TIP 1000
Thermal Process Controller

User's Manual

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1.0 Introduction

Congratulations on the purchase of your new TIP 1000 Thermal Process Controller. EIT is combining its 31+ years of experience in process control and electronics engineering with the 25+ years of heater technology experience of Tutco-Farnam in a new Thermal Process Control system.

The days of 'guesstimating' and 'retuning' temperatures and flow rates each time you have to run a process are a thing of the past! With your new TIP 1000, you will be able to actually assign numbers to needed process values and be able to dial up those numbers in a flash for future runs! You have complete control with a digital readout of the temperature, air flow rate, and air exhaust velocity. Only two parameters may be regulated at any one time with output temperature always being one of them.

The TIP 1000 provides an unprecedented level of repeatability and reliability in the thermal process control industry. Furthermore, the risk of heater burnout has been virtually eliminated with a tight loop control system vastly improving the life span of the heater! The typical thermocouple in the hot air stream has been eliminated and the function replaced with a very accurate predictive algorithm that is unaffected by errors caused by hot and cold spots as well as long exposures to high temperatures. You can look forward to great cost savings in not having to replace heater parts and fewer product errors due to more consistent output.

The TIP 1000 is a self contained "plug & play" system. The system contains everything that you need. It takes just a few minutes to plug it in and connect the heater to the control box. You do not need to specify a separate compressor or control package.

In short, you save time and save money!

2.0 WARNINGS!

Do not touch heater when in operation or immediately after long periods of operation!

Do not open chassis when unit is plugged in! There is risk of shock and there are no user serviceable parts. There are ESD sensitive components inside.

Do not operate if the exhaust fan doesn't work or is blocked! (See section 6.0)

3.0 Applications

Day to day processes in which a particular process window (output temperature and/or flow rate) determines the quality of the product are ideally suited for the TIP 1000. Such processes include:

- Drying, curing or activation of coatings, adhesives, resins, labels & inks
- Heat shrinking of films and covers
- Heating & Heat Staking
- Electronics Assembly Processes
- Thermal Process Laboratories
- Sterilization & Sanitizing Assembly Lines

4.0 TIP 1000 Description

The TIP 1000 is a closed-loop thermal process controller with the ability to regulate output temperature, air velocity, and volume flow rate. Only two parameters may be regulated at any one time with output temperature always being one. This breakthrough is possible due to sensors throughout the system which report back to a single controller board (Figure 1). The controller board issues incremental commands (reduce heater power, increase air flow) to maintain the user's desired output values (process window). This constant adjustment and feedback loop maintain stable repeatable process conditions.

Figure 1: Block Diagram

TIP 1K Block Diagram
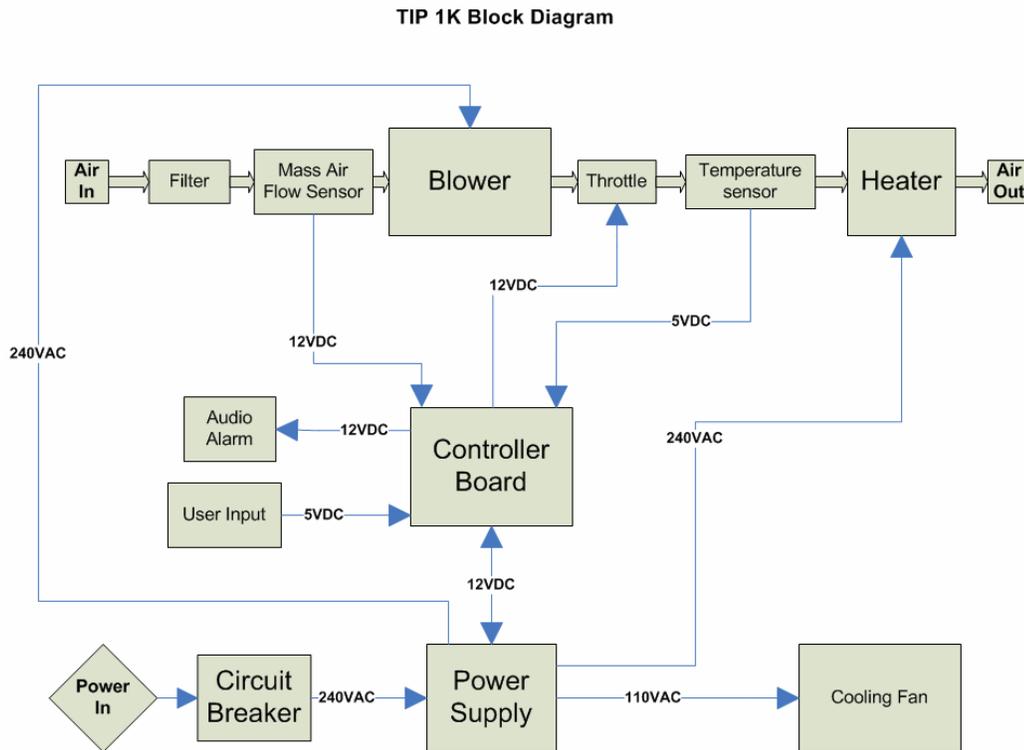
Another issue that the TIP 1000 addresses is potential premature heater failure due to loss of air flow. The tightly controlled closed-loop system on TIP 1000, ensures that the moment such an event occurs, the controller board shuts down all power to the heater and sounds an alarm to warn the user of the event. This dramatically increases the life of the heater and reduces the chance of making poor products.

5.0 Specifications TIP 1000

All specifications subject to change

Specifications	
Heater Power	1.5 KW @ 208-240 VAC @ 6.25 amps, 50-60 Hz, ≈unity PF. System will operate on reduced voltage but may be below maximum temperature specification.
Output Temperature Range	150ºF - 1150ºF (65ºC-620ºC)
Flow Rate	4.5 – 10.0 SCFM (127-311 LPM)
Velocity @ nozzle	20-85 ft/sec (6.1-25.7m/sec)
Enclosure Dimensions	16.4"L x15.4"W x11.6 H" (41.7 cm x 39.1 cm x 29.5 cm)
Enclosure Material	Powder Coated Aluminum
Weight	Enclosure 35 lbs
	Enclosure, heater w/5' hose, 40 lbs
Power Input, Heater (full power) and Blower	≈1900 VA@ 8 amps, ≈0.95PF
Heater Material	Stainless Steel
Air Filter	2 micron, very clean air suitable for a wide variety of applications
Alarms	Front panel audible & flashing display
Repeatability	> 1%
Control Accuracy	Temperature: $\pm$ 3% of Full Scale
	Flow rate: $\pm$ 2% of Full Scale
	Velocity $\pm$ 5% of Full Scale

Figure 2: Achievable temperatures (°F and °C) at various flow rates
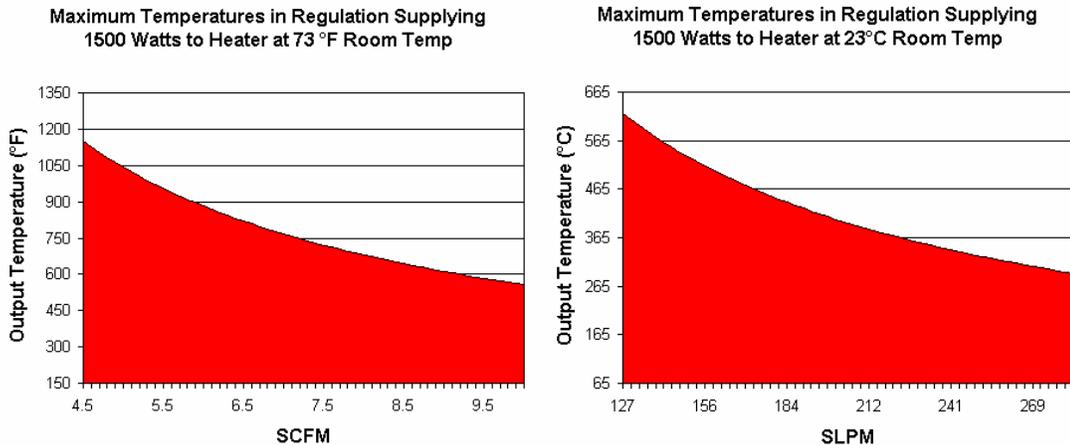
*Note: Red area is achievable temperatures at various flow rates. Maximum values on graph will be less at lower ambient temperatures and/or lower available heater power. Maximum flow rate will decrease as temperature goes up.

Additional features:

- Prevents heater damage with automatic heater shutoff in the event of air flow loss
- System stores current operating values on power down and restores values on power up
- Splash resistant design

Alarm Conditions:

When the system is in an alarm condition, it will continually flash the display and sound an audible alarm. The volume of the audible alarm can be adjusted by turning the small disc on the alarm to a louder or quieter volume.

Parameter	Condition for Alarm
Output Temperature	Display temperature differs from set point by more than 20 °F
Volume Flow Rate	Display air flow rate differs from set point by more than 0.5 CFM
Air Velocity	Display air velocity differs from set point by more than 5FPS

*Note: Audible alarm is disabled for 20 seconds after any parameter change or if the start button is pressed.

Normal Operating Conditions:

- Ambient Operating Temperature range: 0°F to 110°F (-17°C to 43°C)

- Humidity: up to 90% non condensing

- Elevation: calibrated to sea level

*Note: EIT has been a pioneering leader in the process control industry for over 30 years. We have used our best practices in developing this product. Please note that this product is not yet CE or UL certified but we plan to pursue these approvals in the future. Please use the product at your own risk.

6.0 Setup Guide

The TIP 1000 Blower System is normally shipped in one box and the heater and connecting hose in another box. Carefully unpack each box.

1. Attach desired plug termination to blower power cord. The green wire goes to ground and the black and white wires are both hot, each connecting to 120VAC to make a total of 240.
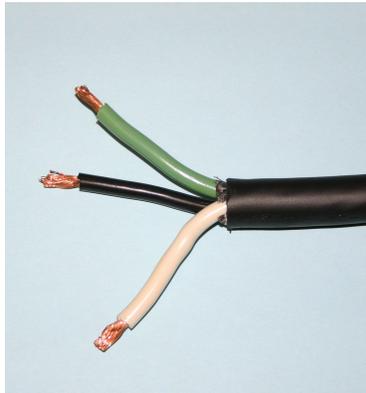
Figure 3-Wire termination

2. The heater hose and a combination power/sensing cable must be attached to the Blower Assembly. The power/sensing cable only attaches one way-do not force the connection. Look closely at Figures 4-7

Figure 4-(Above) Heater Power/Sensing connection on left, hose connection on right
Figure 5-(Below) Heater Power/Sensing cable and Heater Hose shown connected
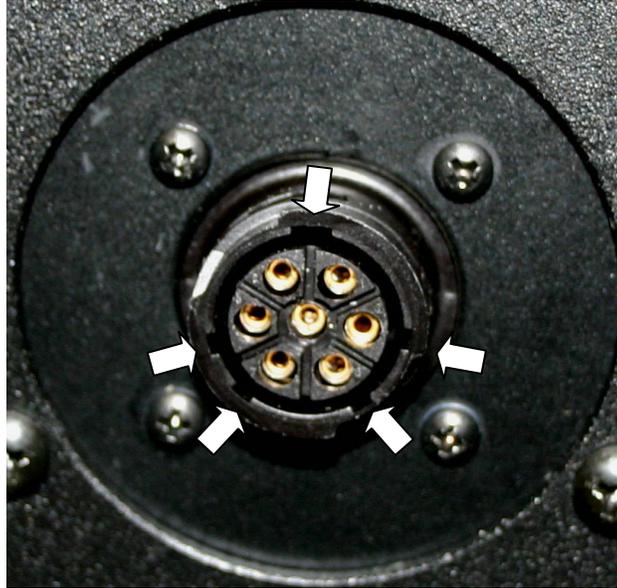
Figure 6-(Above) Close-up of Connector on the side of the Blower Assembly. Note arrows showing mating notches for cable assembly
Figure 7 (Below) Close-up of Cable-Note arrows to help align cable

Figure 8-Close-up of connector on Heater Assembly. This connection has been made at the factory prior to shipping and should not be disconnected

*Note: Do not block exhaust fan located on opposite side of display on blower assembly

Figure 9: Menu

- Turn the system on using the circuit breaker located near the power cord input.
- The menu will stabilize with numbers after a few seconds on power up.
- Set desired output operating temperature using select and arrow keys.
- Press Start/Stop to turn blower and heater on
- Depending on selected output temperature, it may take several minutes to get to desired temperature.
- An alarm will sound if the system is not in regulation with the defined Temperature, Airflow, and Velocity set points.
- Pressing a button to change any set point will disable the alarm for 20 seconds to allow time for the system to reach the desired value without alarming.
- Also note that it will take 60 seconds for the blower to turn off after the Start/Stop button is pressed. This is to allow the heater to cool down before airflow is completely stopped.

Typical Operation Guide:

Select button cycling –each time the select button is pressed, the display menu will cycle in the following sequence.

Figure 10: Menu Cycling
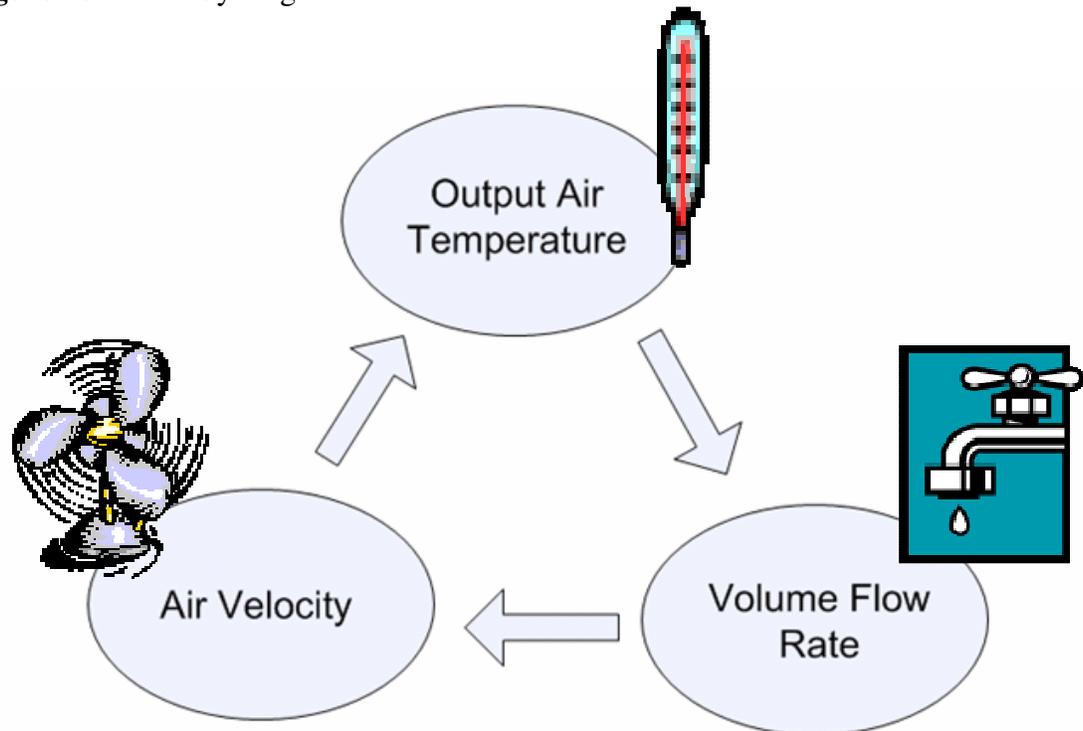
Only two parameters can be regulated at the same time with one always being Output Air Temperature. You can set either of the other two to be regulated by simply pressing the up/down arrow to choose a value on that screen. If the Volume Flow Rate (in SCFM) is being regulated, then the Air Velocity menu screen will have dashes for the set point value, Figure 10. If Air Velocity is being regulated, then the Volume Flow Rate menu screen will have dashes for the set point value. If you are on the unregulated Volume Flow Rate or Air Velocity menu screen, then any set point adjustment on that screen will make the system regulate to that parameter (Volume Flow Rate or Air Velocity) and disable the other one.

7.0 Display Interface

Menu screen layout and functions:
- Main display (shows actual values)
- Set point (target value that main display is trying to reach)

- Error flags
- Select button
- Set point adjustment arrows (Up/Down)
- Start/stop button

Figure 11: Display layout
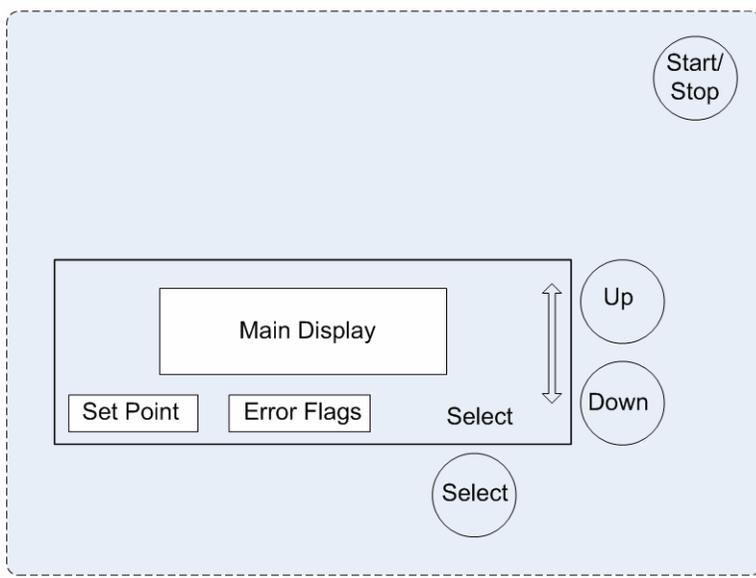
Figure 12: Output temperature screen (no error flags)
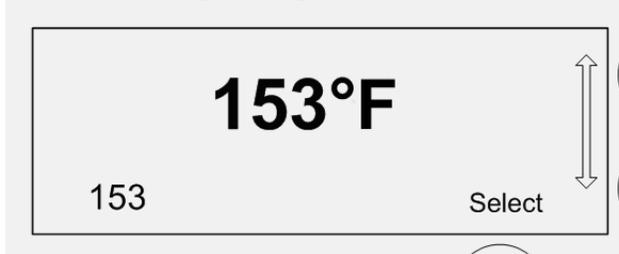
Figure 13: Volume flow rate screen (no error flags)
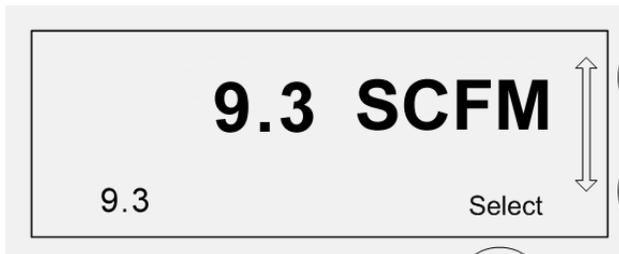
Figure 14: Air Velocity screen (The Air velocity is not being regulated on this screen. This is indicated by the series of dashes on the lower left of the screen.)
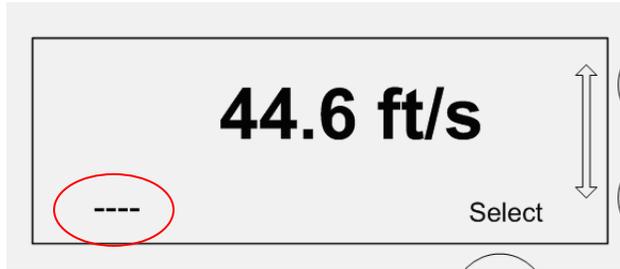
Error Alarm Conditions:

In the event that a user selected value cannot be regulated, an alarm will sound bringing immediate attention to the discrepancy. The following are the alarm flags that will be displayed on screen.

-*Temp (Temperature out of regulation by +/- 20°F)
-*CFM (Volume flow rate out of regulation by 0.5 SCFM or more)
-*Air Vel (Air velocity out of regulation by 5 ft/s)
*Note: Alarm is disabled for 20 seconds after any set point changes

Figure 15: Temperature is out of regulation (Temp error flag is flashing)

8.0 Quick Start Guide

Terminate power cord with desired 240VAC plug. Green wire goes to ground and the black and white wires each go to separate lines.

Set Temperature:
1 – Press select button located below the display until you cycle to Temperature screen.
2 – Use the up and down arrows located to the right of the display to change the target temperature. Target temperature is displayed on the lower left corner of the display.

Set Volume Flow Rate: Option 1

1 – Press select button located below the display until you cycle to Air Flow screen.
2 – Use the up and down arrows located to the right of the display to change the target air flow. Target air flow is displayed on the lower left corner of the display.

Set Air Velocity: Option 2

1 – Press select button located below the display until you cycle to Air Velocity screen.
2 – Use the up and down arrows located to the right of the display to change the target air velocity. Target air velocity is displayed on the lower left corner of the display.

*Note: Option 1 and 2 cannot be set concurrently. Choose to set one or the other.

Start/Stop Unit:

Press the Start/Stand-by button to start regulation of user selected values. Press this button again to go to Stand-by mode. The heater will shut off immediately, but the blower will continue to run for 60 seconds.

9.0 Maintenance

> **Filter:** Make sure air intake is not blocked or clogged by dust or other particulate matter. The air filter should be replaced every 1000 hours of operation or sooner if being used in a very dirty environment. Contact EIT to purchase replacement.
>
> > Manufacturer: Solberg Manufacturing
> > 2 micron filter P/N: 10
>
> **Power Cables:** Inspect for any wear or breaking of insulation and replace if necessary. Such wear is caused by regular movement of cables against a sharp corner and should be avoided to prevent damage or injury. Any cable rated for 230VAC is acceptable but may need to be re-terminated with the proper plug. Contact EIT to purchase replacement.
>
> > Manufacturer: McMaster-Carr
> > Power Cord P/N: 7082K85
>
> **Hose:** If the connecting hose from blower to heater has a hole in it, all output values will be incorrect. Hoses with any leakage should be repaired or replaced prior to continued use. Contact EIT to purchase replacement.
>
> > Manufacturer: McMaster-Carr
> > Hose P/N: 5304K45

10.0 Customer service and support

For service and support, call the following number:

Phone: 703-478-0700
Fax: 703-478-0815
Email: sales@eitinc.com

Our normal hours are 9-4:30 EST.

11.0 Warranty

EIT (Seller) warrants to Purchaser that the goods manufactured and sold by it will be free from defects in materials for a period of 12 months from the day of delivery of the goods. Seller's liability under this warranty shall be limited, at the Seller's elections, to the purchase price or the replacement or the repair of such defective goods. No claim under this warranty shall be valid unless made in writing to the Seller within 12 months of the delivery of the goods sold hereunder, nor will any claim be allowed on goods which have been processed or altered in any manner (normal inspection procedures excepted). Seller shall have a reasonable opportunity to examine all goods claimed to be defective. Transportation charges for the return of each defective goods to the original point of delivery or such other place designated by the Seller shall be paid by the Purchaser who shall be credited by Seller for such reasonable transportation cost. This warranty supersedes and is in lieu of any other warranty, expressed or implied, or no agreement, or understanding varying, or extending this warranty will be binding upon Seller unless in writing, signed by a duly authorized officer of Seller.

12.0 Application Notes

Nozzle Temperature Profile:

Below is the temperature profile across the heater nozzle at various distances. Individual heater profiles may vary slightly across the x-axis due to internal mechanical alignment. The information below is intended purely as reference material.

Graph 1: Nozzle Temperature Profile