

**DSD-2 Differential Thermostat .**

This microcomputer based controller is capable of Testing and Controlling the Temperature Difference between Two remote locations. It reads the temperature from two external sensor probes and controls the heaters, fans or coolers via the on-board relays in order to maintain the temperature difference within the preset range as programmed by the user.



Front view of the DSD-2 controller.

**“ON” ( maximum ) DIFFERENTIAL :**

The “ON” or “UPPER” Differential is programmed by a single rotary knob located on the right hand side of the controller face plate under the 3-digit LED display indicating the preset value during programming. When the setting is complete, the display shows the current temperature reading from the external probe designated as the **IN**side probe and every several seconds it will also indicate the “UPPER” differential preset value. Note, that a variety of standard and custom ranges are available.

**NOTE:** When a DOT in the lower right corner of this display is ON, it also indicates that the load controlling relays are energized.

**“OFF” ( minimum ) DIFFERENTIAL :**

The “OFF” or “LOWER” Differential is programmed by a single rotary knob located on the left hand side of the controller face plate under the 3-digit LED display indicating the preset value during programming. Note, that this knob also controls the thermostat’s ON / OFF function .

When the setting is complete, the display shows the current temperature reading from the external probe designated as the **OUT**side probe and every several seconds it will also

indicate the “LOWER” differential preset value. Note, that a variety of standard and custom ranges are available. Both Differential presets may be changed at any time.

**NOTE:** The controller has an “Anti-Cycle” function built in, that prevents the relays from switching too frequently when the temperature is near the switching point.

Additional options like OVERHEAT PROTECTION, LOW TEMPERATURE LIMIT and FREEZE PROTECTION are available also with additional, medium power relays that can be used to activate additional Fans, Pumps or Valves .

**Temperature Sensor PROBES:**

Each controller kit includes 2 external temperature probes. A number of standard Temperature Probes is available depending upon the application. Most probes are small in size. The most popular is a black anodized housing appx. 25 mm long and 5 mm diameter ( 1“lg. x 0.2” dia. ). The probes have two thin wires attached at one end.

The wiring may be extended with *any type of a 2-conductor cable* up to appx. 150 m ( 500 ft. ).

Standard probes have 1% accuracy and the operating ranges vary from 0F to +208F (-17C to +98C) up to -60F to +480F (-50C to +250C).

The probes are enclosed in a non-corrosive housing that may be Stainless Steel, chrome plated, black anodized, brass or plastic with two PVC or Teflon jacketed leads, sealed with epoxy resin to prevent moisture penetration. Please note that it is advisable to protect the leads with additional coat of, for instance, silicon sealant or epoxy rosin against possible excessive moisture condensation.



DSD-2 controller view with mounting front plate and two attached temperature probes with leads extendable up to 500 ft (150m).

**Electrical:**

The DSD-2 controller models are available for 120Vac, 208-240Vac, 12Vac, 24Vac, 50Hz or 60Hz as well as 12V or 24V DC. The supply voltage must be specified when ordering. The controller electronics is protected by one on-board 20 mm, removable fuse that can be serviced in the field.

Standard models have two on-board relays, each Single Pole, Normally Open. The two relays can switch loads up to 30Amp, 240Vac max. each ( 40 Amp is optional ). The contacts of both relays may be completely isolated from the controller supply and from each other, depending upon the chosen method of wiring.

**Options:**

Many Temperature and Differential ranges, as well as various types of relays and wiring methods, may be supplied upon the customer request.

In models for heating, the on-board relays are controlled to close, while in models for cooling, the relays action is reversed. Models with any desired configuration may be requested when ordering.

Models operating in either *Celsius or Fahrenheit* are available.

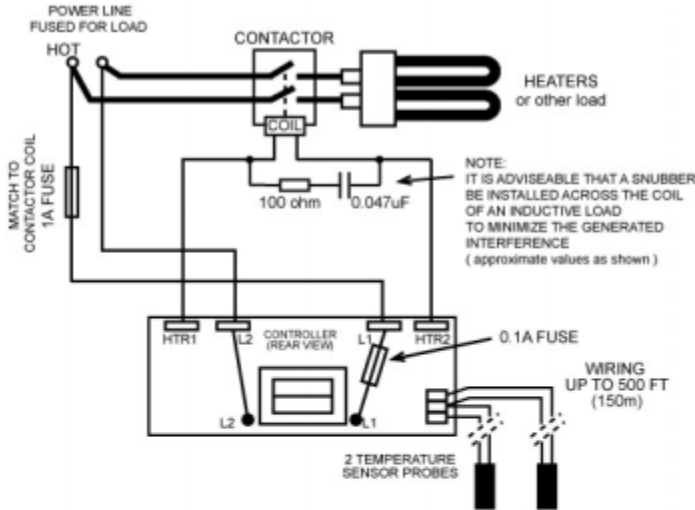
**Installation:**

DSD-2 controllers are normally shipped without enclosures (optional) and are designed to fit in a standard 3-gang electrical box or in a panel. The plastic overlay may be installed on either a customer supplied face plate or the standard Mounting Plate included in the kit. All mounting hardware, screws and wiring connectors are attached. When correctly installed, there are no screws visible on the face plate.

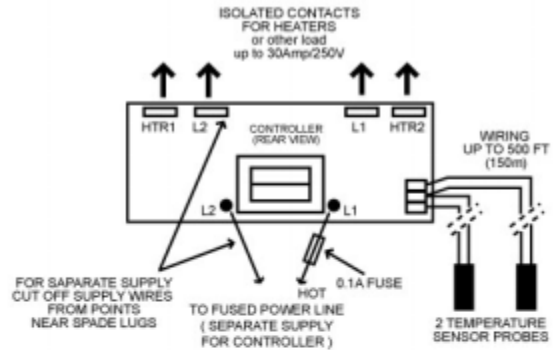
**Applications:** Solar Heating, Ventilation Control, Humidity Prevention, Air Conditioning, Heating, Cooling, etc...



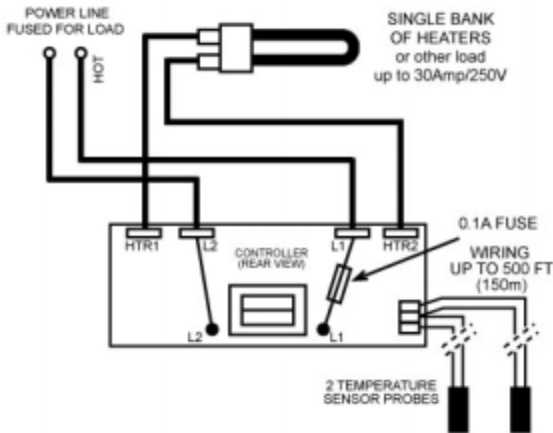
Mounting kit and accessories included with each controller set.



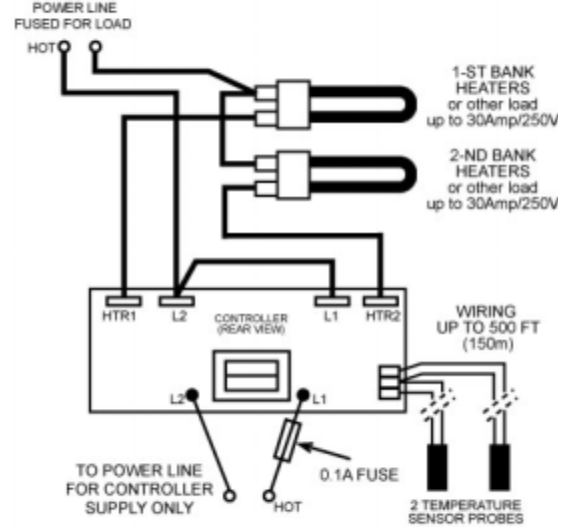
WIRING EXAMPLE WITH EXTERNAL CONTACTOR TO BOOST THE LOAD POWER



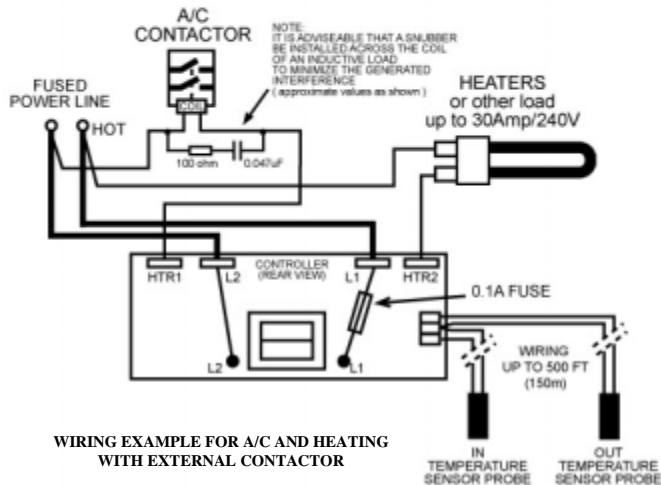
WIRING EXAMPLE WITH POWER LINE SUPPLY SEPARATED FROM THE RELAYS CONTACTS



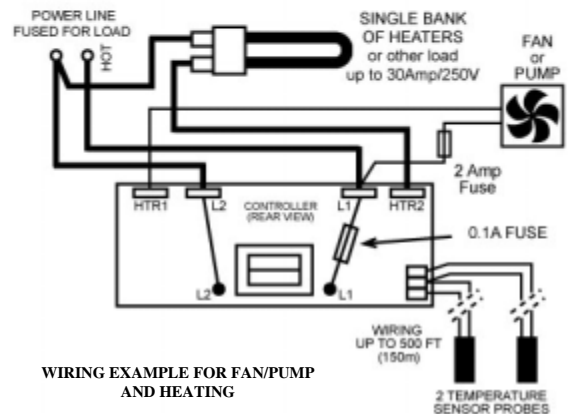
WIRING EXAMPLE WITH POWER LINE SUPPLY COMMON FOR THE CONTROLLER AND THE LOAD



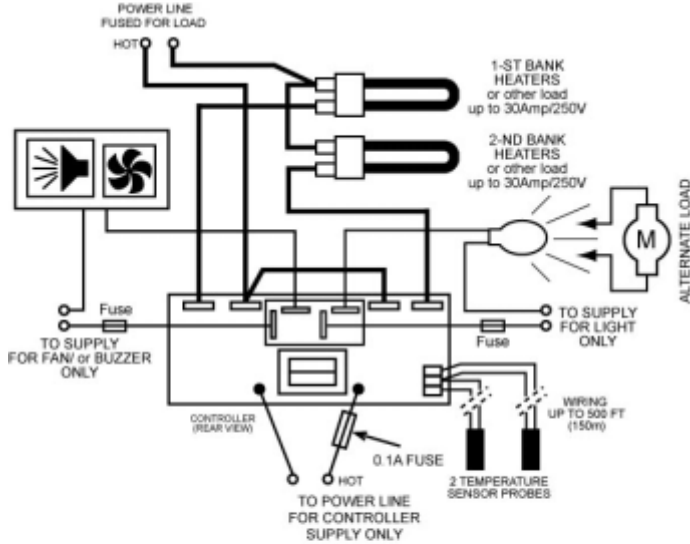
WIRING EXAMPLE WITH 2 BANKS OF LOADS ( TO INCREASE THE POWER ) AND SEPARATE SUPPLY FOR THE CONTROLLER AND THE LOAD



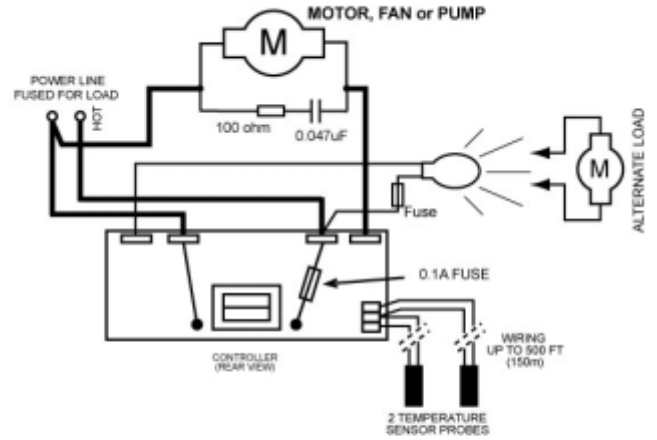
WIRING EXAMPLE FOR A/C AND HEATING WITH EXTERNAL CONTACTOR



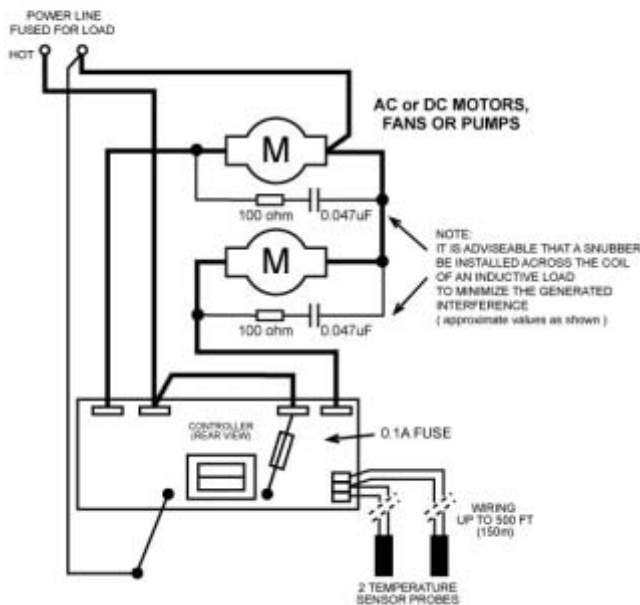
WIRING EXAMPLE FOR FAN/PUMP AND HEATING



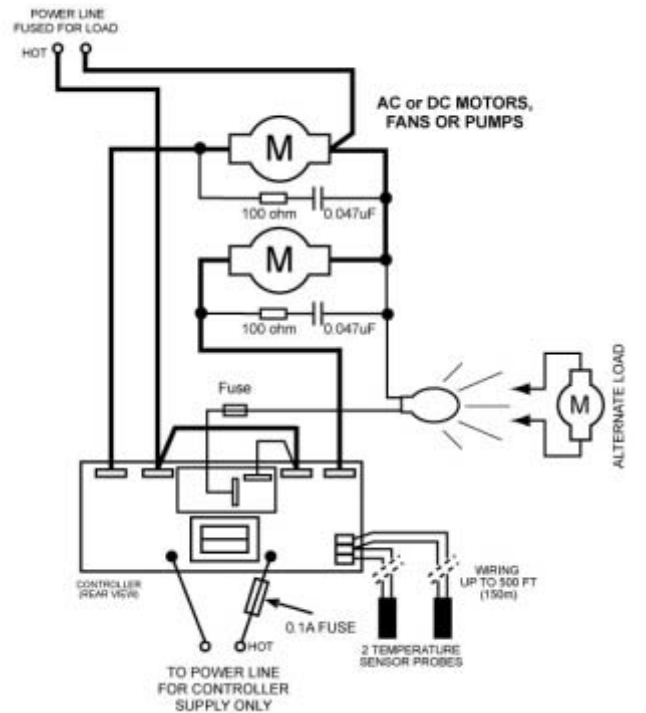
WIRING FOR 2 HIGH POWER LOADS AND 2 ADDITIONAL RELAYS FOR LIGHT, PUMP, FAN ETC... THE SUPPLY FOR LOADS AND THE CONTROLLER ARE SEPARATED



WIRING FOR MOTOR AND LIGHT OR OVERHEAT PUMP ON THE SAME POWER LINE WITHOUT ADDITIONAL RELAY



WIRING FOR 2 HIGH POWER AC or DC MOTORS AND THE SAME SUPPLY FOR CONTROLLER



WIRING FOR 2 HIGH POWER MOTORS AND ADDITIONAL RELAY FOR LIGHT, OVERHEAT OR FREEZE PROTECTION AND WITH SEPARATE SUPPLY FOR CONTROLLER



OPTIONAL SENSOR PROBE PLATES  
( PLASTIC model PPP-4 or METAL model PPS-4 )



OPTIONAL SENSOR PROBE PROTECTIVE SHIELD  
Model PG-5

NA7100KB4100BLK



NA7100KB4100CHR



NA7100KB4100RDT



NA7100KB4100SQT



NA7100KB4100DPD



NA7100KB4100SHD



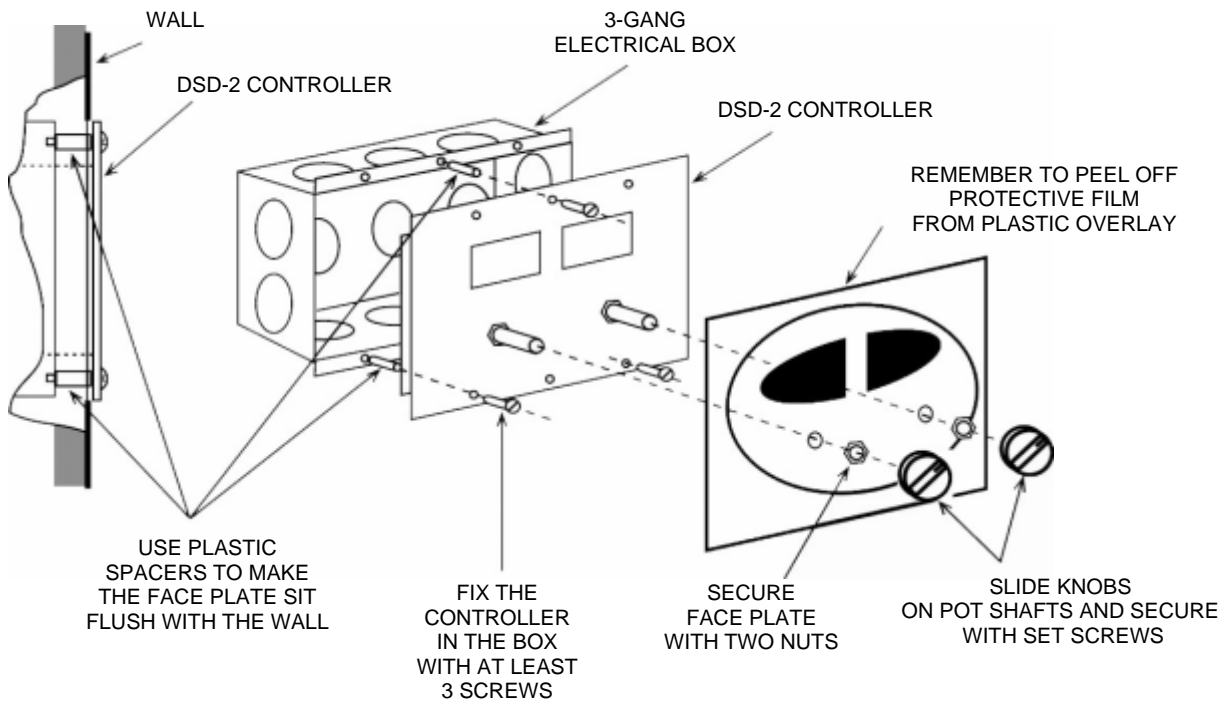
PT1000TC38550MM



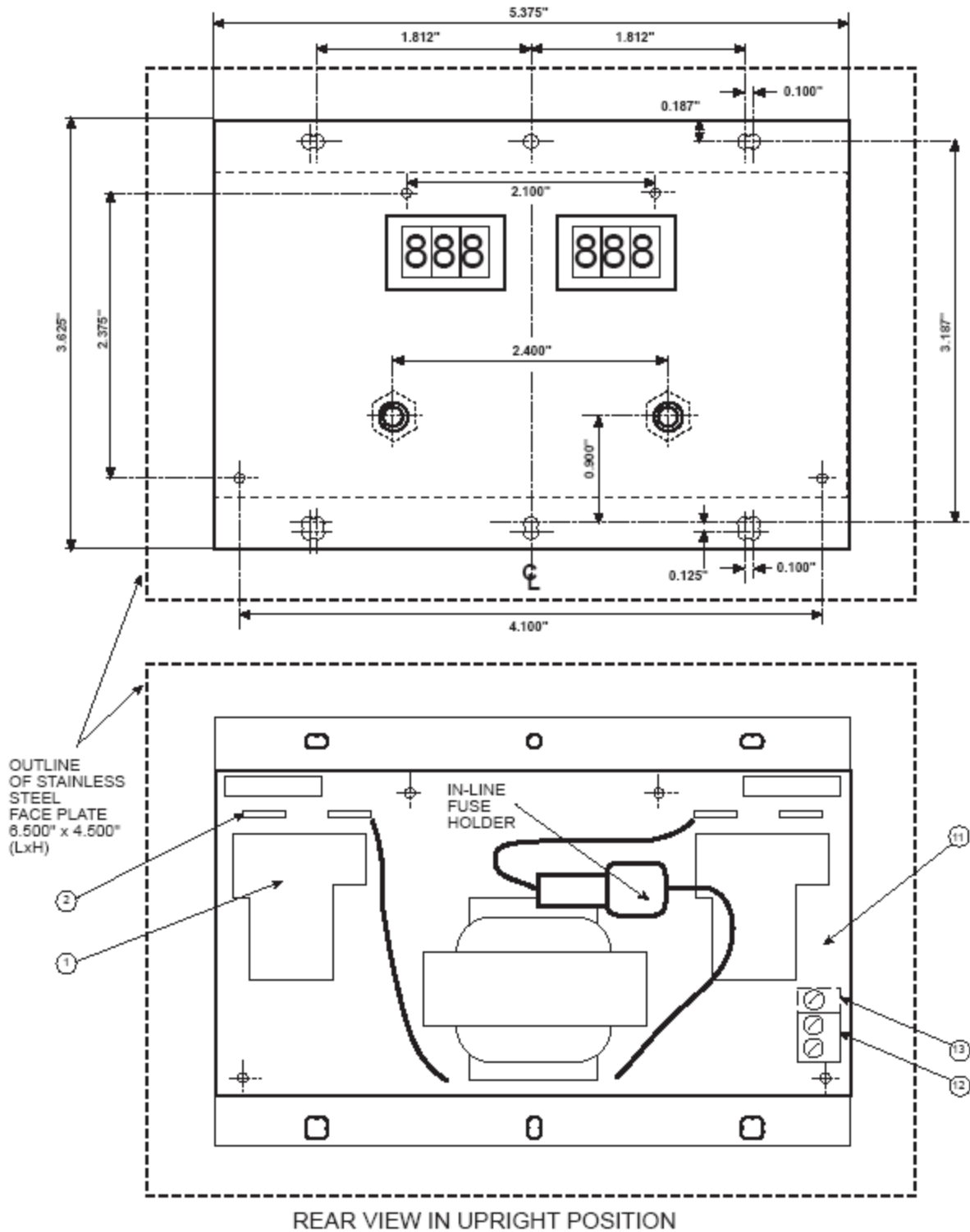
NA7100KB4100PIPTR

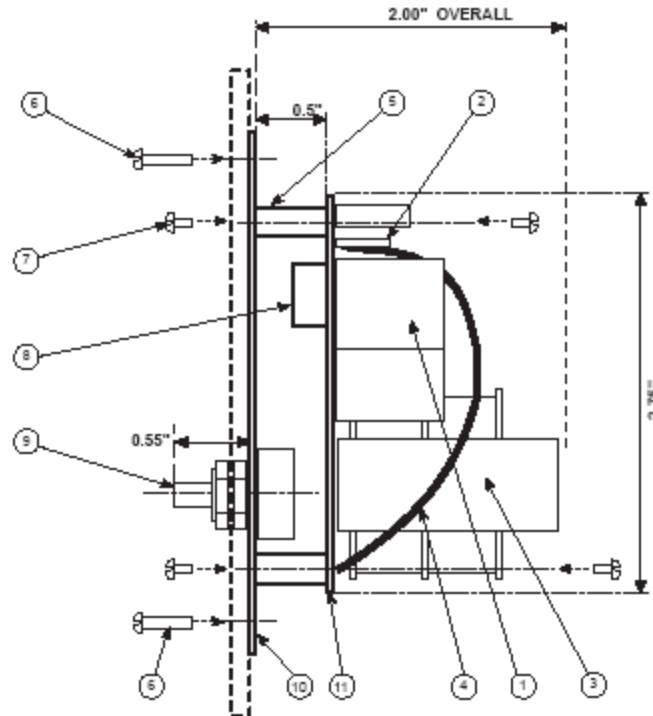


Variety of available temperature sensor probes.



**DSD-2 CONTROLLER INSTALLATION IN A 3-GANG ELECTRICAL BOX**

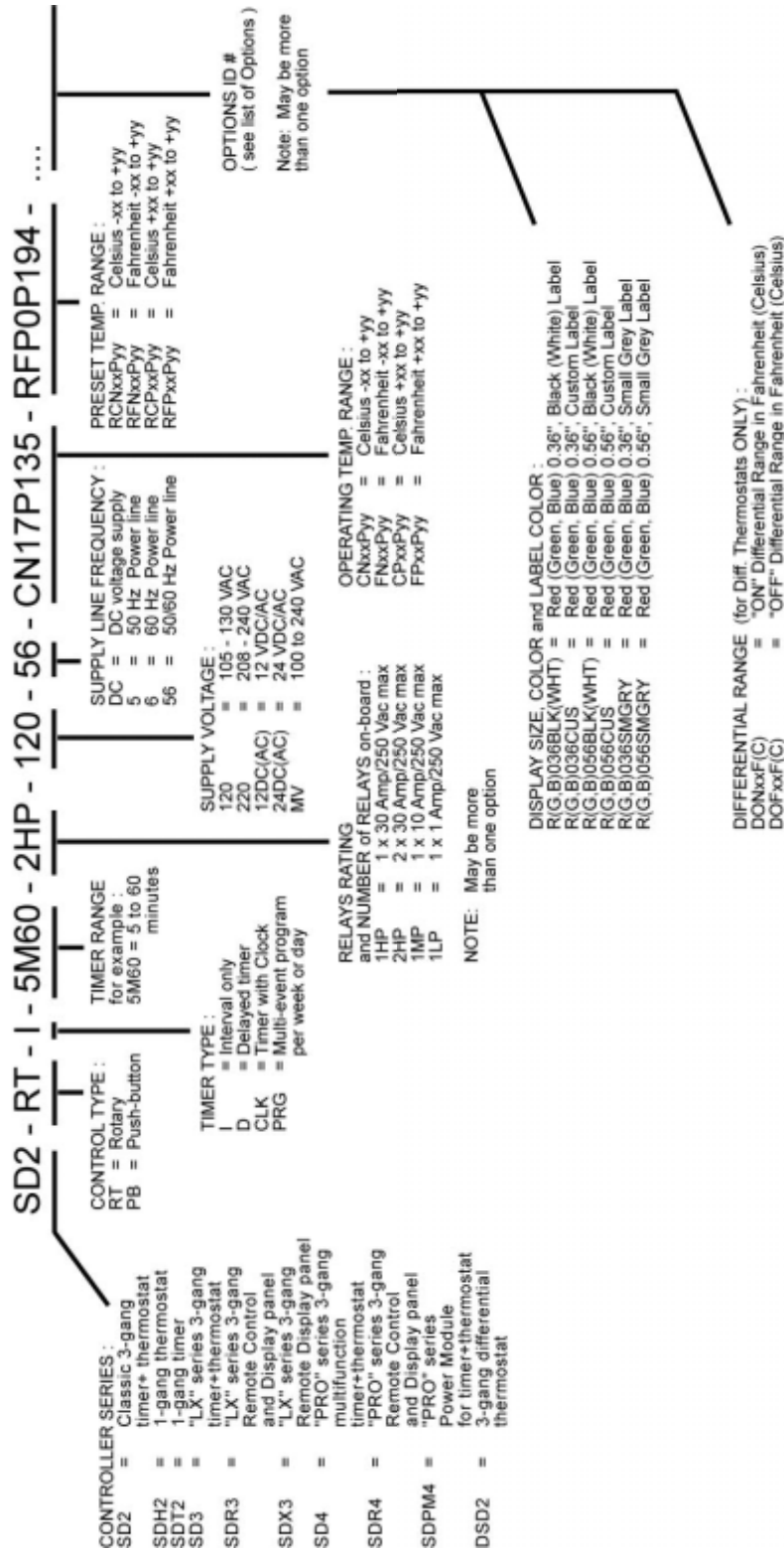




- 1 - POWER RELAYS (30Amp or 10Amp SPST contact)
- 2 - SPADE LUGS for relay contacts
- 3 - LINE TRANSFORMER (120 or 230VAC)
- 4 - WIRES for line voltage trafo.
- 5 - BOARD SPACERS
- 6 - BOX/PANEL MOUNTING SCREWS (#6-32)
- 7 - BOARD SANDWICH MOUNTING SCREWS (#4-40)
- 8 - LED DISPLAY (6 digits)
- 9 - PRESET POTS WITH FACE PLATE HOLDING NUT
- 10 - FRONT MOUNTING BOARD
- 11 - CONTROLLER BOARD
- 12 - PROBE SCREW TERMINAL BLOCK
- 13 - ADDITIONAL TERMINAL FOR OPTIONAL 2-ND PROBE

NOTE:

- 1 - HIGH POWER RELAYS MAY BE REPLACED WITH LOWER POWER
- 2 - OPTIONAL: UP TO 2 RELAYS MAY BE ADDED
- 3 - SPADE LUGS MAY BE REPLACED WITH WIRES
- 4 - FOR LOW VOLTAGE MODELS (12/24V) THE LINE TRANSFORMER IS ABSENT
- 5 - FACE PLATE LABEL DEPENDS UPON MODEL



**IMPORTANT NOTE :**

THERE ARE MANY DIFFERENT TYPES AND CONFIGURATIONS FOR THE SD-2 SERIES CONTROLLERS. WHEN ORDERING PLEASE SPECIFY YOUR REQUIRED APPLICATION AND DESCRIBE YOUR EXPECTED OPERATION SO THAT WE CAN ASSIGN THE CORRECT MODEL NUMBER TO YOUR ORDER. FOR INSTANCE, DEPENDING UPON THE MODEL, THIS CONTROLLER CAN BE USED FOR HEATING; COOLING, AIR CONDITIONING, VENTILATION AND VARIETY OF TIMER AND TEMPERATURE RANGES ARE AVAILABLE. ALSO, THE TYPE OF THE TEMPERATURE PROBE MAY CHANGE WITH EACH PARTICULAR APPLICATION.



***OPERATING INSTRUCTIONS: ( Example for Solar Heating applications )*****HOW TO START:**

The knob on the left hand side operates as the Controller ON/OFF switch.

The decimal point in the display above the knob indicates the "controller ON" status and the text "OFF" on the display indicates the "controller OFF" status.

**NOTE:** The position of this knob also sets the "MINIMUM DIFFERENTIAL VALUE" which is the temperature difference below which the load will be always switched OFF.

To see the current Minimum Preset, rotate the knob on the left (within the "ON" range) or the "UPPER" knob and observe the readings. The display on the right will show the "ON" Differential preset value, while the display on the left shows the Minimum "OFF" Differential preset value.

While adjusting the "Minimum Differential", the "ON" ( "UPPER" Differential will be automatically readjusted to maintain a constant "ON-OFF" OFFSET between the two differentials. To readjust that Offset manually, use the knob on the right ("UPPER").

**DIFFERENTIAL CONTROL OPERATION:**

Controller switches the load ON when the temperature difference between IN and OUT sensors exceeds the preset differential value ("UPPER").

The load is switched OFF when the difference becomes lower than the preset "LOWER DIFFERENTIAL" value.

During normal operation both IN and OUT temperature readings are also displayed.

Every several seconds the preset UPPER Differential value and the LOWER Differential will be displayed for a few seconds.

**NOTE:** The decimal point on the display on the right hand side is turned ON to indicate when the on-board relays are energized,

**DIFFERENTIAL TEMPERATURE ADJUSTMENT DURING OPERATION:**

User may readjust both the "UPPER" and the "LOWER" differentials by rotating either or both knobs while the controller is operating.

**HIGH TEMPERATURE WARNING:**

When the temperature exceeds the upper limit of the controller range, the message "Hi" is displayed. The load will be switched OFF.

**( Optional ) HIGH TEMPERATURE (OVERHEAT) PROTECTION RELAY:**

When the temperature exceeds the optional overheat limit, the load will be switched OFF and the optional additional Relay will be activated. This option may be useful to protect the solar heating systems.

**LOW TEMPERATURE WARNING:**

When the temperature is under the lower limit of the controller temperature range, the message "Lo" is displayed. The load will be switched OFF.

**( Optional ) LOW TEMPERATURE (or FREEZE) PROTECTION RELAY:**

When the temperature falls under the optional LOW limit ( or Freeze limit ), the load will be switched OFF and the optional additional Relay will be activated.

**( Optional ) LOW TEMPERATURE (or FREEZE) PROTECTION FUNCTION:**

When the temperature falls under the optional LOW limit ( or Freeze limit ), the load will be switched ON irregardless of the temperature differential, to assure that the pump(s) are circulating to prevent freezing. This option may be useful to protect the solar heating systems.

**MANUAL STOP:**

Turn the knob to "OFF" or activate a REMOTE STOP switch (optional).

**AUTOMATIC STOP:**

The controller stops automatically when a malfunction is detected or the controller temperature limits are exceeded.

**IDLE/MONITORING OPERATION:**

The display shows "OFF" to indicate that the controlled load is switched OFF. The controller continues to monitor and display the temperature readings from both probes.

**CAUTION:** All installation and adjustments of the controller options MUST be done ONLY when ALL POWER to the load and the controller is disconnected.

**TROUBLESHOOTING:**

The sensor wiring and internal parts are continually checked for proper operation. If a malfunction is detected, the controller will automatically switch OFF the load and deactivate itself. At the same time the display will show text "Err".

The controller cannot be reactivated until all causes of the malfunction are fixed.



Following is an example of specifications for a selected model. Note that all Differential and Thermostat ranges, electrical as well as mechanical specifications may be modified to the customer requirements.

Example model: **DSD-2-2SC-2HP-120-DON22F-DOF20F-FP0P208-NA7100KB4100BLK**  
( preconfigured for simple Solar Heating applications)

<i>SPECIFICATIONS:</i>	<i>VALUE</i>	<i>NOTES, COMMENTS</i>
<i>Electrical:</i>		
Supply Voltage:	105-130Vac, 50/60 Hz	208-240Vac, 50/60Hz or 12/24V AC/DC
Supply Current (controller):	50 mA RMS max. ( at 120Vac )	May be lower for different voltages, relays and display brightness or color
High Power Relays:		
Max. Switched Load:	2 x 30 Amp, 240Vac Max.	May be different for other relay models
Optional Medium Power Relays:		
Max. Switched Load:	2 x 10 Amp, 240Vac Max.	May be different for other relay models
Switching Reliability:	1,000,000 electrical 1,000,000 mechanical	For AC load
Switching Anti-Cycle:	10 sec. On ON action	May be preset to other value on request
Electr. Ambient temperature:	0 to +50C (32 to +122F) (standard)	0 to +90C extended with high temp LEDs
Control temperature F:	0 to +208F (standard)	May be extended or moved
Control temperature C:	-16 to +98C (standard)	May be extended or moved
UPPER DIFF Preset Range:	1C to 12C (2 to 22F)	Other ranges available
LOWER DIFF Preset Range:	0.5C to 11C (1 to 20F)	Other ranges available
Temp. reading accuracy:	+/- 1%	Over the operating range
Hysteresis (differential):	+0.5C, -0C (+1F, -0F)	May be set to any value on request
Temp. Display resolution F:	1 F	Other available on request
Temp. Display resolution C:	1 C	Other available on request
Probes Temperature Range:	-40 to +140C (-40 to +284F) (standard)	Extended temp. avail. on custom orders
Probes wiring distance:	500 Ft. (150 m ) max.	May be extended on special order
Probes dimensions:	25mm lg. x 5mm dia. (1" x 0.2" dia)	Black or Chrome plated or brass housing
Display color:	Super RED	Different colors upon request
<i>Mechanical:</i>		
Face plate:	Stainless Steel	Controller may be installed without face plate
S.S. face plate dimensions:	165mm x 115mm ( 6.5" x 4.5" )	
Mounting Front plate:	Fiber Glass	Used to install
Mounting plate dimensions:	136mm x 92mm ( 5.35" x 3.62" )	
Controller dimensions::	136mm x 70mm x 48mm (LxWxD) ( 5.35" x 2.76" x 1.89" )	Models with line transformer
Overall weight:	350 gm	Models with line transformer
Shipping Packaging:	Carton padding 6 pcs per volume of 432mm x 127mm x 152mm ( 17" x 5" x 6" )	6 sets per volume, 24 sets per carton
Accessories pack:	Pointer Knobs: 2 pcs Crimp Spade connector: 4 pcs, Mounting screws: 4 pcs S.S. plate and Plastic Label: 1 pc each	