

**HELIOTROPE
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MODEL DTT-74 / 794

DRAIN DOWN CONTROL

Installation Instructions

DESCRIPTION

The Delta-T DTT-74/794 controllers are for use with a 115 VAC circulation pump and the HG 115VAC or 12VDC drain down valve. The DTT-74 / 794 is the culmination of years of data on the best method of control logic for drain down systems. The DTT 74 / 794 assures proper performance and protection from freeze damage.

CONTROL LOGIC

The following chart summarizes the valve and pump functions that the control performs at set temperatures:

Valve Opens:	80° collector temperature and stays open a minimum of 45 minutes. 10 minute wait begins before pump can come on.
Valve Closes:	55° collector temperature or high limit storage temperature (160° or 180°)
Pump On:	15° or greater differential temperature. Also for 10 minutes during valve closing if valve closing is caused by storage reaching high limit.
Pump Off:	3° or less differential temperature. High limit temperature (pump stays on for 10 minutes after high limit temperature is met, during closing)

DAILY SEQUENTIAL EVENTS

Valve - OPEN

When collector has reached 80° regardless of differential. The valve will open and remain open for a minimum of 45 minutes. This time period is required to prevent the premature draining of collector when incoming cold water possibly cools the collector to below 55°F

Pump - ON

Once valve has been activated for 10 minutes. Pump is allowed to turn on if collector is 15° or more degrees warmer than storage. Also the pump will continue running for 10 minutes after high limit has been reached and the valve has been deactivated to drain.

Pump - OFF

Pump turns off when collector is 3° or less, warmer than storage. Pump also turns off after a 10 minute delay when high limit has been reached.

Valve - CLOSE

When collector has dropped to 55° or less the valve will deactivate (close).

High Limit - OFF

When storage temperature reaches the selectable high limit (160° or 180°) the drain down strategy commences. The valve deactivates (closes) while the pump continues to run for 10 minutes.

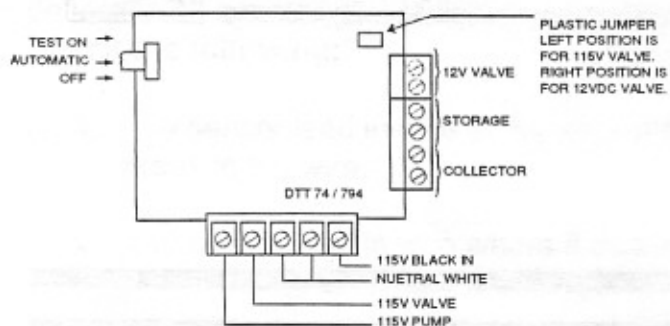
The hysteresis of the high limit is set at 30° to prevent refilling the heated collector after minimal hot water use.

CONTROL INSTALLATION

Mount the control box on an inside wall, where it will not be exposed to weather, close to the pump to be controlled. The control may be mounted using the mounting holes in the backside of the wiring compartment.

Power Wiring for DTT-74

After verifying correct voltage (115 VAC) and disconnecting power, make connections to the high voltage terminal strip as shown in illustration.



This control should be installed by a qualified electrician and conform to the National Electric Code and prevailing local codes.

Connect all ground wires (green) to case ground clip. If valve is 12VDC see **“POWER CONNECTION FOR 12VDC VALVE”**.

Power Connections DTT - 794

The incoming 115VAC power is supplied by plugging the line cord into any grounded 115VAC outlet.

The connections to the 115VAC pump and valve are made by plugging their linecords into the appropriate grounded outlets on the bottom of the controller marked **“PUMP”**, **“VALVE”**.

Power Connections for 12VDC Valve

The two pin connector above the four pin sensor connector is for the low voltage connection to a 12VDC drain down valve. Remove connector, inset wires from valve under connector screws and tighten firmly into place. Reinsert the connector.

NOTE: The controls are shipped from the factory set to operate only a 115VAC drain down valve. To operate a 12 VDC drain down valve an internal change must be made to the control. To change; remove cover from controller, locate plastic jumper on right side of the circuit board identified **“VALVE”**, move jumper from left to right position, replace cover.

HIGH LIMIT SETTINGS

The DTT - 74 / 794 controls are shipped from the factory preset at 160° high limit. To change the high limit to 180°, two (2) wire jumpers on the circuit board must be cut. Locate wires on the right side of the circuit board and cut as instructed.

SENSOR PLACEMENT

The sensor leads are Class 2 wiring and carry 4VDC. Use two conductor 18-24 GA zip or bell wire to run from sensor location to the control.

Collector Sensor

Attach **SAS-10** sensor with hose clamp to outlet pipe of collector array as close to collector as possible. Insulate over the installed sensor. This sensor detects the higher temperature of the Delta-T function and determines when the valve should open and close.

Storage Sensor

Attach **SAS-10** sensor as close (thermally) as possible to storage tank bottom. The mounting can be achieved by (1) using a sensor mounting stud supplied on some solar hot water tanks. (2) taping sensor to wall of tank under tank insulation, or (3) clamping (hose clamp) the sensor to a supply pipe at the tank bottom and insulate. This sensor detects the temperature of the cold water in the tank for the differential function. It also doubles as the high limit sensor.

CAUTION: This high limit device is not UL approved as temperature limiting device. Water leaving the solar storage tank hotter than 180° may cause unsafe pressures and temperature in the storage tank. It may be necessary to add a temperature limit control in the system to prevent risk of water overheating.

Insulating Connections and Sensors

At the termination of all sensors weather insulating procedures should be exercised. If the wire nuts are exposed to weather they should be sealed with silicone. When a sensor is installed on the outside of a pipe, the sensor must be covered with waterproof

thermal insulation so that the sensors will pick up only the temperature of the surface, not the ambient air. This is absolutely necessary for accurate sensing.

Immersion Sensors

Should it be necessary to place the sensor into a liquid, it is recommended to utilize one of the optional sensors designed for this: BP - 25 - 10, BP - 50 - 10, RBP - 50 - 10, IS - 2.5 - 10 or IS - 1.0 - 10.

Protection of Sensors and Sensor Wiring

Sensor wiring can cause apparent control failure:

1. Use caution when stapling wires. The insulation can be broken and the wire may be shorted or open.
2. Check for wires not secured for protection against breakage or damage.
3. Use caution when pulling wires through metal flashing as wire may be easily stripped or shorted by sharp metal objects.
4. Protect buried wires from shovels, burrowing animals, etc. Use conduit.

Sensors require protection:

1. Attach sensors securely to pipe, collector, etc. and insulate from air contact to obtain a correct indication.
2. Waterproofing is important because moisture from rain, humidity, etc. can corrode the wire connections and cause sensor failure. Also, corrosion can cause breakage and inaccurate readings. To protect from this, seal wire nut connections with silicone and wrap with tape.
3. Check the physical location of the sensor in relation to external sources of heat or heat sinks eg. vents blowing air onto sensors. Sensor location

plays a very important role in how accurately your control responds to system temperature changes.

CONNECTING SENSORS TO CONTROL

Sensors are connected to the controller by using a four position, plug-in connector.

Unplug the connector from the unit and orient it with screws up. Connect the two lead-in wires from the collector sensor to positions 1 and 2 by sliding the wire into the retainer and tightening the screws. Connect the two lead-in wires from the storage sensor to positions 3 and 4. Reinsert the connector into its socket firmly.

TROUBLESHOOTING GUIDE

Basic Function Test

Due to the elaborate circuitry and numerous factory temperature settings, the DTT - 74 / 794 is not capable of field testing. Contact the factory for information if the controls operation is in question.

THERMISTOR SENSORS TEST

All SAS - 10 sensors manufactured by Heliotrope General are tested to be within $\pm 0.6^\circ\text{F}$ of a reference test sensor. This means that all SAS - 10 sensors are compatible with one another. If one sensor were to fail it would be necessary to replace

only that failed sensor. The SAS - 10 sensors have a negative temperature coefficient, which means they exhibit a very high resistance at low temperatures and a very low resistance at high temperatures. To properly perform a sensor check you

F	°C	Ohms Resistance 10K
Open		Infinite
32	0	32,630
41	5	25,380
50	10	19,890
59	15	15,710
68	20	12,490
77	25	10,000
86	30	8,057
95	35	6,531
104	40	5,326
113	45	4,368
122	50	3,601
131	55	2,985
140	60	2,487
149	65	2,082
158	70	1,751
176	80	1,255
194	90	917
212	100	680
Short		None

will need a volt - ohmmeter.

Connect the volt - ohmmeter leads to the two wire leads coming from the sensor. If the volt - ohmmeter shows an infinite reading (ie: a 1 in the display or no deflection on a meter) this indicates an open circuit.

Check the following:

1. The sensor lead in wire to the sensor for a break in the wire.
2. The sensor lead in wire where it connects to the sensor leads for a possible disconnection.

If the volt - ohmmeter indicates a short (ie: a 0 in the display or full deflection on a meter).

Check the following:

1. A nail or staple through the sensor wire shorting leads.
2. Insulation that has been scraped off the sensor wires around sharp metal edges such as roof flashing.
3. At the sensor where it is connected to the sensor lead in wire to determine if the sensor itself is shorted.

If the volt - ohmmeter indicates a large variation in the resistance relative to what you believe is the true temperature referencing the "Temperature Verses Resistance" chart then a failure of the sensor may have occurred. To further check the suspected faulty sensor you can compare it to another known good sensor set in exactly the same spot with the same

insulation, if any, around the sensors. If this is not possible you can disconnect the suspected faulty sensor from the system and compare it at room temperature with a good sensor. Be sure to leave both sensors in the room together for about 30 minutes so they can both reach the same temperature. If the suspected sensors shows a large variation from the good sensors this would confirm a faulty sensor. If not, the sensor is good and the large temperature variation is probably a problem with the plumbing of the system.

Switching Type Sensors

As the name indicates, these sensors are switches which open/close at pre set temperatures. The FS-5 sensor offers an optional freeze redundancy protection and is not required with the DTT - 74 / 794 control. However, some installers may opt to install these. If so, the FS - 5 opens at 42°F with lowering temperatures and does not close until temperature returns to 52°F, $\pm 5^\circ$. It is installed in series with the SAS - 10 collector sensor.

DEFECTIVE CONTROLS OR SENSORS

All Delta-T® controls carry a ten-year limited warranty. During the first year replacement of defective merchandise with a tested replacement will be made with at no charge.

For years 2 through 5 replacement will be made for a service fee not to exceed 25% of the current list price and for years 6 through 10 the fee will not exceed 50% of the current list price. Ask for a copy of the warranty for full details.