Tektronix®
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DC 504
COUNTER/TIMER

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
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Serial Number _____

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INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first number or letter designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B000000	Tektronix, Inc., Beaverton, Oregon, USA
100000	Tektronix Guernsey, Ltd., Channel Islands
200000	Tektronix United Kingdom, Ltd., London
300000	Sony/Tektronix, Japan
700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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CHANGE INFORMATION

SAFETY SUMMARY

The following text contains a two-part summary of general safety precautions that must be observed during all phases of operation, service, and repair of this instrument.

OPERATIONS SAFETY SUMMARY

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions may be found throughout the manual where they apply, but may not appear in this summary.

TERMS

In This Manual:

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

As Marked on Equipment:

CAUTION indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER indicates a personal injury hazard immediately accessible as one reads the markings.

SYMBOLS

In This Manual:

This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment:

DANGER—High Voltage.

Protective ground (earth) terminal.

ATTENTION—refer to manual.

Grounding the Power Module

This instrument is grounded through the grounding conductor of the power module. To avoid electrical shock, plug the power module cord into a properly wired receptacle before connecting to the instrument input or output terminals.

Do not use the power cord grounding conductor as the only grounding connection between two or more devices. To avoid electrical shock, connect the grounding terminals together with separate conductors.

Use the Proper Power Cord

Use only the power cord and connector specified for the power module. Use only a power cord that is in good condition.

For detailed information on power cords and connectors, see the power module manual.

Refer cord and connector changes to qualified service personnel.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your instrument, and which is identical in type, voltage rating, and current rating.

Refer fuse replacement to qualified service personnel.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this instrument in an atmosphere of explosive gases unless it has been specifically certified for such operation.

Do Not Remove Covers or Panels

To avoid personal injury, do not remove the instrument covers or panels. Do not operate the instrument without the covers and panels properly installed.

Do Not Operate Without Covers

To avoid personal injury, do not operate this instrument without covers or panels installed. Do not apply power to the instrument via a plug-in extender.

SERVICING SAFETY SUMMARY

FOR QUALIFIED SERVICE PERSONNEL ONLY

Refer also to the preceding Operators Safety Summary.

Do Not Service Alone

Do not perform internal service or adjustment of this instrument unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On

Dangerous voltages exist at several points in this instrument. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, soldering, or replacing components.

Power Source

The power module is intended to operate from a power source that will not apply more than 250 volts between the supply conductors or between either supply conductor and ground. A protective ground connection by way of the grounding conductor in the power cord is essential.

@ OCT 1980

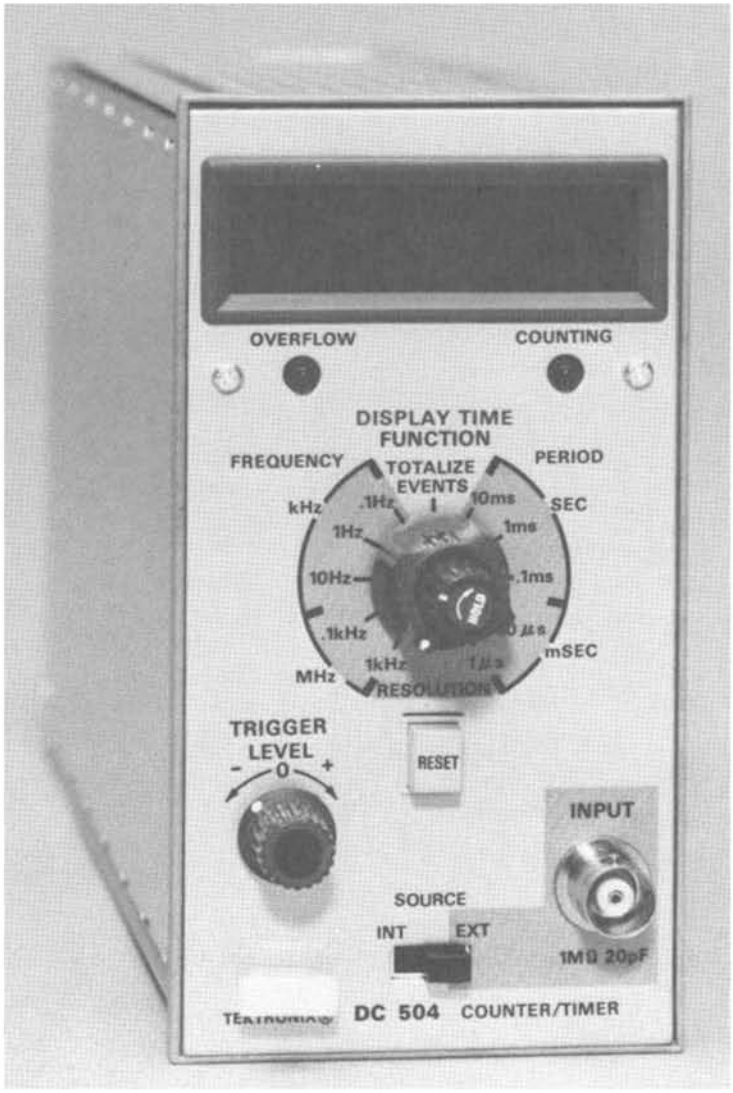


Fig. 1-1. The DC 504.

OPERATING INSTRUCTIONS

INSTRUMENT DESCRIPTION

The DC 504 Counter/Timer measures frequency from 0.1 Hz (0 Hz with 0.1 Hz resolution) to at least 80 MHz. It measures period from 1 μs to 999.99 s, and totalizes events from 0 to 99,999 at a maximum rate of at least 80 MHz. A resolution of 0.1 Hz can be obtained by allowing the more significant figures of the counter to overflow.

Five 7-segment light-emitting diodes (LED) provide a highly visible numerical display. The decimal point is automatically positioned and leading zeros (to the left of the most significant digit or decimal point) are blanked. Digit overflow is indicated by a front-panel LED.

Signals to be counted or timed can be applied to either a front-panel bnc connector or to the rear interface connector. The DC 504 is designed to operate in any of the TM 500-Series Power Modules. It is completely compatible with other members of the TM 500 family in terms of signal interconnections.

The DC 504 is designed to operate in ambient temperatures between 0° C and +50° C. It can be stored in temperatures ranging from −40° C to +75° C. After storage in temperatures outside the specified operating temperatures, allow the DC 504 to return to a room ambient temperature within the operating range before applying power.

PREPARATION FOR USE

INSTALLATION AND REMOVAL

CAUTION

Turn the power module off before inserting the plug-in; otherwise, damage may occur to the plug-in circuitry.

Check to see that the plastic barriers on the interconnecting jack of the selected power module compartment match the cut-outs in the DC 504 circuit board edge connector. Align the DC 504 chassis with the upper and lower guides (see Fig. 1-2) of the selected compartment. Push the module in and press firmly to seat the circuit board in the interconnecting jack.

To remove the DC 504, pull on the release latch (located in the lower left corner) until the interconnecting jack disengages and the DC 504 will slide out.

Apply power to the DC 504 by pulling out the power switch knob of the power module.

CONTROLS AND CONNECTORS

Refer to Figs. 1-3 and 1-4. Even though the DC 504 is fully calibrated and ready to use, the functions and actions of the controls and connectors should be reviewed before attempting to use it. Note that some thought must be given to the settings of the internal switches shown in Fig. 1-3; for example, if you want to measure rpm, the RPM/NORM switch must be set for RPM. Also, if measuring events that occur at a slow rate, the Input Coupling switch should be set for dc.

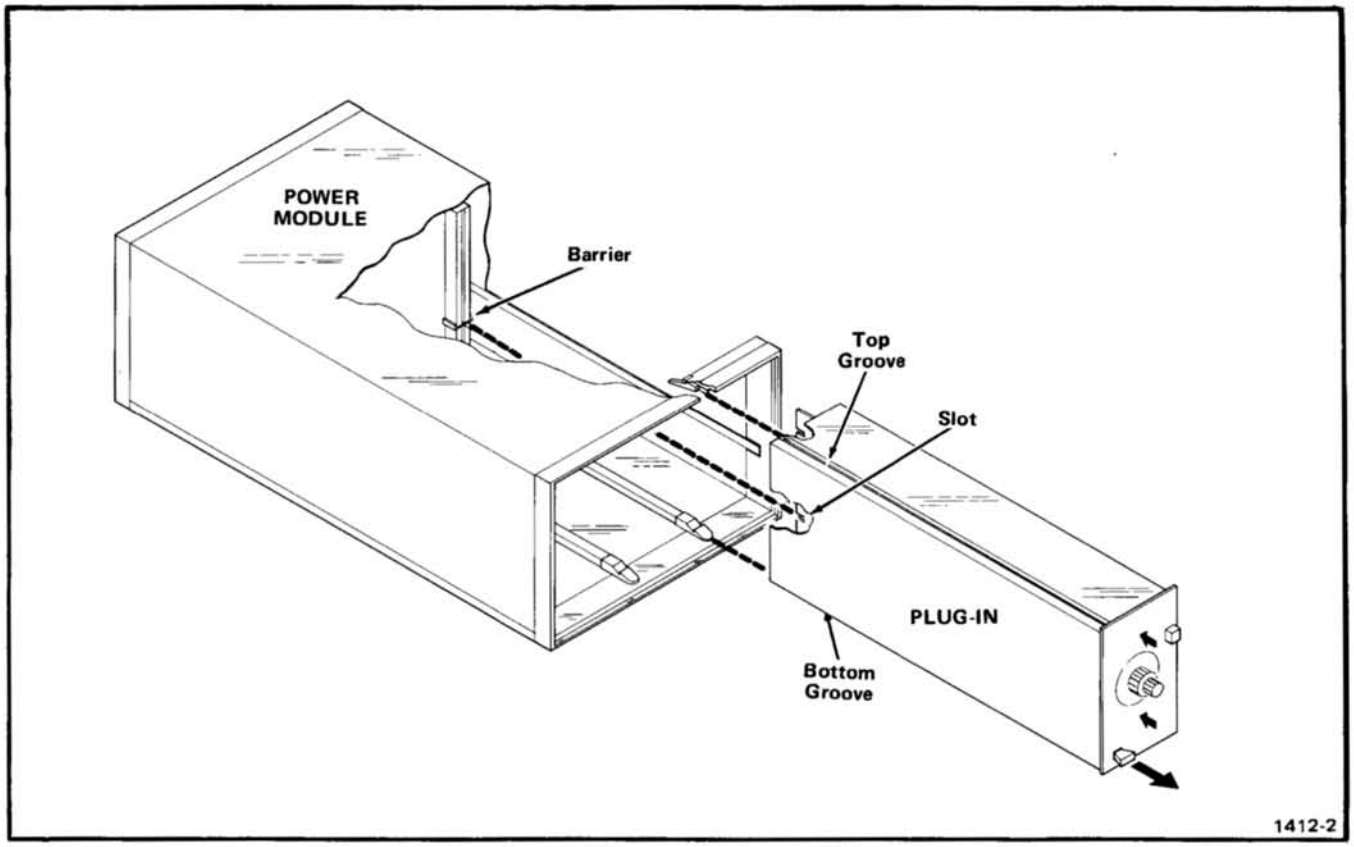


Fig. 1-2. Plug-in installation and removal.

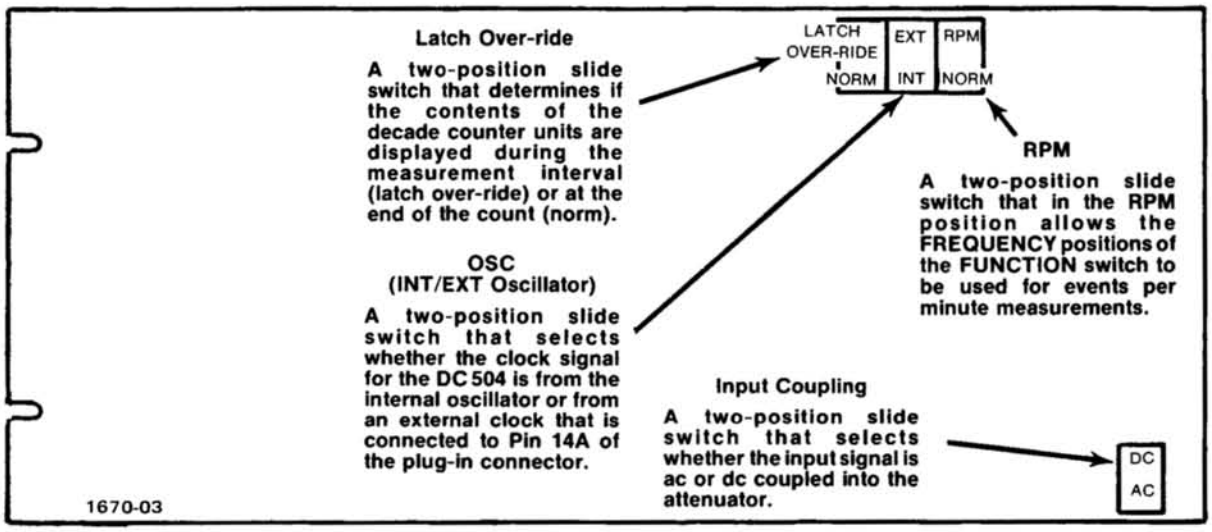


Fig. 1-3. Internal switch locations.

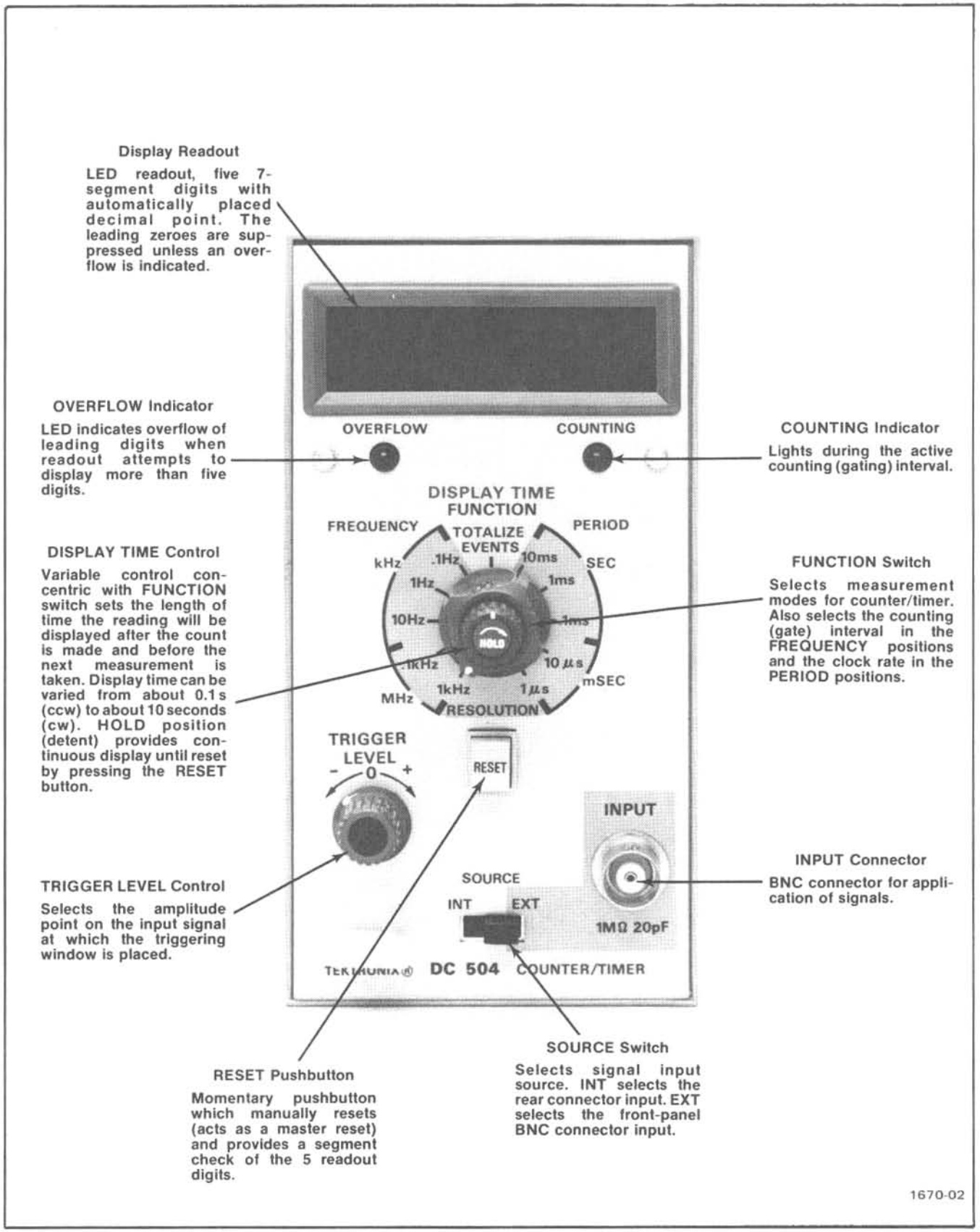


Fig. 1-4. Function of Controls and Connectors.

INPUT CONSIDERATIONS

INPUT SOURCES

The front-panel SOURCE switch selects either the front-panel bnc connector (EXT), or the rear interface connector (INT) via pin 16A.

The external input presents a high impedance of approximately 1 MΩ, paralleled by about 20 pF. The internal input circuit presents a nominal 50 Ω impedance to match typical coaxial cable signal connections.

TRIGGERING

The TRIGGER LEVEL and Input Coupling (internal switch) controls affect the counter's ability to make a measurement. In general, the trigger controls are similar to oscilloscope controls, except that the end result is not a stable waveform graphic display, but a stable digital frequency display.

Input Coupling Switch. An internally mounted Input Coupling switch (see Fig. 1-4) selects ac (capacitive) or dc (direct) coupling for the input signal. This coupling takes place after the signal arrives from the selected source and before it is passed on to the fixed attenuator. Ac coupling is convenient for most frequency measurements to avoid readjusting the TRIGGER LEVEL control for changing dc levels. It does, however, reduce sensitivity to signals below 10 Hz. Thus, for period measurements longer than 0.1 s dc coupling should be used.

TRIGGER LEVEL. The TRIGGER LEVEL control must be properly adjusted for a stable reading. It will not be difficult to adjust unless the signal amplitude or frequency is close to (or perhaps beyond) the specified limits. Large amplitude signals (≥5 V) at high frequencies (≥50 MHz) will cause the trigger point to shift negative from its normal 0 location.

A signal that looks stable on an oscilloscope may still show jitter when measured with a digital counter. If the count varies from reading to reading, it is probably due to jitter in the signal source. If the count changes unreasonably, the DC 504 is not being triggered properly, either because the controls are not set right or the signal is beyond the counter's capabilities (too small in amplitude or too high in frequency). A stable input signal will show only ±1 count of jitter (±1 of least significant digit) when the DC 504 is properly triggered.

NOTE

The specified jitter for the DC 504 is ±0.5% of one input cycle ±1 count.

MEASUREMENT INTERVALS

To adjust the trigger controls, choose the TOTALIZE EVENTS position of the FUNCTION switch (or for any FUNCTION switch position, manually over-ride the latch using the internal Latch Over-Ride switch). This gives rapid feedback via the display as to whether the Counter is being triggered or not. If it is, numbers will appear in the display. Frequencies below 0.1 Hz will not be resolvable in the lowest frequency kHz scale. For such low frequencies, a period measurement is better suited.

MAXIMUM INPUT VOLTS, SENSITIVITY, AND FREQUENCY RANGE

The maximum safe input voltage is 250 V (dc + peak ac) at 500 kHz or less. Above 500 kHz, the maximum safe positive voltage decreases linearly at 20 dB per decade. A ±5 volt input is tolerable at any frequency.

The DC 504 will respond to signal amplitudes of at least 20 mV, rms, (56.6 mV peak-to-peak) at frequencies of up to at least 15 MHz, 35 mV, rms (99 mV peak-to-peak) up to 50 MHz, and 175 mV, rms (499 mV peak-to-peak) up to 80 MHz.

Depending on the coupling mode selected, the low frequency limit for the input is either 0 Hz (dc coupled) or 10 Hz (ac coupled).

Because of the very high input sensitivity of the DC 504, signal sources and coaxial cables providing the input to the counter/timer must be terminated in their characteristic impedances if fast rise-time signals (such as square waves) are used as inputs. Otherwise, the impedance mismatch will cause reflections or ringing along the input coaxial cable. The undesired ringing peaks may be of a large enough amplitude to trigger the DC 504, and the reading obtained will be an integer multiple of the actual input frequency. In addition, the reading may vary by integer factors as the TRIGGER LEVEL control is rotated. See Fig. 1-5 for examples.

SETTING SLOPE AND LEVEL

The Trigger circuit responds to the positive-going transition of the input signal for both frequency and period functions.

The TRIGGER LEVEL control allows the operator to move the hysteresis window of the trigger circuit to an optimum level on the input signal to ensure stable triggering. See Fig. 1-6. The TRIGGER LEVEL control adjusts over a nominal ±1.5 V range of the input signal. If a wider range is desirable, use ac input coupling or attenuate the input signals (use a 10X probe or attenuator).

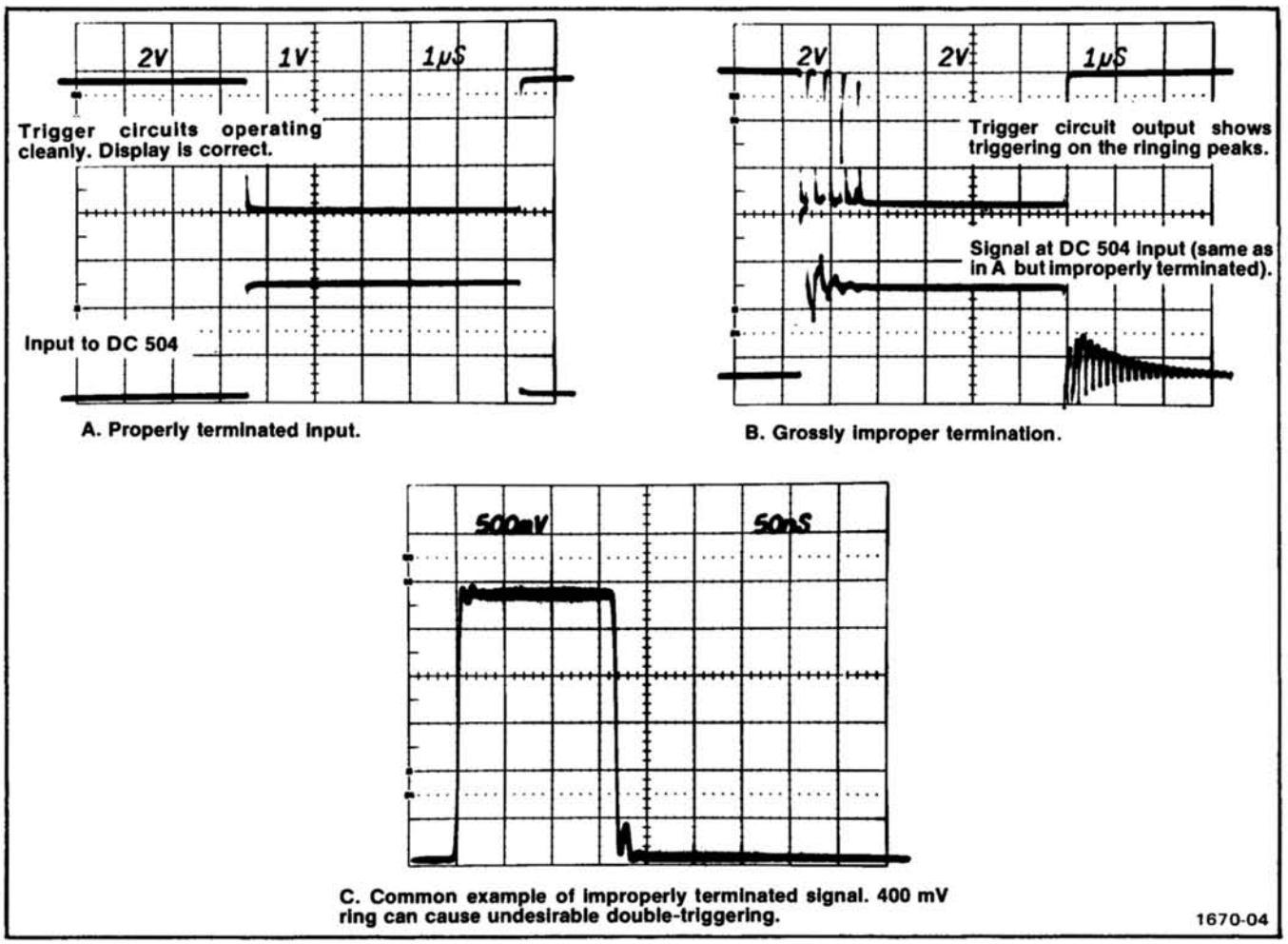


Fig. 1-5. Illustration showing effects of proper input signal termination and improper input signal termination.

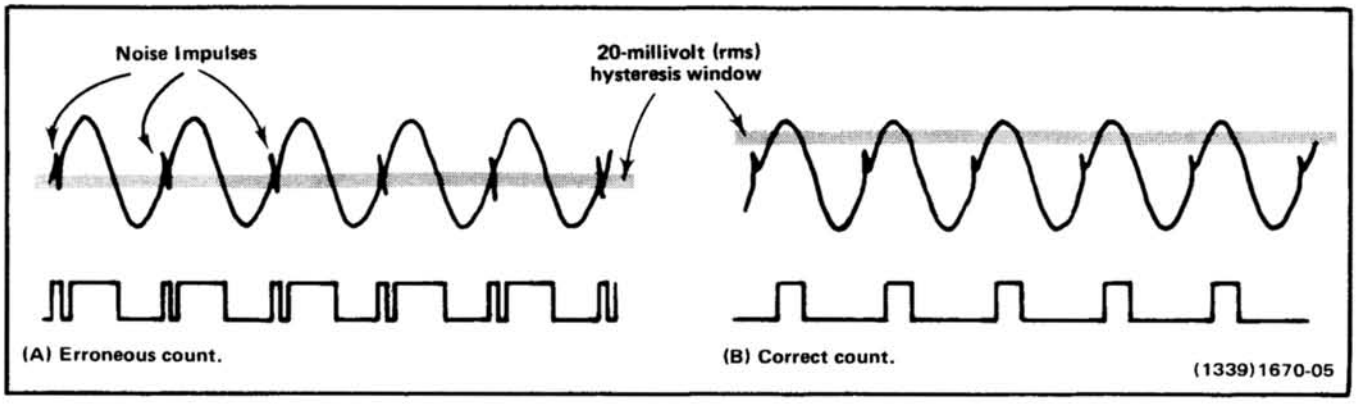


Fig. 1-6. Triggering circuit responses to improper (A) and proper (B) TRIGGER LEVEL settings.

APPLICATIONS

FREQUENCY MEASUREMENTS

To measure and display the frequency of a signal up to 80 MHz, set the FUNCTION switch to the appropriate FREQUENCY position. Set the DISPLAY TIME control fully ccw, connect the signal to the INPUT connector, and set the SOURCE switch to EXT (front-panel bnc connector). You will note that higher resolution measurements take more counting time, e.g., a 1 kHz resolution measurement on the MHz scale requires 1 ms[1] while a 0.1 Hz resolution measurement on the kHz scale takes 10 s.

Final selection of FREQUENCY position of the FUNCTION switch depends on the frequency being measured, desired resolution, and willingness of the operator to wait for a measurement. Using the FREQUENCY MHz position, higher frequencies may be measured, but at the expense of the greater resolution capabilities of the longer FREQUENCY kHz position.

Overflow. Through intentional use of "overflow" displays, it is possible to improve the resolution of the counter. Choose the FUNCTION switch position that displays the most significant number of the measurement as far to the left as possible. Note the numbers displayed to the right of the decimal. Move the decimal point to the left by choosing a higher resolution FUNCTION position, if possible. The OVERFLOW LED will light when the most significant number overflows the last storage register. Note that the increased resolution does not change the accuracy of the measurement. Jitter in the input signal will become more apparent as the resolution increases.

Measurement Rate. Once a stable measurement is obtained, the rate at which measurements are made can be controlled by the DISPLAY TIME control. Turning the control cw holds off the counting and stores the display for a longer time before a new measurement is made and displayed. Display time and counting time together complete a measurement-display cycle.

The DISPLAY TIME control is uncalibrated and variable from about 0.1 s at the ccw end to about 10 s at the cw end. At the cw end, there is a detent position called HOLD. In HOLD, the last count taken will be stored and displayed for an indefinite time. A new count and display may be initiated by pushing the RESET button, by turning the DISPLAY TIME control ccw, or changing the FUNCTION switch to any other position.

REVOLUTIONS PER MINUTE (RPM) MEASUREMENTS

The internal RPM switch, when set to its RPM position, allows the DC 504 to be used as an rpm counter in the FREQUENCY positions of the FUNCTION switch. By moving the RPM switch to RPM, the gate times of the DC 504 are lengthened by a factor of six, so that the longest gate time becomes 1 minute, giving a "counts per minute" or rpm function. The decimal point is erased from the display in the rpm measurments to indicate that rpm rather than FREQUENCY is the selected function and to facilitate the use of transducers with other than 1 pulse per revolution. Table 1-1 should be used to interpret the DC 504 front-panel markings and the rpm display readings.

Table 1-1

FUNCTION Switch		RPM	RPM	Read display[a]
FREQUENCY	RESOLUTION	Gate Time	Resolution	number as
MHz	1 kHz	6 ms	10,000	rpm X10,000
MHz	.1 kHz	60 ms	1,000	rpm X1,000
kHz	10 Hz	.6 s	100	rpm X100
kHz	1 Hz	6 s or .1 m	10	rpm X10
kHz	.1 Hz	60 s or 1 m	1	rpm X1

[a]Assumes that transducer produces 1 pulse per revolution. If transducer produces 10 pulses per revolution, readings will be increased by a factor of 10.

[1]The DISPLAY TIME control setting (about 0.1 s minimum) will effectively swamp out this short gate time.

TOTALIZING

In the Totalize Events mode, signal events applied to the INPUT are counted and the accumulated total is displayed until the reset button is pushed or the FUNCTION switch is changed to another position. This mode is a manual analog of the frequency mode. Its main application is to accumulate a count of relatively slow and irregular events.

Starting the Count. Apply the signal to the INPUT connector and set the trigger controls the same as for frequency measurement. Adjust the TRIGGER LEVEL control until the displayed total begins to increment. The accumulated count is displayed in whole numbers. In the Totalize Events mode, only the TRIGGER LEVEL control and the RESET button affect the display.

Stopping the Count. If pin 28B at the rear interface connector is pulled to ground, the Totalize mode operation will be stopped (no more incoming events will be added to the total). This is the most reliable method of stopping the count. A discrete transistor or open-collector logic should be used to pull pin 28B on the interface connector low, i.e., pin 28B must not be forced high. Rotating the TRIGGER LEVEL control until the DC 504 no longer reacts to the input signal will also stop the totalize count. An extra count may be added to the total by rotating the TRIGGER LEVEL control ccw through the 0 level.

NOTE

Connections to the rear interface connector are to be made by qualified service technicians only.

Restarting and Resetting. When pin 28B at the rear interface connector is allowed to go high, or when the TRIGGER LEVEL control is again adjusted to trigger the DC 504 on the input signal, incoming events will advance the displayed total.[2] Resetting the count to zero can be done at any time by pressing the RESET button or by moving the FUNCTION switch to some other position, then back to TOTALIZE EVENTS position.

PERIOD MEASUREMENTS

Gating. Period measurement is provided in counter/timers primarily to overcome a basic limitation of counters, i.e., the long time required to make a high-resolution, high-accuracy measurement of low-frequency signals. For example, a 1 kHz signal requires 1,000 seconds of counting time to accumulate a million counts. However, in only one second, a 1 kHz signal can gate one million clock pulses from a 1 MHz clock into the counter.

Simply stated, the PERIOD mode reverses the functions of signal and clock as compared to the frequency mode. In frequency mode, signal events are counted for some number of clock pulses, then displayed. In PERIOD, clock pulses are counted for some number of signal events then displayed.

Low Frequencies. Period measurements of signal below 10 Hz, and particularly in the lowest decade from 0.1 Hz to 1.0 Hz, become rather sensitive to wave shape and amplitude. Since it is desirable for the signal to pass through the trigger hysteresis abruptly, square-wave inputs are preferred. Sine and triangle waves can be measured accurately at the very low end if the input amplitude is kept somewhat above minimum specification so that the trigger input is driven hard.

NOTE

Be especially wary of high frequency ringing or noise on the input signal. They can cause false triggering in the PERIOD mode.

[2]However, if the TRIGGER LEVEL control is rotated through the threshold point (0 level for zero volts dc) in a ccw direction, the displayed total will advance by one.

FUNCTIONS AVAILABLE AT REAR INTERFACE CONNECTOR

CONTROL LINES

Solder pads have been connected to unassigned pins at the rear connector for routing signals to and from the DC 504 for specialized applications (see Rear Connector Pin Assignments). One or more compartments of a multi-plug-in power module can be wired with barriers installed to provide specific functions between compartments. See the power module instruction manual for additional information.

A reset input line (pin 26A), which doubles as a reset output signal line, clears the counter to zero when a low is applied to the line.

An external clock signal may be used instead of the internal 1 MHz clock by connecting the external standard to the Ext Clock input line, pin 14A, and setting the internally located Int/Ext Oscillator switch to Ext. A shielded cable connected between the E.O. solder points near pin 14A and U180 will be required.

The external oscillator input is somewhat duty-cycle sensitive. It is recommended that the positive portion of this input have a duty cycle of at least 15% but no more than 70%. Individual DC 504s may allow the user to exceed these limits by a small margain. It is possible for large amplitude, fast-rise external oscillator signals to generate crosstalk with the internal 1 MHz at S160. Thus it is recommended that the Ext Clock Input be removed from pin 14A if it is not to be used for a period of time. Likewise, if you expect to use an external oscillator as the sole time base signal for the DC 504, then the internal oscillator can be disabled by removing Y160. Unsoldering at least one side of R180 from the circuit board will also suffice.

A Count Holdoff input line forces the DC 504 into the "hold" mode as long as pin 28A is held high. The DC 504 display will hold the lastest measurement and will take another count only after the reset button has been pushed, the FUNCTION switch rotated, or the count holdoff signal goes low (or open).

A Totalize Start/Stop input line can be used to inhibit the gate (stop the counting) in the TOTALIZE mode. In any other mode, the counting will stop and the display will go to zero after a time determined by the DISPLAY TIME control. Pin 28B must not be forced high or the gate will be forced open in all modes. Open-collector logic or a discrete transistor without a pull-up resistor is recommended to pull pin 28B low. Pin 28B is also used as a Gate Out signal line (see following text).

SIGNAL LINES

These lines provide for signal input, counter status and clock signal outputs, and bcd data outputs. An overflow output line (pin 23B) goes high to indicate that the counter is in an overflow condition.

The Reset output line is described above as a control line.

The Latch output line, (pin 19B) provides a positive "data good" pulse of about 10 μs duration at each updating of the display register.

The BCD Output data lines provide the count in an 8-4-2-1 serial-by-digit method. The output is active-high logic and is interpreted in conjuction with the Digit Select Out lines. The 8-4-2-1 lines are pins 20B, 20A, 21B and 19A, respectively.

The Digit Select Out lines consist of time-slot lines TS1—TS5. The output is active-high logic. The lines scan from the most significant digit to the least significant digit at about a 3.5 kHz rate. The TS1—TS5 lines are pins 25A, 24A, 23A, 22A and 21A respectively.

A Decimal Point Scanned Output line, (pin 27B) goes high only when the decimal point is to the left of the digit whose select line is high.

A Gate Out line, pin 28B, provides a signal that goes high during the time that the gate is open, i.e., while the input signal is gated into the decade counter units. This pin is also used as the Totalize Start/Stop input line.

REPACKAGING FOR SHIPMENT

If the Tektronix instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag showing: owner (with address) and the name of an individual at your firm that can be contacted. Include complete instrument serial number and a description of the service required.

Save and re-use the package in which your instrument was shipped. If the original packaging is unfit for use or not available, repackage the instrument as follows:

Surround the instrument with polyethylene sheeting to protect the finish of the instrument. Obtain a carton of corrugated cardboard of the correct carton strength and having inside dimensions of no less than six inches more than the instrument dimensions. Cushion the instrument by tightly packing three inches of dunnage or urethane foam between carton and instrument, on all sides. Seal carton with shipping tape or industrial stapler.

The carton test strength for your instrument is 200 pounds.

SPECIFICATION AND PERFORMANCE CHECK

SPECIFICATION

PERFORMANCE CONDITIONS

The electrical characteristics are valid only if the DC 504 has been calibrated at an ambient temperature between +20° C and +30° C and is operating at an ambient temperature between 0° C and +50° C unless otherwise noted.

Items listed in the Performance Requirements column of Table 2-1 are verified by completing the Performance Check in this manual. Items listed in the Supplemental Information column are not verified in this manual; they are either explanatory notes or performance characteristics for which no limits are specified.

Table 2-1

ELECTRICAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
	INPUT	
Frequency Range or Revolutions Per Minute (rpm)		
DC Coupled	0 Hz to at least 80 MHz	Coupling selected with an internal switch
AC Coupled	10 Hz to at least 80 MHz	Coupling selected with an internal switch
Sensitivity	20 mV rms (56.6 mV p-p) below 15 MHz 35 mV rms (99 mV p-p) at or below 50 MHz derated to typically <175 mV rms (495 mV p-p) at 80 MHz (see Fig. 2-1)	Sine wave used for measurement
Input Impedance	1 MΩ paralleled by approximately 20 pF	
Maximum Safe Voltage	250 V at 500 kHz or less; derate −20 dB/decade to 25 MHz. ±5 V from 25 MHz to 80 MHz	
Trigger Level Range	Nominally −1.5 V to +1.5 V	
Triggering Error	≤0.5% of one cycle at minimum trigger sensitivity	
Signal Source	Internal (rear connector interface) or external (front panel bnc)	Selected by front panel SOURCE switch
Slope		Plus for all functions
	DISPLAY	
Display Accuracy	±1 count ±time-base accuracy ±trigger error	

Table 2-1 (cont)

Characteristics	Performance Requirements	Supplemental Information
Maximum Resolution		
FREQUENCY (or RPM)		
kHz Positions	0.1 Hz, 1 Hz, and 10 Hz (1 rpm, 10 rpm and 100 rpm)*	Seven digit resolution possible in overflowed kHz position
MHz Positions	0.1 kHz, and 1 kHz (1000 rpm and 10 k rpm)*	Nine digit resolution possible in overflow kHz position
TOTALIZE EVENTS		Events being totalized must be positive-going pulses at least 6.25 ns in width. The repeatable of the pulse must be at least 6.25 ns apart (i.e., 80 MHz square-wave). The pulse amplitude must meet 80 MHz input sensitivity requirements. Less input amplitude will be required for wider pulses.
PERIOD		
mSEC Positions	1 μs, and 10 μs	A random error of up to 5 counts may occur in the 10 μSEC period position when measuring periods of less than 2.00 ms. Such short periods should be measured in the 1 μs period position to obtain higher resolution.
SEC Positions	10 ms, 1 ms, and 0.1 ms	
Display Time		Variable from about 0.1 s to about 10 s. Detent position of DISPLAY TIME knob provides a HOLD mode.

INTERNAL TIME BASE

	Standard (1 MHz)	Option 1 (5 MHz)
Crystal Frequency		
Stability 0° C to +50° C after 1/2 hour warm-up	Within 1 part in 10^5	Within 5 parts in 10^7
Long-Term Drift	1 part or less in 10^5 per month	1 part or less in 10^7 per month
Accuracy	Adjustable to within 1 part in 10^7	Adjustable to within 5 parts in 10^9

*Assuming transducer output is one pulse per revolution.

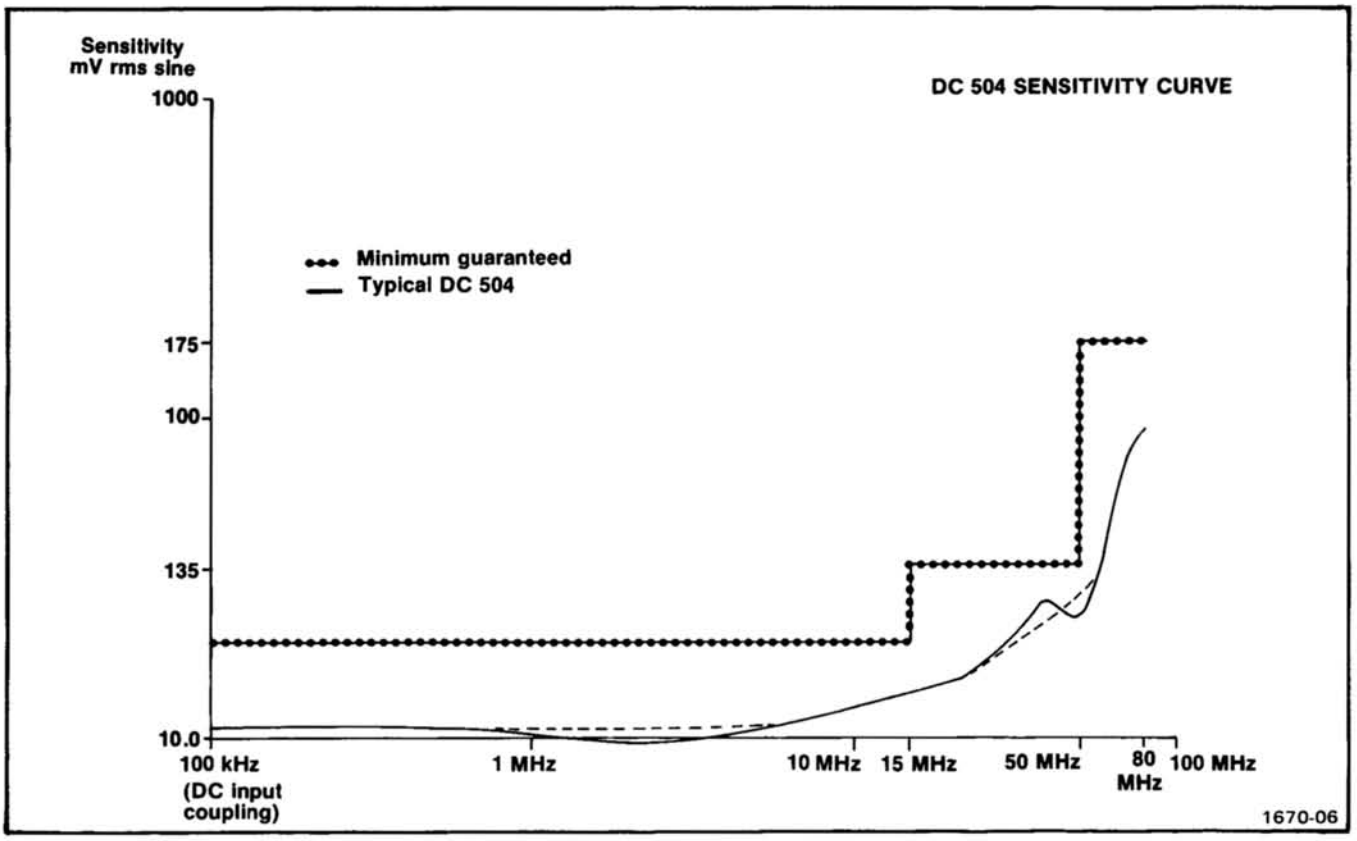


Fig. 2-1. DC 504 Sensitivity Curve.

Table 2-2
ENVIRONMENTAL CHARACTERISTICS

Characteristics	Performance Requirements	Supplemental Information
Temperature		
Operating	0°C to +50°C	
Storage	−40°C to +75°C	
Altitude		
Operating	To 15,000 feet	
Storage	To 50,000 feet	
Vibration		
Operating and Non-operating	With the instrument complete and operating, vibration frequency swept from 10 to 50 to 10 Hz at 1 minute per sweep. Vibrate 15 minutes in each of the three major axes at 0.015" total displacement. Hold 3 minutes at any major resonance, or if none, at 50 Hz. Total time, 54 minutes.	
Shock		
Operating and Non-operating	30 g's, 1/2 sine, 11 ms duration, 2 shocks in each direction along 3 major axes, for a total of 12 shocks.	

PERFORMANCE CHECK

INTRODUCTION

This procedure checks the electrical characteristics of the DC 504 that appear in the Specification section of this manual. If the instrument fails to meet the requirements given in the performance check, the Adjustment procedure should be performed. This procedure can also be used by an incoming inspection facility to determine acceptability of performance.

The electrical characteristics in this manual are valid only if the DC 504 is calibrated at an ambient temperature of +20°C to +30°C and operated at an ambient temperature of 0°C to +50°C.

Tolerances that are specified in this performance check procedure apply to the instrument under test and do not include test equipment error. Limits and tolerances in this procedure are instrument performance requirements only if stated as such in the Specification section of this instrument manual.

TEST EQUIPMENT REQUIRED

The following test equipment, or equivalent, is required to perform the performance check. Test equipment characteristics listed are the minimum required to verify the performance of the equipment under test. Substitute equipment must meet or exceed the stated requirements. All test equipment is assumed to be operating within tolerance.

Special test devices are used where necessary to facilitate the procedure. Most of these are available from Tektronix, Inc., and can be ordered through your local Tektronix Field Office or representative.

Table 2-3

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
Power Module	Provide power for DC 504 and other TM 500-Series test equipment used in this procedure.	All steps.	TM 504 or equivalent.
Medium Frequency Sine-wave Generator	Output frequencies of 2 MHz, 15 MHz, 50 MHz and 80 MHz with variable p-p output amplitude from from 56 mV to 2.7 V.	Steps 3 and 8.	SG 503 Leveled Sine Wave Generator or equivalent.
Low Frequency Sine-wave Generator	Output frequency of 10 Hz with a p-p output amplitude of 56 mV.	Step 8.	SG 502 Oscillator or equivalent.
Time-Mark Generator	Marker outputs: 1 s, 0.5 s, 0.1 s, 50 ms, 10 ms, 5 ms, 2 ms, 0.5 ms, 0.1 ms and 50 μs accurate within ±0.1%.	Steps 5, 6, and 9.	TG 501 Time Mark Generator or equivalent.
1 MHz Frequency Standard	Output frequency of 1 MHz accurate within 2 parts in 10^8 (1 part in 10^9 for Option 1).	Steps 7a and 7b.	Hewlett-Packard Model 105A/B[b] or equivalent.

[b]For best accuracy, the frequency standard used should be calibrated immediately before making this performance check.

Table 2-3 (cont)

Description	Performance Requirements	Application	Example
50 Ω Feed-through Termination	Tolerance ±2%, bnc connectors.	Steps 3, 5, 6, 8 and 9.	Tektronix Part No. 011-0049-01 or equivalent.
600 Ω Feed-through Termination	Tolerance ±2%, bnc connectors.	Step 8.	Tektronix Part No. 011-0092-00 or equivalent.
50 Ω Coaxial Cable	Length 42 inches, bnc connectors.	Steps 3, 5, 6, 7, 8, and 9.	Tektronix Part No. 012-0057-01.

PRELIMINARY PROCEDURE

NOTE

The performance of this instrument can be checked at temperatures between 0° C and +40° C. Make adjustments at a temperature between +20° C and +30° C (+68° F and +86° F).

1. Ensure that the correct nominal line selector block has been installed on the line selector pins on the power module interface board and the regulating range selected includes the applied line voltage. Refer to the installation section of the power module manual.

2. Remove the left side cover from the DC 504 and set the group of three slide switches to their down positions. Set the single slide switch (coupling) to its upper (DC) position. Replace the cover.

3. Install the DC 504 and all TM 500-Series test equipment into the power module(s).

4. Connect the power module(s) and test equipment to a suitable line voltage source. Turn all equipment on and allow at least 30 minutes for the equipment to stabilize.

5. Set the following DC 504 controls:

DISPLAY TIME	ccw
FUNCTION	TOTALIZE EVENTS
TRIGGER LEVEL	cw
SOURCE	EXT

PERFORMANCE CHECK PROCEDURE

1. Check Display

a. Push DC 504 RESET button and hold in.

b. CHECK—For a display of 88888, and all segments have approximately the same intensity.

c. Release the RESET button.

d. CHECK—For a display of 0.

NOTE

The COUNTING light is continuously on when in the TOTALIZE EVENTS mode.

2. Check Function Switch

a. Set the following controls:

DC 504

DISPLAY TIME	ccw
FUNCTION	FREQUENCY MHz, 1 kHz RESOLUTION
TRIGGER LEVEL	Fully cw
SOURCE	EXT
All internal switches except the Input Coupling switch	Down position
Internal Input Coupling switch	DC, up position

b. Check the switch functions and display in the following chart.

FUNCTION		RESOLUTION	DISPLAY
FREQUENCY	MHz	1 kHz	.000
		.1 kHz	.0000
	kHz	10 Hz	.00
		1 Hz	.000
		.1 Hz	.0000
TOTALIZE EVENTS			0
PERIOD	SEC	10 ms	.00
		1 ms	.000
		.1 ms	.0000
	mSEC	10 μs	.00
		1 μs	.000

3. Check Triggering

a. Set the following controls.

SG 503

Frequency	≈2 MHz
Amplitude Multiplier	X1
Output Amplitude	2.7

DC 504

DISPLAY TIME	ccw
FUNCTION	FREQUENCY MHz, 1 kHz RESOLUTION
TRIGGER LEVEL	cw
SOURCE	EXT
All internal switches except the Input Coupling switch	Down position
Internal Input Coupling switch	DC, up position

b. Turn DC 504 TRIGGER LEVEL knob ccw until display changes from .000 to .001. Slight rotation about the "trip point" will cause the display to change between .000 and .001.

c. CHECK—That the index on the TRIGGER LEVEL knob is pointed toward the top of the DC 504 and is approximately centered when at the "trip point."

d. Connect the SG 503 Output to the DC 504 INPUT through a coaxial cable and a 50-0hm terminator. The terminator should be placed at the DC 504 end of the cable.

e. Turn the DC 504 TRIGGER LEVEL knob fully cw.

f. CHECK—That the DC 504 is not triggered (display should be .000).

g. Turn the DC 504 TRIGGER LEVEL knob fully ccw.

h. CHECK—That the DC 504 is not triggered (display should be .001).

i. Remove the SG 503 Output from the DC 504 INPUT.

4. Check Display Time Interval.

a. Set the following controls:

DC 504

DISPLAY TIME	ccw
FUNCTION	FREQUENCY MHz, 1 kHz RESOLUTION
All internal switches except Input Coupling switch	Down position
Internal Input Coupling switch	DC, up position

b. CHECK—Rapid blinking of COUNTING light.

c. Turn the DISPLAY TIME knob slowly to cw position but not in detent.

d. CHECK—That the COUNTING light blinks progressively slower until, at the full cw position, COUNTING light blinks approximately every 8 to 10 seconds.

e. Set the DISPLAY TIME knob to detent.

f. CHECK—COUNTING light stays off.

5. Check Decade Counters.

a. Set the following controls.

DC 504

DISPLAY TIME	ccw
FUNCTION	TOTALIZE EVENTS
TIRGGER LEVEL	Midrange
SOURCE	EXT
All internal switches except Input Coupling switch	Down position
Internal Input Coupling switch	DC, up position

TG 501

Variable Timing	In
Marker (sec)	.5 s

b. Connect the TG 501 Marker Out to the DC 504 INPUT through a coaxial cable and a 50-ohm terminator.

c. Adjust the DC 504 TRIGGER LEVEL so that the first digit least significant digit (LSD) starts counting.

d. Push the RESET button and release.

e. CHECK—That the first digits count continuously and that all segments light properly.

f. Repeat the above check for the remaining digits using the following settings. Adjust the TRIGGER LEVEL as necessary for a count.

TG 501 MARKER (SEC)	DC 504 Digit
50 ms	Check 2nd
5 ms	Check 3rd
.5 ms	Check 4th
50 μs	Check 5th

g. Push the RESET button.

h. CHECK—Count starts over and the OVERFLOW light is off until the fifth digit counts past 9.

i. Remove the TG 501 OUTPUT from the DC 504 INPUT.

6. Check Internal Switch Functions (Optional—Only those functions that are used should be checked).

a. Set the following controls.

DC 504

DISPLAY TIME	ccw
FUNCTION	FREQUENCY kHz, .1 Hz RESOLUTION
TRIGGER LEVEL	Midrange
SOURCE	EXT
All internal switches except Input Coupling switch	Down position
Internal Input Coupling switch	DC, up position

WARNING

Dangerous potential exist at several points through out the DC 504. Remove the DC 504 from the power module or otherwise disconnect power module power before changing position of internal switches.

b. Set the TG 501 marker dial to 2 ms.

c. Connect the TG 501 Marker Out to the DC 504 INPUT through a coaxial cable and a 50-ohm terminator.

d. Adjust the DC 504 TRIGGER LEVEL for a reading of approximately .5000. The reading won't appear for about 10 seconds.

e. Set the Latch Over-ride switch (S245, the rearmost of the group of three internal slide switches) to its upper position. Turn off the DC 504 power, remove the left side cover to gain access to the switch, then replace the cover and re-apply power.

f. CHECK—That the digits of the DC 504 are incrementing with each input pulse, rather than remaining at zero until the measurement is complete.[1]

g. Set the Latch Over-ride switch (S245) back to its down position.

[1]**If this function will not perform correctly (in instruments before serial number B022370) R257 and R260 should be changed from 1 kΩ to 5.6 kΩ.**

h. Set the TG 501 marker dial to .1 ms.

i. Set the DC 504 FUNCTION to FREQUENCY kHz, 10 Hz RESOLUTION.

j. CHECK—DC 504 to read approximately 10.00.

k. Set the RPM switch (S210, the frontmost of the group of three internal slide switches) to its upper position.

l. CHECK—DC 504 to read approximately 6000.

m. Set RPM switch S210 to its lower (NORM) position.

n. Remove the TG 501 OUTPUT from the DC 504 INPUT.

7a. Check Standard Clock Accuracy

a. Set the following controls.

DC 504

DISPLAY TIME	ccw
FUNCTION	FREQUENCY kHz; .1 Hz RESOLUTION
TRIGGER LEVEL	Midrange
SOURCE	EXT
All internal switches	Down

b. Connect the 1 MHz frequency standard to DC 504 INPUT.

c. CHECK—DC 504 reads ≥9.9900 (999990.0 Hz) and ≤0.0100 (1000010.0 Hz) with OVERFLOW light on.

NOTE

Actual reading will depend on accuracy of input standard and the internal adjustment of the DC 504 clock. Note also that with .1 Hz resolution, sixth decade and above digits overflow.

7b. Check Option 1 Clock Accuracy

a. Set the following controls.

DC 504

DISPLAY TIME	ccw
FUNCTION	FREQUENCY kHz, .1 Hz RESOLUTION
TRIGGER LEVEL	Midrange
SOURCE	EXT
All internal switches	Down

b. Connect the 1 MHz frequency standard to DC 504 INPUT.

c. CHECK—DC 504 reads ≥9.9995 and ≤0.0005 with OVERFLOW light on.

NOTE

Actual reading will depend on accuracy of input standard and the internal adjustment of the DC 504 clock.

d. Remove the 1 MHz frequency standard from the DC 504 INPUT.

8. Check Counter Sensitivity and Range

a. Set the following controls.

DC 504

DISPLAY TIME	ccw
FUNCTION	FREQUENCY kHz, 1 Hz RESOLUTION
TRIGGER LEVEL	Midrange
SOURCE	EXT
All internal switches	Down

SG 502

FREQUENCY (Hz)	1
MULTIPLIER	X10
STEP ATTENUATOR	40

SG 503

Amplitude Multiplier	X.1
Frequency Range (MHz)	10 MHz—25 MHz

NOTE

Use an oscilloscope having adequate bandwidth to set specified signal amplitudes.

b. Set the SG 502 Var Attenuator for a signal amplitude of 56 mV peak-to-peak, when terminated with 600-ohms.

c. Connect the SG 502 sine-wave output to the DC 504 INPUT through a coaxial cable and a 600-ohm terminator.

d. Set the DC 504 TRIGGER LEVEL as necessary to obtain a stable display.

CHECK—DC 504 reads .010, ±.001 (depends on frequency setting accuracy of SG 502).

e. Remove the SG 502 output from DC 504 INPUT.

f. Connect the SG 503 Output to DC 504 INPUT through a coaxial cable and a 50-ohm terminator. The terminator must be placed at DC 504 end of the cable.

g. Set the DC 504 FUNCTION to 1 kHz.

h. CHECK—Counter sensitivity from 15 MHz to 80 MHz using the following table. Also check for a stable DC 504 display.

SG 503 FREQUENCY	SIGNAL AMPLITUDE (Peak-to-Peak)	DC 504 DISPLAY
15 MHz	56 mV	15.000
50 MHz	99 mV	50.000
80 MHz	495 mV	80.000

NOTE

When the three-digit accuracy of the SG 503 is expanded to five-digits on the DC 504, the display rounding process in the SG 503 becomes apparent.

i. Remove the SG 503 Output from DC 504 INPUT.

9. Check Period

a. Set the following controls.

DC 504

DISPLAY TIME	ccw
FUNCTION	PERIOD SEC, 10 ms RESOLUTION
TRIGGER LEVEL	Midrange
SOURCE	EXT
All internal switches	Down

TG 501

Variable Timing	IN
Marker (Sec)	1 s

b. Connect the TG 501 Marker Output to DC 504 INPUT through a coaxial cable and a 50-ohm terminator. The terminator must be placed at the DC 504 end of the cable.

c. Adjust the DC 504 TRIGGER LEVEL as necessary for a display.

d. CHECK—Period measurement function using the following table.

NOTE

1. Disregard least significant digit (or ±1 count).
2. If a different generator is used for checking the period mode, its signal-to-noise must be high enough to ensure adequate triggering and it must be free of aberrations and ringing with amplitudes larger than 50 mV peak-to-peak.

TG 501 MARKER (SEC)	DC 504 FUNCTION	DC 504 DISPLAY
1 s	10 ms	1.00
1 s	1 ms	1.000
1 s	.1 ms	1.0000
.1 s	10 μs	100.00
10 ms	1 μs	10.000

e. Remove the TG 501 Marker Output from DC 504 INPUT.

This completes the Performance Check Procedure.

ADJUSTMENT

SERVICE AVAILABLE

Tektronix, Inc. provides complete instrument repair and adjustment at local Field Service Centers and at the Factory Service Center. Contact your local TEKTRONIX Field Office or representative for further information.

TEST EQUIPMENT REQUIRED

The test equipment listed in Table 3-1, or equivalent, is required for making adjustments to the DC 504. Test equipment characteristics listed are the minimum required to verify the accuracy of the adjustments made. Substitute equipment must meet or exceed the stated requirements. All test equipment is assumed to be operating within tolerance.

PROCEDURE

NOTE

The performance of this instrument can be checked at any temperature within the 0° C to +50° C range. Make any adjustments at a temperature between +20° C and +30° C (+68° F and +86° F).

1. Preparation

Place the DC 504 on a plug-in extender (Tektronix Part No. 067-0645-02). Plug the extender into the Power Module to be used. Turn on the Power Module and all test equipment. Allow 30 minutes warm-up time before proceeding.

Table 3-1

LIST OF TEST EQUIPMENT REQUIREMENTS

Description	Performance Requirements	Application	Example
Oscilloscope	1 MHz bandwidth or greater.	Time Base frequency check and adjustment.	Tektronix SC 501.
Probe	10X attenuation to reduce circuit loading, 1 MHz bandwidth or greater, bnc connector.	Frequency check and adjustment.	Tektronix P6006.
Power Module	Provide voltages, currents and connections suitable for TM 500-Series test equipment.	All steps.	Tektronix TM 504.
Plug-in Extender	Must make connections between DC 504 and Power Module so that the DC 504 can be operated outside the Power Module.	All steps.	Tektronix Part No. 067-0645-02.
Frequency Standard	1 MHz output, accurate to within 2 parts in 10^8 (1 part in 10^9 for Option 1).	Frequency check and adjustment.	Hewlett-Packard Model 105A/B.
Voltmeter	Measure 0 to 15 volts, accuracy within ±3%.	Measure power supply voltages.	Tektronix DM 501.

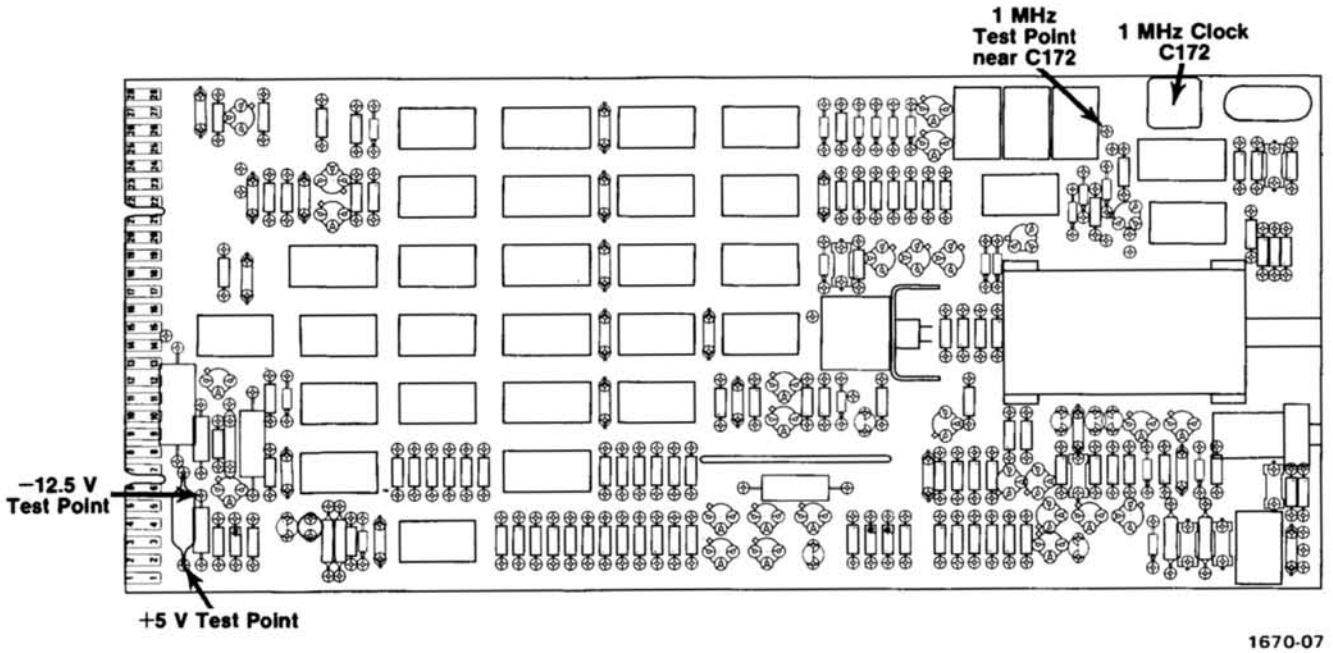


Fig. 3-1. Test point and adjustment locations.

2. Check Power Supplies (see Fig. 3-1)

a. Connect the voltmeter between the +5-volt test point and ground.

b. Check that the voltage is +5 volts within ±5%.

c. Check the voltmeter between the −12.5-volt test point and ground.

d. Check for a voltage of −12.5 volts ±0.5 volt.

3. Check and Adjust Time Base Frequency

a. Connect the DC 504 1 MHz (5 MHz for Option 1) time-base reference and the frequency standard to the oscilloscope as shown in Fig. 3-2. Adjust the oscilloscope to display several complete cycles.

b. Observe the rate of horizontal drift of the displayed waveform. If the waveform moves to the right, it indicates the time-base frequency is less than 1 MHz; if it moves to the left, the frequency is greater than 1 MHz. The period in seconds for the waveform to move the width of one cycle is equal to the frequency difference in parts in 10^6. For example, if the waveform drifts to the right at a rate of one cycle every 10 seconds, the time-base frequency is 0.1 part in 10^6 low. Maximum allowable frequency difference is 1 part in 10^7.

c. Adjust C172 for no observable drift (opening the plates of C172 increases the oscillator frequency, closing them decreases the frequency).

This concludes the Adjustment Procedure.

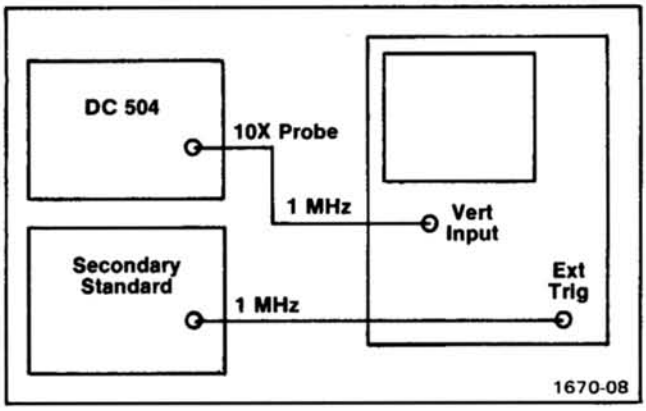


Fig. 3-2. Test setup for Time Base frequency check.

MAINTENANCE

GENERAL

The Power Module instruction manual contains the general maintenance procedures to be followed in maintaining the TM 500-Series plug-ins. This manual contains specific procedures for things not covered in the Power Module manuals.

CLEANING THE CHASSIS

The instrument should be cleaned by first loosening dust and other foreign matter with a small paint brush, then using a vacuum cleaner to remove the loosened material. Hardened-on dirt can be removed with water and a mild detergent solution. Isopropyl alcohol is also permitted as a cleaning agent. Do not use any other cleaning solutions or solvents.

CLEANING SWITCH CONTACTS

Use isopropyl alcohol for cleaning the switch contacts. Care should be taken to keep the alcohol away from the lubricated switch detents so that the lubricant is not removed or spread where it is not wanted.

After cleaning, normally lubricated contacts can be relubricated with a no-noise lubricant (Tektronix Part No. 006-0442-00). Use this lubricant sparingly and keep it off the IC sockets.

CAUTION

Use only the lubricant recommended.

CIRCUIT DESCRIPTION

BLOCK DIAGRAMS

Two block diagrams are provided, A simplified block diagram that shows the relationship of the circuitry on Diagram 1 with that of Diagram 2 is placed on the apron of Diagram 1. A detailed block diagram that shows the relationship of the various functions within the instrument is given on a separate foldout.

INPUT (DIAGRAM 1)

Input, Fixed Attenuation and Input Protection

Events to be counted or timed are applied to front-panel INPUT connector J100, or to plug-in connector (50 Ω nominal impedance) Pin 16A. Front-panel SOURCE switch S100 selects which input is fed to the amplifying and shaping circuits. Internal Input Coupling switch S102 (shown on the Controls, Connector and Interface Information foldout) allows the user to select either dc coupling or ac coupling (C102 is used to block out the dc voltage). The signal is then fed to a frequency compensated attenuator (R106-R108), which has a 1 MΩ input resistance. The fixed attenuator provides current limiting overload protection for the DC 504.

High Impedance Input and High Frequency Amplifier

A source follower consisting of Q110A and Q110B presents a very high impedance to the source and drives the succeeding circuitry from a low impedance. Q110A and Q110B are a matched pair of junction field effect transistors, so matched that the quiescent output is at zero volts. The output of the source follower drives a high-frequency cascode amplifier consisting of Q114 and Q130. Front-panel TRIGGER LEVEL control R125 varies the bias on Q130, providing a variable dc offset to the input signal. This offset capability allows the DC 504 triggering point on the input signal to be selected. If the TRIGGER LEVEL control is rotated fully ccw, Q130 will be saturated, making its output independent of its input. This condition of Q130 may be useful as a manual gate control in the Totalized Events mode.

Signal Shaping and Schmitt Trigger

The output of the cascode amplifier is connected through emitter-follower Q134 to the input of Schmitt trigger circuit Q140 and Q150. The Schmitt trigger produces jitter-free triggering for input signals having slow rise and fall times. The hysteresis width of the Schmitt trigger is designed for an overall sensitivity of 20 mV rms (56.6 mV peak-to-peak). This 20 mV window can be positioned over a nominal ±1.5 V range with the TRIGGER LEVEL control. The output of the Schmitt trigger is a low impedance, TTL compatible driving source for the following stages.

Time Base

The time base integrated circuit (U160) oscillates at 1 MHz as determined by crystal Y160 or option 1 crystal. Capacitor C172 permits the oscillator to be set to exactly 1 MHz. If an external clock is to be used, then the internally located Osc Int/Ext switch S160 (shown on the Controls, Connector and Interface Information foldout) is set to Ext and the external clock signal is connected to pin 14A of the plug-in connector. A shielded cable must be connected from the E.O. solder point near pin 14A to the E.O. solder point near U160.

The 1 MHz oscillator signal is decade divided by U160 to produce the gate signal for the counter/timer. The division factor for the gate signal is selected by placing the appropriate voltage levels on pins 11 through 14 of U160, see Table 5-1.

In rpm mode, the output of U210 is supplied via emitter follower Q210 to the FUNCTION switch in place of the normal time base output signal. Since the signal supplied to the FUNCTION switch from Q210 is six times longer than the normal time base signal, the counter measures a frequency that is six times higher. This results in cycles per minute (rpm) rather than cycles per second (if the decimal point is mentally shifted). The Operating Instructions section in this manual contains further rpm information.

Table 5-1

Division Ratio	Gate Time	U160 Pin Voltage Level				FUNCTION Switch Positions
		11	12	13	14	
10^0	1 μs	gnd	gnd	gnd	gnd	PERIOD mSEC — 1 μs RESOLUTION
10^1	10 μs	gnd	gnd	gnd	+5 V	PERIOD mSEC — 10 μs RESOLUTION
10^2	100 μs	gnd	gnd	+5 V	gnd	PERIOD SEC — .1 ms RESOLUTION PERIOD SEC — 1 ms RESOLUTION
10^3	1 ms	gnd	gnd	+5 V	+5 V	FREQUENCY MHz — 1 kHz RESOLUTION PERIOD SEC — 10 ms RESOLUTION
10^4	10 ms	gnd	+5 V	gnd	gnd	FREQUENCY MHz — .1 kHz RESOLUTION
10^5	100 ms	gnd	+5 V	gnd	+5 V	FREQUENCY kHz — 10 Hz RESOLUTION
10^6	1 s	gnd	+5 V	+5 V	gnd	FREQUENCY kHz — 1 Hz RESOLUTION
10^7	10 s	gnd	+5 V	+5 V	+5 V	FREQUENCY kHz — .1 Hz RESOLUTION

Gate Generator

The input to gate generator U220C, which produces the control signals for the counter, is determined by the position of FUNCTION switch S200. In the FREQUENCY positions of the FUNCTION switch, the input to the gate generator is the time base signal with a period determined by the RESOLUTION setting of the FUNCTION switch. In the PERIOD positions of the FUNCTION switch, the gate generator input is the DC 504 front-panel or plug-in connector input signal, after it has passed through the input amplifier and shaping circuits.

Operation of Frequency Mode

Assume that the cycle starts just after a reset signal (front-panel generated by RESET pushbutton), or just after a CLEAR signal (internally generated before the next measurement cycle). A short time after the front-panel RESET pushbutton is released, the stretched reset pulse in the time base ends, and 1 μs later the time base outputs a falling edge that is applied to inverter U215E via the FUNCTION switch. The signal from U215E is applied to pins 3 and 11 of U217, which is connected as a three-state counter. Prior to the falling edge from the time base, both pins 5 and 9 of U217 were set high by the CLEAR signal.

The first rising edge at pin 3 of U217 causes pin 5 to go low and pin 6 to go high. Since NAND gate U220D now has a high at both inputs, its output goes low. U215C inverts the output of U220D and applies it to pin 9 of U220C, opening the gate. With the gate open, the amplified and shaped input signal to the DC 504 is inverted by U220B and applied through U220C to the decade counter units (DCU). The gate (U220C) can be forced to close by pulling pin 9 of U220C to ground through interface connector pin 28B, thus stopping the count. CR226 protects U215C when pin 28B is connected to ground.

The next rising edge from the time base (which occurs after a period T, selected by the FUNCTION switch RESOLUTION setting) keeps pin 5 of U217 low and also forces pin 9 to go low. This removes the high from pin 13 of U220D, causing its output to go high. The rising edge now occurring at pin 11 of U220D is applied to pin 3 of U255, a one-shot multivibrator, where it causes an output pulse approximately 10 μs wide. This output pulse from U255 passes through a diode OR gate (CR257-CR245-CR246) and is buffered by Q260 and Q264. The pulse signal available at the output of Q264 is the LATCH signal used for the DCU. The high output now available at pin 11 of U220D is also inverted by U215C and used to close the gate (U220C), forcing the output of U220C high regardless of the input signal to the counter.

When pin 9 of U217 went low due to the second rising edge from the time base, Q185 was turned off. Q185 turning off allowed timing capacitor C190 to start charging toward +5 V through R187 and R190, the front-panel DISPLAY TIME control. After a period of time, which is determined by the setting of the DISPLAY TIME control, C190 reaches a sufficient voltage level to fire unijuction transistor Q195. C190 now discharges through Q195 and R195, causing Q198 to turn on. Q198 turning on generates a CLEAR signal that resets U217 and clears the DCU.

The U160 dividers for the gate control are reset to all nines, after the gate signal has occurred, by applying a positive pulse to pin 7 of U160. This reset allows the DC 504 counting cycle to restart immediately following a reset or a clear pulse. If the U160 dividers were not reset to all nines, the delay before the next count could begin would be equivalent to one gate-time interval. The nines reset pulse to pin 6 of U160 is stretched by C205 to make sure that all other counter circuits have been released from their clear pulses before the counter starts the next counting cycle.

The output of U160 occurs at pin 1. U180A synchronizes U160's output with the 1 MHz clock to reduce jitter. The time base output is then fed to RPM switch S210. In the Norm (normal counter operation) switch position, the time base output runs directly to the FUNCTION switch and is connected to the proper circuit depending on the setting of the FUNCTION switch. In the PERIOD mode, synchronizer U180A is by-passed since time base jitter is not significant at low frequencies. Also, the RPM switch is by-passed since the RPM mode applies to frequency measurements only.

When S210 is set to the RPM position, the output of U180A is sent to the divide-by-six circuit consisting of U210. This unique divide-by-six circuit can be set to its maximum count (essentially five) by pulsing pin 7 of U210 through Q204. This allows U210 to be set to its maximum count at the same time U160 is set to all nines (its maximum count). The advantage of doing this maximum count resetting has been prevously explained.

When Q198 goes low (CLEAR), Q200 is forced high after a delay determined by the rc network in its base circuit. Then when CLEAR is released, Q200 goes low after another delay. The Q200 signal is used to reset the time base to all nines, and the delay in going low ensures that the time base is the last part of the circuitry to be released from the clear.

DECADE COUNTER UNITS (DIAGRAM 2)

The input to the decade counter units (DCU) is a gated series of pulses from the gate generator (pulses are at either the front panel input frequency for frequency measurements, or are from the time base for period measurements).

The 10^0 through 10^4 DCU is composed of five cascaded divide-by-ten counters. The first decade counter is a specially-selected decade divider that can operate at the maximum frequency capability of the DC 504. When the CLEAR signal to pin 13 of U294 is high (U288, U282, U276, and U270 require a low signal on CLEAR) the counter is enabled. The input signal is applied to the clock input (pin 8), of U294. On every tenth clock input counted by the first decade counter, the output of U294 goes low, providing a carry signal that becomes the clock input for the second decade counter. Each subsequent decade divides by ten in a similar manner. Four bcd output lines are connected from each DCU to its associated storage-register/latch. When the CLEAR signal is activated, all of the decade counters are reset to the zero-count state.

Storage Register and Gates

The Storage Register comprises latches U296-U290-U284-U278-U272; it stores the corresponding decade counter bcd output. The bcd output number is applied to the data inputs at pins 2, 6, 7, and 3 (2^0, 2^1, 2^2 and 2^3 bits respectively). The LATCH signal is applied to the clock input at pins 4 and 13 of each latch at the end of GATE (negative transition on pin 9 of U220) or when the FUNCTION switch is placed in the TOTALIZE EVENTS position. While the LATCH signal is high, the logic levels from the decade dividers are read into the storage-register. The outputs of the latches are connected to gates (U298-U292-U286-U280-U274) that are controlled by the time-slot decoder. The gates place the bcd information sequentially on lines running to the seven segment decoder and on the bcd output pins of the plug-in connector.

Overflow Register

When the decade counters have counted 99,999, the counters are full. At the next count, the falling edge at the 2^3 output of U270 (pin 11) is inverted by U220A and used as a clock signal for U260A. When the clock causes U260A to toggle, pin 6 will go low. The next latch pulse will cause pin 6 of U265, which is connected as a bistable multivibrator (RS latch), to go low, causing the front-panel OVERFLOW light emitting diode (LED) to light. Pin 11 of U265 goes high when pin 6 goes low to prevent the leading-zero suppression during the overflow condition. The OVERFLOW LED will stay on until the next LATCH signal occurs, at which time the magnitude of the count is again assessed.

Scan Clock

The scan clock determines the scanning rate of the time-slot decoder. The scan clock is a free-running (astable) multivibrator consisting of Q300 and Q310 which runs at approximately a 3.5 kHz rate.

Time-Slot Decoder

The time-slot decoder consists of shift register U310 and gate U315B. The purpose of U315B is to guarantee that only a single high is circulated in the shift register (after the DC 504 has completed a single start-up scan). It does this by feeding lows into the shift register as it sequences, as long as a high exists in any time slot except the last (least significant digit) position. The shift register time slots, which control what display digits will be energized and which latch will have its count gated out, scan from the most significant digit (MSD), pin 15, to the least significant digit (LSD), pin 10. The time slots are available on the plug-in connector pins as digit select outputs.

Power Inverters, Anode Voltage Enable and Decimal Point

The time slot outputs from the time-slot decoder are buffered by high-current inverters (U325D, U325E, U325F, U325A, and U325B) and then used to enable the anode voltage supply transistors Q350, Q355, Q360, Q365, and Q370. The decimal point is positioned in the proper time slot by the cam switch. Inverter U325C provides the proper decimal point logic levels for the plug-in connector output and for leading zero blanking. The scanned decimal point belongs (decimal point appears) to the left of the digit that is active when the decimal scan goes high.

Seven-Segment Decoder and Leading Zero Suppression

The seven-segment decoder (U320) decodes the bcd information used to drive the seven-segment display LED. U320 pulls the appropriate LED segment lines (LED cathodes) low, while at the same time the anode voltage enable transistors (Q350, Q355, Q360, Q365, and Q370) apply high levels to the appropriate LED digit lines (anodes).

U320 has a zero blanking feature that, in combination with U260B and U315B, provides leading zero suppression (blanking) for the DC 504 display. When one of the inputs to OR gate U315A goes high, its output goes low, setting pin 9 of U260B high. The high at pin 9 of U260B is applied to a diode OR gate (CR320 and CR322) whose output forces pin 5 of U320 high. In this condition, all input digits will be displayed (no zeros will be blanked). The conditions that can cause a low at the output of U315A are:

a. Time slot 5 (LSD) is high (LSD is always displayed in Totalized Events mode, even if zero).

b. The decimal point is high (all zeros to the right of the decimal point are displayed).

c. Overflow has occurred.

The leading zero suppression circuit is reset to the blanking state by the leading edge of time-slot 1 through a differentiator circuit (C325 and R325) feeding the direct clear input (pin 13) of U260B. This will cause pin 5 of U320 to be held low by R322 and any zero digit at the input to U320 will result in a blank display. If a zero digit is sensed and blanked by U320, it responds by outputting a low level on pin 4. This low is recycled to U260B on the next scan clock pulse to allow subsequent zeros to be blanked. If, however, a high (non-zero) is sensed, pin 4 of U320 goes high, setting U260B to unblank on the next scan clock pulse. This disables the zero blanking until U260B is reset by the next time slot 1 pulse.

When the front-panel RESET pushbutton is pressed, pin 3 of U320 is forced low while pin 5 is forced high. This results in all 35 (5 LED X 7 segments) LED display segments being lit for verification.

POWER SUPPLIES (DIAGRAM 3)

+5 Volt Supply

U400 derives a temperature-compensated, highly regulated +5 V from the +33.5 V unregulated supply of the TM 500 Series Power Module. The NPN transistor, which is located in the power module for proper heat dissipation, is used for the series-pass transistor. R405 provides current limiting for the supply, while R400 will turn off U400 if the supply attempts to draw excessive current through the IC.

−12.5 Volt Supply

The −12.5 V Supply is derived from the TM 500 Series Power Module −33.5 V unregulated supply. The supply consists of amplifier Q425 driving the PNP transistor (located in the power module) as an emitter follower. The output of the emitter follower is divided by R432 and R435 and compared to the voltage across Zener diode VR430. Any difference between the Zener diode voltage and the voltage at the center of voltage divider R432-R435 is coupled as feedback to the base of Q425, which then drives the series-pass PNP transistor to correct the output voltage. VR430 and Q425 temperature compensate each other to the first order to provide a temperature stable power supply.

Q428 protects the supply, in the event the output is shorted, by limiting the current demanded from the supply under excessive load. This is accomplished by having Q428 monitor the supply current through R427.

REPLACEABLE ELECTRICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

ACTR	ACTUATOR	PLSTC	PLASTIC
ASSY	ASSEMBLY	QTZ	QUARTZ
CAP	CAPACITOR	RECP	RECEPTACLE
CER	CERAMIC	RES	RESISTOR
CKT	CIRCUIT	RF	RADIO FREQUENCY
COMP	COMPOSITION	SEL	SELECTED
CONN	CONNECTOR	SEMICOND	SEMICONDUCTOR
ELCTLT	ELECTROLYTIC	SENS	SENSITIVE
ELEC	ELECTRICAL	VAR	VARIABLE
INCAND	INCANDESCENT	WW	WIREWOUND
LED	LIGHT EMITTING DIODE	XFMR	TRANSFORMER
NONWIR	NON WIREWOUND	XTAL	CRYSTAL

CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
00136	MC COY ELECTRONICS COMPANY	WATTS AND CHESTNUT STR.	MT. HOLLY SPRINGS, PA 17065
01121	ALLEN-BRADLEY COMPANY	1201 2ND STREET SOUTH	MILWAUKEE, WI 53204
01295	TEXAS INSTRUMENTS, INC. SEMICONDUCTOR GROUP	P.O. BOX 5012	DALLAS, TX 75222
04222	AVX CERAMICS, DIVISION OF AVX CORP.	P O BOX 867	MYRTLE BEACH, SC 29577
04713	MOTOROLA, INC., SEMICONDUCTOR PROD. DIV.	5005 E MCDOWELL RD,PO BOX 20923	PHOENIX, AZ 85036
07263	FAIRCHILD SEMICONDUCTOR, A DIV. OF FAIRCHILD CAMERA AND INSTRUMENT CORP.	464 ELLIS STREET	MOUNTAIN VIEW, CA 94042
12969	UNITRODE CORPORATION	580 PLEASANT STREET	WATERTOWN, MA 02172
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
14433	ITT SEMICONDUCTORS	3301 ELECTRONICS WAY P O BOX 3049	WEST PALM BEACH, FL 33402
14552	MICRO SEMICONDUCTOR CORP.	2830 E FAIRVIEW ST.	SANTA ANA, CA 92704
16546	GLOBE UNION INC. USCC/CENTRALAB ELECTRONICS DIV.	4561 COLORADO	LOS ANGELES, CA 90039
22229	SOLITRON DEVICES, INC., SEMICONDUCTOR GROUP	8808 BALBOA AVENUE	SAN DIEGO OPERS, CA 92123
27014	NATIONAL SEMICONDUCTOR CORP.	2900 SEMICONDUCTOR DR.	SANTA CLARA, CA 95051
32159	WEST-CAP ARIZONA	2201 E. ELVIRA ROAD	TUCSON, AZ 85706
50088	MOSTEK CORP.	1400 UPFIELD DR.	CARROLLTON, TX 75006
50434	HEWLETT-PACKARD COMPANY	640 PAGE MILL ROAD	PALO ALTO, CA 94304
50579	LITRONIX INC.	19000 HOMESTEAD RD.	CUPERTINO, CA 95014
56289	SPRAGUE ELECTRIC CO.	87 MARSHALL ST.	NORTH ADAMS, MA 01247
57668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
58361	GENERAL INSTRUMENT CORP. OPTO ELECTRONICS DIV.	3400 HILLVIEW AVE	PALO ALTO, CA 94304
59660	TUSONIX INC.	2155 N FORBES BLVD	TUCSON, AZ 85705
59821	CENTRALAB INC SUB NORTH AMERICAN PHILIPS CORP	7158 MERCHANT AVE	EL PASO, TX 79915
71034	BLILEY ELECTRIC CO.	2545 W. GRANDVIEW BLVD.	ERIE, PA 16512
71590	CENTRALAB ELECTRONICS, DIV. OF GLOBE-UNION, INC.	P O BOX 858	FORT DODGE, IA 50501
74970	JOHNSON, E. F., CO.	299 10TH AVE. S. W.	WASECA, MN 56093
75042	TRW ELECTRONIC COMPONENTS, IRC FIXED RESISTORS, PHILADELPHIA DIVISION	401 N. BROAD ST.	PHILADELPHIA, PA 19108
79727	C-W INDUSTRIES	550 DAVISVILLE RD.,P O BOX 96	WARMINISTER, PA 18974
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
82389	SWITCHCRAFT, INC.	5555 N. ELSTON AVE.	CHICAGO, IL 60630
90201	MALLORY CAPACITOR CO., DIV. OF P. R. MALLORY AND CO., INC.	3029 E. WASHINGTON STREET P. O. BOX 372	INDIANAPOLIS, IN 46206
91637	DALE ELECTRONICS, INC.	P. O. BOX 609	COLUMBUS, NE 68601
96733	SAN FERNANDO ELECTRIC MFG CO	1501 FIRST ST	SAN FERNANDO, CA 91341

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
A1	672-0424-01	B010100	B010156	CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-01
A1	672-0424-00	B010157	B032859	CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-00
A1	672-0424-02	B032860	B032869	CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-02
A1	672-0424-03	B032870		CKT BOARD ASSY:FUNCTION SWITCH	80009	672-0424-03
A2	670-3133-00	B010100	B010156	CKT BOARD ASSY:DISPLAY	80009	670-3133-00
A2	670-3133-01	B010157	B032859	CKT BOARD ASSY:DISPLAY	80009	670-3133-01
A2	670-3133-02	B032860		CKT BOARD ASSY:DISPLAY	80009	670-3133-02
A3	670-3602-00			CKT BOARD ASSY:TIME BASE	80009	670-3602-00
A3	----- -----			(OPTION 01 ONLY)		
C10	283-0204-00			CAP.,FXD,CER DI:0.01UF,20%,50V	96733	R2676
C10	----- -----			(OPTION 01 ONLY)		
C102	283-0008-00			CAP.,FXD,CER DI:0.1UF,20%,500V	56289	3C37X7R104M500B
C104	281-0503-00	B010100	B032869	CAP.,FXD,CER DI:8PF,+/-0.5PF,500V	59660	0301-080-COHO-80
C104	281-0592-00	B032870		CAP.,FXD,CER DI:4.7PF,+/-0.5PF,500V	59660	0301080COH0479 D
C106	281-0519-00			CAP.,FXD,CER DI:47PF,+/-4.7PF,500V	59660	308-000C0G0470K
C116	281-0629-00			CAP.,FXD,CER DI:33PF,5%,600V	04222	7027-C0G-330J
C120	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C121	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
C128	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C144	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	59821	SDDH69L103Z
C167	281-0781-00			CAP.,FXD,CER DI:68PF,10%,500V	59660	301-000-T3D0680K
C167	----- -----			(STANDARD ONLY)		
C170	281-0782-00			CAP.,FXD,CER DI:33PF,10%,500V	59660	301-000N4700330K
C170	----- -----			(STANDARD ONLY)		
C172	281-0131-00			CAP.,VAR,AIR DI:2.4-24.5PF,250V	74970	189-0509-075
C172	----- -----			(STANDARD ONLY)		
C190	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C205	283-0080-00			CAP.,FXD,CER DI:0.022UF,+80-20%,25V	59821	2DDU60E223Z
C235	283-0002-00	B010100	B036569	CAP.,FXD,CER DI:0.01UF,+80-20%,500V	59821	SDDH69L103Z
C235	290-0534-00	B036570		CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C240	290-0534-00			CAP.,FXD,ELCTLT:1UF,20%,35V	56289	196D105X0035HA1
C250	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
C255	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
C270	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
C276	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
C282	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
C288	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
C294	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
C300	283-0001-00			CAP.,FXD,CER DI:0.005UF,+100-0%,500V	59821	2DDH61L502P
C310	281-0525-00			CAP.,FXD,CER DI:470PF,+/-94PF,500V	59660	301000X5U471M
C315	283-0002-00			CAP.,FXD,CER DI:0.01UF,+80-20%,500V	59821	SDDH69L103Z
C325	283-0003-00	B010100	B036569	CAP.,FXD,CER DI:0.01UF,+80-20%,150V	59821	2DDH66J103Z
C325	283-0065-00	B036570		CAP.,FXD,CER DI:0.001UF,5%,100V	59660	0835-591Y5EO102J
C340	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
C405	290-0535-00			CAP.,FXD,ELCTLT:33UF,20%,10V	56289	196D336X0010KA1
C408	283-0000-00			CAP.,FXD,CER DI:0.001UF,+100-0%,500V	59660	831610Y5U0102P
C415	290-0512-00			CAP.,FXD,ELCTLT:22UF,20%,15V	56289	196D226X0015KA1
C420	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
C421	283-0023-00			CAP.,FXD,CER DI:0.1UF,+80-20%,12V	71590	2DDU66B104Z
C425	283-0081-00			CAP.,FXD,CER DI:0.1UF,+80-20%,25V	59821	2DDU69E104Z
C435	290-0536-00			CAP.,FXD,ELCTLT:10UF,20%,25V	90201	TDC106M025FL
CR108	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR160	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
CR161	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR181	152-0008-00			SEMICOND DEVICE:GERMANIUM,75V,60MA	14433	G1409
CR210	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR212	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR220	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR225	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR226	152-0008-00			SEMICOND DEVICE:GERMANIUM,75V,60MA	14433	G1409
CR235	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR240	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR245	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR246	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR247	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR255	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR257	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR320	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR322	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
CR325	152-0141-02			SEMICOND DVC,DI:SW,SI,30V,150MA,30V,DO-35	12969	NDP0263 (1N4152)
DS250	150-1001-01			LAMP,LED:RED,2V,100MA	50434	HLMP-3200
DS350	150-1018-00	B010100	B032859	LAMP,LED:RED,NUMERIC	50579	DATA-LIT 10A
DS350	150-1037-00	B032860		LAMP,LED,RDOUT:7 SEGMENT,LH DECIMAL,ORANGE	58361	03409/MAN36202
DS355	150-1018-00	B010100	B032859	LAMP,LED:RED,NUMERIC	50579	DATA-LIT 10A
DS355	150-1037-00	B032860		LAMP,LED,RDOUT:7 SEGMENT,LH DECIMAL,ORANGE	58361	03409/MAN36202
DS360	150-1018-00	B010100	B032859	LAMP,LED:RED,NUMERIC	50579	DATA-LIT 10A
DS360	150-1037-00	B032860		LAMP,LED,RDOUT:7 SEGMENT,LH DECIMAL,ORANGE	58361	03409/MAN36202
DS365	150-1018-00	B010100	B032859	LAMP,LED:RED,NUMERIC	50579	DATA-LIT 10A
DS365	150-1037-00	B032860		LAMP,LED,RDOUT:7 SEGMENT,LH DECIMAL,ORANGE	58361	03409/MAN36202
DS370	150-1018-00	B010100	B032859	LAMP,LED:RED,NUMERIC	50579	DATA-LIT 10A
DS370	150-1037-00	B032860		LAMP,LED,RDOUT:7 SEGMENT,LH DECIMAL,ORANGE	58361	03409/MAN36202
DS375	150-1001-01			LAMP,LED:RED,2V,100MA	50434	HLMP-3200
J100	131-0955-00			CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
L340	108-0317-00			COIL,RF:FIXED,15UH	32159	71501M
Q110	151-1042-00			SEMICOND DVC SE:MATCHED PAIR FET	22229	S2089
Q114	151-0424-00			TRANSISTOR:SILICON,NPN	04713	SPS8246
Q130	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q134	151-0221-00			TRANSISTOR:SILICON,PNP	04713	SPS246
Q140	151-0424-00			TRANSISTOR:SILICON,NPN	04713	SPS8246
Q150	151-0424-00			TRANSISTOR:SILICON,NPN	04713	SPS8246
Q180	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q180	----- -----			(STANDARD ONLY)		
Q185	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q195	151-0504-00	B010100	B029999	TRANSISTOR:SILICON,N-CHAN,UNIJUNCTION	04713	SU392
Q195	151-0504-01	B030000		TRANSISTOR:SILICON,N-CHAN,UNIJUNCTION	04713	SU309
Q198	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q200	151-0302-00			TRANSISTOR:SILICON,NPN	07263	S038487
Q204	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q210	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q235	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q240	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q245	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q247	151-0342-00			TRANSISTOR:SILICON,PNP	07263	S035928
Q260	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q264	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q300	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919
Q310	151-0341-00			TRANSISTOR:NPN,SI,TO-106	04713	SPS6919

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
Q350	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q355	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q360	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q365	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q370	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q425	151-0301-00			TRANSISTOR:SILICON,PNP	27014	2N2907A
Q428	151-0302-00			TRANSISTOR:SILICON,NPN	07263	S038487
R10	304-0681-00			RES.,FXD,CMPSN:680 OHM,10%,1W	01121	GB6811
R10	----- -----			(OPTION 01 ONLY)		
R11	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R11	----- -----			(OPTION 01 ONLY)		
R12	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	57668	NTR25J-E51E0
R12	----- -----			(OPTION 01 ONLY)		
R100	315-0510-00	B010100	B032869	RES.,FXD,CMPSN:51 OHM,5%,0.25W	57668	NTR25J-E51E0
R100	303-0510-00	B032870		RES.,FXD,CMPSN:51 OHM,5%,1W	01121	GB5105
R102	315-0330-00			RES.,FXD,CMPSN:33 OHM,5%,0.25W	01121	CB3305
R106	323-0385-00			RES.,FXD,FILM:100K OHM,1%,0.50W	75042	CECT0-1003F
R108	322-0621-00			RES.,FXD,FILM:900K OHM,1%,0.25W	75042	CEBT0-9003F
R110	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	57668	NTR25J-E300E
R114	315-0561-00			RES.,FXD,CMPSN:560 OHM,5%,0.25W	01121	CB5615
R116	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R117	315-0111-00			RES.,FXD,CMPSN:110 OHM,5%,0.25W	57668	NTR25J-E110E
R120	315-0910-00			RES.,FXD,CMPSN:91 OHM,5%,0.25W	01121	CB9105
R123	315-0151-00			RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R125	311-0091-00			RES.,VAR,NONWIR:1K OHM,10%,0.50W	01121	W-3083E
R127	315-0361-00			RES.,FXD,CMPSN:360 OHM,5%,0.25W	01121	CB3615
R130	315-0112-00			RES.,FXD,CMPSN:1.1K OHM,5%,0.25W	01121	CB1125
R134	315-0510-00			RES.,FXD,CMPSN:51 OHM,5%,0.25W	57668	NTR25J-E51E0
R136	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R139	315-0121-00			RES.,FXD,CMPSN:120 OHM,5%,0.25W	01121	CB1215
R140	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R144	315-0390-00			RES.,FXD,CMPSN:39 OHM,5%,0.25W	57668	NTR25J-E39E0
R146	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
R150	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R152	315-0471-00			RES.,FXD,CMPSN:470 OHM,5%,0.25W	57668	NTR25J-E470E
R154	315-0270-00			RES.,FXD,CMPSN:27 OHM,5%,0.25W	01121	CB2705
R160	315-0221-00			RES.,FXD,CMPSN:220 OHM,5%,0.25W	57668	NTR25J-E220E
R165	316-0186-00			RES.,FXD,CMPSN:18M OHM,10%,0.25W	01121	CB1861
R165	----- -----			(STANDARD ONLY)		
R167	316-0126-00			RES.,FXD,CMPSN:12M OHM,10%,0.25W	01121	CB1261
R167	----- -----			(STANDARD ONLY)		
R170	315-0243-00			RES.,FXD,CMPSN:24K OHM,5%,0.25W	57668	NTR25J-E24K0
R170	----- -----			(STANDARD ONLY)		
R175	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R176	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R177	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R179	315-0153-00			RES.,FXD,CMPSN:15K OHM,5%,0.25W	01121	CB1535
R180	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
R180	----- -----			(STANDARD ONLY)		
R181	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R182	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R187	315-0512-00	B010100	B036569	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R187	315-0752-00	B036570		RES.,FXD,CMPSN:7.5K OHM,5%,0.25W	57668	NTR25J-E07K5
R190	311-1342-00			RES.,VAR,NONWIR:PNL,500K OHM,0.5W,W/SW	16546	BA206-014
R190	----- -----			(PART OF S190)		

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R195	315-0100-00	B010100	B036569	RES.,FXD,CMPSN:10 OHM,5%,0.25W	57668	NTR25J-E 10E0
R195	315-0200-00	B036570		RES.,FXD,CMPSN:20 OHM,5%,0.25W	01121	CB2005
R198	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R200	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R203	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R204	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R205	315-0272-00			RES.,FXD,CMPSN:2.7K OHM,5%,0.25W	57668	NTR25J-E02K7
R206	315-0512-00	B036570		RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R207	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R208	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R210	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R212	315-0362-00			RES.,FXD,CMPSN:3.6K OHM,5%,0.25W	01121	CB3625
R215	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R220	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R225	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R226	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R227	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R230	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R232	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R235	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R240	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R243	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R245	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R247	315-0103-00			RES.,FXD,CMPSN:10K OHM,5%,0.25W	57668	NTR25J-E10K0
R250	315-0474-00			RES.,FXD,CMPSN:470K OHM,5%,0.25W	57668	NTR25J-E470K
R252	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R255	315-0303-00			RES.,FXD,CMPSN:30K OHM,5%,0.25W	01121	CB3035
R257	315-0102-00	B010100	B036569	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R257	315-0562-00	B036570		RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
R260	315-0102-00	B010100	B036569	RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R260	315-0562-00	B036570		RES.,FXD,CMPSN:5.6K OHM,5%,0.25W	57668	NTR25J-E05K6
R262	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R264	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R268	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R300	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R304	315-0333-00			RES.,FXD,CMPSN:33K OHM,5%,0.25W	57668	NTR25J-E33K0
R306	315-0334-00			RES.,FXD,CMPSN:330K OHM,5%,0.25W	01121	CB3345
R310	315-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.25W	01121	CB5115
R315	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R316	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R317	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R318	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R322	315-0301-00			RES.,FXD,CMPSN:300 OHM,5%,0.25W	57668	NTR25J-E300E
R325	315-0512-00	B010100	B036569	RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R325	315-0102-00	B036570		RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R330	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
R330	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R331	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
R331	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R332	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
R332	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R333	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
R333	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R334	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
R334	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E

Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
R335	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
R335	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R336	315-0750-00	B010100	B032859	RES.,FXD,CMPSN:75 OHM,5%,0.25W	57668	NTR25J-E75E0
R336	315-0151-00	B032860		RES.,FXD,CMPSN:150 OHM,5%,0.25W	57668	NTR25J-E150E
R340	315-0101-00			RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R350	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R351	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R355	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R356	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R360	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R361	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R362	315-0512-00			RES.,FXD,CMPSN:5.1K OHM,5%,0.25W	57668	NTR25J-E05K1
R363	315-0301-00	B010100	B032859	RES.,FXD,CMPSN:300 OHM,5%,0.25W	57668	NTR25J-E300E
R363	315-0101-00	B032860		RES.,FXD,CMPSN:100 OHM,5%,0.25W	57668	NTR25J-E 100E
R365	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R366	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R370	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R371	315-0271-00			RES.,FXD,CMPSN:270 OHM,5%,0.25W	01121	CB2715
R375	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R400	304-0331-00			RES.,FXD,CMPSN:330 OHM,10%,1W	01121	GB3311
R402	321-0225-00			RES.,FXD,FILM:2.15K OHM,1%,0.125W	91637	MFF1816G21500F
R403	321-0260-00			RES.,FXD,FILM:4.99K OHM,1%,0.125W	91637	MFF1816G49900F
R405	308-0463-00			RES.,FXD,WW:0.3 OHM,1%,3W	91637	RS2B-R3000F T/R
R408	315-0162-00			RES.,FXD,CMPSN:1.6K OHM,5%,0.25W	01121	CB1625
R425	301-0222-00			RES.,FXD,CMPSN:2.2K OHM,5%,0.5W	01121	EB2225
R427	308-0686-00			RES.,FXD,WW:2.2 OHM,5%,2W	75042	BWH-2R200J
R428	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R430	315-0131-00			RES.,FXD,CMPSN:130 OHM,5%,0.25W	01121	CB1315
R432	315-0102-00			RES.,FXD,CMPSN:1K OHM,5%,0.25W	57668	NTR25JE01K0
R435	301-0511-00			RES.,FXD,CMPSN:510 OHM,5%,0.50W	57668	TR50J--E 510E
S100	260-0816-00	B010100	B032869	SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF-126-0012A
S100	260-1833-00	B032870		SWITCH,SLIDE:DPDT	82389	11P-1092
S102	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
S160	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
S190	----- -----			(PART OF R190)		
S200	263-1031-00			SW CAM ACTR AS:FUNCTION	80009	263-1031-00
S210	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
S235	260-1421-00			SWITCH,PUSH:1 STA,MOMENTARY,NON-SHORT	59821	2KAA010000512
S245	260-0723-00			SWITCH,SLIDE:DPDT,0.5A,125VAC	79727	GF126-0028
U10	156-0079-02			MICROCIRCUIT,DI:DECADE COUNTER,SCREENED	01295	SN7490A(NP3 OR J
U10	----- -----			(OPTION 01 ONLY)		
U160	156-0410-00			MICROCIRCUIT,DI:COUNTER TIME BASE	50088	MK5009P
U180	156-0041-05			MICROCIRCUIT,DI:DUAL D-FLIP FLOP	01295	SN7474
U210	156-0079-02			MICROCIRCUIT,DI:DECADE COUNTER,SCREENED	01295	SN7490A(NP3 OR J
U215	156-0058-02			MICROCIRCUIT,DI:HEX INVRTR,SCREENED	01295	SN7404
U217	156-0041-05			MICROCIRCUIT,DI:DUAL D-FLIP FLOP	01295	SN7474
U220	156-0180-04			MICROCIRCUIT,DI:QUAD 2-INPUT NAND GATE	01295	SN74S00NP3
U255	156-0081-02			MICROCIRCUIT,DI:RETRIG MONOSTABLE MV,SCRN	80009	156-0081-02
U260	156-0041-05			MICROCIRCUIT,DI:DUAL D-FLIP FLOP	01295	SN7474
U265	156-0030-00			MICROCIRCUIT,DI:QUAD 2 INPUT NAND GATE	01295	SN7400(N OR J)
U270	156-0079-02			MICROCIRCUIT,DI:DECADE COUNTER,SCREENED	01295	SN7490A(NP3 OR J
U272	156-0040-02			MICROCIRCUIT,DI:QUAD LATCH,SCREENED	01295	SN7475(NP3 OR JP
U274	156-0057-02			MICROCIRCUIT,DI:QUAD 2-INP NAND GATE,SCRN	01295	SN7401(NP3 OR JP
U276	156-0079-02			MICROCIRCUIT,DI:DECADE COUNTER,SCREENED	01295	SN7490A(NP3 OR J

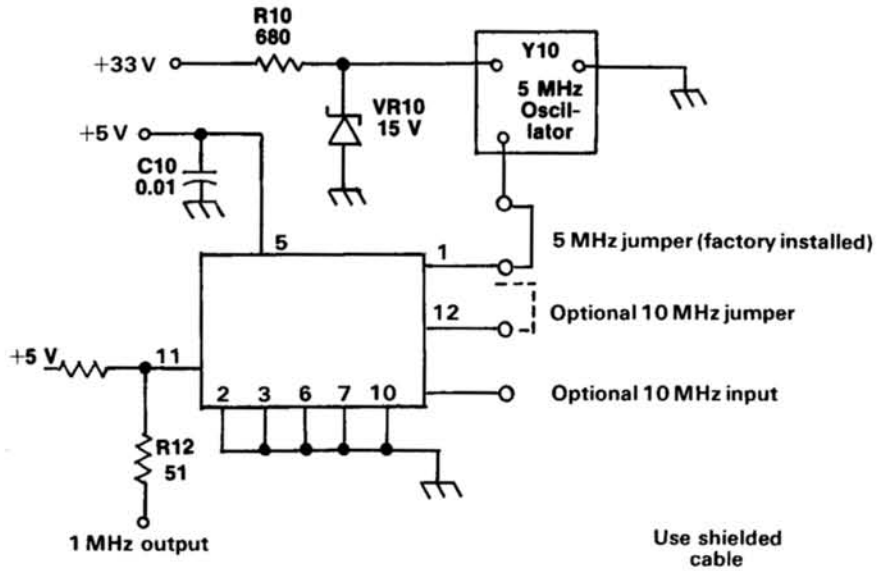
Ckt No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Name & Description	Mfr Code	Mfr Part Number
U278	156-0040-02			MICROCIRCUIT,DI:QUAD LATCH,SCREENED	01295	SN7475(NP3 OR JP
U280	156-0057-02			MICROCIRCUIT,DI:QUAD 2-INP NAND GATE,SCRN	01295	SN7401(NP3 OR JP
U282	156-0079-02			MICROCIRCUIT,DI:DECADE COUNTER,SCREENED	01295	SN7490A(NP3 OR J
U284	156-0040-02			MICROCIRCUIT,DI:QUAD LATCH,SCREENED	01295	SN7475(NP3 OR JP
U286	156-0057-02			MICROCIRCUIT,DI:QUAD 2-INP NAND GATE,SCRN	01295	SN7401(NP3 OR JP
U288	156-0079-02			MICROCIRCUIT,DI:DECADE COUNTER,SCREENED	01295	SN7490A(NP3 OR J
U290	156-0040-02			MICROCIRCUIT,DI:QUAD LATCH,SCREENED	01295	SN7475(NP3 OR JP
U292	156-0057-02			MICROCIRCUIT,DI:QUAD 2-INP NAND GATE,SCRN	01295	SN7401(NP3 OR JP
U294	156-0482-01			MICROCIRCUIT,DI:PRESETTABLE DECADE CNTR,SCR	27014	DM74S196(NA+ OR
U296	156-0040-02			MICROCIRCUIT,DI:QUAD LATCH,SCREENED	01295	SN7475(NP3 OR JP
U298	156-0057-02			MICROCIRCUIT,DI:QUAD 2-INP NAND GATE,SCRN	01295	SN7401(NP3 OR JP
U310	156-0073-02			MICROCIRCUIT,DI:5-BIT SHIFT REGISTER,SCRN	01295	SN7496
U315	156-0165-02			MICROCIRCUIT,DI:DUAL 4 INP NOR GATE	01295	SN7425
U320	156-0128-01			MICROCIRCUIT,DI:BCD-TO 7 SEG DCDR/DRVR	80009	156-0128-01
U325	156-0093-02			MICROCIRCUIT,DI:HEX INV BUFFER,BURN-IN	01295	SN74LS00 (NP3)
U400	156-0071-00			MICROCIRCUIT,LI:VOLTAGE REGULATOR	04713	MC1723CL
VR10	152-0243-00			SEMICOND DEVICE:ZENER,0.4W,15V,5%	14552	TD3810983
VR10	----- -----			(OPTION 01 ONLY)		
VR110	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
VR140	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
VR146	152-0226-00			SEMICOND DEVICE:ZENER,0.4W,5.1V,5%	14552	TD3810980
VR430	152-0280-00			SEMICOND DEVICE:ZENER,0.4W,6.2V,5%	80009	152-0280-00
Y10	119-0262-00			OSCILLATOR,RF:XTAL CONTROLLED,5 MHZ ADJ	71034	C214-3
Y10	----- -----			(OPTION 01 ONLY)		
Y160	158-0079-00			XTAL UNIT,QTZ:1 MHZ,+/-0.001%	00136	ORD BY DESCR
Y160	----- -----			(STANDARD ONLY)		

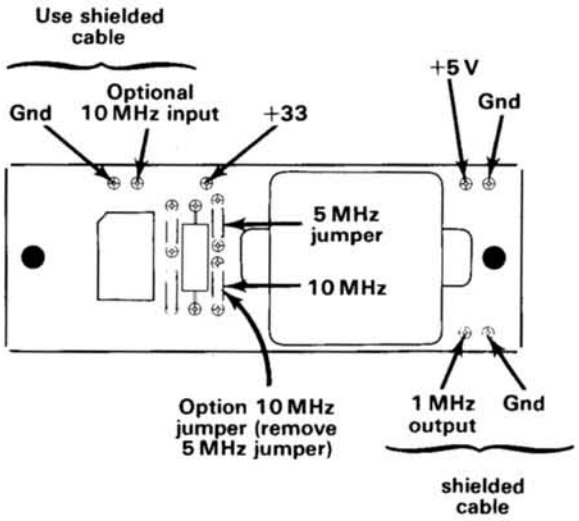
OPTIONS

Your instrument may be equipped with one or more options. This section describes those options, or directs the reader to where the option is documented.

OPTION 1

Option 1 equips the DC 504 with a temperature compensated, 5 MHz crystal oscillator to obtain a highly stable and precise internal time base. This option includes an IC which may be connected as either a divide-by-five (5 MHz oscillator) or a divide-by-ten (10 MHz oscillator).





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DIAGRAMS AND CIRCUIT BOARD ILLUSTRATIONS

Symbols and Reference Designators

Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μF).

Resistors = Ohms (Ω).

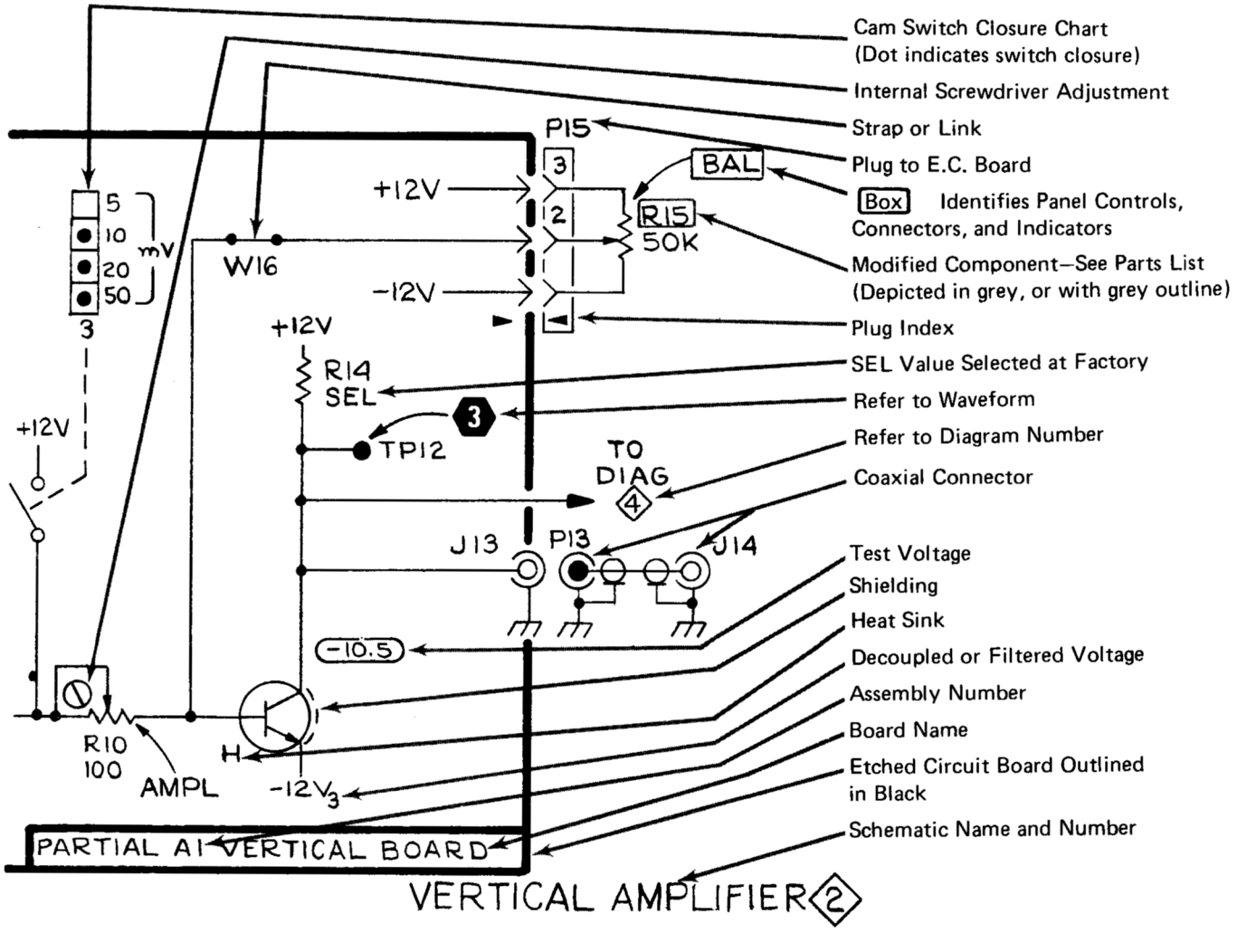
Symbols used on the diagrams are based on ANSI Standard Y32.2-1975.

Logic symbology is based on ANSI Y32.14-1973 in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

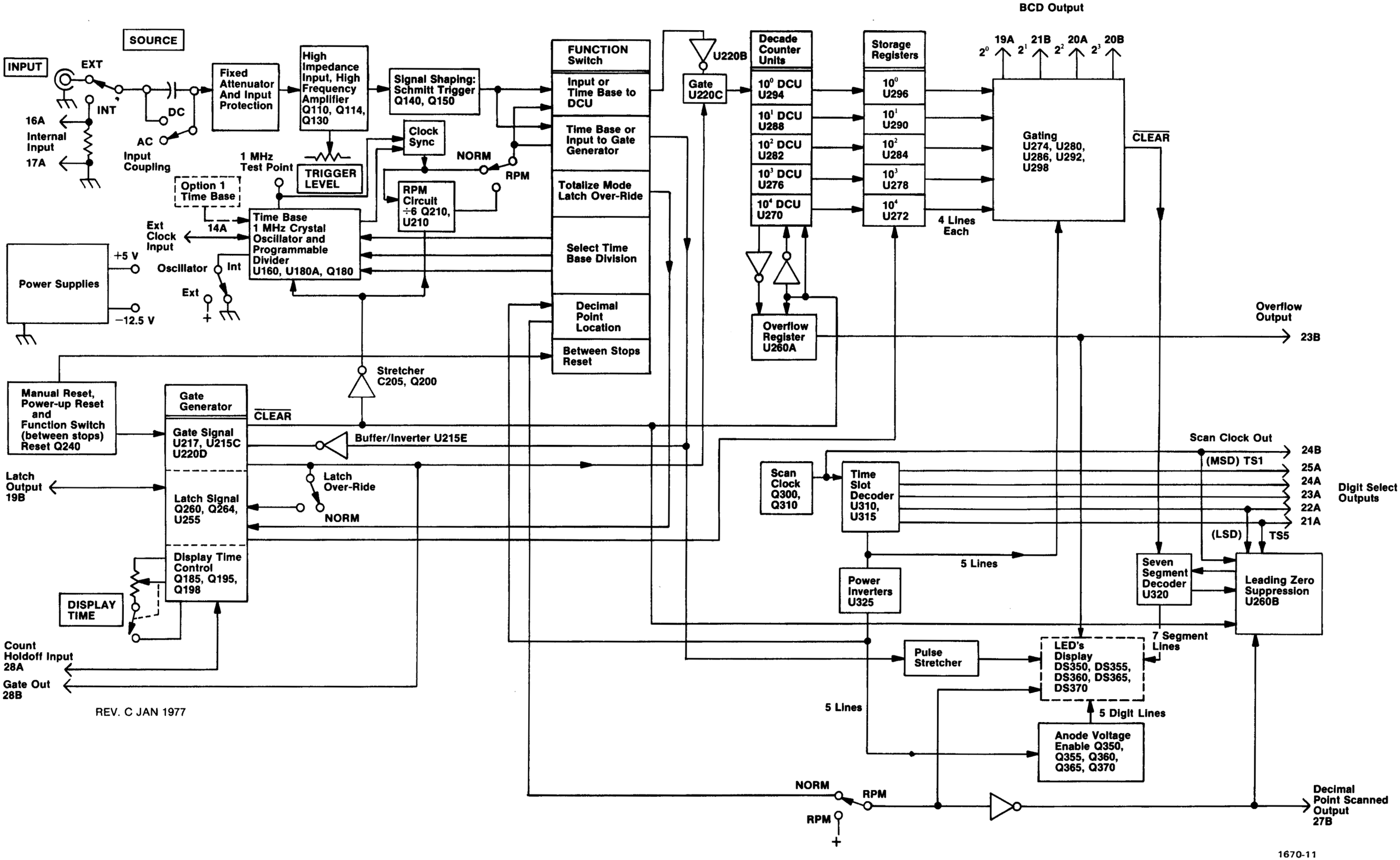
The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	H	Heat dissipating device (heat sink, heat radiator, etc.)	S	Switch or contactor
AT	Attenuator, fixed or variable	HR	Heater	T	Transformer
B	Motor	HY	Hybrid circuit	TC	Thermocouple
BT	Battery	J	Connector, stationary portion	TP	Test point
C	Capacitor, fixed or variable	K	Relay	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
CB	Circuit breaker	L	Inductor, fixed or variable	V	Electron tube
CR	Diode, signal or rectifier	M	Meter	VR	Voltage regulator (zener diode, etc.)
DL	Delay line	P	Connector, movable portion	W	Wirestrap or cable
DS	Indicating device (lamp)	Q	Transistor or silicon-controlled rectifier	Y	Crystal
E	Spark Gap	R	Resistor, fixed or variable	Z	Phase shifter
F	Fuse	RT	Thermistor		
FL	Filter				

The following special symbols are used on the diagrams:



BLOCK DIAGRAM



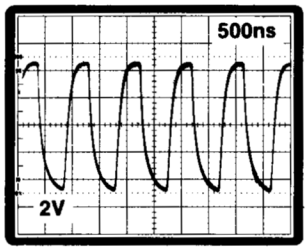
REV. C JAN 1977

1670-11

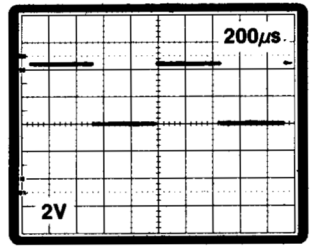
The voltages and waveforms shown on the diagrams were taken with a 1 MHz, 1 volt peak-to-peak sinewave input signal and the DC 504 front panel controls set as follows:

FUNCTION	MHz 1 kHz RESOLUTION
SOURCE	EXT
DISPLAY TIME	midrange
TRIGGER LEVEL	midrange

In waveforms, ground reference is the center horizontal graticule line.



1



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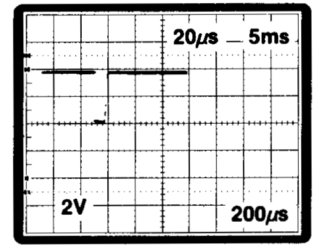

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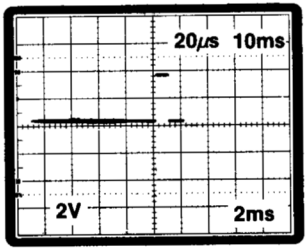

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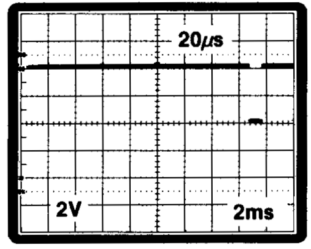

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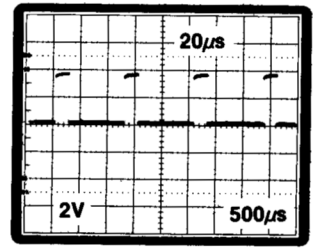


6

INPUT-OUTPUT ASSIGNMENTS FOR PLUG-IN REAR INTERFACE CONNECTOR

Remarks	Maximum Recommended Loads	Active Level	Output or Input	PIN B		PIN A	Output or Input	Active Level	Maximum Recommended Loads	Remarks
High During COUNTING Time	5 TTL	High	Gate-Out	28		28	Count Holdoff Input	High	Fan-in <1	
Pull low to stop TOTALIZE (use open collector)	Must sink 5 mA (3 TTL)	Low	TOTALIZE START/STOP (Input)	28						
Nominal 0.25 ms Wide Pulse	24 TTL	High	Decimal Point Scanned Output	27		27				
				26		26	Reset Input/ Output	Low	Output: 6 TTL Input: 9 TTL or transistor to sink at least 15 mA	
				25		25	TS1 (MSD) Digit Select Output	High	4 TTL each	Nominal 0.25 ms Wide Pulse
Nominal 3.5 kHz	1 TTL	TTL Compatible	Scan Clock Out	24		24	TS2 Digit Select Output			
	8 TTL	High	Overflow Output	23		23	TS3 Digit Select Output			
				22	Measurement Barrier Slot	22	TS4 Digit Select Output			
	6 TTL	High	BCD Output 2	21		21	TS5 (LSD) Digit Select Output			
	6 TTL	High	BCD Output (MSB) 8	20		20	4 BCD Output	High	6 TTL	
Nominal 10 μs Wide Pulse	10 TTL	High	Latch Output (Data Good)	19		19	1 (LSB) BCD Output	High	6 TTL	
				18		18				
				17		17	Internal Input Ground			50 ohm Nominal Input Impedance
				16		16	Internal Input			
				15		15				
				14		14	Ext Clock Input	TTL Compatible (internally clamped to 0 V and +5 V)	Should swing between 0.4 V and +4 V to guarantee accurate slaving	User must connect shield jumper between two circuit board pads marked E.O. inside DC 504
			25 VAC winding	13		13	25 VAC winding			
			+33.5 V filtered DC	12		12*	+33.5 V filtered DC			
			Collector Lead of PNP Series-Pass	11*		11*	Base lead of PNP Series-Pass			
			Transformer/ shield lead	10		10*	Emitter lead of PNP Series-Pass			
			±33.5 V common return	9*		9	±33.5 V common return			
			−33.5 filtered DC	8*		8	−33.5 V filtered DC			
			Collector Lead of NPN Series-Pass	7*	TM500 Barrier	7*	Emitter lead of NPN Series-Pass			
			No connection	6	Slot	6*	Base lead of NPN Series-Pass			
			17.5 VAC winding	5		5	17.5 VAC winding			
			+11.5 V common return	4		4*	+11.5 V common return			
			+11.5 V common return	3		3*	+11.5 V common return			
			+11.5 V filtered DC	2*		2	+11.5 V filtered DC			
			25 VAC winding	1		1	25 VAC winding			
				B	Rear-View of plug-in	A				

REFER TO PARTS LOCATION GRID.

Assignments listed for pins 1A—13A and 1B—13B are available in all power modules; however only those pins marked with an asterisk (*) are used by the DC 504.

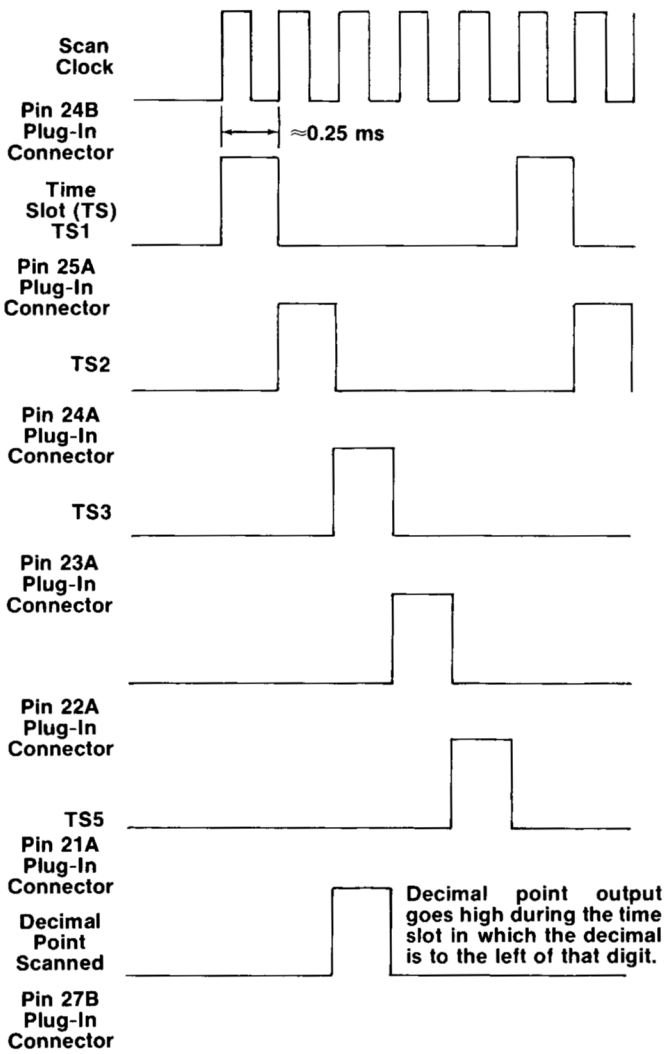
LSD — Least significant digit; MSD — Most significant digit; LSB — Least significant bit; MSB — most significant bit.

[1]Pin 26A level goes low only when: (a) Front-panel RESET pushbutton is pushed; (b) During power-up reset; (c) Change in position of FUNCTION siwtch. It does not go low when the DC 504 clears itself for another count.

1670-10

DIGIT SELECT OUTPUT, DECIMAL POINT SCANNED OUTPUT AND SCAN CLOCK OUT INTERFACE INFORMATION

DC 504



NOTE:

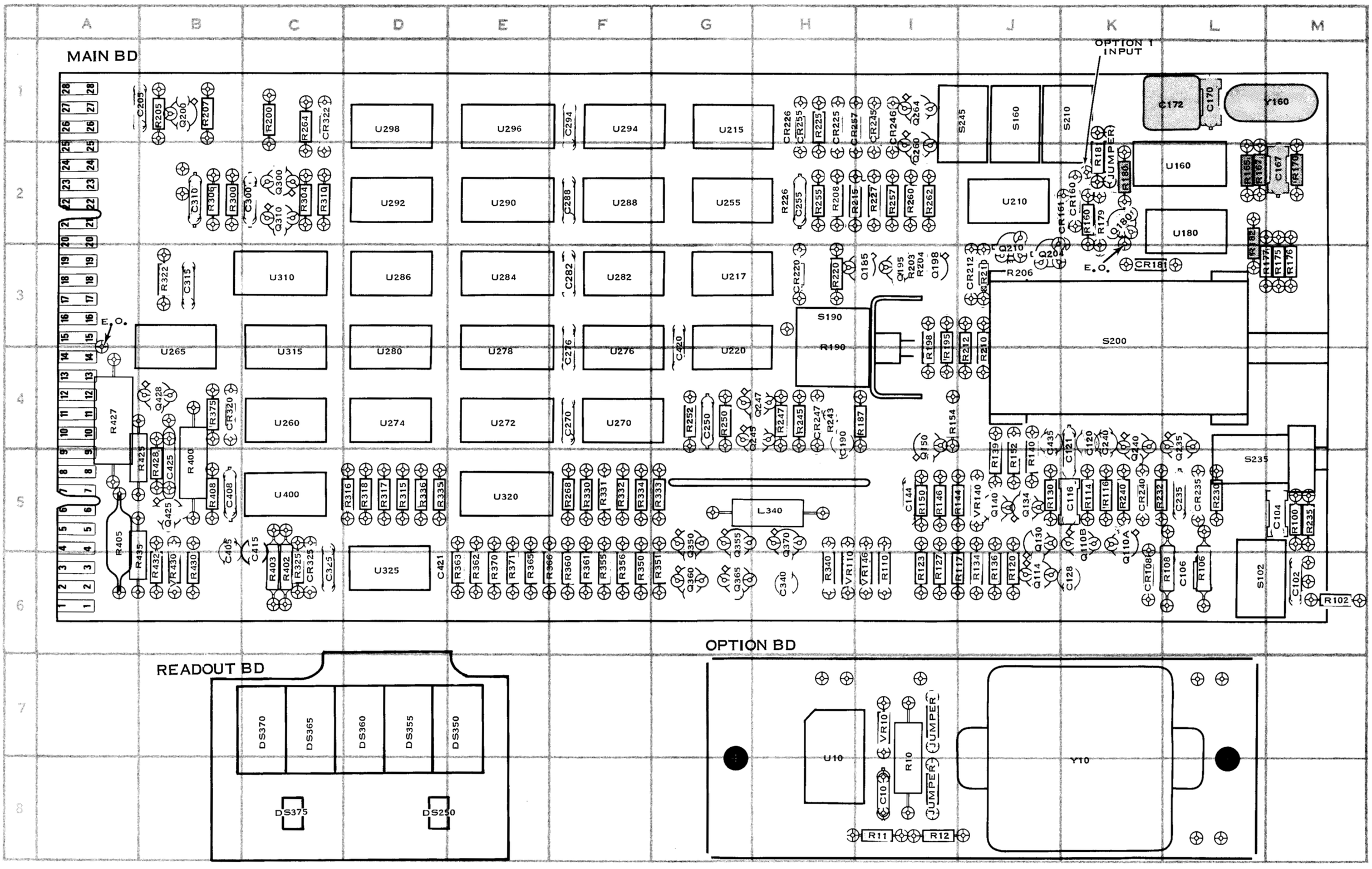
Example shown with decimal point scanned going high in TS3 will result in a display of __.XXX

1670-15

PARTS LOCATION GRID

DC 504

REMOVED FOR OPTION 1



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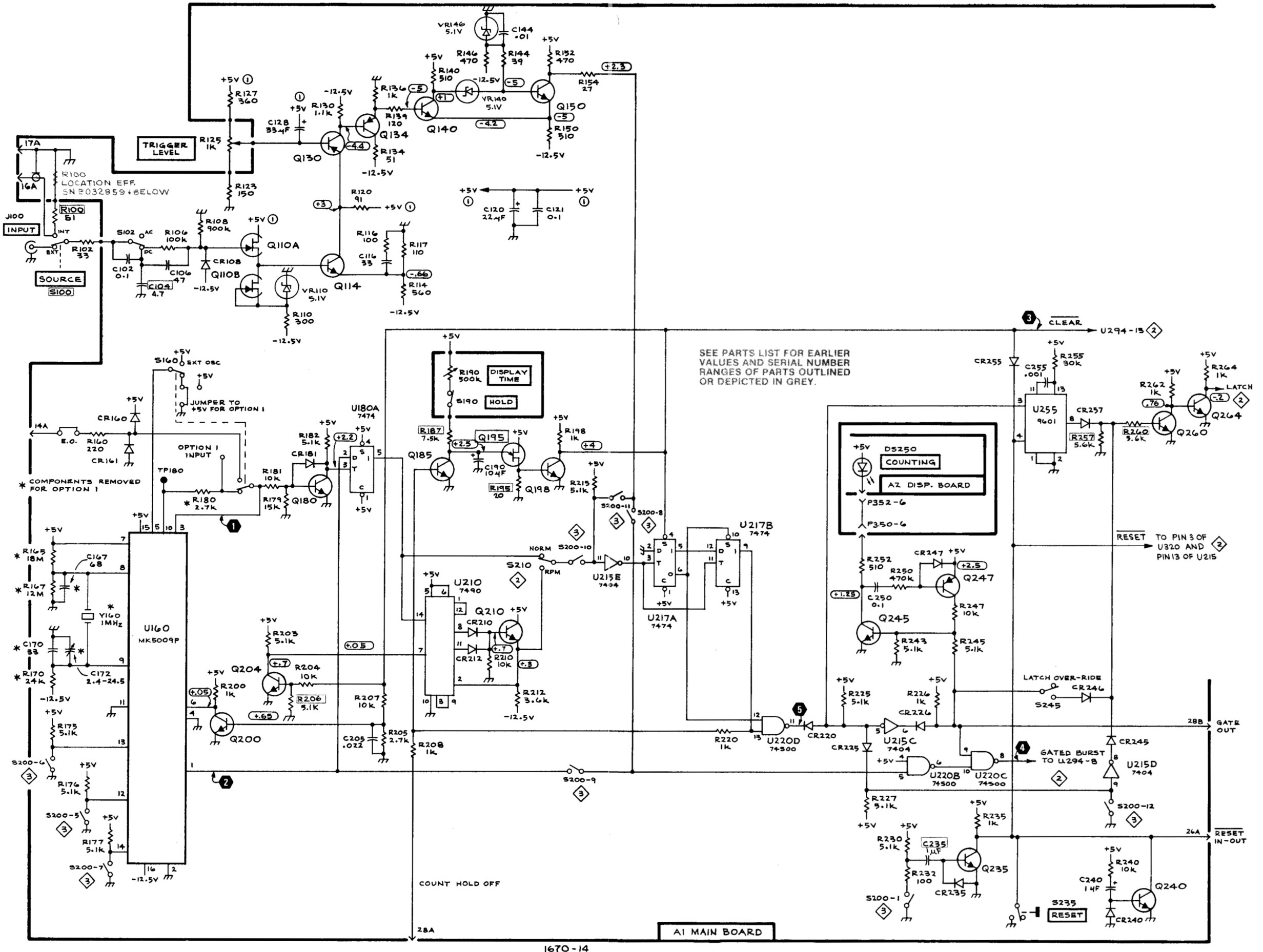
REV E MAR 1980

CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC	CKT NO	GRID LOC
C102†	M6	DS250	D8	R140	J5	R315	D5	U260	C4
C104†	M5	DS350	E7	R144	J5	R316	D5	U265	B4
C106	L6	DS355	D7	R146	I5	R317	D5	U270	F4
C116	K5	DS360	D7	R150	I5	R318	D5	U272	E4
C120	K4	DS365	C7	R152	J5	R322	B3	U274	D4
C121	K5	DS370	C7	R154	I4	R325	C6	U276	F4
C128	K6	DS375	C8	R160	K2	R330	F5	U278	E4
C144	I5			R165	L2	R331	F5	U280	D4
C167	M2	L340	H5	R167	L2	R332	F5	U282	F3
C170	L1			R170	M2	R333	G5	U284	E3
C172	L1	Q110	K5	R175	M3	R334	F5	U286	D3
C190	H4	Q114	J6	R176	M3	R335	D5	U288	F2
C205	B1	Q130	J5	R177	M3	R336	D5	U290	E2
C235	L5	Q134	J5	R179	K2	R340	H6	U292	D2
C240	K4	Q140	J5	R180	K2	R350	F6	U294	F1
C250	G4	Q150	I5	R181	K2	R351	G6	U296	E1
C255	H2	Q180	K2	R182	L3	R355	F6	U298	D1
C270	F4	Q185	I3	R187	I4	R356	F6	U310	C3
C276	F4	Q195	I3	R190	H4	R360	F6	U315	C4
C282	F3	Q198	I3	R195	I4	R361	F6	U320	E5
C288	F2	Q200	B1	R198	I4	R362	E6	U325	D6
C294	F1	Q209	J3	R200	C1	R363	E6	U400	C5
C300	C2	Q210	J3	R203	I3	R365	E6		
C310	B2	Q235	L5	R204	I3	R366	F6	VR110	H6
C315	B3	Q240	K5	R205	B1	R370	E6	VR140	J5
C325	C6	Q245	H4	R206*	J3	R371	E6	VR146	I6
C340	H6	Q247	H4	R207	B1	R375	B4	VR430	B6
C405	B5	Q260	I1	R208	H2	R400	B5		
C408	B5	Q264	I1	R210	J4	R402	C6	Y160	M1
C415	C5	Q300	C2	R212	J4	R403	C6		
C420	G4	Q310	C2	R215	I2	R405	A5		
C421	E6	Q350	G5	R220	H3	R408	B5	Option 1	
C425	B5	Q355	G5	R225	H1	R425	B5		
C435	J4	Q360	G6	R226	H2	R427	A4	C10	I8
		Q365	G6	R227	I2	R428	B5	R10	I8
CR108	K6	Q370	H5	R230	L5	R430	B6	R11	I8
CR160	K2	Q425	B5	R232	L5	R432	B6	R12	I8
CR161	K2	Q428	B4	R235	M5	R435	B5	U10	H8
CR181	K3			R240	K5			VR10	I8
CR210	J3	R100[1]	M5	R243	H4	S102	L6	Y10	K8
CR212	J3	R102	M6	R245	H4	S160	J1		
CR220	H3	R106	L6	R247	H4	S190	H4		
CR225	H1	R108	L6	R250	G4	S200	K4		
CR226	H1	R110	I6	R252	G4	S210	J1		
CR235	L5	R114	K5	R255	H2	S235	L5		
CR240	K5	R116	K5	R257	I2	S245	J1		
CR245	I1	R117	J6	R260	I2				
CR246	I1	R120	J6	R262	I2	U160	L2		
CR247	H4	R123	I6	R264	C1	U180	L2		
CR255	H1	R127	I6	R268	F5	U210	J2		
CR257	I1	R130	J5	R300	B2	U215	G1		
CR320	B4	R134	J6	R304	C2	U217	G3		
CR322	C1	R136	J6	R306	B2	U220	G4		
CR325	C6	R139	J5	R310	C2	U255	G2		

* See Parts List for serial number ranges.

†Located on back of board

[1] NOTE: R100 relocated on S100



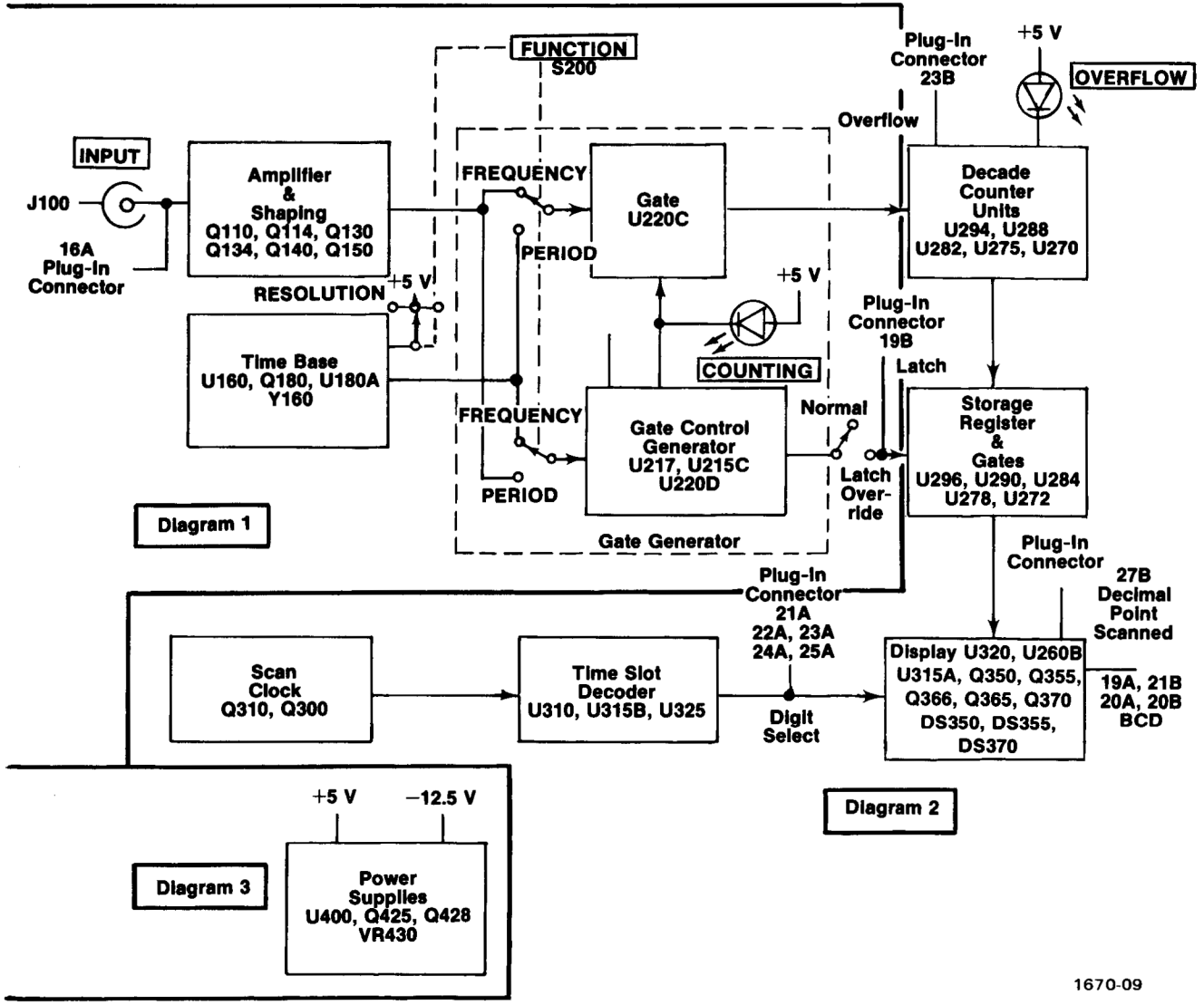
A1 MAIN BOARD

1670-14
REV F MAR 1980

DC 504

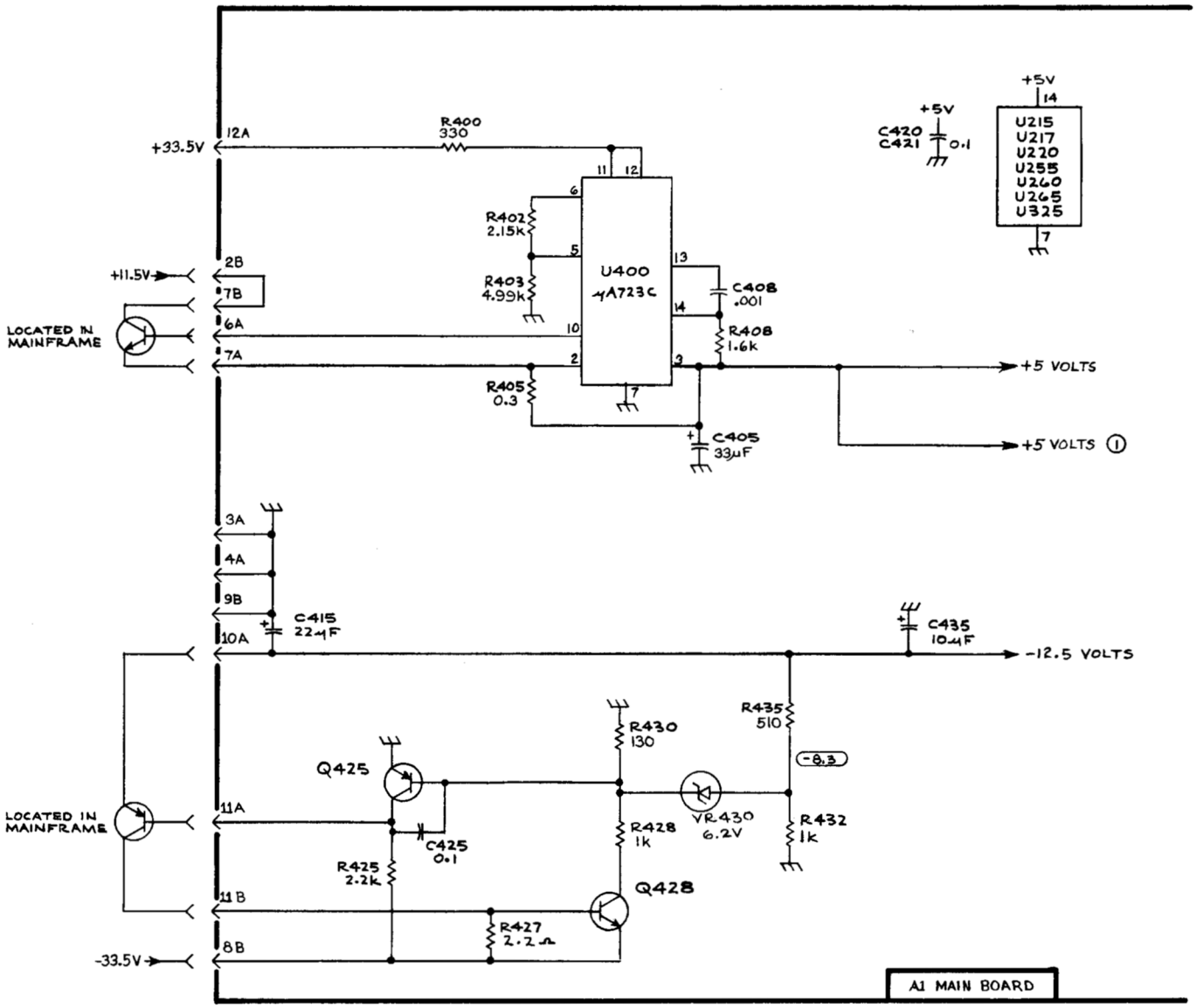
COUNTER TIME BASE AND CONTROL (1)

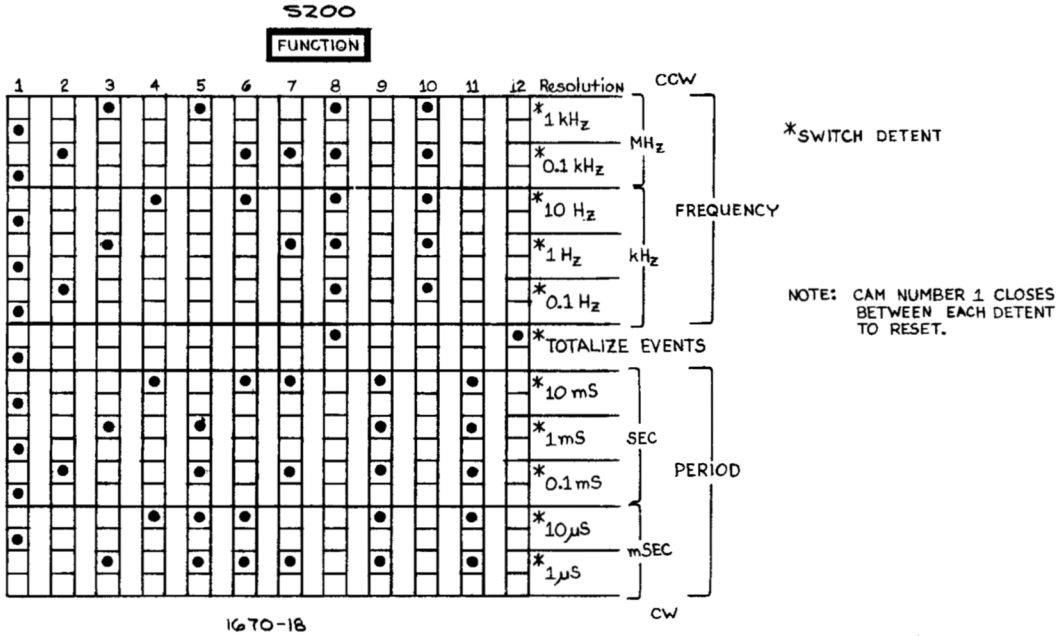
DEH 0474


FUNCTION
S200
INPUT
J100
16A
Plug-In
Connector
Amplifier
&
Shaping
Q110, Q114, Q130
Q134, Q140, Q150
FREQUENCY
PERIOD
Gate
U220C
RESOLUTION
+5 V
Time Base
U160, Q180, U180A
Y160
+5 V
COUNTING
FREQUENCY
PERIOD
Gate Control
Generator
U217, U215C
U220D
Normal
Gate Generator
Plug-In
Connector
23B
Overflow
+5 V
OVERFLOW
Decade
Counter
Units
U294, U288
U282, U275, U270
Plug-In
Connector
19B
Latch
Latch
Over-
ride
Storage
Register
&
Gates
U296, U290, U284
U278, U272
Diagram 1
Plug-In
Connector
21A
22A, 23A
24A, 25A
Plug-In
Connector
27B
Decimal
Point
Scanned
Scan
Clock
Q310, Q300
Time Slot
Decoder
U310, U315B, U325
Digit
Select
Display U320, U260B
U315A, Q350, Q355,
Q366, Q365, Q370
DS350, DS355,
DS370
19A, 21B
20A, 20B
BCD
Diagram 2
+5 V
−12.5 V
Diagram 3
Power
Supplies
U400, Q425, Q428
VR430
1670-09

SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES OF PARTS OUTLINED OR DEPICTED IN GREY.

+5V R300 5.1K R304 39K R306 330K R310 510
C300 .005 C310 470
Q300 Q310
U310 7496 T/S DECODER
C315 .01
U315B 7425
21A 22A 23A 24A 25A LSD MSD DIGIT SELECT
SCAN CLOCK OUT 24B
BCD OUT MSB 20B 20A 21B LSB 19A
OVERFLOW 23B
LATCH 19B
(C)Q264 LATCH
GATED BURST U220C-8
U294 82S90
C294 0.1
(C) Q198 CLEAR
U298 7401
U296 7475 LSD
U292 7401
U290 7475
U286 7401
U284 7475
U280 7401
U278 7475
U274 7401
U272 7475 MSD
U215A 7404
U288 7490
C288 .001
U282 7490
C282 .001
U276 7490
C276 .001
U270 7490
C270 .001
U220A 74S00
U265 7400
U260A 7474
CLEAR
RESET
R315 1K R316 1K R317 1K R318 1K
U320 7447 7 SEGMENT DECODER
U315A 7425
U260B 7474
CR320 CR322
R322 300
RESET
R330 150 R331 150 R332 150 R333 150 R334 150 R335 150 R336 150
R325 1K CR325
C325 .001
U325D 7416
U325E 7416
U325F 7416
U325A 7416
U325B 7416
U325C 7416
S200-4 S200-3 S200-2
R362 5.1K
R363 100
S210 NORM RPM
R375 1K
R268 510
P375 P377 P350 P352
R340 100 L340 15µH C340 10µF
R351 270 R350 1K Q350
R356 270 R355 1K Q355
R361 270 R360 1K Q360
R366 270 R365 1K Q365
R371 270 R370 1K Q370
DS350 LSD DS355 DS360 DS365 DS370
A2 DISPLAY BOARD
OVERFLOW DS375
27B DECIMAL POINT OUT
A1 MAIN BOARD





1670-18
REV E JUN 1979

POWER SUPPLY & SWITCH DETAILS (3) 11-73 JEN

REPLACEABLE MECHANICAL PARTS

PARTS ORDERING INFORMATION

Replacement parts are available from or through your local Tektronix, Inc. Field Office or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest circuit improvements developed in our engineering department. It is therefore important, when ordering parts, to include the following information in your order: Part number, instrument type or number, serial number, and modification number if applicable.

If a part you have ordered has been replaced with a new or improved part, your local Tektronix, Inc. Field Office or representative will contact you concerning any change in part number.

Change information, if any, is located at the rear of this manual.

SPECIAL NOTES AND SYMBOLS

X000	Part first added at this serial number
00X	Part removed after this serial number

FIGURE AND INDEX NUMBERS

Items in this section are referenced by figure and index numbers to the illustrations.

INDENTATION SYSTEM

This mechanical parts list is indented to indicate item relationships. Following is an example of the indentation system used in the description column.

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
- - - * - - -
Detail Part of Assembly and/or Component
Attaching parts for Detail Part
- - - * - - -
Parts of Detail Part
Attaching parts for Parts of Detail Part
- - - * - - -

Attaching Parts always appear in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

Attaching parts must be purchased separately, unless otherwise specified.

ITEM NAME

In the Parts List, an Item Name is separated from the description by a colon (:). Because of space limitations, an Item Name may sometimes appear as incomplete. For further Item Name identification, the U.S. Federal Cataloging Handbook H6-1 can be utilized where possible.

ABBREVIATIONS

"	INCH
#	NUMBER SIZE
ACTR	ACTUATOR
ADPTR	ADAPTER
ALIGN	ALIGNMENT
AL	ALUMINUM
ASSEM	ASSEMBLED
ASSY	ASSEMBLY
ATTEN	ATTENUATOR
AWG	AMERICAN WIRE GAGE
BD	BOARD
BRKT	BRACKET
BRS	BRASS
BRZ	BRONZE
BSHG	BUSHING
CAB	CABINET
CAP	CAPACITOR
CER	CERAMIC
CHAS	CHASSIS
CKT	CIRCUIT
COMP	COMPOSITION
CONN	CONNECTOR
COV	COVER
CPLG	COUPLING
CRT	CATHODE RAY TUBE
DEG	DEGREE
DWR	DRAWER
ELCTRN	ELECTRON
ELEC	ELECTRICAL
ELCTLT	ELECTROLYTIC
ELEM	ELEMENT
EPL	ELECTRICAL PARTS LIST
EQPT	EQUIPMENT
EXT	EXTERNAL
FIL	FILLISTER HEAD
FLEX	FLEXIBLE
FLH	FLAT HEAD
FLTR	FILTER
FR	FRAME or FRONT
FSTNR	FASTENER
FT	FOOT
FXD	FIXED
GSKT	GASKET
HDL	HANDLE
HEX	HEXAGON
HEX HD	HEXAGONAL HEAD
HEX SOC	HEXAGONAL SOCKET
HLCPS	HELICAL COMPRESSION
HLEXT	HELICAL EXTENSION
HV	HIGH VOLTAGE
IC	INTEGRATED CIRCUIT
ID	INSIDE DIAMETER
IDENT	IDENTIFICATION
IMPLR	IMPELLER
IN	INCH
INCAND	INCANDESCENT
INSUL	INSULATOR
INTL	INTERNAL
LPHLDR	LAMPHOLDER
MACH	MACHINE
MECH	MECHANICAL
MTG	MOUNTING
NIP	NIPPLE
NON WIRE	NOT WIRE WOUND
OBD	ORDER BY DESCRIPTION
OD	OUTSIDE DIAMETER
OVH	OVAL HEAD
PH BRZ	PHOSPHOR BRONZE
PL	PLAIN or PLATE
PLSTC	PLASTIC
PN	PART NUMBER
PNH	PAN HEAD
PWR	POWER
RCPT	RECEPTACLE
RES	RESISTOR
RGD	RIGID
RLF	RELIEF
RTNR	RETAINER
SCH	SOCKET HEAD
SCOPE	OSCILLOSCOPE
SCR	SCREW
SE	SINGLE END
SECT	SECTION
SEMICOND	SEMICONDUCTOR
SHLD	SHIELD
SHLDR	SHOULDERED
SKT	SOCKET
SL	SLIDE
SLFLKG	SELF-LOCKING
SLVG	SLEEVING
SPR	SPRING
SQ	SQUARE
SST	STAINLESS STEEL
STL	STEEL
SW	SWITCH
T	TUBE
TERM	TERMINAL
THD	THREAD
THK	THICK
TNSN	TENSION
TPG	TAPPING
TRH	TRUSS HEAD
V	VOLTAGE
VAR	VARIABLE
W/	WITH
WSHR	WASHER
XFMR	TRANSFORMER
XSTR	TRANSISTOR

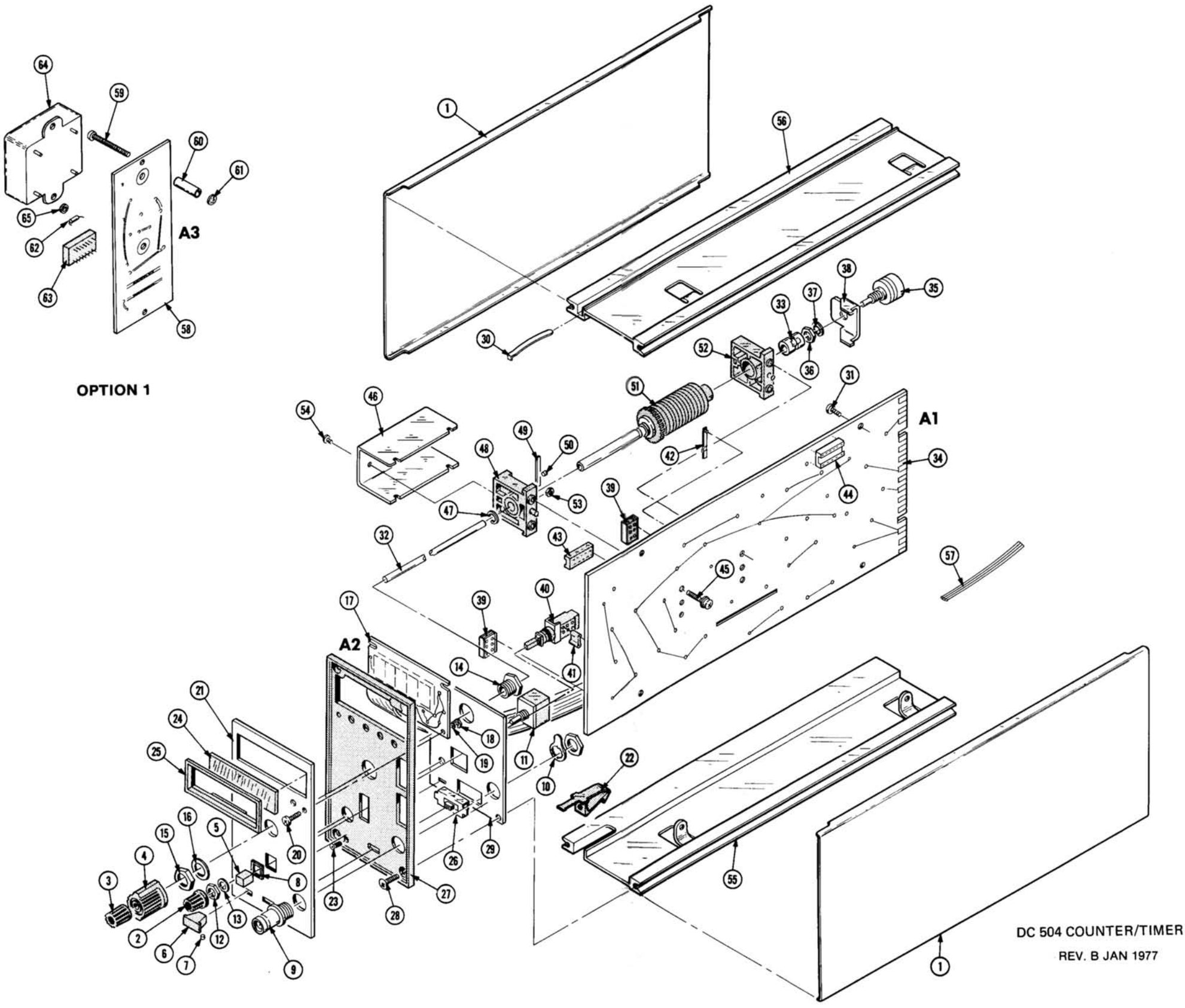
CROSS INDEX—MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip
000CY	NORTHWEST FASTENER SALES, INC.	7923 SW CIRRUS DRIVE	BEAVERTON, OR 97005
00779	AMP, INC.	P.O. BOX 3608	HARRISBURG, PA 17105
08261	SPECTRA-STRIP CORP.	7100 LAMPSON AVE.	GARDEN GROVE, CA 92642
09922	BURNDY CORPORATION	RICHARDS AVENUE	NORWALK, CT 06852
13511	AMPHENOL CARDRE DIV., BUNKER RAMO CORP.		LOS GATOS, CA 95030
22526	BERG ELECTRONICS, INC.	YOUK EXPRESSWAY	NEW CUMBERLAND, PA 17070
45722	USM CORP., PARKER-KALON FASTENER DIV.		CAMPBELLSVILLE, KY 42718
57668	R-OHM CORP.	16931 MILLIKEN AVE.	IRVINE, CA 92713
73743	FISCHER SPECIAL MFG. CO.	446 MORGAN ST.	CINCINNATI, OH 45206
78189	ILLINOIS TOOL WORKS, INC.		
	SHAKEPROOF DIVISION	ST. CHARLES ROAD	ELGIN, IL 60120
78471	TILLEY MFG. CO.	900 INDUSTRIAL RD.	SAN CARLOS, CA 94070
79136	WALDES, KOHINOOR, INC.	47-16 AUSTEL PLACE	LONG ISLAND CITY, NY 11101
79807	WROUGHT WASHER MFG. CO.	2100 S. O BAY ST.	MILWAUKEE, WI 53207
80009	TEKTRONIX, INC.	P O BOX 500	BEAVERTON, OR 97077
83385	CENTRAL SCREW CO.	2530 CRESCENT DR.	BROADVIEW, IL 60153
86113	MICRODOT MFG. INC.,		
	CENTRAL SCREW - KEENE DIV.	149 EMERALD ST.	KEENE, NH 03431
87308	N. L. INDUSTRIES, INC., SOUTHERN SCREW		
	DIV.	P. O. BOX 1360	STATESVILLE, NC 28677
90484	ITT, SURPRENANT DIV.	172 STERLING STREET	CLINTON, MA 01510
93907	TEXTRON INC. CAMCAR DIV	600 18TH AVE	ROCKFORD, IL 61101

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5 Name & Description	Mfr Code	Mfr Part Number
1-1	337-1399-00			2	SHLD,ELECTRICAL:SIDE	80009	337-1399-00
-2	366-0494-00			1	KNOB:GRAY WITH SETSCREW	80009	366-0494-00
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL BK OXD,HEX	000CY	ORD BY DESCR
-3	366-1031-05			1	KNOB:RED--CAL	80009	366-1031-05
	213-0153-00			1	.SETSCREW:5-40 X 0.125,STL BK OXD,HEX	000CY	ORD BY DESCR
-4	366-1170-01			1	KNOB:GRAY,4 SIDED	80009	366-1170-01
	213-0153-00			2	.SETSCREW:5-40 X 0.125,STL BK OXD,HEX	000CY	ORD BY DESCR
-5	366-1257-30			1	PUSH BUTTON:GRAY--RESET	80009	366-1257-30
-6	366-1422-00	B010100	B033829	1	KNOB:LATCH	80009	366-1422-00
	366-1690-00	B033830		1	KNOB:SIL GY,0.53 X 0.23 X 1.059	80009	366-1690-00
					**********(ATTACHING PARTS)**********		
-7	214-1840-00	B010100	B033829	1	PIN,KNOB SECRG:0.094 OD X 0.120 INCH LONG	80009	214-1840-00
					**********(END ATTACHING PARTS)**********		
-8	426-0681-00			1	FR,PUSH BUTTON:	80009	426-0681-00
-9	131-0955-00			1	CONN,RCPT,ELEC:BNC,FEMALE	13511	31-279
					**********(ATTACHING PARTS)**********		
-10	210-0255-00			1	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	80009	210-0255-00
					**********(END ATTACHING PARTS)**********		
-11	----- -----			1	RES.,VAR:(SEE R125 REPL)		
					**********(ATTACHING PARTS)**********		
-12	210-0583-00			1	NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-13	210-0940-00			1	WASHER,FLAT:0.25 ID X 0.375 INCH OD,STL	79807	ORD BY DESCR
					**********(END ATTACHING PARTS)**********		
-14	358-0029-00			1	BSHG,MACH.THD:HEX,0.375-32 X 0.438"LONG	80009	358-0029-00
					**********(ATTACHING PARTS)**********		
-15	210-0590-00			1	NUT,PLAIN,HEX.:0.375-32 X 0.438" BRS	73743	2X28269-402
-16	210-0978-00			1	WASHER,FLAT:0.375 ID X 0.50 INCH OD,STL	78471	ORD BY DESCR
					**********(END ATTACHING PARTS)**********		
-17	----- -----			1	CKT BOARD ASSY:DISPLAY(SEE A2 REPL)		
					**********(ATTACHING PARTS)**********		
-18	210-0405-00			2	NUT,PLAIN,HEX:2-56 X 0.188,BRS,CD PL	73743	12157-50
-19	210-0001-00			2	WASHER,LOCK:#2 INTL,0.013 X 0.18 OD,STL	78189	1202-00-00-0541C
-20	211-0159-00	B010100	B032859	2	SCREW,MACHINE:2-56 X 0.375 INCH,PNH STL	87308	ORD BY DESCR
	211-0034-00	B032860		2	SCREW,MACHINE:2-56 X 0.50 INCH,PNH	83385	ORD BY DESCR
	361-0019-00	B032860		2	INSULATOR,DISK:0.094 DIA X 0.078 INCH L	80009	361-0019-00
					**********(END ATTACHING PARTS)**********		
	----- -----			-	CKT BOARD ASSY INCLUDES:		
	136-0252-04			4	.SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
	175-5366-00	B040460		1	.CA ASSY,SP,ELEC:6,26 AWG,7.0 L,RIBBON	80009	175-5366-00
	131-0707-00	B040460		6	..CONTACT,ELEC:22-26 AWG,BRS & CU BE GOLD	22526	47439
	352-0164-01	B040460		1	..HLDR,TERM CONN:6 WIRE,BROWN	80009	352-0164-01
	175-5367-00	B040460		1	.CA ASSY,SP,ELEC:10,26 AWG,8.0 L,RIBBON	80009	175-5367-00
	131-0707-00	B040460		10	..CONTACT,ELEC:22-26 AWG,BRS & CU BE GOLD	22526	47439
	352-0168-01	B040460		1	..HLDR,TERM CONN:10 WIRE,BROWN	80009	352-0168-01
-21	333-1783-00			1	PANEL,FRONT:	80009	333-1783-00
-22	214-1513-01	B010100	B033829	1	LCH,PLUG-IN RET:	80009	214-1513-01
	105-0719-00	B033830		1	LATCH,RETAINING:PLUG-IN	80009	105-0719-00
					**********(ATTACHING PARTS)**********		
-23	213-0254-00			1	SCREW,TPG,TF:2-32 X 0.250,100 DEG,FLH	45722	ORD BY DESCR
					**********(END ATTACHING PARTS)**********		
	105-0718-00	B033830	B035989	1	BAR,LATCH RLSE:	80009	105-0718-00
	105-0718-01	B035990		1	BAR,LATCH RLSE:	80009	105-0718-01
-24	331-0314-00			1	WINDOW,READOUT:RED	80009	331-0314-00
-25	426-0916-00			1	FRAME,RDOUT WDO:	80009	426-0916-00
-26	----- -----			1	SWITCH,SLIDE:(SEE S100 REPL)		
-27	386-2292-00			1	SUBPANEL,FRONT:	80009	386-2292-00
					**********(ATTACHING PARTS)**********		
-28	213-0229-00	B010100	B036279	4	SCR,TPG,THD FOR:6-20 X0.375"100 DEG,FLH ST	93907	ORD BY DESCR
	213-0123-00	B036280		4	SCREW,TPG,TF:6-32 X 0.375,SPCL TYPE,FLH	93907	ORD BY DESCR
					**********(END ATTACHING PARTS)**********		
-29	337-1888-00			1	SHIELD,ELEC:	80009	337-1888-00
-30	214-1061-00			1	SPRING,GROUND:FLAT	80009	214-1061-00
	----- -----			1	CKT BOARD ASSY:FUNCTION SWITCH(SEE A1 REPL		
					**********(ATTACHING PARTS)**********		
-31	213-0146-00			4	SCR,TPG,THD FOR:6-20 X 0.313 INCH,PNH STL	83385	ORD BY DESCR
	210-0005-00			4	WASHER,LOCK:#6 EXT,0.02 THK,STL	78189	1106-00
					**********(END ATTACHING PARTS)**********		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-	----- -----			-		CKT BOARD ASSY INCLUDES:		
-32	384-1290-00			1		.EXTENSION SHAFT:0.125 OD X 4.660 INCH LON	80009	384-1290-00
-33	376-0051-01			1		.CPLG,SHAFT,FLEX:0.127 ID X 0.375 OD	80009	376-0051-01
-34	----- -----			1		.CKT BOARD ASSY:MAIN(SEE A1 REPL)		
-35	----- -----			1		..RES.,VAR:(SEE A1R190 REPL)		
						..**********(ATTACHING PARTS)**********		
-36	210-0583-00			1		..NUT,PLAIN,HEX:0.25-32 X 0.312 INCH,BRS	73743	2X20317-402
-37	210-0046-00			1		..WASHER,LOCK:0.261 ID,INTL,0.018 THK,BRS	78189	1214-05-00-0541C
-38	407-0803-00			1		..BRACKET,ELEC SW:BRASS	80009	407-0803-00
						..**********(END ATTACHING PARTS)**********		
	131-0566-00			2		..BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
	214-0579-00			1		..TERM,TEST POINT:BRS CD PL	80009	214-0579-00
	----- -----			-		..(STANDARD ONLY)		
-39	----- -----			4		..SWITCH,SLIDE:(SEE S102,160,210,245 REPL)		
-40	----- -----			1		..SWITCH,PUSH:(SEE S235 REPL)		
-41	361-0383-00			2		..SPACER,PB SW:CHARCOAL,0.33 INCH LONG	80009	361-0383-00
-42	131-0604-00			12		..CONTACT,ELEC:CKT BD SW,SPR,CU BE	80009	131-0604-00
	----- -----			-		..(SEE MAINTENANCE SECTION FOR REPAIR)		
-43	136-0260-02	B010100	B041289	8		..SKT,PL-IN ELEK:MICROCIRCUIT,16 DIP,LOW C	09922	DILB16P-108T
	136-0728-00	B041290		1		..SKT,PL-IN ELEK:MICROCKT,14 CONTACT	09922	DILB14P-108
-44	136-0269-02	B010100	B041289	20		..SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP	09922	DILB149P-108
	136-0729-00	B041290		1		..SKT,PL-IN ELEK:MICROCKT,16 CONTACT	09922	DILB16P-108T
	131-0608-00	B010157		16		..TERMINAL,PIN:0.365 L X 0.025 PH BRZ GOLD	22526	48283-036
	136-0234-00	B036570		2		..SOCKET,PIN TERM:0.088 OD X 0.247 INCH L	00779	380598-1
	136-0252-04	B036570		6		..SOCKET,PIN TERM:U/W 0.016-0.018 DIA PINS	22526	75060-007
	175-5364-00	B040460		1		..CABLE ASSY,RF:50 OHM COAX,12.0 L,9-4	80009	175-5364-00
	175-5365-00	B040460		1		..CABLE ASSY,RF:3,26 AWG,4.0 L,RIBBON	80009	175-5365-00
	263-1031-00			1		.SW CAM ACTR AS:FUNCTION	80009	263-1031-00
						.**********(ATTACHING PARTS)**********		
-45	211-0116-00	B010100	B039689	4		.SCR,ASSEM WSHR:4-40 X 0.312 INCH,PNH BRS	83385	ORD BY DESCR
	211-0292-00	B039690		4		.SCR,ASSEM WSHR:4-40 X 0.29,BRS NI PL	78189	ORD BY DESCR
						.**********(END ATTACHING PARTS)**********		
	----- -----			-		.ACTUATOR ASSY INCLUDES:		
-46	200-1010-00			1		..COVER,CAM SW:12 ELEMENT,0.83 INCH DIA	80009	200-1010-01
-47	354-0219-00			1		..RING,RETAINING:FOR 0.25 INCH SHAFT	79136	5103-25-MD-R
-48	401-0057-00			1		..BEARING,CAM SW:FRONT	80009	401-0057-00
-49	214-1139-03			1		..SPRING,FLAT:RED COLORED	80009	214-1139-03
	214-1139-00			1		..SPRING,FLAT:0.885 X 0.156 CU BE GLD CLR	80009	214-1139-00
-50	214-1127-00			1		..ROLLER,DETENT:0.125 DIA X 0.125,SST	80009	214-1127-00
-51	105-0558-00			1		..ACTUATOR,SWITCH:	80009	105-0558-00
-52	401-0056-00			1		..BEARING,CAM SW:REAR	80009	401-0056-00
-53	210-0406-00			4		..NUT,PLAIN,HEX:4-40 X 0.188,BRS,CD PL	73743	12161-50
-54	211-0022-00			2		..SCREW,MACHINE:2-56 X 0.188,PNH,STL,CD PL	83385	ORD BY DESCR
	210-0001-00			2		..WASHER,LOCK:#2 INTL,0.013 X 0.18 OD,STL	78189	1202-00-00-0541C
	210-0405-00			2		..NUT,PLAIN,HEX:2-56 X 0.188,BRS,CD PL	73743	12157-50
	386-3657-00	B033860	B036559	2		SUPPORT,PLUG-IN:	80009	386-3657-00
	386-3657-01	B036560		2		SUPPORT,PLUG IN:	93907	ORD BY DESCR
	210-1270-00	B033860		2		WASHER,FLAT:0.141 ID X 0.04 THK,AL	80009	210-1270-00
-55	426-0724-04			1		FR SECT,PLUG-IN:BOTTOM	80009	426-0724-04
-56	426-0725-05			1		FR SECT,PLUG-IN:TOP	80009	426-0725-05
	198-2213-00	B010100	B040459	1		WIRE SET,ELEC:	80009	198-2213-00
-57	175-0826-00	B010100	B040459	FT		.WIRE,ELECTRICAL:3 WIRE RIBBON	80009	175-0826-00
	175-0829-00	B010157	B040459	FT		.WIRE,ELECTRICAL:6 WIRE RIBBON	08261	SS-0626-710610C
	175-0833-00	B010157	B040459	FT		.WIRE,ELECTRICAL:10 WIRE RIBBON	08261	SS-1026-7
	131-0707-00	B010157	B040459	16		.CONTACT,ELEC:22-26 AWG,BRS & CU BE GOLD	22526	47439
	352-0164-01	B010157	B040459	1		.HLDR,TERM CONN:6 WIRE,BROWN	80009	352-0164-01
	352-0168-01	B010157	B040459	1		.HLDR,TERM CONN:10 WIRE,BROWN	80009	352-0168-01
	175-1020-00	B032860	B040459	FT		.CABLE,RF:50 OHM COAX,WHT POLYTHN JKT	90484	DAB70JAAAWHITE
-58	----- -----			1		CKT BOARD ASSY:TIME BASE(SEE A3 REPL)		
	----- -----			-		(OPTION 01 ONLY)		
						**********(ATTACHING PARTS)**********		
-59	213-0206-00			2		SCR,TPG,THD FOR:6-32 X 1.25 INCH,PNH STL	86113	ORD BY DESCR
-60	361-0682-00			2		SPACER,SLEEVE:0.648 X 0.189 BRS	80009	361-0682-00
-61	210-0006-00			2		WASHER,LOCK:#6 INTL,0.018 THK,STL CD PL	78189	1206-00-00-0541C
						**********(END ATTACHING PARTS)**********		

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
1-	----- -----			-		CKT BOARD ASSY INCLUDES:		
-62	131-0566-00			1		.BUS CONDUCTOR:DUMMY RES,2.375,22 AWG	57668	JWW-0200E0
-63	136-0269-02	B010100	B041419	1		.SKT,PL-IN ELEK:MICROCIRCUIT,14 DIP	09922	DILB149P-108
-64	----- -----			1		.OSCILLATOR(SEE A3Y10 REPL)		
-65	210-1014-00			4		.WASHER,NONMETAL:0.094 ID X 0.312" OD,TEFL	80009	210-1014-00


A1
A2
A3
OPTION 1
DC 504 COUNTER/TIMER
REV. B JAN 1977

ACCESSORIES

Fig. & Index No.	Tektronix Part No.	Serial/Model No. Eff	Dscont	Qty	1 2 3 4 5	Name & Description	Mfr Code	Mfr Part Number
	070-1670-01			1		MANUAL,TECH:INSTRUCTION	80009	070-1670-01