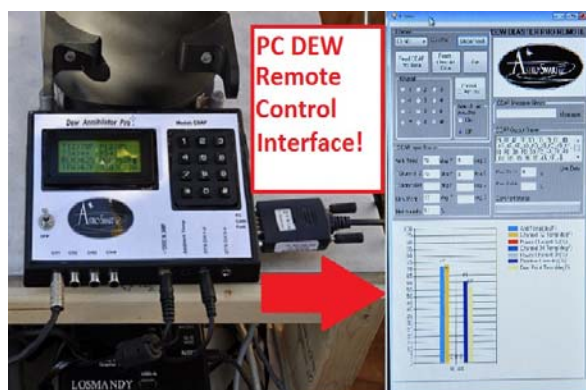# User's Manual Computerized Dew Annihilator Pro (Model CDAP)

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User's Manual

for the

Astro-Smart

Computerized Dew Annihilator Pro (Model CDAP)

Contents

Computerized Dew Annihilator Pro (Model CDAP)

A. Overview

Astro-Smart is the innovator of this elegant *automatic solution to your dew problem*. The **Computerized Dew Annihilator Pro (Model - CDAP)** is one to the most advanced dew controllers made available to the amateur or professional Astronomer and at a price comparable by no other system on the market. **The Computerized Dew Annihilator Pro (Model - CDAP)** is designed to be used with any make or model of telescope which has more features than any other dew control system being offered at a fraction of the cost. Whether you have a refractor, newtonian, schmidt-cassegrain, or a ritchey-chretien, the CDAP will solve your dew problems automatically while informing you every step of the way. Its like having a hired dew specialist at your disposal. The CDAP can be controlled remotely by a computer or locally as a standalone unit. In addition, the automated worry free operation for the CDAP can be operated manually if the user so desires for special purpose applications or to be used for multiple scopes and or accessories at once using dew heater strap extensions.

Since, the inception of this unique product at Astro-Smart , the CDAP was many years in the making, over long periods in astronomy using existing products on the market to control dew, identifying their weaknesses and limitations making the product you see before you. Features such as patent pending heat distribution which minimizes heat currents on optics during imaging, Humidity, Dew point and differential temperature alarms with automated decision making on dew control, Updateable Firmware, Computer Control, Intelligent software GUI interface with Multi-Readout Large LCD and keypad interface to name a few. The CDAP is finally here!!!

Figure 1: Computerized Dew Annihilator Pro (CDAP)

B. Features

The Astro-Smart **Computerized Dew Annihilator Pro (Model - CDAP)** has these innovative and Unique features:

1.   Full Computer Driven Or Manual Operated Dew Control Solution.

2. 4 Output Port Control Automated or User Controlled.

3. 4 line Multi-Readout Sensor and Port Activity Backlit LCD Display.

4.   Full 12 Keypad user interface for entry of System Parameters and Control Functions.

5. Patented Astro-Smart Wave Cancellation Pulse Width Modulation(PWM) for Efficient Heat Output Suited For Imaging.

6. Audible Alarms For Dew Point Approaching (DWP) and Differential Delta Monitoring.

7. Dual Differential Temperature and Humidity measurement and Control.

8. Automated Dew Point and Temperature Variance set point for Dew Control.

9. Dual Fahrenheit or Celsius Temperature Display Feature.

10. Upgradeable Firmware and Standalone Software GUI Interface.

11. USB Control with Software Interface Via Remote Computer.

12. Automatic System Data Logger Storage and Retrieval Plot Capability.

13. High quality design employs multi-layer PCB form factor and only the best quality components with conformal coating for outdoor use.

14. Void of RFI(Radio Frequency Interference) protected to enhance Astro-Imaging .

15. Price point designed for affordability while providing advanced features.

Providing the Astronomical Community with Premier Products, Services, and Training

The Astro-Smart Computerized Dew Annihilator Pro (**CDAP**) was designed with the same Astro-Smart USER-Friendly design philosophy as all our other products:
- Usable
- Serviceable
- Elegant
- Reliable
- Build with burn in time testing before ship.
... USER-Friendly

Incorporates a four port heater capability controlled by two channels using two remote temperature sensors (one optional). It will work with one remote temperature sensor or with a second remote sensor (available separately) making your corrector dew control independent from your eyepiece or guidescope dew control for instance.

C. Contents of Box

1. CD with **CDAP** Pro SW, manual and video tutorials.

2. **CDAP** Controller Module.

3. One Differential Temp Sensor.

4. One USB to serial interface Cable.

5. Velcro Strips for easy mounting to bottom of unit.

D. Input / Output Power Specifications

The **CDAP** requires the following:

- At a minimum of 12 Volts DC at 3.3 amps a 2.5mm DC power connector on your AC/DC supply. Based on the 4 channel configuration, the CDAP Pro is rated at 5 Amps per duplexed channel or 10 Amps total. Ie. Ch1-2 5 Amp max + Ch3-4 5 Amp max for a total of 10 Amps at 12 VDC which gives a variety of heat strap configurations possible. A power supply rated at 12 VDC and 10 Amps rms is the ideal configuration which astro-smart recommends and provides as a purchase option.

  Note: This current drawn through the **CDAP** is dependent on the resistance of each dew strap being used with the **CDAP** . The total current for all the dew straps must not exceed the power supply current rating.

The total resistance of all the dew straps used with the iDDHM must follow this equation for SAFE operation:

$$\frac{\text{Current Rating of Power Supply}}{\text{Voltage output of Power Supply}} = \frac{1}{R_{strap\ 1}} + \frac{1}{R_{strap\ 2}} + \frac{1}{R_{strap\ 3}} + \frac{1}{R_{strap\ 4}}$$

Astro-Smart LLC assumes no responsibility if this warning is not heeded.

- Center positive voltage, sleeve ground, sees Figure 2.

Positive (+)   ●——————→ Grounded Sleeve
12VDC

Figure 2 DC power plug

- Uses dew straps manufactured by other astronomical vendors.
- **Note:** Astro-Smart recommends you buy our certified tested power supplies for this product. Users can buy and connect their own power supplies to this product, but they do so at their own risk.

Providing the Astronomical Community with Premier Products, Services, and Training

E. CDAP Front Panel And Connector Diagram

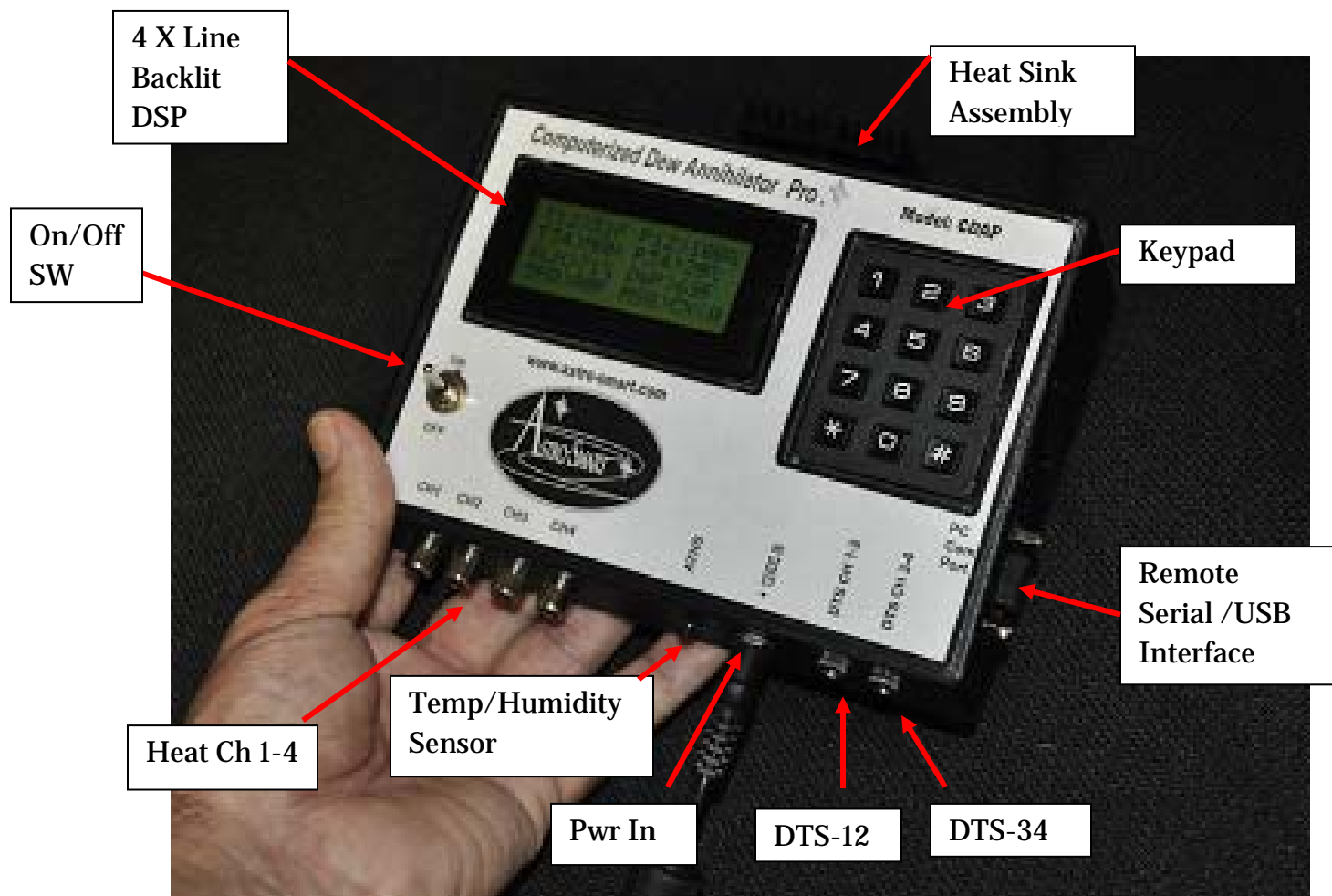➢ **Computerized Dew Annihilator Pro (Model- CDAP)** Configuration . See Figure 3 below.

4 X Line Backlit DSP

Heat Sink Assembly

On/Off SW

Keypad

Remote Serial /USB Interface

Heat Ch 1-4

Temp/Humidity Sensor

Pwr In

DTS-12

DTS-34

Figure 3 CDAP Overview Model (2015).

F. Basic Functionality

The user can watch as the CDAP adjusts heat and controls dew on your telescope based on humidity, dew point, local ambient and temperature differential from optical interfaces with the surrounding environmental conditions. The automatic bootup default control summary features are explained below with user override options for manual control during standard operation described below in next section.

An online video demo of operation can be found on our website at :
http://www.astro-smart.com/index.php?p=1_24

G. BootUp: Default

1. Fix all connections to your CDAP as depicted in Figure 2. This includes heater straps CH1/CH2 and at least one external temperature sensor plugged in DTC12 and power supply interface as specified in Figure 1, Figure 2.(Expected Def Operation.)
2. Turn On power switch from center(OFF) to Up position(ON). This is the computers power on interrupt reset.
3. Note: Boot up sequence on display and power illuminated. All functions go "Beep" will be heard at the init logo.

-T12 and T34 represent the readouts of your DT12 and DT35 external plugged in temp sensors.
-RLH represents the Relative Humidity Level from your humidity sensor.
-TPA represents the external ambient temperature.
-P12 represent the Output Power % going to your optic devices which have dew heater straps plugged into CH1 and CH2 ports.
-P34 represent the Output Power % going to your optic devices which have dew heater straps plugged into CH3 and CH4 ports.
-MSG represents any key message information displayed to the user as explained below.

4. Note: After about 5 secs, TPA, T12, RLH, P12, DWP and MSG are now active information in operation. For example in automatic mode note P34 and T34 " ** " denote not used until DT34 option is plugged in and user selected to the system described below.

5. Note: display readout for reference . DTS12 and or DT34 need to be plugged in the system to operate correctly in pure automatic mode.
6. The CDAP requires a complete circuit meaning the heat straps being plugged in to provide current drawl.

H. Default Operation (Automated Dew Control)

By default operation, the **CDAP** is a automated dew heater that samples its surroundings and takes the appropriate actions, so you don't have to. So, lets look at a few scenarios, the unit may encounter!

1. **Case 1. (Emergency Heat required because optic surfaces are colder than the surrounding environment!)**
    ➤ **Equipment:** DT12 and 1 Dew strap plugged into CH1 for main telescope optics. DT34 input and CH3 and CH4 outputs not being used. In this case DT34 is not plugged in.
    ➤ **User Keypad Input Actions:** None! **CDAP in** Automatic Mode of Operation.
    ➤ Read Section L and M for more information.

CDAP Conditions And Actions:
i.   **(Automatic Mode: Optic temperatures < Ambient temperatures by 10 degs or more)** Optics very cold and need immediate warm up. (ie, T12 by 10 degrees F or more).
  a. *Depending on the surrounding humidity, the dew point will be calculated and may be reached*, in which case, the user will be notified that conditions for dew are present but the system will respond by abating by applying moisture heat control on the optics.
  b. *1KHz Alarm On Warning Heard.* This tells the user Dew may form with high probability and the system can control it automatically or by the user as well.
  c. *Power to Dew Straps.* (Optic temperatures < Ambient temperatures.)
      In this case the optic differential channel will have a P12 power on display shown as PWM % during operation and heat strap output by touch. In this case the MSG> window shows that the corrector optics are 10 deg F less than the surrounding ambient temperature. This forces the system to apply heat to the optics as shown at a 100% PWM heat rate shown on P12> which is the MAX temperature duty rate.
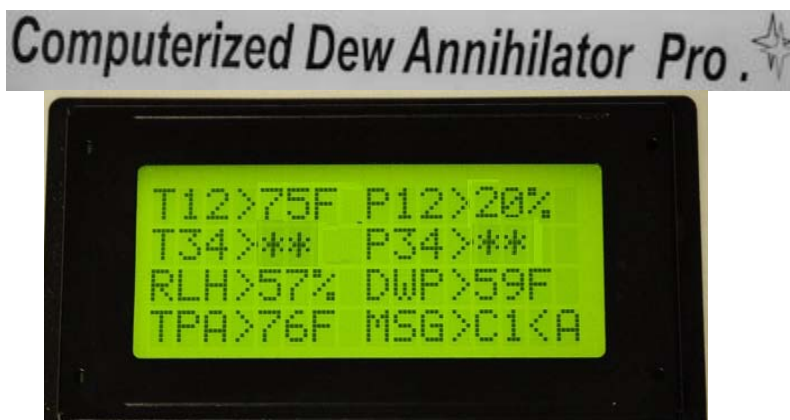

Computerized Dew Annihilator Pro.

2. **Case 2. (Normal Automated Dew Control, CPU PWM Controlled Heat)**
   - ➢ **Equipment:** DT12 and 1 Dew strap plugged into CH1 for main telescope optics. DT34 input not plugged in and CH3 and CH4 outputs not being used.
   - ➢ **User Keypad Input Actions:**   None! **CDAP in** Automatic Mode of Operation.
   - ➢ Read Section L and M for more information.

CDAP Conditions And Actions:
   i.   **Automatic Mode: (Optic temperatures < Ambient temperatures by 5 degs or less CH 1-2 Only.)**

   a. *Depending on the surrounding humidity, the dew point will be calculated and may be reached*, in which case, the user will be notified that conditions for dew are present but the system will respond by abating the issue by applying moisture heat control on the optics.
   b. *No alarm is heard* unless dewpoint is approaching. No alarm heard as optics are approaching ambient temperatures.
   c. *Power to Dew Straps.* (Optic temperatures < Ambient temperatures.) In this case the optic differential channel will have a P12 power on display shown as PWM % during operation and heat strap output by touch. In this case the MSG> window shows that the corrector optics are 1 deg F less than the surrounding ambient temperature. This forces the system to apply heat to the optics as shown at a 40% PWM heat rate shown on P12 temperature duty rate.

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```
T12>75F  P12>20%
T34>**   P34>**
RLH>57%  DWP>59F
TPA>76F  MSG>C1<A
```

3. **Case 3. (Normal Automated Dew Control, CPU PWM Controlled Heat)**
   - ➢ **Equipment:** DT12 and 1 Dew strap plugged into CH1 for main telescope optics. DT34 input plugged in and CH3 and CH4 outputs being used.
   - ➢ **User Keypad Input Actions:**   Activate CH 3-4 with 8 key! **CDAP in** Automatic Mode of Operation.
   - ➢ Read Section L and M for more information.

CDAP Conditions And Actions:

ii. **Automatic Mode: (Optic temperatures < Ambient temperatures by 5 degs or less on Ch12 and Ch34)**

   a. *Depending on the surrounding humidity, the dew point will be calculated and may be reached*, in which case, the user will be notified that conditions for dew are present but the system will respond by abating the issue by applying moisture heat control on the optics.
   b. *No alarm is heard* unless dewpoint is approaching. No alarm heard as optics are approaching ambient temperatures.
   c. *Power to Dew Straps.* (Optic temperatures < Ambient temperatures.) In this case the optic differential channel will have a P12 power on display shown as PWM % during operation and heat strap output by touch. In this case the MSG> window shows that the corrector optics are 4 deg F less than the surrounding ambient temperature for CH 3-4. This forces the system to apply heat to the optics as shown at a 80% PWM heat rate shown on P34 temperature duty rate. A prior MSG indicated C3 < A or T12 was 3 degrees below ambient making a 60% duty rate shown on P12. The dew point is calculated based on the ambient temperature and relative humidity captured by onboard sensors.

Computerized Dew Annihilator Pro.

```
T12>74F  P12>60%
T34>73F  P34>80%
RLH>84%  DWP>71F
TPA>77F  MSG>C4<A
```

4. **Case 4. (Normal Automated Dew Control, CPU PWM Controlled Heat)**
   - ➢ **Equipment:** DT12 and 1 Dew strap plugged into CH1 for main telescope optics. DT34 input plugged in and CH3 and CH4 outputs being used.
   - ➢ **User Keypad Input Actions:** Activate CH 3-4 with 8 key! **CDAP** in Automatic Mode of Operation.
   - ➢ Read Section L and M for more information.

CDAP Conditions And Actions:
   iii. **Automatic Mode: (Optic temperatures < Ambient temperatures by 5 degs or less on Ch12 and Ch34) , Ch12 has stabilized and requires no heat.**

   a. *Depending on the surrounding humidity, the dew point will be calculated and may be reached*, in which case, the user will be notified that conditions for dew are present but the system will respond by abating the issue by applying moisture heat control on the optics.
   b. *No alarm is heard* unless dewpoint is approaching. No alarm heard as optics are approaching ambient temperatures.
   c. *Power to Dew Straps.* (Optic temperatures < Ambient temperatures.) In this case the optic differential channel will have a P12 power on display shown as PWM % during operation and heat strap output by touch. In this case the MSG> window shows that the corrector optics are 1 deg F less than the surrounding ambient temperature for CH 3-4. This forces the system to apply heat to the optics as shown at a 20% PWM heat rate shown on P34 temperature duty rate. A prior MSG indicated C =< A or T12 was 0 degrees below ambient making a 0% duty rate shown on P12 meaning no heat is needed and the channels have stabilized. The dew point is calculated based on the ambient temperature and relative humidity captured by onboard sensors.

I. Manual With Automatic Operation (Apply Heat As Desired On Channels)

1. **Case 1. (Manual With Automatic Operation, Apply Heat As Desired CH-34)**

   ➢ **Equipment:** In this case, DTS12 and DTS34 are plugged in but DTS-34 will be ignored when in manual power mode as the user is controlling output power and bypassing CDAP sensor input. When the user returns to automatic mode, the sensors will regain usage by the system. DTS12 and P12 is in Automatic Mode independent of Ch-34 Manual activity.

   ➢ **User Keypad Input Actions: Example.** Pressing keypad button "7 " followed by a "5" forces manual PWM heat to CH3-4 regardless of CDAP sensor input. User Mode of Operation forcing 40% PWM at the outputs.

   ➢ Note: CH1-2 still in Automatic Mode. The CDAP requires a complete circuit meaning the heat straps being plugged in to provide current drawl.

   ➢ Read Section L and M for more information.

   Conditions:
   i.   **(Manual Mode: User forces Desired Power %)**

      a. User input on keypad and or computer WebGUI as described in Section L and G.
      b. In this case, Manual Operation can be achieved by user as well on either channels as shown below in standard operations section. Note: display readout for reference .

Computerized Dew Annihilator Pro .

```
T12>74F   P12>60%
T34>MAN   P34>20%
RLH>83%   DWP>70F
TPA>77F   MSG>C3<A
```

2. **Case 2. (Manual Operation, Apply PWM Heat As Desired CH-12)**

➢ **Equipment:** DT12 and DT34 can be plugged in or removed but they will be ignored when in manual power mode as the user is controlling output power and bypassing CDAP sensor input. When the user returns to automatic mode, the sensors will regain usage by the system if they are plugged in.

➢ **User Keypad Input Actions: Example.** Pressing keypad button "7 " followed by a "5" forces manual PWM heat to CH3-4 regardless of CDAP sensor input. User Mode of Operation forcing 20% PWM at the output of CH-34 shown as P34 below.

➢ Note: CH1-2 still in Automatic Mode.

➢ Read Section L and M for more information for this option.

Conditions:

ii.   **(Manual Mode: User forces Desired Power %)**

a. User input on keypad and or computer WebGUI as described in Section L,M.
b. In this case, Manual Operation can be achieved by user as well on either channel as shown in other cases below. Note: display readout for reference .

Computerized Dew Annihilator Pro .

T12>MAN P34>20%
T34>74F P12>60%
RLH>83% DWP>70F
TPA>77F MSG>C3<A

3. **Case 3. (Manual Operation, Apply PWM Heat As Desired CH-1234)**

➢ **Equipment:** DT12 and DT34 can be plugged in or removed but they will be ignored when in manual power mode as the user is controlling output power and bypassing CDAP sensor input. When the user returns to automatic mode, the sensors will regain usage by the system if they are plugged in.

➢ **User Keypad Input Actions: Example. Case 1 and 2 above**

➢ Read Section L and M for more information for this option.

Conditions:

iii.   **(Manual Mode: User forces Desired Power %)**

a. User input on keypad and or computer WebGUI as described in Section L,M.

b. In this case, Manual Operation can be achieved by user as well on either channel as shown in other cases below. Note: display readout for reference .

4. **Case 4. (Return to Automatic Operation From Manual CH-1234)**

   ➢ **Equipment:** DT12 and DT34 can be plugged in or removed but they will be ignored when in manual power mode as the user is controlling output power and bypassing CDAP sensor input. When the user returns to automatic mode, the sensors will regain usage by the system if they are plugged in.
   ➢ **User Keypad Input Actions: User Presses "*" key**
   ➢ Read Section L and M for more information for this option.

Conditions:

   iv.   **(Return to Automatic Operation From Manual CH-1234)**

   a. User input on keypad and or computer WebGUI as described in Section L,M.
   b. In this case, Manual Operation can be achieved by user as well on either channel as shown in other cases below. Note: display readout for reference .


Computerized Dew Annihilator Pro.

J. Standard Keypad Entry Instructions(MSG > Key?/Done)

Note: The following user entry instructions are needed when multiple key strokes are needed for certain menu behavior to work correctly namely CDU menu options 1, 2, 3 and 7 as described in section L and M. Note these steps when accessing the keypad for manual modes and or functions available on your CDAP. Used in next Section H.

1. Please use the Keypad Activation Instructions below when using the keypad summary of operations in section H in the next section.
2. Some modes may require more than one button to access. Section H summary of keypad access will outline any of these cases. It is important you watch the screen to aid in these entrees to aid in keypad de-bouncing.
3. Press and hold first keypad number sequence mode desired and wait for all display activity to freeze indicating it has detected your button press.
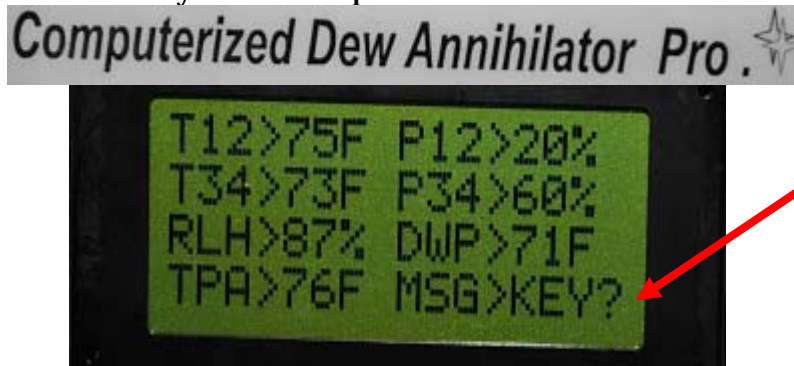
4. Now, Release the 1st button pressed and note the wait message appears. **MSG>KEY ?**
5. You have upto 2 secs to press the next sequence button required.
6. After you release the button, you should see the message done button. **MSG> DONE**
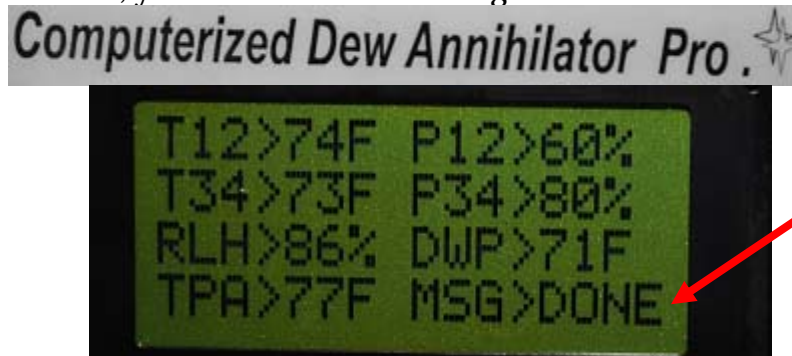
7. New value and or mode should now be in effect.

K. Summary Keypad Entry Commands (System Control)

Note: Use keypad entry instructions above when using buttons on keypad. These operations below apply to CDAP keypad and or WEBGUI entry if operating remotely.

Note: The CDAP pro can be operated in either of the following modes simultaneously:

- **Remote or Local Standalone mode** :
  - In this mode the user can control and view the CDAP remotely from a computer and or operate the CDAP as standalone using the CDU keypad.

Note: Picture examples of modes are shown below of what to expect in MSG window on the CDU before the system responds to the user action invoked.

➤ **'#' Enter:** *on keypad or WEBGUI will perform a soft CDAP reset of the system.*

➤ **'*' Enter:** *on keypad or WEBGUI will place the system back in Automatic Mode when entering Manual mode operation. Automatic mode is the default mode.*

➤ **'O' Enter:** *on keypad or WEBGUI will enable audible alarms such as dew point approaching or optic temperature delta greater than 10 degrees requiring emergency heat. Default mode is sound on.*

➤ **' 1' Enter**: *on keypad or WEBGUI is used if user wishes to set a **variance setpoint between ambient and optic temperature DTS CH1-2** or re-calibrate DTS CH1-2 channel. This has been done at factory. Default activation on power up and reset user modification from sensor value. For example pressing 1 followed by another 1 in subtraction mode will cause DTS CH1-2 to be lowered by 1 deg F. If it is desired to add value to DTS CH1-2, mode 5 must be pressed to go into add mode before performing operation. See below in option 5.*

➤ **' 2' Enter**: *on keypad or WEBGUI is used if user wishes to set a **variance setpoint between ambient and optic temperature DTS CH3-4** or re-calibrate DTS CH3-4 channel. This has been done at factory. Default activation on power up and reset user modification from sensor value. For example pressing 1 followed by another 1 in subtraction mode will cause DTS CH3-4 to be lowered by 1 deg F. If it is desired to add value to DTS CH3-4, mode 5 must be pressed to go into add mode before performing operation. See below in option 5.*

➢ **' 3' Enter**: *on keypad or WEBGUI is used if user wishes to set a **variance setpoint between optics and ambient temperature T ambient(ATHS)** or re-calibrate ATHS channel. This has been done at factory. Default activation on power up and reset user modification from sensor value. For example pressing 1 followed by another 1 in subtraction mode will cause ATHS to be lowered by 1 deg F. If it is desired to add value to ATHS, mode 5 must be pressed to go into add mode before performing operation. See below in option 5.*

➢ **' 4' Enter**: *on keypad or WEBGUI is used if user wishes to disable audible alarms when quite mode is required.*

MSG>NSND

➢ **' 5' Enter**: *on keypad or WEBGUI is used if user wishes to set a **variance add mode setpoint** between sensors by using a value offset in add mode. This has been done at factory. Default activation on power up and reset subtracts from sensor value. For example pressing 5 followed by a 1 and then another 1 will cause DTS CH1-2 to be increased by 1 deg F. If it is desired to return to subtract mode, either reset the system or use the mode 6 button to return to subtract value mode. See example below.*

MSG>Add!

➢ **' 6' Enter**: *on keypad or WEBGUI is used if user wishes to set a **variance subtract setpoint** between sensors by using a value offset in subtract mode. This has been done at factory. Default activation on power up and reset subtracts from sensor value. For example pressing 6 followed by a 1 and then another 1 will cause DTS CH1-2 to be decreased by 1 deg F. See example below.*

MSG>Sub!

➢ **'7' Enter** *: on keypad or WEBGUI to enter CDAP Pro **full manual operation mode for all 4 channels**. The user will have the ability to manually operate dew power to straps. In this mode all sensor monitoring is ignored from automatic mode and will not be displayed. Only the output power is shown. The offering is at 20-40-60-80-100% on all or individual channels CH1-2-3-4 at the users discretion. Combinations can be made to have CH12 on Manual while CH34 is automatic or vice versa. If all manual operation is wanted, then simply select the channels desired until completed. The steps are shown below to achieve this. Press 7 and hold until the MSG>Key? is seen then release and press the desired power percent mode and channel as shown below and witness MSG> Done.*

MSG>MANP

➢ **Summary of all manual modes of button sequences are below:**

Note: Examples below indicate pressing a 7 followed by the 0-9 for various power combinations shown on next page.

- 7-1 → **Power CH1-2, 20%**
- 7-2 → **Power CH1-2, 40%**
- 7-3 → **Power CH1-2, 60%**
- 7-4 → **Power CH1-2, 80%**
- 7-5 → **Power CH3-4, 20%**
- 7-6→ **Power CH3-4, 40%**
- 7-7→ **Power CH3-4, 60%**
- 7-8→ **Power CH3-4, 80%**
- 7-9→ **Power CH1-2-3-4, 100%**
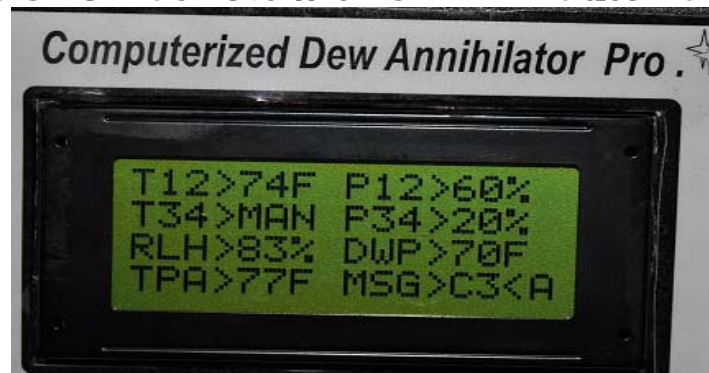- 7-0→ **User Break Command. This cancels entry in mode 7.**

MSG>BRK!

Note: Example.
a. Pressing 7-1 give CH1-2 at 20%, Pressing 7-7 now give CH3-4 at 60%. The system will show all channels now in manual mode as shown below.

Note: Example.
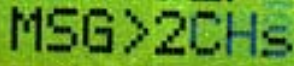**a. Pressing 7-1 gives CH3-4 at 20% with CH1-2 in automatic mode.**

➢ **'8' Enter:** *on keypad or WEBGUI to enter CDAP pro with all 4 Channels activated CH 1-2-3-4*

➢ **'9' Enter:** *on keypad or WEBGUI to enter CDAP pro with only 2 Channels CH 1-2 activated.*

CDAP Pro Firmware:

➢ *Currently, the CDAP Pro is designed for optimum performance using the following control profile profile in relation to the optic temperature compared to ambient.*

- *-(>5 or greater) deg 100%,-(4) deg 80%,-(3) deg 60%,-(2) deg 40%,-(1) deg 20%, +(0 or greater) deg 0%.*

➢ *The CDAP Pro's firmware can be updated on user request for special features not listed and or for future use and updates. One such feature under investigation requested was to provide manual control for a user entered delta temperature profile for ambient and optic sensors. The user would be able to enter a desired delta turn on point. The CDAP pro would then calculate the profile for remaining delta and set appropriate power levels. Ie. If the user entered 4 deg delta, CDAP pro would create a profile as shown: -(>4 or greater) deg 100%,-(3) deg 80%,-(2) deg 60%,-(1) deg 40%, 0 deg 20%, +(0 or greater) deg 20%. Today, the user can perform this operation without the need to make a formal firmware update. The user can simply lower one or both optic sensors by a newly calibrated temperature that would yield the desired results. For instance, assuming the default CDAP pro profile is used and the user wished to add a 1 degree offset to the profile to get the new user profile above, the user would subtract 1 degree from both calibrated optic sensors or add 1 degree to the ambient calibrated sensor.*

L. PC Dew Control Remote User Interface Summary

Your CDAP Pro can be monitored or controlled from your computer. Just connect the serial to usb cable and in the device manager of your operating system, you must know what port is used when connected. The settings will be automatic and the host PC install program provided will list all available serial ports to connect. You just pick the correct one. A video tutorial is listed in the support page of our website to go thru the basic operations of this feature. Some basic features are listed below.
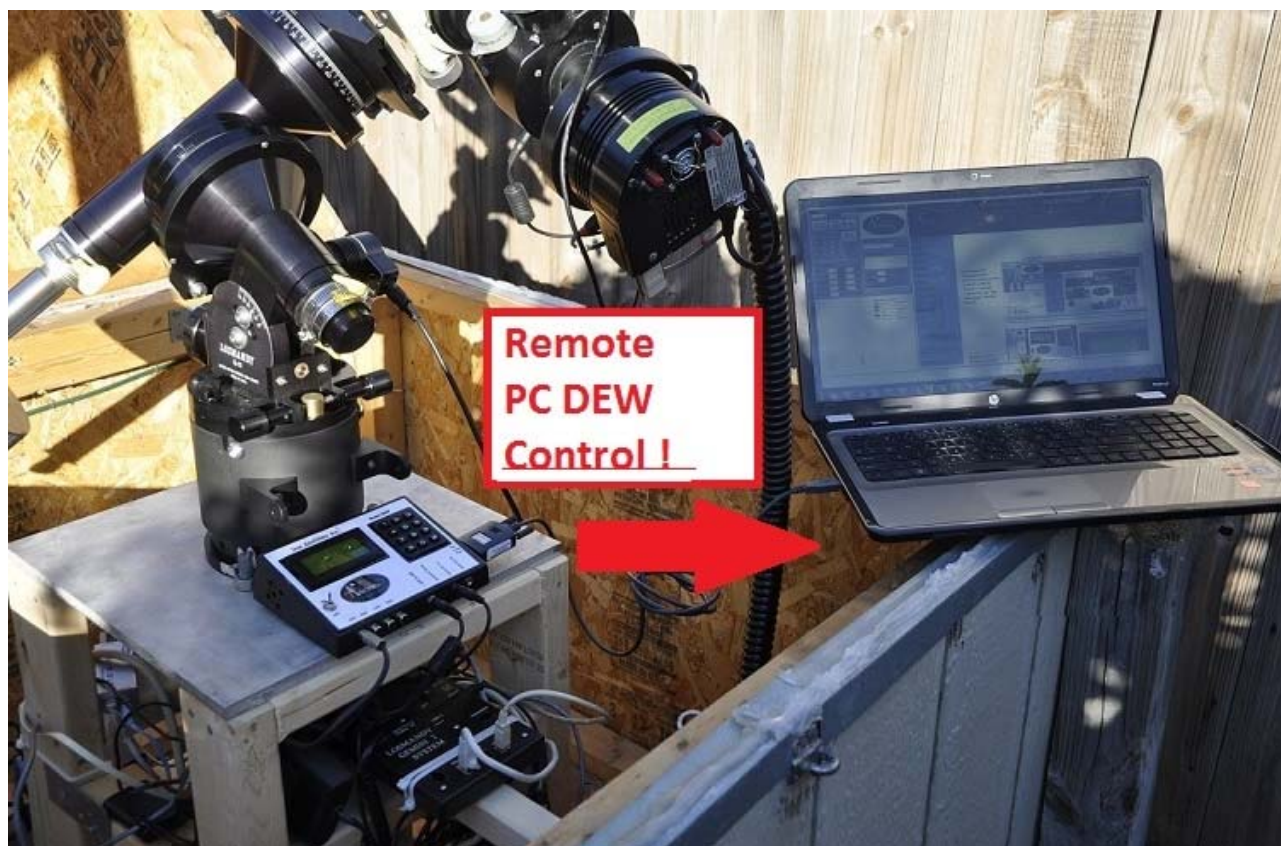
The simplicity of operation can be seen in the following figure below.
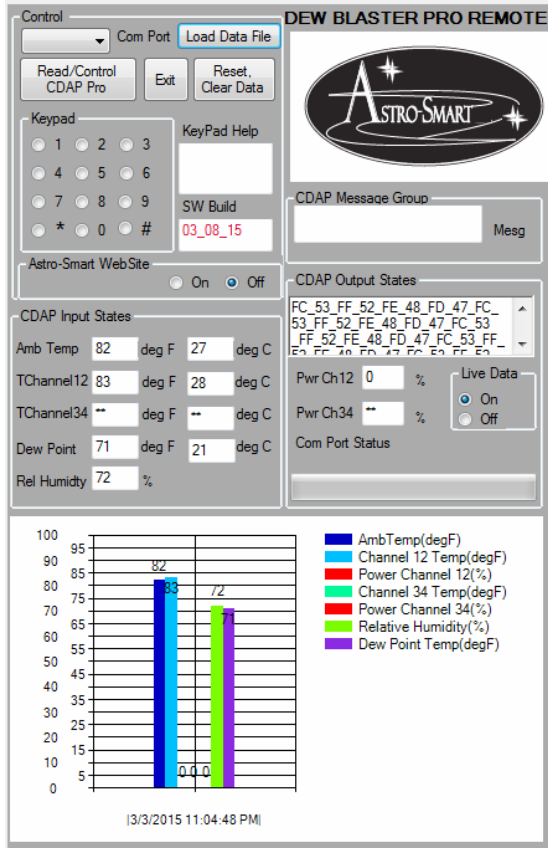
The PC SW remote interface snap shot main screen is shown to the left. Its a USB-Serial connection to the CDAP tested across multiple PC operating system platforms.

The snapshot on the CDAP product page shows the left side window with current remote activity of all parametric values, virtual keypad and various graphs to track ambient temperature, Optic temperatures, Power Out per channel, Dew Point and monitoring of Alarms. The WebGUI interface also includes a data logger system that automatically stores data files which can be loaded, and plotted to retrieve prior historical data night sessions. This feature is explained below.

As part of the CDAP pro package, new CDAP purchases will get the standard PC SW remote platform for free.

The HW/SW requirements for the CDAP to work with remote PC communication are the following:

1. Connect serial to USB cable provided by Astro-Smart.
2. Install the CDAP Pro SW on your computer(Win XP, Win 7 or Win 8).
3. Turn on the CDAP Pro, then run the device manager on your PC OS to determine which port the CDAP Pro is attached to. Then run the CDAP Pro SW. For compatibility select XP compatibility and Admin control for Win 7 and 8 after installed before running.

4. While in CDAP Pro PC interface, select the serial port CDAP Pro is attached to.
5. You now have two options for mode of operation. Monitor or Remote.
Note: Operation on computer keypad should perform as if you are in standalone mode CDU instructions as shown above in CDU operation details.

6. **If CDAP Pro Monitoring operation is preferred**.
    i. Select Control CDAP Pro button and watch the data arrive in the Output status window.
    ii. In about 5-8 secs, the data will be parsed and reported in I/O status window and also on
       the graphic output. Anytime, you wish to update from the device, simply press this button
       again.
    iii. In this mode you query the CDAP Pro without the use of the SW keypad in the WebGUI.

7. **If Remote Control of the CDAP Pro operation is preferred**.
    i. In this mode you can also control the CDAP Pro in addition to query its operation.
    ii. Select Control CDAP Pro button and watch the data arrive in the Output status window.
    iii. In Remote Mode, On the CDAP Pro SW interface, select the Control CDAP Pro button
       followed by keypad entry's to control your CDAP Pro remotely.
         ->. For example, if it is desired to set the power on the CDAP Pro to 40% on CH12 the
         sequence would be:
         1. Hit Control CDAP PRO
         2. Followed by a 7 and 2 on the keypad.
    iv. To break Remote Mode looped operation as in step iii above,
       select the Control CDAP Pro button followed by keypad entry's of "0" a zero.
    v. Anytime, you wish to update from the device, simply press the Control CDAP Pro
       button again, enter data within 5-8 secs and repeat the process to control or monitor the
       CDAP Pro.

8. **Automatic Data File Logging Feature->Saving, Retrieval and Plotting**.
This feature is very powerful when wanting to collect and compare prior data results from your
CDAP Pro as a data logger.

To activate this feature do the following:
        i.   After performing and collecting multiple samples from your CDAP Pro using
           the Read/Control CDAP Pro button, the system automatically stores the files
           on your hard drive in C:\CDAP_Pro_Data directory.
       ii. Hit the Load Data File button and the software takes you to the directory to
           select a file of interest. The files are time stamped and will be recognized by
           the program when loaded. These files are plotted and data is shown with the
           prior history time stamp to compare and or retrieve data taken from prior
           night sessions.
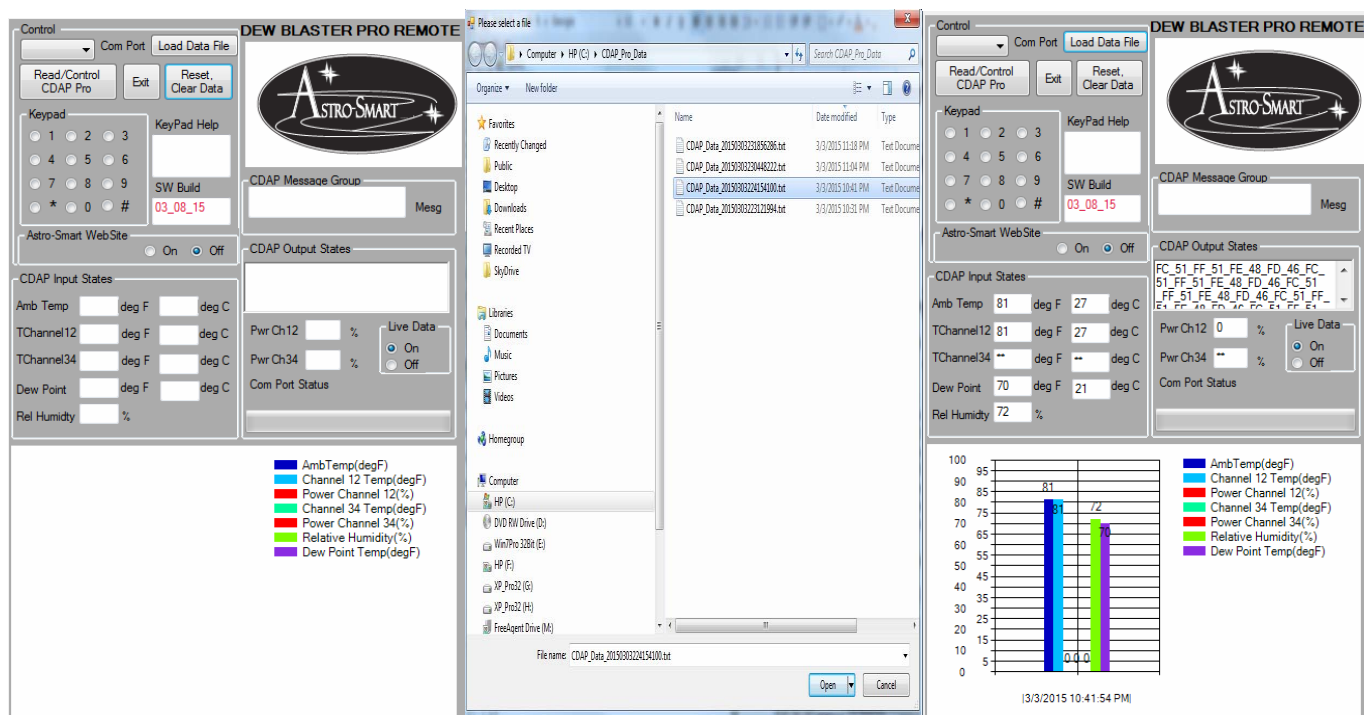   iii. The figures below show this behavior.
       iv.

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Automatic Data Logger and File Retrieval Plotting Capability:

9. Other features of the GUI and examples can be seen by demonstration on our website
   to browse support pages, video tutorials of this product and others.
   i. http://www.astro-smart.com/index.php?p=1_49_Video-Overviews
   This link above is for the CDAP Pro software interface demo and CDAP overview.

10. Enhancements to the software will be made based on user input on a continual basis and can
   be uploaded from our site for your convenience.

Another snapshot shown below is the data acquisition upgrade suite of the standard CDAP Pro SW
including Multi-Variant Data and File Plot Retrieval Storage, Multiple Data Graph Analysis and RTE
Data Acquisition. This product upgrade software is available for free for customer referrals. The right
side of the GUI triggers the website for product updates available for release and site downloads such as
user manuals. This feature can be enabled or disabled at any time.

CDAP Pro Multi-variant Data Acquisition and Analysis Suite

M. External Temperature Sensor Hints:

Install the Remote Sensor at each location under the dew strap with the flat face of the sensor facing the telescope piece. Try to attach to an area where no heating element is in contact with the sensor . You want to monitor optic temperature, not the heating element. See Figure 3 below

Figure 3 Remote Sensor Placement

If no other option is available, route the remote sensors cables along with the dew strap cables underneath the fabric portion where no heating element resides. A convenient way to do this is to braid the two cables together, Figure 4 below.

If you have two Remote Sensors route one with the dew strap that is used for your telescope's front corrector. Route the second Remote Sensor cable along with either the dew strap that is used for your eyepieces or your finderscope.

Figure 4 Route Sensor cable with Dew Strap cable

N. Accessories

You may use a power supply you already have that meets the specifications listed above, or you may purchase one from Astro-Smart(Recommended). See section C above. Our power supplies provide 12v at 5 amps or 10 amp supply will provide years of dependable service along side your **CDAP**.

Figure 5   Additional Remote Sensor / Right Angle Dew Strap Accessories

An optional second remote sensor is available (2RSCDDDH-D), Figure . This 2nd Remote Sensor allows you to control the heating of separate optical elements. For instance, one remote sensor would be placed with your heater at the corrector. A second sensor could be placed at your eyepiece or finder scope objective lens. In this setup each pair of heaters is controlled by their respective sensor. This allows greater control for the user. This item can be purchased at the same time as you purchase your **CDAP** or at a later time. If you only use the included remote sensor, then all four heater connectors are controlled by the one sensor; and it can be plugged into either remote sensor jack. Another convenient accessory that Astro-Smart offers is a right angle heater connector (RAHC-DM), **Error! Reference source not found.**. This allows your heater to be connected to the CDAP Pro at a right angle. This may be convenient for you to alleviate any bending that you have of your heater connector and wire.

Another convenient accessory that Astro-Smart offers is Three versions of power supplies based on your dew heating needs as shown in **Error! Reference source not found.**7 for 3.3Amp, 5 Amp or 10Amp 12 VDC supplies.

Figure 7 Power Supply

Visit Astro-Smart for more astronomical products, services, and training at www.astro-smart.com .

Repair/Warranty

In general, Astro-Smart will support you product for life. Upon receipt of returned product, Astro-Smart will assess the item/s to determine if they comply with the conditions of our warranty. Items that do comply will be fixed or replaced free of charge. Items that are deemed to be out of warranty or have had their warranty voided will, with the customer's knowledge, be fixed at our costs specified below or replaced with new product paid for at full retail value. Please note that items that have been returned for repair or assessment and are deemed to be in proper working order will have a $60.00 bench charge applied as well as return shipping costs. **Astro-Smart warranty is covered for life from date of purchase. Ie. Free Firmware and Standard Software Updates for Life.** Our warranty does not cover damage due to misuse, accidental, incidental or intentional abuse, tampering or the wear and tear of normal use.

In no event shall Astro-Smart be liable for any claim for incidental or consequential damage arising out of or in connection, manufacture, delivery or use of any product offered on this website or by information received by US mail, E-mail, data files or fax. Astro-Smart   is not responsible for damage caused by the freight carrier, i.e.: UPS, FED EX, etc., to our product. Warranty coverage excludes normal wear and tear, or damage caused by improper installation, any modification, abuse, misuse, improper maintenance, and unauthorized repairs or modifications to the original product. Warranty does not cover those parts prone to failure under normal wear and tear. Any product repair request must be submitted and approved before shipment to Astro-Smart . Shipper is responsible for proper packaging, shipping and insurance on approved repair items.

Return Policy

All items must be in new (mint) condition. Returned items cannot show evidence of use or wear, dirt, or blemishes of any kind. Merchandise must be returned in its original packaging and should include all supplied materials, instructions, warranty cards, original accessories, hardware, and any software provided. Astro-Smart is not responsible for lost or damaged packages. Return shipping costs are the responsibility of the customer. A **20% restocking fee** will apply to returnable items if they are returned within 15 days of shipment from us. Items must be in "as new" condition and unopened. We ask that you open and inspect your order upon receipt since no insurance or damage claims will be accepted more than three days after delivery. All Customers MUST call before returning products for warranty or repair to get an RMA# (Return Merchandise Authorization) or an SRO# (Service Repair Order) as well as return shipping instructions and return shipping address. Items being returned from the continental US must be sent 'PARCEL POST', unless directed by Astro-Smart to do otherwise. Failure to do so will result in customs and administration charges being charged to the customer's

account or the shipment being refused. Product is to be returned with delivery and insurance charges prepaid and these charges are not refundable.