

## Introduction

The SemiTek 201.net Discrete Semiconductor Test System is PC-based using a CPU-based hardware controller to control the electrical tests it performs. In its sixth generation, the 201.net has served the semiconductor test industry for over twenty-five years in manufacturing and inspection.

As a general-purpose tester, the 201.net is ideal for inspection and production applications where precision measurements and versatility are required.

Under program control, the 201.net tests a growing number of devices including:

- Diodes / Zeners
- Bipolar Transistors
- Field Effect Transistors
- Arrays
- MOSFET
- MOSFET Depletion
- Optocouplers
- JFet / JFet NO
- Mechanical Relays
- Sidac
- Triac / SCRs

This list lengthens as SemiTek develops new hardware and software modules to meet the application-specific needs of our customers. For more information, refer to the 201.net Series Detailed Test Specifications.

Modular-in-design, the standard 201.net test system is configured in a bench top enclosure approximately 20 inches wide, 24 inches deep, and 22 inches high. Stimulus and measurement resources are shared with up to four remote test terminals.

There are two test terminal configurations. The standard is used primarily for 3-leaded devices and includes an interface/adaptor receiver for Base, Collector, Emitter, and Guard. In addition to a multi-pin matrix, the 5x16 Matrix test terminal includes two additional voltage sources under program control for devices such as mechanical relays, opto-couplers, multiple parts in a large package, arrays, hybrid parts with logic, etc.

The SemiTek 201.net XTOS operating system controls the test system and provides a window-oriented user interface for programming and operation. The most popular method to program involves selecting pre-programmed Actions and filling in the specification limits and test conditions. Quick key Help is always available for every Action.

## Main Station

The 201.net Main Station houses the common test control modules, power sources, and measurement instrumentation. Modules are interconnected via discrete cable assemblies to minimize internal system resistance and improve test measurement accuracy. This architectural design makes the SemiTek 201.net the most reliable system available.

### • Operation Overview

For each Action (test instruction), the I/O Module sends commands to the other modules to establish their voltage and current range settings. These settings are then applied to the DUT by the Source Modules. Typically the Input Source drives the DUT input terminal (transistor base, thyristor gate, etc.) while the Output Source drives the DUT output terminal (transistor collector, thyristor anode, etc.). The third terminal (transistor emitter, thyristor cathode, etc.) is the common, or reference, terminal and is sensed by the Measurement Module. The Measurement Module is the ground reference.

The Input and Output Modules stimulate the DUT. Depending on the test command, either the DUT input voltage, output voltage, or common current is measured. The Measurement Unit has a 16-bit ADC and reports the measured values to the controlling computer through the I/O Module. The computer compares the test results and determines the DUT acceptance compared to the programmed action specification.

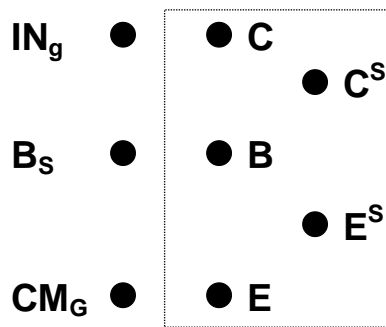
The 201.net's Relay Module plays an integral role in the system's test function connecting each module to the DUT in any combination. The integrated relay matrix controls power to the DUT and the Kelvin Sense leads. An additional relay is provided to connect a plug-in external component (like a resistor) between the DUT base and emitter.

- **System Power Source**

The standard Output Source Module of the 201.net provides up to 200V or 20A under program control. With the 0201130 Power Module Add-on, this can be extended to 2000V or 200A.

- **Device Under Test (DUT) Interface**

The DUT interface is configured using eight patterned terminal receptacles providing Base (**B**), Base Sense (**B<sub>S</sub>**), Collector (**C**), Collector Sense (**C<sub>S</sub>**), Current Meter Guard (**CM<sub>G</sub>**), Emitter (**E**), Emitter Sense (**E<sub>S</sub>**), and Input Guard (**IN<sub>g</sub>**). These terminals connect to the interface plugs of the DUT Adapter to access the DUT. For handler applications, a Handler Adaptor connects these leads to the handler contacts via cables. SemiTek has a complete inventory of device adapters for any type requirement and manual testing. This 201.net Standard interface is shown below (Test Terminal View).



**Terminal Legend**

- B Base (Normally connected to the Source Input Module)
- B<sub>S</sub> Base Sense
- C Collector (Normally connected to the Source Output Module)
- C<sup>S</sup> Collector Sense
- CM<sub>G</sub> Current Meter Guard
- E Emitter (Normally connected to the System Current Meter)
- E<sup>S</sup> Emitter Sense
- IN<sub>g</sub> Input Guard

 Terminal layout is compatible with the Tektronix Curve Tracer 576-style interface adapters.

## 201.net Standard Electrical Specifications

Provided here is a summary of the stimulus and measurement system modules. For complete electrical specifications, refer to the 201.net Series Detailed Test Specifications.

- **Source Input Module**

The Source Input Module is normally the source for power applied to the input terminal of the DUT. According to the mode commanded digitally by the I/O Unit, that power may be controlled as voltage at the DUT input (voltage source mode), or as current into the DUT input (current source mode). In voltage source mode the current is limited according to the current range selected.

	Range	Accuracy <sup>(1)</sup>	
		Full Scale	Value
<b>Voltage</b>			
<b>Standard</b>	+/-4.000V	+/-0.25%	+/-0.25%
	+/-40.00V	+/-0.25%	+/-0.25%
<b>Current</b>			
<b>Standard</b>	+/-200.0nA	+/-1.00%	+/-1.00%
	+/-2.000uA	+/-0.25%	+/-0.25%
	+/-20.00uA	+/-0.25%	+/-0.25%
	+/-200.0uA	+/-0.25%	+/-0.25%
	+/-2.000mA	+/-0.25%	+/-0.25%
	+/-20.00mA	+/-0.25%	+/-0.25%
	+/-200.0mA	+/-0.25%	+/-0.25%
	+/-2.000A	+/-0.25%	+/-0.25%
	+/-20.00A	+/-0.25%	+/-0.25%

• **Source Output Module**

The Source Output Module is the source for current applied to the output terminal of the DUT. According to the mode commanded by the I/O Unit, the current may be controlled as to voltage at the DUT output (voltage source mode), current into the DUT output (current source mode), or voltage via a selected series resistor to the DUT output (load mode).

	Range	Accuracy <sup>(1)</sup>	
		Full Scale	Value
<b>Voltage</b>			
<b>Standard</b>	+/-2.000V	+/-0.25%	+/-0.25%
	+/-20.00V	+/-0.25%	+/-0.25%
	+/-200.0V	+/-0.25%	+/-0.25%
<b>0201130 Add-on</b>	+/-20000V	+/-0.50%	+/-0.50%
<b>Current</b>			
<b>Standard</b>	+/-200.0uA	+/-0.25%	+/-0.25%
	+/-2.000mA	+/-0.25%	+/-0.25%
	+/-20.00mA	+/-0.25%	+/-0.25%
	+/-200.0mA	+/-0.25%	+/-0.25%
	+/-2.000A	+/-0.25%	+/-0.25%
	+/-20.00A	+/-0.25%	+/-0.25%
<b>0201130 Add-on</b>	+/-200.A	+/-0.50%	+/-0.50%

• **Measurement Module**

The Measurement Unit of the 201.net is configured to make different types of measurement by the I/O Unit via the 8-bit data bus. It can measure the current from the DUT common terminal or the DUT input or output voltage from one of the source unit voltmeters. The measurement is made by a fast 16-bit ADC. The measurement is then reported to the PC via the CPU-based controller.

The DUT input voltage and output voltage are measured in the Input Source and Output Source respectively and scaled samples sent to the Measurement Unit. The common current of the DUT is measured in the Measurement Unit by providing a path to ground through a selectable shunt resistor and measuring the resultant voltage drop.

	Range	Accuracy <sup>(1)</sup>	
		Full Scale	Value
<b>Voltage</b>			
<b>Standard</b>	+/-2.0000V	+/-0.25%	+/-0.25%
	+/-20.000V	+/-0.25%	+/-0.25%
	+/-200.00V	+/-0.25%	+/-0.25%
	+/-4.0000V	+/-0.25%	+/-0.25%
	+/-40.000V	+/-0.25%	+/-0.25%
<b>0201130 Add-on</b>	+/-2000.0V	+/-0.50%	+/-0.50%
<b>020333 Add-on</b>	+/-200.00mV	+/-0.25%	+/-0.25%
	+/-20.000mV	+/-0.50%	+/-0.50%
<b>Current</b>			
<b>Standard</b>	+/-200.00nA	+/-4nA	+/-0.50%
	+/-2.0000uA	+/-0.25%	+/-0.25%
	+/-20.000uA	+/-0.25%	+/-0.25%
	+/-200.00uA	+/-0.25%	+/-0.25%
	+/-2.0000mA	+/-0.25%	+/-0.25%
	+/-20.000mA	+/-0.25%	+/-0.25%
	+/-200.00mA	+/-0.25%	+/-0.25%
	+/-2.0000A	+/-0.25%	+/-0.25%
	+/-20.000A	+/-0.25%	+/-0.25%
<b>0201130 Add-on</b>	+/-200.00A	+/-0.50%	+/-0.50%
<b>0201132 Add-on</b>	+/-2.0000nA	+/-1.00%	+/-0.50%
	+/-20.000nA	+/-0.50%	+/-0.50%
<b>0201330 Add-on</b>	+/-20.000pA	+/-2.50%	+/-2.50%
	+/-200.00pA	+/-2.50%	+/-2.50%
	+/-2.0000nA	+/-1.00%	+/-0.50%
	+/-20.00nA	+/-0.50%	+/-0.50%
<b>AC</b>			
<b>Standard</b>	Gain=1	+/-1%	+/-1%
	Gain=10	+/-1%	+/-1%
	Gain=100	+/-1%	+/-1%
	Gain=1000	+/-2%	+/-2%

## Test Terminals

A test terminal provides the interface between the Device Under Test and the test and measurement instruments of the tester. SemiTek offers two terminals designed for general applications. Custom terminals for specific applications are also available.

**0201295-02** The Standard Stand-alone terminal provides the Device Under Test (DUT) platform which includes test activation buttons, PASS/FAIL indicators, and binning indicator. The test terminal is approximately 20 inches wide, 12 inches deep, and 5 inches high and is provided with six (6) foot interconnect cables.

**0201163** The 0201116, 5x16 Test Terminal provides the capability to test mechanical relays, opto-couplers, multiple parts in a large package, arrays, hybrid parts with logic, etc. It is configured with the standard DUT terminal access and a 37-pin connection to the 5x16 built-in matrix. The test terminal includes:

- Two programmable power sources with a voltage range of 800mV and 8.00V in current monitoring ranges of 200mA, 20mA, 2mA, 200microA, and 20microA.

Note: Maximum 2000V/200A at standard DUT terminal and 200V/10A using the 5x16 matrix. Both DUT terminals can be configured for 1000V/10A.

## System Options

The 201.net has many options to consider for specialty or unique tests or functions. This list of options includes most of the popular available, but SemiTek engineering is open to any request.

**0201130** Power Module. The power module extends the output capability of the Output Module to 2000V/200A under program control. Includes 0201076 Diagnostic Adapter set. Unit is installed in the Main Station and requires factory Installation.

**0201132/  
0201132M** 20nA Low Current Test Head mounted (1000V Max.). 0201132 for use with a standard test terminal and 0201132M for use with the 5x16 Matrix and built in. Provides the following add-on test ranges:

<u>Range</u>	<u>Resolution</u>
20.000nA	1pA
2.0000nA	100femtoA

**0201166/  
0201166M** Ton/Toff/Tr/Tf Test Head and Adapter for Optical Couplers and relays 100nSec Resolution 10A Max. 0201166 for use with a standard test terminal and 0201166M for use with the 5x16 Matrix and built in.

**0201193** Handler/Prober Multiplexed Interface with customer-supplied mating connector and interface schematics for Logic and Analog signals. (Requires Test Terminal)

**0201314** Calibration Test Head. The calibration test head provides a series of precision resistors calibrated and traceable to NIST standards to verify the accuracy of the 201.net system instrumentation. Verify test routines are provided to check each stimulus and measurement range of the system. Requires a Keithley Meter 2000DMM with IEEE-488 interface quoted separately.

**0201315** Thermal Resistance Testing of die attachment for Diodes and Thyristors. Provides the following heating current ranges:

<u>Current</u>	<u>Max Duration</u>
2.0A	65 sec
20.0A	100 ms
20.0A	65 sec (Requires external source.)

Measurement delay programmable from 3msec to 3msec.

**0201318** I-Hold Network Test Head for Thyristors, including provision to call up various loads and networks in test program. Includes an auxiliary source for I-Hold pre-bias.

- 0201322** Inductive Load Test Head. Used to verify how much energy a component can withstand without physical damage. The energy (measured in Joules) is 200pJ to 1.5J. Generated from the following programmable stimulus:
- Current Up to 10A
  - Inductance 100uH to 204.7mH
- 0201324** Power Module to Base Adapter. Used to switch Power Module output to the Base lead of a dual diode device.
- 0201330** 20pA Low Current Test Head (200V Max). Adds low current measurement capability to the standard 201.net test system to test any device under test (DUT). Using UHF-style connectors to interface the DUT, the current is more accurately measured by making the actual measurement as close to the DUT as possible. Test signals are multiplexed through the test head's 6x2 relay matrix to test dual device package types. The test head is fully programmable and adds the following measurable current ranges:
- Range Resolution
- 20.000nA 1pA  
2.0000nA 100femtoA  
200.00pA 10femtoA  
20.000pA 1femtoA
- 0201333** 20mV Low Voltage Measurement. Extends the Output Source to include milliohm measurement ranges of RDSon in Fets and relay contact resistance.
- Range Resolution
- 200.00mV 10mV  
20.000mV 1mV
- 0201337** Three Phase Bridge Diode Rectifier Switch Matrix Test Head. The Test Head provides an external matrix to multiplex the 201C test system resources to test a bridge rectifier. It tests the Forward and Reverse characteristics of each individual diode within a bridge while using a proprietary guard circuit to eliminate any parallel electrical leakage paths.
- 0201357** Sidac Test Head. Provides firing current to 10A to 20A at 100V/us. Measures peak switching voltage (up to 600V), forward voltage drop (up To 20V at up to 2A), and holding current.
- 0201630** 3x6 Matrix Test Head. Used to connect dual 3-leaded packaged devices using the 0201295-02 test terminal.
- 0201361** External Scope Timing Test Head for measuring Ton, Toff, Trr etc. 1nSec resolution for devices such as diodes, transistors and FETs. Used to measure switching times for small-signal discrete semiconductor devices, such as FETs, Bipolar, and Diode devices in accordance with MIL-STD-750, Paragraph 4.1. This general-purpose test head is used with an external oscilloscope and designed primarily for use in receiving inspection and some production applications. The following tests may be performed and are fully programmable, within the specifications listed below:
- | Device | Bipolar-ON | Bipolar-OFF | FET-ON | FET-OFF | DIODE |
|--------|------------|-------------|--------|---------|-------|
| Test   | Ton        | Toff        | Ton    | Toff    | trr   |
|        | Td         | Ts          | Td(on) | Td(off) |       |
|        | Tr         | Tf          | Tr     | Tf      |       |
- Pass-through Mode
    - Current: 0 to 20A
    - Voltage: 0 to 1000V

- Timing Mode
  - Collector/Drain Current 0 to 10A
  - Collector/Drain Voltage 0 to 200V at 200mA
  - Collector/Drain Voltage 0 to 20V at 10A
  - Base/Gate Current (pulse) 0 to 1A
  - Base/Gate Voltage (pulse) 0 to 20V
  - Trr Current (pulse) 0 to 1A

Requires 0201361 Series DUT adapters. Digital Storage Oscilloscope quoted separately.

- 0201362** Test Terminal Multiplexer – The Terminal Multiplexer multiplexes the control and signal buss of the 201 and allows multiple terminals to be controlled by a single Main Station. One multiplexer is required for every two or more detached test terminals.
- 0201365** Quad Parametric/20nA Low Current Test Head. Provides four (4) active multiplexed test sites to switch tests leads. Each site is addressable under program control and limited to one test routine at a time. Test Head also provides the following add-on test ranges for each site:
- | <u>Range</u> | <u>Resolution</u> |
|--------------|-------------------|
| 20.000nA     | 1pA               |
| 2.0000nA     | 100femtoA         |
- 0201366** RDson Prober Matrix System Module. Used to test the low milliohm RDson of a single MOSFET device on a wafer when access to the bottom-side Drain is not directly available. Under program control and using the 0201365 Quad Parametric/20nA Low Current Test Head, the RDson Prober Matrix Module provides a matrix and 4-wire top-side access of the bottom-side Drain through the Source contact of an adjacent device. Requires 0201365 Quad Parametric/20nA Low Current Test Head.
- 0201368** Capacitance/Inductance Measurement Test Head. Provides the capability to test capacitance and inductance using an external meter. Results are integrated with the standard results output of the 201.net system. External meter not included and manufacturer and model are subject to review.

## XTOS Operating System

The XTOS Operating System is Microsoft Windows 7 Professional based and used to control the programming and operation of the 201.net Test System. From individual windows, the operator will select a test file to run and view the results. Whether the device passes or fails is determined by it meeting the criteria specified at the time of programming. Pass or Fail indicators are in clear view of the operator at the monitor and the test terminal. A Results window lists each of the tests performed and includes a pass/fail indicator to advise the operator of each specific test's status.

Programming is made simple using the XTOS Build editor. A new test file is opened and preformatted test or Action modules are selected to add to the new file or routine. Each component of the test is specified and once all the modules are set up, the file is compiled and ready for use. Help is included in several forms. F1 key for complete help on a module or test, hovering over an input area or test label, through the Help index, or through the virtual manual.

## Operating Specifications

- **Power**

115 VAC, single phase, 60 Hz, 20 Amp standard input with the ground pin connected to earth ground. International power also available.

- **Environmental**

Temperature: 15 to 35° C

Humidity: 70% RH Non Condensing to 1000M ohm  
50% RH Non Condensing above 1000M ohm

## **Other**

- Programming assistance.
- Programming, Operations, and Maintenance Manuals on CD.
- Installation and on-site training. (Optional)
- Spares Kit. (Optional)

## **SemiTek Advantages**

- Manufactured in the U.S.A.
- Large worldwide installation base.
- One (1) year full system warranty, part and labor.
- Free training available at SemiTek facilities in Dallas, TX.
- Twenty-four (24) hour technical assistance
- Module replacement program.
- Software upgrades for the life of the system.