

# 346

# Cryogenic Temperature Controller

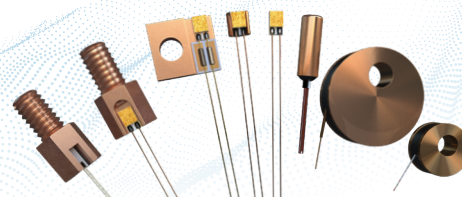


# Next-generation temperature controller

## 400 W of control power with measurements down to 300 mK

The Model 346 cryogenic temperature controller is designed for rapid and precise temperature management, featuring four 100 W heater outputs that deliver a total of 400 W of power—allowing the system to warm up twice as fast. It also includes four low-power 1 W heater outputs. With 10 standard inputs expandable up to 26 with option cards, the controller measures temperatures ranging from 300 mK to 1500 K.

Enhanced system control is achieved through two digital inputs for external triggering and two relays. The touchscreen interface ensures simple setup and monitoring, while the included ColdSync™ software facilitates advanced setup, initial configuration, and comprehensive data monitoring.



Use the 346 temperature controller with Lake Shore cryogenic temperature sensors

400 W heater power	Measure 300 mK to 1500 K	System control
System warm-up twice as fast	RTD/diode/thermocouple	USB, Ethernet, GPIB (optional)
Four 100 W heater outputs	Includes 10 inputs	Two relays for process control
Four 1 W heater outputs	Up to 26 inputs with option cards	Two digital inputs for external triggering

# The front panel

The front panel of the Model 346 features a user-friendly touchscreen interface designed for basic control and monitoring. It allows easy toggling between different display modes, including:

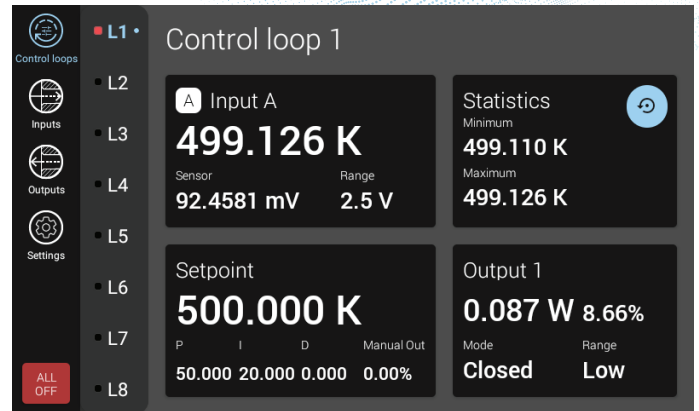
**Control Loops**  
View paired input and output for each control loop

**Inputs**  
Monitor all input channels

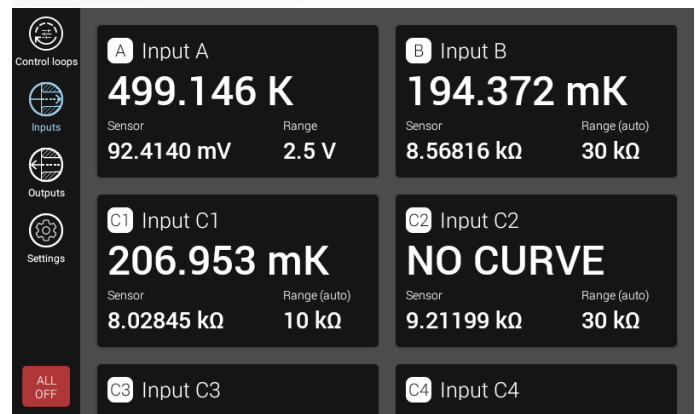
**Outputs**  
Configure all output channels

**Settings**  
Configure various instrument settings

Additionally, the front panel provides real-time error notifications, such as broken leads, allowing for prompt troubleshooting. Custom naming of inputs is also supported to help organize the setup. For advanced functionalities, the accompanying ColdSync software offers comprehensive tools for loading curves, data collection, setting up zones, and more complex configurations.



346 temperature controller showing control loops



346 temperature controller showing sensor data

# The back panel

## Measurement inputs

- A.** Two high-speed measurement inputs — 100 ms update rate
- B.** Eight standard measurement inputs — 400 ms update rate
- C.** Four option card slots to expand inputs
  - [RTD/diode option card adds 4 inputs](#)
  - [Thermocouple option card](#)

## Communication

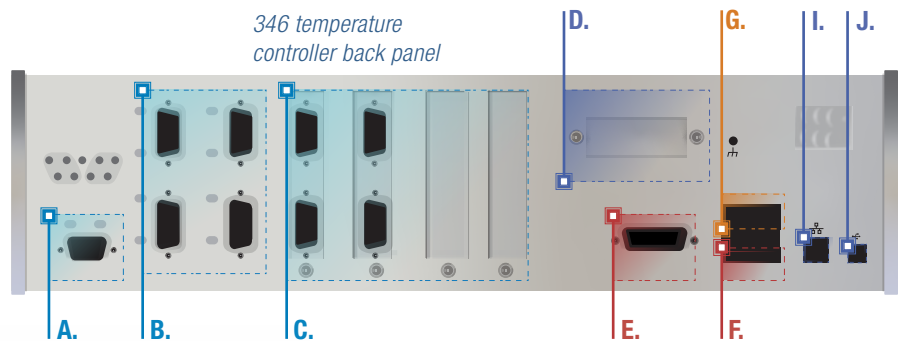
- D.** GPIB option card slot
- I.** USB
- J.** Ethernet

## Heaters

- E.** Four high-power 100 W heaters
- F.** Four analog outputs/1 W heaters

## System control

- G.** Two digital I/O, two relays



346 temperature controller back panel

# ColdSync™ software

ColdSync software, included with the measurement instrument, is designed to streamline the process of setting up new sensors and collecting data. Key features include:

## Chart Recorder

Stream data live and easily save recordings

## Data Editing

Directly edit the data collected

## Curve Handler

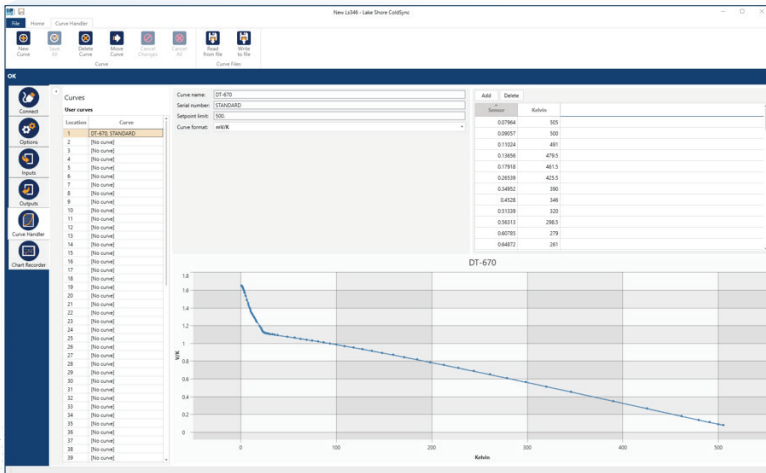
Load unique sensor curves into the instrument

## Instrument Configuration

Set, modify, and import/export instrument settings

## Command Sending

Test remote communications by sending and receiving text commands



ColdSync software

## Option cards

The Model 346 features four option card slots for sensor inputs, along with an additional slot for GPIB communication. Adding an option card does not occupy any existing inputs.

### RTD/diode option card

Each option card increases the number of inputs by four. With four option card slots and 10 existing inputs, the total can be expanded to up to 26 inputs.

### Thermocouple option card

Add two thermocouple measurement inputs for temperature readings up to 1500 K.

### GPIB option card

Add GPIB communication via a dedicated option card slot, separate from the four slots designated for sensor inputs.

# Specifications

## Model 346 input specifications

	Sensor temperature coefficient	Electronic control stability <sup>1</sup>	Excitation current	Measurement temperature coefficient	Input range	Display resolution	Measurement resolution	Electronic accuracy <sup>6</sup>
<b>Diode</b>	- Negative	±20 µV	10 µA ±0.05% <sup>2,3</sup>	(10 µV + 0.0005% of rdg)/°C	0 V to 2.5 V	10 µV	10 µV	±80 µV ±0.005% of rdg
<b>PTC RTD</b>	+ Positive	0.4 mΩ	1 mA <sup>4</sup>	(0.01 mΩ + 0.001% of rdg)/°C	0 Ω to 10 Ω	0.1 mΩ	0.2 mΩ	±0.002 Ω ±0.01% of rdg
		4 mΩ	1 mA <sup>4</sup>	(0.1 mΩ + 0.001% of rdg)/°C	0 Ω to 100 Ω	1 mΩ	2 mΩ	±0.004 Ω ±0.01% of rdg
		40 mΩ	1 mA <sup>4</sup>	(1 mΩ + 0.001% of rdg)/°C	0 Ω to 1 kΩ	10 mΩ	20 mΩ	±0.04 Ω ±0.02% of rdg
<b>NTC RTD 10 mV</b>	- Negative	±3 mΩ	100 µA <sup>4</sup>	(0.1 mΩ + 0.001% of rdg)/°C	0 Ω to 100 Ω	1 mΩ	1.5 mΩ	±0.01 Ω ±0.04% of rdg
		±9 mΩ	30 µA <sup>4</sup>	(0.3 mΩ + 0.0015% of rdg)/°C	0 Ω to 300 Ω	1 mΩ	4.5 mΩ	±0.01 Ω ±0.04% of rdg
		±30 mΩ ±0.004% of rdg	10 µA <sup>4</sup>	(1 mΩ + 0.001% of rdg)/°C	0 Ω to 1 kΩ	10 mΩ	15 mΩ + 0.002% of rdg	±0.1 Ω ±0.04% of rdg
		±90 mΩ ±0.004% of rdg	3 µA <sup>4</sup>	(3 mΩ + 0.0015% of rdg)/°C	0 Ω to 3 kΩ	10 mΩ	45 mΩ + 0.002% of rdg	±0.1 Ω ±0.04% of rdg
		±300 mΩ ±0.004% of rdg	1 µA <sup>4</sup>	(10 mΩ + 0.001% of rdg)/°C	0 Ω to 10 kΩ	100 mΩ	150 mΩ + 0.002% of rdg	±1.0 Ω ±0.04% of rdg
		±900 mΩ ±0.004% of rdg	300 nA <sup>4</sup>	(30 mΩ + 0.001% of rdg)/°C	0 Ω to 30 kΩ	100 mΩ	450 mΩ + 0.002% of rdg	±2.0 Ω ±0.04% of rdg
		±3 Ω ±0.01% of rdg	100 nA <sup>4</sup>	(100 mΩ + 0.002% of rdg)/°C	0 Ω to 100 kΩ	1 Ω	1.5 Ω + 0.002% of rdg	±10.0 Ω ±0.04% of rdg
<b>Thermocouple (Optional)</b>	+ Positive	±0.8 µV	NA	(0.1 µV + 0.001% of rdg)/°C	±50 mV	0.1 µV	0.4 µV	±1 µV ±0.05% of rdg <sup>5</sup>

<sup>1</sup> Control stability of the electronics only, in ideal thermal system

<sup>2</sup> Current source error has negligible effect on measurement accuracy

<sup>3</sup> Diode input excitation can be set to 1 mA

<sup>4</sup> Current source error is removed during calibration

<sup>5</sup> Accuracy specification does not include errors from room temperature compensation

<sup>6</sup> Accuracy at  $T_{cal}$ , typically 23.5 °C ±1.5 °C; with current reversal enabled for RTD measurements

# Specifications

## Sensor input configuration

	RTD/diode	Thermocouple
Measurement type	4-lead differential	2-lead differential, room temperature compensated
Excitation	Constant current with current reversal for RTDs	NA
Supported sensors	Diodes: Silicon	Most thermocouple types
	RTDs: 100 $\Omega$ platinum, Cernox <sup>®</sup> , and Rox <sup>™</sup>	
Standard curves	DT-670, PT-100, RX-102A, RX-202A, RX-103A	Type E, Type K
Input connector	Normal density, socketed DE-9 D-subminiature (2 inputs per connector)	Screw terminals in a ceramic isothermal block

### Input details

#### Number of inputs

10 (up to 26 with RTD/diode option card)

#### Isolation

Sensor inputs electrically isolated from other circuits but not each other

#### A/D resolution

24-bit

#### Maximum update rate

2 primary inputs: 100 ms update rate  
Other inputs: 400 ms update rate

#### Autorange

Automatically selects appropriate NTC RTD or PTC RTD range

#### Math

Maximum and minimum

#### Filter

Averages 2 to 64 input readings

#### Additional features

4-lead break detection with 2-lead failover mode

### Control specifications

#### Control outputs

8 control outputs

#### Control type

Closed loop PID with manual heater output, open loop, warm-up mode, or mirroring

#### Update rate

10/s

#### Control stability

Sensor dependent, see input specifications table

#### Manual output

0 to 100% with 0.01% setting resolution

#### Zone control

10 temperature zones with P, I, D, manual out, range, control channel, ramp rate

#### Warm-up heater mode

#### Warm-up percentage

0 to 100% with 1% resolution

#### Warm-up mode

Continuous control or auto-off

### High-power heater outputs

#### Output

Outputs 1, 2, 3, 4

#### Output type

Variable DC unipolar current source

#### Heater load range

10  $\Omega$  to 100  $\Omega$

#### Ranges

2 (decade steps in power)

#### Heater noise

0.12  $\mu$ A RMS

#### Grounding

Output referenced to chassis ground

#### Connector

Normal density, socketed DA-15, D-subminiature

#### Safety limits

Curve temperature, power up heater off, short and open circuit protection

#### Maximum power

100 W with 25  $\Omega$  load, 50 W with 50  $\Omega$  load

#### Maximum current

2 A with 25  $\Omega$  load, 1 A with 50  $\Omega$  load

#### Voltage compliance

50 V with 25  $\Omega$  load, 50 V with 50  $\Omega$  load

#### Heater load for maximum power

25  $\Omega$ , 50  $\Omega$

### Low-power analog outputs

#### Output

Outputs 5, 6, 7, 8

#### Output type

Variable DC unipolar voltage source

#### Additional control type

Monitor output

### Monitor output settings

#### Scale

User selected

#### Data source

Temperature or sensor units

#### Settings

Input, source, top of scale, bottom of scale, or manual

#### Range

0 V to +10 V

#### Maximum current

100 mA

#### Maximum power

1 W (into 100  $\Omega$ )

#### Resolution

0.3 mV

#### Accuracy

$\pm$ 2.5 mV

#### Noise

0.3 mV RMS

#### Minimum load resistance

100  $\Omega$  (short-circuit protected)

#### Connector

10-pin 2.5 mm detachable terminal block

# Specifications

## General specifications

### Ambient temperature

15 °C to 35 °C at rated accuracy;  
5 °C to 40 °C at reduced accuracy

### Power requirement

100 V to 240 V (universal input),  
50 to 60 Hz, 500 + VA

### Size

435 mm W × 89 mm H × 368 mm D  
(17 in × 3.5 in × 14.5 in), full rack

### Weight

6.1 kg (13.5 lb)

### Approvals

CE, NRTL

## Interface

### USB host

#### Function

Firmware updates, flash drive support

#### Type

USB 3.0, mass storage class  
(MSC) device

#### Connector

USB Type-C™

### USB device

#### Function

Emulates a standard RS-232 serial port

#### Type

USB 2.0

#### Baud rate

921, 600

#### Connector

B-type USB connector

### Ethernet

#### Function

TCP/IP command and control

#### IPv6 compatibility

Yes

#### Speed

1 Gb/s

#### Connector

RJ-45

### IEEE-488.2

(with option card)

### Compatibilities

SH1, AH1, T5, L4, SR1, RL1, PPO, DC1,  
DT0, C0, E1

### Reading rate

To 10 rdg/s on each input

### Software support

ColdSync™, MeasureLINK™,  
LabVIEW™, Python

### Alarms

#### Data source

Temperature or sensor units

#### Actuators

Display annunciator, beeper, and relays

### Relays

#### Number

2

#### Contacts

Normally open (NO), normally  
closed (NC) and common (C)

#### Contact rating

30 VDC at 3 A

#### Operation

Activate relays on high, low, or both  
alarms for any input, or manual mode

#### Connector

10-pin 2.5 mm detachable  
terminal block

### Digital inputs

#### Number of inputs

2

#### Isolation

Optical

#### Maximum low-level input voltage

+1 V

#### Minimum high-level input voltage

+4 V

#### Safe input voltage range

-5 V to +35 V

## Option cards

### Option slots

4

### Supported option cards

Thermocouple, RTD/diode

## Front panel

### Display

5 in capacitive touch, color TFT-LCD  
WVGA (800 × 480) with LED backlight

### Power switch

SPST mains/line power switch

### Display units

K, °C, V, mV, Ω

### Reading source

Temperature, sensor units, maximum,  
and minimum

# Next-generation Cryogenic Temperature Controller



Let's talk about your application

## Ordering information

Tel: +1 614 891 2244

Email: [sales@lakeshore.com](mailto:sales@lakeshore.com)

Website: [www.lakeshore.com](http://www.lakeshore.com)

Copyright © Lake Shore Cryotronics, Inc.  
All rights reserved. Specifications are  
subject to change. 031725

