



Valco Instruments Co. Inc.

**Instrumentation
Temperature Controller
Instruction Manual
Model ITC2**

North America, South America, and Australia/Oceania contact:
VICI Valco Instruments Co. Inc.
800 · 367 · 8424 sales
713 · 688 · 9345 tech
713 · 688 · 8106 fax
valco@vici.com

Europe, Asia, and Africa contact:
VICI VICI AG International
Schenkon, Switzerland
Int + 41 · 41 · 925 · 6200 phone
Int + 41 · 41 · 925 · 6201 fax
info@vici.ch

General Safety Requirements



Do not open the controller enclosure. There are no user-serviceable parts inside, and you may cause a dangerous failure.



Do not replace the power entry module fuses with anything but 5 x 20 mm 250V 5A FAST BLOW fuses.



Do not make physical or electrical contact with the heater assembly controlled by the ITC2 before disconnecting the ITC2 from its power source and allowing adequate time for the heater to cool. The time required will vary, depending on the heater mass.



Make sure that the heater voltage rating matches the power input voltage rating of the power into which the ITC2 is connected



To prevent temperature runaways on new installations, after power up, watch to see that the measured temperature begins to show a positive movement upward. (This may take slightly longer for a large heated mass.) If there is no increase, shut down everything and check the system

NOTE:

The product meets all current CE requirements for its intended application environment.

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Description

The ITC2 is designed to control an isothermal zone, such as a Valco heated valve enclosure (HVE), to a high degree of accuracy and stability through the use of a type K thermocouple. The thermocouple was chosen because of its low mass, simplicity, and quick response to temperature changes. It also employs a solid state zero crossing high current relay to keep electromagnetic noise and heat generation to an absolute minimum.

Temperature sensing is provided through a 15-bit analog-to-digital converter. The controller utilizes a PID* algorithm for configuring the best scheme according to the mass, power applied, and heat loss.

*For more on PID, refer to "Appendix A: Operation Terms and Principles" on page 5.



For proper functioning, the input voltage will determine the output power. That is, if you are supplying 120 VAC at the input, you must use a 120 VAC heater rated at 600 watts maximum; 240VAC at the input requires a 240 VAC heater rated at 1100 watts maximum

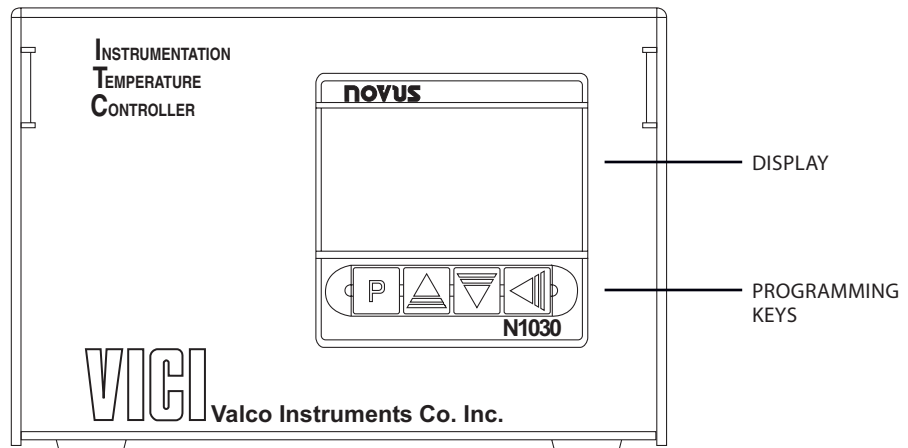


Figure 1: ITC2 front panel

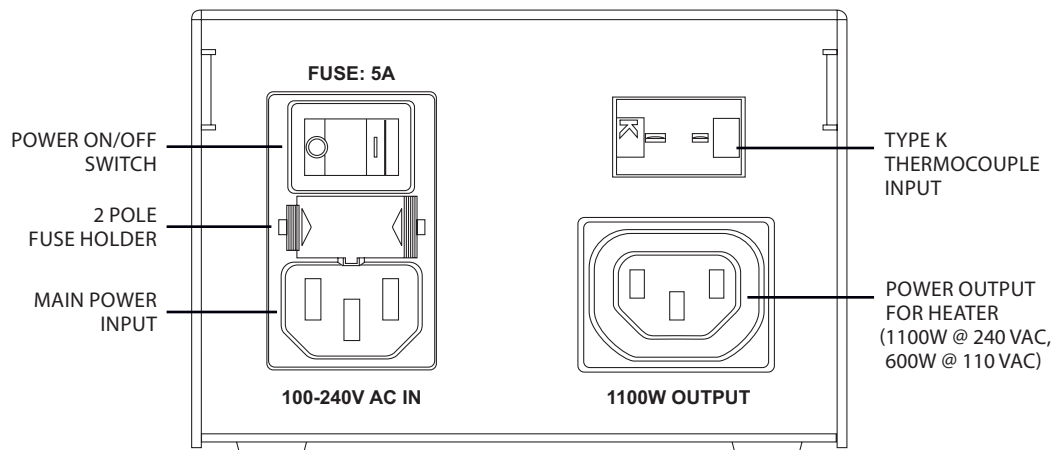


Figure 2: ITC2 rear panel

Setup and Operation

Connections

1. Connect the thermocouple and heater power cord to the ITC2 rear panel.
NOTE: Take care to verify the polarity of the thermocouple input, as described below.
2. Plug the power cord into the ITC2 and into a properly grounded outlet
3. Turn the power switch to "On".

On initial power up, the controller will go through a boot sequence in which the thermocouple is checked for proper connection. If the red temperature display shows "nnnn", the thermocouple is not connected properly. Turn the power off and fix the connection before proceeding.

When a proper connection is detected, the controller starts controlling at the setpoint indicated in the green LED readout. The ITC2 leaves the factory with a setpoint of 20.0, so there will probably be no power applied to the heater until the setpoint is increased.

Adjusting the Temperature Setpoint

Use the up and down arrows on the controller (**Figure 3**) to select the desired temperature setpoint.

Verifying Thermocouple Polarity

To verify the correct polarity of the thermocouple input, increase the set point and verify that the temperature increases. If the temperature in the readout is decreasing, the thermocouple is not polarized correctly. Correct before proceeding.

Running Autotune

As mentioned previously, the controller utilizes a PID algorithm for configuring the best scheme according to the mass, power applied, and heat loss. We recommend using the autotune feature to establish these values. To learn more, refer to "Appendix A: Operation Terms and Principles" on page 6. All other functions of the controller have been factory set for optimum performance; it is recommended that these settings remain unchanged.

Autotune has two modes: Fast, for the shortest execution time, and Full, for maximum temperature stability.

Initiating the Autotune Sequence: Fast Mode

1. Press hold the P key for five seconds. "RUN" will appear in the upper red LED and "OFF" will appear in the lower green LED
2. Momentarily press the down arrow. When "FRSt" appears in the lower green LED, press the P key again to select the fast mode.
3. Press the P key eight more times. At this point, the TUNE LED illuminates, the setpoint and actual temperatures are displayed, and the fast autotune sequence begins.
4. Use the up and down arrows on the controller (**Figure 3**) to adjust the temperature setpoint to the desired reading. This can be done before the autotune sequence is completed.

Initiating the Autotune Sequence: Full Mode

1. Press hold the P key for five seconds. "RUN" will appear in the upper red LED and "OFF" will appear in the lower green LED
2. Momentarily press the down arrow. When "FASL" appears in the lower green LED, press the down arrow again to show "FULL". Press the P key again to select the full mode.
3. Press the P key eight more times. At this point, the TUNE LED illuminates and the setpoint and actual temperatures are displayed.
4. Use the up and down arrows on the controller (**Figure 3**) to adjust the temperature setpoint to the desired reading.

The ITC2 will now execute a full autotune. This can take from 10 to 60 minutes, depending on the zone conditions.



During a full autotune, the controller will overshoot the set point several times, by as much as 40°C. If there are any components in the heated zone that might be damaged by this, set the temperature 40°C lower than the final setpoint. When the TUNE LED goes out, indicating that the autotune procedure is completed, set the temperature as desired

5. Allow an additional 15 minutes for further temperature stabilization of the heated zone.

When to Repeat Autotune

Autotune should be repeated any time there are physical changes to the heated zone or if there is a large change in the set point temperature.

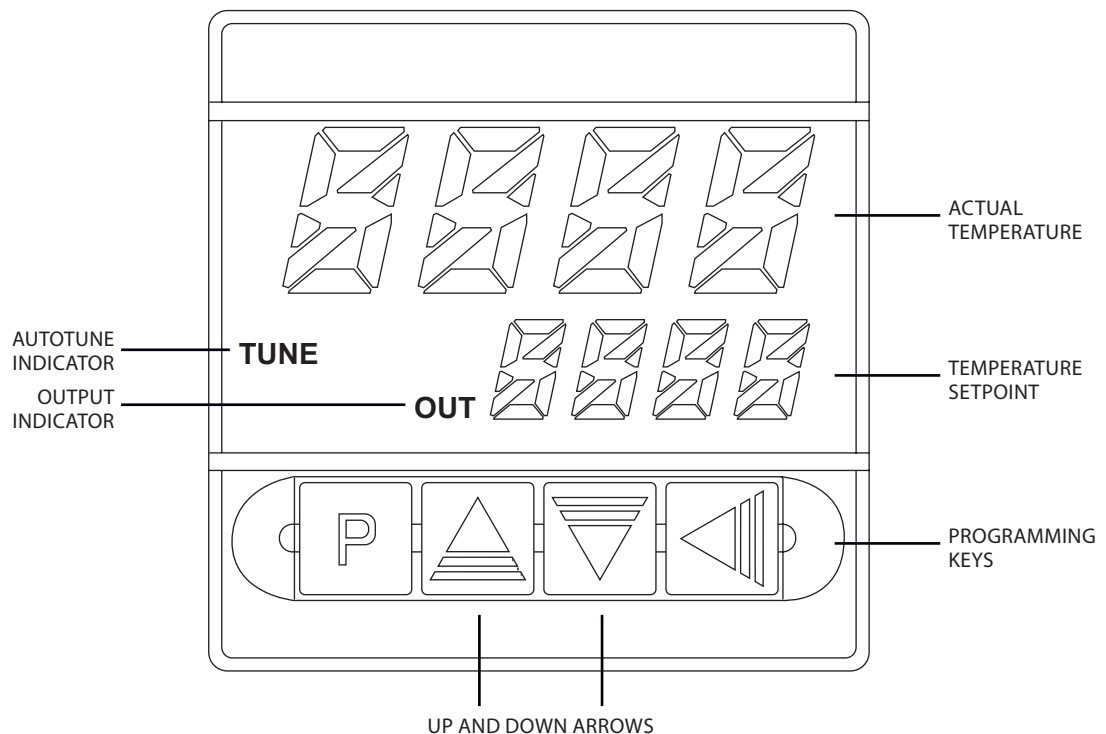


Figure 3: ITC2 controls and display

Specifications

Power supply	100 to 240 VAC ($\pm 10\%$), 50/60Hz
Maximum consumption	5 amps
Environmental conditions	
Operation temperature	0 - 50°C
Relative humidity	80% @ 30°C*
Input	
Input type	Type K thermocouple
Internal resolution	32767 (15 bits)
Resolution of display	0.1 Celsius
Control Range	-20 to 400 Celsius
Rate of reading	up to 5 / second
Accuracy	$\pm 0.25\%$ of span ± 1 degree
Output	5 amps max, 100-240 VAC

*For temperatures above 30 Celsius, reduce 3% for each degree.

Troubleshooting

Symptom	Cause
Red temperature display shows "nnnn"	Faulty thermocouple connection
No LEDs are lit	Fuse is blown

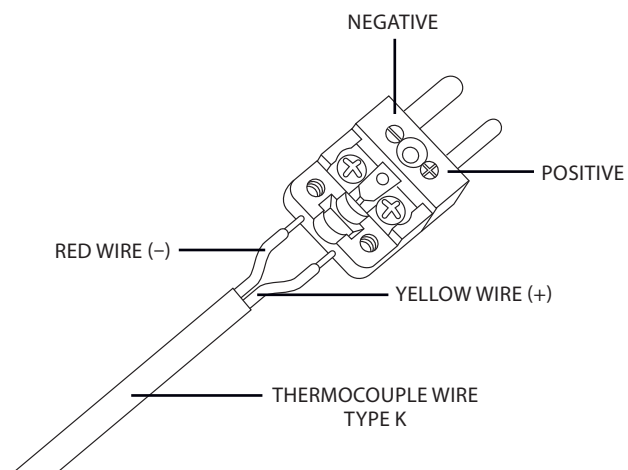


Figure 4: Wire connections for Type K thermocouple

Appendix A: Operation Terms and Principles

P (band) P_b

"P" (band) is the proportion term – the primary term for controlling the error, or deviation from the temperature set point. This setting directly scales the error, so with a small "P" the controller will make small attempts to minimize the error, and with a large "P" the controller will make larger attempts. If "P" is too small the error may never be minimized, and the unit may not be able to respond to changes affecting the zone. If "P" is too large, unstable oscillations can occur, resulting in a severe overshoot of the desired temperature.

I (rate) I_r

"I" (rate) is the integral term that allows the controller to handle errors that accumulate over time. This works well for handling steady state errors. If "I" is too high there can be instability in response to short term changes.

D (time) d_t

"D" (time) is the derivative term, concerned with how the system is responding between intervals. This helps dampen the system, improving stability.

The autotune feature has 3 options: OFF, FAST, and FULL. If the OFF option is selected the P, I, and D values may be set manually. Consult the factory for more information.

Appendix B: Certifications

The Novus Temperature Controller model N1030-PR has been tested to the following standards by CBCRE-accredited testing laboratory IBEC (Brazil), per test report # IBED 194968 – Rev. 1.0. Phone: (+55 19)3845-5965

- IEC/CISPR 11 Ed. 6.0 (2015) + A1 (2016) for Radiated and Conducted emission
- IEC/61000-4-4 Ed. 3.0 (2012) for Electrical and fast transients and burst (EFT&B)
- IEC/61000-4-6 Ed. 4.0 (2013) for Immunity to RF conducted disturbances
- IEC/61000-4-3 Ed. 3.0 (2006) + Amd.1 (2007) + Amd.2 (2010) for Immunity to RF radiated disturbances
- IEC/61000-4-2 Ed. 2.0 (2008) for Electrostatic discharge (ESD)
- IEC/61000-4-5 Ed. 3.0 (2014) + Amd.1 (2017) for Surge
- IEC/61000-4-11 Ed. 2.0 (2004) (2004 + Amd.1 (2017) for Voltage dips/interruptions

The complete Valco Instruments Co. Inc. ITC2 assembly which includes the Novus Temperature Controller model N1030-PR has been further tested to the following standard by the A2LA- and ILAC MRA-accredited testing laboratory NCEE Labs (USA), per test report # R20200629-30-S01. Phone: +1 (888) 657-6860

- EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use -- Part 1: General requirements

For product certification details, please contact Valco Instruments Co. Inc.

Warranty

This Limited Warranty gives the Buyer specific legal rights, and a Buyer may also have other rights that vary from state to state. For a period of 365 calendar days from the date of shipment, Valco Instruments Company, Inc. (hereinafter Seller) warrants the goods to be free from defect in material and workmanship to the original purchaser. During the warranty period, Seller agrees to repair or replace defective and/or nonconforming goods or parts without charge for material or labor OR at seller's option demand return of the goods and tender repayment of the price. Buyer's exclusive remedy is repair or replacement of defective and nonconforming goods OR at Seller's option repayment of the price. SELLER EXCLUDES AND DISCLAIMS ANY LIABILITY FOR LOST PROFITS, PERSONAL INJURY, INTERRUPTION OF SERVICE, OR FOR CONSEQUENTIAL INCIDENTAL OR SPECIAL DAMAGES ARISING OUT OF, RESULTING FROM, OR RELATING IN ANY MANNER TO THESE GOODS. The Limited Warranty does not cover defects, damage or nonconformity resulting from abuse, misuse, neglect, lack of reasonable care, modification or the attachment of improper devices to the goods. This Limited Warranty does not cover expendable items. This warranty is VOID when repairs are performed by a nonauthorized service center or representative. If you have any problem locating an authorized service center or representative, please call or write Customer Repairs, (713) 688-9345, Valco Instruments Company, Inc., P.O. Box 55603, Houston, Texas 77255. At Seller's option, repairs or replacements will be made on site or at the factory. If repairs or replacements are to be made at the factory, Buyer shall return the goods prepaid and bear all the risks of loss until delivered to the factory. If Seller returns the goods, they will be delivered prepaid and Seller will bear all risks of loss until delivery to Buyer. Buyer and Seller agree that this Limited Warranty shall be governed by and construed in accordance with the laws of the State of Texas. THE WARRANTIES CONTAINED IN THIS AGREEMENT ARE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. This Limited Warranty supersedes all prior proposals or representations oral or written and constitutes the entire understanding regarding the warranties made by the Seller to Buyer. This Limited Warranty may not be expanded or modified except in writing signed by the parties hereto.