

Tektronix 370 Curve Tracer Specs

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370

Programmable Curve Tracer Operator Manual

070-6064-00

**Please check for change information
at the rear of this manual.**

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SECTION 1

GENERAL INFORMATION

DESCRIPTION

The 370 is a high-performance, GPIB-programmable digital-storage curve tracer that provides static and dynamic semiconductor device measurements. This versatile instrument stimulates, measures, and displays the semiconductor characteristics of a variety of two-, three-, and four-terminal devices; including bipolar transistors, field effect transistors, silicon-controlled rectifiers, diodes, thyristors, optoisolators, wafers, integrated circuits, etc. A variety of measurements can be performed using either grounded-emitter or grounded-base configurations.

The collector supply produces ac, rectified ac, or dc voltages ranging from 0 to ± 2000 volts. This high voltage, combined with a current sensitivity of 100 pA/div, permits extended breakdown measurements on a device under test. A step generator produces voltage or current steps of either polarity for application to the base or emitter terminal. The step generator may also be operated in a pulsed mode to reduce DUT power dissipation.

In addition to conventional curve tracer performance, the 370 includes the following features:

1. Digital storage capability that allows bright and stable display and useful cursor measurements. The 370 can store up to 16 families of characteristic curves in a bubble memory cassette, display them on the crt, and send them for data processing via the GPIB. The bubble memory also provides non-volatile storage for up to 16 complete front-panel setups.
2. Two extended acquisition modes, called Averaging and Envelope. Averaging reduces display noise in high sensitivity ranges. Envelope mode displays the maximum and minimum vertical or horizontal excursion of each curve, which is useful for detecting long-term variations such as thermal drift.
3. GPIB command-controllable front-panel functions. Nearly all are remotely controllable. (Exceptions are those controls intended only for manual operation, such as INTENSITY, FOCUS, COLLECTOR SUPPLY HIGH-LOW control, etc. Also, curve data can be sent to or received from an external controller through the GPIB.
4. The CENTRONICS-compatible plotter interface permits sending displayed curve data and digital on-screen readouts to a digital plotter without an external controller.
5. Other features include an auxiliary voltage supply, cursor measurement readout, and diagnostic routines.

INSTALLATION

Initial Inspection

This instrument was thoroughly inspected for mechanical and electrical defects before shipment. It should be free of marks or scratches and meet or exceed all electrical specifications. To confirm this, inspect the instrument for physical damage incurred in transit and test the electrical performance by following the First Time Operation instructions in Section 3, Operating Instructions. For a complete verification of instrument performance, refer a qualified service technician to the performance check section of the service manual. If a discrepancy is found, contact your local Tektronix Field Office or representative.

Power Source Information

This instrument operates from a power source having a neutral at or near ground (earth) potential. It is not intended for operation from two phases of a multi-phase system, nor across legs of a single-phase, three wire system. This instrument can be operated from either a 115-volt or 230-volt nominal supply source, 48 to 66 Hz. Table 1-1 is a listing of the line voltage ranges, line frequency range, and power consumption.

TABLE 1-1
Line Voltage Ranges

Setting of the RANGE switch	Setting of the NOMINAL switch	
	115VAC	230VAC
HIGH	107VAC to 132VAC	214VAC to 250VAC
LOW	90VAC to 110 VAC	180 VAC to 220 VAC
Line frequency range	48 to 66 Hz	
Power consumption		
Max.	400W, 3.5 A at 132V 60Hz	
Typical	120W, 1.3 A at 115 V 50 Hz	

Operating Voltage Selection and Line Fuse Verification

⚠ The LINE VOLTAGE SELECTOR switches (NOMINAL and RANGE, located on the rear panel) allow selection of the operating line voltage. To select the correct operating line voltage, 1) Disconnect the 370 from the ac power source before changing the operating voltage, 2) Select the nominal ac power-source voltage with the NOMINAL switch, and 3) Select the operating line voltage with the RANGE switch.



To prevent damage to the instrument, always check the settings of the LINE VOLTAGE SELECTOR switches located on the rear panel of the 370 before connecting the instrument to the line-voltage source.

To verify that the power-input fuse is for the nominal ac source voltage selected, perform the following:

1. Use a small straight-slot screwdriver to pry the cap (with the attached fuse inside) out of fuse holder.
2. Verify proper fuse value:

Nominal voltage 230 V	2A slow blow
Nominal voltage 115 V	4A slow blow
3. Install the proper fuse and reinstall the fuse holder cap.

Power Cord Information

A power cord with the appropriate plug configuration is supplied with each instrument. The color-coding of the power cord conductors appears in Table 1-2. Also, should you require a power-cord plug other than that supplied, refer to Table 1-3, Power-Cord and Plug Identification.

TABLE 1-2
Power-Cord Color Conductor Identification







Conductor	Color	Alternate
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Light Blue	White
Grounded (Protective Ground)	Green/Yellow	Green/Yellow

WARNING

This instrument operates from a single-phase power source, and has a detachable three-wire power cord with a two-pole, three-terminal grounding-type plug. The voltage to ground (earth) from either pole of the power source must not exceed the maximum rated operating voltage (250 volts rms).

Before making connection to the power source, make sure that the instrument is set for the power source voltage, and is equipped with a suitable plug (two-pole, three-terminal, grounding type).

**TABLE 1-3
Power-Cord and Plug Identification Information**

Plug Configuration	Usage	Nominal Line-Voltage (AC)	Reference Standards	Option #
	North American 120V/15A	120 V	¹ ANSI C73.11 ² NEMA 5-15-P ³ IEC 83	STANDARD
	Universal Euro 220V/16A	240 V	⁴ CEE (7), II, IV, VII ³ IEC 83	A1
	UK 240V/13A	240 V	⁵ BS 1363 ³ IEC 83	A2
	Australian 240V/10A	240 V	⁶ AS C112	A3
	North American 240V/15A	240 V	¹ ANSI C73.20 ² NEMA 6-15-P ³ IEC 83	A4
	Switzerland 220V/10A	220 V	⁷ SEV	A5

¹ANSI—American National Standards Institute
²NEMA—National Electrical Manufacturer's Association
³IEC—International Electrotechnical Commission
⁴CEE—International Commission on Rules for the Approval of Electrical Equipment

⁵BS—British Standards Institution
⁶AS—Standards Association of Australia
⁷SEV—Schweizerischer Elektrotechnischer Verein

This instrument is safety class 1 equipment (IEC³ designation). All accessible conductive parts are directly connected through the grounding conductor of the power cord to the grounding contact of the power plug. Therefore, the power plug must only be inserted in a mating receptacle with a grounding contact. Do not defeat the grounding connection. Any interruption of the grounding connection can create an electric shock hazard.

For electric shock protection, connect the instrument to ground before connecting to the instrument input or output terminals.

Operating Temperature

The 370 can be operated where the ambient air temperature is between +10° C and +40° C and can be stored in ambient temperatures from -40° C to +65° C. After storage at temperatures outside the operating limits, allow the chassis temperature to reach the safe operating limits before applying power.

The 370 is cooled by air drawn in through the air filter on the rear panel and blown out through holes in the side panels. For proper instrument cooling, provide adequate clearance on the rear and sides of the instrument to ensure free air flow and dissipation of heat away from the instrument.

¹International Electrotechnical Commission.

WARNING

Following use of the 370 at high power settings, the device, fixture, or protective cover may be hot enough to cause injury. Avoid touching any of these items until cooled.

Test Adapter and Protective Cover

To use the 370 to display and measure the characteristic curves of most devices, a test adapter and the protective cover must be installed. Four test adapters are provided as standard accessories. Six other test adapters are available as optional accessories. The test adapter is inserted into the adapter connectors provided on the front panel. These connectors allow two devices to be set up at a time.

WARNING

Up to 2000 V may appear at the front-panel collector terminals. To avoid injury or equipment damage, do not remove the protective cover.

CAUTION

Double-wide test adapters are designed to fit in the left set of adapter connectors. If you try to forcibly install a double-wide test adapter in the right side, you might damage the connector. The connectors are identified by the following numbers:

A1006
A1007
A1008
A1009
A1010

Rackmounting Information

Latching. The 370 incorporates a spring-latch design built into the rackmounting ear. To release, pull the rackmount latch release (see Fig. 1-1). To relatch, push the rackmount latch release until the spring latches engage.

For those applications that require additional rackmounting security, the rackmounting ears of the 370 are drilled for screw fasteners (see Fig. 1-1).

The 370 is 12.25 inches high, a multiple of 1.75 inches (the standard rack spacing). If the 370 is installed in a rack with standard hole spacing, and positioned some multiple of 1.75 inches from the bottom or top, all holes should line up and no drilling should be required.

The slide-out tracks mount easily to the rack front and rear vertical mounting rails if the inside distance between the rails is within 19.8 to 26.5 inches. If the tracks are to be installed in a rack having other dimensions, provide extra support (for example, extensions to the rear mounting brackets) for the rear ends of the slide-out tracks.

The front rack rails must be at least 17 inches apart. The front lip of the stationary-track section mounts in front of the rail. (Use bar nuts behind untapped front rails.) The front lip of the stationary track section must mount in front of the front rail to allow the 370 spring latch to function properly.

The slide-out tracks consist of two assemblies, one for each side of the instrument. Each assembly consists of three sections (see Fig. 1-4). The stationary section of each track attaches to rack rails as shown in Figure 1-5. The chassis section mounts on the instrument and is installed at the factory. The intermediate section fits between the other two sections, allowing the instrument to be fully extended out of the rack.

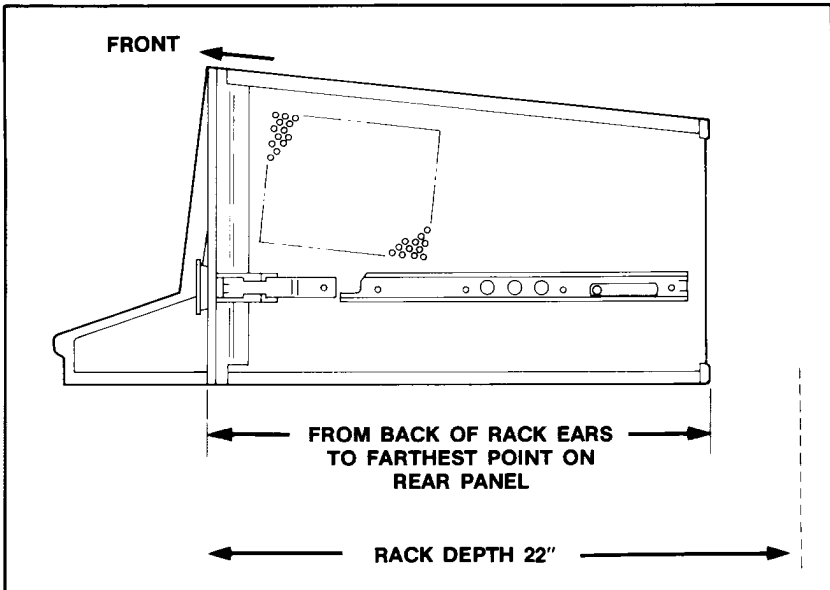


Figure 1-3. Rackmounting Length and Clearance.

The stationary and intermediate sections for both sides are shipped as a matched set and should not be separated. The package includes matched sets for both sides and mounting hardware. To identify the assemblies, note that the automatic latch and intermediate section latch stop holes are located near the top when the matched sets are properly mated to the chassis sections.

1. Select the appropriate holes in the rack rail, using Figure 1-2 as a guide.
2. Mount the stationary-track sections to the front rack rails with truss head screws (and bar nuts, if necessary).
3. Mount the stationary-track sections to the rear rails, using one of the methods depicted in Figure 1-5. Note that the rear mounting bracket can be installed to fit either deep or shallow cabinet racks.
4. After mounting the instrument in the slide-out tracks, adjust for proper width by loosening the front and rear screws and allowing the slides to seek the proper width. Center the instrument, then tighten the screws.
5. Push the instrument into the rack, and check that the automatic spring latch engages the spring latch catch to hold the instrument in place.
6. Extend the instrument out of the rack by pulling the rackmount latch releases on the front panel (see Fig. 1-1) out to disengage the spring latches. Then, pull the instrument out.
7. Once the instrument is out of the rack, press the latch release and push the instrument back into the rack.

Rackmount to Cabinet Conversion. To convert the 370 rackmount version to a cabinet model, use the following procedure (see Fig. 1-6):

1. Remove the bracket from each corner of the instrument rear panel.
2. Replace the left and right side panels with cabinet model side panels.
3. Mount a carrying handle assembly on the left and right sides of the top.
4. Fasten a foot at each corner on the bottom of the instrument.

Cabinet to Rackmount Conversion. To convert the 370 cabinet model to a rackmount version, use the following procedure (see Fig. 1-6):

1. Remove the bracket from each corner on the rear panel.
2. Replace the side panels with rackmount version side panels.
3. Attach brackets at each corner on the rear panel.

REPACKING FOR SHIPMENT

If this instrument is to be shipped long distances, we recommend that the instrument be repackaged the same as when it arrived. The cartons and packaging material in which your instrument was shipped should be saved and used for this purpose.

If your instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the instrument showing the following:

- Owner of the instrument (with address),
- Name of a person at your firm to contact,
- Instrument type
- Instrument serial number
- Description of the service required.

If the original packaging is unfit for use or not available, package the instrument as follows:




1. Obtain a corrugated cardboard shipping carton with a 375-pound test strength that has inside dimensions at least six inches greater than the instrument dimensions.
2. Surround the instrument with polyethylene sheeting to protect the finish.
3. Cushion the instrument on all sides by tightly packing dunnage or urethane foam between the carton and the instrument, allowing three inches on all sides.
4. Seal the carton with shipping tape or with an industrial stapler.
5. Write the address of the Tektronix Service Center and your return address on the carton in one or more prominent locations.

SPECIFICATION

Performance Conditions

The following electrical and environmental characteristics are valid for instruments operated at ambient temperatures from +10° C to +40° C after an initial warmup period of 20 minutes, when previously calibrated with a temperature from +15 to +25° C.

**Table 1-4
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
COLLECTOR SUPPLY		
Polarity		
+ LEAKAGE	Applies positive dc voltage to the collector terminal. Measures emitter current. Sensitivity is increased 1000 times.	
+ DC	Applies positive dc voltage to the collector terminal. Measures collector current.	
+ 	Applies positive full-wave rectified sine wave to the collector terminal. Measures collector current.	
AC 	Applies line-frequency sine wave to the collector terminal. Measures collector current.	
- 	Applies negative full-wave rectified sine wave to the collector terminal. Measures collector current.	
- DC	Applies negative dc voltage to the collector terminal. Measures collector current.	
- LEAKAGE	Applies negative dc voltage to the collector terminal. Measures emitter current. Sensitivity is increased 1000 times.	
DC Mode Ripple	2% or less of voltage or 0.1% or less of full-range voltage.	AC p-p open circuit Measurement.
Max Peak Volts		
LOW range	16V, 80V, 400V	
HIGH range	2000V	
Voltage Accuracy	Peak open circuit voltage on all ranges within +10, -0%	at MAX PEAK POWER of 50 WATTS

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement				Operation Information
Range	16V	80V	400V	2000V	
Max Peak Current	10A	2A	0.4A	0.05A	
Peak Current, pulsed	20A	4A	0.8A	0.1A	
Minimum Series Resistance (ohms)	0.26	6.4	160	20K	
Maximum Series Resistance (ohms)	800	20K	500K	12.5M	
Series Resistance Available (ohms, $\pm 5\%$ or ± 0.1 ohm)	0.26 160 100K	1.3 800 500K	6.4 4K 2.5M	32 20K 12.5M	
Peak Power Watts LOW range (16, 80 and 400V)	220W 0.4W	50W 0.08W	10W	2W	Derived from nominal peak open-circuit collector voltages and nominal series resistance values.
HIGH range (2000 V)	50 W 0.08W	10 W	2 W	0.4 W	
Variable Collector Supply	0 to 100.0%				Uncalibrated variable collector supply amplitude control from 0 to 100% in 0.1% increments.
Resolution % Indicator (5 LEDs)	0.1%				Indicates approximate % of MAX PEAK VOLTS
Safety Interlocks					Applies to all ranges 16, 80, 400, 2000 V). The protective cover must be in place over test terminals and lid shut before voltage can be applied to the collector terminals.
Collector Supply Disabled (LED)					Amber light on indicates interlock is open.

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Warning Indicator		Red light on indicates dangerous voltage maybe applied to collector terminal.
Limiter Indicator		Indicates that internal sensing circuit automatic protection is operating.
Looping compensation		Cancels stray capacitance between collector terminal and ground.

NOTE

The collector supply is limited to a maximum continuous peak current operating time under the following duty cycle and ambient temperature conditions:

With the PEAK POWER WATTS at 50 or 220, the following limitations apply:

50w: Maximum continuous operating time at rated current (100% duty cycle) into a short circuit is 20 minutes at 25° C ambient, or ten minutes at 40° C ambient.

220w: Maximum continuous operating time at rated current (100% duty cycle) into a short circuit is 30 minutes at 25° C ambient, or 90 seconds at 40° C ambient.

Alternatively, the duty cycle may be limited to 50% at 25° C ambient or 25% at 40° C ambient. (A normal family of transistor curves will produce a duty cycle effect to 50% or less, even if operated continuously.) Collector Supply over-dissipation temporarily shuts off the power, turns on the amber COLLECTOR SUPPLY VOLTAGE DISABLED indicator, and prints a message on the screen. No damage results when over-dissipation occurs.

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
STEP GENERATOR		
Accuracy (Current or voltage steps including Offset)		
Incremental	1.5%	
Absolute	Less than 1.5% x total output + 3% x AMPLITUDE setting + 1 mV or 1 nA. (less than 1.5% of total output + 10% of STEP/OFFSET setting + 1 mV or 1 nA with STEP MULTI .1X enabled.)	
Offset Control Range Resolution	Variable from -10 to +10 times STEP AMPLITUDE. STEP/OFFSET AMPLITUDE setting X1%.	
Current Mode Amplitude Range	50 nA to 200 mA in 1-2-5 sequence of 21 steps.	Selected by STEP/OFFSET AMPLITUDE.
Maximum Current	20 times STEP AMPLITUDE, except 10X STEP AMPLITUDE when control is set to 200 mA.	
Maximum Voltage	At least 10 V.	
Maximum Opposing Offset Current	Ten times STEP AMPLITUDE	
Maximum Opposing Volts	Less than 7 V.	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Ripple Plus Noise	Less than 0.5% x STEP AMPLITUDE + 1 nA BW:20 MHz.	
Voltage Mode		
Amplitude Switch Range	50 mV to 2 V, in 1-2-5 sequence.	
Maximum Voltage	20 times STEP AMPLITUDE	
Maximum Current	At least 2 A at 10 V or less; 10 mA at 40 V.	
Short Circuit Current Limiting	20 mA, 100 mA, 500 mA, 2 A +50%, -20%	Selected by CURRENT LIMIT switch
Maximum Opposing Offset Volts	10 times STEP AMPLITUDE.	
Maximum Opposing Current	Less than 10 mA	
Ripple Plus Noise	Less than 0.5% x STEP AMPLITUDE + 1 nA BW:20 MHz	
Step Rates	2 x Line frequency (1 x Line frequency in ac collector supply mode). Steps occur at zero collector voltage.	
Pulsed Steps	80 μ or 300 μ μ s wide \pm 10%, at mesial line, with 1 k Ω load, 1 mA STEP/OFFSET.	
Steps and Offset Polarity	Corresponds to Collector Supply Polarity when STEP GENERATOR POLARITY INVERT disabled. Opposite to Collector Supply Polarity when STEP GENERATOR POLARITY INVERT is selected or CONFIGURATION switch is set to BASE=COMMON. BASE=COMMON configuration disables STEP GENERATOR INVERT.	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Number of Steps	Ranges from 0 to 10.	
AUX SUPPLY		
Range	From -40 to +40 volts in 20 mV increments.	
Accuracy	Within 50 mV +1.5% of total output	
Output current	At least 100 mA at ±20 V	
	At least 10 mA at ±40 V	
Ripple plus noise	Less than 50 mV p-p	

NONSTORE VERTICAL DEFLECTION SYSTEM

NONSTORE MODE		
Cursor Accuracy	CROSS and WINDOW Within 0.06 division.	
Collector Current		
Range	1 μA/div to 2 A/div in 1-2-5 sequence of 20 steps. X10 MAG extends maximum sensitivity to 100 nA/div (1 nA resolution).	
Accuracy	Within 2% of crosshair cursor readout + 0.1 x VERT/DIV settings.	
Maximum displayed noise or ripple	1% or the following, depending on setting of MAX PEAK VOLTS	
	16 80 400 2000	
	1μA 1μA 2μA 5μA p-p	
Emitter Current Range	1 nA/div to 2 mA/div in 1-2-5 sequence of 20 steps. X10 MAG extends maximum sensitivity to 100 pA/div.	Collector Supply Polarity is either +LEAKAGE or -LEAKAGE.

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Accuracy	Within 2% of crosshair cursor readout + 0.1 x VERT/DIV settings, +1 nA.	
Maximum displayed noise or ripple	1% or the following, depending on setting of MAX PEAK VOLTS:	
	16 80 400 2000	
	1 nA 1 nA 2 nA 5 nA p-p	
Step Generator Display		
Range	1 step/division	
	10 steps/division	with STEP MULTI .1x
	1 step/10 divisions	with VERT x10
Accuracy	Within .3 division	
Display offset	Vertical offset range: ± 10 divisions in half-division steps.	
Display mag X10 accuracy	0.5% of readout + 0.3 div X setting.	
Display invert accuracy	Within 0.1 div X setting.	
DIGITAL STORAGE VERTICAL ACQUISITION		
A/D converter		
Resolution	10 bits for 10.24 divisions, 100 counts per division.	
max data points	1024	
max sampling rate	line frequency x 1024	
min sampling rate	line frequency x 2	
Collector Current		
Range	1 μ A/div to 2 A/div in 1-2-5 sequence of 20 steps. X10 MAG extends maximum sensitivity to 100 nA/div (1 nA resolution).	
Accuracy	Within 1.5% of dot cursor readout + 0.03 x VERT/DIV settings.	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Emitter Current		
Range	1 nA/div to 2 mA/div in a 1-2-5 sequence of 20 steps. X10 MAG extends max sensitivity to 100 pA/div (1 pA resolution).	LEAKAGE mode
Accuracy	Within 1.5% of dot cursor readout + 0.03 x VERT/DIV settings, + 1 nA.	
Step Generator Display		
Range	1 step/division	
	1 step/10 divisions	with VERT x10
	10 steps/division	with STEP MULTI .1x
Accuracy	Within 0.3 division	
Display offset	Vertical offset range: ± 10 divisions in half-division steps.	
Accuracy	Within 0.5% of offset readout + 0.01 x VERT/DIV setting.	
Display Mag Accuracy	0.5% of readout + 0.3 x VERT/DIV setting.	
Display Invert Accuracy	Within 0.04 x VERT/DIV and HORIZ/DIV settings.	

NONSTORE HORIZONTAL DEFLECTION SYSTEM

Cursor Accuracy	Within 0.06 division	
Collector volts		
Range	50 mV/div to 500 V/div in a 1-2-5 sequence of 21 steps. X10 MAG extends maximum sensitivity to 5 mV/div (50 V resolution).	
Accuracy	Within 2% of crosshair cursor readout + 0.1 x HORIZ/DIV setting.	
Displayed Noise	16 80 400 2000 V 2 10 50 250 mV p-p	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Base/Emitter Volts		
Range	50 mV/div to 2 V/div in 1-2-5 sequence of 6 steps. X10 MAG extends sensitivity to 5 mV/div (50 μ V resolution).	
Accuracy	Within 2% of crosshair cursor readout + 0.1 x HORIZ/DIV setting.	
Input Impedance	At least 100 Megohms	
Displayed noise	Less than 10 mV p-p	
Step Generator Display		
Range	1 step/division	
	1 step/10 division with HORIZ x10	
	10 steps/division	with STEP MULTI .1x
Accuracy	Within 0.3 division	
Display offset	Horizontal offset range: ± 10 divisions in half-division steps.	
Accuracy	0.5% of offset readout + 0.1 x HORIZ/DIV setting.	
Display Mag Accuracy	0.5% of readout + 0.3 x HORIZ/DIV setting.	
Display Invert Accuracy	Within 0.1 x HORIZ/DIV setting.	

DIGITAL STORAGE HORIZONTAL ACQUISITION

A/D converter		
Resolution	10 bits for 10.24 divisions. 100 counts per division.	
Max data points	1024	
Max sampling rate	line frequency x 1024	
Min sampling rate	line frequency x 2	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Collector volts Range	50 mV/div to 500 V/div in 1-2-5 sequence of 21 steps. X10 MAG extends maximum sensitivity to 5 mV/div (50 μ V resolution).	
Accuracy	Within 1.5% of dot cursor readout + 0.03 x HORIZ/DIV setting.	
Base/Emitter Volts		
Range	50 mV/div to 2 V/div in a 1-2-5 sequence of 6 steps. X10 MAG extends maximum sensitivity to 5 mV/div (50 μ V resolution).	
Accuracy	Within 1.5% of dot cursor readout + 0.03 x HORIZ/DIV setting.	
Step Generator Display Range	1 step/division	
	1 step/10 divisions	with HORIZ x10
	10 steps/division	with STEP MULTI .1x
Accuracy	Within 0.3 division	
Display offset	Vertical offset range: ± 10 divisions in half-division steps.	
Accuracy	0.5% of offset + 0.01 x HORIZ/DIV setting.	
Display Mag Accuracy	0.5% of readout + 0.3 x HORIZ/DIV setting.	
Display Invert Accuracy	Within 0.04 X VERT/DIV and 0.04 X HORIZ/DIV setting.	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
ACQUISITION MODES		
NORMAL ENVELOPE	Vertical envelope, Horizontal envelope	
AVERAGING	Averages last four or last 32 acquisitions	
CRT AND READOUT		
CRT		
Type	Electrostatic deflection	
Phosphor	P31	
Acceleration Potential	12 kV typical	
Screen Size	7" diagonal Internal graticule and on-screen scale factor readout.	
Total Addressable Points (Graticule Area)	1000 x 1000	
Geometry	1/2 minor division or less of tilt or bowing; 3/4 minor division or less of keystone.	
Resolution	At least 10 lines/div	
Spot Size	Within 0.95 mm at screen center; Elsewhere on screen: Within twice center value.	
Orthogonality	90°, within 0.3°.	
Trace Rotation Range	At least $\pm 3^\circ$.	
READOUT		
	Automatic on-screen display. Over range shown by a flashing display.	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information
Per Vertical Division	100 pA to 2 A.	
Per Horizontal Division	5 mV to 500 V.	
Per Step	5 nA to 200 mA and 5 mV to 2 V	
BETA or gm Per Division	500 x 10 ⁹ to 400 x 10 ⁶ for BETA and 50 x 10 ⁻⁹ S to 400 S for gm.	
CURSOR	4-digit Horizontal and Vertical values without x10 MAG, 5-digit with MAG.	
OFFSET	4-digit value.	
AUX SUPPLY	-40.00 V to +40.00 V	

TEXT DISPLAY

Text Area		
Alphanumeric Character Font (1)	SP, I, ..., A, B, ..., 0, 1 —, 9, /, ..., a, b, ..., y, z, ... u is recognized as micro	GPIB-accessible by using TEXT command
Alphanumeric Character Font (2)	A, B, ..., Y, Z, (space), m, u, n, p, ..., 0, 1, ..., 9, -, /, *, (,) u is recognized as micro	Accessible by using VERTICAL and HORIZONTAL knobs.
Maximum TEXT Characters	24	
Character Size	Approximately 3 mm height, 2 mm width.	

CONNECTORS

Adapter Connectors		
Collector Collector sense		C, B, and E stands for collector, base, and emitter, respectively.
Maximum output voltage	± 2000	Sense connectors allow Kelvin sensing of voltage for high-current device.
Maximum output Current	± 20 A	

**Table 1-4 (cont)
Electrical Specification**

Characteristic	Performance Requirement	Operation Information						
Base Base Sense Emitter Emitter Sense								
Maximum output voltage Δ	± 40 V							
Maximum output Current	± 20 A							
Step Gen Out Connector Maximum output voltage Δ	± 40 V							
Maximum output Current	± 2 A							
Aux Supply Connector Maximum output voltage and current Δ	± 40 V @ ± 10 mA, or ± 20 V @ ± 100 mA.							
Ext Base or Emitter Connector Maximum output voltage Δ	± 40 V							
Maximum output	± 2 A							
Power source Line voltage Ranges High Low	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">115 VAC</td> <td style="width: 50%; text-align: center;">230 VAC</td> </tr> <tr> <td style="text-align: center;">107 VAC to 132 VAC</td> <td style="text-align: center;">214 VAC to 250 VAC</td> </tr> <tr> <td style="text-align: center;">90 VAC to 110 VAC</td> <td style="text-align: center;">180 VAC to 220 VAC</td> </tr> </table>	115 VAC	230 VAC	107 VAC to 132 VAC	214 VAC to 250 VAC	90 VAC to 110 VAC	180 VAC to 220 VAC	
115 VAC	230 VAC							
107 VAC to 132 VAC	214 VAC to 250 VAC							
90 VAC to 110 VAC	180 VAC to 220 VAC							
Line Frequency Range	48.0 to 66.0 Hz.							
Power Consumption Max. Typical	<p>400 W 3.5A at 132 V 60 Hz</p> <p>120 W 1.3 A at 115 V 50 Hz.</p>							

**Table 1-5
Mechanical Specification**

Characteristic		Performance Requirement
Weight	(Std.) (Option 1R)	35 kg (77 lbs.) 36 kg (79.2 lbs.)
Height		326 mm (12.8 in) with feet 310 mm (12.2 in) without feet
Width		429 mm (16.9 in)
Depth		635 mm (25.0 in)

**Table 1-6
Environmental Specification**

Characteristic		Performance Requirement
Temperature		
	Non-Operating	-40 to +65° C.
	Operating	+10 to +40° C.
Altitude		
	Non-Operating	to 50,000 feet
	Operating	to 15,000 feet

Maximum operating temperature decreases 1° C each 1,000 feet above 5,000 feet.

Humidity		
	Non-operating and operating	Tested non-operating at 60° C and operating to meet MIL-STD-810C method 507. 1 procedure IV, modified as specified in MIL-T-28800B paragraph 4.5.1.1.2. Five cycles (120 hours) at 80% relative humidity.
EMC (Electromagnetic compatibility)		
	Conducted Emissions	DIN 57871/VDE 0871/6.78 CLASS B

Table 1-6 (cont)
Environmental Specification

Characteristic	Performance Requirement
Susceptibility	CS06-MIL-STD-461B PART 5 PLUS ADDITIONAL REQ. CS01-MIL-STD-461B PART 7 CS02-MIL-STD-461B PART 4
Radiated Emissions Susceptibility	DI N 5771/VDE 0871/6.78 CLASS B RE01-MIL-STD-461B PART 4 CHARACTERIZATION ONLY
Electrostatic Discharge	Mainframe—15kV Bubble cassette—5kV Adapter—5kV
Vibration (operating)	Tested to MIL-T-28800B, Section 4.5.5.3.1; 15-minute sweep along each of three major axes at a total displacement of 0.015 inch p-p (2.3G at 55 Hz), with frequency varied from 10 Hz to 55 Hz to 10 Hz. Held 10 minutes at each major resonance, or if no major resonance present, held 10 minutes at 55 Hz.
Shock (nonoperating)	Tested to MIL-T-28800B, Section 4.5.5.4.1; 30 G, half-sine, 11 ms duration, three shocks per axis in each direction for a total of 18 shocks.
Bench Handling	Meets MIL-STD-810C, Method 516.2, Procedure V (MIL-T-28800B, section 4.5.5.4.4).
Packaged Transportation Drop	Meets the limits of the National Safe Transit Association test procedure 1A-B-2; 10 drops of 24 inches.
Package Transportation Vibration	Meets limits of the National Safe Transit Association test procedure 1A-B-1; excursion of 1 inch p-p at 4.63 Hz (1.1G) for 60 minutes.

Interface Specification

**Table 1-7
Parallel Interface Pin Assignment Table**

Signal Pin No.	Return Pin No.	Signal	Direction	Description
1	19	STROBE	OUT	An active low strobe qualifies data. Data may be latched on STROBE low or may be clocked on positive transition of STROBE.
2	20	DATA 1	OUT	INPUT DATA LEVELS—A logic one is INPUT DATA LEVELS—A logic one is represented by a high level.
3	21	DATA 2	OUT	
4	22	DATA 3	OUT	
5	23	DATA 4	OUT	
6	24	DATA 5	OUT	
7	25	DATA 6	OUT	
8	26	DATA 7	OUT	
9	27	DATA 8	OUT	
10	28	A CKNLG	IN	
11	29	BUSY	IN	A high-active signal indicates that the plotter is not ready for data.
12	30	PE	IN	Paper Empty—A low signal indicates that the plotter is not paper set.
13	-	SLCT	-	Not used.
14	-	NC	-	Not used.
15	-	NC	-	Not used.
16	-	NC	-	Not used.
17	-	FG	-	370 chassis GND. In the 370, the chassis GND and the logic GND are isolated from each other.
18	-	+5V	OUT	+5V
19-30	-	GND	-	TWISTED-PAIR RETURN signal GND level.
31	-	INIT	OUT	Low for Plotter initialize.

Table 1-7 (cont)
Parallel Interface Pin Assignment Table

Signal Pin No.	Return Pin No.	Signal	Direction	Description
32	-	$\overline{\text{FAULT}}$	IN	The 370 aborts data transmission when ERROR signal is low.
33	-	NC	-	Not used.
34	-	NC	-	Not used.
35	-	NC	-	Not used.
36	-	NC	-	Not used.

Cable. CENTRONICS 36-pin I/F cable. (see Fig.1-7).

Electrical Specifications

All input/output signals are TTL-compatible.
(I_{ol} 20 mA)
(I_{oh} - 10 mA)

Recorded Data (Bubble Memory). The Bubble Memory interfaces only with the 370 Programmable Curve Tracer. The Bubble Memory cassette has a capacity of 128K bytes, and can store the data for 16 curves and 16 setups.

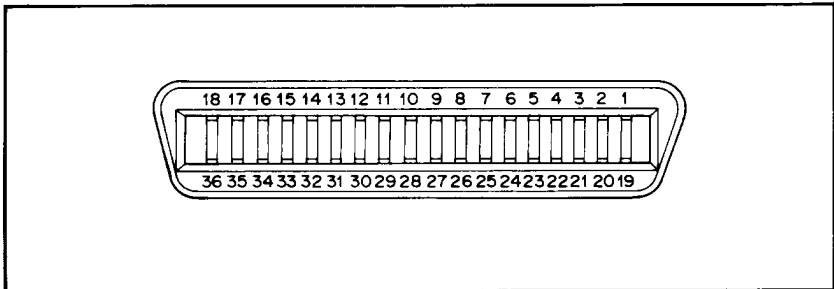


Figure 1-7. 18-bit Parallel Interface Connector.

GPIB Interface. The IEEE-488-1978 (GPIB) standard defines the GPIB interface functions and the allowed subsets of those functions.

Function	Implemented As
Source handshake	SH1
Acceptor Handshake	AH1
Talker	T6
Listener	L4
Service request	SR1
Remote Local	RL2
Parallel poll	PPO
Device clear	DC1
Device trigger	DT0
Controller	CO

ACCESSORIES

Standard Accessories

Operators Manual	070-6064-00
Pocket Reference Guide	070-6066-00
Instrument Interface Guide	070-6067-00
FUSE 250V, 2A, medium-blo	159-0260-00
125V, 4A, medium-blo	159-0259-00
Protective Cover	337-3344-00
Bubble Cassette	020-1310-00
Power Cord	161-0066-00

Text Fixture Adapters

Blank adapter	A1001
In-line adapter	A1002
Axial Lead Adapter	A1005
4 & 6 Lead Transistor Adapter	A1007

Optional Accessories

TO-3/TO-66 Adapter	A1003
Offset Lead/Power Adapter	A1004
Long-Lead Transistor Adapter	A1006
Long-Lead FET Adapter	A1008
4 and 6-Lead FET Adapter	A1009
IC Adapter	A1010
Service Manual	070-6065-00
Camera Adapter, (C59AP)	016-0244-06
Camera Adapter, C5C op. 01	016-0357-01
Camera Adapter, C4 op. 02	016-0357-01