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SOLAR HOT WATER

INSTALLATION
GUIDE

DELTA T PRO
CONTROL UNIT

**EXCELLENCE
BY DESIGN**

1. DELTA T PRO

1.0. Description

This Delta-T Pro solar controller has been specifically designed to control solar thermal collector systems, including open loop, closed loop with a heat exchanger, drain back, residential domestic water heating with electrical ignition gas single tank storage, combination systems with space heating, and commercial systems with variable speed pump operation.

There are two versions of the Delta-T Pro, one with a 10Base-T Ethernet connection (DLTA 000 001), and one with a Wi-Fi/802.11b Connection (DLTA 000 002).

The controller comes loaded with interface software, accessed like a web page through any PDA, handheld, phone, laptop or computer with a rich HTML internet browser such as Microsoft's Internet Explorer. Connecting the control to an existing home or office network will enable any user on that network to view the system parameters and thermal performance data.

For the most basic system, the control requires two SAS-10 (10,000 Ohm @ 77°F) thermistor sensors, while additional inputs are required to take advantage of the more sophisticated operations, like energy calculation and data storage. Please see the table at the end of this manual for functions and their explanations, as well as the inputs required to run them.
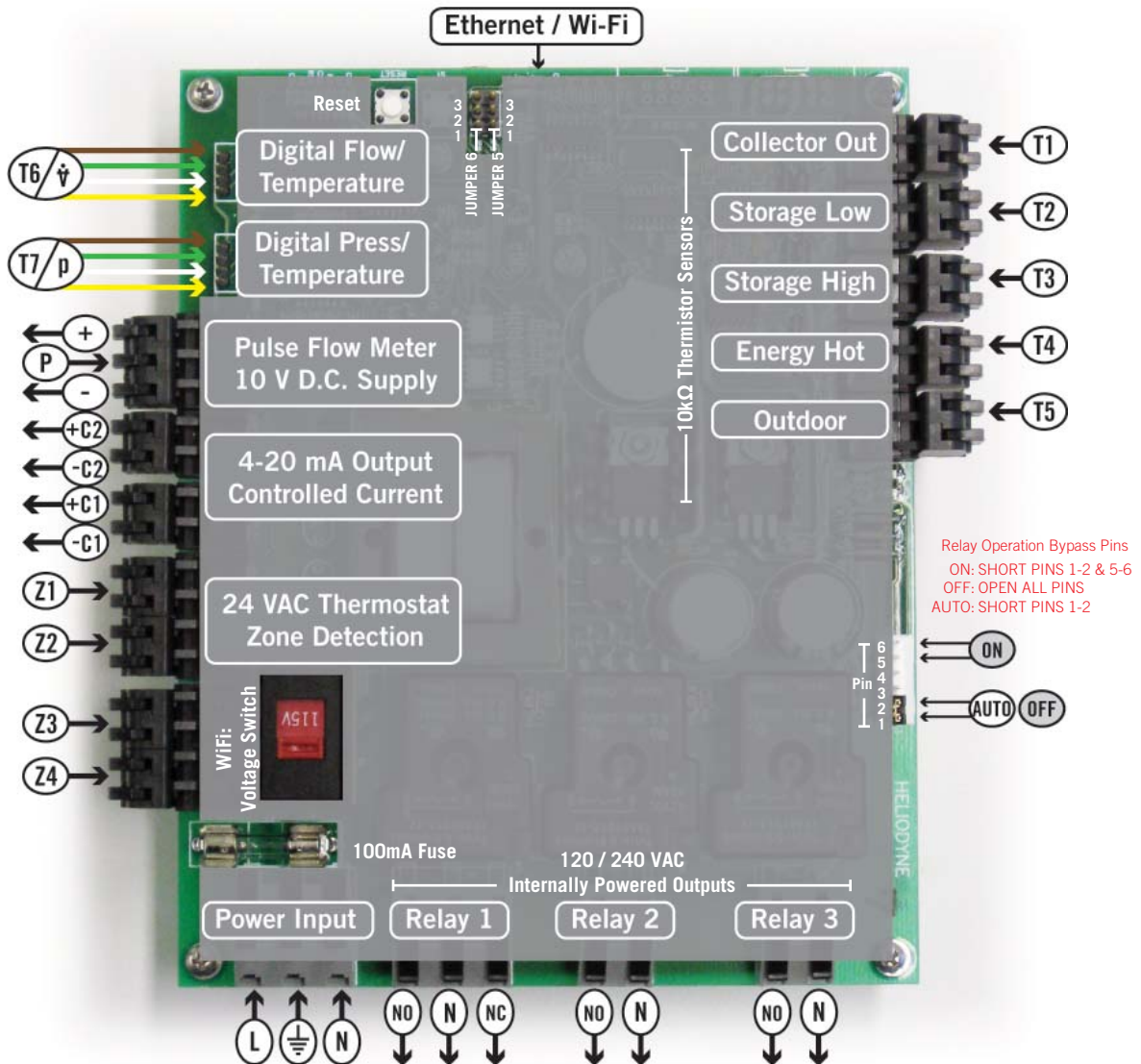
Figure 1.0.-1 Delta T Pro I/O

2. INSTALLATION

2.0. General Notes

This control conforms to the National Electric Code and is certified by the Underwriters Laboratory. Installation should adhere to all national and local electric codes, and be installed by a qualified electrician or contractor. Any electrical wiring or modifications to the control I/O should be performed with the power disconnected.

2.1. Mounting

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. The back page of this manual has a screw template.
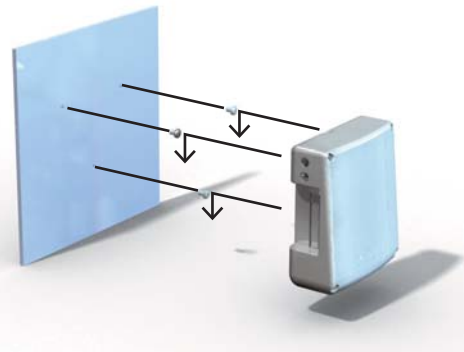
2.2. Power and Wiring

This control comes pre-wired with an electric line cord for plug-in operation. The voltage is factory set to accept 115 VAC nominal. If 230 VAC operation is desired, switch the red slider to reveal 230; modification of the line cord may be necessary to adapt to the field plug receptacle. The operation voltage determines the relay output voltage.

Wire solar loop pumps into Relay 1, using the Normally Open (NO) terminal on the relay. The Normally Closed (NC) terminal can be used to supply power to a unit for use when the collectors are not heating the storage, like a swimming pool or hot tub. See Figure 2 below, and the reference table at the end of this manual for use descriptions.
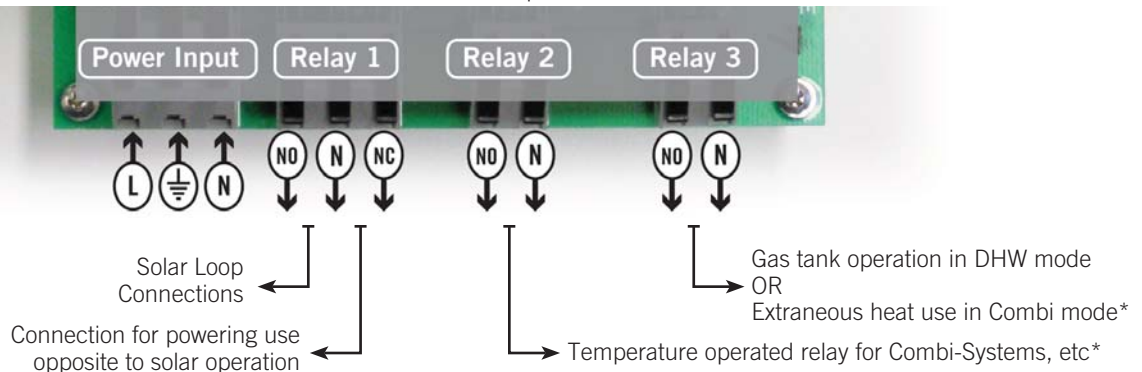
Figure 2. Relay Connections

*The minimum operation temperature is user set

2.3. Thermistor Sensors

The SAS-10s sense temperature by conduction, and are not for liquid immersion, or inside collectors. For a proper reading, ensure the copper lug on the sensor is firmly against the desired surface using an SS pipe clamp across the flat surface or bolted via the through hole. Use surrounding insulation to avoid ambient temperature and other sources of reading interference.

The sensor leads are 24 GA Class II wiring and carry 4 VDC. Use a conductor 18-24 GA zip or bell wire to run from the sensor location to the control. Use caution when installing to avoid wire damage. Shielded wire is not necessary.

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3. SETTINGS

3.0. Network Connection

The Delta-T Pro comes preset with network parameters that in most cases will not be compatible with existing network configurations.

IP Address:	169.254.148.50
Subnet Mask:	255.255.0.0
Gateway:	169.254.148.1

If the above parameters are acceptable to your current configuration, connect an Ethernet cable to the RJ 45 jack on the control, and connect the other end into your network hub. If these settings must be adapted for your existing network, or you do not have a network, then you must connect the Ethernet cable directly to your computer to view the software.

After connection, wait for the computer to resolve the IP address (up to 30 seconds depending on computer speed), then enter the IP Address above into an internet browser to bring up the system user interface.
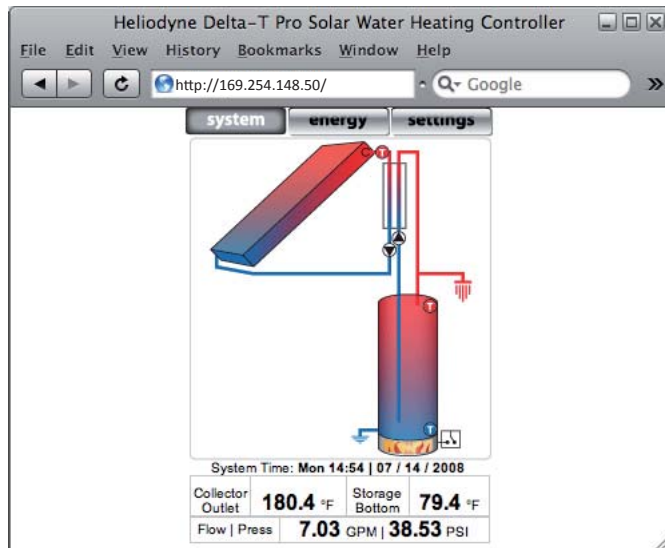
3.1. Helio-Pak Pro Systems and DLTA 000 002

The Helio-Pak Pro systems and DLTA 000 002 come pre-packaged with the Wi-Fi signal and the appropriate network settings. Users must disable any ethernet connection first, and then can connect to the "DTT Pro WiFi" network with a Wi-Fi enabled device when the Helio-Pak is installed and powered up.

3.2. Changing the Network Settings on the 001

If the above parameters are not acceptable to your network configuration, the control must be directly hooked up to a computer or laptop with an RJ 45 / Ethernet port. (DLTA 000 002 WIFI models are part of an Ad Hoc network, and the settings cannot be changed at this time.)

With the control connected and powered up, enter the above IP Address into an internet browser. After it has loaded, navigate to the "Settings" page, then to the "Network" tab on the settings page. Enter the appropriate site specific network parameters into each box and write them in this manual using a pencil in case of modifications:

My IP Address: _____

My Subnet Mask: _____

My Gateway: _____

Now press "Save". You will no longer be able to access the control via the default address, and must now use the last saved IP Address to access the control software. If the last setting is unknown, short the reset pins 1&2 at Jumper 5 directly on the board, and press the reset button. The default network settings and password have been reset. See Figure 1 for JP5 location.

3.3. Setting the System Clock

After the network settings have been adjusted to meet the installed environment, the system clock must be set to ensure optimal system performance and accurate energy graph data.

3.4. Setting System Parameters

The default operation setting for the Delta-T Pro is closed loop residential domestic water heating system. If this configuration does not match what has been installed, the operation system type must be changed immediately before the control is set into operation. For more information on functions and settings, see the table at the end of this manual.

The Delta-T Pro has many user adjustable functions which can be accessed via the settings page, behind a password protected area. The user and changeable default password are:

User name:	Admin
Password:	caution

Navigation Bar

INDEX

system | energy | settings

System Time: Mon 14:54 | 07 / 14 / 2008

| Collector Outlet | 180.4 °F | Storage Bottom | 79.4 °F |
| Flow \| Press | 7.03 GPM \| 38.53 PSI | | |

Delta-T Pro Auto Refreshed Energy Data
Updated: 15:35:20 | 07 / 14 / 2008
Download the last 60 minutes of sensor data

Collector Outlet (T1)	182.19 °F
Storage Bottom (T2)	83.37 °F
Storage Top (T3)	74.56 °F
Heat Exch. In (T4)	181.10 °F
Outdoor (T5)	75.01 °F
Flow Meter Temp (T6)	181.71 °F
Pressure Temp (T7)	177.43 °F
Flow Rate	6.97 GPM
Pressure	38.80 PSI
Current Energy Rate	6.170 BTU/min

eSensors.txt - Notepad

system | energy | settings
DAILY MONTHLY YEARLY TEMPS

Today (kBTU/hr)

Last 7 Days (kBTU)

Mo Su Sa Fr Th We Tu

Past 12 Months: MBTU

Jul May Mar Jan Nov Sep

Life   Last 5 Years: MBTU

CO2

MBtu lbCO2   '08 '07 '06 '05 '04

Temperatures

T1 T2 T3 T4 T5 T6 T7

system | energy | settings

To view this page, you need to log in to area "Admin" on 169.254.148.50:80.

Your log-in information will be sent securely.

Name: Admin
Password: ●●●●●●

☐ Remember this password

Cancel   Log In

system | energy | settings
System Time Network

System
[2] Closed Loop Residential DHW

Password
Current Password: caution
Edit Password: caution

Advanced Settings
Download System Energy
Version: 0.6.5E-TS
Save

system | energy | settings
System Time Network

System Clock
Current Time: 08 : 49
Edit 08 : 49

Current Date: 07 / 14 / 2008
Edit 07 / 14 / 2008

Save

system | energy | settings
System Time Network

Network Configuration
IP Address
169 . 254 . 148 . 50
Subnet Mask
255 . 255 . 0 . 0
Default Gateway
169 . 254 . 148 . 1
Port
80

Save

system | energy | settings
Meter DHW Combi Comm

System Metering
☑ Grundfos Flow & Temp Sensor
Range: 2 to 40
☐ Pulse Flow Sensor
0 Pulses / GAL
☑ Grundfos Press & Temp Sensor

Use with caution! Changing advanced settings may cause system damage, and void warranties.
Save

system | energy | settings
Meter DHW Combi Comm

DHW Operation
18 On Differential (°F)
5 Off Differential (°F)
50 Glycol Concentration
180 Tank High Limit (°F) ☑ ON
82 Useful Collector Temp (°F)
120 Vacation Mode (°F) ☐ ON
35 Freeze Recirc. (°F) - Open Loop Only
☐ Gas Tank Operation

Use with caution! Changing advanced settings may cause system damage, and void warranties.
Save

system | energy | settings
Meter DHW Combi Comm

Heating System Operation
120 Solar Water Supply Temp (°F)
180 Summer Heat Use (°F) ☐ ON

Use with caution! Changing advanced settings may cause system damage, and void warranties.
Save

system | energy | settings
Meter DHW Combi Comm

Commercial Pump Selection
☐ Variable Speed Collector Pump
☐ Variable Speed Storage Pump

Use with caution! Changing advanced settings may cause system damage, and void warranties.
Save

eNumbers.txt - Notepad

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4. SOFTWARE

4.0. Energy Exporting

Both versions of the Delta-T Pro store sensor and calculated energy data in a comma delimited text file format for easy import into spreadsheet applications. The Delta-T Pro can export:
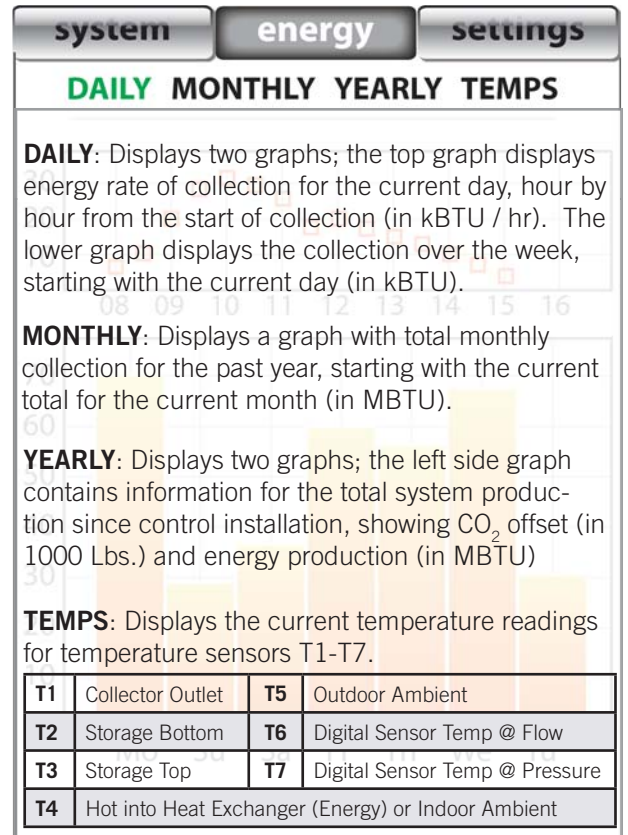
1. **eSensors.txt:**
   - The past hour's accumulated sensor readings (Temperature sensors 1 to 7, flow sensor and pressure sensor). Sensors not connected will read 0.
2. **eNumbers.txt:**
   - Last (7) days of hourly energy production (BTU)
   - Last (30) days of daily energy production (kBTU)
   - Last (12) months of monthly energy production (MBTU)
   - Last (5) years of yearly energy production (MBTU)
   - Total energy production (MBTU)
   - Total CO_2 offset (kLbs.)

Right click on the appropriate link and choose the "save as" option. If the file to be exported has the same name as an existing file in that location, you will need to change the name of the file you are saving for it to export properly. Upon spreadsheet application import, choose "separate columns by commas".

4.1. Energy Page Graphs

DAILY: Displays two graphs; the top graph displays energy rate of collection for the current day, hour by hour from the start of collection (in kBTU / hr). The lower graph displays the collection over the week, starting with the current day (in kBTU).

MONTHLY: Displays a graph with total monthly collection for the past year, starting with the current total for the current month (in MBTU).

YEARLY: Displays two graphs; the left side graph contains information for the total system production since control installation, showing CO_2 offset (in 1000 Lbs.) and energy production (in MBTU)

TEMPS: Displays the current temperature readings for temperature sensors T1-T7.

T1	Collector Outlet	T5	Outdoor Ambient
T2	Storage Bottom	T6	Digital Sensor Temp @ Flow
T3	Storage Top	T7	Digital Sensor Temp @ Pressure
T4	Hot into Heat Exchanger (Energy) or Indoor Ambient		

4.2. Settings Page

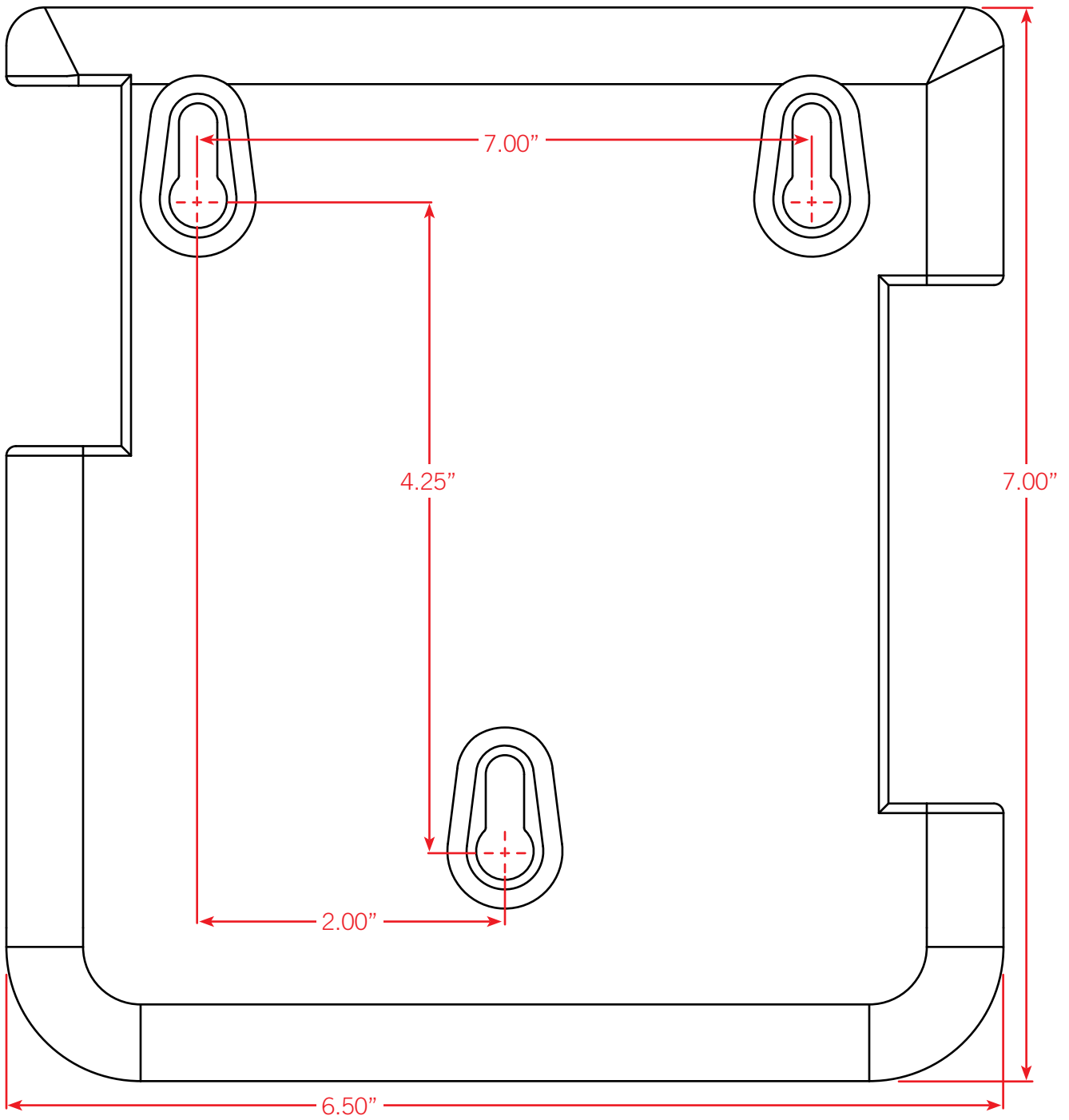| TAB	VARIABLE	VARIABLE TITLE	DESCRIPTION
Sys	System	Controlled System	System selection and description: 1 = Open Loop, 2 = Closed Loop Residential, 3 = Closed Loop Commercial, 4 = Combination DHW + Heating **(Default = 2)**
	Password	Settings Password	Change password from the default "caution" password. Press the reset button on the control PCB for changes to take effect.
		Advanced Settings	Opens the advanced system settings page
		Download System Energy	Opens a new window with text values in comma delimited format of stored system data Right click on the link and choose save as for best formatting results.
Time		Current Time	Adjust current hour and minute of 24 hour system clock
		Current Date	Adjust current day of system clock
Network		IP Address	Browser address for accessing user software
		Subnet Mask	Value for network subnet control is installed on
		Gateway	Address of network gateway

5. ADVANCED SETTINGS

5.O. Advanced Settings Page Function Reference

TAB	VARIABLE TITLE	DESCRIPTION	DEFAULT
Meter	Grundfos Flow & Temp Sensor	Checkbox for use of a digital Grundfos flow and temperature sensor	checked
	Range	Text field for entering range of Grundfos flow sensor in Liters / Minute	2-40
	Pulse Flow Sensor	Checkbox for use of a pulse (analog) type flow meter	unchecked
	Pulses / GAL	Text field for entering pulse meter calibration value	0
	Grundfos Press & Temp Sensor	Checkbox for use of a digital Grundfos pressure and temperature sensor	unchecked
DHW	On Differential	Value in °F (T1) must be greater than (T2) by to turn solar loop circulators on	18 / CL, 9 / OL
	Off Differential	Value in °F (T1) must be equal to or less than (T2) to turn solar circulators off	5 / CL, 4 / OL
	Glycol Concentration	Percent by volume of glycol to water (Volume Glycol / Total Collector Volume * 100)	50 / CL, 0 / OL
	Tank High Limit	Highest storage tank value accumulated in °F read from (T3) or the average of (T2, T3 if installed) if checked. **Always use a cold water mixing valve to prevent scalding.**	180, checked
	Useful Collector Temp	Lowest value in °F read at (T1) for solar loop operation with a satisfactory differential	80
	Vacation Mode	Value in °F read at (T3) for which collectors radiate storage tank heat through collectors at nightime (with correct system clock setting), if checked.	120, unchecked
	Freeze recirc	Value in °F read at (T1) at which collectors will circulate water to prevent freeze	OL only
	Gas Tank Operation	Operates Relay 3 for use in conjunction with single tank gas storage systems. For use only with electrical ignition gas tanks. May lower system overall performance.	unchecked
Combi	Solar Water Supply Temp	Minimum value in °F read at (T3) or average of (T2, T3 if installed) to operate Relay 2, provided system selection = 4 and any Thermostat input is closed	120
	Summer Heat Use	Minimum value in °F read at (T3) or average of (T2, T3 if installed) to operate Relay 3, provided system selection = 4 and box is checked	Unchecked
Comm	Variable Speed Collector Pump	Operates 4-20 mA controlled current output (C1) for variable speed pump operation on collector pump when checked. Adjusts pump speed to match optimum differential throughout solar day, while minimizing parasitic pump electricity for maximum payback. When used in conjunction with High Limit, slows down pump as high limit is approached to avoid collector stagnation. Relay 1 is operated if there is no variable speed storage side pump.	Unchecked
	Variable Speed Collector Pump	Operates 4-20 mA controlled current output (C2) for variable speed pump operation on storage side pump when checked. Adjusts pump speed to match optimum differential throughout solar day, while minimizing parasitic pump electricity for maximum payback. When used in conjunction with High Limit (High Limit is checked), slows down pump as high limit is approached to avoid collector stagnation.	Unchecked

5.1. Useful Conversion Factors

1 kBTU = 1,000 BTU; 1 MBTU = 1,000,000 BTU; 1 THERM = 100,000 BTU; 1 kWh = 3,412 BTU

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Delta-T Pro Case Mounting Template

7.00"

7.00"

4.25"

2.00"

6.50"

SCALE = 1:1