

Instruction Manual

Athena 6050
Temperature Controllers



ATHENA

INSTRUCTION MANUAL

ATHENA 6050

Automatic Tuning

Temperature Controller

SPECIFICATIONS:

Inputs:

Line Voltage 120/240 Vac +10%, -15%, 50, 60 Hz

Sensor Thermocouple

Power Consumption Less than 6 VA (Instrument)

Ranges Available J Couple 0-1400°F (0-760°C)
K Couple 0-2500°F (0-1370°C)

Accuracy: 0.2% of full scale

Temperature Stability 5 mV/°C Max 3m V/°C typ.

Cold end tracking 0.05°C/°C ambient

Operating ambient for
rated accuracy 0 to 55°C

Maximum T/C lead
resistance for
rated accuracy 100 Ohm

Series mode noise
rejection: 80 dB

Common mode noise
rejection 120 dB

T/C break protection: Upscale standard

Dual display: Process temperature displayed
continuously; set point or other
parameters updated on lower display.

Display update rate:	5 times per second
Filtering:	Analog and digital filtering techniques increase stability of process and display.
°F/°C:	Internal switch selection-- process, set point.
output:	Heating only
-B Relay (time proportioning)	SPST relay 7 Amps resistive at 120 Vac, 5 amp resistive at 240 Vac, 50 VA inductive.
-F Current proportional	4-20mADC into 500 Ohm max. For driving SCR power controllers.
-S Pulsed voltage	20 Vdc pulsed time proportioning signal for driving solid state relays.
-T Triac time proportional	Solid state plug-in triac output. Rated 1 Amp holding & 10 amps inrush.
Filtered LED display:	4 digits for process, 4 digits for parameters.
T/C linearization:	Continuously calculated and updated using rom based algorithm.
Connections:	Inputs and outputs via barrier strips with U. L. approved locking terminals.
Dimensions:	Front panel: 96mm X 96mm X 22mm Case: 92mm X 92mm X 118mm Depth behind panel: 96mm (approx. minus panel thickness)
Mounting:	Channel slides and screws
Weight:	2 lb



FRONT PANEL ADJUSTMENTS

Touch Key

1 Index: Allows the following adjustments to be selected.

- | | |
|--------------------------------------|--|
| 1) Set point temperature | 0- 1400° F (760°C)
0- 2500° F (0- 1370°C) |
| 2) Heat cycle time | *1 to 120 seconds |
| 3) Prop. Band (indicated
as gain) | 0.25-25% of span |
| 4) Rate with tracking reset | **4-255 seconds |
| 5) Auto Tune (AT) | |

Up/Down keys: increases/decreases values of above adjustments.

Tune/Cancel: "cancel" puts output on stand-by to permit set-up

"tune" triggers automatic tuning procedure

E Enter: writes selected value to nonvolatile memory

NOTES: *setting to zero initiates 60 millisecond timebase for ultra fast cycling. Use with external solid state relays or SCR Power Controllers.

**Setting to zero disables reset and rate action for proportional only control. Reset is six times higher than rate

FOR OPTIMUM RESULTS WITH THE AUTO-TUNE MODEL 6050

1. Set point must be a minimum of 100°F above ambient for proper start-up.
2. Multi-zone applications require auto-tune units on each zone and simultaneous warm-up.

3. Loss of power or turn-off during warm-up requires a re-start from ambient.
4. Change of state processes, i.e. solid to liquid or liquid to gas, may introduce erroneous tuning parameters during process warm-up.

GENERAL

1. Accurately measures, linearizes and displays temperature in °F and °C.
2. Automatically calculates and displays parameters-heat gain, and rate/reset time.
3. Can be field converted from relay output "B", to solid state relay "T", to solid state driver "S" or to a 4-20 mA output SCR driver "F".
4. Will remember its "entered" settings after power failure or shut-off and not "Go To Sleep".

CAUTION: HIGH VOLTAGE AND HIGH TEMPERATURES CAN CAUSE INJURY AND ARE A FIRE HAZARD. PLEASE READ ALL INSTRUCTIONS, HAVE ONLY SKILLED PROFESSIONALS WIRE THE UNIT, AND USE APPROVED TEMPERATURE AND/OR PRESSURE SAFETY CONTROL. EVEN THE BEST COMPONENTS CAN BE DAMAGED OR MAY NOT FAIL SAFE.

CONFIGURATION

Depending on the model number of the unit you have ordered, you will find one of four basic modules installed. The fifth digit of the code indicates the output module type.

B - Relay 7A/5A @ 120/240 Vac

F - 4-20 mA (Proportional)

T - Triac 1 Amp @ 240 Vac

S - 20 VDC Pulsed for driving solid state relays

Example: 6050-F has proportional 4 to 20 mA heat output.

Note: If you have not received your controller from the factory direct, check to confirm that the correct module for your application is installed. Since the modules plug-in, and since controller plug into cases as well, previous users may have changed modules, which can result in severe controller damage.

INSTALLATION INSTRUCTIONS

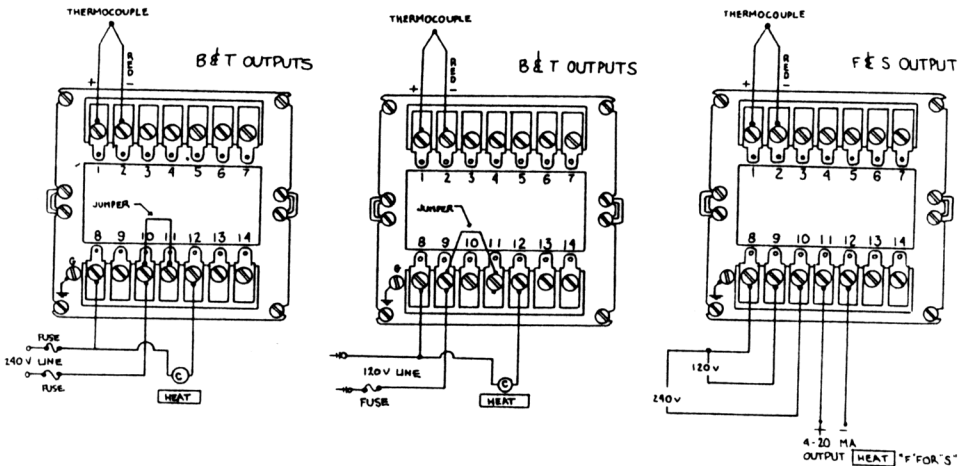
Unpacking Unpack the instrument and inspect for shipping damage. Report any damage to the carrier immediately.

Locating Select a location for the controller where it will not be subject to excessive shock, vibration, dirt, moisture or oil. The ambient temperature of the area should be between 30° and 130°F. (Dust, oil, and water resistant covers available).

Mounting Mount the controller into a 92mm (3 5/8") square cutout. See figure below for the cutout and case dimensions. The plug-in controller does not have to be removed from its housing for mounting.

Remove two screws that hold the mounting slides, and then remove the slides. Insert case from front panel and reinstall the two slides and two screws. Do not overtighten screws. The length of the slides must be reduced if the controller is to be mounted in an extra thick panel. If the controller has been unplugged from its housing, the top of the housing can be determined because it displays the serial tag.

Terminal Designations



Output Modules

The Athena 6050 offers users field interchangeable output modules. This unique feature makes it possible to fill output requirements for a variety of applications with a single controller model.

Module Type B: This 7A/5A relay (at 120/240 Vac) is used for driving resistive heaters.

NOTE: Do not use this output module with mechanical contactors because they generate an excessive EMI field which can interfere the 6050's microprocessor. Instead we recommend "T" output modules for this application.

Module Type F: This 4-20mA output module can deliver full output to loads having an input impedance of 500 Ohms or less. The cycle time setting must be ZERO for smooth current output.

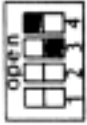
A push-on terminal is utilized as a return for ground currents of the milliamp source. It is connected internally to the mating lug on the heat sink. To avoid ground loops, drive floating (ungrounded) loads or use isolated thermocouples.

Module Type T: This solid state relay is capable of 1 AM² at 120/240 Vac. It is zero voltage switched and optically isolated from the drive signal. With it, resistive loads up to 120 watts at 120 Vac and 240 watts at 240 Vac may be controlled directly. Using direct control there is no lower limit on the cycle time setting (down to 60 milliseconds). Larger loads may be controlled utilizing an external contactor. In this case, it is advisable to use cycle settings of ten seconds or greater to minimize contactor wear. External suppression of the contactor is mandatory.

Module Type S: Similar to F, but pulsed 20V/20mA DC output for driving solid state relays. Up to 6 (input series connected) solid state relays can be used. Cycle time can be set to optimize the load response time requirements without sacrificing S.S.R. life.

INTERNAL SWITCHES

Damping Control - To allow the controller to provide automatic tuning for processes with varying heating characteristics and with varying heating capabilities, the 6050 offers three damping choices:



- 1) High damping: for over-powered heating systems, systems with multiple heat lags, and/or poor coupling between the heater and the temperature sensor.



- 2) Normal: for most standard processes where the heater is properly sized for the system and there is good coupling between the heater and the temperature sensor.



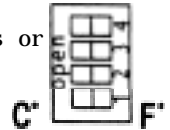
- 3) Low damping: for adequately powered systems with excellent coupling between the heater and the temperature sensor where quick response and the tightest possible temperature control are desired.

Keypad Security - Switch 2 in the open position locks the operator out of access to all parameters except set point.



CELSIUS/FAHRENHEIT DISPLAY SECTION

Switch 1 allows both displays to read in degrees Celsius or Fahrenheit, and is indicated on front panel LED's.



WIRING THERMOCOUPLE CIRCUITS

Before wiring, check thermocouple and extension wire to make sure that they conform to the appropriate thermocouple type specified on the serial number tag. In thermocouple circuits, the negative lead is colored red. Extension wires must be the same alloy and polarity as the couple. The thermocouple circuit resistance should not exceed 100 OHMS. Do not run thermocouple leads in the same conduit as the power lines. If shielded thermocouple is used, terminate the shield only at the controller end using the corner screw provided for that purpose.

STANDARD THERMOCOUPLES

I. S. A. TYPE	MATERIALS	COLOR CODE
J	Iron Constantan (I/C)	White(+) Red(-)
K	Chromel Alumel (C/A)	Yellow(+)

THERMOCOUPLE PLACEMENT

Proper thermocouple placement can eliminate many problems in the system. The probe should be placed so that it can detect any temperature change with minimal thermal lag. In a process that requires fairly constant heat output, the probe should be placed close to the heater. In processes where the heat demand is variable, the probe should be close to the work area. Some experimenting with probe location is often needed to find its optimum position.

In a bath process, addition of a stirrer will help to eliminate thermal lags. Since the thermocouple is basically a point measuring device, putting more than one thermocouple in parallel will provide an average temperature reading and produce better results in air heated processes.

NOTE: If controls with "F" or "S" outputs drive loads with grounded or hot input terminals (not floating), an isolated thermocouple must be used. Otherwise, when both input and output are grounded, ground loop currents will result, causing errors and controller damage.

Standard thermocouple limits of error are 4°F or 0.75% of sensed temperature (half that for special) plus drift caused by improper protection or overtemperature. This is far greater than controller error, and can not be corrected at the sensor except by selection and replacement.

Start-Up

Before line voltage is applied, double-check the following:

- 1) Make sure the thermocouple type is correct, and properly connected (see section on thermocouples) to terminals 1 and 2 (red on 2).
- 2) Make sure there is no AC or DC voltage leading or arcing to T/C.
- 3) Make sure the proper terminals are selected for line voltage. (8 & 9 for 120V, 8 & 10 for 240V)
- 4) Check to assure there are no heater shorts, or shorts to ground, and no bare wires or frayed insulation.
- 5) Make sure correct plug-in module is used.

OPERATING INSTRUCTIONS

How to Start the automatic tuning procedure

STEP 1: Energize the unit and proceed immediately to step 2.

STEP 2: Place the unit on standby by holding the "Index" button until the "Autotune" LED lights then press the Cancel button.

The unit is now ready for set point and cycle time entry.

STEP 3: To enter a set point: A) Hold "Index" button until the SP LED lights and B) Use the appropriate touch key, either up or down to enter set point.

When you've entered the desired set point, simply press the enter key. NOTE: Set point must be at least 100°F above ambient.

STEP 4: Set cycle time by advancing "Index" to "HC" and select desired value using up or down keys. Cycle time is shown in seconds, from 1-120. Setting zero initiates a 60 millisecond cycle time for ultra fast cycling for use with "F" or "S" output modules. For mechanical relays or contactors use 10-120 seconds. When you've found the desired cycle time press the enter key.

STEP 5: To start warm up and calculate all PID parameters advance Index to auto tune again and press the "tune" button.

The "AT" L. E. D. will light and "HT" L. E. D. will light. You may now index to any parameter for viewing as process heats. Upon completion of tuning, the "AT" L. E. D. will be off.

NOTE: The parameters that the 6050 calculates automatically can be entered on the Athena 6000/6200 to achieve the same smooth and precise temperature control on your process.

How to override automatic tuning parameters

It is possible to set or fine tune three mode parameters manually on the 6050.

To manually enter parameters:

- 1) Press "Index" button until the LED for the desired parameter lights.
- 2) Enter the new parameter using the up or down key.
- 3) Press the "enter" button.

The new parameters will now take control of the process. To calculate the PID parameters without using the automatic tuning mode, consult the Athena 6000/6200 instruction manual.

Reading automatically calculated PID parameters

Press the "index" key. The LED's in the "Index" display will light in sequence, and as they change, the lower digital display will show each parameter.

TROUBLE SHOOTING

Front dark - no instrument power.

Process display shows CCCC - Open thermcouple. Short terminals 1 and 2. Process display should indicate temperature at back of case. Repair or replace thermcouple.

About Half or Twice Expected Reading - Check position of °C/°F switch. Short 1 and 2 to read room temperature. 22-30 is °C, 70-85 is °F.

About 30% Error - Wrong thermcouple type. Disconnect couple. "J" units over range above 1400°F, "K" above 2500°F.

No Heat - No heater power, heater wiring, wrong output module.

Heat Stays On - Welded relay contacts, shorted output module, or shorted power handler.

Process Display Shows 0000 Or Initially Displays Room Temperature Then Counts Down Scale As Process Warns - Check for reversed thermcouple.

Display blinks, entered values change - Caused by electromagnetic interference. Suppress arcing contacts in system to eliminate high voltage spikes, separate sensor and controller power wiring from "dirty" power lines. Ground heated devices.

Unit Repairs

It is recommended that units requiring service be returned to an authorized service center. When a controller is returned for service, a note stating the problem should accompany the unit.

NOTE: Warranty is void when units are modified by the customer or other non-authorized parties.

A spare parts list can be supplied upon request if complete model number, serial number and temperature range is supplied.

WARRANTY

This equipment is warranted to be free from defects of material and workmanship. It is sold subject to our mutual agreement that the liability of Athena Controls, Inc. is to replace and/or repair at its factory, provided the equipment is returned, transportation prepaid within (2) years of its purchase.

The purchaser agrees that Athena Controls, Inc. shall assume no liability for consequential damages resulting from its use or packaging of shipments returned to the factory.

Components which wear or which are damaged by misuses are not warranted. These include contact points, fuses, triacs, and modules. Units which have been modified by customer are not warranted.

Specifications are subject to change without notice.



ATHENA

Controls, Inc., 5145 Campus Drive
Plymouth Meeting, PA 19462 (215) 828-2490