 | PG TERMINATOR, RT. ANGLE | 06090 | DG07-10 |
| J203 | 600951 | CONNECTOR, BNC, RECEPTACLE | 02660 | 31-223 |
| R49 | 000510 | RES. CARB COMP. 51 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF510J |
| (3)1 | 921238 | MODULE ASSY., 3351 INTERFACE | 21793 | 921238 |
| (4)1 | 401991 | PCB ASSY., FREQUENCY DISTRIBUTION | 21793 | 401991 |
| (5)1 | 404782 | CABLE ASSY., LED FAIL | 21793 | 404782 |
| (6)1 | 404993 | SHIPPING KIT, 3351R | 21793 | 404993 |
| (8)1 | 404979-001 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-001 |
| (10)1 | 404979-004 | CABLE ASSY., FREQUENCY DISTRIBUTION | 21793 | 404979-004 |
| (12)1 | 404980-001 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-001 |
| (13)1 | 404980-002 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-002 |
| (14)1 | 404980-003 | CABLE ASSY., FREQUENCY OUT | 21793 | 404980-003 |
| (18)1 | 455805 | PANEL FRONT, 3351R | 21793 | 455805 |
| (19)1 | 455818 | PANEL TOP, 3351 | 21793 | 455818 |
| (20)1 | 455819 | PANEL BOTTOM, 3351 | 21793 | 455819 |
| (21)1 | 455820 | PANEL RIGHT, 3351R | 21793 | 455820 |
| (22)1 | 455821 | PANEL LEFT, 3351R | 21793 | 455821 |
| (23)1 | 455822 | PANEL REAR 2X.1 PCB | 21793 | 455822 |
| (24)1 | 455823 | HEATSINK, 3351R | 21793 | 455823 |
| (26)1 | 455827 | BRACKET, OSC. MOUNTING | 21793 | 455827 |
| (27)A/R | 500002 | TUBING, SHRINK, .187 ID | 29005 | RNF-100-1-3/16 |
| (28)A/R | 500064 | TUBING, SHRINK, .093 ID, BLK | 29005 | RNF-100-1-3/32 |
| (29)A/R | 500132 | WIRE, TEFLON TWISTED PAIR, 24 GA, BLK/WHT | - | - |
| (30)A/R | 500254 | CABLE, COAXIAL, 50 OHM | 92194 | 91788 |
| (32)A/R | 524000 | WIRE, TEFLON STRANDED, 24 GA, WHT | - | - |
| (33)A/R | 524555 | WIRE, TEFLON STRANDED, 24 GA, GRN | - | - |
| (34)A/R | 524999 | WIRE, TEFLON STRANDED, 24 GA, BLU | - | - |
| (39)2 | 601195 | PLUG, JUMPER, 0.1 CTR, LOW PROFILE | 00779 | 530153-2 |
| (41)5 | 610777 | CABLE TIE | 16956 | 08-432 |
| (42)6 | 610949 | RIVET, .2050 X .276L | 19738 | 1601-5307 |
| (44)1 | 611264 | HANDLE, EXTRACTOR, BOTTOM | 62559 | 20817-327 |
| (45)1 | 611265 | HANDLE, EXTRACTOR, TOP | 62559 | 20817-328 |
| (46)1 | 611266 | MOUNTING HARDWARE, HANDLE | 62559 | 21100-745 |
| (48)35 | 615539 | SCREW, PFH, 4-40X.125 | - | - |
| (49)4 | 615542 | SCREW, PFH, 4-40 X .312 | - | - |
| (50)2 | 615543 | SCREW, PFH, 4-40X.375 | - | - |
| (51)5 | 615541 | SCREW, PFH, 4-40X.250 | - | - |
| (52)2 | 616251 | SCREW, PPH, SEMS ASSY, 4-40X.250 | 78189 | - |
| (53)2 | 616405 | SCREW, PFH, M2.5-.45 X .12 | - | - |
| (54)8 | 616480 | SCREW, PFH, 4-40 X .375 | - | - |
| (56)1 | 921059 | LABEL, CAUTION, STATIC | 21793 | 921059 |
| (57)1 | 921090 | RUBIDIUM OSCILLATOR | 55761 | FRS-C-1A8A4C |
| (59)1 | 921148 | LABEL SET, VXI-VME | 21793 | 921148 |
| (61)1 | 921212-016 | LABEL, VXI GENERATOR | 21793 | 921212-016 |

401991 PCB ASSY., FREQ. DISTR. 3351R/E

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|--|--------|--------------------|
| C1-C6 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C5 | 100150 | CAPACITOR. .1 UF. 50V | 104222 | MD015E104MAA |
| C7 | 100150 | CAPACITOR. .1 UF. 50V | 104222 | MD015E104MAA |
| C9 | 100150 | CAPACITOR. .1 UF. 50V | 104222 | MD015E104MAA |
| C10 | 100150 | CAPACITOR. .1 UF. 50V | 104222 | MD015E104MAA |
| C11-C14 | 100062 | CAP. CERAM. .01 UF 100V. 10 PERCENT | 105397 | C320C103K1R5CA |
| C15 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C16 | 100150 | CAPACITOR. .1 UF. 50V | 104222 | MD015E104MAA |
| C20 | 100150 | CAPACITOR. .1 UF. 50V | 104222 | MD015E104MAA |
| C21 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C22 | 100062 | CAP. CERAM. .01 UF 100V. 10 PERCENT | 105397 | C320C103K1R5CA |
| C23 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C24 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C25 | 100062 | CAP. CERAM. .01 UF 100V. 10 PERCENT | 105397 | C320C103K1R5CA |
| C27 | 100063 | CAP. FIXED CER | 156289 | C023B501E103M |
| C31 | 100063 | CAP. FIXED CER | 156289 | C023B501E103M |
| C32 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C33-C35 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C38 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C41 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C44 | R-21-3035 | CAP. SILVER MICA. 150PF. 250V. 2 PCT | 171468 | 454-52 |
| C45 | R-21-1685 | CAP. CERAM. 27PF. 63V. 2PCT | 118324 | 632-34279 |
| C46 | R-21-2830 | CAP. SILVER MICA. 205PF. 400V. 1 PCT | 171468 | 454-52 |
| C47 | R-21-2848 | CAP. SILVER MICA. 301PF. 400V. 1 PCT | 171468 | 454-52 |
| C48 | R-21-1688 | CAP. CERAM. 47PF. 63V. 2PCT | 118324 | 632-34479 |
| C49 | R-21-2857 | CAP. SILVER MICA. 392PF. 400V. 1 PCT | 171468 | 454-52 |
| C50 | R-21-2647 | CAP. SILVER MICA. 2.7NF. 400V. 2 PCT | 171468 | 454-274 |
| C51 | R-21-2587 | CAP. SILVER MICA. 470PF. 400V. 2 PCT | 171468 | 454-273 |
| C52 | R-21-2647 | CAP. SILVER MICA. 2.7NF. 400V. 2 PCT | 171468 | 454-274 |
| C53-C55 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C92 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C93 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C94 | 110238 | CAP. ALUM. ELEC. 33UF. 25V. 20 PCT | 162643 | SM25VB330M |
| C95 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C97-C99 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C100 | 110238 | CAP. ALUM. ELEC. 33UF. 25V. 20 PCT | 162643 | SM25VB330M |
| C101 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C103-C105 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C106 | 110238 | CAP. ALUM. ELEC. 33UF. 25V. 20 PCT | 162643 | SM25VB330M |
| C107 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C109 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C129 | 110238 | CAP. ALUM. ELEC. 33UF. 25V. 20 PCT | 162643 | SM25VB330M |
| C130 | 110238 | CAP. ALUM. ELEC. 33UF. 25V. 20 PCT | 162643 | SM25VB330M |
| C131 | 110238 | CAP. ALUM. ELEC. 33UF. 25V. 20 PCT | 162643 | SM25VB330M |
| C138-C140 | 100133 | CAP. CERAMIC. .1UF. LOW PROFILE. 20PCT | 172982 | 8131LP-100-Z5U-1 |
| C141-C143 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C145 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C146 | 100150 | CAPACITOR. .1 UF. 50V | 104222 | MD015E104MAA |
| C149 | 110237 | CAP ALUM. ELEC. 220UF. 16V. 20 PCT | 162643 | SM16VB221M10X12 |
| C150-C153 | 110126 | CAP. TANTA. 6.8UF. 35V. 20 PERCENT | 105397 | T355F685M035A5 |
| C154 | 110238 | CAP. ALUM. ELEC. 33UF. 25V. 20 PCT | 162643 | SM25VB330M |
| CR1 | 210070 | DIODE. POWER. 3A | 104713 | 1MR501 |
| CR2 | 210070 | DIODE. POWER. 3A | 104713 | 1MR501 |
| CR3-CR13 | R-22-1029 | DIODE. SILICON | 114433 | 1N4149 |
| DS1-DS4 | 210121 | DIODE. LIGHT EMITTING. GRN | 191802 | 15350T1LC |
| J3 | 601925 | CONNECTOR. PCB. RECEPT. 3 ROW. 96P | 152072 | 1618008 |
| J4 | 601925 | CONNECTOR. PCB. RECEPT. 3 ROW. 96P | 152072 | 1618008 |
| J5 | 601208-012 | CONNECTOR. PCB. PLUG. 5-PIN | 152072 | 1CA-S05-23B-43 |
| IK1 | 1310215 | RELAY. 1 FORM C. 5V COIL | 177342 | 1T81H5D312-05 |

401991 PCB ASSY., FREQ. DISTR. 3351R/E

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|--|-------|--------------------|
| L1-L3 | 310098 | CHOKO, RF, 3.3UH | 99800 | 1537-24 |
| L4 | 310218 | CHOKO, RF, 1.2UH, 10PCT | 99800 | 1025-22 |
| L5 | 310216 | CHOKO, RF MOLDED, 2.7UH, 10 PCT | 99800 | 1025-30 |
| L6 | 310069 | CHOKO, RF, 15UH, 10 PERCENT | 99800 | SERIES1537 |
| L8 | 100164 | CAP, FEED-THRU,800PF, 50V | 00779 | 842448-2 |
| L9 | 310193 | CHOKO, SHIELDED, 5UH | 91637 | IH-5-5-10 |
| L10 | 100164 | CAP, FEED-THRU,800PF, 50V | 00779 | 842448-2 |
| L11 | 310098 | CHOKO, RF, 3.3UH | 99800 | 1537-24 |
| L12 | 310193 | CHOKO, SHIELDED, 5UH | 91637 | IH-5-5-10 |
| L13-L18 | 310217 | CHOKO, RF, 47UH, 5PCT | 99800 | 1537-60 |
| L19 | 310219 | CHOKO, RF, MOLDED, 27UH, 10 PCT | 99800 | 1025-54 |
| P1 | 601675-001 | CONNECTOR, EUROCARD, 96 PIN (MODIFIED) | 21793 | 601675-001 |
| P2 | 601675-001 | CONNECTOR, EUROCARD, 96 PIN (MODIFIED) | 21793 | 601675-001 |
| Q1 | 200298 | TRANSISTOR, NPN | 04713 | 2N3904 |
| Q2 | R-22-6017 | TRANSISTOR, NPN | 04713 | 2N2369 |
| Q3 | R-22-6017 | TRANSISTOR, NPN | 04713 | 2N2369 |
| Q4 | R-22-6018 | TRANSISTOR, PNP | 04713 | MPS3640 |
| Q5 | R-22-6017 | TRANSISTOR, NPN | 04713 | 2N2369 |
| Q6 | R-22-6018 | TRANSISTOR, PNP | 04713 | MPS3640 |
| Q7 | R-22-6017 | TRANSISTOR, NPN | 04713 | 2N2369 |
| Q8 | R-22-6018 | TRANSISTOR, PNP | 04713 | MPS3640 |
| Q9-Q12 | R-22-6017 | TRANSISTOR, NPN | 04713 | 2N2369 |
| Q13-Q18 | R-22-6079 | IC,NPN,HI SPEED SWITCH | 22119 | ZTX313 |
| Q19 | 200298 | TRANSISTOR, NPN | 04713 | 2N3904 |
| R1 | 000272 | RES, CARBON,2.7K,1/4W,5 PERCENT | 81349 | RC07GF272J |
| R2 | 000272 | RES, CARBON,2.7K,1/4W,5 PERCENT | 81349 | RC07GF272J |
| R3 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R4 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R5-R7 | 000201 | RES, CARBON, 200 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF201J |
| R8 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R9 | 000473 | RES, CARBON,47K,1/4W,5 PERCENT | 81349 | RC07GF473J |
| R10 | 000201 | RES, CARBON, 200 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF201J |
| R11 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R12 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R13 | 000151 | RES, CARBON,150 OHM,1/4W,5 PERCENT | 81349 | RC07GF151J |
| R14 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R15 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R16 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R17 | 000152 | RES, CARBON,1.5K,1/4W,5 PERCENT | 81349 | RC07GF152J |
| R18 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R19 | 000103 | RES, CARB COMP, 10K, 5 PERCENT, 1/4W | 81349 | RC07GF103J |
| R20 | 000152 | RES, CARBON,1.5K,1/4W,5 PERCENT | 81349 | RC07GF152J |
| R21 | 000472 | RES, CARB COMP, 4.7K, 5 PERCENT, 1/4W | 81349 | RC07GF472J |
| R50 | 000223 | RES, CARBON,22K,1/4W,5 PERCENT | 81349 | RC07GF223J |
| R51 | 000223 | RES, CARBON,22K,1/4W,5 PERCENT | 81349 | RC07GF223J |
| R55 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R56 | 000272 | RES, CARBON,2.7K,1/4W,5 PERCENT | 81349 | RC07GF272J |
| R57 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R58 | 000103 | RES, CARB COMP, 10K, 5 PERCENT, 1/4W | 81349 | RC07GF103J |
| R59 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R61 | 000100 | RES, CARB COMP, 10 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF100J |
| R62 | 000562 | RES,CARBON,5.6K,1/4W,5 PERCENT | 81349 | RC07GF562J |
| R63 | 000562 | RES,CARBON,5.6K,1/4W,5 PERCENT | 81349 | RC07GF562J |
| R64 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R65 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R66 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R67 | 000820 | RES, CARBON, 82 OHM, 1/4W, 5PCT | 81349 | RC07GF820J |
| R68 | 000100 | RES, CARB COMP, 10 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF100J |
| R69 | 000562 | RES,CARBON,5.6K,1/4W,5 PERCENT | 81349 | RC07GF562J |

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|--|--------|--------------------|
| R70 | 000562 | RES, CARBON, 5.6K, 1/4W, 5 PERCENT | 81349 | RC07GF562J |
| R71 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R72 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R73 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R74 | 000121 | RES, CARB COMP, 120 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF121J |
| R75 | 000100 | RES, CARB COMP, 10 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF100J |
| R76 | 000562 | RES, CARBON, 5.6K, 1/4W, 5 PERCENT | 81349 | RC07GF562J |
| R77 | 000562 | RES, CARBON, 5.6K, 1/4W, 5 PERCENT | 81349 | RC07GF562J |
| R78 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R79 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R80 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R81 | 000151 | RES, CARBON, 150 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF151J |
| R82-R84 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R85 | 000122 | RES, CARB COMP, 1.2K, 5 PERCENT, 1/4W | 81349 | RC07GF122J |
| R86 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R87 | 000272 | RES, CARBON, 2.7K, 1/4W, 5 PERCENT | 81349 | RC07GF272J |
| R88 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R89 | 000122 | RES, CARB COMP, 1.2K, 5 PERCENT, 1/4W | 81349 | RC07GF122J |
| R90 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R91 | 000272 | RES, CARBON, 2.7K, 1/4W, 5 PERCENT | 81349 | RC07GF272J |
| R92 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R93 | 000122 | RES, CARB COMP, 1.2K, 5 PERCENT, 1/4W | 81349 | RC07GF122J |
| R94 | 000470 | RES, CARB COMP, 47 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF470J |
| R95 | 000272 | RES, CARBON, 2.7K, 1/4W, 5 PERCENT | 81349 | RC07GF272J |
| R96 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R151 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R152 | 000471 | RES, CARBON, 470 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF471J |
| R153 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R154 | 000100 | RES, CARB COMP, 10 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF100J |
| R155 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R156 | 000330 | RES, CARBON, 33 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF333J |
| R157 | 000330 | RES, CARBON, 33 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF333J |
| R158 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R160 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R161 | 000471 | RES, CARBON, 470 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF471J |
| R162 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R163 | 000100 | RES, CARB COMP, 10 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF100J |
| R164 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R165 | 000330 | RES, CARBON, 33 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF333J |
| R166 | 000330 | RES, CARBON, 33 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF333J |
| R167 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R168 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R169 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R170 | 000471 | RES, CARBON, 470 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF471J |
| R171 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R172 | 000100 | RES, CARB COMP, 10 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF100J |
| R173 | 000102 | RES, CARB COMP, 1K, 5 PERCENT, 1/4W | 81349 | RC07GF102J |
| R174 | 000330 | RES, CARBON, 33 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF333J |
| R175 | 000330 | RES, CARBON, 33 OHM, 1/4W, 5 PERCENT | 81349 | RC07GF333J |
| R176 | 000332 | RES, CARB COMP, 3.3K, 5 PERCENT, 1/4W | 81349 | RC07GF332J |
| R183 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R186 | 000101 | RES, CARB COMP, 100 OHM, 5 PERCENT, 1/4W | 81349 | RC07GF101J |
| R194 | 000223 | RES, CARBON, 22K, 1/4W, 5 PERCENT | 81349 | RC07GF223J |
| R195 | 000223 | RES, CARBON, 22K, 1/4W, 5 PERCENT | 81349 | RC07GF223J |
| R196 | 000223 | RES, CARBON, 22K, 1/4W, 5 PERCENT | 81349 | RC07GF223J |
| T1-T3 | IR-17-3227 | TRANSFORMER | K8918 | 17-3227 |
| TP1 | 601197 | POST, TEST, .025 SQ | 100779 | 6-87022-6 |
| TP2 | 601197 | POST, TEST, .025 SQ | 100779 | 6-87022-6 |
| U1 | 230547 | IC, QUAD COMPARATOR | 27014 | LM339N/A-1 |

401991 PCB ASSY., FREQ. DISTR. 3351R/E

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|------------------------------------|-------|--------------------|
| U2 | 230378 | IC, 3-TERM NEG. REGULATOR | 27014 | 7915CT |
| U3 | 230380 | IC, QUAD MAND GATE | 27014 | DM74LS03N |
| U4 | 230234 | IC, HEX INVERTER | 01295 | SN74LS04N |
| U5 | 230194 | IC, DUAL D-TYPE BISTABLE | 01295 | SN74LS74AN |
| U6 | 230317 | IC, DECADE COUNTER | 01295 | SN74LS90 |
| U7 | 230547 | IC, QUAD COMPARATOR | 27014 | LM339N/A-1 |
| W1-W5 | 601208-010 | CONNECTOR, PCB, PLUG, 2-PIN | 21793 | 601208-010 |
| {96}1 | 411991 | PCB VXI FREQUENCY DIST. (UNLOADED) | 21793 | 411991 |
| {99}A/R | 500022 | WIRE, BARE COPPER/TIN, 22 GA | 21793 | 500022 |
| {113}1 | 610833 | WASHER SAOLDER, NYLON | 86928 | 5607-45 |
| {114}1 | 610851 | INSULATOR, TO-220 | 18565 | 60-11-5791-1674 |
| {115}3 | 611258-001 | STANDOFF, SWAGE 4-40 X .170 | 06540 | 8091-11B-B-440-28 |
| {117}1 | 616253 | SCREW, PPH, SEMS ASSY, 4-40 X .375 | 78189 | - |
| {119}1 | 617004 | NUT, HEX, 4-40 | - | - |
| {121}A/R | 921055 | TAPE, DBL SIDED FOAM | 34359 | Y-4930 |

404979-001/010 CABLE ASSY., FREQ. DISTRIBUTION

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|--------------------------|-------|--------------------|
| {2}A/R | 500254 | CABLE, COAXIAL, 50 OHM | 92194 | 91788 |
| {4}2 | 601263 | TERMINAL, SDR, COAX, STR | 06090 | D-607-09 |

404980-001/010 CABLE ASSY., FREQ. OUT

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|------------------------------|-------|--------------------|
| {2}A/R | 500002 | TUBING, SHRINK, .187 ID | 29005 | RNF-100-1-3/16 |
| {3}A/R | 500064 | TUBING, SHRINK, .093 ID, BLK | 29005 | RNF-100-1-3/32 |
| {4}A/R | 500254 | CABLE, COAXIAL, 50 OHM | 92194 | 91788 |
| {6}1 | 600808 | CONNECTOR, BNC, 150 RECEPT | 02660 | 31-010 |
| {8}1 | 601263 | TERMINAL, SDR, COAX, STR | 06090 | D-607-09 |

404386 OSCILLATOR ASSY., (04E)

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|--------------------------------|-------|--------------------|
| {1}1 | 401822 | PCB, DOUBLER | 21793 | 401822 |
| {2}1 | 454879 | OSCILLATOR, 5 MHZ FREQ. STD | 21793 | 454879 |
| {4}A/R | 500064 | TUBING, SHRINK, .093 ID, BLK | 29005 | RNF-100-1-3/32 |
| {6}2 | 610304 | SPACER, .250DX.125 LG | 21793 | 610304 |
| {8}2 | 611074 | SCREW, METRIC PPH, M3X10 | 21793 | 611074 |
| {10}2 | 617102 | WASHER, FLAT, #4, LIGHT SERIES | - | - |
| {11}2 | 617127 | WASHER, LOCK, #4, LIGHT SERIES | - | - |
| {22}1 | 404691 | CABLE ASSEMBLY | 21793 | 404691 |

401822, PCB ASSY., DOUBLER

| REF DESIG | RACAL-DANA P/N | DESCRIPTION | FSC | MANUFACTURER'S P/N |
|--------------|-------------------|--|-------|---------------------|
| C1-9 | R-21-1801 | CAP, CHIP, 10 NF | 95275 | VJ1206Y103MF |
| D1-2 | R-22-1029 | DIODE, SILICON | 14433 | 1N4149 |
| L1 | 310151 | CHOKE, 10 PERCENT, 100 UH | 83125 | DD100UH |
| Q1-2 | 200299 | TRANS, PNP | 04713 | 2N3906 |
| Q3-6 | 200298 | TRANS, NPN | 04713 | 2N3904 |
| R1 | R-20-5776 | RES, CHIP, 33 OHM, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-33 OHM-5 PCT |
| R2-3 | R-20-5764 | RES, CHIP, 100 OHM, 1/8W, 5 PERCENT | 65940 | MCR18-100 OHM-5 PCT |
| R4 | R-20-5792 | RES, CHIP, 1K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-1K-5 PCT |
| R5-6 | R-20-5765 | RES, CHIP, 470 OHM, 1/8W, 5 PERCENT | 65940 | MCR18-470 OHM-5 PCT |
| R7 | R-20-5794 | RES, CHIP, 1.5K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-1.5K-5 PCT |
| R8-9 | R-20-5798 | RES, CHIP, 3.9K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-3.9K-5 PCT |
| R10 | R-20-5794 | RES, CHIP, 1.5K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-1.5K-5 PCT |
| R11 | R-20-5792 | RES, CHIP, 1K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-1K-5 PCT |
| R12 | R-20-5808 | RES, CHIP, 39K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-39K-5 PCT |
| R13 | R-20-5803 | RES, CHIP, 15K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-15K-5 PCT |
| R14 | R-20-5816 | RES, CHIP, 330K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-330K-5 PCT |
| R15 | R-20-5768 | RES, CHIP, 10K, 1/8W, 5 PERCENT | 65940 | MCR18-10K OHM-5 PCT |
| R16 | R-20-5792 | RES, CHIP, 1K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-1K-5 PCT |
| R17-18 | R-20-5798 | RES, CHIP, 3.9K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-3.9K-5 PCT |
| R19 | R-20-5764 | RES, CHIP, 100 OHM, 1/8W, 5 PERCENT | 65940 | MCR18-100 OHM-5 PCT |
| R20 | R-20-5792 | RES, CHIP, 1K, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-1K-5 PCT |
| R21 | R-20-5814 | RES, CHIP, 51 OHM, 1/8W, 5 PERCENT, 200V | 65940 | MCR18-51 OHM-5 PCT |
| T1-2 | R-23-7149 | TRANSFORMER | 21793 | R-23-7149 |
| TP1 | R-24-3537 | TERMINAL ASSY. | 21793 | R-24-3537 |
| {10}1 | 411822 | PCB, DOUBLER (UNLOADED) | 21793 | 411822 |
| {68}3 | R-24-3519 | AV LUGS | 19738 | AVLUG1107/C20B |

SECTION 8

WIRE LIST

| | | |
|------------|--------------------------------------|-----|
| 404946-001 | Final Assy., 3351R | 8-2 |
| 404946-002 | Final Assy., 3351R Opt. 01 | 8-3 |
| 404946-003 | Final Assy., 3351R/10M | 8-4 |

WIRE LIST

| FROM | TO | CONDUCTOR TYPE GAUGE. COLOR | PART NUMBER | WIRE LENGTH | REFERENCE |
|-----------------------------|-----|--------------------------------|----------------|----------------|-----------------|
| P23-1 | E4 | TEF, STRND, 24GA. WHITE | 524999 | 5 1/2" | |
| P23-6 | E1 | TEF, STRND, 24GA, GREEN | 524555 | 5 3/4" | |
| P23-9 | E2 | TEF, STRND, 24GA, GREEN | 524555 | 5 3/4" | |
| P23-10 | E3 | TEF, STRND, 24GA, BLACK | 524000 | 5 3/4" | |
| P23-COAX | J22 | CABLE, COAX, 2 COND 1 STRND | 500254 | 6.0" | |
| J203-RECEPTACLE TERMINAL | E5 | TEF, STRND, 24GA. WHITE | 500132 | 5.0" | TWISTED PAIR |
| J203-PLUG TERMINAL | E6 | TEF, STRND, 24GA. BLACK | | | |

RACAL-DANA Instruments Inc. 4 GOODYEAR, IRVINE, CA 92718

| DOCUMENT TITLE | SIZE | CODE ID NO | DOCUMENT NO. | REV |
|---------------------|------|------------|--------------|-----|
| MODULE ASSY., 3351R | A | 21793 | 404946-001 | A |
| | DRN | | | |

WIRE LIST

| FROM | TO | CONDUCTOR TYPE GAUGE, COLOR | PART NUMBER | WIRE LENGTH | REFERENCE | |
|--|-----|--------------------------------|----------------|----------------|-----------------|-----|
| P23-1 | E4 | TEF, STRND, 24GA. WHITE | 524999 | 5 1/2" | | |
| P23-6 | E1 | TEF, STRND, 24GA, GREEN | 524555 | 5 3/4" | | |
| P23-9 | E2 | TEF, STRND, 24GA, GREEN | 524555 | 5 3/4" | | |
| P23-10 | E3 | TEF, STRND, 24GA, BLACK | 524000 | 5 3/4" | | |
| P23-COAX | J22 | CABLE, COAX, 2 COND 1 STRND | 500254 | 6.0" | | |
| J203-RECEPTACLE TERMINAL | E5 | TEF, STRND, 24GA. WHITE | 500132 | 5.0" | TWISTED PAIR | |
| J203-PLUG TERMINAL | E6 | TEF, STRND, 24GA. BLACK | | | | |
| | | | | | | |
| RACAL-DANA Instruments Inc. 4 GOODYEAR, IRVINE, CA 92718 | | | | | | |
| DOCUMENT TITLE | | | SIZE | CODE ID NO | DOCUMENT NO. | REV |
| FINAL ASSY., 3351R, OPT. 01 | | | A | 21793 | 404946-002 | A |
| | | | DRN | | | |

REPAIR AND CALIBRATION REQUEST FORM

To allow us to better understand your repair requests, we suggest you use the following outline when calling and include a copy with your instrument to be sent to the Racal Repair Facility.

Model No. _____ Serial No. _____ Date _____

Company Name _____ P.O.No. _____

Billing Address _____

City State Zip

Shipping Address _____

City State Zip

Technical Contact _____ Phone Number () _____

Purchasing Contact _____ Phone Number () _____

1. Describe, in detail, the problem and symptoms you are having. Please include all set up details, such as input/output levels, frequencies, waveform details, etc.

2. If problem is occurring when unit is in remote, please list the program strings used and the controller type.

3. Please give any additional information you feel would be beneficial in facilitating a faster repair time (i.e., modifications, etc.)

4. Is calibration data required? Yes No (please circle one)

Call before shipping:

Customer Service
(800) 722-3262

Ship instrument to:

Customer Service Department
Racal Instruments Inc.
4 Goodyear Street
Irvine, CA 92718

Note: We do not accept "collect" shipments.