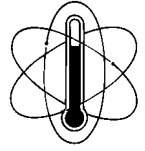


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MegaFlow 4 x 3KW

Installation and Operation Manual ***Special Build ECN 217***

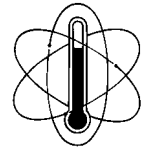
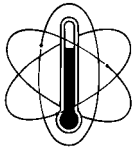
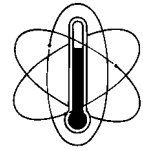
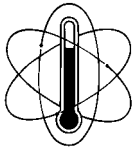


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Please observe the following warnings:

- **The MegaFlow system is to be used with the specified bottle size only.**
- **Do not modify equipment so that gas can be overheated.**
- **Disconnect unit from supply power before opening any electrical panels**
- **Separate all field wiring circuits with solid barriers or clamps**
- **Make certain that the power and signal cables for each cylinder zone are grouped correctly**

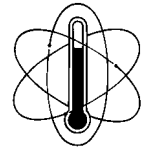
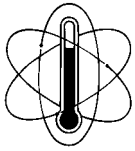


1 Theory of Operation

The MegaFlow 4 X 3KW System is a fully integrated temperature control system designed for use with “Ton” cylinder containers containing liquefied chemicals. Heating is achieved using 3 phase heating assemblies fastened to each cylinder in the system. The cylinder and heating assemblies are placed and strapped on a support cradle and covered with an insulation blanket. The controller is connected to the cylinder units using power and signal cables. Power output to the cylinder units is controlled using temperature feedback signals from the cylinders. The controller allows for the addition of energy to the cylinder to maintain a set operating temperature.

The MegaFlow 4 X 3KW Controller is a multi-zone 3 phase power controller specially designed to meet the safety needs of the application. The controller can control up to 4 cylinder zones independently. Each cylinder control zone features independent ON and OFF controls, microprocessor controller, heater over temperature protection, vessel over temperature protection, temperature process alarms, and fault indicators. All controls are housed in an industrial NEMA 12 enclosure with easy-to-use front-panel operator controls.

The MegaFlow 3KW Cylinder Unit is specially designed for use with the DOT 3A-1800 “Ton” or “Y” Cylinder. These containers are commonly used with liquefied chemical such as NH₃ (Ammonia). Each cylinder unit consists of a heating assembly, insulation blanket and cylinder cradle. The heating assembly provides heat using a flexible wire-wound resistance element bonded in a flexible lamination. The heating panel lamination is bonded into a protective metal shield. Three thermocouple signal are used to measure the vessel and heating element for process control and over temperature control. The hot junction of each thermocouple is bonded into the flexible heating panel. The heating assembly is fastened to the cylinder using straps and can be removed for service without removing the cylinder from the support cradle. The support cradle can be lifted with a fork lift from all sides. The cylinder unit can be easily disconnected from the controller for service or refilling.



2 System Specifications

2.1 Mechanical Specifications

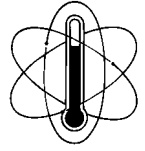
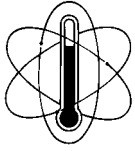
- *Control System* Fully Integrated; PID Microprocessor
- *Temperature Range*¹ Up to 52 °C (125 °F)
- *Measurement Precision* ±1 °C (±1.8 °F)
- *Heating Capacity*² 3 kW Per Zone (10,236 BTU/hr) @ 480 VAC
- *Temperature Sensors* Type K thermocouple
- *Maximum Theoretical Flow Rate per Zone for Some Specific Chemicals based on maximum heat input capacity:*

<u>Gas</u>	<u>Flow Rate (SLPM)</u>
NO ₂	250
C ₂ F ₆	125
CO ₂	470
NH ₃	94
Cl ₂	110
CHF ₃	110
HCl	94
SO ₂	87
SF ₆	134

- *Dimensions, H x W x D:*
- *Controller* 91 x 123 x 31 cm (36" x 48" x 12")
- *Skid* 85 x 68 x 222 cm (34" x 27" x 88")
- *Weight:*
- *Skid* 68 ± 5 kg (150 ± 10 lb.)
- *Controller* 114 ± 5 kg (250 ± 10 lb.)

¹ This temperature can be attained only in a no-flow situation. If heat is being consumed by the system a gradient is needed to transfer heat. Due to OSHA requirements the heaters must not exceed 125°F and the upper temperature range of the cylinder will be limited by this requirement.

² Power is proportional to voltage supplied.



2.2 Electrical Specifications

<i>Voltage:</i>	<i>480 VAC</i> <i>±10% full range.</i>
<i>Phase:</i>	<i>3</i>
<i>Frequency:</i>	<i>50/60 Hz</i> <i>±1% nominal</i>
<i>Circuit Current Requirement</i>	<i>20 Amp</i>
<i>Nominal Running Current</i>	<i>8 to 12 Amp</i>
<i>Total Maximum Output Power</i>	<i>16KW</i>

Meets SEMI E33-94 Regulatory Standards

2.3 Control Safety Features

Main Safety disconnect switch

(4) ON/OFF selector with ON pilot lamp

(4) Vessel temperature limit protection with pilot lamp and audible alarm (manual reset)

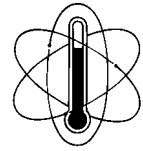
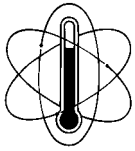
(4) Heater temperature limit protection (automatic reset)

(4) System failure alarm/reset with pilot lamp and audible alarm

Ground fault protection (manual reset)

(4) Customer alarm and enable connections

(4) 4-20mA-process temperature output



3 Installation

The system should be labeled according to all local and federal codes, including but not limited to chemical type.

NOTE:

It is recommended that the mounting holes be marked with the equipment in place rather than pre-drilling the mounting holes.

3.1 Mechanical Connections

The skid must be mounted on a solid and level surface. This is particularly important for systems utilizing scale systems. The system can be moved using a forklift. Forklift fork access holes can be found on all sides of the cylinder cradle. Make certain that the forklift forks are placed inside of the access holes only. The MegaFlow system is provided with a weatherproof insulation blanket and can be mounted outdoors. It is recommended that the control system and the skid be within 50 feet (15 meters) of each other.

The controller is to be mounted so that the access handle is two to six feet above ground (0.6-1.9m). The control panel with the operator interfaces must be visible to the system operator.

The system has seismic restraint brackets and is mounted with two ½-13 bolts. The bolt pattern is shown below.

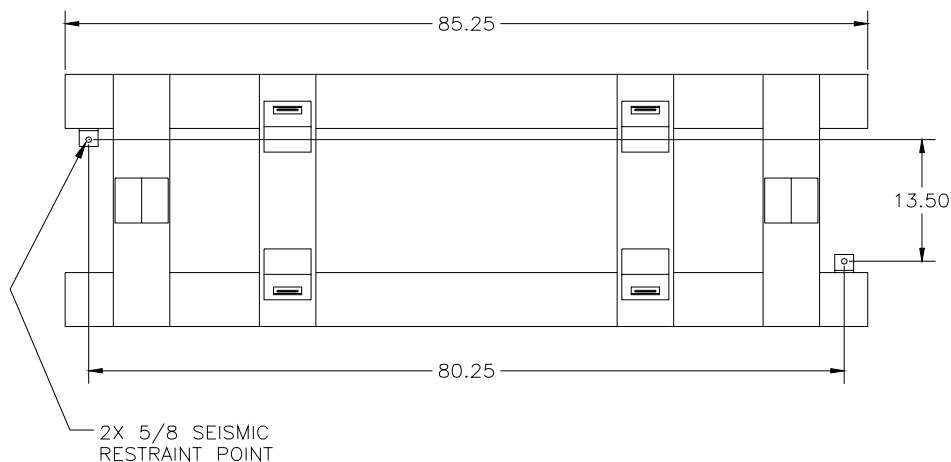
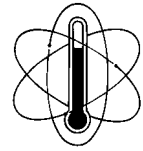
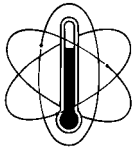
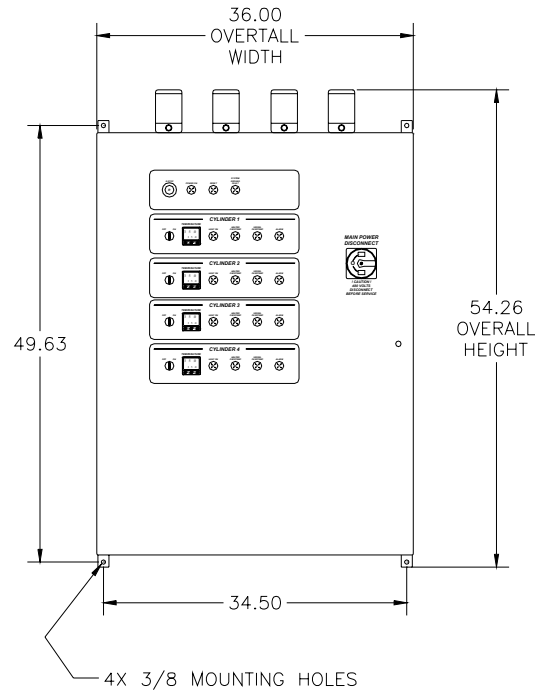


Figure 1
Cylinder Cradle



The control system must be mounted right side up and 0°-30° from vertical such that the door faces upwards. The controller mounting holes are sized for using four 1/4-20 bolts and are located at the corners of a 49.63" X 34.50" rectangle

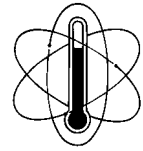
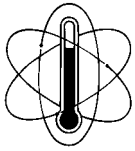


*Electrical Enclosure Layout
Figure 2*

3.2 Electrical Connections

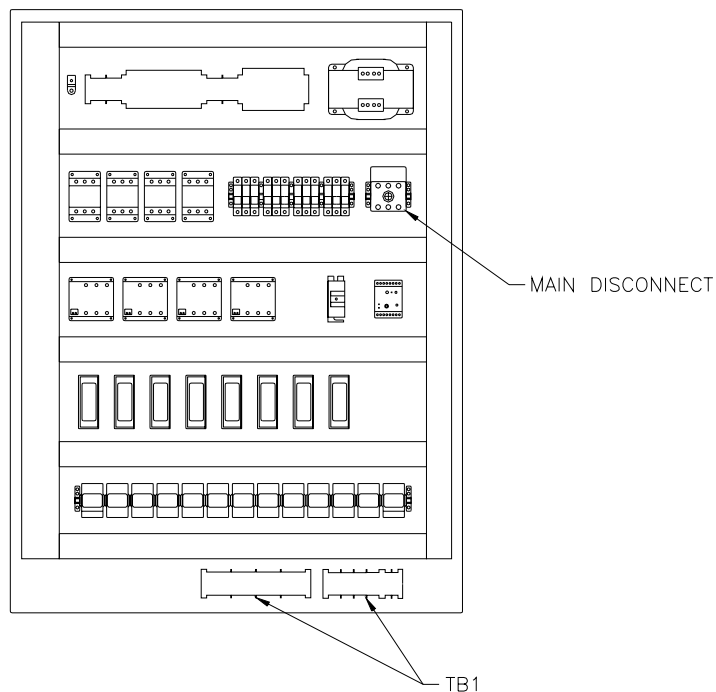
Important Safety Instructions

1. *The product is to be installed in accordance with Article 427 of the National Electric Code.*
2. *Do not use the product outside the listed ratings.*
3. *Only install this product as described in these instructions.*

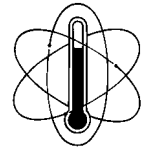
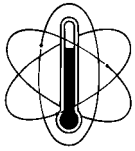


The MegaFlow controller is a permanent wall mounted enclosure with provisions for strut, or anchor mounting into various surfaces. All penetrations into, and hardware connected to the enclosure should be appropriate to the environment in which the enclosure is mounted.

- *Penetrations should be limited to the sides of the enclosure far enough from the back that none of the internal components are damaged. The supply power wiring should be brought in from the upper right side of the enclosure.*
- *All field wiring must conform to any applicable codes and regulations including, but not limited to NFPA 70 ART. 427-18. Over-current protection must be provided, and qualified personnel should perform all wiring and installation.*
- *Locate the controller in a level location not subject to movement or vibrations.*
- *The MegaFlow system operates on voltages listed Section 2.2 Electrical Specifications.*
- *Terminate the main power supply to the main disconnect switch (DISCON). See line 101 on sheet 1 of the electrical schematics.*
- *Connect the power and signal cables to the appropriate receptacle located on the bottom of the controller enclosure.*

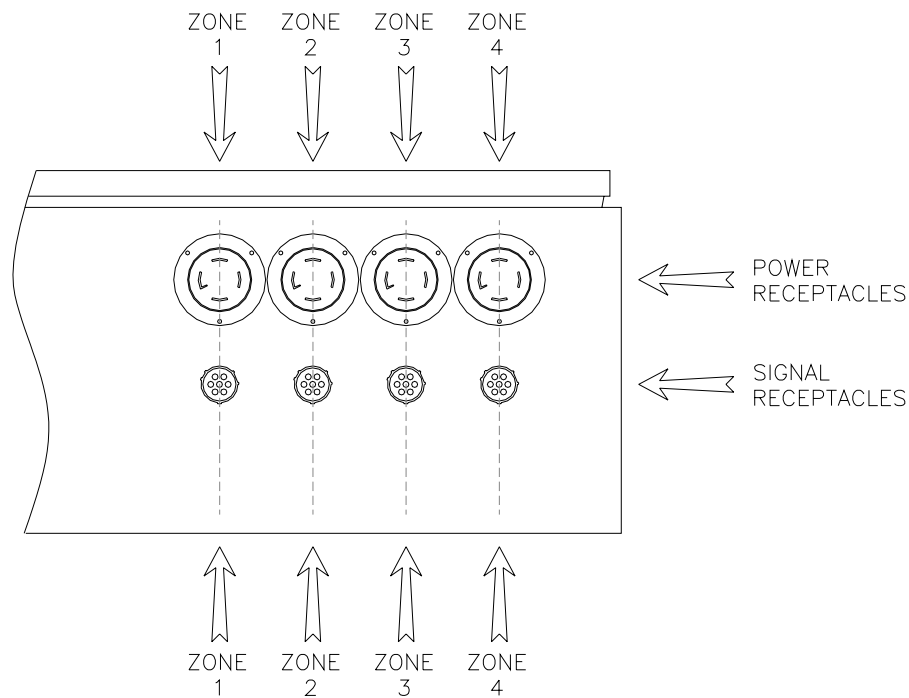


*Electrical Power Connection
Figure 3*

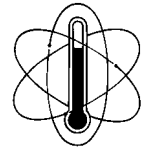
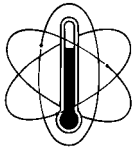


Important Safety Instructions

Make certain that the power and signal cables are grouped correctly. The signal cable for a cylinder zone will always be connected to the receptacle directly behind the power cable receptacle for that cylinder zone. All power and signal receptacles are located on the bottom right hand side of the control enclosure.



Receptacle Connections
Figure 4



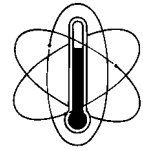
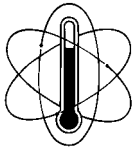
3.3 Customer Interconnections

The MegaFlow Control System provides six electrical interconnects for customer use. These connections can be used to control the system and/or interface with system status alarms. Interconnects are not required for system operation.

The first connection is a “Run Enable” contact which can be found on line 201, sheet 2 of the electrical drawings. This connection can be made on terminals TB1-14 and TB1-15 in the lower right section of the electrical panel. The connection requires an isolated contact closure to run the system. A closed contact will allow the system to function. An open contact will prevent the system from operating. The remote contact installed and controlled by the customer will require only 24VDC 5Watt. If this connection is not used the terminals TB1-14 (wire 5002) and TB1-15 (wire 5003) will require a jumper. This jumper is not included from the factory and will have to be added as part of the installation.

The second connection is a “System Healthy” circuit which can be found on line 216, sheet 2 of the electrical drawings. This connection can be made on terminals TB1-16 (wire 5201) and TB1-17 (wire 5205) in the lower right section of the electrical panel. The circuit is rated for up to 240 Volts at 3 Amps. This circuit provides continuity when the system is healthy. The circuit will be closed when the system is healthy. Several conditions can cause the circuit to lose continuity, which will indicate system alarm. The circuit will be open when the system or any cylinder zone is in an alarm state. Some alarms will have to be reset by the operator. The following conditions will cause the circuit to be open.

- *Ground fault*
- *Cylinder zone high process alarm*
- *Cylinder zone vessel over temperature*



The third through sixth connections are analog output signals from the cylinder zone process controllers. The signal can be scaled by the operator and will be proportional to the process temperature of the cylinder zone. The scaling of the output will be covered in Section 4.2.8 Analog Output. Electrical connections are made on TB1. Make connections according to the following table.

Cylinder Zone	Terminal	Cable No. / Color	Signal
1	TB1-21	1CB5 / Red	4-20mA Positive
	TB1-22	1CB5 / Black	4-20mA Negative
	TB1-23	1CB5 / Shield	Cable Shield
2	TB1-27	2CB5 / Red	4-20mA Positive
	TB1-28	2CB5 / Black	4-20mA Negative
	TB1-29	2CB5 / Shield	Cable Shield
3	TB1-33	3CB5 / Red	4-20mA Positive
	TB1-34	3CB5 / Black	4-20mA Negative
	TB1-35	3CB5 / Shield	Cable Shield
4	TB1-39	4CB5 / Red	4-20mA Positive
	TB1-40	4CB5 / Black	4-20mA Negative
	TB1-41	4CB5 / Shield	Cable Shield

Refer to the electrical drawings for further information.

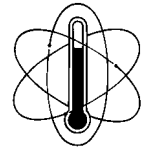
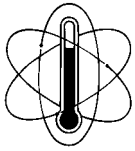
4 Controls

4.1 Control Panel Interfaces

All operator controls are located on the front panel of the main electrical enclosure. The front panel controls are grouped into System Controls and Zone Controls. The System Controls include push buttons and pilot lamps that control the state and display status of the entire system. The Zone Controls include selector switches, process controls and pilot lamps that control a particular zone. The System Controls can effect operation of all zones. All of the zone controls are isolated from each other. Following is an explanation of each operator control device.

4.1.2 System Controls

- **E-Stop (Locking Push Button)** – All system power will be turned off when depressed. Once depressed the switch will need to be turned clockwise to release. Use this push button to turn the entire system off in case of emergency or system shutdown.
- **Power On (Green Illuminated Push Button)** – Depress this push button to enable the system to run. When the push button is illuminated green the system is enabled and all ready to run. The push button will not illuminate if the system has



been stopped, the system has been remotely stopped, or there has been a system ground fault.

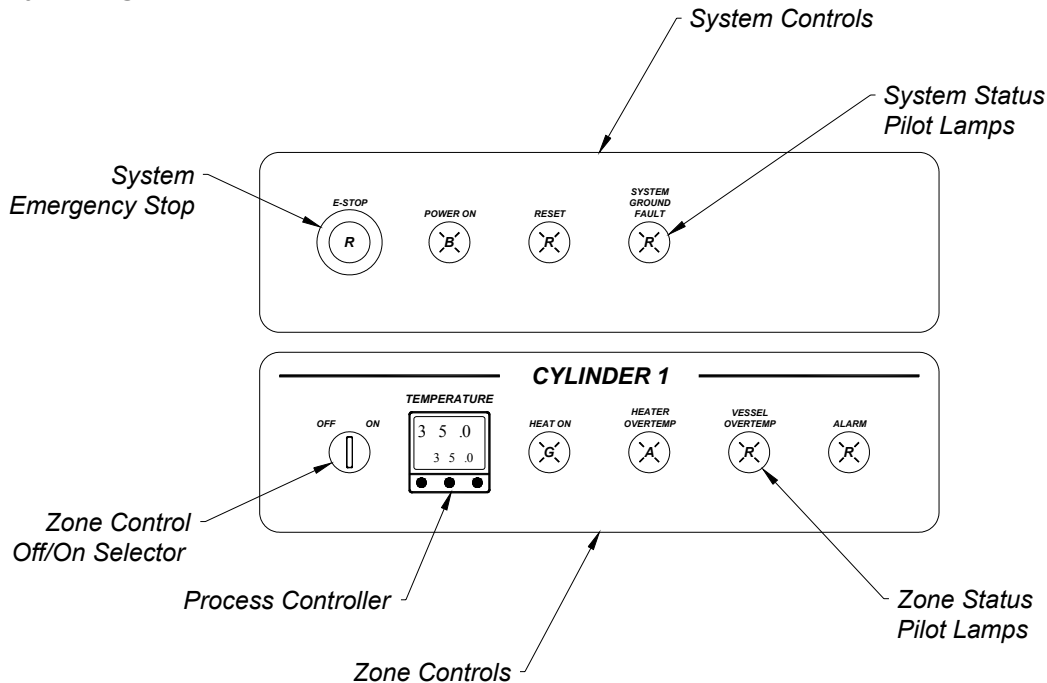
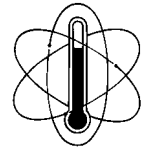
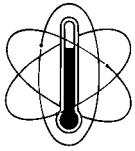


Figure 5
Front Panel Controls

- **Reset (Red Illuminated Push Button)** – Depress this push button to reset system and zone faults and alarms. The push button will illuminate red if there has been a system ground fault.
- **System Ground Fault (Red Pilot Lamp)** – This pilot will illuminate when there has been a system ground fault.

4.1.3 Zone Controls

- **OFF ON (Selector Switch)** – Selects the mode of the zone. When OFF the system will not output power to the heater for this zone. When ON the system is enabled to output power to the heater for this zone. This selector only controls the output for one zone.
- **Temperature (Process Controller)** – This device allows the operator to select the operating temperature for the system and alarm limit for process alarms. See Section 4.2 Digital Controller for further details on the operation of this device.
- **Heat On (Green Pilot Lamp)** – This lamp will illuminate when the zone mode is ON and there are no alarms or stop conditions. The lamp will not be illuminated if the zone mode is OFF, the heater is over temperature, the system has been stopped, or if there is a zone alarm condition.



- **Heater Overtemperature** (Amber Pilot Lamp) – This lamp will illuminate when the heating panel is at maximum temperature. This condition may occur often if the zone is delivering maximum output.
- **Vessel Overtemperature** (Red Pilot Lamp) – This lamp will illuminate when the vessel is at or over the maximum allowable limit of 125°F (51.7°C). When the lamp is illuminated the zone will not allow output.
- **Alarm** (Red Pilot Lamp) – This lamp will illuminate if there is a zone fault or alarm. When the alarm is active the zone will not allow output. The lamp will be illuminated if the vessel is over maximum temperature, or if there is a high process alarm (see Section 4.2.1 High Temperature Alarm). Vessel overtemperature alarms will have to be cleared and reset using the system reset push button.

4.2 Digital Controller

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.

4.2.1 Programming the Secondary Output (SP3) - 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.

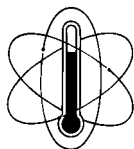
- Press the ▲ and ▼ keys simultaneously and hold for three seconds to enter the menu mode. The display should read *TUNE*.
- Press the ▼ key once and the display will show *LEVL 1*.
- Press the ★ key and the ▼ until the display shows *LEVL A*.
- Press the ▲ key until the display reads *SET.3* and flashes 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.

4.2.2 Entering the Operating Set Point

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

4.2.3 Recommended Parameter Settings

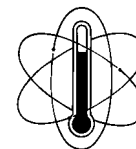
The controller assembly is tested and pre-programmed at the factory. Below is a list of the pre-programmed control parameters. To change parameters on menu levels



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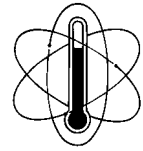
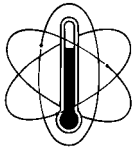
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higher than 1 you must change menu levels. From the menu mode select the menu parameter and hold the ★ key, enter the desired menu level by using the ▲ or ▼ arrows. Parameters shown in bold are required for the application. Parameters not in bold are either not critical or not used for the application.

Menu Level	Option	Description	Setting (or default)
LEVL A	<i>AN.HI</i>	High Scale	1000
	<i>AN.LO</i>	Low Scale	0
	<i>HL.IN</i>	Input High	50.0
	<i>LO.IN</i>	Input Low	0.0
	<i>DECP</i>	Decimal Place	0000
	SP3.A	Alarm Mode – High Temp	FS.HI
	<i>SP3.B</i>	Alarm Second Mode	NONE
	SET.3	High Temp Alarm Setpoint	User Set High Temp Alarm
	<i>HYS.3</i>	Alarm Hysteresis	0.1
	<i>BRN.3</i>	Alarm Burnout	UPSC
	<i>REV.3</i>	Alarm Output Sense	3R
LEVL P	<i>PROG</i>	Program Number	1
	<i>RUN</i>	Run Program	OFF
	<i>FAIL</i>	Power Failure Recovery Mode	RSET
	<i>ST.U</i>	Program Start Value	PV
	<i>SPRU</i>	Setpoint Ramp Time	HOURL
	<i>SEG</i>	Segment Number	1
	<i>TYPE</i>	Segment Type	SPR
	<i>SPRR</i>	Setpoint Ramp Rate	100
	<i>T.SP</i>	Adjust Target Setpoint	20
	<i>HB.U</i>	Holdback Value	OFF
	<i>EO.P</i>	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
	<i>OFST</i>	Offset	0
	<i>SP.LY</i>	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	<i>SP1.P</i>	Power Output Percent Read	0 (read only)
	<i>HAND</i>	Manual Output Power Percent	OFF
	<i>PL.1</i>	Power Output Limit Percent	100
	PL.2	Analog Output Limit Percent	100
	SP2.A	Analog Output Mode	FS.HI
	<i>SP2.B</i>	Second Analog Output Mode	NONE



Menu Level	Option	Description	Setting
	<i>DISP</i>	Display Resolution	<i>1*</i>
	<i>HI.SC</i>	High Scale Sensor Maximum	<i>1200</i>
	<i>LO.SC</i>	Low Scale Sensor Maximum	<i>0</i>
	<i>INPT</i>	Input Type	<i>TC K</i>
	<i>UNIT</i>	Select Units	<i>C</i>
<i>LEVL 3</i>	<i>SP1.D</i>	Power Output Type	<i>SSD</i>
	<i>SP2.D</i>	Second Power Output Type	<i>ANLG</i>
	<i>BURN</i>	Sensor Burnout Mode	<i>UP.SC</i>
	<i>REU.D</i>	Output Sense	<i>IR.2D</i>
	<i>REU.L</i>	Indicator Sense	<i>IN.2N</i>
	<i>SPAN</i>	Sensor Span	<i>0.0</i>
	<i>ZERO</i>	Sensor Zero	<i>0.0</i>
	<i>CHEY</i>	Set Monitor	<i>OFF</i>
	<i>READ</i>	Read Accuracy Monitor	<i>VAR*</i>
	<i>TECH</i>	Read Autotune Data	<i>CTA</i>
	<i>UER</i>	Software Version	<i>Read Only</i>
	<i>RSET</i>	Reset Parameters	<i>NONE</i>

4.2.4 Display Indicators

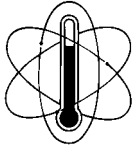
- The display will show the temperature reading as measured by the thermocouple.
- The primary SP1 and secondary SP2 output indicators are located on the main display screen. SP1 is located in the upper left corner of the display. SP1 will be energized when the green square light is lit. SP2 is located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

4.2.5 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 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.

4.2.6 AutoTune

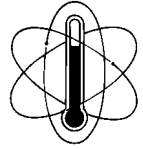
Always let the system cool to ambient conditions before starting this procedure. Follow instructions in Section 2.2.1 to set the high temperature alarm to highest value that is safe for the system. Follow instructions in Section 2.2.2 to set the desired system setpoint. Follow this procedure to Autotune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



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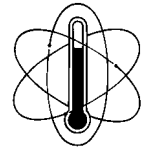
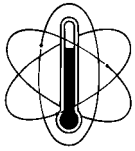
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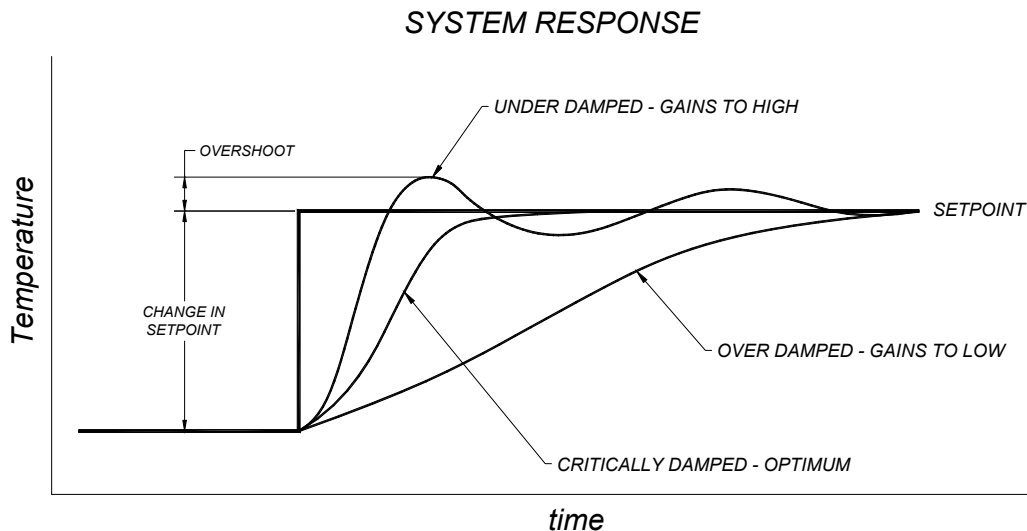
- Press the ▲ and ▼ keys simultaneously and hold for three seconds to enter the menu mode. The display should read *TUNE*.
- Press the ★ key and the ▲ or ▼ to display *AT.SP*
- Press the ▲ and ▼ keys simultaneously and hold for three seconds to exit the menu mode.

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.



4.2.7 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”:

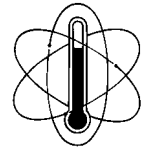
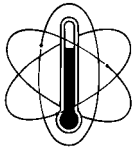
- Lower the *BAND* (SP1 Proportional band / Gain)
- Raise the *IN.NT* (SP1 Integral time)

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.



4.2.8 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 TB1. See Section 3.3 Customer Interconnections. 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.

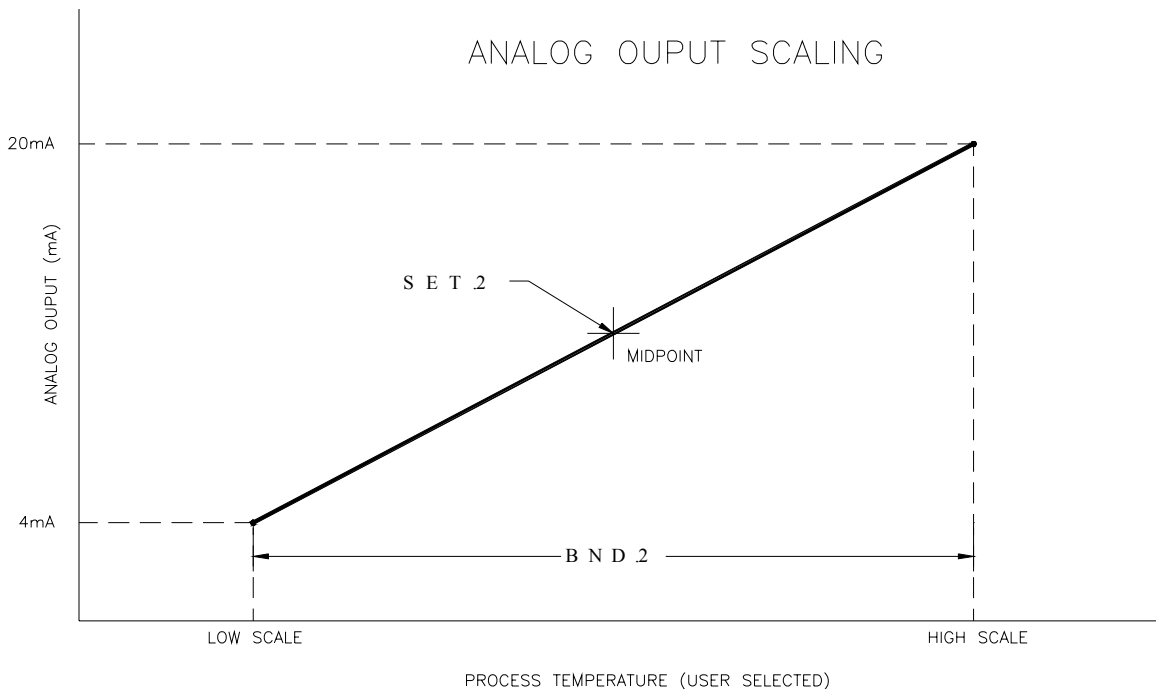
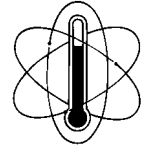
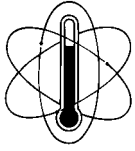


Figure 6
Analog Output



5 Operation

Follow the steps below for operation of the system.

To start the system:

- *Connect the power and signal cables to the correct receptacles on the bottom of the control enclosure.*
- *Verify that the power and signal cables are grouped correctly – power cable 1 with signal cable 1 and so on.*
- *Turn the Main Power Disconnect to the ON position*
- *Turn the System E-Stop push button clockwise to release and reset.*
- *Depress the Power On push button*
- *Check for System Alarms*
- *Set the cylinder high temperature alarm setpoint*
- *Set the cylinder setpoint*
- *Turn the cylinder zone selector switch to the ON position*
- *Check for cylinder zone alarms and system alarms*

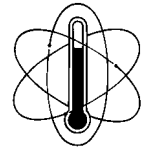
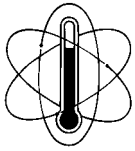
*Once the system is up and running the HEAT ON pilot lamp will illuminate. **The amber HEATER OVERTEMPERATURE lamp may illuminate often when the system is at maximum output. This is normal and will occur when the cylinder is heating to the set temperature.***

To change cylinders:

- *Turn the cylinder zone selector switch to the OFF position*
- *Disconnect the power and signal cables for the cylinder*
- *Remove and replace the cylinder unit with a full unit*
- *Connect the power and signal cables for the cylinder*
- *Turn the cylinder zone selector switch to the ON position*
- *Check for Alarms*

Important Safety Instructions

Make certain that the power and signal cables are grouped correctly. The signal cable for a cylinder zone will always be connected to the receptacle directly behind the power cable receptacle for that cylinder zone. All power and signal receptacles are located on the bottom right hand side of the control enclosure.

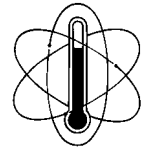
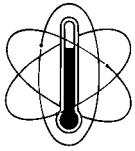


6 Recommended Spare Parts List

Following is a list of recommended spare parts. These critical parts will keep equipment running in most failure modes. Other parts are non-critical or do not effect normal operation. This parts list will not cover all failure modes.

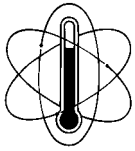
Qt	Part Number	Description	Manufacturer	Label
1	MEGP5021	Heating Panel, 3KW	AGCS	
1	MEGP5031	Insulation Blanket, Type 2, A3-1800	AGCS	
1	100-A09NZ24-3	Contactor, 3 Pole, 24VDC	Allen Bradley	1CON
1	100446	Controller, Limit Type	AGCS	1VT
10	ATMR5	Fuse, 5A	Gould	1F1
1	800E-2DL3	Pilot Lamp Module	Allen Bradley	1PL1
1	RH4B-UDC24V	Relay, 4 Pole, 24VDC	Idec	1R1
1	RSDA-660-30-3DO	Solid State Relay	Continental	1SSR
1	800E-3X01	Switch, Contact Block, N/C	Allen Bradley	S2
1	800E-3X10	Switch, Contact Block, N/O	Allen Bradley	S1
1	95P21PA000	Controller	Cal Controls	1PC

Please contact Accurate Gas Controls Systems for parts pricing and availability. Other parts and assemblies are available. Please see the system bill of material for all parts and component locations.



7 Troubleshooting & Maintenance

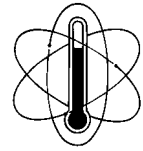
Symptom	Possible Cause	Remedy
<i>No power to controller</i>	<i>External Power Off</i>	<i>Turn on MAIN POWER switch. Replace main fuse, the main circuit breaker or switch.</i>
	<i>Main circuit breaker tripped or in off position.</i>	<i>Make sure enclosure door is closed and the handle is in the "ON" position.</i>
	<i>Loose electrical connection</i>	<i>Make sure electrical connection is secure.</i>
<i>Heaters will not heat</i>	<i>Electrical contact not made.</i>	<i>Make sure the cylinder units are connected to the controller according to schematic.</i>
	<i>Short between heater legs.</i>	<i>Make sure the cylinder units are connected to the controller according to schematic.</i>
	<i>Heater Failure</i>	<i>Check resistances between heater leads. The resistance between any two sets of leads should be between 135Ω and 165Ω. If resistances fall outside this range replace heater (s).</i>
	<i>Temperature controller malfunction</i>	<i>Power cycle the controller. If it is still malfunctioning call A.G.C.S.</i>
<i>System is unable to maintain setpoint</i>	<i>External Permissive not enabled</i>	<i>Verify Run Enable interlock</i>
	<i>Heater inhibit shuts off heater power.</i>	<i>If the system is running high flow rates at a high temperature (Near upper temperature limitation) the upper temperature limitation of the heaters may prevent sufficient heat from being driven into cylinder to replace exiting energy. This is a regulatory limitation. If lower delivery pressures are acceptable (due to the lower cylinder temperature) lower the setpoint. If not, contact A.G.C.S.</i>



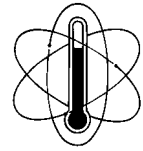
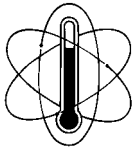
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	<p><i>Short between heater legs.</i></p> <p><i>Heater failure</i></p> <p><i>Thermocouple Failure</i></p> <p><i>Set point is not entered.</i></p>	<p><i>Make sure the cylinder units are connected to the controller according to schematic. Check resistances between heater leads. The resistance between any two sets of leads should be between 135Ω and 165Ω. Rewire as necessary</i></p> <p><i>Check resistances between heater leads. The resistance between any two sets of leads should be between 135Ω and 165Ω. If resistances fall outside this range replace heater (s).</i></p> <p><i>Verify TC Inputs. If they give a false input it may appear as if system is not getting up to temperature. Replace heater in which the failed TC exists.</i></p> <p><i>Insure set point is entered.</i></p>
<p><i>Over-temperature</i></p>	<p><i>Thermocouple Failure</i></p> <p><i>Controller Overshoot</i></p>	<p><i>Verify TC Inputs. If they give a false input it may appear as if system is not getting up to temperature. Replace heater in which the failed TC exists.</i></p> <p><i>Use the auto tune feature of the control system as outlined above.</i></p>



8 Parts Replacement

Important Safety Instructions

High Voltage!

*Electrical shock may cause severe injury or death.
Before completing any electrical maintenance disconnect
power at the main circuit breaker.*

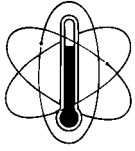
The following procedures can be used to make most field repairs. For further technical support or troubleshooting assistance please consult the factory.

8.1 Controller Components

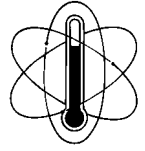
- *Switch the Main Disconnect Switch to the OFF position*
- *Open the front door of the enclosure and verify that the system has no voltage*
- *Troubleshoot the system and identify the defective component*
- *Remove and replace defective components wire for wire*
- *Verify the component replacement with the electrical schematic*
- *Close the front door of the enclosure*
- *Switch the Main Disconnect Switch to the ON position*
- *Start the system and check for correct operation*

8.2 Heater Panel

- *Switch the cylinder zone requiring service to the OFF position*
- *Disconnect the cylinder unit requiring service from the controller*
- *Remove the insulation blanket*
- *Remove the heating assembly from the cylinder*
- *Remove the cover from the junction box on the heating panel shield*
- *Unwire the power and thermocouple cables*
- *Using a sharp instrument peel the flexible heating panel from the heating panel shield.*
- *Using a sharp instrument and paint thinner remove and clean all bonding materials from the inner surface of the heating panel shield*
- *Apply bonding material in an array to the inner surface of the heating shield*
- *Place the new heating panel in the heating panel shield.*
- *Bonding materials must cure for 24 hours*
- *Rewire the power and thermocouple cables. Take special care to make certain that all wires are connected according to wire labels and the correct electrical schematic.*
- *Replace the heating panel and insulation blanket.*
- *Connect the cylinder unit to the controller*
- *Switch the cylinder zone requiring service to the ON position*
- *Verify the cylinder zone is heating and maintaining setpoint*



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Revision History

<i>Rev</i>	<i>Date</i>	<i>ECN</i>	<i>By</i>	<i>Description</i>
1	8/6/02	221	CD	Released to Manufacture
A	8/26/02	221	CD	As Built