

ADDENDUM M-2A CONTROLLER

ATO PLUGS
718.00142.00

NOTE: The M-2A must be tuned upon initial start-up. See Page 4. Since some features of the M-2A are different from the M-2, this addendum should be read entirely before initiating operation.

M-2A

The M-2A is a microprocessor based temperature controller designed for exclusive use with the Sterlco temperature control units. The M-2A monitors and maintains the temperature of the fluid in any given process to a selected setpoint. The controller directs the system to heat or cool the fluid as required by the process.

The M-2A employs a unique PID auto-tuning program to precisely control process temperature.

The M-2A has LED displays for setpoint and delivery temperatures. Controller status lights are provided for the following functions: °F/°C, heat/cool, heater high/low, power, run & program, high & low alarm sets.

The controller includes self-diagnostics to check all hardware functions. Diagnostic status lights are provided for the following functions: low pressure, pump rotation, safety thermo, delivery and return probes, high and low alarms and auto vent.

BOLD-faced type designates the controller keypads, the "QUOTED" words are the controller functions.

STATUS LIGHTS

- °F/°C- Indicates temperature scale being displayed on “SETPOINT” and “Temperature” LED’s. Used in conjunction with optional °F/°C selector switch.
- HI-LO HEAT - Indicates high or low heat selection of the M-2A.

Note- The “HI-LO HEAT” also functions as a keypad to manually control selection of the heat function. Depressing the keypad once will lock the controller into the “low heat” selection. Depressing it again will lock the controller into the “high heat” selection.

The M-2A default is high heat. If an autotune is completed with high heat, do not switch to low heat, unless a new autotune is initiated using low heat. Failure to comply will result in poor controllability.

DIAGNOSTIC AND ALARMS

Indicates alarm conditions:

- FLUID PRESSURE - Indication of low fluid pressure alarm; alarm shuts down the unit. Unit will resume operation when pressure is restored.
- AUTO VENT - Flashing light for duration of auto vent condition. The auto vent feature is deactivated on high temperature oil units.
- PUMP ROTATION - Indication of improper pump rotation or pump failure. This is a fatal fault which requires disconnection of main power to reset.
- SAFETY THERMO - Indication of unit over temperature; heater outputs are disabled. Pump will continue to operate and the M-2A will energize the “cool” solenoid in order to prevent damage to the heater. This a fatal fault which requires disconnection of main power to reset.
- DELIVERY PROBE - Indication of probe failure. Alarm will reset when new probe is installed.
- RETURN PROBE - Indication of probe failure. Alarm will reset when new probe is installed.

PROGRAMMING THE M-2A

Depressing any program keypad (**PROGRAM PROCESS**, **PROGRAM HI ALARM**, **PROGRAM LO ALARM**) displays the stored value. The controller will idle and the "Program" LED will flash, allowing the limits to be reset. The following programmable features are allowed by the M-2A.

- PROGRAM PROCESS** - Depress and hold the **PROGRAM PROCESS** keypad and the up or down arrow simultaneously to increase or decrease the setpoint display.
- **PROGRAM HI ALARM** - Depress and hold the **PROGRAM HI ALARM** and the up or down arrow to set the alarm high limit. To disable the function, set the limit out of range. The controller will automatically program a high alarm of 25°F over setpoint. This program feature is used only to override the alarm value programmed by the controller.

- PROGRAM LO ALARM** - Depress and hold the **PROGRAM LO ALARM** and the up or down arrow to set the alarm low limit. To disable the function, set the limit out of range. The controller will automatically program a low alarm of 25° under setpoint. This program feature is used only to override the alarm value programmed by the controller.

OTHER KEYPAD FUNCTIONS

- **RETURN TEMP** - Depressing the **RETURN TEMP** keypad will cause the returning fluid temperature to be displayed on the digital "temperature" LED display. The display will revert to delivery temperature when the keypad is released.
- **ΔT TEMP DIFF**- Depressing the **ΔT TEMP DIFF** keypad will cause the ΔT, or difference between delivery and return temperature, to be displayed on the digital "temperature" LED display. When

- the keypad is released, the display will revert to delivery temperature.
- **DOWN ARROW** - Depressing the **DOWN** arrow keypad will energize the “cool” output of the controller, causing the unit to crash cool. This will cause a rapid drop in process temperature.
 - **UP ARROW** - Depressing the **UP** arrow keypad will perform a lamp test of all the LED’s.
 - **HIGH ALARM** - Indication of process fluid temperature exceeding high alarm limit.
 - **LOW ALARM** - Indication of process fluid temperature exceeding low alarm limit.

TUNING

The M-2A is capable of tuning itself to a specific process. A new controller **MUST** be tuned upon initial start-up. For optimum results the M-2A should be re-tuned whenever the process is changed.

To initiate the autotune feature, energize the controller and program the setpoint at which the controller will operate. After autoventing is complete, simultaneously depress **PROGRAM PROCESS** and **DELIVERY TEMP** keypads; the “RUN” LED will flash during the autotune process. The M-2A will then begin ramping up to the programmed setpoint, and tune itself to the process it is controlling. During the ramp-up, the M-2A will occasionally go into heat and cool cycling, or into a brief “standby” mode to measure ambient temperature losses. The controller will then ramp-up to the programmed setpoint with minimal overshoot. The “run” LED will stop flashing when the autotune is complete.

Do not attempt to reprogram the M-2A or depress any keypads during the tuning process, or the process will be disrupted.

To cancel the tuning process, press and hold **PROGRAM PROCESS** for three (3) seconds. The M-2A will retain its previously stored PID values.

Note the following:

- Process temperature must be stabilized at least 10°F lower than setpoint in order to achieve a proper autotune.

If the autotune process is canceled or not initiated, the controller will re-use the parameters stored in its memory from the last tuning process.

- If the tuning parameters for the process are known (i.e., P,I,D values), they can be manually inputted to avoid having to retune. Consult factory if this feature is required.

CAUTION: If heat is applied to the process from any source other than the Sterlco temperature control unit during an autotune (e.g. induction heater, hot air, etc.) it is **MANDATORY** that the gain ratio be adjusted from the factory default value of 10. This is done via Mode 2 Set-Up (see below). More powerful external heat sources will require a **LOWER** gain ratio. Failure to do so may result in a runaway heating situation during the autotune “drift” cycle.

“MODE 2” SET-UP

The “set-up: programming mode can be accessed by simultaneously pressing and holding the **UP** and **DOWN** arrows while the controller is energized. Select the parameter to be programmed by pressing the keypad shown below. Once the parameter is accessed it can be changed by pressing the **UP** and **DOWN** arrows individually.

PARAMETER	KEYPAD
Cool gain ratio “ RAT ”	HEAT HI/LO
PID constant RATE “ D ”	DELIVERY TEMP
PID constant RESET “ I ”	RETURN TEMP
PID constant GAIN “ P ”	ΔT TEMP DIFF
Baud Rate “ BAU ”	PROGRAM PROCESS
Communications ID “ C I D ”	PROGRAM HI ALARM
Communications Protocol Type “ tPE ”	PROGRAM LOW ALARM

To exit Set-Up Mode 2, power to the M-2A must be cycled off and back on again. This will return the M-2A to the “Run” mode with the new parameters stored in memory.

SAMPLE SET-UP

1. Simultaneously press **UP** and **DOWN** arrows. Turn the controller on. M-2A will enter the “Set-UP” mode.
2. Press **PROGRAM PROCESS**. Controller displays current baud rate.
3. Press **UP** or **DOWN** arrow repeatedly until desired baud rate shows in the display.
4. Press **PROGRAM HI ALARM**. Controller displays current communications ID.

5. Press **UP** or **DOWN** arrow until desired ID shows in the display.
6. Turn controller power “off” and then back on again.

7. The M2A will come on in the "RUN" mode, with the new values for Baud Rate and Communications ID in its memory.

NOTE: After an autotune, the "SET-UP" mode can be used to determine the rate, reset and gain parameters established for that process. By recording and saving those values, they can be manually inputted through the "SET-UP" mode each time that process is run, rather than performing another autotune.

If the Sterlco temperature control unit is not shifted between different processes, it should not be necessary to retune or change the PID values. The initial values obtained on the first autotune will be stored and reused indefinitely.

PREVENTIVE MAINTENANCE

Prior to any servicing, disconnect all power to the unit, let the unit cool down, and turn off the water. Failure to do so can result in serious injury or death.

Draining

The Sterlco unit should be thoroughly drained if it is to be taken out of service for a long period of time, or exposed to freezing. Drain plugs are provided at the base of the heater tank and at the base of the pump pedestal.

Periodic Checks

Every six months, inspect all electrical connections for secure attachment and for safe and secure ground connections. Inspect the power cable, especially at the entrance point to the unit. This inspection should be made by a qualified electrician. Check for leaks, especially under the pump, as this may indicate a worn pump seal.

CORRECTIVE MAINTENANCE

Pumps and Seals

Before leaving our factory, each unit is completely tested for a considerable period of time and calibrated. Afterwards, the unit is drained and blown out with warm air to remove the water from the piping systems. If the unit is allowed to stand idle for a long time before being installed in your factory, the housing gasket at the pump can dry out and can possibly leak when the unit is started. In most cases these gaskets will soon swell and form a tight seal. In other cases, it may be necessary for you to tighten the pump bolts to stop a leaking condition.

It is possible to have the pump seal surfaces separate slightly because of rough handling or vibration during transit. This could cause a leak at the pump seal when the pump is started, but in most cases the surfaces will mate again after the pump is allowed to run for a short period of time. If they do not reseal, it may be necessary to open the pump and free the seal by hand. It is seldom necessary to install a replacement seal in a new unit unless the seal has been damaged because the unit was started without water.

Our pump seals give a long period of service life. There are conditions, of course, which tend to shorten the seal life, such as: presence of grit, operation of the unit without water, sustained high water temperature, or presence of certain chemicals in the water. Our pump seal assembly has been developed to resist abrasive particles that are present in many water systems. This is done by a special flushing system that uses water exiting the pump to constantly wash the seal area. It is also fitted with high temperature flexible components for maximum heat resistance.

These same components remain flexible even at low temperatures. Thus, the standard seal is a fine combination of heat resistant and wear resistant components. Unfortunately, even under normal use, the seal will eventually wear and require replacement.

A small puddle underneath the unit is a sign of rotary seal wear, and if investigation confirms the pump as the source, the seal should be replaced as soon as practical. If allowed to leak, the water will eventually find its way to the lower motor bearing and cause further damage. The water slinger is intended to provide temporary protection against this, but a continued and substantial leak will ruin the motor bearing.

After the unit has been in service for a period of years where abrasive conditions are present, you may find that the pump bracket (the top half of the pump casting), can be eroded away in the area around the seat of the rotary seal. This area should provide a straight, smooth bearing surface for the cup seal. Should your casting show signs of erosion in this area, the casting needs to be replaced. The replacement cost of the casting is very modest compared to the down time and maintenance cost for frequently replacing the seal.

Under some conditions, the pump may not start. After turning off the power supply, check the motor shaft to be certain it is free to turn. By removing the drip cover on top of the motor, the end of the shaft can be accessed. It has been slotted to make it easy to turn with a screwdriver. If the shaft is free to turn, next check that the motor overloads are set, check for blown fuses, and finally check the power supply to each leg to the motor. If these items have been checked, a qualified electrician should be called upon to check the motor and its circuit.

NOTE: IF THE PUMP MOTOR WIRING IS DISCONNECTED FOR REMOVAL FROM THE UNIT, IT IS VERY IMPORTANT THAT YOU CHECK THE ACTUAL DIRECTION OF ROTATION WHEN THE MOTOR IS REWIRED TO THE UNIT. THE PHASE SENSOR USED WITH THE M-3 TO DETECT PROPER ROTATION WILL NOT INDICATE PROPER ROTATION IF THE MOTOR WIRE LEADS ARE REVERSED AT REINSTALLATION. CONSULT ELEMENTARY DIAGRAM.



<u>UNIT SYMPTOM</u>	<u>POSSIBLE CAUSE</u>	<u>SOLUTION</u>
Temperature fluctuations/rapid cycling from hot to cold.	Undersized connectors/water lines.	Increase size of connectors/water lines.
	Long connecting lines between unit and mold.	Move the unit closer to the mold and shorten connecting lines.
	Serpentine flow through mold.	Connect lines for parallel flow instead of series flow.
	Blocked water line in mold.	Check mold for metal chips or lime build-up. Clean mold.
	Quick disconnect fitting with check valve.	Remove and replace fitting or valve.
	Lime buildup in unit piping or fittings.	Clean or replace.
	Faulty Sterlco TCU	Check unit by connecting 3/4" line directly from delivery to return line. Run unit to determine if TCU controls setpoint temperature.
Unit does not heat properly/ cannot achieve setpoint.	Reversed Probes	Switch Return & Delivery Probes
	Loss of water in process.	Check all lines/connections/ fittings.
	Faulty/dirty solenoid valve*	Depress "vent" button several times to flush valve. **
Unit will not heat.	Defective heater contactor.	Visual inspection of coil and contacts. Repair/ replace defective contactors.
	Defective immersion heater.	Check resistance on all 3 legs of heater with an ohm meter. If not all equal, contact factory for replacement heater.
	Heater burnout.	Check heater tank for scorched/discolored paint. Check resistance on all 3 legs of heater with an ohm meter. Replace heater as required.
	Controller heat output open	Check the heater output with an ohm meter to ground. It should read in the mega-ohm range. Infinite or zero readings indicate a defective output.
	Unit overheats/ unable to cool.	Water supply to unit is turned "off"

* Usually detected when there is a steady stream/trickle of water out of the drain line.

** If the leak continues, disconnect the power to the unit, turn off the water supply, and clean or replace the solenoid.



Drain is plugged or excessive back pressure in drain line.

Clear drain line or eliminate back pressure condition.

Faulty solenoid valve.

Test solenoid valve by pressing "vent" button and listen for valve operation. Replace if faulty.

Controller Cool output open.

Check the cooling output with an ohm meter to ground. It should read in the mega ohm range. Infinite or zero readings indicate a defective output.

* Usually detected when there is a steady stream/trickle of water out of the drain line.

** If the leak continues, disconnect the power to the unit, turn off the water supply, and clean or replace the solenoid.

M2A Set Up

1. Verify model number and description to be set-up. 512.03 = Water @ 250°F ect.
2. Cut Power jumper **if needed** (separate power)
3. Plug Calibration box into controller, 250° for water units, 650° for oil units.
4. Plug test fixture connectors into controller.
5. Turn power on to controller and hold the 3 top buttons on the right hand side of the controller, (Del Temp, Ret Temp, AT Temp Diff) *as unit turns on.*

-- Displays should now read *Set* --

Keypad	Controls / Display	Options/Range
Program Process	Vent - Unit	EnA / dIS
Program Hi Alarm	Setpoint Hi Limit - SHI	Set to order
Program Lo Alarm	Setpoint Lo Limit - SLO	Set to order
Del Temp	Safety Thermo - thr	EnA / dIS
Ret Temp	Pressure Circuit - PrS	EnA / dIS
Temp Difference	Cycle Rate - Cyc	10 or 11

6. Press the appropriate pad and use the up and down arrows to make adjustments.
7. Using the chart provided, enable or disable VENT, PRESSURE and SAFETY THERMO circuits,
8. Set the Hi and Lo Temperature Setpoint limits.
9. Set the Cycle rate to 10 or 11
10. Turn power off to controller
11. Turn Power Back on to controller this time holding the "UP" and "DOWN" Keypads.

-- Displays should now read *Set* --

Keypad	Controls / Display	Options/Range
Program Process	Used for communications	
Program Hi Alarm	Used for communications	
Program Lo Alarm	Used for communications	
Del Temp	D - 0	5
Ret Temp	I - 1	24
Temp Difference	P - P	85
HI/LO Heat	Rate - rA	1

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12. Using the appropriate keypad and the "UP and Down" arrow keys adjust P, I, D, and Rate.
13. Turn power off again and back on.
14. Verify calibration of unit and operation of enabled circuits.

15. Turn power off and disconnect from test fixture.
16. Apply Calibration sticker to lower left front.
17. Make sure there is a M2A logo or sticker in the center.
18. Apply a Sterico Parts Express sticker to the wide White striped cable running between boards on the right hand side. (Athena Models, Sticker is applied to the back-side of the Nameplate card on the left hand side) * **Please note that some orders may request that this sticker NOT be applied, - DBAR -**
19. Place Model number sticker on the backside of the front plate, lower right hand corner.

M2A Model Number descriptions for Set-Up

Model Number	Controller Type	Vent	Quality Therms	Mount	Power Range
601.00512.01	M2A, 180°, Nb Vent	dlS	EnA	33	
601.00512.02	M2A, 200°	EnA	EnA	34	
601.00512.03	M2A, 250°	EnA	EnA	35	
601.00512.04	M2A, 300°	EnA	EnA	36	
601.00512.05	M2A, 400°, 90 Series	dlS	dlS	38	OUT
601.00512.06	M2A, 550°, 90 Series	dlS	dlS	39	OUT
601.00512.07	M2A, 650°, 90 Series	dlS	dlS	40	OUT
601.00512.08	M2A, LowLimit 68°F	EnA	EnA	41	
601.00512.09	M2A, Spd Optns, Quik Cool	EnA	dlS	42	OUT
601.00512.13	M2A, 250°, R/S 232	EnA	EnA	37	
601.00512.14	M2A, 300°, R/S 232	EnA	EnA	38	
601.00512.16	M2A, 550°, 90 Series, R/S 232	dlS	dlS	40	OUT
601.00512.23	M2A, 250°, R/S 422	EnA	EnA	39	
601.00512.26	M2A, 550°, 90 Series, R/S 422	dlS	dlS	40	OUT
601.00512.33	M2A, 250°, R/S 485	EnA	EnA	41	
601.00512.36	M2A, 550°, 90 Series, R/S 485	dlS	dlS	41	OUT
601.00512.99	Special, See Comments				
	60 Series Oil	dlS	EnA	42	

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