

# **Appendix A**

## **SPECIFICATIONS**

This appendix specifies the electrical, mechanical, and environment performance requirements of the 371A.

### **PERFORMANCE CONDITIONS**

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

The performance of all stimulus outputs (collector high current, collector high voltage, step generator current, step generator voltage) should be verified on the test fixture unit.

**Table A-1**  
**Collector Supply Electrical Specification**

Characteristic	Performance Requirement	Supplemental Information
Collector supply polarity		Selected by the collector supply POLARITY button.
NPN+	Positive pulse for 300 W/3 kW peak power watts Positive rectified sine-square wave for 30 W/3 W/300 mW/30 mW peak power watts.	
PNP-	Negative pulse for 300 W/3kW peak power watts Negative rectified sine-squared wave for 30 W/3 W/300 mW/30 mW	
Peak power watts range	3 kW 300 W 30 W 3 W 300 mW 30 mW	Selected by the PEAK POWER WATTS buttons, but 300 mW or 30 mW setting is selected by the 30 W or 3 W button with the SHIFT button. Derived from nominal peak open circuit collector voltages and nominal series resistance value.
Collector peak current		With a shorted load in the test fixture unit.
3 kW range	400 A	Pulsed collector supply
300 W range	40 A	Pulsed collector supply
30 W range	40 mA, -20%, +20%	Sine wave collector supply
3 W/300 mW range	4 mA, -20%, +20%	Sine wave collector supply
30 mW range	0.4 mA, -20%, +20%	Sine wave collector supply
Maximum peak voltage	Peak open circuit voltage	At 100% collector supply VARIABLE
3 kW range	30 V, +10%, -5%	Pulsed collector supply
300 kW range	30 V, +10%, -5%	Pulsed collector supply
300 W range	30 V, +10%, -5%	Pulsed collector supply
30 W range	3 kV, +10%, -0%	Rectified sine-squared wave collector supply
3 W range	3 kV, +10%, -0%	Rectified sine-squared wave collector supply
300 mW range	300 V, 15%, -0%	Rectified sine-squared wave collector supply
30 mW range	300 V, +15%, 0%	Rectified sine-squared wave collector supply

(table continued on next page)

**Table A-1 (cont.)  
Collector Supply Electrical Specification**

Characteristics	Performance Requirement	Supplemental Information
Collector supply variable	0 to 100.0%	% of maximum peak voltage value is displayed in the CRT readout area.  Provides uncalibrated variable control of the collector supply amplitude from 0 to 100% in 0.1% increments.
Looping compensation	Valid for high-voltage mode	Cancels stray capacitance between the collector terminal and ground at collector supply PEAK POWER WATTS 30 w/3 W/300 mW/30 mW
Sweep start voltage	Less than +10%, -10% of peak volt	Valid for high voltage mode
OUTPUTS indicator		Lights when all outputs (collector supply and step generator output terminals) are enabled.
Pulsed collector supply	Pulse amplitude is controlled by the collector supply VARIABLE	Available in high current mode (PEAK POWER WATTS 3 KW/300 W)
Repetition rate	One-fourth (X.25) line frequency	at 3 KW peak power watts
	One-half (X.5) line frequency	At 300 W peak power watts
Pulse width (half amplitude)	250 $\mu$ s +10%, -10%	More than 30 % of the collector supply VARIABLE at open circuit
	150 $\mu$ s to 250 $\mu$ s	5% to 30% of the collector supply VARIABLE at open circuit
Rise time/fall time	40 $\mu$ s to 120 $\mu$ s	With collector supply VARIABLE at 50%
Overshoot/undershoot	Less than 5% of the total output	More than 5% of the collector supply VARIABLE at open circuit



**Table A-2 (cont.)**  
**Step Generator Supply Electrical Specification**

Characteristics	Performance Requirement	Supplemental Information
Pulsed current steps		When pulsed collector supply (peak power watts 3 KW/300 W) is selected, the step current automatically becomes pulsed.
Pulse width	500 $\mu$ s, +10%, -10%	With 1-k $\Omega$ load, 1-mA/step
Rise time (see NOTE )	Less than 40 $\mu$ s	With 1-k $\Omega$ load, 1-mA/step
Fall time (see NOTE )	Less than 40 $\mu$ s	With 1-k $\Omega$ load, 1-mA/step
Overshoot/undershoot	Less than 10%	With 1-k $\Omega$ load, 1-mA/step and zero collector supply VARIABLE.
Voltage mode		Provides a voltage staircase step
Step amplitude range	200 mV to 5 V in a 1-2-5 sequence	Selected by STEP/OFFSET AMPLITUDE control.
Short circuit current limiting	100 mA +50%, -20%	
Maximum voltage	20 times step amplitude except 10 times when STEP AMPLITUDE control is set to 5 V/step.	
Ripple plus noise	Within 1 % of the step amplitude +10 mV	Check with an oscilloscope with 20 MHZ bandwidth.

**NOTE:** Degradation occurs when the DUT resistance ( $R_{dut}$ ) is X10 greater than the current sense resistor ( $R_{sense}$ ) of the amplifier.

The time constants for the rise and fall time is  $T_{dut} = T_O (1 + R_{dut}/R_{sense})$ ; where  $T_{dut}$  is the time constant for the DUT with  $R_{dut}$  resistance, and  $T_O$  is the time constant for the DUT with zero resistance.

The following lists the current sense resistors and their corresponding STEP AMPLITUDE setting (with STEP MULTI .1X on)

$R_{sense}$	STEP AMPLITUDE (with STEP MULTI .1X on) Setting
0.1 $\Omega$	2 A and 1 A STEP (200 mA and 100 mA STEP)
1.0 $\Omega$	500, 200, and 100 mA STEP (50, 20, and 10 mA STEP)
10 $\Omega$	50, 20, and 10 mA STEP (5, 2, and 1 mA STEP)
100 $\Omega$	5, 2, and 1 mA STEP (500, 200, and 100 $\mu$ A STEP)
1.0 k $\Omega$	500, 200, and 100 $\mu$ A STEP (50, 20, and 10 $\mu$ A STEP)
10 k $\Omega$	50, 20, and 10 $\mu$ A STEP (5, 2, and 1 $\mu$ A STEP)
100 k $\Omega$	5, 2, and 1 $\mu$ A STEP (500, 200, and 100 nA STEP)

**Table A-3**  
**Vertical Deflection System Electrical Specification**

Characteristics	Performance Requirement	Supplemental Information
Collector current ( $I_C$ ) range	1 A/DIV to 50 A/DIV	With PEAK POWER WATTS set to 3 kW
	500 mA/DIV to 5 A/DIV	With PEAK POWER WATTS set to 300 W
	100 $\mu$ A/DIV to 5 mA/DIV	With PEAK POWER WATTS set to 30 W
	10 $\mu$ A/DIV to 500 $\mu$ A/DIV	With PEAK POWER WATTS set to 3 W/300 mW
	1 $\mu$ A/DIV to 50 $\mu$ A/DIV	With PEAK POWER WATTS set to 30 mW
Collector current ( $I_C$ ) accuracy	Within 0.1 division of the vertical graticule lines.	
Collector current ( $I_C$ ) cursor accuracy	Within 1.5% of the readout $\pm 0.1$ division of the CURRENT/DIV setting.	In store mode (use the dot cursor).

**Table A-4**  
**Horizontal Deflection System Electrical Specification**

Characteristics	Performance Requirement	Supplemental Information
Collector supply range	Volts ( $V_{CE}$ ): 100 mV/DIV to 5 V/DIV in a 1-2-5 sequence.	With peak power watts set to 3 kW/300 W
	50 V/DIV to 500 V/DIV in a 1-2-5 sequence.	With peak power watts set to 30 W/3W
	5 V/DIV to 50 V/DIV in a 1-2-5 sequence.	With peak power watts set to 300 mW/30 mW
Step generator volts ( $V_{BE}$ ) range	100 mV/DIV to 5 V/DIV in a 1-2-5 sequence.	
Step generator volts ( $V_{BE}$ ) accuracy	Within 0.1 division	
Step generator volts ( $V_{BE}$ ) cursor accuracy	Within 1.5% of the readout $\pm 0.1$ division of the HORIZONTAL VOLTS/DIV setting	Check using the dot cursor.
	At 100 mV/DIV COLLECTOR: Within 5% of the readout $\pm 0.2$ division of the HORIZONTAL VOLTS/DIV setting.	

**Table A-5**  
**CRT and Text Display Electrical Specification**

Characteristics	Performance Requirement	Supplemental Information
CRT		
Type	Electrostatic deflection	
Phosphor	P31	
Screen Size	7 inch diagonal, internal graticule and scale factor	
Orthogonality	90 degrees, within 0.6 degrees	
Trace rotation	At least $\pm 3$ degrees	
Geometry	0.5 minor division or less of tilt or bowing	
	0.75 minor division or less of keystone effect.	
Text display		
Alphanumeric Character set (1)	ASCII character set except double quote (") (the lower-case u is recognized as $\mu$ ).	GPiB-accessible with the <b>TEXT</b> (GPiB) command
Alphanumeric Character set (2)	space, A, B, . . . Z, space, m, $\mu$ , n, q, . 0, 1 . . . 9, -, /, *, (, ), =	Accessible with the cursor position buttons (up, down, left, right).
Maximum text string length	24 characteristics	
Character size	About 3 mm height, 2 mm width.	

**Table A-6**  
**Power Source Electrical Specification**

Characteristic	Performance Requirement		
	Range	Main Fuse	Collector Fuse
240 V	216 V - 250 V	250 V, 1 A, slow blow	250 V, 2 A, slow blow
200 V	180 V - 220 V		
120 V	108 V - 132 V	250 V, 2A, slow blow	250 V, 4 A, slow blow
100 V	90 V - 110 V		
Line Frequency	48 Hz - 63 Hz		
Maximum Power	400 W, 4.5 A		

**Table A-7  
Mechanical Specification**

Characteristic	Specification
Weight	Approximately 79.3 lb (36 kg)
Height	Approximately 13.1 in (333 mm)
	With feet and handles removed: approximately 16.9 in (429 mm)
Width	Approximately 16.9 in (429 mm)
Depth	Approximately 24.1 in (638 mm)

**Table A-8  
Environmental Specification**

Characteristic	Performance Requirement
Temperature	
Operating	+10° C to +40° C
Storage	-22° to +60° C
Transportation	-40° C to +65° C
Temperature gradient	
Operating	≤ 15° C per hour (no condensation)
Storage and Transportation	≤ 30° C per hour (no condensation)
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/operating	MIL-T-28800D paragraph 4.5.5.1.1.2 (5 days humidity with temperature cycling)
Relative humidity	
Operating	20% to 80% (no condensation)
Storage	10% to 90% (no condensation) Maximum wet bulb temperature shall be 45° C.
Transportation	5% to 95% (no condensation) Maximum wet bulb temperature shall be 45° C.

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**Table A-8 (cont'd)**  
**Environmental Specification**

<b>Characteristics</b>	<b>Performance Requirement</b>								
EC Declaration of Conformity	Meets intent of Directive 89/336/EEC for Electromagnetic Compatibility. Compliance was demonstrated to the following specifications as listed in the Official Journal of the European Communities:								
Emissions									
Enclosure	EN 55011 Class B limits for radiated emissions								
AC Mains	EN 55011 Class B limits for conducted emissions EN 60555-2 Power line harmonics								
Immunity									
Enclosure	IEC 801-3 RF electromagnetic field, 3 V/m, 27 MHz to 500 MHz IEC 801-2 ESD 8 kV								
AC Mains	IEC 801-4, 1 kV <sub>p-p</sub> , 5/50 ns, T <sub>r</sub> /T <sub>h</sub> , 5 kHz IEC 801-5, Surge								
Electromagnetic Compatibility									
Conducted emissions	DIN 57871/VDE 0871/6.78 Class B FCC Part 15 Subpart J Class A								
Radiated emissions	DIN 57871/VDE 0871/6.78 Class B FCC Part 15 Subpart J Class A								
Electrostatic discharge	Mainframe: 15 kV Adapter Socket: 5 kV								
Safety	UL3111-1 – Standard for electrical measuring and test equipment  CAN/CSA C22.2 NO.1010.1 – Safety requirements for electrical equipment for measurement, control and laboratory use  IEC1010-1 – Safety requirements for electrical equipment for measurement, control, and laboratory use								
Installation category	Installation Category CAT II (as defined in IEC 1010-1, Annex J)  Terminals on this product may have different installation category designations. The installation categories are:  <table> <tr> <td>Category</td><td>Descriptions</td></tr> <tr> <td>CAT III</td><td>Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location</td></tr> <tr> <td>CAT II</td><td>Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected</td></tr> <tr> <td>CAT I</td><td>Secondary (signal level) or battery operated circuits of electronic equipment</td></tr> </table>	Category	Descriptions	CAT III	Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location	CAT II	Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected	CAT I	Secondary (signal level) or battery operated circuits of electronic equipment
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Pollution degree	Pollution Degree 2 (as defined in IEC 1010-1)  Secondary (signal level) or battery operated circuits of electronic equipment								

**Table A-8 (cont'd)**  
**Environmental Specification**

<b>Characteristics</b>	<b>Performance Requirement</b>
Vibration	A 15 minute sweep along each of three major axes at a total displacement of 0.003 inch p-p (0.5 G at 55 Hz), with frequency varied from 10 Hz to 55 Hz to 10 Hz. Hold 10 minutes at each major resonance, or if no major resonance present, hold 10 minutes at 55 Hz.
Shock (non-operating)	20 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) with floppy disk drive non-operating and vacant of media.
Packaged transportation drop	Meets the limits of the National Safe Transit Association test procedure 1A-B-2; 10 drops of 24 inches.
Packaged transportation vibration	Meets the limits of the National Safe Transit Association test procedure 1A-B-1; excursion of 1 inch p-p at 4.63 Hz (1.1 G) for 60 minutes.

## INTERFACE CHARACTERISTICS

### Plotter Interface

The plotter interface is based on IEEE 488-1978 (GPIB) standard. The 371A can send VIEW or STORE curve data and CRT readouts with graphic commands (HPGL) to a plotter.

The IEEE 488-1978 (GPIB) standard defines the GPIB interface functions and the allowed subsets of the functions listed in Table A-9.

**Table A-9**  
**Plotter Interface Functions**

Function	Implemented As
Source handshake	SH1
Acceptor handshake	AH1
Talker	T4
Listener	L0
Service request	SR0
Remote local	RL0
Parallel poll	PP0
Device clear	DC0
Device trigger	DT0
Controller	C0

### GPIB Interface

The IEEE 488-1978 (GPIB) defines the GPIB interface functions and the allowed subsets of the functions listed in Table A-10.

**Table A-10**  
**GPIB Interface Functions**

Function	Implemented As
Source handshake	SH1
Acceptor handshake	AH1
Talker	T6
Listener	L4
Service request	SR1
Remote Local	RL2
Parallel poll	PP0 (not implemented)
Device clear	DC1
Device trigger	DT0 (not implemented)
Controller	C0 (not implemented)