ACCURATE GAS CONTROL SYSTEMS
2825 S. Rodeo Gulch Rd. #1, Soquel, CA 95073
TEL (831)-462-0500, FAX: (831)-462-0507, E-mail: agcs@accurategas.com

AT-NEALC11 Controller
Installation and Operation Manual

*Accurate Gas Control Systems offers the AT-NEALC11. This controller assembly houses a complete single channel control system in a heavy duty, wall mounted, NEMA4X enclosure (AT-NEA). The controller is designed for use with Accu-Trace Heat Trace System, AT- HTZ, Uniflow Cylinder Heating Systems and other applications requiring temperature control. This controller is certified and meets **UL** Standards. **CE** and **ATEX** certifications pending.*

*The proportional-integral-derivative (PID) microprocessor based temperature controller is fully programmable either manually, or using the advanced Auto-tune algorithm functions to tune control parameters automatically. **CAUTION: Do not run Autotune when using with Heat Trace.***

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 solid state 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 NEALC11***

Power Handling Capacity:	*1200 W Total Output*
Min. Circuit Requirements:	*100~ -120~ VAC, 15A, 50/60 Hz.*
Controller:	*1/16 DIN, Microprocessor based PID Controller*
Protection Devices:	*GFCI AC Power Source Required*
Temperature Sensor:	*Type K Thermocouple*
Primary Output, SP1:	*Solid state / external solid state relay*
Secondary Output, SP2:	*Solid State relay / external SPDT LC mechanical relay*
Dimensions:	*15.38" high X 12" wide X 7" deep*
Part Number Designation:	***AT-NEALC X-Y***
	X = 1 *⇒ single channel* ***Y = 1*** *⇒ 100-125 VAC*
	X = 2 *⇒ dual channel* ***Y = 2*** *⇒ 208-240 VAC*
	LC *= Limit Control (for use with temperature limited loads)*
Analog Output:	*4-20mA / 500Ω / ±0.1% of full scale typical / user scaled*

2. Installation Instructions

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

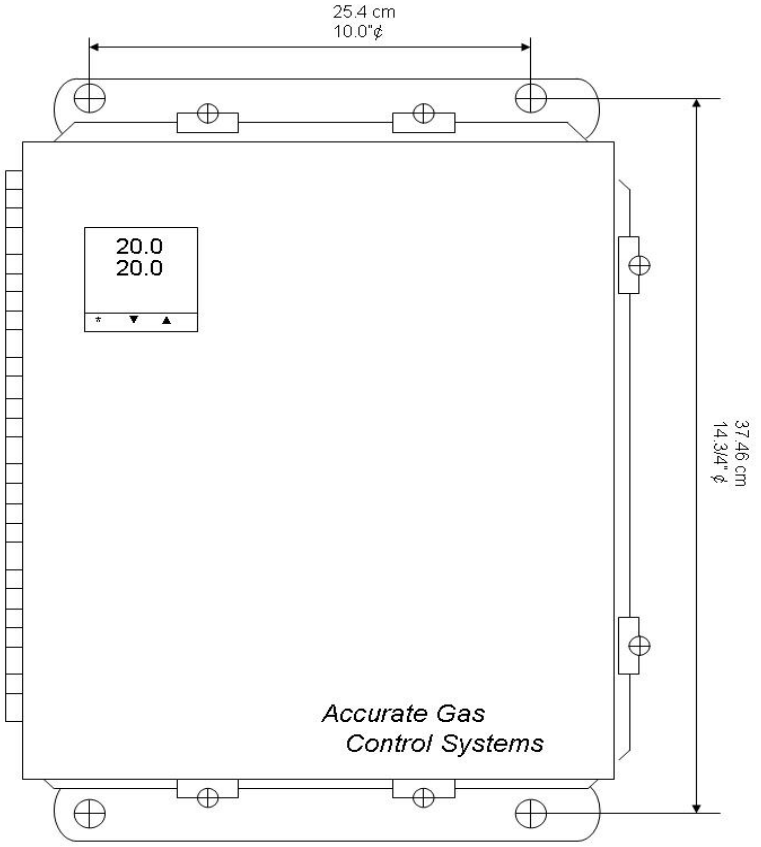
- *Locate the controller assembly in a dry and level location not subject to movement. See page 3 for mounting diagram. Mount controller using (qty=4) min. ¼" x 20 SS x3/4" bolts using appropriate anchors or hardware. It is not recommended to mount this unit on other than masonsary or metal surface.*
- *The mounting holes on center are 25.4cm across and 37.46cm top to bottom.*
- *Connect the input (TB1) to a properly sized electrical supply. Refer to Electrical Schematic N11E103 for specifications. Enclosure penetrations will be required for installing this product. 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, in addition to the supplied connection cord, with this product.*
- *This product should be installed and serviced by qualified service personal only.*

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, and Uniflow 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, and Uniflow Cylinder Heating Systems.*

- *Connect the heating panels to load terminals TB2 and TB3. Refer to Electrical Schematic N11E103 for connection specifications. Enclosure penetrations will be required for the power and thermocouple wires. Make certain that the "Process" and "Element" thermocouples for each zone are connected as shown in the electrical schematic. The "Process" Thermocouple is connected to the process controller (PC1). The "Element" Thermocouple is connected to the limit controller (LC1). Make certain that the power and thermocouple cables are connected in the correct group or channel to the correct terminal group. AT-HTZ, and Uniflow Cylinder Heaters are fitted with (2) Type K Thermocouples. (Yellow + positive and Red – negative.) The NEALC11 Controller is programmed for use with Type K Thermocouples.*

- *Label each process zone to a particular gas cabinet or cylinder.*
- *Close and screw case cover down before activating the unit.*



AT-NEALC11 Mounting Diagram

- Mount controller using (4) ¼" x 20 SS x ¾" bolts into concrete or brick wall.

2.2 Controller Programming

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

The secondary output (SP3) 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 once and the display will show* **LEVL 1**.
- *Press the ★ key and the ▼ until the display shows* **LEVL A**.
- *Press the ▲key until the display reads* **SET.3** *and flashes the current set point (set to* **0** *from the factory)*
- *Press the ★ key and the ▲ or ▼ to adjust the alarm 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

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

2.2.3 Recommended Parameter Settings

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. Parameters shown in ***bold*** *are required for the application. Parameters not in bold are either not critical or not used for the application.*

Menu Level	***Option***	***Description***	***Setting*** *(or default)*
LEVL A	AN.HI	High Scale	1000
	ANLO	Low Scale	0
	HI.IN	Input High	50.0
	LO.IN	Input Low	0.0
	DECP	Decimal Place	0000
	SP3.A	**Alarm Mode – High Temp**	**FS.HI**
	SP3.B	Alarm Second Mode	NONE
	SET.3	**High Temp Alarm Set point**	**User Set High Temp Alarm**
	HYS.3	Alarm Hysteresis	0.1
	BRN.3	Alarm Burnout	UPSC
	REV.3	Alarm Output Sense	3D

Menu Level	Option	Description	Setting
LEVL P	PROG	Program Number	1
	RUN	Run Program	OFF
	FAIL	Power Failure Recovery Mode	RSET
	ST.U	Program Start Value	PV
	SPRU	Setpoint Ramp Time	HOUR
	SEG	Segment Number	1
	TYPE	Segment Type	SPR
	SPRR	Setpoint Ramp Rate	100
	T.SP	Adjust Target Setpoint	20
	HB.U	Holdback Value	OFF
	EO.P	Event Output	NONE
LEVL 1	TUNE	Autotune Mode	OFF
	BAND	Proportional Band	2.5
	INT.T	Integral Time	5.0
	DER.T	Derivative Time	25
	DAC	Derivative Approach	1.5
	CYC.T	Output Cycle Time	0.1
	OFST	Offset	0
	SP.LY	Setpoint Lock	OFF
	SET.2	Analog Output Midpoint	User Set Midpoint (50)
	BND.2	Analog Output Range	User Set Range (100)
	CYC.2	Analog Output Cycle Time	0.1
LEVL 2	SP1.P	Power Output Percent Read	0 (read only)
	HAND	Manual Output Power Percent	OFF
	PL.1	Power Output Limit Percent	100
	PL.2	Analog Output Limit Percent	100
	SP2.A	Analog Output Mode	FS.HI
	SP2.B	Second Analog Output Mode	NONE
	DISP	Display Resolution	1*
	HI.SC	High Scale Sensor Maximum	1200
	LO.SC	Low Scale Sensor Maximum	0
	INPT	Input Type	TC K
	UNIT	Select Units	C
LEVL 3	SP1.D	Power Output Type	SSD
	SP2.D	Second Power Output Type	ANLG
	BURN	Sensor Burnout Mode	UP.SC
	REU.D	Output Sense	1R.2D
	REU.L	Indicator Sense	1N.2N
	SPAN	Sensor Span	0.0
	ZERO	Sensor Zero	0.0
	CHEY	Set Monitor	OFF
	READ	Read Accuracy Monitor	VAR*
	TECH	Read Autotune Data	CTA
	UER	Software Version	Read Only
	RSET	Reset Parameters	NONE

2.3 Display Indicators

- 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 when the analog output is on. SP3 will be energized in alarm mode when the circular red light is lit.

2.4 Tuning the Controller

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 autotuning 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. ***CAUTION: Do not run Autotune when using the controller with Heat Trace Tape.*** Heat Trace is self regulating and will give the Controller false readings

2.4.1 Autotune

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.

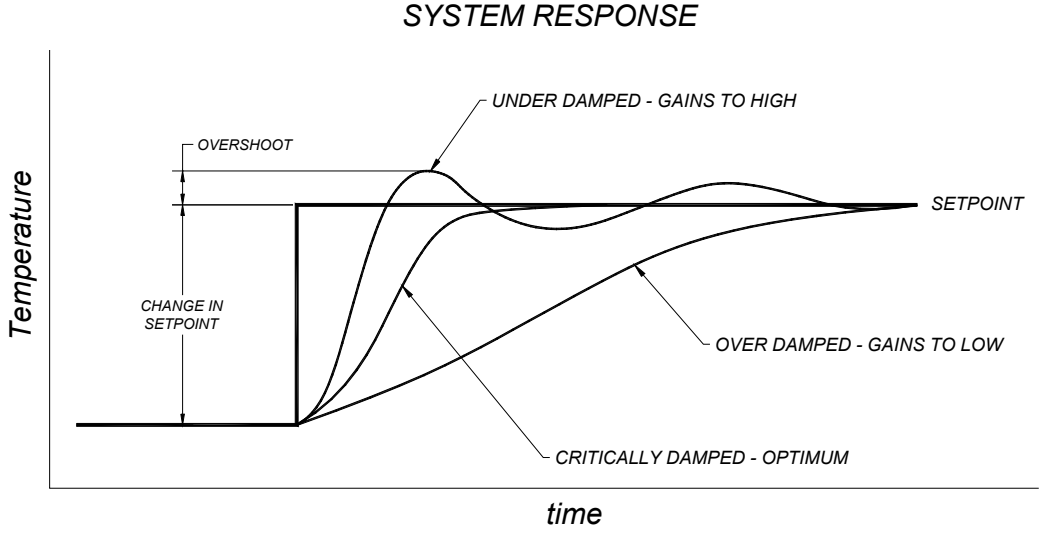
- Press the ▲ and ▼ keys simultaneously and hold for three seconds to enter the menu mode. The display should read **TUNE**.
- Press the ★key and the ▲ or ▼ to display **AT.SP**
- Press the ▲ and ▼ keys simultaneously and hold for three seconds to exit the menu mode.

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.

If tuning becomes difficult check the system for proper installation then consult the factory**. (NOTE**) Each controller can be reset to basic operation. This is reset (rset) option on level 3 of the **menu.** After resetting the controller, the options highlighted in **bold print** on page 3 & 4 of this manual will need to be **checked or changed.**

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)*

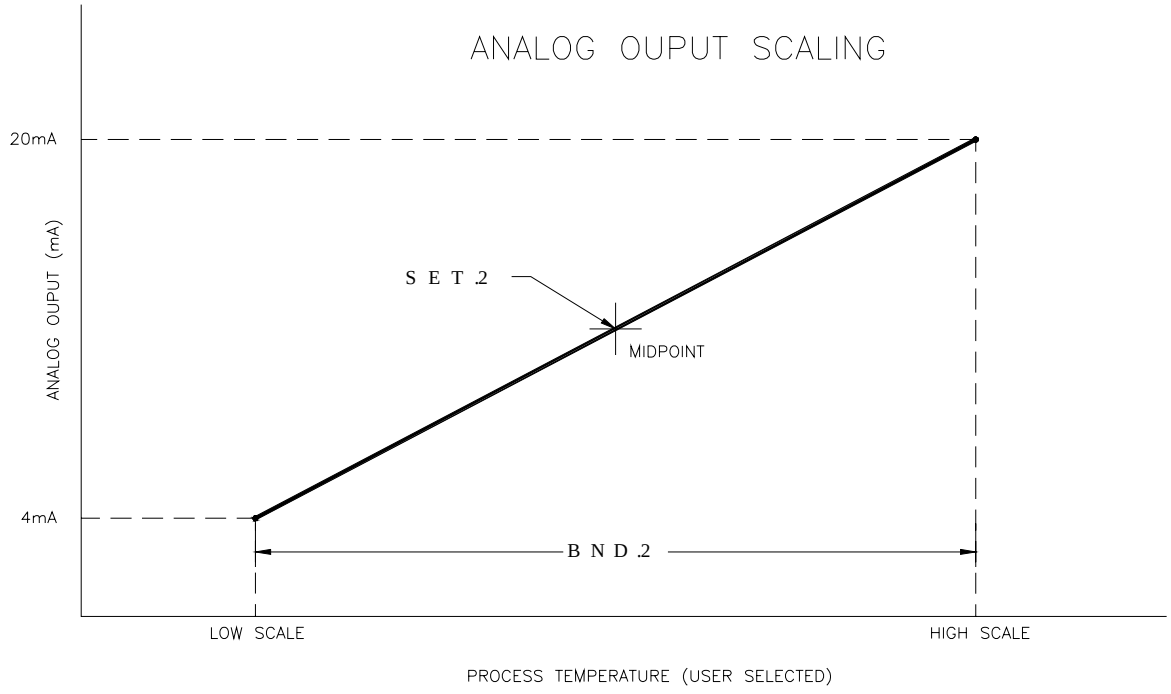
Make adjustments of 20% to 50% initially then make successively smaller adjustments. Optimum performance will occur when the system responds very quickly with little or no overshoot. It may be necessary to allow the system to cool down after several steps have been made. Always tune the system at or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

2.4.3 Analog Output

The process controller is fitted with a 4-20mA analog output. A user scaled 4-20mA analog output signal corresponds to the process temperature of the system. The signal can be used to supply supervisory equipment with continuous process data.

Signal connections are made at the process controller (PC1). Connect a shielded signal cable to pins 17 (+) and 18 (-). Terminate the shield to an instrument ground at the signal destination. Enclosure penetrations will be required to fit the signal cable. Follow appropriate electrical codes for installation of pipe and wire.

Scaling of the analog output signal is achieved by adjusting program setting. Refer to Section 2.2 of this manual for menu navigation and parameter adjustment instructions. Two parameters are used to control the scaling of the 4-20mA output. SET.2 *will define the* ***midpoint*** *of the output curve.* BND.2 *will define the* ***range*** *of the output. Output specifications for this 4-20mA output are 500Ω / ±0.1% of full scale typical.*



3. Troubleshooting Guide

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

Fault Symptom	Possible Cause and Remedy
• Display shows an **INPTFAIL** sensor burnout error message.	Check sensor integrity. Replace sensor if faulty.
• No output is registered at system.	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

Part Number	Service Voltage (Volts)	Maximum Length (Feet)	Maximum Maintenance Temperature	Maximum Intermittent Exposure	T-Rating[1]
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

		120 Volt				240 Volt			
Watts/Ft	Start-Up Temp.	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

Rev	Date	ECN	By	Description
A	12/1/05	282	MP	Release