# heliodyne
SOLAR HOT WATER

# DELTA-T PRO
# CONTROL UNITS

DELTA-T PRO
CONTROL UNITS
WIFI + ETHERNET

V. 3.1

EXCELLENCE
BY DESIGN

# Power Supply Protection for Delta-T Pro

Voltage spikes, current surges, and noise can occur in a building's AC power supply once a month or hundreds of times a day.  They can arrive from the grid or be generated inside the building by fluorescent lighting, electric motors, HVAC equipment and office machines.

If a sufficiently strong power surge is supplied to the Delta-T Pro, it may be subject to data loss, settings resetting to their default, network disconnection, or general failure.  For this reason Heliodyne recommends installing a surge suppressor between the Delta-T Pro and a power source.

A variety of surge suppressors are available.  Some surge suppressors include a circuit breaker for overcurrent protection, which is different from power surges.  Overcurrent is a condition where equipment draws more current than its rating, such a ground fault or short circuit.  Typically, overcurrent events  happen on the consumer's side of the power supply, whereas power surges happen on the utility side of the power supply.

If a surge suppressor is selected that does not provide a separate circuit breaker, there is no interruption to the power supply when the protection activates or the suppressor reaches the end of its lifetime.

For convenience, Heliodyne offers some off-the-shelf surge suppressors that are selected to provide a basic level of protection.  Please contact your Heliodyne salesperson for more information.
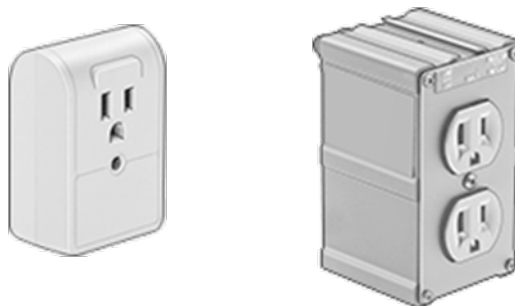
# 1. OVERVIEW

## 1.0. For service, contact Heliodyne: (888)878.8750

1.0.0. Safety Guidelines
This controller conforms to the National Electric Code and is certified by the Underwriters Laboratory. Any electrical wiring or modifications to the control I/O should be performed with the power disconnected. Service should only be performed by a qualified professional.

Carefully review all instructions in this manual for installation and use.  Do not modify equipment under any circumstances; use only as designed.  Install all components in an accessible location for servicing and maintenance.  Noncompliance with these guidelines will void all warranties.

Follow all local building codes and regulations, as well as these industry accepted guidelines and standards:

BUILDING USEC, UBC, UPC, NRCA
ASHRAE  Solar Energy Equipment
NFPA 70 National Electric Code

1.0.1. Introduction
The Delta-T Pro controller is designed to control solar thermal systems for use in domestic hot water, space heating, industrial process heating systems, and for general purpose heat metering with remote monitoring.  Special water-proof enclosure is available for solar pool heating systems.

The controller's user interface can be accessed using a PC or a MAC through its mini-USB port, or by accessing its assigned IP address with a web browser.  When the device is connected to the Internet, the controller can transmit data to the Heliodyne monitoring site for remote monitoring data logging.  For best results, Heliodyne recommends consulting an IT professional for connecting to the device and configuring network parameters. An intermediate level of knowledge in IT is required to install this controller.

The Pro Controllers contain battery-backed SRAM, protecting the system clock, settings and data in case of a power outage. Because the battery is only lightly used during these events, it is not user serviceable and will last the life of the control.

1.0.2. Models
The Delta-T Pro controller is available with an Ethernet only and Etherneet plus Wi-Fi versions

- DLTA 000 005 [Ethernet]
- DLTA 000 008 [Wi-Fi + Ethernet]

1.0.3. Hardware and sofware Requirements for initial setup
- PC or Mac
- mini-USB cable (provided with the controller)
- Window 7/8/10 or Mac OS X or Linux
- USB drivers (available at http://www.deltatcontrols.com/software-updates/1-drivers/)

1.0.4. Network Requirements for Monitoring Communication
- Consistent internet connection
- DHCP enabled network or available static IP-Address for controller
- Network must allow TCP communication on port 9999
- [Wi-Fi] 802.11b/g/n compatible router with Open, WPA-personal, WPA2-personal.
  !WEP OR WPA/WPA2-ENTERPRISE ARE NOT SUPPORTED!

1.0.5.  Surge Protection Requirements

- Voltage spikes, current surges, and noise can occur in a building's AC power supply once a month or hundreds of times a day.  They can arrive from the grid or be generated inside the building by fluorescent lighting, electric motors, HVAC equipment and office machines.
- If a sufficiently strong power surge is supplied to the Delta-T Pro, it may be subject to data loss, settings resetting to their default, network disconnection, or general failure.  For this reason Heliodyne recommends installing a surge suppressor between the Delta-T Pro and a power source.

Please contact your Heliodyne salesperson for more information.

1.0.6.  Relay Wiring

THIS CONTROLLER IS INTENDED FOR INDOOR INSTALLATIONS ONLY. THE ELECTRICAL INSTALLATION SHOULD BE PERFORMED BY AN AUTHORIZED PROFESSIONAL. FOLLOW ALL LOCAL REGULATIONS AND CODES WHEN INSTALLING WIRE, FUSES, GROUNDING, ETC. PROTECT THE DELTA-T FROM OVERCURRENT AND SURGE. BEFORE ANY ELECTRICAL WORK IS DONE, ENSURE THE DELTA-T LINE CORD IS DISCONNECTED FROM THE ELECTRICAL SOURCE.

1.  When wiring to the individual relays, use the supplied UL listed cable. This cable is prewired to the control board relay and a strain relief is provided on the controller enclosure. If the load requires larger gauge wire than what is in the cable, consult Heliodyne.

2.  The relay cable consists of three conductors, the color code is as follows:
     Black = N.O. Load, White = Neutral, Green = Ground
     *More detail is provided in section 2 of this manual

3.  Once outside of the controller enclosure, the relay cable must be run in wire duct or conduit and cannot exceed 6ft length before termination. Always conform to local electrical code and regulations and National Electrical Code NFPA 70.

4.  The termination of the end of the cable depends on the component being controlled or powered. If the three conductors are going to be terminated to a pump with screw or clamp type terminal blocks, approved wire ferrules should be installed properly on each conductor.  The three conductors must be terminated within an approved junction box for the location. Be sure the ground terminal or lug is of the proper size for the conductor. The cable must be properly connected to the junction box with an approved strain relief fitting.

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# 2. INSTALL & WIRING

## 2.0. Installation

2.0.0. Mounting the Standalone Box

The Delta-T Pro should be mounted on a wall indoors, away from weather and interference. Using the mounting holes on the back of the box, securely install 3 screws into mounting plane leaving 1/4" between the wall and the back of the bolt head; place control back upon screws and slide down to secure box tightly into screw pattern.  A screw template is provided with this manual on page 21.

An ideal installation location is:
* About 5 ft. (1.5m) off the finished floor
* Away from equipment and other sources of electrical interference
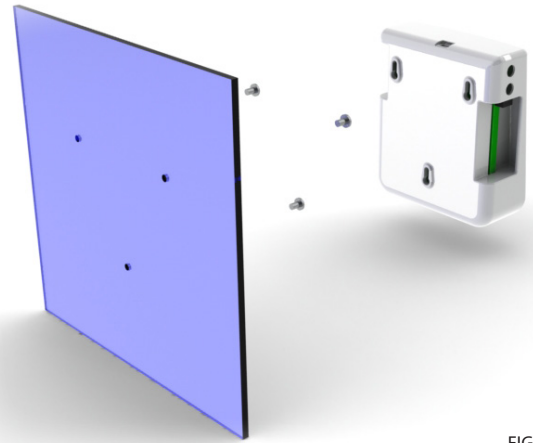* Out of direct sun; in a cool dry location

FIG. 2.0.0

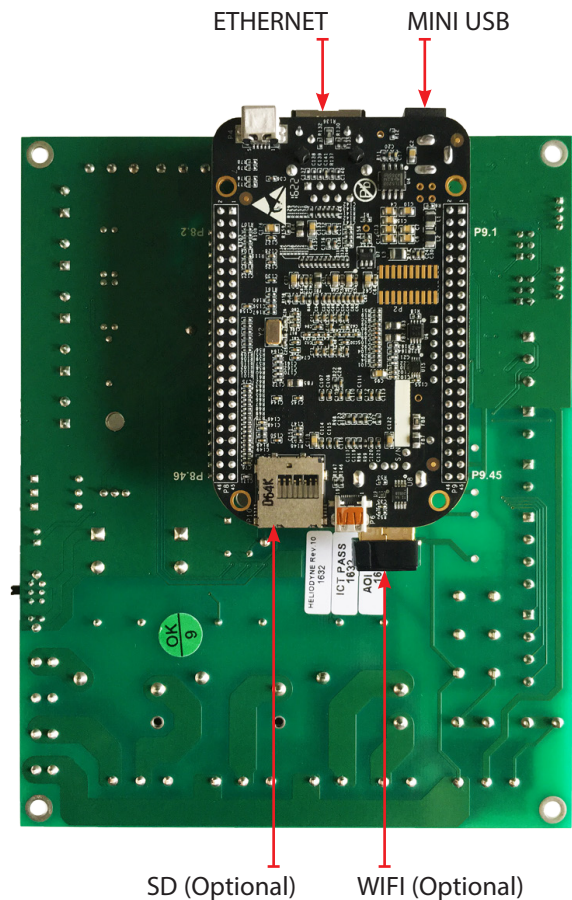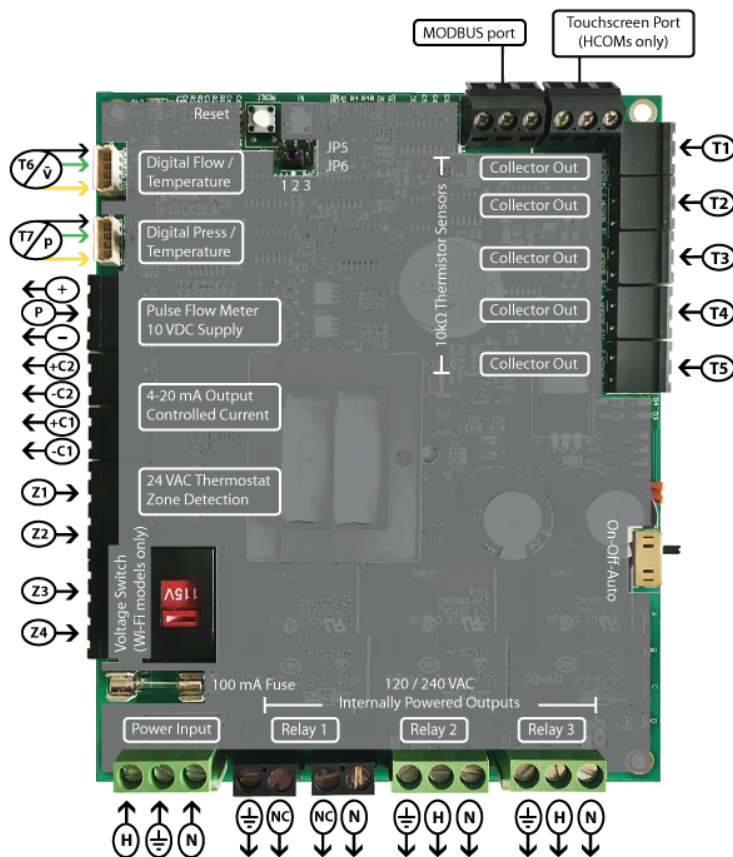## 2.1. Controller Inputs and Outputs

FIG. 2.1.0

## 2.2. Wiring

2.2.0. Power Wiring and LED Indication
This control comes pre-wired with a grounded electric cord for plug-in operation in 115VAC, 10A systems.  If a modification needs to be made to the power connection, connect the appropriate gauge Load, Ground and Neutral wires to the connector.

Red LEDs will light up when power is applied to the board. Likewise, when the relays have been activated, either by the controller or manually, red LEDs next to the active relay will show.

POWER WIRING

RED  POWER LED

RED RELAY LED

R1   R2   R3

LOAD

NEUTRAL
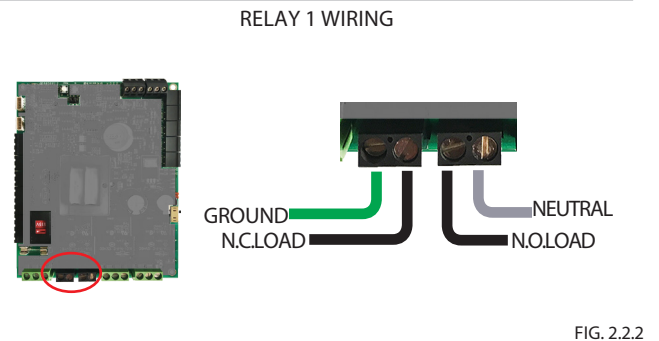
GROUND

FIG. 2.2.0
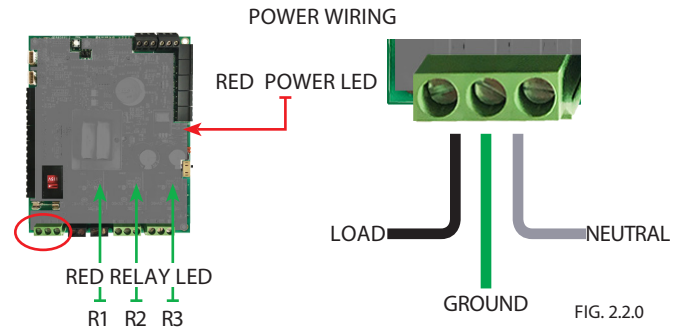
2.2.1. 230 VAC Switch
The voltage switch can be adjusted to handle 230VAC supply (modification of the cord plug may be necessary).  Use caution as this also changes the supply voltage to the relays.  I.E. if the switch is set to 230VAC supply, the pumps or accessories wired to the relays must also be able to operate on 230VAC.  Heliodyne packaged units come default with 115 VAC pumps, unless specifically ordered otherwise.

VOLTAGESWITCH

230VAC

115VAC

FIG. 2.2.1
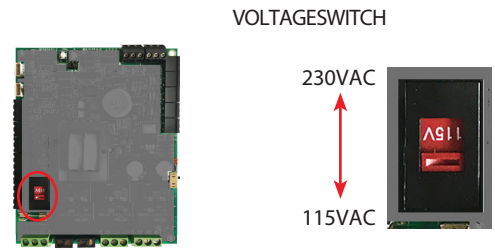
2.2.2. Relay 1 Wiring and Functionality
Relay 1 has a N.O. and N.C. connection; they share a common middle neutral connection.  For components with a ground wire, a connection can be made using the relay 1 ground connection.
   •  N.O. - Solar Relay: this is the connection for the solar operation pumps.  Both the solar and the tank pumps in dual-pump systems are connected here. It operates based mainly on T1-T2 temperature differential.
   •  N.C.: this connection can be used to power components that operate opposite to the solar operation, such as a pool controller with domestic water heating priority

RELAY 1 WIRING

GROUND
N.C.LOAD

NEUTRAL
N.O.LOAD

FIG. 2.2.2

2.2.3. Relay 2 Wiring and Functionality
Relay 2 has only a N.O. connection.  For components with a ground wire, a connection can be made using the relay 2 ground connection.  Relay 2 can have one of two potential uses, depending on the operating mode (see SETTINGS for more information on operating modes)
   •  Space Heating Mode: Relay 2 can operate a pump or valve when a thermostat terminal is closed and the set temperature is reached in the tank sensor (T2 or T3 if installed)
   •  Dual pump Mode: In dual-pump systems the controler can operate Relay 2 to power the domestic water circulator independently of the solar loop circulator.

RELAY 2 WIRING

GROUND

NEUTRAL

N.O.LOAD

FIG. 2.2.3
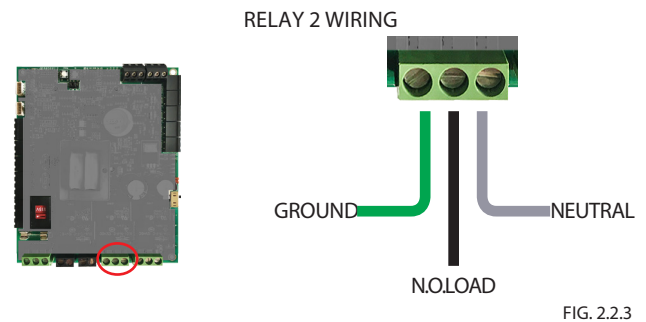
2.2.4. Relay 3 Wiring and Functionality
Relay 3 has only a N.O. connection.  For components with a ground wire, a connection can be made using the relay 3 ground wire.  Relay 3 can have four purposes:
   •  Electric Ignition Gas Tank Operation:  Connect the tank power cord to this relay.
   •  Timer Operation:  Turn this relay on and off at a set hour during each day.
   •  Aquastat Operation:  Operate this relay when a sensor reaches a set temperature.
   •  Simple Differential Operation: Operate a second differential using sensors of your choice.

RELAY 3 WIRING

GROUND

NEUTRAL

N.O.LOAD

FIG. 2.2.4

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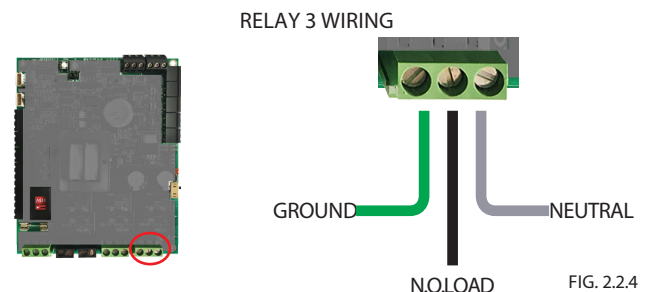
### 2.2.5. Relay Specification Summary Table

| ITEM | RELAY 1 | RELAY 2 | RELAY 3 |
|---|---|---|---|
| Contact Voltage (Wetted) | 115 or 230 | 115 or 230 | 115 or 230 |
| Contact Type | N.O. & N.C. | N.O. | N.O. |
| Max Ratings | 1HP, 115V; 2HP, 230V [N.O.] | 1/4 HP, 115V; 1/2HP, 230V [N.C.] | |

## 2.3. Sensors

### 2.3.0. Types
The Delta-T Pro can read four types of sensors: 10kΩ Thermistors and Grundfos VFS (Vortex Flow Sensor), RPS (Relative Pressure Sensor) sensors, and pluse flow sensors.

### 2.3.1. Temperature Sensors
We have two mounting styles of thermistors available, each suitable for different system placement:

- SENS 000 001: The flattened copper lug can be attached to the sensor stud on a solar storage tank, or can be strapped to the outside of the system fluid tubing (must be wrapped with insulation).
- SENS 001 001: This sensor works in conjunction with the immersion well, and can be placed in the fluid stream for greater accuracy.



BRASSIMMERSIONWELL-1/2"NPT

SENS 000 001          SENS 001 001

The sensor leads are 24AWG Class II and carry 4VDC. Use 18-24AWG zip or bell wire to run from the sensor location to the controller. Use caution when installing to avoid wire damage. Shielded wire is not necessary. Use insulation and weatherproofing for accurate sensor readings. Install out of direct sunlight. We also recommend applying thermally conductive gel between the sensor and immersion well to reduce measurement error.

### 2.3.2. Flow rate and pressure Sensors
Heliodyne supports Grundfos VFS sensors and pulse flow sensor for flow rate measurement. VFS sensor measures the frequency of the vortex street with a piezoelectric sensor and has no moving parts. Both VFS and RPS has an embedded temperature sensor. Five flow rate ranges and 1 pressure range are supported:

- FLOS 005 000 [0.25 to 5 GPM]
- FLOS 010 000 [0.5 to 10.5 GPM]
- FLOS 026 000 [1 to 26 GPM]
- FLOS 053 000 [2 to 53 GPM]
- FLOS 106 000 [5 to 106 GPM]
- PRSS 150 000 [0 to 150 psi]

SENSORINSTALLATION

THERMISTOR SENSORS
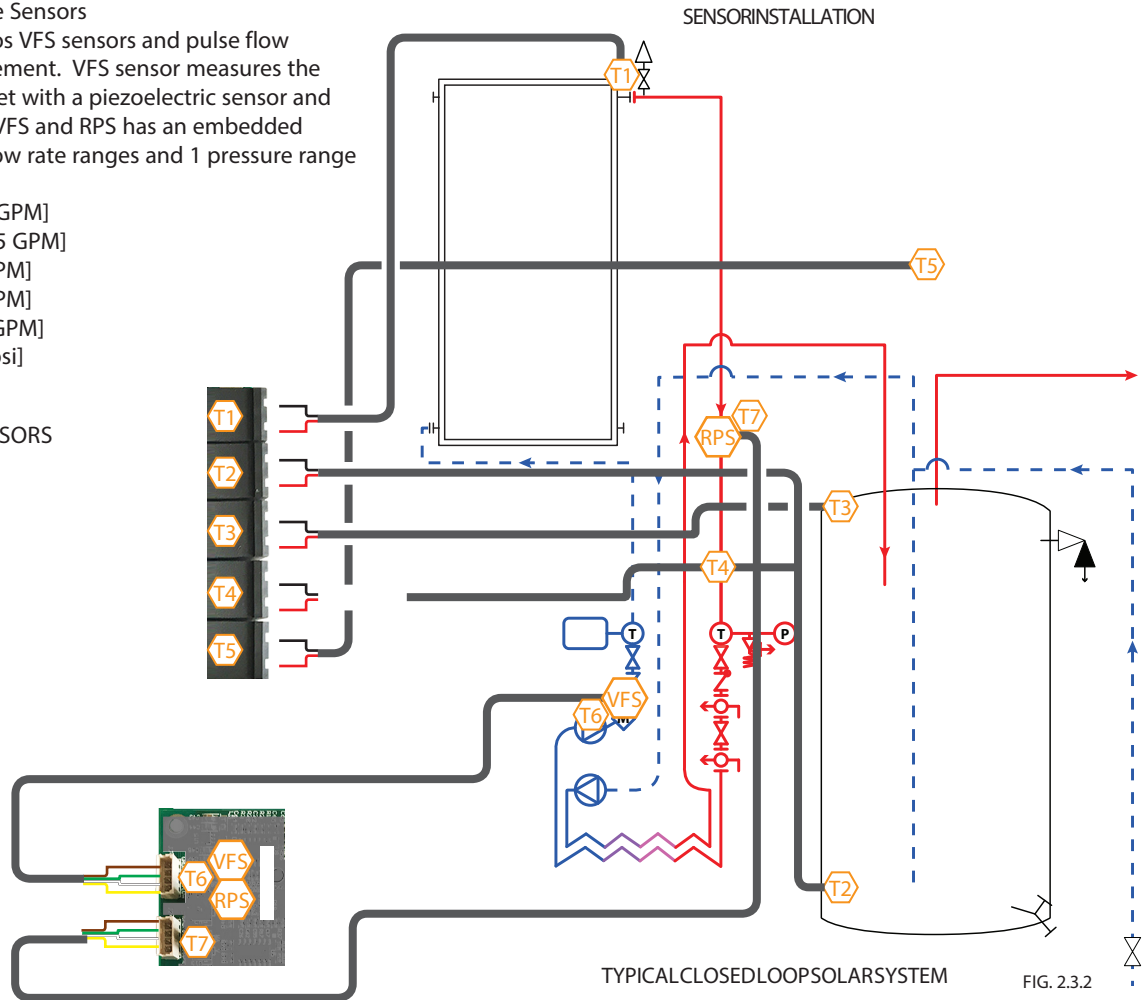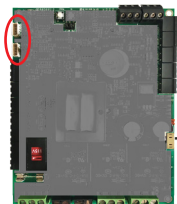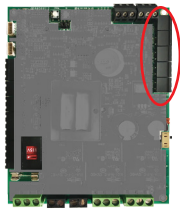


TYPICALCLOSEDLOOPSOLARSYSTEM          FIG. 2.3.2

### 2.3.3. Collector Sensor T1
Supplied with HPAK, HCOM, HPASS, and HFLO systems
TYPE:     10kΩ Thermistor
USE:       REQUIRED
FUNCTIONS:
- 'Hot' differential operation
- 'Hot' energy calculation
- Freeze monitoring sensor for open loop
- Low temperature monitor for vacation mode
- Useful collector temperature monitor
- Drain back system high limit monitor

WARNINGS:
- Must be well insulated
- Never install inside collector
- Install on collector outlet header only

### 2.3.4. Low Tank Sensor T2
Supplied with HPAK, HCOM, HPASS, and HFLO systems
TYPE:     10kΩ Thermistor
USE:       REQUIRED
FUNCTIONS:
- 'Cold' differential operation
- Tank high limit monitor
- Low temperature monitor for vacation mode
- Single Tank Gas function monitor average w/T3
- Relay 2 space heating setpoint
- Relay 3 operation setpoint

WARNINGS:
- Must be well insulated
- Ensure contact with tank wall

### 2.3.5. High Tank Sensor T3
Supplied with HCOM systems
TYPE:     10kΩ Thermistor
USE:       OPTIONAL
FUNCTIONS:
- 'Cold' differential operation average with T2
- Tank high limit monitor average with T2
- Low temperature monitor for vacation mode average with T2
- Single Tank Gas function monitor average with T2
- Relay 2 space heating setpoint in place of T2
- Relay 3 operation setpoint in place of T2

WARNINGS:
- Isolate from ambient
- Ensure contact with tank wall
- To use average, use checkbox in Settings

### 2.3.6. T4
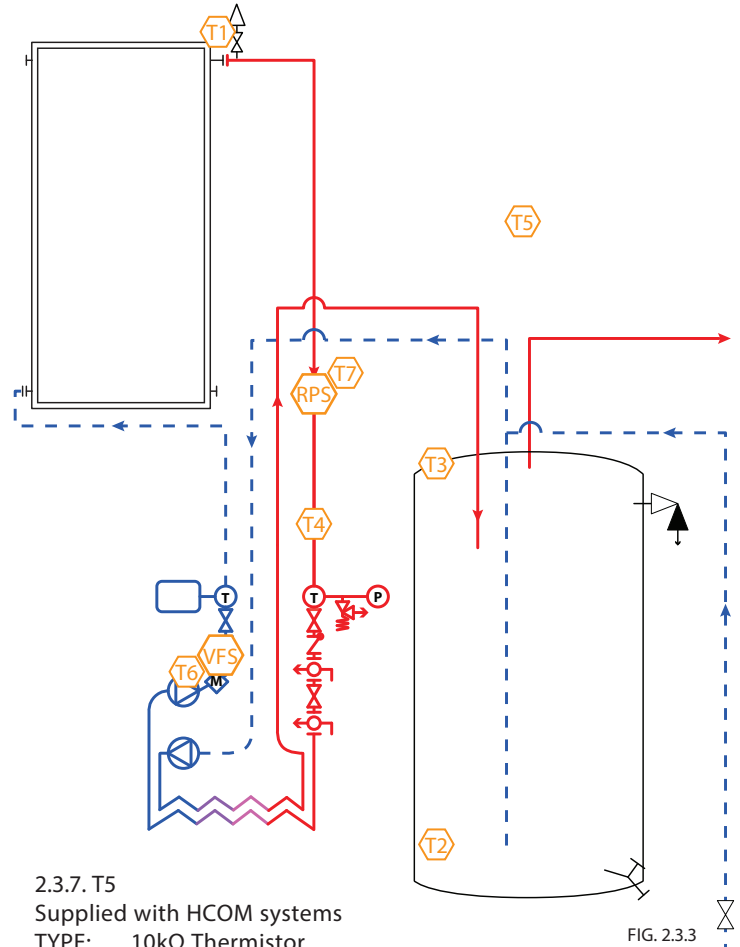Supplied with HCOM systems
TYPE:     10kΩ Thermistor
USE:       OPTIONAL
FUNCTIONS:
- Use for energy calculation sensor
- Use for simple differential operations
- HCOM - Water side HX inlet (Cold)

WARNINGS:
- Must be well insulated
- Ensure good thermal contact with measuring surface or use immersion sensor



FIG. 2.3.3

### 2.3.7. T5
Supplied with HCOM systems
TYPE:     10kΩ Thermistor
USE:       OPTIONAL
FUNCTIONS:
- Use for energy calculation / simple differential
- Outdoor reset in space heating mode

WARNINGS:
- Keep out of direct sunlight

### 2.3.8. Grundfos VFS and T6
Supplied with Pro Series and HCOM
TYPE:     Vortex Flow Sensor
USE:       OPTIONAL
INFO:      Can be moved to measure flow rate anywhere in the collector loop. Set T6 as the cold temperature sensor in the controller setting
FUNCTIONS:
- Monitor flow rate and temperature for energy calculation

WARNINGS:
- Ensure correct VFS range is set in settings

### 2.3.9. Grundfos RPS and T7
Supplied with HCOM systems
TYPE:     Relative Pressure Sensor / 2 x 5VDC Analog Sensing
USE:       OPTIONAL
FUNCTIONS:
- Collector loop pressure monitoring
- Insolation monitoring with compatible pyranometer
- Electricity monitoring with compatible current transformer

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## 2.4. Additional Functions

### 2.4.0. Functions
Additional functions as described below.  Control reset and manual operation of the relays are also addressed here.

### 2.4.1. Thermostat Zone Detection
Household thermostats can be connected to Z1 - Z4 There is one removable insert for two connection pins.
The contacts are not wetted and need to be supplied for each zone input signal with 24VAC to detect a call for heat.  In space heating mode, Relay 2 will be energized if a zone calls for heat and the temperature reading on the set sensor is within the set limits.

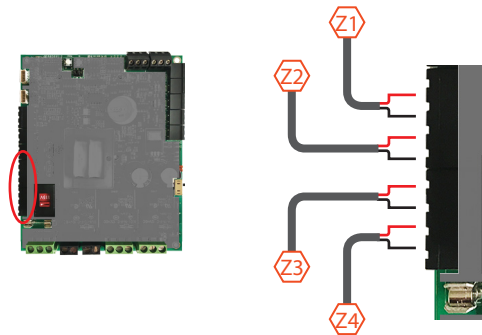Relay 3 can also be set to perform this function.

ZONE DETECTION WIRING

FIG. 2.4.1

### 2.4.2. Variable Speed Current Output
Two 0-10VDC output signals are supplied to variable speed pumps when selected in the settings. the algorithim implemented in the controller  adjusts the mass flow rate of the collector loop based on the temperature difference between the collector outlet and the storage tank and the total collector area, ensuring the flow rate is always optimized for maximum solar gain and reduced pump power consumption. If there is ample solar radiation, the pumps operate at maximum speed.
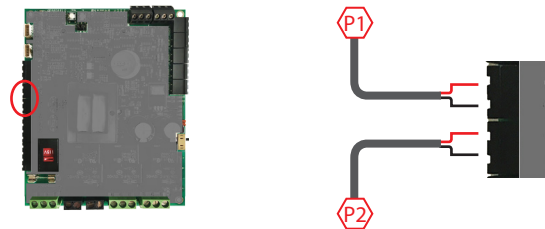
CONTROLLED CURRENT WIRING

FIG. 2.4.2

### 2.4.3. Pulse Flow Meter Connection
If necessary, a pulse flow meters can be used in place of Grundfos VFS.  The meter must be capable of producing a square-wave pulse with a pull up to positive DC voltage of 3VDC.  The controller provides 10VDC supply to the meter.  Ensure the number of pulses K-value are set in the settings.

PULSE FLOW METER WIRING

FIG. 2.4.3

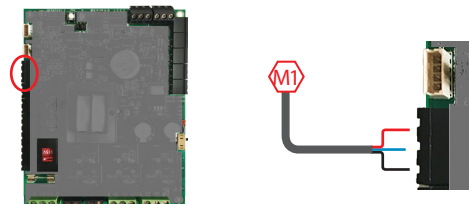### 2.4.4. Manual Operation of Relays
Often it is necessary to test the relays manually, or shut off the relays should a problem occur.  This part of the board is low voltage (<5VDC).
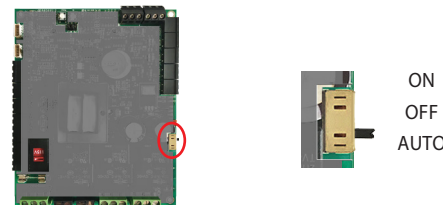
MANUAL RELAY OPERATION

ON
OFF
AUTO

FIG. 2.4.4

### 2.4.5. Manual Reset of Network Parameters
To reset the network parameters, press the reset button shown in Fig. 2.4.5.
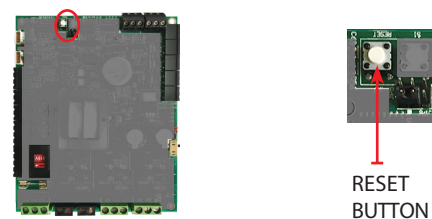
NETWORK RESET

RESET BUTTON

FIG. 2.4.5

### 2.4.6. Alternative Purposes at Grundfos Pressure Sensor

The 'Grundfos Pressure' signals can be used for two alternate purposes: measuring an electric circuit with a current transformer (CT) such as a main supply and electric tank element, or monitoring solar radiation with a pyranometer. Two signals can be read simultaneously.
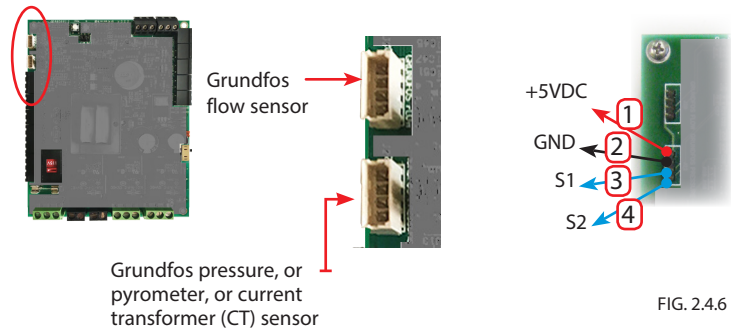
Grundfos flow sensor

Grundfos pressure, or pyrometer, or current transformer (CT) sensor

+5VDC (1)
GND (2)
S1 (3)
S2 (4)

FIG. 2.4.6

MODBUS INPUT

### 2.4.7. Modbus Connection

The DTT Pro has the ability to communicate with Modbus protocol to a Building Automations. Heliodyne also offers bridge translators to map out Modbus communication to almost any well known machine language. Please contact your local Heliodyne representative for details on this feature.
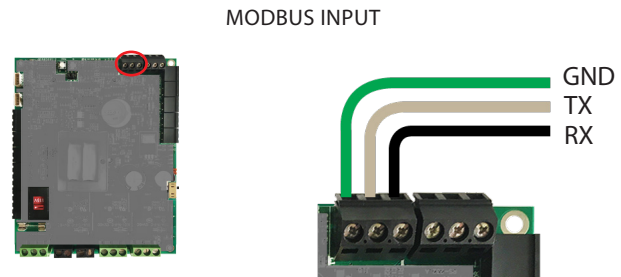
GND
TX
RX

# 3. NETWORKING

FIG. 2.4.7

## 3.0. Network Overview

The Heliodyne controllers provide internet connectivity for system monitoring via Ethernet and/or WiFi. In addition, the controller has a USB connection for setup and local system monitoring.

All settings are behind a log-in. The CASE Sensitive defaults password:

Password:      caution ('admin' for firmware 5.8 and prior versions)

## 3.1. Communication to the controller

3.1.0. Connecting to the controller using the mini-USB port
With proper drivers, the DTT Pro controller can be connected to a computer though its mini-USB port with the Ethernet-over-USB feasture, which creates a virtual private network. It is the default method for communicating to the controller.

1. Download drivers available at http://www.deltatcontrols.com/software-updates/1-drivers/. Install derivers with administator priviliege (e.g. in Windows, righ click the driver file and select 'run as administrator'). Ignore mulitple warnings of Windows Driver Certification warning. For winddow 8/10, follow following steps to disable driver signature verification (require reboot)
   a. Hold down shift key while click restart option
   b. Select trouble shoot option
   c. Select advanced option
   d. Select startup settings
   e. Click the "Restart" button to restart your PC into the Startup Settings screen
   f. Type F7 at the Startup Settings screen to activate the "Disable driver signature enforcement" option.
   g. Your PC will boot with driver signature enforcement disabled and you'll be able to install unsigned drivers

   For Mac, allow install software from unsigned developers.

   a) Navigate to system preference -> Security and Privacy
   b) Select any where for allow apps downloaded from

   If above option is not shown, open a terminal window (command+space, then enter terminal), and run

          sudo spctl --master-disable

   Then repeat steps a) and b).

   Reboot the computer after the drivers is installed.

2. Connect the computer to the controller with the provided mini-USB to USB cable. If connects sucessfully, controller shows in the computer as a portable usb driver and a local network connection can be found as 'Linux USB Ethernet'

3. Open a new browser window and enter the controller's address: 192.168.7.2 in the address bar and hit enter/return key. If the controller user interface (see Fig. 3.0) does not come up right away, refresh your browser. Note the user interface might take up to one minute to load completely depending on the web brower and OS.
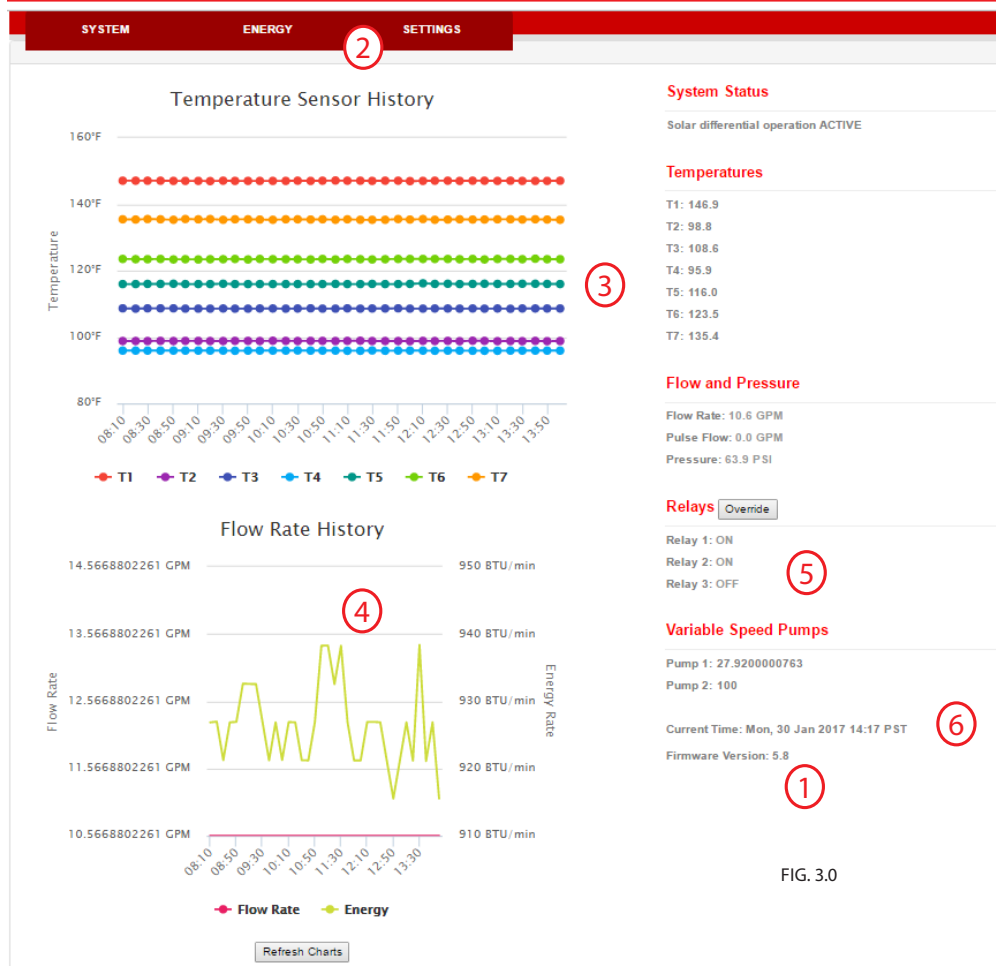
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1. Firmware Version
2. Navigation Bar
3. Temperature reading
4. Flow rate and energy production
5. Relay state
6. System Date and Time

Note: you can hide the data curves by clicking the legend

FIG. 3.0

3.1.1. Connecting to the controller through local network
If the controller is aleady connected to the local network via either Ethernet or WiFi, the controller user interface can be accessed through its IP address assigned by local network (refer to 3.2 for network configuration).

1. Connect the computer to the same router/local network the controller is connected to

2. Open a new browser window and enter the controller's IP in the address bar and hit enter/return key. The controller's IP address can be found in the networking setting page if connection is established

## 3.2. Network

The DTT Pro controller can be connected to the Internet through Ethernet connection or WiFi connection (the additional USB-WiFi adapter is pre-installed with the DTT Pro Ethernet+WiFi model) Once the controller is connected to the Internet and registered to the Heliodyne monitoring site, users can view and download the system performance in terms of temperature, flow rate, pressure (optional), instantaneous and time-integrated energy production from the monitoring site.

The network configuration consists of two parts: 1) Setup connection to the local network; 2) Submit request for monitoring site registration.

### 3.2.0. Setup with DHCP with Ethernet connection

Bring up the controller's user interface as in section 3.1.

1. Navigate to Settings page and Network tab
2. Under the Network tab, check the 'Wired (Ethernet)' box.
3. Select 'Obtain a network address automatically'
4. Click save Network settings. Controller reboots automatically after network setting has been changed. If the controller did not reboot sucessfully, i.e., 4 Blue LED is not flashing after one minute, open the controller enclosure and reboot manually by pressing the reset button on the PCB board.
5. After the controller restarts, check the status of the connection by click 'refresh network status'. The status below should show its assigned IP address and show three green yes, indicating the controller is connected to the local network, internet, and monitoring site. The assigned IP address can also be found here.
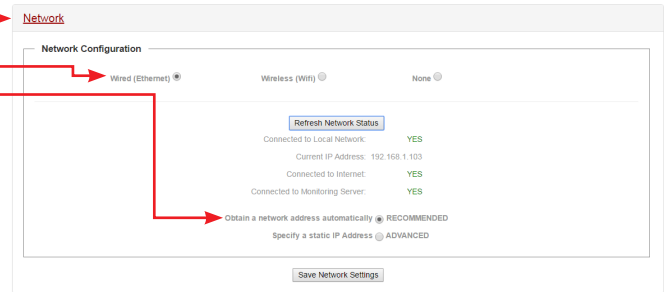
FIG. 3.2.0

### 3.2.1 Setup with Static IP with Ethernet connection

1. Follow steps 1-2 in 3.2.0
2. Select 'Specifiy a static IP address'
3. Enter IP address, subnet, and gateway information according to local network configuration (consult local IT personal)
4. Click save Network settings and reboot controller (refer to step 4, 3.2.0)
5. Check network status (refer to step 5, 3.2.0)
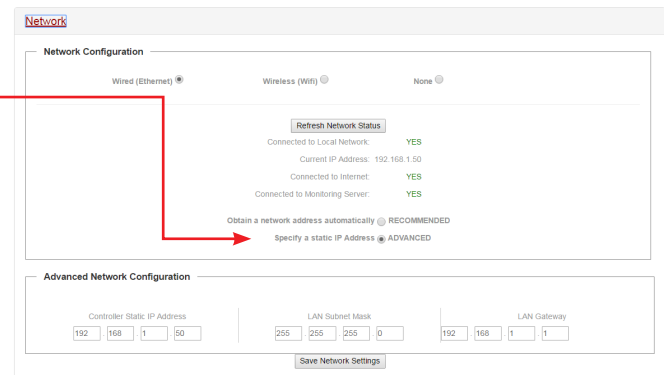
FIG. 3.2.1

### 3.2.2. Setup with DHCP or Static IP with WiFi connection

1. Navigate to Settings page and Network tab
2. Select 'Wireless (WiFi)'
3. Click scan to refresh the list of available WiFi connections, and then sellect the desired WiFi connection from the drop down list
4. Select either open or WPA according to the particular WiFi connection setting (supports open, WPA-Personal and WPA2-Personal)
5. Enter the WiFi password
6. Either select DHCP or configure Static IP as desired (refer to 3.2.0 and 3.2.1)
7. Save network setting and restart (refer to step 5, 3.2.0)
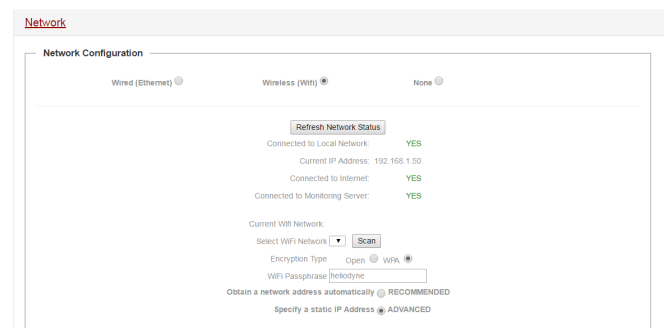8. Check network status (refer to step 5, 3.2.0)

FIG. 3.2.2

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# 4. SETTINGS

## 4.0. Quick Start

For fast setup, here is a list of parameters that may need to be adjusted to properly control simple DHW systems.  Remember to save any adjusted settings.

1. Adjust the system clock to reflect the local time.
2. If using an open loop system, change the system type to Open Loop for enabling freeze protection.
3. If using a Grundfos VFS other than installed in an HPAK, HFLO or HCOM, adjust the flow range to match the sensor installed.

4. If using a gas tank as the solar storage with electric ignition, enable the Gas Tank Operation checkbox.
5. If using a drain back system, enable the Drain Back Operation checkbox.
6. Adjust the high tank limit to the desired value. Default is 160 F
7. Enable vacation mode as needed (e.g. significant hot water demand decrease)

## 4.1. SETTINGS Screens and Pro Functions

### 4.1.0. SYSTEM
### 4.1.0.0. System Box

There are 5 user selectable operation modes for non-HCOM operation (i.e. Jumper 6 OFF).  Each mode has its default parameter profile optimized for its particular system type.

1. Open Loop Residential DHW
   - Differentials: On at 9°F and Off at 4°F
   - Enables freeze recirculation at 35°F
   - Adjusts Glycol Concentration to 0% (water)
2. Closed Loop Residential DHW
   - Differentials: On at 18°F and Off at 5°F
   - Disables freeze recirculation
   - Adjusts Glycol Concentration to 50%
3. Closed Loop Commercial
   - Same as Closed Loop Residential PLUS
   - Enables variable speed operation with Solar collector loop pump on Relay 1, storage tank loop on Relay 2
4. Closed Loop Combination
   - Same as Closed Loop Residential PLUS
   - Enables Relay 2 operation with zone thermostat detection.
5. Closed Loop Pool Heating
   - Same as closed loop commercial PLUS
   - Enables a 1 degree hysteresis on Relay 1

### 4.1.0.1. Settings Login Password
This changes the password to log in to the settings only, it does not change the WiFi password.  Enter the password twice, passwords must be 20 characters or less.

### 4.1.0.2. 24 Hour System Clock
The time and date need to be set to stamp sensor and energy correctly for communication with our monitoring servers. Note that once internet connection is established or connected to a computer with internet connection, the system time will be updated automatically. Save time setting by click 'save time setting' and then 'save settings'.

### 4.1.0.3. Modbus Protocol
This allows you to enable RTU or TCP communication through Modbus.

### 4.1.0.4 Link
- 'Setup Monitoring Communication' takes you to a page to register your controller with the Heliodyne Monitoring Service.  See section 5.



FIG. 4.1.0

- 'Download System Sensor and Energy Data' Download a csv file including raw data collected by the controller
- 'Update firmware' Upload new firmware by clicking the 'Choose file'. See section 4.2 for more details on firmware upgrade.

## 4.1.1. OPERATION Tab
## 4.1.1.0. Solar Relay Box

| PARAMETERS | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| On Differential | The minimum Differential (T1 - T2), or if T3 is installed and the average is used [T1 - (T2+T3)/2] ), to turn Relay 1 ON from OFF | 18°F [CL], 9 [OL] | 2°F - 100°F |
| Use Tank Avg | Check this box to use the tank average in Differential and High Limit Operation (with T3 installed) | OFF | ON / OFF |
| Off Differential | During Relay 1 operation, the maximum Differential the system can exhibit in order for Relay 1 to turn back OFF | 5°F [CL], 4 [OL] | 0°F - On Diff. |
| Glycol concentration | The percentage of Dowfrost HD propylene glycol in the heat transfer fluid to be used in the energy calculation | 50% [CL], 0 [OL] | 0% - 70% |
| High Tank Limit | The limit Value T2, or the average of T2 & T3 if installed, at which the solar relay will turn OFF even with a satisfactory differential.  NOT TO BE RELIED UPON AS A SAFETY LIMIT OR PRIMARY LIMIT CONTROL. | 160°F [ON] | 80°F - 200°F [ON/OFF] |
| High Limit Hysteresis | The value that the tank temperature must drop by in order to enable the solar relay to add more solar energy | 5° | 1°F - 20°F |
| Useful Collecto Temp | The minimum Value T1 must be greater than for the differential function to begin monitoring the differential | 82°F [CL], 80 [OL] | 50°F - 200°F |
| Vacation Mode | Uses the cool nighttime collectors to deplete energy from the storage.  Set the minimum T2 Value, or T3 if installed, to cool the tank down to. | 120°F [OFF] | 80°F - 200°F [ON/OFF] |
| Freeze recirc. | If the selected system on the SETTINGS > SYSTEM tab is Open Loop, recirculates warm storage water through the collector loop when this value is greater than T1. | 35°F [Open loop ON, other OFF] | 33°F - 80°F [ON/OFF] |
| Drain back option | Check this box when operating a Drain Back system to prevent thermal shock when the Differential is greater than 100°F and the Solar Relay, Relay 1, is off. | OFF | ON / OFF |
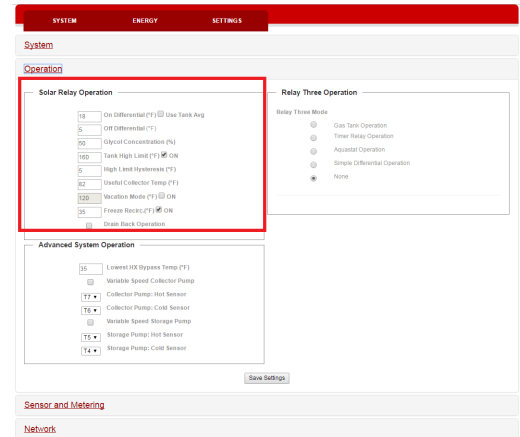


FIG. 4.1.0.4

### 4.1.1.1. Relay Two Aquastat Operation (Closed loop Combination System Only)
To use relay two in aquastat operation, with or without thermostat input, ensure 'Closed Loop Combination' system is active in the SYSTEM tab.  Inputs will be inactive without this system set.

| PARAMETERS | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| Relay two on temperature | The temperature the selected sensor must exhibit to turn R2 ON.  If this temperature is less than the R2 OFF temp, R2 will be ON in between the OFF and ON temp; otherwise, it will be ON above the R2 ON temp, and turn back off at the R2 OFF temp | 120°F | 50°F ≤ V ≤ 200°F |
| Relay two off temperature | The temperature the selected sensor must exhibit to turn R2 OFF.  See above if R2 OFF > R2 ON. | 110°F | 50°F ≤ V ≤ 200°F |
| Aquastat sensor | The installed sensor for reading the ON and OFF values set above. | T2 | T1 ≤ v ≤ T7 |
| Channel selection | Select any thermostat channel as an extra condition for operation of R2. E.g. turn on R2 only if the temperature conditions set above AND a selected thermostat is active.  Leave unchecked for temperature condition only. | No Channels Active | Any or all channels active |
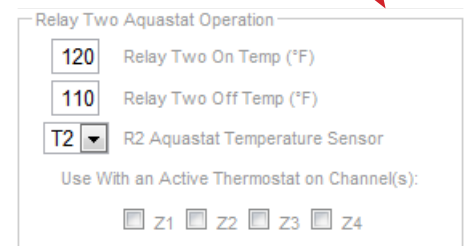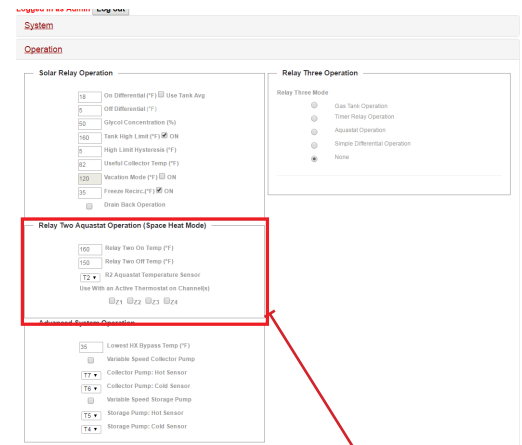


FIG. 4.1.1

### 4.1.1.2. Relay Three Operation: Gas Tank Operation

In a residential domestic water heating system, it is possible to use a single tank gas system with solar, provided the gas tank has an electric ignition.  Because this is a residential function, it cannot be combined with commercial or space heating operations.

| PARAMETERS | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| Enable button | Check this box if using a electric ignition gas fired solar storage tank systems (EIGFSS), with power controlled by R3. | OFF | ON / OFF |
| Gas tank recovery rate | In EIGFSS tank systems, the tank's rated recovery rate in kBTU (1000 x BTU) | 74kBTU | 30kBTU ≤ V ≤ 120 |
| Gas tank set temperature | In EIGFSS tank systems, the limit Value at which T2, or T3 if installed, will disable R3, preventing any backup energy | 120°F | 80°F ≤ V ≤ 140°F |
| Hot water usage | In EIGFSS tank systems, the estimated household demand in gallons used per day | 80GAL | 40 ≤ V ≤ 140GAL |
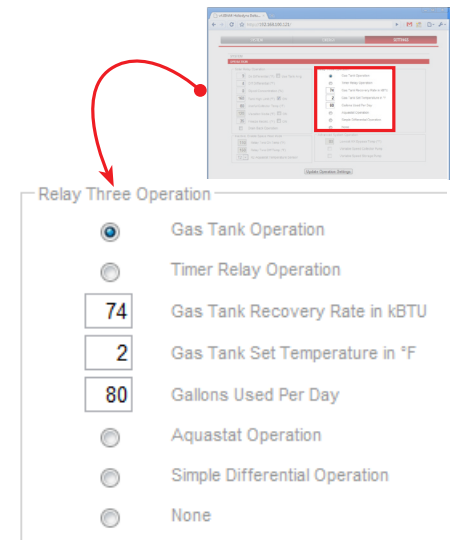


FIG. 4.1.1.2

### 4.1.1.3. Relay Three Operation: Timer Relay Operation

Relay three can be used to operate on a time setting.

| PPARAMETERS | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| Enable button | Check this box if using R3 as a timer relay. | OFF | ON / OFF |
| Off hours | At the top of this hour Value, i.e. 8:00 or 8 AM, R3 will shut OFF.  The clock is a 24-hour clock. | 8:00 | 0 - 23 |
| On hours | At the top of this hour Value, i.e. 17:00 or 5 PM, R3 will turn ON.  The clock is a 24-hour clock. | 17:00 | 0 - 23 |
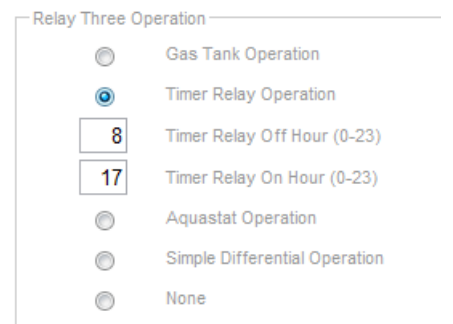


FIG. 4.1.1.3

### 4.1.1.4. Relay Three Operation: Aquastat Operation

Relay Three can also be operated in Aquastat Mode, identical to the Space Heating Function for Relay Two.  Check the 'Aquastat Operation' button to enable this function.

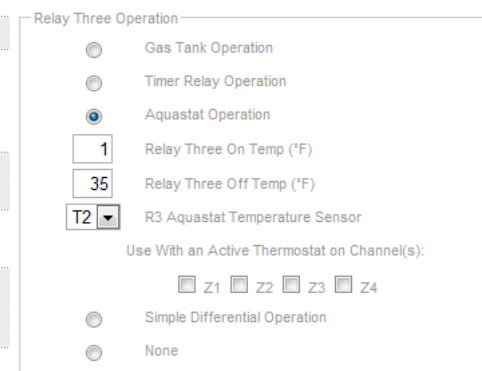| PARAMETER | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| On temperature | The temperature the selected sensor must exhibit to turn R3 ON.  If this temperature is less than the R3 OFF temp, R3 will be ON in between the OFF and ON temp; otherwise, it will be ON above the R3 ON temp, and turn back off at the R3 OFF temp | 160°F | 50°F - 200°F |
| Off temperature | The temperature the selected sensor must exhibit to turn R3 OFF.  See above if R3 OFF > R3 ON. | 150°F | 50°F - 200°F |
| Aquastat sensor | The installed sensor for reading the ON and OFF values set above. | T2 | T1 - T7 |
| Channel selection | Select any thermostat channel as an extra condition for operation of R3.  E.g. turn on R3 only if the temperature conditions set above AND a selected thermostat is active.  Leave unchecked for temperature condition only. | No Channels Active | Any or all channels active |



FIG. 4.1.1.4

## 4.1.1.5. Relay Three Operation: Simple Differential Operation
Relay three can be operated using a secondary differential with a high limit

| PARAMETERS | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| Hot sensor | HOT temperature sensor for the differential equation (ΔT=Hot Sensor - Cold Sensor) | T1 | T1 - T7 |
| Cold sensor | COLD temperature sensor for the differential equation (ΔT=Hot Sensor - Cold Sensor) | T2 | T1 -T7 |
| On differential | The minimum ON Differential | 18°F | 2°F – 100°F |
| Off differential | During Relay 3 operation, the maximum Differential the system can exhibit in order for Relay 3 to turn back OFF | 5°F | 0°F – On Diff. |
| High limit | The limit value COLD sensor at which R3 will turn OFF even with a satisfactory differential. NOT TO BE RELIED UPON AS A SAFETY LIMIT OR PRIMARY LIMIT CONTROL. | 160°F | 80°F - 200°F |
| Enable button | Check this box to use the R3 high limit function | ON | ON / OFF |
| Condition 1 | Choose this option to operate Simple Differential only when the Solar Relay is ON | | |
| Condition 2 | Choose this option to operate Simple Differential only when the Solar Relay is OFF due to the Solar Tank greater than the high limit value (T2 or the Average of T2 & T3 if installed and Use Average is selected) | | |
| Condition 3 | Choose this option to operate Simple Differential when the selected sensor is hotter or colder than the set temperature. | T1, 160°F | T1 - T7  50°F – 200°F |
| Condition 4 | Choose this option to operate Simple Differential all the time | | |



FIG. 4.1.1.5
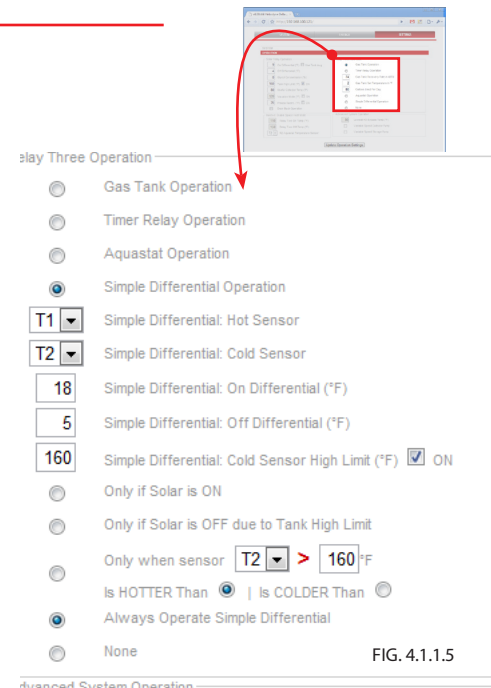
## 4.1.2. SENSORS AND METERING Bar
### 4.1.2.0. System Metering Box
The Delta-T Pro can be fitted with many different inputs above the normal temperature sensors, including an electronic pressure sensor, pyranometer or current transformers.  In addition, the energy calculation algorithm can be adjusted for the installed parameters.

| PARAMETERS | METER DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| VFS enable | Select if a Grundfos VFS flow and temperature sensor is installed | ON | ON / OFF |
| Range | Set the flow Range for the Grundfos VFS; this is the flow range in LPM.  HPAK / HFLO Pro and HCOM's have the default's preset.  If a sensor is purchased separately, the range is printed on the packaging. | HPAK/HFLO 2-40  HCOM 20 - 400 | MIN:  2-40  MAX: 20-400 |
| Pulse flow enable | Select if using a square wave pulse flow meter (paddlewheel) | OFF | ON / OFF |
| K valve | When using a pulse flow meter, set the slope of the reading curve, in Pulses / Gallon. This information will be provided with the pulse meter. | 0.0 | 500.0 |
| Heat metering sensor selection | Set which flow meter reading will be used in the System Energy Calculation | Grundfos VFS | VFS or Pulse |
| Hot sensor | Select which sensor will be used for the HOT sensor in the System Energy Calculation. FOR GREATEST ACCURACY, SELECT TWO SENSORS OF THE SAME TYPE (I.E. Thermistors T1-T5, or Grundfos T6 & T7) | T1 | T1 - T7 |
| Cold sensor | Select which sensor will be used for the COLD sensor in the System Energy Calculation. FOR GREATEST ACCURACY, SELECT TWO SENSORS OF THE SAME TYPE (I.E. Thermistors T1-T5, or Grundfos T6 & T7) | T6 | T1 - T7 |
| RPS enable | Select whether a Grundfos RPS pressure sensor is installed (0 - 150PSI) | OFF | ON / OFF |
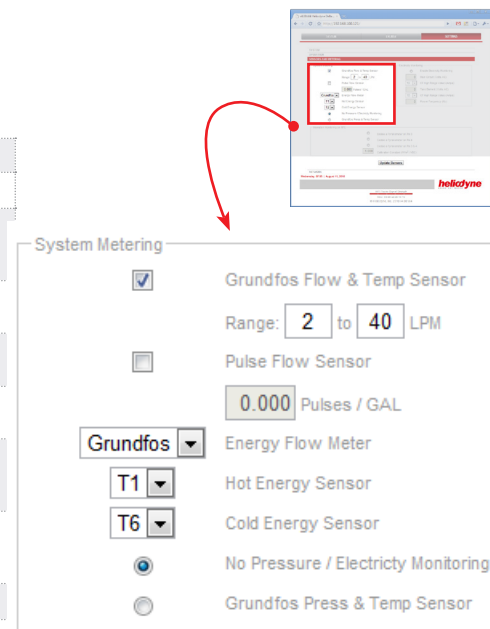


FIG. 4.1.2 A

The 'Grundfos Pressure' signals can be for two alternate purposes in place of the RPS sensor (Pressure and T7): measuring an electric circuit with a current transformer (CT) such as a main supply and electric tank element, or monitoring insolation with a pyranometer. Two signals can be read simultaneously. The Delta-T Pro electrical requirements are below. At right is the PCB signal layout.

| Power Supply | 5VDC |
|---|---|
| Signal Reading Range | 0-5VDC |

+5VDC ①    Grundfos Flow
GND ②    Grundfos Pressure
S1 ③
S2 ④

FIG. 4.1.2 B

**IMPORTANT: Reversing polarity or going outside of signal ranges will damage circuits.**
Contact Heliodyne for connector with 12" wire leads, part number: 21816.

### 4.1.2.1. Electricity Monitoring Box

| PARAMETERS | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| Main circuit Voltage | Main Circuit Volts AC is the nominal Voltage the CT connected to S1 | 240VAC | 10 ≤ V ≤ 500VAC |
| CT Full scale | This is the CT's full scale value (when the controller reads 5VDC, the CT is at full scale) | 50A | 10, 20, 50, 100, 150, 200A |
| Tank voltage | Tank Circuit Volts AC is the nominal Voltage the CT connected to S2 | 240VAC | 10 ≤ V ≤ 500VAC |
| CT Full scale | This is the CT's full scale value (when the controller reads 5VDC, the CT is at full scale) | 50A | 10, 20, 50, 100, 150, 200A |
| Frequency | This is the power frequency (60Hz is standard in USA) | 60Hz | 40 - 70Hz |

Electricity Monitoring
◉ Enable Electricity Monitoring
240   Main Circuit (Volts AC)
50 ▾   CT High Range Value (Amps)
240   Tank Element (Volts AC)
20 ▾   CT High Range Value (Amps)
60   Power Frequency (Hz)

Contact Heliodyne for information about compatible CT's.

FIG. 4.1.2.1

### 4.1.2.2. Insolation Monitoring Box

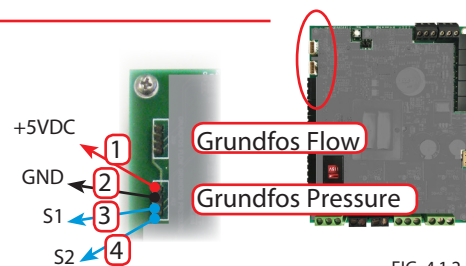| PARAMETERS | FUNCTION DESCRIPTION | DEFAULT | SETTING LIMIT |
|---|---|---|---|
| Enable pin 3 | Select to enable insolation monitoring on Pin 3 (S1) | - | - |
| Enable pin 4 | Select to enable insolation monitoring on Pin 4 (S1) | - | - |
| Enable both 3 and 4 pins | Select to read dual pyranometers, on Pin 3 (S1) AND Pin 4. | - | - |
| Calibration constant | Calibration constant of the installed pyranometer. This is the multiplier the controller will use to turn the read voltage into insolation. | 1.0 | 1000.0 |

Insolation Monitoring on RPS
○ Enable a Pyranometer on Pin 3
○ Enable a Pyranometer on Pin 4
○ Enable a Pyranometer on Pin 3 & 4
1.000   Calibration Constant (W/m$^2$ / VDC)
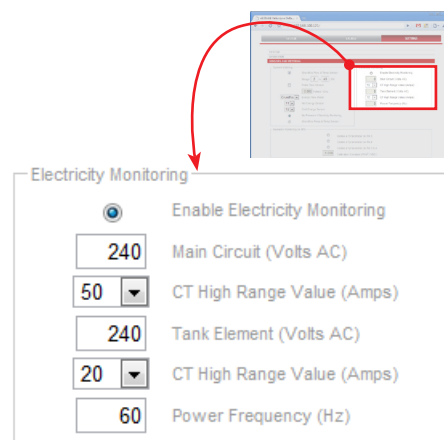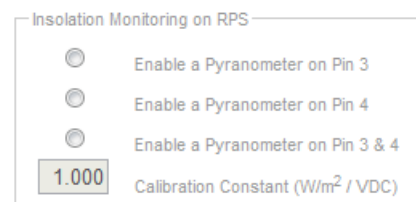
FIG. 4.1.2.2

## 4.2 Firrmware update

The DTT Pro controllers can be easily updated through the controller user interface. To upgrade, download the latest software from http://www.deltatcontrols.com/software-updates/2-firmware-updates/. The firmware is saved in a file with the extension .deb.

1. Navigate to Settings -> System tab -> Choose file
2. Select the downloaded firmware and confirm. After the firmware is loaded, the process bar shows full, and a new upgrade firmware button shows
3. Click the 'upgrade firmware button'. A dialogue window might pop up requesting password.
4. Wait for one mintue for the controller to complete the firmware upgrade and reloading process. Confirm the controller is running with a new firmware version in the system page. If user interface is not repsoning after a few minute after the upgrade, manually reboot the controller by press the reset button.

**Setup Monitoring Communication**
Download System Sensor and Energy Data
Upgrade firmware:
[Choose File] Heliodyne_5_8.deb
Progress: ▓▓▓▓▓▓▓▓
[Upgrade Firmware]

FIG. 4.1.3.1

Current Time: Tue, 14 Feb 2017 10:38 PST

Firmware Version: 5.8

FIG. 4.1.3.2

# 5. MONITORING

## 5.0. Overview
The Controller has two types of monitoring and data logging, the built in or local monitoring that is stored in the controller's memory, and the Heliodyne Web Monitoring service.   When the controller is connected to a network with an internet connection, it communicates with the monitoring site server, which is available for viewing performance data.

## 5.1. Local Monitoring
### 5.1.0. ENERGY Page
In addition to the sensor data graphs on the home page, the controller also displays the last 30 days, and 12 months of accumulated energy data.  More in depth monitoring is provided on the Heliodyne Web Monitoring service.  At this point all numbers are in imperial units.

### 5.1.1. SETTINGS Page - Download System Sensor and Historical Data
This page displays all the current saved sensor and energy history data for the controller.  This is the same data that is sent to the monitoring site server.  The Pro Controllers has 1GB usable space for storing historical data, sufficient for the life time of typical solar thermal system. This data is taken as an average of sensor readings over a complete 10 minute period.  (Sensor readings are taken every second).

## 5.2. Heliodyne Web Monitoring (http://monitoring.heliodyne.com)

### 5.2.0. Monitoring Setup
Navigate to the SETTINGS home page, under the SYSTEM bar and click on the 'Setup System Monitoring' link.  You will be directed to an email form on the Heliodyne website.  Fill out all the required fields and send it.

When you click on the link, it saves the controller's MAC Address in the browser address bar, for easy copy and paste into the email form.  Heliodyne will register your controller and send all associated parties an email on login information within one business day.
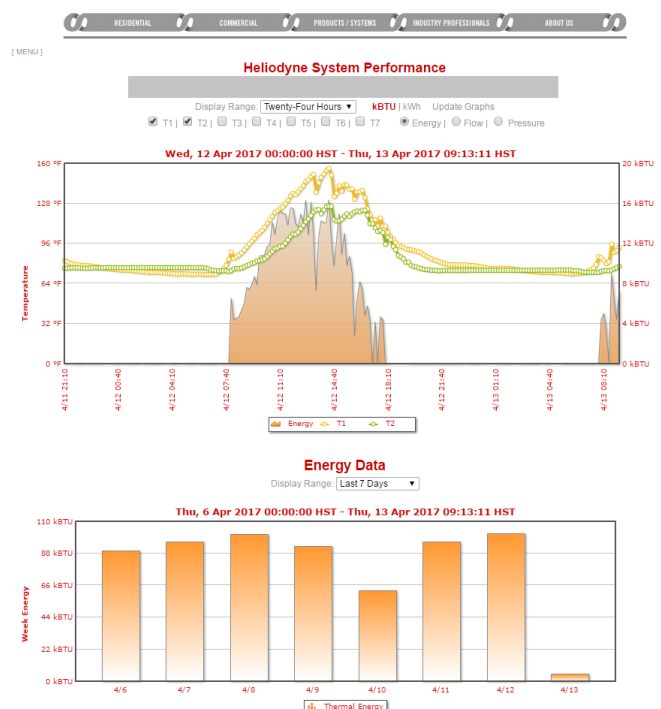


FIG. 5.2..0

# 6. TROUBLESHOOTING

## 6.0. Delta-T Pro Testing and Troubleshooting

More in-depth knowledge is available at www.heliodyne.com/controls.

Before contacting Heliodyne tech support, run through this entire section to see if it solves the problem.  If the issue cannot be resolved by these tests and common problems, their answers will give Heliodyne a better idea of what the issue might be.

### 6.0.0. Testing Controller Logic

| TEST NAME | METHOD | OUTCOME |
|---|---|---|
| Power Test | Supply the controller with power | If there is a red LED near the thermistor sensor inputs, the control PCB board has power. If there is no red LED, check the fuse for continuity.  If the fuse is bad, replace with a similar 100mA fuse. |
| On / Off Test | Manually turn the relays on or off | Review section 2.4.4. Turn the relays on; each relay should have a red LED lit up next to it.  When lit, test the voltage at the NO contact to see if 120VAC (or 240VAC if switched) is supplied. Turn the relays off; no red LEDs next to the relays should be lit.  Test the NO contacts to be sure there is no voltage supplied when off |
| Basic Sensor Test | Short or Open sensors | A sensor short signals to the controller a high temperature of around 350°F, an open signals a very low temperature of around -90°F. |
| Sensor Operational Test | Measure the sensor resistance | Disconnect the sensor from the controller to prevent any controller feedback.  Using a multimeter set to read Ohms, measure the resistance of the installed sensor.  Check this table to see if the measured values correspond to the expected values.  Bad values can mean the connecting wires or the sensor itself.  If a bad sensor is suspected, check the sensor at the 6" factory leads. <br><br> (resistance table below) |
| Basic Function Test | Short or Open sensors (assuming no high limit or other extreme conditions) | Test the differential setting & collector: short T1; the pumps should turn on Test the differential setting & storage: open T2; when T1 is above the Usable Collector Temperature set in the SETTINGS; the pumps should turn on Test the freeze protection in open loop mode: open T1, the pumps should turn on |

Resistance table (within Sensor Operational Test):

| °C | °F | Ω | | | |
|---|---|---|---|---|---|
| OPEN | | Infinity | 40 | 104 | 5,326 |
| 0 | 32 | 32,630 | 50 | 122 | 3,601 |
| 10 | 50 | 19,890 | 60 | 140 | 2,487 |
| 20 | 68 | 12,490 | 70 | 158 | 1,751 |
| 25 | 77 | 10,000 | 80 | 176 | 1,255 |
| 30 | 86 | 8,057 | 100 | 212 | 680 |
| | | | SHORT | | 0 |

### 6.0.1. Troubleshooting Communication and Network Issues

| ISSUE | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| • Can't connect to the controler through USB | Driver not installed properly | Re-install the driver with administrator/root previlige, and reboot. Check the driver version. |
| | Ethernet-over-USB connection failed to establish | Try plug and unplug the USB cable; try delete the Ethernet-over-USB adapter in network connection setting in OS, then re-plug the USB cable |
| | User interface froze | Press the reset button on the PCB board, and re-plug the USB cable |
| | One-board computer damaged or not running | Verify one blue LED on the one-borad computer is steady, and two out of 4 blue LEDs are flashing. If not, press reset to reboot the one-board computer. If all the LEDs are still off, the PCB or the one-board computer is likely damged. |
| • Can't connect to the interent | Unstable router wifi signal | Try connect to the same router with your cellphone or laptop, verify that the router signal is stable. Try connect to a different router. |
| | Wrong WiFi credential | Ensure the router SSID, password,  and the encryption mode are correct. |
| | Router setting | Log in to the router setting page, check if there is any restriction or special setting that would prevent controller to connect (consult local IT support), ensure there is no IP conflicts |
| • Don't see data on monitoring site | Connection to the internet is lost | Reset the controller, then check the networking setting. Power outage or power surge might cause drop of the internet connection |
| | Router setting | Ensure TCP port 9999 is open. Most routers' default setting don't block any TCP communication. |

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## 6.0.2. Troubleshooting Operation

| ISSUE | POSSIBLE CAUSE | SOLUTION |
|---|---|---|
| • Bad or no sensor readings in the control software | Incorrect piping connections or dip tube lengths | Check the heat transfer appliance tank connections and ensure the hot goes into the top of the tank with a short or no dip tube, and the cold goes into the bottom of the tank, or the top with a along diptube.  Ensure the hot out of the tank to the fixtures is not shared with the solar equipment. |
| | Controller doesn't turn on pumps | Check the sensors and ensure they are contacting the piping or tank sufficiently and they are well insulated from the ambient temperatures to provide accurate readings. |
| | Improper wiring or loose connections | Ensure all the connections are placed in the proper input area i.e. the low tank sensor actually does connect to the controller at T2; wire colors are oriented in the proper terminals (Specifically Grundfos VFS and RPS sensors), the connectors are firmly connected and pressed all the way in or down, and all connections are metal to metal, no plastic or wire insulation can interfere for proper operation. |
| | Bad sensors or wiring | Use the Sensor Operational Test in 6.0.0. to determine if the thermistors are sending an appropriate reading to the controller. |
| | Sensor not installed | If the sensor reads a very low temperature in the range of -80°F to -110°F, the control is not receiving any signal from that sensor, i.e. it is not installed or installed properly. |
| • Pump does not start | Controller is in OFF position | Review section 2.4.4.  If there is no jumper in the correct location, use the jumper located at JP5 for resetting the network parameters (No jumper at JP5 has no affect on the network parameters). |
| | No electricity to pump | Check the pump wiring to ensure pump(s) have correct wires at the terminals (i.e. white goes to N, green to ground, etc) and at the relay contacts.  Measure voltage at the relay contact to determine if voltage is supplied.  Ensure the unit is plugged in and the controller voltage switch is set to provide the correct voltage.  Check the fuse to make sure it has not blown. |
| | Differentials are set too high | Adjust the differentials back to the defaults as described in section 4.2.1. |
| | Loose or bad contact | Clean contacts and firmly place connections, ensure metal to metal contact. |
| | Bad sensors or wiring | Use the Sensor Operational Test in 6.0.0. to determine if the thermistors are sending an appropriate reading to the controller. |
| • Pump cycles on and off | Minimal solar energy available | This can be normal operation in fall, winter and spring depending on the collector to storage ratio.  To alleviate in these months:<br>• Set a higher ON differential<br>• Increase the usable collector temperature |
| | For open loop systems, the freeze protection may be set too high | Decrease the temperature at which the controller will recirculate hot storage water to prevent freezing; see section 4.2.1. to reset the default value. |
| | Bad sensors or wiring | Use the Sensor Operational Test in 6.0.0. to determine if the thermistors are sending an appropriate reading to the controller. |
| • Pump runs continuously | Controller is in ON position | Review section 2.4.4. and remove any unnecessary jumpers. |
| | Usable Collector Temperature is set too low | Increase the temperature at which the collector must reach to begin monitoring the differential function; see section 4.2.1. to reset the default, or increase the value. |
| | Bad sensors or wiring | Use the Sensor Operational Test in 6.0.0. to determine if the thermistors are sending an appropriate reading to the controller. |

WARRANTY                                                                                                      21

# 7. WARRANTY

HELIODYNE, shall provide a warranty for defects in compliance with the purchased goods delivered after 3/1/2009. This warranty applies to the first retail buyer and to any subsequent owners. Product shall be free from defects in material and workmanship, malfunctions and failure to perform, under normal use, service and maintenance, provided that said products have been installed in accordance with HELIODYNE's Installation Instructions.  The warranty term for each product shall begin on the date of installation and remain active for the period of time as specified and applicable for each individual product.

The HCOM, HPAK, HFLO, HPAS Products and their variants.
• Five (5) year limited warranty (parts only, no labor, no shipping) from date of installation when installed with HELIODYNE Collectors.
• Three (3) year limited warranty (parts only, no labor, no shipping) on Integrated Electronics (such as controller, pumps, sensors, etc.)
• In the event that the Product is installed with another brand of collector, or any equipment other than HELIODYNE collectors, then the period of time shall be one (1) year from date of installation for Product and Electronics.

The GOBI Collectors and their variants.
• Ten (10) year limited warranty (parts only, no labor, no shipping) from date of installation.

The DELTA-T Products and their variants.
• Three (3) year limited warranty (parts only, no labor, no shipping) from the date of installation.

In the event that evidence cannot be provided to indicate the date of installation, then the warranty period shall begin on the date the product was manufactured.

Objects are warranted at HELIODYNE's discretion by repair of the object of purchase or replacement of defective parts, exchange or reduction of price. The right of the contractor to convert objects is ceded by common consent. Replaced parts become the property of HELIODYNE. Wages and costs spent on shipping, installation and disassembly must be covered by the client. This provision similarly applies to all warranty agreements. It is at HELIODYNE's discretion to replace defective goods with similar, faultless goods. In this case, any rights to cancel the agreement cease. The client expressly waives the right for it and its legal successors to assert claims for damages or loss of profit (including without limitation special, indirect, loss of use, contingent, or consequential damages) due to defects or nonconformity in the purchased good. The warranty set forth above constitutes the sole and exclusive remedy against HELIODYNE for the furnishing of any nonconforming or defective goods.  THE ABOVE WARRANTY IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTY AS TO MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE.

If the Product contains a defect that cannot be repaired after a reasonable number of attempts to do so, you, the buyer, may elect either a refund of its purchase price, or a replacement without charge. A replacement may consist of a new or factory rebuilt

product of at least the same quality. A new warranty shall apply to any replacement.  Claims on warranty will only be admitted and considered if they are announced in writing immediately after the defect was first noticed. Oral communication or communication by telephone is not sufficient. To obtain service on the Product, notify Heliodyne Customer Service by email at sales@heliodyne.com, or by letter to 4910 Seaport Ave., Richmond, CA, 94804.  Provide proof of purchase and date.

Should service be requested and no defect found in the Product, then a reasonable charge will be made for the service.

In no event shall HELIODYNE be liable for the following:
• Conditions resulting from a defect in a component or part that does not make up the HELIODYNE Product.
• Conditions resulting from a significant departure from Heliodyne's Installation Instructions.
• Conditions resulting from any misuse, abuse, negligence, weather damage, accident or alteration.
• Consequential damages such as: damage to your property, loss of time, inconvenience or loss of use of the Product or any incidental expenses resulting from any breach of the express warranty. Conditions that may occur in the normal operation of the Product shall not be invoked by HELIODYNE to reduce or defeat the coverage of this warranty.
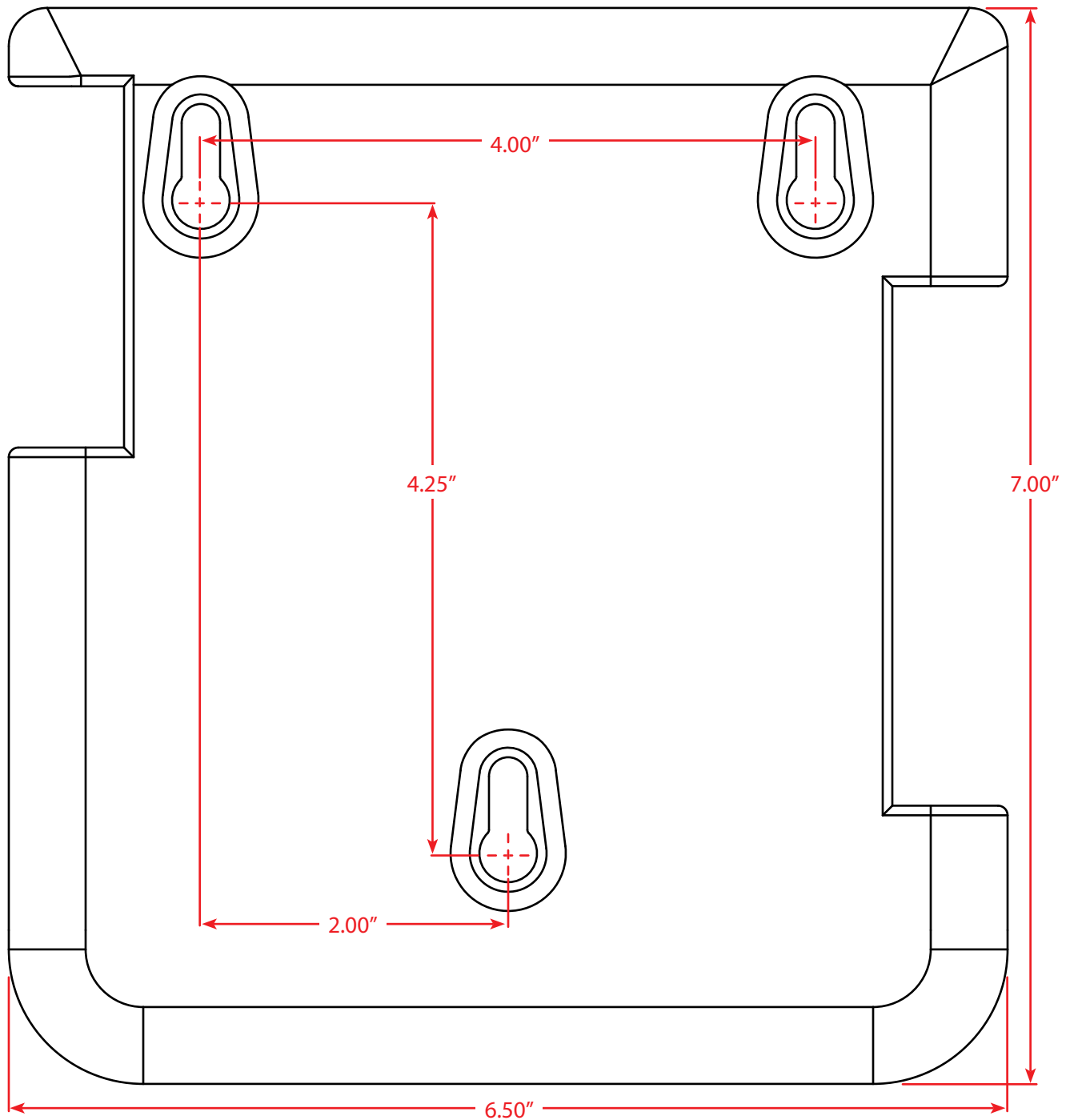
HELIODYNE's liability under this warranty shall be in lieu of all warranties of fitness and in lieu of all warranties of merchantability. Heliodyne shall not be liable for any incidental or consequential damages covered by a defective product. The maximum liability under this warranty shall not exceed the contract price of the Product. Some states do not allow the exclusion or limitations of incidental or consequential damages, and some states do not allow limitations on implied warranties, such as that of fitness and of merchantability. Therefore the above exclusions and limitations do not apply to you.

The warranty excludes damage caused by force majeure and malfunction that are due to improper assembly, and/or product installation. HELIODYNE is not liable for possible costs resulting from defects. Glass breakage in collectors is specifically excluded.  In order for HELIODYNE to accept liability:
• Installation must have been carried out by a licensed specialized company (heating contractor or plumber) following the version of installation instructions in force;
• HELIODYNE or its representative was given the opportunity to check complaints on site immediately after any defect occurred;
• Confirmation exists that the system was commissioned properly and that the system was checked and maintenance was performed annually by a specialized company licensed for this purpose. The warranty agreed by HELIODYNE is only valid for their clients.

This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. Unless otherwise explicitly agreed in writing, it is understood that these are the only written warranties given by HELIODYNE, and HELIODYNE neither assumes nor authorizes anyone to assume for it any other obligation or liability in connection with the Product.

**heliodyne**
SOLAR HOT WATER

# MOUNTING TEMPLATE



4.00"

4.25"

7.00"

2.00"

6.50"

SCALE = 1:1

**heliodyne**
SOLAR HOT WATER