
# ADVANCED TEC CONTROLLER

## MODEL 54100 SERIES

A thermoelectric cooler (TEC) module is a solid state device which can control heat flux using current. First discovered in the 19th century and called the Peltier effect, TEC's operate by electrical current flow between two dissimilar conductors. Depending on the direction of the flow heat will be either absorbed or released. This technology is very useful for small scale temperature control; providing fast temperature response and ultra-high temperature stability. TEC temperature control equipment is also very compact and energy efficient in comparison to conventional thermal chambers. TECs have the added advantage of control case temperatures directly and have mechanical moving parts.

Chroma's Model 54100 series of advanced TEC Controllers provide an excellent temperature monitoring engine via two thermal couple inputs. The cold junction of the engine is internally stabilized to 0.001˚C, providing 0.01˚C temperature resolution. The TEC driver circuit within the 54100 uses a filtered PWM architecture which provides much higher drive currents over ordinary PWM drivers and provides smooth current modulation which is critical for electro-magnetic sensitive measurements.

Another important feature of Chroma's 54100 TEC Controllers is its true auto tune function providing for optimum control and temperature response. Stability down to the temperature resolution of 0.01˚C is regularly achieved regardless of the size and geometry of thermal platforms.

High TEC driving capability is another merit of Chroma's 54100 controllers. Currently two modles are available (150W and 300W) with 800W under development. More TEC driving power means wider temperature range, faster temperature response, and larger platform applications. For comparable accuracy and stability, Chroma offers one of the best TEC driving power-to-price ratio in the market.

* Operation temperature range of platform is independent with TEC controller range, and proper platform design should be considered to obtain certain temperature.

## MODEL 54100 SERIES

### *KEY FEATURES*

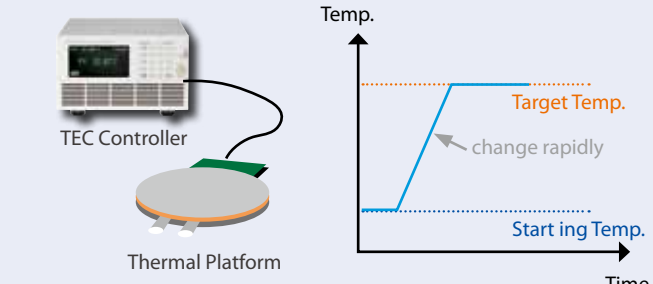
- Bidirectional driving with 150W (24V 8A), 300W (27V/12A),or 800W (40V/20A) output
- Filtered PWM output with >90% driving power efficiency while maintaining linear driving with current ripples<20 mA
- Temperature reading and setting range -50 to 150˚Cwith 0.01˚Cresolution and 0.3˚C absolute accuracy
- Short term stability (1 hour) ±0.01˚C and long term stability ±0.05˚C with optimal PID control
- Feature true TEC large signal PID auto tune for best control performance
- 2 T-type thermal couple inputs, one for control feedback and the other for monitor and offset, providing versatile control modes
- RS232 serial communication port for PC remote operation and thermal data recording
- Powerful and user-friendly PC program available
- Perfect matching all Chroma designed temperature controlled platforms

Chroma

## EXCELLENT THERMAL RESPONSE, TEMPERATURE PRECISION, AND CONTROL STABILITY

TEC module is a bi-directional heat pump controlled by current. So a temperature control system with TEC modules can reach temperatures higher or lower than ambient. Compared with traditional temperature control methods, the 54100 provides a compact, fast responding, solution to thermal control applications.

Chroma's Advanced TEC Controller is specially designed for optimal performance. Changing temperature from one value to another rapidly without overshoot are primary benefits of the 54100 series. Effects of thermal perturbations by the unit-under-test can even be minimized up to 100W on/off, by the 54100 and often reduces temperature variation to less than 1˚C within few seconds. If temperature stability is concerned, Chroma's Advanced TEC Controllers offer 0.01˚C stability in almost most applications.

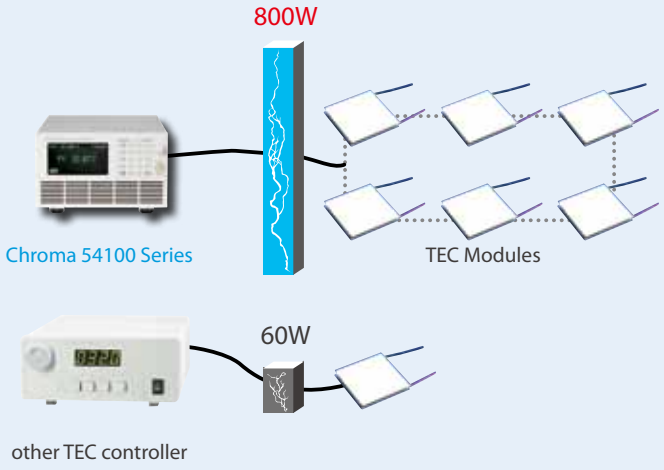



Using Chroma's TEC methord, speed of heating and cooling is about 5~60˚C per minute.

## HIGH DRIVING CAPABILITY

There were many low output power TEC controllers on the market mainly for small devices and small scale lab tests. As technologies grow, higher TEC driving power is required in many modern applications. For example, testing solar cells larger than 4 inch square from -20˚C to 85˚C requires more than 100W driving power and thermal loads of sunlight can add 30W or more. Designers of high power LEDs must have great concern about their thermal properties. 30 W-LED module testing from -20˚C to 150˚C also demands high driving power.

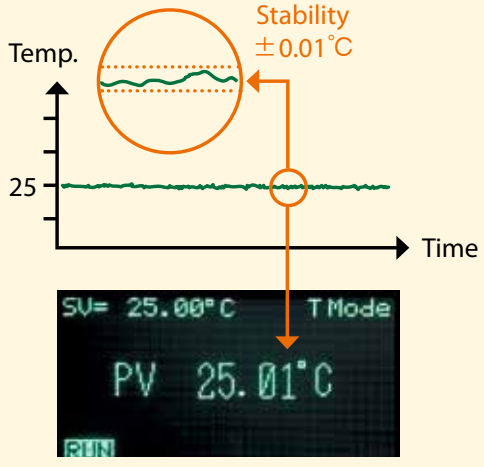
Chroma's Advanced TEC Controllers can deliver 150W or 300W (and soon 800W) driving power, satisfying needs of both small to large platforms. Another benefit of high driving power is that in many applications several units can be driven from a single TEC controller reducing costs and test times.




## HIGH TEMPERATURE RESOLUTION AND ACCURACY

TEC controllers using thermal couples currently on the market usually have accuracy of only about 1˚C and poor resolution (0.1˚C). This is inadequate for many modern applications. For example, rating solar cell power efficiency requires temperature accuracy much better than 1˚C since phase changes of some solar materials can occur within 0.1˚C or less. Some biochemical process can be very sensitive to temperature variations as well. Thermal resistance measurements of heat pipes often results in a temperature deviation much less than 1˚C. Some high resolution TEC controllers are using different types of temperature sensors, such as RTD, temperature IC, or thermistors. Unfortunately, these temperature control methods often cannot provide direct case temperate control/contact and can be too bulky for measuring at the point of interest.

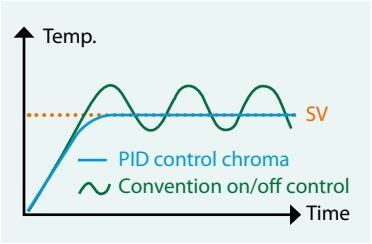
Chroma's Advanced TEC Controllers are thermal couple based and with temperature accuracy* 0.3˚C and resolution down to 0.01˚C. Users can take advantage of a wide range of thermal couple for easy measurement setup, while maintaining high accuracy and resolution. This means users can achieve test results with high repeatability, high accuracy, and therefore high confidence.

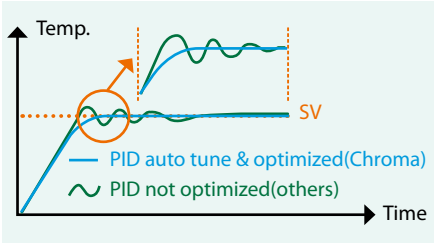



Chroma 54100 Series

## TRUE LARGE-SIGNAL PID / AUTO TUNE FOR TEC CONTROL

PID control is an important feature for a good controller. The PID parameters basically describe the dynamic response of a system and can be very different from one to another. A guarantee of successful control cannot be achieved without setting proper PID parameters and setting PID parameters manually is very time consuming. Chroma 54100 provides an advanced PID auto tune feature making PID setting fast, repeatable and easy.

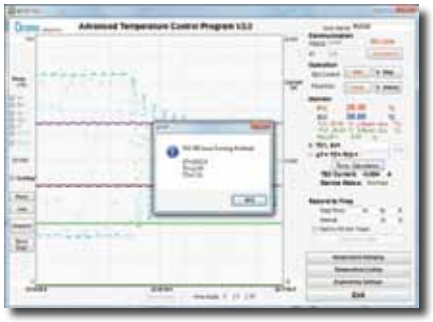


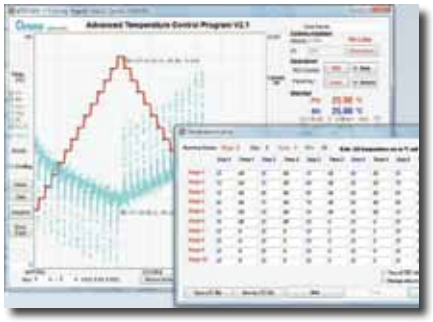




Many other TEC controllers use a small signal and one-directional temperature transient to find PID parameters. This auto tune method is OK for heater only temperature control, but is not always successful for TEC control. In order to truly match the thermal response of a TEC control system, Chroma's Advanced TEC Controllers use a large-signal and bi-directional driving method for PID auto tune. This proprietary method results in the superb temperature control behavior which is fast, precise, and very stable. While some other TEC controllers require a set of PID parameters for every 20˚C interval, Chroma's Advanced TEC Controllers need only a set of optimal PID parameters (usually auto tuned at 40~50˚C) to cover all operation from -40 to 150˚C.

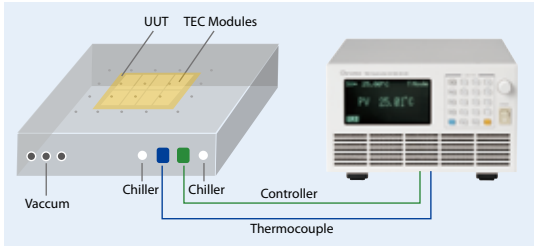
## SOFT PANEL

Available for Chroma's Advanced TEC Controller are graphical softpanels which allow for intuitive control and measurements. Viewing TEC current and temperature vs. time curves, recording data to a file, and running temperature cycling, ramping sub-programs, etc., are all provided. PID parameters, current limit, and other important settings can also be read and set from a pop-up setup windows.





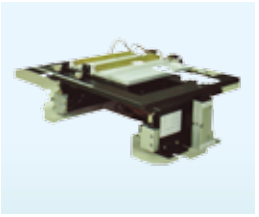
## HIGH EFFICIENCY STANDARD PLATFORMS




TEC Platform Architecture

There are numerous TEC platforms be developed by Chroma for sue with the 54100 TEC Controllers. Such platforms include LEDs, solar cells, e-paper, burn-in, and many others. As shown below each are designs to provide a wide temperature range with typical temperature stability of 0.01˚C.

e-paper



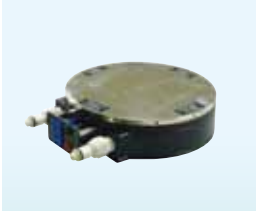
Solar Cell

LED Burn-In

LED Integrated Sphere

Micro Projector

General Platform



Wafer Chuck

## SPECIFICATIONS

| Model | | 54115-24-8 | 54130-27-12 | 54180-40-20 |
|---|---|---|---|---|
| TEC Output Voltage | | 24VDC | 27VDC | 40VDC |
| TEC Output Current | | 8A | 12A | 20A |
| TEC Driving Output Power | | 150W | 300W | 800W |
| **Controller Temperature Performance** | | | | |
| Controller Temperature Setting Range | | -49 to 149˚C | | - 70 to 250˚C *1 |
| Controller Setting Resolution | | 0.01˚C | | |
| Temperature Control Stability | Short Term | ≦0.01˚C | | |
| | Long Term | ≦0.05˚C | | |
| **Temperature Monitoring** | | | | |
| Monitoring Temperature Range | | -49 to 149˚C | | - 70 to 250˚C *1 |
| Temperature Sensor Type | | T-type thermocouple | | Standard : T-type thermocouple<br>Optional : K-type thermocouple |
| Monitoring Temperature Resolution | | 0.01˚C | | |
| Monitoring Temperature Relative Accuracy | | < ±0.3˚C | | |
| Monitoring Temperature Absolute Accuracy | | < ±(0.3+0.002×\|T-25\|) ˚C | | |
| **Environmental** | | | | |
| Working Temperature | | 5~40˚C | | |
| Humidity | | < 80 % RH | | |
| Power Requirement | | 90 to 240 VAC, 50/60 Hz | | |
| Maximum Power Consumption | | 330W | 550W | 1400W |
| Fuse | | 3A/250V | 5A/250V | 12A/250V |
| PC Communication Port | | RS-232 Half Duplex | | RS-232 Half Duplex ;<br>USB2.0 ;<br>LAN 10/100Mbps |
| Storage Temperature | | -20~60˚C | | |
| Storage Humidity | | 80%R H | | |
| Dimensions (WxDxH) | | 362 x 286 x 131.2 mm / 14.3 x 11.3 x 5.17 inch | | 241 x 441 x 135 mm /<br>9.5 x 17.4 x 5.3 inch |
| Weight | | 6.3 kg / 13.9 lbs | 6.6 kg / 14.6 lbs | 9.5 kg / 20.9 lbs |

**Note *1 :** Platform temperature range is highly relating to the structure and design and will need to apply external elements to reach extreme conditions. To reach below -30 degree, it will need extra coolant. To reach beyond 150 degree, other heating material will need to be considered.

**Note *2 :** The temperature control stability depends on not only the controller but also platform and environment. The PID parameters must be optimized for the platform. Avoid any liquid or air turbulence around the platform. Attach the temperature feedback thermocouple firmly with good thermal conductivity. Shield for electromagnetic interference if necessary. Extremely high control temperature stability can be achieved with all these issue taken care.

**Note *3 :** Monitoring Temperature Relative Accuracy is defined as the temperature difference between the two thermocouples reading the same thermal point. It is the working ambient temperature, which must be thermal balance within 20~30˚C, and exclude thermocouples error for controller specifications to be guaranteed. If the operation temperature is out of 20~30˚C, the specification will be modified to < ±(0.3+0.002×|T-25|), where T here is the working ambient temperature.

## ORDERING INFORMATION

**54115-24-8 :** TEC Controller 150W
**54130-27-12 :** TEC Controller 300W
**54180-40-20 :** TEC Controller 800W
**A541151 :** TEC Thermal Platform for LED integrated sphere
**A541152 :** TEC Thermal Platform for LED burn-in
**A541153 :** TEC Thermal Platform for LED wafer
**A541154 :** TEC Thermal Platform for e-paper
**A541155 :** TEC Thermal Platform for solar cell

54115-24-8 / 54130-27-12

54180-40-20

**Distributed By:**
**Signal Test, Inc**
**1529 Santiago Ridge Way**
**San Diego, CA 92154**
**Tel. 1-619-575-1577 USA**
**www.SignalTestInc.com**
**Sales@SignalTestInc.com**

SIGNAL TEST™
New & Used Test Equipment