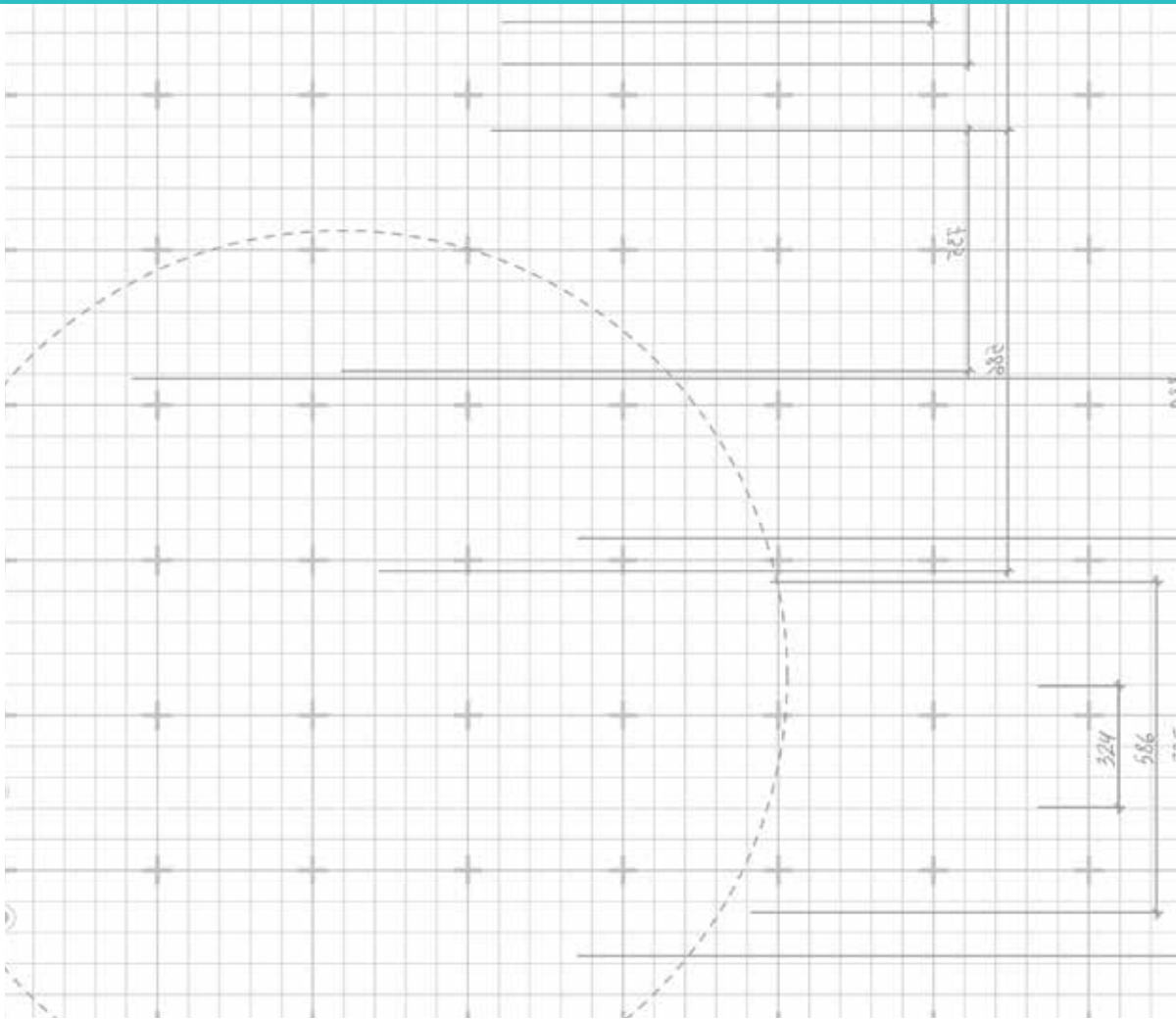


SMART VALVE SYSTEM (SVS) OPERATING AND MAINTENANCE MANUAL





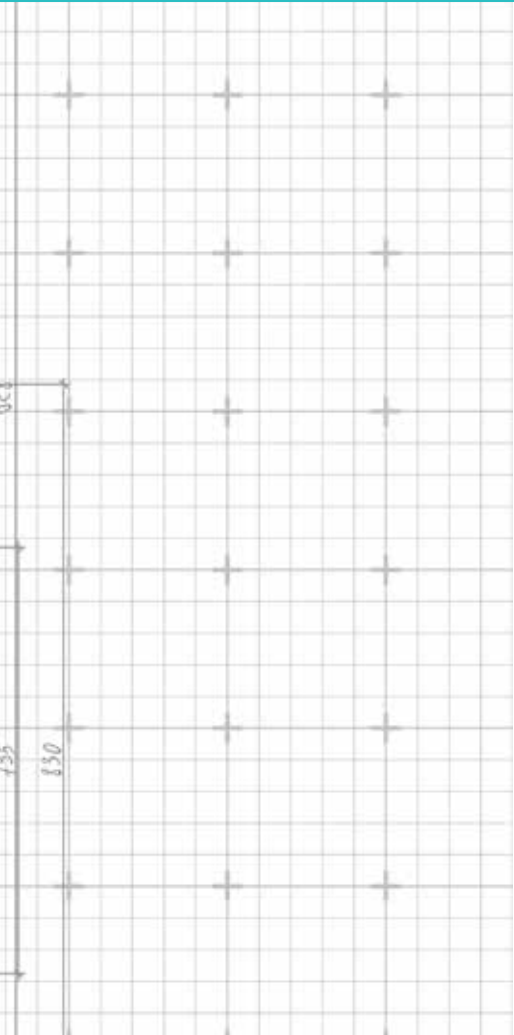
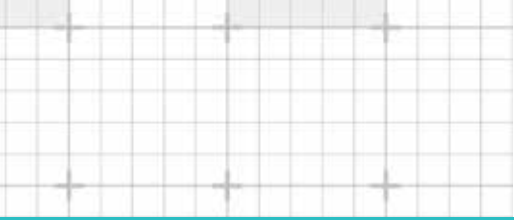


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SPECIFICATIONS

PHYSICAL	SVS Control Box	Junction Box
Length	10 in / 254 mm	4 in / 101.6 mm
Width	10 in / 254 mm	4 in / 101.6 mm
Height	4 in / 101.6 mm	2 in / 50.8 mm
Weight	9 lbs / 4.08 kg	0.41 lbs / 0.19 kg
ELECTRICAL		
Input Voltage	110V	NA
Input Power	40VA	NA
Fuse	2A time delay	NA
Maximum Actuator Power	20VA	NA
Dry Cooler Output	Dual normally open contracts rated 40V @ 100VA	NA
OPERATING SPECIFICATIONS		
Air Temperature Range	20°F - 70°F (-6°F - 21°C)	NA
Air Temperature Differential	1°F - 5°F (0.6°C - 2.8°C)	NA

TECHNICAL DESCRIPTION

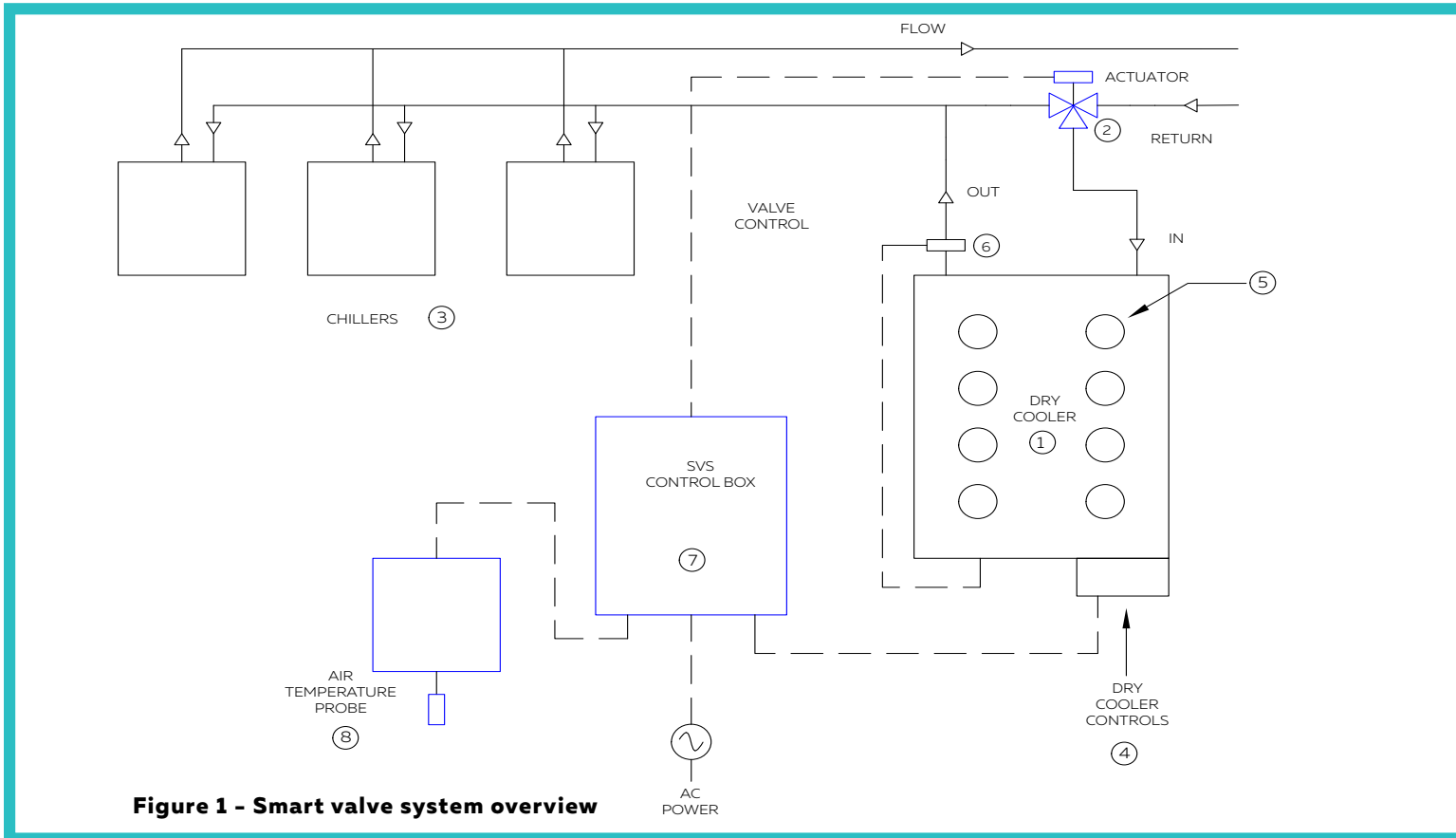


Figure 1 - Smart valve system overview

The Smart Valve System (SVS) allows up to two dry coolers to be added to a Surma hydronic cooling system. The automated valve system and associated controls cycle the dry cooler(s) to supplement the primary chilled water loop based on outside temperature. The SVS increases system efficiency and decreases operating costs. **Figure 1** shows the Surma SVS as integrated into a hydronic cooling system. In this case, only one dry cooler (4) is shown. The SVS components are shown in blue.

The system operates as follows:

The external air temperature is monitored by an air temperature probe (8), mounted separately from the unit. When the external air temperature is above 35°F (1.7°C), the dry cooler (1) is bypassed by the three-way valve (2) and the chillers (3) support the entire cooling load.

When the external temperature is at or below 35°F (1.7°C), the three-way valve will operate to allow return water to flow through the dry cooler. At the same time, the dry cooler controls will be enabled.

The dry cooler controls monitor the return water using a water temperature probe (6). When the return water is above 45°F (7°C), the dry cooler fans will run (5), pre-cooling the return water before it flows into the chillers. When the return water goes below 45°F (7°C), the fans will stop.

When the external temperature rises above 35°F (1.7°C), the dry cooler controls will be disabled and the three-way valve will bypass the dry cooler.

Each SVS control box (7) supports up to two discrete dry coolers and their associated three-way valves.

WARNINGS

DEFINITIONS

CAUTION: Risk of minor/moderate injury if precaution not taken.

WARNING: Risk of death/serious injury if warning isn't heeded.

DANGER: Risk of death/serious injury if danger isn't avoided.

SAFETY SYMBOLS USED



CAUTION: Important information, read the provided instructions carefully



WARNING: Potential electric shock hazard



Protective earth connection



Action prohibited

SVS SAFETY GUIDE



Consult with a licensed electrician before attempting electrical installation. Please read the information in this document carefully prior to attempting the installation, operation and/or servicing of the Surna SVS. This document contains all information required to install and operate the Surna SVS. Failure to follow the directions provided herein may impair the safeties provided and could cause damage to the Surna SVS equipment and/or accessory equipment, damage to building facilities, and/or cause serious injury to death to the operator. Please adhere to all applicable safety guideline requirements in this document and all applicable electrical and mechanical jurisdictional codes.



Prior to providing power to the equipment, inspect the area for water spills, which may present a shock hazard to the user. Take extra care to mount accessory electrical equipment away from areas regularly exposed to water. Provide secure wire and cable routing to protect personnel from shock hazards.



Only operate the equipment with an appropriately sized breaker in place and wire sizes with adequate current carrying capacity.



Using Surna SVS equipment in a manner not described in this manual may void its warranty .



Following unit installation and maintenance activities, observe the system operation to verify that normal operation has resumed prior to leaving the equipment to operate unattended.



Only use Surna supplied or recommended equipment with the SVS.



This unit must be connected to a protective earthing system prior to operation. DO NOT remove the grounded connection while power is being supplied to the equipment. Doing so presents an electric shock hazard to users and service personnel.

WARRANTY INFORMATION

Equipment manufactured by Surna ("Company"), the warranty shall exist for a period of twelve (12) months from initial start-up or eighteen (18) months from date of shipment, whichever period is shorter, against failure due to defects in material and/or manufacturing and warranted to the capacities and ratings set forth in Company's catalogs and bulletins ("Warranty").

Equipment, material, and/or parts that are not manufactured by Company are not warranted by Company and carry such warranties as may be extended by the respective manufacturer.

Exclusions from this Warranty include damage or failure arising from: wear and tear; corrosion, erosion, deterioration; modifications made by others to the Equipment; repairs or alterations by a party other than Company that adversely affect the stability or reliability of the Equipment; vandalism; neglect; accident; adverse weather or environmental conditions; abuse or improper use; improper installation; commissioning by a party other than Company; unusual physical, electrical or mechanical stress; lack of proper startup or maintenance as recommended by Company; operation with any accessory, equipment or part not specifically approved by Company; and/or refrigerant not recommended or supplied by Company.

Company shall not be obligated to pay for the cost of lost refrigerant or lost product or any other direct, indirect, or consequential damages. Company's obligations and liabilities under this Warranty are limited to furnishing replacement equipment or parts, at its

option, FCA (Incoterms 2000) factory or warehouse (f.o.b. factory or warehouse for US domestic purposes) at Company-designated shipping point, freight allowed to Company's warranty agent's stock location, for all non-conforming Company manufactured Equipment which have been returned by Customer to Company.

Returns must have prior written approval by Company and are subject to restocking and replacement charges where applicable.

No warranty liability whatsoever shall attach to Company until Customer's complete order has been paid for in full and Company's liability under this Warranty shall be limited to the purchase price of the Equipment shown to be defective.

Additional warranty and service protection is available on an extra-cost basis and must be in writing and agreed to by an authorized signatory of the Company.

The warranty excludes: (a) labor, transportation and related costs incurred by the Dealer or Customer; (b) re-installation costs of repaired equipment; (c) re-installation costs of replacement equipment; (d) removal costs of equipment; (e) consequential damages of any kind; and, (f) reimbursement for loss caused by interruption of service.

EQUIPMENT MANUFACTURED BY COMPANY THAT INCLUDES A REQUIRED START-UP AND SOLD IN NORTH AMERICA WILL NOT BE WARRANTED BY COMPANY UNLESS COMPANY OR ITS AUTHORIZED

AGENT PERFORMS THE EQUIPMENT STARTUP.

COMPANY MAKES NO REPRESENTATION OR WARRANTY, EXPRESS OR IMPLIED, REGARDING PREVENTION OF MOLD/MOULD, FUNGUS, BACTERIA, MICROBIAL GROWTH, OR ANY OTHER CONTAMINATES.

EXCEPT FOR COMPANY'S WARRANTY EXPRESSLY SET FORTH HEREIN, COMPANY DOES NOT MAKE, AND HEREBY EXPRESSLY DISCLAIMS, ANY WARRANTIES, EXPRESS OR IMPLIED CONCERNING ITS PRODUCTS, EQUIPMENT OR SERVICES, INCLUDING, WITHOUT LIMITATION, ANY WARRANTY OF DESIGN, MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR OTHERS THAT ARE ALLEGED TO ARISE FROM COURSE OF DEALING OR TRADE.

SMART VALVE SYSTEM ORDER

Below is a list of all parts provided with each SVS. The following are included with the order (quantities are dependent on individual order).

1. Surna SVS product manual
2. Junction box (includes air temperature probe and two (2) wire nuts) (**figure 3**)
3. Surna SVS control box (**figure 4**)

The following parts are necessary for the SVS to function properly and may be provided by Surna or customer at customer's discretion:

4. Three-way valve
5. Valve actuator

INSTALLATION INSTRUCTIONS

PLUMBING

Figure 2 shows a detailed view of the three-way valve. Surna recommends installing four union ball valves (9) at the specified locations, to allow the system components to be isolated for any service or replacement. Surna also recommends a flow meter (10) of the customer's choice be installed to measure the flow rate of the inlet water to the dry cooler, as shown in **figure 2**. Consult a licensed plumber in your area if you are not familiar with the installation of this recommended equipment.

SVS CONTROL BOX

The SVS Control Box should be mounted in a location that is easily accessible for operation and maintenance.

AIR TEMPERATURE PROBE

The junction box containing the external air temperature probe should be mounted in a location that is shielded from direct sunlight and out of the wind, as shown in **figure 3**. The junction box should be mounted in an orientation such that the air temperature probe points down, so that snow and ice will not accumulate around or on the air temperature probe. Connections to the probe should be weather proof. See **figure 3** for recommended mounting distances and a detailed view of the junction box with air temperature probe. Terminations to the probe leads are then made inside the junction box using the included wire nuts.

WATER TEMPERATURE PROBE

The dry cooler controls have an external temperature sensor that should be fitted in a well in the outlet water from each dry cooler, as indicated previously by (6) in **figure 1**. This sensor detects when the outlet water is above the configured set point, and runs the fans based on this as well as the differentials set, provided that the unit is enabled by the control box. The water temperature probe is included standard with the dry cooler.

WIRING

Contact an electrician if you are not familiar with the local codes and standards in your jurisdiction. Before attempting electrical installation, be sure to verify that appropriately sized circuit breakers are in place to handle the electrical load of your SVS. See the **specifications** section of this document for electrical specifications. Consult an electrician for more information on power wire sizing and connection.

Figure 4 is a wiring diagram for the SVS Control Box. Use this figure as a reference for the following sections.

THREE WAY VALVE WIRING

The system is designed to have the valve stem up during normal operation with the flow going only through the chillers. When the SVS control detects the outside temperature is at or below the set point, the valve positioner will drive the stem down to divert the flow through the dry cooler(s).

Run a three-core control cable (18 AWG) from the three-way valve terminals in the control box to each three-way valve.

1. Control Box Terminal B to Valve Terminal B
2. Control Box Terminal W to Valve Terminal W
3. Control Box Terminal T1 to Valve Terminal T1

DRY COOLER WIRING

The dry cooler will be enabled to run when the outside temperature is at or below the set point and when the three-way valves are operating.

Run a two-core control cable (18 AWG) from the dry cooler terminals in the control box to each dry cooler.

1. Control Box Terminal N/O to Dry Cooler Terminal
2. Control Box Terminal COM to Dry Cooler Terminal

EXTERNAL PROBE WIRING

Run a two-core control cable (18 AWG) from the temperature probe terminals in the control box to the temperature probe.

1. Control Box Terminal white to external temperature probe white lead
2. Control Box Terminal black to external temperature probe black lead

POWER INPUT WIRING

The unit may be powered from 110V, 208V or 230V AC at 40VA and is shipped set up for 110V input. For protection, it is fitted with a 20mm x 5mm 2AT incoming fuse. The unit must be grounded. To change the voltage to 208V, remove the black wire from the power terminal block and insulate it. Locate the red wire on the primary side of the transformer and connect this to the power terminal block. To change the voltage to 230V, remove the black wire from the power terminal block and insulate it. Locate the orange wire on the primary side of the transformer and connect this to the power terminal block.

PLUMBING DETAIL

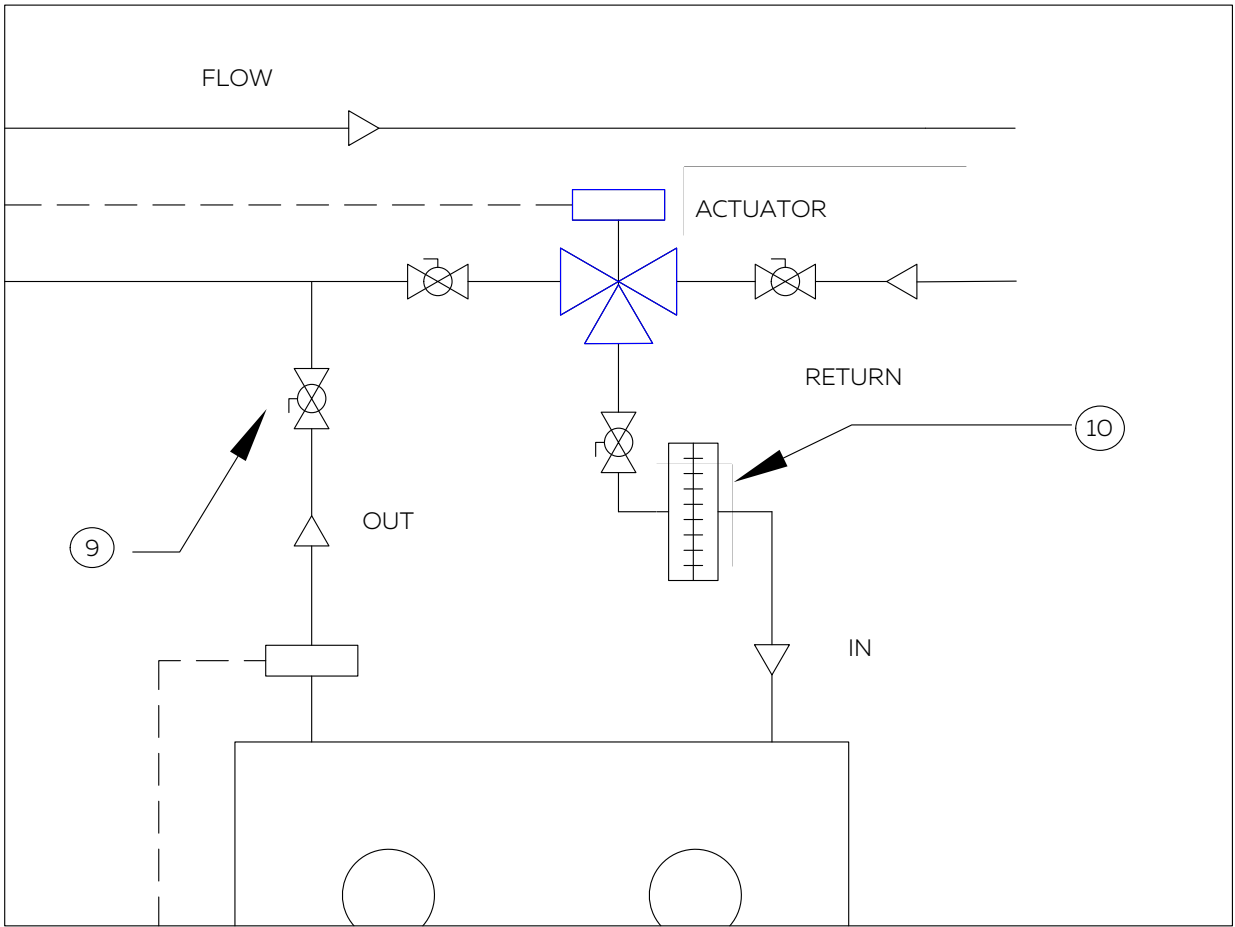


Figure 2 - Plumbing detail for the SVS

MOUNTING DETAIL

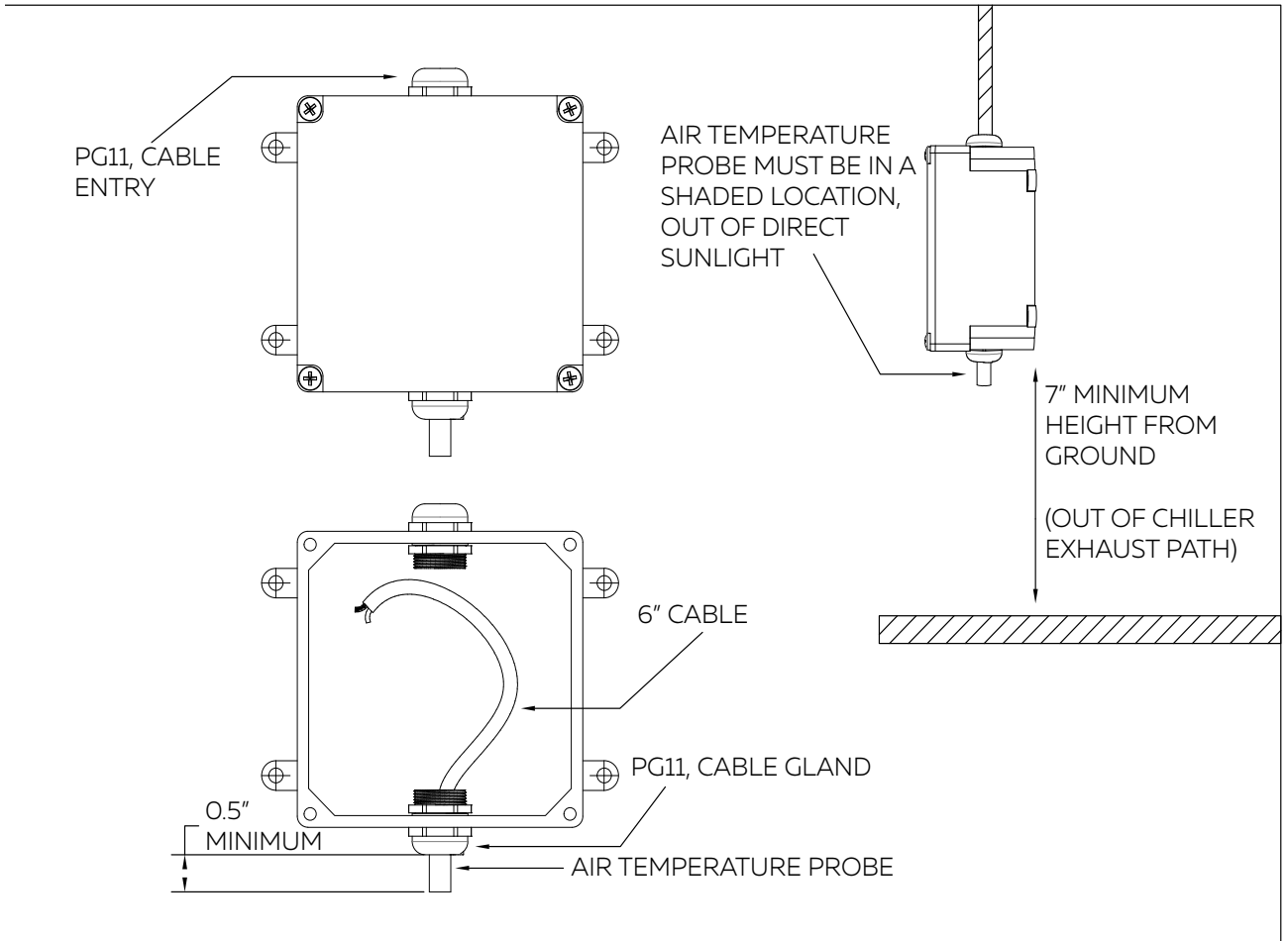


Figure 3 - Junction box with air temperature probe mounting diagram

WIRING DIAGRAM

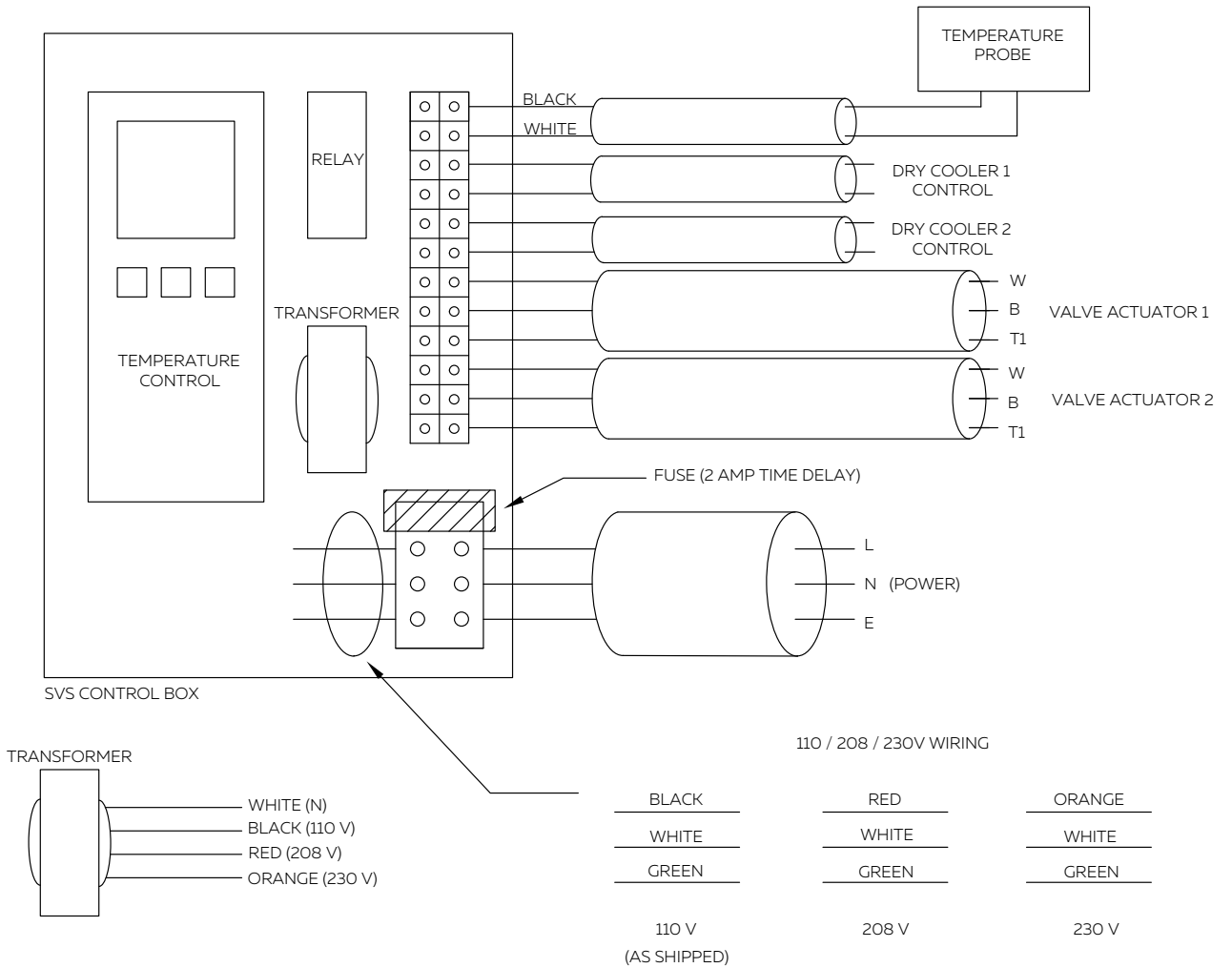


Figure 4 - SVS control box wiring diagram

OPERATION INSTRUCTIONS

Surna's SVS system is designed to be entirely automatic and in continuous operation once the installation, electrical wiring, and programming has been completed.

Note: SVS is not designed to operate during any period where the outside air temperature is above 35°F (1.7°).

CONTROL BOX

To program the unit up to function as required, the following procedure must be used.

1. Power the unit on. The three-way valve motor may run if the valve is not in the home position. Wait until it stops moving to complete the programming.
2. The Ranco display will show "S1" and the current temperature (or "EP" if the temperature probe is disconnected).
3. Press SET on the Ranco Controller and the backlight will illuminate.
4. Press SET again and "F" will be displayed confirming units in degrees Fahrenheit.
5. Press SET again and "S1" will flash and the set point will be displayed. This should be set to 35°F (1.7°C). Use the up and down keys to adjust.
6. Press SET again and "DIF1" will flash and the differential will be displayed. This should be set to 1°F (0.6°C). Use the up and down keys to adjust.
7. Press SET again and "H1" should be displayed. Use the up arrow key to toggle if "C1" is displayed.
8. Press SET again to complete setup and the current temperature will be displayed.

DRY COOLER CONTROLS

Please refer to the Johnson Controls documentation for setting the set points and differentials on the dry cooler.

ROUTINE MAINTENANCE

While routine system maintenance is not specifically required for the continual operation of the Surna SVS, it is recommended to check components of the system seasonally to ensure proper working condition.

During consistent external air temperatures below freezing, ensure that the air temperature probe is not covered in either ice or snow.

During the transition from warm to cold seasons, the customer may want to ensure preemptively that the dry cooler and dry cooler fans will run as expected. This can be achieved by temporarily changing the set point within the SVS Control Box to a higher temperature, allowing the customer to check that the three-way valve and dry cooler fans operate normally.

TROUBLESHOOTING

The SVS is designed to provide the customer with years of worry-free operation. In the event that the SVS does not work properly, check the system for the errors listed below and implement the corresponding solution. Remember to adhere to all safety guidelines outlined in the **warnings** section of this document before attempting to troubleshoot the system.

RANCO DISPLAY WITHIN THE SVS CONTROL BOX SHOWS "EP"

The air temperature probe is disconnected. Reconnect the air temperature probe and check to ensure all electrical connections are working properly.

RANCO DISPLAY WITHIN THE SVS CONTROL BOX IS BLANK

There is no power to the unit. Check the fuse and ensure that power is supplied to the unit.

THREE-WAY VALVE OPERATES, BUT DRY COOLER DOES NOT RUN

Check to ensure that the water temperature probe at the outlet of the dry cooler is connected and working properly. In the event that the probe has failed, contact the supplier of the probe (Surna, or a third party) for a replacement. If the probe is connected and functional, the control signal is not reaching the dry cooler. Ensure all electrical connections are working properly.

CONTACT US

Contact Surna via email at support@surna.com or via phone at 303.993.5271.



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