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MODEL 40400 / 40500 / 120 Ω
SODA LOAD

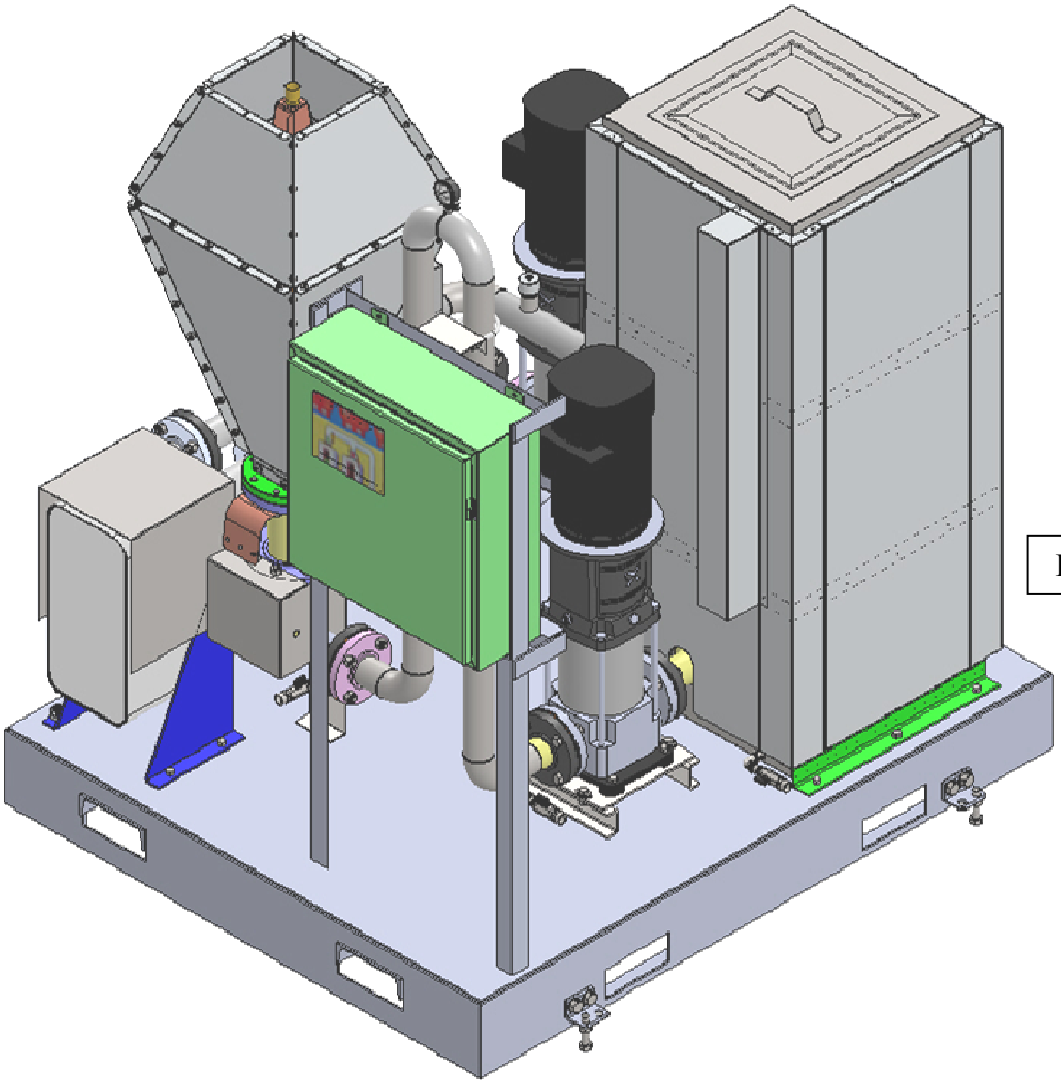

Fig. 1.1

MODEL 40400 & 40500
120 Ω SODA LOAD
400/500 KW

LIMITED TWO-YEAR WARRANTY

We take pride in manufacturing products of the highest quality and we warrant them to the original purchaser to be free from defects in material and workmanship for the period of two years from date of invoice. Additionally, products of our manufacture repaired by us are warranted against defects in material and workmanship for a period of 90 days from date of invoice, with the provisions described herein.

Should a product or a portion of a product of our manufacture prove faulty, in material or workmanship, during the life of this warranty, we hereby obligate ourselves, at our own discretion, to repair or replace such portions of the product as required to remedy such defect. If, in our judgment, such repair or replacement fails to be a satisfactory solution, our limit of obligation shall be no more than full refund of the purchase price.

This warranty is limited to products of our own manufacture. Equipment and components originating from other manufacturers are warranted only to the limits of that manufacturer's warranty to us. Furthermore, we shall not be liable for any injury, loss or damage, direct or consequential, arising out of the use, or misuse (by operation above rated capacities, repairs not made by us, or any misapplication) of the equipment. Before using, the user shall determine the suitability of the product for the intended use; and the user assumes all risk and liability whatsoever in connection therewith.

The foregoing is the only warranty of Altronic Research Incorporated and is in lieu of all other warranties expressed or implied.

Warranty returns shall first be authorized by the Customer Service Department and shall be shipped prepaid. **Warranty does not cover freight charges.**

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PRECAUTIONS

!!!DANGER!!!

Do not attempt any service or parts replacement without first disconnecting all AC power and RF power. Failure to do so may result in serious or *fatal electrical shock*.

!!!WARNING!!!

Before operating equipment insure interlock is operating properly. Not doing so can result in a dangerous, possibly lethal condition.

⚠ WARNING ⚠

Do not expose open tank to flames or sparks. The contents of the tank might be explosive.

!WARNING!

Ethylene Glycol may cause permanent damage to the kidneys, liver and other organs if ingested. Avoid excessive contact with skin or eyes. See the Material Safety Data Sheet for the specific precautions and first aid measures prescribed by the manufacturer.

!WARNING!

USE OF ANYTHING OTHER THAN PURE POTABLE OR DISTILLED WATER OR A MIXTURE OF HIGH QUALITY PASSIFIED ETHYLENE GLYCOL (i.e. SR1) AND POTABLE WATER WILL VOID THE WARRANTY!

CAUTION!

Operating without interlock will void the warranty.

DEFINITIONS

The following defined terms are used throughout this document:

These definitions only apply to the product for which this manual is supplied. This is not a comprehensive list of definitions and should only be used as an aid in understanding the document as it is written.

Calorimetry – A system to measure applied RF energy by calculation of heat differentials throughout the load-system.

Dry Cooler – The cooling device for removal of heat from the Secondary System.

Heat Exchanger – The Plate Exchanger used to transfer heat from the Primary System to the Secondary System.

Primary or Soda System – This system contains the soda solution which cools the resistor element. In addition, this system maintains the proper resistance in the reaction chamber.

Primary Pump – This pump generates the flow in the primary or soda loop.

Secondary or Water-Based System – This system is responsible for managing the large volume of heat generated by the primary soda loop system.

Secondary Pump – This pump generates flow in the Secondary System.

Set Point – The configurable internal operating temperature of the Primary System. This adjusts the proper impedance of the load-system.

Soda Load – Refers to the load-system that this document describes and accompanies.

Resistor – The resistive-element-system used in the product that this document describes and accompanies. As defined, in Section 1-4.

Tank – The reservoir that holds the soda solution.

VNA – Vector Network Analyzer

INTRODUCTION

This handbook is for skilled technical personnel as an aid in understanding and performing installation, service and maintenance procedures for the OMEGALINE® Model 40400 & 40500 Soda Load. Skilled personnel are considered to have the necessary knowledge and practical experience of electrical and radio engineering to appreciate the various hazards that can arise from working on radio transmitters, and to take appropriate precautions to ensure the safety of personnel.

SECTION I

DESCRIPTION AND LEADING PARTICULARS

1-1. Purpose and Application of Equipment. The OMEGALINE® Model 40400 & 40500 Soda Loads are designed to safely dissipate a maximum of 400 kW or 500 kW of electrical energy, respectively.

1-2. Sequence & Theory of Operation. In preparation for operation, the soda load system is energized with AC Mains power (not RF power). A liquid heater is then switched on to warm the soda solution to a set point. This set point of 75ºC allows the system to work at high ambient temperatures. The set point temperature may be altered in the field to compensate for different soda mixture concentrations. When the soda solution has reached the set point, RF power may be applied.

There are two isolated liquid loops in this system:

(1) The soda solution loop is a system that receives solute from the tank. The primary pump directs solution to the resistor, through the heat exchanger, and back to the tank. There is no flow control valve in this loop.

(2) The water coolant loop is a sealed and pressurized system that receives water-based coolant from the Dry Cooler. The secondary pump directs the coolant to a 3-way valve, which divides the stream and sends a portion of it through the heat exchanger as necessary to maintain the set point. Excess coolant is combined with the heat exchanger discharge and returned to the Dry Cooler. Temperature measurements are made on the inlet and outlet coolant ports of the soda cell. The temperature difference between these points is mathematically combined with the flow and specific heat of the soda solution and this calculation yields the applied power: **Power in KW = Temperature Difference (°C.) X Flow (GPM) X 0.268**

As applied RF power heats the soda solution flowing through the resistor, the cold inlet temperature must be decreased proportionally to maintain the average temperature in the load. Precise temperature control is achieved by using a 3-way valve controlled by a programmable logic controller. This valve mixes the hot water from the heat exchanger with colder water from the cooler and maintains the required temperature to the coolant side of the heat exchanger. The position of this valve is proportional to a signal that is generated by the calorimetry/controller module. This signal is based on calculations derived from measurement of the cold-solute inlet of the load. A look-ahead algorithm based on projected power augments this control process.

1-3. Digital Calorimetry. Digital calorimetry is included in the soda load package. This operates at all power settings with accurate and repeatable measurements. A programmable logic controller utilizes this high-speed calorimetric data and provides total automatic control of the soda load system. Additionally, it adapts to changing environmental conditions. The program continuously scans for fault conditions and protects the Soda Load and transmitter in fault conditions whenever transmitter power is applied to the load. Safety points monitored include soda solution flow, temperature and soda solution tank level.

1-4. Resistive Components. The resistive element is constructed using two non-conductive tubes; one smaller tube inside a larger tube. The cross-sectional area of these tubes provides the required fluid flow rates while minimizing pressure drops. The tubes are mounted on a dual sweep elbow. The soda solution flows into the smaller tube up to a housing cap at the top. It is diverted down through the cavity between the small OD and the large ID tubes. When it reaches the outlet elbow, it is directed to the system heat exchanger for heat removal.

The top housing cap is metallic. The RF energy is applied at this point. The dual sweep elbow serves as ground and the termination point for RF signals. The complete resistive element assembly is enclosed in a semi-log tapered outer shield. The spacing at the RF end is dimensioned to match the source impedance. The shape tapers as it approaches the ground end. This matches the impedance of the solution as it approaches ground.

Many factors determine the resistive component of the load. The liquid cross-sectional area, length and metal surface contact area are fixed by the design. The concentration and set point temperature of the soda solution (solute) are variable and controlled by the operator.

1-5. Preparation for Reshipment. Prior to shipment, drain fluids and use air to blow out any excess fluids. There are three valves that must be opened to completely drain the soda side. The dry cooler side of the system can be drained by using the drain valves located at the lowest point of the plumbed system. **NOTE:** After the system is drained, these valves must be closed prior to recharging the system.

1-6. Long-term Storage. The Soda Load system can be stored with soda and glycol mixtures in place for extended periods, i.e.: 4 to 6 months. With AC Mains connected to the Soda Load, run the pumps periodically for a short time as a preventive maintenance procedure. Adjustments (add water or soda) to the soda solution may need to be made after long-term storage. If the load is to be stored dry, take all the necessary actions to drain and remove all liquids from the load, close all drains, and cover all open pipes.

HEATER WARNING

DISCONNECT AND LOCKOUT AC MAINS POWER TO THE SODA LOAD BEFORE DRAINING SODA SYSTEM TANK. OPERATION OF THE SODA TANK HEATERS WHEN THEY ARE NOT COMPLETELY COVERED IN LIQUID WILL RESULT IN IMMEDIATE FAILURE!

SECTION II

SYSTEM COMPONENTS

2.1. **Soda Load Electrical Panel.** The Soda Load electrical panel is generic and populated to accommodate the specific load requirements. There is a standard program in the PLC and Display. Each panel uses a hardware selection to specify load size to the program. This selection adapts to pipe size and the number of fans in the Dry Cooler. A hardware strap is installed between 24VDC and appropriate pin on the PLC. See Section VIII for PLC terminal configuration.

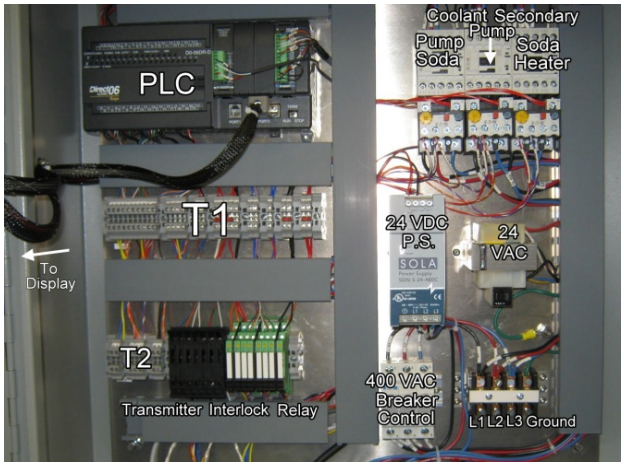


Fig. 2.1

2.2. **Dry Cooler Off / On Contactor.** Switch on front of Dry Cooler AC panel door that controls power to Dry Cooler.

2.3. **Transmitter Interlock.** The transmitter interlock prevents the transmitter from providing power if the enable is not present.

WARNING: The transmitter interlock should always be used and never operated in a wire-around configuration. Failure to connect the interlock may result in injury to personnel, fire, and/or damage the Soda Load system. Operation with the interlock not connected voids the warranty and responsibility of the Soda Load system. The interlock is only enabled when both hardwire and computer-monitoring requirements are met. A direct access is provided through the E-Stop button which may be pressed by operators in the event of an unsafe or emergency situation.

Transmitter Interlock Schematic:

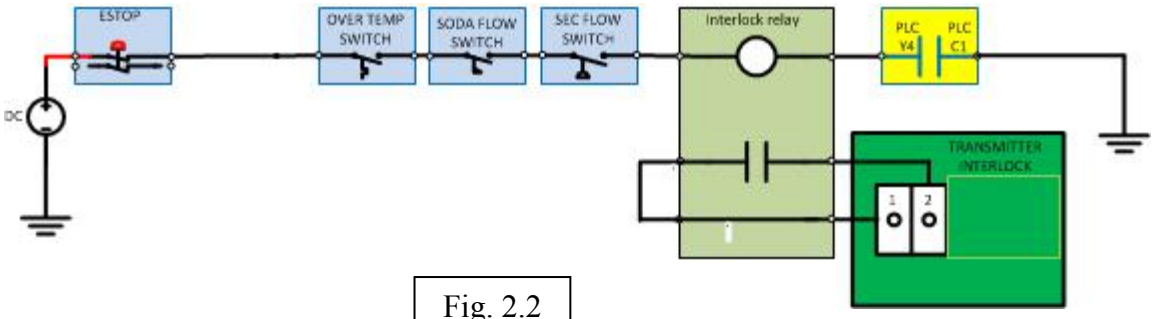


Fig. 2.2

Transmitter Interlock Relay shown in Figure 2.3

There are five (5) mechanical switches wired in series providing power to the relay. The PLC provides a ground. Loss of any switch closure will disable the transmitter.

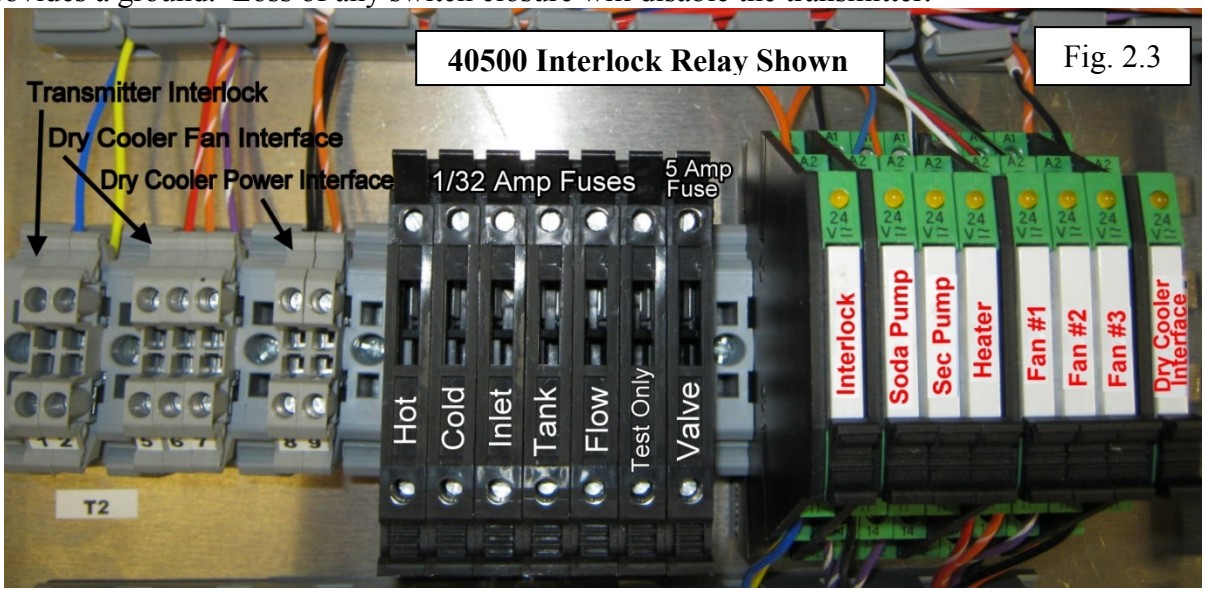


Fig. 2.3

NOTE: The interlock relay contacts are isolated. The enabled condition has a closure across the NO contacts. This is wired in a fail-safe arrangement.

Figures 2.4 – 2.8 show the switches in the interlock relay circuit:

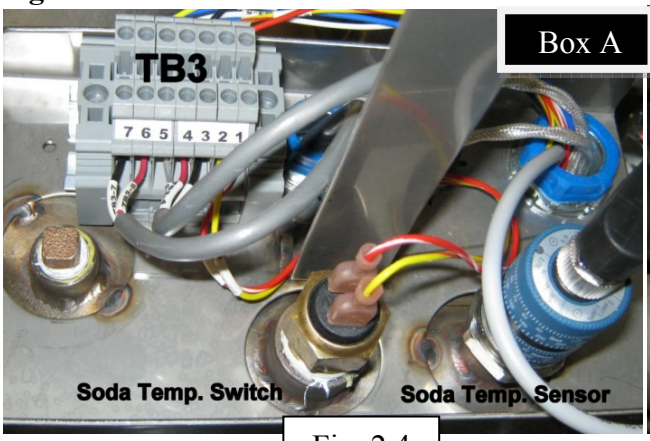


Fig. 2.4

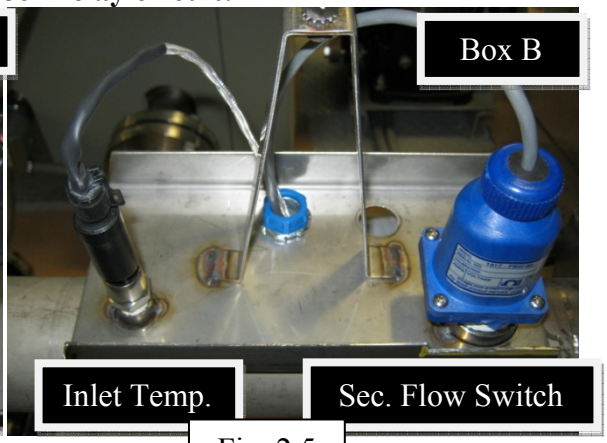


Fig. 2.5

Fig. 2.6

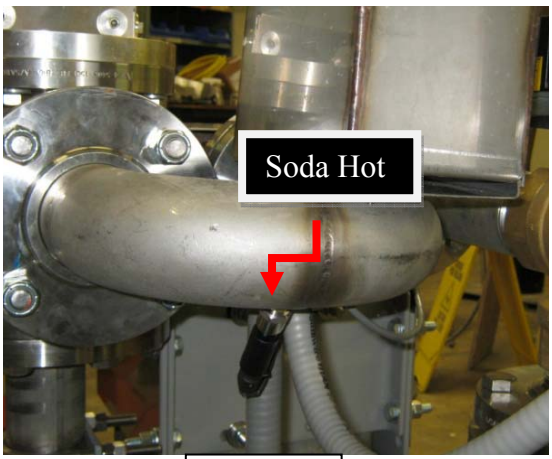


Fig. 2.7

Fig. 2.8

2.4. **Relays.** The control relays are mounted on a din rail in the lower left section of the electrical panel.

2.5. **Power Contactors.** The contactor relays with overloads are located in the top right section of the panel. In the event of an overload condition, the overload will need to be reset.

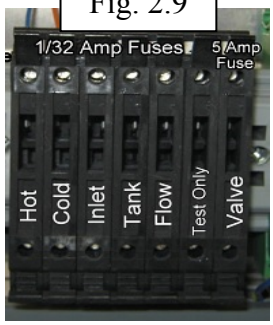
2.6. **DC Power Supply.** The DC power provides system power, with a 3-phase input at mains potential providing 24 VDC for system operation.

2.7. **E-Stop.** The E-Stop is located on the front of the electrical box. It is a push-to-engage, rotate-to-reset device. When pressed, ALL heaters, valves and pumps should stop and transmitter enable signal must be automatically removed.

2.8. **PLC.** The Programmable Logic Controller is located in the upper left of the electrical box. There is an analog output card on the left of the IO card slots and an analog input card on the left.

NOTE: These units were programmed at the factory. In the event of a PLC software revision, the PLC Programming Procedure will need to be updated. The "Run Term Stop" 3-position toggle switch located on the right PLC should be in the "Term" middle position. To program the PLC, a programming cable must be connected at Port 1 (RJ7). System communications occur between the PLC port2 (DB15) and the display Port. See Appendix A for programming procedures.

Fig. 2.9



2.9. **Analog I/O Fuses.** Fuses are used on all IO and are incorporated into the terminal block. **NOTE:** A good fuse will measure ~ 40 ohms.

2.10. **OFF/ON Switch.** The Off/On switch on the front of the enclosure door serves as a switch and a breaker. This controls the power to the display screen.

2.11. **Heater.** The heater is located in the tank and controlled by a power contactor.

2.12. **3-Way Valve.** The 3-way valve is located on the pipe manifold in front of the plate exchanger. The valve controls the coolant passing through the plate exchanger. It is a RF voltage controlled device controlled by the PLC and powered by 28 VAC.

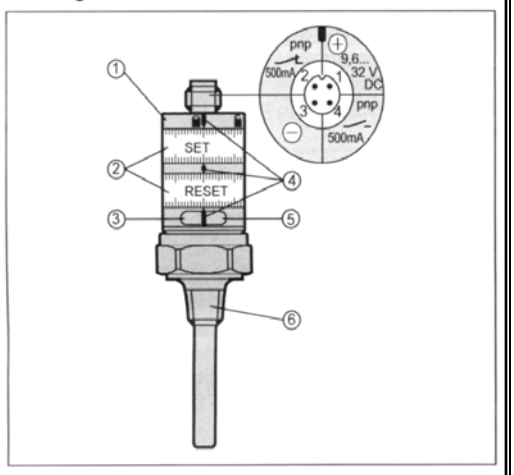
2.13. **Pump Motors.** There are two pumps on the Soda Load system. One pumps soda solution through the resistor and the plate exchanger. The other pumps the secondary coolant through the Dry Cooler system and the isolated side of the plate exchanger. The pumps operate on 3-phase Mains power and are controlled and protected by power contactor relays.

2.14. **Plate Exchanger.** The plate exchanger provides heat transfer, while isolating the soda and dry cooler systems.

2.15. Flow Meter. The flow meter is a magnetic velocity sensor. It provides a 4- 20 mA current that is proportional to the velocity. This velocity multiplied by the area of the piping provides an accurate flow calculation.

2.16. Temperature Switches. The temperature switches are used to protect the Soda Load system and disable the transmitter interlock. Once they are tripped, they will not return to a normal state until the system has cooled down.

Electronic



Mechanical

The mechanical temp. switch is not adjustable. If it is defective, remove and replace.

Fig. 2.10

The procedures for setting the dial-in settings are as follows:

1. Remove enclosure covers as required for access.
2. Unlock locking ring.
3. Adjust "Set" ring to 95 C.
4. Adjust the "Reset" ring to 50 C.
5. Lock locking ring.
6. Reinstall enclosure covers as required.

2.17. Flow Switches, Mechanical

Soda Flow Switch. The flow switch is set by the factory and no adjustment is required.

Secondary Flow Switch. The flow switch is set from the factory and no adjustment is required.

2.18. **Soda Pressure Switch Adjustment.** The switch is adjusted at the factory to "close" at the standard flow and to "open" if the pressure drops. (See Fig. 2.11 below)

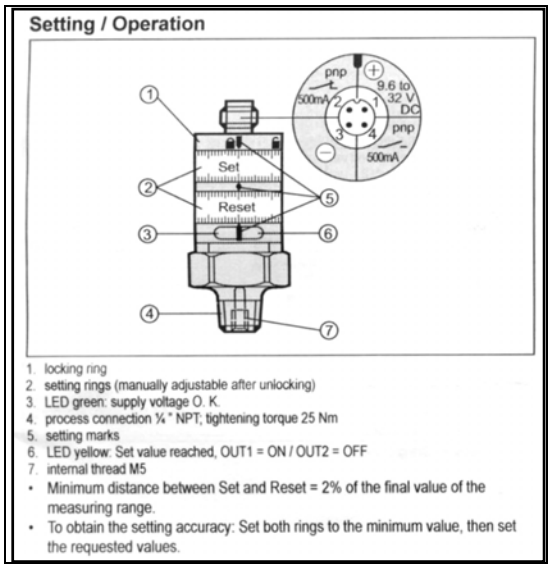


Fig. 2.11

The soda pressure switch signal is used to verify pressure in the soda side for pump protection. If this signal is not present after the pump is started, it will shut down the pump. This device has an LED status indicator. The Green indicator indicates that the pressure has reached the dial in setting. The Yellow indicator indicates the pressure has gone below the dial in reset setting.

The procedures for setting the dial in settings are as follows:

1. Remove enclosure covers as required for access.
2. Unlock locking ring.
3. Adjust "Set" ring to lowest setting. **Note**: The "Reset" ring will rotate to a high setting concurrently with adjustment of "Set" ring.
4. Start soda pump.
5. Adjust the "Set" ring downward until the yellow LED indicator goes on.
6. Adjust the "Set" ring back 5 psi.
7. Adjust the "Reset" ring 5 psi lower than the Set position.
8. Repeat steps 4-7 until the Yellow LED remains on and the pump continues to run.
9. Lock locking ring.
10. Reinstall enclosure covers as required.

2.19. **Flow Control Loop.** Section of piping formed as loop provides a straight flow at the flow meter.

2.20. **Frame Safety Grounding Point.** The safety ground is provided for bounding the frame of the Soda Load to the facility and/or transmitter grounds as required by local directives.

2.21. **Display/PLC Communication Cable.** The cable is a custom db15 to RJ7 that provides a communications path between the display and PLC.

2.22. **Control Electronics.** The control electronics consist of two major components: (1) the PLC and (2) the Display. A row of LED indicators located on the right upper section of the PLC housing indicates communications are occurring. The row of LED indicators across the top of the PLC reflects output status. The row of LED indicators across the bottom of the PLC indicates the logic inputs. The Display provides all the decision-making capabilities of the system. If there is a failure in either of these components, the defective unit will need to be replaced with programmed units. The latest software revisions from www.altronic.com should be used. See Section VIII for control replacement and Appendix A for programming procedures.

2.23. **Fill and Drain Valves.** The ball valves allow access to the system for filling and draining. They have a built-in locking mechanism that must be moved up the handle for positioning the valve. When the handle is parallel with the plumbing the valve is open, when the valve is perpendicular the valve is closed. All valves are closed for normal operation.

2.24. **Dry Cooler Fan Operation**. The number of fans is dependent on the power capability of the Soda Load system. They are configured in groups, which are turned on as the applied power is increased. Fan banks that are "ON" are shown on the Display Dry Cooler screen.

2.25. **AC Transformer**. The AC transformer located on the middle right side of the soda electrical panel provides AC voltage for the 3-way valve. There is an overload circuit breaker built into the transformer. This will need to be reset if there is an overload condition.

2.26. **Temperature Sensors, Analog.** The sensors used to measure the temperatures utilize platinum elements. These are packaged with instrumentation electronics in a single package. They provide a 4 to 20 mA current signal proportional to the temperature. The electronic section of the sensor is sensitive to ambient temperatures. The critical sensors should not be mounted with the probe down. Additionally all calibration should be conducted with the enclosure covers installed. The sensor resistor on the analog to digital convertor is 125 ohms. The operation voltages measured across the sensor resistor is .5 to 2.5V. Readings below .5 indicate an open circuit path. **NOTE: There is a 1/32 A fuse in line with all sensor signals. Check the fuse first if the voltage is below .5 V**. Industrial grade temperature sensors that perform to the specification requirements of the soda system are not readily available. Lab grade sensors are expensive. The sensors inherently have nonlinearity and mismatch. This is corrected by using a sensor calibration procedure. This approach has been chosen to allow the use of the industrial sensor, and provide for field removal and replacement. This allows the precision requirements of calorimetric measurement to be achieved. The Hot and Cold sensors precision is critical for calorimetric accuracy. A specialized calibration at the temperature of operation matches these sensors. The electronics section of the probe is sensitive to the ambient temperature. This necessitates the sensors to be mounted with a probe up or horizontal

configuration, never with a probe down altitude for critical sensors. **NOTE: All calibrations should be conducted with enclosure covers in place.**

2.27. **Temperature Sensor Calibration.** Fluid driven through a system picks up the heat of the energy required to circulate the fluid i.e. a 5-HP pump will pass 3750 Watts to the transported fluid. This added heat is removed during calibration of sensors. A two-step procedure is utilized during sensor calibration. The first process matches the Hot and Cold sensors at the set point temperature and removes friction-induced temperature differences. The second process matches the slope of the temperature differences.

2.28. **Analog Output**. The output of the digital-to-analog card is 2 to 10 VDC which passes through a 1/32 A fuse and connects to Pin 3 on the 3-way valve terminal strip. When testing at the 3-way valve, use Pin 1 as ground. Additionally there should be ~22 VAC between Pin 1 and Pin 2 on the 3-way valve terminals. See Appendix B.

2.29. **Valve Control Signal.** The valve control signal is the summation of two different controlling functions. One function strives to maintain the fluid temperature at the set point temperature. The second function adjusts valve movement using power, inlet temperature, and compensated plate exchanger temperature drop at the applied power level.

2.30. **Power Relay/Overload**. The power relays have an overload contactor attached. There is a RED test button in the middle to simulate tripping which may be pulled to test operation and status indicators. There is a RESET button on the right to reset the circuit breaker after it has cooled down. The adjustable overload trip setting on the left is sized to the normal current rating for its specific circuit. A manual adjustment should be adjusted to approximately ¾ of max current. The reset may be configured as automatic or manual reset by selecting A or H position.

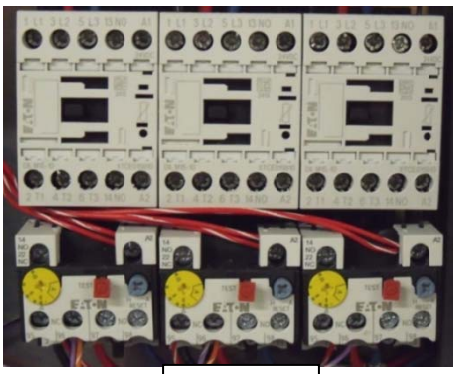


Fig. 2.12

2.31. **Secondary Fluid Flow Timing**. Soda Load systems are provided with the pumps selected for the maximum power rating. The flow parameters of the secondary loop are dependent on the piping length and diameter and the specific Dry Cooler. These introduce an unknown delay from the moment the 3-way valve moves until the returning fluid is sensed. To determine this delay the Flow Timing Procedure (Section 5.9) must be accomplished at start up. The information obtained from this procedure must be programmed into the "TIME" element of the offset screen.

2.32. **Bleeding Air from Secondary System**. As the fluid is forced through the system, air is initially trapped in the high points. This trapped air must be removed for optimum system operation. This process may take a few hours before all the air is completely removed. When using high concentrations of glycol, especially at lower temperatures,

foam may form in the liquid. It may be necessary to turn off the secondary pump and let the bubbles dissipate. After this is accomplished, the air removal process will need to be repeated.

2.33. **High and Low Liquid Level Switch**. There are no adjustments for these items. If either fails to work, remove and replace.

2.34. **System Drains.** There are three valves that must be opened to completely drain the soda side. The dry cooler side of the system can be drained by using the drain valves located at the lowest point of the plumbed system. **NOTE:** After the system is drained, these valves must be closed prior to recharging the system

SECTION III

DRY COOLER INSTALLATION

3.1. **Inspection Prior to Unpacking.** Inspect outer carton for evidence of damage during shipment. We suggest that the user collect and preserve all documentation such as Bills of Lading, Manifests, etc. Prior to shipping, the manufacturer of the Dry Cooler pressurized it to approximately 14 psi/97kPa. This pressure should be checked **prior to unpacking**. There is a Schrader valve installed in one of the blind coolant flanges on the Dry Cooler. Use a pressure gauge to verify a positive pressure at this point. If there is not a positive pressure, pressurize with dry air or nitrogen, and check again in 24 hours. If there is no positive pressure at this check, leak isolation should be performed using a soapy water bubble test particularly around the pressure cap, fittings and connections. If low pressure continues after detecting and fixing any leaks, the Dry Cooler may be damaged. *Claims for damage in shipment must be filed promptly with the transportation company involved. Altronic Research Inc. is not responsible for damage incurred in transportation.*

3.2. **Unpacking.** Remove crating. The cooler and leg assemblies are mounted to the shipping platform with lag bolts. All of these bolts must be removed. Retain shipping materials if unit is to be reshipped.

> **Special Equipment Required: Crane–Adequate capacity with lifting slings.**
>
> **Attachment A – Installation, Operation and Maintenance (Section 4.2) contains detailed sling, spreader bar and lifting instructions. Personnel who are to perform the task of lifting the unit should read and follow these directions to avoid damage to the coil assembly.**

3.3. **Site Plan. The engineering site plan is developed by the group responsible for RF, electrical, mechanical, and layout of the project.** The final plan for this installation must be developed on-site and is beyond the scope of this manual. **See Attachment B: Dry Cooler Foundation Dimension Plan for dimensions.** It is recommended that the Soda Load be installed on level ground with the Dry Cooler no more than 2 feet (.61 meter) above the soda load base on a 4-inch (10.2 cm) concrete reinforced pad with a leak containment basin.

3.4. **Installation.** The configuration of the Dry Cooler may be varied. The smaller systems may be shipped complete, while the larger units may require some assembly. All loads have an expansion tank that may or may not require installation. The support legs may have to be installed on the larger dry coolers. The manufacturer of the Dry Cooler has prepared detailed plans for its assembly and installation. They are included in this manual as Attachments A and B. Be certain that these instructions are read and understood before beginning the installation work. The basic steps are summarized below:

1. Prepare footing for placement.
2. Lift cooler coil assembly and install mounting legs (on some units).
3. Position Dry Cooler in installation spot and securely bolt it in place.

4. Install expansion tank if not installed prior to shipment. The Site Installation Coordinator provides pipe fittings.

3.5. **Leg Installation** when required:

1. Lift Dry Cooler.
2. Position legs and bolt to Dry Cooler.
3. Lower Dry Cooler.

3.6. **Expansion Tank Installation** when required:

1. Bolt expansion tank to Dry Cooler mechanical using supplied bolts and nuts.
2. Connect supplied hose between expansion tank port and Dry Cooler return line.

3.7. **Electrical Installation.** Electrical safety and lockout procedures:

1. Turn off main power source to applicable system.
2. Lock out applicable breaker.
3. Tag and flag locked out breaker.
4. Comply with all electrical safety procedures and practices as required by site safety plan.
5. Verify that power has been removed from the applicable unit using voltmeter at the AC Mains terminals.
6. IF power is present, repeat steps 1 thru 5.

NOTE: The electrical enclosure of the Dry Cooler has no holes for the power or control wiring. Holes will have to be drilled in the bottom of each enclosure. Size holes to user-supplied conduit. The A/C wiring will be routed through a conduit knock-out at the bottom of the electrical box and the wires will be routed to the top right of the electrical enclosure and connected to the Off/On contactor input. The control cable will be routed to a terminal strip located in the mid-lower section of the cabinet.

3.8. **Wiring Connection.** **Refer to attachments, Dry Cooler Schematics**

3.9. **Dry Cooler Electrical.**

1. Switch OFF Dry Cooler Off/On contactor.
2. Route the high voltage wiring from AC Mains service to Dry Cooler. Ensure that the supply voltage matches the specified motor voltage.
3. Install all phase wiring, neutral and ground as applicable.
4. Torque electrical terminations.
5. Install safety cover as applicable.

3.10. **Fan Control Cabling.**

1. Route control wiring from Dry Cooler to Soda Load electrical interface control box. This cable should be installed in site-appropriate conduit for control cable.
2. Connect control cabling to Dry Cooler as shown in following table:

SIGNAL	SODA LOAD	DRY COOLER
Fan Bank 1	**TB2 PIN (5)**	Terminal 005
Fan Bank 2	**TB2 PIN (6)**	Terminal 008
Fan Bank 3	**TB2 PIN (7)**	Terminal 011
AC Com	**TB2 PIN (8)**	Terminal 002
24 VAC	**TB2 PIN (9)**	Terminal 003

Note: Fan Bank 3 is not used on 200 KW Soda Load

Fig. 3.1

3.11. <u>Dry Cooler Fan Rotation Verification</u>. NOTE: TWO PERSONNEL ARE REQUIRED TO PERFORM THIS OPERATION

1. Verify electrical lockout procedures for Dry Cooler have been performed.
2. Ensure power to the Soda Load is OFF "Inside breaker of Soda AC box".
3. Ensure Dry Cooler Off/On Contactor is OFF "Front Door Dry Cooler".
4. Obtain a 4" (10 cm) insulated #14 or larger wire and strip both ends.
5. Insert one end into terminal 002 and screw down.
   Caution: Ensure the other end is not contacting a conductive surface
6. Apply facility power to the Dry Cooler.
7. Switch Dry Cooler Off/On contactor ON "Front Door Dry Cooler".
8. Momentarily touch the free end of the jumper wire to Terminal 003. The fan should rotate.
9. Verify that the fans are blowing up through the coils. **If correct,** end of procedure. If fans are blowing in the wrong direction, perform steps 10-13.
10. Perform electrical lockout procedures for Dry Cooler
11. Switch OFF Dry Cooler Off/On contactor.
12. Swap two of the 3-Phase AC input wires.

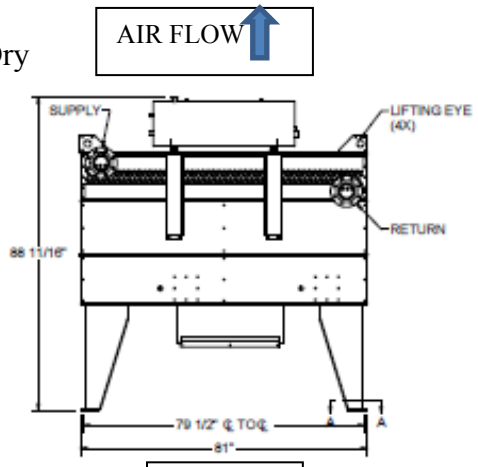


Fig. 3.2

End of Dry Cooler Fan Verification procedure.

3.12. **Plumbing Installation.** Fabricate pipe and assemble to fittings in accordance with site plan plumbing drawings. Connect source and drain lines to Dry Cooler assembly.

NOTE: The "HOT" fluid from the Soda Load mates with the top left flange **supply** on the Dry Cooler, **return** "COLD" mates to the lower right flange of the Dry Cooler.

3.13. **Flange Connection Procedures**.

1. Inspect flange gaskets.
2. Insure free from cracks and cuts.
3. Replace any defective gaskets and clean.
4. Insert lower bolts into flange.
5. Insert gaskets between flanges on top of bolts.
6. Install remaining bolts and attach nuts finger tight.
7. In a crisscross pattern, sequence torque all bolts in 10 lb. steps to 80 ft. lbs.

END OF DRY COOLER INSTALLATION PROCEDURE

SECTION IV

SODA LOAD INSTALLATION

4.1. **Inspection**. Inspect for damage. Compare packing list with shipment.

4.2. **Unpacking.** Remove packaging and crating. The Soda Load is shipped partially disassembled. Place in a prepared area with an adequate drain or basin to catch any possible liquid leakage.

4.3. **Hopper Assembly / Installation.**

Fig. 4.1

1. Remove hopper assembly from box.
2. Inspect hopper and resistor for damage.
3. Remove shipping plate by removing the 8 bolts and lock washers from the flange. Save bolts for attaching hopper.
4. Remove the inner tube from the outer tube inside the flange and hopper.
5. Place the inner tube onto the inner part of the Tee assembly. Check that the O-ring (EP433) is in the O-ring groove. (Note: Both ends of the inner tube are interchangeable.)
6. Holding the flange and hopper, carefully lift and place the flange over the inner tube. Slide the hopper assembly down while maintaining the assembly in an upright position. The inner tube will self-position as the flange fits to the Tee flange. Turn the hopper assembly until the holes from both flanges are aligned and the model number is facing forward.
7. Use the same bolts and lock washers (8 ea.) to secure the flange together. Insert the bolts and lock washers up from the bottom flange and turn to tighten.
8. After all 8 bolts and lock washers are installed, proceed to tighten and torque to 80 ft. lbs. using a criss-cross pattern. Do not use locktite on bolt threads.
9. After torquing of bolts is complete, add torque seal to each bolt.
10. Check for water leaks around the flange. If a leak is present, remove bolts and lock washers in reverse order of installation and check for incorrect seating of O-ring or damage to O-ring.

    END OF PROCEDURE

4.4. **Installation of Soda Load Platform.**

Install in accordance with site drawings. **Leveling:** Four leveling and anchoring points are built into the soda frame assembly. They must be adjusted to level the Soda Load assembly. Holes are provided for anchoring.

4.5. **Electrical Safety and Lockout Procedures.**

1. Turn off main power source to applicable system.
2. Lock out applicable breaker.
3. Tag and flag locked out breaker.
4. Comply with all electrical safety procedures and practices as required by site safety plan.

5. Verify that power has been removed from the applicable unit using voltmeter at the AC mains terminals. IF power is present repeat steps 1 thru 5.
END OF PROCEDURE

4.6. **Connect AC Mains.** Fig. 4.2

1. Route wiring from facility power to Soda Load electrical interface control box. This cable should be installed in site-appropriate conduit.
2. Connect L1, L2, L3, and G from 400 VAC 50Hz Delta AC Mains supply to terminal block.
3. Connect safety ground as shown in Fig. 4.3.

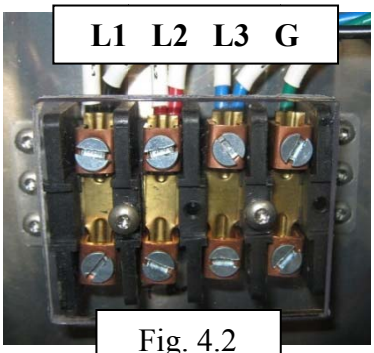


Fig. 4.2

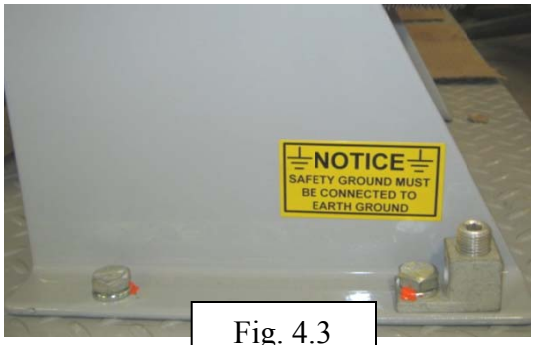


Fig. 4.3

4.7. **Connect Transmitter Interlock.** Fig. 4.4

TB2 is located in the lower left of the Soda Load electrical panel. The transmitter interlock wiring should be connected to **TB2 PIN (1)** and **TB2 PIN (2) NOTE: This provides a contact closed condition when the transmitter is enabled.**

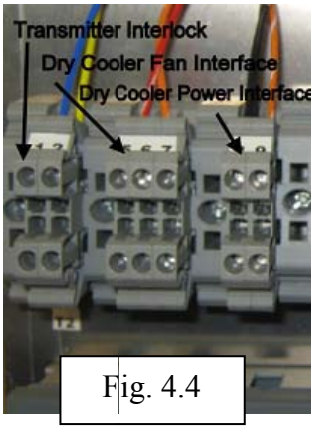


Fig. 4.4

4.8. **Connect Dry Cooler Control Cabling.** Fig. 4.5

SIGNAL	SODA LOAD	DRY COOLER
Fan Bank 1	**TB2 PIN (5)**	Terminal 005
Fan Bank 2	**TB2 PIN (6)**	Terminal 008
Fan Bank 3	**TB2 PIN (7)**	Terminal 011
AC Com	**TB2 PIN (8)**	Terminal 002
24 VAC	**TB2 PIN (9)**	Terminal 003

Note: Fan Bank 3 is not used on 200 KW Soda Load

Fig. 4.5

4.9. Connect Dry Cooler Plumbing.

NOTE: The Dry Cooler connections are on the lower section of the Soda Load. The flange that is connected at the bottom of the 3-way valve "T" is the hot liquid going to the Dry Cooler and connects to the upper left flange on the Dry Cooler. The flange that is connected to the suction side of the secondary pump is the cold fluid returning from the Dry Cooler.

Flange Connection Procedures:

1. Inspect flange gaskets.
2. Insure free from cracks and cuts.
3. Replace any defective gaskets and clean.
4. Insert lower bolts into flange.
5. Insert gaskets between flanges on top of bolts.
6. Install remaining bolts and attach nuts finger tight.
7. In a crisscross pattern, sequence torque all bolts in 10 lb. steps to 80 ft. lbs.
8. End of procedure.

Special high ambient installation:

High ambient conditions may require a flow restriction valve in the line going to the Dry Cooler. If applicable, an adjustable butterfly valve is included with shipment. Use this valve to lower flow through the Dry Cooler for high ambient operation. This adjustment may be accomplished by observing inlet temperature and adjusting the valve to give the lowest inlet temperature during operation. After adjusting, secure the valve to prevent further adjustments. Lowering the water flow through the Dry Cooler will increase the efficiency according to site conditions.

4.10. Connect RF Line to Soda Load.

1. Insure proper center conductor alignment.
2. Mate outer conductor and install mounting hardware.
3. Tighten and torque mating hardware.

END OF SODA LOAD INSTALLATION PROCEDURE

SECTION V

INITIAL SODA LOAD SYSTEM START-UP

5.1. Soda Load Start-Up.

Note: Refer to Section 2.30 Pg. 16 Power Relay/Overload for clarification on overload.

1. Set /verify current settings on breakers in Soda Load control panel.
2. Reset overloads on breakers.
3. Apply Soda Load AC Mains power.
4. Set power breaker inside soda electrical control panel to "ON" position.
5. Set switch on front of door "ON".
6. Verify power supply "ON" indicator is illuminated.
7. Verify lights on PLC are illuminated.
8. Verify display lights up. Refer to Section VII, Program Instructions for display screen descriptions.
9. Verify current program revision is displayed at sign-on screen. If not current revision, perform DISPLAY PROGRAMING PROCEDURE in Appendix A.
10. Verify offsets are loaded into Display *refer to offset screen.*
11. Verify temperature readings in the Test screen.
12. Momentarily turn off then turn back on inside breaker on soda electrical control panel.
13. Verify 3-way valve cycles when breaker turns back on. This will take 30 seconds to start moving.

5.2. Soda Charging Procedure.

NOTE: A small pump may be required to charge the system.

1. Fill the soda tank.
2. Connect the input side of the priming pump to the water source.
3. The lid on the tank will have to be removed to view the fluid level.
4. Actuate the source pump and fill the system to 8 cm below the tank high-level switch.

NOTE: Bleed the soda pump air-bleed port after the tank is filled and before starting the pump. Failure to do this will result in damage to the pump.

5. Open the bleed valve on the pump.
6. Vent until liquid comes out and then close the valve.

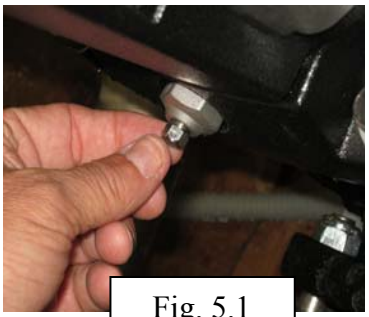


Fig. 5.1

5.3. Pump Rotation Check Procedure.

1. Press in the applicable relay contactor momentarily for ½ second.

NOTE: There are arrow markings on the top of the pump indicating direction of proper rotation. See Figure 5.2.

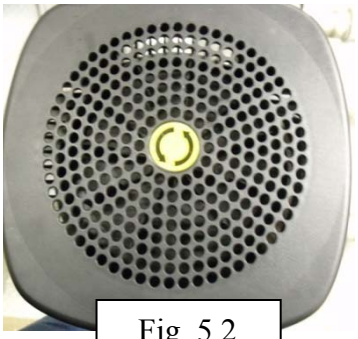


Fig. 5.2

2. Observe direction of pump motor.

IF WRONG ROTATION:

a. Disconnect and lock out AC Mains power to electrical interface control box.
b. Set breaker to OFF.
c. Exchange 2 wires of the AC Mains supply at Soda Load input terminal strip.
d. Turn on Soda Load AC Mains supply.

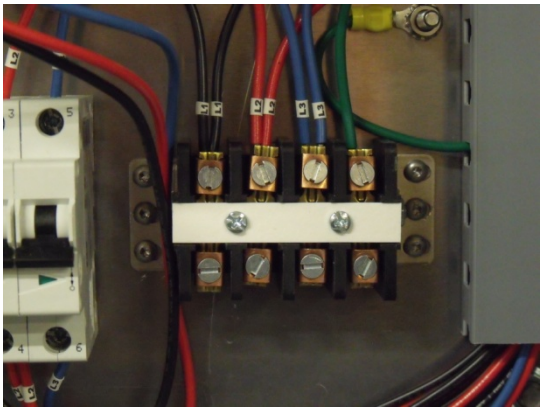


Fig. 5.3

IF CORRECT ROTATION:
END OF PROCEDURE

5.4. Pump Priming Procedure.

1. Open the bleed valve on the pump. Vent until liquid comes out, then close the valve.
2. Momentarily depress the pump starter relay (<1 second). Pump will start to run.
3. Vent until liquid comes out, then close the valve.
4. Press and hold the starter contact on the pump relay for 5 seconds. The pump will change sounds as it primes.
5. Release the starter contact. If the pump does not prime, then repeat steps 1thru 4.
6. Open the bleed valve on the pump.
7. Vent until liquid comes out, then close the valve.

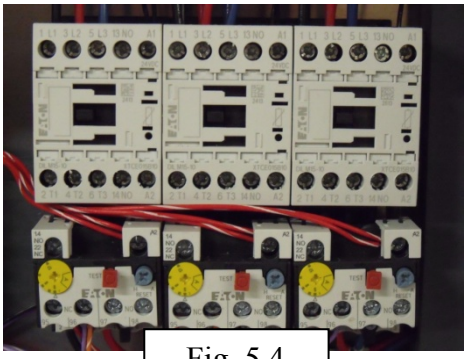


Fig. 5.4

8. From the display screen select Menu->Controls> press the soda pump on. The pump will run for about 5 seconds and shut off if there is a fault condition. Should this occur, troubleshoot the following items:
   a. Pressure switch setting is preset at factory. Set at 20 psi, reset 5 psi. Refer to Soda Pressure Switch Adjustment, Section 2.18, Page 14.
   b. Temperature switch setting is preset at 95°C and 50°C. If they are not at these settings, refer to Soda Pressure Switch Adjustment Section 2.16, Page 13.
   c. Soda flow switch. There are no adjustments for this switch. If there is a flow failure, troubleshoot air in the system.
9. Run the pump for five minutes to complete purging the system of air. After this time, the pump should run smoothly. If the pump still surges, repeat steps 1thru 7.

NOTE: The secondary will not run for more than 5 seconds unless the soda pump is running.

5.5. Secondary Start Up.

PLUMBING PURGING AND CLEANUP
Prior to pressure testing and initial fill, the new plumbing must be cleaned of any debris, metal cuttings, oils, etc.

WARNING!
DO NOT USE ANY STOP LEAK, SEALANTS, OR AUTOMOTIVE ANTIFREEZE IN COOLANT. USE OF ANYTHING OTHER THAN PURE POTABLE OR DISTILLED WATER OR A MIXTURE OF HIGH QUALITY PASSIFIED ETHYLENE GLYCOL (i.e. SR1) AND POTABLE WATER WILL VOID THE WARRANTY!

Prepare a 30-40% solution (depending on lowest ambient temperature) of corrosion-inhibited ethylene glycol (Dow SR1 or equivalent) and distilled and/or potable/drinking water suitable for human consumption in an appropriate container. The U.S. Environmental Protection Agency has established standards for potable water at a maximum of 500 ppm of dissolved solids.

NOTE: A small priming pump is required to charge the system.
1. Connect the output of the priming pump to the OUTPUT side of the secondary pump.
2. Insert the input side of the priming pump into the prepared containers of glycol / water mix.
3. Actuate the source pump and fill the system to ¾ capacity, per site-specific documentation.

NOTE: There are two air bleed points on the soda load platform relating to the secondary system. One is in the top of the piping from the secondary pump to the plate exchanger. The other is on the secondary pump. These points will have to be repeatedly accessed to remove all air from the system. The general operation is to open the bleed port until liquid comes out, and then close the port.

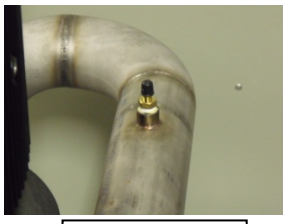


Fig. 5.5

4. Turn on the breaker inside the control box.
5. Turn on the switch on the front of door.
6. Apply facility power to the Soda Load system.
7. From the Display screen, select Menu-> Controls.
8. Press the soda pump on indicator.
9. Press the secondary pump on indicator.
   NOTE: The pump will run for about 5 seconds and shut off if there is no flow or if the soda pump is not running.
10. Open the bleed valve on the secondary pump and remove air. Close when liquid starts to come out.
11. Repeat these procedures until the pump is primed.
12. Fill the secondary system to ¼ point of sight gage on Dry Cooler. Depending on the installation, the air may have to be bled at the Dry Cooler as well.
    NOTE: If the solution becomes air saturated, the pump will have to be turned off and allow the air to separate from the liquid. This may take up to one hour.
13. Turn off secondary pump.
14. Turn off soda pump.
15. When the secondary system is charged, the priming pump may be removed.

END OF PROCEDURE

5.6. System Start Up.

1. Apply/verify power to Dry Cooler and Contactor Off/ON Switch is ON.
2. Apply/verify power to Soda Load and All switches are set to ON.
3. Verify the E-Stop button is Reset. “Rotate to Reset”.
4. Press Menu->Control Soda pump, Sec Pump, and Heater ON.
5. Verify the Transmitter Interlock is OPERATIONAL on the transmitter control panel. This may be tested by pressing the ESTOP push button. The transmitter enable on the transmitter control panel should go out. To reset, rotate the ESTOP push button. **NOTE: The transmitter will need to be reset after an interlock trip condition.**
6. Press Menu>Raw Data Temperature Indicators should indicate ~ ambient temperatures
   Hot
   Cold
   Inlet
   Tank
   DTemp

7. Flow indicator: Flow as prescribed in specifications.
8. Press Menu>Control Heater ON.

5.7. Setting Impedance Procedure.

NOTE: The soda is shipped in a separate container. The end mixture will vary with the type of water used.

1. Press Menu> All Start
2. Press Menu-> Offset-> Setpoint Soda → 75->Enter
3. Press Menu->Control-> Heater ON

NOTE: This will start the heating of the liquid in the tank and will take a few hours to reach setpoint temperature. The amount of soda required depends on the system size. Allow the soda temperature to heat up to 75°C.

CAUTION: Liquid-proof safety glasses and gloves should be used for the following steps in the commissioning procedure. The addition of sodium carbonate to water may cause vigorous bubbling and splashing of the hot solution.

4. If available, use a complex impendence analyzer or transmitter instrumentation to measure.
5. When the solution has reached approximately 75°C, slowly pour the sodium carbonate into the water through the top of the tank. Begin by mixing about 1 liter of the soda into the water.
6. Read the impedance on the transmitter. This should start to come down and the load will absorb power.
7. Pour small portions into the tank while monitoring impedance.

NOTE: The impedance will decrease about 2.5 ohms per °C increase in temperature. The approximate impedance at this point should be 120 ohms. When using the transmitter to measure, the impedance will be 50 ohms and increase 1 ohm per °C.

8. As the impedance approaches the desired ohms value, apply smaller amounts of soda and wait about 1 minute for the reading to stabilize before adding additional soda. The VSWR reading of 1.05 or better should be achieved.
9. The final adjustment will be made when the mixture is heated to 75°C by applied RF. The reflected power will drop to zero when the proper impedance is achieved.

END OF PROCEDURE

5.8. Sensor Calibration Procedure.

1. Apply AC power to Soda Load system.
2. Enter Set Point to 85°C.
3. Turn on pumps and heater.

4. Allow fluid temperature to reach 75°C. This may take several hours depending on the starting temperature of fluid. The process may be accelerated by using RF Power to heat the liquid. If no transmitter power is available, the system may be left on overnight.
5. When the temperature of the cold water is 75°C +/- 1°, turn off the transmitter and heater.
6. Enter set point to 75°C.
7. The secondary pump may be turned off at this time.
8. Allow the system to stabilize for 15 minutes.
9. Record the Cold and Hot temperatures. Using the Hot offset adjust the Hot Temp to match the Cold Temp.
10. When they match and Delta T is zero, record the Hot Offset on the inside of the electrical box door.

NOTE: Allow 3 minutes to pass before removing power to display for permanent memory to be stored!

END OF PROCEDURE

5.9. Fluid Flow Timing.

NOTE: A timing device that has a 1-second resolution is required for this procedure.

1. Press Menu->Offset->Set Point.
2. Adjust set point to 10°C below inlet temperature. **Note:** The 3-way valve will start to reposition.
3. Start timer.
4. Press Menu-> Raw Data.
5. Observe the inlet temperature for a significant change.
6. Stop the timer when change is observed.
7. Record delay time.
8. Press Menu->Offset.
9. Adjust set point to 75°C.
10. Press Menu->Offset-> Time.
11. Adjust Time to the recorded delay time.
    NOTE: Power must not be removed from the display for 3 minutes to allow data storage.

END OF PROCEDURE

5.10. Calibrate Power.

Calibrate power settings by using Flow_S gain setting in Offset Screen. Adjust Soda Load power to match Transmitter power. Decreasing the Flow_S gain increases the displayed power of soda system; conversely, increasing the valve lowers the soda system power. When this is accomplished, record setting on label inside door.

END OF START-UP PROCEDURE

5.11. Normal Operation.

After initial system set up is performed, the following procedures are used for normal system operation.

1. Check water levels.
2. Turn Power ON.
3. Check for leaks.
4. Allow sufficient time for the solution to heat up. The temperature will increase approximately 18°C per hour using heaters. The impedance will change approximately 1 ohm per degree C. increase in temperature. Low level RF power may be applied until the set point of 75°C is reached.
5. Operate as needed. Digital calorimetry provides accurate and repeatable measurements. The PLC utilizes the data and provides total automatic control of the Soda Load system. The program continuously scans for fault conditions and protects the Soda Load and Transmitter in fault conditions whenever transmitter power is applied to the load. Refer to Section VII for program screen instructions.

SECTION VI

RESISTOR DESCRIPTION

The Altronic Soda Load Resistor consists of three sections combined to absorb RF power and to act as a cooling medium for removal of heat from the load. Section one is a 4-inch diameter segment of polypropylene tube. Section two is a 2 ½ -inch piece of polypropylene tube, with the same length and position inside the housing as section one. The last section is the outer conductor, which is tapered sheet metal housing. Water enters from the flanged connection at the bottom of the load, and flows up through the center of the 4-inch tube. After reaching the top of the 4-inch tube, water flows down between the 2 ½ -inch and 4-inch tube. Water leaves the resistor through the flanged connection on side two of the load. The shape of the outer conductor is used to set the VSWR of the dummy load.

WARNING!!!

OPERATION OF THE SODA LOAD WITHOUT THE RESISTOR HOUSING IN PLACE COULD CAUSE FATALITY, INJURIES AND/OR DAMAGE THE LOAD.

RESISTOR MAINTENANCE

The Altronic Soda Load Resistor will require little in the way of maintenance. Components located inside the resistor assembly other than the resistor element are not subject to field maintenance. The resistor is field replaceable in those instances where there is no extensive damage to the resistor components, due to improper operation of the load. In the event of mechanical damage to the unit, operational difficulty, or information concerning a desired unusual application of the load, contact the factory.

Minor repairs can be accomplished without removing the resistor from the load. If it is found that the 4-inch polypropylene tube has to be replaced, the resistor must be removed from the load. If the replacement resistor does not install easily, the inner tube length may need to be adjusted. Please contact the factory for instructions. The following page shows the resistor assembly as Figure 6.1.

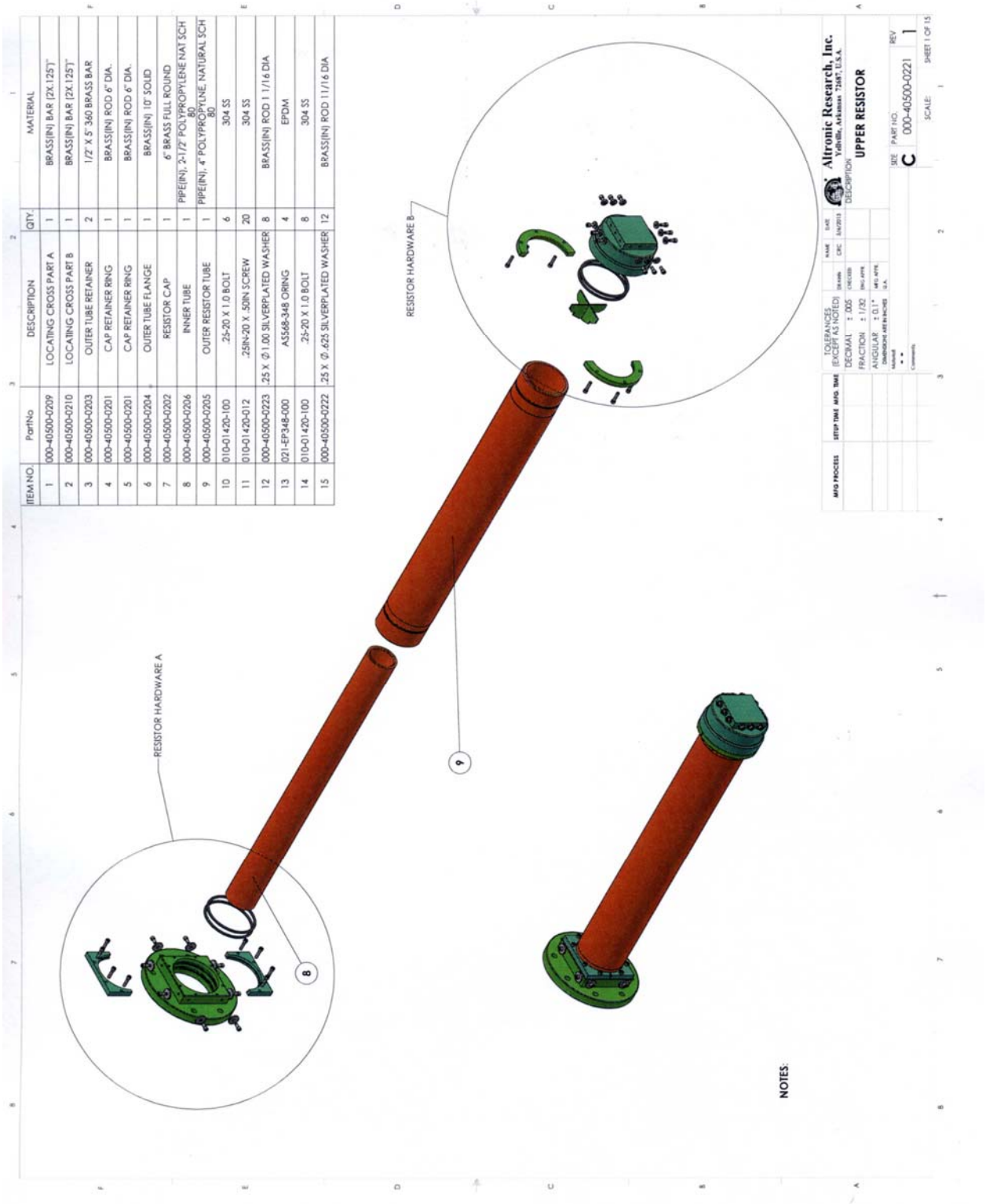

ITEM NO. | PartNo | DESCRIPTION | QTY. | MATERIAL
1 | 000-40500-0209 | LOCATING CROSS PART A | 1 | BRASS(IN) BAR (2X.125")
2 | 000-40500-0210 | LOCATING CROSS PART B | 1 | BRASS(IN) BAR (2X.125")
3 | 000-40500-0203 | OUTER TUBE RETAINER | 2 | 1/2" X 5" 360 BRASS BAR
4 | 000-40500-0201 | CAP RETAINER RING | 1 | BRASS(IN) ROD 6" DIA.
5 | 000-40500-0201 | CAP RETAINER RING | 1 | BRASS(IN) ROD 6" DIA.
6 | 000-40500-0204 | OUTER TUBE FLANGE | 1 | BRASS(IN) 10" SOLID
7 | 000-40500-0202 | RESISTOR CAP | 1 | 6" BRASS FULL ROUND
8 | 000-40500-0206 | INNER TUBE | 1 | PIPE(IN), 2-1/2" POLYPROPYLENE NAT SCH 80
9 | 000-40500-0205 | OUTER RESISTOR TUBE | 1 | PIPE(IN), 4" POLYPROPYLNE, NATURAL SCH 80
10 | 010-01420-100 | .25-20 X 1.0 BOLT | 6 | 304 SS
11 | 010-01420-012 | .25IN-20 X .50IN SCREW | 20 | 304 SS
12 | 000-40500-0223 | .25 X Ø1.00 SILVERPLATED WASHER | 8 | BRASS(IN) ROD 1 1/16 DIA
13 | 021-EP348-000 | AS568-348 ORING | 4 | EPDM
14 | 010-01420-100 | .25-20 X 1.0 BOLT | 8 | 304 SS
15 | 000-40500-0222 | .25 X Ø.625 SILVERPLATED WASHER | 12 | BRASS(IN) ROD 11/16 DIA
RESISTOR HARDWARE A
RESISTOR HARDWARE B
NOTES:
Altronic Research, Inc.
Valhalla, Arkansas 72687, U.S.A.
UPPER RESISTOR
000-40500-0221
C
SCALE:
SHEET 1 OF 15

Fig. 6.1

SECTION VII

PROGRAM INSTRUCTIONS
(MAY VARY FROM ILLUSTRATIONS)

This screen is displayed only at power on. The key next to the EXIT must be pressed to advance to the next screen below.

NFB indicates the number of fan banks of the dry cooler, determined by the strapping configuration in the control panel and reflects the power capability of the system.

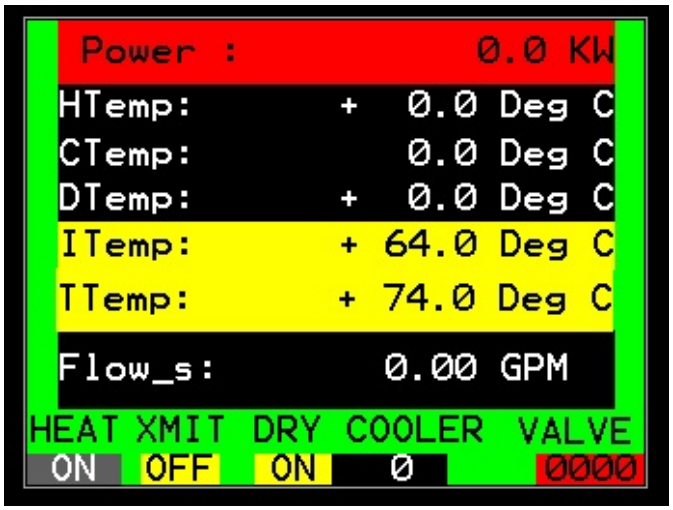
Fig. 7.1

Each of the squares shown above is touch switches and will advance to the selected screen. The Hard key located in the lower left of the screen area will cause the program to return to this menu screen, and will be referred to as the Menu Key henceforth. Following are the functions of each key shown above in Figure 7.1.

Power	**To small monitor screen**
Test	**To large monitor screen**
Control	**To manual control screen**
Status	**To status display screen**
Image	**To picture control screen**
Offset	**To system constants screen**
Gage	**To gage view power indicator**
Dry Cooler	**To dry cooler indicators**
All Start	**To turn on the pumps and heaters**
All Stop	**To turn off the pumps and heaters**
Alarm Status	**To display the alarms and allow reset of manual alarms**

The "Power" screen shown in Figure 7.2 is averaged, providing a highly accurate reading for performance evaluation.

Fig. 7.2

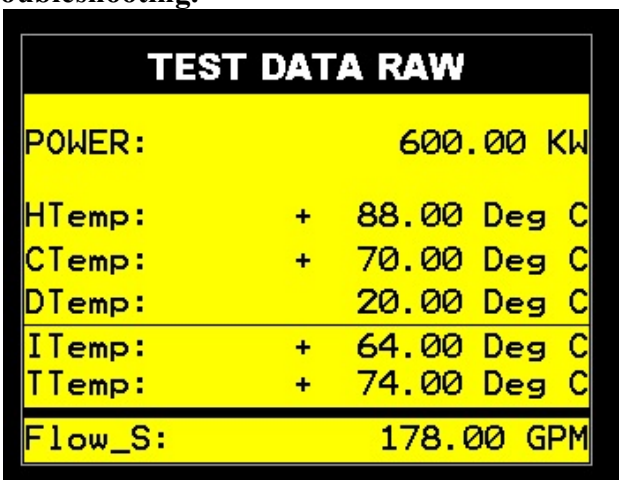


The following values may be monitored on this screen:

- **The applied power.**
- **The temperature of the soda solution exiting the load.**
- **The temperature of the cold soda solution entering the load.**
- **The difference between the Hot and Cold Ports.**
- **The flow in gallon per minute of the soda system.**
- **The temperature of the cold solution from the Dry Cooler.**
- **The soda heater on; transmitter off.**
- **Dry Cooler fans in operation; 3-way valve position.**

The "Test" screen shown in Figure 7.3 is not averaged, and allows an instantaneous view for maintenance and troubleshooting.

Fig. 7.3

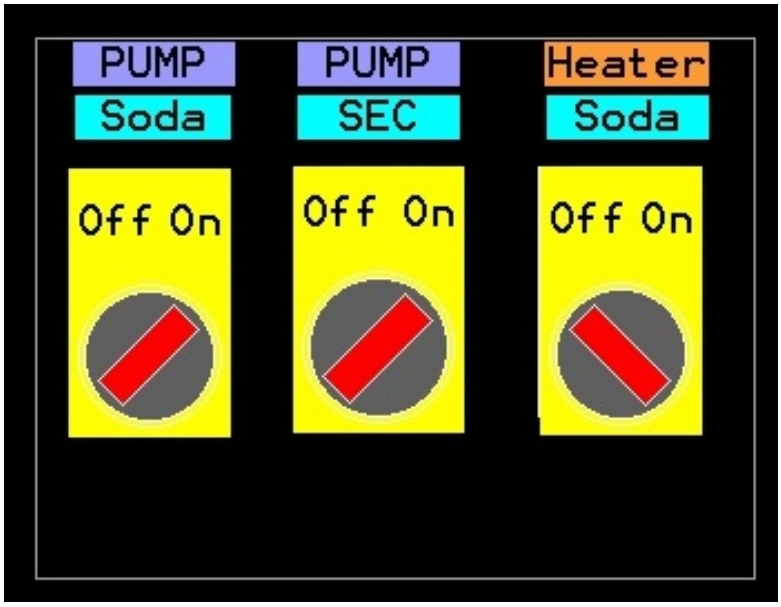


The following values may be monitored on this screen:

- **The applied power.**
- **The temperature of the soda solution exiting the load.**
- **The temperature of the cold soda solution entering the load.**
- **The difference between the Hot and Cold ports.**
- **The flow in gallon per minute of the soda system.**
- **The temperature of the cold solution from the Dry Cooler.**
- **T Temp is measuring the soda tank temperature.**
- **Flow_S is measuring the flow of the soda side.**

The "Control" screen shown in Figure 7.4 displays the switches for power control.

Fig. 7.4



- **Touch red area to toggle switch.**
- **The soda pump may be started or stopped.**
- **The water coolant pump may be started or stopped.**
- **The heater switch is an enable and disable mode only.**
  Note: the heater will automatically turn on and off to maintain the tank temperature. To soda offset temperature, if the heater switch is on.

The "Status" display shown in Figure 7.5 shows the real time operation of the monitored points.

Fig. 7.5

The indicators will be green if conditions are acceptable and will be red if a fault exists.
Automatic faults will clear when the required condition is met.
Manual faults will flash the letters until the condition is accepted on the reset screen.
REFER TO TROUBLESHOOTING SECTION for more information.

Following are the functions of each key shown above in Figure 7.5.

Soda Pressure	**Indicates insufficient pressure in the soda system**
FlowSwSoda	**Indicates low soda flow**
Soda OverI	**Over current on primary pump**
Dry Cooler Pwr	**Indicates the main power for the dry cooler is off**
Tank High Sw	**Indicates the soda solution in the tank is high**
HeaterI	**Over current on heater**
TempSwSoda	**Indicates the outlet solution has exceeded 90°C**
FlowSwSec	**Indicates low soda flow**
Sec OverI	**Over current on secondary pump**
EStop	**Indicates the E-Stop is pressed**
Tank LowSW	**Indicates the soda solution in the tank is low**
SodaHot	**Indicates the outlet solution has exceeded 90°C**

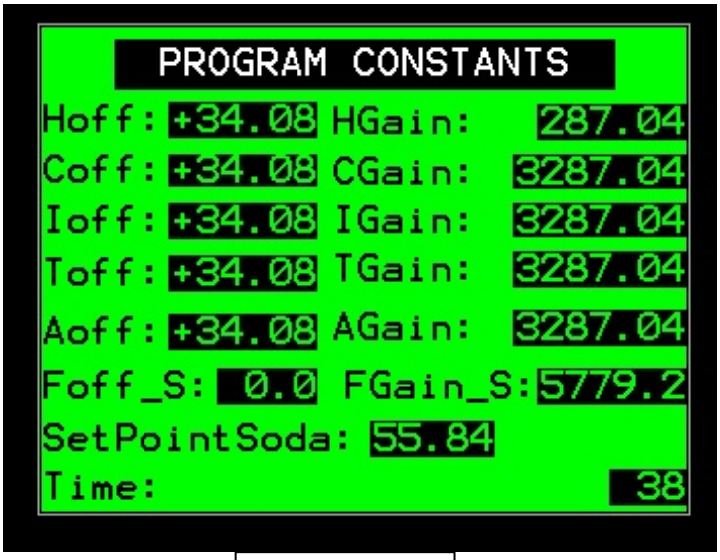


Fig. 7.6
"Offsets"

Determine fluid flow time of system by starting from Menu screen, select Offset screen, set to 10°C below ambient temperature, and then start timing using a watch with a second hand. Change to Raw Data screen (Menu > Test > Raw Data). Observe the inlet temperature for a significant change. Stop the timing event and record delay. Set Offset to 75°C (Menu > Offset > Setpoint). Set Offset Time to the recorded delay. Record this time on the door label.

A provision has been added to synchronize the inlet temperature measurement with the system fluid flow in relation to valve movement. This change will provide a more stable control loop and lower VSWR drift. The final setting of the Time should be accomplished at the final installation. This is a required site-specific entry.

IMPORTANT: After exiting the Program Constants screen, the power must not be removed from the display for 3 minutes. Failure to comply with this may result in data not being written to permanent memory.

Fig. 7.7
"Dry Cooler"

Fig. 7.8
"Alarm Status"

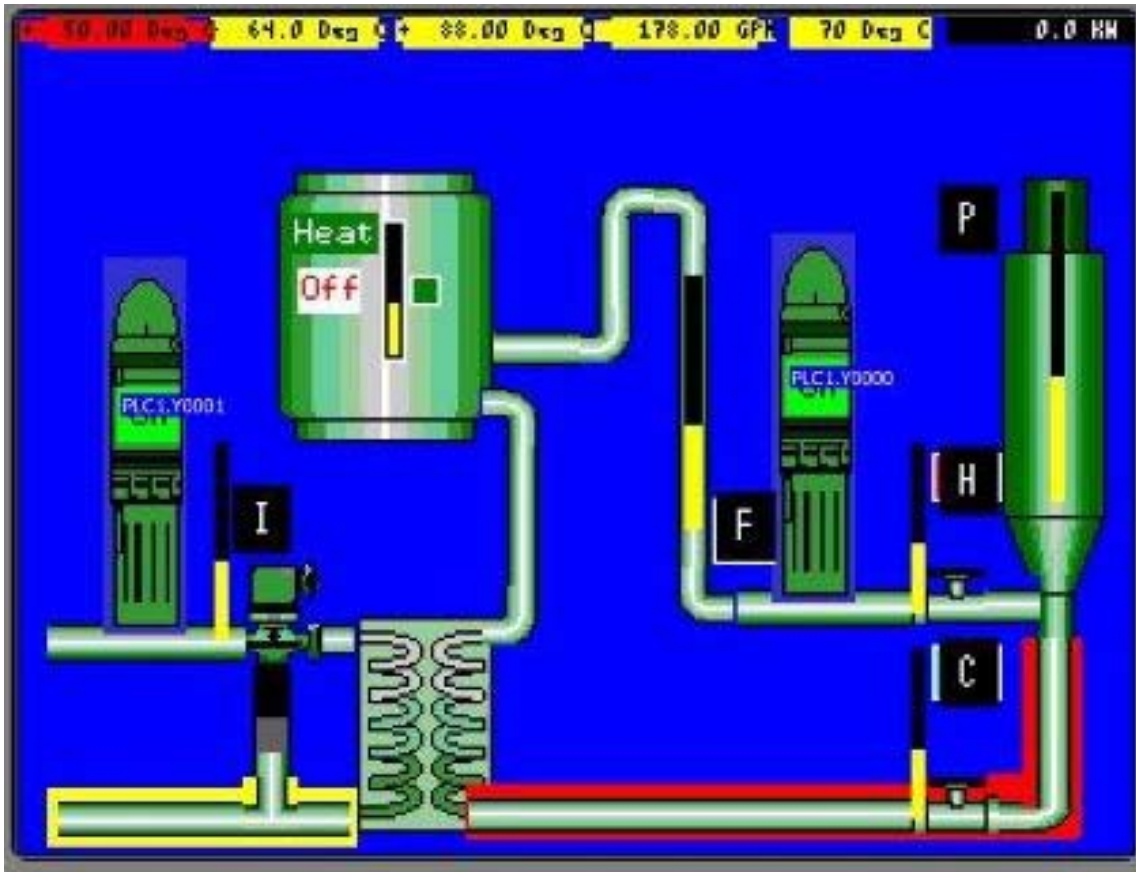


Fig. 7.9

The "Image" screen in Figure 7.9 shows a schematic view of the Soda load. Pressing the color squares will display the information at the top of the screen.

Dry Cooler operation is not included in this screen.

The following calibration table indicates typical data:

TYPICAL PROGRAM CONSTANTS LOADED AT CALIBRATION

(To be completed at start-up)

Hoff:	**HGain:**
Coff:	**CGain:**
Ioff:	**IGain:**
Toff:	**TGain:**
Aoff:	**AGain:**
Foff_S:	**FGain_S:**
SetPointSoda:	**Time:**

SECTION VIII

CONTROL COMPONENT REPLACEMENT

The control electronics consist of two major components: (1) the PLC and (2) the Display. A row of LED indicators located on the right upper section of the PLC housing indicates communications are occurring. The Display provides all the decision-making capabilities of the system. If there is a failure in either of these components, they will need to be replaced with programmed replacements from Altronic Research. If not ordered pre-programmed, see Appendix A. The latest software revisions from www.altronic.com should be used.

(1) The PLC may be replaced by loosening the screws attaching the terminal strip top and bottom. The terminal strips will unplug from the PLC. The PLC is affixed to the back panel with DIN rail hardware. The release point is located on the bottom and may be snapped down to release. The plug-in circuit assemblies on the PLC may be removed and replaced individually. This must be accomplished when the power is off. These devices are slot-specific and must be installed in their respective slot positions. The PLC has two add-on circuit assemblies that provide an I/O interface. The voltage output card is located in slot one (1). This card provides a 0 to 10 VDC signal controlling the position of the three-way valve. The input card located in slot four (4) provides 4-20 mA interface to the temperature and flow sensors. There is a 3-position switch located on the right side of the PLC. This switch must be in the middle position for normal operation.

(2) The Display may be changed by removing the attached wiring and cables and the mounting screws located around the edge of the display.

NOTE: The controls and software function on varied configurations. There is an electrical hardware strap "jumper" between (+) on PLC to "X" Pin on PLC that adjusts to different heat exchanger and piping sizes.

PLC terminal configuration:

X21 200KW
X20 300KW
X22 400KW
X23 500KW

Fig. 8.1

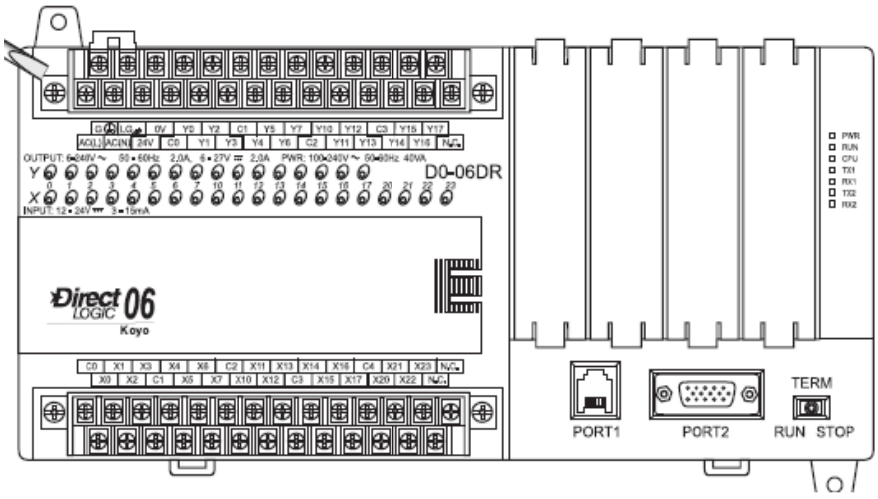


Fig. 8.2

PLC ANALOG OUTPUT CARDS:

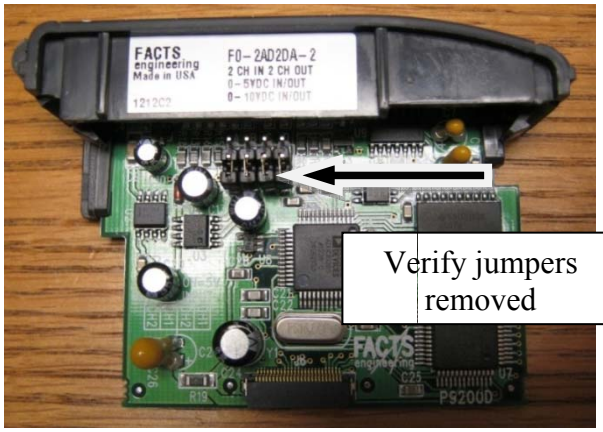


Fig. 8.3

DISPLAY CONNECTIONS:

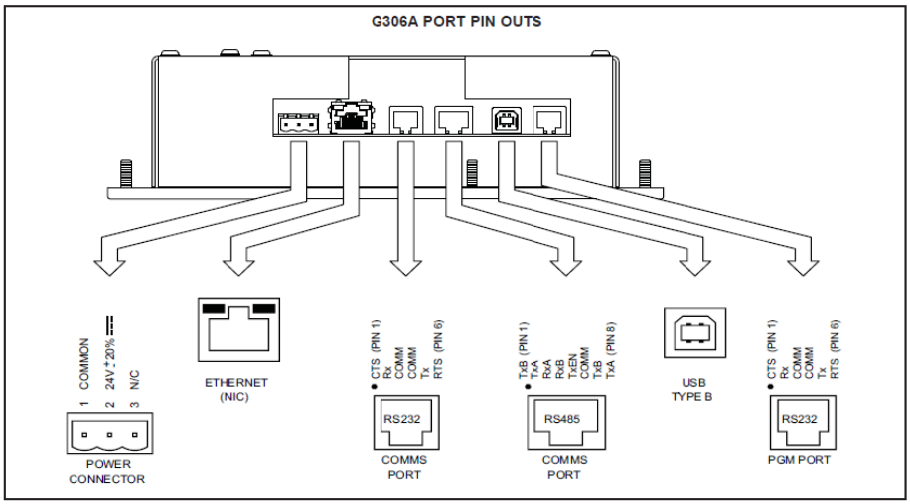


Fig. 8.4

OUTLINE DRAWINGS

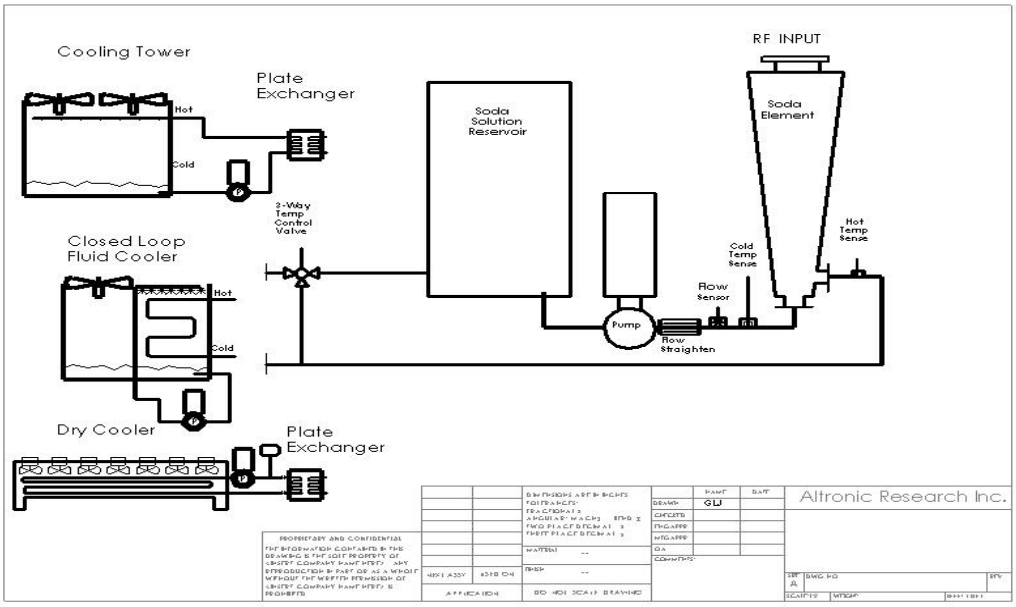


Fig. 9.1

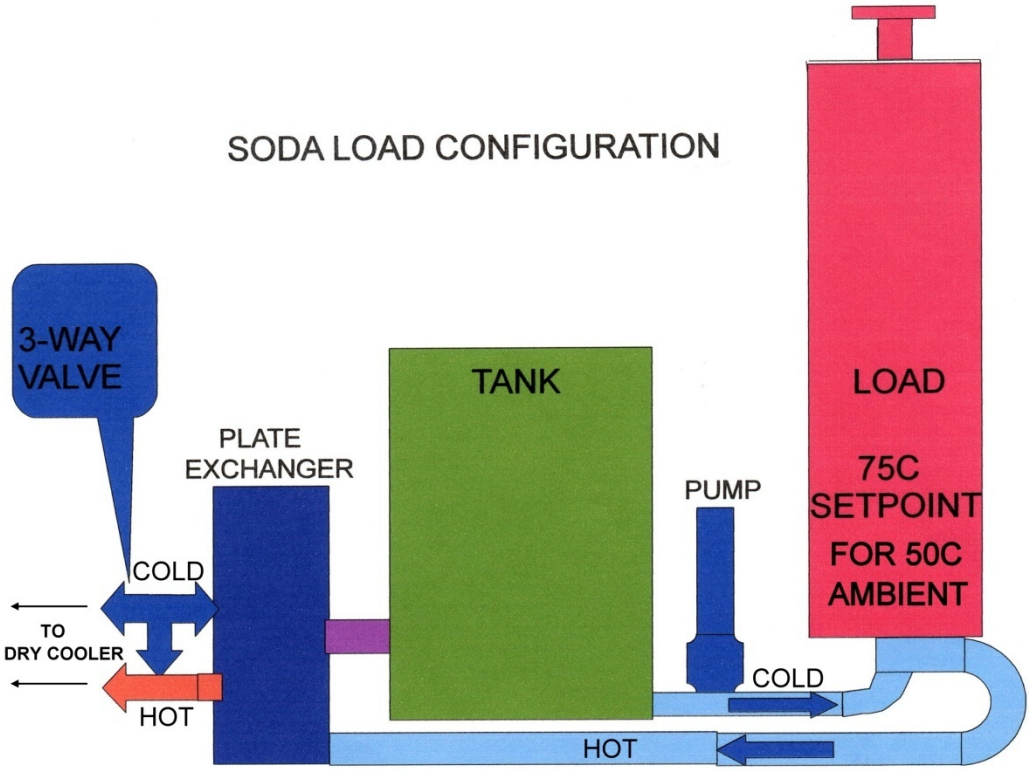


Fig. 9.2

SCHEMATIC DIAGRAM

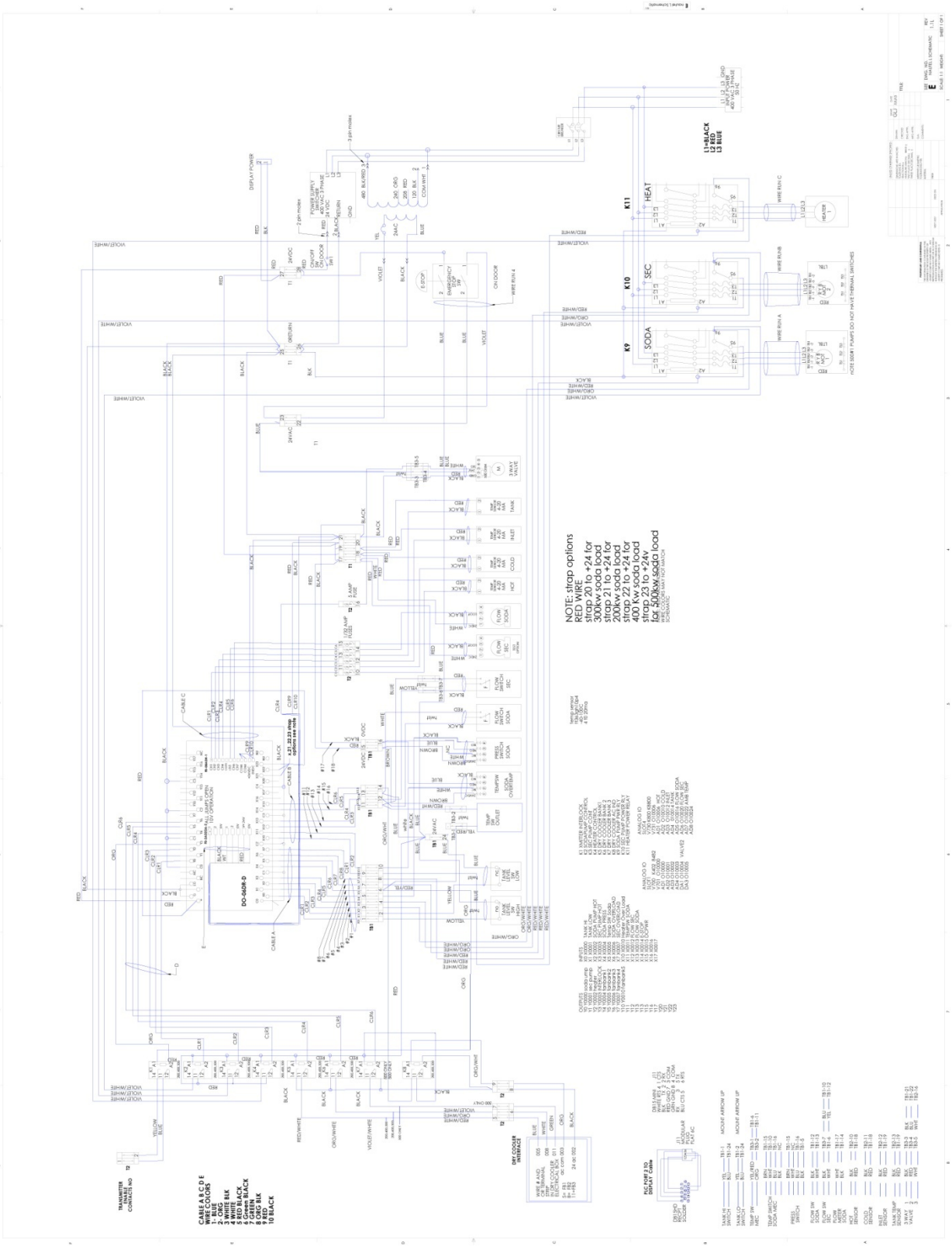


Fig. 9.3

REPLACEMENT PARTS LIST

MODEL 40400 & 40500

(TYPICAL)

Item	Qty.	Description	Part Number
1	2	Pump-40500 Pump-40400	900-10000-001 900-10000-002
2	3	Motor Starter DC	313-10000-270
3	1	3-Way Valve	100-10000-005
4	1	3-Way Valve Control/Actuator	100-10000-006
5	1	PLC "Programmed"	700-10000-020
6	1	8-Channel I/O Card	700-10000-007
7	1	2-Channel I/O Card	700-10000-009
8	1	Display "Programmed"	313-10000-269
9	1	Heater Element	087-10000-024
10	3	Overload Relay	313-10000-271
11	1	Power Supply DC	313-10000-272
12	1	AC Transformer	354-5041C-000
13	1	Pressure Switch	700-10000-017
14	1	Flow Switch	674-10000-017
15	1	Flow Meter	674-10000-009
16	1	Temperature Switch	700-10000-016
17	3	Temperature Sensor/Transmitter	889-10000-013
18	2	Switch, Level	578-10000-126
19	1	Dry Cooler Fan	
20	1	Dry Cooler Fan Hub	
21	1	Dry Cooler Motor Starter	

TECHNICAL CHARACTERISTICS:
Model 40400 & 40500

Impedance:	**120 ohms nominal**
Frequency Range:	**50 Hz to 2 MHz (including full load for harmonics 2 and 3)**
Resistive Type:	**Soda Solution (Sodium carbonate + Water)**
Max Power:	**400/500 KW** 200/300 KW Carrier Power + 125% Peak Modulation
RF Input:	**Box Line 10 ½" x 10 ½" square line**
Stabilized VSWR:	**1.05:1**
Accurate Power Measurement:	**Digital Calorimetric Range 10 to 100% FSR** **Accuracy ±< 4% FSR**
Dimensions: (Nominal)	**60 in. W x 72 in. L x 82 in. H** **(152.4cm x 182.9cm x 208.3cm)**
Weight:	**2800 lbs/1270kg (with crate)**
AC Power Requirements:	**Load Module 40 Amp. ; Dry Cooler 30 Amp.** **400 VAC, 3 Phase, 50 Hz**

System Protection:

MECHANICAL PROTECTION:
LOW FLOW
LOW TANK LEVEL
OVER CURRENT: fans, pumps and control
OVER TEMPERATURE

COMPUTER CONTROLLED PROTECTION:
LOW FLOW
OVER TEMPERATURE

Water Coolant Circuit:

Dissipation:	400/500KW
Cooling medium:	SR1 10-40% + distilled water
Flow rate of cooling medium:	115/150 GPM
Cooling air temperature:	-10ºC to 40ºC

Load rating based on optimum clean system conditions.
Load derates @ less than optimum conditions.
RF module must remain above freezing temperature.

Serial No. _____ Frequency MW Resistance 120Ω

Model_____Inspected by ___Date _____ Software Revision 40xxx.___

CRAFTED WITH PRIDE IN ARKANSAS, U.S.A.

TROUBLESHOOTING:

The wiring configuration of the Soda Load control circuitry provides redundant fail-safe protection. Mechanical switches are wired in series along with a Programmable Logic Controller (PLC) to enable the transmitter interlock relay. The fluid flows of the soda and secondary loops are monitored by individual mechanical switches along with the outlet temperature of the resistor. These signals are combined with redundant sensors that are monitored and controlled by the PLC. This insures the integrity, reliability and safety of the Soda Load system and protects personnel and equipment. In addition to transmitter enable controls, there are individual protection mechanisms on the pumps, heater and Dry Cooler. Fault indications on these are displayed on the monitor screen.

Fault Condition	**Recommended Solution(s)**
TANK HI	**Open soda tank lid and see if liquid is above top sensor. If it is, drain to below sensor. If not above sensor, troubleshoot tank Hi Level switch and wiring.**
TANK LOW	**Open soda tank lid and see if liquid is below bottom sensor. If it is, fill until above sensor. If not below sensor, troubleshoot tank low level switch and wiring.**
SODA PUMP OVER CURRENT	**Reset overload on contactor. If fault repeats, measure current on each leg of power. If current high, troubleshoot pump motor. If current within limits, remove and replace contactor.**
SEC PUMP OVER CURRENT	**Reset overload on contactor. If fault repeats, measure current on each leg of power. If current high, troubleshoot pump motor. If current within limits, remove and replace contactor.**
HEATER OVER CURRENT	**Reset overload on contactor. If fault repeats, measure current on each leg of power. If current high, troubleshoot heater. If current within limits, remove and replace contactor.**
DRY COOLER POWER	**Check AC Mains is applied to Dry Cooler. Measure 24VAC on secondary of transformer in Dry Cooler. If present, troubleshoot interconnect wiring and circuitry. If absent, troubleshoot Dry Cooler circuitry.**
ESTOP	**This is not a fault, but all other sensors will show fault if this is engaged. Rotate ESTOP switch to reset.**

The following faults must be evaluated in sequence as they are wired in series:

FLOW SWITCH SODA
FLOW SWITCH SECONDARY
TEMP SWITCH SODA
FLOW SODA SWITCH

(See Figure 9.4 following page)

Troubleshooting Flow Chart

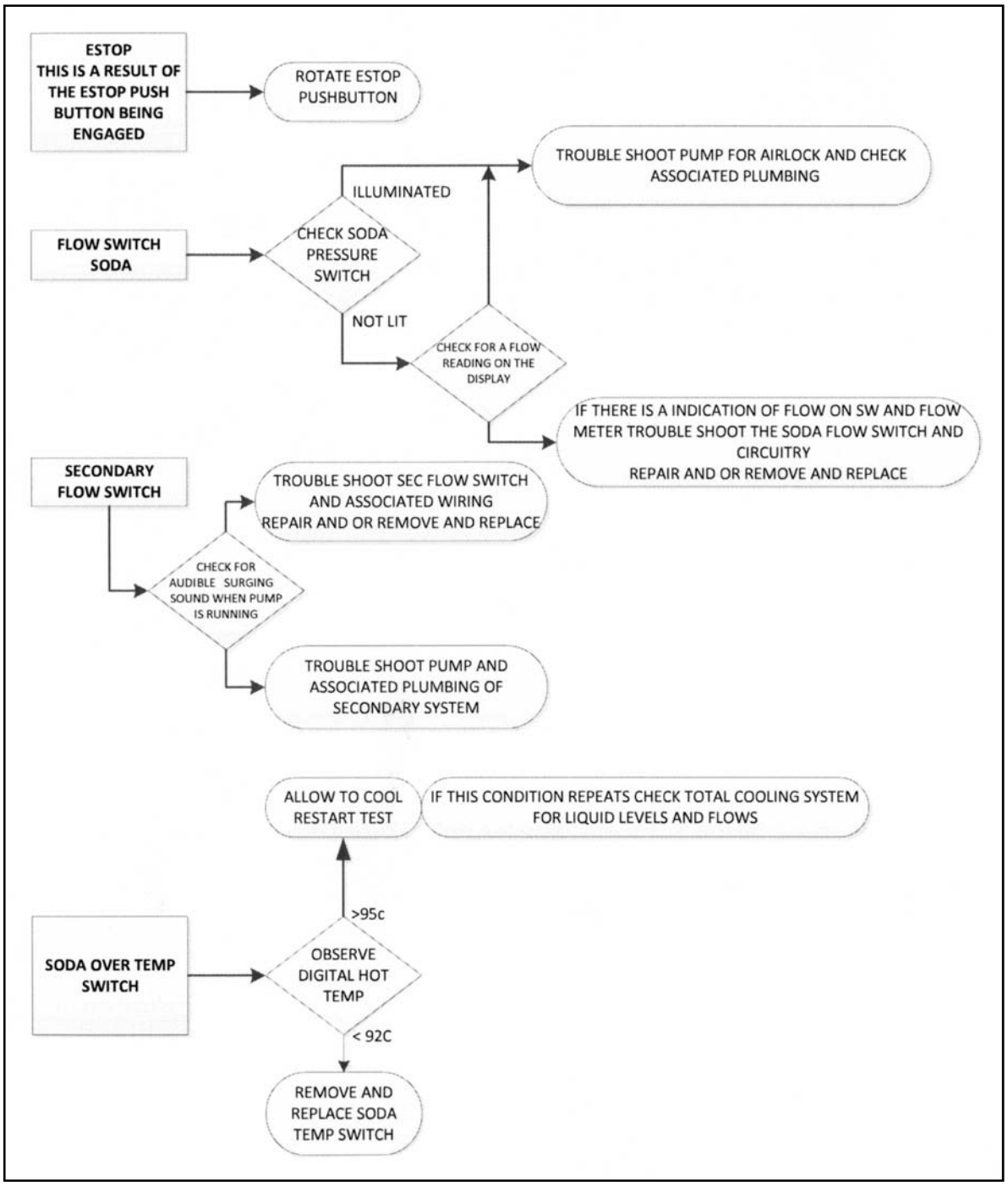


Fig. 9.4

APPENDIX A

PLC PROGRAMMING

OPERATING PROGRAM SOLEY OWNED BY ALTRONIC RESEARCH INC. AND IS LICENSED FOR USE IN ITS OWN PRODUCTS AND IS NOT TO BE DUPLICATED OR USED IN OTHER EQUIPMENT. ALL RIGHTS RESERVED.

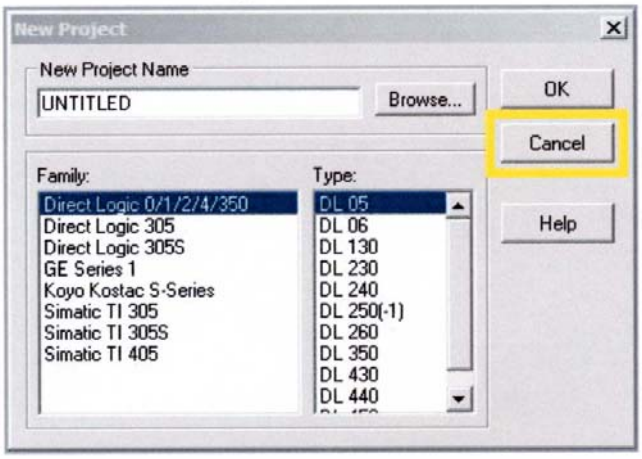
Prerequisites for programming the DirectLogic 06 PLC

The following items are needed to program the DirectLogic 06 PLC (hereafter referred to as PLC):

- DirectSOFT100 free programming utility (Automation Direct part number PC-DS100)
- Modular programming cable (Automation Direct part number EA-MG-PGM-CBL) or compatible.
- An active internet connection may be required to download software or drivers.

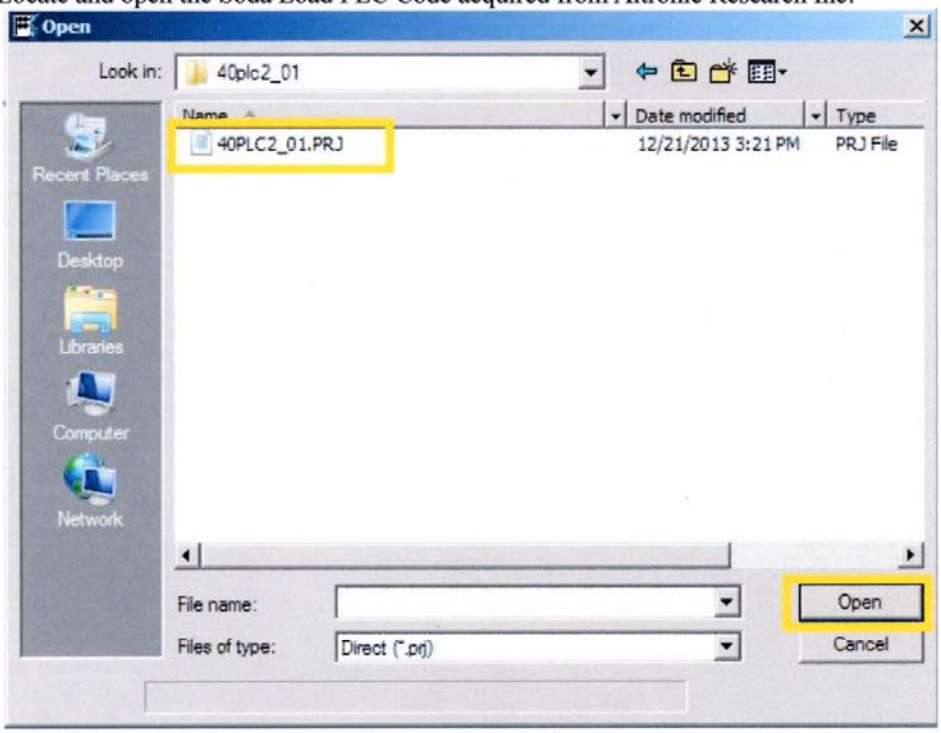
The DirectSOFT100 programming utility may be downloaded directly from Automation Direct via:
http://support.automationdirect.com/demos.html

1. Install the DirectSOFT100 utility onto a capable and compatible device hereafter referred to as 'laptop.'
2. Obtain the latest revision of the Soda Load PLC Code from Altronic Research Inc. A specific link to this part on http://www.altronic.com/ will be provided in release versions of this document.
3. Power the PLC and set the switch on it's face to the 'TERM' position.
4. Connect the laptop to 'PORT1' on the PLC using the modular or compatible programming cable.
5. Wait for any necessary drivers to install. Internet access may be required to complete this step.
6. Start the DirectSOFT100 utility.
7. Select 'Cancel' from this initial dialog :

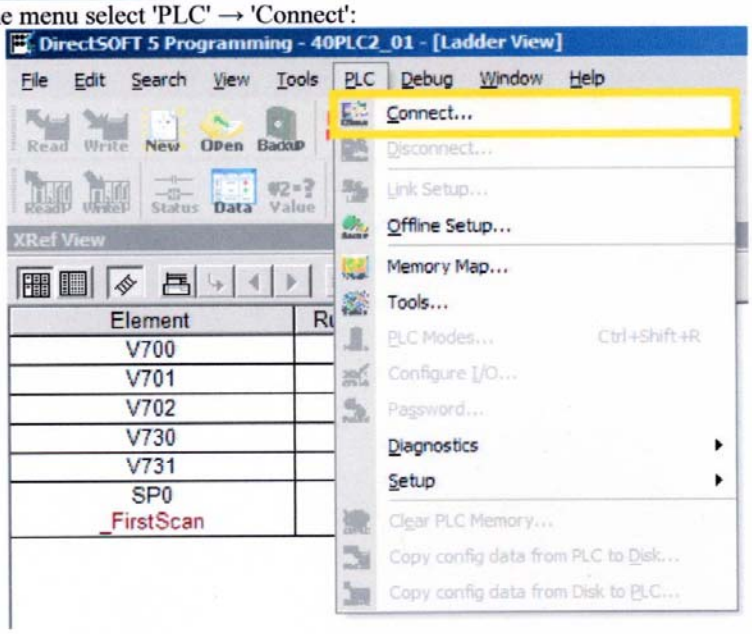


8. Select 'Open' from this toolbar:

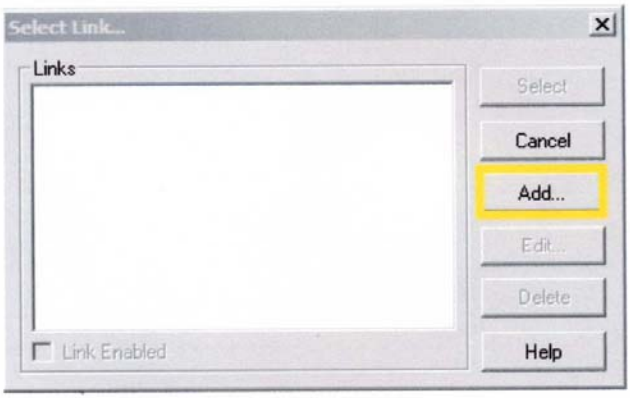
9. Locate and open the Soda Load PLC Code acquired from Altronic Research Inc:



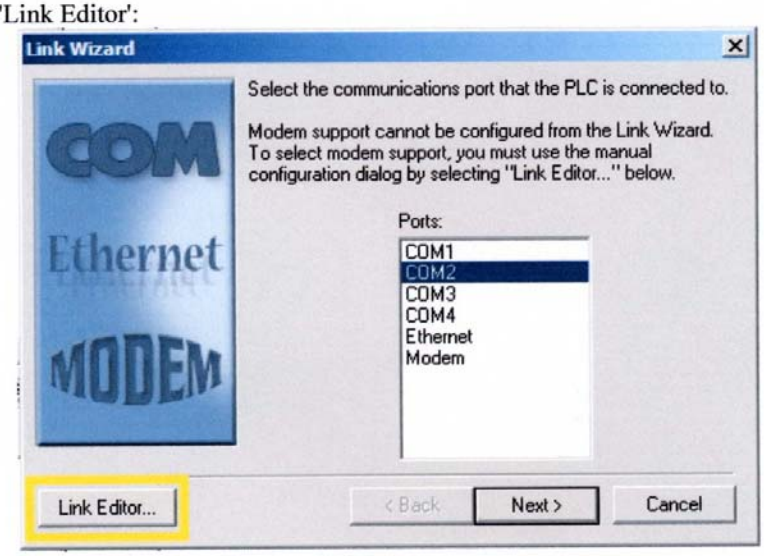
10. From the menu select 'PLC' → 'Connect':



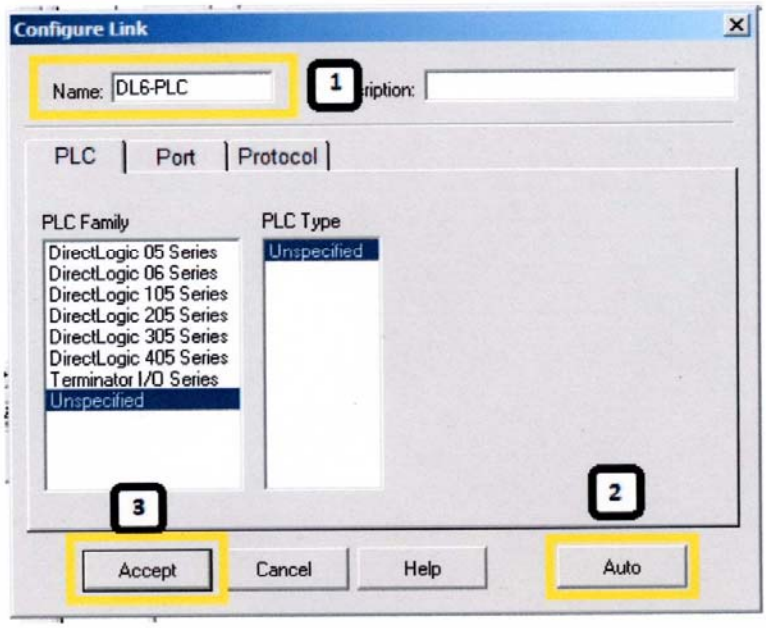
11. Select 'Add':



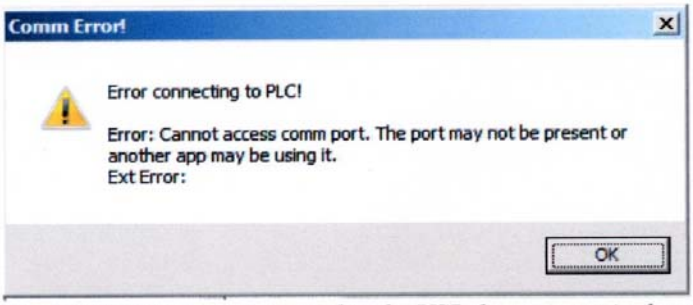
12. Select 'Link Editor':



13. Enter (1) an identifier in the 'Name' field for the link (DL6-PLC here,) and (2) press 'Auto' and then (3) 'Accept' :

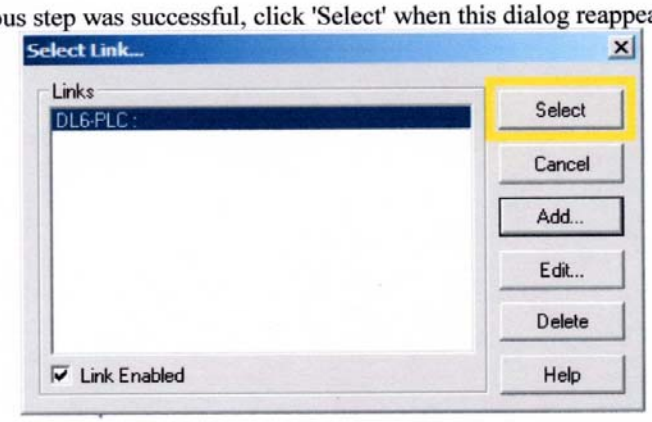


If Auto setup fails a dialog similar to this will appear:

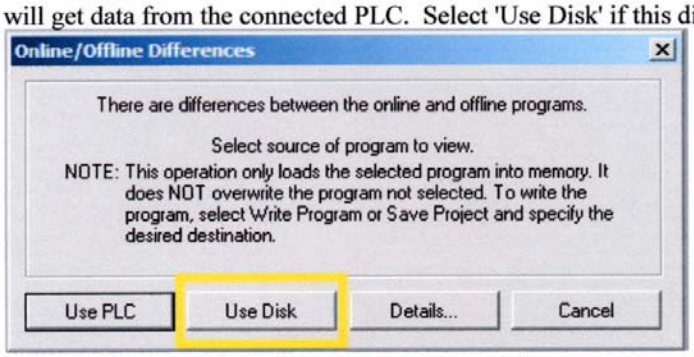


This indicates that the COM port assigned to the USB device is not in the range accessible to the PLC programming utility. This error is due to limitations of DirectSOFT100. Unplug the USB cable, plug it into a different USB port on the laptop and try again. If this fails then the port assigned to the USB Modular Programming Cable must be configured manually in Windows Device Manager to use a COM port between 1 and 4. The aforementioned procedure is beyond the scope of this document. Altronic Research Inc will be unable to assist in rectifying this issue. For resolution seek technical support from the manufacturer of the USB cable in use.

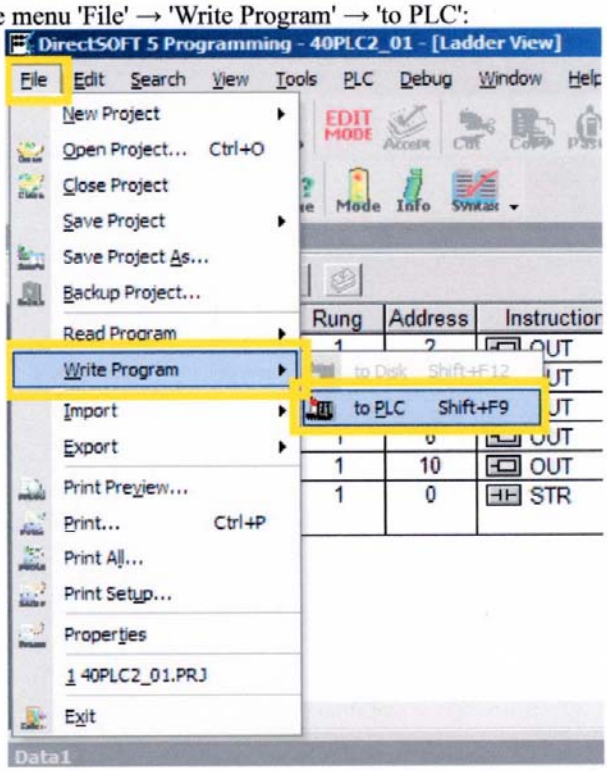
14. If the previous step was successful, click 'Select' when this dialog reappears:



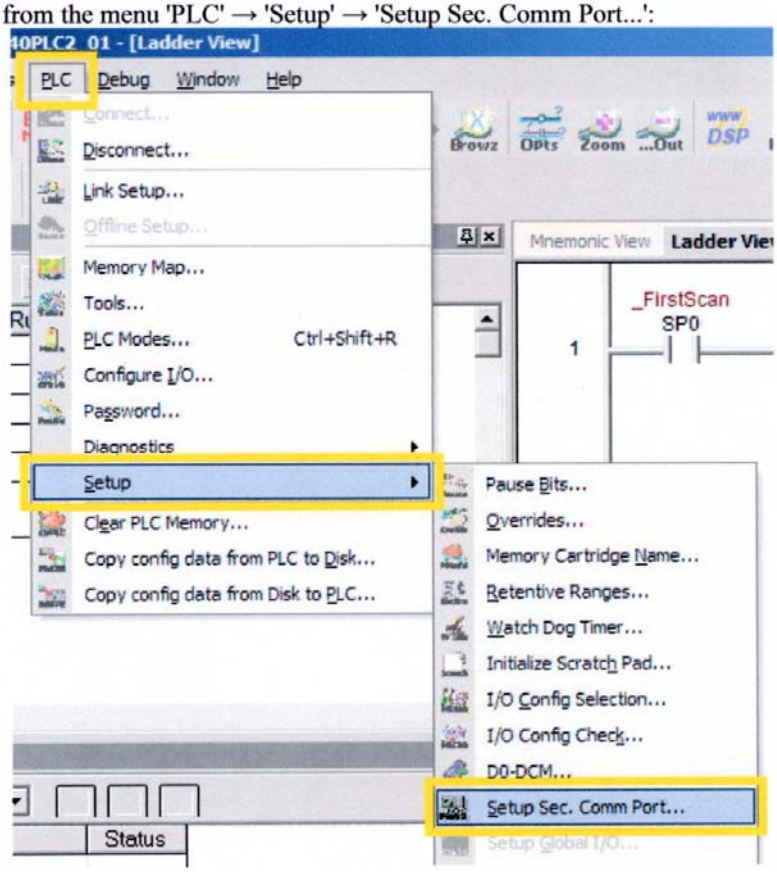
15. The utility will get data from the connected PLC. Select 'Use Disk' if this dialog appears:



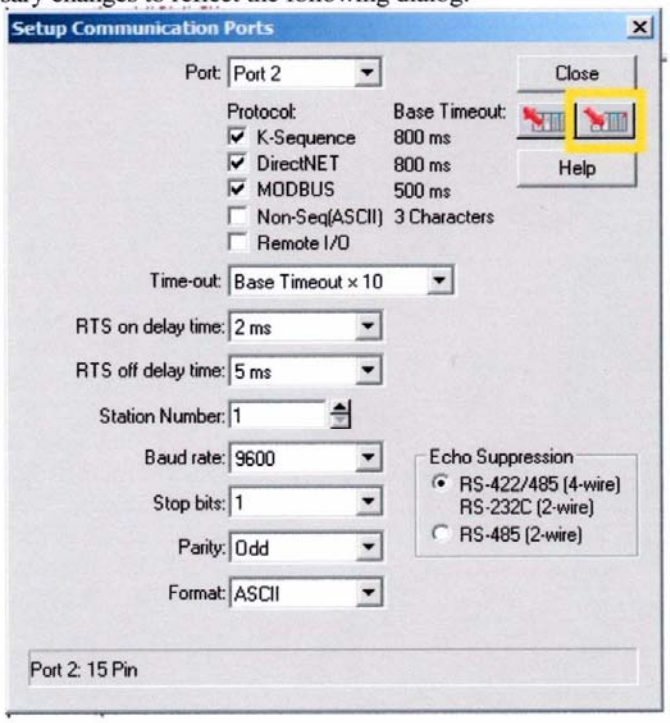
16. Select from the menu 'File' → 'Write Program' → 'to PLC':



17. Select from the menu 'PLC' → 'Setup' → 'Setup Sec. Comm Port...':

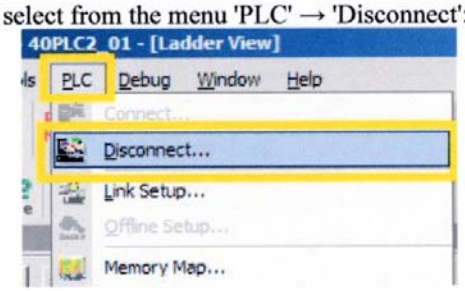


18. Make necessary changes to reflect the following dialog:



19. Click the download to PLC button highlighted above in yellow, which appears as:

20. Close the dialog and select from the menu 'PLC' → 'Disconnect':



21. Programming is complete. Set the switch on the PLC face to 'RUN', disconnect the programming cable, and exit the DirectSOFT100 utility.

APPENDIX A (continued)

DISPLAY MODULE PROGRAMMING

Prerequisites for programming the Red Lion G306 Display Module

The following items are needed to program the Red Lion G306 Display Module (hereafter referred to as Display):

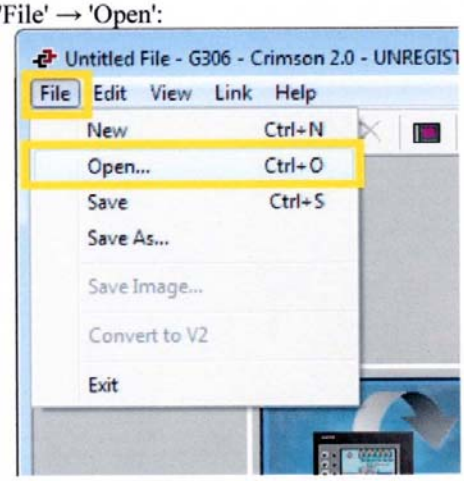
- Crimson 2.0 free programming utility from Red Lion Controls.
- Standard USB peripheral cable (printer cable) with type A and B plugs.
- An active internet connection may be required to download software or drivers.

The Crimson 2.0 programming utility may be downloaded directly from Red Lion Controls via:
http://www.redlion.net/Support/Downloads/SoftwareLibrary/Crimson2.html

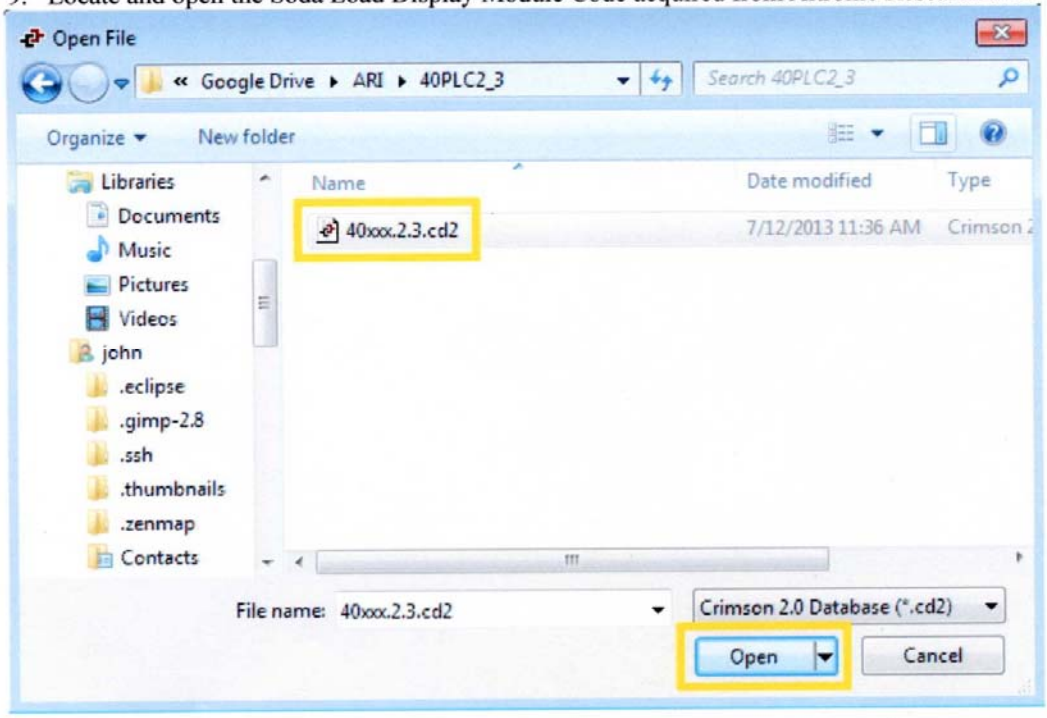
1. Install the Crimson 2.0 utility onto a capable and compatible device hereafter referred to as 'laptop.'
2. Obtain the latest revision of the Soda Load Display Module Code from Altronic Research Inc. A specific link to this part on http://www.altronic.com/ will be provided in release versions of this document.
3. Power the Display.
4. Connect the laptop to the USB port on the Display using the USB peripheral cable.
5. Wait for any necessary drivers to install. Internet access may be required to complete this step.
6. Start the Crimson 2.0 utility.

7. Enter your user information in this dialog or select 'Skip':

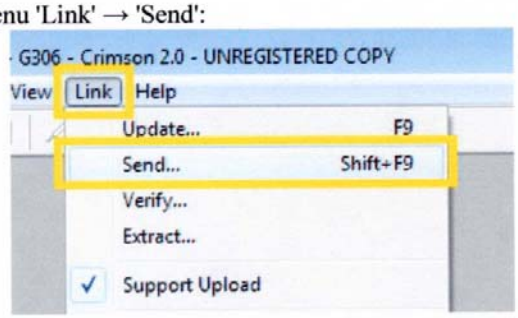
8. Select from the menu 'File' → 'Open':



9. Locate and open the Soda Load Display Module Code acquired from Altronic Research Inc:



10. Select from the menu 'Link' → 'Send':



11. Programming is complete. You may now disconnect the USB peripheral cable and close the Crimson 2.0 utility.

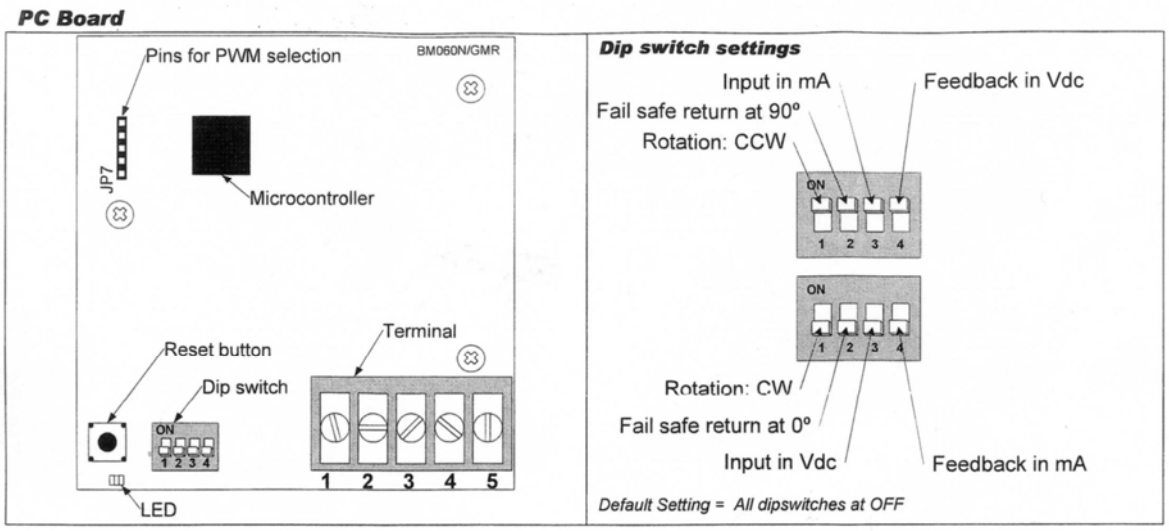
12. **Leave the display powered for five minutes after programming or changing settings in order to ensure proper data integrity.**

APPENDIX B

3-WAY VALVE PROGRAMMING

The valve controller is programmed from the factory to operate in the analog mode. If this program is lost or changed, the controller will need to be programmed before operation.

The settings for the dipswitches are located in the 3-way valve control box and are 1 ON and 2, 3, 4 OFF. This sets the direction of operation and speed. These are set after all other operations are completed and should be considered the default settings for 3-way valve operation. See diagram below. If the valve operation is backwards i.e. it is open when it should be closed, reverse the position of dip switch 1.



Mode Programming: Remove power and put all dip switches "OFF". Reapply AC power to the valve controller. This may be accomplished by cycling circuit breaker (lower left) in the power control box. Within 10 seconds of power application, press and release the reset button. The LED should be blinking. Switch dip switch #3 ON, then OFF.

Valve Travel Programming: This is set to the default and would not normally be changed. To calibrate, apply power and wait at least 10 seconds. Press and release the reset button. The LED should be illuminated. **First Option:** the actuator will travel in both directions to find its limit and position itself according to the demand. The LED will extinguish, completing the process. **Second Option:** When the desired end position is reached, press and release the reset button. The actuator will now return to the original position. You can also press and release the reset button when it reaches the original position. The LED will extinguish, completing the process.

3 Way Valve Span

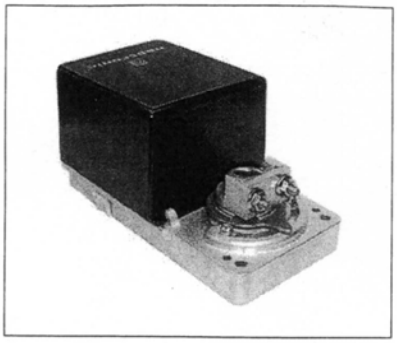
It is necessary for the 3-way valve to move a full 90 degrees in operation and this should be confirmed:

1. Display->Menu->Power

NOTE: The reading on the lower right of the display is the valve command word. A reading of 4095 is fully open and the mechanical pointer on the valve should point to 0 degrees. A reading of 820 is fully closed and the mechanical pointer should point to 90 degrees. The valve command word may be temporarily changed from the display screen.

2. Turn the secondary pump off
3. Display>Menu>Offsets Soda Set Point
4. Enter Set Point Soda to a value well below the tank temperature i.e. 10°C. The valve should go to 0°C and the valve command word should be 4095
5. Enter Set Point Soda to a value well above tank temperature i.e. 90°C.
6. The valve should go to 90° and the valve command word 820.
7. If the valve spans the full 90° range, set the Set Point Soda to 75°C.
8. If the valve fails to travel the 90 degree span, perform Zero and Span Calibration procedure in the valve data sheet on Page 54 and repeat this procedure.
9. Turn the secondary pump on.
10. End of procedure.

NOTE: Do not turn off power to the display for 3 minutes to insure the data is stored to memory.

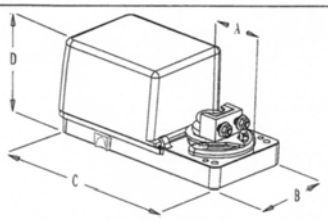


Feature:

- Mounts easy on round & square shaft (with option –8).
- External clutch for manual adjustments.
- Maintenance free.
- Position indicator.
- Control signal fully programmable.
- Auto stroke on power up
- Brushless DC driven motor.

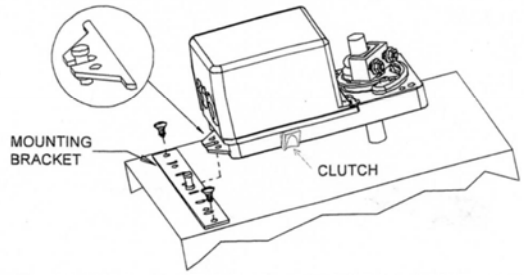
Technical Data	
Running time through 90°	15 sec
Power consumption	10 VA
Torque	50 in.lb. [5,6 Nm] at rated voltage
Fail safe - *Enerdrive*	No
Auxiliary switches	No
Ingress protection	IP22 equivalent to Nema type 2, IP54 equivalent to Nema type 3R if water tight inlet bushings (not supplied NEP617) are installed
Feedback	4 to 20 mA or 2 to 10 VDC adjustable (default setting: 4 to 20mA)
Power supply	22 to 26 VAC or 28 to 32 VDC
Electrical connection	18 AWG [0.8 mm^2] minimum
Inlet bushing	2 inlet bushing of 5/8 in [15.9 mm] & 7/8 in [22.2 mm]
Control signal	Analog, Digital or Pulse with modulation (PWM) programmable (default setting: Analog control signal)
Angle of rotation	0 to 90 degrees, mechanically adjustable (default setting: 90° stroke)
Direction of rotation	Reversible, Clockwise (CW) or Counterclockwise (CCW) (default setting: CW direction)
Ambient temperature	-22°F to +122°F [-30° C to +50° C]
Storage temperature	-22°F to +122°F [-30° C to +50° C]
Relative Humidity	5 to 95 % non condensing.
Weight	3 lbs. [1.4 kg]
Warning: Do not press the clutch when actuator is powered	

Dimensions



Dimension	Inches	Metric (mm)
A	1.50	38.1
B	3.26	82.8
C	6.60	167.5
D	3.01	76.4

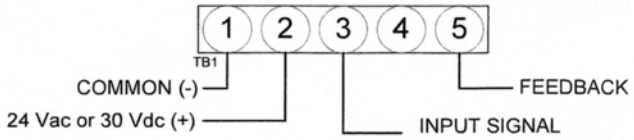
Mechanical Installation



1. Manually close the damper blades and positioned the actuator at 0° or 90°.
2. Slide the actuator onto the shaft.
3. Tighten the nuts on the "U" bolt to the shaft with a 8mm wrench to a torque of 60 in.lb. [6,7 Nm].
4. Slide the mounting bracket under the actuator. Ensure free movement of the slot at the base of the actuator. The bracket pin must be placed in the mid distance of the slot.
5. Fix the bracket to the ductwork with #8 self-tapping screws.

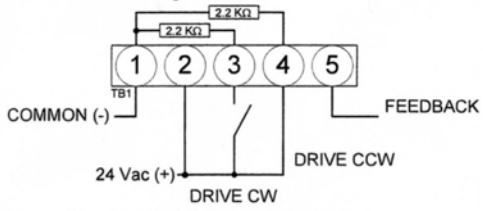
Wiring Diagrams

Analog or PWM

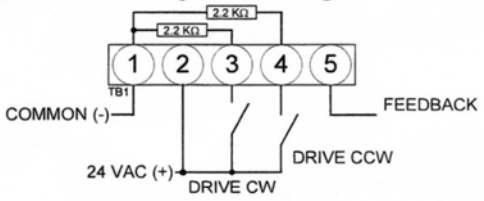


Digital signal

Digital – 3 wire / 2 position



Digital – 4 wire / 3 point floating



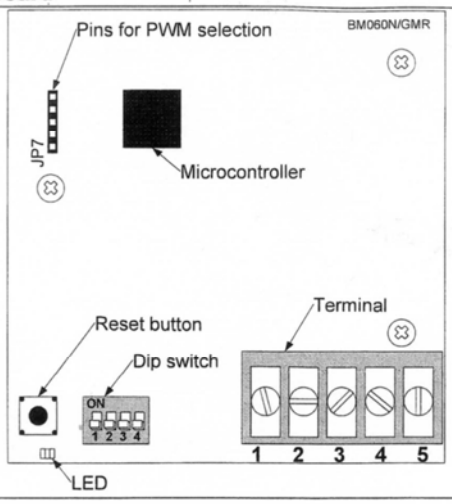
Special consideration for Digital control

In this mode, the actuator is sensitive to induced electrical voltages **from external sources**. To prevent such interference, if the signal on pins 4 and 3 on TB1 are from an **external 24 Vac source**, install a resistor 2.2kohm, 0.5W between pins 4 and 1 and another of 2.2kohms, 0.5W between pins 3 and 1 of TB1. These resistors are included.

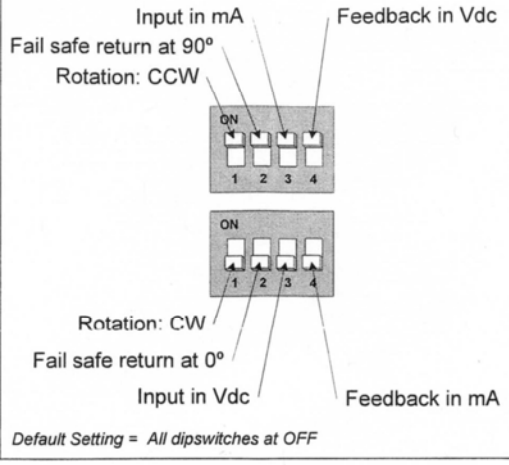
Input Signal and Feedback setup

	Input Signal	Feedback
Analog Mode	Input Signal is set with Dipswitch # 3 DS1-3 at OFF = 2 – 10Vdc (default setting) DS1-3 at ON = 4 – 20mA	Feedback is set with Dipswitch #4 DS1-4 at OFF = 4 – 20mA (default setting) DS1-4 at ON = 2 – 10Vdc
Digital & PWM Mode	No Input Signal Setting ⚠ *DS1-3 MUST be at OFF*	

PC Board



Dip switch settings



Default Setting = All dipswitches at OFF

Stroke adjustment – No control signal change

1. Apply power and, **WAIT FOR LED TO BE OFF (around 10 seconds)**.
2. Press and release the reset button to start the auto-stroke process.
   The LED should be illuminated.
   - **First option:**
     The actuator will then travel in both directions to find its limit and position itself according to the demand.
     The LED will extinguish, the process is complete.
   - **Second option:**
     When the desired start position is reached, press and release the reset button. The actuator will now go the end position. (you can also press and release the reset button when It's reaches the end position)
     The LED will extinguish, the process is complete.

Programming – Change of control signal & PWM pulse setting

1. Remove power and put all dip switches "OFF" (default setting).
2. Apply power and, **within 10 seconds**, press and release the reset button. The LED should be blinking.
3. Select the control signal with dip switches:

	Digital or Analog Modes	PWM Mode
Move switch **No1** "ON" and then "OFF".	**Digital** (On/Off or 3 point floating)	5 sec. pulse (default setting)
Move switch **No2** "ON" and then "OFF".	**Analog** (Default)	25 sec. pulse

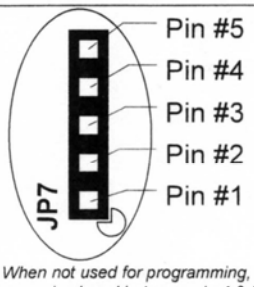
Stroke adjustment
see the stroke adjustment section above.

Enabling or disabling PWM mode

1. Remove power supply to actuator
2. Install jumper between pin 3 & 4 of JP7
3. Select the desired action using the dipswitches (DS1):

DS1-1	DS1-2	Action
OFF	ON	Enable PWM Mode
ON	OFF	Disable PWM Mode

4. Re-apply power supply to actuator
5. **Wait 5 seconds**
6. Remove power supply to actuator
7. Remove jumper between pin 3 & 4 of JP7, re-install it between pin 4 & 5.
8. Re-apply power supply to actuator
   PWM is factory preset at 5 sec. pulse,
   refer to programming section above to change pulse setting.



When not used for programming, jumper is placed between pin 4 & 5

Zero and span calibration

This feature is applicable to analog control signal only.

1. Remove power and put all dip switches "OFF". (factory preset).
2. Apply power and, **within 10 seconds** press and **hold** the reset button until the LED blinks once.
   The Zero and span calibration process then start.
3. Release the reset button. The LED is now constantly illuminated.
4. Apply new minimum voltage.
   It can be any value between 0 to 7 Vdc, with an external 0 to 10 volt supply (ex: MEP).
5. Press and release the reset button to memorize the new minimum voltage. The LED blinks.
6. Apply new maximum voltage.
   It can be any value between 3 to 10 Vdc, this value should be greater than the new minimum value.
7. Press and release the reset button to memorize the new maximum voltage. The LED blinks.
   The Zero and span calibration process is complete.

Note: To reset zero and span to 2 to 10 Vdc (default setting). You just have to re-select the analog control signal mode, see Programming.