

Description

The 8029 is a 400 watt electronic load suitable for testing and characterising a wide variety of dc power sources. It can be used to investigate the behaviour of many different types of power source such as batteries and solar cells, as well as electronic power supply units.

Its wide voltage/current range, multiple operating modes and built-in transient generator give it the versatility to offer test solutions from the design laboratory through to the component test area. The 8029 is full bus remote control via USB and RS-232, connected to a control centre module or external PC.

Multiple Modes of Operation

Constant Current:

Constant current mode is used for load testing of normal voltage source power supplies and for constant current discharge testing of batteries. This mode provides rapid measurement of power source regulation (V/I characteristics).

Constant Voltage:

Constant voltage mode is used for load testing of constant current power supplies. The unit operates as a high power shunt regulator.

Constant Power:

Constant power mode simulates a load whose power consumption is independent of the applied voltage. This is true of many types of equipment that incorporate switchmode regulators. This mode may be particularly suitable for testing power sources of portable devices such as Lithium-ion batteries.

Constant Resistance:

Constant resistance mode simulates a standard resistive load by providing a current drain proportional to voltage. Settings are displayed in Ohms or milli-Ohms. Unlike fixed resistors or rheostats, the load provides a precisely controllable resistance with high power dissipation over a wide value range.

Constant Conductance:

Constant conductance (CG) mode is also incorporated. As well as showing settings in amps per volt, this mode provides better resolution when setting very low equivalent resistance values.

Features

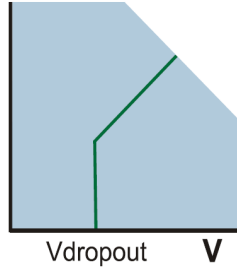
- Versatile solution for testing DC power sources
- Constant current, resistance, conductance, voltage and power modes
- Wide voltage and current range, 0 to 80 V and 0 to 80 A
- 400 W continuous dissipation at 28 °C (360 W at 40 °C)
- 600 W short-term dissipation capability
- Low minimum operating voltage of below 1 V at 40 A
- High resolution and accuracy for level setting
- Built-in transient generator with variable slew
- Current monitor output for waveform viewing
- Variable drop-out voltage for battery testing
- High resolution backlit graphic LCD with soft key control
- Analog remote control of levels and TTL control of on/off and transient switching
- Programmable, EasyCal software compatible
- Primary console fitting



Features (continued)

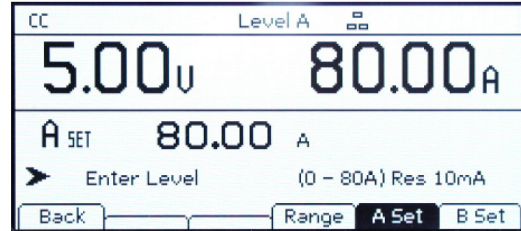
Adjustable voltage drop-out

Resistive discharge (conductance mode) with voltage dropout. **I**
Note that in CR mode the load performs the equation $I = (V - V_d)/R$ where V_d is the dropout voltage.



Some power sources, such as rechargeable batteries, can be damaged if their output voltage falls below a certain level. The 8029 provides automatic protection by incorporating fully variable voltage dropout (CI, CR, CG and CP modes). If the voltage applied to the load falls below a preset level, the load current is rapidly reduced to zero.

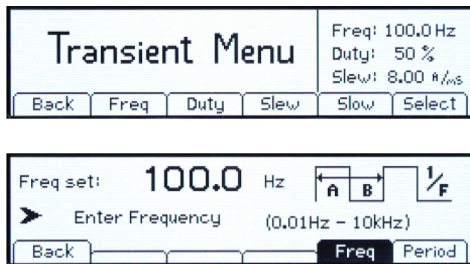
High resolution setting and measurement



The levels for each operating mode are set using high quality ten turn potentiometers for both level A and level B.

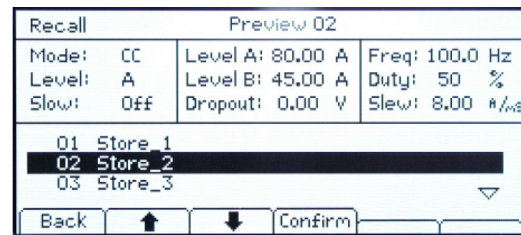
Levels are displayed using four digit meters which provide resolution down to 1mA, 1mV and 1mΩ. The meters have an accuracy of 0.1% for voltage and 0.2% for current.

Transient generator and variable slew



The 8029 incorporates a full variable frequency, variable duty cycle transient generator. Switching between the two preset levels can be done at any frequency between 0.1Hz and 10kHz. The transient generator can be used in all operating modes. The rate of change between levels (slew rate) is controllable over a wide range. Slew rate control applies to all changes of level including remote control and manual changes between level A and level B. A slow-start function can be selected for situations where latching would otherwise occur at switch-on.

Setting Memories



Thirty non-volatile memories are provided which store all of the parameters of the load. This makes the 8029 module ideal for repetitive test use.

Current waveform monitor

It is often important to be able to observe the load current waveform on an oscilloscope. The 8029 provides a calibrated monitor output for this purpose as well as a sync output from the transient generator. The monitor output has several volts of compliance with respect to the load input, thus allowing it to be connected to a grounded oscilloscope without current diversion.

Remote control

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Technical Specifications

Input specifications

Maximum input ratings

Current	80 Amps max. through the rear panel terminals. 30 Amps max. through the front panel terminals.
Voltage	80 Volts max. while conducting current. Surge suppressors start to conduct at 120 V (nominal). Max. non-repetitive surge energy: 80 Joules.
Power continuous	400 Watts max. up to 28 °C, derating to 360 watts at 40 °C.
(1) Power short term	600 Watts max. up to 28 °C, for up to 60 seconds on-time, with off time at least double the on time.
Min. Operating volts	<2 V at 80 A; typically equivalent to 25 mOhm above 100 mV (at 4 A).
Off state leakage	< 10 mA (including voltage sense circuit input resistance).
Reverse polarity	Diode will conduct; 80 Amps max.
Isolation voltage	± 300 Vdc max, either load input to chassis ground.

Input terminals

Rear panel input	Safety terminals accepting 5 mm diameter wire, or 8 mm spades up to 80 A max, or 4 mm plugs at 30 A max.
Front panel input	Safety terminals accepting 4 mm diameter wire, 4 mm plugs or 6.5 mm spades up to 30 Amps max.

External voltage sense

Connection	Terminal block on rear panel. Sense selection by slide switch.
Input impedance	680 kOhm each input to load negative.
Max. sense offset	6 V (allowance for backing-off supply for zero volt operation).

Transient control

Transient generator

Pulse repetition rate	Adjustable from 0.01 Hz (100 seconds) to 10 kHz.
Pulse duty cycle	1 % to 99 % (percentage of period at Level A).
Setting accuracy	± 1 %

Slew rate control

The slew rate control applies to all changes of level whether caused by manual selection, remote control or the transient generator. The level change is a linear slew between the two level settings. The range available in each mode is shown above.

Setting accuracy..... ± 10 % (on linear part of slope, excl. high frequency aberrations).

Variation in level

Settings..... ± 5 digits of specified setting resolution for present mode and range.

Oscillator sync output

Connection..... Terminal block on rear panel. Opto-isolated open collector output conducts during Level B phase of internal transient generator.

Ratings..... Max Off State Voltage: 30 V. Collector Current: 2 mA (typical)

Dropout voltage

The load will cease to conduct if the applied voltage falls below the Dropout Voltage setting; active in all modes except Constant Voltage. The Dropout Voltage setting is also the threshold for the Slow Start facility and acts as an offset voltage in Constant Resistance mode.

Setting accuracy..... ± 2 % ± 20 mV.

Slow start

If Slow Start is enabled, the load will not conduct any current until the source voltage reaches the Dropout Voltage setting; it will then ramp the controlled variable up (in CC, CP and CG modes) or down (in CR and CV modes) to the Level setting at a rate determined by the Slew Rate setting.

Operating modes

Constant current mode (CC)

Current ranges	0 to 8 A (1 mA resolution) and 0 to 80 A (10 mA resolution).
Setting accuracy	± 0.2 % ± 30 mA.
Regulation	< 30 mA for 90 % load power change (V > 2 Volts).
Temp. coefficient	< (±0.02 % ± 5 mA) per °C.
(2) Slew rate ranges:	
8 A range	<2.5 Amp per s to >250 Amp per ms. 80 A range: <25 Amp per s to >2500 Amp per ms.
(3) Min. transition time	50 μs.

Constant power mode (CP)

Power range	0 to 400 (or 600) Watts.
Setting accuracy	± 0.5 % ± 2 W ± 30 mA).
Regulation	< 2 % over 5 V to 75 V source voltage change (using remote sense).
Temp. coefficient	<(± 0.1 % ± 5 mA) per °C.
(2) Slew rate ranges	<40 W per s to >6000 W per ms.
(3) Min. transition time	150 μs.

Constant resistance mode (CR)

Resistance ranges	0.04 to 10 Ohm (0.01 Ohm resolution); 2 to 400 Ohm (0.1 Ohm resolution).
Setting accuracy	± 0.5 % ± 2 digits ± 30 mA.
Regulation	< 2 % for 90 % load power change (V > 2 Volts, using remote sense).
Temp. coefficient	< (±0.04 % ± 5 mA) per °C.
(2) Slew rate ranges	10 Ohm range: <1 Ohm per s to 100 Ohm per ms. 400 Ohm range: <40 Ohm per s to 4000 Ohm per ms.
(3) Min. transition time	150 μs.

Constant conductance mode (CG)

Conductance ranges	<0.01 to 1 A/V (1 mA/V resolution); <0.2 to 40 A/V (0.01 A/V resolution).
Setting accuracy	± 0.5 % ± 2 digits ± 30 mA.
Regulation	< 2 % for 90 % load power change (V > 2 Volts, using remote sense).
Temp. coefficient	< (±0.04 % ± 5 mA) per °C.
(2) Slew rate ranges	1 A/V range: <0.1 A/V per s to >10 A/V per ms. 40 A/V range: <4 A/V per s to >400 A/V per ms.
(3) Min. transition time	150 μs.

Constant voltage mode (CV)

Voltage ranges	Vmin to 8 V (1 mV resolution) and Vmin to 80 V (10 mV resolution).
Vmin depends on current	typically <2 V at 80 A
Setting accuracy	± 0.2 % ± 2 digits.
Regulation	< 30 mV for 90 % load power change (using remote sense).
Temp. coefficient	< (0.02 % + 1 mV) per °C.
(2) Slew rate ranges	8 V range: <0.8 V per s to >80 V per ms. 80 V range: <8 V per s to >800 V per ms.
(3) Min. transition time	150 μs.



Technical Specifications - Continued

Meter specifications

Display type256 x 112 pixel backlit graphic LCD.

Measured values

Volts & Amps Measured values of current through and voltage across the load.

Watt & Ohms Power and equivalent load resistance, calculated from Volts and Amps.

Voltage accuracy $\pm 0.1\% \pm 2$ digits.

Current accuracy $\pm 0.2\% \pm 3$ digits.

Current monitor output

Output terminals 4 mm safety sockets on front panel or terminal block on rear panel.

Output impedance 600 Ohms nominal, for >1 MOhm load (e.g. oscilloscope)

Scaling 50 mV per Amp (4 Volts full scale).

Accuracy $\pm 0.5\% \pm 5$ mV.

Common mode range ± 3 V dc max. See note (4).

Analog remote control

External control input characteristics

Connection Terminal block on rear panel.

Input Impedance 400 kOhm each input to load negative.

Common Mode

Range ± 100 V to load negative.

External analogue voltage control

Operating mode The applied voltage sets the operating level within the selected range.

Scaling 4 Volts full scale.

Accuracy $\pm 2\% \pm$ accuracy of selected range.

Common mode

Rejection Better than -66 dB.

External logic level (TTL) control

Operating mode The applied signal selects between Level A and Level B settings.

Threshold + 1.5 V nominal. A logic high selects Level B.

Remote disable input

Connection Terminal block on rear panel.

Input to the LED of an opto-isolator through 1 kOhm resistor.

Threshold Apply > +3 V to disable load input (+12 V maximum)

Digital remote control

Digital remote interfaces

USB & RS232 interfaces for full remote control. When ordered with a control centre module it is connected inside the console.

RS232 Standard 9-pin D connection. Baud rate: 9600.

USB Standard USB 2.0 connection. Operates as virtual COM port.

GPIB (optional) Conforming to IEEE488.1 and IEEE488.2. Capabilities SH1, AH1, T6, L4, SR1, RL2, PP1, DC1, DT0, C0, E2.

LAN (optional) Ethernet 100/10base-T connection with auto cross-over detection. LXI v1.4 Core 2011 compliant.

Protection

Excess power The unit will attempt to limit the power to approx 430 Watts; if this fails the unit will trip into the fault state at about 460 Watts. If intermittent mode operation is enabled, these levels are 610 W and 630 W.

Protection current The input is disabled if the measured current exceeds a user set limit.

Excess current The unit will trip into the fault state at nominally 92 Amps.

Protection voltage The input is disabled if the measured voltage exceeds a user set limit.

Excess voltage The unit will conduct a current pulse (to absorb inductively generated spikes) for 1 ms at about 90 V.

The unit will trip into the fault state at nominally 106 V.

Surge suppressors will start to conduct above 120 V.

Temperature The unit will trip into the fault state if the heatsink temperature exceeds safe levels.

Sense error The unit will trip into the fault state if the external voltage sense is more than 6 V below the internal sense.

General

AC input 110 V–120 V or 220 V–240 V AC $\pm 10\%$, 50/60 Hz. Installation Category II. As per CalBench supplied.

Power consumption 30 VA max. Mains lead rating 6 A.

Operating range + 5 °C to + 40 °C, 20 % to 80 % RH.

Storage range - 40 °C to + 70 °C.

Environmental Indoor use at altitudes up to 2000 m, Pollution Degree 2.

Cooling Variable speed fan in module. Console cooling system.

Safety Complies with EN61010-1 and EN61010-2-030.

EMC Complies with EN61326.

Module width 295 mm (primary console fitting only)

Specification Notes

(1) In 600 Watt short-term operation mode the dynamic response is not specified, and both the slew rate and the transient oscillator frequency range are restricted. The slew rate limitation applies also to external voltage control. This mode is primarily intended for limited duration operation at a fixed level setting.

(2) Slew Rate Ranges refer to the theoretical slope of the transition between two levels, regardless of whether that transition can be achieved when taking into account the level difference, the set transition duration, the minimum transition time, and the characteristics of the source.

(3) Minimum Transition Time specification is an indication of the fastest available transition using a benign battery source and low inductance connections, with a minimum terminal voltage of 5 V and a minimum current of 1 A. The actual performance attainable with electronically regulated power supplies depends on the combination of source and load loop bandwidths and interconnection inductance.

(4) The common mode capability of the current monitor is to provide tolerance of voltage drops in the cables. The monitor negative must be connected at some point to the load negative circuit. Accuracy specifications apply for 18 °C – 28 °C, at 50 W load power (in normal 400 W mode), after 30 minutes operation at the set conditions; regulation specifies variation at other powers. Setting accuracies apply with slew rate at the 'Default' setting.

Ordering Information

8029 DC Electronic Load Module - 80 A, 80 V, 400/600 watts, programmable.

Due to continuous development Time Electronics reserves the right to change specifications without prior notice.