# INSTRUCTION MANUAL

Serial Number ____________

# TYPE 283/R283 REAL TIME ADAPTER

*Tektronix, Inc.*

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070-0618-00

1266


TYPE 283 REAL TIME ADAPTER
REAL TIME/DIV
DISPLAY
NORMAL
SINGLE
START
EXT PROGRAM
OFF
ON
REAL TIME TRIGGERING
TRIGGER LEVEL
CHANNEL A
CHANNEL B
MODE
SLOPE
INT
DC
AC
EXT
FREE RUN
SERIAL
TEKTRONIX, INC. PORTLAND, OREGON, U.S.A.
TYPE R 283 REAL TIME ADAPTER

# SECTION 1
# CHARACTERISTICS

## General

This manual pertains to two electrically identical instruments. They are the Type R283 Real Time Adapter for certain Tektronix 19 inch rack mounted sampling systems, and the Type 283 Real Time Adapter unit for certain Tektronix bench operated sampling oscilloscopes.

The two Real Time Adapter units are accessory items to the Tektronix Type 3T4 Programmable Sampling Sweep. The vertical unit must be the Type 3S76 Sampling Dual-Trace unit, the Type 3S3 Sampling Probe Unit or other Tektronix sampling unit that can operate in the 560-series Oscilloscopes and has vertical output signals. The adapter converts the sampling oscilloscope from equivalent time sampling to real time sampling with sweep rates of 1 millisecond to 1 second per division in a 1, 2, 5 sequence. Digital readout of the real time sampling measurements is provided by the Tektronix Type 6R1A Digital Unit when the plug-in units are operating in a Type 567 Readout Oscilloscope.

Real time sampling can be normally programmed from the Real Time Adapter front panel, or automatically programmed by a Tektronix Type 262 Programmer or other closure-type programmer. When a Real Time Adapter is properly connected between the programmable sampling sweep unit and a Type 262 Programmer, the Type 262 can control all the programmable functions of both the sampling sweep unit and the Real Time Adapter.

## Electrical Characteristics

The following electrical characteristics apply over an ambient temperature range of 0° C to +50° C. These characteristics apply only after an instrument warm-up time of at least 5 minutes.

**TABLE 1-1**

ELECTRICAL CHARACTERISTICS

| General Characteristics | Performance Requirement | Supplemental Information |
|---|---|---|
| Real Time Sweep Rates | 1 ms/div to 1 s/div | Ten fixed rates in a 1, 2, 5 sequence. |
| Sweep Rate Accuracy: | | |
| Digital Readout (Type 6R1A Time Measurement) | ±0.1% added to the time measurement tolerances of associated Digital Unit. | Set by crystal controlled clock pulses. Not tested. |
| Oscilloscope CRT Time/Div | | Tolerance limited by Type 3T4 samples/div accuracy and accuracy of HORIZ GAIN adjustment. |
| Trigger Sensitivity | | |
| Internal: | | |
| DC Coupled | ≤0.5 major div deflection of CRT display from DC to 1 kHz. | |
| AC Coupled | ≤0.5 major div deflection of CRT display at 1 kHz. | INT AC Low frequency —3 dB frequency ≈15 Hz. |
| External: | | |
| AC Coupled only | ≤0.5 V peak to peak at 1 kHz. | EXT AC Low frequency —3 dB frequency ≈150 Hz. |
| TRIGGER LEVEL Control Range | | |
| Internal | The sweep can be started over a CRT vertical scan range of ≥ + and —8 major CRT divisions. | |
| External | The sweep can be started over a trigger signal voltage range of ≥ + and — 0.7 volt from ground using a 1 kHz square wave. | |
| Maximum external trigger signal voltage | ±20 volts | Not tested |
| External Trigger input impedance | Initially 50 Ω changing to 1 kΩ with 50 ns time constant, then to several megohms with a 10 ms time constant. | Not tested |
| Single Display Start | One sweep is begun when START button is depressed. | |

## Operating Characteristics

### Real Time Triggering

Modes—Free Run, Internal AC or DC, External AC Only.

Slope—+ or — both Internal and External.

Source—Internal: Channel A or Channel B of the oscilloscope vertical unit.

External: through a BNC connector.

### Ext Equiv Time Trigger Input

A BNC connector feeds external trigger information directly to the Type 3T4 external trigger input connector when the Type 3T4 Time/Div switch selects the equivalent sweep rate, or when the Real Time Adapter EXT PROGRAM switch is at ON and the Type 3T4 Time/Div switch is at Remote Program. The EXT EQUIV TIME TRIGGER INPUT connector is automatically disconnected and left open circuited during real time sampling.

## Operating Modes

The operating modes discussed here are those of the sampling oscilloscope as controlled by the Real Time Adapter. Control is possible only when the sampling sweep unit controls are properly set as stated in Section 2 under First Time Operation. The Real Time Adapter EXT PROGRAM switch must be at its OFF position.

1. Normal repetitive triggered real time display with the sweep rate and triggering controlled by the Real Time Adapter, including digital readout.

2. Single display, non-synchronous with vertical information, as started by either the Real Time Adapter or the sampling sweep START button. Digital readout not possible.

Other operating modes, when the Real Time Adapter EXT PROGRAM switch is at ON, are controlled by the Type 262 Programmer. Such operating modes include all remotely programmable functions of the sampling sweep unit as described on page 1-1 of the Type 3T4 instruction manual. Real Time Adapter real time triggering controls are not remotely programmable. However, the trigger circuit can be turned on by the Type 262. The Real Time Adapter clock rate is remotely programmable, so it is possible to remotely control real time sampling if the trigger circuit controls are manually operated, or if a remote triggering circuit provides the single display start signal to J260-26.

## Power Requirements

Power for operation of the Real Time Adapter is provided by the oscilloscope through the sampling sweep unit and the cable connected to J250.

## Mechanical Characteristics

Panel—R283: $3\frac{1}{2}$ inches x 19 inches. 283: 7 inches x 5 inches. Anodized aluminum with silk screened lettering.

Depth—R283: $7\frac{3}{4}$ inches. Cable connectors require approximately two more inches. 283: $4\frac{1}{2}$ inches.

Net Weight—R283: 4 pounds. 283: $3\frac{1}{2}$ pounds.

Cabinet—R283: Aluminum. 283: Aluminum, vinyl blue wrap-around.

## Standard Accessories

A list of the accessories shipped with the Type 283/R283 can be found in the Mechanical Parts List, section 7 of this book.

## Optional Accessories

| | Tektronix Part No. |
|---|---|
| 1. 50 Ω coaxial cable, 42 inch length, with BNC connectors. | 012-0057-00 |
| 2. GR Type 874 to BNC female connector adapter. GR Type 874 QBJA. | 017-0063-00 |
| 3. GR Type 874 to BNC male connector adapter. GR Type 874 QBPA. | 017-0064-00 |

See your Tektronix Field Engineer or Representative for other accessories suitable for use with the Real Time Adapter and sampling systems.

# SECTION 3
# CIRCUIT DESCRIPTION

## General

The circuits of the Type 283 Real Time Adapter and the Type R283 Real Time Adapter are identical. Each unit contains two independent circuits: the clock circuit and the trigger circuit. The clock circuit provides continuous, accurately timed pulses to the Type 3T4 Programmable Sampling Sweep unit external trigger input. These pulses are "sample" commands. Their rate is controlled by the REAL TIME/DIV switch to provide 1000 samples per 10 division sweep. The trigger circuit receives vertical signal information from the vertical sampling unit and triggers each sweep. The point along the slope of the vertical signal at which the sweep begins is determined by the SLOPE, TRIGGER LEVEL and TRIGGER SOURCE DC LEVEL controls.

The Types 3T4, 283/R283 and the vertical sampling unit operate as a real time sampling system. Since the circuit functions of the Type 283/R283 are extensions of the Type 3T4 circuits, it is well to be familiar with the Type 3T4 circuits before reading this circuit description. Some details of Real Time Sampling can be found in the Type 3T4 instruction manual on pages 2-9, 2-10, 3-1, 3-2 and 3-3.

Fig. 3-1 shows a block diagram of the Type 283/R283.

## Trigger Circuit

The trigger circuit has four modes of operation. They are: EXT (AC ONLY), INT DC, INT AC and FREE RUN. In the EXT (AC ONLY), INT DC, and INT AC modes a single display start pulse is generated at a point on the slope of the incoming signal determined by the TRIGGER SOURCE DC LEVEL, SLOPE and TRIGGER LEVEL controls. In the INT DC and INT AC modes the incoming signal is the vertical signal from the vertical sampling unit. In the EXT (AC ONLY) mode, the triggering signal is applied to the REAL TIME TRIGGER INPUT. In the FREE RUN mode, the trigger circuit is converted to an astable multivibrator. The astable multivibrator provides continuous single display start pulses which start the sweep about once every 5 ms. This mode of operation is included to place a zero signal trace on the oscilloscope screen.

**DC Operation.** When the internal TRIGGER SOURCE DC LEVEL switch is at 3S76-3S3 and the MODE switch is at INT DC, the base of Q226 is grounded. Current flows in Q216 or Q226 depending upon the voltage level at the base of Q216. If Q216 base is also at ground, both transistors conduct equally (assuming equal DC $\beta$). If Q216 base is taken negative, Q226 will carry the total current available. Maximum current value is set by R222, the common emitter return resistor to the —12.2 volt supply. R222 sets the comparator maximum current to approximately 5.5 mA when both transistor bases are grounded.

The collector circuits of Q216 and Q226 are controlled by the SLOPE switch and the MODE switch. During AC, DC and EXT operation Q216 collector load resistor (R220) is shorted out of the circuit. As shown on the schematic diagram, Q216 collector is grounded and Q226 collector is connected to the cathode of tunnel diode D231. Q226 therefore controls the current through D231. When the signal at Q216 base is sufficiently negative, Q226 conducts causing D231 to switch to its high voltage state.

A DC mode cycle of operation depends upon the DC level of the incoming vertical signal. The input voltage from a Type 3S3 or a Type 3S76 vertical sampling unit rests at +10 volts when the vertical unit is properly balanced for a CRT centered display. This +10 volts is bucked back near ground by adjustment of the TRIGGER LEVEL control so the base of Q216 receives a ground referenced signal. As the AC signal component takes the base of Q216 positive (from ground), Q216 emitter also rises positive and takes the emitter of Q226 positive. Q226 stops conducting, which causes the voltage drop across D231 to become zero. (Q216 emitter can go sufficiently positive for this action even though the collector is grounded.) Q233 is not conducting when D231 voltage drop is zero.

As Q216 base goes negative, the grounded base of Q226 stops Q226 emitter from following Q216 base. Q226, therefore, conducts all the current and Q216 cuts off. At some point during the negative signal excursion, Q226 conducted enough current for D231 to switch to its high state. The voltage drop across D231 then places its cathode at approximately —0.52 volt. Approximately 0.25 volt is added to the —0.52 volt step across D231 by current in D232/R234 producing a saturation bias of approximately —0.77 volt at Q233 base. Q233 saturates which effectively grounds its collector, sending a Single Display Start pulse to the sampling unit through R236/SW238 and D238. R232 prevents D232/R234 current from keeping D231 in its high state. C232 and C233 assure that high frequency information reaches Q233 base in a physically short path at the time D231 switches states.

Thus operation of the comparator in the —INT DC mode causes Q226 collector to go negative when the input signal goes negative. Q226 negative output switches D231, which causes Q233 collector to rise from —12.2 volts to ground.

Switching the slope switch to + connects Q216 collector to the cathode of D231 and grounds Q226 collector. Now positive going signals will switch D231 and cause Q233 to saturate.

The two capacitors from the comparator transistor bases to ground (C214 and C228) bypass high frequency clock feed-through and assure that the circuit operates from incoming trigger signals only.

**AC Operation.** AC operation differs from DC operation in that the MODE switch places the base of Q226 at —4.8 volts. The —4.8 volts is supplied by a bypassed voltage divider consisting of R227, R228 and C227. The TRIGGER LEVEL control midrange voltage value is —6.1 volt allowing AC coupled signals greater than 8 volts peak to peak to

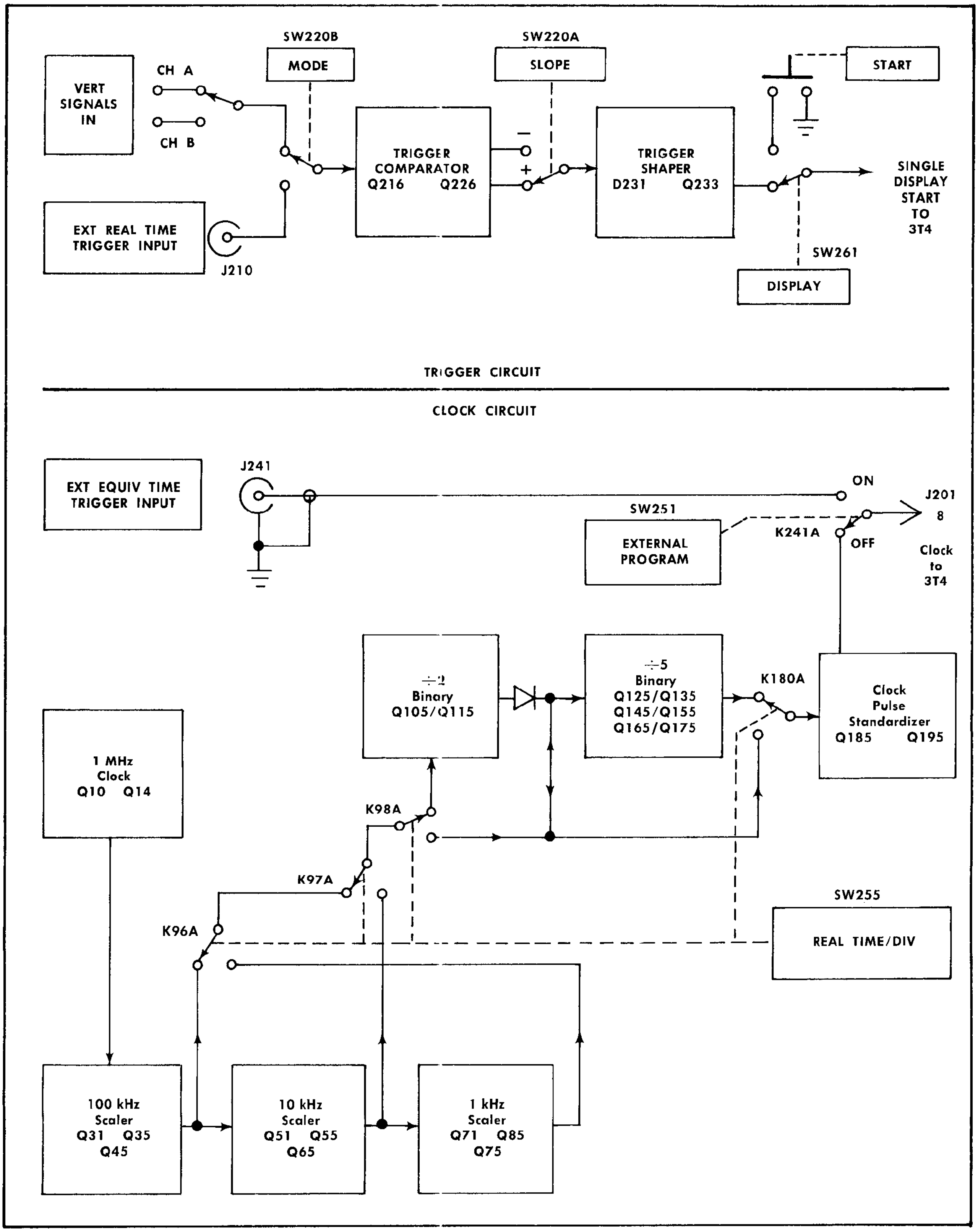



Fig. 3-1. Type 283/R283 complete block diagram.

properly drive the comparator. Circuit operation is the same as described for DC operation except that the D231 switching occurs when the signal at the base of Q216 passes through approximately —5 volts.

When the Type 283/R283 is used with a vertical unit which has a ground referenced vertical output signal, the TRIGGER SOURCE DC LEVEL switch should be set to ZERO VOLTS. In this mode, circuit voltages are identical to AC operation although the input is DC coupled.

**External Operation.** External operation is AC coupled only, through C218. Diodes D213 and D214 protect the two comparator transistor base-emitter junctions in the event the EXT REAL TIME TRIGGER INPUT jack receives a signal of 20 volts. 20 volts from a low impedance supply would damage at least one of the transistors during C218 charge time if the diodes were not in the circuit. R219 and C219 terminate the EXT REAL TIME TRIGGER INPUT jack with 51 ohms for fast rise pulses.

**FREE RUN Operation.** FREE RUN operation is included for the purpose of placing a trace on the CRT in the absence of a triggering signal. The comparator is converted to an astable multivibrator when the MODE switch inserts R220 (Q216 collector), C226 (from Q216 collector to Q226 base) and R229 (Q226 base). Incoming triggering signals are disconnected from Q216 base circuit. Q216 base is then connected directly to the —4.8 volts bypassed biasing network normally attached to Q226 base.

The astable oscillation rate (time of one square-wave period) is controlled by the RC time constant of R220, C226 and the base impedance of Q226 paralleled with 10 kΩ R229. As the MODE switch is set to FREE RUN, C226 (assumed to be discharged) applies a turn-on signal to Q226 base. The rise of Q226 emitter turns off Q216 current, causing R220 to add to the turn on signal through C226. About 2.5 ms later, C226 has charged enough to allow Q226 base to fall negative to a point where its emitter biases Q216 into conduction. Conduction of Q216 applies a negative signal to C226 that speeds the turn-off of Q226 in a regenerative manner. About 2.5 ms later, R229 has changed C226 charge sufficiently to bring Q226 back into conduction and one cycle is complete.

Q216 or Q226 drives tunnel diode D231 in an identical manner as previously described. Thus square wave signals with about a 5 ms period are applied to the Type 3T4 Single Display Start lead and produce a free run trace on the CRT.

## Control Switching and Interconnections

The switching circuits contain several silicon disconnect diodes. These diodes permit more than one control circuit to be connected in parallel without interaction. For instance, if a Type 262 Programmer is connected, and if the programmer grounds pin 13 of J260, D253 prevents all other circuits at the anode side of D253 from also being grounded. Conversely, D251 (diagrammed at the EXTERNAL PROGRAM switch) grounds the lead of K241 when the EXTERNAL PROGRAM switch is set to OFF. Yet with the EXTERNAL PROGRAM switch at ON, D251 will prevent J260 pin 17 from being grounded if a programmer grounds only J260 pin 15.

All external programmer circuits that are used to operate the Type 283/R283 circuits must contain similar switching diodes. Such diodes are intended to prevent the REAL TIME/DIV switch from actuating external circuits when a programmer remains connected to J260 during front-panel real time sampling.

External switching circuits have a maximum of —12.2 volts in the open circuit condition. Maximum closed circuit current is approximately 45 mA.

## Power Supply

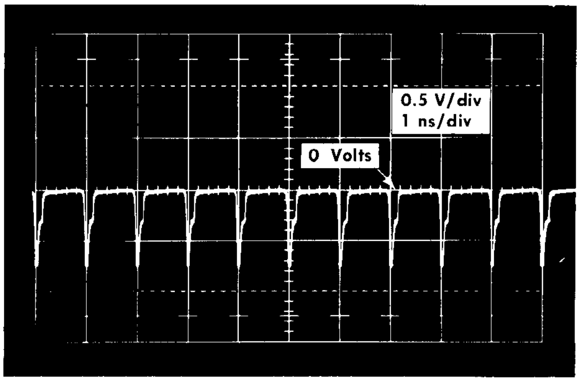
All circuits within the Type 283/R283 are supplied from the oscilloscope —12.2-Volt power supply. The Type 3T4 Time/Div switch applies power through the cable attached to its front panel Remote Program connector when the switch is at Remote Program. Power within the Type 283/R283 is applied directly to three circuits of the Trigger circuit and switched on or off for all other circuits by the EXTERNAL PROGRAM switch and Q244. The power to all other circuits may also be turned on or off by external programmer control through J260 pin 15 or pin 17. Pin 15 is to be grounded (to turn on Type 283 circuits) whenever the programmer (Type 262) controls the real time sweep rate. Pin 17 is to be grounded whenever the Type 283 REAL TIME/DIV switch is used to control the real time sweep rate.

Q244 and the two LC filters serve to isolate the clock circuit pulses from the trigger circuit. Q244 operates either at cut off or in saturation. Base current through R242, D251 and SW251 assure that the collector voltage is no more than a few millivolts less negative than the emitter voltage at —12.2 volts. The DC resistance of K241 and R241 assures Q244 base voltage will cut off any current whenever the EXTERNAL PROGRAM switch is at ON and pins 15 and 17 of J260 are not grounded.

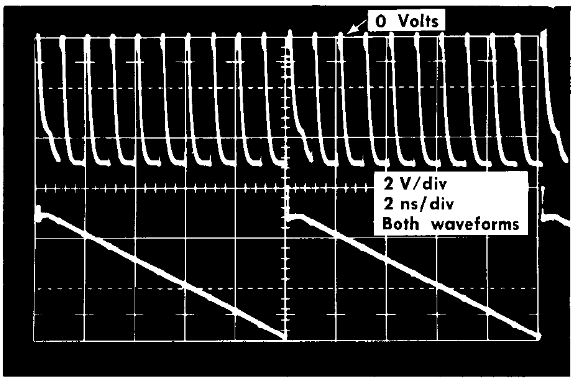
## Clock Circuit

The clock circuit consists of a 1 MHz crystal-controlled clock, three ÷10 scalers, a ÷2 binary set, a ÷5 binary set series and an output multivibrator that provides constant amplitude clock pulses regardless of clock rate. The ÷10 scalers contain a constant current ramp delay circuit that combines with drive pulses to a reset multivibrator which puts out a pulse at the same time it resets the ramp voltage. Relay coil reed switches select the various scaler and binary output signals and couple them to the output multivibrator (Clock Standardizer). The Clock Standardizer sends proper amplitude and duration pulses to the sampling sweep unit external trigger input connector through K241A, which appears on the Trigger circuits schematic diagram.

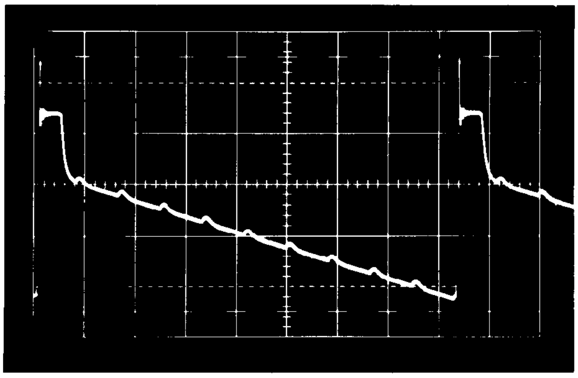
**Oscillator.** The 1 MHz Clock is a modified Colpitts crystal controlled oscillator with the crystal operating in a parallel mode between Q10 base and ground. Q10 static current value is limited by R13. Its value is determined by the voltage at Q10 base, set by the divider R10/R11. C13 provides positive feedback to sustain oscillations that begin when power is applied. Q10 current pulses produce negative-going voltage pulses of approximately —0.8 volt across Q14 base-emitter junction. R14 assures that Q14 is cut off when Q10 is not conducting. Q10 is the oscillator; Q14 is an amplifier/inverter that provides positive pulses to the 100 kHz Scaler. Both Q10 and Q14 operate in a non-linear mode so that pulses from Q14 collector are definitely not sinusoidal (see Fig. 3-2).




A. Q10 collector signal.




B. Upper, TP14; lower, Q35 emitter.



C. Algebraically added Q35 base and emitter signals. Vertical and horizontal deflection factors not calibrated.

Fig. 3-2. Clock and 100 kHz Scaler signals.

Test Point TP14 is a convenient test oscilloscope signal source for checking the Clock output pulses. Since Q14 is driven alternately from cut-off to saturation, the signal at TP14 swings from about —5.2 volts to essentially ground. Fig. 3-2 shows the signals at both the oscillator collector and at the non-linear amplifier collector, TP14. The Clock pulses combine (at Q35 base) with a negative going ramp (at Q35 emitter) in the 100 kHz Scaler described below.

**100 kHz Scaler.** Q35 and Q45 form a reset multivibrator that is adjusted to produce one positive output pulse for each ten input clock pulses. It is Q35 base-emitter signals that determine when the multivibrator will put out a pulse. The two input signals to Q35 come from Q14 collector through R18 and from the ramp generator C33/Q31.

Assume the two signals at Q35 base-emitter junction have just caused a regenerative action. The following conditions exist: 1) both transistors are cut off. 2) Q35 base voltage is swinging from —4.87 to —4.45 volts (the 5.2-volt pulses at TP14 shown in Fig. 3-2B are attenuated by R18/R43/R44). 3) Q31 is charging C33 at a constant rate, causing Q35 emitter voltage to fall in a negative direction. Q35 emitter signal is shown in Fig. 3-2B. The two Q35 signals were combined algebraically to form one composite waveform shown in Fig. 3-2C. The composite waveform shows that the reset multivibrator is keyed into conduction by the clock signal.

Should the oscillator stop, and if Q14 is not conducting, the scaler circuits will not recycle. If the oscillator stops, and after Q31 has charged C33 sufficiently negative to cause Q35 to conduct, the current passed by Q31 is so small that the voltage drop across R34 will not cause Q45 to conduct. Q45 is caused to conduct only when the clock signal at Q35 base increases Q35 current to the point where R34 voltage drop exceeds about —0.5 volt. Q35 emitter is bypassed for clock pulses by C33 so the stage gain is sufficient for a clock pulse to turn Q45 on.

As Q45 conducts, its collector voltage applies additional turn-on signal to Q35 base so that both transistors quickly saturate. The charge obtained by C33 during the ramp rundown is shorted by Q35 emitter-collector path in series with Q45 base-emitter path. Q45 base current is essentially the current available from C33 (R34 does not conduct much of the current because of the low voltage across it from Q45 base-emitter diode voltage). Once C33 is discharged, the small current allowed by Q31 cannot maintain Q45 in conduction. Q45 collector voltage then goes negative, turning Q35 completely off. Q31 current then again charges C33 negatively for another cycle.

A reset multivibrator cycle of operation relies upon the C33/Q31 ramp signal to prevent Q35/Q45 conduction until after 9 clock pulses have occurred. The ramp current will not fire the reset multivibrator alone. The ramp must reach a voltage level that causes Q35 to conduct slightly before the 10th clock pulse will cause both Q35 and Q45 to conduct.

**Ramp Generator.** The constant current mentioned above for C33/Q31 is controlled in the following manner. Q23 is an emitter follower with a low impedance output that is the voltage reference for Q31 (and Q51 and Q71) base. Should Q31 base current change, Q23 emitter will supply the current with essentially no change in voltage.

Q23 emitter sets Q31 base voltage at —6.2 volts, approximately 6 volts more positive than the —12.2-volt supply. Q31 emitter return resistance to the —12.2-volt supply then sets the current through Q31 by Ohm's law. (R32 + R30/R31 and 6 volts minus Q31 base-emitter junction voltage drop.) Q31 collector operates as a typical "pentode-like" high impedance, allowing its collector voltage (across C33) to change without changing the current value. Thus, a constant current is established by Q23/Q31 for the purpose of charging C33 linearly. The ramp-slope of C33 charge can be changed by changing Q31 emitter return resistance at R30, the 100 kHz CAL control.

**10 kHz and 1 kHz Scalers.** The remaining two scaler circuits function in an identical manner to that of the 100 kHz Scaler just described. The major difference is the ramp capacitor size and the ramp current value that establishes different ramp slopes for longer periods of multivibrator lock-out delay.

The 100 kHz Scaler drives the 10 kHz Scaler through D45. The resistive voltage dividers between the —12.2-volt supply and ground on both sides of silicon diode D45 are identical. Therefore, the quiescent voltage values on both sides of D45 are identical. The diode then completely disconnects Q35 base circuit from Q55 base circuit, unless D45 anode reaches a point about 0.5 volt more positive than its cathode. The clock pulses at Q35 base circuit are approximately +0.42 volts peak; less than enough to turn D45 on. Thus D45 effectively isolates the clock pulses from the 10 kHz Scaler, but connects Q45 collector positive signal to Q55 base through R48 at the time of each 100 kHz Scaler output pulse. (D65 isolates Q75 base from 100 kHz Scaler output pulses.)

All three scaler circuit output pulses are selected by reed relays to operate the remainder of the clock circuits.

D45 and D65 serve a second function. They disconnect any shunt capacitive loads on the binary and clock standardizer circuits from Q45 and Q65 collector circuits. Some positions of the REAL TIME/DIV switch connect enough shunt capacitance to D45 and D65 cathodes so that the scaler output pulse lasts longer at the diode cathode than at the anode. The slow rate of fall, if applied to Q45 (or Q65) collector, would alter the ÷10 action of the scaler to ÷11 at some sweep rates. The 1 kHz Scaler does not need the disconnect diode, because the slow ramp rate of at C73 is not affected by the various shunt capacitive loads at Q85 collector.

The 1 kHz Scaler has a capacitor (C75) between base and emitter of Q75. C75 serves to cancel some noise modulation at Q75 base that would otherwise add noticeable jitter to the 1 kHz Scaler output pulses.

**Binary Set Circuits.** These circuits are bistable multivibrators. Each binary remains with one of a pair of transistors conducting until a positive pulse arrives. Stable conduction of only one transistor at a time is assured by voltage divider resistors from each transistor collector to the other transistor base and then to ground.

Using the ÷2 binary as an example, if Q105 is conducting, its base receives a steady turn-on signal from current in R114 and R115. Q105 collector is saturated to a voltage of about —0.3 volt. R105/R106 assures that Q115 base does not have a turn-on signal.

The binary state is switched by a positive pulse that arrives through steering diode D114. The diode couples the positive pulse through C115 to Q105 base which starts to turn Q105 off. As Q105 collector goes negative, R105 and C105 couple a turn-on signal to Q115 base. The positive change in Q115 collector voltage adds to the positive trigger signal and the set changes states in a fast regenerative action.

Each binary set changes states with a single input lead positive pulse. Its output is from only one of the transistors. Positive-going output pulses from Q115 are AC coupled to the single input lead of the first set in the ÷5 binary series. Thus, the ÷5 binary series receives one positive input pulse for each two positive input pulses to the ÷2 set.

**÷5 Binary Set Series.** The ÷5 binary set series is three ÷2 sets in series, with feedback applied from Q165 to Q135 and Q155. Feedback assures that the three sets do not count to 8, but that rather they all reset to zero after 5 input pulses. Input to the ÷5 binary series is to Q125/Q135. The ÷5 series output pulse is taken from Q175.

There is one isolation diode between the ÷2 and the ÷5 series input. D120 conducts only when Q115 collector signal goes positive. It does not conduct when K98 couples positive scaler pulses into the ÷5 series, thus preventing false triggering of the ÷2 set. Two other isolation diodes, D135 and D155 assure that positive signals pass only one way in the feedback path from Q165 to Q135 and Q155.

**Clock Pulse Standardizer.** The Clock Pulse Standardizer multivibrator transistors Q185 and Q195 do not conduct in their quiescent state. Positive pulses that arrive through C181/R181 cause the circuit to put out fast positive pulses. The incoming pulses arrive at the base of Q185. As Q185 conducts, Q195 also conducts. C193 assures fast turn on of both transistors in normal regenerative action. Output pulse duration at Q195 collector is approximately 2 to 4 μs and is controlled primarily by the L/R time constant of LR184. The output pulse to the sampling sweep unit has a pulse duration of approximately 0.4 μs due to the differentiation by C195 and R196. C186/R186 decouple the

**TABLE 3-1**

Relay Closures & Clock Pulse Periods for each Real Time Sweep Rate

| Real Time/ Div | Relay Coils Energized | Clock Pulse Period |
|---|---|---|
| 1 ms/div | K96, K98, K180 | 10 μs |
| 2 | K96, K180 | 20 |
| 5 | K96, K98 | 50 |
| 10 | K96 | 100 |
| 20 | K97, K180 | 200 |
| 50 | K97, K98 | 500 |
| 0.1 s/div | K97 | 1 ms |
| 0.2 | K180 | 2 |
| 0.5 | K98 | 5 |
| 1.0 | None | 10 |

—12.2-volt supply lead to Q185 and keep the high current of each output pulse confined to the immediate area of the standardizer circuit.

**Relay Switching.** Positive pulses out of the 100 kHz Scaler, 10 kHz Scaler and 1 kHz Scaler are relay switched to the clock circuits. When the front-panel REAL TIME/DIV switch is set for a real time sweep rate of 1 ms, the 100 kHz Scaler output is fed directly to the Clock Pulse Standardizer. Thus the clock pulses sent to the sampling sweep unit have a 10 $\mu$s period. Table 3-1 lists the relay closures and clock pulse period for each position of the REAL TIME/DIV switch.

Remote operation of the Type 283/R283 clock circuits is done by grounding certain pins of J260. Table 3-2 lists the correct pins of J260 that must be grounded to pin 16 for each Real Time/Div sweep rate.

**TABLE 3-2**

Real Time/Div Operation by Remote Type 262

| Real Time/ Div | J260 Remote Ground Closures to Pin 16 |
|---|---|
| 1 ms/div | 24, 14, 13, 15, 25, 5 |
| 2 | 24, 13, 15, 25, 7 |
| 5 | 24, 14, 15, 25, 6 |
| 10 | 24, 15, 25, 5 |
| 20 | 22, 13, 15, 25, 7 |
| 50 | 22, 14, 15, 25, 6 |
| 0.1 s/div | 22, 15, 25, 6 |
| 0.2 | 13, 15, 25, 6 |
| 0.5 | 14, 15, 25, 6 |
| 1.0 | 15, 25, 5 |

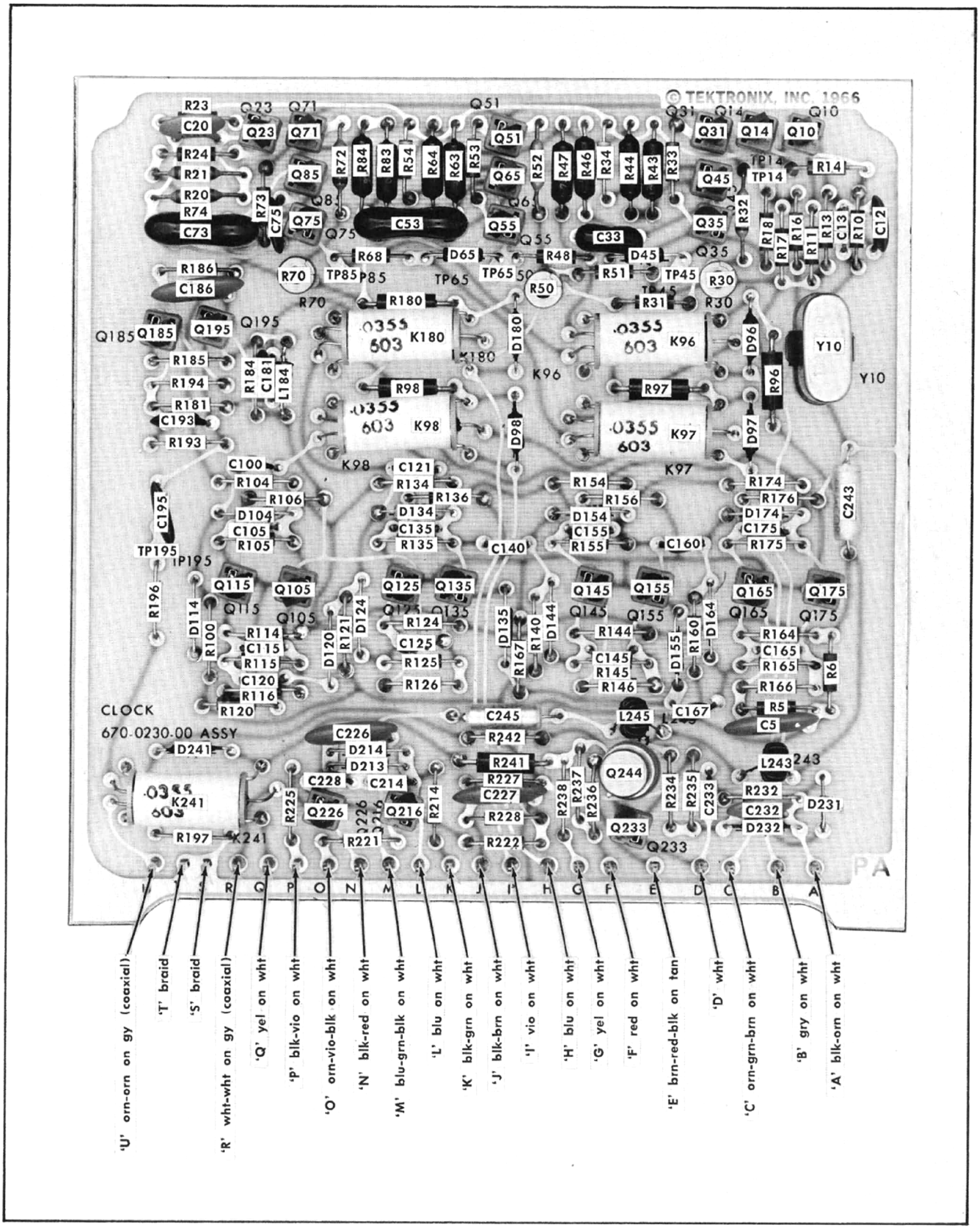



Fig. 4-1. Location of parts on the Type 283/R283 circuit board.



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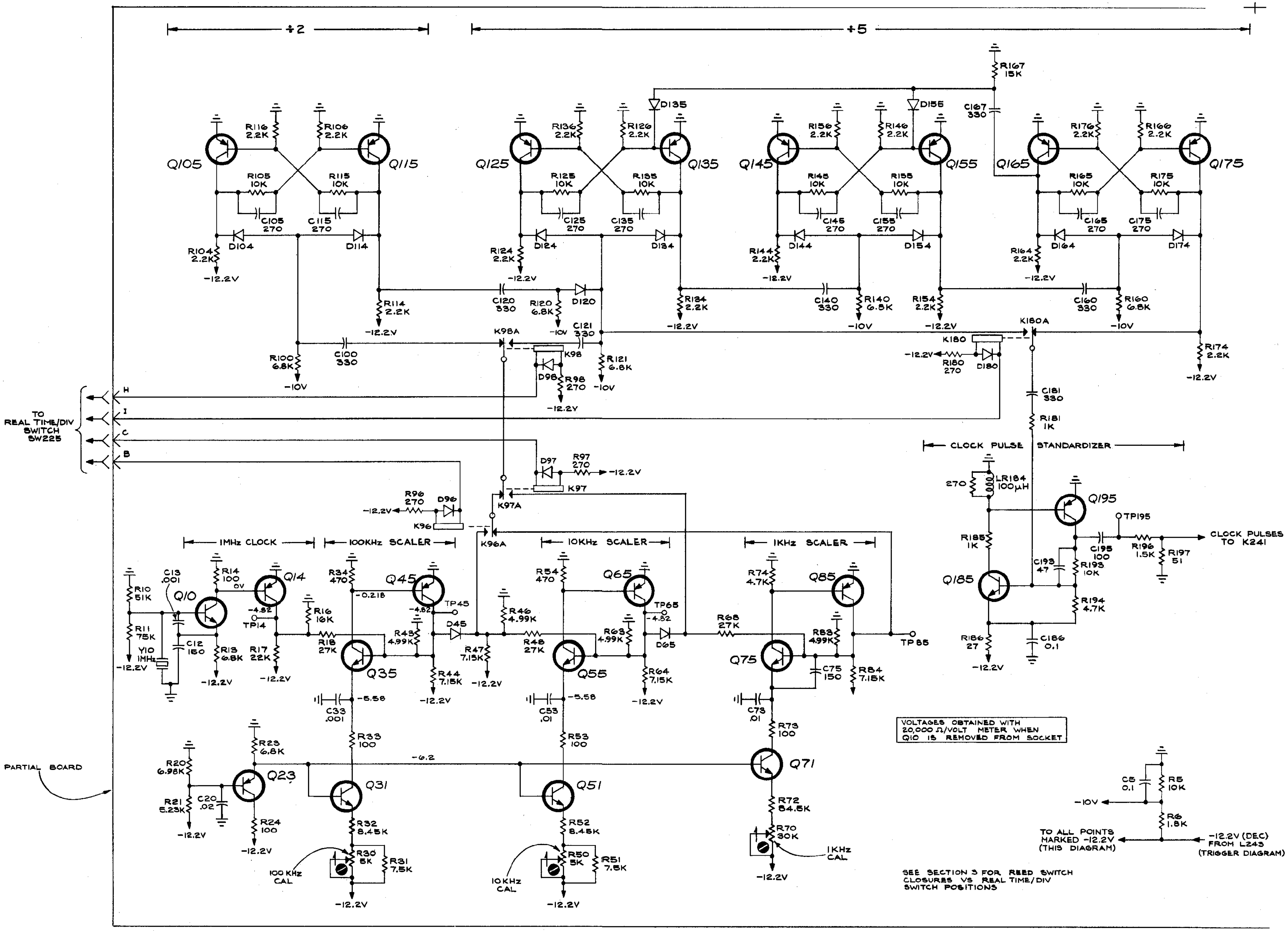


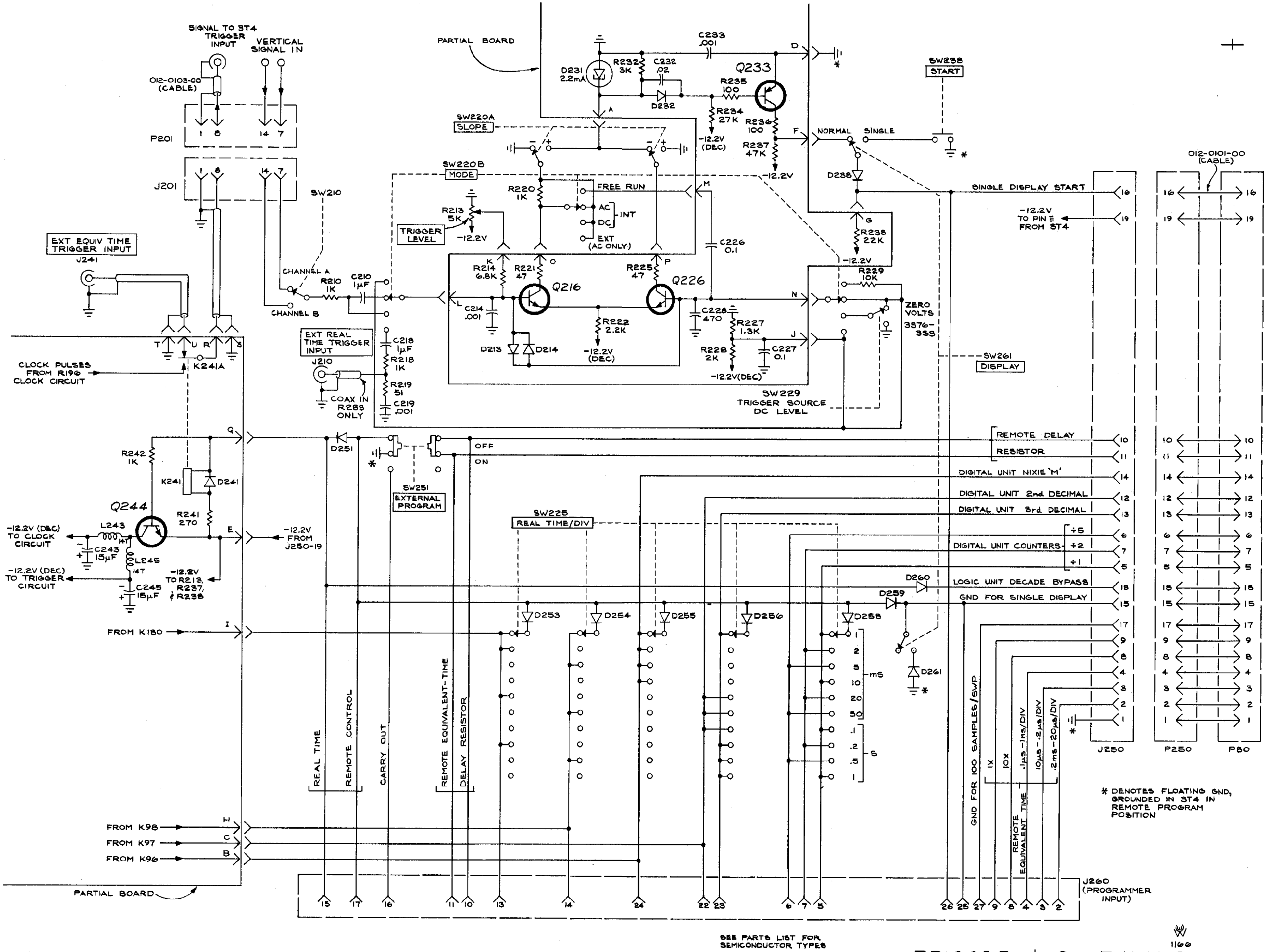

SEE PARTS LIST FOR SEMICONDUCTOR TYPES

TYPE 283/R283 REAL TIME ADAPTER

A

CLOCK CIRCUIT

1166




TYPE 283/R283 REAL TIME ADAPTER

TRIGGER & SWITCHING

## Inductors

| | | |
|---|---|---|
| L184 | 108-0226-00 | 100 $\mu$H |
| L243 | *120-0382-00 | Toroid, 14 turns, single |
| L245 | *120-0382-00 | Toroid, 14 turns, single |

## Transistors

| | | | |
|---|---|---|---|
| Q10 | 151-0190-00 | Silicon | 2N3904 |
| Q14 | 151-0188-00 | Silicon | 2N3906 |
| Q23 | 151-0188-00 | Silicon | 2N3906 |
| Q31 | 151-0190-00 | Silicon | 2N3904 |
| Q35 | 151-0190-00 | Silicon | 2N3904 |
| Q45 | 151-0188-00 | Silicon | 2N3906 |
| Q51 | 151-0190-00 | Silicon | 2N3904 |
| Q55 | 151-0190-00 | Silicon | 2N3904 |
| Q65 | 151-0188-00 | Silicon | 2N3906 |
| Q71 | 151-0190-00 | Silicon | 2N3904 |
| Q75 | 151-0190-00 | Silicon | 2N3904 |
| Q85 | 151-0188-00 | Silicon | 2N3906 |
| Q105 | 151-0188-00 | Silicon | 2N3906 |
| Q115 | 151-0188-00 | Silicon | 2N3906 |
| Q125 | 151-0188-00 | Silicon | 2N3906 |
| Q135 | 151-0188-00 | Silicon | 2N3906 |
| Q145 | 151-0188-00 | Silicon | 2N3906 |
| Q155 | 151-0188-00 | Silicon | 2N3906 |
| Q165 | 151-0188-00 | Silicon | 2N3906 |
| Q175 | 151-0188-00 | Silicon | 2N3906 |
| Q185 | 151-0190-00 | Silicon | 2N3904 |
| Q195 | 151-0188-00 | Silicon | 2N3906 |
| Q216 | 151-0190-00 | Silicon | 2N3904 |
| Q226 | 151-0190-00 | Silicon | 2N3904 |
| Q233 | 151-0188-00 | Silicon | 2N3906 |
| Q244 | *151-0136-00 | Silicon | Replaceable by 2N3053 |