Introduction

The 4x is the next generation test system for discrete semiconductors. It is configured for high power applications with output voltage programmable to 3000V and current programmable to 200A. Voltage and current are fully programmable to meet your specific requirement.

Devices tested include:

Transistors · IGBT · SCR · Optocouplers
MOSFETs · JFets · Diodes

Hardware

The 4x is self-contained and is approximately 19 inches wide by 12 inches deep and 6 inches high (483mm x 305mm x 152mm). Within this small footprint, the 4x can produce a test stimulus to 3000V and 200A under program control. Robust in design, there are two Stimulus/Measurement Units (SMU)s which are independently controlled and each can withstand long ON times. The system is designed to automatically detect when the programmed source stimulus (voltage or current) is reached to sense the desired characteristic (voltage or current) to measure and perform the test.

FORCE VOLTAGE RANGE	Measure to	Max Ton*	Trise	Tfall
3000V	2.5mA	∞	200us	200us
50V	200A	300us	60us	60us
5V				
500mV				
50mV				
5mV				

*Max Ton is software limited for safety.

| FORCE CURRENT RANGE	Measure to	Max Ton*	Trise	Tfall
200A	50V	300us	60us	60us
20A				
2A				
200mA	2000V		200us	200us
20mA	3000V	∞		
2mA				
200uA				
20uA				
2uA				
200nA				
20nA				
2nA				

As of August 1, 2020. Subject to change without notice.

Both SMUs include a voltage and current source originating from the raw power supply within and individual meters to make measurements.

- The SOURCE lead of the DUT is typically connected to RETURN (RtnX) or a low current meter as specified by the specific test.
- The In SMU typically connects to the GATE (InX) lead of the DUT.
- The Out SMU typically connects to the DRAIN (OutX) lead of the DUT.
- All DUT circuit paths are 4-wire Kelvin and guarded to the front panel.
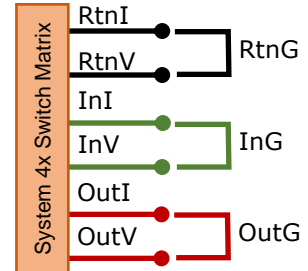
The power source and sense can be applied in the NEGATIVE as well as the POSITIVE. Each SMU source has its own Digital to Analog Converter (DAC) for controlling the amount of current and voltage specified for the DUT. Using proprietary circuitry, voltage and current can be held tightly to the programmed value.

Notes:
1. All force voltage is available across all current ranges unless otherwise noted.
2. All current flow is available across all voltage ranges unless otherwise noted.

IN SMU		RESOLUTION		ACCURACY
		Source	Measure	
VOLTAGE	5V	75uV	150uV	±(0.5% of the range + 0.5% of the value)
	50V	750uV	1.5mV	
CURRENT	200pA	3aA	6aA	
	2nA	30fA	60fA	
	20nA	300fA	600fA	
	200nA	3pA	6pA	
	2uA	30pA	60pA	
	20uA	300pA	600pA	
	200uA	3nA	6nA	
	2mA	30nA	60nA	
	20mA	300nA	600nA	
	200mA	3uA	6uA	
	2A	30uA	60uA	
	20A	300uA	600uA	

(SOURCE/MEASURE RANGE)

OUT SMU		RESOLUTION		ACCURACY
		Source	Measure	
VOLTAGE	5mV	75nV	150nV	±(0.5% of the range + 0.5% of the value)
	50mV	750nV	1.5uV	
	500mV	7.5uV	1.5mV	
	5V	75uV	150uV	
	50V	750uV	1.5mV	
	300V*	5mV	10mV	
	3000V*	50mV	100mV	
CURRENT	2nA	30fA	60fA	
	20nA	300fA	600fA	
	200nA	3pA	6pA	
	2uA	30pA	60pA	
	20uA	300pA	600pA	
	200uA	3nA	6nA	
	2mA	30nA	60nA	
	20mA	300nA	600nA	
	200mA	3uA	6uA	
	2A**	30uA	60uA	
	20A**	300uA	600uA	
	200A**	3mA	6mA	

(SOURCE/MEASURE RANGE)

*200mA max.   **50V max

Software

Test operations are controlled from the 4x Dashboard at the PC. The dashboard provides access to basically three system applications.

- BUILD The Build Editor is used to create and edit a test procedure to verify the electrical characteristics of your DUTs. Following the published specification, you simply complete each test module from a list of fill-in-the-blank templates adding them in a spreadsheet format to *build* a procedure. A test procedure includes all of the test modules as specified by the DUT specification and operator prompts.

- RUN Run executes the test procedure built in Build. The test procedure is run sequentially with programmable branches based on the PASS or FAIL condition of a module (test).

- TOOLS System Tools includes:

- Auto-Cal sets compensation values for all stimulus and measurement ranges for the SMUs. The 4x has no hardware adjustments for calibration.
- Debug allows you to verify every source and measurement range of each SMU. This is useful for troubleshooting and general maintenance of the system.

Screen Shots

BUILD

In this view, a list of tests for Bipolar devices is presented in the pane to the left. When selected, the test is added to the routine to the pane on the right where each of the test arguments are set according to the DUT specification. Arguments may be ordered in the routine for best fit.

Typically all tests must pass for the device to PASS, but Categories allows you to sort devices based on their ability to pass or fail specific tests. This is also known as Binning.

Operator prompts may also be added to the routine providing hook up instructions, etc.

As of August 1, 2020. Subject to change without notice.
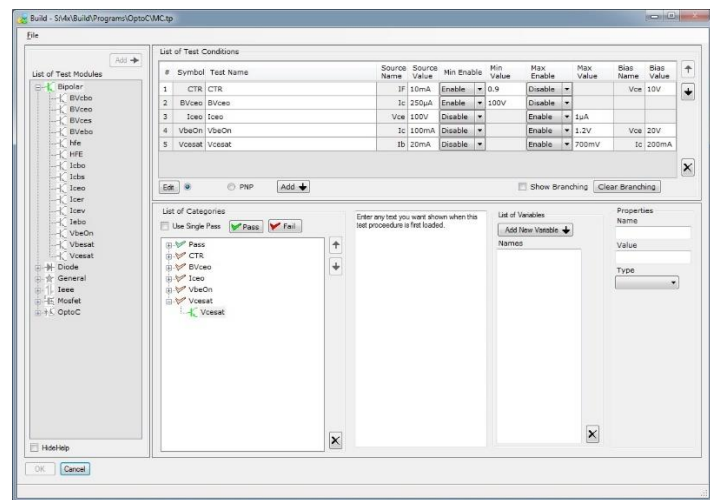
RUN

Test routines are run by clicking Run or by using a hotkey from the PC or from a remote controller. In prober/handler applications, automatic SOT and EOT signals are used. In this view, a test procedure has been run 12 times and the DUTs all passed. The results of the last DUT tested are displayed in the Results pane and all of the DUT results are displayed in the Log File pane. Bin and Category panes are also displayed. To the far right, a pane showing the communication between the PC and embedded computer is shown. Any pane may be hidden as desired.
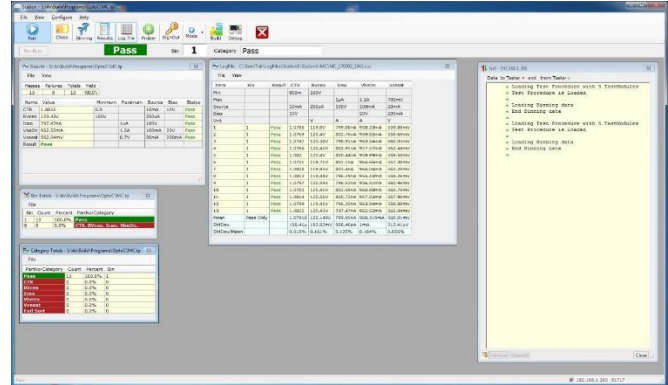
TOOLS

In this Debug/Maintenance view each SMU can be addressed and set independently for troubleshooting. Auto Cal is initiated from the pane and the output from the raw power supplies can also be viewed.
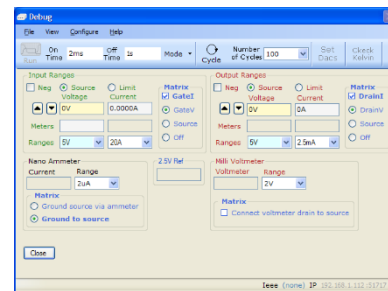
Setup

The 4x is powered by an external power unit equipped with a standard IEC320-C14 inlet and adopting the input range from 85VAC to 264VAC. The unit outputs 24VDC which plugs directly into the 4x main station. The power unit measures approximately 8.5"L by 3.75"W by 2'H (220mm x 95mm x 46mm).

The processor within the main station operates its own private Local Area Network (LAN) via an isolated Ethernet connection to the Windows-based PC for all system and instrument functions. The PC provides all user-interface functions such as building and executing test routines. The PC may be connected to another LAN via a separate Ethernet connection.

As of August 1, 2020. Subject to change without notice.