HIGH PRECISION SOURCE MEASURE UNIT MODEL 52400 SERIES

The Chroma 52400 series is a PXI based SMU (Source Measurement Unit) card designed for highly accurate source or load simulation with precision voltage and current measurements.

The SMU combines four-quadrant operation with precision and high speed measurement. This makes the SMU an ideal instrument in many parametric test applications ranging from ICs, two-leaded components such as sensors, LEDs, laser diodes, transistors, to solar cells, batteries and many other electronic devices.

The 52400 series features: 16 selectable control bandwidths to ensure high speed output and stable operation; multiple source/measure ranges with an 18-bit DAC/ADC to provide the best resolution and accuracy available with a sampling rate up to 100K s/S; programmable internal series resistance for battery simulation; ±force, ±sense and ±guards lines to avoid leakage current and reduce settling time -- especially useful for low current test applications.

The 52400 series has a patented hardware sequence engine that uses deterministic timing to control each SMU. The sequencer's on-board memory can store up to 65535 sequencer commands and 32k measurement samples per channel, allowing cross module/card synchronization and latency free output control and measurement. No PC communication is required during execution of the hardware sequencer test process.

C, C#, LabView, LabWindows APIs and versatile soft front panels come standard with each SMU. The back connectors are compatible with both PXIe and hybrid chassis. All of these features enable easy integration to PXI or PXI-hybrid systems designed for a wide range of applications.

PXI Systems Alliance

MODEL 52400 SERIES

KEY FEATURES

- Hybrid slot - compatible PXI-1 module
- Four quadrant operation
- 18-bit source/measure resolution (multiple selectable ranges)
- Low output noise
- High measurement speed (100k s/S)
- High output slew rate
- Optional measurement log
- DIO/Trigger bits
- Output profiling by hardware sequencer
- Programmable output resistance
- Floating & Guarding output
- 16 Control Bandwidth Selection
- Master / Slave operation
- Driver with LabView/LabWindows & C/C# API
- Softpanel GUI

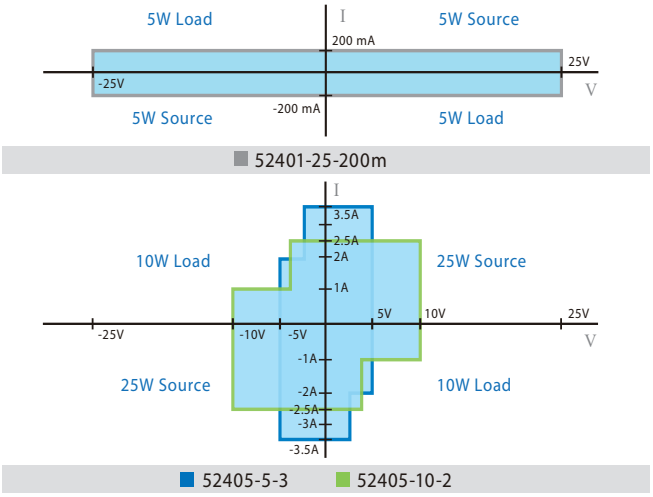
APPLICATIONS

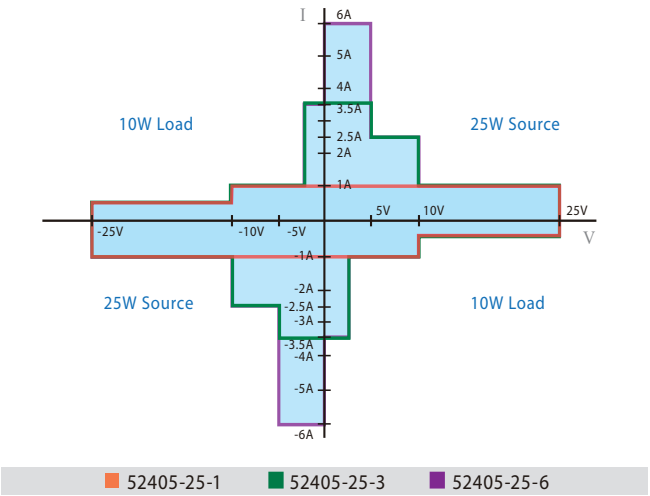
- Semiconductor test
- LED / laser diode test
- Battery test
- Transistor test
- Solar cell test
- Electric vehicle test
- Avionics test
- Power electronics test
- Sensor test

Chroma

FOUR QUADRANT OPERATION

All Chroma 52400 series SMUs support four quadrant operation for applications that require a reverse voltage/current source or load. During a load operation, the module is limited by the PXI chassis' standard of 20W heat dissipation per slot. Shown below are the quadrant diagrams with the operating regions of the Chroma PXI SMUs:

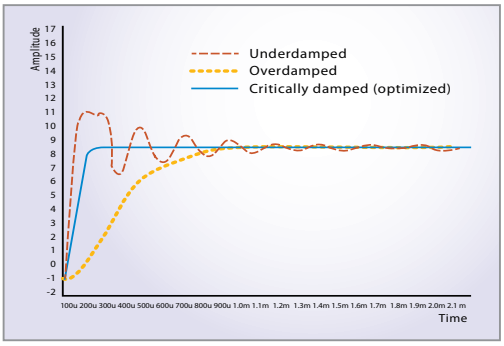




CONTROL BANDWIDTH SELECTION

To reduce test times, Chroma's SMUs are designed for fast response providing high speed output voltage and current. The impedance of the DUT, fixture, or cabling may cause loop instability under voltage or current source mode. An unstable loop can cause saturation, oscillation, or even damage the DUT.

To prevent system instability, the 52400 series SMUs provide 16 user selectable control bandwidths, eliminating the need for external capacitors or inductors placed near the DUT. This results in faster output rise time, reduced voltage ripple and noise, and reduced transient response. The control bandwidth can be modified via software to maximize test flexibility and minimize downtime when changing DUTs.

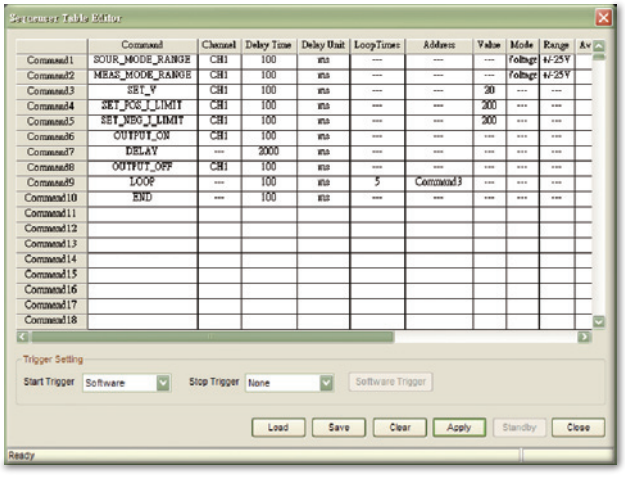


SMU Output Waveform under Bandwidth Control

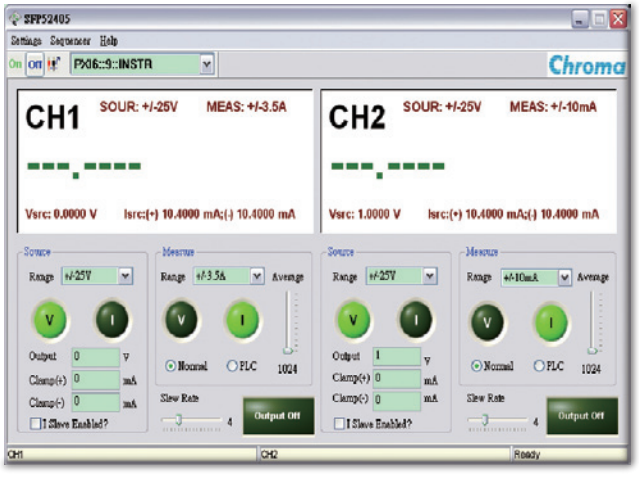
UNIQUE HARDWARE SEQUENCER

The Chroma Hardware Sequencer is a powerful tool that can predefine commands as instrument executable steps. This allows latency free control and measurement since no PC interaction is required during execution. Once the instrument receives the start trigger, it will execute step commands in the sequencer table line by line or as defined by the trigger. Shown below are the soft panels for the SMU in hardware sequencer mode (left) and direct operation mode (right).

VERSATILE SOFT FRONT PANEL

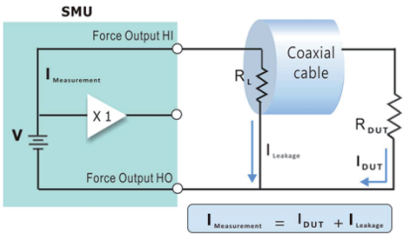


Hardware Sequencer Mode Soft Front panel

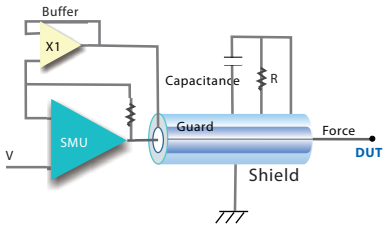


Direct Operation Mode Soft Front Panel

GUARDING FOR LOW CURRENT APPLICATION



Leakage current flows through the cable's insulation resistance



Guard Connection: Cable Capacitance is eliminated with Triaxial Cable

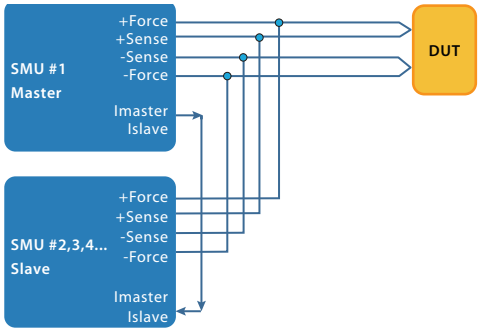
Guarding is an important technique for very-low current measurements. Guarding reduces leakage current error and decreases settling time. This is achieved by keeping the potential of the guard connector at the same potential as the force conductor, so current does not flow between the force and guard conductors. Guarding also eliminates the cable capacitance between the SMU and DUT.

The Chroma 52400 series features two ±guard wires per channel, resulting in faster and more accurate measurements.

MASTER/SLAVE OPERATION

For maximum flexibility, the Chroma 52405 SMUs support Master/Slave operation when higher current under FVMI (Force Voltage Measure Current) mode is required. To ensure accurate current sharing between modules and maximum performance, Master/Slave operation is only allowed between SMUs of the same model number.

Current sharing is achieved by one channel operating as the Master under FVMI mode while the Slaves operate in FIMV mode. The Master channel is programmed in voltage mode while the Slaves are set to current mode. The Slaves will follow the Master's set voltage. The wiring diagram for current sharing in master/slave control is shown to the right.



Wiring Structure for Master/Slave Control

SPECIFICATIONS

Model Name	52401-25-200m	52405-5-3 *1	52405-10-2 *1	52405-25-1 *1	52405-25-3 *1	52405-25-6 *3
Slots	1	1				
Output Channels	2	2				
Source	5W x 2	25W x 2				
Load	5W x 2	10W x 2				
Input Voltage	External 48VDC source required *2					
Input Current	0.7A Max	2.2A Max				
Output Isolation	Isolated	Isolated by External Power Supply				
Bit Resolution	18 bits	18 bits				
Programmable Loop Bandwidth	16 steps	16 steps				
Force Voltage Ranges	±25V, ±10V, ±5V, ±2.5V, ±1V, ±500mV	±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±25V, ±12.5V, ±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±25V, ±12.5V, ±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±25V, ±12.5V, ±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV
Force Current Ranges	±200mA, ±20mA, ±2mA, ±200µA, ±20µA, ±2µA, ±200nA	±3.5A, ±2.5A, ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±2.5A, ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±3.5A(≤5V), ±2.5A(≤10V), ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±6A(≦5V & Pulse Mode Only), ±3.5A(≦5V), ±2.5A(≦10V), ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA
Measure Voltage Ranges	±25V, ±10V, ±5V, ±2.5V, ±1V, ±500mV, ±250mV, ±100mV, ±50mV, ±25mV, ±10mV, ±4mV	±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±25V, ±12.5V, ±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±25V, ±12.5V, ±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV	±25V, ±12.5V, ±10V, ±5V, ±2V, ±1V, ±500mV, ±200mV, ±100mV
Measure Current Ranges	±200mA, ±20mA, ±2mA, ±200µA, ±20µA, ±2µA, ±200nA	±3.5A, ±2.5A, ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±2.5A, ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±3.5A(≤5V), ±2.5A(≤10V), ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA	±6A(≦5V & Pulse Mode Only), ±3.5A(≦5V), ±2.5A(≦10V), ±1A, ±100mA, ±10mA, ±1mA, ±100µA, ±10µA, ±1µA

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SPECIFICATIONS

Model Name	52401-25-200m	52405-5-3 *1	52405-10-2 *1	52405-25-1 *1	52405-25-3 *1	52405-25-6 *3
Force Voltage Accuracy	0.05% reading + 0.0076% F.S. (≥500mV Range) 0.02% reading+25uV (<500mV Range)	0.05% reading + 0.008% F.S. (≥500mV Range) 0.05% reading + 25uV (<500mV Range)				
Force Current Accuracy	0.05% reading +0.05% F.S. (≥2μA Range) 0.05% reading + 200pA (<2μA Range)	0.1% reading + 0.1% F.S. (>1A Range) 0.05% reading + 0.05% F.S. (≤1A Range)				
Measure Voltage Accuracy	0.05% reading + 0.0076% F.S. (≥500mV Range) 0.05% reading+25uV (<500mV Range)	0.05% reading + 0.008% F.S. (≥500mV Range) 0.05% reading + 25uV (<500mV Range)				
Measure Current Accuracy	0.05% reading + 0.05% F.S. (≥2μA Range) 0.05% reading+200pA (<2μA Range)	0.1% reading + 0.12% F.S. (>1A Range) 0.05% reading + 0.05% F.S. (≤1A Range)				
Wideband Source Noise	< 20 mV pp 20Mhz BW No Load	<20mVpp 20MHz BW No Load				
Measurement Sampling Rate	100K Samples/s	100K Samples/s				
Output Connection	6 Wires (±Force, ±Sense, ±Guard)	6 Wires (±Force, ±Sense, ±Guard)				
Measurement Log	32K Samples/channel	32K Samples/channel				
Output Profiling	65535 Steps	65535 Steps				
Trigger Input Trigger Output	1 channel	Programmable 8 channels				
Floating Output	Channel Isolated	Channel Isolated				
Master/Slave Mode	No	Yes				
Programmable Resistance	No	Yes				
Regulatory Compliance	CE/FCC	CE/FCC				

Note *1 : The limitation of the duty cycle for 52405 series.
Below are the maximum duty cycles while PXI-SMU card is at full load with frequency larger than 1Hz : duty cycle = 50% at 2.5A range ; duty cycle = 40% at 3.5A range. When the PXI-SMU card is over temperature, it will automatically disconnect output to protect the unit.
Note *2 : Required voltage range 48V ± 5% ; required voltage noise ≤ 100mVpp
Note *3 : In the pulse mode of 54405-25-6, pulse width 100μS~5mS, maximum duty 5%, and voltage range ±5V only

ORDERING INFORMATION

52401-25-200m : High Precision Source Measurement Unit, 25V/200mA
52405-5-3 : High Precision Source Measurement Unit, 5V/3.5A
52405-10-2 : High Precision Source Measurement Unit, 10V/2.5A
52405-25-1 : High Precision Source Measurement Unit, 25V/1A
52405-25-3 : High Precision Source Measurement Unit, 25V/3.5A
52405-25-6 : High Precision Source Measurement Unit, 25V/6A under Pulse Mode
A524006 : External AC-DC Power Adapter (drives up to 3x 52401 or 1x 52405 SMUs)
A524011 : High Power External AC-DC Adapter (drives up to 3x 52405 SMUs)
A524009 : 52405 Output Triaxial Cable, except 52405-25-6
A524012 : 52405-25-6 Cable Set, for 52405-25-6 application only

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