Advanced TEC Controller
Model 54100 Series

A thermoelectric cooler (TEC) module is a solid state device which can control heat flux using current. It is very useful in small scale temperature control, providing fast temperature response and ultra-high temperature stability. TEC temperature control equipment can also be very compact and green. No mechanical moving or hot/cold material consumption is needed.

Chroma's Advanced TEC Controllers have an excellent temperature monitoring engine, which allows 2 T-type thermocouple inputs. The cold junction of the engine is internally stabilized up to 0.001°C, for that 0.01°C temperature resolution and control stability can be achieved. The TEC driver uses a filtered PWM architecture, which obtains high driving power efficiency as ordinary PWM drivers have, but smoothens the current modulation to a DC-like output. It's very important for electro-magnetic sensitive measurements.

Another important feature of Chroma's Advanced TEC Controllers is the true TEC PID auto tune function. Chroma's Advanced TEC Controllers have unique auto tune algorithm to guarantee the best control and temperature response. Stability down to the temperature resolution, which is 0.01°C, is regularly achieved regardless the size and geometry of thermal platforms.

High TEC driving capability is another merit of Chroma's Advanced TEC Controllers. Chroma's Advanced TEC Controllers deliver 150W, 300W, 800W for high power TEC driving. 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.

KEY FEATURES

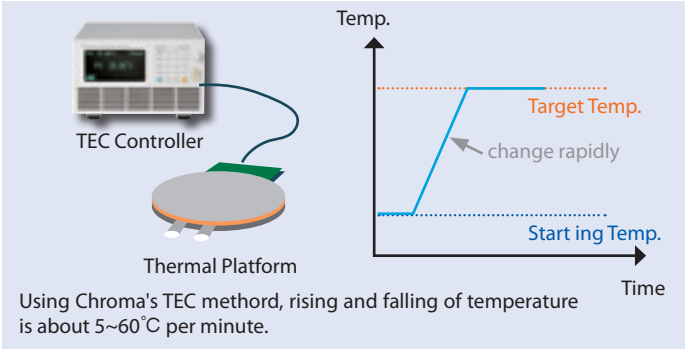
- Bidirectional driving with 150W (24V/8A), 300W (24V/13A) or 800W (40V/20A) output
- Filtered PWM output with > 90% driving power efficiency while maintaining linear driving with current ripples < 20 mA
- Temperature reading and setting range -70 to 250°C with 0.01°C resolution and 0.3°C absolute accuracy
- 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 thermocouple inputs, one for control feedback and the other for monitor and offset, providing versatile control modes
- RS232, USB2.0, LAN 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, this is compact, fast responding, and using only one controller.

Though there are many special features for TEC modules, users still need good TEC controllers to get all the benefit. Chroma's Advanced TEC Controller is specially designed for optimal performance of TEC temperature control. Changing temperature from one to another can be very fast. There is no overshoot or minimal overshoot approaching the target temperature. When thermal perturbation happens, even for a 100W on/off perturbation, Chroma's Advanced TEC Controllers can often reduce the temperature variation to less than 1˚C within few seconds. As temperature stability is concerned, Chroma's Advanced TEC Controllers offer 0.01˚C stability in most cases.

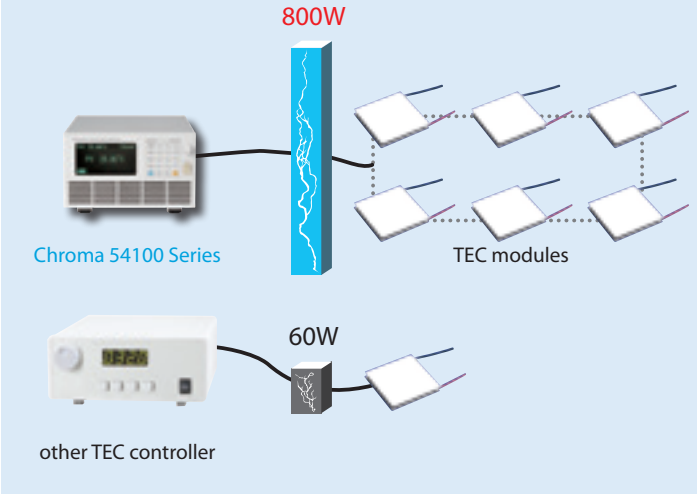


Using Chroma's TEC methord, rising and falling of temperature is about 5~60˚C per minute.

HIGH DRIVING CAPABILITY

There were many small output power TEC controllers in the market mainly for small devices and small scale lab tests. As technologies grow, higher TEC driving power than before is demanded in many new applications. For example, testing solar cells larger than 4 inch squares from -20˚C to 85˚C requires more than 100W TEC driving power, not to mention the thermal load of sunlight can be 30W or more. High power-LEDs for lighting have great concerns about their thermal property. 30 W-LED module testing from -20˚C to 150˚C also demands high TEC driving power.

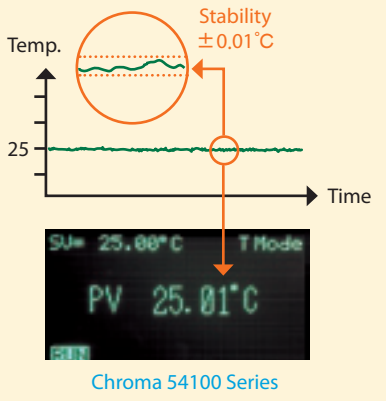
Chroma's Advanced TEC Controllers can deliver 150W/300W/800W TEC driving power, satisfying needs from small to large platforms. In typical applications, many pieces of high power TEC modules can be driven by a controller output. For the cost of every driving power, Chroma offers very competitive solutions.



HIGH TEMPERATURE RESOLUTION AND ACCURACY

TEC controllers using thermocouple in market usually have accuracy about 1˚C and resolution 0.1˚C. This is not good enough for many applications. For example, rating solar cell power efficiency needs temperature accuracy much less than 1˚C. Phase change of some material can happen within 0.1˚C or less. Some biochemical process can be very sensitive to a critical temperature. Thermal resistance measurement 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 sensors can have trouble for metal contact, or too bulky to measure the point of interest.

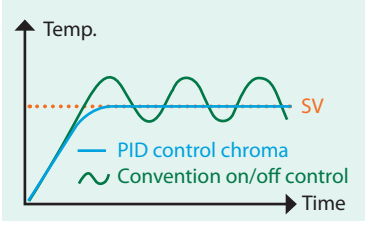
Chroma's Advanced TEC Controllers are thermocouple based and with temperature accuracy* 0.3˚C and resolution down to 0.01˚C. Users can take advantage of thermocouple for easy measurement setup, while maintain high accuracy and resolution. This means users can achieve test results with high repeatability,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

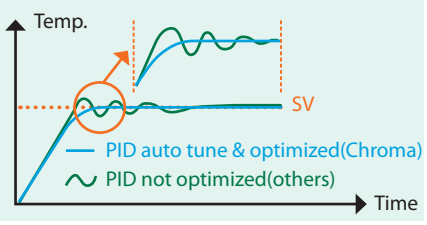


Chroma 54100 Series

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. It does not guarantee a successful control unless proper PID parameters are set. It is very painful and time consuming to search for PID parameters manually. So an advanced controller should feature PID auto tune function.

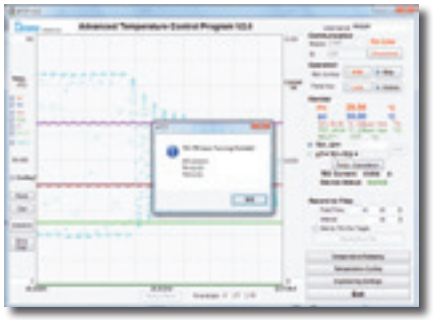




Many other TEC controllers use a small signal and one-directional temperature transient to find PID parameters. This auto tune method is OK for heater only temperature control, but not always successful for TEC control. In order to truly match the thermal response of a TEC control system, Chroma's Advanced 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 -70 to 250˚C.

SOFT PANEL

Chroma's Advanced TEC Controller Program provides a GUI which can set and read temperatures, viewing TEC current and temperature v.s. time curves, recording data to a file, and running temperature cycling and ramping sub-programs. PID parameters, current limit, and important settings can also be read and set from a pop-up engineering setup window.



HIGH EFFICIENCY STANDARD PLATFORMS

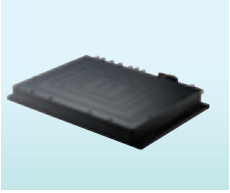
There are numerous TEC platforms worked with Chroma Advanced TEC Controllers, including standard platforms for LEDs, solar cells, e-paper, burn-in, and so on. Each one shown below can reach wide temperature range with typical stability 0.01˚C.


Solar Cell


LED Burn-In


LED Integrated Sphere


Wafer Chuck


E-paper

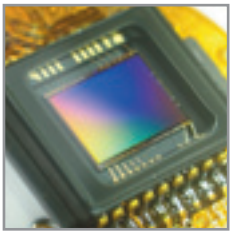

Micro Projector


General Platform

APPLICATIONS


Semiconductor


Bio Tech & Life Science


Optical Sensor


LED/ Laser Diode


Material analysis


Solar Cell


Panel Display


Chemical Process

SPECIFICATIONS

Model		54115-24-8	54130-24-13	54180-40-20
TEC Output Voltage		24VDC	24VDC	40VDC
TEC Output Current		8A	13A	20A
TEC Driving Output Power		150W	300W	800W
Temperature Control				
Setting Temperature Range		- 70 to 250˚C		
Setting Temperature Resolution		0.01˚C		
Temperature Control Stability	Short Term	≦0.01˚C		
	Long Term	≦0.05˚C		
Temperature Monitoring				
Monitoring Temperature Range		- 70 to 250˚C		
Temperature Sensor Type		Standard : T-type thermocouple 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		5~45˚C		
Humidity		< 80 % RH		
Power Requirement		90 to 240 VAC, 50/60 Hz		
Maximum Power Consumption		200W	480W	1000W
Fuse 150 W		3/2 A for 110/220 VAC	5/3 A for 110/220 VAC	12/6 A for 110/220 VAC
PC Communication Port		RS-232 Half Duplex ; USB2.0 ; LAN 10/100Mbps		
Dimensions (WidthxDepthxHeight)		241mm x 405mm x 90mm		241mm x 405mm x 135mm
Storage Temperature		-20~60˚C		
Storage Humidity		80%R H		
Weight		6.2 Kg		7.5 Kg

Note *1 : In applications, the temperature range can be reached strongly depends on the platform structure and environment. It is a portion of the controller setting range and less than the controller setting range.

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
54130-24-13 : 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

Rear panel

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