Dimplex
Thermal Solutions

At **Dimplex Thermal Solutions** we are aware that our success depends on your satisfaction. We thank you for the confidence you have displayed in our company through your recent purchase of a **Dimplex Thermal Solutions chiller**.

The unit is designed with your specific needs in mind to provide years of service and ongoing satisfaction. It has been thoroughly tested in our plant prior to shipping and stands ready to exceed expectations.

Please thoroughly review the enclosed materials before installation or operation. These pages contain detail regarding suggested fluids, start-up/maintenance operation and controls applications. They will guide you through the important steps of making this purchase part of your process.

As always, we stand by our product and should you require clarification or service please call us at:
1-800-YOU-KOOL (968-5665)
or 269-349-6800

Dimplex
Thermal Solutions

AIR COOLED CHILLER
INSTALLATION and OPERATION MANUAL

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GENERAL INFORMATION REGARDING DESIGN TEMPERATURE

Our custom chiller systems are designed to maintain the temperature of cooling fluids within a selected temperature range. Each of our units is tested through monitored operation within design parameters. This enables our experienced technicians to calibrate all instrumentation precisely to the customers needs and verify that each individual unit will function as specified. Supporting test data is enclosed either in digital format or in print.

The units are designed to operate efficiently within given parameters. Due to varying heat exchange rates outside of design temperature, it is highly recommended that the machine operate only at temperatures within 10°F of the specified temperature. **Consult the factory if a process requires changes in excess of 10°F in either direction of design temperature**.

INSTALLATION:

1. Read and follow all information included with the chiller manual.

2. Read and understand all warning labels and tags on the chiller before installation.

3. Ensure the unit is placed on a flat, level, hard surface. Unless the chiller has been built for outdoor operation, it must be placed indoors. Space above and around the unit must be capable of dissipating the heat rejected by the chiller and allow room for servicing. Keep the unit at least 3ft away from walls or other objects and allow full access to all openings and electrical enclosures. At a minimum, 8ft of clearance is required above the unit for proper air circulation around the chiller as shown in Fig 1.

4. Chillers with solid feet should be secured using the provided mounting holes if possible. Units that have caster wheels should be locked to ensure the chiller does not move around.

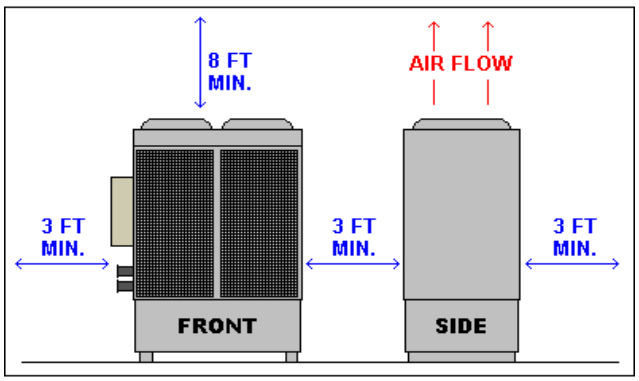


Figure 1. Minimum Installation Clearances

5. Connect fluid lines to the proper fittings from the process to the chiller marked “FLUID INLET TO CHILLER” and “FLUID OUTLET FROM CHILLER”. Make sure that the flow of fluid to and from the unit can not be shut off or blocked while the chiller is in operation. Piping size should be large enough to match the fluid flow conditions, generally the size of the fittings on the chiller.

6. Fill the process plumbing and, if applicable, the chiller reservoir with the proper type and amount of fluid. **Check with the manufacturer of the process equipment for specific fluid requirements. Refer to the “Process Fluid Recommendations” section of the manual for information on using water in the chiller.**

7. Purge any air out of the fluid system to ensure that the pump suction is flooded. If possible, bleed any air trapped in the pump by opening the vent plug at the top of the pump until no more air comes out and fluid is present in the pump cavity.

DO NOT ALLOW THE FLUID PUMP TO RUN DRY. THIS WILL DAMAGE THE PUMP SEALS AND WILL NOT BE COVERED UNDER WARRANTY.

8. Connect any communication wiring between the chiller and process equipment including remote controls and interlocks. All communication and remote wiring is to be provided by the customer. Refer to the chiller’s electrical prints for information on wiring locations.

9. Run power wiring to the chiller's main disconnect. Conductor size should match the chiller's disconnect size and power requirements in accordance with local codes. Ensure the power supplied matches the chiller data plate requirement for voltage, frequency, and amperage.

10. All inclusive units are shipped with the proper refrigerant charge in place. No adjustments should be necessary to the refrigeration system before startup. Refrigeration service valves are shipped in the open (back-seated) position.

11. Chillers with a remote condenser are shipped with a nitrogen charge from the factory. Refer to the included refrigeration drawing or contact Dimplex Thermal Solutions (DTS) for instructions on installing remote condenser units.

BASIC COMPONENTS:

Refer to Figure 2 for identification of the main parts on a standard DTS chiller. Please note that this is only a general representation of components and the model of your chiller may differ from the design shown. Contact Dimplex Thermal Solutions for specific component information regarding your chiller.

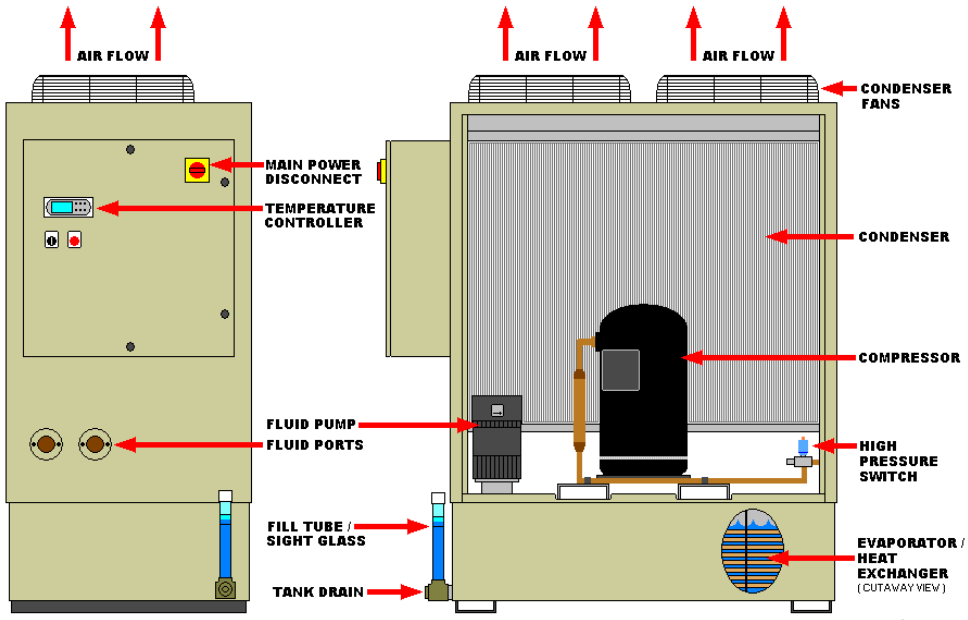


Figure 2. Basic Air-Cooled Chiller Components

PRE-STARTUP PROCEDURE:

1. Complete all steps of the *installation* process before applying power to the chiller.

2. If the unit is equipped, ensure the system switch is in the OFF position, then turn on the main power disconnect. The temperature controller will turn on and automatically go into a self-test. When the self-test is complete, the controller will begin to monitor the process fluid.

3. For units that run on three-phase power, **motor rotation must be checked and corrected to avoid damaging the chiller and voiding the warranty**. If the chiller is equipped with a phase protector, the unit will not start up and may display a fault if phase rotation is not correct. Correcting phase rotation should make this fault go away.

   Single phase units will not be affected by any certain phase rotation and should continue on with step 4 of the *pre-startup procedure*.

   If the unit is equipped with a process fluid pump, phase rotation can be checked by briefly turning on the system and allowing the pump to energize. Watch the rotation of the cooling fan on the pump to see that it is turning in the direction indicated by the rotation arrow on the pump motor. Do not use condenser fans to judge phase rotation as many three phase units have single phase fans and will run correctly from DTS even with incorrect power phasing.

   If the unit does not have a pump or any other visual method of checking rotation, a phase checking device can be used to check power at the disconnect. All components of the chiller are wired to operate with a "right-hand" phase rotation. If you do not have a phase checking device, a certified refrigeration technician should be utilized to monitor refrigerant pressures as the chiller compressor comes online.

   All motors within the chiller are synchronized at the factory for proper rotation. If one motor is turning in the wrong direction, all other motors will as well. **DO NOT** change the orientation of any motor leads within the chiller. If phase rotation is incorrect, shut off the power feed and change any two incoming power leads BEFORE the main disconnect.

4. Chillers two tons or larger are equipped with a compressor crankcase heater. These units must have power supplied to the unit with only the disconnect switch on for 8 hours prior to starting the chiller. This will raise the temperature of the compressor oil enough to vaporize any refrigerant that may be in the crankcase oil. **Failure to allow this warm-up can result in compressor damage.**

5. Ensure all process fluid lines and shutoff valves are open and the system is able to flow freely. Re-check the fluid level in the system before continuing with the startup.

INITIAL STARTUP & OPERATING PROCEDURE:

1. Complete all steps of the *pre-startup procedure* before starting the chiller process.

2. Before turning on the chiller system, become familiar with the operation of the temperature controller on the chiller. Refer to the *temperature controller guide* in this manual for instructions.

3. Turn on the chiller process by moving the selector switch to either ON or LOCAL. If the unit is wired to start remotely, turn the selector switch to REMOTE and start the chiller from the other location.

   Chillers that do not have a process selector switch or remote control should begin the chilling process as soon as the disconnect switch is turned on.

4. If the unit is equipped with a process pump, it will energize and produce flow as soon as the chiller is turned on. Monitor any system

pressure gauges and make note of initial pressures. The pump may need to run for several minutes to allow any air to be worked out of the system before regular flow is established. Any fluid bypass valves in the system should be factory set according to customer specifications but may need slight adjustment in the field. **Consult the factory before making any adjustments to the system.**

5. Check the entire fluid system for leaks and ensure there is flow throughout the system.

6. After the pump turns on, the temperature controller will then analyze the process fluid temperature and determine whether or not cooling is needed. If the fluid temperature is above setpoint, the refrigerant compressor will commence and begin cooling the fluid.

7. Monitor the chiller to ensure it is performing as designed. The chiller should be able to maintain the desired fluid setpoint under a full load from the process. Slight adjustments may be necessary according to your specific process. Please consult a technician at Dimplex Thermal Solutions before making any changes to the unit.

8. To turn off the chiller process, move the selector switch to the OFF position. With the selector OFF, the temperature controller display will be on to monitor the process, but indicate the system is off. **Keep the chiller's main power-disconnect ON even when the chiller is not in use**, unless it is used to turn the chiller process off and on. This keeps the power to the crankcase heater and prevents compressor damage when starting again.

   If the unit is equipped with a fluid maintenance heater, the heater will operate if the fluid falls below the factory setpoint and will operate with the selector switch off.

MAINTENANCE :

Proper maintenance is the key to extending the life of your chiller. Routine checks and a watchful eye will minimize costly repairs and down time. Establish a regular schedule of maintenance depending on the amount the chiller is used and the environment in which it is used. Environments that are very dirty or dusty will require more attention than ones that maintain a cleaner atmosphere.

This list of maintenance items will help to ensure an operational chiller:

1. **Inspect and clean condenser / air filters**
   Excessive buildup of dirt, oil, and other debris on the condenser coil will cause refrigerant pressures to increase and not allow the unit to perform to its full capacity. Ensure the fins of the condenser are clean and not damaged to keep airflow at a maximum. Use compressed air at no more than 30PSI to blow out the condenser in the opposite direction of air flow. If the unit is equipped with air filters, clean them with compressed air or wash them out with water and allow drying before reinstallation.

2. **Check water quality / glycol mixture**
   The process fluid should be clean and free of contaminants. If the chiller has a reservoir, check for debris or contaminants which could reduce the efficiency of your chiller. Check for normal inlet and outlet fluid pressures through the chiller. A large pressure differential could indicate a plugged heat exchanger or dirty tank. Test the process fluid to ensure proper freeze and corrosion protection in accordance with original design specifications. Do not test the process fluid from the sight glass due to the lower turnover at that location.

3. **Inspect fluid filters**
   Fluid filters should be clean enough to allow for proper flow and pressure in the system. An increased fluid pressure on the system may indicate a dirty filter. Replacement of fluid filters should be done at regular intervals to keep the fluid system clean and free flowing. Inspect fluid filters shortly after initial start-up of the chiller and establish a basis for how frequently they may need to be changed in the future.
4. **Inspect fluid system**

Visually check for fluid leaks throughout system. Physically check for loose pipe fittings or hoses. Ensure that no plumbing parts are wearing, cracking, or chafing.

5. Check voltage & amp draws

Check for proper incoming voltage and current draws on all motors and heaters. Refer to the chiller's electrical schematics or the motor nameplate for proper voltage and amperage ratings. Readings should be within +/- 10% of the nameplate and have a maximum difference of +/- 2% between each phase.

6. Inspect mechanical components

Check mechanical components of the chiller for signs of wear or over-heating. Metallic sounds or other excessive noise could indicate a problem with the chiller. Discolored paint or metal could be a sign of a motor under excessive load and over-drawing current. Keep all components with lubrication fittings properly filled according to the nameplate data or information tag.

7. Check all wiring

Ensure the chiller's main power disconnect is OFF. Check the electrical box and all junction boxes for any loose or damaged wiring. Replace any wiring that could cause problems with shorting or unintentional grounds.

8. Inspect/test refrigeration system

Check the inside of the chiller for evidence of refrigerant leaks. Spots of oil inside of the chiller or refrigeration lines covered in oil could indicate a possible leak. Have a certified refrigeration technician check the refrigeration system for proper operation. The technician should leak check the unit, monitor operating pressures, and adjust as needed.

9. Pump seals

All pump seals are designed to have some leakage to promote long seal life. The two parallel parts of the pump seal are separated by a thin film of the fluid being pumped. If pump seals did not leak at all, the two halves of the pump seal would contact each other and quickly be destroyed. With this said, with water or water/glycol most of the leaking fluid evaporates before ever dripping below the pump. With a water/glycol mixture some evidence of glycol staining or a drop or two below the pump is considered normal. With pumps used with oil, one should expect some evidence of oil near the pump considering that the oil cannot evaporate. A small amount of leakage is considered normal and desirable for long seal life.

- **For more information, contact the DTS Service Department 24 hours a day at 1-800-YOU-KOOL. Be sure to have model and serial number ready when calling.**

- **To purchase spare parts and regular maintenance items for your chiller, contact our Parts department at 1-800-YOU-KOOL.**

PROCESS FLUID RECOMMENDATIONS:

For recommendations on the correct process fluid to use in your chilling system, refer to the manufacturer of the equipment served by the chiller. Most manufacturers have a specified type of fluid for correct system operation. This document should serve as a guide only when using a glycol and water mixture for the heat transfer fluid.

USING WATER FOR CHILLER PROCESS:

Dimplex Thermal Solutions recommends the use of an industrial inhibited glycol and water mixture in its water chiller systems. The main job of glycol is to prevent freezing of the process fluid and ensure consistent flow at the operating temperature. Inhibited glycols will also prevent formation of scale and corrosion while protecting metals such as brass, copper, steel, cast iron, and aluminum. Water systems treated with inhibited glycol will also be protected from algae and bacteria that can grow and degrade the fluid system performance. **Ethylene** and **Propylene** are the two standard types of inhibited glycols that can be used in DTS chillers.

- Do not mix different types or brand names of glycol as this can result in some inhibitors precipitating out of the solution.
- Do not use automotive grade anti-freeze in the chiller process. These types of glycols are not designed for industrial applications and may cause problems with heat transfer or fluid flow.

Many automotive glycols contain silicate-based inhibitors that can coat heat-exchangers, attack pump seals, or form a flow restricting gel.

Check state and local codes when selecting the process fluid. Certain areas may have environmental regulations concerning the use and disposal of glycol or other additives.

ETHYLENE GLYCOL:
Ethylene glycol is the standard heat-transfer fluid for most industrial applications. This type of glycol can be used in any application where a low-toxicity content is not required. Ethylene glycol has moderately acute oral toxicity and should not be used in processes where the fluid could come in contact with potable water, food, or beverage products.

PROPYLENE GLYCOL:
Propylene glycol maintains generally the same freeze protection, corrosion and algae prevention as ethylene glycol, but has a lower level of toxicity. This type of glycol is more readily disposable than ethylene and safer to handle. Propylene glycol is commonly used in the food industry and in applications where the user may come in frequent contact with the fluid.
Dimplex Thermal Solutions recommends the use of K-Kool Glycols in its units.

WATER:
When selecting the water to mix with the glycol, use a good quality, filtered source that meets the requirements of the process machine manufacturer. Dimplex Thermal Solutions recommends the use of **distilled** or **reverse-osmosis** water for the water / glycol mixture.

De-ionized water can be used to fill the chiller process initially, but should not be maintained to a de-ionized state thereafter. Unless the chiller has been ordered and designed for the use of water that is continually de-ionized, the fluid will actually attack certain metals within the chiller and cause damage to some components. Damage caused by the use of maintained de-ionized water in a chiller not designed for it will not be covered under warranty. Consult DTS before continuously using de-ionized water to check for compatibility.

The use of regular tap water is not recommended. Water from the "city" or "ground" contains deposits and additives which can decrease component life and increase maintenance time.

GLYCOL / WATER MIXTURES:
The location of the chiller and environmental concerns must be taken into account when selecting the proper mixture of glycol and water for the chiller process. A process which is located completely indoors and has no chance of freezing will require less glycol than a system located outdoors where low temperatures can cause the fluid to freeze and piping to burst. Applications that have a low operating temperature (below 30°F) should use a glycol mixture equivalent to an outdoor system.

After selecting the proper glycol and water types, use the following chart to determine the recommended mixture depending on application and location of the process. The glycol percentage figures in the chart below will apply to any brand of ethylene or propylene glycol.

APPLICATION	GLYCOL %	WATER %	FREEZE PROTECTION*	BURST PROTECTION*
Indoor chiller and process	30	70	5°F / -15°C	-20°F / -29°C
Outdoor chiller / Low fluid temperature system (<30°F)	50	50	-35°F / -37°C	-60°F / -60°C

*** Figures based on performance of DTS "K-Kool-E" brand of Ethylene Glycol.**

FLUID MAINTENANCE / FILTRATION:

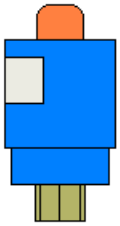
Maintaining clean process water and the proper glycol content will extend the life of the system and reduce costly down-time. If the chiller was not equipped with a fluid filter from the factory, it is highly recommended to install some sort of filtering system to remove unwanted dirt and debris. Refer to the *Chiller Maintenance* section of the manual for water and filter maintenance information.

TROUBLESHOOTING GUIDE:

- This guide should serve as a general outline for troubleshooting issues with all Dimplex Thermal Solutions chillers. Due to the various models of DTS chillers, the items listed in *possible causes* may not apply to every DTS chiller. Contact the DTS customer service department for assistance at 1-800-YOU-KOOL

- Refer to the *Warranty Procedures* section of this manual before having any work performed on units that are under warranty.

PROBLEM	POSSIBLE CAUSE	CORRECTIVE ACTION
Chiller will not turn on. (No display on temperature controller)	• No power to chiller. • Main disconnect turned off. • Blown fuses. • Tripped starter overloads.	• Check power feed to chiller. • Turn on main disconnect. • Check for and replace blown fuses. • Reset any tripped overloads.
Chiller turns on but nothing happens. (Display is on but no pump or cooling cycle)	• Selector switch not turned on. • Remote signal not active. • Fault present within chiller. • Fluid pump not operating. • Blown fuses. • Phase rotation incorrect.	• Turn selector switch to ON or LOCAL. • Check remote connection for signal. • Determine fault and clear if possible. • Check pump overload and power to contactor. • Check and replace fuses. • Correct phase rotation at main disconnect.
Fluid pump is on but does not create required pressure or flow. (Flow fault)	• No fluid present at pump suction. • Pump discharge closed or blocked. • Fluid is dirty / dirty filters. • Fluid line size too small. • Pump / fluid system is air-bound. • Phase rotation incorrect.	• Check fluid level and ensure there is fluid at the pump's suction. • Ensure all fluid lines are open to flow. • Clean fluid and change filters. • Up-size fluid lines outside of chiller. • Vent pump cavity to flood the suction. • Correct phase rotation at main disconnect.
Fluid pump is operational but the refrigerant compressor will not run.	• Fluid temp is below setpoint. • Inadequate fluid flow. • Low refrigerant pressure. • High refrigerant pressure. • Compressor overload tripped. • Compressor lube protector tripped (If equipped). • Blown fuses to compressor. • Faulty temp controller output. • Bad compressor.	• Allow fluid system to increase in temperature. • Correct fluid system to establish flow. • SEE "Low refrigerant fault" section. • SEE "High refrigerant fault" section. • SEE "Compressor overload" section. • Reset lube protector. • Check and replace blown fuses. • Consult DTS customer service department. • Consult DTS customer service department.
Chiller is running but does not maintain the desired fluid temp.	• Fault present within chiller. • Phase rotation incorrect. • Fluid or heat exchanger is dirty. • Loss of flow or fluid level. • Low refrigerant pressure. • Ambient temperature too high. • Heat load exceeds chiller's capacity.	• Determine fault and clear if possible. • Correct phase rotation at incoming power. • Replace fluid and clean fluid system. • Check fluid system for free flow and ensure chiller has adequate fluid level. • Restart chiller or clear fault on controller. SEE "low refrigerant fault" section. • Ensure chiller is operating within its designed ambient temperature specification. • Reduce heat load to chiller if possible. Check the factory specifications to ensure the chiller is not being operated more than +/- 10°F of the original temperature setpoint or fluid flow.

Low refrigerant pressure fault - (Automatically reset when satisfied with pressure)	• Low ambient air temperature. • Loss of fluid flow through evaporator. • Loss of refrigerant. • Refrigerant solenoid not functional. • Faulty pressure switch. • Compressor crankcase not warm or faulty crankcase heater.	• Ensure chiller is operating within its designed ambient temperature specification. • Check fluid flow and ensure evaporator is clean. • Have a refrigerant technician leak check unit and charge with the appropriate refrigerant. • Check wiring to solenoid or replace valve. • Replace pressure switch. • Ensure main power disconnect has been on for at least 8 hours prior to use. Replace crankcase heater if faulty.
High refrigerant pressure fault - (Manually reset inside of chiller)  (Example of a high pressure switch shown)	AIR COOLED CHILLERS: • Air filters dirty. • Condenser dirty. • Incoming air too hot. • Inoperative fans. • Back panel out of chiller. • Phase rotation incorrect. • Refrigerant system overcharged. WATER COOLED CHILLERS: • Low water flow to condenser. • Condenser dirty. • Regulating valve operating incorrectly. • Refrigerant system overcharged.	• Clean filters (See maintenance section). • Clean condenser (See maintenance section). • Ensure the chiller is properly ventilated with fresh air not exceeding 90°F, unless designed for high-ambient temperature operation. • Check for blown fan fuses. • Ensure all covers and panels are in chiller. • Correct phase rotation at incoming power. • Have a refrigeration technician ensure the system is properly charged. • Check condenser water supply and pressure. • Clean condenser. • Have a refrigeration technician adjust the valve to the proper pressure setting and check operation. • Have a refrigeration technician ensure the system is properly charged.
Compressor overload - (May be manually or automatically reset, depending on compressor)	• Compressor running too hot. • Temperature setpoint too high. • Refrigerant pressures too high or low. • Faulty overload module. • Low voltage to chiller. • Defective compressor.	• Allow compressor to cool, then restart unit. • Move temperature setpoint to +/- 10°F of factory setting. • Have a refrigeration technician monitor pressures and determine cause. • If compressor will run, check amp draw on compressor leads to verify compressor is ok. • Correct incoming voltage. • Replace compressor.

GENERAL WARRANTY PROCEDURES:

WARRANTY WORK:

Before doing any work on a chiller covered under warranty, call Dimplex Thermal Solutions (DTS) and explain the problem to one of our service technicians who can then determine the best course of action. DTS will not be obligated to pay for warranty service performed without our prior approval.

Please Note: It is the service contractor's responsibility to enclose a service report/work order with each invoice. Unless pre-authorized for special circumstances, DTS will not honor invoices for work done by two or more people at a time, or for overtime labor charges. If the customer requests work that falls into either of these categories, the customer is responsible for the extra charges incurred.

WARRANTY PARTS:

All replacement parts under warranty must come from Dimplex Thermal Solutions. When it is necessary for DTS to replace parts which are under warranty, we will issue a Returned Goods Authorization (RGA) for all parts we wish to have shipped back to our factory, freight prepaid. RGA's are valid for a period of thirty (30) days. If DTS has not received the requested parts by the expiration date, the customer will be invoiced for the replacement cost at that time.

Please Note: While DTS is willing to pay freight charges one way for replacement parts, special freight charges such as next day service, Saturday delivery, etc, are not included. If the customer requests one of these special services, they are responsible for the charges incurred.

DIMPLEX THERMAL SOLUTIONS

2625 Emerald Drive
Kalamazoo, MI 49001

1-800-YOU-KOOL
(1-800-968-5665)

NATIONAL REFRIGERANTS™

Material Safety Data Sheet

R-22

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: R-22
DISTRIBUTOR: National Refrigerants, Inc.
661 Kenyon Avenue
Bridgeton, New Jersey 08302

FOR MORE INFORMATION CALL:
(Monday-Friday, 8:00am-5:00pm)
1-800-262-0012

IN CASE OF EMERGENCY CALL:
CHEMTREC: 1-800-424-9300

2. COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT NAME	CAS NUMBER	WEIGHT %
Chlorodifluoromethane	75-45-6	100

Trace impurities and additional material names not listed above may also appear in Section 15 toward the end of the MSDS. These materials may be listed for local "Right-To-Know" compliance and for other reasons.

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Colorless, volatile liquid with ethereal and faint sweetish odor. Non-flammable material. Overexposure may cause dizziness and loss of concentration. At higher levels, CNS depression and cardiac arrhythmia may result from exposure. Vapors displace air and can cause asphyxiation in confined spaces. At higher temperatures, (>250°C), decomposition products may include Hydrochloric Acid (HCI), Hydrofluoric Acid (HF) and carbonyl halides.

POTENTIAL HEALTH HAZARDS

SKIN: Irritation would result from a defatting action on tissue. Liquid contact could cause frostbite.

EYES: Liquid contact can cause severe irritation and frostbite. Mist may irritate.

INHALATION: R-22 is low in acute toxicity in animals. When oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur.

INGESTION: Ingestion is unlikely because of the low boiling point of the material. Should it occur, discomfort in the gastrointestinal tract from rapid evaporation of the material and consequent evolution of gas would result. Some effects of inhalation and skin exposure would be expected.

DELAYED EFFECTS: None Known

Ingredients found on one of the OSHA designated carcinogen lists are listed below.

INGREDIENT NAME	NTP STATUS	IARC STATUS	OSHA LIST
No ingredients listed in this section			

4. FIRST AID MEASURES

SKIN: Promptly flush skin with water until all chemical is removed. If there is evidence of frostbite, bathe (do not rub) with lukewarm (not hot) water. If water is not available, cover with a clean, soft cloth or similar covering. Get medical attention if symptoms persist.

EYES: Immediately flush eyes with large amounts of water for at least 15 minutes (in case of frostbite, water should be lukewarm, not hot) lifting eyelids occasionally to facilitate irrigation. Get medical attention if symptoms persist.

INHALATION: Immediately remove to fresh air. If breathing has stopped, give artificial respiration. Use oxygen as required, provided a qualified operator is available. Get medical attention immediately. DO NOT give epinephrine (adrenaline).

INGESTION: Ingestion is unlikely because of the physical properties and is not expected to be hazardous. DO NOT induce vomiting unless instructed to do so by a physician.

ADVICE TO PHYSICIAN: Because of the possible disturbances of cardiac rhythm, catecholamine drugs, such as epinephrine, should be used with special caution and only in situations of emergency life support. Treatment of overexposure should be directed at the control of symptoms and the clinical conditions.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES

FLASH POINT:	Gas, not applicable per DOT regulations
FLASH POINT METHOD:	Not applicable
AUTOIGNITION TEMPERATURE:	Unknown
UPPER FLAME LIMIT (volume % in air):	None*
LOWER FLAME LIMIT (volume % in air):	None*
	*Based on ASHRAE Standard 34 with match ignition
FLAME PROPAGATION RATE (solids):	Not applicable
OSHA FLAMMABILITY CLASS:	Not applicable

EXTINGUISHING MEDIA:

Use any standard agent – choose the one most appropriate for type of surrounding fire (material itself is not flammable)

UNUSUAL FIRE AND EXPLOSION HAZARDS:

R-22 is not flammable at ambient temperatures and atmospheric pressure. However, this material will become combustible when mixed with air under pressure and exposed to strong ignition sources.
Contact with certain reactive metals may result in formation of explosive or exothermic reactions under specific conditions (e.g. very high temperatures and/or appropriate pressures).

SPECIAL FIRE FIGHTING PRECAUTIONS/INSTRUCTIONS:

Firefighters should wear self-contained, NIOSH-approved breathing apparatus for protection against possible toxic decomposition products. Proper eye and skin protection should be provided. Use water spray to keep fire-exposed containers cool.

6. ACCIDENTAL RELEASE MEASURES

IN CASE OF SPILL OR OTHER RELEASE: (Always wear recommended personal protective equipment.)

Evacuate unprotected personnel. Protected personnel should remove ignition sources and shut off leak, if without risk, and provide ventilation. Unprotected personnel should not return until air has been tested and determined safe, including low-lying areas.

Spills and releases may have to be reported to Federal and/or local authorities. See Section 15 regarding reporting requirements.

7. HANDLING AND STORAGE

NORMAL HANDLING: (Always wear recommended personal protective equipment.)

Avoid breathing vapors and liquid contact with eyes, skin or clothing. Do not puncture or drop cylinders, expose them to open flame or excessive heat. Use authorized cylinders only. Follow standard safety precautions for handling and use of compressed gas cylinders.

R-22 should not be mixed with air above atmospheric pressure for leak testing or any other purpose. See Section 5: Unusual Fire and Explosion Hazards

STORAGE RECOMMENDATIONS:

Store in a cool, well-ventilated area of low fire risk and out of direct sunlight. Protect cylinder and its fittings from physical damage. Storage in subsurface locations should be avoided. Close valve tightly after use and when empty.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS:

Provide local ventilation at filling zones and areas where leakage is probable. Mechanical (general) ventilation may be adequate for other operating and storage areas.

PERSONAL PROTECTIVE EQUIPMENT

SKIN PROTECTION:

Skin contact with refrigerant may cause frostbite. General work clothing and gloves (leather) should provide adequate protection. If prolonged contact with liquid or gas is anticipated, insulated gloves constructed of PVA, neoprene or butyl rubber should be used. Any contaminated clothing should be promptly removed and washed before reuse.

EYE PROTECTION:

For normal conditions, wear safety glasses. Where there is reasonable probability of liquid contact, wear chemical safety goggles.

RESPIRATORY PROTECTION:

None generally required for adequately ventilated work situations. For accidental release or non-ventilated situations, or release into confined space, where the concentration may be above the PEL of 1,000 ppm, use a self-contained, NIOSH approved breathing apparatus or supplied air respirator. For escape: use the former or a NIOSH approved gas mask with organic vapor canister.

ADDITIONAL RECOMMENDATIONS:

Where contact with liquid is likely, such as in a spill or leak, impervious boots and clothing should be worn. High dose-level warning signs are recommended for areas of principle exposure. Provide eyewash stations and quick-drench shower facilities at convenient locations. For tank cleaning operations, see OSHA regulations, 29 CFR 1910.132 and 29 CFR 1910.133.

EXPOSURE GUIDELINES

INGREDIENT NAME	ACGIH TLV	OSHA PEL	OTHER LIMIT
Chlorodifluoromethane	1000 ppm TWA (8hr)	1000 ppm TWA (8hr)	None

OTHER EXPOSURE LIMITS FOR POTENTIAL DECOMPOSITION PRODUCTS:

Hydrogen Fluoride: ACGIH TLV = 3ppm ceiling

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Clear, colorless liquid and vapor
PHYSICAL STATE:	Gas at ambient temperatures
MOLECULAR WEIGHT:	86.45
CHEMICAL FORMULA:	$CHC1F_2$
ODOR:	Faint ethereal odor
SPECIFIC GRAVITY (water = 1.0):	1.21 @ 21.1°C (70°F)
SOLUBILITY IN WATER (weight %):	0.3 wt% @ 25°C and 1 atmosphere
pH:	Neutral
BOILING POINT:	-40.8°C (-41.40°F)
FREEZING POINT:	-160°C (-256°F)
VAPOR PRESSURE:	136.1 psia @ 70°F 311.4 psia @ 130°F
VAPOR DENSITY (air = 1.0):	3.0
EVAPORATION RATE:	>1 **COMPARED TO:** $CC1_4$ = 1
% VOLATILES:	100
FLASH POINT:	Not applicable

(Flash point method and additional flammability data are found in Section 5.)

10. STABILITY AND REACTIVITY

NORMALLY STABLE? (CONDITIONS TO AVOID):

The product is stable.
Do not mix with oxygen or air above atmospheric pressure. Any source of high temperatures, such as lighted cigarettes, flames, hot spots or welding may yield toxic and/or corrosive decomposition products.

INCOMPATIBILITIES:

(Under specific conditions: e.g. very high temperatures and/or appropriate pressures) – Freshly abraded aluminum surfaces (may cause strong exothermic reaction). Chemically reactive metals: potassium, calcium, powdered aluminum, magnesium, and zinc.

HAZARDOUS DECOMPOSITION PRODUCTS:

Halogens, halogen acids and possibly carbonyl halides.

HAZARDOUS POLYMERIZATION:

Will not occur.

11. TOXICOLOGICAL INFORMATION

IMMEDIATE (ACUTE) EFFECTS:

LC_{50} : 4 hr. (rat) - $\geq$ 300,000 ppm / Cardiac Sensitization threshold (dog) - 50,000 ppm

DELAYED (SUBCHRONIC AND CHRONIC) EFFECTS:

Subchronic inhalation (rat) NOEL – 10,000 ppm
Not mutagenic in *in-vitro* or *in-vivo* tests
Not teratogenic

OTHER DATA:

Lifetime exposure of male rats was associated with a small increase in salivary gland fibrosarcomas.

12. ECOLOGICAL INFORMATION

Degradability (BOD): R-22 is a gas at room temperature; therefore, it is unlikely to remain in water.
Octanol Water Partition Coefficient: Unknown

13. DISPOSAL CONSIDERATIONS

RCRA

Is the unused product a RCRA hazardous waste if discarded? Not a hazardous waste
If yes, the RCRA ID number is: Not applicable

OTHER DISPOSAL CONSIDERATIONS:

Disposal must comply with federal, state, and local disposal or discharge laws. R-22 is subject to U.S. Environmental Protection Agency Clean Air Act Regulations Section 608 in 40 CFR Part 82 regarding refrigerant recycling.

The information offered here is for the product as shipped. Use and/or alterations to the product such as mixing with other materials may significantly change the characteristics of the material and alter the RCRA classification and the proper disposal method.

14. TRANSPORT INFORMATION

US DOT PROPER SHIPPING NAME: Chlorodifluoromethane
US DOT HAZARD CLASS: 2.2
US DOT PACKING GROUP: Not applicable
US DOT ID NUMBER: UN1018

For additional information on shipping regulations affecting this material, contact the information number found in Section 1.

15. REGULATORY INFORMATION

TOXIC SUBSTANCES CONTROL ACT (TSCA)

TSCA INVENTORY STATUS: Listed on the TSCA inventory
OTHER TSCA ISSUES: None

SARA TITLE III / CERCLA

"Reportable Quantities" (RQs) and/or "Threshold Planning Quantities" (TPQs) exist for the following ingredients.

INGREDIENT NAME	SARA / CERCLA RQ (lb.)	SARA EHS TPQ (lb.)
No ingredients listed in this section		

Spills or releases resulting in the loss of any ingredient at or above its RQ requires immediate notification to the National Response Center [(800) 424-8802] and to your Local Emergency Planning Committee.

SECTION 311 HAZARD CLASS: IMMEDIATE
PRESSURE

SARA 313 TOXIC CHEMICALS:

The following ingredients are SARA 313 "Toxic Chemicals". CAS numbers and weight percents are found in Section 2.

INGREDIENT NAME	COMMENT
Chlorodifluoromethane (HCFC-22)	None

STATE RIGHT-TO-KNOW

In addition to the ingredients found in Section 2, the following are listed for state right-to-know purposes.

INGREDIENT NAME	WEIGHT %	COMMENT
No ingredients listed in this section		

ADDITIONAL REGULATORY INFORMATION:

R-22 is subject to U.S. Environmental Protection Agency Clean Air Act Regulations at 40 CFR Part 82.

WARNING: DO NOT vent to the atmosphere. To comply with provisions of the U.S. Clean Air Act, any residual must be recovered. **Contains Chlorodifluoromethane ,** an HCFC substance which harms public health and the environment by destroying ozone in the upper atmosphere. Destruction of the ozone layer can lead to increased ultraviolet radiation which, with excess exposure to sunlight, can lead to an increase in skin cancer and eye cataracts.

WHMIS CLASSIFICATION (CANADA):

This product has been evaluated in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

FOREIGN INVENTORY STATUS:

Canada – Listed on DSL
EU - EINECS # 2008719

16. OTHER INFORMATION

CURRENT ISSUE DATE: December, 2008
PREVIOUS ISSUE DATE: August, 2007

OTHER INFORMATION:

HMIS Classification: Health – 1, Flammability – 1, Reactivity – 0
NFPA Classification: Health – 2, Flammability – 1, Reactivity – 0
ANSI/ASHRAE 34 Safety Group – A1
UL Classified

Regulatory Standards:

1. OSHA regulations for compressed gases: 29 CFR 1910.101
2. DOT classification per 49 CFR 172.101
3. Clean Air Act Class II Substance

17. DISCLAIMER

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INSTRUCTIONS FOR THE 16A2 & 16A3 SERIES MICROPROCESSOR BASED TEMPERATURE / PROCESS CONTROL

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CONTENTS

GETTING STARTED

1. Install the control as described on page 4.
2. Wire your control following the instructions on page 5. If you are using a two-wire transmitter as an input, see the drawing and instructions on page 6. Option wiring instructions are on Page 7. Option descriptions and specific instructions start on page 16.
3. Most controls do not need many (if any) program changes to work on your process. For best results when changing the programming, make all the necessary changes in the Secure Menu (page 26) before making changes to the Secondary Menu (page 19). If error messages occur, check the Error Messages on page 34-36 for help.

Take the example of a Model 16A3010 that comes from the factory programmed for type J thermocouples. Suppose for this example you wish to change the input to a 100 ohm Platinum RTD and limit the set point range between 0° and 300° C.

First, enter the Secure menu by pressing and holding the **UP ARROW** &

ENTER keys for 5 Seconds (see Page 28.) Press the **INDEX** key until the display shows inP and press the **DOWN ARROW** until the display shows P365. Don't forget to press the **ENTER** key to retain your setting.

Next, press the **INDEX** key to display Un t. Press the **DOWN ARROW** until the display shows C. Press **ENTER**.

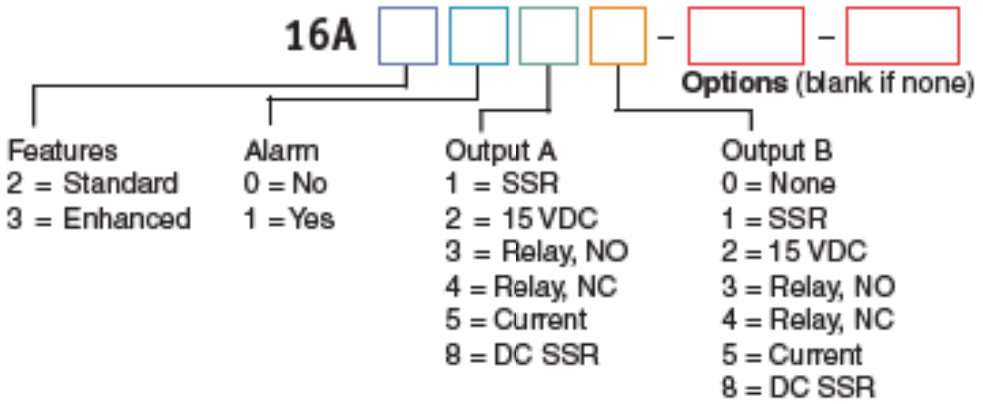
Next, press the **INDEX** key until SPL is displayed (pass the oPt and inP t selections). Press the **UP ARROW** until the display shows 0. Press **ENTER**.

Finally, press **INDEX** key to display SPH. Press the **DOWN ARROW** until the display shows 300. Press **ENTER**.

The necessary program changes are now complete. After 30 seconds the display will switch back to the temperature reading. If you want to return faster, press the **UP ARROW** and **ENTER** keys (at the same time) and then press the **DOWN ARROW** and **INDEX** keys (again at the same time). This will 'back out' of the menu and immediately display the temperature reading.

If you want to use SelfTune®, Auto/Manual, or the Ramp/Soak Programmer features, see the special sections on these items. Page numbers for these are in the Contents section on the previous page.

MODEL IDENTIFICATION



Option Description

924* Analog Remote Set Point, 0 to 10 VDC, scalable.
926* Analog Remote Set Point, 0 to 20 mADC, scalable (may be programmed for 1 to 5mA, 4 to 20 mA, etc.).
928* Analog Remote Set Point, 0 to 10,000 ohms, scalable.
934* Analog Retransmission of Process Variable or Set Variable, 0 to 20 mAdc, scalable (may be programmed for 1 to 5mA, 4 to 20 mA, etc.).
936* Analog Retransmission of Process Variable or Set Variable, 0 to 10 Vdc, scalable.
948 4-Stage Set Point. One of four pre-set set point values can be implemented via contact closure.
992* RS-485 Serial Communications, Lovelink™ protocol.
993* RS-232 Serial Communications, Lovelink™ protocol.
995* RS-232 Serial Communications, Modbus™ protocol.
996* RS-485 Serial Communications, Modbus™ protocol.
9502 12 - 24 Vdc/Vac 50-400Hz power supply (control operates on low voltage equipment).

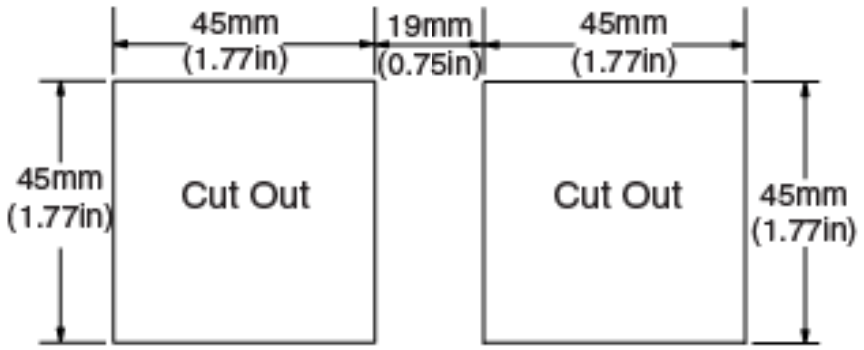
*These options may not be combined with each other. Option 948 may be combined with only one of options 934 or 936. Option 9502 may be combined with any other options.

INSTALLATION

Mount the instrument in a location that will not be subject to excessive temperature, shock, or vibration. All models are designed for mounting in an enclosed panel.

Select the position desired for the instrument on the panel. If more than one instrument is required, maintain the minimum of spacing requirements as shown on the drawing below. Closer spacing will structurally weaken the panel, and invalidate the IP66, UL type 4X rating of the panel.

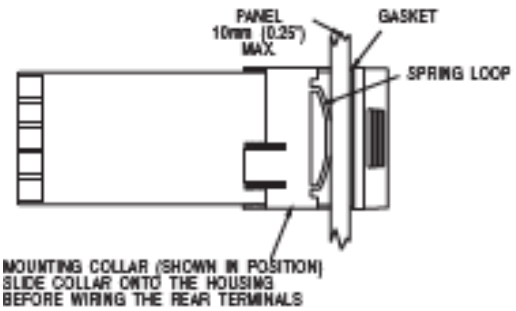
Prepare the panel by cutting and deburring the required opening.



All Tolerances are -0.00 +0.60mm (-0.000 +0.020 in.)

From the front of the panel, slide the housing through the cut out. The housing gasket should be against the housing flange before installing.

From the rear of the panel slide the mounting collar over the housing. Hold the housing with one hand and using the other hand, push the collar evenly against the panel until the spring loops are slightly compressed. The ratchets will hold the mounting collar and housing in place.



CAUTION: It is not necessary to remove the instrument chassis from the housing for installation. If the instrument chassis is removed from the housing, you must follow industry standard practice for control and protection against Electro-Static Discharge (ESD). Failure to exercise good ESD practices may cause damage to the instrument.

WIRING

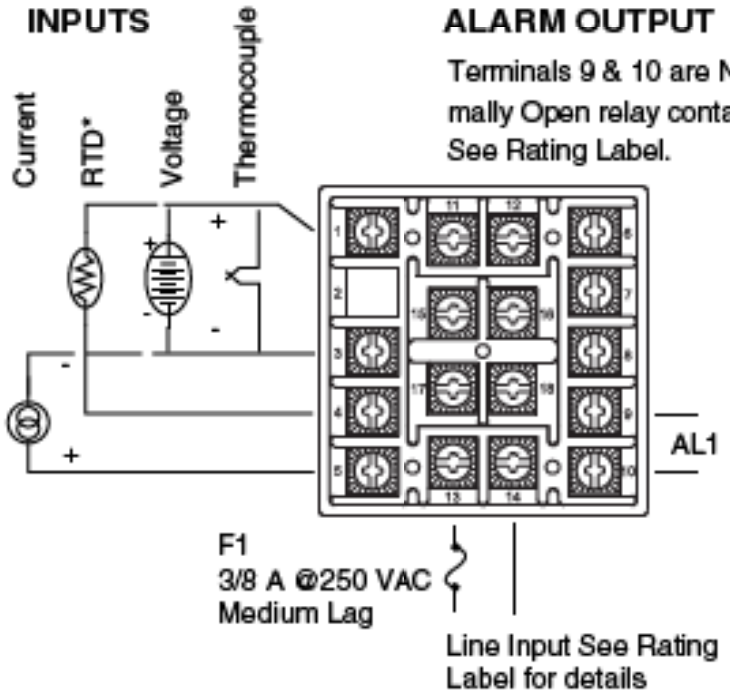
Do not run RTD, thermocouple, or other class 2 wiring in the same conduit as power leads. Use only the type of thermocouple or RTD probe for which the control has been programmed. Maintain separation between wiring of sensor, optional inputs and outputs and other wiring. See the "Secure Menu" for input selection.

For thermocouple input always use extension leads of the same type designated for your thermocouple.

For supply connections use No. 16 AWG or larger wires rated for at least 75°C. Use copper conductors only. All line voltage output circuits must have a common disconnect and be connected to the same pole of the disconnect.

Input wiring for thermocouple, current, and RTD; and output wiring for current and 15 VDC is rated CLASS 2.

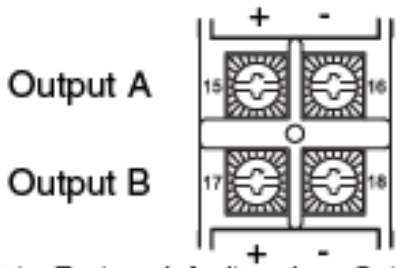
Control wiring is as shown (view is from rear of instrument showing wiring terminals).



* For 2-wire 1000 Ω RTD use terminals 1 & 3.
For 2-wire 100 Ω RTD use terminals 1 & 3, and place a jumper wire between terminals 3 & 4.

OUTPUTS

(Rear View showing center block of wiring terminals.)



For AC SSR or relay type outputs (Output Codes 1 or 3), 15 & 16, and 17 & 18 are Normally Open. For relay (Output Code 4) outputs are Normally Closed. See Rating Label for details.

For Pulsed DC, Current, or DC SSR outputs (Output Codes 2, 4, or 8), 15 & 17 are positive, 16 & 18 are negative.

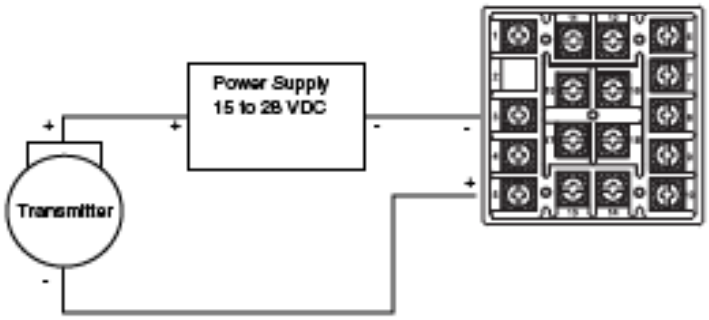
Note: Factory default assigns Output A to Set Point 1 and Output B to Set Point 2. If necessary, these relationships may be reversed. See SP 0 in the Secure Menu.

Wiring for 4 to 20mA Transmitter Inputs

Wire power and outputs as shown above. Two-wire transmitters wire as shown below. View is of instrument as seen from the rear to show wiring terminals.

For three- or four-wire transmitters follow the wiring instructions provided with your transmitter.

CAUTION: DO NOT WIRE THE 24 VOLT POWER SUPPLY ACROSS THE INPUT OF THE CONTROL. DAMAGE TO THE CONTROL INPUT CIRCUITRY WILL RESULT.



Wiring for Optional Inputs and Outputs

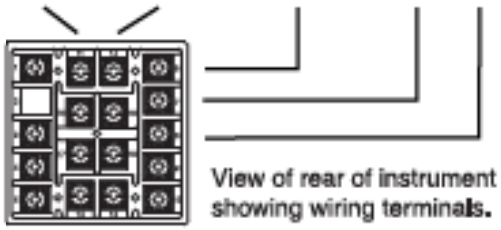
Options are described on Page 3. Detailed option programming and operation starts on Page 16. Wire power and outputs as shown on pages 5 and 6. Wiring for options is shown opposite. All wiring shown below is Class 2. Shielded twisted pair is required for Options 992 and 996. Shielded cable is required for Options 993 and 995. Options 924, 926, and 928 share a common ground with input.

CAUTION: DO NOT RUN SIGNAL WIRING IN THE SAME CONDUIT OR CHASE AS THE POWER WIRING. ERRATIC OPERATION OR DAMAGE TO THE CONTROL CIRCUITRY WILL RESULT.

SWITCH CONTACTS FOR OPTION 948 MUST BE ISOLATED AND CAN NOT SHARE WIRING WITH OTHER CONTROLS.

OPTION / TERMINALS	11	12	6	7	8
934 PV/SV Retransmission, Current (e.g. 4 to 20 mA)	+	-	na	na	na
936 PV/SV Retransmission, Voltage (e.g. 0 to 10 V)	+	-	na	na	na
924 Remote Set Point, Voltage (e.g. 0 to 10 V)	+	-	na	na	na
926 Remote Set Point, Current (e.g. 4 to 20 mA)	+	-	na	na	na
928 Remote Set Point, Resistance (e.g. 0 to 10,000Ω)	CCW	Wiper	na	na	na
948 4-Stage Set Point Selection	na	na	Signal Ground	A	B
992, 996 RS-485 Serial Communications	B	A	na	na	na
993, 995 RS-232 Serial Communications	Data In	Data Out	Signal Ground	na	na

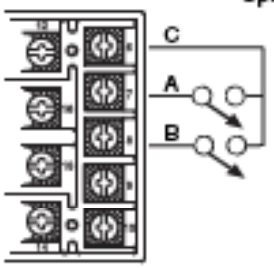
948 Truth Table		
A to Gnd.	B to Gnd.	SP
OPEN	OPEN	1SP1
CLOSED	OPEN	2SP1
OPEN	CLOSED	3SP1
CLOSED	CLOSED	4SP1



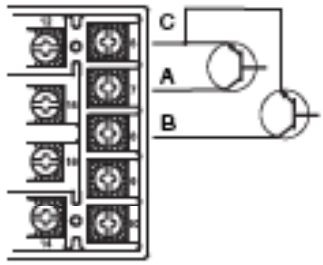
View of rear of instrument showing wiring terminals.

Option 948

Wiring for Relay control (Coil wiring not shown)



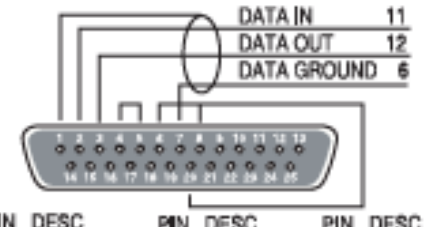
Alternate wiring for Transistor control. Use NPN open collector transistors. (Drive circuit not shown)



RS-485 Daisy Chain Wiring Example

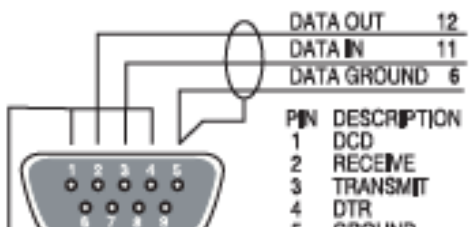
Note: Industry standard designation for RS-485 lines is A and B. Some equipment manufacturers use a non-standard designation of plus and minus. The association of A to minus and B to plus is based on a sample of devices marked as plus and minus and is not intended to represent ALL such labelled devices. Final responsibility for correct identification of leads and terminals rests with the user/installer and the manufacturer of the other device(s) installed in the system.

RS-232 DB-25 WIRING
(VIEWED FROM WIRE SIDE)



PIN	DESC	PIN	DESC	PIN	DESC
1	SHIELD	4	RTS	7	GROUND
2	TRANSMIT	5	CTS	8	DCD
3	RECEIVE	6	DSR	20	DTR

RS-232 DB-9 WIRING
(VIEWED FROM WIRE SIDE)



PIN	DESCRIPTION
1	DCD
2	RECEIVE
3	TRANSMIT
4	DTR
5	GROUND
6	DSR
7	RTS
8	CTS

FRONT PANEL KEY FUNCTIONS

The decimal point flashes when Self Tune is operating.

Keys are illuminated when pressed. Key functions are as follows:

- **INDEX:** Menu Navigation. Pressing the INDEX key advances the display to the next menu item. May also be used in conjunction with other keys as noted below.
- **UP ARROW:** Increments a value, changes a menu item, or selects the item to ON. The maximum value obtainable is 9999 regardless of decimal point placement.
- **DOWN ARROW:** Decrements a value, changes a menu item, or selects the item to OFF. The minimum value obtainable is -1999 regardless of decimal point placement.
- **ENTER:** Pressing ENTER stores the value or the item changed. If not pressed, the previously stored value or item will be retained. The display will flash once when ENTER is pressed.
- **AUTO/MANUAL (16A3):** This key toggles the control output between Automatic mode and Manual mode. Press and hold key for three seconds to activate. See section on AUTO/MANUAL operation on Page 14.
- **RUN/HOLD (16A3):** This key toggles the Ramp/Soak program functions between Run mode (program runs as set up), and Hold mode (program functions are suspended). Press and hold key for three seconds to activate. See section on Ramp/Soak (Page 11) for further details.
- **UP ARROW & ENTER:** Menu Access. Pressing these keys simultaneously brings up the secondary menu starting at the alarm, tune, or cycle item (depending on programming). Pressing these keys for 5 seconds will bring up the secure menu.
- **INDEX & DOWN ARROW:** Menu navigation. Pressing these keys simultaneously will allow backing up one menu item, or if at the first menu item they will cause the display to return to the primary menu.
- **INDEX & DOWN ARROW:** Alarm Reset. If an alarm condition has occurred, press and hold these keys for three seconds to reset the alarm. Note that the alarm condition will not reset if the alarm condition still exists.
- **INDEX & ENTER:** 'Global Reset'. Pressing these keys simultaneously and holding them for 5 seconds forces a 'warm boot', restart-

ing the control (similar to turning power off and on). 'Global Reset' will allow recovery from errors and reset the following menu items:

AL .H: Alarm inhibit
OPEn inP: Input error message
bAd inP: Input error message
CHEC CAL: Check calibration error

Correct the problems associated with the above conditions before using these reset keys. More than one error could be present. Caution is advised since several items are reset at one time.

While in the **Primary** or **Secondary Menu,** if no key is pressed for a period of 30 seconds, the display will return to the HOME position displaying the temperature value. While in the **Secure Menu,** if no key is pressed for a period of 60 seconds, the display will return to the HOME position displaying the temperature value. Outputs are disabled (turned off) when the **Secure Menu** is active.

NOTE: To move to the **Primary Menu** quickly from any other menu, press the **UP ARROW** & **ENTER** keys followed by pressing the **INDEX** & **DOWN ARROW** keys.

SECURITY LEVEL SELECTION

Four levels of security are provided. The display shows the current security level. To change security levels change the password value using the **UP ARROW** and **DOWN ARROW** keys and press the **ENTER** key. Refer to the password table (following) for the correct value to enter for the security level desired. The SECr menu item security level may be viewed or changed at any time regardless of the present security level.

To set the access level to, for example, 2, at the SECr menu item press the **UP ARROW** key until the upper display shows the password for level 2 access, 1101. Press the **ENTER** key. The display will blink and return with the level value, 2, in the upper display.

The password values shown in the table cannot be altered, so retain a copy of these pages for future reference. This is the only reference made to password values in this instruction book.

PASSWORD TABLE

Security Level Menu	Status	Displayed Value When Viewed	Password Value To Enter
Primary Secondary Secure	Locked Locked Locked	1	1 1 0
Primary Secondary Secure	Unlocked Locked Locked	2	1 0 1
Primary Secondary Secure	Unlocked Unlocked Locked	3	0 1 1
Primary Secondary Secure	Unlocked Unlocked Unlocked	4	1 1 1

NOTATION CONVENTIONS FOR THE MENUS

Because of the number of features available in this control, information is included that may not apply to your specific control. All usable features are included in this book, but may not be used in your process. To increase clarity the following conventions are used:

1. Certain features, menu items, and functions shown in this book may or may not appear on your control, depending on other menu item selections. At various places in the menus there are notes identifying menu items that "control" or "direct" other menu items. If you are looking for a particular menu item and can't find it, check the menu item that is its "control" for proper setting.

2. The "#" symbol is used in two ways. It is used inside a group of characters to indicate which set point function (*SP 1* or *SP2*) is being affected. It is also used before a group of characters of a menu item to indicate that there may be more than one selection or value for that menu item. This is used for certain repeated items such as in the Ramp/Soak Program section.

3. *Features that apply only to Options will be printed in Italics.* **Features that apply only to the 16A3 Series will be notated in Roman serif type.**

THE HOME DISPLAY

The home display is the normal display while the control is operating. If no errors or functions are active, the HOME display will indicate the Process Variable (the temperature, pressure, flow, RH, etc., that is being measured) on the top display and the Set Variable (Set Point 1) on the bottom.

Items that can change the HOME display are the Auto/Manual function, the Run/Hold function, the Prog function, the Pct0 function, and any error message. Description of these special displays follows.

If the Auto/Manual key is pressed, the Manual indicator lights, and the home display is changed. The upper display continues to show the Process Variable (PV), but the lower display changes to show the percentage of output in tenths of a percent to 99.9% (0.0 to 99.9), or 100 if 100%. The display digit to the right of the number shows a flashing letter o to indicate that the value displayed is no longer the SV, but percent output. The SP2 percent output is indicated by the use of an overline on the letter o. Access to the SP2 value is made by the INDEX key. See Auto/Manual Operation on Page 14 for further information.

If Prog is turned On, the HOME display changes the SV display from SP 1 to the Present Set Variable as calculated by the Ramp/Soak Programmer function. See Programming and Operation for Ramp/Soak Feature below for more information.

If Pct0 (Secondary Menu) is turned On, the lower display changes to show the active percentage of output as required to maintain SP 1. The display is similar to the Auto/Manual display above, except that the percent indicators (o,o) do not flash, and the output is displayed in whole percentages of output, not in tenths of a percent. If the control has both SP 1 and SP2, the lower display will alternate between the SP 1 percent output and the SP2 percent output.

Error messages are listed on Pages 37-39.

Programming and Operation for Ramp / Soak Feature (16A3 only)

The ramp / soak feature offers a great deal of flexibility by allowing changes in the set point to be made over a predetermined period of time. Dwell times can be programmed, and the alarm output relay can be programmed to open or close during any of the segments.

Theory of Operation

The 16A3 Series controls offer a very simple approach to programming a ramp. Rather than requiring the operator to calculate an approach rate (usually in degrees per minute), the 16A3 does the calculation internally. Thus, the operator only needs to program the target set point and the time desired to reach that point. When the ramp segment is executed by the control, it calculates the ramp required to move the process from the starting value (current PV) to the desired value (programmed SP) in the time allowed.

Soaks (or dwells) are ramp segments where the target set point is the same as the beginning process value. This allows for multistage ramps without wasting intermediate soak steps. Care must be taken, however, that the process does actually reach the soak value before the soak time starts. If not, the next segment will calculate a slope from the starting PV to the target SP. Depending on your process requirements, this difference may be important. Make sure to test any program for desired results before running production material.

Do not operate Self Tune while a ramp function is operating. The ramp function will prevent the Self Tune from operating properly. Make sure that all tuning is set up before operating Ramp / Soak.

Program Setup

All of the programming for the Ramp / Soak function is done in the Secondary Menu. You may wish to work out your program on paper before going into the programmer menu sequence.

In the Secondary Menu ⮌ INDEX to Prog and make sure that Prog is set to OFF.

⮌ INDEX to PSEt and turn On. Press ↵ ENTER.

Skip the StRt setting (this is discussed later) and press ⮌ INDEX to tbAS.

The time base menu item, tbAS, allows selection of the amount of time that is counted per time unit. Setting tbAS to 1 makes all time settings use a time base of one second. A tbAS setting of 60 makes all time settings use a time base of 60 seconds, or one minute. Make the appropriate selection and them press ↵ ENTER and ⮌ INDEX to t 1.

The following items repeat in the following order: t 1, SP1, A1 (if AL1 in the Secure Menu is programmed set to Enht), t2, SP2, A2, . . . , t16, SP16, A16. To avoid repetition each item will only be described once.

Set 1t1 to the amount of time you want for the first ramp. This value is in time units (determined by the tbAS menu item) from 0 to 9999. Press ↵ ENTER.

Set 1SP to the target value desired for the first ramp. This value is in actual units just like SP1. If the control is programmed for temperature, then the SP displays are in temperature. If the control is programmed for some other engineering unit, the SP is set in that unit.

Press ↵ INDEX to continue. If Alarm 1 is programmed as an event (AL1 = EVnt), then 1A1 will appear. If you wish the Alarm 1 contact to function for this segment, set 1A1 for On. If not, set for OFF. Press ↵ ENTER. When 1A1 is set to On, the Alarm 1 function will be active for the entire period set in 1t1 above.

Complete setting the segment times (2t1 ... 16t1), segment set points (2SP ... 16SP), and event alarms (2A1 ... 16A1) to On or OFF.

For unneeded or unused segments set the segment times (2t1 ... 16t1) to 0, and set the segment set points (2SP ... 16SP) to the same value as the last active set point. A segment alarm may be set to indicate "end of run" at the segment number you select.

The last menu item for the ramp / soak function is PEnd. PEnd determines what the control does when the program has ended. You may choose to have the program repeat (LooP), Hold the last set point (16SP), revert to the local SP1, or turn the outputs off (CoFF).

It is important to remember that if you want the program to repeat, you must allow the process to return to the same condition that existed when the program first started. Remember that the ramp function calculates the slope by drawing a line from the beginning PV to the ramp target set point. If the PV at the end of the program is different than the PV at the initial start, the ramp will calculate differently.

Ramp / Soak Operation

When you wish to start the program, enter the Secondary Menu and set the Prog menu item to On. Return to the HOME position by waiting for the display to time out or by pressing the ▲ ↵ UP ARROW & ENTER keys and then the ▼ ↵ DOWN ARROW & INDEX keys.

The home display will read as it normally does. The HOLD indicator by the RUN / HOLD key will be lit. To start the program press the RUN / HOLD key for three seconds. The HOLD indicator will go out, and the program will start.

To suspend the program at any time, press the RUN / HOLD key. Press the key again to resume.

Pressing the A/M AUTO / MANUAL key will also suspend the program operation. The difference is that AUTO / MANUAL also puts the control into manual mode. See Auto / Manual Operation on page 14.

The function of the Primary Menu will change depending on the setting of the StAt menu item in the Secondary Menu. If StAt is OFF then the Primary Menu is not changed.

If the StAt menu item is set to On, then the Primary Menu has three additional information items added before SP 1 appears. The first INDEX item displays the time remaining in the current segment in the top display (####), and the message tr, in the lower display . The next INDEX item displays the total time for the active segment in the upper display (####) and the message ##tr (tr1... tr16), in the lower display. The third INDEX item displays the segment set value (####) in the top display, and the message ##SP (1SP... 16SP) in the lower display. The next INDEX press resumes the normal Primary Menu

AUTO / MANUAL OPERATION (16A3 ONLY)

The AUTO / MANUAL function allows you to manually adjust the output of the control. This is normally used during process setup or start up. It can also be used for troubleshooting. To switch from AUTO to MANUAL press the A/M AUTO / MANUAL key and hold for three seconds. The MANual indicator will light and the lower display will change from normal to showing the actual output in percent. The value will be the actual percentage of output that was active when the key was pressed. This is usually known as "bumpless transfer".

If you wish to change the output while in manual, press the ▲ UP ARROW or ▼ DOWN ARROW keys to change the value, and press ↵ ENTER to retain it. It is important to remember that the value of the display can be read as 0 to 100% of the full control output, or 0 to 100% of the range between S1OL and S1OH or S2OL and S2OH. If APCt is set for rEAL, a reading of 50% in MANUAL represents 10 mA (Assuming a current output regardless of the S1OL or S1OH settings.) If APCt is set for Adj, then 50% in MANUAL will represent the mid point in output between S1OL and S1OH. (Assuming a current output, 4 to 20 mA,with S1OL set to 20 and S1OH set to 100, 50% will represent 12 mA.)

To return to AUTOmatic control, press the A/M AUTO / MANUAL key again. The MANual indicator will go out, and the set point will take over. However, if you want bumpless transfer back to AUTO, slowly change the percentage of output until the process variable matches (or at least is close) to the set point. The further away the PV is from the set point, the greater the "bump" or upset there will be in the output.

Operation of Self Tune Function

Self Tune allows automatic selection of the necessary parameters to achieve best control operation from your 16A2 & 16A3 Series control. If you are using the control output as a simple on-off function (Out 1 set for OnOF), none of the following will apply.

Theory of Operation

The Self Tune function calculates the Pb 1, rES, and rtE parameters under the P id tunE selection, and the Fbnd and FrtE parameters, as shown in the Secondary Menu . These values are determined by measuring the response of the process connected to the control. When Self Tune is started, the control temporarily acts as an on-off control. While in this mode the control measures the overshoot and undershoot of the process, and the period of the process (the time from peak value to the next peak value). These measurements are collected over a period that lasts three periods of overshoot and undershoot. The data collected over this time is then compared and calculated into final PID and Fuzzy Logic values. The effect of Fuzzy Logic on the process is still controlled by the F mt (fuzzy intensity) setting. If F mt is 0, the Fbnd and FrtE will be calculated, but will have no effect. The calculations for the PID values are the same as used in the standard Ziegler - Nichols equations that have been recognized as standard for decades.

The only modification to the application of the Ziegler - Nichols equations is controlled by the dFAC menu item. This menu item controls the amount of rate (derivative) that is applied. A dFAC setting of 3 (factory default) or less allows for less damping. A dFAC setting of 4 allows for critical damping as set forth in Ziegler - Nichols. A dFAC setting of 5 or more allows over damping of the process.

Program Setup and Operation

Do not cool the process or add heat while the tuning is occurring. In the secondary menu set tunE to SELF. Skip tErn and check to make sure that dFAC is set to the desired value. Back up to tErn and set to YES. The control will begin the Self Tune function. While the Self Tune function is active, the right hand decimal point on the lower display will blink. When Self Tune is complete, the blinking will stop.

After Self Tune is complete, the tunE setting automatically switches to P id. This allows examination and / or modification of the values calculated. We recommend that you do not change the calculated values unless you have a firm understanding of the parameters involved and their function.

Options 924, 926, 928, Analog Remote Set Point

The analog remote set point allows the control set point to be determined by an outside analog signal. The signal may be 0 to 10 VDC (Option 924), 0 (or 4) to 20 mADC (Option 926), or 0 to 10,000 Ohms (Option 928).

Wire the input as shown on page 7.

To set up the analog remote set point, first determine the scale range that the analog signal will represent. The maximum span is 11,998 degrees or counts. In the Secure Menu set rSCL for the scale value that will be represented by the low end of the analog signal (0 Volts, 0 mA, 0 Ohms). Set rSCH for the scale value that will be represented by the high end of the analog signal (10 Volts, 20 mA, 10,000 Ohms).

If you require a suppressed scale or input, use the following equations to determine the proper settings for rSCL and rSCH.

K = (Highest desired scale reading - Lowest desired scale reading) / (Maximum desired analog signal - Minimum desired analog signal).
*rSCH = ((Maximum possible analog signal - Maximum desired analog signal) * K) + Highest desired analog reading.*
*rSCL = Lowest desired scale reading - ((Minimum desired analog signal) * K).*

Operation is simple. Make sure that a valid analog signal is available to the control. In the Secondary Menu set the rSPt to On. The REM indicator on the front of the control will turn on. When the control returns to the HOME position, the displayed SV will be the value supplied from the analog remote signal. If the analog remote signal fails or goes out of range of the SPL or SPH settings, the control will revert to the internal SP 1 (or #SP 1), and flash the error message CHEC rSPt. If SPL or SPH are set outside of rSCL or rSCH then the error will be suppressed, and the control will attempt to work with the remote value.

To clear the error message, change rSPt to OFF.

Option 934, 936, Isolated Analog Retransmission.

The analog retransmission option allows the Process Variable or the Set Variable to be sent as an analog signal to an external device. The signal may be either 0 to 10 VDC (Option 936) or 0 (or 4) to 20 mADC (Option 934). The output may be changed in the field from one to the other by the toggle switch located on the top printed circuit board.

Wire the output as shown on page 7.

To set up the analog retransmission, first determine the scale range that the analog signal will represent. The maximum scale is 9999°F, 5530°C, or 9999 counts. In the Secondary Menu set POL for the scale value that will be represented by the low end of the analog signal (0 Volts or 0 mA). Set POH for the scale value that will be represented by the high end of the analog signal (10 Volts or 20 mA).

If you require a suppressed scale or output, use the following equations to determine the proper settings for POL and POH.

K = (Highest desired scale reading - Lowest desired scale reading) / (Maximum desired analog signal - Minimum desired analog signal).
*POH = ((Maximum possible analog output - Maximum desired analog signal) * K) + Highest desired analog reading.*
*POL = Lowest desired scale reading - ((Minimum desired analog output) * K).*

Next select whether you want the retransmission signal to follow the Process Variable or the Set Variable. Usually the Process Variable is sent to recorders or other data acquisition devices. Usually the Set Variable is sent to other controls to be used as an analog remote set point. If you want the analog retransmission signal to follow the PV, in the Secondary Menu set POS- to inP. If you want the analog retransmission signal to follow the SV, set POS- to SPt.

Operation is automatic. There are no further programming steps required.

Option 948, 4-Stage Set Point

The 4-stage set point option allows four different values to be used for SP 1 and all of the values associated with the tunE menu items. The control will switch to a given stage when an external contact or contacts are made or opened across the appropriate terminals at the rear of the control (SPSR, Set Point Switch Action, set for remote, rE), or when the stage is selected from the Secondary Menu, SP (when SPSR is set for int). When the state of a contact changes (or the stage number is changed in the Secondary Menu), the values in use are stored and the previously stored values for the new stage are used.

Wire the input as shown on page 7.

Usually the control is configured for external switching of the stages. In this case, the operation is usually automatic, selected by the external switches driven by the machine logic. If it is necessary to program the stages in advance, you may select the stage to modify with the SP menu item. When SP is changed while the SPSR is set for rE, the selected stage is displayed for modification, but only used when the appropriate contact is made.

Option 992, 993, 995, 996 Serial Communication.

The serial communications options allow the control to be written to and read from a remote computer or other similar digital device. Communication is allowed either through a RS-485 (Option 992, 996) port, or a RS-232 (Option 993, 995) port.

Wire the communication lines as shown on Page 7. Wiring for the RS-485 is run from control to control in a daisy chain fashion with a termination resistor (120 ohms) across the transmit and receive terminals of the last control in the chain.

Select the control address and communication baud rate with the Addr and bAUd menu items in the Secure Menu.

NOTE: THE BAUD RATE AND ADDRESS MENU ITEM SETTINGS WILL TAKE EFFECT ON THE NEXT POWER UP OF THE CONTROL. BE SURE TO TURN THE POWER TO THE CONTROL OFF AND ON BEFORE USING THE NEW BAUD RATE AND ADDRESS VALUES.

In operation, you have the option of preventing a write command from the host computer. To prevent the host from writing to the control change the LO-E menu item in the Secondary Menu to LOC. To allow the host to write commands to the control set LO-E to rE. (The host does have the ability to change the LO-E state, but it is not automatic.)

If your system depends on constant reading or writing to and from the host, you may wish to set the No Activity Timer (nAt) to monitor the addressing of the control. When the LO-E is set to rE and the nAt is set to any value other than OFF, the control will expect to be addressed on a regular basis. If the control is not addressed in the time set by the value of nAt, then the control will display the error message CHEC LO-E. To clear the message set LO-E to LOC.

Serial Communications Options and Nonvolatile Memory

There are many different types of memory used in computer driven devices. The terms RAM (random access memory) and ROM (read only memory) are a couple with which you may be familiar.

RAM is used in computers to run programs and hold data for a short period of time. This is the memory that is used primarily in PCs. RAM is very fast and can be read and written to over and over again. Its major weakness is that it is erased when the power is turned off.

ROM is used in computers to hold the 'permanent' programming that allows a PC to start. This memory is 'burned in' to the chip itself and can not be changed. Unlike RAM, however, this memory is permanent. While it can not be changed, it can not lose its programming when power is turned off. This is the type of memorythat is used to store the permanent programming for the control.

There is a third type of memory that is now currently used to combine the characteristics of both RAM and ROM. This is known as EEPROM (electrically erasable programmable read only memory). While the name may be long and somewhat cryptic, the EEPROM can be erased and re-written many times, and yet hold the programmed data even over long periods when the power is off. This is the type of memory that Love Controls uses to save the settings you program in your control. The reliability and longevity of the data retention is what allows us to guarantee a 10 year data retention without power.

In normal operation, the control uses RAM, just as any other computerized device. Whenever you make a change to one of the parameters in the control, the set point for example, the new value is written into the EEPROM. This way, if power goes off for whatever reason, when power resumes, the latest settings are preserved. When power is turned on, the data is copied from the EEPROM to the RAM to restore operation.

You might ask, "If EEPROM is such a wonderful thing, why bother with RAM?" One reason is that is that RAM is much faster than EEPROM. Faster speed gives you better performance in critical control functions.

Perhaps the most important reason is that RAM allows an unlimited number of writes, while EEPROM has a limit to the number of times that it can be erased and re-written. Current technology now sets that limit at about one million erase / write cycles. In a dynamic control situation, it may be necessary to update RAM every few milliseconds. EEPROM can not keep up to that pace, and, even if it could, it would be 'used up' in a matter of days.

If you think about how long it would take to make a million changes to the control programming through the front key pad, you will see that it would take a very long time to get to use up the life of the EEPROM.

Adding one of the computer communications options (e.g. 992, 993, 995, 996) changes the picture. The speed of computer communications is such that hundreds of instructions can be made in less than a minute. In such a situation, the million erase / write cycles could be used up in a couple of months causing the chip (and the control) to fail.

Usually in such a situation, the control is under close observation by the host computer. It may not be necessary, then, to have the data written to the EEPROM, as it is 'transitory' in nature (changing set points for a ramp/soak sequence for example).

Controls equipped with a Serial communications option have a menu item in the Secure menu (Stor) that allows the serial communications to write to RAM (Stor = no).

The factory default is 'write to EEPROM' (Stor = YES).

If your computer system will be making frequent changes to the control, we strongly recommend that you select the 'write to RAM' parameter (Stor = no). If you are primarily reading from the control, there is no need to change the setting.

For further information on protocols and technical information regarding computer programming for the Serial Communications options, see our web site at http://www.love-controls.com/protocol/.

MENU SELECTIONS

PRIMARY MENU

Press **INDEX** to advance to the next menu item. Press **UP ARROW** or **DOWN ARROW** to change the value in the display. Press **ENTER** to retain the value. If StAt, (Secondary Menu [16A3]), is On, the three program status menu items shown on Page 14 will precede the following.

#SP 1 *(Option 948, 4-Stage Set Point) or*
SP 1 Set Point 1 Adjust, Control Point 1.

SP2 Set Point 2 Adjust (if equipped), Control Point 2.

SECONDARY MENU

Hold **UP ARROW** & **ENTER.** Press **INDEX** to advance to the next menu item. Press **UP ARROW** or **DOWN ARROW** to change the value in the display. Press **ENTER** to retain the value.

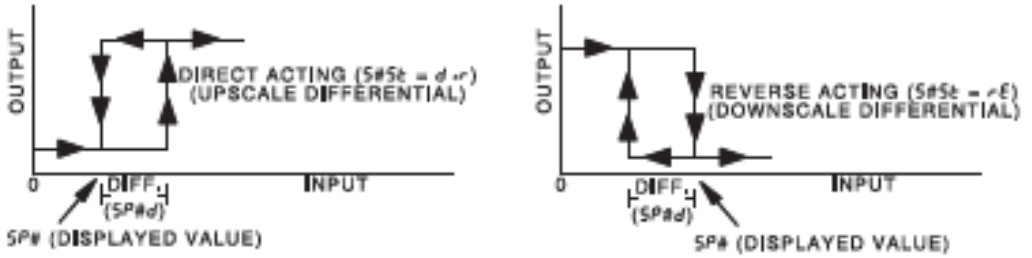
A1Lo Alarm 1 Low: The Low Alarm point is usually set below the Set Point. May not appear depending on AL 1 setting in Secure Menu.

A1H, Alarm 1 High: The High Alarm Point is usually set above the Set Point. May not appear depending on AL 1 setting in Secure Menu.

Out 1 Output selection: Select OnOF, #tP, #PuL, or ProP.

OnOF A setting of OnOF allows the control to operate in simple on/off mode. This setting forces the control to turn off at set point, and on at the set point plus the differential (SP id). When selected, the Out 1 OnOF menu item is followed by #### SP id, and the tunE, Pb, rES, OFS, and rtE selections in the Secondary menu and the S iOL and S iOH selections in the Secure menu are suppressed.

SP id Set Point On-Off Differential (hysteresis). Set for the amount of difference between the turn off point and the turn on point. Select 1 to 9999 (direct acting), or -1 to -9999 (reverse acting). This value will be negative for reverse acting set points, and positive for direct acting outputs. The following drawing shows output behavior for reverse and direct action. For reverse action note how the output decreases as the input process variable increases, e.g. heat power goes to zero as the temperature increases to set point.



##tP Time Proportioning Cycle Time. Select 1tP to 80tP.

1tP A setting of 1tP is recommended for solid state outputs (SSR or 15VDC).

2tP to 80tP Time Proportioning Control is adjustable in 1 second steps. Recommended for mechanical outputs (relays, solenoids, etc.). For best contact life, a time should be selected as long as possible without causing the process to wander.

#PuL Pulsed Time Proportioning Output: Select 1PuL to 7PuL. 1PuL = Linear and 7PuL = most non-linear. Changes output linearity for use in cooling applications or for extremely fast response processes. At the center of the proportional band, a pulse value of 1 provides an output

of one second on and one second off (50% output). A pulse value of 2 provides an output of one second on and two seconds off (33% output). Output at center of band equals one second on, $2^{(\text{pulse value}-1)}$ seconds off.

ProP For Current (Code 5) outputs only.

The following menu items apply only if your control is equipped with a second set point (last digit of model number is not zero). If your control does not have a second set point, jump to the tunE menu on the next page.

Out2 Output selection: Select OnOF, #tP, #Pul, or ProP.

OnOF A setting of OnOF allows the control to operate in simple on/off mode. This setting forces the control to turn off at set point, and on at the set point plus the differential (SP2d). When selected, the Out2/OnOF menu item is followed by #### SP2d, and the Pb2 selection in the Secondary menu and the S20L and S20H selections in the Secure menu are suppressed.

SP2d Set Point On-Off Differential (hysteresis). Select 1 to 9999 (direct acting), or -1 to -9999 (reverse acting). See SP id on the previous page.

##tP Time Proportioning Cycle Time. Select 1tP to 80tP.

1tP A setting of 1tP is recommended for solid state outputs (SSR or 15VDC).

2tP to 80tP Time Proportioning Control is adjustable in 1 second steps. Recommended for mechanical outputs (relays, solenoids, etc.). For best contact life, a time should be selected as long as possible without causing the process to wander.

#Pul Pulsed Time Proportioning Output: Select #Pul to 7Pul. #Pul = Linear and 7Pul = most non-linear. Changes output linearity for use in cooling applications or for extremely fast response processes. At the center of the proportional band, a pulse value of 1 provides an output of one second on and one second off (50% output). A pulse value of 2 provides an output of one second on and two seconds off (33% output). Output at center of band equals one second on, $2^{(\text{pulse value}-1)}$ seconds off.

ProP For Current (Code 5) outputs only.

SP *(Option 948, 4-Stage Set Point) Active Set Point Stage. Select* 1SP 1, 2SP 1, 3SP 1, 4SP 1. *(See Page 17 for more detail.)*

- 1SP 1 *Set Menu Items to display Stage 1 for view and change access. If SPSA is set for* Int, 1SP 1 *is made active.*
- 2SP 1 *Set Menu Items to display Stage 2 for view and change access. If SPSA is set for Int,* 2SP 1 *is made active.*
- 3SP 1 *Set Menu Items to display Stage 3 for view and change access. If SPSA is set for Int,* 3SP 1 *is made active.*
- 4SP 1 *Set Menu Items to display Stage 4 for view and change access. If SPSA is set for* Int, 4SP 1 *is made active.*

#SP 1 *(Option 948, 4-Stage Set Point) Adjust Control Point 1 for Stage selected above.*

Note: The menu items for tunE (below) are modified when Option 948 is active. Then, the menu items are shortened or shifted right, and preceded with the stage number selected in SP above. Each stage has its own set of tunE parameters as indicated by #tun.

#tun *(Option 948, 4-Stage Set Point) or*

tunE Tuning Choice: Select SELF, P id, SLO, nor, or FAST.

- SELF The Controller will evaluate the Process and select the PID values to maintain good control. Active for SP1 only.
  - LErn Select YES or no
    - YES Start Learning the Process. After the process has been learned the menu item will revert to no.
    - no Learning will stay in present mode.
  - dFAC Damping factor, Select OFF, 1 to 7. Sets the ratio of Rate to Reset for the SELF tunE mode. 7 = most Rate. Factory set to 3. For a fast response process the value should be lowered (less Rate). For a slower process the value should be increased (more Rate).
- P id Manually adjust the PID values. PID control consists of three basic parameters, Proportional Band (Gain), Reset Time (Integral), and Rate Time (Derivative).
  - #Pb 1 *(Option 948, 4-Stage Set Point) or*
  - Pb 1 Proportional Band (Bandwidth). Select 1 to 9999 °F, °C, or counts.
  - Pb2 Proportional Band (Bandwidth). Select 1 to 9999 °F, °C, or counts. Appears only if control

is equipped with second set point and Out2 is NOT selected as OnOF.

#rES *(Option 948, 4-Stage Set Point) or*

rES Automatic Reset Time. Select OFF, 0.1 to 99.9 minutes. Select OFF to switch to OFS.

#OFS *(Option 948, 4-Stage Set Point) or*

OFS Manual Offset Correction Select OFF, 0.1 to 99.9 percent. Select OFF to switch to rES.

#rtE *(Option 948, 4-Stage Set Point) or*

rtE Rate Time. Select OFF, 0.01 to 99.99 minutes, Derivative.

SLO PID values are preset for a slow response process.

nor PID values are preset for a normal response process.

FASt PID values are preset for a fast response process.

P id2 Linkage of PID parameters between SP1 and SP2: Select On or OFF.

On Applies SP1 rES, rtE, Fbnd, and FrtE terms to SP2 for heat/cool applications.

OFF SP2 functions without rES, rtE, Fbnd and FrtE.

ArUP Anti- Reset Windup Feature: Select On or OFF.

On When ArUP is On the accumulated Reset Offset value will be cleared to 0% when the process input is not within the Proportional Band.

OFF When ArUP is OFF, the accumulated Reset Offset Value is retained in memory when the process input is not within the Proportional Band.

ArtE Approach Rate Time: Select OFF, 0.01 to 99.99 minutes. The function defines the amount of Rate applied when the input is outside of the Proportional Band. The ArtE time and the rtE time are independent and have no effect on each other. To increase damping effect and reduce overshoot set the approach rate time for a value greater than the natural rise time of the process (natural rise time = process value time to set point).

F int Fuzzy Logic Intensity: Select 0 to 100%. 0% is OFF (disables Fuzzy Logic). The function defines the amount of impact Fuzzy Logic will have on the output.

Fbnd Fuzzy Logic Error Band: Select 0 to 4000 °F, °C, or counts. Sets the bandwidth of the Fuzzy Logic. Set Fbnd equal to PID proportional band (Pb 1) for best results.

FrtE Fuzzy Logic Rate of Change: Select 0.00 to 99.99 counts/second. For best initial setting, find the counts/second change of process value near Set Point 1 with output ON 100%. Multiply this value by 3. Set FrtE to this calculated value.

PEA The Peak feature stores the highest input the control has measured since the last reset or Power On. At Power On PEA is reset to the present input. To manually reset the value PEA must be in the lower display. Press the **ENTER** key to reset. PEA will be reset and display the present input value.

UAL The Valley feature stores the lowest input the Instrument has measured since the last reset or Power On. At Power On UAL is reset to the present input. To manually reset the value UAL must be in the lower display. Press the **ENTER** key. UAL will be reset and display the present input value.

PctO Percent Output Feature: Select On or OFF.

- On When selected On, the HOME lower display will indicate the output of the controller in percent. An "o" will appear in the right hand side of the lower display to indicate percent output for SP1. An "o" will appear on the right hand corner of the lower display to represent percent output for SP2, if the control is so equipped. The display will alternate between these values.
- OFF Percent Output display is disabled.

Prog Ramp/Soak Feature (16A3): Select On or OFF

- On Allows Programmed Ramp/Soak function to be started by the Run/Hold key on the control front panel.
- OFF Turns Ramp/Soak function OFF and resets program to beginning.

PSEt Programmer function set (16A3). Select On or OFF.

- OFF Skip Ramp/Soak Programming. Go to next Secondary Menu Item, InPC on the next page.
- On Enable Ramp/Soak Programming.

StAt Programmer Status Display in the Primary Menu when Prog (above) is On (16A3): Select On or OFF.

- OFF The Primary Menu operates as normal.
- On The Primary Menu is altered to have the following items inserted before the SP1 menu item:
  #### t, time remaining in active segment

##t1 total time in active segment
##SP segment target set point

tbAS Ramp/Soak Time Base (16A3). Select 1_S or 60_S.
- 1_S Ramp/Soak time base is in 1 second increments. Program time t1...t16 is measured in seconds.
- 60_S Ramp/Soak time base is in 60 second increments (minutes). Program time t1...t16 is measured in minutes.

The following items repeat in the following order: t1, SP1, tA1 (if AL1 is programmed as tEvnt), t2, SP2, tA2, ... , t16, SP16, tA16. To avoid repetition each item will only be described once.

t1 Segment Time (16A3): Select 0 to 9999 units (minutes if tbAS is set to 60_S, seconds if tbAS is set to 1_S).

SP1 Segment Set Point (16A3): Set to target value desired.

tA1 Segment Alarm 1 Event (16A3): Select On or OFF.
- On Alarm 1 is active during segment 1 time (t1).
- OFF Alarm 1 is inactive during segment 1 time (t1).

PEnd Program End action (16A3): Select Hold or CoFF.
- Hold Stay at the Present Set Point (SP16).
- CoFF Turn Off SP1 and SP2 Outputs at the end of the program.
- LooP Repeat program starting at t1.
- SP1 Revert to SP1 value.

inPC Input Correction: Select -500 to 0 to 500 °F, °C, or counts. This feature allows the input value to be changed to agree with an external reference or to compensate for sensor error. **Note:** inPC is reset to zero when the input type is changed, or when decimal position is changed. Factory default is 0.

FiLt Digital Filter: Select OFF, 1 to 99. In some cases the time constant of the sensor, or noise, could cause the display to jump enough to be unreadable. A setting of 2 is usually sufficient filtering (2 represents approximately a 1 second time constant). When the 0.1 degree resolution is selected this should be increased to 4. If this value is set too high, controllability will suffer.

LPbr Loop Break Protection: Select OFF, 1 to 9999 seconds. If, during operation, the output is minimum (0%) or maximum (100%), and the input moves less than 5°F (3°C) or 5 counts over the time set for LPbr, the LOOP bAd message will appear. This condition can also be routed to an Alarm Condition if alarms are present and turned On (see ALbr in the Secure Menu). The loop break error can be reset by pressing the ↵ **ENTER** key when at the LPbr menu item. The ⟲ ↵ **INDEX** & **ENTER** keys may also be used.

POL *(Option 934, 936, Analog Retransmission Output) Process Output Low: Select -450°F, -260°C, or -1999 counts to any value less than POH.*

POH *(Option 934, 936, Analog Retransmission Output) Process Output High: Select from any value greater than POL to +9999°F, +5530°C, or 9999 counts.*

POSr *(Option 934, 936, Analog Retransmission Output) Process Output Source: Select inP or SPt.*

- inP *Output follows the Process Variable (input).*
- SPt *Output follows the Set Variable.*

rSPt *(Option 924, 926, 928, Analog Remote Set Point)* **Remote Set Point: Select On or OFF.**

- OFF *The control uses the value set for SP 1.*
- On *The control uses the value set by the analog remote set point signal as established by the Secure Menu items rSCL and rSCH. If the analog signal fails, the control will display the error message CHEC rSPt and revert to the SP 1 local value.*

LOrE *(Option 992, 993, 995, 996, Serial Communications) Local / Remote Status: Select LOC or rE. Does not affect other instruments on daisy chain.*

- LOC *The host computer is advised that remote write commands will be rejected. Any write commands sent to this control will be rejected. All read commands are accepted.*
- rE *The host computer is allowed to send write commands. If the control is not addressed within the time set in nAt (No Activity Timer in the Secure Menu) the CHEC LorE error message will be displayed.*

Rddr *(Option 992, 993, 995, 996, Serial Communications) Control Address: Set from 1 to 3FF (Options 992 and 993) or set from 1 to FF (Options 995 and 996). This number (hexadecimal, base 16) must match the address number used by the host computer. Not settable in this menu. To change this parameter, see Rddr in the Secure Menu.*

SECURE MENU

Hold **UP ARROW** & **ENTER** for 5 Seconds. Press **INDEX** to advance to the next menu item. Press **UP ARROW** or **DOWN ARROW** to change the value in the display. Press **ENTER** to retain the value.

OUTPUTS ARE DISABLED (TURNED OFF) WHILE CONTROL IS IN SECURE MENU.

SECr Security Code: See the Security Level Selection and the Password Table in this manual, in order to enter the correct password.

inP Input Type: Select one of the following. Refer to the Wiring section for the proper wiring.

J-IC	Type "J" Thermocouple
CA	Type "K" Thermocouple
E-	Type "E" Thermocouple
t-	Type "T" Thermocouple
L-	Type "L" Thermocouple
n-	Type "N" Thermocouple
r-13	Type "R" Thermocouple
S-10	Type "S" Thermocouple
b-	Type "B" Thermocouple
C-	Type "C" Thermocouple
P392	100 ohm Platinum (NIST 0.00392 Ω/Ω/°C)
n120	120 ohm Nickel
P385	100 ohm Platinum (IEC/DIN 0.00385 Ω/Ω/°C)
1P38	1000 ohm Platinum (IEC/DIN 0.00385 Ω/Ω/°C)
Curr	DC Current Input 0.0 to 20.0 or 4.0 to 20.0 mA.
Volt	DC Voltage Input 0.0 to 10.0 or 1.0 to 10.0 volts.
d.FF	DC Voltage Input -10 to +10 mV.
- - - -	Reserved

OSUP Zero Suppression: Select On or OFF. Only with Current and Voltage input types.

OFF	The input range will start at 0 (zero) Input.
On	The input range will start at 4.00 mA or 1.00 V.

Un it F, C or nonE.

F °F descriptor is On and temperature inputs will be displayed in actual degrees Fahrenheit.

C °C descriptor is On and temperature inputs will be displayed in actual degrees Celsius.

nonE °F and °C descriptors will be Off. This is only available with Current and Voltage Inputs.

dPt Decimal Point Positioning: Select 0, 0.0, 0.00, 0.000, or .0000. On temperature type inputs a change here will alter the Process Value, SP1, SP2, ALLo, ALHi, and InPC. For Current and Voltage Inputs all Menu Items related to the Input will be affected.

0 No decimal Point is selected. This is available for all Input Types.

0.0 One decimal place is available for Type J, K, E, T, L, RTD's, Current and Voltage Inputs.

0.00 Two decimal places is only available for Current and Voltage Inputs.

0.000 Three decimal places is only available for Current and Voltage inputs.

.0000 Four decimal places is only available for Current and Voltage inputs.

inPt Input Fault Timer: Select OFF, 0.1 to 540.0 minutes. Whenever an Input is out of range (UFL or OFL displayed), shorted, or open, the timer will start. When the time has elapsed, the controller will revert to the output condition selected by inPb below. If OFF is selected, the Input Fault Timer will not be recognized (time = infinite).

inPb Input Fail Action (16A3): Select FAIL, AUE, or PrE. When the Input is out of range (UFL or OFL displayed) and the Input timer (inPt) time has elapsed, the controller will revert to the selected condition.

FAIL Outputs are disabled (go to 0% output).

AUE The outputs will hold at the last known average percentage of output.

PrE The outputs will maintain preprogrammed percentages of output as specified in PrE1 and PrE2.

PrE1 Preset output for Set Point 1. Select 0 to 100%.

PrE2 Preset output for Set Point 2. Select 0 to 100%.

APCt **Manual and PctO display adjustment (16A3). Select rEAL or Adj.**

- rEAL **Manual display will display output 0 to 100% relative to actual range of the output.**
- Adj **Manual display will display output 0 to 100% relative to the S#0L and S#0H settings.**

SEnC Sensor Rate of Change: Select OFF, 1 to 4000 °F, °C, or counts per 1 second period. This value is usually set to be slightly greater than the fastest process response expected during a 1 second period, but measured for at least 2 seconds. If the process is faster than this setting, the SEnC bAd error message will appear. The outputs will then be turned off. This function can be used to detect a runaway condition, or speed up detection of an open thermocouple. Use the **INDEX** & **ENTER** keys to reset.

SCAL Scale Low: Select 100 to 11998 counts below SCAH. The total span between SCAL and SCAH must be within 11998 counts. Maximum setting range is -1999 to +9999 counts. For Current and Voltage inputs, this will set the low range end. Value not adjustable for Thermocouple and RTD ranges.

SCAH Scale High: Select 100 to 11998 counts above SCAL. The total span between SCAL and SCAH must be within 11998 counts. Maximum setting range is -1999 to +9999 counts. For Current and Voltage inputs, this will set the high range end. Value not adjustable for Thermocouple and RTD ranges.

SPL Set Point Low: Select from the lowest input range value to SPH value. This will set the minimum SP1 or SP2 value that can be entered. The values for SP1 or SP2 will stop moving when this value is reached.

SPH Set Point High: Select from the highest input range value to SPL value. This will set the maximum SP1 or SP2 value that can be entered. The values for SP1 or SP2 will stop moving when this value is reached.

SP 1O Set Point 1 Output Select: Select OutA or Outb.

- OutA Set Point 1 is routed through Output A, Set Point 2 (if equipped) is routed through Output B.
- Outb Set Point 1 is routed through Output B, Set Point 2 (if equipped) is routed through Output A.

S1St Set Point 1 State: Select dir or rE.

- dir Direct Action. As the input increases the output will increase. Most commonly used in cooling processes.
- rE Reverse Action. As the input increases the output will decrease. Most commonly used in heating processes.

If Out1 (Page 21) is set for ##tP, #PUL, or ProP, then S1OL and S1OH appear. If Out1 is set for OnOF, then skip to S1rE.

S1OL Set Point Output Low Limit: Select 0 to 100% but not greater than S1OH. This item limits the lowest output value. This is useful for adding a bias to the process when needed. Factory set to 0 for output codes 1,2, 3, 4, and 8. Factory set to 20 for output code 5 (20% output equals 4 mA output).

S1OH Set Point 1 Output High Limit: Select 0 to 100% but not less than S1OL for output codes 1, 2, 3, 4, or 8. Select 0 to 102% but not less than S1OL for output code 5. This item allows setting the maximum output limit. This is useful with processes that are over powered. Adjustment to 102% allows setting current output to force a full on condition for output devices which do not have bias adjustments. Factory set to 100 for all output codes.

If Out1 is set for ##tP, #PUL, or ProP, then skip to S1LP below.

If Out1 is set to OnOF (in the Secondary Menu), then the next three menu items can make the SP1 and SP1d settings act like a high or low alarm set point. See the information on alarm settings and the cautions and warnings that apply to them on Pages 33-34.

Note that when Set Point 1 Power Interrupt, S1P1, is On, and Set Point 1 Reset, S1rE, is programmed to HoLd, the SP1 output will automatically reset upon a power failure and subsequent restoration, if the process is below SP1.

S1rE Set Point 1 Reset. Select OnOF or HoLd.

- OnOF Output will automatically reset when process passes back through SP1d.
- HoLd Manual Reset. Reset (acknowledge) by simultaneously pressing the **INDEX** & **DOWN ARROW** keys for 3 seconds.

S1P1 Set Point 1 Power Interrupt. Select On or OFF.

- On — Alarm Power Interrupt is On. Output will automatically reset on power-up if no alarm condition exists.
- OFF — Alarm Power Interrupt is OFF. Output will be in the alarm condition on power-up regardless of condition of process.

S1Inh Set Point 1 Inhibit: Select On or OFF.

- On — Alarm Inhibit is On. Alarm action is suspended until the process value first enters a non-alarm condition.
- OFF — Alarm Inhibit is OFF.

SiLP Set Point Lamp: Select 1 on or 1oFF.

- 1 on — Lamp ON when Output is ON.
- 1oFF — Lamp OFF when Output is ON.

If your control is not equipped with Set Point 2, then proceed to the alarm section (next page).

S2t Set Point 2 type: Select Abs or dE.

- Abs — Absolute SP2. SP2 is independent of SP 1, and may be set anywhere between the limits of SPL and SPH.
- dE — Deviation SP2. SP2 is set as a deviation from SP 1, and allows SP2 to retain its relationship with SP 1 when SP 1 is changed (SP2 tracks SP 1).

S2St Set Point 2 State: Select dir or rE.

- dir — Direct Action. As the input increases the output will increase. Most commonly used in cooling processes.
- rE — Reverse Action. As the input increases the output will decrease. Most commonly used in heating processes.

If Out2 is set for ##tP, #PUL, or ProP, **then** S20L and S20H appear. If Out2 is set for OnOF, then skip S20L and S20H.

S20L Set Point Output Low Limit: Select 0 to 100% but not greater than S20H. This item limits the lowest output value. This is useful for adding a bias to the process when needed. Factory set to 0 for output codes 1,2, 3,4, and 8. Factory set to 20 for output code 5 (20% output equals 4 mA output).

S20H Set Point 2 Output High Limit: Select 0 to 100% but not less than S20L for output codes 1, 2, 3,4, or 8. Select 0 to 102% but not less than S20L for output code 5. This item allows setting the maximum output limit. This is useful with processes that are over powered. Adjustment to 102% allows setting current output to

force a full on condition for output devices which do not have bias adjustments. Factory set to 100 for all output codes.

If Out2 is set to OnOF (in the Secondary Menu), then the next three menu items can make the SP2 and SP2d settings act like a high or low alarm set point. See the information on alarm settings and the cautions and warnings that apply to them on the next pages.

Note that when Set Point 2 Power Interrupt , S2P , is On, and Set Point 2 Reset, S2rE, is programmed to Hold, the SP2 output will automatically reset upon a power failure and subsequent restoration, if the process is below SP2.

S2rE Set Point 2 Reset. Select OnOF or Hold.
- OnOF Output will automatically reset when process passes back through SP2d.
- Hold Manual Reset. Reset (acknowledge) by simultaneously pressing the **INDEX** & **DOWN ARROW** keys for 3 seconds.

S2P , Set Point 2 Power Interrupt. Select On or OFF.
- On Alarm Power Interrupt is On. Output will automatically reset on power-up if no alarm condition exists.
- OFF Alarm Power Interrupt is OFF. Output will be in the alarm condition on power-up regardless of condition of process.

S2 ,H Set Point 2 Inhibit: Select On or OFF.
- On Alarm Inhibit is On. Alarm action is suspended until the process value first enters a non-alarm condition.
- OFF Alarm Inhibit is OFF.

S2LP Set Point 2 Lamp: Select O on or OoFF.
- O on Lamp ON when Output is ON.
- OoFF Lamp OFF when Output is ON.

ALARM TYPE AND ACTION (if alarm function is present)

Caution: In any critical application where failure could cause expensive product loss or endanger personal safety, a redundant limit controller is required.

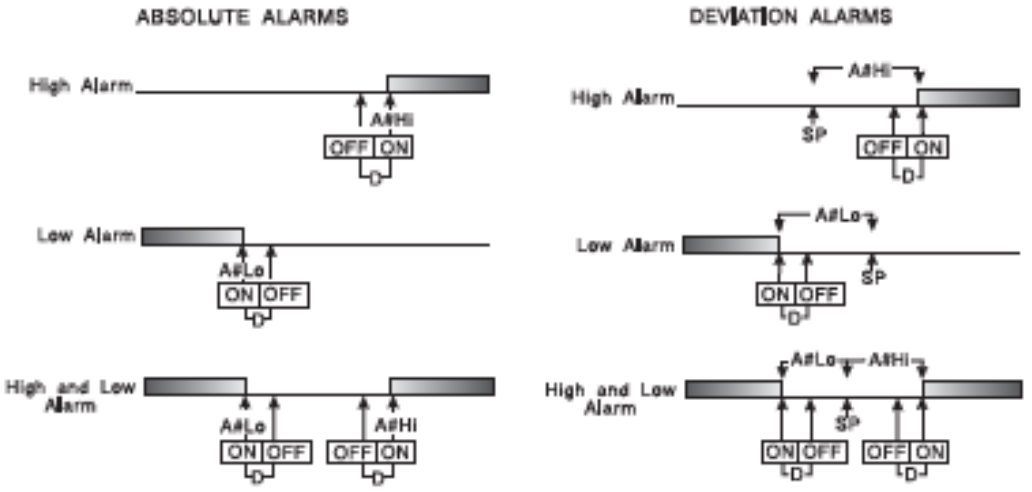
When setting an alarm value for an absolute alarm (A 1t = AbS), simply set the value at which the alarm is to occur.

When setting the alarm value for a deviation alarm (A 1t = dE), set the difference in value from the Set Point desired. For example if a low alarm is

required to be 5 degrees below the Set Point, then set A1Lo to -5. If a high alarm is required 20 degrees above the Set Point, then set A1Hi to +20. If the Set Point is changed, the alarm will continue to hold the same relationship as originally set.

The diagram below shows the action and reset functions for both absolute and deviation alarms.

D = 1 degree F, 1 degree C, or 1 count.



Note that when Alarm Power Interrupt, A1P1, is programmed On and Alarm Reset, A1rE, is programmed for Hold, the alarm will automatically reset upon a power failure and subsequent restoration if no alarm condition is present.

If Alarm Inhibit, A1iH, is selected On, an alarm condition is suspended upon power up until the process value passes through the alarm set point once. Alarm inhibit can be restored as if a power up took place by pressing both the ↵ ▼ **INDEX** and **ENTER** keys for 3 seconds.

WARNING: IF INHIBIT IS ON AND A POWER FAILURE OCCURS DURING A HIGH ALARM, RESTORATION OF POWER WILL NOT CAUSE THE ALARM TO OCCUR IF THE PROCESS VALUE DOES NOT FIRST DROP BELOW THE HIGH ALARM SETTING. DO NOT USE THE ALARM INHIBIT FEATURE IF A HAZARD IS CREATED BY THIS ACTION. BE SURE TO TEST ALL COMBINATIONS OF HIGH AND LOW ALARM INHIBIT ACTIONS BEFORE PLACING CONTROL INTO OPERATION.

The following menu items apply only to the alarm.

AL 1 Alarm 1 function: Select OFF, Lo, Hi, HiLo, or EUnt.

- **OFF** Alarm 1 is disabled. No Alarm 1 menu items appear in the Secondary or Secure menus.
- **Lo** Low Alarm Only. A1Lo appears in the Secondary Menu.
- **Hi** High Alarm Only. A1Hi appears in the Secondary Menu.
- **HiLo** High and Low Alarms. Both A1Lo and A1Hi appear in the Secondary Menu, and share the same Alarm 1 Relay output.
- **EUnt** **Alarm 1 is controlled by the Ramp/Soak program function. (16A3). See pages 11-14 and 26 (#A1) for further information.**

If AL 1 is set to OFF and the control is not equipped with options, the Secure Menu ends here. If AL 1 is set to OFF and the control is equipped with options, proceed to SPSA, Addr, or rSCL below.

If AL 1 is set to EUnt, go to A1St below.

A1t Alarm 1 Type: Select Abs or dE

- **Abs** Absolute Alarm that may be set anywhere within the values of SCAL and SCAH and is independent of SP 1.
- **dE** Deviation Alarm that may be set as an offset from SP 1. As SP 1 is changed the Alarm Point will track with SP 1. A deviation alarm will also track any active ramp or soak set point.

A1rE Alarm 1 Reset: Select AnOF or Hold.

- **AnOF** Automatic Reset.
- **Hold** Manual Reset. Reset (acknowledge) by simultaneously pressing the **INDEX** & **DOWN ARROW** keys for 3 seconds.

A1P Alarm 1 Power Interrupt: Select An or OFF.

- **An** Alarm Power Interrupt is An.
- **OFF** Alarm Power Interrupt is OFF.

A1iH Alarm 1 Inhibit: Select An or OFF.

- **An** Alarm Inhibit is An. Alarm action is suspended until the process value first enters a non-alarm condition.
- **OFF** Alarm Inhibit is OFF.

A1St Alarm 1 Output State: Select CLOS or OPEn.

- **CLOS** Closes Contacts at Alarm Set Point.
- **OPEn** Opens Contacts at Alarm Set Point.

A1LP Alarm 1 Lamp: Select On or OFF.

- On — Alarm Lamp is ON when alarm contact is closed.
- OFF — Alarm Lamp is OFF when alarm contact is closed.

A1Lb Alarm 1 Loop Break. Select On or OFF.

- On — Loop Break Condition will cause an Alarm Condition.
- OFF — Loop Break will not affect the Alarm Condition.

SPSA *(Option 948, 4-Stage Set Point) Switch Action: Select rE or Int.*

- rE — Set Point Stage selected by external contact closures.
- Int — Set Point Stage selected by internal menu selection. See SP menu item in Secondary Menu.

Addr *(Option 992, 993, 995, 996, Serial Communications) Control Address: Set from 1 to 3FF for Options 992 and 993. Set from 1 to FF for Options 995 and 995. This number (hexadecimal, base 16) must match the address number used by the host computer. Power to instrument must be turned off and on before change takes effect (see Page 18).*

bAUd *(Option 992, 993, 995, 996, Serial Communications) Communication Baud Rate: Select 300, 1200, 2400, 4800, 9600 (baud), 19.2, 28.8, or 57.6 (kbaud) for Options 992 and 993. Select 300, 1200, 2400, 4800, 9600 (baud), or 19.2 (kbaud) for Options 995 and 996. This number must match the baud rate used by the host computer. Power to instrument must be turned off and on before change takes effect (see Page 18).*

nAt *(Option 992, 993, 995, 996, Serial Communications) No Activity Timer: Select OFF or 1 to 99 minutes.*

- 1 - 99 — *Maximum time between host computer accesses. If timer counts to 0, CHEC LorE will be displayed.*
- OFF — *No Activity Timer function is disabled.*

Stor *(Option 992, 993, 995, 996, Serial Communications) Store to EEPROM: Select YES or no. (See additional information on page 18).*

- YES — *Menu Item changes made through the Serial Communications are stored directly to the EEPROM.*
- no — *Menu Item changes made through the Serial Communications are stored in RAM.*

rSCL *(Option 924, 926, 928, Analog Remote Set Point) Remote Scale Low: Select* 100 *to* 11998 *counts below rSCH. The total span between rSCL and rSCH must be within 11998 counts. Maximum setting range is -1999 to +9999 counts.*

rSCH *(Option 924, 926, 928, Analog Remote Set Point) Remote Scale High: Select* 100 *to* 11998 *counts above* rSCL*. The total span between* rSCL *and* rSCH *must be within 11998 counts. Maximum setting range is -1999 to +9999 counts.*

NOTES

ERROR MESSAGES

Any error message may be cleared by using the 'Global Reset' by pressing and holding the ⇧ ↵ INDEX & ENTER keys for five seconds.

DISPLAY	MEANING	SP OUTPUTS	ACTION REQUIRED
A-EA (Alternates with PV)	This message appears if the ambient temperature of the control approaches the ends of tolerance.	Set point outputs active Alarm active	Correct the ambient temperature conditions. Ventilate the area of the cabinet or check for clogged filters. If internal temperature sensor (RJC located in terminal 2) is broken, return to factory for service.
A-EA	This message appears if the ambient temperature of the control is out of range or RJC sensor is broken.	Set point outputs active Alarms active	Correct the ambient temperature conditions. Ventilate the area of the cabinet or check for clogged filters. If internal temperature sensor is broken, return to factory for service.

ERROR MESSAGES

Any error message may be cleared by using the 'Global Reset' by pressing and holding the INDEX & ENTER keys for five seconds.

DISPLAY	MEANING	SP OUTPUTS	ACTION REQUIRED
UFL or OFL	Underflow or Overflow: Process value has exceeded input range ends.	Set point outputs active Alarm active	May be normal if Input signals go above or below range ends. If not the case, check sensor, input wiring and correct.
	UFL or OFL will sequence to display one of these messages if the InPt is set for a time value.	Set point outputs inactive Alarm active	When InPt (input fault timer) has been set for a time, the outputs will be turned off after the set time. Setting the time to OFF causes the outputs to remain active, however UFL or OFL will still be displayed.
bAd InP	For RTD inputs RTD is open or shorted.		Correct or replace sensor.
OPEn InP	For THERMOCOUPLE inputs thermocouple is open.		Correct or replace sensor. Clear with 'Global Reset'.
LOOP bAd	The sensor may be defective, heater fuse open, heater open, or the final power output device is bad.	Set point outputs inactive. Alarm active.	Correct or replace sensor, or any element in the control loop that may have failed. Correct the problem. Clear with 'Global Reset'
SEnC bAd	Sensor Rate of Change exceeded the programmed limits set for SEnC.	Set point outputs inactive. Alarm active	Check for the cause of the error. The value setting may be too slow for the process, or the sensor is intermittent. Correct the problem. Clear with 'Global Reset'.
CHEC CAL	Check calibration appears as an alternating message if the instrument calibration nears tolerance edges.	Set point outputs active Alarm active	Remove the instrument for service and / or recalibration.
	Check calibration appears as a flashing message if the instrument calibration exceeds specification.	Set point outputs inactive Alarm active	Remove the instrument for service and / or recalibration.

ERROR MESSAGES

Any error message may be cleared by using the 'Global Reset' by pressing and holding the INDEX & ENTER keys for five seconds.

DISPLAY	MEANING	SP OUTPUTS	ACTION REQUIRED
No display lighted	Display is blank. Instrument is not getting power, or the supply voltage is too low.	Set point outputs inactive Alarm inactive	Check that the power supply is on, measure supply voltage, check that the external fuses are good.
FAIL tESt	Fail test appears upon power up if the internal diagnostics detect a failure. This message may occur during operation if a failure is detected. Displays flash. Fail test may also occur due to an EEPROM failure.	Set point outputs inactive Alarm inactive	The display alternates between FAIL tESt and one of the following messages: FACt dFLt: Memory may be corrupted. Press the **DOWN ARROW** and **ENTER** keys to return control to the factory default settings. Recheck controller programming. rEt FACt: Unrecoverable error, return to factory for service.
CHEC SP 1, CHEC SP2, CHEC 1SP, ..., CHEC 16SP,	This message will appear upon power up if SP 1, SP2, #SP 1, or ##SP is set outside of the SPL or SPH values.	Set point outputs inactive Alarm active	Correct the SP 1, etc. or adjust the SPL or SPH values by programming new values.
CHEC SPL or CHEC SPH	This message appears at power up if SPL or SPH values are programmed outside the input range ends.	Set point outputs inactive Alarm active	Correct the SPL or SPH values by programming new values.
CHEC rSPt	This message appears if the analog remote set point signal is out of range.	Set point outputs active Alarm active	The control will revert to SP 1. Correction of the analog signal or turning OFF the rSPt clears the error message.
CHEC LorE	This message appears if the Serial Communications has timed out.	Set point outputs active Alarm active	Change the LorE to LOC. Restore the communications line and switch LorE back to rE.

SPECIFICATIONS

Selectable Inputs: Thermocouple, RTD, DC Voltage, or DC Current selectable.

Input Impedance:

Thermocouple = 3 megohms minimum. RTD current = 200 µA.
Current = 10 ohms. Voltage = 5000 ohms.

Sensor Break Protection: De-energizes control output to protect system after customer set time. (See inPt in Secure Menu.)

Set Point Range: Selectable (See Input Ranges Page 43).

Display: Two 4 digit, 7 segment 0.3" high LEDs.

Control Action: Reverse (usually heating), Direct (usually cooling) selectable.

Proportional Band: 1 to 9999 °F, °C, or counts.

Reset Time (Integral): Off or 0.1 to 99.9 minutes.

Rate Time (Derivative): Off or 0.01 to 99.99 minutes.

Cycle Rate: 1 to 80 seconds.

On - Off Differential: Adjustable 1° F, 1° C, or 1 count to full scale in 1° F, 1° C, or 1 count steps.

Alarm On - Off Differential: 1° F, 1° C, or 1 count.

Fuzzy Percent: 0 to 100%.

Fuzzy Rate: Off or 0.01 to 99.99 counts per second.

Fuzzy Band: Off or 1 to 4000 °F, °C, or counts.

Accuracy: ±0.25% of span, ±1 least significant digit.

Resolution: 1 degree or 0.1 degree, selectable.

Line Voltage Stability: ±0.05% over the supply voltage range.

Temperature Stability: 4µV/°C (2.3 µV/°F) typical, 8 µV/°C (4.5 µV°F) maximum (100 ppm / °C typical, 200 ppm / °C maximum).

Common Mode Rejection: 140 db minimum at 60 Hz.

Normal Mode Rejection: 65 db typical, 60 db at 60 Hz.

Isolation:

Relay and SSR outputs: 1500 Vac to all other inputs and outputs.

SP1 and SP2 Current outputs: 500 Vac to all other inputs and outputs, but not isolated from each other,

SP1 and SP2 Switched Voltage outputs: 500 Vac to all other inputs and outputs, but not isolated from each other.

Process Output (934, 936): 500 VAC to all other inputs and outputs.

Supply Voltage: 100 to 240 Vac, nominal, +10 -15%, 50 to 400 Hz. single phase; 132 to 240 Vdc, nominal, +10 -20%.

Supply Voltage (Option 9502): 12 to 24 Vdc, Vac 40-400 Hz, ±20%.

Power Consumption: 5VA maximum.

Operating Temperature: -10 to +55 °C (+14 to 131 °F).

Storage Temperature: -40 to +80 °C (-40 to 176 °F).

Humidity Conditions: 0 to 90% up to 40 °C non-condensing, 10 to 50% at 55 °C non-condensing.
Memory Backup: Nonvolatile memory. No batteries required.
Control Output Ratings:
SSR: 2.0 A combined outputs A & B @ 240 Vac at 25 °C (77°F). Derates to 1.0 A @ 55° C (130°F).
Relay: SPST, 3 A @ 240 Vac resistive; 1.5A @240 Vac inductive; Pilot duty rating 240 VA, 2 A @ 120 Vac or 1 A 240 Vac.
Alarm Relay: SPST, 3 A @ 240 Vac resistive; 1/10 HP@ 120 Vac.
Current (isolated): 0 to 20 mA across 600 ohms maximum.
Switched Voltage (isolated): 15 Vdc @ 20 mA.
DC SSR: 1.75 A @ 32 Vdc maximum.
Panel Cutout: 45 mm x 45 mm (1.775" x 1.775").
Depth Behind Mounting Surface: 121.6 mm (4.79") maximum.
Weight: 220 g (8 oz).
Agency Approvals: UL, C-UL E83725; CE.
Front Panel Rating: IP66, (UL Type 4X).

OPTIONS
-924 Analog Remote Set Point
Input: 0 to 10 VDC
Input Impedance: 1 Meg Ohms
Isolation: Shares common ground with PV input.
Scale: Programmable from 100 to 11998 counts, depending on PV range selected.
-926 Analog Remote Set Point
Input: 0 to 20 mADC.
Input Impedance: 10 Ohms
Isolation: Shares common ground with PV input.
Scale: Programmable from 100 to 11998 counts, depending on PV range selected.
-928 Analog Remote Set Point
Input: 0 to 10,000 ohms, two wire.
Search Current: 4 µA.
Isolation: Shares common ground with PV input.
-934 Analog Retransmission of PV/SV (programmable)
Output: 0 to 20 mADC into 600 Ohms, maximum.
Isolation: 500 VAC
Scale: Programmable from 100 to 11998 counts, depending on PV range selected.
-936 Analog Retransmission of PV/SV (programmable)
Output: 0 to 10 VDC @ 20 mA maximum.
Isolation: 500 VAC
Scale: Programmable from 100 to 11998 counts, depending on PV range selected.

-948 Four Stage Set Point

Input: Dry contact or NPN Open Collector Transistors.
Current: 1 mADC.
Isolation: Shares common ground with PV input.

-992 RS-485 Series Communications

Port Compliance: EIA-485
Isolation: 500 VAC
Protocol: Lovelink™ II
Address Range: 001H to 3FFH
Baud Rates: 300, 1200, 2400, 4800, 9600, 19.2k, 28.8k, 57.6k.
Mode: Half duplex
Character: 8 bits, 1 start, 1 stop, no parity.
Number of units on line/port[1]: 32.
Cable Length[1]: 6,000 ft (1,828 m).
Termination: 120 Ohms, balanced.

-993 RS-232 Serial Communications

Port Compliance: RS-232C
Isolation: 500 VAC
Protocol: Lovelink™ II
Address Range: 001H to 3FFH
Baud Rates: 300, 1200, 2400, 4800, 9600, 19.2k, 28.8k, 57.6k.
Mode: Half duplex
Character: 8 bits, 1 start, 1 stop, no parity.
Number of units on line/port: 1.
Cable Length: 25 ft (7.6 m).

-995 RS-232 Serial Communications

Port Compliance: RS-232C
Isolation: 500 VAC
Protocol: MODBUS® RTU
Address Range: 001H to 0FFH
Baud Rates: 300, 1200, 2400, 4800, 9600, 19.2k.
Mode: Half duplex
Character: 8 bits, 1 start, 1 stop, no parity.
Number of units on line: 1.
Cable Length: 25 ft (7.6 m).

-996 RS-485 Serial Communications

Port Compliance: EIA-485
Isolation: 500 VAC
Protocol: MODBUS® RTU
Address Range: 001H to 0FFH
Baud Rates: 300, 1200, 2400, 4800, 9600, 19.2k.
Mode: Half duplex
Character: 8 bits, 1 start, 1 stop, no parity.
Number of units on line[1]: 32
Cable Length[1]: 6,000 ft (1,828 m).

Termination: 120 Ohms, balanced.

[1] Number can be increased through use of a repeater such as the Mother Node™. Consult factory for details.

Lovelink™, Lovelink™II, and Mother Node™ are Trademarks of Love Controls.
MODBUS® is a trademark of Schneider Automation.

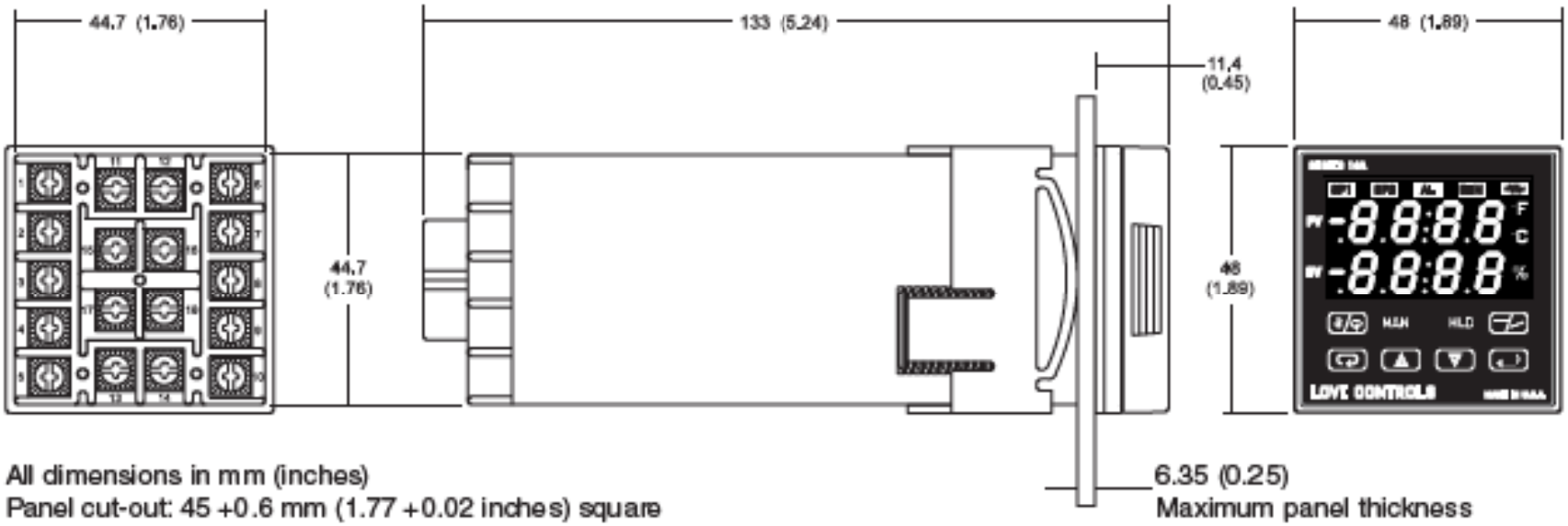
INPUT RANGES

INPUT TYPE	RANGE °F	RANGE °C
Type J or L[1] Thermocouple	-100 to +1607	-73 to +871
Type K[1] Thermocouple	-200 to +2500	-129 to +1371
Type T[1] Thermocouple	-350 to +750	-212 to +398
Type E[1] Thermocouple	-100 to +1800	-73 to +982
Type R Thermocouple	0 to 3200	-17 to +1760
Type S Thermocouple	0 to 3200	-17 to +1760
Type B Thermocouple	+75 to +3308	+24 to +1820
Type C Thermocouple	0 to 4208	-17 to +2320
Type N[1] Thermocouple	-100 to +2372	-73 to +1300
100 Ω Plt. 0.00385 DIN[1] RTD	-328 to 1607	-200 to +875
100 Ω Plt. 0.00392 NIST[1] RTD	-328 to 1607	-200 to +875
120 Ω Nickel 0.00628 US[1] RTD	-112 to +608	-80 to +320
1000 Ω Plt. 0.00385 DIN[1] RTD	-328 to +1607	-200 to +875
Current/Voltage/Δ Voltage[2]	Scalable Units from -1999 to +9999	

[1] These Input Types can be set for 0.1° display. If temperature goes above 999.9° or less than -199.9° the display will return to whole degree resolution.

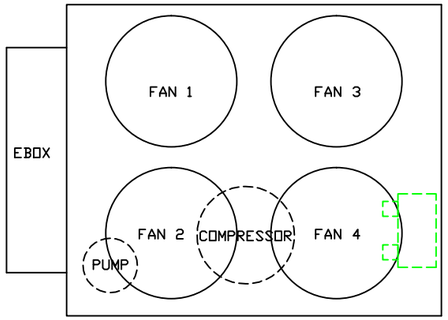
[2] The 0 to 20 mADC, 4 to 20 mADC, 0 to 10 VDC, 2 to 10 VDC, and -10 to +10 mVDC inputs are fully scalable from a minimum of 100 counts span placed anywhere within the within the range of -1999 to +9999. Decimal point position is adjustable from the zero place (9999), tenths (999.9), hundredths (99.99), thousandths (9.999), or ten thousandths (.9999).

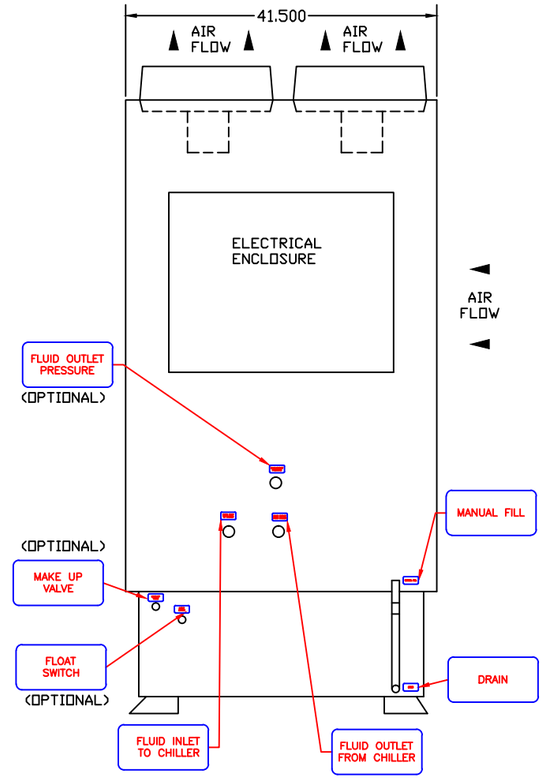
Dimensions

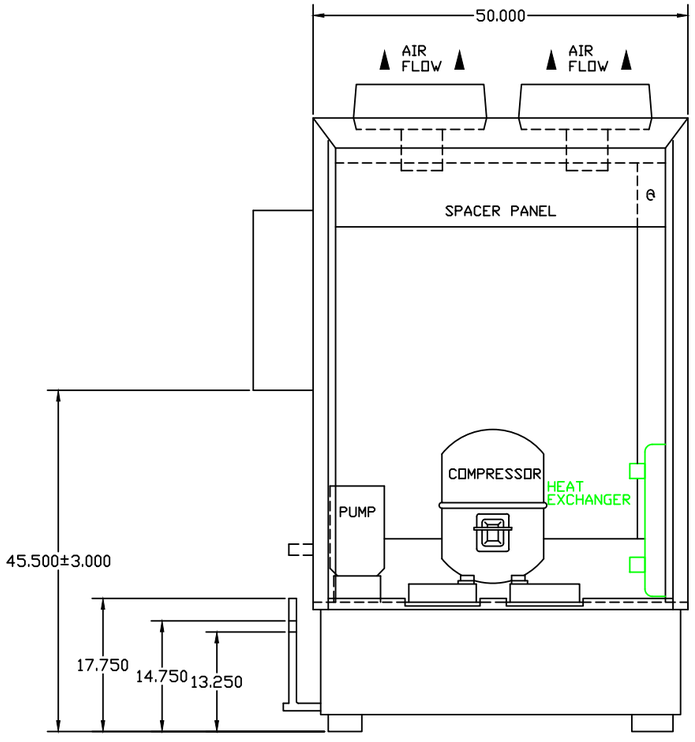


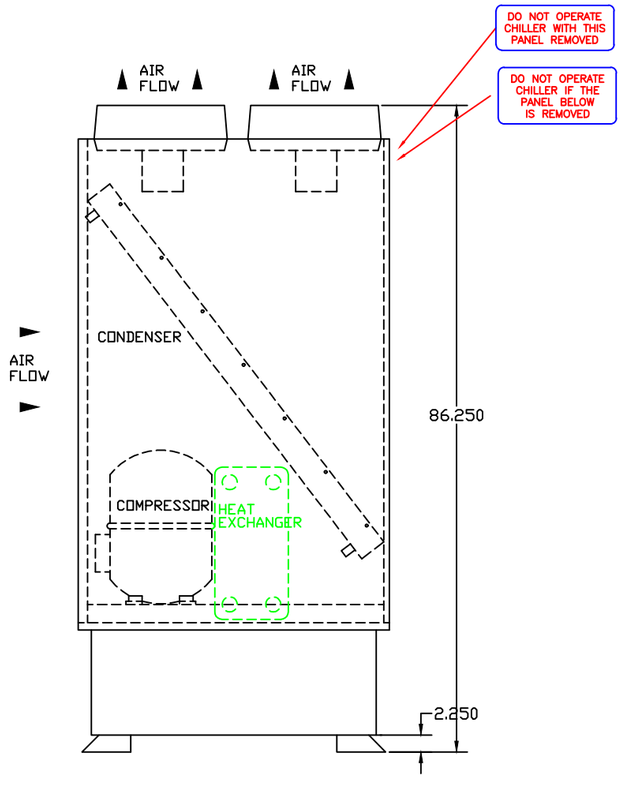
All dimensions in mm (inches)
Panel cut-out: 45 +0.6 mm (1.77 +0.02 inches) square

6.35 (0.25)
Maximum panel thickness









SEE PIPING PRINT FOR LINE SIZES

ALL DIMENSIONS ARE IN INCHES

DATE	DESCRIPTION OF REVISION	APPROVED BY
11/20/07	UPDATED TAGS, TITLE BLOCK	AJO

KOOLANT KOOLERS

Dimplex Thermal Solutions

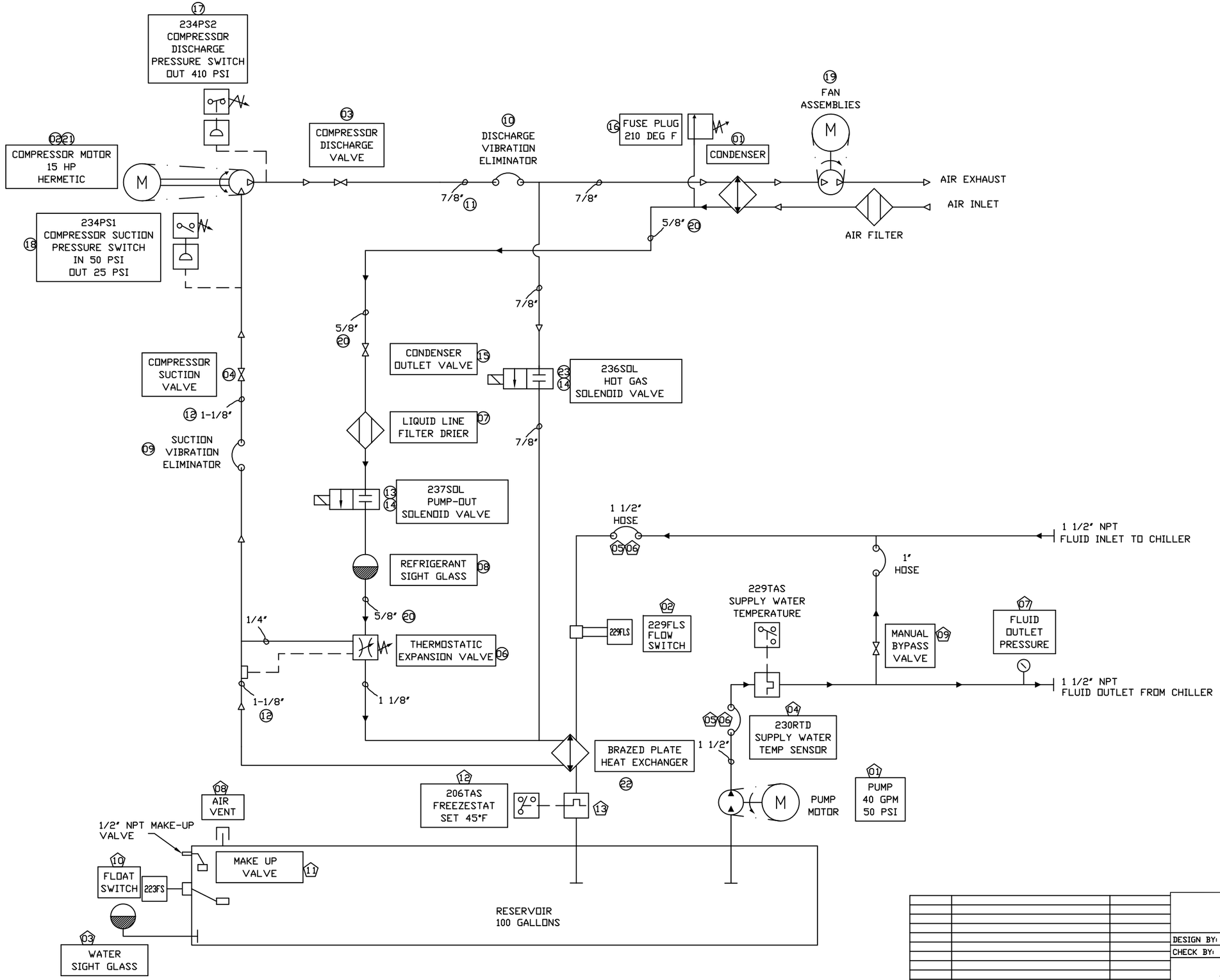
SCHREIBER CHILLERS

DESIGN BY: BRIAN	DRAWN BY: BRIAN	KALAMAZOO, MI. PH (800) 968-5665 WWW.DIMPLEXTHERMAL.COM
DATE: 11/12/01	PAGE 1 OF 1	

HOV 12,000/ 15,000 PR

LAYOUT

DRAWING NO. 418294



ALL DIMENSIONS ARE IN INCHES

DATE	DESCRIPTION OF REVISION	APPROVED BY

KOOLANT KOOLERS, INC.
2625 EMERALD DR. KALAMAZOO MICH. 49001-4542 (616) 349-6800

DESIGN BY: DOUG	DRAWN BY: DOUG	SCALE: 1=1	
CHECK BY:	PAGE 1 OF 2	DATE: 12-12-01	

HOV 15,000 PR-MB-NF

PIPING

DRAWING NO. 418480

PIPING PARTS ⬠

	NO.	ID/DESCRIPTION	K.K. PART#	QTY	TYPE
	001	HDV15000PR-MB-NF MCHNCL	0418479		ASSEM
		418480*****SCHEMATIC			
		418479*****BILL OF MATERIAL			
	001	CRKI8-60/4 PUMP VERTICAL 3.0 H.P.	1781836	1.0	PC
		230-460/3/60 TEFC MOTOR			
		NEMA TC/TC VITON SEALS (AUUV)			
		GRUNDFOS			
	002	Q-5/3/2/B FLOW SWITCH	3896028	1.0	PC
		HARWIL			
	003	KK SIGHT GLASS ASSEMBLY NON-FERROUS	7400004	1.0	ASSEM
*	001	PIPE 1 PVC CLEAR	7408800	1.5	FT
*	002	TEE 1 X 1 X 1 FPT BRS	7508105	1.0	PC
*	003	ADAPTER 1 MPT X 1 SLIP MALE PVC40	7408701	1.0	PC
*	004	NIPPLE 1 MPT X 3 BRS	7508003	1.0	PC
*	005	PLUG 1 MPT BRS	7508900	1.0	PC
*	006	CAP 1 PVC40	7408900	1.0	PC
	004	1/2 SENSOR ASSEMBLY	0607072	1.0	ASSEM
*	001	MP-981217 RTD 100 OHM (10 FT)	4801205	1.0	PC
		100 OHM PLATINUM, 3 WIRE CONST-			
		RUCTION W/ DRAIN WIRE ATTACHED TO			
		SHEATH, 3/16 DIA SHEATH, 316 SST			
		5-1/2 OVERALL LENGTH, 4-1/2 HOT LEG			
		W/90 DEG BEND, PVC LEAD-WIRE W/			
		SHIELD AND DRIAN, 10 FT LONG			
		GREY WIRE COVER, NO COLD END TERM-			
		INATION; GENERALLY USED ON 15 TON			
		UNITS AND BELOW, W/ 4 POINT CRIMP			
		SENSORTEC			
*	002	COMPRESSION FITTING 1/2 NPT X 3/16	7504920	1.0	PC
		TUBE			
	005	HOSE 1-1/2 ORTAC 250 PSI RED	4410004	3.0	FT
		-20 TO 190 deg F, CEMVEK, GOODYEAR			
	006	HOSEBARB 1-1/2 MPT X 1-1/2 HOSE BRS	7512901	4.0	PC
	007	WGG100C GAUGE PIPING CBM 0-100 PSI	4243100	1.0	PC
		(GASLI) PRECISION (MADE IN SPAIN)			
	008	PMB-05-10 AIR VENT 3/8	4100003	1.0	PC
		FENNER			
	009	B-6000 VALVE BALL BRONZE 1	4113101	1.0	PC
		WATTS			
	010	L-21N-15A-2-B FLOAT SWITCH HORIZ.	3896107	1.0	PC
		NORYL PLASTIC & 316 STAINLESS STEEL			
		MAX - 200 DEG.F. 100 PSI 1/2 HP			
		15 AMP @ 125 OR 250 VAC 1-1/4 NPT			
		WITH CORD GRIP CONNECTION NOT FOR			
		USE ON JOBS REQUIRING CONDUIT TO			
		THE FLOAT SWITCH. HARWIL			
	011	RM-79-BK FLOAT VALVE	4170999	1.0	PC
		ROBERT MFG.			
	012	A19ACA-15C TEMPERATURE CONTROL	3651005	1.0	PC
		-30 TO 100 DEGREE F. MANUAL RESET			
		SPST OPEN LOW USED AS FREEZESTAT			
		JOHNSON CONTROLS			
	013	WEL14A-602R BULBWELL ASSEMBLY	3664000	1.0	PC
		JOHNSON CONTROLS			

* PARTS NOT SHOWN ON DRAWING DETAIL

REFRIGERATION PARTS ◯

	NO.	ID/DESCRIPTION	K.K. PART#	QTY	TYPE
	014	HDV15000-PR REFRIG 460/3/60	0608729	1.0	ASSEM
	001	COIL 12-15 TON 60 X 41.5	1413017	1.0	PC
		KK DWG 404918			
	002	ZR19M3-TWD-551 COMPRESSOR SCROLL 15	1291050	1.0	PC
		15 TON R-22 460/3/60, 380-420/3/50			
		WITH 120 VAC PROTECTION MODULE			
		SUCTION: 2-1/4 ROTOLOCK			
		DISCHARGE: 1-3/4 ROTOLOCK			
		COPELAND			
	003	VALVE ANGLE ROTOLOCK V07	1446005	1.0	PC
		1-3/4 R X 7/8 S			
	004	VALVE ANGLE ROTOLOCK 2-1/4R X 1-1/8	1446011	1.0	PC
	005	VCT-2 BULK CORK INSULATION TAPE	4450000	0.5	ROLL
		KMP			
	006	OVE-15-CP100 VALVE EXPANSION	2760026	1.0	PC
		SPORLAN			
	007	C-305S FILTER DRIER	2730005	1.0	PC
		SPORLAN			
	008	SA-15S SIGHT GLASS 5/8 ODF	2720004	1.0	PC
		SPORLAN			
	009	VAF-9 VIBRATION ELIMINATOR 1-1/8	2980009	1.0	PC
		1-1/8 X 13 (UL P-9) PACKLESS			
	010	VAF-8 VIBRATION ELIMINATOR 7/8	2980008	1.0	PC
		7/8 X 11-1/2 (UL P-8) PACKLESS			
	011	TUBING 7/8 HARD COPPER ACR	7307010	9.1	FT
	012	TUBING 1-1/8 HARD COPPER ACR	7309010	5.0	FT
	013	E14S250 VALVE SOLENOID	2710008	1.0	PC
		SPORLAN			
	014	MKC-2E 120V 50-60 HZ COIL ASSEMBLY	0608315	2.0	ASSEM
		NOT UL LISTED			
		SPORLAN			
	001	MKC-2E SOLENOID COIL 120V 50-60 DIN	2710110	1.0	PC
		NOT UL LISTED			
		SPORLAN			
	002	CONNECTOR 12205: DIN 43650 18MM W/	4807100	1.0	PC
		5 METER GRAY PVC CABLE AC/DC 0-230V			
		18 GA WIRE, MURRELEKTRONIK			
	015	VALVE ANGLE REFRIG 5/8	3980002	1.0	PC
		WITH ACCESS PORT			
	016	3NP210 FUSE PLUG 3/8	1438020	1.0	PC
	017	P100DA-13D SWITCH HIGH PRESSURE 410	3640007	1.0	PC
		CUT OUT 410 PSI MANUAL RESET			
		ENCAPSULATED WITH A 9 FOOT CORD			
		JOHNSON CONTROLS			
	018	P100AA-33D SWITCH LOW PRESS. 50/25	3641002	1.0	PC
		IN 50 OUT 25 AUTO RESET			
		ENCAPSULATED WITH A 9 FOOT CORD			
		JOHNSON CONTROLS			
	019	FAN ASSEMBLY - 16" 3PH 5/8 INDOOR	0608309	4.0	ASSEM
		INDOOR USE ONLY			
*	001	048H17T3 MOTOR 1/2 HP 3 PH, 5/8 KEY	4051301	1.0	PC
		ED SHAFT, SEALED ON SHAFT, 48 FRAME			
		END, TENV, 60 DEG C			
		60HZ 1/2HP, 208-230/460, 1.8-1.6/.8			
		50HZ 1/3HP, 190/380, 1.4/.7, SF=1.0			
		MARATHON			
*	002	FAN GUARD MOUNT 16 DWG #101513	4507016	1.0	PC
		1.5 INCH TALL RENFRO FRANKLIN			
*	003	FAN GUARD FULL 16 DWG #101514	4507017	1.0	PC
		4.5 INCH TALL RENFRO FRANKLIN			
*	004	VENTURI 16 STEEL DWG #201677	4504161	1.0	PC
		18 GAUGE MEMPHIS METAL			
*	005	61146601 FAN BLADE 16 INCH 5/8 KEY	4500036	1.0	PC
		ED HUB CW F Y - 5/8			
		ON DISCHARGE 3/16 KEY WAY LAU			
*	006	VIBRA-TITE 1 OZ. BOTTLES	9803000	0.1	PC
		ACCT 4620.00.000			
*	007	BL50 LOCKNUT 1/2 TIGER GRIP STEEL	3800600	2.0	PC
		APPLETON			
*	008	STG-50 O-RING GASKET 1/2 NEOPRENE	3800203	2.0	PC
		STEEL BACKED APPLETON			
*	009	CG-5050S CORD STRAIN RELIEF	3800471	2.0	PC
		0.500-0.625 CABLE 1/2 ST HUB			
		APPLETON			
*	010	WIRE 14/4 SOW-A 600V BLACK	3807037	5.0	FT
		1000' REEL			
*	011	FAN MOUNTING RING 16 AND 18	0101534	2.0	ASSEM
*	001	SHEET 12 GA GALV. 48 X 120	9531200	1.0	LB
		CHEM-TREAT G-90 DRY 181.2 LBS/SHEET			
	020	TUBING 5/8 SOFT COPPER REFRIG.	7305000	7.0	FT
	021	018-0036-02 CRANKCASE HEATER (15)	1298010	1.0	PC
		460 V, 70 WATTS, COPELAND			
	022	V27X70H/1P HEAT EXCHANGER BRAZED	2200228	1.0	PC
		16/35.1 SWEAT REFRIG CONN.			
		1-1/4 NPT PROCESS CONNECTIONS			
		REF QUOTE # 0112RS08			
		SWEP			
	023	E19S270 VALVE SOLENOID	2710001	1.0	PC
		SPORLAN			
*	024	REFRIGERANT R22 IN A 125 LB CYL	2990013	30.0	LB

* PARTS NOT SHOWN ON DRAWING DETAIL

ALL DIMENSIONS ARE IN INCHES

DATE	DESCRIPTION OF REVISION	APPROVED BY

KOOLANT KOOLERS, INC.
2625 EMERALD DR. KALAMAZOO MICH. 49001-4542 (616) 349-6800 FAX (616) 349-0931

DESIGN BY: DOUG	DRAWN BY: DOUG	SCALE: 1=1	
CHECK BY:	PAGE 2 OF 2	DATE: 12-12-01	

HDV 15,000 PR-MB-NF

PIPING

DRAWING NO. 418479

PRIMARY MENU

TAS SETTINGS

SP1 = 70.0, SP2 = −3.0

To change operation temperature: Press '↵' and adjust SP1, then press '↵'. Do not adjust SP2.

229TAS

16

FLOW FAULT R 1819

LOW TANK LEVEL FAULT R 1819

OVERTEMP FAULT R 1819

SYSTEM OFF ON 1001

PUMP/SYSTEM RESETN G 2425

FREEZESTAT FAULT R 1819

KOOLANT KOOLERS, INC.
MADE IN KALAMAZOO, MICH. U.S.A.

Model HDV15000PR-MB-NF

Serial No.

Customer No.

Compressor H.P. 15.0

Pump H.P. 3.0

Refrig R-22 Lbs 35

Volts 460 Amps 37.1

Phase 3 Cycle 60

KOOLANT KOOLERS, INC.

DANGER HIGH VOLTAGE

460 VOLTS

101DISC 05

CAUTION LEAVE DISCONNECT ON TO MAINTAIN POWER TO THE COMPRESSOR CRANKCASE HEATER TO PREVENT REFRIGERANT MIGRATION. TURN DISCONNECT OFF FOR SERVICE.

DANGER HIGH VOLTAGE

460 VOLTS

105FU1 105FU2 105FU3 114FU1 114FU2 114FU3 132FU1 132FU2

1 1/2 WIRE WAY

136T

H1 H3 H2 H4

X2 X1 X3 X4

135FU1 09

05 101DISC

101CU1 101CU2 101CU3

GRD

1-1/2" WIRE WAY

234M 103OL1 226M 206CR 232CR 223CR

13 17 18 20 20 20

14 15

EP 03

EB 02

SECONDARY MENU

AlHi	10.0		
Alld	1.0	VAL	XXX
Out1	OnOF	PctO	OFF
SP1d	1	InPC	0.0
Out2	OnOF	FiLt	2
SP2d	3	LPbr	OFF
ArUP	OFF		
ArtE	OFF		
Fint	0		
Fbnd	0		
FrtE	0.00		
PEA	XXX		

SECURE MENU

SECr	2 (1101)	S2rE	OnOF
InP	P385	S2PI	OFF
Unit	F	S2IH	OFF
dPt	0.0	S2LP	O on
InPt	OFF	AL1	HI
SEnC	OFF	ALt	dE
SCAL	-328	ALrE	OnOF
SCAH	1607	ALPI	OFF
SPL	45	ALIH	OFF
SPH	100	AlSt	CLOS
SP1O	OutA	AtLP	O on
S1St	rE	AtLb	OFF
S1rE	OnOF		
S1PI	OFF		
S1IH	OFF		
S1LP	O on		
S2t	dE		
S2St	Dir		

CAUTION: LEAVE DISCONNECT ON TO MAINTAIN POWER TO THE COMPRESSOR CRANKCASE HEATER TO PREVENT REFRIGERANT MIGRATION. TURN DISCONNECT OFF FOR SERVICE.

A COPY OF DATA TAG TO BE LOCATED INSIDE OF ELECTRICAL BOX DOOR BELOW DISCONNECT.

NO.	ID/DESCRIPTION	K. K. PART#	QTY	TYPE
001	HDV15000-PR 460/3/60 EBOX PG3	0418481		ASSEN
	418482*****POWER DISTRIBUTION			
	418483*****LOGIC			
	418481*****LAYOUT AND BOM			
001	10 IEC TERMINAL BLOCKS A-B 1492-W4	0606532	2. 0	ASSEN
	AWG 22-12 600V AC/DC 30A 50PCS/FT			
* 001	1492-W4 TERMINAL BLOCK	3123021	10. 0	PC
	ALLEN BRADLEY			
* 002	1492-EB3 END BARRIER	3123086	1. 0	PC
	ALLEN BRADLEY			
* 003	1492-EA35 END ANCHOR	3123087	1. 0	PC
	ALLEN BRADLEY			
* 004	1492-WG10 GROUNDING BLOCK	3123017	1. 0	PC
	ALLEN BRADLEY			
* 005	1492-CJ6-10 TERMINAL SIDE JUMPER	3123094	0. 3	PC
	10 POLE INSULATED ALLEN BRADLEY			
* 006	199-DR1 MOUNTING RAIL	3127100	1. 0	PC
	5PC/BOX 1 METER LONG			
	ALLEN BRADLEY			
002	BOX NEMA 4/12 24 X 30 X 8	3444015	1. 0	PC
	SAGINAW CONTROLS			
003	PANEL 30 X 24 PRE-PUNCHED	3418299	1. 0	PC
	KOOLANT KOOLERS			
004	HC-0250-41 TRANSFORMER 250VA	3842252	1. 0	PC
	DONGAN			
005	9421-ND3-NW2-NS16 DISCONNECT IEC 60	3211027	1. 0	PC
	AMP WITH 10" SHAFT			
	FOR 12" DEEP BOX USE SHAFT 3211028			
	SQUARE D			
006	1492-FB1C30 FUSED TERMINAL BLOCK	3123138	2. 0	PC
	ALLEN BRADLEY			
007	AT01-1/2 FUSE	3500115	2. 0	PC
	GOULD			
008	AJT50 FUSE	3500916	3. 0	PC
	GOULD			
009	TRM3 FUSE	3500030	1. 0	PC
	GOULD			
010	800EP-SM22 SWITCH 2 POS. SELECTOR	3121042	1. 0	PC
	ALLEN BRADLEY			
011	800E-3LX10 CONTACT 1 NO 3 ACROSS	3121092	1. 0	PC
	COMPLETE LATCH ALLEN BRADLEY			
012	100-C09D10 CONTACTOR 120VAC COIL	3100200	1. 0	PC
	ALLEN BRADLEY			
013	100-C37D10 CONTACTOR 120VAC COIL	3100205	1. 0	PC
	ALLEN BRADLEY			
014	193-EA1HC OL RELAY 12-37 AMP	3103507	1. 0	PC
	FITS CONTACTOR C30-C37			
	ALLEN BRADLEY			
015	193-EA1FB OL RELAY 3. 7-12 AMP	3103505	1. 0	PC
	IEC FITS CONTACTOR M05-C23			
	ALLEN BRADLEY			
016	16A2111-90*029 TEMPERATURE CONTRDL	3849018	1. 0	PC
	PROCESS CONTROLLER. FIELD			
	SELECTABLE INPUTS, DUAL SSR OUTPUTS			
	RELAY ALARM OUTPUT			
	4/20: ADD . 10 DEG RESO. HYST.			
	DWYER			
017	193-EPM1 MOUNT OVERLOAD RELAY	3103600	1. 0	PC
	FOR USE WITH 193-EA**B, 193-ES**B,			
	193-EA**C, & 193ES**C			
	ALLEN BRADLEY			
018	800EP-PL4 LIGHT RED	3120032	4. 0	PC
	ALLEN BRADLEY			
019	800E-3DL5R 120VAC LED MODULE, RED	3120125	4. 0	PC
	FULL VOLTAGE MODULE WITH 120 VAC			
	RED LED BULB, REQUIRES LENS ASSEM.			
	ALLEN BRADLEY			
020	700-CF220D RELAY 120 VAC 2ND 2NC	3104100	3. 0	PC
	ALLEN BRADLEY			
021	AJT6 FUSE	3500907	3. 0	PC
	GOULD			
022	AJT5 FUSE	3500932	3. 0	PC
	GOULD			
023	60358SJ FUSE BLOCK 3 POLE 30A AJT	3501043	2. 0	PC
	HOLDS LPJ, AJT 1-30A FUSES; 600 VAC			
	SPACE SAVING SIZE: 3. 90 X 3. 62			
	GOULD			
024	800EP-PL3 LIGHT GREEN	3120031	1. 0	PC
	ALLEN BRADLEY			
025	800E-3DL5G 120VAC LED MODULE, GREEN	3120126	1. 0	PC
	FULL VOLTAGE MODULE WITH 120 VAC			
	GREEN LED BULB, REQUIRES LENS ASSM.			
	ALLEN BRADLEY			

* PARTS NOT SHOWN ON DRAWING DETAIL

CONSTRUCTION NOTES:

PAINT:
E-BOX EXTERIOR:
E-BOX INTERIOR:
E-BOX DOOR INTERIOR:

ALL DIMENSIONS ARE IN INCHES.

DATE	DESCRIPTION OF REVISION	APPROVED BY

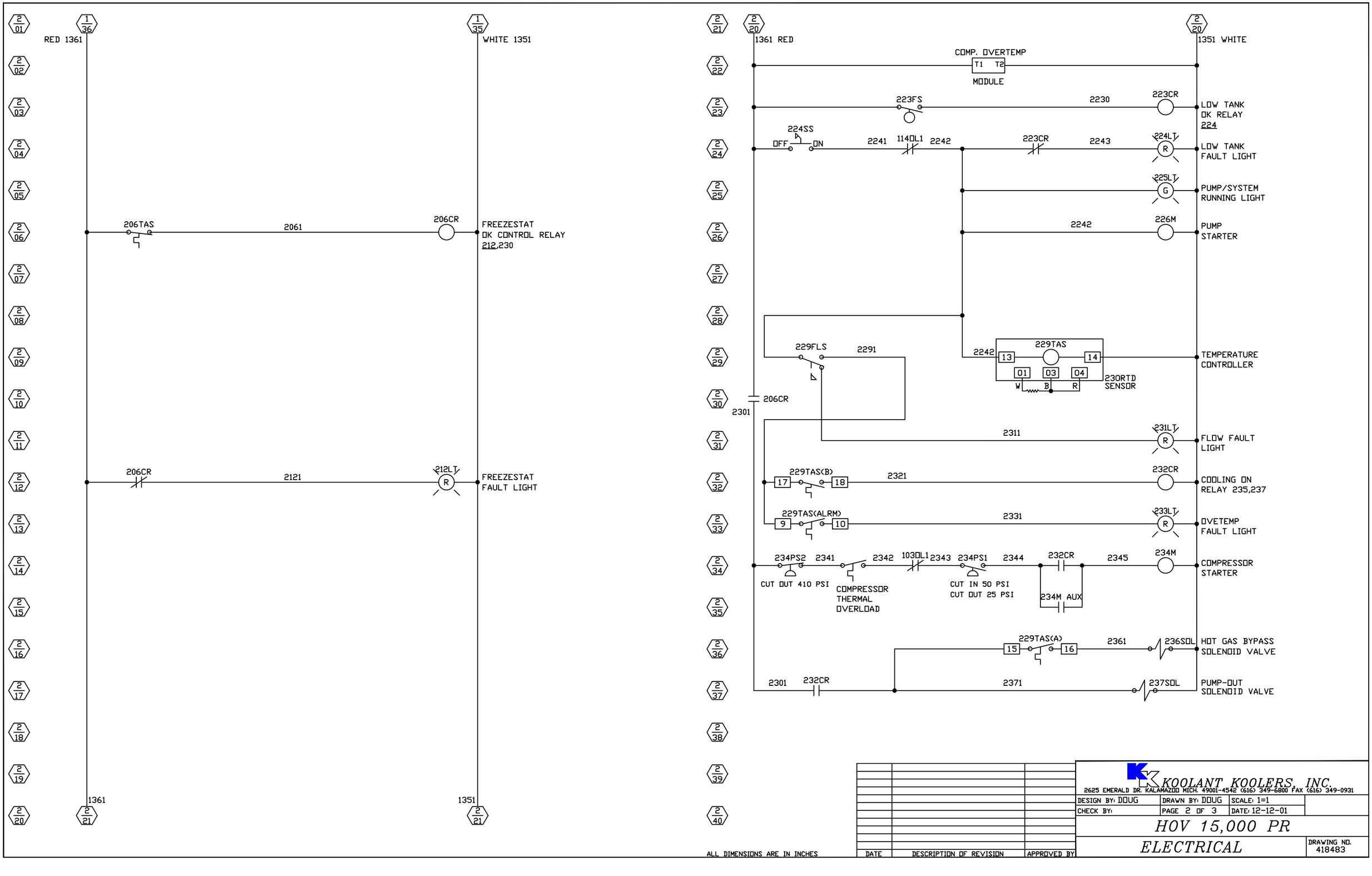
KOOLANT KOOLERS, INC.
2625 EMERALD DR. KALAMAZOO MICH. 49001-4542 (616)349-6800

DESIGN BY: DOUG	DRAWN BY: DOUG	SCALE: 1=2.5
CHECK BY:	PAGE 3 OF 3	DATE: 12-12-01

HOV 15,000 PR

ELECTRICAL

DRAWING NO. 418481



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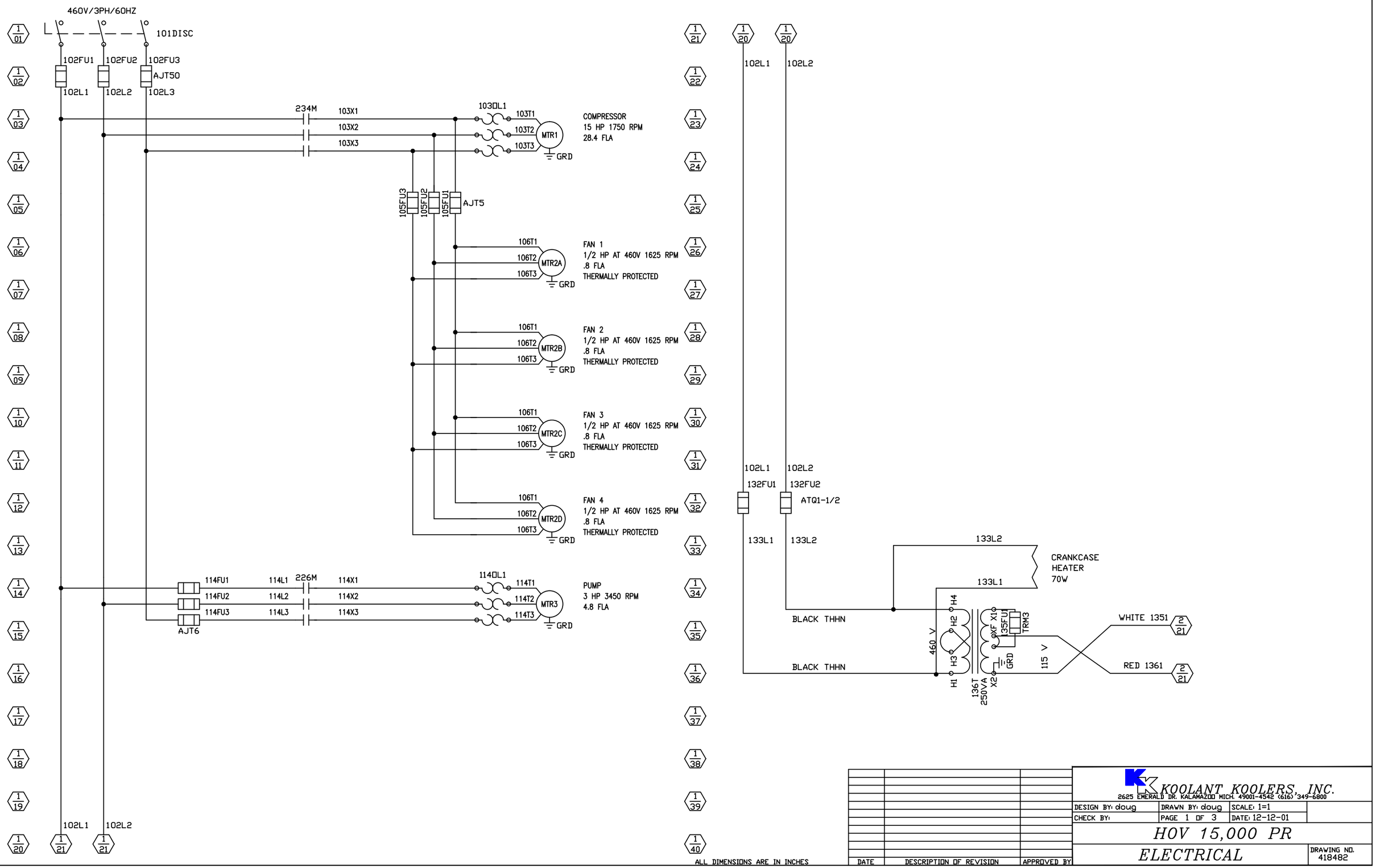
KOOLANT KOOLERS, INC.
2625 EMERALD DR. KALAMAZOO MICH. 49001-4542 (616) 349-6800 FAX (616) 349-0931

DESIGN BY: DOUG	DRAWN BY: DOUG	SCALE: 1=1
CHECK BY:	PAGE 2 OF 3	DATE: 12-12-01

HOV 15,000 PR

ELECTRICAL

DRAWING NO. 418483



ALL DIMENSIONS ARE IN INCHES

DATE	DESCRIPTION OF REVISION	APPROVED BY

KOOLANT KOOLERS, INC.
2625 EMERALD DR. KALAMAZOO MICH. 49001-4542 (616) 349-6800

DESIGN BY: doug	DRAWN BY: doug	SCALE: 1=1
CHECK BY:	PAGE 1 OF 3	DATE: 12-12-01

HOV 15,000 PR

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