

## **AT-NEA Controller Assembly Specifications and Installation Instructions**

Accurate Gas Control Systems offers the controller assembly: the AT-NEA. Each controller assembly houses a complete single or dual channel control system in a heavy duty, wall mounted, NEMA4X enclosure (AT-NEA). The controller is designed for use with Accu-Trace Heat Tracing Systems, AT-HTZ Cylinder Heating Systems, and the AG-NFH Nitrogen Heater System, and other applications requiring temperature control.

The proportional-integral-derivative (PID) microprocessor based temperature controller is fully programmable either manually, or using the advanced Auto-tune algorithm function to tune control parameters automatically. **Do not run auto-tune when used with heat trace tape.**

Power switching is accomplished via a solid state relay connected to the controller's primary solid state driver output allowing fast response control modes. A normally open mechanical relay is connected to the controller's secondary output providing a safety alarm circuit for interrupting power to the application in the event of a high temperature alarm.

### **1. Specifications**

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Power Handling Capacity: 1625 W total output (1 or 2 channel)

Min. Circuit Requirements: 100-125 VAC, 15 A, 50/60 Hz per channel (120 VAC)  
208-240 VAC, 10 A, 50/60 Hz per channel (220 VAC)

Controller: 1/16 DIN, Microprocessor based PID Controller

Protection Devices: GFCI Power Supply Required

Temperature Sensor: Type J Thermocouple, 12'

Other types and lengths available upon request.

Primary Output, SP1: Solid state / external solid state relay

Secondary Output, SP2: SPDT mechanical relay / external SPDT mechanical relay

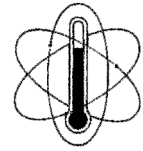
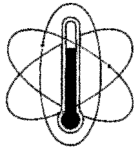
Dimensions: 10.0" high X 8.0" wide X 6.0" deep. AT-NEA Models

Part Number Designation: **AT-NEAX-Y**

where **X** specifies number of channels, **Y** specifies the voltage,

**X = 1** ⇒ single channel      **Y = -1** ⇒ 100-125 VAC

**X = 2** ⇒ dual channel        **Y = -2** ⇒ 208-240 VAC



## **2. Installation Instructions**

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The Controller Assembly has been pre-programmed at the factory for basic operation. **The user must program the high temperature alarm output (SP2) set point and control set point.** Depending on the application, other controller settings may be recommended. Recommended controller settings given by the application over-ride the basic factory pre-set settings.

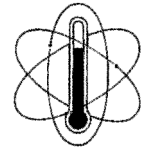
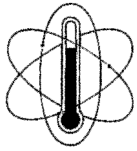
### **2.1 Controller Assembly Installation**

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- Locate the controller assembly in a dry and level location not subject to movement.
- Connect the output cord to the system to be controlled. Make electrical connections in an approved enclosure when connecting the output cord to Accu-Trace Systems. Install this product only as described in these instructions. These instructions are not to supersede any other instructions. Install heat trace products according to the heat trace installation instructions.
- Connect the thermocouple to the system to be controlled. Make sure the thermocouple makes intimate contact with the system and is thermally isolated from the ambient surroundings. Proper temperature control of the system is achievable only if an accurate temperature reading is obtained.
- Connect the input to a properly sized electrical supply. See Section 1 and 4 for specifications. Enclosure penetrations will be required for installing all AT-NEA-P products. Follow appropriate electrical codes for installation of pipe and wire. This product is to be installed in accordance with Article 427 of the National Electric Code (NEC). Do not use this product outside of its Listed ratings. Do not use extension cords with this product.

NEC 1999, 427-22 may require a **ground fault circuit interrupt power supply** to be used with installations controlling Accu-Trace Heat Tracing or AT-HTZ Cylinder Heating Systems.

NEC 1999, 427-55 requires a power supply with a **disconnect means** for controllers used with installations controlling Accu-Trace Heat Tracing or AT-HTZ Cylinder Heating Systems.



## **2.2 Controller Programming**

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### **2.2.1 Programming the Secondary Output (SP2) - High Temperature Alarm**

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The secondary output (SP2) of the controller will be activated shown by the illuminated red light on the face of the controller upon first applying power. No output voltage will be present to the application. The alarm set point should be set 2 to 3 degrees above the control set point.

- Press the ▲ and ▼ keys simultaneously and hold for three seconds to enter the menu mode. The display should read *TUNE*.
- Press the ▼ key until the display reads *SET.2* and flashes the current set point.
- Press the \* key and the ▲ or ▼ to adjust the set point.
- Release the \* key and press the ▲ and ▼ keys simultaneously and hold for three seconds to return to the standard display.

### **2.2.2 Entering the Operating Set Point**

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- While pressing the \* key, enter the desired operating temperature using the ▲ or ▼ arrows.

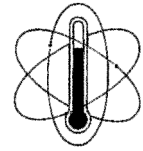
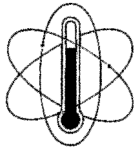
### **2.2.3 Recommended Parameter Settings**

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The controller assembly is tested and pre-programmed at the factory. Below is a list of the pre-programmed control parameters. To change parameters on menu levels higher than 1 you must change menu levels. From the menu mode select the menu parameter and hold the \* key, enter the desired menu level by using the ▲ or ▼ arrows.

<b>Menu Level</b>	<b>Option</b>	<b>Description</b>	<b>Setting</b>
1	<i>SET.2</i>	<i>SPT 2 Mode - Full scale high alarm</i>	<i>Programmed by customer</i>
1	<i>CYC.T</i>	<i>SP1 Proportional cycle time</i>	<i>1 seconds</i>
1	<i>BAND</i>	<i>SP1 Proportional band / Gain</i>	<i>2.5%</i>
1	<i>DER.T</i>	<i>SP1 Derivative time / Rate</i>	<i>25 seconds</i>
1	<i>DAC</i>	<i>SP1 DAC approach control</i>	<i>1.5x proportional band</i>
1	<i>INN.T</i>	<i>SP1 Integral time</i>	<i>5 seconds</i>
2	<i>INPT</i>	<i>Sensor Select</i>	<i>J T/C</i>
2	<i>SP2.A</i>	<i>SP2 Operating Mode</i>	<i>FS.hi- Full scale alarm - high</i>
2	<i>UNIT</i>	<i>Unit of measurement</i>	<i>°C</i>
3	<i>SP1.D</i>	<i>SP1 Output Device</i>	<i>SSd- Solid state relay driver.</i>
3	<i>SP2.D</i>	<i>SP2 Output Device</i>	<i>rly- Latching alarm.</i>

Reference the controller-operating manual for the complete list of parameter and function options.



### **2.3 Display Indicators**

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- The display will show the temperature reading as measured by the thermocouple.
- The primary SP1 and secondary SP2 output indicators are located on the main display screen. SP1 is located in the upper left corner of the display. SP1 will be energized when the green square light is lit. SP2 is located in the lower right hand corner of the display. SP2 will be energized in the alarm mode when the circular red light is lit.

### **2.4 Tuning the Controller**

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The controller will need to be tuned for best performance. Each load requires a different response from the controller to achieve minimum variation from setpoint. The controller can be tuned manually or by an internal auto-tuning feature. For best results first Autotune the controller. If the system does not respond favorably try manual adjustments. If tuning becomes difficult check the system for proper installation then call the factory for assistance. **Do not run auto-tune when used with heat trace tape.**

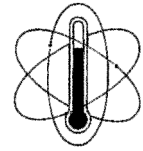
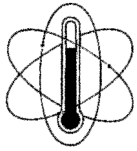
#### **2.4.1 AutoTune**

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Always let the system cool to ambient conditions before starting this procedure. Follow instructions in Section 2.2.1 to set the high temperature alarm to highest value that is safe for the system. Follow instructions in Section 2.2.2 to set the desired system setpoint. Follow this procedure to Autotune the controller.

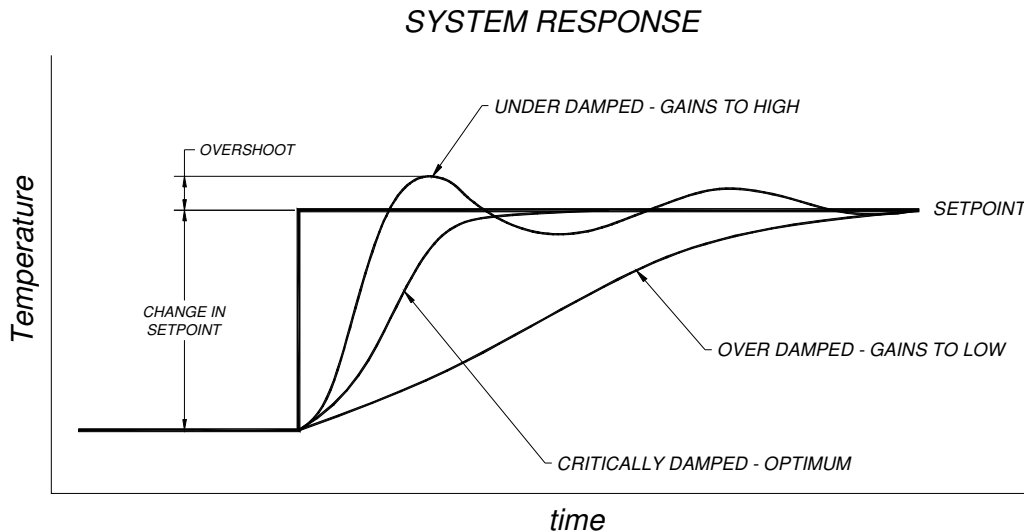
- Press the ▲ and ▼ keys simultaneously and hold for three seconds to enter the menu mode. The display should read *TUNE*.
- Press the \* key and the ▲ or ▼ to display *AT.SP*
- Press the ▲ and ▼ keys simultaneously and hold for three seconds to exit the menu mode.

Once you exit the menu mode the controller will run the Autotune routine. The display will show the process temperature alternating with *TUNE*. When the routine is complete the controller will resume normal operation with PID values calculated from the Autotune. Once normal operation has resumed follow instructions in Section 2.2.1 to set the high temperature alarm. The alarm set point should be set 2 to 3 degrees above the control set point.



### 2.4.2 Manual Tuning

Follow instructions in Section 2.2.1 to set the high temperature alarm to highest value that is safe for the system. Follow instructions in Section 2.2.2 to set the system setpoint 3 to 5 degrees below the desired setpoint. Allow the system to stabilize as best possible. Raise the setpoint at least 2 degrees and observe the system response.



If the process temperature overshoots the setpoint the system is “under damped”:

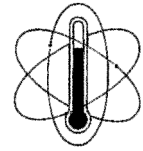
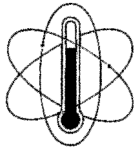
- Lower the **BAND** (SP1 Proportional band / Gain)
- Raise the **IN.NT** (SP1 Integral time)

If the process temperature responds slowly or does not reach the setpoint the system is “over damped”.

- Raise the **BAND** (SP1 Proportional band / Gain)
- Lower the **IN.NT** (SP1 Integral time)

Make adjustments of 20% to 50% initially then make successively smaller adjustments. Optimum performance will occur when the system responds very quickly with little or no overshoot. It may be necessary to allow the system to cool down after several steps have been made. Always tune the system at or near the desired setpoint. Manual tuning may require many adjustments to discover the best set of parameters.

If tuning becomes difficult check the system for proper installation then consult the factory.



### **3. Troubleshooting Guide**

*Should the system not operate properly, reference the table below.*

#### **Fault Symptom**

- *Display shows an INPTFAIL sensor burnout error message.*
- *No output is registered at system.*

#### **Possible Cause and Remedy**

*Check sensor integrity. Replace sensor if faulty.*

*Temperature set point has not been entered. Check the temperature set point. Alarm output is activated. Check alarm set point value. The alarm set point must be above the temperature set point.*

*If both the temperature and alarm set points are properly entered, check all wiring.*

- *Continuous output*

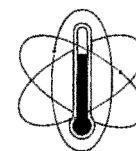
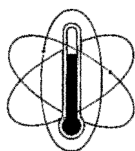
*Sensor is not properly sensing system temperature. Check sensor location and installation. The temperature sensor must make intimate contact with system and be thermally isolated from the ambient surroundings.*

*The solid state relay has failed and the high alarm set point is not properly programmed. Test the solid state relay and replace if faulty, and check the high alarm set point value.*

- *Temperature will not reach set point*

*Sensor is not properly sensing system temperature. Check sensor location and installation. The temperature sensor must make intimate contact with system and be thermally isolated from the ambient surroundings.*

*Check the control parameters. If the temperature is stable but a few degrees below set-point, raise the manual reset value (menu Level 1 OFST) incrementally.*



## 4. Performance and Rating Data

### 4.1 Accu-Trace Heat Trace Ratings

<b>Part Number</b>	<b>Service Voltage (Volts)</b>	<b>Maximum Length (Feet)</b>	<b>Maximum Maintenance Temperature</b>	<b>Maximum Intermittent Exposure</b>	<b>T-Rating<sup>1</sup></b>
AT-BTXG5-1	120	270	150°F	180°F	T6
AT-BTXG8-1	120	210	150°F	180°F	T6
AT-BTXG10-1	120	180	150°F	180°F	T6
AT-UTXG5-1	120	310	250°F	428°F	T6
AT-UTXG8-1	120	190	250°F	428°F	T6
AT-UTXG10-1	120	135	250°F	428°F	T6

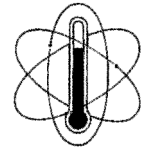
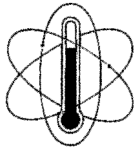
1.) Electrical equipment T-Rating codes define the maximum surface temperature that the equipment will reach. It is used in hazardous classified area applications.

### 4.2 Accu-Trace Heat Trace Circuit Breaker Selection Guide

<b>Watts/Ft</b>	<b>Start-Up Temp.</b>	<b>120 Volt</b>				<b>240 Volt</b>			
		15A	20A	30A	40A	15A	20A	30A	40A
AT-BTXG 5W/ft	50°F	225	270			460	540		
	0°F	155	205	270		310	415	540	
	-20°F	135	180	270		275	370	540	
8W/ft	50°F	145	195	210		295	390	420	
	0°F	100	130	195	210	200	265	395	420
	-20°F	90	115	175	210	175	235	350	420
10W/ft	50°F	115	150	180		230	305	360	
	0°F	85	110	155	180	165	220	325	360
	-20°F	75	100	145	180	150	195	290	360
AT-BTXG 5W/ft			185	245	310		385	500	620
8W/ft			115	150	190		225	300	375
10W/ft			80	110	135		160	215	270

**Notes:**

- 1.) Circuit breakers are sized per article 427-4 of NEC and are based on start-up temperature between -20°F and 50°F.
- 2.) When using 240 volt product at 208, 220 or 277 volts, use the circuit adjustment factors shown in the voltage adjustment table.
- 3.) When using 2 or more heater cables of different wattage ratings in parallel on a single circuit breaker, use the 15A column amperage of 15 amps combination loads. These amps/foot factors include the NEC sizing factor in Article 427-4.
- 4.) The G series heater cable contains a metal ground shield. This qualifies them for use on nonmetallic pipe (Article 427-23 NEC) and allows their use without ground fault protection (Article 427-22 NEC for all applications except Division 1 Hazardous Areas).



### *Revision History*

<i>Rev</i>	<i>Date</i>	<i>EC N</i>	<i>By</i>	<i>Description</i>
<i>0</i>	<i>12/1/99</i>	<i>N/A</i>	<i>AP</i>	<i>First publication</i>
<i>1</i>	<i>5/1/00</i>	<i>N/A</i>	<i>CD</i>	<i>Revised for change to Cal 9300 controller</i>
<i>A</i>	<i>5/8/00</i>	<i>N/A</i>	<i>CD</i>	<i>Released to Production</i>
<i>B</i>	<i>5/22/00</i>	<i>N/A</i>	<i>CD</i>	<i>Added Doc No, edited footer per new procedure, created inventory no.</i>
<i>C</i>	<i>5/23/00</i>	<i>N/A</i>	<i>CD</i>	<i>Updated area code in header</i>
<i>D</i>	<i>10/9/00</i>	<i>162</i>	<i>CD</i>	<i>Section 2.1 codes added</i>
<i>E</i>	<i>8/1/01</i>	<i>183</i>	<i>CD</i>	<i>Section 2.4, 4.1 and 4.2 added</i>
<i>F</i>	<i>9/25/07</i>	<i>284</i>	<i>MM</i>	<i>Address Update, Auto Tune &amp; Heat Trace</i>
<i>G</i>	<i>5/03/10</i>	<i>286</i>	<i>MM</i>	<i>Revised to reflect updates in product and remove AT-MODEA</i>