MCerberus® HVAC Monitoring
Software User Guide

RT Automation

We make automation simple™

CONTACT INFORMATION

RT Automation
14111 Bluff Grove Drive
San Antonio, TX 78218
Email: sales@mcerberus.com
Web: www.mHVACmonitor.com

TABLE OF CONTENTS

I.   Introduction

Welcome to the mCerberus® Software User Guide. This manual will provide you basic instructions on how to use the SOFTWARE. This Guide assumes that the SOFTWARE has been successfully installed and the mCerberus® Hardware unit has been successfully installed.

II.   Purpose of the Software

The mCerberus® 400 Series is the HVAC monitoring system that can be installed in fifteen minutes on new and existing home or business central (forced air) air conditioning and heating systems.

The System is designed for the HVAC Contractor who may require the capability/capacity to monitor hundreds of installations as well as the home or business owner that requires the ability to self-monitor their own unit(s). Our backend SOFTWARE application analyzes the data obtained by the hardware unit and determines the current state of the HVAC system.

The SOFTWARE was designed for the HVAC Contractor responsible for managing tens, hundreds, and/or evening thousands of installations. The SOFTWARE provides the following features for a typical installation of the system:

- Manage customer information (name, address, phone, email address, HVAC System)
- Download and analyze the data (statistically and graphically). The SOFTWARE provides a quick summary of the current hardware status via the SUMMARY output (GREEN == GOOD, RED = CHECK IT OUT)
- Run and export automated reports directly to Microsoft Excel
- Customize settings associated with analyzing data (min/max set points)

III.   Running the Program (HVAC Contractor Mode)

After the SOFTWARE is installed, the User may double click the SOFTWARE Program Icon to execute it. A splash screen similar to the one shown appears when the program is executed. The SOFTWARE will only run under Windows 7, Windows 8, and Windows 10. Previous versions of the Windows Operating System are NOT supported.
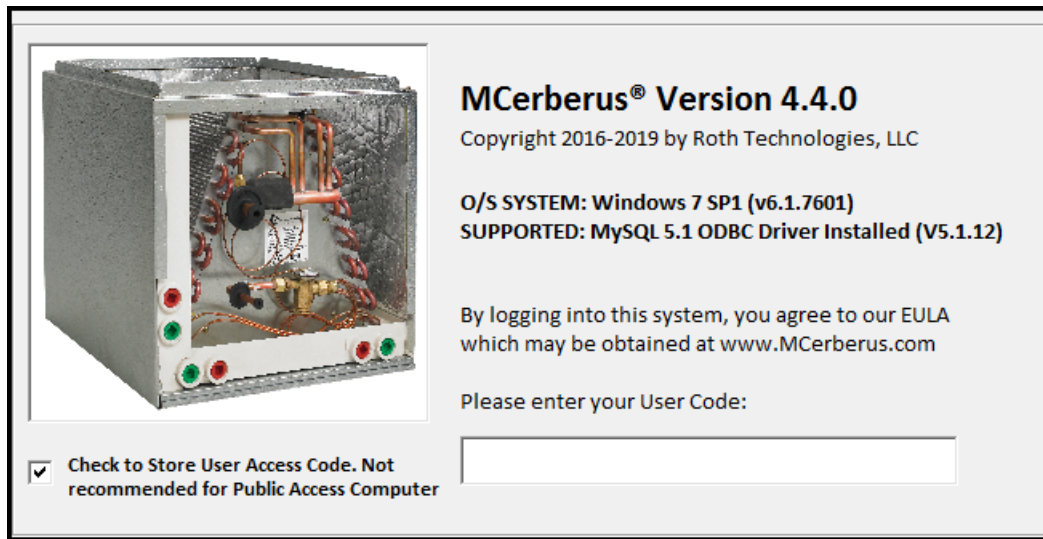
The SOFTWARE login screen indicates what version of the Windows operating system you are utilizing as well as the MySQL ODBC driver that is loaded on your computer.

Your company has been provided a ten to sixteen character length access code for logging into the SOFTWARE system. This character string identifies your company within the SOFTWARE. The EULA prohibits you from sharing this character string to any unauthorized users. If you happen to lose control of your passcode, contact us and we will change your login passcode.

You can have the software save your access code by checking the "Check to Store User Access Code" checkbox.

IV.   Customer Account Mode

The SOFTWARE as written was designed for the HVAC Professional to maintain and manage tens, hundreds, or even thousands of units installed in the field. The SOFTWARE provides READ and WRITE access to the data. In these cases it is advantageous for the Client to also have access to their particular installation. The SOFTWARE allows Client access to their data in READ only mode -- that is the customer may view but not modify the installation.

The HVAC Managing firm may provide to the Client the MAC ID of the installed hardware device. This MAC ID is provided as part of the installation package and may also be read directly from the mCerberus® Hardware label. The Client may obtain the SOFTWARE and MySQL ODBC Drivers directly from our website and install it using the mCerberus® Software Installation Guide.

In the example shown to the right the format of the MAC Hardware address is illustrated. However the MAC Address shown is just an example and is NOT an active mCerberus® Hardware Installation. Using "XX:YY:ZZ:11:22:33" will result in an error message from the SOFTWARE.
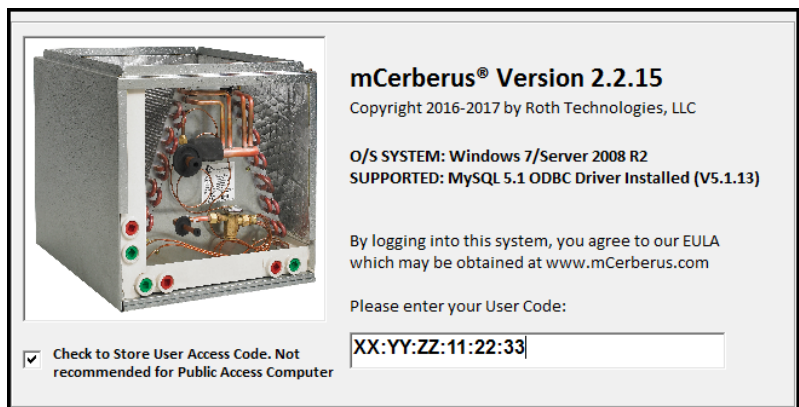
When the Client runs the SOFTWARE the following introductory message box will appear at the time of logging into the SOFTWARE.
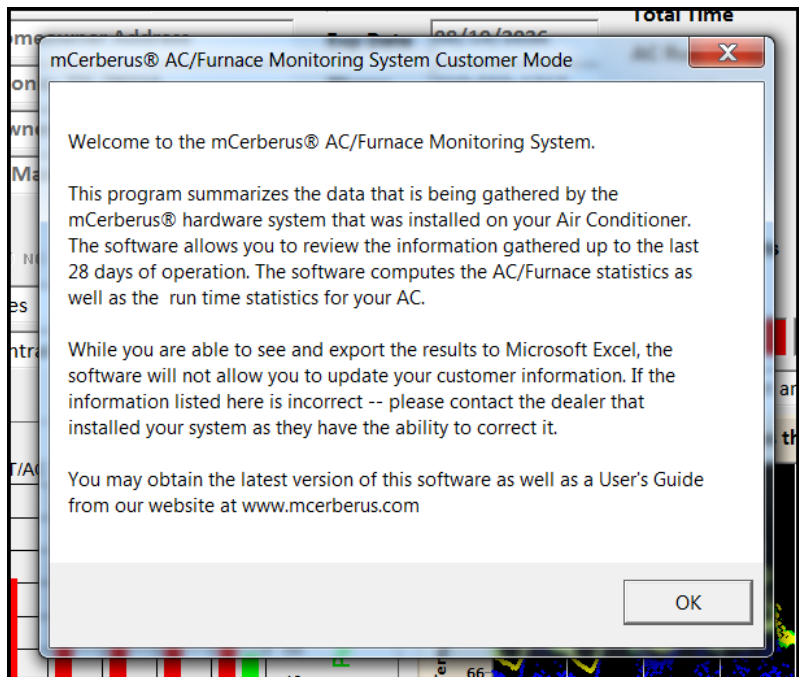
V.   Software Overview

The SOFTWARE was developed and compiled to run under the Microsoft Windows Operating System. This section provides basic instructions on how to use the SOFTWARE.

The SOFTWARE is organized into four zones or areas in which data is either entered and/or outputs are computed and displayed for the User's use. These areas are as follows:

(1) DROP DOWN MENUS: The region provides commands that may be applied to a particular data set including Database Operations, Report Generation, Profile Editing, and Rise Time analysis. For those individuals with Admin rights -- the menu bar also provides the Admin and Clean functions.

(2) STATUS BAR: When running and interacting with the SOFTWARE, the Status Field provides information to the User with regards to the current operation of the SOFTWARE and what the SOFTWARE expects the User to be doing at that particular moment.

(3) CUSTOMER INFORMATION: This section allows the User to enter and update (via the Database Menu Dropdown) the customer information for a particular installation. These fields include the customer name, address, phone number, email address, and information about the installed HVAC system. This customer information will show up on all Reports generated from the Main Menu Report function.

(4) CONFIGURATION: This section allows the User to quickly configure (and save) information about the installed hardware unit. These fields include the following fields:

- Flip Sensors
- Analysis
- AC Filter Time
- Heater Filter Time
- Time Zone
- Active
- Fan Mode
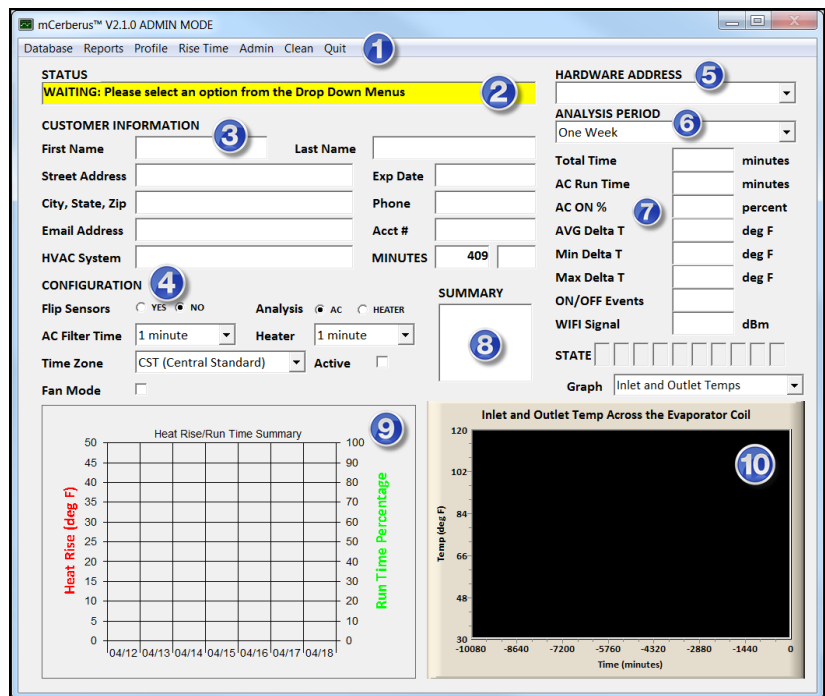
(5) Hardware Address: All installed units have a unique identifier (also known as MAC ID or MAC Address). The MAC Address consists of six two-digit hexadecimal numbers separated by colons. As part of an installation -- the MAC Address is provided on the hardware outside label as well as INSERT in the Installation Box. If you have only one HVAC monitoring system assigned to your account, the SOFTWARE will bring this system up automatically.

NOTE: If you are managing multiple units -- it is important to track the MAC ID of your hardware unit to the HVAC installation location. We are unable to perform this task for you.

(6) Analysis Period: The Analysis Period may be set to Today, Today/Yesterday, One Week, Two Weeks, or Four Weeks. On a new set of data the default setting is one week. The Analysis Period setting changes the time period that is applied for the Statistical Analysis Results (Section 7), the individual Means/On-Off Percentages displayed graphically in Section 9, and all of the Graphs in Section 10.

(7) Statistical Results: Based on the Analysis Period Setting, the statistical results for the time period are summarized in this section. This includes the following items:
(a) Number of minutes of data captured in the time period. The expected sampling period of the hardware unit is one measurement per minute. Not all hardware units "store" at this rate, in particular, when there are WiFi issues which are typically caused by a low WiFi signal strength,
(b) Run Time (in minutes) -- the output is NOT adjusted by the filter time setting, the
ON percentage = Run Time/Total Time * 100%,
(d) Mean/Average delta T or Heat Rise -- this output is affected by the filter time setting,
(e) Min/Max Delta T or Heat Rise -- from the given data set for the particular analysis period, this the min/max (as applicable) value found when the unit was ON,
(f) Average Cycle Time -- this is the average run time of the HVAC unit during the analysis period,
(g) dP Filter Quality -- For units equipped w/ the dP monitoring system (MCB404 units) - the metric reports the current quality of the HVAC filter. A value of 100 percent = good/no degradation and a value of 0 percent = needs to be replaced immediately.
(h) WiFi Signal Strength -- this is the measured and adjusted statistical min WiFi signal strength that is being used by the Hardware unit. Transmission of data may be affected when this value is smaller than -85 dBm.

(8) Summary/State Machine: For any given data set -- a set of "rules" are applied which determine the current operating state of the HVAC system under the current analysis method (i.e. AC or Furnace). The overall RESULTS is shown graphically in the SUMMARY block.

The results are as follows:
(a) GREEN = Good. The current hardware system is good BASED on the current data set.
(b) YELLOW = Good but with a warning. One or more of the rules is close to being violated.
(c) RED = Failed. One or more rules has been failed. We recommend the User review the data set in detail to make a determination whether the HVAC system has an issue.

In order to determine that a unit needs maintenance (i.e. a rule has been violated) -- we require a certain amount of "data" to be obtained by our unit and that the HVAC has run for a specific amount of time. The following situations with a failed or failing HVAC system will NOT be identified by our SOFTWARE unit:

(1) The HVAC does not run or is unable to run at all.
(2) The HVAC runs but only runs for short periods of time (i.e. less than ten percent of the day)

While it would be to our advantage that our SOFTWARE could identify these situations - these cases are very catastrophic in nature and the Homeowner or Business Owner where our product is installed will be in a situation where they (more than likely) are aware that there is an issue and probably has placed a service call for repair. Our newer systems include a room temperature sensor that allows for direct monitoring of the controlled space.

(9) Delta T or Heat Rise Daily Summary: This graph provides statistical results on a daily basis for the HVAC system based on the current analysis method (AC or Heat Mode). It also provides the Daily Run Time Percentages for the HVAC system.

This graph is useful as the SOFTWARE implements an algorithm to determine statistical changes in behavior in the HVAC system. A statistical change in HVAC behavior may be easily observed in this graphical result. As an example, our SOFTWARE would flag the data set with a WARNING if the heat rise in a system for the majority of the days was at or around 40-45 degrees but the last day of the data set showed a heat rise of only 20 degrees.

(10) Graphical Results: The SOFTWARE provides the following graphs based on the Analysis Period as well as the Filter Time settings: (a) Inlet and Outlet Temps, (b) delta T/Heat Rise, (c) WiFi Signal Strength, (d) Current Probe reading, and (e) dP readings (for MCB404 monitoring units).

VI.   Menu Options

This section details the various options that are available under the Main Menu.

Database

The Database Option under the Main Menu allows the User to Store or Update the Customer Information associated with the current MAC ID. This includes configuration data associated with the Customer. The SOFTWARE will require that you confirm this operation before it proceeds.
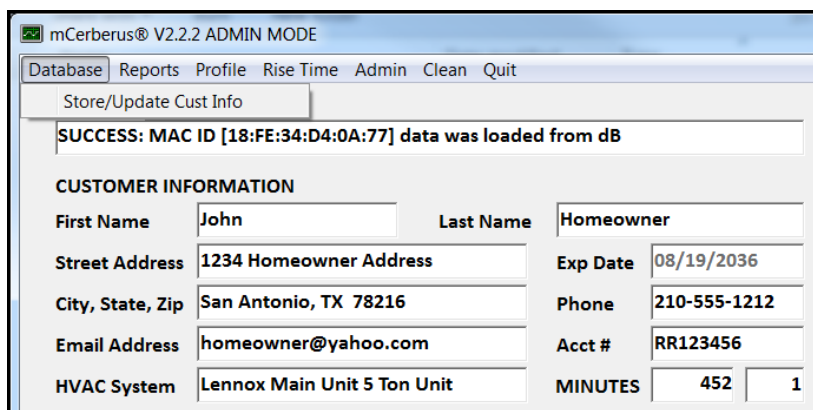
Reports

The Report Option under the Main Menu allows the User to generate and save reports from the SOFTWARE. These Reports are generated and stored in Microsoft Excel. This requires that the User have Excel loaded on the computer. If the Excel program is not installed -- the Report function will not work.
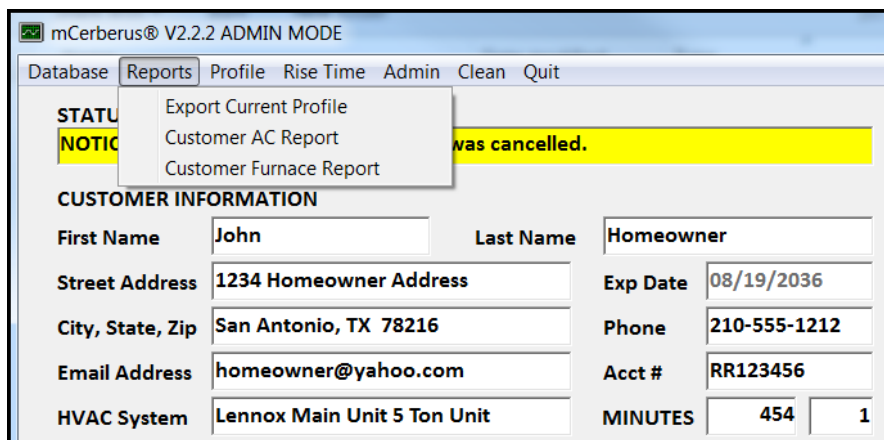
The following options are available under the Report Menu Item:

(a) The User may export the current User Profile to Excel. This option basically exports a screen shot of the current User Profile directly to Microsoft Excel,

(b) Customer AC Report: The SOFTWARE will execute and export an AC summary report for all of the User Profiles associated with your account. The units that have issues will be placed and sorted at the top of the report. If you have several units associated with your account -- this function may take a while to completed. The following screen shot illustrates the AC Summary Report for our demo account installations.

(c) Customer Furnace/Heating Report: The SOFTWARE will execute and export a Heat Mode summary report for all of the User Profiles associated with your account (similar to the AC Mode summary).

Profile

The Profile function allows the User to manage your Profile associated with your account. This account information will show up automatically on all of your Reports. This section also allows the User to Manage the Global Configuration settings that are used to determine PASS/FAIL states when managing the data sets. After making your updates -- select SAVE to save the results or DISCARD to discard your updates.
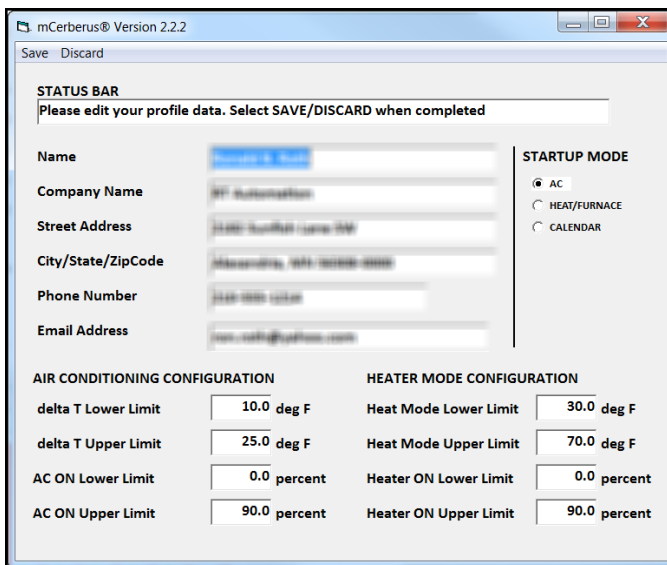
Rise Time

The Rise Time function allows the data set for the current hardware to be analyzed in terms of "capacity to perform." This function is similar to time required for an automobile to accelerate from 0 to 60 mph that is commonly used in television commercials. The Software provides this analysis in the following fashion:

1. Up to five sequences are identified by the software for the current stored data set.
2. These data sets must be at least 30 minutes in length (with filtering applied)
3. The SOFTWARE determines the rise time. Rise time is the number of minutes it takes for the delta T or Heat Rise to go from fully OFF to 63 percent of the fully ON (steady-state) value.

It is considered that "faster" is "better" in terms of the Rise Time Index. As a unit starts to degrade due to various factors, the rise time of a unit will increase. A rise time that is changing or getting to be a large value indicates that service may be required for the AC or Furnace Unit. The rise time results may and will be affected by the location of the temperature sensors as installed.
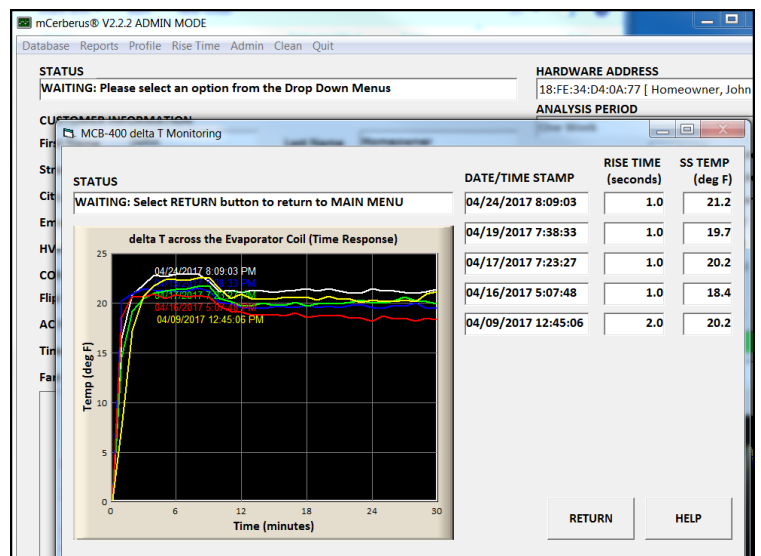
Quit

In order to exit the SOFTWARE - the User must select Quit from the Main Menu. The SOFTWARE will automatically terminate if it is not used in thirty minutes.

VII. Configuration

This section discusses in more detail the CONFIGURATION section of the SOFTWARE. The CONFIGURATION section allows the User to configure (and save) information about the installed hardware unit. The settings for a particular installation may be SAVED by selecting **Database** from the Main Menu as discussed in Section V of this Users Guide.
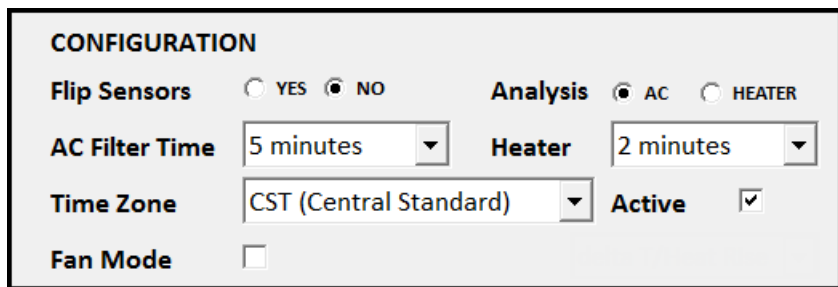
Flip Sensors

If the Sensors are installed backwards for a particular install (i.e. Inlet connected to Outlet and Outlet connected to Inlet) -- this parameter allows the Software to "switch" them rather than having a service person return to the Installation to flip the connections. The following figure illustrates the proper positions of the Inlet and Outlet Temperature. We also refer the reader to the Installation Guide for additional instructions.

The need to "Flip Sensors" in software may be realized when the HVAC system is (or should be) in AC running mode but no data shows up in the analysis field (since the data is inverted).

Setting the FLIP SENSOR configuration will only need to be done once (and saved) for a particular installation.
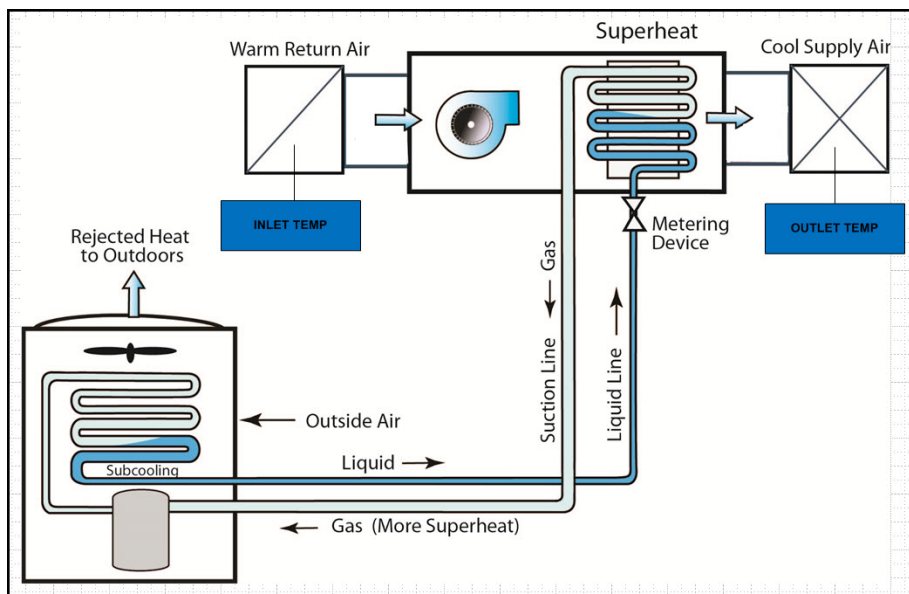
Analysis Mode

This selection allows the User to choose the current analysis type on a particular installation. The two options are AC (Cooling) and Heater (Furnace) modes.

AC/Heater Filter Time

This setting allows the User to set the filter time (in minutes) for an installation. The filter time is the number of minutes the system allows before assuming the HVAC system is in steady state. Data obtained during the filter time is "ignored" and not used in the analysis. The data points during the filter time are still shown on the graphs.

The following GRAPH shows an actual data set (rise time) for an HVAC system in AC (cooling) mode when the system first came on.. In this case the filtering time was set to five (5) minutes.

- Data points to the left of the vertical red line are ignored by the SOFTWARE. The AC system has just turned on and has not reached a steady state operating point.
- Data points to the right of the vertical red line are included in the SOFTWARE analysis. The AC system at this point is basically in a near steady state operating state.
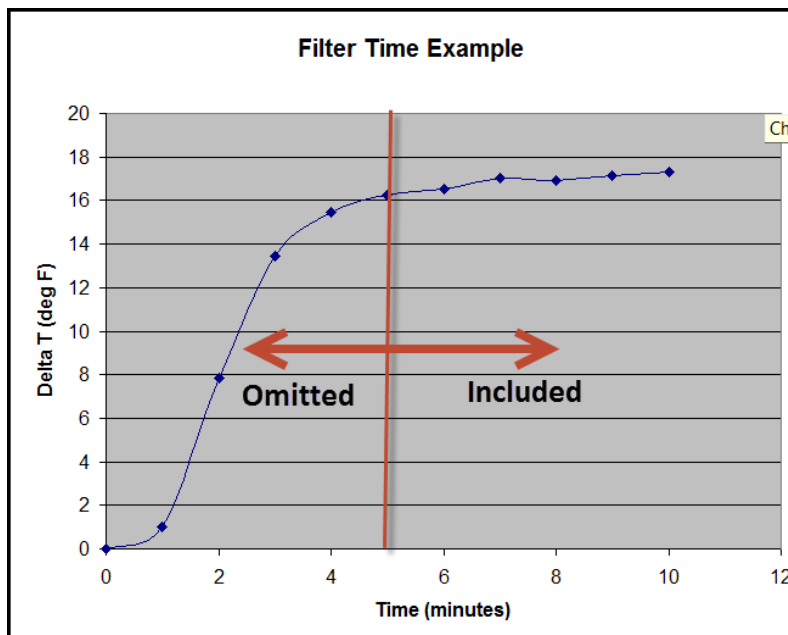
Choosing the proper filtering time is an important factor in analyzing the HVAC performance in both heating and cooling modes. We typically suggest a filtering time of 5 to 10 minutes as being appropriate. This value is SMALLER than what is typically suggested by HVAC experts but we believe these values are appropriate as the temperature sensor installation points are very close to the Heat Exchanger as compared to measuring the temperature at the entrance/exit vents.

The following two figures illustrate the graphical representation of the filtering setting when analyzing a data set in AC mode. The graph of the Left had a filter time set to 5 minutes while the graph on the right had the filter time set to 2 minutes. The BLUE Points represent the "after filtering" Delta T data points used in the measurements while the WHITE Points represent the "filtered out" measurements. As the filter time is set to a lower value - more of the measurement points are included in the analysis. However, utilizing measurement points when the equipment first turns on may not be representative of the equipments performance as the system may not be operating at a steady-state condition.

Filter Setting = 5 minutes   Filter Setting = 2 minutes
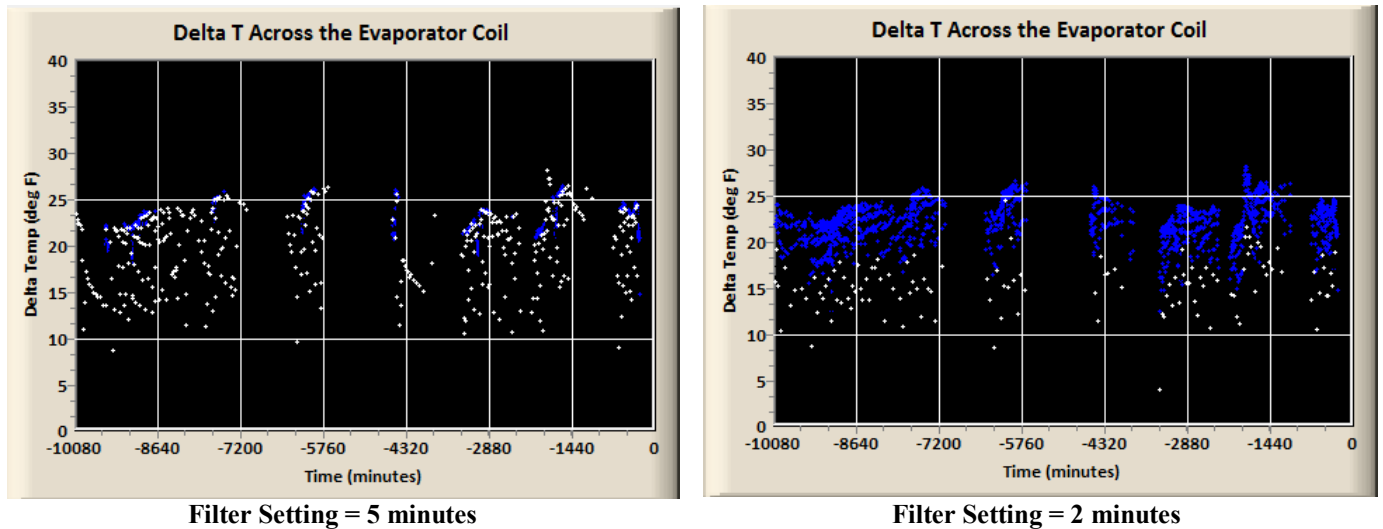
The Software INCLUDES all data points where the unit is ON with filtering applied. However, since there are so many data points, the SOFTWARE will EXCLUDE data points where the system is OFF to make the results look cleaner and simpler.

Time Zone

This setting allows the User to set the Time Zone where the Hardware unit is installed. The default setting is for Central Standard Time (CST).

Active

Checking this check box includes the Customer Hardware Installation in the Report function from the Menu Bar.

Fan Mode

Some Home Owners have the FAN on all the time regardless of if the AC or Furnace is on or off. This configuration by the Homeowner makes the analysis of the data more difficult and less precise. We address this issue by providing a Fan Mode option. This allows the data set to be analyzed and the sections where the Fan is ON but the AC/Furnace is OFF to be ignored.

VIII. Hardware Address

This section discusses the Hardware Address drop down box located on the upper left hand corner of the Software Main Page as shown.

All installed units have a unique identifier (also known as MAC ID or MAC Address). The MAC Address consists of six two-digit hexadecimal numbers separated by colons. As part of an installation -- the MAC Address is provided on the hardware outside label as well as INSERT in the Installation Box. If you have only one HVAC monitoring system assigned to your account, the SOFTWARE will bring this system up automatically.

The Hardware Address drop down combo box will list all of the Hardware units assigned to your account. The customer first name and last name will also show up on this dialog box which is obtained from Customer Information dialog boxes.
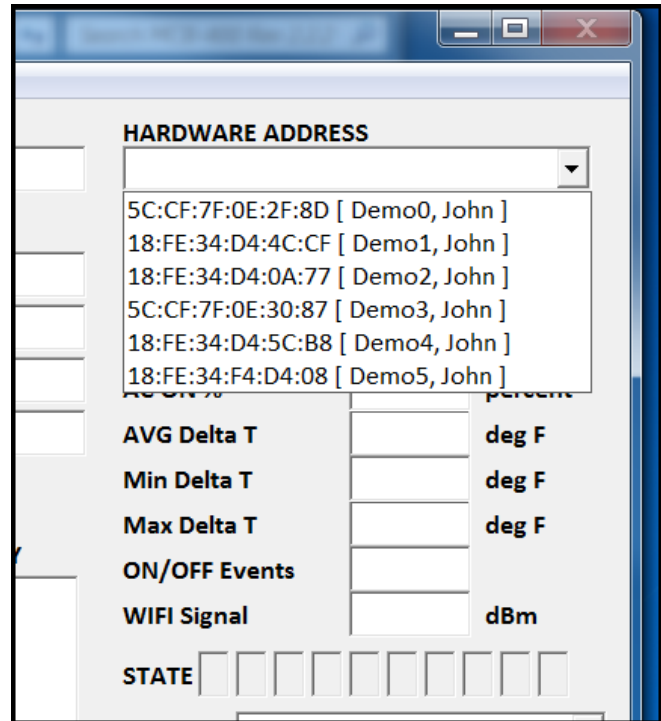
If you are managing multiple units -- it is important to track the MAC ID of your hardware unit to the HVAC installation location. We are unable to perform this task for you.

IX. Analysis Period

The Analysis Period may be set to the following settings:

- Today,
- Today/Yesterday,
- One Week,
- Two Weeks, or
- Four Weeks

The default setting for this combo box is one week. The Analysis Period setting changes the time period that is applied for the Statistical Analysis Results, the individual Means/On-Off Percentages displayed graphically, and all of the Graphs.
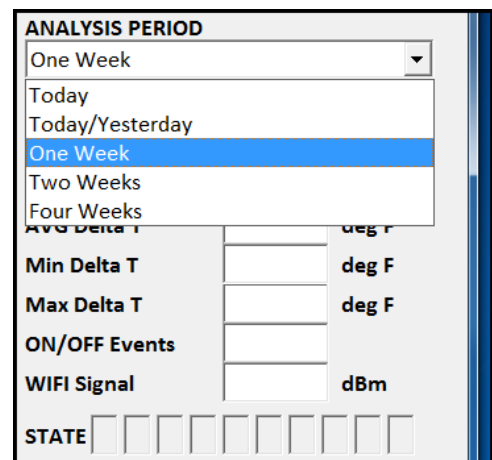
X. Statistical Information and Reporting

Based on the Analysis Period Setting, the statistical results for the time period are summarized in this section. This includes the following items:

The **Total Time** is the Number of minutes of data captured in the time period. The expected sampling period of the hardware unit is one measurement per minute. Not all hardware units "store" at this rate, in particular, when there are WiFi issues which are typically caused by a low WiFi signal strength. The typical (max) number of readings in one day will be approximately 1,440 (= 60 minutes * 24 hours).

   . The **Run Time** is the number of (unfiltered) minutes the Unit was ON.

   . The **ON percentage** is calculated by the equation = Run Time/Total Time * 100%,

Mean/Average delta T or Heat Rise is the computed statistical mean or average delta T or Heat Rise for the data set for the sampling period. This output is affected by the filter time setting,

Min/Max Delta T or Heat Rise -- from the given data set for the particular analysis period, this is the min/max (as applicable) value found when the unit was ON. These values will be affected by the filter time setting.

Average Cycle Time -- This is the average run time of the HVAC unit during the analysis period. This metric is computed by the Software by measuring the run time (from the beginning of the unit tuning ON to when it just turns OFF) and averaging the results from all start/stop operations. This metric is utilized to determine if a system is short cycling.

dP Filter Quality -- For MCB404 units this metric is the reported health of the HVAC filter. A value of 100 percent means that the HVAC filter is good. As the HVAC filter begins to capture the various elements of the air (dirt, dust, etc) the delta P across the filter will increase. As a result the dP Filter quality metric will begin to degrade from 100 percent to a smaller number. As each system is different, the User will need to calibrate the unit using the dP Config menu option.
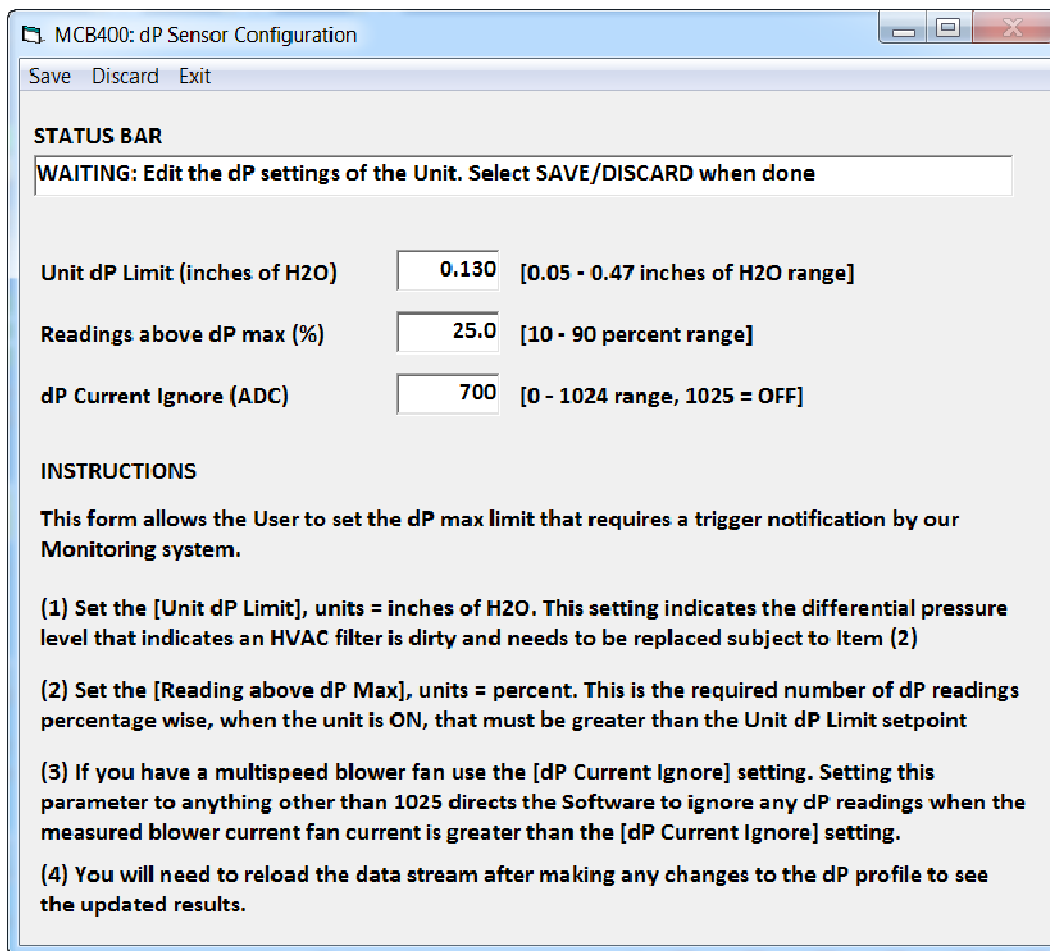
WiFi Signal Strength -- this is the measured and adjusted statistical minimum WiFi signal strength that is being used by the Hardware unit. Transmission of data may be affected when this value is smaller than -85 dBm.

The SOFTWARE will NOT flag a WiFi issue until the number of samples is less than 70 percent of the project sampling rate. The easiest method of solving a low WiFi signal strength issue is by installing a Wi-Fi Range Extender. At the time of the writing of this document -- we recommend the purchase and installation of the following:

- TP-Link | AC2600 WiFi Range Extender (RE650 or equivalent). This unit is KNOWN good.

- We do NOT recommend a low end extender as these units have too much lag and result in lost data packets (e.g. NETGEAR N300 Wi-Fi Range Extender, Essentials Edition EX2700).
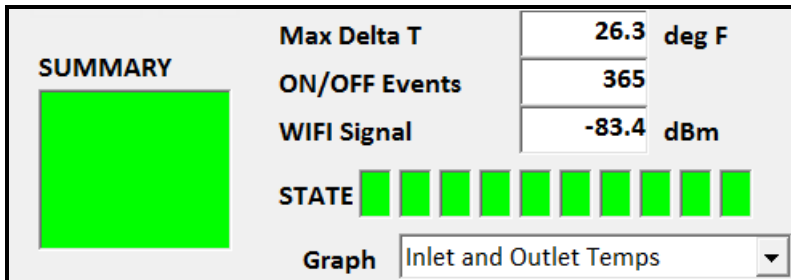
XI. dP Configuration

Units equipped with a dP sensor allow for the monitoring of the HVAC filter. These units are identified with the part number MCB404 rather than MCB400. The dP monitoring system may be tuned or calibrated via the [dP Config] menu option.

MCB400: dP Sensor Configuration

Save   Discard   Exit

STATUS BAR

WAITING: Edit the dP settings of the Unit. Select SAVE/DISCARD when done

Unit dP Limit (inches of H2O)	0.130	[0.05 - 0.47 inches of H2O range]
Readings above dP max (%)	25.0	[10 - 90 percent range]
dP Current Ignore (ADC)	700	[0 – 1024 range, 1025 = OFF]

INSTRUCTIONS

This form allows the User to set the dP max limit that requires a trigger notification by our Monitoring system.

(1) Set the [Unit dP Limit], units = inches of H2O. This setting indicates the differential pressure level that indicates an HVAC filter is dirty and needs to be replaced subject to Item (2)

(2) Set the [Reading above dP Max], units = percent. This is the required number of dP readings percentage wise, when the unit is ON, that must be greater than the Unit dP Limit setpoint

(3) If you have a multispeed blower fan use the [dP Current Ignore] setting. Setting this parameter to anything other than 1025 directs the Software to ignore any dP readings when the measured blower current fan current is greater than the [dP Current Ignore] setting.

(4) You will need to reload the data stream after making any changes to the dP profile to see the updated results.

XII. Summary of Results

For any given data set -- a set of "rules" are applied which determine the current operating state of the HVAC system under the current analysis method (i.e. AC or Furnace). The overall RESULTS is shown graphically in the SUMMARY block.

The results are as follows:

(a) GREEN = Good. The current hardware system is good BASED on the current data set.
(b) YELLOW = Good but with a warning. One or more of the rules is close to being violated.
(c) RED = Failed. One or more rules has been failed. We recommend the User review the data set in detail to make a determination whether the HVAC system has an issue.

In order to determine that a unit needs maintenance (i.e. a rule has been violated) -- we require a certain amount of "data" to be obtained by our unit and that the HVAC has run for a specific amount of time. The following situations with a failed or failing HVAC system will NOT be identified by our SOFTWARE unit:

(1) The HVAC does not run or is unable to run at all.
(2) The HVAC runs but only runs for short periods of time (i.e. less than ten percent of the day)

While it would be to our advantage that our SOFTWARE could identify these situations - these cases are very catastrophic in nature and the Homeowner or Business Owner where our product is installed will be in a situation where they (more than likely) are aware that there is an issue and probably has placed a service call for repair.

The STATE Boxes provided more information with regards to what RULE was violated or broken. The following general rules were built into the SOFTWARE at the time of its writing (and probably more available with the current version of the SOFTWARE you are executing as our algorithms continue to develop and progress. Information about a rule can be determined by placing the mouse cursor directly over one of the STATE boxes and waiting a few seconds -- an online help message will pop up with more information


- AC MIN delta T/Heat Rise Min: Sets a lower bound in deg F. These limits may be observed on the delta T/Heat Rise graph

- AC MAX delta T/Heat Rise Max: Sets an upper bound in deg F. This limit may be observed on the delta T/Heat Rise graph

- ON Percentage Minimum: Sets a lower bound for HVAC run time. This is typically set to 0 percent (i.e. no lower bound) but you may assign a value depending on the application.

- ON Percentage Maximum: Sets an upper bound for the HVAC run time. This value defaults to 90 percent and is used to detect a system that is running ALL the time

- Statistical Change in behavior: This algorithm looks for statistical changes in behavior in the Unit before the Unit's output has changed enough to violate a different rule (i.e. AC Min Delta T).

- WiFi: No data records in the last sixty (60) minutes. Indicates a WiFi issue that in most cases will resolve itself automatically but it is an early warning indicator.

- WiFi: System not recording at the desired rate. This rule is violated when the recording rate is less than 70 percent of the desired rate of 1 sample/minute.

- WiFi: Signal Strength is too low. The SOFTWARE examples the signal strength of the installed unit. If the statistical lower limit of the WiFi strength is less than -85 dBm -- an error is triggered which indicates that a WiFi extender may need to be installed.

- Inlet and Outlet Temperature Sensors: The SOFTWARE looks at the data collected by the Hardware unit and determines if the Temperature Sensors are working properly.

- Heater Mode: Outlet Temperature Sensor exceeds max limit. This indicates that the outlet temperature from the Furnace/Heat Exchanger is too high.

- ON-OFF Frequent Cycling: This error indicates that the HVAC is turning ON and OFF more frequently than would be expected.

XIII. Software Output (Charts)

The SOFTWARE provides graphical representations of the results obtained from the installed HARDWARE unit (based on the MAC ID), the analysis mode (AC or Furnace), and time period. Some of these results are displayed in CHARTS located in the Lower Left Hand portion of the Main Form.

The current displayed CHART is managed by the CHART drop down dialog box. The following example shows the CHART results for a data set when analyzing in AC mode for delta T/Heat Rise (Left Graph)
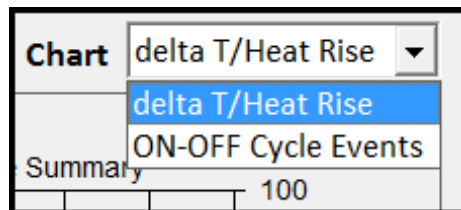
- The X-Axis Chart Data provides the DATE of the analysis period.

- The Red Columns provide the average (or mean) Delta T in degrees F for the DATE. These results are affected by the Filter Time setting.

- These graphical results are affected by the Filter Time designated by the User. Setting a low filter time (i.e. near zero) allows more data points into the analysis when the SYSTEM is not operating in a steady-state mode. If the Filter Time setting is set to a very high setting - - it is possible that no results are provided for a particular DATE

- The Green Columns provide the AC ON percentage for the DATE. These results are independent of the Filter Time setting.

The ON-OFF Cycle Chart provides information with regards to the number of ON-OFF events that occur for a specific DATE. A high or large ON-OFF value may indicate a system that is short cycling.
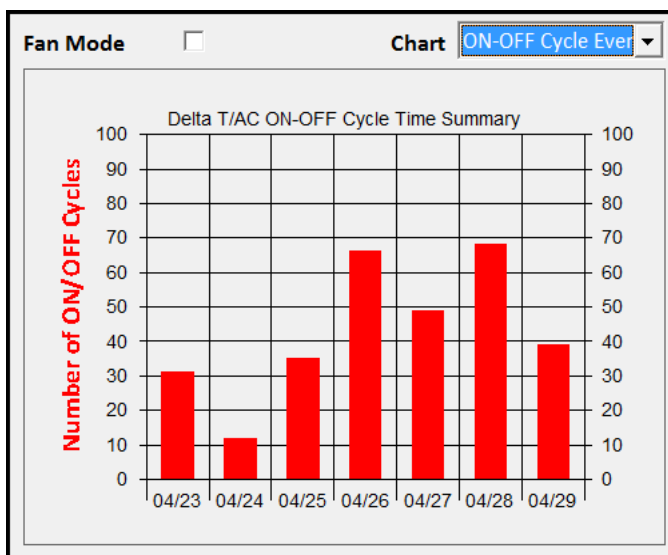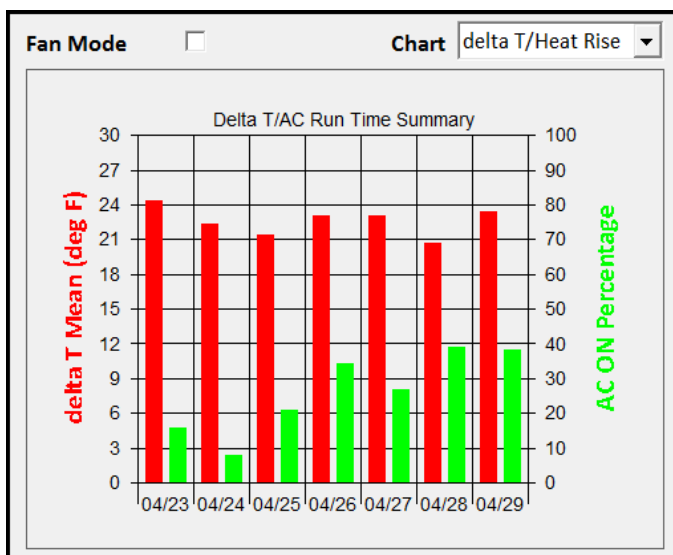
The following example shows the CHART results for a data set when analyzing a data set while in Furnace Mode for Heat Rise. In this particular installation, the End User of the Furnace had the system FAN operating all the time. This configuration resulted in the SOFTWARE reporting extremely HIGH operating percentages for the equipment. The SOFTWARE was configured to ignore the FAN ON only operating points by selecting (and SAVING) the Fan Mode selection box.

- The X-Axis Chart Data provides the DATE of the analysis period.

- The Red Columns provide the average (or mean) Heat Rise T in degrees F for the DATE. These results are affected by the Filter Time setting.

  These graphical results are affected by the Filter Time designated by the User. Setting a low filter time (i.e. near zero) allows more data points into the analysis when the SYSTEM is not operating in a steady-state mode. If the Filter Time setting is set to a very high setting -- it is possible that no results are provided for a particular DATE

The Green Columns provide the HEATER ON percentage for the DATE. These results are independent of the Filter Time setting.
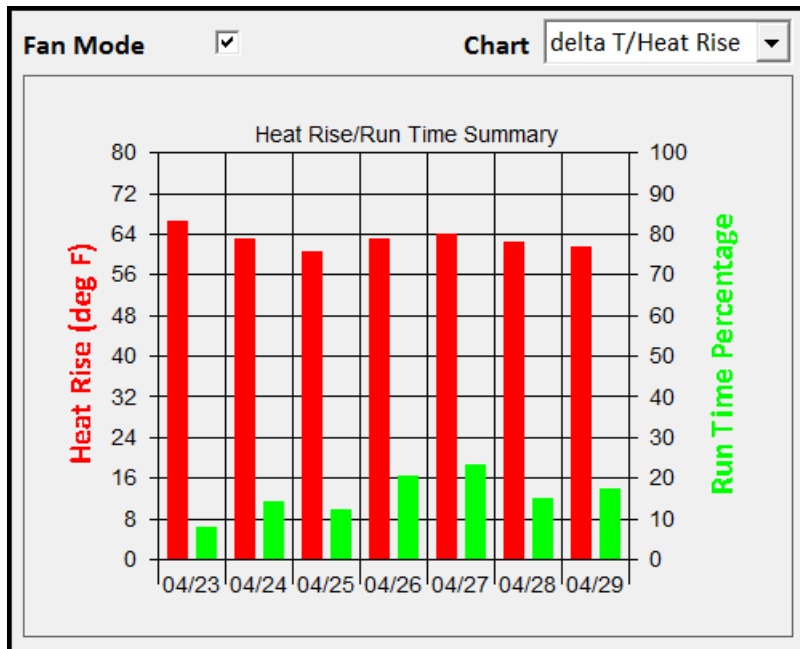
XIV. Software Output (Graphs)

The SOFTWARE provides graphical representations of the results obtained from the installed HARDWARE unit (based on the MAC ID), the analysis mode (AC or Furnace), and time period. Some of these results are displayed in GRAPHS located in the Lower Right Hand portion of the Main Form.

The current displayed GRAPH is managed by the GRAPH drop down dialog box. The following example shows the graphical results for a data set when analyzing in AC mode for the **Inlet and Outlet Temperature** for an actual customer data set.
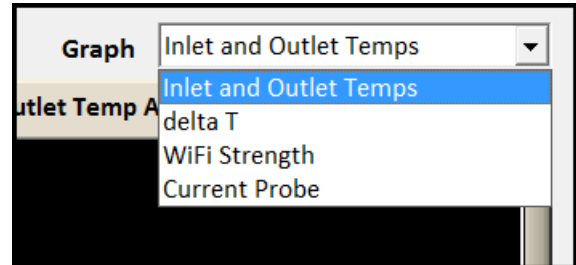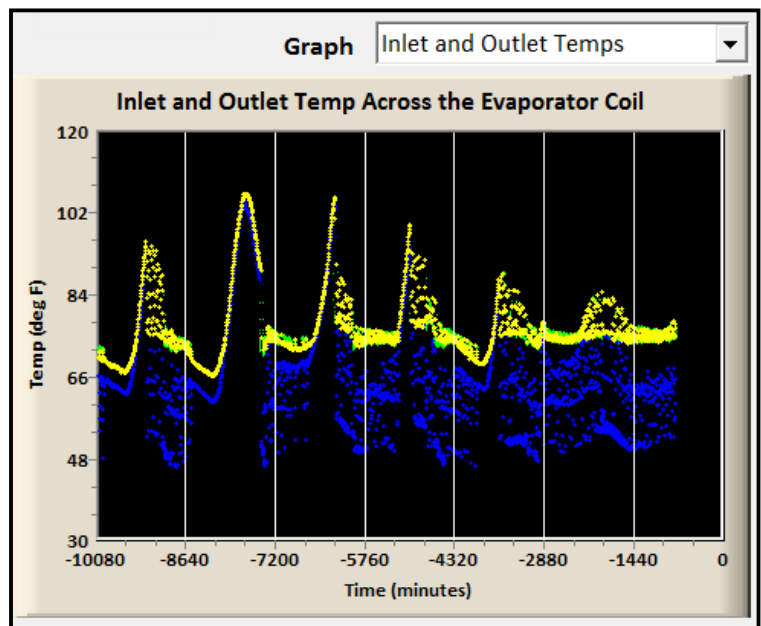

- The X-Axis Range provides the time period of the analysis period.

  - Zero (0) minutes is set to midnight of the current day.
  - (minus) 1440 minutes is set to midnight of the previous day
  - (minus) 2880 minutes is set to midnight of two days prior to the current date.

  Adjusting the analysis Time Period (Today, Today/Yesterday, One Week, etc) will adjust the time period displayed.

- The Blue Dots are the Outlet Temperature. When the AC system is ON (and operating correctly), these values will be significantly less than the Inlet Temperature and will be typically in the 45 to 55 deg F range BUT depend on the Inlet Temperature.

- The Yellow/Green Dots are the Inlet Temperature.

  When the AC System is ON and at Steady-State, these values will represent the temperature of the Air coming from the HOME.

  When the AC System is OFF, with time these values will begin to represent the temperature of the environment that the sensor is located. If the installation is located in the Home Attic you will notice how HOT the attic gets during Summer afternoons.
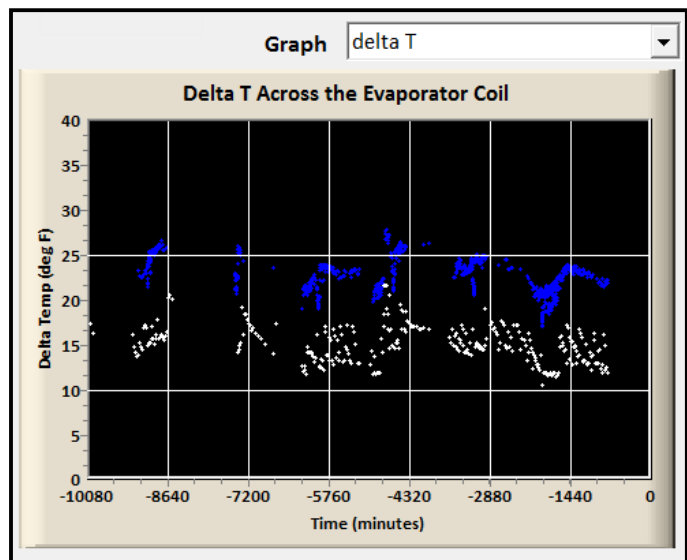
delta T/Heat Rise Graph

The following example shows the graphical results for a data set when analyzing in AC mode for the **delta T** for an actual customer data set.

- The X-Axis Range provides the time period of the analysis period.

    . Zero (0) minutes is set to midnight of the current day.
    . (minus) 1440 minutes is set to midnight of the previous day
    . (minus) 2880 minutes is set to midnight of two days prior to the current date.

    Adjusting the analysis Time Period (Today, Today/Yesterday, One Week, etc) will adjust the time period displayed.

- The Blue Dots are the computed (filtered) delta T values when the AC system is ON. The location and number of these values are affected by the Filter Time Setting. These points represent the data points that are utilized in the data analyzes as they represent when the SYSTEM is operating in a steady-state condition. These data points represents how well the AC or Heater is operating.

- The White Dots are the computed delta T values when the AC System is ON but are NOT included in the analysis as they occurred when the SYSTEM is a non-steady state condition. The location and the number of these values are affected by the Filter Time Setting. Setting the Filter Time to 0 minutes will result in no white dots being displayed.

- The Two White Horizontal Lines (in the example -- displayed at 10 deg F and 25 deg F) are the displayed min and max values used in determining a the state of the SYSTEM. These values may be adjusted (and saved) in the Profile function from the Main Menu.

The SOFTWARE allows for computed delta T data points to be above or below the specified limits (as shown in the example to the left) as we take the viewpoint that the overall AVERAGE of the system must meet the requirements.

WiFi Signal Strength Graph

The following example shows the graphical results for a data set when analyzing the WiFi signal strength for the Hardware unit for an actual customer data set.

One would expect the WiFi field strength in a home or installation to be constant but reality shows that this is not the case (i.e. it changes as a function of time). The HARDWARE operates very well when the field strength is great than -75 dBm. Issues start to arise when the field strength is a value less than -85 dBm. The HARDWARE will continue to operate BUT there may be instances when the obtained data cannot be transmitted to our Server for storage (i.e. it is lost).
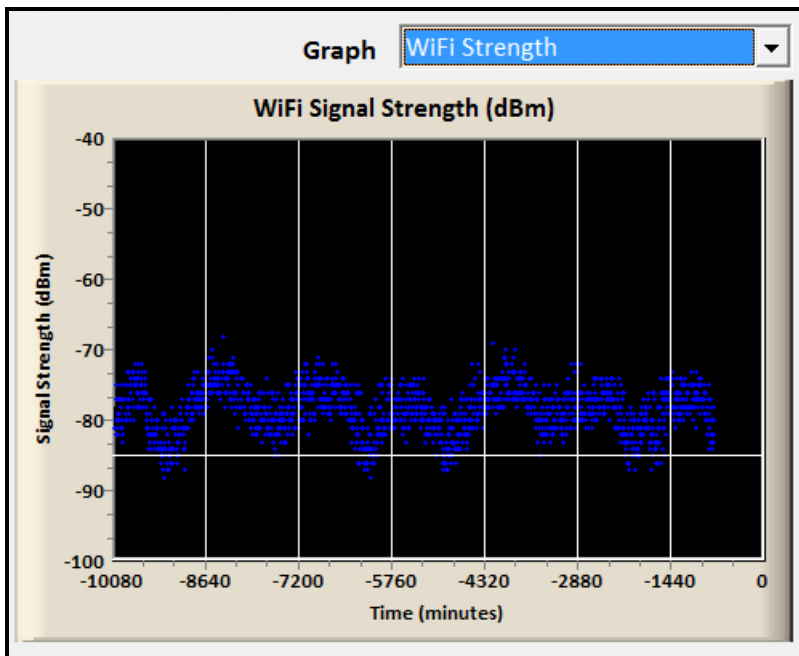

The SOFTWARE will NOT flag a WiFi issue until the number of samples is less than 70 percent of the project sampling rate. The easiest method of solving a low WiFi signal strength issue is by installing a Wi-Fi Range Extender. At the time of the writing of this document -- we recommend the purchase and installation of a NETGEAR N300 Wi-Fi Range Extender, Essentials Edition (EX2700). These units sell for less than $30/each. We do NOT included this unit as part of our product.

The 70 percent value was chosen as part of the Hardware development. We can set this value for your installation to whatever value you deem appropriate at no charge.

Customer Probe Reading Graph

The following example shows the graphical results for a data set when analyzing the **Current Probe Reading** for an actual customer hardware installation data set. As part of the Hardware Installation, a current probe is installed on the fan blower. This current sensor determines when the AC or Furnace is ON.
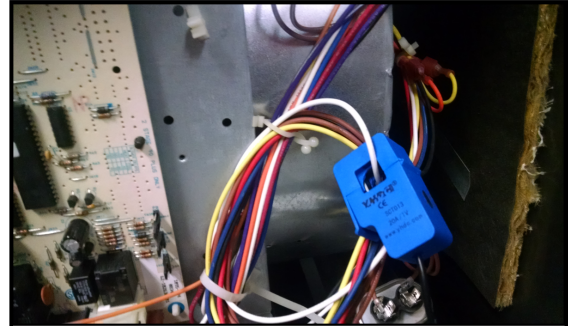
This sensor has some noise associated with it so we perform a significant amount of filtering to the sensor input to arrive at filter version of the sensor reading. The typical current sensor installed has a 30A range although your installation may be using a 20A or 50A.

The following summarizes the Current Probe Graphical results:

- The X-Axis Range provides the time period of the analysis period.

  . Zero (0) minutes is set to midnight of the current day.
  . (minus) 1440 minutes is set to midnight of the previous day
  . (minus) 2880 minutes is set to midnight of two days prior to the current date.

  Adjusting the analysis Time Period (Today, Today/Yesterday, One Week, etc) will adjust the time period displayed.

- The Y-Axis results are the Current Probe Readings in percent of range. The Hardware triggers on readings above 15 percent (or as programmed). The Blue Dots represent readings where the AC/Heater is considered to be OFF. The Red Dots represent readings where the AC/Heater is considered to be ON. Modern HVAC equipment may have multi-speed capability as illustrated by the following example.
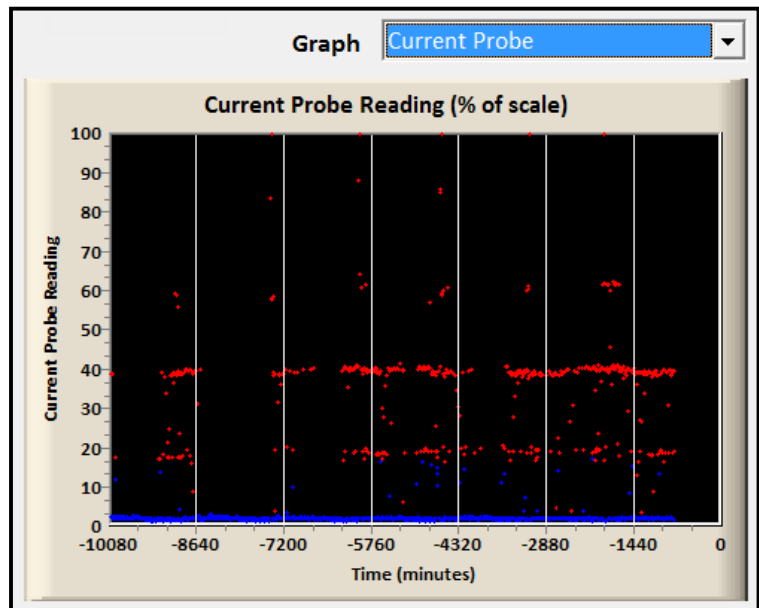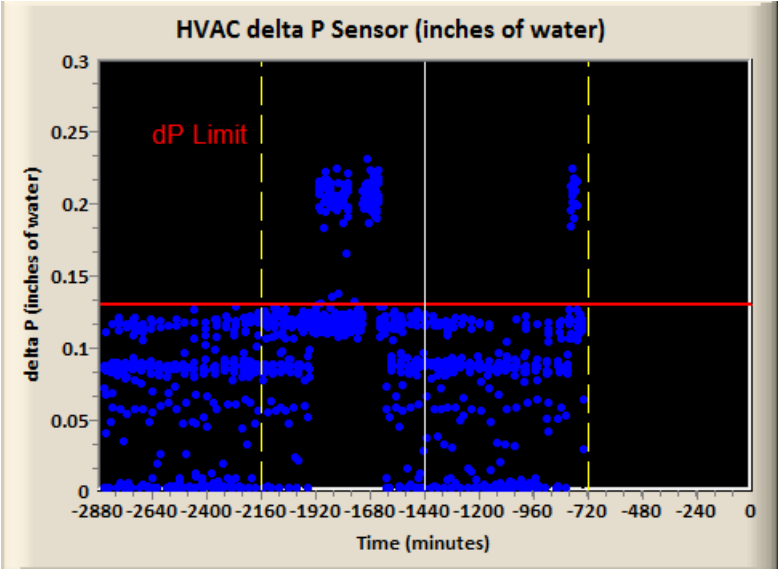
dP Monitoring

For those units equipped with a dP sensor (MCB404 series) the HVAC delta P sensor graph may be selected.

. The red line shows the current dP Limit value
. The blue dots show the measured dP values

The dP monitoring system may be turned/calibrated via the dP configuration menu option.

XV.   Demo Accounts

The SOFTWARE was written to allow prospective new customers to execute and evaluate the SOFTWARE before purchasing. You may contact us at sales@mcerberus.com about establishing a demo account. We will provide you a unique access code that will allow you to execute the SOFTWARE for a period of time before timing out.

When you run the SOFTWARE with your demo access code, the following screen will appear notifying the User that the SOFTWARE is running in demo mode. This mode allows you to view some of the customer accounts that have the mCerberus® system installed. The names and locations of the installations have been changed to protect their identities.
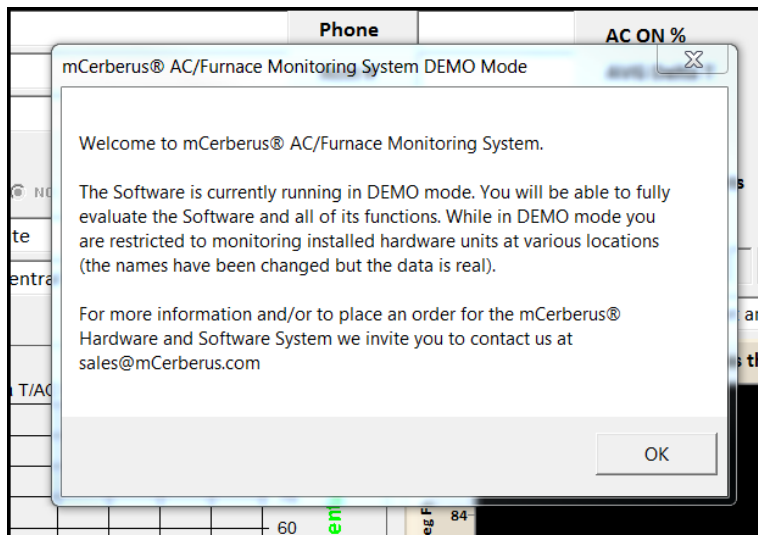
The following screen shot shows the account information for one of our demo accounts.

XVI.   Reporting Errors or to Request Feature Updates

Report system crashes or situations where the SOFTWARE generates incorrect results via email to sales@mcerberus.com. Please provide as much information as possible including screenshots with regards to the setup of the program when the error occurred.

We also encourage and accept feature requests from our Users. Please email these requests to sales@mcerberus.com as well.

We provide UPDATES to the SOFTWARE at no charge. The most recent version of the software may be obtained from our website at www.mHVACmonitor.com via the DOWNLOAD page. The SOFTWARE installation program may be downloaded and executed. The installation program will automatically update/over write the current software version but make sure that the current installed program is not being RUN (or executed) during the installation process.

XVII.   Reference Documents

- **MCB-400 Software Installation Guide,** RT Automation
- **MCB-400 Hardware Installation Guide**, RT Automation
- **MCB-400 delta T HVAC Monitoring** Power Point Presentation, RT Automation
- **End Users License Agreement** is available on our website at www.mHVACmonitor.com